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Validation of Multi-plane Particle Shadow Velocimetry to Quantify Turbulence Scales CHRISTINE TRUONG, STEVEN HINKLE, KYLE SINDING, JEFF HARRIS, MICHAEL KRANE, RHETT JEFFERIES, Pennsylvania State University — Estimates of radial integral length scales using multi-plane Particle Shadow Velocimetry (PSV) are presented using measurements from the 11.2-inch diameter glycerin tunnel in the Applied Research Lab Garfield Thomas Water Tunnel. Particle shadow velocimetry (PSV) enables illumination of a volume and is an efficient means of obtaining multi-plane illumination. The combination of two colors in the LED backlight and a dichroic mirror makes possible the imaging of two planes in space. Thus, velocity fields in two imaging planes separated radially along the optical axis can be simultaneously measured. These multi-plane velocity fields are correlated over a range of separations to obtain integral length scales. Integral time scales are also calculated and converted into a streamwise length scale using Taylor's hypothesis for further confirmation. The inter-plane radial length scales, the in-plane length scales, the converted time scale in the inter-plane radial direction, and multi-plane turbulent statistics are compared with published studies, which used proven measurement methods. An additional, independent check is provided from PSV measurements in a single radial-axial plane.

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