
Annex 1: WPTE Research Topics for 2026-2027 Experimental Campaigns on AUG, TCV, MAST-U, and WEST

The present document describes the structure of Research Topics under WPTE, aiming at collecting new experimental proposals to be carried out on the four WPTE devices, AUG, TCV, MAST-U and WEST in 2026 and 2027. For each Research Topic, a **list of Scientific Objectives** is provided together with the WPTE devices where these objectives will be addressed.

In 2026-27 the same structure of 9 Research Topics as in the previous year will be maintained. This choice underlines the continuity of the WPTE program which is built to fulfil the two main missions of EUROfusion: preparation for ITER operation and guiding the design of next-step fusion devices. The work performed in previous years has laid the foundation for the WPTE program. It is the intention to progress further on selected scientific objectives, reflecting the main priorities of the research effort of each individual Research Topic. In some cases, new objectives have been established to account for progress achieved in previous years or to further streamline research activities. When this is the case, explanations are provided under the corresponding Research Topic section with further documentation available on the WPTE wiki page (please consult the page https://wiki.euro-fusion.org/wiki/WPTE_wikipages:_Call_for_proposals_2026). The link between the former and new Scientific Objectives is clarified as well as the attribution of starting Subjective Scientific Readiness Level (SSRL). Strong team effort will be appreciated to facilitate the technical and scientific realisation of all the set objectives.

Any analysis and modelling effort (including those for the past JET campaigns) will be reflected in the work plans addressing the individual scientific objectives to be entered in the Call for Participation (to be launched in late October 2025). Therefore, the analysis and interpretative modelling of experimental data from previous campaigns will be an integral part of the activities inside each Research Topic, but the present Call for Proposals should only focus on experimental proposals to be carried out in 2026 and 2027 in the WPTE devices listed above.

Please note the following guidelines when preparing your proposals:

- Proposals are expected to be **well-structured**, built around a **core team of experts**, taking advantages of the specific features of each device and considering the achievements from past campaigns.
- Proposals should consider the **operational boundary conditions** and machine schedules (see details in Annex 2).
- Proposals for **multi-machine experiments** making the best use of specific capabilities of WPTE devices are strongly encouraged.
- Proposals should also consider the investigation needed in support of the **new ITER baseline**. Reference documents have been made available on the wiki page (https://wiki.euro-fusion.org/wiki/WPTE_wikipages:_Call_for_proposals_2026)
- Proposals for experiments in **preparation of the scientific exploitation of JT-60SA** on the four EU devices involved in this call (AUG, MAST-U, TCV and WEST) are welcome but the experimental proposals to be run on JT-60SA are not part of this Call.

- Experimental proposals derived explicitly from TSVV activities aiming at undertaking **benchmarking or validation exercises against experimental data** are strongly encouraged.
- TFLs do encourage the proponents to **discuss with the current Research Topic Coordinators (RTCs)** to avoid duplication and guarantee the best possible combined and coherent proposals. Please note, however, that a Call for new RTCs for the period 2026-2027 is launched concurrently with this Call for Proposals
- As a guideline to prepare well focused and realistic proposals, the table below indicates a provisional distribution (percentage) of machine time, WPTE Task Force Leaders have envisaged to make progress on the scientific objectives by the end of 2027. This distribution is tentative and might be revised after the General Programme Meeting (4-6/11/2025).

RT	AUG	MAST-U	TCV	WEST
RT01	10	10	10	2
RT02	7	15	10	2
RT03	10	0	10	10
RT04	5	10	10	8
RT05	8	15	10	10
RT06	10	0	0	35
RT07	15	25	10	5
RT08	10	15	10	6
RT09	5	10	10	2
Contingency	20	0	20	20
Sum	100	100	100	100

Research Topic RT01: Core-Edge-SOL integrated H-mode scenario compatible with exhaust constraints in support of ITER

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:
 - D1 - Develop and understand stationary H-mode scenarios at low collisionality and with dominant electron heating
 - D2 - Provide physics-based cross-field transport coefficients for heat, fuel particles and impurities to TSVs 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 conditions closer to future devices including large SOL opacity, low pedestal collisionality, and peeling limited plasma
 - D5 - Quantify pedestal transport and screening of impurities in conditions relevant for next-step fusion devices

Research Topic RT02: Physics understanding of alternatives to Type-I ELM regime

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:
 - D1 - Quantify turbulent and MHD driven transport in the vicinity of the separatrix and implications for making predictions for ITER and DEMO
 - D2 - Quantify first wall loads in no-ELM scenarios and provide a model for SOL transport extrapolation
 - D3 - Extend the parameters space of no-ELM scenarios to large P_{sep}/R and/or 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 - Quantify the level of ELM mitigation with 3D fields in low torque plasmas and its impact on W transport
 - D6 - Quantify the overall performance, primarily improved confinement, of negative triangularity plasmas in view of next-step devices

The 2025 scientific Objective *D5 - Determine access window and physics understanding for RMP ELM suppression and its compatibility with ITER FPO scenarios* - has been reformulated as follows: *Quantify the level of ELM mitigation with 3D fields in low torque plasmas and its impact on W transport* refocusing therefore the specific R&D request from ITER.

Research Topic RT03: Strategies for disruption and run-away electron mitigation

- Devices: AUG, TCV, WEST
- Scientific Objectives:
 - D8 - Develop an understanding of pellet assimilation for plasma densification in shattered pellet injection (SPI) experiments to avoid runaway electron (RE) generation.
 - D9 - Develop an understanding of SPI dynamics in off-normal plasmas, such as close to density limit and/or during impurity accumulation.
 - D10 - Determine the physics mechanisms leading to benign termination of RE with H and D, specifically in the ITER relevant parameter range.

- D11 - Determine the physics mechanisms generating run-away electrons in the current quench, including during a vertical displacement event (VDE), and in the plasma start-up phase, including electron cyclotron (EC) pre-ionization and EC-assisted burn-through.
- D12 - Perform interpretative modelling of disruption mitigation dynamics, specifically aiming at physics understandings of experimental measurements to extrapolate models to ITER (in collaboration with TSVV-F).
- D13 - Characterise disruption loads, in particular during VDEs, to improve predictions for ITER.
- D14 - Investigate the role of plasma phenomena (turbulence, MHD, waves, fast ions etc) on the transport and confinement of REs

Recent SPI experimental results from JET and AUG have expanded our understanding of the impact of various parameters on efficient SPI injection, further motivating a reformulation of the Scientific Objectives. The modifications have been introduced to account for the work performed in previous years including inputs received from ITER DMS Task Force. The proper correspondence between the new (D8-D14) and the original 2025 (D1-D7) objectives, including the attribution of SSRL starting level are available at https://wiki.euro-fusion.org/wiki/WPTE_wikipages:_Call_for_proposals_2026:_RT03, together with a further clarification of the work expected within the newly formulated Scientific Objectives

Research Topic RT04: Physics-based machine generic systems for an integrated control of plasma discharge

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:
 - D6 - Develop generalized controllers and state observers designed for application to a variety of devices
 - D7 - Develop integrated control algorithms and techniques for pulse trajectory optimization in view of possible applications to next step device controllers
 - D8 - Optimize off normal events handling and disruption avoidance strategies for machine protection
 - D9 - Integrate machine learning and physics driven techniques for control augmentation and performance boosting

Given the progress achieved and the breadth of tools successfully developed in recent campaigns, scientific objectives have been revised to reflect a hierarchical view of the functionalities expected from a modern tokamak discharge control system. This updated structure is intended to support the systematic integration of individual controllers into a machine-agnostic Plasma Control System. The proper correspondence between the new (D6-D9) and original (D1-D6) objectives, including the attribution of SSRL starting level are clarified on the WPTE wiki page https://wiki.euro-fusion.org/wiki/WPTE_wikipages:_Call_for_proposals_2026:_RT04, together with a further clarification of the work expected within the newly formulated Scientific Objectives

Research Topic RT05: Physics of divertor detachment and its control for ITER, DEMO and HELIAS operation

- Devices: AUG, MAST-U, TCV, WEST
- Scientific Objectives:
 - D1 - Characterize detachment access and core plasma performance in scenarios using different fuelling schemes, different impurity mixtures
 - D2 - Develop reduced physics models which can be included in radiative detachment control schemes or extrapolations to DEMO/ITER

- D3 - Quantify edge-SOL particle, impurity, and heat transport, above and below the X-point under detached conditions
- D4 - Assess the compatibility and stability in terms of overall confinement of X-point radiator regimes
- 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)

Research Topic RT06: Preparation of efficient Plasma Facing Components (PFC) operation for ITER, DEMO and HELIAS

- Devices: AUG, WEST
- Scientific Objectives:
 - D1 - Quantify local power load distributions on castellated and shaped PFCs for ITER and DEMO, including melting events
 - 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 and determine material migration pathways, in particular to assess W sources from the first wall and the net erosion rates.
 - D4 - Quantify fuel retention in devices with metallic walls, with a focus on long pulse operation, including the impact of boronisations and using laser-based diagnostics where available
 - D5 - Assess fuel-removal efficiency in metallic devices, including the impact of boronisations and propose fuel removal procedures for next step metallic devices
 - D7 - Assess the efficiency and lifetime of wall conditioning methods in metallic devices, with a focus on boronisation

Note that since 2025, the previous Scientific Objective D6, dealing with gross vs. net erosion is no longer in use and is embedded into D3.

Research Topic RT07: Physics understanding of alternative divertor configurations as risk mitigation for DEMO

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:
 - D1 - Determine the characteristics for plasma exhaust and scenario control as well as core compatibility in H-mode for different alternative divertor configurations (ADCs)
 - D2 - Characterize possible benefits of snowflake and other ADCs with multiple X-point configurations for their X-point radiation stability and dissipated power in H-mode
 - D3 - Quantify the degree of heat load mitigation during ELMs and other transients, achieved by impurity seeding, and investigate their dependences on relevant machine parameters
 - D4 - Evaluate existing reduced SOL models against ADCs and validate core-edge, SOL and divertor models of increasing complexity against experimental data, for divertor optimisation as well as plasma exhaust understanding and control

Research Topic RT08: Physics and operational basis for high beta long pulse scenarios

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:

- D1 - Consolidate understanding of flux pumping mechanism and extrapolate to ITER/DEMO/JT60
- D2 - Quantify compatibility of high β_N long-pulse with mitigated ELMs and/or with exhaust in metallic wall devices in view of extrapolating scenario to JT-60SA W-wall operation
- D3 - Characterize the fast and thermal ion transport together with the ExB, magnetic shear, and turbulence conditions in steady-state scenarios at high-q
- D4 - Validate state of the art models for scenario extrapolation towards future devices
- D5 - Develop intrinsically steady-state solutions at high β_N (>3) in terms of q/pressure profile with mild MHD activity. Investigate the dependence of the scenario to the available actuators, and compare it to the expected JT-60SA and DEMO scenarios particularly in terms of extending operational space toward high Greenwald fractions
- D6 - Develop steady-state scenarios in metallic devices at high β_N in conditions of MHD characteristics close or above the no-wall ideal limit. Investigate the dependence of the scenario to the actuators and characteristics expected to be used in JT-60SA

Research Topic RT09: Physics understanding of energetics particles confinement and their interplay with thermal plasma

- Devices: AUG, TCV, MAST-U, WEST
- Scientific Objectives:
 - D1 - Provide high quality demonstration of diagnostic techniques for the characterization of confined and lost fast ions with fast ion characteristics relevant for ITER and JT60-SA, qualify further diagnostic techniques required for deployment on JT-60SA
 - D2 - Quantify ion and electron heating and core-turbulence stabilisation by fast ions in view of 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 driven MHD instabilities on transport in various scenarios including those relevant to JT-60SA.
 - D4 - Integrate the available heating, fast-ion and transport modelling tools for interpretation of experimental results in view of extrapolation of results to ITER and DEMO
 - D5 - Quantify fast-ion losses and associated heat load from edge perturbations (ELMs and RMPs)
 - D7 - Identification of AE control actuators and assessment for ITER and JT-60SA relevant scenarios

The previous 2025 D6 is now considered to be absorbed into D4 as a subject for analysis of existing data or parasitic analysis of 2026 experiments.