DEELS

2 days only
20-30 participants only

Diagnostics Experts of European Light Sources

Experts (?), yes **but still learning**
from mistakes, errors etc.

European **and more** …
let's share **worldwide !**

2020 7th DEELS ELETTRA
2019 6th DEELS ESRF → **Welcome !**
2018 5th DEELS DLS
2017 4th DEELS SOLEIL
2016 3rd DEELS DESY
2015 2nd DEELS ALBA
2014 1st DEELS ESRF

supported by workpackage ADA
Advanced Diagnostics for Accelerators
within the ARIES network

Thank you !

David MARTIN and Kees SCHEIDT

installing a light-source with … all the beam-lines already in place …

EBS = Extremely Brilliant Source

replacing the >25 years old ring , which was …

➔ 3+ generation light source !

➔ with an excellent & continuing record of performance & scientific appreciation !

➔ but of **4nm** horizontal emittance …

with a **new ring** with **160pm** horizontal emittance … **= EBS**

installing a light-source with … all the beam-lines already in place ...

to give you an insight of these particular difficulties & challenges of EBS

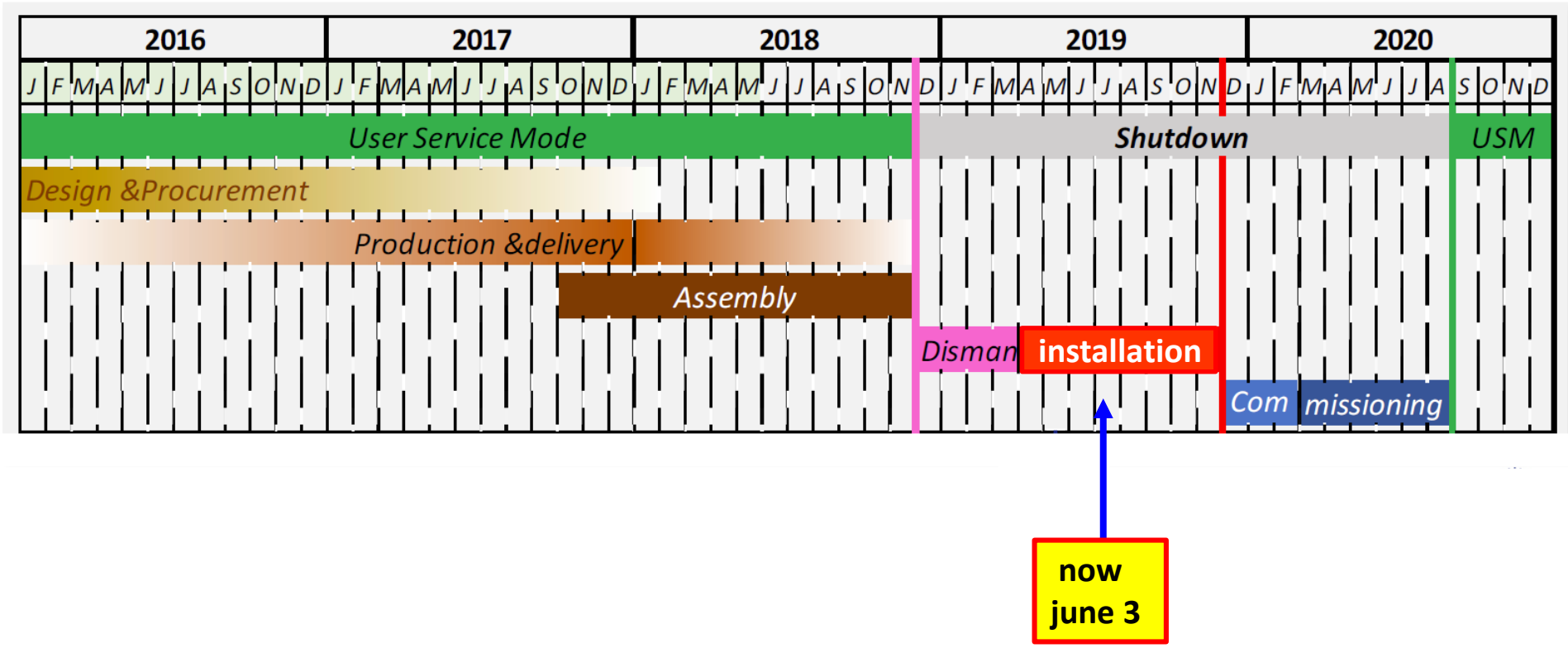
➔ with a guided visit this Monday after 5pm (small groups of 5 or 6 people each)

➔ with any more short & individual visits or discussions during your stay

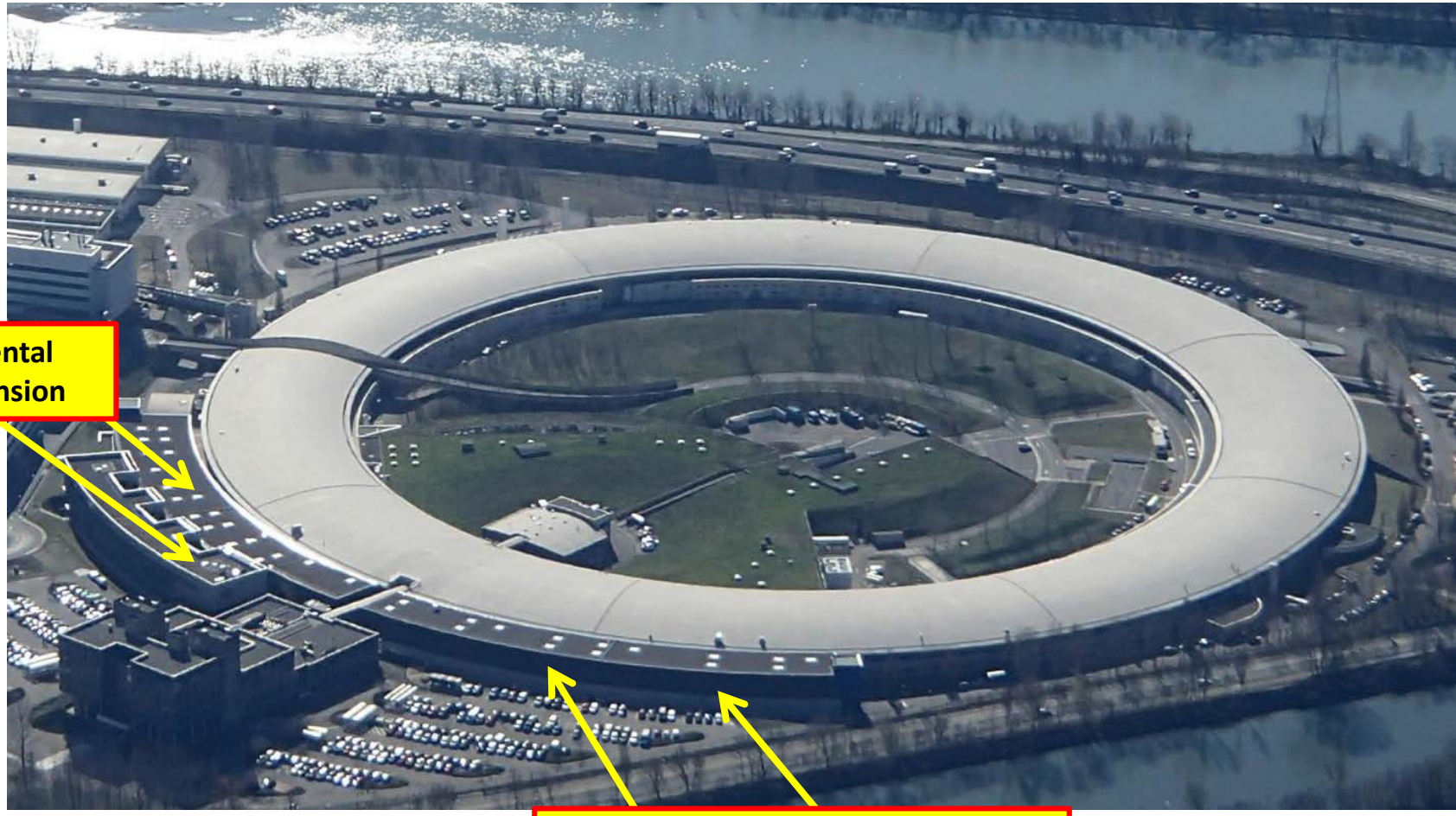
➔ with this presentation by David and myself

EBS planning 2016 …. 2020

20 October	2017	Start girder assembly *(12 months)*
10 December	2018	Start long shutdown *(20 Months)*
		Dismantling *(3 months)* and Installation *(9 months)*
19 November	2019	Start accelerator commissioning
04 March	2020	Start beamlines commissioning
25 August	2020	Back to USM



in its 25 years the ESRF had major upgrades before : e.g. the extension of the experimental hall in 2014



Experimental Hall Extension

with 4 totally refurbished beam-lines

Experimental Hall Extension

with space for 4 totally refurbished beam-lines … but not yet … : this space was used for the preparation of the EBS : mock-up cell, magnet-measurements, storage of girders (assembled)

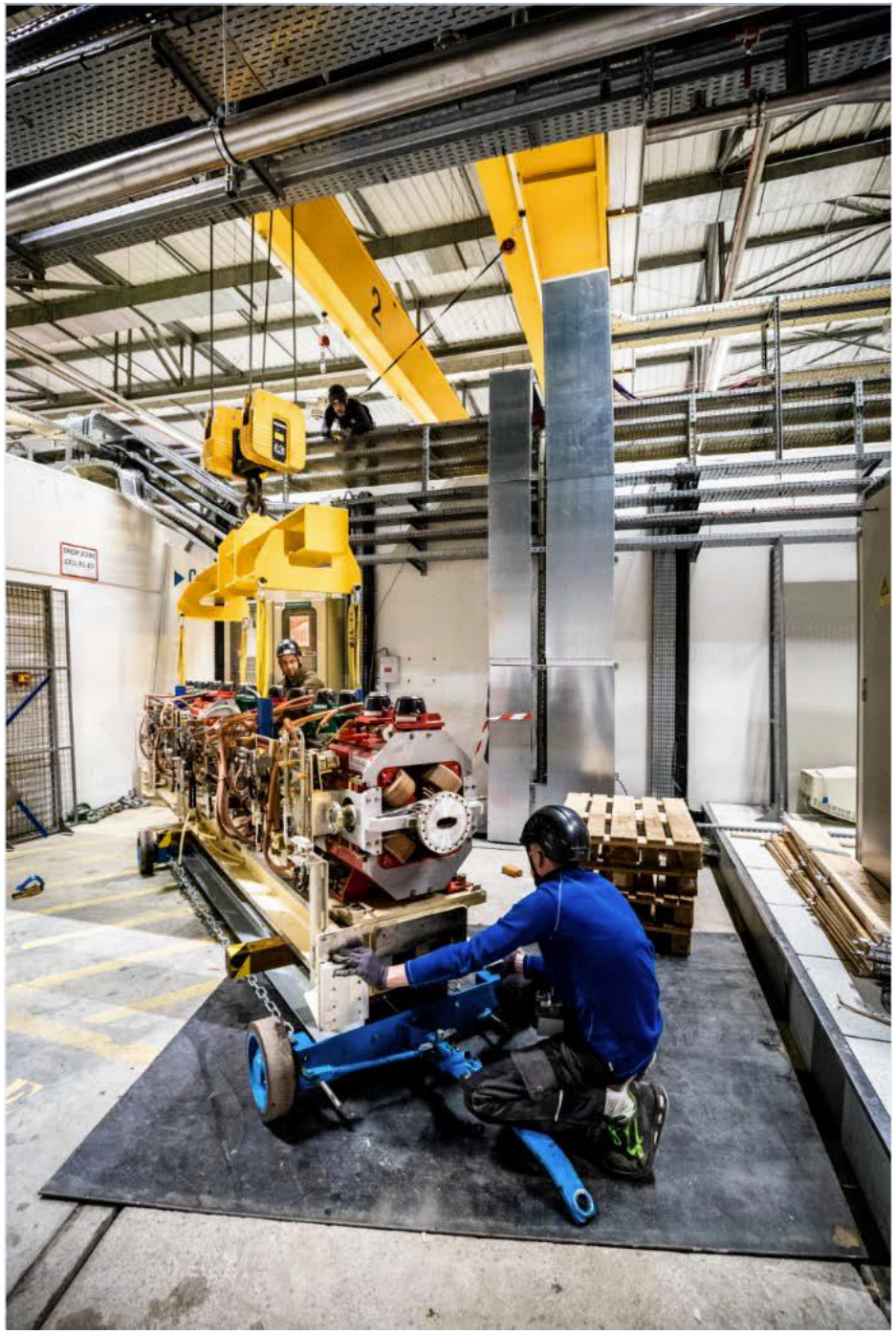
dismantling

dismantling is possible with the ordinary crane

but NOT for the new girder installation …

too heavy !!
see later

the men in black
grave-diggers …



drop-zones in our
technical galleries
to receive the old girders

on trolleys,
to then be transported

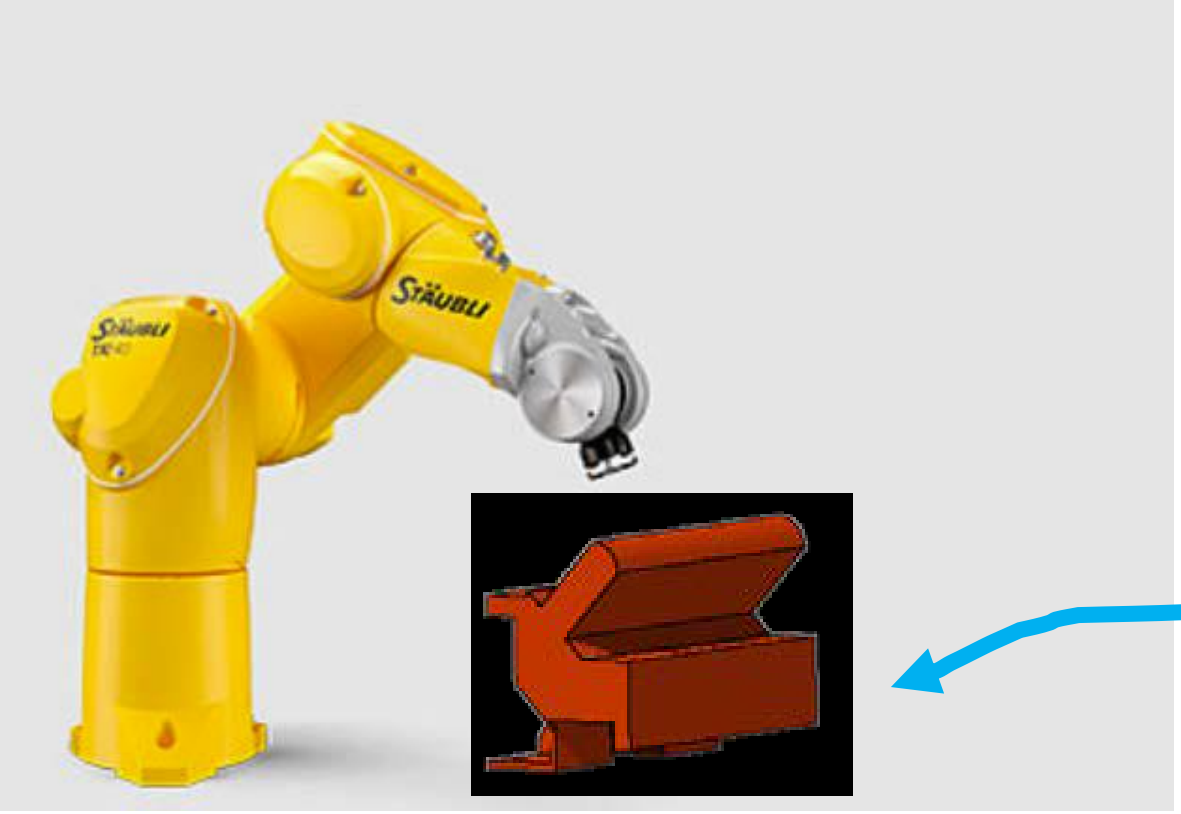
to specific areas for
activation measurements

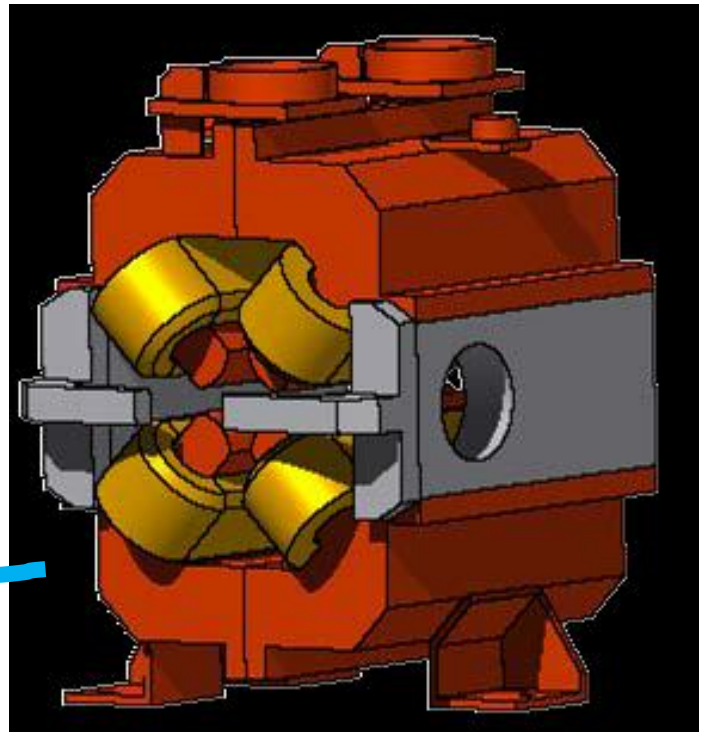
and (eternal ?) storage


is this
the end ?
funeral cortege … ?


the men in black


Procédure de démontage des girders G30
Tâches préparatoires
Démontage des parties supérieures des aimants
Démontage de la partie supérieure du quadrupôle QD6
Démontage de la partie supérieure du sextupôle S22
Démontage de la partie supérieure du quadrupôle QF7
Démontage de la partie supérieure du sextupôle S24
Démontage de la partie supérieure du quadrupôle QD1
Démontage de la chambre à vide CV15
Démontage des parties inférieures des aimants
Démontage du quadrupôle QD6
Démontage du sextupôle S22
Démontage du quadrupôle QF7
Démontage du sextupôle S24
Démontage du quadrupôle QD1
Tâches finales





6 years of (semi-automized) activation measurements **until 2025 …**
planned on <u>all components</u> that come out of the tunnel
- cables and cable trays
- support structures
- vacuum vessels and pumps and valves
- absorbers
- magnets (totally dismounted individually)

special closed room, the robot & detector sniffing in shifts of 16/24hrs

Cables

counter-weights
in Quadrupoles

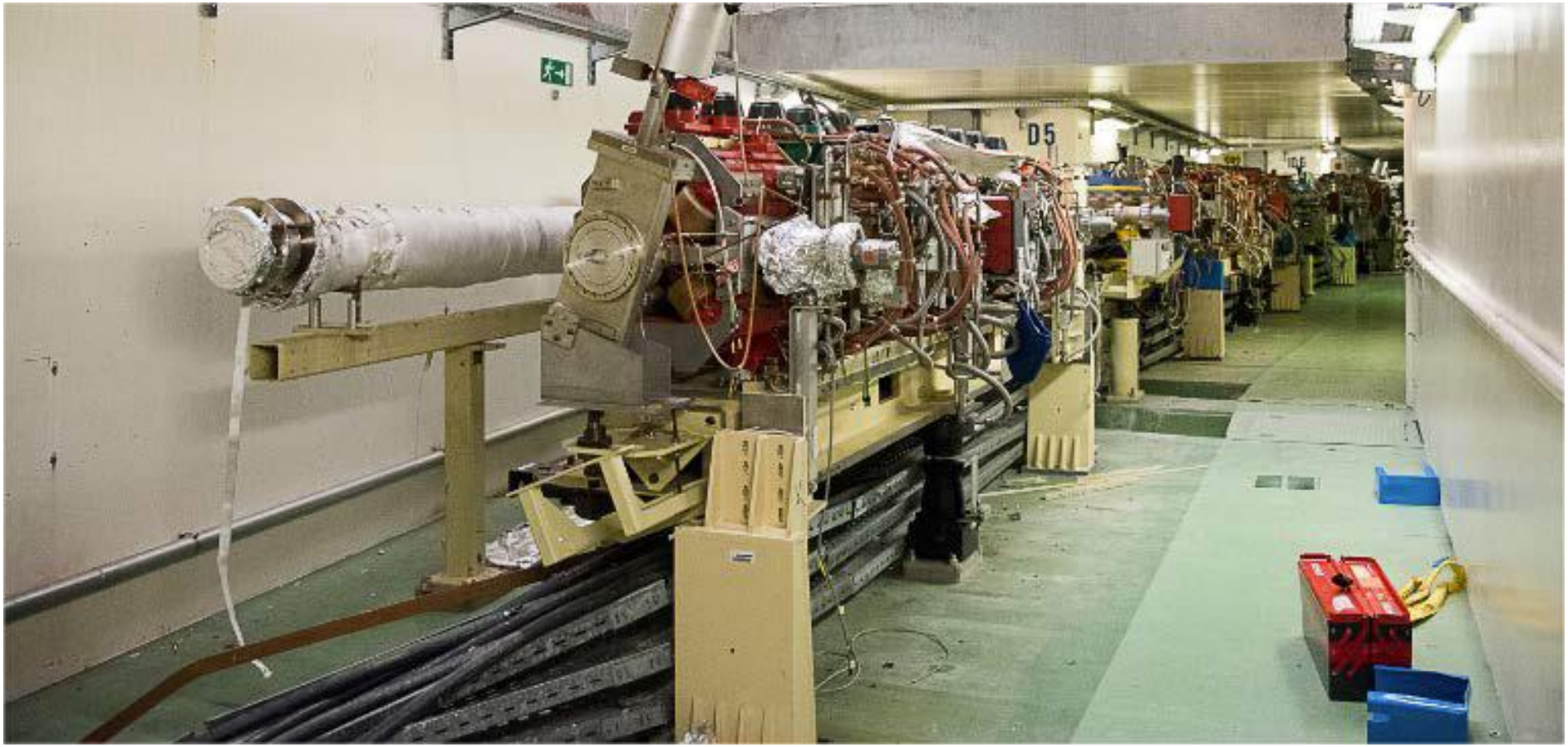
the **only** piece found activated : 4nSv/hr ….
typical natural background level : 50nSv/hr !!

fish-eye view on one of the waste storage areas (cemetery)

everything is stored,
awaiting activation measurements : 6 years !

also, everything is labelled & bar-coded

back to dismantling …



a few views in the tunnel :
1 : after removal of water services (pipes, valves) and cable trays


a few views in the tunnel :
2 : after removal of the girders

a few views in the tunnel :
3 : only the fixation plates remaining

a few views in the tunnel : 4 : grinding the floor

a few views in the tunnel : 5 : **Front-Ends** protected, ready for painting

Tunnel

the **dismantling** was done in **3-4 months**
including many civil works (renovating/preparing the tunnel)

essentially done by **external** companies (a total of 85-100 workers),
supervised by ESRF staff,
including from the ESRF scientific / experimental Division

no one got hurt ! 

planning fully respected

Technical Zones

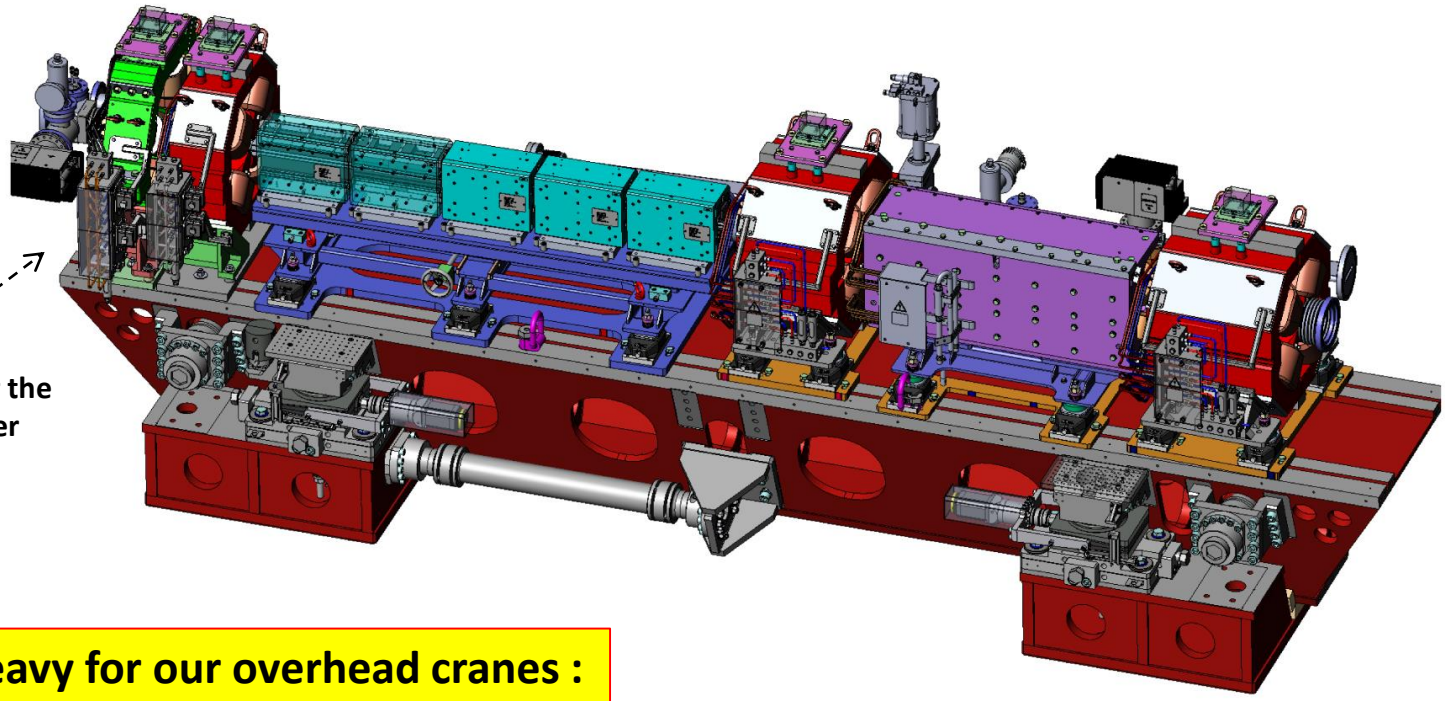
the “dismantling” work on the **technical zone side** (cubicles) was also considerable
this was recuperating & protecting equipment for re-use
and to cut & remove all old cables
essentially done by ESRF staff (colleagues responsible for the equipment)

the 128 girders were assembled and pre-aligned in a new dedicated building in 2017 & 2018
90 of these had to be temporarily stored off-site (>40km) due to lack of space

orthogonal heptapod

- 4 motorized adjustable supports in vertical direction
- 3 manual horizontal jacks (1 longit. and 2 radial)
- Girder material: carbon steel
- Typical thickness: 30mm (20-50)
- Piece junction: full penetration and continous welding

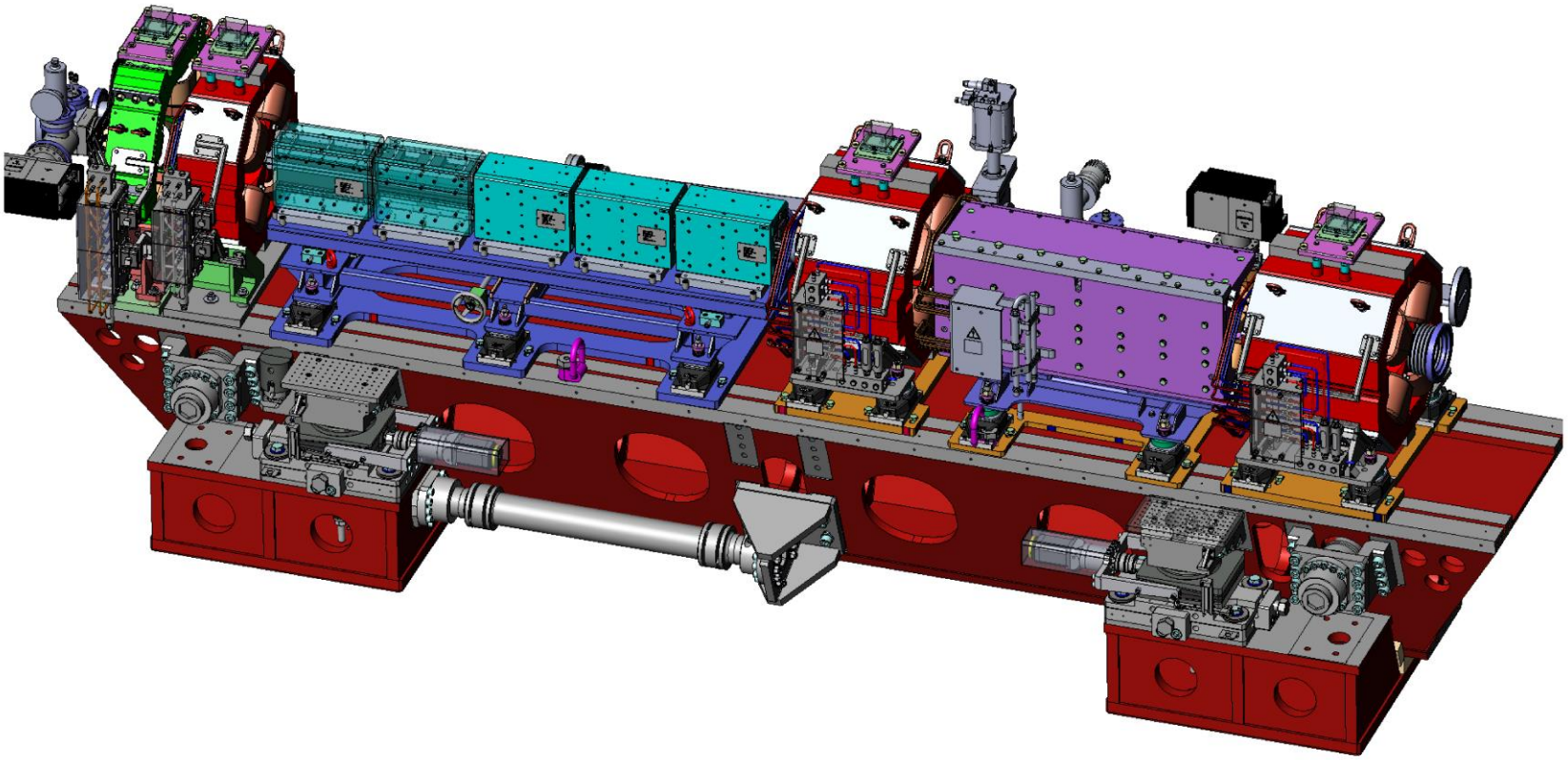
- Girder length = 5.1m
- Girder weight ~ 3500kg
- magnets weight ~ 6000kg
- motorized Z adjustment resolution 5µm
- manual Y adjustment resolution 5µm
- 1st natural frequency > 50Hz



+/- 50um flatness over the full surface of the girder

too heavy for our overhead cranes : this complicates the handling & transportation & installation

all the vacuum chambers & equipment had also been tested under bake-out conditions, incl. BPM-blocks



now to be entered into the ESRF tunnel, **via roof access**, in April & May 2019 using **only three** such specific entries

and then **driven** to their final position with a **special vehicule**

this complex girder installation of **128 units** was completed in just **24 days** ...

Storage in Chartreuse Hall (ESRF-extended Experimental Hall) → only 21 storeable
→ 90 others stored **off-site**

special gantry cranes

able to lift the girder

from a entry-zone in the Experimental Hall

into the Tunnel

only 3 such entry-zone existed

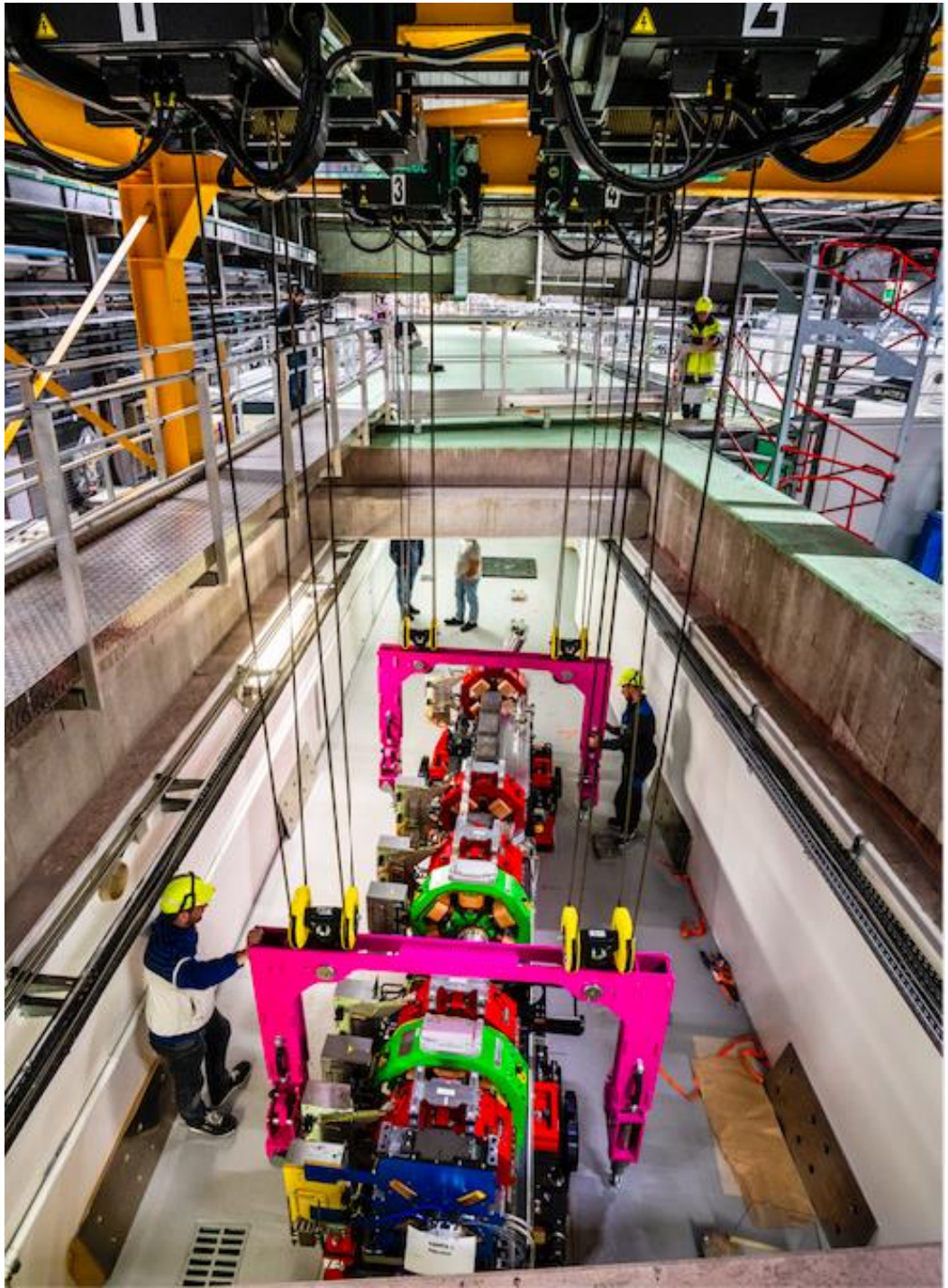
to get the 128 girders into the 850m tunnel circumference

exp. hall

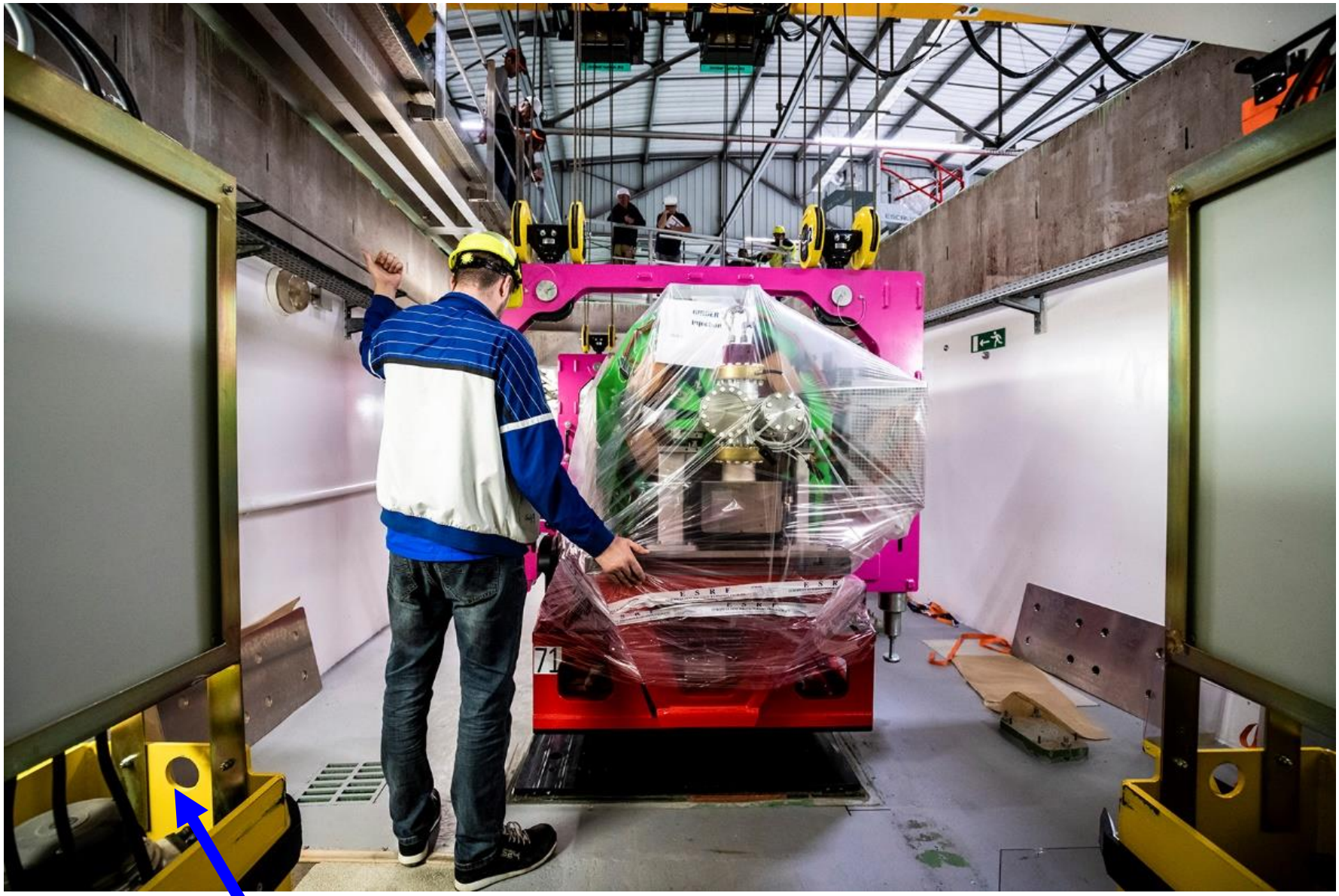
tunnel

tunnel wall


EUROBLOC
1
EUROBLOC
EUROBLOC
2
EUROBLOC
4



descending into the tunnel



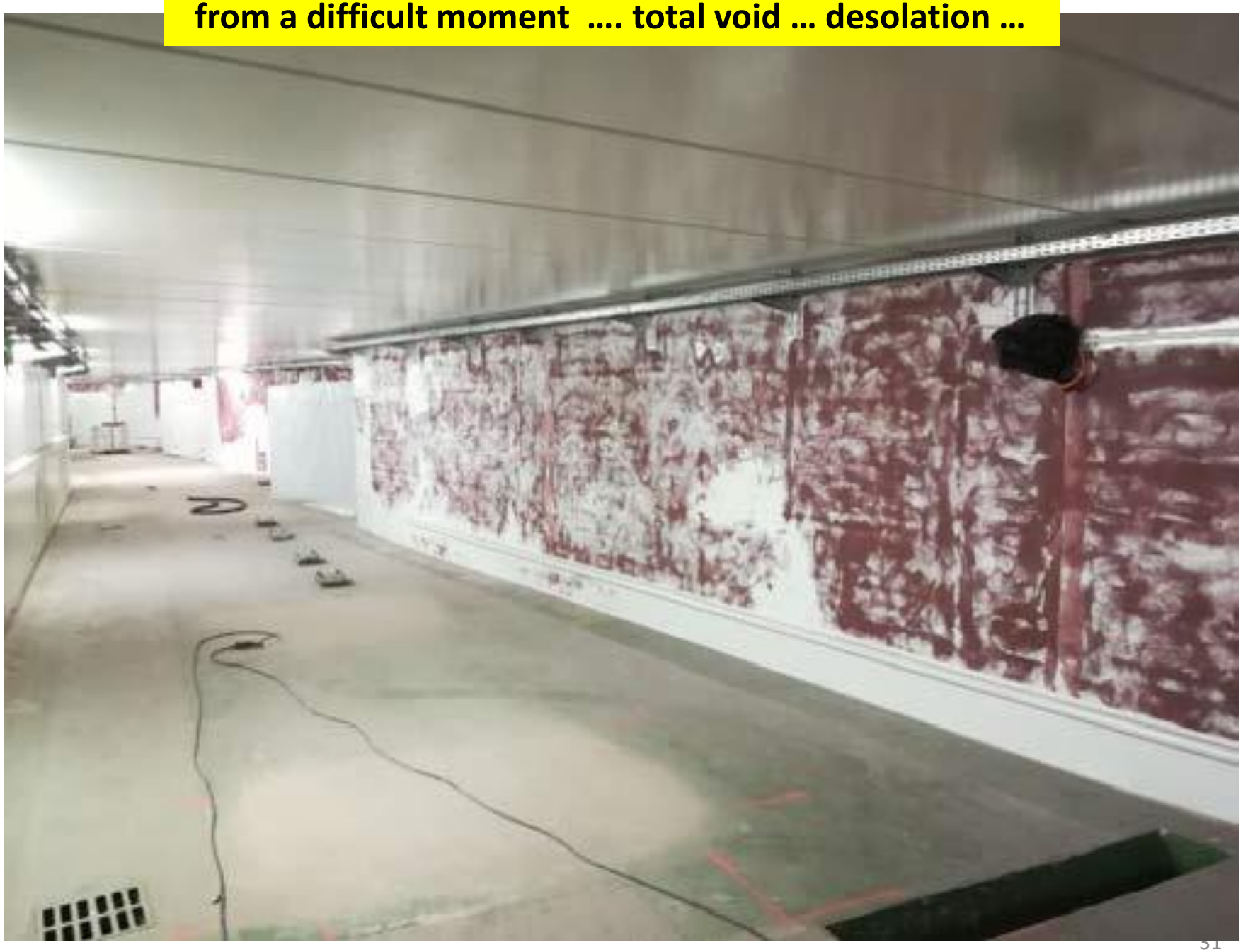
Taxi is waiting ….

descending into the tunnel

vehicule picking-up the girder …. ready for a drive (upto 300m) …

can it get any tighter … ?

from a difficult moment …. total void … desolation …



back to life !! or at least hope …

staff doing alignment & survey work

all girders, all magnets etc. installed … but are we ready ??

the **installation is NOT finished**
OK : the 128 girders are now all in place, rough alignment & survey controls done
and also these (numerous) chambers that interconnect the girders

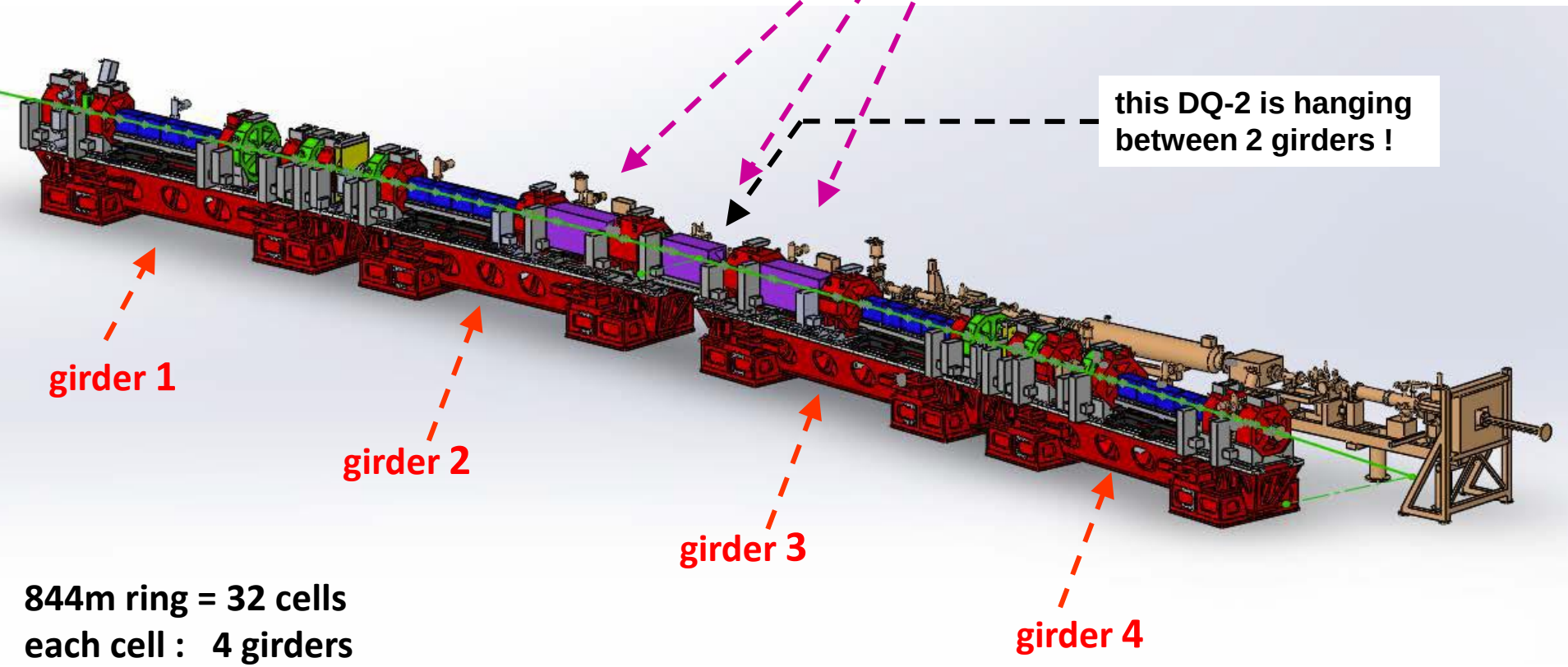
and again : nobody got hurt ! 

planning so far respected

NO *show-stoppers* ahead, although some delivery delays on e.g. Kicker chambers but alternative solutions being prepared

<u>still to be done (and underway) :</u>
- Water-piping (services)
- Cable trays
- Cables
- Connectorizations
- Alignment & survey tasks
- IDs-installation, Front-Ends to be re-connected
- Equipment tests : Power-Supplies, Vacuum, **Diagnostics**, RF, HLS-alignment etc.
- Tests on connectivity, polarity, calibrations (e.g. in-situ Lambertson on 320 BPMs)
- Vacuum bake-outs
- Tests of software & device-servers

→ **injection into new Ring planned in 1rst week of December**



844m ring = 32 cells

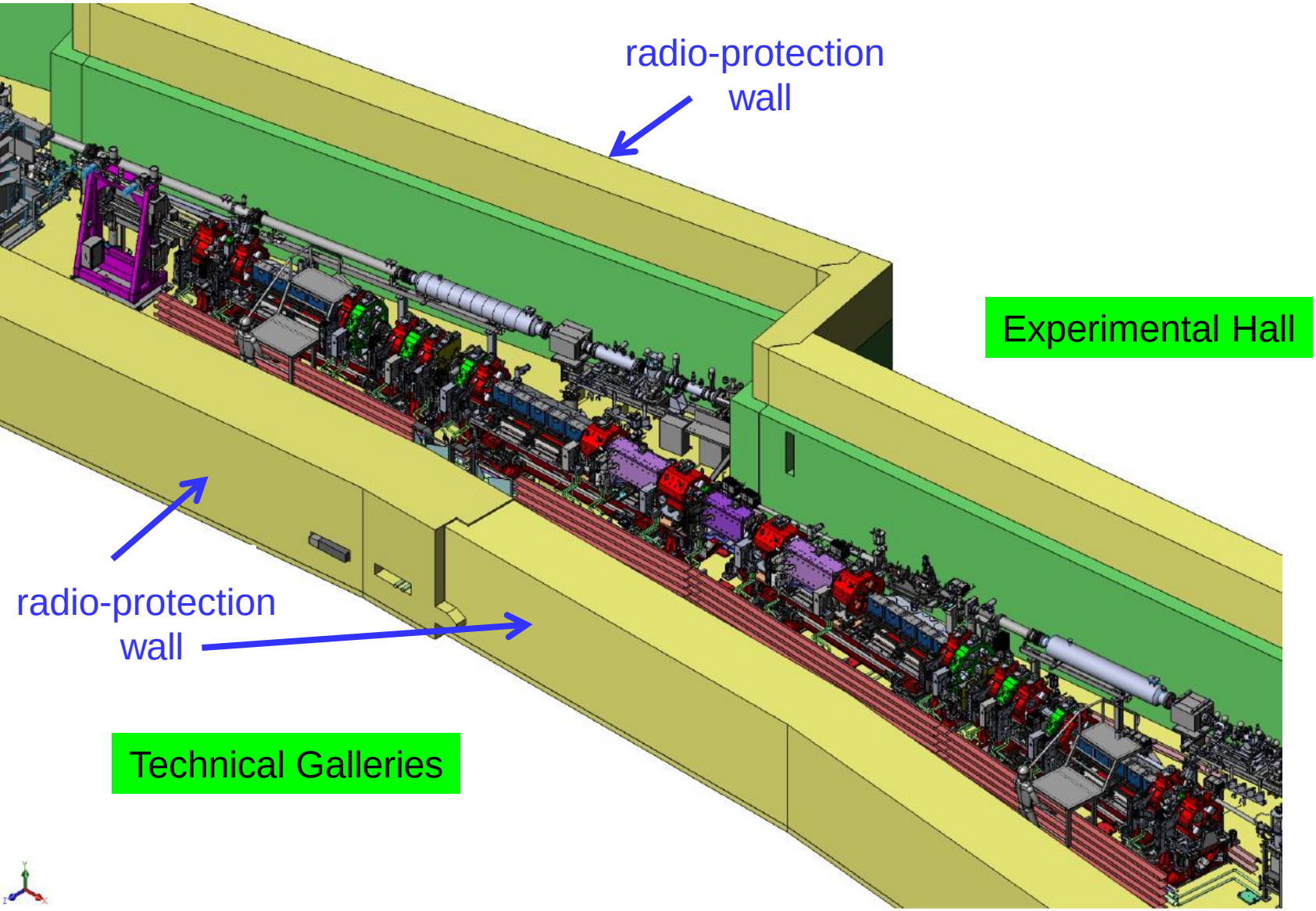
each cell : 4 girders

- 4 permanent magnets
- 3 combined dipole/quadrupole
- 16 quadrupoles
- 6 sextupoles (incl. 6 H & V steerers & 6 skew-quads, slow)
- 2 octupoles
- 3 fast steerers (H & V)
- 10 BPMs

vacuum pipe size :

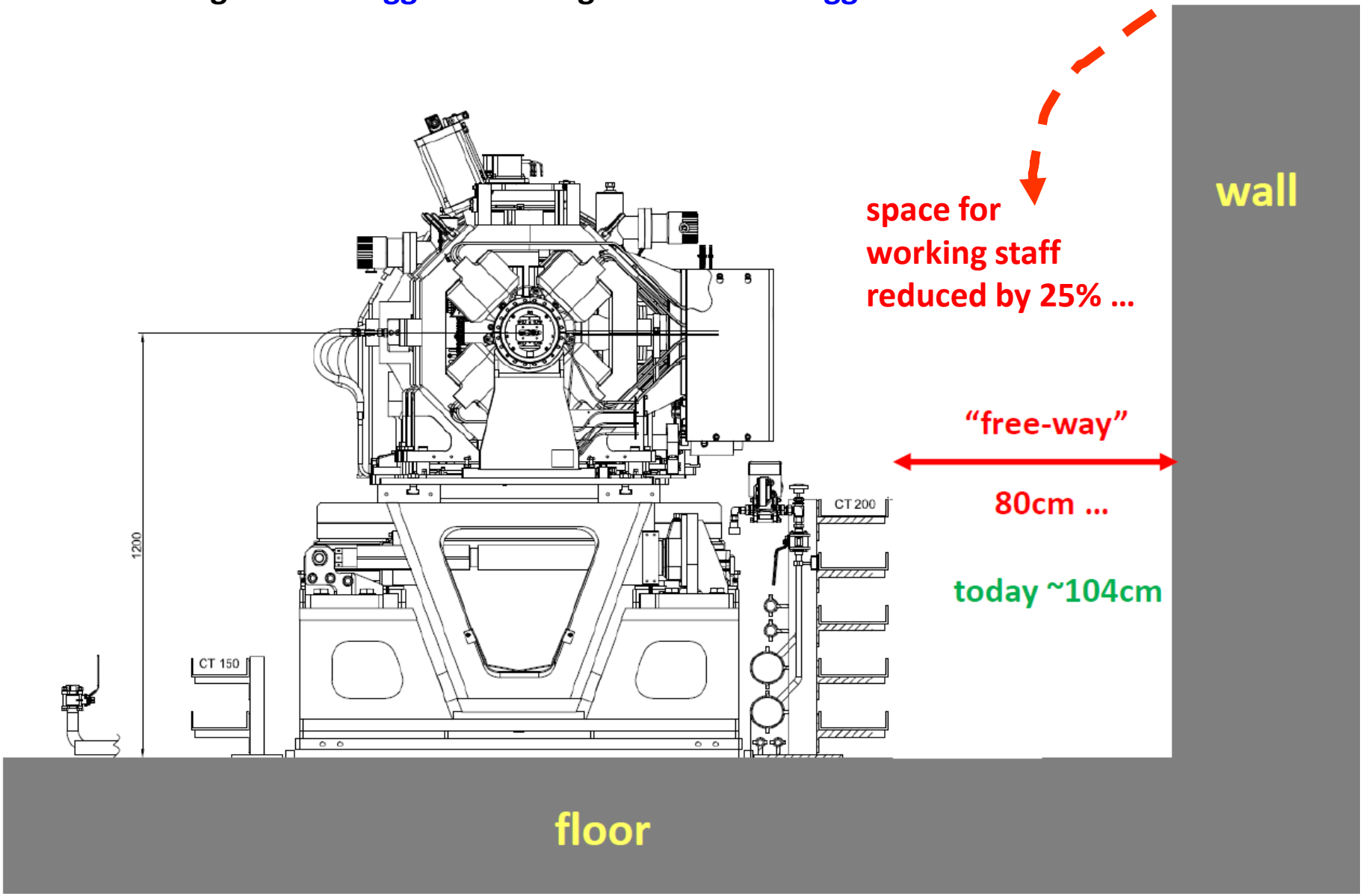
- Small , in the center
- Larger , at the extremes

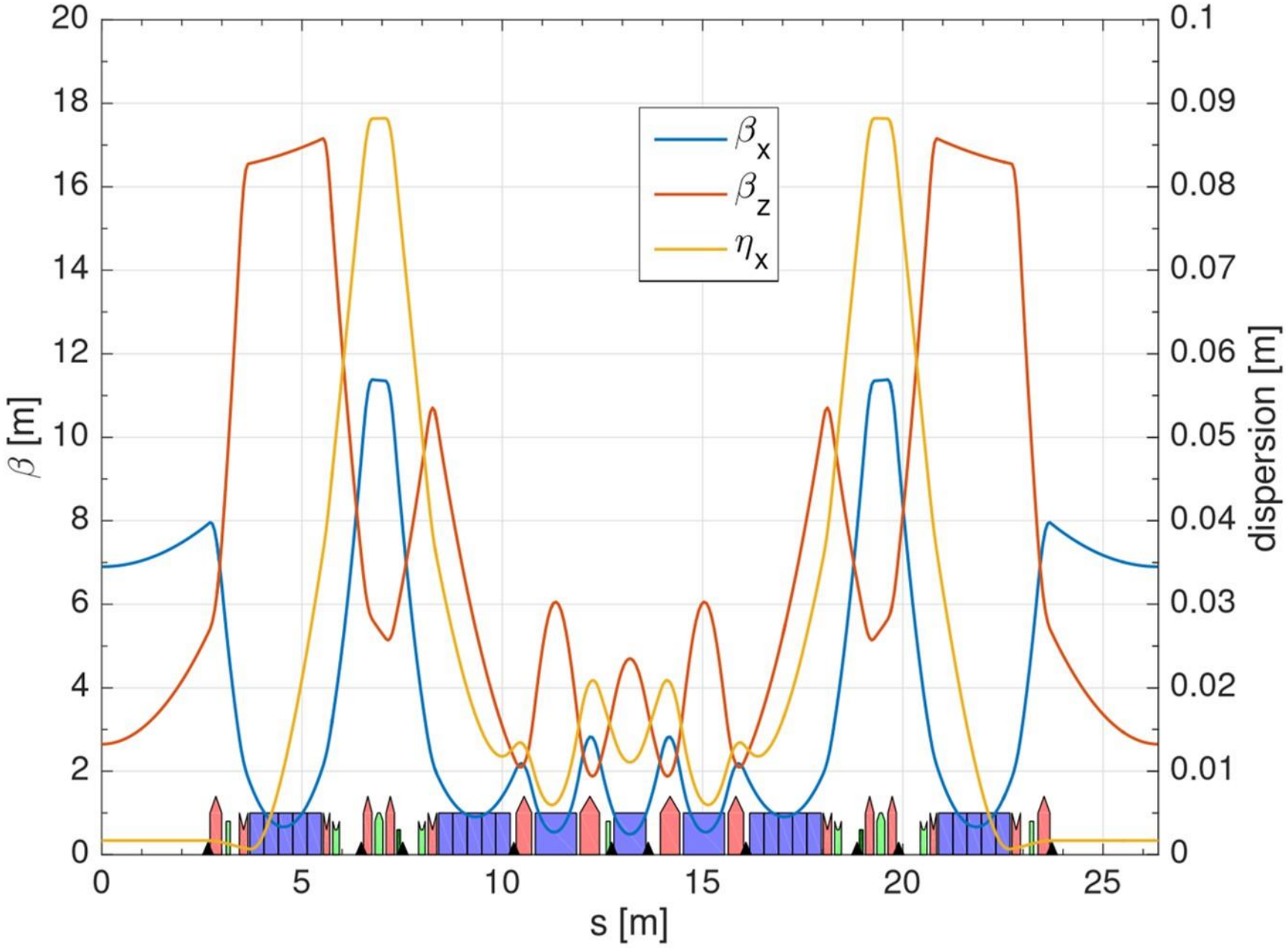
challenges : the **narrow** existing tunnel



small emittance → small beam size → small beam-pipe → Yes, **small …**

but : magnets are bigger and the girder is much bigger ….




β_x
β_z
η_x
β [m]
dispersion [m]
s [m]
0
2
4
6
8
10
12
14
16
18
20
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
0
5
10
15
20
25

44 beamlines to commission:

- **31** public ESRF beamlines with 35 endstations
- **13** CRG beamlines on BM ports

ESRF beamlines:

- 26 ID ports with 4 canted straight sections
- BM05 – 2-pole wiggler, mark A
- BM23 – 2-pole wiggler
- BM29 – 2-pole wiggler, mark B
- BM18 – 3-pole wiggler (high field)

CRG beamlines: 13 BM ports

- 7 single bend magnets
- 3 2-pole wigglers, mark A
- 3 2-pole wigglers, mark B

majority of **Insertion Devices (IDs) : 26** but **Bending Magnet sources (17)** are not forgotten : **dedicated wigglers**

DEELS 2019,
ESRF June 3-5

Kees SCHEIDT

thank you for your attention !

Next : David MARTIN
Head of ALGE group

installing a light-source with …
all the beam-lines already in place …