Neutral particle fluxes on the divertor during overload mimic scenarios in Wendelstein 7-X

A. LeViness[1], P. Drewelow[2], J.D. Lore[3], G. Schlisio[2], G. Wurden[4], B. Cannas[6], K. Hammond[2], M. Jakubowski[2,5], F. Pisano[6] and W7-X team

[1] *Universität Greifswald, Greifswald, Germany*

[2] *Max-Planck-Institut für Plasmaphysik, Greifswald, Germany*

[3] *Oak Ridge National Laboratory, Oak Ridge, United States*

[4] *Los Alamos National Laboratory, Los Alamos, United States*

[5] *Faculty of Mathematics and Physics, University of Szczecin, Szczecin, Poland*

[6] *Università degli Studi di Cagliari, Cagliari, Italy*

Wendelstein 7-X will perform high-power long-pulse discharges with the actively cooled divertor from the early 2020's. It is predicted [1] that in some configurations, during the first 100 s of the discharge, the toroidal current in the plasma will evolve and change the magnetic topology such that the edges of the divertor may be overloaded. The planned solution to this is the installation of 'scraper element' components. Two of these components are expected to be installed for OP 1.2b [2] to test their effectiveness and influence on plasma performance. One of the key questions is whether neutral divertor compression will be reduced too much due to strong interaction of the plasma with the surface of the scraper element.

Because of the limits on pulse length and energy input, the overload scenario cannot occur during OP 1.2. Instead, five magnetic configurations were designed to mimic the topology created by the toroidal current as it evolves from 0 to 43 kA, including the peak overload case of 22 kA. In order to compare actual heat and particle loads to those predicted by EMC3-EIRENE simulations, and to establish baseline measurements for comparing performance with and without the test divertor scraper elements, experiments were performed during the previous campaign using these mimic configurations.

In this work, we analyze the H-alpha camera diagnostic data in order to quantify divertor particle fluxes and relate them to neutral divertor pressure measured by pressure gauges. Results showed heat and particle flux patterns closely matching those predicted by simulations.

References

[1] H. Hoelbe, et al., Nucl. Fusion 56, 025015 (2016)

[2] J.D. Lore, et al., IEEE TPS 42, 539 (2014)