

## **2D core ion temperatures and impurity density with Coherence Imaging Charge Exchange Recombination Spectroscopy (CICERS) at Wendelstein 7-X**

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The first 2D maps of core ion temperatures and impurity density in the Stellarator Wendelstein 7-X are presented. The measurements are made using a new Coherence Imaging Spectroscopy diagnostic, specially developed and optimized for active charge exchange radiation. Using a toroidal view and localized to one neutral beam source, a true 2D image covering a large part of the poloidal cross-section is obtained. The dramatically improved spatial resolution comes at the cost of spectral resolution, requiring the development of new strategies to isolate the active charge exchange emission from passive and Bremsstrahlung radiation.

This work presents the development of the diagnostic as well as the signal processing and background radiation modelling techniques used for background subtraction under different conditions. Finally, the 2D maps of ion temperature and impurity density are validated against conventional diagnostics in standard and high-performance plasma scenarios. These maps provide significantly higher spatially resolved profiles than the existing systems and enable the study of asymmetries, for example showing the ion temperature flattening in core magnetic islands.

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