Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Hybrid plasma model simulations of a plasma opening switch[1]
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Plasma models have regimes of validity that depend on local parameters. In some problems a computationally expensive model is required in a small subset of the domain while faster reduced models can adequately describe the plasma behavior everywhere else. Partitioning the domain and using the simplest plasma model that is locally valid can maintain global physical fidelity while improving computational efficiency. Coupling between the models is handled using boundary conditions to convert the variable set of one constituent model to that of another. This research investigates the coupling between MHD and two-fluid plasma models using a physics-based domain-decomposition. Comparisons are made on accuracy and performance of using a hybrid plasma model with a single conventional plasma model on the planar plasma opening switch. The setup consists of a low density background and a high density bulk plasma with a large density gradient, leading to drift instabilities which are not captured by MHD models. However, elsewhere MHD models provide sufficient accuracy. Collisional transport and non-ideal MHD effects are also investigated to determine which parameter regimes require these processes in order to gain physical fidelity.

[1]This research was supported by a grant from the United States Air Force Office of Scientific Research

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Date submitted: 14 Jul 2017 Electronic form version 1.4