Contribution ID: **100** Type: **Oral (Plenary Session)**

Analysis of TAEs and FBs induced fast ions redistribution and losses in MAST using a reduced fast ion transport model

Thursday, 5 September 2019 09:50 (25 minutes)

In MAST dedicated experiments were carried out to study the redistribution and loss of neutral beam injected fast ions due to their interaction with Toroidal Alfvén Eigenmodes (TAEs) and Fish-Bones (FBs) by integrating observations from Fast Ion D-alpha diagnostics, a multi-channel Charged Fusion Product Detector (CFPD) and a Neutron Camera (NC) [1]. The experimental observations were modelled in TRANSP/NUBEAM using a combination of the "ad-hoc"time-dependent anomalous diffusion coefficient and the FB model available in NUBEAM. The main limitations of this study were the lack of a physical justification for the level of anomalous fast ion diffusion required to match predictions and observations and the fact that it was not possible to identify a fast ion distribution that was simultaneously in agreement with both FIDA and NC observations.
In this work, these experimental observations are now revisited using the "kick model"[2] in which spatial diffusion coefficients emerge from the estimate of the fast ion diffusion in pitch and energy phase space estimated by Monte Carlo simulations of test particle trajectories in presence of perturbations of the plasma equilibrium. The Probability Density Function (PDF) of the "kicks"in energy and pitch is estimated using the ORBIT code in which the perturbation(s) eigenfunction(s) and amplitude(s) are provided in input. The perturbation eigenfunctions are estimated using NOVA and MISHKA codes while amplitude is proportional to root mean square value of the magnetic field perturbation at the edge measured by Mirnov coils, with the proportionality constant as the single free parameter. The fast ion distribution calculated in TRANSP/NUBEAM on the basis of the "kicks"PDF is then compared with FIDA, CFPD and NC observations.

[1] Cecconello M, Jones OM, Boeglin WU, Perez RV, Darrow DS, Klimek I, et al. "Energetic ion behaviour in MAST"Plasma Phys Control Fusion. 2015 57 014006.
[2] Podestá M. "A reduced fast ion transport model for the tokamak transport code TRANSP"Plasma Phys Control Fusion 2014 56 055003.

Country or International Organization

Sweden

Primary author: CECCONELLO, Marco (Uppsala University)

Presenter: CECCONELLO, Marco (Uppsala University)

Session Classification: Plenary

Track Classification: Transport of Energetic Particles