

FCFDv1.1 for HRPPDs

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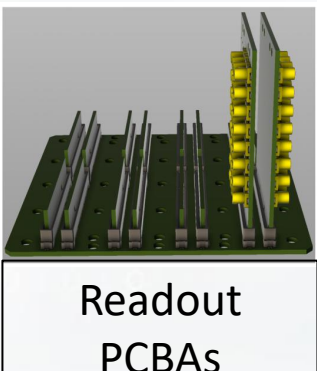
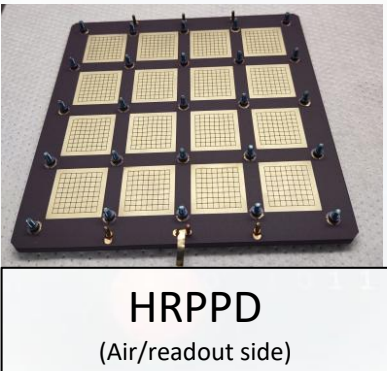
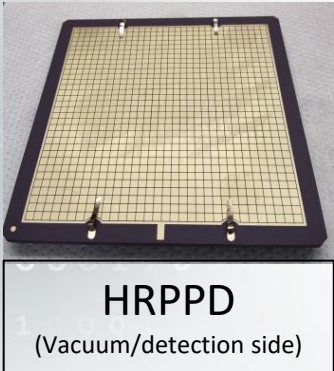
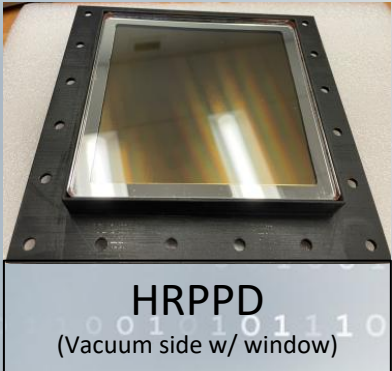


U.S. DEPARTMENT
of ENERGY



Background

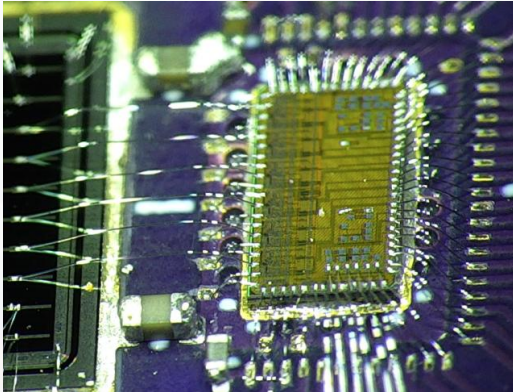
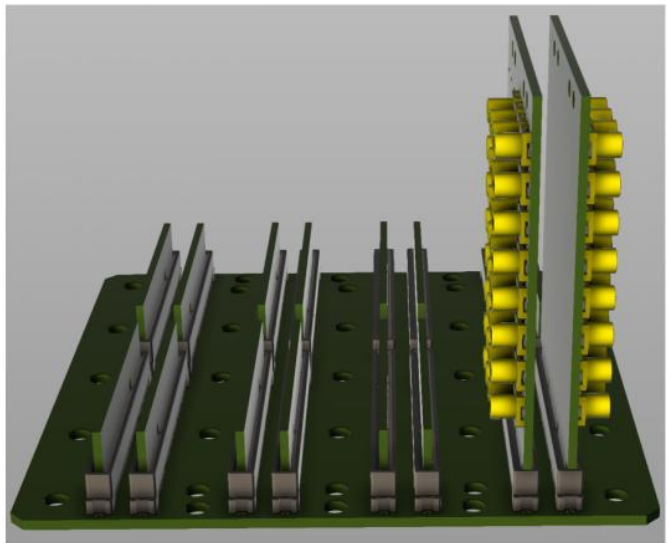
- Testing feasibility of FCFDv1.1 (analog front-end only) with HRPPDs for use in the pFRICh (and hpDIRC*)
- Front end board designed
 - Uses 2x ASICs to test 12 channels in a 4x3 array in fixed locations
 - Test discriminators, analog outputs, and raw signals through MCX connectors
- Boards finally in hand 3/11 after much delay
 - Issue with board – 2.5V regulator stuffed with a 3.3V regulator. Replacement parts should arrive Friday
 - Board is functional otherwise
 - Will be sent to BNL for wirebonding then testing



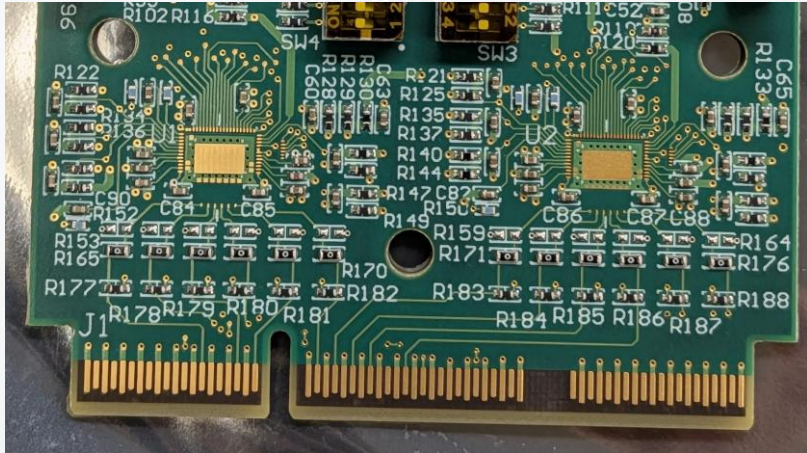
FEB: 6x3 inches

Challenges

- Will FCFD and HRPPDs work with mounting method?
 - FCFDs wirebonded directly to AC-LGADs, but connected to HRPPDs through traces/vias
 - Interconnects are significantly longer, but are 50Ω impedance matched
- Limited inputs
 - Only 12 of 1024 channels can be tested
 - Still allows measuring of charge sharing and crosstalk
- Is dynamic range of FCFD sufficient?
 - FCFD max input is 70fC, but single photons from HRPPD can reach 160fC without attenuation
- How much charge attenuation is required?
 - FCFD input impedance is 180-200Ω, so a 66.5Ω resistor is used to match it to the 50Ω line
 - This causes ~75% charge attenuation, which causes issues on low end of DR
 - Not very adjustable without impacting reflections
 - Increasing gain of HRPPD impacts aging
 - *Open to suggestions if anyone has alternate solutions



FCFD with AC-LGAD



FCFD routed on FEB

Timeline

- Hopefully have preliminary results by next monthly meeting
- March – April
 - Will have 5 weeks to test with HRPPDs
 - HRPPDs being sent to CERN for beam testing in May until end of June
 - Hoping to test FEBs at CERN if preliminary testing goes well
 - Need rough estimate of capability and changes to give initial feedback to FNAL
- May – June
 - Bench test FEB if necessary
 - No HRPPD unless we can find an extra unit
- July – TBD
 - If testing in April is insufficient, will continue in July when HRPPDs return
- Q4 2026?
 - Start fabrication of FCFDv1.2 variant and rename ASIC
 - Very much dependent on testing and scope of changes to FCFD
- October 2026
 - HRPPDv2 available for testing