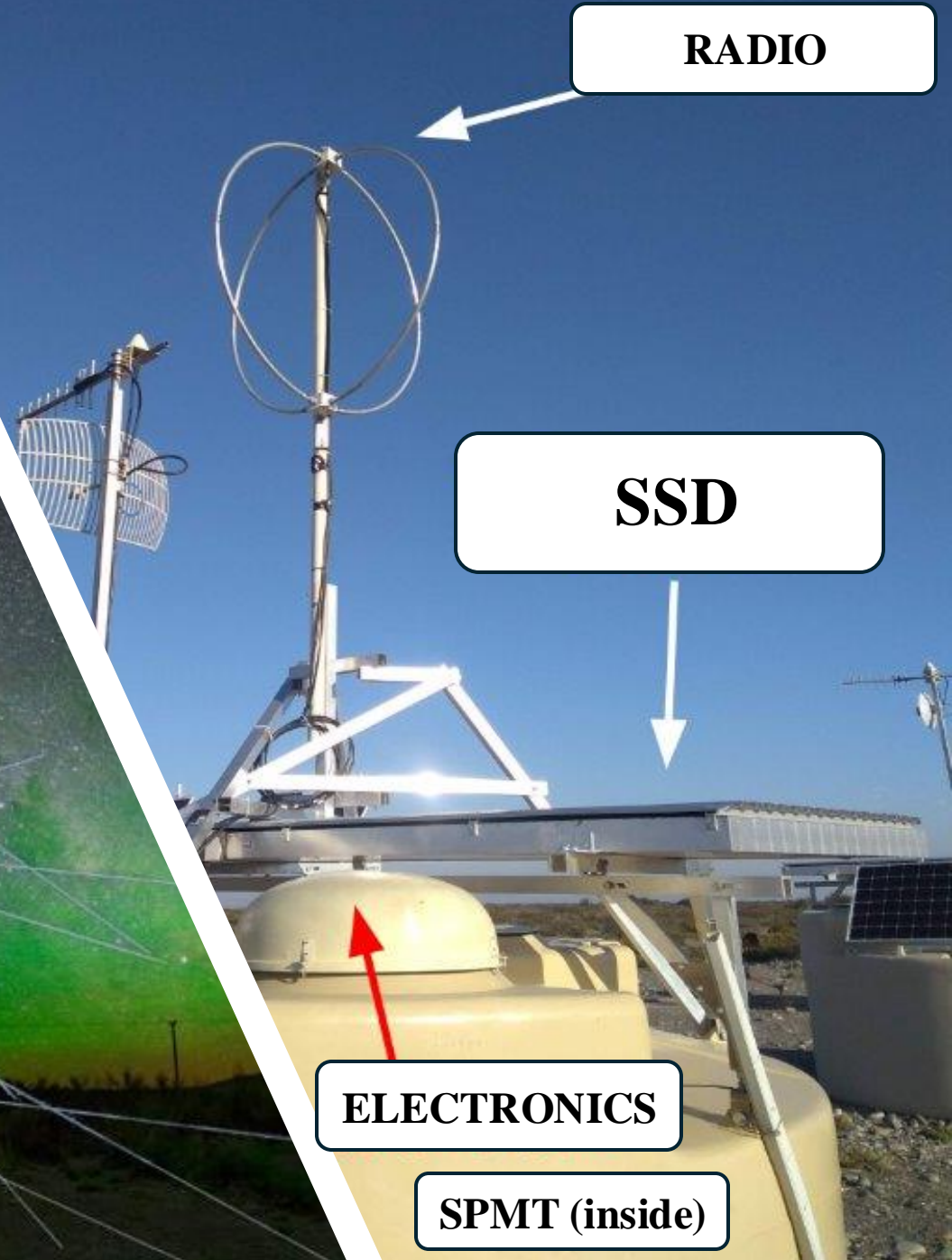


Trigger and UUB commissioning task

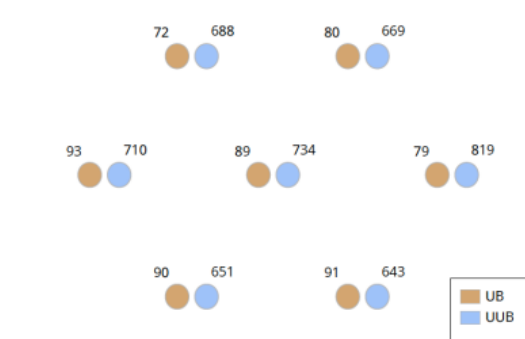
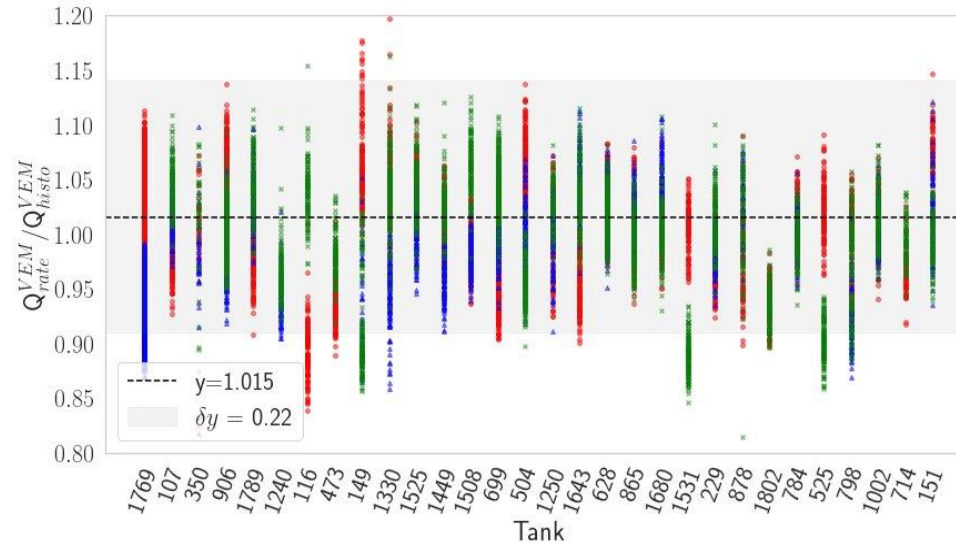
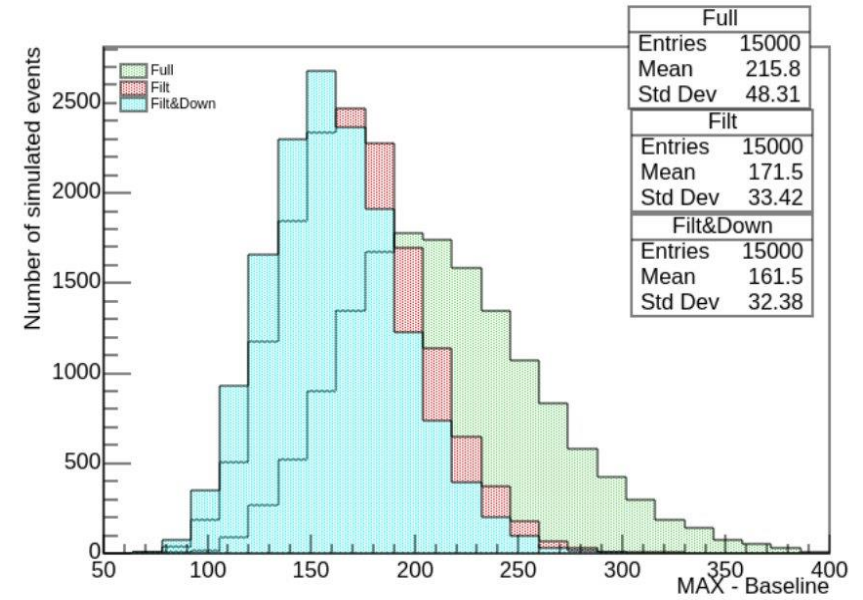
*Fabio Convenga
on behalf of L'Aquila Group*



INTRODUCTION



- The estimation of the UUB Calibration online parameters (VEM charge and VEM peak online) has been improved
- The maintenance of UUBs is in progress.
- The UB-UUB compatibility has been verified by using the UUB-UB hexagon array.
- SMPT Calibration fixed and running (maybe we could see what happens with the new VEM charge online)
- Mitigated ToTs/MoPs noise related issues.
- New triggers working progress
- Work in progress on DAQ instabilities



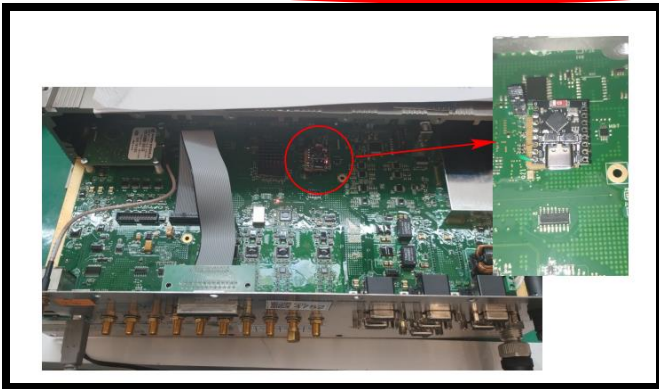
UUB-UB hexagon array

INSTABILITY OF CDAS-DAQ AND E-FUSE



Issue:

- Recent strong lightning storms have affected the functioning of CDAS-DAQ.
- The current CDAS-DAQ lacks algorithms to manage a large T3 request queue.
- Most T3 requests are lost during lightning storms.
- **Mitigation:** Ricardo has already implemented and tested solutions to address the issue.
- **Next Step:** Upload the modified CDAS-DAQ code to implement the mitigation.



efuse problem: issues with the battery can cause the FPGA to stall in booting; UUBs with this problem must be reprogrammed with a JTag and a PC and then brought to the lab

- A **new e-fuse problem** has been identified in station Amil (1752).
- **Cause:** Likely due to a **bad power connection**, not a battery issue.
- **Mitigation:** A procedure has successfully tested to make the UUB to start using a micro-controller (mini), **without the use of the pc**



Disassembly and Repair of Sens-Tech HV Modules

Campaign duration: 25 November – 13 December.

- **Team involved:** Antonio and Francesco (Torino), Juan-Pablo, and Sebastien.

Work completed:

- Total HV modules disassembled: 102.
- Repaired: 92.
- Damaged and set aside for future maintenance: 10.

Pending Repairs: 180 Sens-Tech HV modules still need to be repaired.

Additional Work:

- 30 old HV modules retrieved from the field were sent to Torino for diagnostic and repair.

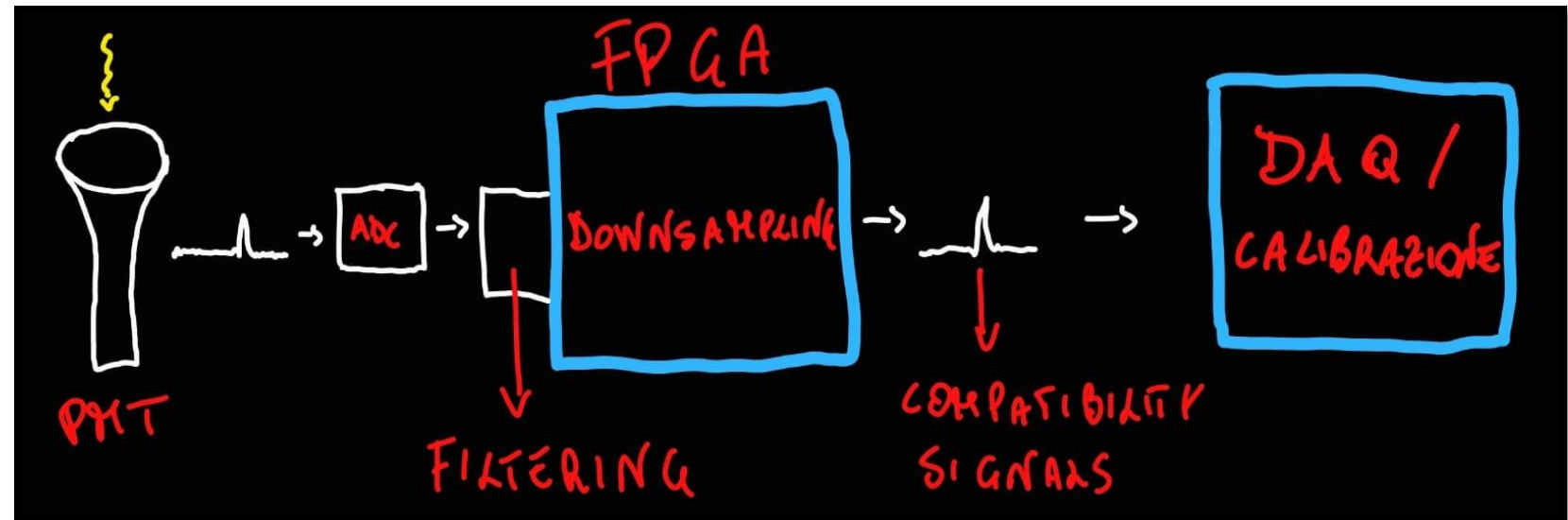
SPMT Status Check

- **Performed by:** Antonio and Francesco during their stay in Malargue.
- **No major failures** reported in SPMTs.
- **Issues observed:**
 - Some (~20 stations) did not turn on after tank interventions (e.g., battery or UUB replacement).
 - Certain stations lacked **stable monitoring data transmission**, making it impossible to verify SPMT functionality.
 - **6 SPMTs under observation** for slight anomalies (daily Imon variations $<0.1\%$ amplitude).



PROBLEM OF FILTERED SIGNALS

Over-simplified acquisition system



Ricardo discovered that the filtered data for some PMTs have a NULL value even though the raw data for these PMTs seems to be correct.



The problem induces masked PMTs (the 0 value in the filtered signal causes bad calibration and consequently masked PMT).

This problem could explain the large number of masked PMTs reported by **Martin** some time ago.

The problem can be mitigated by reloading the FPGA code.

Reading random trigger traces as an additional check to confirm if the FPGA code was loaded correctly.



The **entire array** has been running with **updated software and firmware** since **19 September 2024**.

Firmware Release & Improvements:

- Firmware version **22060824** committed to **KIT GitLab**.
- Key features included:
- **Production trace cleaner.**
- **Muon buffer burst flags** indicating which PMTs fired.
- **Updated documentation.**
- **RD Firmware Version: V17.**
- The trace cleaning process introduces an **additional trigger delay of ~150ns.**

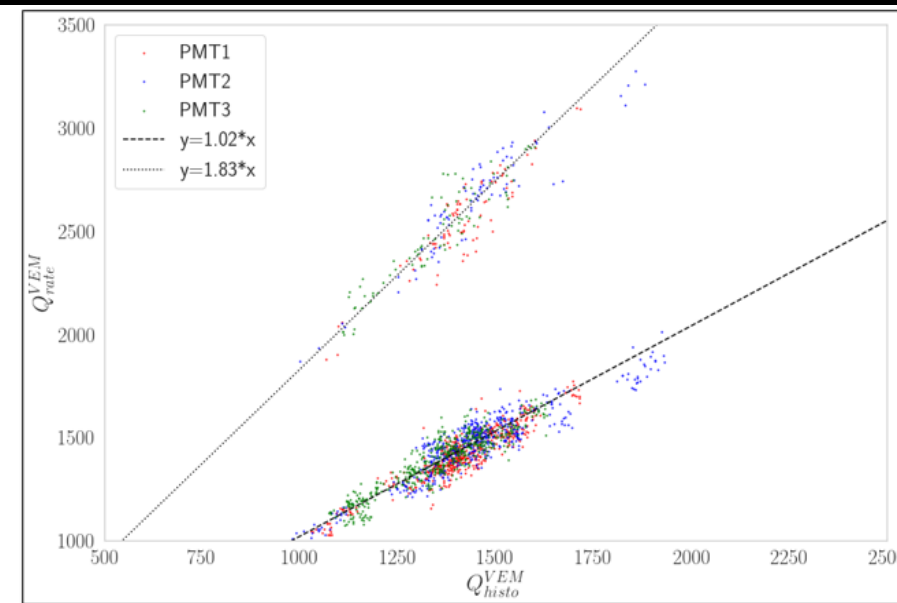
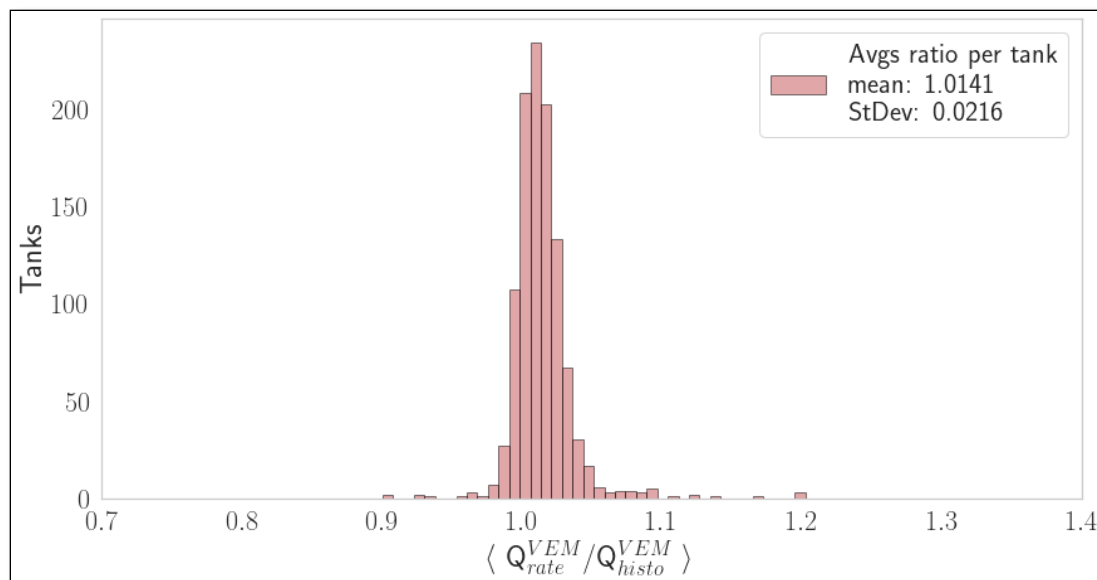
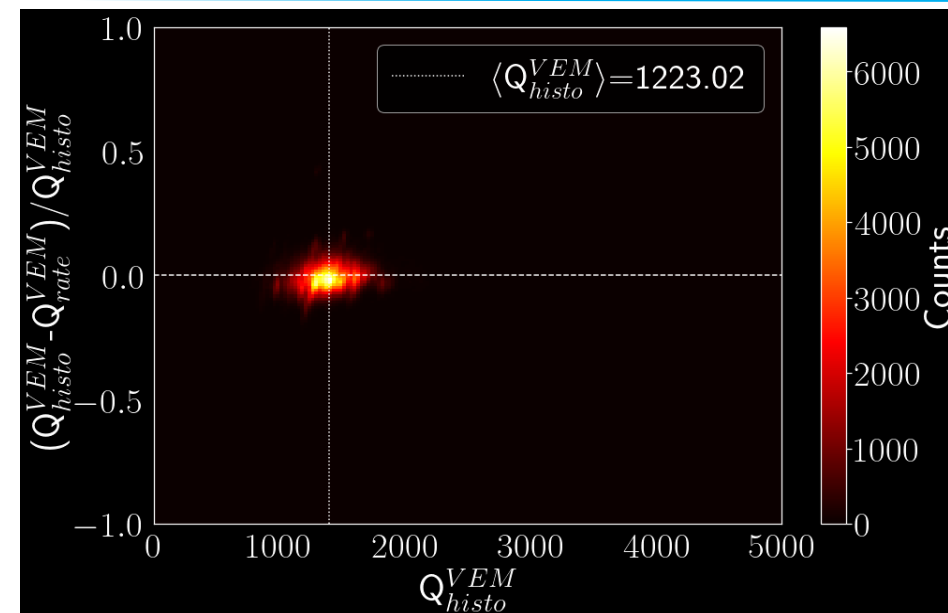
A DAQ **new configuration** was applied to stations, ensuring proper trigger settings based on the number of PMTs.

- Inclusion of **MOPS and ToTD triggers.**
- **Updated Configuration:**
 - **1 PMT: No MOPS or ToTD.**
 - **2 PMTs: All triggers enabled.**
 - **1 PMT: Only T1 and ToT enabled.**
- **Better estimate for the online muon charge.**

CALIBRATION



- The estimation of the UUB VEM charge online has been improved
- The estimates seem to be compatible with what was previously seen on UB
- The scatter plot shows also a correlation for the previous configuration, in principle the factor 1.827 could be used to correct the data prior to the inclusion of the DAQ under test.





Baseline Triggers working properly – The rates of downscaled basic triggers (**ToT, threshold, and T2**) are similar to UB trigger rates:

- **ToT:** ~1 Hz
- **T2:** ~20 Hz
-

MOPS and ToTD Triggers:

Affected by **noise bursts**, leading to unreliable triggering.

Mitigation Implemented:

- Noise bursts are **identified in FADC traces**.
- Traces are **"cleaned"** before triggering to reduce "false" signals.

Development of New Triggers:

- **Neutrino-Oriented Triggers:** developing new triggers to improve neutrino detection (Dave's work).
- **Issue:** discrepancies between **T2 damps and trigger information in Monitoring** (not yet investigated).

RD Trigger Development:

- **Data Collection:** conducted in **5 test tanks**, using **memory sticks**.
- **Issue:** data transfer to **Lyon data center**

Next Steps:

Investigate discrepancies in **T2 damps and Monitoring triggers**.

Resolve **data transfer issues** for RD trigger analysis.

SUNRISE NOISE

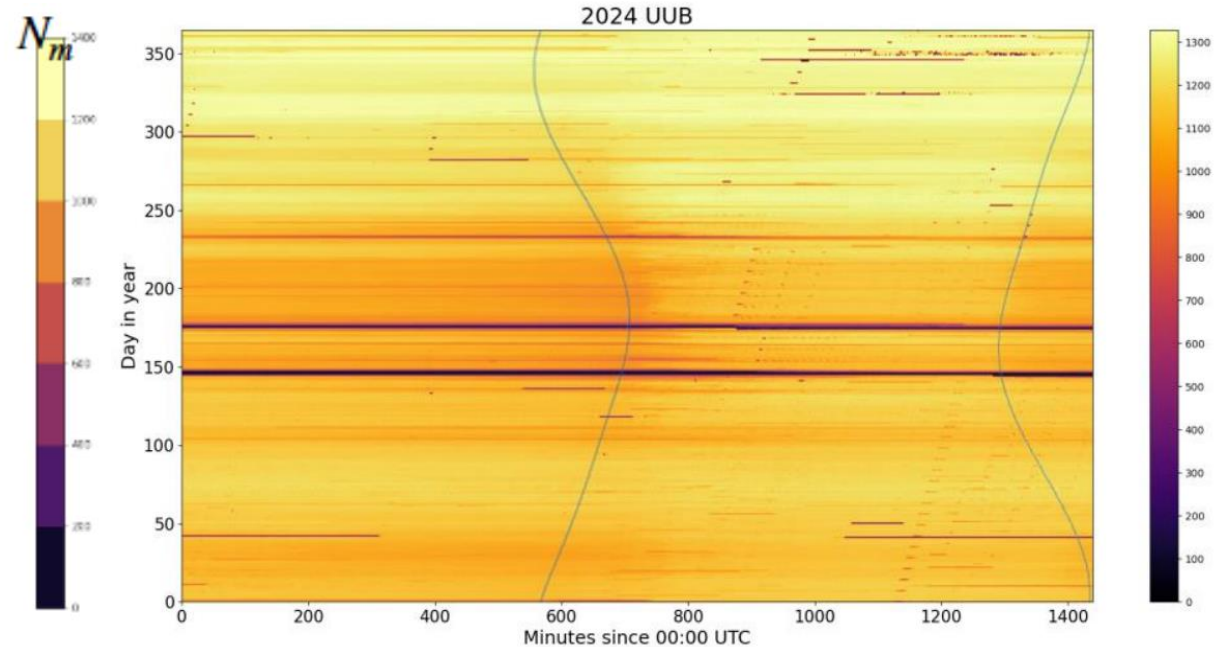
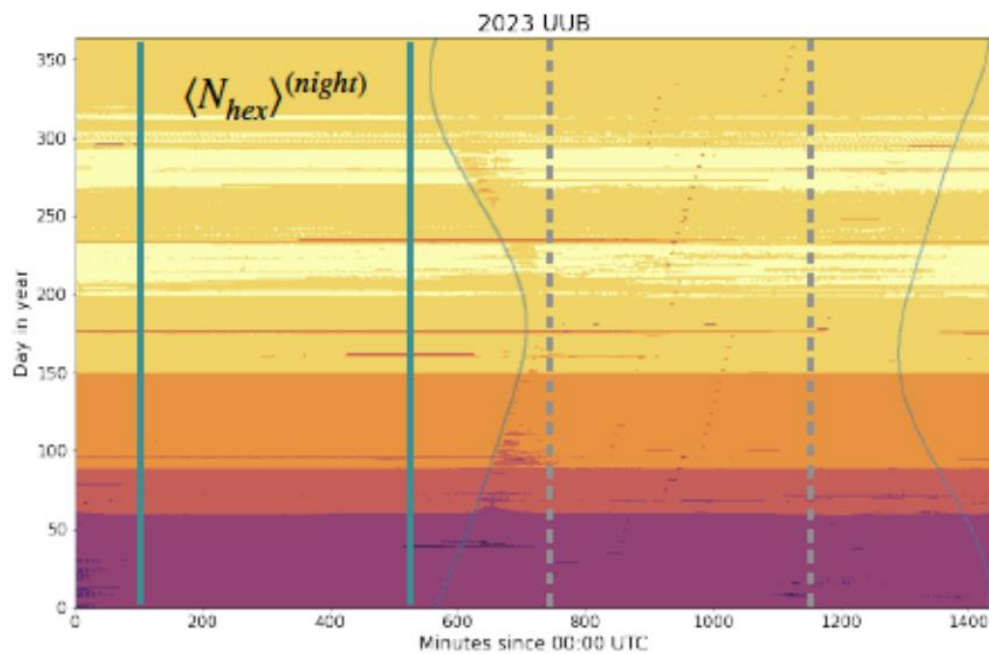


Total Upgraded Station Power Consumption: ~14W

Total Pre-Upgraded Station Power Consumption: 10-12W

- **Most batteries are still functioning properly.**
- **Insufficient spare batteries for replacements.**
- **Increase battery maintenance efforts.**
- **Order additional Moura batteries for immediate replacements.**

We should ensure that battery capacity is sufficient for bridging over the night and over a few days without sun





- See introduction
- Phase I e II performance paper

