# MOLLER Detector cable interfacing

March 16, 2021

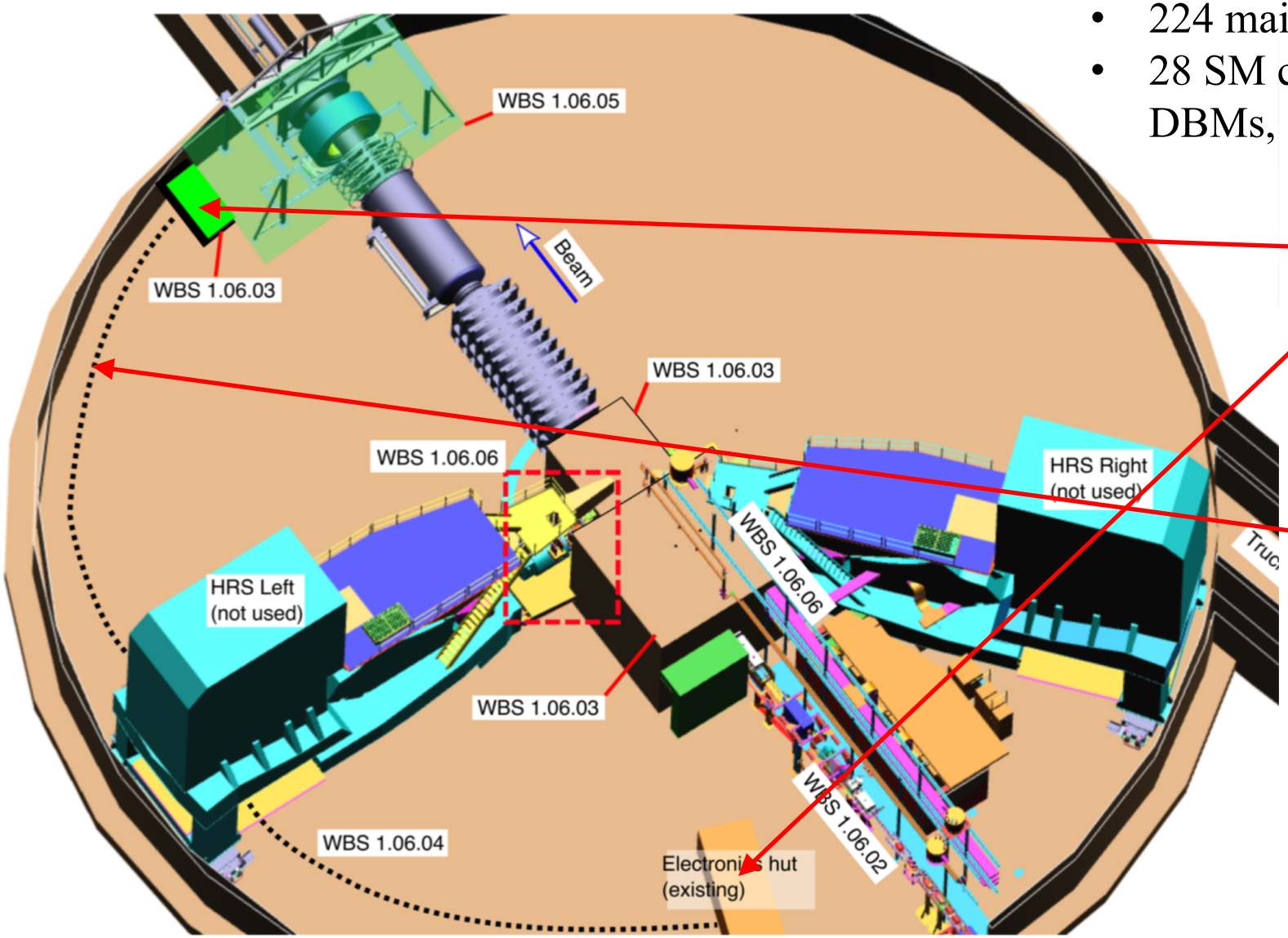
Dustin McNulty

(Idaho State University)

# Outline

- Cabling overview
- Electronics bunkers
- Signal breaks and patch panels
- Some cabling ideas to start discussion
- Breakout box and patch panel details

# MOLLER Hall Layout




## Detector Cabling

- 224 main detector channels
- 28 SM channels, 14 pion, 8 SAM, LAMs, DBMs, scanners

--Two electronics huts – one downstream and one upstream

--Signal and HV

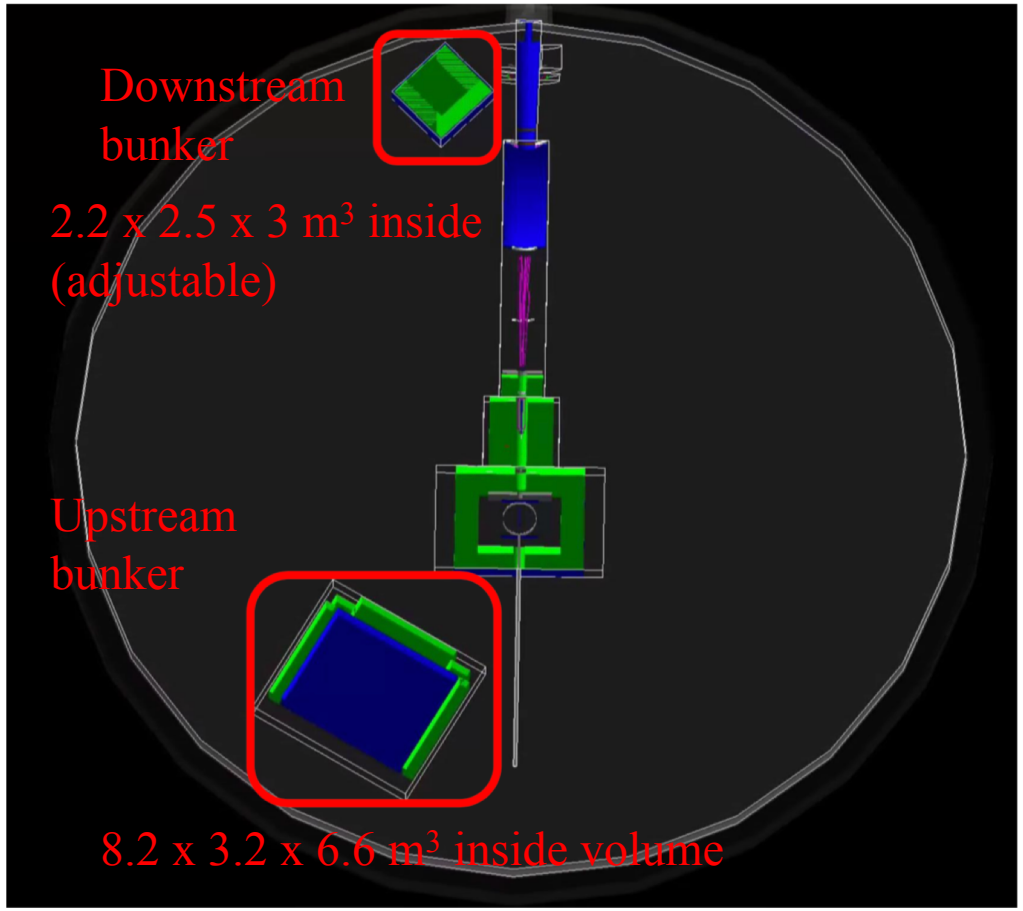
- 50 ft runs from detectors to patch panels
- 320 ft runs from patch panels to upstream hut (ADCs)

--LV and switching

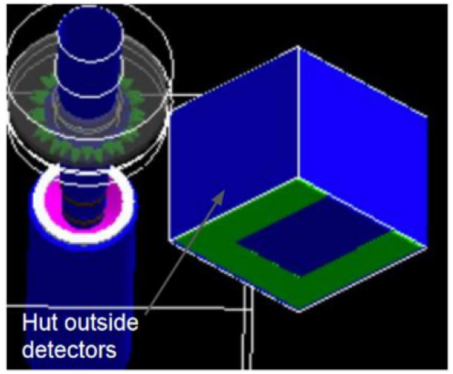
- For powering PMT base relays and preAmps
- And for switching PMT dynode chain and preamp gain

# Slides from Ciprian's Dir. Review talk (Aug 2020)

## Locations of interest: Shielded bunkers



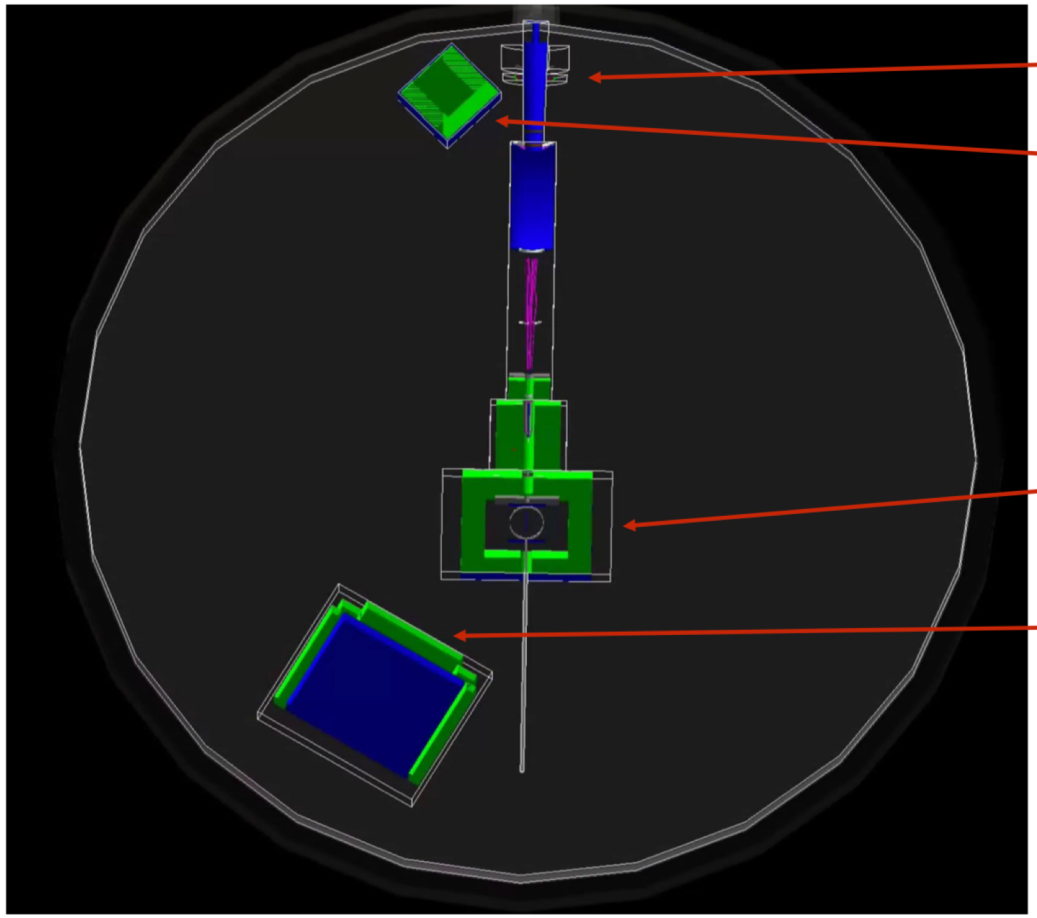

- These bunkers will house sensitive electronics as well as power supplies and controllers for the magnet systems
- We find the levels of neutron and electromagnetic radiation to be several orders of magnitude below damage thresholds
- Optimization of the shielding will follow and ensure that we keep a conservative level of radiation




Shielding 12

Jefferson Lab

# Locations of interest



Main detector area

Detector electronics
(Counting and GEMs)
Movement mechanism
hut

Target region

SBS bunker to contain:
a) Magnet power supplies
b) detector electronics

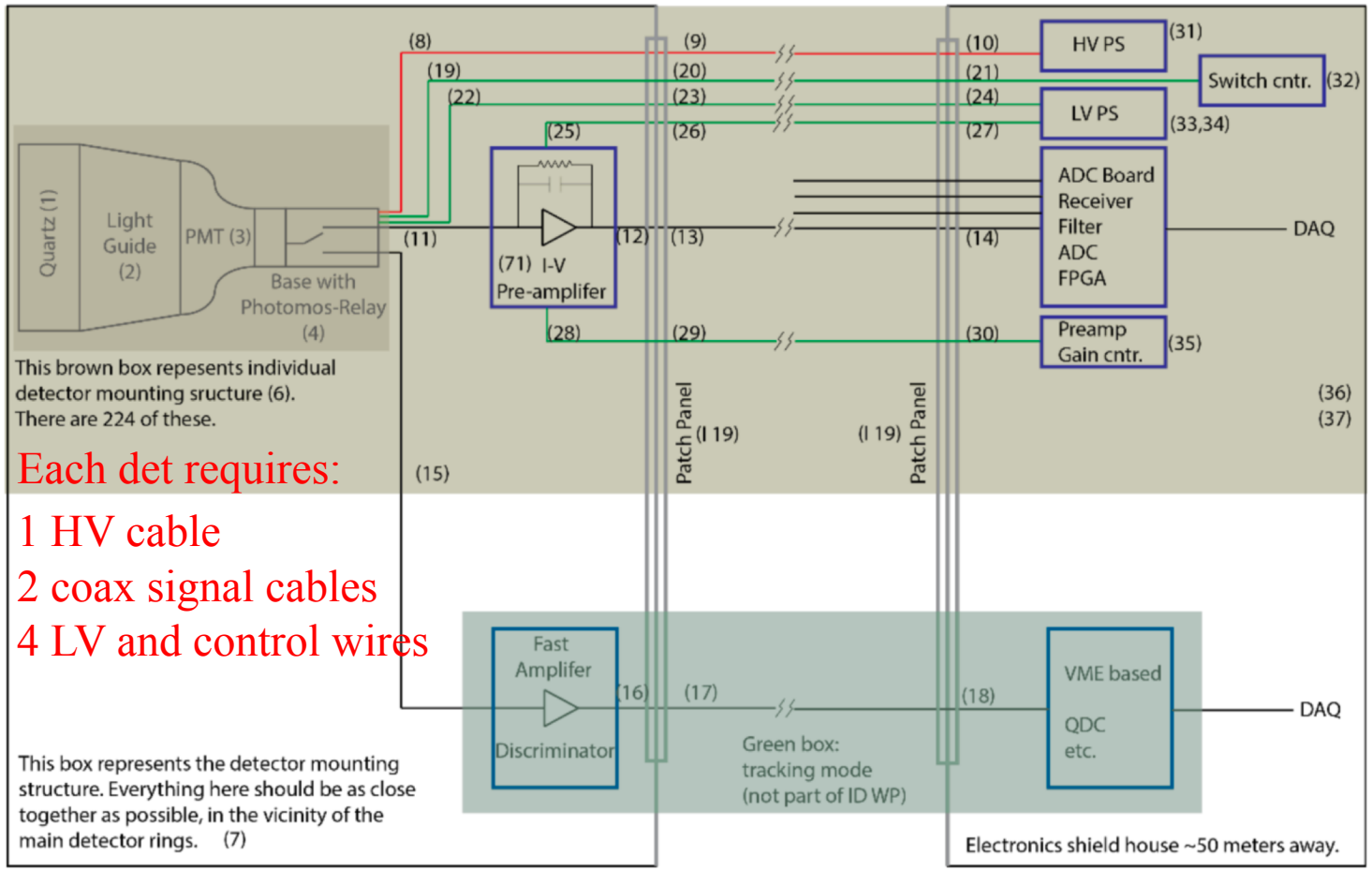
# Detector Cabling

- *Twinax RG108AU cables: 302x60", 604x600" & 400x320ft.*
- *Two patch panels for 400 Twinax cables each + cable trays.*
- *RG58 cables: 604x600"*
- *Two patch panels for 302 RG58 cables each + cable trays*
- *384 High Voltage channels (3.5 kV/ 3mA/common floating).*

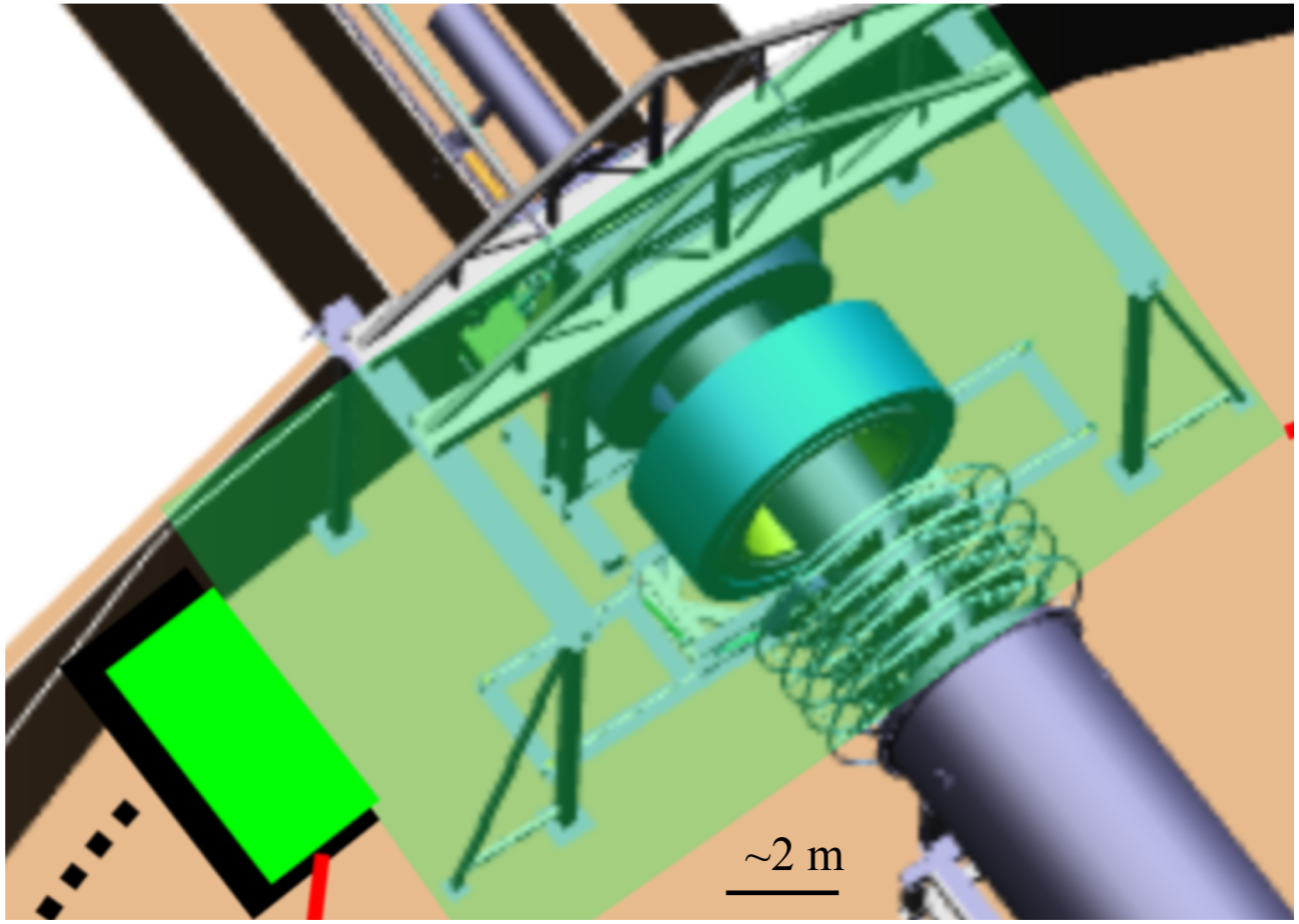
- *HV cables: 16 - 320ft multi-conductor HV cables. 52-pin Radiall connectors both ends. 384 HV channels total*
- *8 HV breakout boxes (48 ch each) Radiall to SHV*
- *384 RG8A/U, 600"- long, SHV-to-SHV*
- *LV: 1048 ch, grouped into 66 power supplies, V/I TBD, floating. Cabling to electronics in vicinity*

**Overview:**

- The electronics includes
  - PMT bases (high/low gain)
  - Integrating Preamplifier
  - ADC board
  - LV Power supplies
  - Gain control
  - Base switching control
  - Tracking electronics (green) not part of this project



# Signal breaks and patch panels




## Integration mode signals

--Two patch panels for 400 det channels:
one near detectors and other in US bunker

--1.5 meter cable from PMT to pre-amp (RG-58)
--15 m cable from pre-amp to DS PP (twinax)
--100 m cable between DS-PP and US-PP (twinax)
--15 m cable from US-PP to integrateADC (twinax)

- 1st signal break at pre-amps must be close to detector
- DS-PP needs to be 'close' to detector—for cable relief,…

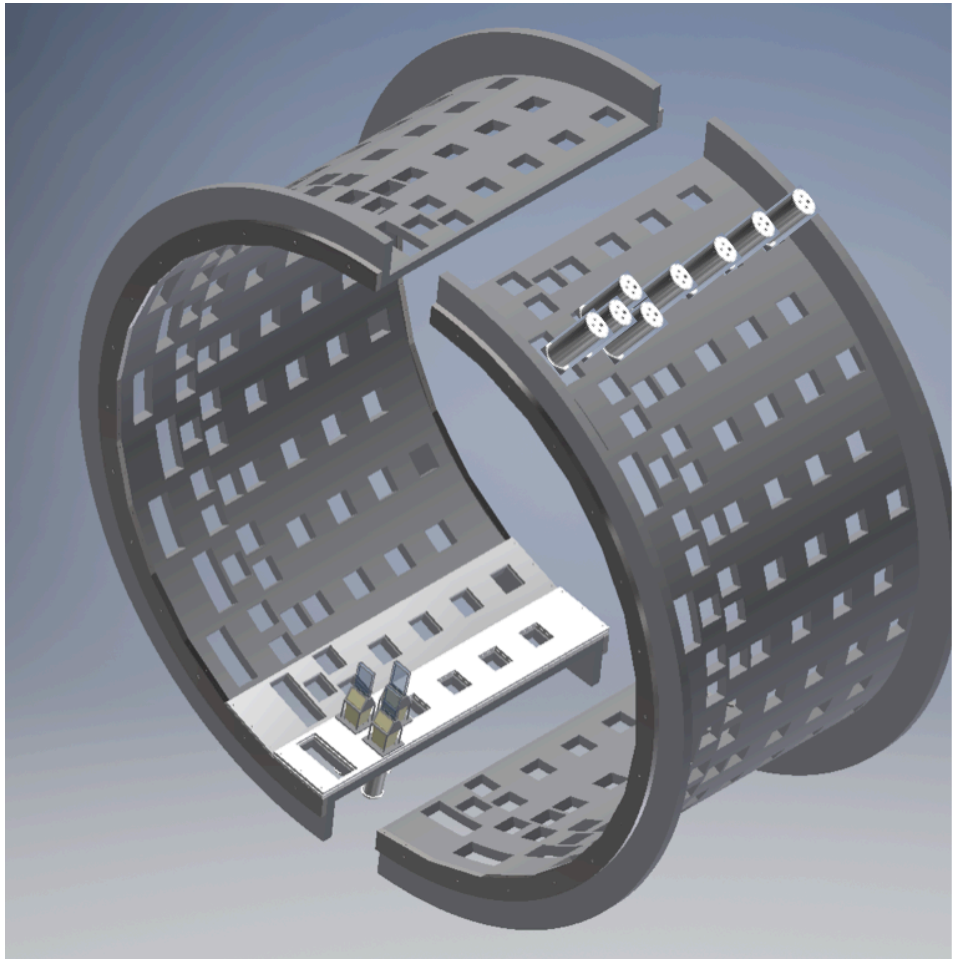
## Counting mode signals

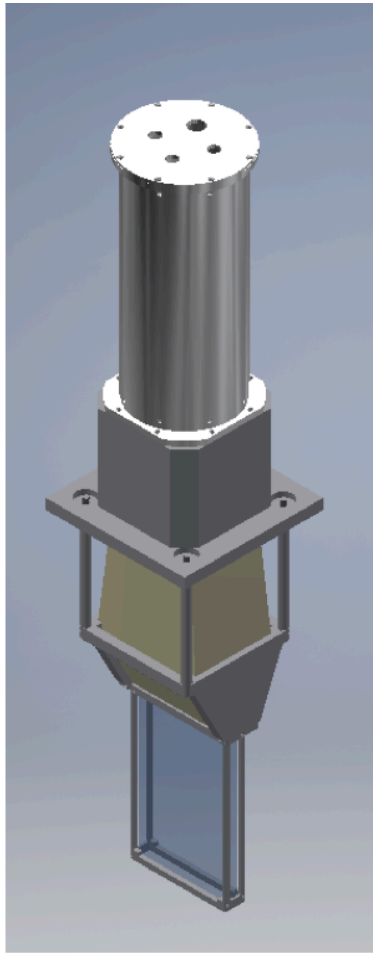
--Two patch panels for 302 det channels:
one near detectors? and other in US bunker

--15 m cable from PMT to fast-amp/DS-PP? (RG-58)
--100 m cable between DS-PP and US-PP (RG-58)
--15 m cable from US-PP to flashADC (RG-58)

- 1st signal break at detector 1/28 segment patch panel
- 2nd signal break at fast amplifiers located in DS bunker?

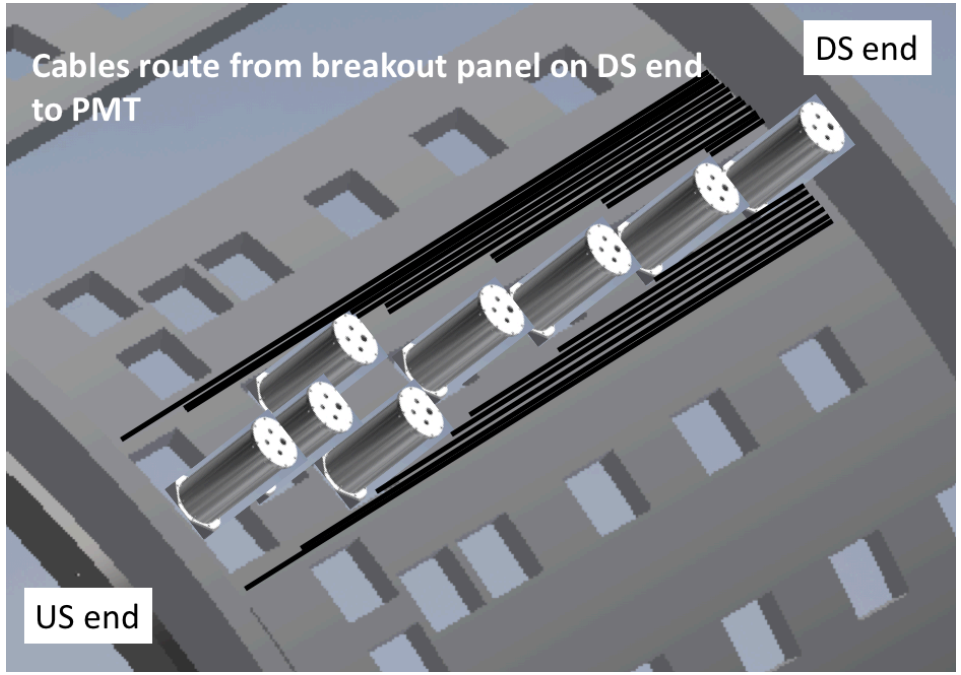
# Idea for cable routing at detector assembly





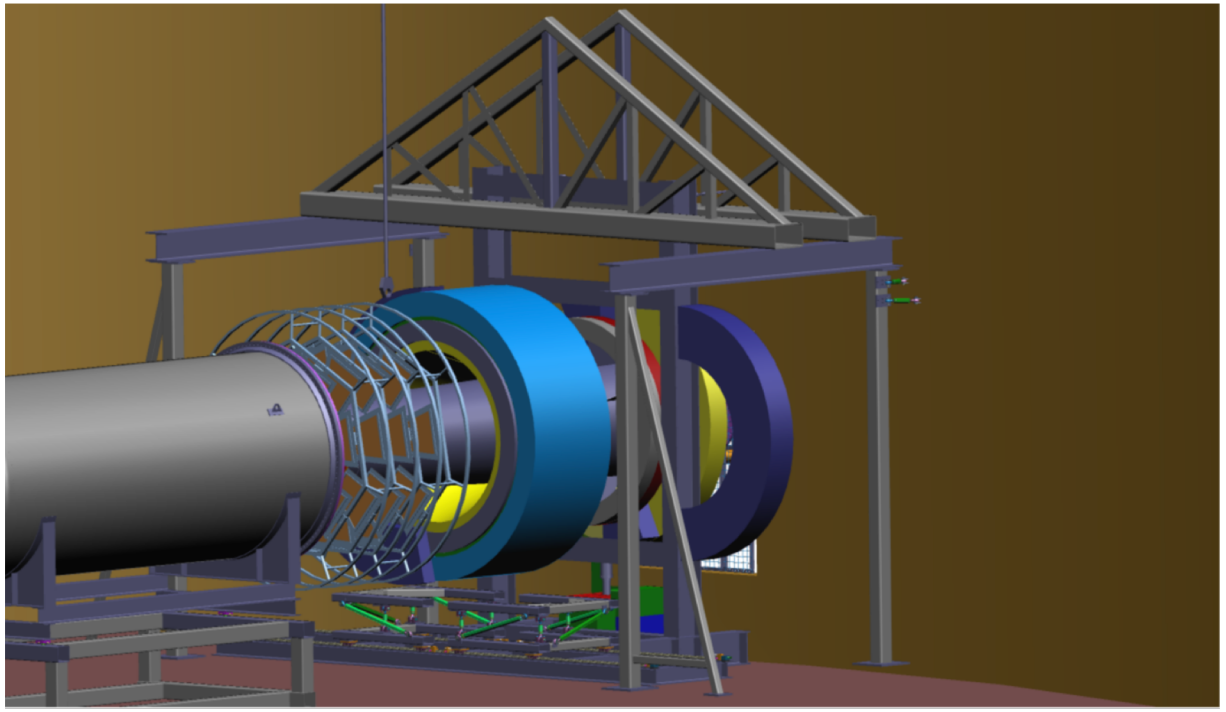
- This is the original idea for the Pb barrel (two solid ‘clam-shells’)
- We now plan to have each 1/28 segment be a separate assembly

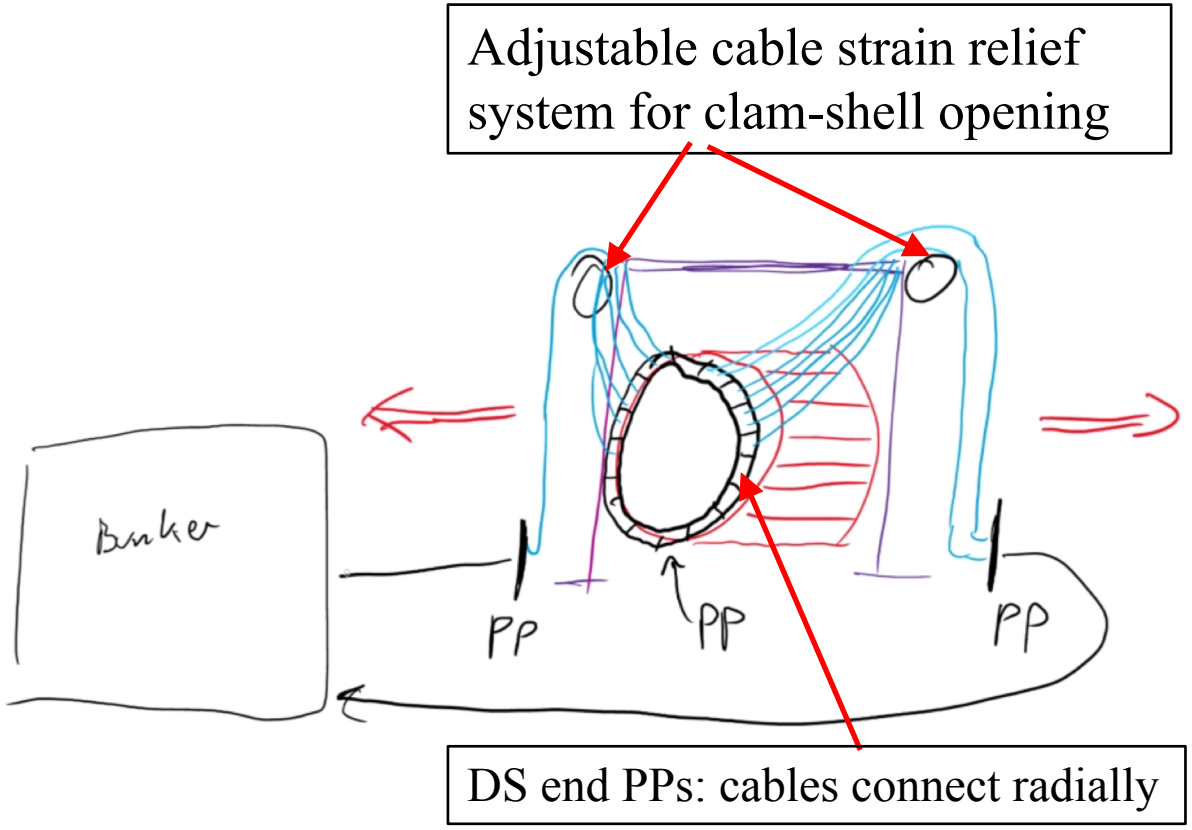
- 8 detectors per 1/28 segment
  => 24 HV & signal cables and 32 ch of LV/control wiring
- Idea is to have custom patch panel mounted on downstream end of each segment
- Panel could house preamps as well as small gas manifold for dry air flow distribution




All cables can be disconnected from custom PP to facilitate segment install/de-install

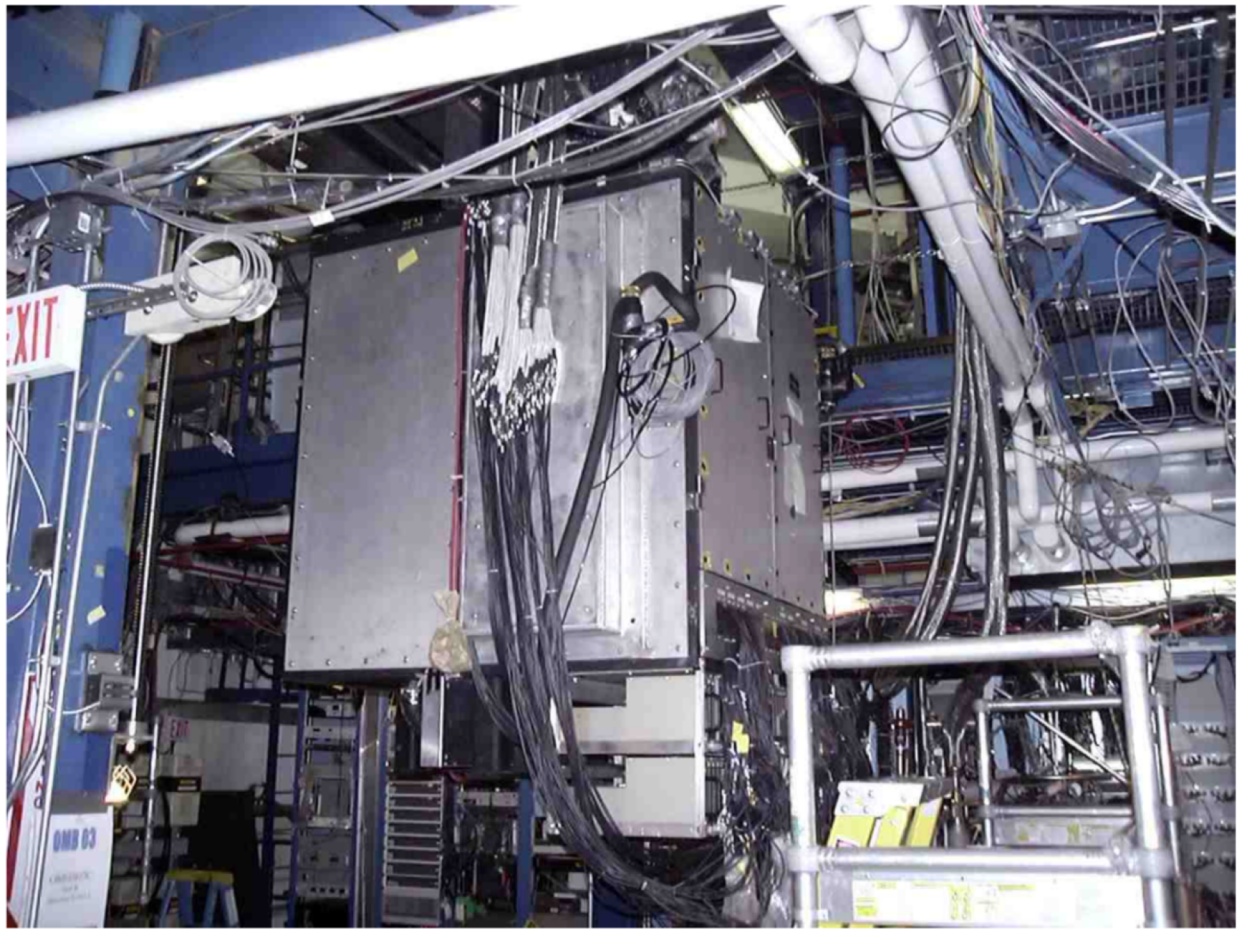
# Idea for cable routing from detector barrel to nearby patch panels (not in DS bunker)

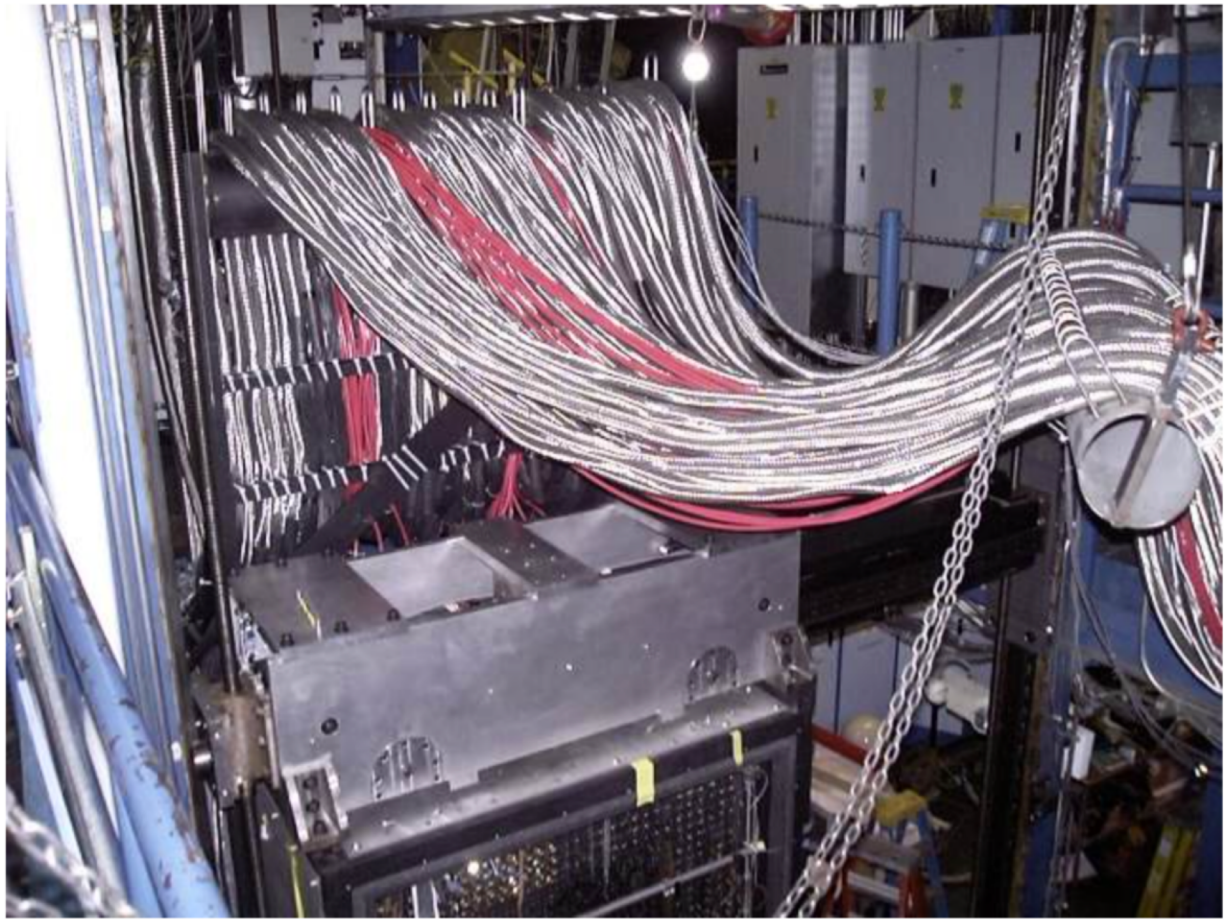




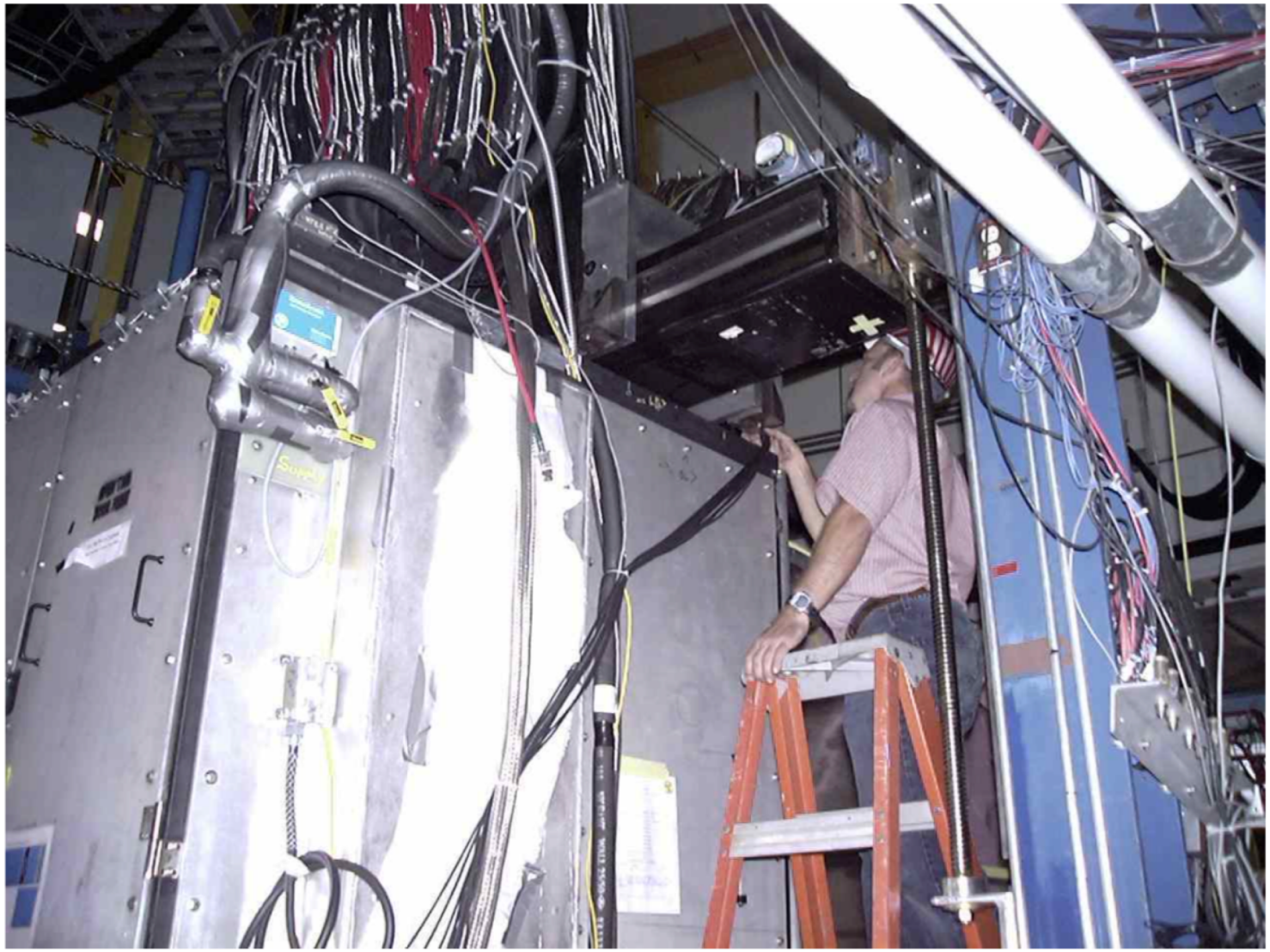

- Integrating signals: Long cable runs go from PPs near detectors to PP's in US bunker
- Counting signals: Long cable runs go from Fast-amps/PPs near detectors to PP's in US bunker
- HV cables: Long cable runs go from PPs in US bunker to PPs near detectors

# Hycal hanging from transporter in Hall B

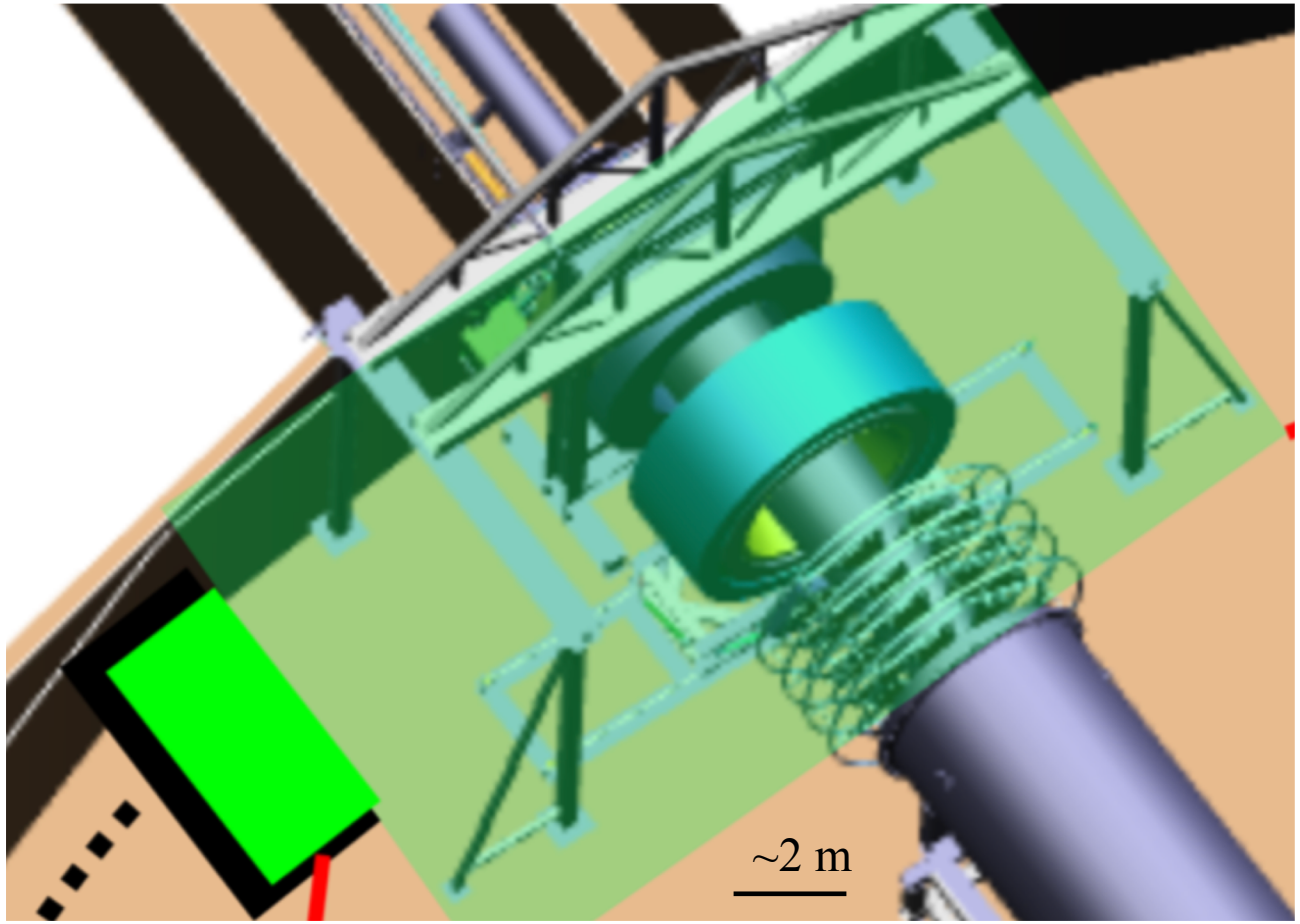


# Hycal hanging again



# HV cable breakouts and Signal PPs




- 384 HV channels (3.5 kV / 3 mA / common floating)

--8 breakout boxes (48 ch each), one set located near detectors, the other set in US bunker

--Breakout boxes are made in-house and do not need to be in bunkers; they use passive splitters

--15 m cable from det segment PP to nearby BB (SHV-SHV)
--Two 100 m radial 52pin cables run between each HV BB

- 400 integrating signal channels

--10 patch panels; each accommodates 40 channels

--Can imagine 5 PPs on each side of beamline near detectors and 10 inside US bunker

- 302 counting signal channels

--8 patch panels; each accommodates 40 channels

--Perhaps 4 PPs on each side of beamline near detectors and 8 inside US bunker (but need to consider fastamps here)