Evolution of Plasma in the Influence of Varying Ratio of Transverse to Ambient Magnetic Field of LVPD-Upgrade

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The Large Volume Plasma Device-Upgrade (LVPD-U) is a cylindrical device of dimension (L=3m, ϕ=2m) and it accommodates a concentrically placed, Large Area Multifilamentary Plasma Source (LAMPS) of diameter 1.8m having emission area made up of W-filaments (n=162, ϕ= 0.0005m. L-0.18m). It also accommodates at its axial center a varying aspect ratio large solenoid, called as an electron energy filter (n=155, min extent of 0.04m to maximum extent of 1.85m, axial width=0.04m). It is capable of producing a transverse magnetic field of ≤ 250G. The pulsed plasma (Argon) of discharge duration, Δt~ 50ms is produced in LVPD-U under the influence of the varying ratios of transverse (Bx) to ambient (Bz) magnetic field. The strength of the transverse magnetic field of radially 1 m charged EEF is varied by charging it to different currents. The EEF divides LVPD-U plasma into three distinct plasma regions of source, EEF and target plasma.

The discussion on results obtained on plasma evolution for the ratio of B_x/B_z ~ 16 is presented. The plasma is produced for varying pulse widths of discharge pulses. This resulted to a plasma confinement time of ~ 350μs. The formation of radial equilibrium profiles are investigated in the two regions, A and B (0cm < x < 55cm & 55cm< x <90cm) of source and target plasma for the imposed condition of magnetic field ratio. For proper emphasis to the existence of different effects, we have radially segregated, LVPD-U plasma into two regions i.e., region- A (x <55 cm) & region-B (x ≥55 cm) respectively. Results show that for active EEF, the region-A of target plasma is characterized with gradient scale lengths of electron temperature, L_T ~ 1.6m and plasma density, L_n ~0.8m. In contrast, the source region has large gradient scale lengths in both density (L_n~8.5m) and electron temperature (L_T ~2.7m) respectively. The source region also exhibits a hollowness in plasma density. The outer regions of source plasma, on the other hand, show gradients in in both plasma density and electron temperature. The gradient in scale lengths of temperature and density so obtained in source and target plasma are L_T ~ 0.9 m, L_n ~ 0.3m and L_T~ 0.6m, L_n~ 0.3m respectively. As far as plasma potential profiles are concerned, region-A in target plasma shows the presence of a radial electric field of strength, E_x~ 6.3 V/m while it remains absent in the source region. Initial observations show that typical diamagnetic drift velocities in region B of source and target plasma are 3.8 x 10^3 m/s and 1.4 x 10^3 m/s respectively. The diamagnetic drift velocities in region-A are approximately an order less than that of region-B.

Preliminary observations in the two regions of source and target plasma get significantly modified in presence of charged EEF. Detailed characterization of evolved equilibrium plasma profiles for different imposed ratios of Bx/B_Z and their consequence on fluctuations will be discussed in the conference.

References

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