

ONSET/ANNIHILATION OF THE PRECESSING VORTEX CORE. EXPERIMENTAL STUDY.

A Valera-Medina^a, M Vanierschot^b

^a College of Physical Sciences and Engineering, Cardiff University, United Kingdom

^b Department of Mechanical Engineering, KU Leuven, Belgium

Abstract

Swirl stabilised flows are the most common technology for gas turbine combustion stabilization. Considerable work has been procured to characterise some of the most intrinsic structures of these flows, with respectable success obtained through experimental and numerical studies. However, onset of these structures is still barely understood, thus requiring further fundamental research. One of these fundamental structures is the Precessing Vortex Core (PVC), whose ambiguous characteristics make it an adequate mechanism for chemical mixing whilst being a detrimental component for thermoacoustic stabilisation. Therefore, this research presents experimental work detailing the onset/annihilation of such a structure in a generic swirl burner under isothermal conditions. By changing the height of the nozzle outlet two different flow patterns were produced, i.e. an Open jet and a Coanda jet flow. High speed stereo PIV at 125 and 1,000 Hz was employed for measuring purposes for the transient analysis of the coherent structures in those two jets. In case of an Open jet, a PVC was observed in the shear layer between the central recirculation zone and the jet. This PVC disappears during the transition to the Coanda flow as the Coanda effect near the burner outlet produces stable backflow. Also, the transition is accompanied by a shift in acoustic frequency between both states.

Keywords: Precessing Vortex Core, Transition, Open Jet Flow, Coanda.