Development of a 2-MW, CW Coaxial Gyrotron at 170 GHz and Test Facility for ITER

J.-P. Hogge[1], S. Alberti[1], A. Arnold[2a,3], D. Bariou[4] , P. Benin[4], T. Bonicelli[5], A. Bruschi[6], R. Chavan[1], S. Cirant[6], R. Claesen[7], O. Dumbrajs[8], D. Fasel[1], F. Gandini[6], E. Giguet[4], T. Goodman[1], R. Heidinger[2b], M. Henderson[1], S. Illy[2a], J. Jin[2a], C. Lievin[4], X. Llobet[1], R. Magne[9], P. Marmillod[1], P.-L. Mondino[5], A. Perez[1], B. Piosczyk[2a], L. Porte[1] T. Rzesnicki[2a], M. Santinelli[7], M. Thumm[2a,3], M.Q. Tran[1], I. Yovchev[1]

[1]Centre de Recherche en Physique des Plasmas, Association Euratom-Confédération Suisse, EPFL Ecublens, Station 13, CH-1015 Lausanne, Switzerland
[2]Forschungszentrum Karlsruhe, Association EURATOM-FZK,
[a]Institut für Hochleistungsimpuls- und Mikrowellentechnik, [b]Institut für Materialforschung I, Postfach 3640, D-76021 Karlsruhe, Germany,
[3]Universität Karlsruhe, Institut für Höchstfrequenztechnik und Elektronik, Kaiserstr. 12, D-76128 Karlsruhe, Germany
[4]Thales Electron Devices, 2 Rue de Latécoère, F-78141 Vélizy-Villacoublay, France
[5]European Fusion Development Agreement, Boltzmannstrasse 2, D-85748 Garching bei Muenchen, Germany
[6]Instituto di Fisica del Plasma – Consiglio Nazionale delle Ricerche, Via Cozzi 53, I-20125 Milano, Italy,
[7]Associazione Euratom-ENEA sulla Fusione, Via E. Fermi 45, P.O. Box 65, I-00044 Frascati (Roma), Italy,
[8] Department of Engineering Physics and Mathematics, Helsinki University of Technology, Association EURATOM TEKES, FIN-02150 Espoo, Finland
[9]Association EURATOM - CEA, Centre d'Etudes de Cadarache, 13108 Saint-Paul-lez-Durance, France

Email : jean-philippe.hogge@epfl.ch

In ITER, EC heating and current drive (H&CD) is foreseen not only as a principal auxiliary system for plasma heating and as assist for plasma start-up, but is considered essential in meeting the key requirement of neoclassical tearing mode (NTM) stabilisation, by localized current drive. In the reference ECH design, ITER requires a total of 20MW/CW injected power at 170GHz using 24 gyrotrons with a unit power of 1MW. A higher power per unit (2MW/gyrotron) would result in a strong reduction of the cost of the whole ECRH system, and could also relax the space constraints on the launcher antenna design. In view of the high power capability of coaxial cavity gyrotrons demonstrated with short pulse experiments at FZK, the European Fusion Development Agreement (EFDA) has started (2003) the development of an industrial 170 GHz 2MW/CW coaxial gyrotron, in a collaborative effort between European research associations CRPP/EPFL, FZK, TEKES and Thalès Electron Devices (TED).
The development plan includes three steps to reach successively 2MW/1s, 2MW/60s and finally 2MW/CW operation. The procurement of the first prototype is in progress ; delivery is scheduled in the first quarter of 2006.
The experimental tests of the prototypes will be carried out at CRPP/EPFL, where an ITER relevant Test Facility is presently under construction and will be completed during the second half of 2005. The Test Facility is designed to be flexible enough, to allow the possible commissioning of tubes with differents characteristics, as well as tests of the launcher antenna at full performance.