TG-MHD Subgroups for OP2.x proposals

Subgroups for the collection and discussion of proposal ideas

Proposals are posed individually by proponents.
The subgroup coordination is an attempt to gather many good proposals (and possibly improve them in expert discussions) in order to achieve a good physics program in OP2 .

- high beta, MHD limits (abrupt changes of plasma confinement) [C. Brandt]

- (Quasi-)coherent mode investigation [K. Rahbarnia]

- MHD-optimization [J. Geiger, T. Andreeva]
  - comparison optimized / deoptimized configurations
  - plasma equilibrium and bootstrap current
  - stability of configurations, equilibrium properties and core islands physics

TG MHD: experimental plans / proposals OP2x (1)

- high beta, MHD limits, abrupt changes of plasma confinement [C. Brandt]

  (TF3-deliverables: - Assessment of W7-X MHD optimization criteria at increased plasma beta,
  - Documentation of high-beta plasma profiles for detailed transport analysis and modelling, with emphasis on magnetic fluctuation measurement
  - Documentation of MHD limits)

  - plan for high-beta 1.7 T operation ←→ TG-FI, TG scenarios
  - *high-mirror configuration* is favourable for NBI heating (improved heating capability in NBI and ECRH)
  - proposals will be necessary to prepare high-beta configuration
  - physics:
    - pellet dynamics & plasma response
    - stability and extended high performance phases

- (Quasi-)coherent mode investigation [K. Rahbarnia]

  (TF3-deliverable: Documentation of MHD stability and fast-particle driven MHD modes within the magnetic configuration space)

  - MHD-mode activity: electron-gradient, turbulence-driven, non-linear coupling
  - mode activity associated with ECCD and sudden events & collapses - similar to OP1.2 transients
  - Alfvén Eigenmode activity in advanced NBI/ICRH heating scenarios, fast particle drive → TG-FI [C. Slaby]
  - low frequency activity (ILMs in config. scans, 1-2 kHz mode)

TG MHD: experimental plans / proposals OP2x (2)

- MHD optimization: Investigation of plasma stability, equilibrium properties and core islands physics [J. Geiger, T. Andreeva]
  (TF3-deliverable: - Documentation of MHD stability within the magnetic configuration space,
  - Assessment of W7-X MHD optimization criteria at increased plasma beta
  - Documentation of MHD limits
  - Confirmation of reduced equilibrium currents at higher betas and different magnetic configurations)
  - physics in the extended configurational space (ILD / UFM-like configurations with high mirror), possibly operation in 1.7 T
  - configuration scans (iota, island size variation)
  - poloidally rotate islands (identify localization of modes / tomography and TS-profile effects)
  - zero out the 5/5 island with the control coils and drive a massive 1/1 with the trim coils.
  - use of control coils for variation in the configurational space
  - low shear configuration: suppresion of internal 5/5 islands is possible with main TF coils
  - theory: prediction of criteria for safe ECCD operation (empirical: ~18 kA for EIM-config)
  - impurity-induced temperature holes and their effect on plasma stability
  - bootstrap: further configurations & validation neoclassically predicted dependencies (ECCD as bootstrap boost)?
  - bootstrap current in *low mirror configuration*: large BS current, fast particles are not trapped near axis ←→ TG-Turbulence

TG MHD: experimental plans / proposals OP2x (3)

- Measurement of currents in the plasma edge (ergodization) → TG-Edge
  (TF3-deliverable: Documentation of MHD stability within the magnetic configuration space)
  - c.f. K. Hammond PPCF 2019, M.Rack NF 2012
  - assess influence on magnetic configuration / stability

- Repeat / extend scenario in 20180808.005 → TG-Scenario
  (TF1-deliverable: High plasma performance in the order of seconds)
  - (high density at moderate heating / after failure of gyrotron) for OP2 (Glen)