Status of Diagnostic Engineering

C.I.Walker

R.Barnsley, L.Bertalot, A.E.Costley,

A.Martin, G.Vayakis

Diagnostic Division

ITER International Team

Cadarache JWS; Garching JWS; Naka JWS.

Chris.Walker@iter.org

Phone: +33 4 4225 4332

ITER_D_25N8SB

OUTLINE

Overview of activity

- **Equatorial Port**
- **Upper Port**
  - **NB Cell Ports**
- **Divertor**
- **Vacuum Vessel**
- **Buildings**

Project Management Procedures

- **Design Office - CATIA**
- **2007 Baseline Structure**
- **Procurement Documentation**
- **Procurement Tools**

Diagnostic Work Plan to December 2008

Conclusions

Recent ITER Relevant Interface Changes

A Few Design Change Requests affect the diagnostic engineering:

DCR-56 **Divertor Lower Stop Divertor Diagnostics (to be assessed)** On-going TCM-21 Sept 2006

DCR-49 **NB maintenance scheme and NB cell lay-out Upper Port Plug #05,#06,#07** Ongoing TCM-18 Jan 2006

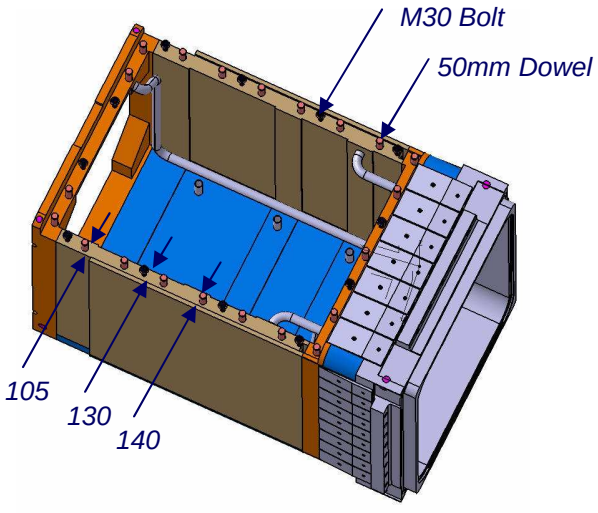
DCR-35 **Hot Cell Design Modifications Subject to significant review –building cost v. functionality descoping** Ongoing TCM-17 May 2005

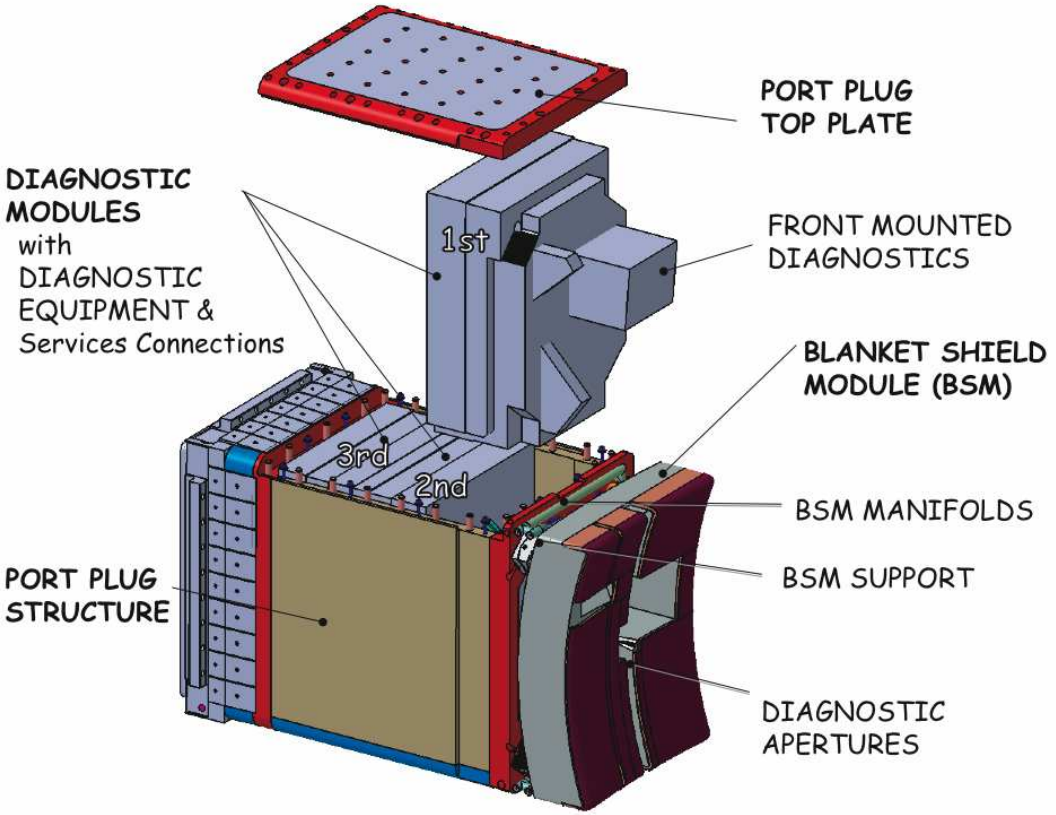
There are many other ad hoc 'reviews' as the project gets going to a fixed timescale, cost, sharing, etc.

EQUATORIAL PORT

Improved Equatorial Port Plug Structure

- **New Top Plate Bolting Arrangement - EqPP Top Plate Fixing (ITER_D_24ZF8M v1.1)**
- **Interface of Generic Diagnostic/Shielding Modules - Structure stepped**
- **Back Plate Opening - Lost Space Evaluated, Input for Seal Study, not universal reference**
- **Design Studies of Flange Attachment & Sealing – 3 alternatives – R&D progressing**
- **Streaming Shields – await analysis**





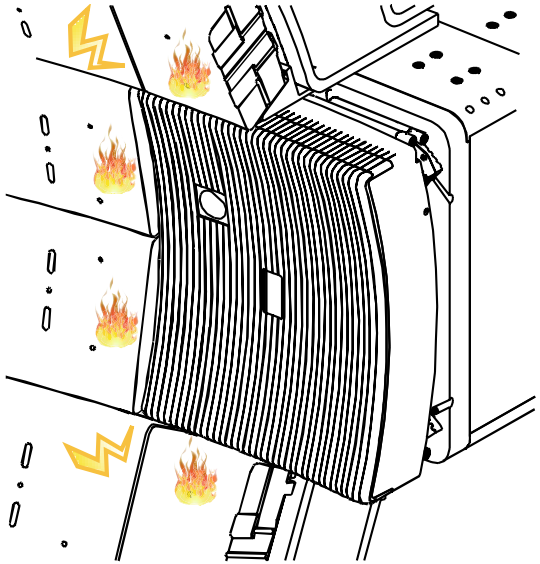
EqPP Expl-01

Equatorial Port Plug BSM

- **BSM apertures defined,** adapted to vertical construction of the BSM
- **Retracted 30mm**
- **BSM Arrangement Proposed- 1st pass, analysed, still to be reviewed & improved**

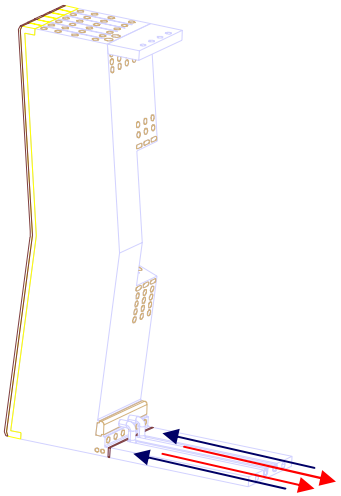
  Port plug interface definition, Port plug structure space/material consumption, Water manifolding, Intrinsic Stiffness, Assembly Access & reliability
- **Feature for Adjustment to Port Survey** – still required

¼ BSM



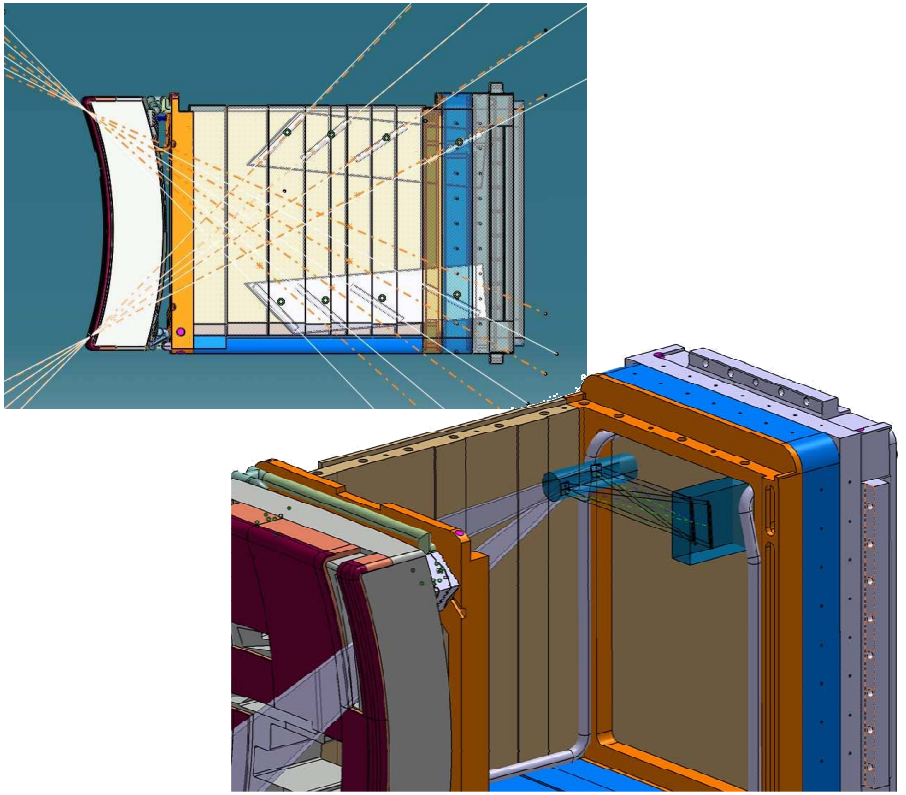
4 x 406mm, 10mm gaps

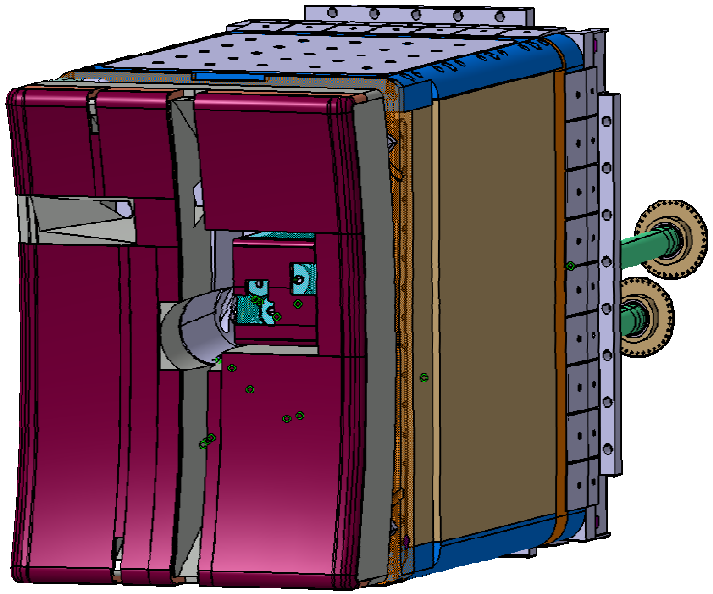
Each with 5 x 3mm slots



Improved Equatorial Port Plug Assembly

- **Removable Elements in Window Seal Plate –** LIDAR, RNC, XRCS
- **Removable Elements from Front** - Thermal analysis done, under study fixation, stress from EM loads, thermomechanical, thermohydraulic, manufacturing,

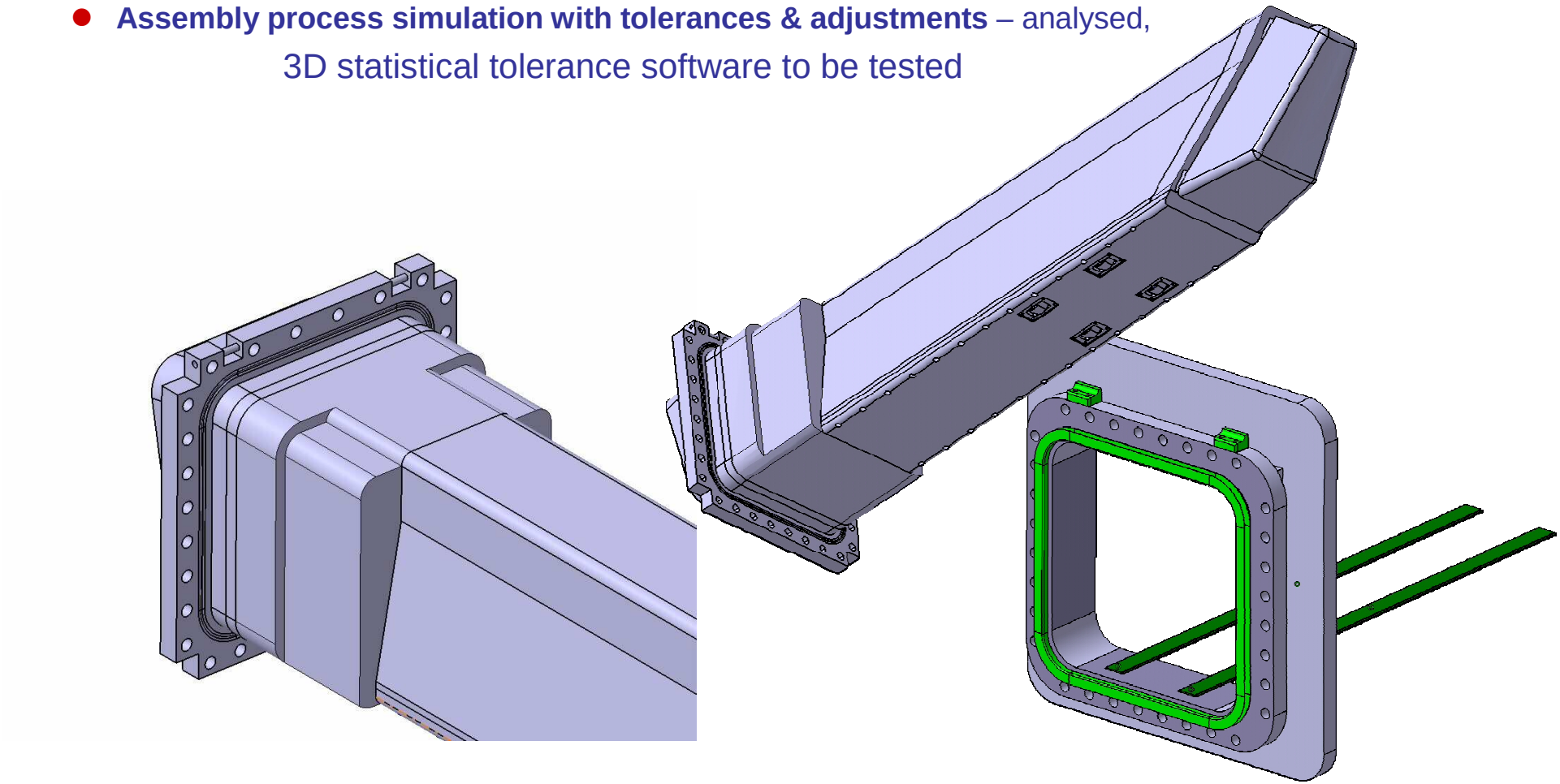




UPPER PORT

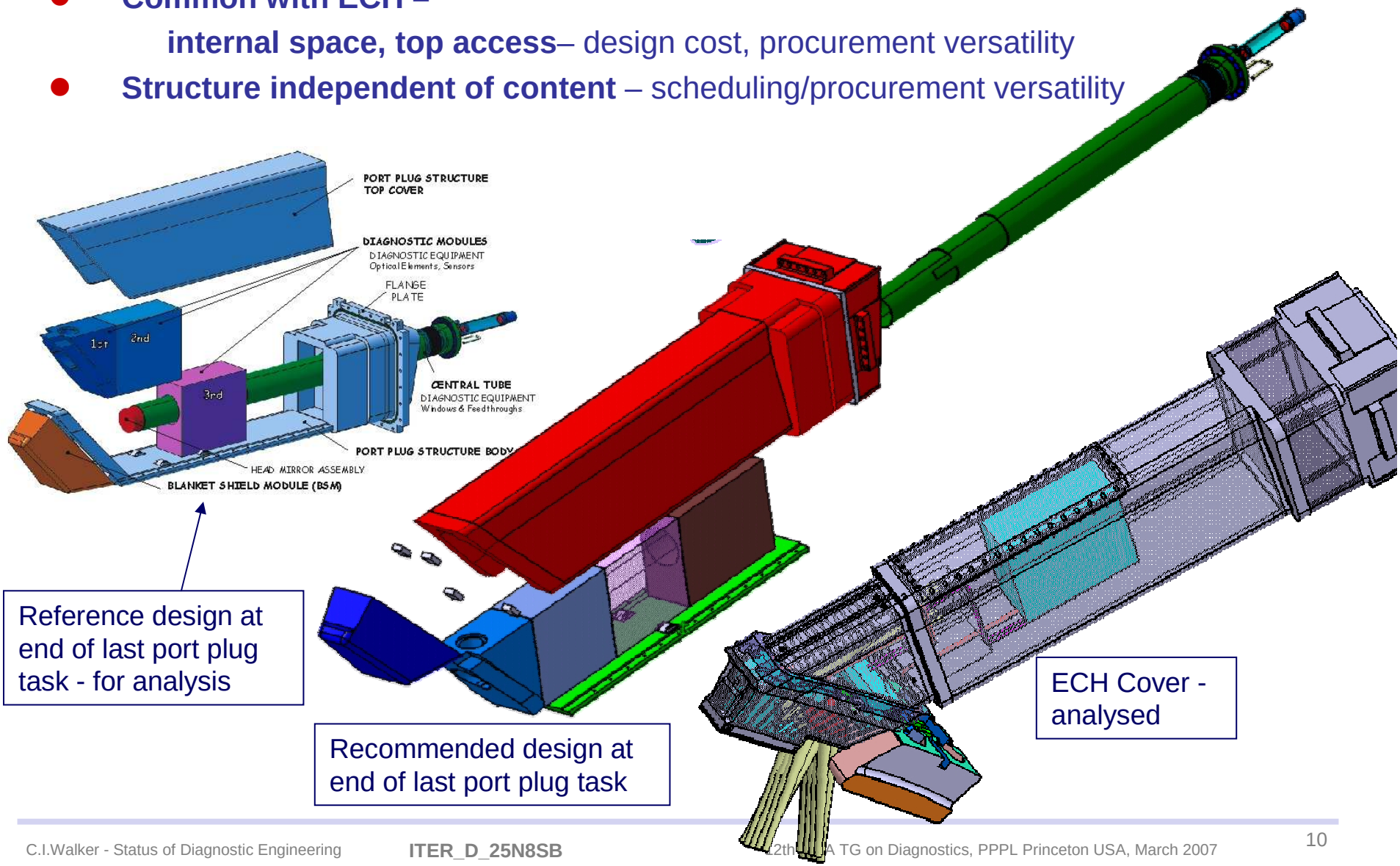
Improved Upper Port Plug Installation

- **Port Plug Seal - 5 designs available**, 4x Lip seal, 1x Bolted Metal Seal
  Impacts RH/Manual, ORE - Study in progress, R&D
- **Handling – 2 options -** analysed, still open
- **Assembly process simulation with tolerances & adjustments** – analysed,
  3D statistical tolerance software to be tested



Improved Upper Port Plug Structure

- **Common with ECH –**
  internal space, top access– design cost, procurement versatility
- **Structure independent of content** – scheduling/procurement versatility



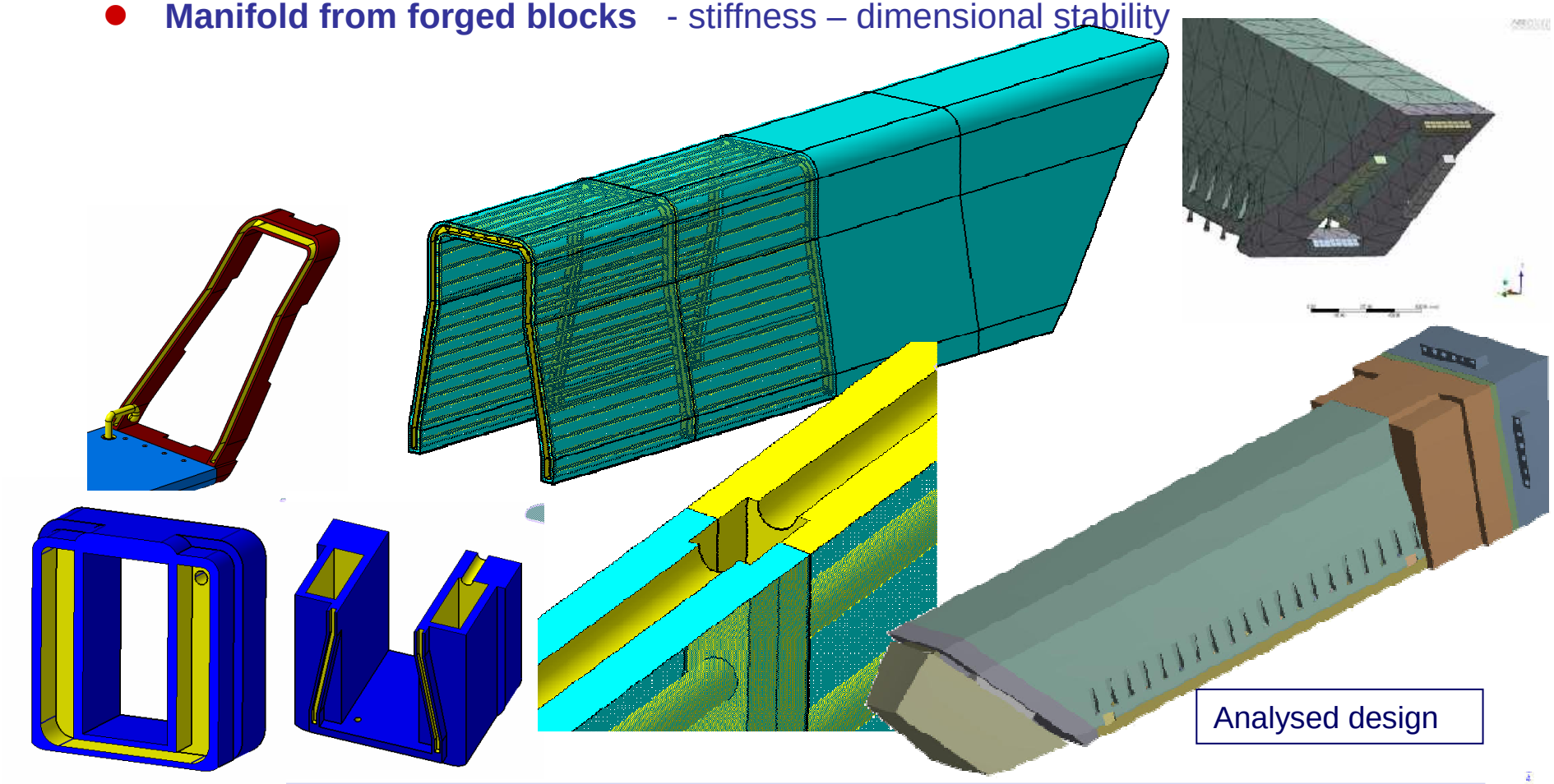
Reference design at end of last port plug task - for analysis

Recommended design at end of last port plug task

ECH Cover - analysed

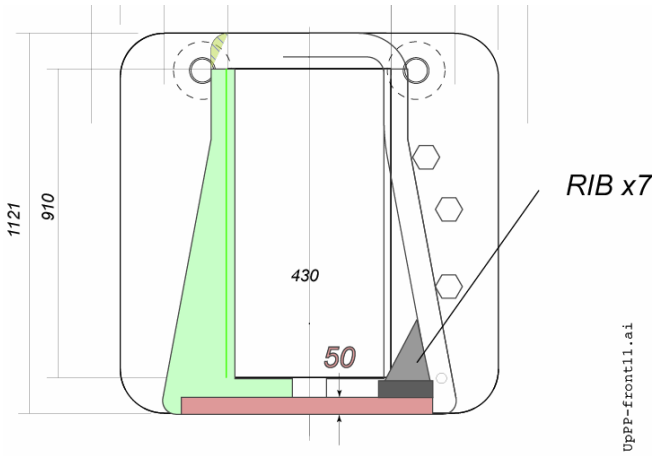
Improved Upper Port Plug Structure Manufacturing

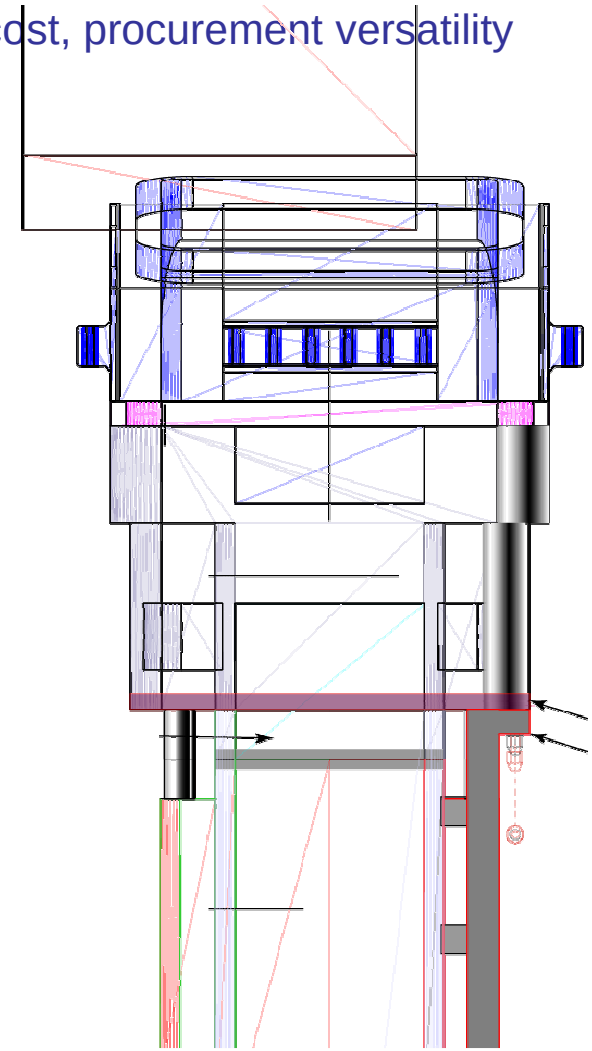
- **Trapezoidal section pressed, drilled** – cost, dimensional stability
- **Bottom Plate bolted & pinned** – analysed globally – details required
- **Back Section uncooled** – analysed operation & baking - cost
- **Manifold from forged blocks** - stiffness – dimensional stability



Improved Upper Port Plug Structure

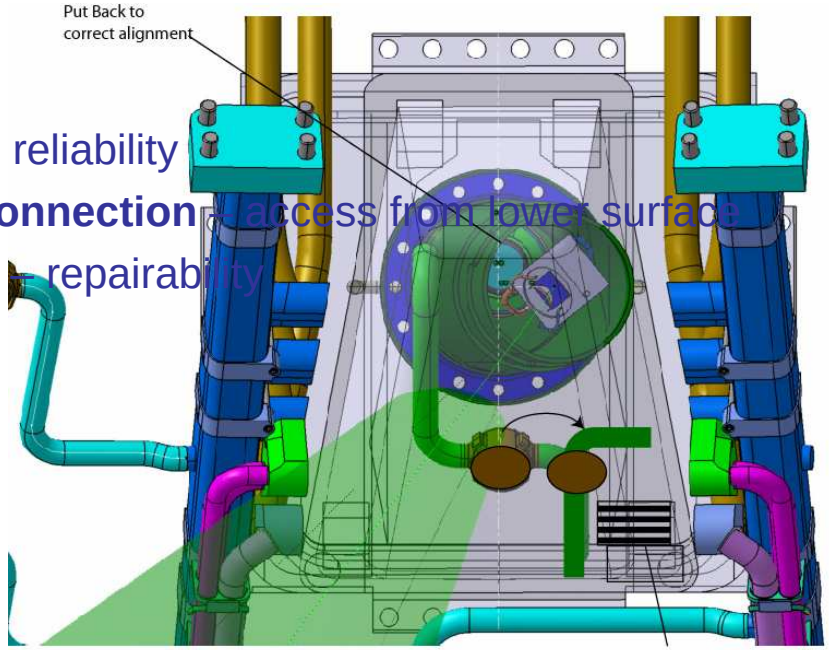
- **Adjust to Survey, Back & BSM Plate -** scheduling versatility
- **Bolted Body to Manifold Box** – to be stressed cost, procurement versatility
- **Ribs** – local stresses

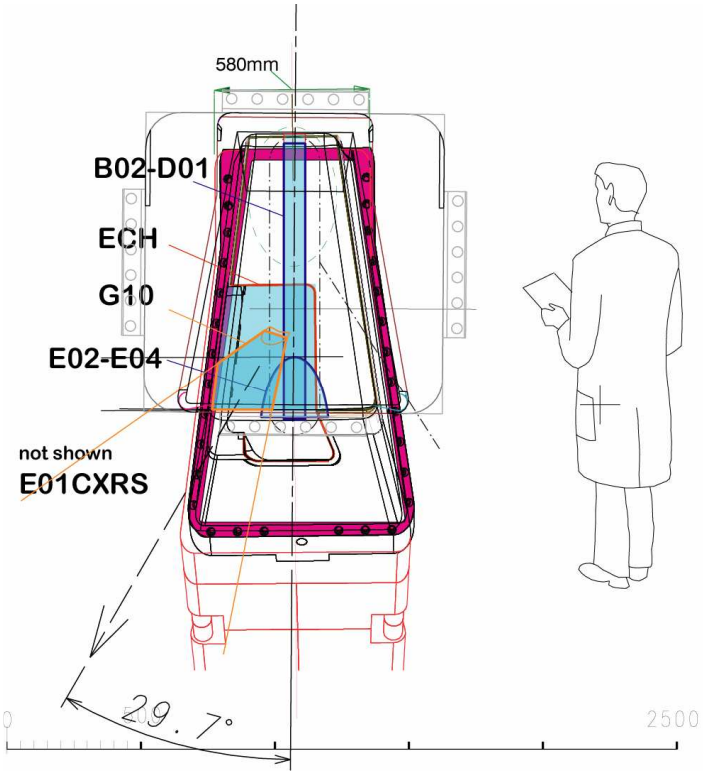


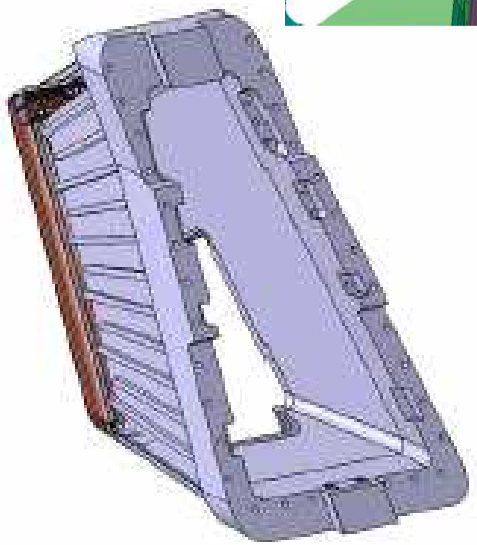


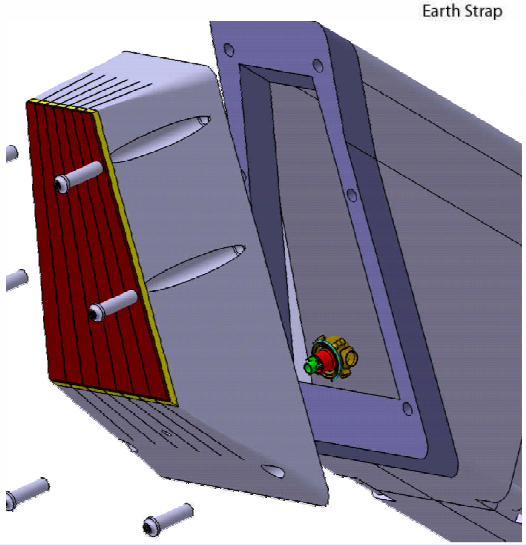
Upper Port Plug BSM

- **Common Aperture** - established
- **Key & Bolts preferred** – ECH assessed - reliability
- **Incorporate standard blanket cooling connection** – access from lower surface
- **Hard Earth** – avoid current in pipe & bolts – repairability









SPECIAL CASE Diagnostic Port Plug #05, #06, #07

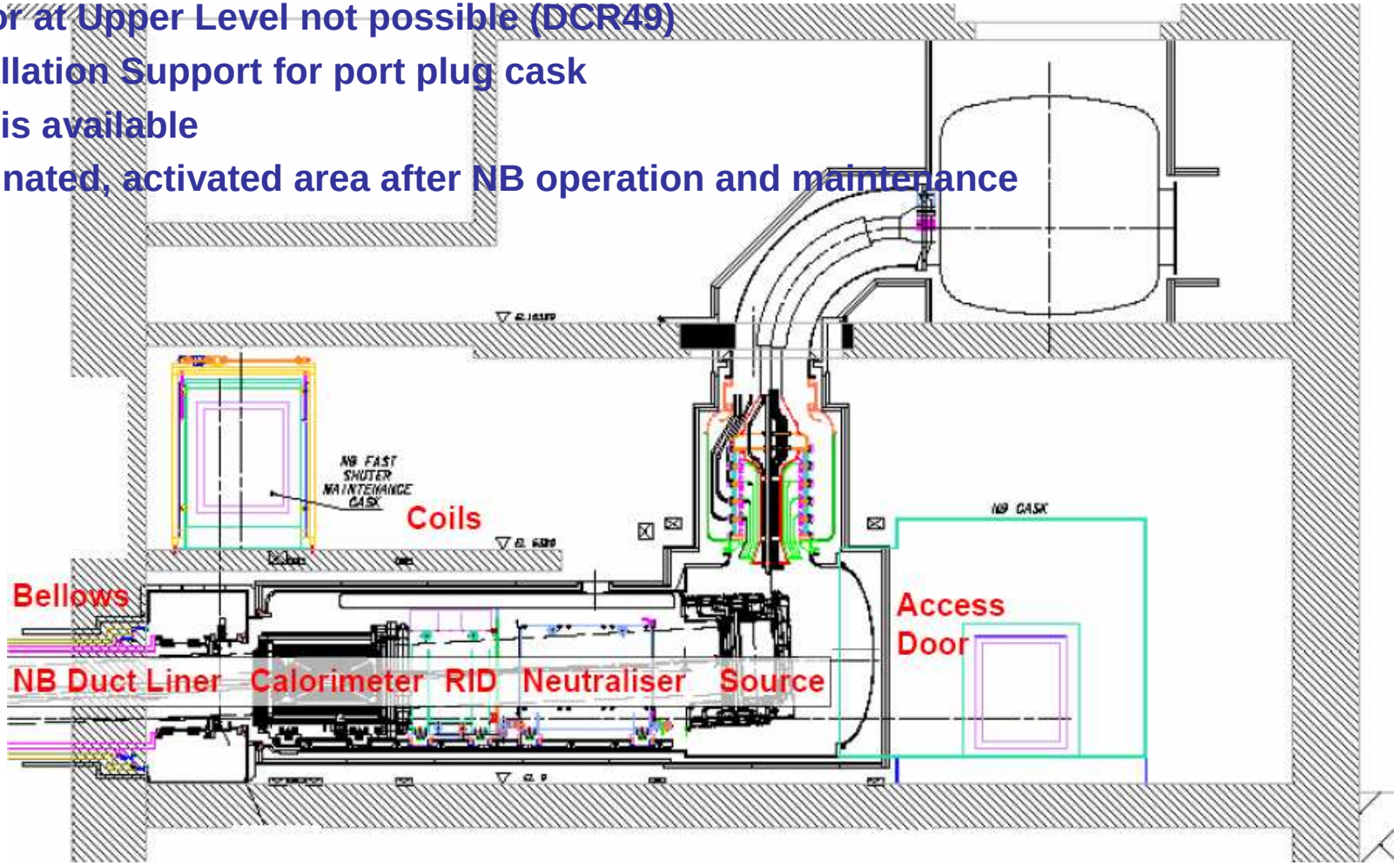
What is involved above NBI Cell

Full Floor at Upper Level not possible (DCR49)

No Installation Support for port plug cask

A crane is available

Contaminated, activated area after NB operation and maintenance

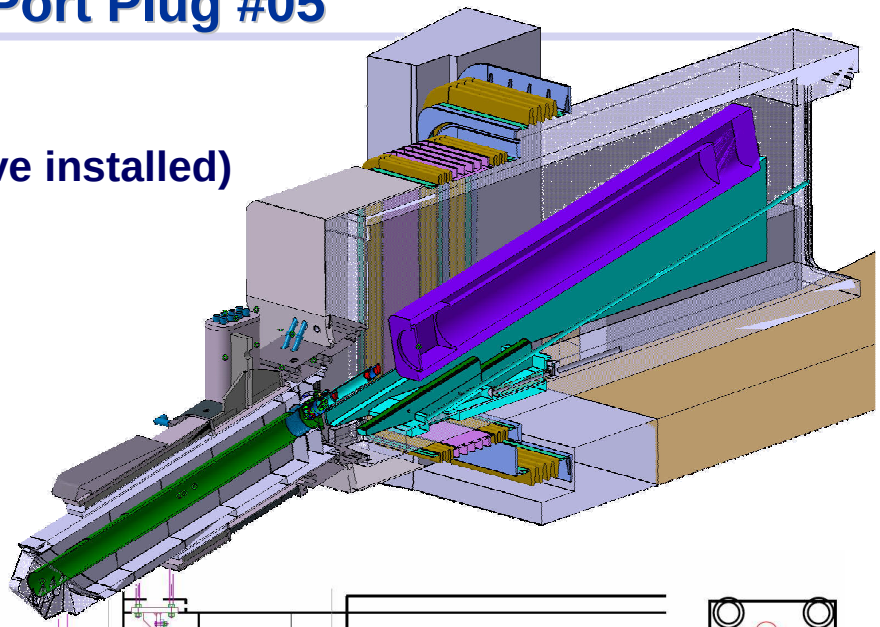


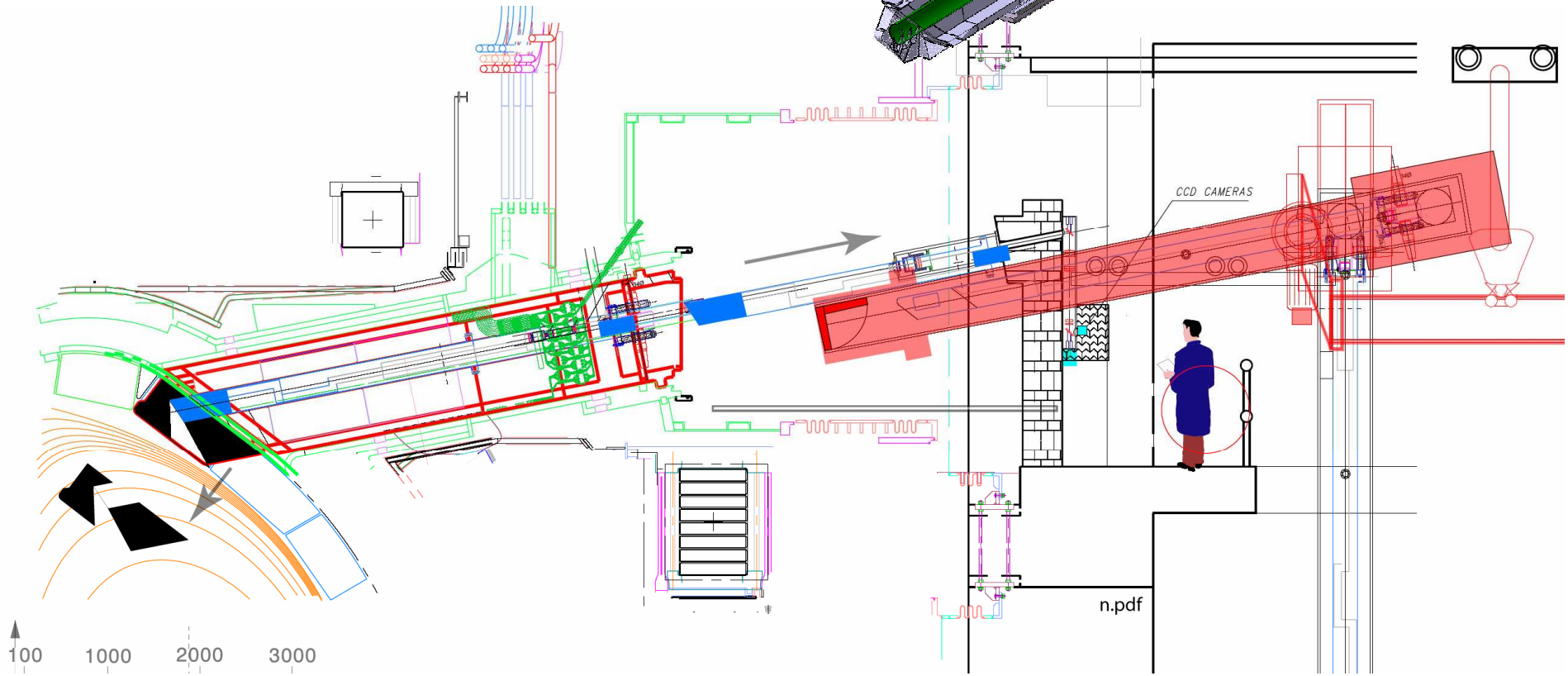
Diagnostic Port Plug #05

A solution is to make port plug RH Class 3 (leave installed)

There are still some RH Class 2 components:

- **Diagnostic Windows**
- **Diagnostic Tube**
- **BSM**



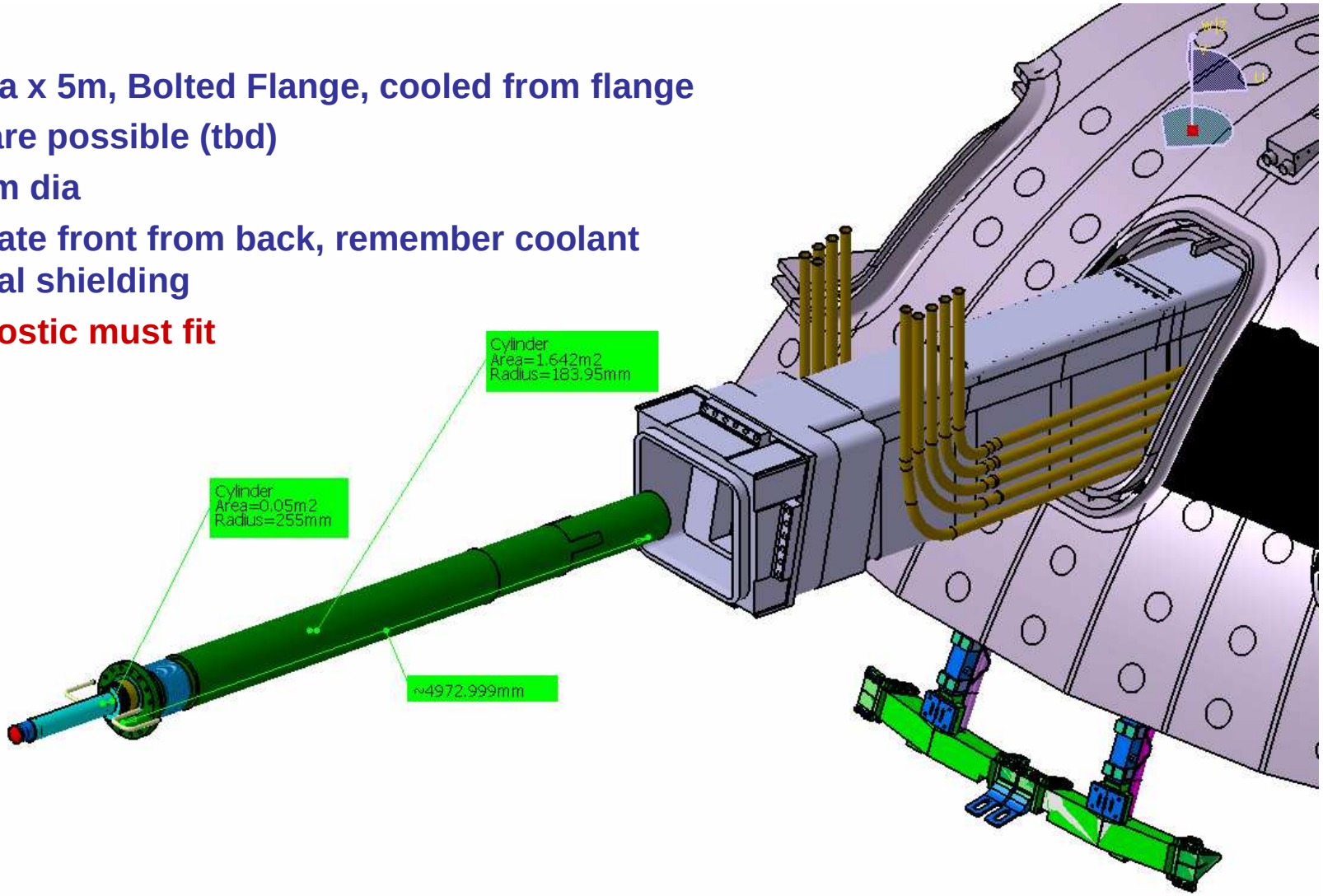


Diagnostic Port Plug #05

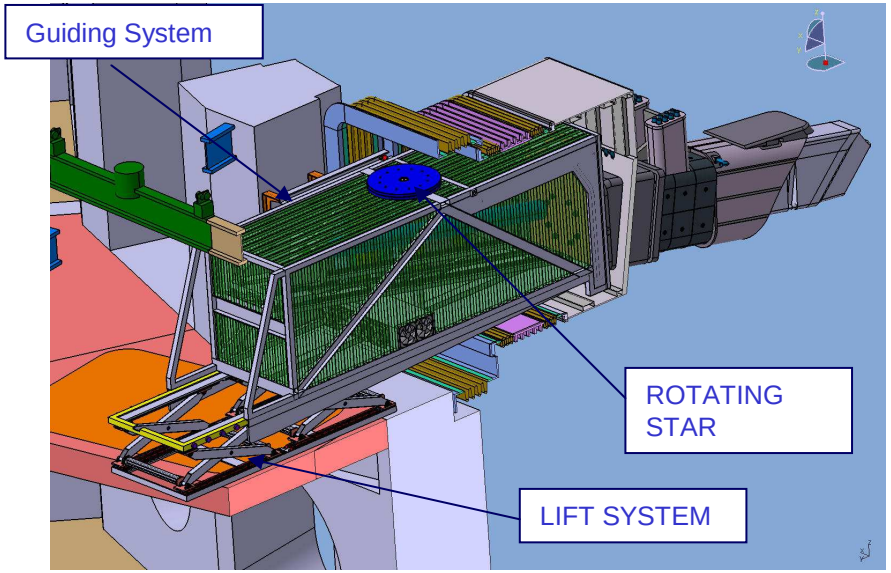
400mm dia x 5m, Bolted Flange, cooled from flange

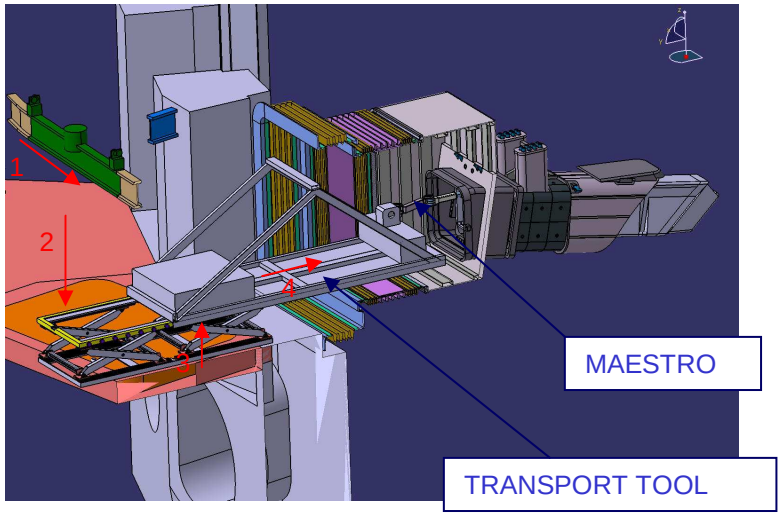
Variants are possible (tbd)

- **200mm dia**
- **Separate front from back, remember coolant**
- **Internal shielding**
- **Diagnostic must fit**



Diagnostic Port Plug #05

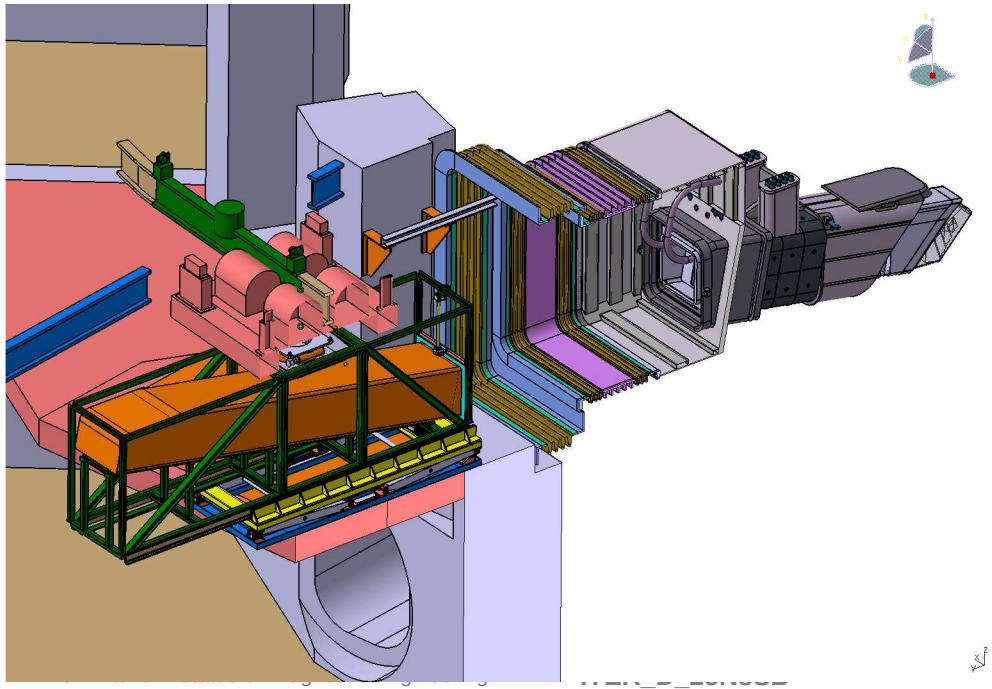


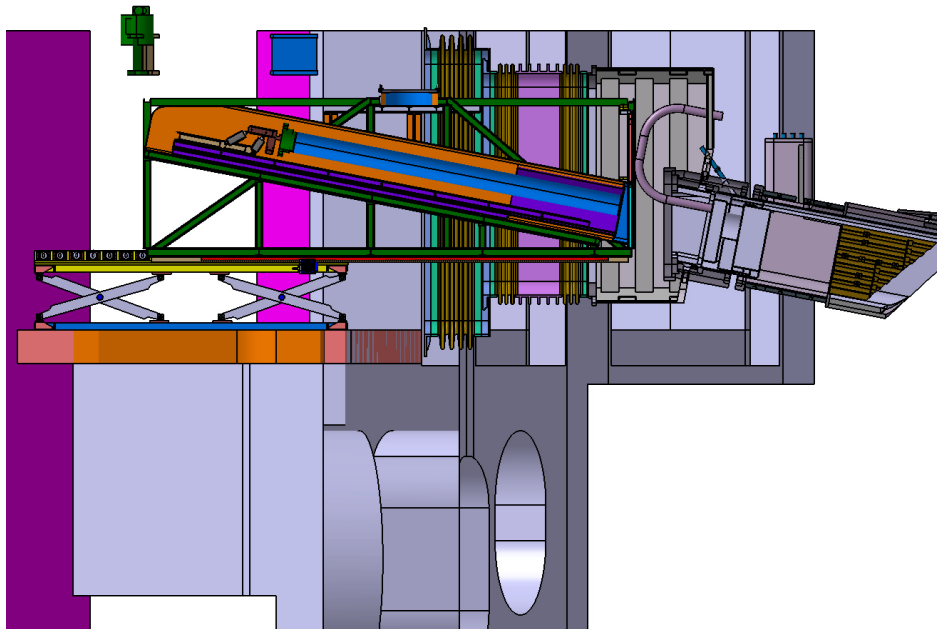


Diagnostic Port Plug #05

Diagnostic Tube Access

- **NB Cell integration**
- **Start of provisional structural analysis of the whole transfer system.**
- **Start the feasibility of the upper plug first assembly tool.**
- **New design of the lifting system**
- **Guiding system on bio-shield**
- **Transport tool for Maestro robot**
  - Cut / Weld cooling system and
  - Unbolt diagnostic tube flange





Diagnostic Port Plug #05

Outstanding Assessments

- **BSM Removal**
- **RH Connector**
- **In-Situ BSM Coolant Connection requirements**

Reliability here is paramount

- **Can leave disabled diagnostic tube**
- **Cannot leave disabled BSM in place**

Pressure on Project Resources

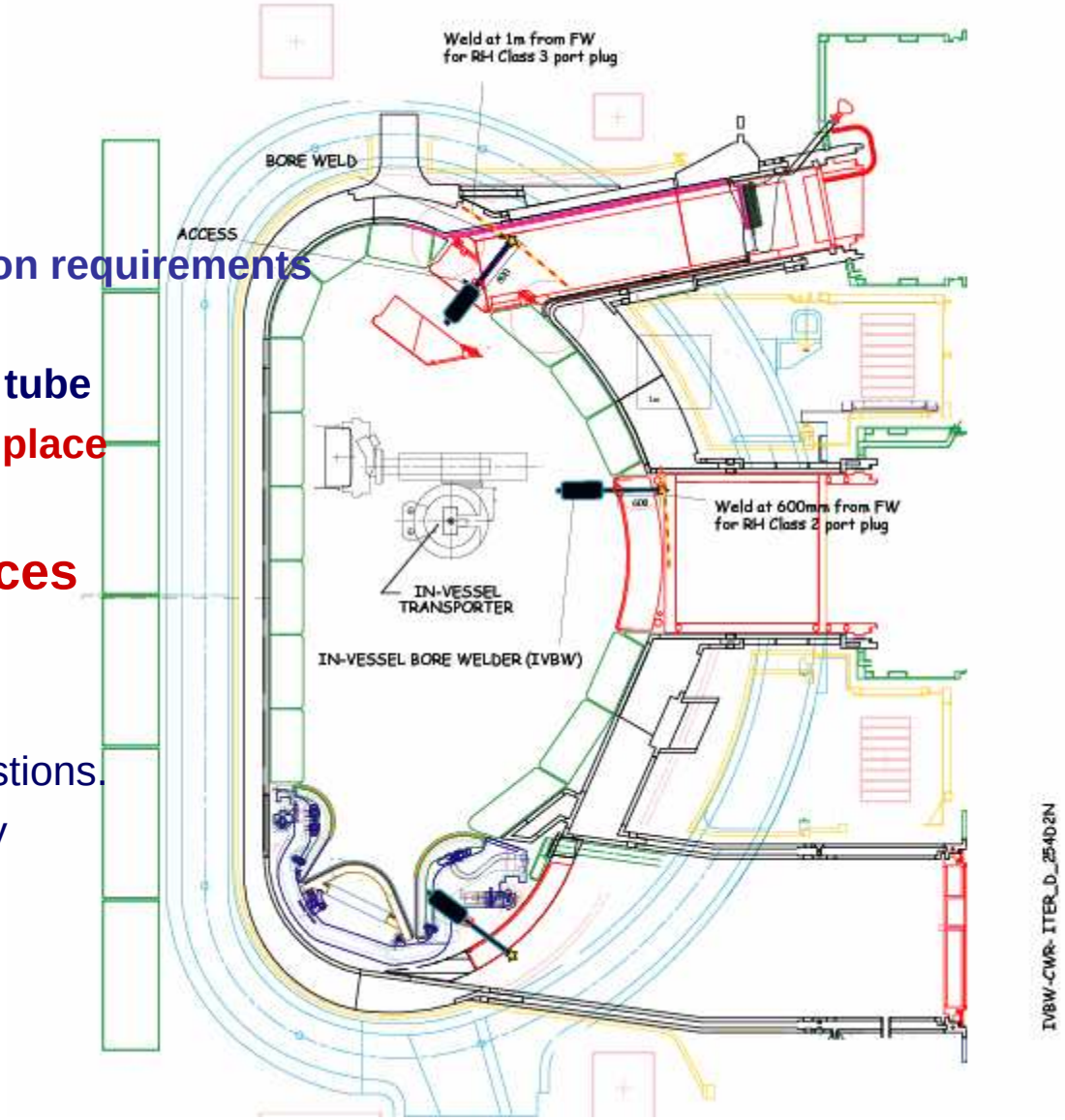
Generally

Diagnostics have answered their questions.

Other Departmants in ITER are slowly

Coming round to theirs.

Not at the rate anticipated by DCR49



DIVERTOR

DIVERTOR LEVEL INTEGRATION

PT design teams have worked with the IT Diagnostic and Divertor Groups on:

- Vertical Neutron Camera
- Impurity Influx Monitor (Visible / UV)
- NFM
- Pressure Gauges
- X-point TS
- Thermocouples
- Magnetics
- Dust Monitor
- Divertor-Interferometer
- IR Thermography

Designs have started for

- Neutron Activation (foil)
- Hydrogen Monitor, RGA
- Bolometry

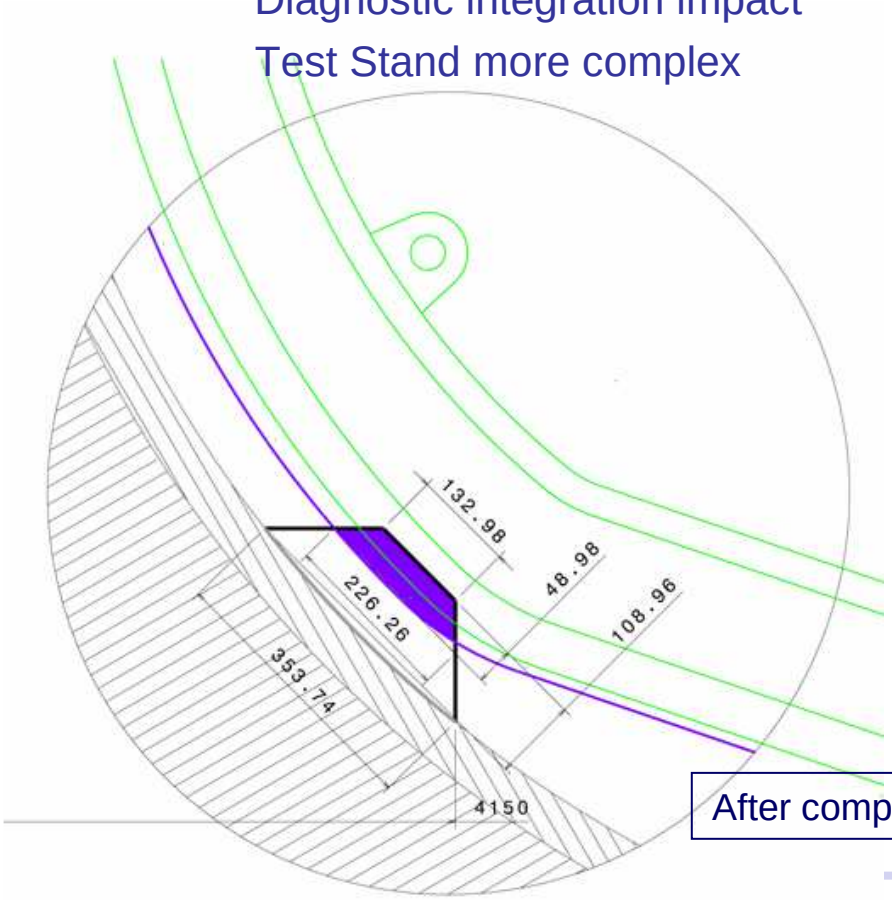
Developments in the following may influence the diagnostic designs.

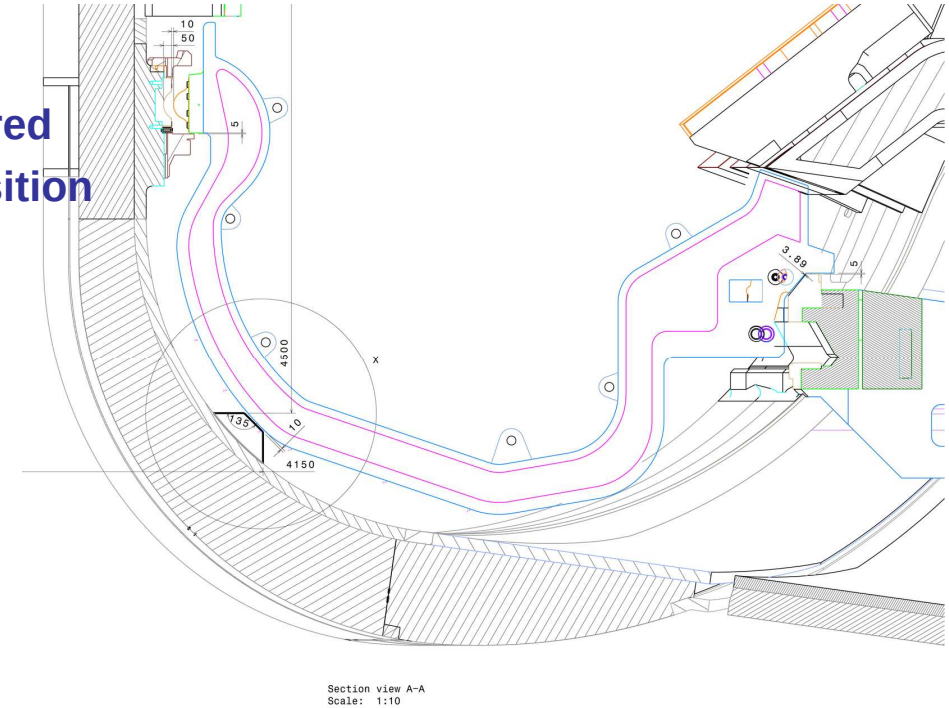
- Gas Injection affects N.Activation, similar solutions are required.
- Outboard Rail and Cassette locking developments have a strong interface with Neutron Camera
- Divertor Inner Rail with Magnetics
- Hardening of Divertor Gaps; TS & Spectroscopy
- Neutron transparency – more load in Rack (water cooled now?) all package leaders
- In-Vessel Viewing – Gas Discharge Cleaning System Probes

Divertor Cassette

Cassette to Vessel attachments

- **VV anchors are developing**
- **Additional cassette support required**
- **Cassette distorted in installed position**
  - Diagnostic integration impact
  - Test Stand more complex





After compression: 49 mm overlapping

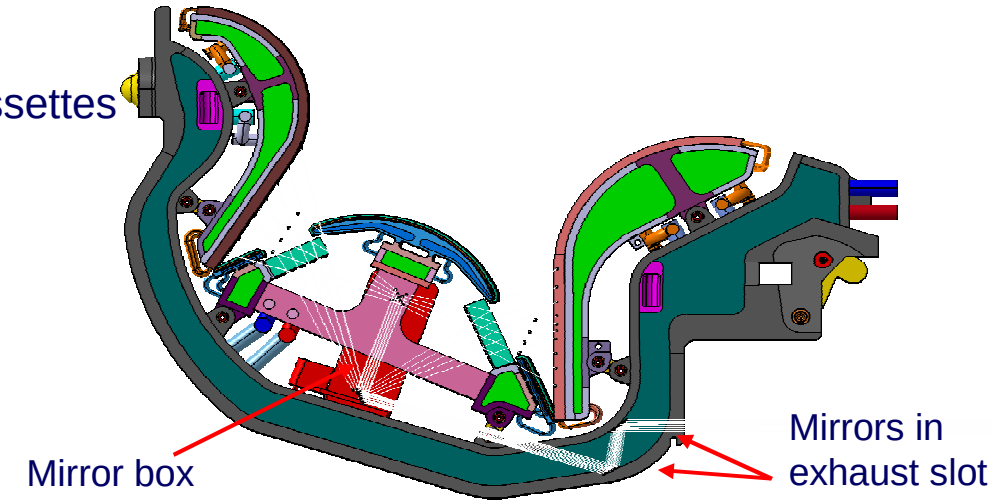
Diagnostics in Divertor Cassette

Developing from DDD definition, to accommodate updated divertor cassette

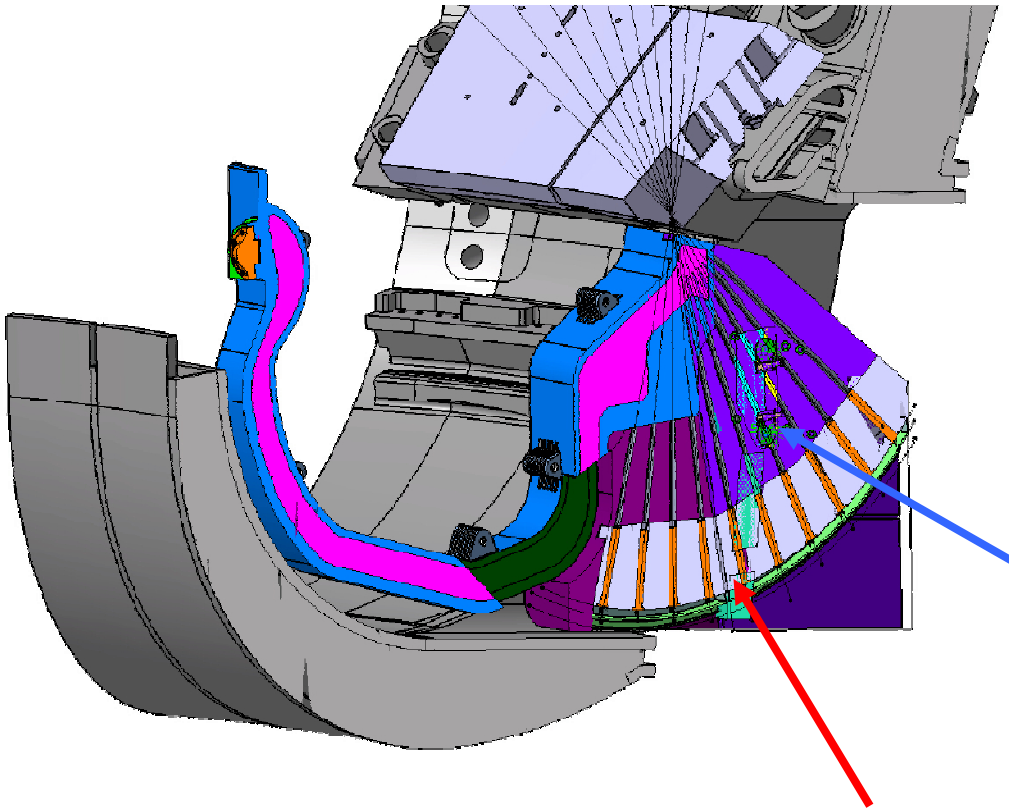
Deriving solutions that as are non-intrusive and as common as possible

Diagnostics can be classified into 6 broad groups according to the interface required on the Divertor Cassette

- Lower Vertical Camera
- Optic systems viewing the plasma from port through Gaps between Cassettes
- Optic Systems viewing the plasma from Port through top of the Cassette
- Optic Systems using Central Optics under the Dome
- Systems using Waveguides
- Probes installed in Instrumented Cassettes



Lower Vertical Neutron Camera



Main Impact:

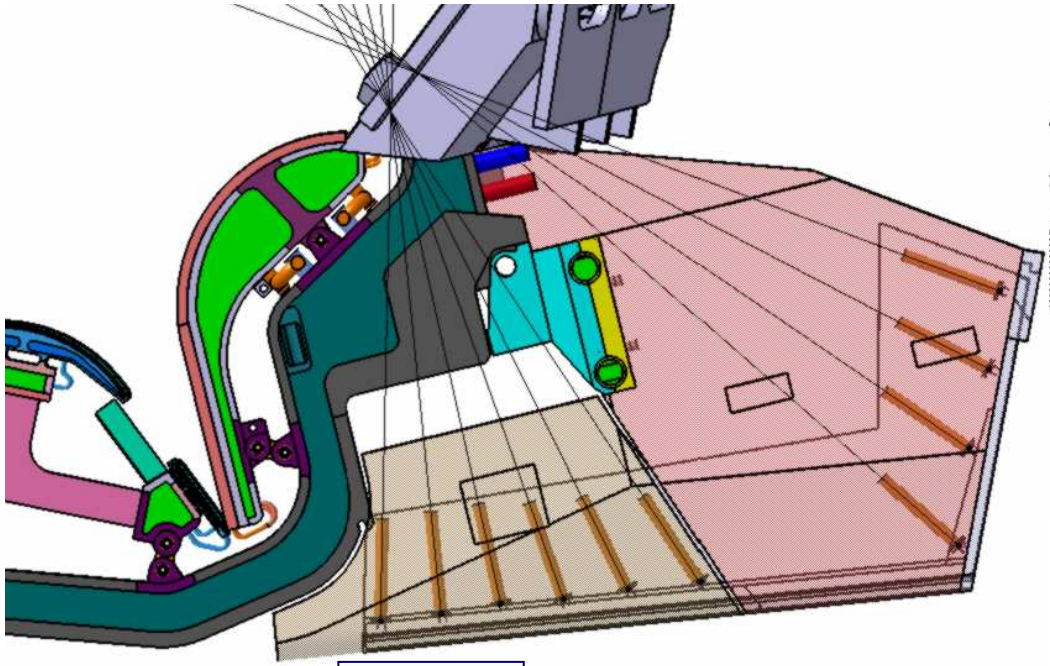
Slots through Blanket Module
Slots through VV Triangular Support
Collimators in Divertor Cassette and Central Cassette Outer Rail
Interfaces with VV, Divertor Port
- Alignment of Blanket , Divertor Cassette and Detectors

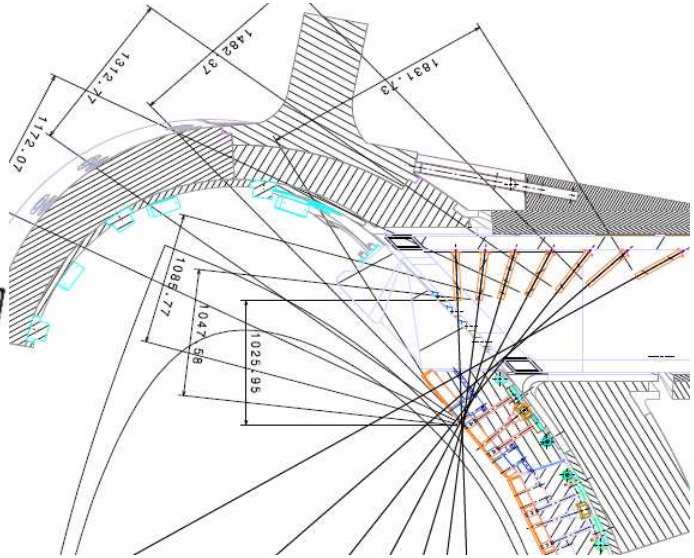
Diagnostic Cooling (Moderator)

Lower Vertical Neutron Camera

A solution exists, but

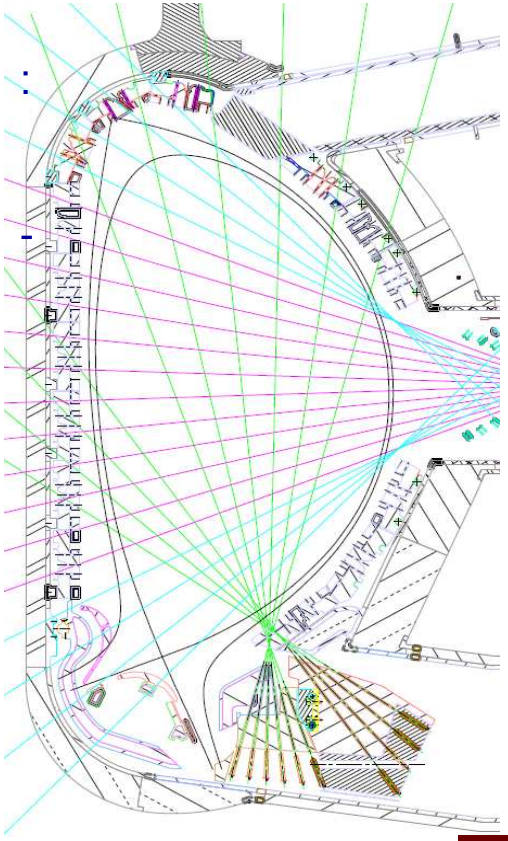
- **Large interface with cassette body**
- **Re-evaluation of integration of VNC in upper port was requested**

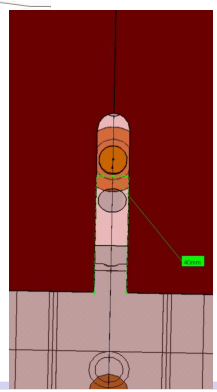




port #02

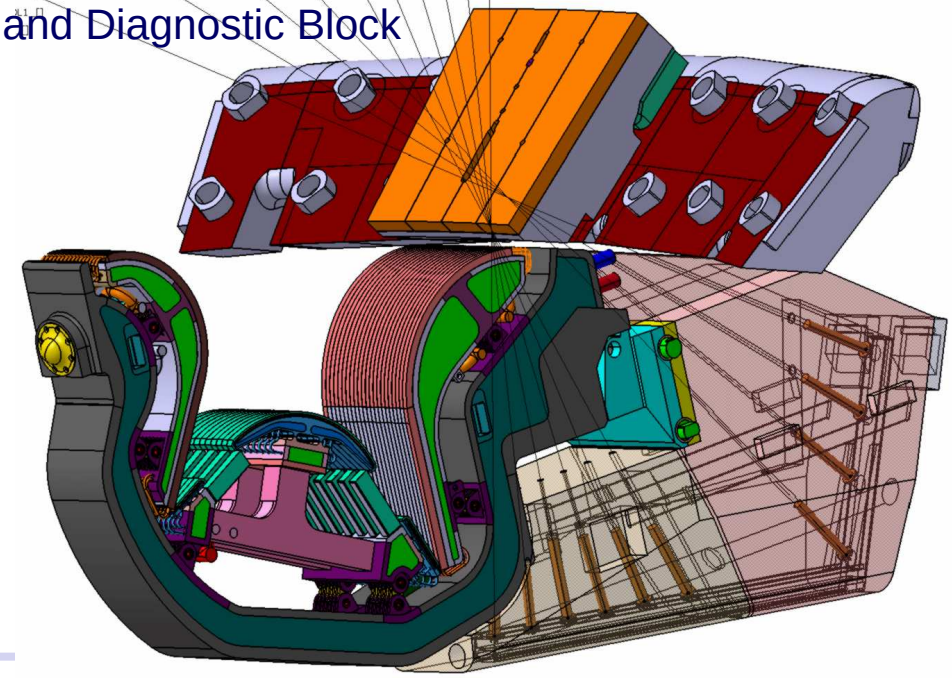
Lower Vertical Neutron Camera



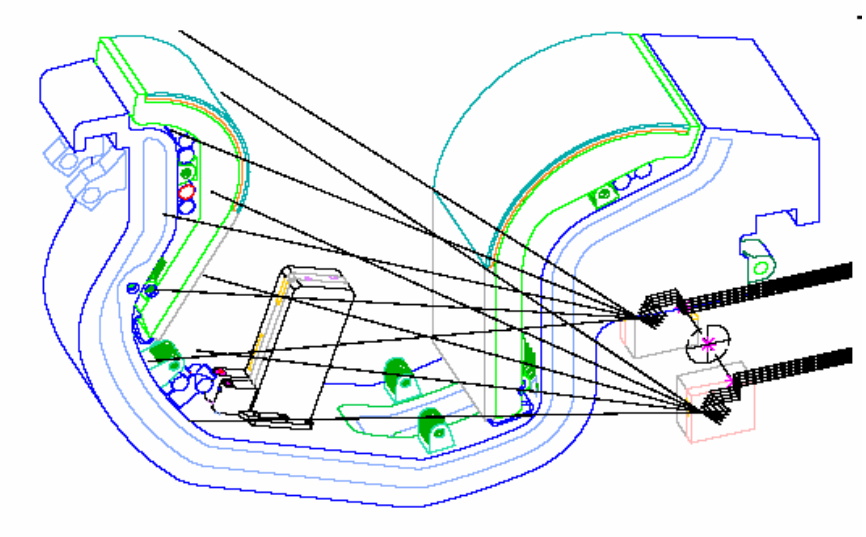


Interfaces to be solved

- Divertor
- Blanket Module
- Triangular Support
- Diagnostic Block in Divertor Port
- Diagnostic block under divertor casette decoupled from divertor
- Alignment requirements between Blanket Module, Divertor Cassette and Diagnostic Block



Optic viewing between Cassettes



E04 - Impurity Monitor Side Views

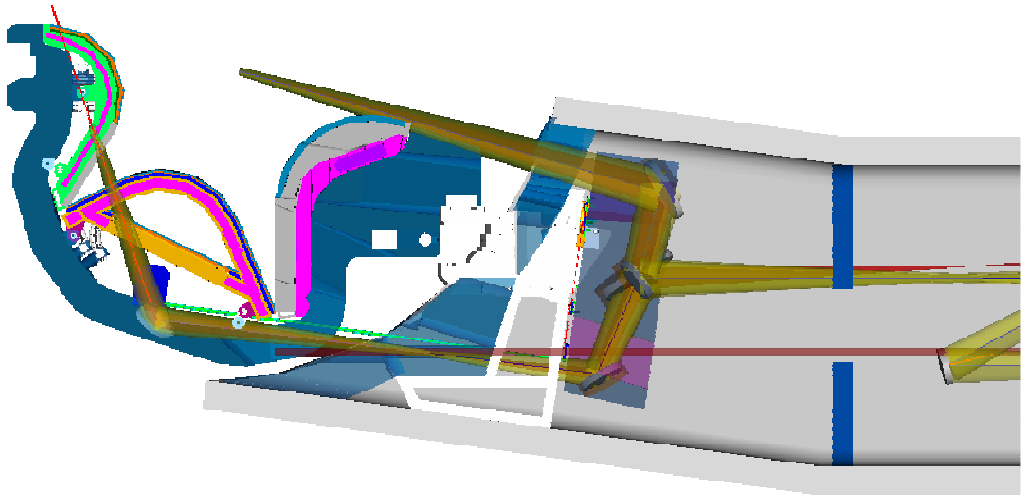
Main Divertor Impact:

Increase of gaps between cassettes
Cut-outs in PFC
Cut-outs in Cassette Body

Design Integration Target:

Common definition of gap between cassettes
Common definition of cut-outs required in the PFC

Optic viewing over top of Cassette



C03 -Divertor X-Point LIDAR TS

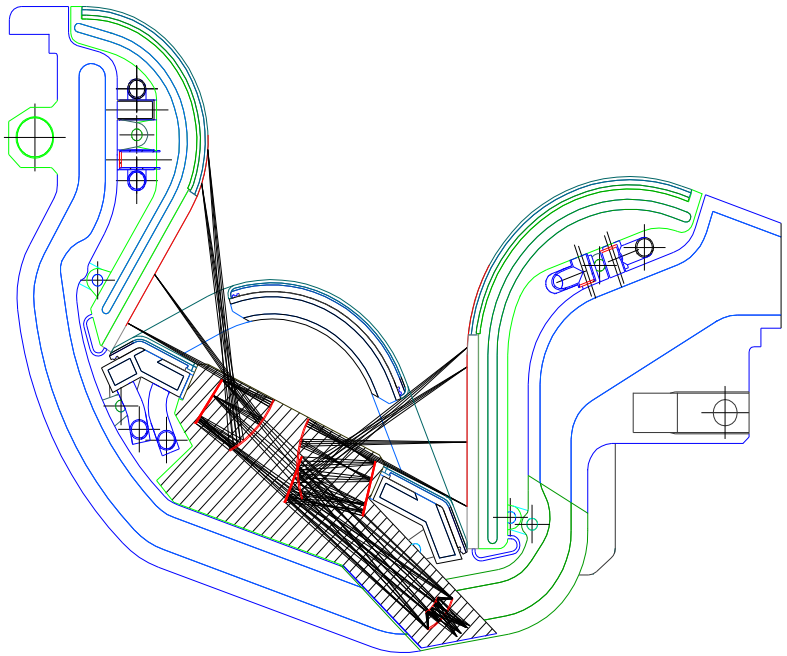
Main Impact on Divertor :

Cut-outs in PFC
Cut-out in Blanket Module # 18
Cut-outs in Cassette Body

Design Integration Target:

Common definition of gap between cassette / blanket module
Common definition of cut-outs

Central Optics under the Dome



Main Impact on Divertor:

Mirror Mount under the dome between Dome Supports

Gaps in liner to ensure Lines of Sights of plasma

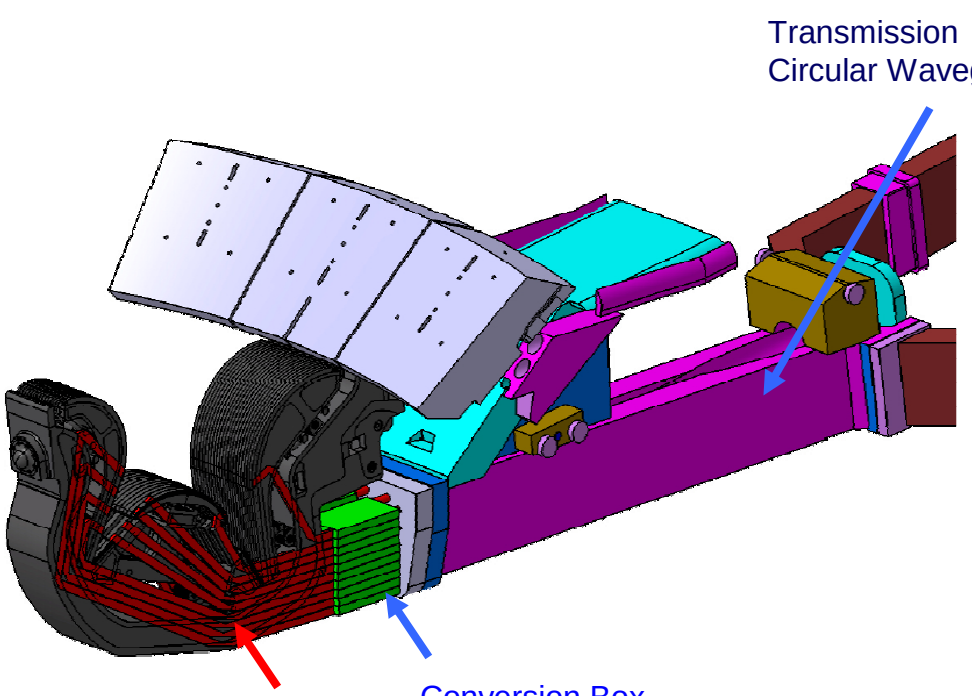
Design Integration Target:

Common

- Mirror Mount concept
- Mirror protection concept: shutters, baffles
- Cassette Body attachment and cooling
- Sight lines through dome liner
- Guiding System

G06 –IR Thermography

Waveguides Systems



Main Divertor Impact:

Increase of gaps between cassettes

Attachment of waveguides to Cassette sides

Attachment of conversion box to cassette body

Diagnostic cooling

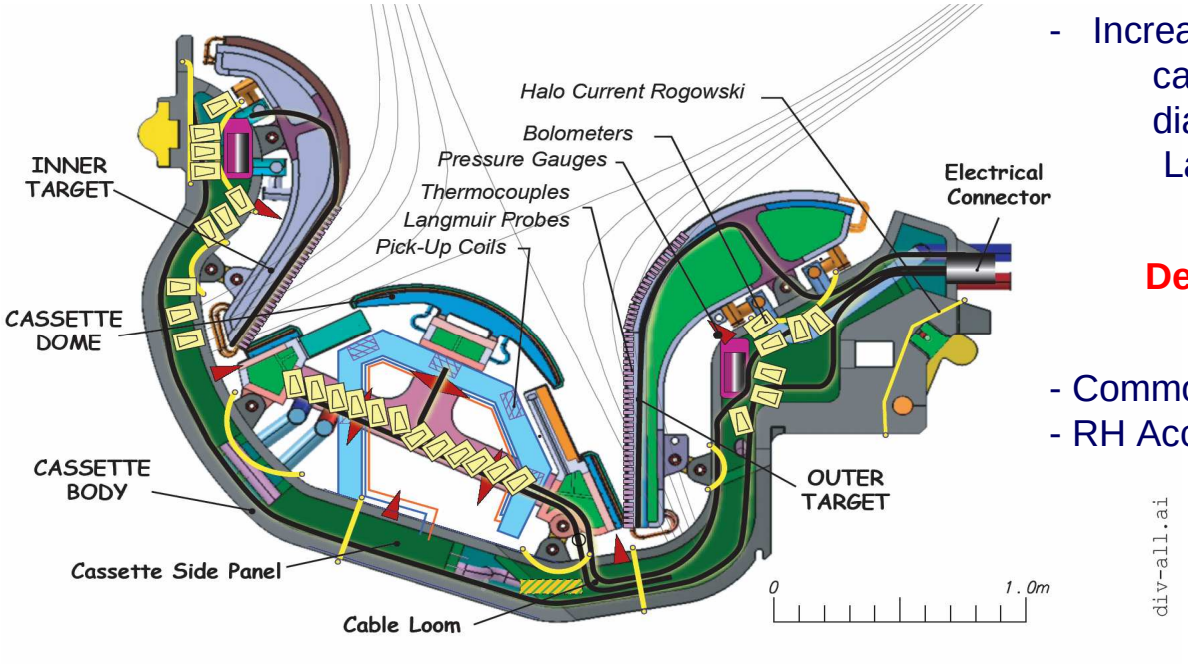
Coupling with Removable Transmission Waveguides installed in RH Port

Design Integration Target:

Common
- definition of waveguide concept
- definition of conversion box

F10 - Interferometer

Probes in Instrumented Cassettes



Main Divertor Impact:

- Attachment of probes to PFC components (Thermocouples, Langmuir Probes)
- Attachment of Halo Rogowski coils , Pick-up coils and Neutron Flux Monitor to Cassette Body
- Increase of gaps between cassettes to provide space for diagnostic probes (Bolometers, Langmuir Probes , Pressure Gauges)

Design Integration Target:

- Common Electrical Connector
- RH Access to Connector

Components in Divertor Port

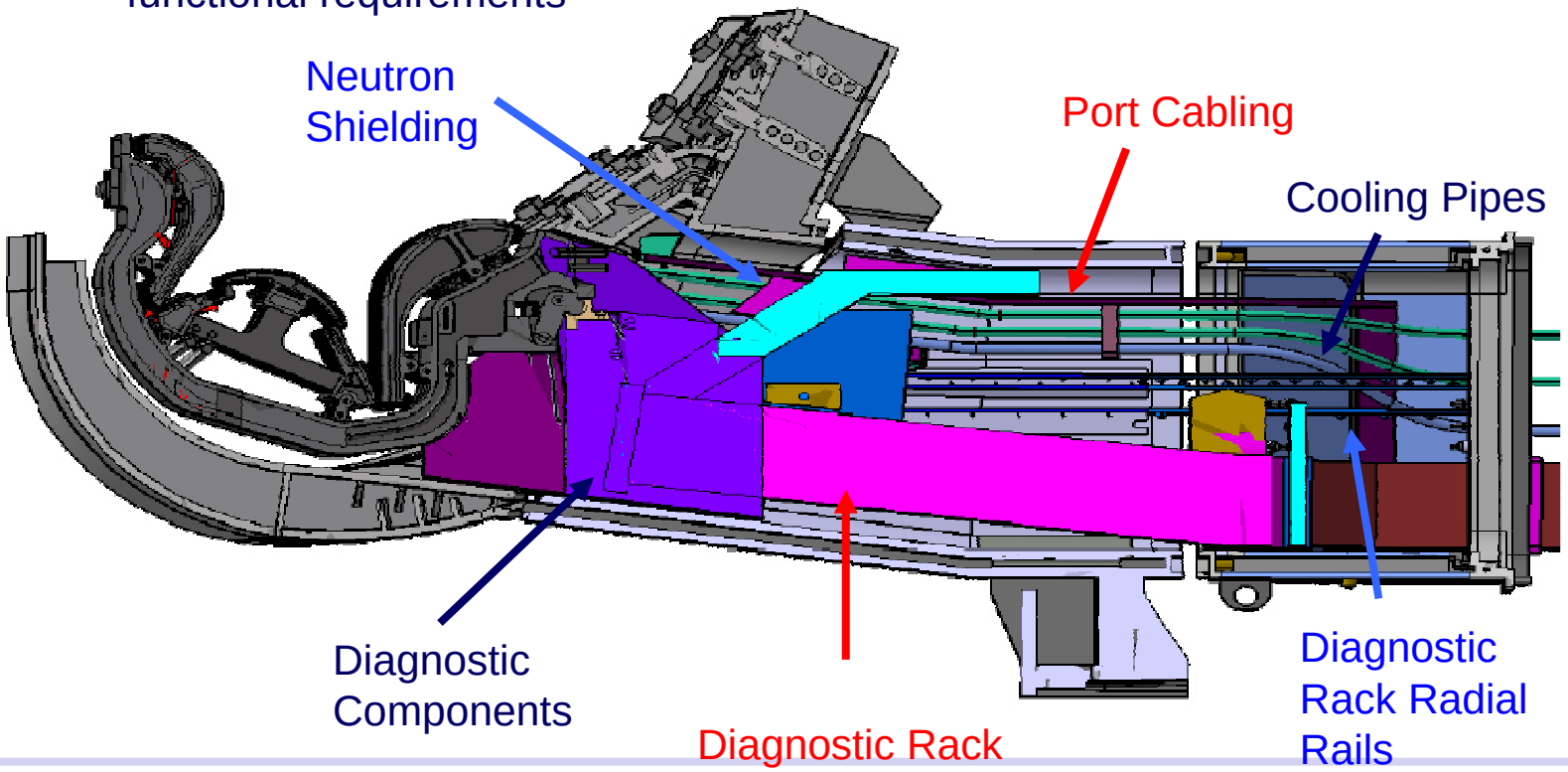
Diagnostic equipment is defined

Common Diagnostic Rack Elements

Neutron shielding provided – nuclear heating a generic or diagnostic problem

Accommodate cabling, fuel / gas injection lines, water cooling pipes, RH port interfaces, additional electrical lines , …

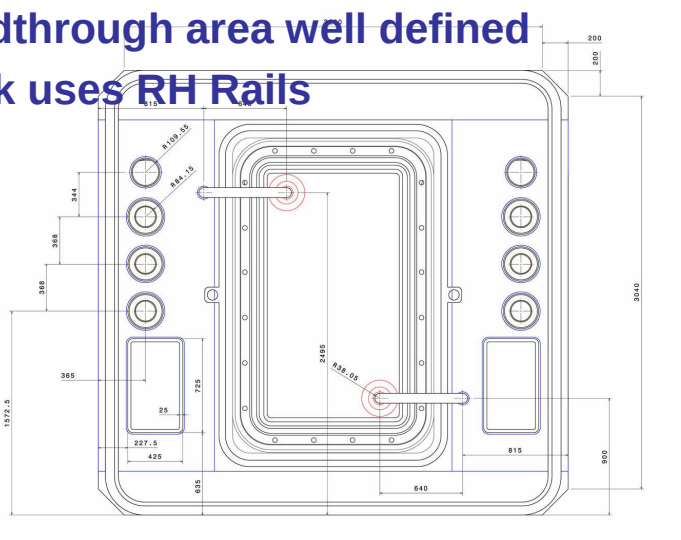
Define common solutions (when possible) for diagnostic port equipment with similar functional requirements

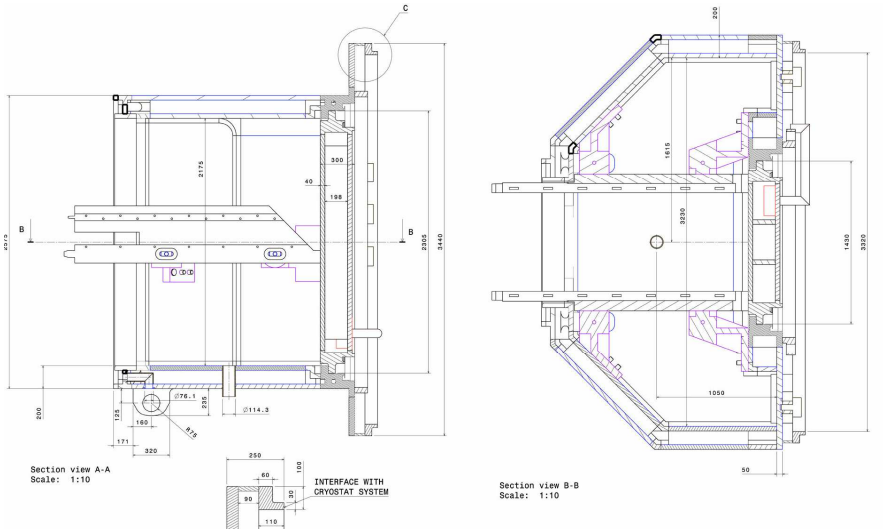


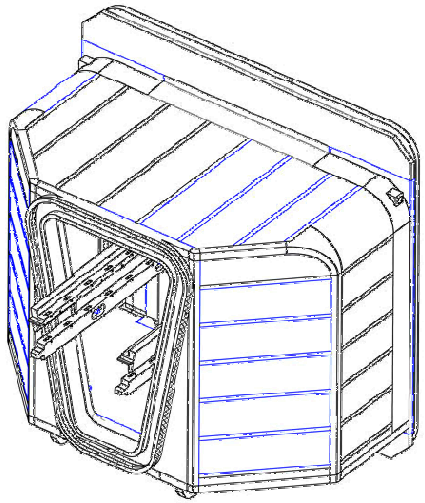
DIVERTOR PORT

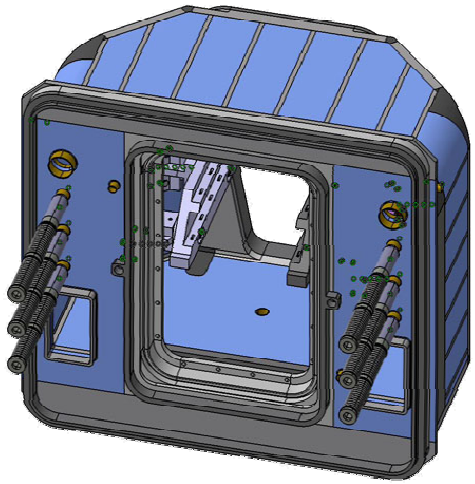
Feedthrough area well defined

Rack uses RH Rails









Vacuum Vessel

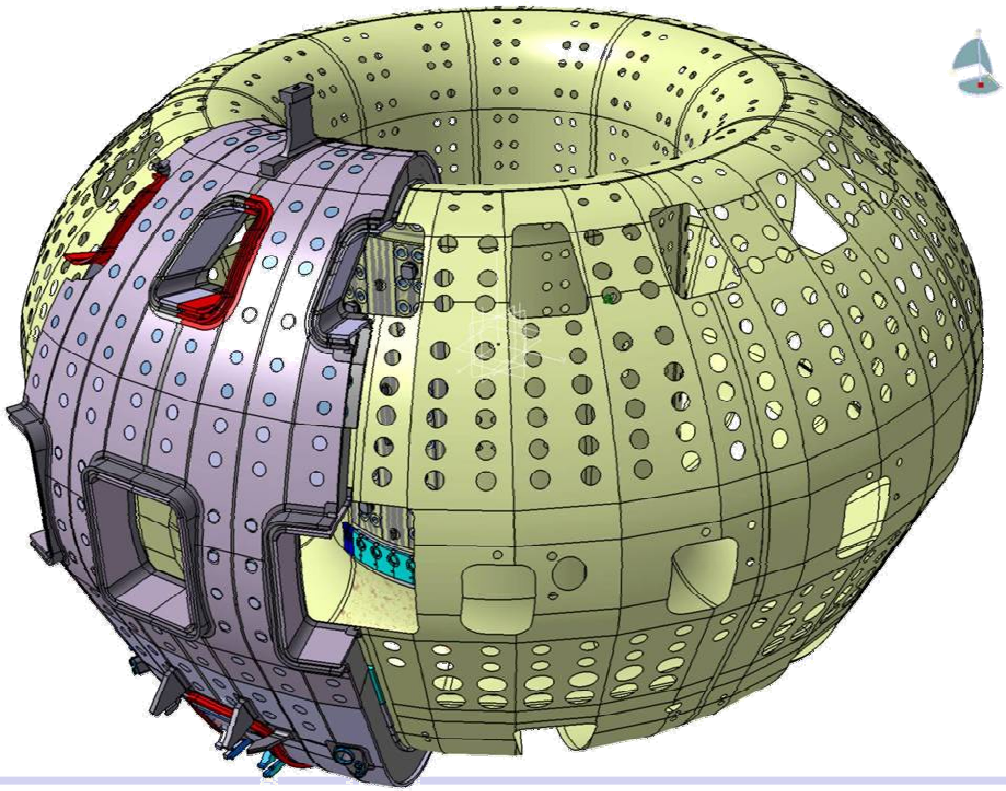
Vacuum Vessel Diagnostics

Work continues in EU and ITER on

- **Magnetic Diagnostics**
- **& In-Vessel Cabling**

An Interface map is required for VV construction and Assembly definition

- **Exists- on old VV profile**
- **A ‘skeleton’ of the VV is required first**



Buildings

Building Interface

Tokamak Building

1.5m larger (E,S,W walls to accommodate RH casks) drawings are now issued.
(+1.5 on N would allow 6m NB source move).

Hot Cell

Diagnostic Maintenance and Test Areas - The diagnostic requirements are noted and will be incorporated. Diagnostic input is still required. Test requirements, usage (port plug reliability), etc.

Neutron Test Area - The diagnostic requirements are defined and being incorporated

But…the Functionality of Building is being challenged

Diagnostic Area

A provisional allocation has been made.

Corroboration by system designers would be valuable.

The building, not the Diagnostic use, is being challenged

Annex Buildings (outside the fence) -starting

Lab space ~ for the main diagnostic areas - optical, microwave etc.

Workshops for local repairs and modifications etc.

Tokamak Building Port Cells

Cell Occupancy

- Port Cell Population
- More diagnostic information needed

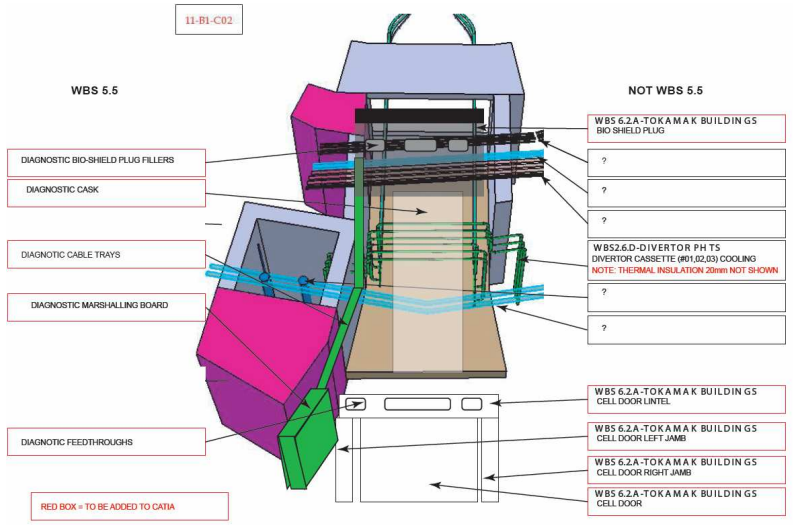
Port Cell Door

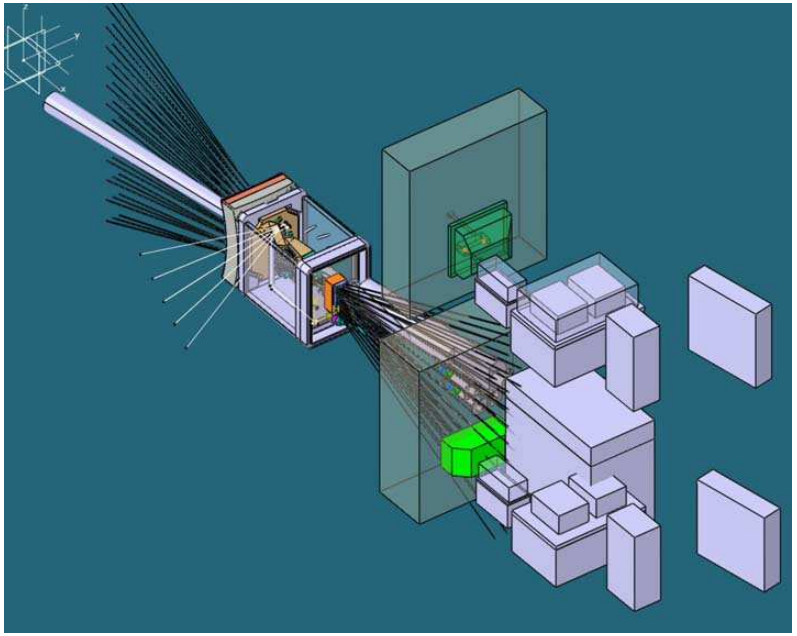
- Defined (40t, 5m, air-lock)
- Design Pressure 200kPa – no design
- Personnel Door required?

Bio-Shield Plug

- Segmentation update
- Define masses for installation
- include 100 mm (activated) removable layer

Requirement to incorporate in CATIA model



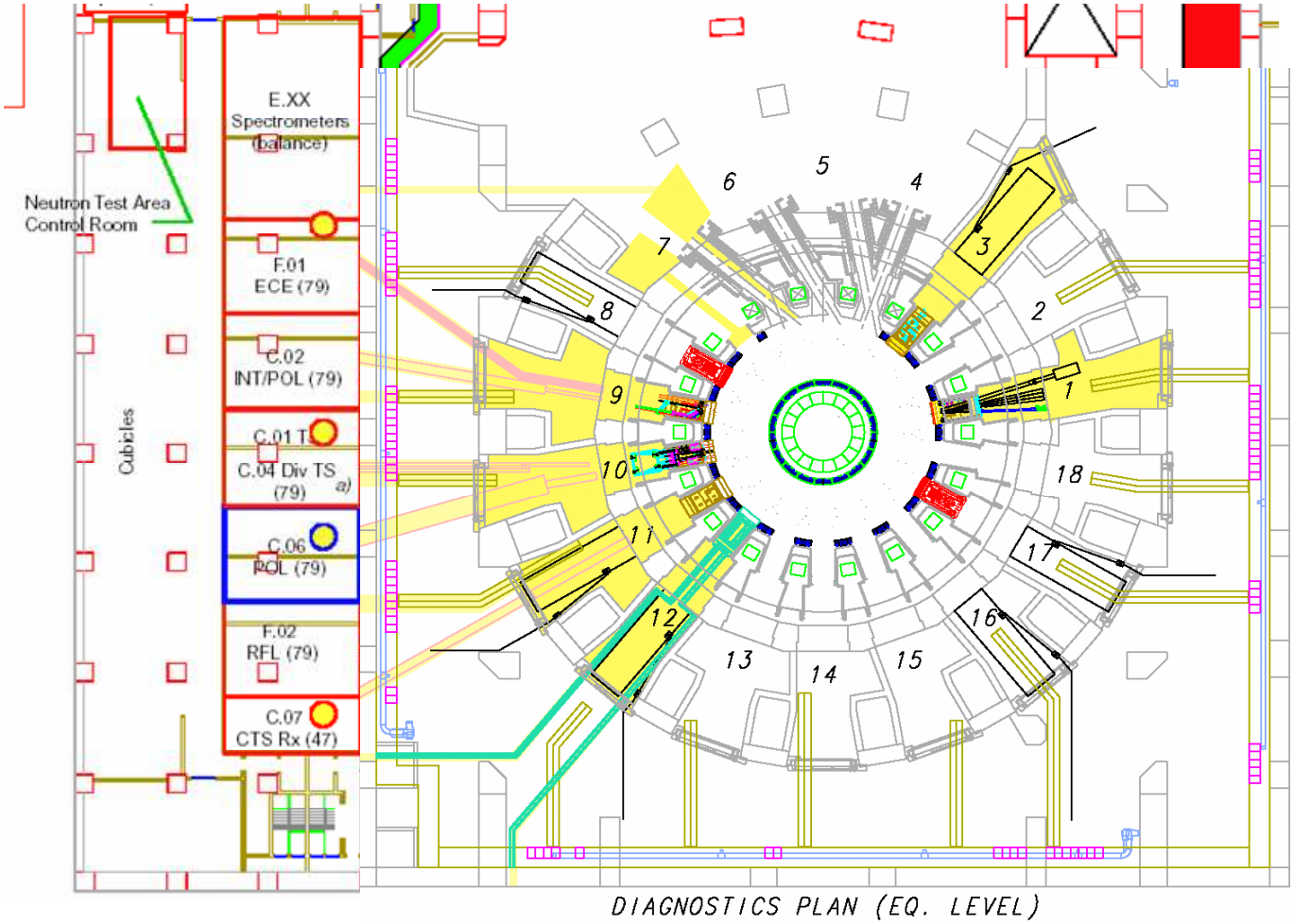


Tokamak Building Gallery

Connection Diagnostic Port Cells to Diagnostic Building

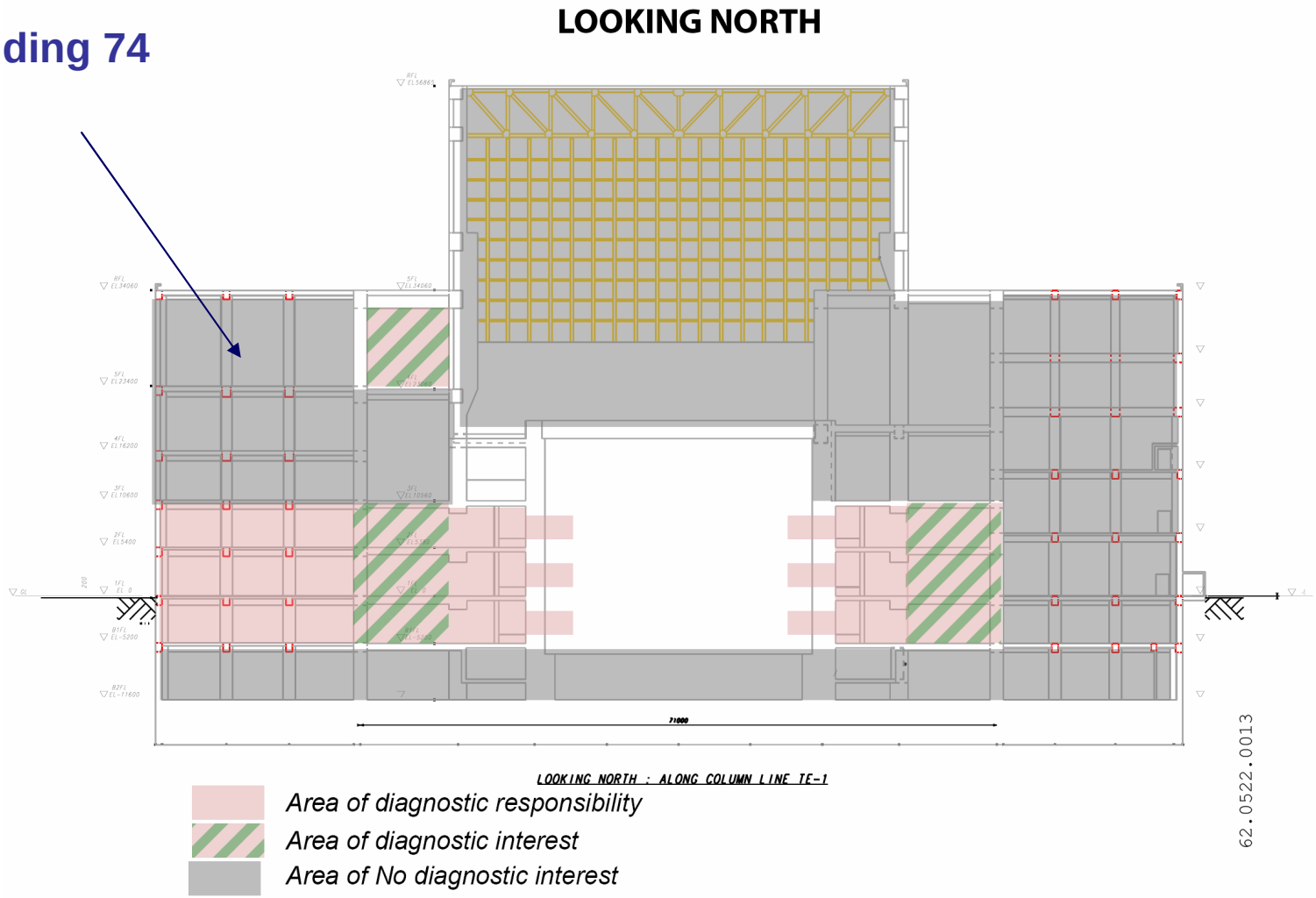
- Transmission Lines
- Cables

No new facts

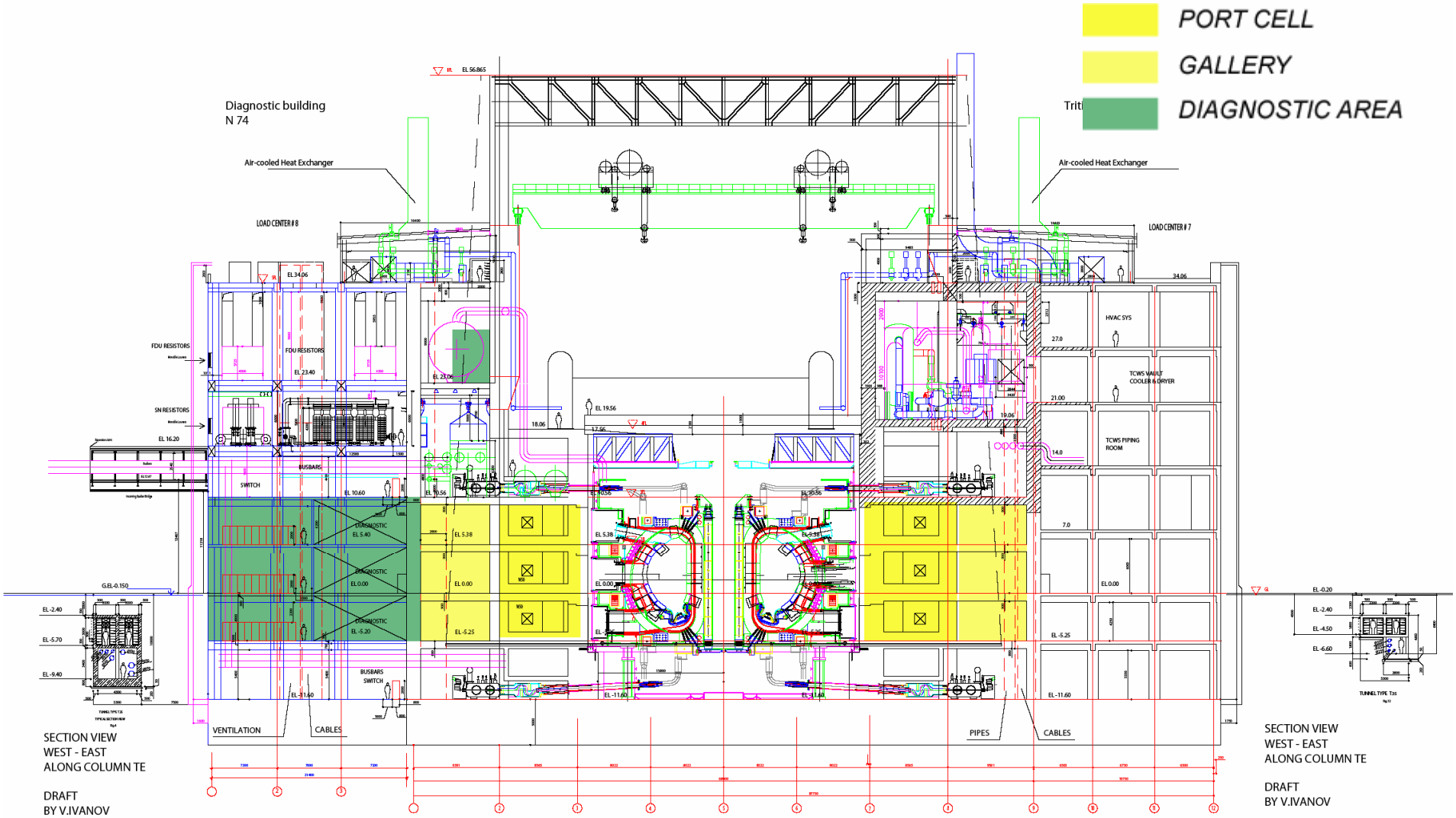


Diagnostic Building

Building 74



Diagnostic Use of Buildings

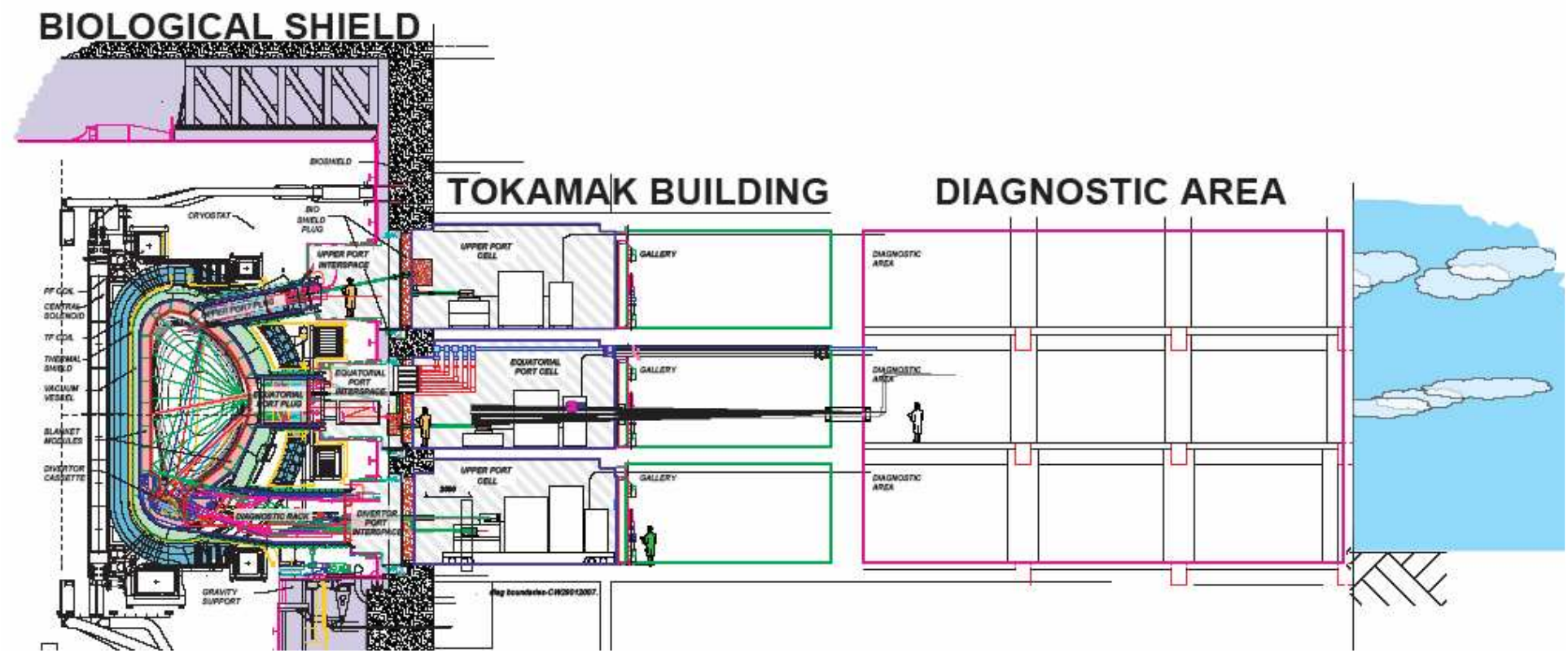


Diagnostic Building

The Diagnostic Area is 3 levels of the Diagnostic Building

Zones from Red to Green

Safety delibrations are refining requirements

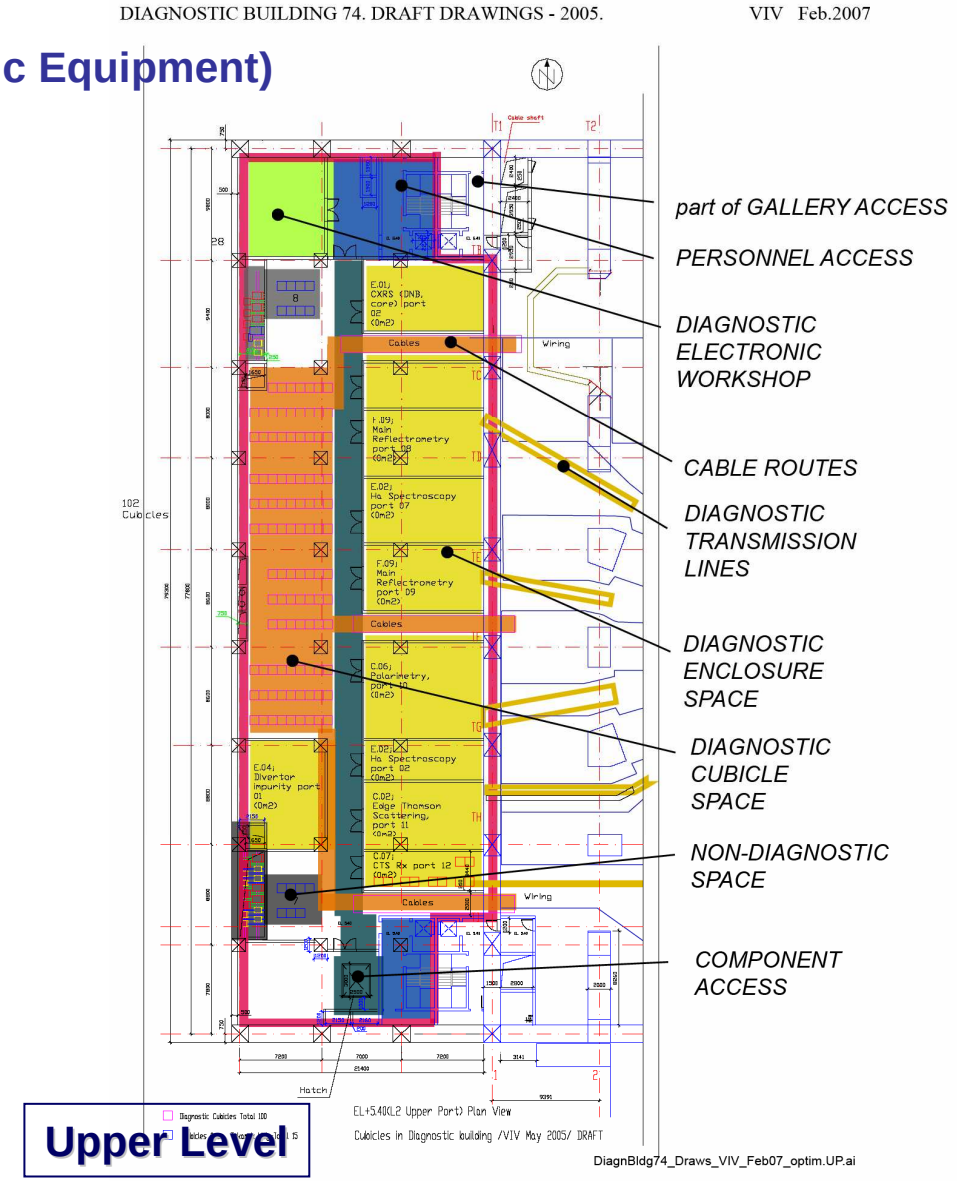


Diagnostic Area

74-L2-01(Cubicles) + 74-L1-02(Diagnostic Equipment)

A layout exists

Substantial wiring from at least 6 port
Substantial wiring from all 18 ports
6 - 8 ports “close” to diagnostic hall
Connectivity for Transmission Lines
Access to West Wall
Rationalised Penetration Points
No internal ‘Walls’
No Windows
Personnel & Equipment Access
Some Tenant Space



Upper Level

Diagnostic Area Requirements & Layout

DDD 5.5.N Diagnostic System Engineering spells out Diagnostic Area requirements

Diagnostic Cubicle Count and Dissipation (ITER_D_2277NR)

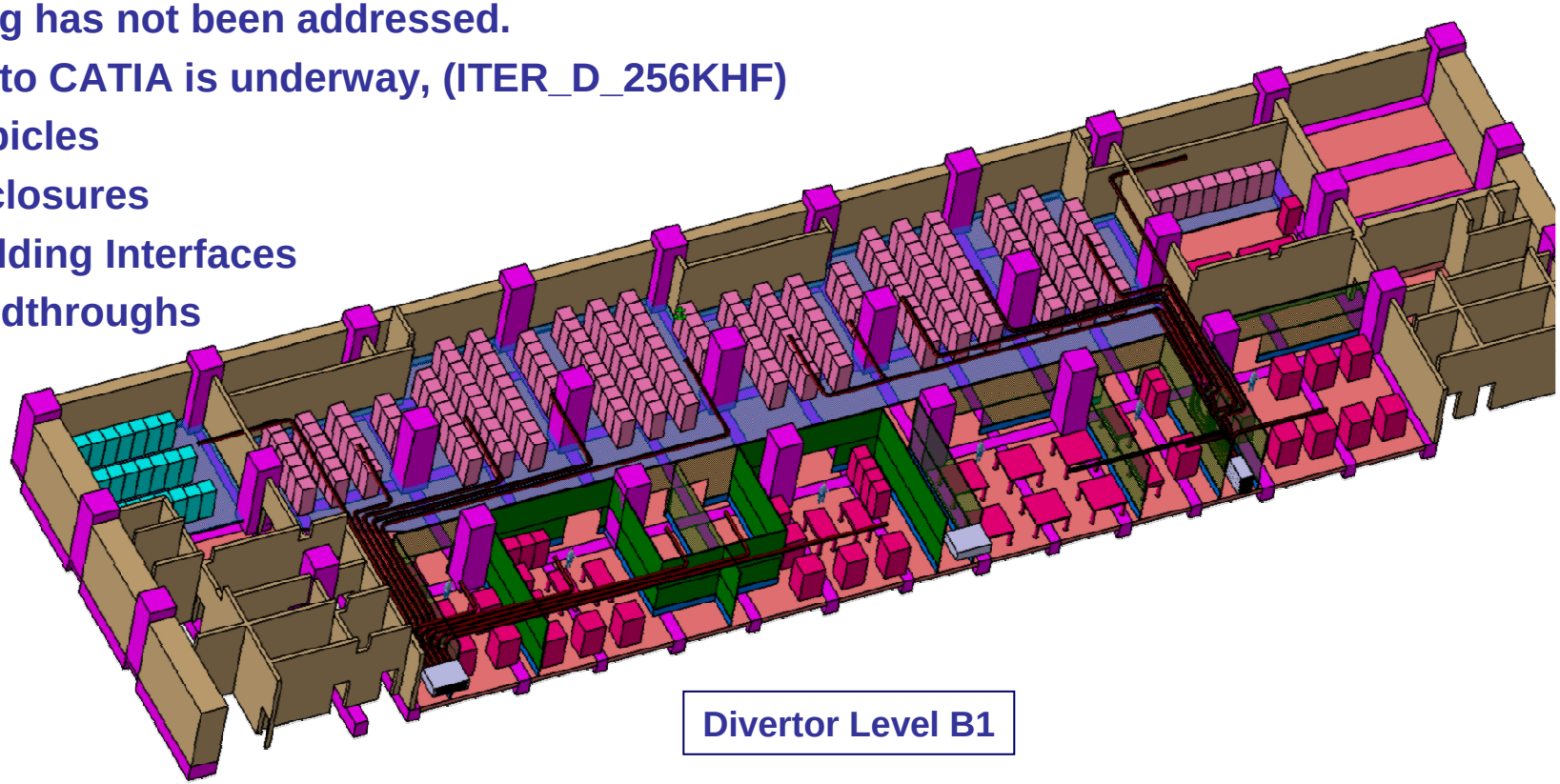
Some domestic facilities are ill defined or missing

HVAC, Workshops, power, store, toilets!

Scheduling has not been addressed.

Migration to CATIA is underway, (ITER_D_256KHF)

- Cubicles
- Enclosures
- Building Interfaces
- Feedthroughs

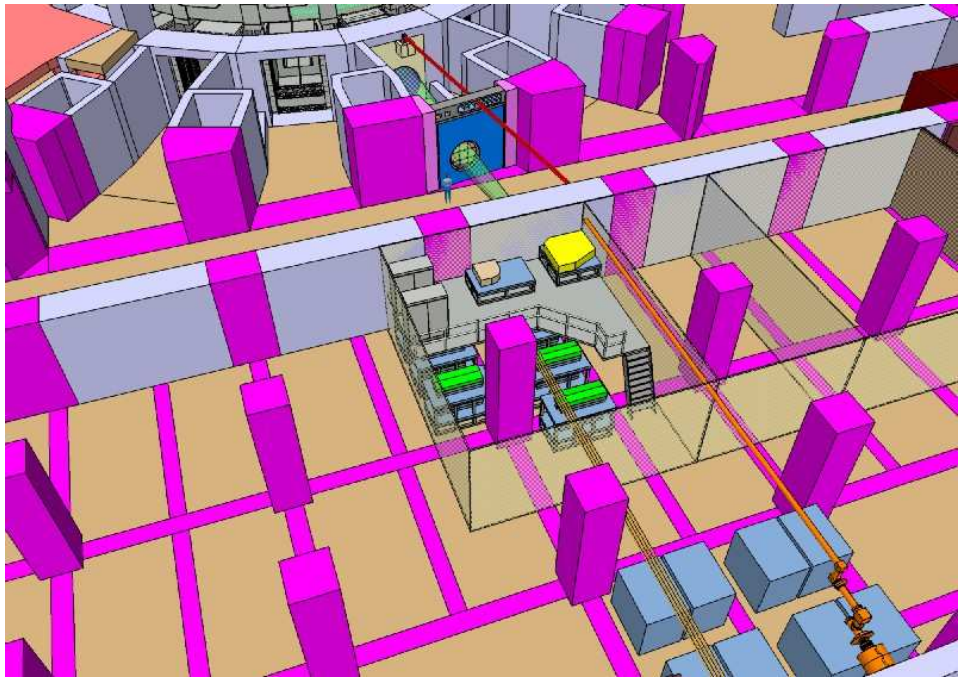


Divertor Level B1

Diagnostic Enclosures

Some Diagnostic Designs have addressed Diagnostic Area use
e,g, 5.5.3.PP14(EU)C01 LIDAR Thomson Scattering (core) with Eq10

Not in ENOVIA
Not yet offered for review
Fits allocated space

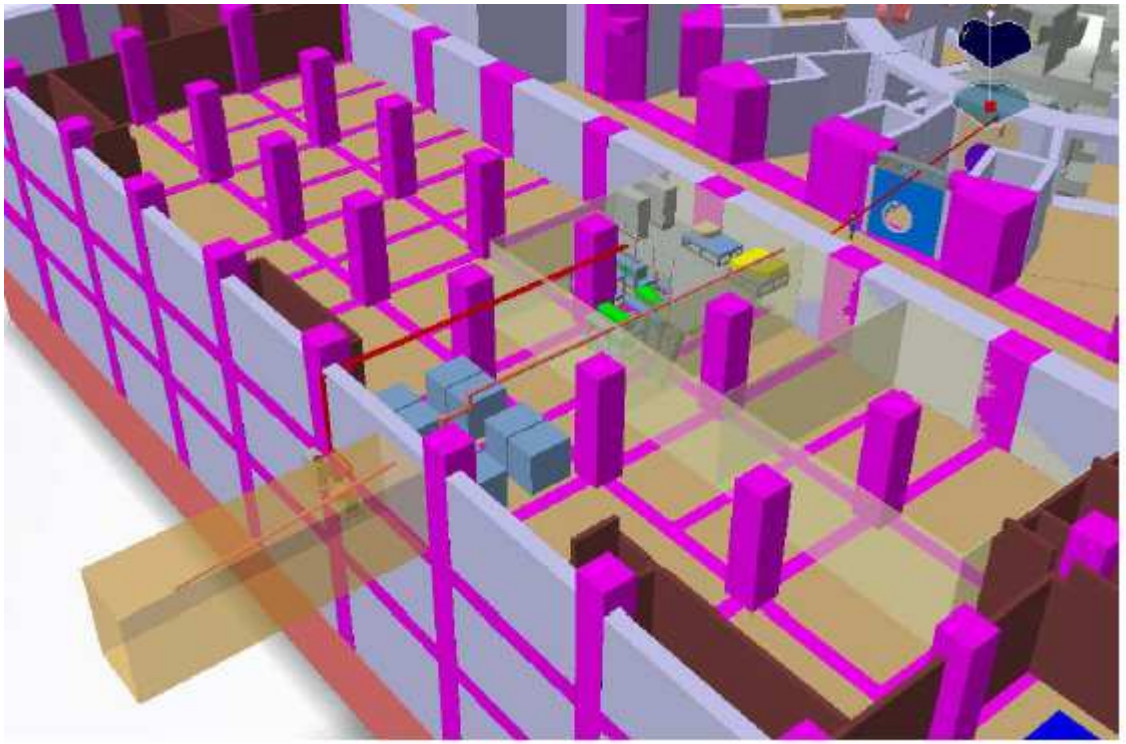


Diagnostic Enclosures

Of course there is
Outstanding Design & Integration work

Penetrations
Laser Test Line

possibly typical of development of any diagnostic design



Project Management Procedures

Project Management Procedures

ITER Working Groups for Project Management

Rules being established - prototypical

Representatives of DAs – should be used

Secretary John How	Quality Assurance	Computer Aided Design	C & S Codes and Standards	Information Technology	Planning and Scheduling	Procurement	CODAC (1st Feb 2007)
ITER Coordinator	K.Sowder	E.Martin	J-P Girard	H-W Bartels	Larry Lew	N.Holtkamp **(Sec:** A.Maas)	J.Lister
China	Y. Zhao	Y. Song	D. Yao	W. Kang	X. Deng	J.Xie	Dr. Jr Luo
India	B. Doshi	R. Prakash	B. Doshi	I. Bandyopadhyay	R. Prakash	S K Mattoo	Y.G.Saxena
Korea (plus deputy)	H. J. Kim (J.H.Han)	N. I. Her (B. C. Kim)	S. I. Lee (H. J. Kim)	I. S. Choi	H. U. Ko (B. C. Kim)	B. S. Lim (H. J. Kim)	H.Jhang
Japan (plus deputy)	M.Higuchi (Y. Neyatani)	K.Koizumi	M.Higuchi	K.Koizumi	K.Koizumi	M.Mori (Y. Neyatani)	Y.Kawano
Russia	V.Muratov	V.Muratov	G.Kalinin	I.Semenov	L. Makarova	V.Belyakov	I.Semenov
USA	M.Skonicki	B. Nelson	B. Nelson	Dan Ciarlette	S. Herron	J. Geouque	
Europe	M.Peyrot	F. Casci	M. Ferrari	K.Thomsen	M. Ferrari	E.Di Pietro	

DESIGN OFFICE - CATIA

ITER Management confirms choice of CATIA V5

All exported – imported data should be native C

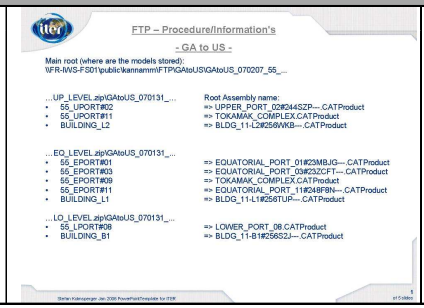
Three main Design Office Collaboration scheme
Scheduled, Synchronous. See "Protocol of Desi
Offices of the ITER International Organization a
Draft "

DO can host Visiting DA Designers for a few we

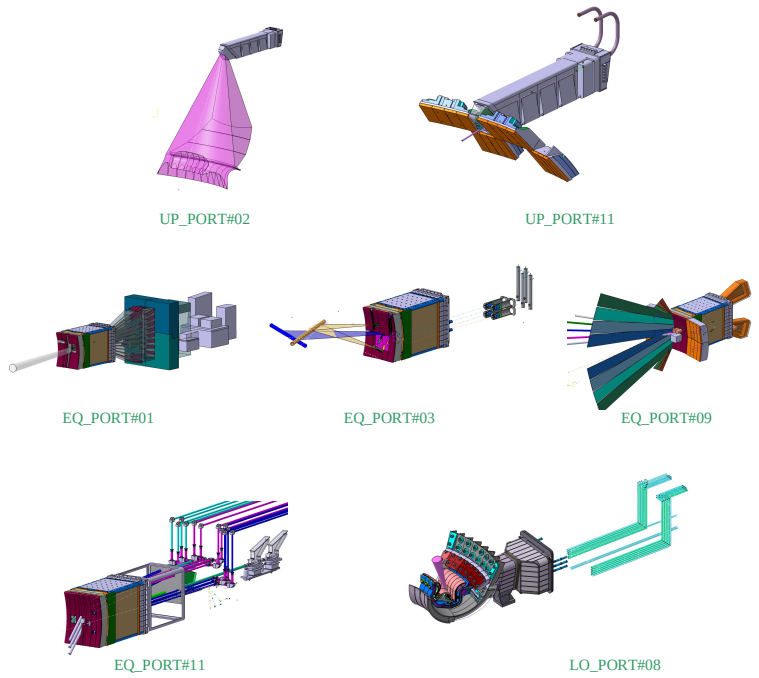
CATIA V5 + ENOVIA LCA R16 in production at I
Moved to CATIA V5 & ENOVIA LCA R17 2006 at
- **Potentially searchable and manipulatab**
- **Bookmark required material for Asynch**

New protocol for CAD transfer to DA

B) DATA DESCRIPTION:

			Yes	X
Root Assembly name:		**Enovia based data**	**No**	

The CATIA assembly opened at partner's site should look like this:



The data described here can be collected at the following FTP adress:	ftp://ftp.iter.org/GAtoUS/GAtoUS_070207_55_ (Partner's Username and password should have been given prior to sending operation)

ITER Project Baseline Documentation

Update of Ongoing Activity coordinated by Design Integration Group

3 primary elements (baselines) define the scope of the project:

TECHNICAL SCOPE BASELINE describes the performance capabilities that the project must provide at the end of the construction phase to achieve the mission need,

SCHEDULE BASELINE that define the time within which the project is to provide the required capabilities, and

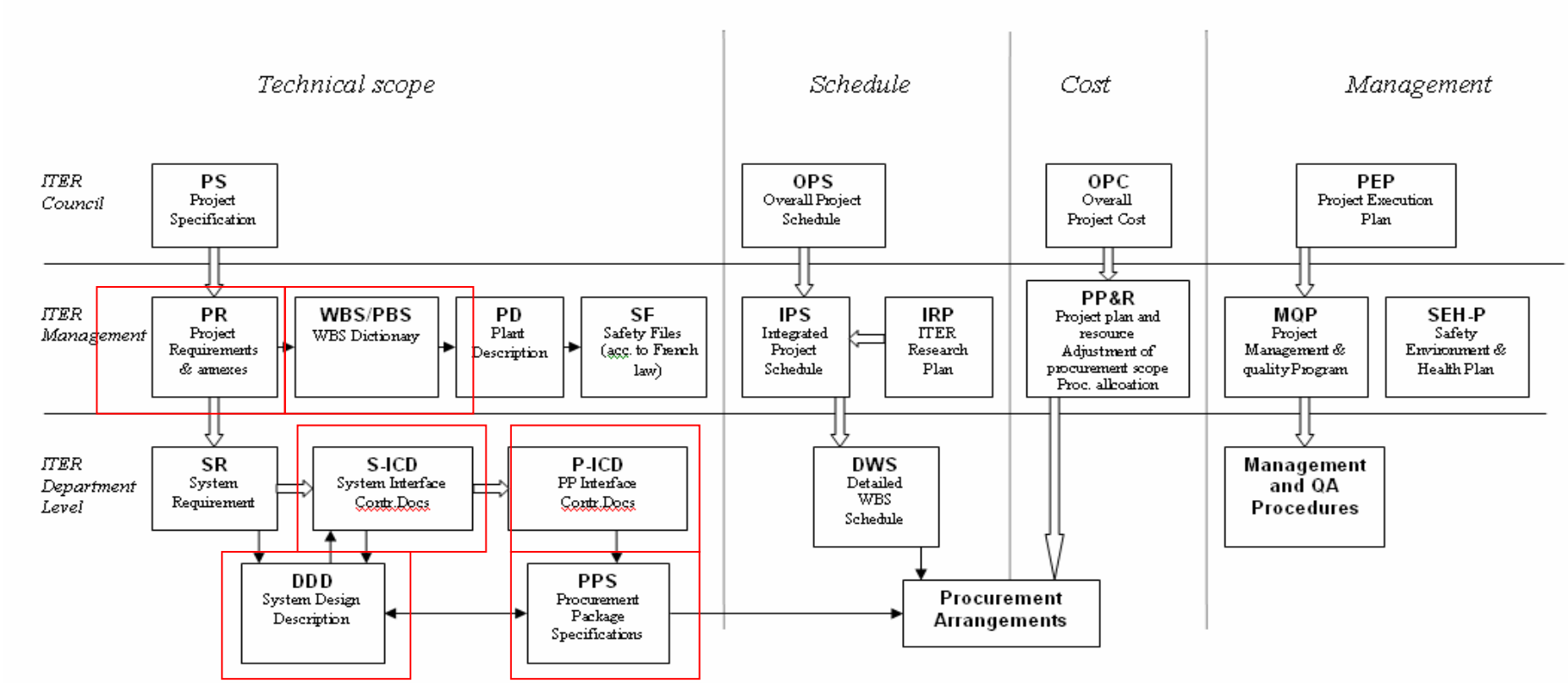
COST BASELINE that describes the total cost of providing the required capabilities within the identified schedule.

Problem with current baseline documents are:

- **ITER documentation is not adequate to start the construction:**
  - **design of some systems in the FDR 2001 was scaled from the large ITER,**
  - **with understanding that additional design work had to be carried out once the decision on construction was taken**
- **It was only partially kept up to date during the last 5 years**
  - **There were resources to work only on the DDDs of key systems**
- **Changes from the Design Review must be incorporated**
  - **Several comments have been raised from the reviewers and industry consultants that have assessed the status of the documentation.**

2007 Baseline Structure

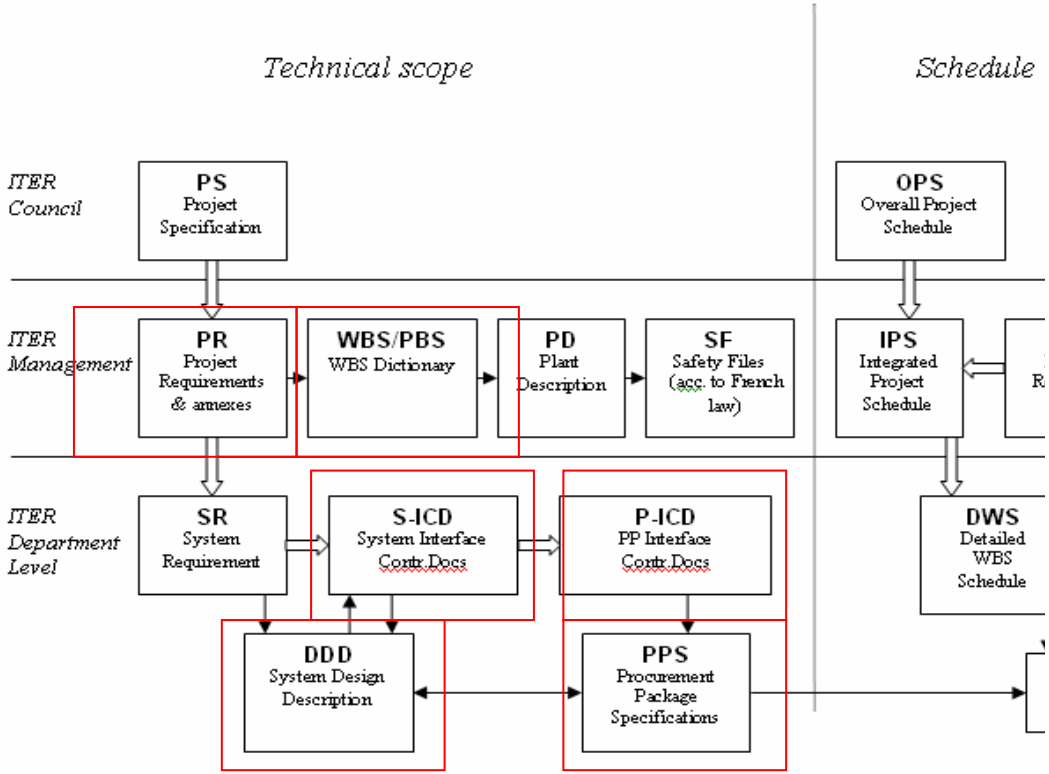
A new Baseline Structure is defined



Proposal for 2007 Baseline Structure

New Structure & Format - mainly old material – to be updated
for Diagnostics & Diagnostic Support Structures - most elements are already written

SRD System Requirement Document = DRG2-Chapter 20 Diagnostics (ITER_D_22GP2) with additions
Writing is in hand in discussion with ITER Project Office
More Formal [ROs,Checkers,Reviewers,Approver, Document Control Manager]
ITERO writes



Proposal for 2007 Baseline Structure

1 Scope

2 Functions, Basic Configuration and System Boundaries
- 2.1 System Functions
- 2.2 System Basic Configuration
- 2.3 System Boundaries

3 Design Requirements
- 3.1 General requirements
- 3.2 System specific requirements
- 3.3 Mechanical requirements (including load combinations)
- 3.4 Vacuum requirements and vacuum classifications
- 3.5 Structural requirements
- 3.6 Electromagnetic requirements
- 3.7 Thermohydraulic requirements
- 3.8 Electrical requirements
- 3.9 Nuclear shielding requirements
- 3.10 Chemical requirements
- 3.11 Seismic requirements
- 3.12 Manufacturing requirements
- 3.13 Construction requirements
- 3.14 Assembly requirements
- 3.15 Testing requirements
- 3.16 I&C requirements
- 3.17 Decommissioning requirements
- 3.18 Grounding and Insulation requirements
- 3.19 Materials requirements
- 3.20 HVAC requirements
- 3.21 Other services

4 Safety Requirements
- 4.1 General safety requirements
- 4.2 Safety functions
- 4.3 Safety Importance Classification and seismic classif
- 4.4 Safety design limits
- 4.5 Monitoring requirements
- 4.6 Safety-specific instrumentation
- 4.7 Safety related testing and inspections
- 4.8 Safety related operations and procedures
- 4.9 Occupational safety
- 4.10 Environmental Impact requirements
- 4.11 Reliability requirements

5 Operation and Maintenance
- 5.1 System operation states
- 5.2 Maintenance class
- 5.3 Reliability assurance requirements
- 5.4 Environment conditions during maintenance
- 5.5 Remote handling requirements
- 5.6 Short term maintenance requirements
- 5.7 Long term maintenance requirements

6 Quality Requirements
- 6.1 Quality classification

7 Applicable Codes and Standards

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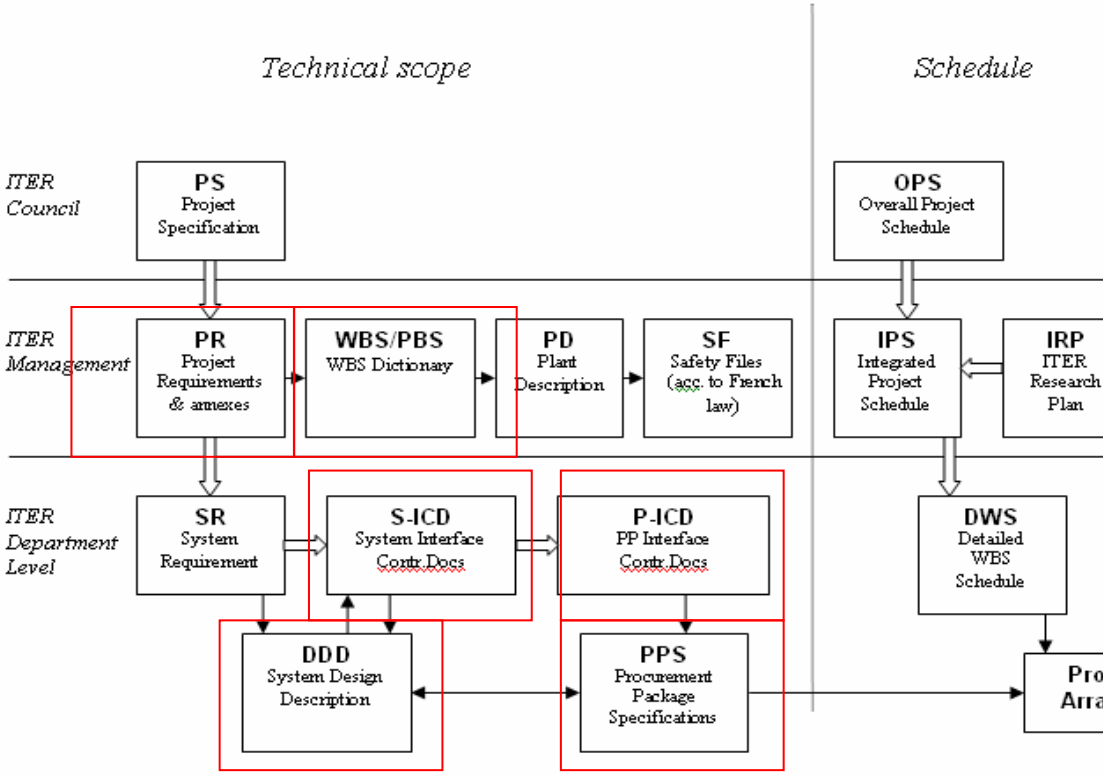
ITERO writes

DDD System Design description = 2001 DDD Updated as necessary
Party writes - ITERO underwrites



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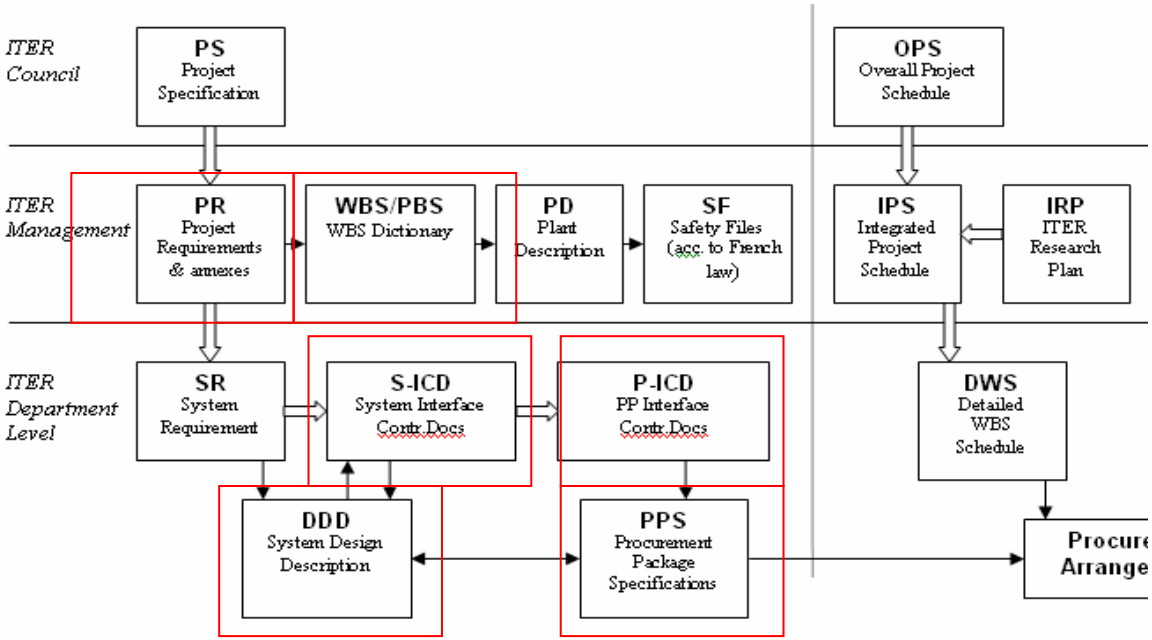

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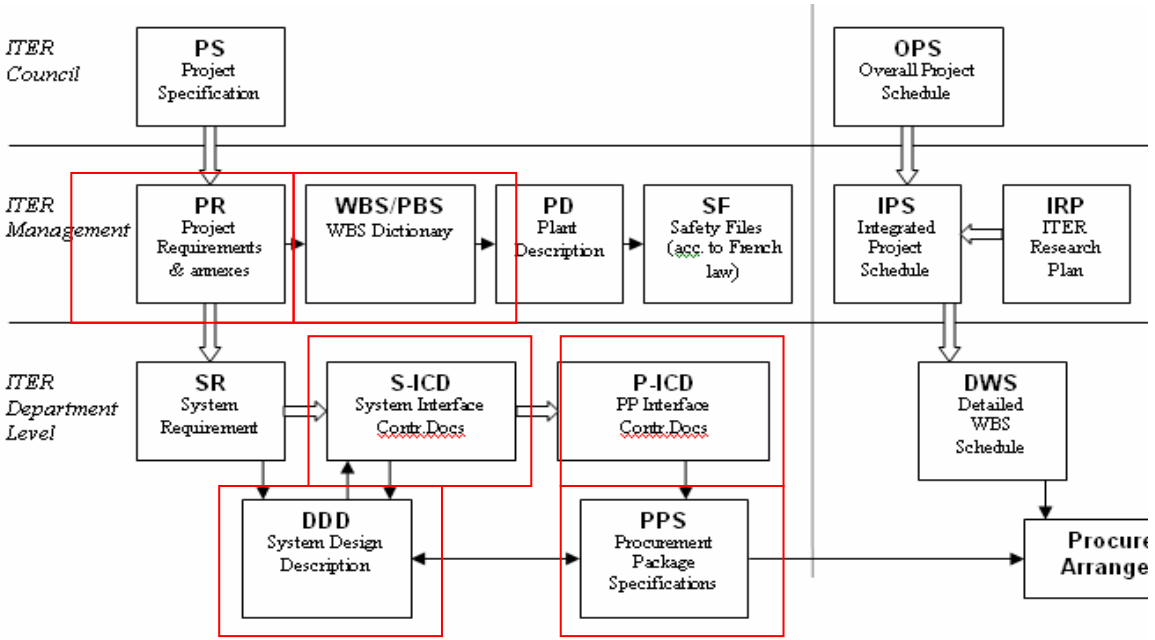
PPS Procurement Package Specification = All Elements of the Procurement Package
Diagnostic Specification - Appropriate part of Procurement Package ANNEX 1: Tech Spec
Party writes - ITERO underwrites
Port Plug Specification - Port Engineering Task Design Specification Updated for Procurement
ITERO writes - Port Engineering Task underwrites
CAD Models & Drawings – at appropriate level of detail
Diagnostic **Party writes - ITERO underwrites**
Port Plug **ITERO writes - Port Engineering Task underwrites**
Integration **Party writes - ITERO underwrites**
Schedule Appropriate part of DWS Detailed WBS Schedule
Party writes coordinated by ITERO

Prop



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S-ICD System Interface Control Document - New system for Handling Interfaces
ITERO writes - Party underwrites

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Party writes coordinated by ITERO

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Procurement Tools

- Integrated Project Schedule - IPS
  - Not Yet Correct at the Diagnostic Level, some inconsistencies at VV Assembly Level. However the IPS is not incompatible with Port Plug Schedule of Port Engineering Task.
  - Diagnostic Details, particualry ITER milestones, will be input soon
- Diagnostic Procurement Plan
  - Design review of diagnostics: May 07
  - Finalise proposed procurement packaging June 07
  - Develop detailed procurement plan for all packages.
  - Initiate preparation of procurement packages Sept 07
  - Develop detailed design of port plug structure complete Dec 07
    - CAD Effort
    - Incorporation design developments
- Diagnostic Procurement Tracking Matrix
  - For internal Diagnostic Division procurement monitoring
  - Defines of milestones towards completion on a scale to 100%.
  - With an objective criterion for each step.
  - Design ready for proc package may mean detailed, or manufacturing, depending on PT or Fund etc

Procurement

Diagnostic Procurement Tracking Matrix

	0%	5%	100%
Diagnostic design			Design ready for proc. package
Diagnostic engineering (portplug etc)		Identified	Design ready for proc. package
Interfaces		Identified	Design ready for proc. package
R+D		Identified	Definitive R&D result, report
IT Package specification		Identified	Agreed with PT
PT pre-procurement		Voluntary Input to IT design (ITPA, Varenna etc)	PT agrees Proc Spec with IT
Package procurement		PT accepts procurement contract	Final commissioning It works!

Diagnostic Work Plan to December 2008

Overall project objectives, activities and milestones that affect Diagnostics and diagnostic staff (from the IPS)

- Preparation of Preliminary Safety Report
- VV Codes and Standards approved by Regulator
- Execution and completion of Design Review
- Update Baseline Documentation
- Preparation and launch Procurement Packages for early procurement systems
- Development of IPS
- Completion of any necessary supporting R&D

Diagnostic Work Plan to December 2008

MAIN ACTIVITIES

Interface Work

Identification and definition of Interfaces with Early Procurement Systems

- **Magnets – design ongoing (EU &ITER)**
- **Buildings – Tokamak Building (Port Cells, Galleries), trnasmission lines & Cabling. Diagnostic Area**
- **Vacuum Vessel – Interface Map, to follow skeleton (needs generating), Triangular Support, Obscured Port.**
- **Safety – Windows, Zones, Port Cell pressures**
- **NB Cell**

Identification and definition of interfaces with All Remaining tokamak systems notably

- **Blanket – Regular Blanket Cut-outs, BSMs, Special BSM**
  - Develop case for cut-outs in upper blanket modules
  - B Mod#11 cutout and Upper port plug BSM discussions with Blanket Gp
  - Upper Port Plug BSM with Blkt Gp & EU ECH
- **Hot Cell – Utilization, functionality, RH, Active Waste, Test Area, Be Area**
- **Divertor – common Generic Interfaces, Diagnostic specials**
- **CODAC Plant I&C system - advancing**
- **Annex Buildings requirements (Lab & workshop) – preliminary**
- **Steady State Power Supplies (& Cable Provision)**

Interface Work

Identification

ITER_D_23E32V						interface with					
			pack	lead	party	Magnets	Building	Safety	Vessel	DCR 49 implication	count
VV all	A03	Magnetics	P22		EU	X			X		1
U06	B08(F)	Neutron Activation (encapsulated foil) (1/2)	P4		KO		X	X		X	2
U08	F09	Reflectometer (Main Plasma, HFS) gap 6 2pr VV_to	P6	lead	RF		X		X		3
U10	C06	Polarimeter / Interferometer	P8	lead	JA		X				4
U11	C02	Edge Thomson Scattering	P9	lead	JA		X				5
U17	F09	Reflectometer (Main Plasma, HFS)gap 6 1pr	P10	lead	US		X				6
Eq01	B01	B01-Radial Neutron Camera	P11a	lead	EU		X				7
Eq01	B11	High Resolution Neutron Spectrometer	P11c		EU		X				8
Eq09	F01	Electron Cyclotron Emission (ECE)	P13	lead	US		X				9
Eq10	C01	LIDAR Thomson Scattering	P14	lead	EU		X				10
Eq10	C08	LIDAR Inner Divertor	UnC		UnC		X				11
Eq011	E08	Neutral Particle analyser (NPA)	P15	lead	RF		X	X			12
Eq012	C07	Collective Thomson Scattering (CTS)	UnC		UnC		X		X		13
Lo08	F10	Divertor-Interferometer (g)	P18	lead	US		X				14
Lo08	E10	LIF (c)	Un_C		Un_C		X				15
Lo10	C04	Thomson Scattering (Divertor Outer)(g)	P19	lead	RF		X				
Lo10	C03	X-point TS,Div ne Te (g)	Un-C		Un-C		X				16
Lo14	F04	Reflectometer(g)	P20	lead	F		X				17
Lo14	F05	ECA (divertor)	P20		F		X				18
Lo14	G08	Plate Erosion (c)	Un -C		Un -C		X				19
	N06	Ex-Bioshield_ Electrical Equipment	P31		F		X	X			20
U06	E03	VUV grazing image Spectrometer (x 2)	P4	lead	KO			X		X	21
U06	B08(F)	Neutron Activation (encapsulated foil) (1/2)	P4		KO		X	X		X	22
U09	E05	X-ray Crystal Spectroscopy (imaging)	P7	lead	IN			X			23
Eq011	E08	Neutral Particle analyser (NPA)	P15	lead	RF		X	X			24
VV some	B03	Microfission Chambers	P24		JA			X	X		25
Eq 8&17	B04	Neutron Flux Monitors (ext)	P25		CN			X			
Lo some	G04	RGA	P28		US			X	X		26
	N10	In-Vessel Diagnostic Services	P30		EU			X	X		27
	N06	Ex-Bioshield_ Electrical Equipment	P31		F		X	X			28
	N07	Window assemblies	P32		F			X			29
U01	F03	Plasma Position Reflectometry (outb gap 4) 1pr VV_	P1	lead	EU				X		30
U01	F03	Plasma Position Reflectometry (outb gap 5) 1pr Plug	P1	lead	EU				X		31
U08	F09	Reflectometer (Main Plasma, HFS) gap 6 2pr VV_to	P6	lead	RF		X		X		32
U14	F03	Plasma Position Refllectometry Gap6 1pr VV_to Cel	P1	lead	EU				X		33
Eq09	C05	Toroidal Interferometer/ Polarimeter	P13		US				X		34
Eq09	F07	Fast Wave Reflectometry	UnC		UnC				X		
Eq09	E07	Soft X-Ray Array (exV)	UnC		UnC				X		35
Eq012	C07	Collective Thomson Scattering (CTS)	UnC		UnC		X		X		36

Diagnostic Work Plan to December 2008

Port Engineering

- Completion of design of diagnostic support structures for two representative ports (one upper and one mid-plane) to the point where detailed specifications can be determined for each port.
- Complete development of design of a representative port structure at the upper and equatorial levels with solutions demonstrated to the key engineering issues
- About 1 PPY from ITERO plus about 2 PPY from the PTs.

Initiation of Port Engineering Task Force

- Initiate cross party task force to co-ordinate the work in the PTs and the IT in preparation for procurement, construction, and installation and commissioning phases of the diagnostic port-based procurement packages.
- Harmonize and coordinate the work on common elements and especially the development of diagnostic and port-plug components and their integration.
- Track the development of the interfaces (plug/port, diagnostic/plug and package/package (hence party/party))
- Develop methods for transfer of knowledge and experience.

Diagnostic Work Plan to December 2008

Port Engineering Prototyping

Plan, and if possible initiate, prototyping of some key components and procedures that are needed to confirm feasibility of the solutions adopted.

- **lifting/handling of port plug**
- **port plug flange attachment**
- **port plug sealing**
- **BSM attachment**
- **RH water welds**
- **Draining and filling tests**

Specifications now required

Diagnostic Work Plan to December 2008

Diagnostic R&D identified

submitted to Project Office for consideration for support through the ITER R&D funds.

DIAGNOSTIC

- **Divertor target Langmuir probe prototype**
- **ECE Hot source**
- **Prototype magnetic coils**
- **In-vessel Hall Probes**
- **Erosion monitor optical transmission prototype**
- **Advanced Photon and Particle Detector Development**

ENGINEERING

- **In-vessel conduit prototype**
- **Divertor Cassette connector prototype**

Specification now required

Diagnostic Work Plan to December 2008

Other Activities

Contribute to ITER Preliminary Safety Report

- **measurement of dust**
- **Boundaries & Zoning**
- **Diagnostic Windows.**

ITER Practice for Windows and Non-Metallic Boundaries.

Contribute to ITER interface work generally.

Design Review

Support other design reviews as needed. Contribute to the efforts to resolve issues related to diagnostics being handled by some of the Working Groups.

- **Building**
- **Safety**

Diagnostic Design internal review ITER DIAGNOSTICS: Baseline Design and Readiness for Procurement (ITER_D_25DBC6 v1.2)

- **Resolution of all diagnostic related issues**

Procurement Packaging

Develop detailed procurement plan for all packages.

Prepare and place procurement packages

Scheduling

IPS, VV Assembly, Diagnostic & Party Schedules

CONCLUSIONS

Integration and Diagnostic Engineering work progresses in all areas.
IT & PT system designers are active on relevant work.
Inevitably there is a resource limitation.
Project priority and urgency supersede Diagnostic Procurement needs in many areas.
Assigning effort to the funded systems will be difficult.
Diagnostic package and system procurers must be mindful of their interests and be active in promoting them.

EQUATORIAL PORT SUMMARY

- Not much design change of basic diagnostic port plug structure
- Still outstanding sealing & BSM attachment Interfaces
- ITER definition is overdue
- Diagnostic integration develops in ITERO & Parties

UPPER PORT SUMMARY

- Significant development in Port Plug Structure Definition (though CAD model required)
- Handling & Sealing – still too many open issues/options (2 /5)
- Mainly from NB cell requirements – standard solution is not essential
- Providing diagnotic ports above NB Cell looks feasible, Tube insertion scheme is advanced
- In-Vessel BSM removal – is not well developed, not demonstrated yet

CONCLUSIONS

DIVERTOR
- Much Design refinement
- Aim to define and match a Common Cassette
- Diagnostic Designs needed for this to develop further
- Generic design points are being dealt within ITERO

VACUUM VESSEL
- Interface definition is overdue

BUILDINGS
- Testing Facility functionality is being challenged
- Diagnost Area looks well founded
- Port Cells are known but not well recorded

CONCLUSIONS

PROJECT MANAGEMENT

Each PT has a member in each Working Group for review and for Procurement Management. These should be used as much as possible to
a) familiarise them with diagnostic specialities and
b) spread the burden of information exchange out of the IT Diagnostic Division

There are any new (prototypical)procedures
Many new people (ITERO from DDDG down & in Party teams)