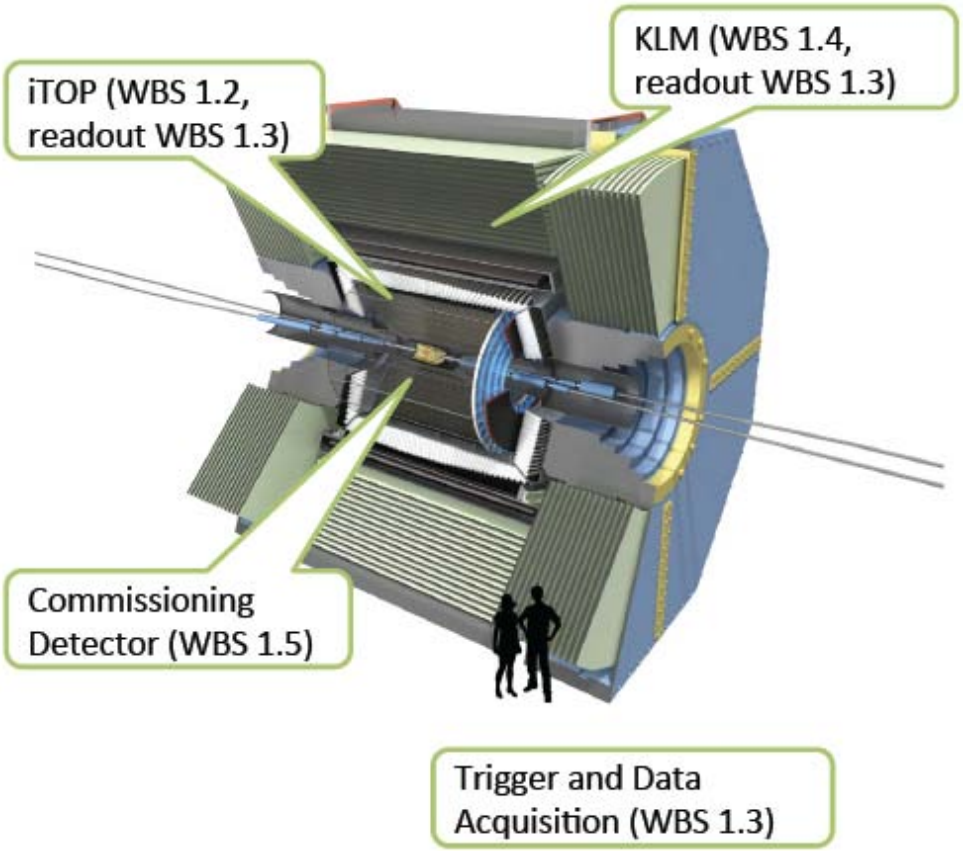
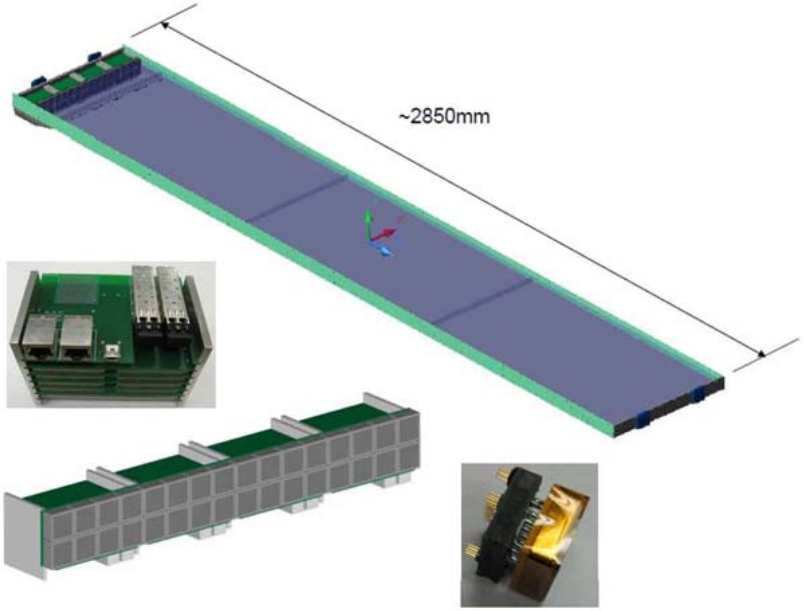
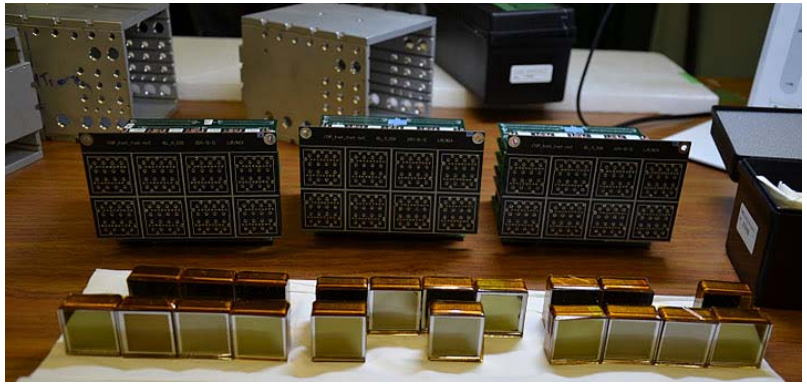
Belle-II imaging Time Of Propagation





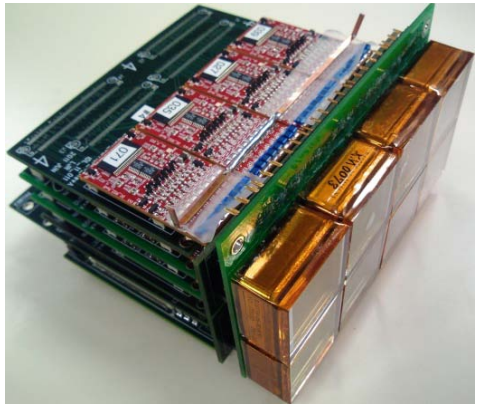


US/DOE Contributions to Belle II

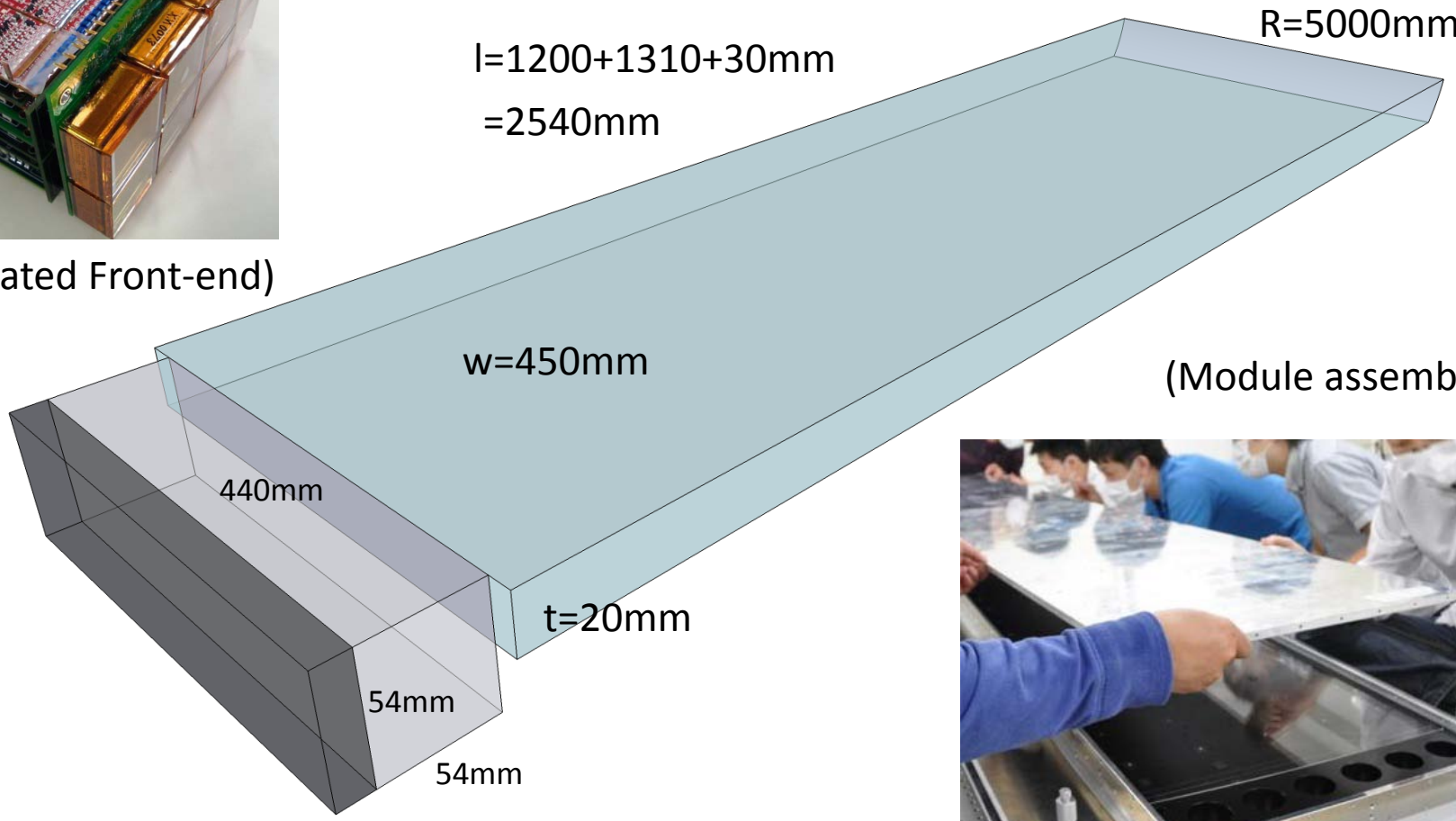
Gary Varner, University of Hawaii, for Belle II TOP Group

August 23rd, 2012

What to test – final components



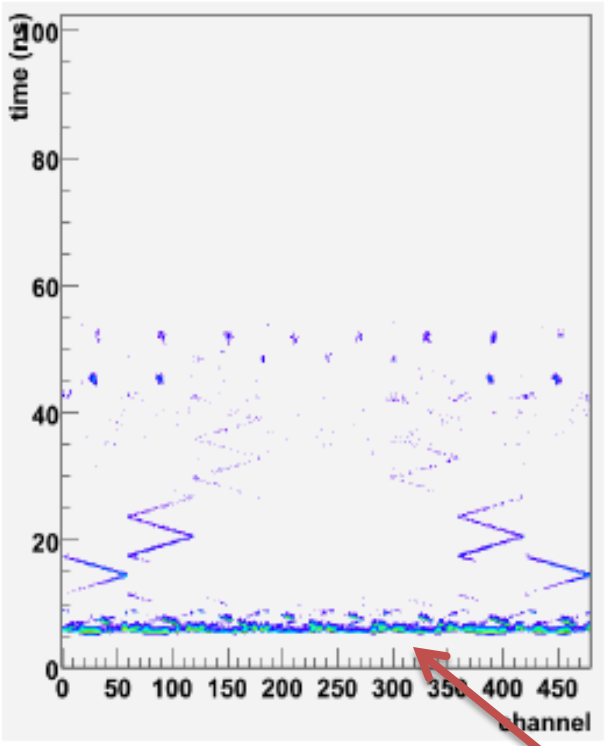
(Integrated Front-end)

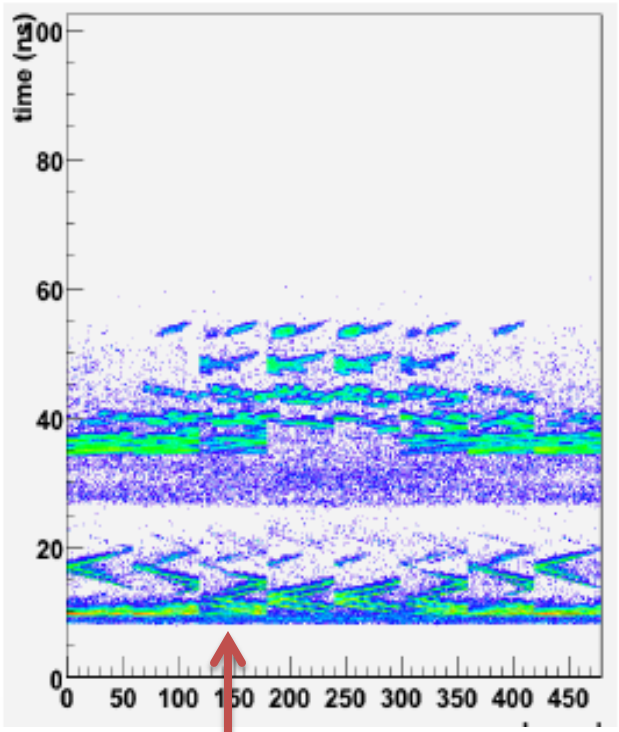


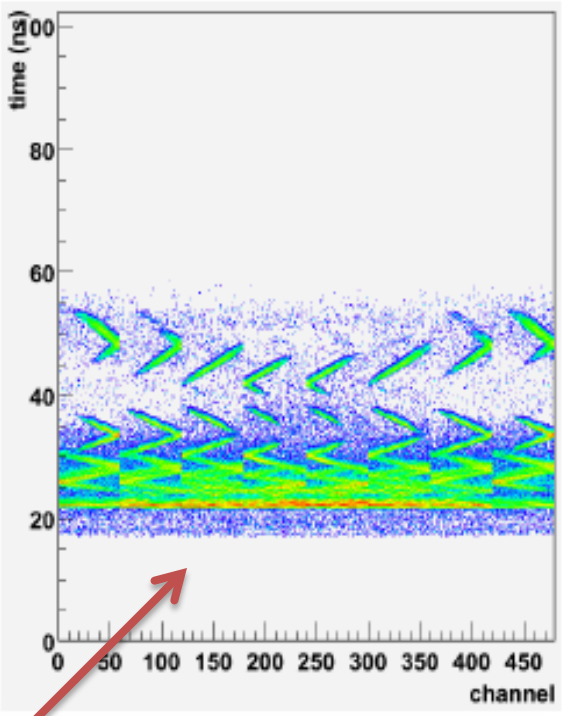
(Module assembly)

Belle II Particle Identification (p/K separation) upgrade
Installation 2015, start running at SuperKEKB in 2016

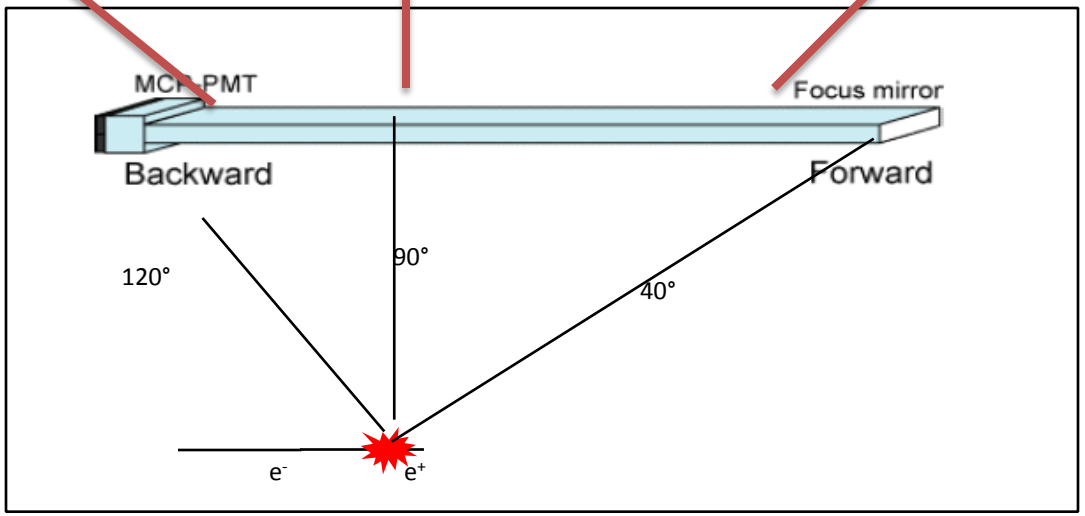
Cherenkov Photon Arrival Patterns (MC)





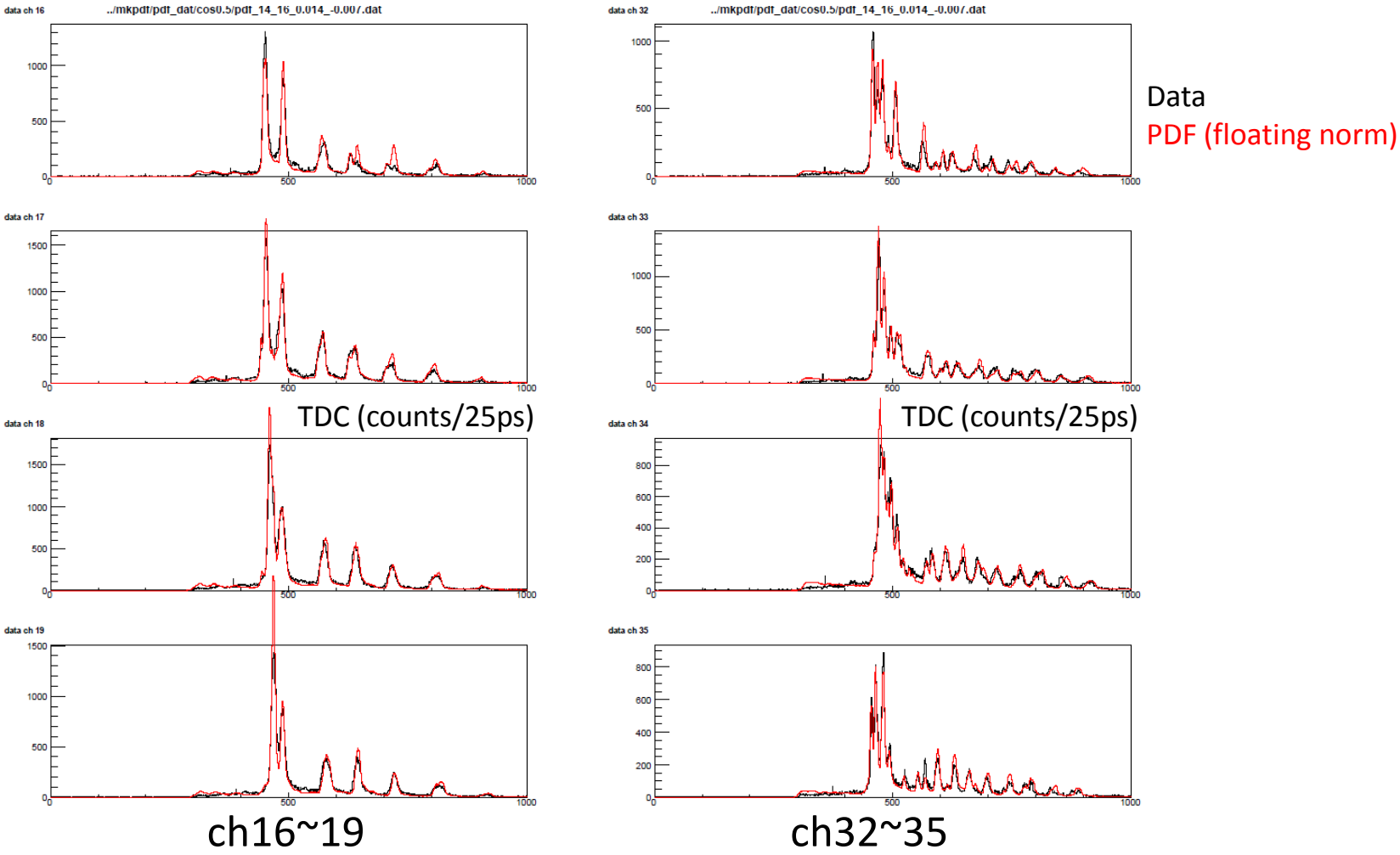


For a given momentum, K/π have a different pattern in space + time



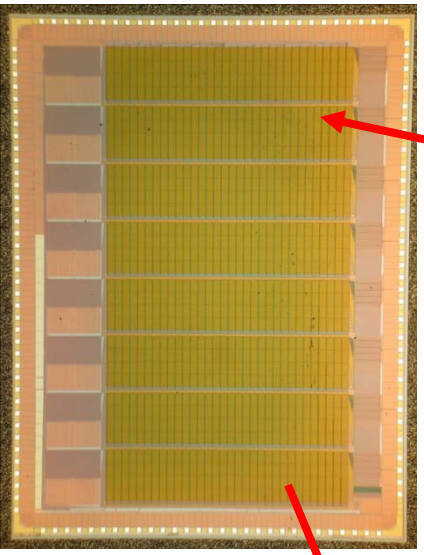
Goal: Data versus Simulation

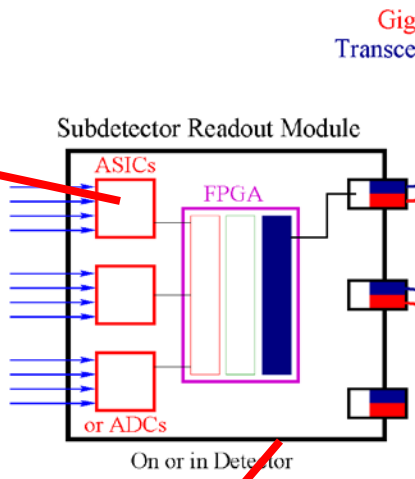
- Use data to tune/confirm Monte Carlo
- Results for different optics, old PMT type & CAMAC readout



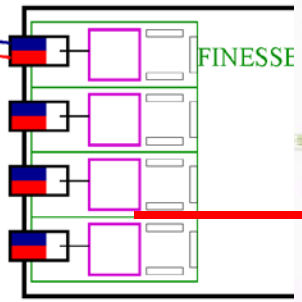
Evaluate Integrated Readout

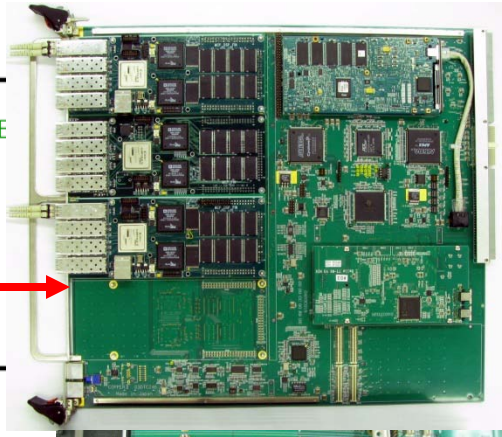
Third generation waveform sampling ASIC

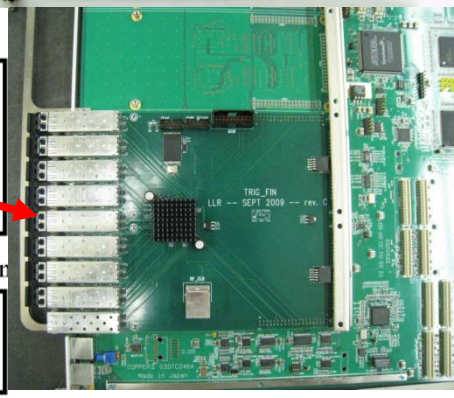




Giga-bit Fiber Transceiver Links

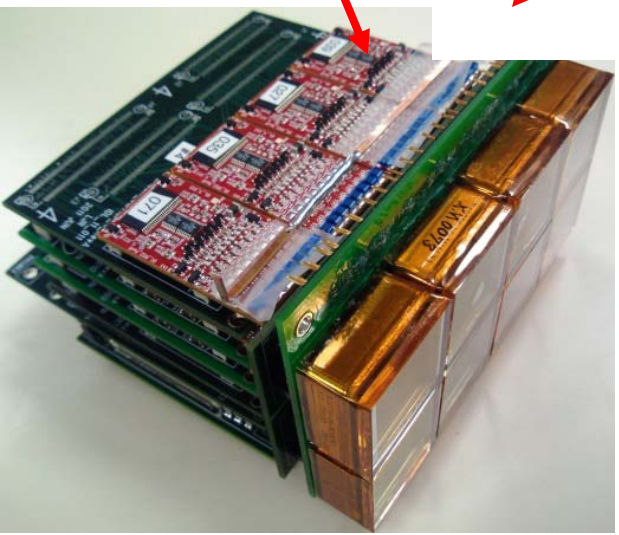




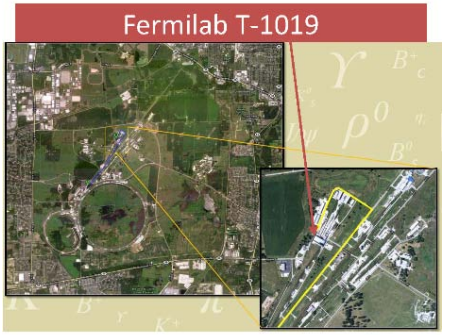


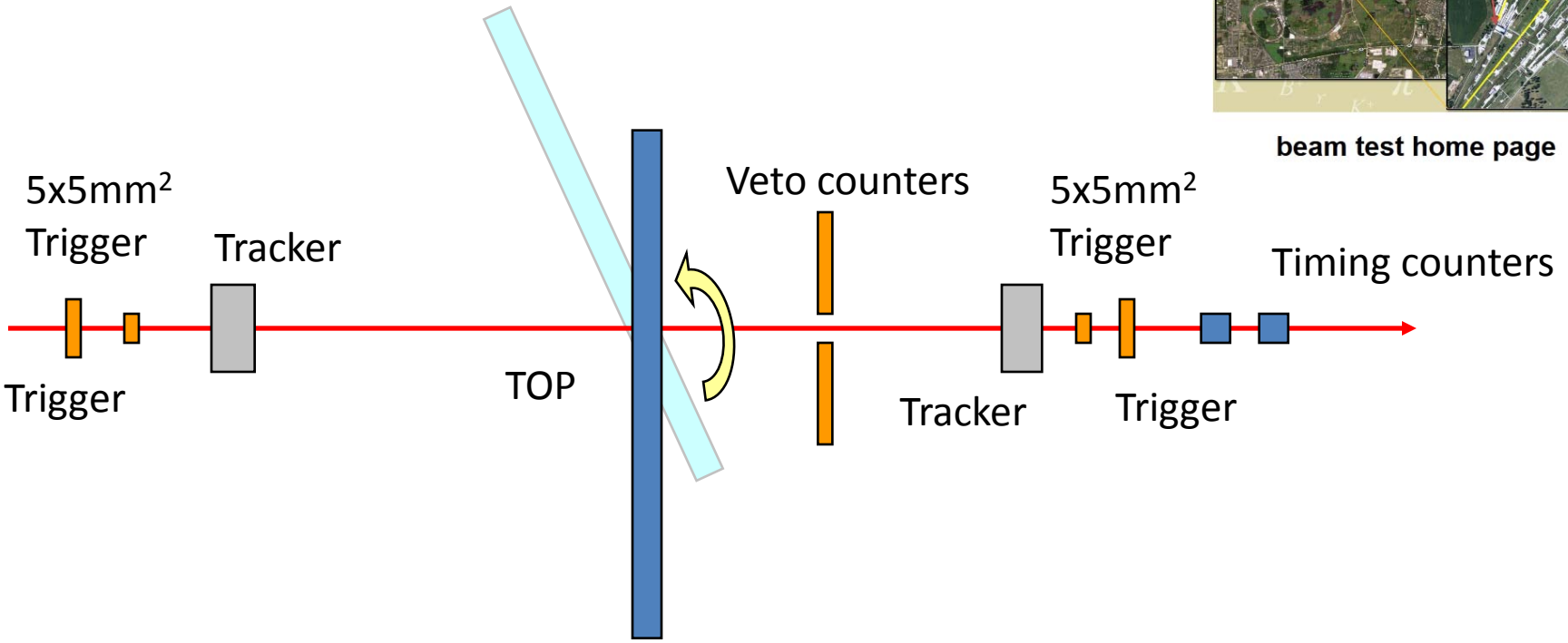
FPGA firmware consists of 3 parts:
1) ASIC/ADC driver (common)
2) Trigger feature extract (subdet. specific)
3) Unified DAQ transport protocol

Clock jitter cleaners



Previous Beam test set-up





- 2-types scintillator trigger counters
  - Larger counters (50x50mm^2) for system checks and beam alignment
  - Smaller counters (5x5mm^2) to realize a collimated beam
- SciFi tracker: 2D, ~3m distance, resolution~1mm
- Veto counters: to reduce showering events
- Timing counters: resolution~22ps

Rotation: Defines space requirements

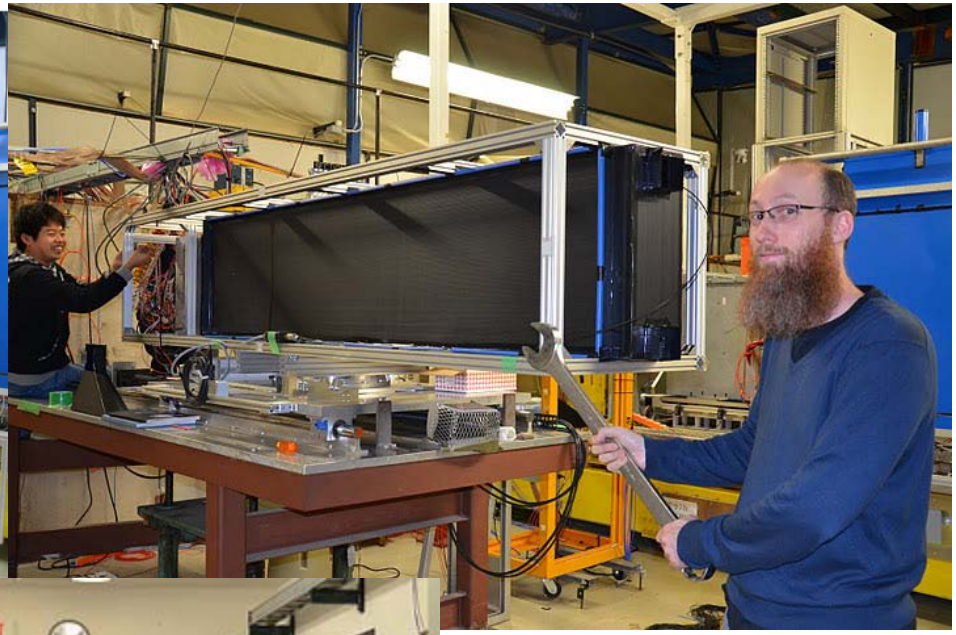
iTOP Beam Test Parameters

Beam parameters	Value	Comments
Particle Type	e-	would positrons be ok? == Yes.
Energy (2-13 GeV)	The higher the better	Reduced Multiple-scattering
Rep Rate (1-5 Hz nominal, Bursts up to 120 Hz)	120 Hz fine	Lower rate means longer run required
Charge per pulse or number of electrons/pulse	Single e-	Average less than one to minimize pile-up
Energy Spread	20% ?	Not critical
Bunch length r.m.s.	N/A	Self-determination of event time
Beam spot size, x-y, emittance	<1 mrad divergence	< few cm spot size (timing counters)
Others (cooling water, gasses, etc.)	Cooling system	We will supply

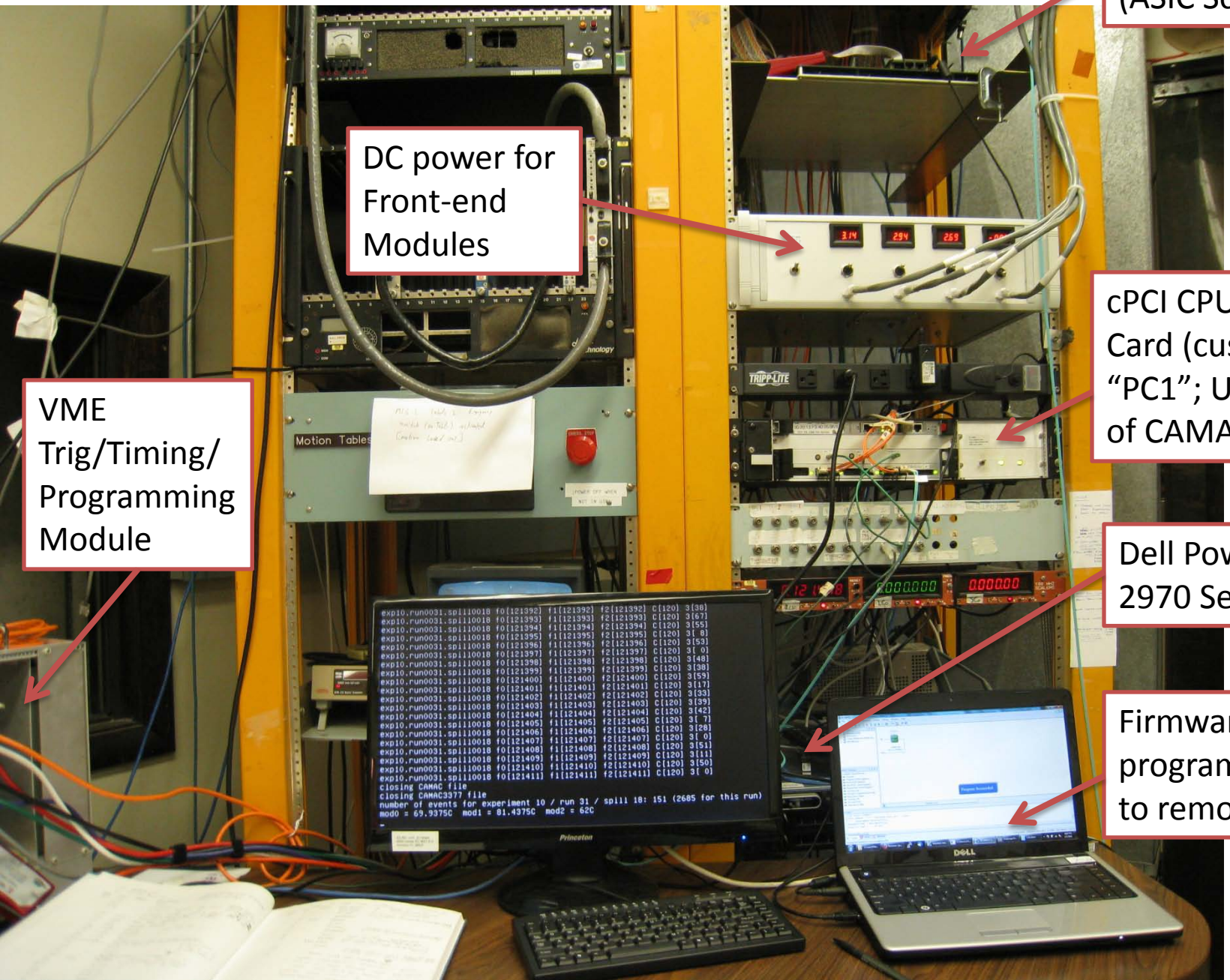
Logistics	Requirements
Space requirements (H x W x L)	1 m x 4 m x 4 m (see earlier slides)
Others (cooling water, gasses, electricity, etc.)	AC power, rack space (electronics & tracking), networking
Duration of Test and Shift Utilization	2 weeks nominal, 24 hours/day
Desired Calendar Dates	April – May 2013

Back-up – previous FNAL run

Merry Christmas from T-1019



DAQ system



Hawaii Tracker (ASIC SciFi readout)

DC power for Front-end Modules

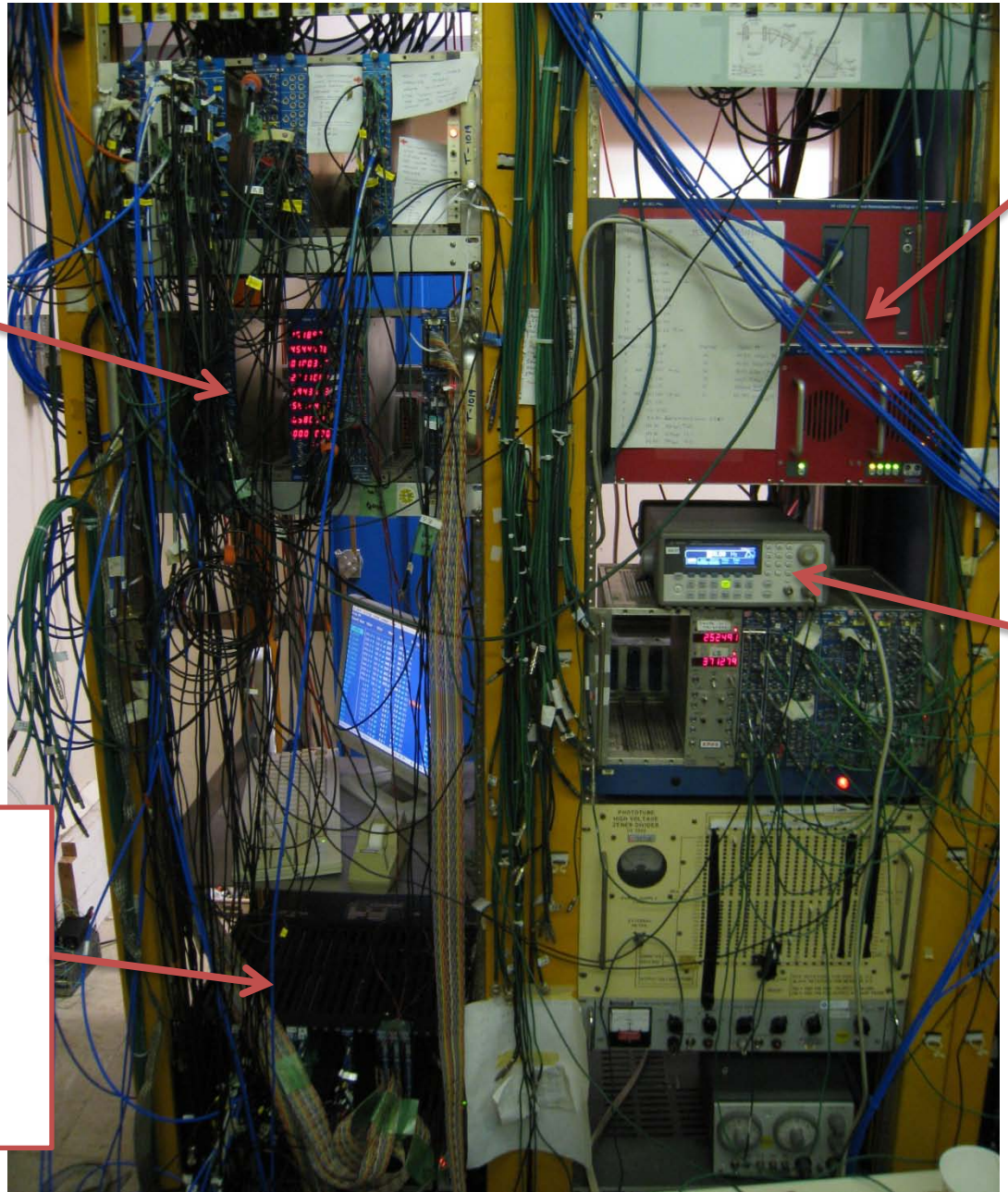
cPCI CPU and fiber Card (custom) = “PC1”; USB readout of CAMAC

VME Trig/Timing/ Programming Module

Dell PowerEdge 2970 Server (“PC2”)

Firmware programming (USB to remote JTAG)

Trigger/HV



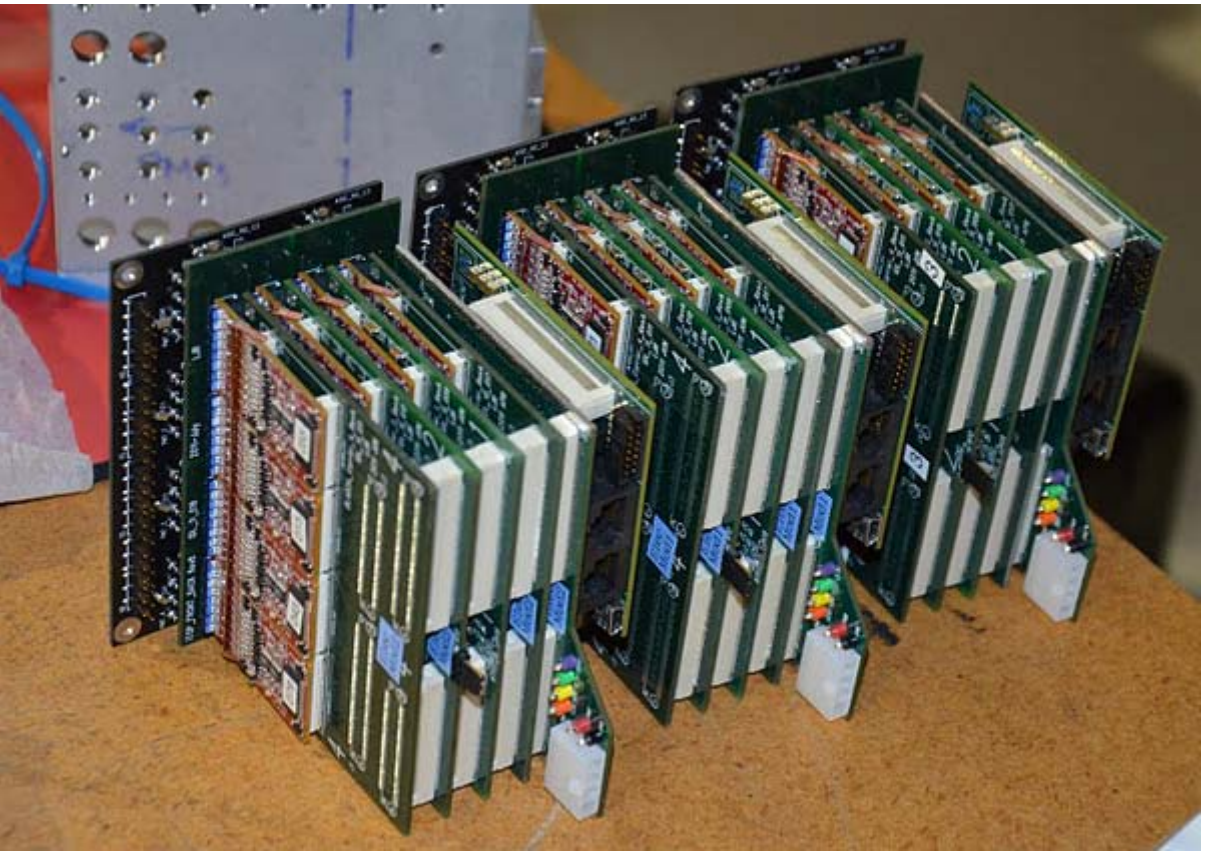
CAEN HV

Nagoya Trigger Logic/Timing Modules

Pico-second Calibration Laser Trigger

CAMAC for "SuperKEKB RF clock phase measurement, Nagoya timing counters/tracker

Event Sizes/Rates – previous & to improve



- Read 4 “windows” of 64 samples from each channel (each channel has 512 windows of storage);
- 1 fiber link/module
- Each event ~74kB/module
- Total ~ 230kB/event
- Logging rate obtained was 130-160 events/spill

(~10MB/s PCI bus + CAMAC USB)

Able to log about 100k beam events per day (~1-2 M single photons), with comparable number of laser calibration events

Will implement zero-suppress/online feature extraction

Start timing/tracking