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Circular synthetic aperture sonar results from autonomous underwater vehicle trials

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The principle of synthetic aperture sonar (SAS) is to combine successive pings coherently from different observation angles in order to increase the azimuth resolution. By collecting data along a circular track, a circular SAS (CSAS) image, or tomographic image, can be made. The image reconstruction can be done either incoherently, fully coherently, or partially coherently where each sub-aperture of coherent processing consists of a section of the circle. In target classification, CSAS has several benefits: the object is observed from all aspect angles giving a better perception; the resolution in the image increases.
In this paper, we calculate required accuracy in navigation, bathymetry and sound velocity for successful circular SAS. Finally, we show circular SAS images of small targets from real data collected by the HUGIN autonomous underwater vehicle carrying the Kongsberg HISAS 1030. We test different beamforming strategies, and show the effect of coherent and incoherent tomographic imaging.