§60. Recent Results on Cone Targets Magnetization

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We report here the results on magnetization of cone targets for Fast Electron as well Proton Fast Ignition research.

The magnetized cone targets were successfully realized and the experiment was set up but due to a technical problem related to the target injection system, the targets were destroyed during injection and experimental data could not be collected. Therefore I will here quickly report the study of the magnetic field effects on proton beam dynamics inside a cone.

In Hemi-cone geometry for Proton Fast Ignition, according to the classic scheme, the ion beam is generated from the hemi-shell mounted on the cone, accelerates in the vacuum gap between the cone and the tip, is collimated by the electric fields at the cone walls and reaches the tip of the cone where penetrates in the compressed plasma.

Preliminary simulations of the process have been performed showing that the proton beam is strongly affected by the magnetic fields developing inside the cone by the return current flowing on the cone walls. These magnetic fields get compressed by the incoming proton-electron plasma, moreover the magnetic field carried in-flow by the proton beam piles us at the cone tip and increases the magnetic field amplitude and cross section. This magnetic field in turn causes the deflection of the proton beam which spreads from the cone tip over a large divergence angle, strongly reducing the coupling efficiency to the compressed fuel.

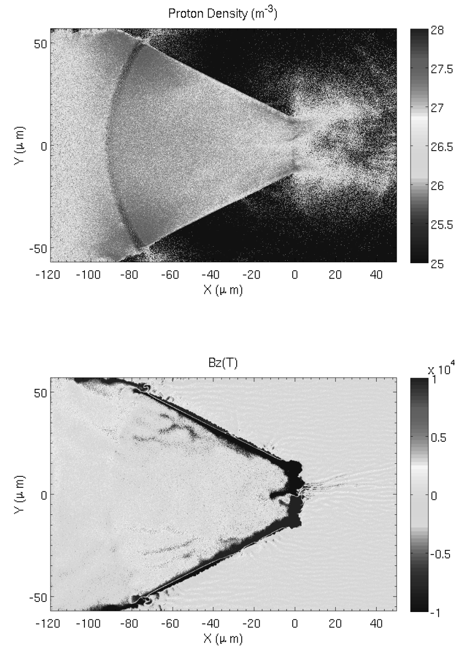

Fig1: top, the TNSA accelerated proton density showing large divergence. Bottom, the magnetic field structure inside the cone at later time, showing the B-field accumulating at the cone tip.

Experiment will be performed through the NIFS program in order to verify the behavior of the TNSA proton beam in cone targets for Fast Ignition.