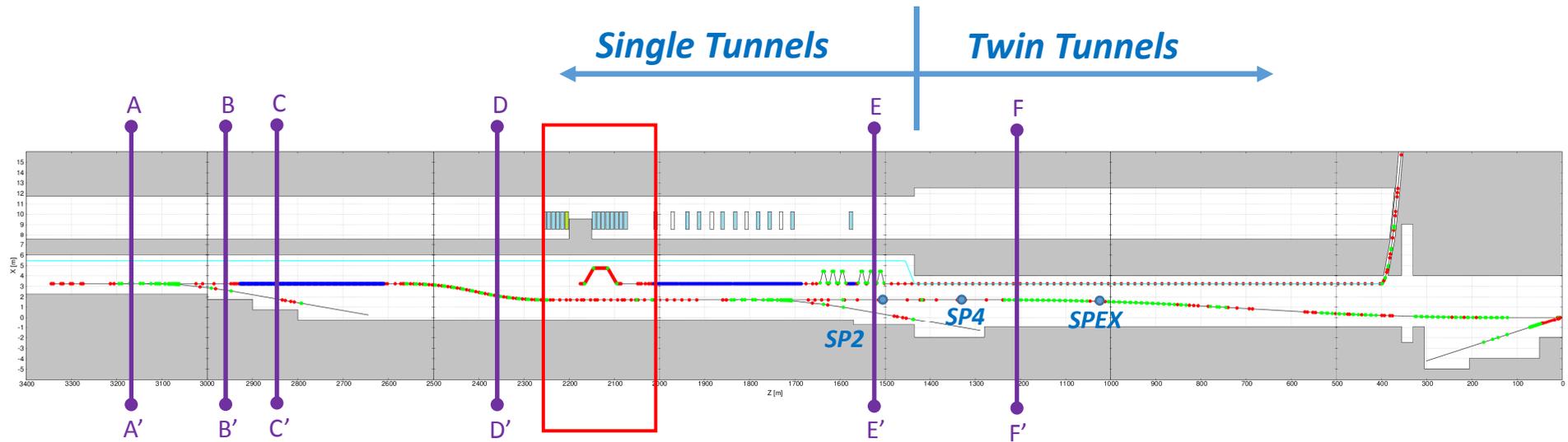


# *Tunnel layout for positron section*

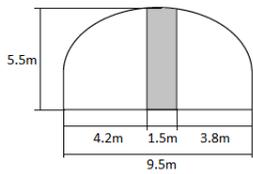
Toshiyuki OKUGI, KEK  
2016/ 04 /16  
ILC CRWG meeting (KEK)

# Electron BDS tunnel layout

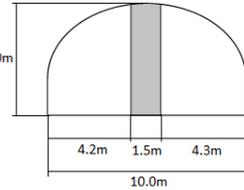
The idea of tunnel layout for positron section to match the following tunnel cross section.



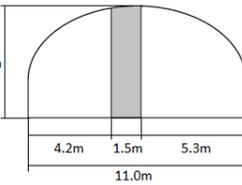
A - A'



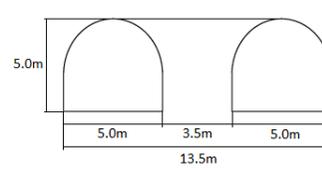
B - B'



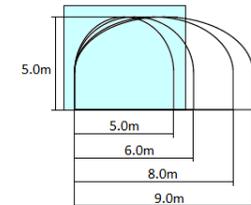
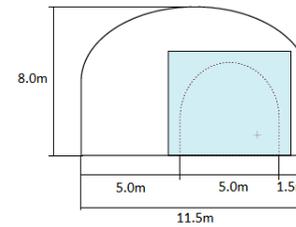
C - C'



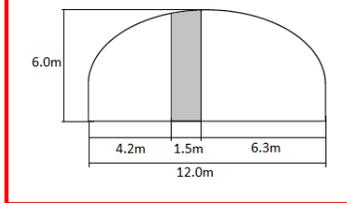
F - F'



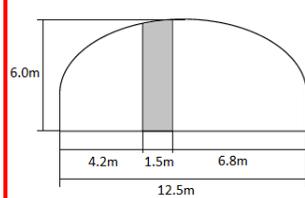
**Muon Hall**



D - D'

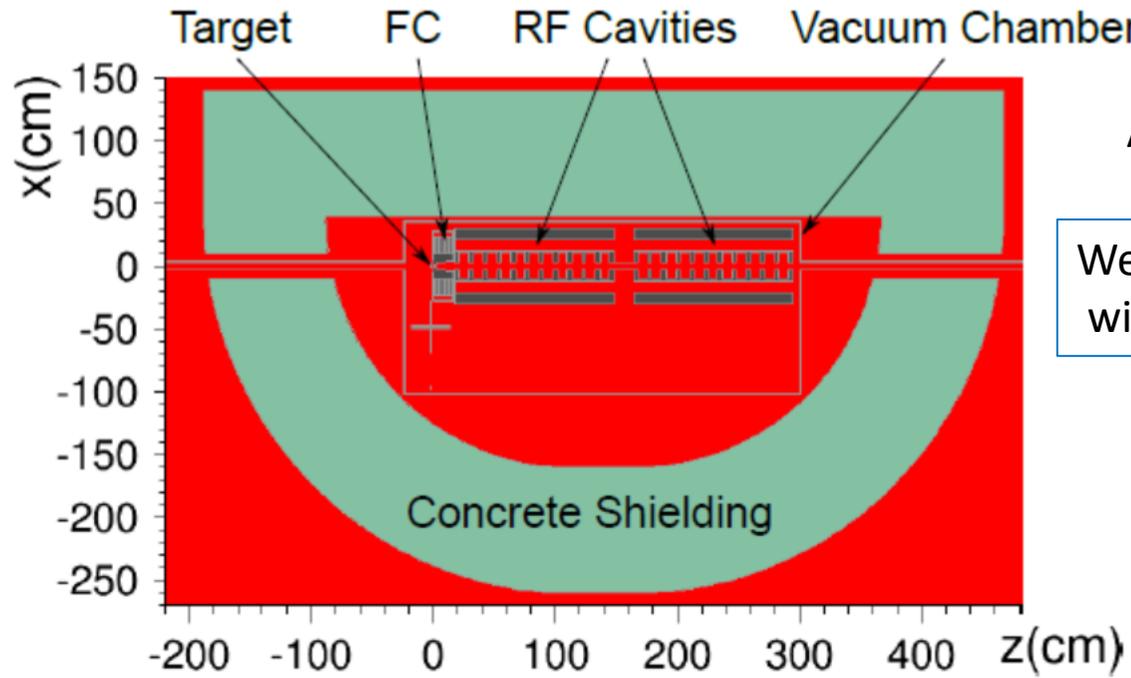


E - E'



*Detail will be presented in tomorrow session.*

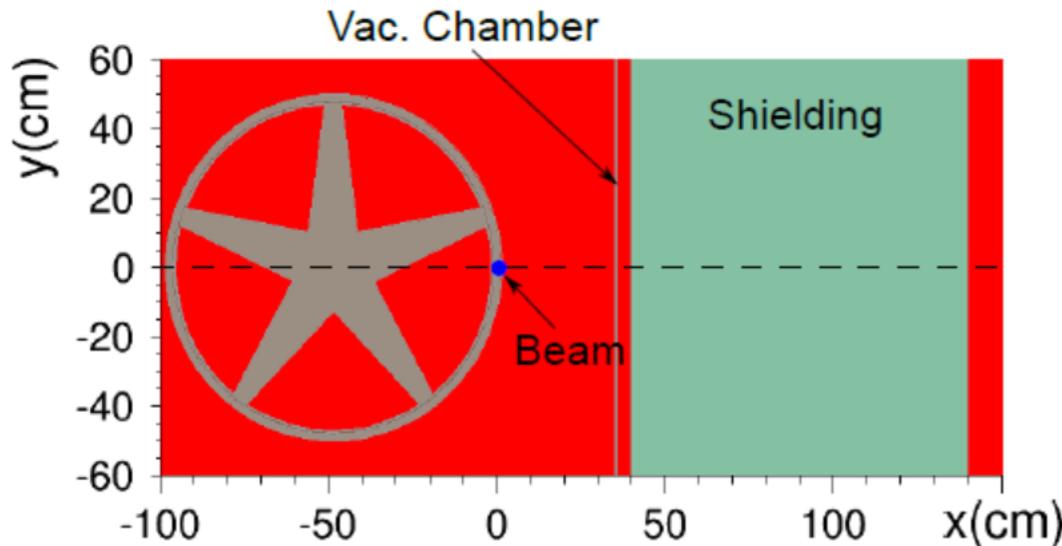
# Positron target Area



A. Ushakov et al., LCWS15

We could reduce the radiation dose with 1m thickness concrete shield.

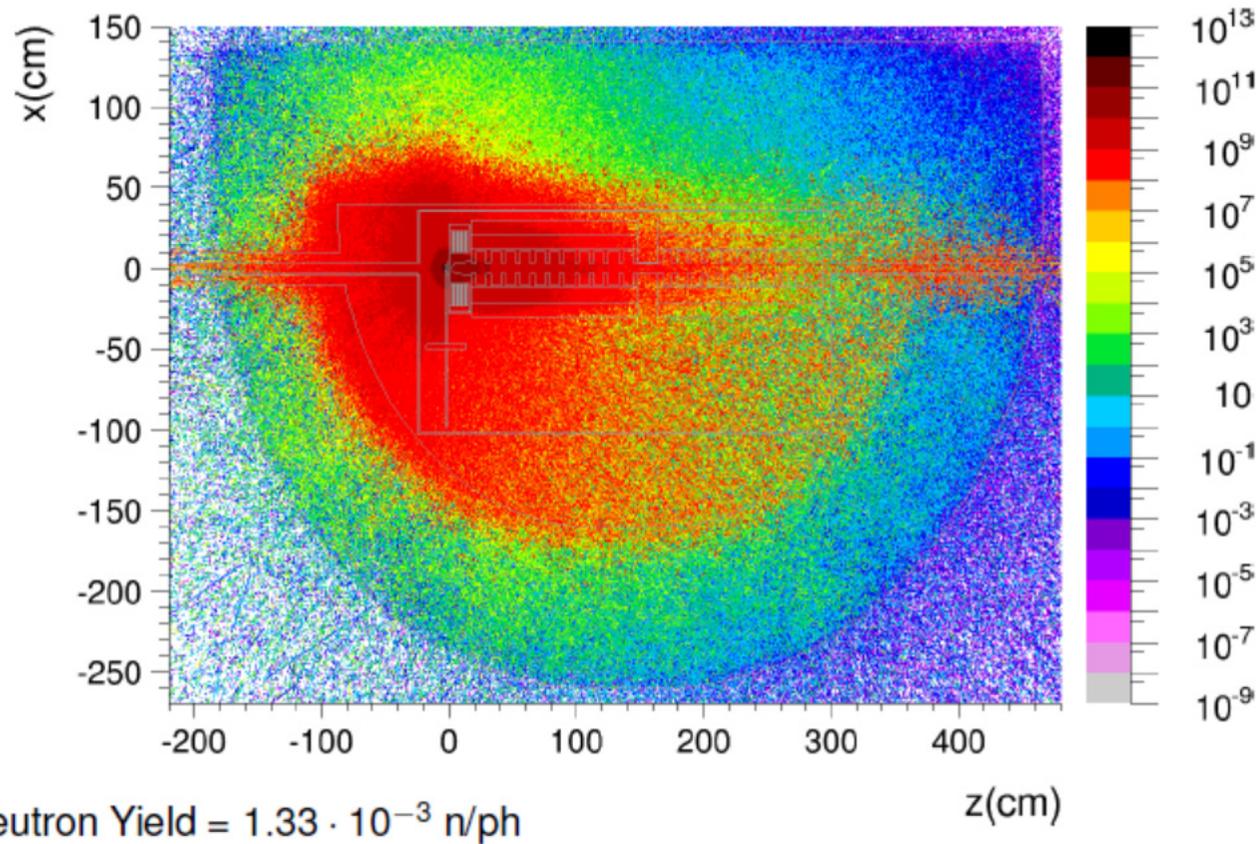
Concrete shield is replaced from 100cm light-concrete to 65cm heavy-concrete.



Target was put horizontally to make the beamline close.

The distance between beamline and shield is 40cm.

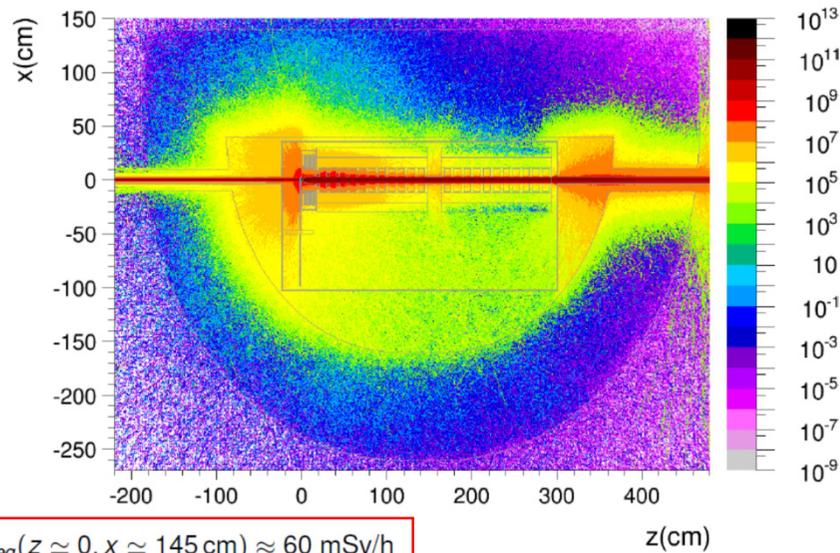
## Neutron Distribution [n/(s cm<sup>3</sup>)]



The neutron is located up to 1<sup>st</sup> accelerating structure.  
We don't have to make a large restricted area ??

## Radiation dose for capture section for undulator positron source

A.Ushakov (University of Hamburg) at LCWS2015

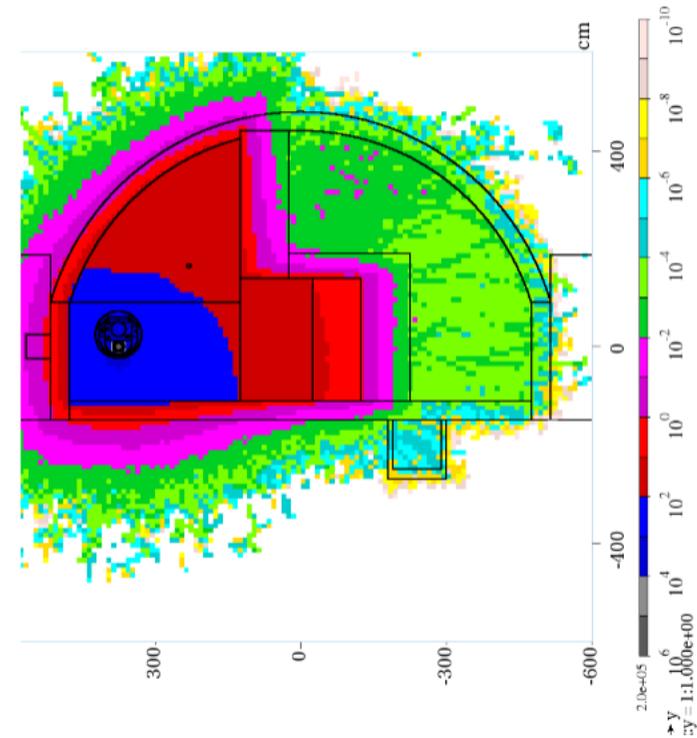


Radiation dose out of 1m-thickness concrete shield  
is less than ML dark current level

## Radiation dose for ML dark current

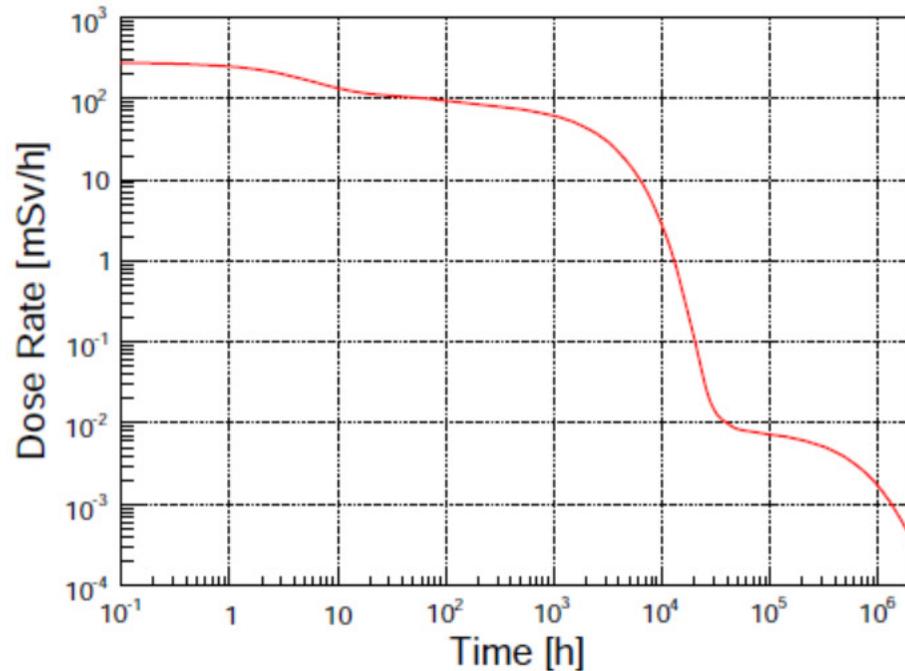
T. Sanami (KEK) at LCWS2015

Normal loss : 6.875e10eps (50nA eq.) due to dark current



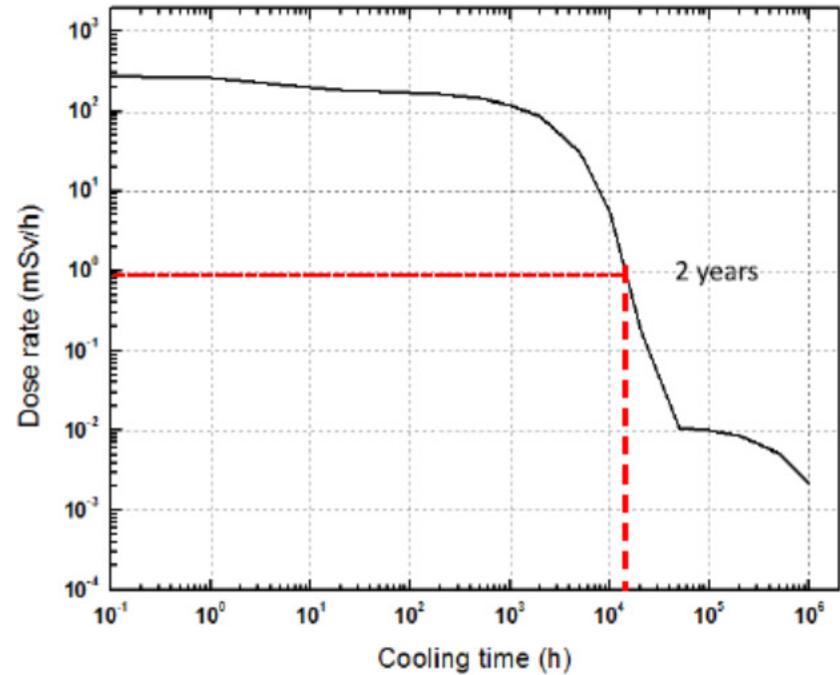
*O(100mSv/h) in accelerator tunnel*

# Target Cooling



A. Ushakov, ILC e<sup>+</sup> Source Collaboration Meeting,  
7 April 2008, Zeuthen, Germany

FLUKA code



Jia Xuejun (IHEP, China), KILC 12,  
24 April 2012, Daegu, Korea

MCNPX code

Since it will spend about 2 years to cooling down the positron target,  
we must consider the space to put the used target in the radiation controlled area.

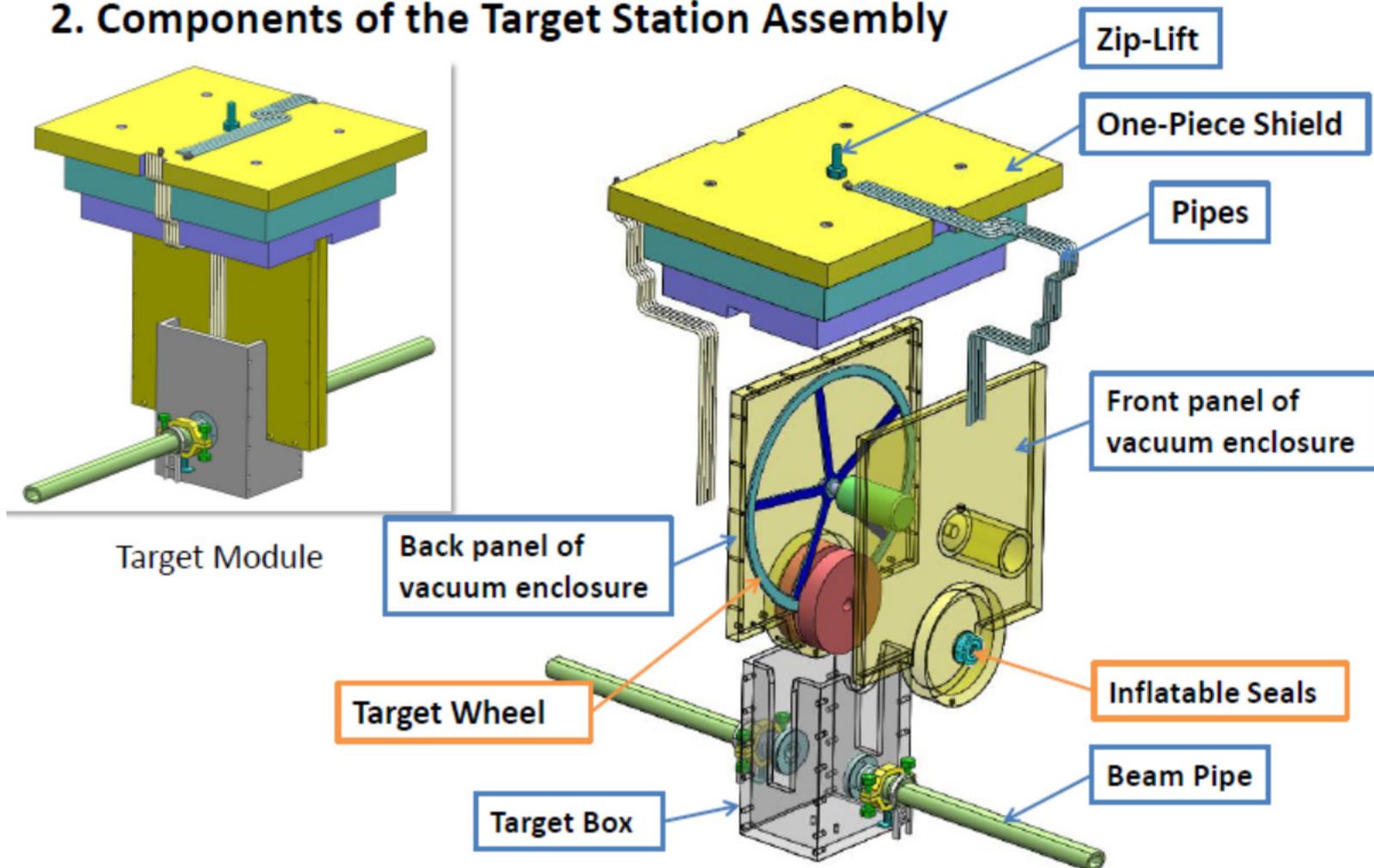
# Idea of remote handling of the target



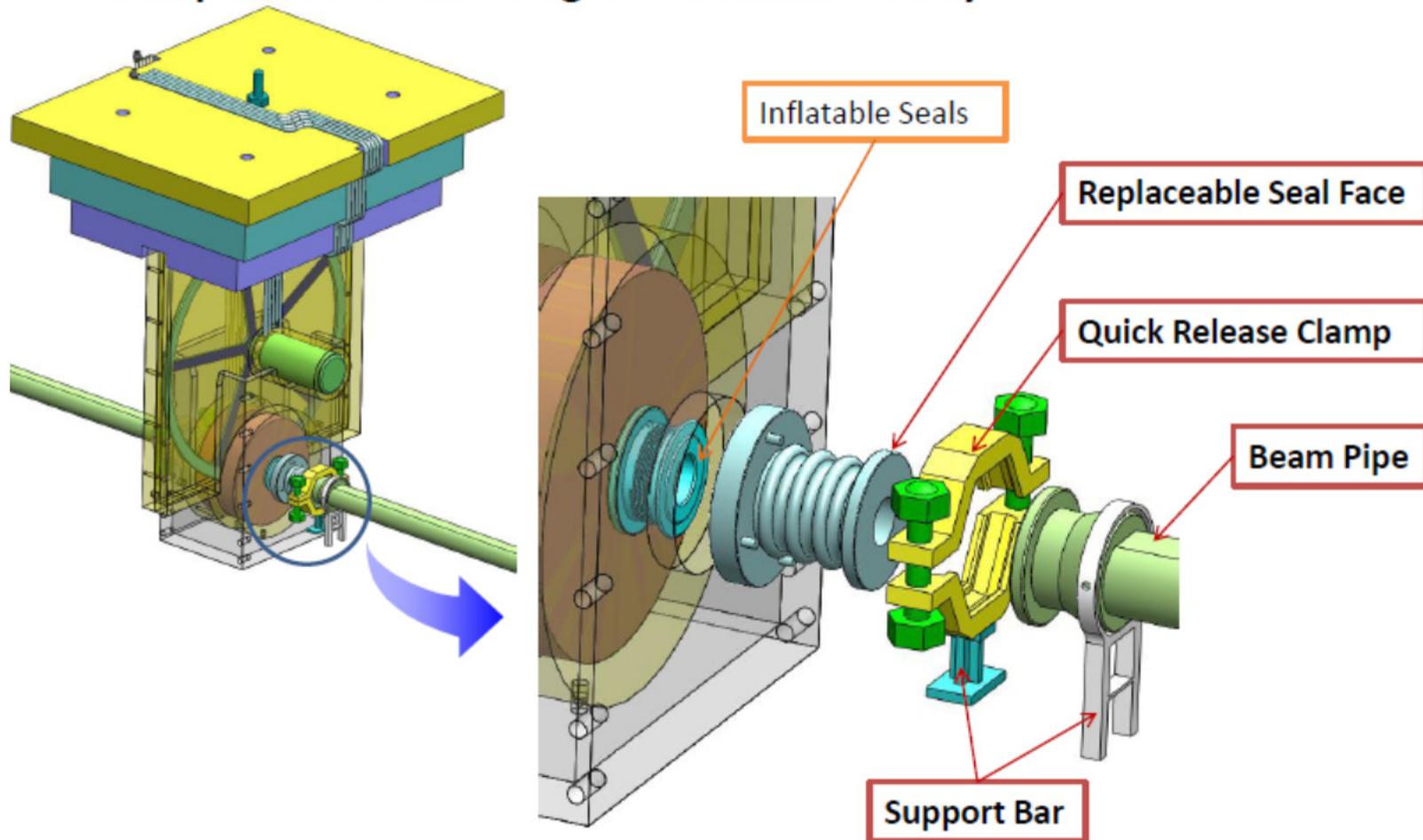
ILC TARGET STATION – REMOTE HANDLING

Jia Xuejun at KILC12

## 2. Components of the Target Station Assembly

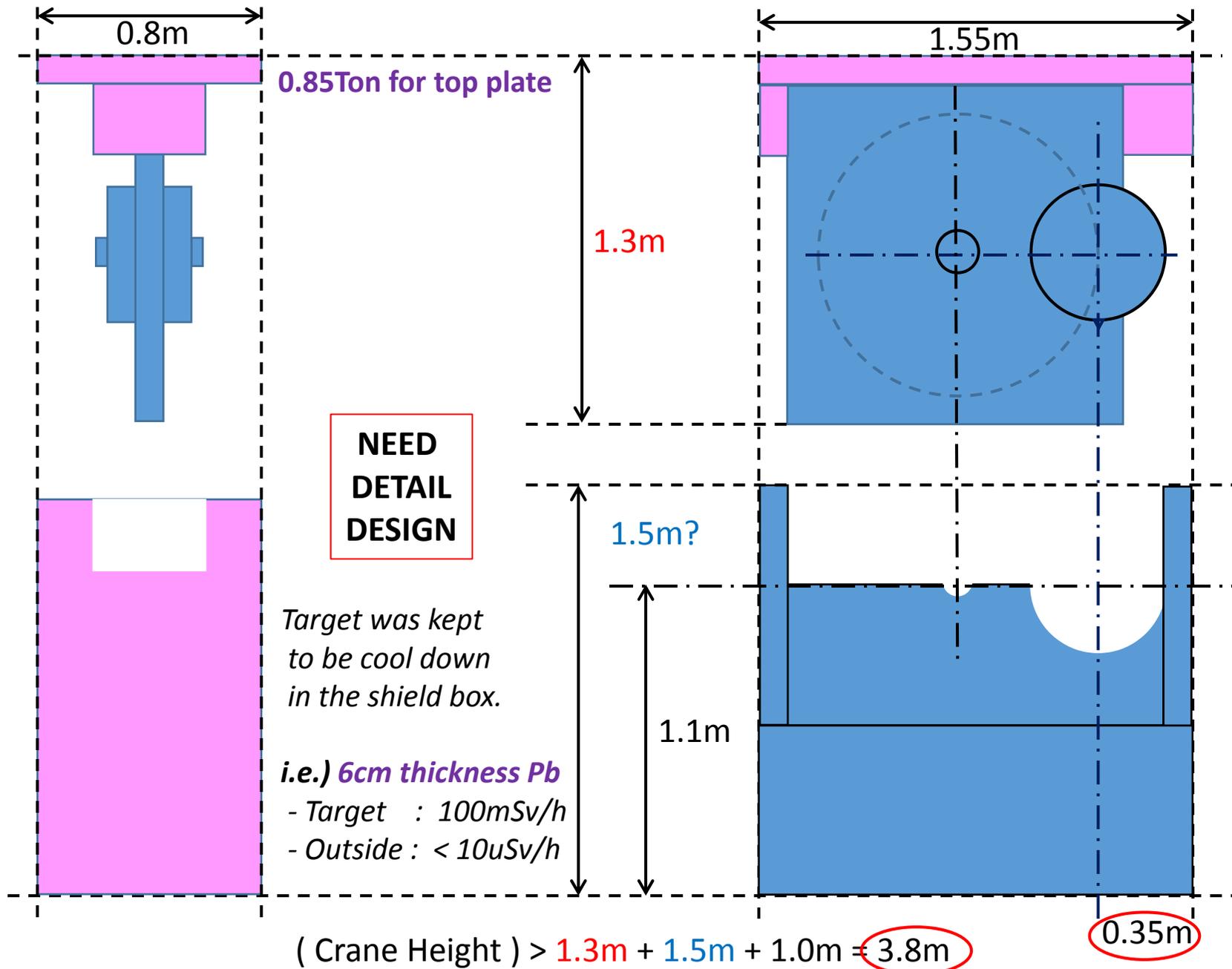


## Components of the Target Station Assembly

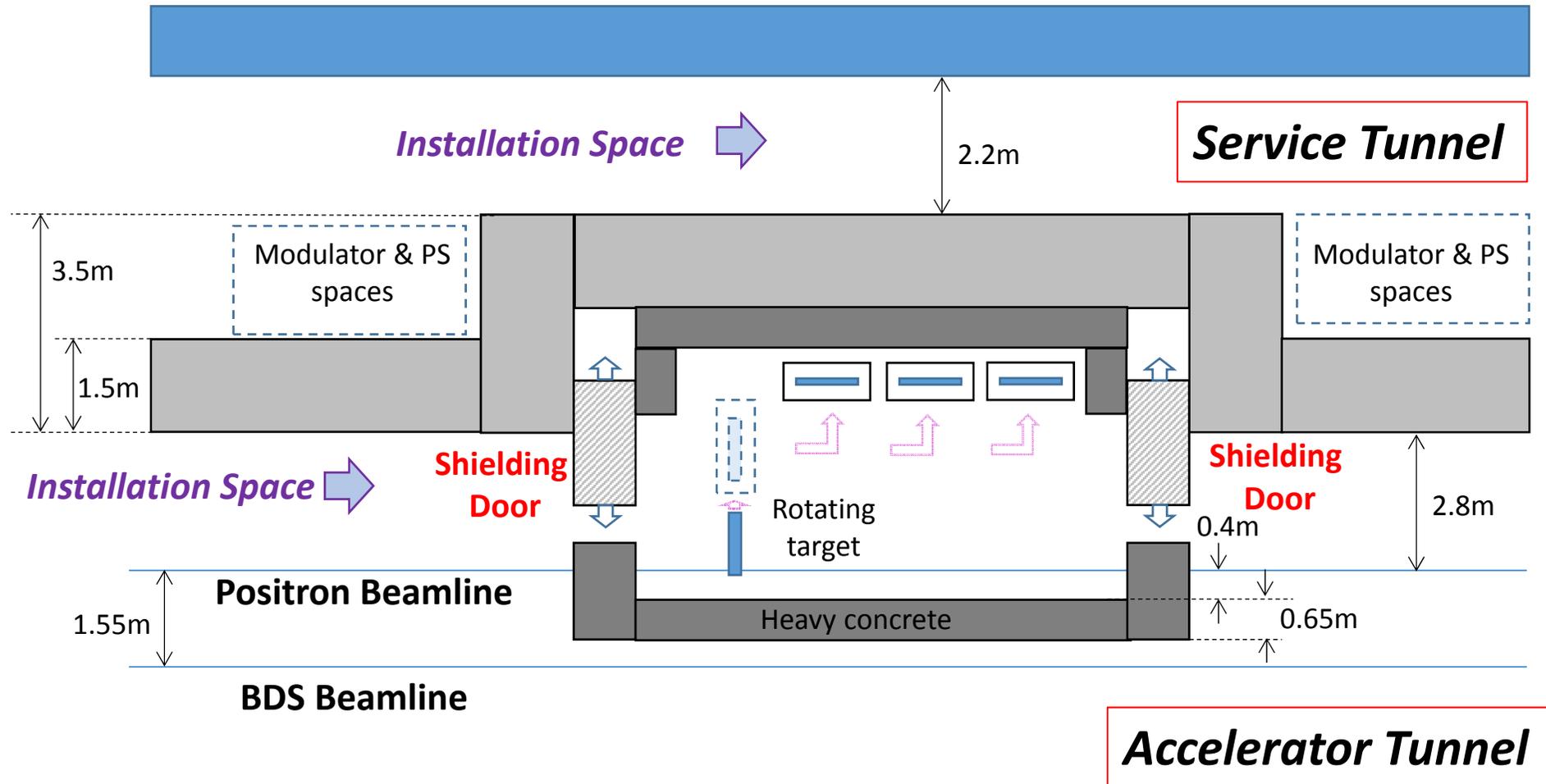


# Requirement of Target

- Modified to
- Target was put horizontally.
  - with thinner top plate.



## Example of the positron target area



*The target area is covered with additional 65mm thickness heavy concrete shield.  
The shielding door is used for installation of the cryomodules for booster linac.*

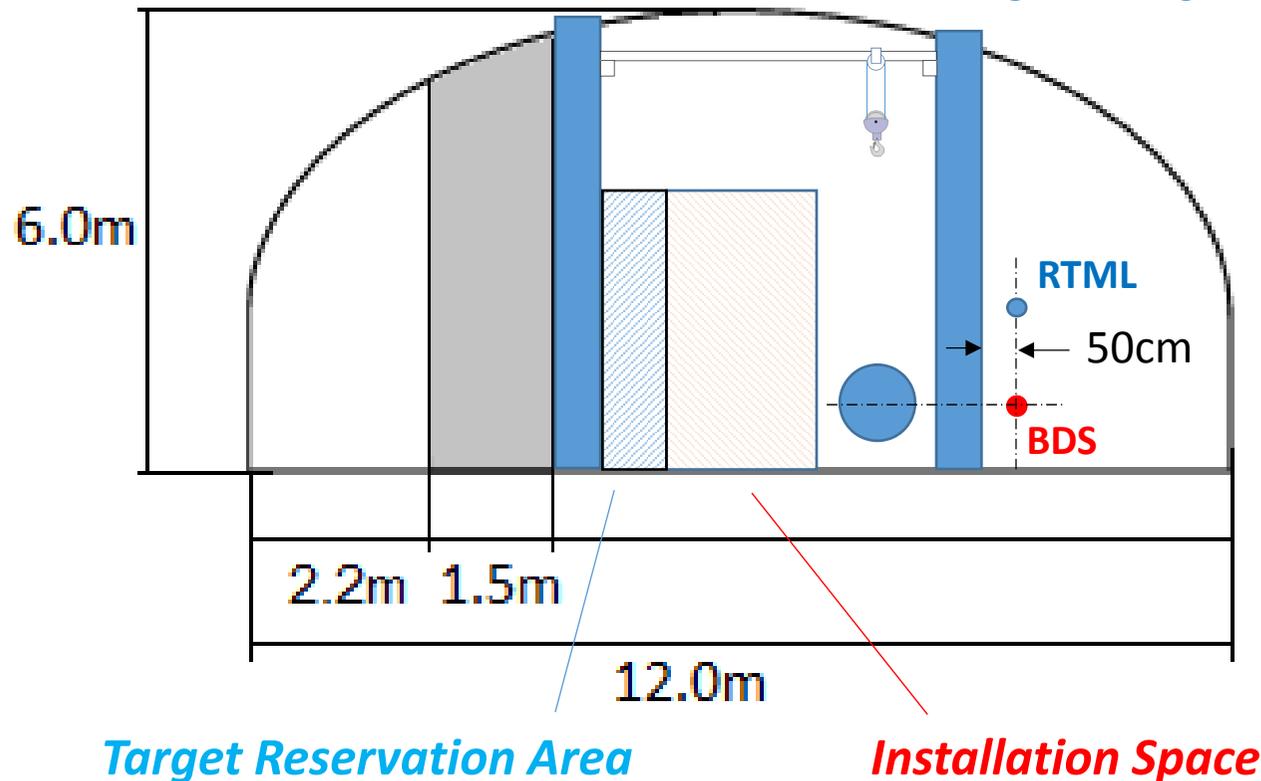
# Positron Target Replacement

- We need to design the detail remote handling procedure.
- We need to design the radiation shield box for used target cooling.
- We need to design the radiation shielding of the photon and electron dumps.

## hoist crane ( < 3 tons ) for target replacement

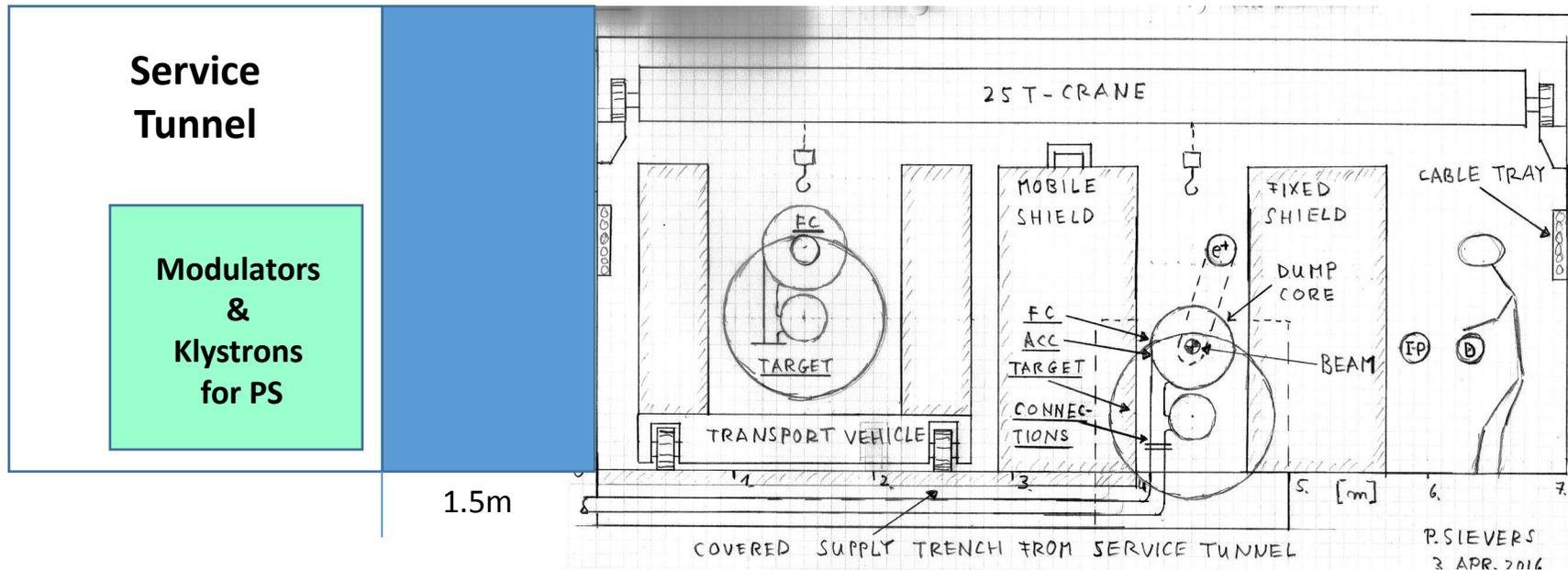
For Japanese safety regulation, ( >3 ton ) crane must take an official performance test in every 2 years.  
( < 3 ton ) crane only require the self load test in every year.

Lighter target design is better.



# Comment for the Idea of P. Sievers

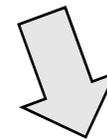
- Neutron from ceiling ?
- Modulator & Klystron ?
- Large Crane ?



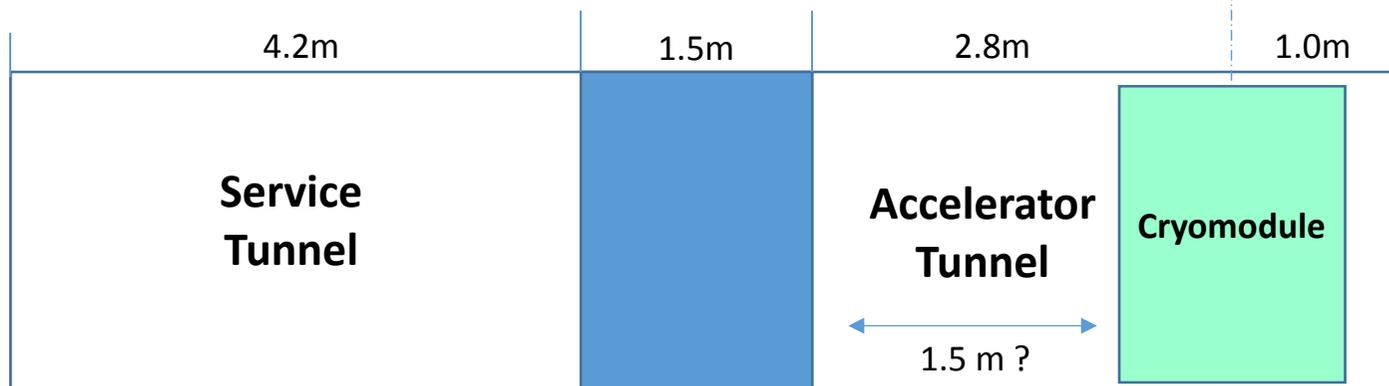
*We should extend the tunnel width of all ML tunnel up to access tunnel for target transportation.*

*or*

*We should make a compact transport vehicle.*



*Beam Line*



*ML Tunnel*

# Comparison

## T. Okugi Idea

- **The shield of the positron target area was designed to fit the BDS tunnel design.**
- **Used Target will be kept to be cool down in the target area.**
  - We should evaluate the radiation dose within the reservation box.
- **The photon and electron dumps are not covered with local shield.**
  - We should design the radiation shield of dumps.

## P. Sievers Idea

- **Overall tunnel design with service tunnel and other beamline will be necessary.**
- **Used Target will be moved from the target area.**
  - The width of the transport vehicle will be shorten ?
  - The transportation space in accelerator tunnel will be widen ?
- **The photon and electron dumps are covered with local shield.**
  - Very long restricted area
- **The neutron shield from ceiling**
- **Heavy weight must be prepared for 25 ton crane**  
(Japanese safety regulation ; 25 ton x 1.25 = 31.25 ton )

*The weight will be used  
only when the performance test.*