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Data Acquisition Systems

Modular, low cost readout electronics for mRICH at EIC

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PROGRESS UPDATE 03/07/20178

EIC- mRICH Requirements

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Problem statement:

- Readout of compact H13700 MCP-PMT
- Compact and dense: 256 channels in 2”x2”
- Timing resolution: ~100ps
- Long buffer
- Abutted tiles
- Might convert to SiPM array later
- Minimize analog cabling (noise and cost)

EIC- mRICH Proposed Solution

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1st gen mRICH prototype based on existing TARGETX chip:

- 1GSa/s full waveform sampling
- 16 us trigger buffer
- 16 channels
- Built-in comparator generates trigger primitives
- Low cost 250nm CMOS
- Avoid costly cabling

Already used in 4 projects – developed FW/SW base:

- Belle II KLM upgrade, ~20k SiPM channels
- Borehole Muon Detector (BMD) prototype: ~100 SiPM channels
- Hawaii Muon Beamline (HMB): ~60 SiPM channels
- Cherenkov Telescope Array (CTA) ~2k SiPM or PMT /telescope

Rev 1.0 Design – building block

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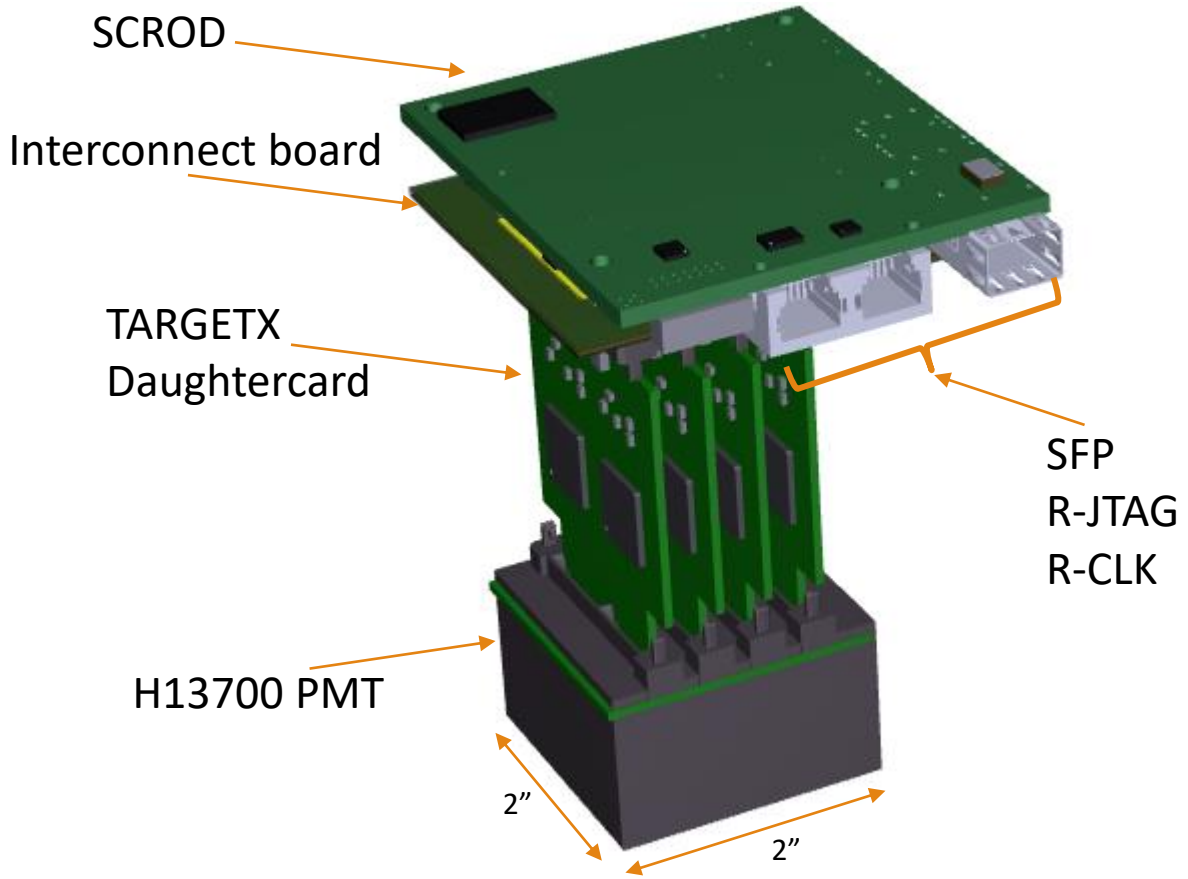
Benefits:

- Better mechanical fitting and PCB routing
- Placed 4x TARGETX chips on one daughtercard
- SCROD (s6 FPGA) boards already fabricated and tested
- Interconnect card purely passive routing
- Reuse KLM detector readout FW and SW
- Can readout all 256 PMT channels
- Compatible with abutting 2x2 PMTs



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Full 1024 channel readout

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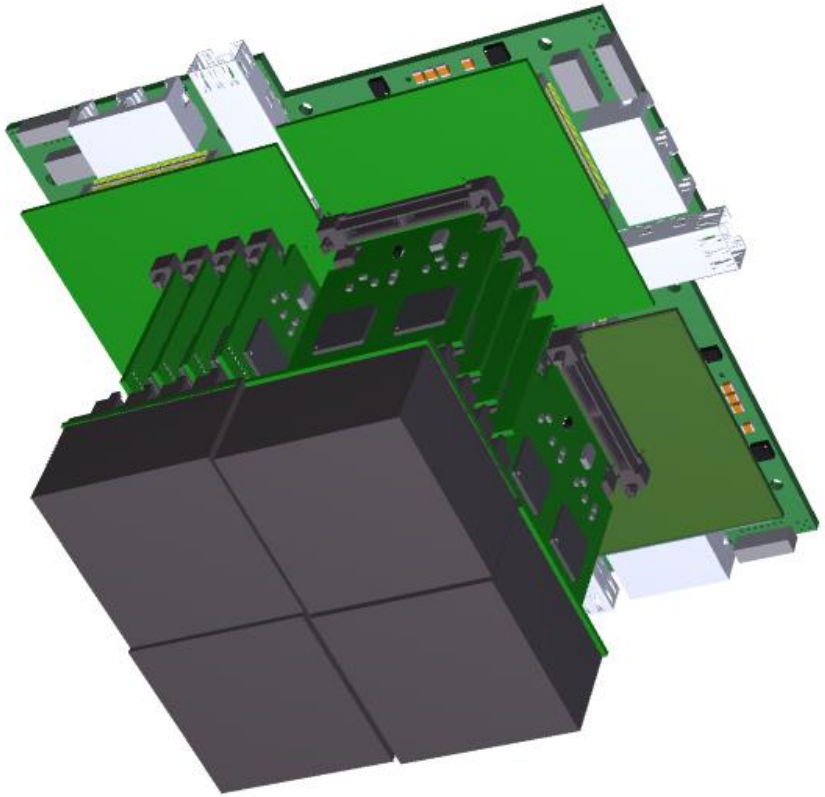

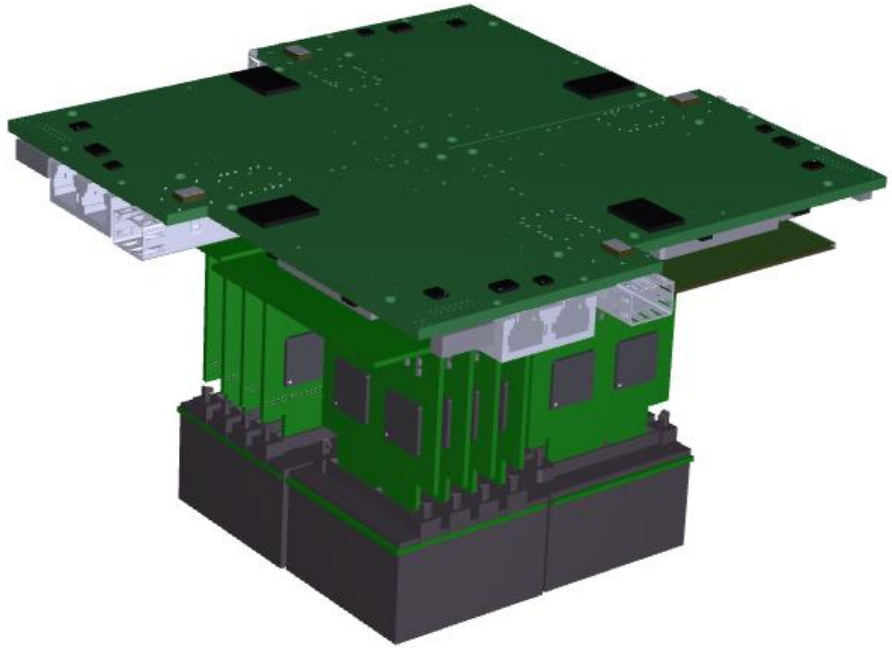

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Progress

Implement schematic/layout/mechanical

- BNL-UH contract in place now
- New students at UH started work
- Design is being prepared for submission – new review in mid March 2018
- Mechanical design reviewed – need to take mech. Support into account.
- SCROD mechanical support might be ok for short term – need long term solution

2nd generation roadmap: SiREAD

- Specialized full waveform sampling SiPM/PMT readout System-on-Chip with proto 32 channels
- Completed Phase I Project - SiREAD Rev 1.0 is under fabrication
- Submitted Phase II SBIR proposal – Should hear back by mid April 2018
- SiREAD eval board submitted for fab

- UH mRICH readout homepage:
  - http://www.phys.hawaii.edu/~idlab/taskAndSchedule/NP/modRICHproto/modularRICHproto.html
- TARGETX based PCB layout almost ready for fab
- Identified FW pieces – ideally only a recompile with little development