

Dismantling of the CNGS target area for AWAKE

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Target Area Dismantling: Why?

- Future experiments can **re-use the area**, rather than dig costly new caverns.
For CNGS: 100m long cavern, with its own proton extraction line & proton beam dump.

Note: Highly radioactive areas need to cool down before dismantling.

For CNGS: last protons 2012 → 12 years cool-down by Q4 2024.

- Maintaining a highly activated and contaminated storage area requires resources.
- The **longer the wait, the higher the risks (costs):**
 - Equipment's integrity deteriorates
 - Expert knowledge & availability of tools decreases
 - Disposal may become more complex and costly
 - Dismantling dose may increase over time (more complex interventions)



CNGS Target Area in 2004

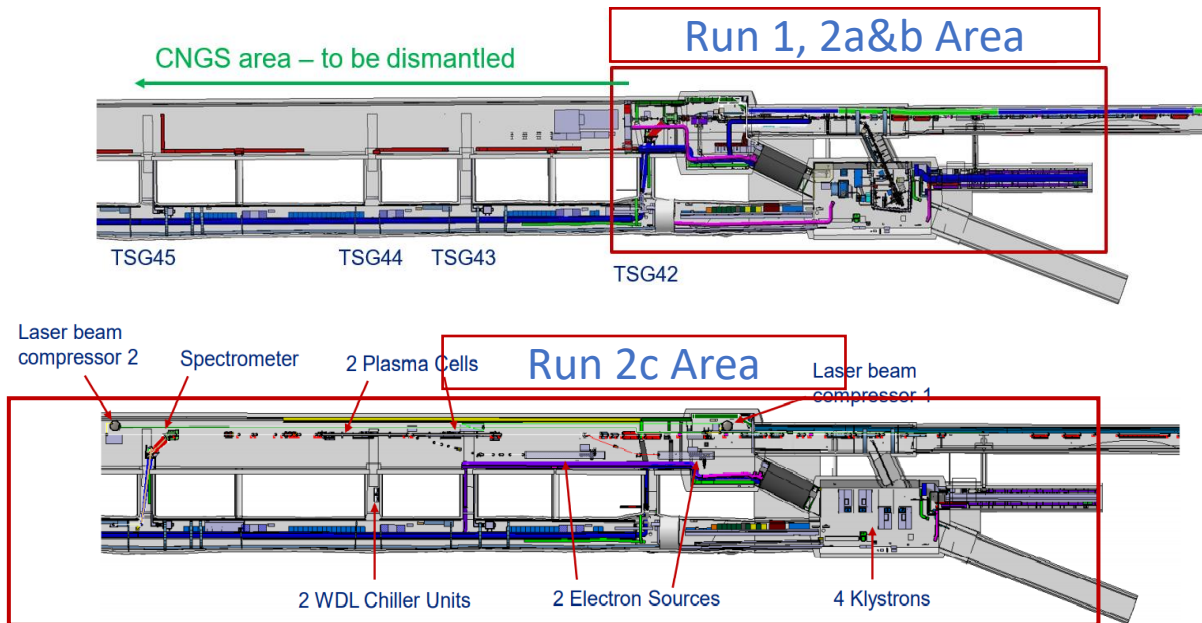


CNGS Target Area in 2005 and now

CNGS Target Area Dismantling: Why Now?

AWAKE Run 2:

- Demonstrate the possibility to use the AWAKE scheme for high-energy physics applications in the mid-term future
→ phased approach: 2a, 2b, 2c, 2d etc.
- AWAKE Run 2c and 2d require a longitudinal **extension of the AWAKE facility of at least 70 meters.**



AWAKE facility, with separation wall to CNGS target area on the left

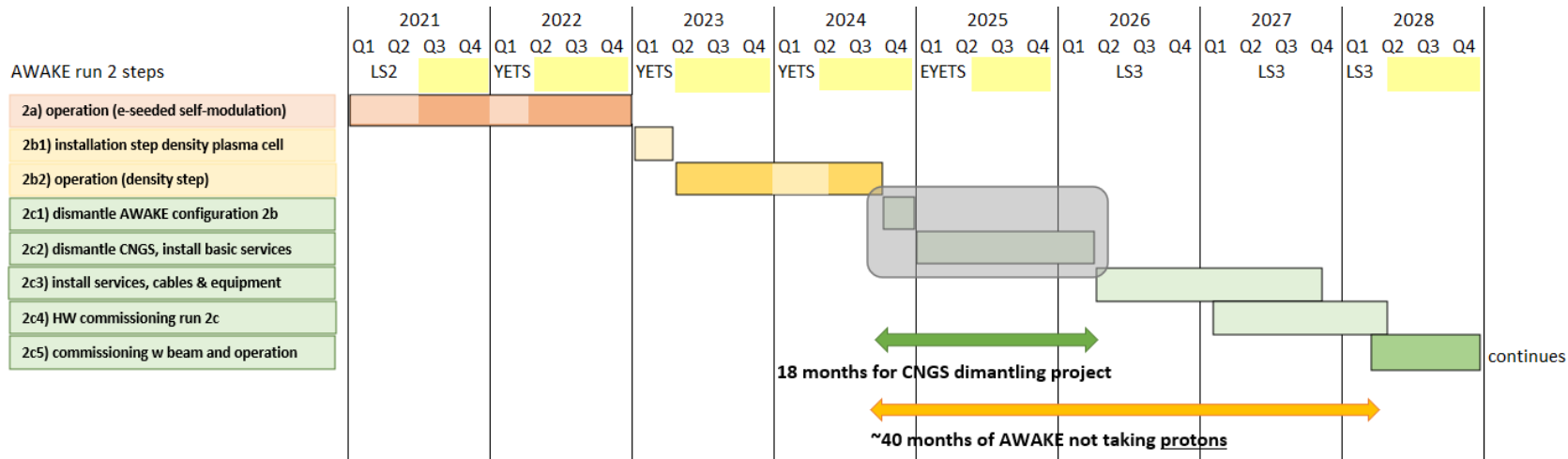
There is no other such location at CERN that also has its own SPS proton extraction line and proton beam dump.

→ The **dismantling of the CNGS target area** is a **prerequisite for AWAKE Run 2c & 2d**

Schedule Considerations

- CNGS dismantling duration is estimated at 18 months of on-site work (including 3 months partial removal AWAKE 2b)
- AWAKE 2b can be dismantled from Q4 2024 on
- AWAKE 2b must be de-cabled before CNGS dismantling starts
- Injector's shutdown (LS3) should fall within 2b-to-2c transformation period

➔ **AWAKE 2b dismantling Q4 2024 and CNGS target area dismantling Q1 2025 - Q1 2026 (*)**



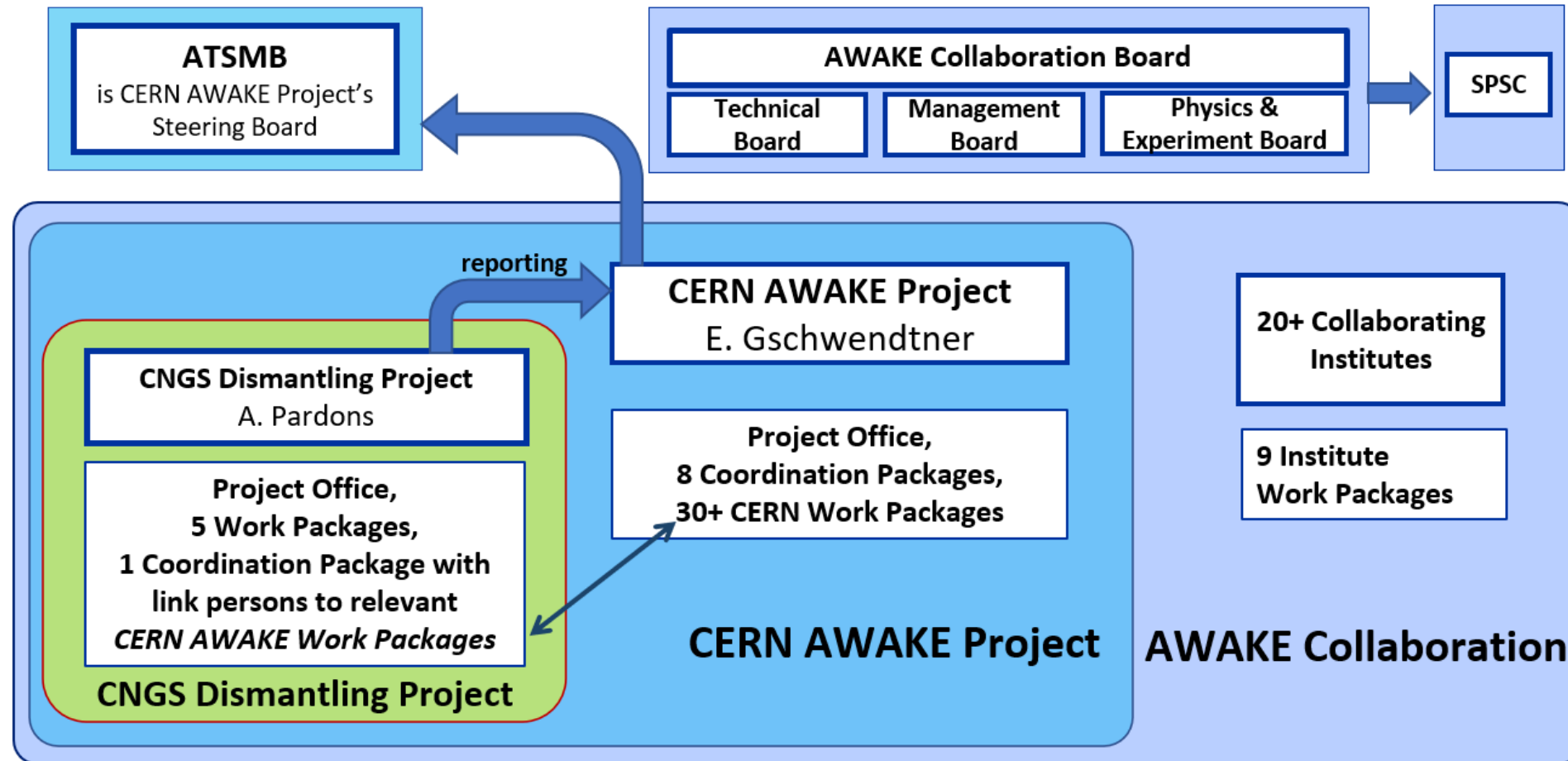
After dismantling, the area will be:

- Empty over its full length
- Free of contamination, with painted floors and cavern walls
- Classified as a simple controlled area (max 50μSv/h)



(*) can be shifted in case a longer 2024 beam run is preferred

Project Structure & Integration in AWAKE



CERN DG's message: CNGS dismantling is supported by CERN and done for AWAKE.

EN DH message: this is an EN-housed project, with the department's full support.

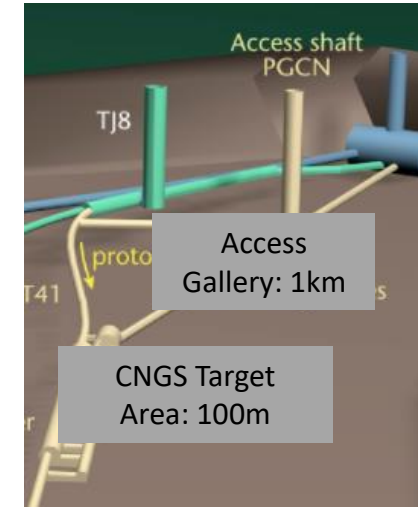
CNGS Target Area and Dismantling Steps

Area content (~600m³):

- ~500 large shielding blocks (up to 7.5t and 0.7mSv/h), including **400m³ of standard concrete shielding blocks**
- A few **high dose-rate elements** (2-50mSv/h on contact)
 - All designed for remote handling
- 70-meter-long aluminium **He-tank**
- **Various** supports, ducts, shielding bricks, cable trays, etc.

Area challenges:

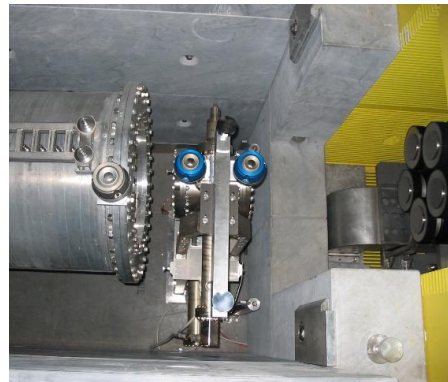
- **6% slope** → wedged supports, special crane
- **large distances** to cover by crane in **TCC4**
- **1km-long tunnel** and 60m-deep pit to surface



Dismantling steps:



Remove roof shielding



Remove high-dose-rate elements:
Horn, TBID, target



Remove all beamline elements

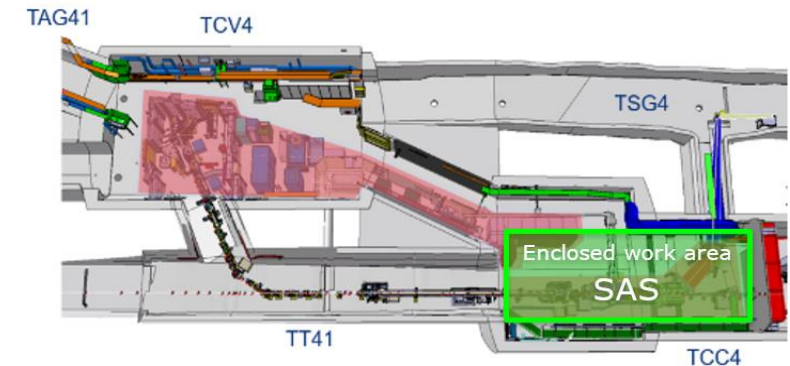
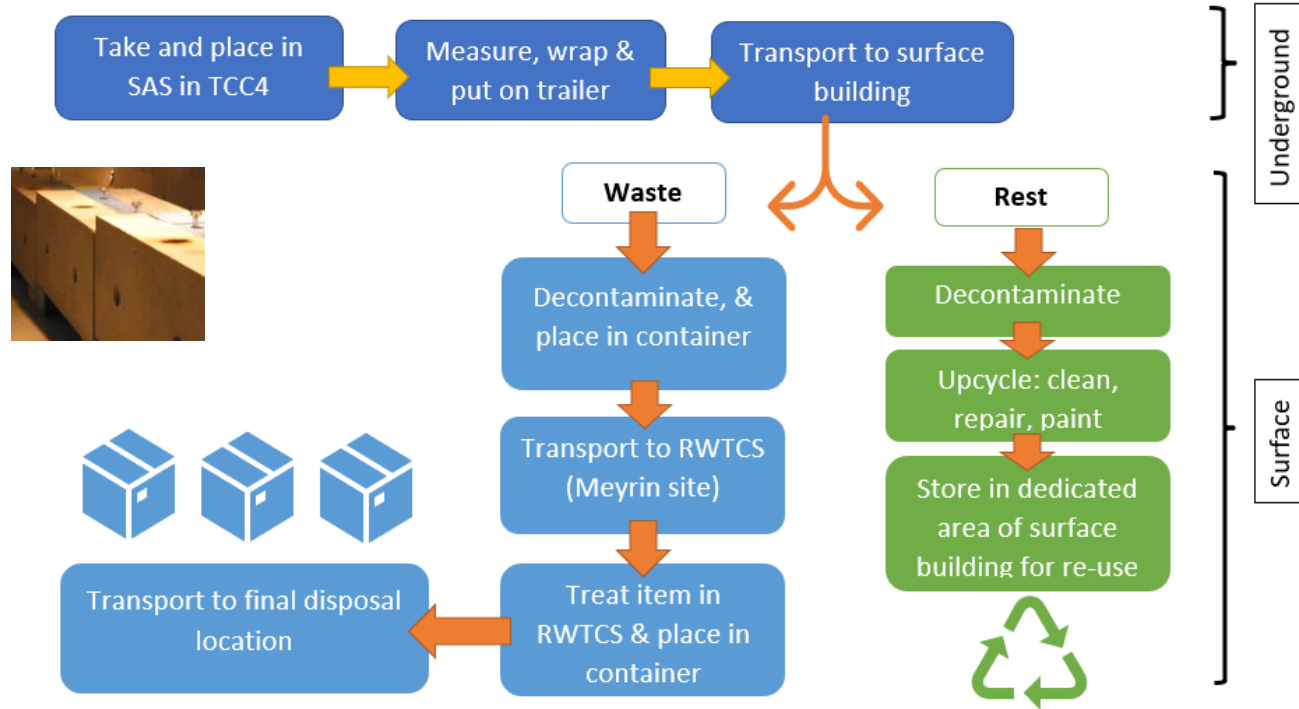


Remove all shielding blocks



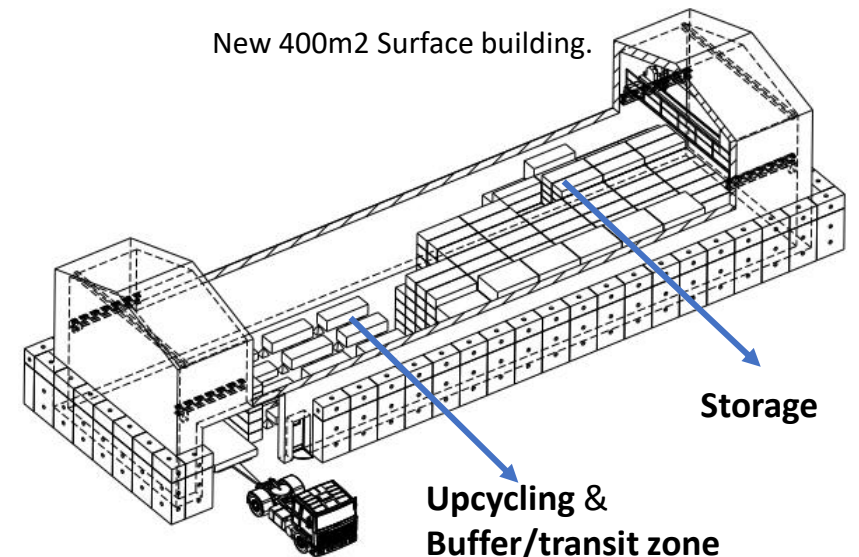
Decontaminate area

Work Processes, Upcycling and Surface building



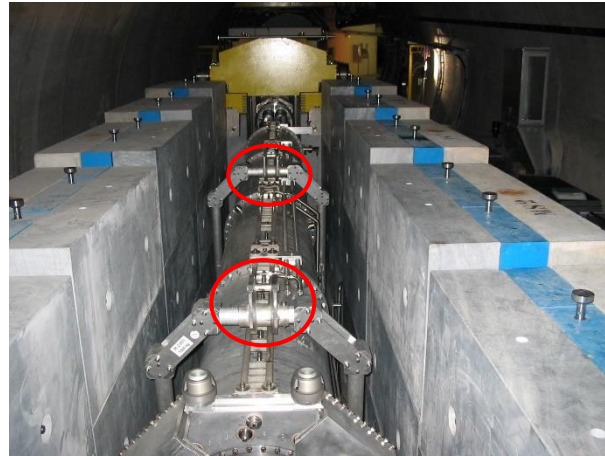
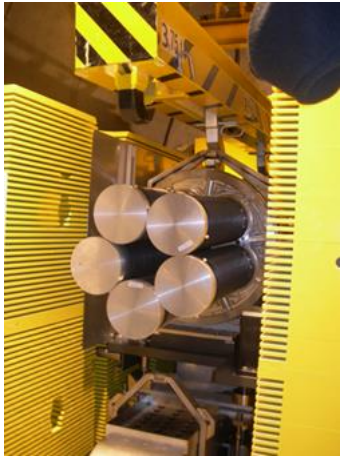
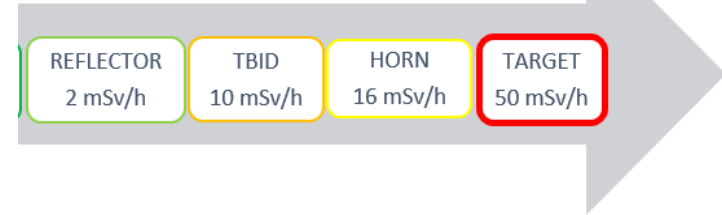
SAS location in upstream TCC4.
Red areas will be emptied before start of works

New 400m2 Surface building.

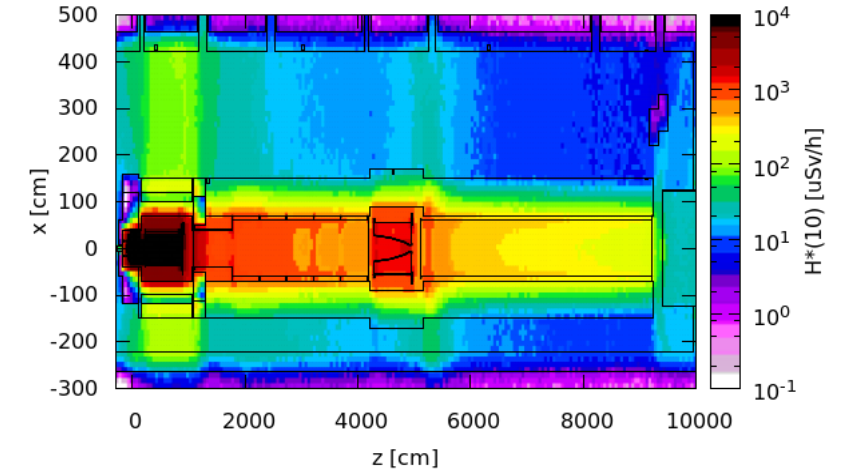


- **Upcycling** 400m³ standard concrete shielding blocks for reuse at CERN **saves 5MCHF** compared to processing them as waste.
- **However**, the upcycling scenario **requires** a 400m² shielded **surface building** (with an overhead crane, access system, ventilation, etc.) to:
 - **Upcycle** the shielding blocks (decontaminate, paint)
 - **Store** the upcycled blocks until reused elsewhere
- During dismantling works, the surface building will also serve as a **buffer/transit zone** for items to be transported on public roads.

High Dose-Rate Elements



Target during installation TBID & remote lifting beam Horn with remote lifting cradles (in red)



Target during installation
(view from crane camera)

Example of remote handling and shielded container
(BDF target, 2019)

- Target, TBID, horn and reflector were **designed for remote dismantling** (CNGS-era)
Dedicated tools and lifting beams, remote dismantling procedures, and crane coordinates for fully remote dismantling and handling exist and have been tested (2006)
- **Shielded containers** for storage and transport need to be designed and ordered

Transport and Handling



TCC4 overhead crane



Tractor with trailer in access gallery

Dedicated, remote controlled, sloped but **slow target chamber overhead crane**, **1-km long sloped access tunnel** and many heavy items to move.

→ **transport & handling is defining the duration of the works:**

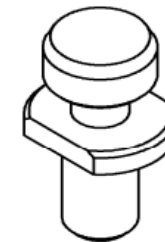
3 months to remove AWAKE 2b, 15 months to empty CNGS

Tools for remote handling of shielding blocks



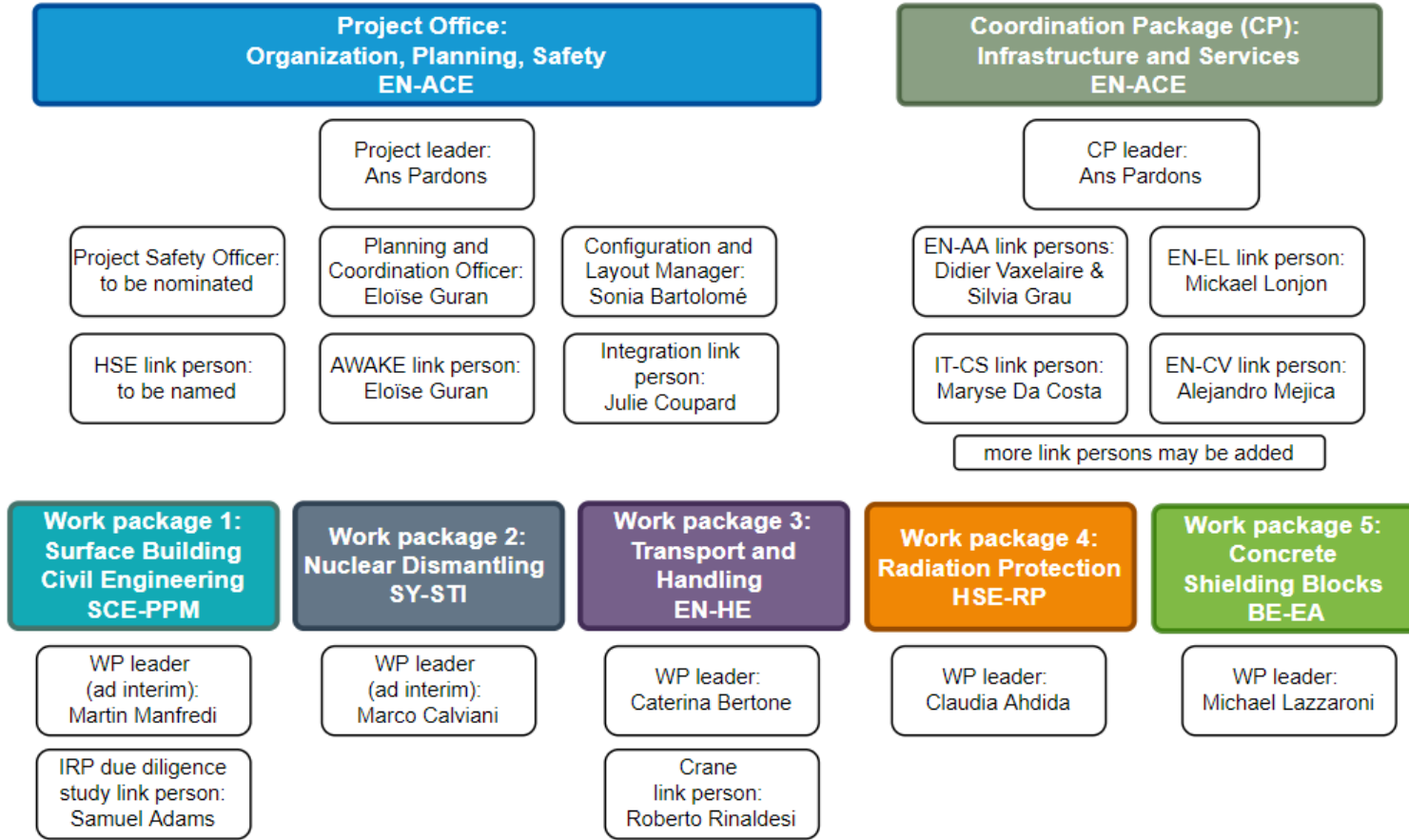
Dedicated tools and lifting beams, procedures and **crane coordinates** for fully remote handling for most items exist and have been tested (2006)

“Mushrooms” – insert for block and lifting beam



Where	What	Max. Load	Specifics	Speed	Round trip (incl. loading)	Travel distance
TCC4	Overhead crane	7.5t	Remote control, cameras, slope	8m/min	10-90min	90km
TAG41	Trailers & elec. tractor	9t	Narrow and long tunnel, slope	60m/min	60min	600km
BB4	Overhead crane	40t	Fast, shared	60m/min	10-20min	100km

Project Structure & Status



- Project structure and WP leaders are defined.
- Project kick-off meeting last March, with a descriptive presentation of each work package
- Current challenge: new surface building:
 - Original civil engineering estimate was 1MCHF short (error) → budget missing
 - **Alternatives were studied**, found t be either not compatible or more expensive, justifying the **request for the missing 1MCHF**
 - **CERN Civil engineering department** will not start the study before the money is there (but it is looking good) and has **very limited study resources** → continuous “lobbying” is needed.
[It takes 23 months from the start of the study until the building is available.]

Conclusion

- The CNGS target area dismantling is essential for the continuation of AWAKE
- Saving 5MCHF by reusing 400m³ blocks requires a 2.8MCHF new storage building
- The target area dismantling project is approved, and the pre-study-estimated budget is available (+1MCHF?)
- The schedule is challenging, especially the availability of the new building

