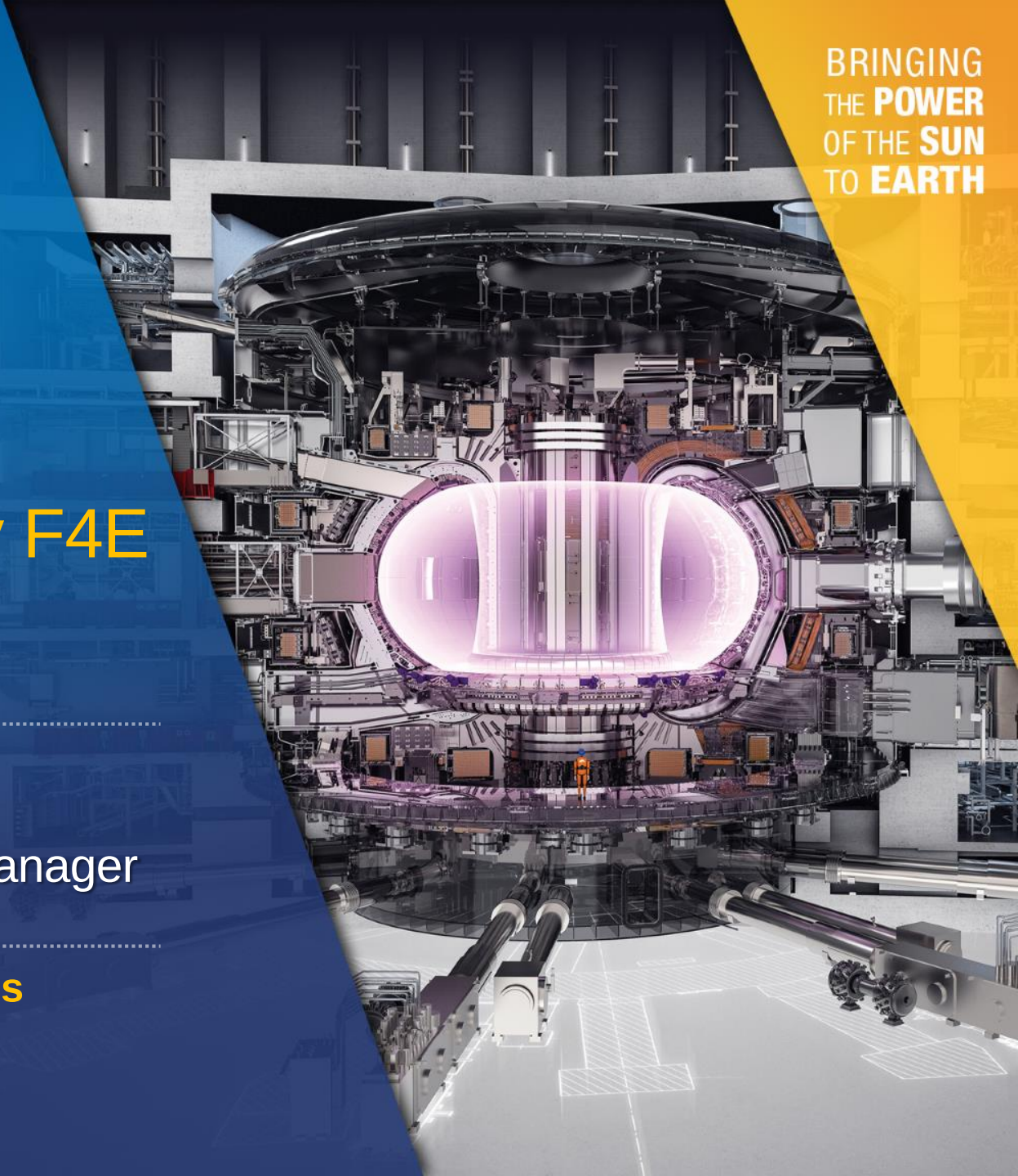
FUSION FOR ENERGY

BRINGING THE POWER OF THE SUN TO EARTH



Fuel Cycle Procurements by F4E

Giovanni Piazza

Fuel Cycle Project Manager

Remote ITER Business Meeting - 2021

7-8 April 2021

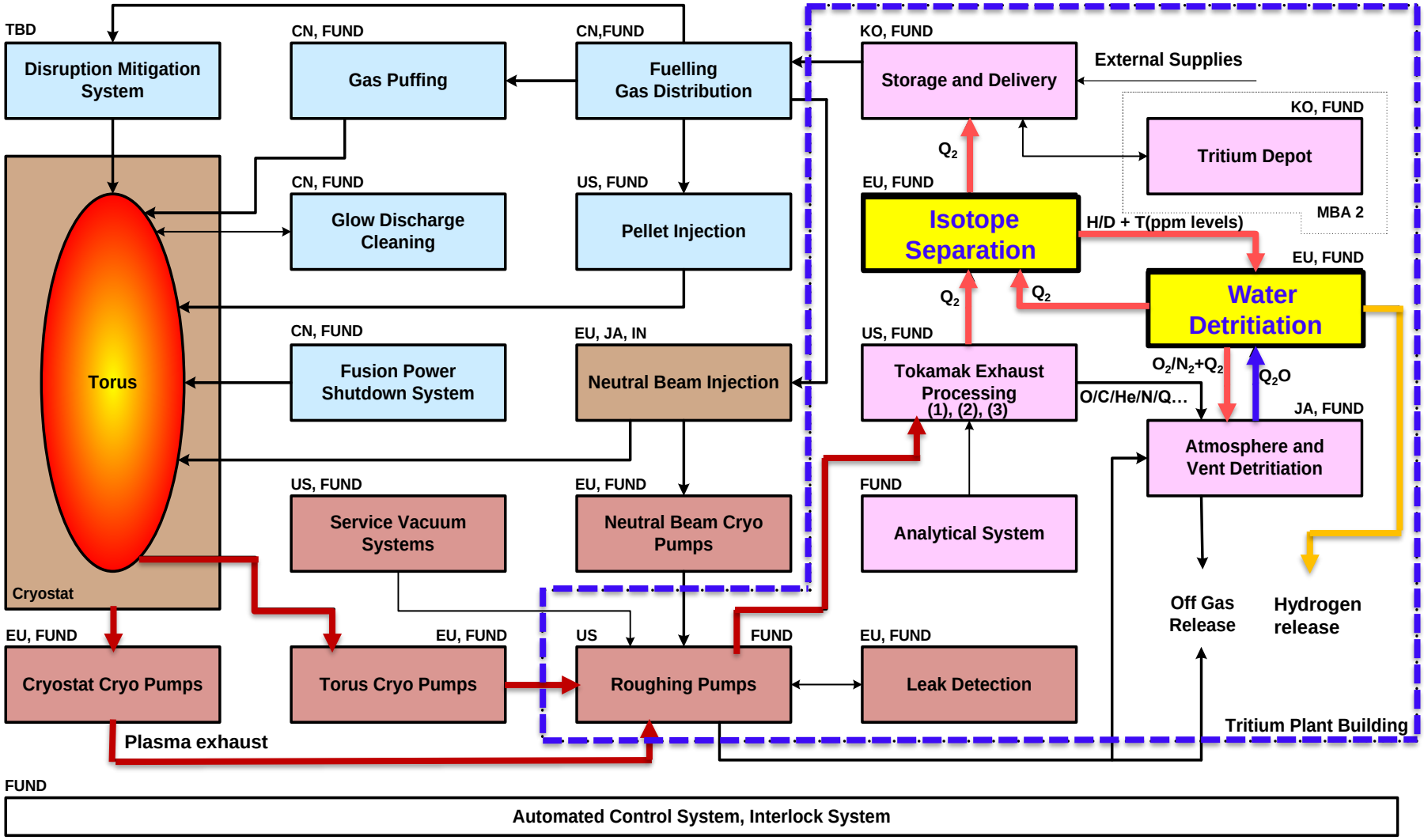
Presentation Overview

- F4E procurement scope in the ITER Fuel Cycle (FC) area:
  - Water Detritiation System (WDS);
  - Hydrogen Isotope Separation System (ISS).

- Hints for F4E Tenders.

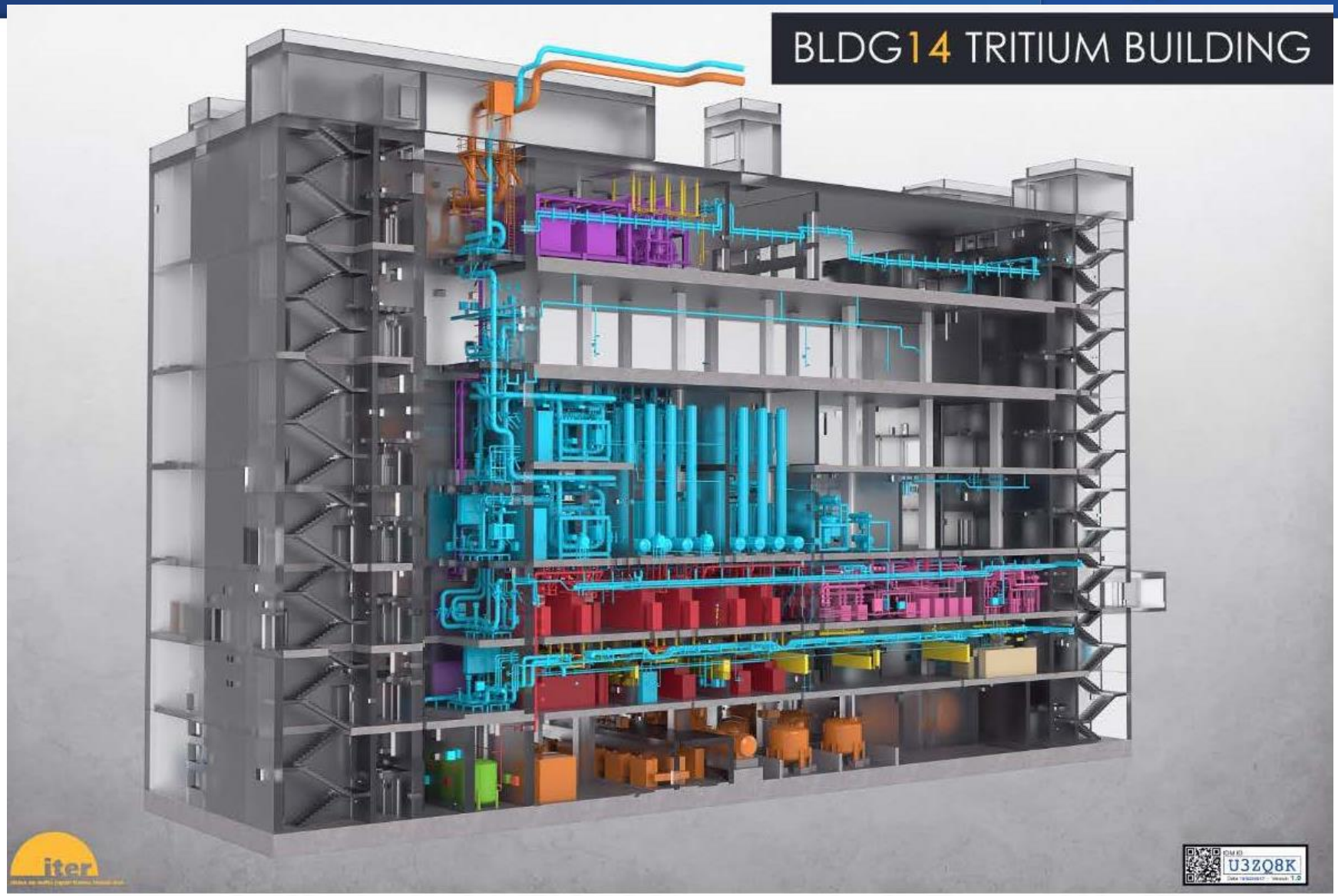
The ITER Fuel Cycle: overview

D. Babineau et alii. "Review of the ITER Fuel Cycle". Tritium conference 2010



Q_2 : mixture of hydrogen isotopes (H, D, T),
(1) Hydrogen-like gases: He, Ne, Q_2; (2) Air-like gases: CQ_4, CO, CO_2, Ar, N_2, O_2, NQ_3; (3) Water-like gases: Q_2O, hydrocarbons (CQ_4)

Tritium Plant Building Layout



I. Bonnet et alii. ITER Buisiness Forum, 2017

F4E Procurement scope for ITER Fuel Cycle: Water Detritiation System

- WDS objectives are:
  - To provide interim storage of tritiated water in Water Holding Tanks and Emergency Tanks;
  - To detritiate water and discharge detritiated hydrogen streams (oxygen is exhausted via the gas detritiation system).
- This is achieved by the **C**ombined **E**lectrolysis **C**atalytic **E**xchange method:
  - *Cracking tritiated water into **hydrogen** and **oxygen** (current design 20 kg/h@10Ci/kg);*
  - *Stripping the residual **tritium** from the hydrogen stream before its exhaust through stack.*
  - *Returning **tritium** to the Fuel Cycle via the Isotope Separation System (ISS).*
  - *Releasing **Oxygen** via Atmosphere Detritiation System (DS)*

Procurements for ITER Fuel Cycle: Water Detritiation System

Current status of procurements:

F4E

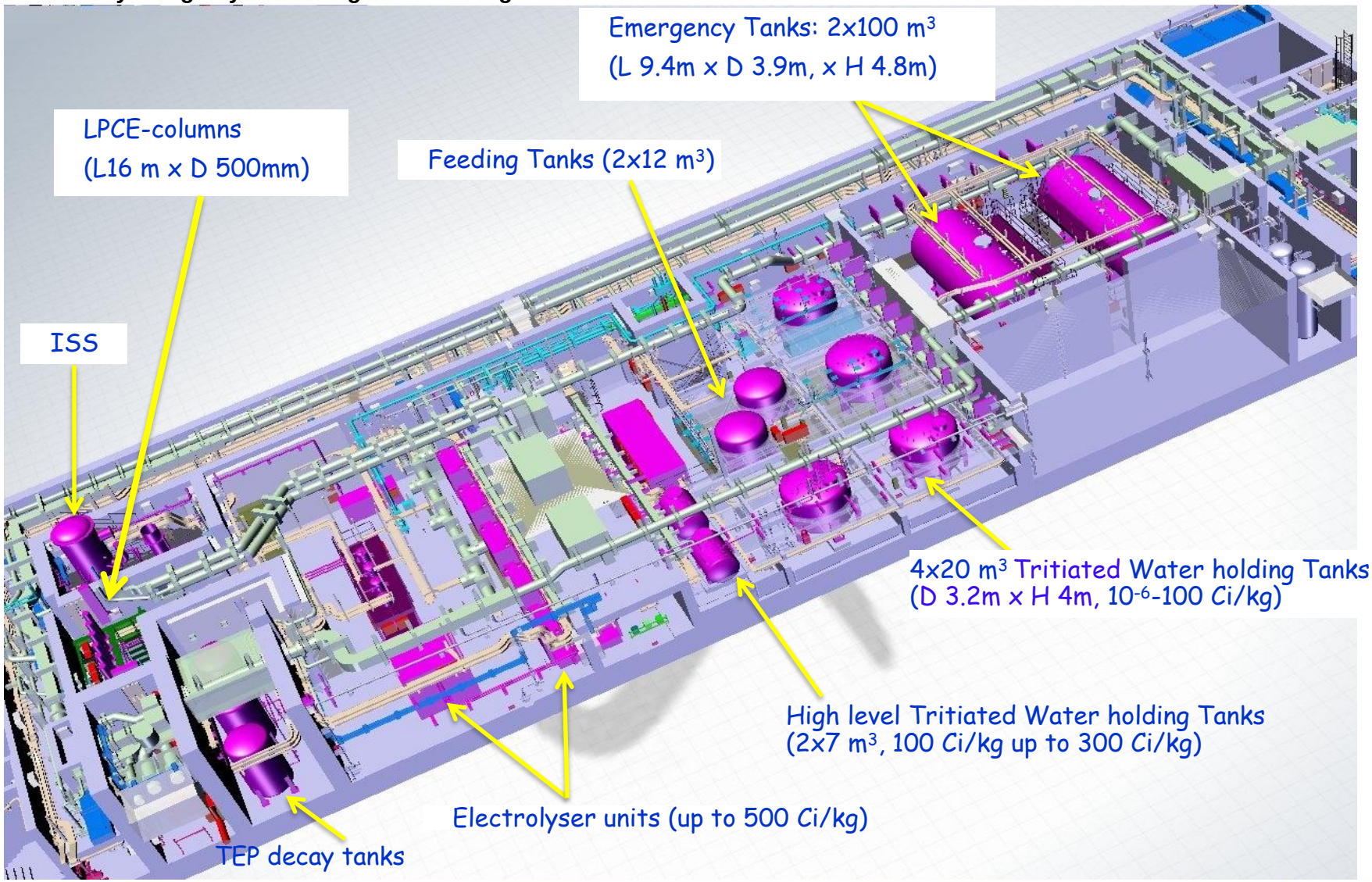
- Contracts for preliminary and final designs and manufacturing for:
  - Emergency Tanks, Water Holding Tanks, Feeding Tanks (completed 2019);
- Contract for preliminary design of WDS Main part (completed 2016)

ITER IO

- 4 year multi-Lot Engineering framework contract tender underway (Launched in 2019) with one specific Lot for WDS preliminary design support
  - Focus on providing support on outstanding specific component technical issues to reduce technical risk on core components such as electrolysers, hydrogen permeators, catalytic exchange columns…etc.

ITER WDS: System Layout (Preliminary Design)

Preliminary design by Kraftanlagen Heidelberg GmbH



ITER WDS: 100 and 20 m3 Tanks installed

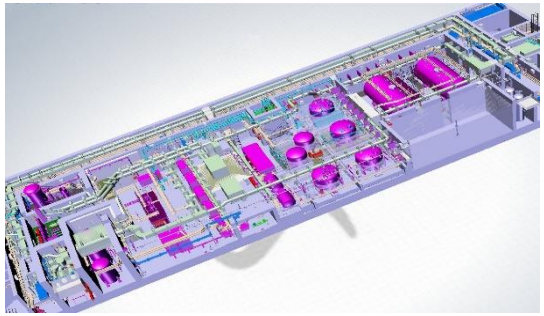
Final Design and Manufacturing by ENSA

ITER WDS: Feeding and High Tritium Level Holding tanks

Loading

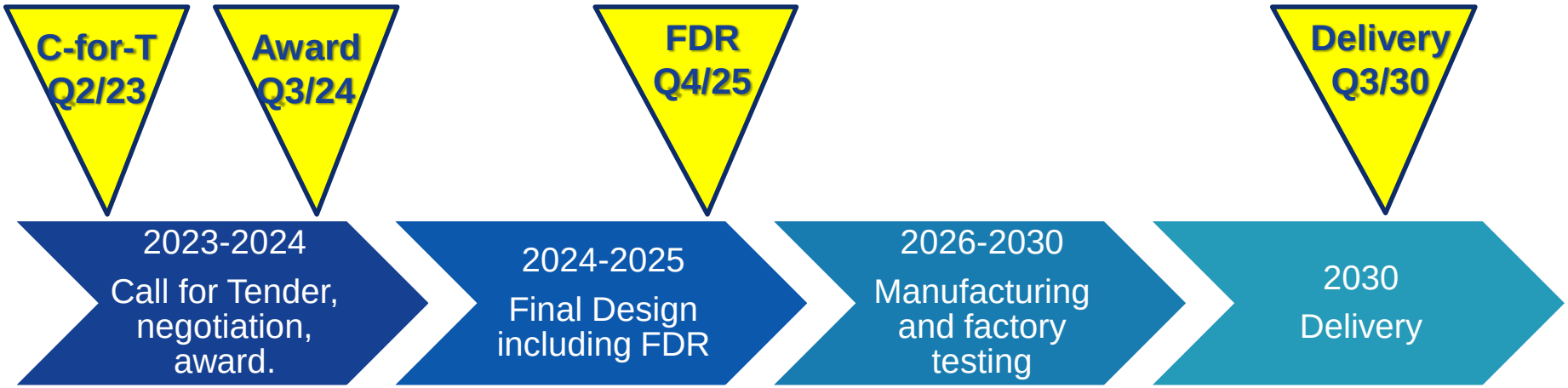
Delivery

Water Detritiation System contract 2023-2030



Scope:
- Final Design,
- Manufacturing,
- Testing, packing & delivery to ITER

Procedure: Competitive with Negotiation



Competences required:

- Chemical engineering: distillation technologies, packing/catalysts, permeators, electrolysers,
- Mechanical Engineering: manufacturing of medium/large size component, glove-boxes
- Handling of tritiated gases,

F4E Procurement scope for ITER Fuel Cycle: Hydrogen Isotope Separation System

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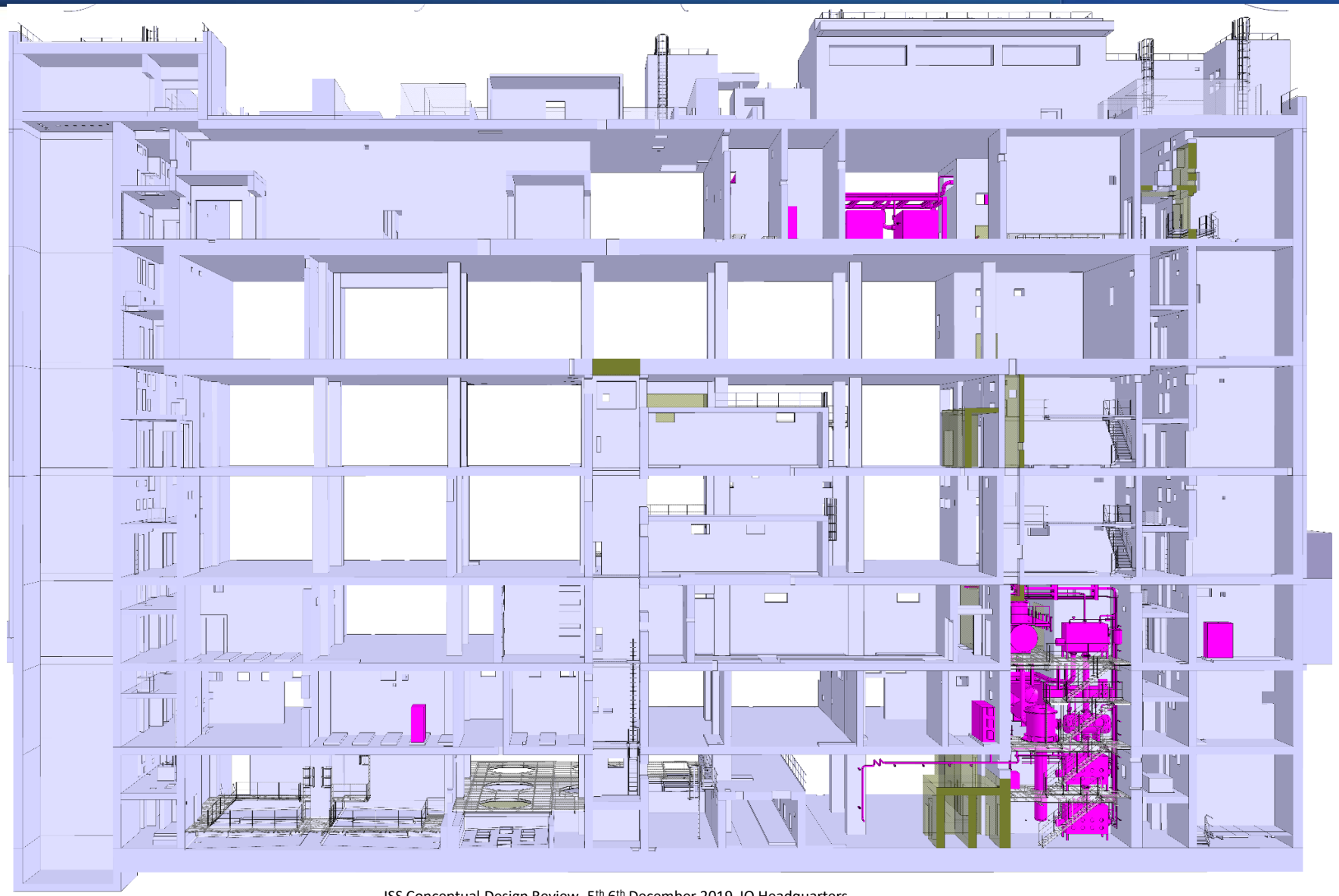
- HISS Objectives are:
  - Recycling of tritium & deuterium from ITER Tokamak exhaust;
  - Support of WDS operation by detritiation of hydrogen stream for discharge.

- This is achieved by:
  - Cryogenic distillation to ***separate the hydrogen isotope*** mixtures supplied by various ITER systems;
  - ***deliver the products*** at required hydrogen isotope quality to the Storage and Delivery System (SDS) and the WDS;

ITER HISS: location in Tritium Plant Building



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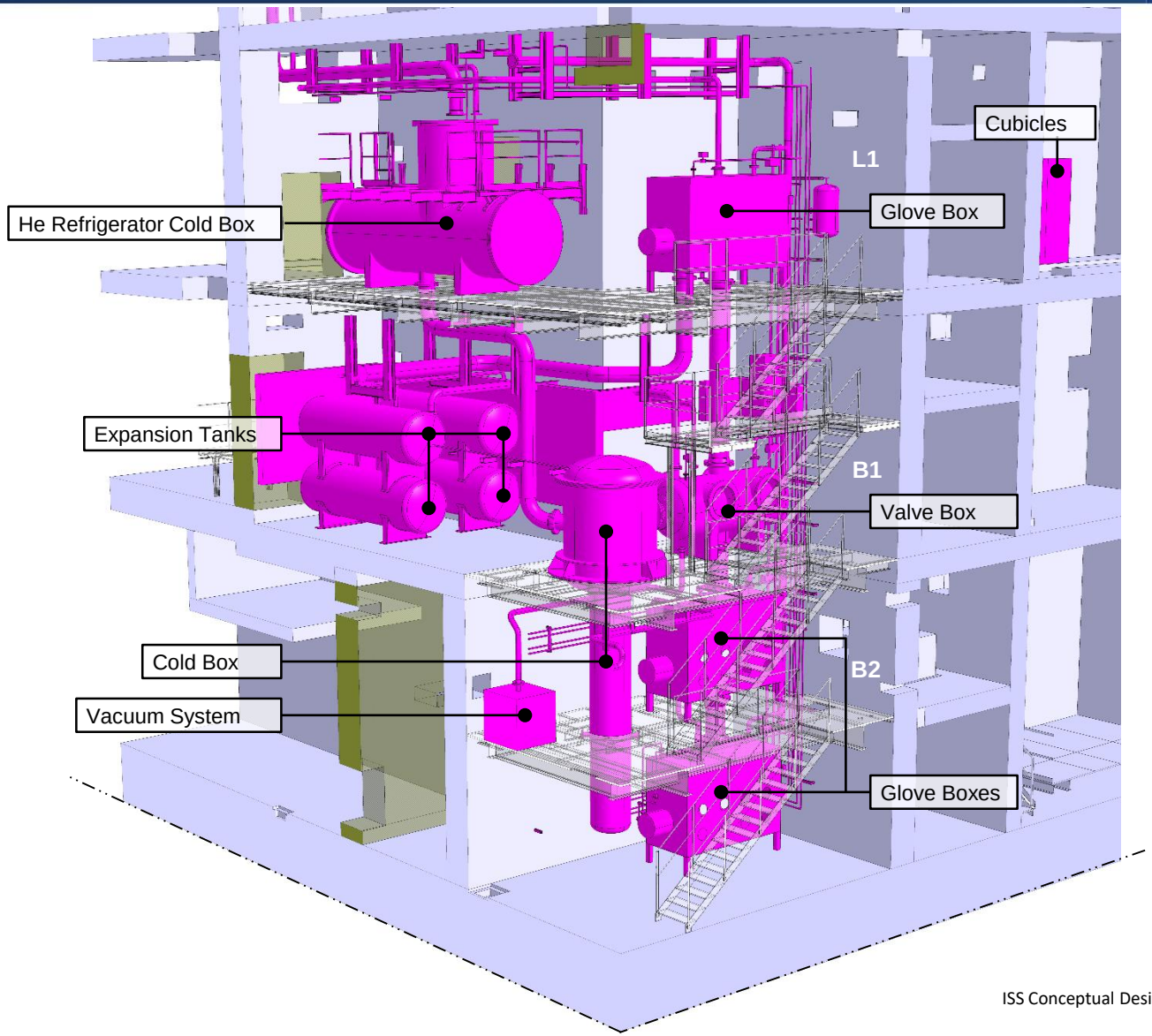
ITER HISS – Process room



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Procurement for ITER Fuel Cycle: Hydrogen Isotope Separation System

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Current status of procurement:

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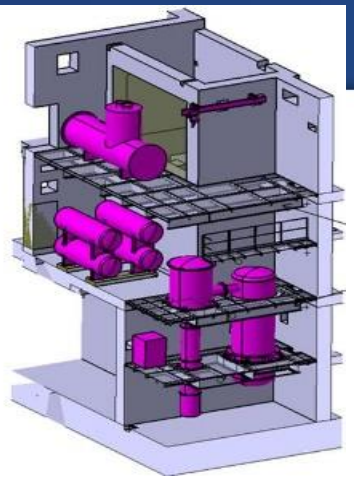
- Contracts for conceptual design of HISS completed (2019):

- 4 year multi-Lot Engineering framework contract tender underway (Launched in 2019) with one specific Lot for HISS preliminary design support

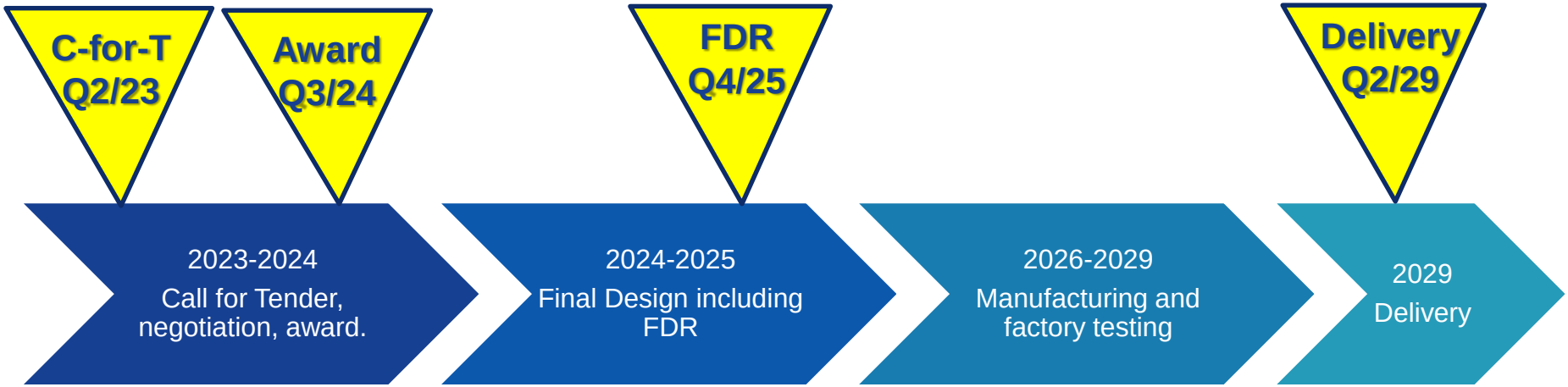
  - Focus on providing support on outstanding specific component technical issues to reduce technical risk on core components such as cryo-heat exchanger cryo-distillation columns.

Hydrogen Isotope Separation System contract 2023-2029



Scope:
- Final Design,
- Manufacturing,
- Testing, packing & delivery to ITER

Procedure: Competitive with Negotiation



Competences required:

- Chemical engineering: distillation technologies, packing, He-refrigerators,
- Mechanical Engineering: manufacturing of medium/large size component, glove-boxes,
- Handling of tritiated gases.

Hints for F4E Tenders

- Key aspects to be considered when applying for F4E procurements:
  - **F4E is an EU agency** and follows public institution financial regulations, i.e. limited flexibility in comparison with private enterprises.
  - **Competitive with Negotiation** procedure contracts are planned in the Fuel Cycle area; Invitation to Tender (ITT) are published on the EU official Journal and on F4E Website (12-15 months duration from ITT to contract signature).
  - **ITER is a Nuclear Installation** and a **first of its type facility** ⟹ very stringent safety and quality requirements ⟹ **not negligible effort/time** will be spent in:
    - documentation preparation and review;
    - development of design, manufacturing and testing with associated procedures reviews;
    - qualification of personnel with the associated documentation (SQEP);
    - Audits carried out by F4E and ITER IO but also, potentially, by French Authorities (ASN).

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