# STAFF ASSESSMENT HAS IDENTIFIED NEED FOR NEW MEASUREMENTS

| Issue/Question | Physics Measurement | Possible Diagnostic Approaches |
|---|---|---|
| **Transport/Turbulence** | | |
| Test for zonal flows | Poloidal and toroidal distribution of potential or electric field, possibly measure local velocity | Upgraded CER, upgraded MSE (counter NBI) |
| | Possibility of $n_e$ fluctuations — | Reflectometer, two cross beam scattering |
| Turbulence driven transport | Improved core fluctuations | Reflectometer, cross beam scattering |
| Magnetic turbulence driven transport | Internal magnetic field fluctuations | Cross polarization scattering of probe beam |
| Cause of electron transport | | |
| Magnetic turbulence | Internal magnetic field fluctuations | Cross polarization scattering |
| ETG turbulence | Shot wavelength, high k turbulence | High k FIR scattering |
| Direct measurement of internal turbulent-driven transport | $n_e$, v, $T_i$ fluctuations — phase resolved | HF-CER |
| Extended tests of SOC in plasma transport | Long radial correlations in turbulence (avalanches) | ECE radiometer, PCI, improved reciprocating Langmuir probes |
| Impurity transport | Injected impurities | Laser ablation |

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| Issue/Question | Physics Measurement | Possible Diagnostic Approaches |
|---|---|---|
| **Profile** | | |
| Edge stability, edge transport | Edge current density | Zeeman splitting with lithium beam, MSE with counter NBI |
| Transport barrier, understanding and control | High resolution core $E_r$ measurement | MSE with counter NBI, improved CER |
| Transport determination, especially in radiative discharges | Improved radiation profile measurement | Improved bolometer |
| Edge stability, pedestal height, edge bootstrap | High time and space resolution of boundary pressure profile | Swept reflectometer for $n_e$, $T_e$ – ???, $T_i$ — CER |
| **Equilibrium and Stability** | | |
| Edge stability, pedestal height, edge bootstrap | Edge current density | Zeeman splitting with lithium beam, MSE with counter NBI |
| Improved equilibrium reconstruction | Direct measurement of $\Delta B_t$ profile | Motional Stark spectroscopy |
| Validation of neoclassical (and classical) tearing mode physics | Detailed structure of internal MHD | Multiple view ECE, highly localized ECE, tangential SXR |
| Magnetic reconnection process | | |

$\Rightarrow$ Edge current density, diagnostic development funded for FY2000

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| Issue/Question | Physics Measurement | Possible Diagnostic Approaches |
|---|---|---|
| **Heating and Current Drive** | | |
| Current carrying electrons from ECCD and FWCD | Electron distribution function, nonthermal electrons | Tangential x-ray camera |
| **Divertor** | | |
| Impurity flow and retention | 2-D measurement of impurities velocity | 2-D Fabry Perot laser fluorescence |
| Source of carbon | Low ionizations states of carbon | Filterscopes, IR cameras |
| Neutral density measurement | Spatially resolved $D_\alpha$ measurement | Tangential viewing TV with large dynamic range |
| Divertor main ion temperature and flow | Divertor $T_i$, velocities | CER with vertical diagnostic beam |
| Source of carbon | Low ionizations states of carbon | Filterscopes, IR cameras |
| Neutral density measurement | Spatially resolved $D_\alpha$ measurement | Tangential viewing TV with large dymamic range |
| **Other** | | |
| Fast ion loss | Flux of energetic ions | Fast neutral detector |
| Pellet ablation | Spatially and temporarlly resolved $D_\alpha$ | Tangential viewing camera |