DONES
Procurement Opportunities

Jose Aguilar (Head of Executive Office)

DONES

Swedish Big Science Forum 2026
Lund (Sweden), March 11-13th 2026

Merits of Fusion Energy

Massive and continuous

"Base load" and "intermediate load "electricity

Not dependent on weather conditions

Resilient to the fuel supply chain

Safe

NO power NO reaction

NO control NO reaction

NO chain reaction at all

Fusion Energy: the energy of stars

Sustainable

NO greenhouse gases

NO high-level radioactive waste

Unlimited fuels in the long term

Open

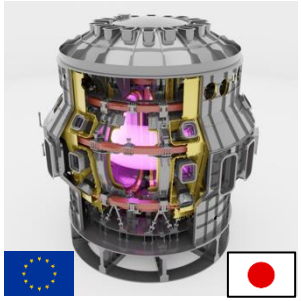
Fuels distributed worldwide

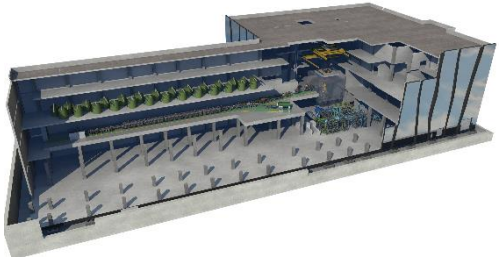
NO geopolitical implications

Energy depends only on Technology

Why IFMIF-DONES?

JT-60SA
135 m^3

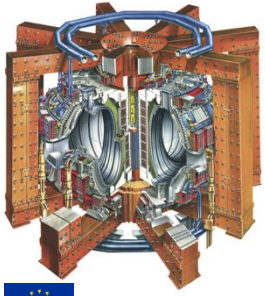




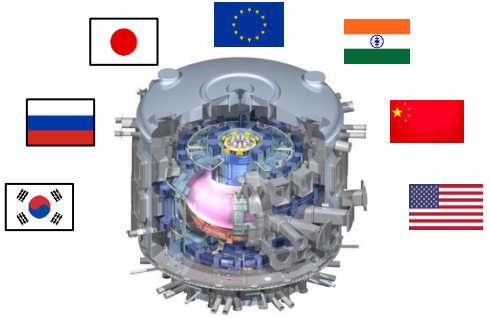
IFMIF-DONES
International **F**usion **M**aterials **I**rradiation **F**acility
DEMO **O**riented **N**eutron **S**ource

It is needed a specific facility for selection and qualification of candidate materials for fusion reactors

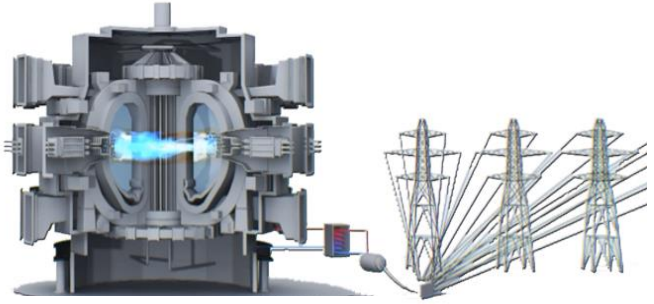
1950 | 1982 | 2023 | 2034 | 2050



JET
80 m^3



ITER
800 m^3
~500 MW

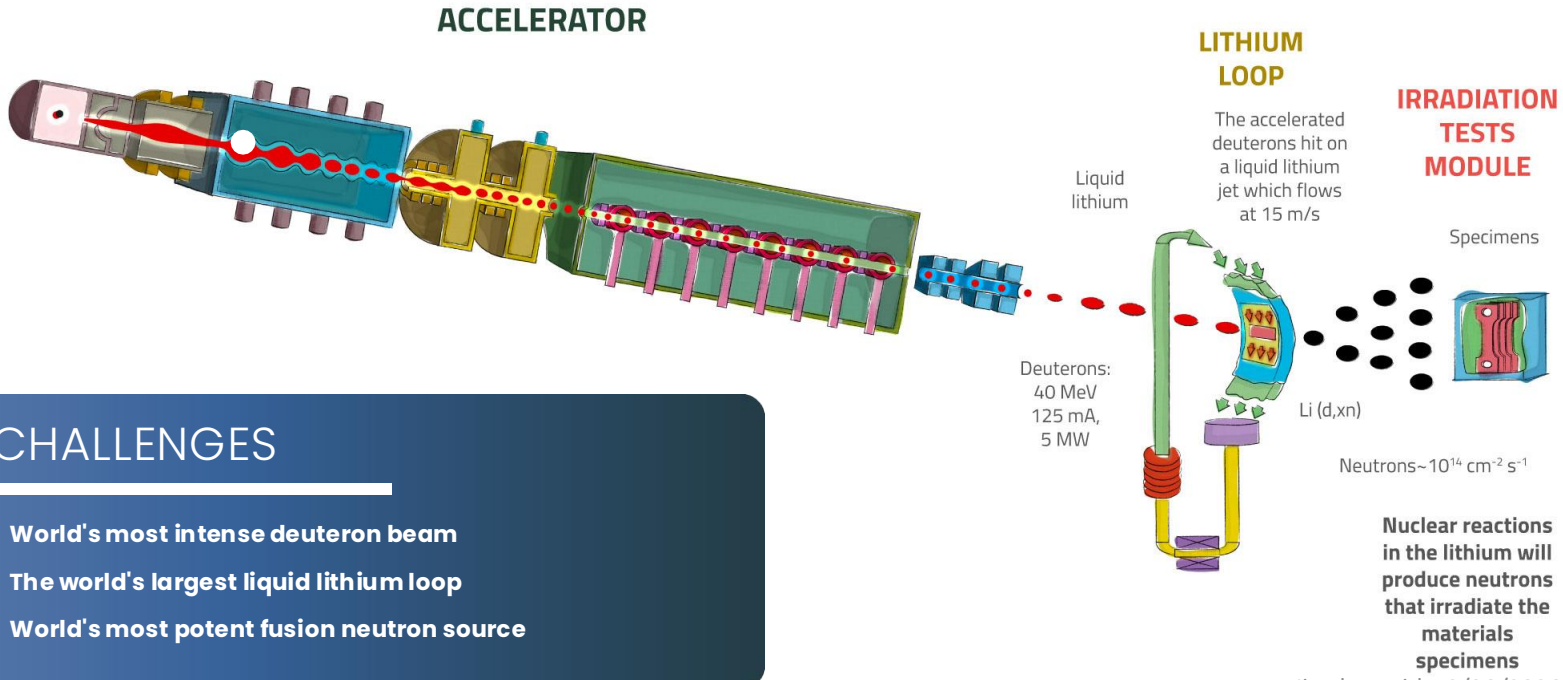


DEMO
~1000 - 3500 m^3
~2000 - 4000 MW

What is IFMIF-DONES?

A fusion-type neutron source is primarily used to qualify the materials used in the DEMO reactor.

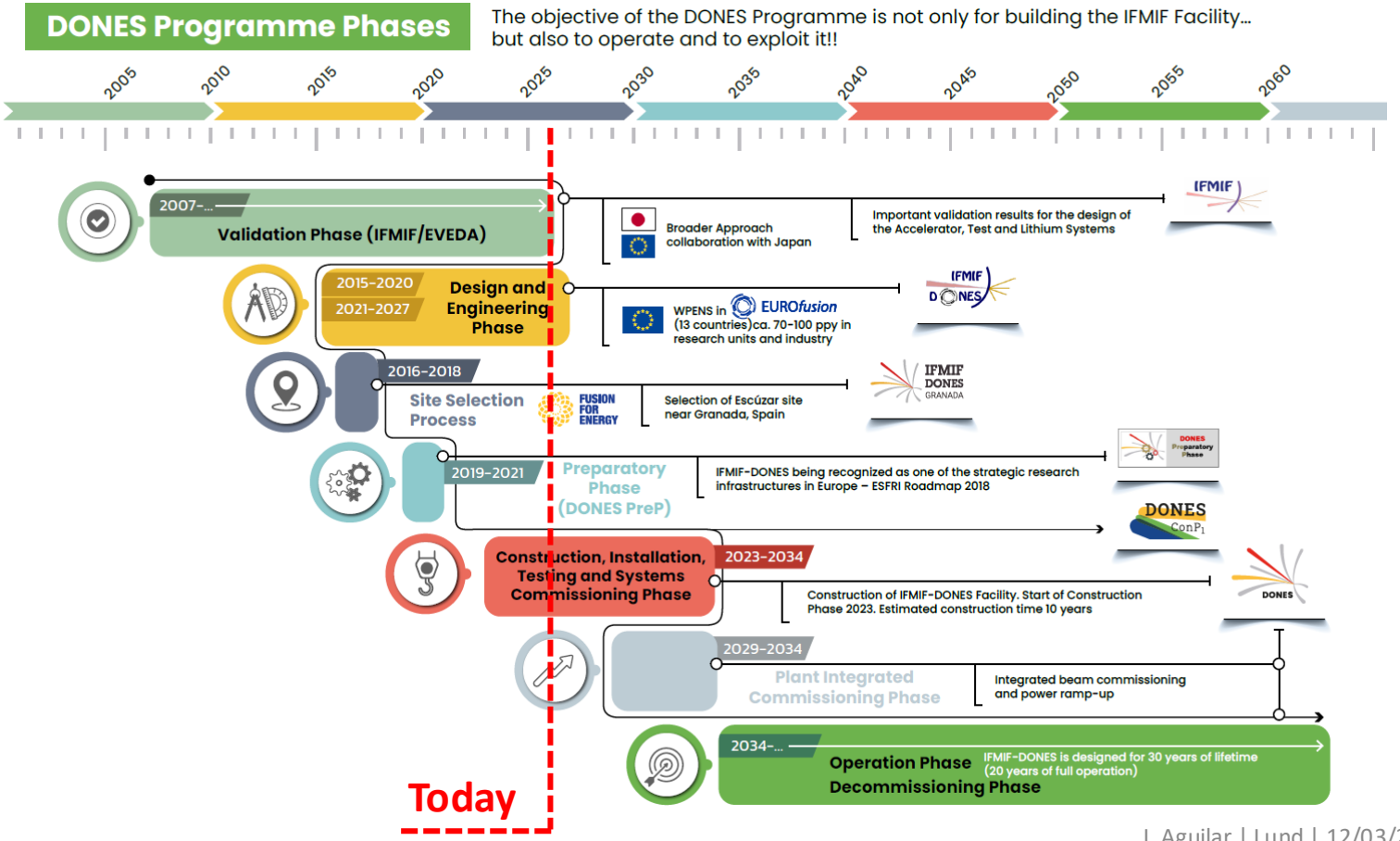
- Identified as a high priority in the **EU Fusion Roadmap.**
- Included in the **ESFRI roadmap as a strategic EU facility**.
- Identified as a 'indispensable' facility in **the EUROfusion Facility Review**.



CHALLENGES

- **World's most intense deuteron beam**
- **The world's largest liquid lithium loop**
- **World's most potent fusion neutron source**

DONES Programme Timeline



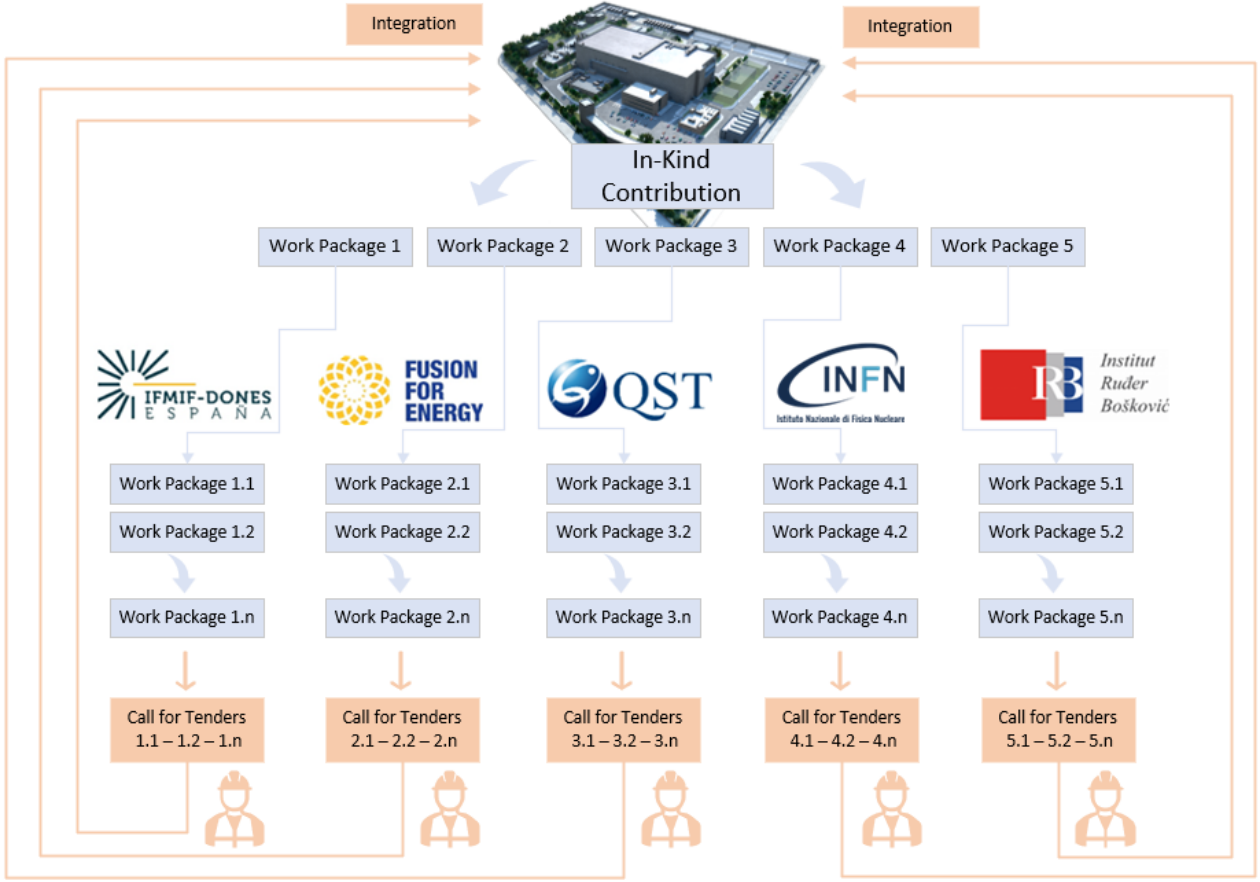
1st DONES-SC on 16 March 2023: Start of the Construction Phase

19 May 2025
Groundbreaking Ceremony
and
Japan&Spain Signing Ceremony

21 November 2025 MIDA Signing Ceremony

DONES Programme Parties

DONES In-Kind Contribution Framework



Tentative Overview of Tenders

⇩

DONES Cost Range Categories (€):

1. **Up to €10,000,000**
2. **€10,000,000 – €100,000,000**
3. **Above €100,000,000**

✚

Tenders Timeline: 2023-2034

Site, Buildings and Plant Systems

1 **Main Building**
Housing of all irradiation systems (Accelerator, Lithium & Test Systems)

Auxiliary Buildings

2 Main Building Access Bldg

EPS [Electric Power System]

3 Main Electrical Bldg
4 Electrical Switchyard Bldg
5 Emergency Power Bldg (Train A)
6 Emergency Power Bldg (Train B)
7 Cooling Towers & Chillers Electrical Bldg

8 Water Treatment Plant
SWS [Service Water System]

9 Boiler for HVAC
10 Chillers & Pumps Bldgs for HVAC
HVAC System

11 Cooling Towers Bldgs
HRS System [Heat Rejection System]

12 Fire Water Pumps Bldg
FPS [Fire Protection System]

13 Empty Casks Storage Area
RWTS [Radioactive Waste Treatment System]

14 Service Gas Areas
SGS [Service Gas System]

15 Administration Bldg
16 Access Gate Bldg
17 Warehouse

Under Construction

IFMIF-DONES ESPAÑA

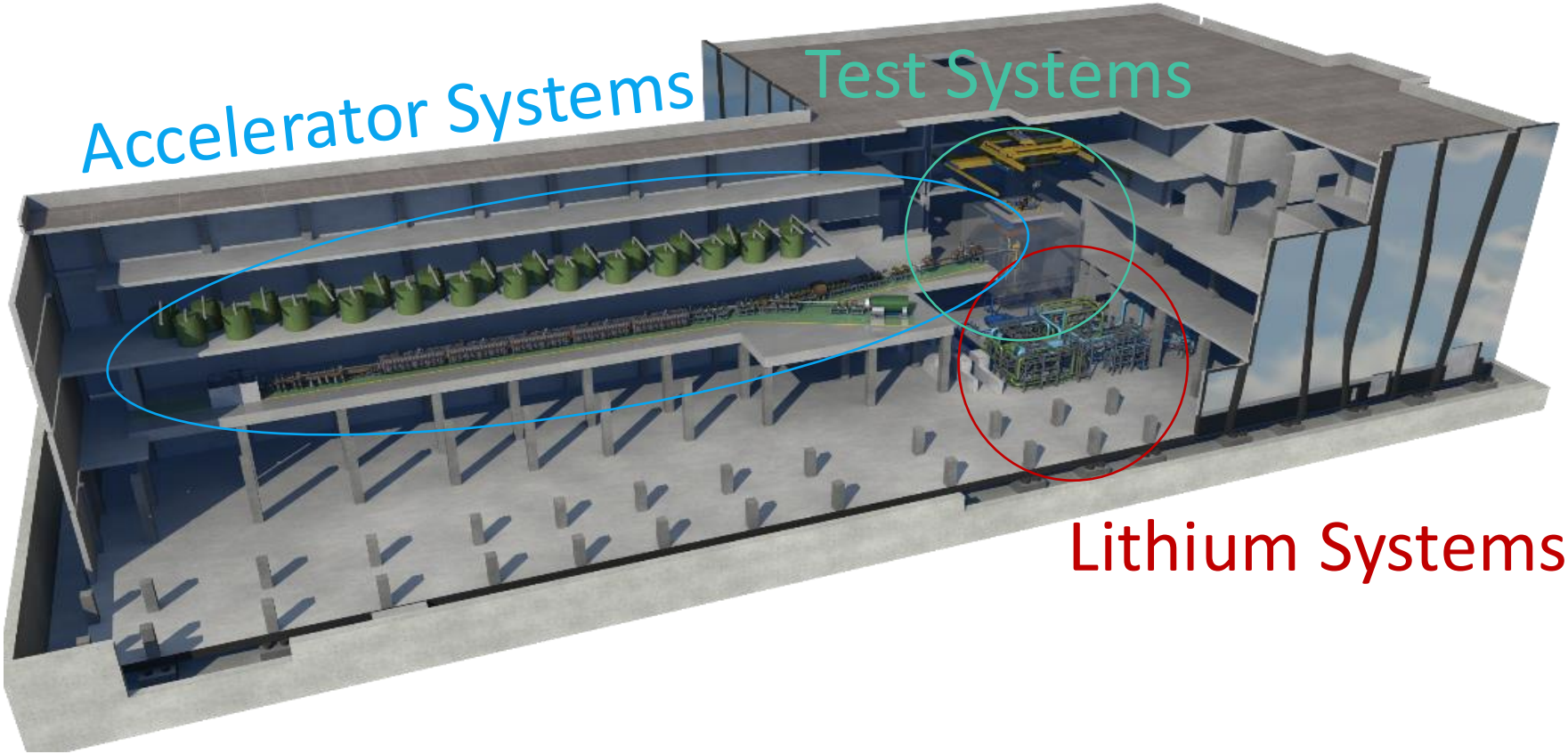
2 **Tenders: - 2025 (awarded)**
- 2028 (Engin. Services)

3 **Tenders: - 2025 (awarded)**
- 2028 (D&B contracts)

Site Status

Escúzar (18 Km from Granada)

Accelerator, Lithium and Test Systems



Accelerator Systems

The accelerator chain (step by step):

1 **Injector** — creating the particles (Deuterons): This is the starting point of the whole accelerator.

2 **RFQ (Radio Frequency Quadrupole)** — first acceleration: The RFQ is the first real accelerator and is essential for beam stability DONES (5 MeV).

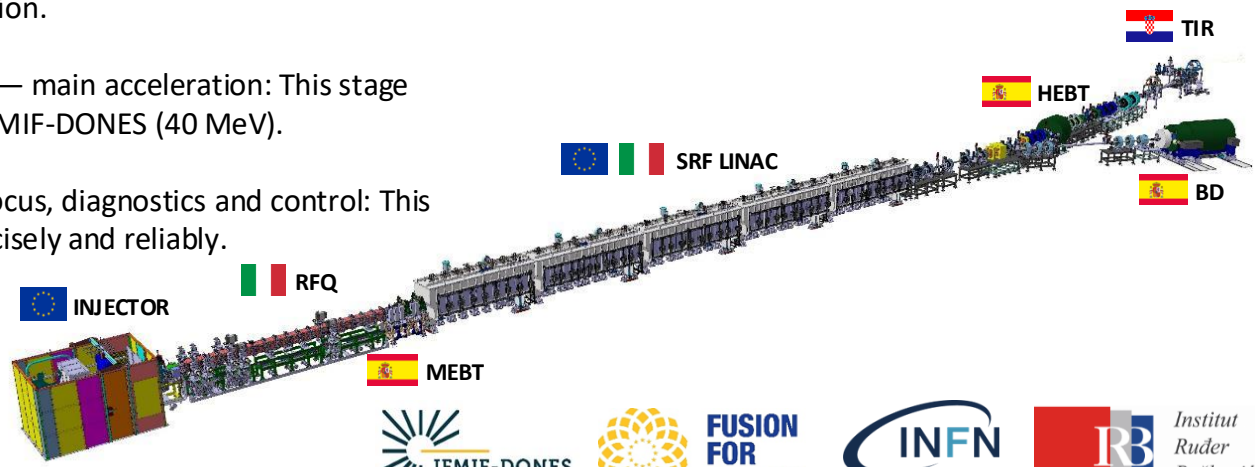
3 **MEBT (Medium Energy Beam Transport)** — checking and adjusting: Think of it as quality control before higher acceleration.

4 **Superconducting accelerator (SRF Linac)** — main acceleration: This stage provides the final beam energy required by IFMIF-DONES (40 MeV).

5 **HEBT (High Energy Beam Transport)** — focus, diagnostics and control: This ensures the beam reaches its destination precisely and reliably.

The Accelerator Systems are the "engine" of IFMIF-DONES

D+ CW 175 MHz SC LINAC
125 mA / 40 MeV → **5 MW**
Total length of ~**100 m**
Liquid **Li target**

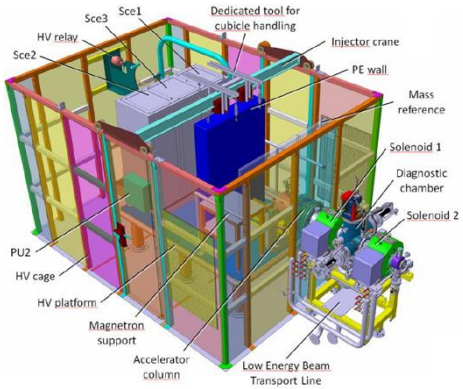


Possibility to upgrade to **IFMIF**, with a **2nd mirror accelerator (10 MW)**

Accelerator Systems (Injector)

Based on LIPAc design

140 mA Continuous Wave deuteron beam at 100 keV



What the Injector does (in simple terms):

✅ **Creates deuterons**
- Deuterons are the particles used to produce neutrons later

✅ **Extracts them as a beam**
- Pulls the particles out in a controlled way (continuous beam)

✅ **Gives them their first energy**
- The particles are still slow (100 KeV), but ready for acceleration

✅ **Sends the beam into the RFQ**
- With the correct size, in the correct direction, at the correct intensity (140 mA)

FUSION FOR ENERGY

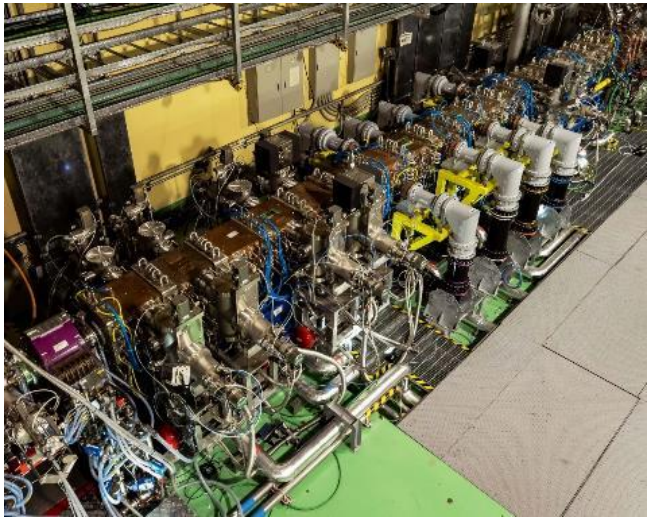
1 **Tenders: 2026-2027**

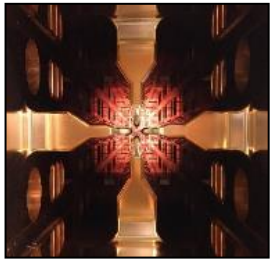
Market Survey February 2026

Needed skills / key technologies:
RF Source
Beam dynamics modelling
Mechanical machining
Specific material (Boron Nitride)
High Voltage and Electronics
Instrumentation for Diagnostics

Accelerator Systems (Radio Frequency Quadrupole)

Based on LIPAc design





What the RFQ does (step by step):

✅ **Receives deuterons** from the **Injector** (they are slow and messy at this stage).

✅ **Bunches them**; Turns a continuous stream into neat "packets".

✅ **Focuses them**; Stops particles from drifting away.

✅ **Accelerates them;** Brings them up to a few MeV (5MeV) of energy.

✅ **After this**, the travel continues to **MEBT**.

Needed skills / key technologies:
RF Source
Beam dynamics modelling
Mechanical machining
High Voltage and Electronics
Instrumentation for Diagnostics

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1 **Tenders: 2026-2027**

Accelerator Systems (Medium Energy Beam Transport)

MEBT Based on LIPAc design

MEBT = transport, matching, and diagnostic section between the RFQ and SRF LINAC

What the MEBT does (in simple terms):

✅ **Keeps the beam focused**
- Uses magnetic elements to stop the beam from spreading

✅ **Adjusts the beam shape**
- Makes sure the beam size and direction are exactly right, to prepare it for SRF LINAC needs

✅ **Measures the beam**
- Special instruments check: Beam intensity, Beam position and Beam quality

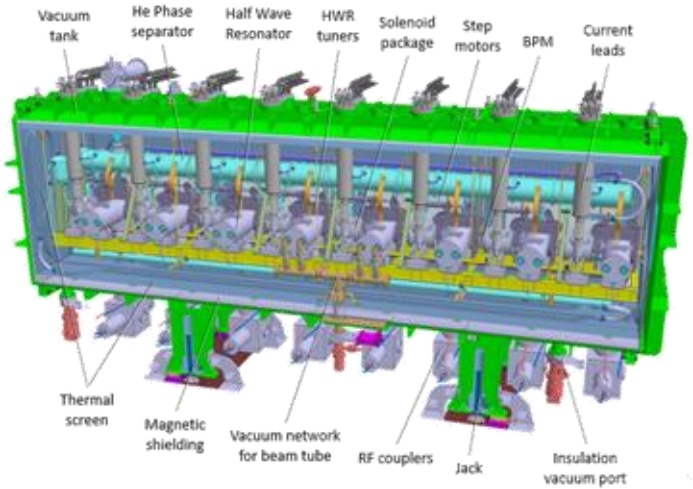
✅ **Protects the accelerator**
- If something is wrong, part of the beam can be stopped or trimmed, this avoids damage to downstream components.

Needed skills / key technologies:
RF Source
Beam dynamics modelling
Mechanical machining
High Voltage and Electronics
Instrumentation for Diagnostics

IFMIF-DONES ESPAÑA

1 **Tenders: 2025 (awarded)**

Accelerator Systems (SRF LINAC)



The **Superconducting Radio-Frequency Linear Accelerator** accelerates the deuteron beam from about **5 MeV** up to **40 MeV**, which is the energy needed to produce fusion-like neutrons.

What the SRF LINAC does (step by step):

1. **Receives the beam from the MEBT**
2. **Uses ultra-cold accelerating cavities**
3. **Gives repeated, perfectly timed pushes**
4. **Keeps the beam focused and stable**
5. **Accelerates the beam to full energy (40 MeV)**
6. **Runs continuously and efficiently**
7. **Delivers the beam to the next system: HEBT**

Needed skills/key technologies:
Simulation, Design and Manufacturing of HWR and RF Couplers
Procurement and handling of special materials (Nb)
Design of cryogenic components and feeders
Machining of components
Assembly in cleanroom (ISO-5)
Solenoid manufacturing and quality control (welding)
High Voltage and Electronics

FUSION FOR ENERGY

2 **Tenders: 2026-2027**

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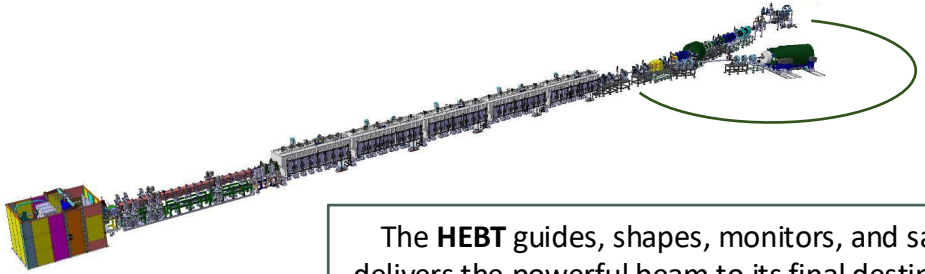
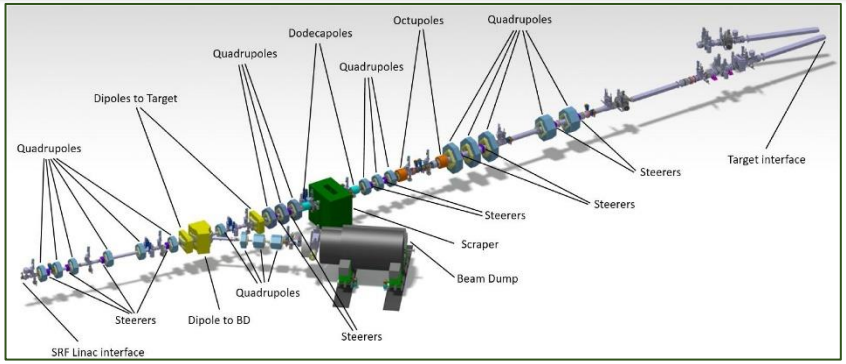
2 **Tenders: 2026-2027**

Accelerator Systems (HEBT, BD & Diagnostics)





The **HEBT** guides, shapes, monitors, and safely delivers the powerful beam to its final destination: Li target.

What the HEBT does (step by step):

1. **Receives the high-energy beam (SRF LINAC)**
2. **Guides the beam safely forward**
3. **Shapes the beam (20x5, 10x5)**
4. **Monitors the beam**
5. **Protects the accelerator**
6. **Sends the beam to liquid lithium target**

The **Beam Dump (BD)** is included in the HEBT to stop the beam during commissioning and start-up phases.

The **TIR diagnostics** check that the beam is in the right place, with the right shape, and safe to hit the target.

HEBT + BD

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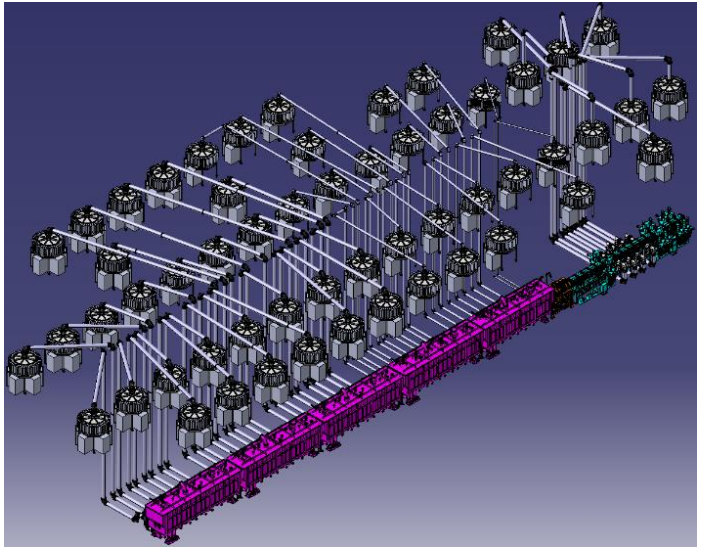
2 **Tenders: 2025 (awarded)**

TIR Diagnostics (Target Interface Room):

Institut Ruđer Bošković

1 **Tenders: 2027**

Accelerator Systems (RF Power System)



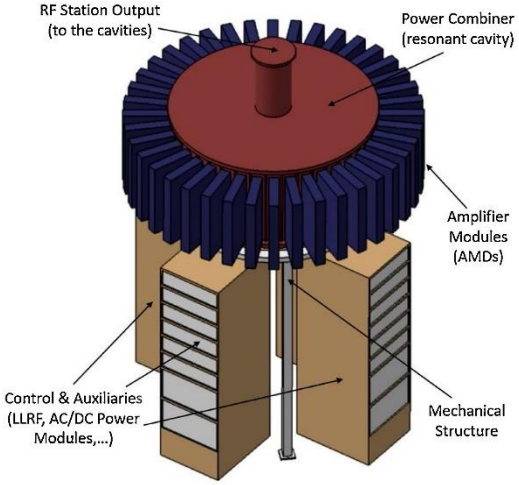
56 RF Stations to supply:

- 8 for RFQ cavities
- 2 for MEBT cavities.
- 8+11+9+9+9 for SRF LINAC cavities

including the respective coaxial lines

Operating frequency: 175 MHz
Mode: Continuous Wave (CW)
Maximum RF power per station: up to 200 kW CW

RF Station (200 kW version with 40 AMDs)



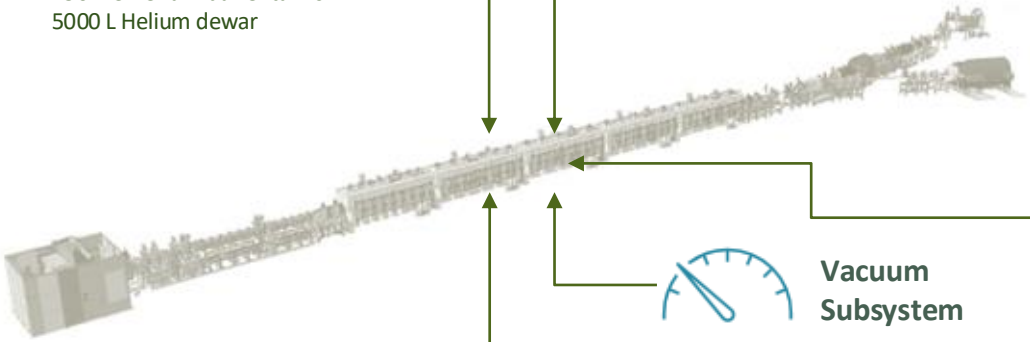
What the RF Power System does (step by step):

1. **Takes electrical power from the grid**
2. **Converts it into high-frequency power** (RF waves)
3. **Amplifies the RF power** (RF signal is made very powerful)
4. **Delivers RF power to the accelerator cavities**
5. **Creates electric fields inside the cavities** (pushing the particles forward)
6. **Keeps the fields stable and controlled**
7. **Enables continuous acceleration**

2 **Tenders: 2026-2027**

Market Survey February 2026

Accelerator Systems (Accelerator System Ancillaries)



Cryoplant

Liquid He 4.45 K and 0.125 Mpa
Superconducting cavities, solenoids
60 K Thermal shielding
150 m3 Helium buffer tanks
5000 L Helium dewar

Gas Distribution

Ar - Argon (dry pumps)
He - Helium (leak testing)
N - Nitrogen (maintenance)
Compressed air (electro-pneumatic devices)
Breathable Air

Water Primary Cooling Loops

Heat load ~10 MW.
15ºC < Temperatures < 27ºC
±0.1ºC < Regulation < ±3ºC

Vacuum Subsystem

Pumping down & protection
of accelerator vacuum chamber
High vacuum pumps
Operating pressure < 5.10^{-6} Pa
4.4 K < Temperature < 540 K

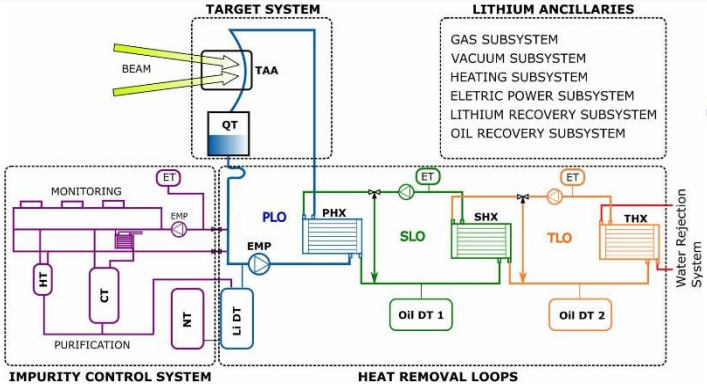
Electrical Distribution

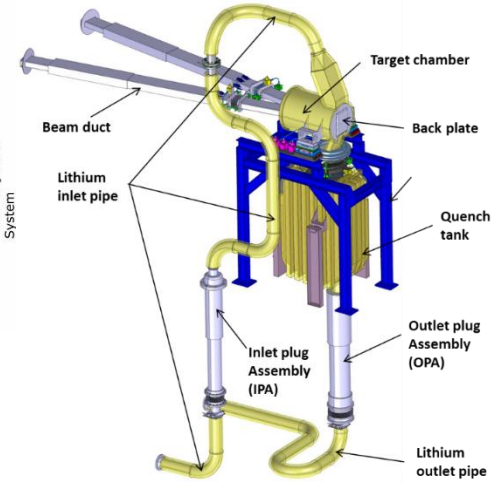
Low & medium voltage
Total apparent power ~25 MVA

FUSION FOR ENERGY

2 **Tenders: 2027-2028**

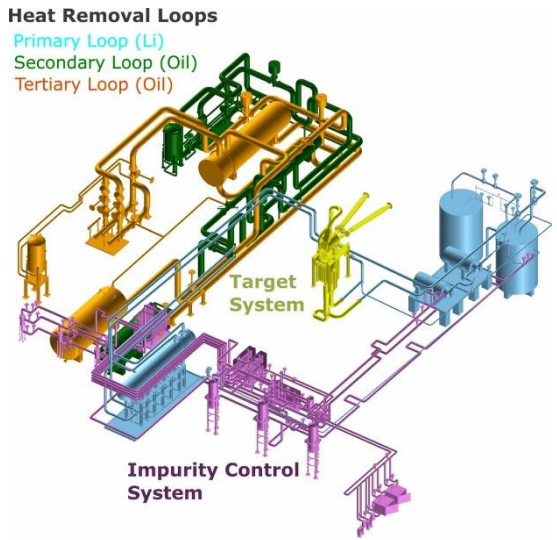
Lithium Systems (Target, HRS, Impurity Control, Ancillaries)





What the Lithium Systems do (step by step):

1 **Make a fast lithium jet**
(in front of the accelerator beam)
2 **Hit the lithium with the beam**
(lithium carries this heat away)
3 **Collect and slow down the lithium**
(quench tank)
4 **Clean, control, and reuse the lithium**
(circulates in a closed loop)



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HRS (2&3rd Loops, Oil R.)

FUSION FOR ENERGY

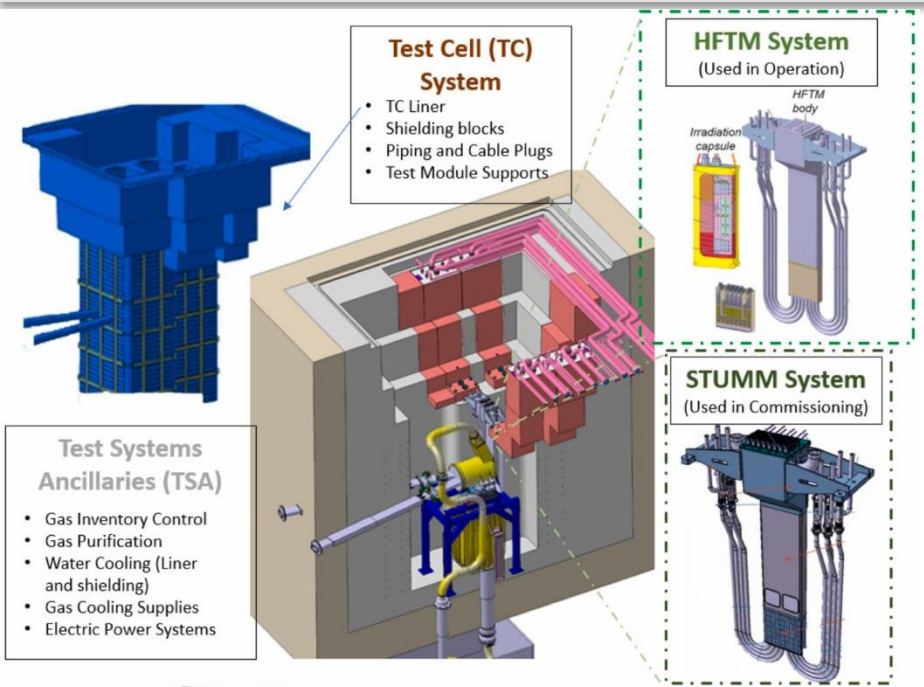
Material (Li, Eurofer)

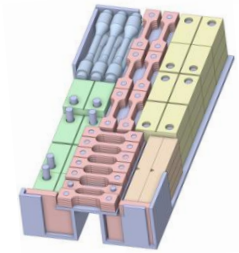
ENEA

TS, ICS, 1st Loop, LSA

1 2 **Tenders: 2027-2028**

Test Systems (Test Cell, Irradiation Modules, Ancillaries)





- 120 specimens per capsule
- Around 1000 specimens in the high-flux region
- Almost 3000 specimens per irradiation campaign
- 1 experiment = 1 year

How the Test Systems work (step by step):

1. **Materials are placed in Test Modules**
   (HFTM, Other Modules: Tritium, Blankets, Cryogenic…)
2. **Neutrons irradiate the materials**
   (This happens continuously, not in short pulses)
3. **Temperature is carefully controlled**
   (He cooling, Water cooling, Gas Systems)
4. **Everything is monitored and controlled**
   (Sensor and diagnostics, gas composition, pressure, impurities)
5. **Remote handling is used**
   (open/close Test Cell, insert and remove modules…)

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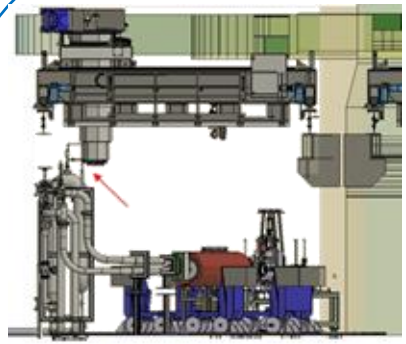
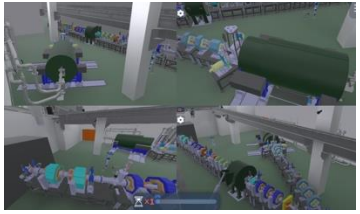
2 **Tenders: 2025 (awarded)** — Test Cell

1 **Tenders: 2027-2028** — STUMM, Ancillaries

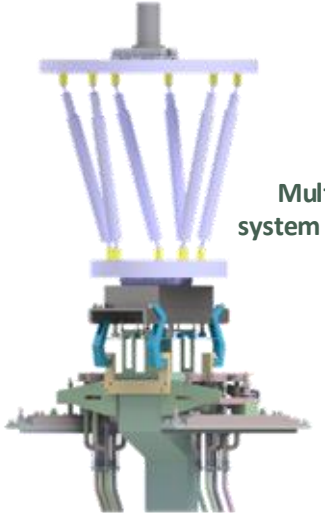
Remote Handling Systems



Cranes + Robotic Arms



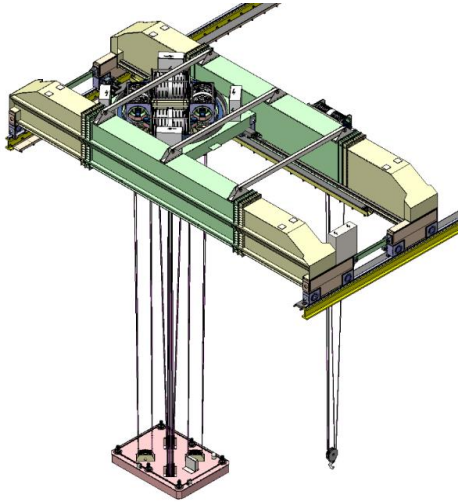
Viewing Systems



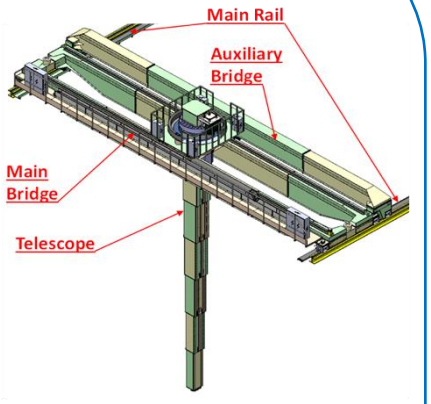
Multipurpose system for HFTM

FUSION FOR ENERGY

2 **Tenders: 2027-2028**



Heavy Rope Crane (HROC)



Access Cell Mast Crane (ACMC) & ACMC Remote Handling Tools

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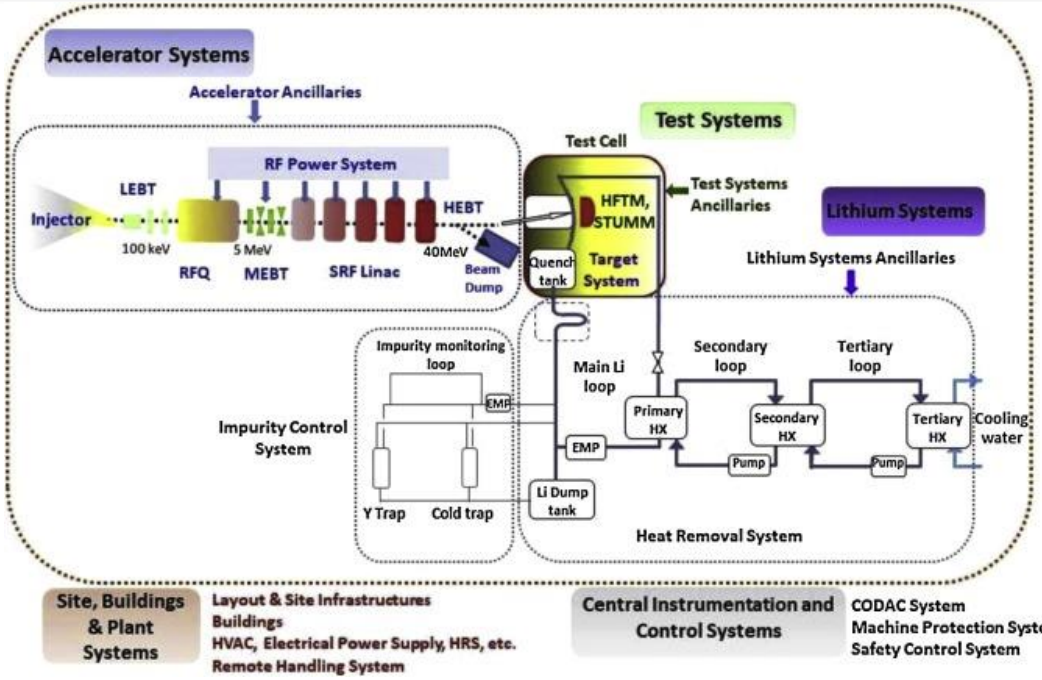
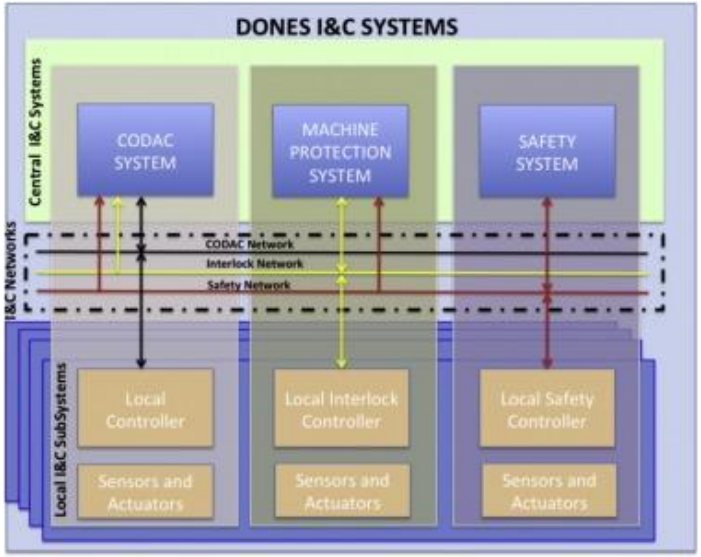
2 **Tenders: 2026-2027**

Central Instrumentation and Control Systems

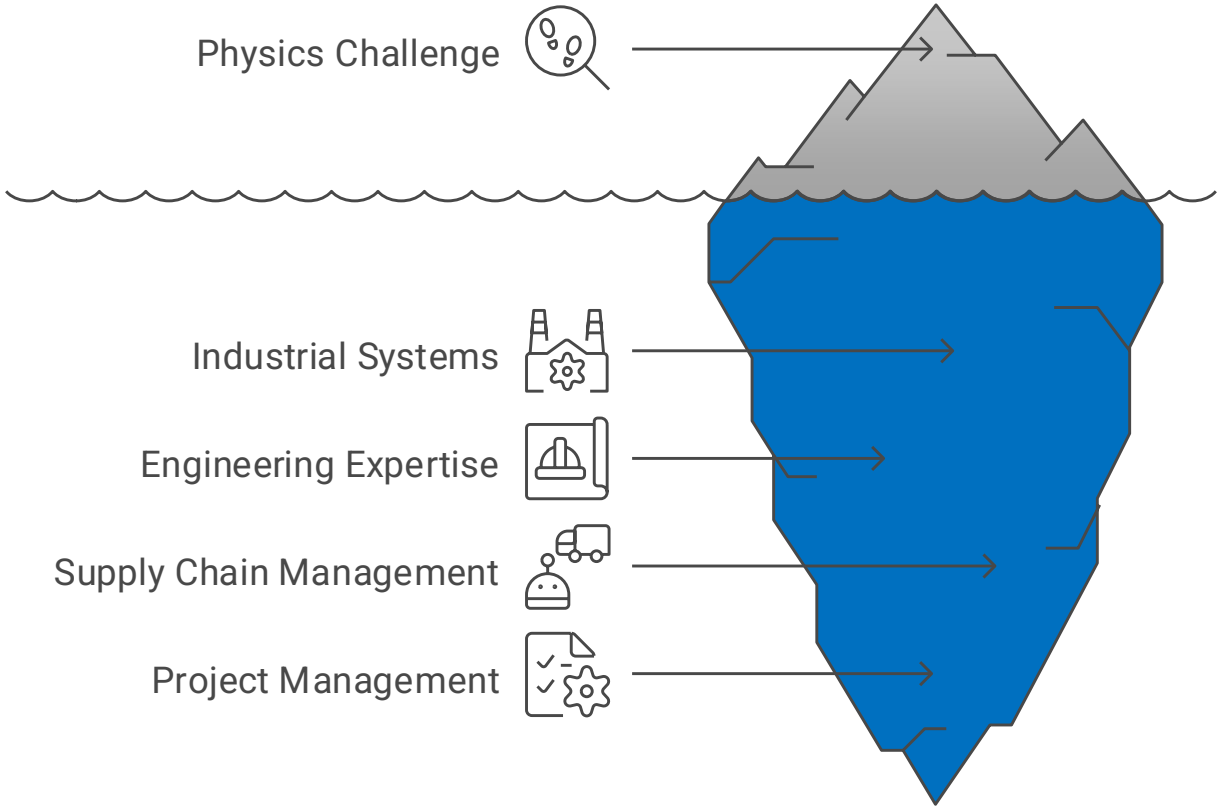




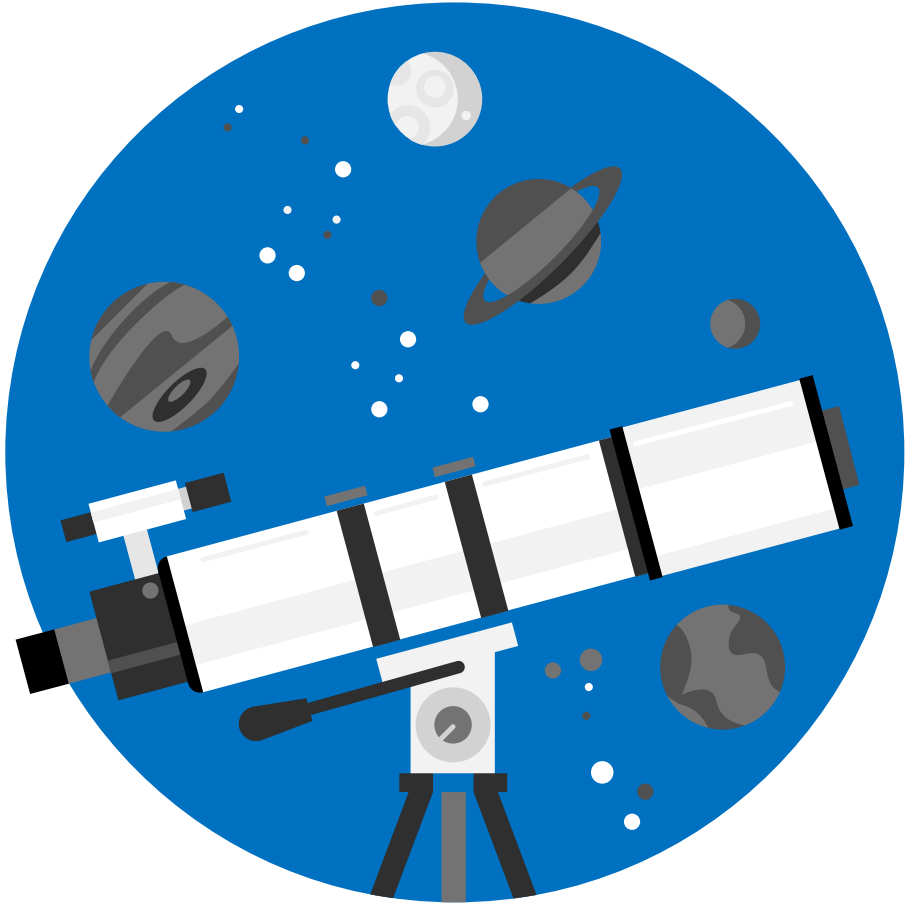
IFMIF-DONES ESPAÑA

1. **Tenders: 2025 (Engineering Support, awarded)**
2. **Tenders: 2027**

IFMIF-DONES – a Challenge beyond Physics



How to get involved in DONES



DONES website
Call for Tenders Section
www.ifmif-dones.org

Fusion for Energy
Industry Portal
www.fusionforenergy.europa.eu

Belén del Cerro
Spanish ILO (Industrial Liaison Officer)
for ITER and IFMIF-DONES
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Industry Office
Big Science Industry
Association
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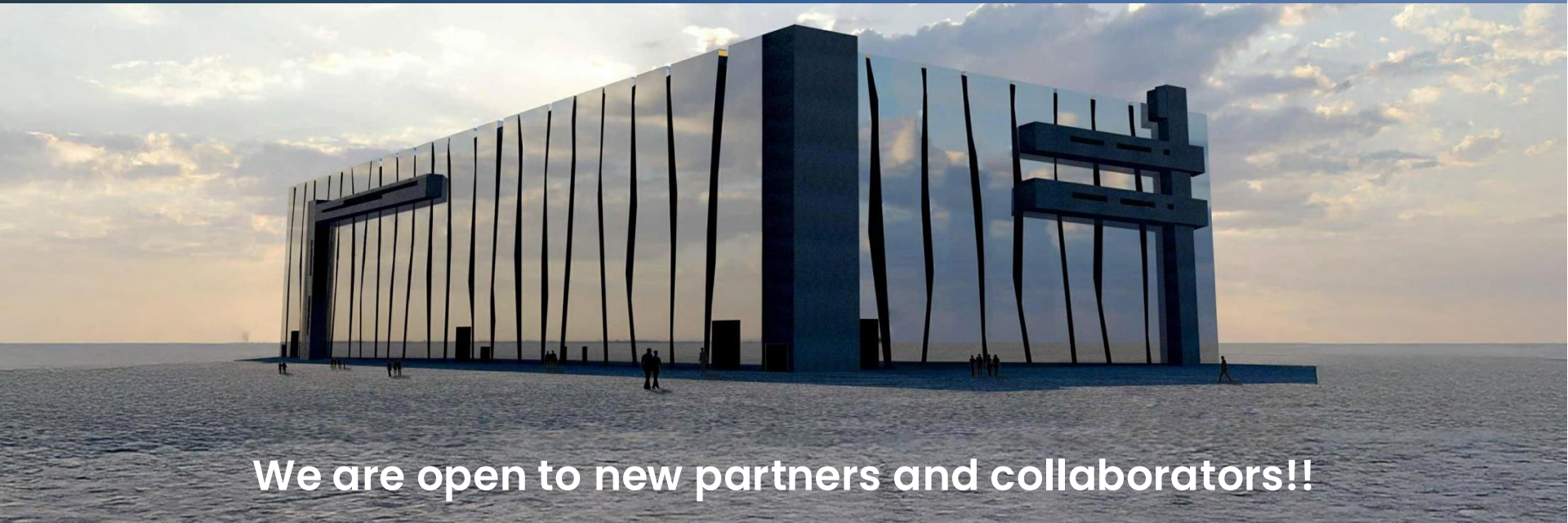
IFMIF-DONES is a **unique opportunity** to contribute to a **key problem of humanity** and to participate in **high-tech development**



We are open to new partners and collaborators!!

Thank you for your attention…

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