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Pressure ratio effects on self-similar scalar mixing of high-pressure turbulent jets in a pressurized volume ADAM RUGGLES, LYLE PICKETT, JONATHAN FRANK, Sandia National Laboratories — Many real world combustion devices model fuel scalar mixing by assuming the self-similar argument established in atmospheric free jets. This allows simple prediction of the mean and rms fuel scalar fields to describe the mixing. This approach has been adopted in super critical liquid injections found in diesel engines where the liquid behaves as a dense fluid. The effect of pressure ratio (injection to ambient) when the ambient is greater than atmospheric pressure, upon the self-similar collapse has not been well characterized, particularly the effect upon mixing constants, jet spreading rates, and virtual origins. Changes in these self-similar parameters control the reproduction of the scalar mixing statistics. This experiment investigates the steady state mixing of high pressure ethylene jets in a pressurized pure nitrogen environment for various pressure ratios and jet orifice diameters. Quantitative laser Rayleigh scattering imaging was performed utilizing a calibration procedure to account for the pressure effects upon scattering interference within the high-pressure vessel.

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