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The interaction between non-parallel planar starting jets and a steady crossflow[1] BEN STEINFURTH, JULIEN WEISS, TU Berlin — A device typically used in flow control applications is employed to generate starting jets characterized by a substantial initial acceleration that is associated with a large peak in over-pressure inside the jet exit plane. In the absence of a crossflow, thick-cored, almost spherical vortex rings are produced despite the high-aspect ratio outlet geometry, see Steinfurth Weiss (JFM, 2020). Here, we conduct phase-locked PIV measurements to investigate the influence of a steady crossflow with a zero-pressure-gradient, turbulent boundary layer on these starting jets. Depending on the velocity ratio between jet and crossflow r, two fundamentally different categories of flow structures are observed. At $r < 4$, hairpin vortices are produced as the vorticity associated with the upstream part of the starting jet is cancelled by the crossflow boundary layer. At $r > 4$, the jets penetrate through the boundary layer, and asymmetric vortex rings are observed. With the current effort, further light is shed upon the flow physics of non-parallel starting jets. This may promote the sophisticated selection of actuation parameters in active mixing and separation control.

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