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3D hybrid simulations of the plasma penetration across a magnetic field[1] YURI OMELCHENKO, Space Science Institute, Boulder, CO, Trinum Research Inc, San Diego, CA — The expansion of hot dense plasmas across ambient magnetic fields in physical systems with spatial scales comparable to the ion gyro and inertial lengths is of great interest to space physics and fusion. This work presents results from recent three-dimensional hybrid simulations (kinetic ions, fluid electrons) of experiments at the LAPD and Nevada Terawatt Facility where short-pulse lasers are used to ablate solid targets to produce plasmas that expand across external magnetic fields. The first simulation recreates flutelike density striations observed at the leading edge of the carbon plasma and predicts an early destruction of the magnetic cavity in agreement with experimental evidence. In the second simulation the plasma contains protons and carbon ions produced during the ablation of a polyethylene target. A mechanism is demonstrated that allows protons to penetrate the magnetic field in the form of a collimated flow while the carbon ion component forms a supporting magnetic structure. The role of ion kinetic and Hall effects in creating an electric field responsible for plasma transport is discussed and results are compared to experimental data. The hybrid simulations are performed with a massively parallel hybrid code, HYPERS that advances fields and particles asynchronously on time scales determined by local physical and geometric properties.

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