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Tomographic PIV in the 48" Diameter Garfield Thomas Water Tunnel To Measure the Volumetric Velocity Field of a Propeller Wake JEFF HARRIS, ADAM NICKELS, Pennsylvania State University, APPLIED RESEARCH LABORATORY TEAM — Tomo-PIV measurements of a propeller wake in the Garfield Thomas Water Tunnel are presented. Performing such measurements in this historic tunnel presents a number of challenges, especially limited optical access with thick windows required to withstand the high static pressures necessary to run at high flow speed. As a demonstration, the simplest optical setup was used. The generic propeller spun at 625 rpm with a thrust of up to 30lbs. The measurements were acquired at 2500 fps using four Phantom v1212 cameras in a linear arrangement and a Photonics DM-50 to illuminate the volume. The measurement volume was up to 5.5x7x1.6 inches (140x180x40mm). Data were processing using tomographic algorithms in LaVision's DaVis 10.0.4 with voxel size of 56 cubic pixels and 51x56x20 vector resolution. Results show that volumetric velocity measurements are possible in relatively large volumes. With a propeller diameter of 10 inches, much of the propeller wake was measured at once with finely resolved time evolution of the flow structures. Given the 4-inch thick acrylic windows, resolving a sizeable volume in the center of the 48-inch water tunnel proved a surmountable challenge.

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