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P4.017 An overview of the in-vessel ICRF-diagnostics in the ASDEX-Upgrade tokamak

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Radio Frequency (RF) waves in the Ion Cyclotron Range of Frequency (ICRF) are successfully used to heat fusion plasmas. For a better understanding of the ICRF wave propagation, absorption and other processes in the plasma good in-vessel diagnostics are essential.
In recent years, a number of high frequency B-field probes have been installed in the ASDEX Upgrade tokamak. These probes, arranged as an array, pick up the magnetic field components of the radiated wave, and can thus be used to characterize the radiation spectrum of the ICRF-antennas during plasma discharges. We have designed dual channel logarithmic RF-detectors with phase detection capability to track the fast variations of the probe signals during events like edge localized modes (ELMs).
The same probes are also used to measure the ion-cyclotron emission (ICE) of plasmas. A fast, open source data acquisition system that digitizes the rf-signal with 125 MSamples/s and 14 bit amplitude resolution records the ICE signals. To allow ICE measurements during ICRF operation notch filters are used to suppress the ICRF signal by 50 dB.
In order to characterize the drive mechanisms and consequences of RF sheaths on the structures around the ICRF-antennas, 12 antenna limiter tiles are equipped with shunts to allow the measurements of RF- and DC-currents during operation. RF-probes in the 3-strap ICRF antennas further provide information on the phasing between central and outer straps.

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