OPTICAL CONFIGURATIONS FOR THE CORE CXRS DIAGNOSTICS FOR ITER

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For the optical system of the core CXRS port plug several designs were developed in the last years. A survey is given of the three most relevant designs. The first design is based on an off-axis ellipsoid mirror as main imaging component. This design has been the basis of opto-mechanical design as described in previous publications [1]. In the first part of this article this design is presented and assessed with regard to the optical properties, the sensitivity to first mirror degradation, the possibility to include a tube to allow replacement of the first mirror (as a possible mitigation of the first mirror degradation) and the manufacturability. A second alternative was later developed that replaced the off-axis ellipsoid mirror with a toroidal mirror. This design significantly increases the distance of the third mirror to the plasma, thus reducing the radiation load on this mirror. Also it is estimated that the toroidal mirror is less critical to manufacture than the off-axis ellipsoid.

The second part of the article describes the development of an alternative optical configuration, in which the aim was to increase the length of the duct from the first mirror to the aperture in the blanket that forms the barrier towards the plasma. In order to find an solution with a longer duct, it was first studied which position of the aperture in the first wall of the port plug would lead to the longest duct length. With this input the search for an optical configuration was restarted. The optical configuration that offers the maximum possible duct length is presented under the given limitations. This design is also based on the used of the toroidal mirror. This optical design is assessed on the same criteria as used for the other designs.

[1] Sadakov S et al, Fusion Sc. and Tech 56, Number 1, July 2009, Pages 134-138