UNIVERSITAT DE BARCELONA

Testing MPPCs for PET at UB (on going work)

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  - Energy Resolution
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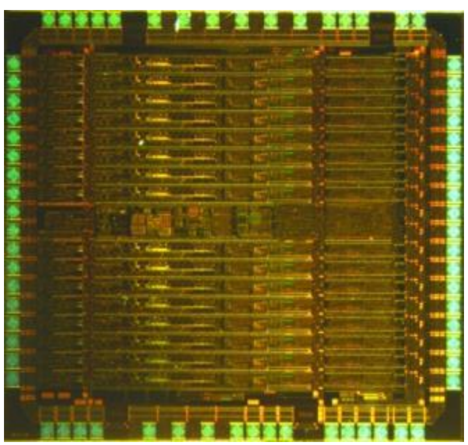
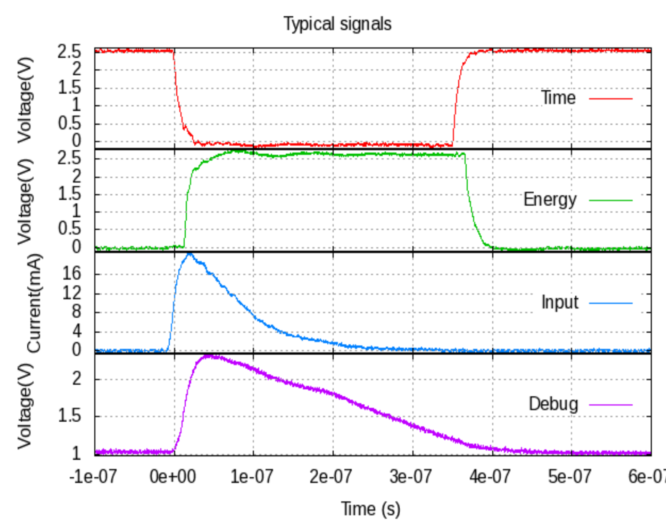
Electronics: FlexToT ASIC

- Joint project with CIEMAT to develop a time-over-threshold ASIC for SiPM based PET
  - ICC-UB: expertise on electronics and microelectronics design for detector FE
  - CIEMAT: expertise on PET and medical imaging instrumentation
- Version optimization for segmented crystals with variable dynamic range



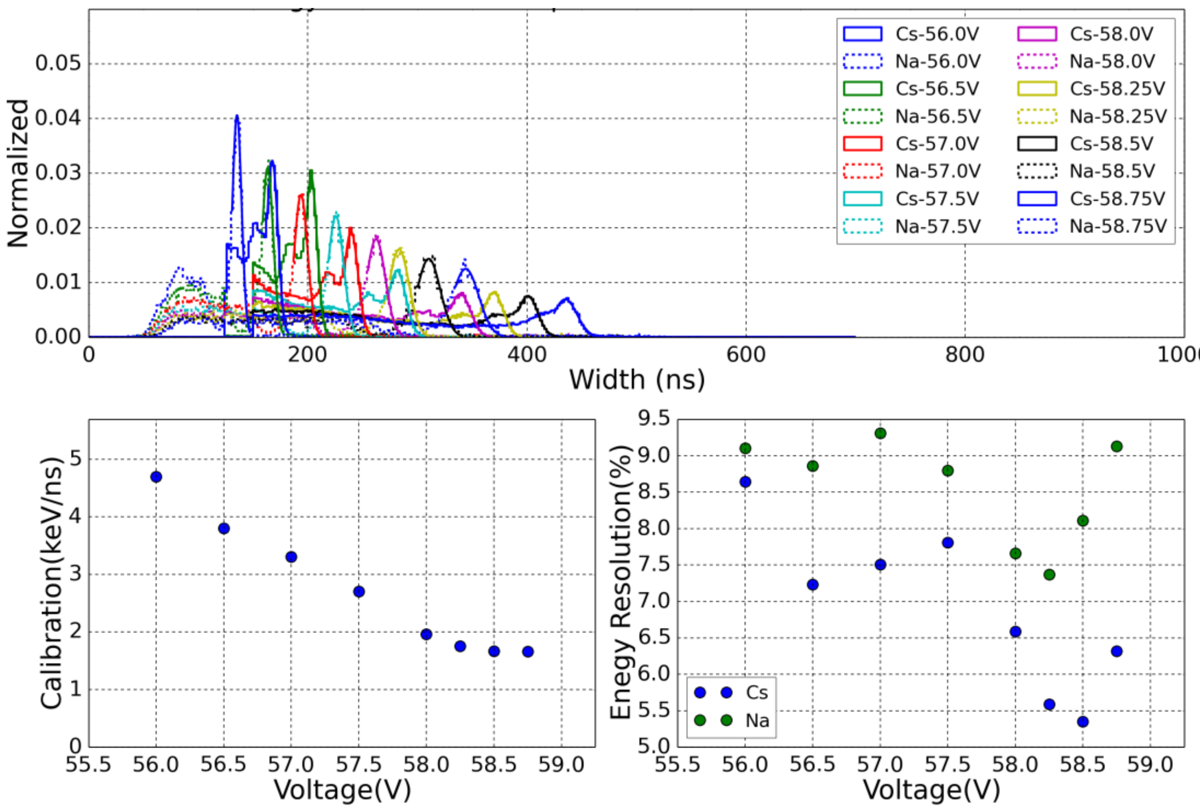
FlexToT

16 channel
SiGe BiCMOS 0.35um
austriamicrosystem
10 mm^2
3.3 V (10 mW/ch)
QFN 64



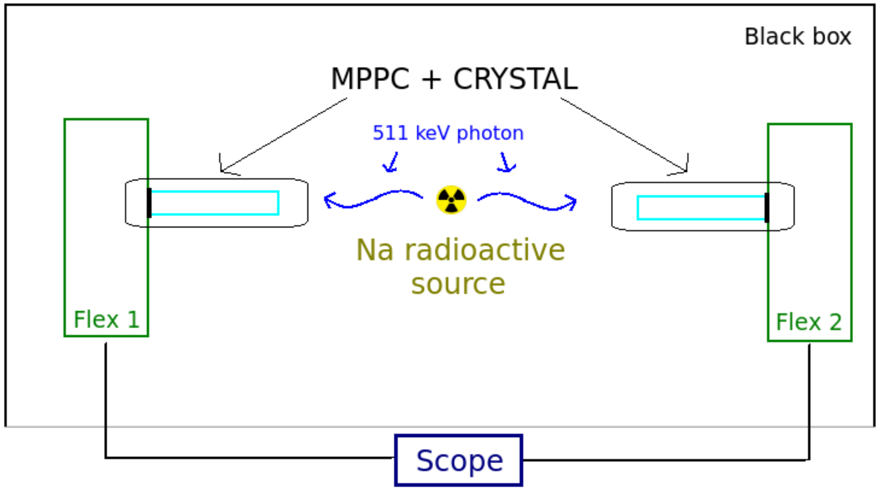
Energy Resolution: small crystal

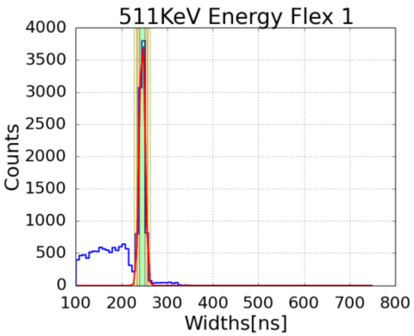
- Energy resolution using Cs 137 and Na 22 for calibration: < 8 %
  - 20x3x3 mm^3 LFS crystals
  - LCT4 3x3 mm^2 - 50 um sensors

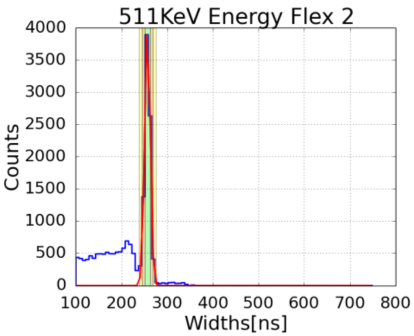


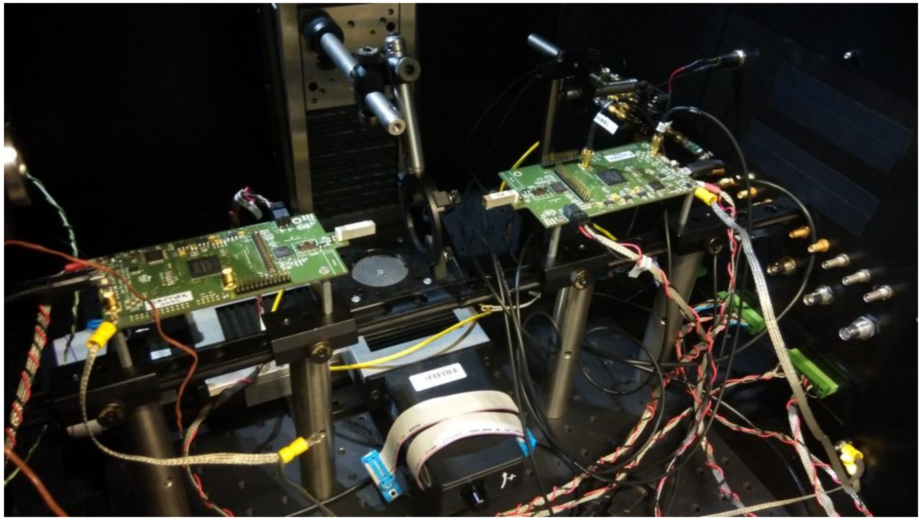
FLEXTOT TIME PROPERTIES: CRT

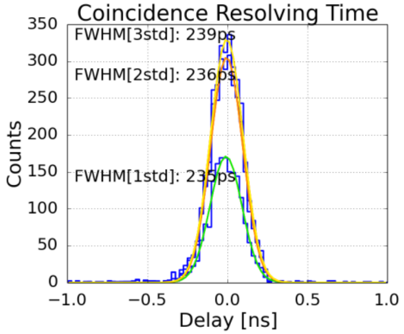
- Coincidence resolution time measurements for
- Classical photopeak selection
  - Results @ ±2σ
  - 20x3x3 mm^3 LFS crystals
  - LCT4 3x3mm 50um

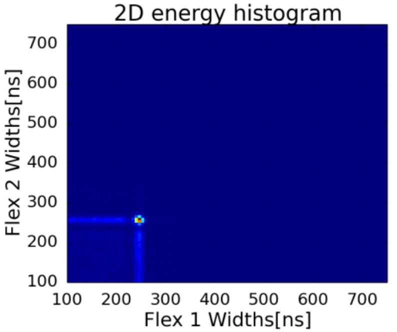






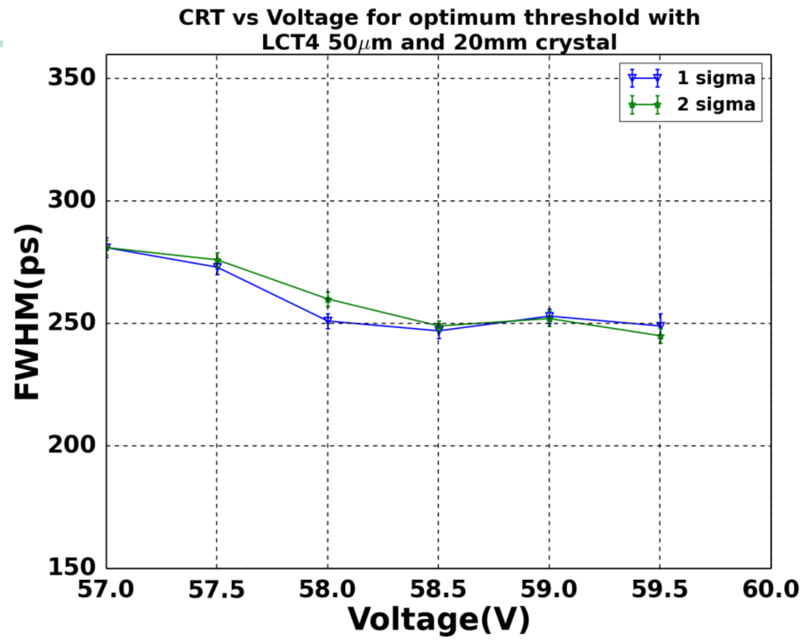


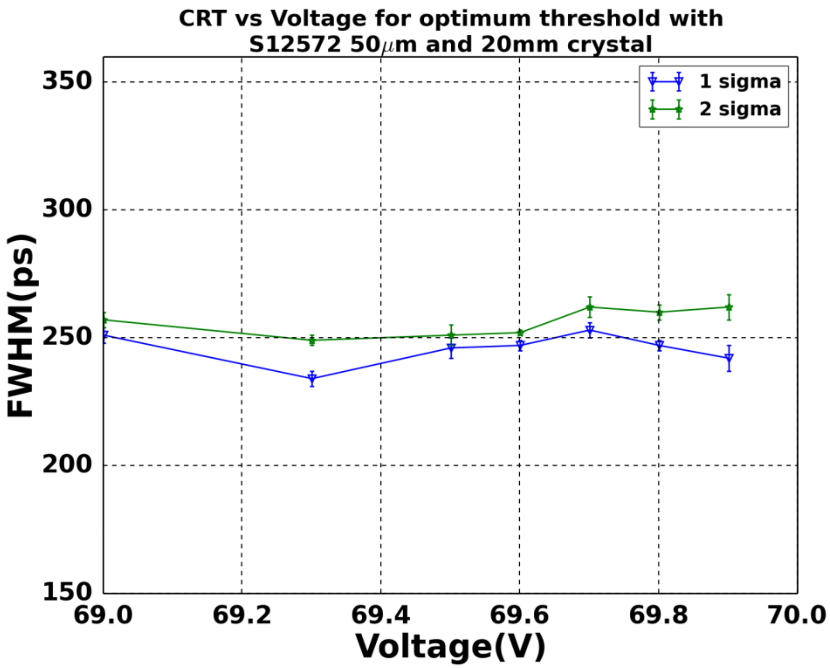


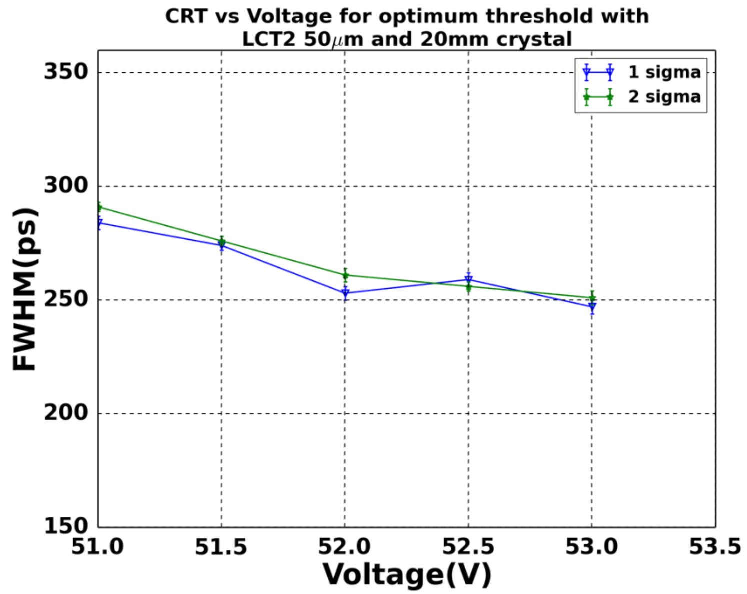


FLEXTOT TIME PROPERTIES: CRT

- CRT results
- Problem in crystal glueing (not best possible results)

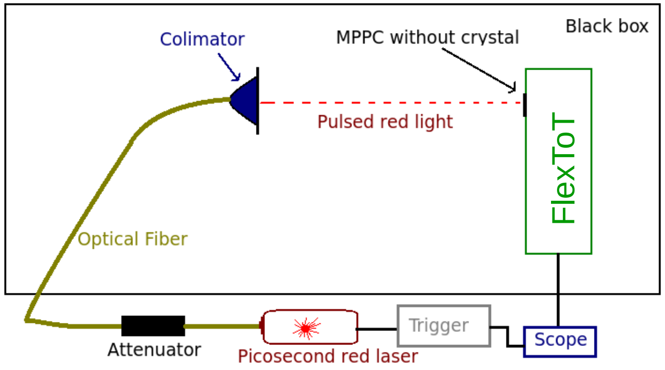


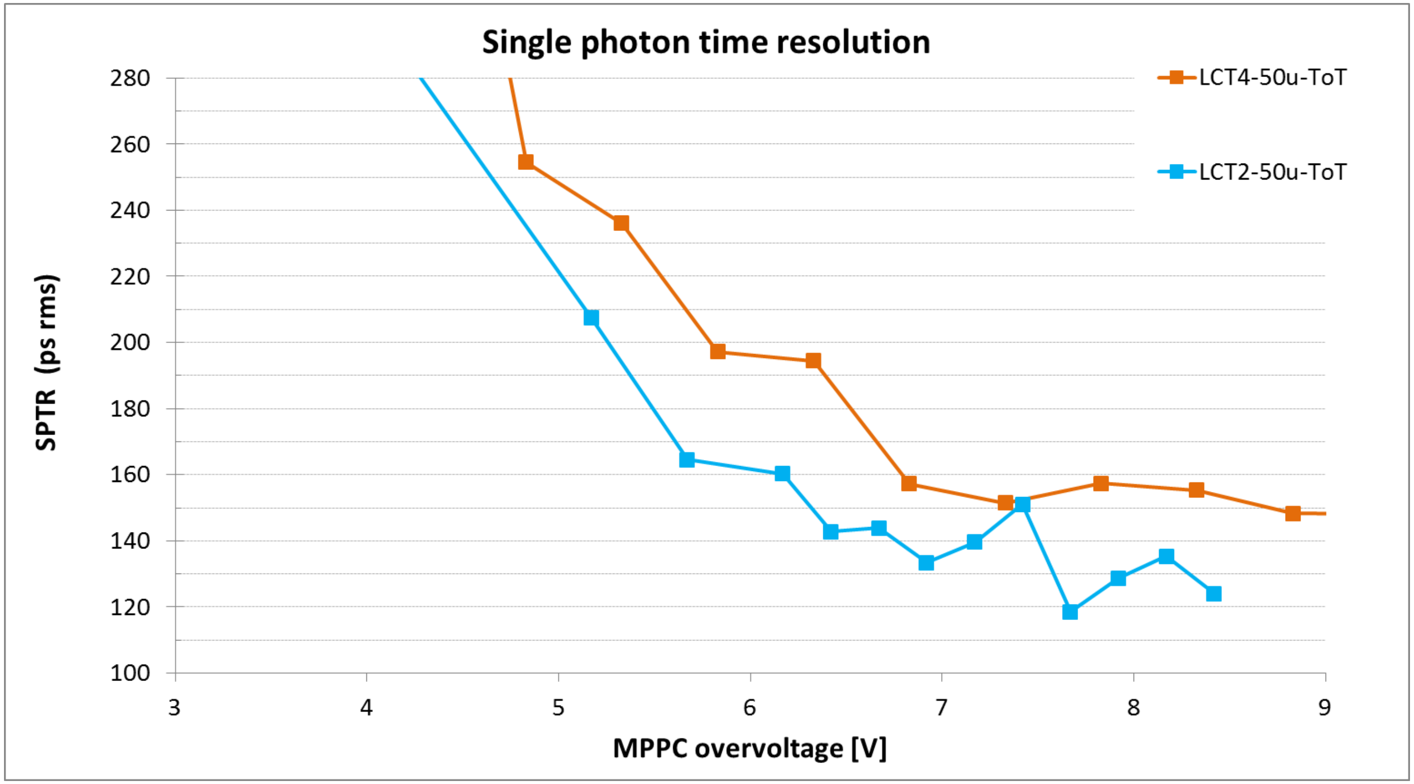




FLEXTOT TIME PROPERTIES: SPTR

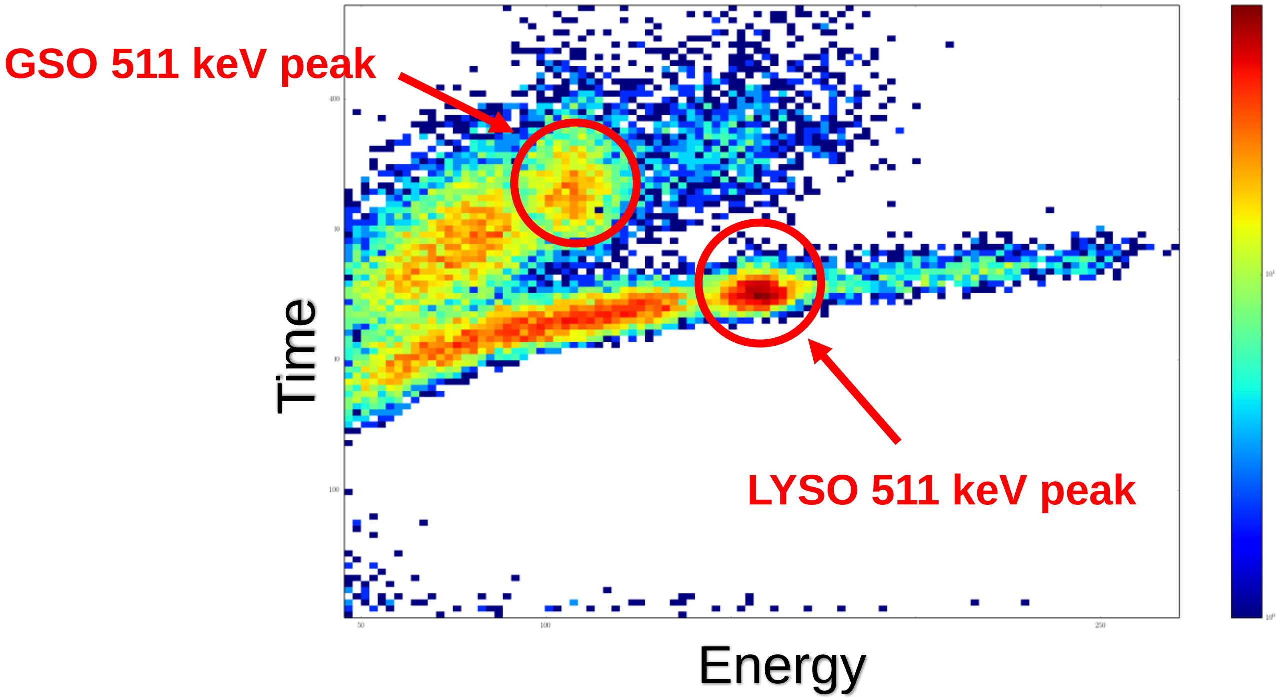
- Single Photon Time Resolution
  - Picosecond (50 ps FWHM) laser
- Jitter floor < 10 ps rms
  - For very large signals





DOI in phoswich configuration

- The FlexToT allows time discrimination from two type of crystals with different decay times.

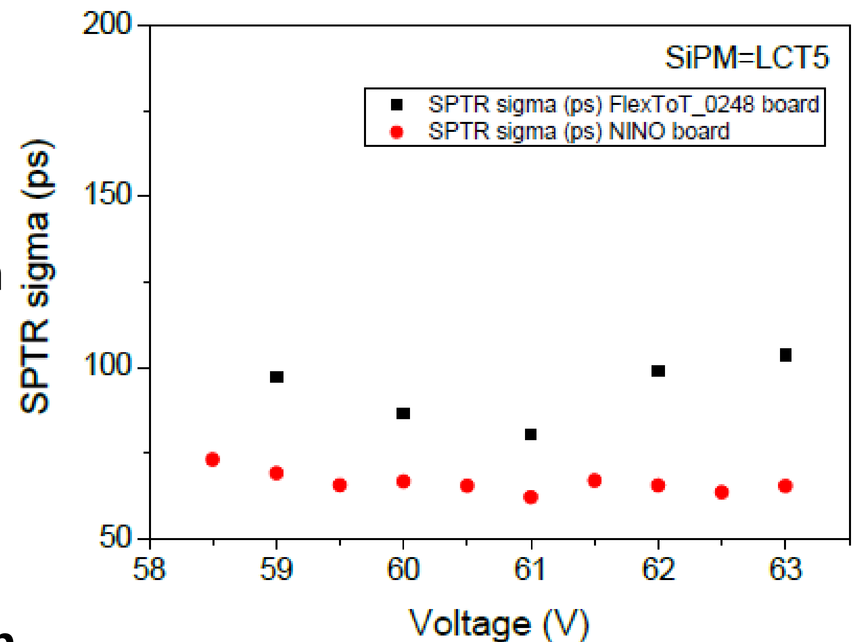


- MPPC array S12572, 4x4 with 3x3mm²/ch with 50um (using 1 channel)
- Stack configuration: GSO and LYSO, 1.35x1.35mm² with 7mm and 8mm long respectively.

FlexToT and NINO comparison

- Measures at CERN by Iciar Sarasol from CIEMAT.
- Comparison between NINO from CERN and FlexToT ASICs: SPTR and CRT

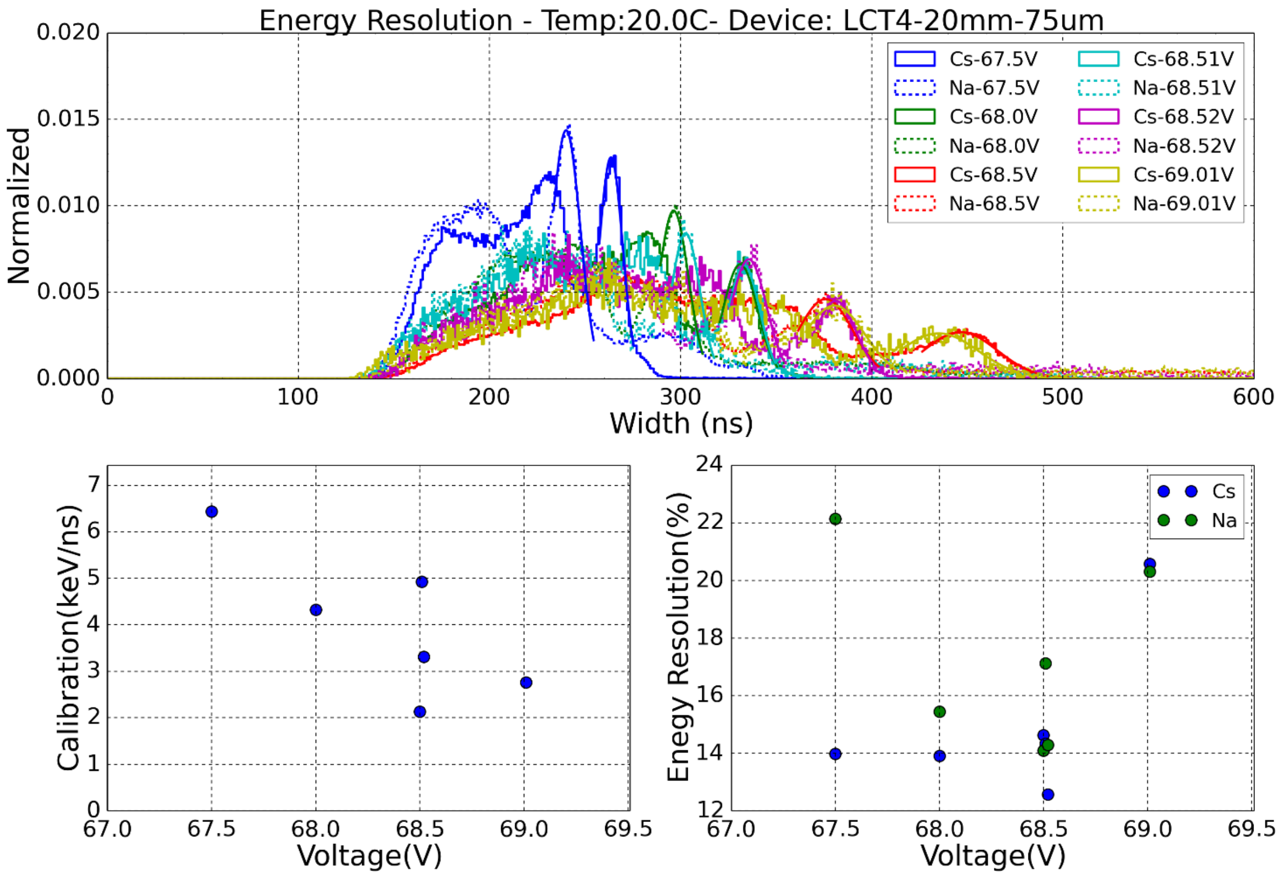
SPTR comparison



CRT comparison

Acquisition boards	LCT5 + LSO:Ce,Ca 2 x 2x 5 mm^3 vs LCT5 + LSO:Ce,Ca 2 x 2x 5 mm^3
NINO vs NINO	97 ps FWHM
FlexToT board 0248 vs FlexToT board 0005	128 ps FWHM

Energy Resolution: with large $LaBr_3$ crystal



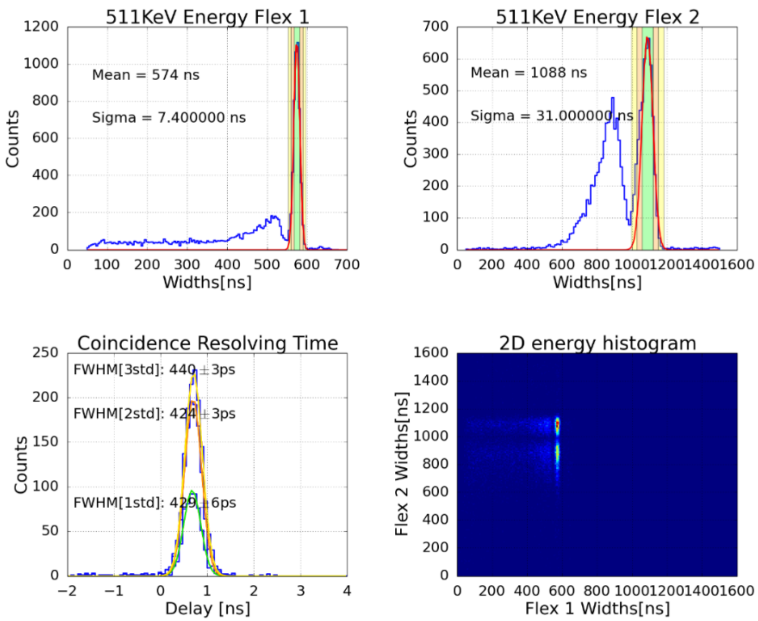
- **MPPC array S12572, 4x4 with 3x3mm²/ch with 50um**
- **LaBr3 crystal of 16x18x5mm³**

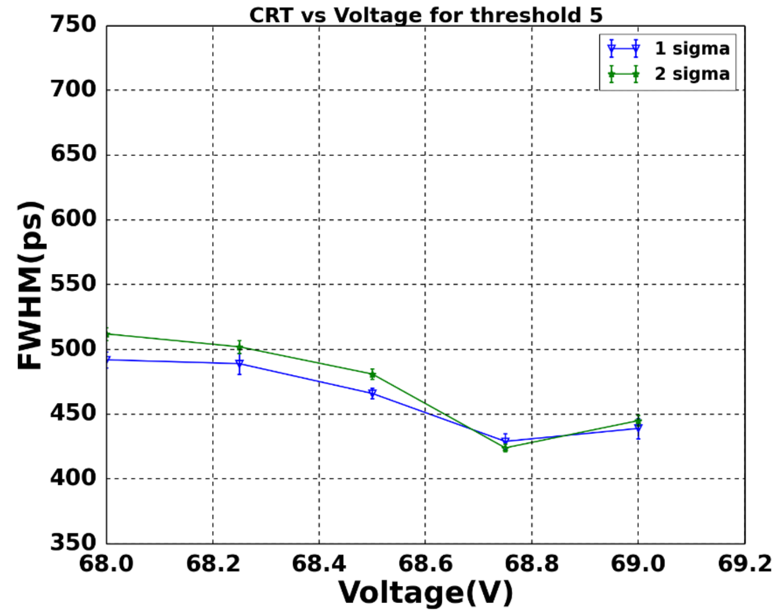
First energy resolution results

no channel equalization

FWHM Resolution at FWHM

BEST CTR with large $LaBr_3$ crystal

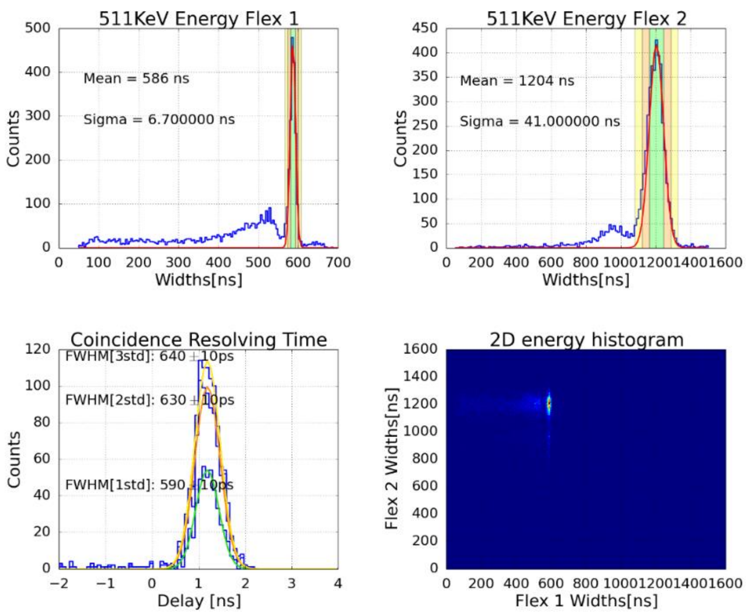


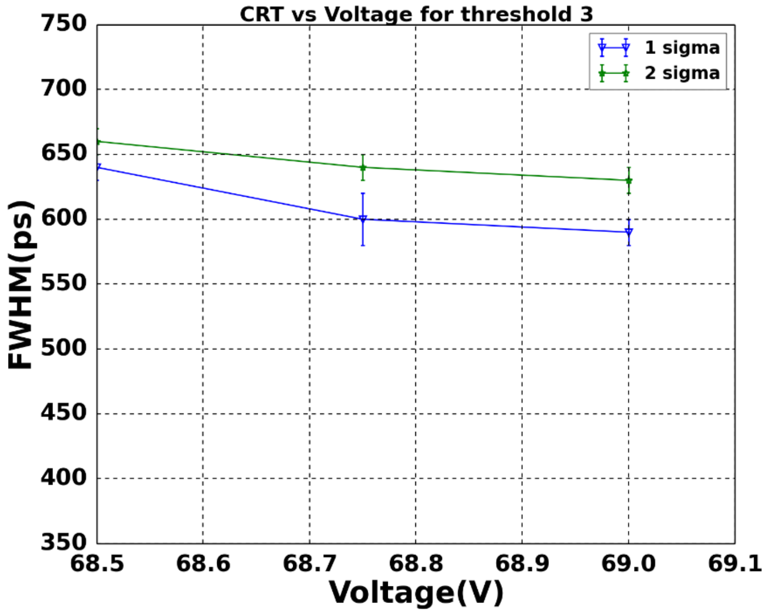


- **MPPC array S12572, 4x4 with 3x3mm²/ch with 50um**
- **$LaBr_3$ crystal of 16x18x5mm³**

•MPPC array with monolithic $LaBr_3$ in coincidence with single channel MPPC.

BEST CTR with large LYSO crystal





- MPPC array S12572, 4x4 with $3x3mm^2$/ch with 50um
- LYSO crystal of $16x18x10mm^3$

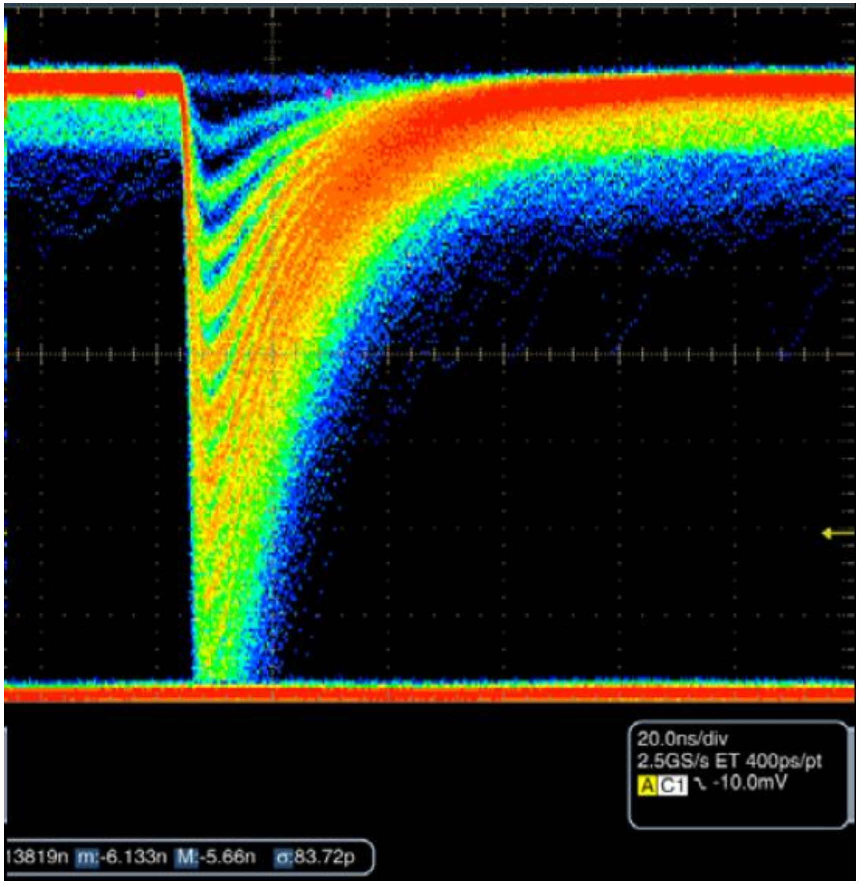
•MPPC array with monolithic LYSO in coincidence with single channel MPPC.

FUTURE STEPS

- PENELOPE simulations for radiation-material interactions inside scintillator crystal.
- ASIC update for monolithic readout optimization.
- Perform a 64 channel board for readout of 25x25x20mm monolithic crystal.
- DOI corrections and channel equalization.

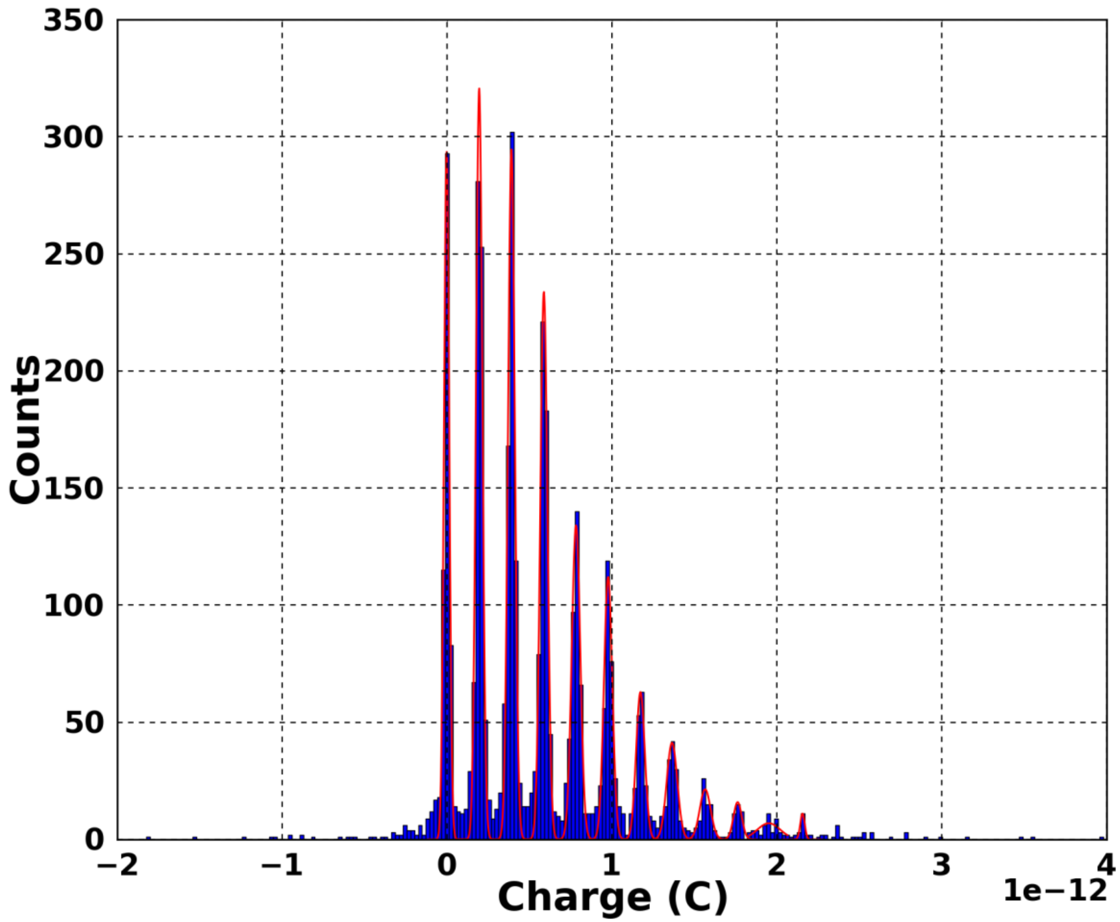
Gracias por su atención!

MPPC characterization photon distribution charge



MPPC signal using PACTA
Picosecond (50 ps FWHM) laser

MPPC characterization photon distribution charge



MPPC characterization Vb and Cd+Cq