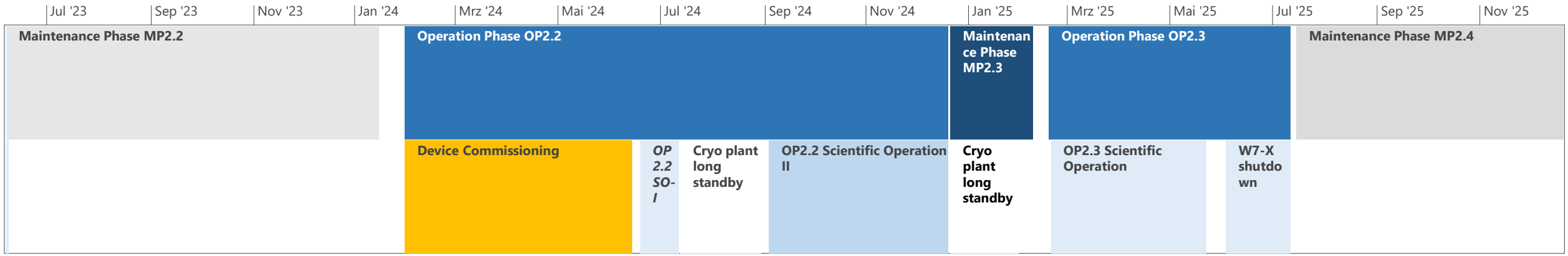
W7-X status:

- schedule is stable (PV closure in Jan., begin device commissioning end of Jan., manufacturing of transformers so far on time, existing transformers tested and ok)
- originally envisaged functionality of system expected to be available for OP 2.2 (1.5MW gyrotron delivery in Jan, pellet injector already on site, ICRH antenna already installed)
- activities to improve/harden systems to enhance reliability (cryo plant, ECRH, Thomson, …)

Operation schedule



Key steps and schedule of program planning:

- call for proposals will go out before Christmas
- short specification will be published by Christmas
- proposal submission period: 01.-29. Feb. 2024
- W7-X program workshop: April 2024
- campaign session plan: by end of plasma commissioning phase 12. July 2024

W7-X optimization and project goals:

I.	feasibility of modular coils and high quality of magnetic flux surfaces	*T. Andreeva et al., Nucl. Fusion **55** (2015)* *T. Sunn Pedersen et al., Nat Commun **7** (2016)*
II.	long-pulse operation	• 30min discharges @ 18GJ energy turnaround
III.	good finite-β equilibrium properties and MHD stability	• high-β operation ($\beta \geq 3\%$) • exploitation of unstable magn. configurations
IV.	good neoclassical confinement	*C.D. Beidler et al., Nature **598** (2021)*
V.	stiff magnetic field geometry	• high-β operation • significant bootstrap current
VI.	good collisionless α-particle confinement	• high-β operation • generation of fast ions
VII.	improved confinement scenarios	• de-/coupling of energy and particle transport • control of impurity accumulation
VIII.	compatible core-edge scenarios	• divertor operation w/ control of PFC heat fluxes • energy/particle exhaust
IX.	reactor-relevant first wall	• studies for future operation with all-metallic PFCs

Discussion points – TF I

O1: High Performance / ne Profile Control / Impurity Accumulation

- scenario 2 (low edge density): Low edge ne caused by boronization or could also be achieved using e.g. right after cleaning pulse? To be tested. [Langenberg]
- routine provide absorbed NBI power in various magnetic configurations: Database or provide Sams tool for W7-X team? [Wurden]
- search for H-mode at W7-X? So far only one proposal for this, to be reevaluated for enhanced P_HEAT and FMM002 configuration in OP2.2 [Wurden]
- scenario 4 (O2 re-introduction): Detailed role of low order rationals e.g. in FMM002, ITB's? [Dinklage]
- definition of 'High Performance'? High beta? Central vs. radial averaged Ti, triple product etc. [von Stechow]
- develop high ne scenario 5 with more available P_HEAT [Fuchert]
- ne profile control: no results w.r.t. main/divertor gas fueling (missing, data available) [Langenberg]
- particle transport analysis missing [Reimold]

O2: W7-X Operational Map / Status of Heating Systems

- NBI current drive exp. missing [Lazerson]
- feedback of P_ECRH power to ne (line integrated as first step) required for stabilization of scenario 4 (CoDaC WP) [Ford et al.]
- heating scenario aspects requires more detailed discussion (high-density, O2, 4xNBI, NBI+O2)[Grulke]
- What causes damage on module 1 heat shield tiles: fast ions or misdirected O2 heating? (no FI loads in standard, high and low iota)

O3: ICRH Startup

- radiation and/or impurity rise during ICRH? Copper impurities near edge? Only 1 antenna missing effect? [Wurden, Ongena, Buttenschön, et al.]
- observable Ti increase during ICRH? [Wurden, Ongena]
- assess density to be sufficient for takeover scenarios with NBI. A minor task could be to identify the density as a function of power and the pulse duration acceptable for ICRH in the breakdown phase. I also expect a predictive modeling based on the results and the Gradic-model for NBI startup [Dinklage]

Discussion points – TF II

O1: Detachment

- strong seeding at high heating power – compatible with core scenarios? [Reimold]
- strategy to improve divertor particle flux/sub-divertor neutral compression? [Grulke]

O3: Tungsten

- strategy of tungsten program (source, transport, compatibility with W7-X goals) [Grulke]

O5: Reference discharge

- need to revise reference discharge (particularly radiation collapse)? [Hammond]
  - 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

general:

Safe operation: how to overcome the TM5h/TM6h limitation?

- erosion effects of seeding impurities?
- effect of gas injection in the midplane on transport (“core cleaning”)?

High performance operation with peaked n_e-profiles: only possible with high pumping walls?

- right after boronization?
- right after ECRH (trains, blips), ICRH-cleaning?

Discussion points – TF III

- analysis tools [Lazerson]:
  - short-term (accompanying session) and detailed (Minerva?)
  - equilibrium reconstruction

- What do we need in the context off island transport, drift effects etc. in the broad divertor picture (density range, neutral compression, exhaust…)? [Grulke]