Chapter 2
PLASMA SCENARIOS

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Total pages : 21 (+8 appendix)

Rationale of Ch.2

- Recalls the time sequence of DTT heating phases and defines the nomenclature of the scenarios achievable in each phase, identifying possible regimes of operation
- Discusses how to build the various phases of a plasma discharge, consistently with electromagnetic constraints (METIS)
- Shows the time dependent 4 baseline scenarios E, A, C, E half BT simulated with ASTRA and first principle transport models
- Shows first calculations of ELM properties and discusses achievability of small ELMs/ELM free scenarios
- Discusses the possibility of investigating alternative scenarios to baseline
- Discussed expectations for negative triangularity scenarios

New subsections

QH, WPQH

In DTT a standard QH is probably impossible to achieve, due to the required high rotation.

A WPQH may be achievable at very small NBI torque. The coherent EHOs that usually regulate the QH edge disappear and a rapid increase in the pedestal pressure height and width occurs.

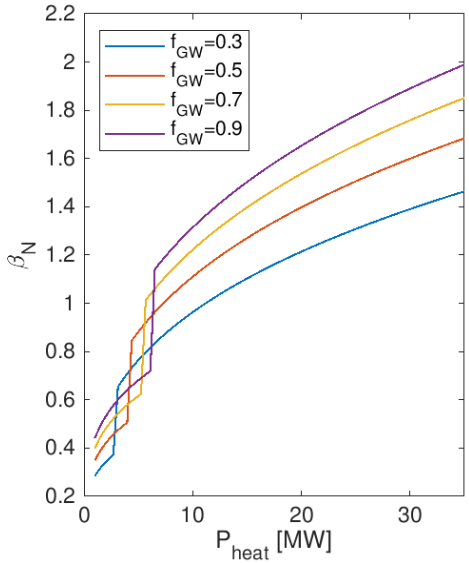
Adding core ECRH improves the WPQH performance.

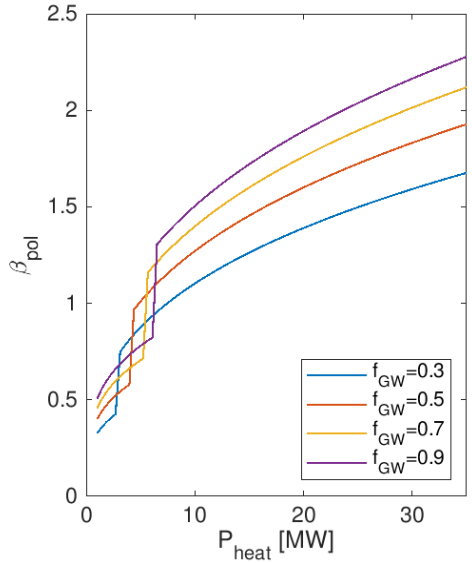
Advanced scenarios

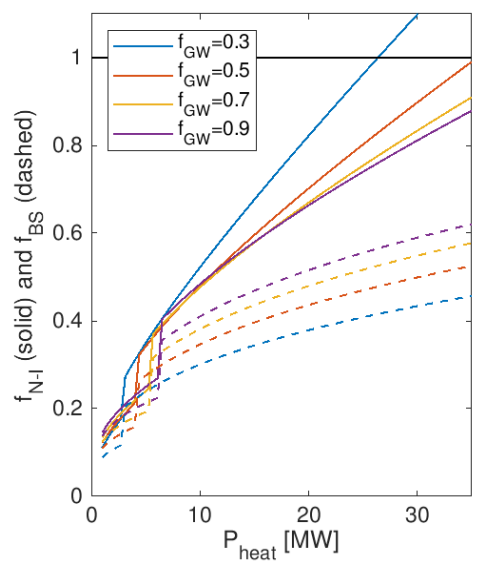
Advanced tokamak scenarios, with high fractions of non-inductive current, can be achieved at half B_T and low I_p.

0D estimates conservatively assuming H = 1, with stored energy provided by the average between the IPB98(y,2) and the ITPA20-IL scaling laws. I_{CD} [kA] = 100 P_{CD} / n_{el} .

At 1.5 MA and f_{GW}~0.5 fully non-inductive operation should be possible.







Headlines

Headline number	Headline contents	Priority (+, ++, +++)	ITER	DEMO
Construction Phase 2022-2029				
C.2.1	Definition of the central solenoid desired capabilities	+++		
C.2.2	Carry out integrated modelling of scenarios alternative to baseline H-mode	++	*	*
Phase 1 2029-2034				
1.2.1	Development of baseline L-mode and H-mode scenarios A, B, C in SN or XD divertor configuration	+++	*	*
1.2.2	Development of Negative Triangularity scenarios	+++		*
1.2.3	Development of Hybrid scenarios at half power	++	*	*
1.2.4	Development of high b_N AT scenarios at half field, half power	++	*	*
1.2.5	First studies of small/no ELMs regimes	++	*	*
Phase 2 2034-2038				
2.2.1	Improvement of all phase 1 scenarios at higher power	+++	*	*
2.2.2	Development of small/no ELMs scenarios	+++	*	*
Phase 3 2038-…				
3.2.1	Optimisation of all phase 1 and 2 scenarios at full power	+++	*	*
3.2.2	Optimisation of small/no ELMs scenarios at full power	+++	*	*

How to develop the content of the chapter for the next versions

- only simulations for SN baseline scenarios have been made so far
- present plan is to continue work on NT scenarios and try Hybrid scenarios
- however may be priority to be given to AT scenarios doable in phase A or B?

Ideas about the follow-up of the DTT-RP activity (work method, proposals of experiments on other tokamaks, code and simulation developments etc.)

- more substantial involvement of people in EU outside Italy, but funding is scarce also for present team, difficult to ask for voluntary work

- collaborations are being made with China, South-Korea, USA: how to involve in RP?

- code and simulation development: make use of progress made in EUROfusion on integrated modelling. More work on IMAS and simulation database should be done within DTT.

Discussion

- Mismatch found regarding NT configurations described in SOL chapter:

  SOL → reverse BT suggested as the only viable (why? It could remain L also in forward BT)

  PLS → forward BT used (reverse not advisable due to NBI orbit losses? Do we need to reverse also Ip?)

- Others?