

MIMAC au LSM

Directional Dark Matter Detection and
Axion-Like particle exploration

(1/2022-12/2023)

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Bi-chamber module (with the Cathode Signal and the new low background 10 cm detectors) (end of February 2022)



MIMAC (bi-chamber module) at Modane Underground Laboratory (France)

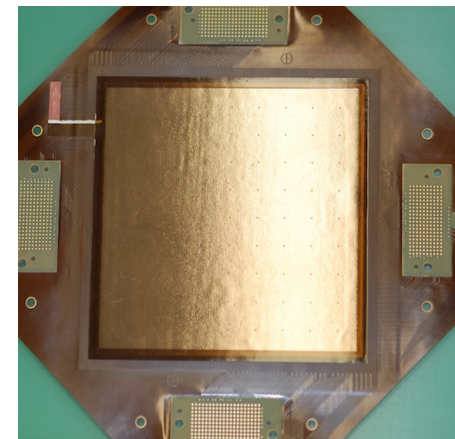
-working at 30 mbar
($C_4H_{10} + 50\% CHF_3$)

-in a permanent circulating mode

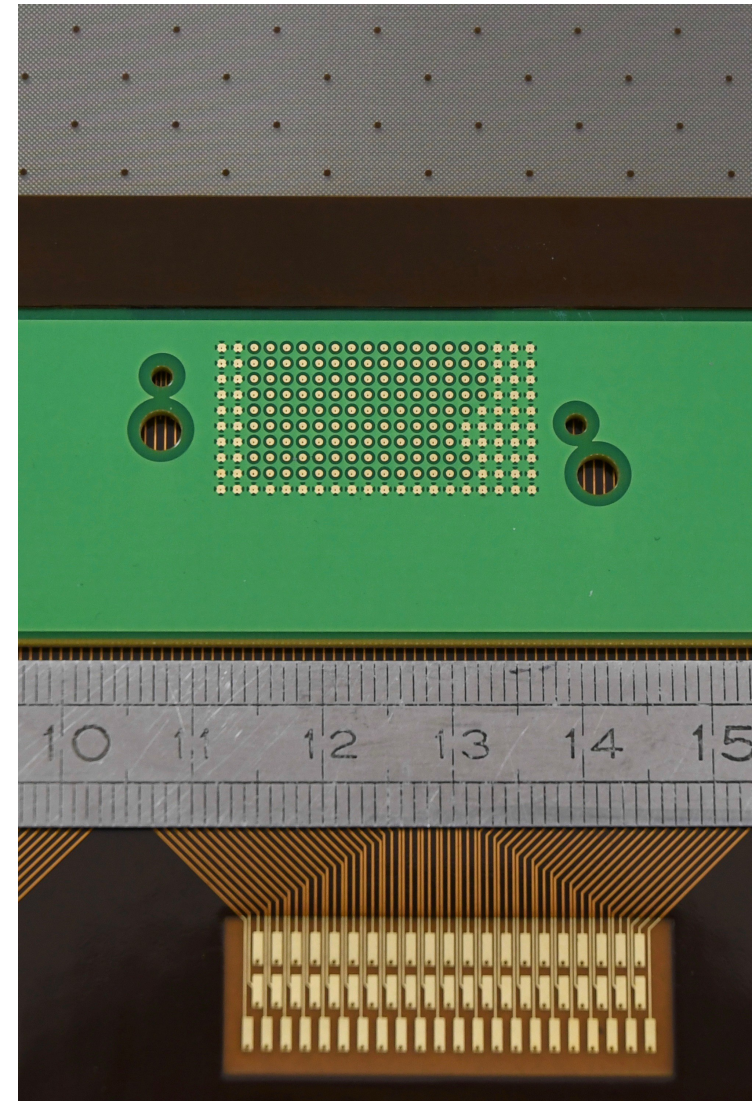
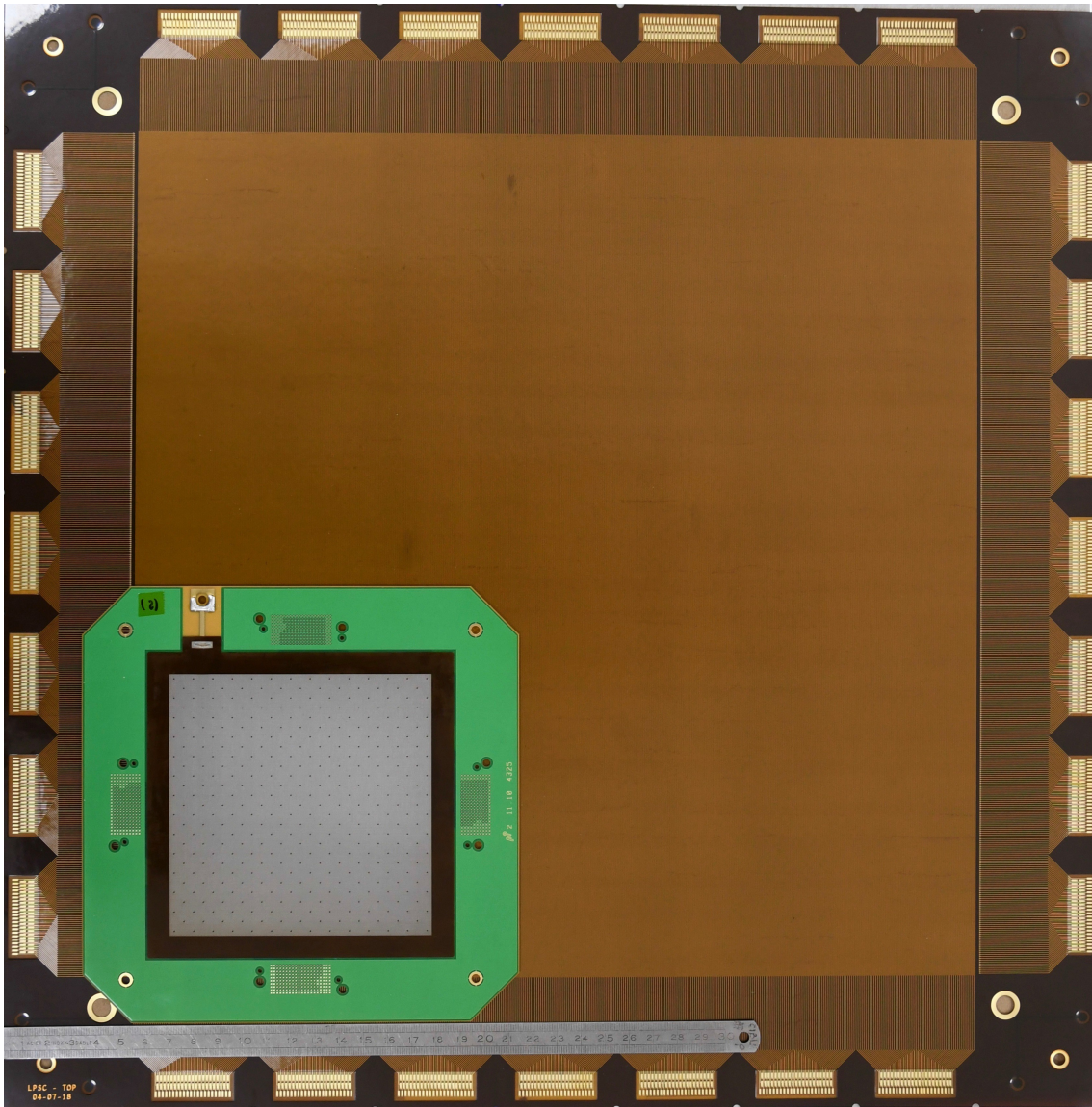
-Remote controlled

and commanded

-Calibration control twice per week



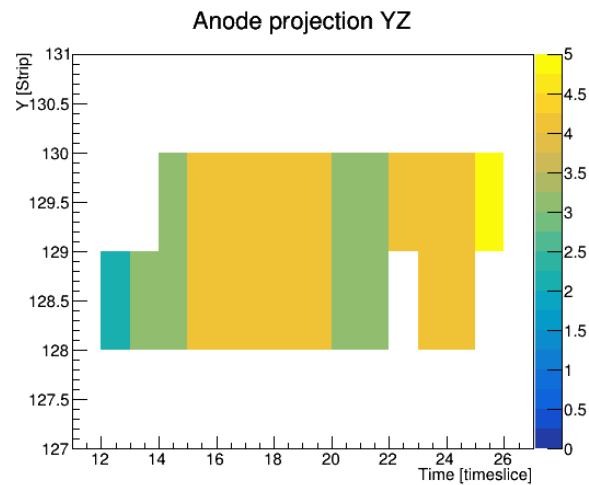
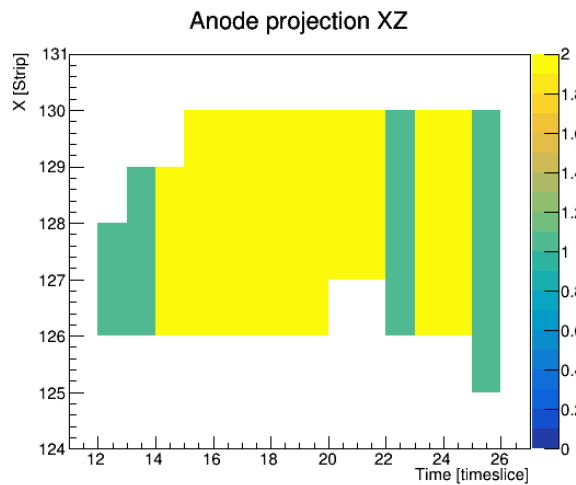
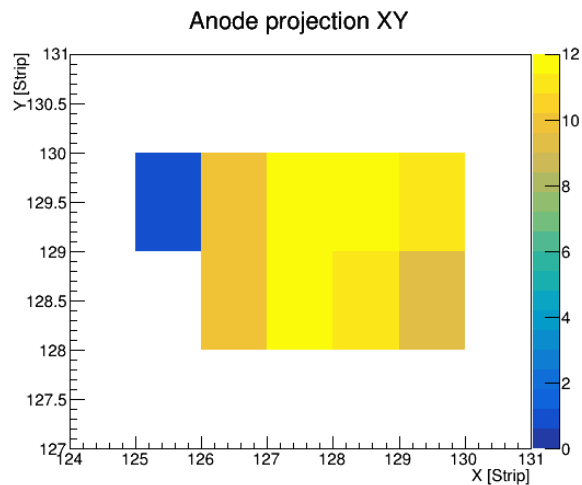
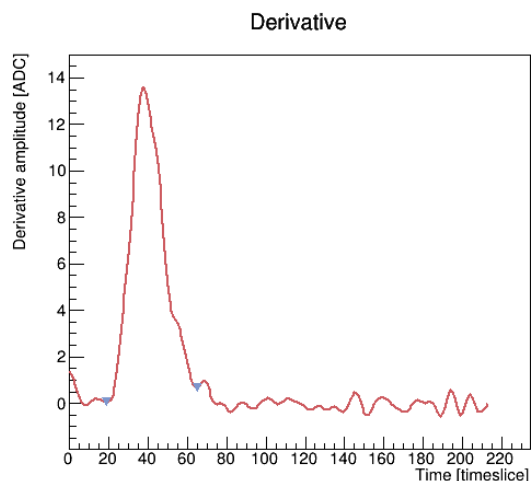
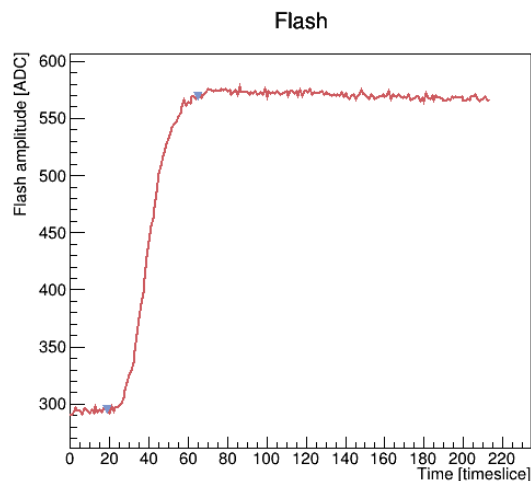
The 35 cm “new technology” MIMAC detector compared to the old one



Bi-chamber module with the 35 cm low background detectors

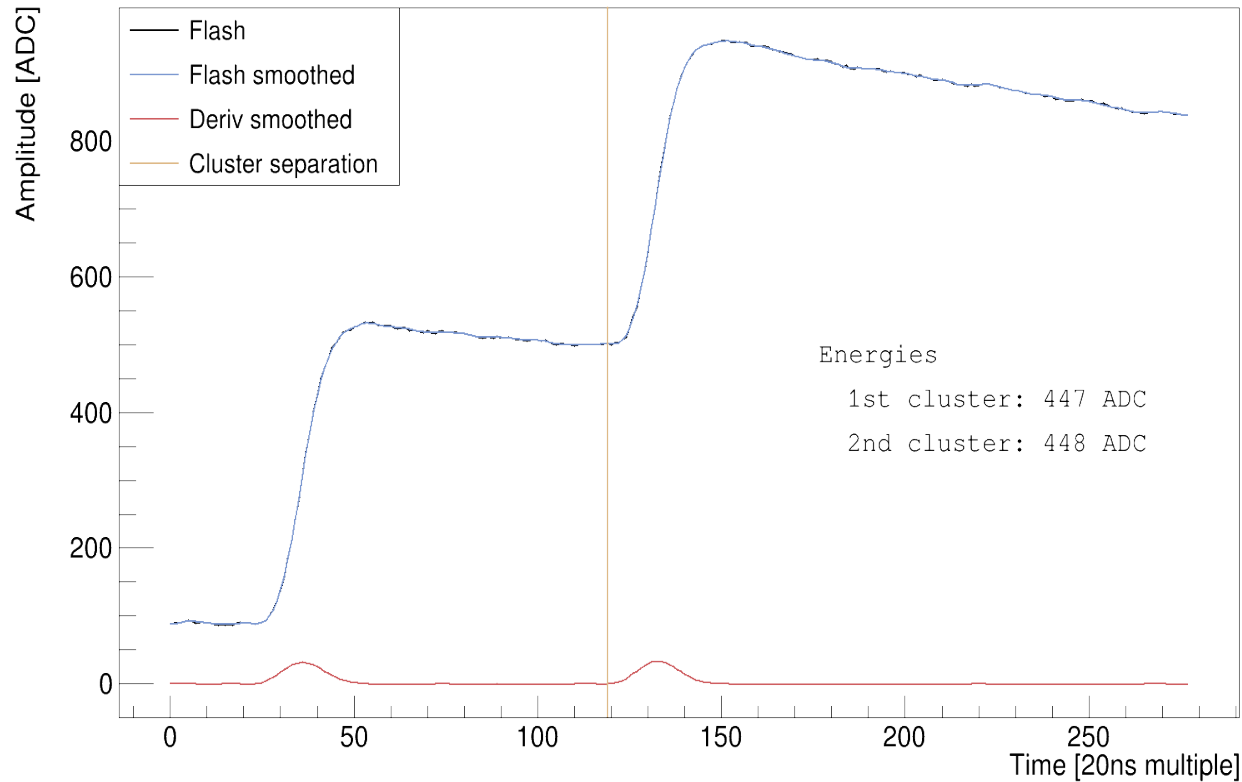
- The electronic boards (1792 channels, 28 ASICs) are being cabled
- The kapton detector is in phase of assembling
- Interphases ready
- The chamber is ready
- First test at LPSC in May 2022
- Commissioning of the bi-chamber module in October 2022

150 eV 3D- Electron track produced by COMIMAC detected by one MIMAC chamber ($C_4H_{10}+50\% CHF_3$) at 30 mbar



$a \rightarrow \gamma\gamma$ signature: Kaluza-Klein axions

- 2 photons of same energy emitted back-to-back \Rightarrow photoelectric effect
- Search for 2 electrons of same energy (~ 4 keV) close to each other



We use Comimac at high-rate to generate a pile-up of two electrons of same energy (4 keV) in one time window

\Rightarrow **Unambiguous signature**, almost no background event can reproduce such signal

\Rightarrow From Monte Carlo simulations, we estimate 70% of efficiency of detection

Understanding the low energy Background MIMAC + Sedine running in 2021

(starting April 2022 ?)

- Using the same gas to have a description of the intrinsic and external background in the range of 50 eV – 20 keV from two different event description (3D tracks from MIMAC and long collection time from spherical detector)
- We can compare the 3D-LSM background with respect to the 3D-LPSC background at low energies
- We'd like to have both detectors close enough to have a quite close LSM zone background

MIMAC – $2\text{m}^3 = 16$ bi-chamber modules ($2 \times 35 \times 35 \times 52 \text{ cm}^3$)

(January 2023- December 2023)

New technology anode
 $35\text{cm} \times 35\text{cm}$

Stretched thin ($12 \text{ }\mu\text{m}$) grid at
 $512\mu\text{m}$.

New electronic board (1792
channels)

Only one big chamber

