Laser calibration
- alternative setups -

F. Neves (LIP)

On behalf of the LIP group: R. Alves, S. Andringa, F. Barão, N. Barros, J. Maneira, V. Solovov

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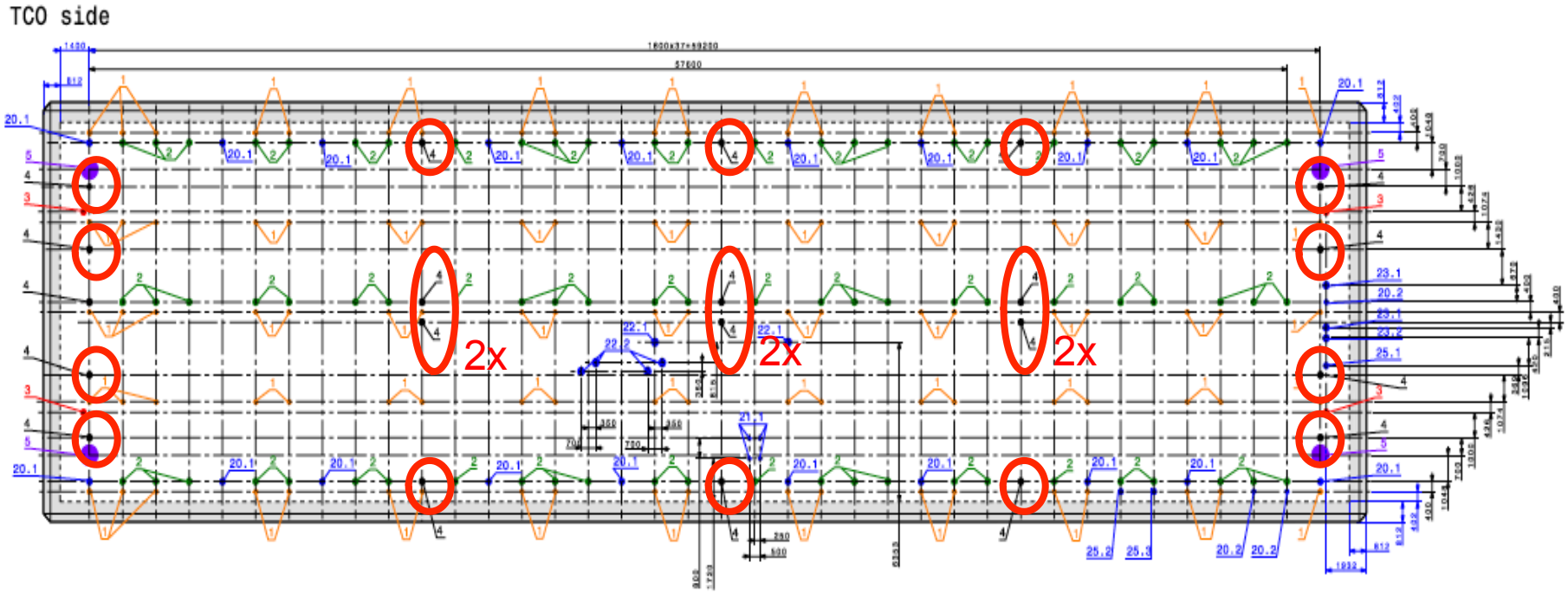
Calibration Ports (rev)

Top TPC ports (4+4+4):

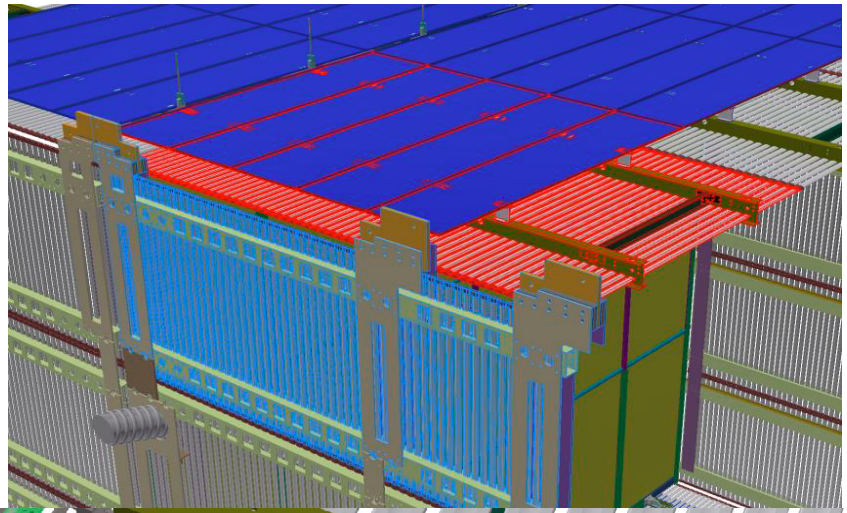
- on top of TPC, at 3 different z positions
- each at about 40 cm from closest APA

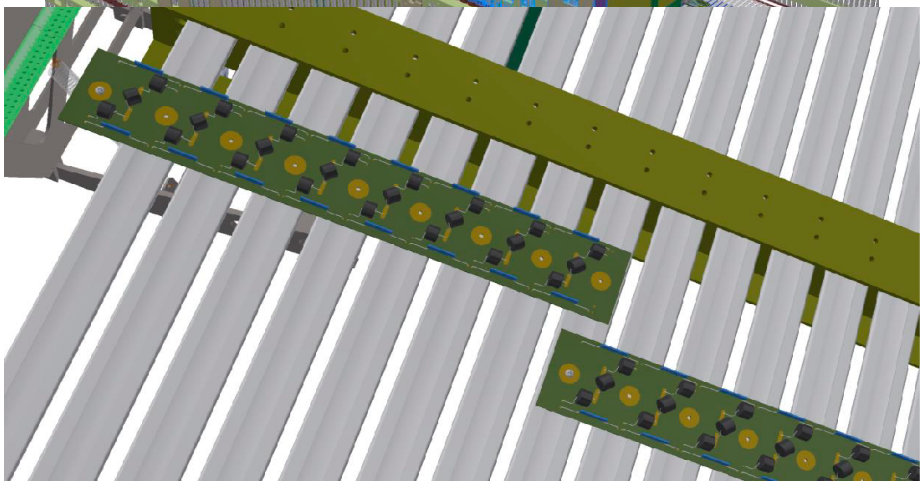
End-wall ports (4 East, 4 West) are:

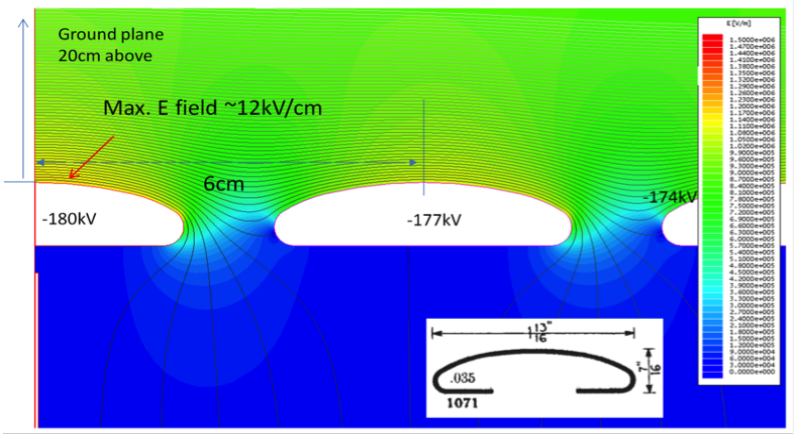
- not on top of TPC, but 40 cm outwards
- not close to APAs, but closer to mid-drift1



Field cage constraints (rev)







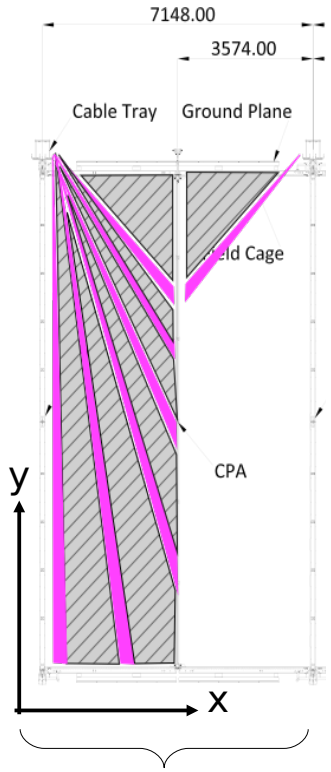
Period of FC profiles: 60 mm

- Wide profiles: 46 mm
- Narrow gaps: 14 mm
- max angle ~ 45 deg

… Can't be too far up because of ground plane

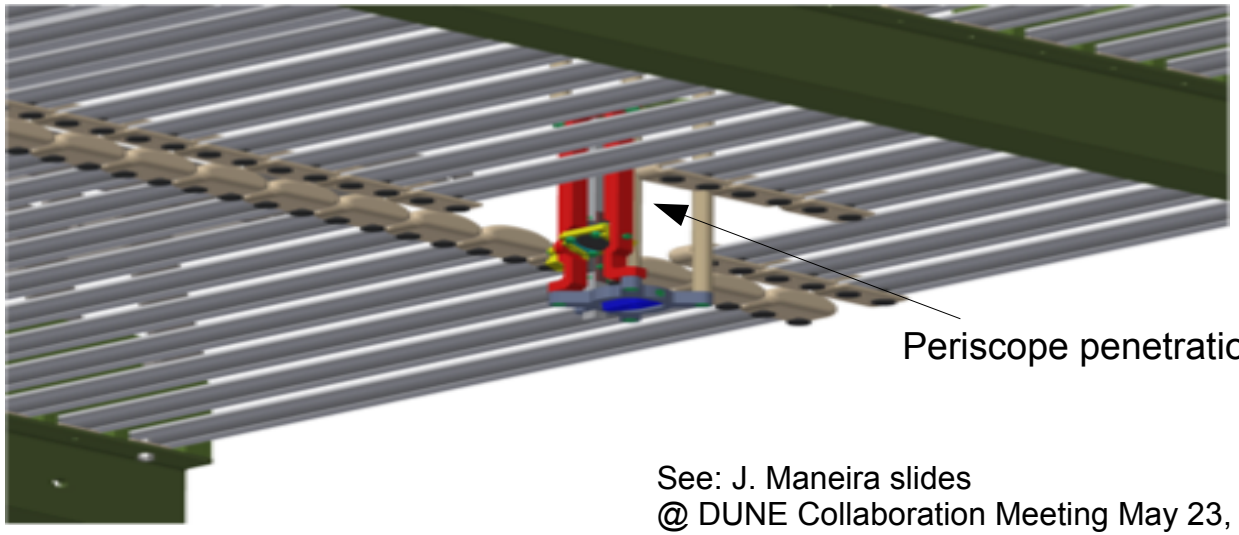
See: J. Maneira slides
@ DUNE Collaboration Meeting May 23, 2019

Coverage from top (rev)



No FC penetration

- ✗ full volume coverage about 20-25% without FC penetration!
- ✓ Should be **better to penetrate**, SBND-style;
  - → Bo Yu presented concrete setups for penetration in April 5 meeting;
  - → Coverage of bottom FC and CPA wall likely 100%, roof coverage limited by I-beams;



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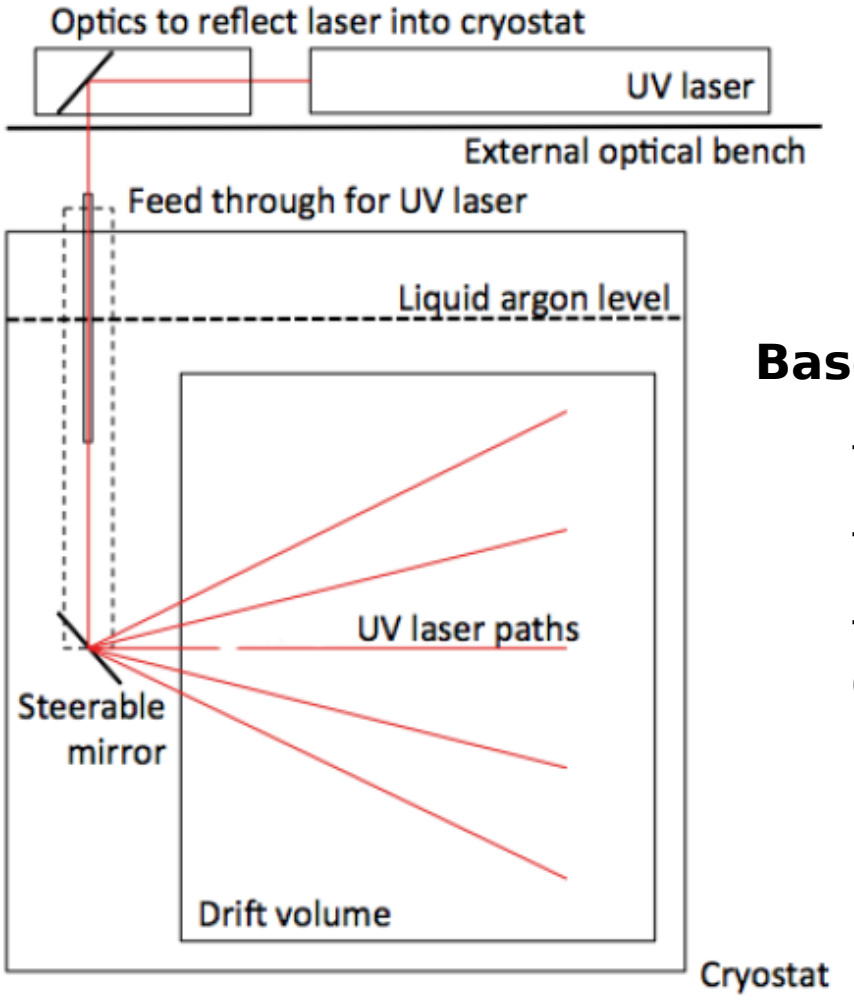
Coverage from end-wall (rev)



Baseline system is **MicroBooNE**-style

- laser come in from outside FC
- at 60% x from APA
- Working on detailed calculation of coverage

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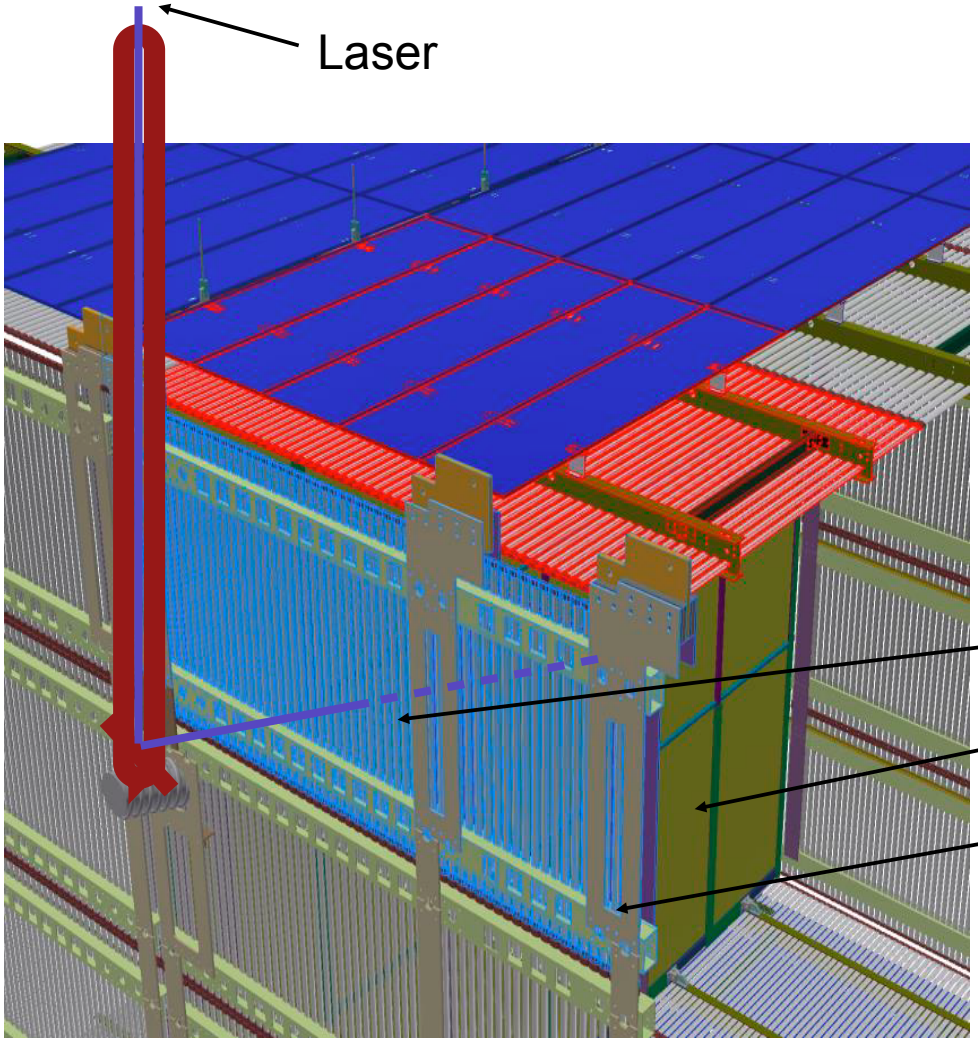
End-wall limitations (rev)



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

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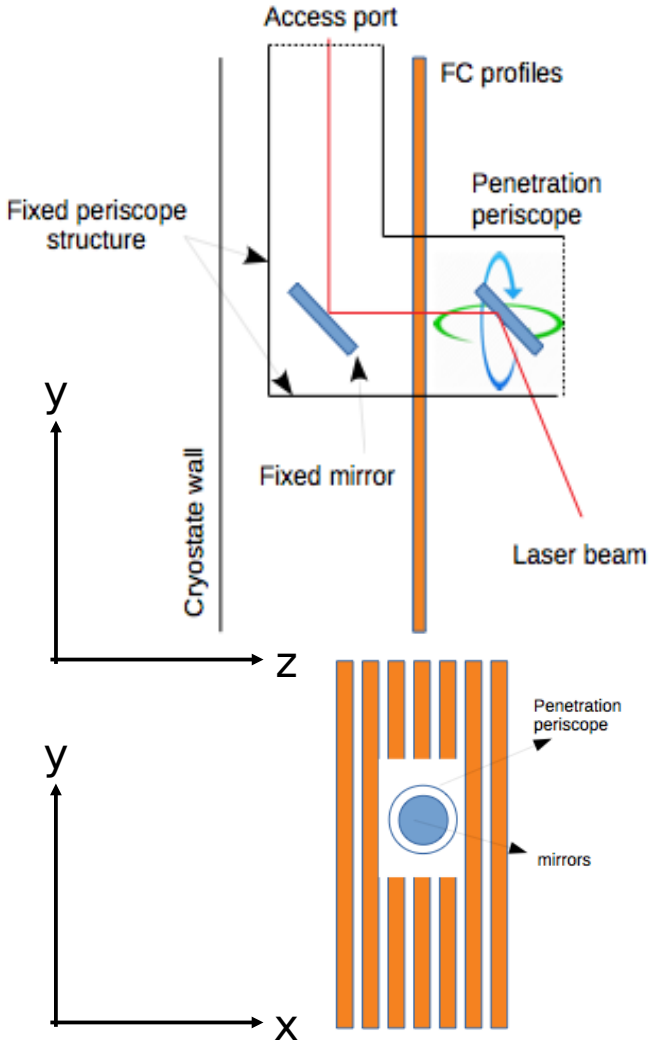
End-wall alternative 1 (rev)



Lateral FC penetration:

Advantages

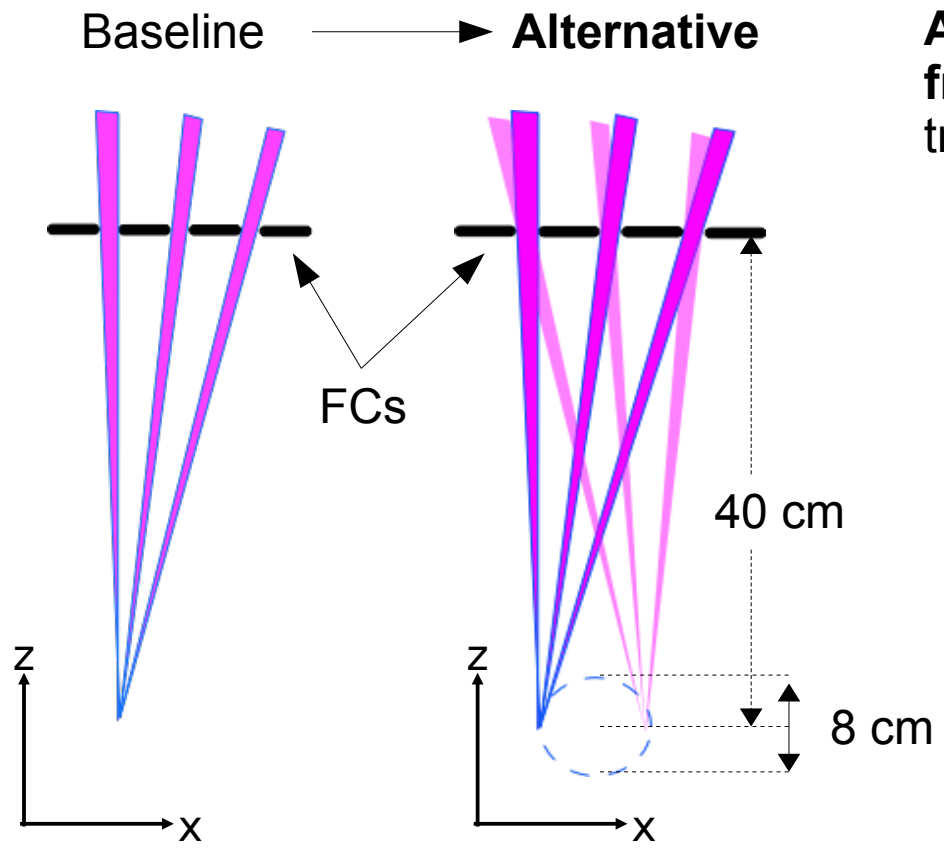
- mirror would be inside FC
- much better coverage

Challenges

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

See: J. Maneira slides
@ DUNE Collaboration Meeting May 23, 2019

End-wall alternative 2 (rev)



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

- Beam origin movable along x, z
- Parallax causes different angular regions to be illuminated
- Working on detailed calculation of coverage

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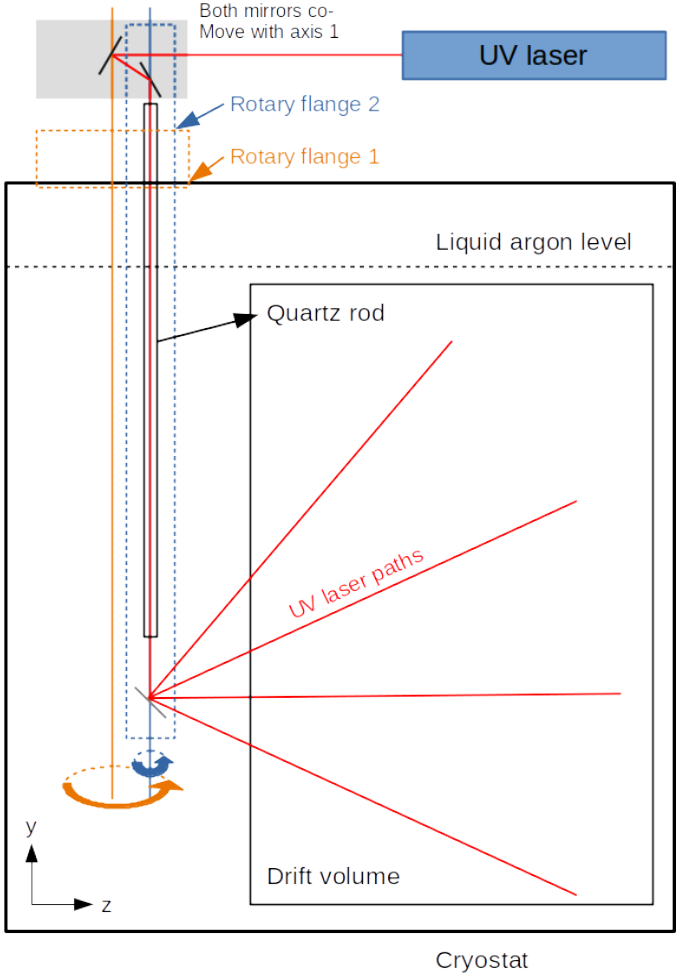
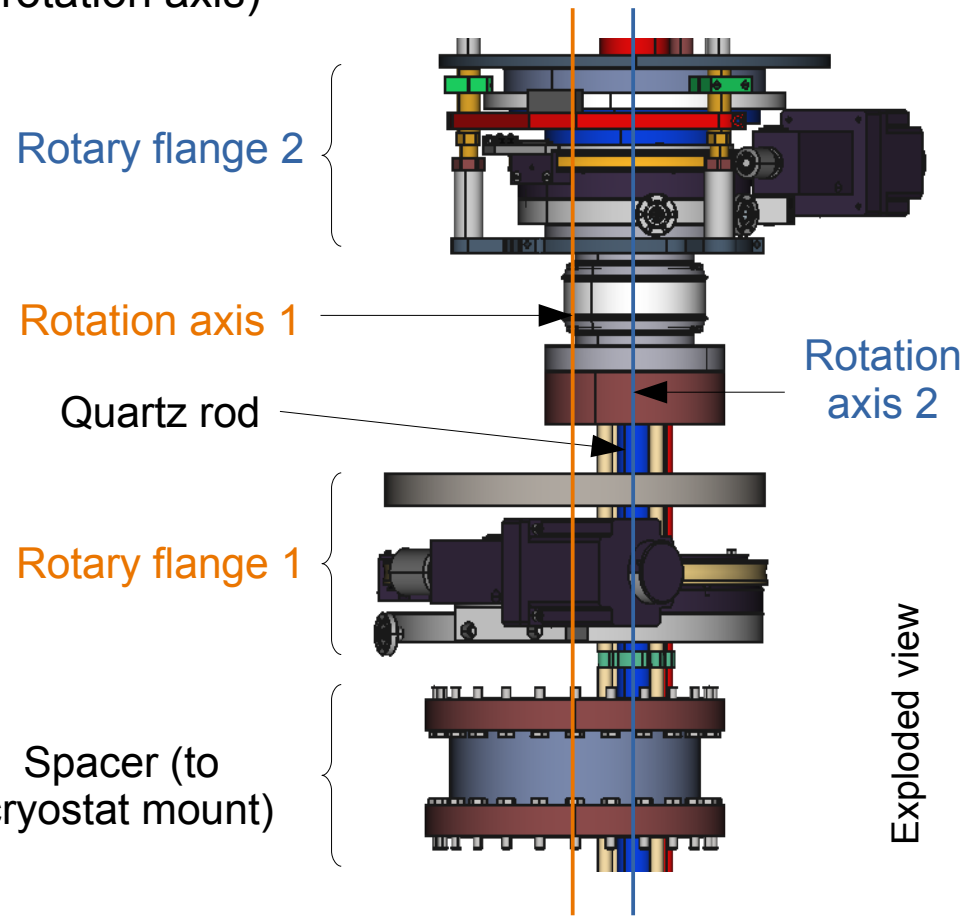
End-wall alternative 2: implementation

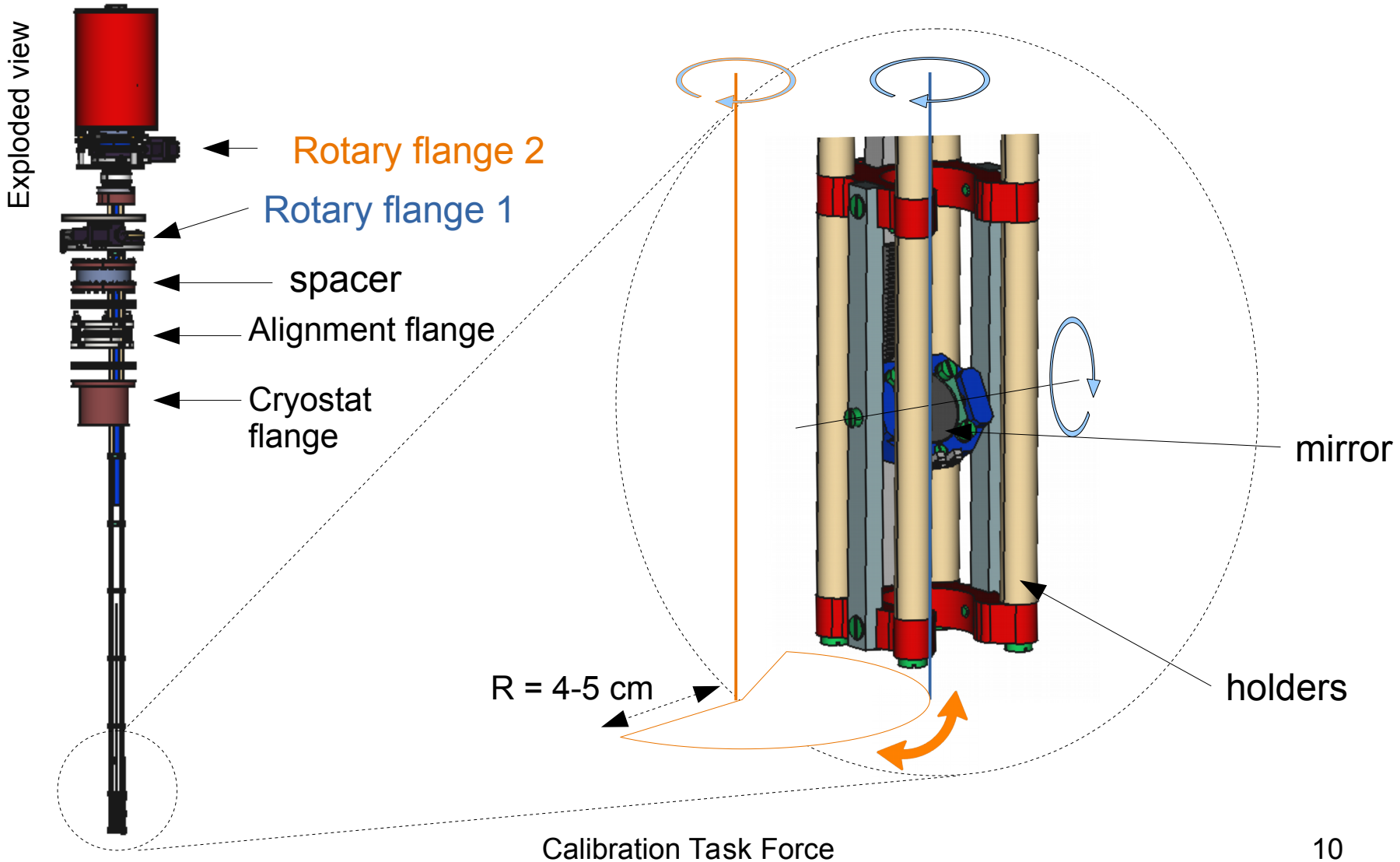


(variation of the MicroBooNE design)

Avoid mechanical complexity inside the cryostat by using 2 eccentric rotary flanges (with parallel rotation axis)



End-wall alternative 2: implementation



Conclusions & future work

- Because it moves mechanical complexity to outside of the cryostat and allows full assembly from the top, **alternative 2** is preferred for the **end-wall laser calibration** points:
  - Complete design, including top mirror setup and connection to laser box;
  - Need actual CAD drawing of calibration port, but it's proven hard to find;
- Provide figures and text for TDR and Calibration workshop review.