Update on Electronics for mRICH

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Task

- mRICH basic block
- H13700 MCP-PMT with 256 channels
- Compact form-factor: must be able to abut and tile
- Readout close to PMT -> avoid cables and amplification

Proposed Solution

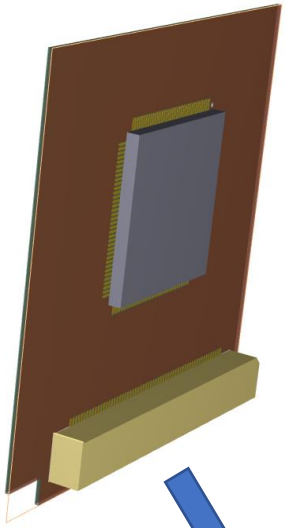
- 1st gen mRICH prototype based on existing TARGETX chip:
  - 1GSa/s full waveform sampling
  - 16 us trigger buffer
  - 16 channels
  - Built-in comparator generates trigger primitives
  - Low cost 250nm CMOS
- Used in 3 projects:
  - Belle II KLM upgrade ~20k SiPM channels
  - Borehole Muon Detector (BMD) prototype: ~100 SiPM channels
  - Hawaii Muon Beamline (HMB): ~60 SiPM channels

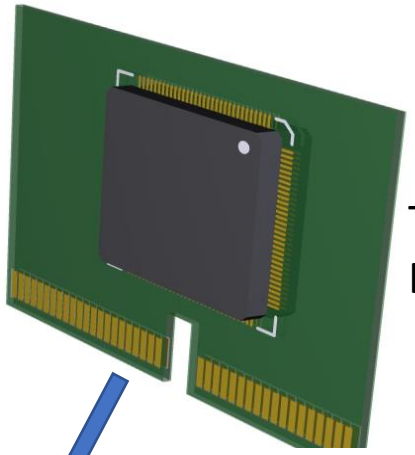
Benefits and Roadmap

- 1st gen mRICH readout: TARGETX
  - Multiple PCB designs available
  - Variations of firmware available
  - Known testing and calibration procedures
  - Low cost Xilinx Spartan 6 FPGA companion
  - Mechanical design – next slide
- 2nd gen mRICH readout: SiREAD
  - 64 channels
  - 1-3 Gsa/s
  - 2-4 us trigger buffer
  - System-on-Chip
  - Funded commercial grade ASIC through DOE SBIR program
  - Chip fab: Sep 2017, evaluation kits available Jan 2018

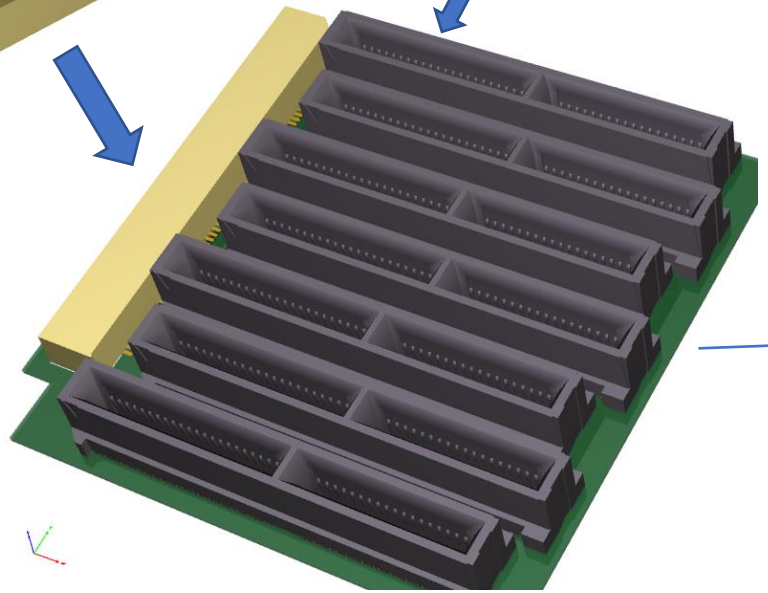
Proposed 1st Gen Design

Spartan6
FPGA
Controller



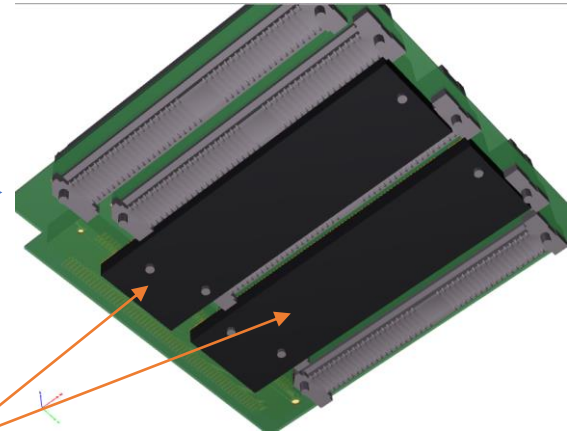


TARGETX
Both sides



Adapter board:
Connects PMT
to TARGETX

Bottom of adapter board



PMT connects directly here

2 TARGETX/ daughtercard
8 daughtercads
16 TARGETXs
16x16=256 channels

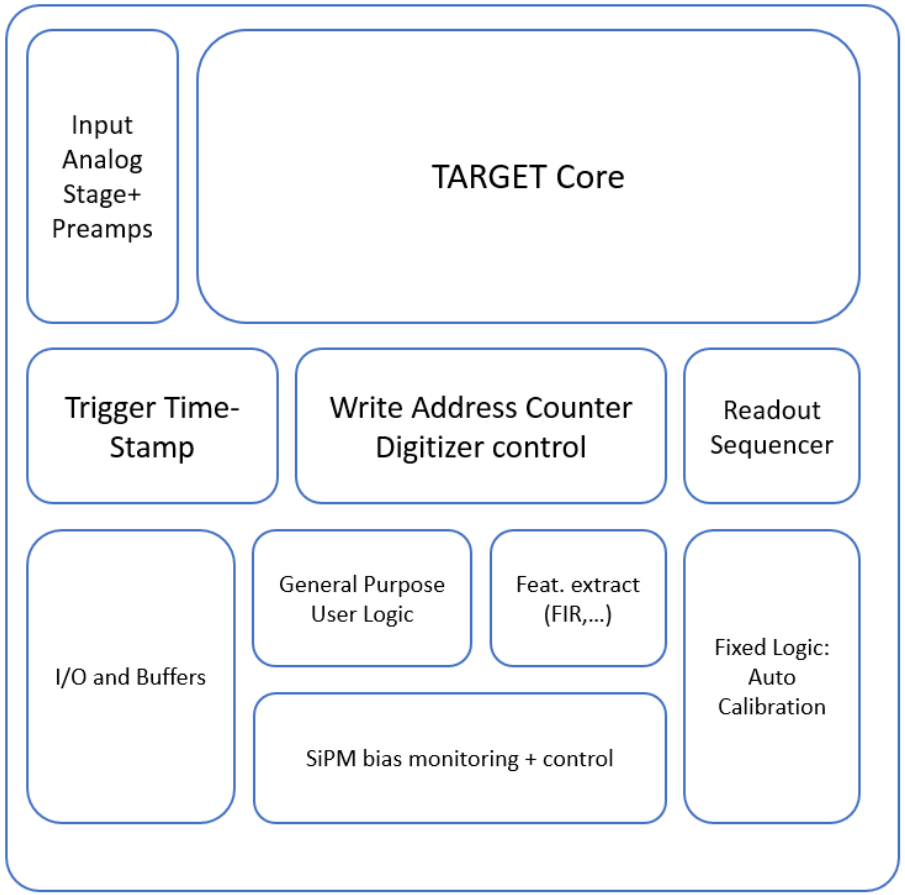
Next steps

- 1st Gen: Allocate formal manpower
  - Finish PCB routing for boards
  - Order parts and fabricate boards
  - Modify existing FPGA firmware
  - Integration and testing

- 2nd Gen: SiREAD based
  - Design and fabricate ASIC as planned
  - Plans for a prototype + mass production

SiREAD: SiPM/PMT Waveform Sampling ASIC

Compact, high performance waveform sampling- current Phase I SBIR



Spec	
Sampling rate	1-3 Gsa/s
ABW	0.8-1.5GHz
Depth	4k Sa
N channels:	64
Fab	250nm CMOS

Key Contribution:

- High performance digitizer: 3+ Gsa/s
- Highly integrated
- Commercially available
- On chip:
  - Analog storage
  - Reconfigurable DSP
  - SiPM Calibration+DACs

Funded and active project- Tape out Sep 2017