

AN ADDITIONAL CRITERION FOR GYROTRON GUN DESIGN

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The first prototype of the EU 170 GHz/2 MW/CW coaxial cavity gyrotron for ITER has been tested¹ in the frame of a collaboration between European Research Institutions (EGYC*) supported by Fusion for Energy (F4E). The experiments showed that the voltage stand-off properties were strongly affected by the magnetic field configuration. Although the voltage stand-off was excellent in absence of magnetic field, problems arose at voltages higher than 60 kV in presence of the nominal magnetic field. The tube was sent back to the manufacturer (TED) and damages were found when it was inspected. An hypothesis based on the existence of populations of electrons trapped by Penning effect and/or magnetic mirroring could explain the voltage stand-off problem and some of the damages. Observations supporting this hypothesis are: (i) the damage locations, (ii) a simple experiment which was carried out on the first prototype tube in Lausanne, and (iii) the previous experience with the 165 GHz/2 MW coaxial gyrotron at FZK.

In order to address the voltage stand-off problem, an additional criterion has been set, i.e. the suppression of electron trapping by the mechanisms mentioned above. An experimental validation of the new design, using the refurbished prototype gyrotron, is planned for the 2nd half of 2010. In parallel with the manufacture of the replacement gun, a mockup gun is being procured in order to validate the new gun design early 2010. The mockup gun geometry is similar to the proposed gun. It has been designed to be flexible so that other anode geometries, magnetic field configurations, external parameters can be studied. The first results of the mockup gun experiments will be also presented.

1. J.-P. Hogge, et al. "First Experimental Results from the European Union 2-MW Coaxial Cavity ITER Gyrotron Prototype", *Fusion Science and Technology*, vol. 55, pp. 204-212, 2009.

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