

P2.1058 Impact of impurity radiation locations on the plasma performance at W7-X stellarator

Tuesday, 9 July 2019 14:00 (2 hours)

see full abstract here

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.1058.pdf>

The optimized stellarator Wendelstein 7-X (W7-X) has recently conducted its first divertor operation. One of the main scientific objectives is to examine and optimize the island divertor as a potential concept for a future stellarator reactor. One promising approach is to keep the impurities released from the plasma-surface-interaction region in the scrape-off layer (SOL), which on the one hand prevents the impurity contamination of the core plasma as well as the deterioration of the plasma confinement, and on the other hand brings benefits to the plasma facing components from impurity radiation by heat load reduction, thus, avoiding material erosion. The search for optimized operating conditions, allowing for both, high-radiation and high plasma performance, is therefore of great concern to us. At W7-X, a two-camera bolometer system is used for measuring the plasma radiation. It consists of a horizontal and a vertical camera having lines of sight covering an entire triangular cross-section, including both the core- and the SOL-region. Information about 2D radiation intensity distribution, total radiated power loss $Prad$ as well as power loss fraction from the SOL, $frac_SOL = Prad_SOL/Prad$, have been obtained from the line-integrated measurements of the channels. It has been observed that 1) at low-radiation levels, the radiation zone is located in the SOL, indicated by a high value of $frac_SOL$ (>80%) outside the LCFS; 2) with increasing density, chord-brightness of SOL-channels weakens resulting in a reduction of $Prad_SOL$ although the overall radiation level enhances. This is interpreted as an inward radial shift of the radiation zone; 3) for high-radiation regimes, the entire zone broadens in the radial direction and sometimes even penetrates into the confined plasma region indicated by a drop of $frac_SOL$. For the latter case a degradation of the plasma stored energy as well as the confinement time E are observed. This may explain the observations that E deviates from the ISS04-scaling at high density scenarios [1]. In this contribution, we will present systematic investigations concerning these issues. They are preconditions for understanding the underlying physics that will guide the future exploration of the optimum operational parameters for the island divertor concept involved in W7-X.

References:

[1] G. Fuchert et al, Preprint: 2018 IAEA Fusion Energy Conference, Ahmedabad EX/3-5

pppo

Presenter: ZHANG, D. (EPS 2019)

Session Classification: Poster P2

Track Classification: MCF