TC-25 Particle transport during transient H-mode phases by pellets

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| **TG priority:** Critical | **Start date:** 2015 | **Status:**  On-going | **Personnel exchange:**  Yes |
| **IO priority:** | **End date:** Not fixed | **Motivation:** Plasma Control | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Device /**  **Association** | **Contact / Teams** | **2016 TG Request** | **Activity (from JEX/JA spreadsheet)** | | | | |
| **2015** | **2016** | **2017** | **2018** | **2019** |
| ITER | A Loarte | Desirable |  |  |  |  |  |
| MAST-U | M Valovič L Garzotti | Desirable | Upgrade | Upgrade |  |  |  |
| AUG | P Lang  M. Valovič L Garzotti | Desirable | Analysis | Committed |  |  |  |
| JET | L Garzotti  M. Valovič  F. Koechl  D. Frigione  M Maslov | Desirable | Committed | Committed |  |  |  |
| EAST |  | Desirable |  |  |  |  |  |
| DIII-D |  | Desirable | Not doing | Not doing |  |  |  |
| WEST |  | Desirable | Upgrade | Upgrade |  |  |  |

**Purpose:** Improve physics basis for density control in ITER by pellets . This includes following areas:

*Pellet deposition:*

* Calibrate models for pellet deposition under ITER-relevant conditions such as HFS launch, restricted velocity, high pedestal temperature, presence of q95=3 surface, pellet triggered ELMs, etc.
* Quantify the drift of pellet material. Multiple drifting plasmoids or single redistribution event (JOREK)?
* Quantify secondary fuelling via neutrals recycled from pellets.

*Post-pellet outward particle transport:*

* Characterise the mechanism of outward loss (pellet retention time) under conditions of mitigated ELMs (by RMP). Compare role of ELMs, microturbulence and neoclassical flow.
* Assess the effect of pellet size on outwards particle transport.
* Assess compatibility of pellet-induced modulation of particle flux with divertor control.

*Post-pellet inward particle transport:*

* Quantify inward particle flux due to diffusion (hollow density profile) or pinch. Why the timescales of density evolution vary between machines (MAST v.s. AUG) and how to extrapolate to ITER.

Assess the core density limit under relevant pinch and pellet deposition (AUG).

**Results for 2015**

* On MAST, effect of pellets on RMP mitigated ELMs is modest. ELMs are non-diffusive. Post-pellet particle loss dominated by ELMs with pellet retention time ~0.17E. **Valovič et al. Nucl. Fusion 55 (2015) 013011**
* On JET, particle transport of transiently hollow density profiles reproduced with QuaLiKiz. For ITER, with hollow profile R/Ln=-1.5 and R/LT=6, the inward particle flux Γ=-0.2x1020 m-2s-1. **Baiocchi et al. Nucl. Fusion 55 (2015) 123001**
* On AUG, low \*, pellets refuel pump-out by RMPs. ELM mitigation is preserved but at compromised level. Pellet retention time ~0.19E. **Valovič et al. Nucl. Fusion submitted**

**Plans for 2016**

* AUG experiments scheduled (January, March 2016)
  + Quasi-stationary plasma with pellet-dominant fuelling and ELMs mitigated by RMP (AUG15-1-2-1)
* JET experiments scheduled
  + Pellet fuelling in high performance baseline (M15-01)
  + Pellet fuelling of hybrid (M15-02)
  + Particle transport in presence of hollow density profile (M15-01, M15-02)