

# WPTE programme for the Campaigns in 2025:

## Overview of research topics and categories of required competencies

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## Introduction

This Annex presents the scientific programme of WP TE for 2025. This includes running experimental campaigns on four devices (AUG, TCV, MAST-U and WEST) as well as performing analysis and modelling for 2025 and past campaigns. This call includes in particular the data analysis and modelling of past JET campaigns. The continuation of work related to the JET DTE2 campaign is also welcome. In addition, this call also covers specific JET data validation tasks. Finally, the call covers work to be done within the JT-60SA Experimental Team and which EUROfusion can support. This Annex should be used as a reference to answer the present Call for Participation.

For the experimental campaigns to be run on AUG, MAST-U, TCV and WEST in 2025, the WP TE scientific programme is structured in 9 Research Topics (RT), keeping the same structure as for 2024.

For each Research Topic, you will find listed in this Annex:

- the related Mission of the EUROfusion roadmap
- the reference WP TE Task Force Leaders (TFL)
- the Research Topic Coordinators in charge
- the associated scientific objectives to be addressed
- An **indicative** number of pulses for each of the RT. Note that this number is only indicative at this stage, and could be updated following the General Planning Meeting foreseen on November 18-19, 2024. In addition, shot allocation might be reviewed as campaign progresses to cope with possible machine availability as well as urgent scientific priorities.

Introduced in 2024, the 2 JET specific RTs, coordinated by the WPTE TFLs, are continuing :

- RT-10 : JET data validation
- RT-11: JET data analysis and modelling from C45 backwards

The novelty for 2025 is the inclusion of 7 specific items related to JT-60SA, corresponding to the Topical Groups (TG) established for JT-60SA in the framework of the JA-EU Experimental Team, as well as an additional item dealing with IMAS activities.

- TG-ORD: Operation Regime Development
- TG-MHD: MHD Stability and Control
- TG-TC: Transport and Confinement
- TG-EP: High Energy Particle Behaviour
- TG-PED: Pedestal and Edge Physics
- TG-DSP: Divertor, Scrape-off Layer and Plasma-Material Interaction
- IMAS: Integrated Data Validation and Data Access with IMAS

An overview of the different topics for the 2025 WP TE programme can be found in Table 1, together with the corresponding IMS tag.

You will also find in Table 2 the 4 categories of competencies to be used in IMS (IMS tag), to indicate whether your expertise lies in diagnostic operation (DO), data analysis and interpretation (DAI), modelling (MOD), data validation for JET (VAL) or in another area (OTH).

You will find detailed instructions on how to answer the present Call for Participation under IMS in **Annex 3**. From the scientific side, the proponents should provide a work plan for each Research Topic / WP TE device they would like to contribute to.

Please note that the **work plan** you provide is the **main element** for WP TE to assess your participation. It should be complete though concise (typically ~2-3 sentences for each Research Topic / device where you

would like to contribute). It should mention which physics issue this would address, in relation to the scientific objectives of the RT listed in this annex.

Therefore, we kindly ask the proponents to carefully read the description of the Research Topics in this Annex and to refer to it when elaborating their work plan. Indications on the quality level expected for the work plans are given in Annex 3.

Concerning the scientific priorities of the RT, you will find additional information in the slides that will be presented at the WP TE Programme Meeting, to be held on November 18-19, 2024. Those slides will be posted on the WP TE wiki in the meetings section.

Please note that contributions addressing issues raised by the new ITER baseline are encouraged and that this should be indicated in your work plan when applicable. You can use as a reference the documents we put online for the Call for Proposals.

Contributions extrapolating findings from present WP TE devices to next step fusion devices, such as ITER and DEMO, are also encouraged.

If you have any further questions about a particular Research Topic, please contact the reference TFLs and the Research Topic Coordinators.

## List of Research Topics and IMS tags

The **IMS tag** (4<sup>th</sup> column) refers to “step 2: select campaign/experiments” in the guidelines to reply to the Call in IMS (Annex 3).

	Research topic	Title	IMS tag
Mission 1	RT-01	Core-Edge-SOL integrated H-mode scenario compatible with exhaust constraints in support of ITER	RT01
	RT-02	Physics understanding of alternatives to Type-I ELM regime	RT02
	RT-03	Strategies for disruption and run-away mitigation	RT03
	RT-04	Physics-based machine generic systems for an integrated control of plasma discharge	RT04
	RT-08	Physics and operational basis for high beta long pulse scenarios	RT08
	RT-09	Physics understanding of energetics particles confinement and their interplay with thermal plasma	RT09
Mission 2	RT-05	Physics of divertor detachment and its control for ITER, DEMO and HELIAS operation	RT05
	RT-06	Preparation of efficient Plasma Facing Components (PFC) operation for ITER, DEMO and HELIAS	RT06
	RT-07	Physics understanding of alternative divertor configurations as risk mitigation for DEMO	RT07
JET specific	RT-10	JET data validation	RT10
	RT-11	Analysis and modelling of DTE2 related experiments on JET	RT11
JT-60SA specific	TG-ORD	Operation Regime Development	RT12
	TG- MHD	MHD Stability and Control	RT13
	TG-TC	Transport and Confinement	RT14
	TG-EP	High Energy Particle Behaviour	RT15
	TG-PED	Pedestal and Edge Physics	RT16

	TG-DSP	Divertor, Scrape-Off Layer & Plasma-Material Interaction	RT17
	IMAS	Integrated Data Validation and data access with IMAS	RT18

Table 1: List of topics for the 2025 WP TE scientific programme. The Missions 1 and 2 refer to the missions of the EUROfusion Roadmap.

## List of competencies and IMS tags

Type of expertise	IMS Tag
Diagnostic operation	DO
Data analysis and interpretation	DAI
Modelling expertise	MOD
JET Data Validation	VAL
Other	OTH

Table 2: List of competencies to be used as tags under IMS.

## Categories of competencies for IMS

Please use the competencies listed in Table 2 to describe your work plan in IMS, in terms of diagnostic operation, data analysis and interpretation, modelling, JET data validation or other activity.

### Diagnostic operation

Please note that WP TE will support work for diagnostics or sub systems operation only for the systems which are not included as part of the device operational costs.

If you plan to operate or support the operation of a diagnostic that is not included in the device operational costs, but will be useful to a Research Topic, please state your expertise in your work plan, providing details on what your work will include.

Please contact the WPTE TFLs if you are uncertain that the diagnostic support you propose is eligible for funding.

### Data analysis and interpretation

Please describe in your work plan the data analysis and interpretation that you can perform for the specific Research Topic and Scientific Objectives, as listed in this Annex. You should identify the diagnostic data you will contribute to analyse (e.g. spectroscopic measurements), the type of analysis and interpretation you will contribute to (e.g. addressing pedestal physics).

## **Modelling Expertise**

Please describe your expertise and include in your work plan the type of modelling you can perform for the specific Research Topic and Scientific Objectives, mentioning also the modelling codes that you will use.

## **JET data validation Expertise**

Please describe your expertise and include in your work plan the type of data validation you would perform for JET within the selected diagnostics (see list in RT10 description) .

## **Other**

You can use this category if none of the above applies to your work plan or if you are a pre-selected RTC.

# RT-01: Core-Edge-SOL integrated H-mode scenario compatible with exhaust constraints in support of ITER

**Mission:** M1.1  
**TFLs:** N. Vianello, B. Labit  
**Coordinators:** C. Giroud, L. Frassinetti, S. Wiesen, D. King

## Scientific objectives

#	
D1	Develop and understand stationary H-mode scenario at low collisionality and with dominant electron heating
D2	Provide physics-based cross-field transport coefficients to TSVVs (1, 3, 4 and 11) for turbulence modelling
D3	Determine the impact of different impurity mixes for partially detached divertors in high power operations in view of ITER radiative scenarios
D4	Assess pedestal performances in condition closer to future devices including large SOL opacity, low pedestal collisionality, peeling limited plasma
D5	Quantify impurity screening for high temperature pedestals

Number of discharges Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2025	30	120	24	15

## Competences

A non-exhaustive list of requested competencies is given hereafter .

### *Data analysis and Interpretation*

MHD spectrum and mode structure; Kinetic profiles pedestal and SOL ( $n_e$ ,  $T_e$ ,  $T_i$ ), Pellet injection/ablation; Bolometer/AXUV; IR thermography; Active and Passive spectroscopy; Light and Heavy impurity transport and concentration; Visible and Multiwavelength Cameras, Real time control (development, analysis,...); Fluctuation diagnostics (PCI, (C)ECE, DBS, Correlation reflectometry, Li-Be, He-Beams),...

### *Modelling*

Pedestal stability (EPED, EUROPED, ELITE, MARS,...); SOL fluid (SOLPS, SOLEDGE2D, EMC3,...); SOL turbulence (GBS, TOKAM3X, HESEL,...); Core GK analysis (GENE, GS2, GWK, Qualikiz,...); Pedestal GK analysis (GENE, GS2, GWK,...); Nonlinear MHD (JOREK, NIMROD, MEGA,...); Interpretative (IMEP, JINTRAC, ETS, ASTRA, RAPTOR, METIS, TRANSP, JETTO, Coconut,...); Material migration (ERO2.0, Walldyn, ...); PIC SOL and core codes (BIT1, SPICE, EPOCH, ...); Momentum transport modelling & analysis.

## RT-02: Physics understanding of alternatives to Type-I ELM regime

**Mission:** M1.1  
**TFLs:** B. Labit, D. Keeling  
**Coordinators:** M. Dunne, M. Faitsch, O. Sauter, E. Viezzer

### Scientific objectives

#	
D1	Quantify turbulent and MHD driven transport in the vicinity of the separatrix and implications for predictions for ITER and DEMO
D2	Quantify first wall load in no-ELM scenarios and provide model for SOL transport extrapolation
D3	Extend the parameters space of no-ELM scenarios to pedestal top collisionalities relevant for ITER and DEMO
D4	Determine the key physics mechanisms regulating edge transport in order to access no-ELM regimes
D5	Determine access window and physics understanding for RMP ELM suppression and its compatibility with ITER FPO scenarios
D6	Quantify the overall performance of negative triangularity plasmas in view of DEMO

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2025	45	120	48	15

### Competences

A non-exhaustive list of requested competencies is given hereafter :

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; RMP coils; CXRS; Bolometer/AXUV; (C)ECE ; IR thermography; Reflectometry; Fast-ions (FILD, FIDA,...); Passive spectroscopy; Gas puff imaging; Langmuir probes; Reciprocating probe (midplane, X-point, RDPA...); Visible fast imaging; ECE imaging; Beam emission spectroscopy (BES); Tangential phase contrast imaging; Real time control (development, analysis,...); Lithium beam; HXR/ SXR (including GEM); Doppler reflectometry: DOPL, RIC/RFL, PREF, DBS,...

#### *Modelling*

Pedestal stability (EPED, EUROPED, ELITE, MARS...); Improved or RT equilibrium reconstruction (CLISTE, CHEASE, CREATE-NL,...); MHD stability (MISHKA, KINX, VMEC, CASTOR, LIGKA...); SOL fluid (SOLPS, SOLEDGE2D, EMC3,...); SOL turbulence (GBS, TOKAM3X, HESEL, GRILLIX ...); Core GK analysis (GENE, GS2, GWK,...); Pedestal GK analysis (GENE, GS2, GWK,...); Nonlinear MHD (JOREK, NIMROD, MEGA,...); Interpretative (IMEP, JINTRAC, ETS, ASTRA, RAPTOR, METIS, TRANSP, ...); MHD: plasma response to RMP (GPEC, MARS-F, VMEC,..., Material migration (ERO2.0, Walldyn, ...)

## RT-03: Strategies for disruption and run-away mitigation

**Mission:** M1.1  
**TFLs:** V. Igochine, A. Hakola  
**Coordinators:** U. Sheikh, C. Reux, O. Ficker, ITER Organization

### Scientific objectives

#	
D1	Optimize disruption mitigations by single and multiple shattered pellet injection (SPI) at high plasma current and energy content in an all-metal environment to validate the ITER disruption mitigation strategy
D2	Quantify the required neon quantity for SPI into dilution cooled plasmas for sufficient thermal and current quench mitigation in ITER and the synchronisation requirements for dual deuterium/neon SPI in ITER
D3	Characterize/optimize the RE impact mitigation schemes and their interactions with the RE companion plasma with different hydrogen/deuterium injection techniques
D4	Determine the physics mechanisms generating run-away electrons in the current quench and in the plasma start-up phase
D5	Interpretative modelling of disruption mitigation dynamics (TSVV-8, TSVV-9) and prediction for ITER
D6	Quantify the radiation asymmetry during disruption mitigation with SPI
D7	Validate the modelling of image currents in conducting structures during disruption with halo current measurements

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2025	60	120	0	30

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; Bolometer/AXUV; (C )ECE; Kinetic profiles (Thomson scattering, Li-Be, He-beam), IR thermography; Reflectometry; Passive spectroscopy; (Visible )fast imaging; ECE imaging; VUV spectroscopy; MSE; Lithium beam; HXR/ SXR (including GEM); Reflectometry: DOPL, RIC/RFL,PREF, DBS,...; MANTIS/MWI filtered imaging analysis; Fast Interferometry; Impurities spectroscopy analysis (W, divertor, Visible, VUV...)/DSS; Bremsstrahlung; Thomson Scattering; RF Antenna; RE energy spectra from gamma-ray/hard X-rays

#### *Modelling*

Nonlinear MHD (JOREK, NIMROD, MEGA, ...); RE impact (ERO, MEMOS, GEANT4, ...); RE modelling (LUKE, GO, STREAM, DREAM, SOFT, KPRAD, R5X2, SOFT....)

## RT-04: Physics-based machine generic systems for an integrated control of plasma discharge

**Mission:** M1.1, M1.3, M2.1  
**TFLs:** M. Baruzzo, V. Igochine  
**Coordinators:** A. Mele, L. Piron, C. Vincent

### Scientific objectives

#	
D1	Develop MIMO (Multi-Input Multi-Output) state-observers for e.g., radiative detachment control on different devices
D2	Develop machine independent strategies for the H-mode entry and exit and off-normal events supported by modelling.
D3	Develop and test disruption avoidance schemes and apply them on several different devices
D4	Develop robust strategies to optimize error field corrections supported by modelling
D5	Optimize plasma start-up and current ramp-up schemes supported by modelling in ITER like scenarios

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2025	50	60	32	15

### Competences

A non-exhaustive list of requested competencies is given hereafter :

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; RMP coils; CXRS; IR thermography; Visible fast imaging; Beam emission spectroscopy (BES); Real time control (development, analysis,...); HXR/ SXR (including GEM); Doppler reflectometry: DOPL, RIC/RFL,PREF, DBS,...; MANTIS/MWI filtered imaging analysis; Impurities spectroscopy analysis (W, divertor...)/DSS; Pellet injection/ablation, Bolometer/AXUV, ECE, LP, Reciprocating Probe, Kinetic Profiles, Impurity spectroscopy analysis

#### *Modelling*

Pedestal stability (EPED, EUROPED, ELITE, MARS...); Improved or RT equilibrium reconstruction (CLISTE, CHEASE, CREATE-NL,...); MHD stability (MISHKA, KINX, VMEC, CASTOR, LIGKA...); ECRH/ECCD/Current drive (PION, TORAY, TORBEAM, CQL3D, C3PO, LUKE, NUBEAM, RABBIT, ASCOT, LOCUST, EPOCH,...); Interpretative (IMEP, JINTRAC, ETS, ASTRA, RAPTOR, METIS, TRANSP, ...); Breakdown, burnthrough, ECWC (TOMATOR-1D, BKDO, GRAY, RAPTOR, EPOCH, ...); RE modelling (LUKE, GO....); MHD (N)TM dynamics (NTMwf,...); Machine Learning, Plasma transients analysis

## RT-05: Physics of divertor detachment and its control for ITER, DEMO and HELIAS operation

**Mission:** M2.1  
**TFLs:** N. Vianello, E. Tsitrone  
**Coordinators:** M. Bernert, S. Henderson, H. Reimerdes, N. Fedorczak

### Scientific objectives

#	
D1	Characterize detachment access and core plasma performance in scenarios using different fuelling schemes, different impurity mixtures
D2	Development of reduced physics model which can be included in radiative detachment control schemes or extrapolations to DEMO/ITER
D3	Quantify edge-SOL particle and heat transport, including the interaction with neutrals, above and below the X-point under detached conditions
D4	Assess the compatibility and stability with X-point radiator regimes with confinement
D5	Quantify the degree of ELM heat load mitigation achievable by impurity seeding, investigating the dependences on relevant machine parameters
D6	Assess the evolution of detachment under slow transients (L-H transitions, sawtooth, loss of impurity seeding)

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2025	35	150	32	15

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; Pellet injection/ablation; CXRS; Bolometer/AXUV; IR thermography; Passive spectroscopy; Gas puff imaging; Langmuir probes; Reciprocating probe (midplane, X-point, RDPA...); Visible fast imaging; Helium beam; Real time control (development, analysis,...); VUV spectroscopy; Lithium beam; MANTIS/MWI filtered imaging analysis; Impurities spectroscopy analysis (W, divertor...)/DSS; Edge Transport & ELM (buffering) analysis; Neutral Pressure analysis

#### *Modelling*

Pedestal stability (EPED, EUROPE, ELITE, MARS...); Improved or RT equilibrium reconstruction (CLISTE, CHEASE, CREATE-NL,...); SOL fluid (SOLPS, SOLEDGE2D, EMC3,...); SOL turbulence (GBS, TOKAM3X, HESEL, GRILLIX ...); Interpretative (IMEP, JINTRAC, ETS, ...); ICRF coupling (EVE-AQL, PION, TORIC-SSFPQL, ...); LH coupling; Impurity transport (STRAHL,...); Plasma transients analysis

## RT-06: Preparation of efficient Plasma Facing Components (PFC) operation for ITER, DEMO and HELIAS

**Mission:** M2.2  
**TFLs:** E. Tsitrone, A. Hakola  
**Coordinators:** Y. Corre, K. Krieger, A. Widdowson

### Scientific objectives

#	
D1	Quantify local power load distributions on castellated and shaped PFCs for ITER and DEMO, including melting events using experimental data and predictive modelling
D2	Assess the impact of sustained high power / high particle fluence plasma exposure on the thermo-mechanical properties of metallic PFCs as well as on plasma operation
D3	Quantify material erosion sources from metallic walls under ITER relevant plasma conditions (including high power and impurity seeding plasmas) and determine material migration pathways, in particular to assess the net erosion rates.
D4	Quantify fuel retention in devices with metallic walls, with a focus on long pulse operation (using recent fuel retention diagnostic upgrades such as laser-based diagnostics where available) and including impact of boronisations
D5	Determine fuel-removal in metallic devices in conditions relevant for ITER (including the impact of boronisation) and extrapolate to DEMO
D7	Assess efficiency and lifetime of conditioning methods in metallic devices, with a focus on boronisation

Note that the previous D3 and D6 scientific objectives dealing with material migration in 2024 have been merged into D3 for 2025, and that an additional scientific objective D7 related to boronization has been added. To avoid confusion, D6 was not kept in the numbering of RT06 scientific objectives.

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2024	30	0	0	180

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

CXRS, LID-QMS, Bolometer/AXUV, IR thermography, Reflectometry, Passive Spectroscopy, LP, Divertor Manipulator, Reciprocating Probe, Visible Fast imaging, Real time control, Barometry, optical penning,

RGA, VUV spectroscopy, NPA, RFA, Li-Beam, HXR/SXR, Impurities spectroscopy, Calorimetry, Fast Interferometry

### *Modelling*

Field line tracing code (PFCflux, SMARDA, SMITTER), MHD stability (MISHKA, KINX, VMEC, CASTOR, LIGKA...), SOL fluid (SOLPS, SOLEDGE2D, EMC3,...), ECRH/ECCD/Current drive (PION, TORAY, TORBEAM,...), LH coupling, Melting PFC (MEMENTO, ...), Material migration (ERO, ERO2.0, Walldyn ...), PIC SOL and core codes (BIT1, SPICE, EPOCH ...)

## RT-07: Physics understanding of alternative divertor configurations as risk mitigation for DEMO

**Mission:** M2.3  
**TFLs:** A. Hakola, B. Labit  
**Coordinators:** C. Theiler, K. Verhaegh, D. Brida

### Scientific objectives

#	
D1	Determine detachment onset, radiated power fractions, and core compatibility in H-mode for the alternative divertor configurations (ADCs) and characterize ELM activity in view of pedestal, heat flux and control in ADCs
D2	Characterize possible benefits of the snowflake configuration for X-point radiation stability and dissipated power in H-mode
D3	Quantify the degree of ELM heat load mitigation achievable by impurity seeding, investigating the dependences on relevant machine parameters
D4	Evaluate reduced SOL models against ADCs

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2024	120	170	48	15

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

Bolometer/AXUV/RADCAM; IR thermography; Passive spectroscopy; Gas puff imaging; Langmuir probes; Reciprocating probe (midplane, X-point, RDPA...); Visible fast imaging; Real time control (development, analysis,...); Coherence imaging; MANTIS/MWI filtered imaging analysis; Impurities spectroscopy analysis (W, divertor...)/DSS; Divertor Thomson, IRVB analysis, Integrated Data Analysis (IDA), Equilibrium design (FIESTA modelling),

#### *Modelling*

SOL fluid (SOLPS, SOLEDGE2D, EMC3,...); SOL turbulence (GBS, TOKAM3X, HESEL, ...); Interpretative (IMEP, ETS, ASTRA, RAPTOR, METIS, TRANSP, ...); DIV1D/SD1D/SPLEND1D

## RT-08: Physics and operational basis for high beta long pulse scenarios

**Mission:** M1.3  
**TFLs:** M. Baruzzo, V. Igochine  
**Coordinators:** A. Bock, F. Auriemma, C. Piron

### Scientific objectives

#	
D1	Consolidate understanding of flux pumping mechanism and extrapolate to ITER/DEMO/JT-60SA
D2	Quantify compatibility of high $\beta_N$ long-pulse with mitigated ELMs and/or with exhaust in metallic devices in view of subsequently testing the scenario in JT-60SA W-wall and extrapolating to ITER and DEMO
D3	Characterize the fast and thermal ion transport together with the ExB, magnetic shear, turbulence conditions in steady-state scenarios at high-q
D4	Develop projection schemes of long pulse at high $\beta_N$ as a potential reactor scenario
D5	Develop an intrinsically steady-state solutions at high $\beta_N (>3)$ in terms of q/pressure profile with mild MHD activity ( $q_{min} > 1$ ), and compare it to the expected JT-60SA and DEMO scenarios particularly in terms of extending operational space toward high Gw fractions
D6	Develop steady-state scenarios in metallic devices at high $\beta_N$ in conditions of MHD characteristics close or above the no-wall ideal limit and assess feasibility on JT-60SA in view of DEMO.

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2024	50	20	48	15

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; CXRS; (C)ECE; Reflectometry; Fast-ions (FILD, FIDA,...); Beam emission spectroscopy (BES); MSE; Lithium beam; HXR/ SXR (including GEM); Doppler reflectometry; DOPL, RIC/RFL, PREF, DBS, Bolometry, SAMI, Fast Ion Diagnostic (FIDA)

#### *Modelling*

Improved or RT equilibrium reconstruction (CLISTE, CHEASE, CREATE-NL,...); MHD stability (MISHKA, KINX, VMEC, CASTOR, LIGKA...); SOL fluid (SOLPS, SOLEDGE2D, EMC3,...); Core GK (GENE, GS2, GKW,...);

ECRH/ECCD/Current drive (PION, TORAY, TORBEAM, CQL3D, C3PO, LUKE, NUBEAM, RABBIT, ASCOT, LOCUST, EPOCH,...); Interpretative (IMEP, ETS, ASTRA, RAPTOR, METIS, TRANSP, JETTO, JINTRAC...); ICRF coupling (EVE-AQL, PION, TORIC-SSFPQL, ...); LH coupling; W sources and transport (SOLPS, SOLEDGE-ERO ...), Reduced transport model (TGLF/MMM)

## RT-09: Physics understanding of energetics particles confinement and their interplay with thermal plasma

**Mission:** M1.2  
**TFLs:** D. Keeling, M. Baruzzo  
**Coordinators:** J. Galdon, Y. Kazakov, A. Jansen van Vuuren, R. Ochoukov

### Scientific objectives

#	
D1	Provide high quality diagnostic information and qualify diagnostic analysis techniques for the characterization of confined and lost fast ions with fast ion characteristics relevant for ITER and JT-60SA
D2	Quantify ion and electron heating and core-turbulence stabilisation by fast ions (FI) in view of the JT-60SA, ITER and DEMO including tailored FI energy profiles and radial locations relevant to JT-60SA.
D3	Quantify the impact of fast ions and fast ion MHD driven instabilities on transport in various scenarios including those relevant to JT-60SA in view of ITER and DEMO.
D4	Integrate the available heating, fast-ion and transport modelling tools for interpretation of experimental results in view of ITER and DEMO
D5	Quantify fast-ion losses and associated heat load from edge perturbations (ELMs and RMPs)
D6	Quantify neutral beam current drive and make predictions for ITER
D7	Identification of AE control actuators and preliminary assessment for ITER, using JT-60SA relevant scenarios where appropriate for eventual experimental testing

### Number of discharges

Indicative number of pulses per device and RT, subject to revision following WP TE Programme Meeting on November 18-19, 2024.

	AUG	TCV	MAST-U	WEST
	Shots	Shots	Shots	Shots
2024	30	100	40	0

### Competences

A non-exhaustive list of requested competencies is given hereafter:

#### *Data Analysis and Interpretation*

MHD spectrum and mode structure; RMP coils; CXRS; (C)ECE; IR thermography; Reflectometry ; Fast-ions (FILD, FIDA,...); Poloidal correlation reflectometry; Proton detector; TAE antenna measurements ; Faraday cups; Gamma-ray spectroscopy, Fluctuation diagnostic (BES, TPCI...), ECCD/ECRH, MSE, HXR/SXR, Gamma ray spectroscopy, Faraday cups, TAE antenna, Ion concentration, Neutron detector, NPA

## *Modelling*

Pedestal stability (EPED, EUROPED, ELITE, MARS...); Improved or RT equilibrium reconstruction (CLISTE, CHEASE, CREATE-NL,...); MHD stability (MISHKA, KINX, VMEC, CASTOR, LIGKA...); Core GK (GENE, GS2, GWK,...); Nonlinear MHD (JOREK, NIMROD, MEGA,...); Interpretative (IMEP, ETS, ASTRA, RAPTOR, METIS, TRANSP, ...); MHD: plasma response to RMP (GPEC, MARS-F, VMEC,...); Fast ion orbits, resonances, distribution function (ASCOT, NUBEAM, EBdyna,...); Synthetic Fast ions diagnostics (FIDASIM, FILDSIM, GENESIS, ...); Velocity-space tomography with FIDA

## RT-10: JET Data Validation

TFLs: D. Keeling

### Scientific objectives

#	
D1	Provide high quality validated data from JET experiments

Please indicate the time you would like to provide for JET data validation for the diagnostics listed below (corresponding to the JET Reqco list). The detailed list of competences requested is indicated in the table below. Additionally for 2025, WPTe will consider supporting training for data validation in the highly scarce areas of KS5 (CXRS/CHEAP) and KT3 (divertor spectroscopy) processes. Please indicate in your workplan if you wish to undertake such training and subsequent contribution to data validation.

Process	Sub-process
<b>Bolometry</b>	Tomography reconstruction
	Divertor
<b>CXRS</b>	Edge CX
	Main CX
	Impurity Ion Temperature (KS5) CHEAP Ion Densities (KS5)
<b>Divertor IR</b>	All KL cameras
	KL11 tomography
<b>ECE</b>	KK3
<b>Interferometry</b>	KG1 – All (LidAll, Lid3, Lid4), KG1V
<b>KY6</b>	Slow
	Fast
<b>KT3</b>	All (KT3a, b,c ...)
<b>EFIT</b>	Fast
	Constrained
<b>HRTS</b>	“standard”
	LTT
<b>Langmuir</b>	KY4D
<b>Reflectometer</b>	KG10
<b>Neutron spectroscopy</b>	All (All KMnn, KN3N, TIN)
<b>Gamma ray</b>	(KM6, KN3G)
<b>Toroidal Alfvén Eigenmodes</b>	KC1T
<b>JINTRAC</b>	Integrated transport modelling
<b>TRANSP</b>	Interpretative transport modelling

Table 3 : list of JET diagnostic eligible for data validation under RT10

## RT-11: Analysis and modelling of JET data before C45

TFLs: D. Keeling, M. Baruzzo

### Scientific objectives

#	
D1	Continue the analysis and modelling of the JET experiments related to DTE2
D2	Data analysis and modelling in support of ITER/DEMO not otherwise related to D1 or RT-01 to 09

For D1, your work plan should be focused on data analysis and modelling of former JET experiments (M18-\*/M21-\*) executed also during C44/C45/C46(DTE3)/C47 and C45b campaigns. Please ensure to indicate in the work-plan the name of the experiment you are applying to (e.g. M21-03, M21-01 etc). Analysis for past WPTE experiments in DTE3 (RT22-xx with xx from -01 to -09) should be submitted under the relevant RT-xx.

Under D2, work to utilise the whole catalogue of available JET data not pertaining to the cases described in D1 (which means unrelated to experiments M18-\*/M21-\*) will be considered. This includes for instance work related to C43 (He campaign). The workplan must specify how such work supports the ITER re base-lining, the ITER research plan and/or ongoing ITER/DEMO design activities.

## TG-ORD (RT-12) : Operation Regime Development (JT-60SA)

**Mission:** M1.1

**TFLs:** J. Garcia

**Scientific Coordinators:** L. Garzotti

### Scientific objectives

#	
D1	Safe increase of toroidal current up to 5.5MA in L mode
D2	Test of plasma control schemes: current, position, density, heating
D3	Break down and plasma formation studies in conditions of low loop voltage
D4	Initial integrated scenarios development towards ITER standard H-mode scenario
D5	Initial development of high beta integrated scenarios
D6	Integration of advanced real time control techniques , e.g. beta or ELMs control, in scenario development
D7	Characterize, by means of integrated modelling, scenario compatible with W as PFC in conditions of full machine availability

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Interpretative (IMEP, JINTRAC, ETS, ASTRA, RAPTOR, METIS, TRANSP, JETTO, Coconut, ...); Integrated modelling (JINTRAC, ETS, ASTRA, RAPTOR, METIS, TRANSP, JETTO...), Free boundary equilibrium codes (METIS-FEEQS, CREATE-NL, SPIDER...), Breakdown codes (BKDO,...), Heating codes (GRAY, ASCOT, SPOT,...), Real time control codes (RAPTOR...), Equilibrium Codes (HELENA, CHEASE...)

## TG-MHD (RT-13) : MHD Stability and Control (JT-60SA)

**Mission:** M1.1

**TFLs:** J. Garcia

**Scientific Coordinators:** G. Pucella

### Scientific objectives

#	
D1	Disruption and runaway electrons studies
D2	Creation of disruption databases
D3	Sawtooth activity and modification by ECH
D4	Tearing Modes during ramp-up, flat-top, and ramp-down phases
D5	Neoclassical tearing modes destabilization with ECH/ECCD and NBI
D6	Neoclassical tearing modes control with ECCD
D7	Resistive wall mode studies
D8	Characterization of MHD activity in high beta plasmas
D9	Error field measurement, characterization and impact on locked mode and NTM activity

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Linear MHD (MISHKA, CASTOR, MARG2D, MINERVA...) Nonlinear MHD (JOREK, NIMROD, MEGA, XTOR...); Resistive Wall Modes (CARMA, STARWALL, RWMaC,...)

## TG-TC (RT-14) : Transport and Confinement (JT-60SA)

**Mission:** M1.1

**TFLs:** J. Garcia

**Scientific Coordinators:** L. Garzotti

### Scientific objectives

#	
D1	Heat transport in electron heated dominated plasmas in L-mode and/or low $\beta$
D2	Characterization of L-mode confinement
D3	Initial characterization of H-mode confinement
D4	Isotope studies by comparison of H and D plasmas
D5	Heat transport in electron heated dominated plasmas in H-mode
D6	Heat, particle and impurity transport in high $\beta$ plasmas
D7	Characterization of H-mode confinement in type-I ELMs plasmas
D8	H/D ratio control by gas-puff and pellet
D9	Characterise potential core and pedestal W screening
D10	Perform fully integrated core+edge+SOL simulations capturing the impact of W PFC on core confinement.

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Integrated modelling (JINTRAC, ETS, ASTRA,...), GK codes (GENE, GS2, GKW, GYSELA, ...); Quasilinear codes (Qualikiz, TGLF, EDWM,...), Phenomological codes (CDBM, Bohm-GyroBohm...)

## TG-EP (RT-15) : High Energy Particle Behaviour (JT-60SA)

**Mission:** M1.1

**TFLs:** J. Garcia

**Scientific Coordinators:** Y. Kazakov

### Scientific objectives

#	
D1	Shine-through studies in H and D, especially with N-NBI
D2	Initial studies of Alfvén modes destabilization by N-NBI
D3	Characterization of fast ions losses
D4	Neutron emission studies and reproducibility with codes
D5	Studies of Alfvén modes destabilization by N-NBI in high beta plasmas and impact on fast ion confinement
D6	Characterization of fast ions losses at high N-NBI power with FILD
D7	Interplay between fast ions and turbulence □ Transport reduction by fast ions
D8	Compatibility of RMP with fast ion confinement
D9	Initial studies of alpha particle behavior in D-3He plasmas

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Core GK analysis (LIGKA, GENE, GS2, GWK, ORB5,...); MHD interaction with Fast Ions (JOREK, CASTOR-K, MEGA,...); Fast ions slow-down characteristics (ASCOT, SPOT...)

## TG-PED (RT-16) : Pedestal and Edge Physics (JT-60SA)

**Mission:** M2.1

**TFLs:** J. Garcia

**Scientific Coordinators:** Y. Liang

### Scientific objectives

#	
D1	L-H power threshold characterization in H and D
D2	ELMs generation studies in different plasma conditions
D3	Characterization of the access to type-I ELMs and comparison to plasmas with no/small ELMs
D4	ELMs control with RMP and pacing pellets
D5	Investigate potential W screening capabilities of predicted pedestal for JT-60SA foreseen scenario at full machine capacity

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Pedestal stability (EPED, EUROPED, ELITE, MARS, ...); Pedestal GKanalysis (GENE, GS2, GWK,...); Nonlinear MHD (JOREK, NIMROD, MEGA,...); 3D linear/nonlinear MHD equilibrium (VMEC, HINT,...); 3D nonlinear MHD analysis (MIPS...); Magnetic perturbation/spectrum analysis (ERGO...); full diffusive field-line diffusion code (FDFLD) ...

# TG-DSP (RT-17) : Divertor, Scrape Off Layer and Plasma-Material Interaction

**Mission:** M2.1

**TFLs:** J. Garcia

**Scientific Coordinators:** G. Falchetto

## Scientific objectives

#	
D1	SOL width scaling at high $I_p$
D2	Neutral compression by the V-shaped corner
D3	Wall conditioning
D4	Neutral compression by the V-shaped corner, He pumping
D5	Initial seeding studies and impact on the heat flux to divertor
D6	Determine the compatibility of the expected heat flux in foreseen JT-60SA at full machine capabilities with W PFC components, including the use of seeded impurities for heat flux mitigation
D7	Investigate divertor W erosion in different scenarios including the potential role of extrinsic seeded impurities for heat flux mitigation and characterise potential SOL W screening

## Competences

A non-exhaustive list of requested competencies is given hereafter.

### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

### *Modelling*

SOL fluid transport (SOLPS, SOLEDGE-EIRENE, EMC3, Coconut,...); SOL fluid turbulence (GBS, SOLEDGEHESEL,...), including neutrals; Material migration (ERO2.0, Walldyn, ...); PIC SOL and core codes (BIT1, SPICE, EPOCH, ...);

## IMAS (RT-18): Integrated data validation and data access with IMAS

**Mission:** M2.1

**TFLs:** J. Garcia

**Scientific Coordinators:** F. Imbeaux

### Scientific objectives

#	
D1	Integrated data validation
D2	Data access with IMAS

### Competences

A non-exhaustive list of requested competencies is given hereafter.

#### *Data analysis and Interpretation*

Magnetic sensors, CO<sub>2</sub> laser interferometer (tangential), Visible TV cameras, Fast camera EDICAM, Divertor Langmuir probes and thermocouples, Soft X-ray detector intensity, Visible spectrometer (tangential), Quadrupole Mass Spectrometer, Magnetic (flux loops, magnetic probes, Rogowski coils, diamagnetic loops, AT probes)

#### *Modelling*

Integrated data validation (IDAV); IMAS