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Real time feedback control of the sawtooth period using ECRH launchers

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Real time feedback control of the sawtooth period using ECRH launchers JAMES PALEY, FEDERICO FELICI, TIMOTHY GOODMAN, FRANCESCO PIRAS, STEFANO CODA, CRPP-EPFL, TCV TEAM — The sawtooth instability is both necessary to remove helium ash from the plasma core in a fusion device as well as a trigger for unwanted, confinement limiting neoclassical tearing modes. This has motivated the development of sawtooth control techniques. One of the more promising control methods is to target localised ECRH/ECCD in the vicinity of the q=1 surface. We have demonstrated on TCV the ability to control the sawtooth period in real time by actuating the ECRH launcher mirror angle. Sawtooth control is complicated by the non-linear, multi-parameter nature of the instability and effect of the ECRH beam. For example, moving the ECRH beam not only modifies the local current profile, but also influences the plasma temperature and position of the q=1 surface. An effective control system should be able to track such changes. The control objective was simple – maintain the sawtooth period at a reference value. The controller was able to locate and maintain the sawtooth period at the reference, despite period modifying disturbances such as plasma density variations.

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