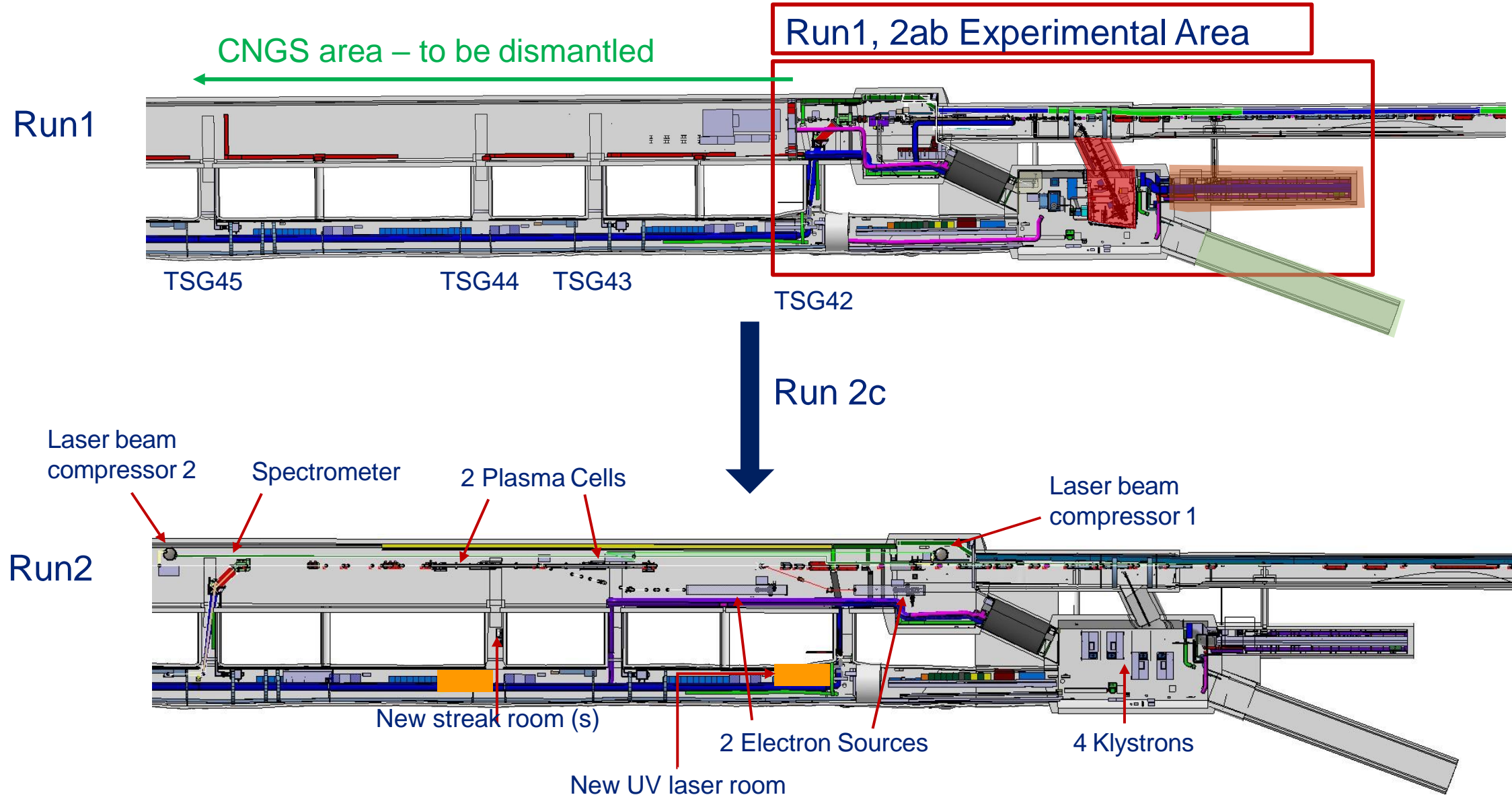


Coordination Package 4: Integration/Infrastructure/ Installation + Planning

AWAKE Run 2c Kick-off Meeting
16/7/2024

Motivation for modifications: Run1, 2ab vs Run2



Coordination Package 4 (CP4)

WP#	WP title	WP leader	Group
WP8	Shielding	Ans Pardons	EN-ACE
WP9	Structures and Fire compartments	Ans Pardons	EN-ACE
WP22	Civil Engineering	Alejandro Martinez Selles/John Osbourne	SCE-SAM
WP23	Cooling and Ventilation	Alejandro Mejica Rodriguez	EN-CV
WP24.1	Electrical Services: Electrical Infrastructure	Mickael Lonjon	EN-EL
WP24.2	Electrical Services: Cabling	Guillaume Gros	EN-EL
WP24.3	Electrical Services: Decabling	Christian Bernard	EN-EL
WP25	Transport and Handling	Caterina Bertone	EN-HE
WP26	Access	Didier Vaxelaire	EN-AA
WP27	Fire and Gas Detection, Emergency Systems	Silvia Grau, Denis Raffourt	EN-AA
WP28	Survey	Jean-Frederic Fuchs	BE-GM
WP29	Ethernet, Wifi, GSM, TETRA	Maryse da Costa, Marc-Antoine Denis	IT-CS
CP4.1	Global integration & planning	Ans Pardons	EN-ACE
CP4.2	Facility maintenance & safety	Ans Pardons	EN-ACE

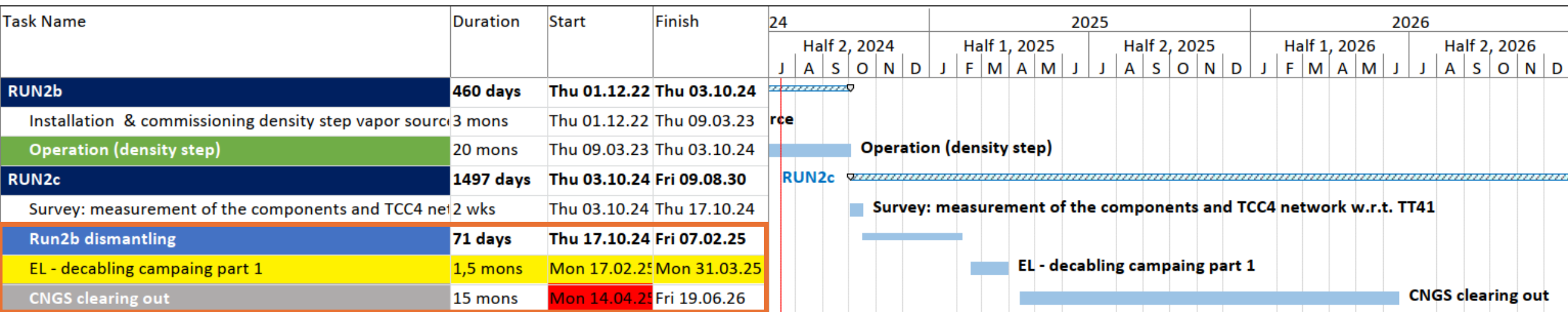
- CP4 does not include the following work packages:
magnets, power converters, interlock, vacuum, control, mechanical design-MME

A few words on the (draft) installation planning used here

- Info collected from discussions with WPs 2021-2023: **duration of works** (according to work **assumptions**, which may change)
- Not yet (significantly) updated since AWAKE Run2c's approval
- It shows AWAKE's "**wishful**" planning with a "**common sense**" sequence, respecting the duration of works received.
- It is not a readiness milestone planning (will come later)
- It does **NOT** take into account
 - **Resource availability** (CERN & contractor), esp. during LS3
 - Late arrival of **tech requirements** (many not yet received)
 - Various **delays** (e.g. from changes in spec)
- This meeting will give valuable **input towards a more realistic installation planning**, as well as a **readiness milestone planning**

Planning AWAKE works up to April 2025

- Assuming the LS3 start date remains between Nov 2025 and August 2026 (no more than 8 months delayed w.r.t. current date)
→ no change to CNGS dism and AWAKE installation planning
- AWAKE works before CNGS dism:
 - Survey and network measuring in TCC4-AWAKE (BE-GM, WP28) **Oct 2024**
 - Run2b dismantling (eq. owners + EN-HE, WP25) **Oct 2024 – Feb 2025**
 - De-cabling of AWAKE area (EN-EL, WP24.3) **Feb – Mar 2025** (end of/after YETS)



Planning AWAKE works from mid 2026 on

- Block 1 (Jun – Sep 2026): Survey, tracing, move p+ magnets
 - Perform survey empty TCC4, establish new network (BE-GM)
 - Move proton beam line magnets to end TCC4 (temp position) (EN-HE, TE-MS)
 - Mark new beam equipment's position (BE-GM)
 - Move proton beam line magnets to final TCC4 position (EN-HE, TE-MS)
- Block 2 (Jul 2026 – Apr 2027): Installation services and cabling part 1
 - Install services part 1: cable trays everywhere & elec general infrastructure (EN-EL), smoke detection and emergency evac equipment in TCC4 (EN-AA), then cabling for TT41 magnets and services (EN-EL)
 - Install services part 2: ventilation, cooling (EN-CV)
 - Install services part 3: GSM and TETRA in TCC4 (IT-CS)
 - Re-install MAD TAG41 (EN-AA)

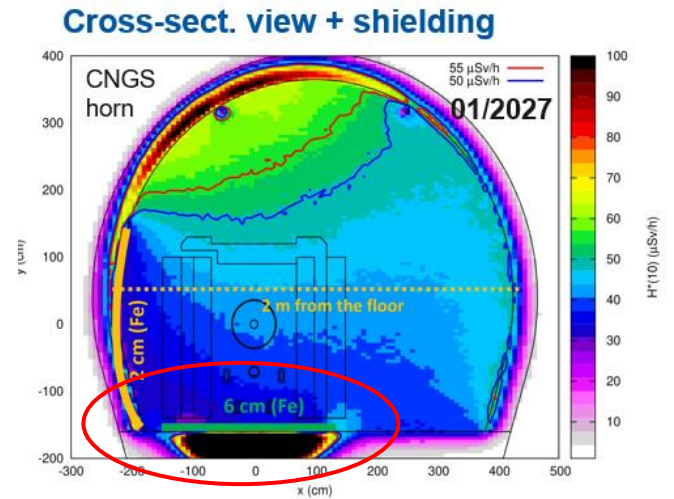
Planning AWAKE works from mid 2026 on

- Block 3 (Feb 2027 – Jan 2028): Installation equipment, supports, vacuum and cabling part 2 (equipment HWC follows after installation)
 - Install supports and beamline equipment (EN-HE: Feb 2027 – Jan 2028)
 - Install laser-related equipment (SY-STI: Feb 2027 – Jan 2028)
 - Install proton and electron line magnets (TE-MS, SY-ABT: Feb – Oct 2027)
 - Cabling for equipment (EN-EL) (Feb 2027)
 - Install elec infrastructure (+racks) for laser, RF, plasma, etc. (EN-EL) (Mar – Apr 2027)
 - Install plasma cells (May 2027)
 - Install RP equipment (May 2027)
 - Install beam instrumentation all lines (SY-BI: Jul – Sep 2027)
 - Install electron sources and klystrons (SY-RF: Jun – Nov 2027)
 - Install beamline vacuum chambers and e-source bake-out (TE-VSC) (Sep 2027 – Jan 2028)
- Block 4 (Jan – Sep 2028): Commissioning before operation
 - (commissioning last equipment: UV beam to e-source)
 - Leak detection and pump-down (TE-VSC: June 2028)
 - Electron and laser beam commissioning (Jun – Jul 2028)
 - Proton beam commissioning (Aug 2028) (SPS post LS3-start = 3/7/2028)
 - Global commissioning (all beams: Sep 2028) → Ready for operation ~Oct 2028

WP8: Shielding – EN/ACE

With

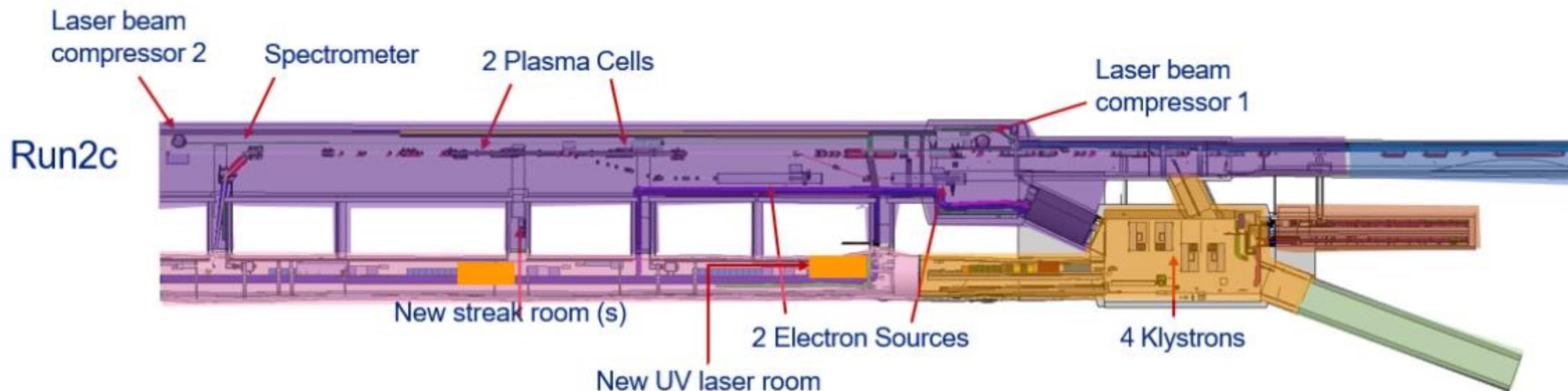
- HSE-RP and SY-STI for Fluka calculations
- EN-HE for handling and transport
- BE-EA for standard shielding procurement
- Design, procure, and install shielding to protect personnel and equipment in the AWAKE area, for example:
 - Shielding (concrete or iron) “carpet” or “wall” in areas in TCC4 with remnant dose rate above $50\mu\text{Sv/h}$ after CNGS dismantling (\rightarrow see RP slides) \rightarrow ~Jun 2026
 - If required (no request received): shielding in TCC4/TSG41 to reduce dose to electronics (Klystron) in TCV4 \rightarrow 2028



WP9 Structures & fire compartments – EN/ACE

With

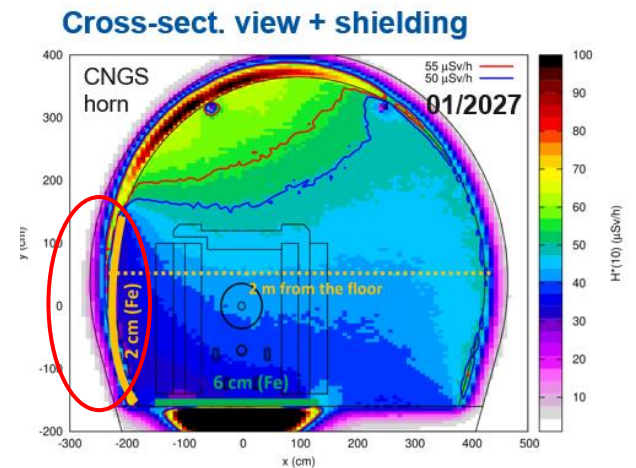
- PSO, HSE-OHS and HSE-FB for definition of compartments, evacuation routes, fire brigade procedures, etc.
- EN-ACE-COS for construction/order/installation of
 - UV Laser rooms (if not same as current spectro room), streak rooms etc. → install second half 2027 (tbc)
 - fire doors and walls → install after Jan 2028 (tbc)



WP22 Civil engineering - SCE

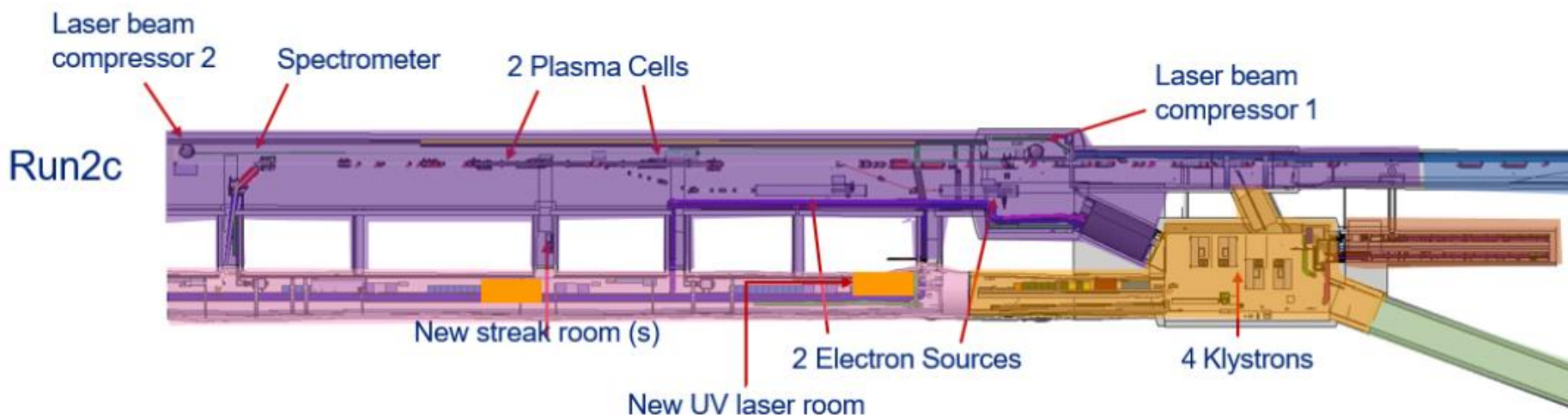
With EN-HE:

- Under discussion: If removal of transformers in TSG4 → removal shielding TSG4 before Jun 2026
- Structure to attach wall shielding TCC4 (depends on CNGS remnant dose rate, only known in March 2026) → Jun 2026 (if needed at all)



WP23 Cooling and ventilation – EN/CV

- Estimated needs from equipment owners on [EDMS 3135126](#) (extrapolation)
- New UV room, more e-sources, plasma cells, klystrons (cooling)
- TCC4 volume increase (ventilation) → Needs new AHU in TSG4, connected to TCC4

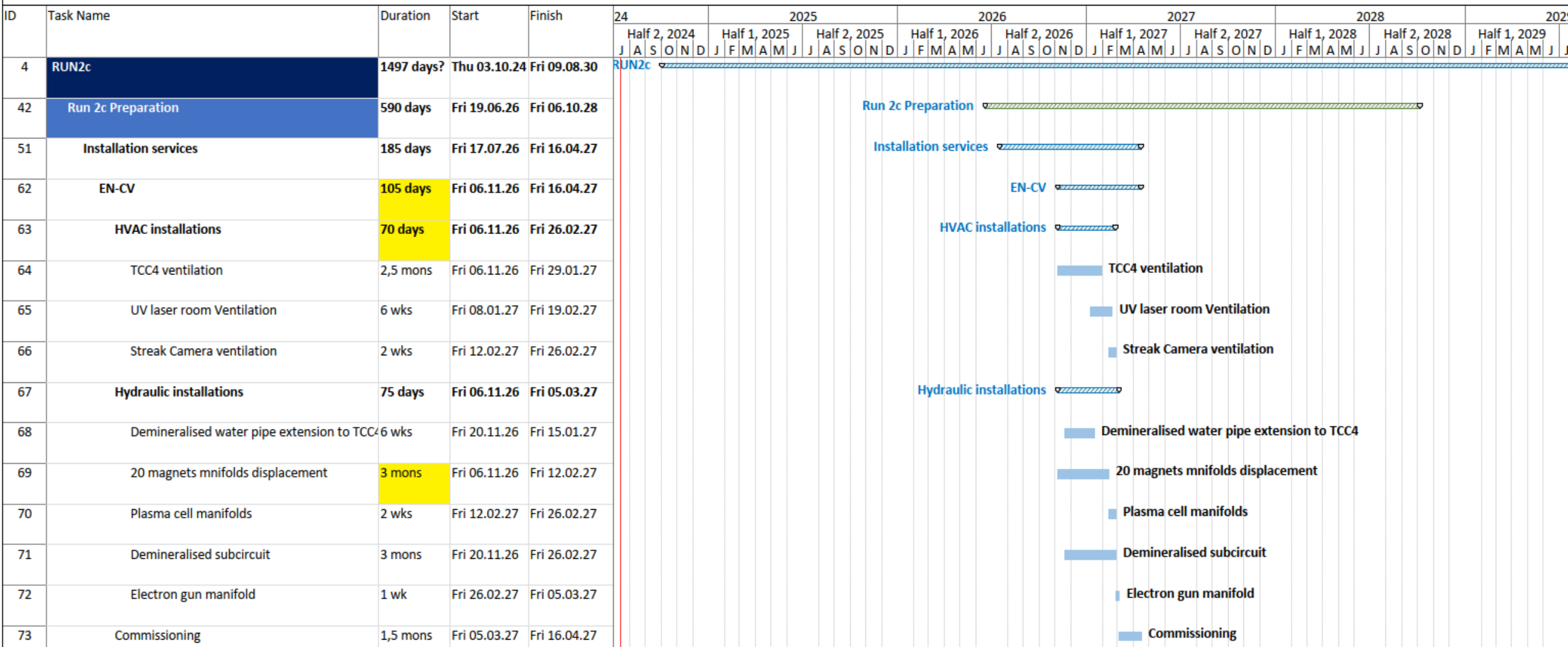


AWAKE Run 2c				
Structure	Water quality	Power kW	location	Comments
IR Laser	raw/chilled	2.4	1. TSG40	Unchanged
UV Laser		2.4	2. TSG4, at junction with TSG42	New room (UV laser) in TSG4 -> +2.5kW in TSG4
Electron gun	demineralised	50	TCC4-C	extra e-source -> + 25kW, full load (50kW) moves from TCV4 to TCC4
Klystron	demineralised	120	TCV4	3 extra klystrons -> + 90kW in TCV4 (25kW removed -> Net +65kW for TCV4
Plasma cell	demineralised	10	TCC4-C	extra plasma cell -> +5kW in TCC4
Spectromagnet	demineralised	28	TCC4-A	Unchanged
GALDEN chillers	chilled	10	TSG4	moved from TSG41 to TSG4
Proton beam magnets	demineralised	1500	TT41 + TCC4	some magnets are relocated to TCC4

AWAKE Run 2c			
Structure	Position in run 2	Heat loads kW	Comments
Proton beam tunnel	TT41	80	some magnets are relocated to TCC4 -> - 10kW
Target chamber	TCC4-C	27	These areas are merged and become AWAKE experimental area -> +22kW
AWAKE experimental area	TCC4-A		
Service gallery	TSG4	45 (*)	more racks -> +15kW
Streak camera room	TSG4	5 (*)	moved from TSG41 to TSG4
Ventilation chamber	TCV4	12	4 klystrons will be located in the area. -> +8kW
Laser room	TSG40	15	Unchanged
New UV laser room	TSG4, at junction with TSG42	15 (*)	new -> +15kW
Hadron stop	TNM42	negligible	Unchanged
Muon chamber	TNM41	negligible	Unchanged

(*)Total heat load in TSG4: 65 kW -> +35kW

WP23 Cooling and ventilation – EN/CV



WP24.1 Electrical Infrastructure – EN/EL

- First EN-EL (M. Lonjon) reflections, based on estimates from equipment owners in 2020:
[EDMS 2471171](#)
- An extract:
 - Upstream TSG4: (doubling installed power: Replace 630kVA transformer with 1250kVA, and replace of the EBD1 switchboard → space needed in TSG4
 - TCV4: (4xKlystrons): Replace switchboard EZD
 - Adding lights and electrical infrastructure (cables) in TCC4-CNGS

4.	Nouveaux besoins pour l'expérience AWAKE
4.1	Zone expérience (ex. CNGS)
4.1.1	GALERIE TECHNIQUE (TSG4)
4.1.2	SALLE LASER (TSG40)
4.1.3	RF GUN ET KLYSTRON (TCV4)
4.1.4	TUNNEL ÉLECTRON (TT43)
4.1.5	LIGNE PROTON (TT41)
4.1.6	CELLULE PLASMA (TT41)
4.1.7	ZONE EXPÉRIMENTALE (TCC4)
4.1.8	VOIE ÉVACUATION SECOURS DU TSG4 (TCC4)
4.1.9	NOUVELLE DISTRIBUTION ÉLECTRIQUE AWAKE
4.2	Salle de contrôle AWAKE - ECA4
4.3	Convertisseurs de puissance AWAKE - BHA4
4.4	Consolidation des infrastructures de supervisi



WP24.3 De-cabling – EN/EL

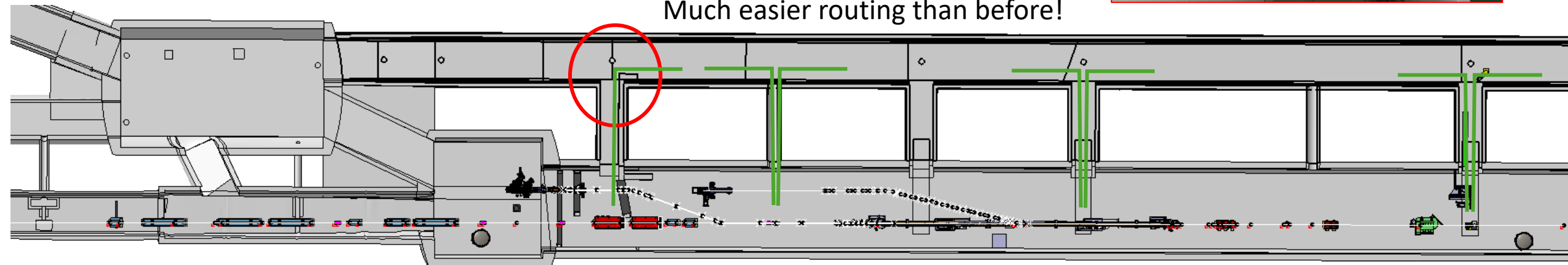
- Estimated at 450kCHF (estimate from 2021)
- Dedicated de-cabling preparation meetings for equipment owners organized by EN-ACE
- Starts end of YETS, when EN-EL resources available

WP24.3 Cabling – EN/EL

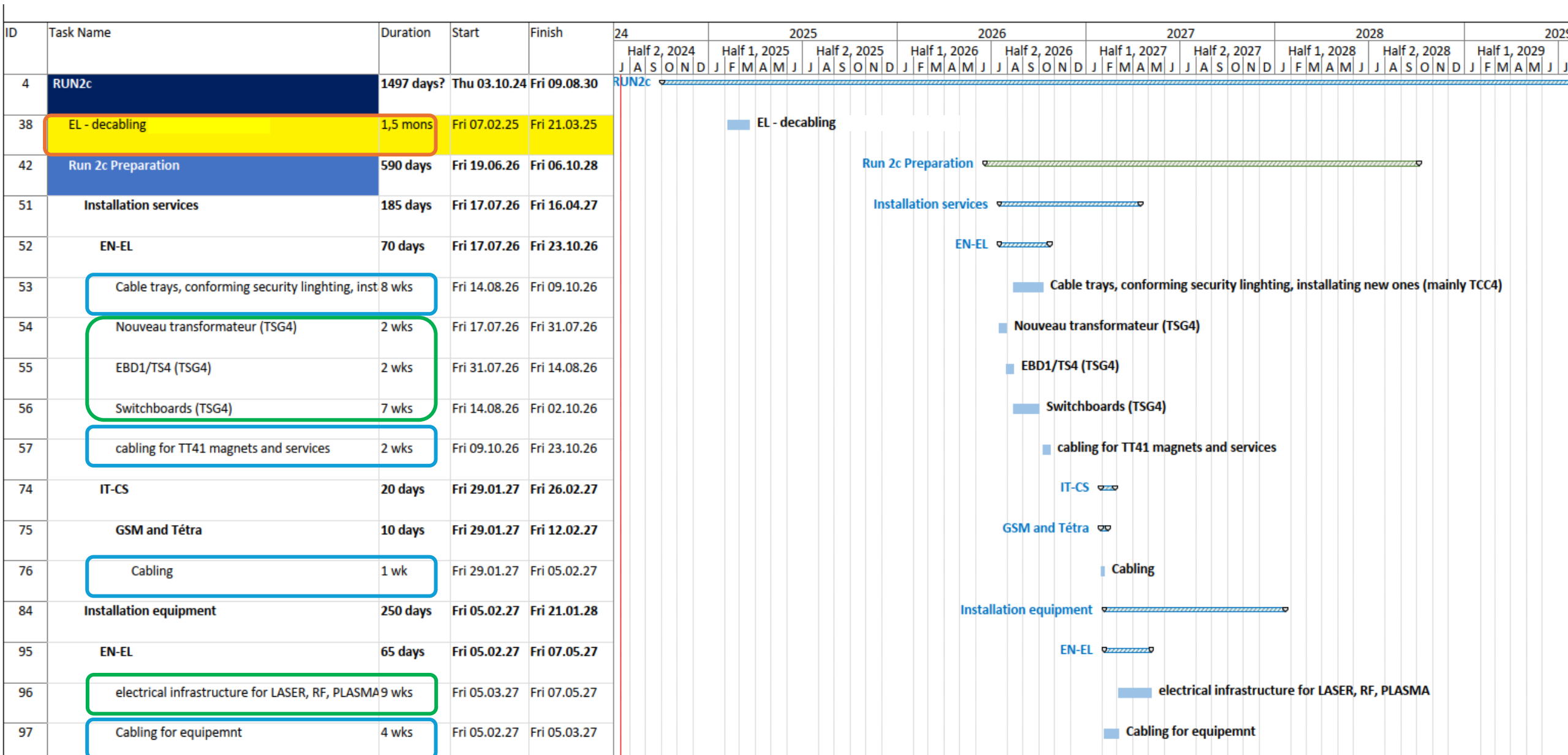
Estimate given to EN-EL 15/4:

- ~1150 control cables (63km)
- ~140 DC cables (11km)
- EL recent cost estimate ~1.5MCHF

Much easier routing than before!

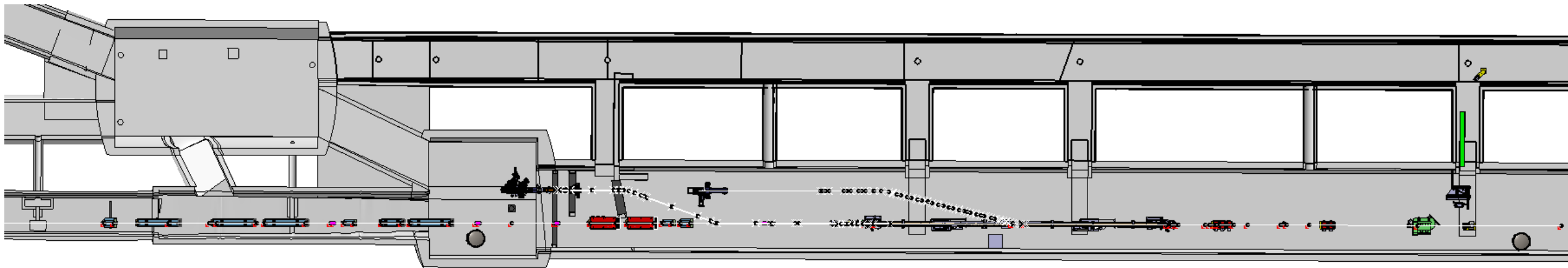


WP24 – EN/EL



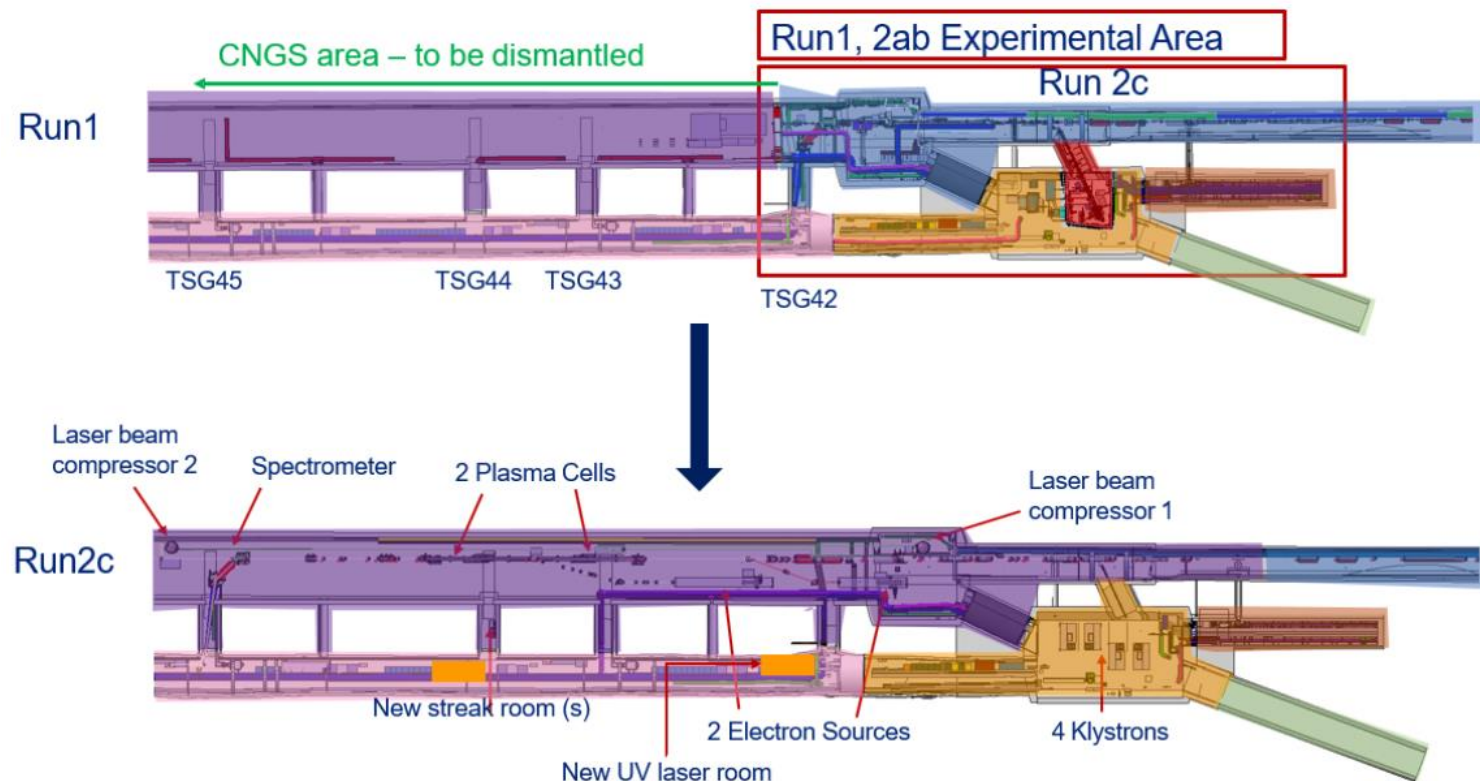
WP25 Transport and handling – EN-HE

- After disconnection by equipment owners, remove AWAKE equipment (Oct 2024 – Feb 2025), vacuum, supports, TSG41 shielding, etc. (see dedicated AWAKE dism meetings)
- Move proton beamline magnets (Jul – Sep 2026)
- Install supports and beamline equipment (Feb 2027 – Jan 2028)
- Plus: crane maintenance, transport support to other teams



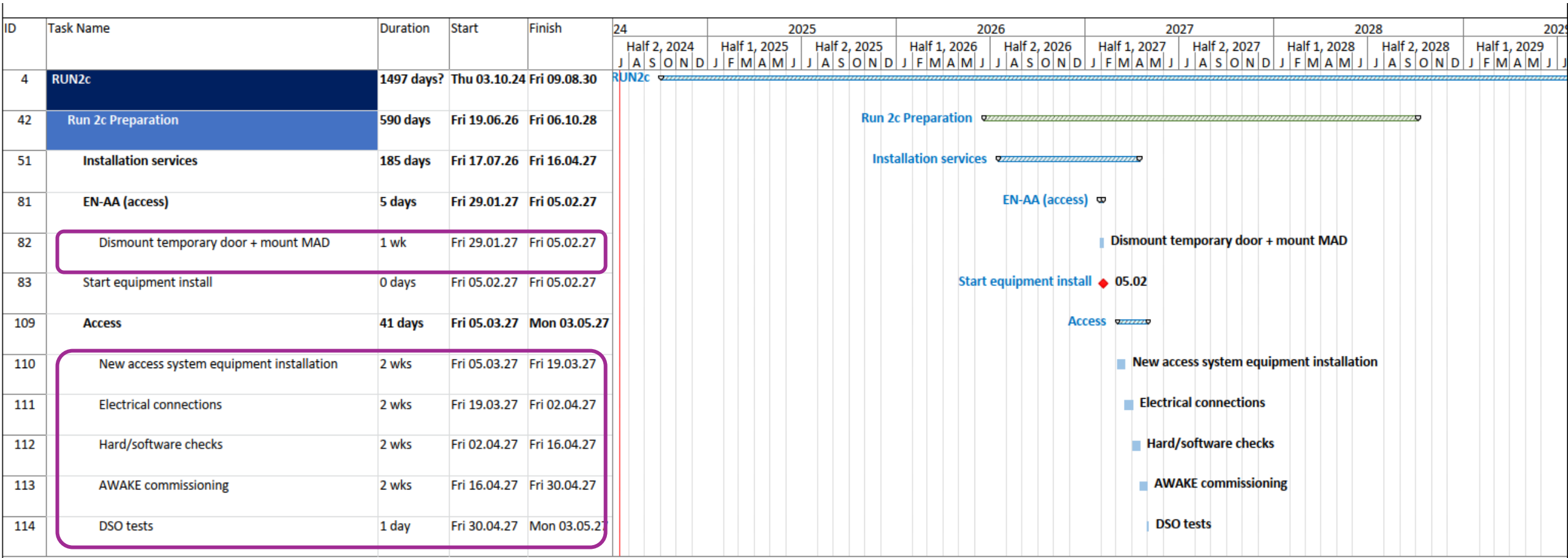
WP26 Access system – EN/AA

- [Remove MAD before CNGS dism], reinstall MAD **before** AWAKE equipment installation (temporary conditions)
- Update of existing access system **during** AWAKE small equipment/support installation : software, hardware, cabling, documentation, tests
 - Extension in TCC4
 - Opening of a few TSG4x galleries
 - Changes TCV4, TT41, TT43, TT41 ... →
 - New racks (location?)
- Minutes preliminary discussion: [EDMS 3082925](#)



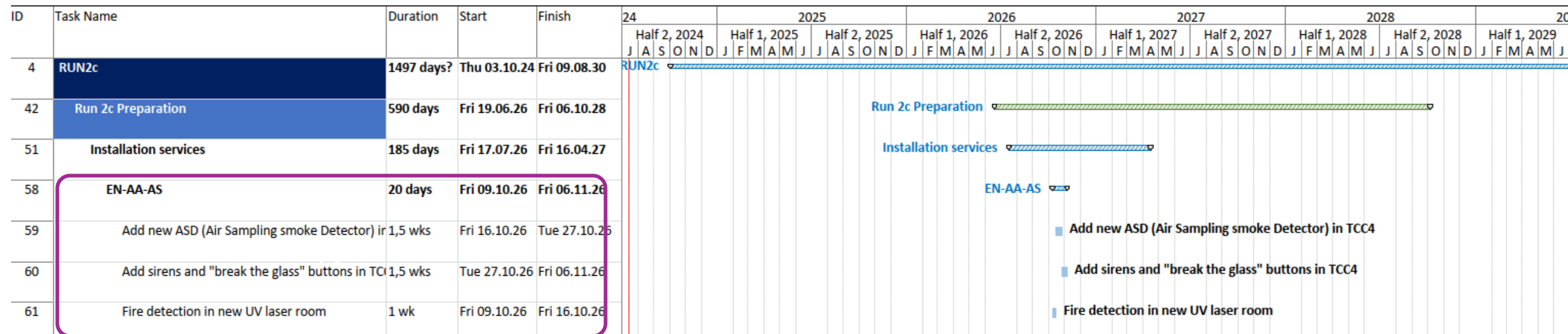
WP26 Access system – EN/AA

- Reinstall MAD: Feb 2027
- Install and test the new access system: March-April 2027
- [Start of AWAKE equipment installation:



WP27 Fire and Gas Detection, Emergency systems – EN/AA

- Install infrastructure in the rest of TCC4 (the former CNGS area was not equipped because of radiation level during beam)
- According to HSE requirements (incl. fire compartmentalization), install additional equipment in the existing AWAKE area.

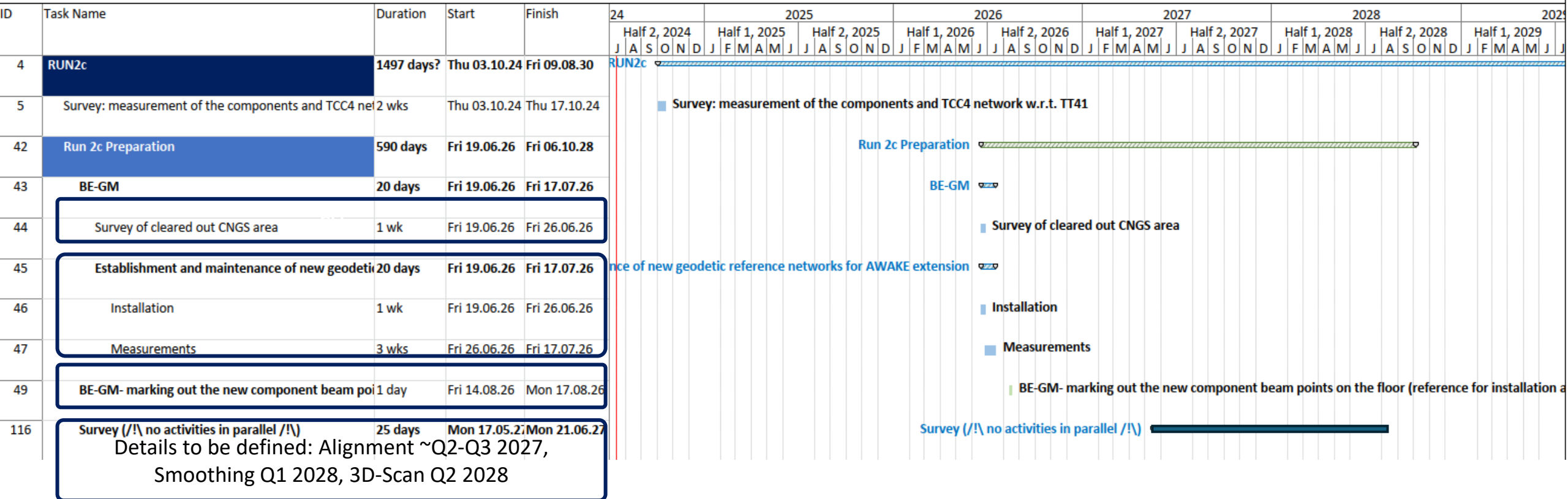


WP28 Survey – BE/GM

- Survey of AWAKE before AWAKE 2b dism (Oct 2024)
- Survey of emptied, decontaminated CNGS area (Jun 2026)
- Establishment of new geodesic network TCC4 (Jul 2026)
- Marking position new components (Aug 2026)
- Alignment of new components (May – Jun 2027)
- Smoothing (V/H) and 3D scan (~early 2028 → add to planning)

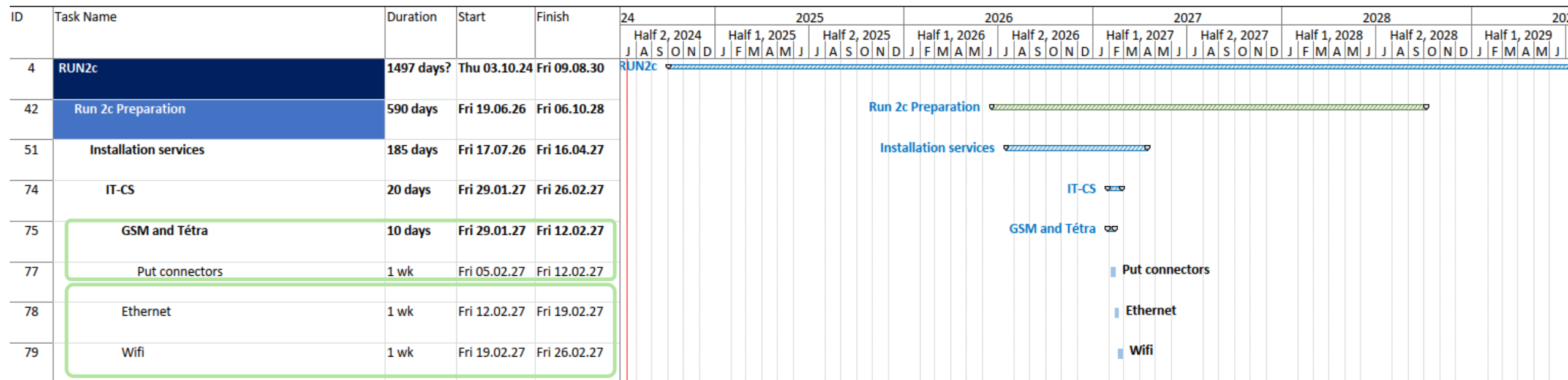
- Minutes preliminary discussion: [EDMS 3082925](#)

WP28 Survey – BE/GM



WP29 Ethernet, Wifi, GSM, TETRA – IT/CS

- Extend existing GSM, TETRA infrastructure towards the rest of TCC4 (the former CNGS area is not equipped)
- According to requirements from other CPs: add Wifi, Ethernet where needed



Critical issues in integration

- Integration: fitting “everything(*)” in TSG4. “Everyone” wants an area shielded from radiation and close to beamlines.
- Safety: Personnel access to/in/from equipment in TCC4 is tricky because of diagonal e-lines spanning the cavern width.
- Cable routing from TSG4 to TCC4 (hopefully easier than Run1!) and in TCC4 (leave passage, do not interfere with crane)
- RF-guide routing (“as straight as possible”) from TCV4 (via TT43, TT41?) to TCC4 – do not interfere with crane and do not limit passage height.
- Many (TE-VSC, EN-MME for supports, EN-EL for cables, EN-CV for magnet cooling, etc.) need a layout with functional positions, heights, etc. already now, but main beamline equipment is not designed yet → use simplified layout, use assumptions based on groups’ expertise.

(*) all equipment and services racks, AHU for TCC4, UV laser room, one or two streak rooms, one spectrum room, UPS, transformer, ...

Critical issues in tech requirement collection

- Late full funding of AWAKE run 2c (Jun 2024)
- Needed to give first **cabling list** Apr 2024, final list in Sep 2024 (also for **racks and fibers**) – while some equipment studies have only just (re)started → extrapolate from Run 1, best guesses
- Need to know **CV needs** (heating, cooling, alarms) and **EL needs** of main equipment owners by ~Sep 2024 to ensure equipment can be designed and procured for timely installation → extrapolate from Run 1, best guesses (some margin in design)
- TE-VSC, EN-MME need to know what the other CPs (laser, beamlines, e-sources, beam instrumentation) need in specs. CP4 provides a simplified layout, the rest must come from others.

Next steps for CP4

- Distribute simplified layout (with CAD model) when available
- Start pre-integration meetings when the service experts have sufficient input from CPs/WPs – start with EN-EL and EN-CV
- Collect any comments on planning from this meeting (and subsequent discussion) – though it may be too early
- With information from CPs and WPs: start establishing a first “readiness milestone” planning