6. PARTICIPATION IN THE MAST PROGRAMME[1]

M.E. Manso (Head), A. Silva, P. Varela, F. Silva, L. Meneses, S. Graça

6.1. INTRODUCTION

The participation of the Association EURATOM/IST on the MAST programme in 2003 was focused in microwave reflectometry aiming to measure the density profile and yield information about density fluctuations.

The system is designed to be operated in O-mode FM-CW, probing the density range 0.4×10^{19} m^{-3} to 4.4×10^{19} m^{-3}, and uses three millimetre frequency bands (K, Ka and U) covering the range 18 to 60 GHz. The design features of the hardware ensure measurements despite long distances between the antenna and the reflecting layers (>1.20 m). The system uses a combination of HTO oscillators, active frequency multipliers, and specially designed in-vessel, focused antennas so that the reflecting layers are properly illuminated. In the last measuring campaign the first experimental results revealed low signal to noise ratio in some frequency regions (most severe in the U band).

The work aimed at identifying the problems and to make the system fully operational for the next measuring campaign in 2004. In parallel support is being given to the MAST team for the implementation of the dedicated data acquisition system based on a VME board developed by CFN.

The following main tasks were carried out:

- The hardware was inspected and testing of the system was performed.
- The transmission line was improved as well as the procedure to implement the system in the machine.
- The data of the 2003 campaign was assessed;

The tests with an in-vessel mirror showed pour alignment of the vacuum flange waveguide feed-through and a subsequently loss of power in some frequency regions. This was likely due to problems occurred during the installation of the diagnostic in MAST. Alignment pins at the feed-through were introduced that minimized this problem and a new procedure to install the system in the machine was studied.

The in-vessel assembly is depicted in Figure 6.1 before being installed in the machine.

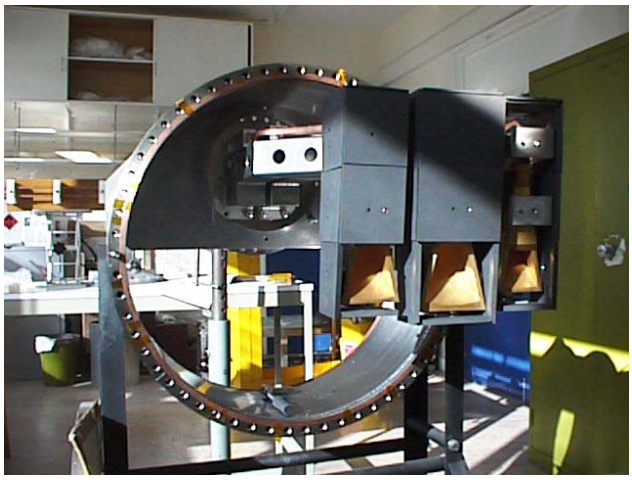

Figure 6.1 – In-vessel antenna assembly for the MAST millimeter wave reflectometer system. A set of three hog-horn antennas are used.

Another problem was identified caused by the high level of harmonics generated by the HTO in U band channel. A new HTO have been ordered.

The first plasma data obtained with the diagnostic is important to assess not only the problems but also to have a first understanding about the performance of the diagnostic. For this purpose, data analysis software for density profile evaluation has been implemented.

Figure 6.2 shows the mapping of the group delay versus time (sweep number) and density for MAST discharge #8519. The value of the group delay due to the wave propagation and reflection in the plasma gives a qualitative indication about the distance from the antenna to the plasma reflecting layer n_{ec}. The effect of large ELMs on the density profiles cause the abrupt increase of the group delay (shift to the red meaning greater distances between the antenna and n_{ec}) indicating an abrupt flattening of the plasma profile. However, the density

[1] Work carried out in collaboration with the MAST Team, of the Association EURATOM/UKAEA (Contact Person: Geoffrey Cunningham).

profile cannot be obtained due to the low signal to noise ratio in some frequency ranges.

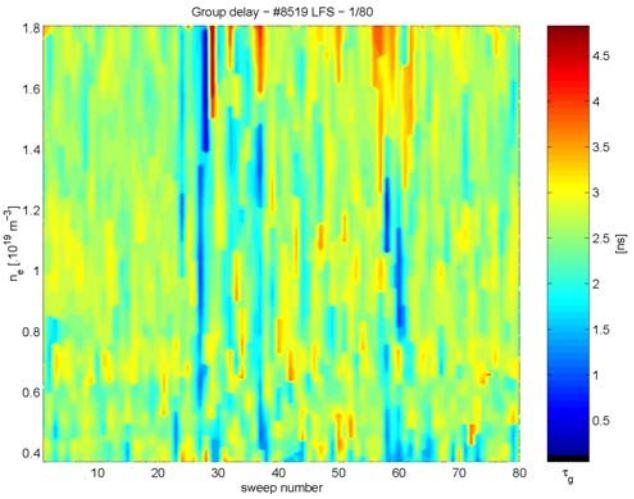

Figure 6.2 - Group delay mapping for K and Ka bands, along time and probing frequency. The density profile flattening (higher group delays) reveals the presence of ELMs on sweeps 27, 30 and a proto-ELM around sweep 59.