

SPACE-CHARGE NEUTRALIZATION OF HEAVY ION BEAMS VIA ELECTRON INJECTION

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One key issue in heavy ion beam fusion (HIBF) is how to effectively focus high-current and high-perveance ion beams onto a small target area, usually with a radius of several mms. Space charge neutralization must be achieved to prevent defocusing as the ion density compresses during focusing. The present study is concerned with the physics of space-charge neutralization by use of various concepts for injection of electrons into the ion beam in addition to plasma neutralization. To date the most widely studied approaches employ a preformed plasma or ionize a background gas in the beam line. However, these schemes face difficulties due to local non-uniformities in charge neutralization due to beam dynamic/focusing effects. Thus, two supplemental techniques are under study and will be discussed here. One involves axial injection of electrons created in a thin foil in the beam path. The other uses a magnetic field to guide the electrons into the direction of the beam path. Both techniques would be used in combination with a conventional background plasma, providing added control. A preliminary analysis these schemes using computer simulations will be presented. Also, possible components that could be added onto an existing HIBF experiment such as NTX at LBL to provide a test of this type of electron injection will be discussed.