

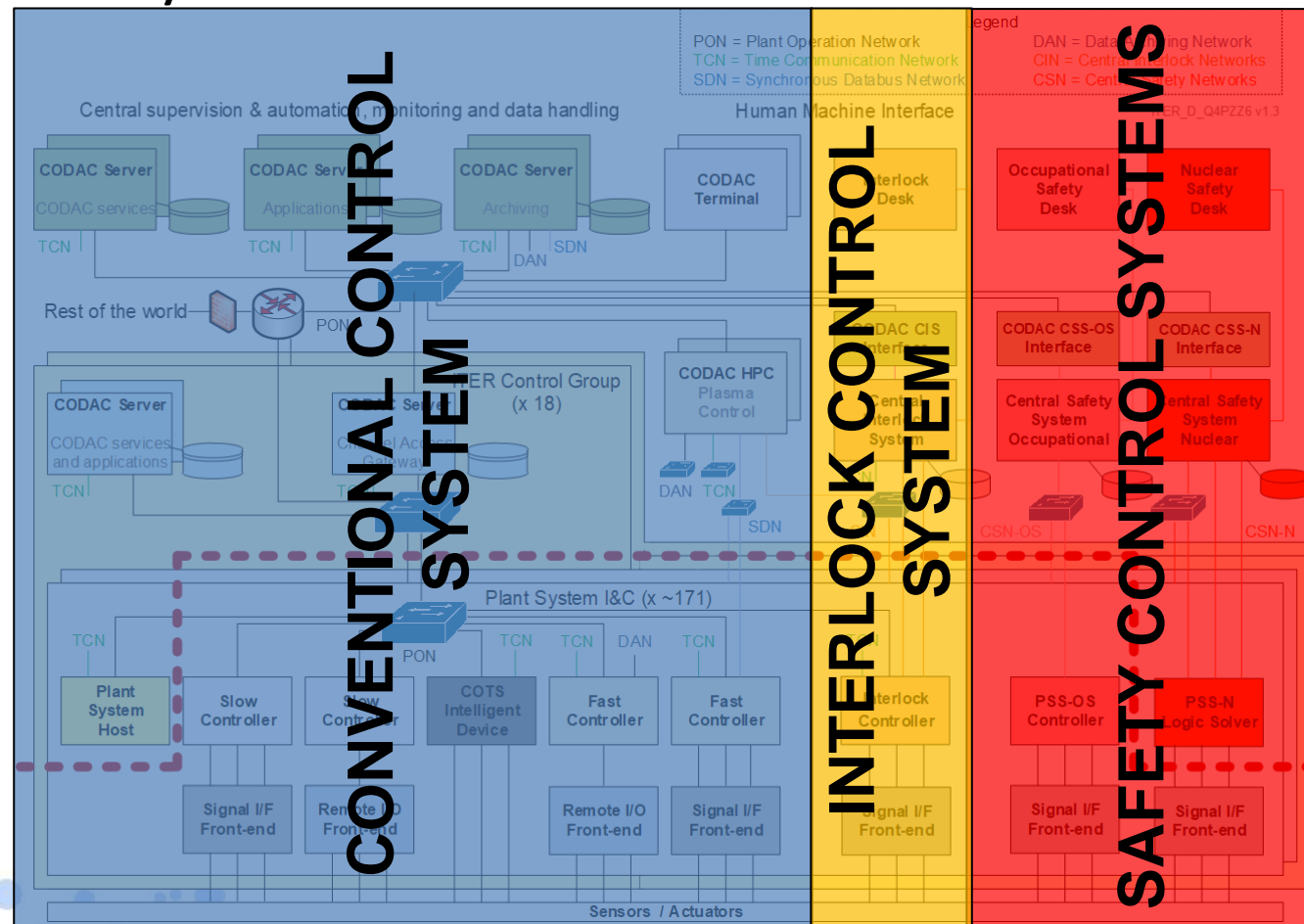
The Progress of ITER Instrumentation and Control, and Business Opportunity

Mikyung PARK
ITER Organization

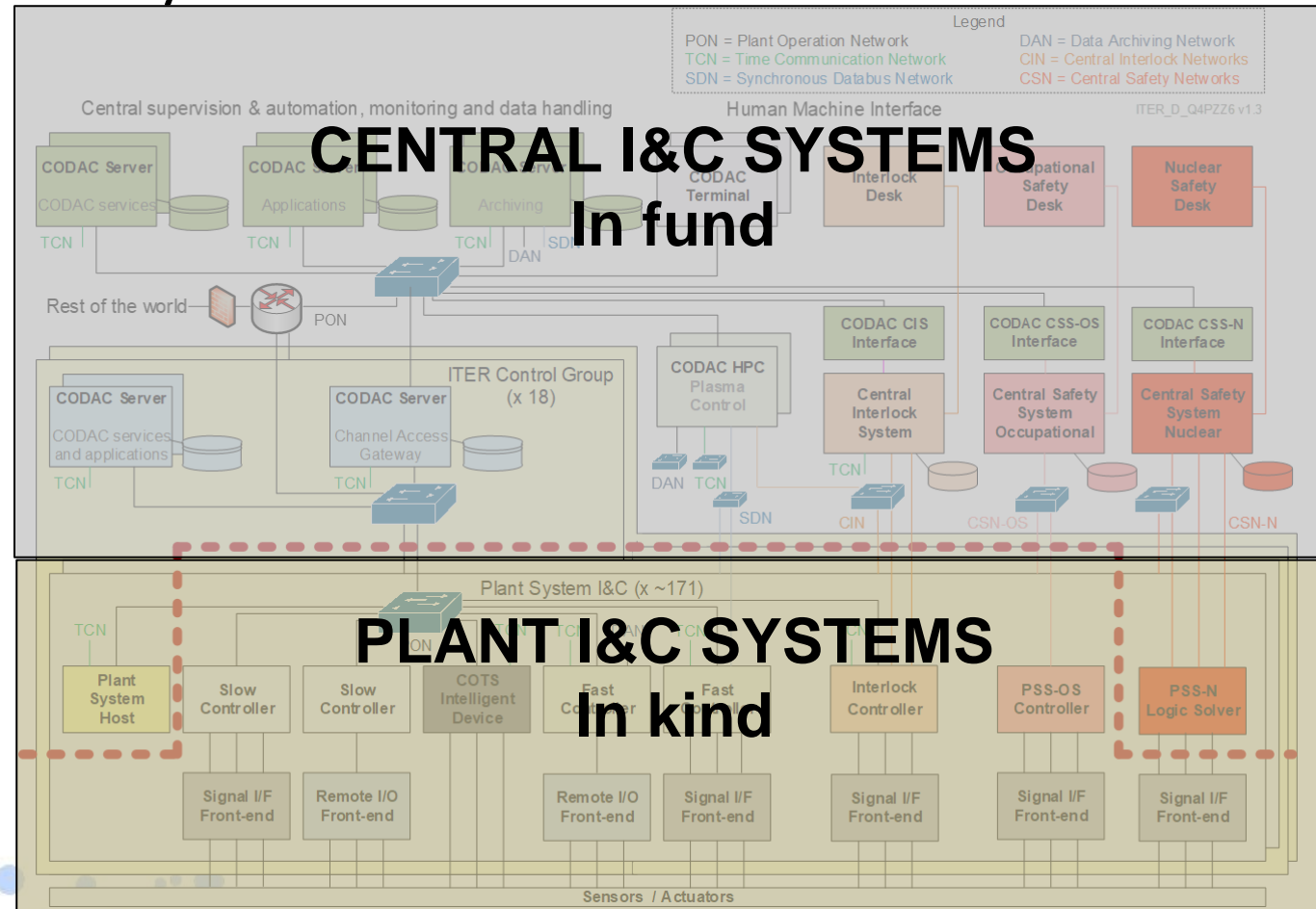
Introduction

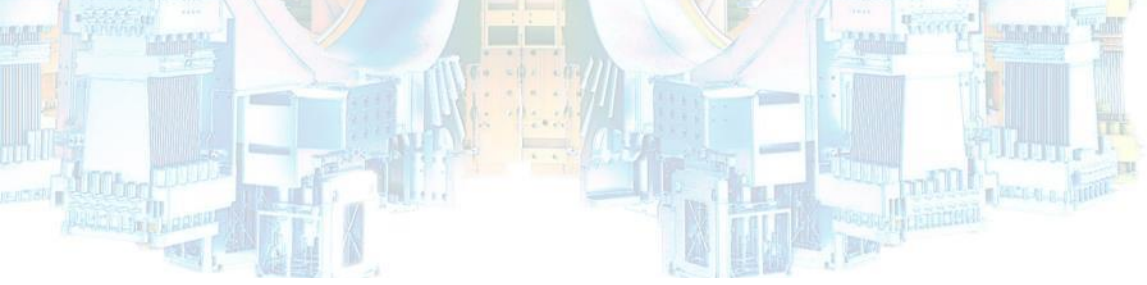


ITER Instrumentation and Control Systems are segregated in three vertical tiers and two horizontal layers.



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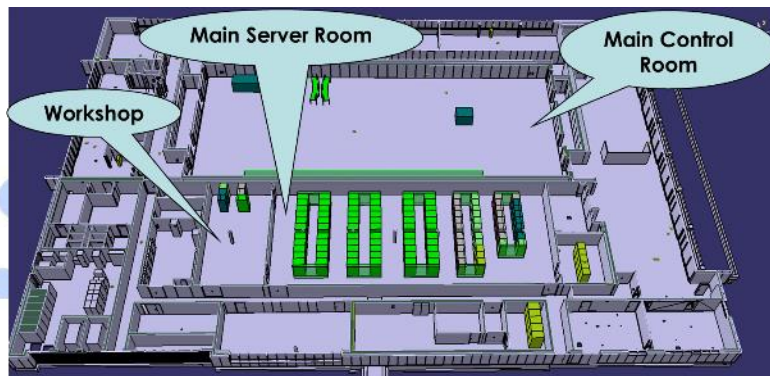
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- **CODAC (Control, Data Access and Communication)**
 - CIS (Central Interlock System)
 - CSS (Central Safety System)
 - ACS (Access Control and Security)
 - Integration of Instrumentation and Control

Standard Software Packages

- **CODAC Core System (CCS):** the base software package for developments of plant control systems
 - RHEL 8.x, EPICS, I/O Drivers, NDS, CS-Studio (Archiving, Alarm, Logging, HMI)
 - 211 software units, ~4M SLOC in total, distributed to ~65 organizations
- **CODAC Operation Application System (COA):** the application software package for Integrated Commissioning and Tokamak Operation
 - Pulse Schedule Preparation System (PSPS)
 - Supervision & Automation (SUP & AUTO)
 - Plasma Control System (PCS)
 - Data Handling
 - Remote participation

Control Infrastructure

- **Network Infrastructure:** under construction
 - ~ 350 switches, ~170 cubicles, ~180 panels, ~300km F/O, ~170km copper cables
- **Main & Back-up Control Rooms:**
 - MCR: 825m², 80 operator desks, large wall screen (24m x 4.8m)
- **Main & Back-up Server Rooms:**
 - MSR: 400m², network core devices, servers, storage, CIS, CSS-OS, PCS



Service Contract for Software Maintenance and User Supports

- Scope:
 - CODAC Core System User Support: help desk, training course
 - Software Maintenance: bug fixes, QA, testing
 - Control System Studio: bug fixes, QA, integration supports
- Value of Contract: Cost Range 'B - C'
- Contract Status: on-going
- Call for new tender: Q4-2024

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR

Engineering Service Contracts for CODAC Operation Application

- Scope: Implementing, testing, commissioning, maintenance
 - Lot 1: Supervision & Automation System (SUP & AUTO), Pulse Schedule Preparation System (PSPS)
 - Lot 2: Real-time Framework (RTF), Plasma Control System (PCS)
- Value of contract: Cost Range ‘C’
- Contract Status: on-going (3years + 2years opt.)
- Call for new tender: Q3-2024 (or Q3-2026)

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR

Engineering Service Contract for Remote Participation Application

- Value of contract: Cost Range ‘A’
- Contract Status: on-going
- Call for new tender: Q1-2025

Engineering Service Contract for Data Handling System

- Value of contract: Cost Range ‘A’
- Contract Status: on-going
- Call for new tender: Q2-2025

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Procurements of Equipment and Servers in CR and SR

- Scope:
 - Servers, storage systems, operator terminals, wall display
 - Supply, installation, testing and maintenance
- Status: BoM ready
- Value of contract: Cost Range ‘C’
- Call for tender (and/or procurement): 2024

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Service Contract for Maintenance of Control Infrastructure – IT Global Support

- Scope: management of applications, service desk, System Admin, management of infrastructure, on-call
- Value of contract: Cost Range ‘D’ (CODAC: ‘B’)
- Call for new tender: Q4-2022 (5 years)
- Contract Owner: IT (+ CODAC)

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR

Procurements of SDCC (Scientific Data and Computing Center) Hardware

- Scope:
 - Servers, storage systems, networks
 - Supply, installation, testing and maintenance
- Status: BoM in preparation
- Value of contract: Cost Range ‘D’
- Call for tender (and/or procurement): Q3-2023
- Contract Owner: IT

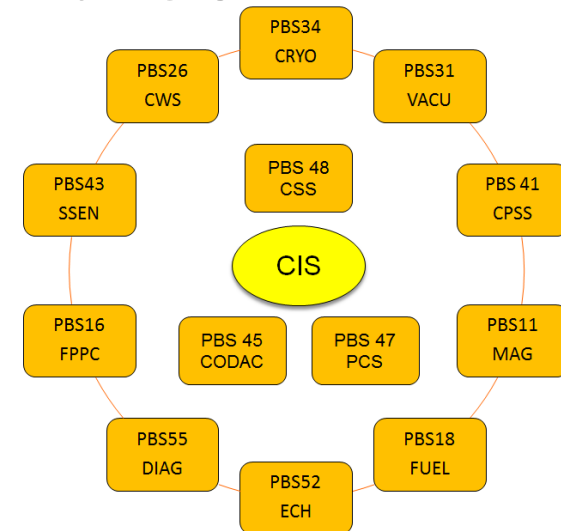
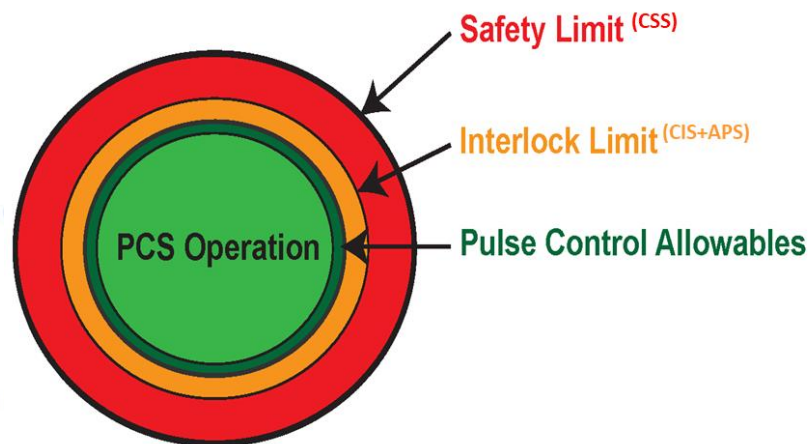
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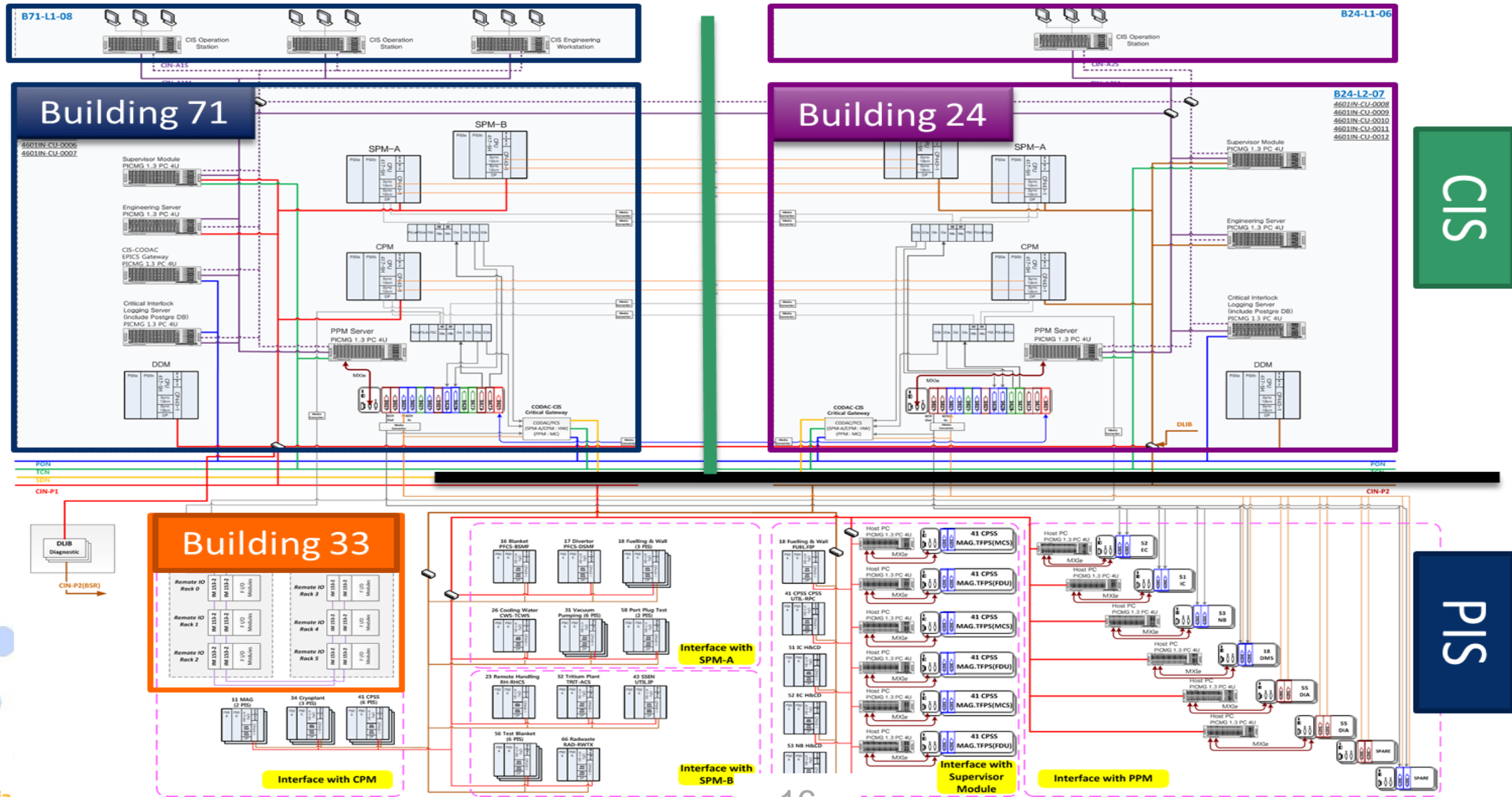
Central Interlock System (CIS)

- **Protects the machine** against **failures** of the plant system components or **incorrect** operation
- Ensures that no **failure** of the conventional ITER controls can lead to a **serious damage** of the machine integrity or availability
- Central Interlock System (CIS) and 40+ Plant Interlock Systems (PIS)
- PIS under deployment and being integrated with CIS



Central Interlock System (CIS)

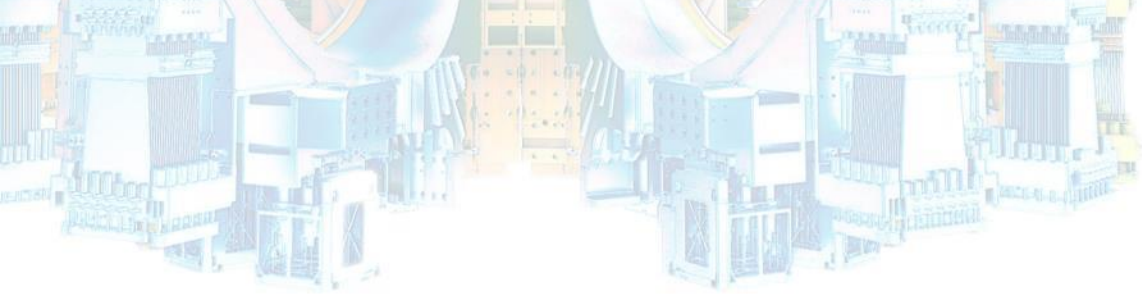
Overall Architecture



Engineering Service Contract for CIS Fast Architecture

- Scope:
 - Design and implementation of Advance Protection System (APS)
- Value of contract: Cost Range ‘A’
- Call for new tender: Q1-2023

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR



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Central Safety System (CSS)

– CSS-N

- Support ITER safety functions: confinement, prevention of radiation exposure
- ~300 safety functions, 40k+ signals, interface with 23 PBSs
- SIC architecture in two trains
- 37 cubicles, 2 operator desks, 2 crisis desks for First Plasma

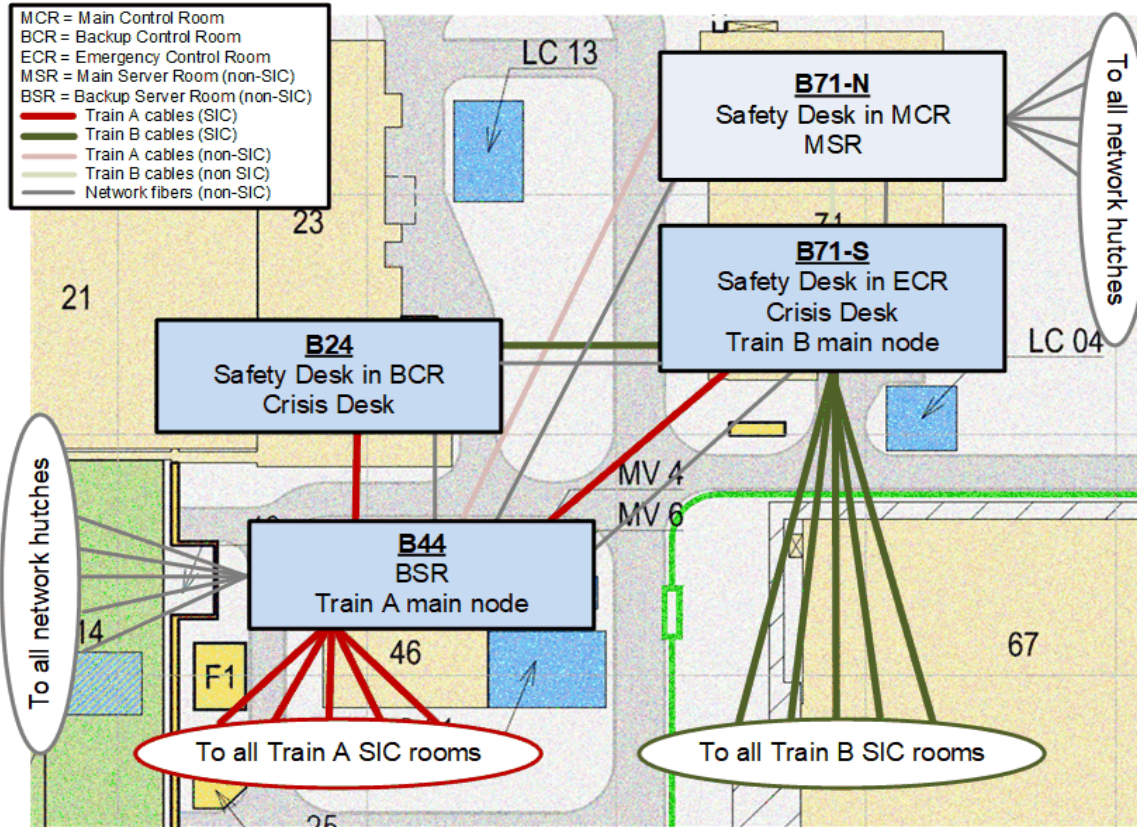
– CSS-OS

- Protect personnel against non-nuclear hazards (Laser safety, oxygen deficiency, protection against RF leak)
- Staged implementation

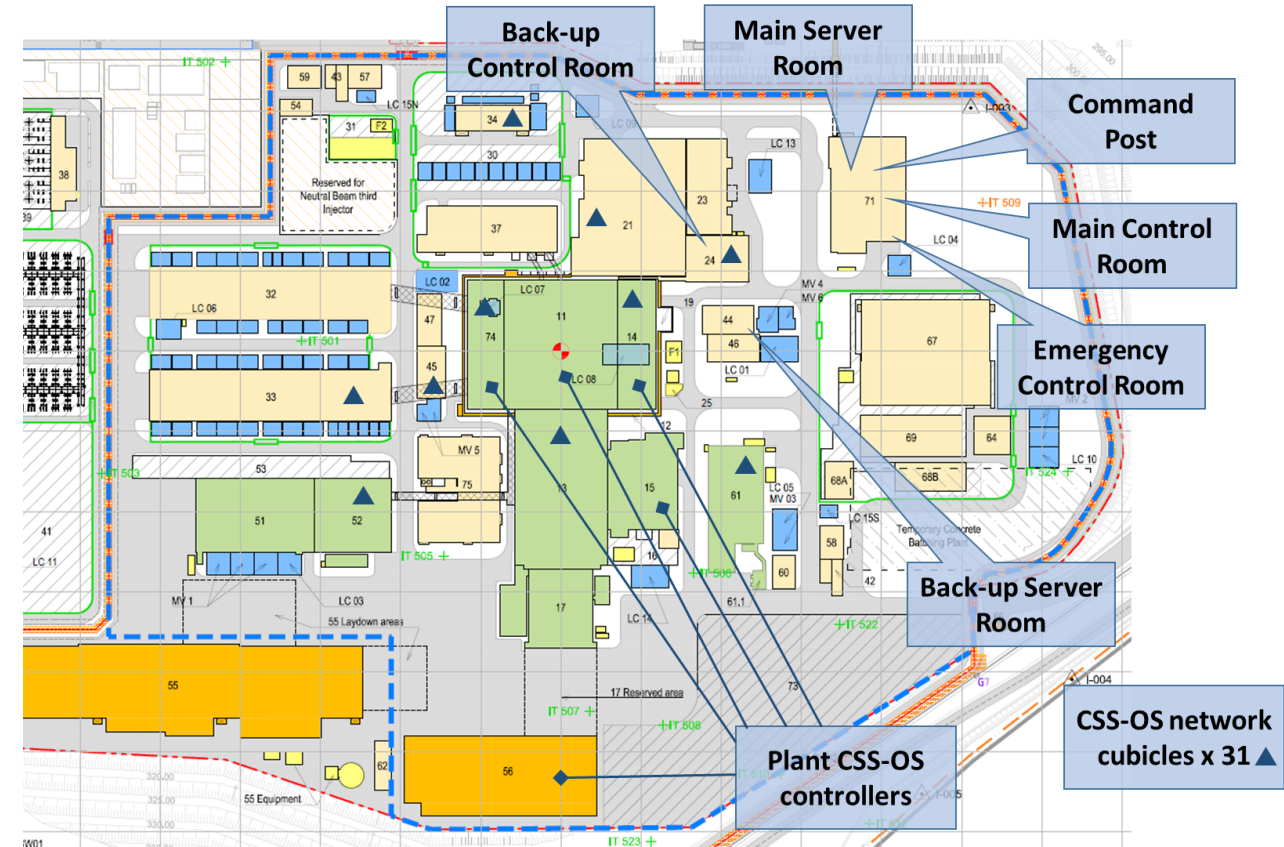
Central Safety System (CSS)

System Layout

CSS - N



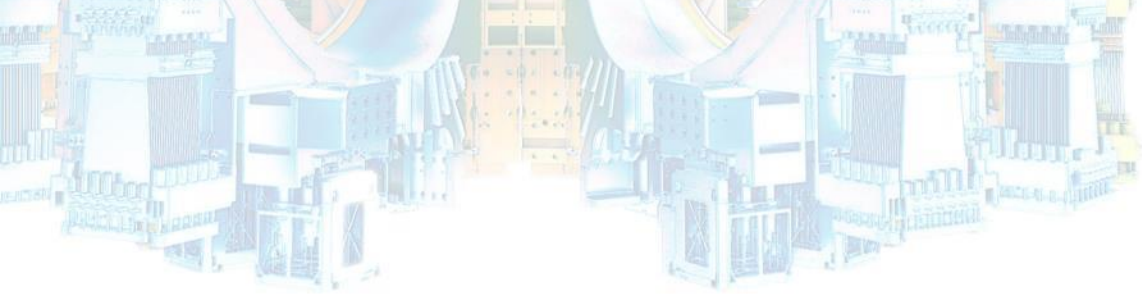
CSS - OS



Service (+ Supply) Contract for Site-wide Fire Monitoring System by CSS-OS

- Scope:
 - Building local CSS-OS cubicles for fire system interface
- Value of contract: Cost Range ‘B’
- Call for new tender: Q4-2022

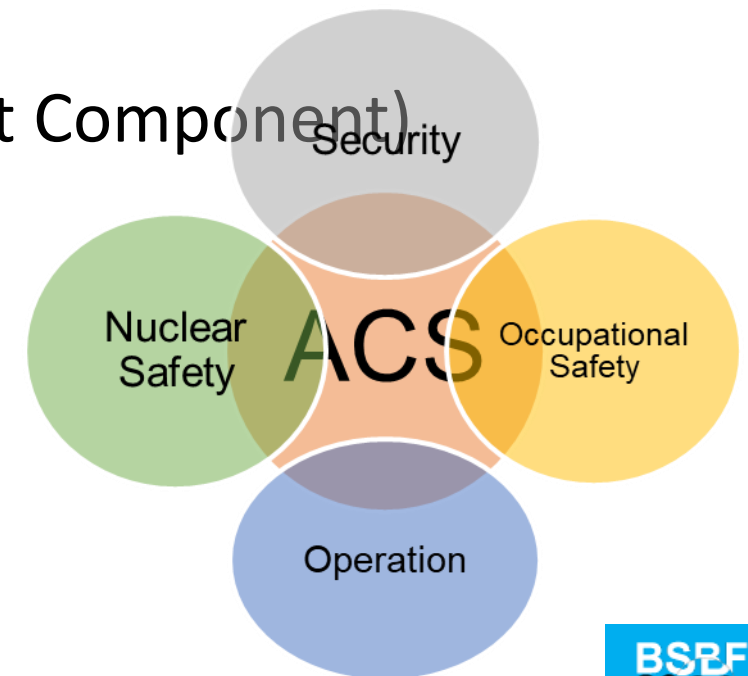
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Access Control & Security (ACS)

- To provides for the safety of personnel
 - access to hazardous only if certain protective conditions are satisfied
 - access to suitably qualified personnel
- Physical Protection of the ITER plant, protection of assets
- 12 sub systems, 6 being PIC (Protection Important Component)
- In all buildings
- About 5000 devices in the field
- Interfaces with ITER site legacy systems



Access Control & Security (ACS)

– First Plasma (FP)

- Access Control / Intrusion detection / Video Surveillance
- Emergency phones / Public Address
- Tokamak Emergency Buttons (PIC) / High Security Fence

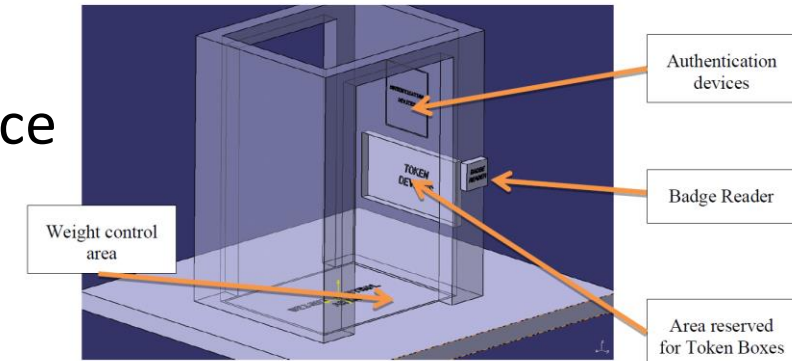
– Pre Fusion Power Operation-I (PFPO-I)

- Alerting signals in nuclear buildings (PIC)

– Pre Fusion Power Operation-II (PFPO-II)

- Access Control / Intrusion detection / Video Surveillance
- Unicity Enforcing Device (UPED) for safety purpose (PIC)
- Sound Powered Phones (PIC) / Site sirens (PIC) / Radios network system (PIC)

– Security and COM systems currently under deployment



Construction of Early Security Fence

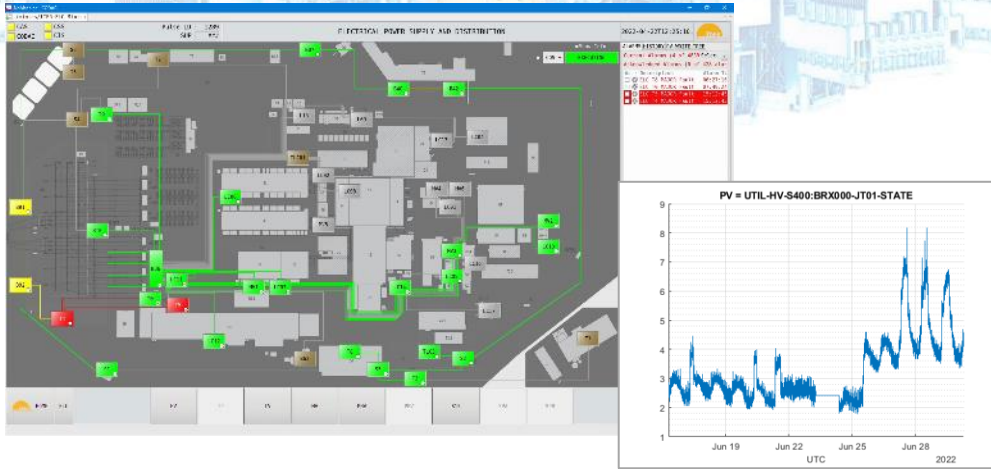
- Scope:
 - Early Security Fence: anti-intrusion fences, detection systems, civil work, gates
 - Design, procurement, installation, validation, commissioning
- Value of contract: Cost Range ‘C’
- Call for tender (and/or procurement): Q2-2023

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Electrical Distribution

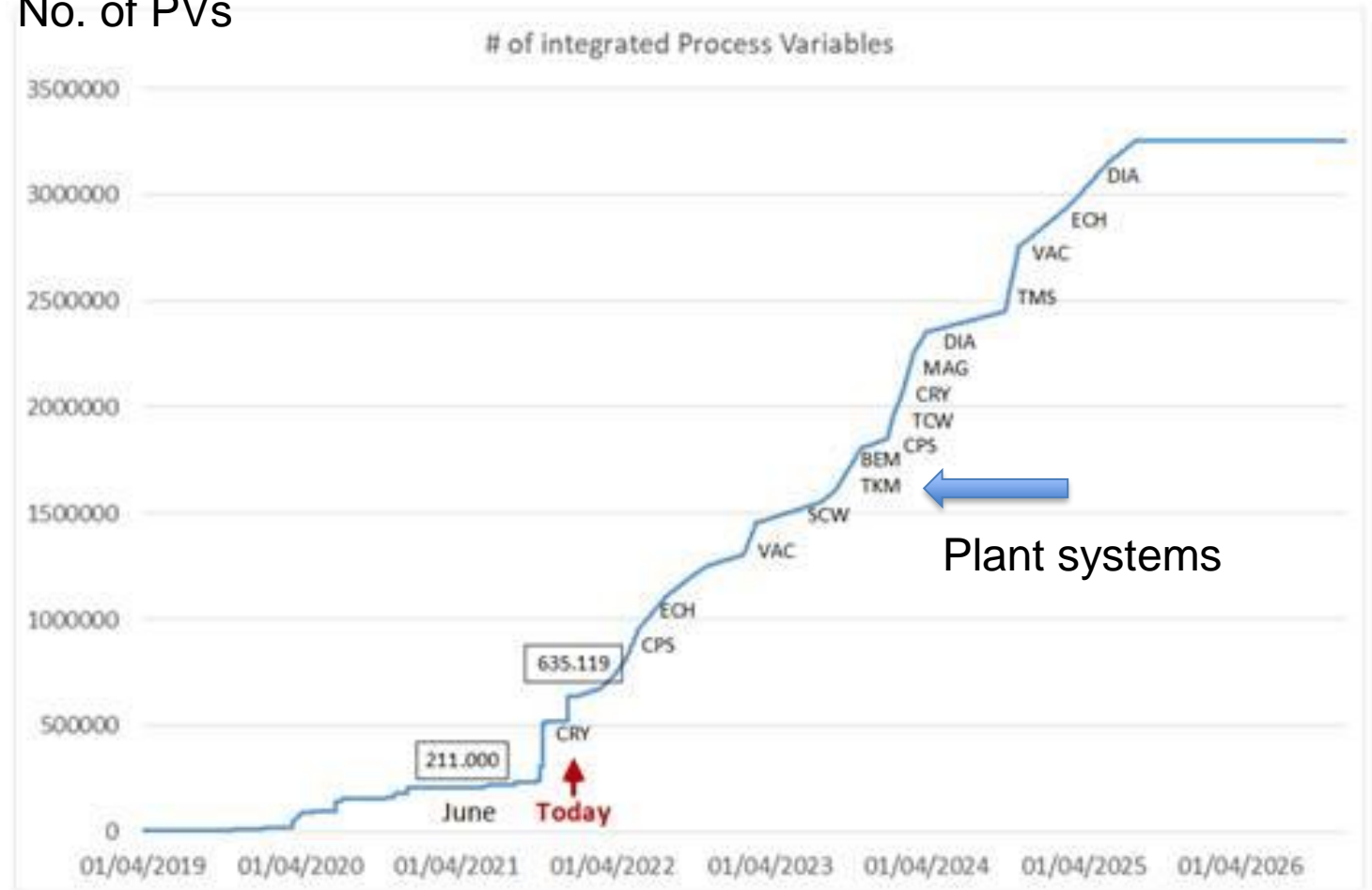


Secondary Cooling Water



Forecast (as of Apr-2022)

No. of PVs



Service Contract for Integration and Commissioning of ITER Control System

- Scope:
 - Validation, deployment, integration, maintenance of I&Cs
- Value of contract: Cost Range ‘B’
- Contract status: on-going
- Call for new tender: Q1-2024

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR

I&C Integration – Opportunity [2]

Service Contract for I&C Design and Integration Support

- Scope:
 - Design, implementation, validation, integration of I&Cs
- Value of contract: Cost Range ‘B’
- Call for new tender: Q2-2023

* Cost Range: **A** 300,000 – 2,000,000 EUR / **B** 1,500,000 – 5,000,000 EUR / **C** 4,000,000 – 12,000,000 EUR / **D** Above 10,000,000 EUR

Service Contract for Instrumentation and Control (I&C) Cubicles Maintenance

- Scope:
 - Maintenance of Instrumentation & Control (I&C) cubicles for conventional, investment protection, access control systems and occupational safety systems
- Value of contract: Cost Range 'B'
- Contract Status: on-going (3years + 2years opt.)
- Call for new tender: Q4-2024 (or Q4-2026)

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