Study of the Impact of High Neon Radiation on Pedestal and Divertor in JET Experiments

S. Glöggler[1,2], M. Wischmeier[1], M. Bernert[1], G. Calabrò[3], A. Huber[4], C. Lowry[5], M. Reinke[6], S. Wiesen[4], X. Bonnin[7], E. Fable[1], S. Henderson[8], JET Contributors[†]

[1] *Max Planck Institute for Plasma Physics, Boltzmannstraße 2, 85748 Garching, Germany*

[2] *Physik-Department 28, Technische Universität München, 85747 Garching, Germany*

[3] *Department of Economics, Engineering, Society and Business Organization (DEIm), University of Tuscia, Largo dell'Università snc, 01100 Viterbo, Italy*

[4] *Forschungszentrum Jülich GmbH, Institut für Energie- und Klimaforschung - Plasmaphysik, 52425 Jülich, Germany*

[5] *European Commission, 1049 Brussels, Belgium*

[6] *Oak Ridge National Laboratory, Oak Ridge, TN 37831, USA*

[7] *ITER Organization, Route de Vinon-sur-Verdon, CS 90 046, 13067 St-Paul-lez-Durance, France*

[8] *CCFE Fusion Association, Culham Science Centre, Abingdon, AX143DB, UK*

[†] *See the author list of "X. Litaudon et al 2017 Nucl. Fusion 57 102001"*

Impurity radiation is a major requirement to protect the divertor targets of future fusion devices, such as ITER and DEMO, from power loads beyond the material limit of $5-10\,\mathrm{MW/m^2}$. Such radiation is induced by deliberate puffing of impurity gases into the plasma. In order to extrapolate the impact of neon on the plasma confinement of DEMO, where in an ITER-like geometry around 70% of the induced radiation must originate from inside the separatrix, recent experiments and numerical simulations have been carried out.

At JET dedicated experiments with high heating powers (over 15 MW), high line-averaged densities (over $5\cdot10^{19}\,\mathrm{m^{-3}}$), $B_\mathrm{T} = 2.6\,\mathrm{T}$, $I_\mathrm{p} = 2.5\,\mathrm{MA}$ were carried out. In particular, measurements of bolometry, spectroscopy, target Langmuir probes, and HRTS were analyzed. With the seeding of neon the radiation in the pedestal region rises, which leads to a strong reduction of the target power flux. It was found that with neon the temperature and density at the pedestal top position degrade by up to 30% but recover towards the core. Despite this degradation, an increase of the global energy confinement time of about 10% is observed. The 1D transport code ASTRA is used to determine a possible impact of the radiation on the energy transport coefficients. In addition, these experimental measurements were used to validate numerical simulations performed with the code package SOLPS-ITER. The details of this validation will be explained.