Summary slide

	Current status	Open questions / comments
Mechanical integration	Well understood	Rail system details; universal transportation cart; survey
High Voltage	Design exists*	HV divider or 5x HV levels?; HRPPD modifications; cabling
Low Voltage	Design exists*	Assumes EICROC in a 256ch configuration
Cooling system	Design exists*	Assumes 256ch EICROC with <3mW/ch
Gas system	Design exists*	Assumes purified nitrogen
Light monitoring	Conceptual design	Need a small PED investment to clarify the conceptual details
Readout electronics	Work in progress	EICROC vs FCFD; FEB layout; RDO design and placement

(*) means a CD-2 level readiness, under certain assumptions

Other topics / meetings

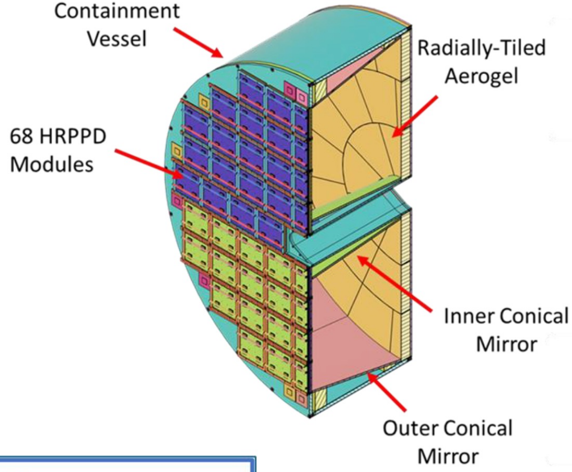
- Weekly Monday 1pm pfRICH engineering meetings
  - Alex E., Daniel, Beni, Sushrut, several other Stony Brook & BNL colleagues

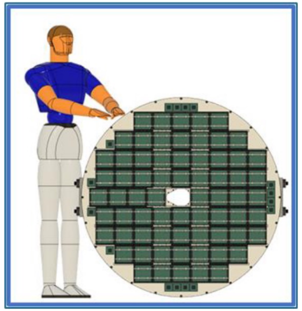
- 2024/09/11 (EIC HRPPD evaluation & path forward)
  - Stimulating feedback obtained
  - Actively looking for other options of performing aging & B-field studies, etc
  - Talks by Tim, Raymond, Gerard: HRPPD electronics & HV distribution scheme

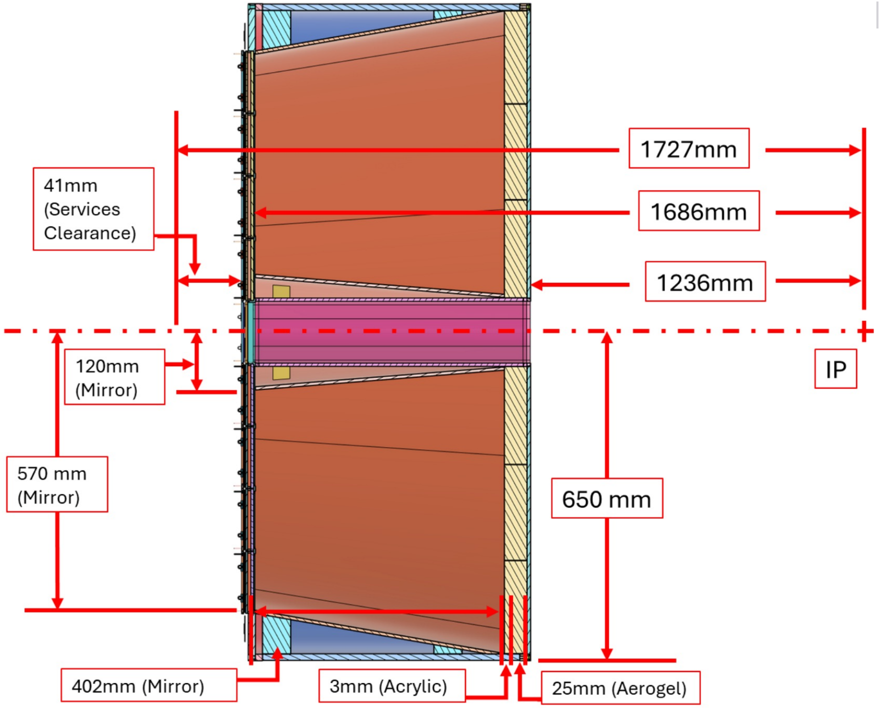
- 2024/10/15 (Fernando, Artur, AK): FCFD ASIC option for pfRICH

- 2024/10/15 (Alex E., Fernando, Beni, Prakhar, AK): pfRICH grounding & shielding

Mechanical integration



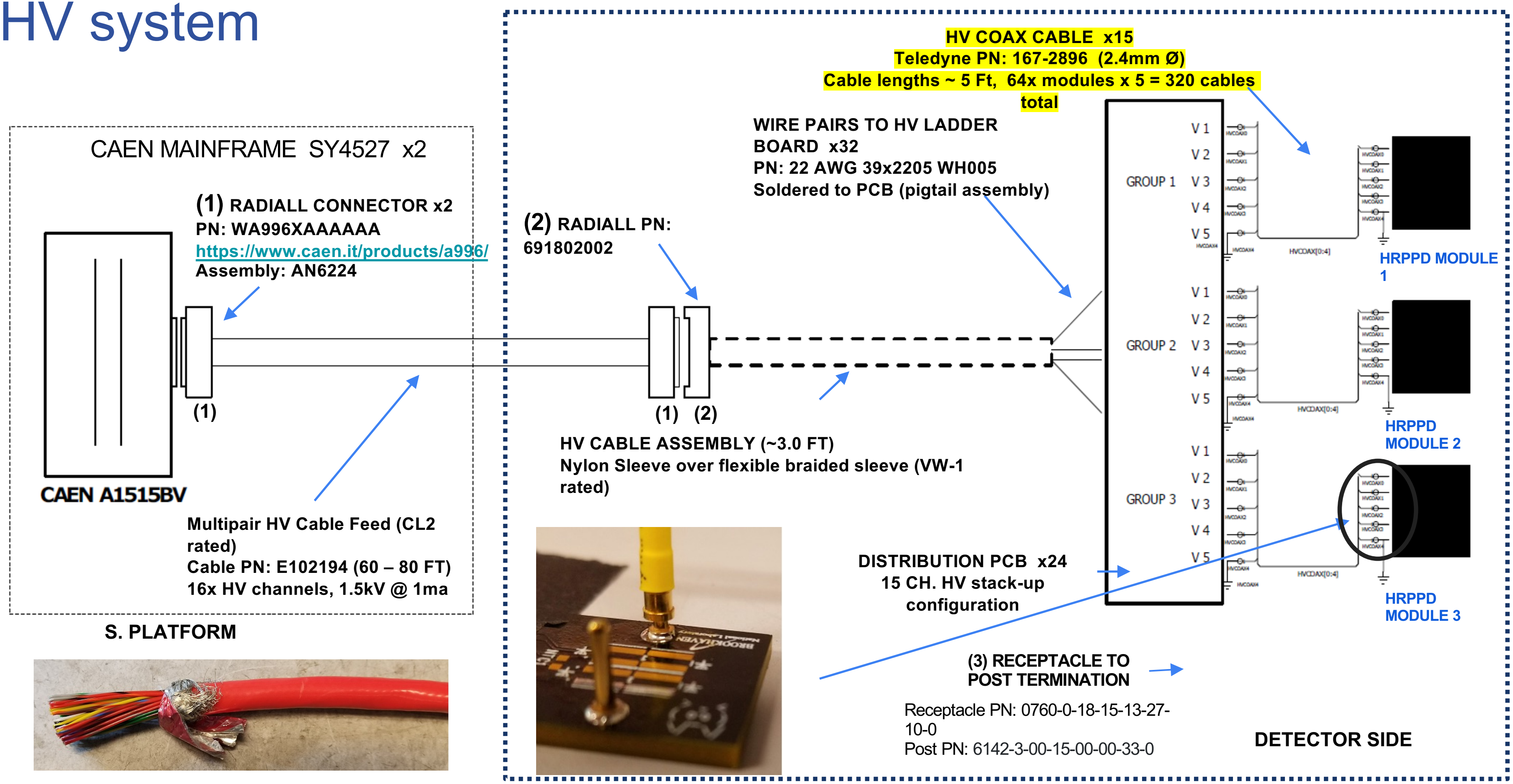




Major Components:

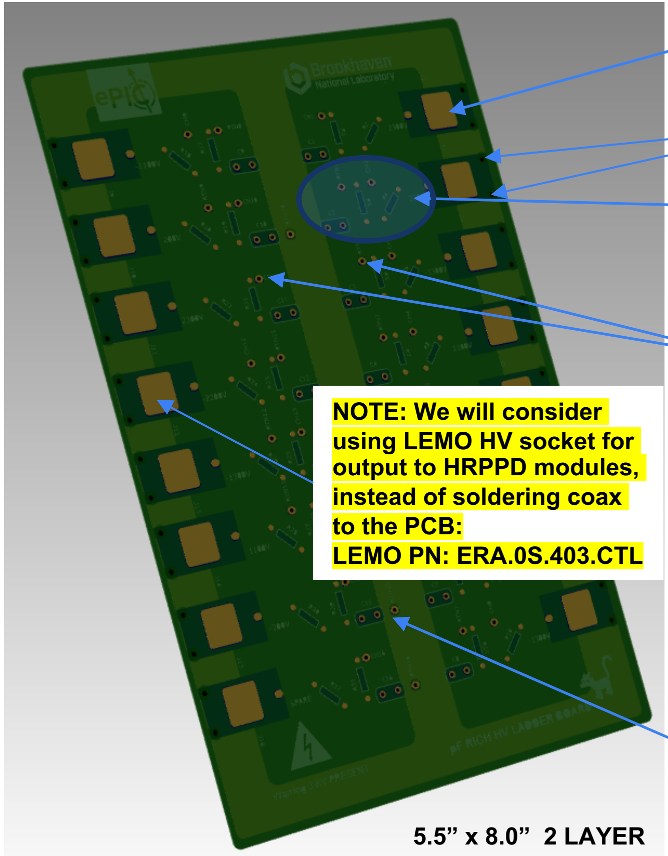
- Vessel
- Sensor Plane
- Mirrors
- Aerogel Wall

HV system



CAEN MAINFRAME SY4527 x2
(1) RADIALL CONNECTOR x2
PN: WA996XAAAAAA
https://www.caen.it/products/a996/
Assembly: AN6224
(1)
CAEN A1515BV
Multipair HV Cable Feed (CL2 rated)
Cable PN: E102194 (60 – 80 FT)
16x HV channels, 1.5kV @ 1ma
S. PLATFORM
(2) RADIALL PN: 691802002
(1) (2)
HV CABLE ASSEMBLY (~3.0 FT)
Nylon Sleeve over flexible braided sleeve (VW-1 rated)
HV COAX CABLE x15
Teledyne PN: 167-2896 (2.4mm Ø)
Cable lengths ~ 5 Ft, 64x modules x 5 = 320 cables total
WIRE PAIRS TO HV LADDER BOARD x32
PN: 22 AWG 39x2205 WH005
Soldered to PCB (pigtail assembly)
GROUP 1
V 1
V 2
V 3
V 4
V 5
GROUP 2
V 1
V 2
V 3
V 4
V 5
GROUP 3
V 1
V 2
V 3
V 4
V 5
HVCOAX[0:4]
HRPPD MODULE 1
HRPPD MODULE 2
HRPPD MODULE 3
DISTRIBUTION PCB x24
15 CH. HV stack-up configuration
(3) RECEPTACLE TO POST TERMINATION
Receptacle PN: 0760-0-18-15-13-27-10-0
Post PN: 6142-3-00-15-00-00-33-0
DETECTOR SIDE

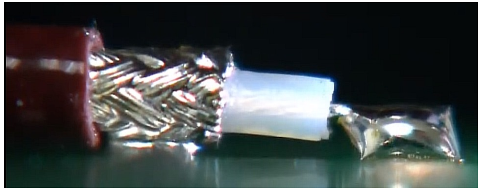
HV system



HV OUT J1 – J16
To HRPPD modules

Coax cable strain relief

Input RC filter

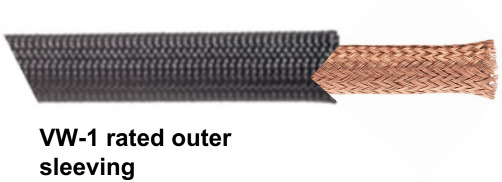


HV Coax cable soldered to pad
Teledyne PN: 167-2896 26AWG

NOTE: We will consider using LEMO HV socket for output to HRPPD modules, instead of soldering coax to the PCB:
LEMO PN: ERA.0S.403.CTL

Input Cable Assembly

- HV Silicone wires solder from PCB bottom through-hole pads
- 22 AWG 39X2205 WH005 or Equ. VW-1 rated
- Wires are covered by braided foil and sleeving (1)
- Through hole solder joints get solder ball



VW-1 rated outer sleeving

(1)

Inner copper braided shield

- Connects to A1515BV Module
- 2 Ft length with Radiall connector disconnect

PCB Details:

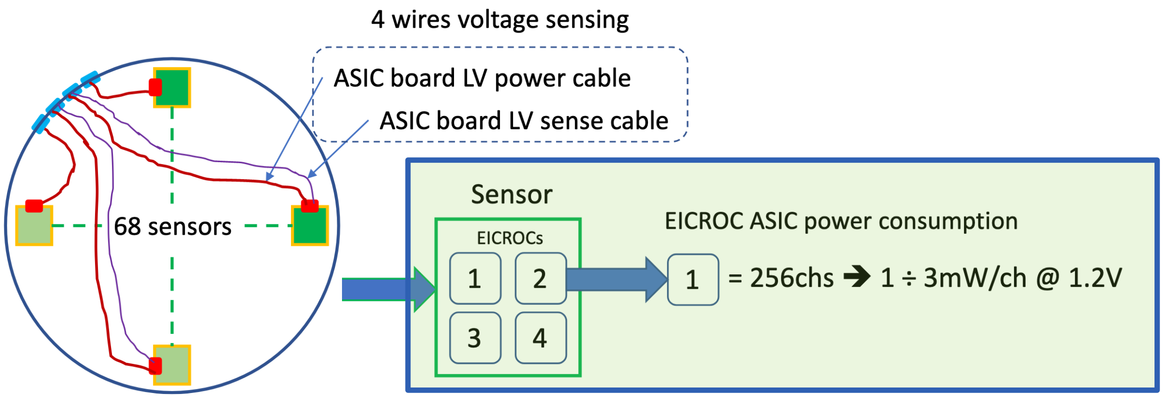
- Conformal coating: IPC-CC-830A Chemtronics CTAR-12
- 3 mil (~ 2.3mm) thick coating
- Core material: ISOLA FR4 406
- 0.093 MIL thick board
- 2 LAYERS

5.5” x 8.0” 2 LAYER PCB

Purpose: interface from CAEN HV cards on S.Platform to HRPPD modules
Next slide will show interconnection flow…

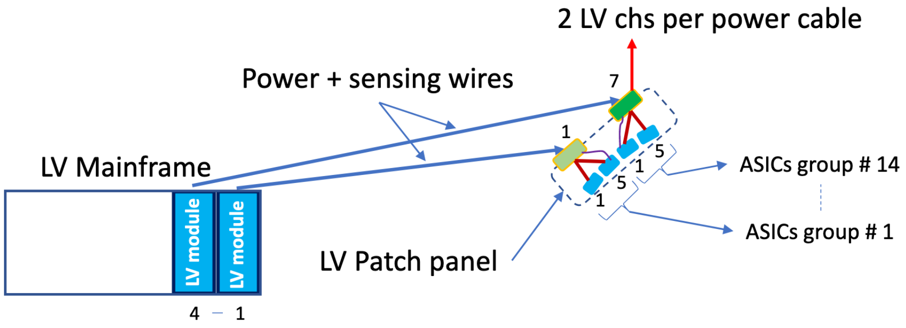
pfRICH HV Distribution “stack-up” Board

LV system



Wiener LV mainframe and modules

- Each Sensor
  - 4EICROCs x 256chs = 1024chs/sensor ➔ @3mW/ch ➔ ~3W/se
- Whole detector
  - 68sensors x 2.5A ➔ 170A@1.2V ➔ 204W
  - Add 20% extra current for the ancillary electronic components
    - 170A + 20% = 204A@1.2V ➔ 245W
  - Add 20% extra current for safety margin
    - 204A + 20% = **<u>245A@1.2V</u>** ➔ **<u>294W</u>**



Cooling system

Off Detector

- Chilldyne Circulator
  - 8 lpm
  - -10 psi
  - 5°C to 40°C

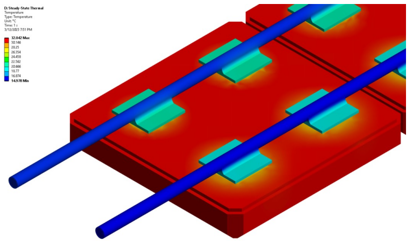
- Polyscience Chiller
  - 9.8 l/min @ 43.4 psi
  - -20°C to 40°C ±0.1°C
  - 800 W @ 10°C

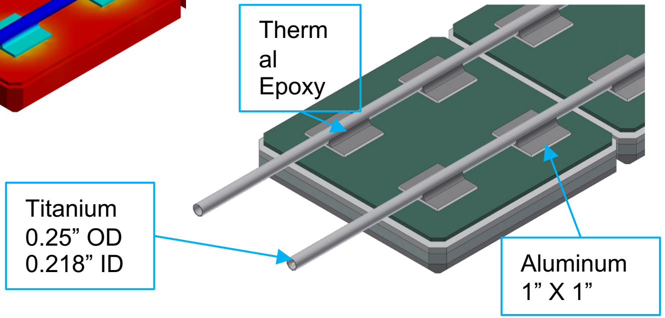
- Distribution Panel
  - Flowmeters
  - Flow Transmitters

On Detector

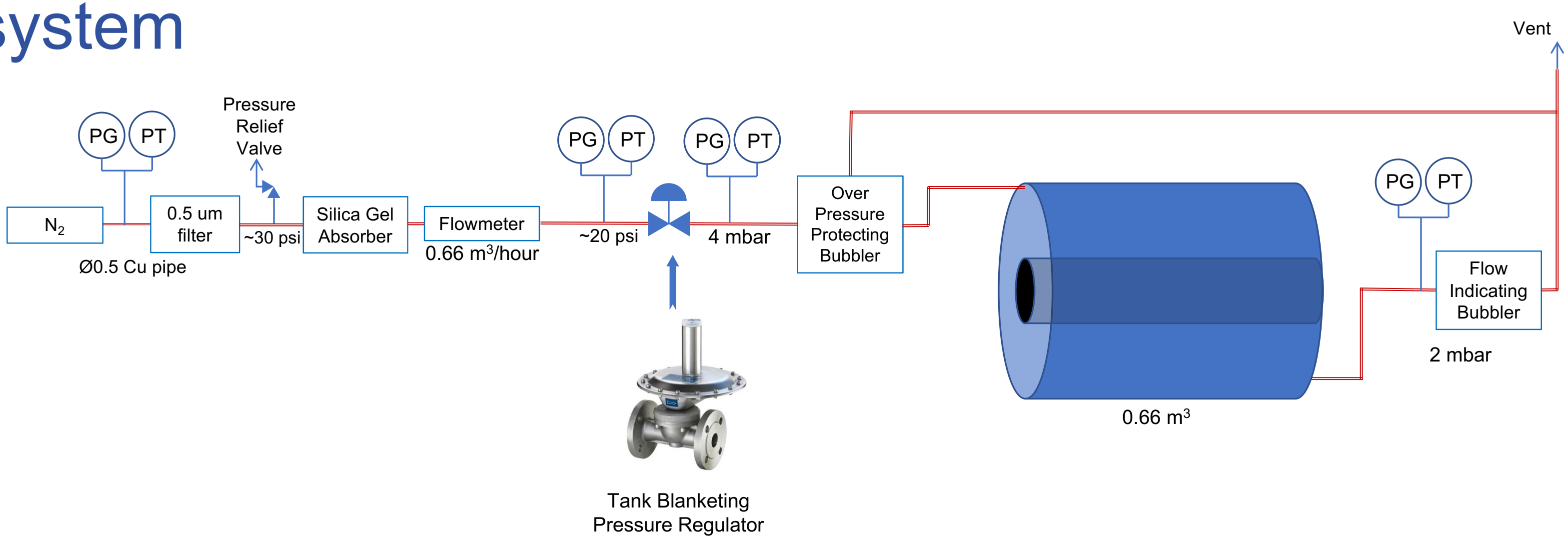
- Heat dissipation: 400W
- Tube @ Δ2°C: ~3 lpm
- ΔP ~0.25 psi

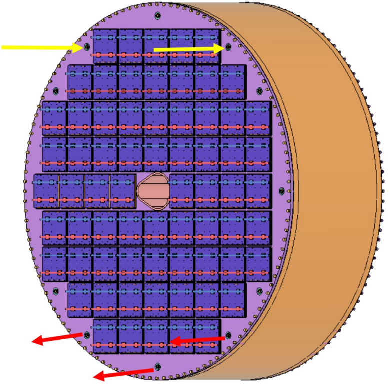
- 9 Modules:
  - ~50W,
  - ~Δ17°C
  - Water ~Δ1.2°C



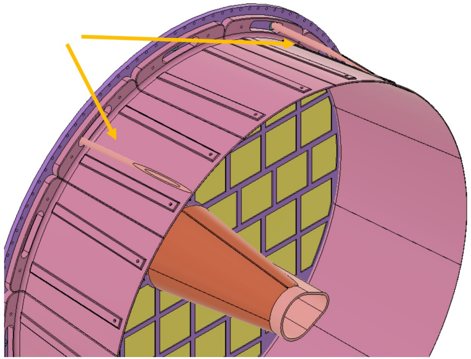


Gas system





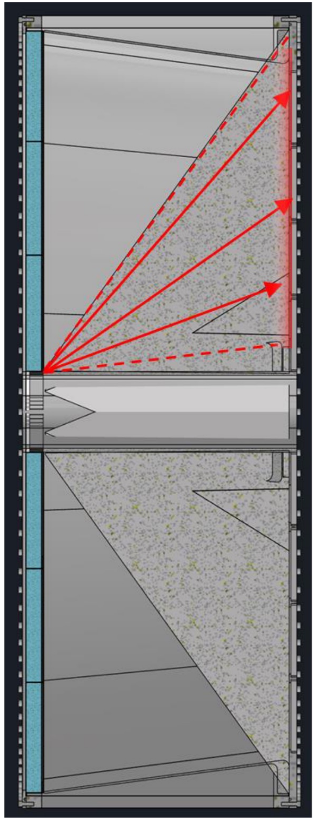
Two 3/8” ID Inlets, Three 3/8” ID outlets

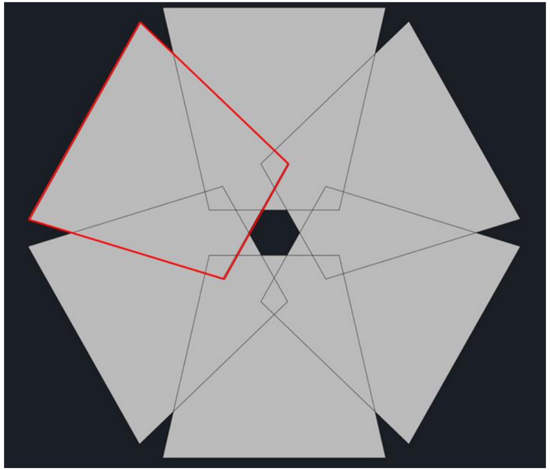


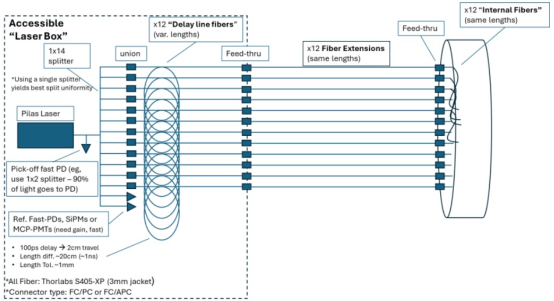
Inlets have two long 3/8” ID tubes at the top with taper pointing to cylindrical vessel walls

- Assume nitrogen only configuration
- One volume exchange per hour at a pressure 2-4 mbar
- Gas quality (industrial, ultra-pure,…) needs to be finalized

Light monitoring system

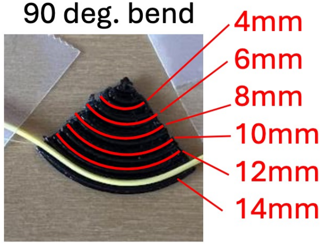


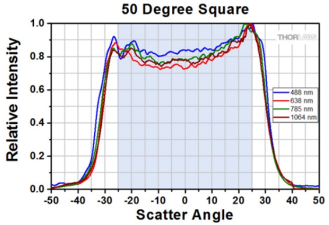




- Want a way to monitor HRPPD timing performance, signal amplitude, QE, and mirror reflectivity over the lifetime of the experiment
- Introduce an array of 12 optical fibers from the aerogel side of the vessel: 6 illuminate the photosensors directly and 6 bounce light off mirrors first
- Distance from fiber to photosensor determines timing and overlapping illumination areas are distinguished by time via fiber delays
- Appropriate square diffuser identified and fiber bending radius tests need to be performed

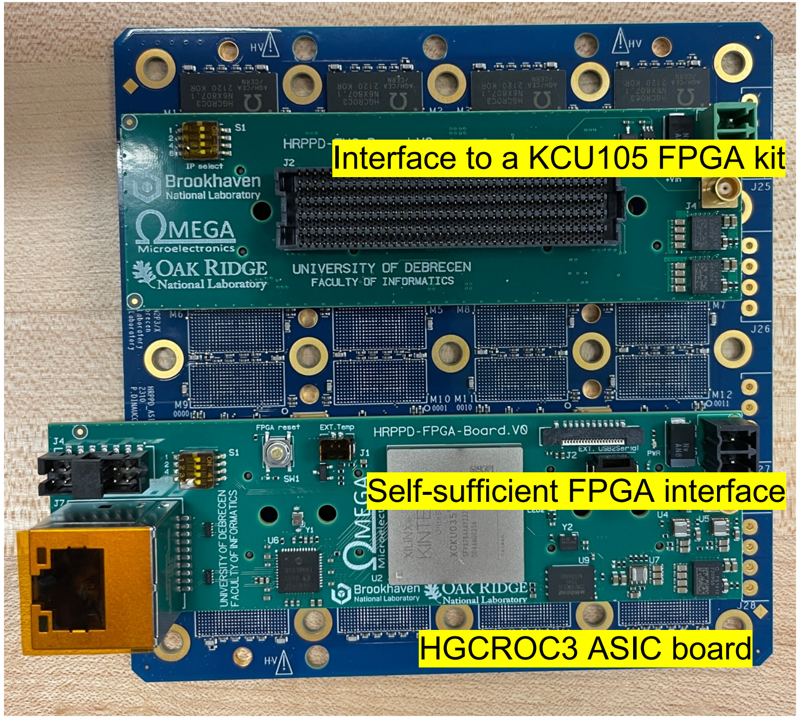
90 deg. bend



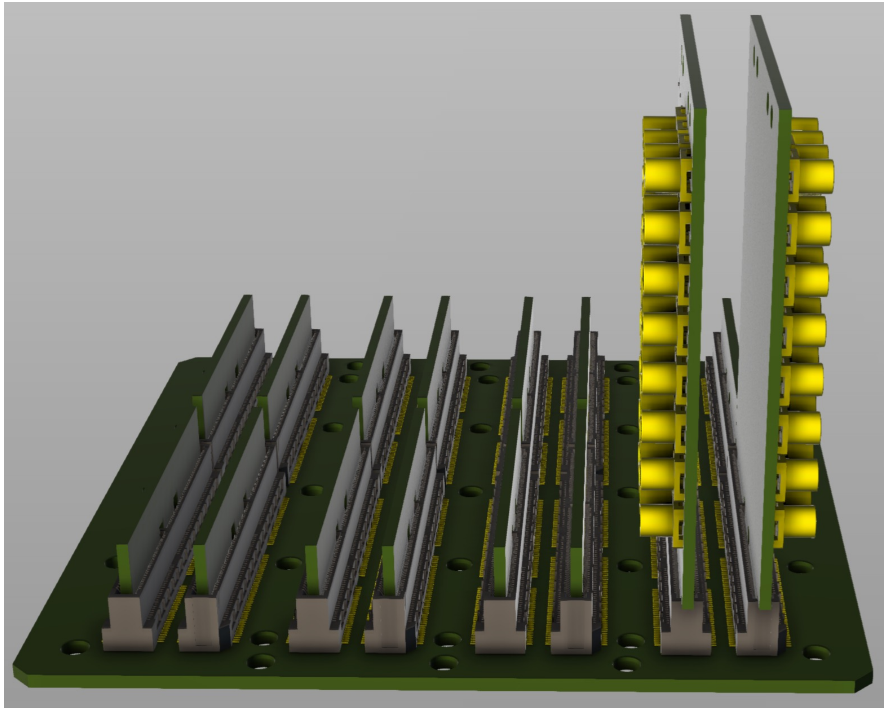


Readout electronics

Present concept: ASIC backplane



Alternative layout: passive backplane + plugin cards



- ➢ Present focus: using HGCROC3, prove that TOA/ADC architecture works well for HRPPDs; beam test
- ➢ Longer term topics: *some* EICROC flavor vs FCFD, on-board ASICs vs plugin cards, RDOs