Preliminary 1D CRASH Resolution Study / Variable Screening
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Introduction
In preparation of the 1D CRASH UQ, simulation runs for 16 ns were performed based on the nominal Hyades output at 1.3 ns. In addition to exercising and testing the software pipeline, these runs serve multiple purposes:
1. Determining the necessary resolution to give sufficiently accurate results without excessive running time.
2. Variable screening: verifying a few hypotheses on the relative importance of factors, based on physical intuitions.
3. For the variables that are relevant, giving a rough estimate on their respective influences on the outputs of interest.

Resolution Study
Using the nominal Hyades output, simulations were performed with \( n = 300, 600, 1200, 2400, \) and \( 4800 \) cells.
1. The running time of the simulation scales as \( O(n^2) \), since the timestep size is limited by the courant condition.
2. All the features are monotonic with \( n \geq 1200 \) cells, which also gives accurate shock position and layer thickness relative to the experimental error. Therefore, it is chosen as the resolution for the UQ production run.

Initial Radiation Effect
Since the energy of the initial radiation is insignificant relative to the total amount of energy in the system, we hypothesized that its effect is insignificant. To test our hypothesis, we designed a run with minimum radiation energy (1eV) through out the space, but the rest of the nominal Hyades output changed as the initial condition. As expected, the initial radiation has no practical effect at later simulation time.

Opacity Sensitivity
The other calibration parameters we are going to vary in the UQ production run are the opacity multipliers \( f \), which simply scales the Rosseland and Planck mean opacity by a constant factor. In addition to the nominal run (with \( f = 1.0 \) by definition), runs with \( f = 0.1, 0.5, \) and \( 1.5 \) were also performed. We can see that as the opacity decreases, the radiative energy escapes more rapidly, so the Xe layer loses more radiative pressure and gets squeezed thinner and denser. The effect is fairly limited, however, within the physical range.

Boundary Condition E
Effects of Opacity Multiplier

Conclusion
In these runs, we determined the appropriate resolution and boundary condition for the UQ production run. Unexpectedly, much of the preliminary runs showed that the results are not sensitive to the calibration parameters, relative to the experimental error. It remains to be seen whether the unaccounted experimental variability can be attributed to the initial condition provided by Hyades, or requires full 2D/3D simulations and/or more sophisticated physics than Gray Diffusion.