

Task Reconnection 7.

“Sawtooth reconnection in tokamaks”

Sawteeth are the most reproducible and best-diagnosed reconnection event in tokamaks. In spite of general communalities, sawteeth show a broad variance in appearance, depending (among others) on q , current distribution, β , collisionality and plasma shape. Improved diagnostics (e.g. ECE imaging) allow a refined view of this process. ASDEX Upgrade has a large respective data base available.

Realistic numerical modeling of these events needs (at least) a 3-d two-fluid MHD code, like the M3D-C1 code developed by PPPL.

1.5 year goal:

we will screen the AUG database for characteristic, well-diagnosed representatives of different classes of sawteeth. Guided by the possible outcome of modeling results we can execute dedicated discharges

We will initiate the modelling effort with the M3D-C1 code by a PhD student from IPP working at PPPL. In the first phases she will extend studies of nonlinear two-fluid reconnection in a slab to include large guide field, and compare results with different forms of Ohm's law. First results for realistic cases should examine the physical mechanisms of the temperature crash, comparing modelling results with 2d ECE imaging and other diagnostics. We will use this phase also for benchmarking between different two fluid codes (XTOR, possibly also JOREK).

Approximate 4-year goal

We will study the seeding of NTMs by sawteeth, in particular addressing the effect of the current profiles and plasma shape. We will examine in modelling (but, if promising, also experimentally) the triggering of sawteeth by external $m=1, n=1$ perturbations. Interpret “snakes” and clarify how both sawteeth and snakes can be present in the same discharge. Clarify under what conditions one would expect stationary interior $m=1, n=1$ helical deformation instead of sawtooth.