

The Tore Supra Lower Hybrid Test Bed : improvements and applications (P3-B-438)

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Within the CIMES project framework in Tore Supra, a klystron TH2103C (3.7 GHz) is under development at THALES ELECTRON DEVICES [1]. It differs from the previous klystrons used in Tore Supra generator mainly in that it has no modulating anode, the RF output power will reach 700 kW CW, by raising the High Voltage value to 76kV and a beam current up to 23A.

The Tore Supra test bed is a dedicated facility used for high power tests on RF components or on RF transmitters. It has been improved to integrate the TH2103C klystron and a specific 100 kV solide state switch [2] which control the beam current. Since April 2005, the integration of the first tube (without modulating anode) and the 100 kV switch has been completed in the Test Bed and has allowed the modifications and tests of the interfaces and security system for the devices. Improvements were also made on the cooling loop flow to dissipate a power of 1750 kW CW. With these devices, the RF power routinely available in the Lower Hybrid Test Bed is 400 kW CW. With the development of the TH2103C, detailed studies and tests on RF components which will be used up to 750 kW CW on match load or 700 kW on VSWR=1.4, are necessary to evaluate their performances and thermal behaviour.

The test a crucial component, the recombiner, which adds the RF powers coming from the two RF outputs of the TH2103C and inject the resulted power into one WR284 waveguide to a test load or to the plasma, was completed. Two tests have been performed : a thermal study with 400 kW during 1000 s, and RF pulsed tests on short cuts to increase the value of the electric field inside the component. The experiments and calculations (ANSYS and HFSS codes) validate the use of this device with the TH2103C.

A module made with two different Beryllium Oxide RF windows, has been under test. The losses on each window are measured by calorimetric measurements and evaluated by computation with HFSS and ANSYS code. The results are compared.

In this paper, the improvements of Lower Hybrid Test Bed are described and the computations and experimental tests available in Tore Supra are detailed and compared with several examples.

[1] F. Kazarian et al. Developing the next LHCD source for Tore Supra
Fusion Engineering and Design, Vol. 74, p. 425-429 (2005)

[2] B.Beaumont and Al "100 kV solid state switch for fusion heating systems" Fusion Engineering and Design, Vol. 75-79, p. 1281-1285 (2005)