Abstract Submitted
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The influence of upstream boundary conditions on swirling flows undergoing vortex breakdown[1] LOTHAR RUKES, MORITZ SIEBER, KILIAN OBERLEITHNER, OLIVER PASCHEREIT, Chair of Fluid Dynamics, Hermann-Foettinger-Institut, TU Berlin — Swirling jets undergoing vortex breakdown are common in research and technology. In part this is because swirling jets are widely used to anchor the flame position in gas turbines. Recently, the benefit in terms of flashback safety of axial air injection via a center body in the upstream mixing tube of a simplified premixed burner was demonstrated, Reichel (ASME Turbo Expo 2014). However, the presence of a center body alone alters the upstream boundary conditions for the downstream swirling flow. This study investigates how different upstream conditions modify the downstream swirling jet in a more generic setup. A swirling jet facility is used, consisting of a swirler, a pipe, a nozzle and an unconfined part. The focus lies on two large-scale flow features: the precessing vortex core (PVC) and the recirculation bubble. The flow field is measured with Particle Image Velocimetry and proper orthogonal decomposition is conducted to extract the dominant coherent structures. Additionally, a feature tracking approach is used to track the instantaneous shape and position of the recirculation bubble. We find that different center bodies modify the inflow profiles of the unconfined part of the flow in a specific way. This leads to significant differences in the large scale dynamics.

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