NUMERICAL STUDY OF FAST MAGNETIC FIELD PENETRATION ALONG ELECTRODES IN PLASMA JET ACCELERATORS*

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Merging coaxial plasma jets are envisioned for use in magneto-inertial fusion schemes as the source of an imploding plasma liner[1]. An experimental program at HyperV[2] is considering the generation of large coaxial plasma jets (length scales on the order of centimeters) at high densities (10^{16}-10^{17} cm^{-3}). Numerical simulations by Hybrid particle-in-cell methods in this parameter regime cannot spatially resolve the small non-neutral sheaths which develop at the electrode surfaces. These simulations demonstrate rapid magnetic field penetration along the unresolved (one-cell thick) non-neutral sheaths. Plasma resupply mechanisms, *e.g.* liberating new plasma particles when original particles hit the wall, can slow the penetration or eliminate it, but the penetration time is found to be strongly dependent on cell size for these coarsely gridded simulations. We describe the results of finely gridded small scale simulations in which non-neutral sheaths are resolved. In this way the physical penetration mechanism can be simulated without being masked by purely numerical effects which result from large cell sizes. Results are shown for simulations with and without plasma resupply. We demonstrate that large-scale coarsely resolved simulations with a properly adjusted plasma resupply mechanism do not lack any important penetration physics which affects the bulk jet motion.

1. Y. C. F. Thio *et al*., J. Fus. Energy, Vol 20, p 1, 2001.

2. F. D. Witherspoon, *et al*, Bulletin of the Amer. Phys. Soc. Vol 52, No. 16, Nov 2007, paper PP8-70.

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