Contribution ID: **576** Type: **Overview**

Recent ASDEX Upgrade Research in Support of ITER and DEMO

Monday 13 October 2014 14:20 (25 minutes)

Research on ASDEX Upgrade is programmatically focused on resolving physics questions that are key to the successful operation of ITER as well as informing design choices for a future DEMO reactor. From 2014 on, a significant part of the ASDEX Upgrade programme is run under the EUROfusion MST programme.
Using the flexible set of in-vessel helical perturbation coils, penetration of 3-d fields into the plasma is studied by analysing its impact on the edge plasma in L-mode discharges or examining the interaction with rotating core MHD modes. ELM mitigation by 3-d fields at high collisionality allows access to very small, high frequency ELMs at edge temperatures and pressure gradients higher than in the usual small ELM regime at high density. This cannot be described by the usual peeling-ballooning model for ELM stability which, in general, is shown to be inadequate to explain the whole variety of type I ELM observations.
The study of the impact of a full metal first wall on plasma operation and performance continues to be a major research topic. Comparison with JET has confirmed many of our results. Characterisation of the ITER Q=10 scenario (standard H-mode at q95 = 3 and betaN = 1.8) revealed that with full metal wall, confinement quality is marginal for reaching H = 1. In this scenario, type I ELMs are large and first attempts using helical fields or pellets showed limited success in mitigation. With higher betaN, confinement regularly exceeds H = 1. These findings suggest that the optimum operational point for ITER Q = 10 might be at higher q95 and betaN, evolving towards the 'improved H-mode'regime under study in ASDEX Upgrade.
Concerning research for DEMO, a major emphasis is put on the exhaust problem. Record values of Psep/R exceeding 7 MW/m (total power up to 23 MW) with simultaneous time averaged peak target power load < 5 MW/m2 have been demonstrated under partially detached conditions using feedback controlled N-seeding. Complete detachment at high input power P > 10 MW was achieved and extensive modelling helps to clarify the mechanisms behind the experimentally observed high density zone in the divertor plasma as well as the stable X-point radiation. Using double feedback on N and Ar impurity seeding, a value of Prad,core/Ptot approx. 70 % as will be needed for DEMO was demonstrated at very good plasma performance. Finally, we will report on operational experience with two rings of tiles consisting of ferritic steel on the high field side heat shield to analyse the implications of a possible use of bare EUROFER wall panels on DEMO and the use of newly installed rings of solid W tiles in the outer divertor strike zones.
All these studies are accompanied by progress in the understanding of the underlying fusion plasma physics, which is essential to obtain true predictive capability, and will be discussed in the contribution.
This project has received funding from the EURATOM research and training programme 2014-2018.

Country or International Organisation

Germany

Paper Number

OV/2-2

Author: Mr ZOHM, Hartmut (Germany)

Presenter: Mr ZOHM, Hartmut (Germany)

Session Classification: Overview 2

Track Classification: OV - Overviews