MDC-20 Requirements for real-time sawtooth control

|  |  |  |  |
| --- | --- | --- | --- |
| **TG priority:** High | **Start date:** 2014 | **Status:**  On-going | **Personnel exchange:**  No |
| **IO priority:**   | **End date:**  N/A  | **Motivation:** Avoid pressure excursions, NTM seeding |

|  |  |  |  |
| --- | --- | --- | --- |
| **Device /****Association** | **Contact****Person** | **2016 TGRequest** | **Activity (from JET/JA spreadsheet)** |
| **2014** | **2015** | **2016** | **2017** | **2018** |
|   | O. Sauter |   |   |   |   |   |   |
|   | I. Chapman |   |   |   |   |   |   |
| AUG  | V. IgochineM. Reich | Desirable | Committed | Committed |   |   |   |
| DIII-D  | R. La Haye | Desirable | Not doing | Analysis |   |   |   |
| EAST  | Y. Sun | Desirable |   |   |   |   |   |
| FTU  | S. Nowak | Desirable |   |   |   |   |   |
| JET  | J. GravesM. Lennholm | Desirable | Committed | Committed |   |   |   |
| KSTAR  | J. JeongT. Goodman | Desirable | Committed |   |   |   |   |
| RFX-Mod  | P. Piovesan | Desirable |   |   |   |   |   |
| TCV  | T. Goodman | Desirable |   | Committed |   |   |   |
| Tore Supra  | G. GiruzziM. Lennholm | Desirable |   |   |   |   |   |
| FOM | M. de Baar | Desirable |   |   |   |   |   |

**This template is based on the 2014 report.**

**Purpose:** Robust/routine sawtooth control

* Assess real-time control of sawteeth across tokamaks to determine ITER requirements and to predict ITER behavior.
* Compare real-time versus feedforward, pacing/locking, assess EC/IC accuracy for (de)stabilization
* Determine if any difficulties at high beta
* Determine role of confinement versus current diffusion time scales

**Background:**

* A previous joint experiment MDC-5 demonstrated the use of ECCD and ICRH to alter the sawtooth period for avoidance of 3/2 NTM triggering. Sawtooth pacing by modulated ECCD and ICRH was also demonstrated, allowing pre-emptive ECCD to stabilize the 3/2 mode after the sawtooth crash.
* MDC-5 was closed in 2012, and a joint paper was published on this work: I.T. Chapman, et al., 2013 *Nucl. Fusion* **53** 066001

**Results for 2014**

* AUG: Locking of the sawtooth period to modulated ECH was tested but not perfect. Role of impurities investigated. But sawtooth control was used in other experiments for transport studies in H-mode
* FTU: Sawtooth locking to modulated ECH demonstrated
* JET: Sawtooth control with HFS ICRF was demonstrated. Importance of ICRH for W control as well.
* DIII-D/RFX: Effect of RMP to control sawteeth was analyzed. Role of proximity to ideal limit analyzed.
* Other machines: No experiments

**Plans for 2015**

* AUG: Sawtooth control at high beta and with fast particles
* EAST: might have ICRH experiments on ST control
* FTU: Tests of sawtooth locking with ECH/ECCD will continue
* JET: Sawtooth pacing/locking with ICRH to be tested
* TCV: Sawtooth pacing/locking to be tested and effects of shape on NTM triggering