Max-Planck-Institut für Plasmaphysik

Data curation for high Performance Scenarios: Post-pellet

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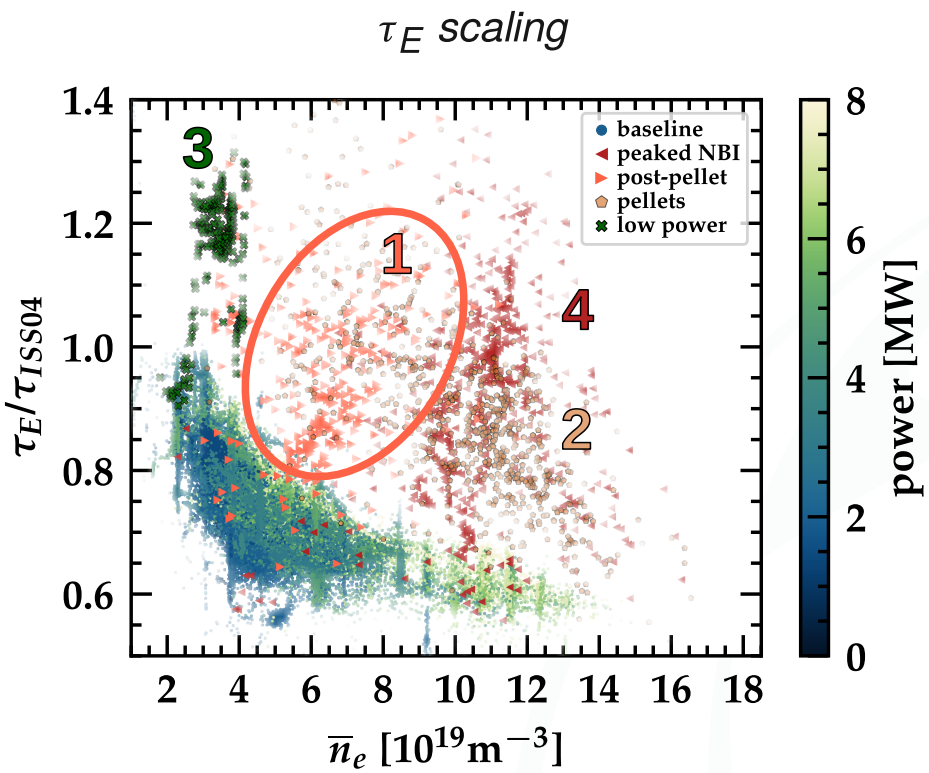
?.?.2026 TG Core Profiles

MAX PLANCK GESELLSCHAFT

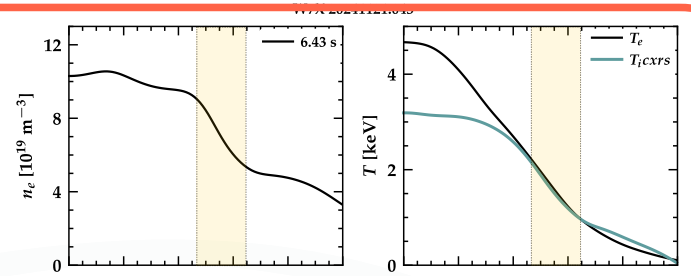
EUROfusion

Reminder: Peaked density scenarios

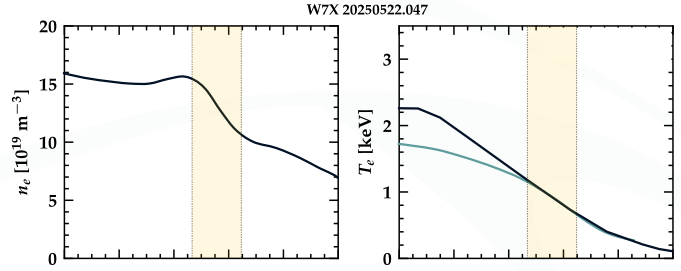
Currently there are 4 main known operational scenarios:
For this presentation, we are looking at #1.



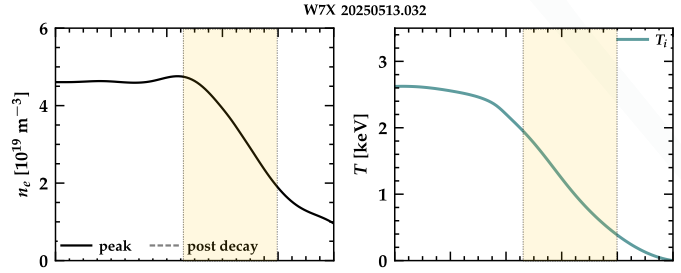
1: Post-pellets



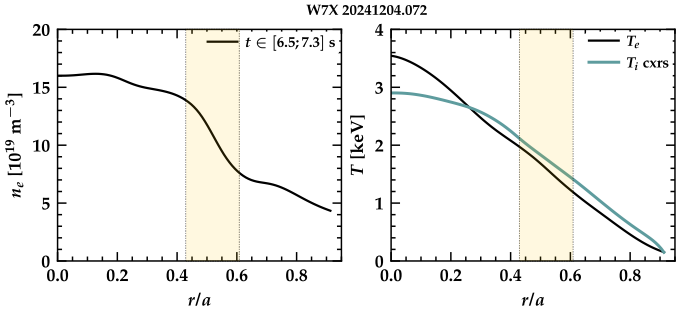
2: 'Steady-state' pellets
(e.g. in press release 2025)



3: Low-power + ?
'intrinsic' peaking

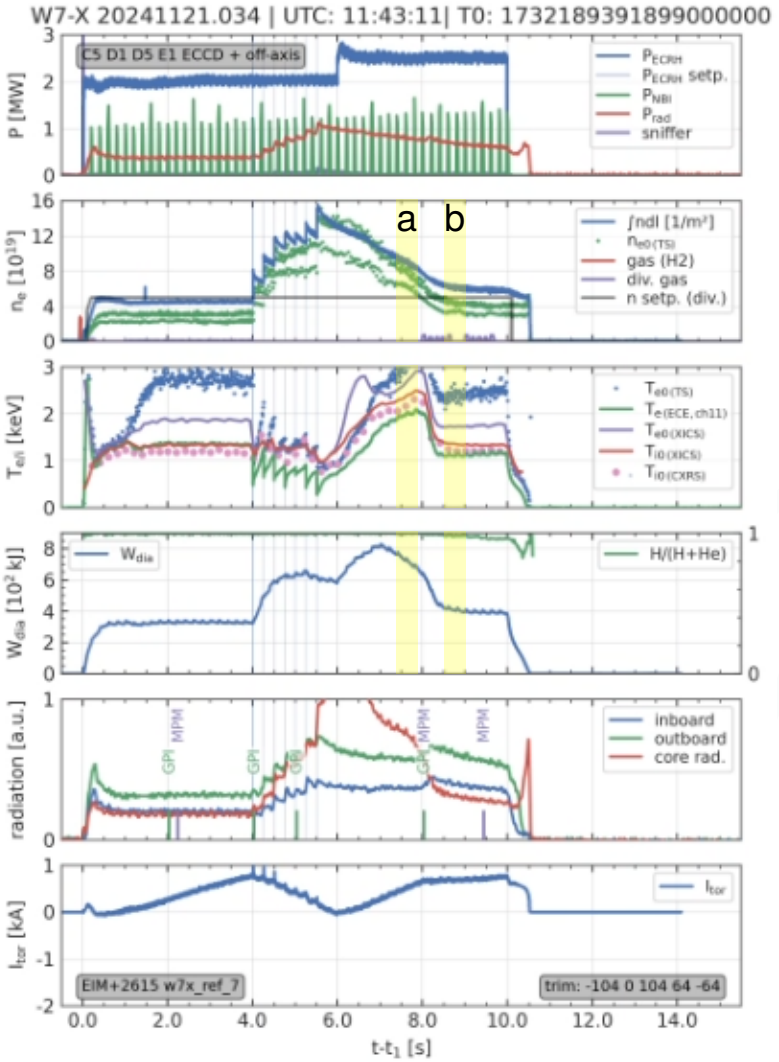


4: NBI + ECRH reintroduction
(e.g. in record n T τ.
+PRL submission)



Post-pellet injection

Rapid pellet injection followed by a long phase of slowly evolving profiles.

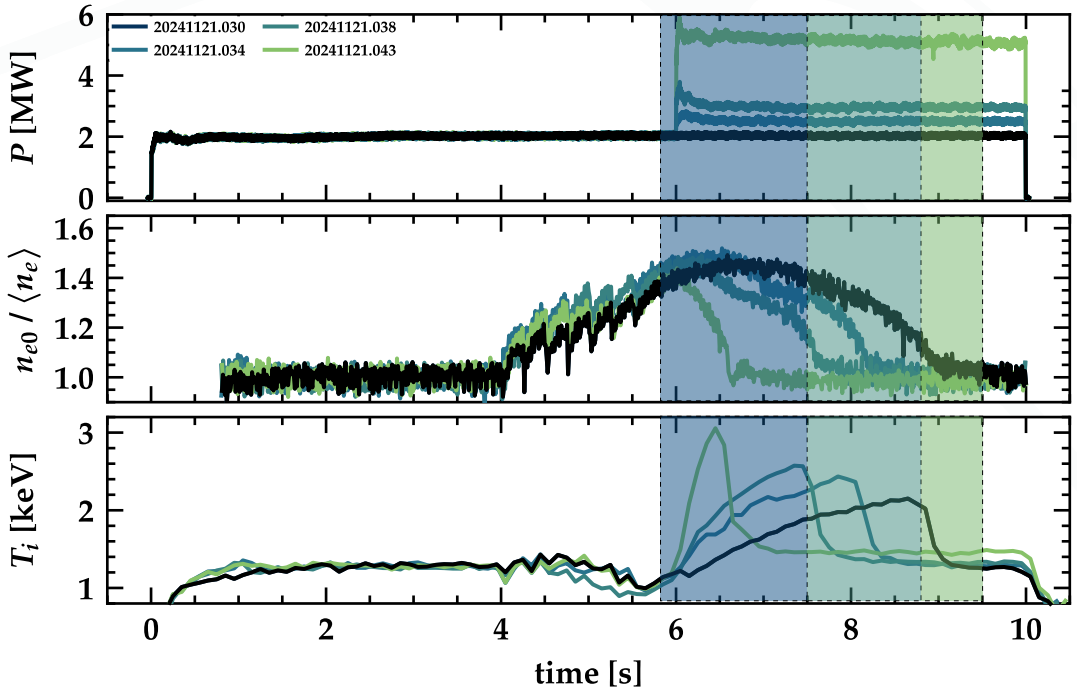


20241121.034
2.5MW X2 ECRH power - central deposition
Slow evolving profiles give particle and heat transport.
NBI blips --> Good Ti data from CXRS
Back-transition: Threshold behaviour of transport with no external changes.

Interesting time points:
a) High T_i, before back-transition.
b) After back-transition.

Wider scan shows different ECRH pump-out effect:
- 20241121.030, 2.0MW
- 20241121.034, 2.5MW
- 20241121.038, 3.0MW
- 20241121.043, 5.0MW

More ECRH --> Faster n_e decay --> earlier back-transition.

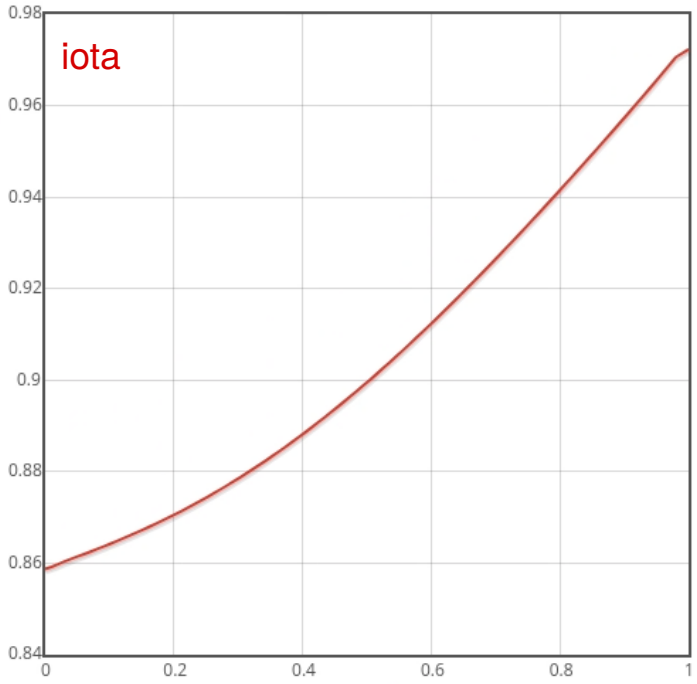


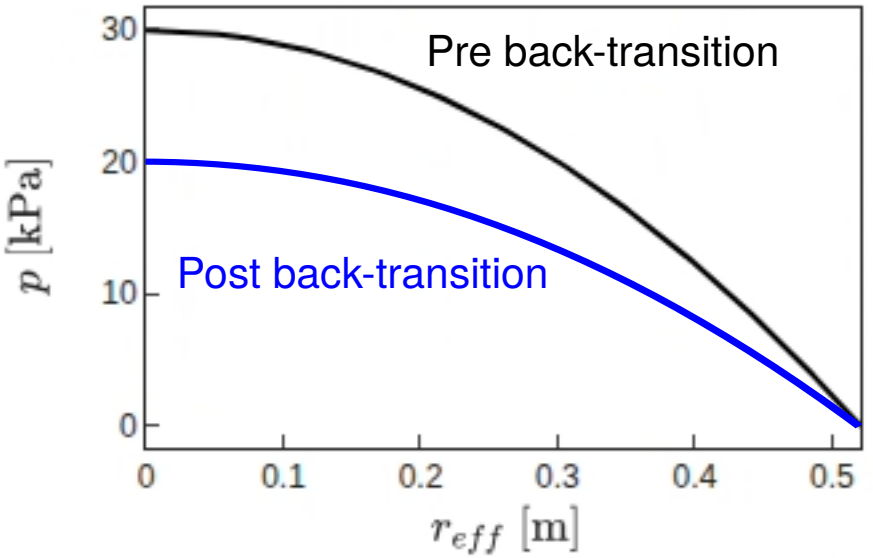
20241121.034 - Configuration

Standard "EIM" with B = +2.615T on axis.
best-fit VMEC from profile cooker for each phase:

High Ti phase: <β> = 0.6%, boz_EIMpl262_phi_2.026_p0_30.00_ppeak_2.00_Itot_0.00_Ipeak_0.00_v20190222135136
After back-transition: <β> = 0.4%, boz_EIMpl262_phi_2.026_p0_20.00_ppeak_2.00_Itot_0.00_Ipeak_0.00_v20190222134845

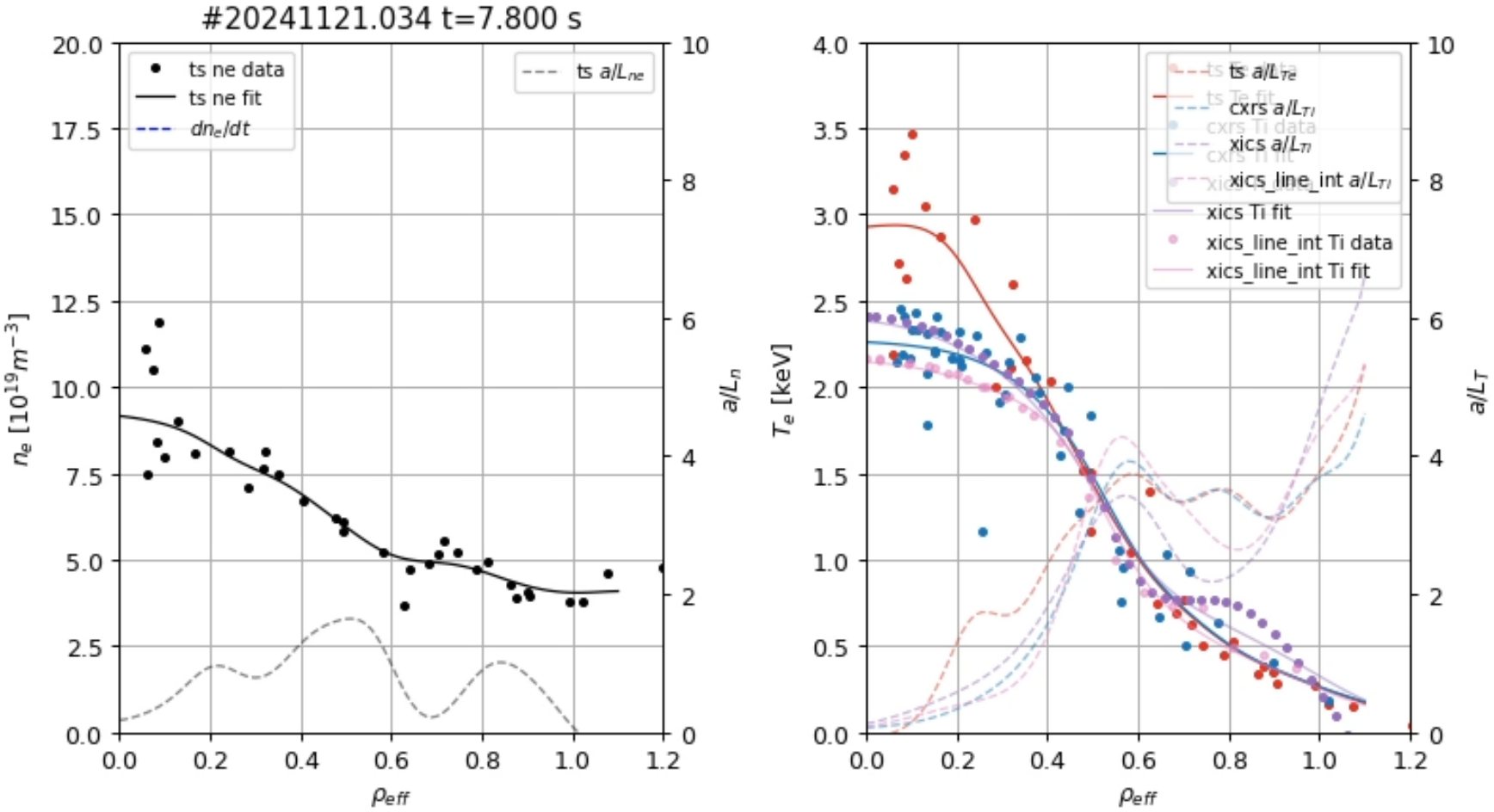
Plasma current is <1kA for the whole discharge.





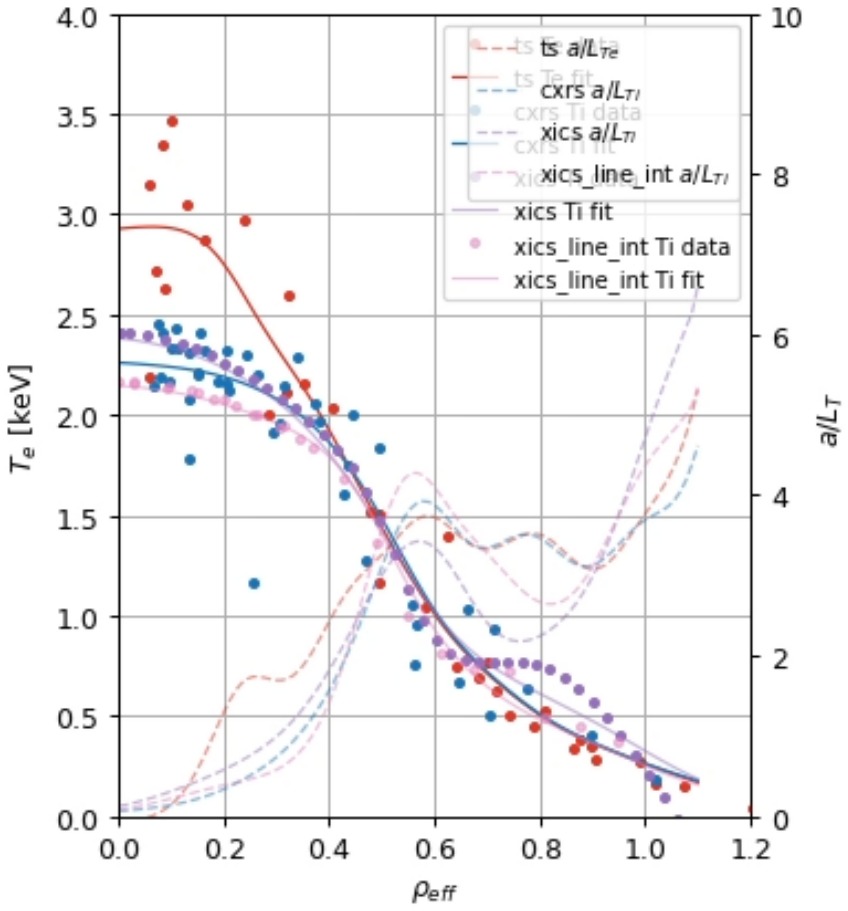
20250327.046 - Thomson Scattering

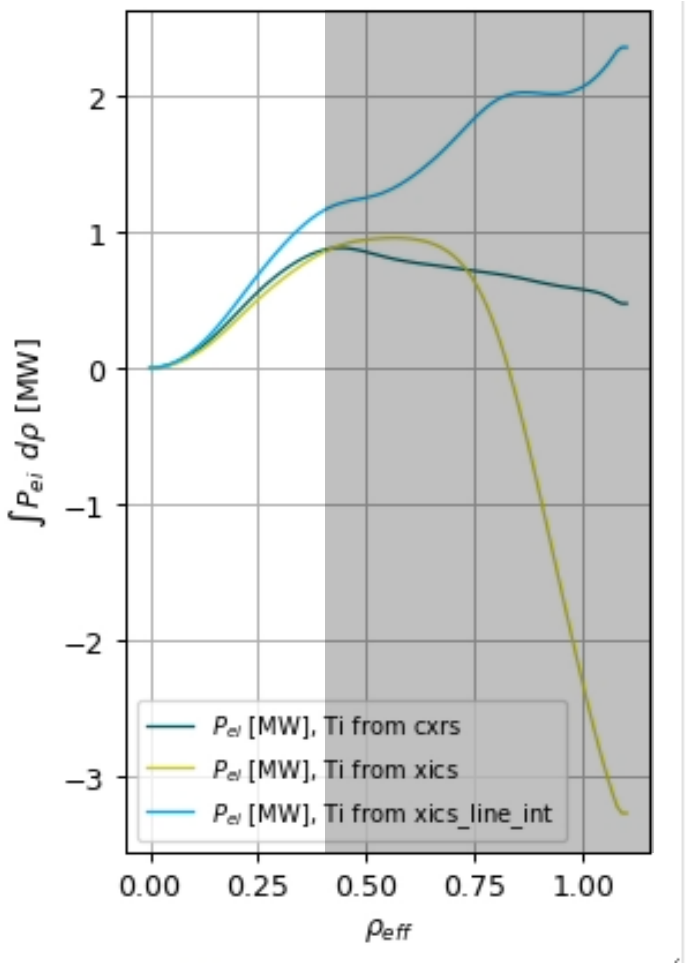
Thomson Scattering and CXRS are good. Individual ne, Te, Ti profiles OK.
XICS matches CXRS with offset of -0.2 keV.
Ti = Te in gradient region - no hope of separating Q_e and Q_i.



20251121.034 - Collisional coupling

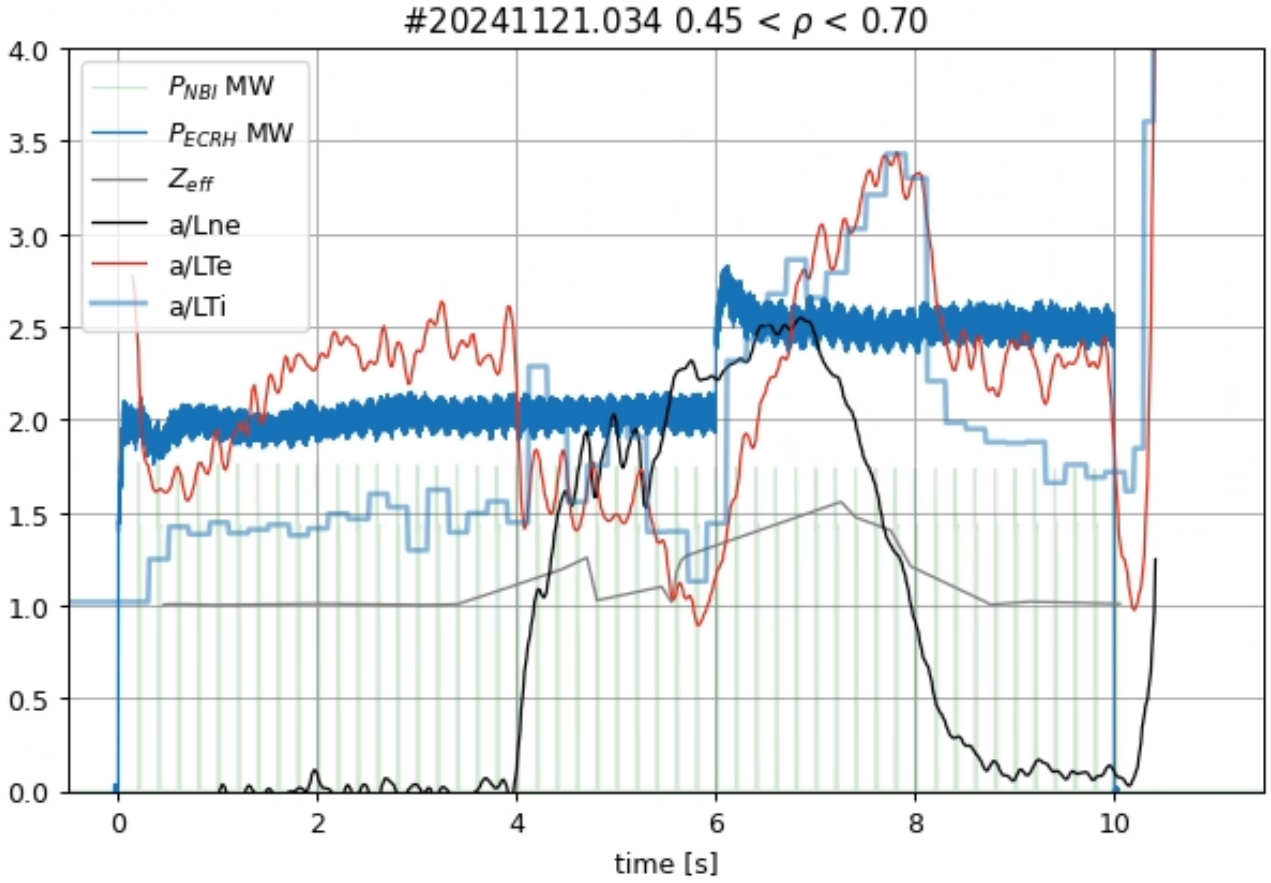
For central region we can be relatively confident that the profiles give the correct ion heating.
but in $T_i = T_e$ in gradient region there is no hope of separating Q_e and Q_i.

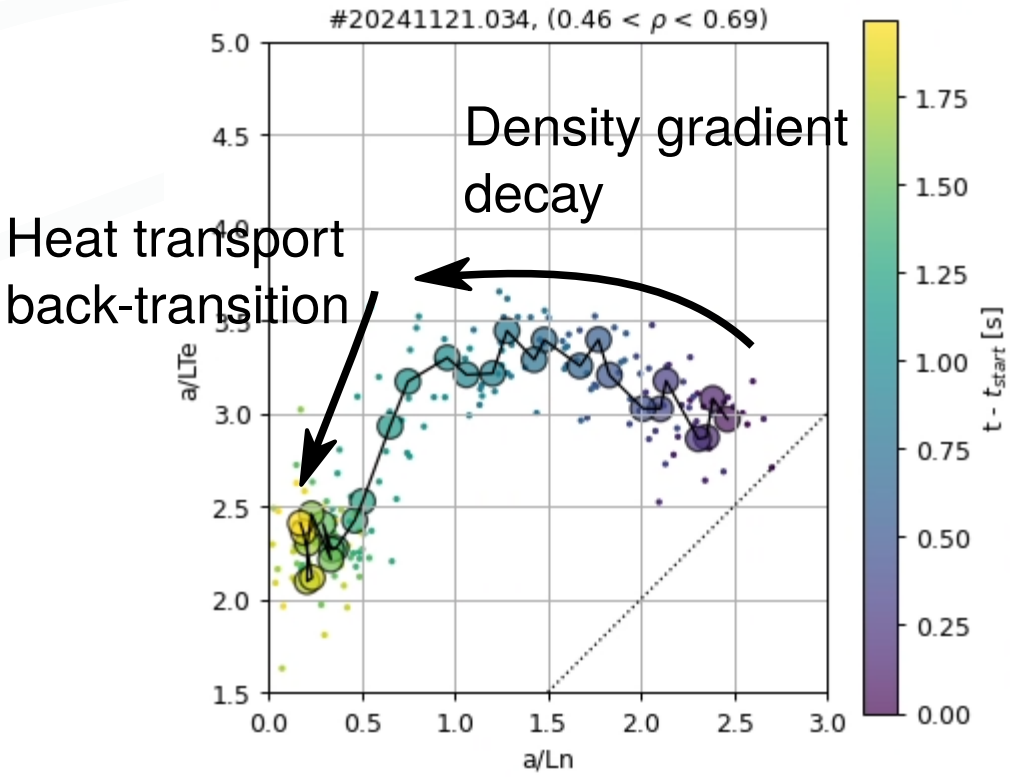




20251121.034 - Back-transition

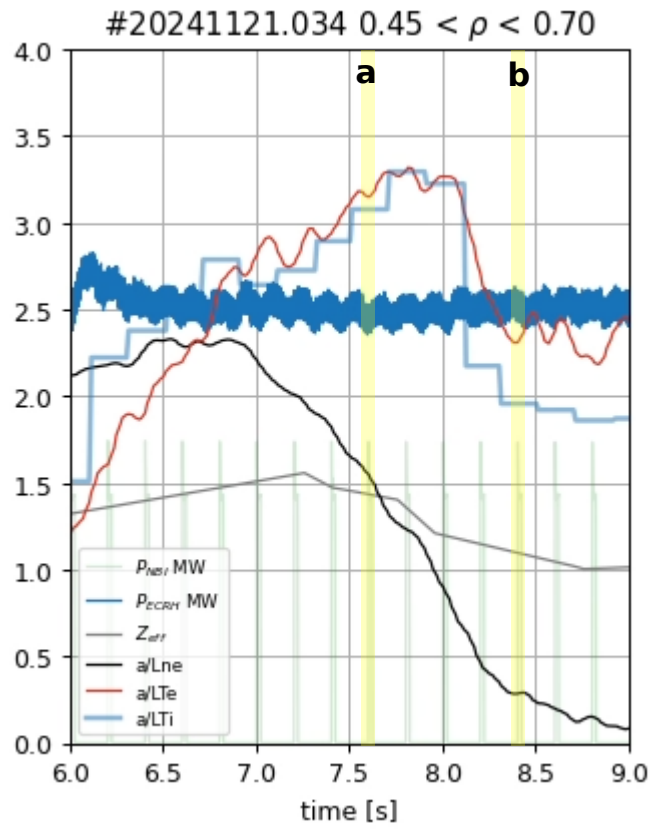
As the density decays, the plasma transitions back to the normal W7-X turbulent dominated scenario.
The back-transition is abrupt and dramatic, despite a relative small change in density.

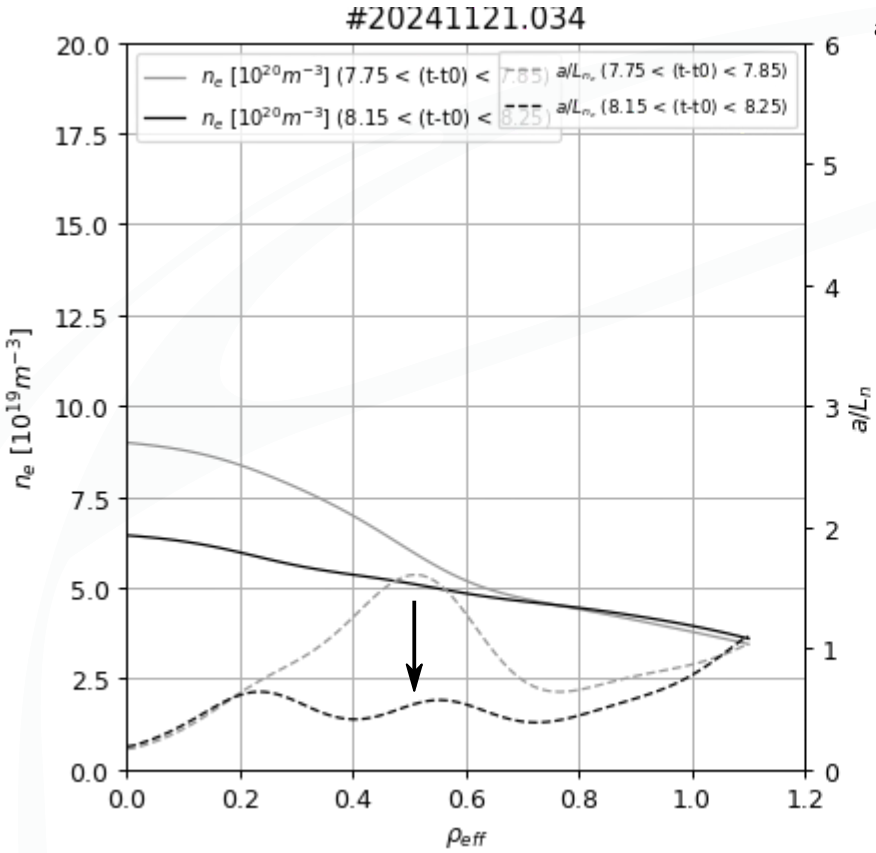


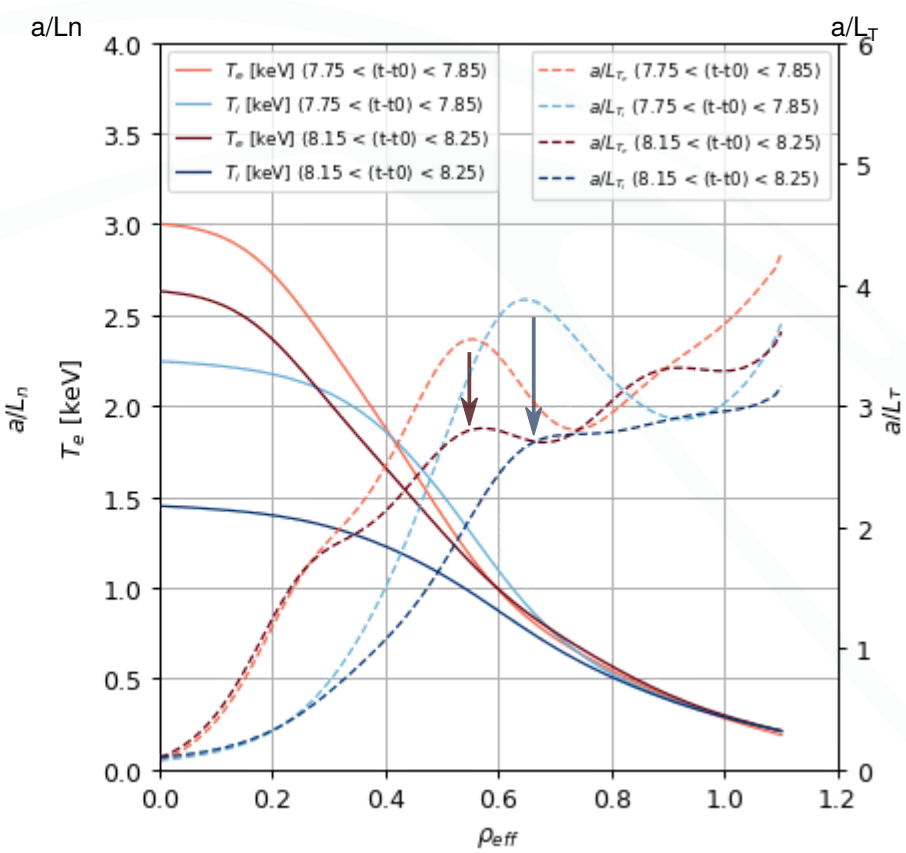


20251121.034 - Back-transition

As the density decays, the plasma transitions back to the normal W7-X turbulent dominated scenario.
The back-transition is abrupt, despite a relative small change in density (a/Ln = 1.5 --> 0.5)







Files / structure

Directory structure is organised as:
scenario / shot / ...

Files:
selected.json - fitted profiles of named selected time points as mentioned in this presentation.
fits.json - automatic fits of profiles at all Thomson Scattering time points
raw_data.json - raw diagnostic data used to generate the fits
cycle_binned.json - pellet cycle averaged fitted profiles
xxxxx.wout - VMEC wout file (downloaded from VMEC web service)