PHYSICAL SCHEMES OF EXPERIMENTAL DEVICES WITH DISK EMG FOR FEASIBILITY STUDY OF THERMONUCLEAR IGNITION IN MAGO SYSTEM

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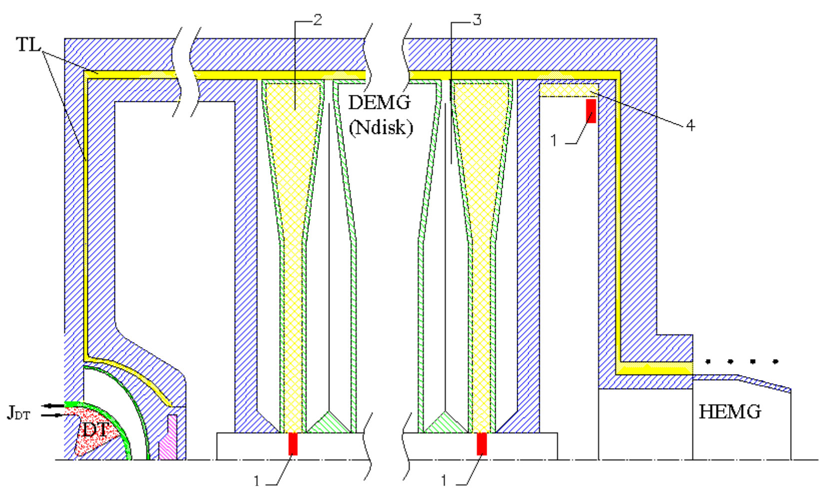
The use of magnetic hydrodynamic compression system (MAGO/MTF)(1,2) is one of the approaches in handling the ignition problem. MAGO system consists of two main parts – the preheating system for magnetized D-T plasma and a plasma compression system. To obtain heated magnetized plasma we use a special MAGO chamber(1), which consists of two toroidal cells conjoined with a narrow annular nozzle. Magnetized plasma is accelerated in the nozzle to ~ 1000 km/s velocities and heated in generated collisionless shock waves. A further compression of plasma in the second cell is required to com up to ignition parameters.



Scheme of quasi-spherical target connected to the multi-module DEMG with the radial-coaxial transmission line (TL)

1. Detonators
2. DEMG HE disk charges
3. Metal DEMG magnetic flux compression cavities
4. Explosive unit of DEMG disconnection from helical EMG (HEMG).

The paper justifies principal parameters for some physical schemes of devices with disk electro-magnetic generators (DEMG)(3), designed in VNIIEF, and cumulating liner systems for preheated magnetized DT plasma compression. The devices under discussion are designed for first experiments on validation of the plasma compression by solid liners for feasibility study of the plasma thermonuclear ignition. In this system the quasi-spherical or cylindrical case of the second cell of the MAGO chamber acts as the inner liner and the aluminum liner of ponder motive unit acts as the outer liner. The computed DT plasma parameters are close to those achieved in the MAGO experiments: average densities are $\sim 8 \cdot 10^{17}$ cm^{-3}, temperatures are ~ 0.25 keV. The computations of plasma compression by quasi-spherical and cylindrical liners are performed in the one-dimensional approximation including magnetic field diffusion, classic electronic and ionic heat conduction, and radiation transport(4).

The computations of devices with various EMG proved that some of the systems with DMG provide D-T MAGO plasma compression close to ignition parameters. Using 0.4-meter-diameter 15-module DEMG, that had been successfully tested in liner experiments, seems to be most efficient and promising. This EMG along with 3-liner or 4-liner quasi-spherical cumulating systems can ensure characteristic plasma compression times about 7μs or 5 μs in copper or aluminum 12-cm-diameter different-thickness compressible MAGO chamber casings of different thickness, with the minimum thickness being about 2 mm. Similar devices with more powerful 0.4-m-diameter EMG are considered in order to assess potentialities of the ignition achievement.

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