

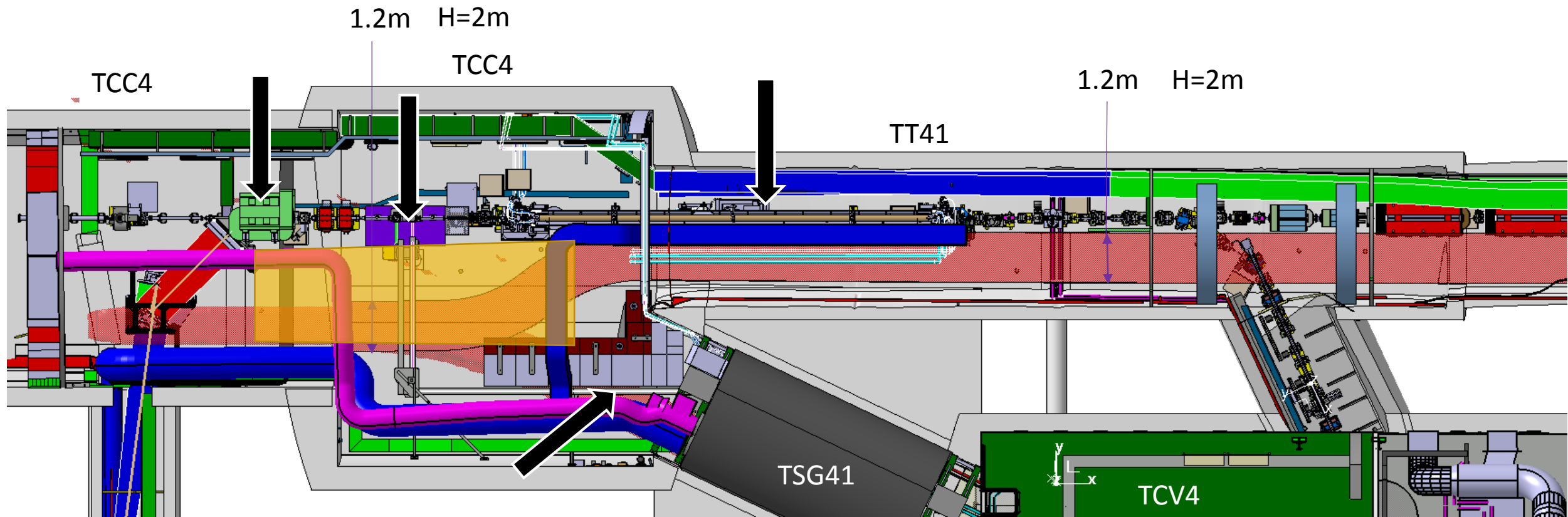
AWAKE Run 2 integration

- effect of installation, transport issues
- comparison of 3 versions

Outline

- Introduction:
 - AWAKE Run 1 transport volume
 - AWAKE-SPS dependency
 - TT43 tunnel
 - Crane in TCC4
 - Parameters for comparison of different integration versions
- Presentation of 3 integration versions:
 - diagonal
 - parallel compact
 - parallel liberty
- Summary table
- Conclusion

AWAKE Run 1 : transport volume

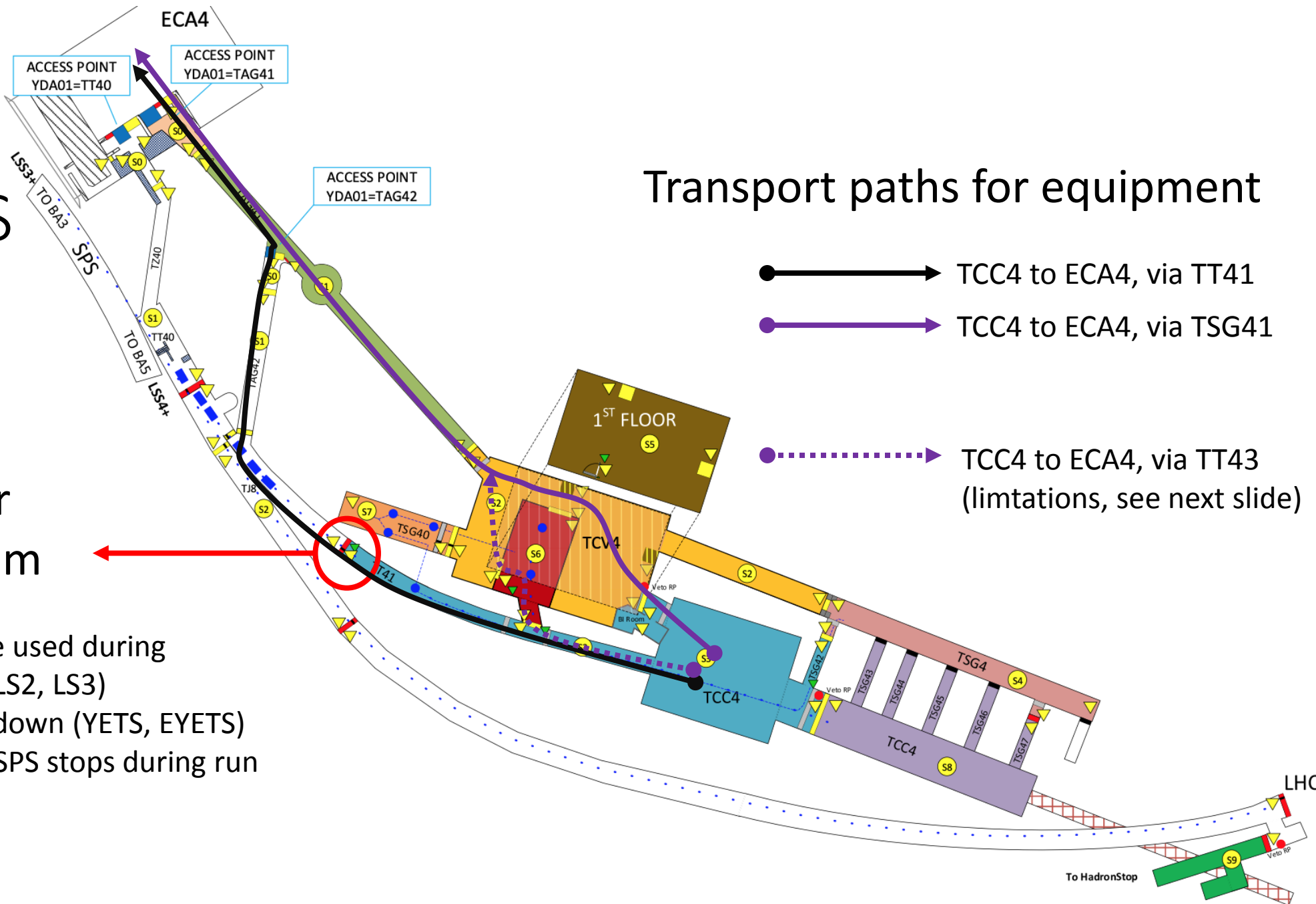


A 1.2m wide and 2m high **transport volume** as shown above is kept free in the run 1 layout. It allows, after shielding removal, to install or remove equipment from TCC4 (or TT41) via TSG41, TCV4 and TAG41, and therefore **independent from SPS operation**. Note also the large **“transfer area”** (from crane to trailer or vice-versa) in upstream TCC4.

AWAKE / SPS dependency

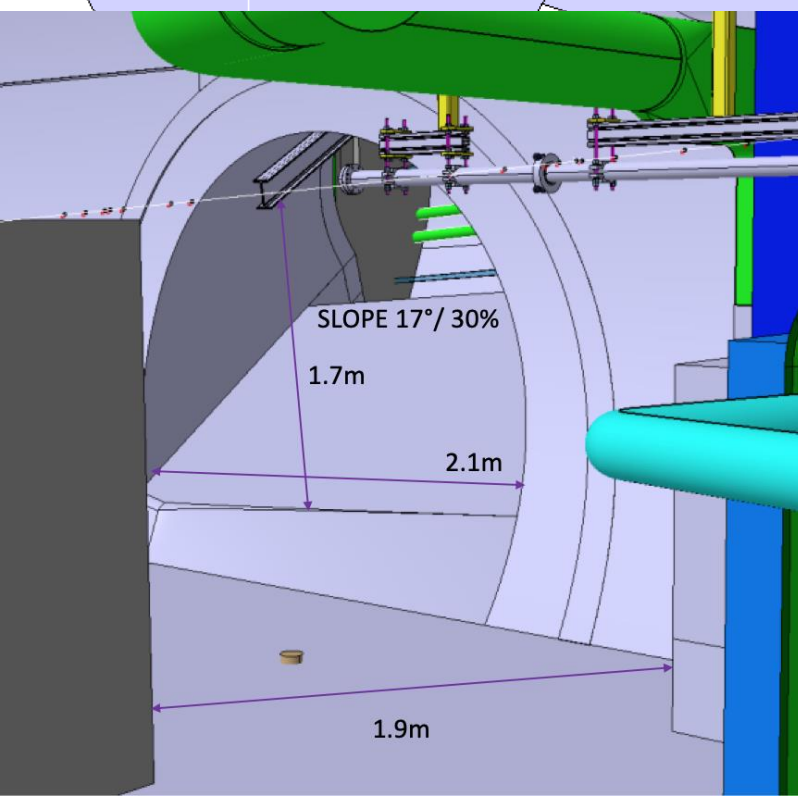
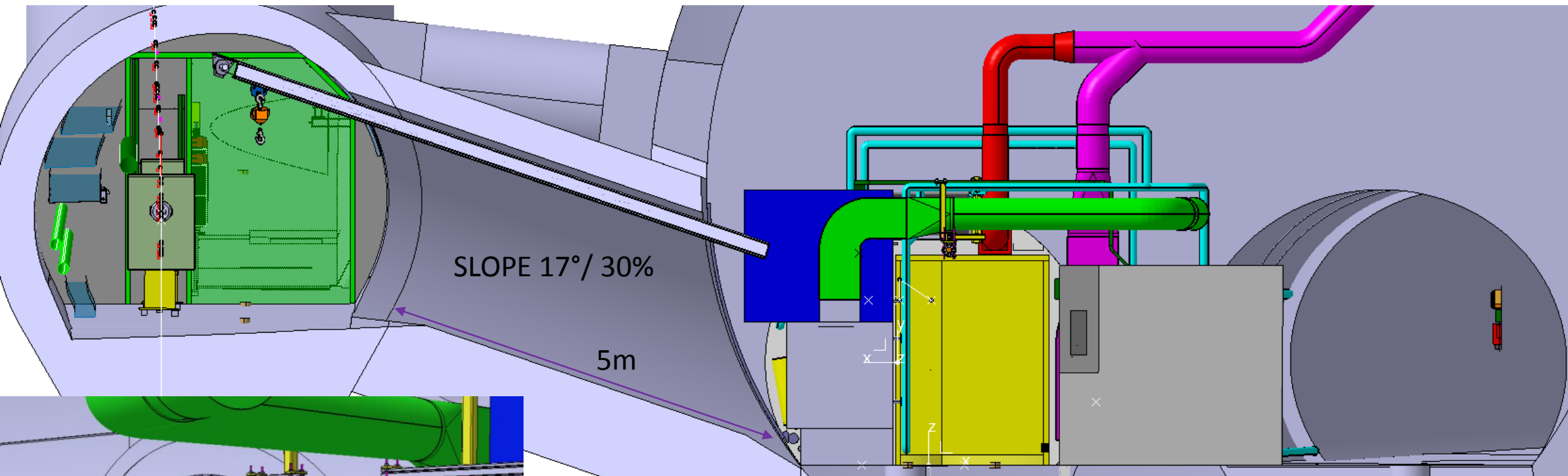
Opening this door stops the SPS beam

- This passage can only be used during
 - Long shutdown (LS2, LS3)
 - End-of-year shutdown (YETS, EYETS)
 - Scheduled short SPS stops during run



Transport paths for equipment

- —→ TCC4 to ECA4, via TT41
- —→ TCC4 to ECA4, via TSG41
- - - - - -→ TCC4 to ECA4, via TT43 (limitations, see next slide)

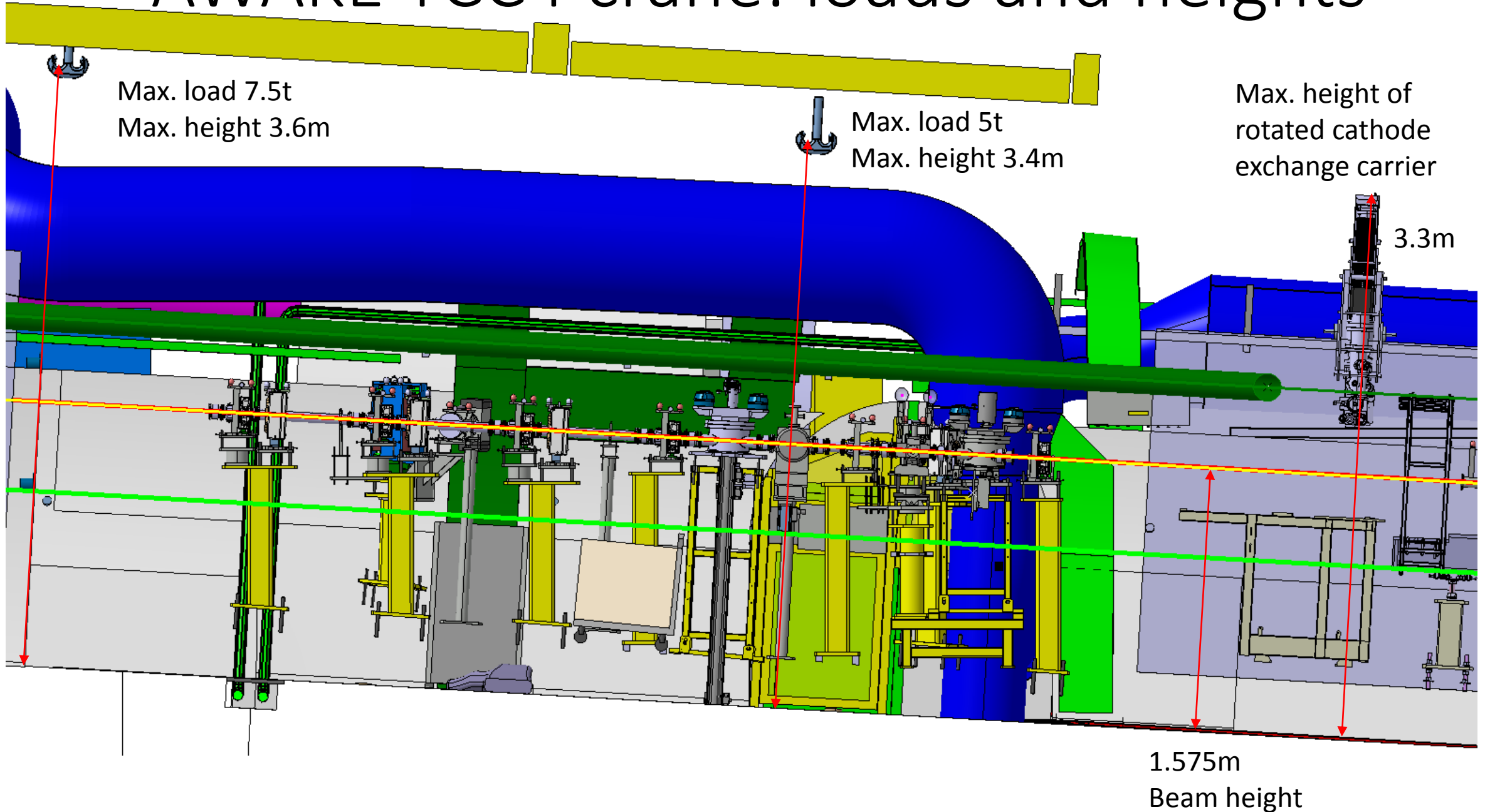


●-----> TCC4 to ECA4, via TT43

This passage has a very steep (30%) slope, and is **not suited** for transport of

- heavy items (>200kg (to be confirmed))
- long items (>1m)
- tall items (>1.2m)
- fragile or complex items

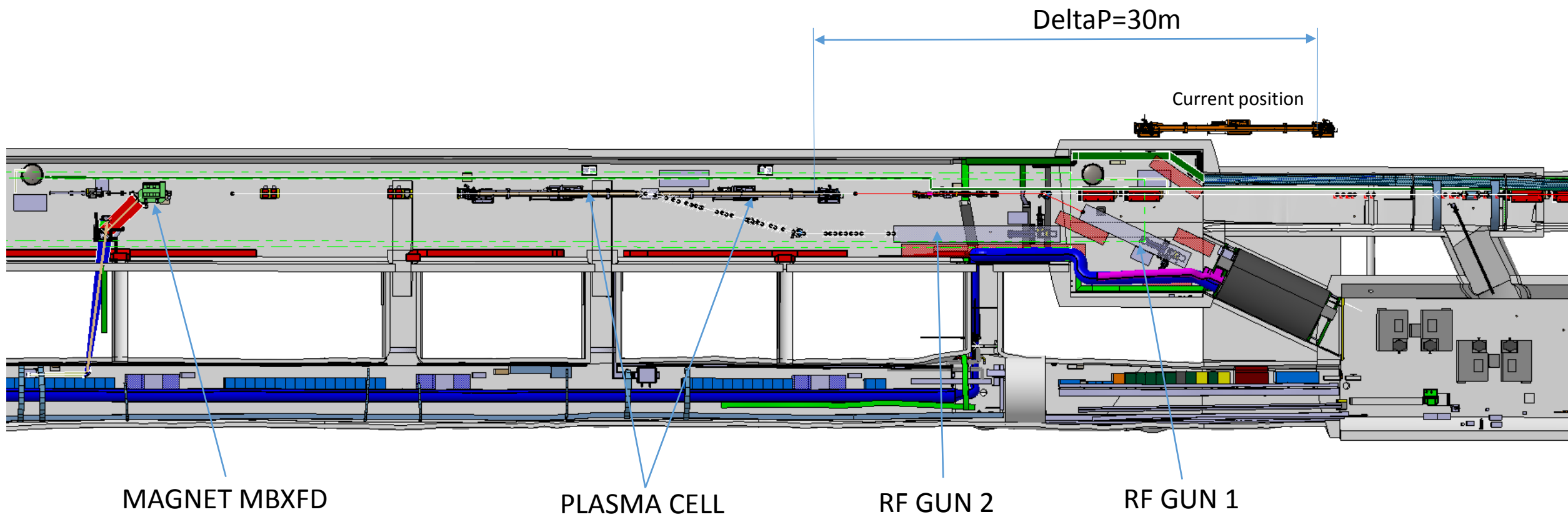
AWAKE TCC4 crane: loads and heights



Versions and comparison

- 3 layout versions in model, named after orientation of first e-source:
 - Diagonal
 - Parallel “compact”
 - Parallel “liberty”
 - Several parameters are used to compare the different versions
 - Plasma cell longitudinal shift w.r.t. run 1 = ΔP
 - Length wave guides e-sources = Lw1, Lw2
 - Accessibility of equipment in TCC4 (800mm free space for access or evacuation)
 - Transfer area in upstream TCC4 (crane to trailer)
 - Transport possibilities out from TCC4
 - Independence from SPS during AWAKE installation
 - Various (rotated cathode, ...)
- } (as in previous slides)

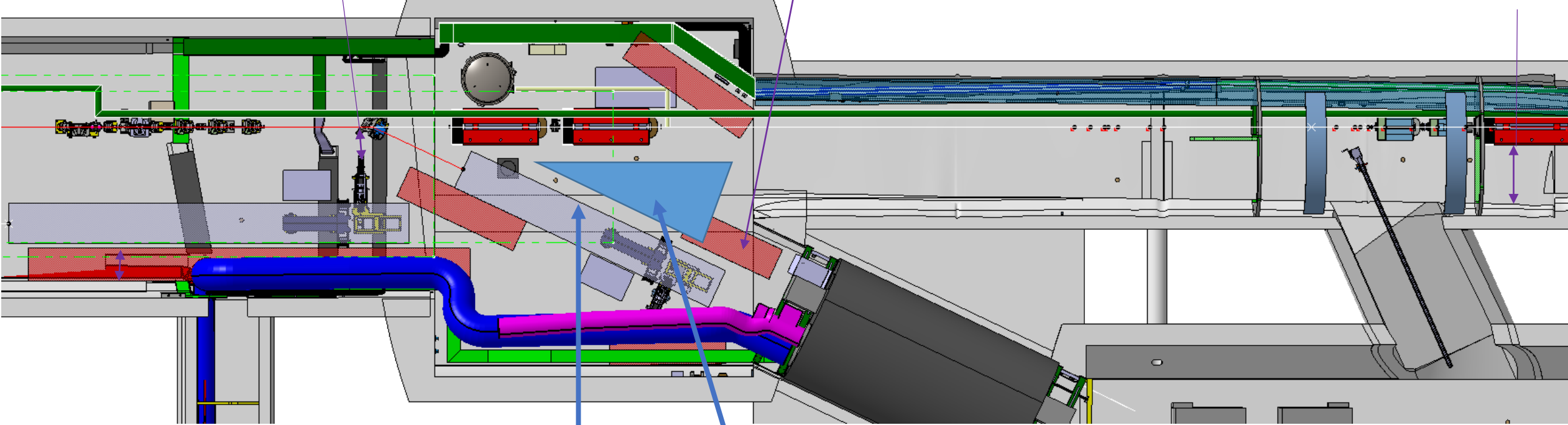
Version 1: First e-source is placed diagonally



0.5m passage only, unless rotated cathode exchange carrier

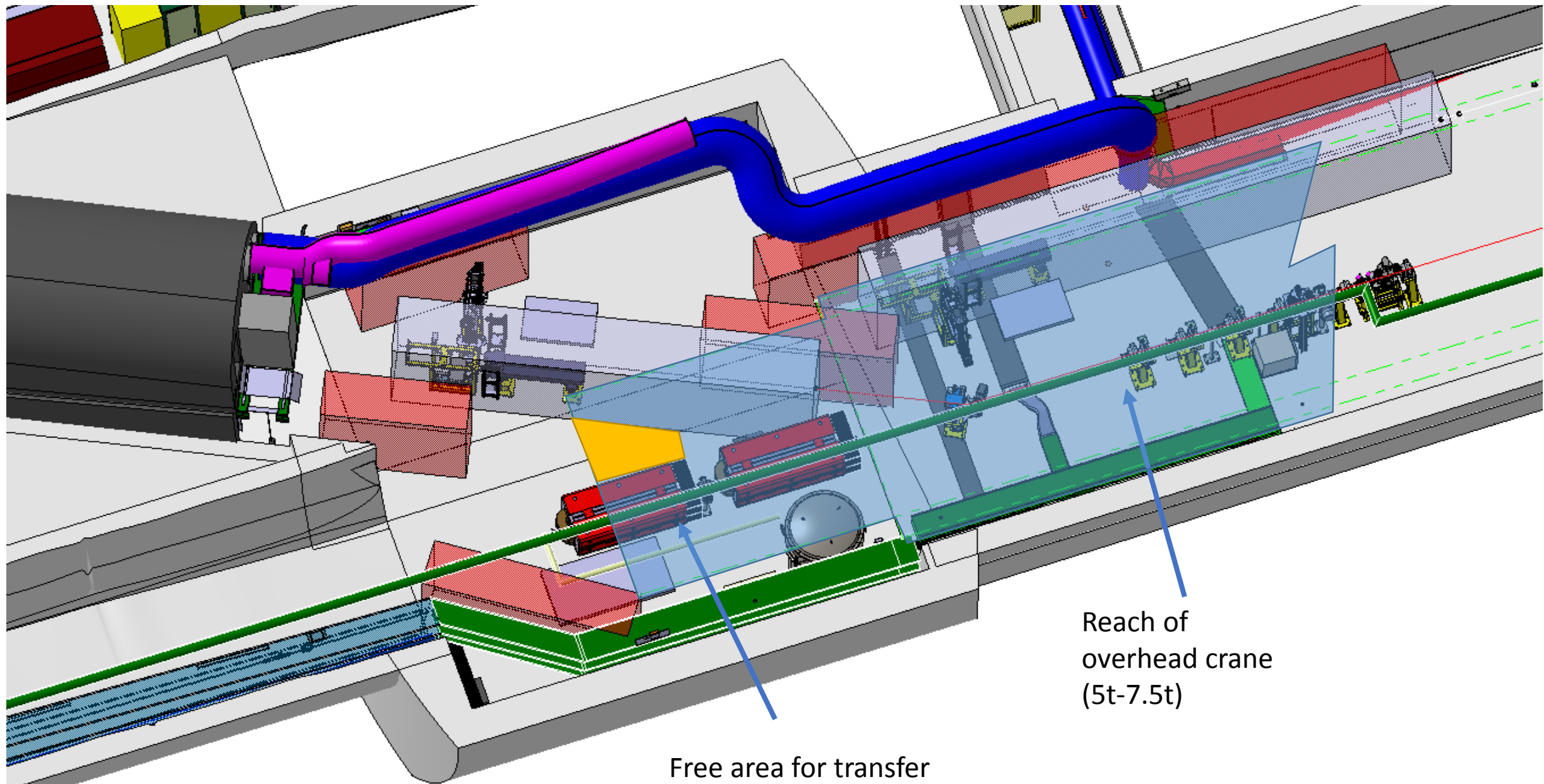
Each red box = passage with $w=0.8m$, $h=2m$

1.25m H=2m



Reach of overhead crane (5t-7.5t)

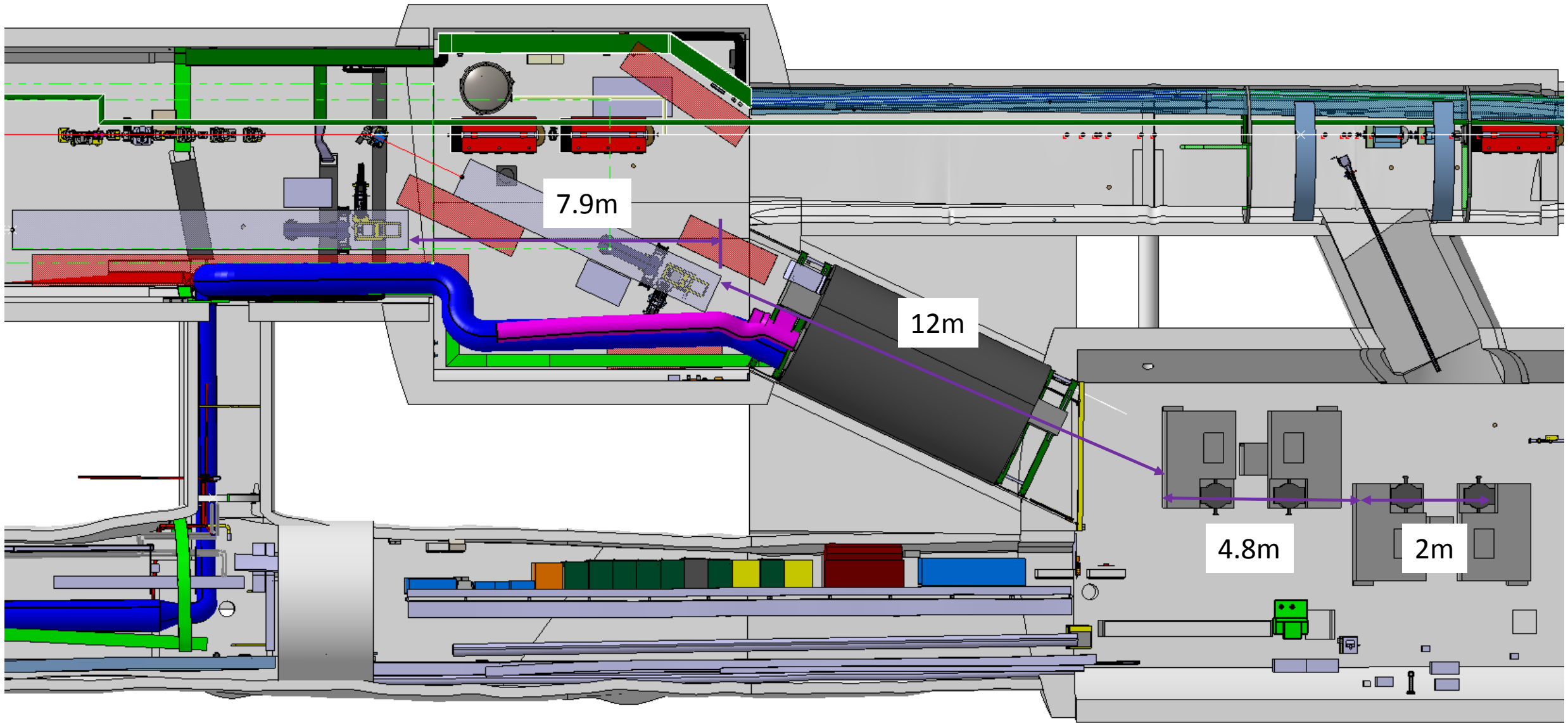
There is very little free space in upstream TCC4. Most but not all equipment is accessible via 0.8m-wide passage. There is virtually no space for additional equipment.



Reach of
overhead crane
(5t-7.5t)

Free area for transfer
of object from crane
to trailer is $\sim 1.5\text{m}^2$

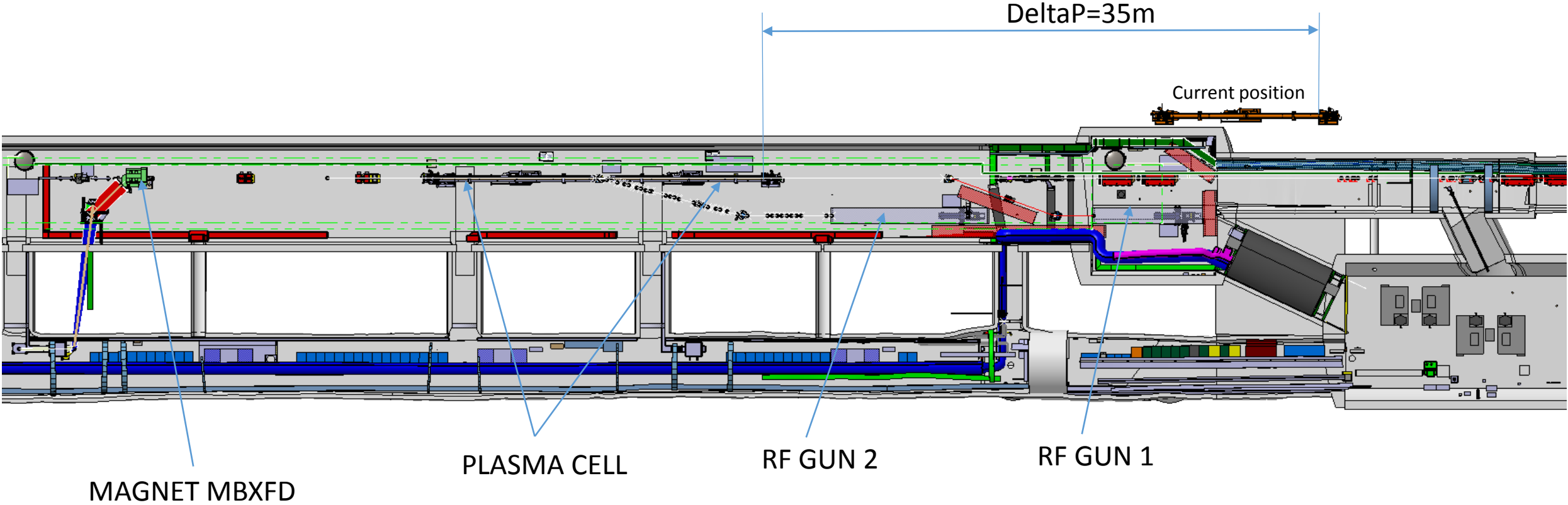
La diagonale

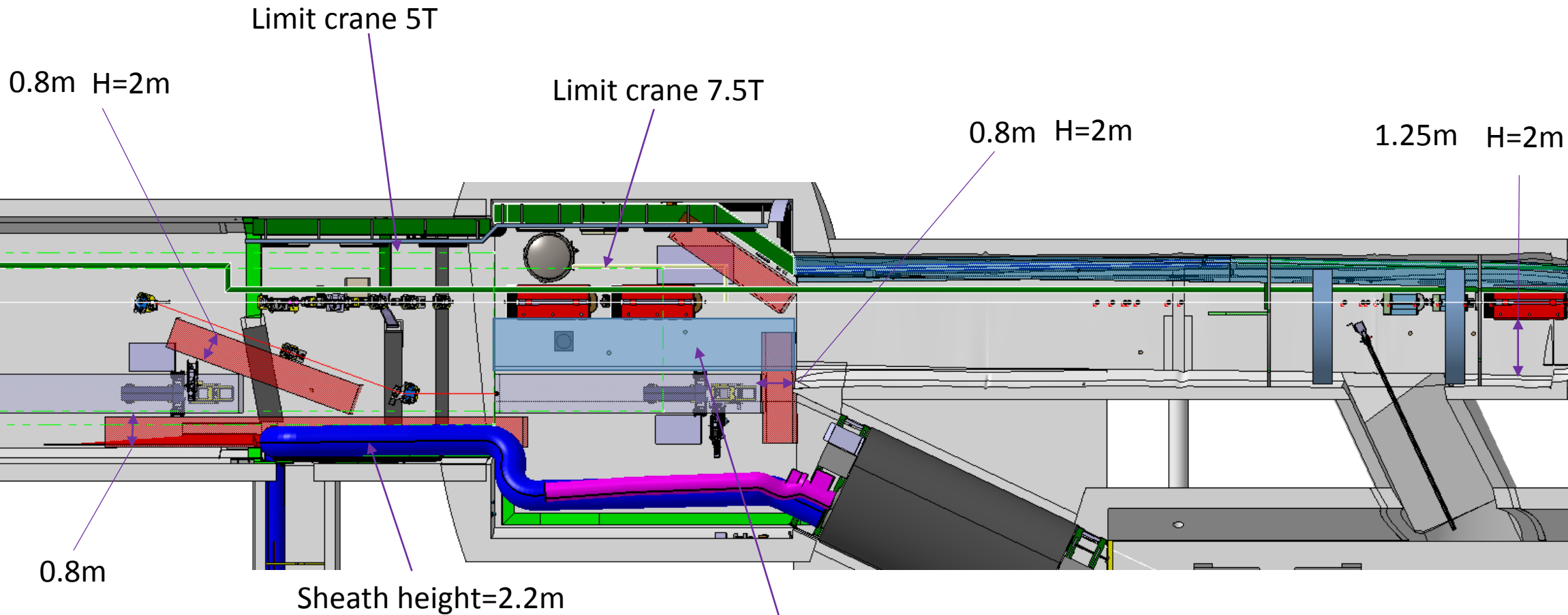


Length waveguides E-source 1 = $2+4.8+12$ + extra (2) = **20.8m = Lw1**

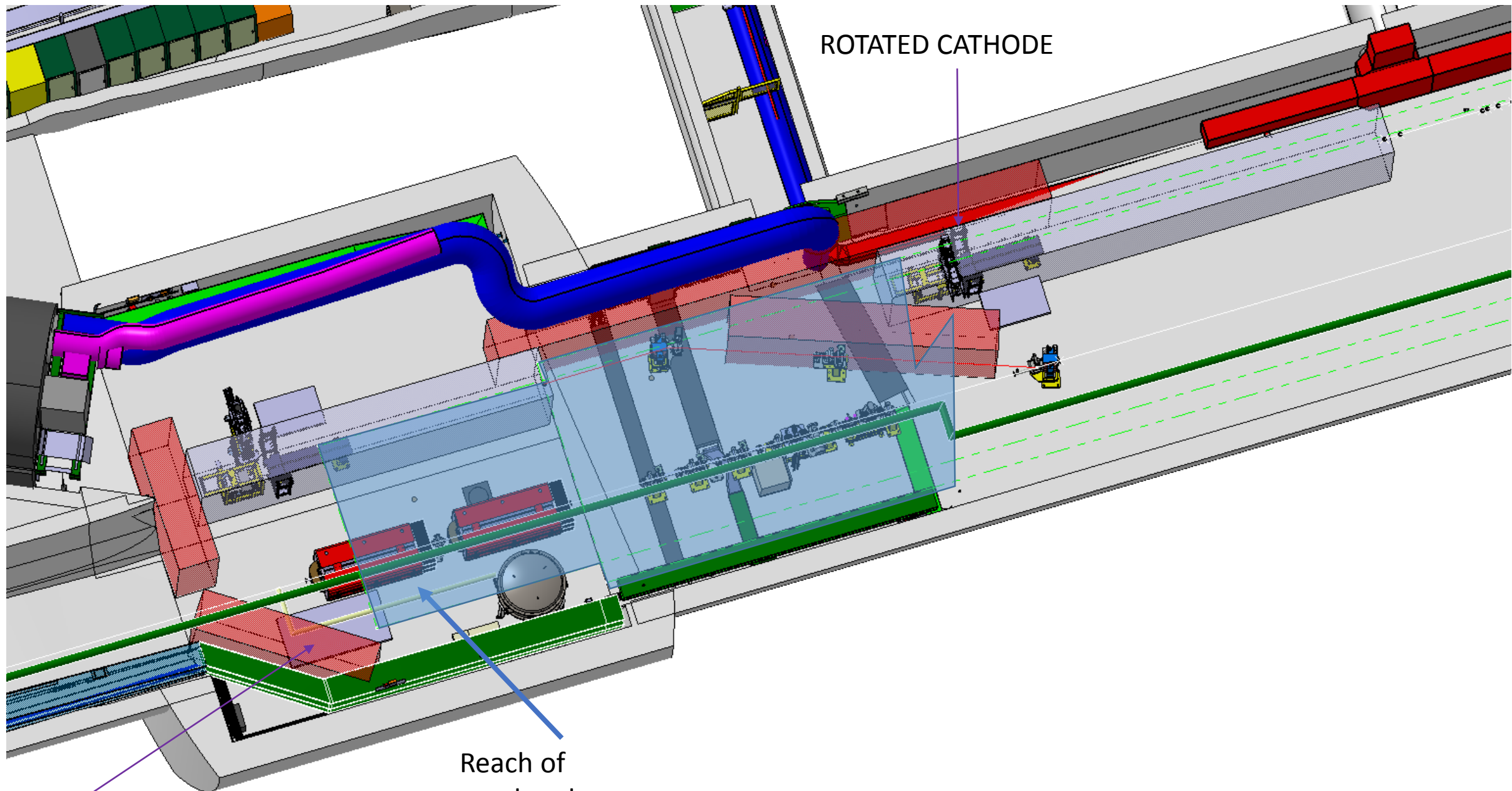
Length waveguides E-source 2 = $4.8 + 12 + 7.9$ + extra (2) = **26.7m = Lw2**

Version 2: First e-source is placed parallel to second, compact version





There is still some free space in upstream TCC4 (width ~1.2m).
In general, all equipment is easily accessible,

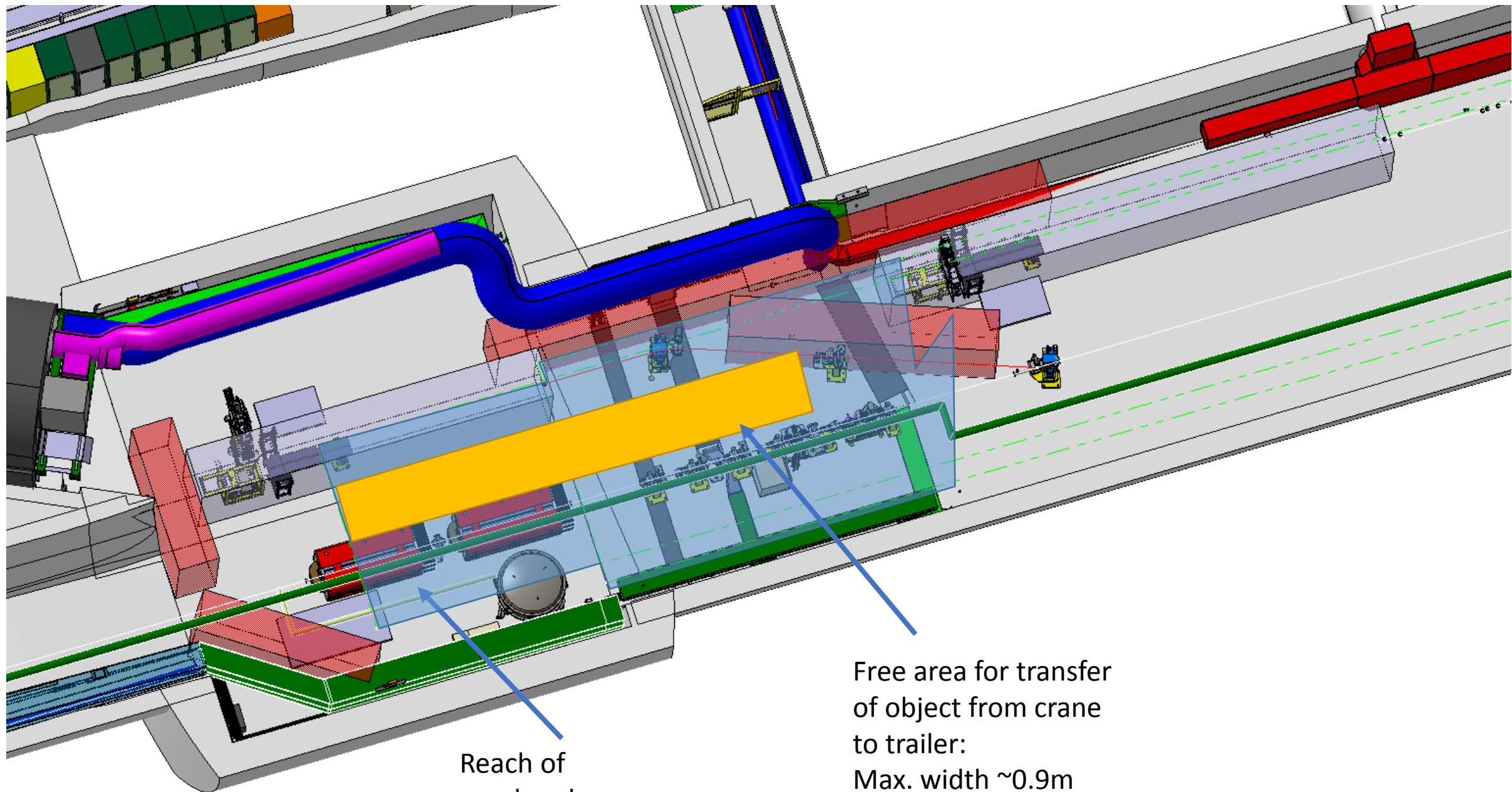


ROTATED CATHODE

Passage 800mm

Reach of overhead crane (5t-7.5t)

La Parallèle Compacte

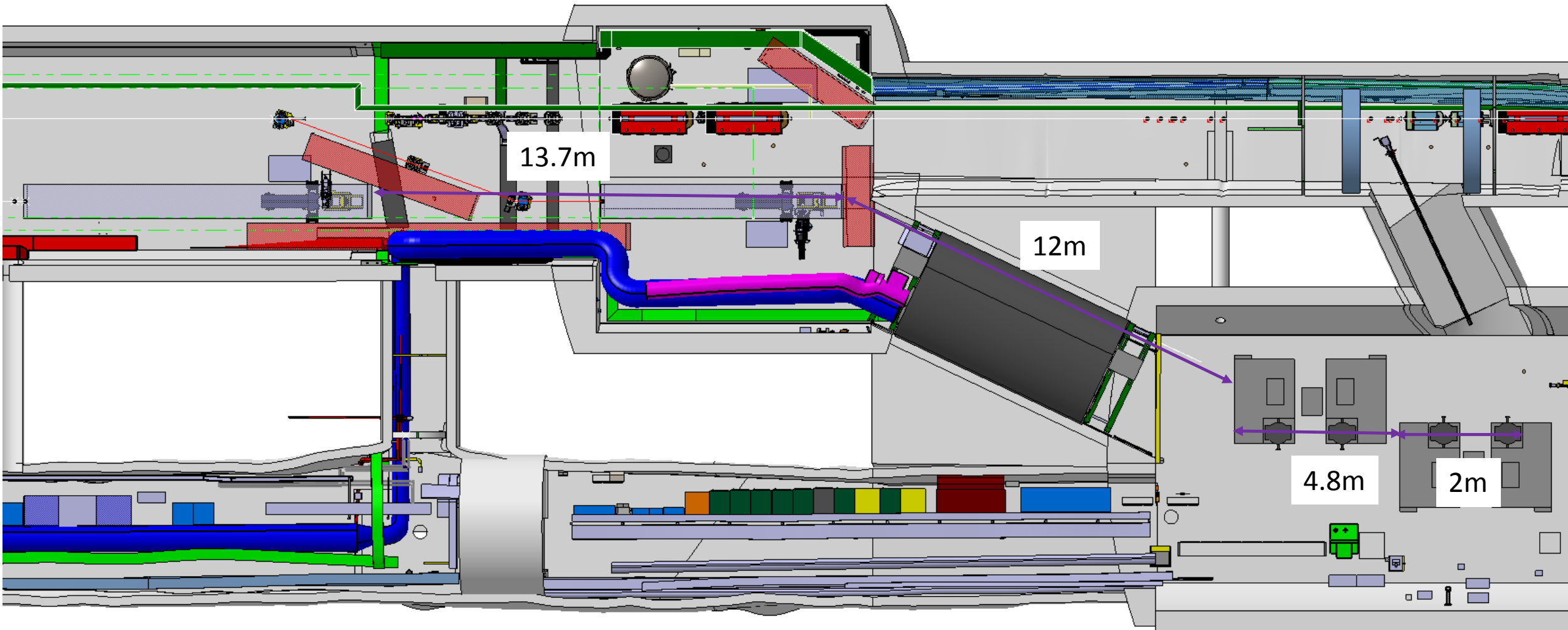


Reach of
overhead crane
(5t-7.5t)

Free area for transfer
of object from crane
to trailer:
Max. width ~0.9m

DISTANCE RF GUN - MODULATOR

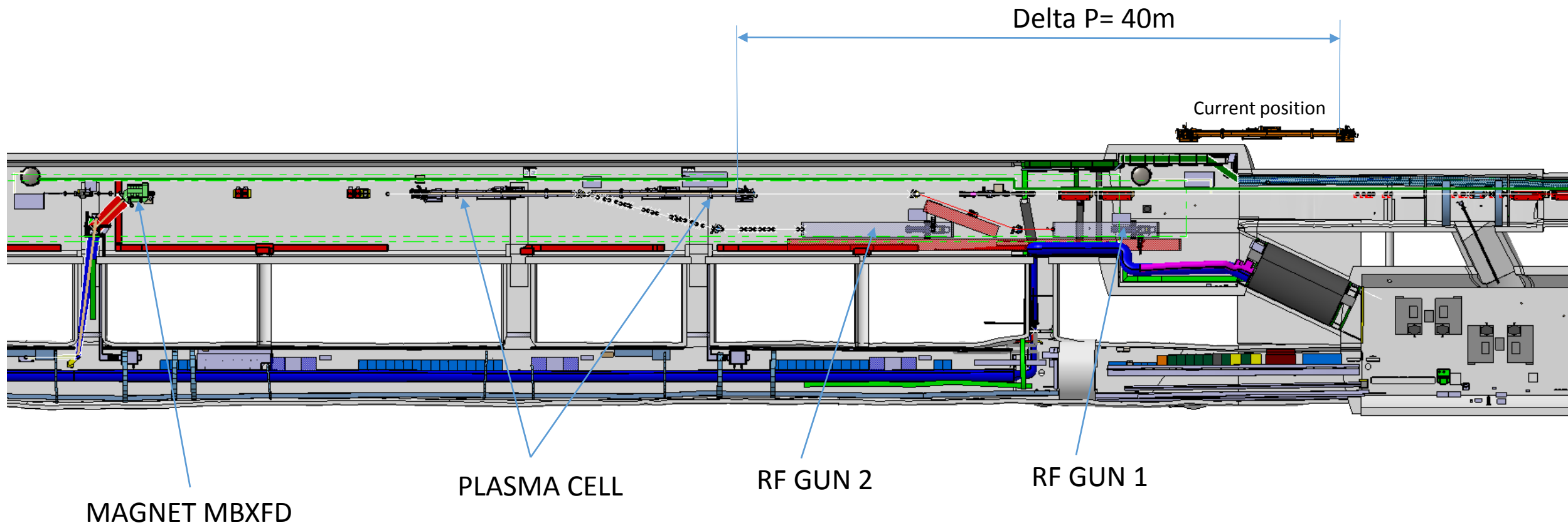
La Parallèle Compacte

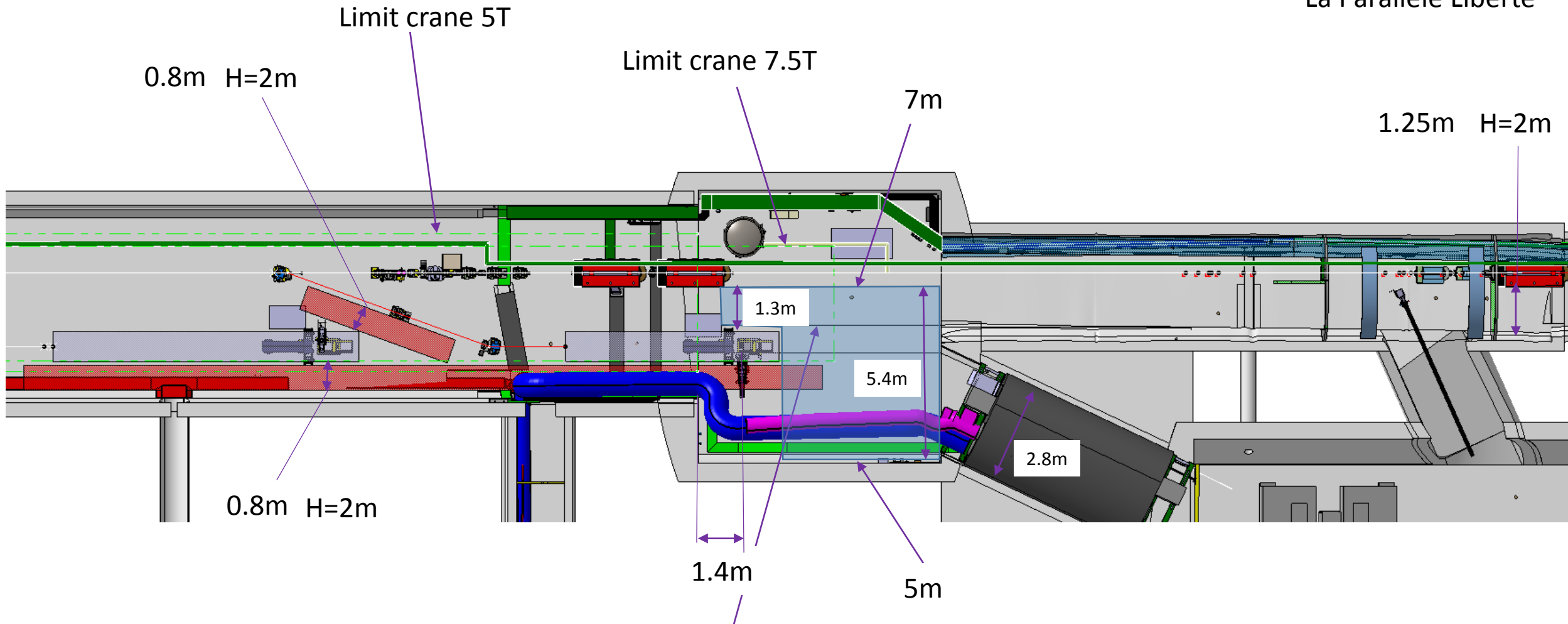


Length waveguides E-source 1 = $2 + 4.8 + 12 + \text{extra } (2) = 20.8\text{m} = \text{Lw1}$

Length waveguides E-source 2 = $4.8 + 12 + 13.7 + \text{extra } (2) = 32.5\text{m} = \text{Lw2}$

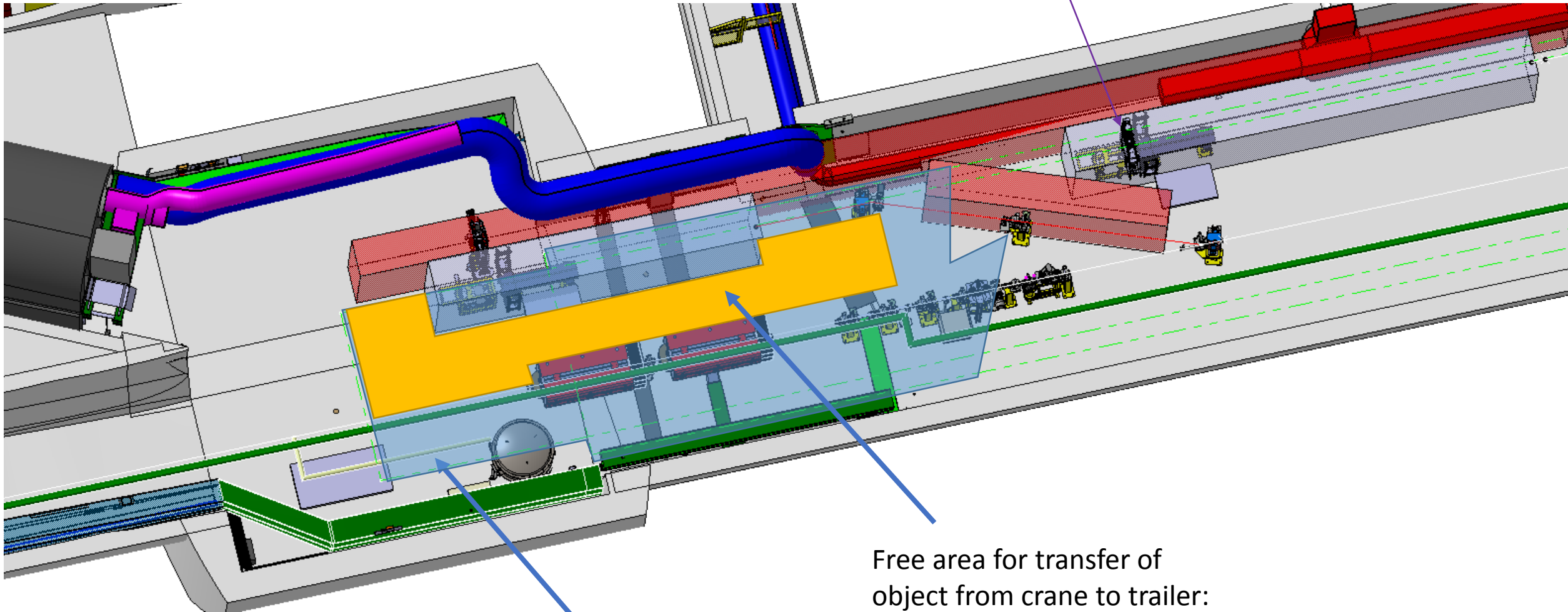
Version 3: First e-source is placed parallel to second, but shifted 5m downstream to leave TSG41 passage → « liberty » version





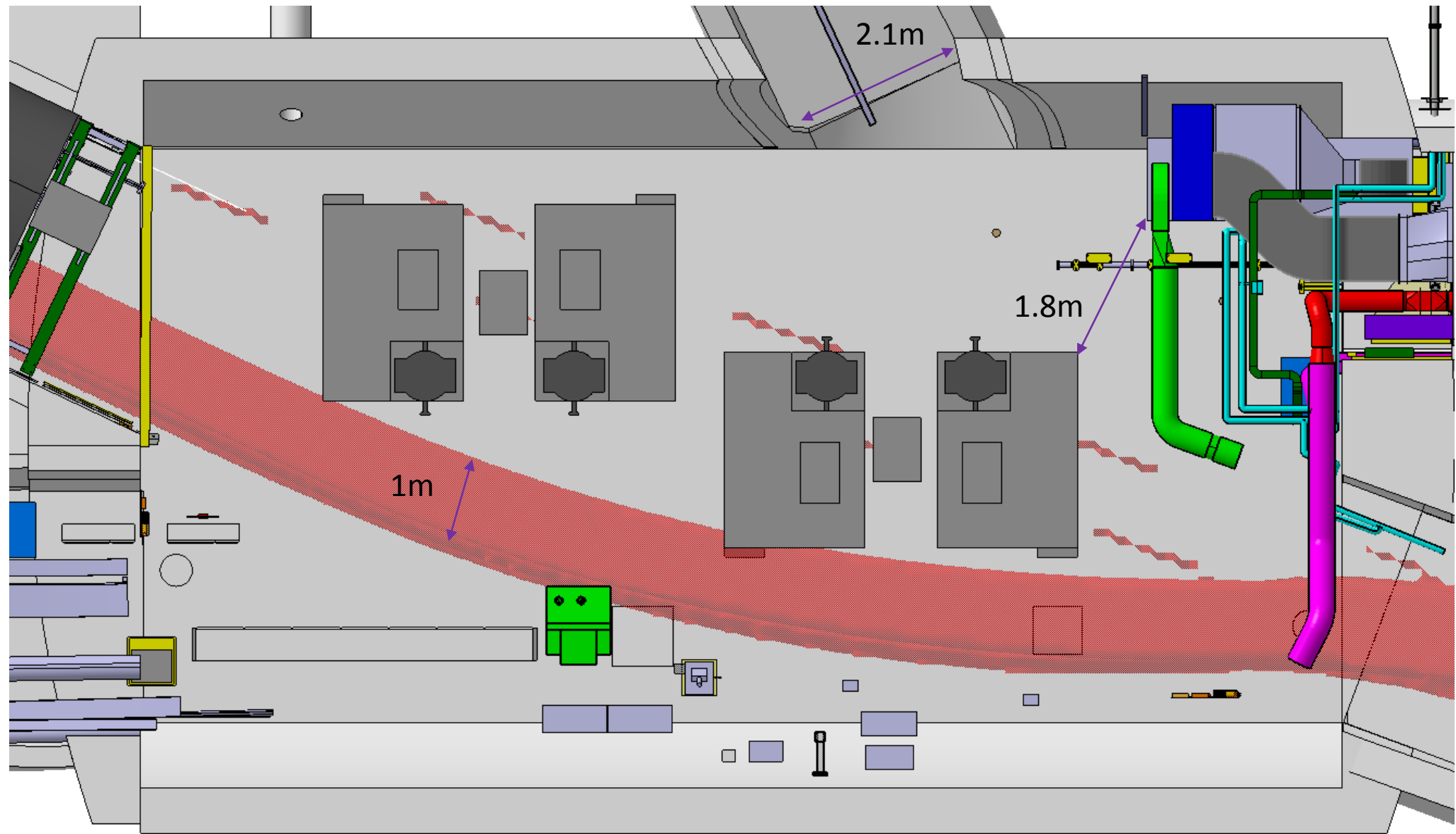
FREE SPACE in upstream TCC4.
In general, all equipment is easily accessible,
easy to work on or move around.
There is still space available for additional equipment

ROTATED CATHODE

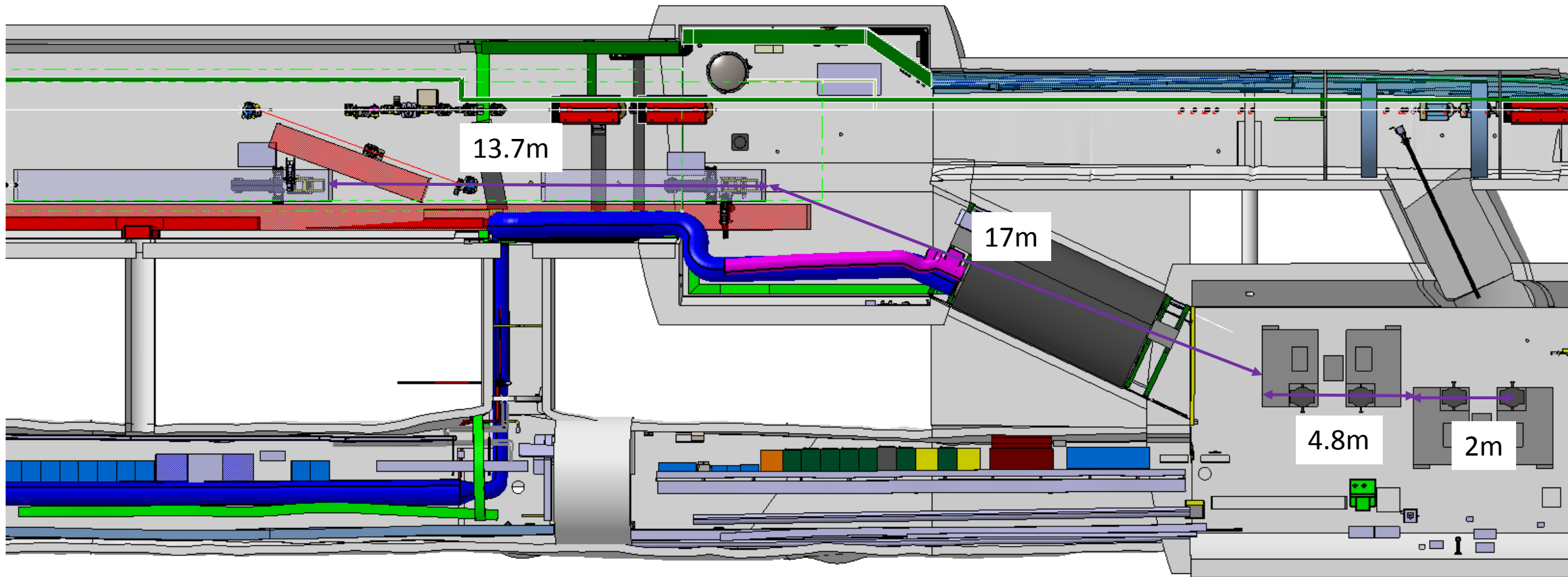


Reach of
overhead crane
(5t-7.5t)

Free area for transfer of
object from crane to trailer:
Max. width
- 1.7m upstream of e-source
- 1.2m upstream of MB190s
- 0.9m next to MB190s



An updated configuration of the 4 Klystrons allows a free passage of 1m-1.2m width (depending on length), from TCC4 to TAG41 (transport independent from SPS operation), while still fulfilling Klystron handling requirements



Length waveguides E-source 1 = $2 + 4.8 + 17 + \text{extra } (2) = 25.8\text{m} = \text{Lw1}$

Length waveguides E-source 2 = $4.8 + 17 + 13.7 + \text{extra } (2) = 37.5\text{m} = \text{Lw2}$

Summary table

Parameter	Diagonal	Compact	Liberty	Run 1
DeltaP	30m	35m	40m	0
WL1 & WL2	20.8m & 26.7m	20.8 & 32.5m	25.8 & 37.5m	<10m
Accessibility equipment and free space in TCC4	Limited, no margin	Good	Very Good	Very Good
Transfer area in TCC4	Very small	OK but narrow	Large	Very large
Transport from/to TCC4	Mainly via TT41 (L<12m, width<1.2m) (*)	Mainly via TT41 (L<12m, width<1.2m) (*)	Either via TT41 (L<12m, width<1.2m) or TCV4 (L<8m, width<1.1m)	Same
Independence from SPS (during installation)	NO (*)	NO (*)	YES (max. width ~1.1m)	YES (max. width 1.2m)
Other	Maybe rotated cathode Can maybe keep current p+beam configuration?	Rotated cathode S2 Probably extra p+beam elements	Rotated cathode S2 Probably extra p+beam elements	-

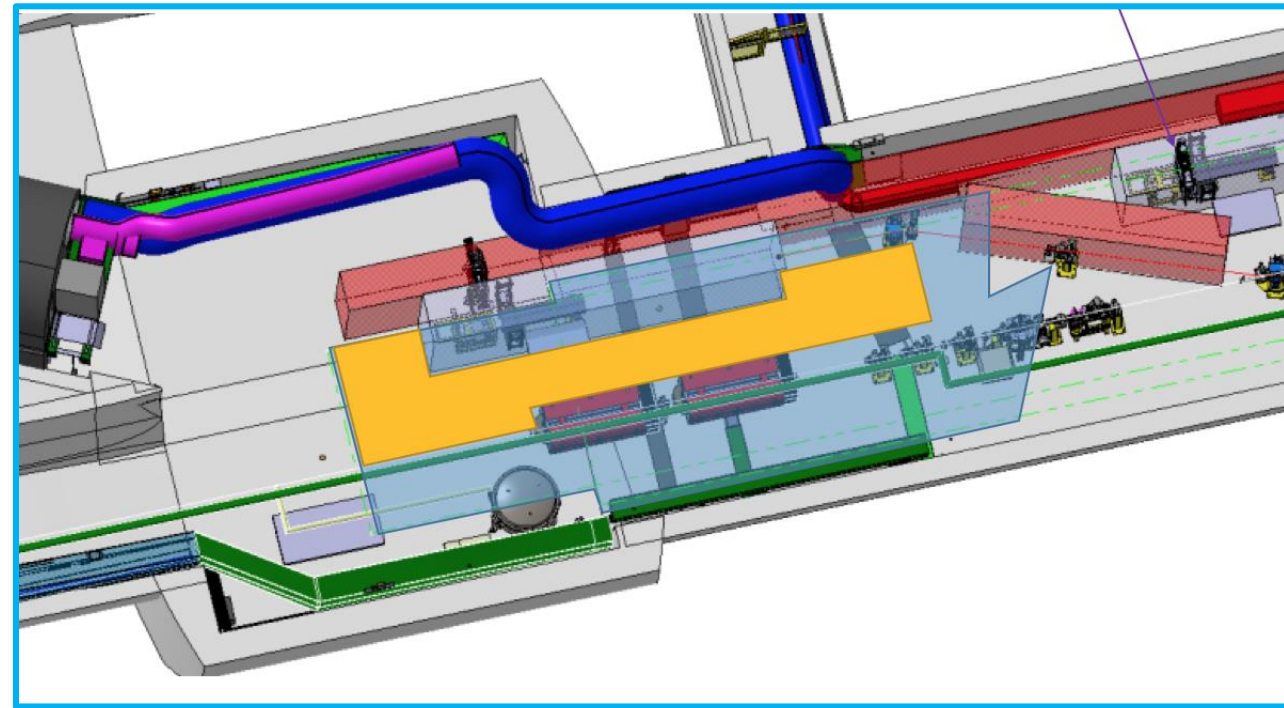
(*) except for small and light items (L<1m, width<1.1m, weight<200kg tbc), they may pass via TT43 and TCV4 - but 30% slope!

Conclusion

- The preferred version from the points of safety, flexibility, installation, future operation, and more is the 3rd version →
- The other versions will cause much longer installation times (link to SPS) and little to no flexibility during the design phase or later during operation.

Also:

- The EN-HE transport expert will become more involved in integration study.
- A few dimensions/weights need to be checked, but will not have a significant influence.



Next: evaluate feasibility, costs, schedule constraints of the preferred version:

- Check effect on proton beam line for 40m shift. Is a study of new design needed? Cost?
- Verify whether waveguide lengths are feasible, same for rotated cathode. Cost?
- (there's surely more)