ITER LHCD PLANS and DESIGN

Ph. Bibet, B. Beaumont, J. H. Belo[1], J.P.S. Bizarro[1], L. Delpech, A. Ekedahl, G. Granucci[2], F. Kazarian, S. Kuzikov[3],X. Litaudon, J. Mailloux[4], F. Mirizzi[5], V. Pericoli[5], M. Prou, K. Rantamäki[6], A. A. Tuccillo[5]

Association Euratom-CEA, CEA/DSM/DRFC, CE Cadarache,13108, St Paul lez Durance, France

[1] Centro de Fusão Nuclear, Associação Euratom-IST, Instituto Superior Técnico,

1049-001 Lisboa, Portugal

2 Associazione Euratom-ENEA sulla Fusione, IFP-CNR, via R. Cozzi, 53-20125, Milano, Italy

3 Institute of Applied Physics, 46, Ulyanova Str, 603950, Nizhny Novgorod, Russia

[4] Euratom/UKAEA Fusion Association, Culham Science centre, Abingdon, OX14 3 DB, UK

[5] Associazione Euratom-ENEA sulla Fusione, CR Frascati, C.P. 65, 00044 Frascati, Rome, Italy

[6] Association Euratom-Tekes, VTT Processes, P.O. Box 1608, FIN-02044 VTT, Finland

LH waves experimentally exhibit the highest Current Drive efficiency at low plasma temperature, therefore they are the most suitable candidates for controlling the current profile in the off axis part of ITER Steady State plasmas. For this purpose, a 5 GHz, 20 MW CW LH system has been designed, that relies on a generator made of 24 klystrons, 1 MW each, 60 metres long circular oversized transmission lines, one antenna, based on the Passive Active Multijunction (PAM) concept. High reliability of the launcher is achieved, by limiting the power density to 33 MW/m^2. Together with the overall system description, the results of different studies are reported: RF computation, launcher coupling properties, thermal analysis, mechanical stress caused by disruption, neutron activation, and acceleration of electrons in the antenna near field.

The PAM concept has already been tested on the FTU tokamak [1] confirming that its coupling properties are as good as expected even near the cut-off electron density. A PAM is presently under design for testing this launcher on ITER like plasmas with Elmy edge and large separatrix-launcher clearance on JET. On Tore Supra, a PAM is under construction to test the technology on long pulse operations (1000 s) as needed on ITER.

In the frame of Tore Supra Cimes Project, a 3.7 GHz 750 kW CW klystron is being realised.

[1] LHCD and Coupling Experiments with an ITER-like PAM launcher on the FTU tokamak, Nuclear Fusion, V. Pericoli et al.