# Direct determination of background neutral density profiles from neutral particle analyzers

K. Mitosinkova[1,2], B. Geiger[3], P. A. Schneider[3], A. van Vuuren[3], A. N. Karpushov[4], the ASDEX Upgrade team[5], the TCV team[6] and the EUROfusion MST1 team[7]

[1] *Institute of Plasma Physics of the CAS, Prague, Czech Republic*

[2] *Charles University, Faculty of Mathematics and Physics, Prague, Czech Republic*

[3] *Max-Planck Institute für Plasmaphysik, Garching, Germany*

[4] *Swiss Plasma Center, EPFL, Lausanne, Switzerland*

[5] *See author list of A. Kallenbach et al 2017 Nucl. Fusion 57 102015*

[6] *See author list of S Coda et al 2017 Nucl. Fusion 57 102011*

[7] *See author list of H Meyer et al 2017 Nucl. Fusion 57 102014*

Profiles of the background neutral density, $n_0$, are important for plasma transport understanding because $n_0$ is responsible for charge-exchange losses, as well as, for plasma fuelling. However, detailed $n_0$ profiles are not routinely available at most fusion devices.

Here we present a fast reconstruction of $n_0$, directly from neutral particle analyzer (NPA) data, which has become possible thanks to the steady improvement of ion temperature and ion density measurements. NPAs measure energy resolved fluxes of neutrals escaping the plasma, $\Gamma(E_n)$, formed by charge-exchange collisions between the plasma ions and the background neutrals. Calculated fluxes $\Gamma(E_n)$, based on knowledge of the other plasma parameters, are fitted to measured ones by optimizing $n_0$ profile parameters.

The method is successfully benchmarked by comparing the actual NPA measurements with synthetic NPA fluxes from FIDASIM simulation with calculated $n_0$ used as the input. In addition the reconstructed $n_0$ profiles are compared with predictions from KN1D, TRANSP/FRANTIC and DOUBLE.

As a fist application of the $n_0$ profiles obtained from the new direct analysis, ELM-resolved neutral densities will be presented. Moreover, the impact of the inferred neutral densities on the level of charge-exchange losses will be discussed for ASDEX Upgrade and TCV cases.