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Experimental investigation of the influence of temperature differences on the precessing vortex core in swirling jets MORITZ SIEBER, LOTHAR RUKES, KILIAN OBERLEITHNER, C. OLIVER PASCHEREIT, Chair of Fluid Dynamics, Hermann-Foettinger-Institut, TU Berlin — Swirling jets undergoing vortex breakdown are commonly used in gas turbine combustors. The vortex breakdown is accompanied by a meandering motion of the vortex core around the jet axis. This is referred to as the precessing vortex core, or short PVC. Extensive research has been done on the occurrence of the PVC in isothermal swirling jets. It was demonstrated that the PVC is a global instability mode. Measurements of the isothermal flow in gas turbine combustors usually show the presence of the PVC. However, recent investigations at our institute revealed that the PVC may be supressed in the reacting flow, depending on the flame position. This feature of non-isothermal swirling jets is of particular interest, because the PVC is known to be a robust structure that is hard to suppress in general. A subsequent theoretical investigation of the flow showed that the suppression of the PVC is related to a change of the hydrodynamic stability. This is again related to the temperature distribution within the flow. In the presented work this phenomenon is experimentally investigated in a swirling jet, where temperature differences are generated by electric heating. Therefore, the influence of the temperature can be investigated separately from the combustion. The experimental investigations consistently show that the PVC is strongly reduced by imposing temperature differences on the flow field. These characteristics are obtained by particle image velocimetry and proper orthogonal decomposition.

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