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P2.058 Design Status of the ITER Core CXRS Diagnostic Setup

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The Charge Exchange Recombination Spectroscopy diagnostic system on the ITER plasma core (CXRS core) will provide spatially resolved measurement of ITER plasma parameters. The optical front-end is located in upper port 3 and the collected light in the wavelength range of 460 nm to 665 nm is routed to spectrometers housed in the tritium building.

Continuing the efforts described in [1] of designing a better layout for the free-space optical chain, a new layout was selected. With the updated optical system in the port plug, cell and interspace, the considerations which triggered the investigation, namely changes in the generic design of the upper port plug hosting the in-port diagnostic components and the concerns regarding the system lifetime as well as internal and external tolerances could be addressed. The new layout was chosen and optimised based on a number of additional criteria, including optical performance, radiation shielding [2], maintainability and robustness.

The main changes at the system level include the addition of a free-space optical chain to relocate the coupling of the light into the optical fibres to the port cell, avoiding significant irradiation of the fibre bundle. As a new sub-system, a line-of-sight finder based on the back-illumination and imaging of apertures at pupils and masks at images was added. With the line-of-sight finder, the absence of an object with detectable edges is addressed, enabling the determination of deviations within the optical chain in between and possibly during plasma shots.

Where feasible, existing solutions for sub-systems such as the shutter were adapted to the changed layout. Where not successful and for new sub-systems, a design is proposed.

The selection process of the optical system and the system-level consideration for the different sub-systems are discussed. The implementation of the main CXRS core sub-systems is detailed.

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