MAX-PLANCK-INSTITUT
FÜR PLASMAPHYSIK

Session overview for TF-II: Edge Scenario Development

K. C. Hammond and D. Naujoks, *on behalf of the W7-X Team*

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

Main objectives for Task Force II

- *O1: Integrated scenarios for long-pulse operation with PFC heat load control, efficient particle exhaust, and impurity screening*
- *O2: Development of long, stationary divertor detachment scenarios with and without impurity seeding*
- *O3: Exploration of scenarios compatible with carbon-free operation and tungsten PFCs*
- *O4: Development of wall conditioning procedures*
- *O5: Reference discharge*

Task Force II objectives and deliverables

- ***O1: Integrated scenarios for long-pulse operation with PFC heat load control, efficient particle exhaust, and impurity screening:***
  - D1: Demonstration of safe divertor scenarios to avoid overloaded plasma-facing components,
  - D2: Determination of trim and/or control coil currents required to correct error fields,
  - D3: Demonstration of effective pumping, high divertor compression, and qualification of fueling actuators,
  - D4: Demonstration of long-pulse operation.

  √ multiple scenarios with > 100 MJ energy or > 6 MW heating
  √ current dataset incomplete
  √ pellets missing; need to feed back on more signals
  √ 1 GJ with low performance

- ***O2: Development of long, stationary divertor detachment scenarios with and without impurity seeding:***
  - D5: Demonstration of scenarios with long, stationary divertor detachment; in particular, for the high-mirror, high-iota and standard configurations,
  - D6: Characterize the conditions under which detachment is possible,
  - D7: Achieve rapid transition to detachment.

  √ no high-iota to date
  √ higher performance and more sophisticated feedback desired
  X need dedicated scenarios

Task Force II objectives and deliverables

- ***O3: Exploration of scenarios compatible with carbon-free operation and tungsten PFCs:***
  - D8: Definition of the operation limits associated with plasma-facing components containing tungsten materials,
  - D9: Characterize the scrape-off layer retention for tungsten impurities (eroded from baffle and heat shield),
  - D10: Determination of erosion effects due to seeding impurities,
  - D11: Characterize enrichment/accumulation for low-Z and high-Z impurities.

- ***O4: Development of wall conditioning procedures:***
  - D12: Condition walls to enable plasmas with high density gradients necessary for high performance

- ***O5: Reference discharge:***
  - D13: Regular performance of a standardized discharge with defined diagnostic coverage throughout the campaign

√ limits for ECRH (O2-misalignment)

X no spectroscopic data in SOL

√ HEXOS calibration with TESPELs

√ some evidence of accumulation in NBI discharges

√ boronization, GDC

√ ECWC (systematic study pending)

X ICWC (not conducted)

X conditioning ⇔ profiles

√ accomplished

√ gas balance analysis required

Results O5: reference discharge

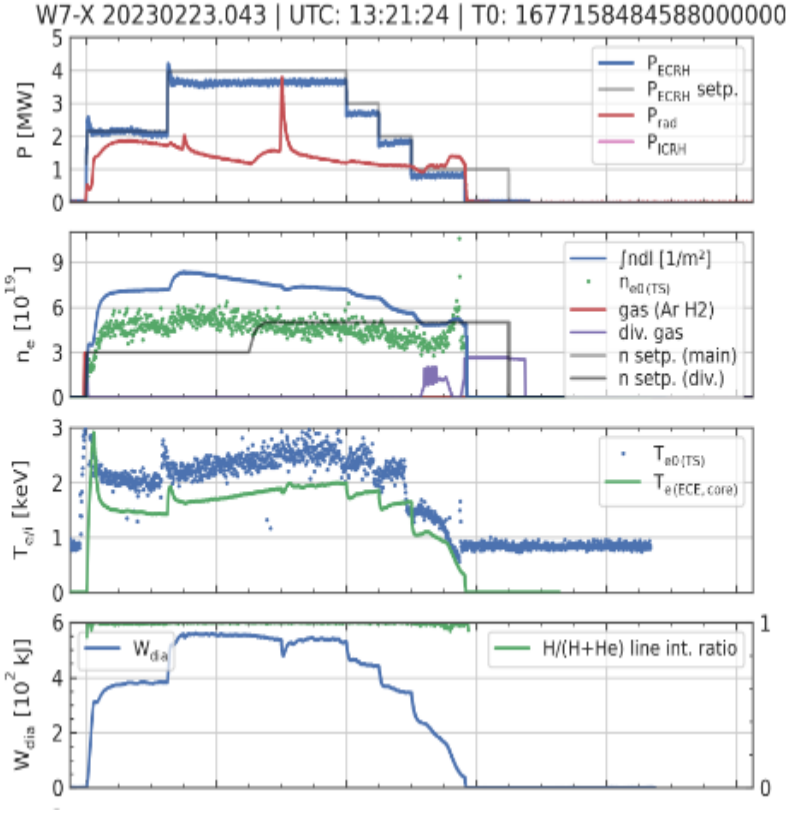
– D13: Regular performance of a standardized discharge with defined diagnostic coverage throughout the campaign

Objectives:

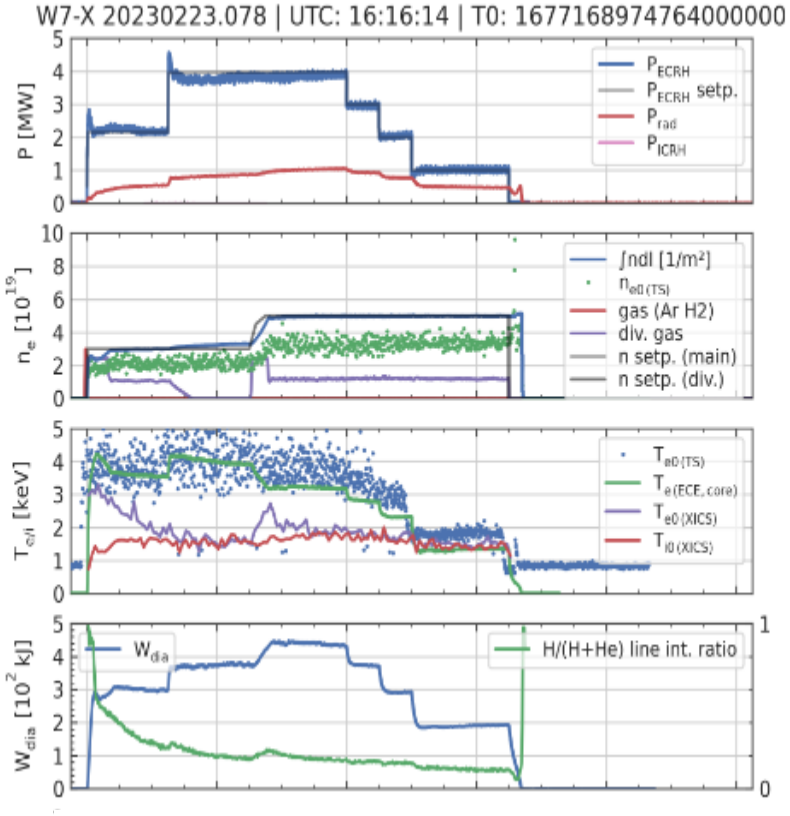
- Validation of edge models
- Tracking of plasma/wall conditions
- Analysis of configuration dependencies

Outcome

- Performed at least once per day during OP2.1
- Strong dependence observed on the nature of the discharges occurring immediately before the reference
- Analysis to be performed



Conducted after high-density NBI+ECRH shots



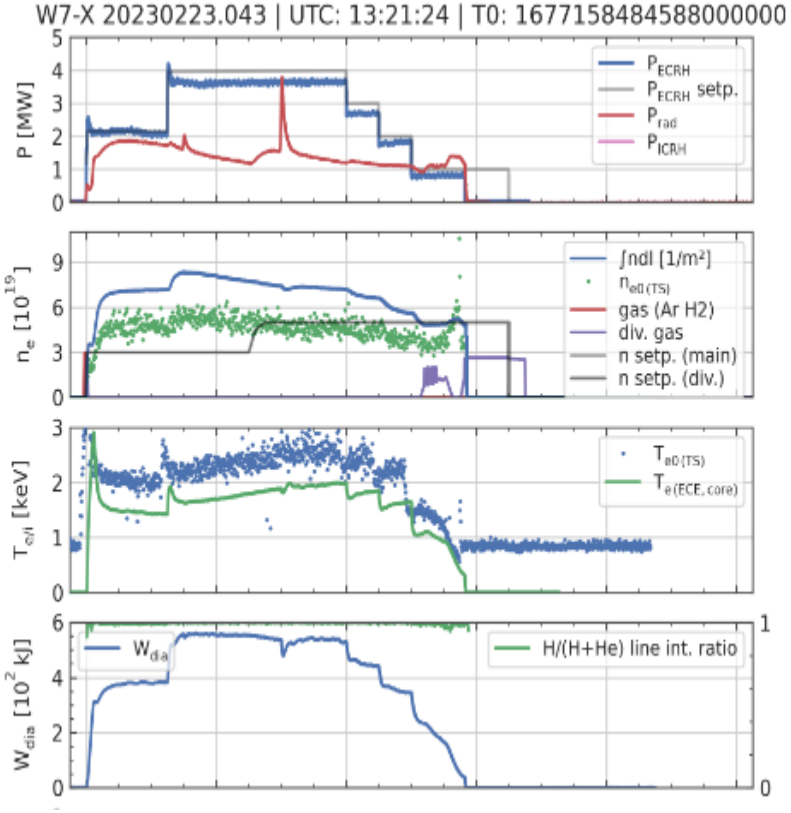
Conducted after (lower-density) ICRH commissioning, later in same day

Results O5: reference discharge

– D13: Regular performance of a standardized discharge with defined diagnostic coverage throughout the campaign

Questions for discussion:

- To what extent have the reference discharges been utilized for analysis so far?
- Are there modifications to the discharge that would make it more useful?
- Is it necessary to finish with high density and low power?



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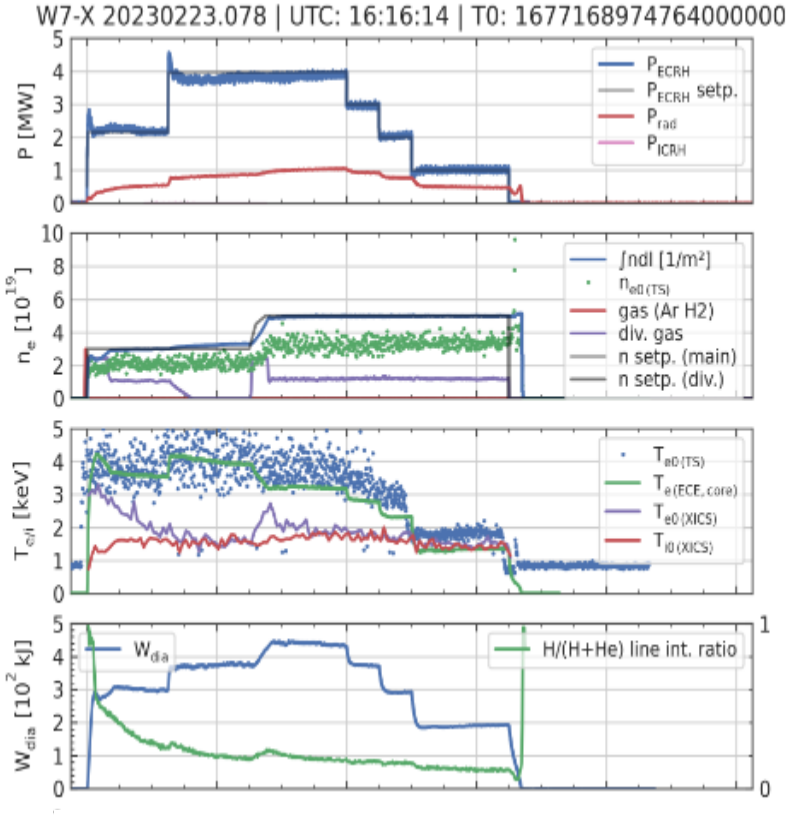

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Overview of this session

Time	Presenter	Topic	Deliverables
13:00	K. C. Hammond	Overview	O5: D13

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13:10	Y. Gao	Development of safe divertor scenarios	O1: D1, D2
13:25	M. Jakubowski	Long-pulse and detached scenarios	O1: D4; O2: D5, D6, D7
13:45	V. Haak	Pumping and exhaust	O1: D3
14:00		Discussion: long pulse and detachment scenarios	

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14:35	C.-P. Dhard	Plasma-wall interactions and tungsten components	O3: D8, D10
14:55	D. Gradic	Edge impurity enrichment & spectroscopic analysis	O3: D9, D11
15:10	V. Winters	Validation of edge transport codes	TF-III O2: D2
15:25	L. Vanó	Wall conditioning: before and during the campaign	O4: D12
15:40		Discussion: tungsten PFCs and conditioning	

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