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Gradient trajectory analysis of the scalar superlayer in a jet flow[1] MARKUS GAMPERT, PHILIP SCHAEFER, NORBERT PETERS, RWTH Aachen — Based on planar high-speed Rayleigh scattering measurements of the mass fraction of propane discharging from a turbulent round jet into co-flowing carbon dioxide at nozzle based Reynolds numbers Re_0=3,000-8,600, we investigate the *scalar superlayer*. The latter is located between the fully turbulent part of the jet and the outer flow and has the so called turbulent/non-turbulent interface embedded within it. It is termed in analogy to the laminar superlayer introduced by Corrsin and Kistler (NACA Report 1244, 1955). Using scalar gradient trajectories, we partition the turbulent scalar field into the afore mentioned three regions according to an approach developed by Mellado et al. (J. Fluid Mech. 626:333-365, 2009) based on which we in a next step investigate conditioned zonal statistics of the scalar pdf as well as the scalar difference along the trajectory and its mean scalar value. Finally, we relate our results for the scalar superlayer on the one hand to the findings made in other experimental and numerical studies of the turbulent/non-turbulent interface and discuss them on the other hand in the context of the flamelet approach in turbulent non-premixed combustion.

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