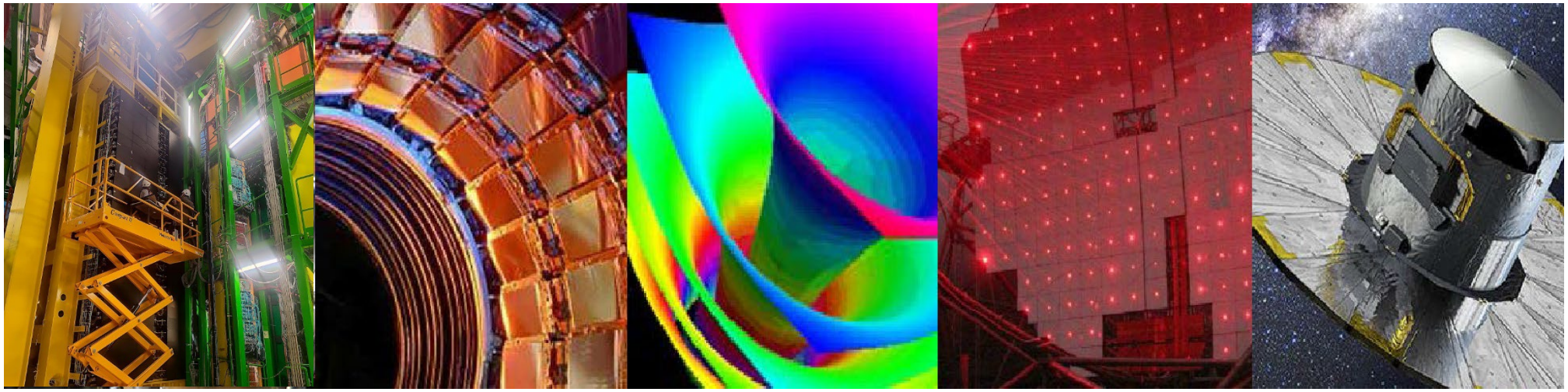
Institute of Cosmos Sciences

EXCELENCIA MARÍA DE MAEZTU



Technological contribution to Ship: FastIC+ and Advanced Readout Electronics

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Plan de Recuperación, Transformación y Resiliencia

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

AGENCIA ESTATAL DE INVESTIGACIÓN

ICCUB

UNIVERSITAT DE BARCELONA

Outlook

I. Introduction

II. R&D Projects

III. Technology Transfer

IV. Beyond the ASIC

V. Summary

I. Introduction

At the ICCUB Technology Unit we do:

1) New instruments for fundamental science
2) R&D in detectors and beyond
3) Technology Transfer → industrial collaborations and societal impact

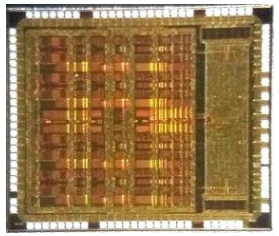
for:

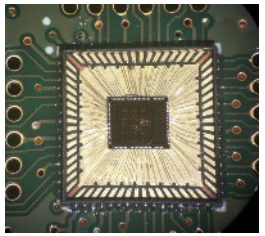
- Particle physics experiments: LHCb
- Ground instruments: CTA, VIRGO
- Space missions: LISA, HERD
- Dark matter searches: IAXO
- Mass Spectrometry, medical imaging and Quantum tech.

II. R&D Projects

LHCb calorimeter:

- 100 acquisition cards of 64 ch
- 6,400 channels (8 ch / ASIC)
- Slow control system
- High speed links (2.5 GB/s)





ICECALv3 chip:

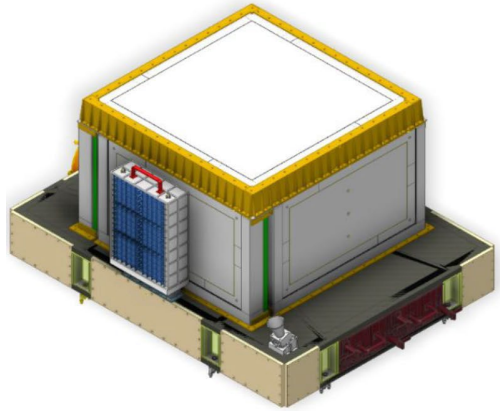
SiGe BiCMOS 0.35um
AMS 10.5 mm^2
12 bit resolution @ 40 MS/s

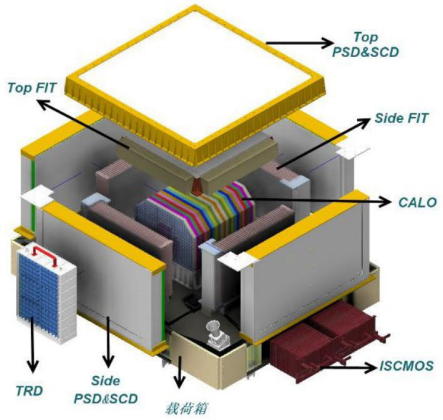
CTA cameras

- DragonCAM for LSTs
- NECTArCAM for MSTs
- More than 100,000 chips produced to equip 15 cameras

HERD (cancelled)

- FIT ~200.000 channels (64 ch / ASIC)
- PSD ~1.000 channels (64 ch / ASIC)





II. R&D Projects: FastIC+ ASIC

FastIC+

- 8 ch ASIC
- Ultra-Fast timing
- Low power consumption per channel
- High dynamic range and linearity
- TDC

Current status

- 4.000 produced ASIC
- Automated QC test for large scale up

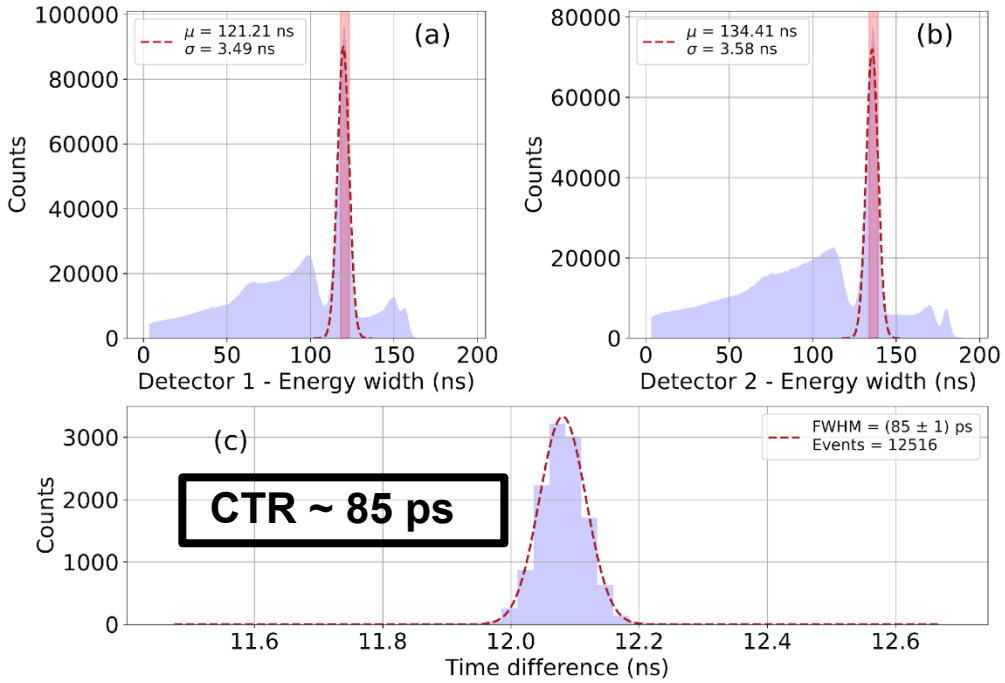
Next steps

- 32 ch BGA (in test phase)

SHiP compatibitity:

- Already identified as a primary candidate for SHiP detectors

Best known results for PET!



D. Mazzanti, et al., https://arxiv.org/abs/2506.11655

Develped in collaboration with CERN microelectronics (R. Ballabriga et. al)

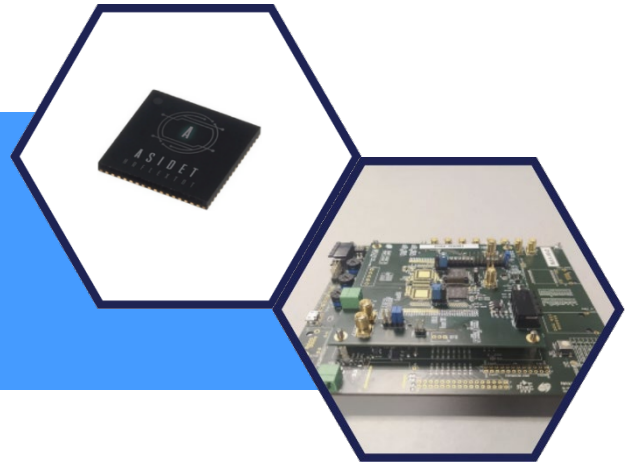
III. Technology transfer

PuLSensing

ASICs and electronic modules

For Fast-Timing…

… and beyond: Space, particle physics, radiation monitoring…



- → From a few **up to 256 channels** per module
- → **PET-scanner tailored electronics** (concentrator, trigger and clock distribution boards...)
- → **Custom modules** and detector **design**

pulsensing.com
info@pulsensing.com

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IV. Electronics Beyond the ASIC

Integrated systems

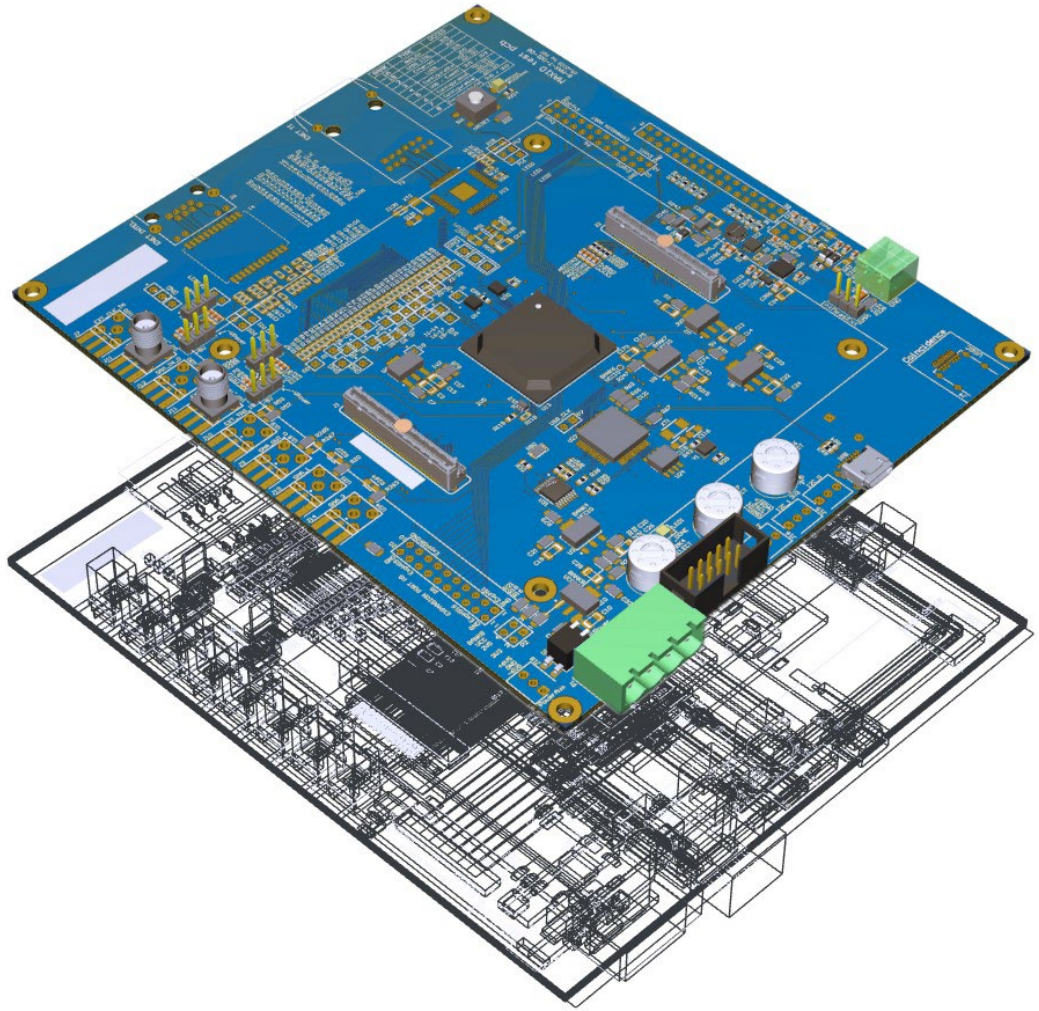
- We don’t just provide chips; we design the entire signal chain

Readout system features

- We develope readout for systems of thousands of channels
- Compatible with ASIC Carrier boards
- PC to ASIC connectivity (USB)

Tailored to SHiP:

- Electronic modules based on FastIC+ for reading ~10,000 channels (which can be used during test beams).



VI. Summary

Technological Unit at ICCUB

Expersitise in the development of detectors and electronics for high energy physics and beyond.

An ASIC for SHiP?

FastIC+ is a fast-timing ASIC that could be particularly suitable for the SHiP readout.

This ASIC provides the best time resolution for PET published so far.

PulSensing

We launched a spinoff company that can provide readout modules based on our ASIC that can handle several thousands of channels in large systems.

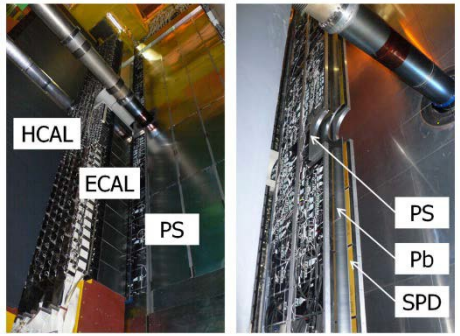
Thank you for your attention

https://icc.ub.edu/research/technology-unit

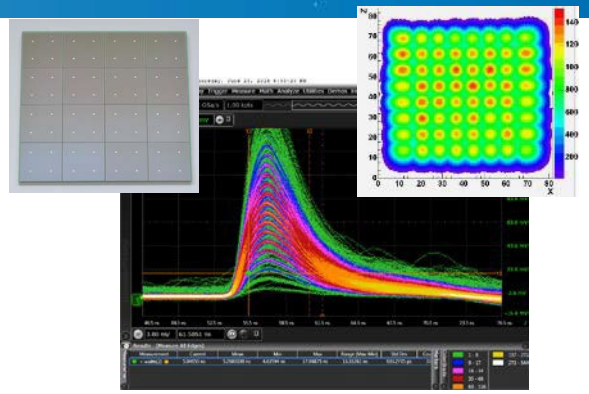
Thanks a lot for materials and contributions to our colleagues !!

Activities in instrumentation

Telescope cameras

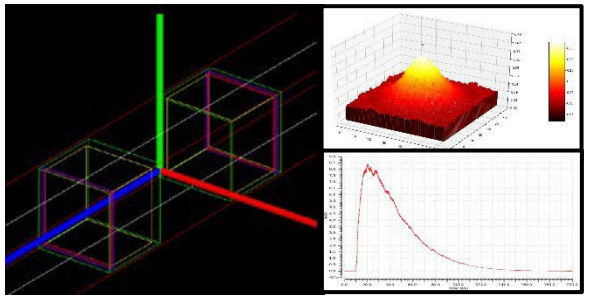


Particle detectors at CERN

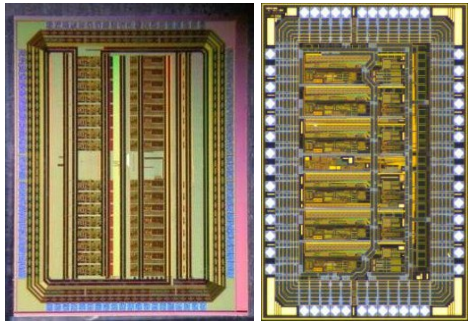


Single-Photon Sensors

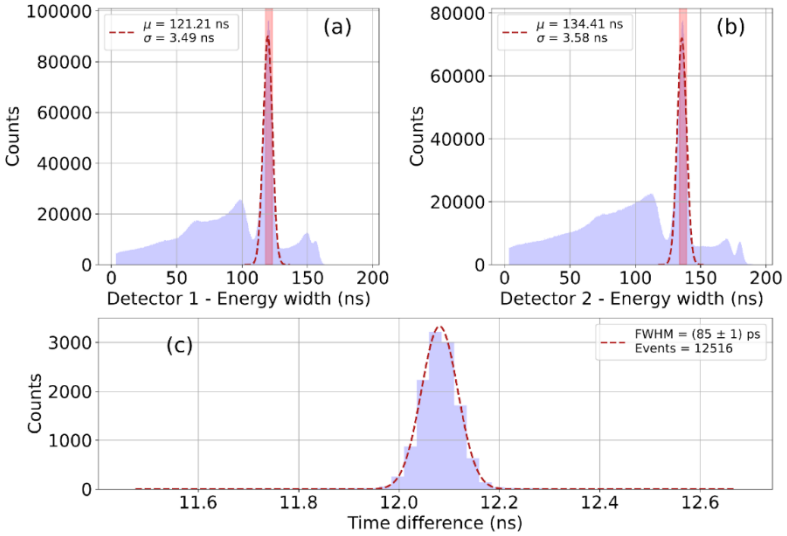
Axion and Dark Matter searches



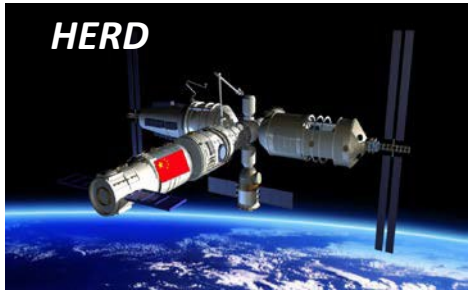
Monte Carlo simulations



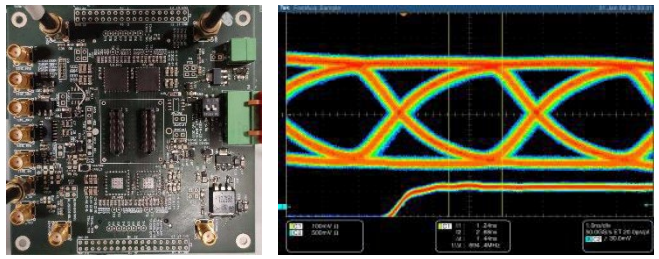
Microelectronics (Chip Design)



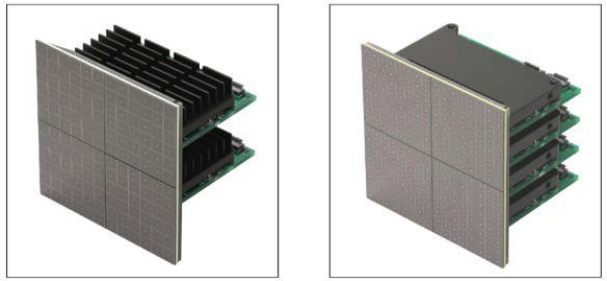
Positron Emission Tomography with Time-of-Flight (ToF-PET)



Space missions



Electronics



Medical Imaging (industrial collab.)