STRONG-2020 ANNUAL MEETING (2022)

JRA8 - ASTRA

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Stefan Meyer Institute

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824093

JR8 - PROJECT MEMBERS

Beneficiary number	Organization legal name (in italics the Research Units)	Short name
2	Oesterreichische Akademie der Wissenschaften	OEAW
26	Sveuciliste u Zagrebu	UNIZG
28	Consiglio Nazionale delle Ricerche	CNR
30	Istituto Nazionale di Fisica Nucleare	INFN
31	Politecnico di Milano	POLIMI
38	Uniwersytet Jagiellonski	UJ

JR8 - GOALS

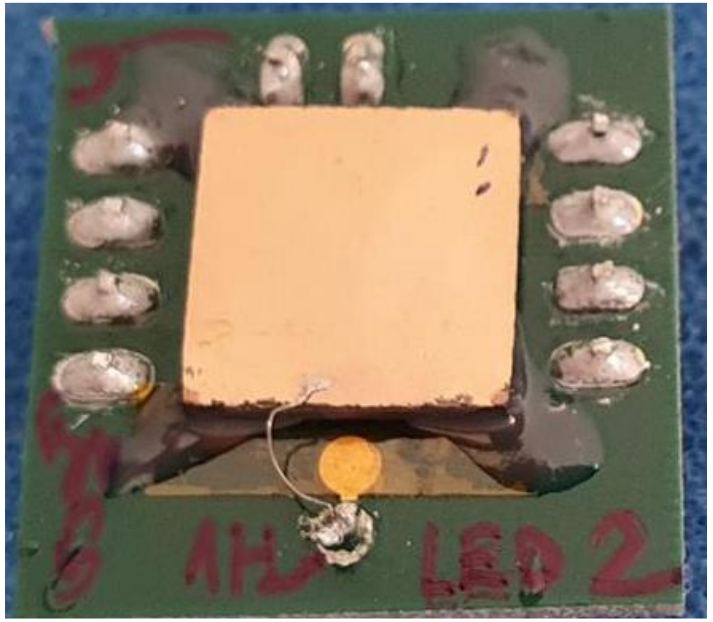
ASTRA will develop a versatile advanced detector system, from sensors and read-out electronics, to DAQ and controls for compact (large-area) CdZnTe detectors to perform high precision photon energy measurements from a few10 keV up to the MeV range.

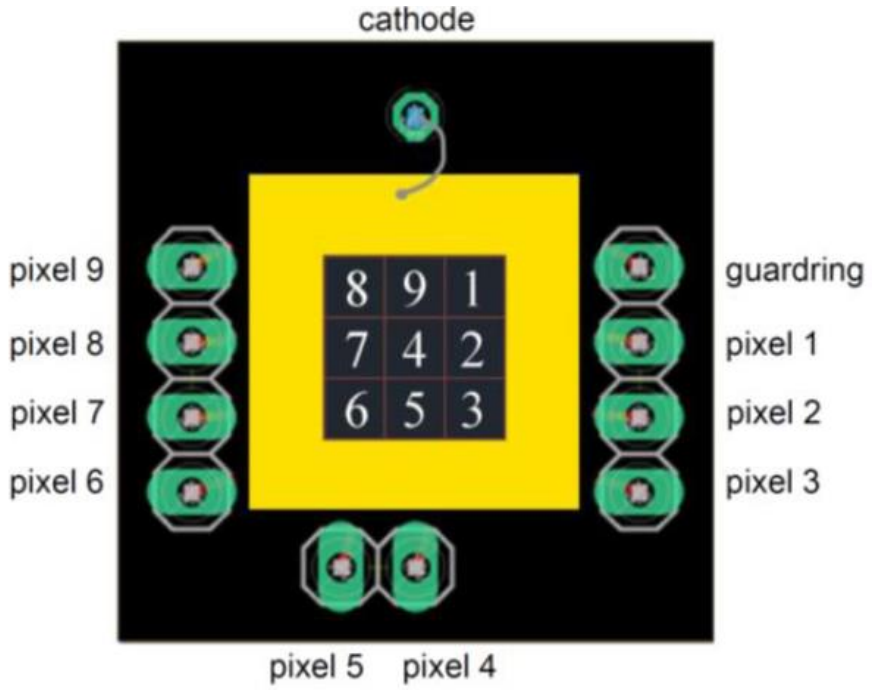
Task 1: Low energy detection region - energy range: ~10 – 100 keV

Task 2: High energy detection region - energy range: ~100 – 1000 keV

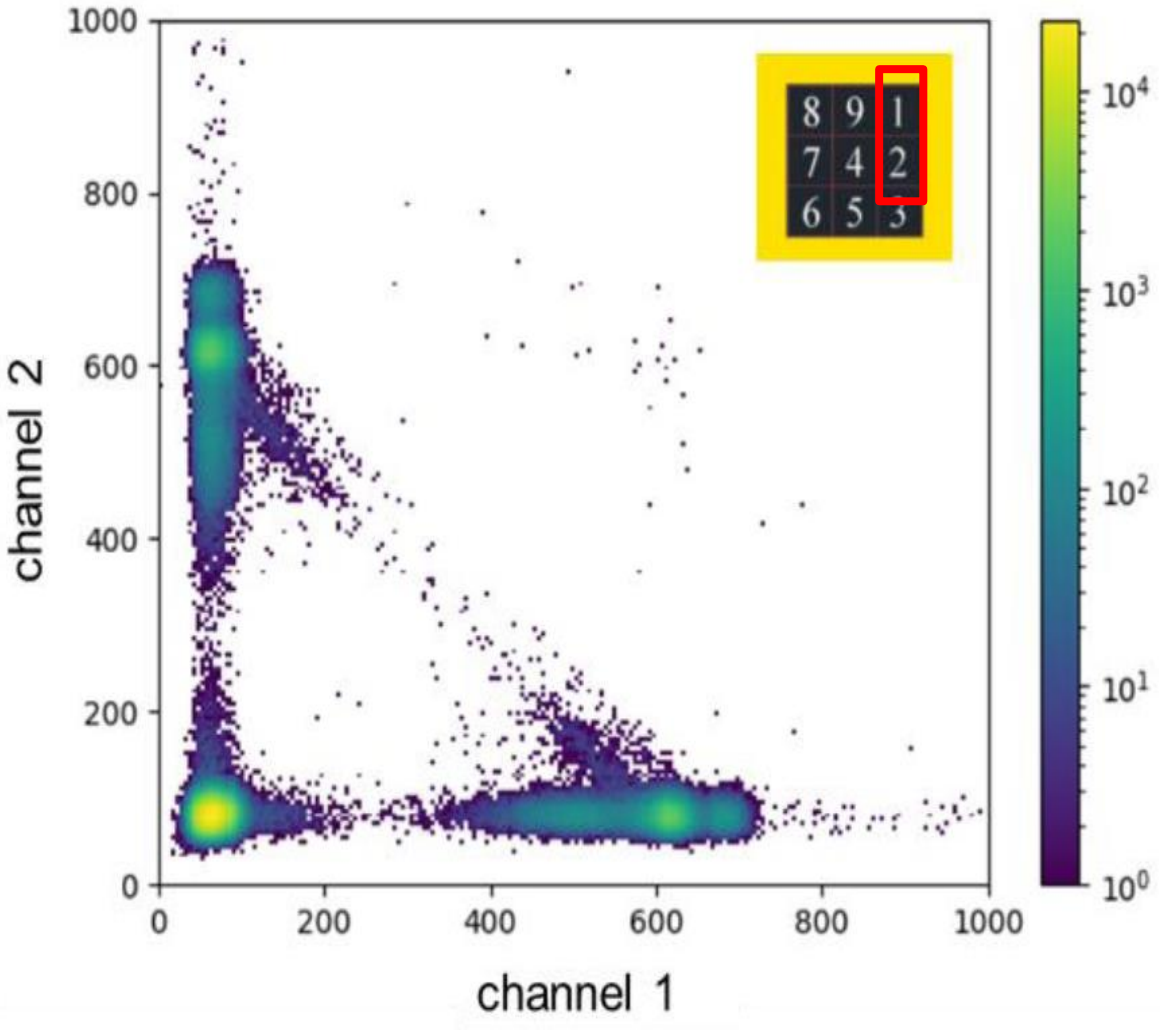
LOW ENERGY DETECTOR

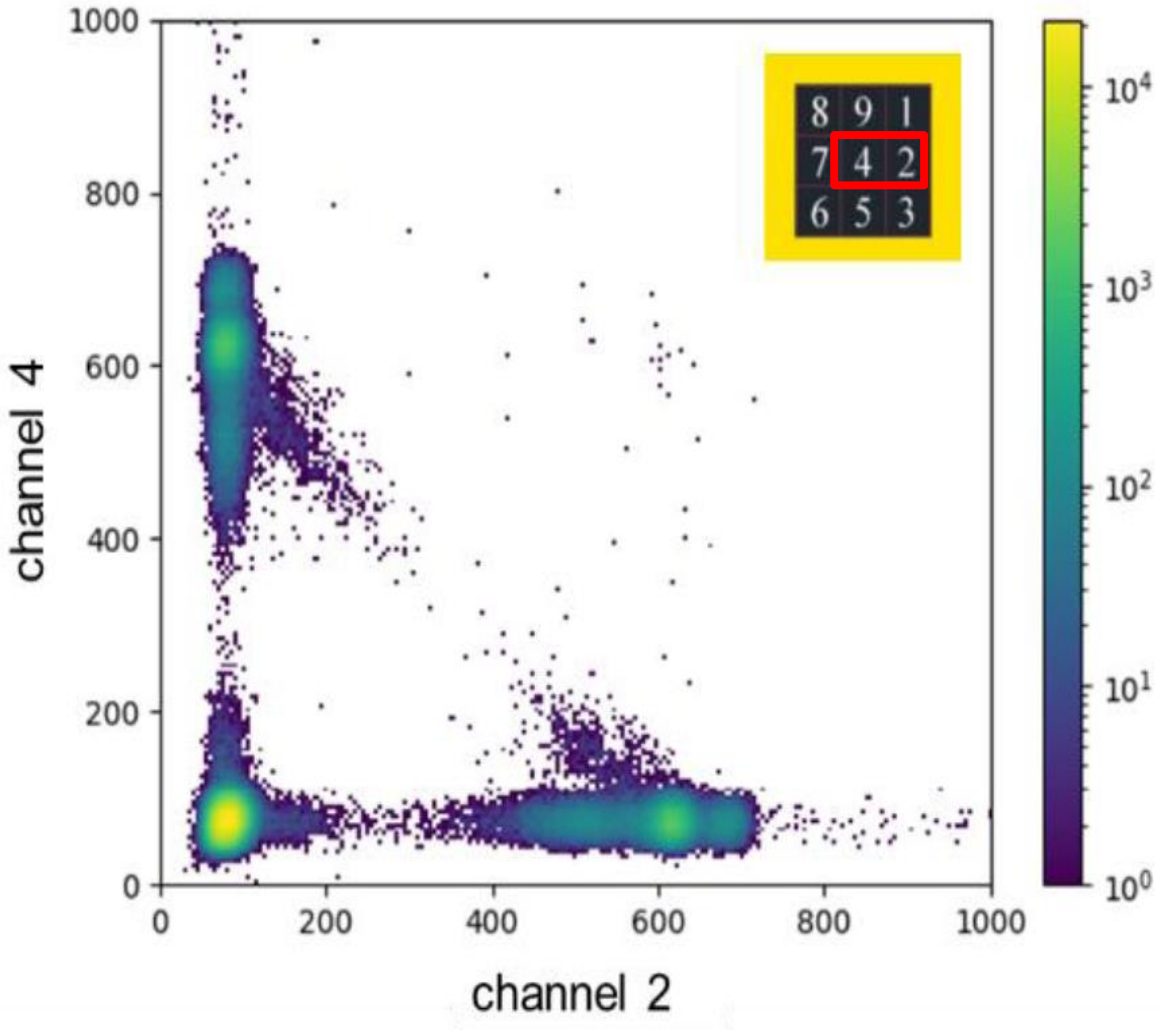
consisting of a 3×3 matrix with a pitch of 1.9 mm, thickness 1.5 mm (pixel size: 1850 µm x 1850 µm pixel, 50 µm gap)





LED - CROSS-TALK DETERMINATION USING CO-57





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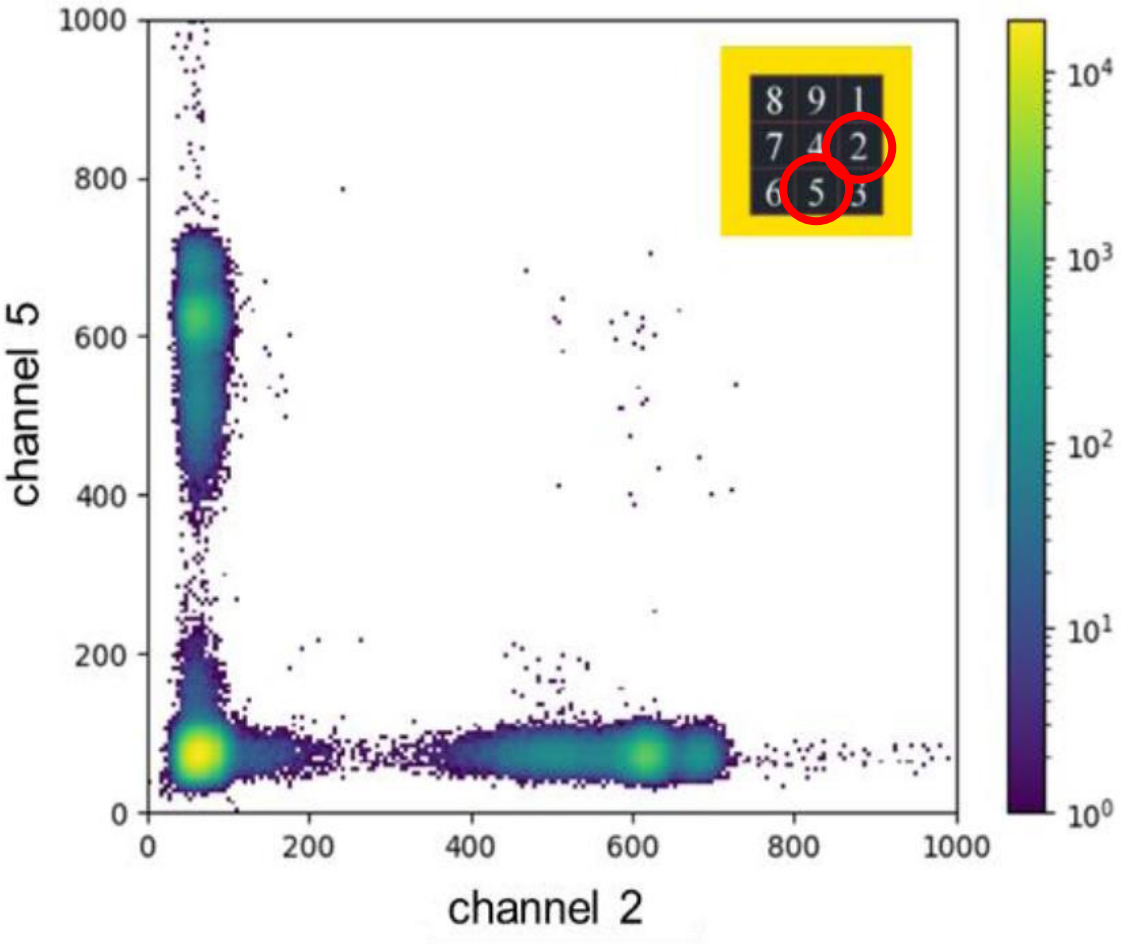
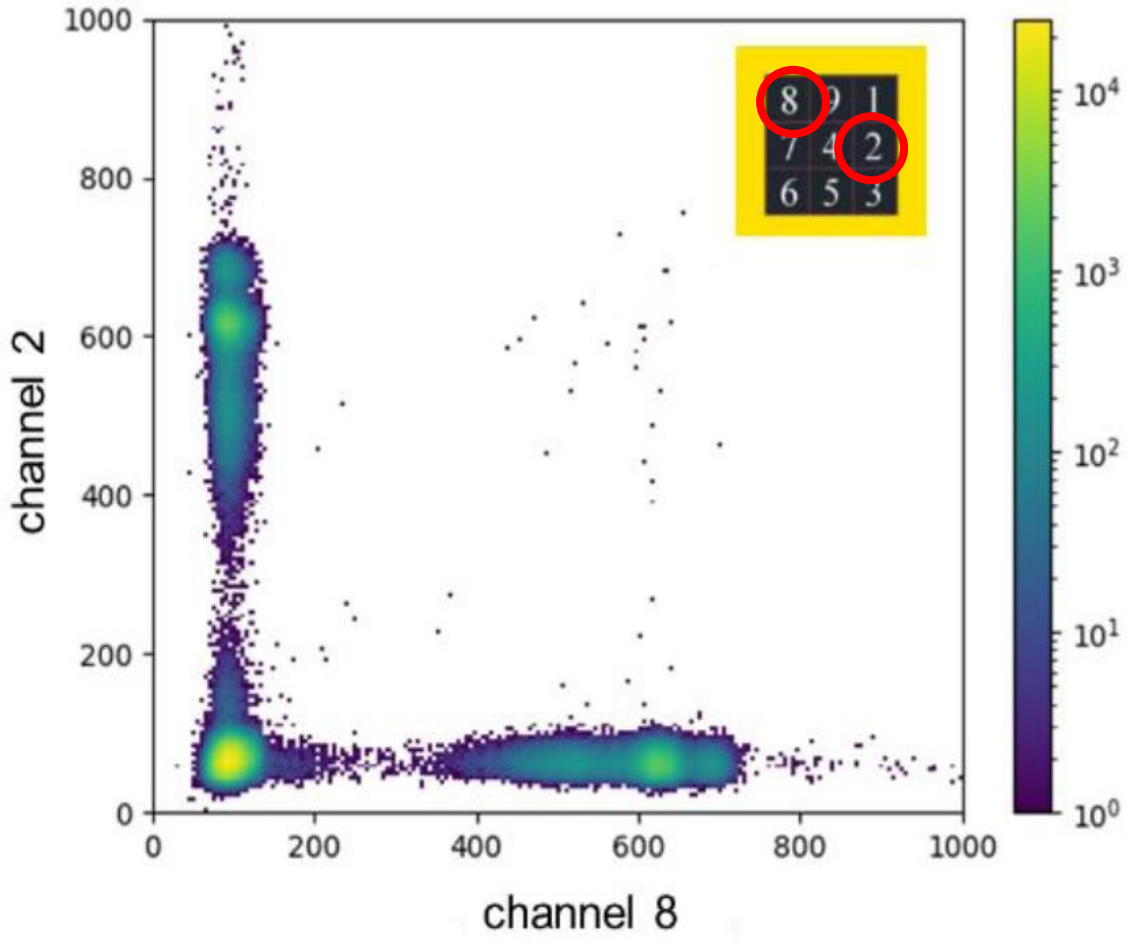
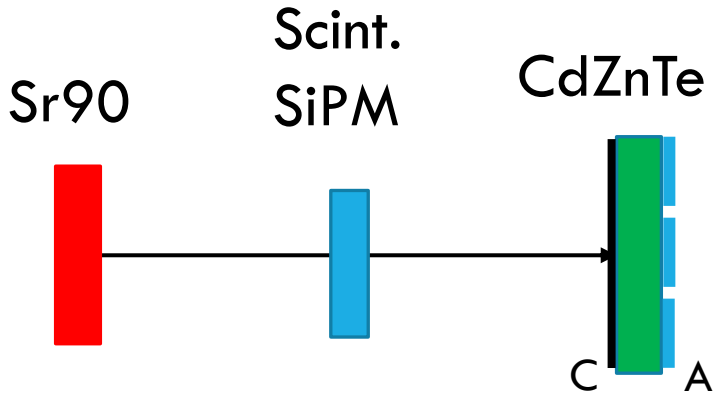
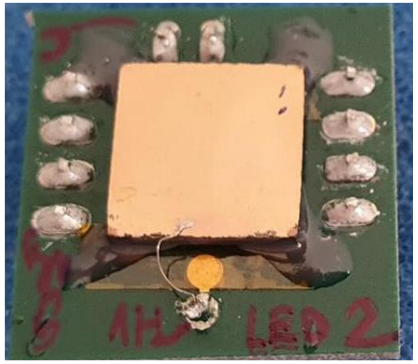
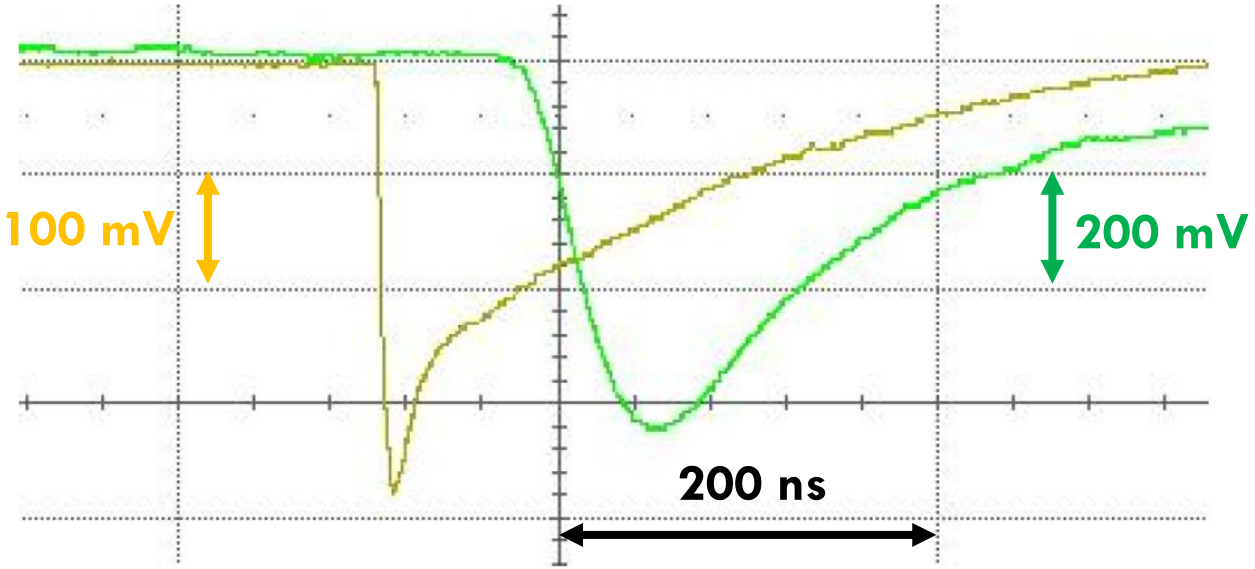




LED - TIMING WITH ELECTRON SOURCE SR-90

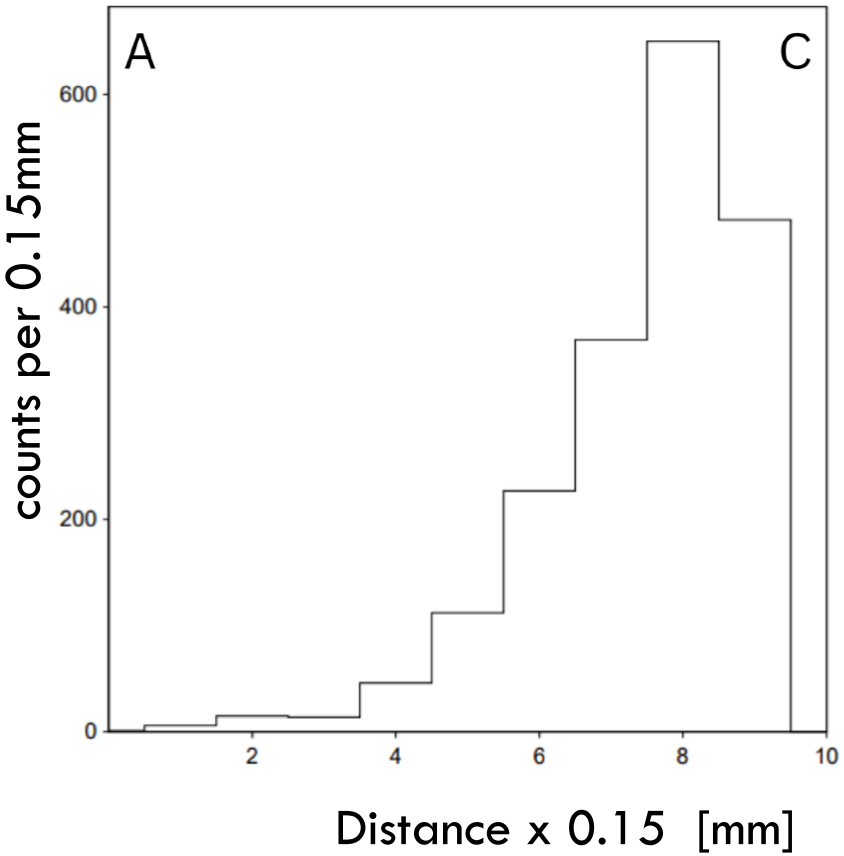




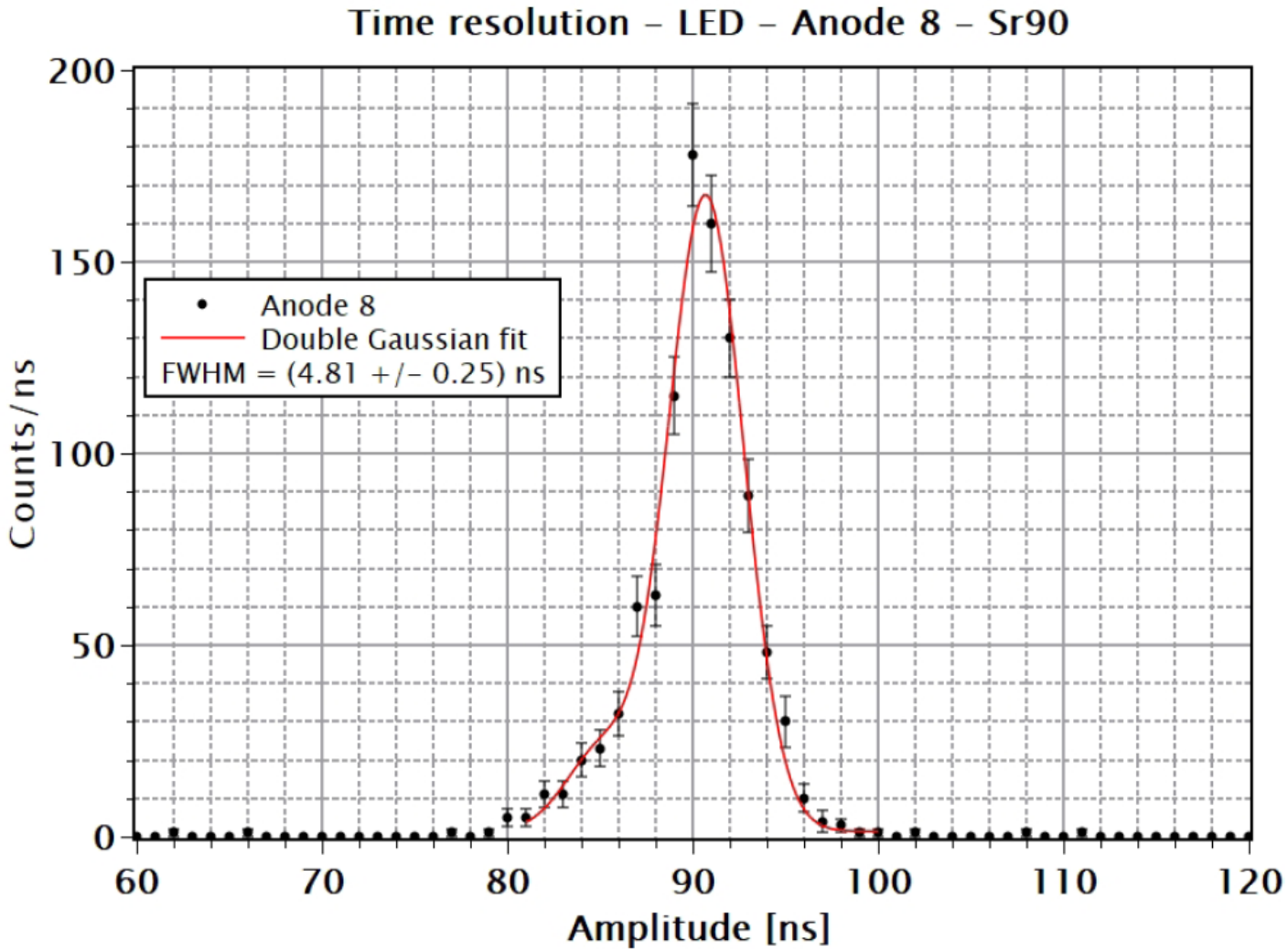


MC simulation: electron stopping distribution

(electron enter on cathode side)



LED - TIMING WITH ELECTRON SOURCE SR-90



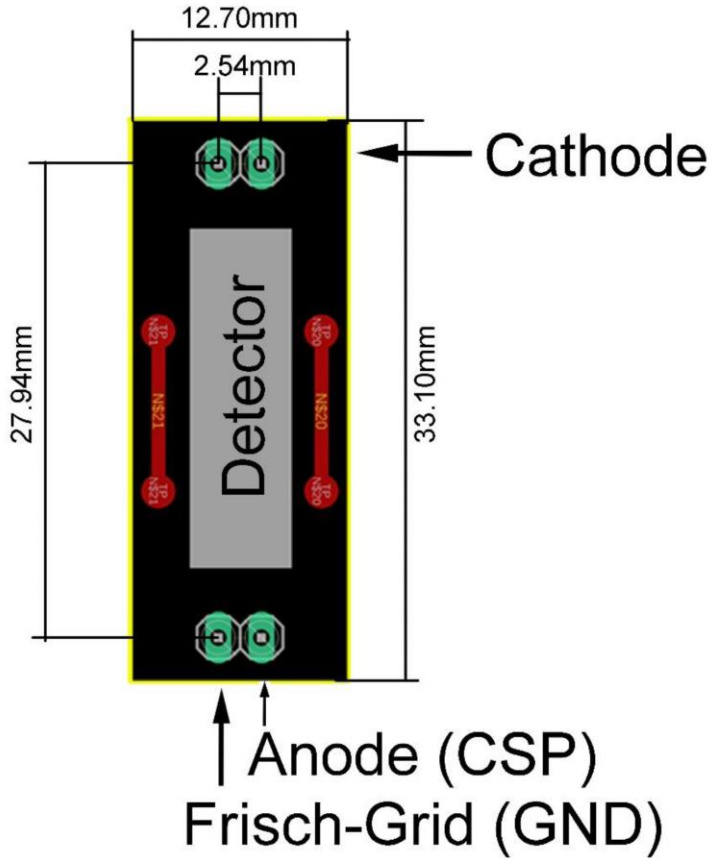
Time resolution [ns]			
	4.81	5.32	4.89
	4.66	5.75	5.16
	5.87	5.1	5.21

Anode			
	8	9	1
	7	4	2
	6	5	3

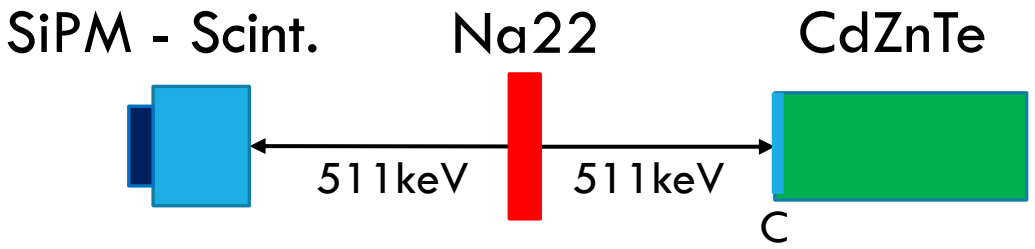
HIGH ENERGY DETECTOR

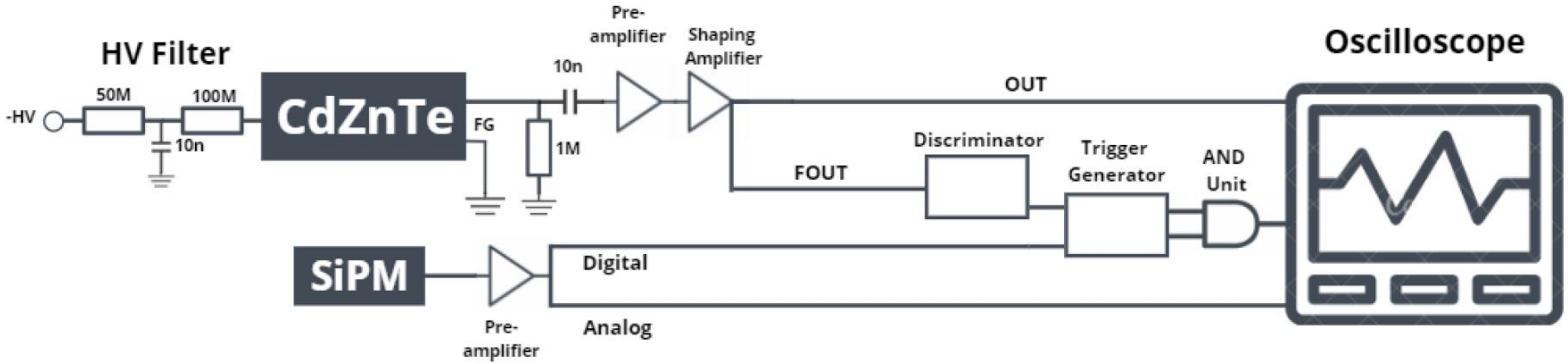
Dimension 6 mm x 6 mm x 19.4 mm

Lateral surfaces of sample were covered with Kapton foils and at the anode side a 5mm Cu tape was coiled around the samples (Frisch-grid)



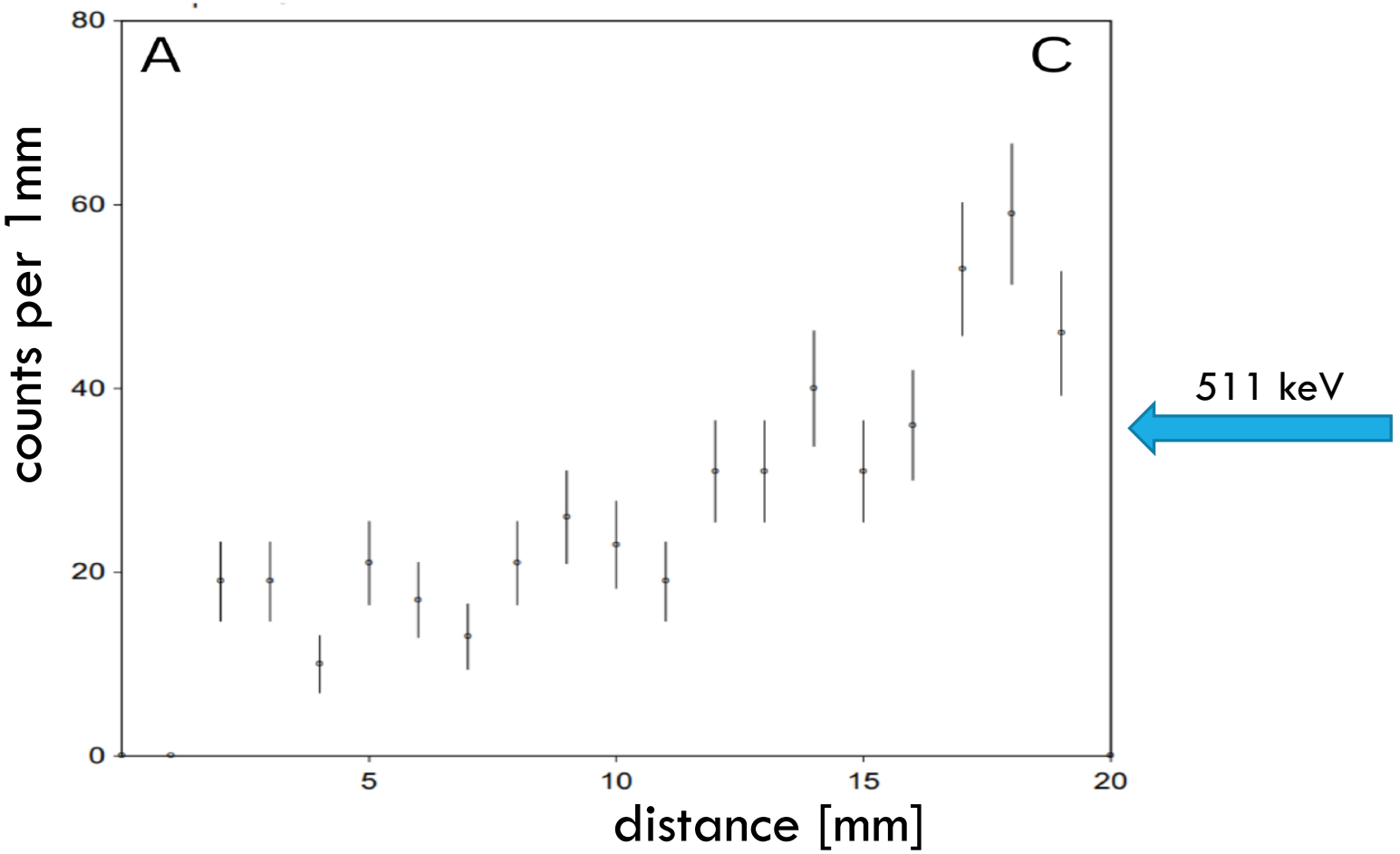
HED TIMING


SiPM - Scint.
Na22
CdZnTe
511keV
511keV
C

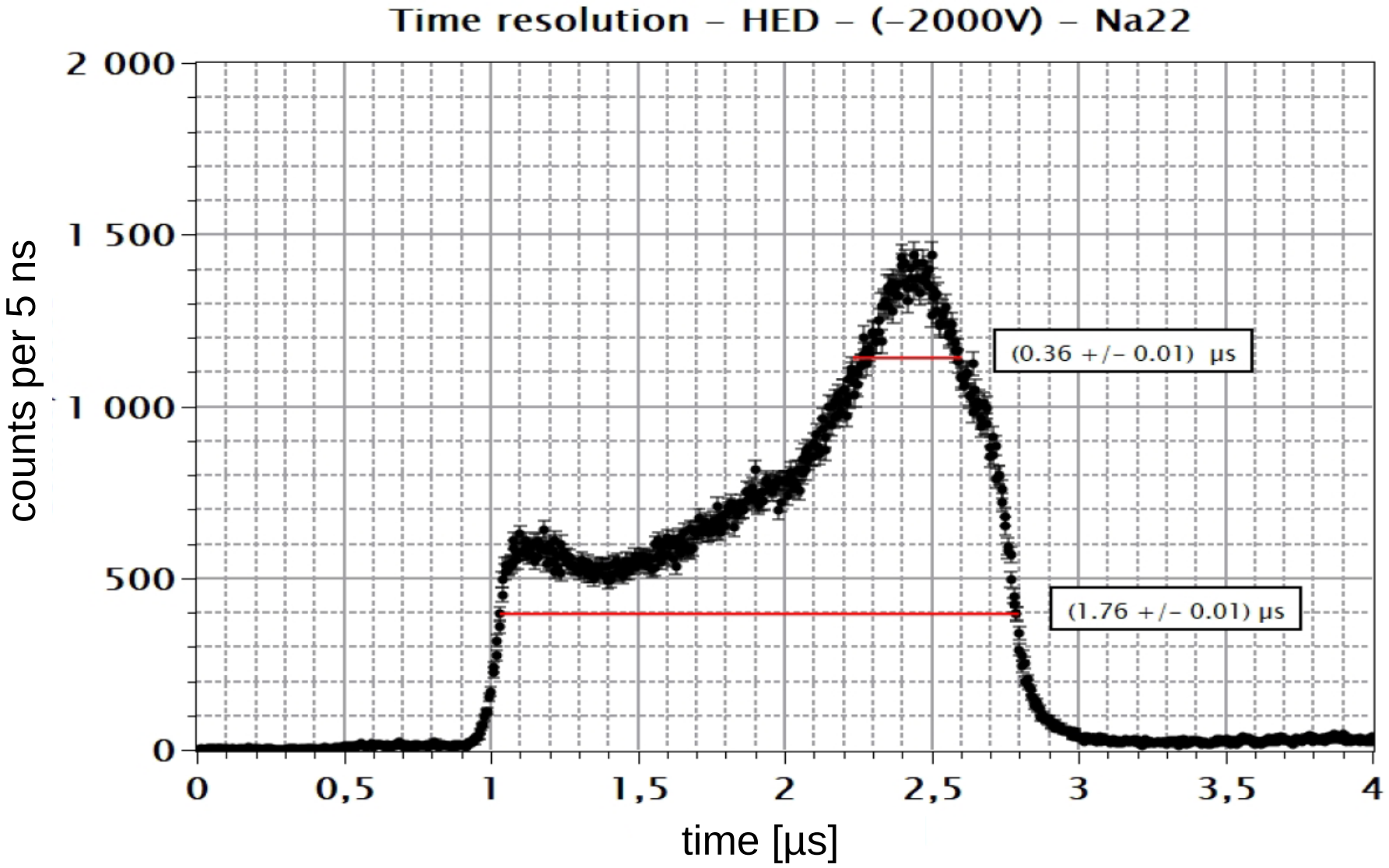

HV Filter
-HV
50M
100M
10n
CdZnTe
FG
10n
1M
Pre-amplifier
Shaping Amplifier
OUT
FOUT
Discriminator
Trigger Generator
AND Unit
Oscilloscope
SiPM
Pre-amplifier
Digital
Analog

HED TIMING – 511 KEV PHOTON STOPPING DISTRIBUTION

Stopping distribution of 511 keV photons in CdZnTe MC simulation (Geant 4)



HED TIMING WITH 511KEV PHOTONS



LED AND HED - CHARACTERIZATION

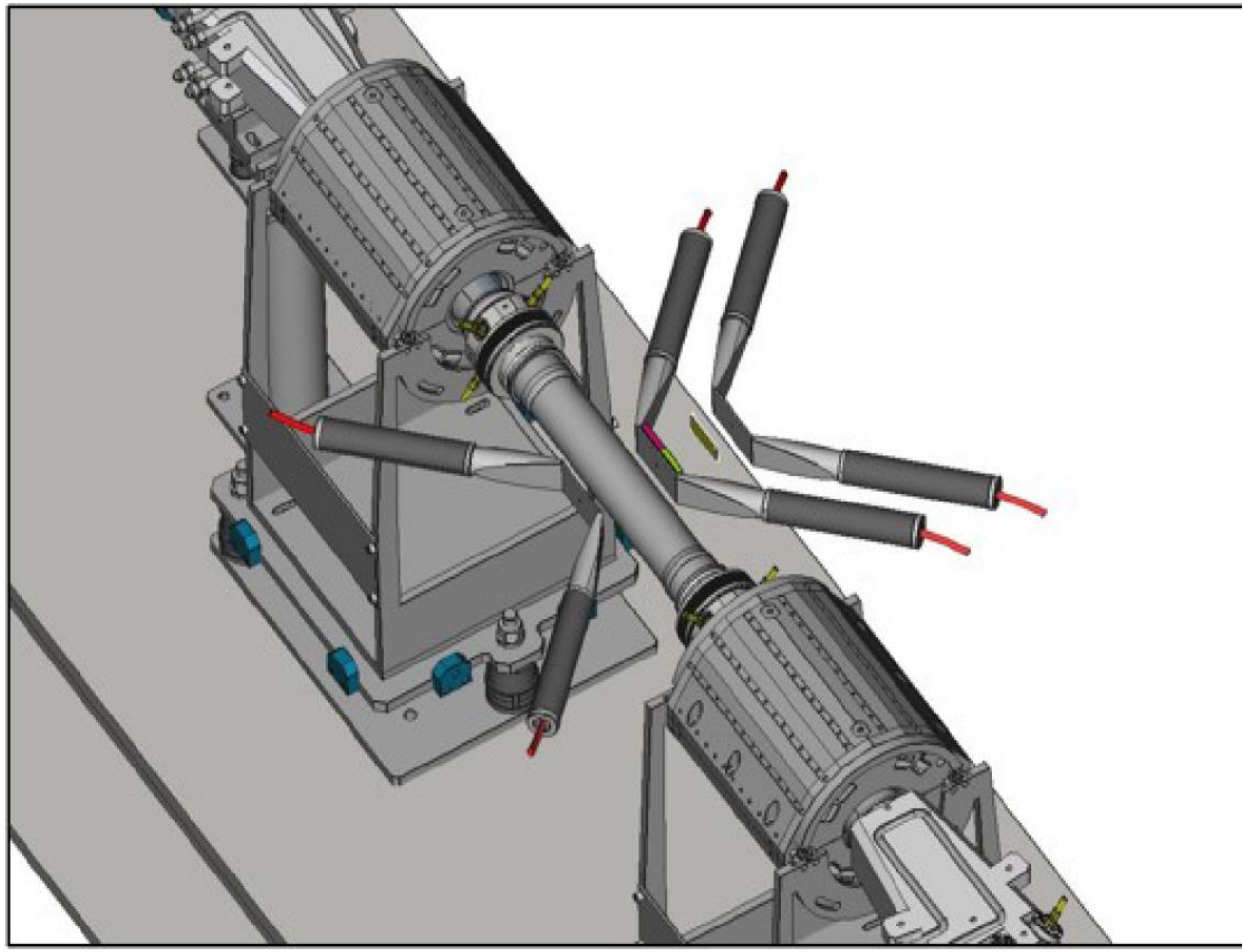
Low energy detector

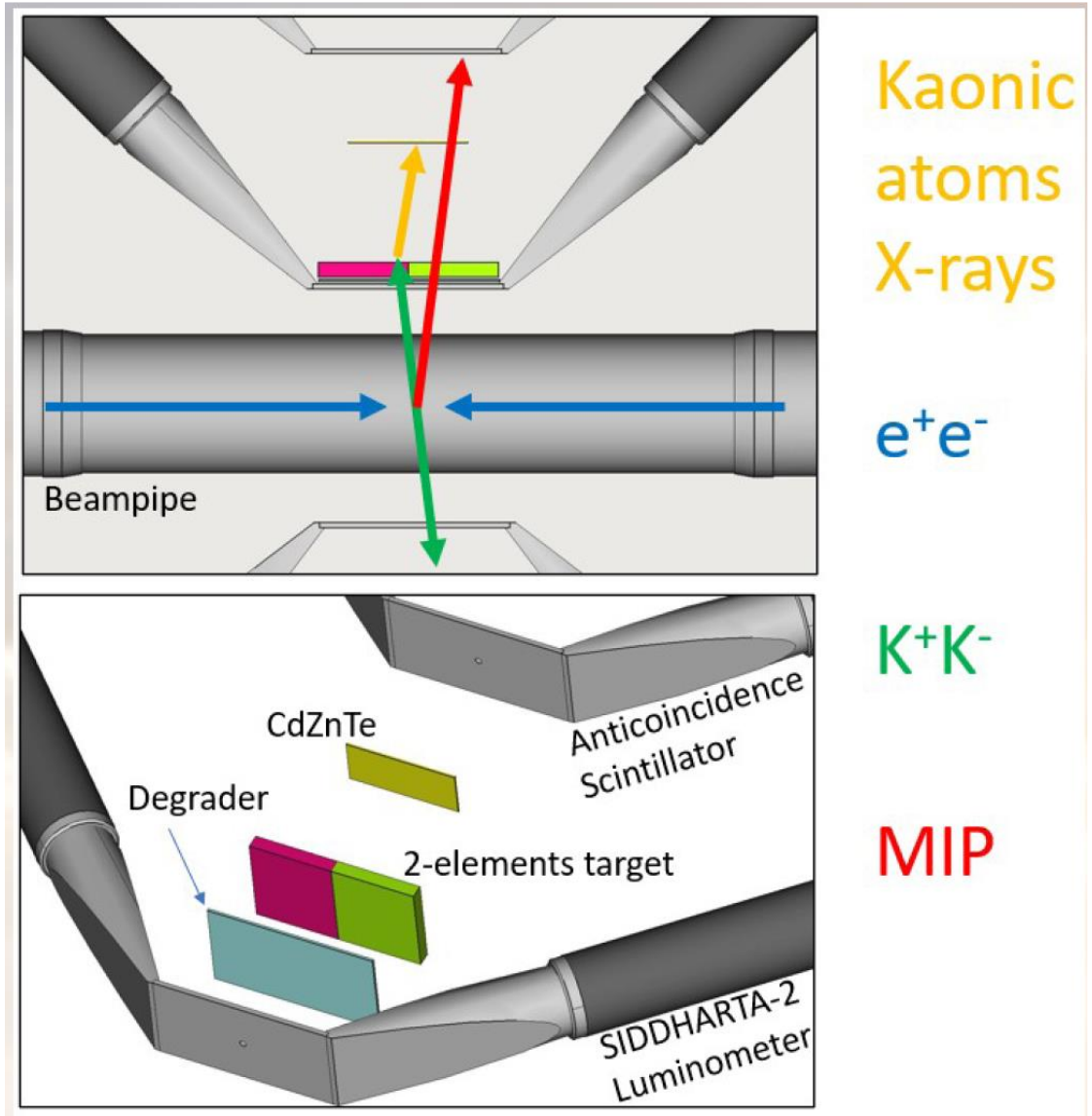
- ✓ Energy resolution
- ✓ Drift time
- ✓ Cross-talk, charge sharing

High energy detector

- ✓ Energy resolution
- ✓ Drift time

FIRST TEST MEASUREMENTS WITH CZT AT DAFNE





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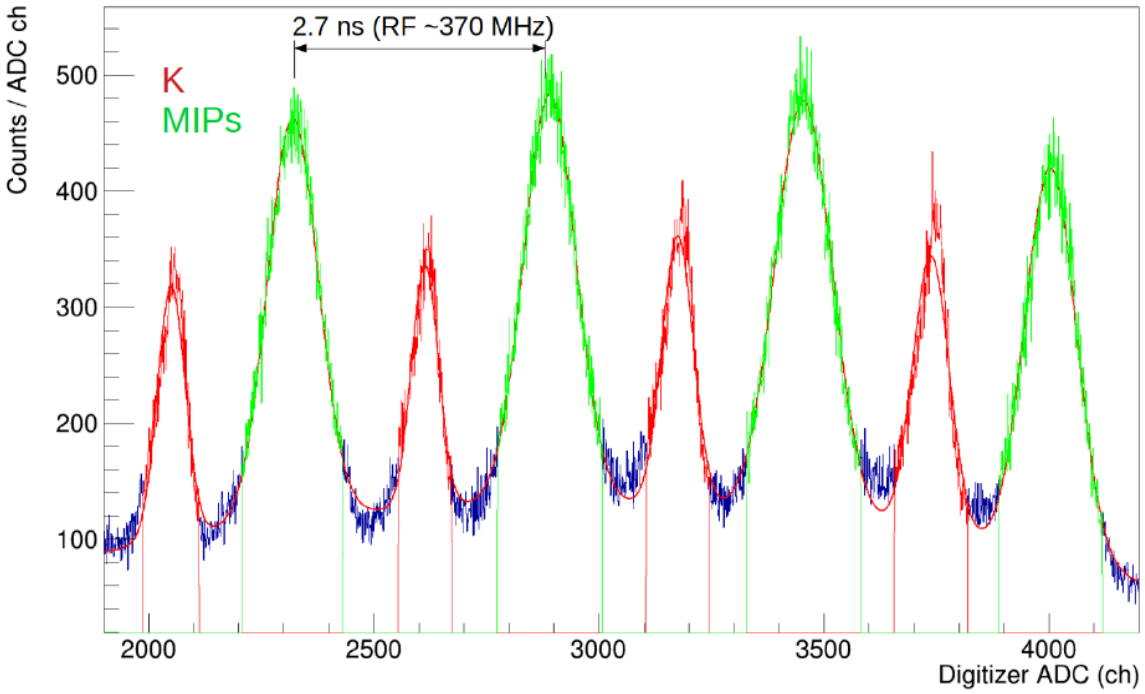

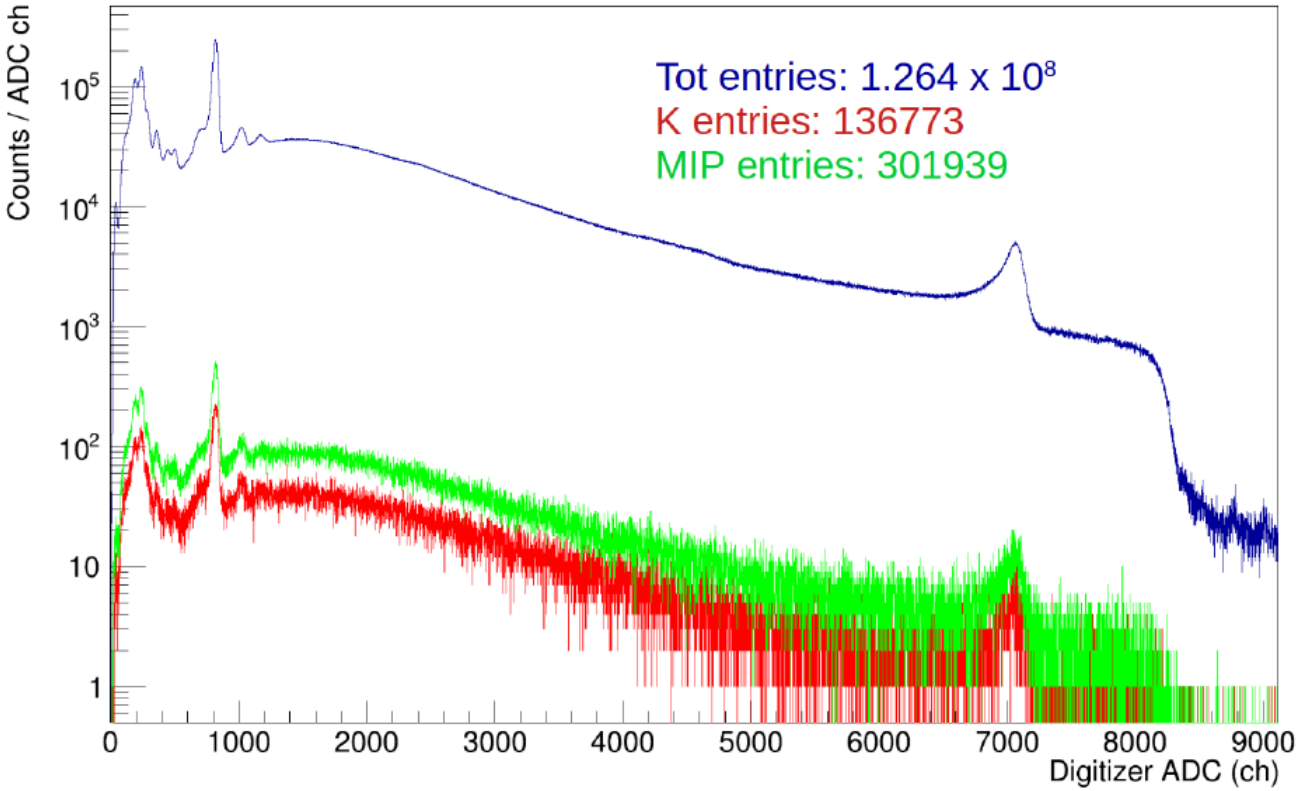

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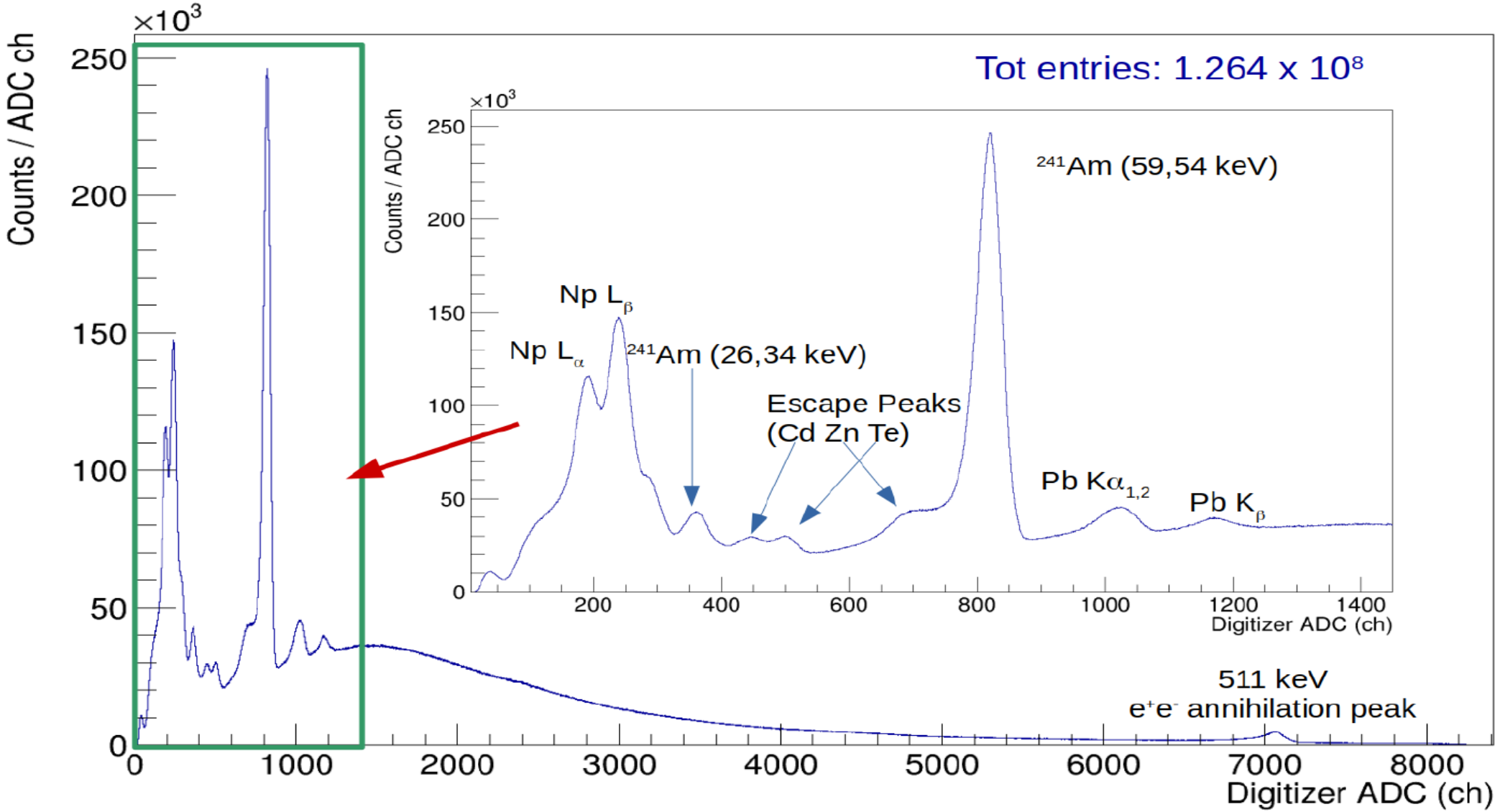

SUMMARY AND OUTLOOK

Low energy detector

Pixel structure: very good timing (drift time < 20 ns)
high rate capability
good energy resolution, working on improvements

High energy detector

Frisch-grid design: very good timing (drift time < 2 μs)
energy resolution as planned (~1% at 511 keV)
working on a 2x2 matrix

- First test measurements of CdZnTe detector at DAFNE

("New opportunities for kaonic atoms measurements with CdZnTe detectors", to be published)