Exploitation of JT-60SA (WPSA)

WPSA organization & Project Execution Plan (PEP)

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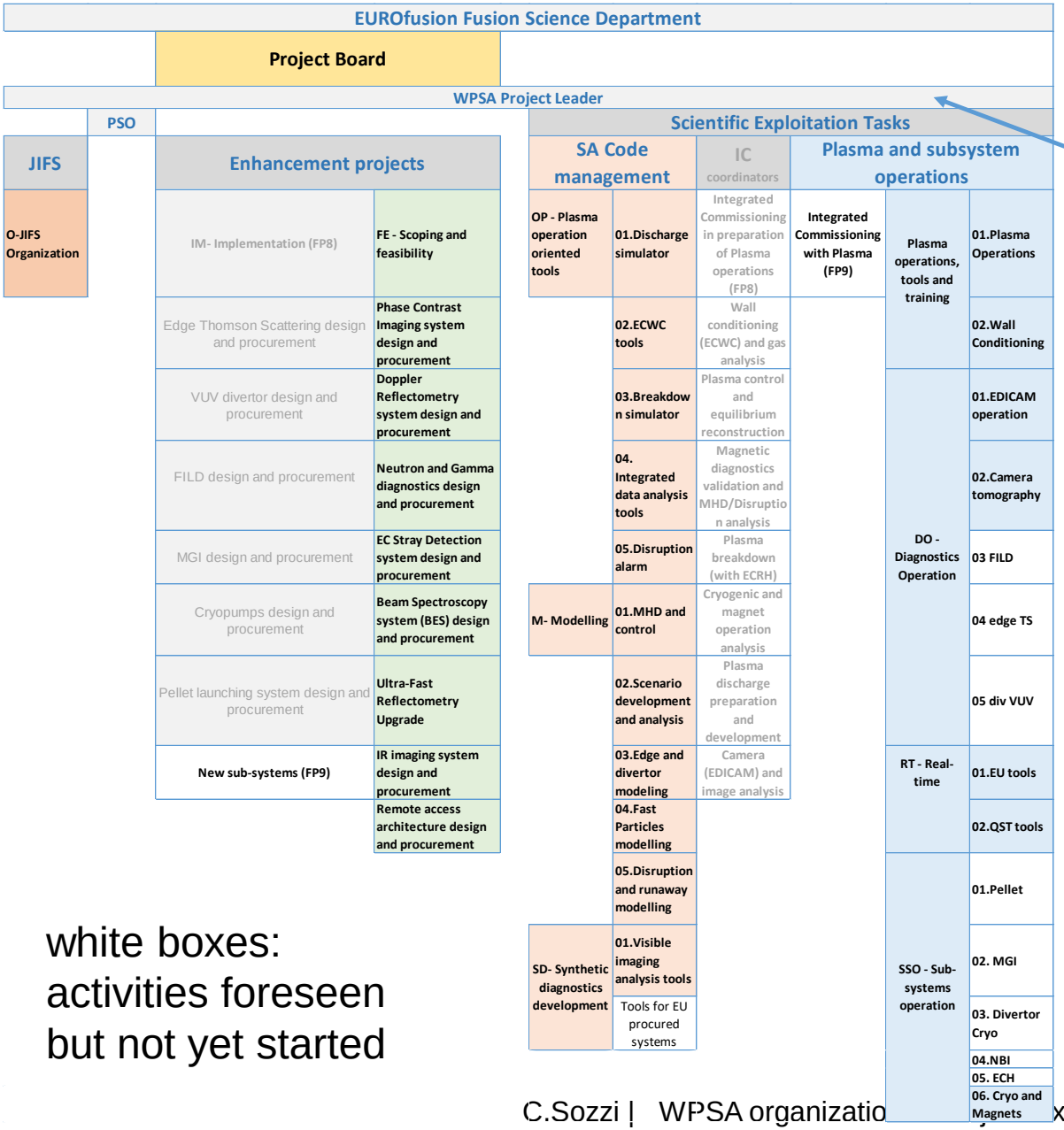
Thanks to E.Joffrin, G.Giruzzi, G. De Tommasi, J. Garcia

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

WPSA organization and Work Breakdown Structure



white boxes:
activities foreseen
but not yet started

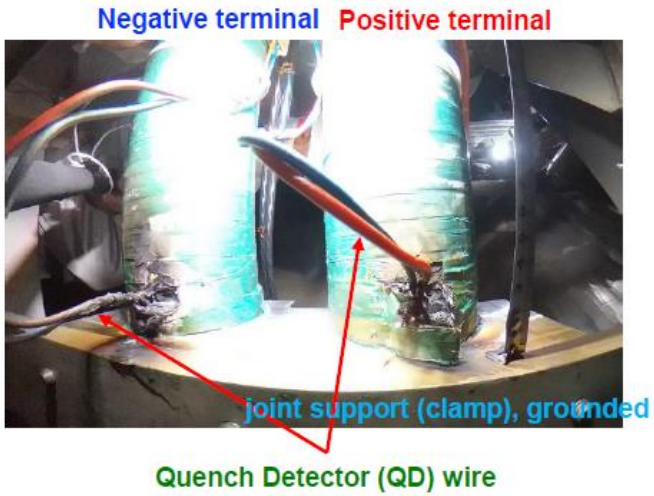
Topical Groups

1. Scenarios
2. Transport
3. Energetic particles
4. MHD
5. PWI and SOL
6. Pedestal

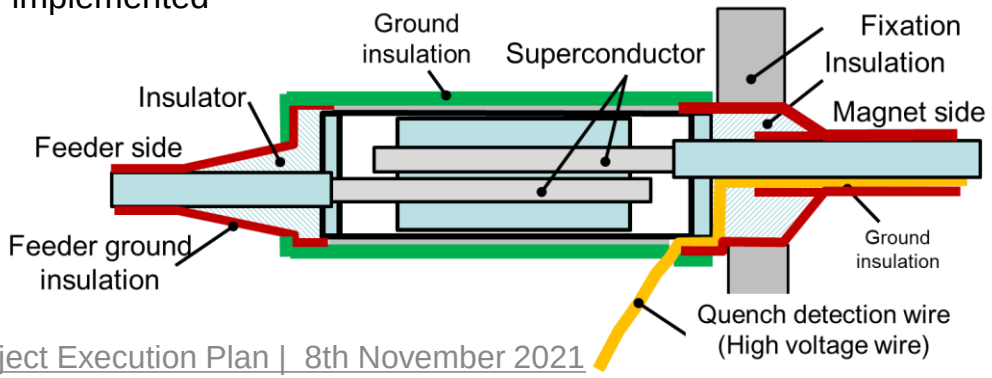
- Hybrid nature of WPSA
  - Runs partially as a project
  - Partially as a campaign
- Mixed Work programme FP8 & FP9 (until 2022)
- Substantial importance of interfaces (F4E, QST…)
- WPDIV, WPPWIE
- WPPrIO, WPTE
- WPAC

JT-60SA status

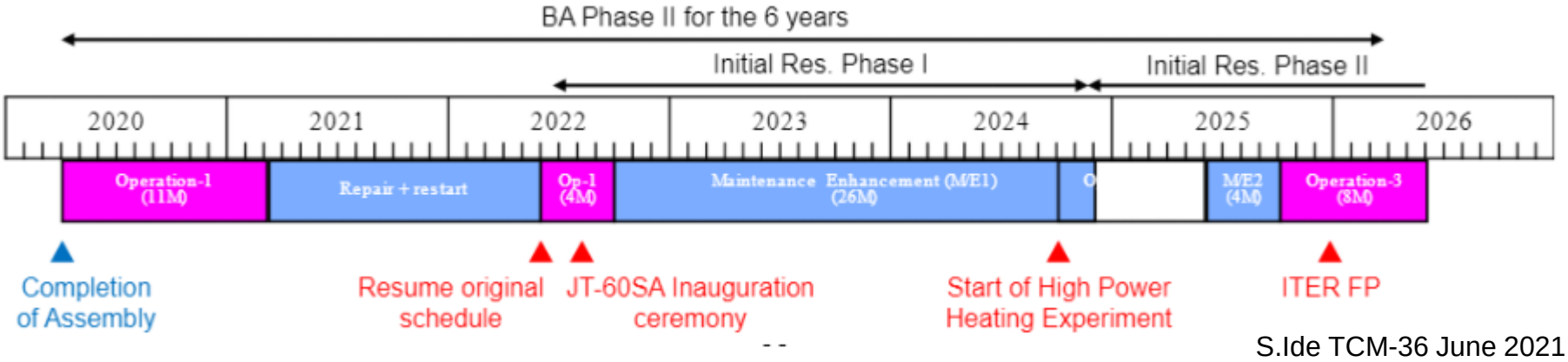
- **Incident analysis**
- First discharge points identified at coil connection joint in EF1. Root cause attributed to poor insulation at the exit of QD wires (inadequate tracking length, poor bonding to ground of EFTE wire insulation, insulation technique probably inadequate with signs of bubbles and partial debonding)
- Extensive campaign of testing completed for mostly all the joints in JT-60SA.
- Test included Extended HV dry test (15-20 kV DC), wet test (1 kV), local Paschen conditions.
- **Insulation of all joints (terminals and mid) has to be remade**
- QD wires under the SS wrap has to be replaced with individually shielded wires (old QD cut and grounded)



- **Repair and recovery (update October. 2021)**
- All insulation procedure and test procedures to be tested on mock-ups allowing also the qualification of personnel
- All terminals and mid-joints will be Paschen tested
- The machine will undergo a global Paschen test prior to energisation (feasibility of Paschen Test at cold conditions being evaluated)
- Detailed mock-up of EF and CS terminals and all the mid-feeder joints ((one-box) developed and validated
- Repair technique applied first on the mock-up and successfully tested
- Following the qualification of the repair technique, now the first one-box joints have been repaired inside the cryostat. The mid-feeder joints on EF 1 were reinsulated first (starting on 09 Oct) and were also successfully tested under local Paschen conditions (19 Oct). Following that the same technique is now being applied to the EF 1 and EF 3 terminal joints.
- Detailed mock-up of TF terminals (twin-box) being developed and tested
- Most of the CS joints are completely inaccessible. Mock-up tests to study how the joints behave in different condition being implemented



Schedule (tentative)



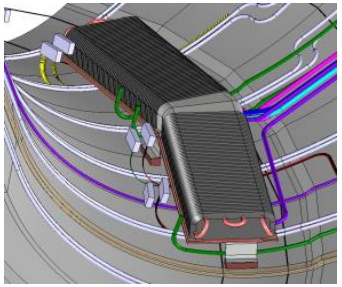
S.Ide TCM-36 June 2021

- The Integrated Project Team is examining the recovery of the delay by implementing the installation of enhanced components in parallel with repairs and improvement of voltage holding capability in the cryostat.
- For this reason, the planning of the activities outside the vessel, including the EU-led enhancement items is not delayed
- **Updated (tentative) schedule**
  - HV test in January 2022
  - Restart of commissioning in February 2022 (vacuum pumping)
  - Plasma operation (OP1) by May-June up to September 2022 (15 months delay wrt original schedule before the coil incident)
  - ME1 24 months Oct 2022-Sept 2024 (2 months recovered)
  - OP2 9 months (Oct 2024-May 2025) (+1 month of experimental campaign wrt original schedule) (Comm.+ Science)
  - ME2 4 months (June 2025-Sept 2025) (2 months recovered)
  - OP3 9 months (Oct 2024-May 2025) (+1 month of experimental campaign wrt original schedule) (Science)

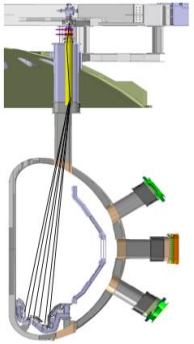
WP activities from FP8=>ending in 2022

- Enhancements in implementation phase (with F4E):
  - Divertor cryo-pumping system
  - Pellet injector
  - MGI (massive gas injection)- (HW)
  - Edge Thomson Scattering (TS) – (HW)
  - VUV spectrometry) – (HW)
  - FILD (fast ion loss detection) – (HW)
  - EDICAM
- Participation to the Integrated Commissioning with 7 operational topics
  - Cryo & magnets,
  - Scenario development,
  - Wall conditioning,
  - EDICAM,
  - Magnetics & Disruptions,
  - Equilibrium Control
  - Breakdown

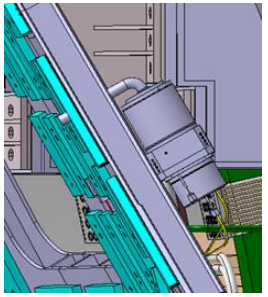
Divertor Cryopumps



VUV Divertor Spectrometer

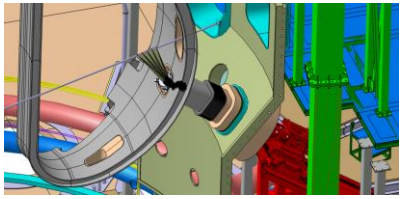


MGI

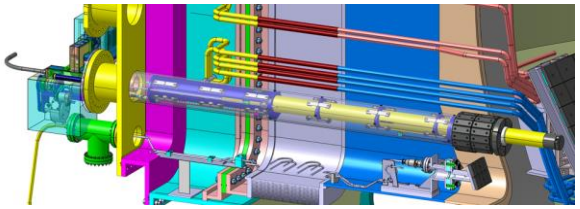


Pellet Launching System

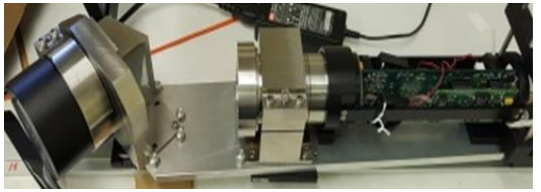
Edge Thomson Scattering



FILD



EDICAM wide-angle camera (in commissioning in Naka)



FP8 Enhancements status (october 2021)

Pellet Launching System

- IPP lab for test bed ready. Fuelling and pacing pellet source in delivery at IPP.
- Centrifuge: it was approved to go for a worldwide CfT . In view of this, the specifications has been updated. Call closure this week.

Divertor Cryopumps

- PA signed and ongoing
- 3D/2D design ready
- Manufacturing trials ongoing with issues on welding, material availability (due to COVID) and charcoal coating (may impact on delivery time, currently being addressed).

MGI

- PA signed and ongoing
- Electronics completed, Valve manufacturing launched. Schedule not critical.

FILD

- PA to be finalised and signed (last iteration ongoing)
- 3rd DRM this week. Details of the design being agreed and fixed

VUV spectrometer

- PA to be finalised and signed.
- Orders for main parts issued (Mirrors, Gratings...) or ready to be launched (detectors). Main components under procurement
- Assembly and test bed in Frascati being prepared to receive the spectrometer.
- DRM by beginning October: Configuration model available and analyses (thermal /electro mechanical under finalisation)

Thomson scattering system

- PA signed and ongoing
- Mechanics: port plug and trolley contracts issued, order for last part of items being issued.
- Polychromators: acceptance test fixed this November
- Optics: under production
- Fibers : DEL4 arrived in Japan . Last shipment will be the 100 km extra length that should provide margins for the bundling process (ready for shipment, documentation verification in progress)
- Laser: under manufacturing. Downstream optics being agreed

NO particularly critical points impacting the machine schedule

Possibly critical points related to administration/project management
FP8-funded projects must end by 2022

Actions being taken to avoid issues related with this

Requests for work extending in 2023 to be included in FP9

FP8: updates on IC and EN budget

FP8 Integrated commissioning PM work		
Planned 2020-21	**Performed 2020-21**	**Residual**
83,01	68,88	14,13

FP8 Enhancement PM work			
Planned 2020-21	**Performed 2020-21**	**Residual**	**New request (2022)**
263,3	208,9	54,4	59

Equipment & Infrastructure 100% (JT-60SA) and Goods & services 100% (JT-60SA)				Planned	Used	Residual
Deliverable	Year	Ben.	Description	Total Contribution	Total Contribution	Total Contribution
SA-EP.A03-T002-D002	2021	IAP	Mechanics procurement	500	130	370
SA-EP.A07-T002-D001	2020	MPG	Valve components, gas handling components, electronics, 50k shifted to 2021	40	40	0
SA-EP.A07-T002-D001	2021	MPG	COVID, Valve components, gas handling components, electronics	50	58	-8
SA-EP.A03-T002-D001	2020	ENEA	collection optics, 15k shifted to 2021	60	60	0
SA-EP.A03-T002-D001	2020	ENEA	Design studies for collection optics	20	20	0
SA-EP.A03-T002-D001	2021	ENEA	Collection optics, 15k shifted to 2021	75	3	72,5
SA-EP.A03-T002-D001	2021	ENEA	COVID, collection optics	15	15	0
SA-EP.A03-T002-D003	2021	ENEA	Laser 2nd payment	240	0	240
SA-EP.A03-T002-D003	2021	ENEA	COVID, Laser 1st Payment	160	40	120
SA-EP.A04-T003-D002	2021	ENEA	Spectrometer, collection optics and ancillaries procurement by Consorzio RFX	100	0	100
SA-EP.A04-T003-D002	2021	IAP	Mechanical stand for spectrometer and optics, vacuum interface (valves, bellows) and port plug	30	0	30
SA-EP.A04-T003-D002	2021	ENEA	COVID, Spectrometer, collection optics, and ancillaries procurement by Consorzio RFX	280	0	280
SA-EP.A04-T003-D002	2021	IAP	COVID, Mechanical stand for spectrometer and optics, vacuum interface (valves, bellows) and port plug	80	0	80
SA-EP.A04-T003-D002	2021	IPPLM	COVID, Vacuum system	80	0	80
SA-EP.A02-T004-D002	2021	CIEMAT	Completion of manufacturing and assembly	450	0	450
SA-EP.A02-T004-D002	2021	CIEMAT	COVID Actuators and control system for tests. Scintillator screens and fast framing camera, initially foreseen in the 2019 budget: 110 keuros, unspent and moved to 2021 22.130 keuro; foreseen for 2020 also moved to 2021-22	70	0	70

Work package milestones 2021

Sequential M ID	Related WBS ID	Title	Due Date (mm/yyyy)	Related GA D/M no.	
SA.SE.CM.M1	SA-SE.CM.OP.01-T001	First simulation of a JT-60SA discharge with the coupled METIS-CREATE codes with controllers.	12/2021		✓
SA.SE.CM.M2	SA-SE.CM.SD.01-T001	Implementation of visible imaging analysis tool (camera tomography)	12/2021		✓
SA.EN.M1	SA-EN.AC.01-T001	Complete the detailed design and secure the procurement to meet the deadline for delivery of the BA phase 2 Enhancements projects	12/2021	SA.D.06	
SA.EN1	SA-EN.REC.01-T001	Start of the EU-REC activity (*)	06/2021	SA.D.05/SA.M.02	✓

- Activity in synergy with F4E, QST. (ENEA,CEA, IPP as EUROfusion contributors)

Status of the 2021 GA milestones/deliverables

GA Milestone no.	Title	Due Date (mm/yyyy)
SA.M.01	Participation in the Integrated Commissioning before plasma operations	June 2021 √

- Active and extended participation until coil incident (March 2021)
- Participation focused to the recovery activities and to the preparation of next year phase in the following period
- Report at the end of the 2021

GA Deliverable no.	Title	Due Date (mm/yyyy)
SA.D.01	Appointment of Experiment Leader from EU (after call issued end 2020)	Apr. 2021 √
SA.D.03	Report and plan on organisation of the JT-60SA scientific exploitation	Dec. 2021

- SA.D.03 to be prepared with the main contribution of the ETL from EU.

2022 programme goals & strategy (AWP 2022)

Overall objectives

- Participation to the IC (OP1b), particularly to the plasma phase
- Complete the delivery of the EU-led systems under implementation
- Progress towards the release of validated simulation tools for scientific exploitation
- Contribute to the start-up of the Experiment Team
  - in 2022 there will 2 parallel structures, IC team and Experiment Leaders / TGL
  - some level of coordination is being discussed in view of designing how the experiment team will work when the IC phase will finish.
- Prepare proposals for future Enhancements (>2025)

Mapping of IC2021 activities in FP9 and IC2022

IC 2021 Topic	FP9 activity / IC2022
ECWC and gas analysis	**FP9 Code Management**. Support QST with the FP9 plasma operation team.
Plasma discharge development	**FP9 Operations – Plasma Operations (partial overlap with the scenario TG)**
EDICAM	**EDICAM -FP9 Operations jointly with CM**
Camera tomography	**Camera tomography – Operations jointly with CM**
Plasma Breakdown	**Operations – Plasma Operations for IC support. Simulation work with CM (partial overlap with the scenario TG)**
Plasma Control and Equilibrium	**Operations – control (CREATE) (partial overlap with the scenario TG)**
Magnetics and MHD	**Operations – Magnetics diagnostics (WG diagnostics) + MHD (partial overlap with the MHD TG) + Disruption Database**
Disruption (database development)	**FP9 Code Management – Disruption trigger development + Disruption avoidance? (partial overlap with the scenario TG)**
Cryo and magnets	**FP9 Operations – Cryo and magnets**

- Crossed disciplinary WGs involving F4E+QST+EUROfusion
- WG help to create a link between operations and scientific work

WGs/Joint meetings
Diagnostics and data validation
Plasma scenarios, breakdown, plasma operations
Real Time Control
Integrated data analysis and Software management
…

Experiment Team Topical Groups
MHD
Pedestal
Scenarios
PWI and SOL
Transport
Energetic Particles

Other supporting activities
Heating systems (ECRF in 2022)
RDA & Remote Participation

2022 programme goals & strategy (AWP 2022)

SA-CM Code management and modelling area — Coordinator G. Falchetto

- **Validate operation oriented tools** on **data from IC**
  - ECWC code
  - Disruption modelling
- **Optimize and provide to EU users simulation tools for operation/scientific exploitation**
  - **Discharge simulator**
    - strong coupling and performance improvements
    - call for test users (operators/scientists) and provide training
  - **Breakdown simulator:** optimization and simulation of breakdown scenarios for JT-60SA using a nonlinear optimization technique. Runaway generation at start-up.
  - **MHD stability workflow** operational for routine use
  - Demonstration of automated application of the **energetic particles (EP) workflow** to the assessment of EP-stability in ramp-up and steady state plasmas.– NBI modelling expertise needed
  - Development of the **disruption mitigation trigg**er
  - Adaptation of **Integrated Data Analysis** and Validation (IDAV) tools to JT-60SA, pending requirement capture and agreement.
- **Finalize/extend the modelling of initial phase scenarios**
  - Assessment of **ramp-up in the ELMy H-mode with operationally oriented integrated transport codes** including first principles transport models and MHD stability analysis
  - Report on sensitivity study on **conditions for divertor detachment** for the initial phase and nominal C scenarios with edge/SOL transport modelling codes, including impurity seeding impact.
  - Modelling **multiple pellet injection** in self-consistently evolving pedestal profile
  - Extend to **runaway electron and disruption modelling**: available manpower?

2022 programme goals & strategy (AWP 2022)

SA-OP Operations area: **Coordinator: E. Belonohy**

- Support the **integrated commissioning in 2022** in
  - Plasma Operations and Commissioning incl. vacuum conditioning and plasma breakdown
  - Magnetics commissioning, MHD, disruption database
  - Control and equilibrium reconstruction
  - Cryo and magnets
  - EDICAM operation
  - Camera tomography

  SA-CM will support integrated commissioning with ECWC & breakdown modelling

  -> Share European operational experience and support QST from Europe and on the Naka-site in establishing commissioning strategies, day-to-day analysis support and recording/reviewing of the IC experience
- Start **new activities in support of the experimental campaigns in 2024-25**
  - Commissioning of enhancements provided by Europe (Thomson Scattering, VUV spectrometer, Divertor Cryo)
  - Control room support preparation (real-time experts for scientific networks)

2022 programme goals & strategy (AWP 2022)

Coordinator: J. Ayllon-Guerola

SA-Enhancement Projects area:

- Tangential Phase Contrast Imaging system: being considered for implementation (JT-60SA ETLs, Project Managers). Completing revision of the mechanical lay-out outside the vessel after changes in the torus hall
- Doppler Reflectometry system: ready for final design by end of 2022 - to be submitted for consideration
- New diagnostics (Neutron & Gamma, Beam Emission Spectroscopy, EC Stray, IR imaging, Ultra Fast reflectometry):
  - Final feasibility study by end of 2022
- Linked to Milestone 2023: Include new enhancement programmes in BA
- Scheme of support for the enhancement being defined

2022 programme goals & strategy (AWP 2022)

SA-JIFS JT-60SA International Fusion School **Coordinator: G. Giruzzi**

- Launch of the 1st JIFS school with support from the European Commission and the Japanese Government in early 2022
- Finalisation of the JIFS programme and selection of the lecturers, supervisors of practical activities
- Call for participation in the 1st JIFS school for European and Japanese participants
- The 1st JIFS school is planned in-person in Autumn 2022 following the JT-60SA first plasma (not possible ***during*** machine commissioning).

Request by the EU Commission: elaborate a more extensive programme of initiatives for students, including JIFS as an element.

2022 WP milestones

Sequential WP-M ID	Related WBS ID	WP Milestone Title	Due Date [mm/yyyy]	Related GA D/M No.	Criticality of Relation to the GA D/M (high/low)
WPM01	SA.SE.OP	Commissioning of the EDICAM camera system on plasma	10/2022*	SA.D.02	high
WPM02	SA.SE.EN	Completion of the exploratory studies on the new enhancements	12/2022	SA.D.04	high
WPM03	SA.SE.CM	Successful test of the upgraded version of the METIS-NICE coupling with all controllers (current, gaps, vertical stability) on a typical JT-60SA discharge flat-top	11/2022	SA.D.02	high

(*)Milestones/deliverables dependent on external conditions to which the workpackage is constrained, see Risk Table

2022 GA milestones/deliverables

GA Milestone no.	Title	Due Date (mm/yyyy)
SA.M.02	Start of the EU-REC project	Apr. 2022

The activity is ongoing, however a reformulation of the milestone may be required due to the changed scope and objective of the work

GA Deliverable no.	Title	Due Date (mm/yyyy)
SA.D.02	Final report on Integrated Commissioning. Results and return of experience, mainly for DTT	Dec. 2022*
SA.D.04	Documented plan of EU enhancement programme for BA Phase II– 2025-2029	Dec. 2022

(*)Milestones/deliverables dependent on external conditions to which the workpackage is constrained, see Risk Table

Synergies

- **Code management:**
  - breakdown simulator activity in synergy with **WPPrIO** (Preparation for ITER Operations) and **WPTE** (Tokamak Exploitation)
  - Development of synthetic diagnostics (**WPPrIO, WPTE, TSVVs...)**
  - "Edge/divertor modelling" & "interaction of RE with PFC" synergetic to **WPDIV**: prepare operation scenarios compatible with C Divertor, ACD-C Divertor and in future with W divertor
- **Operations:**
  - **WPPrIO** (Preparation for ITER Operations) work package
    - The EUROfusion Operations Networks subnetworks (seminars, workshops, trainings) will be offered to QST staff to join -> NBI seminar series
    - Disruption database could be connected to the EUROfusion database
- **Enhancements**
  - **WPPrIO** Collaboration on FILD system (JT-60SA/ITER)
- **Scientific exploitation**
  - **WPTE** link for the development of the scientific programme (code validation, experimental work of common interest,…)

Opportunity for training & development of staff

- EUROfusion Operation Network (EON): WPSA, F4E and QST experts are invited to participate in subnetworks and events established under the EUROfusion Operations Network (WPPrIO) through the Broader Approach Agreement. The first subnetwork confirmed is the monthly NBI seminar series. Further events are expected to be organised around vacuum conditioning, knowledge base and foundation course on session leading, maintenance of (old) equipment and quantification of operational reliability and performance.

- EUROfusion Engineering Grants (EEGs): Continued support of two EEGs completing their programme in 2022 on superconducting coils (CEA) and integration of EU enhancements (IPP). New EEGs are expected on the topics of ECH exploitation and Thomson Scattering diagnostics.

- JT-60SA International Fusion School (JIFS): The first edition of the 2-week JIFS school expected in 2022 is prepared as a joint European-Japanese initiative to provide in-depth and practical training on engineering, operations and physics aspects of fusion research.

International collaborations

- **Direct collaborations (EUROfusion members – INTL partner)**
  - ITER for IMAS workflow developments within modelling tasks
  - ITER for EC stray sensors development and test
  - ITER collaboration involving EEGs (of course if topic/candidates selected)
    - EEG21-15 EU enhancement project for JT-60SA: Thomson Scattering Diagnostics
    - EEG21-20 Development of software tools for ECH exploitation (JT60-SA and ITER)
  - NIFS (National Institute for Fusion Science) for TPCI diagnostics
  - Kyoto University for IDAV
  - NIFS for Doppler Reflectometry

- **Collaboration through the JT-60SA project as partner together with F4E, QST**
  - ITER-F4E-QST trilateral agreement: Meetings on three topics with EUROfusion representative (IC, Assembly, Scientific Exploitation)
  - US for diagnostics (XICS, FIDA)
  - Broader Approach (IFERC, REC)

Risks

- Lack of available manpower in some priority topics (disruptions, runaway modelling, NBI modelling for fast-ion studies)
- Availability of IC experts in 2022 – checked in September-October
  - Some experts moved to ITER (ECWC, Cryo) – hope to maintain connection/involvement through the ITER-F4E-QST trilateral agreement
- Ability to travel to Naka in 2022 (with or without visa)
  - Strong border limitations in Japan due to COVID19
  - Visa-free travel unlikely in early 2022, long process to obtain visa (>6 months)
- Access to IC data cumbersome and limited to a small group of European scientists – *being worked on*
- Potential delay in IC plasma phase
- Potential delay in FP8 Enhancement delivery impacting FP9 resources

Final remarks

- 2022 challenging year with
  - next IC phase
  - Enhancements procurements
  - Setting of the Experiment Team

- The agreed objective is to support 40% of the scientific activity. Resources may be marginal for the scope when things will go to full speed (after 2022)
- Extremely important to reach a level of effective coordination in the side of modelling and simulation
- Another critical aspect is the support for enhancements of high scientific impact using the most suitable scheme. This is a key for effective participation and team integration

Exploitation of JT-60SA (WPSA)

Project Change Requests (PCRs)

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

PCRs: Grant deliverables

ID	Deliverables Table	Date
SA.D.01	Appointment of EU Deputy Experiment Leader (after call issued end 2020)	Apr. 2021
SA.D.02	Final report on Integrated Commissioning. Results and return of experience, mainly for DTT	Dec. 2021
SA.D.03	Report on organisation of the JT-60SA scientific exploitation	Dec. 2021
SA.D.04	Documented plan of EU enhancement programme for BA Phase II– 2025-2029	May 2022
SA.D.05	Delivery and final tests of EU-REC completed	Jan. 2023
SA.D.06	Commissioning and calibration of the EU systems before the 2023 campaign completed.	Mar. 2023
SA.D.07	Final report on the 2023 campaign. Results and return of experience	Mar. 2024
SA.D.08	Commissioning and calibration of the FILD system before 2024 campaign completed.	Jun. 2024
SA.D.09	Final report on the 2024 campaign. Results and return of experience	Mar. 2025
SA.D.10	Delivery of EU procurements (TBD) for the campaign 2026 completed.	Dec. 2025

Updated in the PMP2022
And in the CWP

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. 2022*
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. 2023
SA.D.06	Commissioning and calibration of the EU systems before the OP2 campaign completed.	Jun. 2023*
SA.D.07	Final report on the high power experimental campaign (OP2). Results and return of experience	Dec. 2024*
SA.D.08	Commissioning and calibration of the FILD system before OP3 campaign completed.	Jun. 2024*
SA.D.09	Final report on the high power experimental campaign (OP3). Results and return of experience	Dec. 2025*
SA.D.10	Delivery of EU procurements (TBD) for the OP3 campaign completed.	Dec. 2025*

(*)Deliverables dependent on external conditions to which the workpackage is constrained, see Risk Table (WPR-04)

PCRs: Grant milestones

	Milestones Table	Date
SA.M.01	Participation in the Integrated Commissioning to first 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 2022
SA.M.04	Call to start EU enhancement programme for 2025-2029	Oct. 2022
SA.M.05	Start of the new EU enhancement projects (TBD)	Jan. 2023
SA.M.06	Demonstration of stable operation at 5.5 MA plasma current in H-mode completed (participation)	Dec. 2023
SA.M.07	Demonstration of non-inductive scenario at $\beta_N \geq 3$ completed (participation)	Dec. 2024

Not yet updated in the PMP2022
And in the CWP (miscommunication)

	Milestones Table	*Date*
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	Mar. 2023
SA.M.04	Call to start EU enhancement programme for 2025-2029	Jun. 2023
SA.M.05	Start of the new EU enhancement projects (TBD)	Oct. 2023
SA.M.06	Contribution to the demonstration of stable operation at multiple MA plasma current in H-mode	Dec. 2024*
SA.M.07	Contribution to the demonstration of non-inductive scenario at high β_N	Dec. 2025*

(*)Milestones dependent on external conditions to which the workpackage is constrained, see Risk Table (WPR-04)

FP8 stand-by deliverables

ID	Title	Deliverable Owner	Start Date	Due Date	Work Status	Contractual Status	Report in IDM	PL comment	proposal	Del. Owner comment
SA-EP.A03-T002-D001	Edge Thomson scattering: optics	Roberto Pasqualotto	01/01/2020	31/12/2021	ok	Running	1	Design completed	interim report	ok
SA-EP.A03-T002-D002	Edge Thomson scattering: mechanics	Sorin Soare	01/01/2020	31/12/2021	ok	Running	1	Design advanced up to succesful Design Review Meeting	interim report	ok
SA-EP.A03-T002-D003	Edge Thomson scattering: laser	Roberto Pasqualotto	01/01/2020	31/12/2021	ok	Running	1	Objective 2020 of technical specification for procurement reached	interim report	ok
SA-EP.A05-T002-D001	CAD support during manufacturing phase	Christian Day	01/01/2020	31/12/2021	ok	Running	1	completed	acceptance	ok: I understand this such that you accept the alreday existing report 2PNBR9 as final one to close this deliverable.
SA-EP.A05-T002-D002	Procurement contract follow-up and monitoring	Christian Day	01/01/2020	31/12/2021	ok	Running	1	delayed	interim report	This task will have to be continued in 2022 at additional resources. I understand that you take the already existing report 2PK3QF as interim report and expect further reports to come so that you can close this deliverable by end 2022.
SA-EP.A06-T002-D001	Pellet injection system manufacturing	Peter Lang	01/01/2020	31/12/2021	ok	Running	1	Specifications for extruder completed and manufacturing prepared	interim report	Ok, With the extruders facing further delay and the centrifuge call for tender still under way this will be much later (due date)
SA-EP.A07-T002-D001	MGI system manufacturing	Mathias Dibon	01/01/2020	31/12/2021	ok	Running	1	manufacturing of auxiliaries	interim report	ok
SA-EP.A04-T003-D001	Spectrometer assembly	Marco Valisa	01/01/2020	31/12/2021	ok	Running	1	assessment of the specifications. Gratings procurement delayed	interim report	ok
SA-EP.A04-T003-D002	Spectrometer focusing tests and mirror alignment	Marco Valisa	01/01/2020	31/12/2021	ok	Running	1	design of the alignment system	interim report	ok
SA-EP.A02-T004-D001	FILD: completion of design	Juan Ayllon	01/01/2020	31/12/2021	ok	Running	1	Objectives 2020 reached	interim report	ok, the design will be completed in 2022 and manufacturing will also start in 2022
SA-EP.A02-T004-D002	FILD: tests, manufacturing and assembly	Juan Ayllon	01/01/2020	31/12/2021	ok	Running	1	Test in neutron facility delayed to 2021 due to covid	interim report	Ok, the activity needs to continue in 2022. Tests in Neutron facility will start in 2021 (according to info received from E. Perelli), however the payment will likely be done in 2022.
SA-EP.A01-T004-D001	EDICAM: commissioning and operation	Tamas Szepesi	01/01/2020	31/03/2021	blocked	Running	1	Pre-plasma objective fully achieved. Plasma work delayed	interim report	
SA-O.A06-T003-D002	Plasma control and equilibrium reconstruction	Gianmaria De Tommasi	01/01/2020	31/03/2021	blocked	Running	1	completed	acceptance	ok
SA-O.A06-T003-D003	Magnetic diagnostics validation and MHD/Disruption analysis	Emmanuel Joffrin	01/01/2020	31/03/2021	blocked	Running	1	completed	acceptance	
SA-O.A06-T003-D004	Plasma breakdown (with ECRH)	Gianmaria De Tommasi	01/01/2020	31/03/2021	blocked	Running	1	completed	acceptance	ok
SA-O.A06-T003-D005	Cryogenic and magnet operation analysis	Emmanuel Joffrin	01/01/2020	31/03/2021	blocked	Running	1	partially achieved (missing operation during plasma phase)	interim report	
SA-O.A06-T003-D006	Plasma discharge preparation and development	Eva Belonohy	01/01/2020	31/03/2021	blocked	Running	1	delayed	postpone	
SA-O.A06-T003-D001	Wall conditioning (ECWC) and gas analysis	Eva Belonohy	01/01/2020	31/03/2021	blocked	Running	1	completed	acceptance	ok

FP8: updates on IC and EN budget

FP8 Integrated commissioning PM work		
Planned 2020-21	**Performed 2020-21**	**Residual**
83,01	68,88	14,13

FP8 Enhancement PM work			
Planned 2020-21	**Performed 2020-21**	**Residual**	**New request (2022)**
263,3	208,9	54,4	59

Equipment & Infrastructure 100% (JT-60SA) and Goods & services 100% (JT-60SA)				Planned	Used	Residual
Deliverable	Year	Ben.	Description	Total Contribution	Total Contribution	Total Contribution
SA-EP.A03-T002-D002	2021	IAP	Mechanics procurement	500	130	370
SA-EP.A07-T002-D001	2020	MPG	Valve components, gas handling components, electronics, 50k shifted to 2021	40	40	0
SA-EP.A07-T002-D001	2021	MPG	COVID, Valve components, gas handling components, electronics	50	58	-8
SA-EP.A03-T002-D001	2020	ENEA	collection optics, 15k shifted to 2021	60	60	0
SA-EP.A03-T002-D001	2020	ENEA	Design studies for collection optics	20	20	0
SA-EP.A03-T002-D001	2021	ENEA	Collection optics, 15k shifted to 2021	75	3	72,5
SA-EP.A03-T002-D001	2021	ENEA	COVID, collection optics	15	15	0
SA-EP.A03-T002-D003	2021	ENEA	Laser 2nd payment	240	0	240
SA-EP.A03-T002-D003	2021	ENEA	COVID, Laser 1st Payment	160	40	120
SA-EP.A04-T003-D002	2021	ENEA	Spectrometer, collection optics and ancillaries procurement by Consorzio RFX	100	0	100
SA-EP.A04-T003-D002	2021	IAP	Mechanical stand for spectrometer and optics, vacuum interface (valves, bellows) and port plug	30	0	30
SA-EP.A04-T003-D002	2021	ENEA	COVID, Spectrometer, collection optics, and ancillaries procurement by Consorzio RFX	280	0	280
SA-EP.A04-T003-D002	2021	IAP	COVID, Mechanical stand for spectrometer and optics, vacuum interface (valves, bellows) and port plug	80	0	80
SA-EP.A04-T003-D002	2021	IPPLM	COVID, Vacuum system	80	0	80
SA-EP.A02-T004-D002	2021	CIEMAT	Completion of manufacturing and assembly	450	0	450
SA-EP.A02-T004-D002	2021	CIEMAT	COVID Actuators and control system for tests. Scintillator screens and fast framing camera, initially foreseen in the 2019 budget: 110 keuros, unspent and moved to 2021 22.130 keuro; foreseen for 2020 also moved to 2021-22	70	0	70

WPSA: budget change on PMP (27/09/2021)

Year 2021

2021 Indicative Resources (no UK and CH)			
Initial allocation		27/09/2021 budget review	
Total PM	Total CC k€	Total PM	Total CC k€
251	1.277	130	782

2021 Indicative Resources without only UK and CH			
Initial allocation		27/09/2021 budget review	
Total PM	Total CC k€	Total PM	Total CC k€
10	48	12	58

2021 Indicative Resources budget change details				
WBS level 1	Beneficiary	Year	Total PM	Total CC k€
SA-EN	EPFL	2021	1,60	9,98
SA-SE.CM	LPP-ERM-KMS	2021	-3,00	-14,23
SA-PM	Not Allocated	2021	-9,00	-49,22
SA-SE.EX	Not Allocated	2021	-6,90	-26,95
SA-SE.OP	Not Allocated	2021	-16,40	-64,06
SA-IC	Not Allocated	2021	-85,89	-335,51
			-119,59	-479,99

Year 2022

2022 Indicative Resources (no UK and CH)			
Initial allocation		27/09/2021 budget review	
Total PM	Total CC k€	Total PM	Total CC k€
237	1.264	360	1.764

2022 Indicative Resources UK and CH			
Initial allocation		27/09/2021 budget review	
Total PM	Total CC k€	Total PM	Total CC k€
13	55	13	55

2022 Indicative Resources budget change details				
WBS level 1	Beneficiary	Year	Total PM	Total CC k€
SA-SE.CM	LPP-ERM-KMS	2022	3,00	14,45
SA-PM	Not Allocated	2022	8,29	45,34
SA-SE.EX	Not Allocated	2022	6,90	26,95
SA-SE.OP	Not Allocated	2022	18,70	73,05
			85,89	335,51
			122,78	495,30

Other changes

- CM
  - ECWC replacement of LPP-ERM-KMS manpower due to departure of T Wauters
  - ECWC validation on IC data postponed to 2022
  - Disruption modelling tools validation on first mechanical data postponed to 2022
- ENH
  - Deliverables definition being revised for better adaptation to annual cycle