

QC7:Electronics Test

Baktash Amini

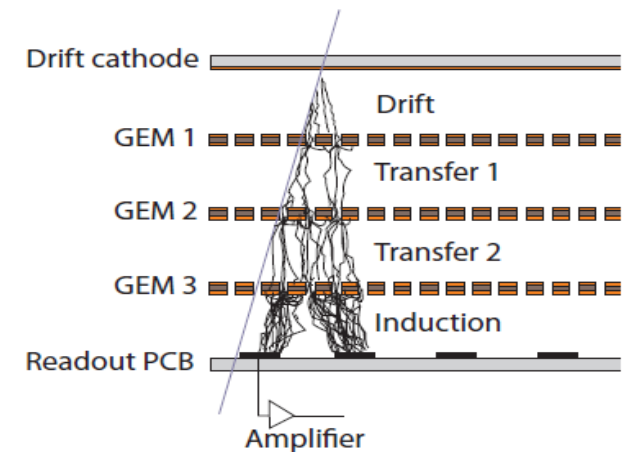
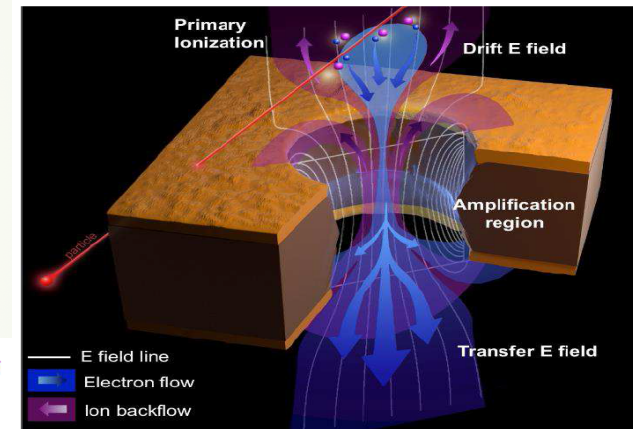
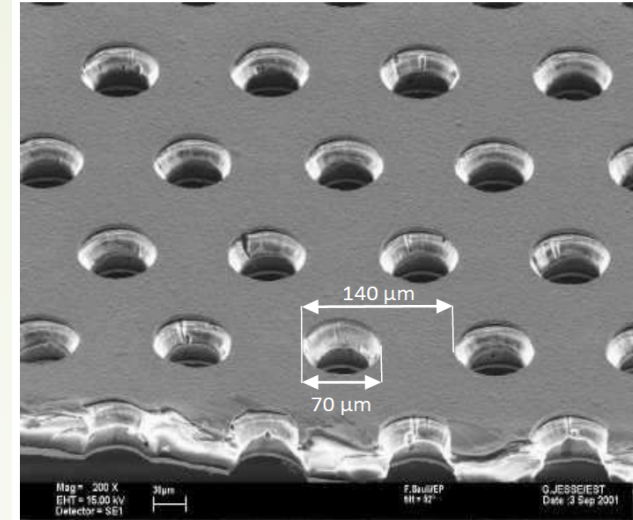
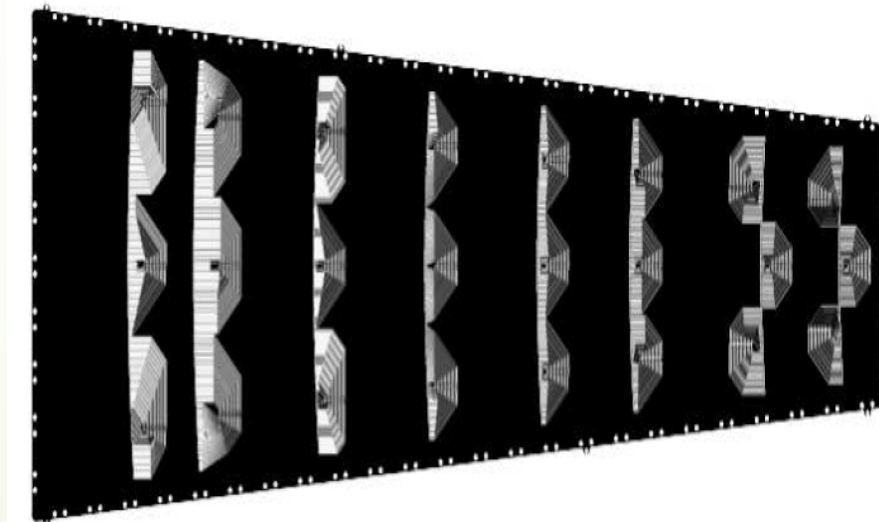
**Supervisor: Jared Sturdy and
Marek Michal Gruchala**

The Triple-GEM detector

- The GEM detector is a gaseous detector and it requires high electric fields.
- The GEM foil is surrounded by gas.
- An muon particle on the detector creates electron-ion pairs in the gas.
- The electrons drift by the action of the electric field to a readout electrodes, where they induce an electrical signal read by the acquisition electronics.

The readout board

- After the amplification by the triple-GEM, the charges are drifted to the electrode.
- The readout electrode is divided in strips.
- The readout board is divided in 384 strips along its width and in 8 sectors along its length.

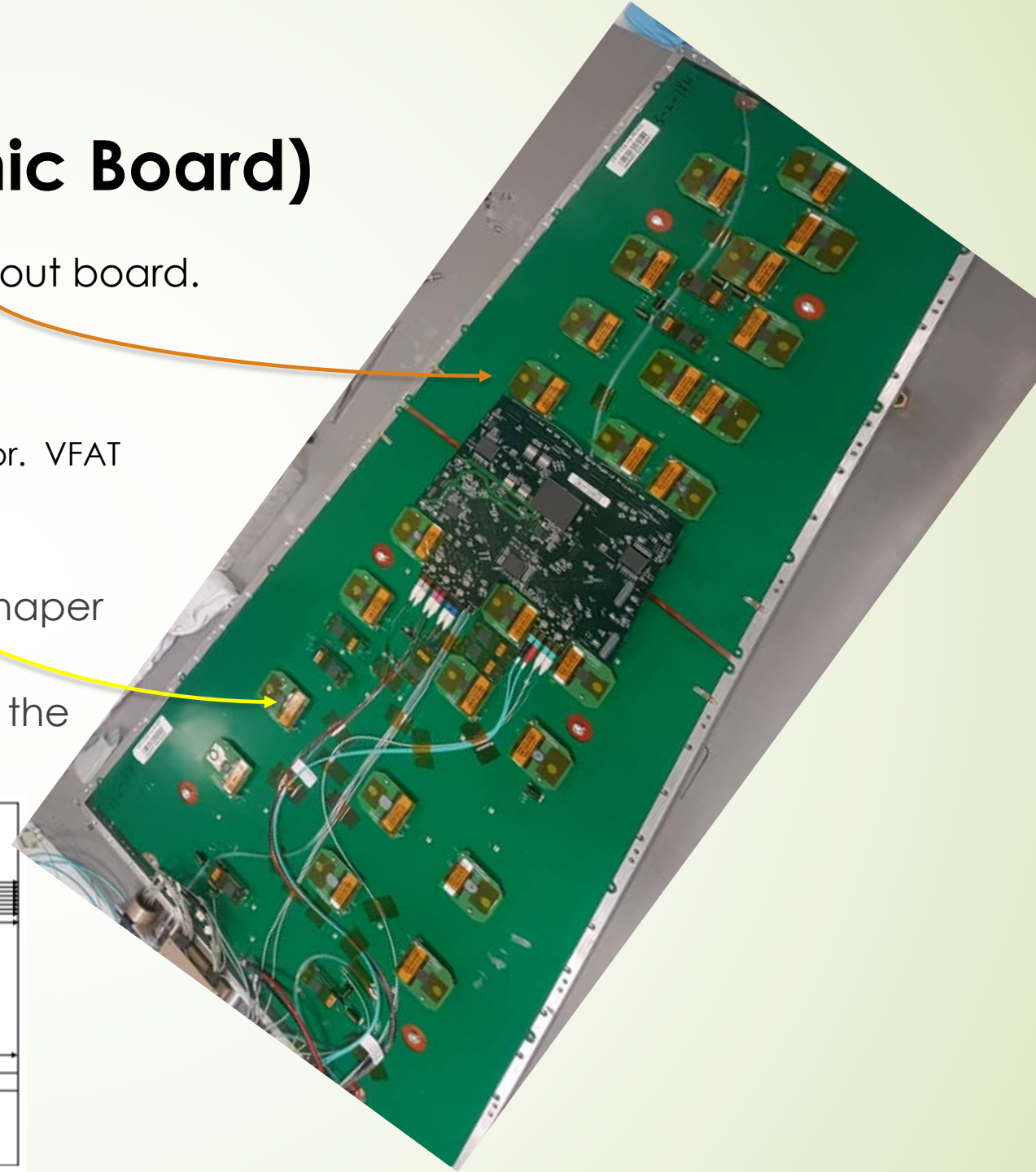
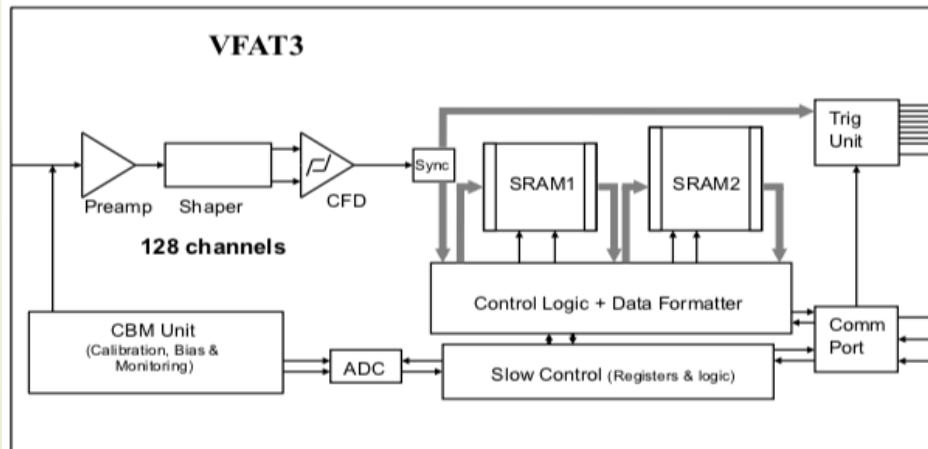


The GEB (GEM Electronic Board)

GEB which comes at the top of the readout board.

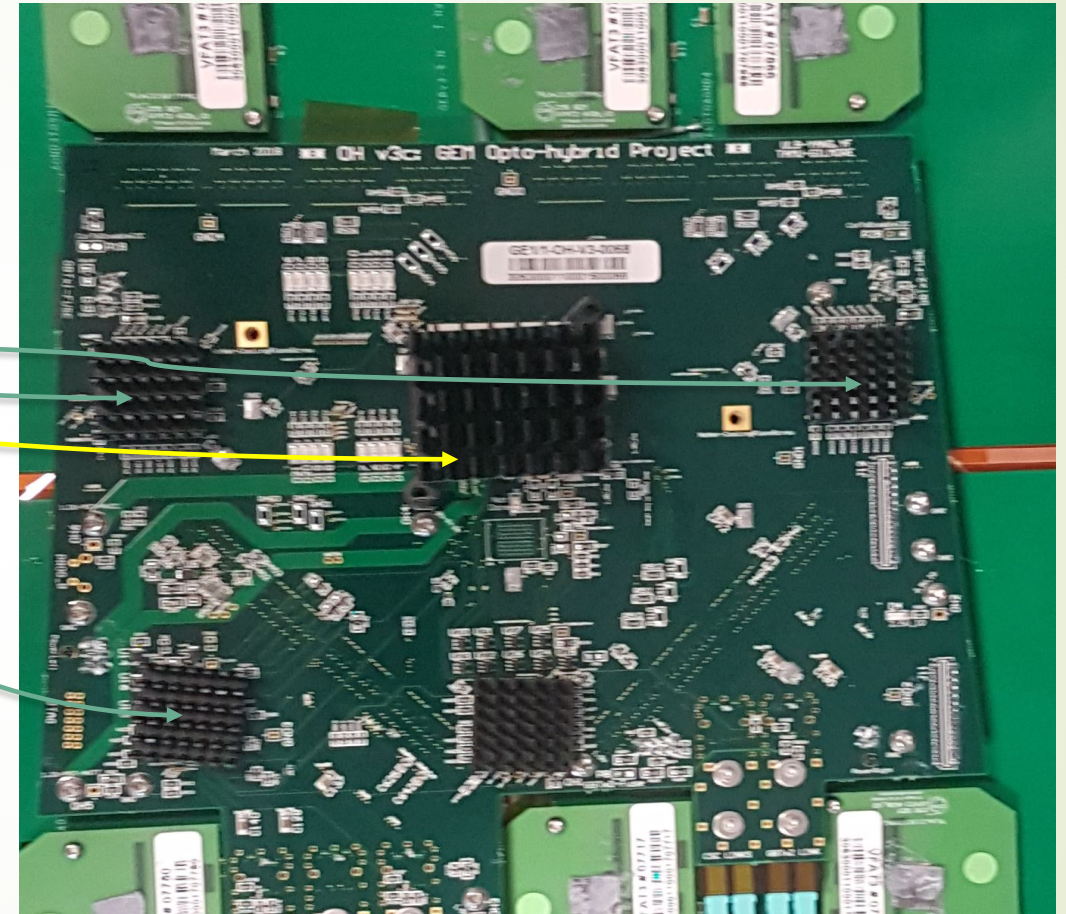
The VFAT chip

- Each VFAT is connected to 128 strips of sector. VFAT has 128 channels.
- Each channel is read at 40 MHz
- Each channel has a preamplifier, a shaper and CFD.
- VFAT3 does all its communication via the Comm-Port.



The Opto-Hybrid

- ▶ Ensures the communication between the VFAT to the off-detector electronics.
- ▶ It is equipped with a field programmable gate array (FPGA), three GigaBit Transceiver (GBTx) modules.
- ▶ The FPGA job is to synchronise and compress the trigger data coming from the 24 VFATs.





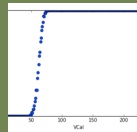
A day in My life!



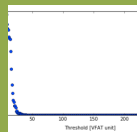
Connectivity test



Sbit Scan



Scurve scan



Threshold Scan

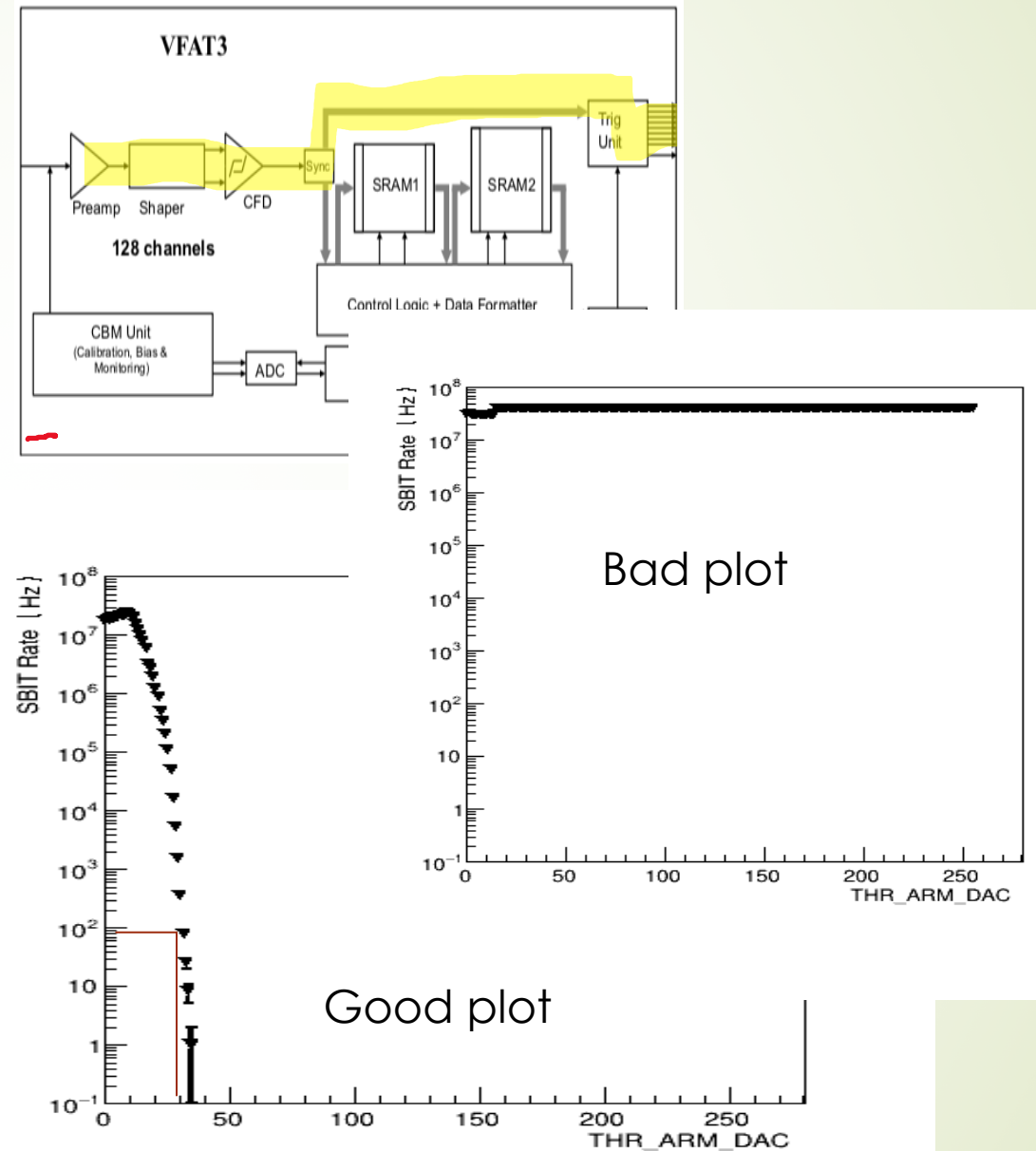
1. Connectivity Test

- GBT communication
- SCA communication
- The Trigger Links
- Selection of the best phases for each of the VFATs

What if we face failures in connectivity Test ?

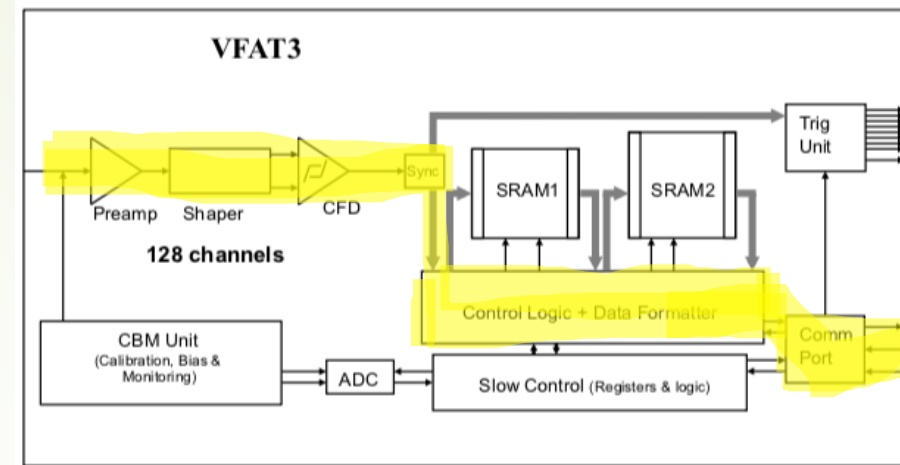
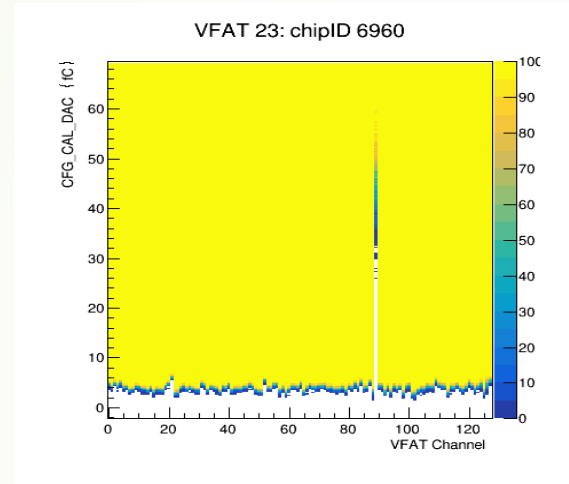
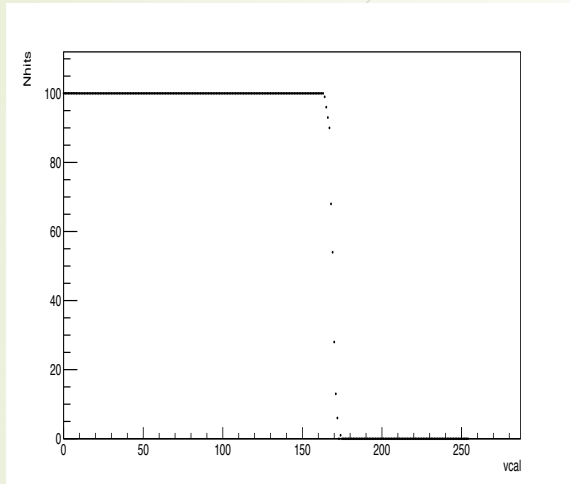
2. SbitScan

- It gives us the relation between the THR_ARM_DAC value and noise events.
- We allow 100 events of noise and select THR_ARM_DAC value for each VFAT.
- We will have 24 values of THR_ARM_DAC from SbitScan.
- The bad plot is maybe due to the VFAT, short along the GEB, or Opto-Hybride (Samtec connector).



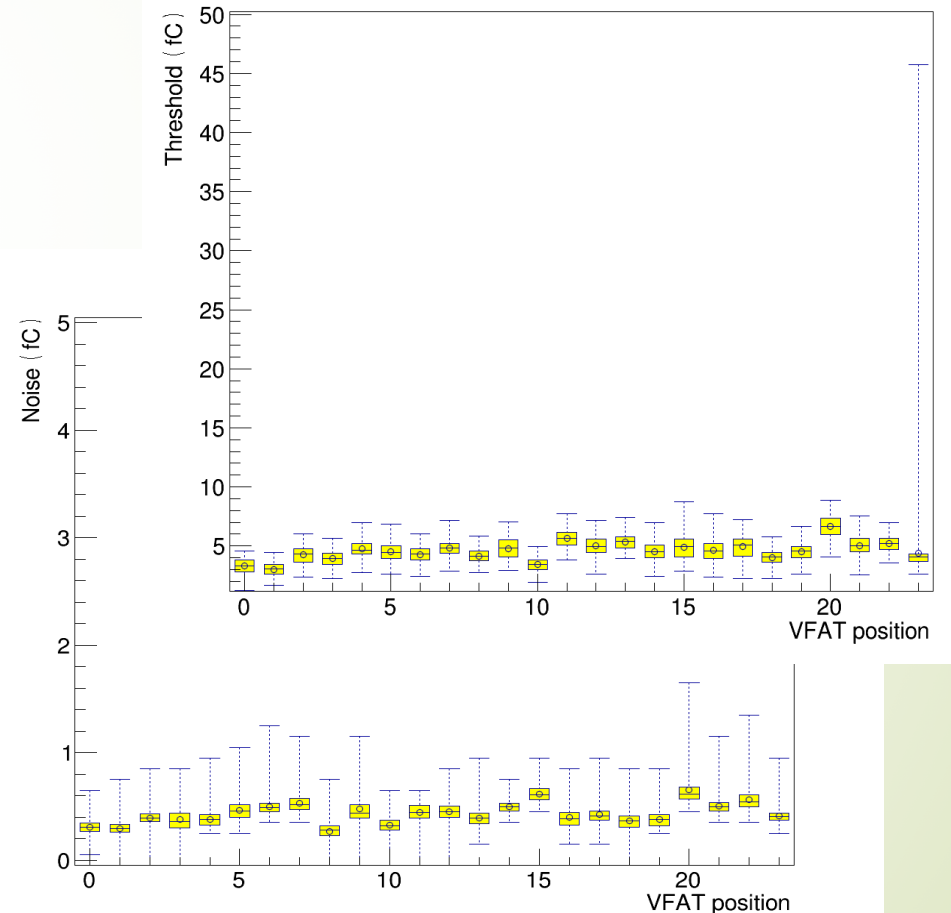
3. Scurve scan

Bad plot



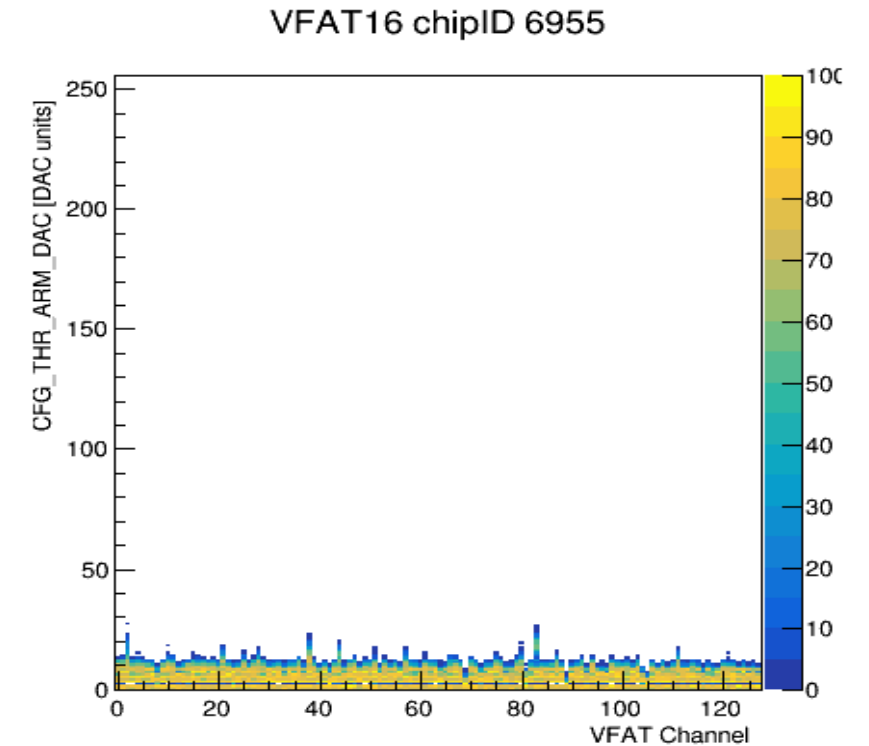
Criteria for Acceptance:

- The threshold CAL_DAC value of all channels should be close.
- No more than 3 dead channels per row.
- The noise of each VFAT should be below 1 fC.
- The Threshold of each VFAT should be below 10 fC.



4. Threshold Scan

- In order to distinguish the muon signal from the noise.
- We want to find the lowest possible THR_ARM_DAC value to efficiently detect the muon signal.
- There is no injecting charge.
- We are sending the trigger signal to readout the tracking data.
- By changing the values of THR_ARM_DAC.
- We see the efficiency of noise.



Summary

- ▶ We test 2 detector per day.
- ▶ One common problem is the interface between the geb and the optohybrid, namely the samtec connector.
- ▶ Most of the problems with VFATs are solved by swapping them, or cleaning the connectors and reinstall them.
- ▶ Once we qualified the detectors, they are passed to the super chamber assembly team.



Thank You!