# Impurity transport in the core region of W7-X during its most recent campaigns.

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The investigation of core impurity transport properties is a demanding task for fusion devices with the potential of steady-state operation since central accumulation of those highly charged ions could yield too strong radiative cooling and early pulse termination. The objective of this paper is to provide an overview of the characterization and documentation of core impurity transport in the optimized stellarator Wendelstein 7-X (W7-X) [1]. One prominent method to study the impurity confinement in W7-X is based on dedicated injection of impurity ions via the laser blow-off technique [2]. This method was applied in 123 experimental programs with different plasma parameters and magnetic field configurations. The evaluation of the injection by means of the already established one-dimensional transport code STRAHL takes into account not only spectroscopic signals and information on the impurity source function but also the kinetic plasma profiles [3]. The ongoing development of the analysis tools is an important point for the verification of the results. In detail, work is being done to achieve a better local resolution of the transport coefficients and to study the sensitivity of the results.

Beyond this, the correlation of transport properties with plasma parameters and the derivation of scaling laws enables a direct comparison to other machines and allows predictive statements about the impurity transport in future plasma scenarios. In particular, the core impurity transport is found to be strongly dependent on turbulence mechanisms. A large diffusive turbulent contribution to the impurity transport in standard ECR heated plasmas (dominant ECR heating without kinetic profile shaping events, e.g., pellet injection) was experimentally and numerically confirmed. In plasma scenarios with low/no ECRH power and additional NBI heating, the impact of turbulence on the transport properties reduces. In these turbulence suppressed scenarios, the neoclassical (and classical) transport becomes important leading to peaked profiles, a better confinement and even impurity accumulation.

## References

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[2] Th. Wegner et al., Review of Scientific Instruments 89, 073505 (2018)

[3] B. Geiger et al., Nuclear Fusion 59 (2019)