HV Bias distribution PCB REV 0

Aluminum Enclosure (~21cm x 15cm x 5cm)

Required for safety & RF shielding

Bonded to clean magnet ground

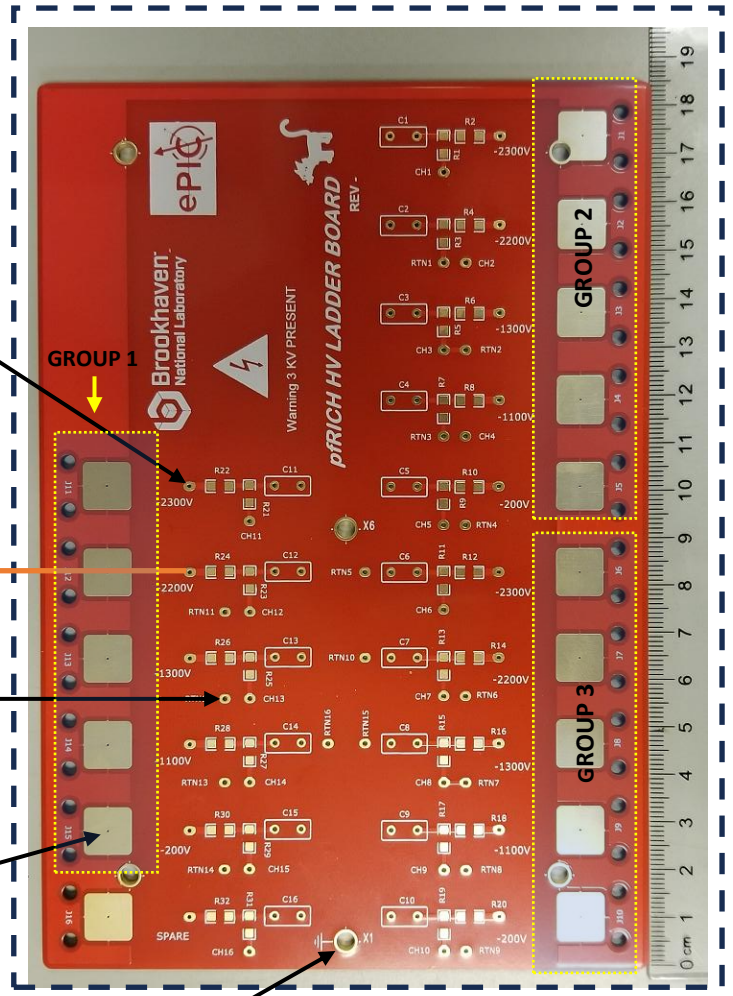
Through hole pad for HV wire to bulkhead connector PN: ERA.0S.403.CTL x 16
3KV 24AWG silicone wire

silicone HV wire

Magnet Ground

Connections to RADIALL pig-tail assembly
PN: 691802002
Input voltage from CAEN modules

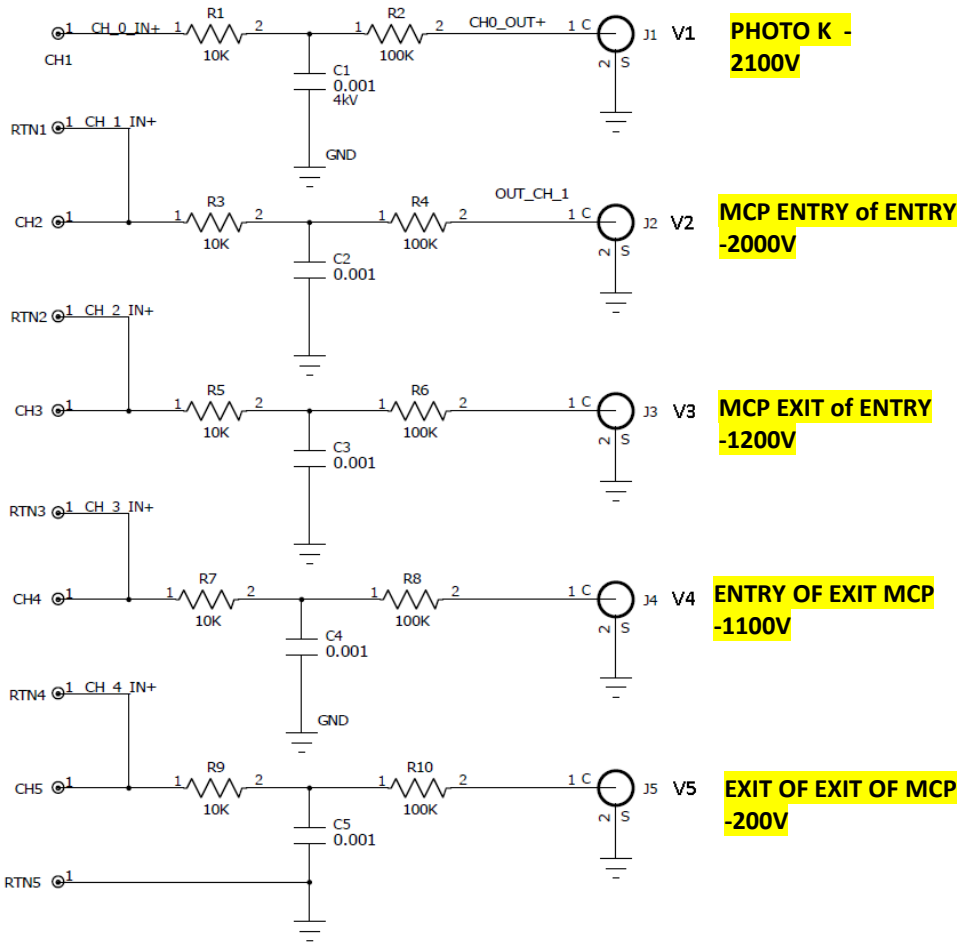
Optional shield termination pad
Obsolete & will not be on final REV of PCB
PCB dimension will probably be smaller for REV 1



PCB mounting & ground x6
200V floating return is connected here
Other HV channel returns are floating

Stackpole HVC Series pulse withstanding resistors 2512

HV bias distribution schematic & RFI filtering circuit



- HV 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

ePIC pfRICH

Tim Camarda for the ePIC project, BNL 2025

pfRICH

Interconnect from S.Platform to Detector

6KV Bulk-head connector x16
Mounted on HV distribution enclosure box
PN: ERA.0S.403.CTL
Mates to PN: FFB.0S.403.CTA32

HRPPD termination
Using BH connectors (slide 3 & 4)

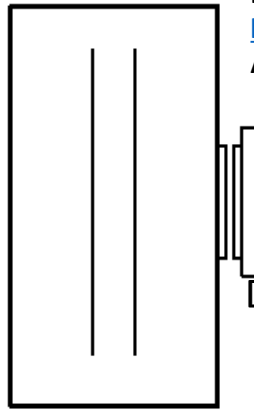
CAEN MAINFRAME SY4527 x2

(1) RADIALL CONNECTOR x2
PN: WA996XAAAAAA
https://www.caen.it/products/a996/
Assembly: AN6224

(2) RADIALL PN: 691802002

WIRE PAIRS TO HV LADDER BOARD x32
PN: 22 AWG 39x2205 WH005
Soldered to PCB (pigtail assembly)

DETECTOR SIDE



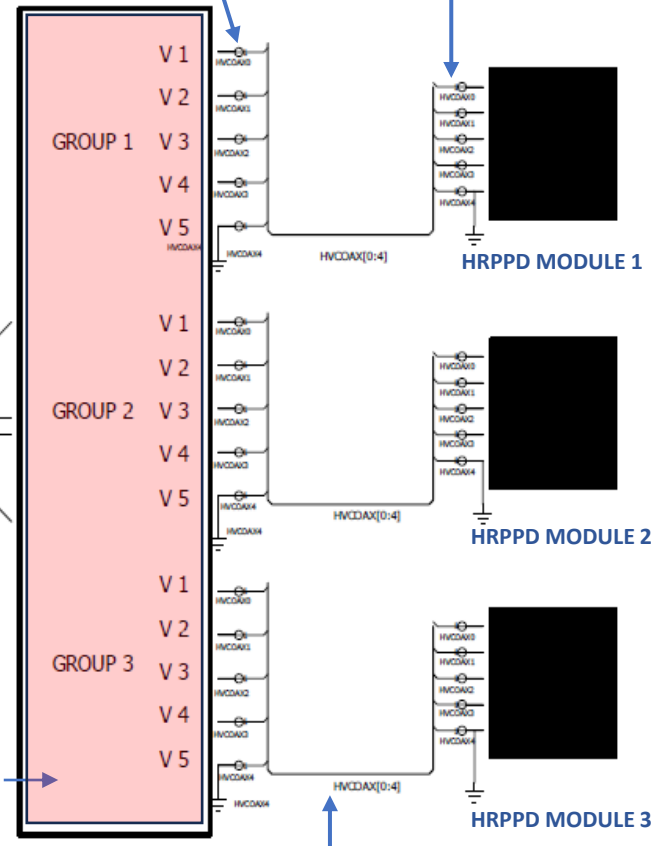
S. PLATFORM

[1]

[1] [2]

Multipair HV Cable Feed (CL2 rated)
Cable PN: E102194 (60 – 80 FT)
16x HV channels, 1.5kV @ 1ma

HV CABLE ASSEMBLY (~3.0 FT)
Nylon Sleeve over flexible braided sleeve (VW-1 rated)



DISTRIBUTION PCB x24
15 CH. HV stack-up configuration

VW-1 rated outer sleeving

(1)

- Copper braided shield
- HV silicone rubber wires covered by braiding
- Covered with VW-1 rated sleeving

HV COAX CABLE x15
Teledyne PN: 167-2896 (2.4mm Ø)
Cable lengths ~ 5 Ft
64x modules x 5 = 320 cables total

Bias Voltage Cable Distribution (HRPPD side of connector assembly)

BH series connector assembly option

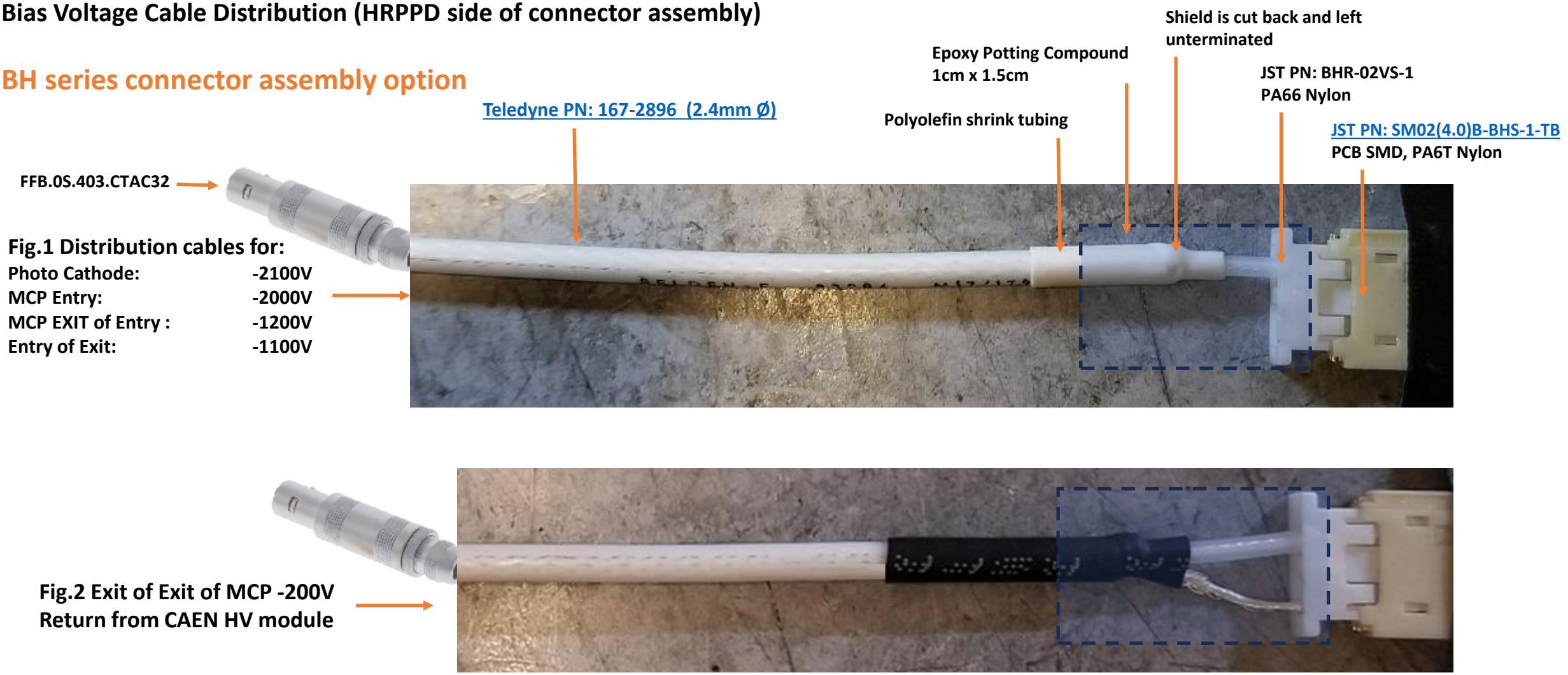


Fig.1 Distribution cables for:

Photo Cathode:	-2100V
MCP Entry:	-2000V
MCP EXIT of Entry :	-1200V
Entry of Exit:	-1100V

Fig.2 Exit of Exit of MCP -200V
Return from CAEN HV module

NOTE: Other end of cable is terminated with LEMO PN: FFB.0S.403.CTAC32
This connects to the HV distribution box
Length of cables TBD

ePIC pfRICH

Bias Voltage Cable Distribution (HRPPD side of connector assembly)

SMP RF Connector Option

Teledyne PN: 167-2896 (2.4mm Ø)

MOLEX RG-174/ 316 RA SMP
CONNECTOR PN: 0734155030
Crimp Termination

FFB.0S.403.CTAC32

Fig.1 Distribution cabl
Photo Cathode:
MCP Entry: -2000V
MCP EXIT of Entry : -1200V
Entry of Exit: -1100V

MOLEX PN: 0853050232
PVB SMD
300 VRMS
NOTE: Should perform DC Hi-Pot test to determine breakdown Voltage

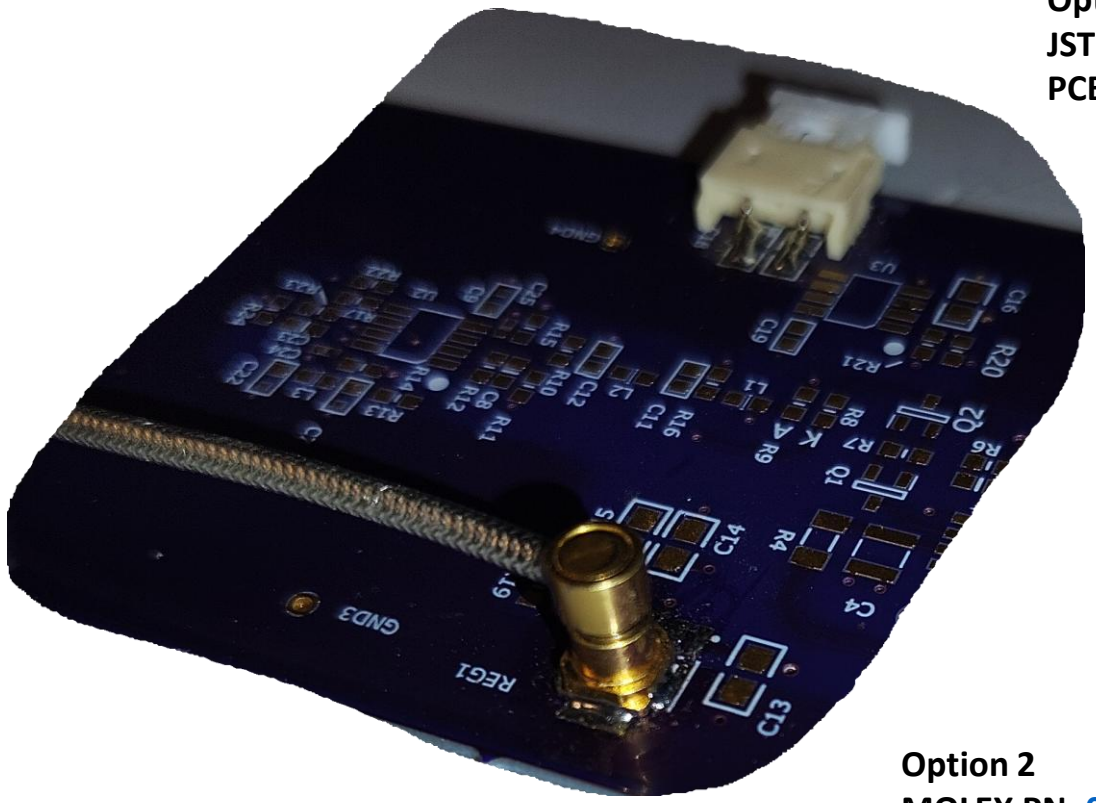
For Voltages > V_B Connector shell must have proper creepage & clearance

Fig.2 Exit of Exit of MCP -200V
Return from CAEN HV module

NOTE: Other end of cable is terminated with LEMO PN: FFB.0S.403.CTAC32
This connects to the HV distribution box
Length of cables TBD

ePIC pfRICH

HRPPD Moule PCB Bias Voltage connector options



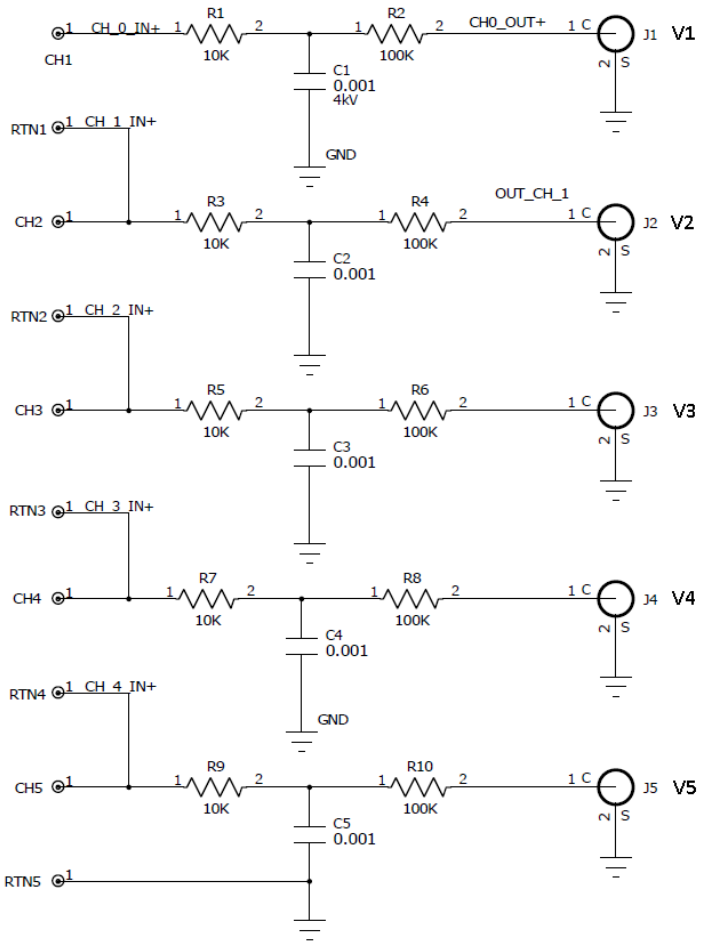
Option 1
JST PN: SM02(4.0)B-BHS-1-TB
PCB SMD, PA6T Nylon

Option 2
MOLEX PN: 0853050232
PCB Mount SMP

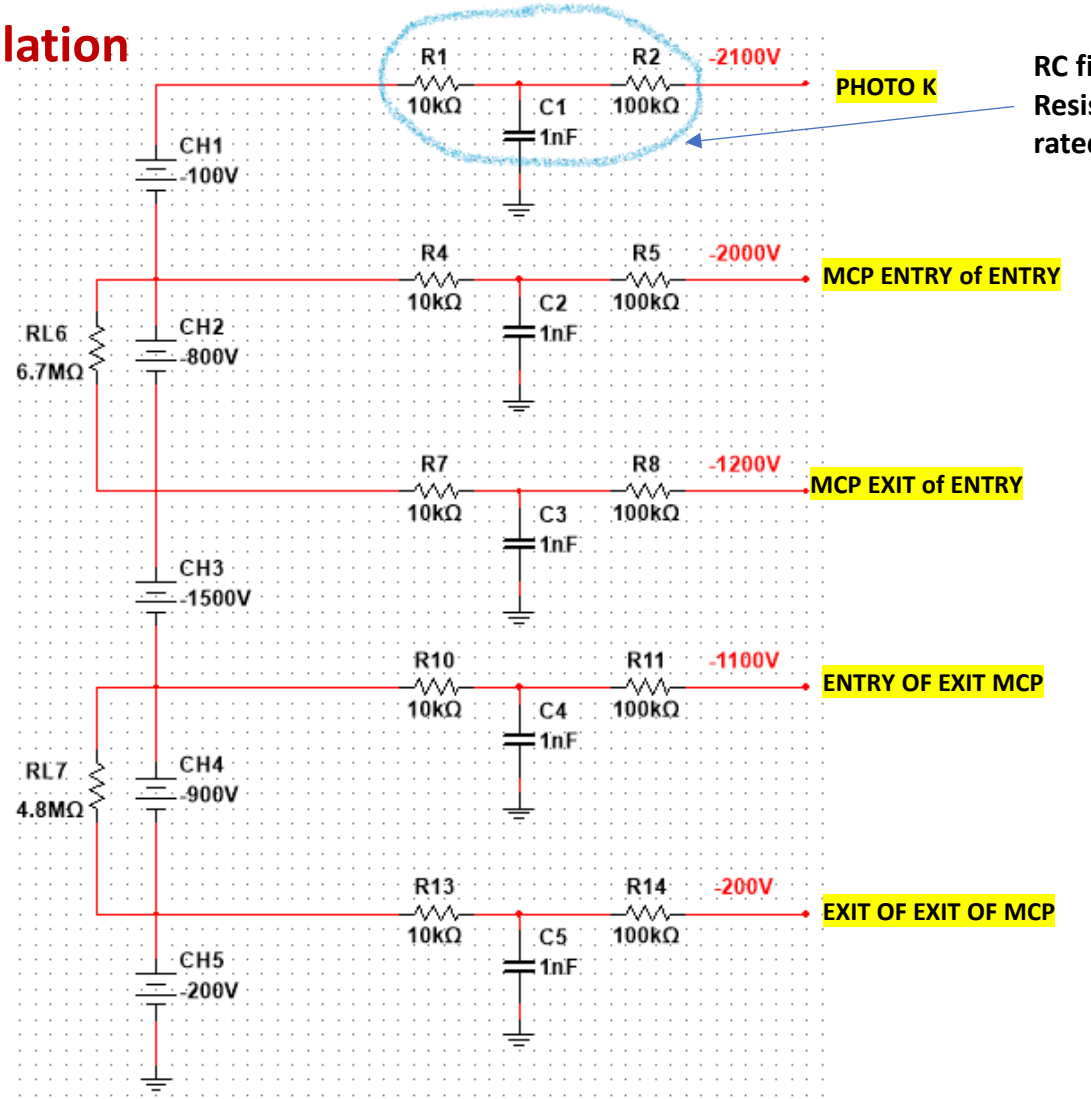
Backup slides 5 – 8 for reference

Tim Camarda, BNL 2024

HV Stack-up, Schematic & Simulation



PCB Schematic, J1 to J5 output HV bias levels to HRPPD module (voltage stack-up)



Floating independent channels: Same as stacking batteries
CAEN A1515BV

Circuit simulation for DC operating voltages

RC filter
Resistor requirement: pulse withstanding rated: Stackpole HVC series or similar

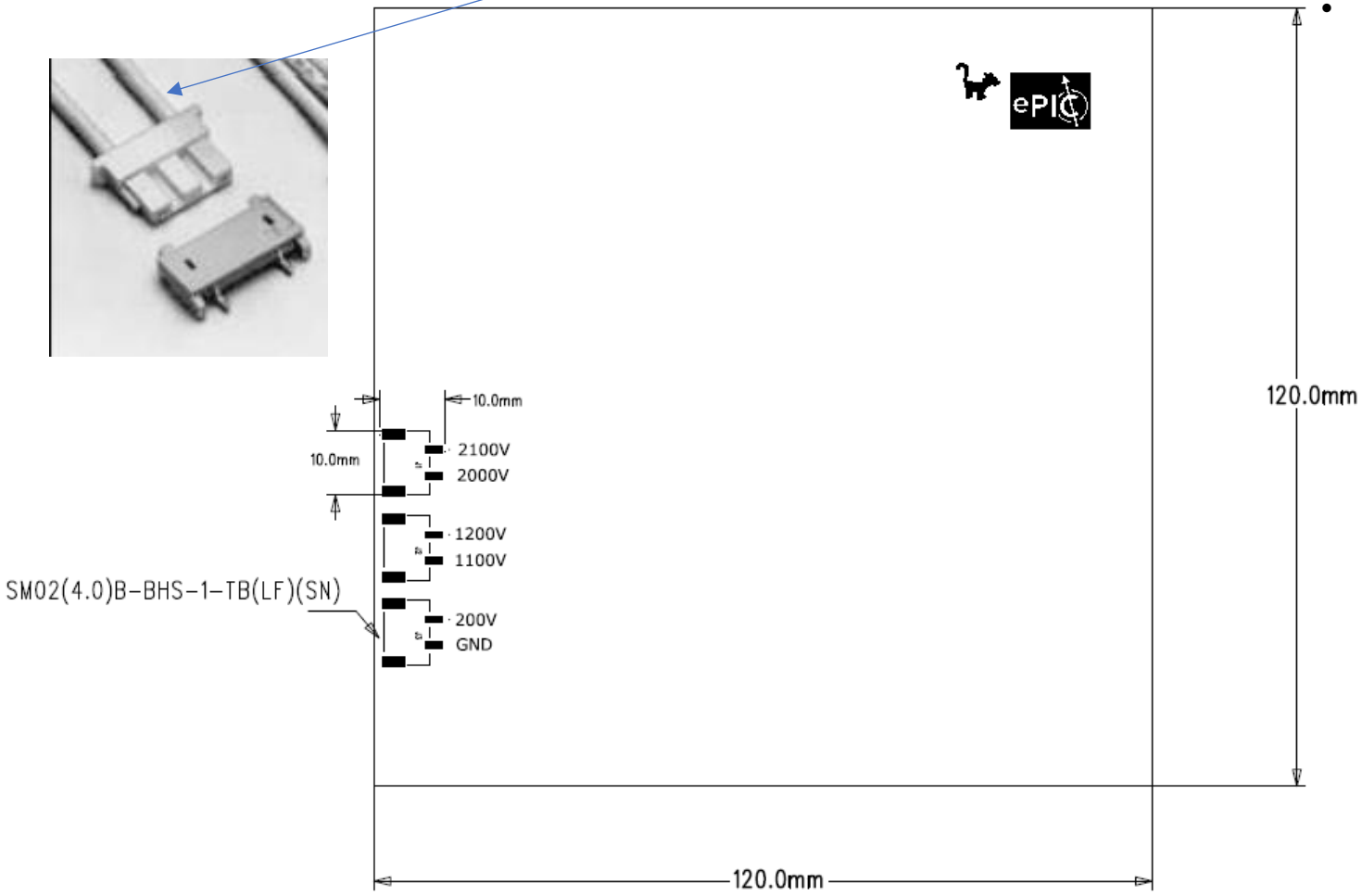
NOTES:

RC FILTER: We may determine that with inductance from long feed cable that a decoupling capacitor is all that is required. We can then omit the resistors and further reduce PCB size.

Burden Resistors (RL6, 7): May be required to provide a minimum load, Feedback could be an issue if load current becomes too small for the A1515BV control & feedback & could cause instability.

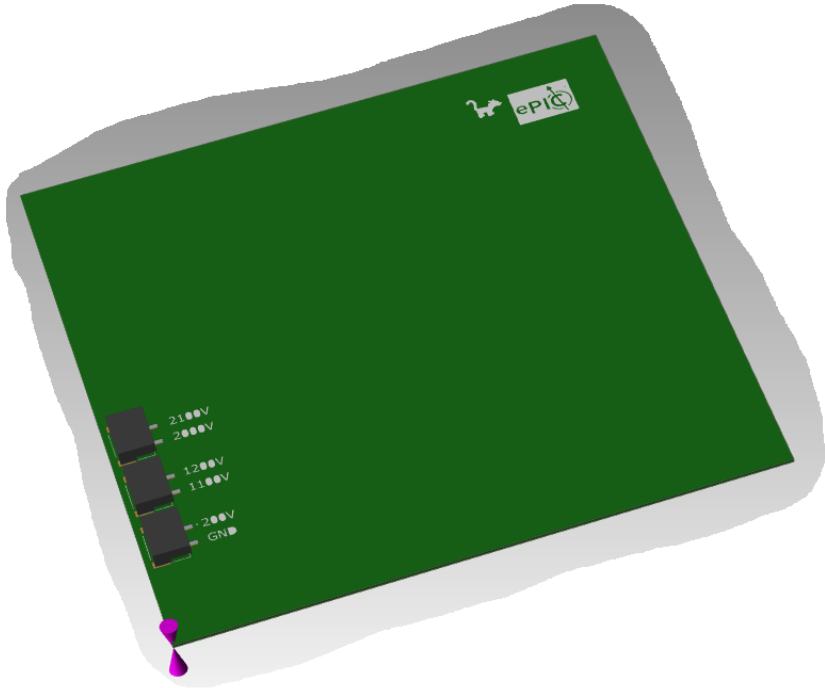
HV BIAS CONNECTIONS TO HRPPD PCB
Space constraints

HV Coax Teledyne PN: 167-2896
EMI shielding & corona effect



Circuit Notes:

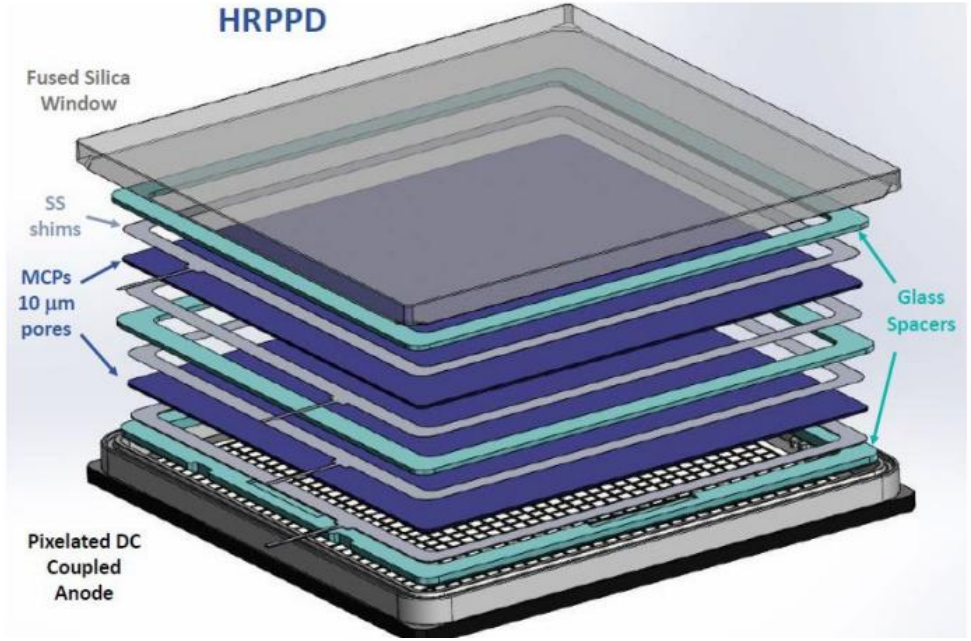
- Decouple bias voltage at input connectors
- HV bias connection points from PCB into HRPPD ceramic layers should be capacitor decoupled on the PCB.

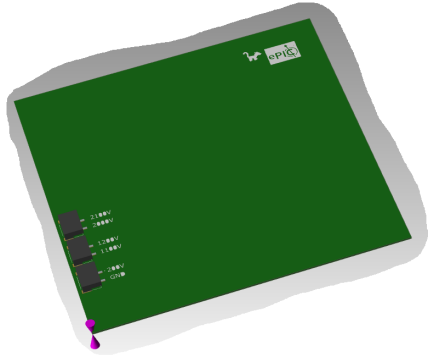


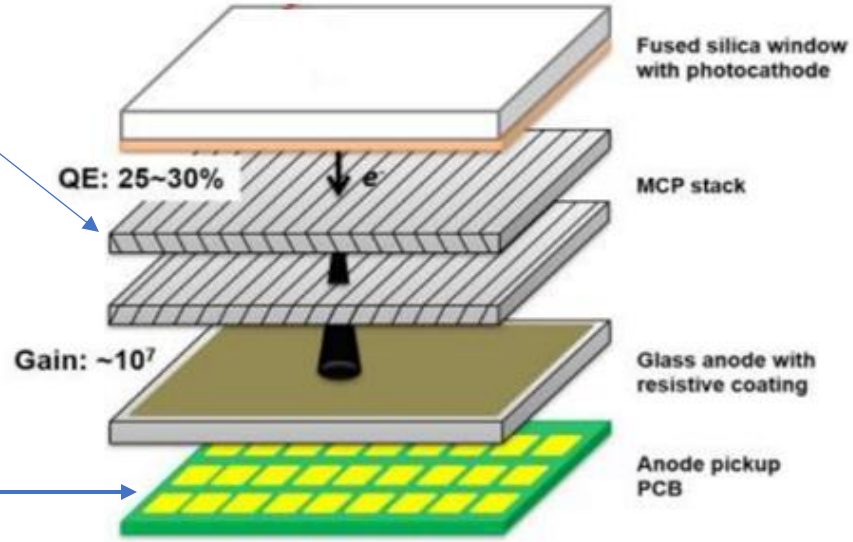
PCB footprint for HRPPD module interface board

As Per HRPPD manufacturer:

- Agreed to place two independent HV contacts per HRPPD side to provide 200V to bottom side of the second MCP
- Make connections to Photo K + 4x sides of the MCPs
- 200V bias common connects to ceramic module ground plane
  - Q. single connection or connect at multiple points?
    - A. connected by eight points for -200V & Return
    - A. MCP voltage taps will be single connections
  - Q. what does ceramic internal planes look like?
    - A. TBD



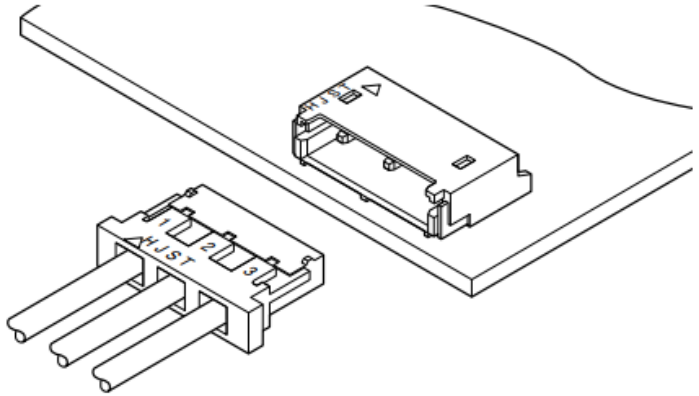




BH CONNECTOR

Emboss Tape

4.0/8.0/12.0 mm pitch/Disconnectable Crimp style connectors



Low profile connectors with high withstanding voltage, designed for connecting liquid crystal display back light lamps to their starters.

- **Low profile**
- **SMT configuration**
- **Applicable to special wires**
- **Headers with locating bosses**
- **Housing lock also serves as polarizing device**

Specifications

- Current rating: 1.0 A AC/DC (AWG #22)
- Voltage rating: 600 V AC/DC
- Temperature range: −25℃ to +85℃
  (including temperature rise in applying electrical current)
- Contact resistance: Initial value/ 10 mΩ max.
  After environmental tests/ 20 mΩ max.
- Insulation resistance: 1,000 MΩ min.
- Withstanding voltage: 1,800 VAC/minute
- Applicable wire: AWG #28 to #22

* In using the products, refer to "Handling Precautions for Terminals and Connectors" described on our website (Technical documents of Product information page).
* RoHS2 compliance
* Dimensional unit: mm
* Contact JST for details.

Standards

Recognized E60389
Certified LR20812