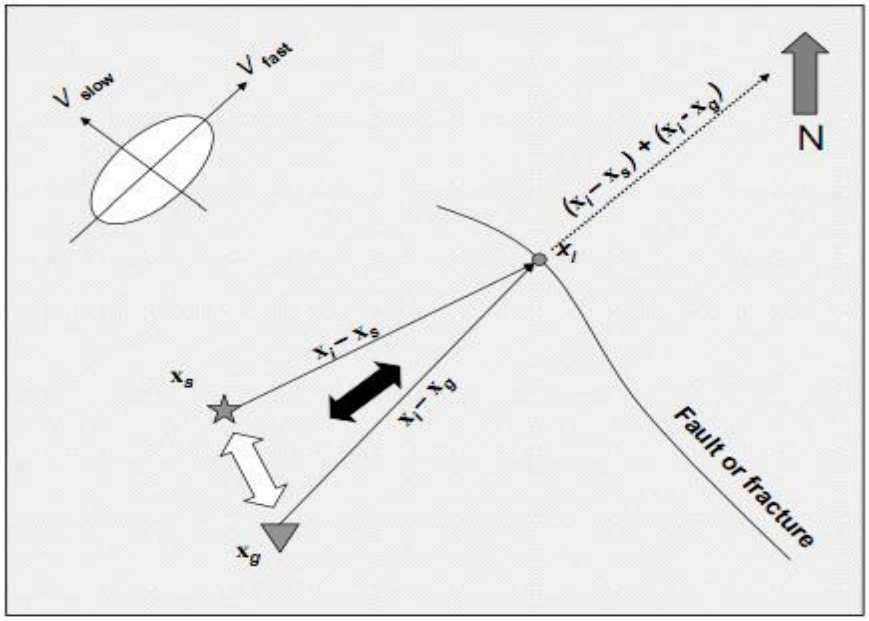
Seismic imaging – PROGRAM aaspi_azim_offset_mig

Program **aaspi_azim_offset_mig** is a prestack time migration based on the Kirchhoff algorithm which adds the anti_aliasing operator based on Gray, S. H. (1992). Program **aaspi_azim_offset_mig** divides the seismic data into bandpass filtered data, and then migrates the data on selective frequency based on the dip information from source and receiver to image point.

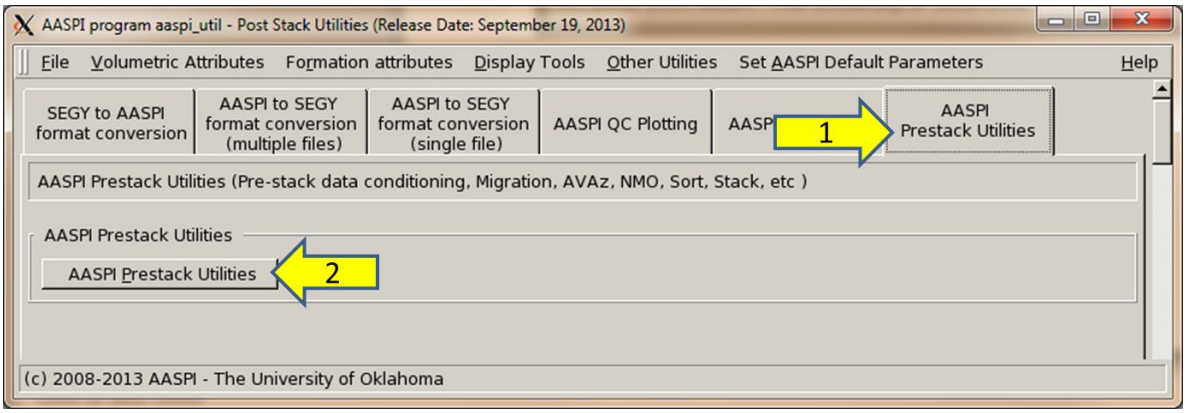
Perez and Marfurt (2008) proposed a new azimuth binning algorithm for Kirchhoff prestack migration, consisting of sorting the seismic data by the azimuth of average travel path from source to subsurface image point and back to receiver, rather than the azimuth between source and receiver directly. The new azimuth binning allows for identification of image contribution from out-of–the-plane, steeply dipping reflectors, fractures, and faults, and it can migrate the original seismic data to be 5 dimensional gathers (e.g. *time*, *azimuth*, *offset*, *cdp_no*, *Line_no).*



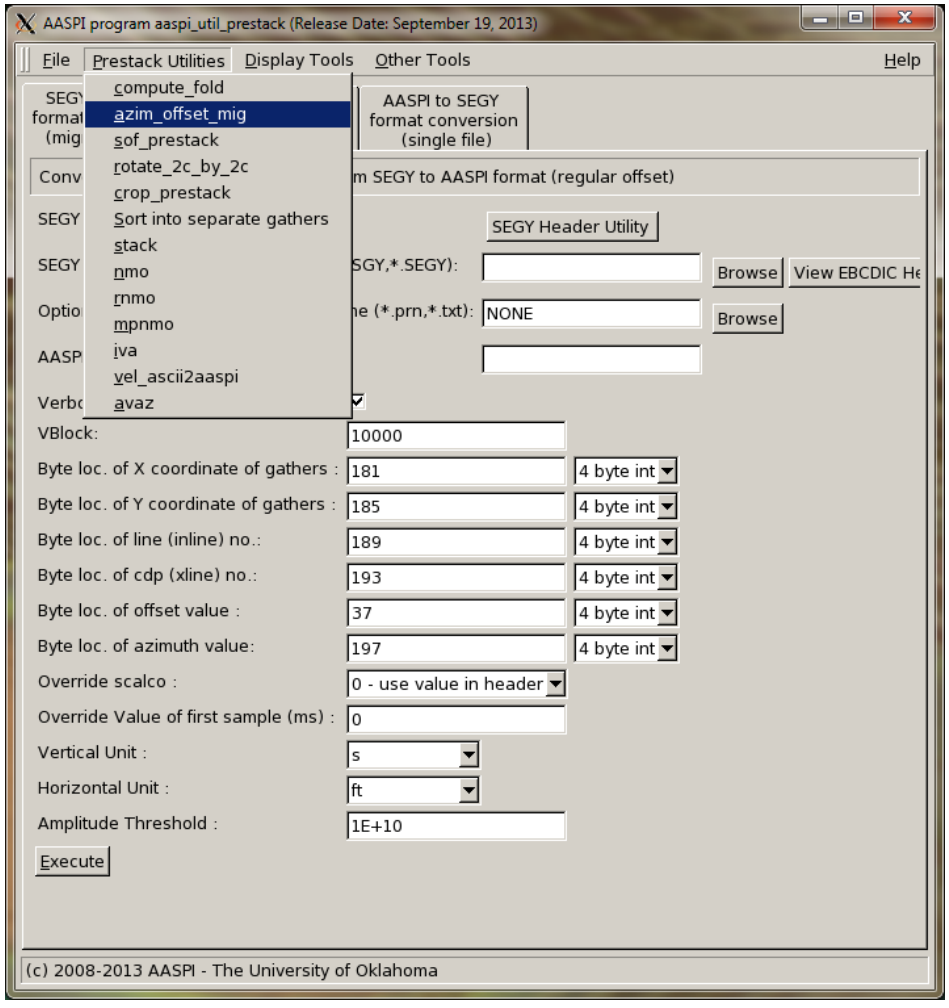
Kui and Marfurt (2009) modified the migration to utilize MPI, which can now run on numerous processors, reaching high levels of efficiency.

Launching the Graphical User Interface (GUI) - aaspi_azim_offset_mig

You can open the Prestack Utility from the aaspi_util GUI (or type : aaspi_util_prestack)

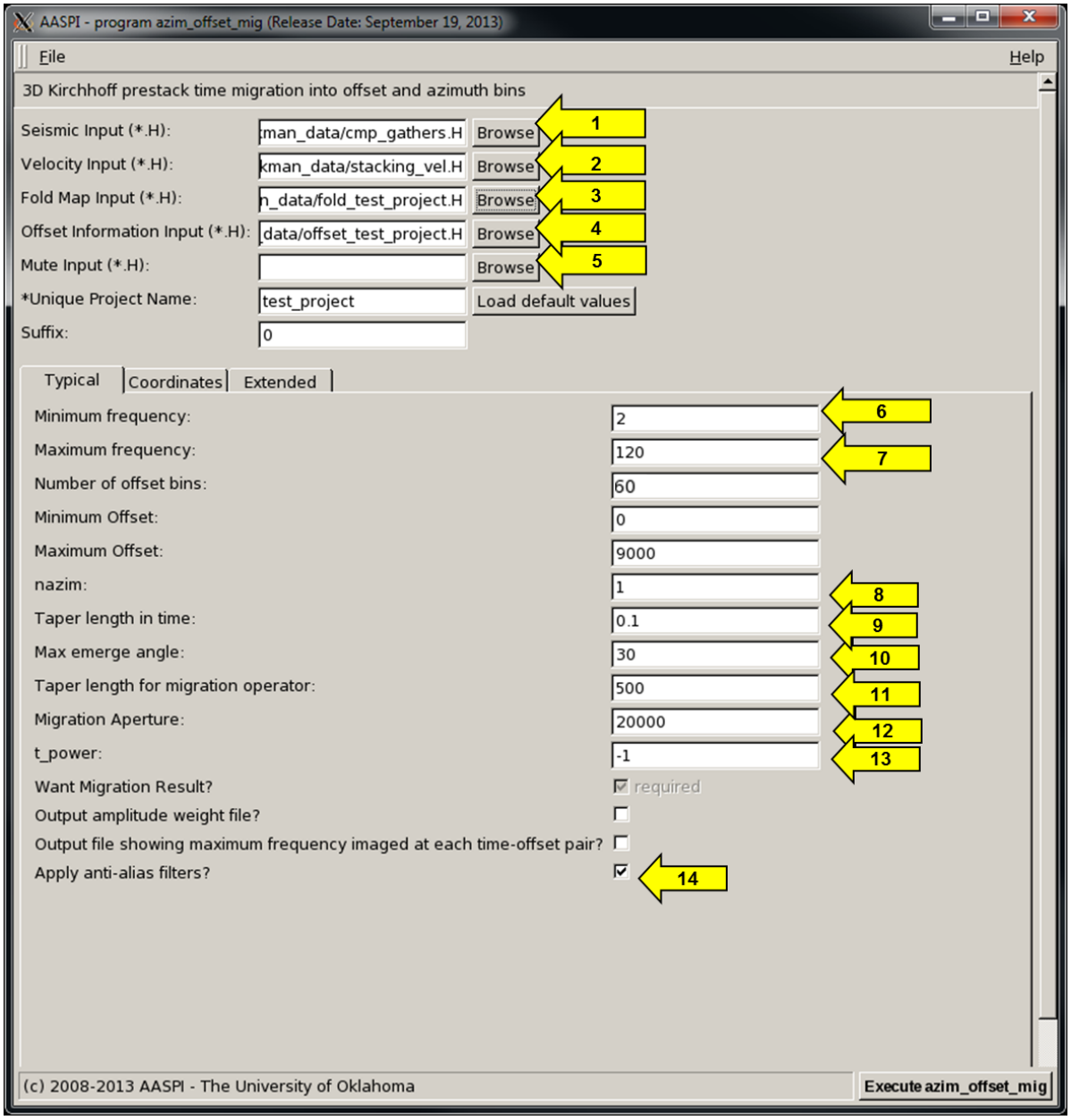


The following GUI appears:



Note: You can also invoke the **aaspi_azim_offset_mig** GUI directly, by typing:

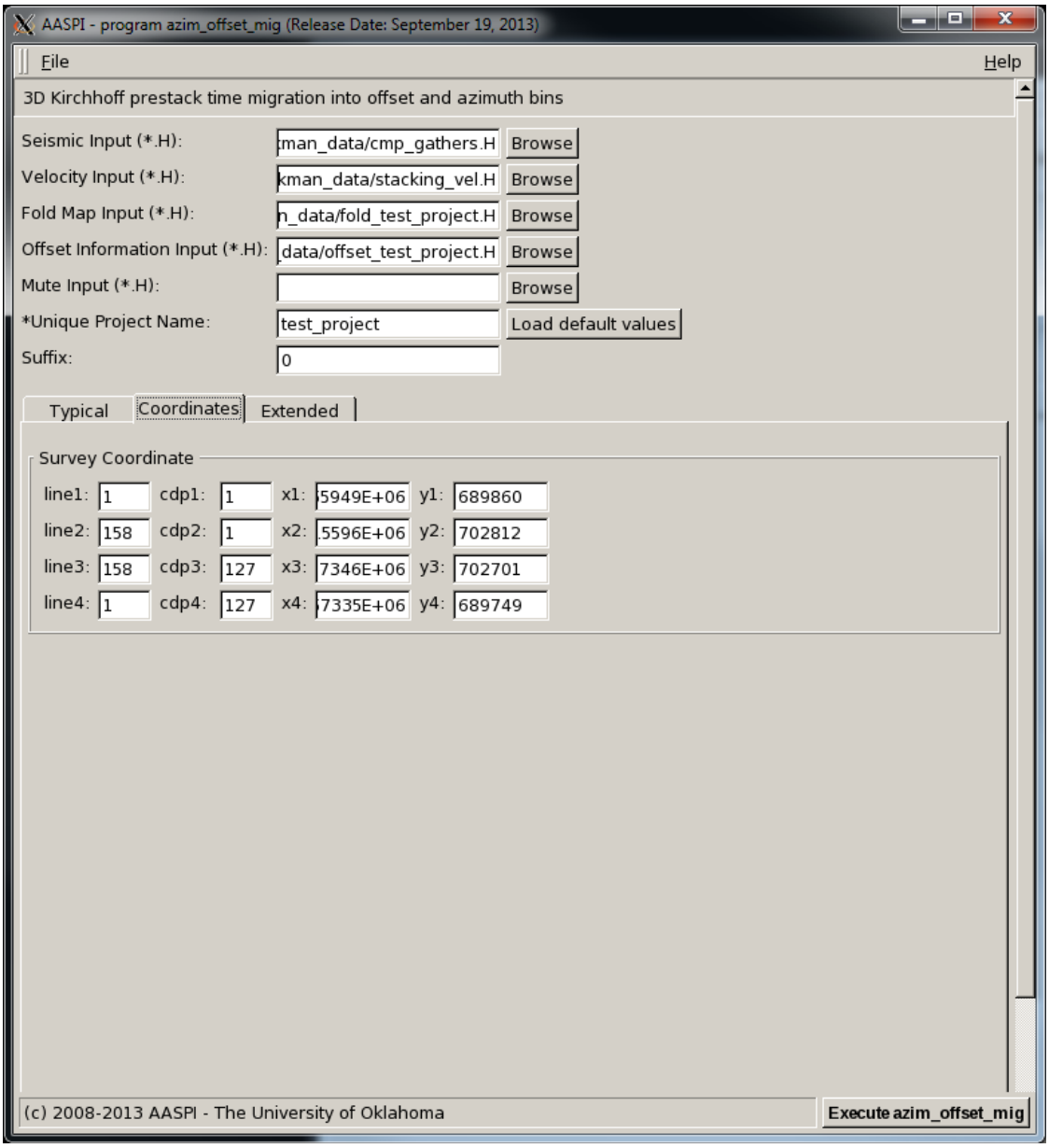
aaspi_azim_offset_mig &



First, (1) select your original seismic gathers, which in this example is cmp_gathers.H. Next (2) select the velocity file, which in this example is stacking_vel.H. As, we have already generated a fold map (3), we input the fold map here, as well as we generated offset information file when we computed the fold, (4) we select the offset information file. Selecting (5) a mute file is optional. Next we see the default parameters. The minimum frequency (6 & 7) and maximum frequency is the frequency range applied to the original gathers before migration. Following that, we see the offset and azimuth information, with default values above, indicating that **aaspi_azim_offset_mig** will migrate the data offsets of 0 ft to 9000 ft, with a 500 ft increment and single azimuth bin. Also, the taper length (9) in time means the taper applied to the filter.

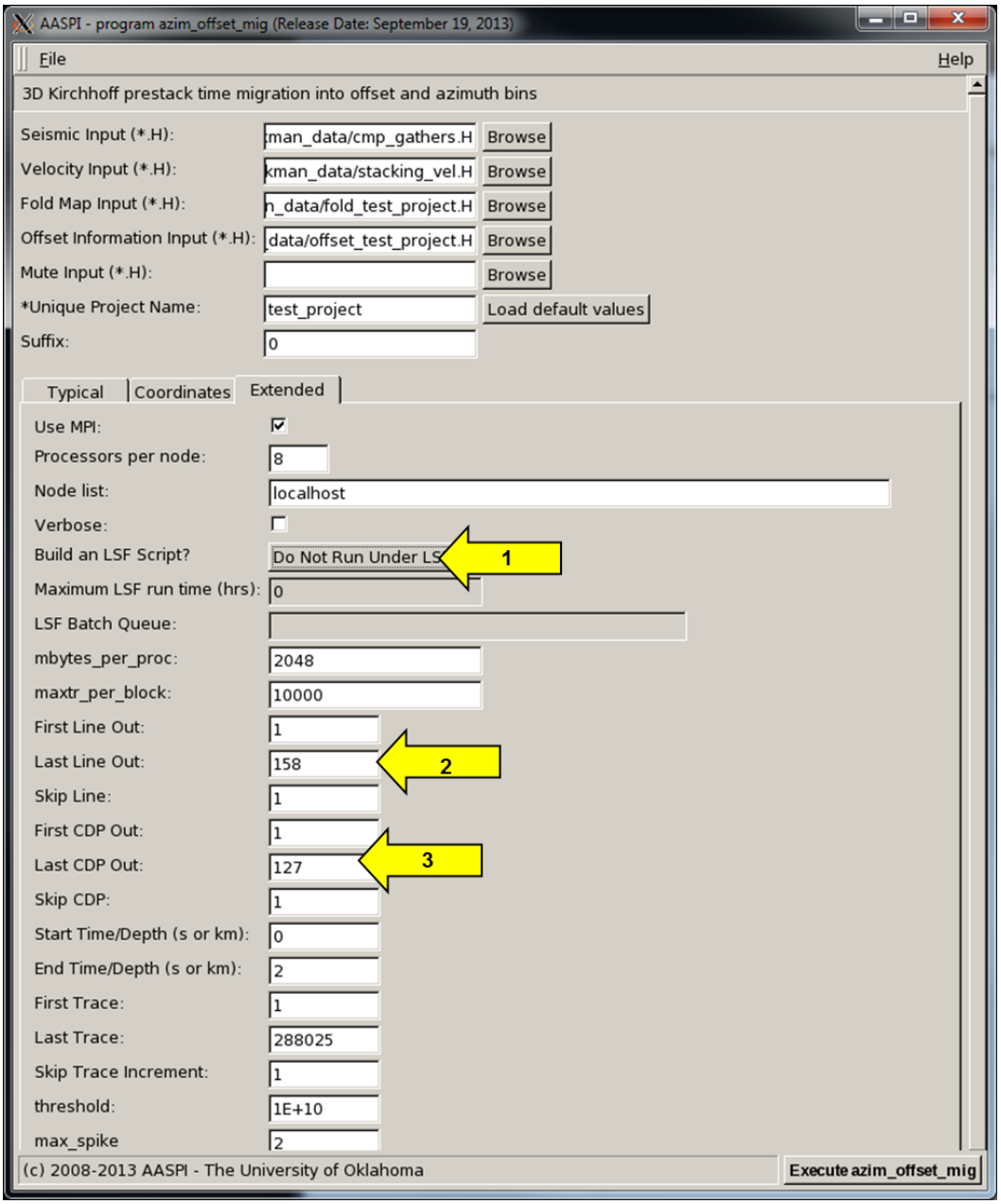
Next is the max emerge angle (10) which denotes the maximum emergence angle to be migrated, and the taper length for migration operator (11) represents the taper length applied to the edge. In addition, you can change the migration aperture (12) as desired, with a default value of 20000 ft. Moreover, you can output the migration weight and alias frequency result if wanted, which can serve as quality control for the resulting migration.

When you click the Coordinates tab, it appears as below:



The coordinate information is based on the velocity file. It can read from the velocity history file automatically.

When you click the extended tab, the following window appears:

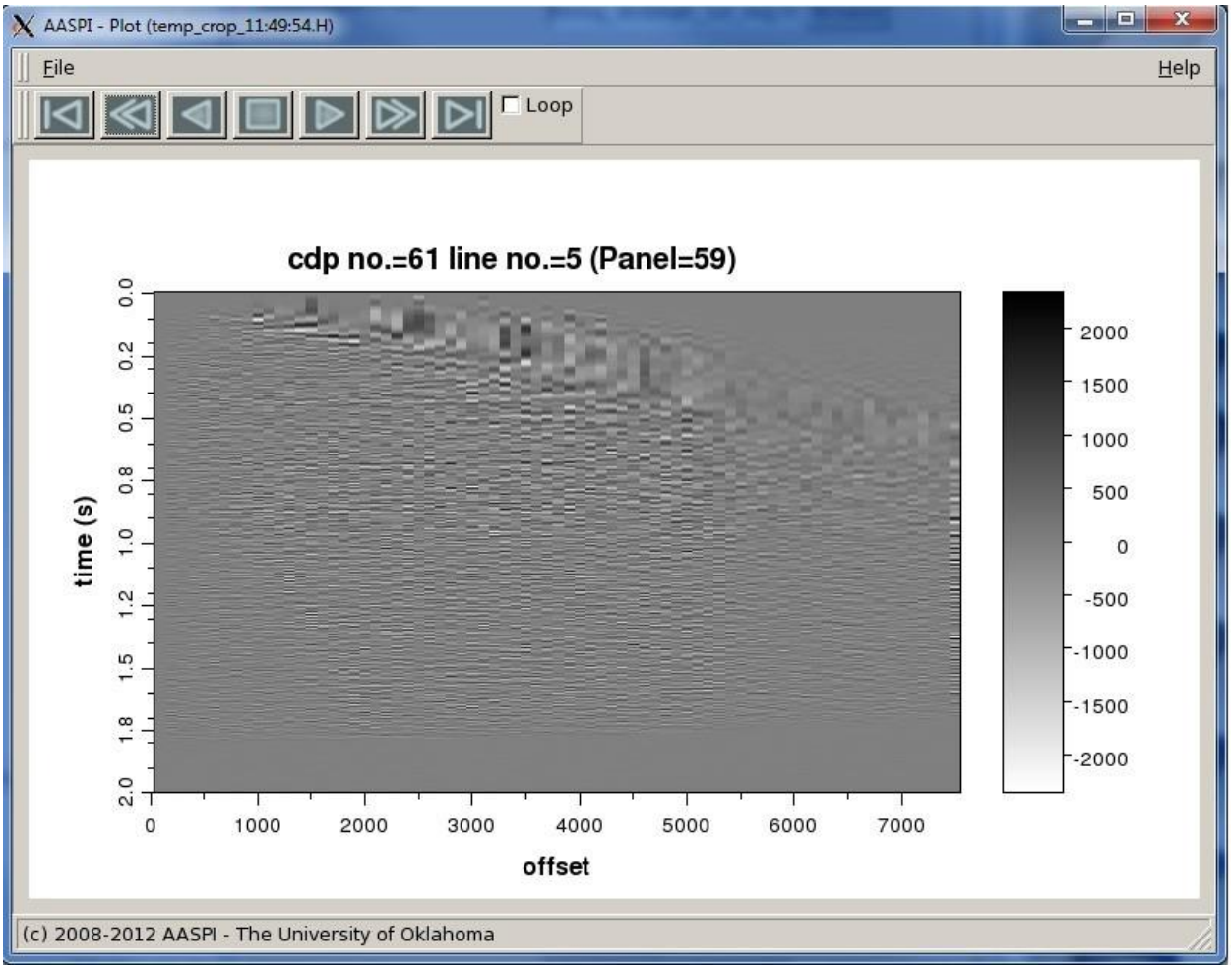


From this window you can choose to use MPI and how many processors per node to use. Also, you can put in control information, for example, there are 158 lines (2) and 127 CDPs (3), you can choose to only output from line 10 to line 120 and from CDP 10 to CDP 100. The same applies with the skip line and skip CDP.

In addition the program will print out information like this to allow you to monitor the program's progress, the flow looks as follows:

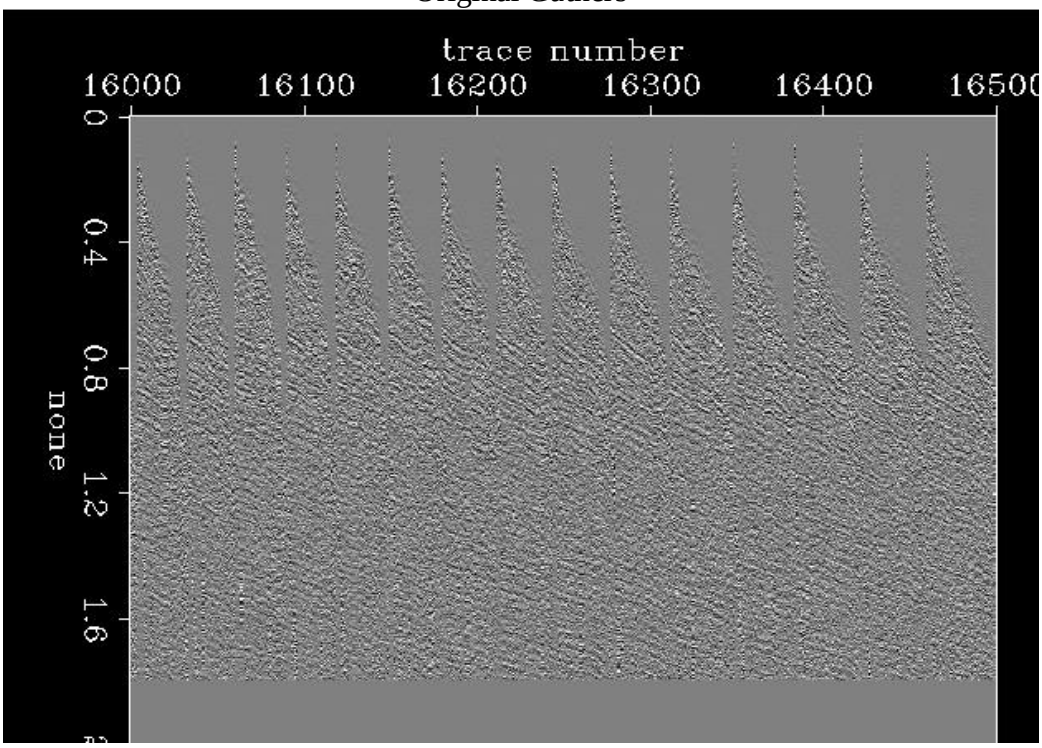
```
119.048 120.000  39.960   0.001        0.000E+00   0.748E+03   0.000E+00   0.105E+01
119.544 120.000  39.960   0.000        0.000E+00   0.751E+03   0.000E+00   0.242E+00
emerge_max,tanmax    30.00000      0.5773503
emerge_max,tanmax    30.00000      0.5773503
emerge_max,tanmax    30.00000      0.5773503
emerge_max,tanmax    30.00000      0.5773503
jr,r,start_amp(jr),end_amp(jr),tmax,smin2 0  0.0000000E+00 0        1000   2.000000      4.5512287E-09
jr,r,start_amp(jr),end_amp(jr),tmax,smin2 1   109.999 11        1000   2.000000      4.5512287E-09
jr,r,start_amp(jr),end_amp(jr),tmax,smin2 2   219.999 21        1000   2.000000      4.5512287E-09
jr,r,start_amp(jr),end_amp(jr),tmax,smin2 3   329.998 31        1000   2.000000      4.5512287E-09
```

As, we plot the migrated output data on the AASPI plot on one CDP point we get :

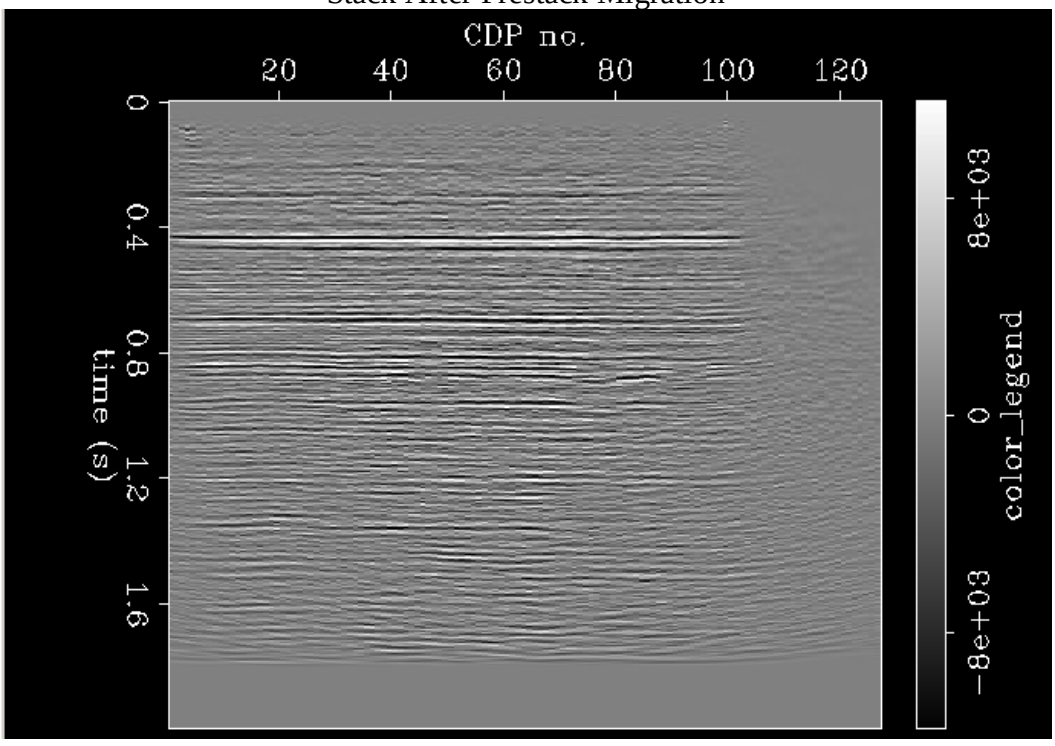


We can see the improvement in the image as we see the original gather and the final stacked data.

Original Gathers



Stack After Prestack Migration



References :

Gray, *S. H.*, *1992*, Frequency-selective design of the Kirchhoff migration operator: *Geophysical* prospecting, 40, 565-571

T Perez, G. and K. J. Marfurt, 2008, New azimuthal binning for improved delineation of faults and fractures Geophysics, 73, S7-S15.