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Comparing Split and Unsplit Numerical Methods for Simulating Low and High Mach Number Turbulent Flows in Xrage[1] JUAN SAENZ, FERNANDO GRINSTEIN, JOSHUA DOLENCE, RICK RAUENZAHN, THOMAS MASSER, MARIANNE FRANCOIS, Los Alamos National Laboratory, LANL TEAM — We report progress in evaluating an unsplit hydrodynamic solver being implemented in the radiation adaptive grid Eulerian (xRAGE) code, and compare to a split scheme. xRage is a Eulerian hydrodynamics code used for implicit large eddy simulations (ILES) of multi-material, multi-physics flows where low and high Mach number (Ma) processes and instabilities interact and co-exist. The hydrodynamic solver in xRAGE uses a directionally split, second order Godunov, finite volume (FV) scheme. However, a standard, unsplit, Godunov-type FV scheme with 2nd and 3rd order reconstruction options, low Ma correction and a variety of Riemann solvers has recently become available. To evaluate the hydrodynamic solvers for turbulent low Ma flows, we use simulations of the Taylor Green Vortex (TGV), where there is a transition to turbulence via vortex stretching and production of small-scale eddies. We also simulate a high-low Ma shock-tube flow, where a shock passing over a perturbed surface generates a baroclinic Richtmyer–Meshkov instability (RMI); after the shock has passed, the turbulence in the accelerated interface region resembles Rayleigh Taylor (RT) instability. We compare turbulence spectra and decay in simulated TGV flows, and we present progress in simulating the high-low Ma RMI-RT flow.

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