Contribution ID: **431** Type: **Overview Poster**

ITER-relevant research on the COMPASS tokamak

Monday, 22 October 2018 14:00 (4h 45m)

In the years 2016-17 the research on the COMPASS tokamak was focused on support of solution of the key challenges for the design and operation of ITER and next-step devices. This included mainly installations and upgrades of state-of-art edge plasma diagnostics, such as the new divertor probe array and the High Resolution Thomson scattering. Strong emphasis was placed on development of relevant scenarios: discharges with impurity seeding at different locations in the divertor were focused on accessing partially detached plasmas. It was demonstrated that such regime can be achieved, when nitrogen is injected at the outer target, although drop of upstream pressure was also observed.

Measurements of peak ELM energy densities in the divertor complemented the existing scaling by Eich et al. and confirmed the validity of proposed model. The same set of probes mounted on the horizontal reciprocating manipulator allowed to perform upstream measurements of power decay length during ELMs. It was observed, that the power decay length exhibits a significant broadening (factor of 4) compared to the inter-ELM value.

Dedicated campaigns were focused on experiments with runaway electrons (RE), studying the role of different gases (Ar, Ne, D) on the generation and mitigation of the RE beam. It appeared that an intensive injection of D may significantly slow down the current decay of RE beams triggered by Ar or Ne injection in the discharge phase with practically zero external loop voltage.

On request of the ITER Organization, a unique system of COMPASS High-field-side (HFS) Resonant Magnetic Perturbation (RMP) coils was used to study the effects of Error Fields (EF) originating from misalignment or inclination of central solenoid on the plasma performance like L-H transition, H-mode performance degradation, locked modes, etc., The experimental observations are compared to predictions of the ideal MHD code IPEC. This study is being carried out in collaboration with ITER Organization and Princeton Plasma Physics Laboratory, USA.

In all the aforementioned fields, a significant progress under the joint EUROfusion effort has been achieved in 2016-17 and the results complemented and broadened the existing databases.

Country or International Organization

Czech Republic

Paper Number

OV/P-3

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Session Classification: OV/P P1-P8 Overview Posters

Track Classification: OV - Overviews