Wrocław University of Technology

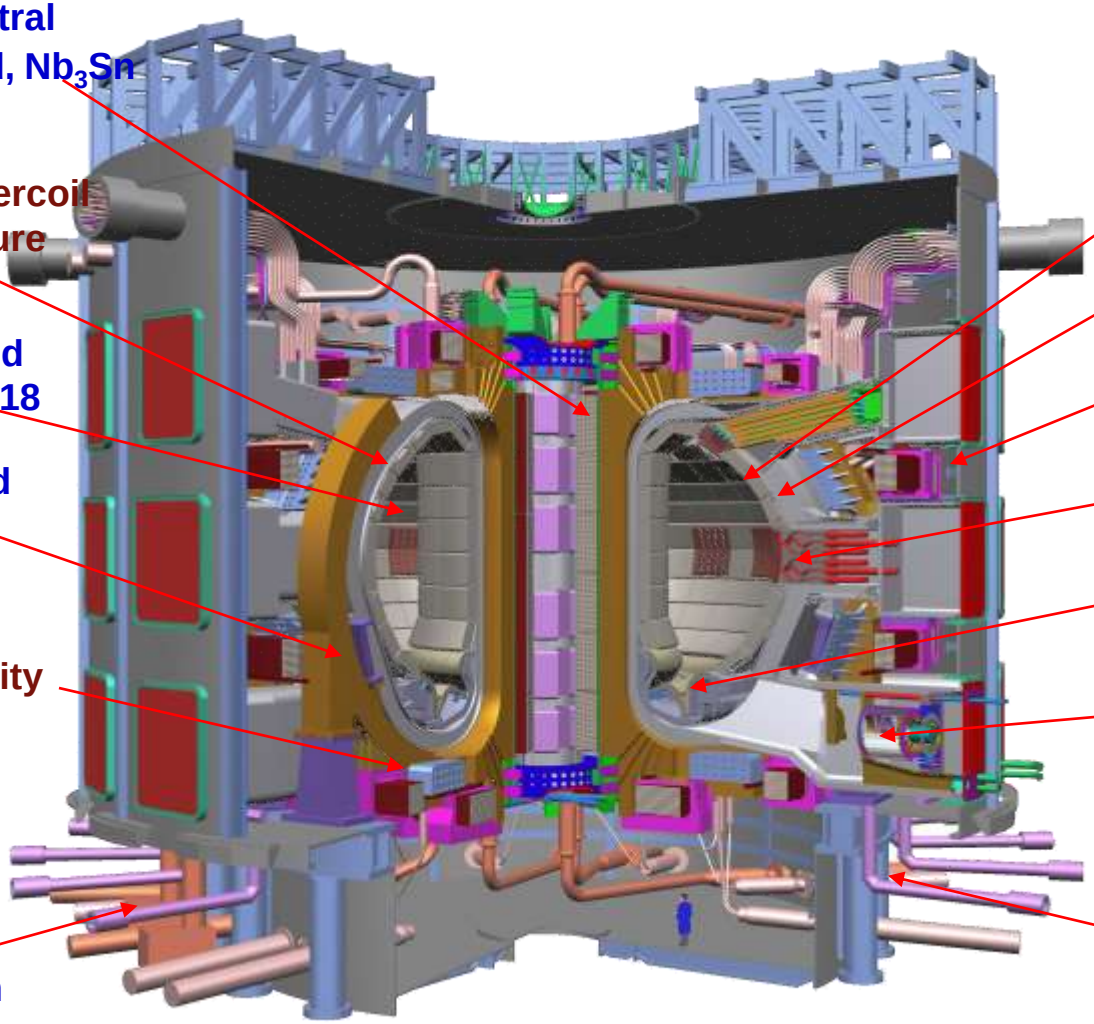
ITER and F4E activities

Maciej Chorowski

Association EURATOM- IPPLM

15.03.13 Kraków

ITER cryogenic system



ITER cost and task sharing

- **China**: magnet conductor, correction coils, feeders and supports, blankets, remote handling transfer casks, gas injection system, electrical switchgear, some diagnostics.
- **India:** vessel ferromagnetic inserts, cryostat, cryolines and cryodistribution, heat rejection system, ion cyclotron and startup electron cyclotron heating power supplies, diagnostic neutral beam, some diagnostics.
- **Japan:** half the TF coils, most of the TF coil structure, part of the TF and all the CS conductors, part of the first wall, divertor outer target, blanket remote handling equipment, atmosphere detritiation, equatorial electron cyclotron launchers and power supplies, neutral beam components, some diagnostics.
- **Korea:** some conductor strand, part of the vessel and vessel ports, blankets, assembly tooling, thermal shield, tritium storage, part of the power supplies, some diagnostics.
- **Russian Federation:** PF coils 1 and 6 and some PF and TF coil conductor, some vacuum vessel ports, blankets and connectors, divertor dome and testing, electrical switchgear, some klystron tubes, some plasma diagnostics.
- **USA:** wind CS coils, some TF conductor, some blankets, port limiters, part of the cooling system, part of the vacuum pumping and fuelling system, tokamak exhaust processing, part of the steady power supplies, RF transmission lines, some plasma diagnostics.
- **Jontly-funded** items: magnet feeder sensors, diagnostic first wall, assembly operations and tooling, hot cell maintenance equipment, on-site assembly of the tritium, vacuum, heating, cooling and cryoplant systems, control and data acquisition, some plasma diagnostics.
- **Europe: the remainder, including sharing in most of the above procurements, plus the buildings – 45% of the budget.**

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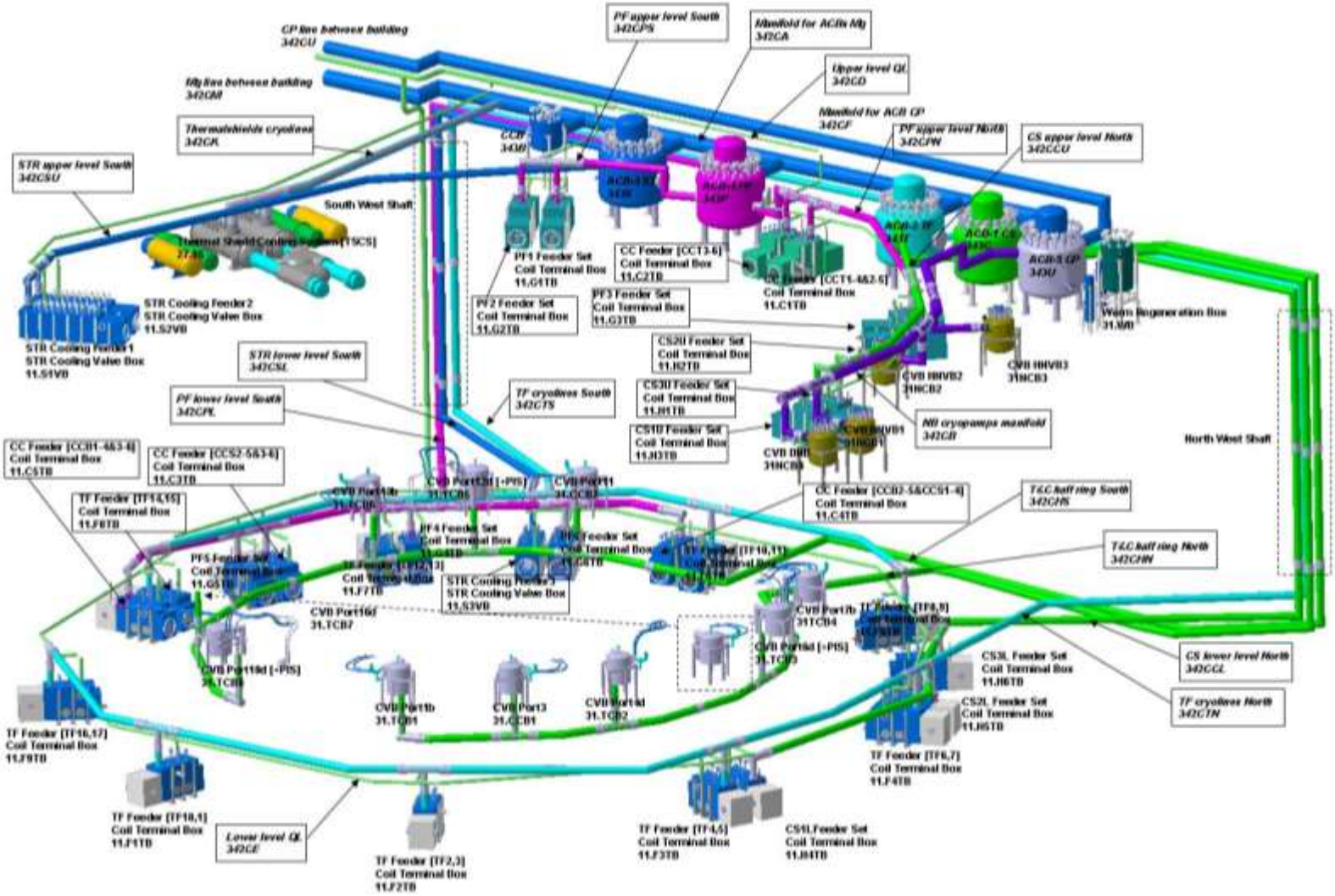
ITER IO

Integration

Content – review of Polish involvement in:

- ITER related activities, contractual agreements with ITER IO
- ITER related activities financed by Domestic Agencies
  - F4E – FPA, grants, contracts
  - ITER India – participation in tendering

ITER Cryodistribution System in the tokamak building - review by WrUT



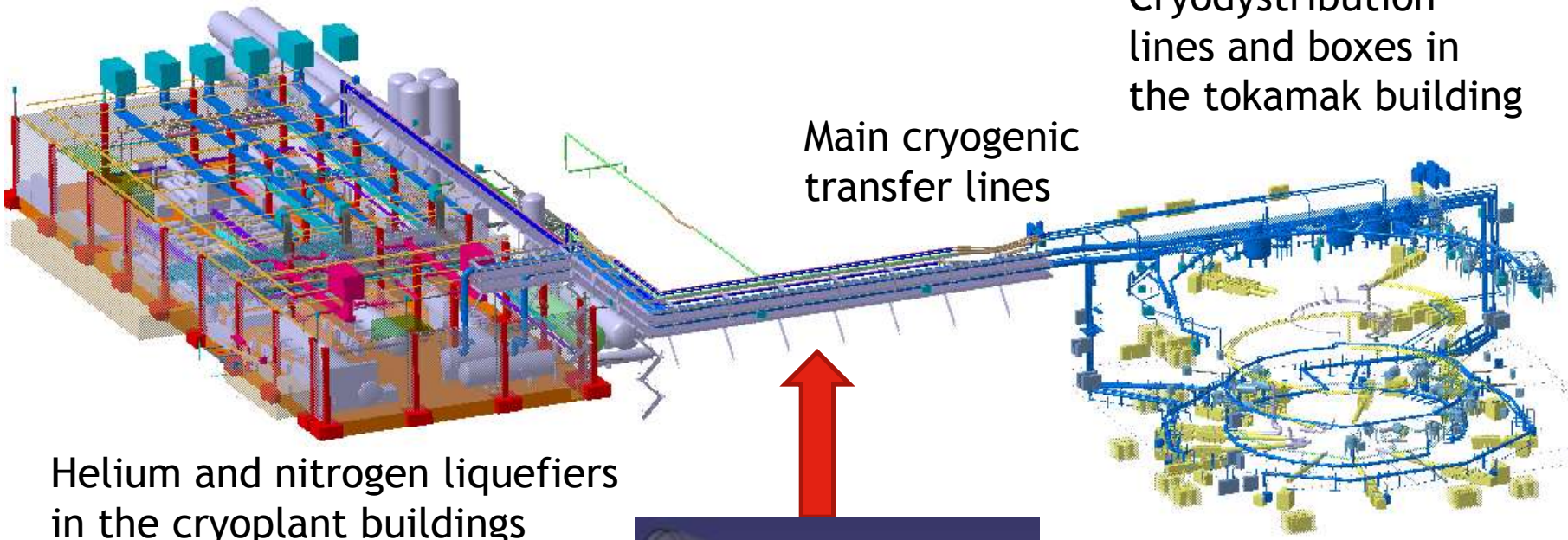
ITER Cryogenic System - risk analysis and design review - continuous task

Non - seismic platform

Seismic platform

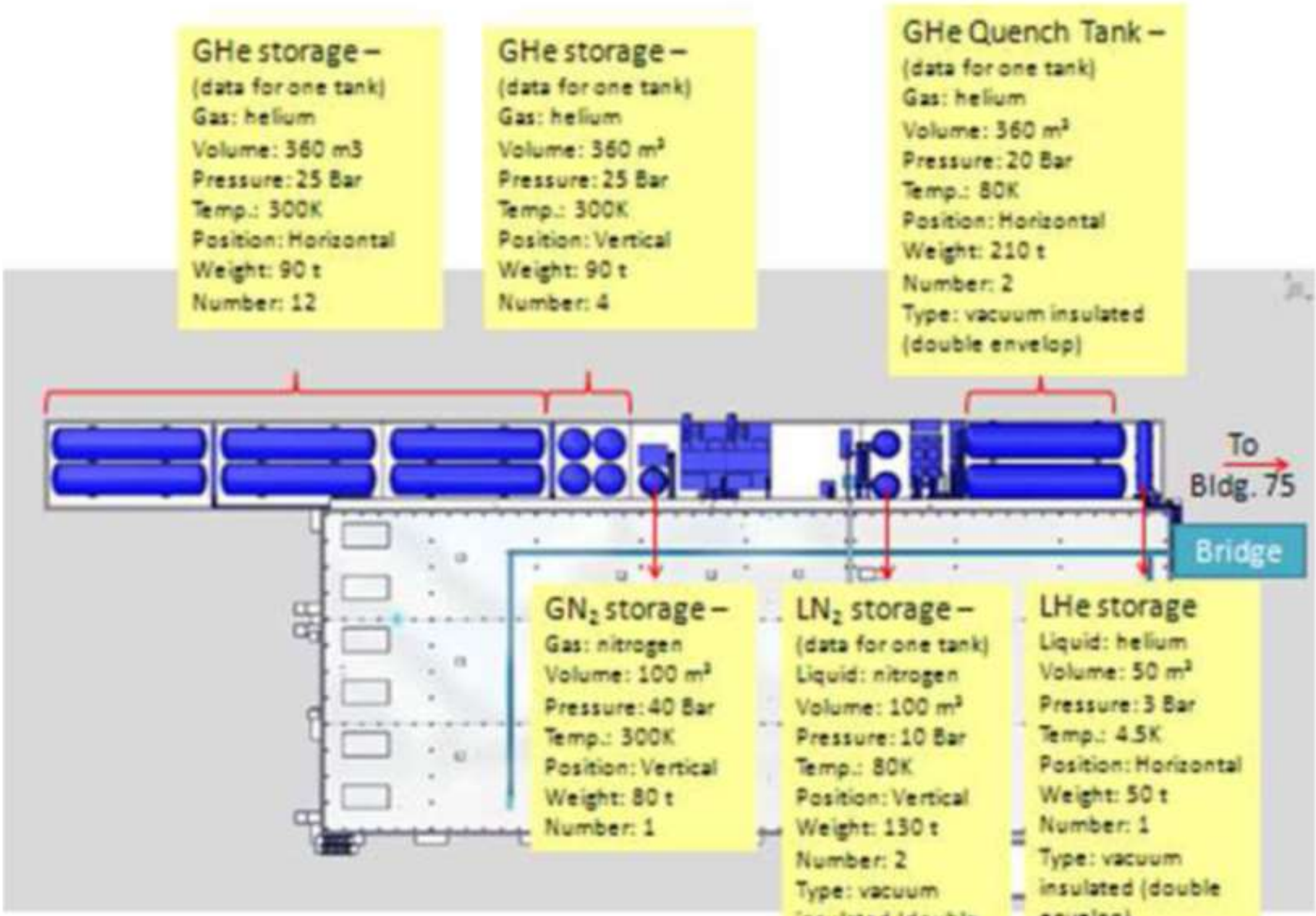
Cryodystribution lines and boxes in the tokamak building

Main cryogenic transfer lines



Helium and nitrogen liquefiers in the cryoplant buildings

Helium inventory tanks at ITER site

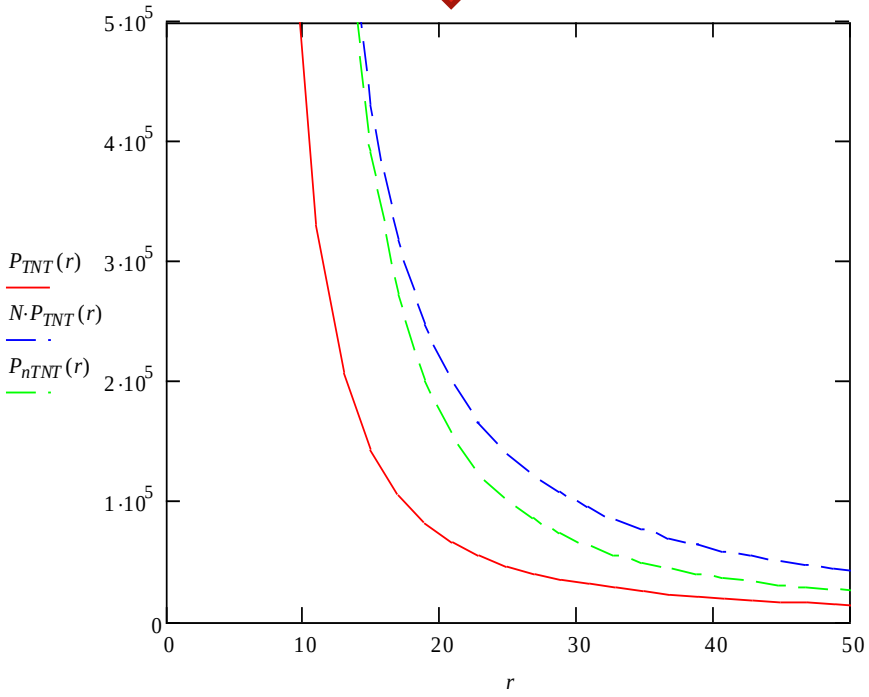


The aim of the analysis of He tank rupture -

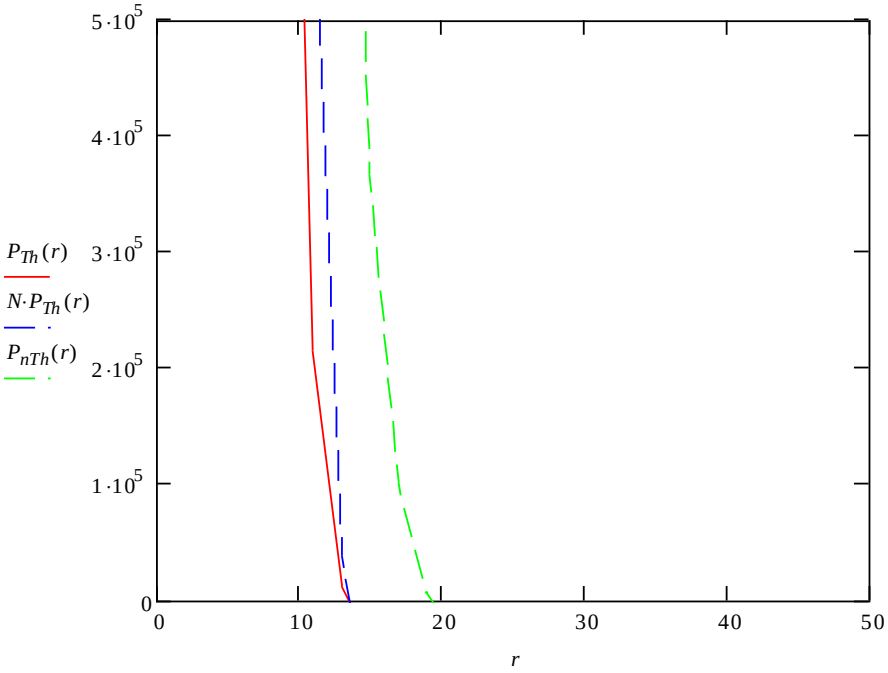
- Accidental rupture of any of the tanks filled with the gases will create a rapid energy release in form of physical blast.
- The aim of the analysis is the estimation of pressure wave distribution following the tank rupture and to decide on potential consequences to the tokamak adjacent infrastructure and building.
- The analysis has a comparative form and it is based on the TNT equivalent approach as well as alternative thermodynamic pressure propagation assumption.

Validation of thermodynamic model

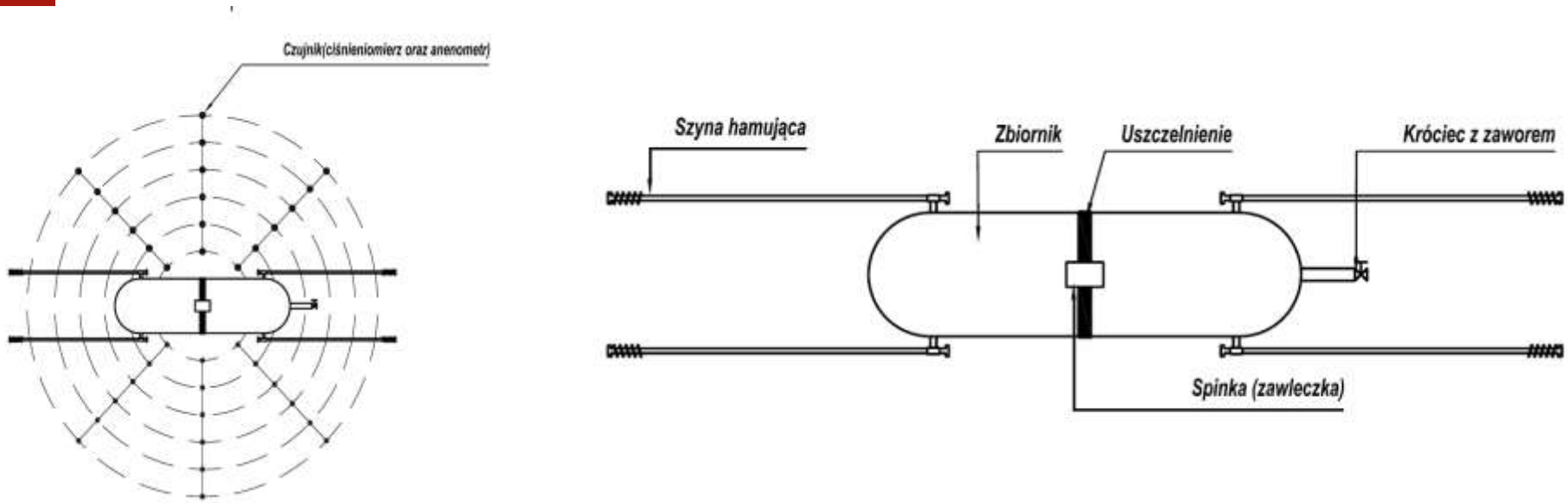
TNT approach – long range impact



Thermodynamic approach – short range impact

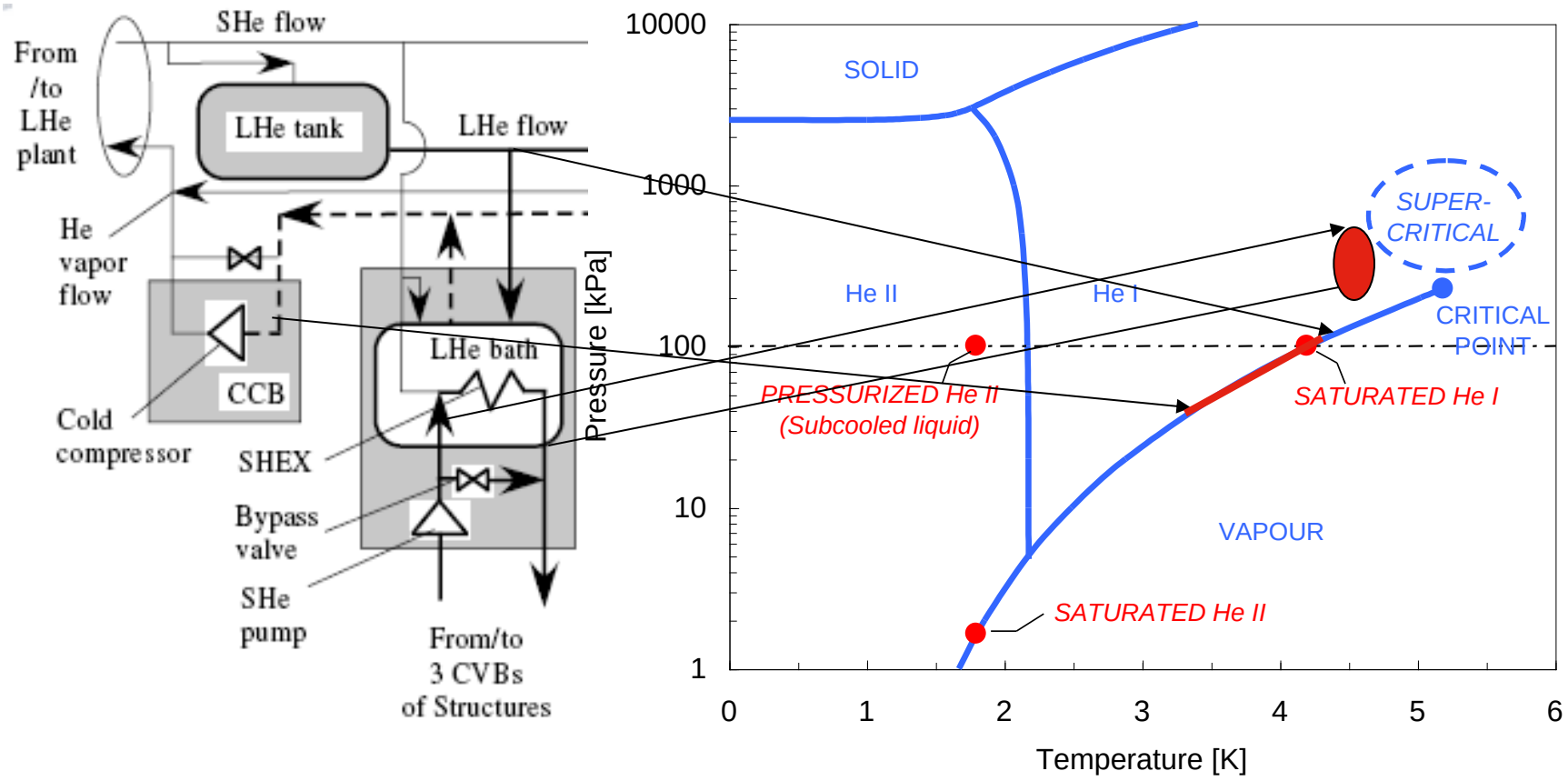


Experimental validation of physical blast impact planned for 2013

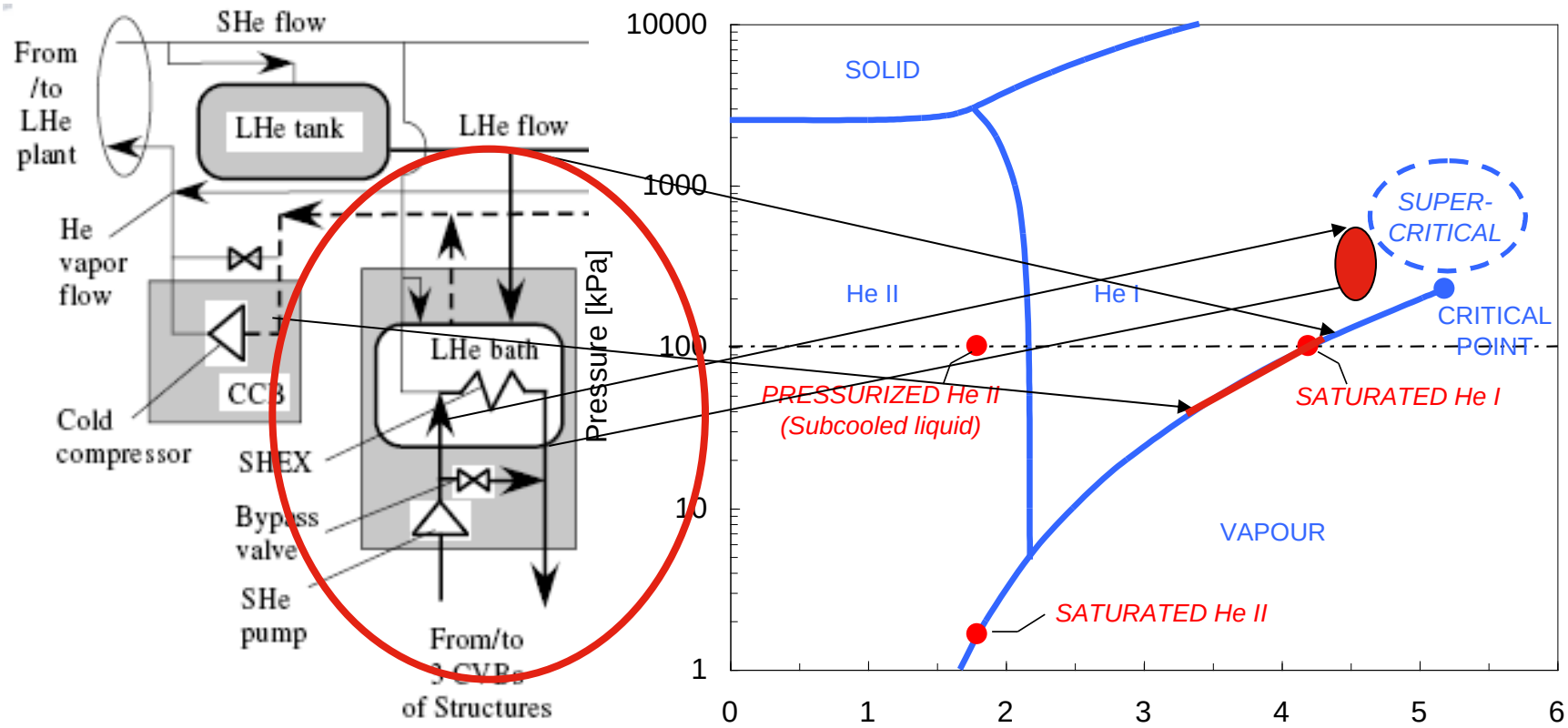


Scheme of the test rig

Helim phases in basic cooling loop

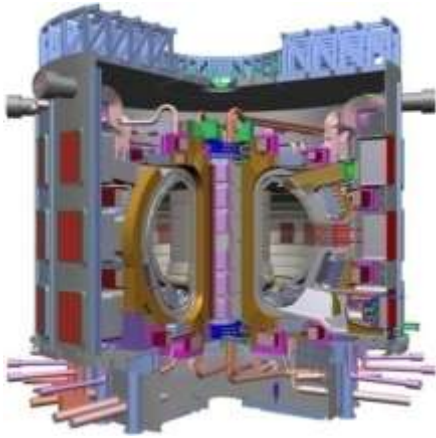


The test cryostat - possible collaboration between Indian and Polish industry (supported by WrUT), open tender launched by ITER India



The cryostat to be delivered to Japan – responsible for the circulators

ITER (F4E)



1. Continuation of the grant :

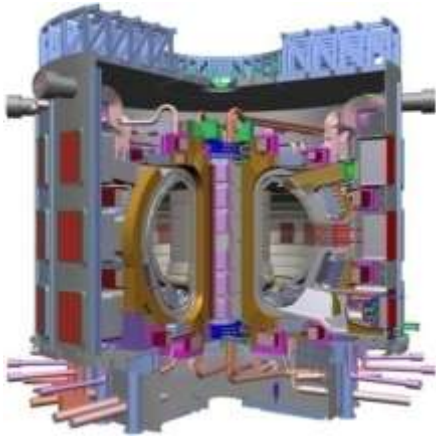
F4E-2008-GRT-014 (ES-AC): Development of an innovative 3H measurement procedure directly in LiPb, HCLL-TBM (Helium-Cooled Lithium-Lead Test Blanket Module) mock-up material

New FPA -395 signed by the Consortium:
ENEA, KIT, NRI (IPP.CR), **AGH**, JSI (MHEST)

Call for the grant agreement on „Nuclear Data" expected soon

Courtesy Roman Zagórski

ITER (F4E)



2. Call for Tender:

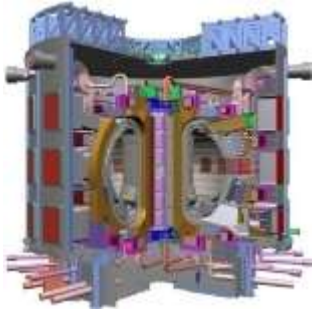
F4E-OFC-358: Radiation Testing Service for ITER Prototype Components and Systems

Reactor MARIA to be used for Radiation Testing

Consortium: **NCBJ**, MHEST

Courtesy Roman Zagórski

ITER (F4E)



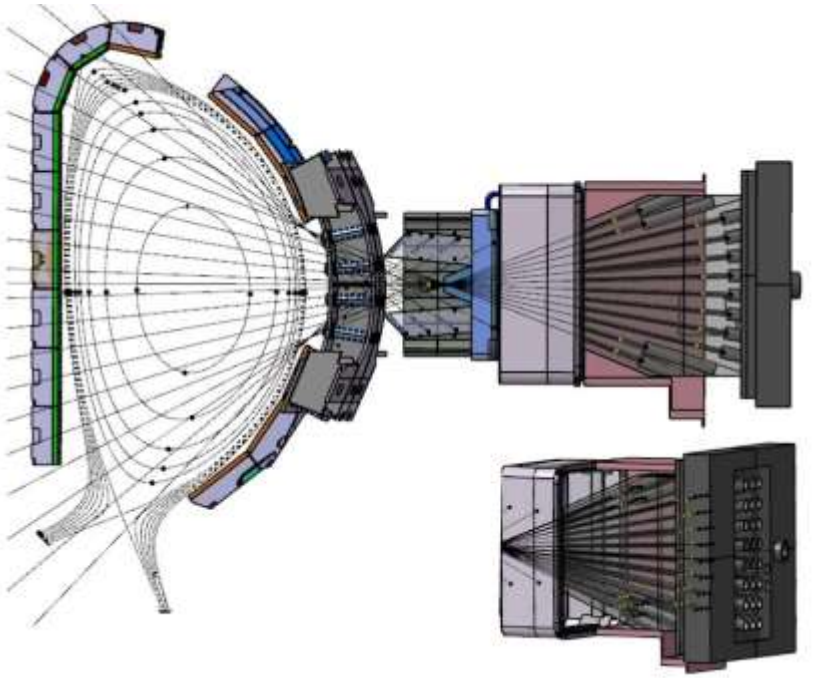
3. FPA for Diagnostic Development and Design:

Radial Neutron Camera (RNC) and Radial Gamma-Ray Spectrometer (RGRS)

Objective: **Supply of R&D and design activities in connection with the ITER RNC and RGRS.**

FPA awarded to the consortium:

ENEA, CNR, **IFJ PAN**, **IPPLM**, IST, UNIMIB



Two grant agreements:

SG01 (Planning Phase) and

SG02 (Coordination Office) to be launched soon.

Courtesy Roman Zagórski

AGH- F4E, plan 2013

Framework Partnership Agreement : F4E-FPA-395
Consortium ENEA, KIT, AGH, CCFE, NPI, JSI

Specific Grant Number : F4E-FPA-395-1
Specific Grant Title: Cu experiment and TBM nuclear instrumentation
dead line WEDNESDAY, 20th of March 2013

Task 1: Design, assembly, execution and measurement of an integral Cu experiment relevant for determination of copper nuclear data under neutron irradiation at energies relevant for the fusion facilities

Task 1.3 Integral measurements of the Cu experiment

AGH task 1.3c *Dose measurement with TLD dosimeters*

Courtesy Władysław Pohorecki

AGH- F4E, plan 2013

Task 2: Computational analysis of the Cu experiment

Task 2.1 Pre-analysis of the Cu experiment

AGH-UST will cooperate in the frame of pre analysis, especially in definition of TLD detectors positions and future TEPC dosimeter location.

Task 2.2 Post-analysis of the Cu experiment

AGH will contribute to Post-analysis for the part concerning dose measurements with TLD detectors.

Task 3: Development of measurement techniques

AGH Task 3.6 *:* Direct tritium production monitors (LCS with Li_2O compound)

Courtesy Władysław Pohorecki

Polish offers for ICT services

Fusion for Energy has announced two tenders for ICT in 2012:

•F4E-ADM-430 'Information and Communications Technology (ICT) Development Services for Fusion for Energy'

- ✓ PGS Software (l)
- ✓ BizTech Konsulting (subcontractor)

•F4E-ADM-464 'Provision of Information and Communications Technology (ICT) Projects to Fusion for Energy'

- ✓ SMT Software – single tenderer
- ✓ Exence – single tenderer

Courtesy Sylwia Wójtowicz

Conclusions

Polish involvement in design and construction of ITER tokamak has been successfully developed as:

1. FPA agreements, grants and industrial contracts (in progress) from F4E, Barcelona
2. Contracts from ITER IO, Cadarache
3. Collaboration with other ITER agencies

Thank you for the attention