Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

High speed OH-PLIF measurement of self-excited circumferential instabilities in an annular combustion chamber NICHOLAS WORTH, JAMES DAWSON, University of Cambridge — Self-excited thermo-acoustic instabilities are a significant issue in the development of lean burn gas turbine combustors. Such instabilities arise through coupling of the unsteady heat release and acoustic waves, which can propagate both longitudinally and circumferentially in annular combustor geometries. Although a large number of studies have investigated longitudinal fluctuations in single axisymmetric flames, it is currently uncertain whether these results can be used to emulate circumferential oscillations in annular geometry. Therefore, the aim of the current project is to investigate the flame dynamics in an annular model gas turbine combustor during self-excited circumferential oscillations. Pressure measurements are used to characterise the circumferential oscillations, with high-speed OH chemiluminescence and OH-PLIF used to capture the flame dynamics. The flame structure and dynamics are significantly affected by both the proximity of neighbouring flames and the excitation mode; with different responses observed for small and large separation distances, and standing and spinning modes. These observations indicate that results from single flame investigations may only be representative of self-excited flames in annular geometry under in a limited set of conditions.

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Date submitted: 26 Jul 2012 Electronic form version 1.4