Role of magnetic field topology in particle confinement in simple toroidal devices.

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Topology of toroidal magnetic field in toroidal devices plays an important role in controlling the flows, fluctuations and hence sustaining the equilibrium. A finite offset in toroidal field may arise due to misalignment of TF coils or due to presence of uncompensated leads. This leads to opening of toroidal field lines and they may not close on themselves. Experimental determination of this offset and magnetic field topology has been performed by Thatipamula et al., in a simple toroidal device[1] using a simple yet novel technique. This technique involves a tiny plasma beamlet source and a regular camera. Moreover, an application of external vertical magnetic field provides significant control over topology of toroidal field.

BETA is a simple toroidal device with major radius of 45 cm and minor radius of 15 cm; the maximum toroidal field can be applied up to 0.1 T. A detailed experimental study of equilibrium profiles flows and fluctuations with variation of parallel connection length ($L_c$) by application of external vertical field ($B_v$) has been performed in BETA[2]. It has been shown that as $L_c$ varies with variation in $B_v$ the nature of fluctuations and flows changes significantly which in turn affects the equilibrium and nature of fluctuations in simple toroidal devices.

Single particle confinement time in a purely toroidal magnetic field configuration is known to be of the order of few microseconds[3], which implies poor confinement. However, the plasma is found to be well confined. An experimental investigation of particle confinement time and a comparison with Single particle confinement time is therefore necessary. Detailed experimental study of particle confinement time with $L_c$ and poloidal flows will be shown. It is believed that the instabilities driven transport regulate the poloidal flows and hence increase the confinement. Details of these experimental investigation will be presented.

References

