



Calibration

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Cathode Strip Constants

| Required for Precision Track Fitting | pulses/detector | bytes/strip | file size |
|---|-----------------|-------------|-----------|
| Pedestals – None (two samples before pulse) | | | |
| Gains - $\sigma_{\text{chip}} \sim 1.2\%$ $\sigma_{\text{chip-to-chip}} \sim 3\%$ | 40 | 2 | 400K |
| Cross Talk – Universal correction ? | 400 | 8 | 1.6M |
| Linearity - Not needed ? | 400 | 10 | 2M |
| Switched Capacitor pedestals - $\sigma \sim 0.5\%$ | 200 | 192 | 40M |
| Extra Electronics Tests | | | |
| Noise | 100 | 1 | 200K |
| Shape | 400 | 10 | 2M |
| Comparator Thresholds | 2000 | 2 | 400K |
| Trigger Tests??? | ? | ? | ? |

Data Rate

$$16 \times 8 \times 96 \times 2200 = 27 \text{ Mbits/pulse}$$

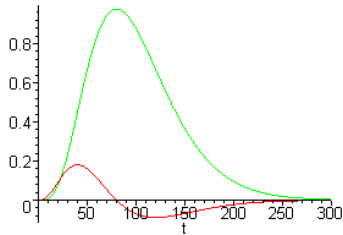
bits time strips CFEs

Strips

200,000 cathode strips

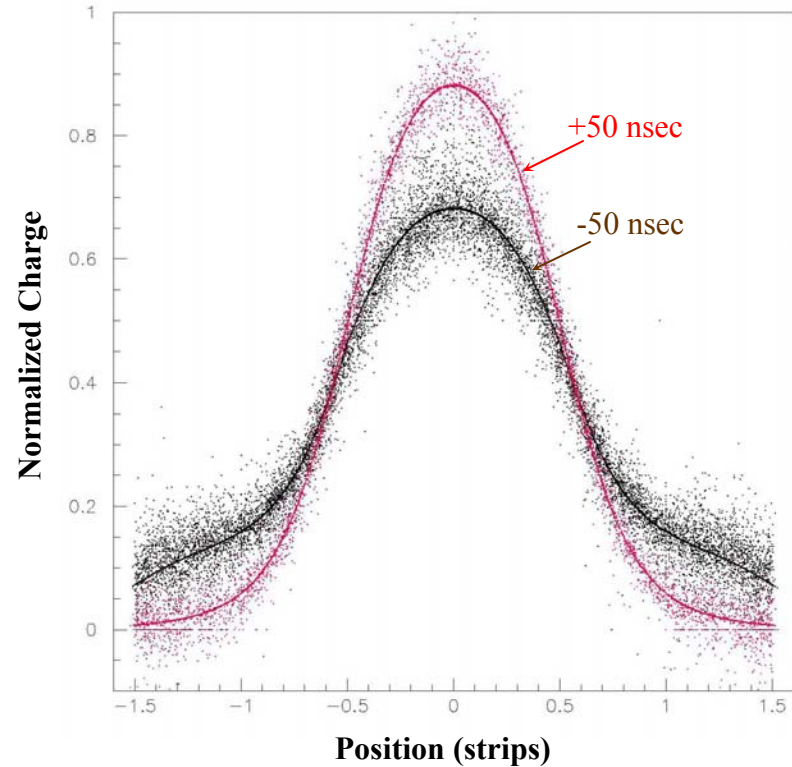
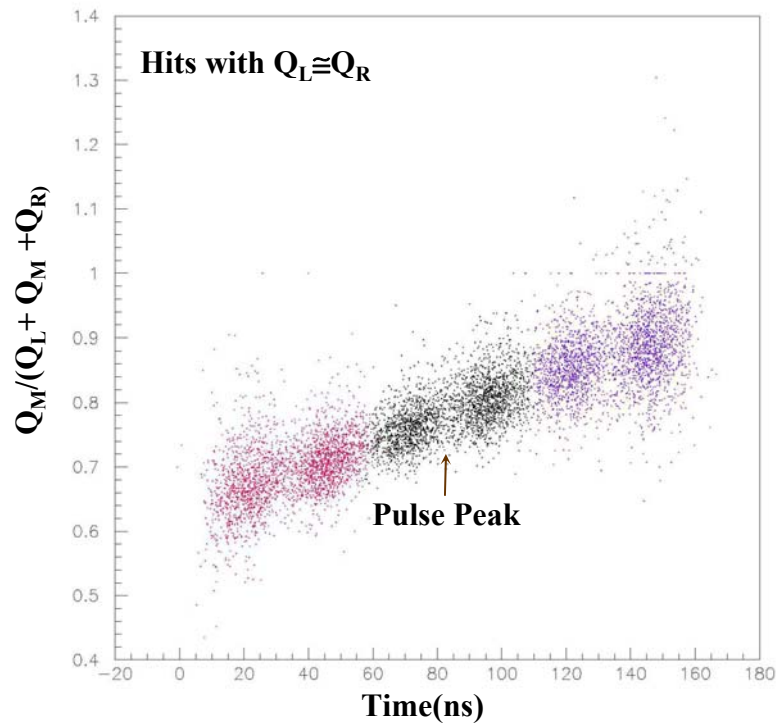


Cross Talk Correction



Cross talk depends on Buckeye Speed + Strip Capacitance

- independent of position along a strip
- mostly capacitive but slightly resistive





Cathode Calibration Hardware

BUCKEYE has internal shift register which controls calibration

JTAG Shift Register Modes

Normal

Precision Ext. Cap (<1%)

Int. Cap Small (1x)

Int. Cap Medium (2x)

Kill

Buckeye Calibration

pulser 12 bit DAC (~1.2 mV pulse steps)

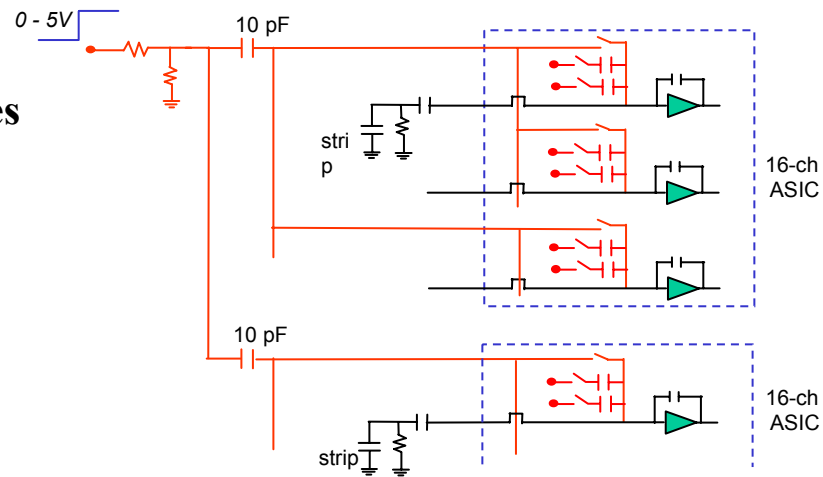
readback 12&16 bit ADC

time delay 7 nsec steps

Trigger

threshold 12 bit DAC 0-3.5V (~0.9 mV steps)

readback 12 bit ADC

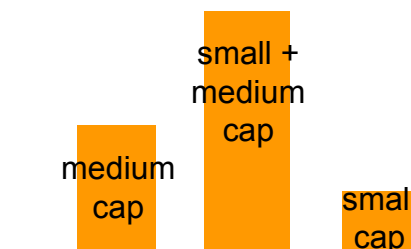




Cathode Calibration Hardware (cont.)

Precision DAQ and Delay on Motherboard Control Pulsing

- CCB board generates pulse and LVL1ACC signals
- Precision Ext Cap. Allows gain, linearity, crosstalk, timing measurement. Oscilloscope-like output for each channel.
- Any channel can be selectively killed
- Trigger logic and thresholds can be checked using small and medium cap



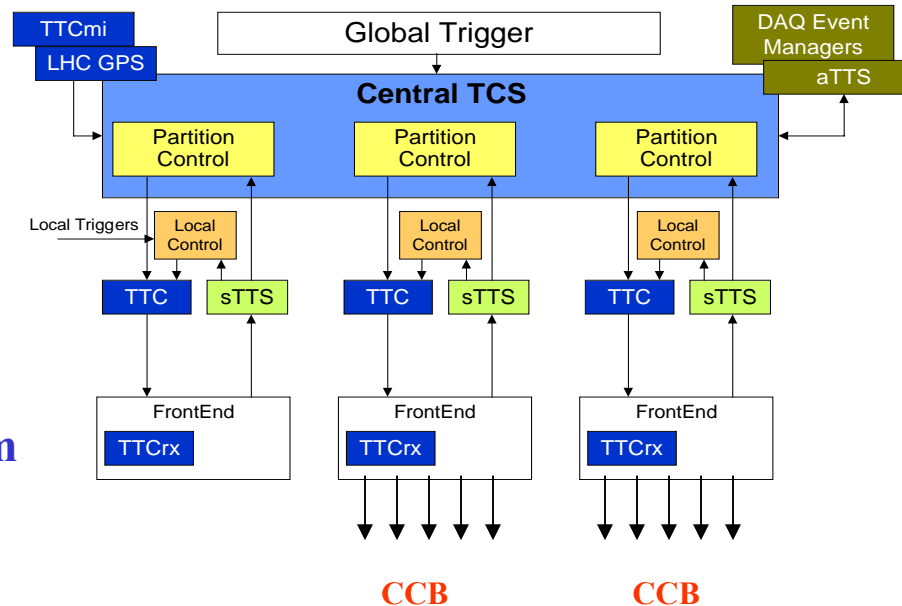


Cathode Calibration Overview

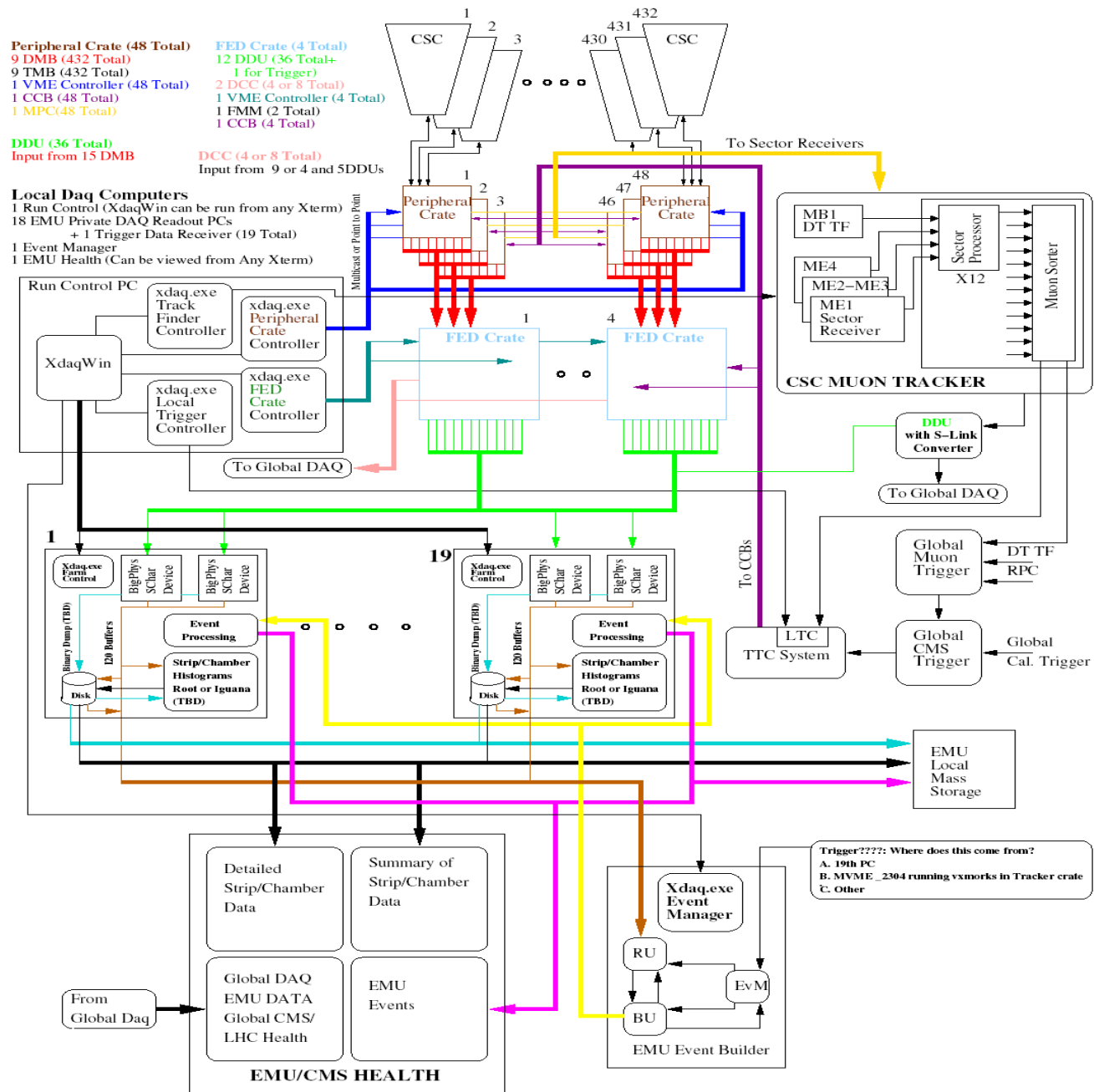
- Calibration will be done with both: 1) spy data, and 2) electronic pulsing
- Pulse calibration will be done offline during beam fills.
- Constants are expected to be stable. Frequency determined later.
- Constant analysis done on 18 PC farm.

The Missing Piece

Local triggers will be handled by the CMS L1 Trigger Control System



EMU has 2 L1 Trigger Partitions





Generating A Typical Pulse

Slow Control (VME in parallel/broadcast)

- 1) shift buckeyes**
- 2) shift time offset**
- 3) shift pulse voltage**
- 4) readback pulse voltage value**

Cable to Local Control

- 5) generate global pulse, LCT, L1A**

18 PC Farm

- 6) data flows through gigabit fibers (2/pc) to analysis**

...



Summary

- **Calibration expected to be fast ~500 pulses/sec**
- **Data rate to PC's (2 fibers) 600 Mbit/s**
- **Analysis distributed over 18 PCs**
- **Constants stored on Large Raid Array**
- **Constant files small 4-40 Mbytes**