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Experimental Investigation of Vortex Ring Interaction with Inclined Surfaces LAUREN D. COUCH, PAUL S. KRUEGER, SMU — A number of experimental and numerical studies have described the collision of a laminar vortex ring with an inclined surface and noted similarities with hairpin vortices found in turbulent boundary layers. However, the dependence of the observed flow on the vortex ring properties and angles of collision have largely been neglected. In the present investigation, vortex ring interactions with an inclined plate were studied experimentally to determine the effects of plate angle on the flow evolution and draw comparisons with coherent structures in turbulent boundary layers. Vortex rings were generated using a mechanical piston-cylinder vortex ring generator at jet Reynolds numbers ranging from 1000 to 3000 and stroke length-to-piston diameter ratios from 0.5 to 2. The plate angle relative to the initial axis of the vortex ring ranged from 3 to 70 degrees. Flow observations were made using planar laser induced fluorescence, 2D digital particle image velocimetry (DPIV), and 3D defocusing DPIV (DDPIV). Results show deformation and stretching of the vortex ring into a loop-like vortex and the generation of secondary vorticity at the surface of the plate.

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