

Multi- Meter-Long Plasma Source for Heavy Ion Beam Charge Neutralization

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Plasmas are a source of unbound electrons for charge neutralizing intense heavy ion beams to focus them to a small spot size and compress their axial length. To produce long plasma columns, sources based upon ferroelectric ceramics with large dielectric coefficients have been developed. The source utilizes the ferroelectric ceramic BaTiO₃ to form metal plasma. The drift tube inner surface of the Neutralized Drift Compression Experiment (NDCX) is covered with ceramic material. High voltage (~ 8 kV) is applied between the drift tube and the front surface of the ceramics. A BaTiO₃ source comprised of five 20-cm-long sources has been tested and characterized, producing relatively uniform plasma in the 5×10^{10} cm⁻³ density range. The source has been integrated into the NDCX device for charge neutralization and beam compression experiments. Initial beam compression experiments yielded current compression ratios ~ 120 . Recently, an additional 1 meter long source was fabricated to produce a 2 meter source for NDCX compression experiments. Present research is developing higher density sources to support beam compression experiments for high energy density physics applications.

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