UK Fluids Network: SRV Report

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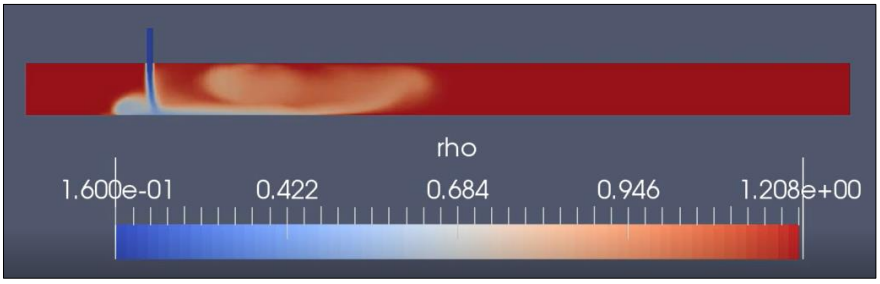
Jocelino's visit at Imperial College from the 8th to 12th of January, 2018 got the ball rolling on an exciting collaboration between Cambridge University and Imperial College. Jocelino is performing experimental investigations on combustion noise. Combustion noise is classified into direct and indirect noise. Direct noise is produced by the unsteady heat release of the flame, while indirect noise is caused by the acceleration of temperature and compositional inhomogeneities. There are still questions which remain unanswered regarding the effects of dispersion on compositional inhomogeneities, and this research partnership will help bridge the gap between experimentalists and numerical modellers to advance the understanding of this problem.

Experimental data was obtained at Cambridge using the Cambridge Wave Generator (CWG). In this set-up, gases of different composition are injected radially into a mean flow of air to produce a compositional 'wave'. Once accelerated through a nozzle, this wave produces indirect noise. Jocelino is now Jocelino is looking to provide accurate numerical results to help understand more about the mixing and dispersion effects in the set-up used, as well as provide a measure of validation to the assumptions employed in 1D analytical models.

Jocelino has started to implement the novel numerical modelling techniques employed at Imperial for the study of compositional wave dispersion in the CWG. He was given access to a high-fidelity in-house LES code BOFFIN to model his experimental set-up. The Thermofluids group in the Department of Mechanical Engineering at Imperial has a large experience developing Large Eddy Simulation (LES) software for complex flows. Jocelino also networked with several research students who helped speed up the learning process. The LES results will be used to compare to the unsteady RANS results (one test case is shown below) obtained at Cambridge using OpenFOAM as well as experimental data obtained via acoustic measurements and laser diagnostics.



URANS results using OpenFOAM: axisymmetric radial injection of helium, depicting the density field cut through the longitudinal plane of the duct. These will be compared to the high-fidelity LES results.