IGNITION IN DEUTERIUM-TRITIUM Z-PINCHES

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The conditions required for ignition in a deuterium-tritium zpinch are examined using a hybrid PIC-MHD model. In the model the deuterium-tritium fuel is treated as a fluid while charged fusion products are modeled as particles. The model includes particle and fluid dynamics, thermonuclear reactions, fuel burn-up and α particle heating. Using 2D simulations ignition criteria are established by considering the initial pinch density, radius, magnetic field and temperature at stagnation as parameters. The dependence of the ignition criteria on the spatial variation of the density and temperature parameters is also demonstrated.

The dynamics of burn-up and ignition are also investigated. It is shown that the transport of charged fusion products is nonlocal due to the magnetic field profile within the pinch while the α particle heating is non-instantaneous due to the relatively low density of the plasma. However, the high magnetic field at the edge of the pinch is effective in compensating for the low density in confinement of the charged fusion products.