Study on Civil Engineering Design for electron-driven positron source

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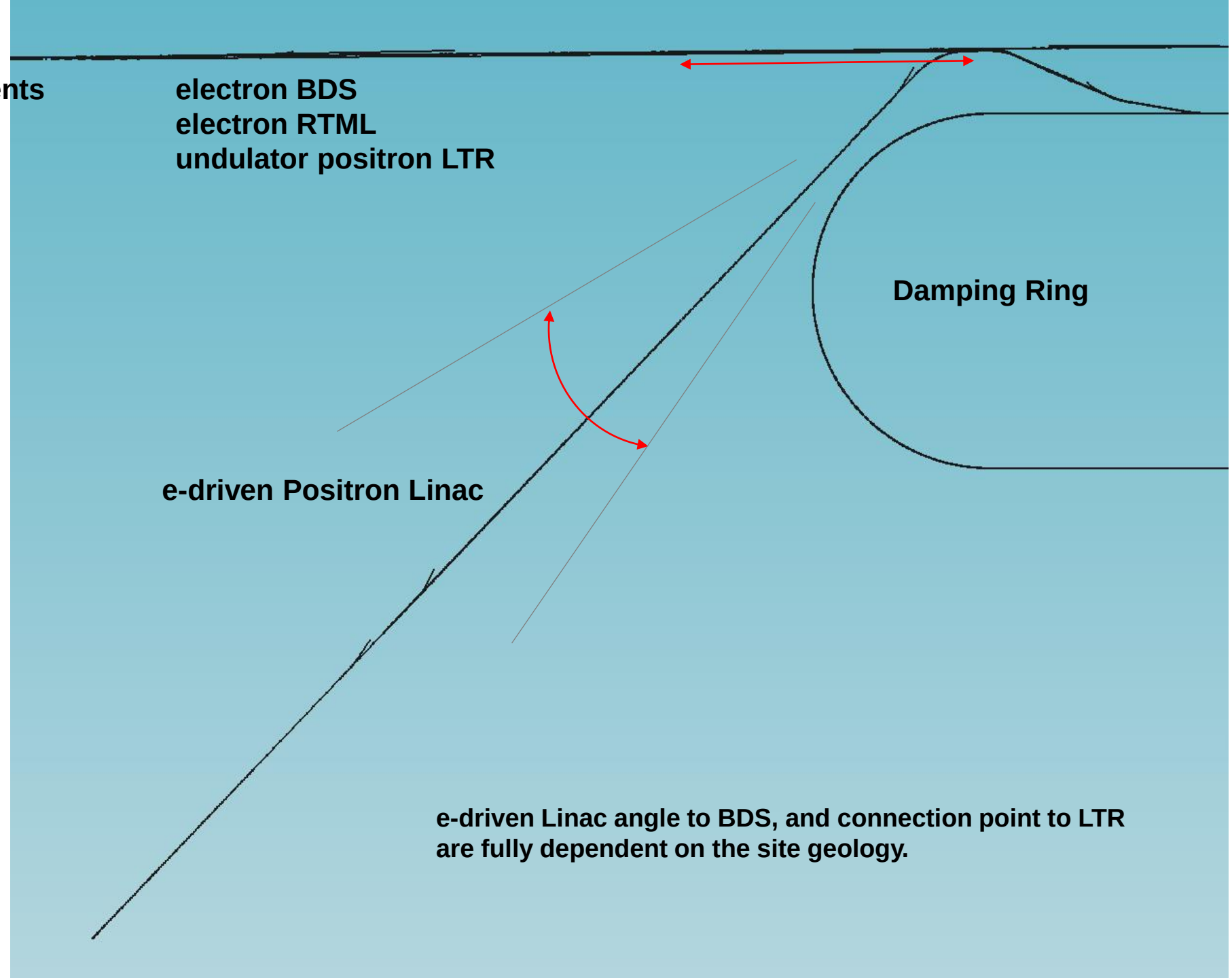
Whole Layout of
e-driven Positron Linac components
&
connection point to e+ LTR line
is shown.

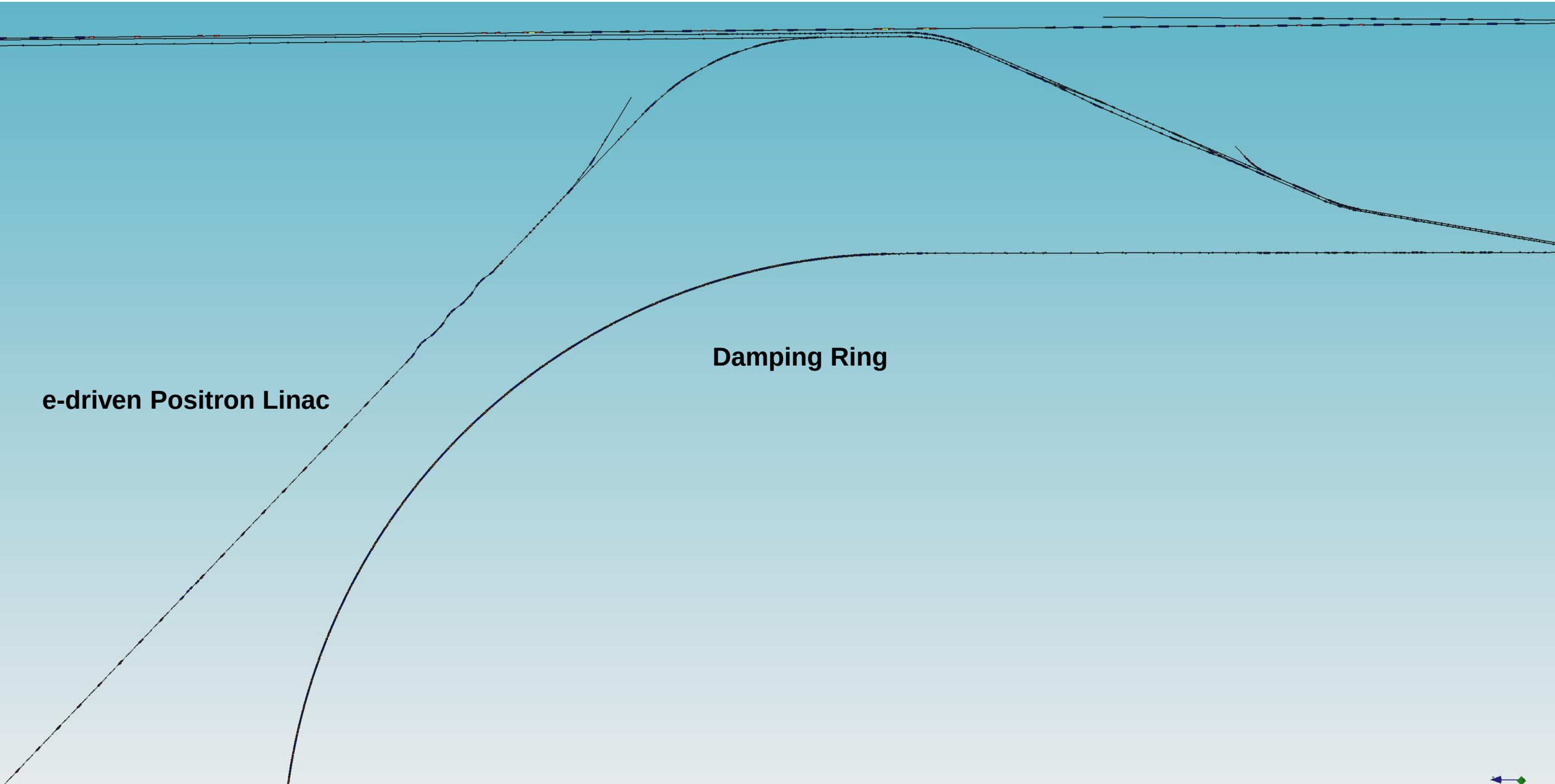
Why independent tunnel for
e-driven Positron Linac?

e-driven Positron Linac
is complicated RF arrangement,
and
require thick radiation shield.

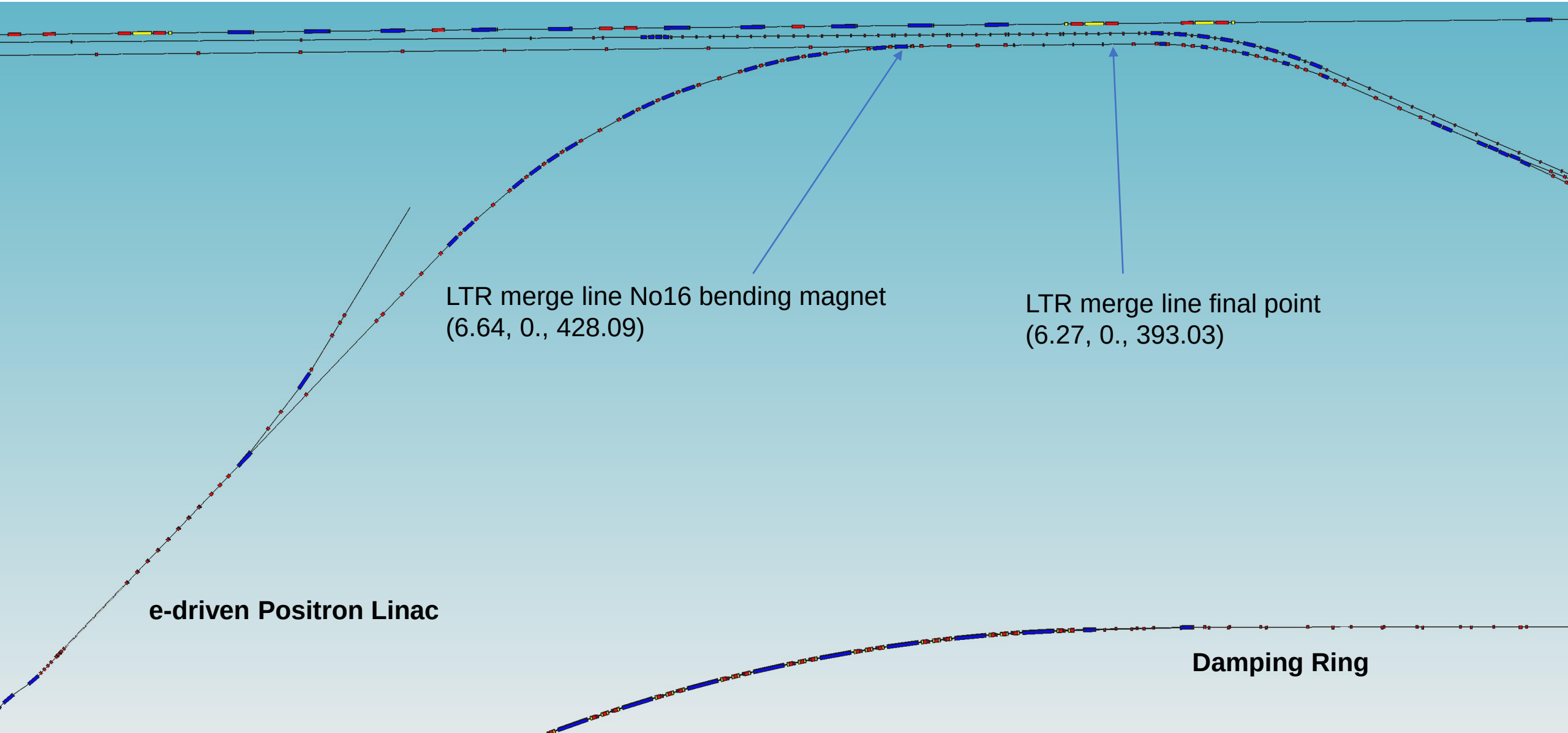
Placing it to the same position of
baseline undulator line introduce
complicated arrangement, and
require more wide, big tunnel.



Expanded view of e-driven Positron Linac components layout & connection point to positron LTR line.

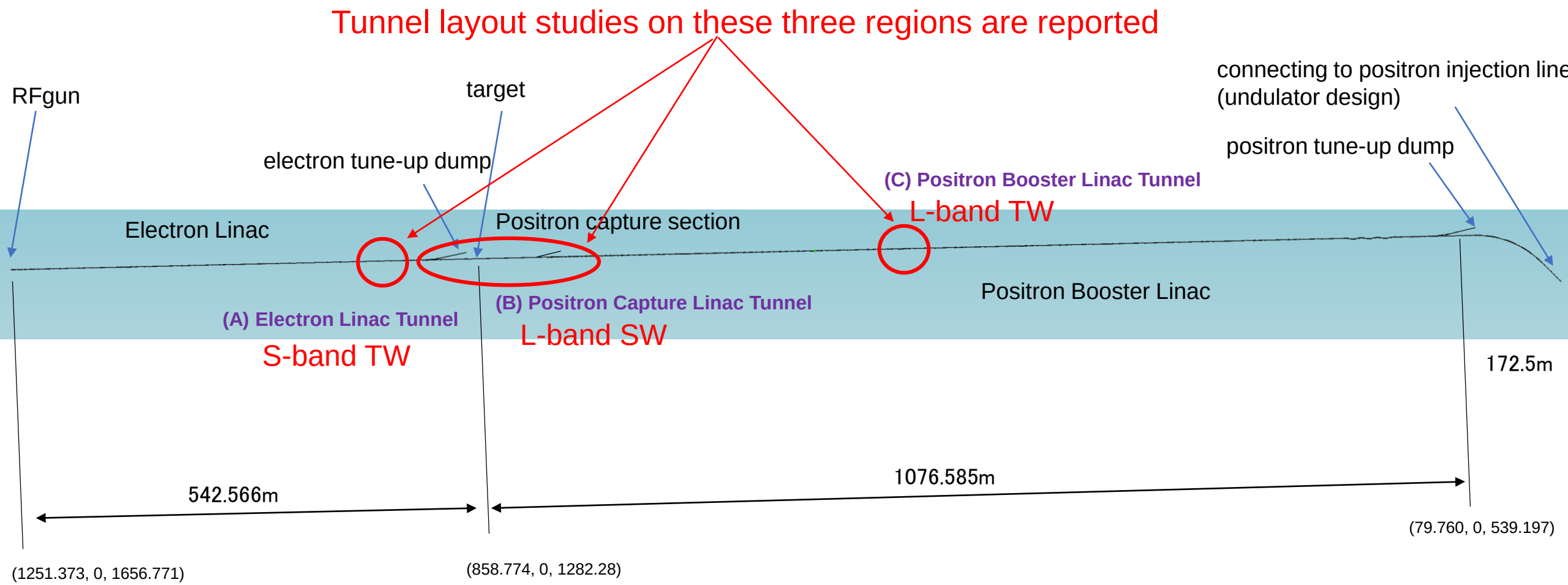


More Expanded view of e-driven Positron Linac components layout & connection point to positron LTR line.



e-driven Linac components arrangement using SAD geometry output

Existing SAD deck were modified to realistic accelerator configulation by putting beam monitors, diagnostic sections and spare RF unit.



Total Length of beam line in this study = 1791.651m (542.566 + 1076.585 + 172.5(curved))

Laser straight tunnel.

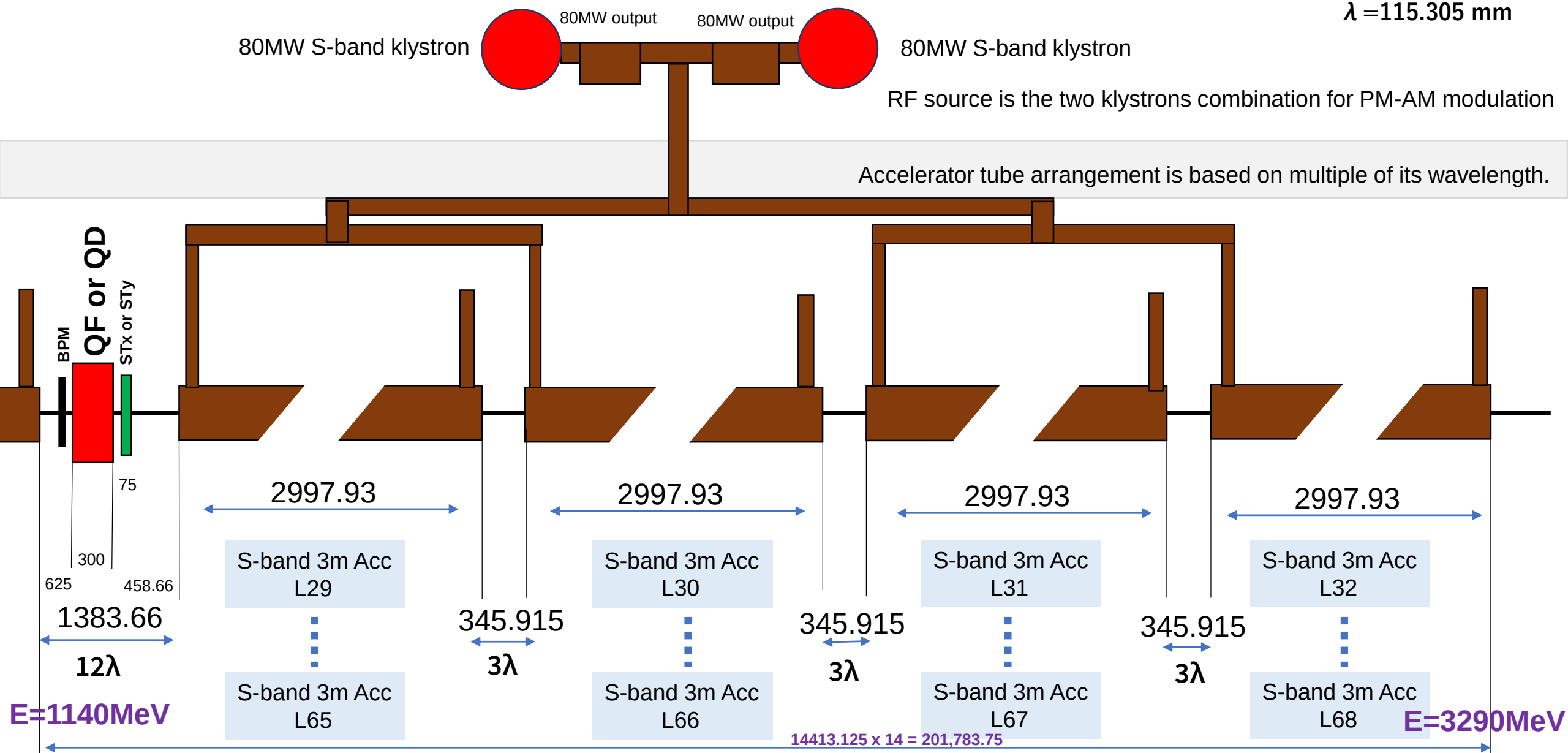
Klystrons are laied out in downward side of above beam line.

(A) Electron Linac Tunnel

Typical arrangement at RF unit #8 - #21 (14 units including 10% margine)

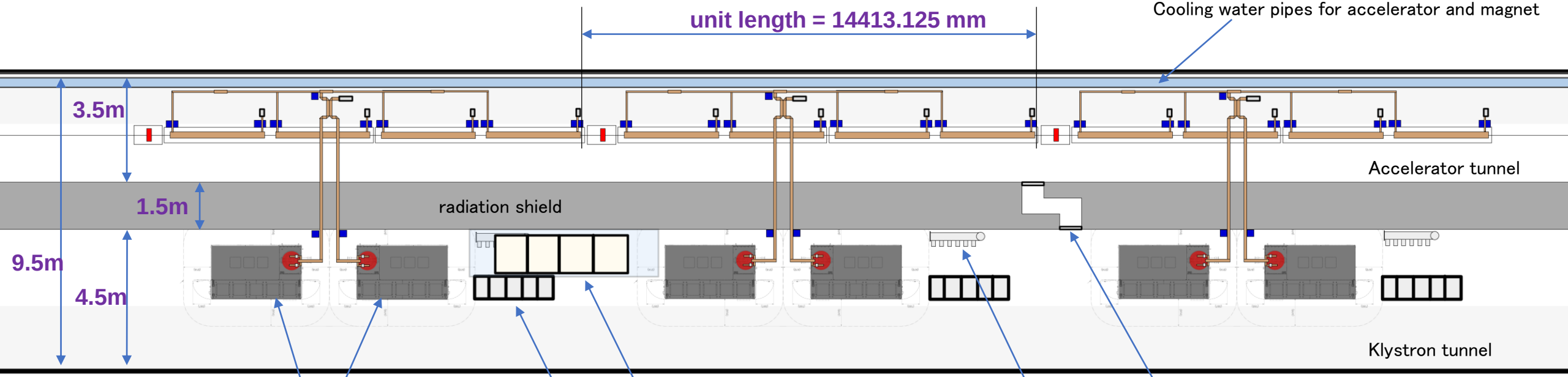
length is not scale.

λ =115.305 mm



Tunnel plain view (S-band TW accelerating structure Unit)

Adopt the same tunnel cross section with Main Linac tunnel.
Adopt the same arrangement of cavity and transport space as the Main Linac.



Klystron & Modulator

3m x 1.8m x 2m(H)

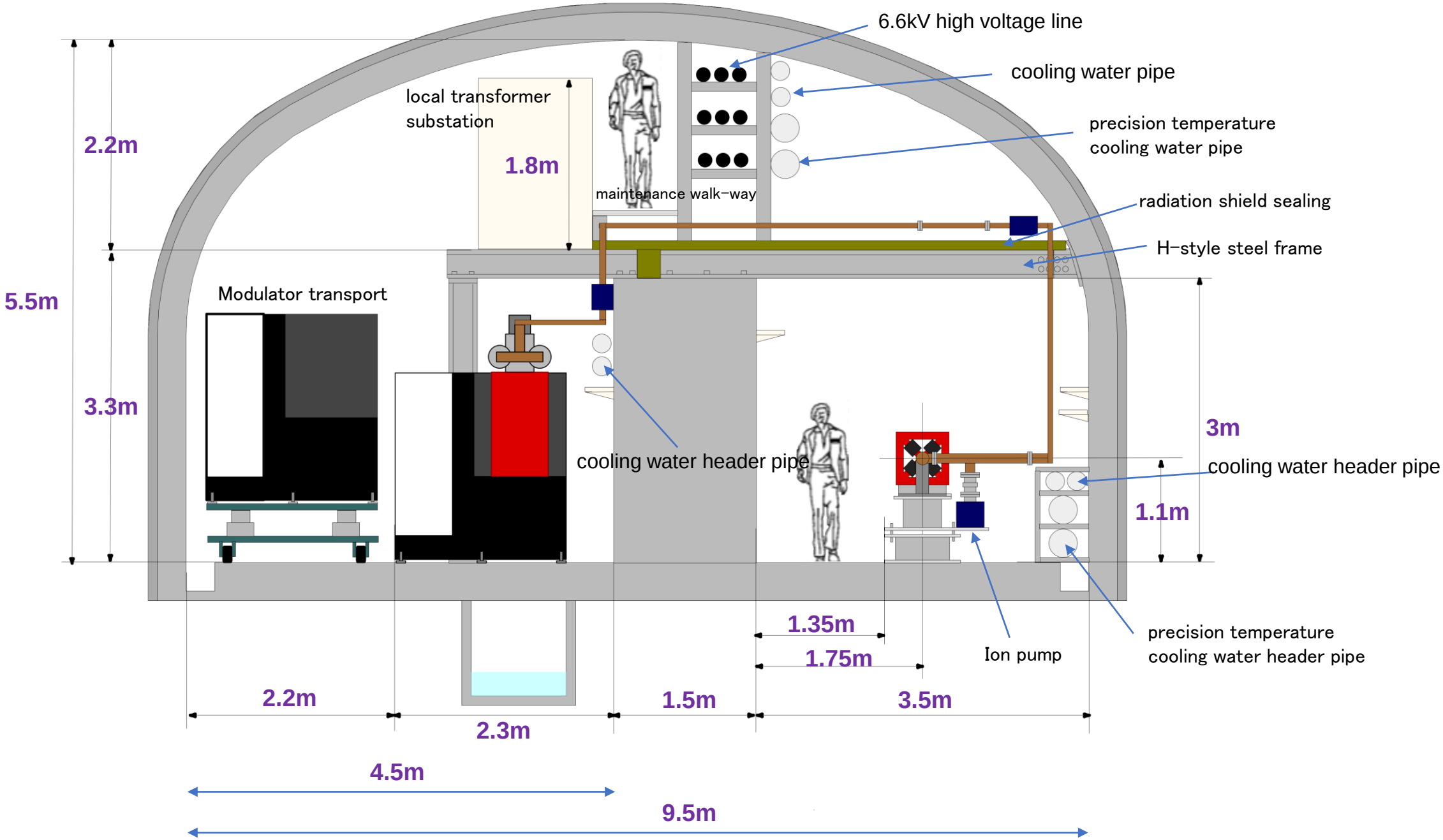
control rack

local transformer substation
6.6kV ->400,200,100V

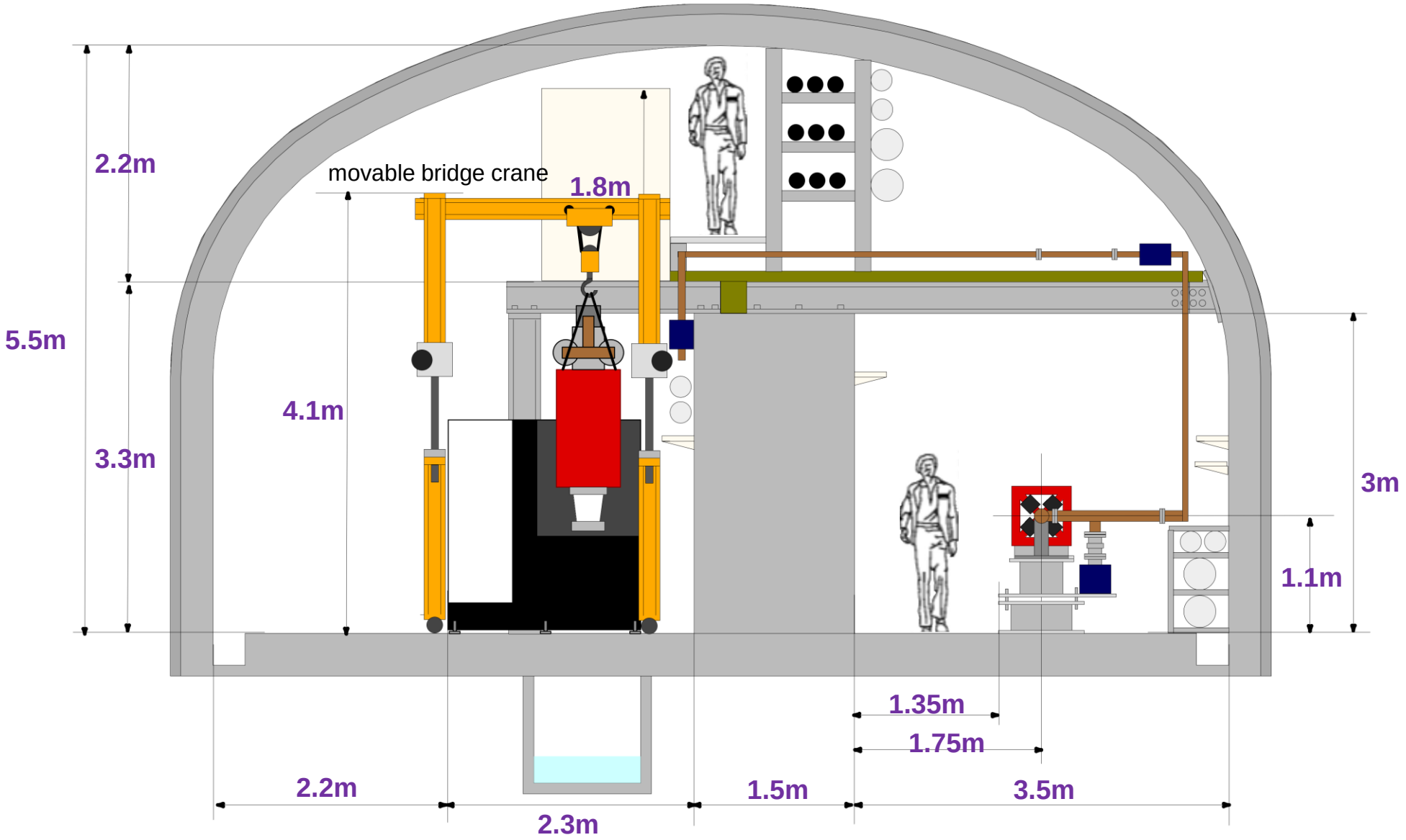
Emergency connection

Cooling water Header

Tunnel cross-section (S-band TW accelerating structure Unit)



Tunnel cross-section (S-band TW accelerating structure Unit)



Use movable bridge crane for exchange work of klystron.
Raised Klystron is moved by the bridge, and mount on the tranport vehicle.

(B) Positron Capture Linac Tunnel

Unit configuration for capture Linac

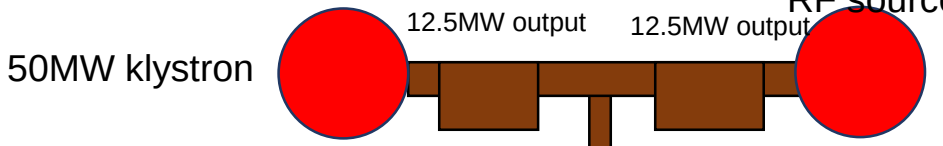
λ =230.610 mm

length is not scale.

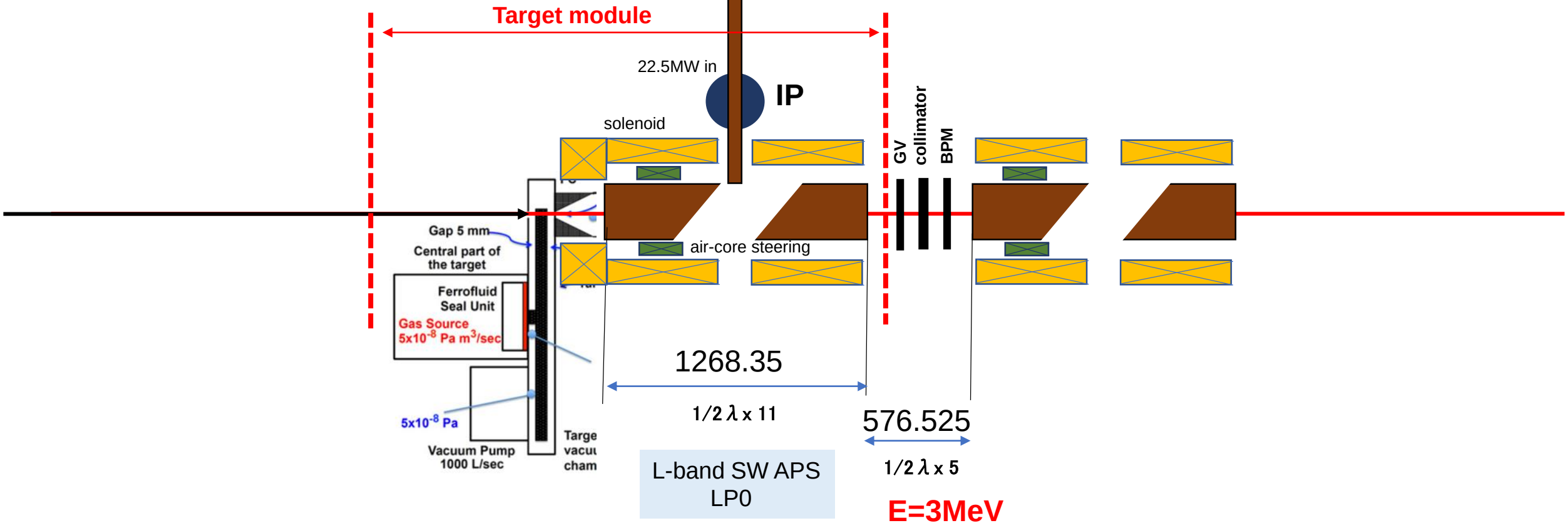
The first unit of capture: 1 unit（2 klystron）1 accelerator cavities（L0）:Energy at Exit =3MeV

12 MV/klystron / 4 = 3 MV :energy gain

RF source is the two klystrons combination for PM-AM modulation



Accelerator tube arrangement is based on multiple of its half-wavelength.



Unit configuration for capture Linac

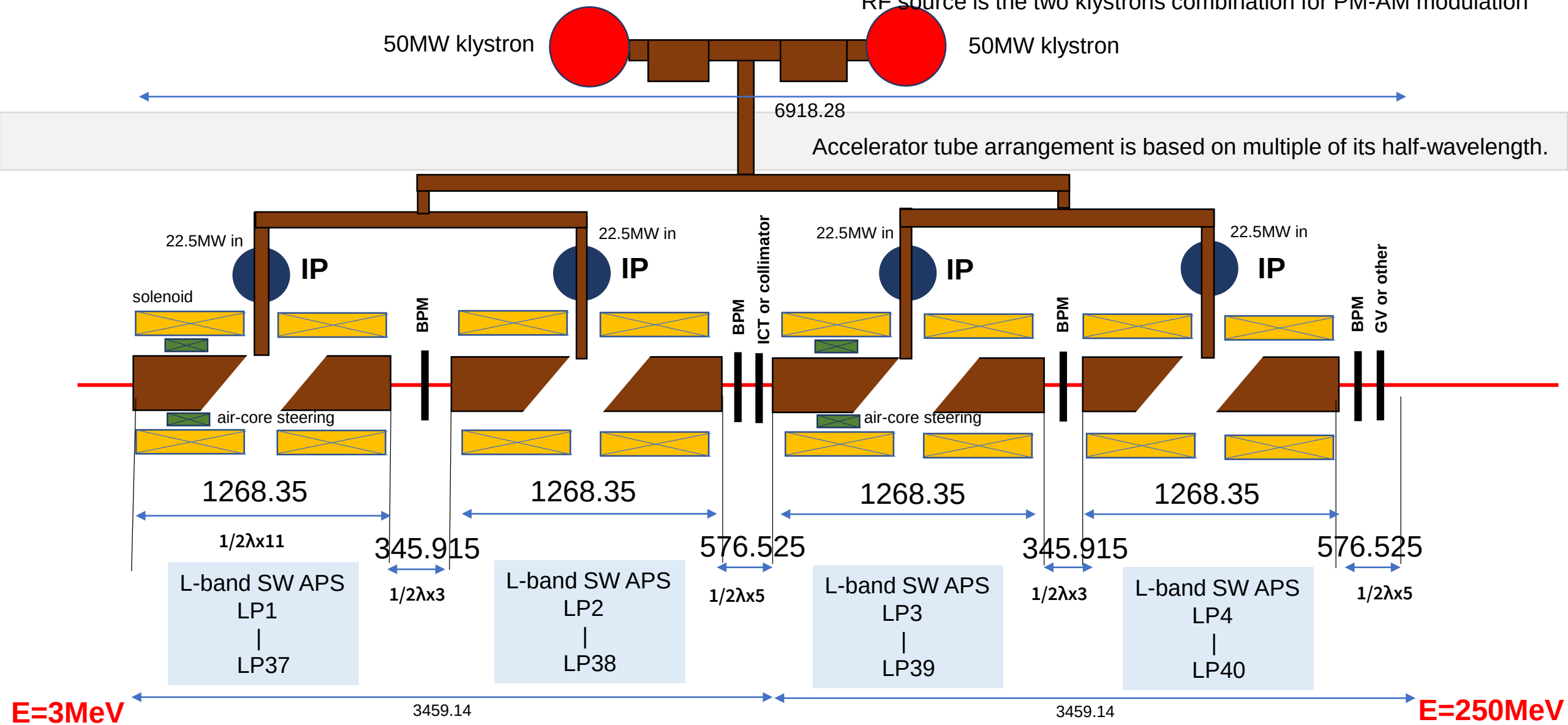
λ =230.610 mm

length is not scal.

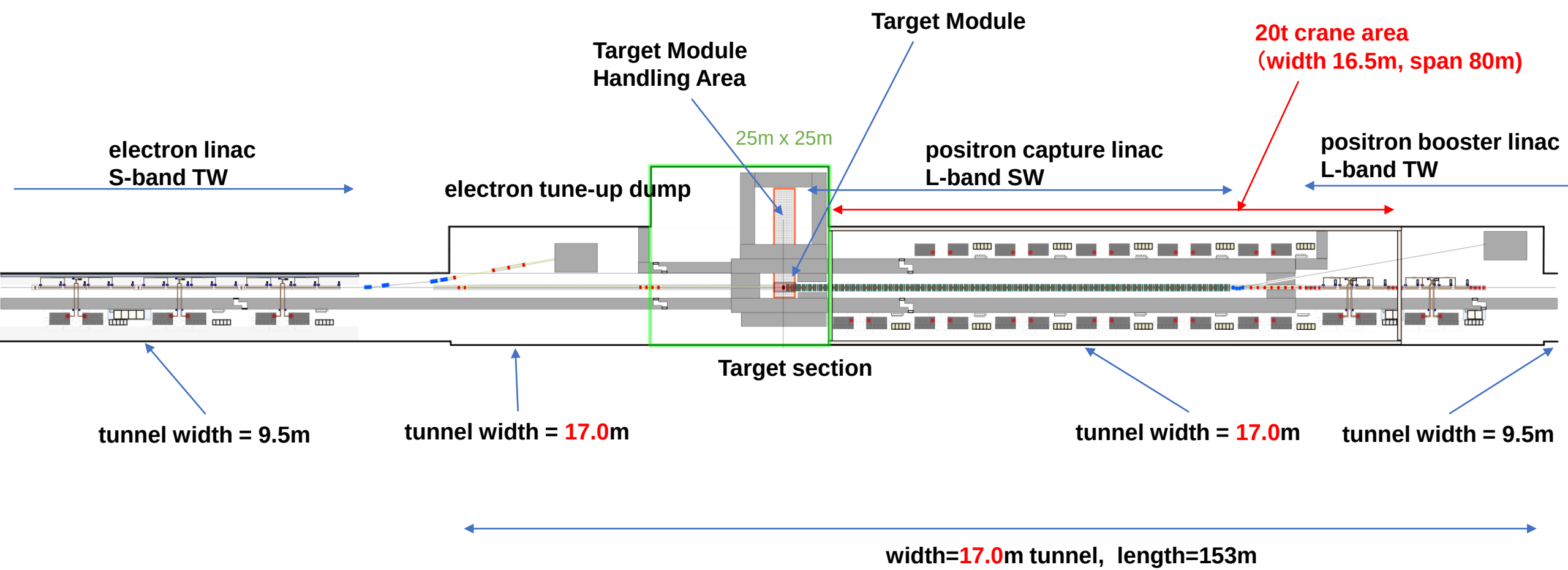
10 unit（20 klystron）40 accelerator cavities（LP1 ~ LP40）:Energy at Exit =250MeV

3 + 12~ 20 MV/klystron x 20 = 243 ~ 403 MV :energy gain

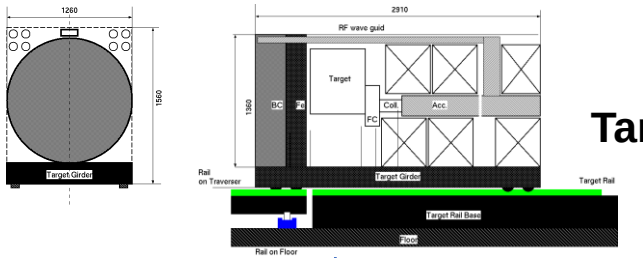
RF source is the two klystrons combination for PM-AM modulation



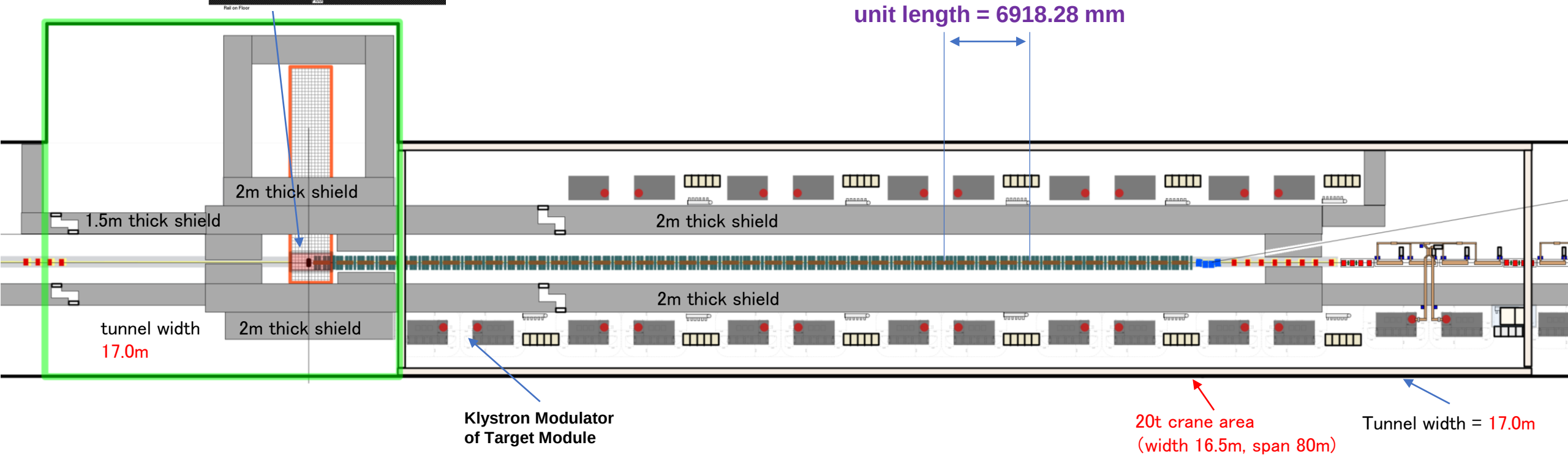
Tunnel plain view (S-band TW / Target / Capture L-band SW / L-band TW)



Tunnel expanded plain view (Target / Capture L-band SW)



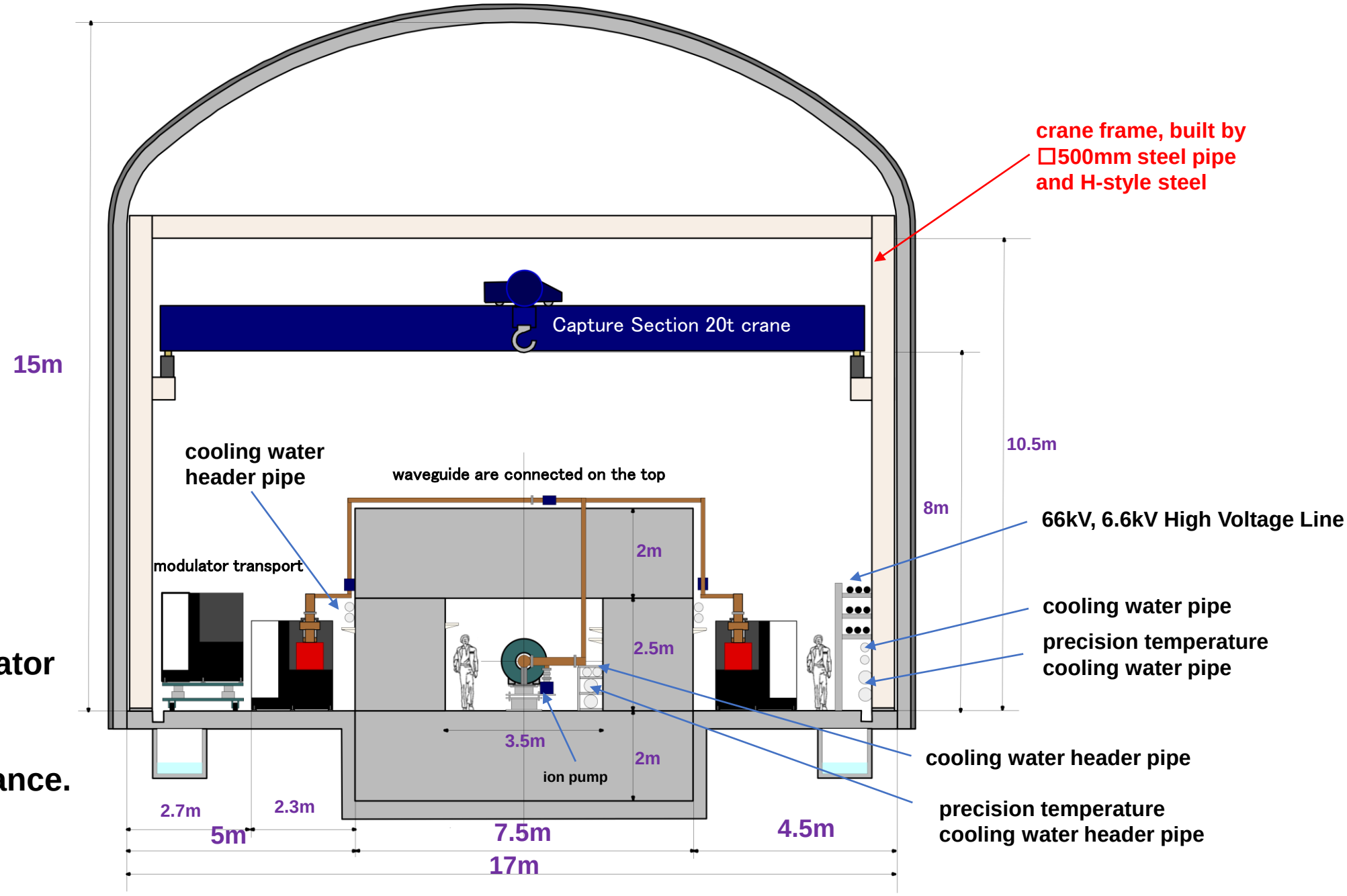
Target Module



Use movable target module for exchange work of target system and 1st accelerator cavity as one unit. Target module is moved remotely by the rail system between accelerator and storage area.

Since accelerator cavities are arranged so dense, two klystron combination system require more space, klystrons are arranged in both side of accelerator shield. Big crane handle their maintenance.

Tunnel cross-section of Capture Section (L-band SW accelerating structure Unit)



klystrons are arranged in both side of accelerator shield.
Big crane handle their installation & maintenance.

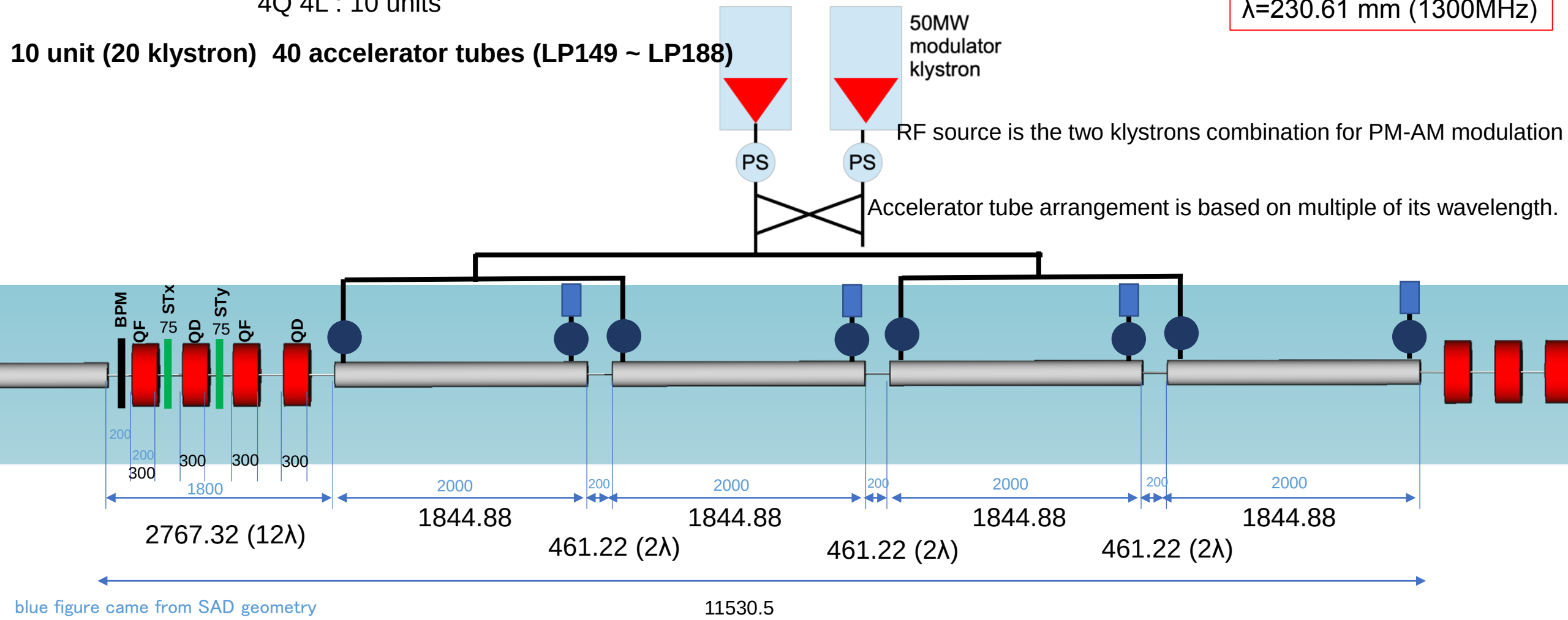
(C) Positron Booster Linac Tunnel

Typical Unit configuration for booster Linac part3-2 LTW

4Q 4L : 10 units

10 unit (20 klystron) 40 accelerator tubes (LP149 ~ LP188)

λ=230.61 mm (1300MHz)

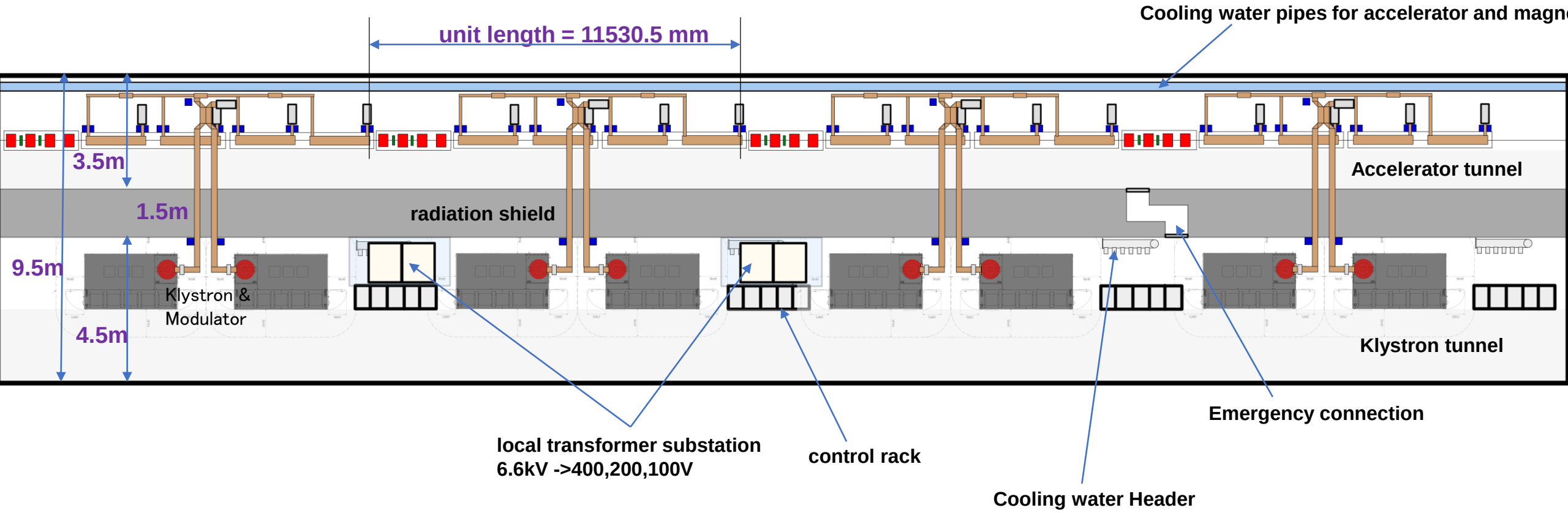


blue figure came from SAD geometry

black figure is for this study

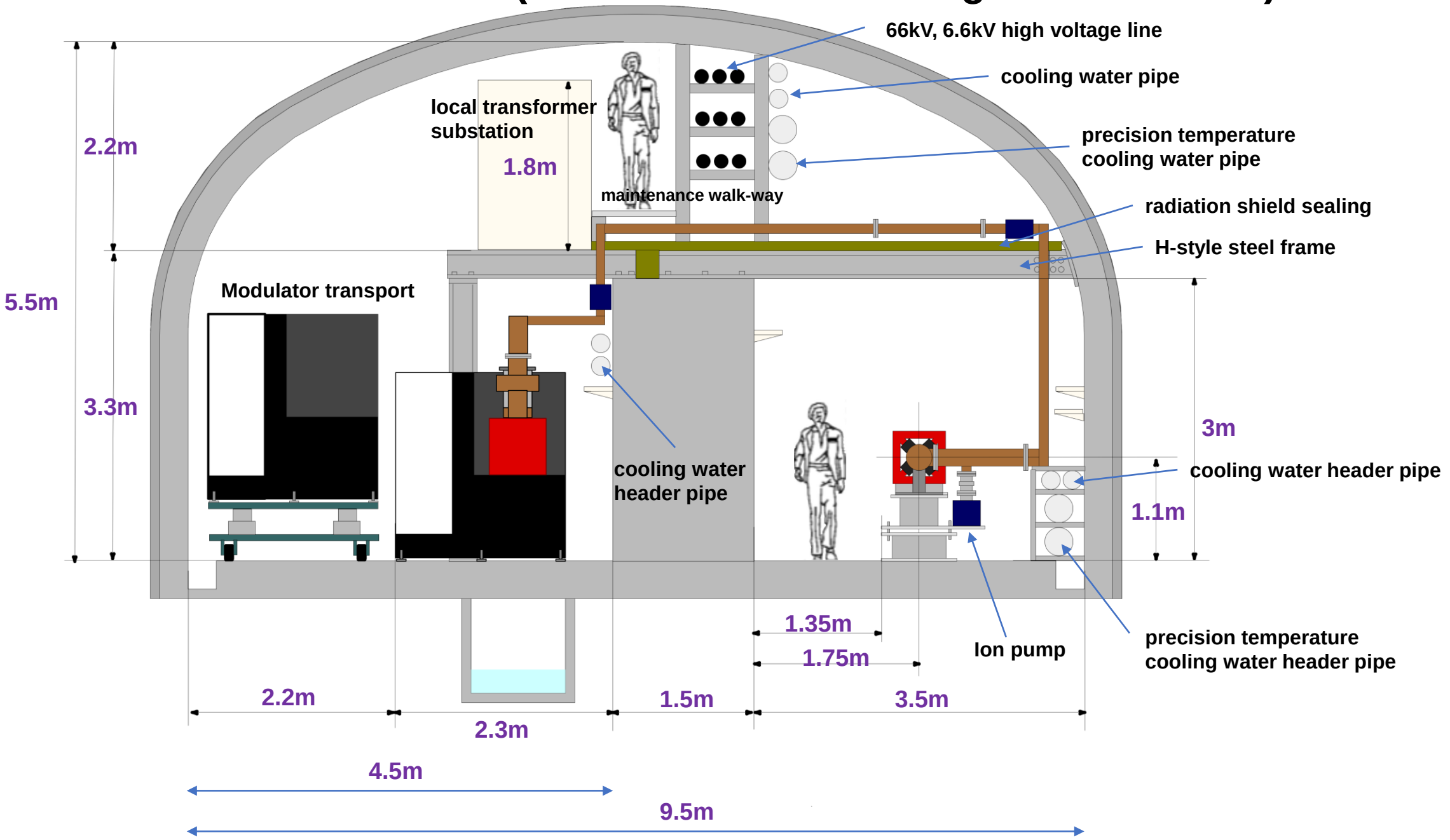
Tunnel plain view (L-band TW accelerating structure unit)

Adopt the same tunnel cross section with Main Linac tunnel.
Adopt the same arrangement of cavity and transport space as the Main Linac.

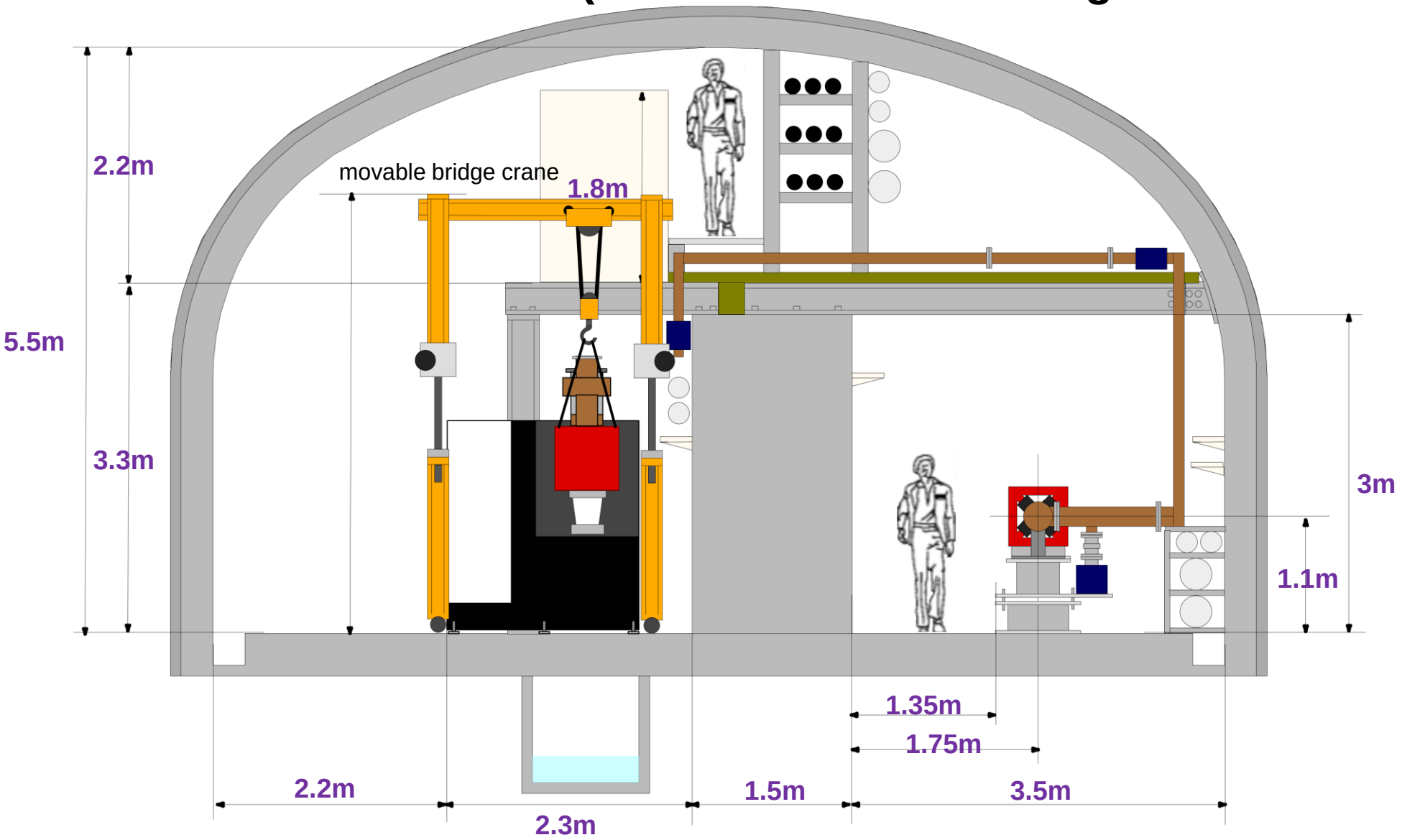


Since accelerator arrangement is more dense than electron linac, local electric substations are devided to two.

Tunnel cross-section (L-band TW accelerating structure Unit)



Tunnel cross-section (L-band TW accelerating structure Unit)



Use movable bridge crane for exchange work of klystron.
Raised Klystron is moved by the bridge, and mount on the tranport vehicle.

Summary

1. **CFS study for independent tunnel of e-driven positron source was performed.**

2. **Realistic accelerator configulation by putting beam monitors, diagnostic sections and spare RF unit were adopted.**

3. **Tunnel configulation to house accelerator, klystron&modulator, electricity and cooling water, is studied.**

4. **Whole tunnel layout, access hall, access tunnel and surface station will be studied in the next step.**

End of slide