Calorimeter Beam Test Plans

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UC EIC consortium meeting

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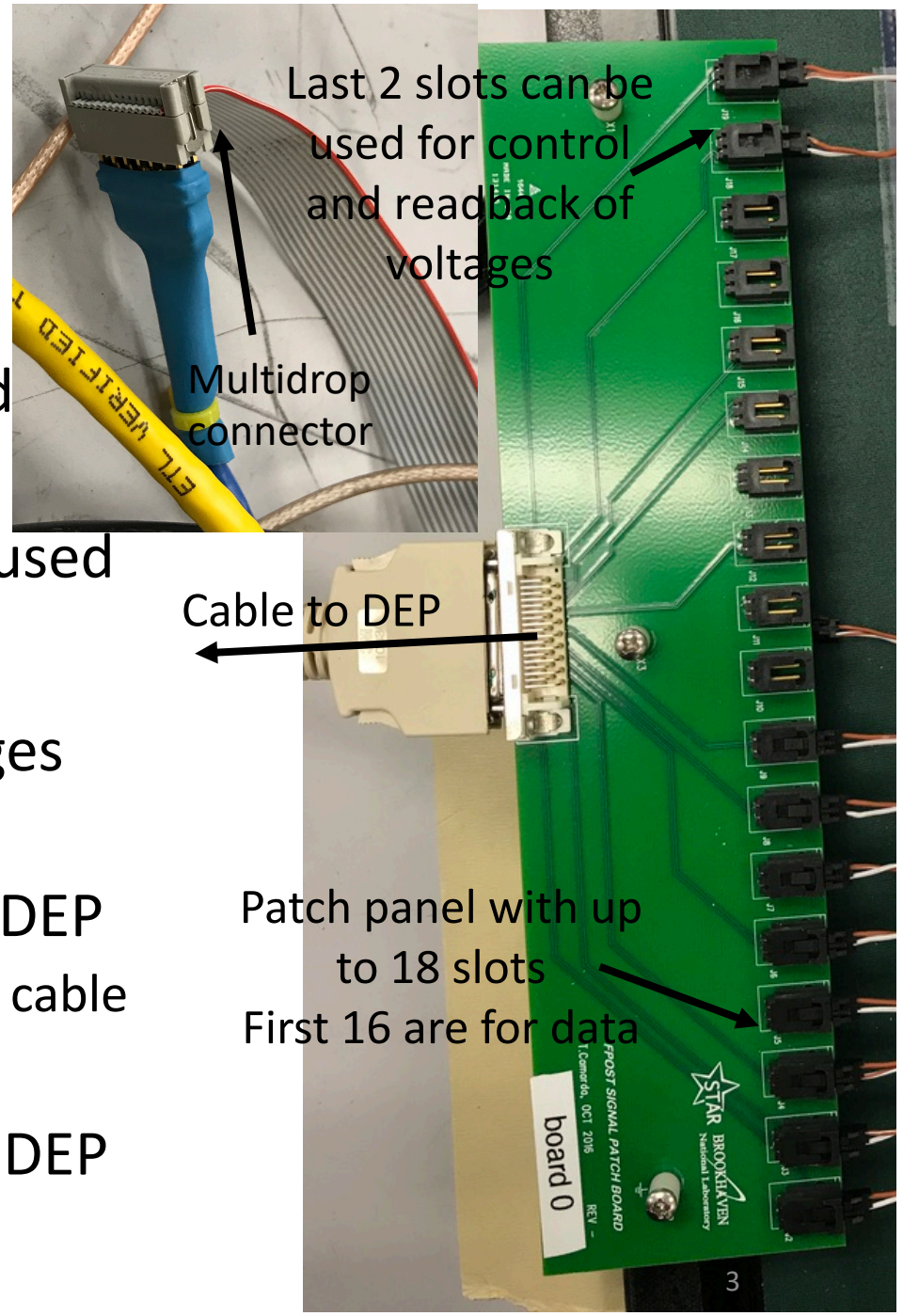
Recap of Run 19

- Successful test of preshower, Ecal, and Hcal for STAR forward upgrade
- Data analysis still underway
  - Hannah
  - Xilin
- What we need to test
  - Ability to control voltages using DEP
  - Change shaping of pulse to improve on trigger and timing
  - What type of SiPMs should be used for final preshower design
  - Gains of Ecal towers for analyzing Run 19 data

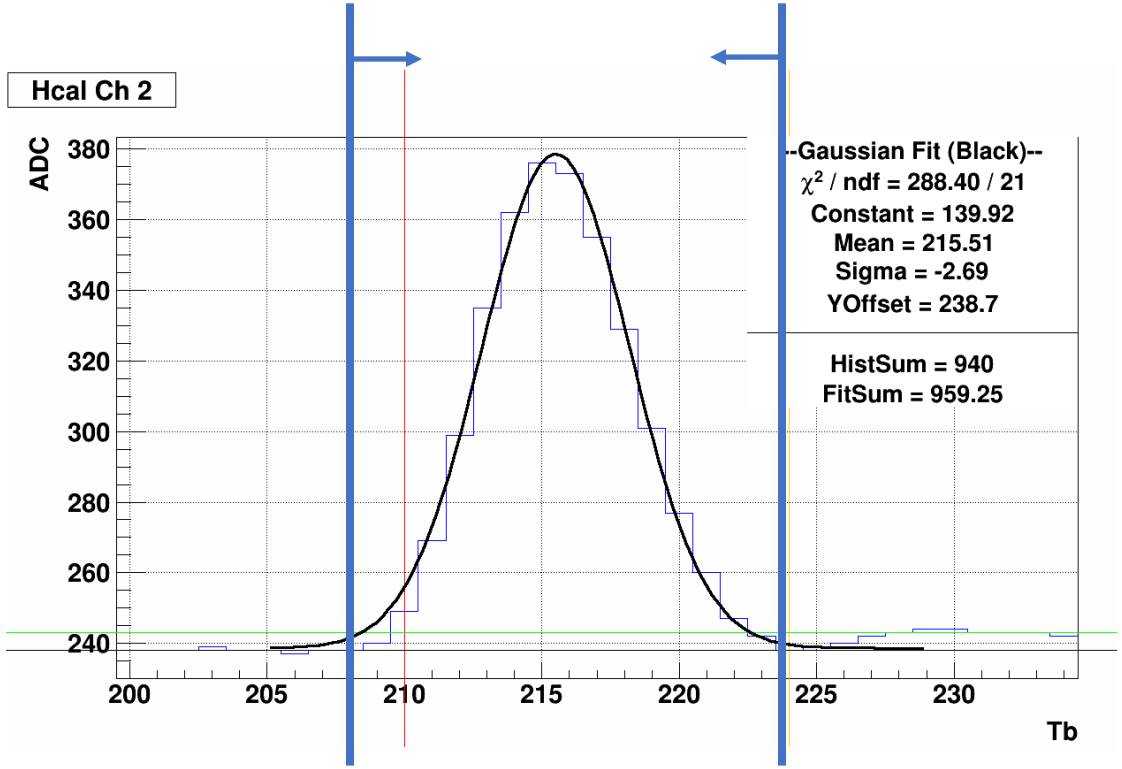
Voltage control using DEP

- Voltage control was done through TUFF box and Tonko's slow control software
- In some setups simply a power supply box was used
- Need a more robust way to control voltages
- DEP boards allow us to set and read back voltages from FEE cards
- Need adapter on power cable to interface with DEP
  - Tim Camarada has designed and produced one such cable
  - It will be installed
- Need to new control software to interface with DEP
  - Paul Nord



Changes to shaping of pulse

- DEP allows readout of the data in timebins so we can see signal in real time
- If the signal is too wide there would be overlap between each RHIC crossing
- Narrower pulse shape should help with this problem
- Also narrower pulse shape makes it easier to find peak which is important in the trigger algorithm
- Gerard is designing and testing new FEEs for this



As can be seen currently about 10 timebins
Want to reduce by maybe factor 2 so only 5 timebins

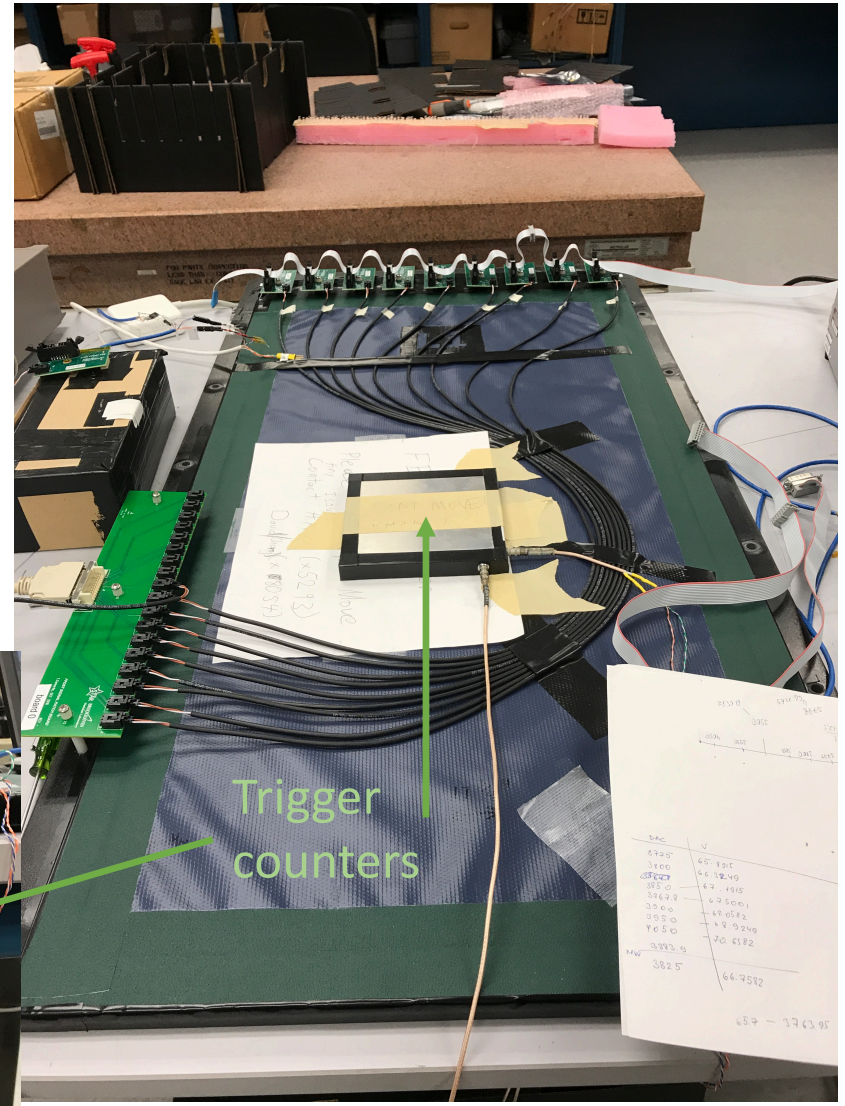
Type of SiPMs to use in preshower

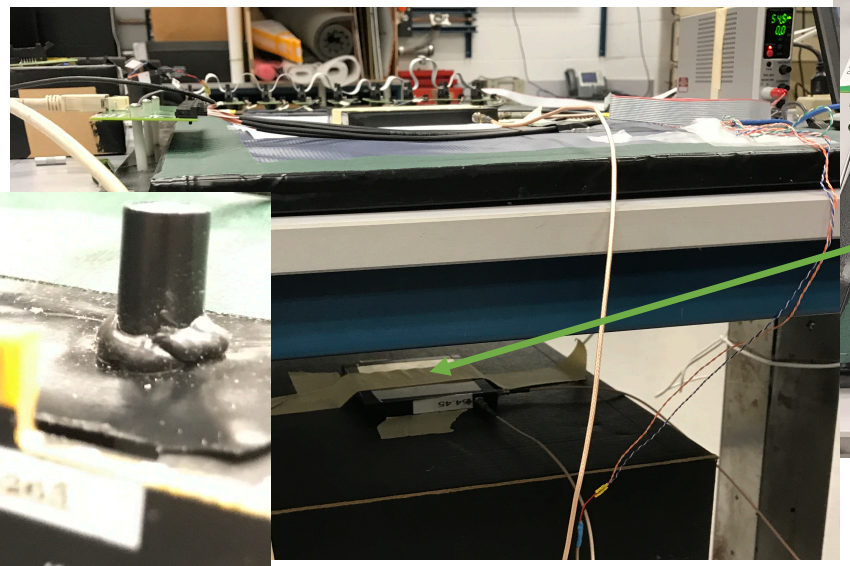
- The STAR forward upgrade will re-use the postshower detector as its preshower detector (fPRE)
- The Run 19 data shows that the preshower was working fine but noisy due to radiation damage
- This means all the SiPMs will have to be replaced on the old postshower
- The question becomes are the SiPMs we plan to order for the calorimeters have sufficient performance to use for the preshower or is a separate model SiPMs need to be ordered
  - One is a SiPM with 15um pixel pitch used for the calorimeters
  - The other has a 50um pixel pitch and is similar to what we had but newer

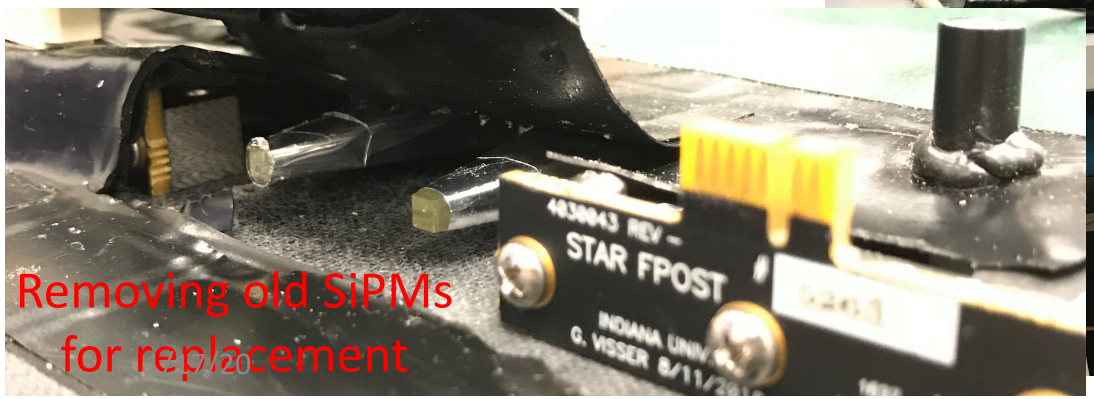
Determining SiPMs

- To determine which SiPMs to use we have set up a cosmic test stand in the lab
- DAQ setup same as Fermilab Test from Oleg
- We characterized the existing SiPMs
- We installed both models of SiPMs alongside the old ones
- Repeat same tests

fPRE prototype
(Postshower layer 1)



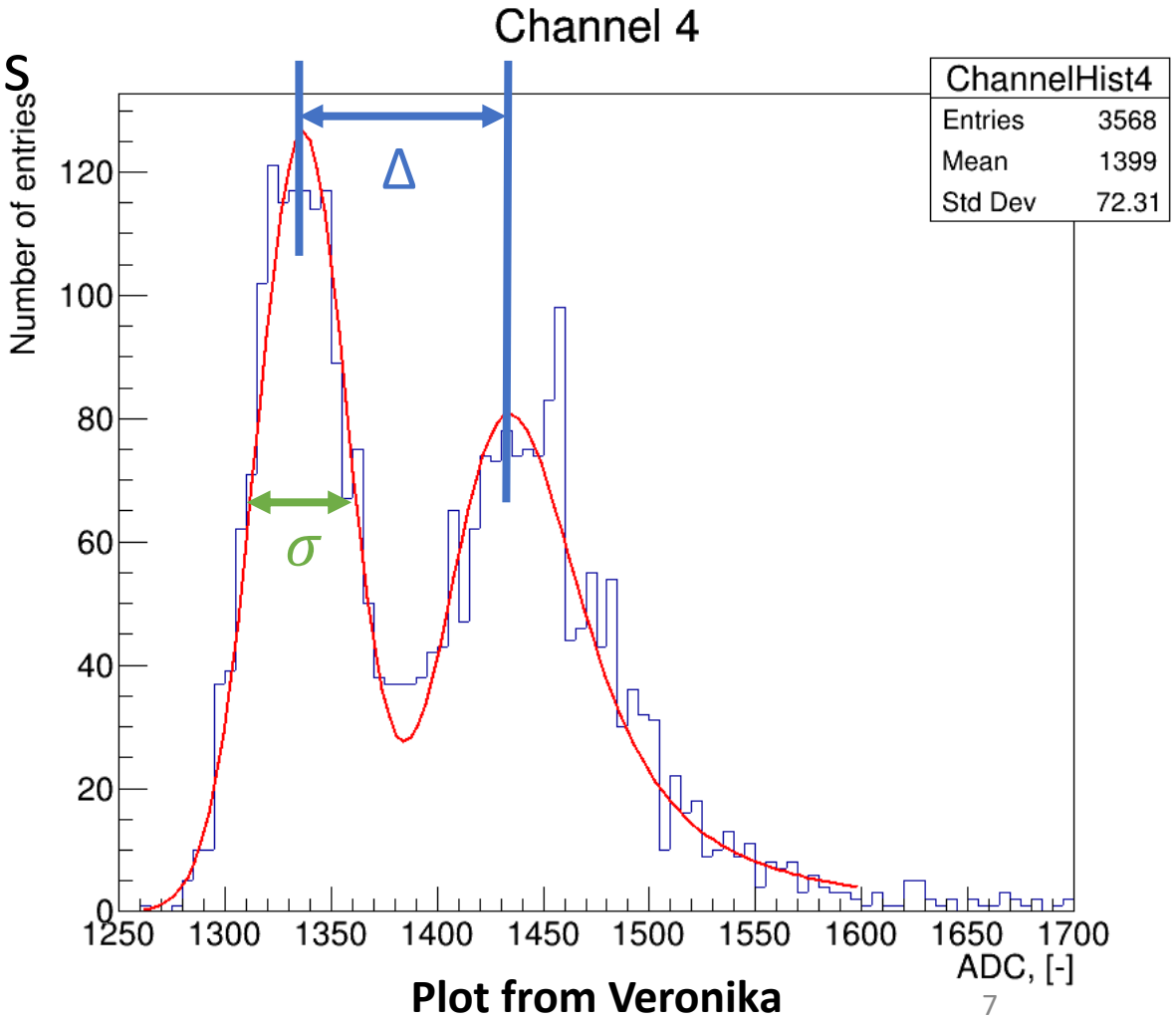




Removing old SiPMs
for replacement

Characterizing SiPMs

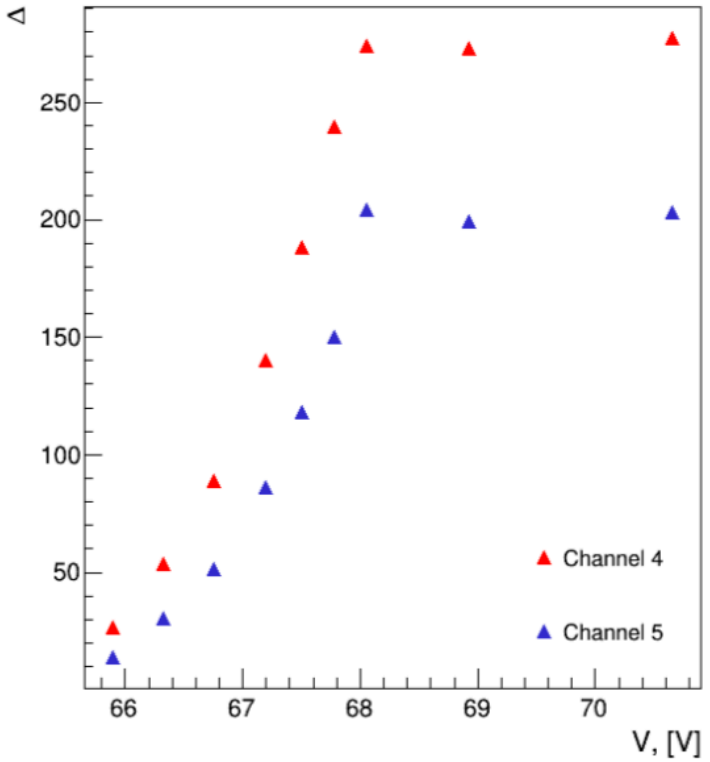
1. Take cosmic data at various voltages
2. Fit MIP peak and pedestal
3. Compute the difference between pedestal peak position and MIP peak position (Δ)
4. Signal to Noise (S/N) defined as Δ/σ, where σ is the width of the pedestal

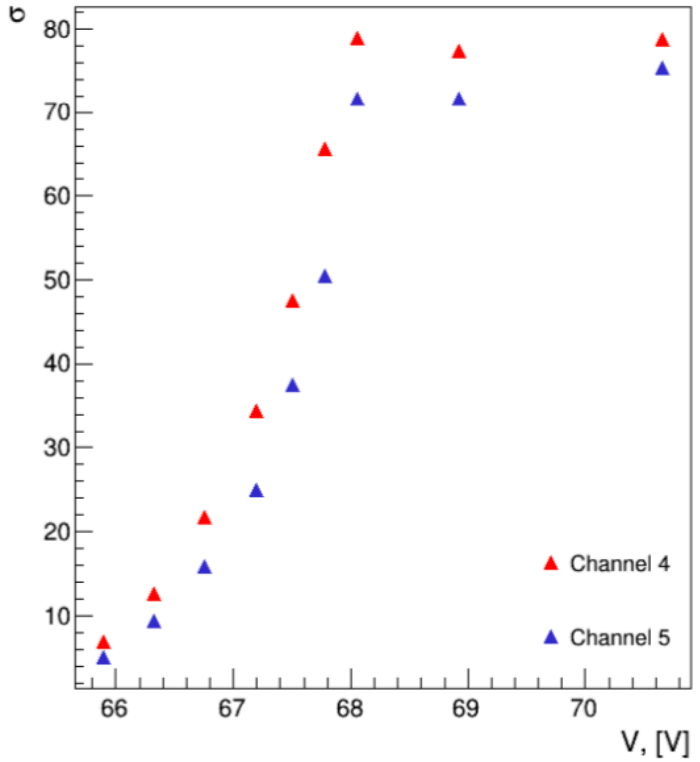


Plot from Veronika

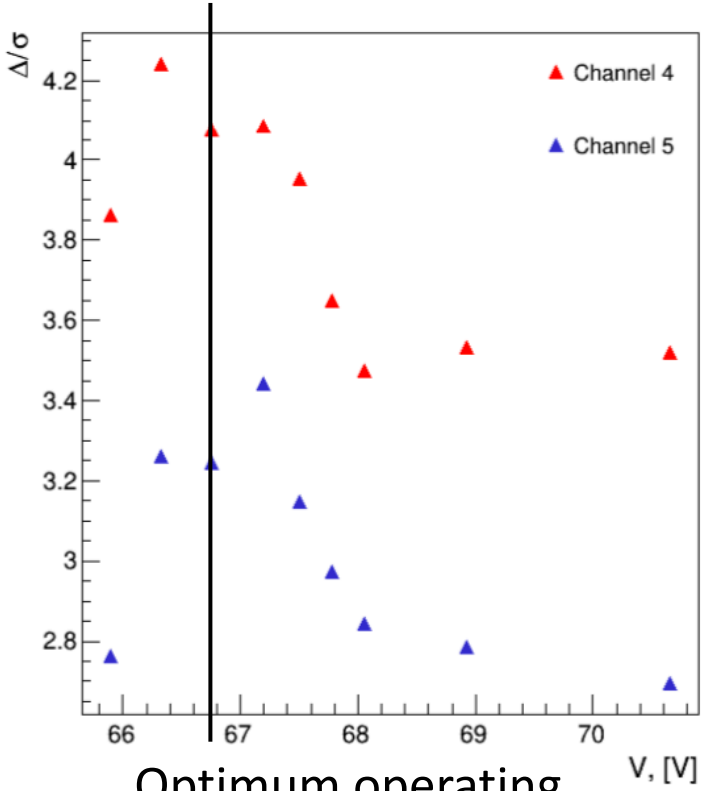
Results from new ones

- Plots below for old SiPMs showing Δ, σ, and Δ/σ as a function of voltage





Plots from Veronika



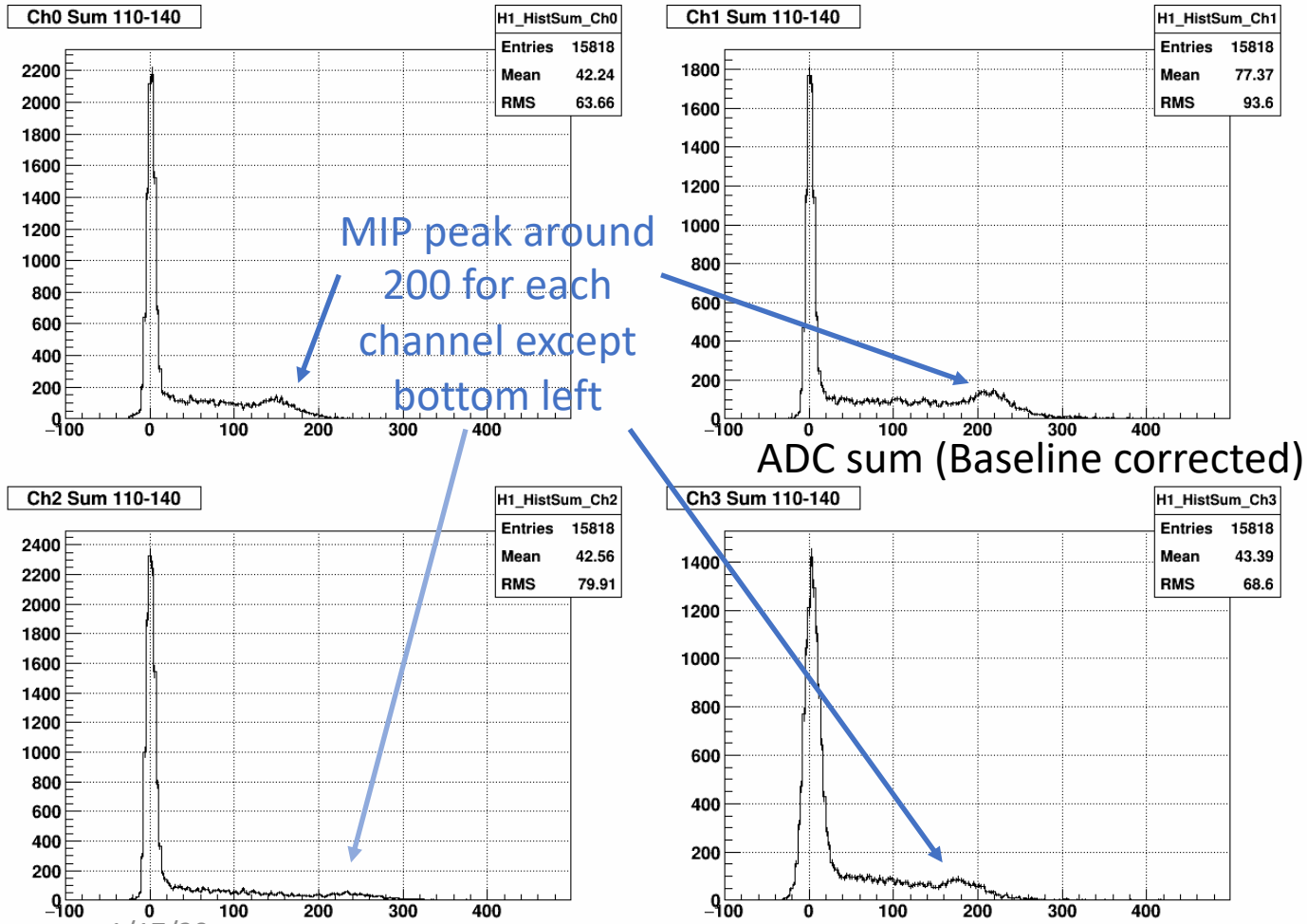
Optimum operating voltage is peak in this plot

Gains on Ecal

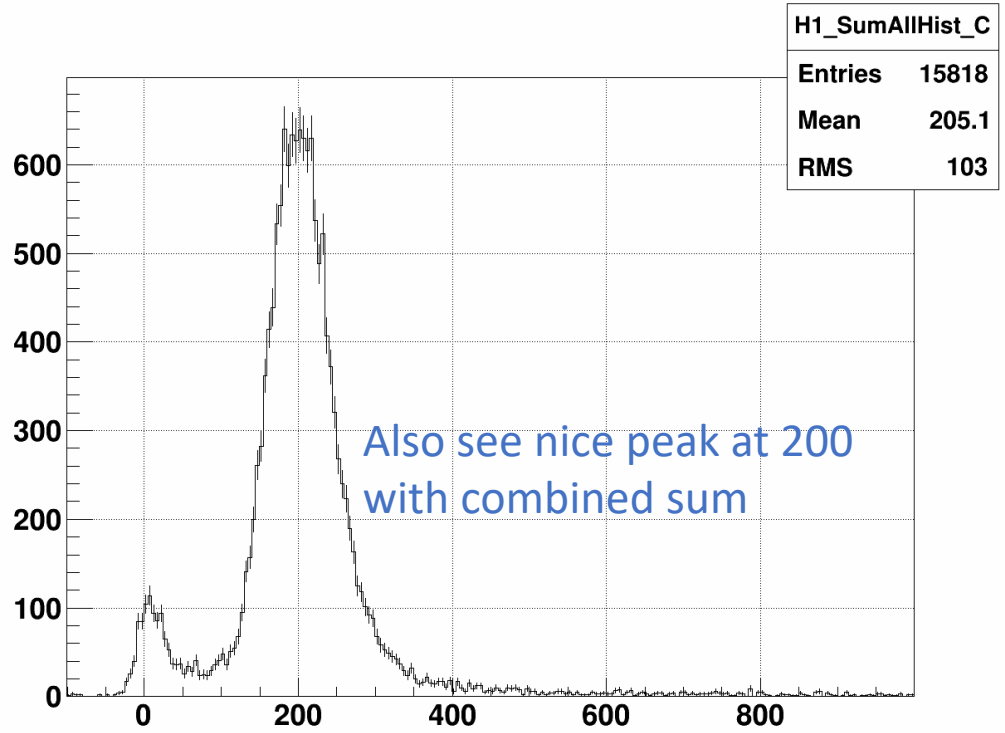
- Use DEP boards to take cosmic data with 2x2 tower of Ecal
  - Use same settings and voltages as Run 19
- This will help us determine the gain for the Run 19 data
- Need the gains to accurately compute energy in the towers
- Also useful in testing DEP control of FEE cards
- Test peak finding software

Results from Ecal Cosmics

Results from Individual channels



Total Sum all 4 towers



- Peak at 200 means gain is roughly 0.3GeV/200=0.0015GeV/ch
- Still need to look at isolated towers and do fitting

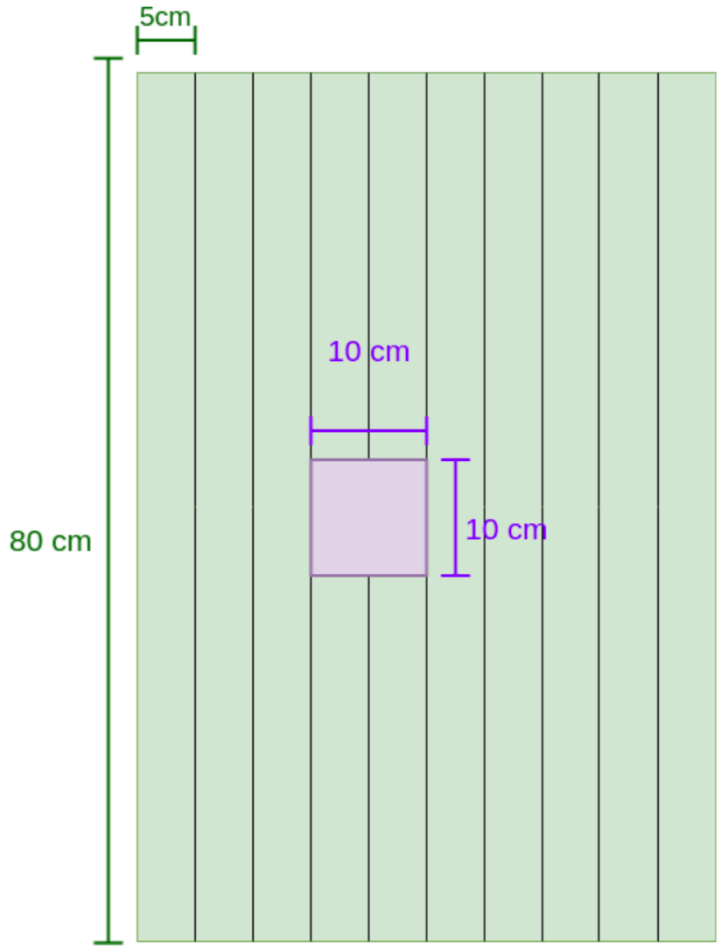
Conclusions and Run20 outlook

- Finish taking data from cosmics
  - Clear method developed using old ones
  - Will apply same principles to new ones
- fPRE prototype installed with new SiPMs
  - Testing underway
- Prepare Ecal with new FEEs
  - Towers installed but no electronics connected
- Install fPRE prototype at STAR
  - DEP control and readout
- Test systems and take data!

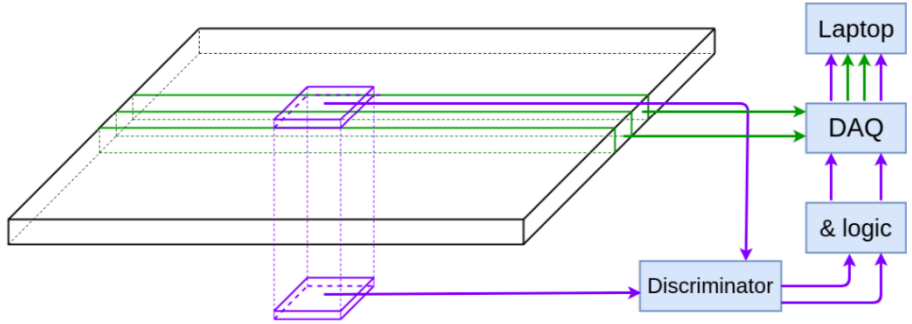
Backup

FPRE setup

Top view



Side view



- Trigger counters 10x10 cm
- 9 slots 80x9 cm
- Distance between trigger counters
  ??? will be measured on Monday
- Gate width: 80 ns
- Sensitivity: 0.2 pC/count

Slide taken from Veronika