

## INTERACTIVE VELOCITY ANALYSIS (AASPI\_IVA) – PROGRAM Precompute Velocity Semblance Interactive Velocity Analysis Velocity Interpolation

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## **Computational Flowchart**



#### Here, in this section we are performing Velocity analysis



Flowchart for Interactive velocity

There are three main utilities in IVA or Interactive velocity analysis, 1. Precompute velocity semblance, 2. Interactive velocity analysis, and 3. Velocity Interpolation. You can launch interactive velocity analysis by selecting **interactive velocity analysis** (see the next image on the following page) on the aaspi prestack utility or by typing **aaspi\_iva** on the terminal window.

### Prestack Data Conditioning IVA – Programs aaspi\_iva

X AASPI program aaspi_util_prestack (Release D	Date: February 4, 2015)	
Eile Prestack Utilities Display Tools	<u>O</u> ther Tools	Help
SEG <sup>•</sup> <u>c</u> ompute_fold forma <u>a</u> zim_offset_mig (mig <u>p</u> restack_mute	SEGY to AASPI AASPI to SEGY format conversion (unmigrated data) (single file)	
Conv sof_prestack rotate 2c by 2c	n SEGY to AASPI format (regular offset)	
SEGY grop_prestack Sort into separate gathers SEGY stack A D <sup>mo</sup>	SEGY Header Utility y,*segy,*.SGY,*.SEGY):	Browse View
Absc rnmo		
Optiointeractive velocity analysis	e (*.prn,*.txt): NONE	Browse
AASP vel_ascii2aaspi		
Uniqu <u>s</u> pec_cwt		
Verbose:		
VBlock:	10000	
Byte loc. of X coordinate of gathers :	181 4 byte int 💌	
Byte loc. of Y coordinate of gathers :	185 4 byte int 💌	
Byte loc. of line (inline) no.:	189 4 byte int 💌	
Byte loc. of cdp (xline) no.:	193 4 byte int 💌	
Byte loc. of offset value :	37 4 byte int 💌	
Byte loc. of azimuth value:	197 4 byte int 💌	
Override scalco :	0 - use value in header 💌	
Override Value of first sample (ms) :	0	
Vertical Unit :	s 🗸	
Horizontal Unit :	ft 🗾	
Amplitude Threshold :	1E+10	
Execute		
(c) 2008-2015 AASPI - The University of	Oklahoma	

This will display window as seen in the following:

AASPI - Interactive Velocity Analysis (Release Date: February 4, 2015)	
Eile AASPI_Utilities	<u>H</u> elp
IVA Precompute Semblance Computes Semblance which will be used in Interative Velocity Ar	nalysis
IVA Precompute Velocity Semblance	
Main Interative Velocity Analysis Uitility	
Interactive Velocity Analyis	
Velocity Interpolation (required for Prestack time migration)	
<u>Velocity Interpolation</u>	

## **Data preparation for Program Velocity Semblance**

Although this tool is capable of doing velocity analysis on any data set, this utility is mostly used for generating velocity to do Non-stretch NMO by a program called **mpnmo**. In general, we perform **mpnmo** after prestack time migration, and the output of PSTM is a NMO corrected data. Therefore, we apply reverse NMO before doing the velocity analysis.

## Program rnmo (Reverse NMO)

Our utility **rnmo** or reverse normal move out removes the NMO effect. The program **rnmo** can be found in the *Prestack Utilities* tab or can be initiated by typing **aaspi\_rnmo** on the Linux terminal window. This utility is also descibed in mpnmo document.

🗙 AASPI	program aaspi_util_prestack (Release [	)ate: February 4, 2015)		_ <b>_ x</b>
]] <u>F</u> ile	Prestack Utilities Display Tools	Other Tools		<u>H</u> elp
SEG forma (mig	<u>c</u> ompute_fold <u>a</u> zim_offset_mig <u>p</u> restack_mute	SEGY to AASPI format conversion (unmigrated data)	NASPI to SEGY mat conversion (single file)	
Conv	<u>s</u> of_prestack rotate 2c by 2c	n SEGY to AASPI format	(regular offset)	
SEGY	<u>c</u> rop_prestack <u>S</u> ort into separate gathers		SEGY Header Utility	
SEGY	<u>s</u> tack	y,*segy,*.SGY,*.SEGY):		Browse Viev
A Absc	<u>n</u> mo <u>r</u> nmo		./	
Optio	<u>m</u> pnmo interactive velocity analysis	e (*.prn,*.txt):	NONE	Browse
AASP	vel_ascii2aaspi			
Uniqu	<u>avaz</u> spec_cwt			
Verbo	se:	<b>1</b>		
VBlock	c	10000		
Byte lo	oc. of X coordinate of gathers :	181	4 byte int ▼	
Byte lo	oc. of Y coordinate of gathers :	185	4 byte int ▼	
Byte lo	oc. of line (inline) no.:	189	4 byte int ▼	
Byte lo	oc. of cdp (xline) no.:	193	4 byte int ▼	
Byte lo	oc. of offset value :	37	4 byte int ▼	
Byte lo	oc. of azimuth value:	197	4 byte int ▼	
Overri	de scalco :	0 - use value in header 🔻	]	
Overri	de Value of first sample (ms) :	0		
Vertic	al Unit :	s 💌		
Horizo	ntal Unit :	ft 💌		
Amplit	ude Threshold :	1E+10		
<u>E</u> xecu	te			
(c) 2008	8-2015 AASPI - The University of	Oklahoma		

Upon selecting **rnmo** the ensuing window will appear:

🗙 AASPI - program rnmo (Release	Date:January 25, 201	.5)		- 0 X
]] <u>F</u> ile				<u>H</u> elp
rnmo - apply reverse normal	moveout to previo	ously migrated or NMO-corre	ected gathers	
Input CRP or CMP gather file	name (*.H):	_final_project/amatitlan.H	Browse	1
Input velocity file name:		oject/velocity_amatitlan.H	Browse	2
Output rnmo-corrected gathe	er file name (*.H):	d_rnmo_amatitlan.H		
*Unique Project Name:		rnmo_amatitlan		
Use MPI:				
Processors per node:	24			
Node list:	localhost			
Verbose:				
Build an LSF Script?	Do Not Run Unde	er LSF		
Maximum LSF run time (hrs):	0			
LSF Batch Queue:				
(c) 2008-2015 AASPI - The U	niversity of Oklah	oma		Execute rnmo

Click (1) *Browse,* and select *amatitlan.H* for your input seismic data. This should be a 4D migrated volume. You will also need to (2) select a velocity file for performing **rnmo.** In our case we used *velocity\_amatitlan.H.* Next (3) give the d\_rnmo volume an output file name ending in \*.*H, d\_rnmo\_amatitlan.H,* and select *Execute.* The results will be a reverse normal out migrated volume as observed in the image on the next page.



Figure 1. *d\_rnmo\_amatitlan.H* 

## Forming a supergather

The first step after we have our rnmo data is to create a super gather using **crop prestack**, which is found under the *Prestack Utilities tab*:

### Prestack Data Conditioning IVA – Programs aaspi\_iva

🗙 AASP	I program aaspi_util_prestack (Release [	Date: February 4, 2015)		- • • ×
] <u>F</u> ile	Prestack Utilities Display Tools	Other Tools		Help
SEG	<pre>compute_fold</pre>	SEGY to AASPI	AASPL to SEGY	
forma	<u>a</u> zim_offset_mig	format conversion fo	rmat conversion	
(inig	prestack_mute	(unmigrated data)	(single file)	
Conv	rotate 2c by 2c	n SEGY to AASPI format	(regular offset)	
SEGY	<u>c</u> rop_prestack		SEGY Header Utility	
SEGY	Sort into separate gathers	v *segv * SGY * SEGY)-		
5201	<u>s</u> tack	,, seg,, ser, see,,	l	Browse Viev
Abso	rnmo		1	
Ontio	<u>m</u> pnmo	e (* nm * txt)·	NONE	
optio	interactive velocity analysis	e ( .pm) .exe).		Browse
AASP	vel_ascii2aaspi			
Uniqu	<u>a</u> vaz spec.cwt			
Verbo	ose:	L L		
VBloc	ik:	10000		
Byte	loc. of X coordinate of gathers :	181	4 byte int 🔻	
Byte	loc. of Y coordinate of gathers :	185	4 byte int 🗸	
Byte	loc. of line (inline) no.:	189	4 byte int 🗸	
Byte	loc. of cdp (xline) no.:	193	4 byte int 🔻	
Byte	loc. of offset value :	37	4 byte int ▼	
Byte	loc. of azimuth value:	197	4 byte int 💌	
Overr	ide scalco :	0 - use value in header 🔻	3	
Overr	ide Value of first sample (ms) :	0		
Verti	cal Unit :	s 💌		
Horiz	ontal Unit :	ft 🗾		
Ampli	tude Threshold :	1E+10		
Exec	ute			
(c) 200	08-2015 AASPI - The University of	Oklahoma		

Upon selecting **crop\_prestack** the ensuing window will appear:

🗙 AASPI program crop_prestack (R	elease Date: July 13, 2014)		
]] <u>F</u> ile			<u>H</u> elp
Crop input data to provide a s All headers are preserved.	maller, decimated volume	for parameter testir	ng.
Input file name (*.H):	_final_project/amatitla	n.H Browse	
Output cropped file name i(*.H	H): an_super_gather_10X1	0.H	
Typical			
Minimum Time/Depth (s):	)		
Maximum Time/Depth (s):	3		
Time/Depth Increment (s):	0.004		
Axis 2 min Offset no.:	L	3	
Axis 2 max Offset no.:	50	<u>/</u>	
Axis 2 inc Offset no.:	L		
Axis 3 min CDP no.:	9997		
Axis 3 max CDP no.:	11252		
Axis 3 inc CDP no.:	5		
Axis 4 min Line no.:	\$126		
Axis 4 max Line no.:	5171		
Axis 4 inc Line no.:	5		
Axis 5 min Unused axis.:	L		
Axis 5 min Unused axis.:	L		
Axis 5 inc Unused axis.:	L		
(c) 2008-2014 AASPI - The Un	iversity of Oklahoma		Execute

Click (1) *Browse*, and select *d\_rnmo\_ amatitlan*.*H* for your input seismic data. This should be a 4D reverse normal moveout migrated volume. Next (2) give the cropped volume an output file name, in our case, *d\_rnmo\_amatitlan\_super\_gather\_10X10*.*H*. Check that the (3) time, offset, CDP and Line values are correct for your survey. The results will be a supergather of your reverse normal out migrated volume (shown below), in which we can carry out semblance and IVA.



Figure 2. d\_rnmo\_amatitlan\_super\_gather\_10X10.H

Program **IVA Precompute Velocity Semblance** is first utility on IVA, you can also initiate the utility by typing **aaspi\_iva\_precompute\_semblance** on the terminal window:

AASPI - Interactive Velocity Analysis (Release Date: February 4, 2015)	X
Eile ASPI_Utilities	<u>H</u> elp
IVA Precompute Semblance Computes Semblance which will be used in Interative Velocity Analysis	
IVA Precompute Velocity Semblance	
Main Interative Velocity Analysis Uitility	
Interactive Velocity Analyis	
Velocity Interpolation (required for Prestack time migration)	
Velocity Interpolation	

Upon selecting the ensuing window will appear:

🗙 AASPI - program IVA Precompute Semblance (Release Date:February 4, 2015)
j <u>F</u> ile <u>H</u> elp
Compute the semblance on CRP (CMP) gathers
Input CRP or CMP gather file name (*.H): super_gather10X10.H Browse
*Unique Project Name: amatitlan
Suffix: 10x10
Use MPI:
Processors per node: 16
Node list: localhost
Verbose:
Velocity Geometry
Minimum Velocity (ft/s): 1000
Maximum Velocity (ft/s): 7000
Velocity Increment (ft/s): 30 5
Semblance Window (s): 0.02
(c) 2008-2014 AASPI - The University of Oklahoma Execute

Click (1) *Browse* to select your seismic amplitude volume; for our example we have *amatitlan\_super\_gather\_10X10.H.* Next, (2) give the project a *Unique Project Name* and *Suffix*. We chose *amatitlan* and *10X10* respectively.

Next, the user can define parameters under the Velocity tab. The (3) Minimum Velocity, (4) Maximum Velocity, (5) Velocity Increment and (6) Semblance window were set to 1000, 7000 and 30m/s and 0.02s in our example. Parameters (3) and (4) are chosen by considering the velocity range of your seismic data. Parameter (5) can be increased to minimize computation time.

The Geometry tab will allow the user to inspect the geometry of the survey; however, no parameters can be changed in this window.

As in all AASPI codes, program progress is echoed to the *xterm* from which **aaspi\_util\_prestack** was launched. The end of the print-out looks like the following image:

X	lin 8212@kwiatkowski:/raid5/lin 8212/p	rojects/3D_f	inal_project				×	
Т	this process, first cdp no. last (	de no. icdu	> 5	9997	11247	101		٦
	this process, first cdp no, last (	dp no. jodi	6	9997	11247	102		
	this process, first cdp no, last o	dp no. icd	· 7	9997	11247	103		
	this process, first cdp no, last o	dp_no, icdi	. 8	9997	11247	104		
	this_process, first_cdp_no, last_o	dp_no, jodi	> 1	9997	11247	105		
	this_process, first_cdp_no, last_o	dp_no, jod	> 2	9997	11247	106		
	this_process, first_cdp_no, last_o	dp_no, jod	> 3	9997	11247	107		
	this_process, first_cdp_no, last_d	dp_no, jod	o 4	9997	11247	108		
	this_process, first_cdp_no, last_0	dp_no, jod	o 5	9997	11247	109		
	this_process, first_cdp_no, last_d	dp_no, jod	> 6	9997	11247	110		
	this_process, first_cdp_no, last_0	cdp_no, jcd∣	» 7	9997	11247	111		
	<pre>this_process, first_cdp_no, last_d</pre>	dp_no, jodı:	> 8	9997	11247	112		
	this_process, first_cdp_no, last_0	cdp_no, jcd∣	> 1	9997	11247	113		
	<pre>this_process, first_cdp_no, last_d</pre>	dp_no, jod¦	> 2	9997	11247	114		
	<pre>this_process, first_cdp_no, last_d</pre>	cdp_no, jcd∣	» 3	9997	11247	115		
	<pre>this_process, first_cdp_no, last_d</pre>	dp_no, jod¦	o 4	9997	11247	116		
	<pre>this_process, first_cdp_no, last_d</pre>	cdp_no, jcd∣	» 5	9997	11247	117		
	<pre>this_process, first_cdp_no, last_</pre>	dp_no, jod¦	> 6	9997	11247	118		
	this_process, first_cdp_no, last_0	dp_no, jod¦	» 7	9997	11247	119		
	<pre>this_process, first_cdp_no, last_</pre>	dp_no, jod¦	> 8	9997	11247	120		
	this_process, first_cdp_no, last_(	dp_no, jod¦	> 1	9997	11247	121		
	<pre>this_process, first_cdp_no, last_c</pre>	dp_no, jod	> 2	9997	11247	122		
	this_process, first_cdp_no, last_(	dp_no, jod¦	o 3	9997	11247	123		
	<pre>this_process, first_cdp_no, last_c</pre>	dp_no, jod	» 4	9997	11247	124		
	this_process, first_cdp_no, last_0	dp_no, jodį	· 5	9997	11247	125		
	this_process, first_cdp_no, last_0	dp_no, jod	> 6	9997	11247	126		
	n_vrms= 81					_		
	first_line, last_line, current	line:	4126 5	166	4146	5		
	this_process, first_cdp_no, last_	dp_no, jodi	> 1	9997	11247	1		
	this_process, first_cdp_no, last_(	dp_no, jodi	~ <u>2</u>	9997	11247	2		
	this_process, first_cdp_no, last_(	dp_no, jodi	° 5	9997	11247	5		
	this_process, first_cdp_no, last_(	dp_no, jodi	> 4	9997	11247	4		
	this_process, first_cdp_no, last_(	ap_no, jodi	<b>ა</b> ხ	9997	11247	5		
	this_process, first_cdp_no, last_(	cap_no, jodi	> 6	9997	1124/	5		
	this_process, first_cdp_no, last_(	cap_no, jedį	· /	9997	11247	6		
	this_process, first_cdp_no, last_( ■	cap_no, jedį	> 8	9997	11247	8		

X	lin8212@kwia	tkowski:~	/raid5/pr	ojects	;/3D_	fina	al_proje	ect 📃 🗆 🗙
Γ	-rwxrwxrwx. 1	lin8212	faculty	380	Jul	11	11:05	iva_disp_semb.parms
	-rwxrwxrwx, 1	lin8212	faculty	374	Jul	11	11:05	iva_2D_display.parms
	-rw-rw-r 1	lin8212	faculty	118K	Jul	11	11:05	gather.bin
	-rw-rw-r 1	lin8212	faculty	2.5K	Jul	11	11:05	aaspi_iva_read_semb.out
	-rw-rw-r 1	lin8212	faculty	1.7K	Jul	11	11:06	aaspi_iva_2D_display.out
	-rwxrwxrwx. 1	lin8212	faculty	198	Jul	11	11:13	velocity_temp.txt
	-rw-rw-r 1	lin8212	faculty	118K	Jul	11	11:13	nmo_corrected_2term.bin
	-rwxrwxrwx. 1	lin8212	faculty	374	Jul	11	11:13	iva_nmo_display.parms
	-rwxrwxrwx. 1	lin8212	faculty	224	Jul	11	11:13	iva_2term_nmo_correction.parms
	-rw-rw-r 1	lin8212	faculty	1007	Jul	11	11:13	aaspi_iva_nmo_display₊out
	-rw-rw-r, 1	lin8212	faculty	1.1K	Jul	11	11:13	aaspi_iva_2D_nmo_corr.out
	-rw-rw-r 1	lin8212	faculty	19K	Jul	11	11:21	aaspi_iva_disp_semb.out
	-rwxrwxrwx, 1	lin8212	faculty	419	Aug	25	14:35	aaspiviewer_prestack.parws
	-rwxrwxrwx, 1	lin8212	faculty	12K	Aug	25	14:35	aaspi_aaspiviewer_prestack.out
	-rw-rr, 1	lin8212	faculty	0	Aug	25	14:43	amatitlan_super_gather_10X10_wor
	kflow.H.temp							
	-rwxrwxrwx, 1	lin8212	faculty	476	Aug	25	14:43	segy2aaspi_prestack.parws
	-rw-rr, 1	lin8212	faculty	0	Aug	25	14:43	test.H.temp
	-rwxrwxrwx, 1	lin8212	faculty	1.5K	Aug	25	14:43	ascii
	-rwxrwxrwx, 1	lin8212	faculty	3.1K	Aug	25	14:43	aaspi_segy2aaspi_prestack.out
	-rw-rr, 1	lin8212	faculty	15	Aug	25	16:13	semblance_amatitlan_10X10.H
	-rw-rr, 1	lin8212	faculty	15	Aug	25	16:13	semblance_amatitlan_10X10.H@@
	-rw-rr, 1	lin8212	faculty	15	Aug	25	16 <b>:</b> 14	semblance_amatitlan_10X10.out
	lin82120kviat	kowski:"/	/raid5/p	roject	ts/3	J_fi	inal_pr	roject\$

If you type '*ls-ltr*' in the above *xterm*, you find the most recent files to be:

This will show use that the output of program **Precompute Velocity Semblance** is called *semblance amatitlan 10X10.H*.

If you want to view the semblance result, you can do so using the **Prestack Data Viewer** which can be found in the **Prestack Utilities** window under the *Display Tools* tab.

<u>F</u> ile			<u>H</u> elp
AASPI_Viewer_Prestack			
Plots /Prestack data files			
Plot section:	Vertical Slices		
AASPI Input Gathers (*.H):		Browse	1
Colorbar file:	rainbow.sep	Browse	
Plot Title:	Semblance from velocity scan	1	
Minimum Time/Depth (s):	0		
Maximum Time/Depth (s):	2		
Time/Depth Increment (s):	0.004		
Axis 2 min Velocity () index:	1000		
Axis 2 max Velocity () index:	7000		
Axis 2 inc Velocity () index:	30		
Axis 3 min index:	9997		
Axis 3 max index:	11197		
Axis 3 inc index:	100		
Axis 4 min index:	4126		
Axis 4 max index:	5126		
Axis 4 inc index:	100		
Axis 5 min undefined	1		
Axis 5 max undefined	1		
Axis 5 inc undefined:	1		
Gain panel:	every -		
Reverse x-axis?	n		
Reverse y-axis?	n		
Want scale bar?	<u>y –</u>		
Automatic amplitude scaling?	Auto-Scale		
Min Amplitude :	0		
Max Amplitude :	0		
All positive?	n		
c) 2008-2014 AASPL The Univ	versity of Oklahoma	to ageniviouer pr	estack

Program **Prestack Data Viewer** is found under the *Display Tools* tab:

Select (1) *Browse* to find your semblance data, in our case, *semblance\_amatitlan\_10X10.H.* Upon confirmation that all other parameters have been automatically filled correctly select the *Execute* button.



The following image is the result of **IVA Precompute Velocity Semblance:** 

Figure 3.

This computed semblance will be the input to IVA.

#### **Program Interactive Velocity Analysis**

Program **IVA** or Interactive Velocity Analysis is used for creating a velocity model for automatic non-hyperbolic velocity analysis after prestack migration. Program **IVA** eliminates the need to import/export large prestack data and 3D velocity models that may be saved in a different format from a different commercial data base.

For **IVA**, the inputs include seismic amplitude and semblance. The output is a velocity pick file. Interactive Velocity Analysis utility can be initiated by clicking on **Interactive Velocity Analysis** or by typing **aaspi\_iva\_input\_output**:

🗙 AASPI - Interactive Velocity Analysis (Release Date: February 4, 2015)	×
Eile AASPI_Utilities	<u>H</u> elp
IVA Precompute Semblance Computes Semblance which will be used in Interative Velocity Analysis	
IVA Precompute Velocity Semblance	
Main Interative Velocity Analysis Uitility	
Interactive Velocity Analyis	
Velocity Interpolation (required for Prestack time migration)	
Velocity Interpolation	

The following GUI appears:

📉 IVA - Input		
]] <u>F</u> ile		<u>H</u> elp
Interactive Velocity Analysis - Inpu	ıt	-
Input AASPI File Name (*.H):	an_super_gather_10x10.H Browse	1
Input Semblance File Name (*.H):	lance_amatitlan_10X10.H Browse	2
Color Bar File:	el/sep_colors/rainbow.sep Browse	3
AASPI File Type :	cmp_gathers	
*Unique Project Name:	amatitlan 4	
Suffix:	10X10 5	
Velocity Geometry	N	
Minimum Velocity (m/s): 1000		
Maximum Velocity (m/s): 7000		
Velocity Increment (m/s): 30		
Half Block Length (s): 0.02		
(c) 2008-2014 AASPI - The Univer	sity of Oklahoma	Execute

Select (1) *Browse* and input the super gather of the reverse normal moveout prestack seismic data, which in this example is *amatitlan\_super\_gather\_10X10.H*. Next, select (2) *Browse* and locate the semblance file previously generated in program **semblance velocity** scan, in our example *semblance\_amatitlan\_10X10.H*. The (3) color bar will be automatically set as *'rainbow'*. The output velocity file name will concatenate the (4) *unique project name* and (5) *suffix* to create an ASCII file called *'velocity\_amatitlan\_10X10.txt'*. The *Velocity* tab and *Geometry* tab can show you previously selected parameters for QC but cannot be changed in this window. By clicking *Execute* another GUI, **Basemap Application**, will appear.

#### **Interactive Basemap Application**





Using the **Basemap Application** the user can now select a CDP and Line intersection, display the subsequent semblance panel and pick velocities of that intersection. To do this: (1) Click the "CDP" or "Line" button to move the velocity analysis location (yellow circle). Alternatively, you can move the yellow circle to a specific location by (2) filling in the "Current CDP No" and "Current Line No". When you are ready to pick velocities, (3) click "PICK" to start the velocity analysis in the next GUI. The seismic gather and semblance windows will show up together.



Seismic Gather of user-defined CDP No. and Line No.:

Figure 5.

Semblance display of user-defined CDP No. and Line No.:



Figure 6.

The (1) amplitude threshold can be changed to increase visibility of the semblance gather. After clicking "APPLY" the changes will be made on the gather. If you want the software to auto-scale the amplitude, (2) click "CLEAR".

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(1) To begin picking, place your mouse on the semblance panel and *LEFT* click. A white square will appear in the semblance display. Repeat this for as many locations as seen necessary. The results will be the white velocity curve connecting your semblance picks. If we want to remove an erroneous pick, put the mouse near it and *RIGHT* click.

A stretch mute can be applied by selecting (2) "Mute Criterion" parameter. We have decided that 1.5 appears adequate for our gather. To apply the mute (3) place a checkmark in the "Mute Option" and click (4) "APPLY NMO". A new window will appear showing the NMO corrected gather with your velocity picks applied.



Display of NMO corrected gather with (Left) no mute applied and (Right) with a mute applied:

Figure 8.

Once you have inspected and are satisfied with the NMO result, (5) click "SAVE" and "EXIT" to close the semblance window and save you picks into an ASCII velocity pick file.

Let's examine the ASCII format velocity pick file:

-rw-rw-r 1 lin8212	lin8212	738	Jul	- 9	15:49	semblance amation OK.H
-rw-rr 1 lin8212	aaspi	741	Jul	9	16:13	semblance_amatitlan_OK.H
-rw-rw-r 1 lin8212	lin8212	15	Jul	9	17:18	velocity_a_
-rwxrwxrwx 1 lin8212	lin8212	440	Jul	10	12:52	aaspiviewer_prestack.parms
-rwxrwxrwx1 lin8212 🗌	lin8212 /	4.4K	Jul	10	12:53	aaspi_aaspiviewer_prestack.out
-rw-rw-r 1 lin8212	lin8212 🗄	394K	Jul	10	13:06	semb.bin
-rwxrwxrwx1 lin8212	lin8212	384	Jul	10	13:17	iva_basemap.parms
-rwxrwxrwx1 lin8212 🗌	lin8212	307	Jul	10	13:18	iva_read_gather_semblance.parms
-rwxrwxrwx1 lin8212	lin8212	402	Jul	10	13:18	iva_disp_semb.parms
-rwxrwxrwx1 lin8212	lin8212	396	Jul	10	13:18	iva_2D_display.parms
-rw-rw-r 1 lin8212	lin8212 :	118K	Jul	10	13:18	gather, bin
-rw-rw-r 1 lin8212 🗌	lin8212	7.9K	Jul	10	13:18	aaspi_iva_read_semb.out
-rw-rw-r 1 lin8212 🗌	lin8212 :	1.1K	Jul	10	13:18	aaspi_iva_2D_display.out
-rw-rr 1 lin8212 🧃	aaspi	213	Jul	10	2014	velocity_amatitlan_OK.txt
-rwxrwxrwx1 lin8212 🗌	lin8212	198	Jul	10	2014	velocity_temp.txt
-rwxrwxrwx1 lin8212 🗌	lin8212	224	Jul	10	2014	iva_2term_nmo_correction.parms
-rw-rw-r 1 lin8212	lin8212 :	118K	Jul	10	2014	nmo_corrected_2term.bin
-rwxrwxrwx1 lin8212 🗌	lin8212	396	Jul	10	2014	iva_nmo_display.parms
-rw-rw-r 1 lin8212 🔅	lin8212 :	1.1K	Jul	10	2014	aaspi_iva_nmo_display.out
-rw-rw-r 1 lin8212 🗌	lin8212 :	1.1K	Jul	10	2014	aaspi_iva_2D_nmo_corr.out
-rw-rw-r 1 lin8212 🔅	lin8212	13K	Jul	10	2014	aaspi_iva_disp_semb.out
lin82120opal:/raid5/li	n8212/pr	o,ject	:s/3	0_ <b>f</b> :	inal_p	roject\$ gedit velocity_amatitlan_OK.txt &

To open the file type gedit *"velocity\_amatitlan\_10X10.txt"* into the xterm window. A document will appear with your velocity picks :

🍞 velocity	_amatitla	an_10X10.	txt (~/ra	aid5/proje	cts/			x
<u>F</u> ile <u>E</u> dit	<u>V</u> iew	<u>S</u> earch	<u>T</u> ools	<u>D</u> ocum	ents	<u>H</u> elp		
New Op	en 🖌	<u>♪</u> Save	) Print	S Undo	Redo	CL	l It	~
📄 velocit	y_amatit	lan_10X1	0.txt	×				
velocit       126     106       0.217993     0.446367       0.217993     0.446367       0.861592     1.069204       1.3356     1.59       1.59     1.69204       1.3356     1.989619       4126     10       0.02402     4       0.38062     1.280277       1.494810     1.737024       1.975779     4126       4126     106       0.38062     0.352941       0.792388     0.968858       1.314879     1.567474       1.823529     1.982699       4126     106       0.352941     0.792388       0.968858     1.314879       1.567474     1.823529       1.982699     4126       0.968858     1.314879       1.567474     1.823529       1.982699     4126       0.968858     1.314879       1.567474     1.823529       1.982699     4126       0.927682     0.349481       <	y_amatii 37 10 1707.02 1697.33 1832.92 2104.11 23 19 20.58 2016.94 20.58 10 1687.65 1677.96 1687.65 1784.56 2016.94 2278.45 2016.94 267.11 2801.45 2830.56 57 8 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 2946.73 3004.84 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 1590.79 1571.42 1755.44 1997.57 2462.46 2675.54 2946.73 3004.84 1629.54 1629.54 1629.54 1629.54 1629.54 1629.54	11729     11729     11729     11729     11729     11729     11729     11729     111     112     1131     114     1155     1165     1165     1165     11662     1167     11662     1167     11662     1167     11662     1167     11662     1167     11662     1167     11662     1167  1167						
1.979239	3053.26	68799						~
Plain Te:	α <b>∨</b> Τ	ab Width:	8 🗸	Ln 1, Col	1		INS	

The value of "5000" indicated the line no; "10000" indicated the CDP no; and "9" indicated by arrow 3 is the number of picked time – velocity pairs. (4) The first column is the time of the pairs, and (5) the second column is the velocity of the pairs.



Figure 9.

Returning to the base map, (1) the green analysis point shows that it has been picked, (2) the yellow analysis point now is active, and (3) the red analysis points are currently unpicked. You can continue to navigate through the basemap until all or an adequate number of semblances are picked, where you can then move on to **velocity interpolation** 

## **Program Velocity Interpolation**

Once we have finished picking a grid of semblance panels, we need to interpolate them to generate a 3D velocity model. Select, program **Velocity Interpolation**, the third utility on the IVA utility. You can also initiate it by typing **aaspi\_iva\_velocity\_interpolate** on the terminal window (see next page).

AASPI - Interactive Velocity Analysis (Release Date: February 4, 2015)	٢				
Eile AASPI_Utilities	lp				
IVA Precompute Semblance Computes Semblance which will be used in Interative Velocity Analysis					
IVA Precompute Velocity Semblance					
Main Interative Velocity Analysis Uitility					
Interactive Velocity Analyis					
Velocity Interpolation (required for Prestack time migration)					
Velocity Interpolation					

The following GUI appears:

X IVA - Interpolation				
∬ <u>F</u> ile			<u>H</u> elp	
Interactive Velocity Analysis - Interpolation				
Input Picked Velocity File Name	(*.*): locity_amatitlan_10	X10.txt Browse		
*Unique Project Name:	amatitlan			
Suffix:	10X10			
Parameters				
Minimum Scan Velocity (m/s):	1000			
Maximum Radius:	300			
sigma_h:	20	3		
sigma_z:	4			
nlag_h:	30			
nlag_z:	5			
h_sm_r:	2			
		8		
(c) 2008-2014 AASPI - The University of Oklahoma				

Select (1) *Browse* and input the \*.*txt* file with your velocity picks. Next assign a *Unique Project Name* and *Suffix*. Add the (2) Minimum Scan Velocity to be the same value as used in the previous programs. Next, infill the (3) Maximum Radius, which is the radius for searching for picked velocities. The (4) sigma\_h and (5) sigma\_z define the half-length for a Gaussian filter in

the horizontal and vertical directions, respectively. The (6)  $nlag_h$  and (7)  $nlag_z$  are the number of lag steps in the horizontal and vertical direction, respectively. Finally, (8) the  $h_sm_r$  is a smoothing operator in the horizontal direction. Upon filling the interpolation parameters select *Execute*.

To display your 3D velocity field, open the **AASPI QC Plotting** under the *Post Stack Utilities* tab. Select *Browse* and find your interpolated velocity field. Then select *Execute* to obtain the following velocity panels.

X AASPI program aaspi_util - Post Stack Utilities (	(Release Date: July 13, 2014)					
Eile Volumetric Attributes Formation	attributes Display Tools Other Utilities Set AASPI Default Parameters Help					
SEGY to AASPI format conversion (multiple files)	AASPI to SEGY format conversion (single file) AASPI QC Plotting AASPI Workflows AASPI Prestack Utilities					
AASPI QC Plotting - A quick tool to display AASPI-fromat attribute volumes						
AASPI format input file name (*.H):	al_project/Amatitlan_Stack_workflow.H Browse					
Colorbar file name:	rainbow.sep Browse					
Enter plot title:	3D Velocity Data					
Plot section:	Inline					
Minimum Time/ Depth:	0					
Maximum Time/ Depth:	2					
Time/Depth Increment:	0.002					
Minimum CDP:	9997					
Maximum CDP:	11253					
CDP Increment:	1					
Minimum Inline:	4126					
Maximum Inline:	5176					
Inline Increment:	10					
Gain panel:	all 🔟					
Reverse x-axis?	n					
Reverse y-axis? (Default is positive dowr	n) auto 🔟					
Want scale bar?	y					
Auto - Scaling?	Auto-Scale					
Min Amplitude :	0					
Max Amplitude :	4243.46					
All positive?	n					
Execute						
(c) 2008-2014 AASPL. The University of Oklahoma						

The following GUI will appear:



Figure 10. 3D Velocity Filed

The end result is a new 3D velocity model which can now be used for a prestack migration.