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A Study of Vortex Rings from Cylinders with Inclined Exits Using V3V DANIEL TROOLIN, TSI Incorporated, ELLEN LONGMIRE, University of Minnesota — Volumetric 3-component velocimetry (V3V) was used to examine the vortical structures generated by impulsively driven pistons within surrounding cylinders. The piston stroke length L was equal to the cylinder inner diameter of 72.8 mm. The Reynolds number based on piston velocity and L was 2500. The measurement volume was 140mm x 140mm x 100mm, and the spatial resolution was 4mm. While an axisymmetric cylindrical exit yields a primary ring that is largely decoupled from a trailing ring of opposite circulation, inclined exits yield a much more complicated topology. The primary ring exits the cylinder with an initial inclination of approximately half the cylinder exit angle. Then, the primary ring interacts directly with two trailing rings associated with the piston stopping. The downstream portions of the trailing vortices are drawn in through the center of the primary vortex and subsequently stretched as they wind around the core of the primary ring. The upstream portions of the trailing rings intertwine. These interactions lead to earlier breakdown of the primary ring as well as decreases in propagation speed. Movies showing the detailed evolution of these structures will be shown.

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