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Short_Oral_14: Guidelines for optimal design of Radio-Frequency in-vacuum coaxial transmission line for mirror cleaning service in ITER diagnostics

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Several optical diagnostics in the ITER fusion reactor make use of big mirrors which are placed within the ITER vacuum vessel (VV), and therefore cannot have high accessibility. Deposition of dust on these mirrors may hinder the reflectivity of the mirror themselves, requiring a remote cleaning operation. The radio-frequency (RF) discharge mirror cleaning service operates a plasma discharge in the vicinity of the mirror, eroding the dust layer and therefore cleaning the mirror remotely. In order to achieve this, RF power needs to be sent from outside the VV to the mirror, using a transmission line. Very stringent design requirements are applicable to the design of this RF line, such as vacuum compatibility, high power handling, low losses, matching, no cable over-heating, etc. This paper analytically addresses the design optimization of the RF mirror cleaning transmission line, taking into account ITER requirements, in order to give robust guidelines for the possible ad-hoc cable design adaptation that is to be undertaken case-by-case. The design guidelines are based on underlying transmission line theory, from which a set of design equations are drawn. The optimal design is achieved using design optimization considerations in the available design space. These guidelines are considered to be a useful design tool for optical diagnostics requiring mirror cleaning operation, and are aimed at harmonising the transmission line design procedures across the different cases.

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