Contribution ID: **3616** Type: **not specified**

P5.1076 Linear stability of the inner core of JET plasmas using gyrokinetic simulations

Friday, 12 July 2019 14:00 (2 hours)

See full abstract here http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1076.pdf

Transport of tungsten (W) in the central part of ITER is expected to be determined by neoclassical and turbulent processes, which strongly depend on the main ion density, temperature, and rotation profiles. Thus, to predict the W core transport behaviour, one needs to know the transport processes determining the density and temperature gradients of the main ions.

In the central zone near the magnetic axis, r/a<0.3, turbulence is close to marginality. In this region, key questions for ITER are 1) whether turbulent diffusion is sufficiently large to offset the neoclassical (inward) pinch of W, 2) if yes, up to which radius and how sensitive this is to the background gradients. An auxiliary question is to which degree standard quasi-linear models such as QuaLiKiz or TGLF are valid in the central zone.

To start providing an answer to these questions, linear gyrokinetic simulations are first performed in the central zone of a JET hybrid H-mode plasma using the gyrokinetic code GKW in the local approximation limit. The studied JET pulse corresponds to the operating phase with Carbon plasma facing components. For this plasma, there are high quality core profile measurements for electron and main ions (Thomson scattering and charge exchange spectroscopy) and the discharge has no sawteeth and no other significant MHD activity. Following this initial modelling, the main ion temperature gradient will be scanned around the experimental value to determine the threshold at which significant turbulent transport can be triggered and its sensitivity to other parameters will be assessed (magnetic shear, Te/Ti, etc.). The simulations will include electromagnetic perturbations, magnetic shear, collisions, plasma beta effects, and will include three species (deuterium, electron, and carbon). The next step will be to perform non-linear gyrokinetic simulations of the same plasma by GKW code and compare the results with quasilinear simulations by QuaLiKiz code to test the validity of the quasi-linear approximation in the central zone (r/a<0.3) of tokamak plasmas.

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Session Classification: Poster P5