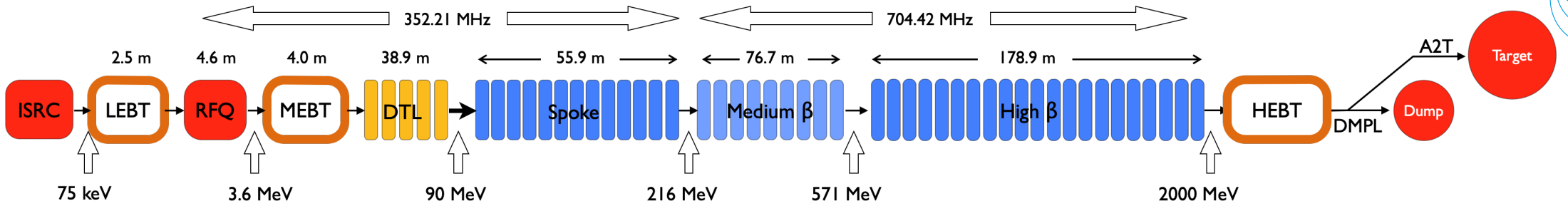
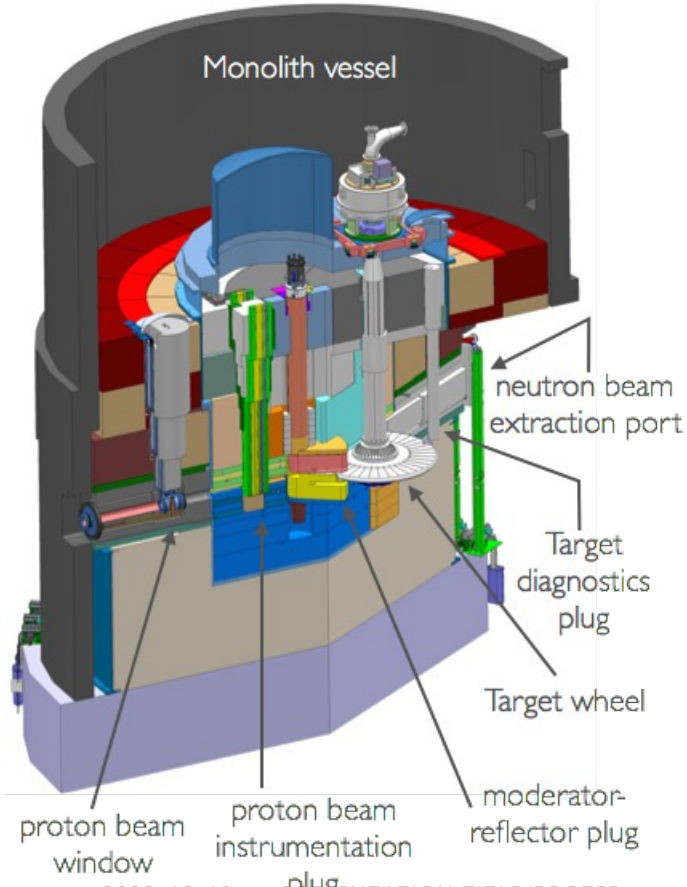
Integrated Commissioning Strategy and Plan

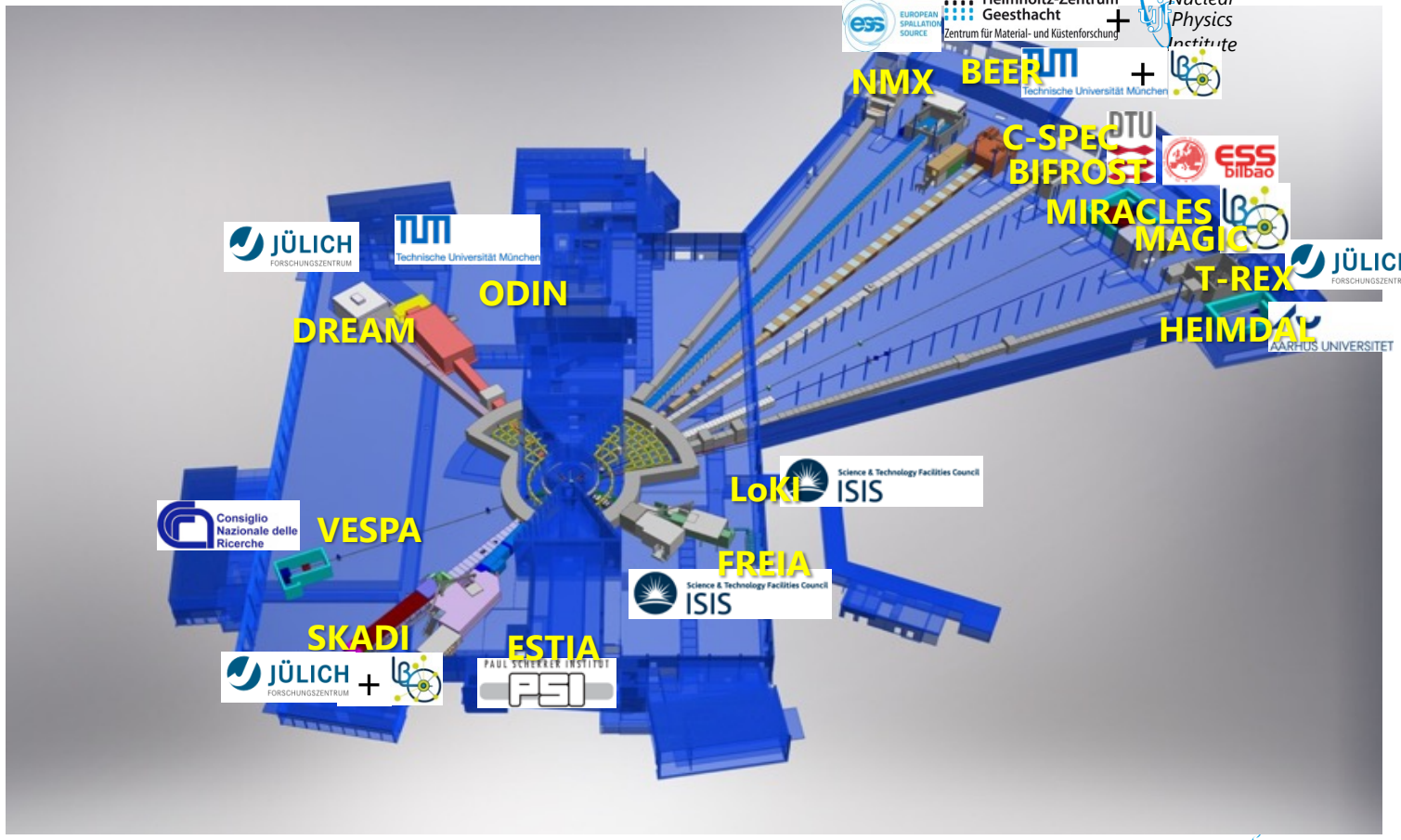
PRESENTED BY ANDREAS JANSSON

2022-10-10

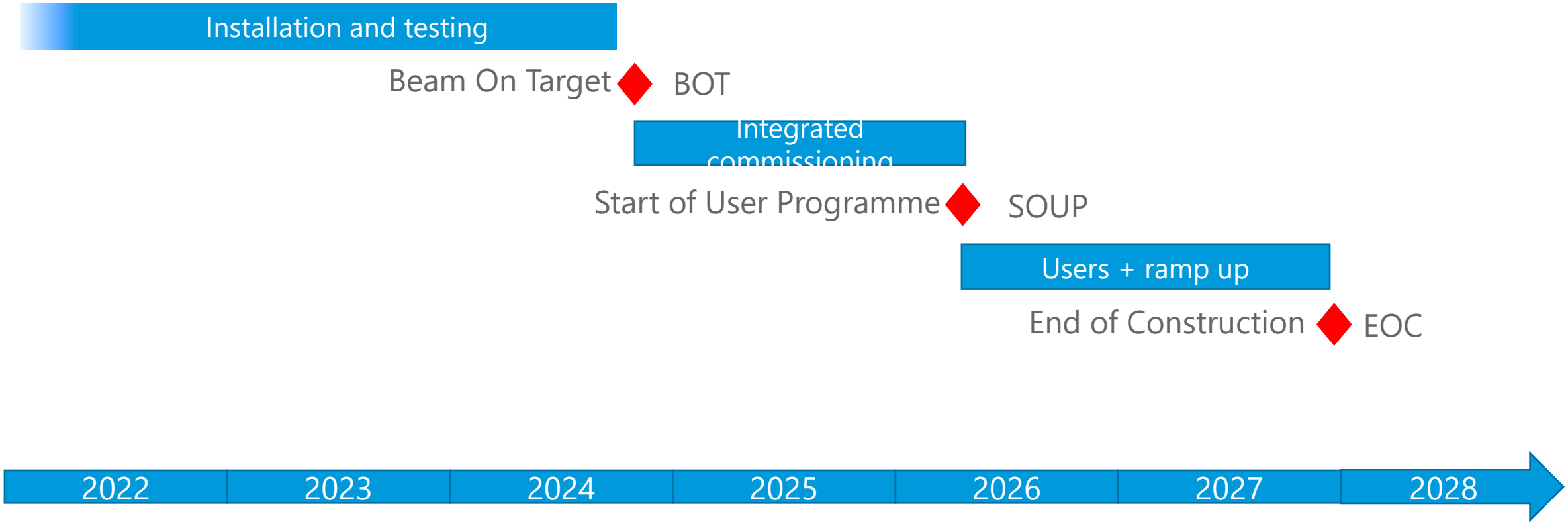
ESS Overview







High Level Schedule Milestones



Baseline dates

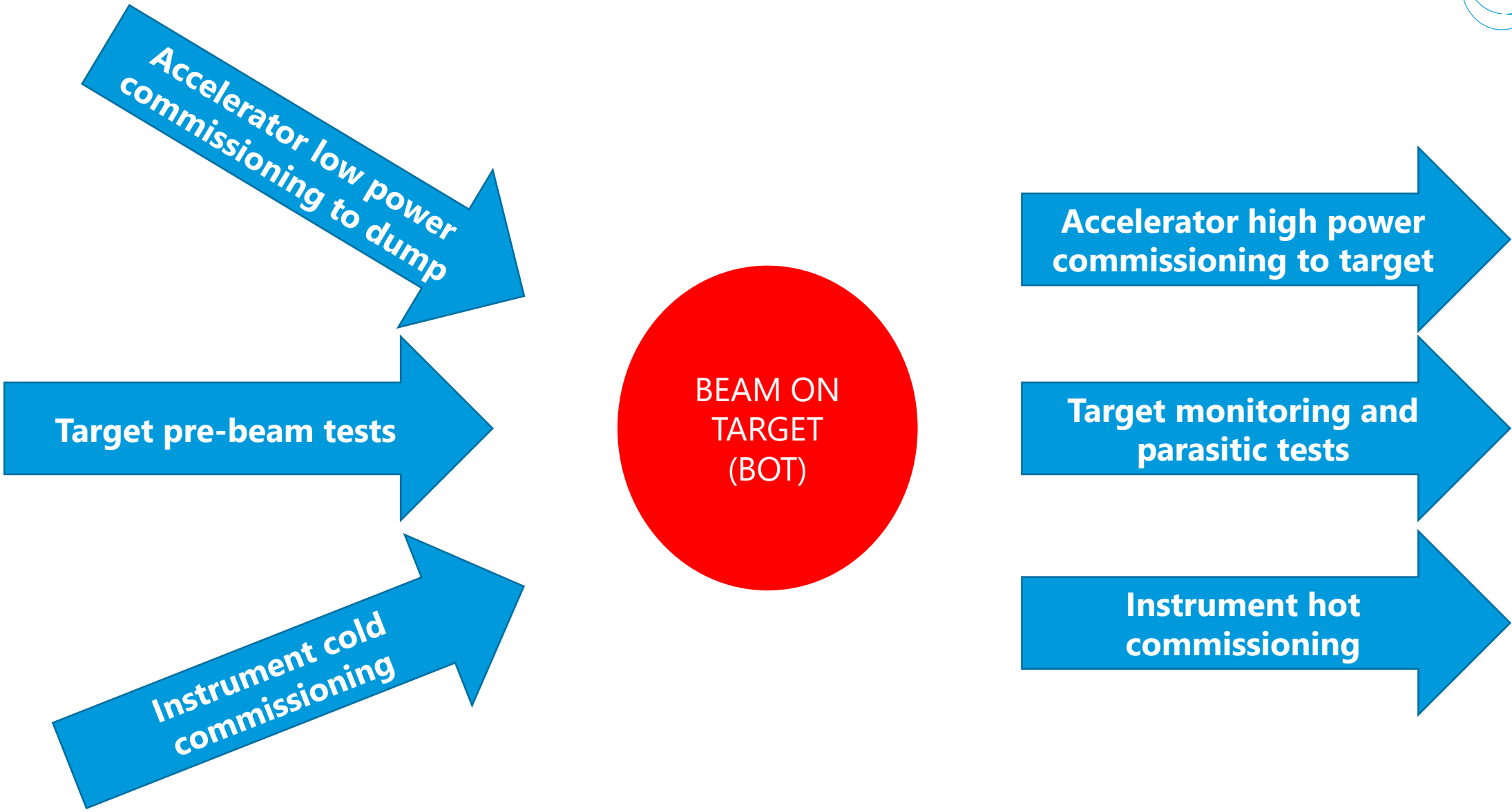
Key ESS milestone dates and definitions

MIlestone	Baseline date	Current estimate	Definition*
BOT	19 Nov 2024	6 May 2025	First protons on target
SOUP	30 Apr 2026	29 Oct 2026	Operating power above 0.57MW Availability 80% 3 instruments in User Program
EOC (End of Construction)	31 Dec 2027	31 Dec 2027	Accelerator 2MW capable, with separate demonstration of • Duty factor (14Hz, 2.86ms) • Beam energy of 800MeV • Nominal current (62.5mA) • Source power >1MW, reliability 80% Nominal neutron production efficiency (@570MeV) 15 instruments installed 10 instruments in User Program User Program infrastructure in place Trained staff, operating permits, system documentation

Note that current estimate is a live value and affected by any ongoing P6 updates.

* Ref. Council/27/05.c (meeting 28 Feb – 1 March 2022)

Project Confluence at BOT



BOT and Beyond

- At BOT
  - Accelerator should be ready to produce at least 570MeV beam (demonstrated to dump)
    - Commissioning of the Dogleg and A2T sections of transfer lines will be done after BOT
  - Target should be completely tested to receive beam
    - Readiness for 5MW beam at BOT is planned
  - Bunker and Neutron Instruments need to be ready to receive beam on target
    - Since there are no heavy shutters, this means all instruments that do not have at least all their shielding and safety systems in place will need temporary shielding and/or plugs.
    - At least the test beamline operational
- After BOT
  - Remaining commissioning need to be coordinated (in particular between accelerator and neutron instruments, target has no foreseen dedicated tests after BOT)
  - Remaining installations need to be coordinated and scheduled

Required proton beam currents

At nominal rep rate and pulse length

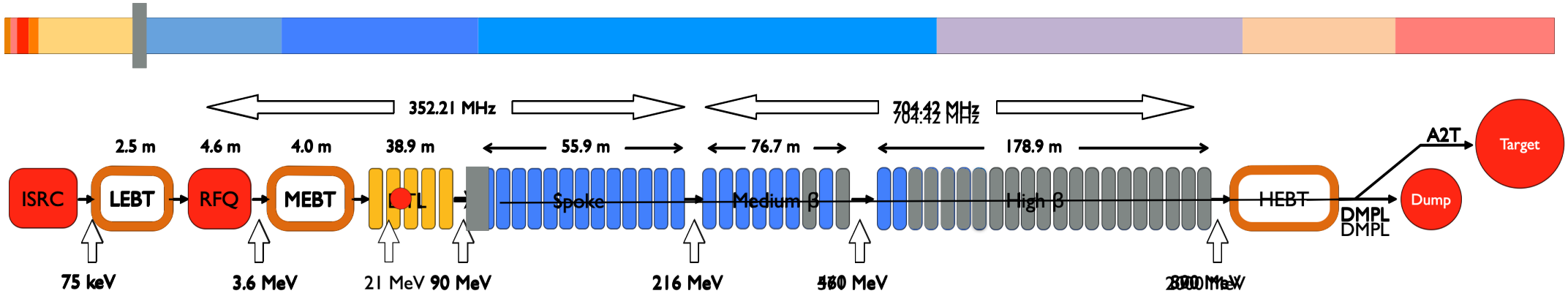
Energy	Power	Current
570 MeV	0.57 MW	25mA
800 MeV	0.57 MW	18mA
800 MeV	1 MW	32 mA

* Nominal current 62.5mA

Note: Beam power is the product of

- pulse length (5-2860us) – determined by users
- beam current (5-62.5mA) – determines beam dynamics
- rep rate (0-14Hz) – our main knob on losses

Accelerator Commissioning



Ion Source License

SRR1 (Isrc & LEBT) – DONE!

NCL License

SRR2a (to MEBT Faraday Cup, with critical diagnostics) – DONE!

SRR2b (to DTL1 Faraday Cup, with critical diagnostics) – DONE!

SRR3 (to DTL4 Faraday Cup, with critical diagnostics)

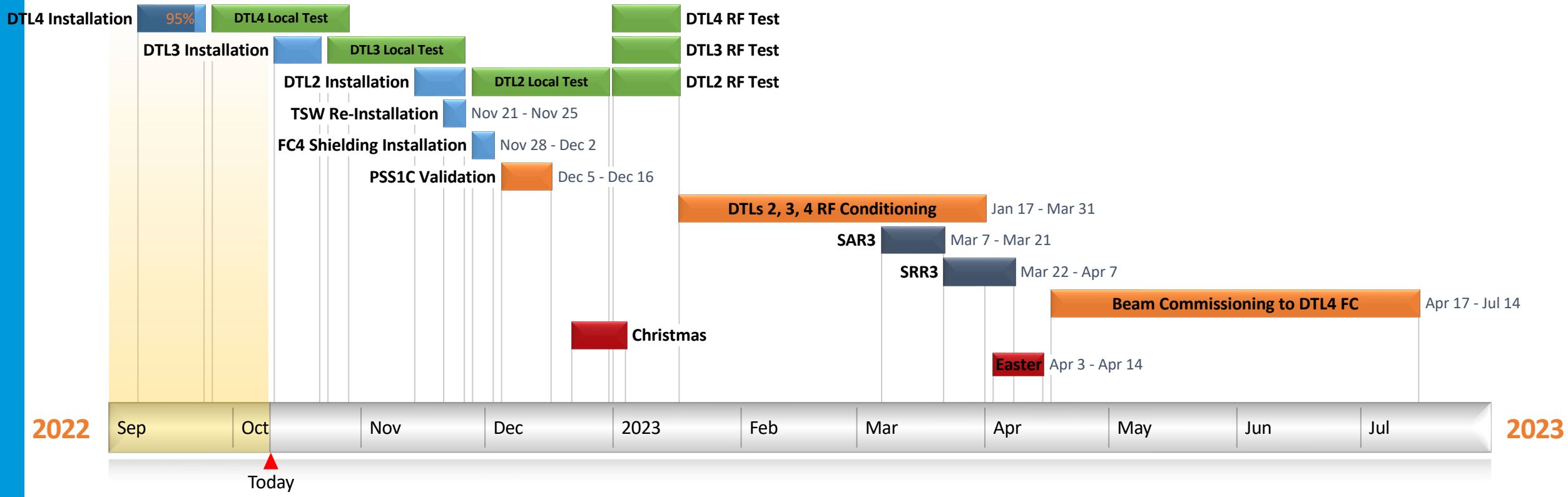
Neutron Production License

SRR4 (to TBD)

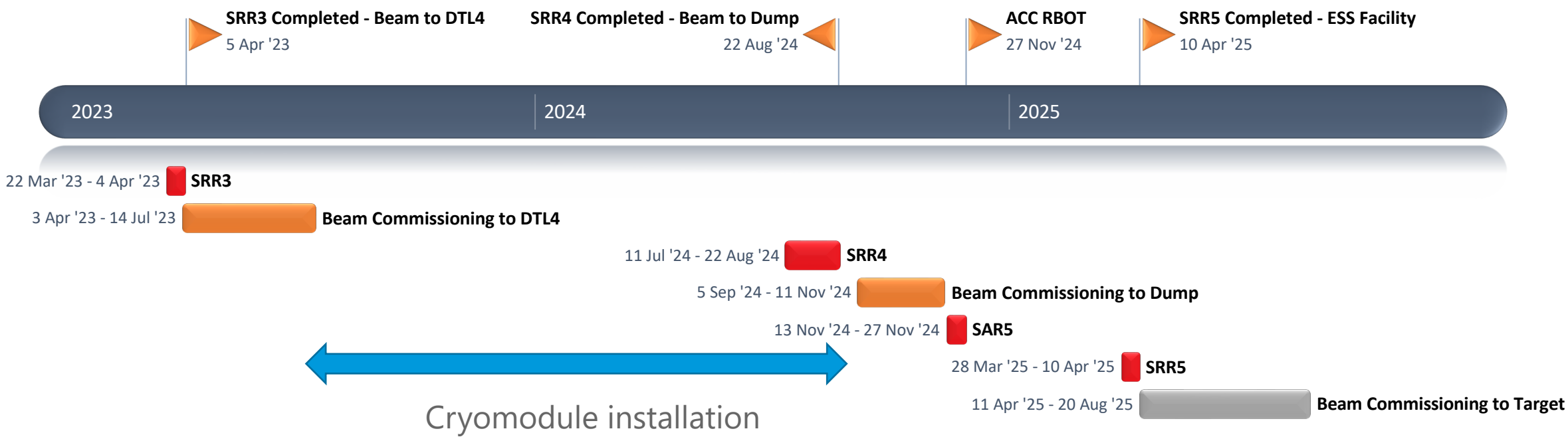
SRR5

2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025

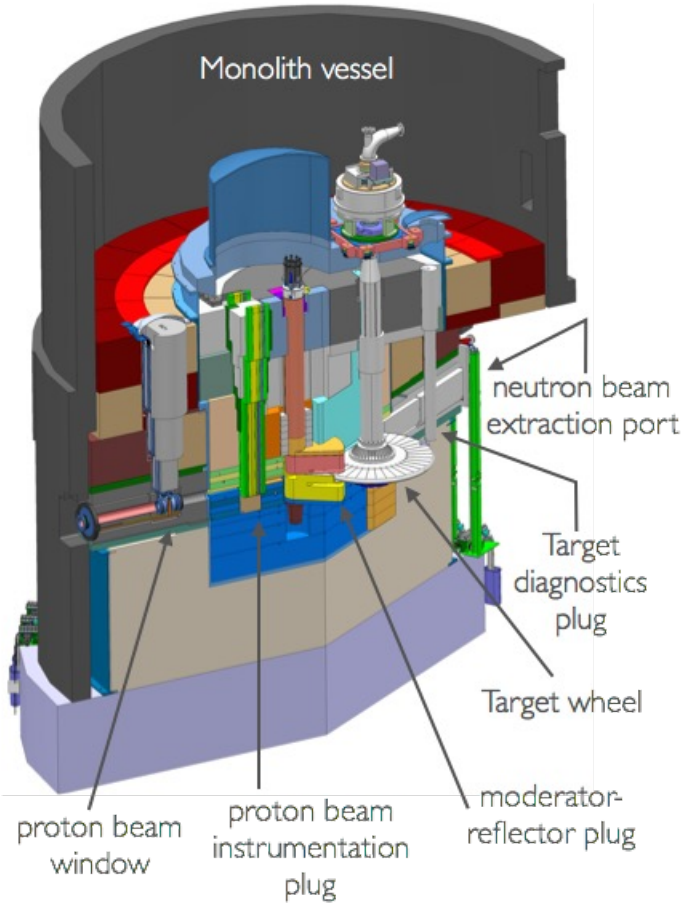
NCL Near Term Plan

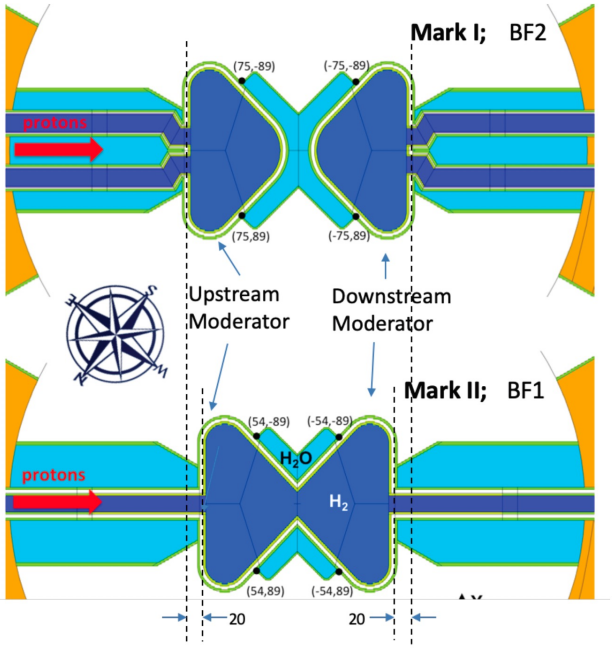


Accelerator Timeline



Target



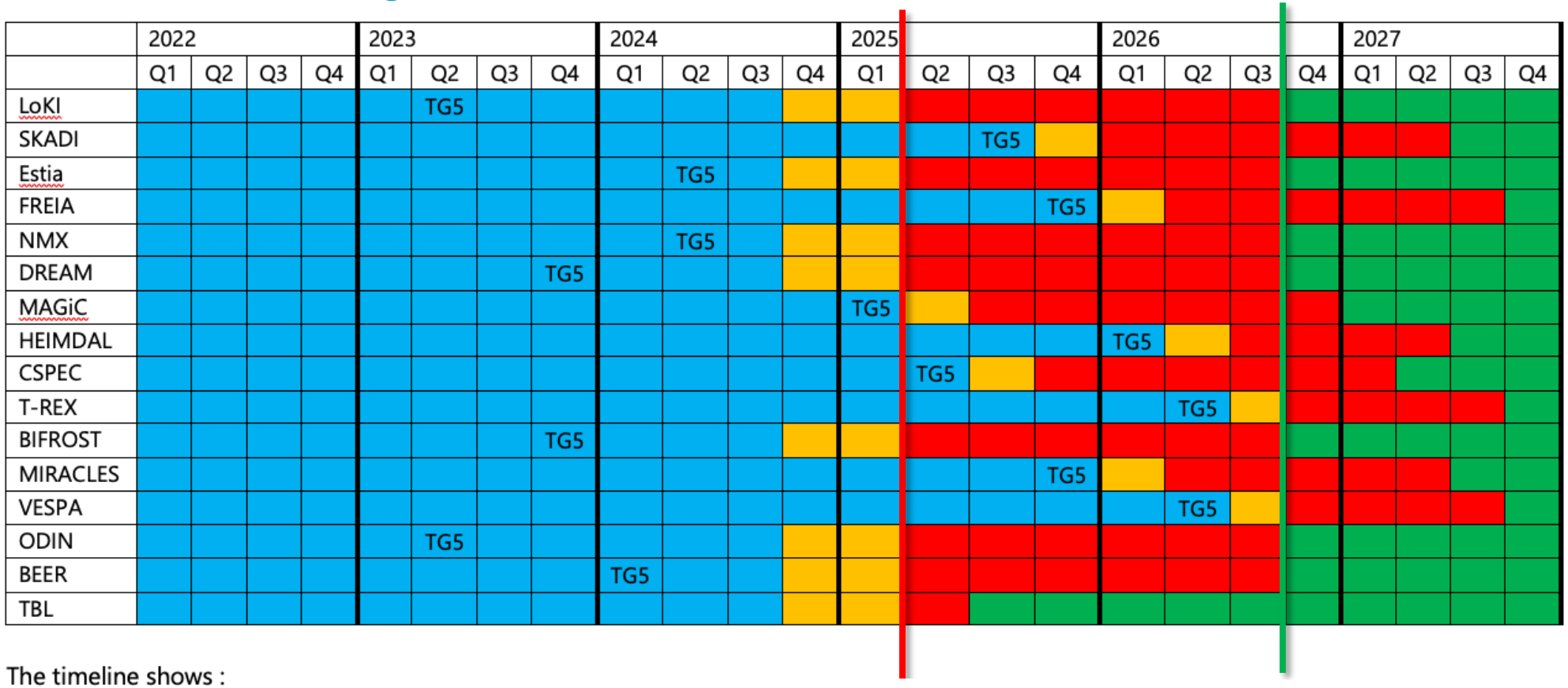


Target luminescent coating

- Target is planning for full 5MW readiness by BOT.
- Only one moderator installed initially, and not the final design
- Proton beam window may need replacement before EOC.
- Detailed plan for first beam on target being drawn up
- Luminescent coating allows measurement of beam position and distribution on target

Instrument Commissioning Plan

Estimates as of August 2022 – with BOT in Q2 2025



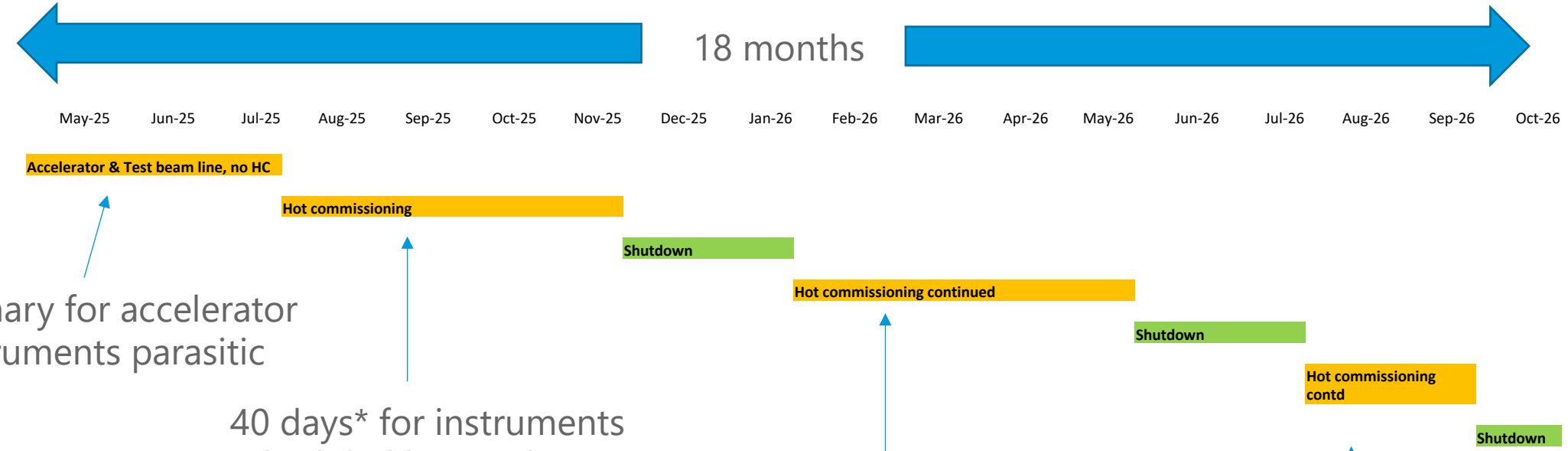
The timeline shows :

	Design, construction, and cold commissioning
	Safety readiness checks and approvals
	Hot commissioning (testing and validation with neutrons) and Early Science
	User programme

NSS commissioning is very parallisable,
but not everything can be done at the same time

From BOT to SOUP

Current discussions



Primary for accelerator
Instruments parasitic

40 days* for instruments
scheduled by accelerator

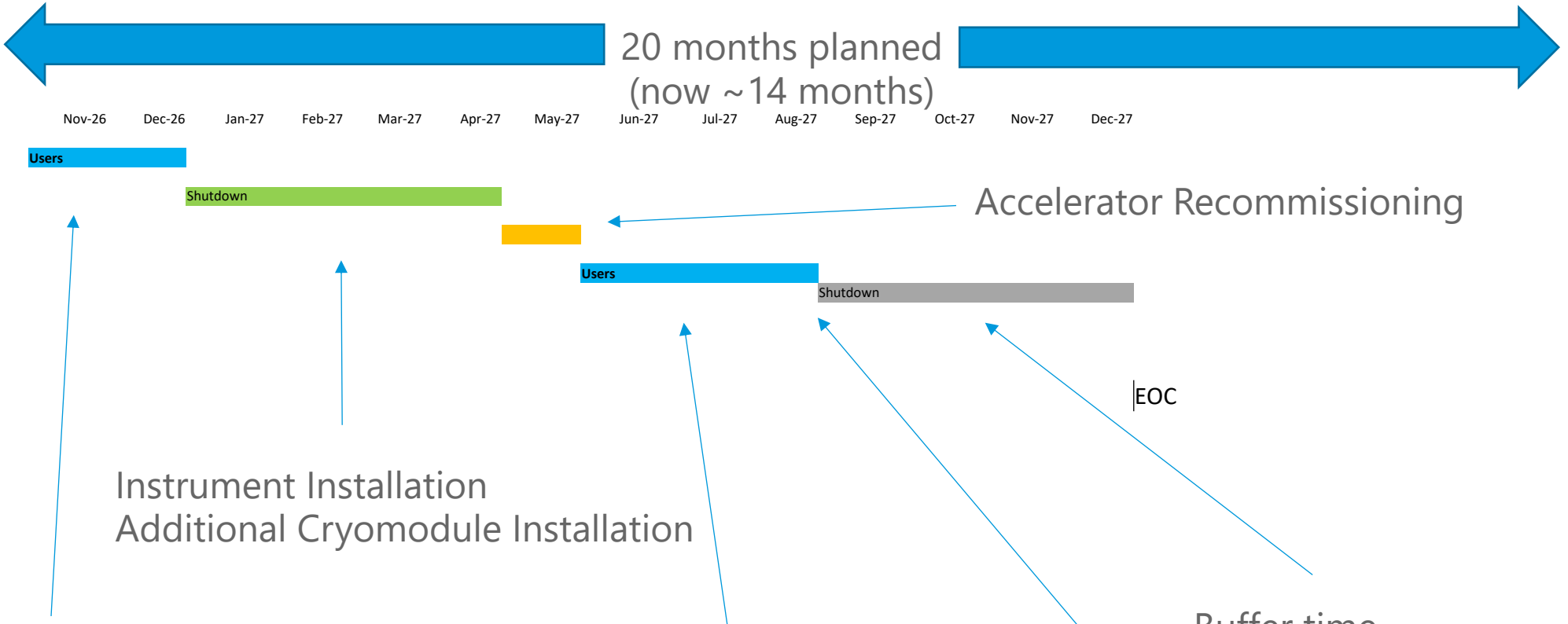
At least 40 days schedule
for instruments
e.g. 5 days every other week

At least 40 days scheduled
for instruments
Up to 10 days per fortnight

*Instrument day defined as 8 hours of beam in 24 period

From SOUP to EOC

Current discussion



Conclusions

- First Beam on Target will be a major milestone for the project (albeit perhaps not the most important one for the stakeholders).
- Planning for sending first beam to target is ongoing.
- Following BOT, commissioning activities and remaining installation work will need to be coordinated to a joint schedule. We have a skeleton for such a schedule.
- Post BOT, subprojects mainly need to integrate commissioning time. There are relatively few interdependencies. This means that shutdowns can be locked in time, simplifying installation planning. Any remaining commissioning or installation activities can simply be moved to the next beam or shutdown window. Likewise, commissioning activities can be performed early when possible.
- There is a clear understanding that Neutron Instruments prefer stability over power. If the accelerator power ramp-up is slower than expected, the beam power for hot commissioning and initial user program will be adjusted to optimize for stability.

backup