# Transient Particle Transport Studies in the Edge Plasma of ASDEX Upgrade

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The edge density profile plays an important role for various topics such as the L-H transition power [Shao PPCF 2016] or the achievable pedestal top pressure [Dunne PPCF 2016]. Under the assumption of local transport the edge density profile is determined by diffusive and convective transport and the particle sources. The analysis of steady state profiles cannot distinguish these different contributions. To be able to predict the density profile for future machines it is however necessary to understand the parameter dependencies of both diffusion coefficient and convection, which is described by a pinch velocity.

Additional information can be obtained by gas-puff modulation experiments. Modulating the fuelling leads to a modulation of the plasma density, an effect that has been used for particle transport studies already for a long time [Gentle NF 1992]. For edge transport studies additional challenges arise from the modulated particle source.

In the study presented here the plasma in ASDEX Upgrade is fuelled and modulated via fast acting valves at the midplane, with which the transition between zero flow and full flow takes less than 0.5 ms [Griener Rev. Sci. Instrum. 2017]. This fast action is beneficial because temporal delays, which show transport phenomena, are not hidden by a slow valve action. The evolving source term and plasma response are modelled self-consistently using ASTRA [Pereverzev 2002]. Through a maximum likelihood fit it is then possible to infer the transport coefficients and the neutral density at the separatrix. The experimental measurements for modulation and mean value of the density by the thermal helium beam [Griener Rev. Sci. Instrum. 2018], lithium beam [Wolfrum Rev. Sci. Instrum. 1993, Fischer PPCF 2008] and interferometry [Mlynek Rev. Sci. Instrum. 2010] can be reproduced by a wide range of diffusivities and neutral densities, even without any convective transport. Measurements from the electron cyclotron emission diagnostic [Suttrop 1996] show a clear modulation of the electron temperature due to the gas-puff modulation. We therefore expand our model to include the impact of neutrals on the heat balance. We also consider measurements from the neutral particle analyzers [Bogar NF 2020] and core transport coefficients from TGLF [Staebler PoP 2007]. By including this additional information in an integrated data approach we can narrow down the ranges of transport coefficients and particle sources in the edge.