Beam Diagnostics and Timing Integration at FRIB

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Diagnostic Systems

- Beam Current Monitor
- Beam Position Monitor
- Profile Monitor
- Wire Scanner
- Allison Scanner
- View Screen

- Fast U Digitizer
- Custom BPM
- Motor Controller
- PLC
- Fast I Digitizer
- Timing EVR
- HV PS
- GigE Camera

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Diagnostic Systems

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- SIS8300-L2
- FGPDB*
- Galil DMC-4143
- A/B
- CAENels Pico8
- FGPDB*
- CAENels Panda
- Basler and TIS

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* FRIB General Purpose Digital Board

GigE Cameras

- Evaluated
  - Basler acA1600-20gm
  - The Imaging Source DMK-33GX174
- Both work with areaDetector and aravisGigE

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Motion Control

- Galil DMC-4143
  - “Econo”
- Not for data acquisition
  - Slow Loop speed
  - Software “time”
  - ADC noise

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CAENels

- AMC-PICO-8
  - 8 channel 20 bit picoammeter
  - 2x FMC on DAMC-FMC25 carrier
  - MTCA.4
  - PCIe w/ MSI interrupts and scatter/gather DMA (32-bit)
  - FRIB customizing firmware (fast MPS and CW statistics)
  - Linux driver and IOC
    - https://github.com/CAENels/amc-pico8-driver
- HV-PANDA
  - 8 channel HV power supply
  - MTCA.4
  - Simple driver w/ devlib2
    - https://github.com/mdavidsaver/devlib2

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SIS

- SIS8300-L2
  - 10 channel 125 MS/s
  - MTCA.4 PCIe w/ Classic IRQ and simple DMA (64-bit)
- SIS8900 RTM
- Linux driver w/ modifications
- FRIB customizing firmware
  - fast MPS and CW statistics

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FGPDB

- FRIB General Purpose Digital Board
- Custom design
- MTCA (diag.) or pizza box (llrf)
- PCIe

http://www.frib.msu.edu/users/digital-board.html

MTCA.4 crate system

- Evaluated
- MCH
  - NAT
  - Vadatech
- CPU
  - Concurrent
  - Vadatech

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MTCA fun

- PCIe clock configuration options
- Bricked CPU
- PCIe DMA lockups
  - Corrected
- PCIe unaligned access lockups
- PSU failure

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MTCA wish list

- Understanding e-key/configure process
  - PCIe device not found?
- PCIe analyzer
  - Extender card w/ analyzer
  - PCIe switch with port mirroring
- Hot plug?
  - When reprogramming fpga

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PCI Modeling w/ QEMU

- Simulate PCI/PCIe device
  - ie. callback for MMIO read/write
- Test of documentation
- Simplifies driver debugging
  - Add printf() in “hardware”
- Increases development time
  - Reduced risk
- Make progress while HW/FW bug is fixed

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Timing

- mrfioc2 version 2.1.0
  - Real soon now
- Includes support for additional hardware
  - PCIe-EVR-300
  - cPCI-EVR-300
  - cPCI-EVG-300
- Contributions from PSI/Cosylab and FRIB

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