



# WPSA Operations Area Activities in 2021

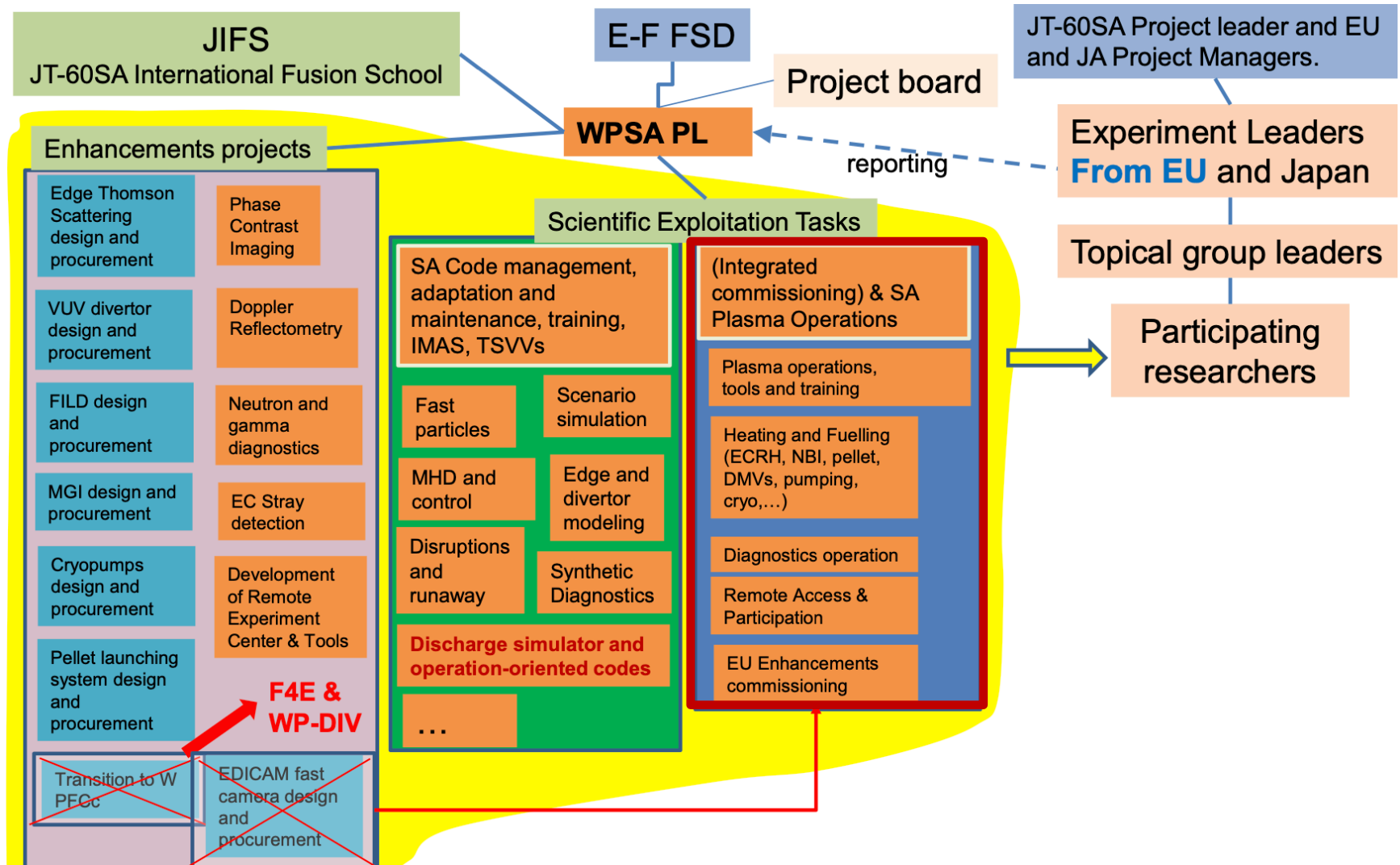
**E. Belonohy**

**WPSA Operations Area Coordinator**

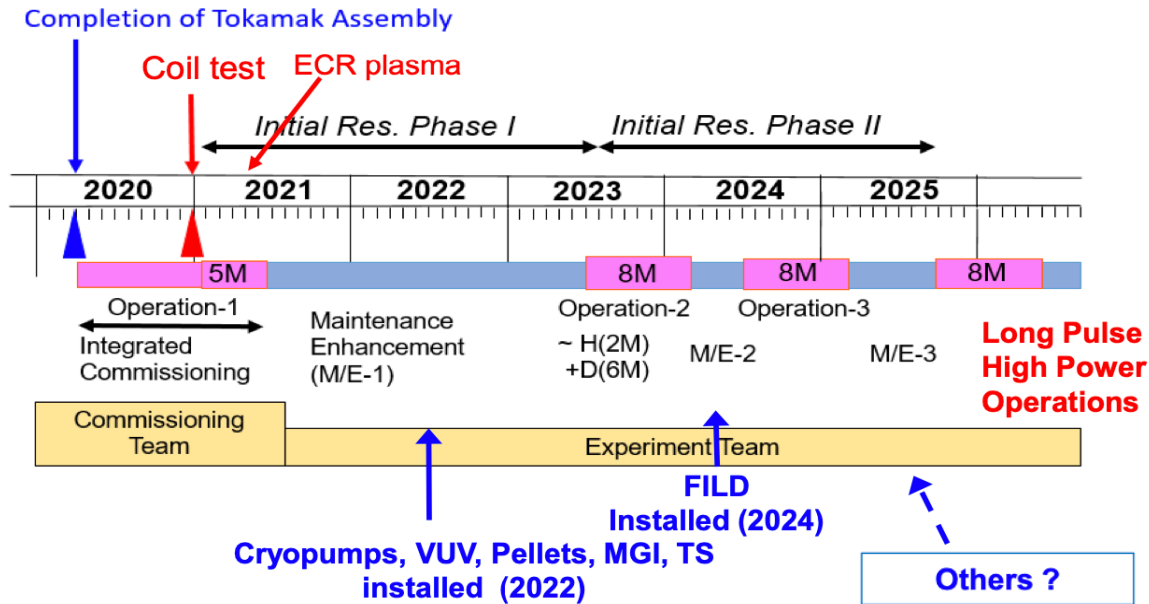


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# WPSA in FP9



# JT-60SA 2021-25 timeline



Activity	Call	Lead by
Integrated Commissioning 2020 - June 2021	Call for Participation 2019	EU Coordination Team (E. Joffrin, G. de Tommasi, E. Belonohy)
FP9 Operations Activity 2021-25	Call for Participation 2020	WPSA Operations Area Coordinator (E. Belonohy)
FP9 Scientific Exploitation 2023-25	At a later date closer to the campaigns	JT-60SA Experiment Leaders (J. Garcia)



Impact of the coil repair not yet known on the Integrated Commissioning timeline. Continuation and completion of the integrated commissioning beyond June 2021 to be discussed.

## **Continuation of activities started in the Integrated Commissioning 2020-21 following its completion will be transitioned into multiple WPSA areas:**

- Code Management - modelling, operational tool development
- Enhancement - upgrade, significant modification
- Scientific Exploitation – use in dedicated experiments, data analysis
- **Operations** – preparation and support of operational activities including control room work



## **Continuation of the activities started in the Integrated Commissioning**

- EDICAM camera
- Wall conditioning
- Plasma Operations
- Equilibrium Control

## **Control room support**

- Plasma Operations (operations experts and session leaders)
- Real-time Experts
- Diagnostic Experts

## **Commissioning and operations of current (and future) EU enhancements**

- Divertor cryopump system
- TS, VUV, FILD diagnostics
- Massive Gas Injection
- Pellet system

## **Commissioning and operations support of QST enhancements**

- Negative NBI and ECH systems

# WPSA Operations Activities in FP9



Define task and deliverable for 2021 (1-2pm per activity)

Activity	2021	2022	2023	2024	2025
Cryo and Magnets	Review coil energisation in the integrated commissioning, analyse lessons learned and support EEG on magnets.	Review coil energisation in the integrated commissioning, analyse lessons learned and support EEG on magnets.			
EDICAM operation	Review operational experience from the integrated commissioning	update where needed	diagnostics operation	diagnostics operation	diagnostics operation
Plasma Operations	Review the operational experience of the integrated commissioning in 2021	Train and contribute to plasma operation preparations	Train and contribute to plasma operations	Train and contribute to plasma operations	Train and contribute to plasma operations
Real-time Networks	Consider tools for JT-60SA based on integrated commissioning experience	Learn about the RT networks at JT-60SA. Develop / integrate suite of tools for JT-60SA	Develop RT networks and support operation	Develop RT networks and support operation	Develop RT networks and support operation
Wall conditioning	Review vacuum conditioning and the ECWC in 2021 from the operational aspect	Contribute to preparation of vacuum conditioning for the 2023 campaign	Monitor wall condition and contribute to operation of ECWC	Monitor wall condition and contribute to operation of ECWC	Monitor wall condition and contribute to operation of ECWC
Diverter Cryo operation		Installation and test	Commissioning and operation, training of resident staff	Commissioning and operation, training of resident staff	Commissioning and operation, training of resident staff
ECH		prepare for operation	Support operation	Support operation	Support operation
NBI			Support operation	Support operation	Support operation
Edge Thomson Scattering		Installation	Installation / commissioning	diagnostics operation	diagnostics operation
VUV operation		Installation	Installation / commissioning	diagnostics operation	diagnostics operation
FILD operation				Installation / commissioning	diagnostics operation
Massive Gas Injection			Installation / commissioning	operation	operation
Pellet Launching System			Installation / commissioning	operation	operation

Start discussion in EU to enable discussions with F4E and QST



## Continuation of the activities started in the Integrated Commissioning

- Cryo and Magnets
  - EDICAM camera
  - Wall conditioning
  - Plasma Operations
  - Equilibrium Control
- Discussion planned in April 2021
- WPSA PPM

## Control room room support

- Plasma Operations
  - Real-time Experts
  - Diagnostic Experts
- WPSA PPM

## Commissioning and operations of current (and future) EU enhancements

- Divertor cryopump system
  - TS, VUV and FILD diagnostics
  - Massive Gas Injection
  - Pellet system
- Joint WPSA PPM sessions with the project leaders

## Commissioning and operations support of QST enhancements

- Negative NBI and ECH systems
- Discussion planned in April 2021



## Continuation of the activities started in the Integrated Commissioning

- Cryo and Magnets
- **EDICAM camera**
- **Wall conditioning**
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## Commissioning and operations support of QST enhancements

- Negative NBI and ECH systems





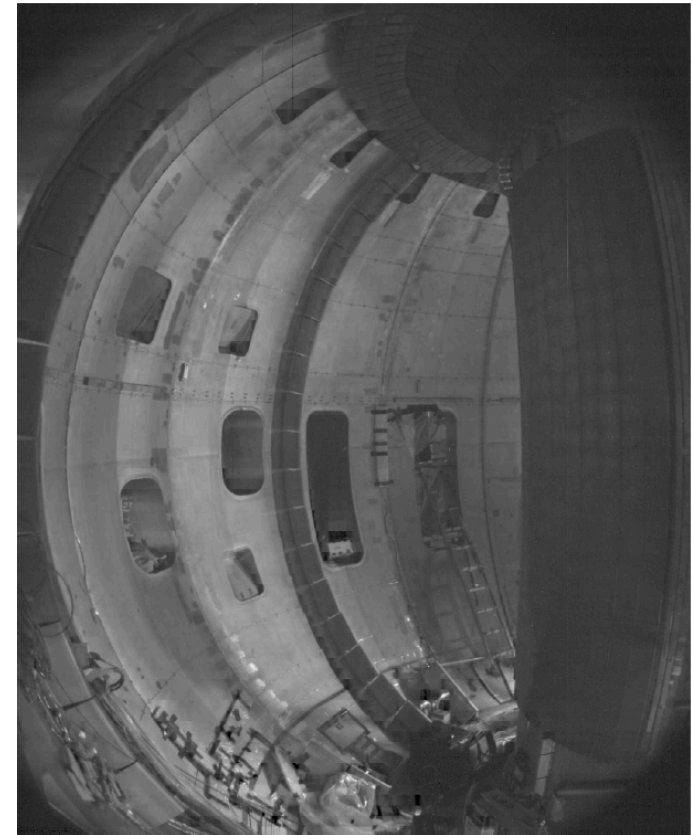
## Integrated Commissioning activities:

- EDICAM installed and commissioned on JT-60SA
- Camera is ready and operational waiting to be used on GDC, EC, ECWC or tokamak plasmas,
- Weekly vacuum inspection requires weekly movement and recalibration of the camera.

Talk: T. Szepesi (Tuesday, 16/3/2021 at 16.00)

## Activities in 2021:

- Procurement of spare optics (agreed) – FP8
- Procurement of new receiver card (to be discussed in April 2021) – FP8
- **Operations activity:** Review of the installation, commissioning, performance, operational experience of 2019-2021 in view of the future operations and future EU enhancements + discuss and propose solution to the weekly vacuum window checks.



## Deliverable in 2021:

Report and presentation on the installation, commissioning, performance and operation of EDICAM



## FP9 Code Management Activities:

- Camera tomography tool developed in python and calibrated to EDICAM – ready to be used.
- Code benchmarked on TCV and COMPASS plasmas
- Consideration to use the QST visible cameras

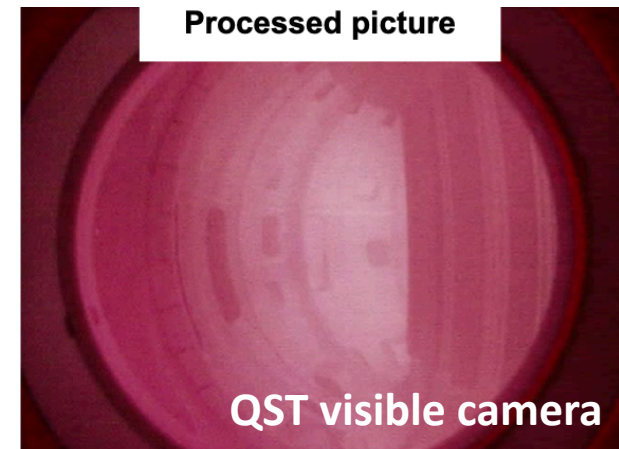
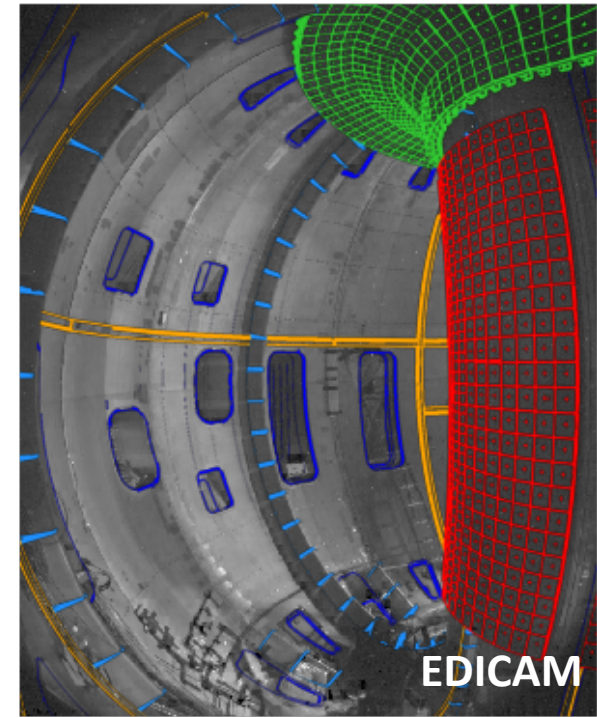
Talk: J. Cavalier (Wednesday, 17/3/2021 at 15.00)

## Operations Activities in 2021 :

- Install code on the Naka server and apply the camera tomography tool on JT-60SA to the EDICAM camera for EC, ECWC and tokamak plasmas to aid the optimization of wall conditioning techniques and provide input into modelling.

## Deliverable in 2021:

- Report on the use of the camera tomography tool on EDICAM for the wall conditioning and first plasma.





## Integrated Commissioning Activities:

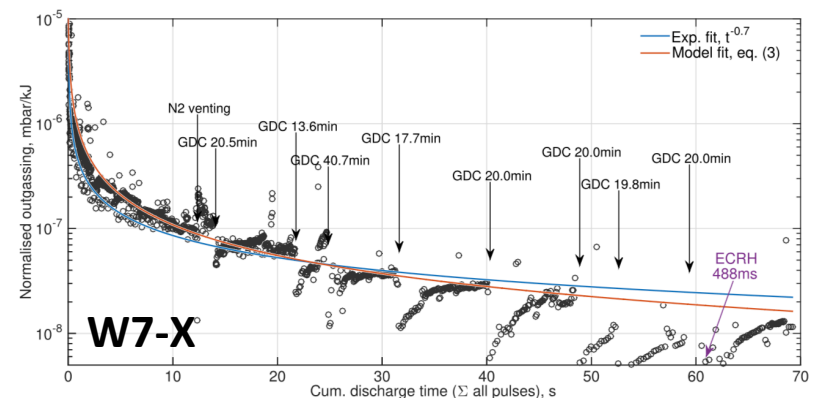
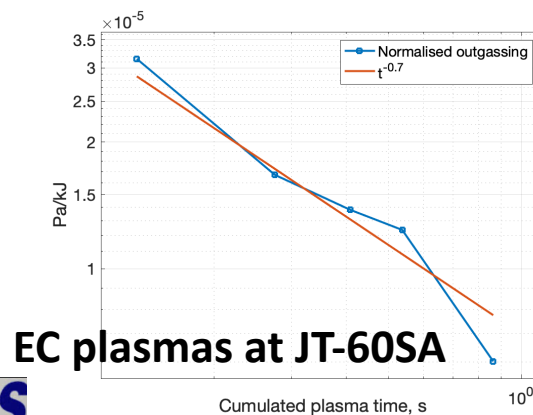
- Modelling of JT-60SA plasma using TOMATOR
- Share EU experience and support creation of the JT-60SA wall conditioning strategy
- Direct support to QST on the optimization of GDC and ECWC operation

## Operations activities in 2021: Talk: T. Wauters (Wednesday, 17/3/2021 at 14.00)

- Review the wall conditioning experience in 2021 (GDC, ECWC, EC), establish the role and performance of the individual methods as an input for the 2023 wall conditioning strategy.

## Deliverable in 2021:

- Report on the wall conditioning experience of the Integrated Commissioning phase in 2021.



# Equilibrium Control – CREATE (Italy)



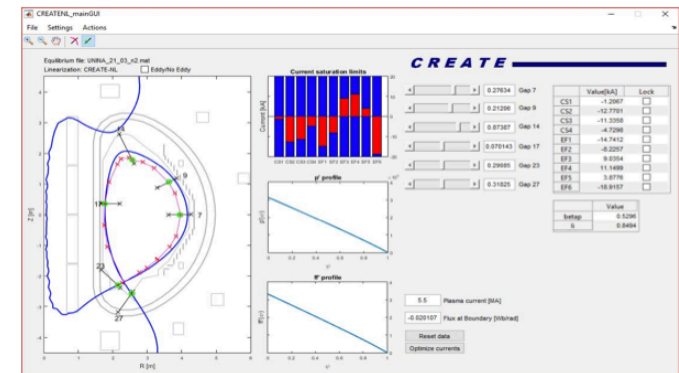
## FP8 Activities:

2D control-oriented modelling tools (CREATE-L and CREATE-NL) used to perform studies of the JT-60SA equilibrium control

CREATE tools coupled to the QST codes on plasma boundary reconstruction (CSS) and flux boundary control (FBC)

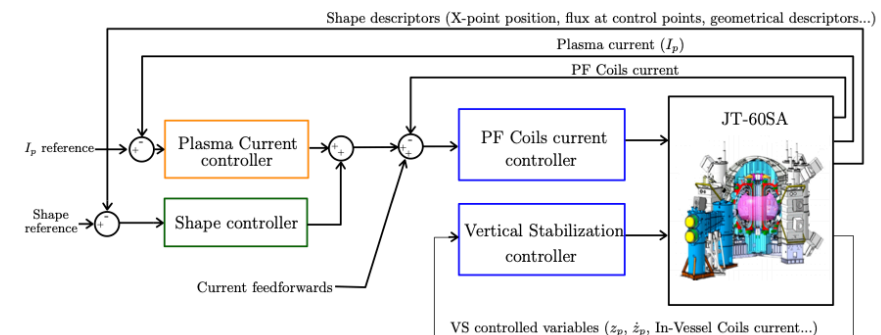
## Operations activities in 2021:

- Add the capability to generate equilibria starting from experimental data in CREATE EGENE
- Open and closed-loop plasma linear model validation
- Learn the QST tools (MECS, if not part of IC in 2021, could be done in 2022)



## Deliverable in 2021:

- Report on progress on the CREATE tools for JT-60SA



Talk: G. de Tommasi (Wednesday, 17/3/2021 at 16.00)



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## **Control room room support**

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## **Integrated Commissioning is the responsibility of QST**

EU support 2020-21 (Call for Participation of 2019)

**EU-Japan operational strategy for the commissioning and campaigns in 2023-25 has not yet been agreed. WPSA plan to start discussion with Fusion for Energy and QST in mid-2021 or after the completion of the integrated commissioning phase the EU contribution to future JT-60SA operation.**

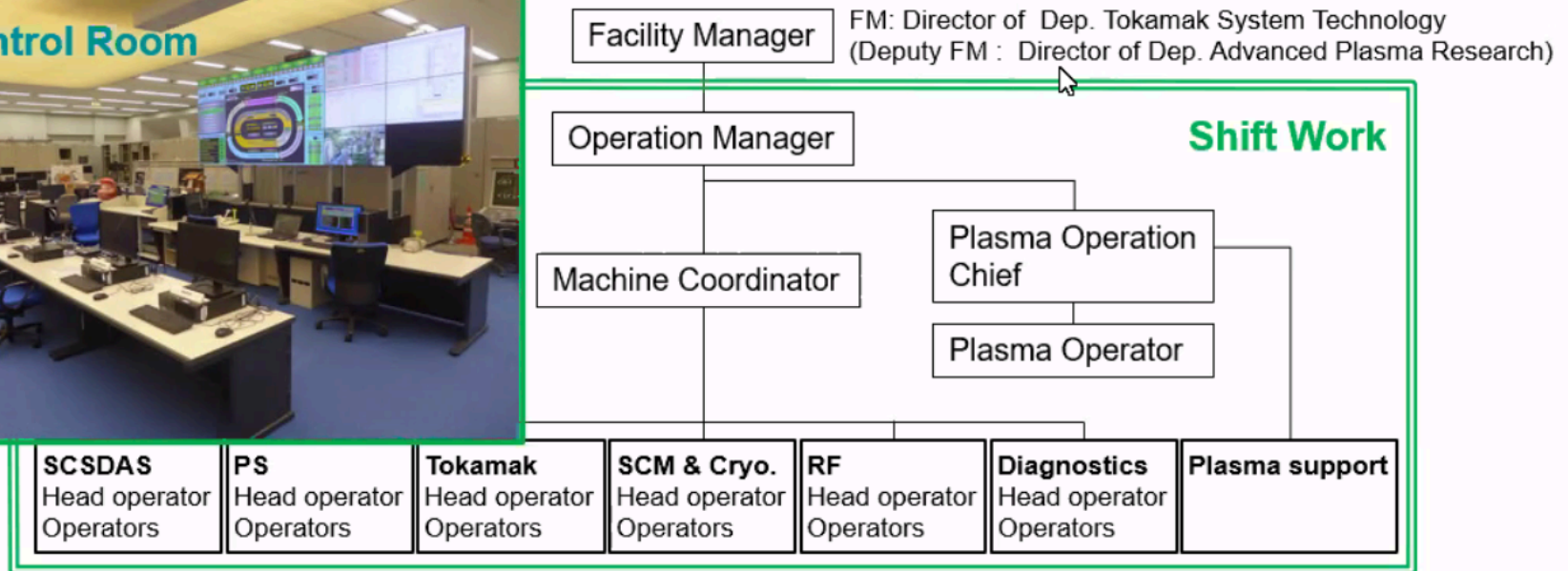
## **Preparation of the 2023-25 campaigns:**

- Share operational experience of EU facilities and learn QST tools and systems
- Consider information exchange and training with a Naka-site visit
- Training for agreed operational roles
- Consider invitation of QST experts to EU facilities (in-person or remote)
- How to overcome language barrier in the JT-60SA control room
- Understand operational processes (weekly, daily, maintenance) that have an impact on EU enhancements
- Agree on potential control room roles for EU experts (Plasma Operation Chief, plasma operator, EU diagnostic expert, real-time expert, plant systems?)





# Control Room



**Plasma Operation Chief:** Execute plasma operation and ECWC requested by **Topic Leaders**. Optimize discharge conditions and shot plan in the day considering subsystem status.

**Plasma Operator:** Program discharge conditions in Human Machine Interface (HMI) according to Plasma Operation Chief.

**Plasma Support:** Support commissioning by monitoring data and analysing data mainly according to request by Topic Leader or Plasma Operation Chief.

*Sometime "Topic leader" holds "Plasma Operation Chief" or "Plasma Operator".  
Some of Plasma Team members join in the shift work as "Plasma Support".*



## Aims:

- Provide control room support as part of the plasma support team
- Train as plasma operator, later as plasma operation chief
- Provide support in various plasma operation specific topics (share operational experience of EU facilities, provide feedback on QST topics)

## Preparation of the 2023-25 campaigns:

- Review integrated commissioning experience of 2021
- Learn to use the QST tools including the Human Machine Interface (HMI) – pulse schedule editor
- Share operational experience of EU facilities (e.g. session leading aspect, discharge editor) -> visit to Japan in 2022?

**Operations activity 2021:** Review operational experience of the integrated commissioning in 2021 and share operational experience of EU facilities.

**Deliverable 2021:** Presentation to share operational experience in local EU facility





## Aims:

- Provide control room support as part of the plasma support team
- Implement real-time networks on QST platform (developed under scientific exploitation)
- Provide support as a real-time expert (if agreed, training would be provided)

## Preparation of the operation of the 2023-25 campaigns:

- Share operational experience of EU facilities,
- Consider real-time network needs of 2023-25 based on integrated commissioning and the scientific programme planned for 2023-25
- Review and train on QST tools -> visit to Japan in 2022?

## Operations Activity 2021 (joint activity of UKAEA and IPP Prague)

- Review real-time control experience on EU facilities and consider real-time network needs and opportunities on JT-60SA (based on available diagnostics and scientific exploitation needs)

**Deliverable 2021:** Report on the current understanding of JT-60SA real-time network needs and opportunities.



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## Joint session on the installation, commissioning and operation of EU enhancement project:

- **Onsite support.** Installation, work in the torus hall and labs are expected to be conducted by Japanese personnel (QST or seconded).
  - Mainly EU expert in supporting/supervisory role in Japan
  - Explore possibility for EU expert to obtain license to work on the Naka-site.
- **Software needs** beyond the ones listed in the Procurement Arrangement: projects use free python tools
- **Knowledge management and transfer** (reports, publication, training). **Training** of EU and Japanese personnel in English/Japanese.
  - Handbooks and video tutorial
  - On-site training of QST personnel

# Commissioning of enhancements



**Joint session on the installation, commissioning and operation of EU enhancement project:**

- **Remote operation/maintenance/commissioning or Remote support**
  - Consider request of 1-2 remote access hardware tool to use for remote maintenance if required.
  - Consider remote operation of diagnostics that need inter-pulse checks and settings
- Understand **interfaces** to safety and protection systems, real-time systems
- Understand **maintenance process, weekly/daily operational processes** and their impact on the enhancement projects
  - Weekly vacuum window checks -> need modification of current enhancement projects?

**Dedicated meeting later this/next year to discuss more in depth**



## Continuation of the activities started in the Integrated Commissioning

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- Discussion planned in April 2021
- Confirm tasks and activities for 2021

## Control room room support

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## Commissioning and operations of current (and future) EU enhancements

- Divertor cryopump system
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- Dedicated meetings later this year  
Start discussion with F4E, later with QST

## Commissioning and operations support of QST enhancements

- Negative NBI and ECH systems
- Discussion planned in April 2021



We will reach out the selected beneficiaries and experts following the Call for Participation approval by the General Assembly in April 2021.

**Thank you for your attention!**

**Feedback and suggestions are welcome**

**WPSA FP9 wiki: [https://wiki.euro-fusion.org/wiki/WPSA\\_wikipages: JT-60SA Work Package](https://wiki.euro-fusion.org/wiki/WPSA_wikipages:JT-60SA_Work_Package)**