Contribution ID: **532** Type: **Poster**

Phase-space resolved measurements of the influence of RF heating and MHD instabilities on the fast-ion distribution in ASDEX Upgrade

Thursday, 20 October 2016 14:00 (4h 45m)

Fast, supra-thermal ions provide a powerful mechanism to heat fusion plasmas and to drive plasma currents and rotation. It is therefore crucial for the success of future fusion devices (such as ITER and DEMO) to understand the physics of fast ions and ensure their safe confinement. In the presented work, experimental studies of the fast-ion phase space are carried out using a FIDA (Fast-Ion D-Alpha) diagnostic at the ASDEX Upgrade tokamak. Recent diagnostic upgrades allow the tomographic reconstruction of the 2D fast-ion velocity distribution at several radial positions on the low-field side.

The FIDA tomography is applied to study the velocity-space dependence of fast-ion redistribution during sawtooth crashes. It is found, that fast ions with high energies and pitches (v||/v) close to zero are less affected by the sawteeth. This can be explained by the fact that these ions have large drift velocities (compared to their parallel velocity) and are thus more weakly bound to the (reconnecting) magnetic field lines.

Moreover, we investigate the acceleration of fast deuterium ions by 2nd harmonic ion cyclotron resonance heating. In this ICRH scenario, hydrogen is resonant at the first harmonic, which is in competition with deuterium absorption and needs to be considered in the data analysis. We show that the FIDA tomography can be interpreted as sum of the D and H distribution function. In an NBI+ICRH phase, the tomographic reconstructions in the plasma center yield two distinct high-energy tails above the NBI energy, which are not present in a NBI-only phase. Basic theoretical considerations suggest, that these tails originate mainly from deuterium. In total, we calculate tomographic reconstructions at six radial positions spanning a broad range of the plasma radius. This is the first time that a radial profile f(E,v||/v,r) of the fast-ion distribution function is reconstructed from FIDA measurements. The high-energy tails vanish in the outer-most radial positions, which is in agreement with the expected ICRH deposition position. A comparison to theoretical models reveals that the tails (above the NBI energy) are under-estimated by TRANSP/TORIC in the very plasma center and over-estimated by TORIC-SSFPQL. These differences are discussed and compared to other fast-ion diagnostics. For lower energies (around and below the NBI energy) good agreement is found.

Paper Number

EX/P6-27

Country or International Organization

Germany

Primary author: WEILAND, Markus (Max-Planck-Institut für Plasmaphysik)

Co-authors: Dr JACOBSEN, Asger (Technical University of Denmark); Dr GEIGER, Benedikt (Max-Planck Institut für Plasmaphysik); Dr RYTER, Francois (IPP-Garching); Dr TARDINI, Giovanni (Max-Planck-Institut für

Plasmaphysik); Prof. ZOHM, Hartmut (Max-Planck-Institut für Plasmaphysik); Dr SALEWSKI, Mirko (Technical University of Denmark); SCHNEIDER, Philip A. (Max-Planck-Institiut für Plasmaphysik); Dr BILATO, Roberto (Max-Planck-Institut für Plasmaphysik); Dr NIELSEN, Stefan Kragh (Technical University of Denmark)

Presenter: WEILAND, Markus (Max-Planck-Institut für Plasmaphysik)

Session Classification: Poster 6

Track Classification: EXS - Magnetic Confinement Experiments: Stability