HPgTPC Readout

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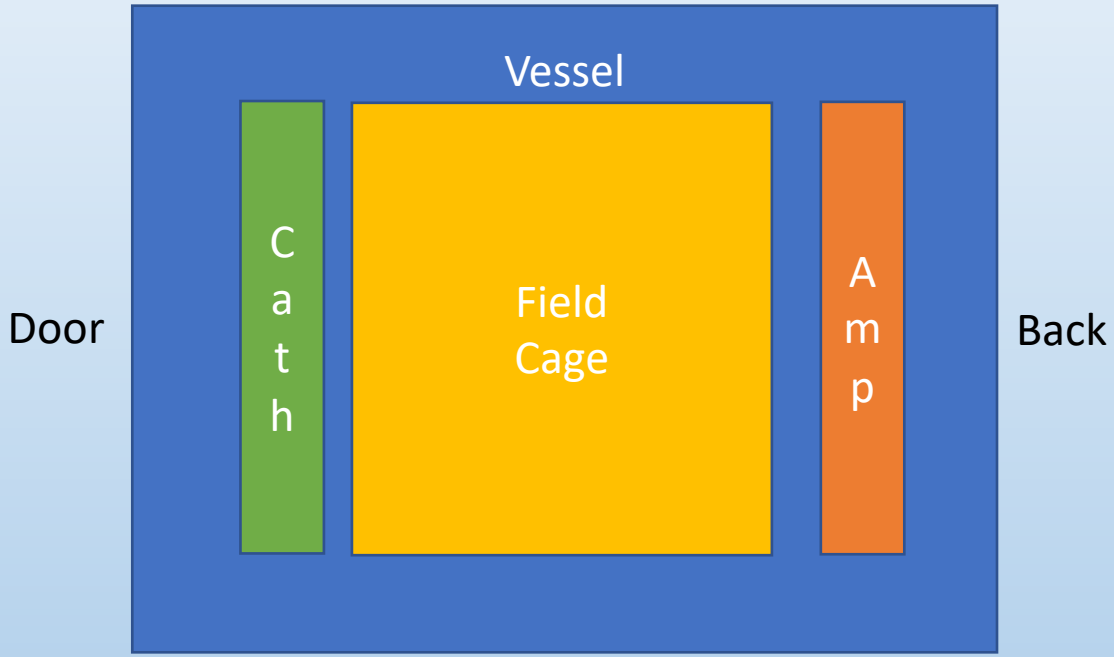
Introduction

- Papers on mesh amplification region have data they need
- Focus shifting to OROC so we need to reconfigure the vessel to accommodate this
- Linda, Alexander, Asher, Harrison and I met at RHUL on Monday and came up with a plan
- We are aiming for a beam test at FNAL in Autumn 2021 (pandemic allowing)
- We have a working setup now for field cage and gas system so important to factorise changes and verify we haven't broken anything at each step

Current setup

- Amp region feedthroughs are at back
- Gas system feedthroughs are at bottom on sides
- Drift cathode feedthrough on door
  - Feedthroughs on door complicate opening procedure
- Cameras are on door
- OROC being tested in atmospheric test box



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DUNE

Cabling the mesh amp region vs the OROC

- OROC designed to have rear access
- Mesh amplification region designed with equally accessible front and back
- We do not think it is practical to cable up the OROC if back is not accessible
- OROC HV connections:
  - Anode: several connection points at same voltage (~2kV)
  - Gating grid: (few hundred V)
  - Cathode and readout pads: low voltage

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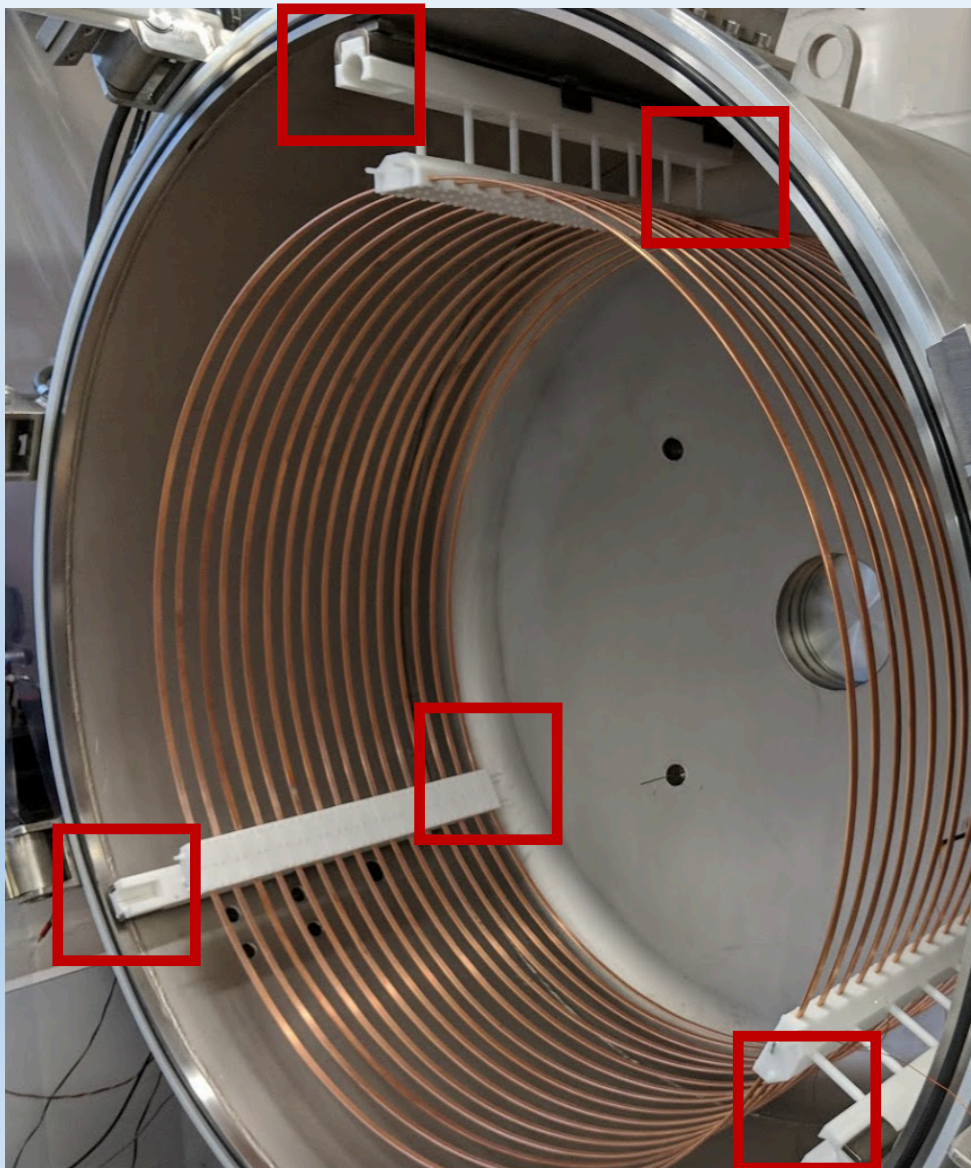
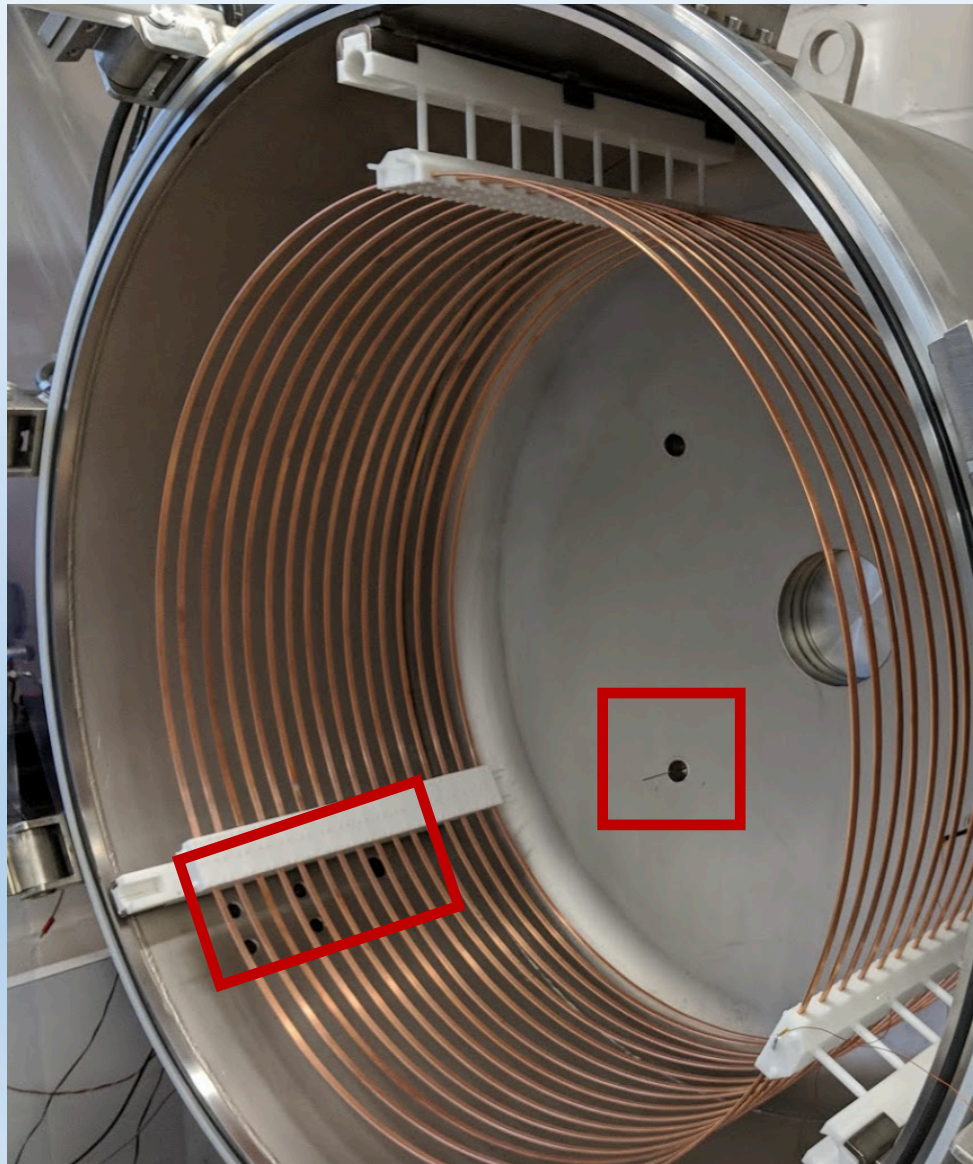
Improvements/checks possible when stack removed

- Currently ends of rails are permanently open
  - Including e.g. during lift at CERN
- With full stack removed we can tap holes in both ends of rails and fit removable caps



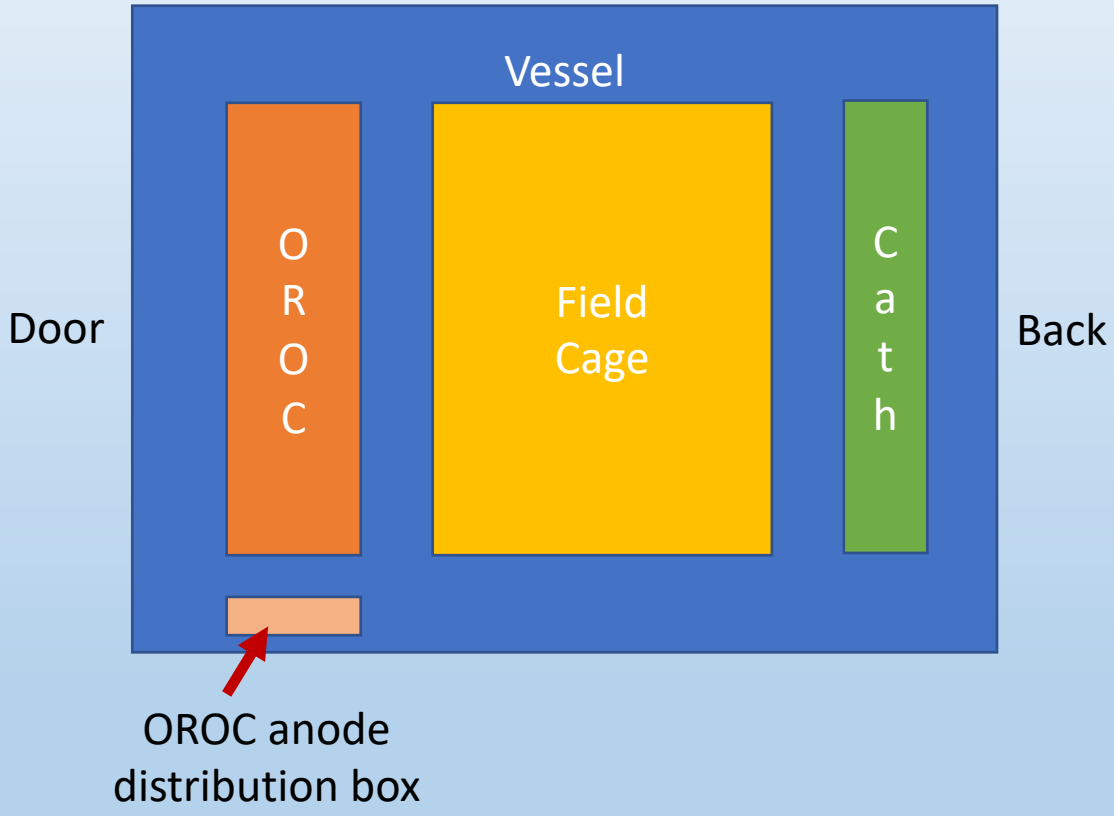
Improvements/checks possible when stack removed

- Currently ends of rails are permanently open
  - Including e.g. during lift at CERN
- With full stack removed we can tap holes in both ends of rails and fit removable caps
- We will be reconfiguring HV feedthroughs so need to check clearance to internal electrodes
  - Can do from CAD but verify inside
  - Good opportunity to improve wire paths



Intended setup

- OROC cabling means we need to flip order
- Factorise this operation to avoid finishing and it not working

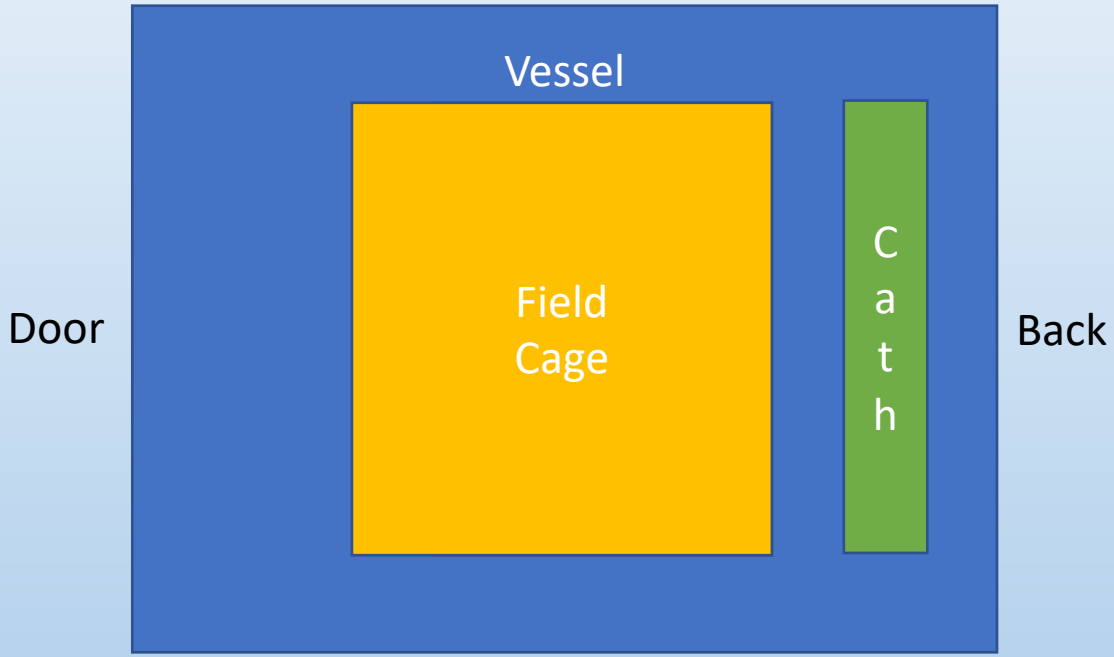


Intended setup

- Step 1: Rail stops, new feedthrough positioning and wiring plan
  - 4 KF40s on door, 4 on back and one spare on each side
  - We may be able to fit all feedthroughs not on door making opening easier
  - May decide to use door for OROC pad readout to shorten path length
  - Can use this opportunity to improve wire insulation
    - E.g. delrin plates to separate wires from vessel, shorter wire paths to reduce closeness to electrodes

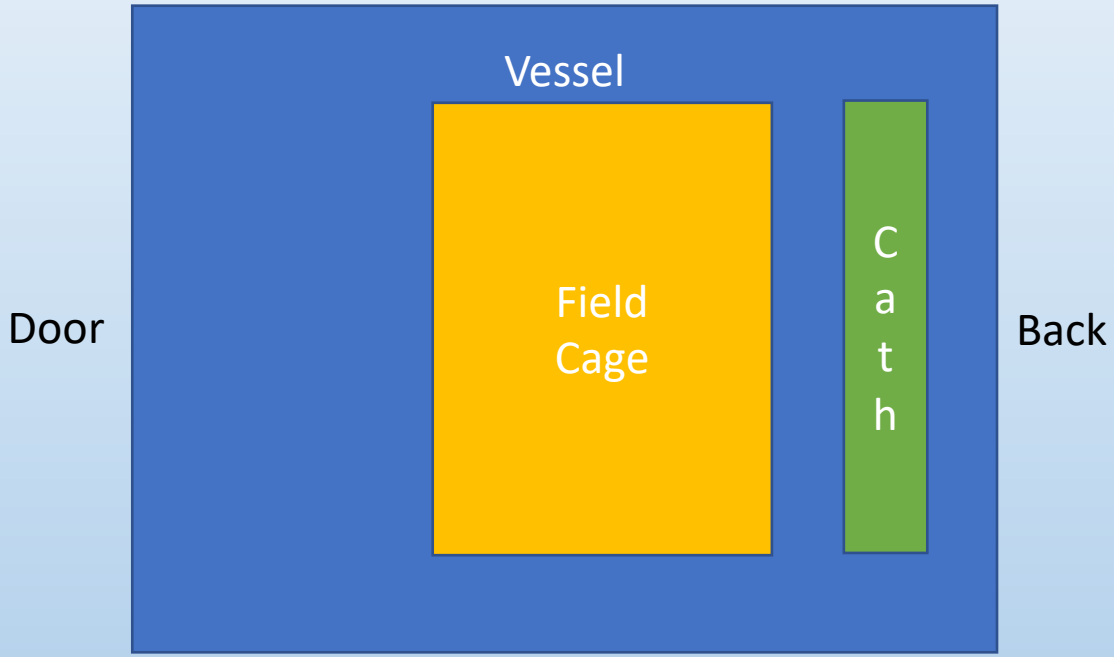
Intended setup

- Step 2: Reinsert field cage and drift cathode in flipped order and verify we get back to same voltage
  - Can also factorise movement of cathode feedthrough



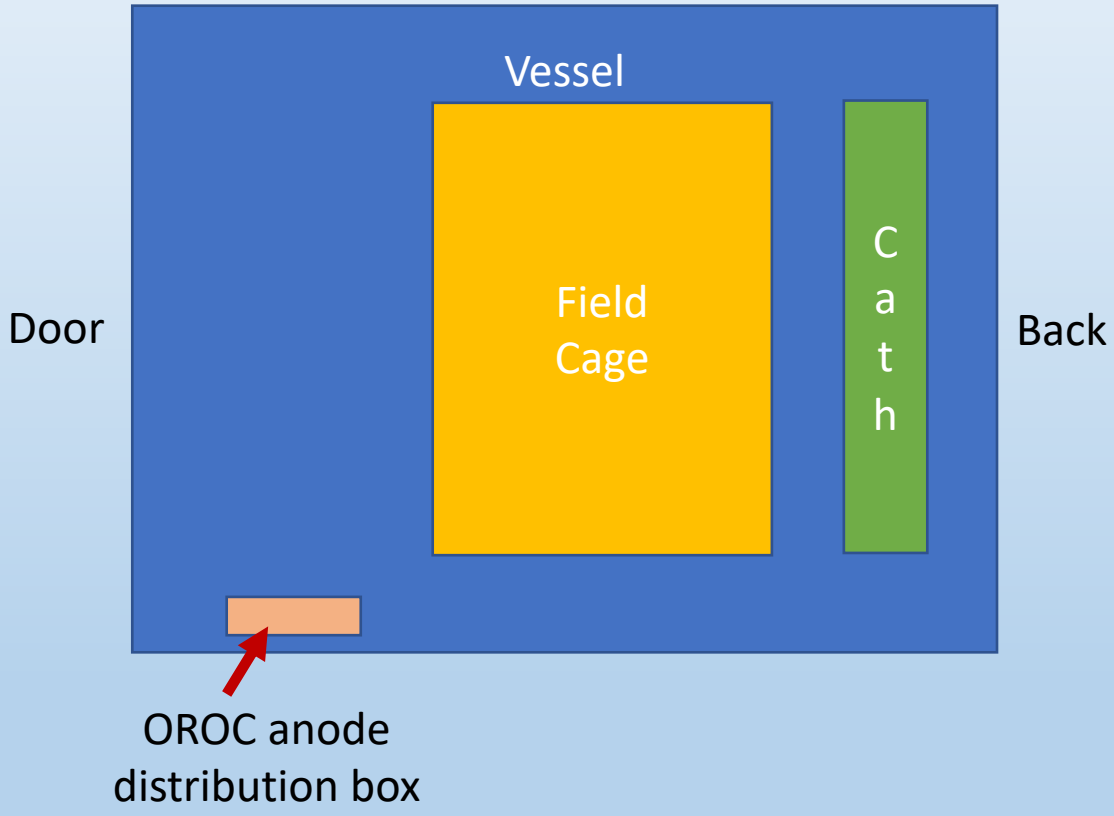
Intended setup

- Step 3: Resize field cage to suit larger OROC and achieve desired drift voltage
  - OROC plus field terminator takes more rail space
  - We want to ensure feedthrough spacing from electrodes
  - We have never reached drift field we want, shorter field cage would allow this



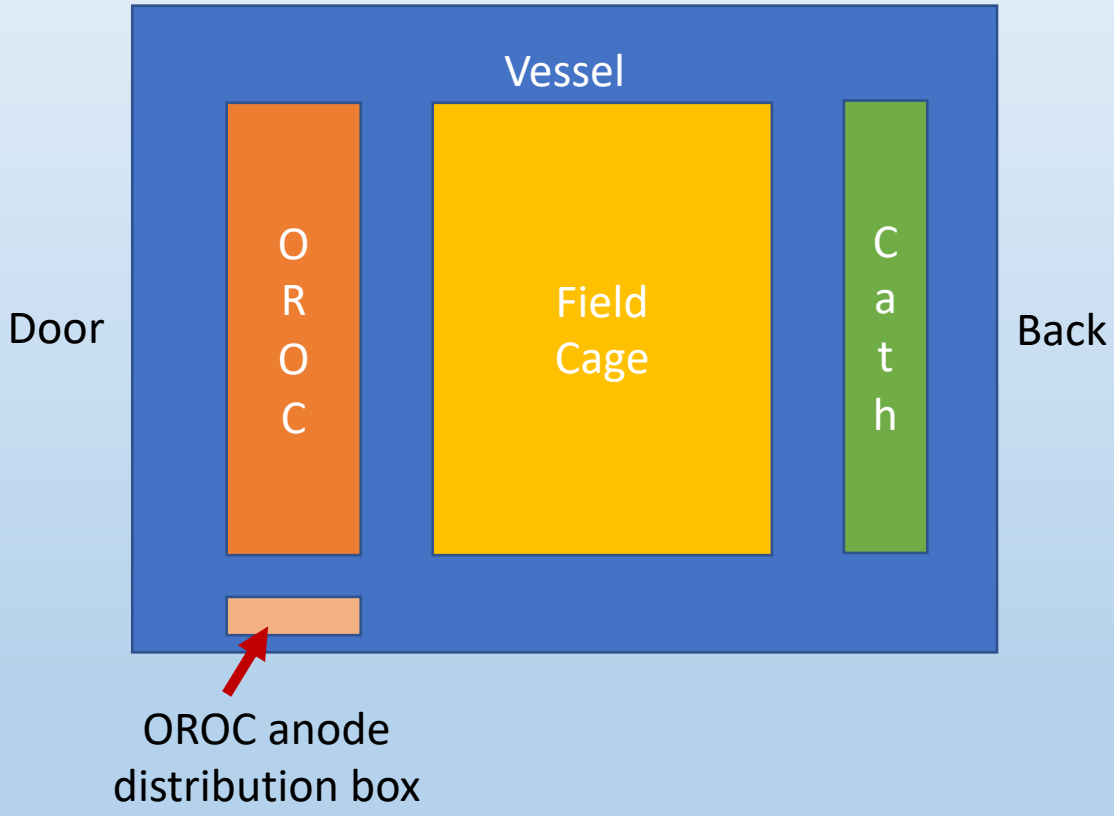
Intended setup

- Step 4: Test OROC HV distribution box at pressure with cables running near field cage
  - All OROC anode wires at same voltage but several connection points
  - Distribution box built and working with atmospheric test box now but needs testing at pressure before sensitive electronics are connected



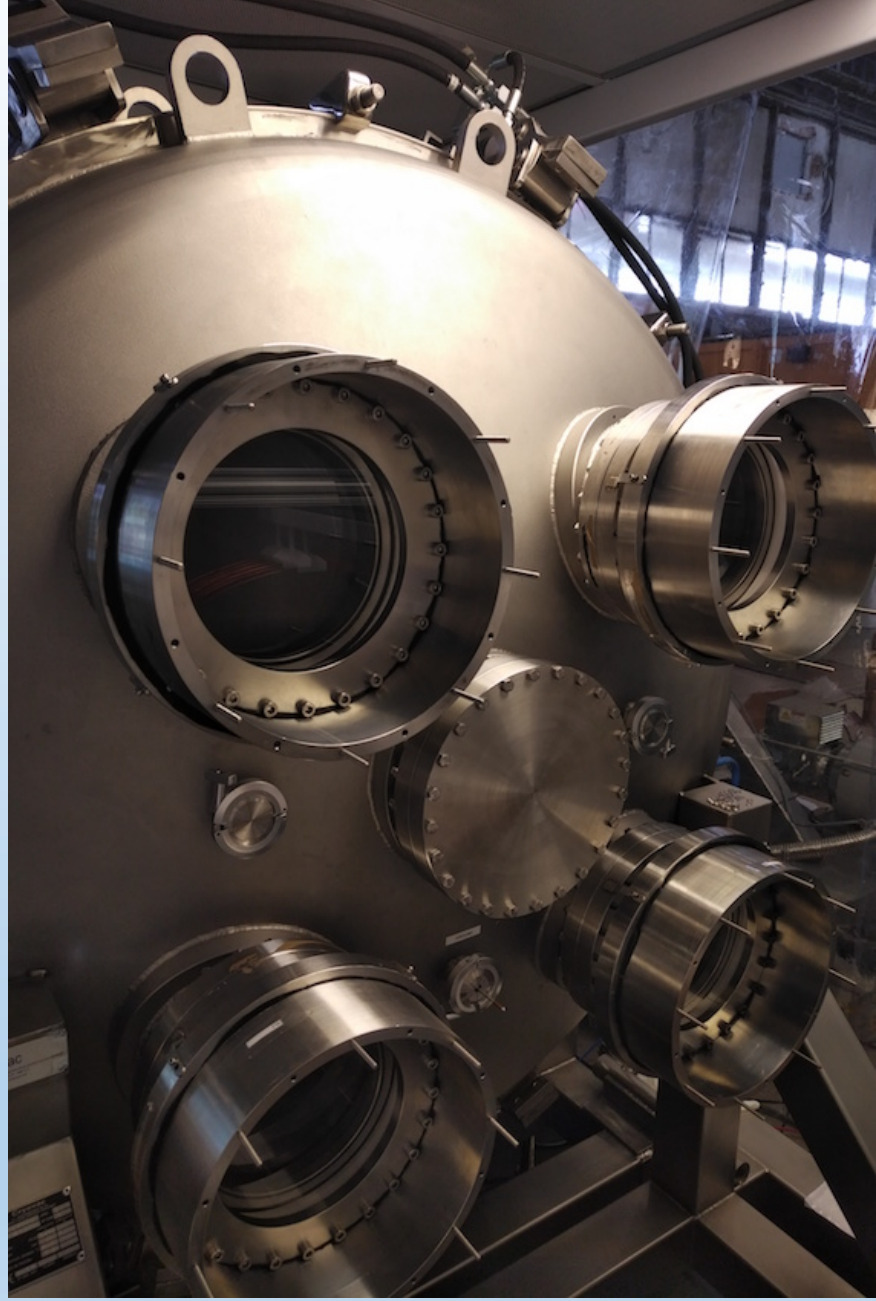
Intended setup

- Step 5: Insert and cable OROC
  - Until this stage OROC tests in test box ongoing in parallel (good for separating people for COVID purposes)
  - OROC not so easy to insert remove as cathode so we will need to hang calibration sources in field cage/other positions before this step



Cameras

- We will only move cameras after other steps completed and verified
- Back of vessel has a single camera compatible flange so we can move one camera there



Readout

- Started transitioning OROC test box readout to full hpdaq based system
- We have a 15 pin DSUB feedthrough that we will use to send signals outside
- OROC test box work will determine which pads/strips we readout and with which preamps
- Final DUNE system evolving so solution for test beam will depend on that

Summary

- Intention is to start next Tuesday with step 1 and possibly 2
- Until step 5 we think all operations need a maximum of 3 people which lab has been approved for
- Likely we'll be allowed 4 people for worked out processes so we will make an itemised plan for step 5
- After step 5 we will likely repeat measurement campaign we carried out in the atmospheric test box and look at different gas mixes
- Can also in parallel start FNAL safety documentation