MDC-20 Requirements for real-time sawtooth control

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

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