Towards Resistive Plate Chambers

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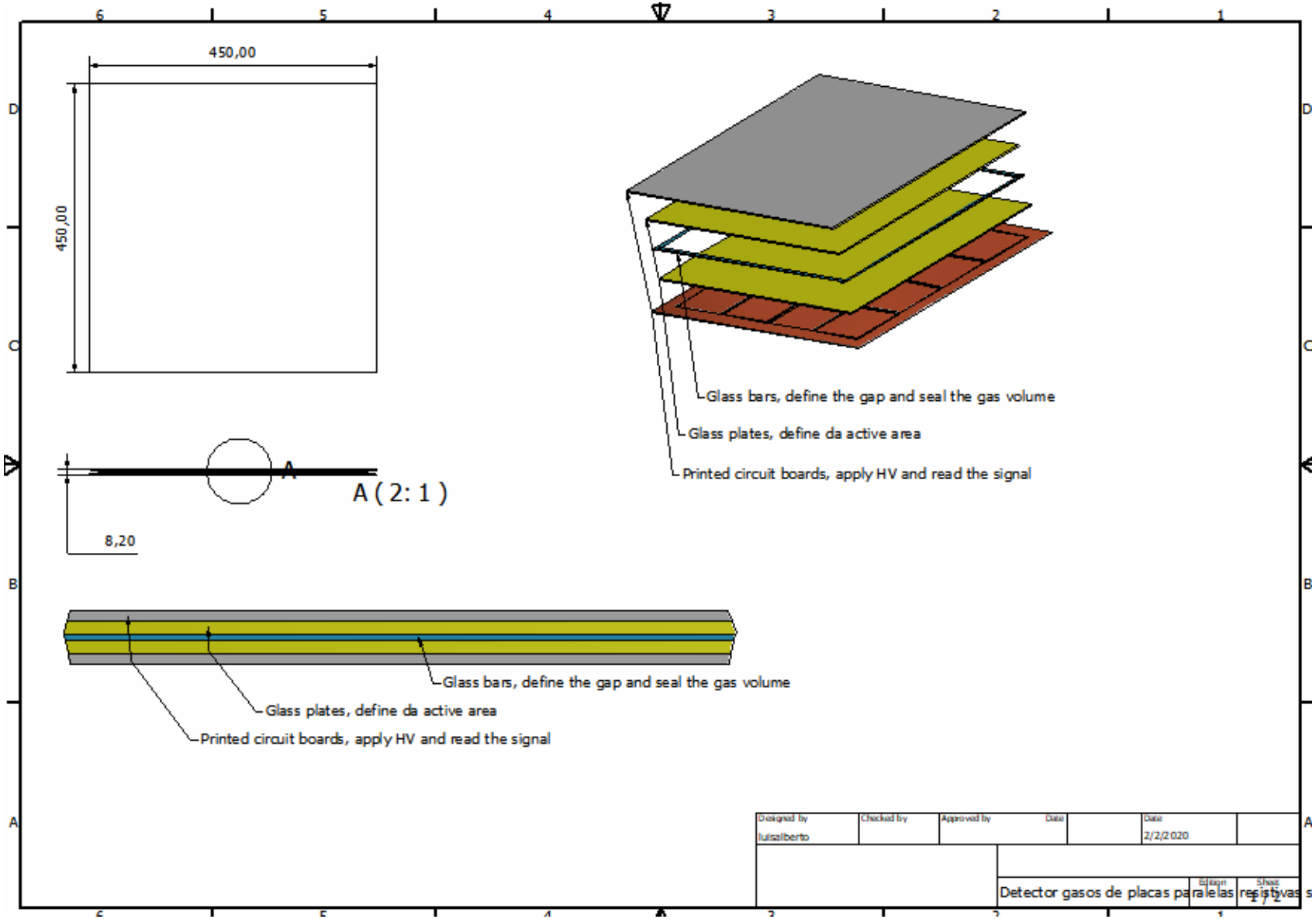
Motivation

- Idea with some years but no time to work on that
- The "open" questions related with R-134a and SF_6
  - GWP
  - Price increase
  - No "real" substitutes that assure acceptable performances,

    at least for timing
- The challenge, for sure the most important
  - Build a zero gas flow RPC

The history – Third attempt, probably not the last



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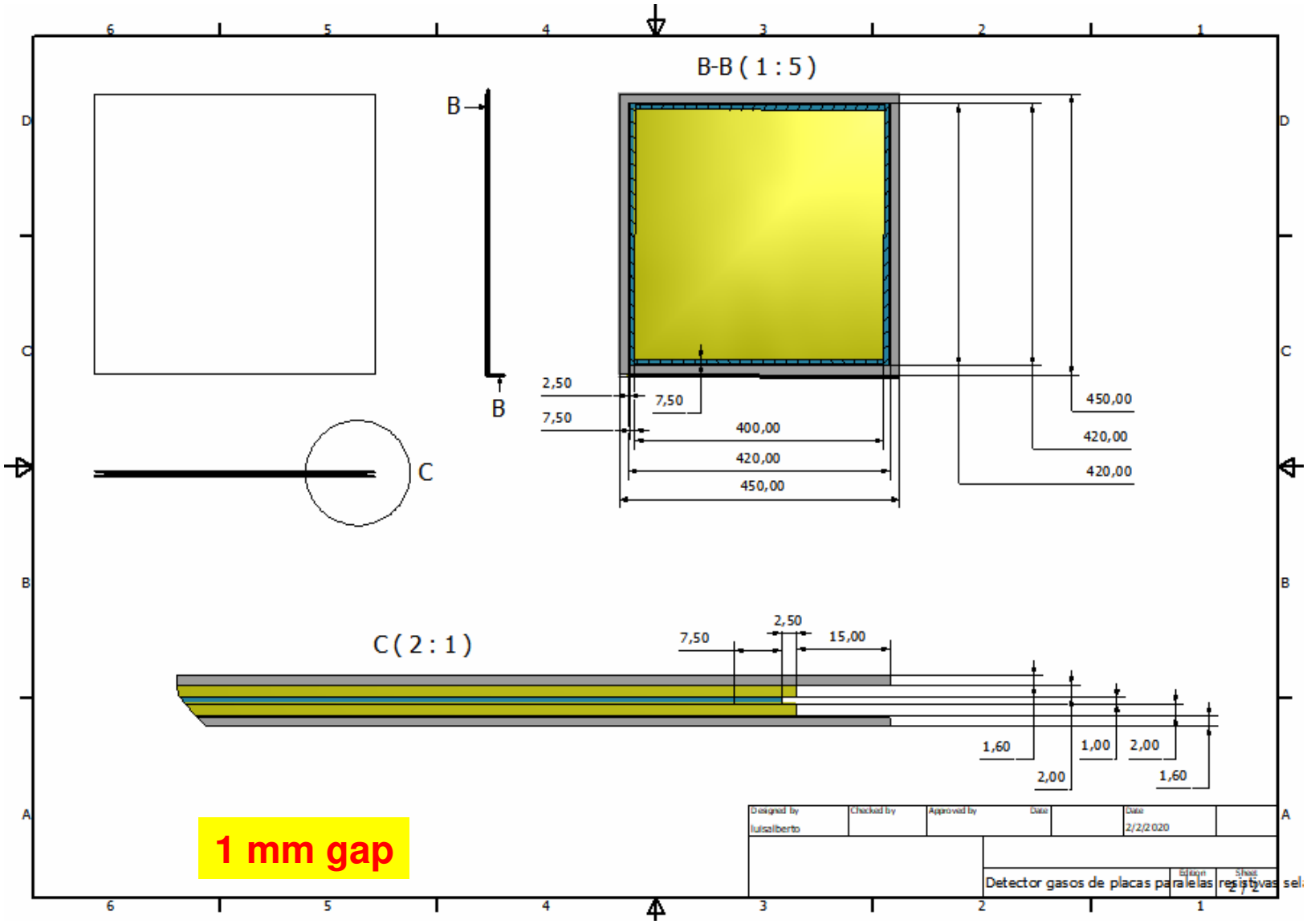

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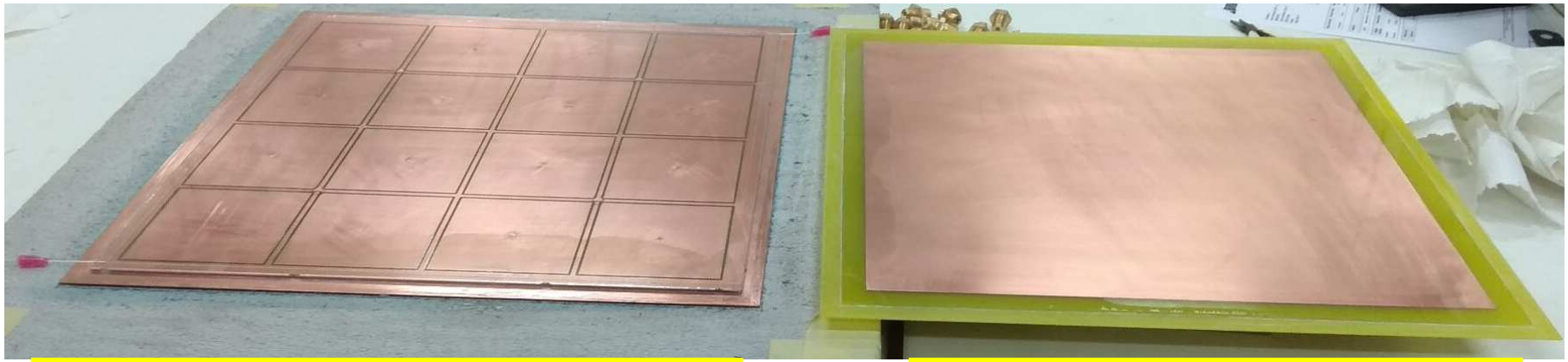
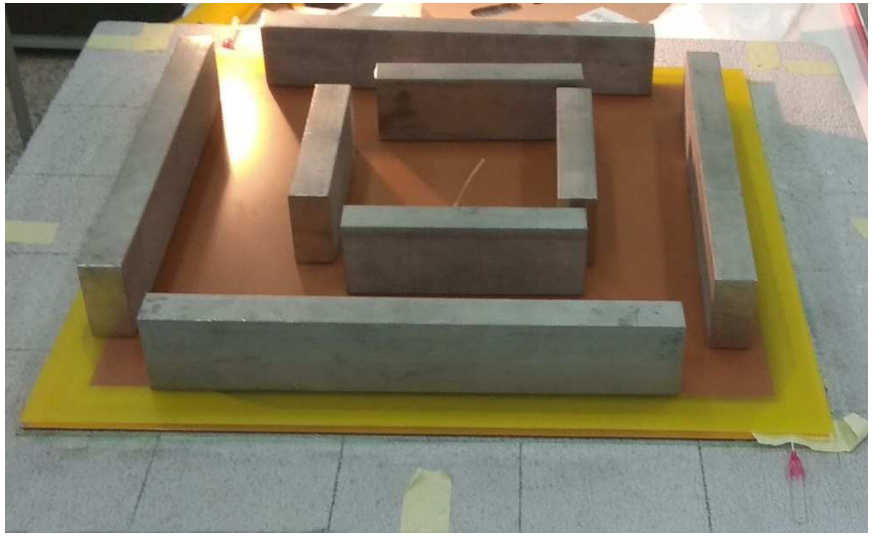
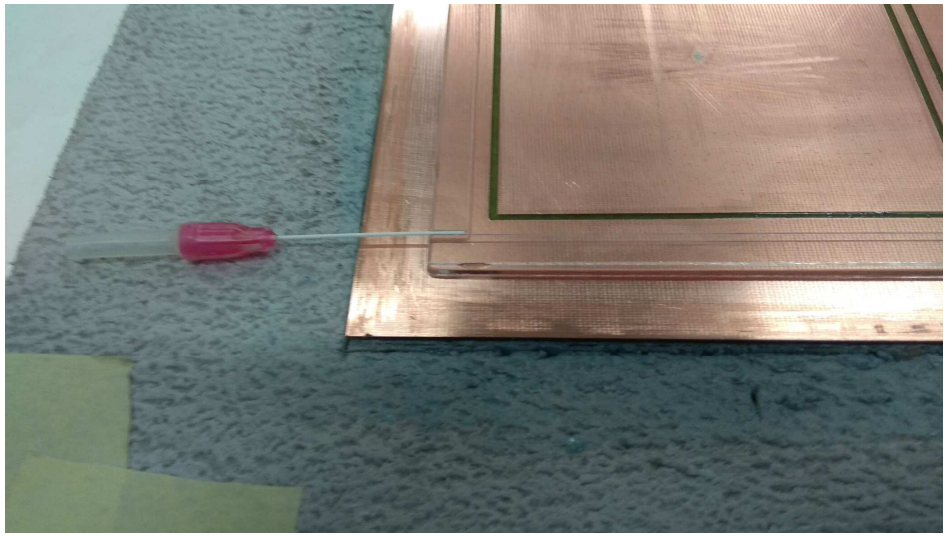


Readout pads 4x4 with 90x90 mm^2

Glass sheets glued to copper





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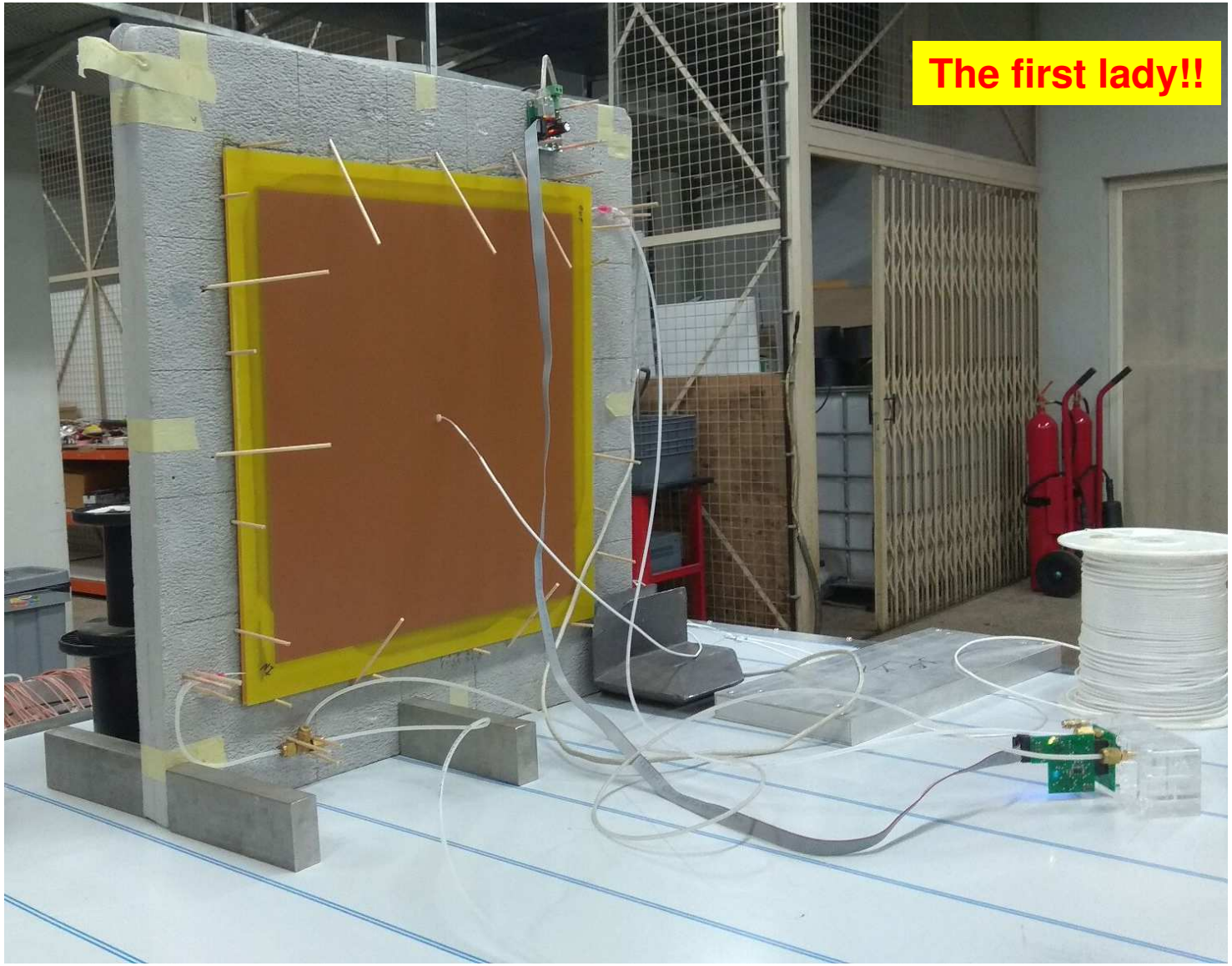
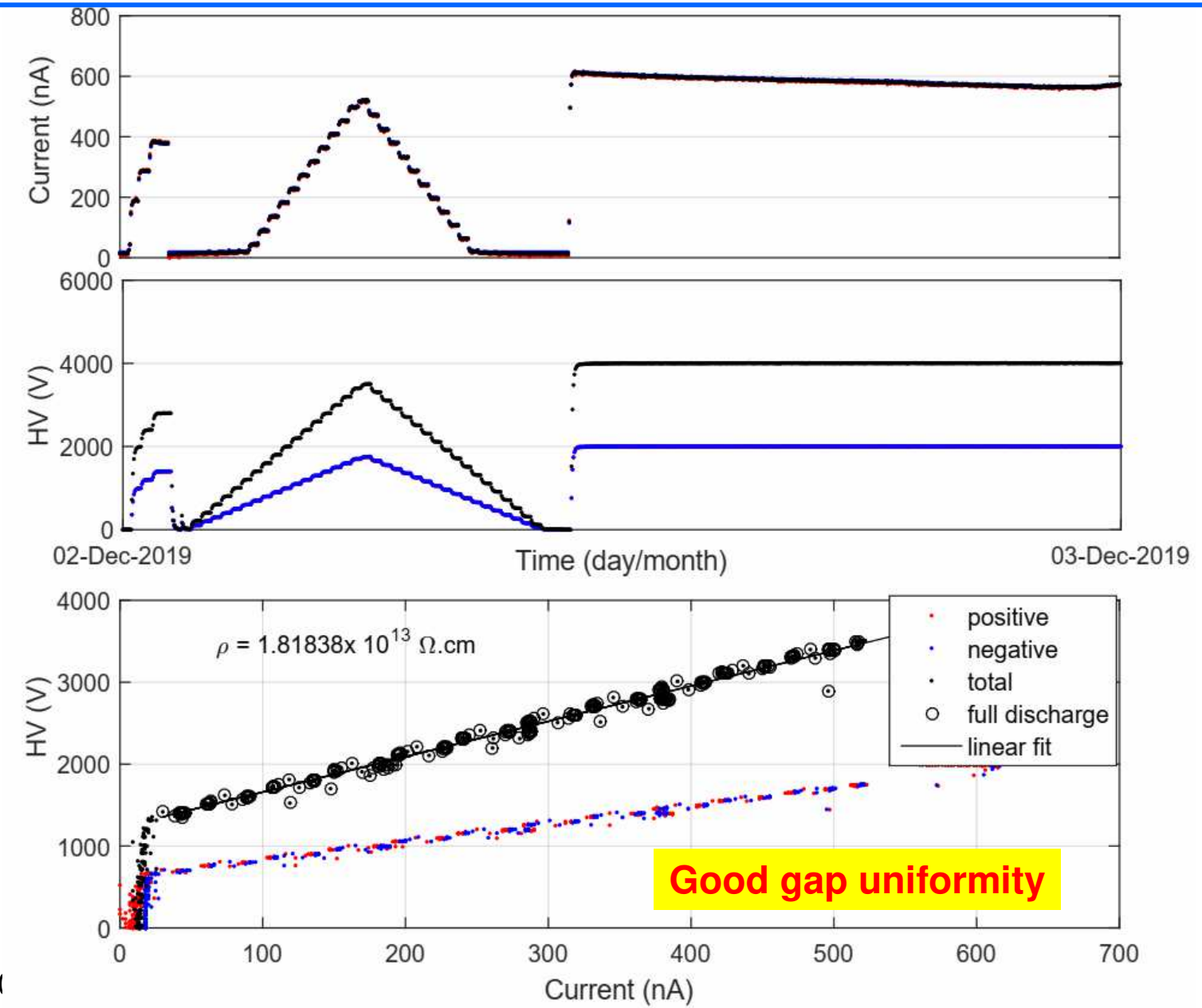
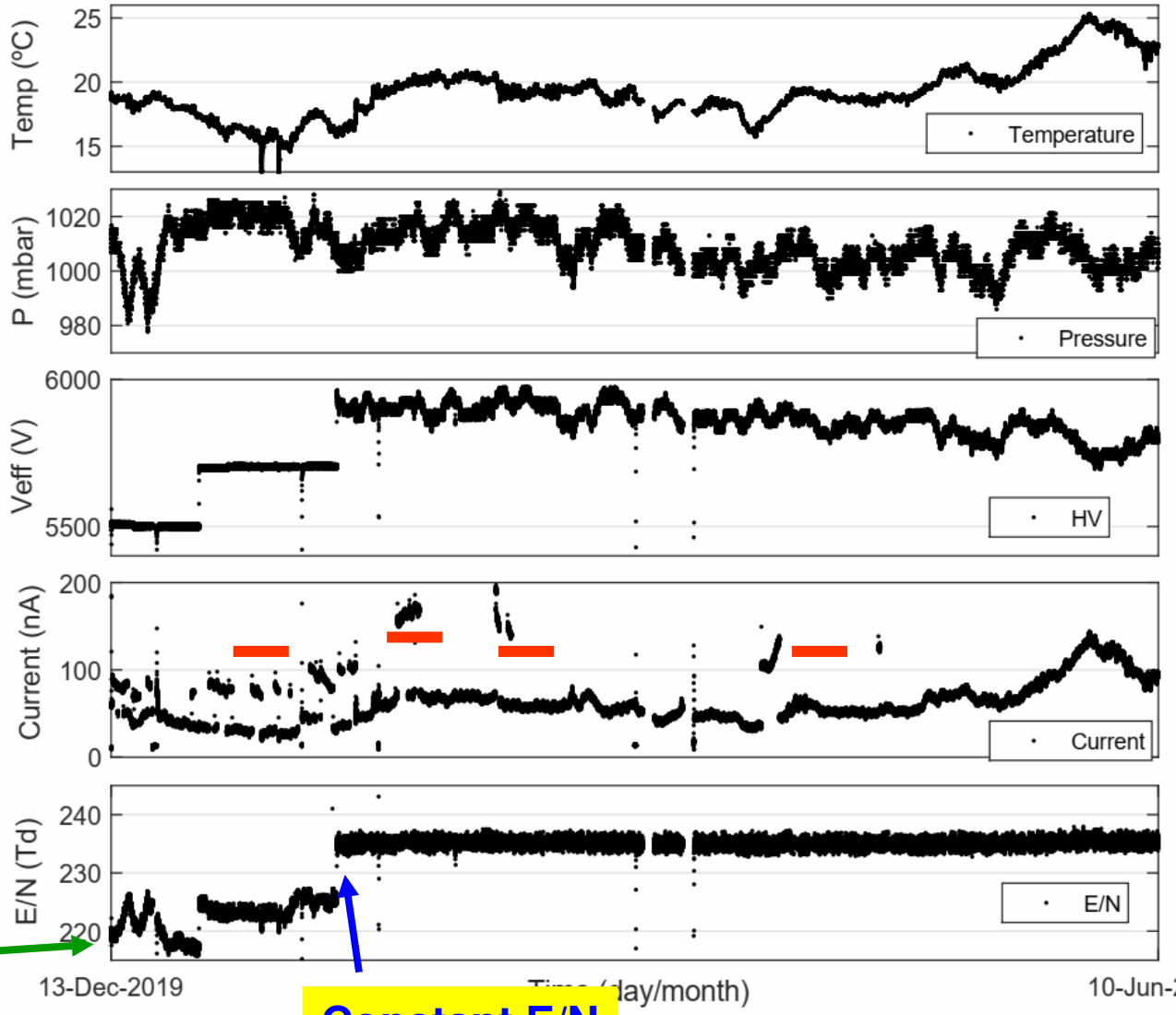


Results – Argon discharge



Results – "Constant" E/N from 21-01-2020

$$V_{eff} = V_{ref} \times \frac{T_{ref}}{T_{measured}} \times \frac{P_{measured}}{P_{ref}}, \quad [V(V), T(^{\circ}C), P(mbar)] \qquad \frac{E}{N} = 0.0138068748 \times \frac{V_{eff,Volts}}{d_{cm}} \frac{(T_{^{\circ}C} + 273.15)}{P_{mbar}}, \quad [Td]$$



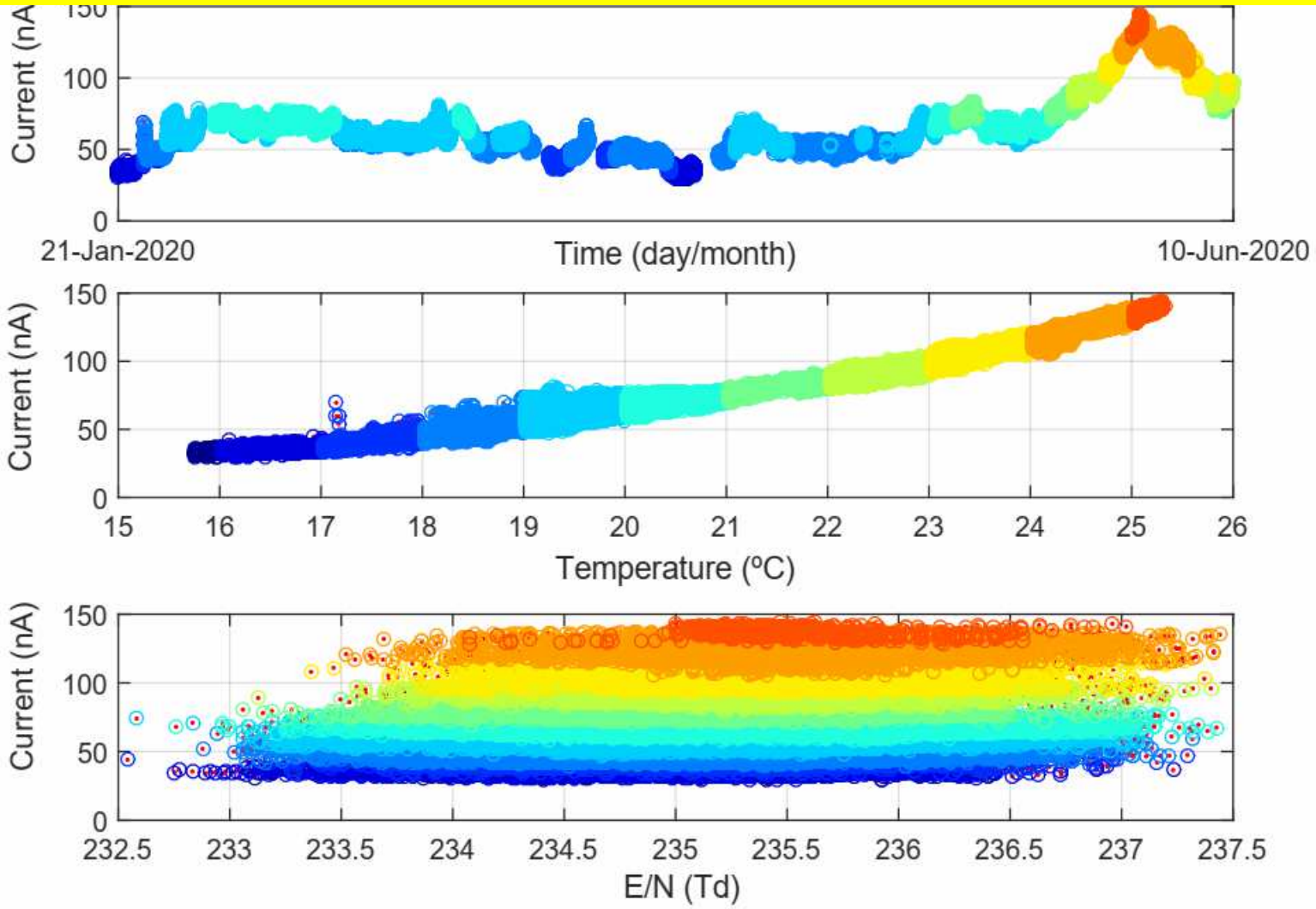
60Co

Zero gas flow

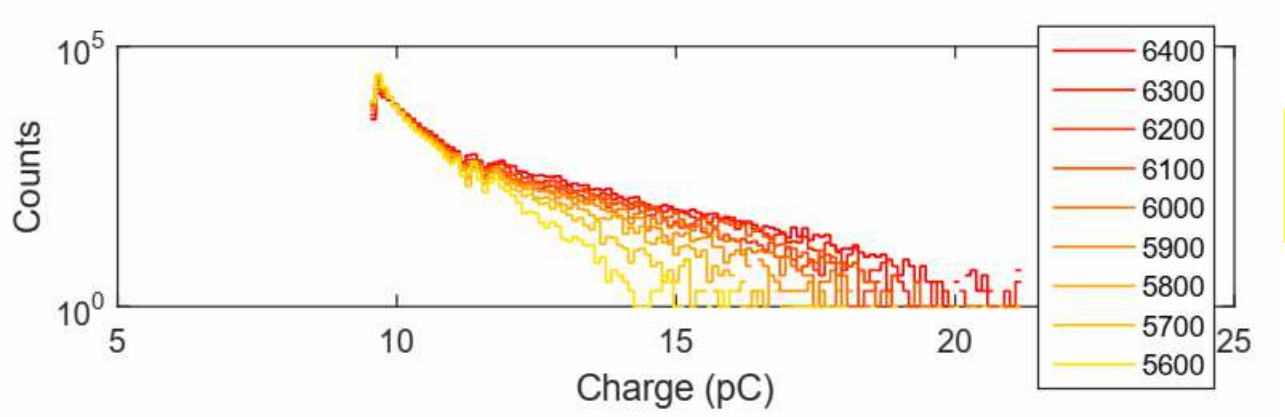
Constant E/N

Results – Current

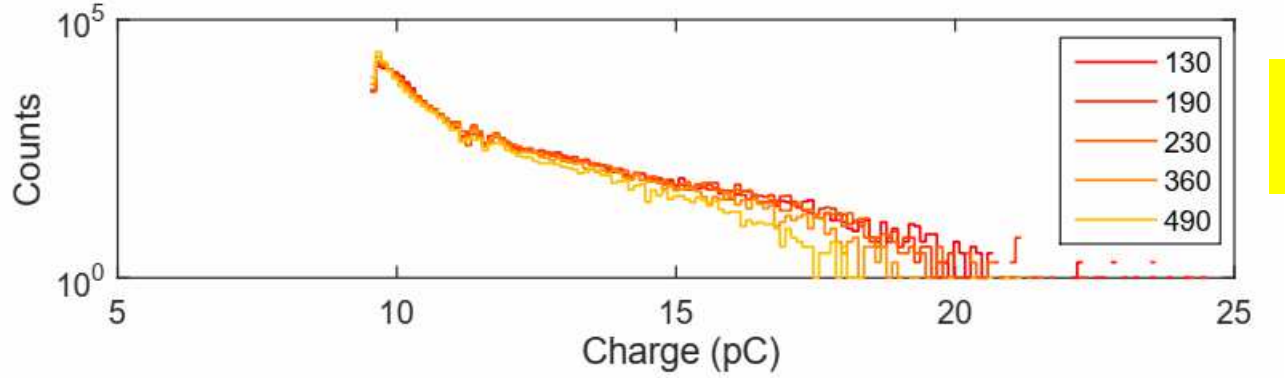
For constant E/N, we should no dependence on the temperature: Possible causes: increase in dark counts, glass resistivity, mechanical changes correlated to pressure variations and some surface DC leaks due to non perfect HV electrodes insulation.



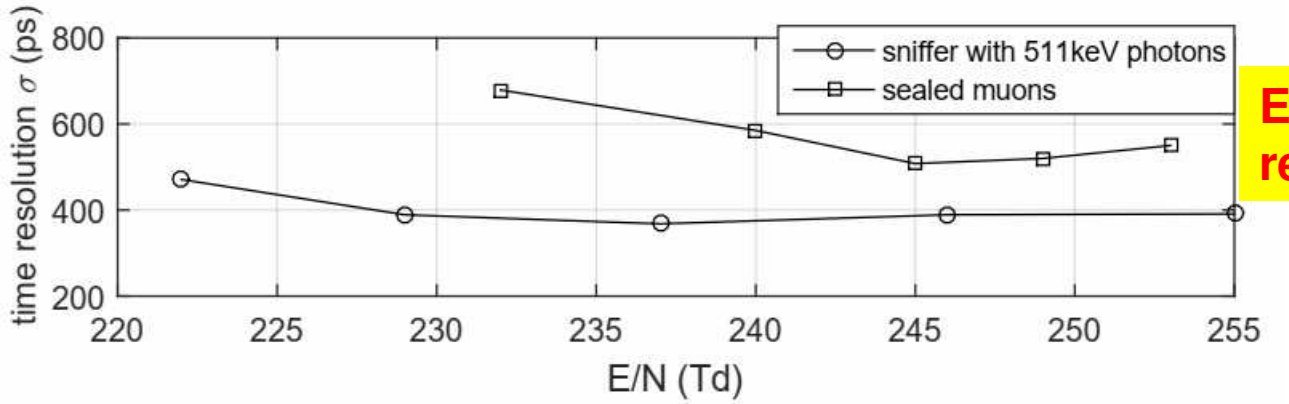
Results – Charge and time resolution



Expected dependence with HV



Expected reaction to rate increase



Expected time resolution.

CONCLUSIONS and Future Work

- **After 6 months the chamber stays stable and no degradation is observed.**
- **Chamber is frequently irradiated with 60Co, increasing the current by a factor 3 and no effect is observed in the "background" current.**
- **We are far from claiming the miracle!!, but it seems to be a productive way to go.**
- **Continue data taking over time**
  - **Different temperature and pressure (daily excursions, 30-40 mbars maximum).**
  - **All practical quantities important for a clear characterization of a RPC**
- **Double gap chambers are already assemble and tests should start in the next weeks**
- **Large area (minimum 1 square meter) chambers will be assemble and tested within this year.**