EFDA GOAL ORIENTED TRAINING SCHEME

TASK AGREEMENT
WP6 - Feasibility of manufacturing in the design of ITER in-vessel components

Trainee Report
Reporting Period: 12.2010-12.2011

Entire Period of Research Training: 01.2009-12.2011

NAME OF TRAINEE:	ROMARIC VOINCHET
EMPLOYING INSTITUTION / TA PARTNER:	FORSCHUNGSZENTRUM JÜLICH – IEK-4

REPORT ON TRAINING ACTIONS

1. Introduction

An important change in the required dimensions of the first mirror has been announced at the end of 2010. During the year 2011, the concept of the mirrors had to be redefined, and checked according to the optical requirements. In addition, a test facility for analysis of inclination of castellation blocks had to be designed and is now being manufactured.

2. My activities

2.1 Design of a concept of assembly of first mirror (M1)

2.1.1 Purpose

The M1 had to be fixed to a side of the diagnostic shield module (DSM). Some concepts of attachment of M1 to both DSM sides have been created to define the most preferable. In this frame, I have done a concept of attachment of the M1 to the left side of DSM (looking to the back of the port plug).

2.1.2 Milestones reached

- The adjusting possibility of the mirror has been analysed;
- The cooling of the parts of the mirror assembly has been defined;
- The 3D model of the mirror assembly with attachment to the DSM has been done with CATIA V5.

2.1.3 Status of deliverables

- A presentation of the concept with detail on mounting and adjusting has been realized (M1 holder concept: c.f. 2.1);
- The CAD data of the 3D assembly have been delivered.

2.2 Thermo-mechanical analysis of a concept of mirror assembly

2.2.1 Purpose

The analysis of the displacement and deformation of the first mirror has to be made for the optical validation of a concept of M1 assembly

2.2.2 Milestones reached

- Determination of the correlation used for the fluid calculation;
- Definition of the conductance between mirror and mirror holder;
- Creation of the model of the mirror assembly with ANSYS, with fluid elements for the cooling;
- Comparison of cooling channel concept;
- Creation of a tool for the calculation of the thermal conductance function of the parameter of the materials at contact;
- Determination of the mirror tilting (thermal conditioning/plasma operation) for different contact assumptions and cooling temperatures of the DSM;
- Determination of the fluid parameters for the cooling of the mirror;
- Calculation of the mirror deformation and tilting for the chosen parameters.

2.2.3 Status of deliverables

- The meshed model of the mirror assembly has been delivered;
- A tool for the calculation of the helium heat transfer coefficient function of its parameters has been delivered (Helium properties);
- A tool for the calculation of the thermal conductance function of the material parameters at contact has been delivered (Thermal_conductance_calculation);
- A tool to calculate the distortion and local curvature radius of the mirror from the displacement of nodes of the surface has been delivered (Thermal_disortion_analysis_CC_comparison);
- A presentation on the thermo-mechanical analysis of the M1 assembly has been delivered (Thermo-mechanical analysis of a mirror assembly concept: c.f. 2.2).

2.3 Analysis of a mirror cooling alternative with strips

2.3.1 Purpose

This alternative has been proposed to improve the heat transfer from the mirror to the holder (actively cooled).

2.3.2 Milestones reached

- The model of 2 alternative concepts of the assembly (holder + strips + M1) have been produced with ANSYS;
- Optimal geometric parameters have been determined for both concepts;
- For the chosen alternative concept, the geometric parameters of the CAD design have been analysed with ANSYS.

2.3.3 Status of deliverables

- The ANSYS model of both alternative concepts have been delivered;
- The Excel table with the results of the analysis have been delivered (Results_strips);
- A presentation on the analysis of the alternative concept with strips connected to the overholder has been delivered (Analysis_of_the_option_with_strips_connected_to_overholder: c.f. 2.3).

2.4 Design of a test facility for analysis of castellation inclination in regard of particle deposition from the plasma

2.4.1 Purpose

The analysis of the particle deposition from the plasma for different inclination of castellation has been performed to determine an optimal inclination for the castellation and check the advantage of optimized shape of castellation.

2.4.2 Milestones reached

- Creation of the 3D assembly of the test facility with CATIA V5;

- Calculation of the tolerances from the chains of dimensions;
- Production of the drawings of all parts of the assembly;
- Production of the assembly and subassembly drawings;
- The related bills of materials have been done.

2.4.3 Status of deliverables

- The 3D model of the assembly of the test facility has been delivered;
- The drawings of the parts have been delivered;
- The assembly and subassembly drawings have been delivered;
- The related bills of materials have been delivered.

3. General performance in comparison to the career development plan of the research training activities including any deviations from the original work plan

3.1 Research training activities in accordance to the original work plan

Concerning the research skills and techniques, I participated to a course on vacuum and cryogenics (c.f. 3.1) and on project management (c.f. 3.2). This allowed me to enrich my knowledge on ITER specific technologies and to get a wider view on our project.

As for my involvement in the ITER CXRS diagnostic port plug, I could do a concept of mirror assembly with CATIA, an analysis of the mirror tilting and deformation with ANSYS, which I presented at the Belgium regional ANSYS conference 2011 (c.f. 3.3). Moreover, I designed a test facility with CATIA, which is now being manufactured. I could then, with this task, take into account the manufacturing aspects. In addition, I visited the factory to get information on the feasibility of some geometry. Finally, I presented my activities at the ITER GOT PPE review meeting 2011: Activity_WP6_R.Voinchet (c.f. 3.4).

3.2 Deviations from the original work plan

I could not be involved on the prototyping: it is still too early to consider it.

4. List of references

2.1. Presentation of the concept with detail on mounting and adjusting: M1 holder concept

2.2. Presentation on the thermo-mechanical analysis of the M1 assembly: Thermo-mechanical analysis of a mirror assembly concept

2.3. Presentation on the analysis of the alternative concept with strips connected to the overholder: Analysis_of_the_option_with_strips_connected_to_overholder

3.1. Course on vacuum and cryogenics at the KIT

3.2. Course on project management at the KIT

3.3. Belgium ANSYS conference 2011, where I gave a talk: Thermo-mechanical analysis of a mirror assembly concept (c.f. 2.2)

3.4. Presentation of my activities for the year 2011: Activity_WP6_2011_R.Voinchet

DATE:	12.12.2011
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