

Wall Thickness and RF Penetrations

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Main Linac beam loss and shielding

- Radiation shielding design of Main Linac
 - *Dose rate in service tunnel*
 - Central wall thickness, size of penetrations
 - *Tritium production in liquid helium*
 - *Radioactivity in air and soil*

 - *These evaluations come from amount of beam losses*

Up to now

- **AWLC2014 : Current Shielding Status**
 - *Full beam loss on the worst target. Prepare a list of parameters should be evaluated for Main Linac shielding*
- **LCWS2014 : Main Linac radiation shielding**
 - *Single pulse beam hits Cryo-module, dose from dark current, activity in Helium, soil*
 - *Failure mode and beam loss*
- **LCWS2015 : Assume beam loss scenario**
 - *Normal operation : Dark current only. Full loss of pilot bunch.*
 - *System failure : 10% of beam loss within 1m*

No access during beam operation

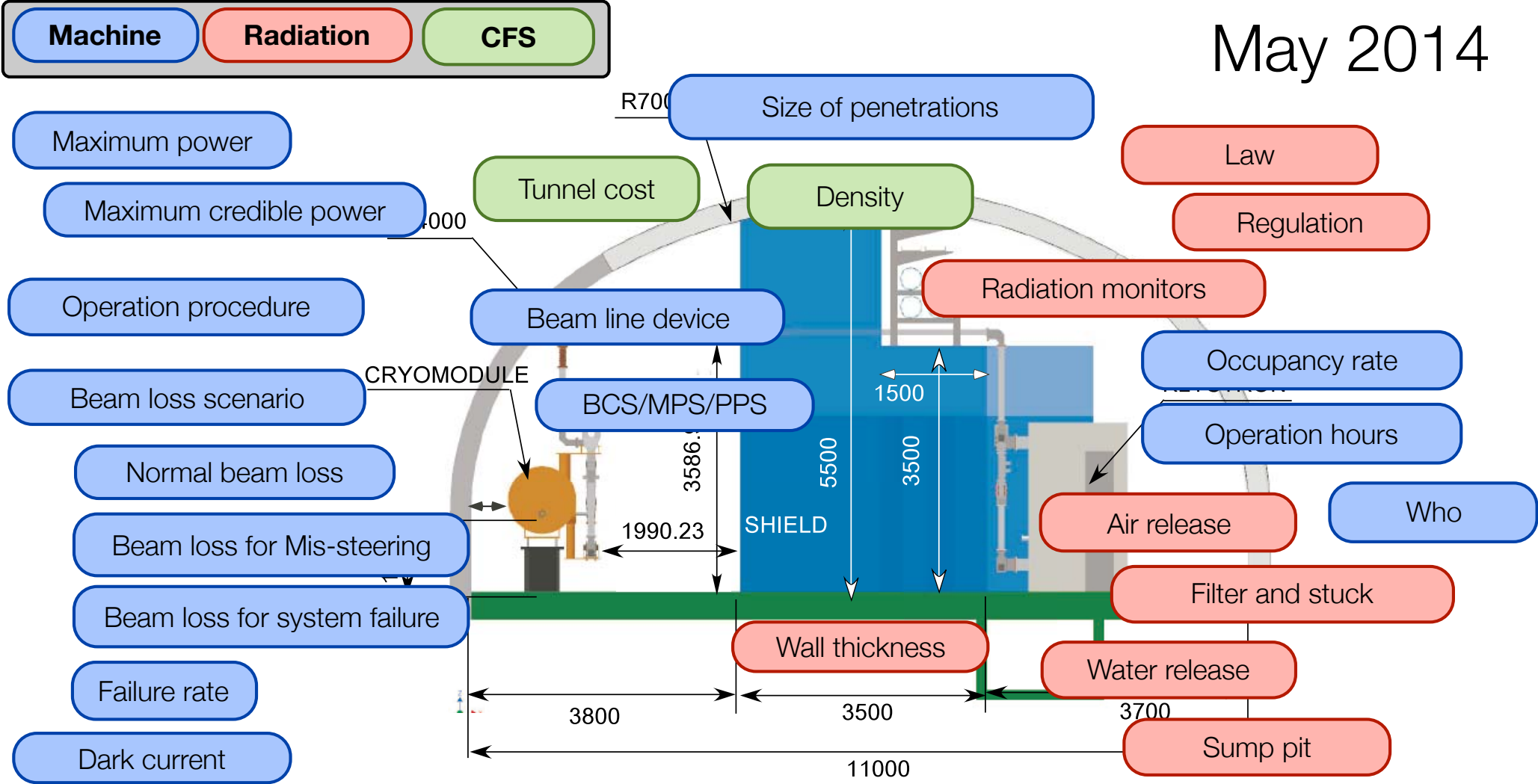
- Access service side only RF operation
 - *Employ separation shield to reduce dose from dark current*
 - No need to worry about system failure, mis-steering situation
 - 1.5 m shield gives 10 $\mu\text{Sv/h}$, since dark current is major loss during operation
 - *Consideration of failure mode scenario is still required, just postpone due to less importance.*
 - *Beam loss for normal operation including tuning phase still has been required. It must be documented and reviewed when we build “real machine”.*
 - *The change is indispensable to generate \$\$\$ for ML extension*

Request from convener

- 15 mins Thickness of Shield wall to protect personnel from dark current, including access between tunnels and cable and RF penetrations
 - *Concerning thickness of shield wall, 1.5 m will be sufficient based on Kubo-san and Yokoya-san's suggested dark current at 2nd ADI-meeting.*
 - *Access between tunnels and cable and RF penetrations are remaining topics to be studied*

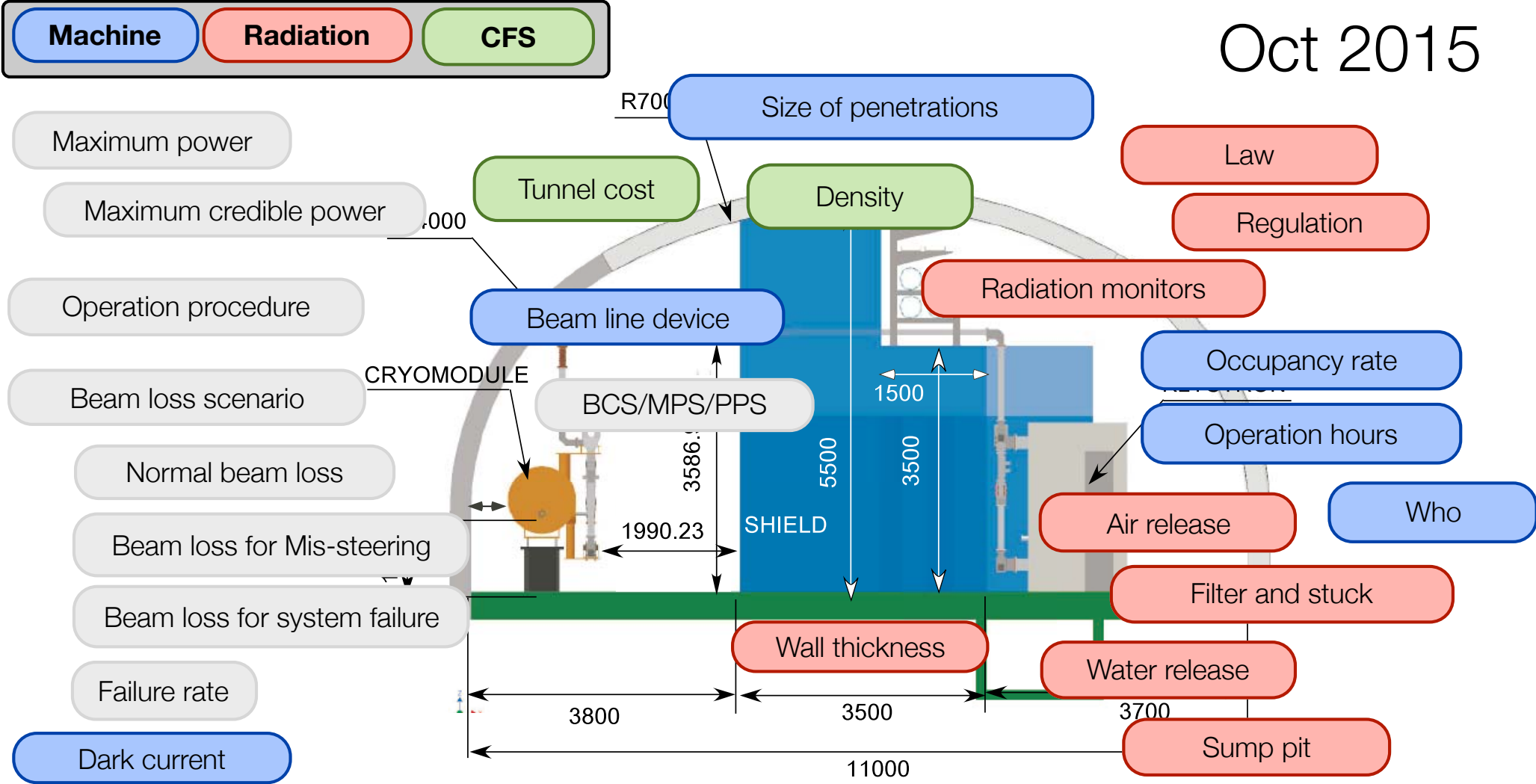
Parameters for radiation shielding design

May 2014



Parameters for wall thickness

Oct 2015



Access between tunnels and cable and RF penetrations

- Access between tunnels

- *Flat, less crank access if preferable. 0.8m(W) x 2.5m (H) at every 150 m, 1.2m(W) x 2.5m(H) at every 600 m*

- Cable and RF penetrations

- *Cable: No dedicated penetration. Remaining space of RF penetration or ceiling of the access can be used*

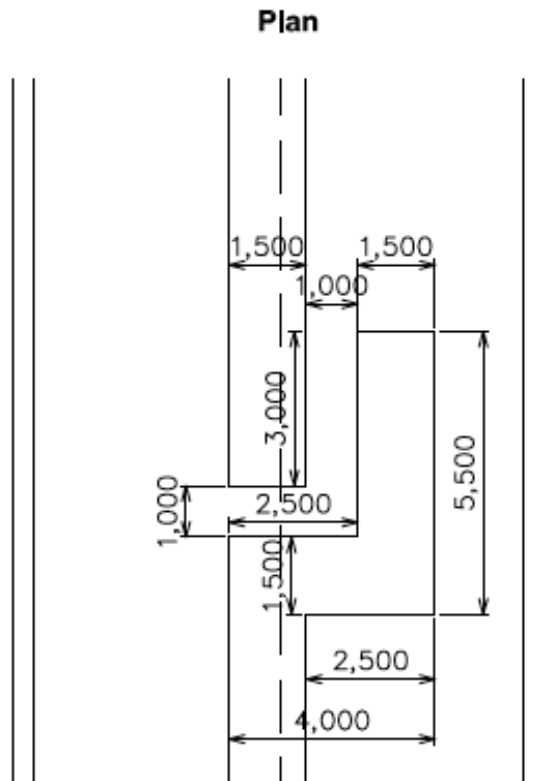
- *RF: 40 cm in diameter will be required to pass through flange of WG. Put shielding materials in if required*

- *The other, for cooling water, liquid helium, is not discussed yet*

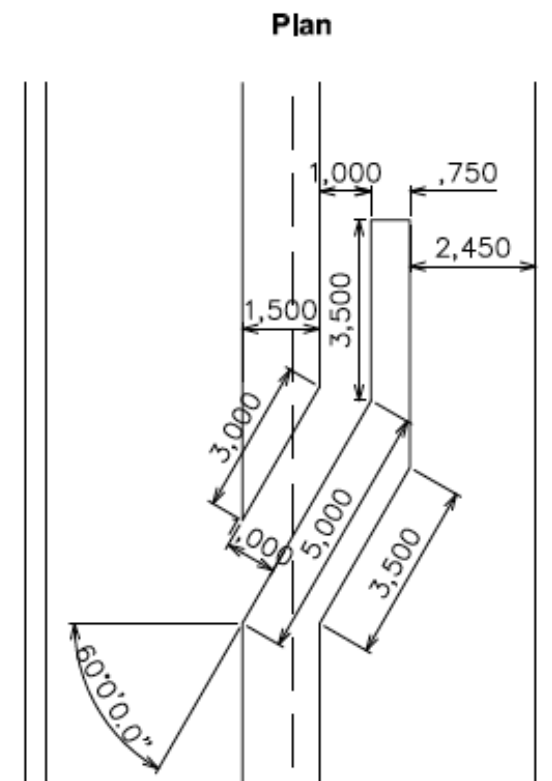
Access between tunnels

- Two ideas are suggested by CFS
 - to ensure 1.5 m concrete thickness anywhere

Plan A



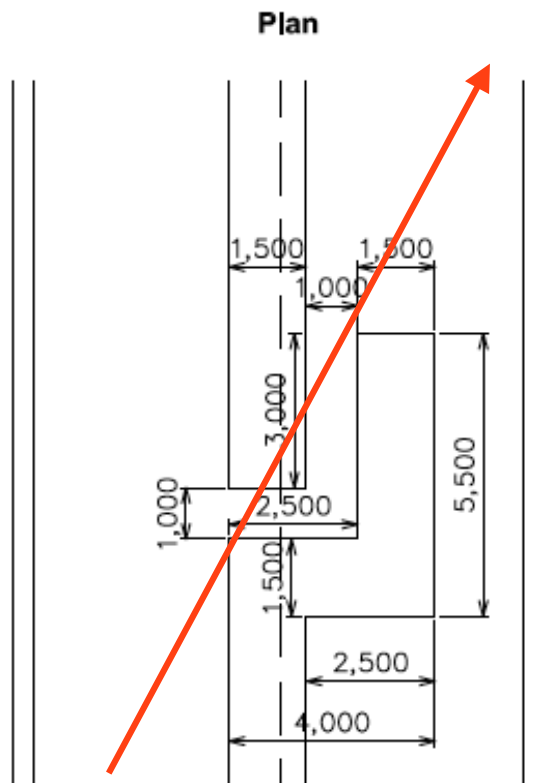
Plan B



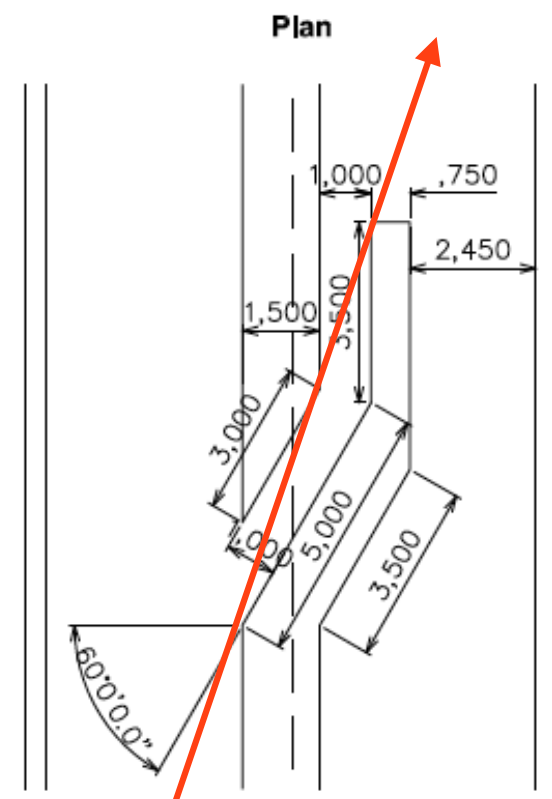
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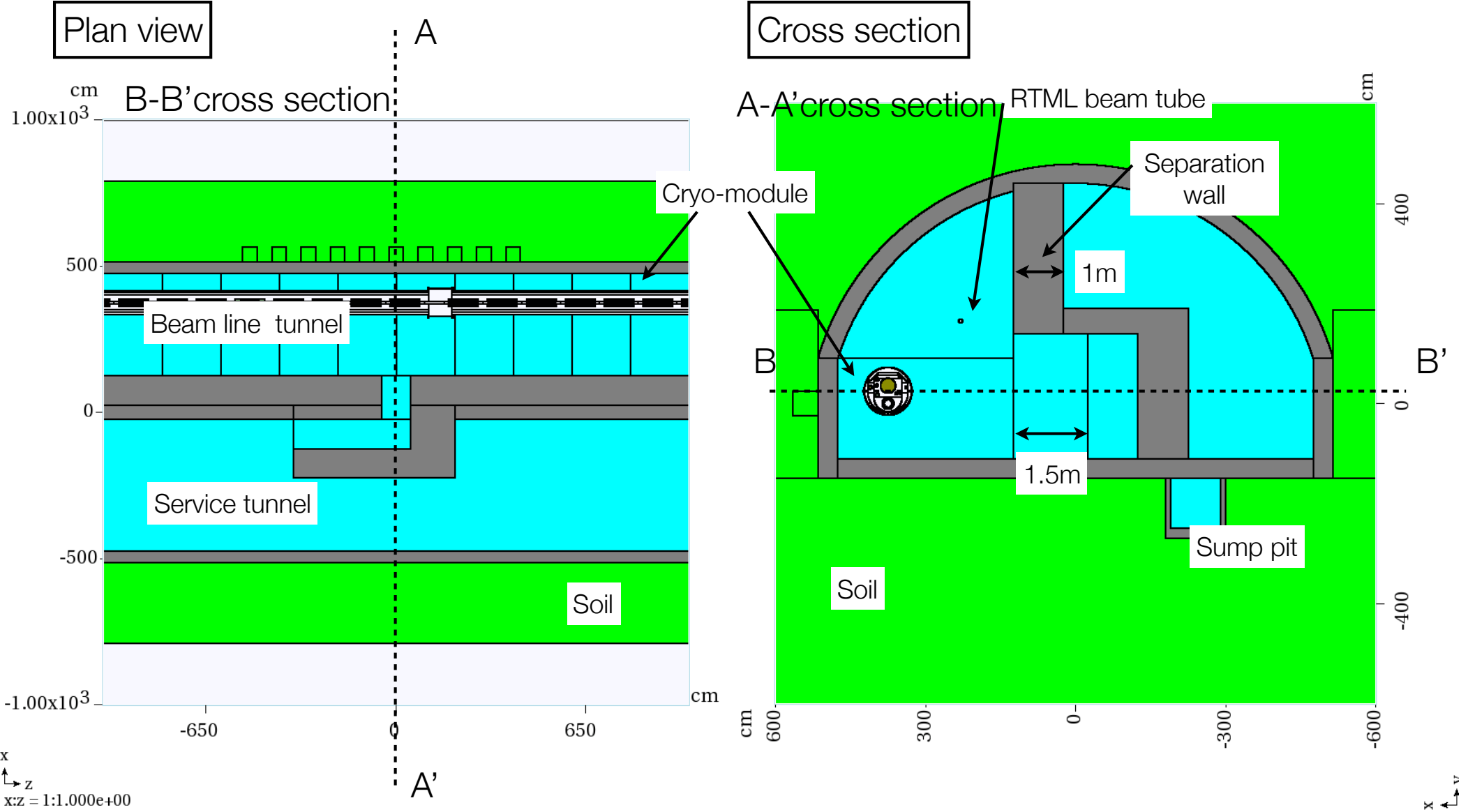
Plan A



Plan B

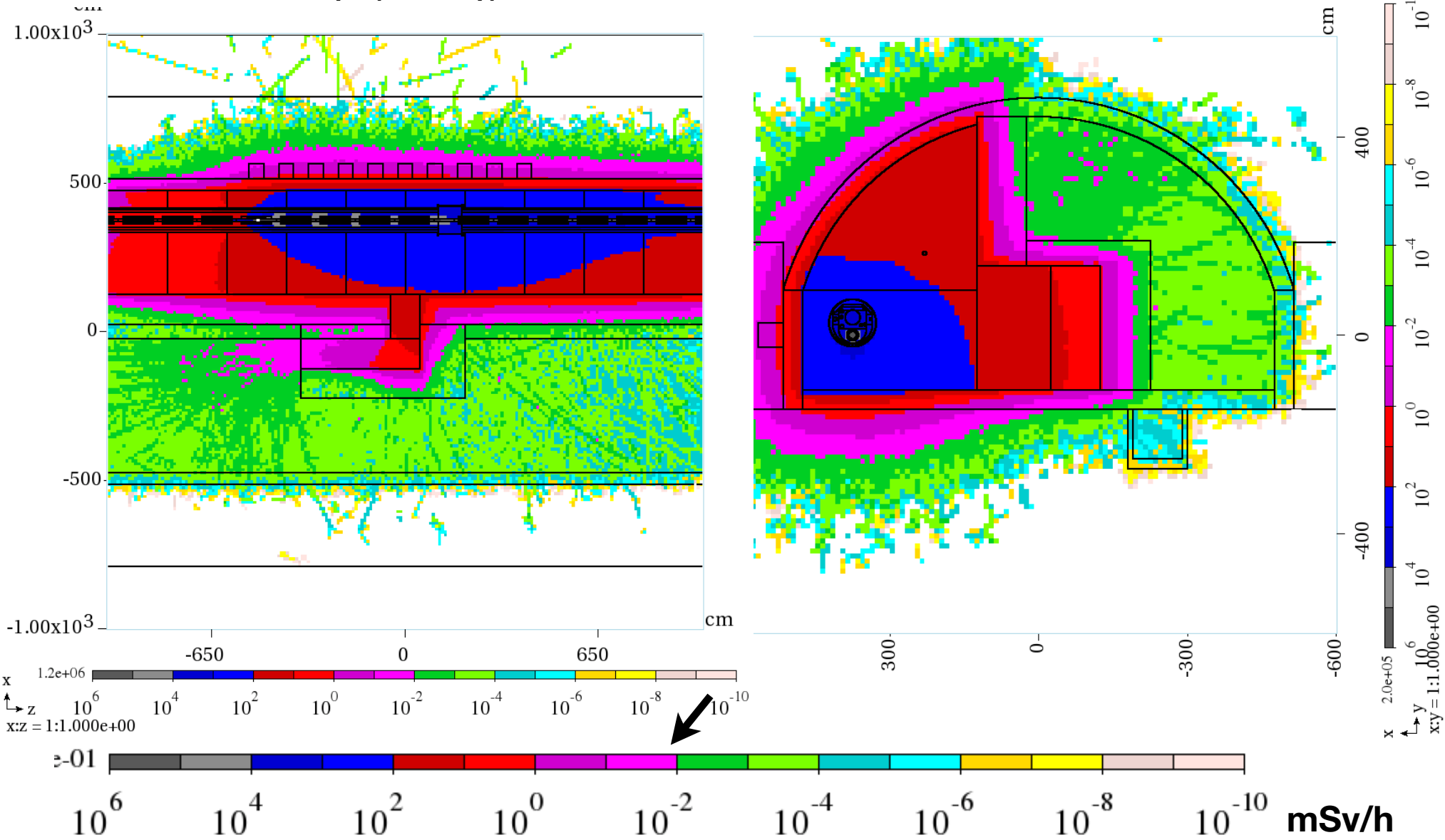


ML simulation model



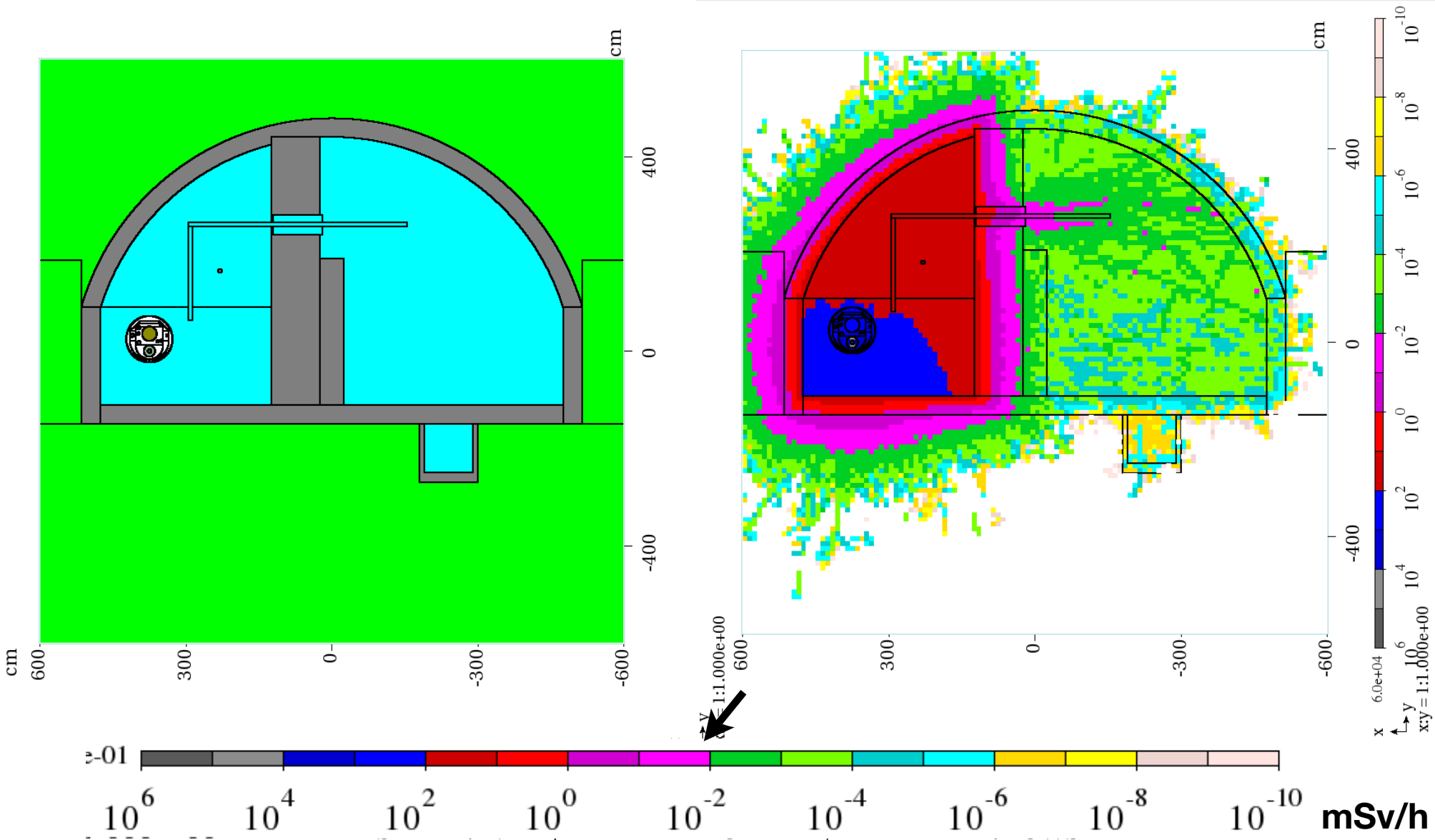
Dose rate for dark current (Access)

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



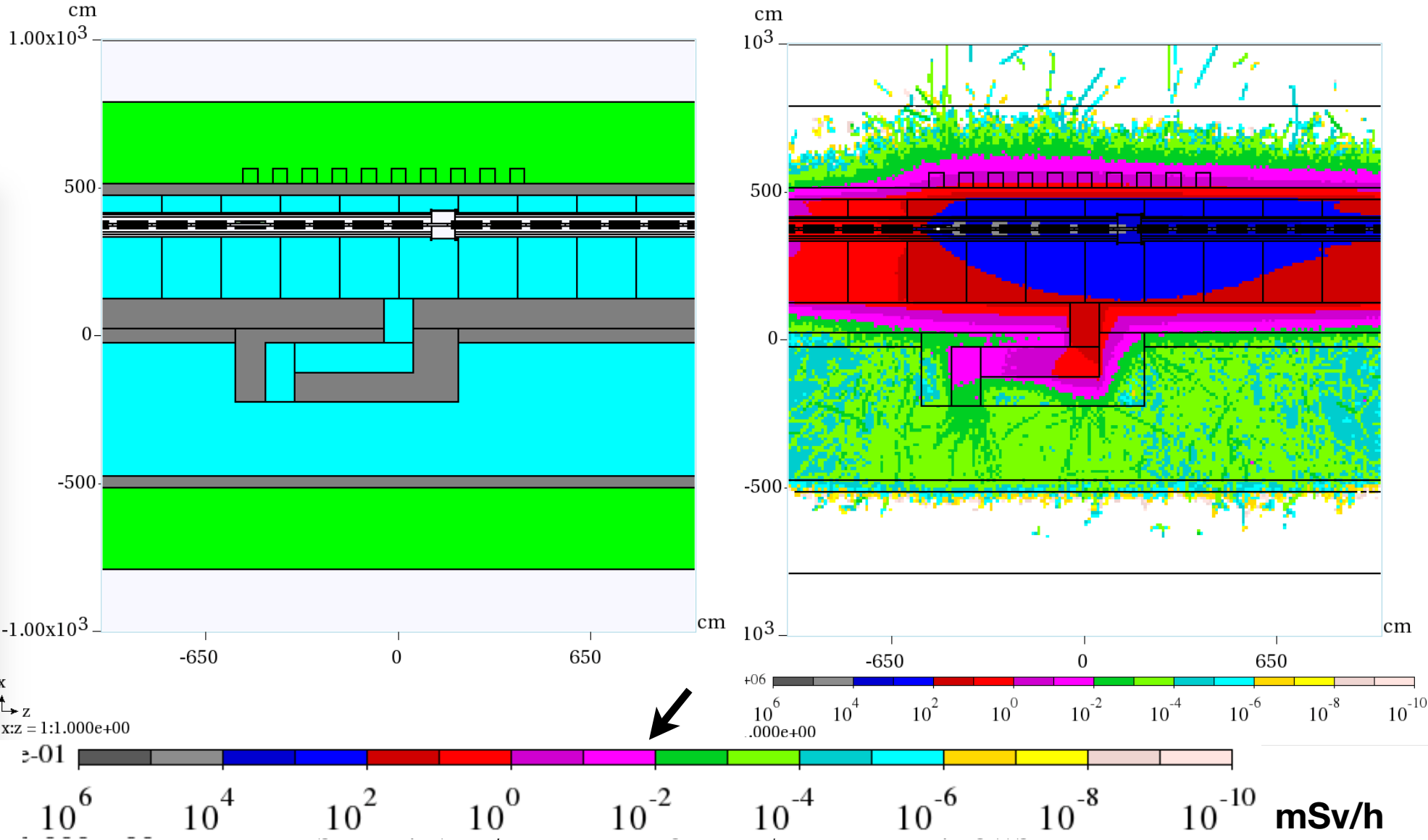
Dose rate for Dark current (Waveguide)

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



Dose rate for Dark current (Waveguide)

Normal loss : 6.875×10^{10} eps (50nA eq.) due to dark current



Conclusion

- Thickness of Shield wall to protect personnel from dark current, including access between tunnels and cable and RF penetrations
 - *Access between tunnels, Plan A*
 - *RF penetration. No cable penetration*
 - *Evaluated under ML shield wall of 1.5 m in thickness*
- Things to do
 - *Make a list of penetrations, interval, diameter and filled material, design access between two areas*
 - *Find a place to confirm simulation results*