Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The Uncertainty of Volume-Flow Rate Inflow/Outflow Measurement By Integrating PIV Velocity Fields RICK CRESSALL, Univ of Notre Dame, ROBBIE SCHAAP, Utah State University, DOUGLAS R. NEAL, LaVision Inc, ALEX MYCHKOVSKY, Naval Nuclear Laboratory, BARTON L. SMITH, Utah State University — The purpose of this work is to assess the performance of non-intrusive volume-flow rate measurements acquired by various Particle Image Velocimetry (PIV) techniques. Both two-component (2C) and stereo (3C) PIV data sets were acquired at the exits of a high aspect ratio rectangular and round planar nozzles for turbulent flow rates of Reynolds numbers between 10,000 and 100,000. The PIV data sets were processed numerous ways by systematically changing the algorithms and parameters. The time-averaged results were then spatially integrated across the planar nozzle exit planes and compared to a calibrated flow meter and Laser Doppler Velocimetry (LDV) data. The PIV measurement performance metrics that are investigated in this work include uncertainty, calculation time, and volume-flow rate deviation. Recommendations for each method are developed and listed with potential drawbacks. The accuracy of the measurement was found to be a weak function of the Reynolds number of the flow. 2C-PIV was found to underestimate volume-flow rate by 2-4

Rick Cressall
Univ of Notre Dame

Date submitted: 28 Jul 2017 Electronic form version 1.4