Tungsten is a promising material for plasma facing components of fusion reactors, because of its high melting temperature, low sputtering yield and acceptable tritium retention. On the other hand, high-Z ions like tungsten causes strong radiative cooling, even at very low concentrations of 10 ppm. Moreover, the neoclassical transport may cause accumulation of high-Z ions in the plasma core where they could hamper the fusion reaction. Therefore, a thorough investigation of the transport mechanisms responsible for removing tungsten from the plasma core is crucial.

Recent studies of tungsten transport driven by MHD modes and sawtooth-crashes [1] call for development of a new method for the estimation of the 2D tungsten distribution in the plasma core with high spatial and temporal resolution. The distribution of the heavy ion density is revealed by their radiation which can be reconstructed by tomographic inversion of the line-integrated measurements of the Soft X-ray (SXR) diagnostics. Reconstruction of SXR radiation from tungsten is demanding due to the presence of very localized features caused by sharp gradients of the tungsten density and steep dependence of the SXR radiation on electron temperature. The reconstruction of such radiation gradients with standard methods like the Cormack or the Fourier-Bessel method results in significant artifacts. Therefore, an alternative non-linear regularization based method was developed. The new method shows superior results compared to these classical methods and the Minimum Fisher regularization method.

An additional gain of information could be achieved by rotation tomography. However, the presence of the centrifugal asymmetry of tungsten density breaks a basic assumption of the rotational invariance of the mode. Therefore, an alternative method based on dimensionality reduction of the multichannel quasi-stationary signal using complex singular value decomposition of the harmonics was developed.

These two methods are tested on data from a recently developed full 3D synthetic SXR diagnostics model [2] for ASDEX Upgrade as well as on real data with the emphasis on finding the limitation of the methods.

References

[1] M. Sertoli et al., this conference