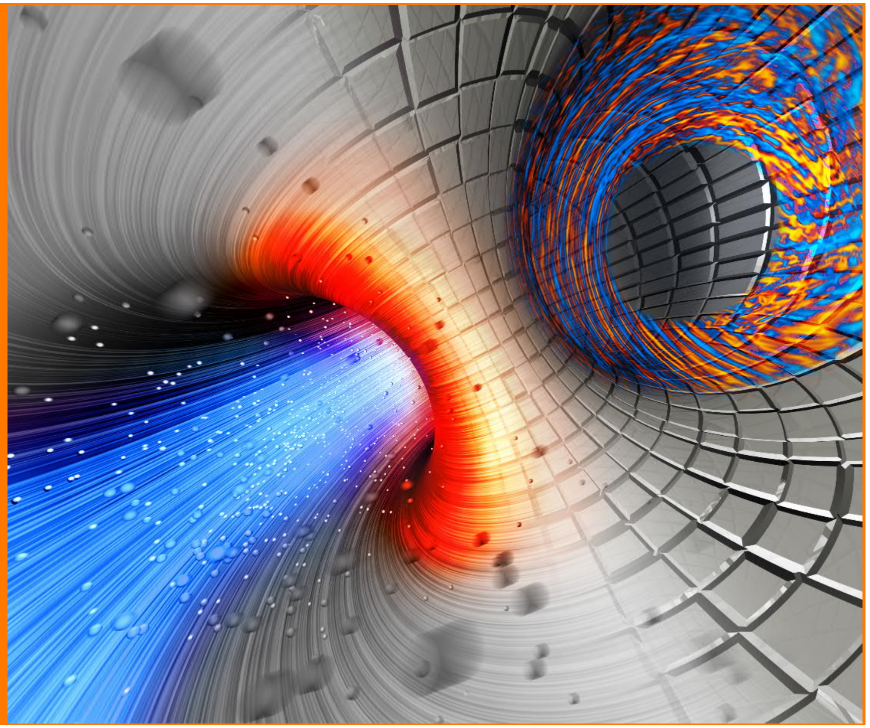
PMI-5.2.5-T012
Fast Particle Losses after sawtooth crash

Taina Kurki-Suonio & Antti Snicker
Aalto University
Emiliano Fable
IPP-Garching



Aim of this task

★ EU-DEMO is large, with large plasma wall clearance

➔ alpha losses expected negligible in *MHD-quiescent* plasmas

★ EU-DEMO : $q_s(\rho = 0) < 1$

➔ sawtooth crashes to be expected

However, introduce a large sawtooth crash

➔ fusion-born alphas ejected towards plasma periphery where MeV-range alphas ought not to exist

➔ estimate the effect of a sawtooth crash on alpha particle losses and power load to the wall

Task Performance – original plan

- ★ The alpha particles distribution after a sawtooth crash to be produced by E. Fable at IPP Garching = input for transport simulations
- ★ The analysis of alpha particle losses after a sawtooth crash will be performed with the code ASCOT
- ★ Results to be compared with the unperturbed case (i.e. when the displacement due to sawtooth crash is not considered).

Aalto University
School of Science

Task Performance – revised plan

- ★ E. Fable at IPP Garching provides ASCOT group with (at least) two different plasmas:
  - – Equilibrium and kinetic profiles corresponding to pre-sawtooth phase
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- ★ ASCOT group will
  - – Run the AFSI code to calculate the birth distribution of fusion alphas for both cases
  - – Run the ASCOT code for both cases to determine if the power arriving at the wall will be significantly larger after a sawtooth
  - – Compare the losses between pre- and post-sawtooth phases

Pre- and post-sawtooth phases

★ Critical quantities at the plasma edge:
- $\rho_L(\alpha) \approx 3$ cm
- $\Delta_b \approx 10$ cm

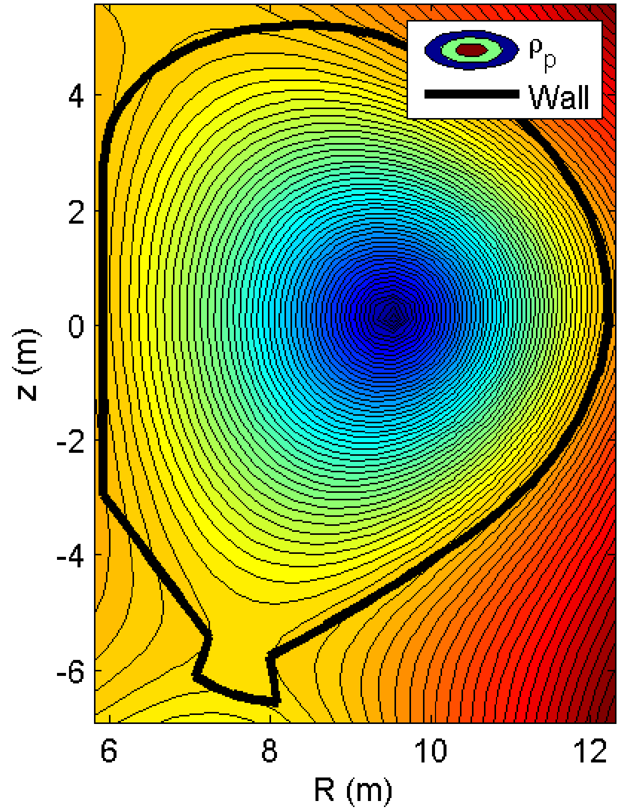
★ Plasma-wall gap > 10 cm

➔ Large power loads not expected even in the post-sawtooth phases

★ *Caviat: axisymmetric plasma*

➔ include the TF-ripple ➔ increased collisionless transport in the plasma periphery

★ *Question: should we use 16 or 18 coils?*



Present status

- ★ Input data under intense preparation
- ★ Verification of the up-to-dateness of input data (wall, coils,…)
- ★ First simulations for the extremely quiescent and extremely disturbed cases to estimate the shift in the fusion alpha birth profile and the corresponding changes in the power loads (if any)
- ★ Repeat the simulations including the TF ripple
- ★ If found necessary, carry out the analysis for the remaining 19 time slices

Possible extension of the work

Time-dependent simulations

- ★ In the recent past, ASCOT has been upgraded to allow for backgrounds evolving in time
- ★ In the absence of a working numerical model for a sawtooth crash this could be applied, together with an ad-hoc diffusion coefficient, to investigate not only the losses of newly-born fusion alphas but even the entire slowing-down population
- ★ We already have snapshot data (21 timeslices) to cover a full sawtooth cycle

Thank you for your patience ☺