Monte Carlo ion cyclotron heating and fast ion loss detector simulations in ASDEX Upgrade

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The orbit-following simulation tool ASCOT-RFOF consists of the orbit-following Monte Carlo code ASCOT [1] interfaced to the radiofrequency heating Monte Carlo code library RFOF [2]. In the present work, ASCOT-RFOF is applied to simulate fundamental mode ion cyclotron (IC) heating of hydrogen in ASDEX Upgrade discharge #33147 at t = 1.0 s and the related fast ion loss detector (FILD) signal. This discharge was chosen because it is well diagnosed and provides the possibility of further, more challenging simulations due to an observed FILD signal oscillation attributed to a beat effect between MHD modes, which is expected to be within ASCOT's simulation capabilities.

In the two-stage simulation scheme, the IC-heated hydrogen population is first created by an ASCOT-RFOF simulation, starting with 500.000 ion markers that represent a Maxwellian hydrogen population making up 3% of the total ion density, which consists mainly of deuterium.

The IC-heated hydrogen distribution is then used as input for ASCOT's distribution-sampling marker source module, and 500.000 sampled hot ion markers are used in a simulation of the hot ion wall load and fast ion loss detector (FILD) signal in the presence of AUG's toroidal field ripple of about 0.5%. The simulation results are compared to FILD signal measurements from the modelled discharge [3].

[1] E. Hirvijoki *et al.*, "ASCOT: Solving the kinetic equation of minoriy particle species in tokamak plasmas". Computer Physics Communications 185 (2014) 1310-1321.

[2] T. Johnson *et al.*, "Library for RF Interactions in Orbit Following Codes". AIP Conference Proceedings 1406 (2011) 373.

[3] M. García-Muñoz and S. Sharapov, at MST1 AUG 1.7-2 Meeting, Seville, Spain, 28 July 2016.

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