VETROC DAQ/GTP Trigger for GRINCH

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Evan McClellan

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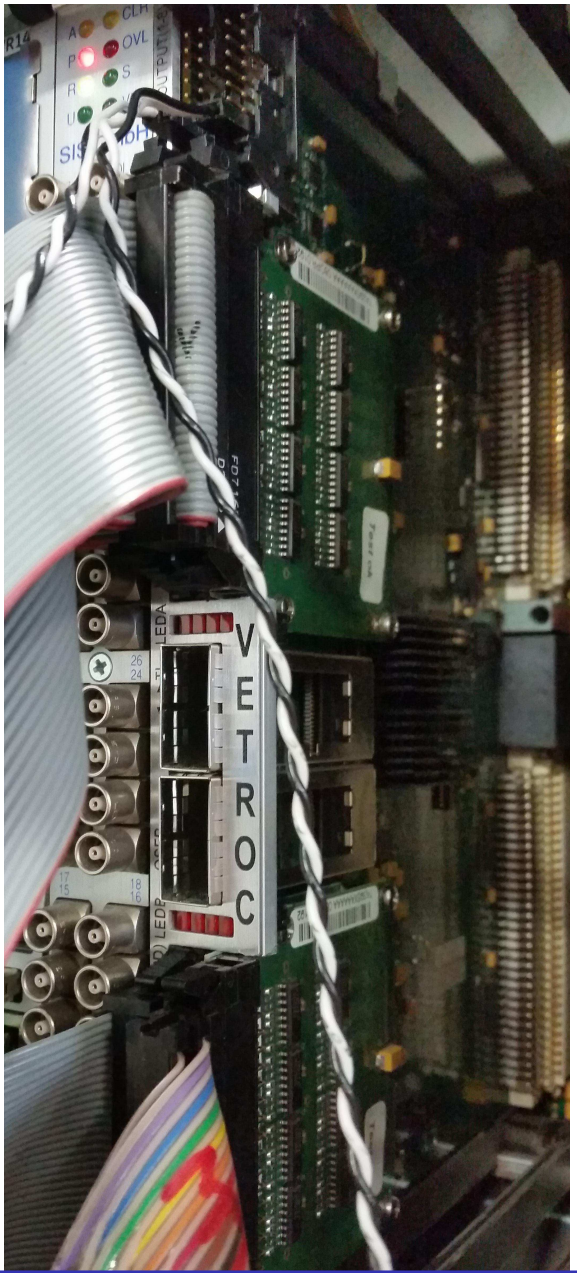
Pronunciation

- ‘vee tee rock’ – Bob Micheals
- ‘veet rock’ – Todd Averett
- ‘vet rock’ – Ben Raydo (and me)
- Can we attain pronunciation unification?

VETROC

- custom VME/VXS FPGA TDC/trigger module
- 128 LVDS inputs (with expansion cards)
- 1ns time resolution on TDC readout
- streams hits to VXS backplane
  - 32ns resolution
- TDC records both edges of hit
- Time-over-threshold 'ADC' possible



GTP - Global Trigger Processor

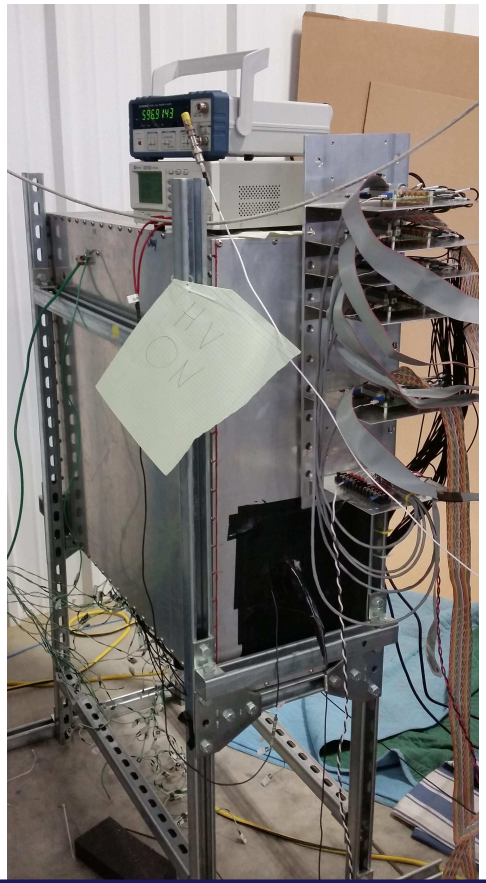
- Reads in data streams from VXS backplane
- Forms trigger decision in FPGA logic
- Internal 250MHz pipeline
- up to 16 input streams
  - using 2 lane serial VXS, 4 Gbps per VETROC
  - 128 channels, 32ns resolution (no compression)
- fixed trigger latency (780ns)
- up to 30 output trigger bits

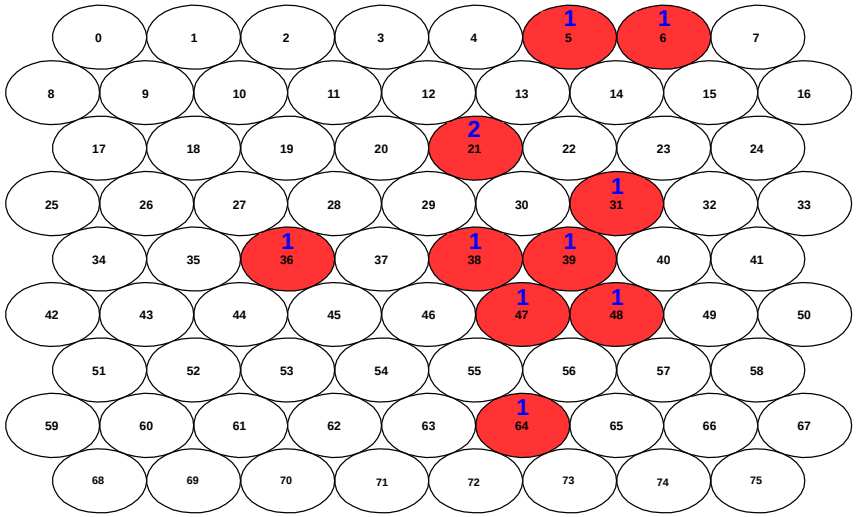
GRINCH

- 510 PMTs (4 VETROCs)
- Trigger rate up to 5 kHz
- background rate up to 1 MHz per PMT
  - 10% occupancy for 100ns window

Prototype Test Setup

- 1/6 GRINCH array (76 PMTs)
- 5 NINO cards
- 1 VETROC
- 2 LEDs within box





Rate Tests

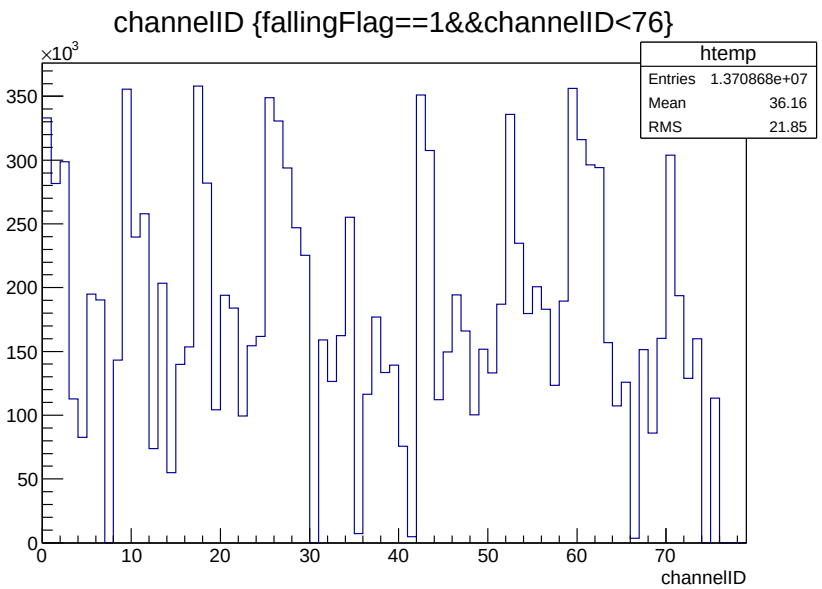
- use 10kHz clock trigger
- Create high-occupancy events with LED
- wide TDC windows: $1\mu s$
- Network Bottleneck!

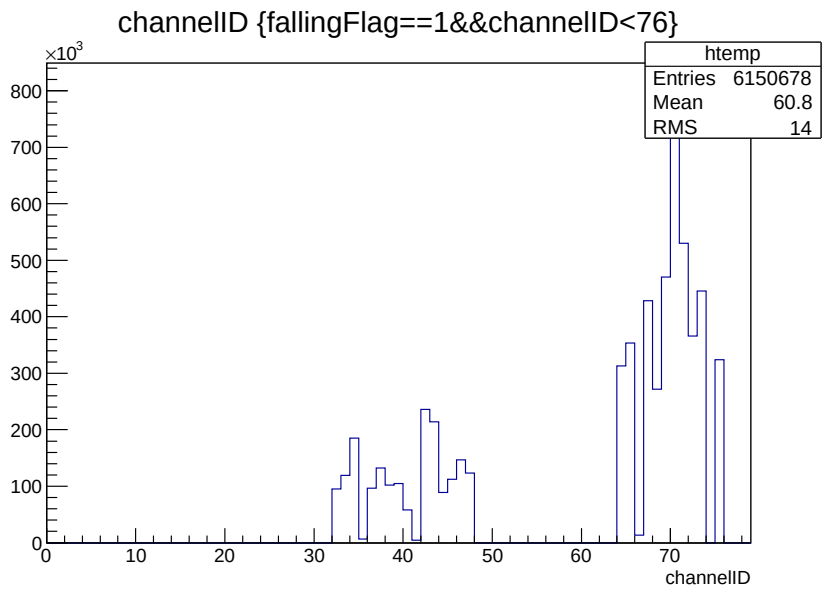
- Upgrade switch and ethernet card to 1 Gbps

Rate Tests

- upgraded network
- $1\mu s$ TDC window
- 10 kHz clock trigger
- 'random' background with LED
- 5 MHz clock into channel 76

- perfect performance through 134/76 avg occupancy
- then, empty groups of 16 input channels

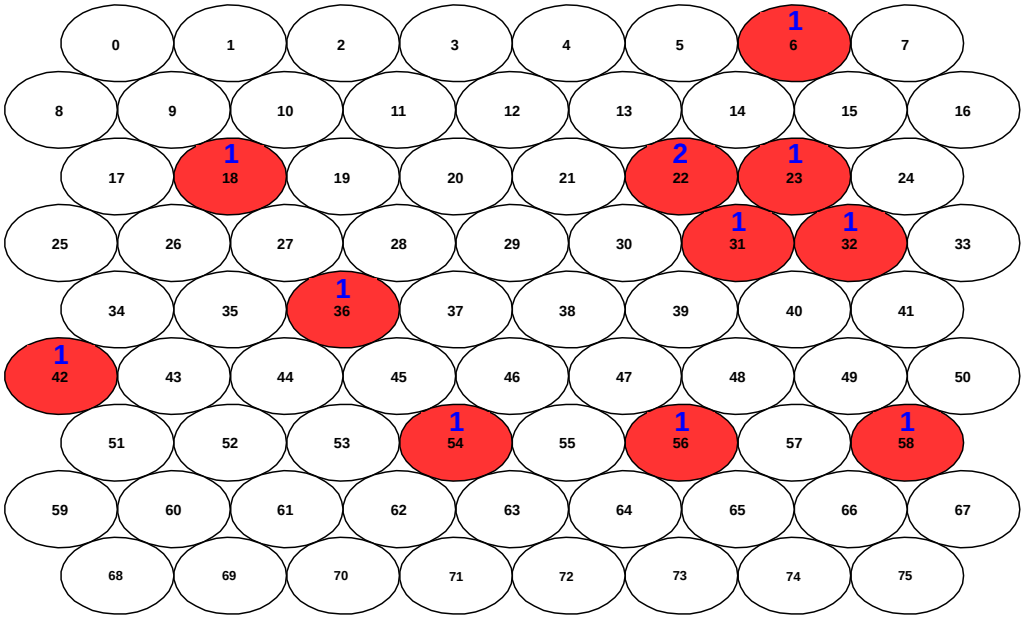




Cluster Trigger

- Scott Barcus, cluster algorithm in GTP
- cluster size: 1-4 (so far)
- It works!

- Need input from simulation for real cluster sizes/shapes



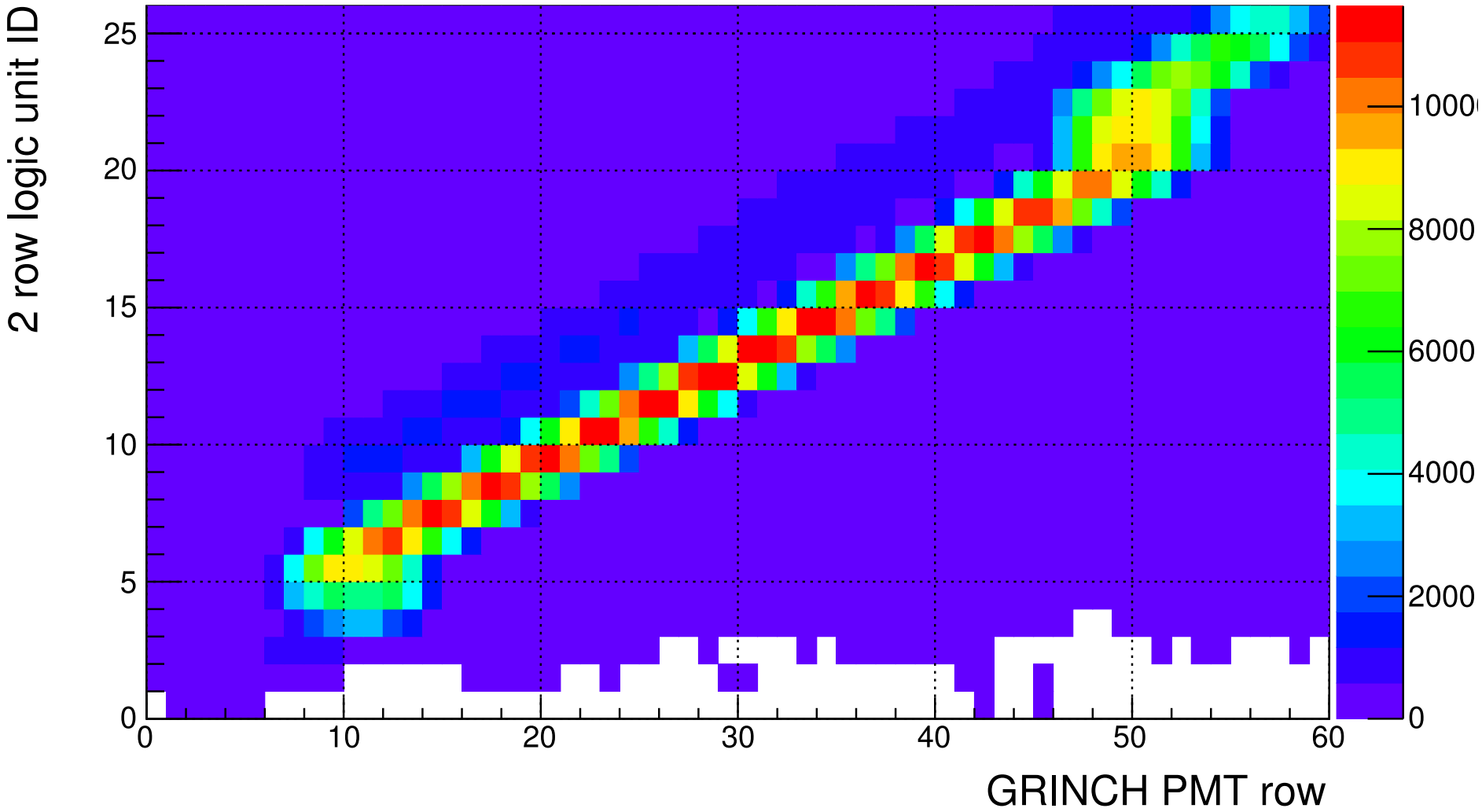
Global Trigger?

- read other detectors into GTP
- Sh/PS: 26 T1, 26 T6 ... 52 signals
- Hodo: 200 inputs
- 2 additional VETROCs: 256 available channels

- Stream signals to GTP (32ns resolution)
- Form global trigger with hit-position correlation

- Also could use VETROCs as TDC readout?

GRINCH/Calo Vertical Hit Position Correlation



Plot credit: Eric Fuchey

Next Steps and Open Questions

- With 4+ VETROCs, bottleneck will be network
- Can we upgrade to 10 Gbps?
- Can/Should we put calo and hodo in the GTP trigger?

- Test four-VETROC configuration
- continue to study VETROC TDC efficiency vs rate
- optimize cluster trigger (based on simulation)