Current profile simulations during eITB formation on TCV

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Plasma scenarios characterized by a sudden drop in the central heat transport coefficient are routinely obtained in TCV (Tokamak à Configuration Variable) thanks to a unique Electron Cyclotron Resonance Heating (ECRH) system. Such advanced performances are achieved in discharges fully non-inductively sustained with Electron Cyclotron Current Drive (ECCD) for over 2s [1]. Improved core electron confinement is usually related to the appearance of an electron internal transport barrier (eITB). Experiments have been conducted on TCV to elucidate the role of the current profile evolution from peaked to hollow in the eITB formation [2], in particular the importance of the occurrence of a zero-shear surface for triggering the barrier. Some typical time traces for an eITB shot are shown in Fig. 1, respectively the plasma current, loop voltage, total input power and the value of the electron temperature in the centre [3]. The eITB is usually created during the transition from the ohmic to the non-inductive phase and a systematic study of the barrier formation has been carried out with the use of the ASTRA transport code [4]. In this context, ASTRA has been employed in an interpretative mode, constrained by experimentally measured density and temperature profiles, to provide modelling of the safety factor (q) and current density profile evolutions, of which there exists no direct measurement. Simulations suggest that the radial location and time of the barrier formation are consistent with the spatial and temporal appearance of a minimum in the q profile. Comparisons of the numerical results with the experimental profiles are also discussed.

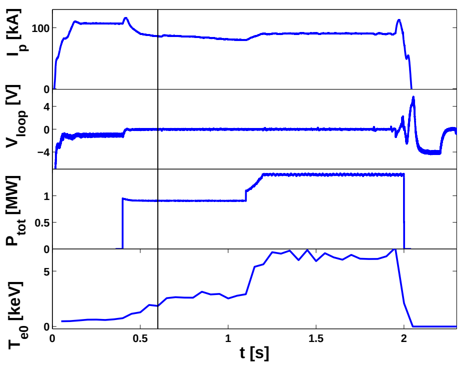

Figure 1: TCV #21655: barrier formation occurs at about 0.6s.

References

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