Analysis and modeling of momentum transport based on NBI modulation experiments at ASDEX Upgrade

C. F. B. Zimmermann[a b], R. M. McDermott[a], E. Fable[a], G. Tardini[a], T. Pütterich[a], U. Stroth[a b], C. Angioni[a], T. Tala[c], A. Salmi[c], B. P. Duval[d] and the ASDEX Upgrade[e] and MST1[f] experimental teams

[a] *Max Planck Institute for Plasma Physics, 85748 Garching, Germany*
[b] *Physik-Department E28, Technische Universität München, 85747 Garching, Germany*
[c] *VTT, P.O. Box 1000, FI-02044 VTT, Finland*
[d] *Ecole Polytechnique Fédérale de Lausanne, Swiss Plasma Center, CH-1015 Lausanne, Switzerland*
[e] *see the author list of H. Meyer et al. 2019*
[f] *see the author list of B. Labit et al. 2019*

At ASDEX Upgrade momentum transport is studied to validate theoretical models and transport codes. In particular, information on the parameter dependencies of the Coriolis pinch, Prandtl number, and residual stress are of interest. Modeling and analysis of the experimental data is carried out with ASTRA and TRANSP. A large database has been created, encompassing 90 phases from 50 discharges with NBI modulation performed in ASDEX Upgrade. A data set from 2017 was chosen to test our analysis methodology. Here, different heating methods using ECRH and ICRH modulation and various NBI modulation frequencies, powers, and beam geometries were applied while keeping the background profiles constant. A code framework for analysis was built and tested on this data set. First results indicate that these tools allow the diffusion and convection to be modelled as a function of time and to separate the intrinsic torque from the other terms. The fitting of the transport coefficients is performed autonomously with several local and global minimization routines employed that provide statistically robust solutions. This work allows us to identify experimental settings that are beneficial in the analysis of momentum transport. This framework will be applied to the entire database. With a large data set that covers a wide parameter space, it should be able to cross-validate the methodology and the numerical fitting approaches and to study the parameter dependencies of the transport coefficients. In particular, the theoretically predicted dependence of the Coriolis pinch on quantities such as the density gradient will be explored. In ongoing experiments, the parameter space of the database will be enlarged, increasing the understanding of the involved physical processes and allowing a more detailed validation of the methodology and theoretical predictions.