Proton Beam Fast Ignition Fusion: Nonlinear Generation of $B_\theta$-Fields by Knock-on Electrons

V. ALEXANDER STEFAN, Institute for Advanced Physics Studies, Stefan University, La Jolla, CA — The knock-on electrons, generated by the fast proton beam in interaction with the free and bound electrons in a precompressed DT fusion pellet, outrun the proton beam, generating the $B_\theta$-fields ahead of the beam, which may lead to the defocusing of the beam, if $B_\theta < 0$. The $B_\theta$-fields are generated due to the magnetic instability, $\partial B_\theta / \partial t \sim (c/\sigma) \nabla \times j_{ne}$, where $j_{ne}$ is the knock-on electron current density, $\sigma$ is the background plasma conductivity, and $c$ the speed of light. The instability growth rate compensates for relatively low knock-on generation efficiency by a proton beam. The saturation level, (electron trapping mechanism), of the B-field ahead of the beam, is of the order of 10 MG and is reached on the time scale of 10ps.
