JET Competencies

JET Competencies are subdivided in 3 basic blocks:

1. **Competencies for control room and operation support**
2. **JET Diagnostic Competencies**
3. **Experiments, Analysis and Modelling competencies**

Please choose up to 5 competencies in the Excel spreadsheet Annex 6, and specify in the Individual Work Plan (IWP) the specific work you propose to do within the chosen competencies.

1. Competencies for control room and operation support

Control Room work is in general associated also with experiment preparation, which normally takes place weeks in advance of the experiment. Participants should be available, remotely or on site, for the necessary preparation stages of the experiment and/or session.

Control Room jobs include shift work. Usual shift times are 6:30-14:30 for the Early shift, 14:00-22:00 for the Late shift.

Id	Competency	Description	More details for JET
SC	Scientific Coordinator	SCs must have the ability to coordinate teamwork, and scientific expertise in specific topics under investigation. The SC is responsible for preparatory meetings, modelling, experiment preparation and execution, coordination of data analysis and modelling associated to experiment, presentation of results to TFs, logging conclusions in experiment wiki, dissemination of results, coordination of publications.	Prepare experiment's wiki (especially experimental strategy, pulse plan, machine requirements) – with Reference Session Leader (see SL description below), and diagnostic requests – with Reference Diagnostic Coordinator (see DC description below). Experiment wiki must be ready in time for approval by JPEC (at least 4 weeks before 1st experimental session), having been peer- reviewed at a prior TF meeting. Duration of Stays: SCs should be on site at JET at least 1 week prior to and after the execution of the experiment for which they are SCs.

Id	Competency	Description	More details for JET
SL	JET Session Leader	SLs are trained JET session leaders with 2MA, 3MA, or full licence. They are self-Sufficient session leaders with a physics background in the scenario under investigation and are experienced in implementing these scenarios on JET. SLs participate in session preparation. Reference SLs (RSL) participate in experiment preparation.	SLs prepare and execute pulses for a given experimental session. Experienced SLs may be requested to act as Reference Session Leader (RSL) for particular experiments. RSLs advise SCs on machine requirements/constraints related to experiment, available plasma configurations, how to best execute experiment, well in advance of the experiment's planned date (leading to JPEC approval of the experiment and machine resources at least 4 weeks before the experiment). Duration of Stays: minimum participation is 6 weeks, with individual stays no shorter than 2 weeks.
ESL	Expert Session Leader	ESLs have an Expert Session Leader License. They have detailed knowledge of the JET machine capabilities and configurations.	Assist SLs with new or complex plasma configurations/scenarios/circumstances. Duration of Stays: minimum participation is 6 weeks, with individual stays no shorter than 2 weeks.
TSL	Trainee Session Leader	TSLs are physicists or engineers who have successfully completed the SL JET training course, and are in training to obtain the 1st level license.	Duration of Stays: ideally at least 6 weeks, with individual stays no shorter than 2 weeks.

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DC	Diagnostic Coordinator	DCs are trained at JET, and have a good understanding of JET diagnostics capabilities. DCs participate in session preparation. Reference DCs participate in experiment preparation and execution.	Session preparation: before the experiment (with input from SC, Diagnostic ROs and Reference DC) the DC requests appropriate diagnostics settings and control room support for the experimental session (at least 2 weeks before the experiment is executed), filling the Diagnostic Request Sheet. On the day of the experiment DCs monitor diagnostics, do basic intershot analysis, communicate with SCs, SLs, etc. Experienced DCs will be requested to act as Reference Diagnostic Coordinator (RDC) for specific Experiments. In this role, RDCs advise SCs on optimal diagnostic settings for the experiment, general availability of given diagnostic, and control room staffing concerns, well in advance of the experiment’s planned date (leading to JPEC approval of the experiment and machine resources at least 4 weeks before the experiment). Duration of Stays: ideally at least 4 weeks. Individual stays no shorter than 2 weeks.
TDC	Trainee Diagnostic Coordinator	TDCs are novice DCs with some experience in tokamak diagnostics, being trained to become DCs. They assist the DC and become DCs in as many sessions as required.	Duration of Stays: individual stays no shorter than 4 weeks, usually 2 for training and 2 as DC.
VSO	Viewing Systems Operator	VSOs understand IR thermography and are familiar with the JET ILW protection system (PIW). They participate in session preparation and execution.	During operation they manage viewing systems during operation. They assist the experimental team (SL, SC, DC) in the inter-shot interpretation of images from the ILW protection cameras in the control room (and after the experiment). Duration of Stays: ideally at least 4 weeks. Individual stays no shorter than 2 weeks for VSOs with recent experience. Training can be provided for stays longer than 2 weeks.

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PDO	Plasma Duty Officer	PDOs have experience in plasma physics, programming and advanced control algorithms for tokamak operation (includes all control tools: detachment, NTM, fuelling, ..). They participate in experiment preparation and execution.	PDOs develop and operate controllers on the JET Real Time Central Control System (RTCC). Duration of Stays: ideally at least 4 weeks. Individual stays no shorter than 2 weeks for PDOs with recent experience. Training can be provided for stays longer than 2 weeks.
MHD-CR	MHD (Control Room)	MHD experts with knowledge of JET MHD diagnostics and data analysis tools.	MHD-CR experts analyse MHD data in preparation for experiments and provide control room support during experiments. Establish what instabilities are observed, advise SCs and SLs on data interpretation and MHD avoidance techniques if needed. Duration of Stays: ideally at least 2 weeks.

2. JET Diagnostic Competencies

Candidates should indicate in their Individual Work Plan (IWP) what they can contribute and write in the IWP the name of the diagnostic in question.

Id	Competency	Description	More details for JET
IRTC	Infra-red fast cameras and thermo-couples	IR analysis and power balance experts. IRTCs have knowledge of IR camera systems and thermo-couples at JET, and familiarity with relevant data processing tools.	Compute power heat loads on the ILW with the relevant tools. Interpretation of inter-ELM and ELM heat loads, hot spots. Data validation, including power and energy balance. Control room support. Specific Diagnostics: Cameras: KL3B, KL7, KL9A, KL9B Thermocouples: KD1D, KD2W
LP	Langmuir Probes	LP analysis experts, familiar with the Langmuir Probes systems at JET.	Choose settings for experiments, provide inter-shot analysis. Analyse profiles in support of specific experiments. Special analysis, such as coherent averaging. Specific Diagnostics: KY4D: divertor and limiter Langmuir probes.
QMB	Quartz Micro-balance	Quartz Microbalance analysis experts, with Plasma Edge physics and SOL physics background, and knowledge of the QMB diagnostic at JET	Measurements of material deposition in the divertor. Incorporation of data in edge physics interpretation and divertor studies. Control room support Specific Diagnostics: KV6: quartz micro-balance (QMB)
TS	Thomson scattering	Experts in Thomson Scattering Systems	Validation and analysis of data, consistency of data within overall electron temperature and density measurements (ECE, reflectometry, interferometry, Li beam). Support update/rewrite of KE11 data display and validation software (IDL). Specific Diagnostics: KE3: LIDAR Thomson Scattering System for bulk plasma KE11: High Resolution Thomson Scattering System (HRTS)

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ECE	Electron Cyclotron Emission	Experts on Electron Cyclotron Emission	Validation and analysis of data. Check consistency of data within overall electron temperature diagnostics (i.e. ECE and Thomson Scattering systems). Control room support. Specific Diagnostics: KK1: Michelson Interferometer KK3, KK3F: Heterodyne Radiometer KK5: ECE Michelson Interferometer
RNEP	Profile Reflectometry	Experts in density profile reflectometry	Detailed profile/physics analysis, comparison with other density measurements (interferometry, Thomson Scattering, Li beam). Improve/develop validation and analysis software for density profiles. Specific Diagnostics: KG10: Profile Reflectometry
RNEF	Fluctuation Reflectometry	Expert on fluctuation analysis with reflectometry	Correlation analysis of normal incidence reflectometry (turbulence), analysis of coherent MHD/fast particle modes, Doppler reflectometry. Specific Diagnostics: KG8B: X-Mode correlation reflectometers, fixed frequency (note: low signal). KG8C: X-Mode correlation reflectometers, tunable frequency, Doppler reflectometry.
LIB	Beams and active spectroscopy	Expert in Li-beam active spectroscopy	Validation and analysis of profile and fluctuation data, integration of data in electron density and temperature profile measurements at the edge. Application of the Li beam to edge current profile measurement. Evaluation of reliability of the data /apparatus. Control room support. Develop software for interpretation of density profile measurements. Specific Diagnostics: KY6: 50kV Lithium Beam

Id	Competency	Description	More details for JET
SXR	Soft X-rays	Expert in Soft X-ray apparatus and experimental impurity profile studies	Validation and analysis of data for reconstruction of high Z impurity profiles and for integration of data in MHD stability analysis. Tomographic reconstruction. Control room support. Specific Diagnostics: KJ3/4, KJ5: Soft X-ray arrays
PVS	Passive visible spectroscopy	Expert in Passive Visible Spectrometry and spectrally filtered imaging diagnostics.	Perform impurity flux measurements, data analysis and tomographic reconstruction of divertor impurity radiation. Control room support. Software development for high level analysis of CCD systems. Improve analysis software for KT3 (idl, Python). Specific Diagnostics: KL1: wide angle view CCD camera. KL11: Divertor view CCD camera. KL8A: Fast Visible CCD Camera. KS3, KS8, KT1: Visible spectroscopy KT3: Divertor Spectroscopy
NGAS	Neutral Gas Analysis	Expert in pressure gauges and mass spectroscopy measurements.	Pressure gauge and RGA spectra analysis and validation. Software support. Control room support. Specific Diagnostics: KT5P: Divertor gas analysis. Baratrons in main chamber.
PUVS	Passive VUV and XUV spectroscopy	Experts on VUV and/or XUV spectroscopy	VUV calibration of KT2, KT7, KT1, KT4 (if available), KS6. Validation of data on impurities. Contribute to divertor and core physics analysis. Specific Diagnostics: KT1: VUV spatial scan KT2: VUV broadband spectroscopy KT4: grazing incidence XUV broadband spectroscopy KT7D: divertor VUV and XUV spectroscopy KZ3: Laser Blow-off system

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NEUT	Neutronics	Expert in neutron diagnostics and gamma-ray detectors.	Validation of data and checks on calibrations. Develop software to unfold neutron energy spectra. Specific Diagnostics: KN1: Neutron Yield Monitor KN2: Neutron Activation KN3: Neutron Profile Monitor KN4: Delayed Neutron Activation KM6: Gamma ray spectrometry, vertical and tangential views KM7: 14MeV Time resolved Neutron Yield monitors, including CVD Diamond Detector KM9: 14MeV Neutron Spectrometer KM11: TOFOR Neutron Spectrometer KM12: 14MeV neutron spectrometer
CXS	Charge exchange	Expertise in CXS/ passive and/or active spectroscopy	Validation and analysis of data, consistency of data within ion temperature, plasma rotation, impurity density measurements, using also data from KX1 system. Consistency checks with data from other systems. Develop software to simulate CX spectra. Related diagnostics and options: KS(4,5): Core CXS KS7: Edge CXS
MSE	Motional Stark Effect	MSE experts evaluate data quality and provide calibrated signals up to pitch angle profiles to use as input for detailed equilibrium reconstruction.	Validate and analyse MSE data and incorporate into equilibrium reconstruction. Carry out consistency checks with polarimetry. Control room support for intershot analysis. Specific Diagnostics: KS9: MSE
NPA	Neutral particle analysis	NPA experts have good knowledge of charge-exchange reactions, atomic transport in plasmas, impurity ionization equilibria, and ion dynamics in tokamak plasmas.	Validation of consistency of simultaneous measurements of three hydrogen isotope species. Evaluation of energy distribution function of energetic ions. Analysis of wave-fast particle interactions. Define and develop high level analysis software. Specific Diagnostics: KR2: low energy NPA KF1: High energy NPA

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BOLO	Bolometer	Bolometry experts are experienced in bolometer measurements and tomographic reconstruction.	Validation of the total radiated power. Quantify radiation from bulk and divertor regions. Perform tomographic reconstruction of bolometry data. Control room support. Specific Diagnostics: KB1: Single channel bolometers KB3D: Divertor bolometers KB5: Ex-vessel bolometers KD1D: Divertor calorimetry
IPOL	Interferometry and Polarimetry	Polarimetry experts are familiar with interferometry/polarimetry diagnostics.	Data analysis from various systems. Maintain and develop analysis software. Validation of interferometry and polarimetry data, consistency checks with Thomson Scattering, reflectometry and MSE. Control room support. Specific Diagnostics: KG1: Multichannel FIR interferometer KG4: Faraday Polarimeter
XRS	X-ray spectroscopy	Expert in X-ray spectroscopy	Benchmark of KX1 concentration data against other diagnostics. Interpretation of saturated data. Instrument function determination. Detailed spectral line identification work. Develop and improve KX1 analysis software. Specific Diagnostics: KX1: X Ray crystal spectrometer KS6: Bragg rotor X-ray spectroscopy
LCP	Lost Charged Particles	Expert in charged particle loss measurements	Calibration, data validation and analysis, interpretation of charged particle losses Specific Diagnostics: KA2: Faraday Cup Array KA3: Lost ion/alpha scintillator
FEB	Fast Electron Bremsstrahlung and Fast Ion Distribution	Expert in Hard X-ray and Gamma ray systems	Analysis and validation of data. Screening from spurious signals due to neutron induced gamma-rays. Radial inversion techniques to obtain fast electron and fast ion distribution profiles. Specific Diagnostics: KH1:Hard X-ray monitors KN3G: Gamma camera in front of the KN3.

3. Experiments, Analysis and Modelling competencies

Physics competencies are arranged by subject. Participation is expected in experiment preparation as well as execution and post-experiment analysis and/or modelling.

Candidates should indicate in their Individual Work Plan (IWP) the options (**-E**, **-M**, **-S**) to which they can contribute, and if these are too broad specify what is planned:
-E: experimentalists, data analysis
-M: modellers, predictive and/or interpretative.
-S: software development for high level analysis

Id	Competency	Description	More details for JET
ICRF	Ion Cyclotron Resonance Frequency	Contribute to the planning, execution, data analysis and modelling of experiments studying / developing ICRF heating scenarios in terms of ICRF wave absorption, RF sheaths, antenna loading.	Aim for effective use of ICRF heating in experiments. May include control room support. Characterise plasma-ICRF wave interaction: coupling, RF-sheaths, estimation of wave absorption and heating scheme properties (BIS, FFT analysis). Forward and interpretive modelling of ICRH & IC acceleration for plasma heating and fast particle experiments, as well as for DT extrapolation. Related Codes: ICRH codes EVE, PION, TORIC… and coupled ICRH/fast particle codes (e.g. SPOT-EVE)
NBI	Neutral Beam Ion heating	Contribute to the planning, execution, data analysis and modelling of experiments on NBI penetration, distribution and current drive efficiency	Interpretation and modelling of data related to NBI heating, power deposition and current drive. May include control room support.
EQR	Equilibrium Reconstruction	Contribute to plasma equilibrium reconstruction *using* internal constrains	Detailed analysis of plasma equilibrium reconstruction with internal constrains using data from e.g. MSE, Polarimetry and total pressure profiles including pedestal. Related Codes: JEC2020, EFIT, CREATE_NL, Equinox

Id	Competency	Description	More details for JET
CMHD	Core MHD	Contribute to the planning, execution, data analysis and modelling of experiments requiring characterisation of MHD core instabilities and their impact on plasma.	Identify MHD modes and instabilities (NTMs, sawteeth, disruptions), assess their effect on plasmas, correlation analysis, etc. See also MHD-CR and PEDM competencies. Modelling of MHD core instabilities using codes such as XTOR, CASTOR. Development/maintenance of MHD codes for mode detection, mode number identification, correlation analysis, etc...
DISR	Disruptions	Contribute to the planning, execution, data analysis and modelling of disruptions (causes, prevention, VDEs, halo currents, detection, prediction, effects), their mitigation with MGI and disruption avoidance schemes	Characterise disruptions and study disruption avoidance and/or mitigation schemes, analysis of halo currents and current quench. Interpretation and prediction for ITER Related Codes: JOREK, M3D, etc ...
RE	Runaway Electrons	Contribute to the planning, execution, data analysis and modelling of experiments on runaway generation and their mitigation using massive gas injection. Analyse related thermal loads and impact on plasma operation.	Analysis of run-away domain and their mitigation using high Z gas injection. Analyse related thermal loads on the ILW and impact on plasma operation. Interpretation and prediction of the run-away dynamics, using the relevant prediction tools, such as LUKE or other ad-hoc models.
FSTP	Fast Particles and fast-particle driven instabilities	Contribute to the planning, execution, data analysis and modelling of experiments where fast particles or fast particle-driven instabilities play a central role.	Monitor relevant diagnostics (e.g. Mirnov coils, reflectometer, TAE antennae ...) Data interpretation and modelling of the effect of fast particle physics or fast particle driven instabilities e.g. CASTOR-K).
FUSP	Fusion products	Contribute to the planning, execution, data analysis and modelling of fusion product experiments: neutrons, alphas, gammas, ...	Provide data interpretation and modelling of aspects of neutron, alpha particle and fusion product physics and guidance for the future DT scenarios.

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MC	Machine conditioning	Contribute to the planning, execution, data analysis of experiments studying / requiring machine conditioning characterisation with different techniques (baking, ICWC and GDC). This includes also assessment of wall conditions after disruptions.	Participation in machine conditioning studies with different techniques including baking, ICWC and GDC. Characterisation of the wall conditions by mass and optical spectroscopy as well as AGHS. Comparison of cleaning techniques with respect to fuel and impurity removal.
PFU	Particle fuelling	Contribute to the planning, execution, data analysis and modelling of experiments on plasma fuelling by gas, pellet and/or recycling with respect to plasma performance and plasma edge conditions .	Characterisation of the fuelling techniques and their impact on plasma edge conditions and core performance. May include control room support in experiments with pellets. Interpretation and prediction of particle transport in various scenario types and pedestal strengths.
GBR	Gas Balance and Recycling	Contribute to the planning, execution, data analysis of experience requiring gas balance studies, recycling and retention quantification	Quantification of gas balance with the aid of AGHS, gas pressure gauges and RGA for different plasma regimes and configurations. Determination of edge recycling fluxes and remaining fuel retention in dedicated experiments.
PWI	Plasma-Wall interaction	Contribute to the planning, execution, data analysis and modelling of experiments studying first wall and/or divertor erosion in steady-state and transients (erosion fluxes, re-erosion/ re-deposition, impurity , recycling and CX fluxes, material mixing with seeding impurities and wall materials, material migration) as well as material melting.	Characterisation of: (re-)erosion & recycling flux (VIS spectroscopy & cameras), wall impurity screening (VUV & CX-spectroscopy), re-deposition flux (QMBs), melt processes (VIS&IR cameras, IVIS, spectroscopy). Modelling of plasma-wall interaction processes for different plasma scenarios and wall conditions. Related Codes: ERO, ERODEP, WALLDYN, DIVIMP, MD-Codes, MEMOS .

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DIVSOL	Divertor and SOL	Contribute to the planning, execution, data analysis and modelling of divertor physics studies under steady-state conditions and during ELMs. Divertor characterisation from low recycling regime to detachment with volume recombination. Divertor modelling with 2D/3D edge codes.	Characterisation of the operational space with respect to SOL/edge plasma conditions, recycling, radiation patterns, heat fluxes, etc. Determination of the divertor plasma parameters with all available techniques. Establish link with upstream parameters. Modelling of plasma background for different scenarios. Provide input for PWI codes, SDI and SMI competencies. Related Codes: 2D/3D edge: EDGE2D-EIRENE, JINTRAC, EMC3EIRENE, SOLPS, SOLEDGE2D, COREDIV, etc. Neutral transport: EIRENE, DSMC, … SOL turbulence: TOKAM3X, (H)ESEL, ATTEMPT, etc.…
IMPS	Impurity Seeding	Contribute to the planning, execution, data analysis and modelling of experiments with radiating divertor operation by impurity seeding. Analysis of the degree of detachment and exploration of potential feedback control. Interpretation and prediction of non-recycling impurity particle transport.	Participation in experiments with radiating divertor operation by impurity seeding and/or high deuterium fuelling and exploration of the radiating divertor domain. Analysis of the degree of detachment and exploration of potential feedback control on spectroscopic, bolometry or infrared signals. Interpretation and prediction of non recycling impurities on various scenario types and pedestal strength. Contribute to DIVSOL, SDI and SMI competencies.
PEDC	Pedestal Characterisation	Contribute to the planning, execution, data analysis and modelling of experiment studying / requiring plasma edge pedestal measurements (temperature, density, rotation…), characterisation of the edge pedestal structure, dimensionless and dimensional scaling, pedestal MHD, L-H transition physics, threshold scaling.	Analysis of plasma edge pedestal measurements (temperature, density, rotation etc.). Characterisation of the edge pedestal structure. Dimensionless and dimensional scaling studies. L-H transition physics.

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PEDM	Pedestal MHD stability	Contribute to the planning and execution of experiments related to pedestal physics. Perform data analysis and modelling of plasma pedestal MHD.	Analysis of plasma edge pedestal MHD measurements. Calculate linear MHD pedestal stability. Extend analysis to non-linear MHD pedestal stability. Related codes: ELITE, EPED, MISHKA, JOREK
ELMM	ELM Mitigation (pellets, magnetic perturbation, kicks)	Contribute to the planning, execution, data analysis and modelling of experiment using pellet/vertical-kicks ELM pacing or ELM mitigation with resonant /non resonant magnetic perturbation.	Specifically targeted at the identification of paced or mitigated vs. natural ELMs. Includes the analysis of the effect of pacing or mitigation on ELM energy, heat losses, pedestal structure and particle and energy confinement. Contains the study of the entire ELM cycle. Related codes: JOREK, others?
IMPT	Impurity Transport	Contribute to the planning, execution, data analysis and modelling of experiments investigating / requiring / developing impurity accumulation avoidances techniques.	Identify impurity sources, characterise impurity transport, develop impurity accumulation avoidance techniques. Model impurity transport, compare with experiment. Contribute to SDI and SMI. Related Codes: NCLASS, NEO, SANCO, etc.
PCTR	Plasma Control	Contribute to the planning, execution, data analysis and modelling of experiments requiring plasma control	Select appropriate measurements, actuators and procedures for real time control of plasma behaviour, such as detachment, impurity penetration, ELM frequency, fuelling, NTMs, etc…
SDI	Scenario development and integration	Contribute to the planning, execution, data analysis of experiments to develop H-mode discharges (baseline, hybrid) and integrated solutions for ITER-relevant scenarios.	Integration of key components of scenario development, such as seeding, fuelling, H-mode entry and exit strategies, current ramps, etc…

Id	Competency	Description	More details for JET
SMI	Scenario modelling and interpretation	Contribute to the planning, execution, data analysis and modelling of scenario development studies, incorporating information from multiple studies and competencies, such as SDI, IMPS, IMPT, DIVSOL, etc...	Preparation of experiments by running predictive scenario simulations. Validation of data with interpretive codes such as TRANSP. Interpret scenario performance in terms of heat and particle sources and transport, current drive and edge integration. Extrapolate the scenario to larger devices and/or DT on the basis of the interpretative runs. Related codes: Edge/core integrated codes: JINTRAC, COREDIV, ETS, etc. Core modelling codes: ASTRA, JETTO, CRONOS, TRANSP, etc. SOL modelling codes: EDGE2D, SOLPS, SOLEDGE2D, etc.
3D	3D physics	Contribute to the planning, execution, data analysis and modelling of experiments related to externally imposed magnetic perturbations and their effects on plasma.	Modelling of expected magnetic perturbations to plasma boundary produced by the JET EFCC coil system. Analysis of experimental results, comparison with predictions.
TURB	Turbulence	Contribute to the planning, execution, data analysis and modelling of turbulent drives and impact of drift-wave turbulence on heat, particle and momentum transport. Interpretation of measurements comparing with analytic theory and running detailed linear/nonlinear micro-Stability analysis/simulations.	Take detailed fluctuation measurements (reflectometry, Li beam BES) during experiments and in particular during sessions dedicated to transport studies and LH transition. Provide interpretation of measurements comparing with theory and run detailed linear/nonlinear micro-stability analysis/simulations. Related Codes: KINEZERO, GENE, GYRO, GKW.
DUST	Dust production and transport	Contribute to the data/interpretation of dust production, dust transport analysis and dust transport modelling.	Measure/evaluate dust production in different circumstances, including Transient Impurity Events. Model/ interpret dust production and transport Related Codes: DTOKS, DUSTTRACK, etc