

Site Measurements

Kiara & Will
TAMBO Collaboration Meeting — Summer 2026



What measurements did we make on site?

- Mini TAMBO panel: radioactive background level & muon rate
- Radiacode: off-the-shelf device to measure radioactive backgrounds
- tinySA: miniature spectrum analyzer for RF backgrounds
- UTEC GNSS receiver: made by UTEC to evaluate satellite availability
- Giulia's GPS: also to evaluate satellite availability

Mini TAMBO panel



- PUCP group prepared for us 2 small panels ($\sim 0.25 \times 0.2$ m)
- Panels stacked, with CosmicWatch on top for muon identification
- DAQ system: CAEN digitizer

Basic idea: measurements with a small TAMBO-style panel to look at muons and general background spectrum

Radiacode 110



Basic idea: handheld (phone size) radiation detector to measure low-energy background spectrum

- Commercially purchased
- 3cm³ CsI(Tl) crystal
- Much better energy resolution than a plastic scintillator panel

Basic idea: handheld (phone-sized) radio spectrum analyzer, to help us look for background RF signals that could disturb Tambito electronics

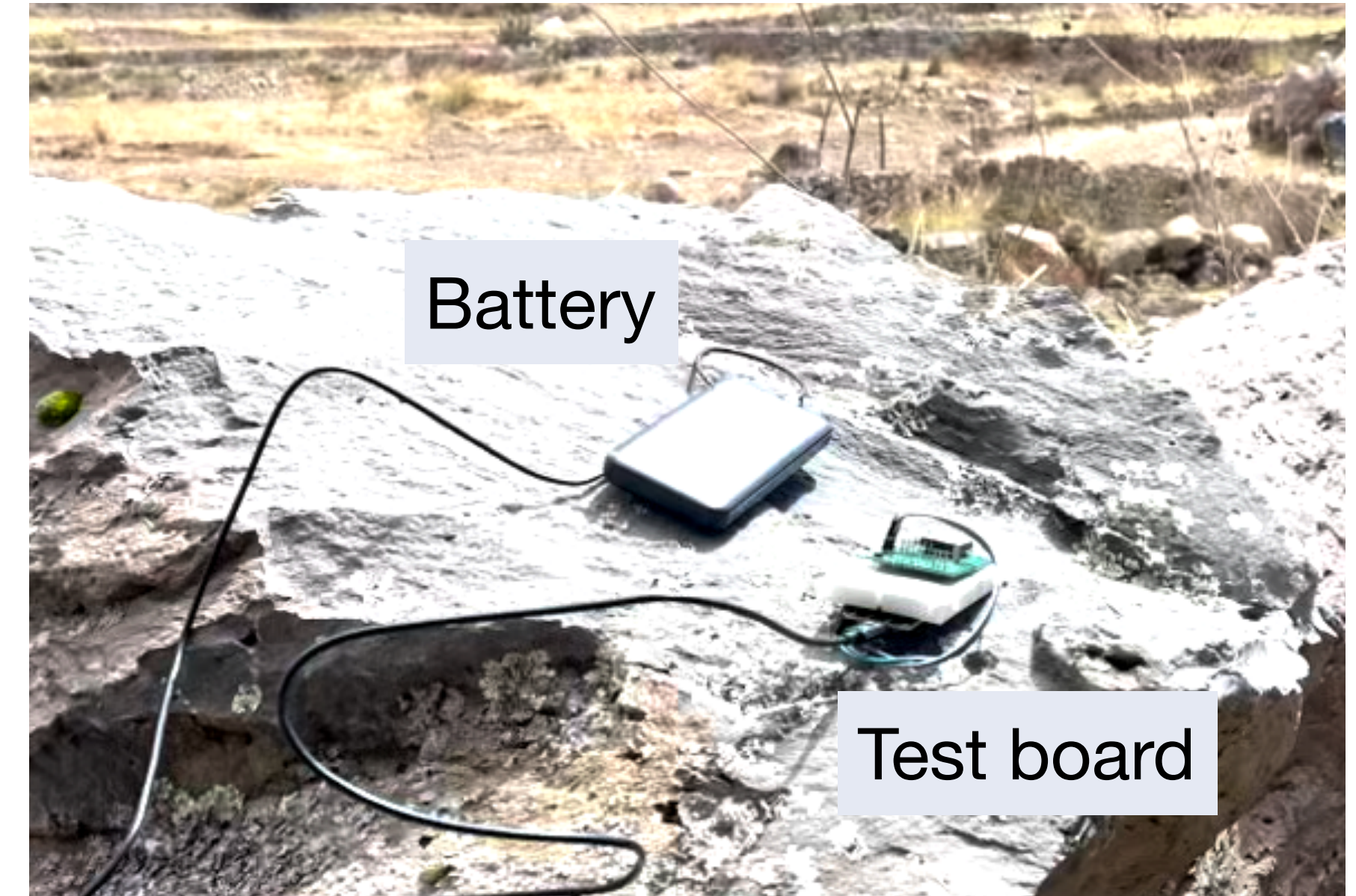
- Commercially purchased
- Scanned from 0-5MHz for a few minutes



GNSS connectivity study

Basic idea: want to understand GNSS satellite availability and signal strength in the canyon, since it's required for our timing

- UTEC group prepared a test board that we just had to plug in to use
- We also checked satellite ability using Giulia's GPS device and Will's watch



Dry-run at UCSP

- Checked solar panel / battery life, checked all power supplies and cabling, and took control measurements
- Thank you PUCP for lending us the small DC HV supply
- Thank you Josue + UCSP for hosting us and setting up this excellent tent



Four Measurement Locations 🔍



- Coporaque (Lower / Upper)
- Mirador de Agotrek — Extra reference point
- Huambo

Four Measurement Locations

SITE		DATE	ELEVATION	
Lower Coporaque	~12:30PM	10 Aug 2026	3,624 m	Cloudy and then sunny
Upper Coporaque	~2PM	10 Aug 2026	3,727 m	Cloudy
Mirador de Agotrek	~12:45PM	11 Aug 2026	3,317 m	Sunny, windy, hot
Huambo	~10:30AM	14 Aug 2026	3,647 m	Sunny

Air temperature was typically ~15°C, we forgot to measure it more exactly

Lower Coporaque — Monday, Aug. 10 at 12:30PM



- At base of the mountain near agricultural land, just off the road
- About 5 minute drive from Coporaque, which is a 15 minute drive from Chivay

Upper Coporaque — Monday, Aug. 10 at 2:00PM

- Partway up the mountain, near grazing land
- About 10 minute drive from Coporaque, which is a 15 minute drive from Chivay
- Required taking a 4x4 up several switchbacks



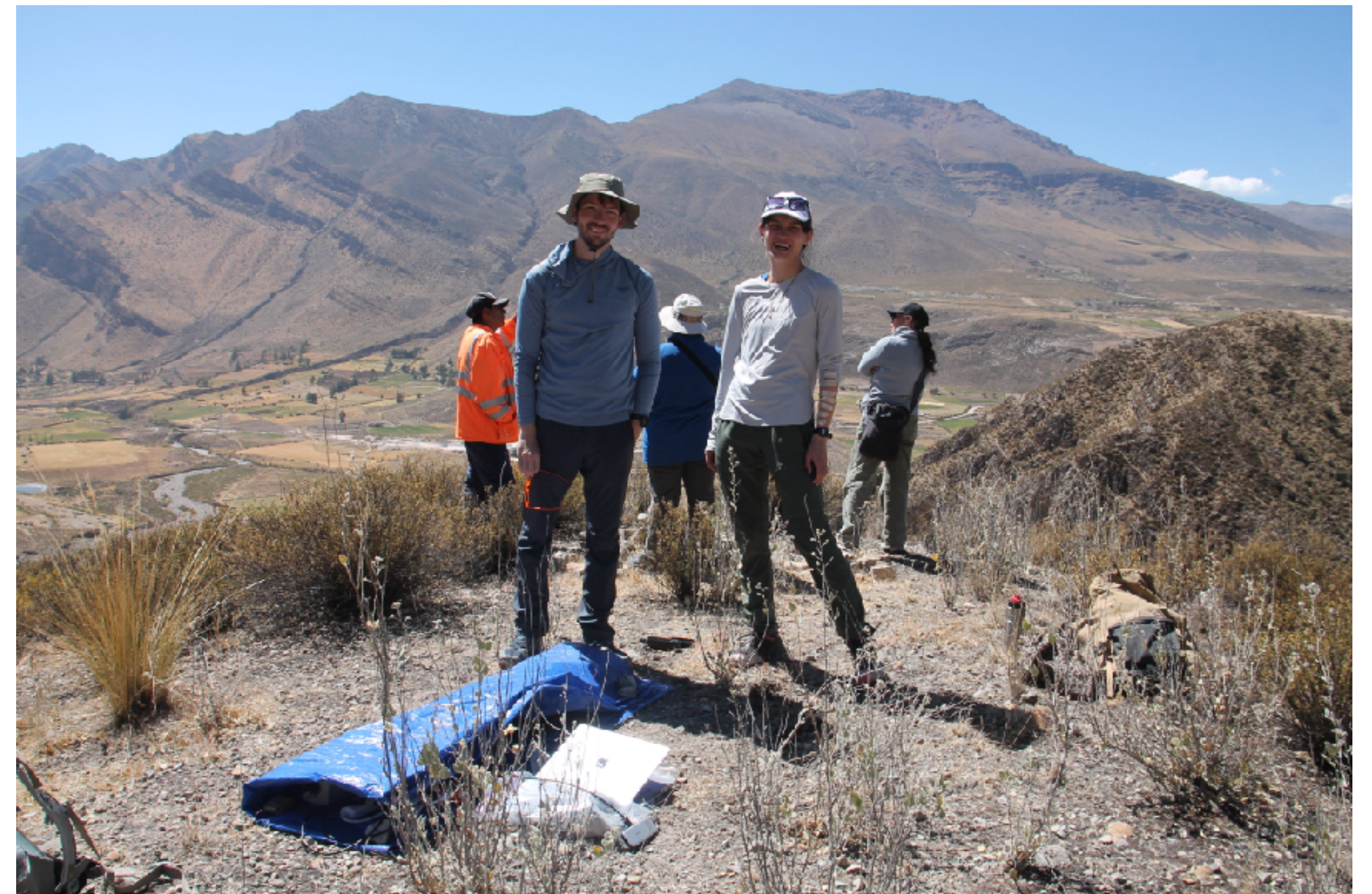
Mirador de Agotrek — Tuesday Aug. 11 at 12:45PM

- Not a candidate TAMBITO site — we took measurements here to have an additional reference point for comparison
- Right beside highway 109, which runs along the south side of the Colca Canyon
- About 40 minute drive from Chivay
- It was relatively windy and hot that day. Lots of dust was kicked up, but not too bad



Huambo — Friday, Aug. 15 at 10:30AM

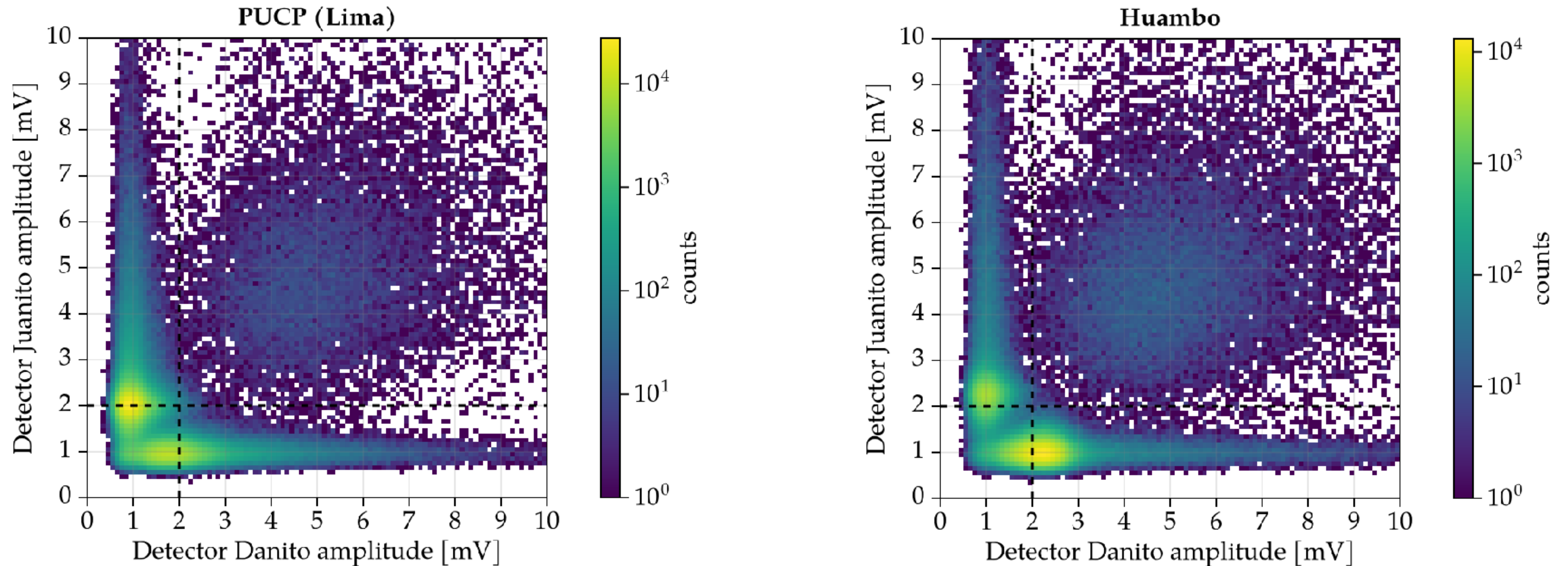
- About a 10 minute drive south from Huambo + a ~20 minute hike up to measurement spot
- Slope we hiked was $\sim 30^\circ$, similar to TAMBO target



Unexpected Issues Encountered

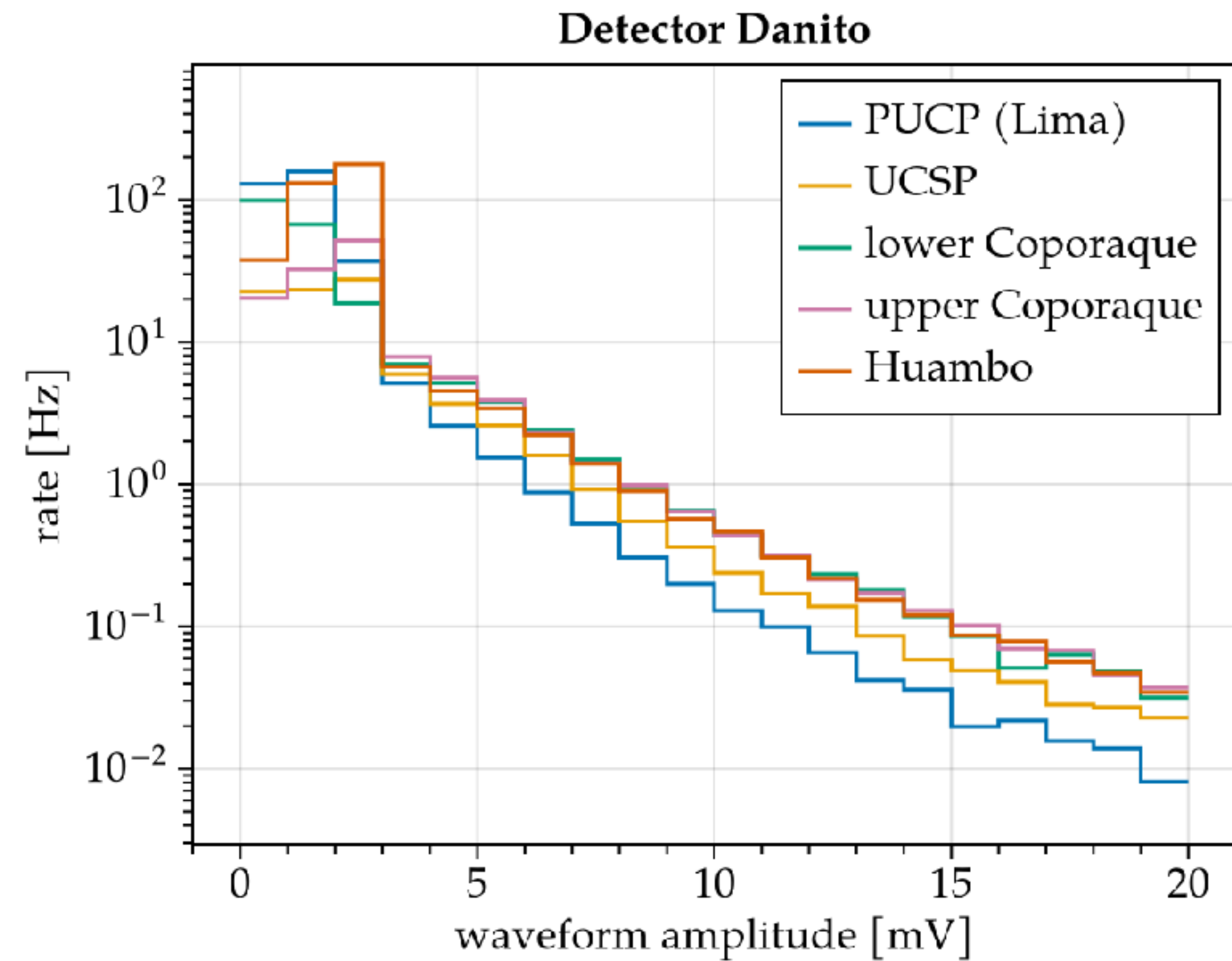
- At first measurements (Coporaque), we discovered that the solar panel induced sinusoidal noise in the CosmicWatch signal
 - We switched to relying on the solar panel battery only
- At Mirador de Agotrek, we struggled with extremely high rates in one panel (Danito / P1 / Ch0)
 - Appeared to come from sinusoidal RFI
 - Contributions also maybe from light leaks
- At Mirador de Agotrek, I accidentally placed the Radiacode in the sun for half the measurement — it got very hot (48°C) before I moved it to the shade and it cooled down (~34°C).
 - Note this is much hotter than ambient air temperature (~15°C).

First peak at the data: muon peak separation

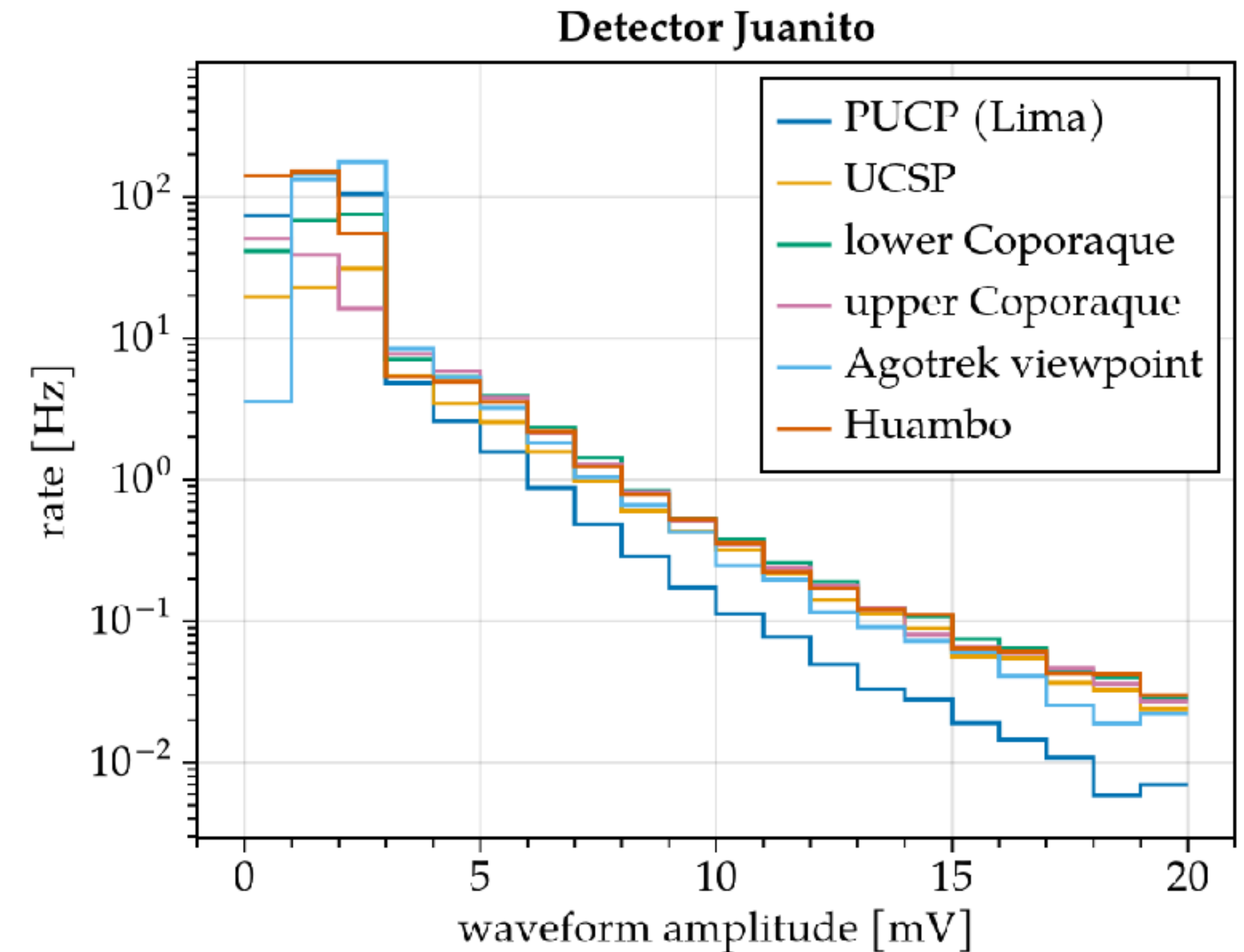
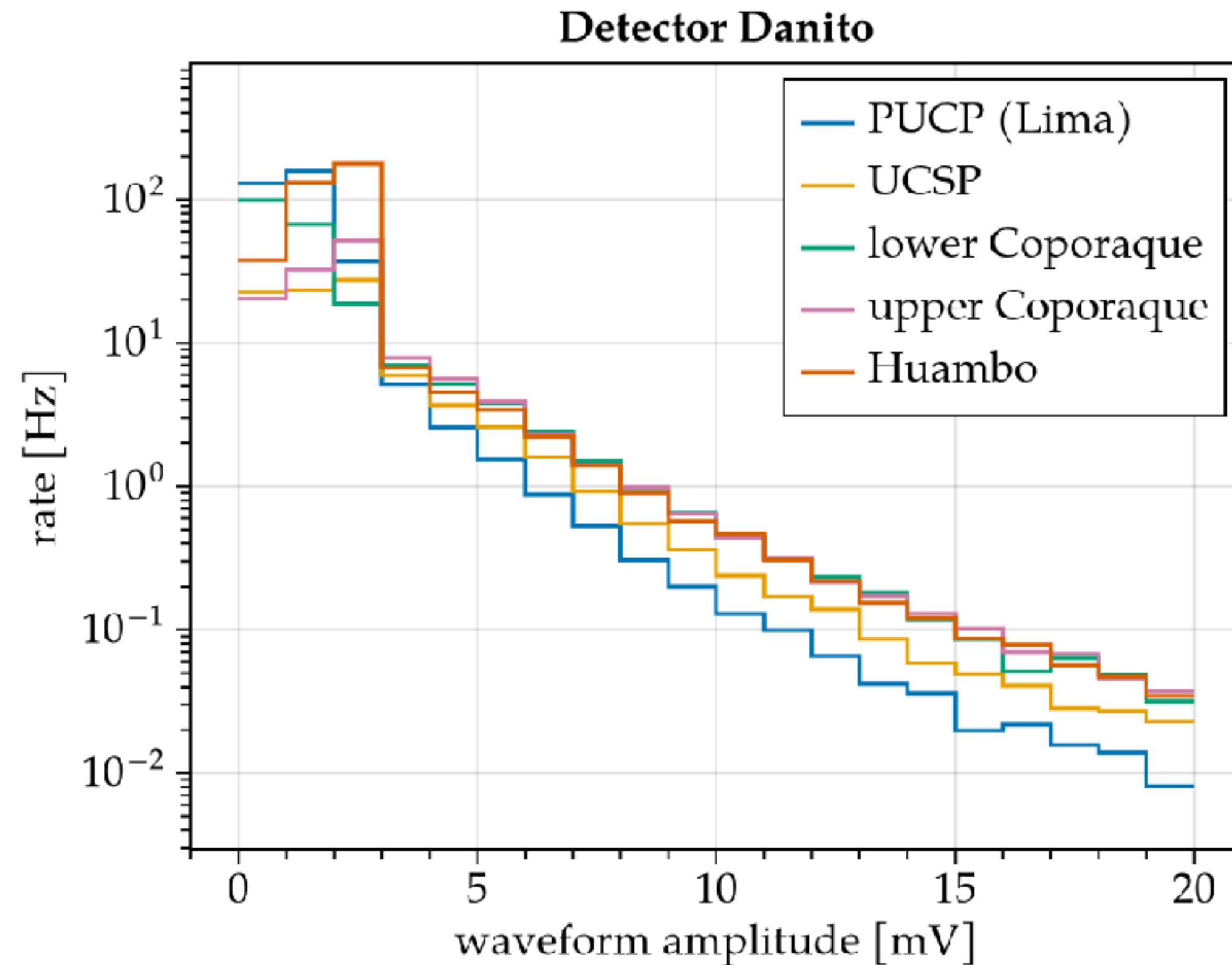


Muon peak clearly separated from backgrounds in lab and in field

First peek at the data: all panel events



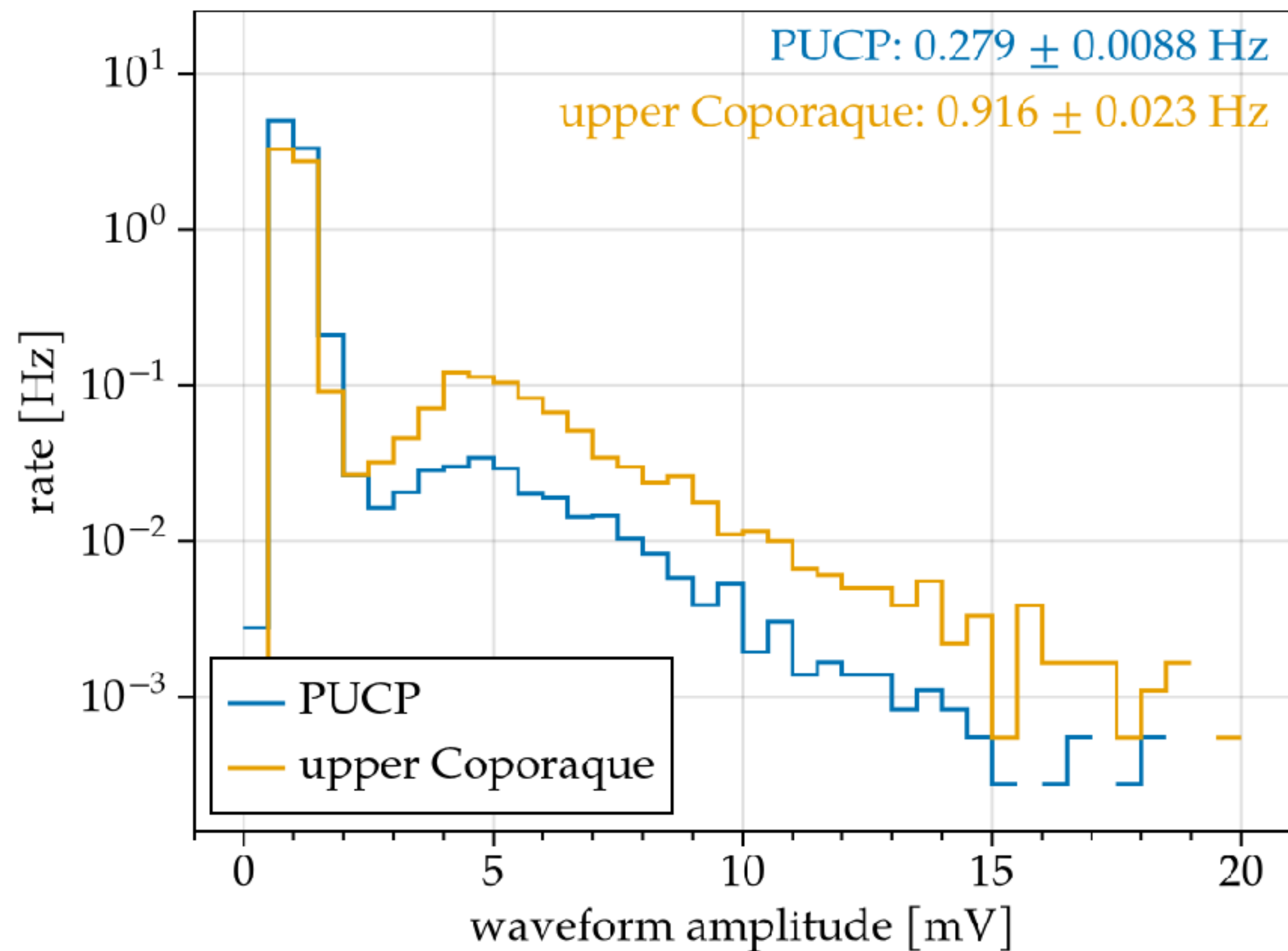
First peek at the data: all panel events



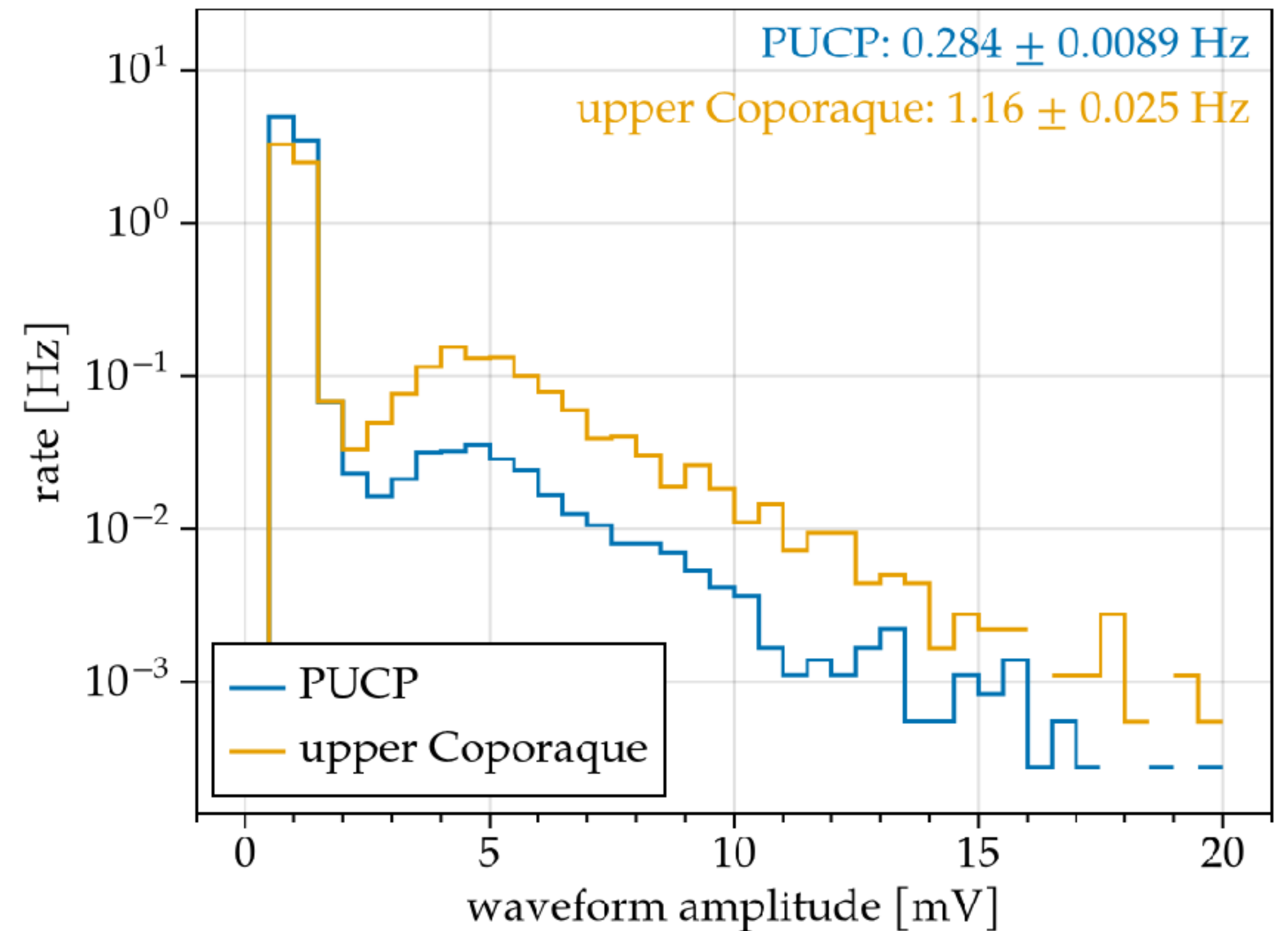
Rate of large signals increases with altitude — this is expected

First peek at the data: muon rates

Detector Danito, coincident with CW > 6 mV



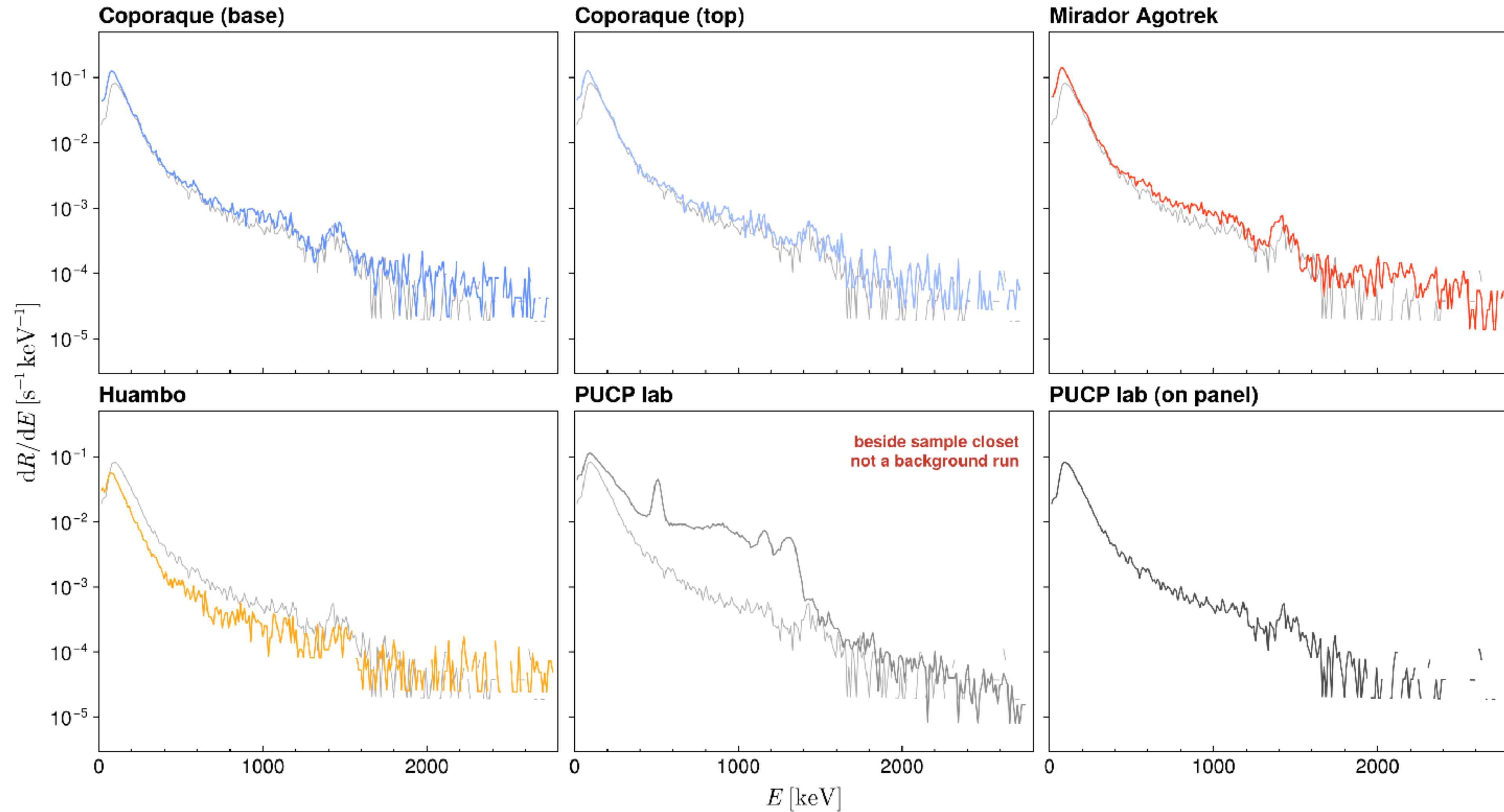
Detector Juanito, coincident with CW > 6 mV



Measured increase in muon rate similar to expectation (~3-4x increase)

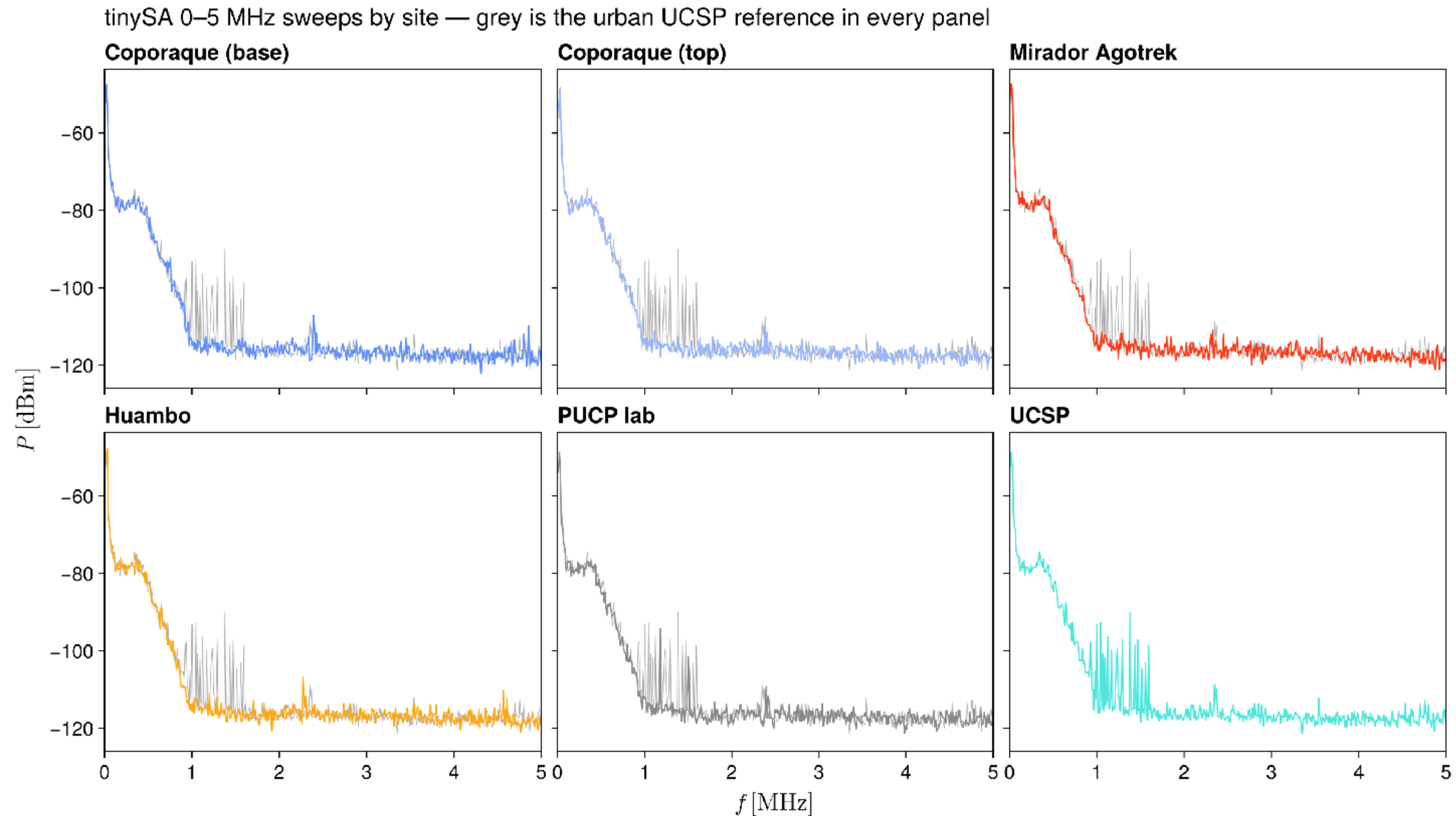
First peek at the data: Radiacode

RadiaCode gamma spectra by site — grey is the clean PUCP lab (on panel) reference in every panel



4 channels per bin · rate normalised by each run's live time · overflow channel removed

First peek at the data: TinySA



¿Preguntas?

