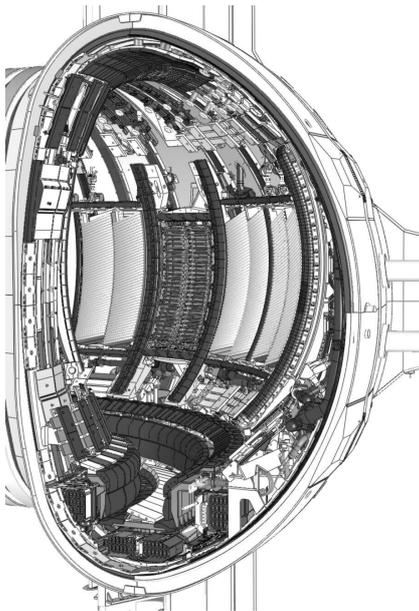

Task Title: JW4-EP-ICRH: CONTRIBUTION TO ICRH COMPONENT MONITORING AND MANAGEMENT

INTRODUCTION

The new JET-EP ICRH antenna aims at coupling high RF power under ELMy H-mode in ITER-like plasma scenarios. CEA has contributed to the conceptual design of this antenna and was in charge of the design and manufacturing of the antenna limiters (JW3-EP-ICRH & JW4-EP-ICRH in previous report).

The manufacturing of the main ICRH components was shared among various companies within Europe. The Inner VTL (inner vacuum wave guide) was attributed to the French company MECAGEST.

Through previous industrial contract dealing with manufacturing of tokamak components CEA/DRFC has acquired an experience with a large number of French companies. Therefore CEA was given the responsibility to interface this contract between MECAGEST and the UKAEA



ICRH Antenna in position in the JET Vessel

CONTEXT

The MECAGEST contract was launched after a european tendering procedure in the previous years. The Scope was to complete detail drawing and then to manufacture the various IVTL components.

The main relevant technologies were based on Inconel 625 machining and special welding, large vacuum bellow manufacturing, ceramic integration and vacuum leak testing. A very strict Quality Assurance procedure, following UKAEA requirements, was to be applied.

The manufacturing monitoring took place in two different plants located around Cherbourg; the vacuum leak testing of the full size components was carried out by the company NORDTEST, in the surrounding wall of a boiler making company TIC in Cadenet, close to Cadarache.

2005 ACTIVITIES

The 2005 activity from CEA was to give local support to UKAEA in the monitoring of the manufacturing activity with MECAGEST.

The main responsibilities of the CEA were the following: to facilitate a good understanding between UKAEA and MECAGEST

- to check the applicable documents and also the good use of them
- to verify that the procedures and the drawings revue are up dated
- to inform UKAEA of the progress or delays in any parts
- to anticipate the hold points and call experts
- to help technically MECAGEST when possible with contact from JET
- to report frequently during fabrication

The launching of this activity was done trough a work session in JET in December 2004.

The monitoring of the MECAGEST activity done during long missions at the manufacturing plant.

Each missions consisted on going trough the various Items under the CEA responsibility.

Many mechanical difficulties were resolved by a close liaison between CEA and UKAEA

Twelve detailed mission reports were completed and were the base for the industrial contract evaluation at JET.



Inner VTL wave-guide tube ready to be tested

Final welding of the guides with all equipment assembly was achieved in september 2005 and checked by CEA and UKAEA.

All the pieces were directly sent at COLLINI FLUHMANN for silver plating.



Vacuum bellows assemblies for IVTL matching equipment

Eventually the components were shipped to the company NORDTEST for he leak testing. Before CEA had undertook the rehabilitation of the installation and the qualification of the equipments.

Finally the leak tests ended on november 25th with no leak detected.

CONCLUSIONS

After a successful high temperature He leak testing all the IVTL components were delivered to JET. Therefore the CEA/DRFC contribution to the monitoring of this activity is now finished.

The Draft final report on this activity has been completed [1] and has been sent to the CSU JET.

REPORTS AND PUBLICATIONS

- [1] 'CEA DRFC report PEFC/CRM 2006/003
Contribution to the manufacturing monitoring of the ITER like inner VTL for the ICRH Antenna at MECAGEST

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CEFDA03-1044

CEFDA03-1180

Task Title: JW3-EP-IRV AND JW4-EP-IRV: DIAGNOSTIC ENHANCEMENT: DEVELOPMENT, FOLLOW-UP OF THE PROCUREMENT AND PERFORMANCE OF ACCEPTANCE TEST

INTRODUCTION

In the framework of the JET-EP project, proposal sent by the Association Euratom-CEA to develop a new diagnostic for thermography analysis was approved by EFDA in 2002. This system will allow to see a large section of the internal components in the vessel such as divertor, main chamber, ICRH antenna etc, aiming at measuring the surface temperature during normal operation and off normal events such as ELMs and disruption. This diagnostic is ITER relevant both for the technology used and for the physic outputs. This system will allow to evaluate the power deposition in the main chamber during transient events and could be used, in the future with implementation of a feedback control, for real time machine protection.

2005 ACTIVITIES

The scope of the work in 2005 was the following-up of the two contracts with industry (under article 7) launched in 2003 for procurement of an infrared camera and an endoscope. The infrared camera has been delivered at CEA-Cadarache at the end of 2004 and the acquisition system was developed during first semester of 2005 at the Cedip premises. Then, intensive and comprehensive tests have been performed both at Cadarache and on JET site allowing to interface the IR diagnostic with the main acquisition system at JET. In July 2005, the reception tests of the IR camera and the acquisition system have been done and the contract with Cedip has been closed.

On the second industrial contract, several problems occurred during the manufacturing and the assembly phases: First, manufacture of the aspheric mirrors, known as a very technical and delicate task, needed several attempts before successful results. Each mirror of the Cassegrain telescope passed the acceptance tests only after the third manufactured mirror. These technical problems induced a delay of about 2 months.

Once the manufacturing phase has finished, the assembly phase started and was expected to last about few days. From the interferogram received from TNO, it has been pointed out that the Cassegrain telescope was not mounted according to the specifications. Assembly of the Cassegrain to the technical specifications (0.3 fringes) required 3 months of effort on optical tests and modifications of the mechanical support. Finally, the Cassegrain telescope was successfully assembled in July.

Then, the endoscope has been delivered at the beginning of August 2005 and reception tests were conducted in the assembly hall at JET, as can be seen on figure 1, and finished on 19th August. On 23rd August 2005, as planned more than one year before, the endoscope equipped with the IR camera was installed in the Lower limiter guide tube on octant 8 on JET.

First infrared and visible images of the in-vessel components, taken during the installation, is shown on figure 2. Commissioning of the diagnostic started in October but due to the delay in the JET restart and the cancellation of the C15 campaign in November, the commissioning phase will be extended until the end of the restart. The diagnostic is operational for the beginning of the experimental campaign C15 which is now planned on 24th April 2006.



Figure 1: Acceptance tests in the Assembly Hall at JET

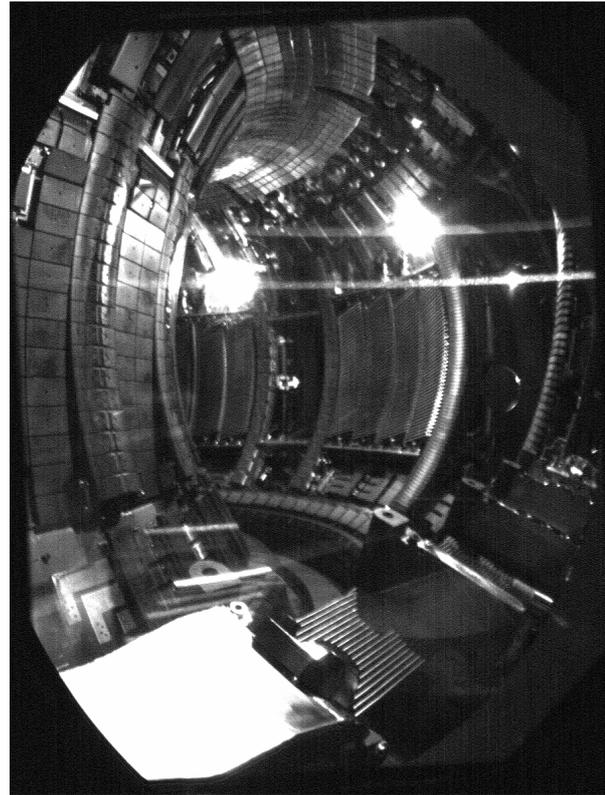
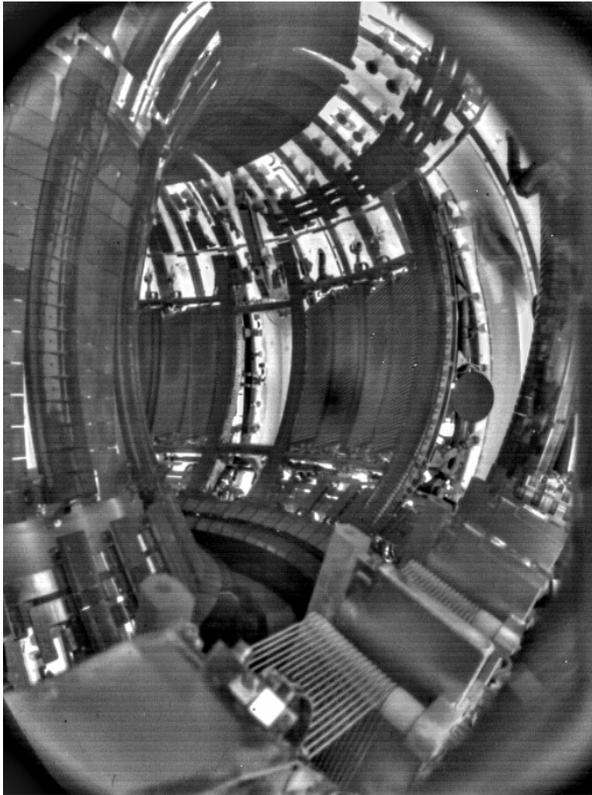


Figure 2: Infrared and visible images of the in-vessel components in JET.

CONCLUSIONS

The assembly and integration phase of the project has been successfully performed although technical difficulties occurred. The JET-EP-IRV diagnostic has been installed during summer 2005, as expected, and the commissioning is under progress. The diagnostic is fully operational for the start of the C15 Campaign.

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