

# Work Experience at Vacuum Section of ITER

Michael Sekatchev

# Day 1

- Vacuum Chamber



# Day 1

- CF Flange:
  - CF stands for Conflat, a tradename.
  - Worldwide Standard.



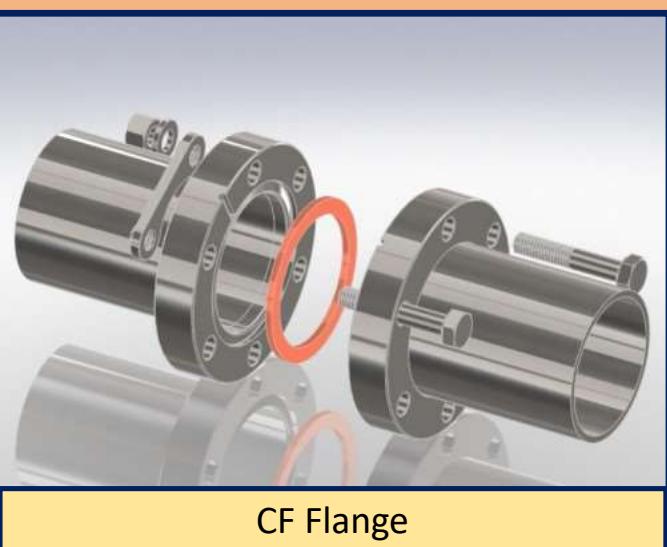
CF Flanges



Misha

# Day 1

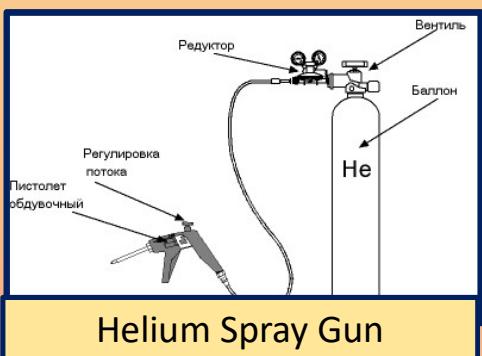
- Metal Gasket Seal on CF Flange
- Helium Mass Spectrometer Leak Detector



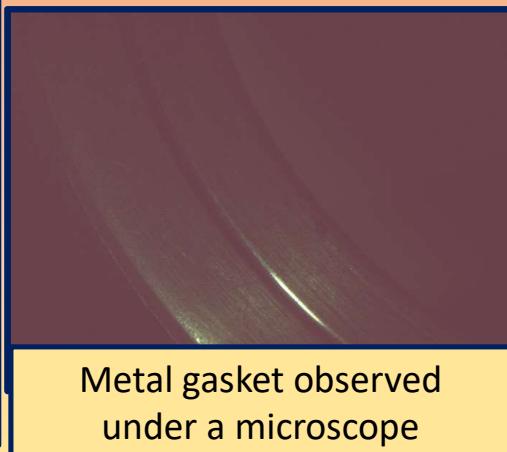
CF Flange



O-Ring



Helium Spray Gun



Metal gasket observed  
under a microscope



Helium Mass Spectrometer Leak Detector

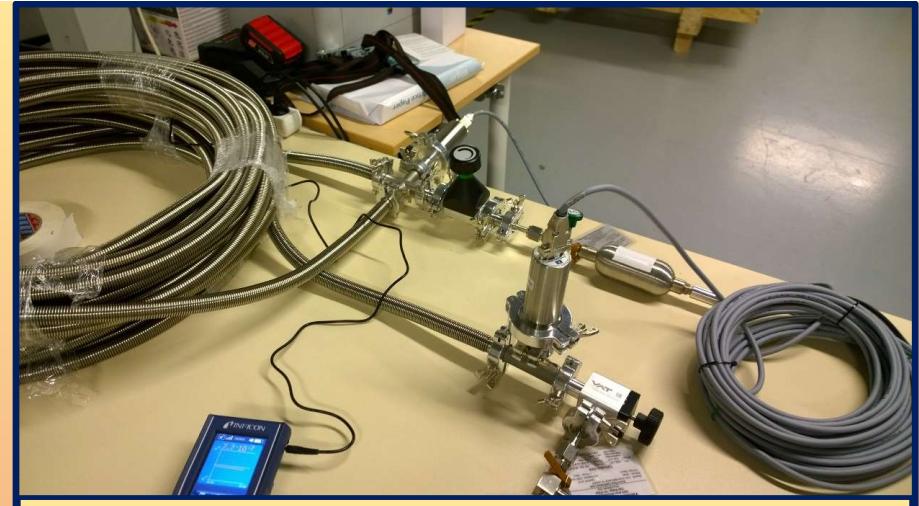
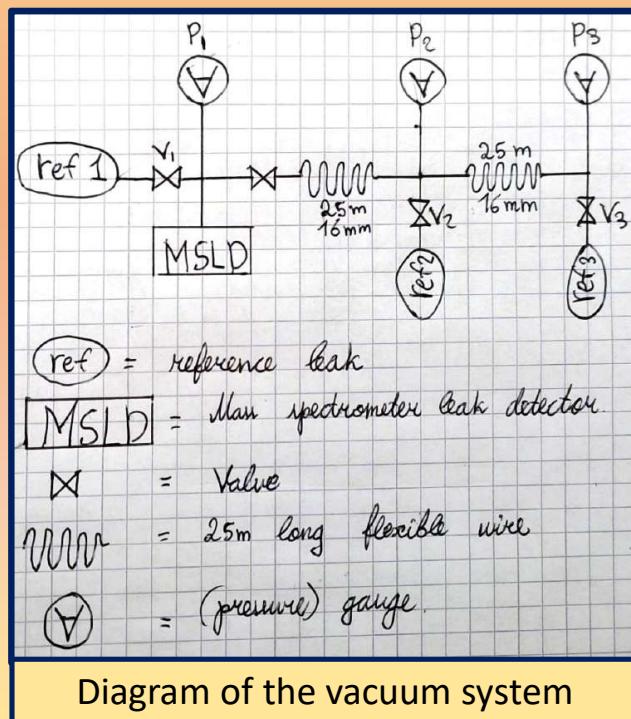


# Day 2

- Helium MSLD
- Vacuum System
  - x3 Reference Leak
  - x3 Pressure Gauge
  - x2 25m hose 16mm ID
  - x4 Valve



Pressure displays



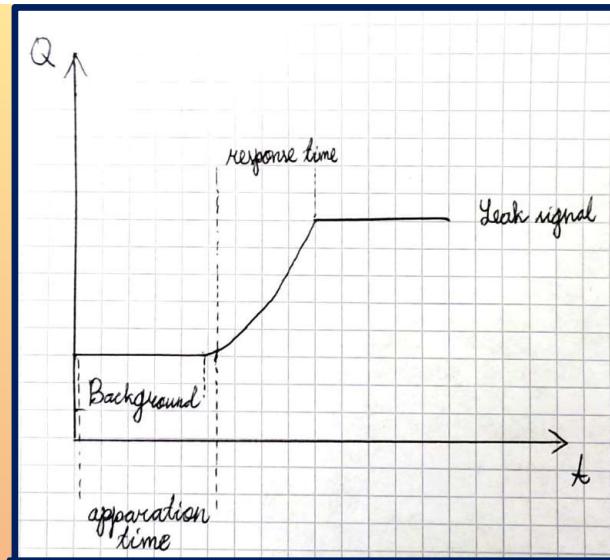
Vacuum system



# Day 2

## Helium Leak Detector

- MSLD Graph Vocabulary:
  - Background
  - Apparition Time
  - Response Time
  - Reference Leak Value
  - Reference Leak Signal
- Response time and Apparition Time increase with distance from MSLD



Pressure VS time graph



Vacuum system



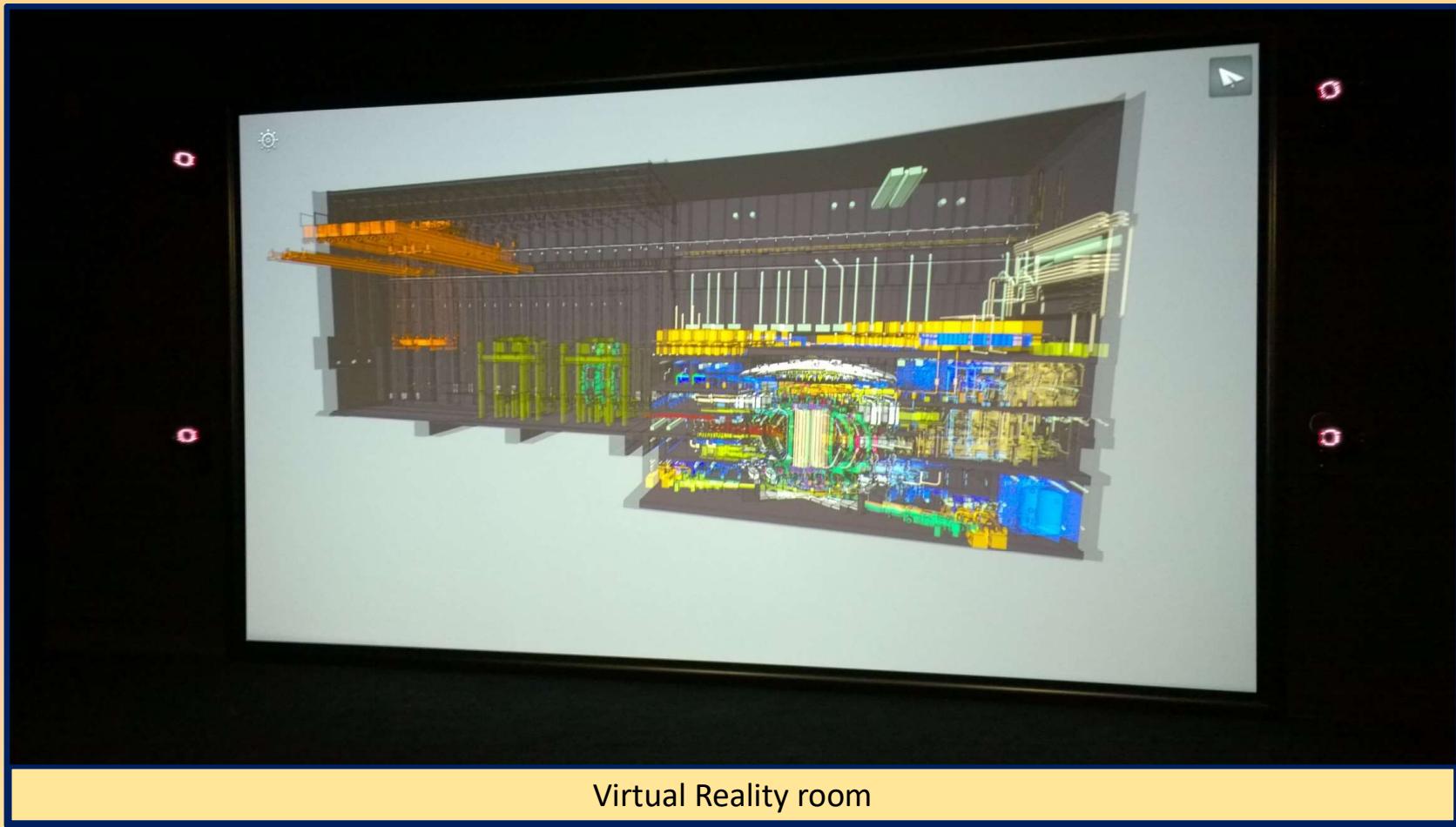
Testing for leaks using Helium Gas



Helium Gas 'Gun'

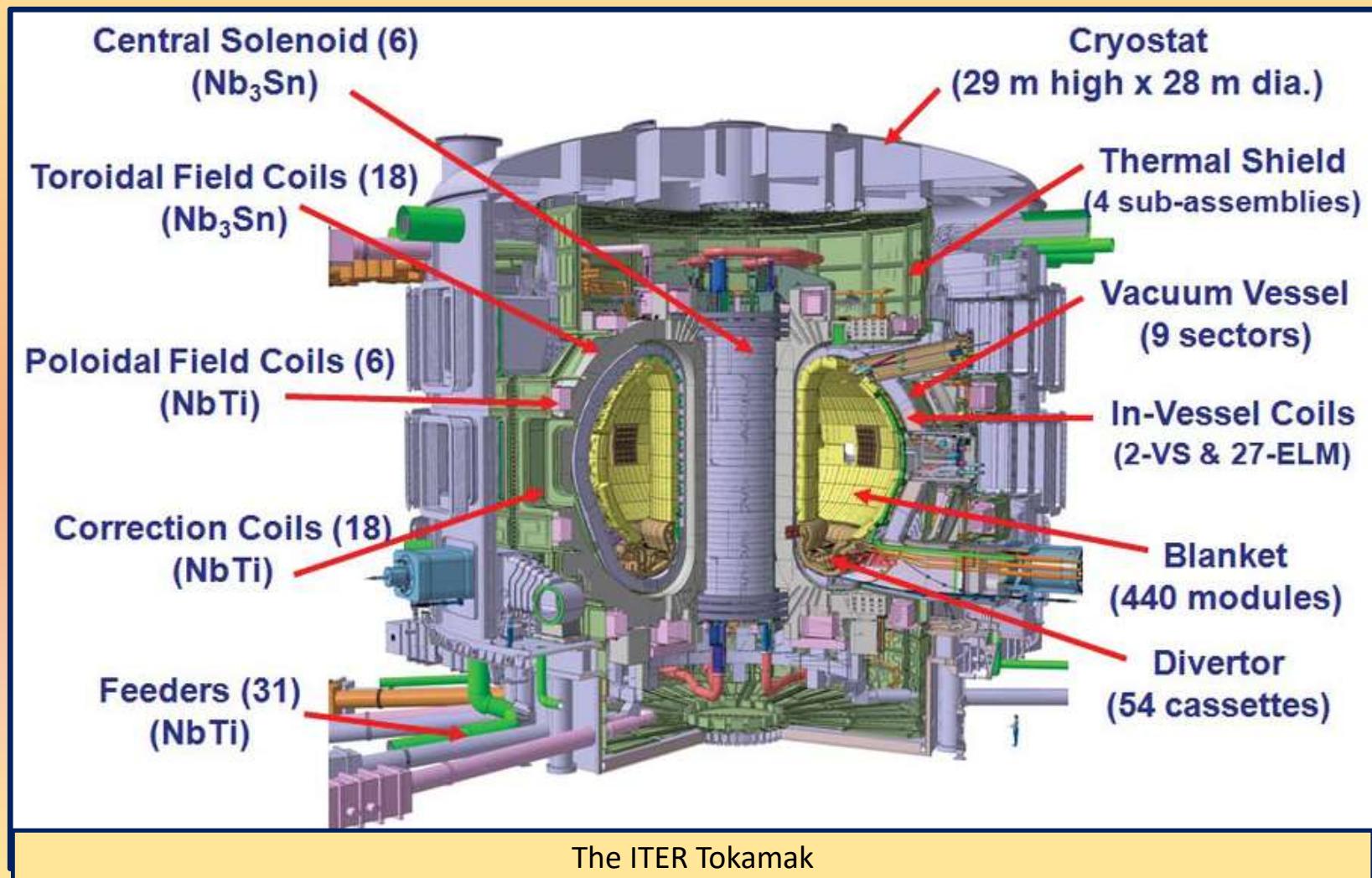
# Day 2

- VR (Virtual Reality) Room



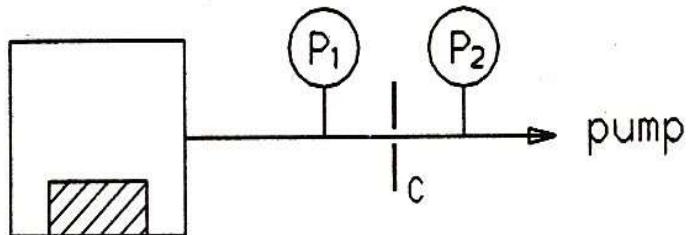
Virtual Reality room

# Day 2



# Day 3

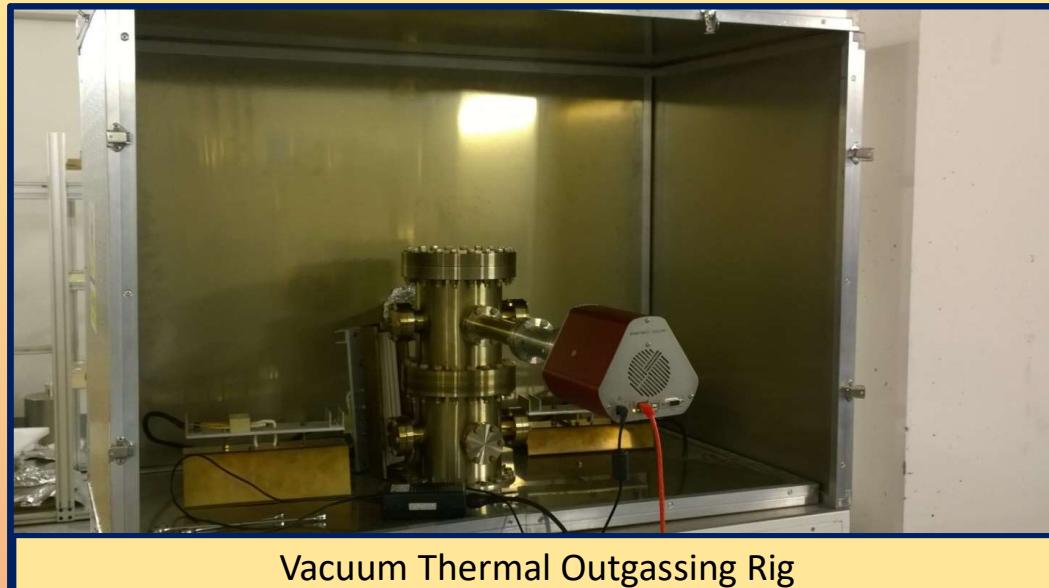
- Thermal Outgassing Rig



Simple diagram of a Vacuum outgassing rig using the throughput method

$$Q = \frac{P * C}{A}$$

Q = Outgassing rate in mbar\*l/sec\*cm<sup>2</sup>  
P = Pressure (gauge signal) in mbar  
C = Conductance (gas flow speed) in l/sec  
A = Surface Area of the material in cm<sup>2</sup>



Vacuum Thermal Outgassing Rig



Vacuum Test Cell inside the Outgassing Rig, with the sample inside.

# Day 3

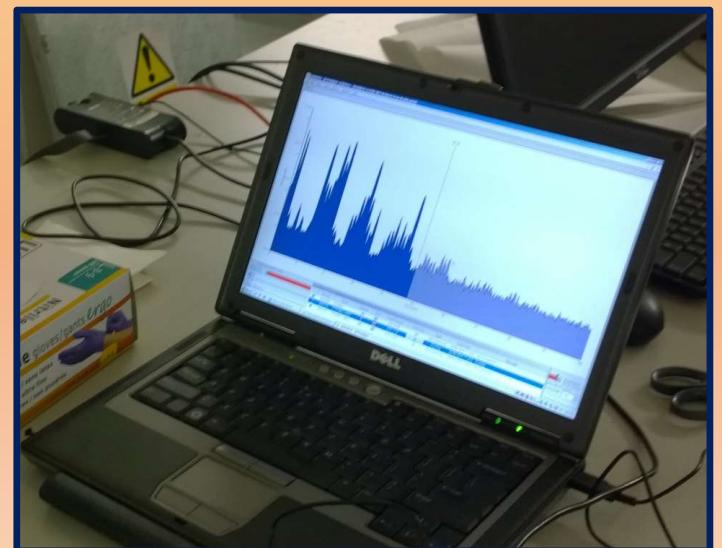
- TMP (Turbo Molecular Pump)
- RGA (Residual Gas Analyzer)



The Turbo Molecular Pump



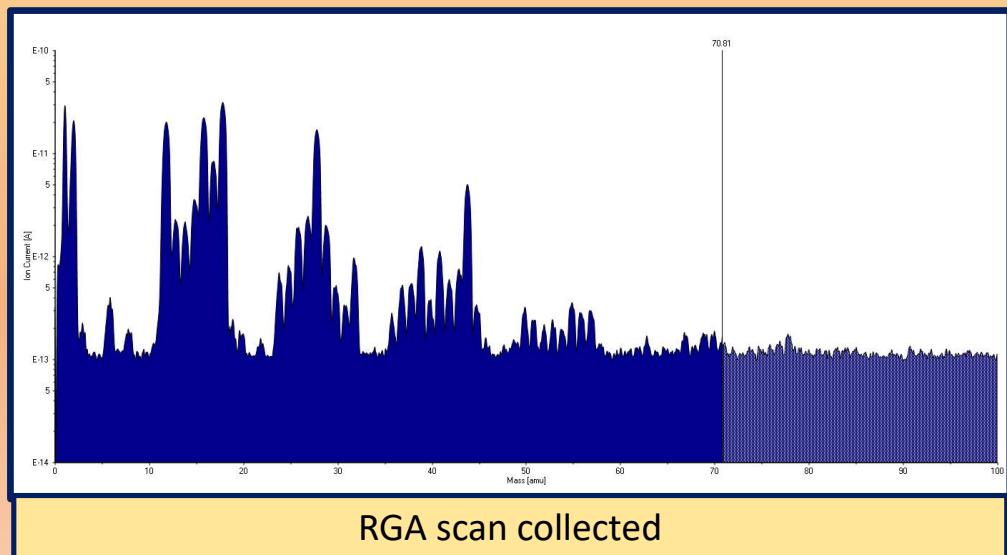
Residual Gas Analyzer



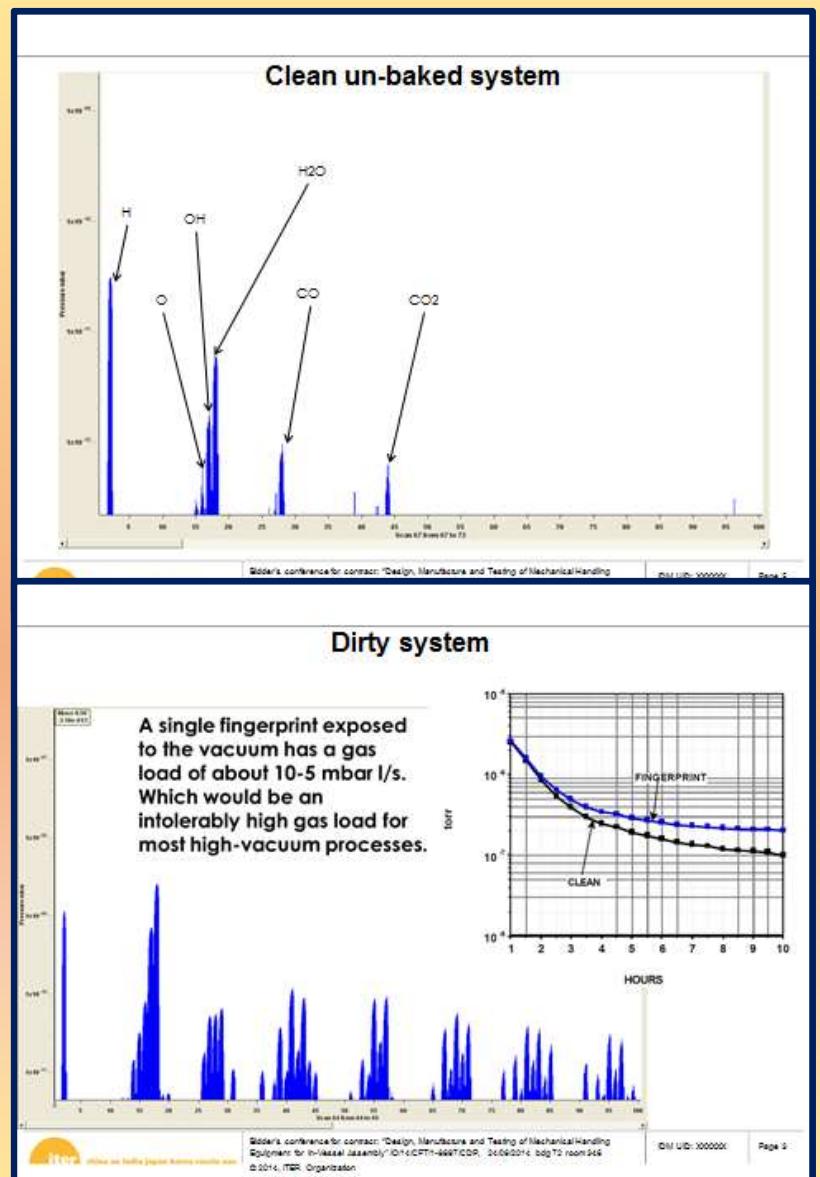
The computer connected to the RGA

# Day 3

- RGA (Residual Gas Analyzer)



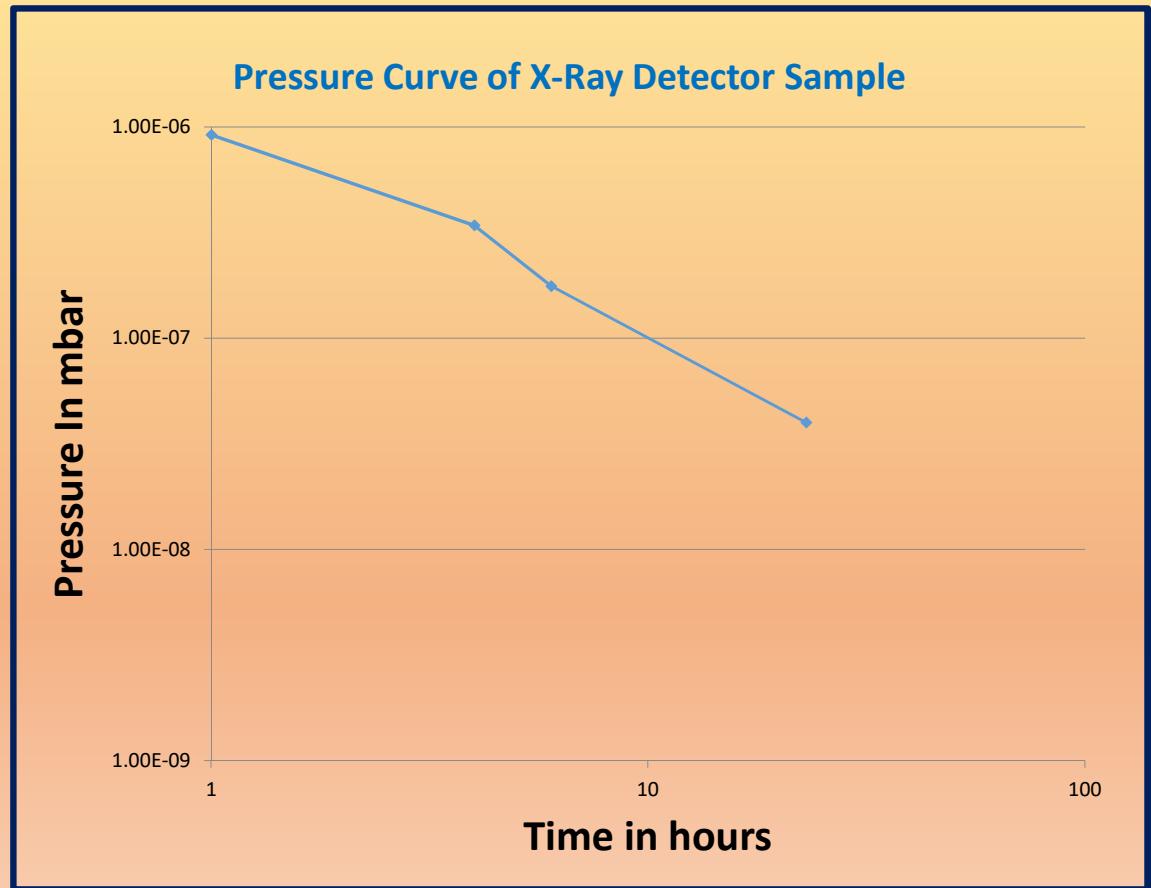
RGA scan collected



# Day 4

- Pressure vs time graph

Time:	Pressure:
1	9.20E-07
4	3.43E-07
6	1.77E-07
10	1E-07
23	4.00E-08



$$Q = \frac{P * C}{A} \quad Q = \frac{1E-7 * 10}{2034} = 5 * 10E-10 \text{ mbar} * l / s * cm^2$$

# Day 4

- Vacuum Materials Database and unlisted Material Approval

Material / Material Class	Grades, (or composition applicable to ITER)	Vacuum Quality Classification							
		1A	1B	2A	2B	3A	3B	4A	4B
Austenitic stainless steels	316L, 316LN 316L(N)-IG + Corresponding EN grades	✓	✓	✓	✓	✓	✓	✓	✓
Silver-based braze	BAg-8 (Japanese Industrial Standard; JIS Z3261) Ag as filler material for brazing on the DNB bushing MAR :- <a href="#">ITER_D_AJL8YX</a> <a href="#">Deviation request ITER_D_4AHGK6</a> <a href="#">Transmutation data ITER_D_4FJRHJ</a> , <a href="#">ITER_D_7PGX7C</a>	✗	+	✗	✗	✗	✗	✗	✗

2 metals listed in the appendix

Material Approval Request(vt.0)								Ref No: Mat-Cha-1 (Assigned by Vacuum RO)		
Material submitted for approval:		Ceramic TRADE Name xxx								
Proposed form:		Solid								
Proposed Use:		HV Bushing								
VQC of proposed use:		1A	1B	2A	2B	3A	3B	4A	4B	N/A
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
If restricted give details of coverage (e.g. amount, surface area etc)										
Chemical Analysis / Material Safety Data Sheet available:		YES	Attached Copy document ref. (electronic if available)							
Agreed test plan:		NO	Attached Copy document ref. (electronic if available)							
Vacuum Test data Available:		YES	Attached Copy document ref. (electronic if available)							
Outgassing rate (at 100 °C)		N/A								
Vapour pressure (at 100 °C)		N/A								
Max temperature:	1000			Operating temperature:			240			
Pre installation treatment (baking, electropolishing etc)		Baked clean								
Requested by:	A.N.Other			Date Submitted:	25/03/09					
Affiliation :	USA			E-Mail	A.Other@USA.org					
Vacuum Material Approval Status: (To be completed by ITER Vacuum Group RO)										
Approved for VQC:		1A	1B	2A	2B	3A	3B	4A	4B	N/A
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Limits / Restrictions (Attached Doc)†										
ITER Vacuum RO		Approver:	L Pressure							
		Date:	30/03/09							

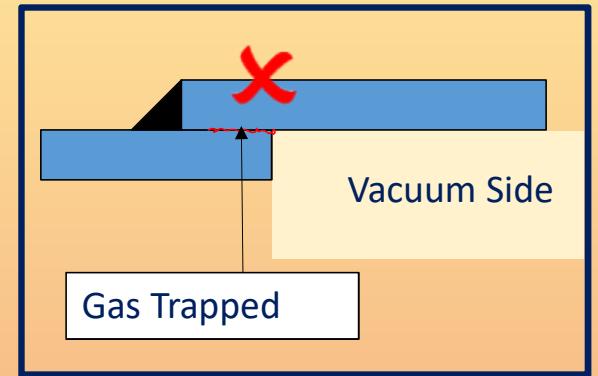
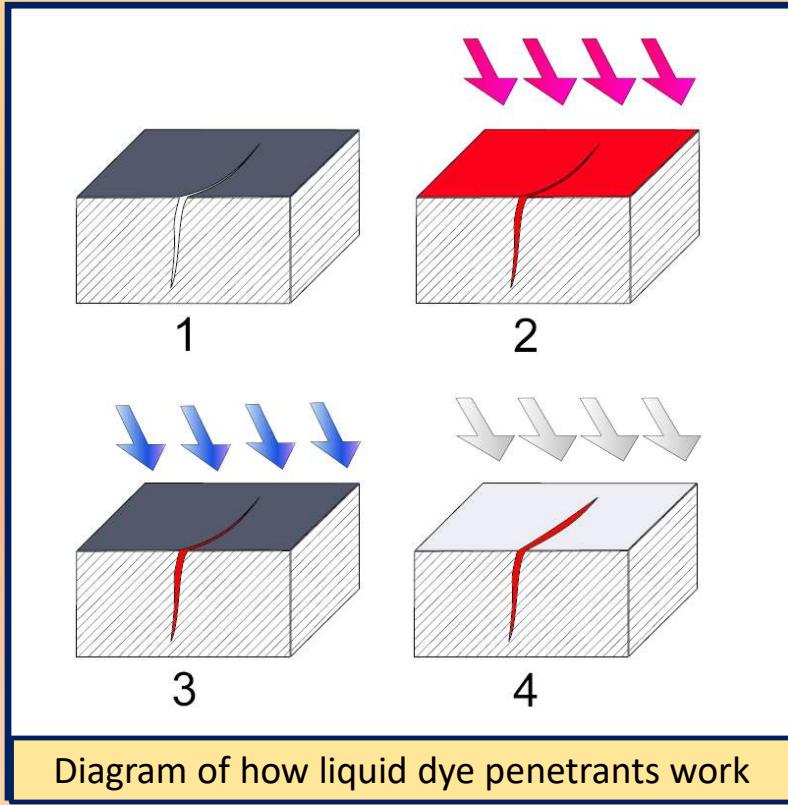
Material Approval Request, for materials not listed in the appendix

# Day 4

- Criteria for Material Approval Request

- Name of material, proposed form, use and VQC (Vacuum Quality Classification)
- Material safety data sheet and chemical analysis
- Operating temperature, Maximum allowable temperature (e.g. baking)
- Any vacuum test data available
- Outgassing rate and vapor pressure at operating temperature
- Any pre-installation treatment
- Agreed vacuum test plan

# Day 4



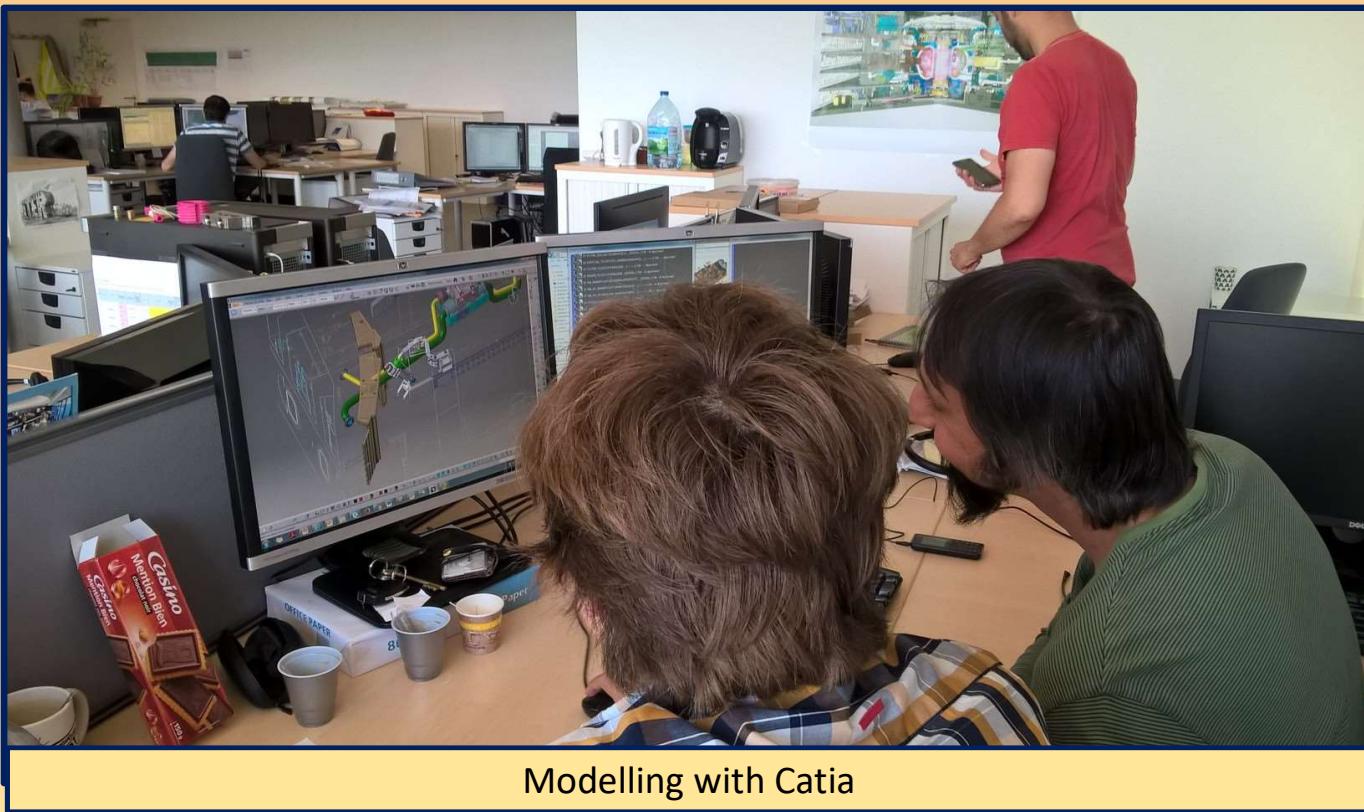
# Day 4



Working lunch with material expert

# Day 4

- Design Office – Modelling with Catia



# Day 4

- EUDA Video Conference Meeting



The conference room

**Meeting Agenda**

**EU-DA / IO Vacuum Team Meeting**

Date: 30/06/2016	Time: 14:00 to 15:00 (GMT+1hr)	Location: 72/2040 Conf. No. 00 33 4 42 17 60 80 mr72-2040@iter.org
Meeting Number:	Prepared by: Lucie Dupoirieux	

**Participants**

Robert Pearce (RPE - IO)	Gourab Bansal (GBL - IO)
Matthias Dremel (MDL - IO)	Jean-Louis Bersier (JLB - IO)
Liam Worth (LWH - IO)	David Laugier (DLR - IO)
Shaun Hughes (SHS - IO)	Alexander Antipenkov (AAV - IO)
Florin Chitu (FCU - IO)	Silvia Giors (SGS - IO)
Bastien Boussier (BBR - IO)	Alain Teissier (ATR - F4E)
Gilles Wolfers (GWS - IO)	Francina Canadell (FCL - F4E)
Eamonn Quinn (EQN - IO)	Aurelien Rousseau (ARU - F4E)
Laxmi Bansal (LBL - IO)	Grigori Kouzmenko (GKO - F4E)
Graeme Vine (GVE - IO)	Giovanni Piazza (GPA - F4E)
Ernst Galutschek (EGK - IO)	Josep Benet (JBT - F4E)
Nick Woods (NWS - IO)	

**Apologies**

**Agenda**

No.	Topic	Presenter	Time
1	Introduction	RPE/ATR	14:00
2	PPC	MDL	14:05
3	FECD PA	SGS	14:15
4	MITICA	RPE/MDL	14:25
5	WRL	GKO	14:35
7	Outstanding Actions	All	14:45
8	Any Other Business	All	14:50

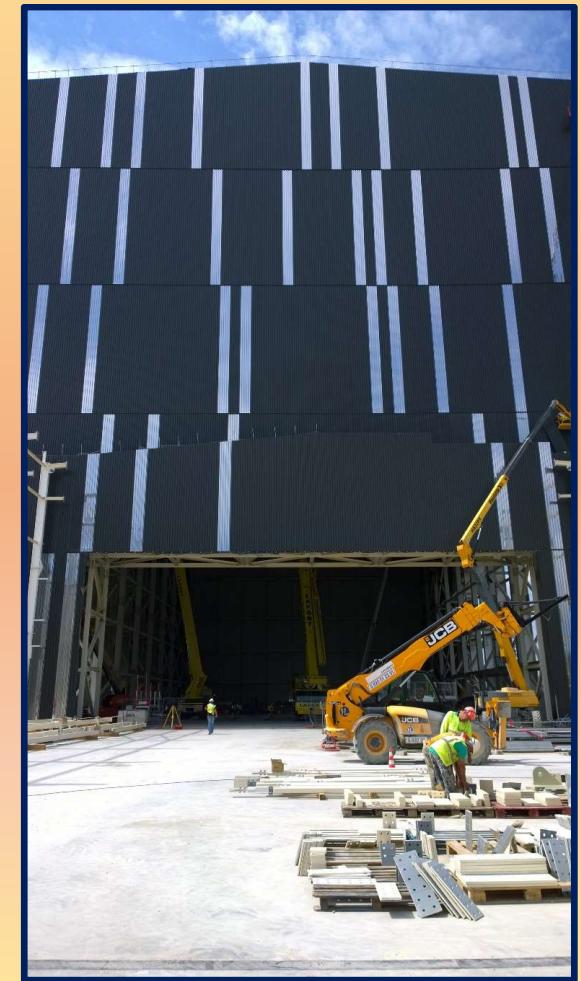
**Meeting Agenda**

# Day 4

- ITER Construction Site Tour



# Day 4

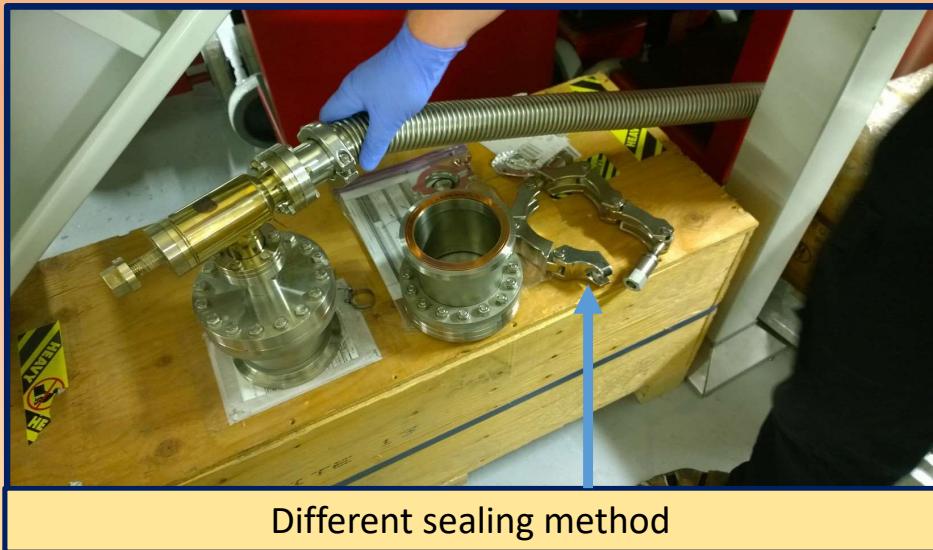


# Day 4



# Day 5

- Taking out X-ray detector sample from outgassing rig
- Looking at a new method for sealing CF Flanges



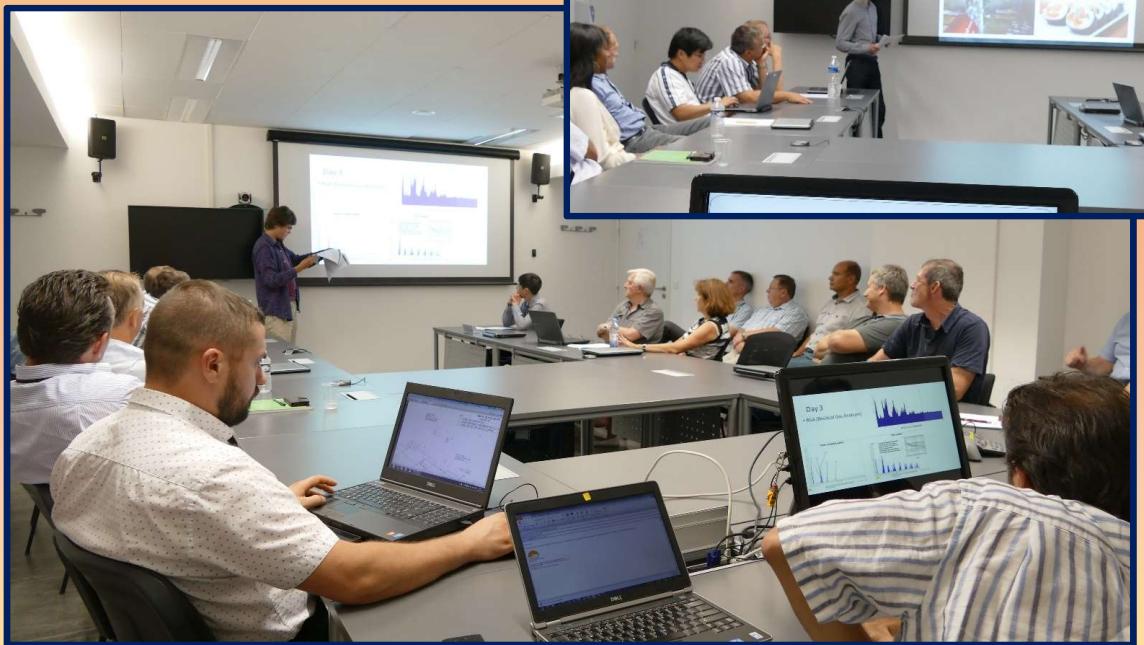
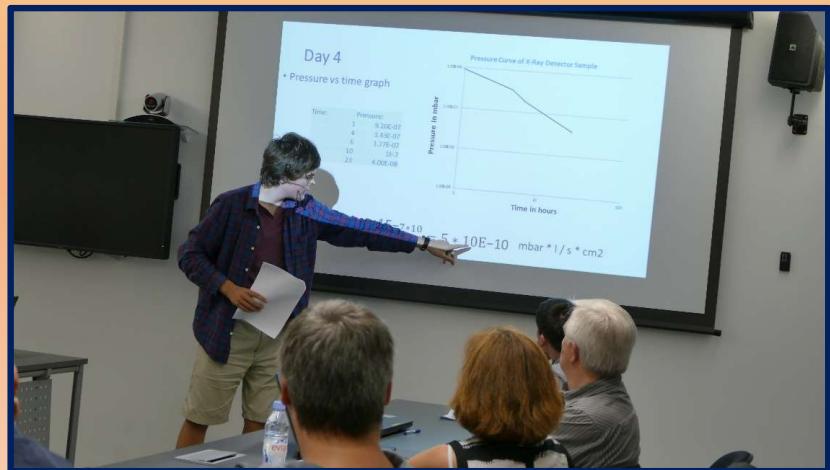
# Day 5

- Lunch with vacuum section



# Day 5

- Presentation



# Day 5

- Certificate



Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Les Duranes Cedex - France

1st July 2016

## VACUUM ENGINEERING WORK EXPERIENCE CERTIFICATE

Michael Sekatchev successfully performed assembly of vacuum flanges, leak detection, outgassing tests and editing of the material database, in the ITER environment.

Michael Sekatchev is awarded this certificate at first class level.

A handwritten signature in black ink that appears to read "R. Pearce".

Robert Pearce  
Vacuum Section Leader



# THANK YOU

Robert Pearce, Bastien Boussier, Eamonn Quin, Shaun Hughes, Graeme Vine, David Laugier and other group members.