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P2.063 Constraints on conceptual design of diagnostics for the high magnetic field COMPASS-U tokamak with hot walls

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COMPASS-U [Panek et al. Fus. Eng. Des. 123 (2017) 11-16], a high magnetic field tokamak with hot walls, will be designed and built at IPP Prague replacing the currently operated COMPASS tokamak. Unique features of this new device bring noticeable constraints and requirements, which make the development of necessary plasma diagnostics highly demanding. In the contribution, main expected constraints influencing a conceptual design of individual diagnostic tools for COMPASS-U will be reviewed and possible solutions will be introduced. Among the most important features of COMPASS-U leading to consideration or development of a new diagnostic design we can name: a high temperature of the tokamak walls about 300℃ to operate in a highly recycling regime; a high plasma density expected to be above 10^20 m^-3, which is characteristic for high magnetic field tokamaks; a high heat flux density (perpendicular to divertor targets) at the outer strike-point in the range 15-20 MW/m^2 caused by a short power decay length and a strong auxiliary plasma heating; the presence of 16 toroidal field coils and vertically symmetric poloidal field coils; and finally, the proposed future use of the liquid metal divertor. As a consequence, the diagnostic designs will require dedicated solutions for all in-vessel cabling, detectors and optical elements. We also show how divertor plasma opacity and geometrical and spatial issues connected with diagnostic elements at the high magnetic field side or with required tangential views are taken into account as well as an optimization of shapes of probe diagnostics (rail probe concept). Last but not least, liquid metals proposed to be used in a divertor introduce a question of the material compatibility, mainly at elevated temperatures, and their transport and redeposition on in-vessel components, including those important for optical diagnostics.

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