

X-ARAPUCA efficiency tests in LAr - Preliminary results

Xe Doping Update

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Measurement goals

Retrieve the efficiency of the X-ARAPUCA with an alpha source Am-241

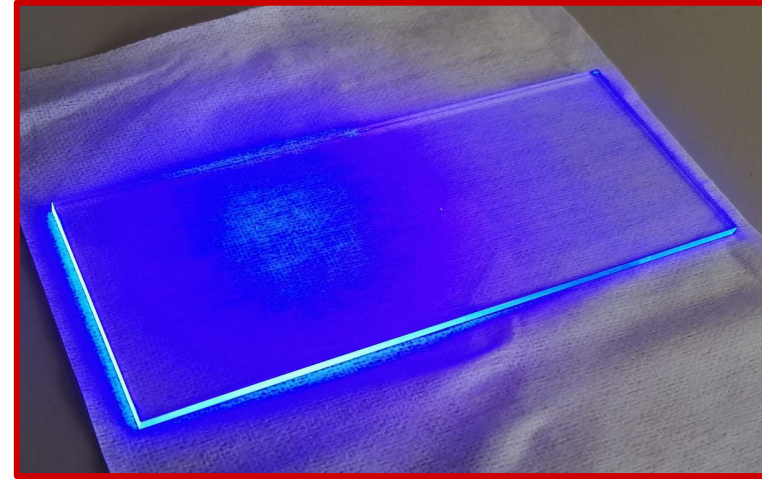
- Eljen 286 slab (PVT)

The results will later be compared with

- Bicocca FB Prototype (PMMA)

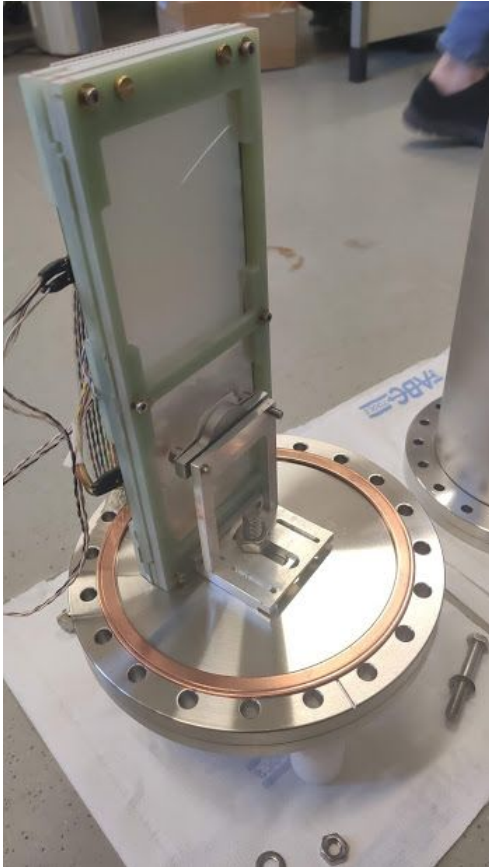
A magnetic manipulator allows the scanning of the X-ARAPUCA along its longitudinal axis.

We can also completely remove the source to make **Muons** and **Gammas** acquisition



Eljen 286

Experimental setup

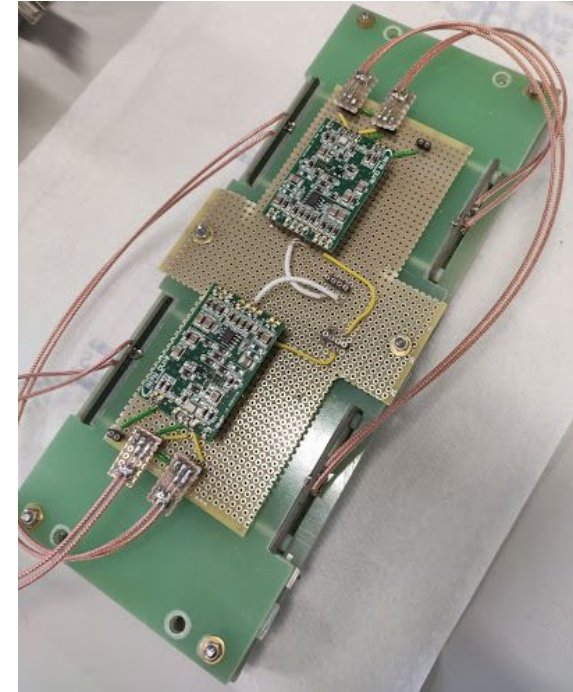


Readout:

- 16 x HPK 14160 6050HS grouped in 4 boards.
- Overvoltage used was +2.7 V and +3V
- 2 x cold circuit, ganging by 8 the SiPMs
- FADC: CAEN DT5725 250 MS/s, 14 bits

Alpha positions:

- Five different positions of the alpha source were chosen.
- One in the very center of the XA.
All the others are symmetric at:
(2.3 and 7.5 cm away from the center)



Experimental setup

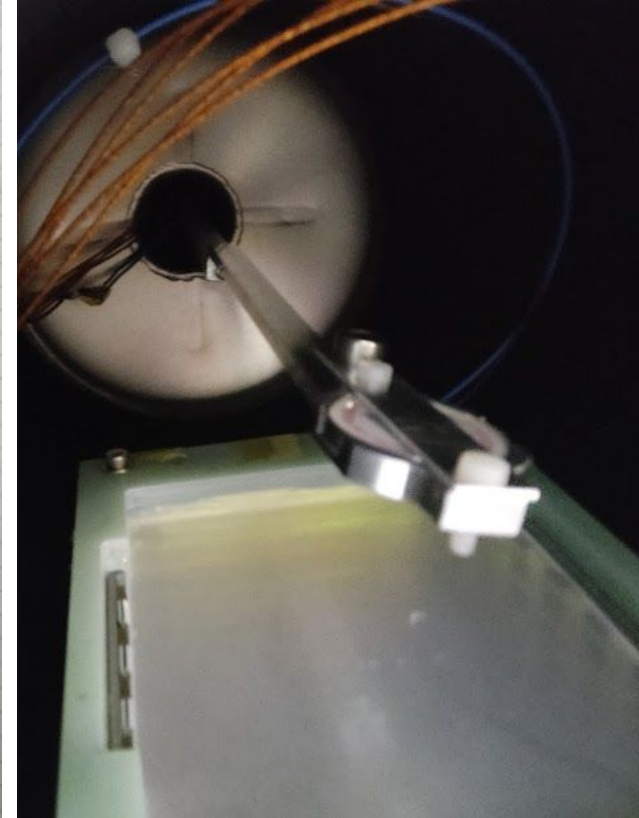
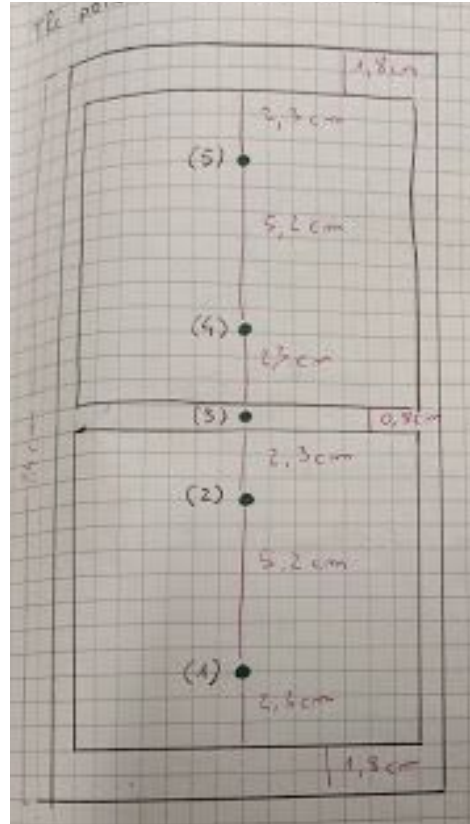
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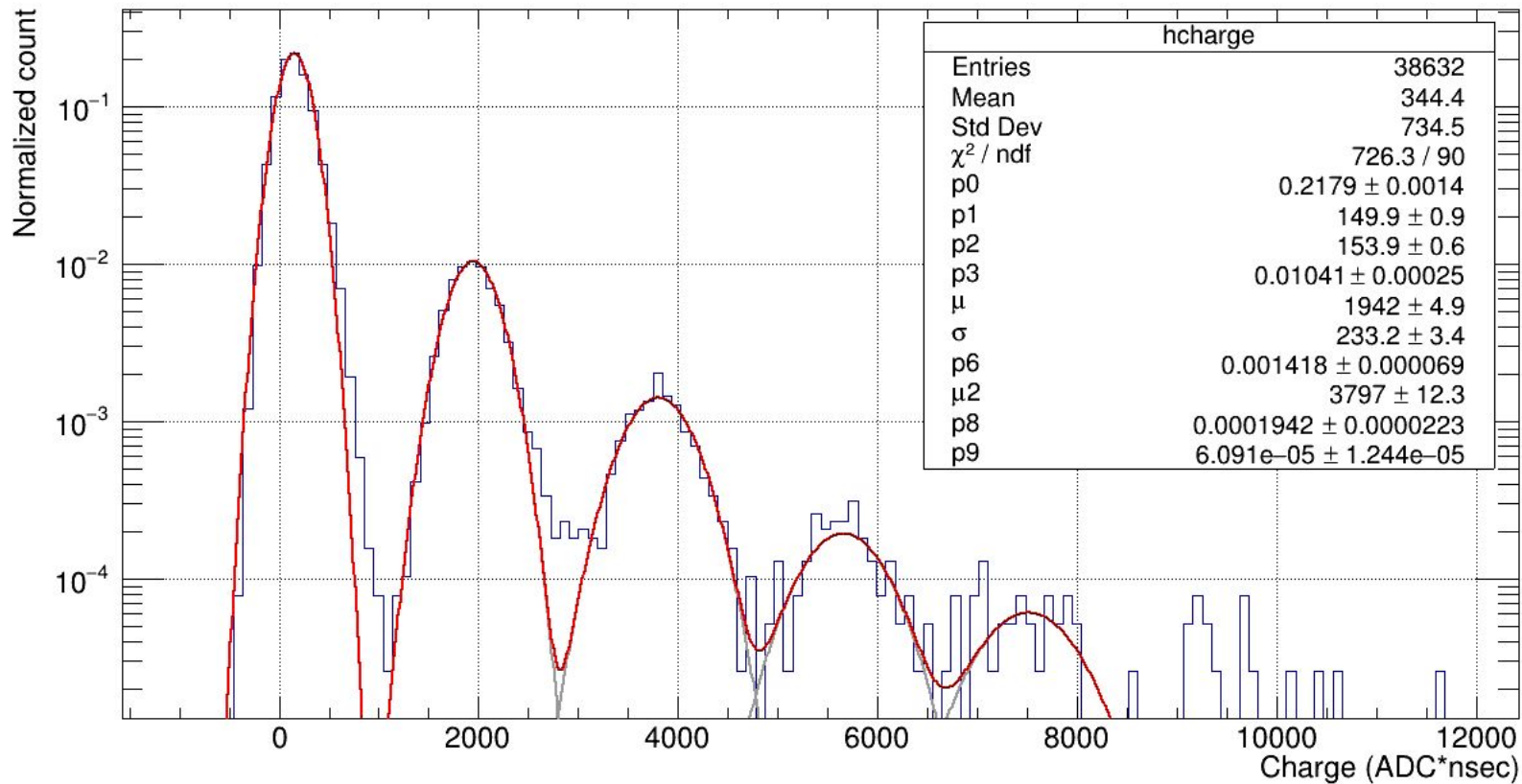
Alpha positions:

- Five different positions of the alpha source were chosen.
- One in the very center of the XA.
All the others are symmetric at:
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The chamber is lined with black cardboard.

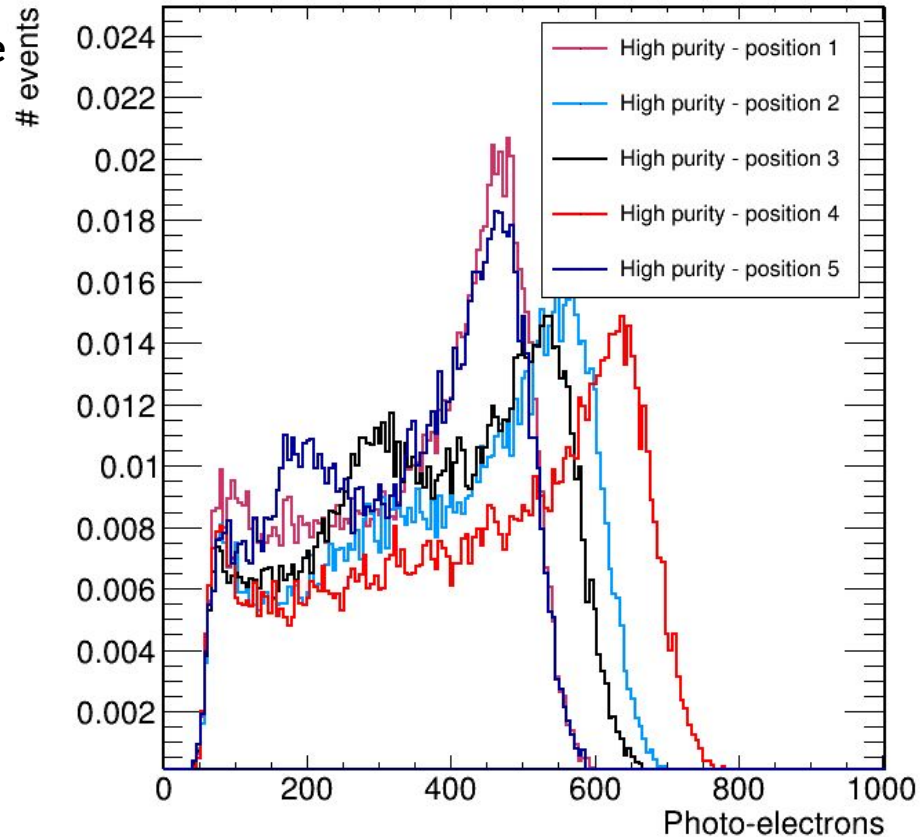


Calibration



Alpha source results

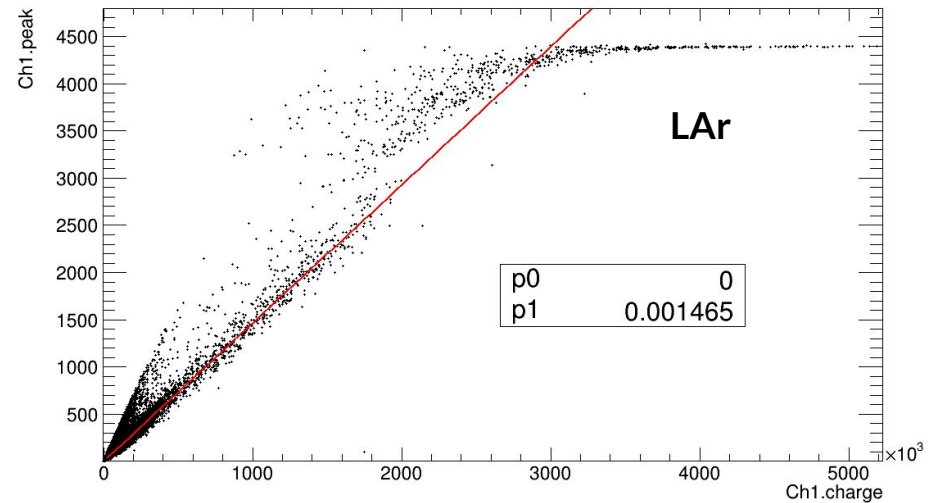
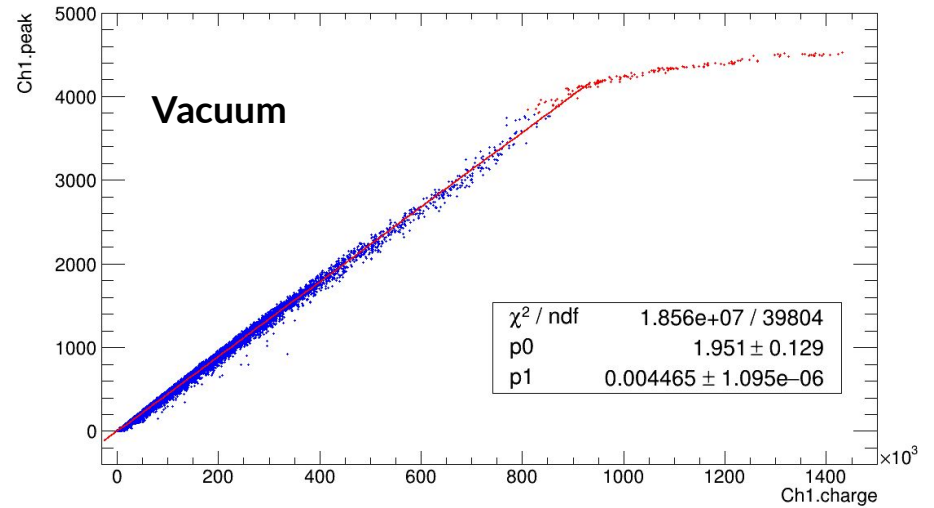
- Results are **preliminar**: the **X-ARAPUCA to source distance** was not constant along the scanning and not really reproducible among different scanings → $d = (5.5 \pm 0.5 \text{ cm})$.
 - The source maybe slightly off-center.
 - **A new mechanical frame is in the construction** and more precise measurements will be repeated.
- A toy model Monte Carlo was done to compute the amount of photons reaching the X-ARAPUCA (Only by solid angle effect)
- **The measured efficiency (no correction)** found was $\sim 2\%$
- When correcting for the liquid argon purity (1 us slow component) and the undershoot present in the waveform, **we found a efficiency of $\sim 2.8\%$**



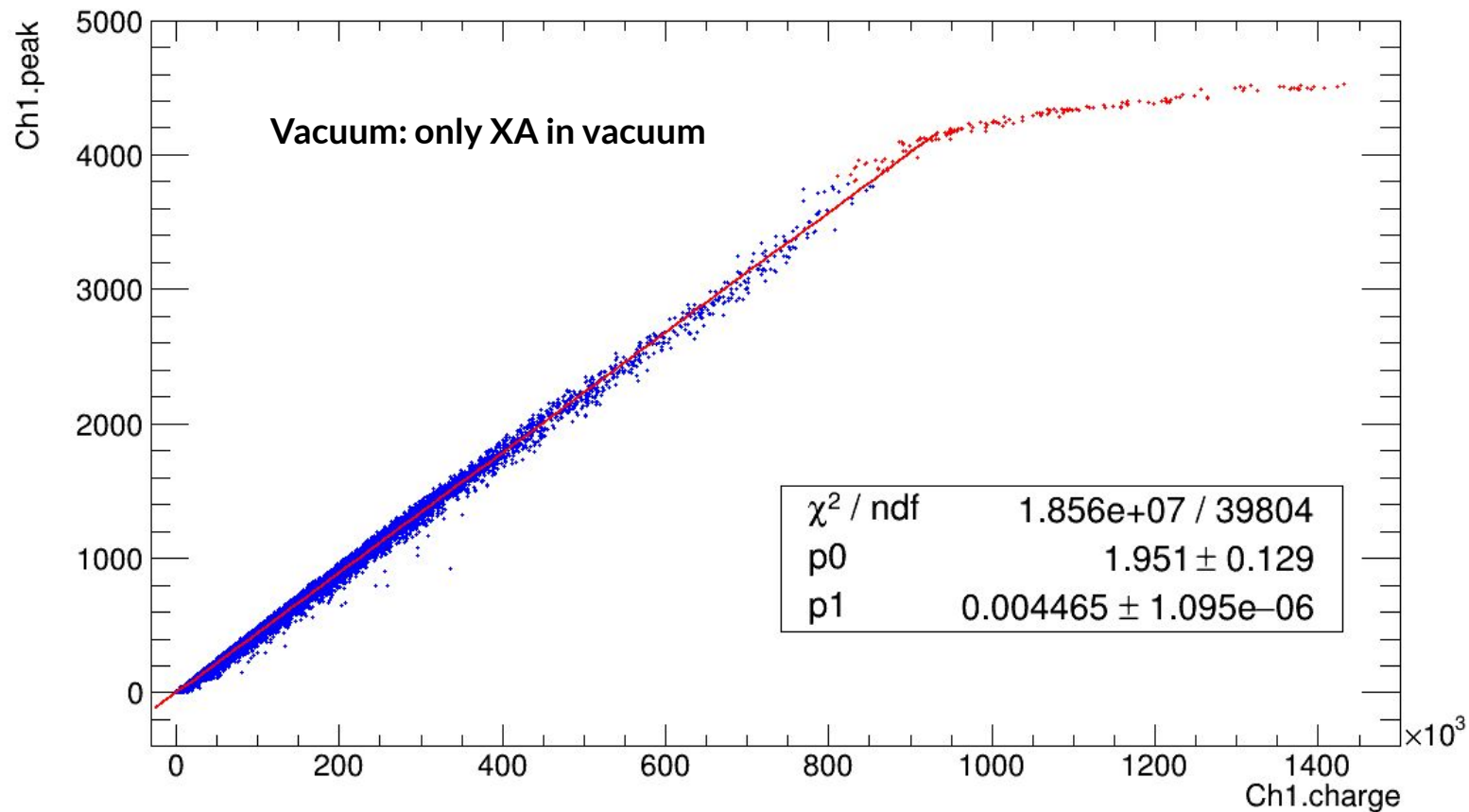
Dedicated Muon acquisition

By removing the alpha source, two muons acquisitions were performing.

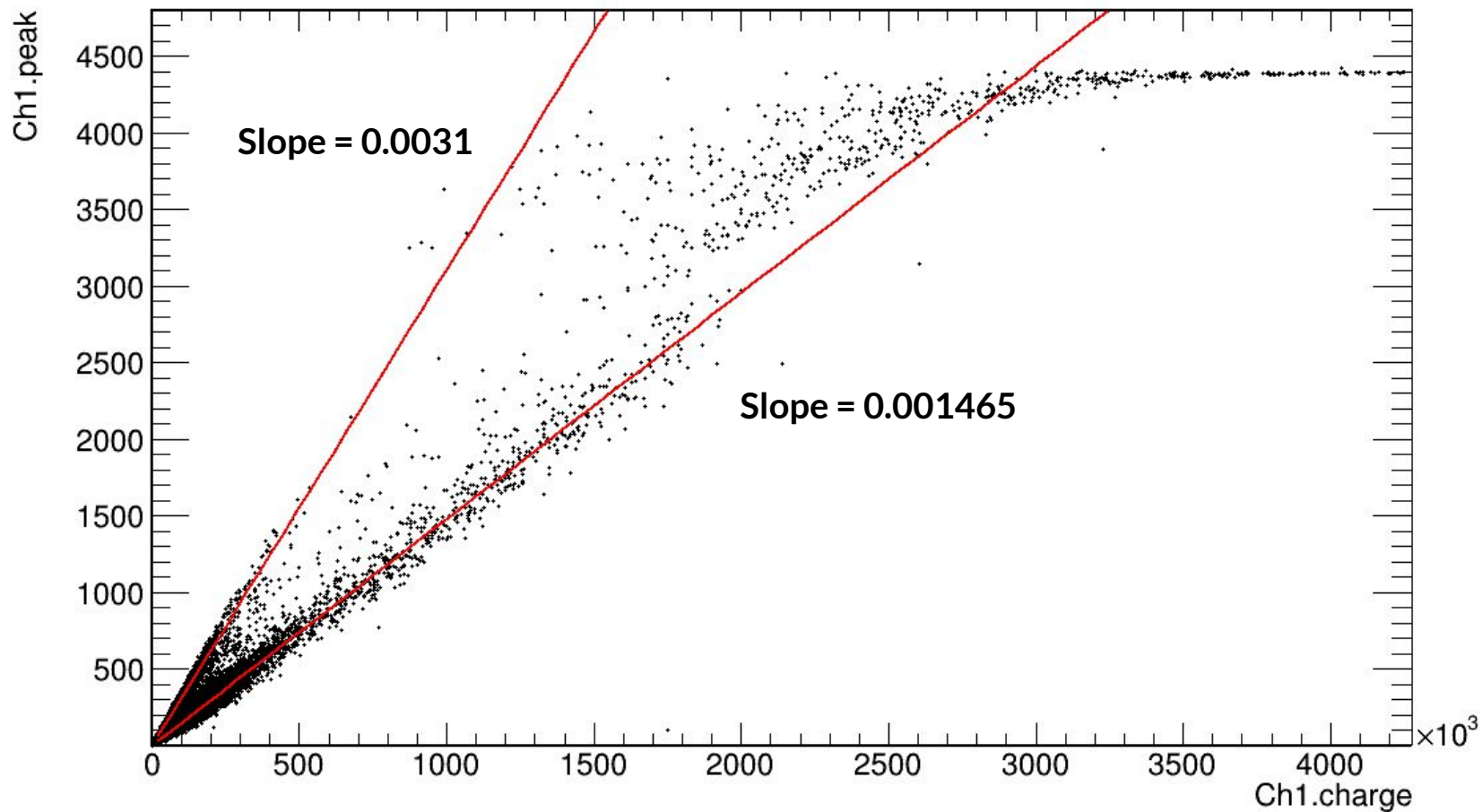
- **At Vacuum**, during the cooling down process. With a temperature about $-133\text{ }^{\circ}\text{C}$ and **one test at LAr**.
- **The test in vacuum should only give light due to Eljen 286 slab scintillation**
- Light detected in the LAr are “contaminated by the light of Elj slab.
- Measurements were normalized by acquisition time



Dedicated Muon acquisition

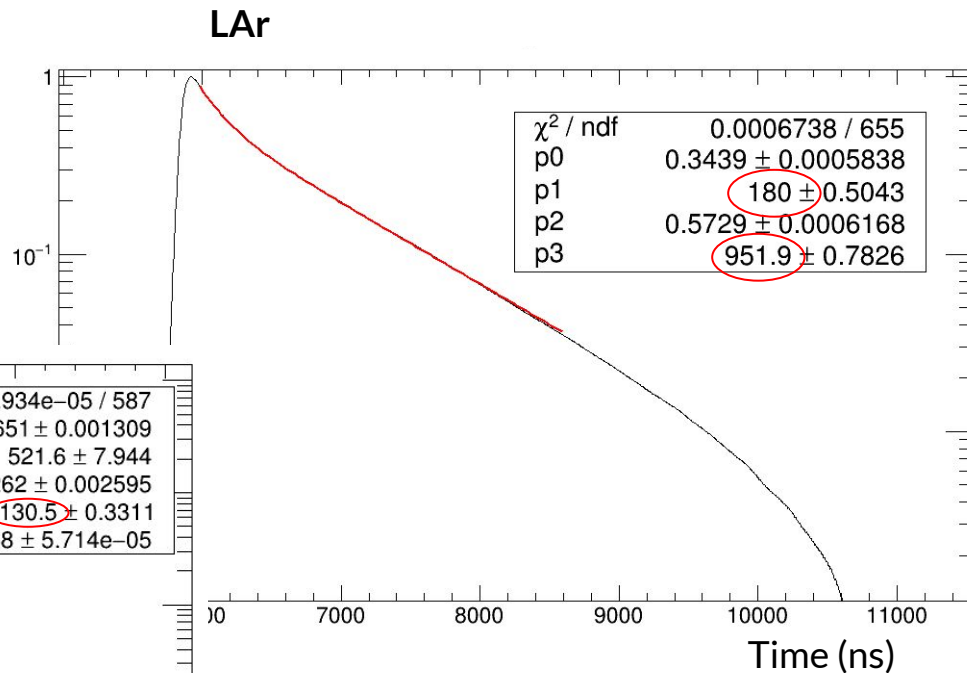


Dedicated Muon acquisition

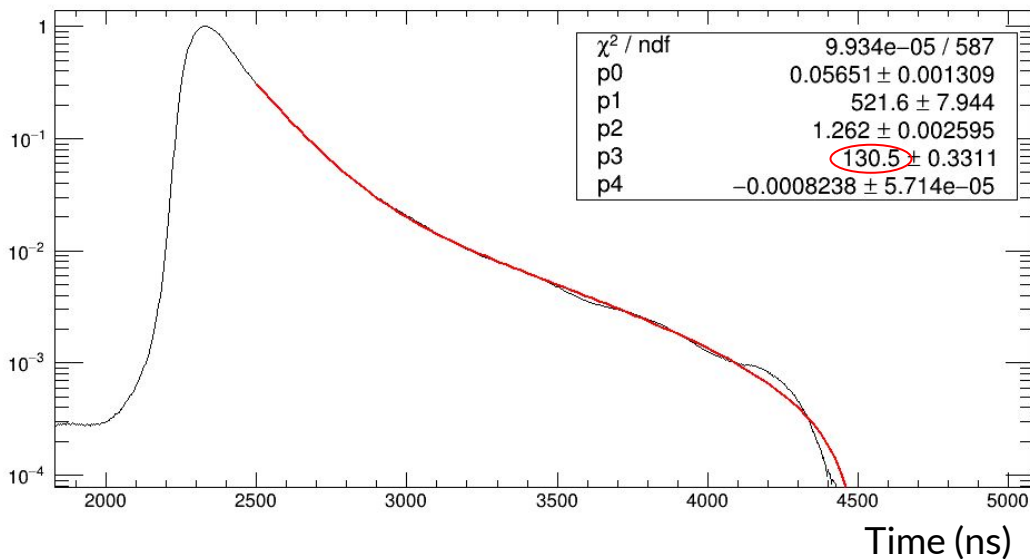


Dedicated Muon acquisition

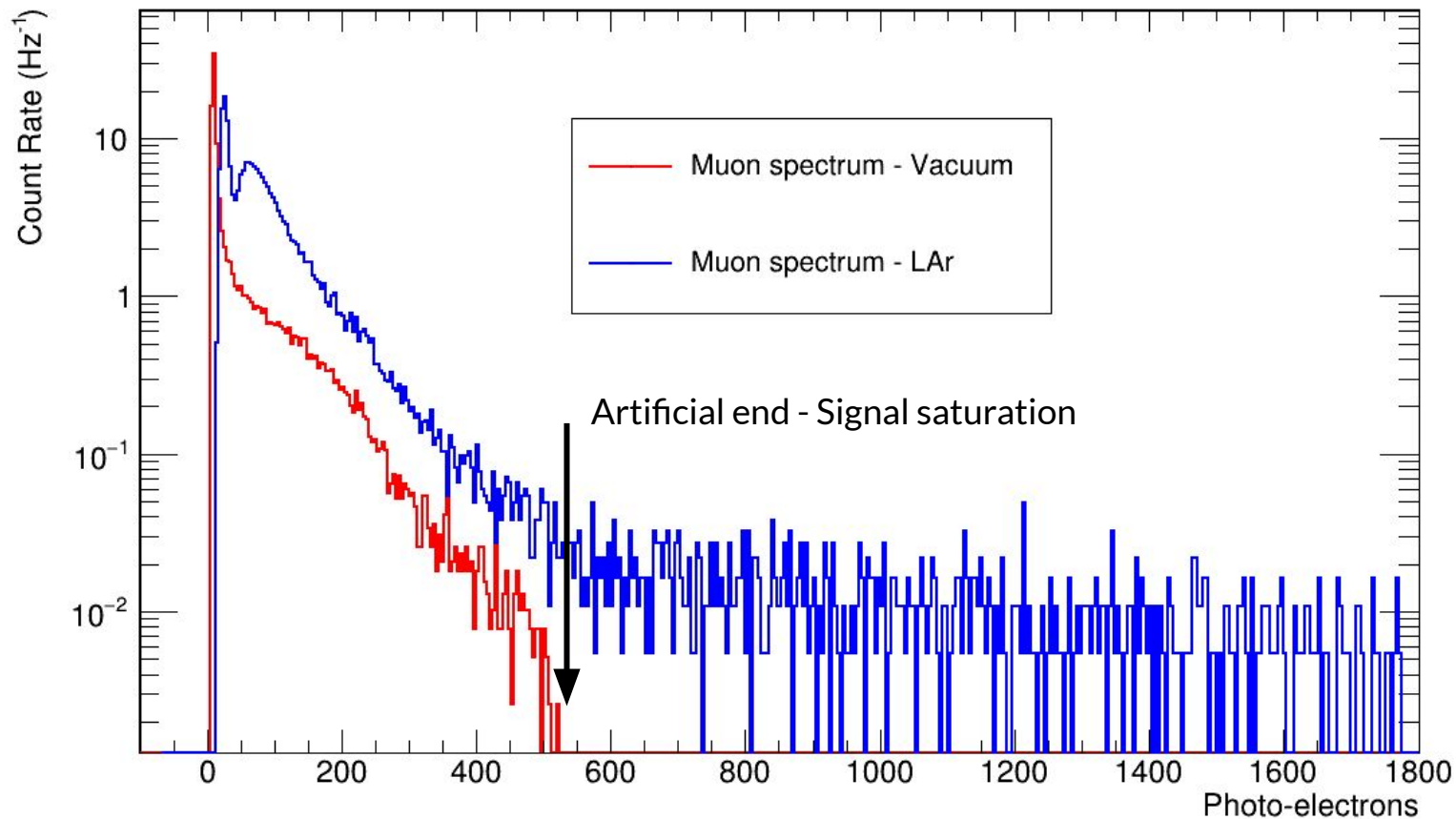
Averaged waveforms



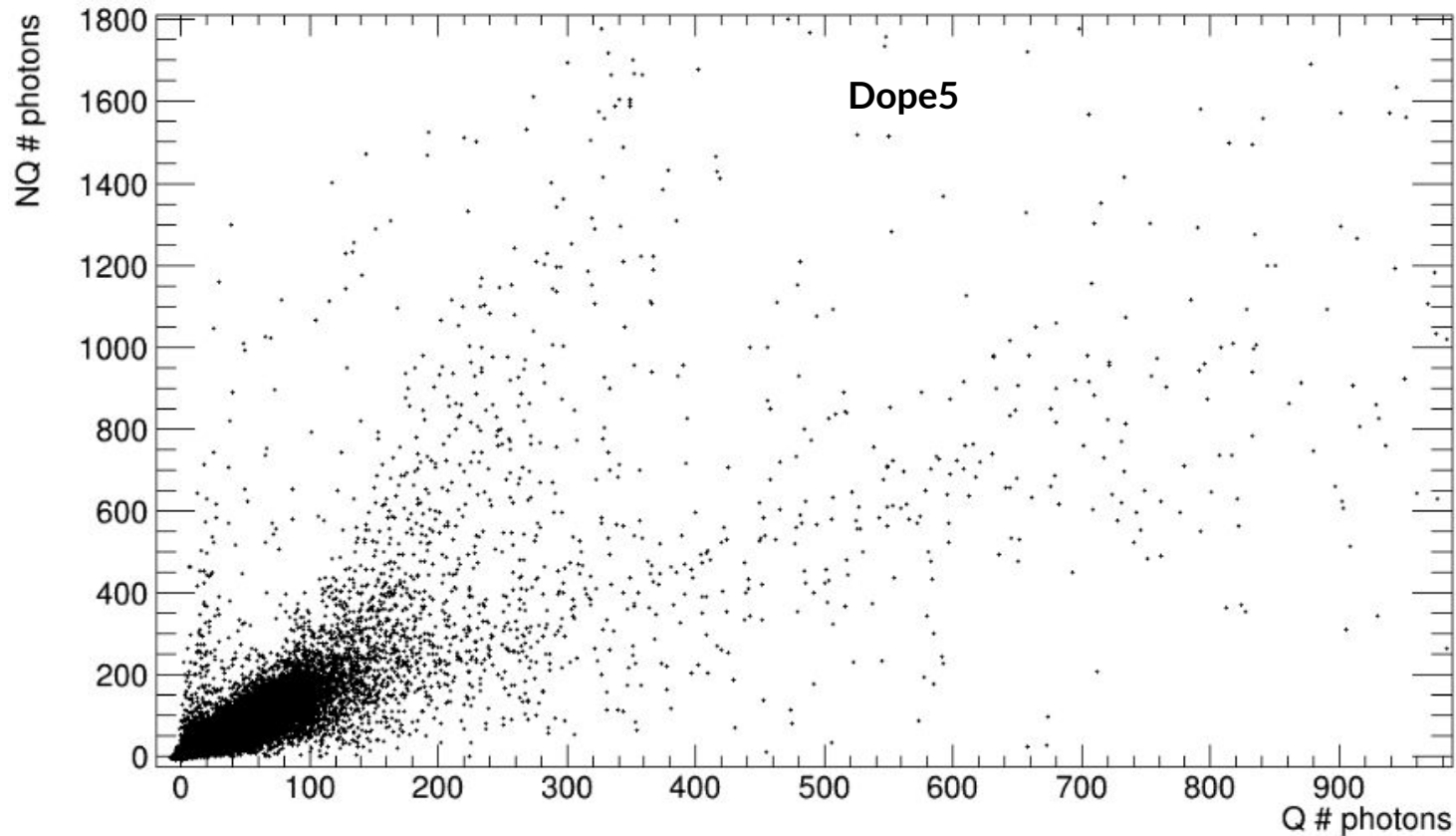
Vacuum



Dedicated Muon acquisition



Comparison with the lobes



Conclusions

- Measurements of the X-ARAPUCA efficiency were performed with preliminary results.
- Scintillation emission of the EJ bar was measured (in vacuum, cryogenic temperature).
- Two lobes structure is present in the peak vs charge integral plot.
 - The upper lobe has the quite the same charge-to-PH ratio of the EJ bar intrinsic scintillation light
 - May the observed lobes structure be related to what observed in pDune?
 - The upper lobe in pDune represents 1% of the events: it may be generated by showers/mu-bundle crossing one XA in coincidence with the muon that has triggered, or spurious from radioactivity etc.
- How much the EJ scintillation contribute to the fast component in the Q XA?
- The results shown are very recent (this week)...still in the process of quantify the observed effect in pDune

Backup

