The Mega-bin technique

In this approach to 3D survey design, it is attempted (the philosophy is) to sample all four spatial coordinates of the 5D prestack wavefield as well as possible. Because of the high cost of dense sampling, this objective leads to coarse sampling of the four spatial coordinates with ensuing difficulties in the application of spatial filters and prestack migration. Alias-free sampling of the whole 5D prestack wavefield is clearly too expensive. Often, it is also impractical, as it requires free access to the whole survey area. The reason that this technique still gives acceptable results for the reported situations, may be that tests were carried out in subhorizontal geology, so that interpolation in common-offset gathers can be quite successful for the dominant reflections (this is the same situation as described in my discussion of "interpolation beyond Nyquist"). Again, fine detail must get lost with coarse sampling.

Instead, in the 3D symmetric sampling approach, we attempt (the philosophy is) to properly sample the single-fold subsets of the chosen areal or line geometry. If we succeed in that more modest objective, the subset's underlying continuous wavefield can be fully reconstructed. This more modest aim is achieved by dense enough sampling of the varying coordinates in each subset.

(This is adapted from a paragraph of the paper 3-D symmetric sampling (Geophysics, **63**, 1629-1647).

Some further comments: An advantage of the Mega-bin technique is its (near) uniformity in all spatial coordinates. This greatly reduces the visible geometry imprint. In contrast the orthogonal geometry has many internal boundaries due to the edges of the cross-spreads. Another advantage of the Mega-bin technique is its capability of building high fold for relatively shallow levels. Of course, this is achieved by the high density of shots and receivers per km². The relatively high fold tends to compensate for the migration noise caused by the coarse sampling. In general, lower fold will be sufficient when using a well-sampled cross-spread geometry, because this geometry only suffers from migration noise along the edges of each cross-spread. The comparison between the Mega-bin technique and the cross-spread technique given in Goodway & Ragan, Proceedings 1997 SEG Summer Research Workshop, uses a low-fold cross-spread geometry with rather coarse sampling (60 m), short inline geophone arrays and no shot arrays. In the given circumstances (subhorizontal geology, access situation) this cannot compete with the high-fold Mega-bin data.