Three-dimensional RF modelling of the revised ITER ICRF launcher

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Since mid-2018 the ITER IC H&CD antenna design has undergone extensive modifications to realize a number of outstanding objectives: stiffening the vacuum transmission line (VTL) assembly, mitigating the possible degradation of the front vacuum window ceramic under irradiation, and simplifying manufacture and assembly. Design changes are also driven by the difficulty of developing an acceptable joint between stainless steel and the water-cooled titanium alloy of the vacuum window, and the difficulty of developing a robust sliding RF contact. A new vacuum ceramic window will be located outside the vacuum vessel and VTL structural stability is now ensured by a new service stub which could provide sufficient mechanical support to the inner conductor.

In this work we present a series of numerical assessments of the RF properties of the resulting new architecture. Various designs aiming at using the service stub as a mechanical support were analysed and compared to the reference 2012 performance: the so-called “internal T-stub” design was selected. CST MWS/Ansys HFSS 3D models of the sub-components of the antenna were developed and simulated, and the resulting scattering matrices were integrated into transmission line models to evaluate RF coupling properties and RF power losses on the conductors. The results are compared with the 2012 performances and the differences are discussed. Also, 3D RF fields maps are produced and areas of improvement are identified.