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Local Velocity Field Measurements towards Understanding Flame Stabilization of Turbulent Non-premixed Jet Flames in Vitiated Coflow[1] ARAVIND RAMACHANDRAN, ANIRUDH REDDY MOTHE, VENKATESWARAN NARAYANASWAMY, North Carolina State University — Turbulent combustion of a non-premixed methane jet issuing into a vitiated coflow is being studied in our lab. Flame luminosity studies demonstrated three dominant characteristic flame motions – a stable flame base (Mode A), complete blowout (Mode B), and partial blowout followed by re-anchoring of the flame by autoignition kernels (Mode C). The experiments presented in this work focused on Mode A, and were carried out over a range of oxidizer temperatures, oxygen molefractions, and fuel jet Reynolds numbers. Measurements of 2-D velocity fields near the base of the lifted jet flame were obtained using Particle Image Velocimetry (PIV) with the objective to delineate the dominant mechanisms involved in the flame stabilization. Statistical analysis of these instantaneous velocity fields will be presented, which shows non-trivial contributions from autoignition kernels as well as edge flame propagation towards flame stabilization. The effect of vortices and high local strain rates was observed to produce local extinctions and destabilize the flame, indicating their role as precursors to (unstable) Mode B and Mode C motions.

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