Contribution ID: **3126** Type: **not specified**

P1.1082 The operational space of the first divertor experiments in Wendelstein 7-X

Monday, 8 July 2019 14:00 (2 hours)

See the full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P1.1082.pdf

One of the main goals of Wendelstein 7-X is to show that stellarators can sustain fusion-relevant plasma conditions in steady-state. It is envisaged to demonstrate plasma operation with a density well above 10^20/m^3, central electron and ion temperatures around 3 keV and a pulse length of half an hour. Finding a suitable target scenario is one of the key issues of the initial experimental campaigns. In this contribution we present the operational space (density and heating power) that has been mapped out already and report on operational limits that have been observed.
At the moment, steady-state heating is only provided by ECRH. The minimum and maximum heating power are determined by the technical capabilities of the heating system. Increasing the power is not a fundamental problem and is planned for future upgrades. However, there are two operational density limits that have been observed so far: One is the occurrence of radiative collapses at a power-dependent critical density and the other is related to the absorbed ECRH power at high densities: The absorption of the microwaves in O2-polarization used for ECR heating above the X2-cutoff at 1.2·10^20 m^-3 depends strongly on the electron temperature and, hence, at fixed power on the density. In contrast to the radiative collapse, the latter does not lead to plasma termination, but prohibits effective heating and poses risks to the machine safety due to stray radiation. At the highest heating powers (up to 7.5 MW), the O2 absorption efficiency drops at densities lower than the radiadtive density limit. Stable plasma operation has been achieved at a line-averaged density of 1.5·10^20 m^-3. At lower heating powers, the critical density for radiative collapses decreases and denies access to such high densities. Close to the critical density, however, stable plasma operation is possible despite a high radiated power fraction. At lower densities, the global confinement benefits slightly (relative to empirical scalings) from the reduced radiation. However, so far detachment, which is considered a prerequisite for high-performance long-pulse operation, has only been observed at high density and heating power. These observations show that stable plasma operation is possible over a large parameter range with the most promising conditions for long-pulse operation at high densities and heating powers. This suggests that planned upgrades to increase the heating power are indeed necessary.

pppo

Presenter: FUCHERT, G. (EPS 2019)

Session Classification: Poster P1

Track Classification: MCF