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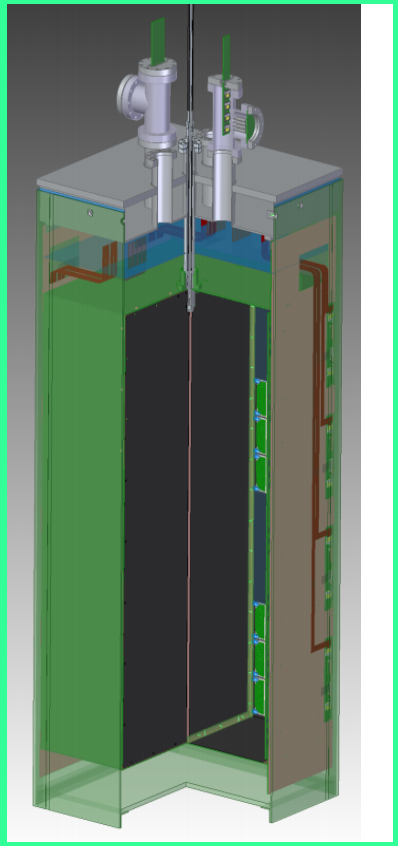
Drift high voltage system for DUNE ND

I. Kreslo, Uni-Bern



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HV in DUNEND

Drift field 0.5 — 1 kV/cm

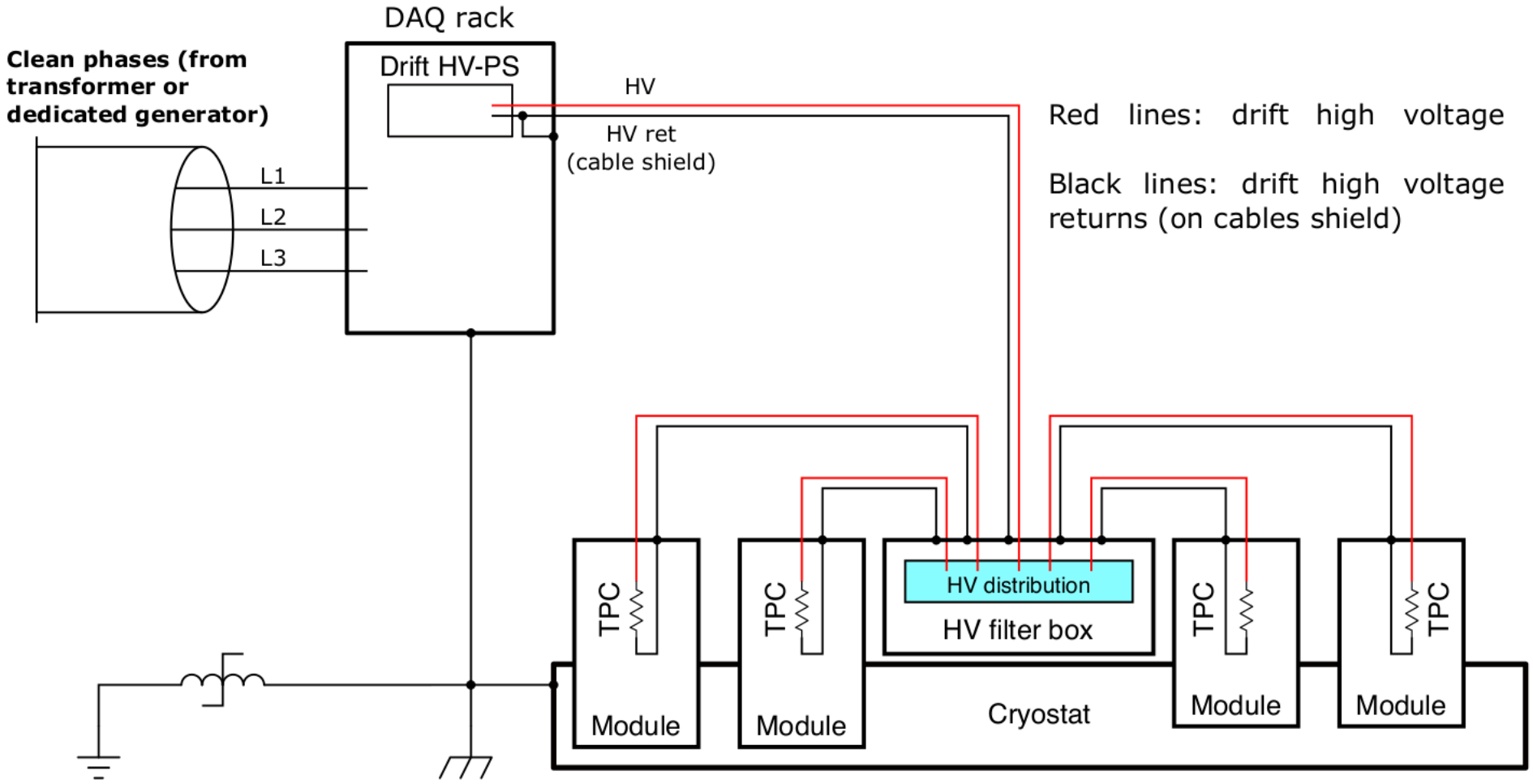
Drift distance 50 cm

Cathode voltage 25 to 50 kV

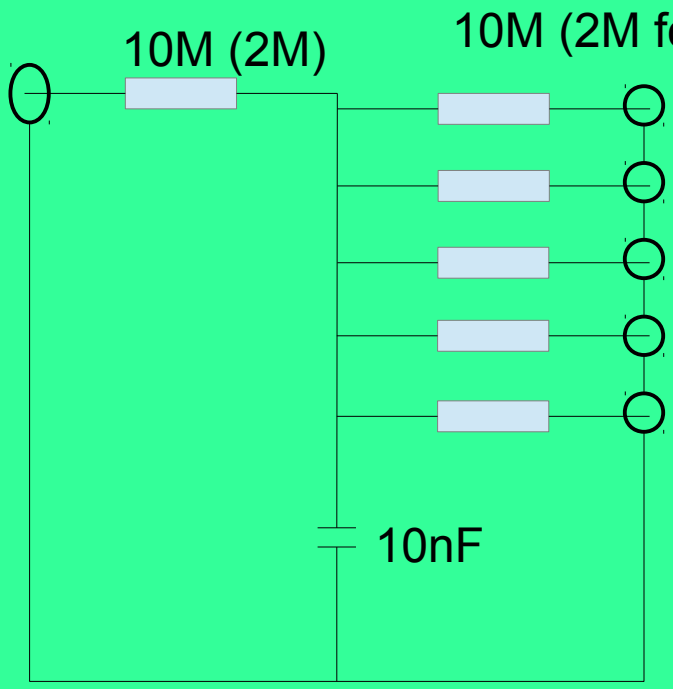
Power supply voltage up to 60 kV, 6 mA

Ripple R-C-R low-pass pot filter-distributor (PFD-4,5)

HV in 2x2: grounding and current return
Similar scheme for DUNE ND



Pot Filter Distributor PFD-5



Fcut = 1.6 Hz

(For DUNE ND 8 Hz)

Mounted in stainless steel pot

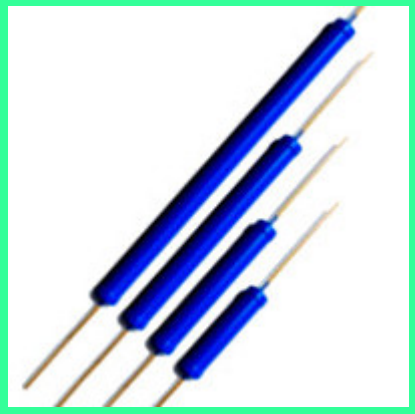
Filled with high-quality transformer oil

Copper foil at the flange bottom

Current return is forced via copper shunts,

No current on the pot case

TDK 60kV



Nicrom 425: 60kV

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HV in 2x2 : 4 modules load

DR8: 2G/sq @1kV/cm, 5G/sq @0.5kV/cm

Field cage: 2 halfs, each is 33x66x120cm,

Module represents 0.044 sq, =>

@ 1 kV/cm R= 88 M, I=0.372 mA, P=12.3W, V_PS=47.88 kV

@ 0.5 kV/cm R=220 M, I=0.074 mA, P=1.2 W, V_PS=19.48 kV

I_PS=1.5 mA

Spellman SL50x300: 50 kV, 6mA (ordered)

Power dissipated in filter 28W @1kV/cm makes about 43C at surface

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HV in DUNE ND : 5 modules load

DR8: 2G/sq @1kV/cm, 5G/sq @0.5kV/cm

Field cage: 2 halfs, each is 50x100x300cm,

Module represents 0.031 sq, =>

@ 1 kV/cm R= 62.5 M, I=0.8 mA, P=40W, V_PS=58 kV

@ 0.5 kV/cm R=156.3 M, I=0.16 mA, P=4 W, V_PS=26.6 kV

Power dissipated in filter 30.7W @1kV/cm makes about 44C at surface

I_PSmax = 4mA

Spellman SL60x300: 60 kV, 5mA

Spellman SL50x300:

Line: ±0.005% of full voltage +500mV over specified input range => < 0.006%

Ripple:
0.1% p-p +1Vrms. ~ 0.1% before the filter

Temperature Coefficient:
100ppm/°C, assuming 10°C change => 0.1%

Stability:
100ppm/hour => 0.01% / h

Filter: Fc=1.6 Hz
@60Hz -38dB (0.02)
@100kHz ripple -96dB (0.000016) => 1.6e-8 w.r.t. output HV
at 33kV ripple is 0.5 mV, pixel capacitance is ~6.6 fF => ripple-induced equivalent charge is 0.0033 fC

Filter: Fc=8 Hz
@60Hz -18dB (0.1)
@100kHz ripple rejection 0.00008 => 8e-8 w.r.t. output HV
at 50kV ripple is 0.5 mV, pixel capacitance is ~6.6 fF =>
ripple-induced equivalent charge is 0.0033 fC

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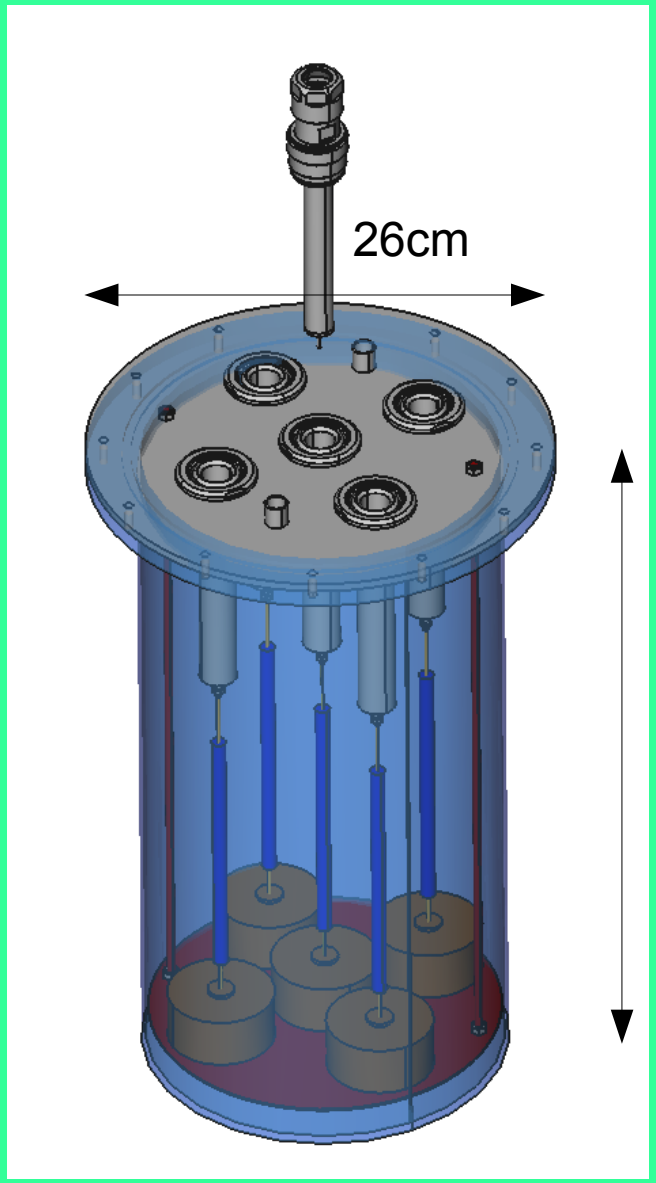
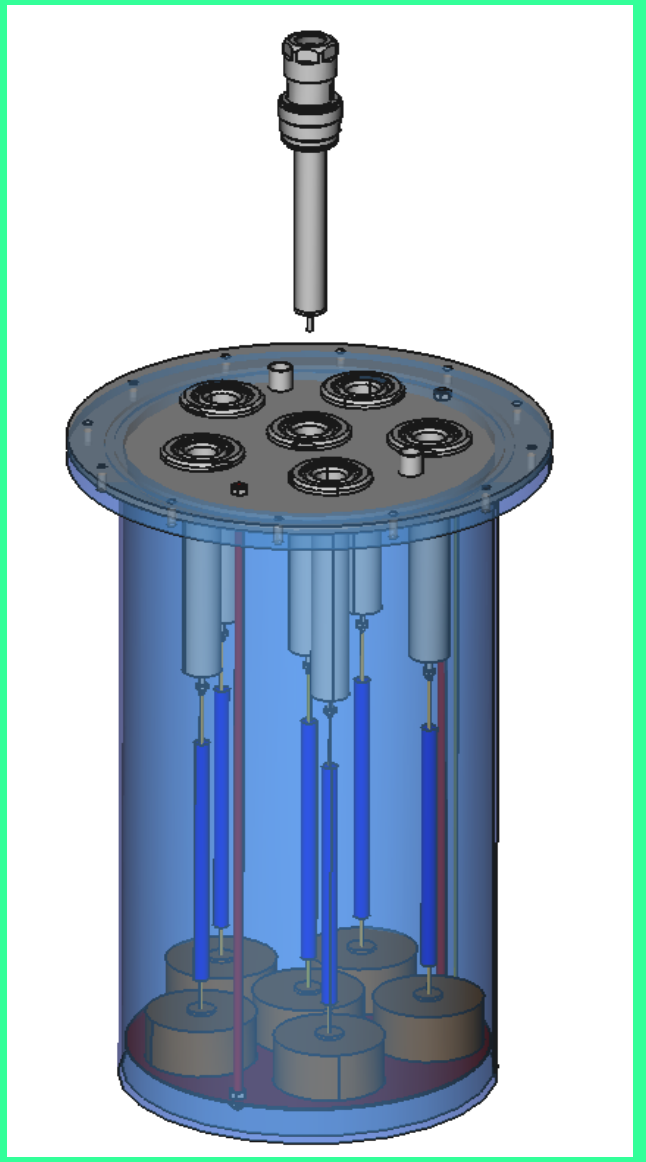
HV in 2x2 and DUNE ND: PFD-4 & PFD-5





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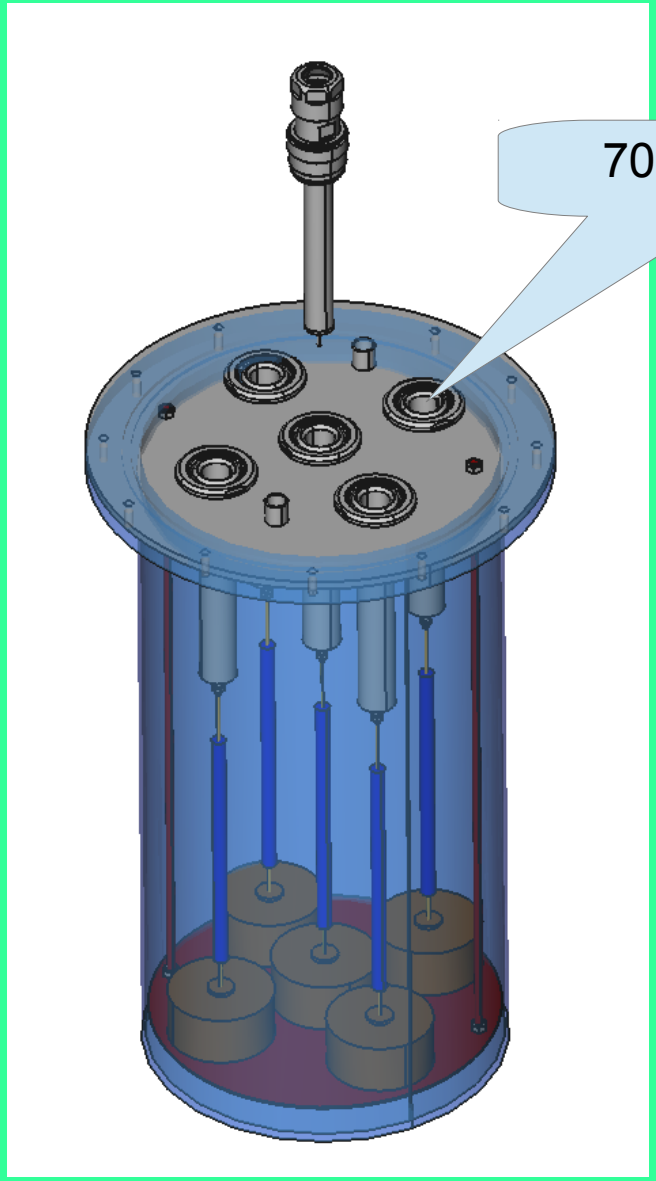
PFD-4



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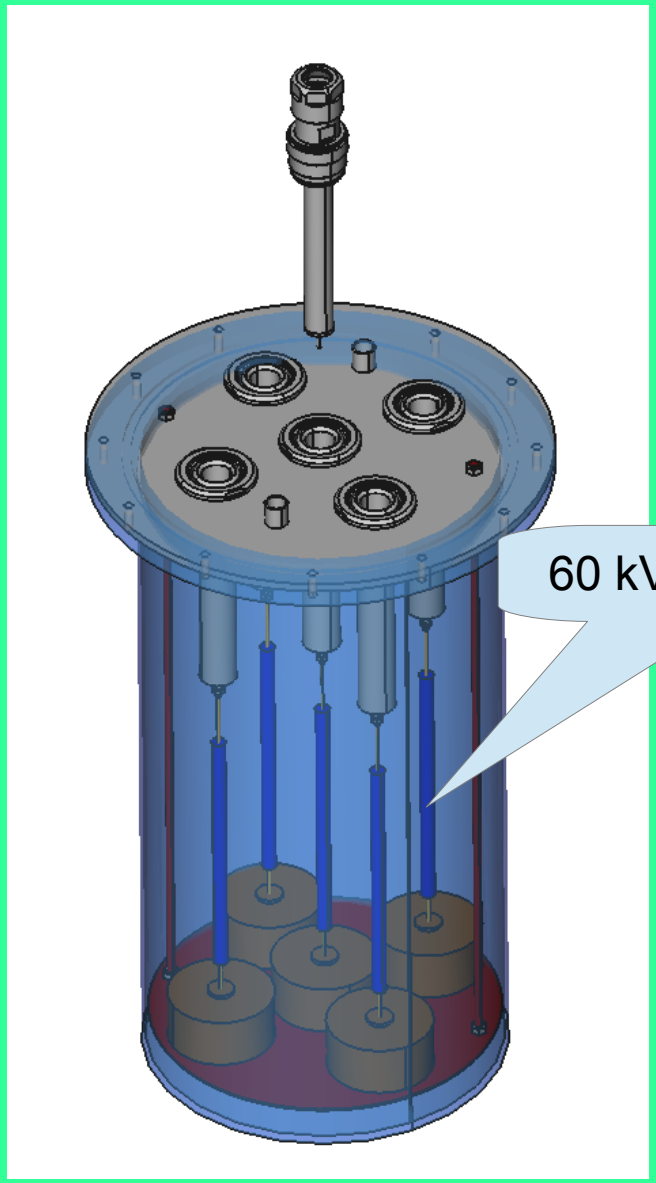
PFD-4



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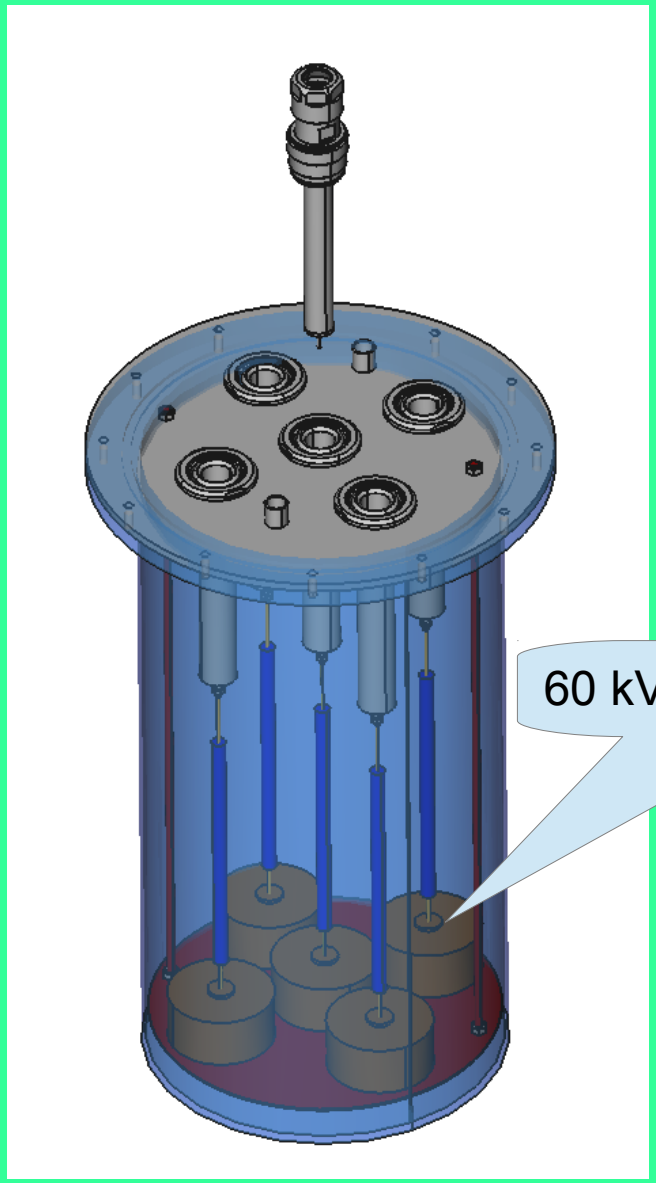
PFD-4



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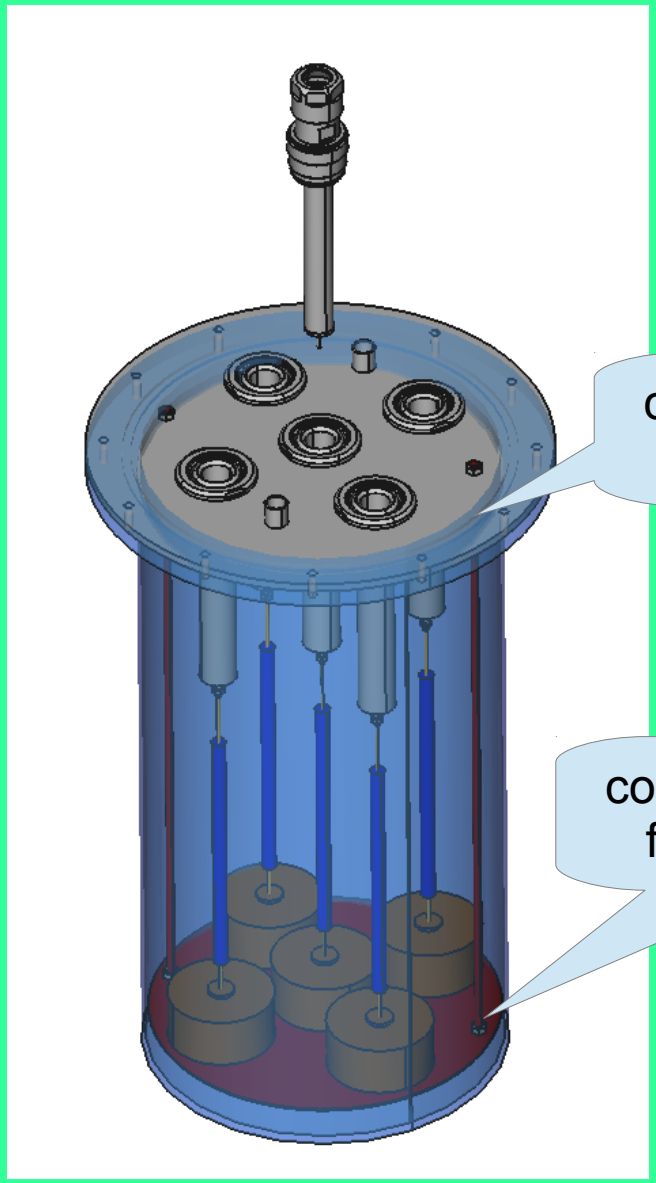

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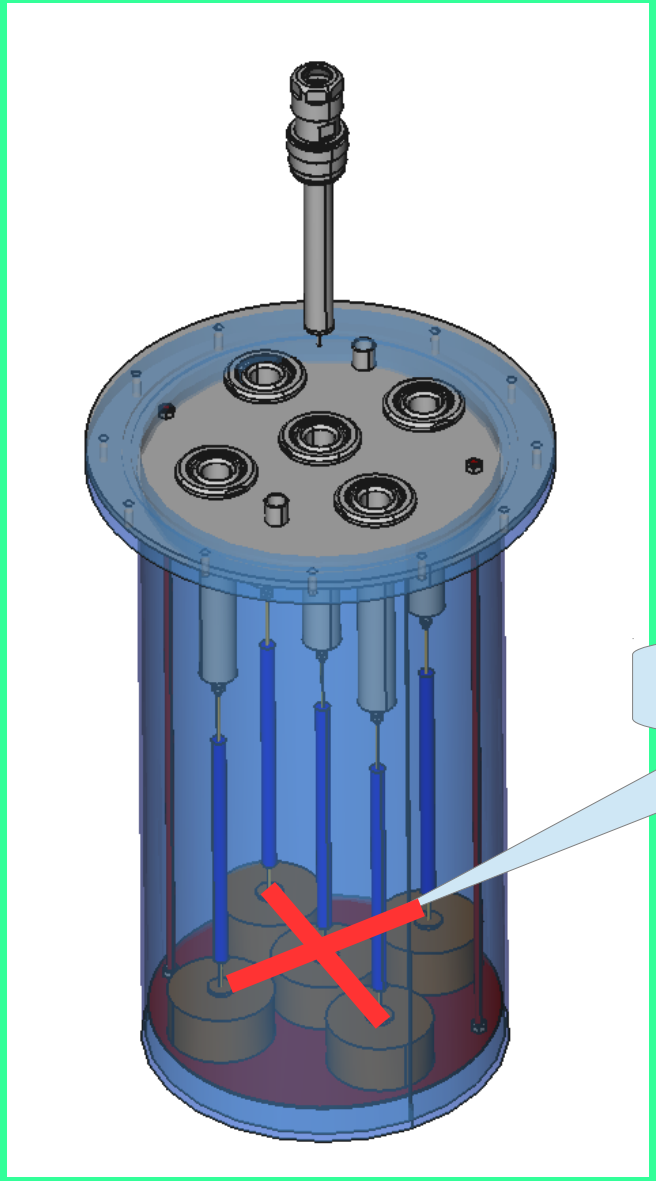

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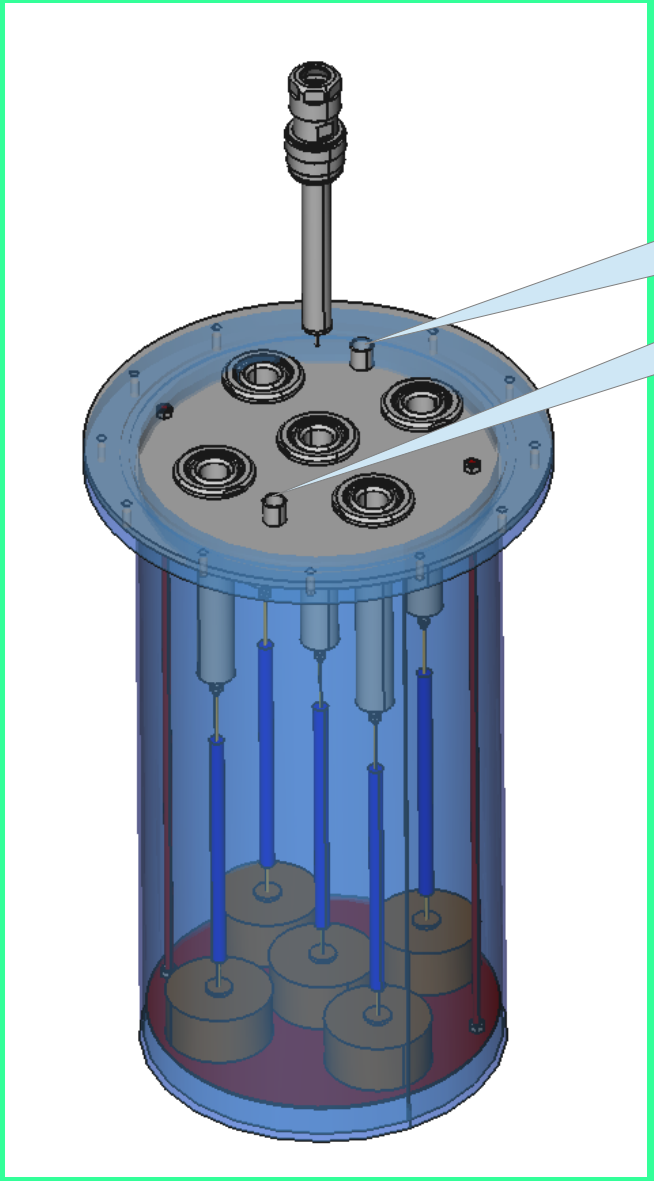

oil filling and level monitoring

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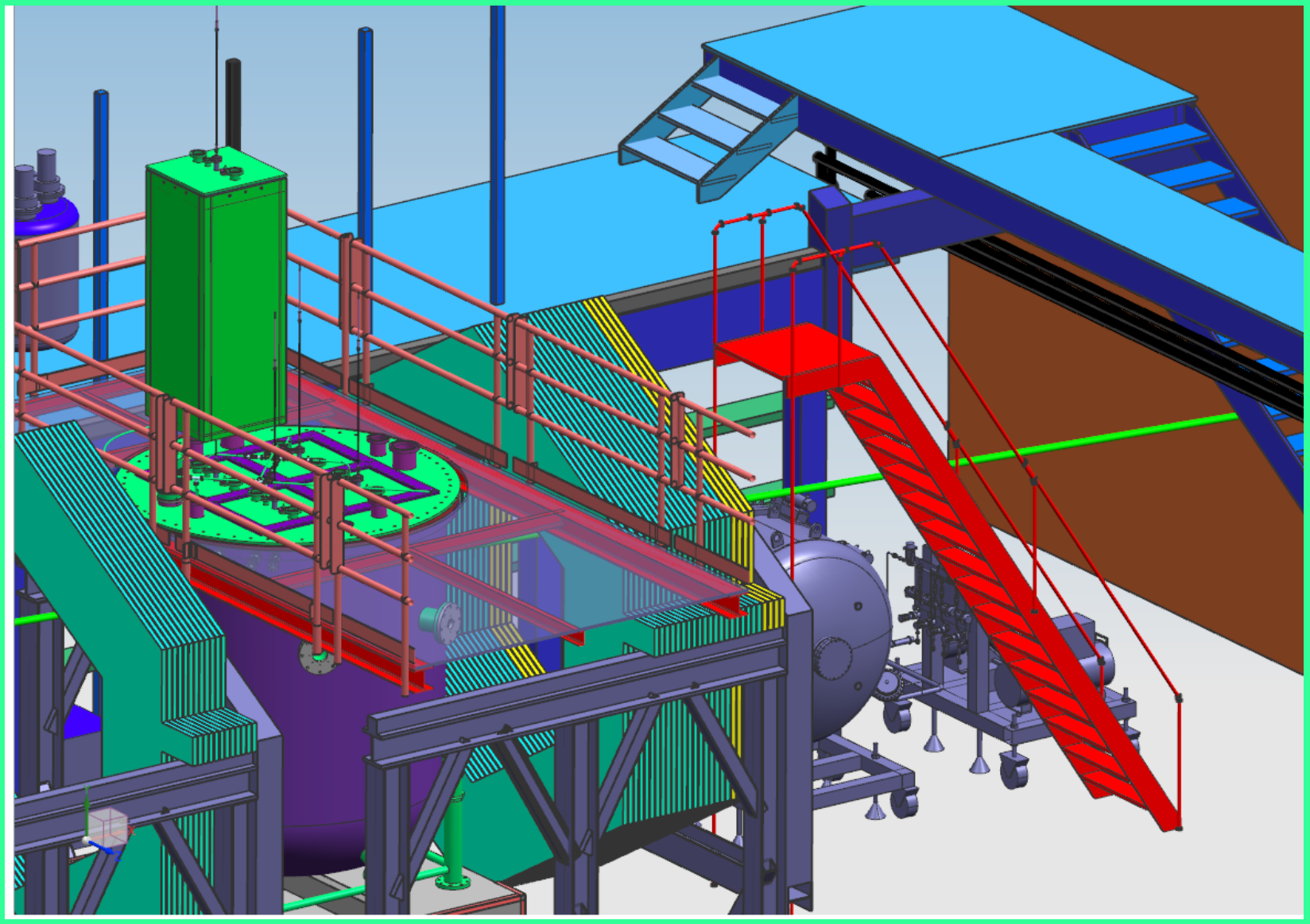
HV in 2x2: PFD-4 location (TBD)



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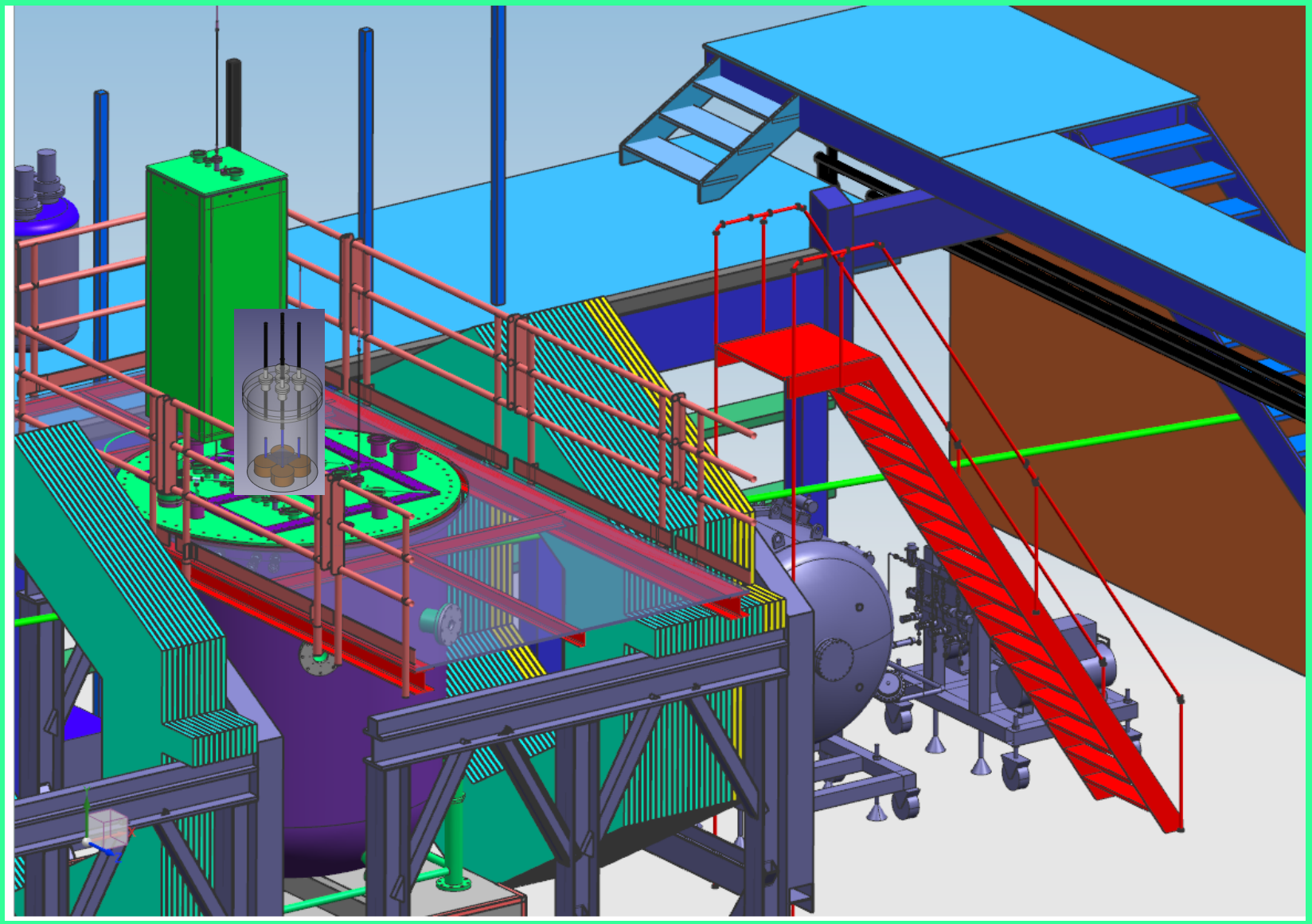
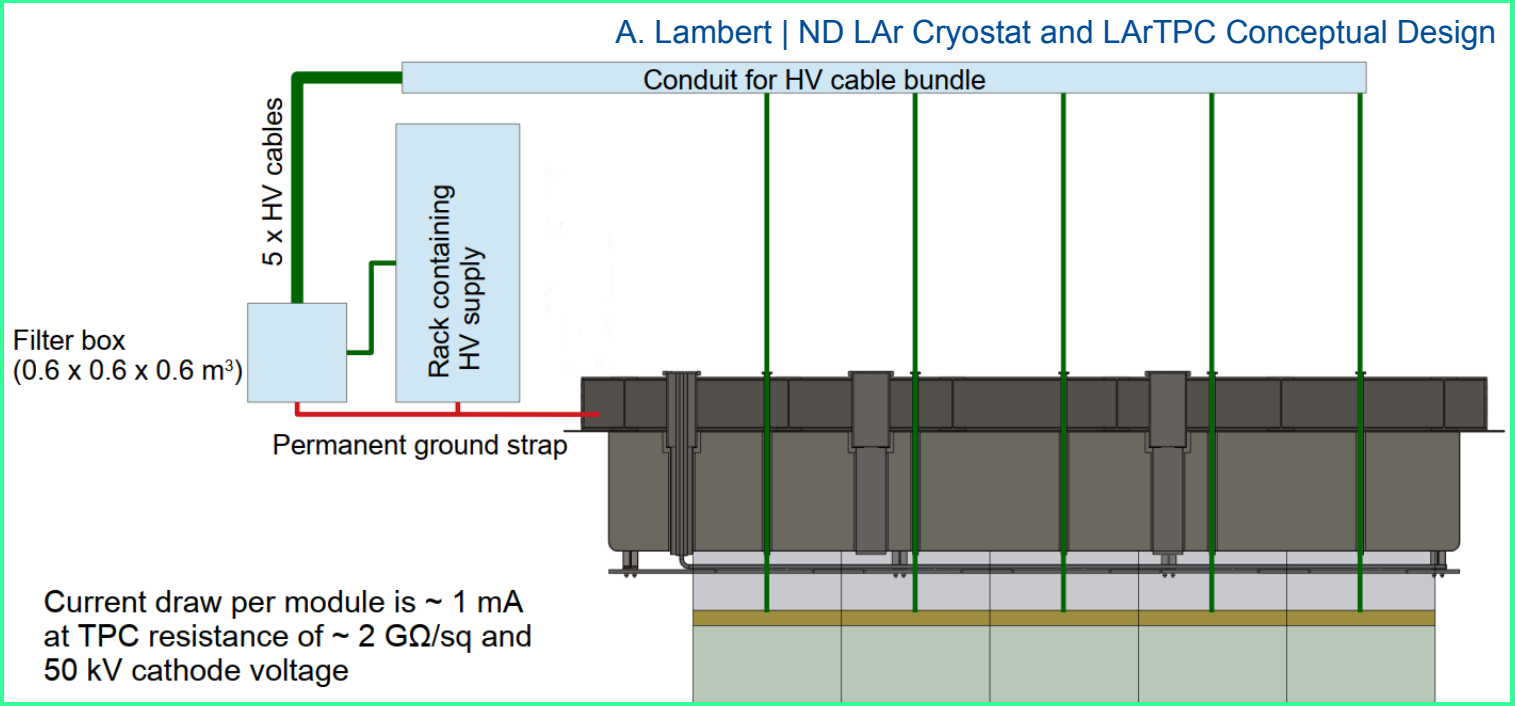
HV in 2x2: PFD-4 location (TBD)



HV in DUNE ND: PFD-5 location (TBD)



HV in DUNE ND: PFD-5 location (TBD)