

BPM System for the PIP2 Injector Test Facility (MOPP33)

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System "Controller"

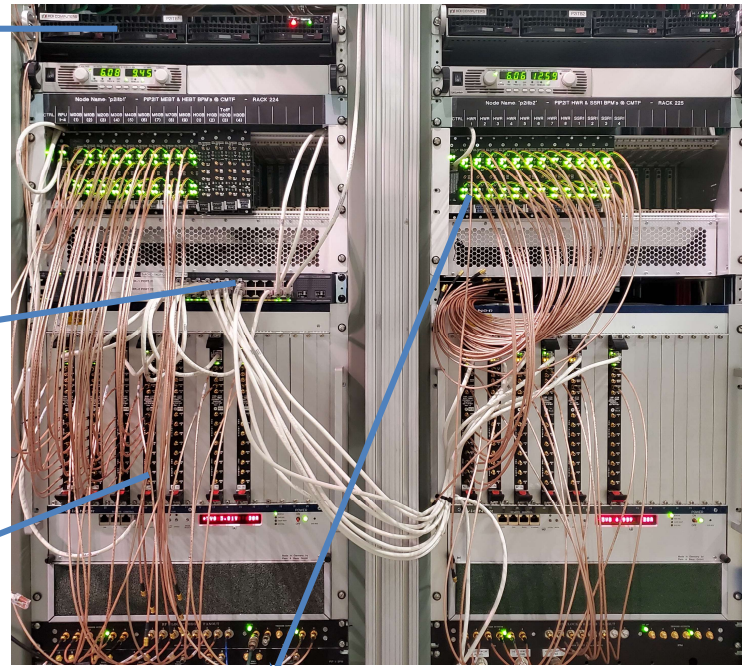
- Standard commodity rackmount server running Linux
- Xeon 4210 10 Core 2.2GHz processor
- 8GB DDR4 upgradeable to 768GB
- Excellent price/performance ratio
- Two 10G Ethernet Interfaces
 - One for local "Bus" private network
 - One for Controls Network

Ethernet Switch "Backplane" for GigEBus

- Standard commodity managed ethernet switch
 - 32 port 10G Switch
 - Standard network monitoring and diagnostics
- Provides a great deal of flexibility...
 - Devices can be separated over large distances
 - Controller may be in controlled environment

Custom Digitizer "Device"

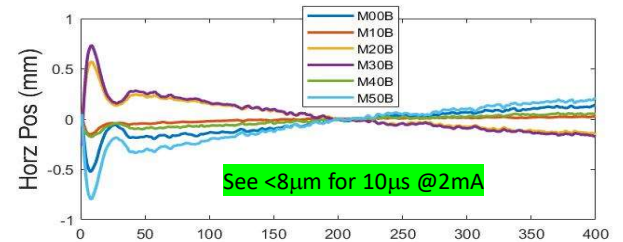
- VME form factor with Gigabit Ethernet on front-panel
- VME crate used for power and cooling
- 8 channel 250MS/s 16bit JESD204b ADCs
- Clocks locked to external machine reference
- Altera Aria V FPGA with NIOS softcore
 - Use NIOS for slow control
 - Use dedicated HDL for high-speed data readout
 - Use UDP to simplify interface



BPM Readout

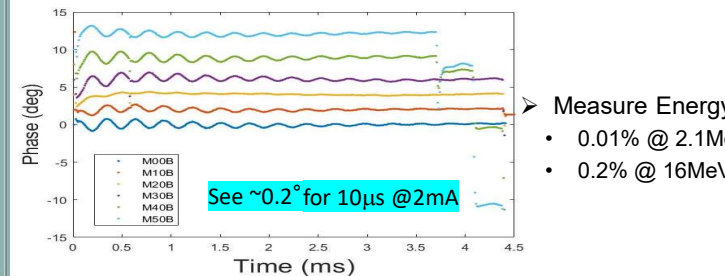
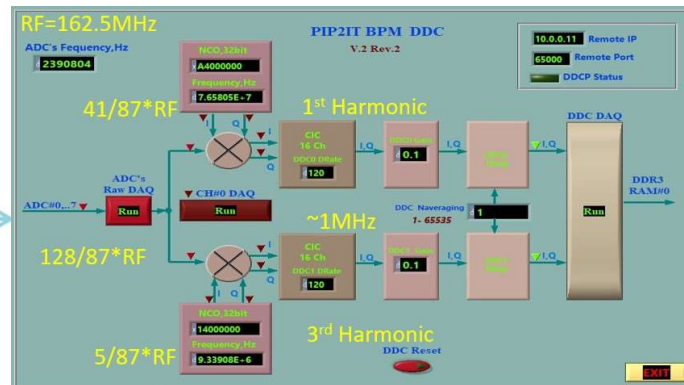
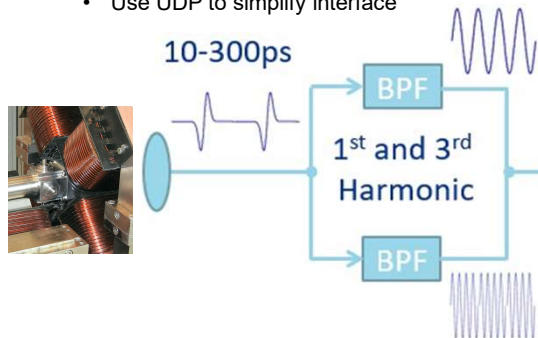
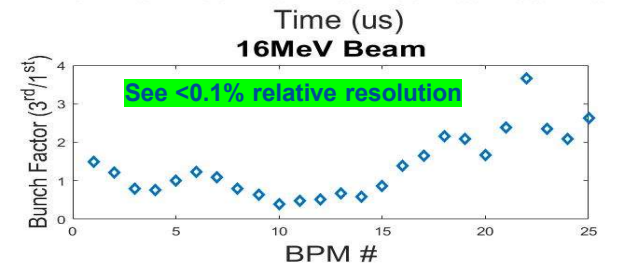
- First full system implementation with GigEBus
- See >100MB/s real readout speeds
- 25 Beam Position Monitors – 4 channels per pickup
 - 2 DDC per channel -> I/Q at 1st and 3rd Harmonics
 - Variable output rate from 1MS/s to 50KS/s
 - Data – (512 samples)*2*2*4*(4 byte) = 16kB/bpm
- Pulsed beam @20Hz from 10μs to 4ms
 - Positions (X,Y), Phase, Intensity (1st & 3rd harmonic)
 - Average over pulse and pulse waveform

BPM Performance



Analog Module

- BPF at 1st and 3rd Beam harmonics
- Flexible gain and attenuation
- Ethernet via Raspberry-PI controller



- Measure Energy
 - 0.01% @ 2.1MeV
 - 0.2% @ 16MeV