Photon Detection System for the ND-GAr Detector

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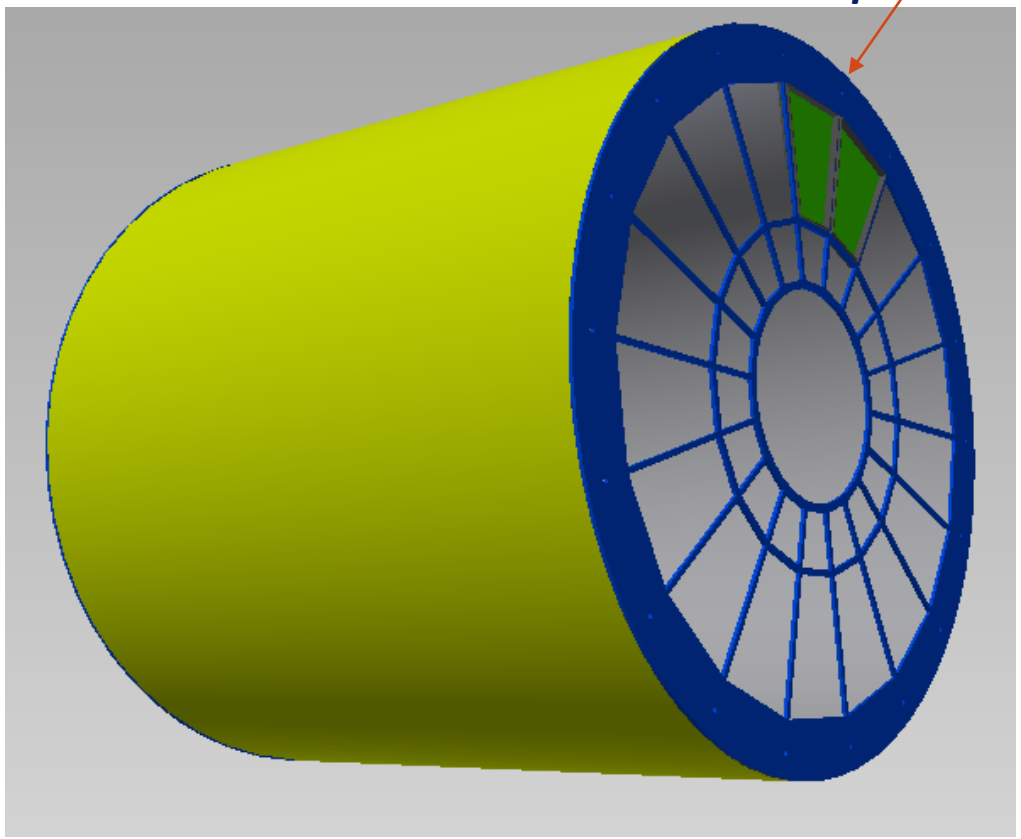
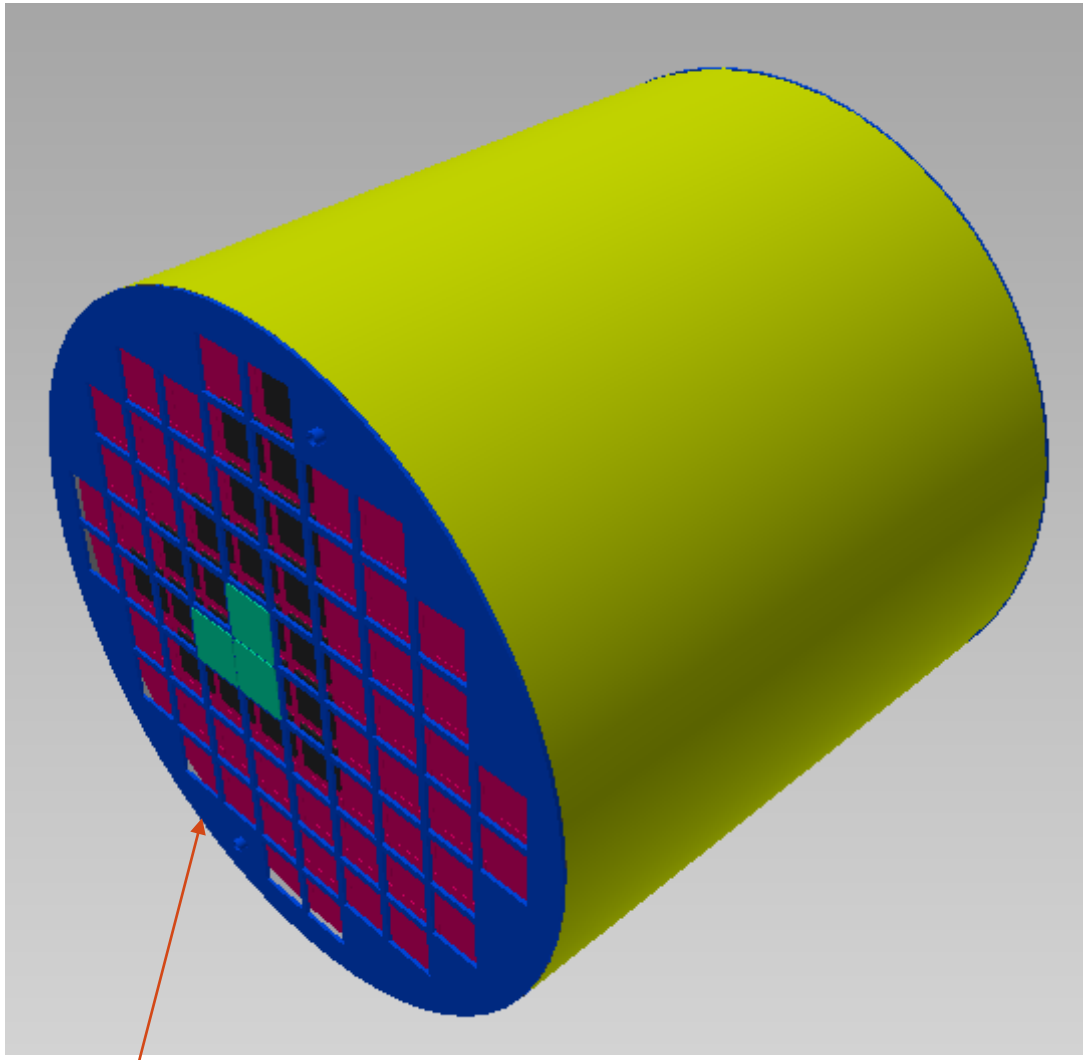
8/16/2021

Views of the ND-GAr Time Projection Chamber



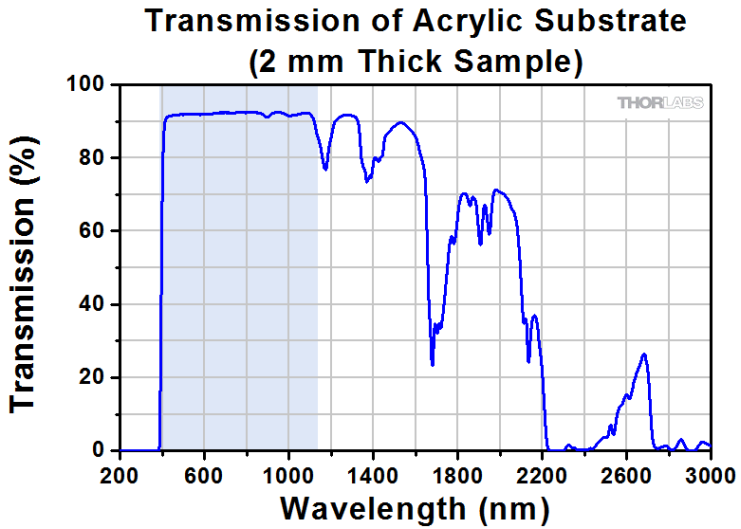


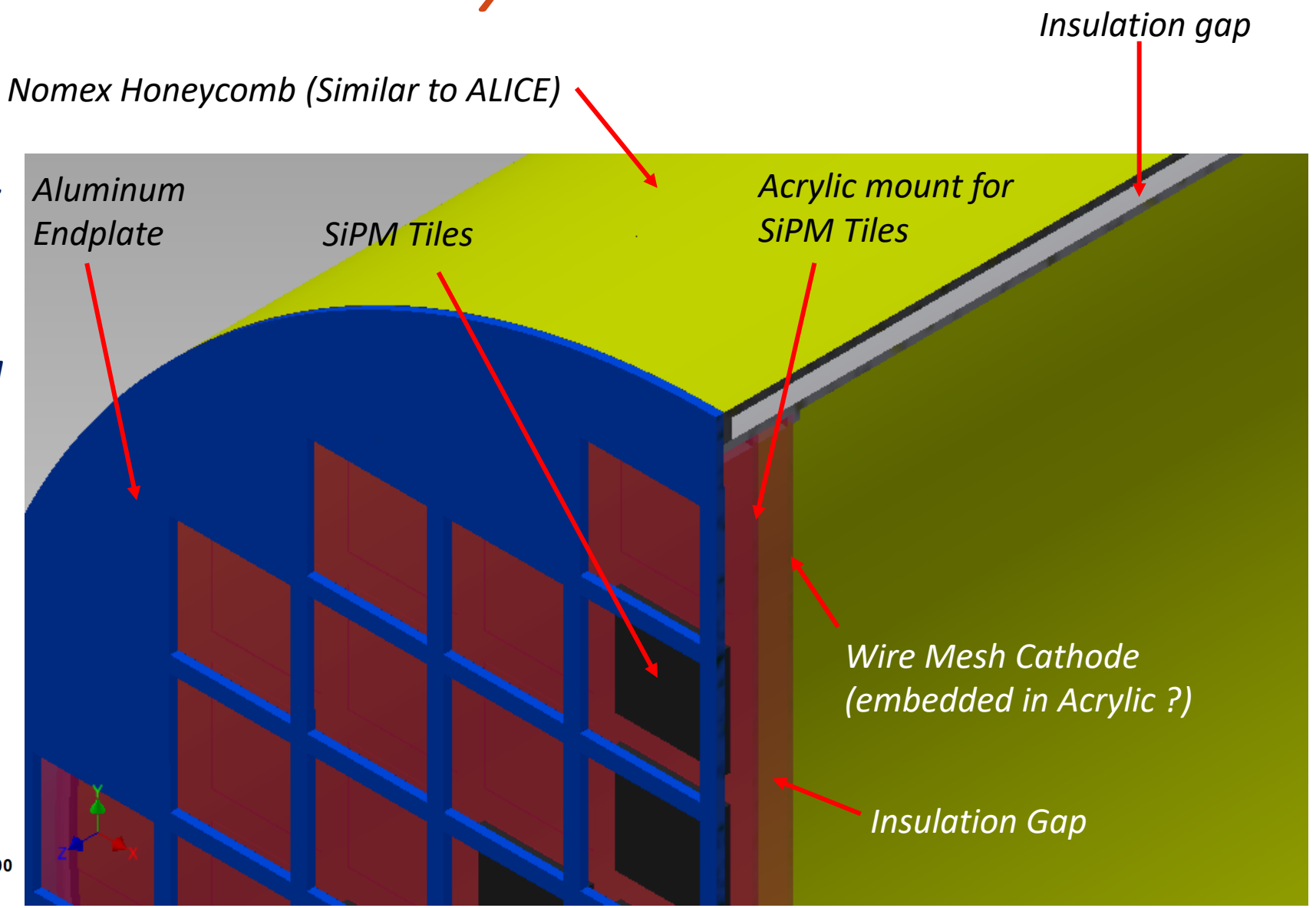
Details of a Photon Detection System

- ***With wire mesh cathode at 200kV and Al Endplate grounded, SiPM tiles will be immersed in large electrostatic field:***

  E = 8.7 kV/cm

- ***Might be a way to mount SiPM tiles external to large E-fields***



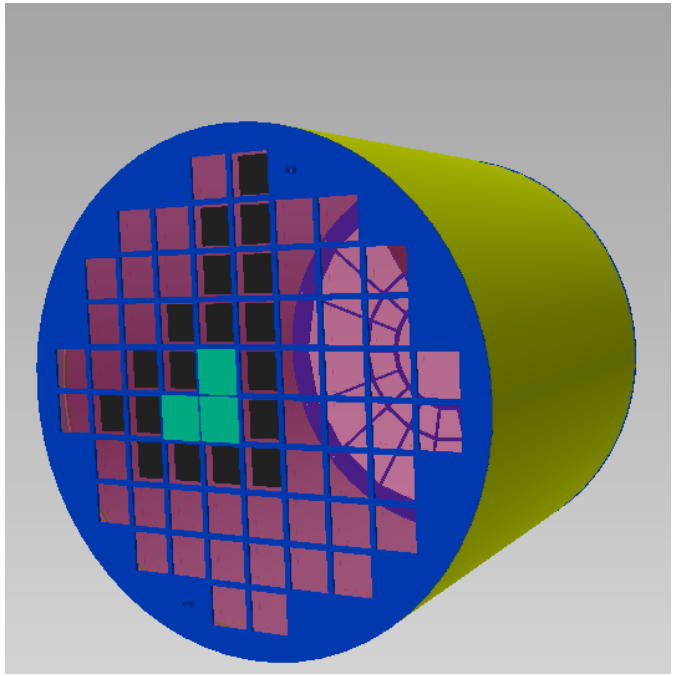


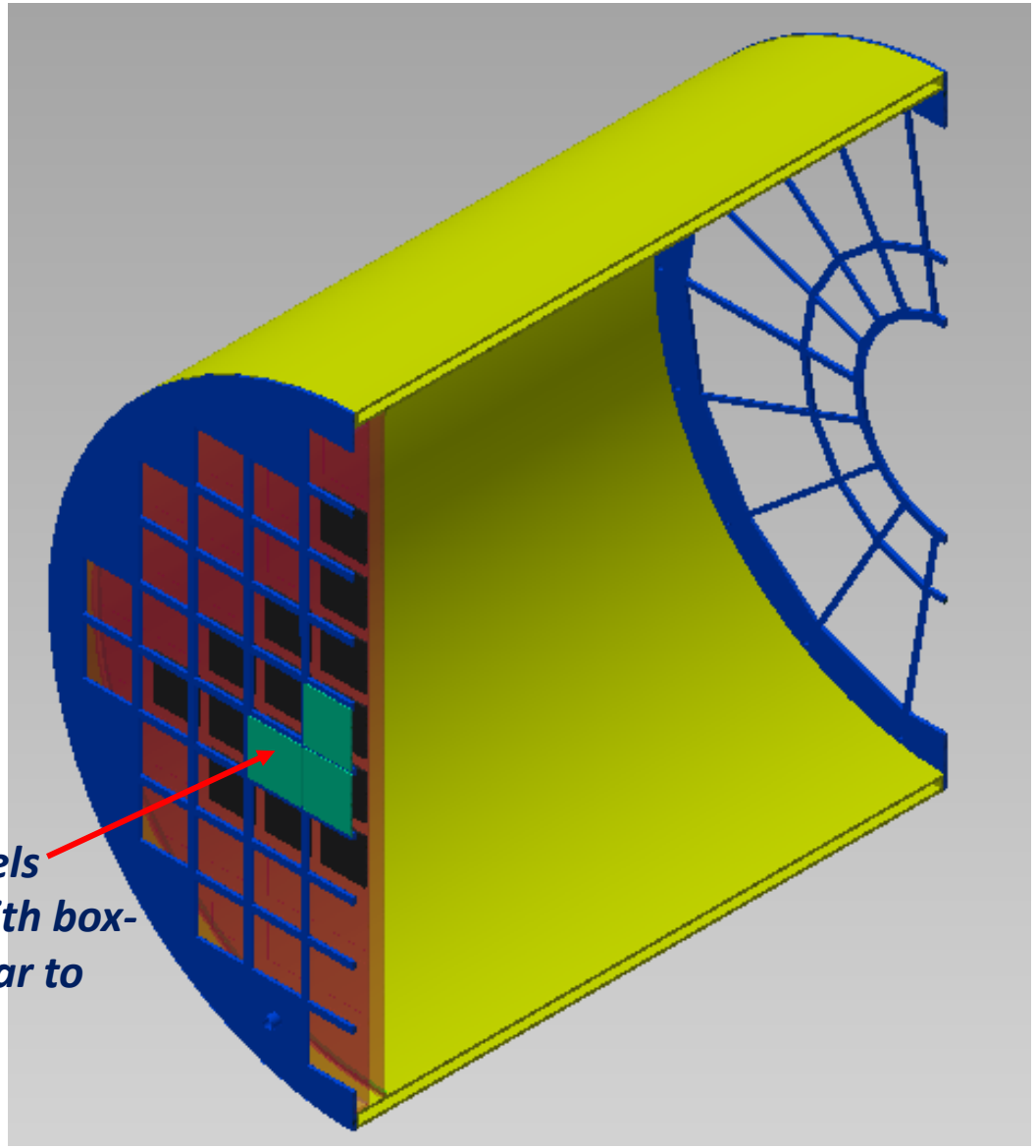
More Views

- *68 SiPM Tiles: 40 x 40 cm^2 fitted with 4,096 SiPMs (fits inside 44 x 44 cm^2 Aluminum Windows)*

- *Hamamatsu sells 2.5 x 2.5 cm^2 "tiles" containing 16 SiPM's which represent a single channel. Large tiles are then constructed with a 16 x 16 array of Hamamatsu products.*

- *17,408 channels total for this configuration*

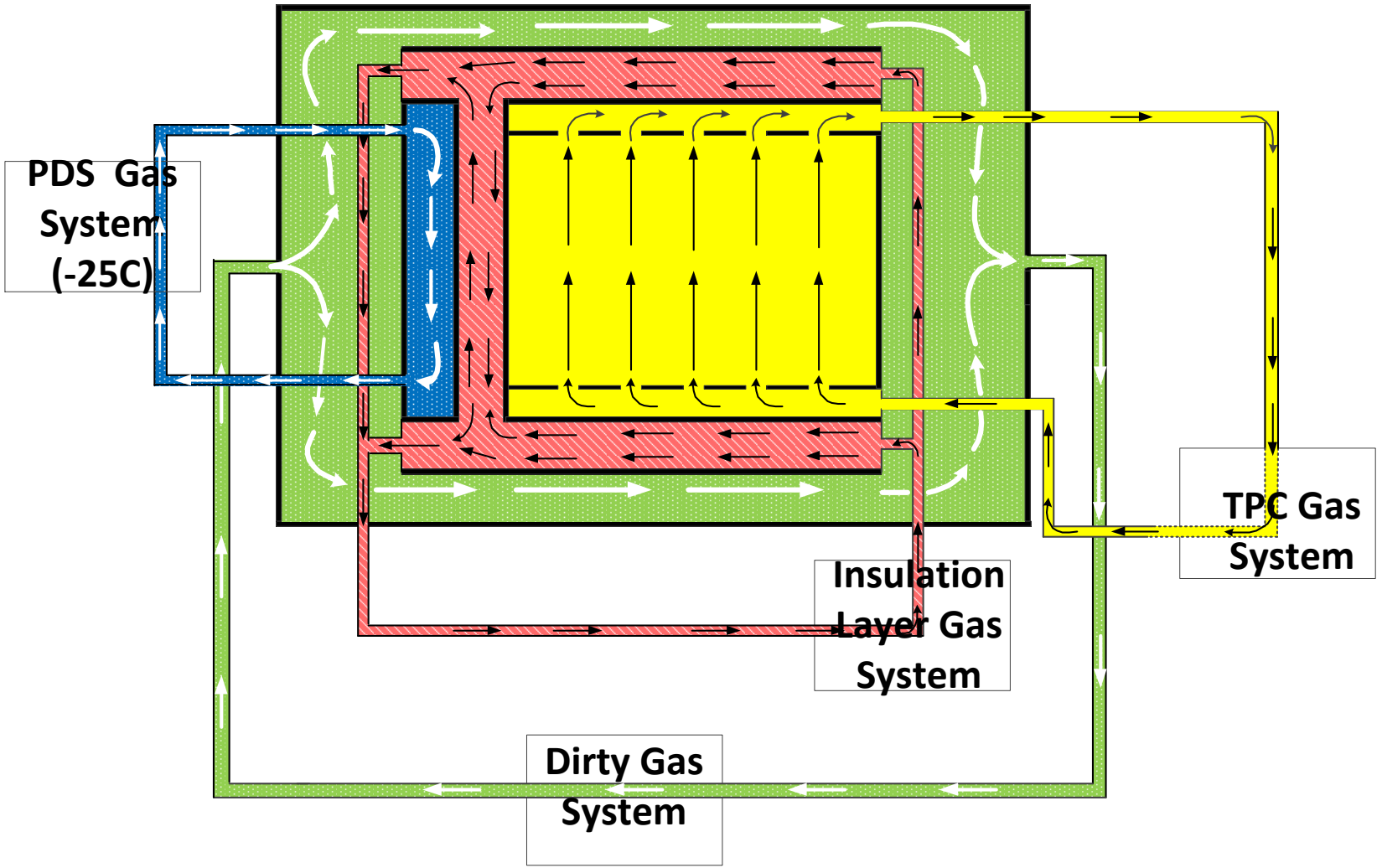




- *SiPM tile access panels Seal inner volume with box-shaped O-rings similar to ROC's on ALICE side*

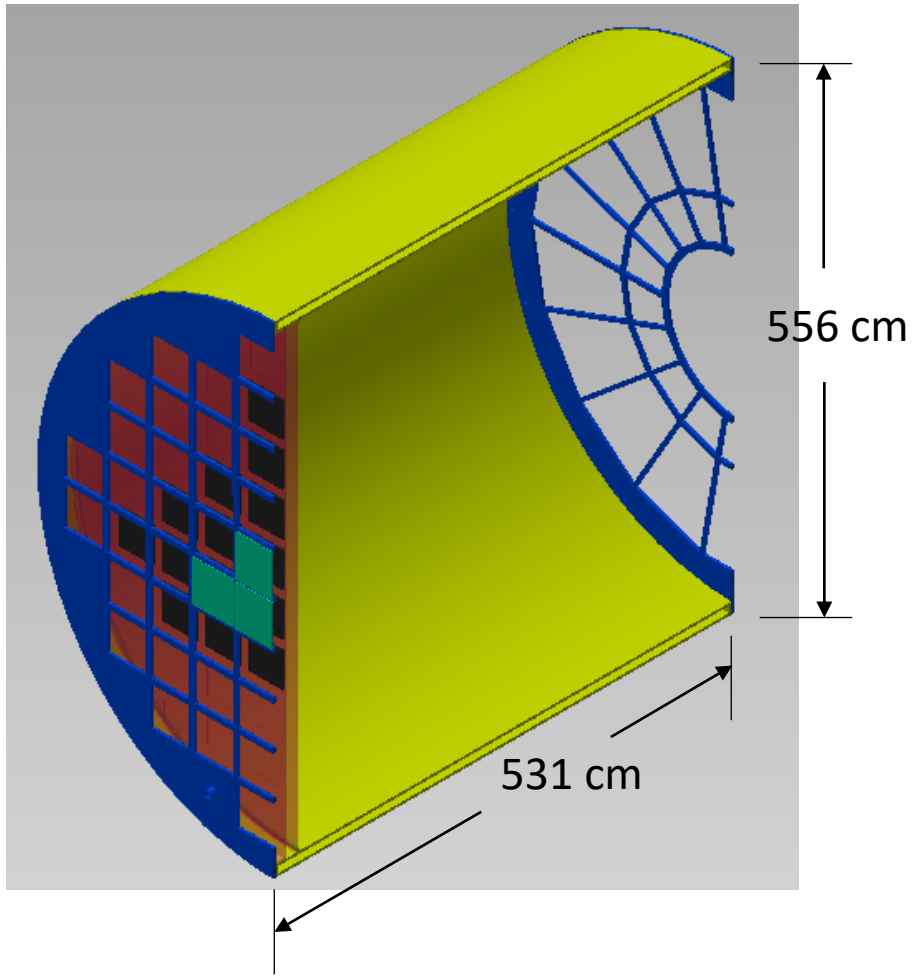
Inclusion of Photon Detection Cooling Gas

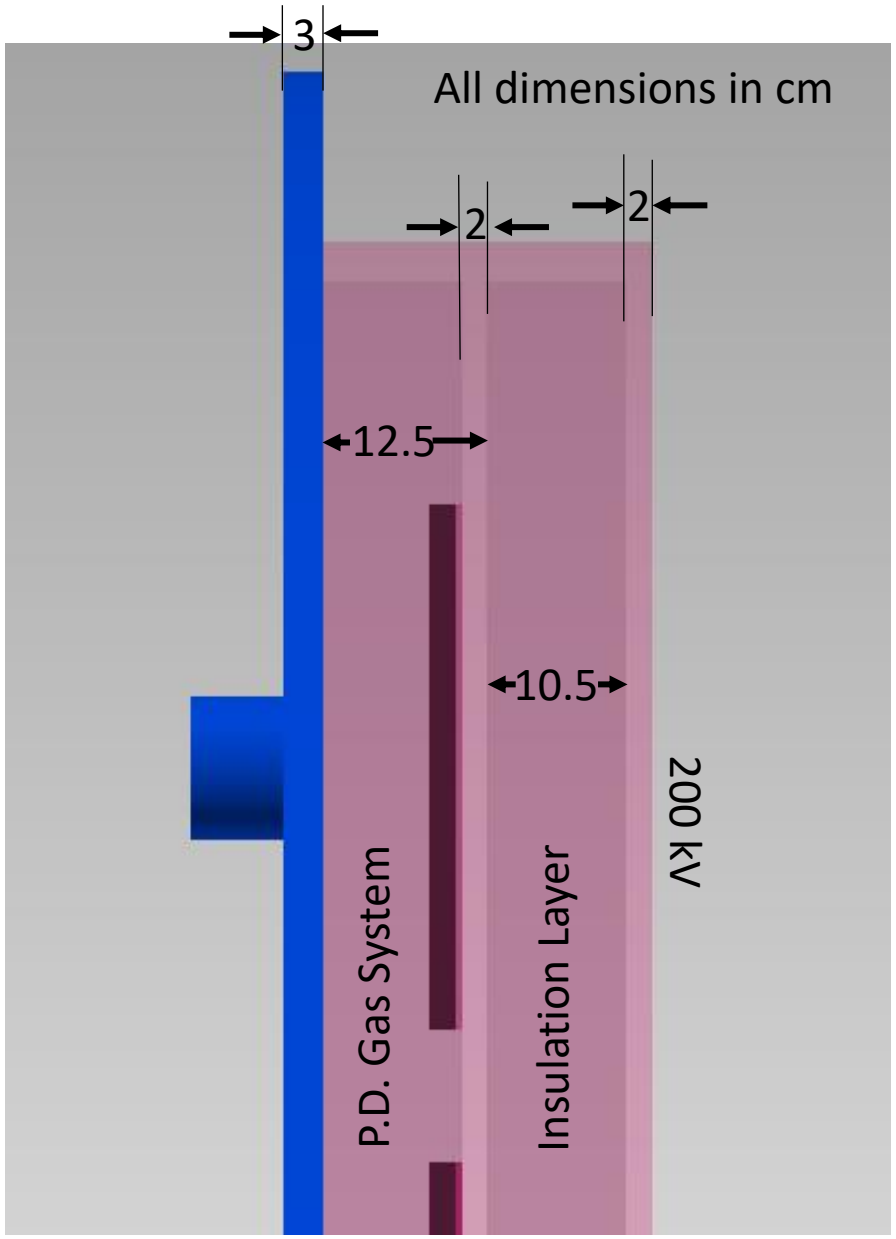
- *Photon Detection System comes with its own low temperature gas system near 10 atm.*
- *Possible cooling gases:*
  Nitrogen / Argon.
- *PDS Gas system volume: 2.3 m^3*
- *Low temperature of PDS gas should not provide residual cooling for the TPC gas system*
- *Cooling of PDS gas system possible with six 1.8 kW ethanol-based chillers*



Dimensions

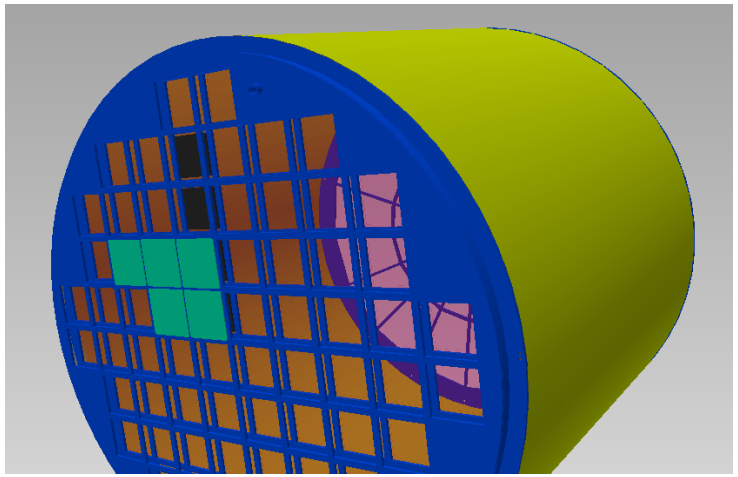
- ***Length of Drift volume: 500 cm***
- ***Radius of Drift Volume: 265 cm***
- ***Width of Insulation Layer Gap at edge of cylinder: 5 cm***
- ***Dielectric constant of PMMA 2.7-4.5***

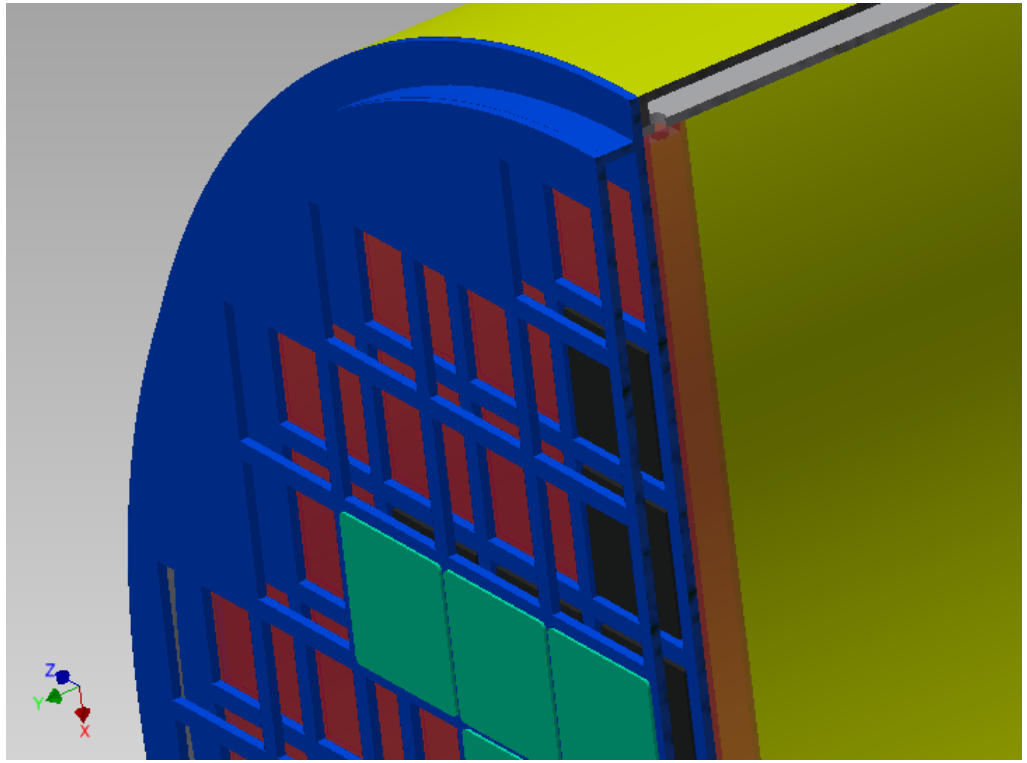




Design II

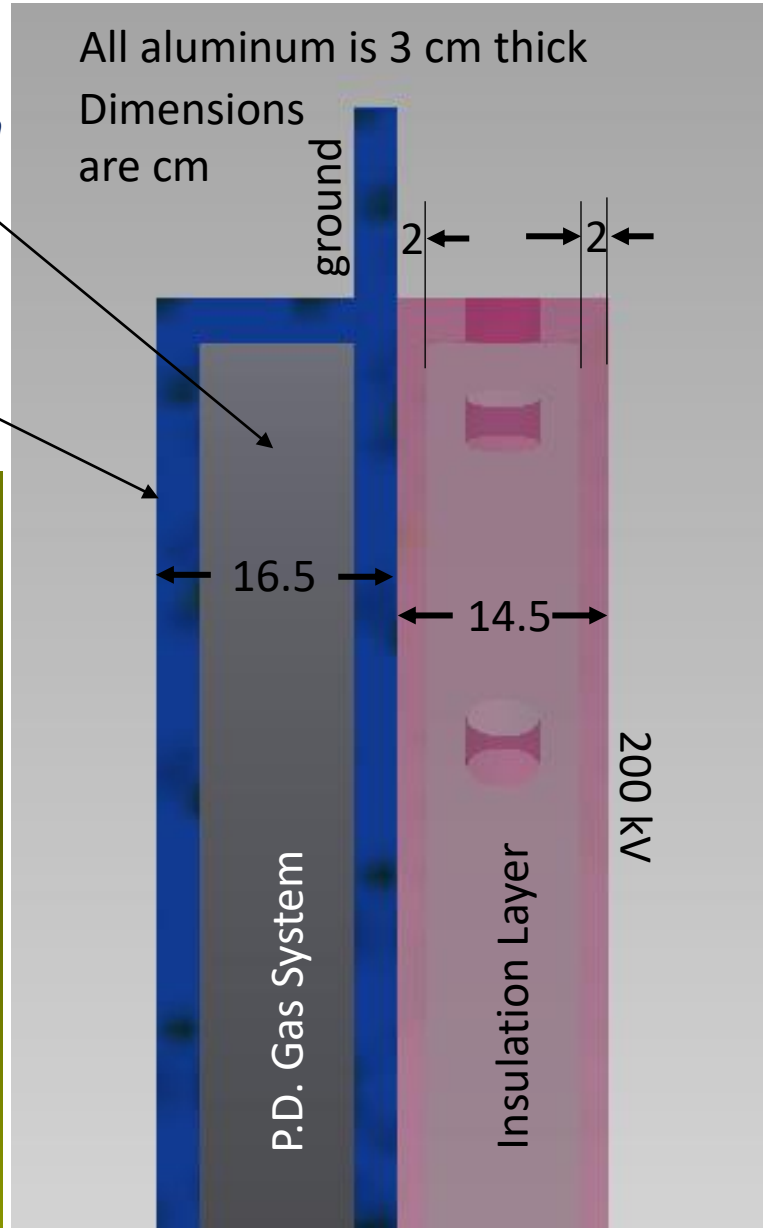
- ***Aluminum endcap is grounded everywhere***
- ***SiPM tiles still mounted to PMMA layer but reside in aluminum windows at ground.***





PDS Gas System

Aluminum here can be replaced with strong thermal insulating material

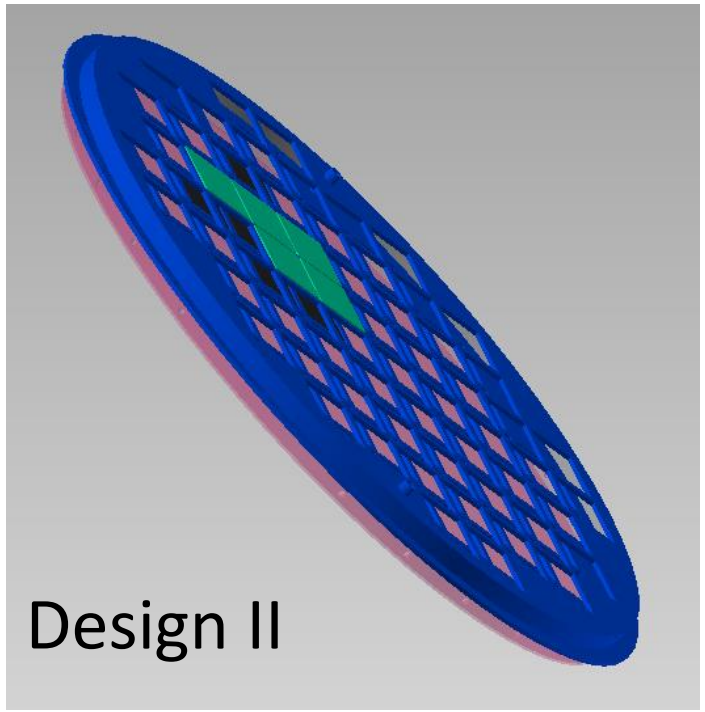


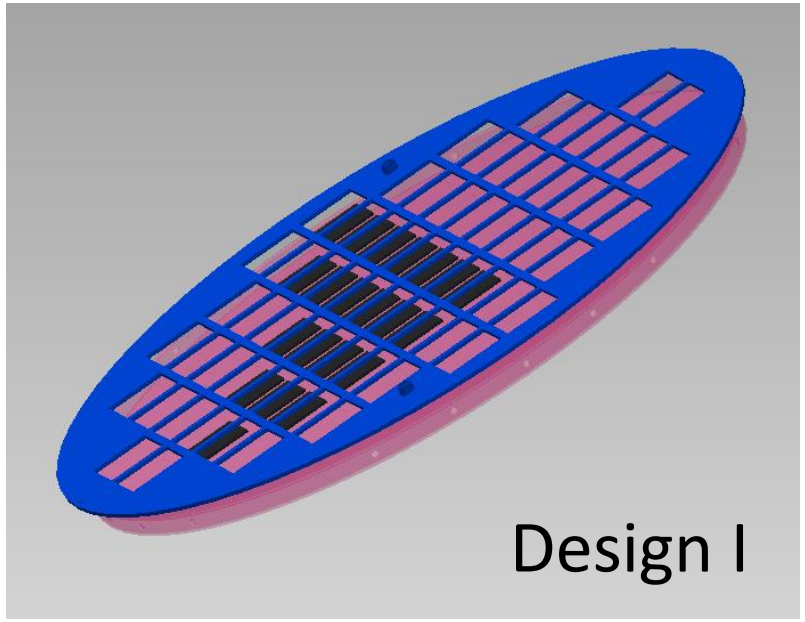
Weight Analysis for PDS

Aluminum Plate (ALICE side) …….0.70 tonnes (1,545 lb)
Aluminum Plate (PDS side) …….0.90 tonnes (1,986 lb)

PMMA Cathode (w/o mesh) …….0.53 tonnes (1,156 lb)
PMMA mount for SiPM tiles …….0.53 tonnes (1,156 lb)
PMMA outer rings (2) ……0.063 tonnes (137 lb)

Aluminum density = 2.7 g/cm³
PMMA density = 1.2 g/cm³





SiPM Tiles are very light:

Hamamatsu 13361-6050 series
W = 1.5 grams w/o connector
W = 2.3 grams w/ connector

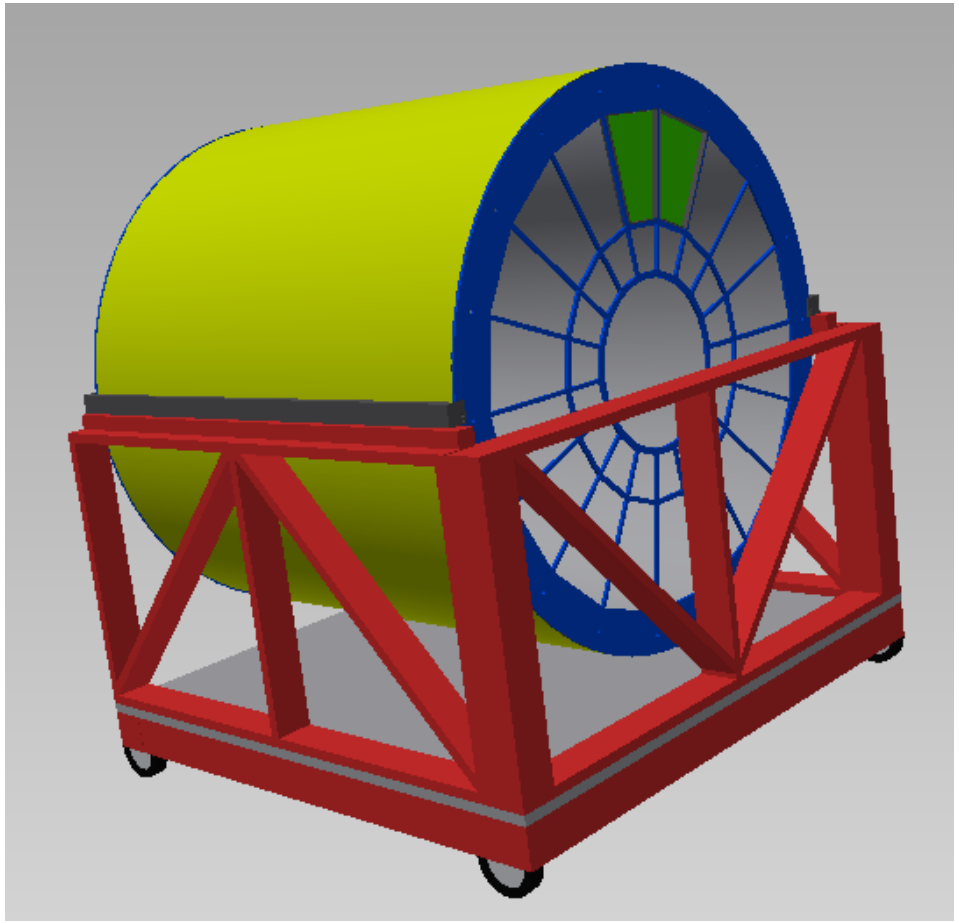
Almost no contribution to the weight of the PDS system

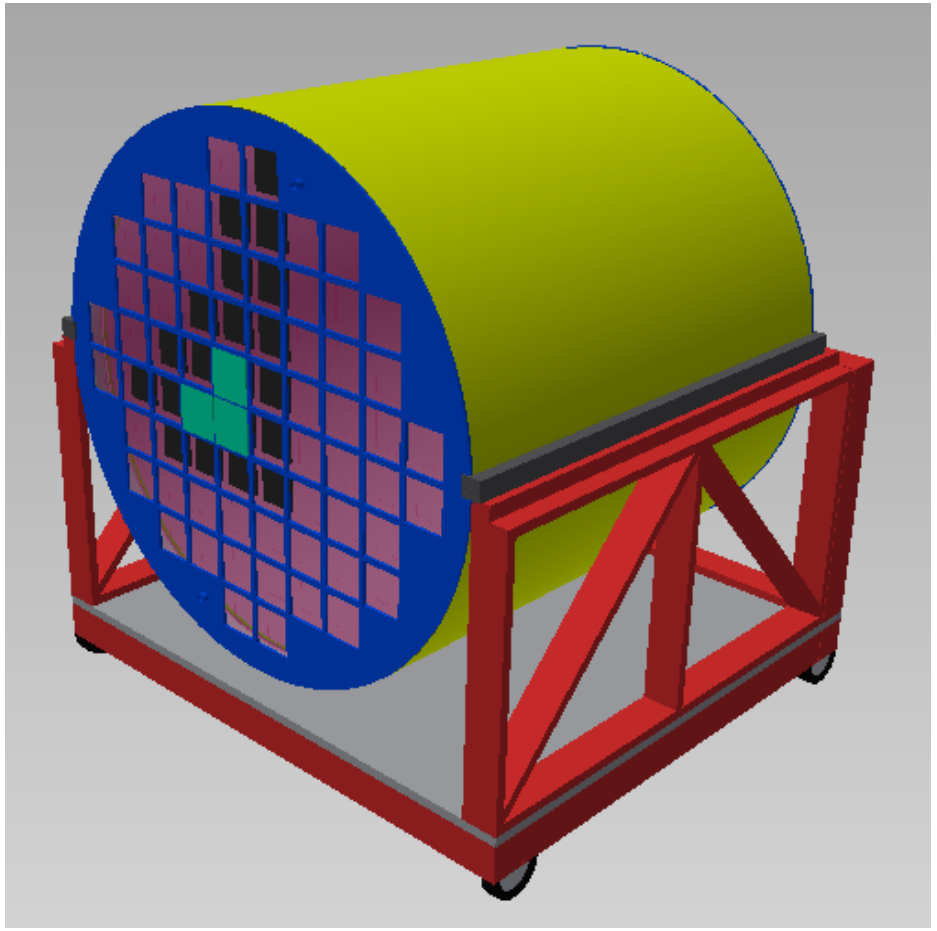
TPC Construction Support/transport

- ***Build TPC on-site at Fermilab***

- ***TPC and the dolly can fit down the shaft at Near Detector Hall (38 feet dia)***

- ***Easy installation into the center of the ND-GAr magnet***





Thanks for Listening