1m diameter methane pool fire

Problem Description

1m methane pool fire has become a valuable case for code validation, due to data collected by [1]. At time $t = 0$ the computational domain is set up to have 1m diameter methane inlet at the bottom wall. The rest of the boundaries are set up to simulate open boundaries. As simulation time progresses, methane pool fire ignites and burns, exhibiting puffing behavior. This problem tests the ability of the Arches algorithm to handle non-adiabatic reacting flow.

Simulation Specifics

Component used: ARCHES

Input file name: methane_1m.ups

Command used to run input file: mpirun -np 64 sus methane_1m.ups

Postprocessing command: scirun methane_1m.srn

Simulation Domain: 3 x 3 x 3 m

Cell Spacing:
3 x 3 x 3 cm (Level 0)

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

Physical time simulated: 0.428 sec.

Results

Figure 1 shows a 2D center-plane contour plot of temperature at $t = 0.428$ seconds. Code speed for methane simulation is relatively slow, but the example cases for this release are limited to 8 hour 64 processors run time. So, figure 1 is just a representation of what can be expected after a run of this duration, much longer run times are required to gather statistics for experimental data comparison. As an example, figure 2 shows first puff leaving the simulation domain at $t = 0.96$ seconds after 26.5 hours run time.

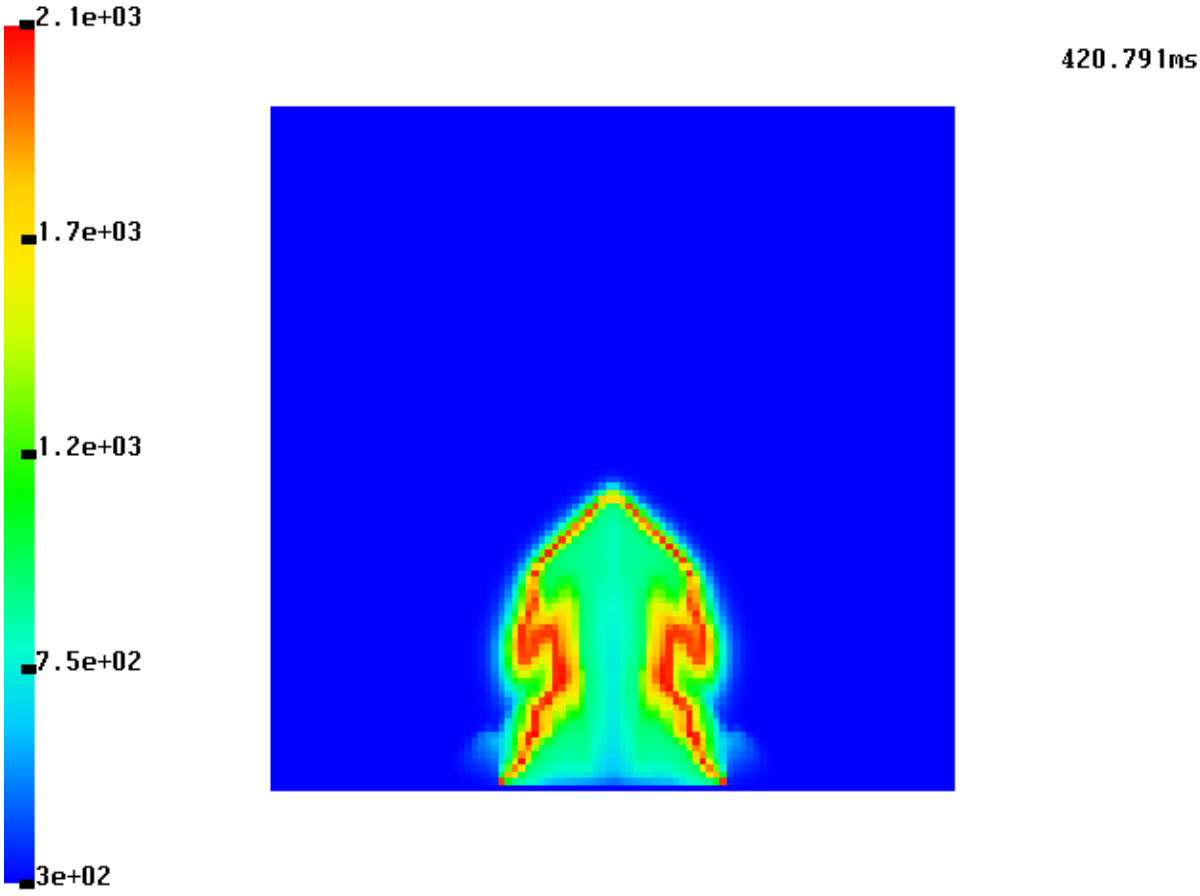

Figure 1: 2D center-plane contour plot of temperature at $t = 0.428$ seconds.

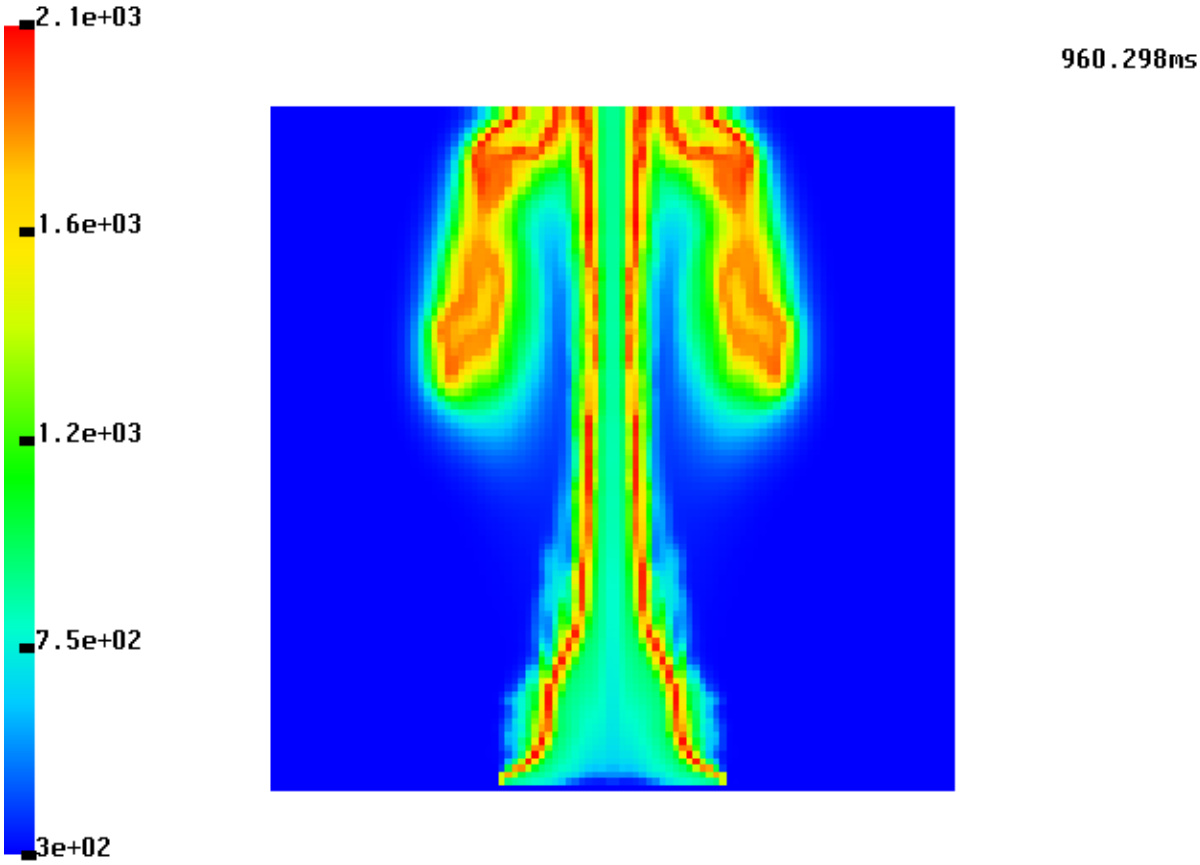

Figure 2: 2D center-plane contour plot of temperature at $t = 0.96$ seconds.

References

[1] S. R. Tieszen, T. J. O'Hern, E. J. Weekman, and R. O. Schefer. Experimental study of the flow field in and around a one meter diameter methane fire. *Combustion and Flame*, 129:378–391.