Karlsruher Institut für Technologie

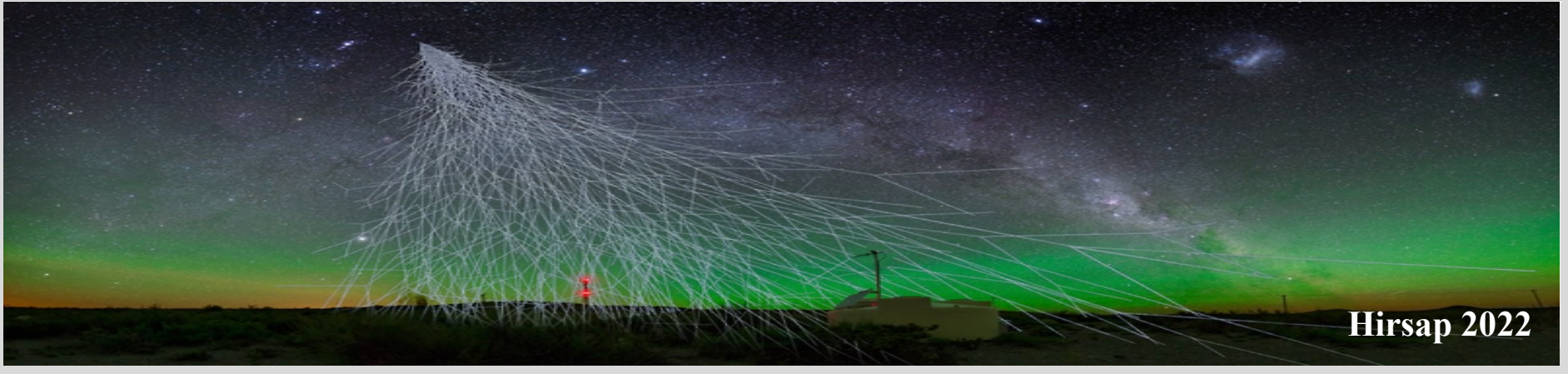
Double Doctoral degree in Astrophysics DDAp

UNSAM

ITeDA Instituto de Tecnologías en Detección y Astropartículas

Low level reconstruction and calibration of the ADC in the Underground Muon Detector

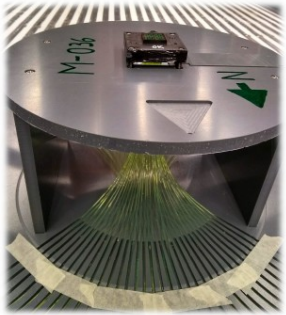
Marina Scornavacche

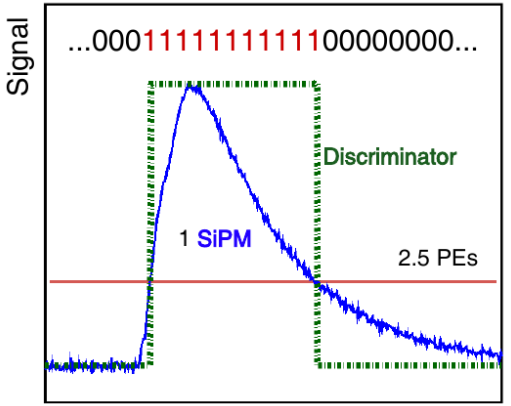


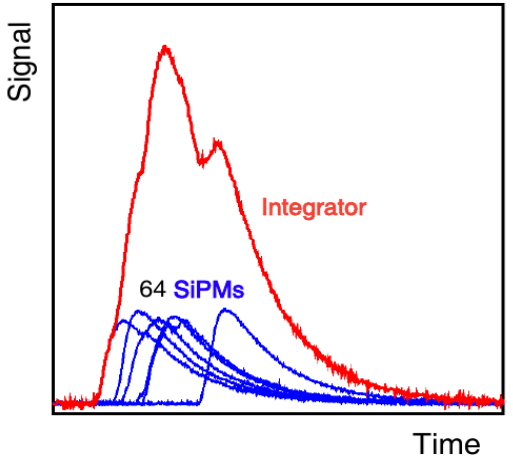
UMD: Counter vs Integrator

- **64 SiPMs independently** through discriminator
- **Nμ sequences of "1"**s
- Low particle density (far from shower core)

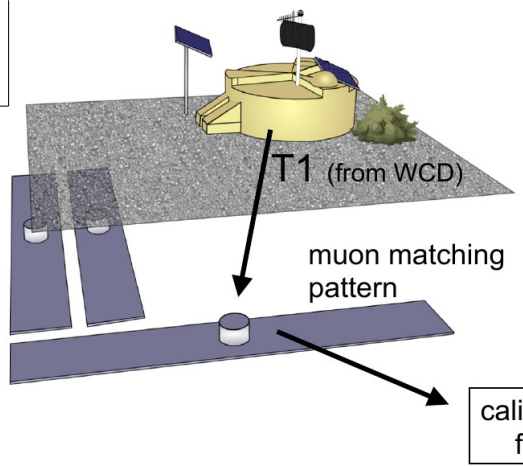
- **64 SiPMs summed**
- **Nμ dividing signal charge by mean charge of single muon**
- High particle density (close to shower core)



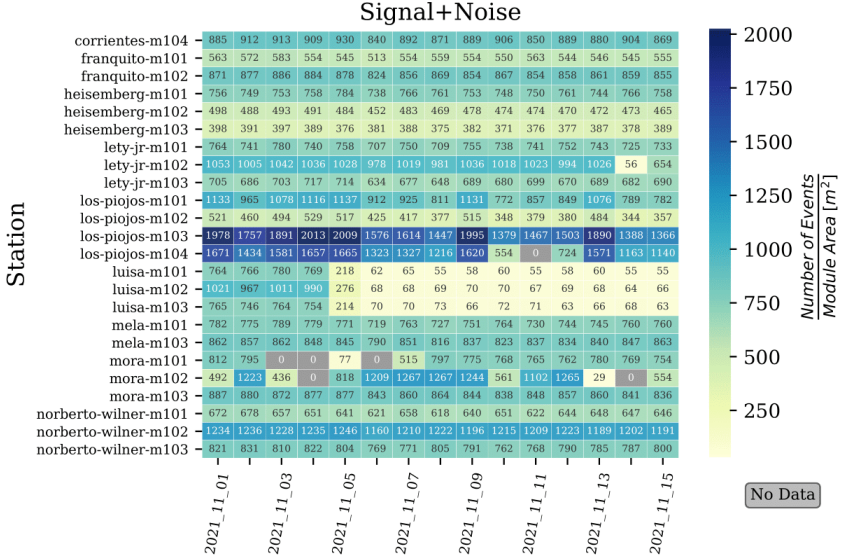


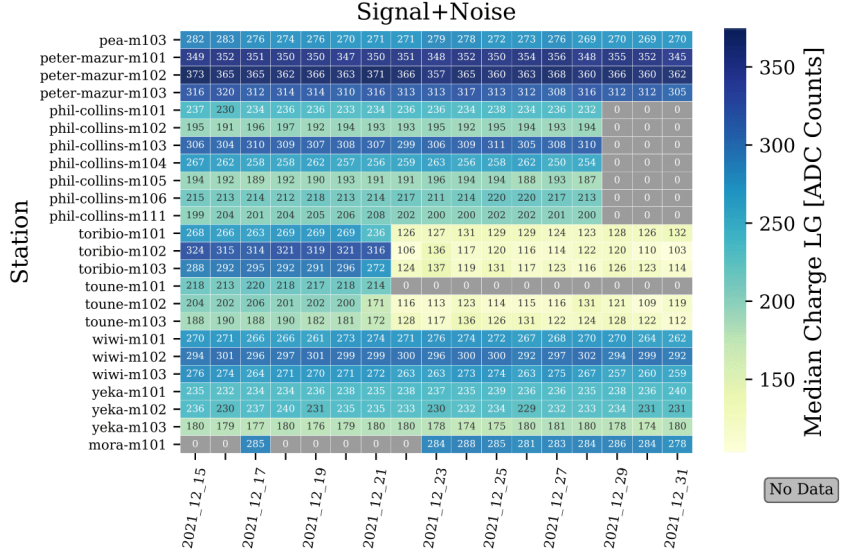


Online calibration



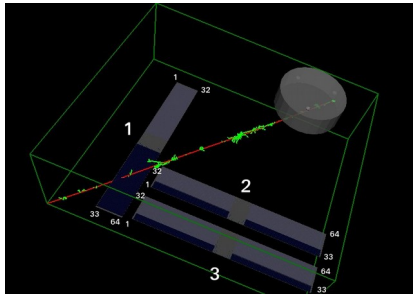
- ➔ Algorithm implemented in the electronics
- ➔ **Single muons** in **T1 events**
- ✔ **Goal:** Monitor online calibration **(UMD Shift)**

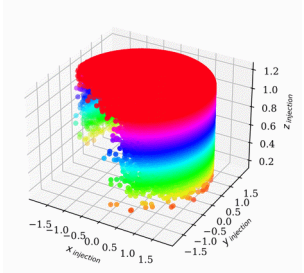


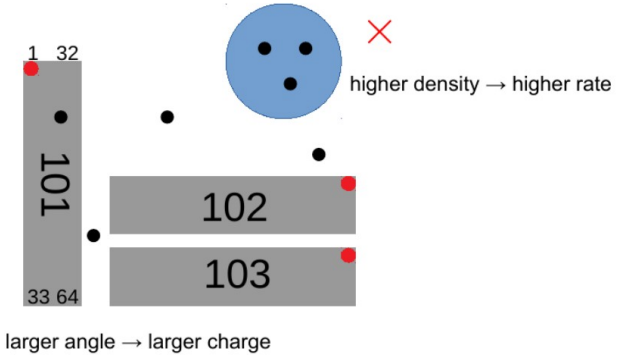


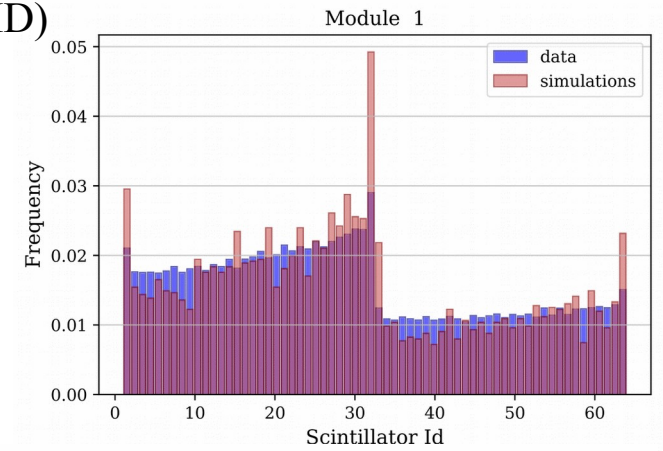
Online calibration

✔ **Goal:** Explain online calibration with **simulated muons in coincidence** (WCD + UMD)



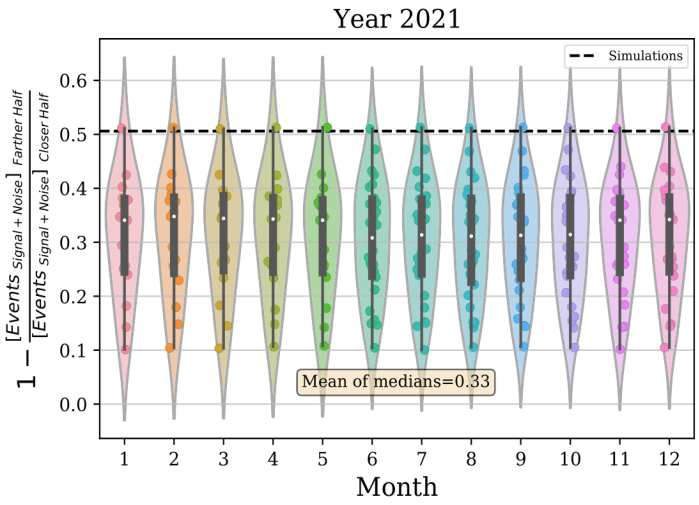


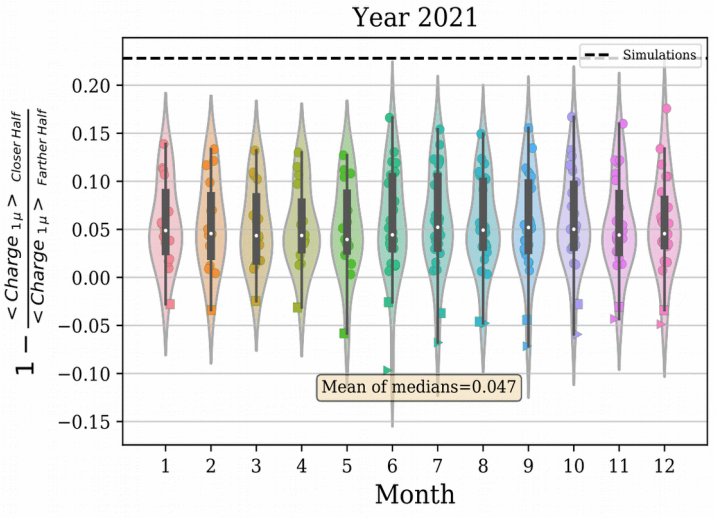




Conclusions:

- ✗ Trigger generates asymmetries
- ✗ Inclined muons in data

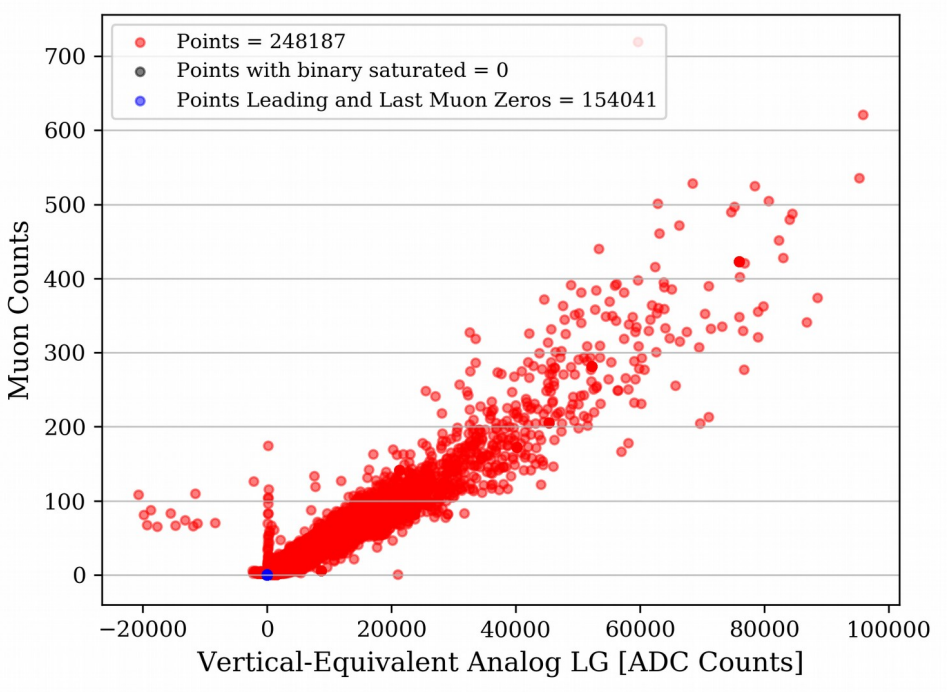




Offline calibration

✔ **Goal:** Calibrate with **T3** shower **events**

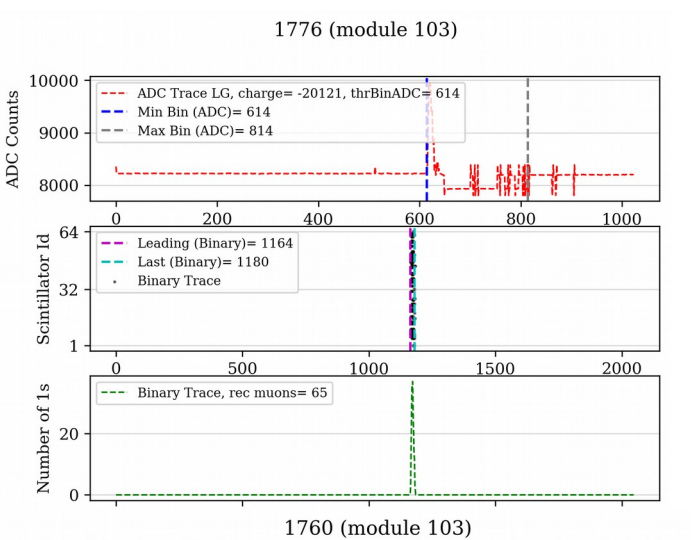
✗ **Problem:** **Low level** reconstruction

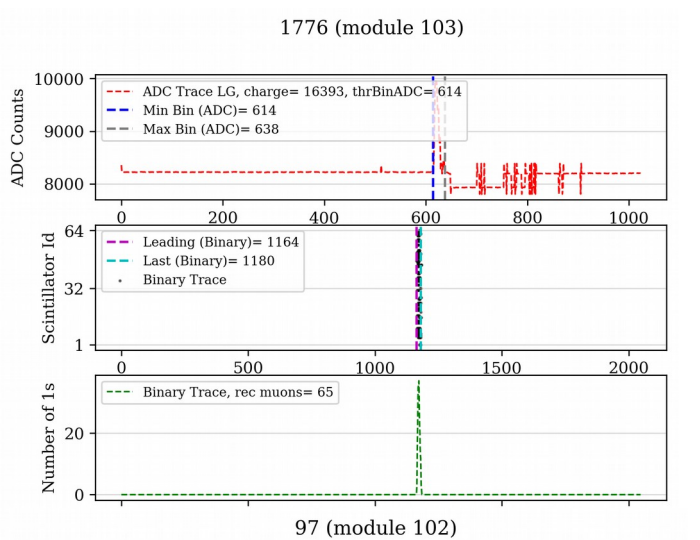


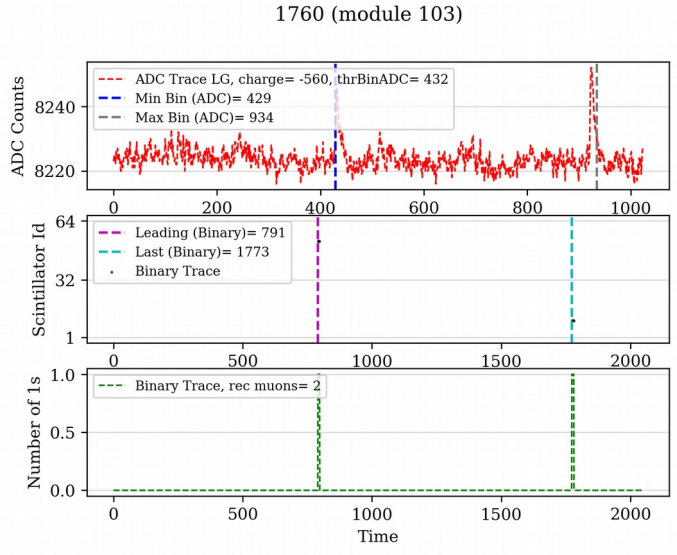
Low Level Reconstruction:

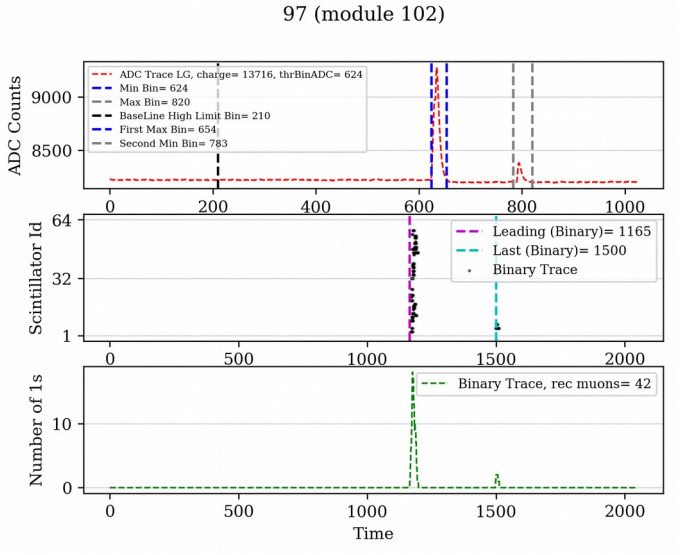
- ➔ Baseline
- ➔ Threshold
- ➔ Delay Binary – ADC
- ➔ Integration Window
- ➔ Remove Glitches

Before / After

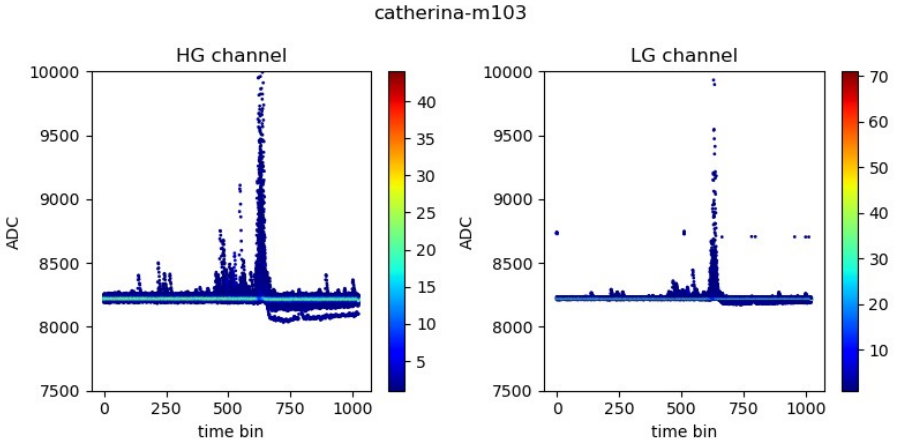


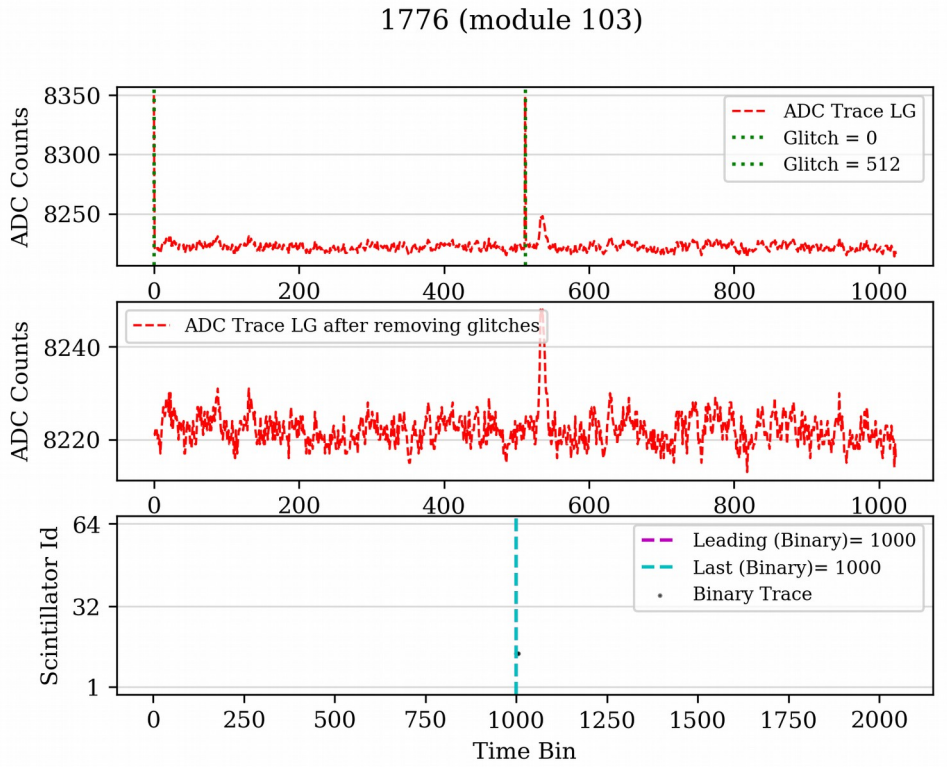






Glitches in data





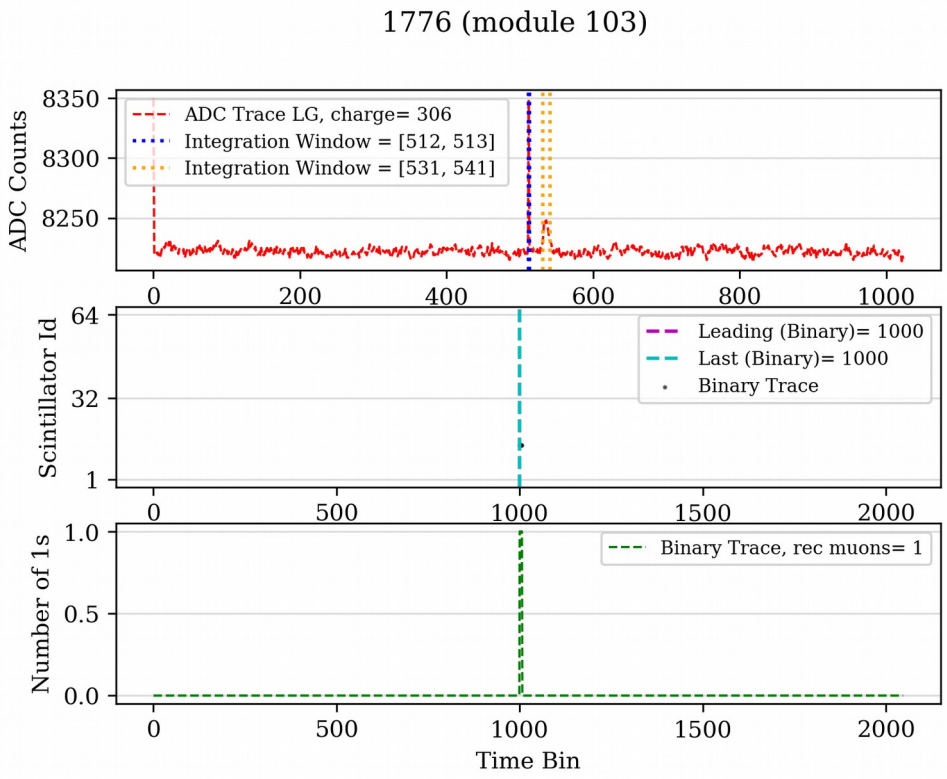
✗ **Problem:** how the FPGA was programmed

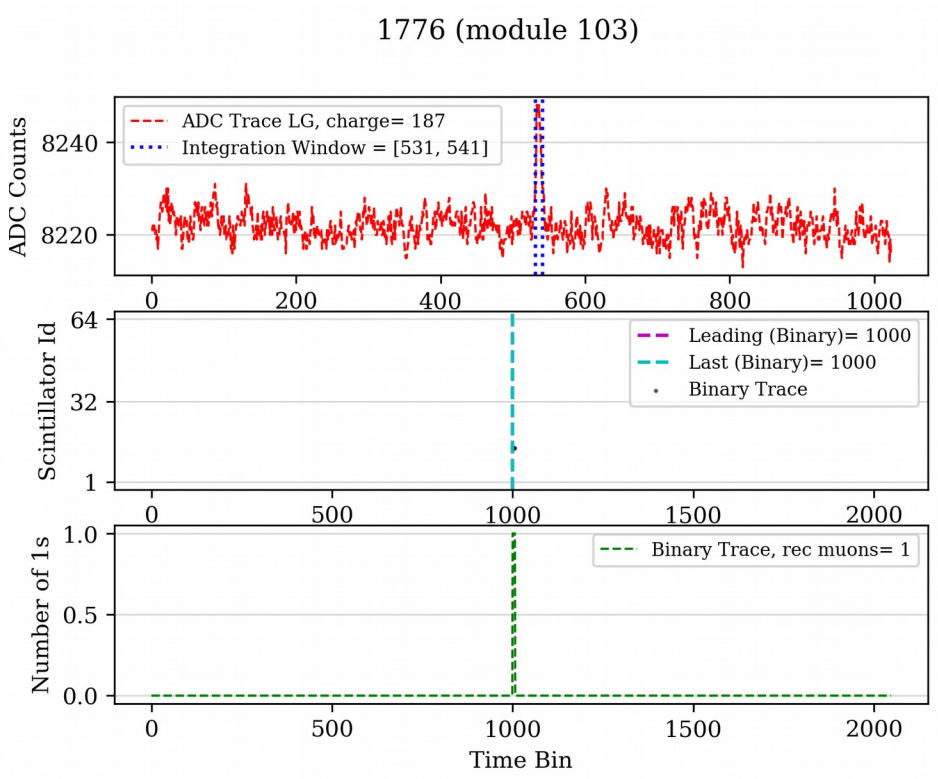
✔ **Solution:** Module to remove glitches

Algorithm checks 6 neighbors and generates new "DeglitchTrace"

Calculate charge with the "DeglitchTrace"

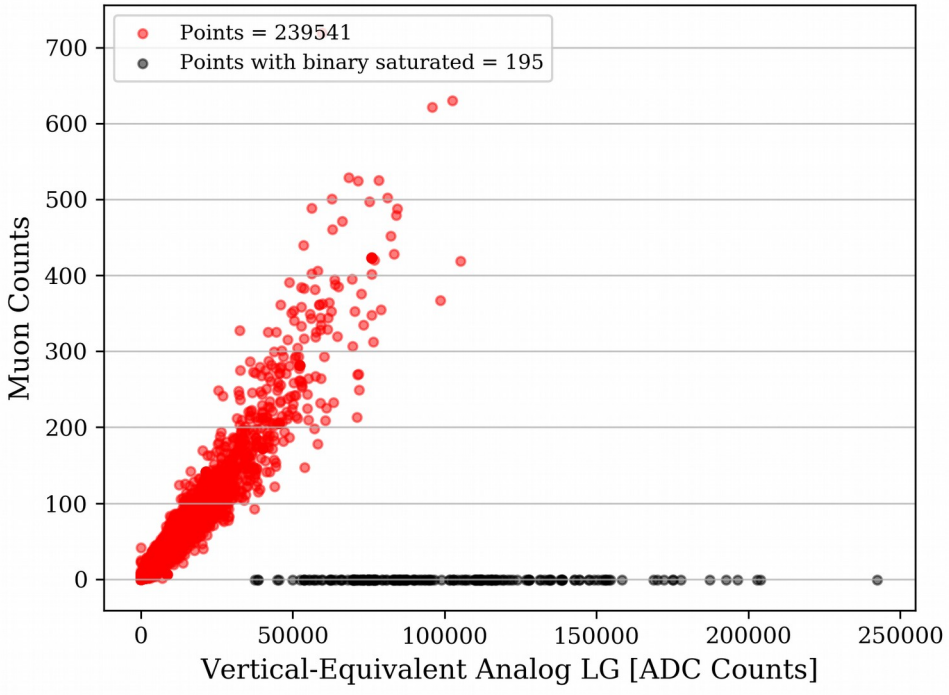
Glitches in data

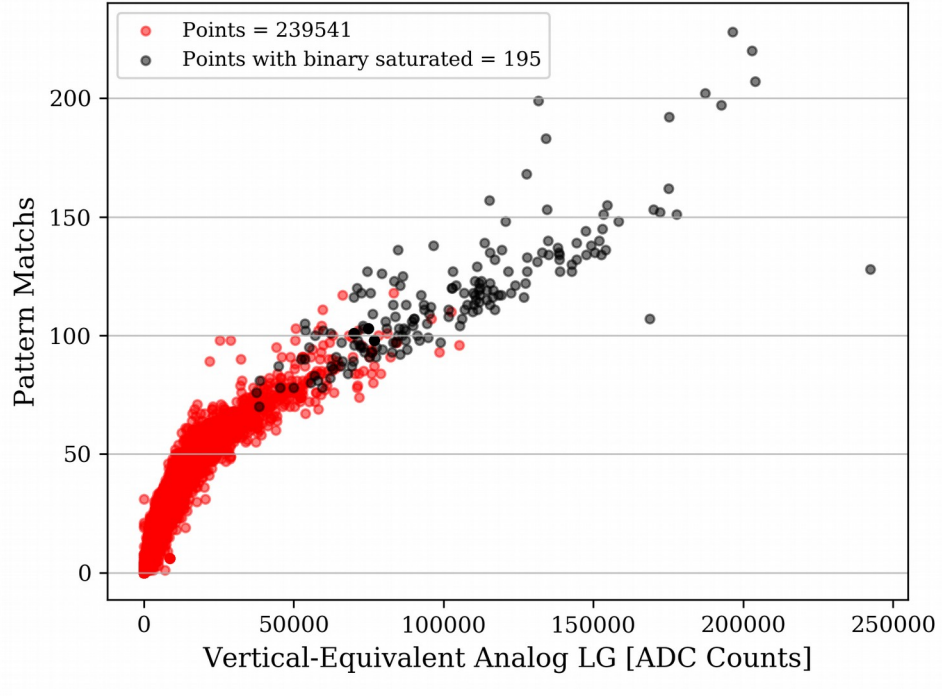




Before / After

Low level reconstruction

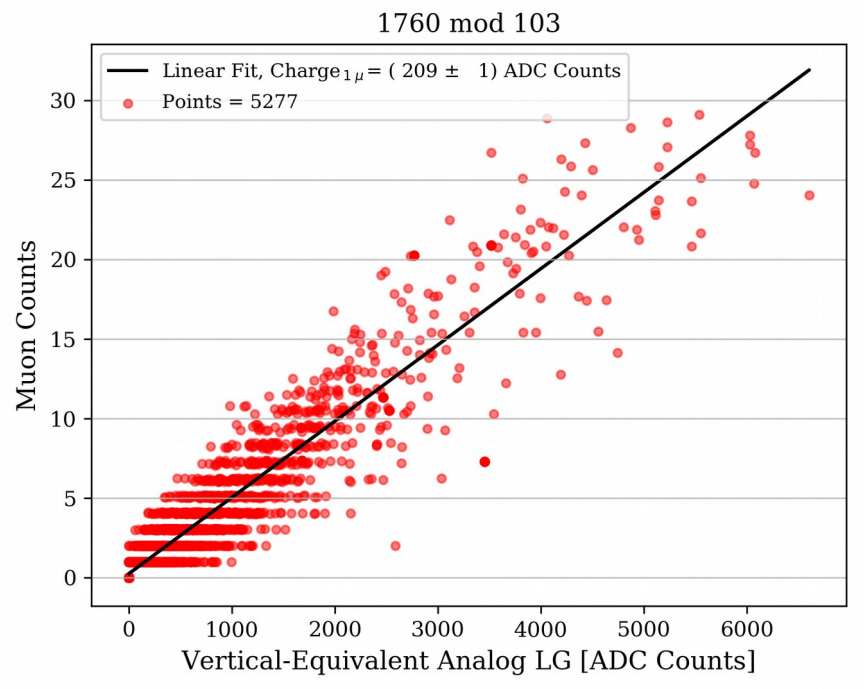


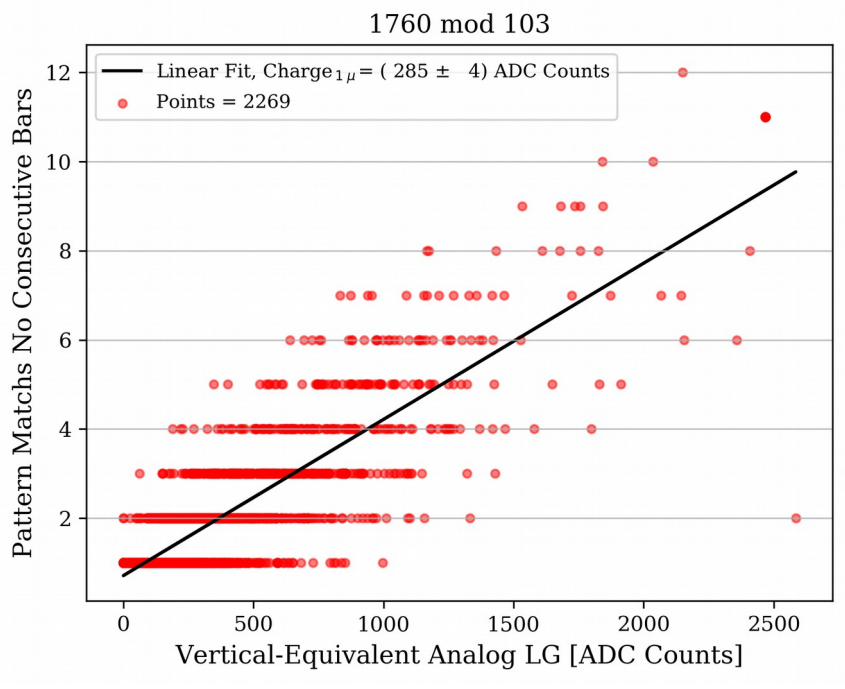


2 months of data

ADC Calibration

Liner fit for module: Muons counts or pattern matchs??



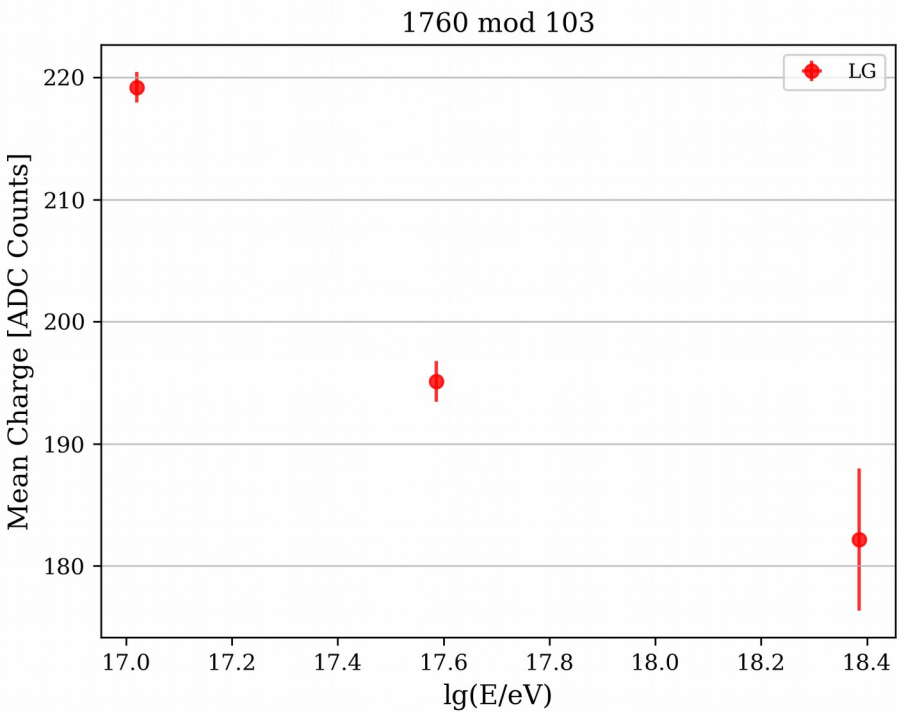


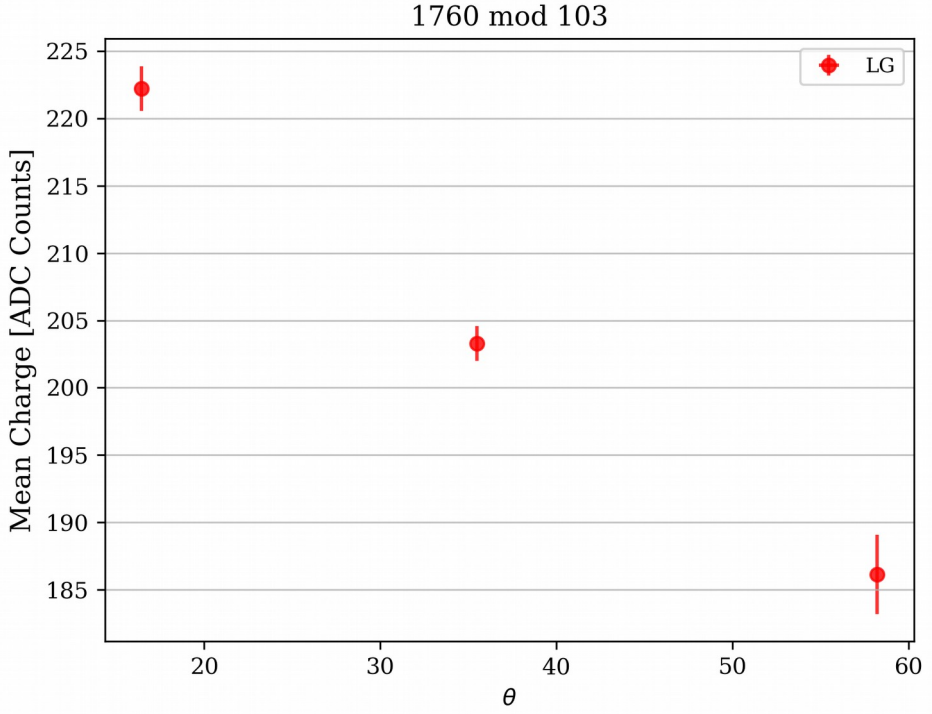
✖ No corner Clipping corrections for data

✔ Remove most corner clipping

✖ Strategy needs lots of statistics

ADC Calibration





Parametrization for zenith, energy and distance??

Summary and future work

- Improving **ADC low level reconstruction**
- Module to **remove glithces**
- **Calibrate with T3 shower events,** check stability and parametrization
- Compare offline calibration with online calibration
- High level reconstruction (soon)

THANKS
FOR
LISTENING