

## Broad band acoustic ranging and velocimetry

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Acoustic ranging has a long history of development beginning with sonar in World War II and continuing with the advent of medical ultrasound. Acoustic velocimetry (velocity measurement) is not as common but has been used to measure blood flow in the body. Simultaneous measurement of range and velocity is used in some medical ultrasound imaging but the resolution is coarser than with conventional medical imaging (ranging only). In the conventional approach to acoustic ranging and velocimetry, short broad bandwidth pulses provide better range resolution while long narrow bandwidth pulses provide better velocity estimates.

In this work we apply a new optical technique developed by Dave Erskine for white light ranging and velocimetry to the acoustic case. We generalize the technique to *coherent* broad band pulses and test it with spheres pulled through a specially designed water tank. We compare the sensitivity of the broad band technique with the conventional narrow band approach for velocity measurements. These experiments show that both range and velocity can be accurately measured with broad band pulses without degrading the range resolution. The technique can be easily applied to conventional sonar or radar, and medical imaging.

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