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## Design evolution of the diamond window unit for the ITER EC H&CD upper launcher

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The torus window unit is a very particular component of the ITER EC H&CD upper launcher aiming to provide the vacuum and confinement primary boundary between the vacuum vessel and the transmission lines (TLs). The high power 170 GHz millimeter-wave beams generated by the gyrotrons travel along the TLs and pass through the window units, before being quasi-optically guided into the plasma via the upper launchers. The design of the window unit shall thus meet stringent requirements to guarantee the safety function, the millimeter-wave beam transmission and the structural integrity during normal operation and off-normal events. The unit consists of an ultra-low loss CVD diamond disk brazed to two copper cuffs; this structure is then integrated into a metallic housing by welding. The compliance with the requirements shall be assured by applying the ASME Section III – Subsection NC code and a dedicated experimental qualification program.

This paper reports the way in which the design of the unit, already optimized by FEM analyses against the ITER loading conditions, was further improved by the application of the ASME III-NC code, leading to a more feasible and simpler manufacturing and assembling sequence. In addition, the impact of the ITER project decision to change the inner diameter of the waveguide from 63.5 to 50 mm, to improve the beams' mode purity, was assessed and it is also discussed. Different materials for the metallic housing and in particular for the millimeter-wave inserts of the unit were compared using appropriate engineering criteria to mitigate the significant increase of the millimeter-wave thermal loads on the waveguides when the diameter is decreased.

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