

P1.2005 3D numerical simulation of magnetically-driven plasma fluxes generated in nested wire arrays

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See the full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P1.2005.pdf>

We study short-lived plasma flows during sub-microsecond Z-pinch implosion by high current facility. To fulfil multiparametric numerical simulations we use radiativemagnetohydrodynamics (RMHD) code MARPLE-3D developed in Keldysh Institute of Applied Mathematics. MARPLE is designed as an expandable full-scale multiphysics research platform using the state-of-the-art physics, mathematics and numerics as well as the up-to-date high performance computing functionality. MARPLE main physics includes: - one-fluid two-temperature MHD model with electron-ion energy relaxation and general Ohm's law, - anisotropic resistivity and heat conductivity in the magnetic field, radiative energy diffusion with multigroup spectral model, - prolonged plasma ablation model, - widerange datatables including equations of state, transport and kinetic coefficients, - opacity and emissivity datatables taking into account non-LTE effects. Multiwire array implosion at Angara-5-1 facility (TRINITI, Troitsk) is studied in a series of numerical experiments. We consider different configurations of wire arrays: cylindrical and quasispherical arrays, single and nested arrays, metal wires and polymer fibers. As it is found the two-cascade nested array design allows a stable compact compression. A shock wave is formed between the cascades, which damps the inhomogeneities of the plasma jets. The effect is also observed when the external and internal cascades are of the same material. The decrease in the trailing mass is more significant in the case of a quasi-spherical array. We show a quite good qualitative and quantitative agreement of the simulation results with experimental data and theoretical estimates.

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