1m diameter helium plume

Problem Description

1m helium plum simulation is a standard test to ensure that CFD algorithm can handle variable density effects, but without extra complications caused by combustion. Validation data for this case is also available [1]. At time $t = 0$ the computational domain is set up to have 1m diameter helium inlet with air coflow. The rest of the boundaries are set up to simulate open boundaries.

Simulation Specifics

Component used: ARCHES

Input file name: helium_1m.ups

Command used to run input file: mpirun -np 64 sus helium_1m.ups

Postprocessing command: scirun helium_1m.srn

Simulation Domain: 3 x 3 x 3 m

Cell Spacing:
2 x 2 x 2 cm (Level 0)

Example Runtimes:
8 hours (64 processors, 2.4 GHz Xeon (inferno cluster))

Physical time simulated: 0.97 sec.

Results

Figure 1 shows a 2D center-plane contour plot of density at $t = 0.97$ seconds. This figure shows what can be expected from the code after 8 hours of run time. Figure 2 second helium puff going through the domain (after 35 hours of run time).

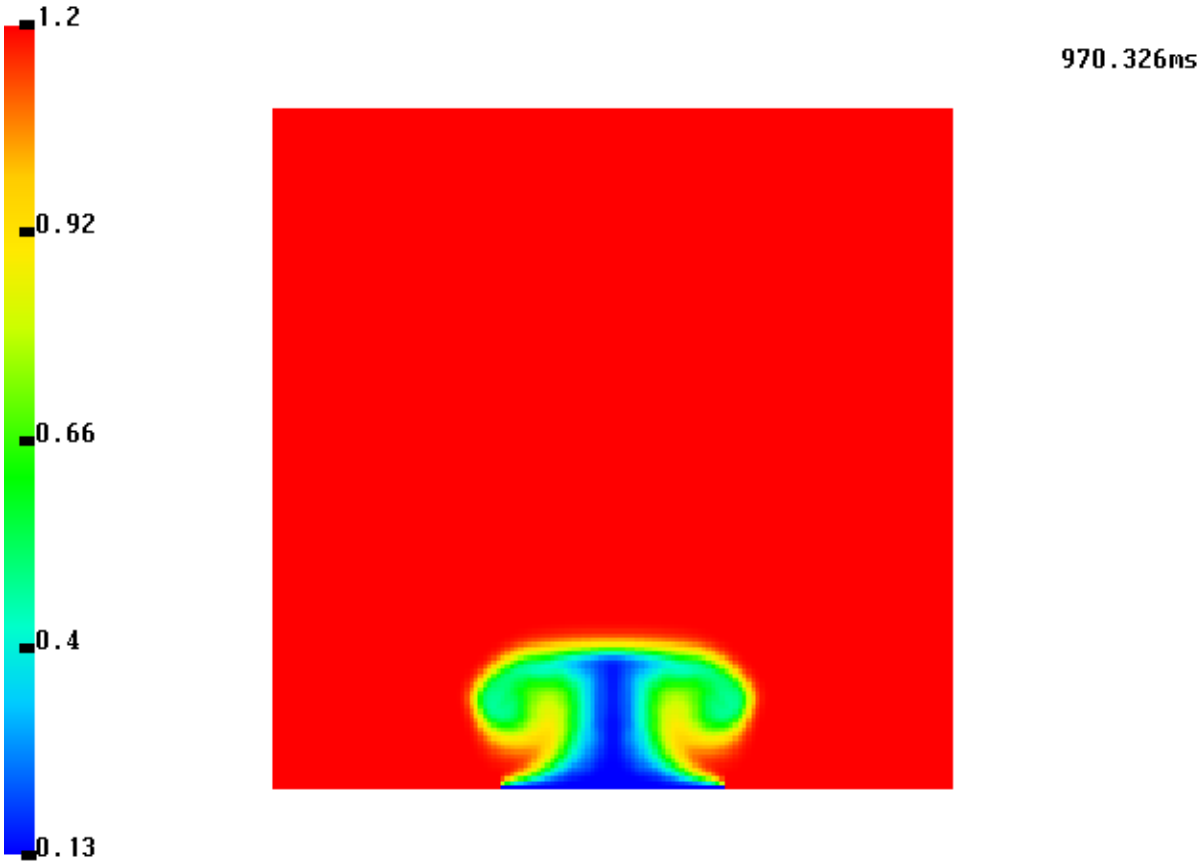

Figure 1: 2D center-plane contour plot of denisty at $t = 0.97$ seconds.

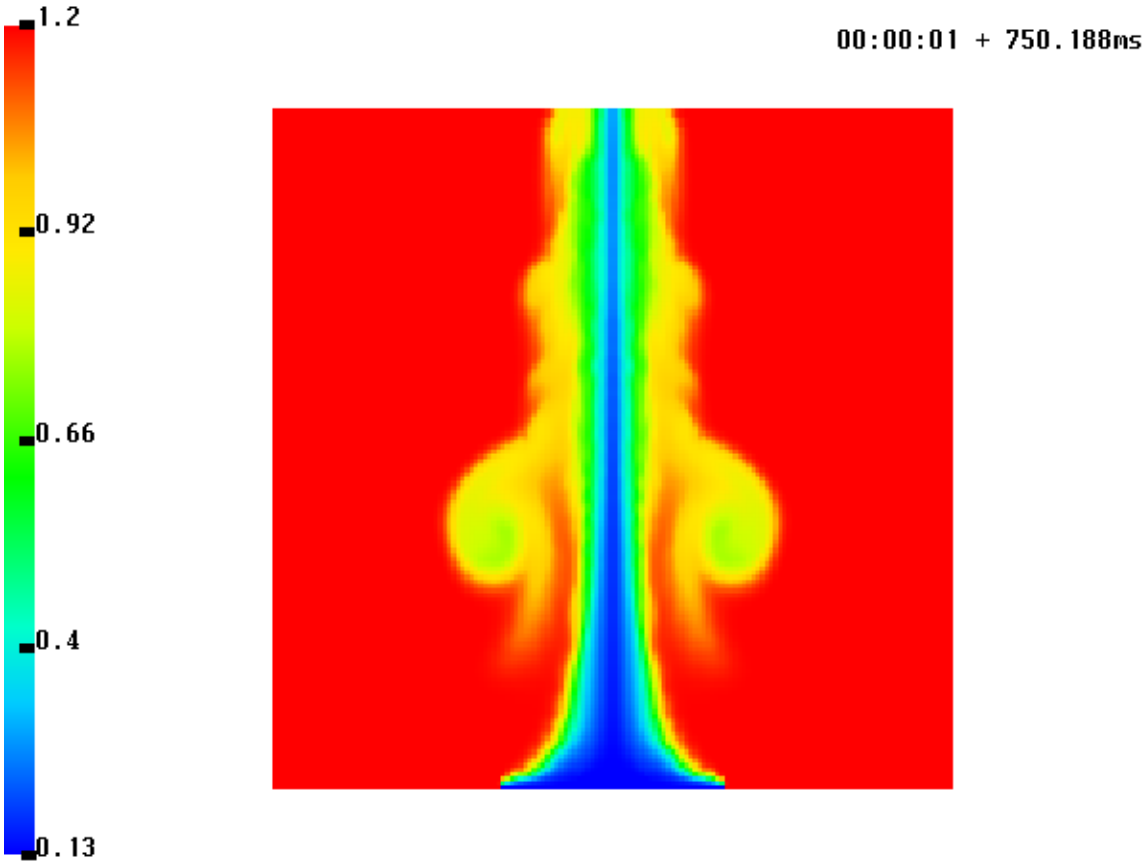

Figure 2: 2D center-plane contour plot of density at $t = 1.75$ seconds.

References

[1] P. E. DesJardin, T. J. O'Hern, and S. R. Tieszen. Large eddy simulation and experimental measurments of the near-field of a large turbulent helium plume. *Physics of Fluids*, 16(6):1866–1883.