

Session Report

SOII - 42 : NBI Scenario Development

"NBI W_{dia} / T_i optimisation in FMM002"

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Session reporting 2.12.2024



Proposals



Priority 1:

stato_028 O2 reintroduction. Deposition profile changes with field scan.
sul_044 Simple NBI source with background ECRH plasma.
sul_038 Big gas puff into pure NBI --> W7-AS like HDH mode?

Priority 2:

alca_003 NBI current drive validation
anla_024 EBE observation during high density NBI (passive)
crb_003 Optimum confinement NBI + ECRH
davku_006 FIDA with internal islands
ddaniel_001 ABES in O2 reintro
fwa_019 NBI +/- ECRH scan

SO discretion:

daz_020 Gas puff into pure NBI - covered by sul_038 and not conducted in SOII-5
stato_021 OXB attempts at end of pure NBI - Can use last few ~100ms of NBI high density.
rlcansi_003 Covered by doing O2 reintroduction in FMM002.
pepo_007 FIDA measurements. Covered by davku_006

Session progress



First session in FMM002 --> Lots of pulse length extension.

14 shots / 1 hour: start-up, density control, 20MJ, 50MJ, 100MJ pulse length extension

Density control initially difficult due to boronisation. Reduce power and gas!

4 shots / 1h 20m: NBI pulse length extension + peaking check.

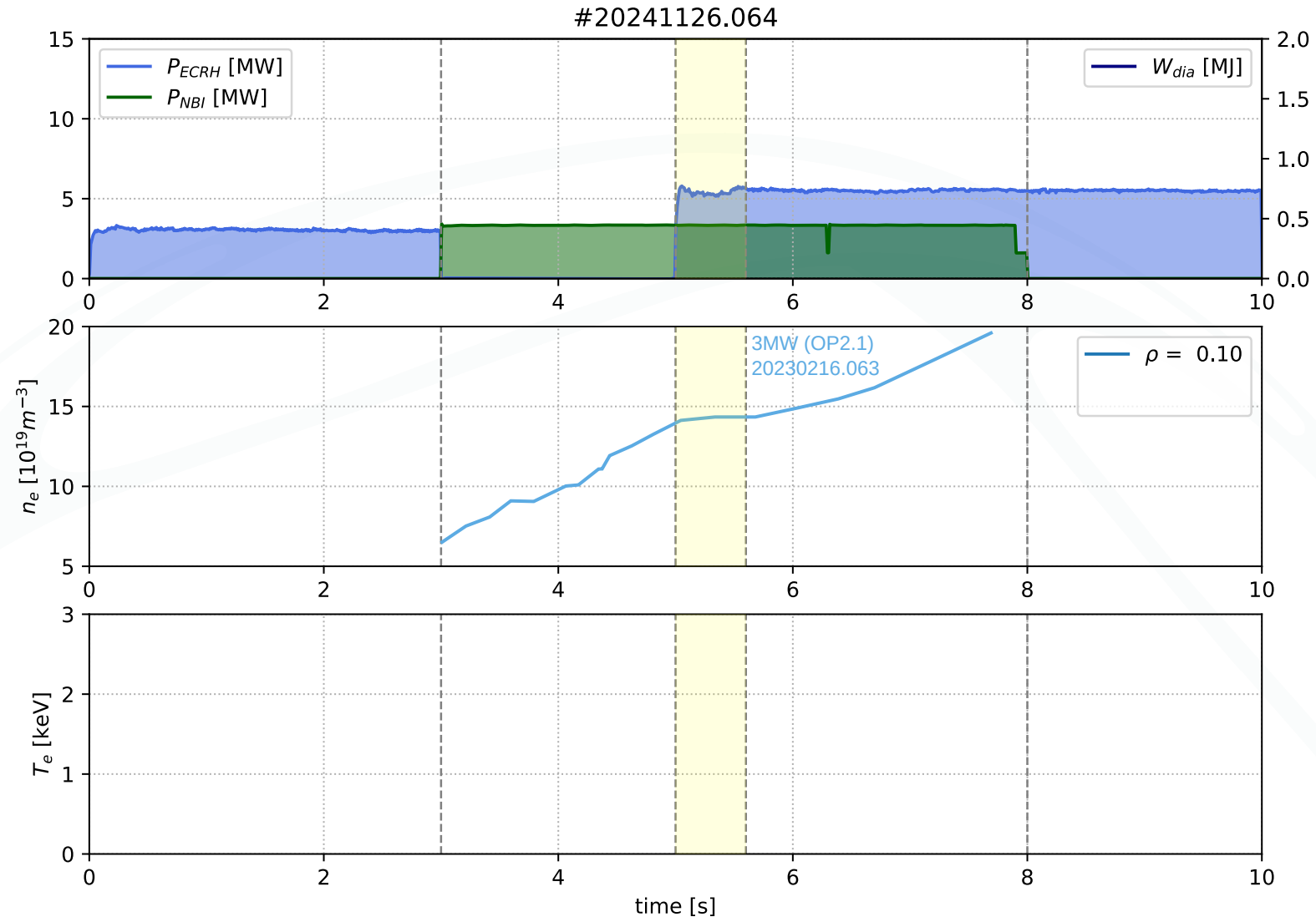
2 shots: Density limit check - No sign of detachment, 2MW at $8e19$ and 2MW at $10e19$ OK!

First NBI+ECRH program after 3 hours.

Reintroduction

O2 Reintroduction optimisation + field scan

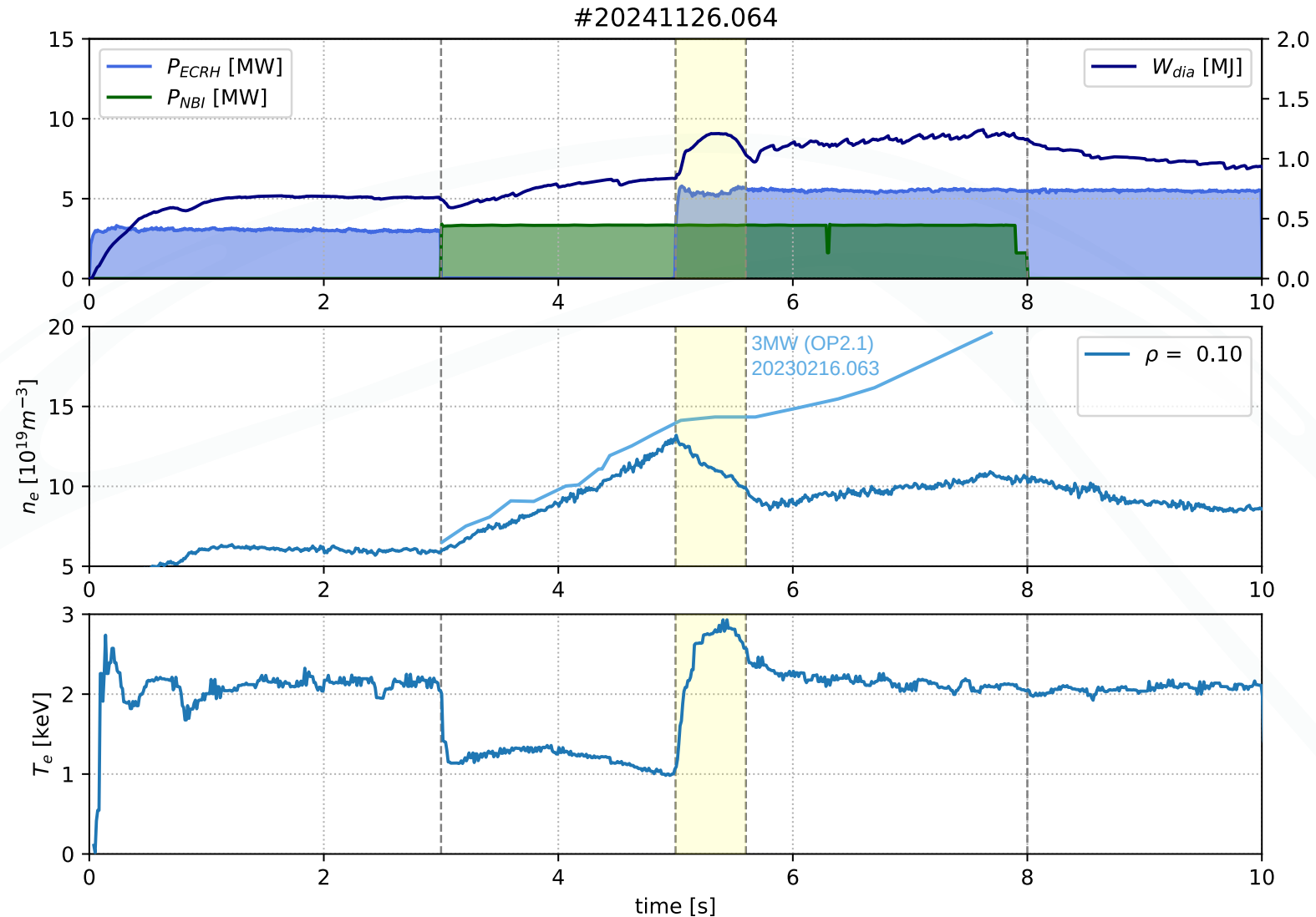
- More power than #20230216.063
- 3MW: Density still rises (OP2.1)
- 5MW: $T_i = 2.4\text{keV}$, density falling
- > Falls out of reduced turbulence
- > $T_i = 1.5\text{keV}$



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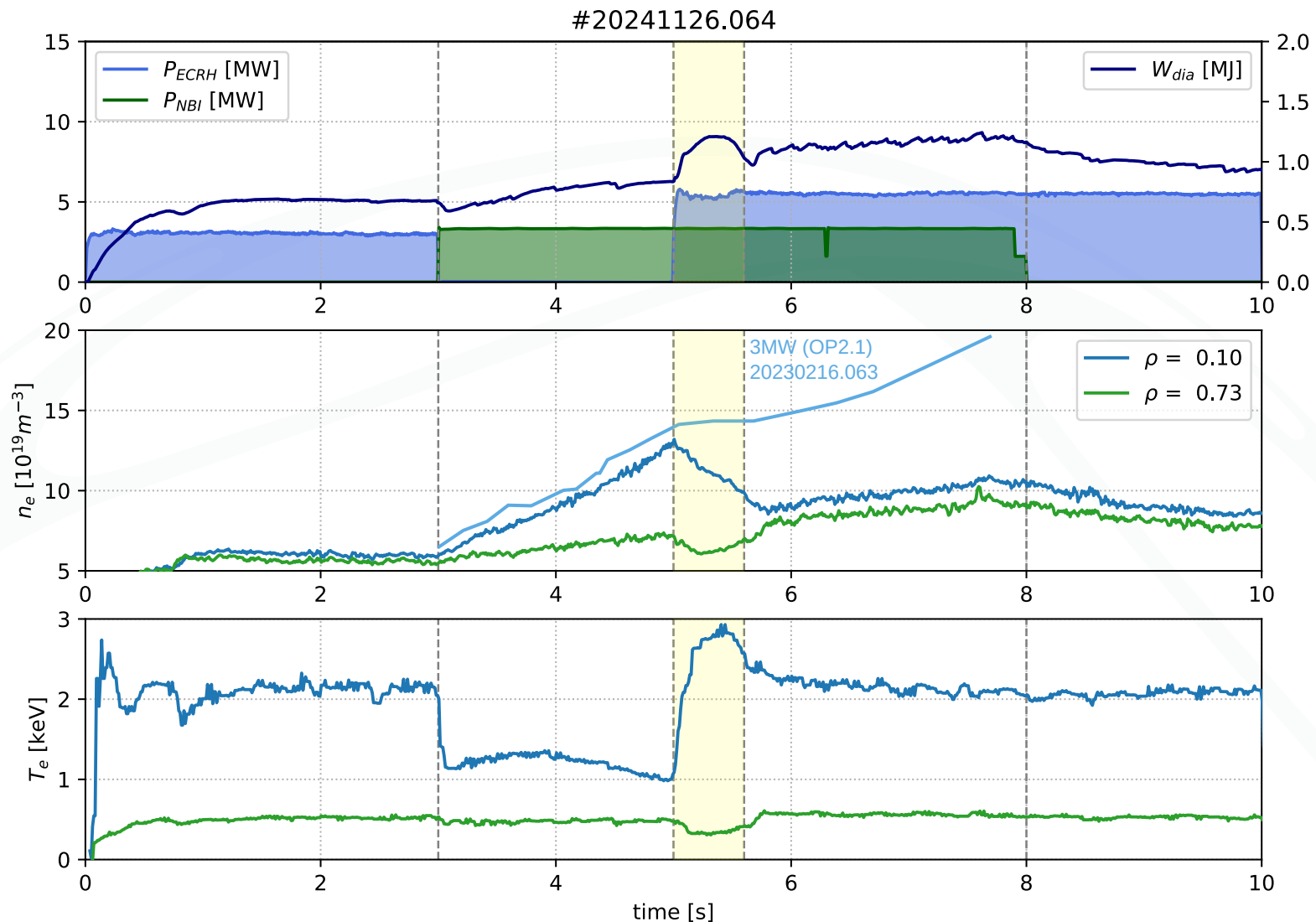


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5MW: $T_i = 2.4\text{keV}$, density falling
--> Falls out of reduced turbulence
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- Island flattening of T_i during reduced turbulence phase.
Recovers after back-transition + fuelling --> high W_{dia} in 'normal' T_i clamped plasma.

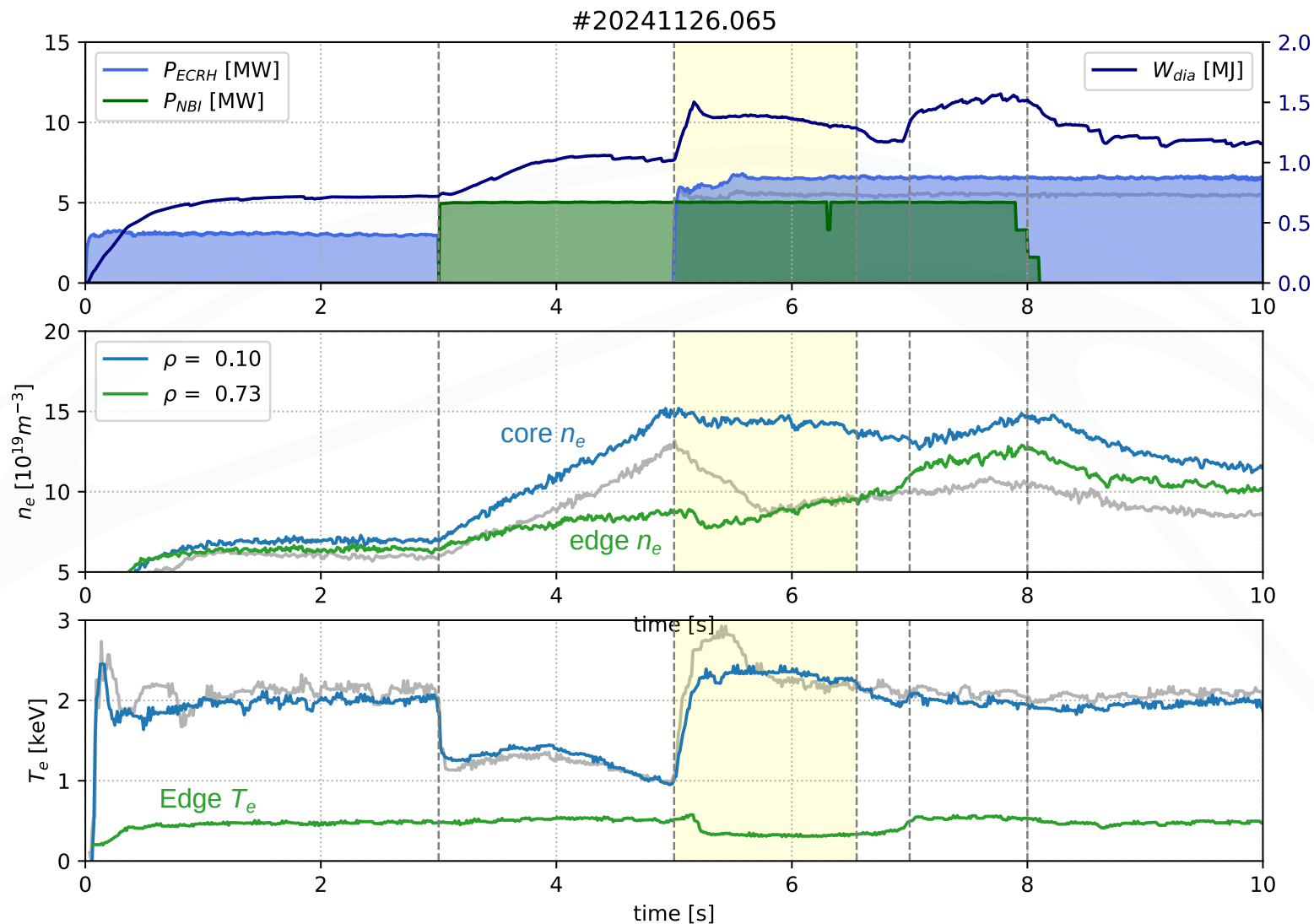


Reintroduction

O2 Reintroduction optimisation + field scan

- 3 NBI sources + 6MW:
- Density only slowly falling
- > Hold $T_i = 1.9$ keV for 1.3s

- Island flattening of T_i during reduced turbulence phase.
- Recovers after back-transition + fuelling --> high W_{dia} in 'normal' T_i clamped plasma.
- > **Record 1.55MJ**

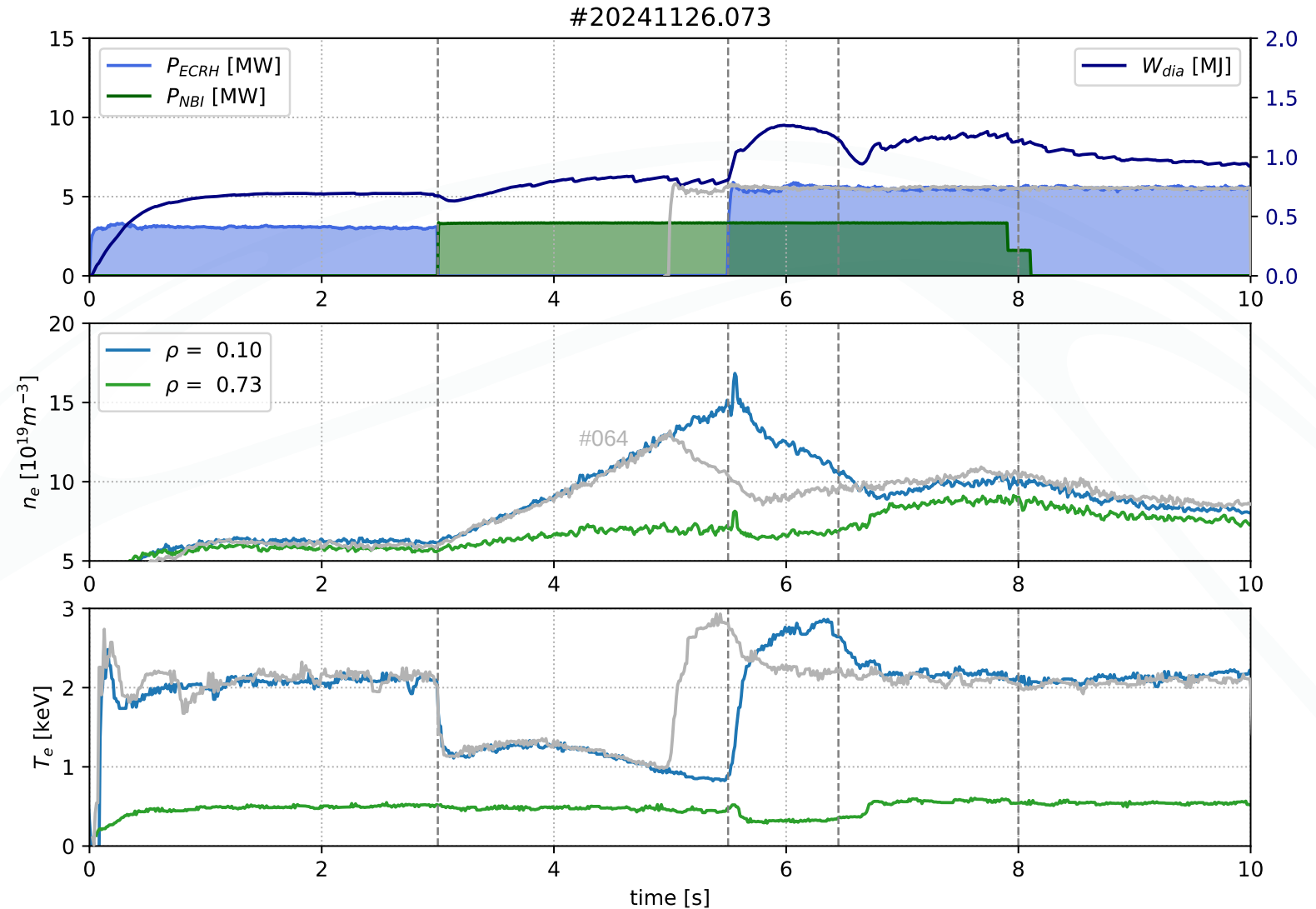


Reintroduction

O2 Reintroduction optimisation + field scan

- Later reintroduction of 5MW (2x NBI):
- Same n_e decay
- Same $T_i = 2.4$ keV, but for ~ 1 s

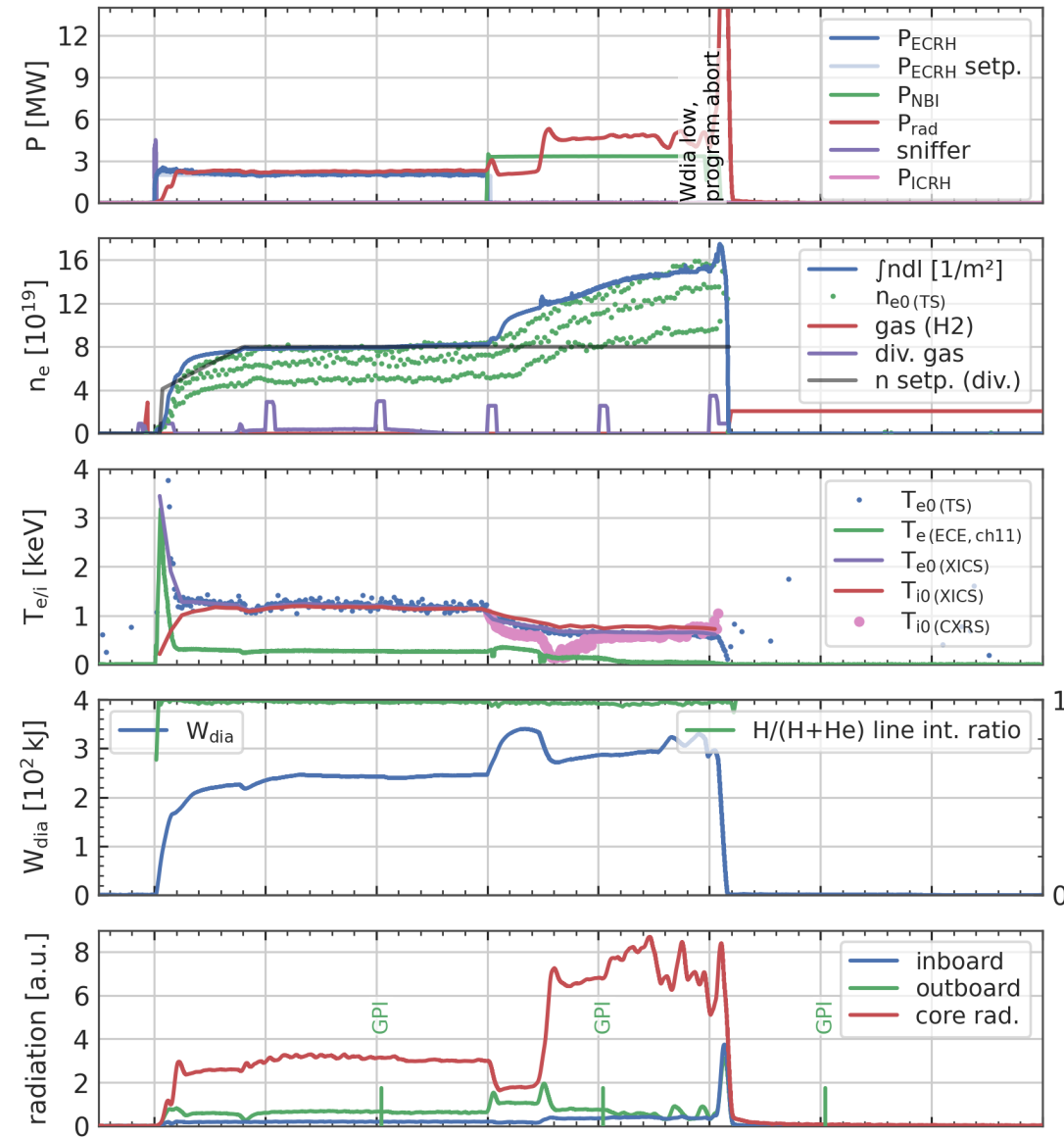
- Island flattening of T_i during reduced turbulence phase. Recovers after back-transition + fuelling --> high W_{dia} in 'normal' T_i clamped plasma.



Massive gas into NBI

Attempted massive gas into NBI:

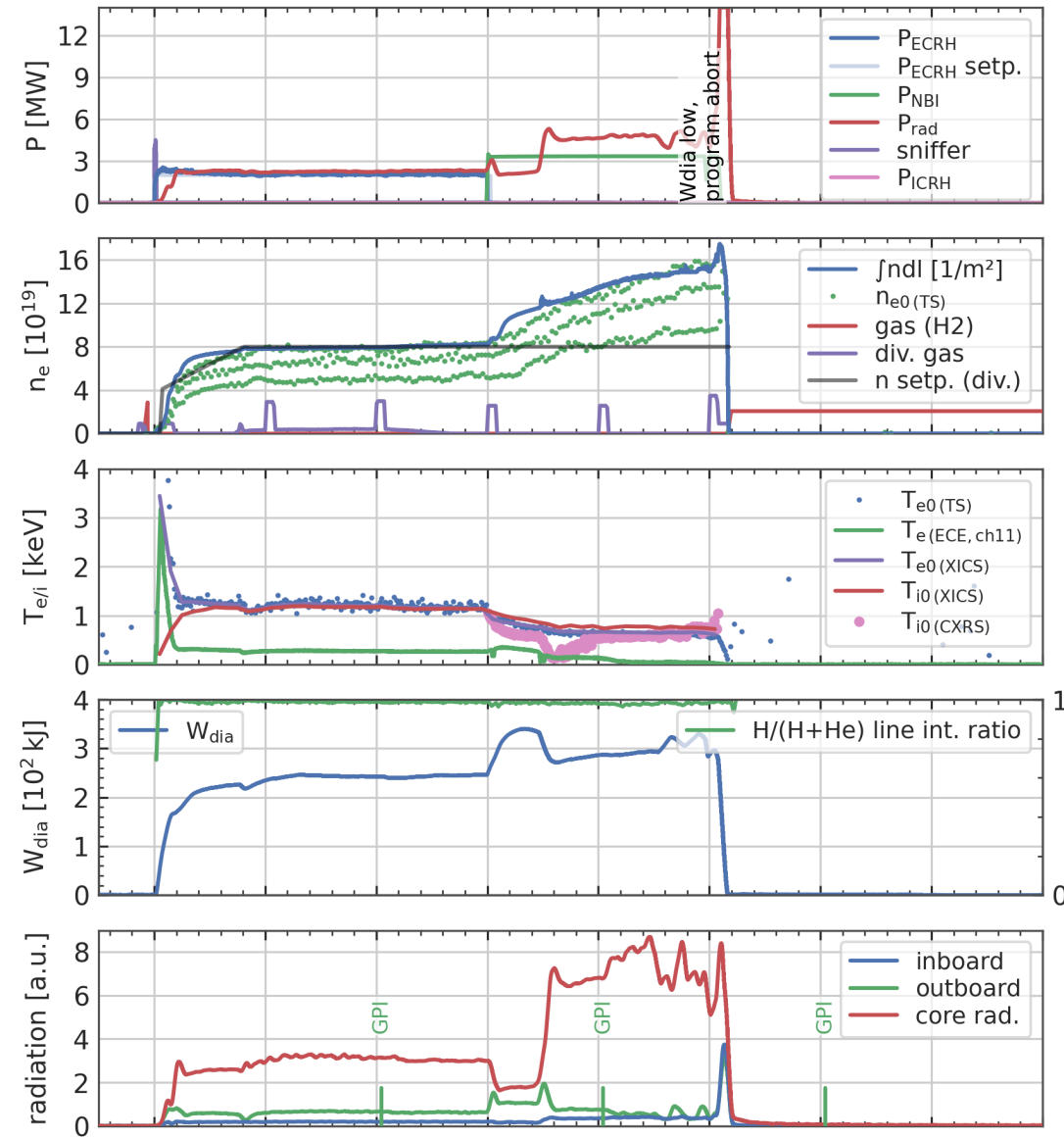
- Plasma turns to small plasma already during ECRH phase.
- Immediately killed by gas puff.
- Early power/density scans allowed 2MW at $8e19$ with no sign of detachment. Why? Short-term effect of boronisation?



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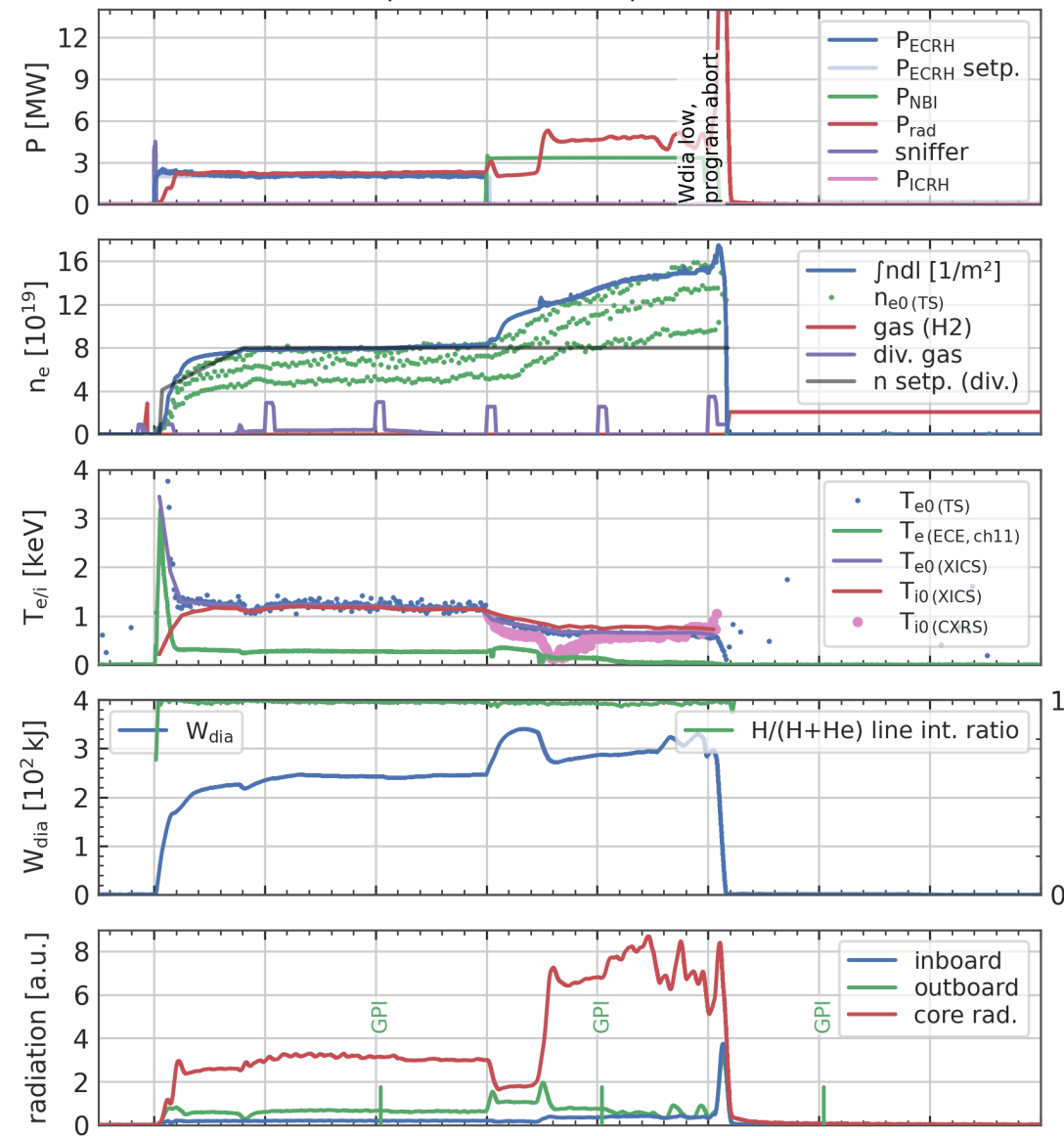
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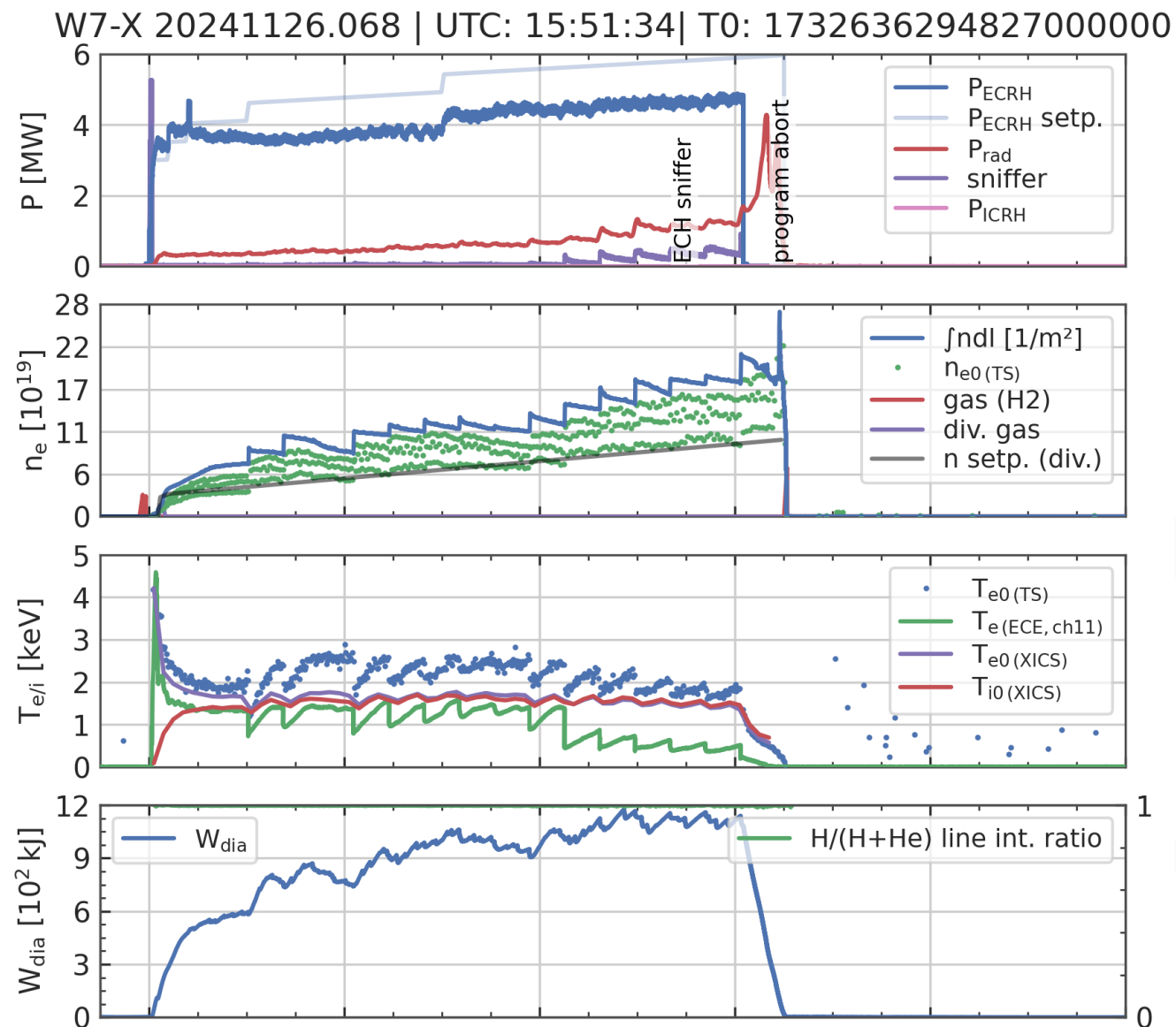
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O2 high density with pellets

While waiting for NBI, O2 discharges with pellets

- Observed higher fuelling efficiency in FMM002 than in standard --> lower pellet frequency.



Conducted shots



ID	Short description	n.Sources	NBI sources		O2 reintro	O2 power	Primary proposal
20	Massive gas puff into pure NBI	2	(S7+S8) / (S3+S4)	EIM	-	-	sul_038
--- Field change, beam steering checks ---							
85	Density limit check - ECRH step downs at 8e19	0					
95	Density limit check - Density ramp up at 3MW						
-	pulse length extension 0.5s NBI	4	All	FMM002+2570	-	-	-
-	pulse length extension 1.0s NBI	4	All	FMM002+2570	-	-	-
-	pulse length extension 5s NBI	4	All	FMM002+2570	-	-	-
100	O2 reintroduction. Higher power	2	(S7+S8) or (S3+S4)	FMM002+2520	2,3s	5MW	stato_028
120	O2 reintroduction. Higher power	2	(S7+S8) or (S3+S4)	FMM002+2520	2,3s	6MW	stato_028
130 100 v4	O2 reintroduction. Earlier Later	2	(S7+S8) or (S3+S4)	FMM002+2520	2,0s	5/6MW	stato_028
140	O2 reintroduction. More source	3+	3/4xS	FMM002+2520	2,3s	5MW	stato_028
150	O2 reintroduction. Field scan	2	(S7+S8) or (S3+S4)	FMM002+2570	2,3s	6MW	stato_028
160	O2 reintroduction. Field scan	2	(S7+S8) or (S3+S4)	FMM002+2620	2,3s	6MW	stato_028
200	Simple source scan	4	All	Any	-	-	sul_044
240	Active FIDA measurements	4	S3,S4 on, S7,8 blips	Any	-	-	davku_006
260	NBCD validation	2		Any	-	-	alca_003

Proposals



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sul_044
sul_038

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Priority 2:

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anla_024
crb_003
davku_006
ddaniel_001
fwa_019

NBI current drive validation
EBE observation during high density NBI (passive)
Optimum confinement NBI + ECRH
FIDA with internal islands
ABES in O2 reintro
NBI +/- ECRH scan

SO discretion:

daz_020
stato_021
rlcansi_003
pepo_007
golof_019+026
stato_034+017

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OXB attempts at end of pure NBI - Can use last few ~100ms of NBI high density.
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FIDA measurements. Covered by davku_006
High density O2 with pellets