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Tomographic Aperture-Encoded Particle Tracking Velocimetry: A New Approach to Volumetric PIV DAN TROOLIN, AARON BOOMSMA, WING LAI, STAMATIOS POTHOS, TSI Incorporated, FLUID MECHANICS RESEARCH INSTRUMENTS TEAM — Volumetric velocity fields are useful in a wide variety of fluid mechanics applications. Several types of three-dimensional imaging methods have been used in the past to varying degrees of success, for example, 3D PTV (Maas et al., 1993), DDPIV (Peireira et al., 2006), Tomographic PIV (Elsinga, 2006), and V3V (Troolin and Longmire, 2009), among others. Each of these techniques has shown advantages and disadvantages in different areas. With the advent of higher resolution and lower noise cameras with higher stability levels, new techniques are emerging that combine the advantages of the existing techniques. This talk describes a new technique called Tomographic Aperture-Encoded Particle Tracking Velocimetry (TAPTV), in which segmented triangulation and diameter tolerance are used to achieve three-dimensional particle tracking with extremely high particle densities (on the order of ppp = 0.2 or higher) without the drawbacks normally associated with ghost particles (for example in TomoPIV). The results are highly spatially-resolved data with very fast processing times. A detailed explanation of the technique as well as plots, movies, and experimental considerations will be discussed.

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