Towards mechanical design of the magnets for GP-SANS guide

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Goal: prepare technical “physicists design” report
for a review by ORNL engineers

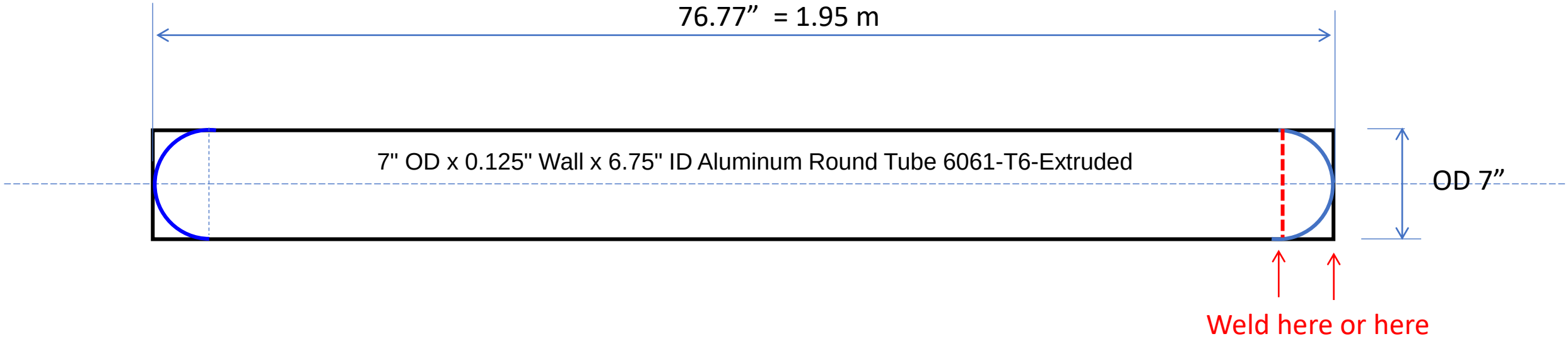
after that we can start construction

(a) magnets built by UKY

(b) gas vessels ? ↕

(c) supports build by UTK

Question of end-flanges



- Advantage of flat flanges is that magnet coil can be wound on the Al-tube body
- Convex welded flanges – more mechanically safe.
- Flat welded flanges – not clear how to assess mechanical reliability.
- Do we need a pressure test for flat-welded?
- What is good thickness of Al windows? Can it be less than 3 mm?
- Miniature gas connection should be on the flanges

Al vessel design.

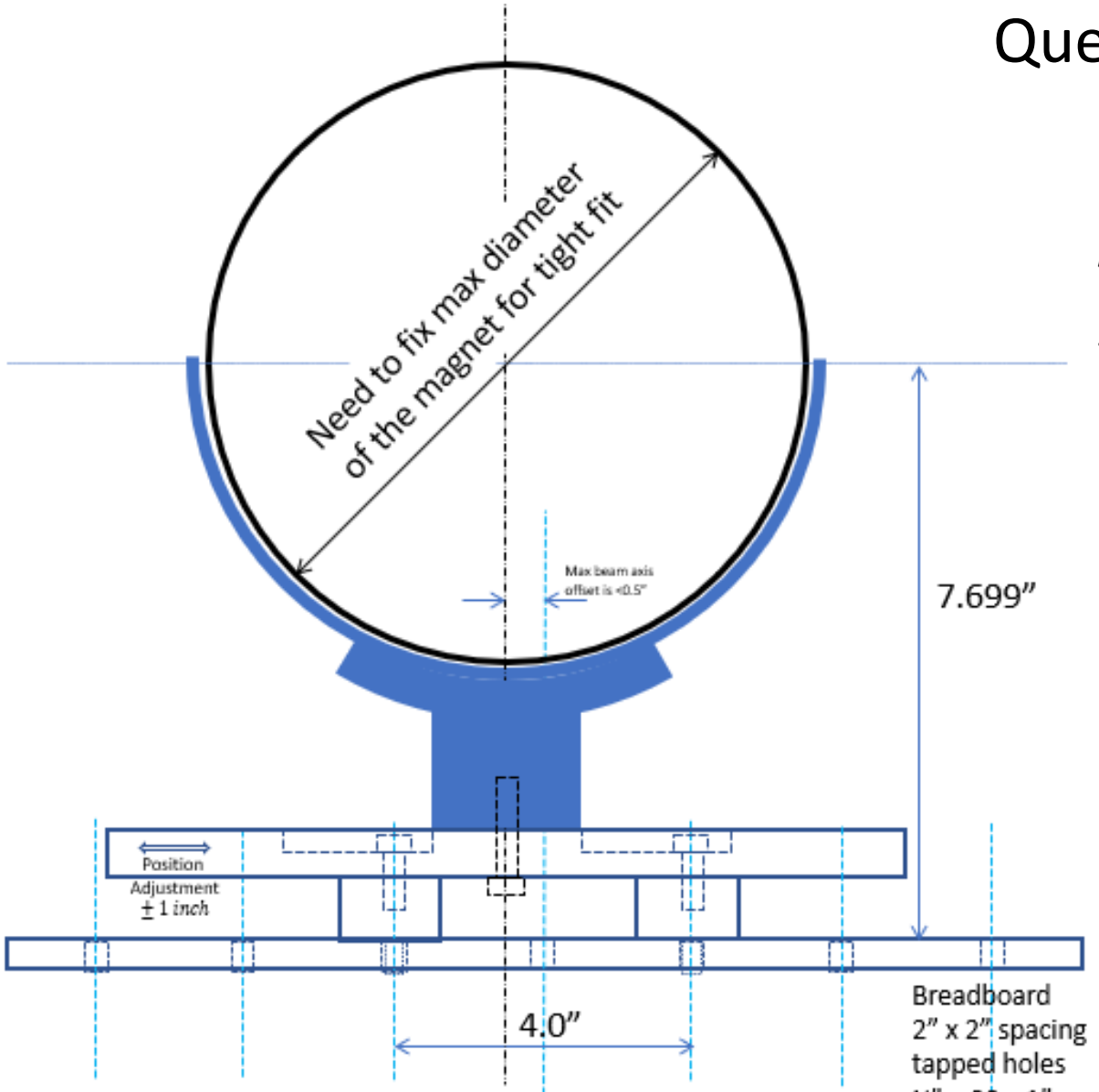
Expected max. operating (inside/outside) overpressure : 1.25 atm = 18.37 psi
Let's assume in design a nominal pressure 3 atmospheres = 14.696 psi x 3 = 44.1 psi
Safety factor 3.6 ➔ 158.76 psi = 160 psi
6061 aluminum allow has a yield tensile strength 276 Mpa (~40,000 psi) (will use 35,000 from the calculator below)
https://www.engineersedge.com/calculators/shell_internal_pres_pop.htm
Inner radius 3" = 76.2 mm
Joint Efficiency of welds (for endcaps) 80%

For 160 psi required wall thickness 0.0172 " = 0.44 mm
For 44.1 psi required wall thickness 0.0047" = 0.12 mm
For 1000 psi required thickness would be 0.1095" = 2.78 mm
Available material
https://www.onlinemetals.com/en/buy/aluminum/8-od-x-0-125-wall-x-7-75-id-aluminum-round-tube-6061-t6-extruded/pid/7083
7" OD x 0.125" Wall x 6.75" ID Aluminum Round Tube 6061-T6-Extruded (wall thickness 0.125" = 3.175 mm)
4'ft length $234 (custom cut available) can be cut into two pieces of 2 m

Vessel pressure test: vacuum outside and 3 atm inside is equal 1 atm outside and 4 atm inside

Question in magnet support

- What will be thickness of μ – metal-tape magnet wrapping? It defines the outer diameter to fit in support



Support for the magnet tubes
Width of support structure is 2" along beam

Gas connections

- Since two supporting structures for a magnet are close to the magnet ends, gas valves can be attached here.

Magnets electrical connections

- Electrical connection for the magnets currents through the vacuum walls.

- Will it require new holes in the walls?
- Can existing feedthroughs be used?