PSD Meeting on the transition of JT-60SA to W, 17/06/2025

New diagnostics proposals relevant for the W phase

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Upgrade of diagnostics for W: Proposals for edge and SOL diagnostics

- **proposals of feasibility studies and conceptual design** to enhance the diagnostic capabilities of JT-60SA for monitoring and investigation of the plasma edge and scrape off layer
- List provided in the call (for reference, not exclusive), agreed with JT-60SA IPT

- Low Energy Neutral Particle Analyzer (LENPA)
- Quartz Micro Balance (QMB)
- Surface Thermo-Couples (STC)
- Fiber Bragg Grating
- IR/Vis cameras
- SOL current
- X rays array (low energy)
- Divertor Thomson scattering
- Beam Emission Spectroscopy

Several proposals received according with the provided list
+ several others to be considered

Prioritization on going
Aiming to complete the first phase of feasibility by 2025

Diagnostics proposals /1

Title or topic	measurement target	comment
EU-DEMO like real-time detachment control diagnostics for JT-60SA	<10 kHz visible (450-750nm) polychromator based divertor spectroscopy systems to detect the loss of detachment defined as a temperature increase above 3 eV of the high density plasma in front of the target (ratio H Balmer lines and C lines); W erosion	stringent requirements on the lines of sight (line integrated measurements). Access from upper port
RE monitor	monitor generation of runaway electrons based on t two BF3 proportional chambers working in count mode and a liquid scintillator working in current mode.	no machine access needed
Enhancement of the fast charge exchange spectroscopy	H, D isotope density profile of the mixture plasma through enhancement of the CXRS diagnostics (Fiber Bragg Grating and Photonic Lantern) to suppress cold H and cold D contribution in the Halpha and D alpha spectra. Ion temperature and rotation velocity could be deduced by the Doppler broadening and Doppler shift of the spectrum	Plug-in device to be installed in the diagnostic room. FBGs, combined with the PLs, installed in the CXRS lab after the light is collected by the multi-mode fiber bundle and before it is directed to the spectrometer, right before the entrance slit
MANTIS multispectral visible imaging	1 kHz radiance and 2D emissivity H, H2, C, N, Ne, Ar… (12 wavelengths) and derived quantities	
High-resolution visible overview camera with real-time and multispectral capabilities	high resolution imaging survey with capabilities for RE synchrotron radiation and spectral analysis (H, C,Fe…) for PWI, pellet ablation, TESPEL, impurities	
SOL-Pedestal Imaging Vacuum-Ultraviolet spectrometer	1D imaging VUV 5-200nm impurity (W) transport in SOL	upper, horizontal, lower oblique considered. Similar to DivVUV
Quartz Crystal Microbalances	Multiple QCMs to monitor erosion, migration and deposition processes in real time	distributed system
Directional Electron Probe	measure scrape-off layer (SOL) current, electron temperature, electron density, ion saturated current and radial electric field along probe's plunge path. SOL current can be used as an indicator of detachment.	Langmuir probe mounted on reciprocating moving system. Likely room needed outside the port

Diagnostics proposals /2

Title or topic	measurement target	comment
Thermal Helium Beam	2D (4 mm space resolution) electron temperature and density profiles, as well as their fluctuations in edge and SOL through line ratio technique of selected neutral He line intensities, emitted by He gas locally puffed into the plasma. Density range between 1 × 10^18 and 8 × 10^19 m−3, te range 5 eV to 200 eV	mid plane or divertor location 0.95-1.1 rho. Retractable mirror in the vessel
Alkali beam emission spectroscopy	5mm spatial resolution, >100kHz sampling density profiles and density fluctuations simultaneously in the plasma edge and the scrape-off layer. Rotation and ion temperature in principle possible.	stringent port requirements
Deuterium beam emission spectroscopy	10 mm, >100kHz 2D density fluctuations and fast transient events in the core and edge plasma. Flow measurement possible. RT possible	stringent port requirements
Divertor Thomson Scattering	electron density and temperature in the divertor region with a spatial resolution better than 2 cm and a precision better than 10% in the temperature range of 5-200 eV at an electron density of 1×10^{19} m^{-3}.	Laser beam directed into the divertor region through the 3 cm gap between the divertor cassettes (P2 lower oblique) and dumped on the opposite side. Collection optics view the laser beam through the same gap
Neutral Gas Analyser	Development of NGA equipped with RGAs and OGA (with preliminary prototype)	distributed system
Gas Puffing Imaging of turbulent structures	edge density fluctuations and turbulence through imaging of neutrals ionization in the visible spectrum.	line of sight tangential to magnetic field lines, in view of gas nozzle
Collective Thomson Scattering	fast-ion dynamics, isotope ratio, bulk ion rotation velocity, ion temperature	hw requirements not yet clearly defined (in particular: vessel components for signal collection?)

Next steps

- Prioritization done in SA, submitted to PSD
- Check on funding in SA completed
- Proposed selection to be shared with F4E and ET

- Discussion with QST planned for 26th June
- Task assignment by end of June
- Kick off by mid July