

Ionization laser system: ideas to improve coverage for end-wall periscopes

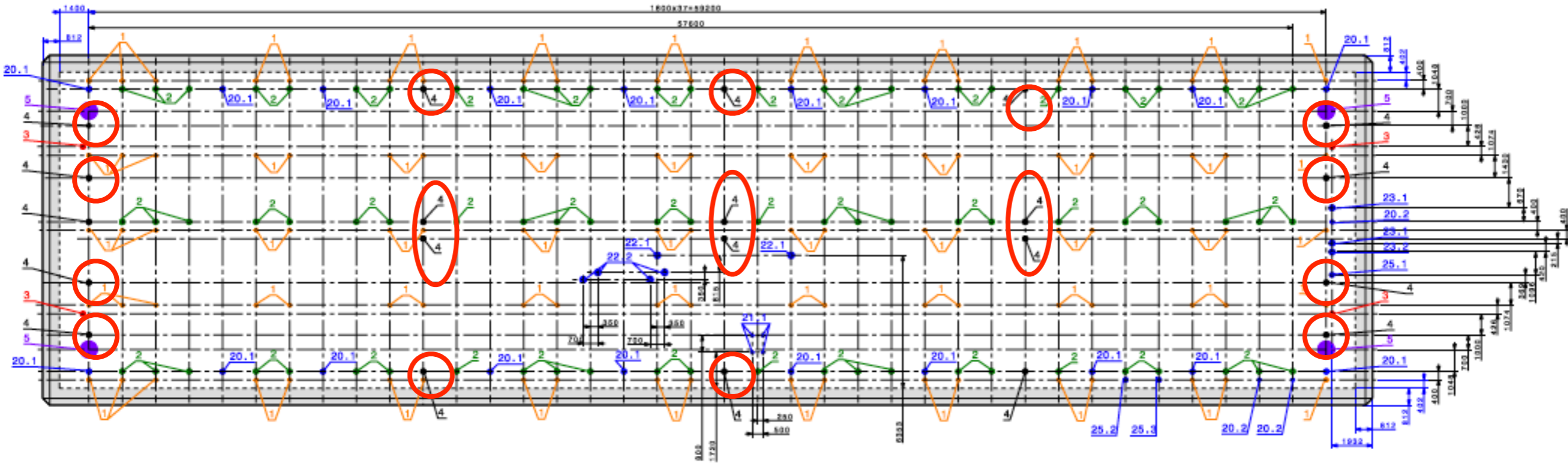
José Maneira (LIP)

following discussions with many from the LIP group: R. Alves, S. Andringa, F. Barão, N. Barros, F. Neves, V. Solovov

Calibration Consortium Meeting
April 26, 2019

Calibration Ports

TCO side

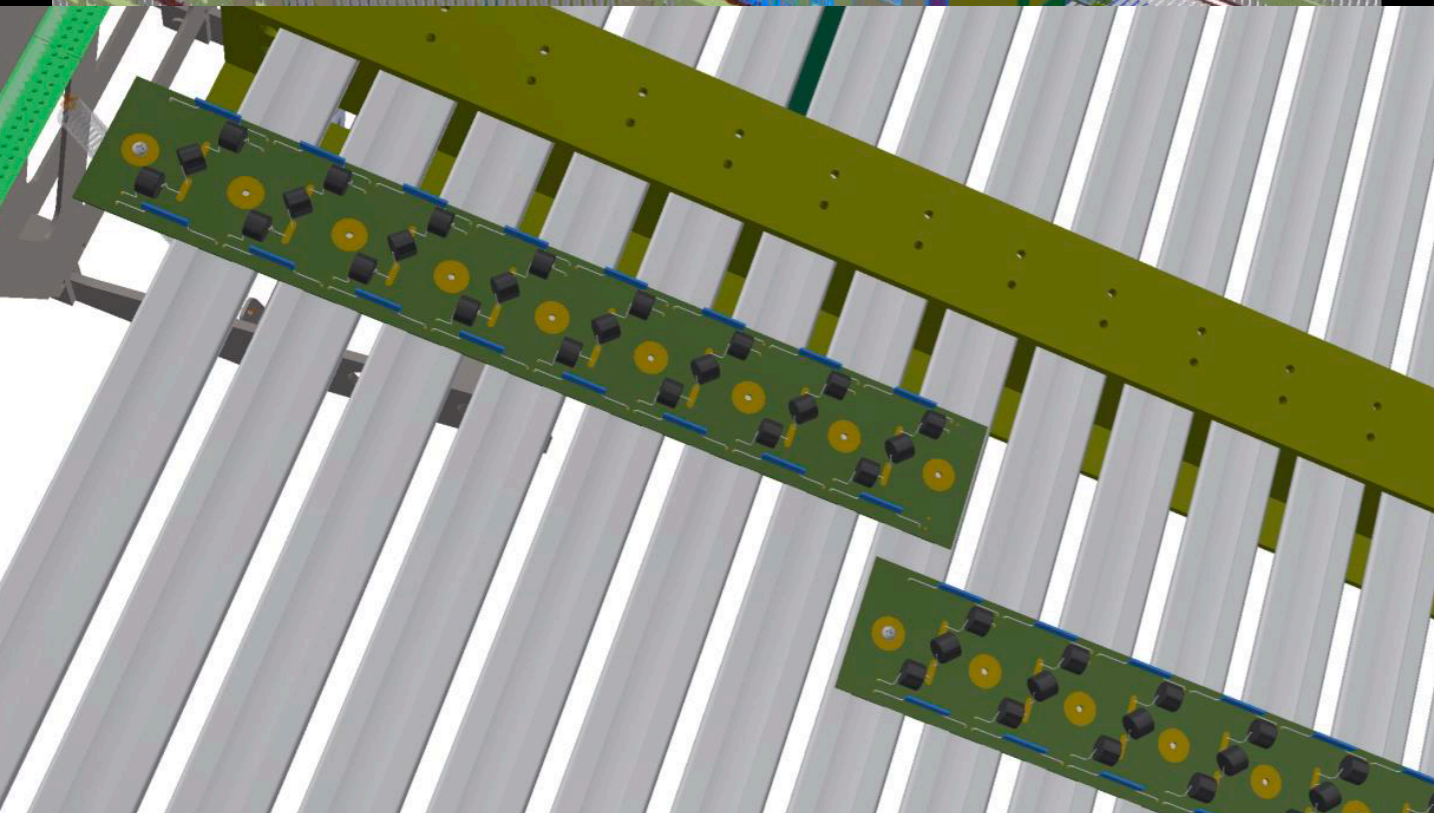
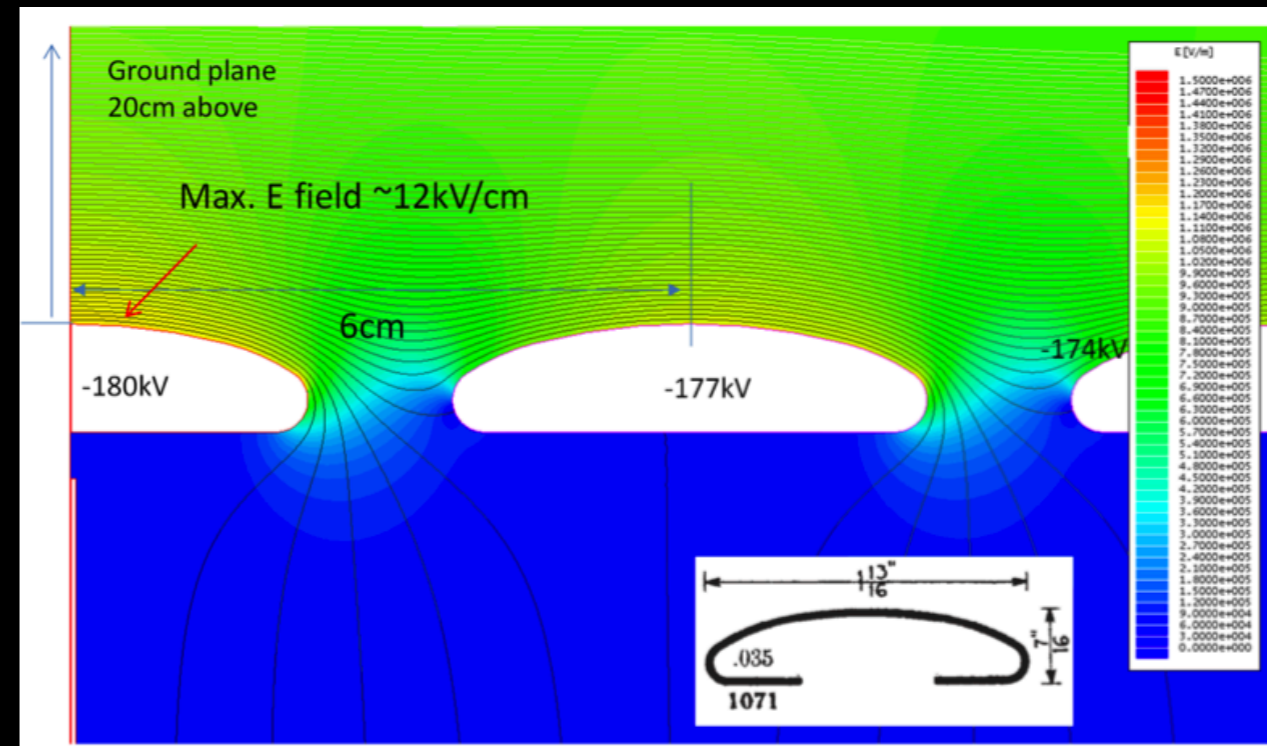
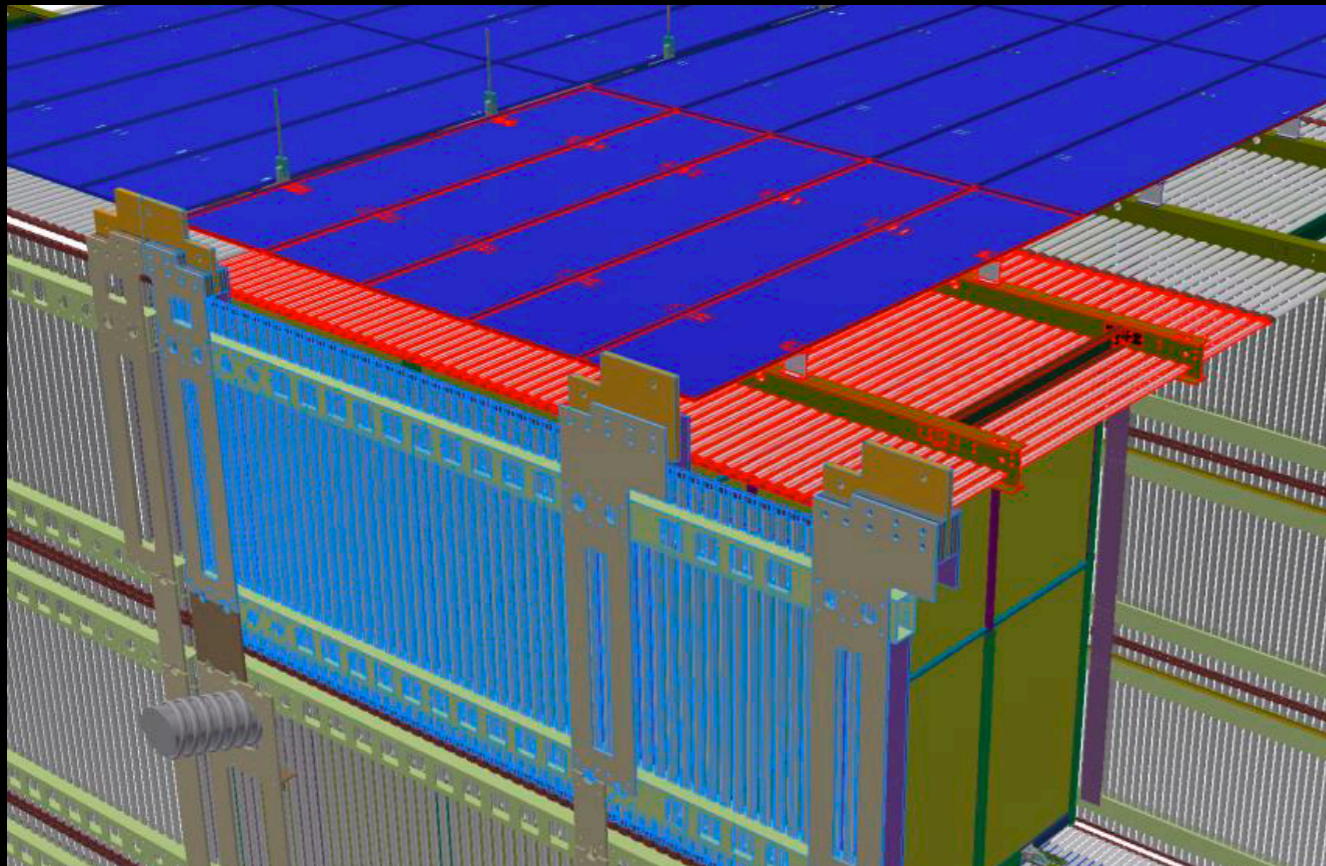


- Top TPC ports (4+4+4)
 - on top of TPC, at 3 different z positions
 - each at about 40 cm from closest APA
- End-wall ports (4 East, 4 West) are:
 - not on top of TPC, but 40 outwards
 - not close to APAs, but closer to mid-drift

Laser system coverage

- How well the laser systems covers the DUNE detector depends strongly on whether we penetrate or not the field cage
- Top FC roof. Feedthroughs on top of FC, ~40 cm from APA's
 - Should be better to penetrate, SBND-style
 - Bo Yu presented concrete setups for penetration in April 5 meeting
- <https://indico.fnal.gov/event/20390/contribution/0/material/slides/>

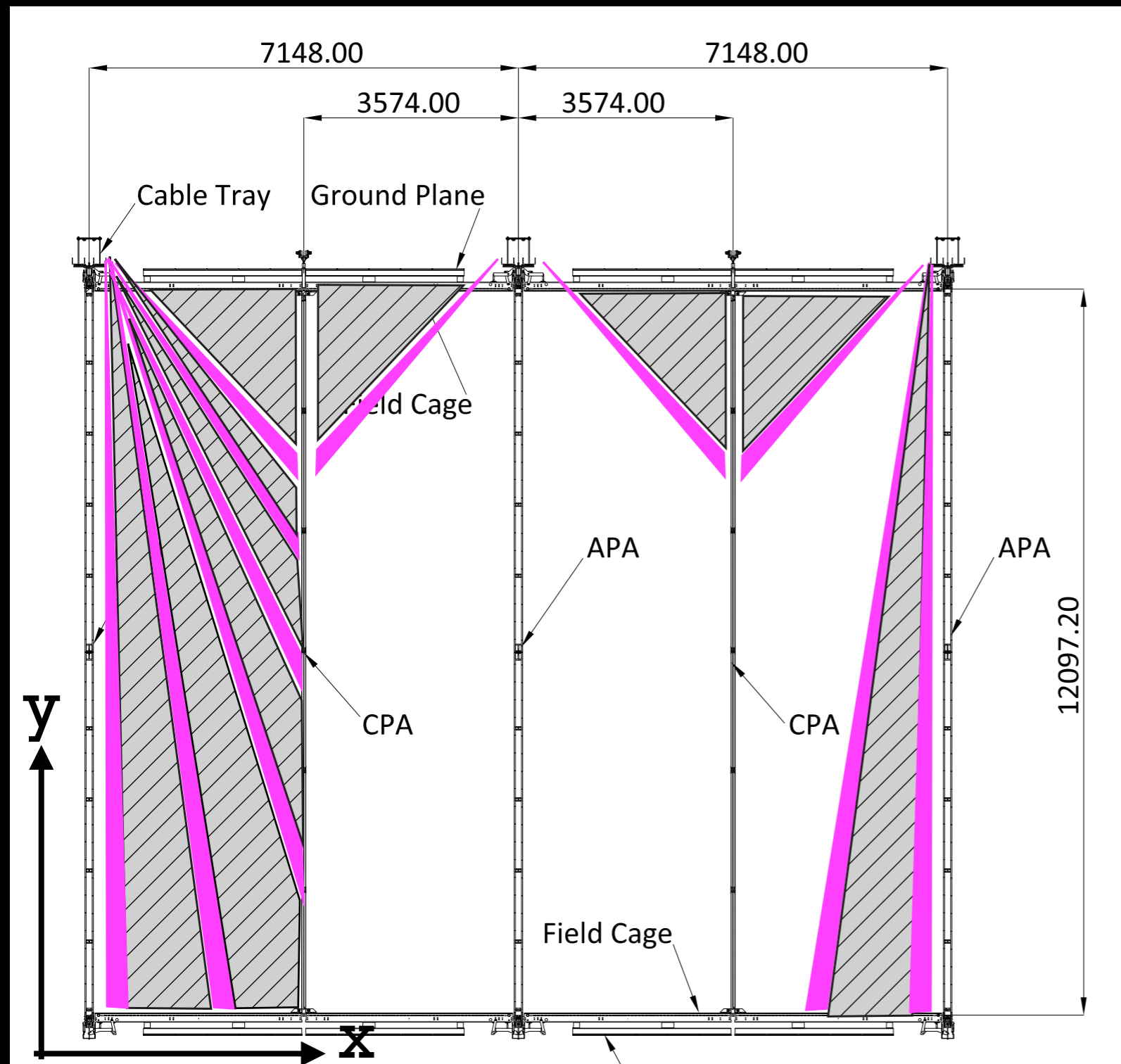
Field cage constraints



- Period 60 mm
 - Wide profiles: 46mm
 - Narrow gaps: 14 mm
 - max angle ~ 45 deg
- Ground plane
 - so can't be too far up

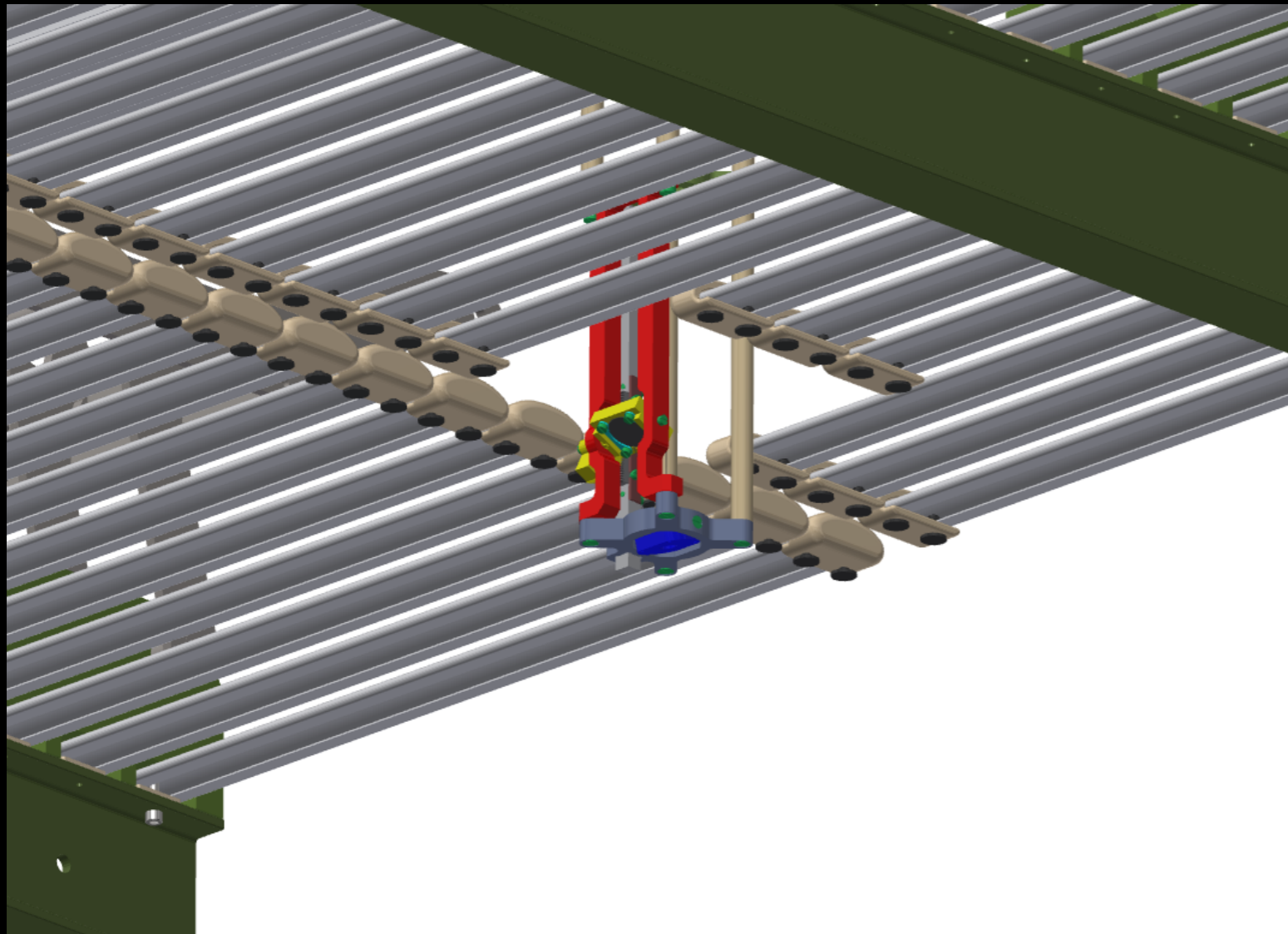
% area covered (Top ports)

Assuming no FC penetration!



- TOP: only about 40 cm (10 %)
 - Most of top FC goes unseen
- Beam width at bottom
 - single slot through gaps ~ 43 cm
(= $1.4/40 \cdot 1240$)
 - single profile shadow ~143 cm
(= $4.6/40 \cdot 1240$)
 - $43/(143+43) \sim 23\%$

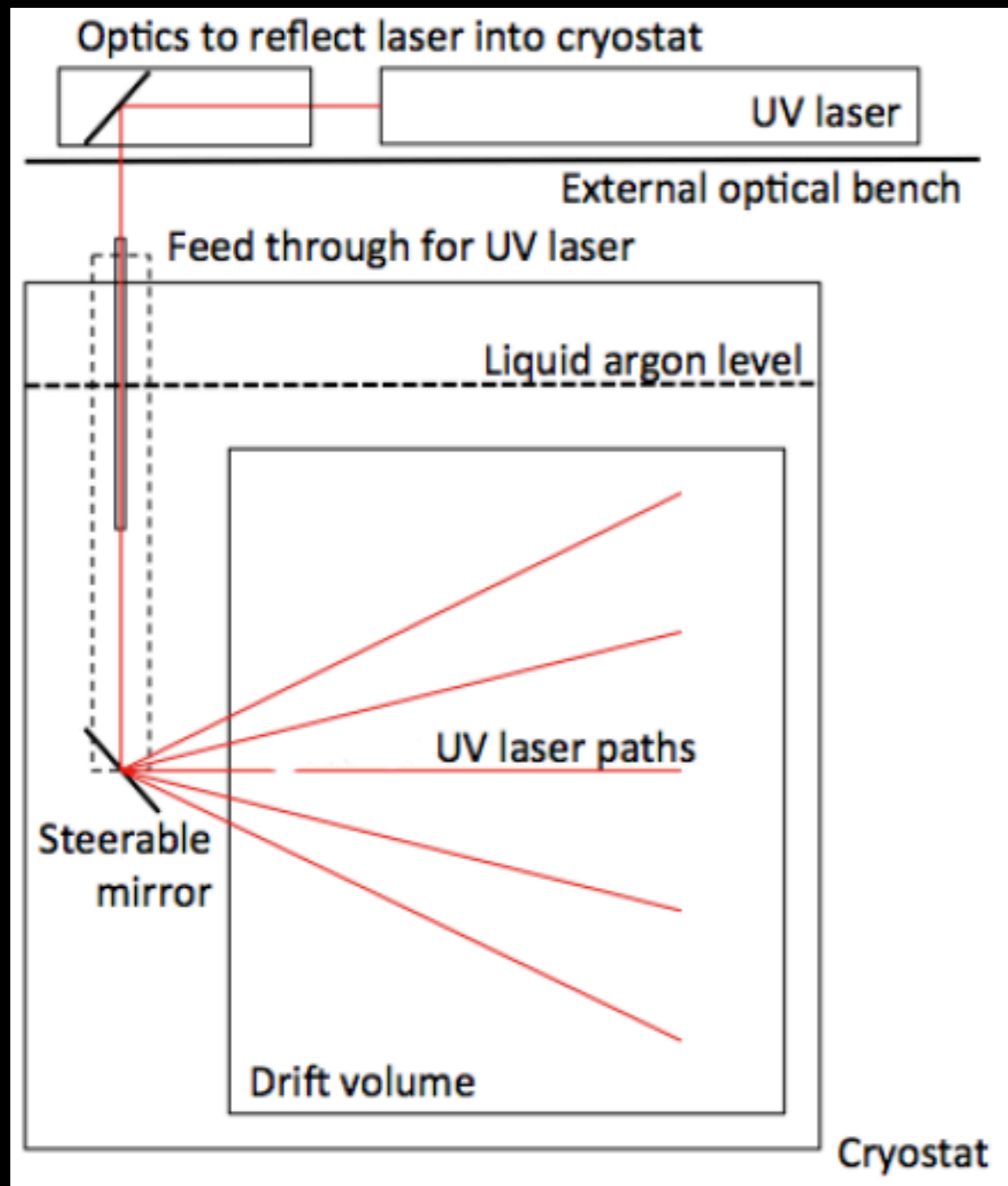
With penetration



- Assuming all TPC top periscopes penetrate the roof FC
- Coverage of bottom FC and CPA wall likely 100%
- roof coverage limited by I-beams

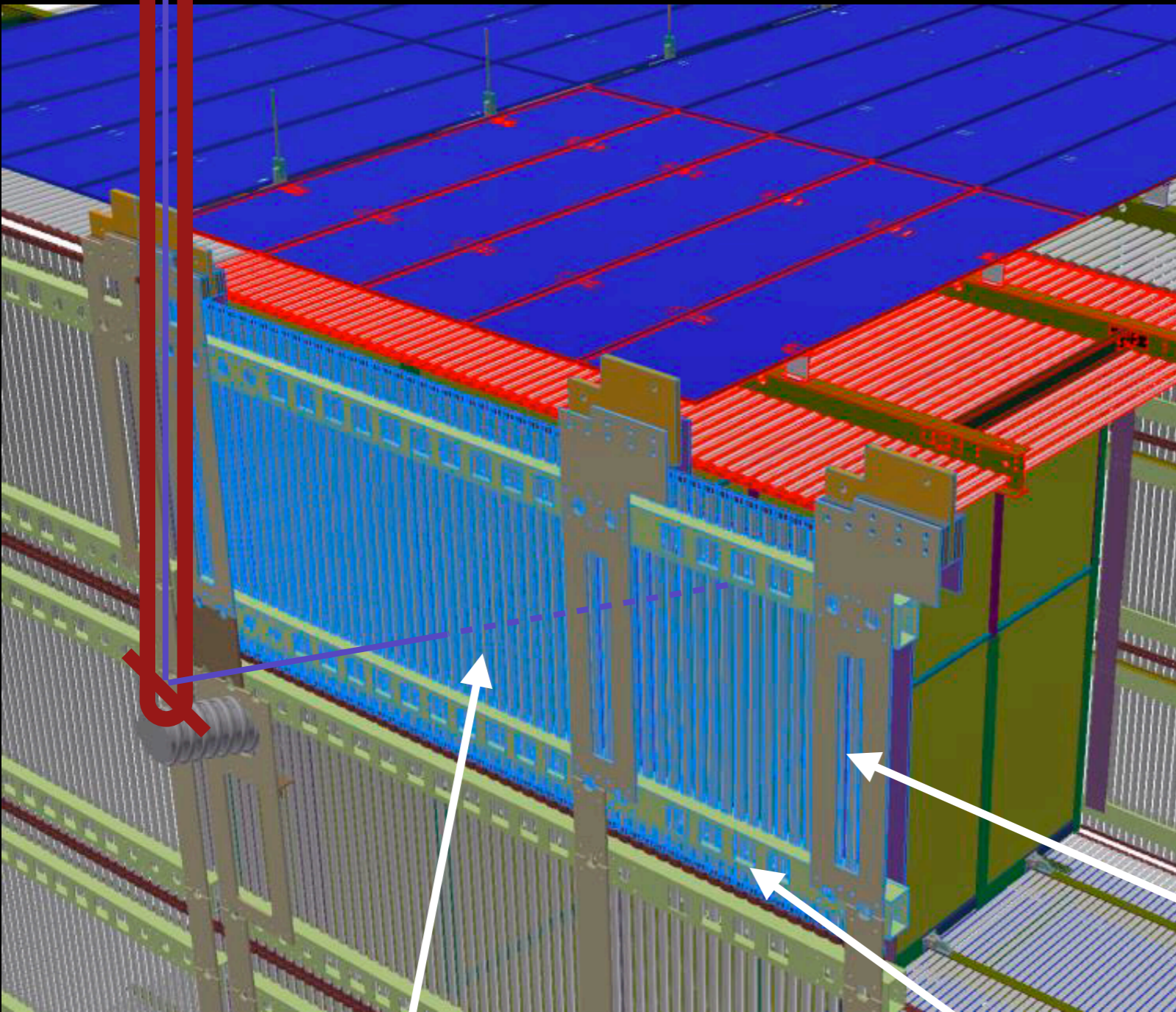
B. Yu, April 5 2019, Consortium Meeting

Coverage from end-wall



- Baseline system is MicroBooNE style
- beams come in from outside FC
- at higher Y than shown (closer to FC roof)
- at 60% x from APA

End-wall limitations



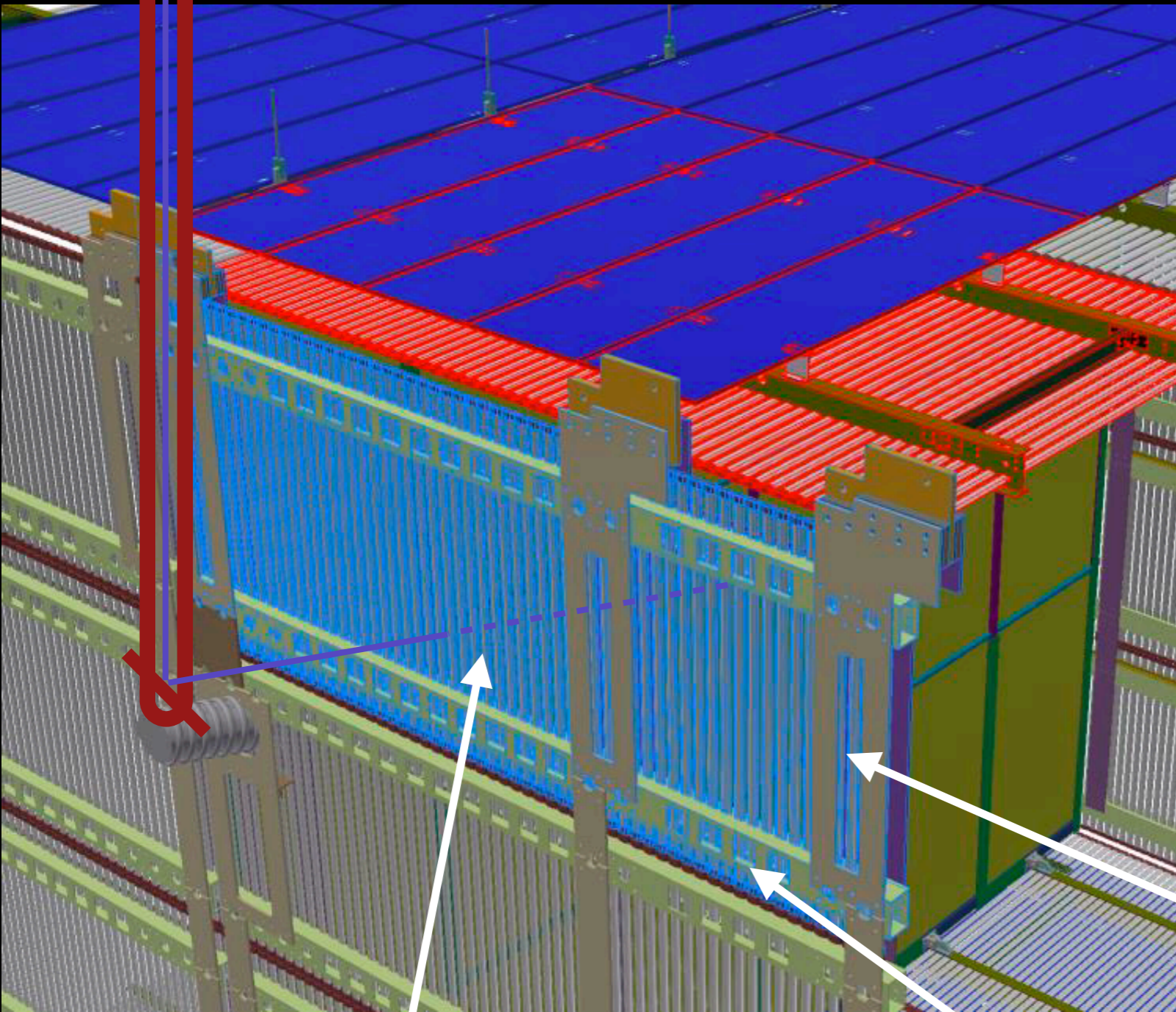
Need to avoid pointing at APA and avoid shadow from all the HV system elements

vertical FC supports

horizontal FC supports

vertical FC profiles

End-wall limitations



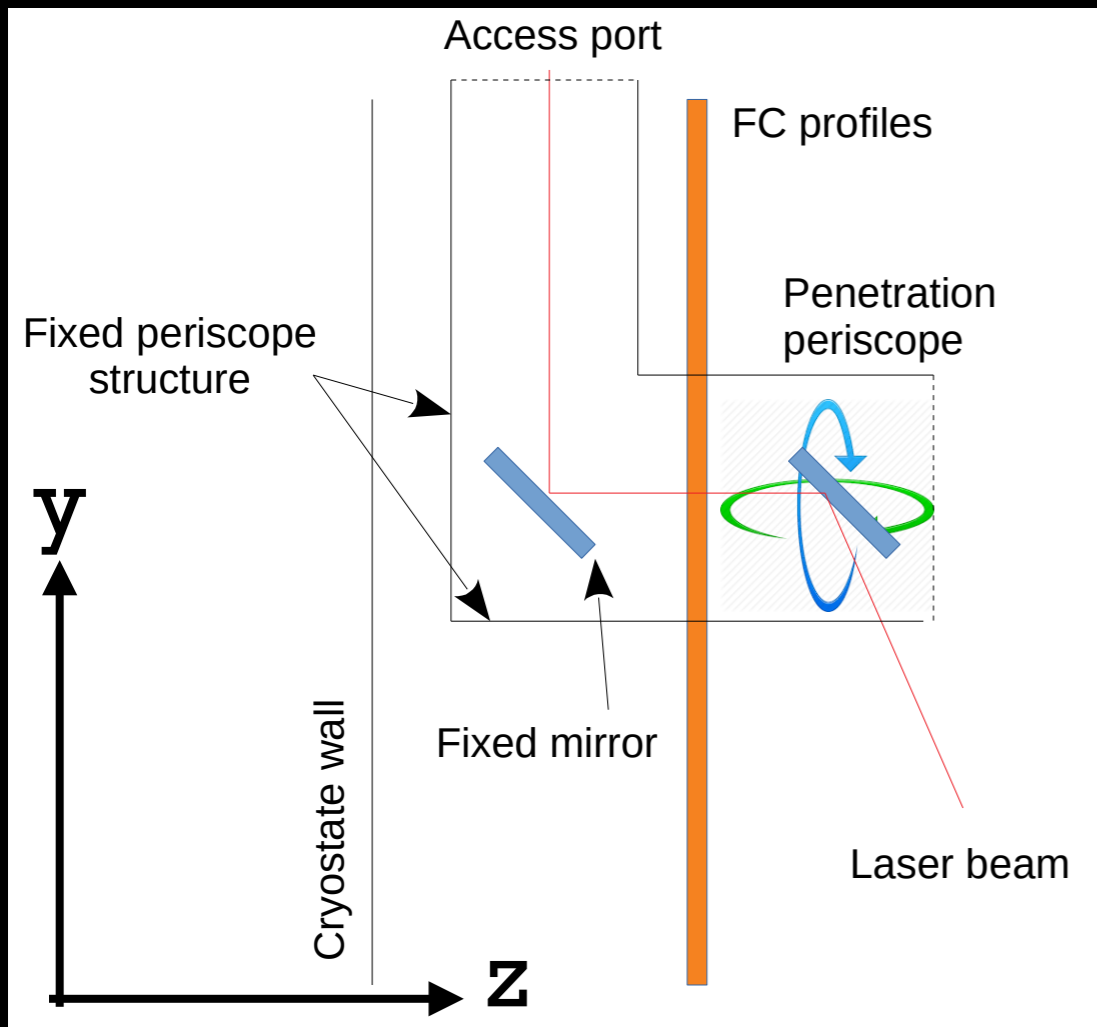
Need to avoid pointing at APA and avoid shadow from all the HV system elements

vertical FC supports

horizontal FC supports

vertical FC profiles

Alternative 1



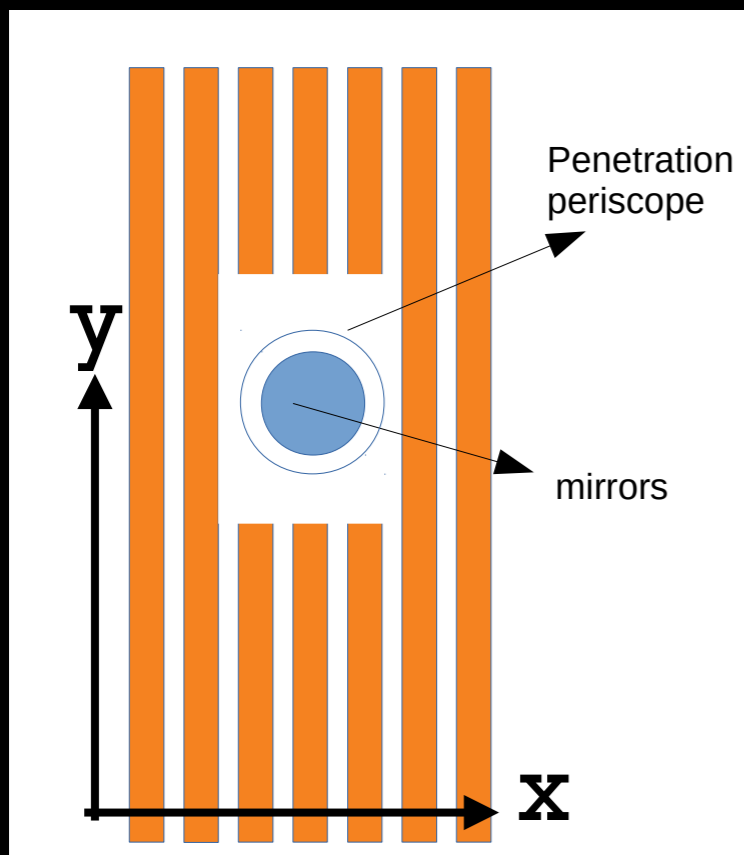
- Lateral FC penetration

- Advantages

- mirror would be inside FC
- much better coverage

- Challenges

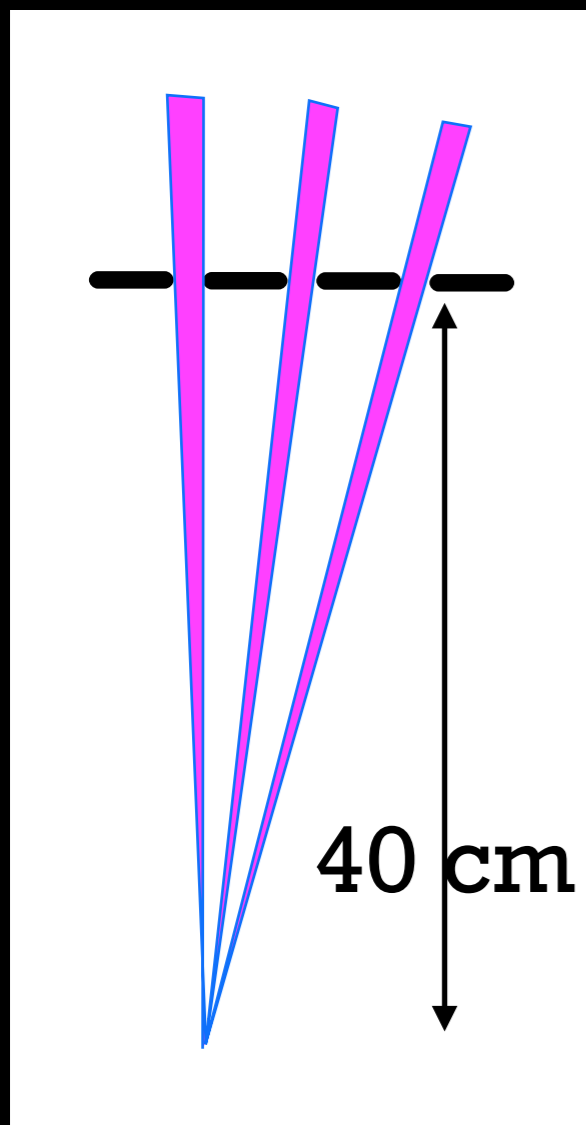
- mechanics of L-shape transmission
 - LIP engineer working on CAD
- installation requires mounting L-shape from bottom
- HV: can we have a hole in the FC at about 2m from APA?



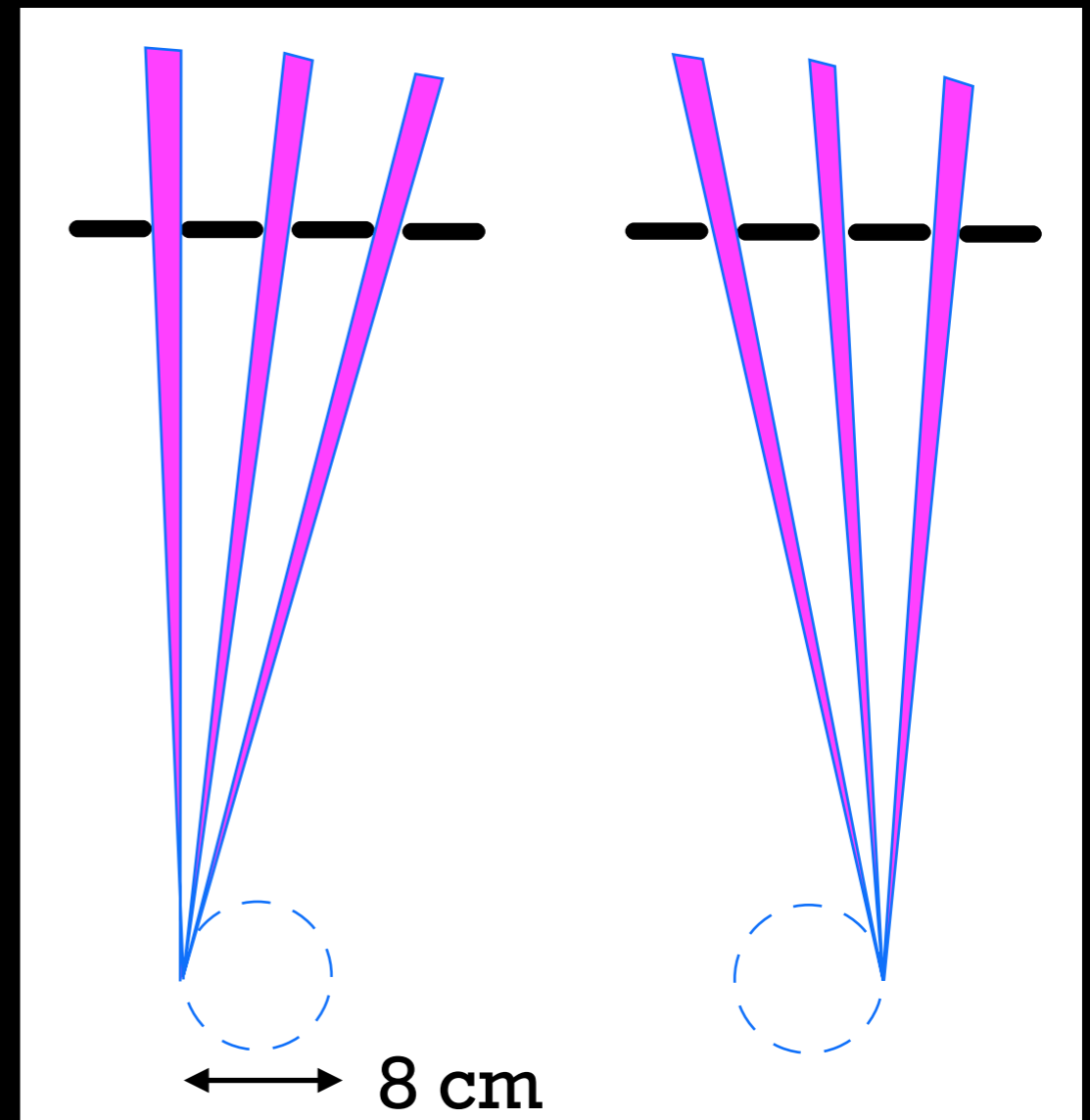
Alternative 2

- Add another rotation degree of freedom so that the bottom mirror translates in a circular path.

Baseline



Alternative



Alternative 2

- How to achieve it?
 - Secondary rotary flange
 - Offset by ~ 4 cm
 - 3 degrees of freedom
 - rotation blue flange (new)
 - rotation red flange (mirror phi)
 - linear stage (mirror theta)
- Advantages
 - No penetration. Mechanical complication all outside cryostat
- Challenges
 - Very new idea, need to check it properly...

