WPSA-2024 objectives

FSD planning meeting

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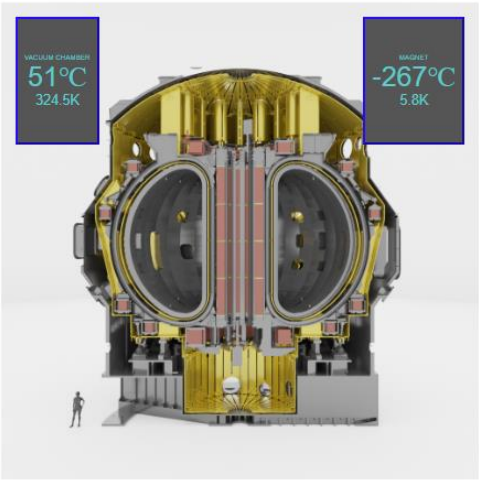
Present status of JT-60SA

- Extensive improvements were made after the EF1 coil incident, including in particular
  - Reinforcing the insulation of the magnet circuits within the cryostat
    - All terminal joints and mid joints
    - All current leads
    - All TF and EF QD wire extractions
    - All TF T-pipes and end caps
    - Specific weak points on CS tails, TF feeders and a TF tail
  - Implementing mid-point grounding to all PF coils, halving the voltage to ground experienced during operation
  - Installing filters to reduce the voltage ripple on the booster power supplies used on EF 1,2 5 & 6
  - Improving monitoring of the cryostat vacuum to prevent entering in Paschen conditions during operation

- TF coils have achieved High Voltage insulation performance under the Paschen condition up to 100 Pa.
- Full Paschen-proof condition not achieved

- Integrated commissioning restarted
  - Cryostat and vessel vacuum pumping from 30th May
  - Cooldown started mid June
  - Coils at working temperature now

JT-60SA COOLDOWN



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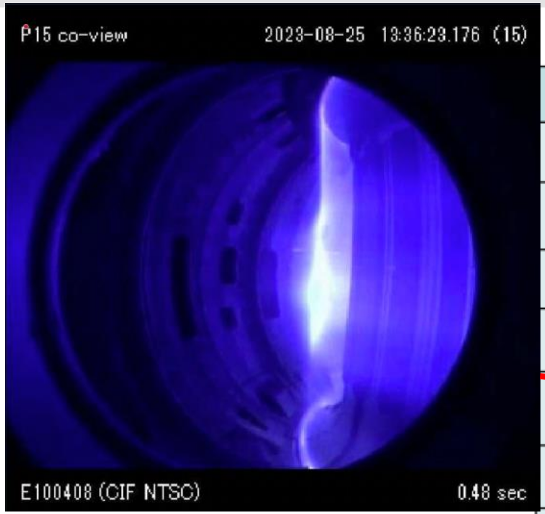
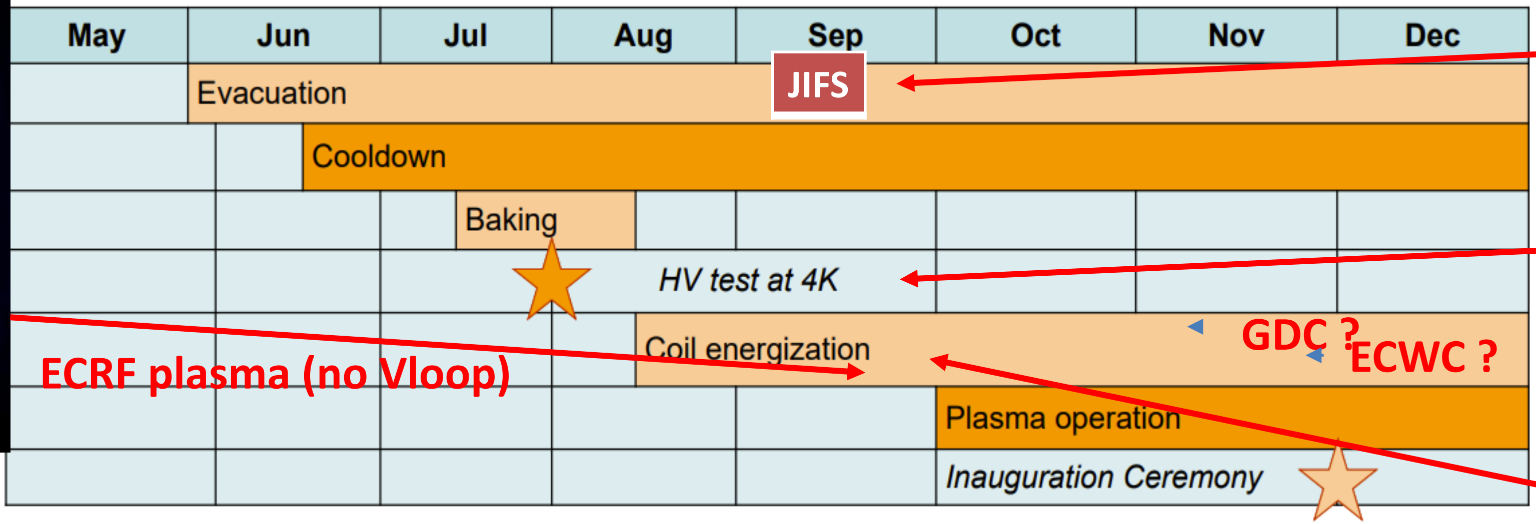
IC plan and objectives (in 2023)





Completed with good success

Completed with good success

TF completed with good success, Ongoing with some delay for EF, CS

- Initially, up to 3 kA and 2 kV across the PF coils at 2.25 T (full TF current), I_p~100 kA
- after that, perform DC tests on the PF at progressively higher voltage
- Objective: confirmation that the magnets and the rest of the plant operate as designed (i.e. at 20 kA) before the 2 year ME1 period

Further insulation reinforcements are foreseen during ME1

- Reinforce the pancake joints and helium inlets of the EF coils.
- Coat the outer surface of the central solenoid in situ with a layer of resin, aiming to seal any Paschen paths present. This would require the construction of a resin-proof enclosure around the CS within the narrow gap between the CS and the TF, which could then be filled with resin to coat the CS and then drained again.

Key events in 2023 that impact 2024 objectives

- HV holding test at 4K (end of July 2023) => the IC may be stopped or delayed=>**OK**

- Proof that the PF coil circuits can be safely operated at their maximum voltage and design current (20kA) (during IC) => IC may be suspended=>**on going this week**

- Qualification of the in situ coating technique of the central solenoid (performed in parallel with the IC) => in situ repair may be cancelled

Worst case: decision for CS extraction for more thorough reinforcement might be taken, depending on the output of the previous points (PF coil circuit performance)

- CS removal would extend the duration of M/E1 by a further 2 years, pushing back Op2 to 2027
- (in situ repair would allow for start of OP2 in November 2025, provided that shift work can be performed in ME1)

- M/E1 is effectively the last realistic opportunity to remove the CS for repair, before the mounting of the upper stage with all of the plasma diagnostics and other equipment

2 scenarios:
- OP2 starting in November 2025 (reference in the following)**=>still holds**
- OP2 starting in 2027 (unlike, but it may materialize at the end of 2023)

Participation to the IC

- On site plan agreed with QST and F4E (!)
- About 10 scientists (in average) on site in October – November
- Experts on site since July for cryo-magnet, from mid September for plasma operations
- Commissioning topics
  - Wall conditioning
  - Breakdown
  - Equilibrium Control
  - MHD and Disruptions
  - Support to cryo-magnet operations
  - EDICAM

- Overall coordination (for EuF: C. Sozzi, G. De Tommasi, M. Iafrati)
  - For almost each topic mix of experts and early career
  - Contact with topic responsibles (QST) through expert/coordinators

  - Weekly IC meeting for the IC participants, including a few remote experts

  - ITER member participating actively (to the meeting) and now on site as well

JT-60SA Global plan

BA SC 31-9.4-1

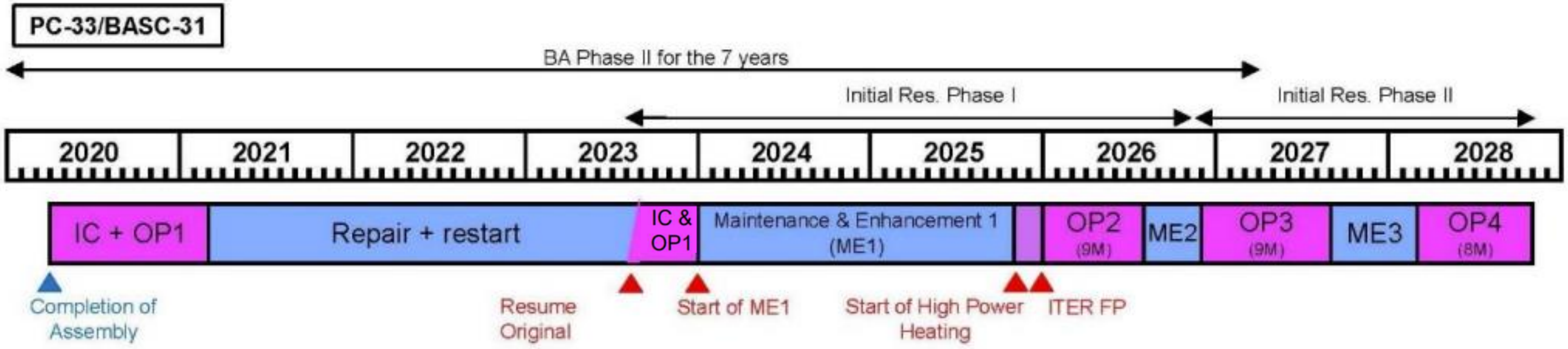
Table 2: Operation phases and status of key components

Research phase	Focus of exploitation	Operation Campaign	Expected operation schedule	[1]	Annual neutron limit	RH	Divertor	Installed NB power	ECRF	Max. usable aux. power[2]
-	Integrated pre-plasma Commissioning	Op-1	2020-2021 (6M) 2023 (6M) First plasma 2023	H	- (N_2 in VV interspace[3])	R&D	Open upper inertially cooled carbon[4]	0	1.5 MW (2 Gyro.)	1.5MW
Initial research phase I	**Initial stable and reliable operation** • H operation for commissioning towards D operation. • Stable operation at high current heated plasma									
		Op-2	2025-2026 (9M)	H / D			Inertially cooled lower pumped carbon[5] (limits high power heating duration)	PNB 8 units, plus NNB Total 16MW (with H) 23.5 MW (with D)	3 MW (4 gyro)	19MW 26.5MW
Initial research phase II	**ITER and DEMO regime access** (high power and high Ip with short pulses) • Access to the ITER standard scenario • High beta access • ITER risk mitigation (ELM, disruption)	Op-3	2026-2027 (9M)	D	3.2e19 (N_2 in VV interspace)					
		Op-4	2028 (8M)					PNB 12 units, plus NNB Total 30 MW		33 MW
Integrated research phase I	**High beta long pulse** **Burning plasma relevant** • ITER standard and hybrid stationary (~2-3tR) • High beta steady-state (~2-3tR), DEMO contribution	TBD	TBD	D	4e20 (water in VV interspace)		Actively cooled lower pumped carbon[6]		7MW (9 gyro.)	37MW
Integrated research phase II	**High beta and metal wall compatibility** • Radiative divertor with impurity seeding • Impurity pumpout from core	TBD	TBD		1e21 (water in VV interspace)	Use	Actively cooled lower pumped tungsten			
Extended research phase		TBD	TBD		1.5e21 (boronated water in VV interspace)		Actively cooled tungsten advanced structure (Upper div. TBC)	34MW[7]		41MW

[1] D indicates that deuterium operation is permitted. Actual use of H / D / He etc. depends on experimental needs
[2] Full details of the auxiliary heating power installed is given on the following pages (tangential and perpendicular PNBI, NNBI & ECRH). However the usable power and / or duration is limited by other factors, notably the power handling of the inertially cooled divertor.
[3] The material used to fill the space between the inner and outer wall of the vacuum vessel in order to provide neutron shielding
[4] Upper carbon divertor (open, inertial cooling) remains available in all subsequent configurations
[5] The allowable heat flux onto the divertor plate will be <10MW/m2 x ~7.5s, 15MW/m2 x ~5s.
[6] The allowable heat flux onto the divertor plate will be <10MW/m2 x100s, 15MW/m2 x ~5s
[7] Additional shield planned to reduce stray beam and increase deliverable power

Mid term JT-60SA plan

Reference: https://users.jt60sa.org/?uid=2DGBXU Satellite Tokamak Project Plan – formally approved up to the end of 2023



Major milestones for the BA ST project
- Start of Maintenance & Enhancement-1: Jan 2024
- Start of High Power Heating Experiment: Nov 2025

Experiment team focuses on the scientific preparation of Initial Research phase I and II
- Coordination of IC+OP1 analyses
- Commissioning phase also necessary in Research phase I

Scientific objectives
- OP2 main objective:
  - Commissioning of the newly installed systems,
  - Stable operation at high current heated plasma, initially in H with transition to D
- OP3
  - develop ITER standard H mode
  - and exploration of High Beta scenario

JT-60SA timeline and scientific objectives

Initial Research phase I (with commissioning of several sub-systems) - 2025-2026

- Commissioning with H plasmas for D plasma operation
  - Commissioning NB injectors into plasma, including monitoring of shine-through vs energy (esp. N-NBI)
  - Step-by-step increase of plasma current up to 5.5 MA
  - Test of plasma control schemes: current, position, density, heating
  - Break down and plasma formation studies
- ITER risk mitigation
  - Studies of L-H transition comparison between H and D and considering the addition of He
  - Disruption studies including suppression of disruptions with MGI;
  - Runaway Generation and mitigation techniques
- Scenario development
  - Initial integrated scenarios development towards ITER standard H-mode

Initial Research phase II - 2027-2028

- Consolidate results from OP2
- ITER risk mitigation
  - Optimise ELM control and disruption mitigation with a focus on risk reduction for ITER
  - Advanced studies about the destabilization of Alfven modes by N-NBI and impact on fast ions confinement and plasma turbulence
- Scenario development
  - Further development of integrated scenarios including advanced real time control techniques
  - Initial steps towards radiative integrated scenarios
  - Initial steps towards high beta scenario development for ITER and DEMO and specific transport and turbulence studies in this regime

Main activities in 2024

- Coordinate Integrated Commissioning analyses (call expected in 2024)
  - Break-down IC results per TG
- Further modification of project plan, notably, in view of ITER research plan changes
- Coordinate joint EU-JA modelling that is focused on the initial JT-60SA campaigns (call proposed in 2023 but not issued yet)
- Continuous evaluation and monitoring of machine enhancement proposals/installation
- Definition of new IC to be performed during OP2
- Revision of CQMS regarding Experiment Team
- Proposal of machine upgrades to ensure quick scientific relevance
  - Increase ECRH power
  - Bring forward W-divertor
  - Possibility of ICRH antenna
  - Speed-up N-NBI use at full energy

Main activities in 2024

- Promote coordination and EUROfusion views on real-time control and disruption mitigation/suppression
- Promote participation of EUROfusion on JT-60SA operation
- Promote the use of IMAS
- Ensure that the scientific tools for participation, data analyses, pinboard etc (developed by QST) are ready on time and can be smoothly used by EUROfusion participants
- Ensure that EUROfusion scientific priorities are well aligned with the JT-60SA scientific programme
- Ensure a minimum level of coordination with WPTE
- Ensure that up-to-date JT-60SA information is properly transferred to EUROfusion members and WPSA project leader

Detailed plan: Operation regime and MHD stability

- **Operation Regime Development**
- Modelling activities:
  - Free and fixed boundary simulations of reduced current scenarios
  - Demonstrate plasma controllability with free boundary simulations
  - Breakdown codes validation with IC data
  - ECRH code validation with IC data
  - Fixed boundary simulations for the ramp-up and flat-top phase for the previous scenarios with QL models for transport and more sophisticated models for sources
- **MHD Stability and Control**
- Modelling activities:
  - Disruption and runaway electrons code validation with IC data
  - MHD formation and control in the ramp-up phase of expected scenarios
  - Neoclassical tearing modes destabilization and control with ECH/ECCD and NBI in high performance plasmas at high beta
  - RWM control in high performance plasmas at high beta

Detailed plan: Transport and Confinement, High Energy Particles

- **Transport and Confinement**
- Modelling activities:
  - L mode simulations and confinement characterization in typical JT-60SA conditions
  - Studies of electron vs ion heating for the expected scenarios to be developed in OP2 and OP3 including ramp-up and flat-top
  - Analysis of the impact of β and fast ion effects in typical JT-60SA plasmas with gyrokinetic simulations and comparison with simplified models
  - Exploration of transport and pedestal screening in plasmas including W.
- **High Energy Particle Behavior**
- Modelling activities:
  - Shine-through characterization of initial scenarios
  - Destabilization of fast ion modes in the ramp-up and flat-top phases of initial scenarios, sensitivity to power and fast ion energy
  - Fast ion transport control with JT-60SA actuators

Detailed plan: Pedestal Physics and Divertor

- **Pedestal and Edge Physics**
- Modelling activities:
  - L-H power threshold calculation in H and D for initial scenarios
  - ELMs control with RMP and pacing pellets
  - Modelling of no ELMs or small ELMs scenarios

- **Divertor, Scrape Off Layer and Plasma-Material Interaction**
- Modelling activities:
  - Compatibility of high power in initial scenarios with inertial cooled divertor
  - Analysis of radiative scenarios with different seeding.
  - Exploration of W divertor capabilities in full power scenarios

WPSA Code Management and simulation Area - 2023 Status

1. Progress towards the release of validated simulation tools for JT-60SA scientific exploitation
2. Support to the JT-60SA Topical Groups leaders for IC analysis and modelling activities

Area Coord.:
G Falchetto

- Contribute to the successful exploitation of the scientific outcomes from the Integrated Commissioning
  - Thermohydraulics calculations for the cryo-magnet system with improved modelling
    - ECWC code validation – pending IC data
    - Breakdown workflow support to new scenarios provided – FEC paper M Mattei validation – pending IC data
    - Disruption modelling codes validation – pending IC data
    - Disruption mitigation trigger: predictive algorithm based on integrated line density ready – pending data
- Optimize and release to EU users the simulation tools for operation and scientific exploitation
  - Equilibrium control – study presented in TG
  - Discharge simulator: performance optimization, identification of test cases, training to ET support to new scenarios provided to TG ORD
  - MHD stability workflow: training to ET ?
  - Energetic particle workflow – ready training to ET?
  - Integrated Data Analysis – pending ET meeting and agreement from QST
- Complete the development of synthetic diagnostics (TPCI, FILD) in support to the EU procured/proposed diagnostics and NEW ENH ongoing

Operation oriented tools
Cryo & magnets
ECWC tools
Disruption modelling tools
Discharge simulator
Breakdown simulator
Disruption mitigation trigger
Integrated data analysis tools
Synthetic diagnostics development
Synthetic diagnostics for PCI
FILD synthetic diagnostics

WPSA Code Management and simulation Area - 2024 Objectives

➢ **Simulation and Modelling area converging into Experiment Team / Topical Groups implementing the scientific directions from ET**

CM area coordinator to coordinate specifically

1. **Cross-topics simulation tools development and validation**
2. **ensure consistent modelling across topical groups**

Call for IC analysis and OP2/3 modelling

Operation Regime Development - ORD

- Free and fixed boundary simulations of reduced current scenarios - ongoing
- Demonstrate plasma controllability with free boundary simulations - ongoing
- Breakdown codes validation with IC data
- ECWC/ECRH code validation with IC data
- Fixed boundary simulations for the ramp-up and flat-top phase for the previous scenarios with QL models for transport and more sophisticated models for sources- ongoing

Transport and Confinement

- L mode simulations and confinement characterization in typical JT-60SA conditions - ongoing
- Studies of electron vs ion heating for the expected scenarios to be developed in OP2 and OP3 including ramp-up and flat-top
- Analysis of the impact of β and fast ion effects in typical JT-60SA plasmas with gyrokinetic simulations and comparison with simplified models
- Exploration of transport and pedestal screening in plasmas including W.

Area Coord.: G Falchetto

Modelling of Initial Research Phase and nominal scenarios *
Scenario development and analysis – ORD + T&C
MHD and control Runaway modelling MHD
Edge and divertor modeling PED + SOL
Energetic Particles modelling EP

New scenarios to be provided by ORD TGL after IC (end 2023 early 2024)

WPSA Code Management and simulation Area - 2024 Objectives

Area Coord.: G Falchetto

MHD Stability and Control

- Disruption and runaway electrons code validation with IC data
- MHD formation and control in the ramp-up phase of expected scenarios
- Neoclassical tearing modes destabilization and control with ECH/ECCD and NBI in high performance plasmas at high beta – previous work to be rehamped
- RWM control in high performance plasmas at high beta – done

High Energy Particle Behavior

- Shine-through characterization of initial scenarios
- Destabilization of fast ion modes in the ramp-up and flat-top phases of initial scenarios, sensitivity to power and fast ion energy - ongoing
- Fast ion transport control with JT-60SA actuators

Pedestal and Edge Physics

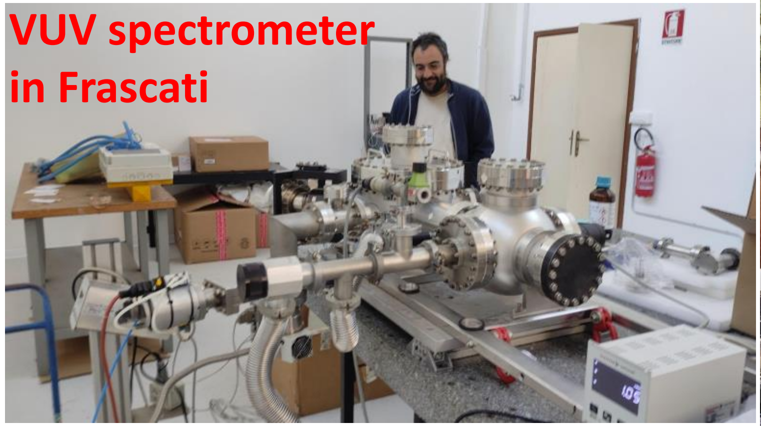
- L-H power threshold calculation in H and D for initial scenarios
- ELMs control with RMP and pacing pellets - ongoing
- Modelling of no ELMs or small ELMs scenarios

Divertor, Scrape Off Layer and Plasma-Material Interaction

- Compatibility of high power in initial scenarios with inertial cooled divertor – done/ongoing
- Analysis of radiative scenarios with different seeding.
- Exploration of W divertor capabilities in full power scenarios - done

Objectives for 2024: “FP8” enhancements

- A number of subsystems will be added in preparation of OP2
- Some of those are projects developed in EU (WPSA-F4E)
- Precise time plan of ME1 not yet available, but most of the systems are scheduled to be installed in ME1
- Delivery on site (several systems or part of them already there) in 2023 or early 2024
- Acceptance or post-delivery test when required
- Ready for the installation plan in 2024



EU-led Enhancements

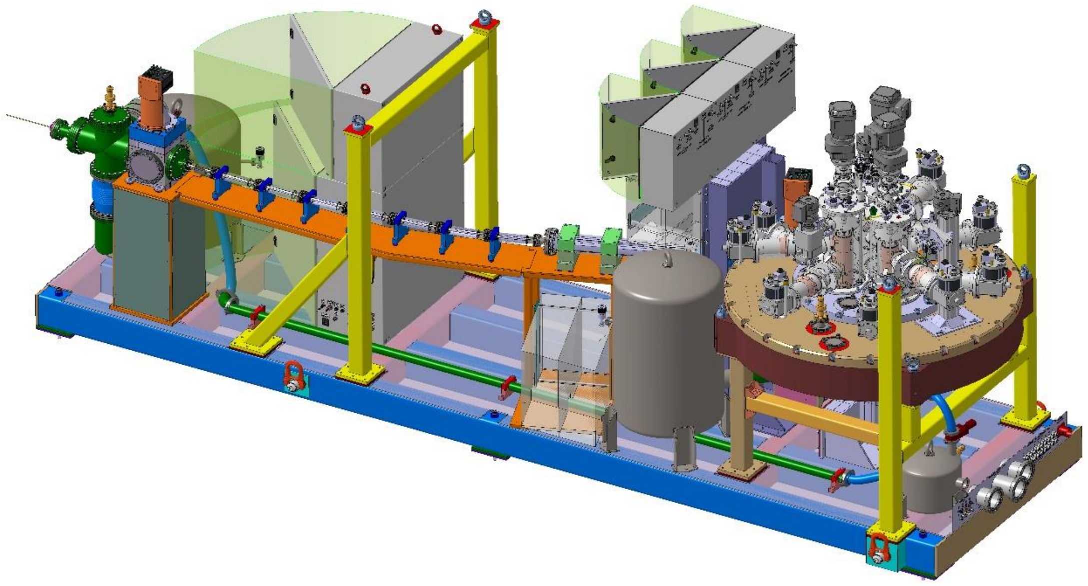
- 2 MGI
- Divertor cryopumping system
- Pellet Launching System
- Thomson Scattering
- Divertor VUV
- (FILD originally in ME2, now being considered for ME1)

FILD:

- contract KoM (F4E/UoS): Launched in July
- design: Aiming to finalize the design within the next few months
- Installation period to be defined (might be advanced) => ET review

PELLET LAUNCHING SYSTEM

- Test facility at IPP remains ready for delivery of hardware for testing
- Service contract in force now, H operation needs ATEX certification
- Pellet sources: contract with Russian company PELIN was reestablished after the stop for EU sanctions
  - It is expected fueling source can be obtained with limited performance
  - Pacing source: if possible get at least part (e.g. extruder screw)
  - Option: launch new call for tender for both sources
- Centrifuge launcher fully designed by SENER
  - Manufacturing to start soon
  - Diagnostics unit included in this contract
- Planning for 2024:
  - Installation and ATEX certification of fueling source
  - Commissioning and characterization of fueling source (and pacing if ready)
  - Installation and test of launcher and diagnostics system
  - Integration of sources, launcher and auxiliaries
  - Commissioning before shipping
  - Prepare technical draft for on-site commissioning plan



Divertor cryopump system

- Manufacturing basically very close to completion: final test almost done (in-vacuum leak test successfully concluded).
- Shipping of the 10 pumps scheduled for this month!
- Upon arrival of the 10 pumps at QST: Final acceptance test on Naka site (does not require presence of KIT).
- Shield neck assembly demonstration with the first-of-a-kind test pump to happen in the next months, then sent to QST. This finalizes the project activities.

- Installation of the pumps is now foreseen for November 2024.

EdgeTS system

Current status

- **Polychromators** - ready for interface with acquisition (QST)
- **Optics edge TS (P1)** – ready for integration in mechanical structure
- **Laser edge TS (P1)** – ready for integration with core TS laser (QST)
- **Mechanics edge TS (P1)** – port plug under vacuum leak test;
  trolley assembly to be completed; overall assembly to be verified at ICSI;

2024 plan:

- Mechanics edge TS (P1) –
assembly, positioning verifications and optics integration at ICSI by February 2024.
final acceptance test at ICSI February 2024
delivery to QST in May 2024
installation in torus hall in 2024/25

- **Laser** integration with core TS laser and input path
- **Polychromators** interface to the acquisition system
- Definition of **calibration & commissioning** procedures to be performed in 2025

VUV spectrometer

- Major activities in 2024 (depending on success of ongoing and planned steps in 2023)
  - => Integration and test of the gratings on going this week
  - Completion of the mechanical assembly for ancillary components

- Q1/2
  - Closure of accompanying documentation (operation manuals, conformity certificates where needed etc)
  - Conclusions of tests in Frascati and preparation of inspection from QST
  - Packaging and shipment

Objectives for 2024: new enhancements

- For the scientific objectives of OP3 (ITER Risk Mitigation and Scenarios Development) a number of new diagnostics have been judged scientifically desirable (ET assessment) and set as priority I for the scientific objectives in in OP3 (2026-2027) and following.
- Some of those (not all) are systems proposed and developed (feasibility study) in WPSA

Desirable additional enhancements (not yet planned)	*Neutron emission profile monitor and neutron energy spectrometer* *Gamma-ray diagnostics* *Phase Contrast Imaging*	*Doppler Reflectometry System* *Fast CXRS* *Vertical ECE*

Reference: https://users.jt60sa.org/?uid=2DGBXU Satellite Tokamak Project Plan

- EU will proceed in developing the Implementation Plan for
  - Neutron Energy Spectrometer
  - Gamma-ray diagnostics
  - Phase Contrast Imaging
  - Doppler Reflectometry System
- QST will manage the plan for Fast CXRS and vertical ECE, will provide the support for integration in JT-60SA and contacts for the review of the design and implementation steps
  - NB: EC stray detection system (has lower scientific priority but is technically relevant for the mitigation of the risk of operation of ITER which is providing the prototype sensors), then an implementation plan will be proposed
- Elements of the implementation Plan (in 2023)
  - Rough cost,
  - time plan,
  - implementing team,
  - Existing or exploitable collaborations with Japanese teams where suitable

Template prepared and distributed, preparation ongoing: basis to launch a call

- F4E will provide support for the procurement (HW cost with a contract with the identified provider)
- EUF-WPSA will support HR cost

Objectives for 2024: start of new enhancements

TPCI

- Completion of detailed diagnostic design, including the optical, mechanical, electronic, and control components
- Detailed hardware listing and budgeting with actionable quotations
- Launching of all procurements (with the goal of receiving all components by the end of 2024)
- Annex B of PA (technical specification) in preparation
- Search for a junior personnel to be integrated in the team

GAMMA

- Finalize definition of system location, size, list and specification of components. Begin purchase of components and, if available within the year, laboratory test of most critical items (project duration: 2024-2025)
- Evaluation of needs for neutronics shielding after specification of final system location and shielding already available at installation location.

DR

- Integration of Japanese/European parts of the proposal into coherent one.
- Develop a conceptual design which adapts to the final diagnostic position and solves a number of minor open issues left in the feasibility study.

NEUTRON SPECTROSCOPY

- Identification of the development team (in 2023)
- Review of the conceptual design coherent with the scientific scope, space constraints and port allocation.

EC stray

- Characterization of the prototype adapted to JT-60SA case: provide and replace the coated bolometer with a specific one compatible with JT-60SA EC frequencies =>test made at MISTRAL last June on the ITER sensor
- ITER will ship the prototype to be adapted for JT-60SA after they will have received the report, to evaluate if any action on the prototype is required by IO side before sending the JT-60SA item, as they belong to the same slot.
- minimal system layout (including requirements for signal boards, I/O units, PCF, cubicles, ... Being defined)

Objectives for 2024: operations and remote participation

- WPSA area coordinator for operation appointed with a call (Matteo Iafrati, ENEA)
- On-site work of support for the EU team during the IC (2023)

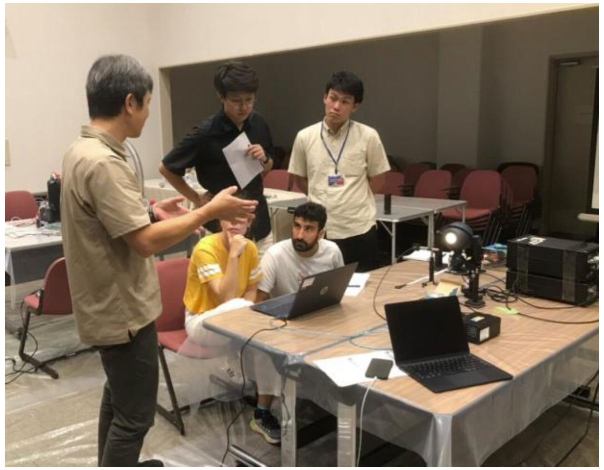
- 2024
- Preparation and support in execution of the commissioning of the EU-led Enhancements
- Favour the bidirectional exchange of operational experience towards/from the European machines
- In collaboration with the WPSA PL, F4E and the Integrated Project Team of JT-60SA, develop a plan for the Eurofusion contribution and participation to the machine operation, including the necessary steps of training and licensing

- Implement and test IMAS wrapper
- Consolidate and test tools for remote participation, including REC in La Bergèrie

Objectives for 2024: JIFS

- Evaluate output of the first edition (2023) – survey ongoing
- Review the members of the organizing team (new Directors for next editions)

- Review the organization if and where necessary
- Identify the training programme for 2024 edition



Overall WP objectives

- Manage (in EU) Call for IC analysis in 2024 – relevant to ITER - topics to be confirmed depending on the results of the IC-2023

- Role in the call for proposal for experiments in JT-60SA to be clarified.

- Call for INTEREST in participation to the ET to be launched soon (2023 - waiting discussion with F4E/QST) – not necessarily implying assignment of dedicated resources in this phase

- Gradual evolution of the WPSA structure – integration and progressive shifting of the roles between WPSA and ET

  - CM area focusing in the development and validation of tools, while application for scientific analysis coordinated by the Topical Groups structure

  - A better framework for Eurofusion participation *might be* the assignment of a PA for
    - Support in scientific exploitation
    - Support in operation
    - Support in enhancement development
  - At present, even if rather significant elements of the JT-60SA programme come from the EuF “influence”, the official role of EuF is not clear at all
  - Also, need to equalize the opportunity for participation on site. At present, national rules heavily affect the possibilities of on site participation, and this will impact the participation to the experimental campaign in future.

Grant Deliverables

GA Deliverable No.	GA Deliverable Title	Due Date [mm/yyyy]
SA.D.01	Appointment of Experiment Leader from EU (after call issued end 2020)	Apr. 2021
SA.D.02	Report on the first phase of the Integrated Commissioning (before plasma operations). Results and return of experience, mainly for DTT	Dec. 2021
SA.D.03	Report on the initial organisation of the JT-60SA scientific exploitation	Dec. 2021
SA.D.04	Documented plan of EU enhancement programme for BA Phase II– 2025-2029	Dec. 2022
SA.D.05	Delivery and final tests of EU-REC completed	Jun. 2024
SA.D.06	Installation of the EU systems before the OP2 campaign.	Dec. 2024
SA.D.07	Report on participation to the OP.2 campaign. Results and return of experience	Dec 2025
SA.D.08	Final Report on the Integrated Commissioning (including plasma operations)	Dec. 2023
SA.D.10	Delivery of EU procurements (TBD) for the OP3 campaign completed.	Dec. 2025*

Milestones

GA Milestone No.	GA Milestone Title	Due Date [mm/yyyy]
SA.M.01	Participation in the Integrated Commissioning before plasma operations	**June 2021**
SA.M.02	Start of the EU-REC project	**Apr. 2022**
SA.M.03	Decision on plan and resources of EU enhancements for BA Phase II – 2025-2029	**June 2023**
SA.M.04	Call to start EU enhancement programme for 2025-2029	Sept.2023
SA.M.05	Start of the new EU enhancement projects (TBD)	Nov. 2023
SA.M.06	Participation to the development of scenario at high plasma current in H-mode**	Dec. 2025*

Back-up slides and details for discussion