# **MARVEL<sup>™</sup> Reference Manual**

### Version 2.1.1





www.panoramatech.com

#### **MARVEL Reference Manual**

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# Contents

About This Book v
Conventions
Introduction
Project Operations
Project Panel
Project Menus and Toolbar
File Menu
Actions Menu
Toolbar
View CDP and Shot Maps 1
jobBuilder Operations
jobBuilder Panel
jobBuilder Menus and Toolbar
File Menu
Job Menu
Toolbar
angle2offset Module
antialias Module
autoMute Module
autopick Module
Theory
autopick Input Model Panels
autopick Computation Panel
autopick Input Data Panel
autopick Output Panel
autopick Main Panel
autopick Project Panel
autopick Advanced Panel
autopick Job Panel
bias Module
bulkStatic Module

collect Module	. 37
deimg Module	. 40
deimg Computation Panel	. 41
deimg Model Panel	. 42
deimg Input Panel	. 43
diskRead Module	. 44
diskRead Main Panels	. 44
diskRead Advanced Panel	. 49
diskRead Selection Panel	. 50
diskWrite Module	. 51
eveBeam Module	. 52
eveBeam Input Panel	55
eveBeam Computation Panel	56
eveBeam Output Panel	. 00 60
eveBeam Tonography Panel	. 00 61
eveBeam Advanced Danel	. 01 62
eyebean Advanced Fanel	. 02
fdmad2d Madula	. 03
	. 04
	. 6/
	. 68
	. 72
	. 74
	. 75
interpShot Main Panel	. 75
interpShot Header Keys Panel	. 76
kdm Module	. 78
kdm Main Panel	. 78
kdm Input Panel	. 81
kdm Computation Panel	. 82
kdm Output Panel	. 82
kdm Topography Panel	. 84
kdm Advanced Panel	. 85
kmodel Module	. 86
kmodel Output Panel	. 88
kmodel Computation Panel	. 89
kmodel Job Panel	. 90
kmodel Model Panel	. 90
km Module	. 91
km Main Panel	. 92
km Input Panel	. 94
km Computation Panel	. 95
km Model Panel	. 96
km Output Panel	98
km Advanced Panel	100
km Topography Panel	102
MERLIN Module	104
MERLIN Model Panels	107
MERLIN Input Panel	110
mandan, input tunci	

MERLIN Output Panels																	111
MERLIN Computation Panels																	113
MERLIN Smoothing Panel	•••	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	118
MERLIN Boundary Panel	•••	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	119
MERLIN Topography Panel	• •	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	121
MERLIN Compression Danel	•••	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	121
MERLIN Compression Faner MEDLIN Job Danal	• •	•••	•	•••	•••	••	••	••	••	•	•••	••	•	••	•••	•	122
	• •	•••	•	•••	•••	••	••	••	••	•	•••	••	•	••	•••	•	125
	• •	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	·	••	•••	•	120
	• •	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	125
	• •	•••	•	•••	•••	••	•••	•••	•••	•	•••	•••	•	••	•••	•	12/
MORK Computation Panel	• •	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	••	•••	•	129
MORK Input Panel	• •	•••	•	•••	•••	••	••	••	•••	•	•••	•••	•	••	•••	•	131
MORK Regularization Panel	• •	••	•	•••	•••	••	••	••	•••	•	•••	•••	•	••	•••	•	132
MORK Topography Panel	• •	•••	•	•••	•••	••	••	• •	•••	•	•••	•••	•	••	•••	•	133
MORK Output Panel	• •	• •	•	•••	•••	••	••	••	••	•	•••	••	•	••	•••	•	134
MORK Headers Panel		••			• •	••	•••	•••		•	•••	•••	•	••	•••	•	135
MORK Job Panel		• •				• •	• •			•			•			•	137
moveout Module							• •			•							139
moveout Main Panel										•							139
moveout Input Panel										•							141
mute Module										•							142
mute Main Panel										•							142
mute Data Panel																	145
oned Module																	146
parsim Module	•••	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	148
narsim Innut Panel	•••	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	150
parsim Computation Panel	• •	•••	•	•••	•••	••	••	•••	•••	•	•••	••	•	•••	•••	•	151
parsim Output Danel	• •	•••	•	•••	•••	••	••	•••	•••	•	•••	••	•	•••	•••	•	153
parsim Topography Danal	• •	•••	•	•••	•••	••	••	••	••	•	•••	••	•	••	•••	•	155
parsim Advanced Denel	• •	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	•	•••	•••	•	104
parsim Job Donal	• •	•••	·	•••	•••	•••	•••	•••	•••	•	•••	•••	·	••	•••	·	155
parsim Job Panel	• •	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	••	•••	•	150
per Module	• •	•••	•	•••	•••	••	••	•••	•••	•	•••	•••	•	••	•••	•	157
postproc Module	• •	•••	•	•••	•••	••	••	••	•••	•	•••	••	•	••	••	•	159
postproc Input Panel	•••	•••	•	•••	•••	•••	•••	•••	•••	•	•••	•••	•	••	•••	•	161
pruneShooter Module	• •	•••	•	•••	•••	••	••	••	•••	•	•••	•••	•	••	•••	•	162
pruneShooter Main Panel	• •	•••	•	•••	•••	••	••	••	•••	•	•••	••	•	••	•••	•	162
pruneShooter RayTracer Panel .	• •	•••	•	•••	•••	••	••	••	•••	•	•••	•••	•	••	•••	•	165
pruneShooter Anisotropy Panel .	• •	•••	•	•••	•••	••	• •	•••		•	•••	•••	•	••	•••	•	168
pruneShooter Output Panel		••			• •	••	•••	•••		•	•••	•••	•	••	•••	•	170
pruneShooter Topography Panel		• •					• •			•							171
pruneShooter Advanced Panel .										•							172
rayshooter Module										•							174
rayshooter Main Panel										•							174
ravshooter Anisotropy Panel																	176
rayshooter Output Panel		• •	•				•••							•••	• •		177
rayshooter Smoothing Panel																	179
rayshooter Computation Panel						•••	•••				•••			••			180
rayshooter Tonography Danel	• •	•••	•		•••	•••	• •	•••	•••	•	••	•••	•		••	•	181
information in the second seco	• •	• •	•	•••	•••	•••	•••	•••	• •	•	•••	• •	•	•••	•••	•	101

rayshooter Model Panel	32
rayshooter Input Panel	83
rayshooter Job Panel	84
resamp3d Module	85
resample Module	87
rtmodel Module	88
Modeling	88
Migration	89
rtmodel Main Panel	89
rtmodel Model Panel	92
rtmodel Input Panel	92
rtmodel Output Panel	94
rtmodel Computation Panels	96
rtmodel Smoothing Panel	01
rtmodel Topography Panel	03
rtmodel Compression Panel	04
rtmodel Job Panel	06
scan Module	08
semblance Module	10
Theory 21	10
Main Panel	11
shooter Module	13
shooter Main Panel	13
shooter RayTracer Danel	15
shooter Anisotrony Panel	18
shooter Output Panel	20
shooter Tonography Panel	20
shooter Advanced Danel	21 22
smoother Module	22
stack Module	≏т 26
staticShift Module	20
staticShift Main Danel	27 28
staticshift Headers Danel	20
staticshift Surface Danel	20 21
timeDenth Module	2J
timeDepth Module	22 22
timeDepth Tenegraphy Danel	25
timeDepth Input Data Danal	26
	00 70
trillindow Modulo	37 20
	20 40
wem Module	+0 ∡1
	+1 40
	43
wem Computation Panel	44 46
	+b
wem Advanced Panel	47
wem Experimental Panel $\ldots \ldots 2^2$	48

Inline Section Operations	249
gathers Module	249
gathers Menus	250
File Menu	250
View Menu	251
Picking Menu	252
Functions Menu	253
Surfaces Menu	254
Gathers Settings Window	255
Clips Window	256
Wiggle View Parameters Window	257
Autopicking Parameters Window	258
Build Model Window	260
Semblance Parameters Window	262
Set Background Model Window	264
Gathers Toolbar	265
XLine Operations	267
CDP Gathers Operations	269
Shot Gathers Operations	271
eyeGlass Cluster Monitor Operations	273
File Formats	277
Topographic Migration Velocity Analysis	2/9
Generalized Topographic Migration Analysis	280
	280
	281
	283
Migrating from Topography	285
	286
Workflow	286
Topographic Migration Velocity Analysis in MARVEL	-287
	207
Depth Migration from Topography	287
Depth Migration from Topography	287 288
Depth Migration from Topography	287 288 290
Depth Migration from Topography       Depth To Time Conversion         Depth To Time Conversion       Depth Velocity Update from Topography         Depth Velocity Update from Topography       Depth Velocity Update from Topography         Data Preparation       Depth Velocity	287 288 290 290
Depth Migration from Topography       Depth To Time Conversion         Depth To Time Conversion       Depth Velocity Update from Topography         Depth Velocity Update from Topography       Depth Velocity Update from Topography         Data Preparation       Fixed Datum versus Real Surface	287 288 290 290 290
Depth Migration from Topography       Depth To Time Conversion         Depth To Time Conversion       Depth Velocity Update from Topography         Depth Velocity Update from Topography       Depth Velocity Update from Topography         Data Preparation       Fixed Datum versus Real Surface         Building the Actual Surface       Depth Velocity	287 288 290 290 290 290
Depth Migration from Topography       Depth To Time Conversion         Depth To Time Conversion       Depth Velocity Update from Topography         Depth Velocity Update from Topography       Depth Velocity Update from Topography         Data Preparation       Fixed Datum versus Real Surface         Building the Actual Surface       Depth Velocity         Time Migration from Topography       Depth Velocity	287 288 290 290 290 291 291
Depth Migration from Topography	287 288 290 290 290 291 291 292
Depth Migration from Topography       Depth To Time Conversion         Depth To Time Conversion       Depth Velocity Update from Topography         Data Preparation       Depth Velocity Update from Topography         Fixed Datum versus Real Surface       Depth Velocity         Building the Actual Surface       Depth Velocity         Time Migration from Topography       Depth Velocity         Depth Estimation for PSTM Topography       Depth Velocity         Time Velocity       Update from Topography	287 288 290 290 290 291 291 291 292 293
Depth Migration from TopographyDepth To Time ConversionDepth Velocity Update from TopographyData PreparationFixed Datum versus Real SurfaceBuilding the Actual SurfaceTime Migration from TopographyDepth Estimation for PSTM TopographyTime Velocity Update from TopographyExample: The NewTopo Project	287 288 290 290 290 291 291 291 292 293 294
Depth Migration from TopographyDepth To Time ConversionDepth Velocity Update from TopographyData PreparationFixed Datum versus Real SurfaceBuilding the Actual SurfaceTime Migration from TopographyDepth Estimation for PSTM Topography OutputTime Velocity Update from TopographyExample: The NewTopo ProjectDepth Migration	287 288 290 290 290 291 291 292 293 294 295

3D Surface Related Multiple Elimination	301
Auto Convolution	301
Multiple Suppression	302
Wavelet Estimation	302
Parameterization	302
Data Assumptions	304
eveBeam Module	305
Overview	305
Data Preparation	307
Parameterization	308
diskRead	308
eyeBeam	312
Index	323

# **About This Book**

This book contains information about installing and licensing the MARVEL program developed by Panorama Technologies.

The book is intended for people doing seismographic data analysis, specifically migration, residual velocity analysis, and interpretation. This includes students in applied geophysics and employees of the petroleum industry, particularly those who deal with seismic migration as processors or interpreters, as well as anyone who is interested in the methodology of subsurface imaging using reflection seismology.

The book assumes that you are familiar with the following topics:

- using the operating systems and applications in your enterprise
- editing and saving text files
- performing seismographic data analysis

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## Conventions

This book uses the following special conventions:

- All syntax, operating system terms, and literal examples are presented in this typeface.
- Variable text in path names, system messages, or syntax is displayed in italic text: testsys/instance/fileName.
- File names and paths are displayed as path/filename.
- The symbol => connects items in a menu sequence. For example, Actions => Create Test instructs you to choose the Create Test command from the Actions menu.
- If you move the cursor over text shown in blue, such as Chapter 1, the cursor will change to a pointer. If you then click the cursor, Acrobat Reader displays the location indicated by the text.
- Web and email addresses are shown as underlined blue text, such as <u>www.panoramatech.com</u>, and will open your default web browser when you click the mouse cursor on the link.

Chapter

# Introduction

This chapter provides a brief overview of the MARVEL Migration and Residual Velocity Analysis program by Panorama Technologies.

Determining the structure, composition, and state of the earth's subsurface from measured data is the principal task of many geophysical experiments or surveys. Standard procedures involve the recording of appropriate data sets followed by the application of data analysis techniques to extract the desired information.

Panorama Technologies provides a complete suite of interpretive processing software for the oil and gas industry, including fast, flexible Kirchhoff migration, common azimuth migration, shot profile migration, and full wave-equation velocity inversion. Our fully-distributed software is the fastest and most accurate in the industry for prestack time migration and prestack depth migration.

Table 1 contains short descriptions of the chapters and appendices in the book.

Chapter	Title	Description
1	Introduction	Provides a brief introduction to the book contents.
2	Project Operations	Defines the relationship between global and local coordinates. These relationships allow the various technologies in MARVEL to process and position the output data relative to its true surface location(s).
4	jobBuilder Operations	Constructs the processing stream and parameters for specific distributed seismic processing jobs.
5	Inline Section Operations	Enables you to visually inspect and interact with line- oriented data.
6	XLine Operations	Enables you to visually inspect and interact with crossline-oriented data.
7	CDP Gathers Operations	Enables you to visually inspect and interact with display data. You can also pick time-velocity pairs and time-mute pairs.
8	Shot Gathers Operations	Enables you to perform a visual inspection of shot records and to select the shot range you want to process.
9	eyeGlass Cluster Monitor Operations	Provides the ability to monitor current CPU status and define the cluster on which distributed jobs will be executed.
A	File Formats	Provides information about the XML data structures used in the MARVEL control files.
В	Topographic Migration Velocity Analysis	Provides a work flow on which topographic migration velocity analysis can be based, including specific information about using topographic migration analysis in MARVEL.
C	3D Surface Related Multiple Elimination	Explains the parameters defining Panorama Technologies' 3D Surface Related Multiple Elimination algorithm (SRME3D) and provides a brief explanation of the assumptions underlying the process.

Table I.	Chapter	Descriptions
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Chapter 2

# **Project Operations**

Project Operations defines the relationship between global or world coordinates and local coordinates. These relationships allow the various technologies in MARVEL to process and position the output data relative to its true surface location(s). The data is stored as an XML file having a .project extension. You can edit an existing project file using the Project panel or with any text editing tool, such as vi.

# **Project Panel**

The Project Panel enables you to select the seismic files you want to process with MARVEL, including datasets, models and output. Figure 1 shows the data tab, while Figure 2 shows the preferences tab. The fields on the panel are described in Table 2.

#### Figure I. Project Panel, Data Tab

<u>A</u> ctions	: <u>U</u> tilitie:	s <u>H</u> ∈	≥lp			
0 0		4	Q			
	1			 		 
ata: mode		prete	rences			
Seismic Fil	es					
Coordinate	5					
Coordinate	5					
Coordinate	s			Line 0	0	
Coordinate Cdp 0 x0	s 0			Line 0	0	
Coordinate Cdp 0 x0 dx	s 0 0			Line 0 y0 dy	0 0 1	
Coordinate Cdp 0 x0 dx Angle	s 0 0 1			Line 0 y0 dy Angle Unit	0 0 1 Degrees	
Coordinate Cdp 0 x0 dx Angle	s 0 0 1 0			Line 0 y0 dy Angle Unit	0 0 1 Degrees	

#### Figure 2. Project Panel Preferences Tab

	~			
	×			
ata model output prefere	nces			
-Preferences				
	-			
Line Byte (Input Seismic)	0			
Cdp Byte (Input Seismic)	0			
# Panels in CDP mode	1			
# Panels in shot mode	1			
Calculate Midneinte	No			
Calculate mupoints				-
X Bin	1			
Y Bin	1			
Coordinates				
Cdp 0		Line 0	0	
		Lineo	0	
x0 0		уO	0	
dx 1		dy	1	
Angle 0		Angle Unit	Degrees	<b>±</b>
			L	
System Left	<b>±</b>			

#### **Table 2. Project Panel Fields**

Tab	Description
Tabs	
data	Displays a list of all open seismic files in the Seismic Files display area. Seismic files are selected from the File menu (see File Menu).
model	Displays a list of all open model files in the Model Files display area. Model files are selected from the File menu (see Project Menus and Toolbar).
output	Displays a list of all selected output volumes in the Output Volumes display area. Output volumes are selected from the File menu (see Project Menus and Toolbar).
preferences	Enables you to modify project preferences.

Tab	Description
Coordinates	
Cdp 0	Default: 0
Line 0	Default: 0
x0	Default: 0
y0	Default: 0
dx	Defines the CDP spacing. Default: 1
dy	Defines the line spacing. Default: 1
Angle	Default: 0
Angle Unit	The angle unit associated with the angle, either degrees or radians. Default: Degrees
System	Defines the model system to be used for the current display, that is, whether the project is to be a left-hand or a right-hand system. Default: Left
Preferences	
Line Byte (Input Seismic)	
Cdp Byte (Input Seismic)	
# Panels in CDP mode	The default number of panels to display in CDP mode.
# Panels in shot mode	The default number of panels to display in shot mode.
Calculate midpoints	
X Bin	
Y Bin	

#### Table 2. Project Panel Fields-continued

# Project Menus and Toolbar

Project operations has a File menu, an Actions menu, and a toolbar.

### File Menu

The Project operations File menu, Figure 3 contains the eight commands described in Table 3.

#### Figure 3. File Menu

<u>F</u> ile	<u>A</u> ctions	
<u></u>	<u>N</u> ew Project	Ctrl+N
9	<u>O</u> pen Project	Ctrl+O
(	Open Seismic	
	Open Model	
. I	Open Output Volume	
	<u>S</u> ave	Ctrl+S
:	Save as	
1	<u>Q</u> uit	Ctrl+Q

#### Table 3. File Menu Commands

Menu Item	Description
New Project	Creates a new project, resetting all project settings to their default values, and clearing the project files lists.
Open Project	Displays standard File Open dialog box enabling you to open an existing project file having a .project extension.
Open Seismic	Displays standard File Open dialog box enabling you to open an existing seismic data file having a .segy extension.
Open Model	Displays standard File Open dialog box enabling you to open an existing model file having a .segy extension.
Open Output Volume	Displays standard File Open dialog box enabling you to open an existing output data file having a .segy extension.

Menu Item	Description
Save	Saves the displayed project data as a project file. Open a Save As dialog box if you are attempting to save an unnamed project.
Save as	Opens a Save As dialog box enabling you to save the project data to the file you specify.
Quit	Quits the MARVEL program.

#### Table 3. File Menu Commands-continued

### **Actions Menu**

The Project operations Actions menu, Figure 4, contains the four items described in Table 4.

#### Figure 4. Actions Menu



#### **Table 4. Actions Menu Commands**

Menu Item	Description
View cdp map	Displays a map of the CDP versus EP (shotpoint) values. See View CDP and Shot Maps.
View shot map	Displays a map of the shot versus EP (shotpoint) values. See View CDP and Shot Maps.
Reindex Data	
Run job builder	Displays the JobBuilder panel. See jobBuilder Operations.

## Toolbar

The Project operations toolbar, Figure 5 contains the five items described in Table 5.

#### Figure 5. Project Toolbar



#### Table 5. Toolbar Commands

Symbol	Description
Г	Creates a new project, resetting all project settings to their default values,
	and clearing the project files lists.
0	Opens a project dataset.
	Saves the project using the current project name.
	Sends the project XML file to the default printer.
Q	Scans the model identified in the project to get the coordinates specified in the model for display in the Coordinates pane at the bottom of this window.

# View CDP and Shot Maps

Figure 6 shows a sample CDP map displayed in MARVEL. Note that the figure shows a selection of the CDPs, shown in black. Figure 7 shows a sample shot map displayed by MARVEL. The fields in the figure are defined in Table 6. The items in the File menu and the Actions menu are defined in Table 7 and Table 8, respectively.



#### Figure 6. Sample CDP Map with Selection

#### Figure 7. Sample Shot Map



Data Field	Description
Num Ensembles	The actual number of CDPs or shots in the project.
Num Selected	The number of CDPs or shots that have been selected (in black in Figure 6).
Min Fold	The smallest number of traces in a CDP or shot map.
Max Fold	The maximum number of traces in a CDP or shot map.

#### Table 6. View CDP and Shot Data Fields

#### Table 7. File Menu

Command	Description	
Open	Opens a new dataset. MARVEL displays a new CDP map of the dataset.	
Save	Saves the selected area of the CDP map into a dataset.	
Save as	Saves the selected area of the CDP map into a dataset.	
Quit	Closes the Project module and display.	

#### Table 8. Actions Menu

Command	Description
View	Displays selected CDP or shot maps. The number of sequential maps displayed at one time depends on the value of the panel setting. This command is the same as the magnifying glass.
Run	Job Runs the JobBuilder program (see jobBuilder Operations). The parameters from this panel are entered automatically in the appropriate locations in the JobBuilder panel.

Chapter 3

# jobBuilder Operations

jobBuilder Operations constructs the processing stream and parameters for specific distributed seismic processing jobs.

#### Note:

A field name shown in red, such as Files in Figure 8, indicates that the field is a required entry. Also, if a tab name is <u>underlined</u>, such as the <u>Main</u> tab in this figure, at least one of the fields in the tab is a required entry.

#### Figure 8. Example jobBuilder Panel

ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp							
	ß	å 🕁 🗣	$\nabla$	Proj	ect:			
Job Cluster								
Modules 🔺		Job Flow		•	d is kWrite			
Main	1	diskWrite			Main Doc			
angle2 offset	2							
antialias	3				Files			
autopick	4							
bias	5			1	Mode	Overwrite	<b>±</b>	
bulkStatic	6			1				
collect	7				Format	IEEE Float	±	
de mig	8							
diskRead	9				Max File Size (MB)	0		
dis kWrite	10				Max Traces per file	0		
eyeBeam	11							
filter	12				Split Header Key			
	13			¥				

# jobBuilder Panel

Figure 9 shows the jobBuilder panel. This panel enables you to select the components you want to use to process your seismic data set. Table 9 defines the terms used on the panel.

#### Figure 9. jobBuilder Panel

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File Job U</u> tilitie:	ss <u>H</u> elp	
	] 🕒 Å & ♥ ▼ Project	Ŧ
Job Cluster	No module	
Main - angle2offset - antialias - auto blute - auto pick - blas - bulk Static - collect - culect - culect - culect - demig - diskRead - diskRea	you now       1       2       3       4       5       6       7       8       9       10       11       12       13       14       15	

#### Table 9. jobBuilder Modules

Module	Description
angle2offset	
antialias	Enables you to eliminate unwanted portions of the spectra and frequencies that might cause aliasing when the sample rate is decreased during seismic processing.
autoMute	Reads and automatically extracts mute information from an input data stream. The mute information is then written to a mute (.pick) output file.
autopick	Uses a shifted-hyperbola technology to calculate the semblance and constant velocity stacks of an input CDP.
bias	Calculates the trace bias (dc) within a sliding window, and either outputs the debiased trace or the bias function.

Таb	Description
bulkStatic	Applies a bulk static to each trace in an input data stream.
collect	Stacks output from migrations.
deimg	
diskRead	Controls reading information from .segy data files.
diskWrite	Controls writing MARVEL output data to a data file.
eyeBeam	Panorama Technologies' parsimonious beam migration program.
fdmod2d	
filter	Applies a (f, k) domain pie shaped filter to an input ensemble or gather of traces. This gather can be a line, cdp, or shot record, but you are responsible for selecting the appropriate data and building the job stream to supply it to dipFilter.
gain	Scales each input trace by either a fixed power of time or a time-variant automatic gain control, or both.
hdrMath	Changes header words.
kmodel	
importVtp	Imports VIEWS VTP or FOCUS HANDVEL time-velocity pairs from an input file and converts them to the internal format used by Panorama Technologies. The output file name is just the input file name with .picks appended.
interpshot	
kdm	Performs Kirchhoff Depth Migration.
km	Performs Kirchhoff curved-ray time migration.
Merlin	Panorama Technologies' two-way wave equation program for modeling, velocity analysis and depth imaging.
MORK	Panorama Technologies' one-way migration module.
moveout	Applies normal moveout (NMO) or the inverse of NMO to input traces.
mute	Mutes above, below, or along a linearly interpolated curve whose width is defined by the times in the mute file, or by the mute X and T values.
oned	
parsim	

#### Table 9. jobBuilder Modules-continued

Tab	Description	
pef		
postproc		
pruneShooter	<ul><li>Provides an interface to a dynamic-anisotropic-maximum-energy traveltime generator.</li><li>Note: The pruneshooter and shooter modules are provided for compatibility purposes only. You should use the rayshooter module, instead.</li></ul>	
raw		
rayshooter	Provides an interface to a dynamic-anisotropic-maximum-energy traveltime generator. The rayshooter module completely replaces the pruneshooter, rayshooter, and shooter modules.	
resamp3d		
resample		
rtmodel	Provides an interface to the reverse time modeling module.	
scan	Performs scans, thresholds input traces and outputs various statistical quantities.	
semblance	Computes the semblance panel for a given CDP gather.	
shooter	<ul> <li>Provides an interface to a dynamic-anisotropic-maximum-energy traveltime generator.</li> <li>Note: The pruneshooter and shooter modules are provided for compatibility purposes only. You should use the rayshooter module, instead.</li> </ul>	
smoother	Enables you to control the smoothing operation performed on the output data.	
stack	Stacks all traces in a given gather.	
staticShift	Calculates and applies elevations statics. The statics can be calculated from information stored in the trace headers, or the module can simply apply a single static shift already stored in an appropriate header location. The module assumes that appropriate elevations are already stored in the trace headers.	
timeDepth	Converts time-to-depth and depth-to-time.	
trsum	Performs basic operations on the input data stream.	

#### Table 9. jobBuilder Modules-continued

Таb	Description
trWindow	Performs a spatial windowing operation on the input data stream.
wem	Panorama Technologies' wave-equation migration module. This module can run in either the common-shot mode for pre-stack shot-profile migrations, or it can run in the poststack mode for post-stack migrations. Regardless of which mode is selected, this is a one-way phase panel method.

#### Table 9. jobBuilder Modules-continued

## jobBuilder Menus and Toolbar

The jobBuilder module has a File menu (Figure 10), a Job menu(Figure 11), and a toolbar (Figure 12).

### File Menu

#### Figure 10. File Menu



#### Table 10. File Menu Commands

Command	Description
New	Removes all modules from the job flow.
Open	Displays a dialog box enabling you to select and open an existing MARVEL job (.job extension).
Open project	Displays a dialog box enabling you to select and open an existing MARVEL project (.project extension).
Save	Saves the current jobBuilder information to the open job file.
Save as	Displays a dialog box that enables you to save to jobBuilder information to the file you specify.

### Job Menu

The Job menu, Figure 11, contains only one command that enables you to run the open job against a project.

#### Figure II. Job Menu



### Toolbar

The jobBuilder toolbar, Figure 12, enables you to perform certain operations without accessing the menu items.

#### Figure 12. jobBuilder Toolbar

🗋 😋 🖨 🍰 🏂 🏠 🕂 🗣 🛛 ▼ Project:

Icon	Description
D	Removes all modules from the job flow in preparation for creating a new job.
Ð	Displays a dialog box enabling you to select and open an existing MARVEL job (.job extension).
	Saves the current jobBuilder information to the open job file.
Đ	Sends the current job file to the default printer.
≿	Runs the open job against a project.
\$ P	Changes the order modules in the job list.
V Project:	Changes the order of modules in the job list.

#### Table II. jobBuilder Toolbar Commands

# angle2offset Module

#### Figure 13. angle2offset Panel

000	🔀 jobBuilder	- Marvel Version	2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp			
	🖺 🍰 🏠 🗣 🔻 Proje	ct: /net/praha06/data1/j	hu/projects/segaap/segslab.project	*
Job Cluster Modules Main M	<ul> <li>▲ Job Flow</li> <li>1 angle2offset</li> <li>2</li> <li>3</li> <li>4</li> <li>5</li> <li>6</li> <li>7</li> <li>8</li> <li>9</li> <li>10</li> <li>11</li> <li>12</li> <li>13</li> <li>14</li> <li>15</li> </ul>	ngle2offset Main Doc Line Key CDP Key Offset Key	ep cdp offset Min 60 Max 60 Inc 1	

#### Table 12. angle2offset Panel Fields

Field	Description
Line Key	The header key specifying where line data is stored in the trace. default: ep
CDP Key	The header key specifying where CDP data is stored in the trace. default: cdp
Offset Key	The header key specifying where offset data is stored in the trace. default: offset
Output Offsets (m/ft)	Min (default: -60), Max (default: 60), Inc (default:1)

## antialias Module

This module enables you to eliminate unwanted portions of the spectra and frequencies that might cause aliasing when the sample rate is decreased during seismic processing.

#### Figure 14. antialias panel

000 🛛	obBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🖨 🖬 🛔 🎄 🛧 🛡 P	oject:	<b>±</b>
Job     Cluster       Main	antialias       Main Doc       Project       Output Lines       Min       Max	
outletest         7          demig         8          diskRead         9          diskWrite         10          eyeBeam         11          fdmod2d         13	Output XLines     Min     Max     Inc       X Aliasing (cdps)     1       Surface Velocity (m/s, ft/s)	
	Remove Evanescent Yes 💌	

#### Table 13. antialias Panel Fields

Field	Description
Project	The project file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. <b>This is a required entry.</b> default: Project selected with File=>0pen Project command.
Output Lines	Min, max, and increment for lines in the output volume. <b>This is a required entry.</b>
Y Aliasing (lines)	The inline anti-aliasing distance, in units of lines.
Output XLines	Min, max, and increment for xlines (cdps) in the output volume. This is a required entry.
X Aliasing (cdps)	The crossline anti-aliasing distance, in units of lines.
Surface Velocity (m/s, ft/s)	The near surface velocity in Equation 2 on page 25.

Field	Description
Remove Evanescent	Do you want to remove seismic noise from the processing (which is typically in the form of exponentially decaying evanescent waves)? Yes or No

#### Table 13. antialias Panel Fields-continued

## autoMute Module

This module reads and automatically extracts mute information from an input data stream. The mute information is then written to a mute (.pick) output file.

#### Figure 15. autoMute Panel

🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
Project:	<b>±</b>
-autoMute       Main Doc       Output File       Line Key       Cdp Key       cdp       Offset Key       Offset Key       Mute Source	
Set Header No Verbose No Verbose	
	▼ JobBuilder - Marvel Version 2.1.1.31pre3, Panorama Tech         ▼ Project:         autoMute         Main Doc         Output File         Line Key         ep         Cdp Key         Cdp         Offset Key         offset Key         Scan from Data         Threshold         100         Set Header         No         Verbose

#### Table 14. autoMute Panel Fields

Field	Description
Output File	The name of the .pick file that will be created by autoMute.
Line Key	The header key specifying where line data is stored in the trace. default: ep
Cdp Key	The header key specifying where CDP data is stored in the trace. default: cdp
Offset Key	The header key specifying where offset data is stored in the trace. default: offset
Mute Source	Scan from Data, Read from Header
Threshold	Percentile threshold for mute detection. This field is displayed only if the Mute Source is Scan from Data. default: 100
Mute Key	Header key signifying the start of the mute values. default: muts

Field	Description
Set Header	If this toggle is set to Yes, set the indicated header in the output trace.
Verbose	Switch for turning debug printing on and off. default: No

#### Table 14. autoMute Panel Fields-continued

### autopick Module

### Theory

The autopick module uses a sophisticated shifted-hyperbola technology based loosely on the paper, Normal Moveout Revisited: Inhomogeneous Media and Curved Interfaces, by Eric de Bazelaire in the February 1988 issue of GEOPHYSICS. The module is able to calculate the semblance and constant velocity stacks of an input CDP rapidly using this technology. The computed ensembles are then used to automatically determine the optimum RMS stacking or migration velocity. The time-velocity pairs specifying peak semblance values at each time-increment are selected, and then edited to assure that the number of spurious values is held to a manageable level.

Traditionally, normal moveout is governed by an equation of the form shown in Equation 1, where  $t_0$  is vertical time and t is the arrival time at half-offset h. In this case, v is the velocity of a homogenous medium with a single reflector at depth  $0.5vt_0$ .

#### **Equation I:**

$$t^2 = t_0^2 + \frac{h^2}{4v^2}$$

While this equation has been used effectively for velocity analysis for many years, it has several deficiencies. The primary deficiency is that using it to correct large offset data dynamically to vertical time requires excessive stretching, and as a result can significantly reduce the frequency content of the data.

A second deficiency occurs because the stretch, as specified by  $t - t_0$ , has considerable variation as a function of h and v, calculating multiple stacks or semblance panels can become computationally expensive when the number of such panels is large. In addition, if the medium is not homogeneous and has even a few curved interfaces, the difference between the stacking velocity estimated by the traditional equation, Equation 1, and the true RMS velocity can be quite large.

In his 1988 paper, de Bazelaire showed that both of the difficulties with the traditional equation, Equation 1 are overcome by using an equation of the form shown in Equation 2, where  $v_a$  is a near surface velocity and  $t_p$  is related to the time of a shifted hyperbola fitting the arrival time curve on a given gather.

Equation 2: 
$$(t - t_0 + t_p)^2 = t_p^2 + \frac{h^2}{4v_a^2}$$

You can rewrite the hyperbola equation as a shift, as shown in Equation 3.

**Equation 3:** 
$$t - t_0 = \Delta t = t_p + \sqrt{t_p^2 + \frac{h^2}{4v_a^2}}$$

You can see that calculating stacking or semblance panels is purely a function of a single shift used for every time value in a trace. Note that the two variables of interest in Equation 3 are  $\Delta t$  and  $t_p$ . Thus, you are computing and picking  $(t_0, t_p)$  panels computed through  $\Delta t$ .

For any given  $(t_0, t_p)$  pair, the correct stacking velocity can then be obtained from Equation 4.

#### **Equation 4:**

$$v = v_a \sqrt{\frac{t_0}{t_p}}$$

Thus, this approach provides an efficient approach to computing accurate stacking velocities in a fully automatic manner over the entire 3D project volume.

### autopick Input Model Panels

The autopick module has three forms of the Input Model panel, depending on the Model Type you select: Single Function (Figure 16), Gridded Seismic (Figure 17), or Picks (Figure 18). The parameter fields on these panels are described in Table 15.

#### Figure 16. autopick Module Input Model-Single Function Model Panel

○ ○ ○ X jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 🕀 🖬 🖨 & 🗣	V Project:	<b>±</b>
Job Cluster		
Modules A Job Flow	autopick	
Main mangle2offset	Input Model Computation Input Data Output Main Project Advanced Job Doc	
	Model Type Single Function	
automute autopick 4		
bias 5 bulkStatic 6		
collect 7	time s	
de mig 8	vels 🕨	
diskWrite 10	va 1500	
#### 000 🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech <u>File Job U</u>tilities <u>H</u>elp 🗋 🚭 🖶 🚔 🎘 🏠 🗣 🛡 Project: ¥ Job Cluster autopick – • Modules Job Flow Main Input Model Computation Input Data Output Main Project Advanced Job Doc 1 autopick ---angle2offset 2 Gridded Seismic --- antialias ModelType ¥ 3 autoMute autopick 4 Guide model (RMS) Ð - bias 5 ---- bulkStatic 6 collect lineKevModel ep 7 ---cuda-test cdpKeyModel cdp 8 --- de mig - diskRead 9 - dis kWrite 1500 10 va yeBeam ♥ 10 eyeBeam ¥ 4

#### Figure 17. autopick Module Input Model-Gridded Seismic Model Panel

#### Figure 18. autopick Module Input Model-Picks Model Panel

OOO 🛛 jobBu	ilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
Eile Job Utilities Help	Project.	
Job Cluster       Modules     Job Flow       Main     1	Autopick     Input Model Computation Input Data Output Main Project Advanced Job D     Model Type     Picks     Guide model (RMS)     va     1500	

#### Table 15. autopick Input Model Panel Fields

Field	Description
Model Type	Type of guide model input: Single Function, Gridded Seismic, or Picks. default: Single Function
times	Pick times for a (single) guide function.
vels	Pick velocities for a (single) guide function.
va	The near surface velocity in Equation 2 on page 25. default: 1500

#### continues on next page

Field	Description
Guide Model (RMS)	RMS velocity guide function.
lineKey Model	Header key for line data in model. default: same as data
cdpKey Model	Header key for CDP data in model. default: same as data

### Table 15. autopick Input Model Panel Fields-continued

## autopick Computation Panel

The autopick Computation panel shown in Figure 19 enables you to set the values of several parameters used in generating autopicks. The fields are described in Table 16.

File Job Utilities Help	obBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
□	oject //ret/praha06/data1/jhu/projects/segaap/segslab.project
Job Cluster	
Modules A Job Flow	-autopick
Main 1 autopick	Input Model Computation Input Data Output Main Project Advanced Job Doc
- angle2offset - antialias - autoblute - autopick - bias - bias - bias	studt [2400
- collect         6           - collect         7           - demig         8           - diskRead         9	enddt soo
-disWite 10 -eyeBeam 11 -fdmod2d 11 -filter 12	incdt -5
-gain 13 -hdrMath 14 -importVtp -interpShot 15	taper 0
	bvw 2000
- mork - mork - moveout - mute - oned	hiw 4000
<b>∀</b> (1)	

### Figure 19. autopick Module Computation Panel

### Table 16. autopick Computation Panel Fields

Field	Description
strdt	Starting dt value for the (t0, tp) analysis. default: 2400
enddt	Ending dt value for the (t0, tp) analysis. default: -800
incdt	Increment for the dt value. The value should always be negative. default: -5
taper	The number of traces to taper. default: 0
loovw	The short-time velocity width of the picking window. default: 2000
hivw	The long-time velocity width of the picking window. default: 4000

### autopick Input Data Panel

The autopick module has two forms of the Input Data panels, depending on whether you set Mute Input to No (Figure 20), or Yes (Figure 21). The parameter fields on these panels are described in Table 17.

#### Figure 20. autopick Input Data Panel, Mute Input No

	🖹 & 🖒	⊕  ▼  Pro	iect:		
Job Cluster					
Modules	▲ Job Flow	<b>^</b>	autopick		
Main	1 autopick		Input Model Computa	tion Input Data Output Main Project Advanced Job Doc	
angle2 offset	2				
antialias	3		Mute Input No		±
auto Mute					
autopick	4	[%]	minfold 2		
bias	5				
bulkStatic	6		maxfold 1000		
collect	7		line Key		
cuda-test	0		intercey ep		
de mig	0		cdpKey cdp		
diskRead	9				
diskWrite	10		Offset Key offset		
eyeBeam	¥ 11				

### Figure 21. autopick Input Data Panel, Mute Input Yes

	4	ŝ 🕯	<b>₽</b> ▼	Project:						
b Cluster										
lodules	•	Job Flow		-autopick						
ain	1	autopick		Input Model	Computation	Input Data	Output I	Main Projec	t Advanced	Job Doc
angle2offset	2									
antialias	3			Mute Incut	Yes					
auto Mute	4 4	-		mute input						- i
bias	× -	-								
bulkStatic	5			minfold	2					
collect	0									
cuda-test	<u> </u>			maxfold	1000					
de mig	8	_								
diskRead	9			lineKey	ep					
eveBeam	10									
fd mod2 d	11			cdpKey	cdp					
filte r	12									
gain	13			Offset Key	offset					
···· hdrMath	14									
····importVtp	15			Mute-Start	Cey muts					
kdm										
				Mute-End K	ey mute					

Field	Description
Mute Input	Flag indicating whether or not the data is to be muted internally. default: No
minfold	This is the minimum input data fold. Nothing is done for smaller gathers. default: 2
maxfold	The maximum input data fold. default: 1000
lineKey	Header key for a line in the trace. default: ep
cdpKey	Header key for a CDP in the trace. default: cdp
Offset Key	Header key for offset in the trace. default: offset
Mute Start Key	Header key signifying the start of the mute values. default: muts
Mute End Key	Header key signifying the end of the mute values. default: mute

### Table 17. autopick Input Data Panel Fields

### autopick Output Panel

The autopick Output panel contains only one variable, Output. You can set the value to Picked Trace, Stack and Velocity Trace, TP Panel, TP Semblance, or Velocity Trace. The default value is Picked Trace.

## autopick Main Panel

Figure 22 enables you to change the values of several parameters used in the autopicking process, Table 18.

ile Job <u>U</u> tilities j				
		roject: /net/pr	anavo/data1/jnu/projects/segaap/segstab.project	
Job Cluster				
Modules 🔺	Job Flow	-autopick		
Main	1 autopick	Input Mod	el Computation Input Data Output Main Project Advanced Job Doc	
ang k2 offset antialias auto Mute bulk Static coluct coluct disk Kead disk Write eye Beam fdmod 2d	2 3 3 4 5 6 7 7 8 9 10 11	numav vout seis pct	0       100	] ] ]
filter gain hdrMath importVtp interpShot	12 13 14 15	pct2 xdt	99000	]
kdm km kmodel merlin mork		etime	1	]
···· moveout ···· mute ···· oned		ttime	1	

#### Figure 22. autopick Module Main Panel

#### Table 18. autopick Main Panel Fields

Field	Description
numav	The number of iterations of a two-point, two-dimensional running average that is applied to computed (t0, tp) panels to stabilize the picking process. default: 5

continues on next page

Field	Description
vout	The velocity output format, vout, can be set to 0, 1, 2, 3, or 4, where
	<ul> <li>0 tells autopick to output velocities</li> <li>1 outputs picked velocities</li> <li>2 outputs reference velocities</li> <li>3 outputs interval velocities using the Dix equation</li> <li>4 outputs reference velocities</li> </ul>
	default: 0
seis	The kind of seismic data to output. The value can be set to 0 or 1, where 0 means to output the stacked trace, while 1 means to output the amplitudes at the pick points only. default: 0
pct	The percent of the current picked function to add to the current reference function to use in picking the next CDP. default: 100
pct2	The percent of the current picked function to add to the new model velocity trace to generate the next reference function. default: 100
xdt	The maximum deviation from current reference. default: 99000
etime	An override time at which picking stops and the reference function is used to define velocities. Normally, this is set to the maximum trace time. default: -1
ttime	The duration used to merge picked and reference times. This parameter is normally set to the sampling increment. default: 1

### Table 18. autopick Main Panel Fields-continued

### autopick Project Panel

The autopick Project panel enables you to set the CDP and line spacing.

- *dx* defines the CDP spacing. The default is 12.5.
- *dy* defines the line spacing. The default is 12.5.

### autopick Advanced Panel

The autopick Advanced panel contains two variables that enable debugging control.

- *verbose* is a switch for turning debug printing on and off.
- *debug* is a switch for turning debug on and off.

### autopick Job Panel

There are two fields on this job control panel: MasterisWorker and RunWorkersLowPriority.

- *MasterisWorker* controls whether the master I/O controller is also used for migrating data. The default is *Yes*.
- If *Runworkerslowpriority* is set to *Yes*, workers will be spawned with reduced priority. although the master process will remain at high priority. This can be useful especially when *MasterIsWorker* is set, so that one worker does not slow down collection or submission of shots for all of the others.

## bias Module

The bias module calculates the trace bias (dc) within a sliding window, and either outputs the debiased trace, or the bias function. The bias panel is shown in Figure 23, and the fields are described in Table 19.

### Figure 23. bias Panel

	8 <b>A J V</b>	Project: /net/nraha06/dat	a1/ihu/nmiects/senaan/sensiah nmiect	
		nojeet. Inceptanaoo/aat	ariun polecui seganti seganti poleci	
Modules     Image: Cluster       Main	Job Flow bins	bias Main Doc Keys Output	Cakulated bias	
fdrod2d 11 fdrod2d 12 fdrod2d 12 		Window (ms/ft/m)	100	
km kmodel merlin mork mork mork mute oned		dt		

### Table 19. bias Panel Fields

Field	Description
Keys	The keys defining an ensemble.
Output	What kind of data to output: debiased data or calculated bias data. default: Calculated bias
Window (ms/ft/m)	default: 100
dt	Time interval to use if the value is incorrect in the header.

## bulkStatic Module

The bulkStatic module applies a bulk static correction to each seismic trace in time in an input data stream. A common static correction is the weathering correction, which compensates for a layer of low seismic velocity material near the surface of the Earth. Other corrections compensate for differences in topography and differences in the elevations of sources and receivers. The bulkStatic panel is shown in Figure 24, and the fields are described in Table 20.

### Figure 24. bulkStatic Panel

🔿 🔿 🔿 🔯 jobBuilder - Marvel Version 2.1.1.31pre3, Panorama Tech		
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🖨 🖬 🚔 🏦 🕀 🛡 PK	oject: /net/praha06/data1/jhu/projects/segaap/segslab.project	<b>±</b>
Job     Cluster       Modules     ▲       Job Flow       Main       -angle2offset       -angle2offset       -angle2offset       -angle2offset       -auto pick       bias       -collect       -collect       -collect       -diskRead       -diskRead       -diskRead       -filter       -gain       -hdrMath       -hdrMath       -km       -km       -km       -moork       -moveout       -mute       -oned	bulkStatic Main Doc verbose 0 stat 0 statKey	
<ul> <li>✓</li> <li>✓</li> <li>✓</li> </ul>		

### Table 20. bulkStatic Panel Fields

Field	Description
verbose	Switch for turning debug printing on and off. default: 0
stat	Bulk static correction to be applied to the data. default: 0
statKey	The key word to be used for statics data in the MARVEL format.

## collect Module

The collect module is designed to stack output from migrations. By default, it does this firstcome, first-served, and the output files will be unsorted. Choose the Preallocate Volume option in the collect panel to avoid this behavior.

The collect module panels are shown in Figure 25, Figure 26, and Figure 27, and the fields are described in Table 21.

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	Help
	🖺 🎘 🚯 🛡 Project
Job Cluster	
Modules	Job Flow collect
Main	1 collect Main Input Output Doc
angle2 offset	2
antialias	- Priert
auto Mute	
autopick	4
bias	5 Output File
bulkStatic	6
collect	7 Stream Key fldr
cuda-test	8 Number of Elements
demig	number of streams 2
diskWrite	
eveBeam	
fd mod2 d	11 Vor
filter	12 Restart
gain	13
hdrMath	Use Absolute Offset Yes
importVtp	
interp Shot	LS Keep Keys tstat
kdm	

### Figure 25. collect Main Panel

### Figure 26. collect Input Panel

OOO 🛛 🕅 jobBu	ilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
	Project:	<b>±</b>
Job Cluster		
Modules Job Flow	▲ -collect	
Main collect	Main Input Output Doc	
antialias 3	Fold Key cdpt	
autopick 4	Line Key ep	_ []]
bias 5 bulkStatic 6		
	Line Key cdp	
demig 8	Offset Header Key offset	
← diskRead ♥ 9		

### Figure 27. collect Output Panel

000	🔿 🔿 🔿 📉 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech			
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp				
	Ž 🕆 🗣 🛡 Proje	ject:	¥	
Job Cluster				
Modules 🔺	Job Flow	collect	1	
Main angle2offset 2	collect	Main Input Output Doc		
antialias 3	×	Output Lines Min Max Inc		
autopick 4		Output XLines Min Max Inc		
bulkStatic 6 collect 7		Output Depths (m/ft) Min Max Inc		
demig 8		Offset Bins Min Max Inc		
€ /// ▶ 10	•			

### Table 21. collect Panel Fields

Field	Description	
Main Panel		
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.	
Output File	The name of the file to be used for output.	
Stream Key	default: fldr	
Number of Streams	default: 2	
Preallocate Volume	Do you want MARVEL to allocate space for the output data before the job starts? Default: No	
Restart	Do you want to be able to restart the job? If Yes, the application will keep information about shots already processed in a restart file. Default: Yes	
Use Absolute Offset		
Keep Keys	default: tstat	
Input Panel		
Fold Key	The key word to be used for FOLD in the MARVEL format. default: cdpt	

continues on next page

Field	Description		
Line Key	The key word to be used for LINE in the MARVEL format. default: ep		
XLine Key	The key word to be used for XLINE in the MARVEL format. default: cdp		
Offset Header Key	The key word to be used for OFFSET in the MARVEL format. default: offset		
Output Panel			
Output Lines	The number of lines to be contained in the output data.		
Output XLines	The number of crosslines to be contained in the output data.		
Output Depths	The number of depths to be contained in the output data.		
Offset Bins	Specifies the offset bins in which to read the data.		

### Table 21. collect Panel Fields-continued

# deimg Module

### Figure 28. deimg Main Panel

OOO 🛛 🕅 jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>l</u> ob <u>U</u> tilities <u>H</u> elp		
0 🕀 🖶 🖕 🎸 🗣 🛡	Project:	<b>.</b>
Job Cluster		
Modules     Job Flow       Main     1     demig	demig       Main     Computation     Model     Input     Doc       Project	]
demig 8 diskRead 9 diskWite 10	Image 🔄	]
	Model	
Image: Second secon	•	

### Table 22. deimg Main Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Max Time (ms)	default: 4000
Output sample rate (ms)	default: 4
Image	This is a REQUIRED entry.
Model	

## deimg Computation Panel

<b>E</b> :	all a brook as			Devel
Figure 29.	aeimg	moaule	Computation	Panel

<u>File</u> Job <u>U</u> tilities	Image: Specific Stress     Image: Specific Stress       Image: Specific Stress     Image: Specific Stress			
	📄 🍰 🏠 🚯 👽 Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	•		
Job Cluster Modules Main 	Image: second			

### Table 23. deimg Main Panel Fields

Field	Description
Line Aperture (m/ft)	The length, in meters or feet, of the line direction aperture limit.
XLine Aperture (m/ft)	The length, in meters or feet, of the crossline direction aperture limit.

## deimg Model Panel

### Figure 30. deimg Model Panel

OOO 🛛 🕅 jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🖨 🖬 🚔 🏦 🗣 🛡	/ Project:	Ŧ
Job Cluster		
Modules Advantage of the second secon	Main     Computation     Model     Input     Doc       Velocity Type     Vp (vertical)     •	
autopick 4 bias 5 bulkStatic 6	Epsilon Model	
-cuda-test 7 	Phi Model	
	Theta Model	
gain 13 hdrMath ¥ 14 	Angle Dimension Degrees	

### Table 24. deimg Model Panel Fields

Field	Description
Velocity Type	Vp (vertical) or VNMO (vertical)
Epsilon Model	File containing a model of Thomsen's Epsilon.
Delta Model	File containing a model of Thomsen's Delta.
Phi Model	File containing a model of Thomsen's Phi.
Theta Model	File containing a model of Thomsen's Theta.
Angle Dimension	Degrees or Radians

## deimg Input Panel

### Figure 31. deimg Module Input Panel

O O O 🛛 🕅 jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
🗋 🖨 🖶 ಿ 🎄 🗣 🛡	Project:	Ŧ
Job Cluster		
Modules Job Flow	▲	
Main 1 demig	Main Computation Model Input Doc	
angle2offset autoMute autoMute	Line Header Key ep	
bias 5	CDP Header Key cdp	
collect 6 collect 7	Source X Header Key 5x	
<mark>demig 8</mark> diskRead 9	Source Y Header Key sy	
diskvme 10 eyeBeam 11	Receiver X Header Key gx	
filter 12 gain 13	Receiver Y Header Key gy	
← hdrMath ♥ 14 € /// ▶ 15	v	

### Table 25. deimg Input Panel Fields

Field	Description
Line Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing CDP designators. MARVEL usually uses cdp, which is a 4-byte integer at location 21 in SEG-Y files. default: cdp
Source X Header Key	Header key specifying where inline source locations are stored in the trace. default: sx
Source Y Header Key	Header key specifying where crossline source locations are stored in the trace. default: sy
Receiver X Header Key	Header key specifying where inline geophone data is stored in the trace. default: gx
Receiver Y Header Key	Header key specifying where crossline geophone data is stored in the trace. default: gy

## diskRead Module

The diskRead module enables you to select the seismic files you want to read. It also enables you to set parameters that control how this data is handled by MARVEL.

### diskRead Main Panels

The format of the diskRead Main panel depends on the Mode you select on the panel: General (Figure 32), Kirchhoff Migration (Figure 33), Beam Migration (Figure 34), or Shot Migration (Figure 35). The data fields are defined in Table 26.

000						🔀 jobBuilder – Marvel	l Version 2.1.1.31pre3, Panorama Tech	
<u>File J</u> ob <u>U</u> tilities	<u>H</u> e	lp						
hao	Þ	8		JR 7	7 Pro	iect:		
		$\sim$		•	v · · · ·			-
Job Cluster								
Madulas		1.	h Elsur		-	diskRead		
Main	<u> </u>	10	UD FIOW			Nain Advanced Calenting	Der	
angle2offset		ais	ккеаd		- II	Main Advanced Selection	LOC	
antialias	2				- 1			
auto Mute	3	:				Files		
autopick	4							
bias	5					Project		
bulkStatic	6				1			
collect	E				i	Skip Traces		
cuda-test	Ľ				- II	Hay Tores		
de mig	1				- II	max ridces		
diskRead	9	·				Mode	General 🗸	
diskwrite	1	0					-	
fdmod2 d	1	1						
filter	1	2						
gain		3			1 1			
hdrMath	H	4			i	Migrate All Offsets At Once	No 👻	
importVtp	H	-			- II			
interp Shot		5			- 1	Report (secs)	60	
kdm	2				- 1			
km					- 1			
kmodel					- 1	Calculate Bins	No 👱	
me rin					- 1			
monk					- 1	Calculate xy	No 👱	
mute					- 1			
oned					- 1			
parsim					- 1			
pef					- 1			
postproc					- 1			
prune Shooter					- 1			
rayShooter					- 1			
re samp3d					- 1			
re sample					- 1			
rtmodel								
scan								
shooter								
smoother					- 1			
stack					- 1			
static Shift					- 1			
time Depth								
trsum	¥							
< /// >								
L	-				_			I

### Figure 32. diskRead Main Panel, General

	1 & 🖨	♥ ₱ ₫	Project:				
Cluster							
ndular [	A 1-4 E		diskRead				
odules	JOD FI	ow					
	1 diskRe	ad	Main Advanced Selection	Doc			
antialias	2						
auto Mute	3		Files				
autopick	4						
bias	5		Project				
bulkStatic	6						
collect	7		SkipTraces				
demin	8		Max Traces				
diskRead	9						
diskWrite	10		Mode	Kirchhoff Migration		±	
eyeBeam	10						
fd mod2 d	11		Migrate All Offsets At Once	No		*	
filte r	12						
gain	13		Report (secs)	60			
hdrMath	14						
intern Shot	15		Quick Scan	No		<b>±</b>	
kdm	/ <b></b>						
km			Calculate Bins	No		±	
kmodel							
merlin			Calculate xy	No		Ŧ	
mork							
moveout							
mute			backupName	/scratch/MPIKT mig scratch			
narim			Officer Disc				
pef			Offset Bins	Min	Inc		
postproc			Offset Key	offset			
pruneShooter							
rayShooter			Offset Bin Key	nar			
re samp3d			Output Lines	Min Max	Inc		
re sample							
rtmodel			Output XLines	Min	Inc		
scan			Line Aperture (m/ft)				
shooter				· · · · · · · · · · · · · · · · · · ·			
smoother			XLine Aperture (m/ft)				
stack			Line Header Key	an			
static Shift			Line medder recy				
time Depth			CDP Header Key	cdp			

### Figure 33. diskRead Main Panel, Kirchhoff Migration

Cluster	4	\$ <b>1</b>	₽, 7	V Proj	ect:					
lodules	1	lob Elow			diskRead					
ain	1	diskRead			Main Advanced Selection	Doc				
angle2offset	1	uskiteau		- II	Main Manaced Delecton					
antialias	2	_		- 1	Cite -				—	-
auto Mute	з				Files					
autopick	4									
bias	5				Project					
bulkStatic	6								L	
collect	0			- II	Skip Traces					
cuda-test	7									
de mig	8				Max Traces					
diskRead	9	1				Dame Minertine				
dis kWrite	10				Mode	Beam Migration			<b>±</b>	
eyeBeam	10	-		- II						
fdmod2d	11	_		- II		No				
filte r	12				Migrate All Offsets At Once				<b>-</b>	
gain	13									
hdrMath	14				Report (secs)	60				
importVtp	15	-								
…interpShot	15	_			Calculate Bins	No				
kdm										
km					Calculate xy	No			<b>*</b>	
kmodel										
merlin					Patch Size (m/ft)	150				
mork										
moveout					Overlap Patches	No			<u>+</u>	
mute										
oned					Bundle Key	tracf				
parsim										
pet					backupName	/scratch/MPIKTmigscratch				R
postproc						-			L	
prune Shooter					Offset Bins	Min	< Contract of the second s	Inc		
- aysnooter										
- resampso					Offset Key	offset				
resample					Offerst Din Ken	Du.				
-scan					Onset Bin Key	tidr				
semblance					Output Lines	Min	<	Inc		
shooter										
smoother					Output XLines	Min Max	¢	Inc		
stack										
static Shift					Line Aperture (m/ft)					
time Depth					XI ine Anerture (m/ft)					
trsum					Same Apendie (Htt)					
trwindow					Line Header Key	ep				
wem										
					CDP Header Key	cdp				

### Figure 34. diskRead Main Panel, Beam Migration

Job <u>U</u> tilities	Help			
) 🖨 🖪 (	\$ ☆ ☆ ♥ ▼	Project:		
Chatta				
		distro-ad		
lodules 🔺	Job Flow	diskRead		
ain	1 diskRead	Main Advanced Selection [	Doc	
angle2oπset	2			
autoMute	3	Files		
autopick	4			
bias	5	Project		
bulkStatic	6			_
collect	7	Skip Traces		
cuda-test	2	Max Traces		7
de mig	8	max maces		
diskNeau	9	Mode	Shot Migration	•
-eveBeam	10			
fd mod2 d	11	Restart file	/scratch/shot restart	
filte r	12			
gain	13	Bernet	Yes	
···· hdrMath	14	Restan		
importVtp	15		No	
Interp Snot		inglate Altonsets At Orice		· _
km		Report (secs)	60	
kmodel				_
merlin		Calculate Bins	No	
mork				
moveout		Calculate xy	No	•
mute				
onea	1			

Figure 35. diskRead Main Panel, Shot Migration

### Table 26. diskRead Main Panel Fields

Field	Description
Mode: General	
Files	List of the input files to be read.
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Skip Traces	The maximum number of traces to skip.
Max Traces	The maximum number of traces to read.
Mode	Mode to read data for specific applications: General, Kirchhoff Migration, or Shot Migration. The selection in this field determines the complement of fields you see on this panel. default: General
Migrate All Offsets At Once	Enables all offsets to be held in memory at one time. This is good for increasing I/O performance. default: No
Report (secs)	How often to report output, in seconds. default: 60

Field	Description
Calculate Bins	
Calculate xy	
Mode: Kirchhoff Migr	ation
Quick Scan	default: no
backupName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/KDmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.
Offset Bins	Specifies the offset bins in which to read the data.
Offset Key	Header key defining the location of the offset in the trace.
Offset Bin Key	The header key for the offset bin parameter.
Output Lines	The number of lines to be contained in the output data.
Output XLines	The number of crosslines to be contained in the output data.
Line Aperture (m/ft)	The length, in meters or feet, of the line direction aperture limit.
XLine Aperture (m/ft)	The length, in meters or feet, of the crossline direction aperture limit.
Line Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: cdp
Line Aperture	The length, in meters or feet, of the line direction aperture limit.
XLine Aperture	The length, in meters or feet, of the crossline direction aperture limit.
Line Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep

#### Table 26. diskRead Main Panel Fields-continued

continues on next page

Field	Description		
CDP Header Key	Header key containing CDP designators. MARVEL usually uses cdp, which is a 4-byte integer at location 21 in SEG-Y files. default: cdp		
Restart File	The application keeps information about shots already processed in this file. It is usually best to put it in the same directory where your output files are located and to give it a similar name. default: /scratch/shot.restart		
Calculate Bins	default: No		
Calculate xy	default: No		
Mode: Beam Migration			
Patch Size (m/ft)	default: 150		
Overlap Patches	default: No		
Bundle Key	default: tracf		
Mode: Shot Migration			
backupName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/KDmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.		
Report (secs)	default: 60		
Quick scan	default: 60		

#### Table 26. diskRead Main Panel Fields-continued

### diskRead Advanced Panel

This panel enables you to define the advanced parameters for the module. Currently there is only one parameter on the panel: Number of Traces to Map. The default value is 10000.

### diskRead Selection Panel

The diskRead Selection panel identifies the file to which the MARVEL output data will be written. The panel is shown in Figure 36, and the terms are defined in Table 27.

000 X	iobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File</u> Job <u>U</u> tilities <u>H</u> elp		
🗋 🖨 🖨 🏝 🎘 🏠 🗣 🔻 Projec	:	<b>±</b>
Job Cluster		
Modules A Job Flow A dis	kRead	
Main 1 diskRead M	lain Advanced Selection Doc	
angle2offset antialias autoMute	Window 1 Key Min Max Inc Fuzz	
-autopick 4 bias 5	Window 2 Key Min Max Inc Fuzz	
collect 6 collect 7	Window 3 Key Min Max Inc Fuzz	
demig 8 <mark>diskRead</mark> 9 	Window 4 Key Min Max Inc Fuzz	
	Window S Key Min Max Inc Fuzz	
← filer ▼ 12		

### Figure 36. diskRead Selection Panel

### Table 27. diskRead Selection Panel Fields

Field	Description
Files	The names of the file to write. <b>This is a REQUIRED entry.</b>
Mode	The mode to write the files: Overwrite or Append.
Format	<ul> <li>The format to be used for the output data:</li> <li>IEEE floating</li> <li>IBM floating</li> <li>Scaled short</li> </ul>
Max File Size	The maximum size of the file that MARVEL should write. default: 0, no size limit

## diskWrite Module

The diskWrite module identifies the file to which the MARVEL output data will be written. The diskWrite panel is shown in Figure 37, and the terms are defined in Table 28.

### Figure 37. diskWrite Panel

OOO 🛛 🕅 jobBu	ilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 3 8 8 8 4 4 7	7 Project	<b>T</b>
Job Cluster		
Modules 🔺 Job Flow	▲ diskWrite	
Main angle2offset antialias autopick bias bulkStatic collect collect demig 8	Main     Doc       Files     Image: Construction of the state of	
diskRead 9 diskWite 10 eye Ream 11 filter 12 filter 12	Max Traces per file 0 Split Header Key	
< /// <b>)</b> 13		

### Table 28. diskWrite Panel Fields

Field	Description
Files	The names of the file to write. This is a REQUIRED entry.
Mode	The mode to write the files: Overwrite or Append.
Format	<ul> <li>The format to be used for the output data:</li> <li>IEEE floating</li> <li>IBM floating</li> <li>Scaled short</li> </ul>
Max File Size (MB)	The maximum size of the file that MARVEL should write. default: 0, no size limit
Max Traces per file	The maximum number of traces to be included in a file. default: 0, no size limit
Split Header Key	

## eyeBeam Module

The eyeBeam module is Panorama Technologies' parsimonious beam migration program. The module decomposes seismic data into effective beamlets and images those beamlets along rays generated by the anisotropic raytracer (see rayshooter Module).

Figure 38	. eyeBeam	Main	Panel,	Stack	Mode
-----------	-----------	------	--------	-------	------

00			🛛 jobBui	der – Marvel Version 2.1.1.31pre3, Panorama Tech	
Job <u>U</u> tilities	<u>H</u> elp				
n e p	ß	Å 🔒	• ▼	Project:	
	-	~ -			
ob Cluster					
Madulas		lah Elaw		eveBeam	
Main .	H.	JOD FIDW		Main Jacob Computation Output Taccomptus Advanced Jack Day	
	1	еуевеат		Main Input Computation Output Topography Advanced Job Doc	
antialias	2	_			
auto Mute	3				
autopick	4				
···· bias	5			Output Mode Stack	
bulkStatic	6				
collect	2 7	-			
cuda-test		-			
de mig	8	_		Offset	
diskneau	9	_			
eveReam	10				
fdmod2 d	11			Worker Timeout (minutes) 15	
filte r	12				
gain	13			BackUpName /scratch/KDmigscratch	
hdrMath	14				
···· importVtp	15	-		Velocity Model	
···· interp Shot	15				·
kdm					
KM				Basel maphame	
				N-	
mork				True Amplitude	
moveout				The hill war	
mute				Fiusnhours 2	
oned				nblock 1	
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b Cluster				
lodules .	▲ Job Flow	eyeBeam		
ain	1 eyeBeam	Main Input Computation C	Output Topography Advanced Job Doc	
angle2 offset	2			
antialias	3	Project		
auto Mute	4			
autopick		Output Mode	Offsets 👻	
	5			
collect	6	Minipate All Offsets At Once	No 👻	
cuda-test	7	inglate Aronet Aronet	÷	
de mig	8			
diskRead	9			
···· dis kWrite	10	Offset Bin Key	fldr	
eyeBeam	11	-		
fd mod2 d	12	worker Timeout (minutes)	15	
filter	12	Packlinhama	/	
gain bdrMəth	13	Backophane	/scratch/k.Dmgscratch	
importVtp	14			
interpShot	15	Velocity Model		
kdm				
km		BaseTmapName		9
kmodel				
me rlin		True Amplitude	No 👻	
mork				
moveout		FlushHours	2	
···· mute				

### Figure 39. eyeBeam Main Panel, Offsets Mode

### Table 29. eyeBeam Main Panel Fields

Field	Description
Mode: Stack	
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a REQUIRED entry.
Output Mode	The mode to write the files: Stack or Offsets.
Offset	
Worker Timeout (minutes)	Worker components that have not responded in this amount of time are assumed to be dead. default: 15 minutes
BackupName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/KDmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.

Field	Description
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data. The velocity model serves two purposes. It provides the necessary velocity information for differential moveout of the traces in each super gather to the average offset of that ensemble. It also defines the near surface velocity for computation of take-off angles.
BaseTmapName	Base name of the required traveltime data. This name is the tmap file name without the .tmap extension. Note: This is a REQUIRED entry.
True Amplitude	When set to YES, eyeBeam will use the amplitudes computed during the generation of traveltimes by rayShooter. default: N
Flush Hours	The time, in hours, between backups. default: 2
nblock	The size of the trace block. <b>Note: This parameter should not be set when using eyeBeam.</b> default: 1
Mode: Offsets	
Output Mode	The mode to write the files: Stack or Offsets.
Migrate All Offsets At Once	If set to YES, traces are read in exactly the order they are stored. If set to NO, traces are read in common offset order. This should be set to NO for Beam Migrations. default: No
Offset Bin Key	The header key for the offset bin parameter. default: fldr

### Table 29. eyeBeam Main Panel Fields-continued

## eyeBeam Input Panel

### Figure 40. eyeBeam Input Panel

D     D     D     D     D     Project:       Job     Cluster       Modules     ▲     Job Fbw       eyeBeam	ile <u>J</u> ob <u>U</u> tilities
Job Cluster Modules A Job Flow eyeBeam Main 1 eyeBeam Main Input Computation Output Topography Advanced Job Doc	
- angle2offset       2         - antbilas       3         - autopick       4         - bias       5         - buk/Static       6         - collect       7         - collect       7         - cuda-test       8         - diskKead       9         - diskKead       9         - diskWite       10         - gweBeam       11         - filter       12         - gain       13         - hdr/Math       14         - miter pShot       15         - kdm       - km         - km       - km         - motk       - motk         - moveout       - motk         - motk       - motk	Job Cluster Modules Main angle2offset autopika autopik autopik bias disWrite fifter bias bidMath importVtp interpShot km mork moveout mute oned parsim

### Table 30. eyeBeam Input Panel Fields

Field	Description
Line key	The header key specifying where line data is stored in the trace. default: ep
Cdp key	The header key specifying where CDP data is stored in the trace. default: cdp
Offset header key	Header key for the offset parameter. default: offset
Bundle key	default: tracf
Velocity-percent Header key	default: tracf

## eyeBeam Computation Panel

### Figure 41. eyeBeam Computation Panel, Max Stack Search Method

00	0					[	Хj	bBu	ilde	r – Marvel Version	2.1.1.31pre3, Panorama Tech	
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Job	Cluste	r										
Mod	lules		•		Job Fk	w			-	eyeBeam		-
Main				1	eve Rea	m				Main Innut Computat	on Output Topography Advanced Job Doc	
	angle2	offset	H		еуевеа			_		main input computer	Capite Topography Advanced 500 Doc	a
	antialia	15	ĽĽ	2				_		Line Aperture (m/ft)	ol	
6	autoM	ute		3								
ē	autopi	ck	- I-	4						XLine Aperture (m/ft)	0	
	bias			5	1							
t	bulkSt	atic	L b	5	-			_		P Search Method	Max Stack 👻	
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· c	uda-t	est		<u> </u>				_				
0	demig		ĿĿ	3								
0	diskRe	ad		9								
0	diskWr	ite		10								
6	eyeBe	am	L b	11				-		Xline P range (ms/tr)	Min Max Inc	
f	fd mod.	2 d	H					_				
f	filter			12				_		Line P range (ms/tr)	Min Max Inc	
9	gain			13								
	hdrMa	th	1	14						Control Room	Fixed P Range	
	mport	vtp		15						contor beam		
	interps kdm	shot								Number of Ps	c.	
	km										·	
		1								P spring range	0.5	
	merlin											
	mork											
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	mute											
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	parsim		•								L <u></u>	
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### Figure 42. eyeBeam Computation Panel, Max Semblance Search Method

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bi Cluster Modules Tain - angle2offset - antalas - autoMute - autoMute - autoMute - bias - bulkStatic - collect - collect - collect - diskRead - dis	J     I	yeBeam			eveBeam Main Input Computation C Line Aperture (m/ft) X Line Aperture (m/ft) P Search Method Semblance Window Length Semblance Threshold Xline P range (m/tr) Line P range (m/tr) Control Beam Number of Ps P spring range	utput Topography A ol Max Semblance 7 0 Min Ekeed P Range 5 0.5	dvanced Job	Doc Jinc	
oned					Dip Gain	0			

	4	å 🕁 🗣	V Pro.	ect:		
b Cluster						
Modules	•	Job Flow		eyeBeam		
lain	1	eveBeam		Main Input Computat	ion Output Topography Advanced Job	Doc
angle2 offset	2		1 1			
antialias	-		- II	Line Aperture (m/ft)	0	
autoMute	3		- 1			
autopick	4		- 1	XLine Aperture (m/tt)	0	
···· bias	5			D Court Marked	Max Stack	
bulkStatic	6			P Search Method		
collect	7		1 1			
cuda-test		-	1 1			
uernig diskRoad	-		- II			
diskWrite	9		- 1			
eveBeam	10		- 1	Xline P range (ms/tr)	Min Max	Inc
fd mod2 d	11					
filte r	12					
gain	13		1 1	Line P range (ms/tr)	Min	Inc
hdrMath	14	-	1 1		[	
importVtp	14		- 1	Control Beam	Fixed P Range	<b>±</b>
interpShot	15		- 1			
kdm				Number of Ps	5	
···· km				P spring range	0.5	
kmodel				r spring range	0.5	
merlin						
mork						
moveout						

### Figure 43. eyeBeam Computation Panel, Fixed P Range Control Beam

### Figure 44. eyeBeam Computation Panel, Automatic Control Beam

Job <u>U</u> tilities	Help			
	🗎 次 ♠ ♥ ▼	Project:		
b Cluster				
lodule s	▲ Job Flow	eyeBeam		
ain	1 eyeBeam	Main Input Computation Ou	Itput Topography Advanced Job Doc	
angle2 offset	2			
antialias	-	Line Aperture (m/ft) 0		
autoMute	2			
autopick	4	XLine Aperture (m/tt)		
bias	5	B Caperb Mathed Max S	Stack	
bulkStatic	6	r Sealch Method		-
collect	7			
cuda-test	8			
diskRead	-			
diskWrite	9			
eveBeam	10	Xline P range (ms/tr) Min	Max	
fd mod2 d	11			
···· filte r	12			
gain	13	Line P range (ms/tr) Min	Max	
hdrMath	14			
importVtp	17	Control Beam Autor	natic	<b>±</b>
interpShot	15			
kdm		Number of Ps 5		
km				
kmodel				
···· merlin		Principal Frequency 20		
mork				
moveout		Surface velocity 1500		
oned				
oneu	-	Dip Gain 0		

000	🔀 jobBuilder – Marvel Versio	n 2.1.1.31pre3, Panorama Tech	1
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
1 <b>3 8 8</b> Å	🚯 🗣 🛡 Project:		-
Job Cluster	Flow eyeBeam Main Input Comput	ation Output Topography Advanced	lob Doc
angle2offset 2 antialias 3 autoMute 4	Line Aperture (m/ft)	     	
bias 5 bulkStatic 6 collect 7 cuda-test 8 demig 8 diskRead 9	P Search Method	Max Stack	
diskWrite 10 <mark>eyeBeam 11</mark> 11	Xline P range (ms/tr	) Min Max	Inc
gain 12 13	Line P range (ms/tr)	Min Max	Inc
- https://www.internet/actionals.com/actiona	Control Beam	No Control	<b>.</b>
mute oned parsim 🗸	Dip Gain	0	

### Figure 45. eyeBeam Computation Panel, No Control Beam

### Table 31. eyeBeam Computation Panel Fields

Field	Description
Line Aperture (m/ft)	The length, in meters or feet, of the line direction aperture limit.
XLine Aperture (m/ft)	The length, in meters or feet, of the crossline direction aperture limit.
P Search Method	Max Stack or Max Semblance.
Semblance Window Length	The window length, in seconds, of the window to use in the semblance spectra. The window length should include a full wavelength. <b>This field is only displayed if P Search Method is set to Max</b> <b>Semblance.</b> default: 0
Semblance Threshold	<b>This field is only displayed if P Search Method is set to Max</b> <b>Semblance.</b> default: 7

### continues on next page

Field	Description
XLine P range (ms/tr)	The max value and increment. The range is then defined from negative max to max. This is a REQUIRED entry.
Line P range (ms/tr)	The max value and increment. The range is then defined from negative max to max. This is a REQUIRED entry.
Control Beam	<ul> <li>No Control</li> <li>Fixed P Range (default)</li> <li>Automatic</li> </ul>
Number of Ps	The actual number of p-values to migrate when Control Beam is Automatic. <b>This field is shown only for a Fixed P Range and</b> <b>Automatic Control Beam.</b> default: 5
P spring range	<b>This field is shown only for a Fixed P Range Control Beam.</b> default: 0.5
Principal Frequency	The Principal Frequency is used to define the Fresnel Zone. <b>This</b> <b>field is shown only for an Automatic Control Beam.</b> default: 20
Surface velocity	If no initial velocity volume is provided, this value defines the near surface velocity. The near surface velocity in Equation 2 on page 25. This field is shown only for an Automatic Control Beam. default: 1500
Curvature Correction	When set to 1, this flag causes the eyeBeam algorithm to correct for local curvature.
Dip Gain	When set, a linearly increasing scale factor will be applied to higher dips. The value can range from 0 through 100. default: 0, do not apply a gain

### Table 31. eyeBeam Computation Panel Fields-continued

## eyeBeam Output Panel

### Figure 46. eyeBeam Output Panel

	bBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 🗠 🖬 🚔 🎄 🗣 🛡	Project	¥
Job Cluster Modules Job Flow Main angle2offset antialias autoMute autopkk bias bulkStatik collect cuda-test diskWrite		
fdmod2 d 11 filter 12	Output Depths (m/ft) Min Max Inc	

### Table 32. eyeBeam Output Panel Fields

Field	Description
Output Lines	The number of lines to be contained in the output data. <b>This is a REQUIRED entry.</b>
Inline aliasing (lines)	Attempt to compensate for aliasing in the inline direction (units: lines). Note: This can be a costly operation. default: 2
Output XLines	The number of crosslines to be contained in the output data. <b>This is a REQUIRED entry.</b>
Xline aliasing (lines)	Defines the desired spacing length for antialiasing. The larger this value is, the more anti-aliasing is applied. (units: lines). Note: This can be a costly operation. default: 2
Velocity scan (%)	
Output Depths (m/ft)	This is a REQUIRED entry.

### eyeBeam Topography Panel

The eyeBeam Topography Panel defines the surface topography for the project. There are two variables on the panel.

- *TopoSurfaceFile* is the path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100 cdp = 500 z = 20.
- *TopoSurfaceName* is the header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

## eyeBeam Advanced Panel

The eyeBeam Module Advanced panel, Figure 47, enables you to define several advanced usage parameters. The parameters are defined in Table 33.

<u>File</u> Job <u>U</u> tilities <u>H</u> elp		
□	Project	×
Job Cluster		
Modules     Job Flow       Main	eyeBeam     Main Input Computation Output Topography Advanced Job Doc      Use trace counter in header     Yes     verbose     No	
	Maxmem 900	
diskWrite <mark>eyeBeam</mark>	Mute Angle (degrees)	
fdmod2d filter gain ♥ 13	Max Frequency (Hz)	

### Figure 47. eyeBeam Advanced Panel

### Table 33. eyeBeam Advanced Panel Fields

Field	Description
Use trace counter in header	Flag indicating whether or not the trace counter that diskRead puts in the trace header will be used. default: Yes
verbose	Switch for turning debug printing on and off. default: No
Maxmem	Maximum amount of memory to be used by MARVEL per kdm instance. default: 900
Mute Angle	The angle, in degrees, measured down from the surface defining a cone limiting the near surface aperture. default: 15
Max Frequency	The maximum frequency allowed by the filtering process. Default: 0, do not filter
## eyeBeam Job Panel

This panel, Figure 48, enables you to define the basic parameters for the module. Table 34 describes the terms used on both panels.

000	🔀 jobBuilder – Marvel Version 2.1	1.1.31pre3, Panorama Tech
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
1 4	🚯 🗣 🛡 Project:	•
Job Cluster Modules Jo Main - antialas	eBeam	Output Topography Advanced Job Doc
- autoMute 3 - autopick 4 - bias 5 - bulkStatic 6 - collect 7 - cuda-test 8 - diskRead 9	Use All CPUs	Yes 👱
disWite eyeBeam fdrwod2 d filter gain hdrMath inportVtp	Master is Worker	Yes 💆
interpShot 15 kdm km kmodel mertin mertin	Run workers low priority	No
····moveout ····mute ····oned ····parsim ♥		

## Figure 48. eyeBeam Job Panel

#### Table 34. eyeBeam Job Panel Fields

Field	Description
Use All CPUs	This really means that each worker should use multiple threads. If No, then there will be one independent worker spawned for each CPU (or core) in the cluster. default: Yes
Master is Worker	Flag that controls whether the master I/O controller is also used for performing calculations. default: Yes
Run workers low priority	If Yes, workers will be spawned with reduced priority, although the master process will remain at high priority. This can be useful, especially when <i>MasterIsWorker</i> is set, so that one worker does not slow down collection or submission of shots for all of the others. default: No

# fdmod2d Module

## Figure 49. fdmod2d Main Panel

00				X jo	obBu	ilder	- Marvel Version 2.1.1.31pre3, Panorama Tech
e <u>J</u> ob <u>U</u> tilities <u>I</u>	<u>H</u> elp						
	3 &	<b>₽</b>		Project	t: /net,	t/praha	06/data1/jhu/projects/blessing/blessing-dense.project
loh Cluster							
He dates					mod2d	ı	
Main	Job	Flow	_	1.5	4 i   1	Dee	
main 	1 fdm	5d2 d				Doc	
	2				f.		
autoMute	3				DA.		
autonick	4				nx		
bias	5		_				
	-				dx		1
collect	6						
cuda-test	7				fz		0
de mig	8						
diskRead	9		_		nz		
dis kWrite	10		_		dz		1
eyeBeam	10		_				·
fd mo d2 d	11				tmax		
filte r	12						
gain	13				nt		0
hdrMath	14		_				
… importVtp	15		_		xs		
interp Shot	15				ZS		
kdm							
km					abs		1,1,1,1
kmodel							
me rlin					mt		1
mork					nml i		1000
moveout					pm	max	1000
mute					pmLt	thick	0
oned							
parsim					hsz		0
per							
- postpioc					V5X		0
					watte	160	0
resamp3d					vendo	, se	<u>۷</u>
re sample					dfile		
rtmodel							
scan					hsfile		
semblance							
shooter					vsfile		
smoother					ssfile		
stack					22116		
···· static S hift					fmax		-1
time Depth							
trs um					fpeak	k	-1
1							
trwindow							

#### Table 35. fdmod2d Panel Fields

Field	Description
fx	
	default: 0
nx	
	This is a REQUIRED entry.

Field	Description
dx	default: 1
fz	default: 0
nz	This is a REQUIRED entry.
dz	default: 1
tmax	This is a REQUIRED entry.
ny	default: 0
XS	This is a REQUIRED entry.
ZS	This is a REQUIRED entry.
abs	default: 1,1,1,1
mt	default: 1
pml_max	default: 1000
pml_thick	default: 0
hsz	default: 0
VSX	default: 0
verbose	Switch for turning debug printing on and off. default: 0
dfile	

#### Table 35. fdmod2d Panel Fields-continued

Field	Description
hsfile	
vsfile	
ssfile	
fmax	
	default: -1
fpeak	
	default: -1

#### Table 35. fdmod2d Panel Fields-continued

# filter Module

The filter module applies a (f, k) domain pie-shaped filter to an input ensemble or gather of traces. This gather can be a line, CDP, or shot record, but you are responsible for selecting the appropriate data, and for building the job stream to supply it to the filter module.

#### Figure 50. filter Panel

X jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
Eile Job Utilities Help
🗋 🖨 🗟 🍰 🏠 🏠 🤍 Project: //net/praha06/data1/jhu/projects/blessing/blessing/blessing-dense.project 🛫
Job Cluster         Modules       Job Flow         Nain       1         main       1         main       1         main       2         main       2         main       3         main       4         main       6         main       6         main       6         main       6         main       6         main       6         main       7         main       6         main       7         main       8         main       9         main       10         main       11         main       12         main       13         main       14         main       14

#### Table 36. filter Panel Fields

Field	Description
dt	
Freqs	Specifies the filter frequencies.
Amps	Specifies the filter amplitudes.
Preserve Mute	If enabled, autodetect the upper mute zone and reapply the mute after the filter has been run.
Phase Shift (deg)	default: 0
Freq Power	default: 0

# gain Module

The gain module scales each input trace by either a fixed power of time or a time-variant automatic gain control, or both. There are six panels used with the gain module, shown in Figure 51 through Figure 56, and the fields are described in Table 37.

#### Figure 51. gain Powers Panel

000	🔀 jobBuil	der – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
	Å <b>⊕</b> ♥ ♥ P	wject:	<b>¥</b>
Job Cluster			
Modules 🔺	Job Flow	-gain	
Main angle2offset antialias 	gain	Powers Scale/Blas Clips AGC Balancing Main Doc	
autopick 4 bias 5		Poweroft	
collect 7 cuda-test 7		Exponential	
diskRead 9		Power	
<ul> <li>✓</li> <li>✓</li></ul>	•		

### Figure 52. gain Scale/Bias Panel

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
Elle Job Utilities Help	🚯 🛛 Project	¥
Modules     ↓       Main     1     gain       -angle2offset     2       -angle3     3       -autoMute     3       -autoMute     4       -bias     5       -bulkStatic     6       -collect     7       -cuda-test     8       -diskWrite     9       -diskWrite     10       -exercement     11	•     -gain       Powers     Scale/Bias       Clips     AGC       Bias	

## Figure 53. gain Clips Panel

<u>File</u> Job <u>U</u> tilities	∑ jobBuilde	er – Marvel Version 2.1.1.31pre3, Panorama Tech	
	🖺 🎘 🏠 🗣 🛡 Pro	ect:	¥
Job     Cluster       Main	Job Flow       1     gain       2     -       3     -       4     -       5     -       6     -       7     -       8     -       9     -       10     -       11     -       12     -	gain       Powers     Scale/Bias     Clips     AGC     Balancing     Main     Doc       Clip	

## Figure 54. gain AGC Panel

OOO 🛛 🕅 jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ ➡ 묘 ♣ ≵ ☆ ♥ ▼	Project	¥
Job Cluster		
Modules 🔺 Job Flow		
Main 1 gain	Powers Scale/Bias Clips AGC Balancing Main Doc	
angle2offset 2		
autoMute 3		
autopick 4	AGC Window (ms)	
bias 5		
bulkStatic 6		
collect 7	Normal	
demig 8	AGC Type	
diskRead 9		
diskWrite ¥ 10		

## Figure 55. gain Balancing Panel

000				X	jobB	Build	der	- Marvel Version 2.1.1.31pre3, Pa	norama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	H	lelp								
0 🗠 🖬	ļ	à.	ĉ 🗅	¢	V	7 р	rojec			¥
Job Cluster										
Modules	*		Job Flov	v		*	-ga	in		۱   ר
Main — ang le2 offset — antialias — auto Mute — auto pick — bias — bulk Static — collect — collect — demig	1	1 2 3 4 5 6 7 8	gain			11	F	owers Scale/Bas Clips AGC Balancing Quantile Balance RMS Balance	No V	
diskRead	*	9 10 11				*				

## Figure 56. gain Main Panel

	Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 🕀 🖬 🖨 🎄 🔶 🛡 🔻	7 Project:	1
Job Cluster		
Modules     Job Flow       Main     angle2offset     1     gain      angle2offset     3     3      autopick     4     3      autopick     4     4      bias     5     6      cude-tist     6     7      dernig     8     9      diskRead     9     10	Powers     Scale/Bias     Clips     AGC     Balancing     Main     Doc       Scale     Header	

## Table 37. gain Panel Fields

Panel	Field	Description
Powers	Power of t	Value used to apply <i>Tpow</i> to each input trace. See Gathers Settings Window.
	Exponential	
	Power	
Scale&Bias	Scale	
	Norm	
	Bias	
Clips	Clip	
	Low Clip	
	Hi Clip	
	Trap	
	UTrap	
	Quantile Clip	
	Absolute Value	default: No

Panel	Field	Description
AGC	AGC Window	The automatic gain control window is the length of the time gate used to calculate the time-varying gain function, in ms. default: 0
	AGC Type	Specifies the type of taper to be applied to the input trace. The taper may be either Normal or Gaussian Taper. default: Normal
Balancing	Quantile Balance	
	RMS Balance	
	Mean Balance	
Main	Scale Header	
	Scale Header Power	This is a fixed constant to be applied to each trace. default: 1
	Use Abs Scale Header	default: 0
	Div Header	
	verbose	Switch for turning debug printing on and off.

## Table 37. gain Panel Fields-continued

**Equation 5:** 

# hdrMath Module

The hdrMath module changes header words through a simple formula shown in Equation 5, where ihw in the value extracted from the input header word.

 $value = \frac{(shift + scale * ihw)}{div}$ 

The hdrMath panel is shown in Figure 57, and the fields are defined in Table 38.

#### Figure 57. hdrMath Panel

 N A D	י 1	 3 &	T Pro	inst (not/nmha06/data1	//hu/nmiacte//blassing/blassing-danse_nmiact	1
	Ę		¥ 110	Jeer. ///eephanaoo/datar	Junt projects/biessing/biessing-bense.project	
ob Cluster						
Modules	*	Job Flow		hdrMath		
Main		1 hdrMath		Main Doc		
angle2offset antialias autoMute autopick		2 3 4		Project	/net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
bias bulkStatic collect		5 6		Output Key		
cuda-test demig diskRead		8		Input Key Scale		
···· diskWrite ···· eyeBeam ···· fdmod2 d		10 11		Shift	0	
filter gain hdrMath		13		Divisor	1	
importVtp interpShot kdm		15		Use absolute value		
km					<u>۳</u>	
kmodel merlin				Calculation	None 🛫	

#### Table 38. hdrMath Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Output Key	Output header key defines the output header location to change.
Input Key	Input header key defines the input header key to use in the calculation.
Scale	A list of floating point numbers used to scale the input header value.

٦

Field	Description
Shift	A list of floating point numbers used to shift the input header value. default: 0
Divisor	A list of divisors used to divide each calculated header number. default: 1
Use absolute value	default: 0
verbose	Switch for turning debug printing on and off. default: 0
Calculation	<ul> <li>None</li> <li>World Coordinates from CDP</li> <li>World Coordinates from CDP and Offset</li> <li>CDP from World Coordinates</li> <li>Offset from World Coordinates</li> <li>Shift World Coordinates with Offset</li> <li>default: None</li> </ul>

#### Table 38. hdrMath Panel Fields-continued

# importVtp Module

The importVtp module imports VIEWS VTP and FOCUS HANDVEL time-velocity pairs from an input file and converts them to the internal data format used by Panorama Technologies. The output file name is just the input file name with .pick appended. The importVtp panel is shown in Figure 58 and the fields are defined in Table 39.

#### Figure 58. importVtp Panel

<u> </u>	<u>H</u> elp		X jo	bBuilder – Ma	arvel Version 2.1.1.31pre3, Panorama Tech
	8	â 🕁 -	🗣 🔻 Р	roject: /net/praha	06/data1/jhu/projects/blessing/blessing-dense.project
Job Cluster					
Modules	•	Job Flow		importVtp	
Main	1	importVtp		Main Doc	
angle2offset antialias autoMute autopick bias bulkStatic collect cuda-test demig diskRead diskWrite eyeBeam firmod2d	2 3 4 5 6 7 8 9 10 11			File Line Key	ep
filter gain hdrMath	12 13			Cdp Key	cdp
<mark>importVtp</mark> interpShot	14				
km kmodel merlin mork	*			Offset Key	offset
< /// >					

#### Table 39. importVTP Panel Fields

Field	Description
File	The name of the input file to be imported.
Line Key	The key word used for LINE in the MARVEL format. default: ep
Cdp Key	The key word to be used for CDP in the MARVEL format. default: cdp
Offset Key	The key word to be used for OFFSET in the MARVEL format. default: offset

# interpShot Module

The two interpShot panels are shown in Figure 59 and Figure 60. The fields are defined in Table 40 and Table 41.

## interpShot Main Panel

#### Figure 59. interpShot Main Panel

🔿 🔿 💿 🔯 🔯 jobBuilder - Marvel Version 2.1.1.31pre3, Panorama Tech						
<u>File J</u> ob <u>U</u> tilities <u>H</u> elp						
🗋 🖨 🖨 ಿ c 🗣 🛡 Project						
Job Cluster						
Modules Job Flow						
-cuda-test     1     interpShot     Main     Hea       -demig     2     project     project       -diskRead     3     -     Output x       -fdmod2d     5     -     Output x       -filter     6     -     Output x       -mindrMath     8     -     Output y       -mindrShot     9     -     Receiver       -mindrShot     10     v     -	der Keys       LOC         receivers (m/ft)       Min         Min       Max         Inc       Inc         Channel Header Key       gmofr         Cable Header Key       gmors					

#### **Table 40. interpShot Module Fields**

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Output x receivers (m/ft)	Note: This is a REQUIRED entry.
Output y receivers (m/ft)	Note: This is a REQUIRED entry.
Receiver Channel Header Key	default: gmofr
Receiver Cable Header Key	default: gmors

# interpShot Header Keys Panel

## Figure 60. interpShot Header Keys Panel

<u>F</u> ile Job <u>U</u> tilities <u>H</u> elp	🔀 jobBuilder – Marvel Vers	sion 2.1.1.31pre3, Panorama Tech
	Project: /net/praha06/data1/jhu	ı/projects/blessing/blessing-dense.project
Job Cluster Modules Job Flow Main angle2offset antialias autoMute autoMute 4	v interpShot t Main_ Header Keys_Doc Line Key Cdp Key	ер
bas 5 bulk Static 6 collect 7 demig 8 diskRead 9 diskRead 9	Alt Line Key Offset Key Shot X Header Key	fdr Contraction of the second
filter 12 filter 12 gain 13	Receiver Y Header Key	gx
Indmatm 14 importVtp 15 interpShot km	Shot X Header Key Shot Y Header Key Receiver X Header Key	swdep
kmodel merlin mork ♥ € //// ▶	Receiver Y Header Key	gwdep

### Table 41. interpShot Header Keys Panel Fields

Field	Description
Line Key	The header key specifying where line data is stored in the trace. default: ep
Cdp Key	The header key specifying where CDP data is stored in the trace. default: cdp
Alt Line Key	default: fldr
Offset Key	Header key defining the location of the offset in the trace. default: offset
Shot X Header Key	The header key specifying where line source data is stored in the trace. default: sx
Shot Y Header Key	The header key specifying where crossline source data is stored in the trace. default: sy

Field	Description
Receiver X Header Key	The header key specifying where inline geophone data is stored in the trace. default: gx
Receiver Y Header Key	The header key specifying where crossline geophone data is stored in the trace. default: gy
Shot X Header Key	default: sdel
Shot Y Header Key	default: swdep
Receiver X Header Key	default: gdel
Receiver Y Header Key	default: gwdep

## Table 41. interpShot Header Keys Panel Fields-continued

# kdm Module

The kdm module is Panorama Technologies' version of Kirchhoff depth migration. This is a full-featured, fault-tolerant, restartable depth migration algorithm which can use parallel processing over both input and output. The major difference between the km and kdm modules is that km calculates the traveltime information it needs internally, while kdm requires that the traveltimes come from the data.

A typical migration job has the following job flow: diskRead  $\Rightarrow$  kdm  $\Rightarrow$  collect

For faster restarts, the Mode option in the diskRead module should be set to Shot Migration (see diskRead Module).

#### Note:

You should be sure the Restart File parameter is in sync with the kdm module. If you edit the parameter in kdm, the parameter in diskRead will be updated.

The collect module is designed to stack output from migrations. By default, it does this firstcome, first-served, and the output files will be unsorted. Choose the Preallocate Volume option in the collect module to avoid this behavior (see collect Module). As with the Restart File option in the diskRead module, make sure the output parameters to collect are in sync with those in kdm.

See also, km Module.

## kdm Main Panel

There are two forms of the kdm Main panel depending on the Output Mode you select: Stack (Figure 61), or Offsets (Figure 62). The fields are described in Table 42.

	Ę	2	å 🕯 י	🗣 🛡 Рк	oject:		
b Cluster		_	Jah Chur		-kdm		
lain	-	1	JOD FIDW		Main Innut Computation	Output Topography Advanced Job Doc	
-angle2offset		-	Kum		main input computation	ouput Topography Navanced 500 boc	
antialias		2			Project		A
auto Mute		-	-				
-autopick		4			Output Mode	Stack 🖌	
bias bulkStatic		5	_		Culput mode	-	
collect	2	6			Offset		
cuda-test		7					
de mig		8			Worker Timeout (minutes)	15	
diskRead		9					
···· dis kWrite		10			BackUpName	/scratch/KDmigscratch	
eyeBeam		11					
filter		12			T rave Itime s		
gain		13					
hdrMath		14			Source Traveltimes		-
importVtp		15					
interpShot					True Amplitude	No 👱	
kmodel					FlushHours	2	
me rlin					nblock	1	
mork							
moveout					Restart	Yes 🗸	

## Figure 61. kdm Main Panel, Stack Output

## Figure 62. kdm Main Panel, Offsets Output

	D & ⊕ & €	Project:	
Job Cluster Modules ▲ — angle2offset — antialias — autoMute — autoPick — bias — buikStatic — collect — cuda-test	Job Flow           1         kdm           2         -           3         -           4         -           5         -           7         -	- kdm       Main     Input     Computation     Output     Topography     Advanced     Job     Doc       Project     Image: Computation     Output     Mignate All Offsets At Once     V       Mignate All Offsets At Once     No     V	]
demig diskRead diskWrite eyeBeam	8 9 10	Offset Bin Key fidr Worker Timeout (minutes) 15	
fd mod2 d filte r ga.in	11 12 13	BackUp Name /scratch/KDmig scratch	
hdrMath importVtp interp Shot	14 15	Source Traveltimes	
<mark>kdm</mark> km kmodel		True Amplitude No 🗸	
merlin mork moveout		FlushHours 2	
mute o ned		Restart Yes 👻	

Field	Description			
Stacks Output Mode				
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. Note: This is a REQUIRED entry.			
Output Mode	The kind of output: Offset gathers or Stack. default: Stack			
Offset	Defines the bin of the run to be used for the output header.			
BackUpName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/KDmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.			
BaseTmapName	Base name of the required traveltime data. This name is the tmap file name without the .tmap extension. Note: This is a REQUIRED entry.			
FlushHours	The time, in hours, between backups. default: 2			
nblock	The size of the trace block. default: 1			
Master is Worker	Flag that controls whether the master I/O controller is also used for migrating data. default: Yes			
Offsets Output Mod	le			
Offset Bin Key	The header key for the offset bin parameter. default: fldr			

## Table 42. kdm Panel Fields

## kdm Input Panel

The kdm Module Input Panel, Figure 63 defines the header keys that provide surface information to the module. The fields are described in Table 43.

### Figure 63. kdm Input Panel

000	🔀 jobł	Builder – Marvel Version	2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp				
	s 🚯 🗣 🛡 Proje	ct: /net/praha06/data1/jhu/proje	cts/blessing/blessing-dense.project	¥
Job Cluster Modules Main 	Job Flow	dm Main Input Computation Ou Line Key Cdp Key Offset Header Key Velocity-percent Header Key	cts/Diessing-dense, project	
me rlin mo rk ♥				

#### Table 43. kdm Input Panel Fields

Field	Description
Line Key	Header key for line designators. default: ep
Cdp Key	Header key for CDP designators. default: cdp
Offset Header Key	Header key for the offset parameter. default: offset
Velocity-percent Header Key	default: tracf

## kdm Computation Panel

The kdm Computation Panel defines the x (line) and y (crossline) aperture limits.

The *LineAperture* is the length, in meters or feet, of the line direction aperture limit. The default is 0.

The *XLineAperture* is the length, in meters or feet, of the crossline (CDP) direction aperture limit. The default is 0.

## kdm Output Panel

The kdm Output panel, Figure 64, defines the aliasing and output line and crossline dimensions. The fields are described in Table 44.

#### Figure 64. kdm Output Panel

000	🔀 jobB	Builder	- Marvel Version	2.1.1.31pre3, Pa	norama Tech	
<u>File Job U</u> tilities J	<u>H</u> elp					
0 🗠 🖬 🖁	B & ♠ ♥ ▼	7 Proje	ect:			<b>*</b>
Job Cluster	Job Flow					]
Main	1 kdm		Main Input Computat	ion Output Topograp	hy Advanced Job Doc	]
angle2offset antialias autoMute	2 3		Output Lines	Min	Max	Inc
autopick	4		Inline aliasing (lines)	2		
bulkStatic collect	6		Output XLines	Min	Max	Inc
cuda-test	7		Xline aliasing (xlines)	2		
diskRead	9		Offset Bins	Min	Max	Inc
d is kWrite	10					
eyeBeam	11		Velocity Scan (%)	Min	Мах	Inc
filter	12					
gain	13		Output Depths (m/ft)	Min	Max	Inc
hdrMath ▼	14	¥				
L						I

#### Table 44. kdm Output Panel Fields

Field	Description
Output Lines	The minimum, maximum, and increment values for output lines. <b>This is a REQUIRED field.</b>
Inline aliasing	The inline anti-aliasing distance, in units of lines. Note: This can be a costly operation. default: 2

Field	Description
Output XLines	The minimum, maximum, and increment values for output crosslines. <b>This is a REQUIRED field.</b>
Xline aliasing	The crossline anti-aliasing distance, in units of lines. Note: This can be a costly operation. default: 2
Velocity scan (%)	
Output Depths	The minimum, maximum, and increment values for output depths. <b>This is a REQUIRED field.</b>

## Table 44. kdm Output Panel Fields-continued

# kdm Topography Panel

The kdm Topography Panel defines the surface topography for the project. There are two variables on the panel.

🔿 🔿 🔿 🔯 🕅 🕅 🕅 🕅	arvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
🗋 🖨 🖨 🍰 🏦 🗣 🔻 Project		¥
Job Cluster		
Modules A Job Flow A kdm-		l
Main 1 kdm Main	Input Computation Output Topography Advanced Job Doc	l
angle2offset 2		L
	oo Surface File	l
autopick 4		l
bias 5 Top	oo Surface Name Topo	L
bulkStatic 6		l
	urce Topo Surface File	L
demig 8		L
	ure Topo Surface Name Topo	L
<ul> <li>✓ 11</li> <li>✓ 11</li> </ul>		
		1

## Figure 65. kdm Topography Panel

### Table 45. kdm Topography Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: $ep = 100 \text{ cdp} = 500 \text{ z} = 20$ .
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Source Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: $ep = 100 \text{ cdp} = 500 \text{ z} = 20$ .
Source Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

## kdm Advanced Panel

The kdm Advanced panel, Figure 66, enables you to define several advanced usage parameters. The parameters are defined in Table 46.

│	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
	7 Project:	<b>.</b>
Job Cluster       Modules     Job Flow       Main     1	kdm       Main     Input     Computation     Output     Topography     Advanced     Job     Doc       Use trace counter in header     Yes       verbose     No       Maxmem     900       Mute Angle (degrees)     15       Max Frequency (Hz)	¥.

## Figure 66. kdm Advanced Panel

### Table 46. kdm Advanced Panel Fields

Field	Description
Use trace counter in header	Flag indicating whether or not the trace counter that diskRead puts in the trace header will be used. default: Yes
verbose	Switch for turning debug printing on and off. default: No
Maxmem	Maximum amount of memory to be used by MARVEL per kdm instance. default: 900
Mute Angle	The angle, in degrees, measured down from the surface defining a cone limiting the near surface aperture. default: 15
Max Frequency	The maximum frequency allowed by the filtering process. Default: 0, do not filter

# kmodel Module

## Figure 67. kmodel Main Panel

00	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
i job <u>U</u> tilities	р ) & & ♥ ▼ Project:	
b Cluster -Culaster -Culaster -demig -diskRead -diskWrite -eyeBeam -fdmod2d -filter -gain -hdMath -importVip	Job Flow Main Output Computation Job Model Doc Main Output Computation Job Model Doc Project Reflector Surface File(s) Number of X Samples Number of Z Samples Number of Z Samples	]
interpShot kdm km <mark>kmodel</mark> merlin	0     Model       1     Use Perturbation	]
mork 2 moveout mute oned	4 Perturbation Model	]
parsim pef	Time (ms)         2000           Dt (ms)         4	
prune Shoote r ray Shoote r	First Time (ms)	
…resamp3d …resample …rtmodel	Peak Frequency (Hz)	
scan semblance	Line or Point Source	
smooter		

#### Table 47. kmodel Main Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. <b>This is a REQUIRED entry.</b>
Reflector Surface File(s)	This is a REQUIRED entry.
Number of X Samples	This is a REQUIRED entry.
Number of Z Samples	This is a REQUIRED entry.

#### Table 47. kmodel Main Panel Fields-continued

Field	Description
Model	
Use Perturbation	
Perturbation Model	
Time (ms)	(default: 2000)
Dt (ms)	(default: 4)
First Time (ms)	(default: 0)
Peak Frequency (Hz)	
Line or Point Source	
Minimum Time	default: offset

# kmodel Output Panel

## Figure 68. kmodel Output Panel

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 0 0 0 0 0 0 0 0 0	Project:	<b>±</b>
Job Cluster		
Modules A Job Flow	kmodel	
diskWrite 1 kmodel	Main Output Computation Job Model Doc	
····eyeBeam 2 ····fdmod2 d 3	Number of Shots 1	
-gain 4	Shot Spacing (m/ft) 50	
hdrMath 5 importVtp 6	First Shot (m/ft) 0	
	Number of Receivers 101	
km 8	Receiver Spacing (m/ft) 15	
merlin 10	First Receiver (m/ft) 0	
moveout 11	# Skipped Receivers 5	
···· mute ♥ 12		

## Table 48. kmodel Output Panel Fields

Field	Description
Number of Shots	
Shot Spacing (m/ft)	
First Shot (m/ft)	
Number of Receivers	
Receiver Spacing (m/ft)	
First Receiver (m/ft)	
# Skipped Receivers	

# kmodel Computation Panel

### Figure 69. kmodel Computation Panel

000	jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 0 0 0 0 0 0 0 0	Project:	¥
Job Cluster		
Modules Job Flow	kmodel Main Output Computation Job Model Doc	
	DX (m/ft) 50	
	First X (m/ft)         0           DZ (m/ft)         50	
	Band Width	
	nxc	
mork 10 moveout 11	# Diffractors per Fresnel Zone 5	
	Smooth Reflectors	
€ /// <b>▶</b> 14	▼	

### Table 49. kmodel Computation Panel Fields

Field	Description
DX (m/ft)	
First X (m/ft)	
DZ (m/ft)	
Band Width	
пхс	
nzc	
# Diffractors per Fresnel Zone	
Smooth Reflectors	

# kmodel Job Panel

## kmodel Model Panel

# km Module

The km module is Panorama Technologies' version of Kirchhoff curved-ray time migration. This is a full featured, fault tolerant, restartable depth migration algorithm which can use parallel processing over both input and output. The parallelization scheme is identical to that used in the kdm module. The major difference between the km and kdm modules is that the km module calculates the traveltime information it needs internally, while the kdm module requires that the traveltime information be present in the data.

A typical migration job has the following job flow: diskRead  $\Rightarrow$  km  $\Rightarrow$  collect

For faster restarts, the Mode option in the diskRead module should be set to Shot Migration (see diskRead Module).

#### Note:

You should be sure the Restart File parameter is in sync with the km module. If you edit the one in km, the one in diskRead will be updated.

The collect module is designed to stack output from migrations. By default, it does this on a first-come, first-served basis and the output files will be unsorted. Choose the Preallocate Volume option in the collect module to avoid this behavior (see collect Module). As with the Restart File option in the diskRead module, make sure the output parameters that you want to collect are in sync with those in the km module.

## km Main Panel

This km Module main panel enables you to define the basic parameters for the module. There are two different versions of the panel depending on the output mode you use: Stack (Figure 70) or Offsets (Figure 71). Table 50 defines the terms used on both panels.

## Figure 70. km Main Panel—Stack Output Mode

ъ. лъ. пъ		3 2 4 8 7				
	Ģ		Proj	ect: /net/praha06/data1/jhu/p	rojects/blessing/blessing-dense.project	
Cluster						
				km		
lodules	F	Job Flow				
ain is m		1 km	- 11	Main Input Computation	Model Output Advanced Topography Job Doc	
anglezonser		2	- 11			
autoMute		3	- 11	Project	/net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
autopick		4	- 11			
bias		5	- 11	Output Mode	Stack 👱	
bulkStatic		6	- 11			
collect		0	- 11			
cuda-te st		7	- 11			
de mig		8	- 11			
diskRead		9	- 11	Offset		
dis kWrite		10	- 11			
-eyeBeam		11	- 11			
famoaza		12	- 11			
ain		12				
hdrMath		15		Worker Timeout (minutes)	15	
impontVtp		14				
interpShot		15	- 11	backupName	/scratch/MPIKTmig.scratch	
kdm						
km			- 11	Flush Hours	2	
kmodel			- 11		-	
merlin			- 11	nblock	10	

## Figure 71. km Main Panel-Offsets Output Mode

	🖹 🏦 🕼 🔻 🔻	7 Project
Cluster		
odules	<ul> <li>Job Flow</li> </ul>	- km
ain	1 km	Main Input Computation Model Output Advanced Topography Job Doc
angle2offset antialias	2	Project
autoMute autopick	4	
bias	5	Output Mode Offsets 🛨
bulkStatic	6	
collect	7	Migrate All Offsets At Once
demig	8	
diskRead	9	Offset Bin Key Adr
diskWrite	10	
eyeBeam fdmod2d	11	Worker Timeout (minutes) 15
- filter	12	hackunName (renth/WPI//Tminenth
gain	13	
hdrMath	14	Flush Hours 2
import√tp	15	

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a REQUIRED entry.
Output Mode	This is the kind of output: Stack or Offset gathers. default: Stack
Migrate All Offsets at Once	(Only visible for Output Mode Offsets.) Enables all offsets to be held in memory at one time. This is good for increasing I/O performance. default: No
Offset Bin Key	(Only visible for Output Mode Offsets.) The header key for the offset bin parameter. default: fldr
Offset	(Only visible for Output Mode Stack.) The bin for the run to be used for the output header.
Worker Timeout (minutes)	Worker components that have not responded in this amount of time are assumed to be dead. default: 15
backupName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/MPIKTmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.
Flush Hours	The time, in hours, between backups. default: 2
nblock	The size of the trace block. default: 10

### Table 50. km Main Panel Fields

## km Input Panel

The km Input panel, Figure 72, defines the header keys that provide surface information to the module. The fields are defined in Table 51.

## Figure 72. km Input Panel

Sila lab Utilitian Hala	ilder – Marvel \	Version 2.1.1.31pre3, Panorama Tech	
	Project:		<b>±</b>
Job Cluster  Modules  Gounce:  Gounda-test  Genig  Genig Genig Genig  Genig  Genig  Genig  Genig Genig  Genig  Genig  Genig  Genig Genig  Genig Genig  Genig Genig Genig G	km     Main Input     Line Heade     Offset Head     Vebcky-per     Mute Heade	t Computation Model Output Advanced Topography Job Doc der Key ep der Key cdp ader Key offset ercent Header Key Inacf der Key muts	
	✓		

#### Table 51. km Input Panel Fields

Field	Description
Line Header Key	Header key with line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing CDP designators. MARVEL usually uses cdp, which is a 4-byte integer at location 21 in SEG-Y files. default: cdp
Offset Header Key	Header key for the offset parameter. default: offset
Velocity-percent Header Key	default: tracf
Mute Header Key	Header key for the mute parameter. default: muts

## km Computation Panel

The km Computation panel, Figure 73, defines the x and y aperture limits to be used in the calculations. The fields are described in Table 52.

### Figure 73. km Computation Panel

OOO 🕅 🕅 jobB	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 0 8 8 8 4 4 7	Project:	<b>±</b>
Job Cluster		
Nodules     Job Flow      cuda-test     1      diskWite     2      diskWite     3      diskWite     4      diskWite     5      diskWite     5      diskWite     6      diskWite     7      diskWite     8	Km     Main     Input     Computation     Model     Output     Advanced     Topography     Job     Doc       Honor Mute     No	

#### Table 52. km Computation Panel Fields

Field	Description
Honor Mute	Switch indicating whether or not the Kirchhoff migration calculation should use the mute setting.
Line Aperture	The length, in meters or feet, of the line direction aperture limit. default: 15000
XLine Aperture	The length in meters or feet of the crossline aperture limit. default: 15000

## km Model Panel

The km model panel, Figure 74, defines the kind and type of input model to be used by MARVEL. The fields are described in Table 53.

#### Note:

All gridded models are assumed to be SEG-Y formatted.

#### Figure 74. km Model Panel

<u>ileile</u> e	lp			
	å 🕯 🗣 🔻	7 Proj	ject.	
Job Cluster				
Modules	Job Flow km		km <u>Main Input Computation</u> Model Output Advanced Topography Job Doc Model Type Gridded 🗸	
diskWrite eyeBeam fdmod2 d			Vebcity Type RMS/Time	
gain 7 hdrMath 8	1		Model And	
… interpShot … kdm … km ♥ 1	0		Model Cdp Key	

#### Table 53. km Model Panel Fields

Field	Description
Model Type	The type of input velocity model. Currently, only a Gridded model is allowed. In the future, models defined by time-velocity pairs will also be permitted. default: Gridded
Velocity Type	The velocity type used with this model: RMS/Time, Int/Depth, Int/Time. default: RMS/Time
Model	The file containing the model you want to use with the Kirchhoff migration. Note: All gridded models are assumed to be SEG-Y formatted.
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data. default: same as data

Field	Description
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data. default: same as data

#### Table 53. km Model Panel Fields-continued

## km Output Panel

The km Output panel, Figure 75, defines the aliasing, output line and crossline dimensions. The fields are described in Table 54.

### Figure 75. km Output Panel

000	🔀 jobBuilde	r – Marvel Version	2.1.1.31pre3,	Panorama Tech	
<u>File Job U</u> tilities <u>H</u> elp					
	🏠 🗣 🛡 Proje	ect:			:
Job Cluster					
Modules 🔺	Job Flow	km			
	km	Main Input Computat	ion Model Output	Advanced Topography	Job Doc
demig 2 diskRead 3		Output Lines	Min	Max	Inc
diskWrite eyeBeam		Inline aliasing (lines)	1		
fdmod2d 5	×	Output XLines	Min	Max	Inc
gain 7		Xline aliasing (xlines)	1		
···· importVtp		Offset Bins	Min	Max	Inc
interp Shot 10		Velocity Scan (%)	Min	Max	Inc
···· kmodel ↓ 12		Output Times (ms)	MIN	max	
<b>4</b> /// <b>&gt;</b> 13	•	L			

## Table 54. km Output Panel Fields

Field	Description		
Output Lines	The minimum, maximum, and increment values for output lines. <b>This is a REQUIRED entry.</b>		
Inline aliasing	Defines the inline anti-aliasing distance, in units of lines. default: 1		
Output XLines	Defines the minimum, maximum, and incremental crossline values. This is a REQUIRED entry.		
Xline aliasing	Defines the crossline anti-aliasing distance, in units of lines. default: 1		
Offset Bins	Defines the endpoints of the desired output offset bins. For example, the values 0, 20,000, and 1000, define output offsets ranging from 500 to 19,500. This field is only visible if you have selected an Output Mode of Offsets in the Main panel.		
Velocity Scan (%)	Setting the minimum, maximum, and increment provide the percentage range over which migrations should be performed. For example, setting this range to 90, 110, 5 will produce output volumes using 90, 95, 100, 105, and 110 percent of the original velocity field.		
Field	Description		
--------------	--		
Output Times	Defines the minimum, maximum, and incremental output time values, in milliseconds. <b>This is a REQUIRED entry.</b>		

## Table 54. km Output Panel Fields-continued

## km Advanced Panel

The km Advanced panel, Figure 76, defines several advanced user parameters. The fields are described in Table 55.

#### Figure 76. km Advanced Panel

000	🔀 jobBuilder – N	Narvel Version 2.1.	1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp				
L 🗃 🖬 🗛 🎉	s 🚯 🗣 🔻 Project:			<b>±</b>
Job Cluster				
Modules A Jo	Job Flow Main	Input Computation N	Indel Output Advanced Toppgraphy Job Doc	
cuda-test 2 demig 2 diskRead 3	Mig	ration Mode	Normal	<u>.</u>
	Alg	orithm	Curved-ray	•
	Usi	e trace counter in header	Yes	•
importVtp 9 interpShot 10	ma	xmem	900	
	Mu	te Angle (degrees)	15	
mork 13 mork 14	Dip	x Frequency (Hz) Gain (0-100)	0	
<ul> <li>mute</li> <li>✓</li> <li>✓</li> <li>✓</li> </ul>				

#### Table 55. km Advanced Panel Fields

Field	Description
Migration Mode	Specifies whether the migration is to be Normal, DoubleV, or from Topography. If the migration is from topography, you can enter data on the km Topography Panel. default: Normal
Algorithm	Specifies the algorithm to be used in the calculations: Curved-ray or Straight-ray. default: Curved-ray
Use trace counter in header	Flag indicating whether or not the trace counter that diskRead puts in the trace header is to be used. default: Yes
Verbose	Switch for turning debug printing on and off. default: 0
maxmem	Maximum amount of memory that MARVEL can use per kdm instance. default: 900

Field	Description
Mute Angle	Defines the angle, measured down from the surface, that defines a cone limiting the near surface aperture. default: 15
Max Frequency	The maximum frequency allowed by the filtering process. default: 0, do not filter
Dip Gain	Variable that enables you to control dip. The value can range from 0 through 100. default: 0, do not apply a gain

#### Table 55. km Advanced Panel Fields-continued

## km Topography Panel

The km Topography panel, Figure 77, defines several topography user parameters. The fields are described in Table 56.

#### Note:

The fields on the panel are visible are only visible if you select From Topography for the Migration Mode on the km Advanced Panel.

#### Figure 77. km Topography Panel

000	🔀 jobBuilde	r – Marvel Version 2.	1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp			
	≞ ≵ ♪ ♥ ♥ ▫▫	ject:		
Job Cluster				
Modules 4	<ul> <li>Job Flow</li> </ul>	-km		
	1 km	Main Input Computatio	n Model Output Advanced Topography Job Doc	
de mig diskRead	2 3	Statics Location	Model Headers	
diskWrite eyeBeam	4	Statics Header	ts tat	
filter	6	Source Elevation Key	selev	
gain hdrMath	7	Source Elevation Key	gelev	
importVtp interpShot	9	Sense of Topography	Down From Model Top 👱	
kdm <mark>km</mark>	10	Topo Min		
kmodel	12	Topo Max		
merlin mork	13	ModelTop	Top of model (z=0) is datum	
mute o ned	15	Topo Surface File		
parsim		Topo Surface Name	Тара	
pet postproc prune Shooter		Reference Velocity	1000	
t /// ►	•			

#### **Table 56. km Topography Panel Fields**

Field	Description
Statics	Model Headers, Data Headers, Surface File
Location	default: Model Headers
Statics Header	The header key for the total statics information. default: tstat
Source	The header key for the source elevation information.
Elevation Key	default: selev

Field	Description
Source Elevation Key	The header key for the source elevation information. default: gelev
Sense of Topography	Down From Model Top, Up From Sea Level/Datum default: Down From Model Top
Topo Min	
Торо Мах	
Model Top	Top of model ( $z=0$ ) is datum, Top of model ( $z=0$ ) is topo surface default: Top of model ( $z=0$ ) is datum
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Reference Velocity	default: 1000

## Table 56. km Topography Panel Fields-continued

# **MERLIN Module**

Two-way wave equation program for modeling, velocity analysis and depth imaging.

#### Note:

You should use MERLIN<sup>®</sup> to perform migrations instead of **rtmodel**.

## Figure 78. MERLIN Main Panel, Model Mode

000			X	jobB	uild	er – N	larvel	Versi	on 2.1	.1.31pre3	, Panoram	na Tech				
<u>File Job U</u> tilities	<u>H</u> elp															
	Đ	Ê	¢	₽	$\nabla$	Proje	:t:									•
Job Cluster Main -angle2offset -antalias -autopick	<ul> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>5</li> <li>6</li> <li>7</li> <li>8</li> <li>9</li> <li>10</li> <li>11</li> <li>12</li> <li>13</li> <li>14</li> <li>15</li> </ul>		Fbw			Projer merlin – Main Proj Mod Resi Pea Wav Wav Wav Sho Outj Sou Sou	Model ect e k Freque elet File elet Lez t Specif put Type rce CDF rce Line	input ency ikation e bocatio	Output	Computation el 1t: h/shot.resta n File umeters	I Smoothing	Boundary	Тород 	raphy		
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ob Cluster													
Modules	•	Job Flow		merlin –									
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angle2offset	2		-1										_
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auto Mute		_	-1										
autopick	۶Ę	_	-1	Mod	e		Migrat	e			<b>.</b>		
bulkStatic	Ê		-1										
collect	P		-1	Rest	art file		/sc rate	h/shot restart			_		
cuda-test	7		-1				/ Period	in shotte start					
···· de mig	8			Pea	k Frequ	ency	5						
diskRead	9		- 1				_						
diskvvrite	1	0	- 11	Wav	elet		From	ile			- <b>-</b>		
fdmod2d	1	1											_
filter	1	2		Wav	elet File							9	
gain	1	3											_
hdrMath	1	4		Wav	elet Lea	ad (ms)	0						
importVtp	1	5					_						
interpShot	Ē		-1	Max	Time (n	15)	4000						
kam			- 1	6							_		
km	н.		- 1	Scra	tch Bas	ename	lec mite	h/urerr/cih/rtr	ndel		_	D	

#### Figure 79. MERLIN Main Panel, Migrate Mode

#### Table 57. MERLIN Main Panel Fields

Field	Description
VTI/TTI Model	Туре
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a REQUIRED entry.
Mode	Model or Migrate
Restart File	The application keeps information about shots already processed in this file. It is usually best to put it in the same directory where your output files are located and to give it a similar name. default: /scratch/shot.restart
Peak Frequency	This field has a somewhat historical definition in units of Hz. The value is based on the definition of the default Ricker wavelet, and refers to the peak frequency of the defining Gaussian pulse (since the Ricker wavelet is the second derivative of the Gaussian pulse, its peak frequency is actually higher than the Gaussian pulse itself). The maximum produced frequency will be roughly 2.8 times this number. default: 5

Field	Description
Wavelet	The name of the wavelet convolved with a reflectivity trace to generate a synthetic seismogram: Ricker (zero-phase) or Spike (which is mostly useful for migration), or From File (where you specify your own wavelet). If you specify a wavelet, you must then specify two additional parameters: Wavelet File and Wavelet Lead.
	<ul><li>Ricker</li><li>Spike</li><li>From File</li></ul>
	default: Ricker
Wavelet File	When you have specified that the wavelet is From File, this field allows a single trace to be read from a seismic input file to define the source wavelet.
Wavelet Lead (ms)	When you have specified that the wavelet is From File, the specified wavelet will be centered at this point. default: 0
Shot Specifications	Parameters or From Data (This field is only displayed for the Model Mode.) default: Parameters
Output Type	Data or Residual (This field is only displayed for the Model Mode.) default: Data
Source CDP Location	(This field is only displayed for the Model Mode.)
Source Line Location	(This field is only displayed for the Model Mode.)
Max Time (ms)	default: 4000
Scratch Basename	The application needs temporary storage for acquired data, accumulated image, and others. All of these filenames will start with this prefix.

#### Table 57. MERLIN Main Panel Fields-continued

## **MERLIN Model Panels**

#### Figure 80. MERLIN Model Panel, VTI/TTI Model Type

Job <u>U</u> tilities	<u>H</u> elp			_									
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b Cluster													
Modules	•	Job Flow		- me rlin -									
lain	1	merlin		Main	Model	Input Ou	tput	Computation	Smoothing	Boundary	Topography	Compression <b>4</b>	>
angle2offset	2						_						-
antialias	3	-		Mod	iel Type		VT	I/TTI			<u>+</u>		
auto Mute	-	-	_										.
autopick	-	-		Vek	city Mo	del							
bulkStatic	-	_									[		┛║
collect	/ <b>P</b>	_		VTI	/ TTI Ve	locity Type	Vp	(vertical)			•		
cuda-test	7	_											
de mig	8			Den	sity Mor	lal						A	ן ר
diskRead	9				any mor								
diskWrite	10											-	ו ר
eyeBeam	11				/ III Ep	silon							
filter	12												ור
gain	13	-		VTI	/ TTI De	e Ita							
hdrMath	14	-											- 1
importVtp	14	-		<u>π</u>	Theta-x								
… interpShot	15												-
kdm				TTI	Azimuth							e)	
km												<u> </u>	
Kmodel				And	le Dime	nsion	De	grees			•		
merk											-		
moveout				Mod	lel Line	Key							
mute													
oned				Mod	lel Cdp	Key							

## Figure 81. MERLIN Model Panel, Constant-Density Acoustic Model Type

ie lob Utilities	Help	X	jobBuilder	- Marvel Version 2.1.1.31pre3, Panorama Tech	
	<b>B</b>	Å 1		ject	
Job Cluster					
Modules	•	Job Flow	<b>^</b>	nertin	
Main	1	merlin		Main Model Input Output Computation Smoothing Boundary Topography	Compress 4 >
angle2 offset antialias	2			Constant-Density Acoustic	
auto Mute	7 3			model type	
autopick	4			L	
bias	5			Velocity Model	<u>a</u>
bulkStatic	6				
collect	7				
	8	-			
diskRead	9				
diskWrite	10				
eyeBeam	10			Angle Dimension Degrees 🛨	
···· fd mo d2 d	11				
filte r	12			Model Line Key	
gain	13			Model Cdp Key	
ndrMath	♥ 14				
< /// ≯	4	111	•		

	8	â 🕯 🗣	₹ 9	roject:						
b Cluster										
Modules	•	Job Flow	•	merlin						
lain	1	merlin		Main Model	Input Output	Computation	Smoothing	Boundary	Topograph	y Compress < 🕨
angle2offset antialias	2			Model Type	Variable	-Density Acous	itic		<b>±</b>	
automute autopick	4								r	
bias bulkStatic	5			vеюслу моа	ei					
collect	6		<u> </u>	Density Mode	a 🗌				—	A
cuda-test demig	8			Densky mou						
diskRead	9									
diskWrite eveBeam	10			Angle Dimen	sion Degrees				¥	
fd mod2 d	11		- 11							
filte r	12	_		Model Line K	ley					
gain	13		_	Model Cdp K	ey					

#### Figure 82. MERLIN Model Panel, Variable-Density Acoustic Model Type

#### Table 58. MERLIN Model Panel Fields

Field	Description
VTI/TTI Model Type	
Model Type	<ul> <li>VTI/TTI</li> <li>Constant-Density Acoustic</li> <li>Variable-Density Acoustic</li> <li>default: VTI/TTI</li> </ul>
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data.
VTI/TTI Velocity Type	Vp (vertical) or VNMO (vertical) default: Vp (vertical)
VTI/TTI Epsilon	
VTI/TTI Delta	
TTI Theta-x	
TTI Azimuth	
Angle Dimension	Degrees or Radians default: Degrees

Field	Description
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data.
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data.
Source Line Location	
Max Time (ms)	default: 4000
Scratch Basename	The application needs temporary storage for acquired data, accumulated image, and others. All of these filenames will start with this prefix.
Constant-Density Acor	ustic Model Type
There are no fields spec	rific just to this model.
Variable-Density Acou	istic Model Type
Density Model	

#### Table 58. MERLIN Model Panel Fields-continued

# MERLIN Input Panel

## Figure 83. MERLIN Input Panel

000	🔀 job	Buil	der –	Marve	l Ver	sion 2.	1.1.31pre3	, Panoran	na Tech				
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	} & ⊕	₽	▼ Р	roject:									Ţ
Job Cluster													
Modules 🔺	Job Flow	•	me rlin —										٦
Main 1	merlin		Main	Model	Input	Output	Computation	Smoothing	Boundary	Topography	Compre	• •	
angle2 offse 2												_	
auto Mute 3			Line	Header	rKey	[	ep					- I	
autopick 4		2				l	-r					1	
bias 5		1		Heade	rKov	ſ	e da					-	
bulkStatic 6				neaue	ricey	l	cup					-1	
cuda-test 7						ſ	-					-	
de mig 8			Min	l races/S	Shot	Į	0					-1	
diskRead 9						,						_	
diskWrite 10	)		Inpu	t Shot M	lormali	zation	RMS					:	
fdmod2 d 11						L						-	
filter 12		-											
	•												

## Table 59. MERLIN Input Panel Fields

Field	Description
Line Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing CDP designators. MARVEL usually uses cdp, which is a 4-byte integer at location 21 in SEG-Y files. default: cdp
Min Traces/Shot	default: 0
Input Shot Normalization	None or RMS. This field is only visible if MERLIN is performing a migrate operation, as selected on the Main panel. default: None

# MERLIN Output Panels

#### Figure 84. MERLIN Output Panel, Model Mode

OOO 🔯 jobBuild	der – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File Job Utilities H</u> elp		
	Project:	•
Job Cluster		
Modules 🔺 Job Flow 🔺	merlin	1
Main         1         merfin           -anitolas         2         3           -autoMute         3         3           -autoMute         4         -           -bias         5         -           -collect         7         -           -demig         8         -           -disKRed         9         -           -eve Ream         10         -	Main         Model         Input         Output         Computation         Smoothing         Boundary         Topography         Complet         I           Scale for CDP and Line         1	
fdmod2 d 11 fdmod2 d 12 •-fdmod2 d 12 •-	Max Depth (m/ft)	

#### Figure 85. MERLIN Output Panel, Migrate Mode

000	X jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp	
	1 V Project
Job Cluster	
Modules     Image: Comparison of the sector of	bow

#### Table 60. MERLIN Output Panel Fields

Field	Description
MERLIN Model	Mode
Scale for CDP and Line	default: 1
Output Receiver Spacing (cdps)	Data will be acquired on a grid centered on the shot point, with this spacing along the CDP axis.

Field	Description
Output Receiver Spacing (lines)	Data will be acquired on a grid centered on the shot point, with this spacing along the line axis.
Max Depth (m/ft)	
MERLIN Migra	te Mode
Output Lines	The number of lines to be contained in the output data.
Input Aliasing (lines)	
Output XLines	The number of crosslines to be contained in the output data.
XLine Aliasing (xlines)	Attempt to compensate for aliasing in the crossline direction (units: lines). Note: This can be a costly operation.
Output Depths	Defines the minimum, maximum, and increment for the each output trace.

## Table 60. MERLIN Output Panel Fields-continued

# **MERLIN** Computation Panels

	P.	Å €	₽⊽	Project:										_
cluster	_	-												
lodules	⁴	Job Flow		merlin									_	_
ain	1	merlin		Mair	Model	Input	Output 0	Computati	ion Smoothing	Boundary	Topography	Compression	•	>
angiezoπset antialias autoMute	2 3			FC	Order			4th	-order				<b>¥</b>	
autopick bias	4			Tir	ne order			4 th	-order				<b>¥</b>	
bulkStatic collect	6			Co	urant Fac	tor		0.9						]
cuda-test demig	8			AI	ow Surfac	e Multipl	es	Ye	s				¥	
diskRead diskWrite	9 10			En	e Surface	2 Locatio	n	Sh	ot Topography				*	
eyeBeam fdmod2d	11			En	e Surface	e Depth	(m/ft)	0						]
filter gain	12			Us	e Bottom	Bounda	ry Absorb	er Ye	s				¥	
importVtp	14			Lir	ie (Y) Ape	rture (m)	ft)	300	00					]
kdm				×L	ine (X) Ap	erture (r	n/ft)	300	00					]
km kmodel				Sł	ot Center	ing		So	urce Point				•	
merlin mork				Gr	id Spacing	gs (m/ft)		x		У	z			]
moveout				G	id-change	Depths	(m/ft)							
oned				D	/DY Grid+	change	Depths (n	n/ft)						]
pef				DZ	Grid-cha	nge Dep	ths (m/ft)							1

#### Figure 86. MERLIN Computation Panel, Model Mode

Job <u>U</u> tilities	<u>H</u> elp								
	4	æ	ſ	¢	▼	Project	:		
Cluster									
Modules		Jol	b Flow			me	rlin		
Main	1	me	rlin			N	tain Model Input Output Computa	ttion Smoothing Boundary Topography Compression Job [	λос
angle2 offset	2								
antialias	antialias			FD Order	4th-order	<b>¥</b>			
auto Mute	4				_				
autopick	-				_		Time order	4th-order	¥
bulkStatic	5								
collect	6						Courant Factor	0.9	
collect 7									
de mig	8						Allow Surface Multiples	Yes	<b>¥</b>
diskRead	9								
···· diskWrite	10						Free Surface Location	Shot Topography	¥
eyeBeam	10	-			_				
···· fd mo d2 d	11	-			_		Free Surface Depth (m/ft)	0	
filte r	12								
···· gain	13						Use Bottom Boundary Absorber	Yes	<b>¥</b>
hdrMath	14								
importVtp	15						Line (Y) Aperture (m/ft)	3000	
… interp ≤ hot		-					XI ine (X) Anerture (m/ft)	3000	
Kam							Active of Apendice of the	3000	
Km							Shot Centering	Model	*
me din									-
mork									_
moveout							Grid Spacings (m/tt)	× y z	_
···· mute									
oned							Grid-change Depths (m/ft)		_
···· parsim							DX/DY Grid-change Denths (m/ft)		
···· pef									
···· postproc							DZ Grid-change Depths (m/ft)		
prune Shooter									
rayShooter							Source-field Impedance Matching	No	<b>¥</b>
re samp3d									
re sample							Reeceiver-field Impedance Matching	No	<b>Y</b>
rimodel									
scan							Illumination Type	Source	¥
shooter									
smoother							Per-shot Illumination	Yes	•
stack									-
static Shift							Illumination cutoff	0.05	
time Depth									
trsum							Illumination Power	0.5	
trwindow								Mar	
wem							Use New Imaging	res	<b>¥</b>

### Figure 87. MERLIN Computation Panel, Migrate Mode

## Table 61. MERLIN Computation Panel Fields

Field	Description
Both Migrate a	nd Model Panels
FD Order	This determines the order of accuracy of the spatial derivatives used in the simulation. For second-order, a second derivative is computed using 3 grid points. For 8 <sup>th</sup> -order,9 grid points are used, with 5 unique coefficients. This is usually the ideal combination for speed and accuracy. Possible values are 2nd, 4th, 6th, 8th, 10, 12th, 14th order. default: 4th order
Time order	$2^{nd}$ -order time uses a three-point stepping algorithm. $4^{th}$ -order uses the wave equation to compensate for errors in the former approach (usually referred to in the industry as 'the Dablain trick').

Field	Description
Courant Factor	The internal time step is determined by the Courant stability condition, involving the grid spacing and the maximum velocity. For the default $4^{th}$ -order time, this code is stable with a factor of .9; for $2^{nd}$ -order time, a value of .85 is recommended. Slightly smaller values <i>may</i> result in slightly better output, but probably will not help.
Allow Surface Multiples	If this field is set to Yes, a free surface is modeled, and the wave field will reflect off the top, leading to multiples in the data. If the field is set to No, an absorbing zone will be placed at the top. default: Yes
Free Surface Location	There are three options to this field: Shot Topography—Reflections occur at the topography defined for shots (see below). Receiver Topography—Reflections occur at the topography defined for receivers (see below). Fixed Depth—Free surface is at user-specified depth.
Free Surface Depth (m/ft)	User-specified free-surface depth, when 'Fixed Depth' is chosen for 'Free Surface Location'.
Use Bottom Boundary Absorber	This field has two options: Yes—Waves are absorbed at the bottom. No—Waves can reflect off the bottom. This generally does little harm, and costs a bit less. default: Yes
Line (Y) Aperture (m/ft)	The computation for each shot is limited along the $y$ axis to a range above and below the center of the shot. default: 3000
XLine (X) Aperture (m/ft)	The computation for each shot is limited along the $x$ axis to a range above and below the center of the shot. default: 3000
Shot Centering	<ul> <li>Source Point</li> <li>Shot + Receiver Box</li> <li>Avg Midpoint</li> <li>Model</li> <li>default: Source Point</li> </ul>

## Table 61. MERLIN Computation Panel Fields-continued

Г

Field	Description
Grid Spacings	If left blank, these will be determined by the 'Output Receiver Spacings' (see above). Otherwise, these specify the spacings of the computation grid.
Grid-change Depths (m/ft)	
DX/DY Grid- change Depths (m/ft)	
DZ Grid- change Depths (m/ft)	
Migrate Panel	Only
Source Field Impedance Matching	Use 'non-reflecting' wave equation for source propagation, and is an attempt to reduce artifacts. Costly, and not very effective. Default: No
Receiver-field Impedance Matching	Use 'non-reflecting' wave equation for receiver back-propagation in an attempt to reduce artifacts. Costly and not very effective. default: No
Illumination Type	An illumination is produced. Generally, the default value of 'Source' should be used. In this case, the illumination is just the sum of the squared source fields at each image point. • Source Point • Shot + Receiver Box • Avg Midpoint • Model default: Source.Receiver
Per-Shot Illumination	Each shot image can be divided by the illumination separately. This tends to be noisier, but can help to image steep dips in some cases.
Illumination cutoff	This field is only available if Per-Shot illumination is set to Yes. default: 0.05
Illumination Power	For a value of '1', the illumination is the squared source. This field is only available if Per-Shot Illumination is set to Yes. default: 0.5

## Table 61. MERLIN Computation Panel Fields-continued

Field 1	Description
Use New Imaging	default: Yes

## Table 61. MERLIN Computation Panel Fields-continued

## MERLIN Smoothing Panel

The Smoothing Panel does not display any fields if the the MERLIN Main Panel Mode Type is set to Model.

### Figure 88. MERLIN Smoothing Panel

	Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ ➡ ■ ≜ ≵ ☆ ♥ ▼	Project:	<b>±</b>
Job         Cluster           Modules         Job Flow           Main         1           -angle2offset         2           -antiblas         3           -autoblute         3           -autoblute         5           -buikStatic         6           -collect         7           -diskRead         9           -diskRead         9           -diskRead         10           -eyeBeam         11           -fibrer         12           -onin         12	mertin       Main     Model     Input     Output     Computation     Smoothing     Boundary     Topography     Compression     Jol 4       Source-field Vel Smoothing     No     V     V0     Z0       Source Vel Smoothing Dists (x,y,z)     x(0     V(0     Z0       Receiver-field Vel Smoothing     No     V       Receiver-field Vel Smoothing     No     V	•
hdrMath ¥ 14	Receiver Vel Smoothing Power	
< /// ▶ 15		

#### Table 62. MERLIN Smoothing Panel Fields

Field	Description
Source-field Vel Smoothing	Flag controlling the smoothing of the source-field velocity (slowness) field used to propagate the source term. This process can be useful for reducing artifacts.
Source Vel Smoothing Dists (x,y,z)	Gaussian widths for smoothing slowness in each direction for the source. defaults: 0, 0, 0
Source Vel Smoothing Power	The number of times to smooth the source volume.
Receiver-field Vel Smoothing	Turn the smoothing of the receiver-field velocity (slowness) field used to propagate the source term <i>on</i> or <i>off</i> . This process can be useful for reducing artifacts.
Receiver Vel Smoothing Dists (x,y,z)	Gaussian widths for smoothing slowness in each direction for the receiver. defaults: 0, 0, 0
Receiver Vel Smoothing Power	The number of times to smooth the receiver volume.

# MERLIN Boundary Panel

#### Figure 89. MERLIN Boundary Panel

000	$\overline{\chi}$ jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File J</u> ob <u>U</u> tilities <u>H</u> elp		
	Project:	
Job Cluster		
Modules 🔺 Job Flow	merlin	-1
Main 1 merlin	Main Model Input Output Computation Smoothing Boundary Topography Compression Job Doc	
angle2offset 2 antialias 3	Use Absorbing BC Yes 👻	
autopick 4 bias 5	Minimum Damping 2e-05	
bulkStatic 6	Pad Aperture	
···· demig	Damping-zone Width (wavelength) 3	
diskRead 9 diskWrite 10	Apply Isotropic Damp	
eyeBeam fdmod2 d 11	Maximum Damping 0.2	
filter 12 gain 13	Damping Power 4	
hdrMath 14	Apply PML (anis. damping)	
interpShot	Maximum PML Amp 0.2	
	PML Power 2	

### Table 63. MERLIN Boundary Panel Fields

Field	Description
Use Absorbing BC	default: Yes
Minimum Damping	This is an isotropic damping factor applied everywhere, regardless of other settings. The default of $2 \cdot 10^{-5}$ should not produce much noticeable effect, but helps when other damping is used to avoid reflections.
Pad Aperture	This field has two possible values: <i>Yes</i> —Computation aperture is increased and damping is done outside the output zone. <i>No</i> —Damping is included in the output aperture.
Damping- zone Width (wavelength)	The damping thickness will be this number of wavelengths for the 'Peak Frequency' at the maximum velocity. The default of 3 should eliminate reflections sufficiently.
Apply Isotropic Damping	If 'Yes', use Isotropic damping in the damping zones.

Field	Description
Maximum Damping	The maximum damping factor to use. The default of 0.2 should be safe, while anything over 0.5 may be unstable, and anything over 1 is <b>very</b> unstable. (This field is only visible if Apply Isotropic Damping is set to Yes.)
Damping Power	Damping is varied from 0 to 'Maximum Damping' over the pad length, with a formula like $d = d_{max}(x/L)^p$ , where $d_{max}$ is <i>MaximumDamping</i> , <i>x</i> is the distance into the pad, <i>L</i> is the pad length, and <i>p</i> is this parameter. The default of 4 is a good choice to avoid reflections caused by damping. (This field is only visible if Apply Isotropic Damping is set to Yes.)
Apply PML (anis. damping)	PML, or 'Perfectly-Matched Layers' is designed to absorb one direction of propagation. Note: This approach of anisotropic damping is much more costly than isotropic damping, and Panorama Technologies believes it does not work as well.
Maximum PML Amp	This is analogous to <i>MaximumDamping</i> . This field is only visible if Apply PML is set to Yes.
PML Power	This is analogous to <i>DampingPower</i> . This field is only visible if Apply Isotropic Damping is set to Yes.

## Table 63. MERLIN Boundary Panel Fields-continued

# MERLIN Topography Panel

#### Figure 90. MERLIN Topography Panel

⊵_ <u>J</u> ob_ <u>U</u> tilities	<u>H</u> elp														
	، <b>د</b>	ŝ <b>t</b>	₽,	▼ Pro	ject:										
Modules		Job Flow			- me rlin -	Madal	Input (	Jutnut	Computation	Smoothing	Roundan	Tapagraph	Compre	tripp lo d	
angle2offset antialias autoMute bias bias bulkStatic collect cuda-test demig diskRead	2 3 4 5 7 8 9				Тор	o Surfac	e File e Name	[	Торо						]
diskWrite eyeBeam fdmod2 d filter	10 11 12				Sou	rce Topo	Sunface	File						8	
gain hdrMath importVtp internshot ♥	13 14 15				Wea	athering '	Velocity	[							

## Table 64. MERLIN Topography Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Source Topo Surface File	The path and name of the source topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Weathering Velocity	The weathering velocity to use in the calculations.

# **MERLIN Compression Panel**

## Figure 91. MERLIN Compression Panel

	Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
0 0 8 8 8 4 4 7	Project:	Ŧ
Job Cluster		
Modules     Job Flow       Main     1     merlin	The final system of the field of the fi	
⊷-filter         ▼         12           €         ////         ▶         13	•	

## Table 65. MERLIN Compression Panel Fields

Field	Description
Use Raw File for Field	Necessary for compression. If No, stored source term is stored in SEG-Y files (SLOW).
Use Forward Field Compression	Turns compression for the source term on or off. <b>Note:</b> This field is only available if the Mode field on the rtmodel Main panel is set to Migrate.
FF Compression Max	As part of the compression, this specifies the amplitude range used to store the samples. For most projects, the default of 120 produces good results, but for some projects, a more dynamic range may be needed. <b>Note:</b> This field is only available if the Mode field on the rtmodel Main panel is set to Migrate. default: 120

## MERLIN Job Panel

#### Figure 92. MERLIN Job Panel

) 🕘 🗳	Ę	▶ ☆ ☆ ♥	🔻 Proj	ject:						
b Cluster										
lodules	٠	Job Flow		merlin						
ain		1 merlin		Main	n Model Inpu	t Output	Computation	Smoothing	Boundary Topography Compression .	Job Doc
angle2offset		2			• • • •	-				
antialias		3	1.1	Use	e All CPUs		Yes			¥
auto Mute	4	4	1 1							
bias			- II	Ma	ax Threads per	Proc				
bulkStatic		-	- II							
collect		0	- 1	Nu	imberof Domai	ns	1			
cuda-test	_	7	- 1		eteric Werker		Yes			
de mig		8	- 1	ma	ister is worker					
diskRead		9	- 1				No			
eveBeam		10		Ru	in workers low	nonty				-
fdmod2 d		11					VEC			
···· filte r		12		Use	e Restart Files		165			Ŧ
gain		13								
hdrMath		14		Ve	rbose		NO			Ŧ
importVtp		15	1							
interp Shot			- 1	Dai	usvchain Retur	ned Shots	Yes			· •

#### Table 66. MERLIN Job Panel Fields

Field	Description
Use All CPUs	This really means that each worker should use multiple threads. If No, then there will be one independent worker spawned for each CPU (or core) in the cluster. default: Yes
Max Threads per Proc	
Number of Domains	default: 1
Master is Worker	Flag that controls whether the master I/O controller is also used for performing calculations. default: Yes
Run workers low priority	If Yes, workers will be spawned with reduced priority, although the master process will remain at high priority. This can be useful, especially when <i>MasterIsWorker</i> is set, so that one worker does not slow down collection or submission of shots for all of the others. default: No

Field	Description
Use Restart Files	If NO, the job will ignore restart information and start from the beginning. default: Yes
Verbose	Switch for turning debug printing on and off. default: No

#### Table 66. MERLIN Panel Fields-continued

# MORK Module

This is Panorama Technologies' one-way migration module. When a seismic section is migrated, reflection events are repositioned so they are below their correct surface locations and have the proper corrected vertical reflection times.

## MORK Main Panel

This panel, Figure 93, enables you to define the basic parameters for the module. Table 67 describes the terms used on both panels.

Job Guines Heip     Job Cluster     Modules     Job Flow     Modules     1     mork		🔀 jobBuilder – Marvel Ve	ersion 2.1.1.31pre3, Panorama Tech	
Job       Cluster         Modules       Job Flow       mork         -diskWrite       1       mork         -eysBeam       2				
	Modules     Job       -diskWrite     1       -eyeBeam     2       -fdrod2 d     3       -fdrod2 d     3       -fdrod2 d     5       -fall     6       -import/tp     6       -kdm     7       -kdm     9       -mertin     10       -moveout     11       -moveout     12       -mole     13	Flow Main Model Com Project Job Name Scratch Directory Restart file Migration Mode	putation Input Regularization Topography Output Headers Job D mork /scratch/ /scratch/shot.restart Shot	

#### Figure 93. MORK Module Main Panel

#### Table 67. MORK Module Main Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Job Name	The name for this job. default: MORK
Scratch Directory	Name of the directory used for temporary files. default: /scratch/

Field	Description
Restart File	The application keeps information about shots already processed in this file. It is usually best to put it in the same directory where your output files are located and to give it a similar name. default: /scratch/shot.restart
Migration Mode	<ul> <li>Shot</li> <li>Common Azimuth</li> <li>Post-stack</li> <li>Data Regularization (common azimuth)</li> <li>default: Shot</li> </ul>

#### Table 67. MORK Module Main Panel Fields-continued

## MORK Model Panel

This panel, Figure 94, enables you to define the basic parameters for the module. Table 68 describes the terms used on both panels.

<u>ile J</u> ob <u>U</u> tilities	<u>H</u> elp		,		
0 🗠 日	8	条 🕁 🗣	V Pr	ject:	
Job Cluster					
Modules	*	Job Flow		-mork	5
···· diskWrite	1	mork		Main Model Computation Input Regularization Topography Output Headers Job Doc	
eyeBeam	2	_			1
td mod2 d	3	_		ModelType VTI/TTI 👻	
gain	4	_	-		
hdrMath	-	_	-	Velocity model	
···· importVtp	-	_	_		
interp Shot	<u>•</u>	_	_	VTI / TTI Velocity Type Vp (vertical)	
kdm	7		_		
Km	8	_	_	VTI / TTI Epsilon	
merlin	9				
mork	10			VTI / TTI Delta	
moveout	11				
mute	12			TTI Theta	
oned	13				
parsim	14			TTI Azimuth	
postproc	15				
prune Shooter			_	Angle Dimension Degrees	
rayShooter	*				
< /// >					1

## Figure 94. MORK Model Panel

## Table 68. MORK Model Panel Fields

Field	Description
Model Type	Constant-density Acoustic or VTI/TTI default: Constant-Density Acoustic
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data.
VTI/TTI Velocity Type	Vp (vertical) or VNMO (vertical) (This field is only visible for VTI/TTI model types.) default: Vp (vertical)
VTI/TTI Epsilon	(This field is only visible for VTI/TTI model types.)
VTI/TTI Delta	(This field is only visible for VTI/TTI model types.)
TTI Theta	(This field is only visible for VTI/TTI model types.)

Field	Description
TTI Azimuth	(This field is only visible for VTI/TTI model types.)
Angle Dimension	Degrees or Radians (This field is only visible for VTI/TTI model types.) default: Degrees

#### Table 68. MORK Model Panel Fields-continued

## MORK Computation Panel

This panel, Figure 95, enables you to define the parameters used in the computations for the module. Table 69 describes the terms used on both panels.

C C C	Hale	X	jobBuilder – Marv	el Versio	n 2.1.1.31pre3,	Panorama Tech		
	<u>P</u>	å 🕯 🗣	Project:					
Job Cluster								
Modules	-	Job Flow	mork					
diskWrite	1	mork	Main Mode	Computat	ion Input Regulariza	tion Topography O	utput Headers Job Doc	
fdmod2 d	2		Min Freq					
gain	4		Max Freq	l				
importVtp	5	_	Time Pad 9	16	0			
… interp≤not … kdm	7		X Aperture	(m/ft)	3000			
km kmodel	8	_	Y Aperture	(m/ft)	3000			
merlin	10		Grid Spacir	ngs (m/ft) :	x	У	z	
moveout	11		Illumination	туре	Source.Receiver			<b>±</b>
oned parsim	12    13		Per-shot III	umination	Yes			<b>_</b>
pef postproc	15		Illumination	cutoff	0.05			
prune Shooter			Illumination	Power	0.5			
···· re samp3d ···· re sample			Water Both	om	0			
rtmodel scan			Shot Cente	ering	Source Point			<b>±</b>
semblance shooter smoother			Scale Freq	uencies	No			<b>±</b>
stack	•							

#### Figure 95. MORK Computation Panel

#### Table 69. MORK Computation Panel Fields

Field	Description
Min Freq	The minimum frequency to be allowed by filtering.
Max Freq	The maximum frequency to be allowed by filtering.
Time Pad	The percent padding to apply to input traces. default: 0
X Aperture (m/ft)	The length, in meters or feet, of the line direction aperture limit. default: 3000
Y Aperture (m/ft)	The length, in meters or feet, of the crossline (CDP) direction aperture limit. default: 3000

Г

Field	Description
Grid Spacings	If left blank, these will be determined by the 'Output Receiver Spacings'. Otherwise, these specify the spacings of the computation grid.
Illumination Type	An illumination is produced. Generally, the default value of 'Source' should be used. In this case, the illumination is just the sum of the squared source field at each image point. default: Source.Receiver
Per Shot Illumination	Each shot image can be divided by the illumination separately. This tends to be noisier, but can help to image steep dips in some cases. default: No
Illumination cutoff	This field is only available if Per-Shot illumination is Yes. default: 0.05
Illumination Power	For a value of '1', the illumination is the squared source. This field is only available if Per-Shot illumination is Yes. default: 0.5
Water Bottom	
Shot Centering	For modeling, the only generally useful choices are: Source Point - computation aperture is centered on the source. Model - computation aperture is centered at the center of the model. Generally, the apertures should be at least half the dimensions of the model in this case. default: Source Point
Scale Frequencies	default: No

## Table 69. MORK Computation Panel Fields-continued

## MORK Input Panel

This MORK Input panel enables you to set one parameter, *InputShotNormalization*, and this field is only displayed if you have selected *Shot* as the *MigrationMode* on the MORK Main panel, Figure 93.

*InputShotNormalization*: Normalization corrects for the amplitude effects of wavefront divergence and damping. It is also used when you apply a subsequent filter for eliminating the surface waves. If RMS, each input shot is divided by its RMS value before processing. Possible values: None, RMS; default: None

# MORK Regularization Panel

## Figure 96. MORK Regularization Panel

	uilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🗃 🖬 🚔 🎄 🗣 🛡	Project	•
Job Cluster		
Modules A Job Flow	mork	
diskWrite 1 mork	Main Model Computation Input Regularization Topography Output Headers Job Do	ic
eyeBeam		
films 3		
	Spread Traces by Wavelength Yes	<u>+</u>
importVtp	4	
interpShot 6	CDP Spreading (wavelens) 0	
kdm 7		
km 8		
kmodel 9	Offset Spreading (wavelens) 0	
mertin 10		
moveout 11	Interpolate Empty Topor	
mute 12		
oned + 12		
< /// > 13	▼	

## Table 70. MORK Regularization Panel Fields

Field	Description
Spread Traces by Wavelength	
CDP Spreading (wavelens)	
Offset Spreading (wavelens)	
Interpolate Empty Traces	

## MORK Topography Panel

This panel enables you to define the basic topographic parameters for the module. There are only two parameters on the panel:

- Topo Surface File: The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100 cdp = 500 z = 20.
- Topo Surface Name: The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

# MORK Output Panel

This panel, Figure 97, enables you to define the basic parameters for the module. Table 71 describes the terms used on the panels.

Image: Second		Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
Job Cluster       Modules     Job Flow     mork       -disWrite     1     mork       -disWrite     2       -fdmod2d     3       -gain     4       -hdrMath     5		7 Project:	<b>.</b>
import/up         <	Job Cluster       Modules     Job Flow	mork   Main Model Computation Input Regularization Topography Output Headers Job Doc   Output Lines Min Max Inc   Inline Aliasing (lines)   Output XLines Min Max Inc   XLine Aliasing (xlines)   Output Depth (myfr) Min Max Inc   Output Illumination No	

## Figure 97. MORK Output Panel

#### Table 71. MORK Output Panel Fields

Field	Description
Output Lines	The minimum, maximum and increment values for the output lines. <b>This is a REQUIRED entry.</b>
Inline Aliasing (lines)	Attempt to compensate for aliasing in the inline direction (units: lines). <b>Note:</b> This can be a costly operation.
Output XLines	The minimum, maximum and increment values for the output crosslines. <b>This is a REQUIRED entry.</b>
XLine Aliasing (xlines)	Attempt to compensate for aliasing in the crossline direction (units: lines). Note: This can be a costly operation.
Output Depth (m/ft)	Minimum, Maximum, Increment for output depths. This is a REQUIRED entry.
Output Illumination	Default: No
## MORK Headers Panel

This panel, Figure 98, enables you to define the basic parameters for the module. Table 72 describes the terms used on both panels.

<u>File Job U</u> tilities <u>H</u> elj	p		
	🚴 🔂 🖶 🛡 Proje	ect: /net/praha06/da	ttal/jhu/projects/blessing/blessing-dense.project
Job Cluster	lob Flow	mork	
- filter 1	mode	Main Model Com	nutation Innut Regularization Topography Output Headers Job Doc
	Implify       Implify	Sx Key Sy Key Gx Key Gy Key Line Key Cdp Key	sx
resample		Offset Key	offset
semblance shooter		Tstat Key	Istat
smoother stack static Shift		Model Line Key	ep
···· time Depth ···· trs um ···· trwindow		Model Cdp Key	cdp

## Figure 98. MORK Headers Panel

#### **Table 72. MORK Headers Panel Fields**

Field	Description
Sx Key	The header key specifying where line source data is stored in the trace. default: sx
Sy Key	The header key specifying where crossline source data is stored in the trace. default: sy
Gx Key	The header key specifying where inline geophone data is stored in the trace. default: gx

Field	Description
Gy Key	The header key specifying where crossline geophone data is stored in the trace. default: gy
Line Key	The header key specifying where line data is stored in the trace. default: ep
Cdp Key	The header key specifying where CDP data is stored in the trace. default: cdp
Offset Key	The header key defining the offset field of the stacked trace. default: offset
Tstat Key	The header key for the total statics information. default: tstat
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data. default: ep
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data. default: cdp

#### Table 72. MORK Headers Panel Fields-continued

## MORK Job Panel

This panel, Figure 93, enables you to define the basic parameters for the module. Table 67 describes the terms used on both panels.

## Figure 99. MORK Job Panel

O O O 🛛 🕅 🕅	Builder – Marvel Versio	n 2.1.1.31pre3, Panorama Tech	
<u>File</u> Job Utilities <u>H</u> elp			
	roject: /net/praha06/data1/jhu/p	rojects/blessing/blessing-dense.project	_
Job Cluster			
Modules A Job Flow	-mork		_
filter 1 mork	Main Model Computation	Input Regularization Topography Output Headers Job Doc	
gain 2			1
hdrMath 3			
importVtp			
interpShot	Use All CPUs	Yes 👻	
model 7			
me nn 8	Master is Worker	Yes 👻	
mute			
10			
11	Max Memory/worker (MB)	900	
un nef 12			
ravShooter	Bun workers low priority	No 👻	
re samp3d		-	
re sample			
rtmodel			
scan		VES	
semblance	Use Restart Files	<b>▼</b>	
shooter			
smoother			
stack			1
static Shift	Verbose	No 👱	1
time Dep th			
···· trsum			
trwindow 👻			1
< /// <b>&gt;</b>			-
			-

#### Table 73. MORK Job Panel Fields

Field	Description
Use All CPUs	This really means that each worker should use multiple threads. If No, then there will be one independent worker spawned for each CPU (or core) in the cluster. default: Yes
Master is Worker	Flag that controls whether the master I/O controller is also used for performing calculations. default: Yes
Max Memory/worker (MB)	default: 900

Field	Description
Run workers low priority	If Yes, workers will be spawned with reduced priority, although the master process will remain at high priority. This can be useful, especially when <i>MasterIsWorker</i> is set, so that one worker does not slow down collection or submission of shots for all of the others. default: No
Use Restart Files	If No, the job will ignore restart information and start from the beginning. default: Yes
Verbose	Switch for turning debug printing on and off. default: No

## Table 73. MORK Job Panel Fields-continued

# moveout Module

The moveout module either applies normal moveout (NMO) or the inverse of NMO to input traces.

## moveout Main Panel

This panel enables you to define the basic parameters for the moveout module. There are two different versions of the panel depending on the model type you use, Gridded (Figure 100) or RMS Picks. Table 74 describes the terms used on both panels.

○ ○ ○ X jobB	uilder – Marvel Ver	sion 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
□ 🖨 🖬 🚔 🏦 🖶 🛡 🕬	ject: /net/praha06/data1/jł	1u/projects/blessing/blessing-dense.project	
Job Cluster			
Modules A Job Flow	moveout		
filter 1 moveout	Main Input Doc		
gain 2			
hdrMath	project	/net/nraha06/data1/ihu/nrojects/blessing/blessing-dense.nroject	A
importVtp			
interp Shot 4	ModelType	Gridded 🖌	
kdm 5	moderrype		
km 6			
kmodel 7	Velocity Model		
- 8		DUC 7:	
moveout 9	Velocity Type	RMS/Time 🝷	
oned			
parsim			
pef 12			
postproc 13	Malashi Madal		
prune Shooter 14	velocity Model		
rayShooter 15			
re samp3d	Direction	Forward	
····· re sample			
w scan	Apply Stretch Scaling	No 👻	
semblance			
shooter	Stretch Mute	1.5	
smoother	Mute Taper (ms)	100	
stack	in the raper (int)		
static Shift	Topography File		A
time Depth			
trsum	Topography Name	Торо	
trwindow 👻			

#### Figure 100. moveout Main Panel-Model Type, Gridded

#### Table 74. moveout Module Main Panel Fields

Field	Description
project	The name of the project. The project file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.

Field	Description
Model Type	The model type to be used for this run: Gridded or RMS Picks. default: Gridded
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data. <b>This field is only displayed for a Gridded Model Type.</b>
Velocity Type	The type of velocity being used, that is, interval time, interval depth, or RMS/Time. <b>This field is only displayed for a Gridded Model Type.</b> default: RMS/Time
Picks	This field is only displayed for the RMS Picks Model Type.
Direction	Specifies whether NMO or inverse NMO is used in the calculations. default: Inverse
Apply Stretch Scaling	If yes, divide output samples by stretch factor. default: No
Stretch Mute	The time, in seconds, defining when the stretch mute is applied. Samples that are larger than the stretch factor are muted. default: 1.5
Mute Taper	The length of the mute taper, in milliseconds, where the mute taper avoids edge artifacts produced in any frequency domain processing due to abrupt start of data at the mute. default: 100
Topography File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: $ep = 100 \text{ cdp} = 500 \text{ z} = 20$
Topography Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

#### Table 74. moveout Main Panel Fields-continued

## moveout Input Panel

The moveout Input panel, Figure 101, enables you to define several data keys used in the input data. The fields are described in Table 75.

☐ ☐ ☐ ∑ jobBuild	der – Marvel Version 2.1.1.31pre3, Panorama Tech	
	Project	<b>.</b>
Job Cluster Modules Job Flow Main -angle2offset -antialias -autopkk -bias -bias -bias -collect -cuda-test -demig -diskWrite -eyeBeam	moveout     Main Input Doc     Line Key ep     Cdp Key cdp     Offset Key offset     Model Line Key     Model Cdp Key	

### Figure 101. moveout Input Panel

#### Table 75. moveout Input Panel Fields

Field	Description
Line Key	The header key specifying where line data is stored in the trace. default: ep
Cdp Key	Header key defining the location of the CDP data in the trace. default: cdp
Offset Key	Header key defining the location of the offset in the trace. default: offset
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data. default: same as data
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data. default: same as data

## mute Module

The mute module mutes above, below, or along a linearly-interpolated curve whose width is defined by the times in the mute file, or by the mute X and T values. Mute values are extrapolated to the left by the smallest time sample on the trace, and they are extrapolated to the right by the last value given in the various mute arrays. (For the purposes of this program, above means shorter time and below means longer time, as would normally be seen on a seismic section.) The linear option allows you to define a corridor around a central line to remove air-blasts or other linear events from the gather. In this case, the mute is defined by the linear velocity parameter.

## mute Main Panel

There are three mute Main panels that enable you to set parameter values used in the mute module depending on the location of the Mute Source, Figure 102, Figure 103 and Figure 104. The parameter fields are described in Table 76.

000					🛛 jobBuilder -	· Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	Н	le lp					
	Ļ	32	3 🕁 🕂	V Pro	oject:		<b>T</b>
Job Cluster							_
Modules	٠		Job Flow		-mute		
cuda-test		1	mute		Main Data Doc		
···· de mig		2					
diskRead		3			Project		
diskWrite		4				Enn Pick File	
fd mod2 d		5			Mute Source		
···· filte r		6					
gain	1	7			Mute File		
···· hdrMath	12	8					
interp Shot		9			Internet days March	Interpolated	
kdm		10			Interplation Mode		
km		11			Taper (ms/ft/m)	0	
kmodel	H	12					
mork		13			Mode	Above 👻	
moveout		14					
mute		15			Absolute		
oned					Linear Velocity	330	
parsim					,		
postproc	¥				tm0	0	
• 111 •	Ľ				L		1

#### Figure 102. mute Main Panel, From Pickfile

	, , [	} & <b>↑</b> ₹	Project:		
Cluster					
odules	•	Job Flow	mute		
cuda-test	1	1 mute	Main Data Doc		
demig		2			
diskRead		3	Project		
- diskWrite		4		From Date Handard	
- fdmod2 d		5	Mute Source	FIOM Data Headers	¥
filte r		6			
-gain	4	7		Above 'Mute Start' Value	
importVtp	1	8	Header Mute Mode		
interpShot		9	Interplation Mode	Interpolated	<b>*</b>
kdm		10			
~km ~kmodel		11	Taper (ms/ft/m)	0	
- me rlin		12	Mode	Above	•
mork		13			
moveout mute		14	Absolute	Yes	¥
-oned	1	15			
parsim			Linear Velocity	330	
pef			tm0	0	

#### Figure 103. mute Main Panel, From Data Headers

## Figure 104. mute Main Panel, From Parameters

≥ <u>J</u> ob <u>U</u> tilities	i <u>H</u> elp					
0 🕘 🛛	<b>B</b>	ê 🕯 🖣	Proj	ect:		;
ob Cluster	_					
Modules	<b>_</b>	Job Flow		mute		
cuda-test	1	mute		Main Data Doc		
···· de mig ···· diskRead	2		_	Project	<b></b>	ון ר
diskWrite eyeBeam	4			Mute Source	From Parameters	
fd mod2 d filte r	6					
gain hdrMath	7	_	_	Mute X Values		
… importVtp … interpShot	9			Mute T Values		
···· kdm ···· km	10			Interplation Mode	Interpolated	
kmodel merlin	12			Taper (ms/ft/m)	0	
mork moveout	14			Mode	Above 🛫	
oned	15			Absolute	Yes 👱	
pef				Linear Velocity	330	
prune Shoote	r			tm0	0	
<pre>mayShooter </pre>						

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Mute Source	Identifies the source of mute information: From Pick File, From Data Headers, or From Parameters.
Mute File	A <i>.pick</i> file picked in the gathers program. This file can contain a large number of time-mute or depth-mute pairs for use in the muting process. <b>This field is only displayed if the Mute Source is From Pick File.</b>
Header Mute Mode	<b>This field is only displayed if the Mute Source is From Data Headers.</b> default: Above Mute Start Value
Mute X Values	This field is only displayed if the Mute Source is From Parameters.
Mute T Values	This field is only displayed if the Mute Source is From Parameters.
Interpolation Mode	Interpolation mode that is to be used: Interpolated or Exclusive, where exclusive means that traces without mutes are not passed. default: Interpolated
Taper	The number of samples to taper (using a sine-squared taper) before a hard mute. default: 0
Mode	Mute above, below, or along a linearly-interpolated curve whose width is defined by the times in the mute file. default: Above
Absolute	Defines whether or not the module uses the absolute value of the offset parameter. default: Yes
Linear Velocity	The linear or apparent velocity defining the arrival times of the air-blast when muting linear events. default: 330
tm0	The start time for the mute process. default: 0

### Table 76. mute Main Panel Fields

mute Module

## mute Data Panel

The mute data panel, Figure 105, enables you to specify the keys used with the data. The key fields are described in Table 77.

) en D.	e,	8	7 Proie	ct: /net/praha0	16/data1/ihu/projects/blessing/blessing-dense.project	
	-	~ •			······································	
Cluster						
lodules 🔺	1	Job Flow	n	nute		
filter	<u> </u>	mute	11	Main Data D	Doc	
gain	2					
hdrMath	-	-				
importVtp	3					
····interpShot	4			Line Key	ep	
···· kdm	5					
km	6					
kmodel	7			Cdp Kov	- ta	
merlin	8			Cup Key	cup	
mork	E-					
muto	9					
oned	10			Offset Key	offset	
parsim	11					
	12					
postproc	13			Nute Start K		
prune Shooter	14		1	mute Staft K	ey muts	
···· rayShooter	15					
···· re samp3d	<u> </u>					
···· re sample				Mute End Ke	y mute	
rtmodel						

### Figure 105. mute Data Panel

#### **Table 77. mute Data Panel Fields**

Field	Description
Line Key	Header key for the line number. default: ep
Cdp Key	Header key for the CDP number. default: cdp
Offset Key	Header key for the offset value. default: offset
Mute Start Key	Header key signifying the start of the mute values. default: muts
Mute End Key	Header key signifying the end of the mute values. default: mute

# oned Module

## Figure 106. oned Main Panel

e <u>J</u> ob <u>U</u> tilities	<u>H</u> elp		
	🖹 🏦 🚯 🗣 🔻	7 Project: /net/praha06/data1/jhu/proje	ects/blessing/blessing-dense.project
lob Cluster			
Modules	A Job Flow	oned	
filter	1 oned	Main Doc	
gain hdrMath	2	dt (ms)	3.5
importVtp	4	Ricker (Gaussian) Width (Hz)	10
kdm km	5	fz0 (ms)	0.2
kmodel	7	pad	4
merlin mork	8	dodb	1
moveout	9	ndamp	0
oned		inject	0
parsim pef	12	crank	0
postproc prune Shooter	13	dampMin	2e-05
rayShooter resamp3d	15	dampMax	0.02
re sample		dorb	1
scan		fullout	1
···· semblance	▼		

### Table 78. oned Panel Fields

Field	Description
dt	
	default: 3.5
Ricker	
(Gaussian) Width (Hz)	default: 10
fz0 (ms)	
	default: 0.2
pad	
-	default: 4
dodb	
	default: 1
ndamp	
	default: 0

Field	Description
inject	
	default: 0
crank	
	default: 0
dampMin	
	default: 2e-05
dampMax	
-	default: 0.02
dorb	
	default: 1
fullout	
	default: 1

#### Table 78. oned Panel Fields-continued

# parsim Module

) 🕘 🖬		enp b 2	°3 1₽	₽	▼ Р	roject:				
h Cluster										
Aodules	•		Job Flow			parsim				
importVtp		1	parsim			Main	Input Computation	Output Topography	Advanced Job Do	c
interp Shot		2			- 1					
···· kdm		3			- 1	Proj	ect			
km		4			-1					
kmodel		- -			-	Out	put Mode	Stack		
mork		2			- 1					]
moveout		0			- 1					
mute		7			_	- "				1
oned		8				Offs	iet			J
parsim		9								
pef		10								_
postproc		11				Wor	kerTimeout (minutes)	15		
prune Shooter		12								
		13			- 1	Bac	kUpName	/scratch/KDmigscratc	h	
resample		14			-1					
rtmodel	1	17			- 1	Vek	ocity Model			
scan	2	15			_					
semblance						Bas	eTmapName			
shooter										
smoother						True	Amplitude	No	<b>v</b>	
statc≮ static≲hift										
time Depth						Flus	hHours	2		
trsum										1
trwindow						nbk	ock	1		

### Figure 107. parsim Main Panel, Stack Output Mode

#### Figure 108. parsim Main Panel, Offsets Output Mode

	4	å <b>⊕</b> ♥ ♥	Project:	
b Cluster				
lodules	•	Job Flow	parsim	
importVtp	1	parsim	Main Input Computation Output Topography Advanced Job Doc	
interpShot	2			
kd m	3		Project 🕘	
km	4			
kmodel	-	-	Output Mode Offsets 👻	
menin mork	-	_		
moveout	6		Migrate All Offsets At Once No 👻	
mute	7		-	
oned	8			
parsim	9		Offset Bin Key fide	
pef	10		in the second se	
postproc	11		Worker Timeout (minutes) 15	
prune Shooter	12			- I
rayShooter	12	-	BackUpName /scratch/KDmigscratch 🔛	
resampsu	15			_
rtmodel	14		Velocity Model	
scan	15			
semblance			BaseTmanName	
shooter				
····smoother			The America In No.	
···· stack				
static Shift			FlushHours 2	
time Depth			۲	
trsum	=		nblock 1	

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a REQUIRED entry.
Output Mode	The mode to write the files: Stack or Offsets.
Offset	
Migrate All Offsets At Once	Enables all offsets to be held in memory at one time. This is good for increasing I/O performance. <b>This field is only visible for Offsets Output Mode.</b> default: No
Offset Bin Key	The header key for the offset bin parameter. <b>This field is only visible for Offsets Output Mode.</b> default: fldr
Worker timeout (minutes)	Worker components that have not responded in this amount of time are assumed to be dead. default: 15
BackupName	The name of the file to contain backup data if a restart becomes necessary. default: /scratch/KDmigscratch Note: This file is not deleted when a job finishes successfully. You must delete the file manually.
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data.
BaseTmapName	Base name of the required traveltime data. This name is the tmap file name without the .tmap extension. Note: This is a REQUIRED entry.
True Amplitude	If set, apply true-amplitude calculation. Yes or No.
Flush Hours	The time, in hours, between backups. default: 2
nblock	The size of the trace block. default: 1

## Table 79. parsim Panel Fields

# parsim Input Panel

## Figure 109. parsim Input Panel

000	🔀 jobBuilder	- Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
	ጵ 🕁 🗣 🔻	Project:	
Job Cluster			
Modules 🔺	Job Flow	parsim	
importVtp 1	parsim	Main Input Computation Output Topography Advanced Job Doc	
interp Shot 2			71
kdm 3		Line Key ep	
kmodel 4	() () () () () () () () () () () () () (		
merlin 5		Cdp Key cdp	
mork 🖉 6			
moveout 7		Offset Header Key offset	
mute 8			
		Bundle Key tracf	
pef 10			
po stproc		Velocity-percent Header Key tracf	
prune Shoote 😽 📕	<b>~</b>		
< /// > <	111 🔹 🕨		-

## Table 80. parsim Input Fields

Field	Description
Line Key	Header key for the line number. default: ep
Cdp Key	Header key for the CDP number. default: cdp
Offset Header Key	The header key defining the offset field of the stacked trace. default: offset
Bundle Key	default: tracf
Velocity- percent Header Key	default: tracf

# parsim Computation Panel

Figure	110.	parsim	Com	putation	Panel
Iguic		Paisiiii	COIII	pacacion	anci

00	00			🛛 job	Builder	r – Marve	Version 2.	1.1.31	ore3, Pano	orama Te	ch		
<u>F</u> ile	Job <u>U</u> tilities	<u>H</u> elp											
Ē		₽,	ĉ 🕩	₽ 7	7 Projec	:t:							Ŧ
Job	Cluster Clu	<ul> <li>1</li> <li>2</li> <li>3</li> <li>4</li> <li>5</li> <li>6</li> <li>7</li> <li>8</li> <li>9</li> <li>10</li> <li>11</li> <li>12</li> <li>13</li> <li>14</li> <li>15</li> </ul>	Set 1	7 4	Project	tt main Main Input Line Aperts XLine Aperts XLine Aperts Semblance Semblance Xline Prans Control Be Number of Principal Fi	Computation ure (m/ft) rture (m/ft) Aethod : Window Lengt : Threshold ige (ms/tr) ge (ms/tr) ge (ms/tr) am Ps requency botity	Output 0 0 Max Max Max 0 Max 0 Max 0 Max 0 S 20 1500	Topography Semblance matic	Advanced Max Max	Job Doc	]nc ]nc	
	···· static Shift ···· time Depth	<b>•</b>				Dip Gain		0					
•	111 >	1											

#### **Table 81. parsim Computation Panel Fields**

Field	Description
Line Aperture (m/ft)	default: 0
XLine Aperture (m/ft)	default: 0
P Search Method	Max Semblance or Max Stack
Semblance Window Length	<b>This field is only visible for a P Search Method of Max Semblance.</b> default: 7
Semblance Threshold	<b>This field is only visible for a P Search Method of Max Semblance.</b> default: 0
Xline P range (ms/tr)	This field is a REQUIRED entry.

Field	Description
Line P range (ms/tr)	This field is a REQUIRED entry.
Control Beam	
	<ul> <li>No Control</li> <li>Fixed P Range</li> <li>Automatic</li> </ul>
Number of P's	default: 5
P spring range	This field is only visible for a Fixed P Range value for the Control <b>Beam.</b> default: 0.5
Principal Frequency	This field is only visible for an Automatic value for the Control Beam. default: 20
Surface Velocity	The near surface velocity in Equation 2 on page 25. This field is only visible for an Automatic value for the Control Beam. default: 1500
Dip Gain	Variable that enables you to control dip. The value can range from 0 through 100. default: 0, do not apply a gain

## Table 81. parsim Computation Panel Fields-continued

# parsim Output Panel

#### Figure 111. parsim Output Panel

ile Job <u>U</u> tilities <u>H</u> el	🔀 jobBuilder –	Marvel Version 2.1.1.31pre3, Panorama Tech	
	) 🚴 🏠 🗣 🛡 Proje	ect:	
Job Cluster			
Modules     Modules	Job Flow         Image: Constraint of the second secon	Main     Input     Computation     Output     Topography     Advanced     Job     Doc       Output Lines     Min     Max     Inc       Inline aliasing (lines)     2       Output XLines     Min     Max     Inc       Xline aliasing (kines)     2       Offset Bins     Min     Max     Inc       Velocity Scan (%)     Min     Max     Inc       Output Depths (myft)     Min     Max     Inc	

### Table 82. parsim Output Panel Fields

Field	Description			
Output Lines	Minimum, Maximum and Increment This is a REQUIRED entry.			
Inline Aliasing (lines)	Attempt to compensate for aliasing in the inline direction (units: lines). Note: This can be a costly operation. default: 2			
Output XLines	Minimum, Maximum and Increment This is a REQUIRED entry.			
Xline Aliasing (xlines)	Attempt to compensate for aliasing in the crossline direction (units: lines). Note: This can be a costly operation. default: 2			
Offset Bins	Specifies the offset bins in which to read the data. Enter the Minimum, Maximum and Increment values.			
Velocity Scan (%)	Minimum, Maximum and Increment			
Output Depths (m/ft)	Defines the minimum, maximum, and increment for the each output trace. This is a REQUIRED entry.			

# parsim Topography Panel

## Figure 112. parsim Topography Panel

≥ <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🗠 🖬 🚔 🏦 🗣 🛡	Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
ob Cluster Modules Modules Job Flow Gluster Gl	parsim       Main     Input     Computation     Output     Topography     Advanced     Job     Doc       Topo     Surface File     Image: Surface File     Image: Surface File     Image: Surface File	

#### Table 83. parsim Topography Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

# parsim Advanced Panel

#### Figure 113. parsim Advanced Panel

File Job Utilities Help	🔾 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama T	
	Project:	
Job Cluster		
Modules Job Flor - interpShot - km - km	v     Main     Input     Computation     Output     Topography     Advance       Use trace counter in header     Yes       verbose     No       Maxmern     900       Mute Angle (degrees)     15       Max Frequency (Hz)	Job Doc

#### Table 84. parsim Advanced Panel Fields

Field	Description
Use trace counter in header	Flag indicating whether or not the trace counter that diskRead puts in the trace header will be used. default: Yes
verbose	Switch for turning debug printing on and off. default: No
Maxmem	Maximum amount of memory to be used by MARVEL per kdm instance. default: 900
Mute Angle	The angle, in degrees, measured down from the surface defining a cone limiting the near surface aperture. default: 15
Max Frequency	The maximum frequency allowed by the filtering process.

# parsim Job Panel

## Figure 114. parsim Job Panel

Job <u>U</u> tilities	<u>H</u> elp			
	🖴 🎗	₽ ₽	Project: /net/praha06/data1/jhu/projects/blessing/ble	ssing-dense.project
b Cluster - filter - gain - hdrMath - importVtp - interpShot - km - km - kmodel - merlin - merlin	Ju           1         pa           2         1           3         1           4         1           5         1           6         1           7         8	ab Flow	Use All CPUs	hy Advanced Job Doc Yes
more mute oned pef	9 10 11 12		Master is Worker	Yes
prune Shooter rayShooter resamp3d resample	14 15		Run workers low priority	No

### Table 85. parsim Job Panel Fields

Field	Description
Use All CPUs	This really means that each worker should use multiple threads. If <i>No</i> , then there will be one independent worker spawned for each CPU (or core) in the cluster.
Master is Worker	Yes—workers will be spawned on the master node of the job. No—workers will NOT be spawned on the master node of the job.
Run workers low priority	If <i>Yes</i> , workers will be spawned with reduced priority. although the master process will remain at high priority. This can be useful especially when <i>MasterIsWorker</i> is set to <i>Yes</i> , so that one worker does not slow down the collection or submission of shots for all of the others.

# pef Module

<b>Figure</b>	15.	pef	Main	Panel

Job <u>U</u> tilities	Help	0	_	-		
1 4 8	Ð		V Pro	ject: /net/praha06/da	ata1/jhu/projects/blessing/blessing-dense.project	
L Churter						
D				nof		
lodules	<b></b>	Job Flow	_			
filte r	1	pef		Main Doc		
gain	2					
hdrMath	3					
···· importv tp	4			Percent Noise	0.001	
interpsnot	5		- 1			
km	5		- 1	Minimum Log (m		
kmodel	0		_	Minimum Lag (m	0	
···· merlin	7		_			
mork	8			Maximum Lag (m	s) 0	
moveout	9					
···· mute	10					
oned	6 11		- 1	Minimum Corr (m	s) 0	
parsim			- 1		<u>.</u>	
pef	12		- 1			
postproc	13		_	Maximum Corr (n	is) 0	
prune Shoote	14					
raysnooter	15			Chan Mission		
resampsu			_	Show Wiener	0	
rtmodel						
scan				Mix	1	
semblance					*	
shooter	*					

### **Table 86. pef Panel Fields**

Field	Description
Percent Noise	default: 0.001
Minimum Lag (ms)	default: 0
Maximum Lag (ms)	default: 0
Minimum Corr (ms)	default: 0
Maximum Corr	default: 0
Show Wiener	default: 0

## Table 86. pef Panel Fields-continued

Field	Description
Mix	
	default: 1

# postproc Module

The postproc Module Main panel, Figure 116, enables you to set parameter values used in the postproc module. The parameter fields are described in Table 87.

#### Figure 116. postproc Module Main Panel

Job <u>U</u> tilities	<u>H</u> elp						
	₿ Å	3 🕩	₽ V	V Pro	oject:		
Chustor							
	•				nostning		
odules	- ·	lob Flow			Main Lanut Day		
cuda-test	1 1	ostproc		- 1	Main Input Loc		
demig	2				nminst		B
- diskRead	3				project		
-eyeBeam	4				Kevs		
-fdmod2 d	5						
- filter	6				Method	FFT 👱	
gain	7						
·hdrMath	8				K-scale Power	0	
-internShot	9				Valacity reals Rower	0	
- kdm	10				velocity-scale rower	0	
km	11				Low-k cutoff	0	
~ kmodel	12				Low b full on		
merlin	13				Low-k tulion	10	
- mork	14				High-K full-on	99	
mute	15						
oned	15				High-k cutoff	100	
- parsim					Malasia Madal		-
- pef					velocity model		
postproc					Phase Shift	0	
- prune Shooter					Thate Shire	0	
- resamp3d					DT (if wrong in header)	-1	
- resample					DV (formers in boundary)		
rtmodel					DA (ir wrong in neader)	-1	
- scan					T Smoothing Width	0	
- semblance	_						
- shooter					X Smoothing Width	0	
- stack					Smoothing Power (intege	r) 0	
- static Shift	<b>v</b>						

#### **Table 87. postproc Module Main Panel Fields**

Field	Description
project	The name of the project. The project file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Keys	
Method	Bias, Laplace, Bias 2, FFT, FFT Deriv, None default: Bias
K-scale Power	default: 0

Field	Description
Velocity-scale Power	default: 0
Low-k cutoff	default: 0
Low-k full-on	default: 10
High-k full-on	default: 99
High-k cutoff	default: 100
Velocity Model	The path and filename of the velocity model to be used in the calculations. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data.
Phase Shift	<b>This field is only visible for the FFT and FFT Deriv methods.</b> default: 0
DT (if wrong in header)	default: -1
DX (if wrong in header)	default: -1
T Smoothing Width	default: 0
X Smoothing Width	default: 0
Smoothing Power (integer)	default: 0

## Table 87. postproc Module Main Panel Fields-continued

## postproc Input Panel

The postproc Module Input panel, Figure 117, enables you to set parameter values used in the postproc module. The parameter fields are described in Table 88.

#### Figure 117. postproc Module Input Panel

000	🔀 jobBuild	der –	Marvel Versio	n 2.1.1.31pre3, Panorama Tech	
<u>File Job U</u> tilities	<u>H</u> elp				
0 🗠 🖬 🕯	฿ ጵ ለ ♥ ▼	Proje	ct: /net/praha06/da	ata1/jhu/projects/blessing/blessing-dense.project	*
Job Cluster			oo stame		
	Job How           1         postproc           2		Main Input Doc Line Key Cdp Key Offset Key	ep cdp offset	
more mute	9 10 11		Model Line Key Model Cdp Key		
✓ /// >	12	•			

### Table 88. postproc Module Input Panel Fields

Field	Description
Line Key	Header key for the line number. default: ep
Cdp Key	Header key for the CDP number. default: cdp
Offset Key	The header key defining the offset field of the stacked trace. default: offset
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data.
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data.

# pruneShooter Module

The pruneShooter module is one of three MARVEL interfaces to a dynamic-anisotropicmaximum energy-travel-time generator. Although this module is still provided for compatibility purposes, its use has been deprecated. It is recommended that you now use the rayshooter module, instead, which combines both the pruneShooter and Shooter modules with more advanced features.

See also rayshooter Module.

## pruneShooter Main Panel

Figure 118 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 89.

#### Note:

If the output range is smaller then the aperture range, the output range is used to limit the size of the traveltime table.

000	🔀 jobBuilder – Marvel Version 2.1.1.26, Panorama Tech		
<u>File</u> Job		<u>U</u> tilities	<u>H</u> elp
🗋 📇 🖶 🍰 🥻 🕁 👽 Project:			Z
Image: Cluster       Job Flow         Modules       Job Flow         Main       1         - autopick       3         - bias       5         - bulkStatic       6         - collect       7         - diskRead       8         - diskRead       11         - filter       10         - gain       11         - hdrMath       12         - kdm       14         - km       15         - mork       - moveout         - mute       - postproc         - pruseShooter       - resamp3d	prune Shooter          Main       RayTracer       Anisotropy       Output       Topography       Advanced       Doc         Project		<u> </u>
- rayShooter - resamp3d - resample - rtmodel	Crossline Aperture (m/ft)	-	

## Figure 118. pruneShooter Module Main Panel

#### **Table 89. pruneShooter Panel Fields**

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Model	The name of the input model.
Tmap Basename	The prefix used to produce the traveltime output files with suffix <i>.tmap</i> .
Line Key	The header key for the line number in the model file. default: ep
Cdp Key	The header key for the CDP number in the model file. default: cdp
Inline Aperture	The output aperture in the line direction.

Field	Description
Crossline Aperture	The output aperture, in meters or feet, of the crossline, or CDP, direction aperture limit.

## Table 89. pruneShooter Panel Fields-continued

## pruneShooter RayTracer Panel

The pruneShooter module RayTracer panel, Figure 119, enables you to specify information that is to be used in ray tracing operations. The fields on the panel are described in Table 90.

Eile Job Utilities Help	Jobbunder - Marver Version 2.1.1.51pres, Panorama Tech	
	Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
Job Cluster       Modules     Job Flow       Immourau     1       -filter     2       -gain     3       -filter     3       -morrbur u     3       -hiter     5       -km     6       -kmodel     7       -mort/u     8       -mort/u     9       -mortin     11       -mortin     12       -mortin     13       -pef     13       -parsim     12       -parsim     14       -resamp3d     -scan       -stack     staicShft       -trowder     -stack       -staicShft     -twindow	Shooter         Main       RayTracer       Anisotropy       Output       Topography       Advanced       Doc         shootFan       Yes	

#### Figure 119. pruneShooter Module RayTracer Panel

#### Table 90. pruneShooter Module RayTracer Panel Fields

Field	Description
shootFan	Selects the shooting direction: Yes causes rays to be shot toward deeper depths, while No causes rays to be shot upward toward shallower depths. default: Yes
maxDist	The maximum horizontal distance a ray can travel. If this parameter is defaulted to zero, the maximum distance a ray can travel is set to the maximum extent of the model.
maxDepth	The maximum depth a ray can travel. If this parameter is defaulted to 0, the maximum depth of a ray is set to the maximum depth of the model.

Field	Description
minDepth	The minimum depth a ray can travel. If this parameter is defaulted, the ray has no minimum depth.
minAmp	The cutoff amplitude of a ray. This value is in terms of <i>paraxial AmpxpathLengthxvelocity</i> .
	<ul> <li>In constant velocity, this value stays at 1.0 all along the ray.</li> <li>For a linear velocity gradient starting with 5000 ft/sec at the surface and reaching 10000 ft/sec at a depth of 10000 feet, this value will be 0.66 at 10000 feet for a ray straight down.</li> </ul>
	Note: It is recommended that you set this value to about 0.10 so that only the very low amplitude rays are dropped. If you set the value to a large value, you will reduce run time at the expense of accuracy. default: 0.01
maxAngle	The maximum angle a ray can attain. When set to 180 degrees, this can potentially cause the generation of turning rays and thus produce corresponding longer traveltimes. Generally, a reasonable compromise between speed and accuracy is to set this value in the neighborhood of 160 degrees. default: 160
maxTime	The maximum time a ray can travel. default: 10
maxXPos	The maximum line or crossline direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
maxYPos	The maximum y or line direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
minXPos	The minimum x or crossline direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
minYPos	The minimum y or line direction distance a ray end point can attain. This value can potentially override the maxDist parameter.

## Table 90. pruneShooter Module RayTracer Panel Fields-continued

Field	Description
dtStepSize	Ray tracing step length (in seconds) used for smoothing the velocity model. This is crucial for stability and for this routine to run quickly. The velocity is smoothed by $1.5xaverageVelocityxstepLength$ . For a 60 Hz freq, the stepLength should be about 0.040 seconds. For velocities that average 7000 ft/sec, the smoothing is then 420 feet. Note: Since ray tracing is adaptive, the smoothing value can actually be fairly small, but this is not recommended. In general, the velocity should be smoothed at least a few hundred feet and probably a few thousand. A value of 0.0 will turn off smoothing. If this value is not 0.0, but it is less than $2.5xMIN(dx, dy)$ , the value will be set to 2.5xMIN(dx, dy). default: 0.004
dtAccuracy	The desired accuracy of travel times. The recommended value is about 0.25x0.5/maxFrequency. Therefore, for 60 Hz data, dtAccuracy is 0.002 sec. default: 0.003
BoundingAngles	The take-off angles anglex1, anglex2, angley1 and angley2 that bound the initial ray fan, and define the direction cosines off vertical. The four values define an initial cone and provide a convenient method for limiting near surface apertures during the migration process. These four angles usually have values of about 70, -70, 70, -70. Examples:
	<ul> <li>anglex1 = -90, angley1 = 0 means horizontal in the negative x direction</li> <li>anglex2 = 0, angley2 = 90 means horizontal in the positive y direction</li> <li>anglex1 = 0,angley1 = 0 means a vertical ray.</li> </ul>
nullTTValue	The value that is set inside a given zone where no rays have penetrated. This is a marker that tells the migration module not to image in these zones. default: -0.001
stepLength	The length of a time step along a ray. Because this value is adaptive, there is little reason to change the default value of .04 second. default: 0.04

## Table 90. pruneShooter Module RayTracer Panel Fields-continued

## pruneShooter Anisotropy Panel

The parameters in the pruneShooter module Anisotropy panel, Figure 120, define the various velocity model input options available for the acoustic and anisotropic raytracer. The fields on the panel are described in Table 91.

#### Note:

You must enter these files in the proper order. What the raytracer requires is enough information to define the *vvelfile* and *eta*. Thus, one and only one of following combinations must be entered:

- epsilon file, del file
- vvelfile, etafile
- vvelfile, epsilon
- vvelfile, delfile

00	🔀 jobBuilder – Marvel Version 2.1.1.26, Panorama Tech
le <u>J</u> ob	<u>U</u> tilities <u>H</u> e
]⊖∎≜≵ ∲♥	▼ Project
lah Olustan	
Modules Job Flow	v prune Shooter
Main 1 pruneSh	nooter Main RayTracer Anisotropy Output Topography Advanced Doc
-autoMute 2	
autopick 3	
-bias	vvelfile
-bulkStatic	
-collect 7	
diskRead 8	
-diskWrite 9	
filter 10	etafile
-gain 11	
hdrMath	
-importVtp 13	epsilonfile
-km	
mork	phifile
moveout	
mute	thetafile
postproc	
prune Shoot	

#### Figure 120. pruneShooter Module Anisotropy Panel

Field	Description
vvelfile	The name of the Vnmo file. This file is closely related to the vertical velocity field.
delfile	The name of the file containing Thomsen's delta.
etafile	The name of the file containing Thomsen's eta.
epsilonfile	The name of the file containing Thomsen's epsilon.
phifile	The name of the file containing Thomsen's phi.
thetafile	The name of the file containing Thomsen's theta.

Table 91.	pruneShooter	Module A	nisotropy	Panel	<b>Fields</b>

# pruneShooter Output Panel

This panel, Figure 121, enables you to control the output from the pruneShooter module. Table 92 describes the fields on the panel.

000	🛛 jobBuilder – Marvel Version 2.1.1.26, Panorama Tech	
<u>F</u> ile <u>J</u> ob		<u>U</u> tilities <u>H</u> elp
🗋 🚭 🗳 🍰 🏂 🚹 🗣 🔍 Projec	tt	Z
Job Cluster		
Modules Job Flow	pruneShooter	
Main 1 pruneShooter	Main RayTracer Anisotropy Output Topography Advanced Doc	
autoMute 2		
autopick 3		
-bias	Inline Image Min Max Inc	
- bulkStatic 6		
- collect 7		
-diskRead 8		
-diskWrite 9	Crossline Image Min Max Inc	
-filter 10		
hdrMath 12		
- importVtp	Zimana Min May	
mork	Red	
moveout		
mute	DShotX	
postproc		
- prune Shoot	DShotY	

## Figure 121. pruneShooter Module Output Panel

#### Table 92. pruneShooter Module Output Panel Fields

Field	Description
Inline Image	The minimum, maximum, and incremental line range of the shot locations of the output travel-time volumes.
Crossline Image	The minimum, maximum, and incremental CDP range of the shot locations of the output travel-time volumes.
Z Image	The minimum, maximum, and incremental depth of each travel-time volume.
Pad	The percent padding to apply to input traces. default: 0
DshotX	
DshotY	
# pruneShooter Topography Panel

This panel, Figure 122, enables you to control the output from the shooter module. Table 93 describes the fields on the panel.

000 🛛	jobBuilder – Marvel Version 2.1.1.26, Panorama Tech		
<u>F</u> ile <u>J</u> ob		<u>U</u> tilities	<u>H</u> elp
🗋 🚭 🖨 🏂 🔒 🕼 🕂 🕈 🛛 🖓 Project			Z
Job Cluster       Modules     Job Flow       Main     1       - autoMute     3       - autopick     3       - bias     5       - bulkStatic     6       - collect     7       - diskWrite     9       - filter     10       - gain     11       - hdrMath     12       - importVtp     14       - kdm     15       - mork     - mork       - mork     - mork       - postproc     - mute       - postproc     - mute	pruneShooler         Main       RayTracer       Anisotropy       Output       Topography       Advanced       Doc         Topo Surface File		

### Figure 122. pruneShooter Module Topography Panel

#### Table 93. pruneShooter Module Output Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

# pruneShooter Advanced Panel

The pruneShooter module displays two versions of the Advanced panel depending on your Compress selection; all fields are shown in Figure 123. The field values are described in Table 94.

### Figure 123. pruneShooter Module Advanced Panel-Compress, No

	obBuilder – Marvel Version 2.1.1.2	6, Panorama Tech
<u>File</u> Job		<u>U</u> tilities <u>H</u> elp
🗋 🔁 🖶 🍰 🎄 🛧 💀 🔻 Project:		Z
Job Cluster Modules Main - autoMute - autopick - bias - bulkStatic - collect	pruneShooter Main RayTracer Anisotropy AmpFlag	Output Topography Advanced Doc
-diskRead         7           -diskWrite         9           -filter         10           -gain         11           -hdrMath         12           13         13	Compress	Yes
	ClipPercent 0	No
mute postproc pruneShoot rauShonter	Run Worker on Master	Yes - Run worker on master 🗖

#### Table 94. pruneShooter Module Advanced Panel Fields

Field	Description
AmpFlag	Determines whether or not amplitudes are calculated and output. default: No
Compress	Determines whether or not traveltimes and amplitudes (if calculated) are compressed. default: Yes
stages	The number of stages to use in the wavelet-based compression scheme. This field is displayed only if <i>Compress</i> = <i>Yes</i> has been selected. default: 1

Field	Description
ClipPercent	The percentage of the maximum amplitude defining the threshold in the wavelet domain below which amplitudes are zeroed. While clipping can increase compression efficiency, it can also seriously reduce accuracy. This field is displayed only if <i>Compress</i> = <i>Yes</i> has been selected. default: 0
verbose	Switch for turning debug printing on and off. default: No
Run Worker on Master	Determines whether or not the master is used in the computational process. default: Yes

# Table 94. pruneShooter Module Advanced Panel Fields-continued

# rayshooter Module

The rayshooter module computes travel-time tables that are independent of output migration locations. Each such table or volume is centered on the shot location so when a sufficient number of shots have been computed, travel-time tables computed by this module are suitable for migrating to any output range. You should use this program when you expect to output a full volume, or when the targeted output may be arbitrarily defined. The rayshooter module combines the earlier pruneShooter and shooter modules together with more advanced features. Panorama Technologies recommends that you use the rayshooter module instead of either of the two other modules when possible.

# rayshooter Main Panel

Figure 124 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 95.

Job <u>U</u> tilities	<u>H</u> elp		
) 🛛 🕒 (	🗣 🛧 🕺 🖴	V Project:	
h Chuster			
	1	- myShooter	
Nodules -	Job Flow		
hdrMath	1 rayShooter	Main Anisotropy Output Smoothing Computation Topography Model Input Compression J	ob Doc
···· importVtp	2		
interpShot	3		
kdm	-	Project	
km	4		
kmodel	5		
merlin	6	Model	
mork	7		
moveout			
mute	°	Output Tmap Name	n
oned	9		<u> </u>
parsim	10		
pet	11	Septh Paranama //weeh/wee/sit/eu/Shartes	78
postproc	12	Scratch Basename /scratch/users/cjb/rayShooter	1
prune Shooter	12		
-rayShooter	13	Shot Lines (min max minc)	
resamp3d	14	Shot cares (nar, nae, nare)	
···· re sample	15		
rtmodel		Shot Xlines (min,max,minc)	
···· scan			
semblance		Max Time (ms) 4000	
snooter			
smootner			
State K		Max Angle (deg) 90	
static snift			
time Depth	1		

### Figure 124. rayshooter Module Main Panel

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. <b>This is a required entry.</b>
Model	The name of the input model. <b>This is a required entry.</b>
Output Tmap Name	The name of the traveltime output file.
Scratch Basename	The application needs temporary storage for acquired data, accumulated image, and others. All of these filenames will start with this prefix. default: /scratch/rayShooter
Shot Lines	minimum, maximum and minc
Shot Xlines	minimum, maximum and minc
Max Time (ms)	default: 4000
Max Angle (deg)	default: 90

### **Table 95. rayshooter Panel Fields**

# rayshooter Anisotropy Panel

Figure 125 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 96.

000	🔀 jobBuilder	r – Marvel Version	n 2.1.1.31pre3, Panorama Tech		
	thr	oject:			Ţ
Job Cluster					_
Modules 🔺 Ji	ob Flow	-rayShooter			5 L
wautopick 1 Pa	vShooter	Main Anisotropy C	Output Smoothing Computation Topography	Model Input Compre 4 >	
his					
		Valasity Type	Vp (vertical)	-	
		velocity Type		-	
cuda-test 4					
de mig 5		Epsilon Model			
diskRead 6					
diskWrite 7		Delta Model			
eyeBeam	2	Dena moder			
fd mod2 d 8					
filter 9		Phi Model			
gain 10					
hdrMath 11		These Medel			
importVtp		I neta Model			
interpShot					
kdm 13		Angle Dimension	Degrees	<b>±</b>	
km 😝 14			L		
<b>4</b> /// <b>&gt;</b> 15	+	L			
					- 1

### Figure 125. rayshooter Anisotropy Panel

### Table 96. rayshooter Anisotropy Panel Fields

Field	Description
Velocity Type	Vp (vertical) or VNMO (vertical)
Epsilon Model	
Delta Model	
Phi Model	
Theta Model	
Angle Dimension	Degrees or Radians

# rayshooter Output Panel

Figure 126 and Figure 127 enable you to specify basic information to be used by the module. The fields on the panel are described in Table 97.

ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp							
0 🗠 日	Ð	ê 🕁 🗣	V P	roje	ect:			•
Job Cluster								
Modules	•	Job Flow	•	- ra	ayShooter			_
autopick	1	rayShooter			Main Anisotropy Output	Smoothing Computation Topography Model Input Comp	ore 🗲 🕽	
bias bulkStatic	2 3				Output Maps	Traveltime	<b>T</b>	
cuda-test demig	4				Mode	Shot-Centered	<b>±</b>	
···· diskRead ···· diskWrite	6 7				Line (Y) Aperture (m/ft)	3000		
eyeBeam fdmod2d	8				XLine (X) Aperture (m/ft)	3000		
···· filter ···· gain	9 10				Output Line Spacing			
… importVtp … interpShot	11 12				Output XLine Spacing			
kdm km	13 14				Output Depths	Min Max Inc		
< /// >	15		•					

## Figure 126. rayshooter Output Panel, Shot-Centered Mode

## Figure 127. rayshooter Output Panel, Target-Volume Mode

<u>J</u> ob <u>U</u> tilities	He	lp										
3 🕒 🛛	Ŀ	, & ⊕ ₹	Ъ <b>№</b> Р	'noj	ect:							
												-
ob Cluster												_
Modules	•	Job Flow	•	ŀ	ayShooter							-
autopick	1	l rayShooter			Main Anisotropy Output	Smoothing	Computation	Topography	Model Input	Compre	1 <b>&gt;</b>	l
···· bias		2				,,					-	1
bulkStatic		3			Output Maps	Traveltime					•	1
collect	10	<b>1</b>									-	l
cuda-test	Ľ	5			Mode	Target-Volu	ıme (pruned)				:	l
diskRead		5										l
···· dis kWrite	-	7			Line (Y) Aperture (m/tt)	3000					- 1	l
eyeBeam	÷		— I″		XLine (X) Aperture (m/ft)	3000						l
···· fd mo d2 d		5										l
···· filte r	9	<u>,                                     </u>			Output Lines	Min	Max	۲ ــــــــــــــــــــــــــــــــــــ	Inc		- 1	l
gain bdrUath	-	10										1
importVtp	-	1			Output XLines	Min	Max		Inc			1
interp Shot	-	12									_	1
kdm		13										1
km	•	14		1	Output Depths	Min	Max		Inc			1
( /// <b>)</b>		15	*	1							_	1

Field	Description
Output Maps	<ul> <li>Traveltime</li> <li>Traveltime/Amplitude</li> <li>Traveltime/Takeoff Angle</li> <li>Traveltime/Amplitude/Takeoff angle</li> <li>Traveltime/Arrival Angle</li> <li>Traveltime/Ampitude/Arrival angle</li> <li>Traveltime/Takeoff/Arrival angle</li> <li>Traveltime/Amplitude/Takeoff/Arrival angle</li> </ul>
Mode	Shot-Centered or Target Volume (pruned) default: Shot-Centered
Line (Y) Aperture (m/ft)	The length, in meters or feet, of the line direction aperture limit. default: 3000
XLine (X) Aperture (m/ft)	The length, in meters or feet, of the crossline (CDP) direction aperture limit. default: 3000
Output Lines	The Minimum, Maximum and Increment for the lines in the output. <b>This field is only displayed for Target-Volume Mode.</b>
Output XLines	The Minimum, Maximum and Increment for the crosslines in the output. This field is only displayed for Target-Volume Mode.
Output Line Spacing	The spacing for the output lines. This field is only displayed for Shot-Centered Mode.
Output XLine Spacing	The spacing for the output crosslines. This field is only displayed for Shot-Centered Mode.
Output Depths	Minimum, Maximum, Increment for output depths. Valid for both modes.

# Table 97. rayshooter Output Panel Fields

# rayshooter Smoothing Panel

Figure 128 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 98.

<u> </u>	<u>H</u> elp		🔀 jobBı	uilder – Marvel Version	2.1.1.31	pre3, Panorama Tech		
	Ð	å 🕯 🖣	V Pro	oject:				
ob Cluster								
Modules .	•	Job Flow		-rayShooter				
hdrMath	1	rayShoote r		Main Anisotropy Output	Smoothing	Computation Topography	Model Input Compression Jo	b Doc
importVtp	2							
… interpShot	3			Velocity Smoothing	No			<b>±</b>
kam	4							
kmodel	5	-						
···· merlin	-	-	_					
mork	0	_						
moveout	7	_						
mute	8							
oned	9							
parsim	10							
pet	11							
postproc	12			Vel Smothing Dists (x,y,z)	хО	y O	z 0	
ravShooter	12	-	_					
re samp3d		-	_					
re sample	14	_						
rtmodel	15							
scan								
semblance								
shooter								
smoother								
···· STACK								
				Vel Smothing Power				_
unic ospin	-							

## Figure 128. rayshooter Smoothing Panel

### Table 98. rayshooter Smoothing Panel Fields

Field	Description
Velocity Smoothing	Turn the smoothing of the velocity (slowness) field used to propagate the source term <i>on</i> or <i>off</i> . This process can be useful for reducing artifacts.
Vel Smoothing Dists (x,y,z)	Gaussian widths for smoothing slowness in each direction. defaults: 0, 0, 0
Vel Smoothing Power	The number of times to smooth the volume.

# rayshooter Computation Panel

Figure 129 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 99.

	Å <b>⊕ ♥ ♥</b> ₱	oject:	•
Job Cluster Modules → hdrMath → importVtp → interpShot → kdm → kdm → km → mork → mork → parsim → parsim → resamp3d → sembhace → smother → stack → smother → stack → smother → stack → smother → stack → smother → stack → smother → smother	Job Flow  application  applicat	-rayShooter -rayShooter Main Anisotropy Output Smoothing Computation Topography Model Input Compression Job D Minimum Amplitude 0.1 Selection Criteria Minimum Velocity	x

# Figure 129. rayshooter Computation Panel

## Table 99. rayshooter Computation Panel Fields

Field	Description
Minimum Amplitude	default: 0.1
Selection Criteria	Minimum Velocity, Minimum Distance, Maximum Amplitude default: Minimum Velocity

# rayshooter Topography Panel

Figure 130 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 100.

000	X	jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
ile Job <u>U</u> tilities <u>H</u>	<u>d</u> elp	
		Project:
Job Cluster		
Modules 🔺	Job Flow	
hdrMath importVtp	1 rayShooter	Main Anisotropy Output Smoothing Computation Topography Model Input Compression Job Doc
interpShot kdm	3	
kmodel	5	
mork moveout	7	
mute o ned	8 9	Topo Surface File
parsim pef	10 11	
prune Shooter	12	
re samp3d	14	
rtmodel scan	15	Topo Surface Name Topo
semblance shooter		
smoother stack		
static Shift time Depth →		

## Figure 130. rayshooter Topography Panel

### Table 100. rayshooter Topography Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. defaults: Topo

# rayshooter Model Panel

Figure 131 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 101.

<u>File</u> Job <u>Utilities</u> <u>H</u> elp	🔀 jobBui	lder – Marvel Version 2.1.1.31pre3, Panorama Tech	
	😤 🏠 🗣 🛡 Proje	eet.	•
Job Cluster			
Modules 🔺	Job Flow	ayShooter	
- hdrMath 1 - importVtp 2 - interpShot 3 - km 4 - km 6 - mork 5 - mertin 6 - mork 7 - mute 8 - oned 9 - parim 10 - pastin 10 - pastpoct 12 - resamp3d 14 - resampa 14 - scan 5 - smoother 15 - mork 12 - parim 12 - pastpoct 12 - source	rayShooter	Main       Anisotropy       Output       Smoothing       Computation       Topography       Model       Input       Compression       Job       Doc         Model Line Key	

## Figure 131. rayshooter Model Panel

### Table 101. rayshooter Model Panel Fields

Field	Description
Model Line Key	Header key for the line number in the model. Use if different from the data.
Model Cdp Key	Header key for the CDP number in the model. Use if different from the data.

# rayshooter Input Panel

Figure 132 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 102.

	<u>1</u>	0								
) 🕘 🗳	ð	Ä 🕆 🕇	₿ 🔻 Р	oject:						
Churter										
Cluster	_									
odules 🛃	<u>ا</u> ــــــــــــــــــــــــــــــــــــ	Job Flow		rayshoo	ter					
hdrMath	1	rayShooter		Main /	Anisotropy C	Output Smoothing	Computation 1	opography Mode	I Input Comp	ression Job Doc
···· importVtp	2									
… interpShot	3									
kdm	Ľ.									
···· km	4									
kmodel	5									
···· me rlin	6									
mork	7	-								
moveout	Ľ.									
···· mute	8			Line	Header Key	ep				
oned	9									
parsim	10									
pef	11	-								
postproc										
prune Shoote r	12									
rayShooter	13									
re samp3d	14									
re sample	15	-		CDP	Header Kev	c dn				
rtmodel	Ľ.									
···· scan										
semblance	I									
shooter	I									
smoother	I									
···· stack	1									
static Shift										
••• time Depth	•									

# Figure 132. rayshooter Input Panel

### Table 102. rayshooter Input Panel Fields

Field	Description
Line Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing CDP (crossline) designators. MARVEL usually uses cdp, which is a 4-byte integer at location 21 in SEG-Y files. default: cdp

# rayshooter Job Panel

Figure 133 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 103.

### Figure 133. rayshooter Job Panel

000			🛛 jobl	Buil	der – Marvel Version	2.1.1.31pr	e3, Panor	ama Tech			
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp										
	4	å 🕯 ,	<b>₽ ∀</b> P	nojec	zt:						
Job Cluster											
Modules	•	Joh Elow		- ra	ayShooter						
hdrMath	1	ravShooter		lΓ	Main Anisotropy Output	Smoothing Co	mputation	Topography Mo	del Input Comp	ression lob	Doc
importVtp	1	ay shooler									
interp Shot	2	_									
kdm	3	_									
km	4										
kmodel	5										
merlin	6				Master is Worker			Yes			<b>.</b>
mork	7										
muto	8										
oned	-	-									
parsim	9	-									
pef	10										
postproc	11				Run workers low priority			No			¥
prune Shooter	12										
rayShooter	13										
···· re samp3d	14										
re sample	15										
rtmodel											_
scan					Use Restart Files			YES			<b>.</b>
shooter											
smoother											
stack	-										
static Shift											
time Depth	<b>v</b>										
< /// >											

### Table 103. rayshooter Job Panel Fields

Field	Description
Master is Worker	Flag that controls whether the master I/O controller is also used for performing calculations. default: Yes
Run Workers in Low Priority	If Yes, workers will be spawned with reduced priority. although the master process will remain at high priority. This can be useful especially when Master Is Worker is set, so that one worker does not slow down collection or submission of shots for all of the others. default: No
Use Restart Files	If NO, the job will ignore restart information and start from the beginning. default: Yes

# resamp3d Module

Figure	134.	resam	p3d	Panel
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### Table 104. resamp3d Panel Fields

Field	Description
Input File	
Output File	
Temp Dir	default: /data1
Х Кеу	The header key specifying where CDP data is stored. default: cdp
Ү Кеу	The header key specifying where line data is stored. default: ep
NI Y	default: 0
NI X	default: 0

Field	Description
NI T	default: 0
Interp Keys	The header keys specifying where source line and crossline data are stored, and where geophone line and geophone crossline data are stored. default: sx, sy, gx, gy
Smooth	default: No

# Table 104. resamp3d Panel Fields-continued

# resample Module

## Figure 135. resample Panel

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-postproc v 13 v	Job Cluster Modules 2 	Job Flow           1         re sample           2            3            4            5            6            7            8            10            11            12	Top Replacement Amp Bottom Replacement Amp Linear Interpolation No	
	postproc	<b>v</b> 13		

## Table 105. resample Panel Fields

Field	Description
Output Times (ms)	Minimum, Maximum, Increment. <b>This is a REQUIRED entry.</b>
Top Replacement Amp	
Bottom Replacement Amp	
Linear Interpolation	default: No

# rtmodel Module

The rtmodel provides an interface to the reverse time modeling module.

### Note:

Although migration can be performed by the application called **rtmodel**, this module has been replaced by a separate application, called MERLIN<sup>®</sup>.

### Note:

Although modeling is currently performed by the application called **rtmodel**, this will eventually be a separate application, tentatively called  $MINDY^{TM}$ .

All the technologies in the module are based on propagation with the acoustic wave equation, Equation 6, where *u* is the wave field, *c* is the velocity, and  $\rho$  is the density.

# **Equation 6:** $\partial_t^2 u(\mathbf{x},t) = c^2 \rho \nabla \cdot \frac{1}{\rho} \nabla u$

Normally, for migration, the density is treated as constant, and the reduced equation, Equation 7, is used. Another version, for anisotropic velocity, will be covered later.

**Equation 7:** 
$$\partial_t^2 u(\mathbf{x}, t) = c^2 \nabla^2 u$$

The equation of motion for the field Equation 6 is solved in these applications using a highorder, centered-grid finite-difference time-domain (FDTD) approach. Boundaries are handled by a choice of tunable isotropic or anisotropic (PML) absorbers.

Typically, a modeling job will involve only this application and the diskWrite module to write the output to disk.

#### Note:

You will probably want to use the *Append* setting of the diskWrite module *Mode* parameter, so that restart jobs will not overwrite previous work (see diskWrite Module).

# Modeling

A source wavelet is inserted at the specified location, and the field is recorded as traces specified locations.

# Migration

This is a 'Reverse-Time' algorithm; the source field is a synthetic modeled shot, cross-correlated with back-propagated data.

# rtmodel Main Panel

Figure 136 and Figure 137 enable you to specify basic information to be used by the module. The fields on the panel are described in Table 106.

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stack					Source Line location			
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trwindow	-				Scialen Basename	/scratcn/users/cjb/ttmodel		

### Figure 137. rtmodel Module Main Panel

### Table 106. rtmodel Module Main Panel Fields

Field	Description					
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.					
Model	This is a seismic file in any format MARVEL can read; typically SEG-Y. The units are $m/s$ or $ft/s$ , but can be any other units, depending on the choice of units in the seismic data.					
Mode	Model, Migrate, Model & Migrate. Setting this field to Migrate modifies the availability of fields in the rtmodel Compression Panel, rtmodel Computation Panels, and rtmodel Input Panel panels. default: Model					

Field	Description							
Restart file	This is where the application keeps information about shots already processed. It is usually best to put it where your output files are, and to give it a similar name. For example, if your output file basename is /home/projects/marmousi/input/marmousi – shots, you might call the restart file /home/projects/marmousi/input/marmousi – shots.restart. default: /scratch/shot.restart							
Peak Frequency	This field has a somewhat historical definition in units of Hz. The value is based on the definition of the default Ricker wavelet, and refers to the peak frequency of the defining Gaussian pulse (since the Ricker wavelet is the second derivative of the Gaussian pulse, its peak frequency is actually higher than the Gaussian pulse itself). The maximum produced frequency will be roughly 2.8 times this number. default: 5							
Wavelet	The name of the wavelet convolved with a reflectivity trace to generate a synthetic seismogram: Ricker (zero-phase) or Spike (which is mostly useful for migration), or From File (where you specify your own wavelet). If you specify a wavelet, you must then specify two additional parameters: Wavelet File and Wavelet Lead. default: Ricker							
Wavelet File	When you have specified that the wavelet is From File, this field allows a single trace to be read from a seismic input file to define the source wavelet.							
Wavelet Lead (ms)	When you have specified that the wavelet is From File, the specified wavelet will be centered at this point.							
Source CDP Location	Either a single value, or a range: minimum, maximum, and increment. This field is not visible for Migrate Mode.							
Source Line Location	Either a single value, or a range: minimum, maximum, and increment. This field is not visible for Migrate Mode.							
Max Time (ms)	Data will be acquired or migrated for this length of time. default: 4000							
Scratch Basename	The application needs temporary storage for acquired data, accumulated image, and others. All of these filenames will start with this prefix.							

### Table 106. rtmodel Module Main Panel Fields-continued

# rtmodel Model Panel

The rtmodel Model panel contains only two parameters that specify the header keys to be used if different from that specified in the input data.

- Model Line Key—Use this value if different from data (see 'Input' group).
- Model Cdp Key—Use this value if different from data (see 'Input' group).

# rtmodel Input Panel

Figure 138 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 107.

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#### Figure 138. rtmodel Module Input Panel, Model Mode

#### **Table 107. rtmodel Module Input Panel Fields**

Field	Description
Line Header Key	Header key containing line designators. MARVEL usually uses <i>ep</i> , which is a 4-byte integer at location 17 in SEG-Y files. default: ep
CDP Header Key	Header key containing line designators. MARVEL usually uses ep, which is a 4-byte integer at location 17 in SEG-Y files. default: cdp

Field	Description
Shot Centering	For modeling, the only generally useful choices are: Source Point - computation aperture is centered on the source. Model - computation aperture is centered at the center of the model. Generally, the apertures should be at least half the dimensions of the model in this case. default: Source Point
Input Shot Normalization	Normalization corrects for the amplitude effects of wavefront divergence and damping. It is also used when you apply a subsequent filter for eliminating the surface waves. If RMS, each input shot is divided by its RMS value before processing. Possible values: None or RMS. <b>Note: This field is visible only if the Mode field in the rtmodel</b> <b>Main Panel is set to Migrate.</b> <b>default: RMS</b>

# Table 107. rtmodel Module Input Panel Fields-continued

# rtmodel Output Panel

Figure 139 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 108.

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## Figure 139. rtmodel Module Output Panel, Model

### Table 108. rtmodel Module Output Panel Fields

Field	Description
Scale for CDP and Line	If the output spacings (see below) are set to odd numbers, the CDP and Line numbers will be fractional. Scaling them by 10 may help in viewing the output. MARVEL viewers do not use fractional CDP and line numbers.
Output Receiver Spacing (cdps)	Data will be acquired on a grid centered on the shot point, with this spacing along the CDP axis. <i>Used for modeling.</i>
Output Receiver Spacing (lines)	Data will be acquired on a grid centered on the shot point, with this spacing along the line axis. <i>Used for modeling.</i>
Output Lines	Min, max, and increment for lines in the output volume. <i>Used for migration</i> .

Field	Description
Inline Aliasing	Attempt to compensate for aliasing in the inline direction (units: lines). Note: This can be a costly operation. Used for migration.
Output XLines	Min, max, and increment for xlines (cdps) in the output volume. <i>Used for migration</i> .
Xline Aliasing	Attempt to compensate for aliasing in the crossline direction (units: xlines). Note: This can be a costly operation. Used for migration.
Output Depths	Min, max, and increment for depths (m/ft) in output volume. <i>Used for migration</i> .

# Table 108. rtmodel Module Output Panel Fields-continued

# rtmodel Computation Panels

There are six slightly different rtmodel Computation panels depending on your selections in the Mode field of the rtmodel Main panel (see Figure 136) and the Allow Surface Multiples field of the Computation panel. For simplicity, only two of these panels are shown, the others are based on these two panels. The fields on these panels are described in Table 109.

#### Figure 140. rtmodel Computation Panel, Model Mode and Allow Surface Multiples=Yes

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### Figure 141. rtmodel Computation Panel, Migrate Mode and Allow Surface Multiples=Yes

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### Table 109. rtmodel Module Computation Panel Fields

Field	Description
FD Order	This determines the order of accuracy of the spatial derivatives used in the simulation. For second-order, a second derivative is computed using 3 grid points. For 8 <sup>th</sup> -order,9 grid points are used, with 5 unique coefficients. This is usually the ideal combination for speed and accuracy. Note: As of MARVEL version 2.1.1.28, orders higher than eight do not work on vectorized platforms; this includes 32-bit and 64-bit x86 architectures, as well as Cell/PPC. default: Fourth Order

Field	Description
Time order	$2^{nd}$ -order time uses a three-point stepping algorithm. $4^{th}$ -order uses the wave equation to compensate for errors in the former approach (usually referred to in the industry as 'the Dablain trick').
Courant Factor	The internal time step is determined by the Courant stability condition, involving the grid spacing and the maximum velocity. For the default 4 <sup>th</sup> -order time, this code is stable with a factor of .9; for 2 <sup>nd</sup> -order time, a value of .85 is recommended. Slightly smaller values <i>may</i> result in slightly better output, but probably will not help.
Allow Surface Multiples	If this field is set to Yes, a free surface is modeled, and the wave field will reflect off the top, leading to multiples in the data. If the field is set to No, an absorbing zone will be placed at the top. default: Yes
Free Surface Location	<ul> <li>This field is visible only if Allow Surface Multiples is set to Yes.</li> <li>There are three options to this field:</li> <li>Shot Topography—Reflections occur at the topography defined for shots (see below)</li> <li>Receiver Topography—Reflections occur at the topography defined for receivers (see below)</li> <li>Fixed Depth—Free surface is at user-specified depth</li> </ul>
Free Surface Depth (m/ft)	User-specified free-surface depth, when 'Fixed Depth' is chosen for 'Free Surface Location'. This field is visible only if Allow Surface Multiples is set to Yes.
Use Bottom Boundary Absorber	<ul> <li>This field has two options:</li> <li>Yes—Waves are absorbed at the bottom.</li> <li>No—Waves can reflect off the bottom. This generally does little harm, and costs a bit less.</li> <li>default: Yes</li> </ul>
Line (Y) Aperture (m/ft)	The computation for each shot is limited along the $y$ axis to a range above and below the center of the shot. default: 3000
XLine (X) Aperture (m/ft)	The computation for each shot is limited along the $x$ axis to a range above and below the center of the shot. default: 3000

# Table 109. rtmodel Module Computation Panel Fields-continued

Field	Description
Shot Centering	<ul> <li>Source Point</li> <li>Shot + Receiver Box</li> <li>Avg Midpoint</li> <li>Model</li> <li>default: Source Point</li> </ul>
Grid Spacings (m/ft )	If left blank, these will be determined by the 'Output Receiver Spacings' (see above). Otherwise, these specify the spacings of the computation grid.
Grid-change Depths (m/ft)	
DX/DY Grid-change Depths (m/ft)	
DZ Grid-change Depths (m/ft)	
Source Field Impedance Matching	Use 'non-reflecting' wave equation for source propagation, and is an attempt to reduce artifacts. Costly, and not very effective. NOTE - probably broken in version 2.1.1.28. This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate. Default: No
Receiver-field Impedance Matching	Use 'non-reflecting' wave equation for receiver back-propagation in an attempt to reduce artifacts. Costly and not very effective. NOTE - probably broken in version 2.1.1.28. This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate. default: No
Illumination Type	An illumination is produced. Generally, the default value of 'Source' should be used. In this case, the illumination is just the sum of the squared source fields at each image point. This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate. default: Source.Receiver

# Table 109. rtmodel Module Computation Panel Fields-continued

Field	Description
Per-Shot Illumination	Each shot image can be divided by the illumination separately. This tends to be noisier, but can help to image steep dips in some cases. This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate.
Illumination cutoff	This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate, and if Per-Shot illumination is Yes. default: 0.05
Illumination Power	For a value of '1', the illumination is the squared source. This field is visible only if the Mode field in the rtmodel Main Panel is set to Migrate, and if Per-Shot illumination is Yes. default: 0.5

# Table 109. rtmodel Module Computation Panel Fields-continued

# rtmodel Smoothing Panel

The Figure 142 panel enables you to specify basic information to be used by the smoothing calculations in the rtmodel module. The fields on the panel are described in Table 110.

#### Note:

The fields on the Smoothing panel are available only if the Mode field in the rtmodel Main panel is set to Migrate, see rtmodel Main Panel.

### Figure 142. rtmodel Module Smoothing Panel, Migrate

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prune Shooter 7 rayShooter 8 resamp3d 9	Source Vel Smoothing Power	
	Receiver-field Vel Smoothing	
	Receiver Vel Smoothing Dists (x,y,z) x0 y0 z0	
static Shift 15 time Depth trsum ♥	Receiver Vel Smoothing Power	

#### Table 110. rtmodel Module Smoothing Panel Fields

Field	Description
Source-field Vel Smoothing	Turn the smoothing of the velocity (slowness) field used to propagate the source term <i>on</i> or <i>off</i> . This process can be useful for reducing artifacts. Note: This field is not available for Modeling or Modeling and Migration. default: No
Source Vel Smoothing Dists (x,y,z)	Gaussian widths for smoothing slowness in each direction. Note: This field is not available for Modeling or Modeling and Migration. default: 0

Field	Description
Source Vel Smoothing Power	The number of times to smooth the volume. Note: This field is not available for Modeling or Modeling and Migration.
Receiver-field Vel Smoothing	Turn the smoothing of the velocity (slowness) field used to propagate the receiver term <i>on</i> or <i>off</i> . This can be useful reducing artifacts. default: No
Receiver Vel Smoothing Dists (x,y,z)	Gaussian widths for smoothing slowness in each direction. default: 0
Receiver-field Vel Smoothing Power	The number of times to smooth the volume.

# Table 110. rtmodel Module Smoothing Panel Fields-continued

# rtmodel Topography Panel

Figure 143 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 111.

<u>File</u> Job <u>U</u> tilities	ļ	<u>H</u> elp		Σ	( jobB	uilder	– Marvel	Versior	2.1.1.31p	re3, Pano	rama Tec	h		
	Ę	<u></u>	â 🗈	₽.	V Proj	ject: /ne	t/praha06/da	ata1/jhu/pr	ojects/blessing/	blessing-den	se.project			•
Job Cluster														
Modules I filter	*		Job Flow			rtmodel			Constantion	Constanting	Derester	<b>T</b>		
gain hdrMath importVtp interpShot kdm km km merlin merlin mork mork mork		1 2 3 4 5 6 7 8 9	rtmodel			Top	o Surface Fil	e Ime	Торо	Smoothing	Boundary	Topography		
oned parsim pef postproc prune Shooter		10 11 12 13				Sou	rce Topo Su	rface File					9	
<ul> <li>rayShooter</li> <li>resamp3d</li> <li>resample</li> <li>rtmodel</li> <li>scan</li> <li></li> </ul>	•	15				Wea	athering Velo	c ity						

## Figure 143. rtmodel Module Job Panel

### Table 111. rtmodel Module Job Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this file is used for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep=100 cdp=500 z=20
Topo Surface Name	A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Weathering Velocity	The weathering velocity to use in the calculations.

# rtmodel Compression Panel

Figure 144 and Figure 145 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 112.

### Figure 144. rtmodel Module Compression Panel

🔿 🔿 🔿 🔯 jobBuilder - Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File Job Utilities H</u> elp	
🗋 🖨 🖨 🍰 h 🗣 🔻 Project	Ţ
Job Cluster       Modules     Job Flow       1     ttmodel       moveout     1       -mute     3       -parin     5       -pef     6       -postpoc       6       -pureShooter       -resample       10	1
-scan 11 -semblance V 12	

### Figure 145. rtmodel Module Compression Panel

000 🛛 🖾	obBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
🗅 🖨 🖶 🍐 🏠 🗣 🔻	Project:	<b>±</b>
Job Cluster		
Modules     Job Flow      mork     1      mork     2      more     3      oned     4      parsim     5      parsim     6      parshooter     7      resamp3d     9      resamp4     10      scan     11      sembance     12	Introdel     Indel     Indel	

#### Table 112. rtmodel Module Compression Panel Fields

Field	Description
Use Raw File for Field	Necessary for compression. If No, stored source term is stored in SEG-Y files (SLOW).

continues on next page

#### MARVEL Reference Manual

Field	Description
Use Forward Field Compression	Turns compression for the source term on or off. <b>Note:</b> This field is only available if the Mode field on the rtmodel Main panel is set to Migrate.
FF Compression Max	As part of the compression, this specifies the amplitude range used to store the samples. For most projects, the default of 120 produces good results, but for some projects, a more dynamic range may be needed. <b>Note:</b> This field is only available if the Mode field on the rtmodel Main panel is set to Migrate. default: 120

# Table 112. rtmodel Module Compression Panel Fields-continued

# rtmodel Job Panel

Figure 146 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 113.

	ß	å t ♥ ▼	Proj	ect: /ne	t/praha06/data	ıl/jhu/pro	jects/blessing/	blessing-den	se.project					¥
lob Cluster														
Modules 🔺	•	Job Flow		rtmodel										
tilter gain	1	rtmodel		Main	Model Input	Output	Computation	Smoothing	Boundary Top	ography (	Compression	Job Doc		
hdrMath importVtp	2 3			Use	All CPUs		Yes						¥	
interpsnot kdm km	4 5			Max	Threads per P	юс								
kmodel merlin	6 7			Num	ıberof Domain	5	1							
mork moveout	8 9			Mas	ter is Worker		Yes						¥	
oned parsim	10 11			Run	workers low pr	io rity	No						<b>¥</b>	
pef postproc	12			Use	Restart Files		YES						Ŧ	
prune Shoote r ray Shoote r	14			Vert	ose		No						<b>±</b>	
···· re samp3d ···· re sample	15			Dais	ychain Returne	d Shots	Yes						¥	

## Figure 146. rtmodel Module Job Panel

## Table 113. rtmodel Module Job Panel Fields

Field	Description
Use All CPUs	This really means that each worker should use multiple threads. If <i>No</i> , then there will be one independent worker spawned for each CPU (or core) in the cluster.
Max Threads Per Proc	If <i>UseAllCPUs</i> is set to <i>Yes</i> , this field limits the number of CPUs (cores) that a single worker can use.
Number of Domains	The computation grid will be split up among this number of workers for each shot. default: 1
Master is Worker	Yes—workers will be spawned on the master node of the job. No—workers will NOT be spawned on the master node of the job.
Field	Description
------------------------------	---
Run workers low priority	If <i>Yes</i> , workers will be spawned with reduced priority. although the master process will remain at high priority. This can be useful especially when <i>MasterIsWorker</i> is set to <i>Yes</i> , so that one worker does not slow down the collection or submission of shots for all of the others.
Use Restart Files	If <i>No</i> , the job will ignore restart information and start from the beginning.
Verbose	Switch for turning debug printing on and off. default: 0
Daisychain Returned Shots	If <i>Yes</i> , multiple shots can be returned at once, and stacked along the way, before going out. This saves I/O time. <i>This field is not used for modeling.</i> default: 1
Movie	

# Table 113. rtmodel Module Job Panel Fields-continued

# scan Module

The scan module, Figure 147, scans and thresholds input traces and outputs various statistical quantities, as described in Table 114.

### Figure 147. scan Panel

	ß	条 🕁 🗣 🦷	Project: /net/prah	a06/data1/jhu/projects/blessing/blessing-dense.project
b Cluster	_		·	
lodules 🔤	•	Job Flow	scan	
moveout	1	scan	Main Doc	
mute	2			
oned	3		Keys	
···· parsim	4		ngroup	
pef			-	
postproc	2		Max Amp	
prune Shooter	6		_	
ray shooler	7		Project	/net/praha06/data1/jhu/projects/blessing/blessing-dense.project
···· re sample	8			
rtmodel	9		Line Key	ep
scan	10		Cdp Kev	cdp
semblance	11			
shooter	12			
smoother	112		-	
stack	13		Offset Bin	Min Max Inc
static Shift	14			
trsum	15			
u a u i i				

### Table 114. scan Panel Fields

Field	Description
Keys	The keys defining an ensemble for reporting.
ngroup	Number of traces per ensemble. This parameter is ignored if Keys is set.
Max Amp	The maximum threshold amplitude.
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Line Key	The header key specifying where line data is stored. default: ep
Cdp Key	The header key specifying where CDP data is stored. default: cdp
Offset Bins	Specifies the offset bins in which to read the data.

Field	Description
Verbose	Switch for turning debug printing on and off. default: No

#### Table 114. scan Panel Fields-continued

# semblance Module

# Theory

The semblance module computes the semblance panel for a given CDP gather. Velocity analysis is usually a two-dimensional process for determining the optimal values of the vertical twoway travel-time and stacking velocity. When the travel-time curve deviates extensively from hyperbolic, the quartic term of the travel-time series must be part of the computations. In its simplest form (with  $a^2 = 0$ ), the optimization of all parameters becomes three dimensional. Repeating a conventional two-dimensional scan for each change of the quartic term produces the desired 3D time-velocity-anisotropy volume. The traveltime function for a scan of this type is defined by Equation 8. The coefficients  $a_1$  and  $a_2$  are assumed to be small and, consequently, deviation from hyperbolic arrival is also small. Triplications are beyond the scope of this program.

$$t^{2} = t_{0}^{2} + \frac{h^{2}}{4v^{2}} - \frac{a_{1}x^{4}}{1 + a_{2}x^{2}}$$

Semblance is defined by Equation 9, where n is the number of non-zero samples after muting, and d(t,j) is the jth trace in the input ensemble. Both the numerator and denominator are smoothed prior to the computation of this quotient.

#### **Equation 9:**

**Equation 8:** 

$$s(t) = \left[\frac{\left(\sum_{0}^{n-1} d(t,j)\right)^{2}}{\sum_{0}^{n-1} d(t,j)^{2}}\right]^{pwr}$$

When the *pwr* factor is greater than 1, it acts as both a compressor and expander, with the upper range of the semblance expanded and the lower range compressed. This tends to decrease the number of large values and makes picking an easier process.

Conversely, when the *pwr* factor is less than 1, this increases the number of large values and makes picking more difficult.

¥

# Main Panel

### Note:

This module expects input data to be in CDP order.

Figure 148 shows a semblance Module panel, and Table 115 describes the fields on the panel.

#### 000 🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech <u>File J</u>ob <u>U</u>tilities <u>H</u>elp 🗋 🖨 🗟 🏂 🛧 🕀 🔻 Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project Job Cluster semblance Modules • Job Flow ⊷interpShot Main Doc 1 semblance --- kd m 2 --- km nv 50 3 --- km odel 4 dv 50 - me rlin --- mork 5 fv 1500 -moveout 6 - mute anis1 0 7 oned 8 - parsim anis2 0 - pef 9 1.5 - postproc smute 10 - prune Shoote 11 dtratio 5 - rayShooter 12 • re samp3d 11 nsmooth - re sample 13 - rtmodel verbose 0 14 scan 15 semblance pwr 1 shooter lineKey ep -smoother --- stack cdpKey cdp ... static Shift - time Depth offsetKey offset - trsum Time-start key delrt - trwindow • wem •

# Figure 148. semblance Main Panel

#### Table 115. semblance Main Panel Fields

Field	Description
nv	The number of velocities in any given scan. default: 50
dv	The velocity increment. default: 50
fv	The first velocity value. default: 1500

Field	Description
anis1	The anisotropy factor in the numerator in Equation 8, that is, <i>a</i> 1. default: 0
anis2	The anisotropy factor in the denominator in Equation 8, that is, <i>a</i> 2. default: 0
smute	The stretch mute value. default: 1.5
dtratio	The ratio of output to input time samples. default: 5
nsmooth	The number of samples to smooth the denominator and numerator in the semblance calculations. default: 11
verbose	Switch for turning debug printing on and off. default: 0
pwr	The power on the semblance function. default: 1
lineKey	The header key where line information is stored. default: ep
cdpKey	The header key where CDP information is stored. default: cdp
offsetKey	The header key where offset information is stored. default: offset
Time-start key	The header key specifying where the initial time of the trace is stored. default: deirt

#### Table 115. semblance Main Panel Fields-continued

# shooter Module

#### Note:

Although this module is still provided for compatibility purposes, its use has been deprecated. It is recommended that you use the rayshooter module, instead.

See also rayshooter Module.

# shooter Main Panel

Figure 149 enables you to specify basic information to be used by the module. The fields on the panel are described in Table 116.

#### Note:

If the output range is smaller then the aperture range, the output range is used to limit the size of the traveltime table.

### Figure 149. shooter Main Panel

	8	🎗 🕁 🗣 🔻	7 Project: /net/prah	a06/data1	/jhu/projects/blessing/blessing-dense.project	
b Cluster						
lodules 🛃	•	Job Flow	shooter			
interpShot	1	shooter	Main RayT	acer Ani	isotropy Output Topography Advanced Doc	
kam	2					
kmodel	з		Project		/net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
me rlin	4					
mork	5		Model			
moveout	6					
mute	7		Tmap Bas	ename		
oned	8					
pef	-	-	Line Key		ep	
postproc	1		Cdp Key		eda .	
prune Shoote r	10		Cupikey			
… rayShooter	11					
re samp3d	12					
···· re sample	13		Inline Ape	ture	Ap (m/ft) dy (m/ft)	
	14					
semblance	15					
shooter						
smoother	1					
···· stack	1					
static Shift	1		Crossline A	perture	Ap (m/ft) dv (m/ft)	
time Depth					di tititi	
usum						

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Model	The name of the input model.
Tmap Basename	The prefix used to produce the traveltime output files with suffix . tmap.
Line Key	The header key for the line number in the model file. default: ep
Cdp Key	The header key for the CDP number in the model file. default: cdp
Inline Aperture	The length, in meters or feet, in the line direction aperture limit.
Crossline Aperture	The length, in meters or feet, of the crossline, or CDP, direction aperture limit.

# Table 116. shooter Main Panel Fields

# shooter RayTracer Panel

The shooter RayTracer panel, Figure 150, enables you to specify information that is to be used in ray tracing operations. The fields on the panel are described in Table 117.

Efe         Job         Links         Help           Image: State of the	0 0 0 🛛 🕅 🛛	bBuilder – Marve	l Version 2.1.1.31pre3, Panorama Tech
Image: Constant     Job Cluster     Modules     Job Flow     Image: Constant     Image: Constant     Job Flow     Image: Constant     Image: Constant <t< td=""><td><u>F</u>ile <u>J</u>ob <u>U</u>tilities <u>H</u>elp</td><td></td><td></td></t<>	<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
Job         Cluster           Modules         Job Flow           Inflor         1		oject: /net/praha06/dat	al /jhu/projects/blessing/blessing-dense.project
- statt Smit - time Depth - trwindow were ▼ ▼	Job Cluster Modules Job Flow - umouzu - filter 1 shooter - gain 2 - hdrMath 3 - hdrMath 3 - interpShot 5 - kdm 6 - kdm 6 - kdm 8 - mork 9 - mork 9 - mork 9 - mork 9 - mork 9 - parsim 12 - mesample - trodel - sample - trodel - stack - stack 5 - stack - stack 5 - stack - trodow - wem	shooter Main RayTracer A shootFan maxDist maxDist maxDepth minDepth minAmp maxAngle maxYPos minYPos dtStepSize dtAccuracy BoundingAngles nullTTValue stepLength	Initial project () bessing dense project         Initial to pography       Advanced       Doc         Yes       •         0.001       •         10       •         0.001       •         0.004       •         0.003       •         0.001       •         0.001       •         •       <
-trsum -trwindow wem v - vem v	-trsum -trvindow wem	stepLength	0.04

### Figure 150. shooter RayTracer Panel

### Table 117. shooter RayTracer Panel Fields

Field	Description
shootFan	Selects the shooting direction: Yes causes rays to be shot toward deeper depths, while No causes rays to be shot upward toward shallower depths. default: Yes
maxDist	The maximum horizontal distance a ray can travel. If this parameter is defaulted to zero, the maximum distance a ray can travel is set to the maximum extent of the model.
maxDepth	The maximum depth a ray can travel. If this parameter is defaulted to 0, the maximum depth of a ray is set to the maximum depth of the model.

Field	Description
minDepth	The minimum depth a ray can travel. If this parameter is defaulted the ray has to minimum depth.
minAmp	The cutoff amplitude of a ray. This value is in terms of paraxialAmp x pathLength x velocity.
	<ul> <li>In constant velocity, this value stays at 1.0 all along the ray.</li> <li>For a linear velocity gradient starting with 5000 ft/sec at the surface and reaching 10000 ft/sec at a depth of 10000 feet, this value will be 0.66 at 10000 feet for a ray straight down.</li> </ul>
	<b>Note:</b> It is recommended that you set this value to about 0.10 so that only the very low amplitude rays are dropped. If you set the value to a large value, you will reduce run time at the expense of accuracy. default: 0.01
maxAngle	The maximum angle a ray can attain. When set to 180 degrees, this can potentially cause the generation of turning rays and thus produce corresponding longer traveltimes. Generally, a reasonable compromise between speed and accuracy is to set this value in the neighborhood of 160 degrees. default: 160
maxTime	The maximum time a ray can travel. default: 10
maxXPos	The maximum x or crossline direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
maxYPos	The maximum y or line direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
minXPos	The minimum x or crossline direction distance a ray end point can attain. This value can potentially override the maxDist parameter.
minYPos	The minimum y or line direction distance a ray end point can attain. This value can potentially override the maxDist parameter.

# Table II7. shooter RayTracer Panel Fields-continued

Field	Description
dtStepSize	Ray tracing step length (in seconds) used for smoothing the velocity model. This is crucial for stability and for this routine to run quickly. The velocity is smoothed by 1.5 x averageVelocity x stepLength. For a 60 Hz freq, your stepLength should be about 0.040 seconds. For velocities that average 7000 ft/sec, the smoothing is then 420 feet. <b>Note:</b> Since the ray tracing is adaptive, the smoothing value can actually be fairly small, but this is not recommended. In general, your velocity should be smoothed at least a few hundred feet anyway, probably a few thousand. A value of 0.0 will turn off smoothing. If this value is not 0.0, but it is less than 2.5 x MIN(dx,dy), the value will be set to 2.5 x MIN(dx,dy). default: 0.004
dtAccuracy	The desired accuracy of travel times. The recommended value of about 0.25 x 0.5/maxFrequency. For for 60 Hz data, dtAccuracy is 0.002 sec. default: 0.003
BoundingAngles	The take-off angles anglex1, anglex2, angley1 and angley2 that bound the initial ray fan, and define the direction cosines off vertical. The four values define an initial cone and provide a convenient method for limiting near surface apertures during the migration process. These four angles usually have values of about 70, -70, 70, -70. Examples:
	<ul> <li>anglex1 = -90, angley1 = 0 means horizontal in the negative x direction</li> <li>anglex2 = 0, angley2 = 90 means horizontal in the positive y direction</li> <li>anglex1 = 0,angley1 = 0 means a vertical ray.</li> </ul>
nullTTValue	The value that is set inside a given zone where no rays have penetrated. This is a marker that tells the migration module not to image in these zones. default: -1
stepLength	The length of a time step along a ray. Because this value is adaptive, there is little reason to change the default value of .04 second. default: 0.04

# Table 117. shooter RayTracer Panel Fields-continued

# shooter Anisotropy Panel

The parameters in the shooter module Anisotropy panel, Figure 151, define the various velocity model input options available for the acoustic and anisotropic raytracer. The fields on the panel are described in Table 118.

#### Note:

You must enter these files in the proper order. What the raytracer requires is enough information to define the vvelfile and eta. Thus, one and only one of following combinations must be entered:

- epsilonfile, delfile
- vvelfile, etafile
- vvelfile, epsilon
- vvelfile, delfile

	<u> </u>	å 🕁 🕂 🐧	Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
Cluster				
odules 🔺	_	Job Flow	shooter	
filter	1	shooter	Main RayTracer Anisotropy Output Topography Advanced Doc	
gain	2			
hdrMath	3		vveffile	<u>a</u>
importVtp	4			
interpShot	5			
kdm	6		delfile	-
kmodel	7	-		
merlin	-			<u> </u>
mork	<u> </u>			
moveout	9			
mute	10		epsilonfile	<b>a</b>
oned	11			
parsim	12			
per	13		phifile	
prune Shooter	14			
rayShooter	15		thatafila	
re samp3d				

#### Figure 151. shooter Anisotropy Panel

#### Table 118. shooter Anisotropy Panel Fields

Field	Description	
vvelfile	The name of the Vnmo file. This file is closely related to the vertical velocity field.	
delfile	The name of the file containing Thomsen's delta values.	

Field	Description
etafile	The name of the file containing Thomsen's eta.
epsilonfile	The name of the file containing Thomsen's epsilon.
phifile	The name of the file containing Thomsen's phi.
thetafile	The name of the file containing Thomsen's theta.

# Table 118. shooter Anisotropy Panel Fields-continued

# shooter Output Panel

The output panel, Figure 152, enables you to control the output from the shooter module. Table 119 describes the fields on the panel.

<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🖨 🖬 🚔 🎄 🖝 🔻 🔻	roject: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	7
Job Cluster		
Modules Job Flow	Main RayTracer Anisotropy Output Topography Advanced Doc	
gain 2 hdrMath 3 importVtp 4 interpShot 5 kdm 6 km 6 km 7	Inline Shots (min,max,inc) Min Max Inc	
merlin morek moveout mute oned 11	Crossline Shots (min,max,inc) Min Max Inc	
parsim 12 pef 13 postproc 14 ressamp6d ressamp6 V	Tmap depths (m/ft) (min,max,inc) Min Max Inc	

# Figure 152. shooter Output Panel

### Table 119. shooter Output Panel Fields

Field	Description
Inline Shots	The Minimum, maximum, and incremental line range of the shot locations of the output travel-time volumes.
Crossline Shots	The Minimum, maximum, and incremental CDP range of the shot locations of the output travel-time volumes.
Tmap Depths	The minimum, maximum, and increment depth of each travel-time volume.

# shooter Topography Panel

This panel, Figure 153, enables you to control the output from the shooter module. Table 120 describes the fields on the panel.

000 8	jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech
Elle Lob Utilities Help	Project         /net/praha06/data1/jhu/projects/blessing/blessing-dense.project
Job Cluster Modules 	Shooter Main RayTracer Anisotropy Output Topography Advanced Doc Topo Surface File

# Figure 153. shooter Topography Panel

### Table 120. shooter Output Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

# shooter Advanced Panel

The shooter module displays two versions of the Advanced panel depending on your Compress selection, shown in Figure 154 and Figure 155. The field values are described in Table 121.

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Pan	orama Tech
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ ➡ ■ ≜ ≵ ▲ ♥ ▼	Project:	<b>~</b>
Job Cluster		
Modules     Job Flow      systeme     1      fdrmod2d     2      filter     3      gain     4      hdrMath     5      mterpShot     6      ktm     8      krodel     9	- shooter     Main RayTracer Anisotropy Output Topography Advan     AmpFlag     Compress	Ves V
mork 10	verbose	No 👱
	Run Worker on Master	Yes - Run worker on master

# Figure 154. shooter Advanced Panel-Compress, No

#### Figure 155. shooter Advanced Panel-Compress, No

000	X	jobBu	ilder – Marvel Versio	on 2.1.1.31pre3, Panorama Tech	
	≞∘∘ È} ĉ ↑ ▼ ₹	🗸 Рюј	ect:		•
Job Cluster	Job Flow		shooter		
- pef - postpoc - pune Shooter - rayShooter - resampla - rtmodel - scan - semblance - shooter - smother - stack	Job Flow           1         shooter           2         -           3         -           4         -           5         -           6         -           7         -           8         -           9         -           10         -		Main RayTracer Anisotr AmpFlag Compress stages ClipPercent	opy Output Topography Advanced Doc	
static Shift time Depth trsum trwindow	11 12 13 14		verbose Run Worker on Master	No 👱	
< /// >	15	•			

Field	Description	
AmpFlag	Determines whether or not amplitudes are calculated and output. default: No	
Compress	Determines whether or not traveltimes and amplitudes (if calculated) are compressed. default: Yes	
stages	The number of stages to use in the wavelet-based compression scheme. This field is displayed only if <i>Compress</i> = <i>Yes</i> has been selected. default: 1	
ClipPercent	The percentage of the maximum amplitude defining the threshold in the wavelet domain below which amplitudes are zeroed. While clipping can increase compression efficiency, it can also seriously reduce accuracy. This field is displayed only if Compress = Yes has been selected. default: 0	
verbose	Switch for turning debug printing on and off. default: No	
Run Worker on Master	Determines whether or not the master is used in the computational process. default: Yes	

### Table 121. shooter Module Advanced Panel Fields

# smoother Module

The smoother module, Figure 156, enables you to control the smoothing operation performed on the output data. The fields on the panel are described in Table 122.

### Figure 156. smoother Panel

) e p	B & A ₽ ▼	Project:			
b Cluster - diskWrite - diskWrite - diskWrite - diskWrite - fdmod 2 d - fifter - gain - influer - interp Shot	▲ Job Flow 1 smoother 2 2 3 4 5 5 5 7	smoother Main Doc Project RMS Picks Anisotropic epsilon	0		] <del>3</del> ] <del>3</del>
kdm km kmodel merlin mork 	8 9 10 11 12 13	Anisotropic delta Topography File Toposurface Name Output Type	0 Topo RMS in Time	ž	) ] <b>a</b> ]
parsim pef postproc prune Shooter ray Shooter resamp3d	14	Output Line Range Output XLine Range Output Z/T Range (nyft/ms)	Min Max Max		] ] ]
re sample rtmodel scan semblance shooter		Interpolation Smoothing	Linear Gaussian	¥.	] ]
<mark>smoother</mark> stack static Shift time Depth		Min Y(Line) Smooth Min X(Cdp) Smooth Min Time/Depth Smooth (ms/m/1	10 10 10		] ] ]

#### Table 122. smoother Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
RMS Picks	
Anisotropic epsilon	default: 0
Anisotropic delta	default: 0

T

Field	Description
Topography File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: $ep = 100 \text{ cdp} = 500 \text{ z} = 20$
Toposurface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Output Type	Interval in Depth, or RMS in Time. default: RMS in Time
Output Line Range	Minimum, maximum and increment values for output lines.
Output XLine Range	Minimum, maximum and increment values for output crosslines.
Output Z/T Range (m/ft/ms)	Minimum, maximum and increment values for output Depth/Time values.
Interpolation	Gaussian Spray + Interpolation, or Linear default: Gaussian Spray + Interpolation
Smoothing	Gaussian, or Boxcar (Linear). This field is only visible if the Interpolation method is Linear. default: Gaussian
Min Y(Line) Smooth	Minimum Y (line) smoothing. Default: 10
Min X(Cdp) Smooth	Minimum X (CDP) smoothing. Default: 10
Min Time/Depth Smooth (ms/m/ft)	Default: 10

### Table 122. smoother Panel Fields-continued

# stack Module

The stack module, Figure 157, controls how the module stacks all traces in a given gather. The fields on the panel are described in Table 123.

### Figure 157. stack Panel

OOO 🛛 🕅 jobB	Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
	Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	<b>±</b>
Job     Cluster       Modules     ▲      filter     1      gain     2      mdrMath     3      mterpShot     4      krm     6      krm     6      mork     9      mored     1	stack Main Doc Keys p cdp Norm Power 1 Offset value 0 Offset Key offset Set Offset Yes	

### Table 123. stack Panel Fields

Field	Description
Keys	The header keys defining a gather or ensemble to stack. defaults: ep, cdp
Norm Power	Defines whether or not the stack is to be normalized by the number of non-zero values at each fixed time. When Norm Power is zero, normalization is not performed. default: 1
Offset value	The value stored in the offset field of the stacked trace. default: 0
Offset Key	The header key defining the offset field of the stacked trace. default: offset
Set Offset	The switch for setting or not setting the offset value in the header. default: Yes

# staticShift Module

The staticShift module calculates and applies elevations statics. The statics can be calculated from information stored in the trace headers, or the module can simply apply a single static shift already stored in an appropriate header location. The module assumes that appropriate elevations are already stored in the trace headers.

The input field *sut* is assumed measured in milliseconds. The basic formulas are:

Equation 10:	$output fieldsstat = sdel - \frac{(selev + sdepth)}{swevel}$
Equation II:	$output field gstat = sstat - \frac{sut}{1000.}$
Equation 12:	$outputfieldtstat = sstat + gstat + \frac{(selev - gelev)}{wevel}$

### Table 124. staticShift Variable Definitions

Field	Description
sstat	The static time shift for the weathering layer below the source.
gstat	The static time shift for the weathering layer below the receiver.
sdel	The datum elevation at the source.
selev	The source elevation from sea level.
sdepth	The source depth.
sut	The uphole time in milliseconds.
swevel	The subweathering velocity.
wevel	The weathering velocity.

# staticShift Main Panel

The staticShift Main panel, Figure 158, controls the static shift module. The fields are described in Table 125.

### Figure 158. staticShift Main Panel

	B	2	1 📼 🗠	in		
		5 10 1	5 V Pio	ject: /net/prana06/data1/jnt	/projects/biessing/biessing-dense.project	
b Cluster						
lodules 🔺		Job Flow		static Shift		
mute	1	static Shift		Main Headers Surface	Doc	
oned	2					
pef	3			Project	lata1/ihu/projects/blessing/blessing-dense.project	
postproc	4					
prune Shoote r	5				Headow Read from totat	
rayShooter	6			Statics Location		
resamp3d	7					
···· rtmodel				Direction	Up 👻	
···· scan	0					
semblance	10			Extend End Values	No 🛫	
shooter	10					
smoother				Replacement Value	0	
static Shift	12					
···· time De p th	13			Weathering Velocity		
···· trs um	14					
trwindow	15			Subweathering Velocity		

### Table 125. staticShift Main Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
Statics Location	Where to find the statics data, read headers from <i>tstat</i> , or calculate using the methodology given in staticShift Module, or read from a surface file. If you select Surface, enter the surface information in the staticShift Surface Panel. Determines how to get the weathering velocity and the subweathering velocity. default: Headers–Read from tstat
Direction	The direction of the shift: Down or Up. Down means to shift to longer times, while Up means to shift to shorter times. default: Up
Extend End Values	

Variable	Description
Replacement Value	default: 0
Weathering Velocity	The actual weathering velocity to use.
Subweathering Velocity	The actual subweathering velocity to use. The subweathering velocity is the velocity of the main top layer.

#### Table 125. staticShift Main Panel Fields-continued

# staticShift Headers Panel

The staticShift module headers panel, Figure 159, enables you to specify the headers used for the static shift module. The fields on the panel are described in Table 126.

000	X jobBuilder – Marvel Version 2	1.1.31pre3, Panorama Tech
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
		r/projects/blessing/blessing-dense.project
Job Cluster		
Modules A Job F mule 	Flow static Shift Shift I Headers Surface Total Static Hdr Source Static Hdr Source Static Hdr Receiver Static Hdr Source Elev Hdr Source Depth Hdr Source Uphole-time Hdr	Doc tstat sstat gstat gstat gelev gelev sdepth sdel sut
trsum 14	Subweathering Vel Hdr	wevel
wem ♥	Subweathering VerHor	swevei

### Figure 159. staticShift Module Headers Panel

#### Table 126. staticShift Module Headers Panel Fields

Field	Description
Total Static Hdr	The keyword specifying the value of the total static correction for this trace. default: tstat
Source Static Hdr	The keyword specifying the value of the source static correction. default: sstat
Receiver Static Hdr	The keyword specifying the value of the receiver static correction. default: gstat
Source Elev Hdr	The keyword specifying the value of the source elevation. default: selev
Receiver Elev Hdr	The keyword specifying the value of the receiver elevation. default: gelev
Source Depth Hdr	The keyword specifying the value of the source depth. default: sdepth

Field	Description
Source Datum Elev Hdr	The keyword specifying the value of the datum elevation. default: sdel
Source Uphole-time Hdr	The keyword specifying the value of the source uphole time. default: sut
Weathering Vel Hdr	The keyword specifying the value of the weathering velocity. default: wevel
Subweathering Vel Hdr	The keyword specifying the value of the subweathering velocity. default: swevel

#### Table 126. staticShift Module Headers Panel Fields-continued

# staticShift Surface Panel

The staticShift Surface panel enables you to specify the headers used for the staticShift module. There are only two fields on this panel, and they are only displayed if you select Surface for the Statics Location on the staticShift Main panel. These two fields are:

Surface File—The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100 cdp = 500 z = 20

Surface Name—The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo

# timeDepth Module

The timeDepth module converts time-to-depth values and depth-to-time values.

# timeDepth Main Panel

There are two different Main panels depending on the model type, Gridded (Figure 161) or Single Function (RMS) (Figure 160), the terms are defined in Table 127.

Figure 160.	timeDepth	Main	Panel-Model	Type,	Single Function	(RMS)
-------------	-----------	------	-------------	-------	-----------------	-------

000	🔀 jobBuilder – Marvel Ve	rsion 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
	Project:		
Job Cluster			
Modules A Job Flow	time De p th		
1 time Depth	Main Topography Input Da	tta Doc	
weveBeam 2			
fdmod2 d 3	Project		
filter 4			
gain 5	Conversion	Time to Depth	
interpShot 7	Input Type	Normal	
kdm 8	Tao Dankara at Ame		
	Top Replacement Amp		
medin 10	Bottom Replacement Amp		
mork 11	Ignore Headers	0	
moveout		-	
mute 13	Model Type	Single Function (RMS)	
oned			
pef 15			
postproc			
prune Shoote r			
may Shooter			
resample	times	▶ <b> </b>	
rtmodel			
scan			
semblance	ven		
stack	Output Range	Min Max Inc	
···· static Shift			
trsum	fudge	0	
< /// <b>&gt;</b>			

000	jobBuilder – Marvel Ve	ersion 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
□ 🗃 🖬 🖺 太 🕁 🛡 🛤	ject:		<b>.</b>
Job Cluster			
Modules A Job Flow	timeDepth		
distances 1 time Depth	Main Topography Input Da	ata Doc	
eveBeam 2			
fdmod2 d 3	Project		
filter 4			
gain 5	Conversion	Time to Depth	
IndrMath			
interp Shot 7	Input Type	Normal 👻	
kdm 8	Ton Replacement Amn		
	Top Replacement Amp		
	Bottom Replacement Amp		
mork	Ignore Headers	0	
moveout			
mute	ModelType	Gridded 👱	
parsim	Model		
postproc			
prune Shooter	Velocity Type	Interval in Depth	
rayShooter			
resamp3d			
rtmodel			
scan			
semblance			
shooter			
smoother	Output Range	Min Max Inc	
static Shift			
···· time Dep th	fudge	0	
trsum 👻		·	

# Figure 161. timeDepth Main Panel-Model Type, Gridded

### Table 127. timeDepth Main Panel Fields

Field	Description
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a required entry.
Conversion	Flag indicating whether the conversion is to be performed Depth to Time, or Time to Depth. default: Time to Depth
Input Type	Flag indicating whether the data is a PSTM from Topography, or a Normal conversion. default: Normal
Top Replacement Amp	

Variable	Description
Bottom Replacement Amp	
Ignore Headers	default: 0
Model Type	Flag indicating whether the model is Gridded, or Single Function (RMS). default: Gridded
Model	The filename of the input model. This field is only displayed for the Gridded Function Type.
Velocity Type	Flag indicating whether the velocity is Interval in Depth or RMS in Time. This field is only displayed for the Gridded Function Type. default: Interval in Depth
Output Range	Provides the minimum time/depth, maximum time/depth, and incremental time/depth values. This is a REQUIRED entry.
times	Pick times for a (single) velocity function. This field is only displayed for the Single Function Function Type.
vels	Pick velocities for a (single) velocity function. This field is only displayed for the Single Function Function Type.
Output Range	Provides the minimum time/depth, maximum time/depth, and incremental time/depth values. This is a REQUIRED entry.
fudge	

# Table 127. timeDepth Main Panel Fields-continued

# timeDepth Topography Panel

The timeDepth topography data panel, Figure 162, enables you to specify the header keys used with the timeDepth module. The fields in the panel are described in Table 128.

Elle Job Utilities Help □ 🔄 🖬 🛱 🏂 🏠 🗣 🛡 Project: Job Cluster
□     □     □     □     ↓     ▼     Project.     ✓       Job Cluster
Job Cluster
Modules         Job Flow         imeDepth          disWrite         1         imeDepth          disWrite         2

# Figure 162. timeDepth Topography Panel

### Table 128. timeDepth Input Data Panel Fields

Field	Description
Topo Surface File	The path and name of the topographic surface file. If given, this specifies the acquisition topography (and if no Source Topo File is given, this is for both sources and receivers). This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: ep = 100  cdp = 500  z = 20 default: ep
Topo Surface Name	The header key specifying where the topographic data are stored. A MARVEL surface file can have many surfaces. This is the name of the one to be used. default: Topo
Time Datum (ms)	

# timeDepth Input Data Panel

The timeDepth input data panel, Figure 163, enables you to specify the header keys used with the timeDepth module. The fields in the panel are described in Table 129.

000	🔀 jobBuilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>File Job Utilities H</u> elp		
□ 🖨 🖬 🛔 🏦 🗣 🔻	Project:	*
Job Cluster		
Modules 🔺 Job Flow	- time Depth	
diskWrite 1 time Depth	Main Topography Input Data Doc	
eyeBeam 2		
fdmod2 d 3		
filter 4		
gain		
hdrMath		
importVtp 6	Line Key ep	
kdm		
8		
9 9		
me rlin 10		
mork 11		
moveout	Cdp Key cdp	
mute		
oned		
parsim 14		
pef 15		
postproc		
prune Shooter	Model Line Key	
rayshooter		
resample		
rtmodel		
scan		
semblance		
shooter	Model Cdp Key	
smoother		
stack		
static Shift		
time De p th		
··· trsum		

### Figure 163. timeDepth Input Data Panel

### Table 129. timeDepth Input Data Panel Fields

Field	Description
Line Key	The header key specifying where line data is stored. default: ep
Cdp Key	The header key specifying where CDP data is stored. default: cdp
Model Line Key	The header word key for line information when the model is gridded. Use if different from the data.
Model Cdp Key	The header word key for CDP information when the model is gridded. Use if different from the data.

# trSum Module

The trSum module enables you to perform basic operations on the input data stream. Figure 164, enables you to specify several control parameters used in the module, and the parameters are described in Table 130.

#### Figure 164. trSum Panel

000		X	jobBuil	der	– Marvel Versi	on 2.1.1.31pre3,	Panorama Tech			
<u>F</u> ile <u>J</u> ob <u>U</u> tilities	<u>H</u> elp									
	4	å 🕁	₽ 7	Pr	oject: /net/praha06	/data1/jhu/projects/bles	sing/blessing-dense.proje	= t		
lah Chuster										
Job Cluster										
Modules	•	Job Flow		•	-trsum					
parsim	1	trsum			Main Doc					
pef	1									
postproc	2	_								
prune Shooter	3				Files			_	A	
rayShooter	4				1 10 3					
···· re samp3d	5									
··· re sample	-	_				Sum		-		
rtmodel	0	_			Operation					
scan	7			12						
semblance	8					No				
shooter	9				Divide	NO				
smoother	10	-								
stack	10	_			Scob(c)			_		
static Shift	11	_			Scale(s)					
time Depth	12									
trsum	13				Power for Div	1				
trwindow	14									
·wem	Ĭ	_								
	15			¥						

#### Table 130. trSum Panel Fields

Field	Description
Files	This is a required entry field.
Operation	Sum, Subtract, Multiply, or Divide
Divide	Yes, or No
Power for Div	default: 1

# trWindow Module

The trWindow module performs a spatial windowing operation on the input data stream. The trWindow panel, Figure 165, enables you to specify several control parameters used in the module. The parameters are described in Table 131.

#### Figure 165. trWindow Panel

OOO 🛛 🗴 jobBu	ilder – Marvel Version 2.1.1	1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp			
□ 🛥 🖬 🚔 🏦 🗣 🔻 🖛	oject: /net/praha06/data1/jhu/project	s/blessing/blessing-dense.project	<b>±</b>
Job Cluster	twindow		
Modules Job Flow			
mork 1 trwindow	Main Loc		
mute 3	Key		
pef 5	Min	•	
prune Shooter 7 rayShooter 7	Max	►	
re samp3d 8 re sample 9	Inc	►	-
	Project	/data1/jhu/projects/blessing/blessing-dense.proj	iect 🖨
shooter 12 smoother 13	X/Y coordinates are CDP/Line	No	- <u></u>
stack 14 static Shift 15	Reject Mode	Do Not Pass Failed Traces	<u>▼</u>
	Reject Empty Traces	No	<u>▼</u>
·wem •			

### Table 131. trWindow Panel Fields

Field	Description
Кеу	The header word key specifying the value on which to window.
Min	The minimum value to pass.
Max	The maximum value to pass.
Inc	The increment to pass. For example, if you set Inc to 2, then alternating traces with the indicated header word will be passed
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates.
X/Y corrdinates are CDP/Line	Yes or No

Variable	Description
Reject Mode	<ul> <li>Do Not Pass Failed Traces</li> <li>Pass Only Failed Traces</li> <li>Zero Failed Traces</li> <li>Zero Good Traces</li> </ul>
Reject Empty Traces	Yes or No

#### Table 131. trWindow Panel Fields-continued

# wem Module

The wem module is Panorama Technologies' wave-equation migration module. This program can run in either the common-shot mode for prestack shot-profile migrations, or it can run in the poststack mode for poststack migrations. Regardless of which mode is selected, this is a one-way phase panel method.

A typical migration job has the following job flow: diskRead  $\Rightarrow$  wem  $\Rightarrow$  collect

For faster restarts, the Mode option in the diskRead module should be set to Shot Migration (see diskRead Module).

### Note:

You should be sure the Restart File parameter is in sync with the wem module. If you edit the one in wem, the one in diskRead will be updated.

### Note:

The collect module is designed to stack output from migrations. By default, it does this first-come, first-served, and the output files will be unsorted. Choose the Preallocate Volume option in the collect module to avoid this behavior (see collect Module). As with the Restart File option in the diskRead module, make sure the output parameters to collect are in sync with those in wem.

# wem Main Panel

There are two different Main panels depending on the mode, Common-shot (Figure 166) and Poststack (Figure 167). The parameters are described in Table 132.

le <u>J</u> ob <u>U</u> tilities	<u>H</u> elp					
0 🕘 日	<b>b</b> &	• • • •	7 Projec	ct:		
Job Cluster						
Modules	•	lob Flow	w	em		
eyebeam	1 1	nem	Ιſ	Main Input Comp	utation Output Advanced Experimental Doc	
td mod2 d	2					
gain	3			Mode	Common-shot 👻	
hdrMath	4					
importVtp	5			Runmode	Single 🗸	
interpShot	6					
km	7			Job Name	job	
kmodel	8					
···· me rlin	-			Project		
mork	-					
moveout	11			Velocity model		A
oned	12					
parsim	12			11-1-1-17		
pef	13			Update file	update	
postproc	14					
ravShooter	15			Restart file	re start	
re samp3d						
···· re samp le				Scratch directory	/scratch/users/cjb/	
rtmodel						

### Figure 166. wem Main Panel, Common-shot Mode

#### Figure 167. wem Main Panel, Poststack Mode

Image: Second state     Image: Second state       Image: Second state     Image: Second state         Image: Second st							
0 🔁 🖬 🚔 🎄 🗠	🗣 🛡 Project:	* *					
Modules     Job Flo	wem Main Input Computation Mode Post Runmode Sing Job Name job Project Velocity model	Output Advanced Experimental Doc tack					
oned 12 parsim 13 pef 13 postproc 14 prune Shooter • 15 • //// •	Scratch directory //scra	ch/users/cjb/					

Field	Description			
Mode	Specifies the mode in which the job is run, common-shot mode for prestack shot-profile migrations, or post-stack mode for post-stack migrations. default: Common-shot			
Runmode	Is the job being run as Master in a cluster, or as Single processor? default: Single			
Job Name	Name of the job to be run. default: job			
Project	The path and name of the project file. This file describes the coordinate system, and how line, crossline and CDP data relate to the x and y coordinates. This is a REQUIRED entry.			
Velocity Model	Name of the file containing the Vint/z velocity model. If the model is not given, MARVEL tries to get the model from the project.			
Update file	Name of a temporary file to update as shots come in. <b>This field is only displayed for Common-Shot Mode.</b> default: update			
Restart file	The application keeps information about shots already processed in this file. It is usually best to put it in the same directory where your output files are located and to give it a similar name. <b>This field is only displayed for Common-Shot Mode.</b> default: restart			
Scratch directory	Name of the directory where the scratch files will be located. default: /scratch/users/cjb			

### Table 132. wem Module Main Panel Fields
### wem Input Panel

This panel enables you to specify the keys used with the web module.

#### Figure 168. wem Input Panel

OOO 🔀 jobBu	ilder – Marvel Version 2.1.1.31pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp		
□ 🖨 🖬 🚔 🏦 🗣 🛡 🕫	pject: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	<b>±</b>
Job Cluster		_
Modules Job Flow	wem	
mork         1         wem          moveout         2	Main     Input     Computation     Output     Advanced     Experimental     Doc       Line Key     ep	
Image: state		

#### Table 133. wem Input Panel Fields

Field	Description
Line Key	Header key in which to find the line number. default: ep
XLine Key	Header key in which to find the crossline number. default: cdp
Min sx	
Min sx	
Min sy	
Min sy	

## wem Computation Panel

The wem computation panel, Figure 169, enables you to specify several parameters used in the wave-equation migration calculations. These parameters are described in Table 134.

<u> </u>	🗴 job	Builder – Marvel Version 2.1.1.31pre3, Panorama Tech	
	å 🕯 🗣 🔻	Project: //net/praha06/data1/jhu/projects/blessing/blessing-dense.project	<b>.</b>
Job Cluster			
Modules	Job Flow         I           wem	Wern         Main       Input       Computation       Output       Advanced       Experimental       Doc         PhiMax       6	

#### Figure 169. wem Computation Panel

#### Table 134. wem Computation Panel Fields

Field	Description
PhiMax	Maximum phase-shift difference to tolerate for background velocities. default: 6
Damping	Transverse damping given as a percent of the maximum full aperture. default: 5
X Aperture	The full aperture in the x, or line, direction.
Y Aperture	The full aperture in the y, or crossline, direction.
PPW	Maximum depth step to take, specified as points per wavelength. default: 4
Min Freq	Minimum frequency to be allowed by filtering. default: 1
Max Freq	Maximum frequency to be allowed by filtering. default: 30

continues on next page

Variable	Description
Time Pad	Percent padding to apply to input traces. default: 9
Max Step	

#### Table 134. wem Computation Panel Fields-continued

### wem Output Panel

The wem ouput panel, Figure 170, enables you to specify various module output parameters. These parameters are described in Table 135.

	<b>b</b> &	<b>⊕</b> ₽	Project: /n	et/praha06/data1/j	ihu/projects/bles	sing/blessing-dense.project		
Job Cluster								
Modules A	J 1 W 2	ob Flow em	wem-	Input Computat	ion Output A	Ivanced Experimental Doc	]	
oned parsim pef postproc	3 4 5 6		Out	put Lines	Min	Max	Inc	
prune Shooter ray Shooter re samp3d re sample rtmodel scan semblance	7 8 9 10 11		Out	put XLines	Min	Max	Inc	
shooter smoother stack static Shift time Depth	12 13 14 15		Out	put Depths (n/ft)	Min	Max	Inc	
trsum trwindow			Mut	e Angle (degrees)	0			

#### Figure 170. wem Output Panel

#### Table 135. wem Output Panel Fields

Field	Description
Output Lines	The minimum, maximum, and increment values for output lines. default: values in the model
Output XLines	The minimum, maximum, and increment values for output crosslines. default: values in the model
Output Depths	The minimum, maximum, and increment values for output times. default: values in the model
Mute Angle	The angle, in degrees, measured down from the surface defining a cone limiting the near surface aperture. default: 0

### wem Advanced Panel

The wem advanced panel, Figure 171, enables you to set special operating parameters, which are described in Table 136.

	♣ ♥ ♥ Project: /net/praha06/data1/jhu/projects/	blessing/blessing-dense.project	
Job Cluster			
Modules     ▲     Job      mork     1     werr      moveout     3       moveout     3       moveout     3       moveout     3       moveout     3       moveout     6       parsim     5       postpoc     6       pruneShooter     7       resamp3d     9       resamp1d     9       semblance     10       semblance     12       semblance     13       stack     14       trsum	i Flow were n N N N N N N N N N	Advanced     Experimental     Doc       Run worker on master     YES	2

#### Figure 171. wem Advanced Panel

#### Table 136. wem Advanced Panel Fields

Field	Description
Run worker on master	Determines whether or not the master is used in the computational process. default: Run master on worker
Use Restart Files	If NO, the job will ignore restart information and start from the beginning. default: Yes
Verbose	Switch for turning debug printing on and off. default: No

### wem Experimental Panel

The wem module experimental panel, Figure 172, enables you to specify various special operating parameters, which are described in Table 137.

	Project: /net/praha06/data1/jhu/projects/blessing/blessing-dense.project	
lob Cluster		
Modules     Job Flow      mork     1     wem      mork     3     -      mored     3     -      pef     5     -      postproc     6     -      mureShooter     7     -      mayShooter     8     -      resamp3d     9     -      scam     10     -      stack     12     -      stack     13     -      trsum     14     -      stack     13     -      trsum    trsum     -	Main Input Computation Output Advanced Experimental Doc Movie No No True-amplitude No	· · ·

#### Figure 172. wem Module Experimental Panel

#### Table 137. wem Module Experimental Panel Fields

Field	Description
Movie	If set, runs movie of the depth slices as calculations progress. (This field is experimental, and probably does not work correctly.) default: No
NStream	Specifies the number of depth steps to take before streaming output to a viewer. default: 0
True amplitude	If set, apply true-amplitude calculation. (This field is experimental, and does not work correctly.) default: No

## **Inline Section Operations**

Inline Section Operations allow you to visually inspect and interact with line-oriented data. When operating in this mode, you are able to pick or define time or depth horizons and surfaces for use in subsequent velocity model building procedures.

## gathers Module

The Gathers module is the velocity analysis module supplied by Panorama Technologies. Figure 173 shows an example of the gathers window displaying the SEG AA' 2D model.

#### Figure 173. Gathers Panel



## gathers Menus

The gathers window has seven menus: File, View, Picking, Functions, and Surfaces, Utilities and Help. They are described in this section.

### File Menu

#### Figure 174. File Menu



#### Table 138. Inline Section File Menu

Command	Description
Open Picks/Surfaces	Displays an Open dialog box enabling you to select a picks file, or surfaces, datasets or projects, with extensions (.pick, .surface, .segy, .dataset, or .project).
Set Background Model	Displays an Open dialog box enabling you to select a model file (extension .model) to be used as default: model.model
Save Picks	Displays a Save As dialog box enabling you to save the current picks. default: picks.picks
Save Surfaces	Displays a Save As dialog box enabling you to save the current surfaces information. default: surfaces.surfaces
Save Section	Displays a Save As dialog box enabling you to save the current section. default: seismic.segy
Preferences	Displays a submenu enabling you to
Quit	Closes the gathers dialog box.

### View Menu

#### Figure 175. View Menu



#### Table 139. Inline Section View Menu

Command	Description
Colors	Displays a submenu that enables you to select the color pattern used for displaying the gathers.
	<ul> <li>grey-white: white troughs to black peaks</li> <li>gray-black: black troughs to white peaks</li> <li>rainbow: full color spectrum</li> <li>red-black:</li> <li>seis1: standard seismic display colors</li> <li>vcontour:</li> </ul>
Set Clips	Displays window enabling you to set upper and lower boundaries for filtering the data being displayed, see Gathers Settings Window on page 255.
Set Gain	Displays window enabling you to set the gain for the display, see Gathers Settings Window.
Wiggles	Displays the Wiggles View Parameters window, see Wiggle View Parameters Window on page 257.

## Picking Menu

#### Figure 176. Picking Menu

<u>P</u> icking	<u>F</u> unctions	<u>S</u> urfa	ces	<u>U</u> tilitie s
<u>P</u> icki	ing Type	>		Mute
Get	background (	picks		TRMS
Sna	Snap to background			Surface
Auto	pick			
Auto	pick All			
Auto	pick paramet	ters		
Clea	ır Picks			
Clea	r ALL Picks			

#### Table 140. Inline Section Picking Menu

Command	Description
Picking Type	Displays a submenu that enables you to select the type of picking to be used in the autopicking procedure.
	<ul><li>Mute</li><li>TRMS</li><li>Surface</li></ul>
	Default: Surface
Get Background Picks	
Snap to Background	
Autopick	Autopicks the displayed panels.
Autopick All	Autopicks all ensembles in the project.
Autopick parameters	Displays a window that enables you to set the parameters controlling the autopick process.
Clear Picks	Deletes the picks in the displayed panels.
Clear ALL Picks	Deletes all picks in the project.

## **Functions Menu**

#### Figure 177. Functions Menu

<u>F</u> unctions	<u>S</u> urfaces	<u>U</u> tilitie s	
NMO			
Stack	Stack		
Sembla	Semblance		
Sembla	Semblance parameters		
Build model			

#### Table 141. Inline Section Functions Menu

Command	Description
NMO	Performs a normal moveout on the data.
Semblance	Performs a semblance on the data.
Semblance parameters	Displays a panel that enables you to set the parameters associated with semblance, see Semblance Parameters Window on page 262.
Build model	Displays a panel that enables you to set the parameters associated with building a model, see Build Model Window on page 260.

## Surfaces Menu

#### Figure 178. Surfaces Menu

<u>S</u> urfaces	<u>U</u> tilitie s	<u>H</u> elp
Create	≘New Sur	face
Edit		
Extrac	t surface	
Get Contour Surfaces		
Grid surface		
Build Model		
Build	Dip Model.	
Snap	Model	
Extrac	t Model	
Select	t Surface	•

#### Table 142. Inline Section Surfaces Menu

Command	Description
New surface	Displays a panel that enables you to create a new surface in the project.
Extract surface	
Grid surface	
Delete surface	
Delete current surfaces	Deletes the current surfaces.
Select Surface	Displays a submenu that enables you to select a surface from a list of the currently defined surfaces.

## Gathers Settings Window

Figure 179 shows the Gathers Settings window. This window enables you to... It contains four tabs: Gain, Data, Cursor/Zoom, and Topography. The fields on the windows are defined in Table 143.

#### Figure 179. Gathers Settings Window

000	)	X ga	athers		
Settings					
Gain	Data	Cursor/Zoom	Topography		
Perce	ntile clip	98			
Low c	lip value	0			
Higho	lip value	0			
TPow		o			
				4	
			Apply		Ok

#### Table 143. Gathers Settings Window Fields

Tab	Field	Description
Gain	Percentile clip	default: 98
	Low clip value	default: 0
	High clip value	default: 0
	Tpow	Scale traces by time raised to a power. default: 0
Data	Data-sort Mode	<ul> <li>Inline</li> <li>Crossline</li> <li>CDP</li> <li>Shot</li> <li>Offsets</li> <li>Semblance</li> </ul>

continues on next page

Tab	Field	Description
Cursor/Zoom	Export Cursor	
	Follow Cursor	
	Export Zoom	
	Follow Zoom	
Topography	Topo File	The path and name of the topographic surface file. If given, this specifies the acquisition topography. This can be a MARVEL surface file, or a simple flat file defining the topography, with each line containing the line, crossline and depth values, for example: $ep = 100$ $cdp = 500$ z = 20.
	Weathering Velocity	The propagation velocity of seismic waves through the heterogeneous surface layer. default: 4000
	Subweathering Velocity	The propagation velocity through a layer between the surface and the datum. default: 4000

#### Table 143. Gathers Settings Window Fields-continued

## Clips Window

For information about fields on this window, see Gathers Settings Window on page 255.

#### Figure 180. Clips Window

-5	Settings	)	🔀 ga	thers	
	Gain	Data	Cursor/Zoom	Topography	
	Perce	ntile clip	98		
	Low c	lip value	0		
	Higho	clip value	0		
	TPow		0		
	J				
				Apply	

## Wiggle View Parameters Window

Figure 181. Wiggle View Parameters Window

Image: Second state state     Image: Second state       Wiggle View Parameters     Image: Second state				
Main				
Wiggle Overlap	1			
Clip Wiggles	No	-		
	Apply	Ok		

The only two parameters on the window are: Wiggle Overlap and Clip Wiggles.

- Wiggle Overlap-
- Clip Wiggles-

## Autopicking Parameters Window

Figure 182 enables you to change the values of several parameters used in the autopicking process, Table 144.

See autopick Module on page 25 for detailed information about how MARVEL performs autopicking.

000	🔀 gathers
Autopicking Parameters	
Main	
Gridded Velocity Mod	dei
Velocity at Top	1690
Velocity at Bottom	6000
Velocity Width at Top	10
Velocity Width at Bot	tom 10
Min picking time	00999999977648
Max picking time	6
incdt	-5
	Apply

#### Figure 182. Autopicking Parameters Window

#### **Table 144. Autopicking Parameters Window Fields**

Field	Description
Gridded Velocity Model	
Velocity at Top	default: 1690
Velocity at Bottom	default: 6000
Velocity Width at Top	default: 10
Velocity Width at Bottom	default: 10

#### continues on next page

Field	Description
Min picking time	default: 0.25
Max picking time	An override time at which picking stops and the reference function is used to define velocities. Normally, this is set to the maximum trace time. default: 6
incdt	Increment for the dt value. incdt should always be negative. default: -5

#### Table 144. Autopicking Parameters Window Fields-continued

## **Build Model Window**

The Build Model window, Figure 183, enables you to control the model building operation performed on the output data. The fields on the panel are described in Table 145.

#### Figure 183. Build Model Window

000	D	🕻 gathers		
Build model				
Main				
Output Type		RMS in Tim	e	=
Output Line Range	Min	Max	Inc	
Output XLine Range	Min	Max	Inc	
Output Z/T Range (m/ft/ms)	Min	Max	Inc	
Interpolation		Gaussian Spray + Int	erpolation	=
Min Y(Line) Smooth	10			
Min X(Cdp) Smooth	10			
Min Time/Depth Smooth (ms/m	/ft) 10			
<u>)</u>				
			Apply	Ok

#### Table 145. Build Model Window Fields

Field	Description
Output Type	Interval in Depth, or RMS in Time. default: RMS in Time
Output Line Range	Minimum, maximum and increment values for output lines.
Output XLine Range	Minimum, maximum and increment values for output crosslines.
Output Z/T Range	Minimum, maximum and increment values for output Depth/Time values.
Interpolation	Gaussian Spray + Interpolation, or Linear default: Gaussian Spray + Interpolation

continues on next page

Field	Description
Min Y(Line)	Minimum Y (line) smoothing.
Smooth	Default: 10
Min X(Cdp)	Minimum X (CDP) smoothing.
Smooth	Default: 10
Min Time/Depth Smooth (ms/m/ft)	Minimum time and depth smoothing. Default: 10

#### Table 145. Build Model Window Fields-continued

## Semblance Parameters Window

Figure 184 shows a semblance Module window, and Table 146 describes the fields on the window.

See semblance Module for detailed information about how MARVEL performs a semblance.

#### Figure 184. Semblance Parameters Window

O O O 🕅 gathers						
-5	emblance Parameters					
	Main					
	Minimum Velocity		7000			
	Maximum Velocity		25000	_		
	Velocity Width (%)		20			
	Num of Velocities		200			
	Stretch Mute		1.5			
	Vert Smoothing (sample	s)	8			
	Power		2	_		
		A	pply		Ok	

#### Table 146. semblance Module Window Fields

Field	Description
Minimum Velocity	
	default: 7000
Maximum Velocity	
	default: 25000
Velocity Width (%)	
	default: 20
Num of Velocities	
	default: 200
Stretch Mute	The time, in seconds, defining when the stretch mute is applied. Samples that are larger than the stretch factor are muted. default: 1.5

continues on next page

#### Table 146. semblance Module Panel Fields-continued

Field	Description
Vert Smoothing (samples)	
	default: 8
Power	
	default: 2

## Set Background Model Window

#### Figure 185. Set Background Model Window

000	$\mathbf{X}$ gathers	1
Background Model		
Main		
Background Model		<u>a</u>
Velocity Type	VRMS/T 💻	
	Apply	

#### Table 147. Set Background Model Window Fields

Field	Description
Background Model	
Velocity Type	VRMS/T or VINT/Z default: VRMS/T

## Gathers Toolbar

#### Figure 186. Gathers Toolbar

Call Call Control	Ŷ	
---	---	--

#### Table 148. Toolbar Commands

Symbol	Description
⊕	Opens a project dataset.
	Saves the project using the current project name.
G	Reloads and redisplays the dataset.
NX.	Toggles variable density display.
	Toggles wiggles display as either right-filled wiggles or standard wiggles.
•	Displays the next panel.

## **XLine Operations**

Crossline Section operations allow you to visually inspect and interact with crossline oriented data. When operating in this mode, you are able to pick or define time or depth horizons and surfaces for use in subsequent velocity model building procedures.

Refer to Inline Section Operations on page 249 for information.

## **CDP Gathers Operations**

CDP Gathers Operations enable you to visually inspect and interact with display data. You can also pick time-velocity pairs and time-mute pairs manually, or enable MARVEL to pick time-velocity pairs automatically. You can also select the range of gathers on which you want to work. See Figure 187 for an example of the CDP Gathers panel.



#### Figure 187. CDP Gathers Panel

## **Shot Gathers Operations**

Shot Gathers Operations enable you to visually inspect and interact with display data. You can also pick time-velocity pairs and time-mute pairs manually, or enable Marvel to pick time-velocity pairs automatically. You can also select the range of gathers you on which you want to work.

Refer to CDP Gathers Operations on page 269 for information.

Panorama Technologies

Chapter 8

## eyeGlass Cluster Monitor Operations

Panorama Technologies' cluster monitor technology is named eyeGlass<sup>™</sup>. eyeGlass enables you define the cluster on which distributed jobs will be executed and monitor the current CPU status for each node in that cluster. Figure 188 shows an eyeGlass display of a cluster. Table 149.



#### Figure 188. eyeGlass Panel

#### Table 149. eyeGlass Panel Descriptions

Field	Description

The size of any given output volume, together with the amount of memory available in a given node, determines the number of nodes required to hold the output volume in memory without swapping. In the example in Figure 188, MARVEL requires four single CPU nodes to hold the

output volume in memory, and there are four such groups. If the output volume was smaller, the same system could be set up as eight groups, each containing two CPUs.

Within each group, the output volume is distributed over CDPs to minimize load balancing problems. Data is distributed so that each group only processes one-quarter of the input. This means that, given a sufficient number of nodes, you can process extremely large output volumes in a single job.

Appendix

## File Formats

All MARVEL control files use the XML specification. The features of XML make it well-suited for use in these types of files. Specifically,

- it is simultaneously human- and machine-readable;
- it has a self-documenting format that describes structure and field names as well as specific values;
- it has strict syntax and parsing requirements that allow the necessary parsing algorithms to remain simple, efficient, and consistent.
Appendix

# **Topographic Migration Velocity Analysis**

This appendix provides a work flow on which topographic migration velocity analysis can be based. As such, the focus is on the direct estimation of a reasonable first velocity volume from datum-corrected data, followed by a general recipe for the subsequent velocity analysis from the true, or nearly true, topographic surface.

Appendix C shows how MARVEL can be used to perform a topographic migration velocity analysis.

# Generalized Topographic Migration Analysis

# Introduction

It is necessary to migrate seismic data from the Earth's surface in areas of significant elevation variation. Proper application of this technology has two necessary requirements:

- The topographic surface of elevations must be part of the migration algorithm. Whether performing prestack-time or prestack-depth migrations, travel times must be calculated from this surface rather than from datum.
- The topographic surface represents time zero, and, as such, all velocity analysis must be performed from this surface.

This second statement is true regardless of whether or not migration is part of the analysis procedure. Rough topographic surfaces generally make the initial velocity analysis difficult or impossible, and as a result, velocity estimation is usually based on data to which elevation statics have been applied. While this method frequently produces an acceptable image, velocities estimated in this way are not normally useful in a migration from topography. Consequently, when the initial model is estimated from data at the datum, the image must be shifted back to the true topographic surface to be useful in the migration velocity analysis stage.

After a reasonable initial model is available, subsequent migration from topography velocity analysis can update the initial model to improve the image until differences between neighboring iterations are negligible. Thus, a major problem with migration from topography is not how to perform the process, but, instead, how to estimate a reasonable starting velocity to start the iterative process that determines a reasonable final imaging velocity volume.

Table 150 identifies the terms used in the equations in the rest of this appendix.

Term	Description	
selev	ource elevation	
sdepth	ource depth	
gelev	receiver elevation	
wevel	weathering velocity	
swevel	sub weathering velocity	
sdel	datum elevation	

#### Table 150. Equation Terms Used in the Appendix

#### continues on next page

Variable	Description	
sut	ource up hole time	
sstat	ource static (time)	
gstat	eceiver static (time)	
tstat	total static (time)	
τ	time from datum	

#### Table 150. Equation Terms Used in the Appendix-continued

### **Elevation Statics**

There are three simple equations for computing elevation statics. These equations are:

Equation 13:	$sstat = \frac{sdel - (selev - sdepth)}{swevel}$
Equation 14:	gstat = sstat – sut
Equation 15:	$tstat = sstat + gstat + \frac{selev - gelev}{wevel}$

To fully understand this process, consider Figure 189, where you can see all of the features of a typical land or ocean bottom cable acquisition. It is a simple topographic schematic with sources and receiver on the topographic surface. There is a zero datum or sea level, a datum that is above all source and receiver elevations, and a topographic surface on which the data is actually recorded. Normally, the datum would be set equal to the highest source or receiver elevation, but this is purely a matter of choice. In fact, the datum could be chosen anywhere on the model. It could even be below sea level, but this is rarely done.



#### Figure 189. Simple Topographic Schematic

Elevation static correction consists of two basic steps. As shown in Figure 190, the first step vertically shifts all of the receivers so they are theoretically aligned on the source. The second step simply shifts this entire shot profile to the desired datum.

Figure 190. Simple Topographic Schematic After Correction to Source Position



Figure 191 shows what happens if you set the datum elevation to zero, that is, sea level.





In this case, the term  $\frac{selev-gelev}{wevel}$  shifts the trace samples so that, in effect, both source and receiver are at the same level. Then, Equation 16 shifts the trace samples so that the sources and receivers now lie on the surface representing zero datum or sea level.

**Equation 16:** 
$$sstat + gstat = 2.0 \left[ \frac{sdel - (selev - sdepth)}{swevel} - sut \right]$$

After the trace has been shifted so that it resides at sea level, the datum elevations term, *sdel* in Equation 13 takes over and shifts the traces so that sources and receivers are now essentially on the datum surface. This is illustrated in Figure 192.

#### Figure 192. Simple Topographic Schematic After Correction to Datum Elevation



Figure 193 represents how data just prior to the beginning of the imaging or migration part of the processing sequence. At this point, you will probably be able to make reasonable estimates of an initial velocity volume. The area above the flat datum is assigned a constant velocity, while velocities are estimated using traditional-style, hyperbolic-arrival assumptions below the datum.

# Figure 193. Building an initial velocity model from topography using a single datum



### Initial Velocity Models

It is important to note that velocity analysis can only take place when and if the midpoints of each trace within a given CDP are located on the same level. As Figure 193 and Figure 194 show, elevation static corrections can be applied trace-by-trace to produce a data set for which each CDP has this property. Figure 193 shows data that are shifted to a flat datum. In this

figure, the datum is at the minimum topographic elevation, but as indicated in Figure 194 any datum, including the true topographic surface, will suffice.

Of course, you should chose *swevel* and *wevel* as close to the true weathering and subweathering velocities as possible, but the real objective is to produce CDP's with arrivals that are as close to hyperbolic as you can achieve. If *swevel* and *wevel* satisfy this requirement, arrivals will be sufficiently hyperbolic so that traditional velocity analysis can proceed, at least in the short-offset case. Moreover, if you choose the CDP-by-CDP shift properly (in other words, to the right surface), this suggests that the initial velocities will be more accurate than those estimated from datum.

Thus, it is clear that to obtain a reasonable initial velocity field, you must first shift the input data to a suitably chosen horizon.

To make this as simple for you as possible, Panorama Technologies has chosen to shift all the traces automatically within any given CDP to whatever you specify as the 'true' topographic surface.

Thus, assuming that appropriate values are in proper header locations, the Gathers module, which is the velocity analysis module supplied by Panorama Technologies, performs the shift automatically to be consistent with Figure 194. You should recognize that, although this is seldom done, you can allow *swevel* and *wevel* to vary across the entire midpoint range.



#### Figure 194. Initial Velocity Model

After the data headers have been set properly, the initial velocity analysis is straightforward. Semblance panels are analyzed and picked in exactly the same manner as you do when the topographic elevation variations are negligible. The picking process, as illustrated in Figure 195, is exactly the same as in a normal processing mode. If the topographic variation within a CDP is relatively small, this process should work well. Note that you will not see the shift to a topographic surface.



#### Figure 195. Picking an initial velocity model from topography

# Migrating from Topography

Before you migrate from topography, you need to make sure that the observed seismic data are shifted to their original time zero locations. This means that sources and receivers must be at the topographic surface as indicated in Figure 189.

If the input data is hung from datum, you must first apply the appropriate static shift module to place the data back at the correct surface elevations. Since the Gathers module automatically applies the proper static shifts to the data on input, it is also necessary that data trace headers

be set correctly. When these objectives have been met, the application of the Panorama Technologies time and depth migration modules in topographic mode is quite simple.

The time migration module handles all topographic variations automatically, and calculates the proper travel times from the given topographic model. To produce accurate travel times, Panorama Technologies' most energetic raytracer must be provided with a suitable topographic model and surface. On successful execution of the either of the three raytrace modules, shooter, pruneshooter or raytracer, the resulting travel time tables contain all of the necessary information for an accurate migration of the input data.

# Migration Velocity Analysis

Migration velocity analysis from topography proceeds through a normal iterative process. Since migration has the net effect of producing coincident source and receiver data, you can think of the migration output as having been topographically shifted as indicated in Figure 194, which shows building an initial velocity model from topography using multiple datums. Note that at each midpoint, the datum is exactly equal to the midpoint's elevation. In this case, velocity estimation is directly *from topography*. Thus, migration velocity analysis proceeds in exactly the same manner as it did for the initial stacking velocity analysis of the preceding section. The only serious concern is that you have to perform all of these tasks without error.

### Workflow

The following simple workflow provides a procedure for migrating from topography. The sequence is as follows:

- 1. Prepare the data so that header locations corresponding to *selev*, *sdepth*, *gelev*, *wevel*, *swevel*, *sdel*, *sut*, *sstat*, *gstat*, and *tstat* are set correctly.
- 2. Remove any elevation statics that may have been applied to the data. Residual statics need not be removed, but refraction statics must not have been applied.
- 3. Perform an initial stacking velocity analysis to determine an initial migration velocity model. (Make sure that the Gathers module is in topographic mode.)
- 4. If running a depth migration, generate travel times from topography.
- 5. Migrate using the current velocity model.
- 6. Repeat the migration velocity analysis until you obtain suitable results.

# **Topographic Migration Velocity Analysis in MARVEL**

While Appendix B presents a generalized analysis of how topographic migration velocity analysis is performed, this appendix shows how MARVEL can be used to perform such an analysis.

Imaging, modeling, and velocity analysis in the presence of topography often leads to confusion on the part of the user. This confusion is partly due to the varying approaches used by different software packages, and partly because a better understanding of the general techniques is needed to make the transition to non-flat surfaces.<sup>1</sup> This appendix explains the approach used in the MARVEL package. The key is that the MARVEL migrations calculate traveltimes directly from the 3*D* surface to the output locations.

## Depth Migration from Topography

In Figure 196, the sources and receivers are all on the topographic surface, while there is a single flat reflector beneath the surface. The real surface is the curved line in the figure, while the top flat line is the highest point on the surface. We have arbitrarily labeled this elevation, which is everywhere above the surface, as z = 0. As we continue, we will be interested in building a model of the earth's velocity beneath the surface. Although we will include "velocities" between z = 0 and the surface to create a regularly gridded model, there is no relationship between these velocities and the real medium in those positions, and we do not use these velocities in the calculations.





The acquisition is shown schematically for one trace in Figure 196. The source is at depth *sz* and the receiver is at depth *gz*. Static shifts, *sstat* and *gstat*, will be applied to the trace.

<sup>&</sup>lt;sup>1</sup>Stanislaw Ulam said "using a term like nonlinear science is like referring to the bulk of zoology as the study of non-elephant animals." In a similar vein, "non-flat surfaces" can also be compared in importance to "non-elephant animals".

Before discussing the method MARVEL uses to migrate directly from topography, it is worth looking at something you may already be using in other packages. In some packages, an artificial "replacement velocity" is used everywhere above the surface, and a static shift,  $sstat + gstat = (sz + gz)/v_{repl}$ , is applied to the traces to try to synthesize data acquisition from the fixed datum, as shown in Figure 197.





Note that:

- 1. This type of shift cannot produce a trace that will image correctly in more than one place.
- 2. A velocity model built to get a good image with this method will not match the real medium.

From Figure 196, you can see that to image this trace, you just need the traveltime from the source to the output location and from the receiver to the output location. To calculate traveltimes for depth migration, you only need to know the source and receiver positions (including depth) and the velocities beneath the surface. Once you know these values, you can sweep the trace out to the correct output locations using a model that matches the real velocities of the medium.

In MARVEL, traveltimes are computed directly from the topographic surface down into the model. Naturally, there are no traveltimes computed above the surface. For the most part, the Kirchhoff pre-stack depth migration (PSDM) can then migrate as usual, ignoring topography (except in interpolating traveltimes).

# Depth To Time Conversion

To convert a stacked section from depth to time, it is just necessary to agree on the mapping of one reference depth datum to one reference time datum. In the absence of topography, it is normal for z = 0 to correspond to t = 0, while, everywhere else, the connection between depth

and time depends on the local velocity function. With topography, it is not necessarily best to make this same connection, since we don't really have velocities above the surface, and any attempt to make the connection requires an artificial velocity in that location. Thus, the most sensible thing to do is to connect the lowest depth on the surface to a specific time.

The PSDM stores the output maximum depth of the surface in the header *sdepth*. The depth-to-time conversion can then continue using the maximum depth of the surface and a time datum.

For conversion from depth to time, we only have velocity information from the surface down. We can compute the time from the surface down to any output depth, but for stacking, of course, we would like to have the traces shifted properly to account for the topography. The best way to do this is to identify a depth which is everywhere at least as deep as the surface (ideally, this depth can be equal to the maximum depth), and to tie that depth to a specific time. This depth is labeled "PSTM datum" in Figure 198.



#### Figure 198. Depth to Time Conversion

To preserve all output data, the time used should be at least the maximum (two-way) traveltime from the surface down to the depth we have chosen. For a constant subsurface velocity, this will be the time from the highest point on the surface down to the reference depth. For more complicated velocities, it will have to be calculated. Note that this process effectively redefines the surface in time, using only subsurface velocities.

The MARVEL **timeDepth** module takes a VINT/depth model and a topographic surface (provided either separately or in the model *tstat* header) and calculates a time section, as needed, with the reference depth stored in *sdepth* and the maximum time from surface to *sdepth* stored in *laga*.

## Depth Velocity Update from Topography

To back out velocities for updating, you need to consider what information to use. After migration is complete, only the depth of the surface at the midpoint is important. The data must first be shifted up by the depth of the surface at the midpoint, and then depth-to-time conversion and NMO can be performed using the valid velocities below the surface. After picking velocities, topography can be used to build a model with z = 0 at the top.

#### Figure 199. Statics for backout



Note that the MARVEL model builder, **smoother**, will not insert a replacement velocity above the surface in depth, but will simply smooth subsurface velocities into that region. This is by far the safest approach for all migration, time/depth and moveout operations to ensure that no "wild" velocities are used in calculations.

### Data Preparation

To perform topographic migration velocity analysis, the data should be acquired and the surface built using the methods described in this section.

### Fixed Datum versus Real Surface

It should be noted that the previous discussion assumes the input data are in an "as-acquired" state; that is, static corrections were not used to move the data to a datum, as in Figure 197, either floating or static. If static corrections have been performed, these shifts must be removed from the data before MARVEL migrations are performed. MARVEL migrations make no use of "replacement velocities" above the surface; these are only needed if they have been used to shift the data to a datum.

### Building the Actual Surface

To create the surface needed for various processing steps, the data should either come with a separate surface specification, or the surface may be stored in trace headers, for example, *selev* and *gelev*. These are usually specified as elevations of source and receiver relative to sea level. The migration and other modules expect to have a measurement down from some arbitrary elevation which is everywhere above the real surface. For example, if you choose your fixed datum to be *d*, where  $d \ge \{selev, gelev\}$ , the surface for MARVEL should be defined as  $d - \{selev, gelev\}$ . A **buildSurface** module will be provided to scan data to build this surface <sup>2</sup>, and to shift it, should you choose to move the fixed datum.

# Time Migration from Topography

The situation is more difficult in time migration since topography is naturally described in terms of depth. To translate topography into time, only subsurface velocities may be used; any artificial replacement velocity above the surface is irrelevant (except, of course, that it may be necessary to remove a to-datum shift as described previously). Figure 200 shows topographic acquisition as seen by pre-stack time migration (PSTM).



#### Figure 200. Topographic Acquisition As Seen by PSTM

For time migration, it is important to ensure that the traveltimes from the surface down to the reflector are adjusted for the difference in time from the surface down to a fixed reference. The safest way to do this is:

- 1. Find the maximum depth of the surface,  $z_{max}$ .
- 2. For each point on the surface, compute the time down to  $z_{max}$ .
- 3. Use this to define the surface in time.

<sup>&</sup>lt;sup>2</sup>At the time of this writing, version 2.1.1 of MARVEL does not include this module.

All of this is done internally by the MARVEL PSTM.

Thus, a flat reflector near the bottom of the surface will be as well-imaged as possible. Note, however, that the position *in time* of the bottom of the surface will change depending on the model. Note also that the highest point of the surface *in time* is not necessarily the highest point *in depth*, and can also change depending on the model.

The output of MARVEL'S PSTM is always such that the highest point of the surface *in time* appears at t = 0, and  $z_{max}$  appears across the section at time  $t_{max}$ .

# Depth Estimation for PSTM Topography Output

To convert time to depth for output of MARVEL PSTM with topography, you will need to know values and functions you can get the easy way or the hard way:

#### The easy way:

- 1. The location of the surface on the output section, *tstat*. This is stored in the trace headers by the PSTM.
- 2. The velocity function from *tstat* down to the output location:
  - If using an RMS model with "t = 0 is surface", this is the function from 0 to  $t_{out} tstat$ .
  - If using a VINT/DEPTH model, this is the velocity function from the (depth) topographic surface down.

or,

#### The hard way:

- 1. The maximum depth of the surface,  $z_{max}$ .
- 2. The value  $t_{max}$  corresponding to  $z_{max}$  on the output section.
- 3. The velocity function from  $t_{max}$  down to the output location.

## Time Velocity Update from Topography

Since the output of the PSTM does not need to be converted to time, this makes for somewhat less effort in backing out velocities. A **staticShift** with default parameters will shift the data back to the surface, and NMO, picking, and other operations may be done then.

#### Note:

When working with RMS/TIME models, it is best to leave the model such that t = 0 corresponds to the topographic surface. When working with INT/DEPTH models, it is currently necessary to build the model with topography, since the raytracers will need it in this form. The MARVEL **smoother** module will place the velocity functions correctly to follow the topography.

In general, when working with topography, it is best to work with VINT/DEPTH models.

# Example: The NewTopo Project

The NewTopo project provides an example and test of migration from topography in MARVEL.

The model shown in Figure 201 is fairly simple and has only four layers. Data have been acquired with sources and receivers resting on the top surface (between blue and yellow), and there are three reflectors (only two can be seen on the model). A MARVEL topographic surface file is provided, along with the model and data.



#### Figure 201. Simple Topographic Model

### Depth Migration

For depth migration, you must first run the raytracer using module **rayShooter** with the proper topographic information, as shown in Figure 202. All you need to provide is the topographic information, while the other parameters are as usual.

#### Figure 202. Raytracer (rayShooter) Job Setup for Topography.

Eile Job     Utilities       □     □     □     ↓     ▼ Project:	
	<u>H</u> elp
	A
Job       Cluster         Modules       Job Flow         1       rayShooter         gain       1         -hd/Math       3         -importVp       5         -kdm       6         7       7         8       7         moveout       9         10       10         postproc       11         resamp3d       13         14       15         Topo Surface Name       Topo         semblance       shooter         -shooter       -smoother	

With the *tmaps* available, you can actually just run the depth migration, **kdm** as normal (see Figure 203), without any indication of topography, and you should be able to get a reasonable result (much of the topography is stored in the *tmaps*). However, for best results, and to set output headers correctly, you should include the topographic surface in the Topography tab; otherwise, this is the same as running the module without topography. Note in particular that **kdm** will do a much better job of interpolating traveltimes if it has the topographic surface.

000	🔀 jobBuilder – Marvel Version 2.1.1.26, Panorama Tech	
ile <u>J</u> ob	<u>u</u>	tilities <u>H</u> elp
□ 🕀 🕒 🏂 🛔 🗗 🗣 🔽	oject:	N
lah Olustar		
Modules Job Flow	kdm	
Main <u>1</u> diskRead	Main Input Computation Output Topography Advanced Doc	
autoMute 2 gain		
autopick 3 kdm	Project Projects/NewTopo/NewTopo.project	9
-bias	Output Mode Offsets	
-bulkStatic		
-collect 7	Migrate All Offsets At Once Yes -	
-diskRead 8		
diskWrite 9	Offset Bin Key	
filter 10		
-gain 11	Worker Timeout (minutes) 15	
hdrMath 12		
- importVtp	BackUpName /scratch/NewTopo-kdm	
- kdm	BaseTmapName Projects/NewTopo/data/tmaps/NewTopo	9
-km		
mork	True Amplitude No	
moveout	FlushHours	
mute		
- postproc	nblock 1	
- pruneShoot		
- rayShooter	Master is Worker No	

#### Figure 203. kdm Job Setup for Topography.

For this project, the stacked result should look like that in Figure 204. The topographic surface shown in red is included in the headers, and was extracted in *gathers* with the Extract Surface menu (see Surfaces Menu on page 254 in Inline Section Operations).



#### Figure 204. Stacked Kirchhoff Depth Migration (kdm) of Data

### Depth-to-Time Conversion and Stack

To produce an image shifted to match the output of the time migration for conversion from depth to time, the **timeDepth** module will also need the topographic surface; other parameters are shown in Figure 205. The results are shown in Figure 206, and should match the PSTM results.



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<u>F</u> ile <u>J</u> ob			<u>U</u> tilities	<u>H</u> elp
🗋 🚭 🖶 💄 🏂 🚹 🕀 🔍 Project:				Ā
Job Cluster	timeDepth			
kdm 1 diskRead	Main Topography Inpu	ut Data Doc		
- km 2 timeDepth - mork 3 diskWrite	Project	/zorak/home/cjb/projects/NewTopo/NewTopo.project	Ð	
moveout 4	Conversion	Depth to Time	1	
- postproc 7	Input Type	Migration from Topography		
rayShooter	Top Replacement Amp			
resamp3d 10 resample 11	Bottom Replacement Amp			
-rtmodel 12	Ignore Headers	0		
-scan 13 -semblance 14	Model Type	Gridded		
- shooter	Model	zjb/projects/NewTopo/data/model/new.topovel.dz40.2lines.0000.segy	8	
- stack	Velocity Type	Interval in Depth		
- staticShift				
-trsum	Output Range	Min 0 Max 2000 Inc 4		
trwindow	fudge	0	-	
	<u></u>			

# Figure 206. Stacked Kirchhoff Depth Migration (kdm) of Data, Converted to Time (Note: Surface Also Converted).



Appendix

# **3D Surface Related Multiple Elimination**

This appendix explains the parameters defining Panorama Technologies' 3D Surface Related Multiple Elimination algorithm (SRME3D) and provides a brief explanation of the assumptions underlying the process. These assumptions essentially define the optimum acquisition scheme to assure the best possible results.

# Auto Convolution

The underlying concepts embodied in SRME3D are quite simple, and this is especially true in one-dimension. If we assume a one-dimensional Earth with a free acquisition surface, then the time of the first multiple is easily predicted by a simple convolution of the recorded trace with itself. If the first arrival occurs at  $t_0$ , the first arrival of the convolution is at the arrival of the first order multiple, that is,  $2t_0$ . If we perform a second convolution using the original recorded trace and the first convolution, the result is a trace where the first arrival is at  $3t_0$ , which is the time of the second multiple. Continuing this process as many times as desired results in a series of traces containing the first order multiples, the second order multiples, the third order multiples, and so on. While the time of each multiple trace is exact, the amplitude and phase of the actual multiple sequence is incorrect. Nevertheless, the sequence of multiple traces can be match filtered to suppress, or, in some cases, completely eliminate, the free surface generated multiples.

In three dimensions, the *nth* order multiple data series  $d_n(\vec{x_s}, \vec{x_r}, \omega)$  is predicted from a deghosted, obliquity-corrected and first-break-muted version of the original shot data,  $d_0(\vec{x_s}, \vec{x_r}, \omega)$ , through the auto-convolution given by Equation 17.

Equation 17: 
$$d_n(\vec{x}_s, \vec{x}_r, \omega) = \int \int d_0(\vec{x}_s, \vec{x}, \omega) d_{n-1}(\vec{x}, \vec{x}_r, \omega) d\vec{x}$$

Note that this process only utilizes the surface acquired data. It does not require any knowledge of the subsurface, and, as far as the obliquity factor is concerned, only superficially requires knowledge of the velocity in the water column. For each multiple order, the process also produces a completely new set of shots and receivers.

# **Multiple Suppression**

Data available after computing the multiple sequence described in Equation 17 consists of the data,  $d_0(\vec{x}_s, \vec{x}_r, \omega)$ , and the multiple estimates,  $d_n(\vec{x}_s, \vec{x}_r, \omega)$ .

For each source and receiver, the demultipled data,  $d_m(\vec{x_s}, \vec{x_r}, \omega)$ , satisfies a series of the form shown in Equation 18, where  $W(\omega) = W(\vec{x_s}, \vec{x_r}, \omega)$  is a special wavelet designed to optimally correct the phase and amplitudes of the estimated multiples to optimize the suppression.

Equation 18:  $d_m(\vec{x}_s, \vec{x}_r, \omega) = d_0(\vec{x}_s, \vec{x}_r, \omega) - W(\omega)d_1(\vec{x}_s, \vec{x}_r, \omega) - W^2(\omega)d_2(\vec{x}_s, \vec{x}_r, \omega) - \dots$ 

# Wavelet Estimation

In the current version of SRME3D, the wavelets  $W(\vec{x_s}, \vec{x_r}, \omega)$  are estimated by solving a set of time domain normal equations of the form shown in Equation 19.

1

$r_0$	<i>r</i> <sub>-1</sub>	•••	$r_{-nw+1}$	$w_0$		<i>c</i> <sub>0</sub>
$r_1$	$r_0$		$r_{-nw+2}$	$w_1$		$c_1$
•	•	•			=	
•						
•	•	•	•	•		•
$r_{nw-1}$	$r_{nw-2}$		$r_0$	$w_{nw-1}$		$C_{nw-1}$

Equation 19:

In this equation, nw is the number of time domain coefficients in the wavelet,  $w_n = w(\vec{x_s}, \vec{x_r}, n\Delta t)$  is the discrete wavelet,  $r_n$  are the multiple autocorrelation coefficients, and  $c_n$  are the coefficients determined by cross correlation of the original data and the estimated first order multiple. One such wavelet is estimated for each source in the input data set.

# Parameterization

Panorama Technologie's 3D SRME has the parameters listed in Table 151:

Term	Description		
Required Paramete	ers		
Project	project name used for this data set		
ShotXRange	min,max,inc		
ShotYRange	min,max,inc		
ReceiverXRange	range relative to shot: min,max,inc		
ReceiverYRange	range relative to shot: min,max,inc		
Optional Paramete	rs		
wavelet file	(blank)		
pathname	default: /scratch/users		
cdpKey	CDP location in header default: cdp		
lineKey	line location in header default: ep		
sxKey	shot X location in header default: sx		
syKey	shot Y location in header default: sy		
gxKey	receiver X location in header default: gx		
дуКеу	receiver Y location in header default: gy		
<i>f</i> 1	lowest frequency to process default: 0.0		
<i>f</i> 4	highest frequency to process default: 60.0		
norder	Highest multiple order to compute default: 1		
niter	Number of wavelet optimization iterations default: 1		

#### Table 151. SRME 3D Parameters

continues on next page

Variable	Description
ทพลข	Length of the wavelet in ms default: 200
wnn	White Noise factor in percent default: 1
alpha	Time domain damping factor (1)
nfill	infill option default: 0–no infill
mutsw	restore mute switch default: 0–no restore
nice	run in Nice mode default: yes
MasterisWorker	Flag that controls whether the master I/O controller is also used for performing calculations. default: no

#### Table 151. SRME 3D Parameters-continued

# Data Assumptions

All inverse-scattering based multiple suppression techniques assume that the input data has full source-receiver reciprocity. This is a very stringent constraint that most, if not all, current acquisition schemes fail to produce. The most important aspect of this assumption is the sub-requirement that each shot in the input data stream contain a trace at zero offset. In many cases, the traces in a short offset DMO-corrected stack can be used to fulfill this requirement. Traces at other offsets may be obtained through a careful application of differential moveout. In most cases, high quality results can only be achieved through a careful regularization of the input data.

# Appendix

# eyeBeam Module

This chapter discusses the optimum utilization of Panorama Technologies eyeBeam module and provides a brief explanation of the assumptions underlying the process. The article is divided into three parts. First, a brief overview summarizes the fundamental principles on which the module is based. Second, the focus is directed toward data preparation for optimum results. Third, the module's parameters are explained in detail.

# Overview

In contrast to the Kirchhoff smear stack approach, eyeBeam estimates local dip elements, or beamlets, from the input data and then applies classical imaging principles to produce a properly migrated image. To a large extent, the process is based on Figure 207. Together with the near surface velocity, *V*, Equation 20 provides the precise relationship between the apparent dip,  $\frac{\Delta t}{\Delta x}$ , and the source and receiver take-off angles,  $\theta_S$  and  $\theta_R$ , respectively. As indicated in the figure, raytracing is used to locate the reflector that gave rise to the apparent dip. The opening angle, or either incidence angle at the intersection of the two rays, determines reflector dip. The sum of the source and receiver take-off angles are directly related to the apparent dip of a subsurface reflector. The opening angle (sum of the incidence angles) define the local reflector dip.

# Figure 207. Fundamental components of Panorama Technologies eyeBeam module.



**Equation 20:** 
$$\frac{\Delta t}{\Delta x} = \frac{\cos\theta_S}{V} + \frac{\cos\theta_R}{V}$$

The ratios  $\frac{\cos\theta_S}{V}$  and  $\frac{\cos\theta_R}{V}$  are the derivatives,  $\frac{d\tau_S}{dx}$  and  $\frac{d\tau_R}{dx}$ , of the source and receiver traveltimes, that is, the gradients in 3D. This fact allows you to compute dynamic traveltimes and provide proper amplitude correction to preserve AVO response and approximate true amplitude imaging. Figure 207 shows the schema for two-dimensions, but the general concept remains valid in three dimensions. In 3D, the source and receiver take-offs are specified by an azimuth and dip.

Key features of eyeBeam and its dynamic raytracer include

- Migration From Topography
- Full TTI imaging based on the dynamic raytracer
- Raytrace arrivals include
  - maximum energy
  - minimum velocity
  - minimum distance

# **Data Preparation**

The quality of the final image produced by eyeBeam is controlled by the quality of the input data. In many cases, the quality of the final image can be controlled by proper preprocessing of the input data volume. Because estimates of local apparent dip are paramount, data preparation can and should focus on input data coherency and frequency content. In many cases, coherency be increased through signal enhancement applications and also careful choice of the frequency bandwidth. Spectral analysis should reveal the extent to which the data can be resampled to a larger sampling increment. Efficiency is highest when the maximum frequency can be limited to 31.5 Hz. To maximize throughput, data preparation should also include storing the properly processed data in a scaled 16-bit format. This reduces the input data size and results in faster data reads and writes. As shown in Figure 208, you do this by setting the output data format to Scaled Short. This setting effectively halves the output file size, thereby improving overall performance and efficiency of eyeBeam migrations.

€ _ File Job Utilities He	In	jobBuilder - geotrac	e-c2306-cggmodel·eyeBeam-14-2011.08.08.job	000
	▶ ▼ Project:			
lob Cluster				
Modules	Job Flow		diskWrite	
>-Data	1 diskRead			
>-Devel	2 eyeBeam 3 diskWrite	Main Doc		
>-Filter	4			
≻Geo	5			
→Interp				
>-10	1	Files	trace/c2306/output/geotrace-c2306-cggmodel-eyeBeam-142011.08.08	
>-Main				
→ Migration				
>-Modeling				
>-Obsolete		Mode	Append ~	
>-Postprocess				
Regularization				
Resample				
>-Seismic		Format	Scaled Short *	
>-Viz	1			
		Max File Size (MB)	0	
		Max Traces per file	0	
		rian nacco per me		
		Split Header Key		
		opine medder key		

#### Figure 208. Setting the output file format to scaled-short in diskWrite

# Parameterization

Parameterization of an eyeBeam project uses both the diskRead module and the eyeBeam module.

## diskRead

Parameterization of an eyeBeam project begins with the diskRead module. Figure 209 shows the Main panel of diskRead along with the parameters required to ensure that diskRead will construct appropriately-sized super-gathers (patches) to feed to the eyeBeam module. At your discretion, the parameters below diskRead's Mode field can also be set in the eyeBeam module. While several of these fields have reasonable defaults, they should always be reviewed before job submission. The fields are defined in Table 152.

Field	Description	
Migrate all Offsets at Once	If set to YES, traces are read in exactly the order they are stored. If set to NO, traces are read in common offset order. This should be set to NO for Beam Migrations.	
Report (secs)	This is the report time for diskRead. For example, a value of 60 causes diskRead to report every minute.	
Calculate Bins	If the input data has only CDPs and lines in the headers, this will calculate the real world coordinates for selecting super-gathers.	
Calculate xy	If the input data does not have CDPs and lines set in the header, set this parameter to YES to have diskRead calculate CDP and line information from the world coordinates in the trace headers.	
backupName	The name and location of the backup file used in restarts and recovery operations.	
Offset Bins	These three fields are the minimum, maximum, and increment defining the leading edges of the offset bins. For example, if these values are set to 0, 20000, 100, then 199 offset bins beginning at 50 will be output.	
Offset Bin Key	The header key for storing the Offset Bin value.	
Output Lines	These three fields are the minimum, maximum, and increment for the desired output line range. Figure 209 is a 2D setup so the values are set to output a single 2D line.	

#### Table 152. diskRead Main Panel Fields

continues on next page

Field	Description
Output XLines	The minimum, maximum and increment for the desired output line range.
Line and Xline Aperture	The desired line and crossline half-apertures.
Line and CDP Header Keys	The header locations where this information is stored.

#### Table 152. diskRead Main Panel Fields-continued

The diskRead main panel is shown in Figure 209. The panel shows selection of Beam Migration in the Mode field. This ensures that diskRead constructs appropriate patches to feed to the eyeBeam module after the sort has been performed.

#### Figure 209. diskRead Main Panel

ob <u>U</u> tilities	E Help	,			
	tr v v Pioject.				
Cluster	<b>ا</b> ر				
ob Flow diskRead			diskRead		
eyeBeam diskWrite	Main Beam Advanced Se	lection Doc			
	Files	e/BigBeez/projects	/hess-tti/input/hess-tti-001-elated	-srme3d-2010.01.05.ep.cdp.offset.datas	et 🕒
	Project	/media/bumblebee	/BigBeez/projects/hess-tti/hess-vt	i.project	a
	Skip Traces				
	Max Traces				
	Mode	Beam Migration			~
	Migrate All Offsets At Once	No			~
	Report (secs)	60			
	Calculate Bins	Yes			~
	Calculate xy	No			~
	backupName	/media/bumblebee	/BigBeez/projects/hess-tti/output/	hess-tti-001-parsim-2009.12.29	
	Offset Bins	Min 0	Max 20000	Inc 1000	
	Offset Key	offset			
	Offset Bin Key	fldr			
	Output Lines	Min 0	Max 0	Inc 2	
	Output XLines	Min 1	Max 3617	Inc 2	
	Line Aperture (m/ft)	0			
	XLine Aperture (m/ft)	20000			
	Line Header Key	ер			
	CDP Header Key	cdp			

The diskRead Beam panel is shown in Figure 210. The most important field in diskRead's Beam panel is the patch field. This field defines the size of the patch in both line and crossline directions. Reasonable values are project dependent, but are typically in the neighborhood of 200 meters. The diskRead Beam fields are defined in Table 153.

ter		
low ead	diskRead	
am Main Beam Advanced	Selection Doc	
⊐		
Datate Circa (m/ft)	240	
Patch Size (m/tt)	240	
Adjust Patch for Short Of	ffsets No	
Min Patch Size (m/ft)	50	
Overlap Patches	Yes	
Bundle Key	tracf	

#### Figure 210. diskRead Beam Panel

#### Table 153. diskRead Beam Panel Fields

Module	Description
Patch Size (m/ft)	The actual patch or super gather size. The value defines a square around sources and receivers. Every trace with a source and a receiver in the corresponding square is included in the patch.
Adjust Patch for Short Offsets	This switch specifies whether or not eyeBeam reduces the patch size for small offsets. It enhances coherence to improve beamlet estimation.
Min Patch Size (m/ft)	The minimum patch size allowed for short offset reduction when the previous field is set to YES.
Overlap Patches	Set this to YES to increase the coherence at shallow depths.
Bundle Key	The header word location containing the unique value assigned to each patch.

The input field in Figure 209 points to either a .segy file with properly filed headers or to a .dataset file containing the appropriate coordinate information to enable proper sorting of the input data into offset binned super gathers. Depending on the computer system being used, the sort may take awhile.

If you plan to do multiple migrations using the same input, the diskRead data stream of super gathers can be output in presorted form by feeding the output from diskRead directly into diskWrite, as shown in Figure 211. The diskWrite module writes the data to the specified super-gather-sorted output file. In subsequent applications of eyeBeam, diskRead's input file field must contain the .segy super-gather-sorted output file and the Mode field must be set to General. Note that this approach can also be used effectively during the data preparation step.

	¢ v Project:					
b Cluster						
Job Flow	diskRead					
diskRead	Main Beam Advanced	Selection Doc				
3	Files	/BigBeez/projects/to	nnta/bg-india/input/cdps-regrid-n	no-filter-resamp-16ms-agc100	0.0000.segy	9
5	Project	/net/bee/data1/bee/	BigBeez/projects/tonnta/bg-india/	new-bg-india-cjb.project		9
	Skip Traces					
	Max Traces					
	Mode	Beam Migration				
		1				
	Migrate All Offsets At Once	No			•	
	Report (secs)	60				
	Calculate Bins	No				
	Calculate xv	No				
	be also Name	lis she there exists there is a dis	for the title in the support Doga			-
	DackupName	jects/tonnta/bg-india	/output/bg-india-eyeBeani-2011-	11-21-3X3-400Patch-inclusion-v		(and
	Offset Bins	Minjo	Max 10000	Inc 200		
	Offset Key	offset				
	Offset Bin Key	fldr				
	Output Lines	Min 0	Max 0	Inc 1		
	Output XLines	Min 14000	Max 29000	Inc 4		
	Line Aperture (m/ft)	0				
	XLine Aperture (m/ft)	12000				
	Line Header Key	ep				
	CDP Header Key	Icdn				

#### Figure 211. diskRead General Panel

### eyeBeam

Figure 212 shows the eyeBeam Main panel. The fields are explained in Table 154, and give the necessary information for a successful run of the module.

#### Figure 212. eyeBeam Main Panel

● _ File Job Utilities Help □ ⊖ ■ ■ ▲ & ● ▼ Project:	jobBuilder - hess-tti-eyeBeam-08-08-2011 job	
Job Cluster		
Job Flow 1 diskRead 2 eyeBeam Main Input	eyeBeam mputation Output Topography Advanced Job Doc	
4 oiskwrite 5 Output Mod Migrate All C	/media/bumblebee/BigBeez/projects/hess-tti/hess-vti.proje Offsets ets At Once No	ct a
Offset Bin Kr Worker Time BackUpNam Velocity Mod BaseTmapN True Amplitu FlushHours nblock	fldr         (minutes)         15         /media/bumblebee/BigBeez/projects/hess-tti/output/hess-tt         /media/bumblebee/BigBeez/projects/hess-tti/model/timode         /media/bumblebee/BigBeez/projects/hess-tti/tmaps/hess-tti         No         2         1	ti-001-parsim-2009.12.29

#### Table 154. eyeBeam Main Panel Fields

Module	Description
Project	This required field defines the input data geometric coordinates.
Output Mode	The output mode is normally Offsets or Stack. Use Offset mode to produce a range of offsets, and Stack to produce a stack of all offsets
Migrate All Offsets At Once	This should always be set to NO for eyeBeam migrations.
Offset Bin Key	It is recommended that this field be left at the default value, but any available header key can be used. <b>Note: Avoid using cdp, line, sx, sy, gx or gy used in other</b> <b>header related fields.</b>

#### continues on next page

Tab	Description
Worker Timeout (minutes)	This field defines the length of time eyeBeam will allow a worker to be inactive. If communication is not achieved after this time limit, the eyeBeam master assumes that the worker is dead.
BackUpName	This file is used to store backup information to enable a restart after any suspension of execution.
Velocity Model	When given, the velocity model serves two purposes. It provides the necessary velocity information for differential moveout of the traces in each super gather to the average offset of that ensemble. It also defines the near surface velocity for computation of take-off angles. This is a seismic file in any format MARVEL can read, typically, SEG-Y. The units are m/s, or ft/s, but can be anything else, depending on the choice of units in the seismic data.
BaseTmapName	The base name of the traveltime file(s). This name is the tmap file name without the .tmap extension. Note: This is a REQUIRED entry.
True Amplitude	When set to YES, eyeBeam will use the amplitudes computed during the generation of traveltimes by rayShooter.
Flush Hours	The length of time between each output of backup information to the BackUpFile.
nblock	Note: This parameter should not be set when using eyeBeam.

#### Table 154. eyeBeam Main Panel Fields-continued

The eyeBeam Input Panel in Figure 213 defines the header storage locations for the various indicated parameters.

#### Figure 213. eyeBeam Input Panel

OOO 🛛 🕅 jobBu	ilder	- Marvel Version 2.1.1.3	1pre3, Panorama Tech	
<u>F</u> ile <u>J</u> ob <u>U</u> tilities <u>H</u> elp				
🗅 🖨 🖬 🚔 🏠 🗣 🛡	7 Proj	ect:		•
Job Cluster				
Modules A Job Flow	<b>A</b>	eyeBeam		1
Main 1 diskRead		Main Input Computation Out	tput Topography Advanced Job Doc	
				Ш
antialias diskWrite		Line Key	ep	Ш
			· · · · · · · · · · · · · · · · · · ·	Ш
		Cdp Key	cdp	Ш
				Ш
collect		Offset Header Key	offset	Ш
cuda-test 7				Ш
<mark>demig 8</mark>		Bundle Key	tracf	Ш
diskRead 9			·	Ш
diskwrite 10		Velocity-percent Header Key	tracf	Ш
				П
<ul><li>&lt; /// ▶ 12</li></ul>	¥	L		
				_

The eyeBeam Computation Panel is shown in three forms in Figure 214, Figure 215, and Figure 216. The fields on these panels are the most important eyeBeam parameters, and are defined in Table 155.

# Figure 214. eyeBeam Computation Panel, Application Range Utilization field set to All

	v rioject.		
Cluster			
Job Flow	eyeBeam		
diskRead	Main Input Computation	Output Topography Advanced Job Doc	
diskWrite	Line Aperture (m/ft)	7000	_
	Vi ine Aperture (m/ft)	5000	_
	ALINE APERture (III/IC)	5000	
	P Search Method	Max Semblance	2
	Semblance Window Length (m	s) 7	
	Semblance Threshold	0	
	Xline P range (ms/tr)	max[6 inc].25	
	Line P range (ms/tr)	max 6 inc .25	
	Application Range Utilization		_
	Application Range Oulization	All	-
	Control Beam	Automatic	
	Number of Ps	4	
	Principal Frequency	20	_
	Surface velocity	1500	
	Surface velocity	1200	
	Curvature Correction	1	
	Dip Gain	0	
## Figure 215. The eyeBeam Computation Panel, Application Range Utilization field set to Exclude

Cluster					
Job Flow	eyeBeam				
diskRead	Main Input Computation O	utput Topography	Advanced Job Doc		
diskWrite	Line Aperture (m/ft)	7000			
	XLine Aperture (m/ft)	5000			
	P Search Method	Max Semblance			
	Semblance Window Length (ms)	7			
	Semblance Threshold	0			
	Xline P range (ms/tr)	max 6	inc .25		
	Line P range (ms/tr)	max 6	inc.25		
	Application Range Utilization	Exclude			
	XLine Application Range (ms/tr)	min-1	max 1		
	Line Application Range (ms/tr)	min-1	max 1	[	
	Control Beam	Automatic			
	Number of Ps	4			
	Principal Frequency	20			
	Surface velocity	1500			
	Curvature Correction	1			
	Dip Gain	0			

# Figure 216. The eyeBeam Computation Panel, Application Range Utilization field set to Include

Cluster					
Job Flow	eyeBeam	I	1		
diskRead	Main Input Computation	Output   Topography	Advanced Job Doc		
diskWrite	Line Aperture (m/ft)	7000			
-	XLine Aperture (m/ft)	5000			
	P Search Method	Max Semblance			
	Semblance Window Length (n	ns) 7			
	Semblance Threshold	0			
	Xline P range (ms/tr)	max 6	inc .25		
	Line P range (ms/tr)	max 6	inc .25		
	Application Range Utilization	Include			
	XLine Application Range (ms,	/tr) min-1	max 1	[	
	Line Application Range (ms/tr	) min-1	max 1	[	
	Control Beam	Automatic			
	Number of Ps	4			
	Principal Frequency	20			
	Surface velocity	1500			
	Curvature Correction	1			
	Din Gain	0			

Module	Description
Line and Xline Aperture	These fields define the migration half-aperture for the migration
pSearch Method.	This field has two options. You can choose the p-values based on either the maximum semblance or maximum slant stack amplitudes. The recommendation is to set this field to Max Semblance.
	<ul> <li>When set to Max Semblance, the two parameters Semblance Window Length and Semblance Threshold appear. Semblance Window Length controls the length of the vertical window from which p-values are selected. Semblance Threshold provides a threshold for rejecting p-values whose semblance is below this value.</li> <li>When set to Max Stack, p-values are determined from the slant stack volume or field. No other parameters need be set.</li> </ul>
Xline P Range	The max value and increment. The range is the defined from negative max to max. Note: This is a REQUIRED entry.
Line P Range	The max value and increment. The range is then defined from negative max to max. Note: This is a REQUIRED entry.
Application Range Utilization	<ul><li>This field can be set to All, Exclude, or Include.</li><li>When set to All, the p-search is performed over the entire set of slant stack p values</li></ul>
	<ul> <li>When set to Exclude, the p-search is performed over those p-values outside the range defined by the Xline Application Range and Line Application Range fields.</li> </ul>
	• When set to Include, the only allowable p-values are based on the range defined within the Xline and Line Application Ranges.
Control Beam	The three options are Fixed P Range, Automatic and No Control.
Number of Ps	The actual number of p-values to migrate when Control Beam is Automatic.

### Table 155. eyeBeam Main Panel Fields

continues on next page

Tab	Description
Principal Frequency	The Principal Frequency is used to define the Fresnel Zone.
Surface velocity	If no initial velocity volume is provided, this value defines the near surface velocity.
Curvature Correction	When set to 1, this flag causes the eyeBeam algorithm to correct for local curvature.
Dip Gain	When set, a linearly increasing scale factor will be applied to higher dips.

## Table 155. eyeBeam Main Panel Fields-continued

Figure 217 shows the eyeBeam Output Panel, which defines the range and limits of the desired output data volume. The meaning of these parameters are defined in Table 156.

b Utilities	Help				
Cluster					
b Flow			eyeBeam		
/eBeam	Main Input Computa	ation Output Topogr	aphy Advanced Job Doc		
Skiinte					
	Output Lines	Min 0	Max 0	Inc 2	
	Inline aliasing (lines)	4			
	Output XLines	Min 1	Max 3617	Inc 2	
	Xline aliasing (xlines)	4			
	Offset Bins	Min 0	Max 20000	Inc 1000	
	Velocity Scan (%)	Min 100	Max 100	Inc 100	
	Output Depths (m/ft)	Min 0	Max 30000	Inc 20	

## Figure 217. eyeBeam Output Panel

#### Table 156. eyeBeam Output Panel Fields

Module	Description
Output Lines	The output line range. Note: This is a REQUIRED entry.
Inline aliasing (lines)	Defines the desired spacing length for antialiasing. The larger this value is, the more anti-aliasing is applied.
Output XLines	The output xLine range. Note: This is a REQUIRED entry.
Crossline aliasing (xlines)	Defines the desired spacing length for antialiasing. The larger this value is, the more anti-aliasing is applied.
Offset Bins	Defines the endpoints of the desired output offset bins. For example, the values 0, 20,000, and 1000, define output offsets ranging from 500 to 19,500.

#### continues on next page

Tab	Description
Velocity Scan (%)	Setting the minimum, maximum, and increment provide the percentage range over which migrations should be performed. For example, setting this range to 90, 110, 5 will produce output volumes using 90, 95, 100, 105, and 110 percent of the original velocity field.
Output Depths	Defines the minimum, maximum, and increment for the each output trace. Note: This is a REQUIRED entry.

## Table 156. eyeBeam Output Panel Fields-continued

The eyeBeam Topography Panel fields in Figure 218 define the topographic surface file and the surface name.

### Figure 218. eyeBeam Topography Panel

Cluster		
ob Flow liskRead eyeBeam	eyeBeam Main Input Computation Output Topography Advanced Job Doc	
IISKWIILE		
	Topo Surface File	
	Topo Surface Name Topo	

The eyeBeam Advanced Panel in is shown in Figure 219. The fields are described in Table 157. It is best to simply use the default values for these fields.

ile Job Utilities	Help	jobBuilder - hess-tti-eyeBeam-08-08-2011 job	
Job Cluster			
Job Flow		eyeBeam	
2 eyeBeam 3 diskWrite	Main Input Computation	Output Topography Advanced Job Doc	
4 5			
	Use trace counter in header	Yes	~
	verbose	No	~
	Maxmem	4000	
	Mute Angle (degrees)	15	
	Max Frequency (Hz)		

## Figure 219. eyeBeam Advanced Panel

#### Table 157. eyeBeam Advanced Panel Fields

Module	Description
Use trace counter in header.	When set to YES, the trace counter is set.
Verbose	When set to YES, eyeBeam will print debug information to the log file.
Maxmem	The amount of memory, in megabytes, to allow for each process on each node.
Mute Angle (degrees)	The value here automatically applies a mute at this angle on each output cdp and line gather.
Max Frequency (Hz)	This field applies a low-pass filter to the input with this value as the highest frequency. It is best to use the default value and avoid the extra calculations. If you want to filter the data, it is better to do so before migration.

The eyeBeam Job Panel shown in Figure 220 defines computer based parameters related to how the process generates output. The terms are defined in Table 158.

ster		
Flow	eyeBeam	
Beam Main Input Computa Write	tion Output Topography Advanced Job Doc	
	Yes	
USC AIR CI US		
Max Threads per Proc		
Master is Worker	Yes	
Run workers low prior	tv Yes	

## Figure 220. eyeBeam Job Panel

#### Table 158. eyeBeam Advanced Panel Fields

Module	Description
Use All CPUs	When this is set to YES, Marvel initializes eyeBeam as a single process utilizing all cores on the node. When set to NO, Marvel initializes eyeBeam as multiple processes, where each process uses a single core.
Max Threads per Proc	When Use All CPUs is set to NO, you can set this value to the number of cores per process. For example, when running on an 8 core node, setting Max Threads per Proc to 4 would cause two instances of eyeBeam slaves to each use exactly 4 cores during execution.
Master is Worker	When set to YES, the master node will also be used as a worker. In this case, the master node will have one master process and at least one slave process in execution. When set to NO, the master node does little or no actual computation. Its primary purpose is to send and receive parameters and monitor and handle input and output. The recommended setting is NO.
Run Workers Low Priority	When set to Yes, all processes, except the master, will be run in a reduced priority <i>nice</i> mode.

## Index

aliasing, 82, 98, 134 amplitude cutoff, 166, 216 flag, 172, 223 maximum, 173, 223 minimum, 180 threshold, 208 analysis (t0, tp), 29 velocity, 25, 210 angle2offset module, 20-20 anisotropy, 168, 210, 212, 218 antialias module, 21–22 aperture, 82, 95 crossline, 48, 82, 95, 98, 115, 129, 178, 198, 214 full, 244 line, 48, 82, 95, 98, 115, 129, 178, 198, 214 near surface, 62, 85, 101, 155, 217, 246 range, 162 automatic gain control, 71 automute module, 23-24 autopick module, 25-34 autopicking parameters, 258 bias, 70, 159 bias function, 35 bias module, 35 bins, 39, 48, 49, 80, 93 bounding angles, 217 bulk static module, 36 CDP maps, 11 clip, 70, 173, 223 collect module, 37-39

compression, 122, 172, 205, 223 pruneShooter, 172 rtmodel, 204 shooter, 222 Courant factor, 115, 198 Dablain trick, 114, 198 damping, 119, 244 damping zone width, 119 datum, 103, 227, 280-286 datum surface, 282 de Bazelaire, Eric, 25 debiased trace, 35 deimg module, 40-44 depth horizon, 249 depth-to-time value, 232 dip gain, 101 diskRead module, 44-50 diskWrite module, 51–51 dt value, 29 elevation static correction, 281 elevation statics, 280, 281 ensemble, 35, 67 ensembles, 12 equation changing header words, 72, 75 Dix, 33 semblance, 210 shifted hyperbola, 25 stacking velocity, 26 statics, 227 traditional moveout, 25 traveltime, 210 wave, 240 extension .dataset, 250

.job, 18, 18, 19 .model, 250 .pick, 23, 250 .project, 3, 7, 250 .segy, 7, 250 .surface, 250 .tmap, 54, 80, 149, 214, 306 eveBeam module, 52–64 FD order, 197 fdmod2d module, 64-66 filter amplitude, 67 frequencies, 67 maximum frequency, 101, 129, 244 minimum frequency, 129, 244 filter module, 67–67 finite difference, 197 FOCUS HANDVEL data, 74 fold, 12forward field compression, 122, 205 gain module, 68–71 gather, 67 gathers module, 249, 250 gathers settings, 255 Gaussian width, 146 geophone, 186 hdrMath module, 72–73 header words, 72, 75 horizon, 249, 284 illumination, 116, 134, 199 impedance, 116, 199 importVtp module, 74 inline operations, 249 interpolation mode, 144 interpShot module, 75-77 isotopic damping, 119 kdm module, 78–85 Kirchhoff curved-ray migration, 91 Kirchhoff depth migration, 78 km module, 91-103 kmodel module, 86–90 linear velocity parameter, 142

merlin module, 104–124

migration Kirchhoff, 44 Kirchhoff curved ray, 91 Kirchhoff depth, 78 poststack, 240 prestack, 240 shot, 44 wave equation, 240 migration mode, 100, 126 migration velocity, 286 model build, 260 set background, 250, 264 model type, 140 MORK module, 125–138 moveout module, 139–141 mute, 23, 67, 95, 142, 212 angle, 62, 85, 155, 246 taper, 140 mute module, 142–145 NMO, 139, 140, 253 normal moveout, 25, 139, 140, 141, 253 one-way phase panel, 240 oned module, 146 output mode, 80, 93 pad aperture, 119 parsim module, 148–156 peak frequency, 105, 191 pef module, 157 perfectly matched layers, 120 picking time, 259 picks, 250 PML, 120 postproc module, 159–161 poststack migration, 240, 241 prestack migration, 240, 280 pruneShooter module, 162–173 quantile clip, 70 rayshooter module, 174–184 reflectivity trace, 105, 106, 191, 191 regularization, 132 resamp3d module, 185

resamp3d module, 185 resample module, 187 Ricker wavelet, 105, 106, 191, 191 Ricker width, 146

RMS migration velocity, 25 RMS stacking velocity, 25 rtmodel module, 188-207 scan module, 208 section, 250 semblance, 25, 25, 253, 284 equation, 210 semblance module, 210-212, 262-263 semblance parameters, 262 shooter module, 213-223 shot maps, 11 smoother module, 224–225 smoothing, 118 spatial windowing, 238 spike wavelet, 105, 106, 191, 191 stack module, 226 stacking velocity, 25 static corrections, 283 staticShift module, 227-231 stretch mute, 140 stretch scaling, 140 subweathering velocity, 284 surface multiples, 115, 198 surfaces, 249, 250, 250, 254 taper, 29, 71, 140, 144 Thomsen's variables, 169, 218 time horizon, 249 time order, 114, 198 time-to-depth value, 232 timeDepth module, 232–235, –236 tmap basename, 163 depths, 220 name, 80, 175 toolbar jobBuilder, 19 project, 10 topo surface file, 61, 84, 103, 121, 133, 154, 171, 181, 203, 221 topographic migration, 279–299 topographic surface, 280 topography, 61, 84, 102, 133, 171, 181, 203, 221, 233 migration mode, 100 trace, 23, 25 trace time, 259 traces, 12

trap, 70 triplications, 210 trSum module, 237 trWindow module, 238 variable delfile, 218 epsilon, 218 epsilonfile, 218 eta, 218 etafile, 218 gelev, 280 gstat, 227, 280 sdel, 227, 280 sdepth, 227, 280 selev, 227, 280 sstat, 227, 280 sut, 227, 280 swevel, 227, 280 tau, 280 tstat, 280 vvelfile, 218 wevel, 227, 280 velocity RMS, 25 stacking, 25 velocity analysis, 25, 210, 249-264 velocity analysis module, 284 velocity model, 140 velocity width, 29 VIEWS VTP data, 74 Vnmo file, 169, 218 wave equation, 240, 246wavelet, 105, 106, 172, 191, 191, 223 wavelet domain, 173 weathering velocity, 121, 227, 228, 231, 256, 284 wem module, 240–248 wiggles, 257 window automatic gain control, 71 sliding, 35 spatial, 238 XML file, 3 zero datum, 281, 282



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