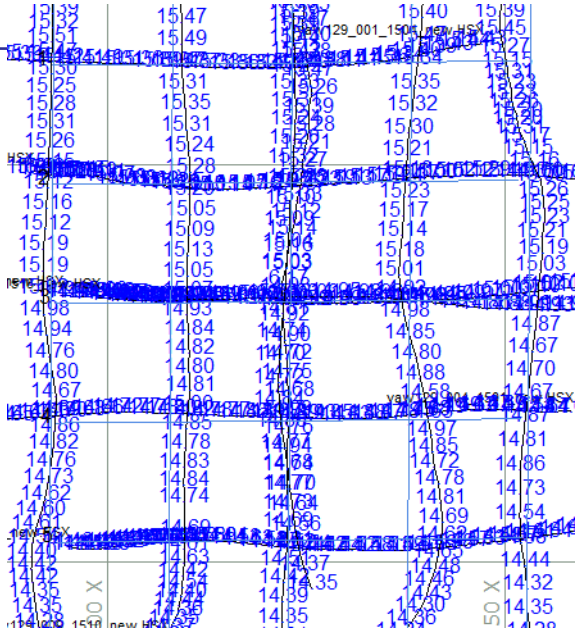
GeoSwath Performance Testing

By Dave Maddock

One of the most common questions we get at HYPACK is ‘What is the "best" configuration of filtering and binning options for interferometry data?’. Given the HYSWEEP® limit of 1440 beams per ping, clearly we have to thin the data in some way to accommodate the software. Furthermore, some obvious noise cleaning is needed during acquisition so we don't spend an eternity post-processing point clouds. The typical HYPACK® methodology has been to bin the data to 300-500 beams across the swath with a fixed beam footprint. Others have insisted that logging the limit of 1440 beams improves data quality (and regularly request that the software be re-engineered to remove this limitation). But what is the optimal configuration and can we quantify what effect an additional 1000 points has on the data quality? I tagged along on a performance test survey using a GeoSwath with HYPACK® to find out.

FIGURE 1. *Track Line Data for Performance Testing*

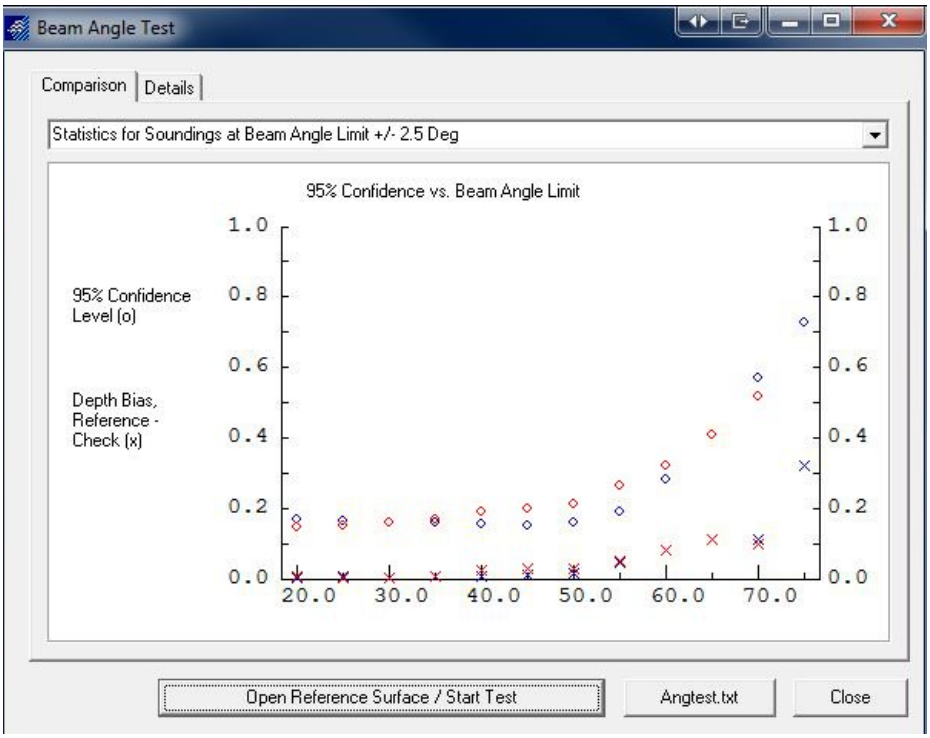


The MBMAX 'Beam Angle Test' estimates the repeatable accuracy of a multibeam at different angles by comparing check lines to a reference surface. We ran 10 lines in a grid for 400% coverage and the 2 center lines a second time as our check lines.

During acquisition, we generated one set of HSX files binned at 450 beams with a footprint of 20cm. Because HYSWEEP® was configured to also log raw RDF files, I was able to reprocess the RDF files with different filter and binning settings in the office using the IFFilter utility. The second set was binned to 1428 beams with a bin size of 7cm. In the 'high density' data set, a large percentage of the bins had 3 or fewer samples, many had only a single point so there was very little averaging taking place.

A reference surface was created for each set of lines by filtering out beams within the 10 degrees under nadir and beyond 45 degrees, then gridded to 1m x 1m and averaged. The beam angle test takes the remaining two lines, compares them to the reference surface, and generates a graph of the 95% confidence levels across the swath. For comparison, I've overlaid both graphs onto a single axis. The 'low density' data set is colored red; the 'high density' is colored blue:

FIGURE 2. *Performance Test Results --High Density Data (blue) vs Low Density Data (red)*



As you can see, the curves are very similar, although the higher density data did improve accuracy a bit between 40 and 60 degrees. However, this also increased processing time in MBMAX as it had to process 3x the number of points.

Interestingly, the 'high density' data set also showed more noise in the nadir region, as you can see when comparing the two reference surfaces. (Note that these surfaces exclude beams beyond 45 degrees.) Figure 3 is a gridded XYZ of the difference between the two surfaces. Here you can see the higher differences along the track lines.

FIGURE 3. *Gridded XYZ Representing the Differences between the High and Low Density Data Sets*