Abstract for ECPD

Influence of secondary beam non-uniformity on plasma potential measurements by HIBD with split-plate detection technique

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In a Heavy Ion Beam Diagnostic (HIBD), the plasma potential is obtained from the measurements of secondary beam energy by electrostatic energy analyzer with split-plate detector (SPD), which transforms the beam energy variation to the difference of currents between the plates. Conventionally, the data from SPD is analyzed with assumption of uniformity of the analyzed beam. However, because the secondary beam presents an effective projection of the primary beam, it should follow the primary beam profile, which, as a rule, has a bell-like non-uniform shape. In this presentation, the influence of the secondary beam non-uniformity on plasma potential measurements is considered using the data from HIBD on the ISTTOK tokamak. It is shown that the secondary beam heterogeneity affects the measurements of plasma potential and its fluctuations due to non-linearity of the SPD response. Obtained results indicate the importance of secondary beam profile control. In conventional SPD applications, realization of the respective measurements during plasma shot is not trivial. The problem can be solved with implementation of multiple cell detector with dedicated resolution, supported by external control of the beam shape, as demonstrated for the 90° cylindrical energy analyzer equipped with guard rings.