The Investigation of Magnetic Field Effect on the Ignition Conditions in Cylindrical Direct Driven Targets

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ABSTRACT

Heavy ion beams are attractive drivers for inertial confinement fusion (ICF) because of the high efficiency, the repetition rate and the reliability of accelerators. So far, targets for heavy ion fusion (HIF), which is ICF with heavy ion beam drivers, have been studied almost exclusively in spherical geometry. We used a cylindrical target structure. This is the scheme of magnetized target fusion (MTF) driven by heavy ion beams. The present work is devoted to cylindrical implosions, which can be driven directly by a single ion beam incident with high symmetry relative to the target axis. Another significant advantage of the cylindrical target geometry is that axial magnetic fields can be applied in order to reduce heat losses. Ignition conditions in axially magnetized cylindrical targets are investigated by examining the thermal balance of assembled DT fuel configurations at stagnation. Special care is taken to adequately evaluate the energy fraction of 3.5 MeV alpha particles deposited in magnetized DT cylinders.

Our results showed that the energy deposition fraction f_α increased by application of magnetic field. By increasing of magnetic field caused a significant reduction of the ρR value. It leads to significantly reduce the driver power required for MTF while pulse energies remain comparable to those required for non-magnetized ICF.

Keywords: Heavy Ion Beam, Cylindrical Target, Magnetic Field, Energy Deposition Fraction