Cryostat System: FE Global Model

Outline:

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- Boundary Conditions
- Load Cases
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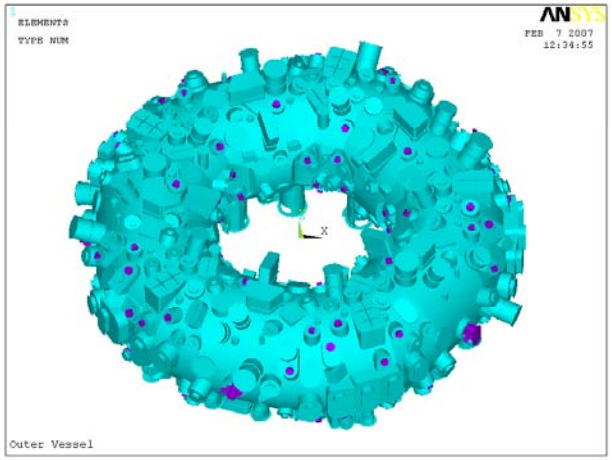
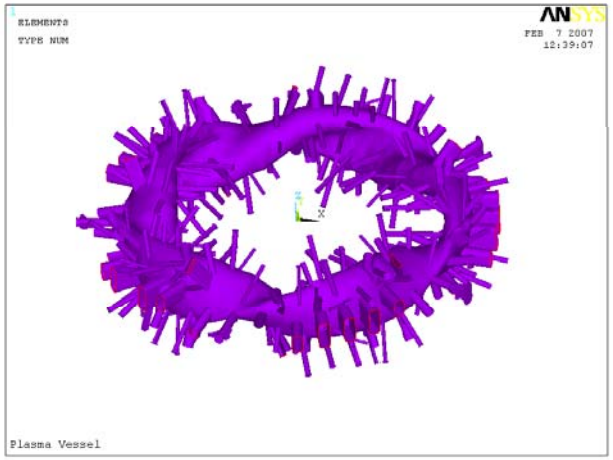
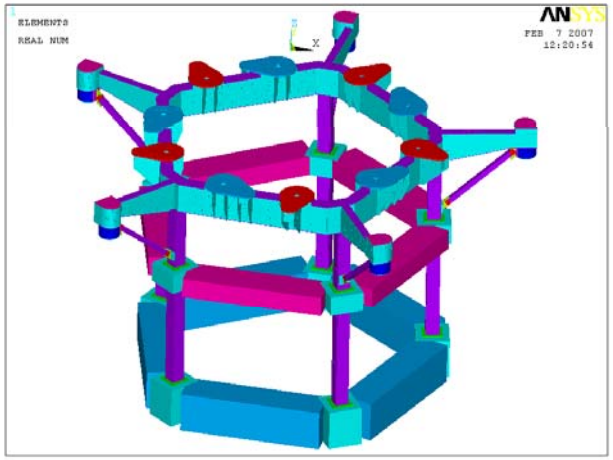
Introduction

ANSYS FE model using the 3-D structural Shell, Beam, Link, Solid and Contact elements was used to perform the global mechanical analysis of the whole 360° W7-X Load Assembly. It is constituted by:

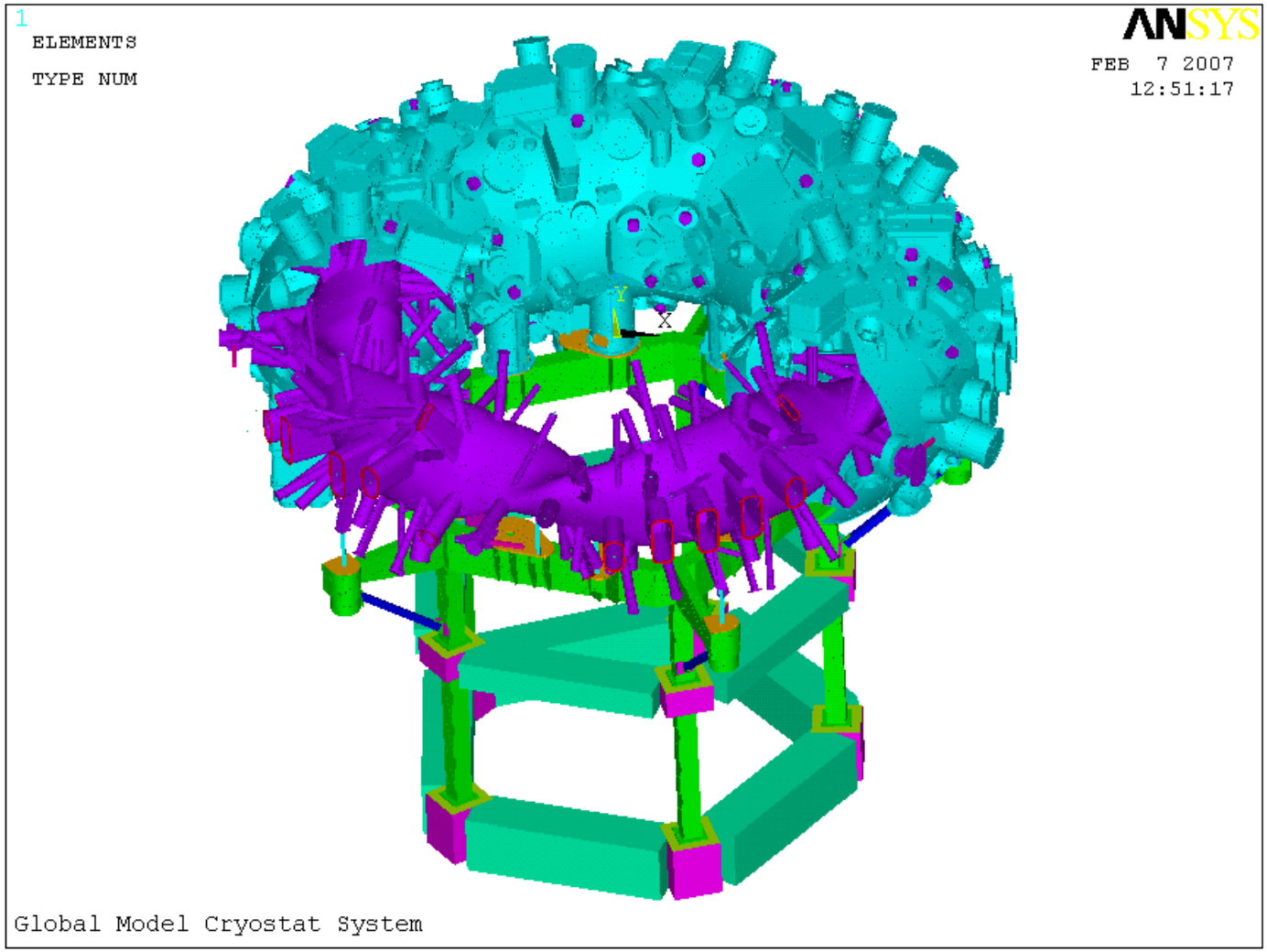
- the Outer Vessel model (IGN rev. 12/2006: file "*model-ov-2006-12-11.db*");
- the Plasma Vessel model (IGN rev. 10/2006: file "*gen81-1.db*");
- the Machine Base model (ENEA rev. 11/2006: file "*MB+2-Basements.db*").







The model consists of about 730,000 elements and nodes.



Boundary Conditions

- Plasma Vessel (PV) – Outer Vessel (OV):

  - the Bellows of all the Ports (type 1 and 2) are described with “4 Beam elements” groups;

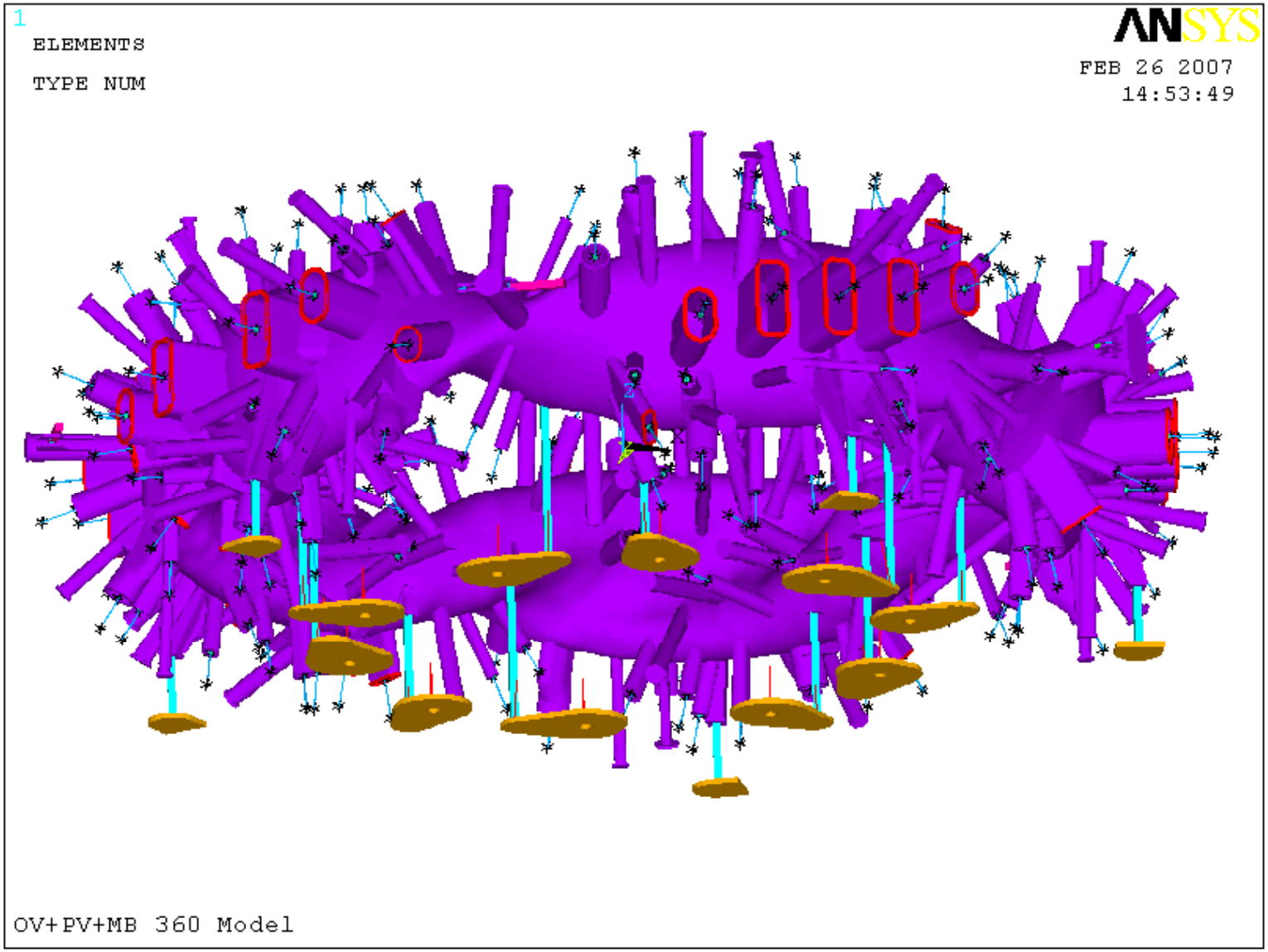
  - the horizontal forces generated by the Plasma Vessel’s fine adjustment and thermal expansion are transmitted to the OV proper AEU ports and ACS.

- Plasma Vessel – Machine Base (MB):

  - the vertical and horizontal forces acting on the PV are supported by appropriate Beam and Contact elements between the MB and the PV itself.

- Outer Vessel – Machine Base:

  - the OV legs are fixed to the MB Plats (nodal UX, UY, UZ degree of freedom are coupled).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ELEMENTS
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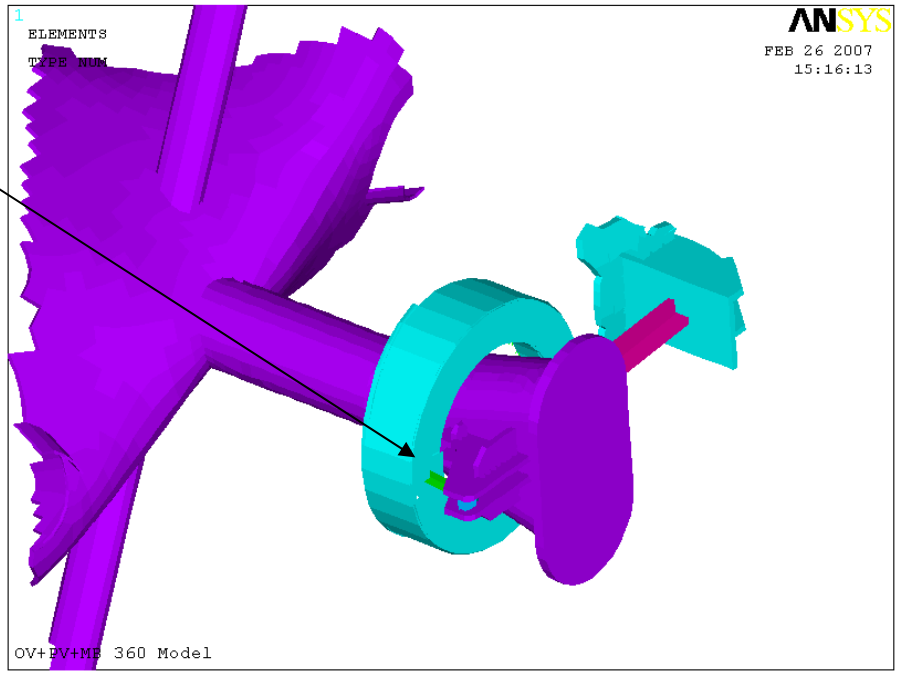
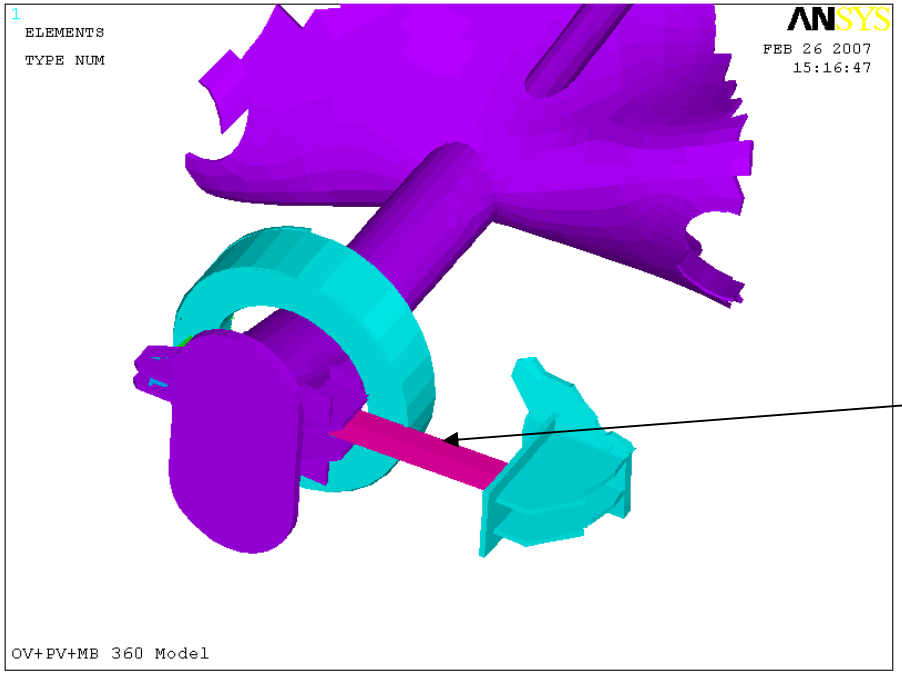
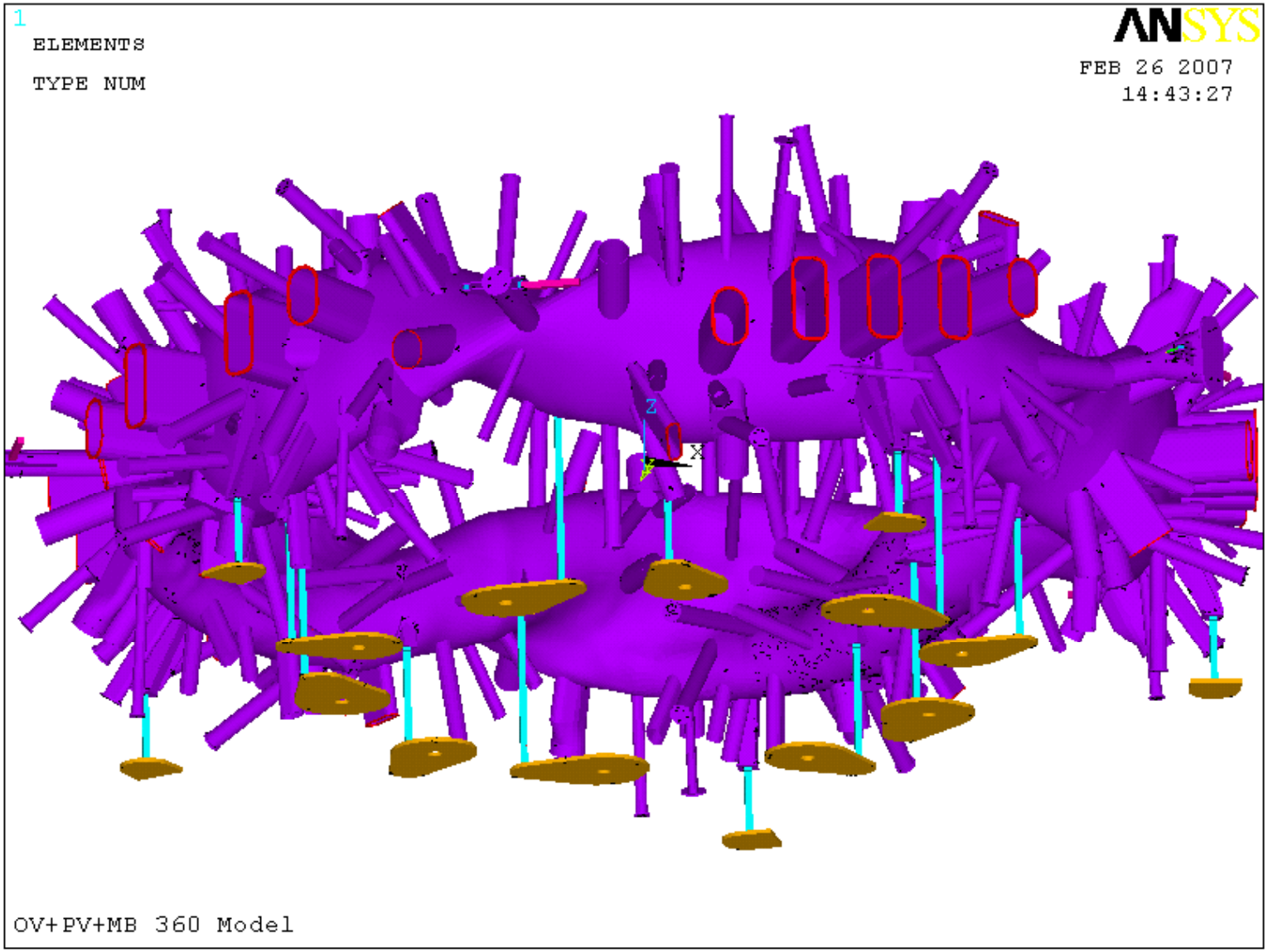
OV+PV+MB 360 Model

PV fine adjustment (radial)





PV fine adjustment (toroidal)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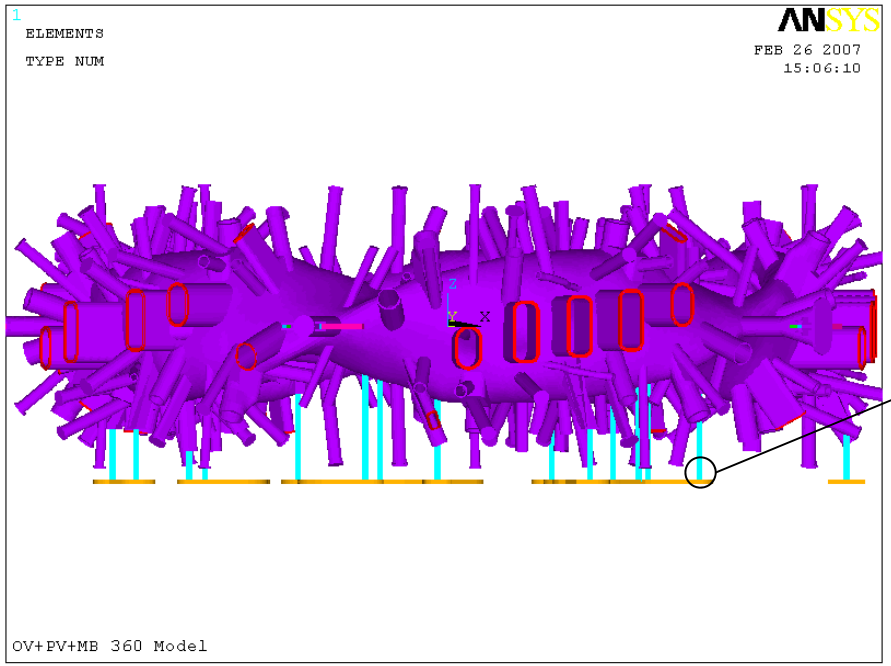
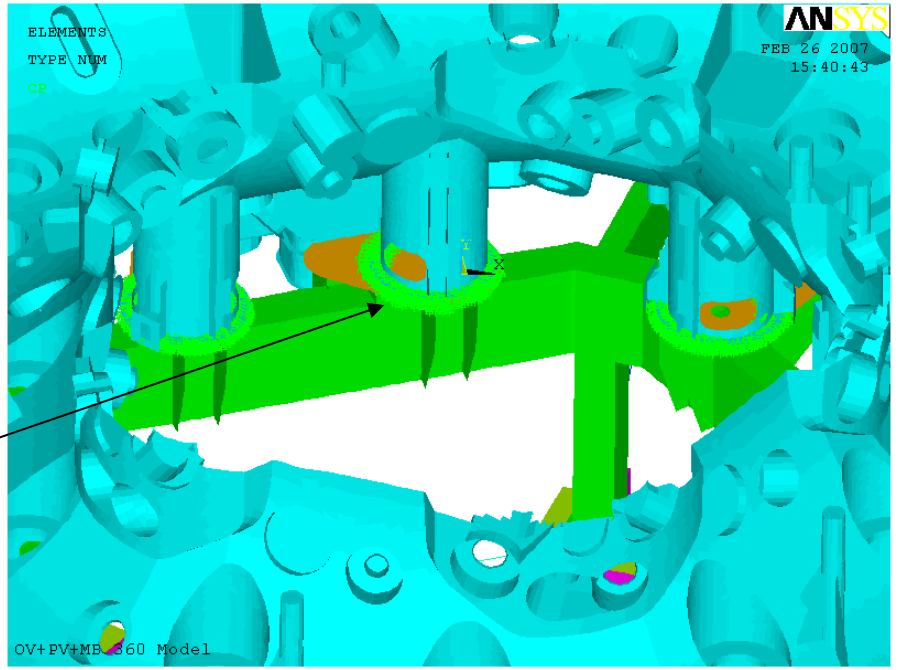
OV+PV+MB 360 Model



PV vertical displacements

OV-MB nodal coupling



Load Cases

Loads / Load Case Name	Dead Weight	PV shifting		PV Inner Pressure		OV Inner Pressure		Port TYPE_1 Loads	ECRH ICRH NBI Cryopumps Diag/Vac	Port TYPE_2 Loads		PV Temperature		OV Temper. 50° C	Electromag. Loads
		Horizontal	*Hor.+Ver.*	*0 bar*	*1 bar*	*0 bar*	*1 bar*	*Pos. F1*		Max	Normal	*60 °C*	*150 °C*		
Analysis_1	X_1														
Analysis_2					X_2	X_2									
Analysis_3												X_3			
Analysis_4			X_4												
Analysis_5															X_5
Op_Sc_001	X_op_1		X_op_1												
Op_Sc_002	X_op_2		X_op_2		X_op_2	X_op_2									
Op_Sc_003	X_op_3		X_op_3	X_op_3		X_op_3									
Op_Sc_004	X_op_4		X_op_4	X_op_4		X_op_4		X_op_4	X_op_4						
Op_Sc_005	X_op_5		X_op_5	X_op_5		X_op_5			X_op_5	X_op_5		X_op_5			
Op_Sc_006	X_op_6		X_op_6	X_op_6		X_op_6		All loads (Domes included)				X_op_6			X_op_6

Ref. Temperature 20°C

Conclusions

A detailed analysis is reported in the document "*01_REPORT - Global Model Cryostat System - Model and Results.doc*".

In this event it is possible to summarize that no problems seem to appear for all the analyzed load cases.