PROJECT

HPTPC

PROTOTYPE PROGRESS

ROYAL HOLLOWAY UNIVERSITY OF LONDON

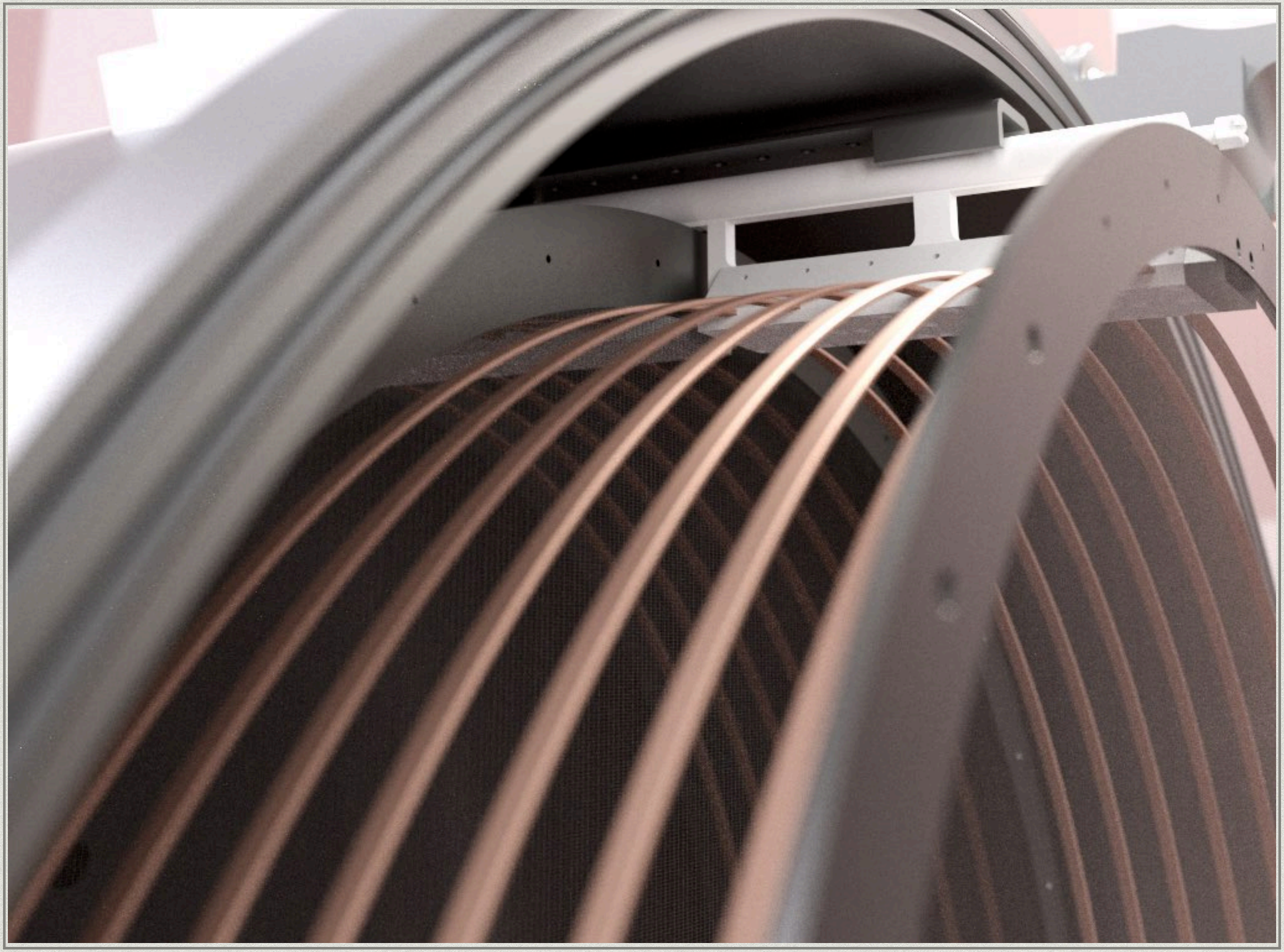
DATE

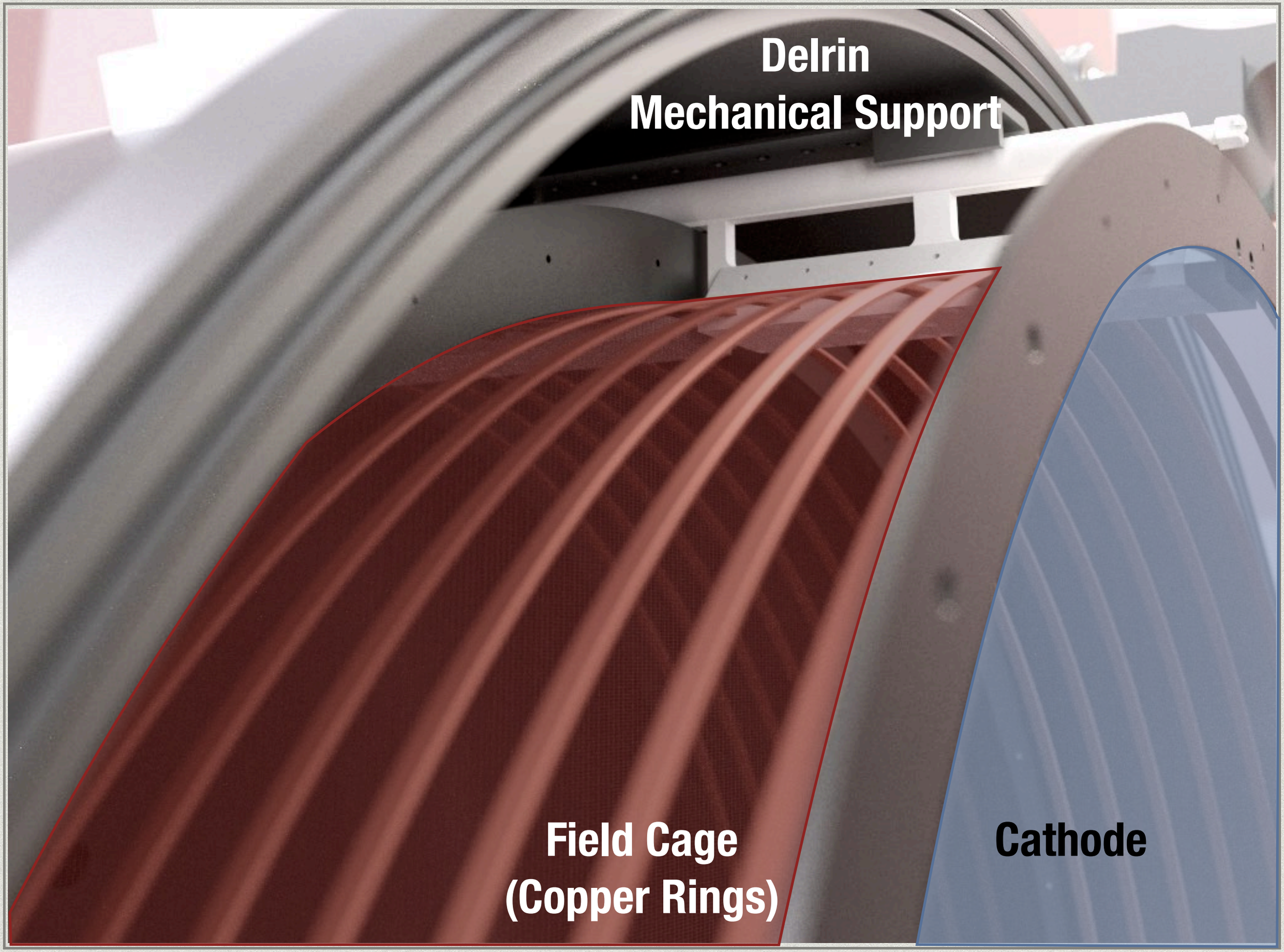
21ST MAY 2017

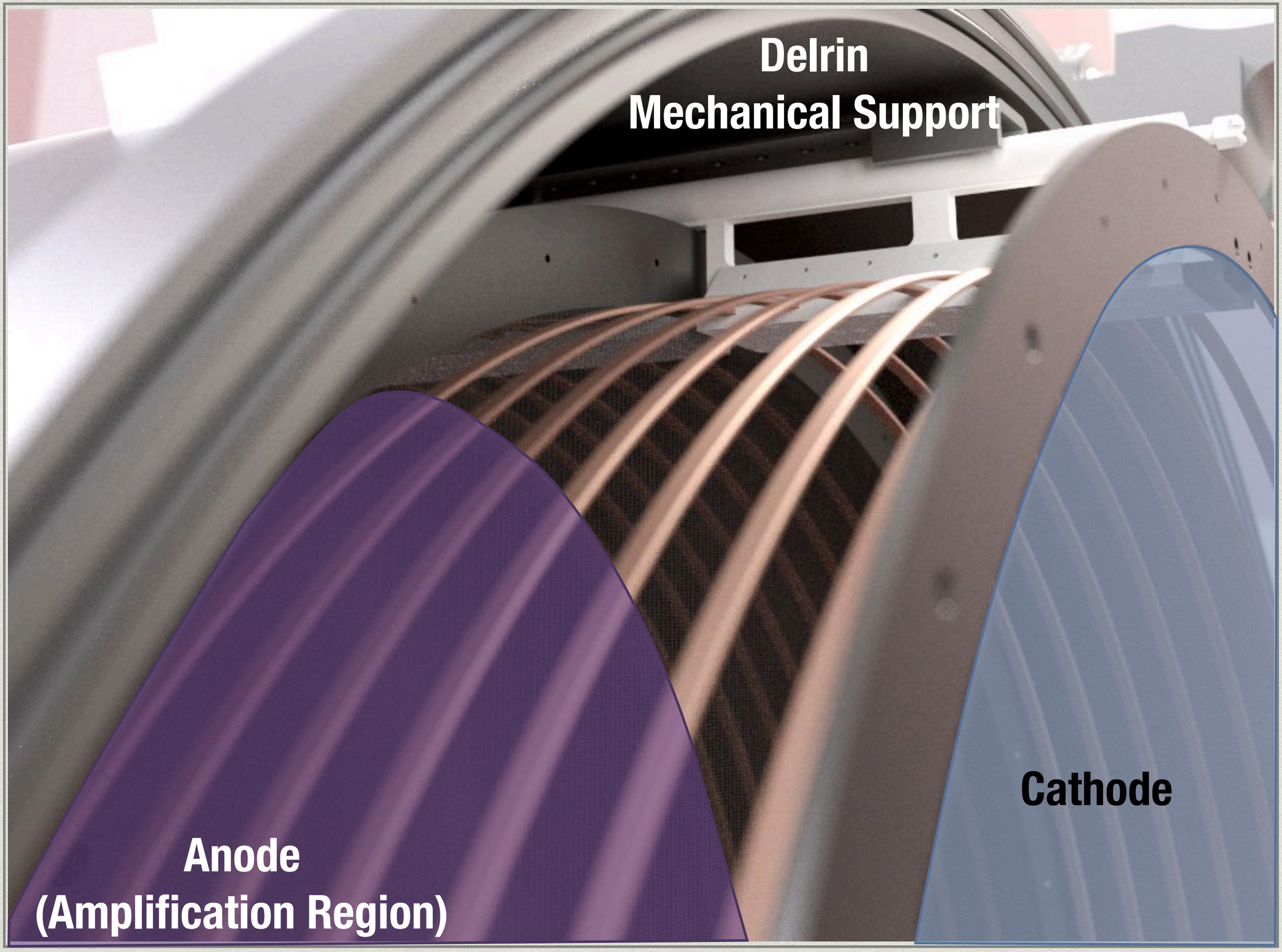
MARK WARD

Overview

- Field Cage
- Pressure Vessel design
- Readout
- Hardware delivery
- 6 month plan

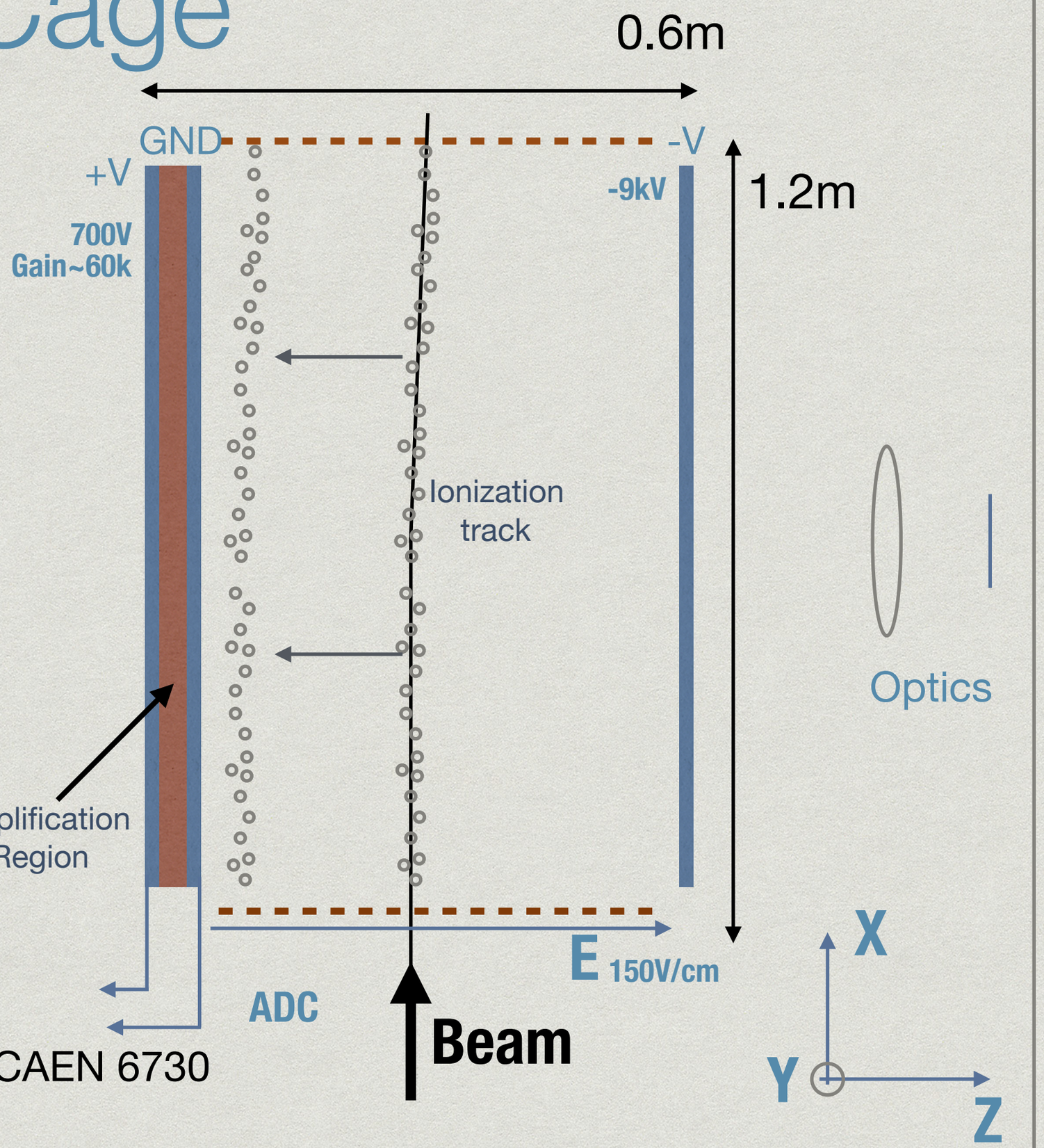



Delrin
Mechanical Support
Field Cage
(Copper Rings)
Cathode

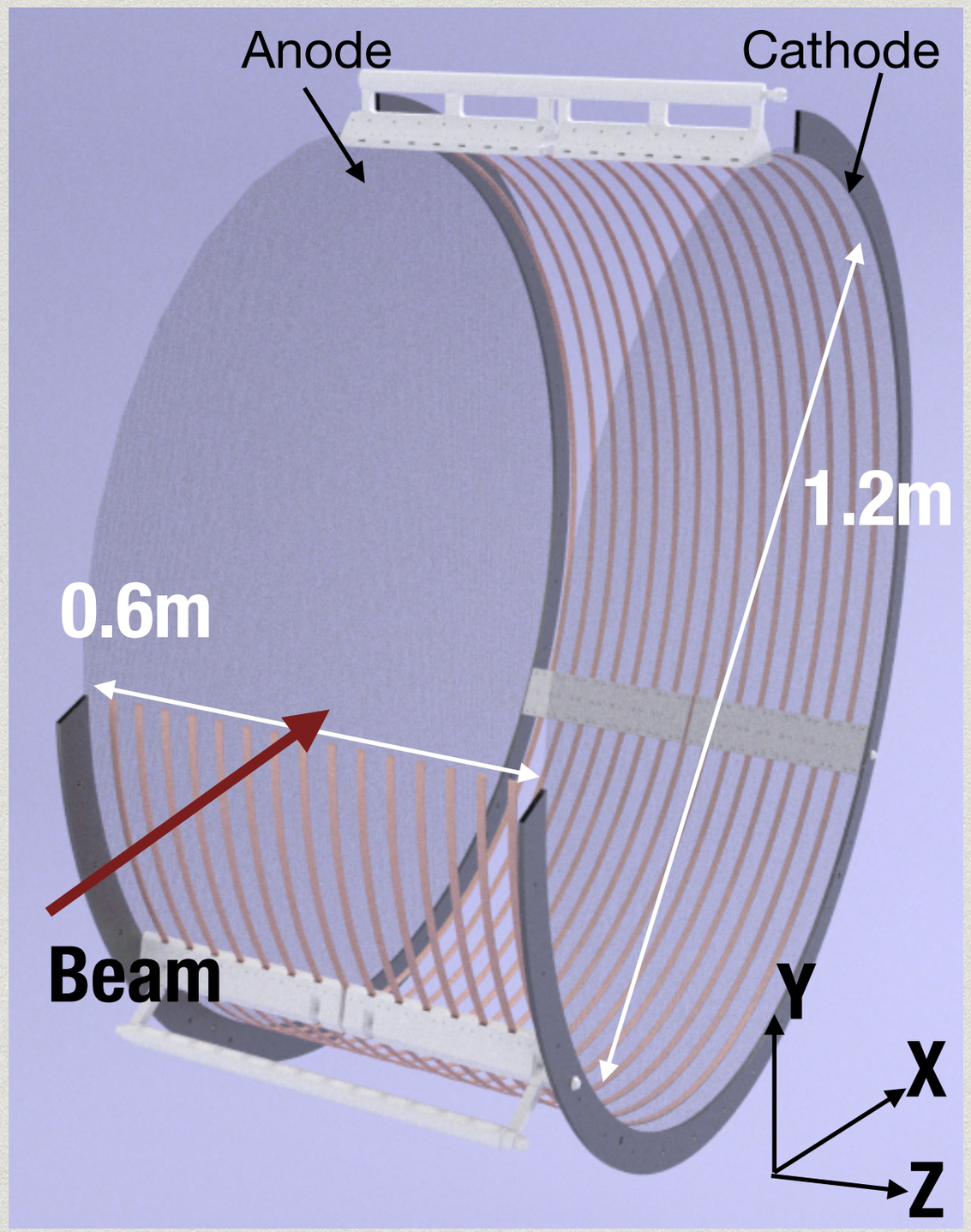

Delrin
Mechanical Support
Anode
(Amplification Region)
Cathode

TPC Field Cage

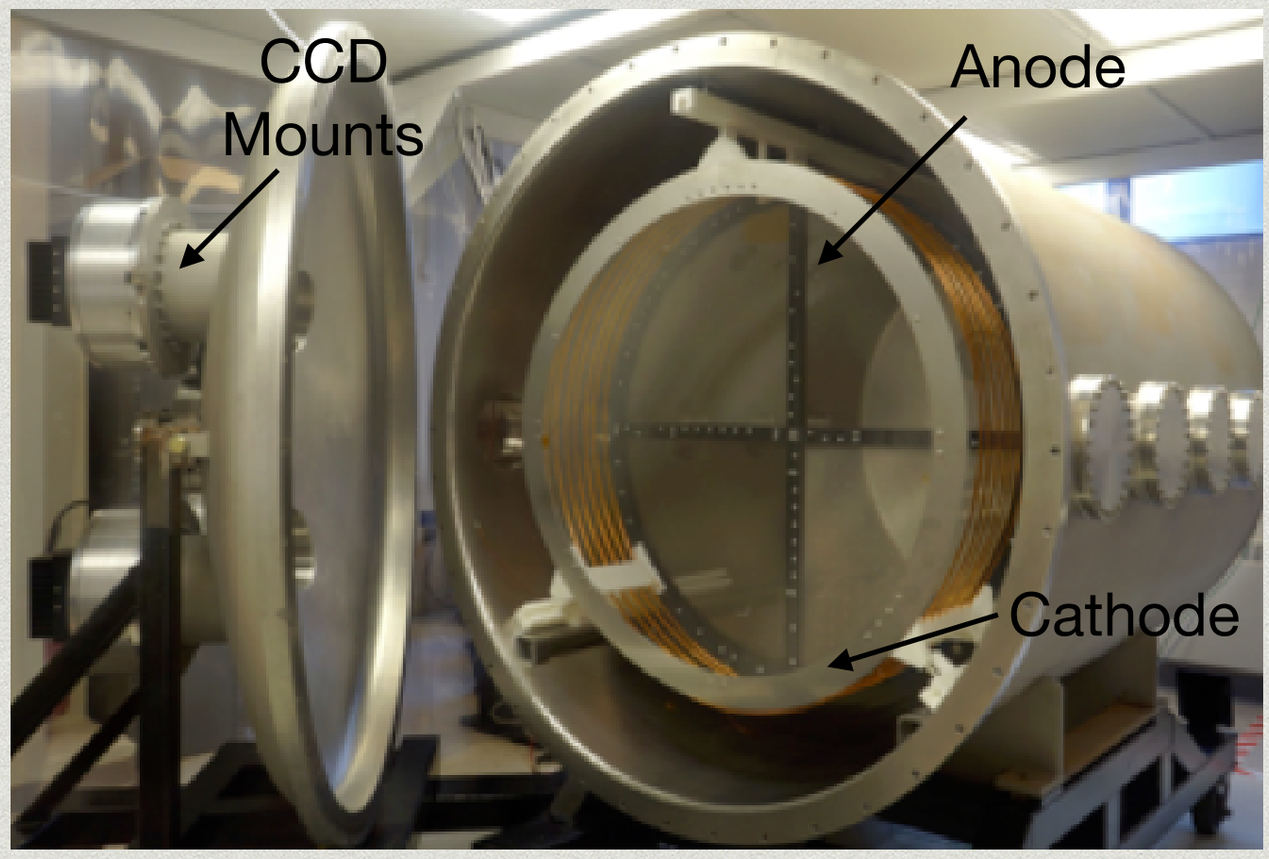
- 15 x 1cm wide copper rings provide field uniformity
- 1.2m diameter, 0.6m long cylindrical volume
- Volume 0.65m^3
- High-voltage supplied by CAEN 1470 and 1470A PSUs
- 150V/cm drift field, for optimal diffusion.
- Optical X/Y amplification plane readout
- Quadrant current readout via CAEN 6730



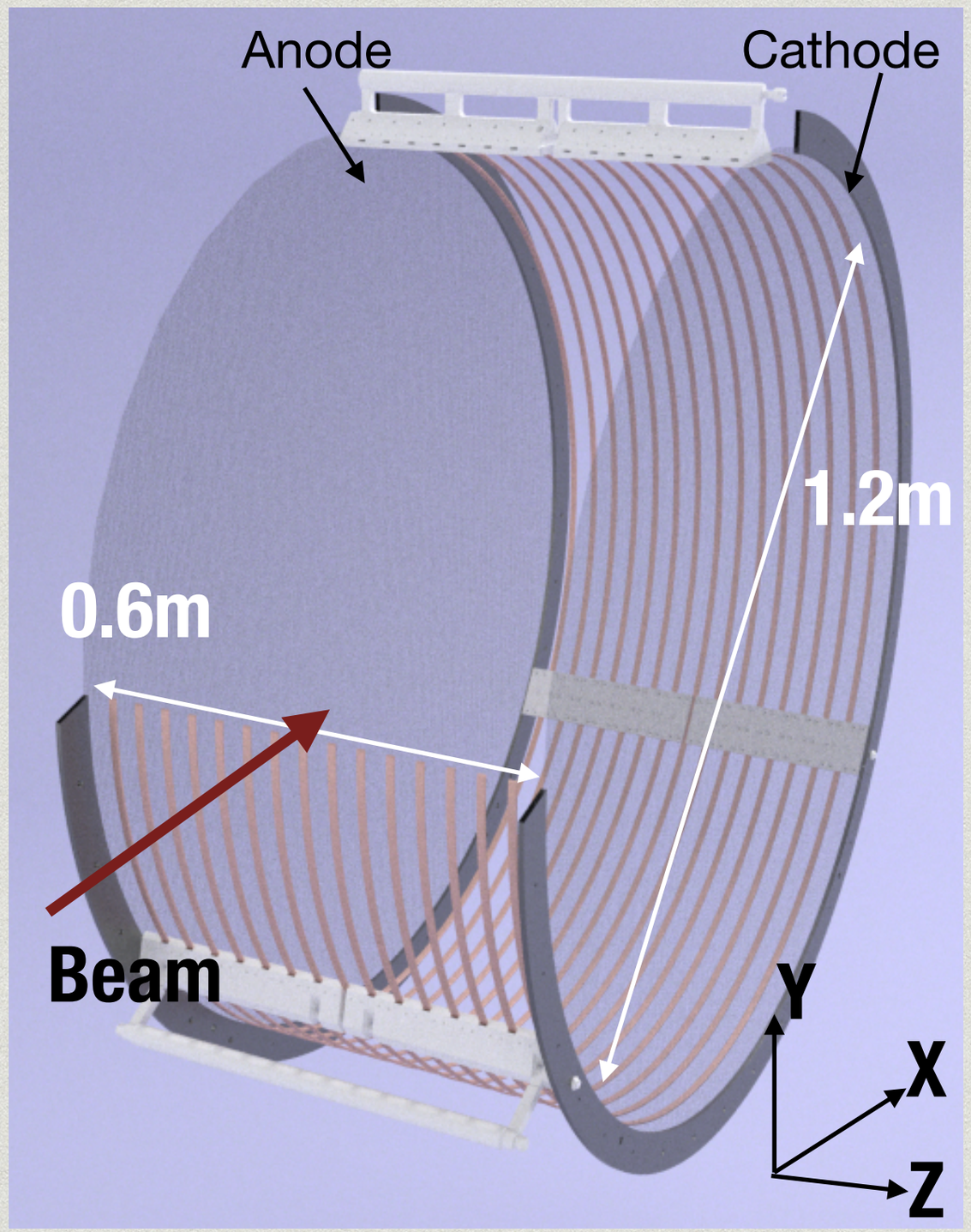
TPC Commissioning



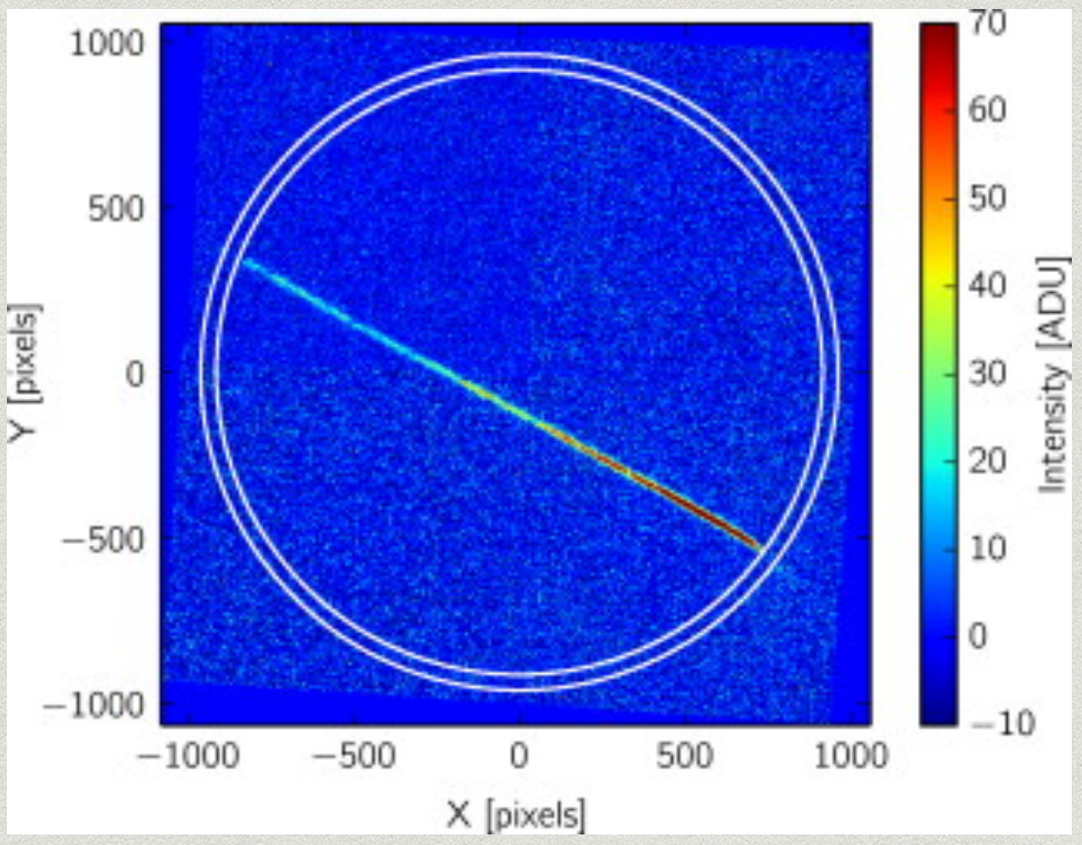
- Prior commissioning inside low pressure vessel
- CCD+Current readout of Anode successfully demonstrated at MIT.
- low pressure vessel and all equipment shipped to RHUL - Arrival in March



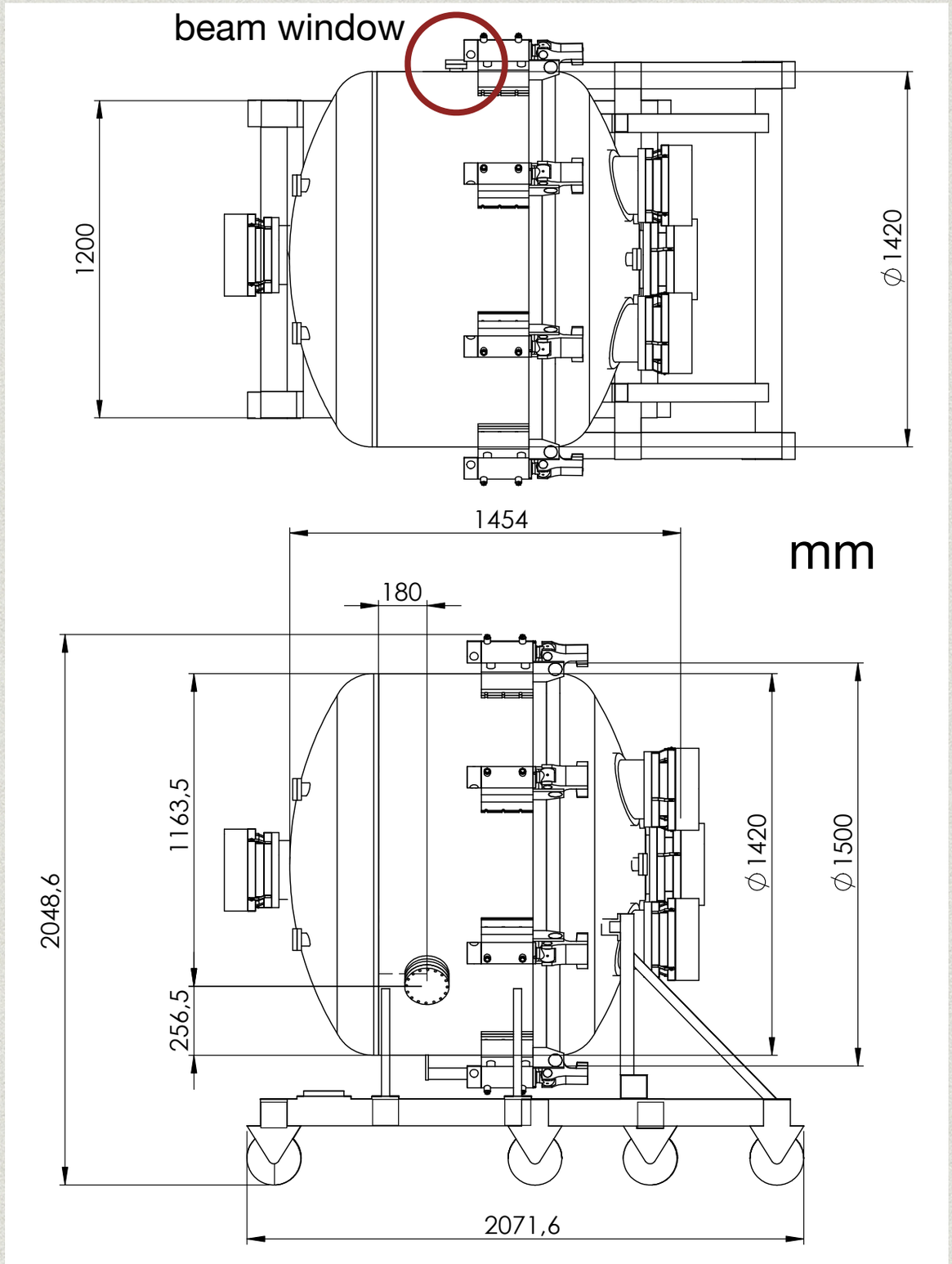
TPC Commissioning



- Prior commissioning inside low pressure vessel
- CCD+Current readout of Anode successfully demonstrated at MIT.
- low pressure vessel and all equipment shipped to RHUL - Arrival in March



High Pressure Vessel



- Fabricated by Cryovac S.L.
- Category IV pressure vessel
- Internal volume ~2m^3
- Maximum rated pressure 7 BarG , 4.75 BarG (operating)
- Delivery at RHUL soon

High Pressure Vessel

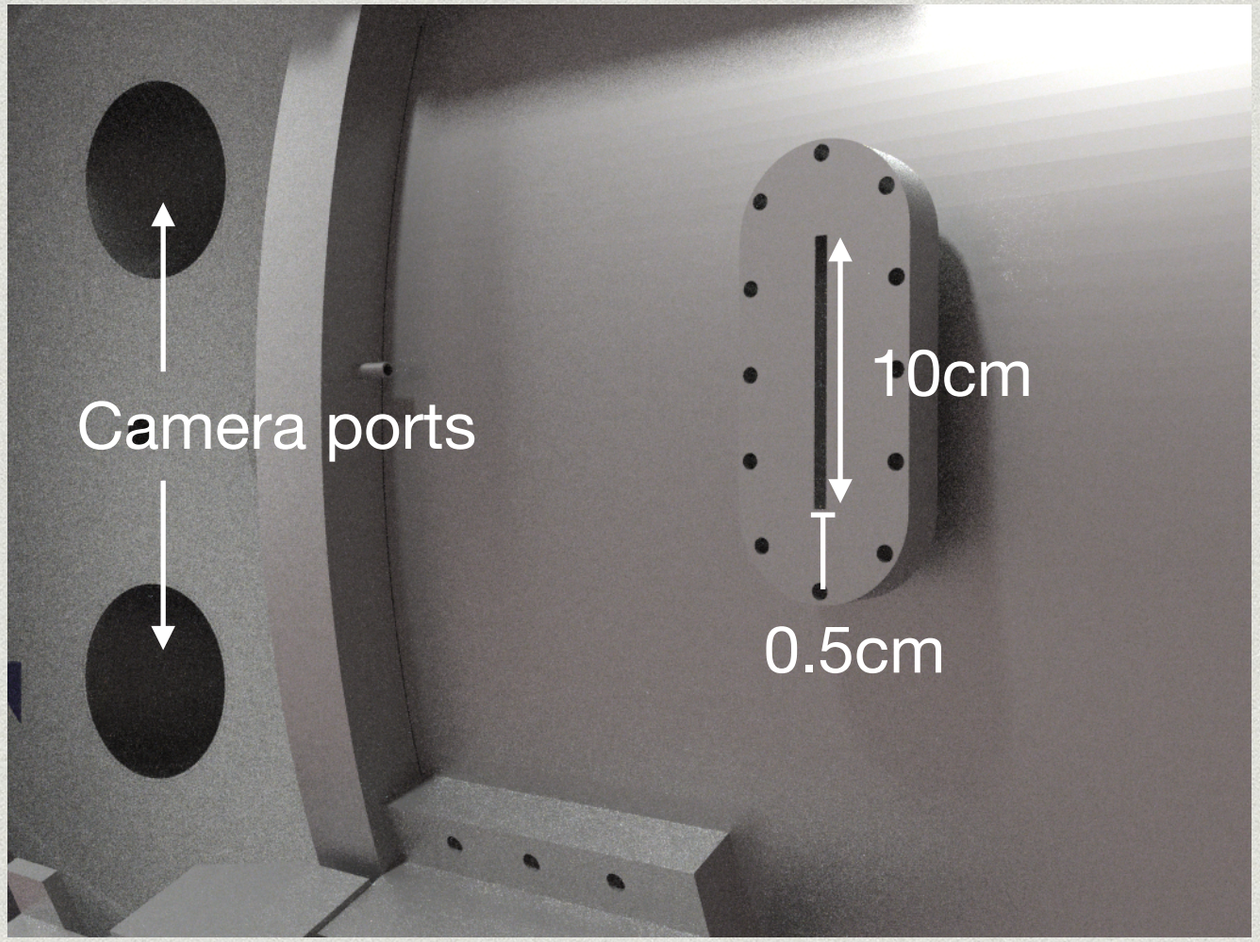
- Double o-ring compression seal
- TPC is mounted via 3 Delrin support structures
- 10 cm stand-off between TPC and vessel structure
- Mobile stand with adjustable height

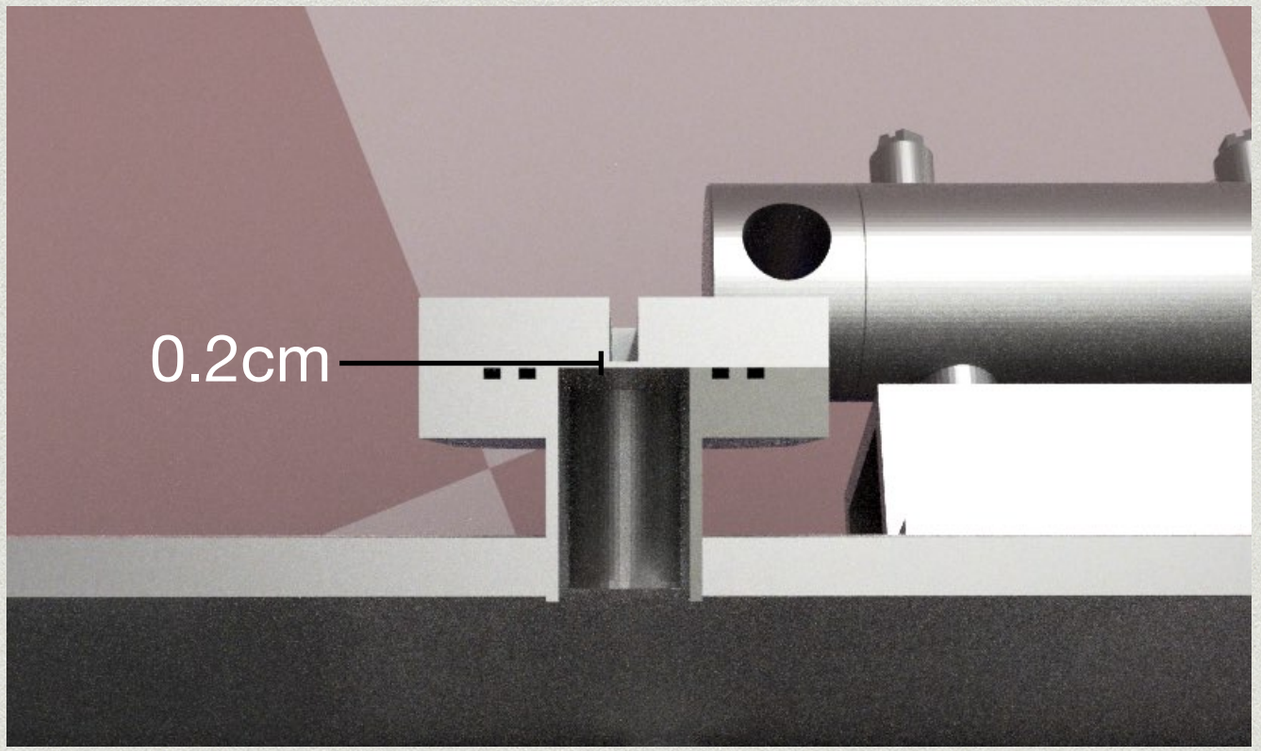
Vessel services

- 4 Quadrant Camera ports
- 2 End to End Camera ports
- Beam Window
- Gas Inlet
- Vacuum
  Agilent Triscrol 800
- 2 pressure safety routes
  (Fike 95% operating ratio Burst Disks)
- Vacuum Gauge
  Inficon PCG55x
- Pressure Gauge
  Wika A-10
- Electrical Feedthroughs
  Cathode Supply
  Anode Supply
  Anode Digitizer

Beam Window

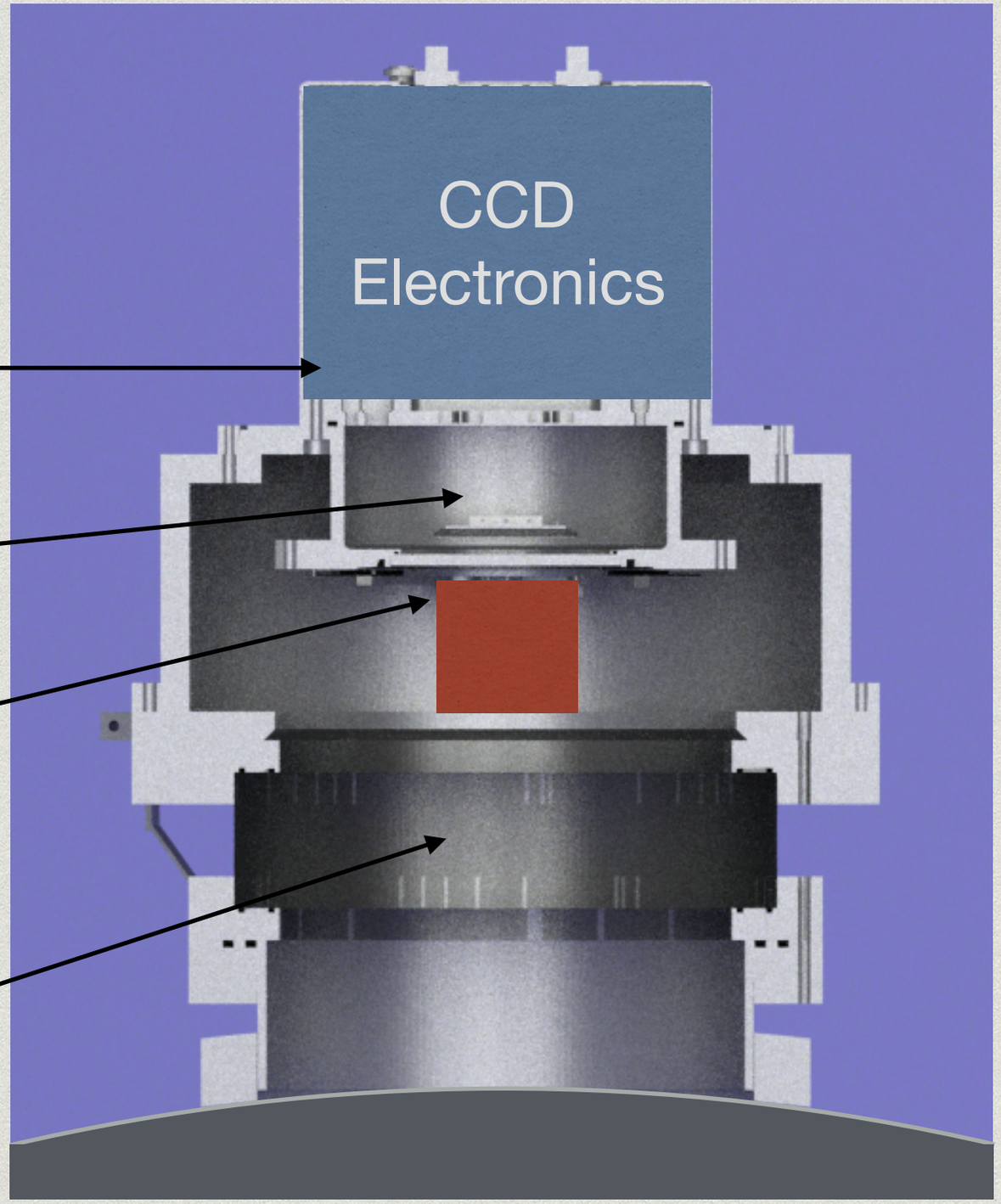
- Designed for use with a highly collimated beam
- Custom Aluminium flange
- 10.0 x 0.5 cm cross section
- 0.2 cm thickness
- If beam cannot be collimated, opposite side of vessel is blank, 1cm thickness



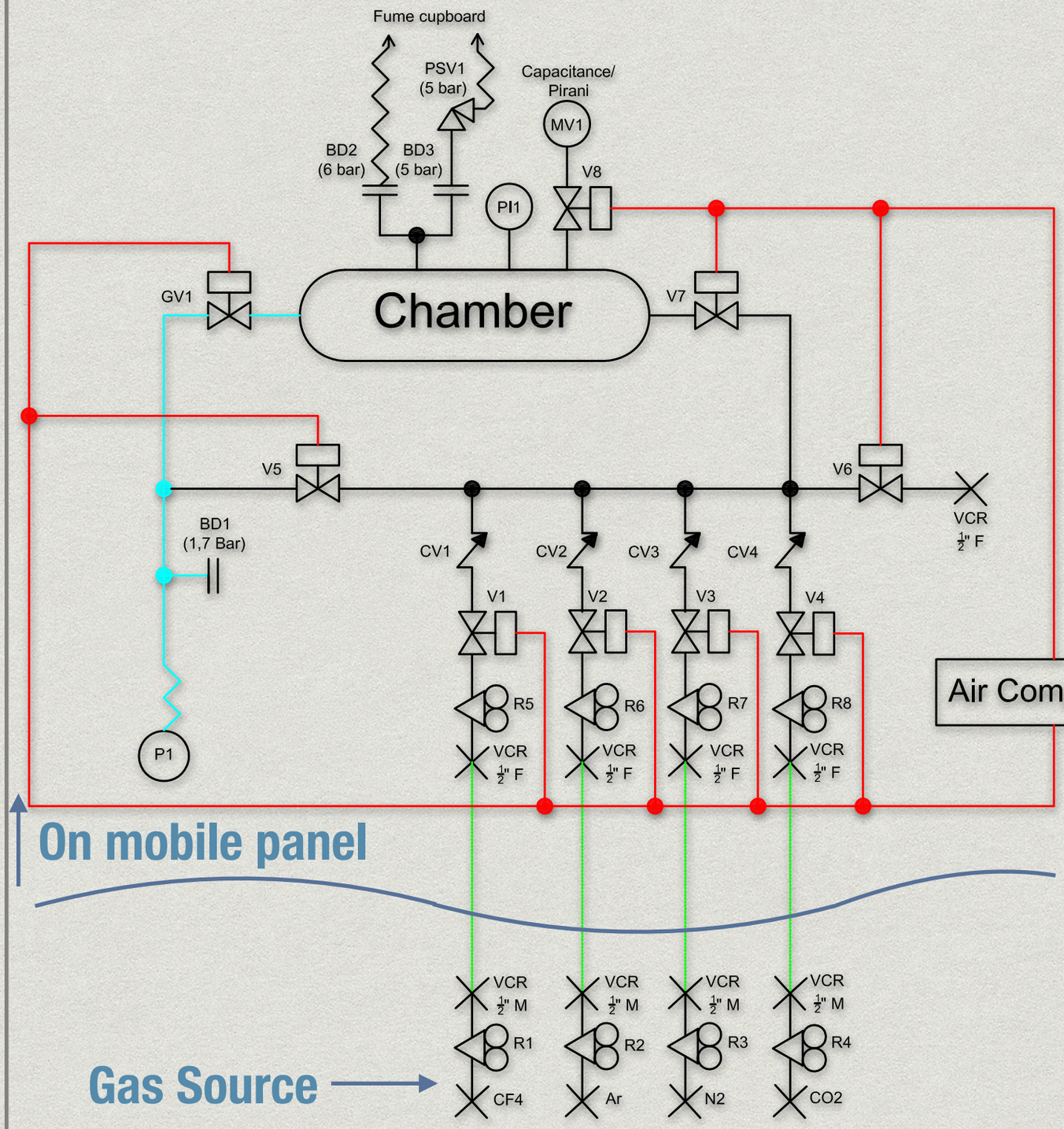


Camera Ports

- Optics and CCD mounted to end flange
- Fairchild CCD486
  4096x4097 pixels (0.15μm pitch)
  61.44x61.45mm
  0.02 e/pix/sec dark count (at -60C)
  Low readout noise (<10e at 1MHz)
  Vacuum Cooled to -60 to 90C)
- Commercial optics 50mm f/0.95 - f/1.2 lens
  (As fast as possible!)
- <0.07mm^2 / pixel mapped to Anode
  (vixel size, ~270μm x 270μm)
- 6cm thick Quartz window separates internal volume from CCD hardware.
- Allows readout to be serviced without opening the vessel



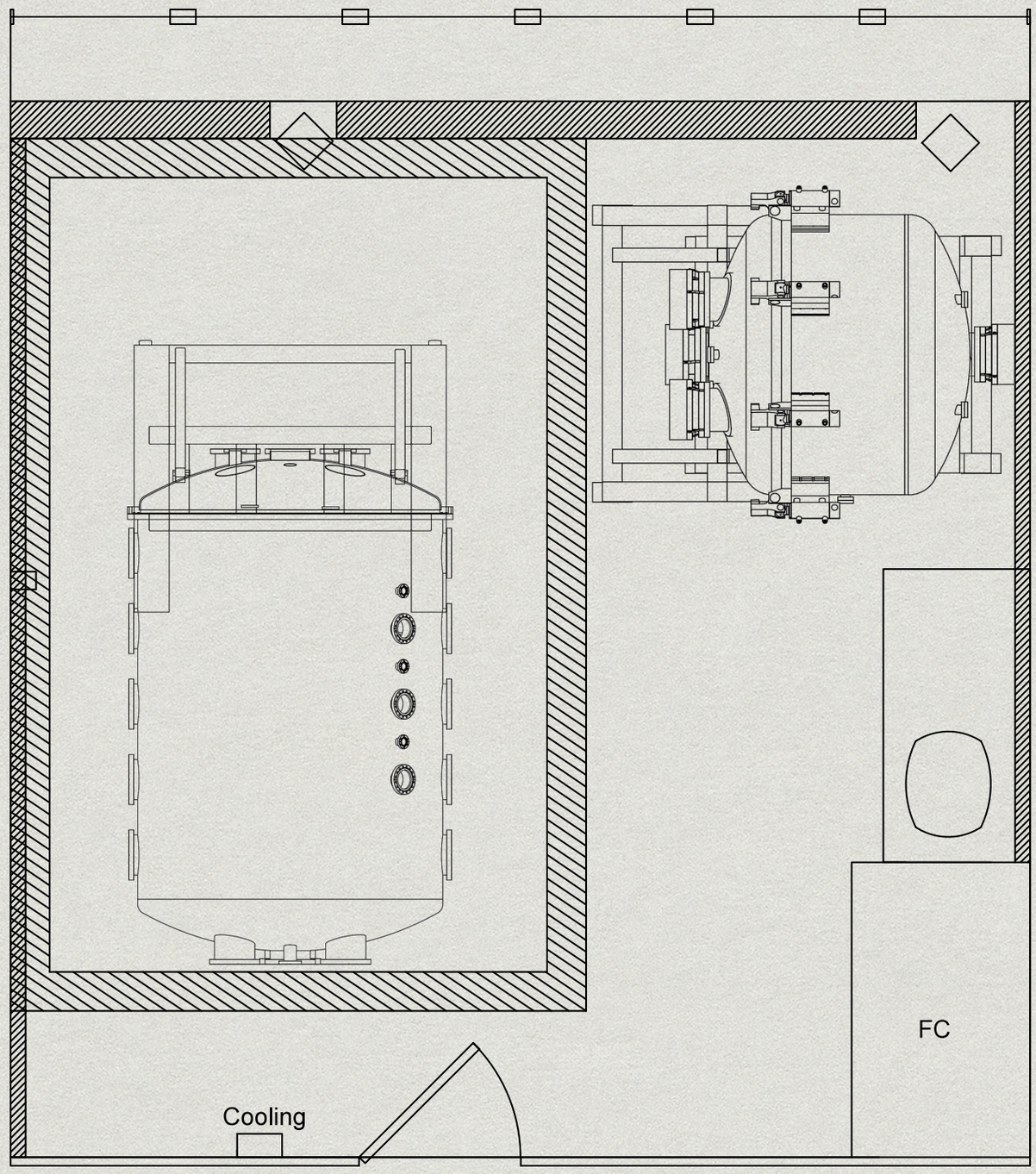
Gas System Design



- Gas Sources - Scientific Grade CF_4, Ar, N_2, CO_2
- Maintain <1ppm Purity gain and drift stability
- Check valve protected inputs
- Bellows sealed Valves used throughout.
- Gas actuated valves for remote operation.
- Option to add flow control
- Twin Safety relief paths

Lab Status

- Lab space and services have been completed
- Soft-wall clean tent has been installed
- Taken delivery of low pressure vessel and all readout hardware
- Recommission TPC using low pressure vessel.
- Transfer operations to high pressure vessel



6 Month outlook

April	Complete Lab and services at RHUL ✔
May	Commission low pressure vessel (in progress)
June	Delivery of high pressure vessel, complete safety inspections
July	Install and commission TPC in high pressure vessel
August	Full operation of DAQ and TPC in high pressure vessel
September	Source runs and calibration

Target 2018 CERN Test Beam

Summary

- TPC and Supporting hardware proven with low pressure vessel at MIT
- Low pressure vessel and supporting hardware arrived at RHUL late March
- High Pressure vessel due end of May
- Target full TPC operation by September