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Boundary-Layer Resolved Measurements of a Three-Dimensional Disturbance Using Magnetic Resonance Velocimetry AHMED NAGUIB, Michigan State University, FLORIAN WASSERMANN, DANIEL FREUDENHAMMER, SVEN GRUNDMANN, TU Darmstadt — Magnetic Resonance Velocimetry (MRV) is a modern flow diagnostic technique with unique advantages including the ability to efficiently capture volumetric measurements of velocity fields in complex geometry without the need for optical access. In comparison to Particle Image Velocimetry, MRV is substantially underutilized, and hence MRV's strengths and limitations to address a variety of flow configurations is yet to be demonstrated. Investigated in the present work is the viability of MRV to provide boundary-layer-resolved measurements of a 3D disturbance created by a circular cylindrical element protruding from the wall. These measurements are challenging because of the high spatial resolution requirement over a relatively large measurement volume (100 x 100 x 250 mm^3), the weak cross-stream disturbance velocities (less than 0.1% of the freesteam velocity), and the difficulties associated with the presence of a wall. Data are acquired using a portable water-flow loop with an acrylic test section placed on the bed of an MRI machine. The cylindrical element is mounted through the test-section's side wall where the boundary layer Reynolds number (Re) is 162 based on displacement thickness. Several element heights are investigated, ranging from a fraction of, to a full boundary layer thickness. The results provide an assessment of the ability of MRV to perform boundary-layer-resolved measurements of weak disturbances.

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