A combined RANS-LES simulation of a turbulent round jet in a large enclosure SASAN SALKHORDEH, SAGNIK MAZUMDAR, D. TYLER LANDFRIED, University of Pittsburgh, ANIRBAN JANA, Pittsburgh Supercomputing Center, Carnegie Mellon University, MARK KIMBER, University of Pittsburgh — A combined RANS-LES simulation of a round turbulent jet confined in a large cylindrical enclosure is conducted. As the computational cost of doing LES over the entirety of the large enclosure is high, LES is done only near the jet axis. First, steady, axisymmetric RANS simulation of the confined jet is performed using a thin wedge-shaped slice of the enclosure. The RANS results are validated with experimental data from literature. LES is then performed in a small cylindrical domain around the jet, with initial and boundary conditions provided by the validated RANS results. After comparing six Sub-Filter Stress (SFS) models, the SFS model chosen for the LES simulation is a variant of the dynamic Smagorinsky model. The effect of inlet flow profile and turbulent fluctuations on the evolution of the jet is investigated. The influence of filter characteristics on simulation results is also analyzed. Finally, the LES results are compared with experimental measurements.

Sasan Salkhordeh
University of Pittsburgh