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Investigation of initial plasma parameters on the Wendelstein 7-X stellarator using the x-ray imaging crystal spectrometer

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The performance of the Wendelstein 7-X (W7-X) stellarator during the first experimental campaign (OP1.1) is explored using measurements from the x-ray imaging crystal spectrometer (XICS) diagnostic. During OP1.1 plasmas have been produced in a limiter configuration, with up to 4 MW of ECH power. The properties of both helium and hydrogen plasmas are investigated.
The XICS system is designed to provide high-resolution profile measurements of the ion and electron temperatures (Ti, Te), plasma flow velocity (v), and argon impurity density (nAr). Profile measurements of Ti and Te are available with up to 5ms time resolution and 2 cm spatial resolution with coverage of nearly the entire plasma radius. The diagnostic is based on spectroscopic analysis of emission from highly charged Argon impurities that are added to the plasma in trace amounts. Routine measurements from the XICS system are available starting from the first week of W7-X operation.
Initial investigations of hydrogen plasmas from the first experimental campaign show thermalized distributions of the ion and electron temperatures. Ion temperatures of 2.1 keV and electron temperatures in excess of 6 keV have been achieved in plasmas with 4 MW of ECH heating and electron densities around a few times 10-19 m-3.
The detailed evolution of the temperature profiles from these initial plasmas are reported along with argon impurity transport measurements and any recent results. Initial estimates of the ion heating and ion heat transport, which2 can be calculated from the temperature profiles and the plasma density, will also be discussed.

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