Contribution ID: **169** Type: **Poster**

Extension of the Operating Space of High-“β_N”Fully Non-inductive Scenarios on TCV Using Neutral Beam Injection

Tuesday 23 October 2018 08:30 (20 minutes)

The fully non-inductive sustainment (“V_loop~0”) of high normalized beta (“β_N”) plasmas is a crucial challenge for the steady-state operation of a tokamak reactor. In order to assess the difficulties associated with such scenarios, steady-state regimes have been explored on TCV using the newly available 1MW Neutral Beam Injection (NBI) system. Compared to the past [O. Sauter et al Phys. Rev. Lett. 84(15) 3322 (2000), S. Coda et al Phys. of Plasmas 12 056124 (2005)], plasmas closer to those expected in ITER, i.e. with significant NBI and ECRH current drive, bootstrap current and fast ion fraction, have been investigated. The operating space has been explored by carefully scanning the total auxiliary power “P_aux=P_EC+P_NB”, the NB power fraction (“P_NB/P_aux”) and the radial deposition location of the NB and EC heating and current drive. “β_N” values up to 1.4 and 1.7 at “V_loop~0”have been reached in L-mode and H-mode plasmas, respectively. Fully non-inductive operation was not achieved with NB alone, whose injection could even increase “V_loop”in presence of EC waves. Internal Transport Barriers, which are expected to maximize the boostrap current fraction, were not formed in either the electron or the ion channel in the plasmas explored to date; and this despite a significant increase in the toroidal rotation and Fast Ion (FI) fraction with NBI, which are known to reduce turbulence [J. Garcia et al Nucl. Fusion 55 (2015) 053007]. The possibility that these plasmas are Trapped Electron Mode (TEM) turbulence dominated is being analysed in dedicated transport analyses. A strong contribution of bulk and FIs to the total plasma pressure has been experimentally evidenced and confirmed by modelling (ASTRA, NUBEAM). Interpretative simulations further predict that FI charge-exchange reactions are the main loss channel for NB heating efficiency. Similar results were also obtained in inductive L-mode plasmas in a circular limited configuration at TCV [B. Geiger et al Plasma Phys. Control. Fusion 509 115002 (2017)]. Interpretative transport analysis with TRANSP coupled to NUBEAM is carried out to quantify the role of NBI losses and of the anisotropy in the FI velocity space distribution in the NBCD efficiency. A complete understanding of this evidence is crucial to the development of fully non-inductive plasmas

Country or International Organization

Italy

Paper Number

EX/P1-30

Author: Dr PIRON, Chiara (ItRFX)

Co-authors: Dr KARPUSHOV, Alexander (ChSPC); Dr MERLE, Antoine (ChSPC); Dr TESTA, Duccio (ChSPC); Dr GIRUZZI, Gerardo (FrCEAIRFM); Dr GARCIA, Jeronimo (FrCEAIRFM); Dr MORALES, Jorges (FrCEAIRFM); Dr PIGATTO, Leonardo (ItRFX); Dr YOSHIDA, Maiko (JpQST); Dr GOBBIN, Marco (ItRFX); Dr AGOSTINI, Matteo (ItRFX); Mr FONTANA, Matteo (ChSPC); Mr VALLAR, Matteo (ItRFX); Ms KONG, Mengdi (ChSPC); Dr SAUTER, Olivier (ChSPC); Dr NOWAK, Silvana (ItIFP); Dr GOODMAN, Timothy (ChSPC)

Presenter: Dr PIRON, Chiara (ItRFX)

Session Classification: P1 Posters