

## ALTERNATIVE SYSTEM DESIGN CONCEPTS FOR THE ITER cCXRS UPPER PORT PLUG FRONT END

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The upper port #3 of ITER is used by the core Charge Exchange Recombination Spectroscopy (cCXRS) to channel out light from the inside of the ITER vacuum vessel. Recent research about the lifetime of the first two mirrors initiated further investigations into possible alternative system design concepts of the upper port plug (UPP). Three main variants of the optical system were chosen for further investigation.

In addition to the optical system, the front of the UPP houses several sub-systems that are of vital importance for the sustained measurement capability of plasma parameters by cCXRS. This includes at least a shutter that is closed during all times where no measurements are performed and the components required for the calibration of the system. Systems very likely to be present in the final UPP are a retractable tube allowing a fast exchange of components deemed vulnerable and a plasma source as cleaning device for the first mirror.

Interactions of the single systems with the optical path and its components as well as with each other have to be accounted for by the overall system design. In addition, the required interactions change depending on the operation modes of cCXRS. Space constraints originating from the envelope of the UPP and requirements emerging from the ITER environment such as remote handling and other maintenance considerations are also influencing the possible placement of the different systems.

In order to cope with the large solution space and the fast changing nature of the system, a parametric model of the front part of the UPP has been created. Alternative system concepts taking the constraints into account are presented and discussed. Implications for further design work on the subsystems are derived from the results.