Abstract Submitted
for the APR08 Meeting of
The American Physical Society

Fluid Solvers For High-Energy Density Applications: Initial Results AMMAR HAKIM, JOHN LOVERICH, Tech-X Corporation — We have developed a general purpose, parallel, high-performance framework, TxFluids, for the solution of plasma fluid equations. TxFluids works on both structured (hexahedral) and unstructured (mixed tetrahedral and hexahedral) meshes and uses modern high-order and high-resolution schemes to solve the MHD equations formulated as systems of hyperbolic conservation laws. In particular, we have implemented the High-Resolution Wave Propagation Scheme and the Discontinuous Galerkin (DG) Scheme. Both these schemes are particularly suited to plasma physics problems as they are very accurate, fully upwind and also capture shocks. In the absence of shocks the DG scheme in TxFluids is spectrally accurate, i.e. it can be run with arbitrary spatial order specifiable in the input file. This allows us to resolve complex flow features even with coarse meshes and is hence valuable to study turbulence and micro-instabilities. TxFluids allows coupled simulations using different fluid models. Among these, we have presently implemented the resistive-MHD model, the Hall-MHD model and the full two-fluid model. The latter includes electron physics needed to simulate micro-instabilities like the Lower-Hybrid Drift Instability. As an application we present initial results of simulating a Magneto-Inertial Fusion (MIF) concept. Here an aluminum liner is collapsed on a target plasma (a Field-Reversed Configuration) to produce intense magnetic fields and fusion conditions. We present results of the FRC formation, translation and heating due to adiabatic compression.

Ammar Hakim
Tech-X Corporation

Date submitted: 11 Jan 2008 Electronic form version 1.4