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Vortex Ring Dynamics in Radially Confined Domains KELLEY STEWART, CASANDRA NIEBEL, SUNGHWAN JUNG, PAVLOS VLACHOS, Virginia Tech — Vortex ring dynamics have been studied extensively in semi-infinite quiescent volumes. However, very little is known about vortex-ring formation in wall-bounded domains where vortex wall interaction will affect both the vortex ring pinch-off and propagation velocity. This study addresses this limitation and studies vortex formation in radially confined domains to analyze the affect of vortex-ring wall interaction on the formation and propagation of the vortex ring. Vortex rings were produced using a pneumatically driven piston cylinder arrangement and were ejected into a long cylindrical tube which defined the confined downstream domain. A range of confinement domains were studied with varying confinement diameters Velocity field measurements were performed using planar Time Resolved Digital Particle Image Velocimetry (TRDPIV) and were processed using an in-house developed cross-correlation PIV algorithm. The experimental analysis was used to facilitate the development of a theoretical model to predict the variations in vortex ring circulation over time within confined domains.

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