Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

See Through the Static: 3D Synthetic Aperture PIV JESSE BELDEN, MIT, TADD T. TRUSCOTT, NUWC, ALEXANDRA H. TECHET, MIT — A new method for resolving three-dimensional (3D) fluid velocity fields using a technique called synthetic aperture particle image velocimetry (PIV) is presented. The method makes use of the lightfield imaging and synthetic aperture refocusing techniques that are emerging in the imaging community. Images are captured using an array of cameras positioned on one plane such that the fields of view of the cameras overlap and images can be easily recombined in software using a warp-shift-average algorithm to digitally refocus on different planes. The result is sharply focused particles in the plane of interest, whereas particles out-of-plane appear blurred. The 3D intensity field of particle-laden flows can be reconstructed by refocusing throughout the entire volume and filtering out the blurred particles. 3DPIV techniques can then be applied to these intensity fields to extract velocity data. This technique shows the potential of enabling larger volumes to be resolved with more particles, yielding higher spatial resolution than existing methods. A simulated vortex ring flow field demonstrates the capability of the technique for resolving vector fields in 3D.

Jesse Belden
MIT

Date submitted: 04 Aug 2009 Electronic form version 1.4