NIER

MAKING CHANGE HAPPEN. MAKING LIFE BETTER.

ENERGY TALKS, Careers in Nuclear

SCUOLA DI INGEGNERIA, BOLOGNA

Stefano La Rovere, PhD

06/06/2025

NIER Ingegneria S.p.a. Società Benefit

Years of experience | **Bologna Headquarters** | **Milano e Napoli branch office** | **Professionals**

NIER Ingegneria S.p.a. is a **multidisciplinary** consultancy company

Positivity of reality is the principle that drives us to overcome daily challenges

The **desire to be useful** and the **idea of doing more** are our other two pillars

NIER **was founded in 1977**, with a strong focus on nuclear fission, contributing to key European programs such as ESSOR and PHÉNIX

Since the 1980s, NIER has been involved into nuclear fusion, starting with the NET (Next European Torus) project.

Decarbonizing the energy system and ensuring stable and reliable energy supply are at the core of our mission.

NIER supports **climate change mitigation** through technical consulting services on energy efficiency, renewable energy, and **nuclear innovation**.

"The integration of foundational engineering disciplines - such as mechanical, electrical, and electronic engineering - with **systems engineering methodologies** is essential for managing complexity and ensuring overall project coherence."

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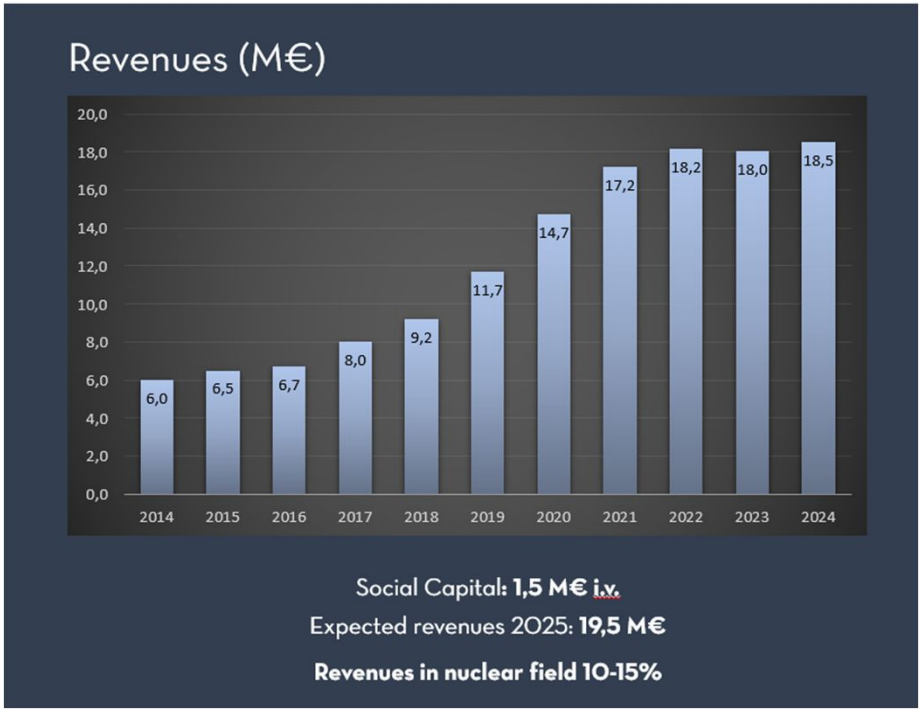
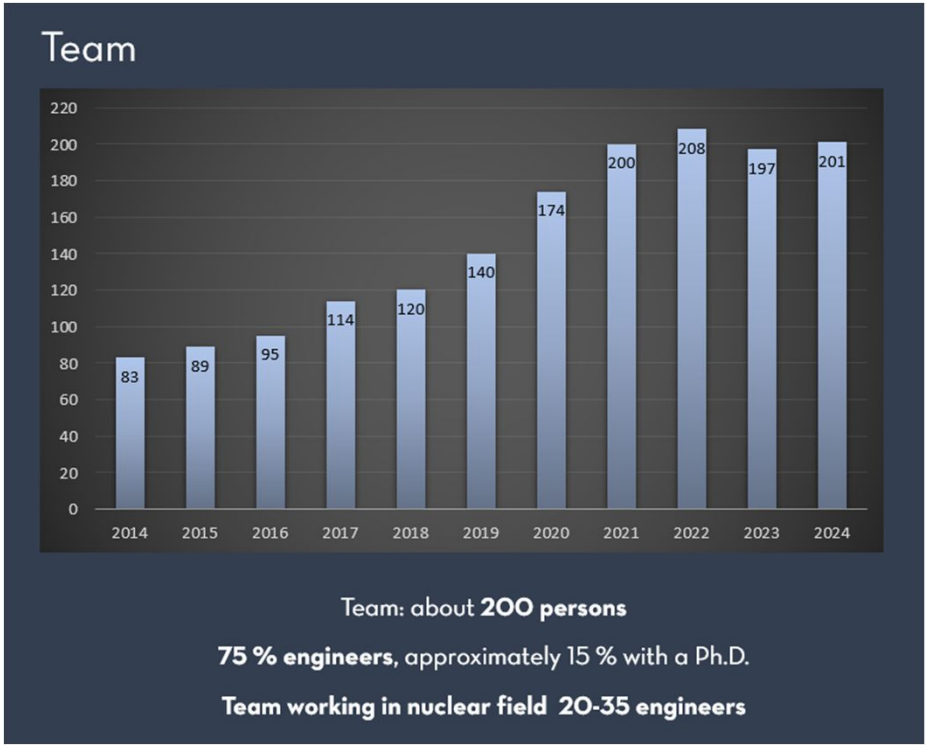
NIER Ingegneria S.p.a. Società Benefit





Main Clients in nuclear field

FUSION FOR ENERGY

iter
china eu india japan korea russia usa

orano

ansaldo nucleare

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

Joint Research Centre
JRC

OCEM
AirfieldTechnology

INFN

Technical activities in nuclear field

Provision methods

SPECIALIST TECHNICAL CONSULTANCY - *We take charge of your technical problem, identify the best team and carry out the service in the agreed times and costs*

CONTINUOUS TECHNICAL SUPPORT - *We contribute to your project by integrating your technical and management teams, providing support in defining processes and methods, in the execution of technical activities and in the management of external parties (customer, suppliers, authorities)*

INTEGRATED DESIGN - *We take responsibility for the design of a system/structure/ component, carrying out and integrating the necessary technical activities, delivering the design baseline in the agreed times and costs*

Quality-Environment-Safety Integrated Management System

ISO 45001:2018

ISO 14001:2015

ISO 9001:2015

UNI PDR 125:2022

*It includes previsions **Nuclear Safety** (e.g. safety classification, safety requirements management and verification, management of changes, deviation and non-conformities)*

Technical activities in nuclear field

Technical services

Systems Engineering

- Requirements Management and Verification
- Systems configuration control
- Functional analysis and modelling
- Reliability, Availability & Maintainability analysis
- Qualification of Structures, Systems, and Components

Safety Engineering

- Safety classification of Structures, Systems, and Components
- Probabilistic Risk Analysis
- Simulation of accidental scenario, e.g. Fire analyses, Seismic analyses
- Compliance to Safety Regulations and Standards

Mechanical and Structural Engineering

- 3D CAD modelling
- Thermo-mechanical analyses
- Structural integrity assessment

Process, Electrical and Control engineering

- Process and flow assurance
- Thermal-hydraulic modelling
- Design of Fluid handling/processing systems (gas, liquid, liquid metals)
- Design, Verification and Validation of I&C systems
- Verification and Validation of Power supply systems

Project Management

- Project control
- Project risk analysis and management

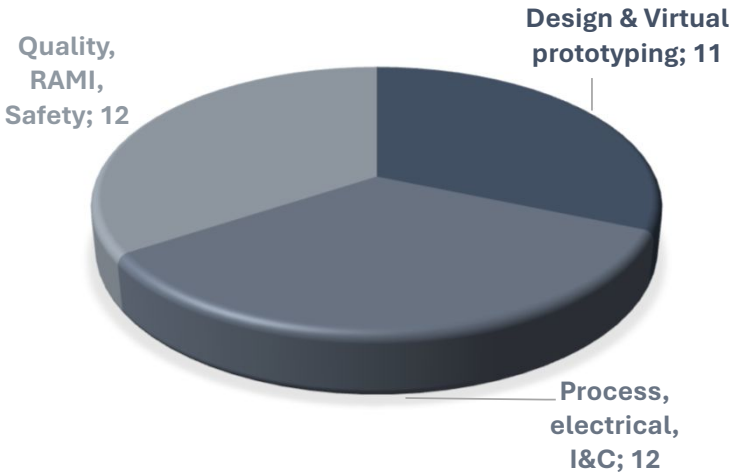
Permitting

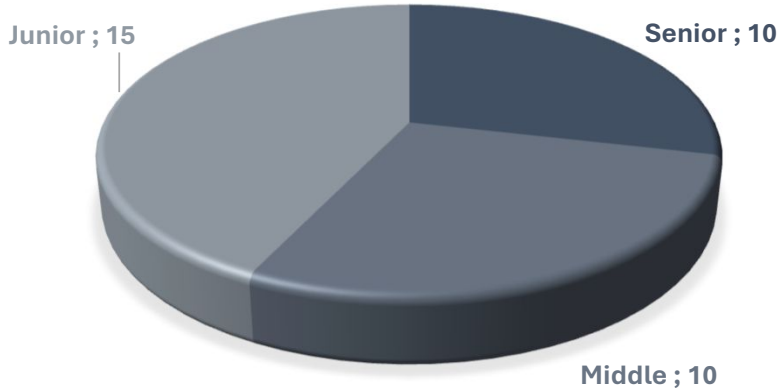
Software development and V&V

- SCADA applications development
- V&V of embedded software

Technical staff in nuclear field

Internal personnel





High relevance of activities in Nuclear field in NIER Strategic development plan

Continuous selection process for new staff

Specific training of staff on relevant technical topics

Involvement of external specialists (professionals, academics, researchers)

Technical staff in nuclear field

Main Academic and research partners

POLITECNICO MILANO 1863

SAPIENZA UNIVERSITÀ DI ROMA

UNIVERSITÀ DI PISA

ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Main industrial partners

N.IN.E.

techfem

DONE
Decarbonization Objectives through Nuclear Engineering
2024 2050
Powered by NIER Ingegneria and Techfem

Other past and ongoing activities

Safety & Systems Engineering

- 2009 - 2012, Consulting contracts on the **Probabilistic Industrial Risk Analysis** for the procurement of the ITER Vacuum vessel & Toroidal field coils (F4E)
- 2013 - 2016, ASAMPSA_E project, on the **Probabilistic Safety Assessment** of (fission) NPP, with focus on external events modelling and Defence-In-Depth implementation (7th FP for Research and Technological Development)
- 2016 - 2022, Framework contract on Neutral Beam Test Facility NBTF, Engineering consultancy and legal services, related to **Supervision of on-site works and compliance with applicable laws for health and safety** (F4E)
- 2023 – today, **Confinement functional analysis**, supporting the development of the ITER Rapport Préliminaire de Sûreté (ORANO).

RAMI Analysis

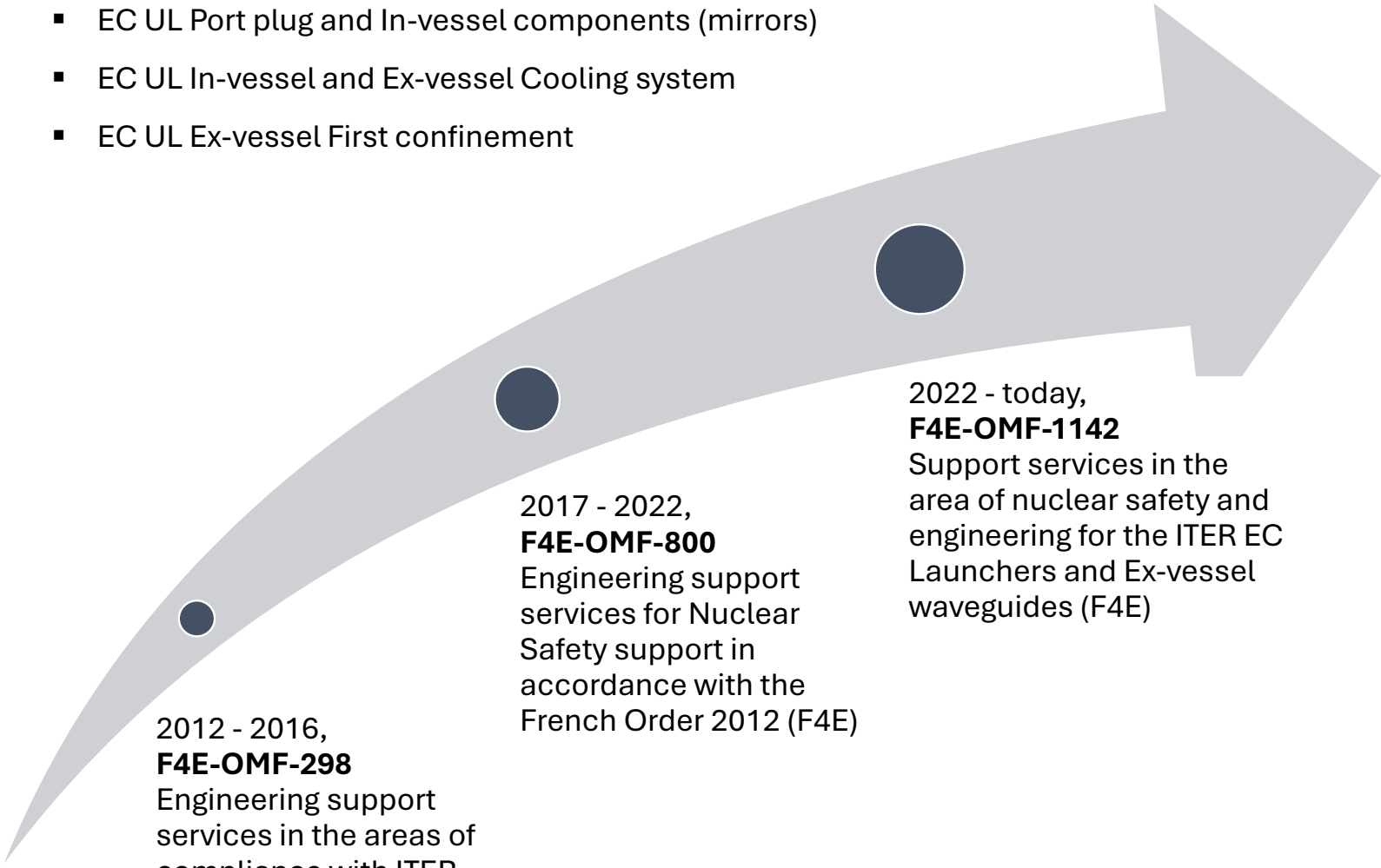
- 2016 - 2018, RAMI Analysis for **ITER Diagnostics systems** (ITER Organization)
- 2019, RAMI Analysis for **ITER Ion Cyclotron Resonance Heating** (ITER Organization)
- 2022, RAMI analysis of the High voltage Power Supply of **ITER ICH&CD System** (OCEM)
- 2022, RAMI analysis and Maintenance plan, for the **ITER EC CHWS subsystem** (ITER Organization)

Design and Structural integrity assessment

- 2021, OMF-0968-02, Provision of services in the field of thermo-hydraulic and structural analysis of the ITER **CXRS Port Plug** components for PDR (F4E)
- 2022 – today, Structural Integrity assessment of **ITER Ex-port RadiaNeutron Camera** (ENEA)
- 2023 - 2024, Structural Integrity Assessment of **ITER EC Chilled Water System l** (ITER Organization)

ITER Electron Cyclotron (EC) Upper Launcher (UL)

- EC UL Port plug and In-vessel components (mirrors)
- EC UL In-vessel and Ex-vessel Cooling system
- EC UL Ex-vessel First confinement

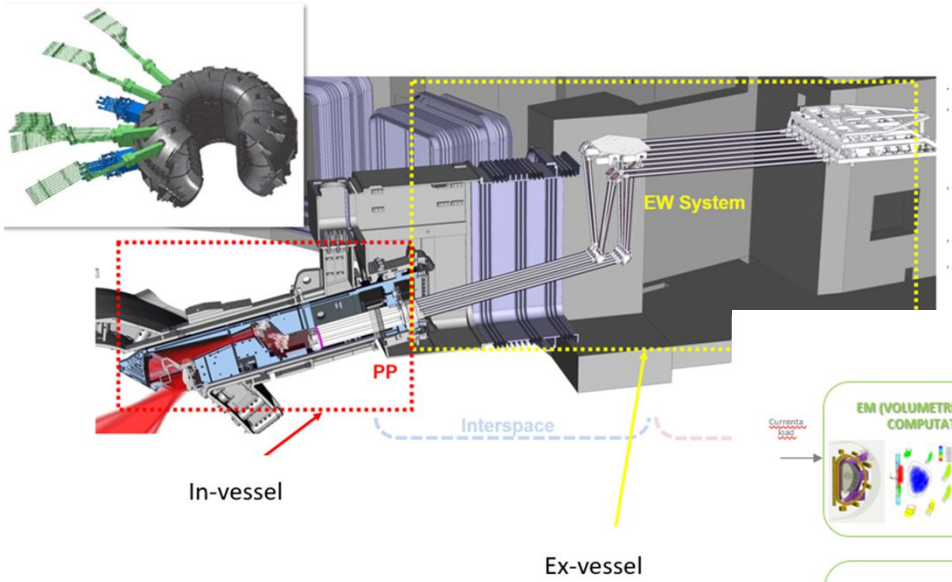


2012 - 2016,
F4E-OMF-298
Engineering support services in the areas of compliance with ITER safety requirements (F4E)

2017 - 2022,
F4E-OMF-800
Engineering support services for Nuclear Safety support in accordance with the French Order 2012 (F4E)

2022 - today,
F4E-OMF-1142
Support services in the area of nuclear safety and engineering for the ITER EC Launchers and Ex-vessel waveguides (F4E)

ITER Electron Cyclotron Upper Launcher



- EC UL Port plug and In-vessel components (mirrors)
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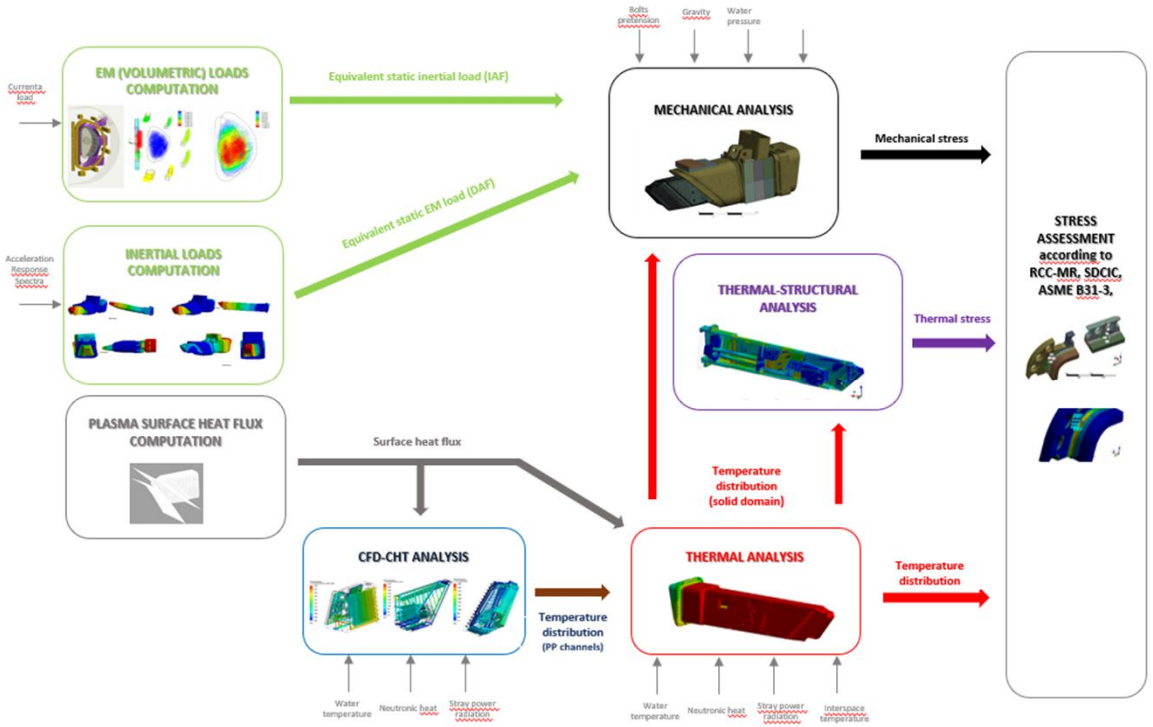
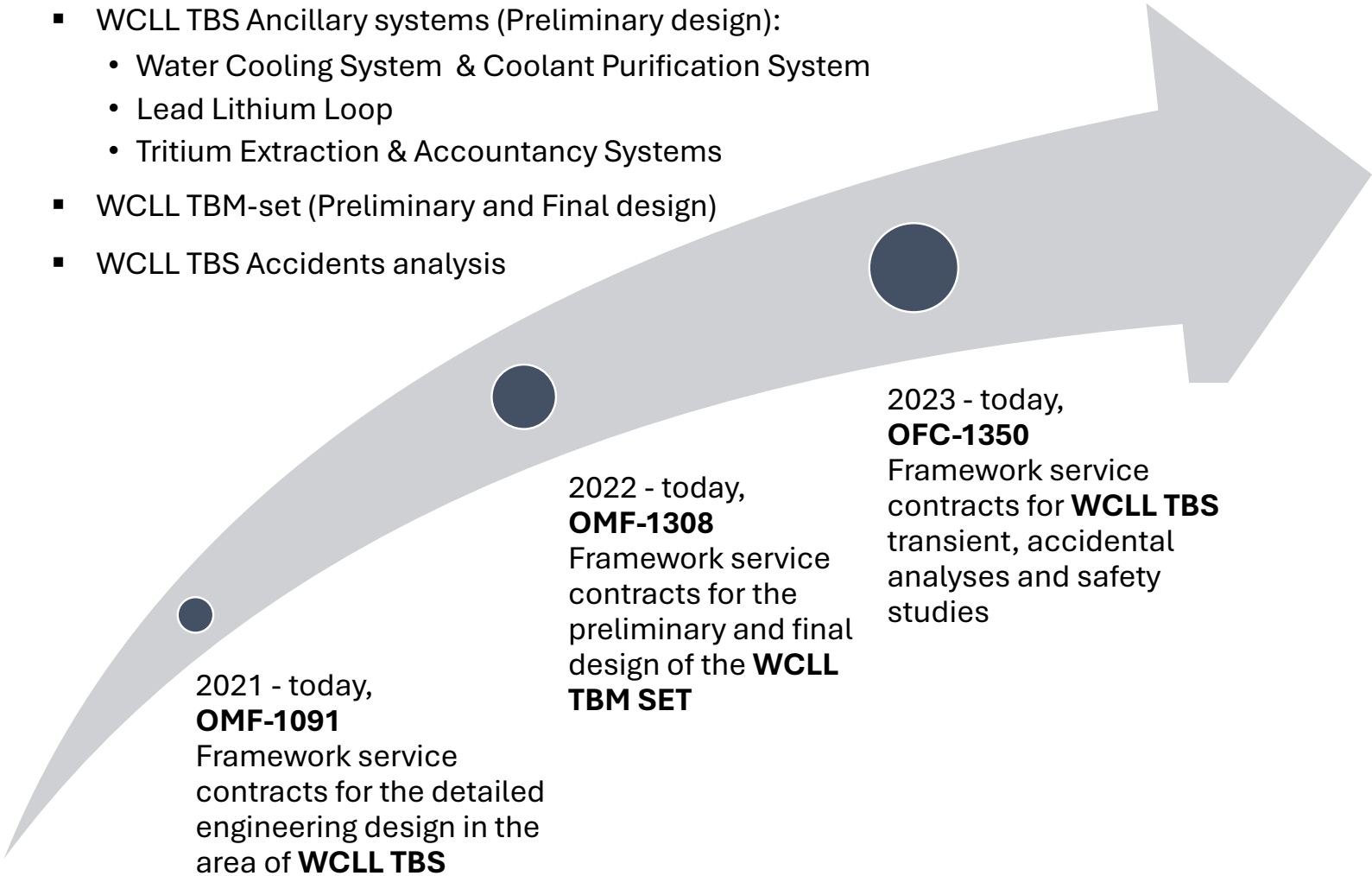


ITER Water-Cooled Lithium-Lead (WCLL) Tritium Blanket System (TBS)

- WCLL TBS Ancillary systems (Preliminary design):
  - Water Cooling System & Coolant Purification System
  - Lead Lithium Loop
  - Tritium Extraction & Accountancy Systems
- WCLL TBM-set (Preliminary and Final design)
- WCLL TBS Accidents analysis



2021 - today,
OMF-1091
Framework service contracts for the detailed engineering design in the area of **WCLL TBS ANCILLARY SYSTEMS**

2022 - today,
OMF-1308
Framework service contracts for the preliminary and final design of the **WCLL TBM SET**

2023 - today,
OFC-1350
Framework service contracts for **WCLL TBS** transient, accidental analyses and safety studies

REQUIREMENTS MANAGEMENT AND VERIFICATION.

Propagation of requirements from WCLL-TBS (PBS L1) to its Ancillary systems (PBS L3):

development of PBS L3 Subsystem Requirement Document;

development of the Requirements Propagation Matrix..

IBM Rational

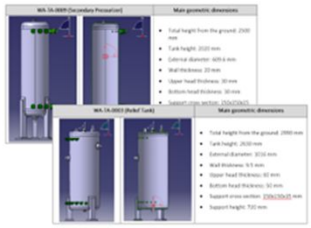
SYSTEMS CONFIGURATION CONTROL.

Development of the "Components database", integrating the Bill-of-Material, Classification of components, List of IO signals, Selection of COTS, Qualification requirements.

Systematic approach for the review, approval and implementation of changes.

ENOVIA

PRESSURE EQUIPMENT (PE) HAZARD ANALYSIS.



Specification of the main physical parameters, operational states and loading conditions.

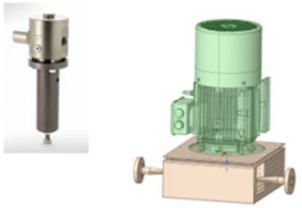
PE/NPE classification.

Specification of credible failure modes (FMEA) for each phase of the lifecycle, their impact on functions and related mitigations.

SELECTION OF SUITABLE CATALOGUE COMPONENT.

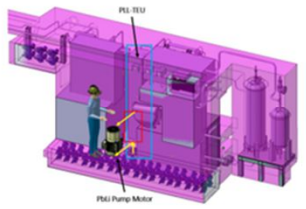
Selection of catalogue components suitable for both operative and accidental conditions, and specification of Qualification requirements

SPECIFICATION OF R&D REQUIREMENTS FOR NON-CATALOGUE COMPONENTS.



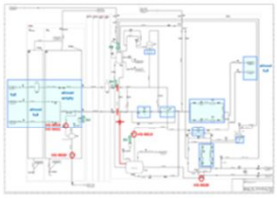
Support in selecting and/or designing both components and sensors with further required R&D needs.

INTEGRATION ACTIVITIES.



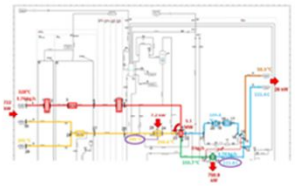
Redefinition of the system layout to meet geometrical, functional and maintainability requirements.

PROCESS RELATED ACTIVITIES.



Modification of the systems layout, revision/production of the Process Functional Diagram (PFD) and Process & Instrumentation Diagram (P&ID).

THERMO-HYDRAULIC ANALYSES: 1D-MODELLING.

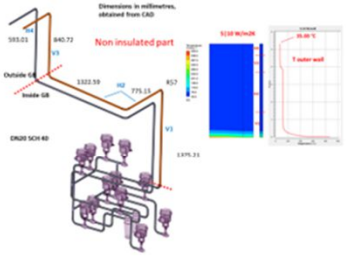


Thermo-hydraulic analysis (e.g. by RELAP) of the systems for pressure drop and heat release calculations, for all operational states.

RELAP5-3D

OM

THERMO-HYDRAULIC ANALYSES: CFD.



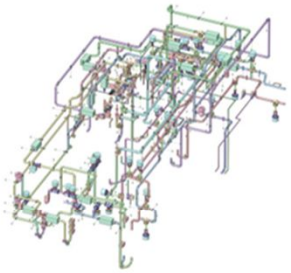
CFD analysis of the natural convection flow on the external surface of TES outlet pipe and assessment of temperature distribution along and across the piping.

Ansys

OpenFOAM

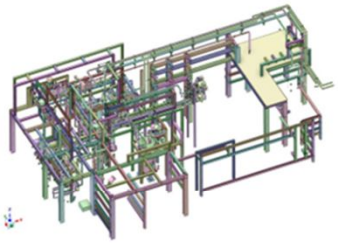
DESIGN & THERMO-MECHANICAL ANALYSIS

PIPING SYSTEMS .



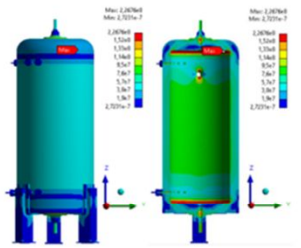
Design and FEA structural integrity assessment of complex piping systems according to the applicable codes (e.g. Eurocodes, ASME, RCC-MRx).

SUPPORT STRUCTURES .



Design and FEA structural integrity assessment of support structures (primary and secondary) of complex piping systems according to the applicable codes (e.g. Eurocodes, ASME, RCC-MRx).

3D COMPONENTS .



Design and FEA structural integrity assessment of 3D components according to the applicable codes (e.g. Eurocodes, ASME, RCC-MRx).

DESIGN tools:

CATIA

FEM/CFD tools:

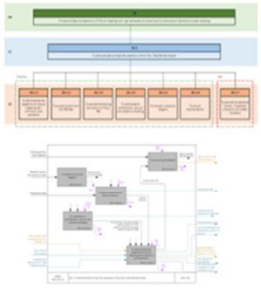
Ansys CAESAR II®

POST-PROCESSING tools:

KAISER

Proprietary tool

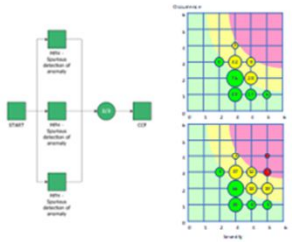
FUNCTIONAL ANALYSIS.



Review and updating of the hierarchical list of functions and integration with Conventional controls, Interlocks and Safety function).

Development of IDEFØ Functional model.

RELIABILITY, AVAILABILITY, MAINTAINABILITY & INSPECTABILITY (RAMI).

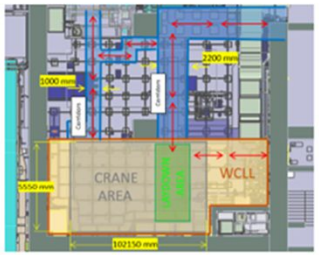


Analysis of the credible failures of' units, evaluation of their criticality (FMECA) and definition of risk mitigation actions.

Calculation of the reliability and availability of the Ancillary Systems and the whole WCLL-TBS.

isograph BlockSim RELIABILITY SAFETY QUALITY ALD

MAINTENANCE PLANNING.

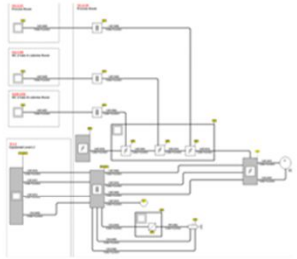


Plants virtual walkthrough for maintainability & inspectability checks.

Specification of the corrective and preventive maintenance strategy and lists of tasks (consistently with RAMI analysis).

Specification of procedures for the execution of maintenance tasks.

I&C DESIGN.

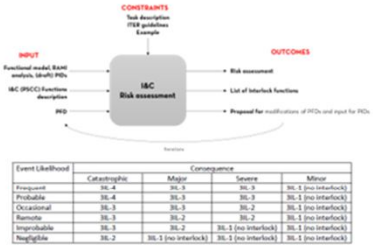


Definition of I&C Architecture (PSCC, PIS, PSS-N).

Development of the Cabling diagrams for each WCLL-TBS Ancillary system.

Definition of the configuration of the I&C (PSCC and PIS) cubicles.

I&C RISK ASSESSMENT.



Event Likelihood	Consequence			
	Catastrophic	Major	Severe	Minor
Frequent	3IL-4	3IL-3	3IL-3	3IL-1 (no interlock)
Probable	3IL-4	3IL-3	3IL-3	3IL-1 (no interlock)
Occasional	3IL-3	3IL-3	3IL-2	3IL-1 (no interlock)
Remote	3IL-3	3IL-2	3IL-2	3IL-1 (no interlock)
Improbable	3IL-3	3IL-2	3IL-1 (no interlock)	3IL-1 (no interlock)
Negligible	3IL-2	3IL-1 (no interlock)	3IL-1 (no interlock)	3IL-1 (no interlock)

Analysis of failures of Process components and I&C components managed by PSCC, for the

specification of the Interlock functions identification of components implementing them (managed by PIS);

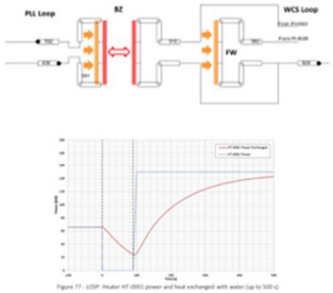
allocation the ITER Interlock Integrity Level (3IL) to the Interlock functions according to the ITER guidelines and IEC 61508.

I&C VALIDATION.

Definition of the activities and documentation to be produced for the design, integration, verification and Validation according to IEC 61513.

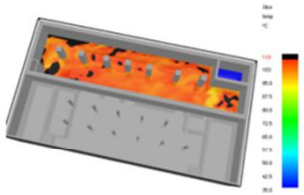
SIMULATION OF ACCIDENTAL SCENARIO

LOSS OF SITE POWER .



Thermo-hydraulic analysis (RELAP) steady-state/transient to assess the needed power in case of LOSP to avoid the PbLi solidification.

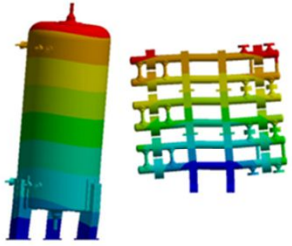
FIRE ANALYSES.



Fire scenario simulations and structural assessment of components through the combination of FDS and thermo-mechanical analyses.

FDS-SMV

SEISMIC ANALYSES.

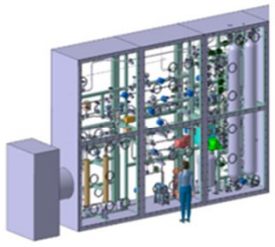


Static and dynamic analyses for the design and structural assessment against seismic load.

Ansys

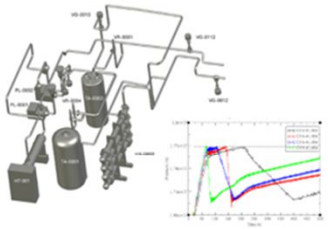
SIMULATION OF ACCIDENTAL SCENARIO

TAS tritium leak in Glove box.



Accident analysis, sensitivity and qualification studies for a loss of gas mixture due to TAS pipe rupture within the Glove box.

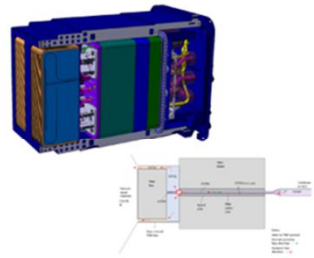
WCLL "LOFA in WCS"



Accident analysis, sensitivity and qualification studies for the "Loss of Flow Accident in WCS", due to break in Port Cell

MELCOR by N.I.N.E

Sensitivity study of the existing WCLL "TBM in-vessel LOCA" analysis



Sensitivity study for the "TBM In-vessel LOCA", focused on the estimation of the in-vessel pressure peak.

MELCOR by N.I.N.E

Required skills

Technologies for nuclear fission and fusion	Plasma modeling for nuclear fusion applications
	Neutronic modeling for nuclear fission applications
	Design of systems for nuclear fusion and fission applications
Nuclear Safety	Radiation protection
	Demonstration of Nuclear Safety
	Qualification of Systems, Structures, and Components
Lifecycle management	Systems engineering
	Regulatory compliance and licensing
	Awareness of the contribution of nuclear energy to sustainability
Soft skills	Continuous learning and problem solving
	Nuclear Safety culture
	Technical communication
	Teamwork and collaboration in multidisciplinary teams

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