

# Preparing the ICRH system for the Wendelstein 7-X stellarator

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An important aim of W7-X is to demonstrate fast ion confinement at volume averaged beta values up to 5% for which W7-X was optimised [1]. These high beta values correspond to plasma densities above  $10^{20}\text{m}^{-3}$ . Mimicking the behaviour of alpha particles in a future stellarator requires the presence of energetic ions with energies in the range  $\sim 100$  keV in the core of W7-X high density plasmas [2]. This is a challenging task, but such a population can be created using Ion Cyclotron Resonance Heating (ICRH) using various heating schemes, including the newly demonstrated 3-ion heating scenario [3,4].

The ICRH system under construction for W7-X aims in its final configuration at delivering RF power levels up to  $\sim 1.5$  MW in the frequency range 25-38 MHz with pulse lengths up to 10s [5]. The antenna consists of two straps and is foreseen with a pre-matching system to limit voltages in the feeding transmission lines and matching system. The shape of the antenna is carefully matched to the 3D shape of the Last Closed Magnetic Surface (LCMS) of the standard magnetic field configuration on W7-X [6].

At the standard magnetic field of 2.5T, fast ( $\sim 100$ -200 keV) H, D,  $^3\text{He}$  and  $^4\text{He}$  particles can be generated in high density ( $n_e > 10^{20}\text{m}^{-3}$ ) W7-X plasmas for studies of fast ion confinement in the optimized stellarator magnetic topology of W7-X using various heating scenarios: minority heating of H, 2nd harmonic heating of D or  $^4\text{He}$ , and using the 3 ion scenario to generate fast  $^3\text{He}$  in H-D or H- $^4\text{He}$  mixture plasmas. A purposely-built test stand in the Institute for Energy and Climate Research/ Plasma Physics (IEK-4, Forschungszentrum Jülich, Germany) is being assembled to check the main properties of the ICRH antenna before installation in W7-X. Checks of the vacuum compatibility, voltage standoff and functionality of the radial positioning system are underway. We will provide a detailed description of the test stand, obtained results and conclusions for the use of the ICRH system at W7-X, and in as far as possible also first results obtained on W7-X.

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