HRPPD Meeting #26 Update

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Raymond Dawson

Jefferson Lab

U.S. DEPARTMENT of ENERGY

Current Status

Tasks:

- Priority tasks
  - Backplane layout
    - HV connectors

Part status

- Interposer
  - Submitted 7/6, req approved 7/20, single source approved 8/18, waiting PO
- HRPPD order status
  - Ordered 6/17, due 10/21
- Sidewall
  - Ordered 6/17, due ~9/1

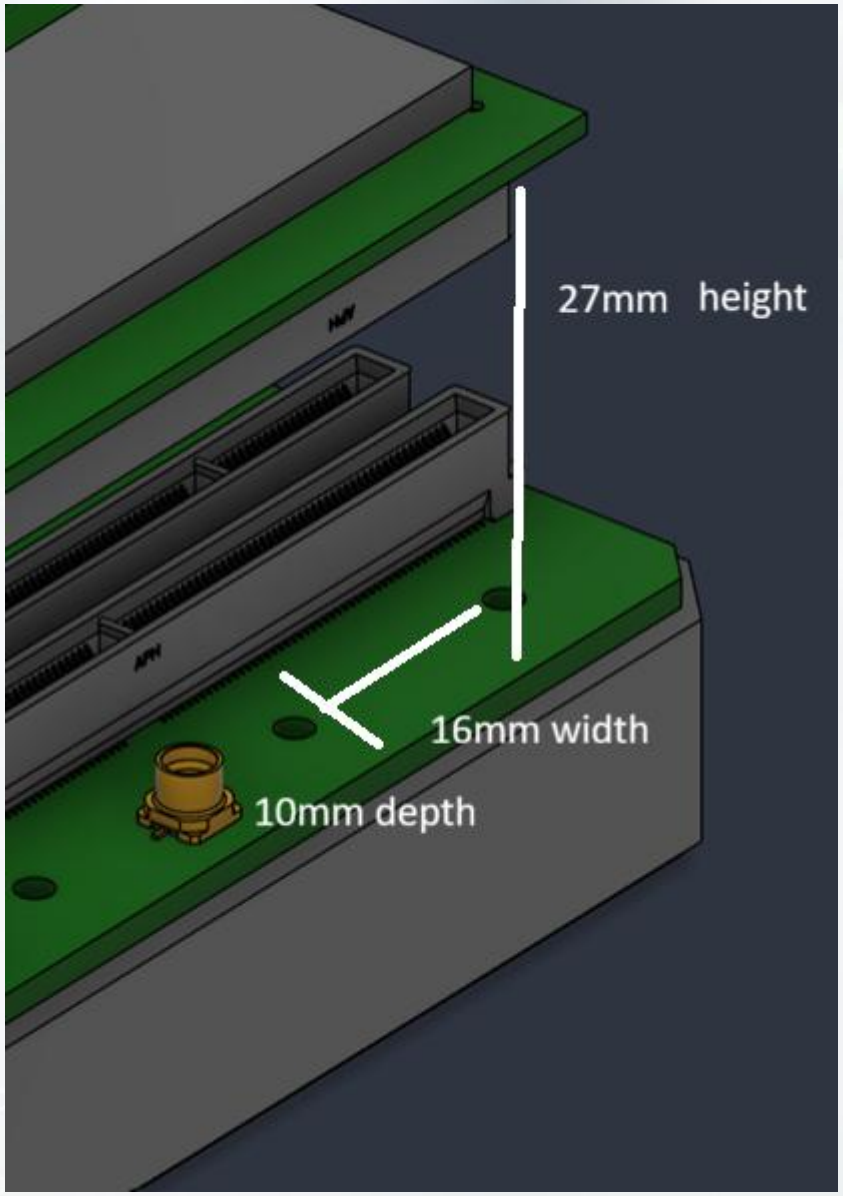
No update

- Open items:
  - N/A
- FCFD Test Board
  - Will resume in July
- Backplane Changes
  - See action item list

High Voltage Connectors

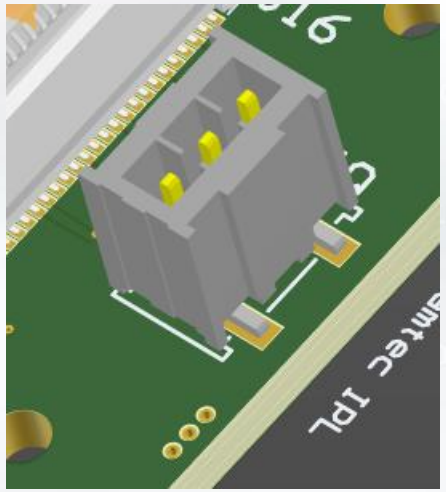
Requirements:

- Fit in envelope of 16 x 10 x 27 mm (LxDxH)
- Rating of 500+ VDC
  - Only Exit of Exit MCP cable will be grounded and shielded
  - All other HV lines are single wire
- SMT only
- Removeable plug or wire
- Max voltage is photocathode at 2.5kV
- Will maintain 1mm/1kV spacing from HV metal
- PTFE or HV silicon wire
  - PTFE has thinner insulation at the expense of pliability
- Reviewed 15 options with 7 potentials



3 pin options

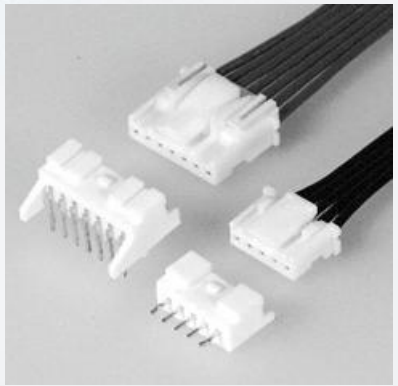
- All (but Samtec) 3 pin connectors are rated for 250 V, and an extra pin is used to provide 500V separation between the ends pins
  - The middle pin will need to be potted or removed
- Pros
  - Small XY footprint with a locking connector
- Cons
  - Requires effort or custom part to remove or pot middle pin
- **Samtec IPL1**
  - Header: IPL1-103-02-L-S-K
  - Rated: 389 VDC / Pitch: 2.54mm / Wire: 20-30 AWG
  - Pros – Teflon wires can be ordered pre-assembled
- **Molex Nano-fit**
  - Header: 1054311203
  - Rated: 250 VDC / Pitch: 2.5mm / Wire: 20-26 AWG
- **Molex Micro-lock Plus**
  - Header: 5055700301
  - Rated: 250 VDC / Pitch: 2.5mm / Wire: 22-26 AWG
- **JST PA**
  - Header: BM03B-PASS
  - Rated: 250 VDC / Pitch: 2mm / Wire: 22-28 (jacket 0.76-1.5)



Samtec IPL

Molex Nano-Fit

Molex Micro-lock



JST PA

2 pin option

Molex Micro-Fit 3.0

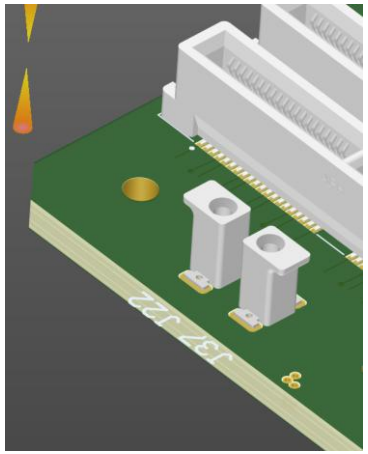
- Header: 436500226
- 600 VDC rated
- 3mm pitch
- Dims: 13.65 x 7.18 x 17.56 mm (LxDxH)
- 18 – 30 AWG
- Pros
  - Very common connector
  - No additional modifications to connector
- Cons
  - Largest of all connectors but still fits in footprint
  - Requires extra clearance around mounting pads or potting

Molex Micro-Fit 3.0

Single pin options

Kyocera AVX 9296-600

- 600 VDC rated, 18-22 AWG (Up to 2.2mm jacket)
- Dims: 4.4 x 3.25 x 6 (LxDxH)
- Pros
  - Small footprint for single connections
  - “Poke home connector” - No plug assembly
  - Color coded
- Cons
  - Not the smoothest wire removal?
  - Wire tension?



Kyocera AVX

Mill-Max

- Dims: 2 x 2 x 15mm (LxDxH)
- Uncoated metal pin requires insulation
- Similar to current brazed pins on HRPPD, but soldering is stronger
- Pros
  - Small footprint for single connections
  - Smallest physical connector but takes up almost as much room as Kyocera
- Downsides
  - Requires custom wire assembly of heatshrink around exposed metal socket
  - Potential breakage risk on installation?
- **Teledyne Reynolds options**

Mill-Max

Socket, soldercup (left) PCB pin (right)

3D Model Tour

- Appearance
- Clearance

Suggestions

1. For locking of HV ground and smallest connectors elsewhere:
   - 4x Kyocera singles for HV + 1x Molex 2 pin for Exit MCP
2. For smallest connectors all around:
   - All Kyocera
3. For locking connectors all around:
   - All Molex Micro-Fit
   - For smaller locking connector, Molex Micro-latch or Samtec IPL with pin removed
4. For pre-assembled cables: Samtec IPL
   - Pre-assembled Teflon wires
   - Requires removal of center pin

Meeting Notes

- Poke-home connectors are not desirable due to concerns over wire retention
- Bundling wires is preferred to reduce risk of installation errors
- Custom made pogo pin connectors were suggested with machined Ultem body
- Order of connector preference:
  - Custom 6-pin pogo pin connector – requires testing (and exception?)
  - 6-pin Molex connector – requires testing and a voltage exception since rated for 600V
  - Combinations of single pin or <6-pin connectors

Appendix

Status Updates

Needed for HRPPDs

- Spacer
  - Thickness selected = 2.8 mm
  - Glue
    - Pull test was performed
    - Is glue finalized, 3M DP460?
  - Helicoils + screws
    - Material: 2-56 stainless steel coil + aluminum screw
      - This will cause corrosion?
    - We previously discussed a screw pull test in the spacer without helicoils to determine if they're even needed
    - Standard length 3/16 or 7/32 should work depending on PCB backplane thickness
- Shims, window
  - Status?
- Interposers
  - MFG drawing provided, req approved, waiting for PO issue
- HV pogo pins
  - Mill-max 0900 SMT pins, readily available for order
- Backplane
  - HV connectors and cables/wiring
  - HV distribution and routing
  - Add MCP bleed and PC current limiting resistors
  - Size bypass caps and anti-ringing resistors
  - How are ASIC cards going to be anchored?
  - Bug fixes – swapped traces

Other priority

- FCFD Testing
  - When, who, and how?
  - Need to settle specifications with hpDIRC team somehow…
  - FNAL starting FCFD Variant v1.2 (analog frontend + digital backend)

Remaining design items

- ASIC card
  - Impedance matching solution – analyzing signal path lengths
    - TBD test on-board terminations
  - Bug fixes – card edge dimensions
  - Maybe preliminary routing can start once FCFDv2 is designed
- Bridge card
  - LV connectors
  - Use a more rugged optical cable for readout rather than included VTRX+ one
- Power distribution
  - Cable lengths from South Platform
  - Account for distribution board. Where located? Tim designed original, will it need to be updated?
- Mechanical (Alex)
  - Preliminary envelope 3D modeled
  - Cooling
  - HRPPD enclosure fit into pfRICH