

Tests on RPC6: F⁻ deposit

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ECOGAS@GIF++ COLLABORATION



EP-DT
Detector Technologies

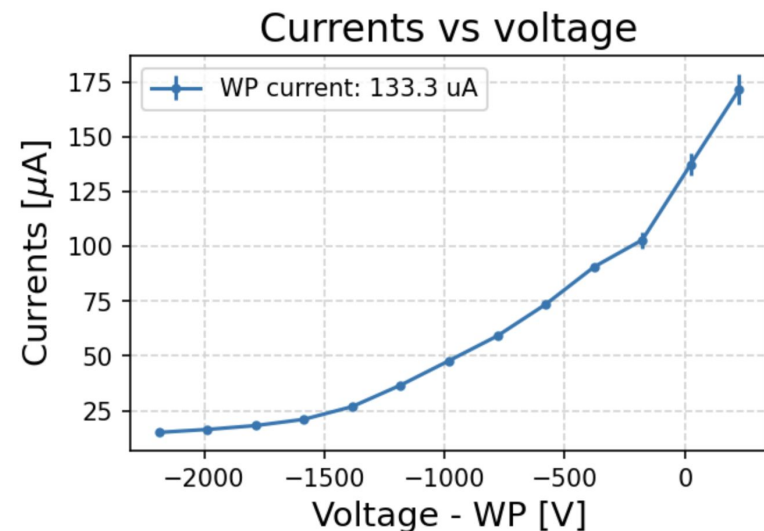
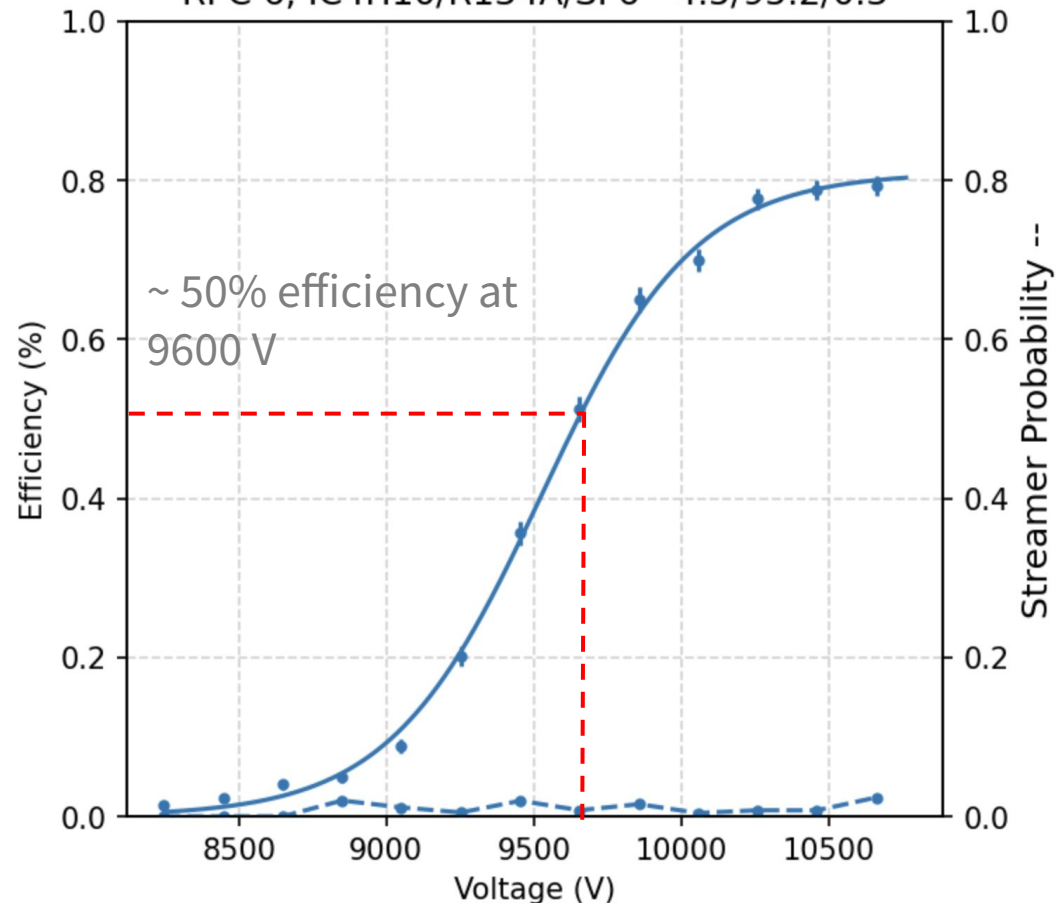
Integrated a total of 300 mC/cm²

Detector dismantled and tested in the lab with cosmic muons

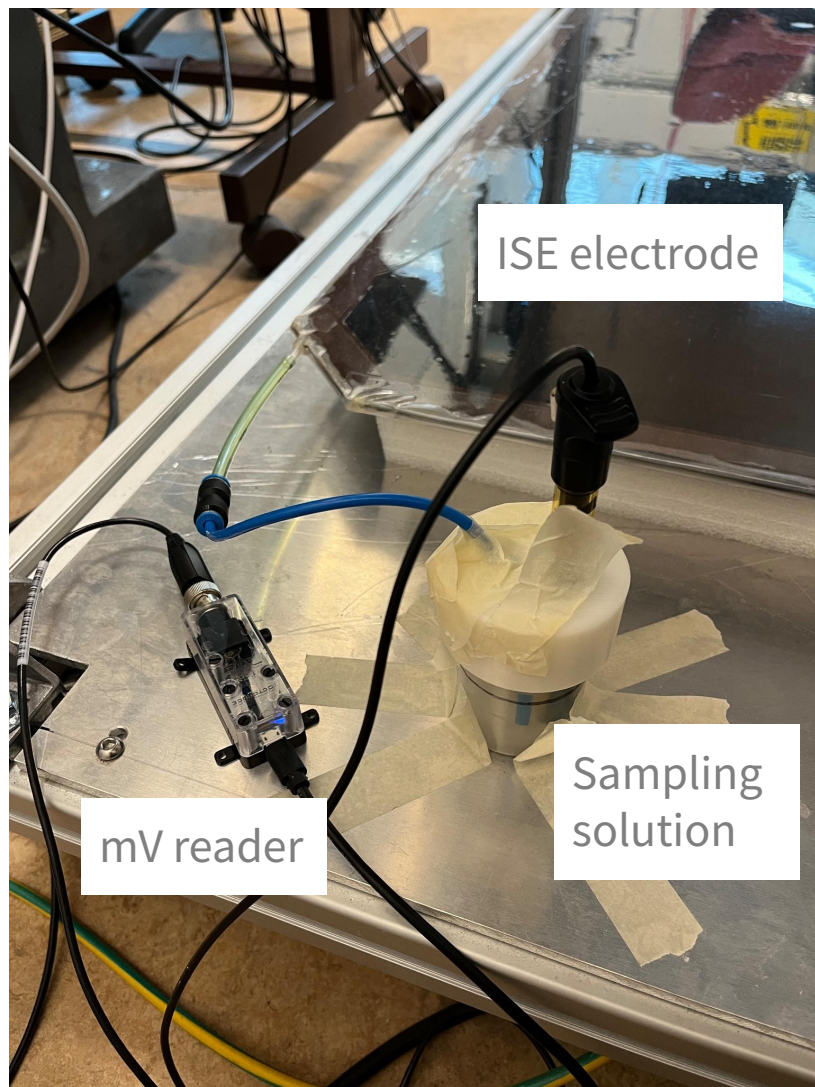
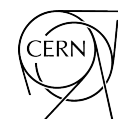
Data taken with STD gas mixture in April 2023

• RPC 6, Eff: 80.99 %, SP: 0.76 %, WP: 10435 V

RPC 6, IC4H10/R134A/SF6 - 4.5/95.2/0.3



Setup and test idea



Goals of the tests:

- Determine the time required to remove the F- deposit from the gas gap
- Investigate the difference between the detector on and off condition
- Study the correlation between F- removal and the detector current

The detector is flowed with **pure argon**, not humidified at 1 l/h

All detector's exhaust is left bubbling in the sampling solution.

Electrode calibration performed periodically

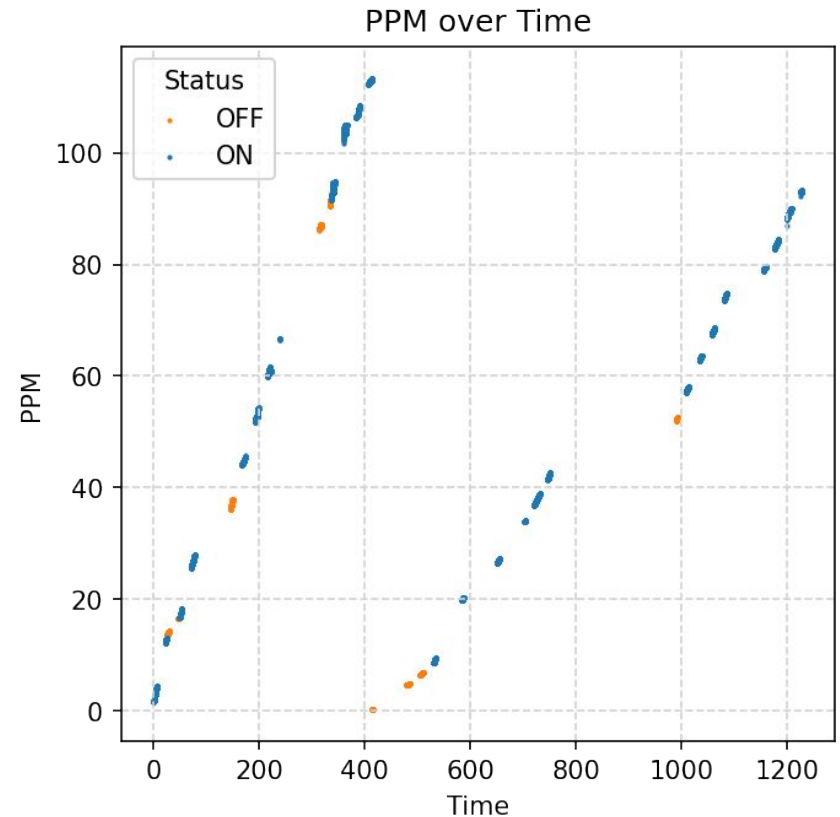
Data Overview



Test started mid-August 2025, together with Summer Student Henrietta

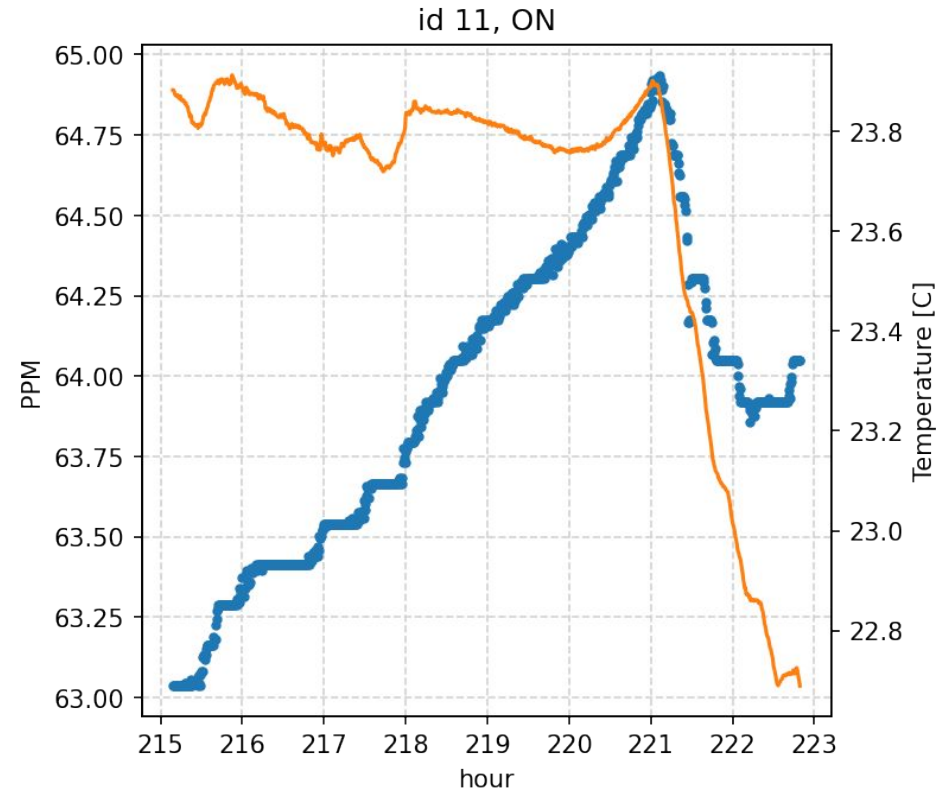
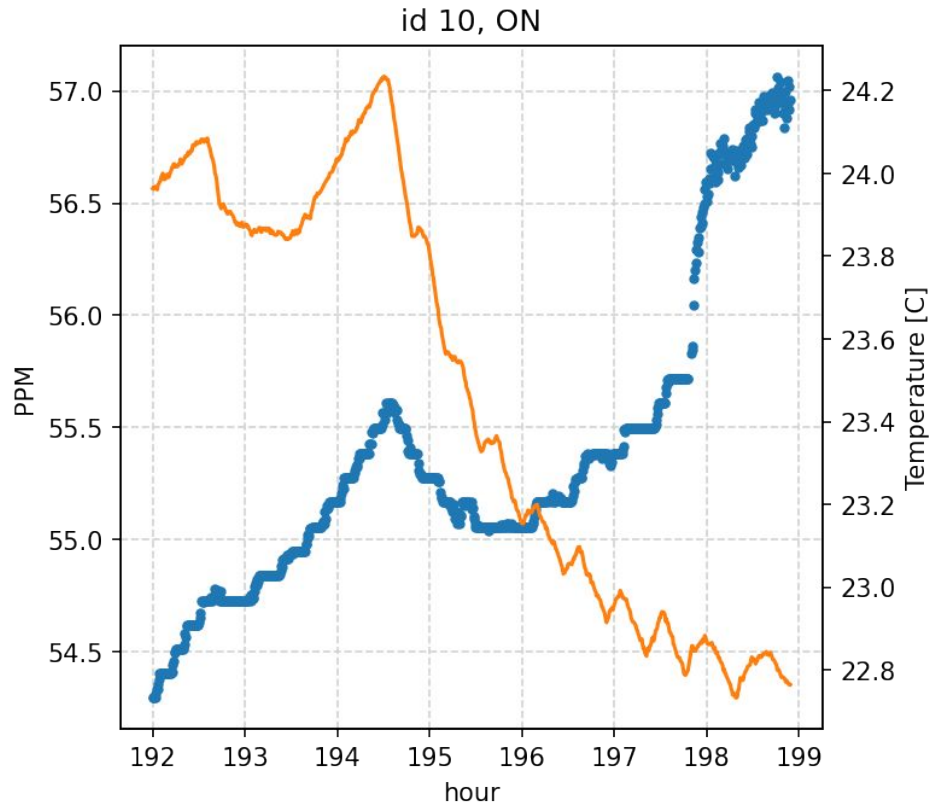
the HV was selected to have initially around 40 μA (2175 V)

The electrode is left in the solution for 6-7 h/day



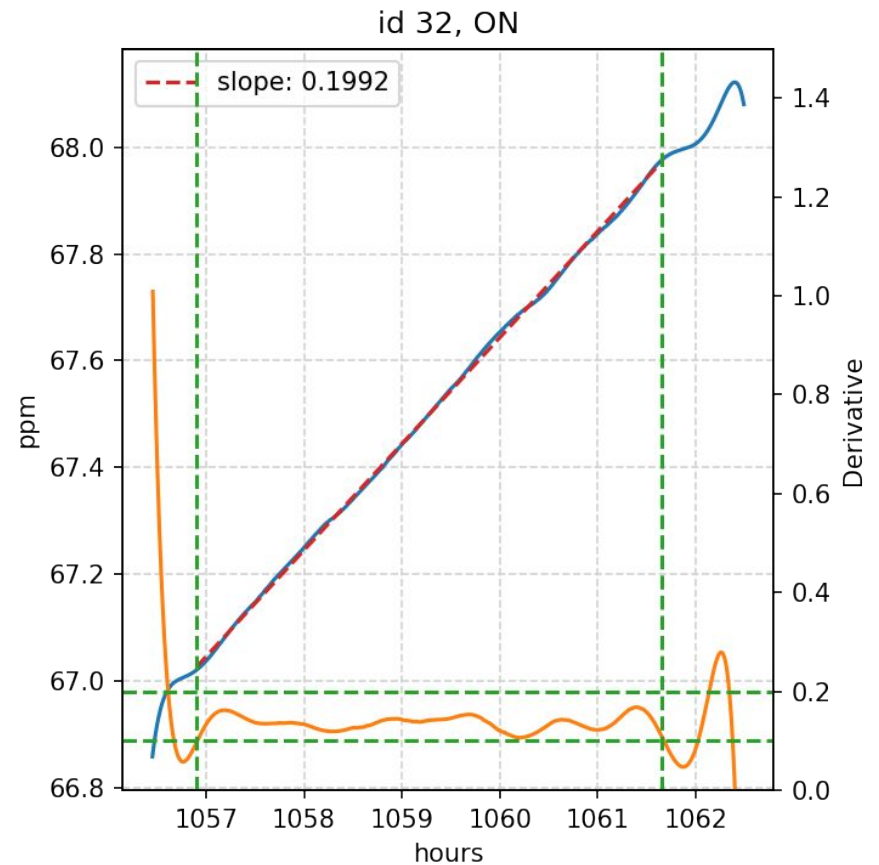
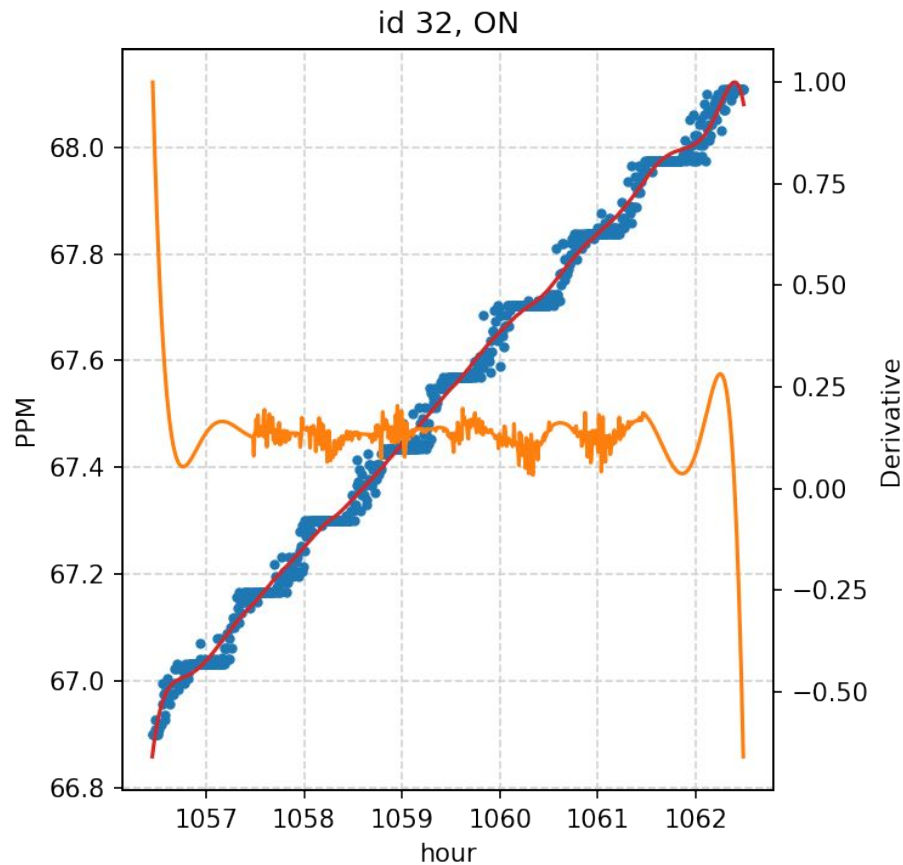
For each measurements, a linear fit was considered to extract PPM/h, selecting the dataset for which the temperature remains stable (± 0.2 $^{\circ}\text{C}$ wrt mean)

Temperature dependence



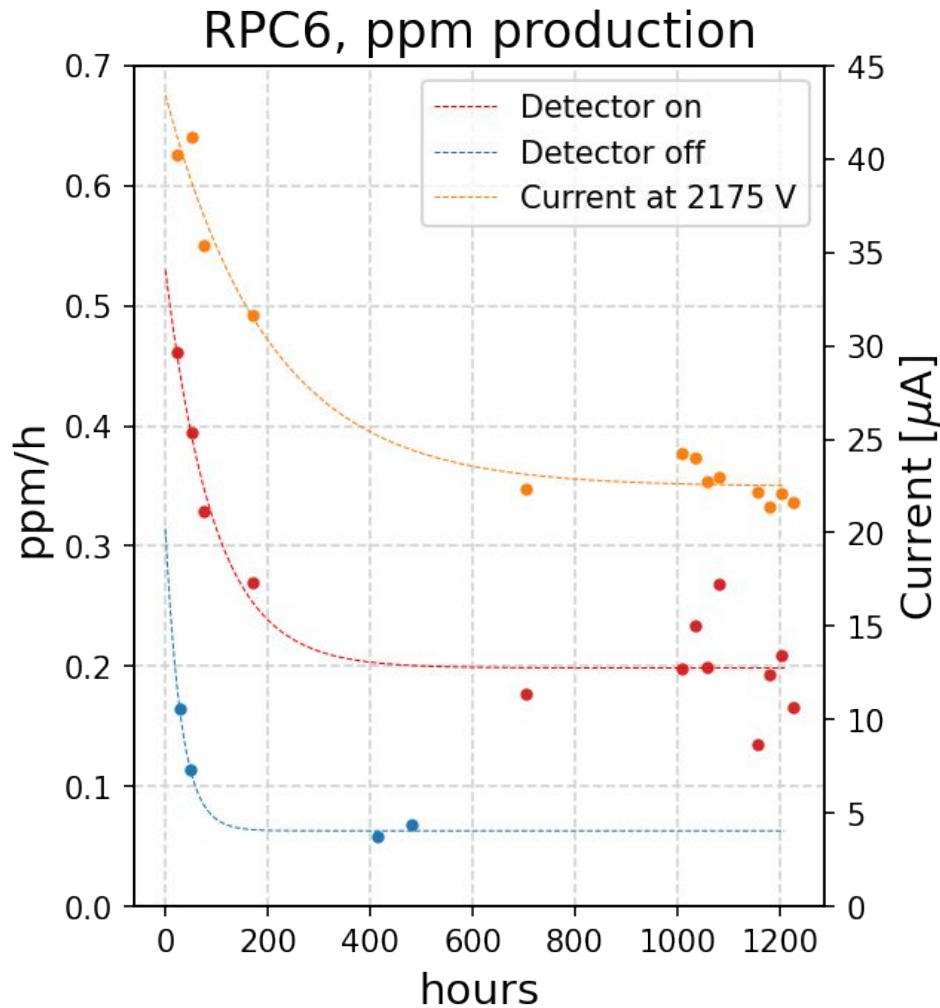
1. The measurements is influenced by the laboratory environment
2. Future tests with a fixed ppm solution could study the correlation between temperature and measurements, allowing to perform a correction on the data
3. For this reason, some interval are not considered in this analysis

Data Example



1. Applying Savgol filter to smooth the data
2. Computing the derivative + smoothing
3. Selecting the bigger interval with the stable derivative (within 0.1)
4. Perform a linear fit and extract the slope on the selected interval

Data Results



- The detector ON condition allows faster removal of F- compared to the OFF condition
- The removal rate stabilizes at around 0.2 ppm/h, indicating a constant F- removal after 600 hours
- The detector current decreases with a similar trend to the F- removal rate, suggesting a linear correlation between the current and the removal rate, even in the absence of fluorinated gases

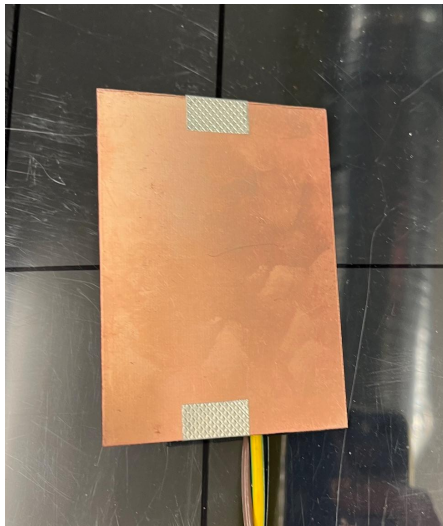
Future tests

- This test demonstrates the feasibility of quantifying the amount of F- accumulated on the detector surface and the possibility of correlating its removal with the detector current
- After these measurements, the detector will be re-tested with the standard gas mixture to verify any improvement in performance
- The test could also be repeated using a working detector on the ECOGAS trolley, to verify this effect, including tests with humidified argon

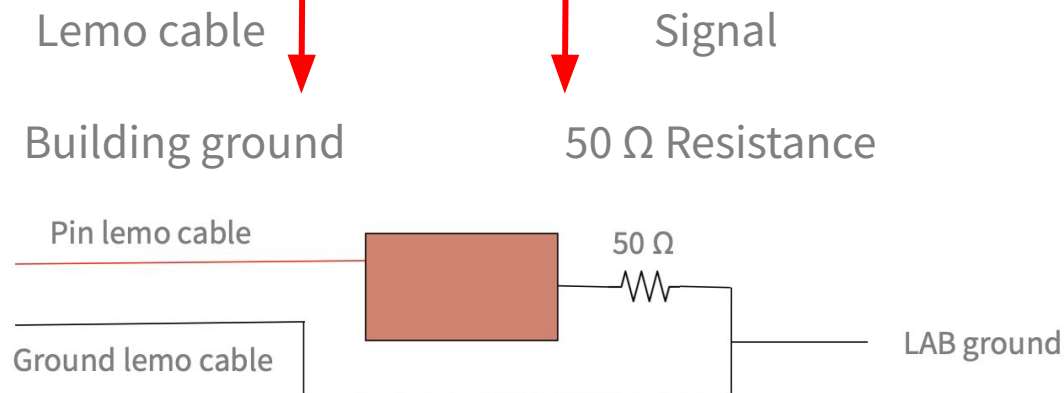
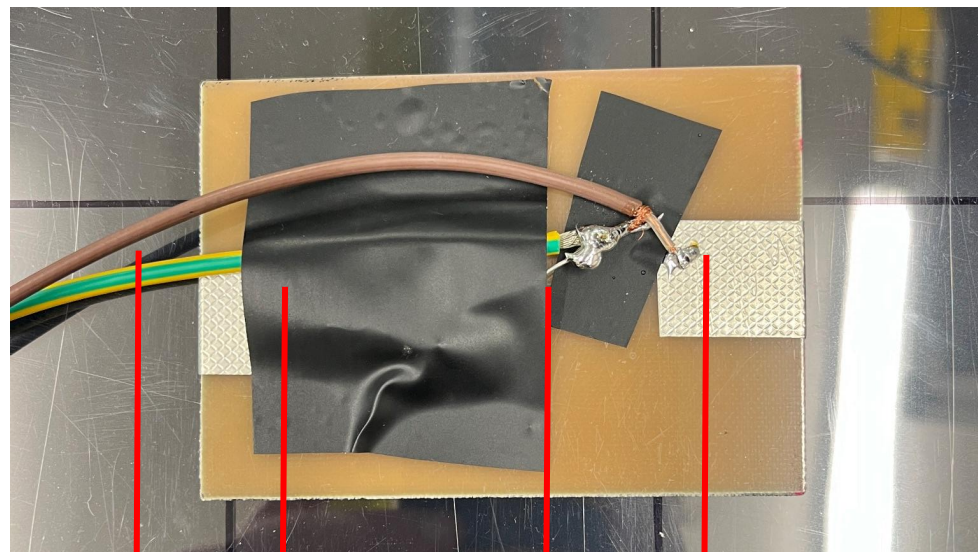
Overall, these tests confirm the results previously observed in the ALICE gas system, while providing a better understanding of the phenomenon and its timescale.

Backup

Set up



- RPC divided into 9x10 square
- Used digitizer 1730 Desktop for the acquisition



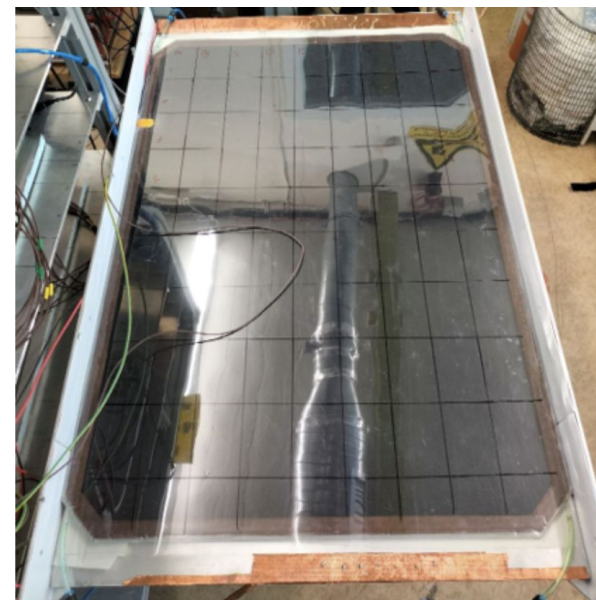
Set up

9 columns (A, B, ..., I)

Gas input

10 rows (1, 2, ..., 10)

Gas output



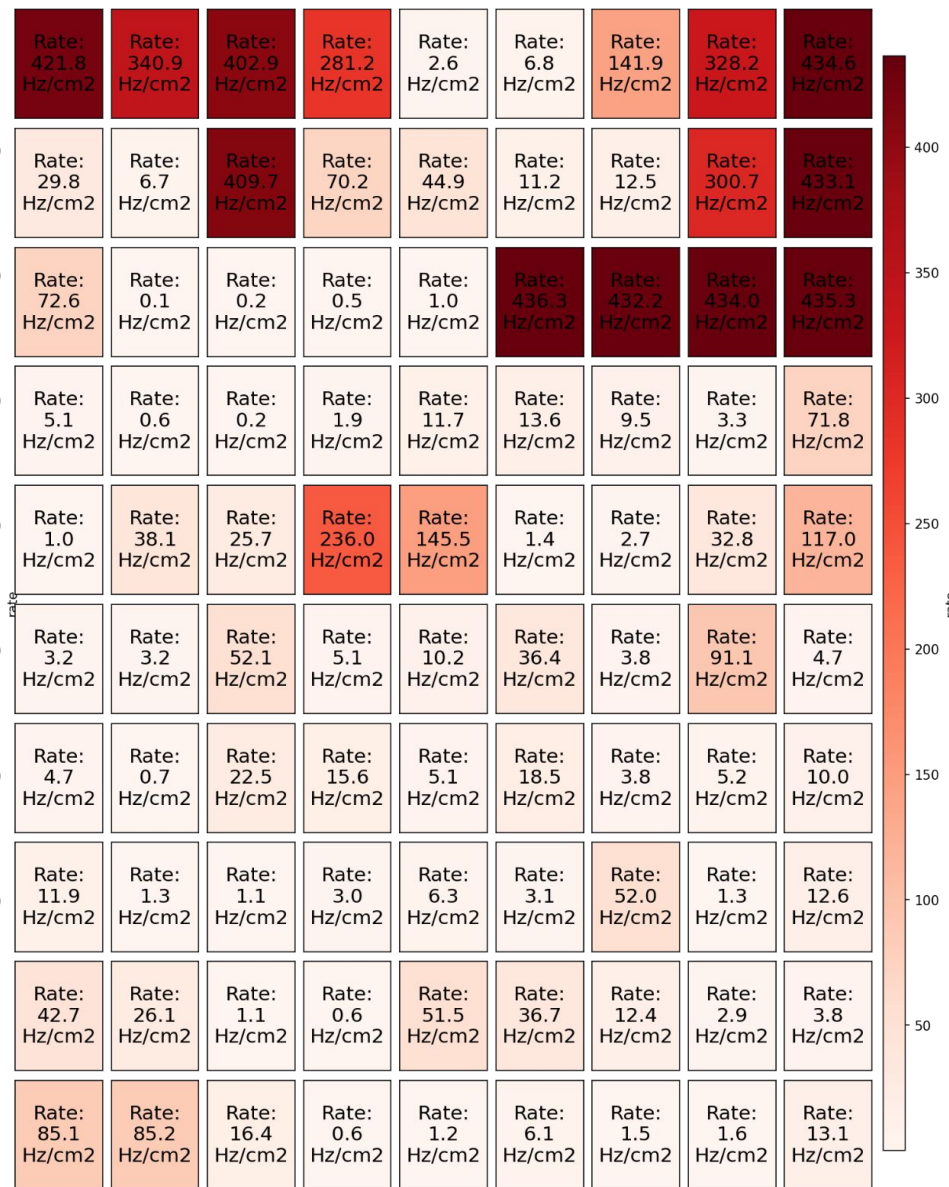
[Plot available here](#)

Rate gradient



9000 V

Rate gradient



9600 V