

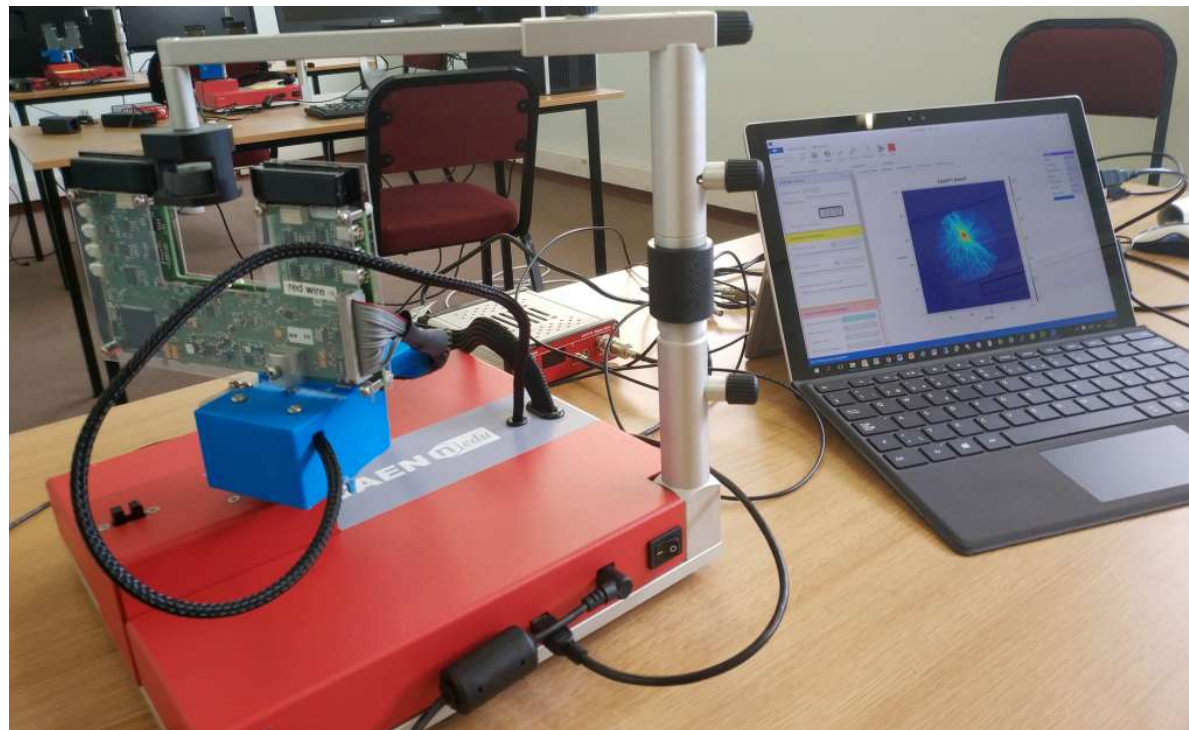


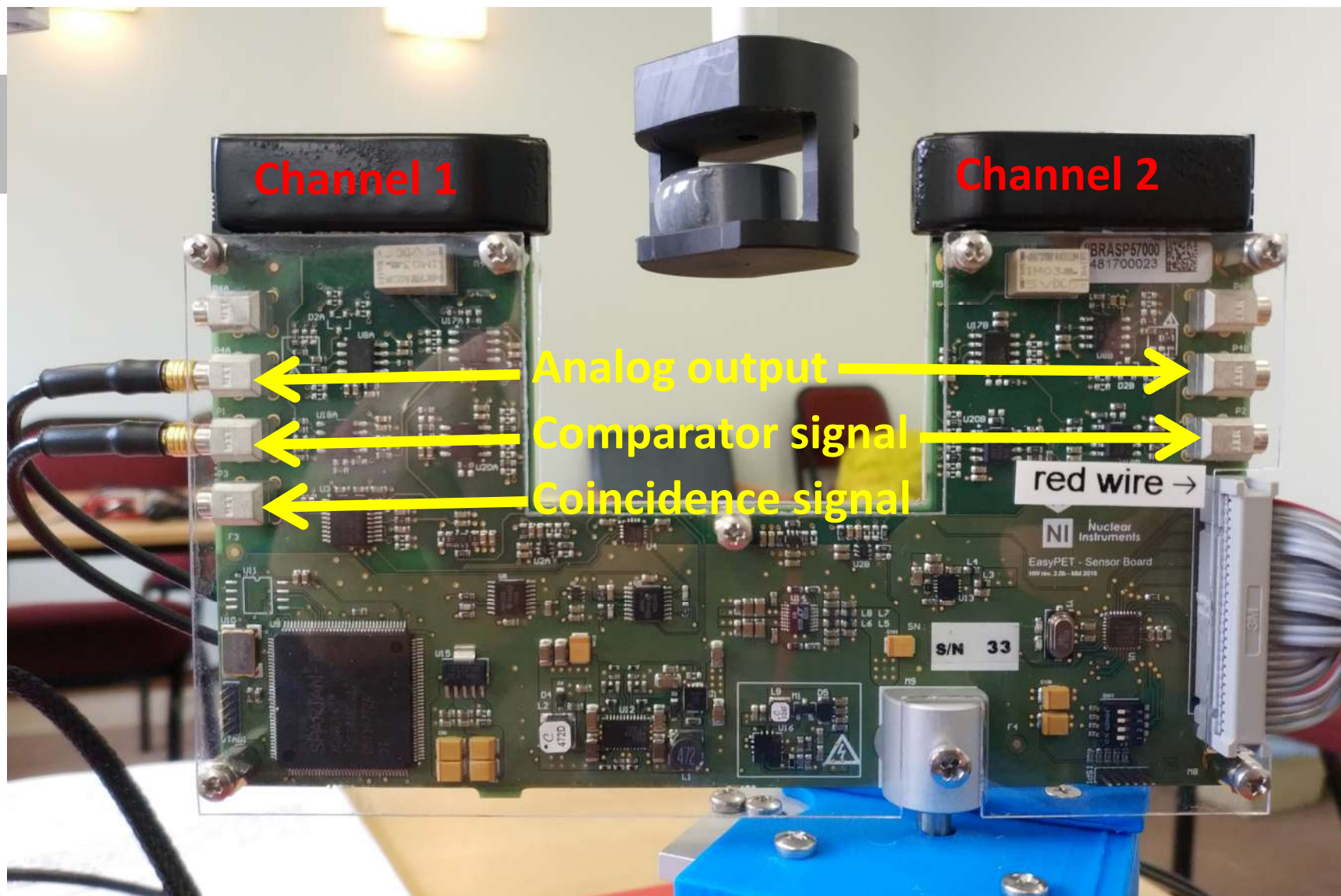
Martin Grossmann :: Center for Proton Therapy :: Paul Scherrer Institute

# CAEN Educational EasyPET Kit: Feedback on Experience

## What is SP5700 EasyPET?

- Portable didactic PET system for high-level education
- Explore physical and technological principles of PET scanners
- $\beta^+$  source  $\rightarrow$  two 511 keV  $\gamma$
- LySO crystals, Silicon PM rotating around the source
- Coincidence electronics
- Control and readout with PC GUI





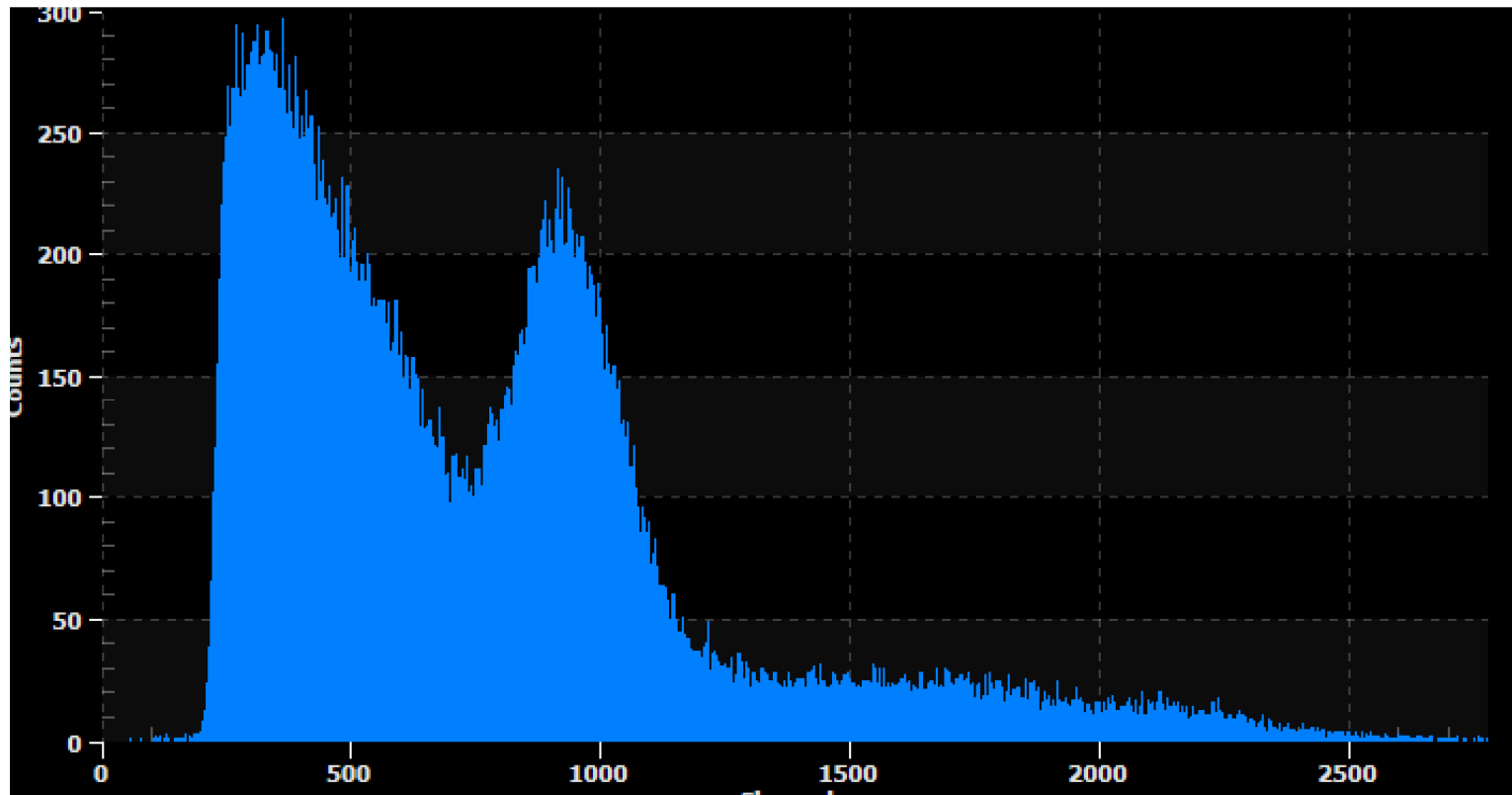
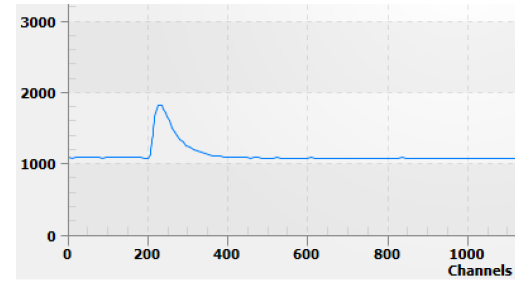
# DT5770 Multi Channel Analyzer (MCA)

- Analyze pulses
- Accept signal and trigger input
- Readout with PC



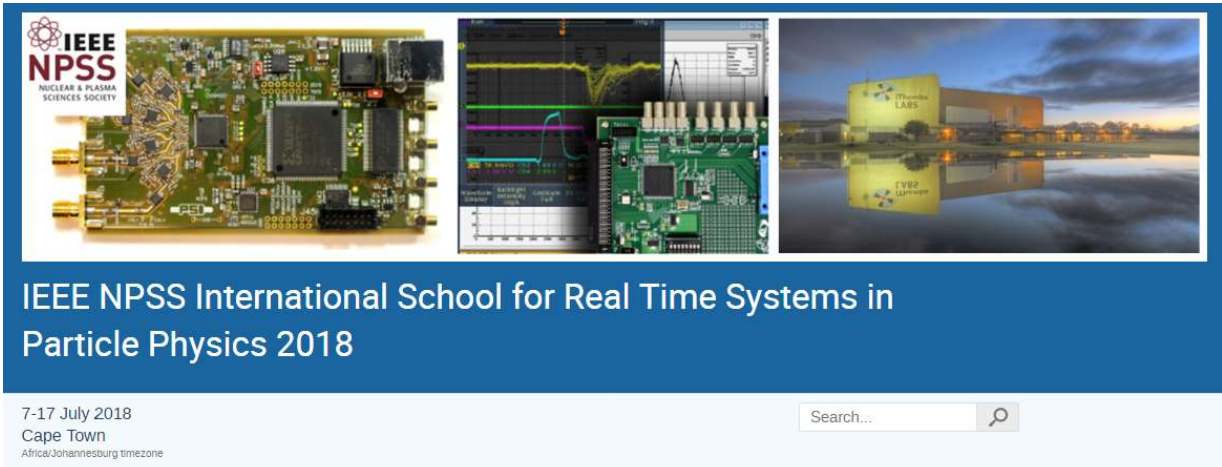
# Multi Channel Analyzer (MCA)

- Look at individual pulses
- Acquire spectrum



# Int. School for Real Time Systems

- iThemba Labs, Capetown, July 2018
- 50 students (mostly South Africa), 14 teachers (mostly IEEE-NPSS)
- 10 days of lectures and laboratory exercises
- <https://indico.cern.ch/e/ISREPP2018>



IEEE NPSS International School for Real Time Systems in Particle Physics 2018

7-17 July 2018  
Cape Town  
Africa/Johannesburg timezone

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  - Women in Engineering
  - Invited Speakers
- Visa
- Key Dates
- Organization
- Application
- Event Photography



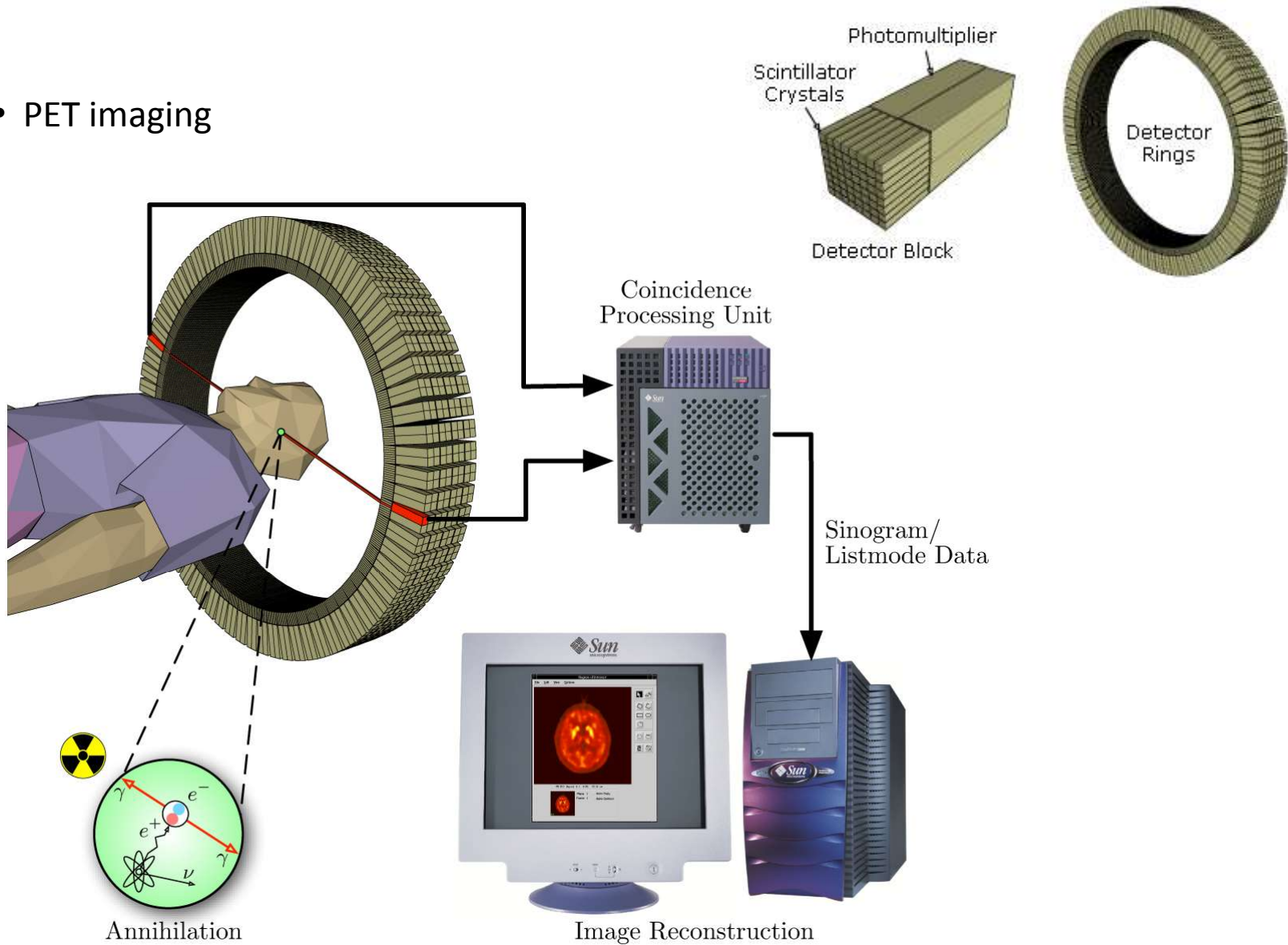
The school is organized by IEEE Nuclear and Plasma Sciences Society and the South Africa- CERN consortium and will be held at iThemba LABS in Cape Town July 7th - 17th. Its intention is to give practical experience with developing and controlling mid-range real time experiments. Hands-on experience is very important. The school provides lectures and laboratory exercises, given by experts in

# Int. School for Real Time Systems

- 4 EasyPET kits (3 on loan from CAEN)
- → students could work in groups of 2...3
- 4 hour exercise

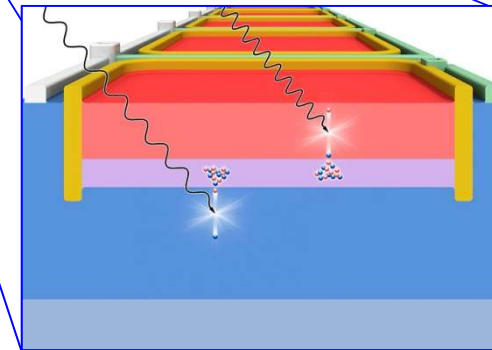
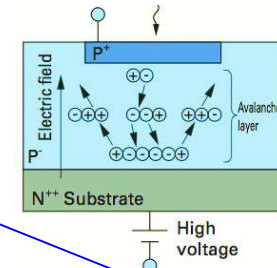
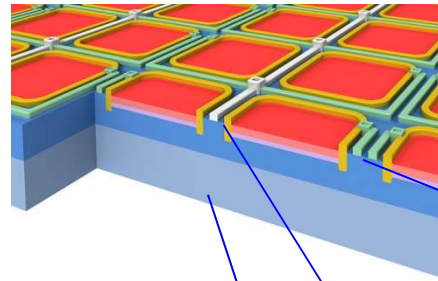


- PET imaging





- Crystals and SiPMs



- SiPM cells
- Bias Voltage
- Dark Count Rate

CAEN Easypet - ver: 1.2.4.0

EasyPET Control Spectroscopy

Serial Port: COM4

Refresh Disconnect Reset Apply Calibration Resolution Start Stop

Instrument Connection Configuration Acquisition

### SiPM Bias Control

Channels Status:  On

SIPM BIAS Voltage:

7372

Power off after acquisition

### Coincidence Parameters

Threshold Ch 1 (mV):

Threshold Ch 2 (mV):

Coincidence Window Length (ns):

### Scan & Acquisition Parameters

Acquisition Result Calibration Resolution Plot DT5770 Signal DT5770 Spectrum

## EasyPET Result

### EasyPet

Status:

Top Angle:

Bottom Angle:

Counts:

Total Counts:

Run Time:

Acq Length:

### DT5770 MCA

Status:

Input Count Rate:

Output Count Rate:

Successfully connected to DT5770

CAEN Easypet - ver: 1.2.4.0

EasyPET Control Spectroscopy

DT5770 List: NID10065

Refresh Disconnect Offline Processing

Oscilloscope Single Photon Spectroscopy

Stop Clear Fitting Tool KeV Log Reset Zoom

Instrument Connection Preset Configuration Spectrum Control

**DT5770 Parameters**

Input Gain

DC - GAIN: 1

Trigger (LSB)

1

Acquisition Result Calibration Resolution Plot DT5770 Signal DT5770 Spectrum

lsb

Channels

**EasyPet**

Status: READY

Top Angle: 0

Bottom Angle: 0

Counts: 0

Total Counts: 0

Run Time: 0 s

Acq Length: 0 s

**DT5770 MCA**

Status: READY

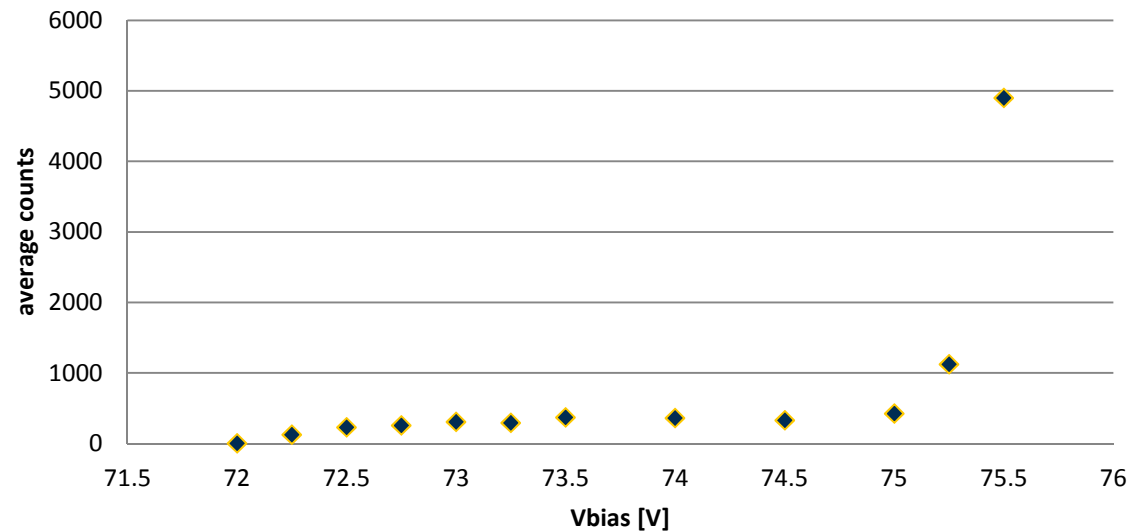
Input Count Rate: 57

Output Count Rate: 57

Operation parameter updated

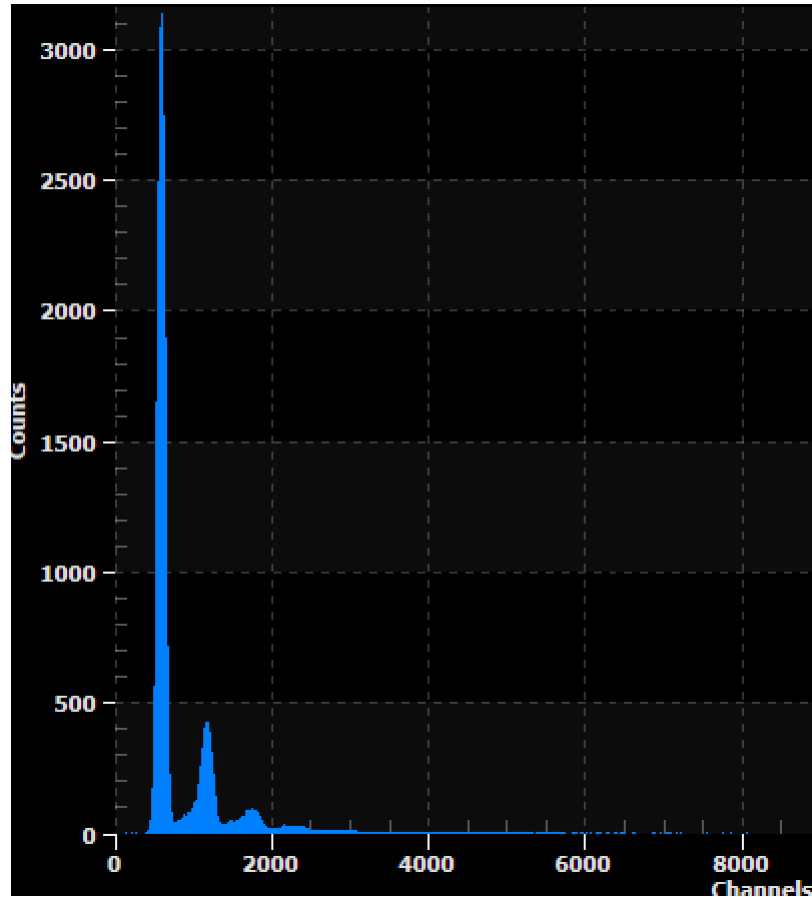
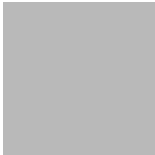
# What can be done?

- SiPM characteristics: find optimal bias voltage (without source)



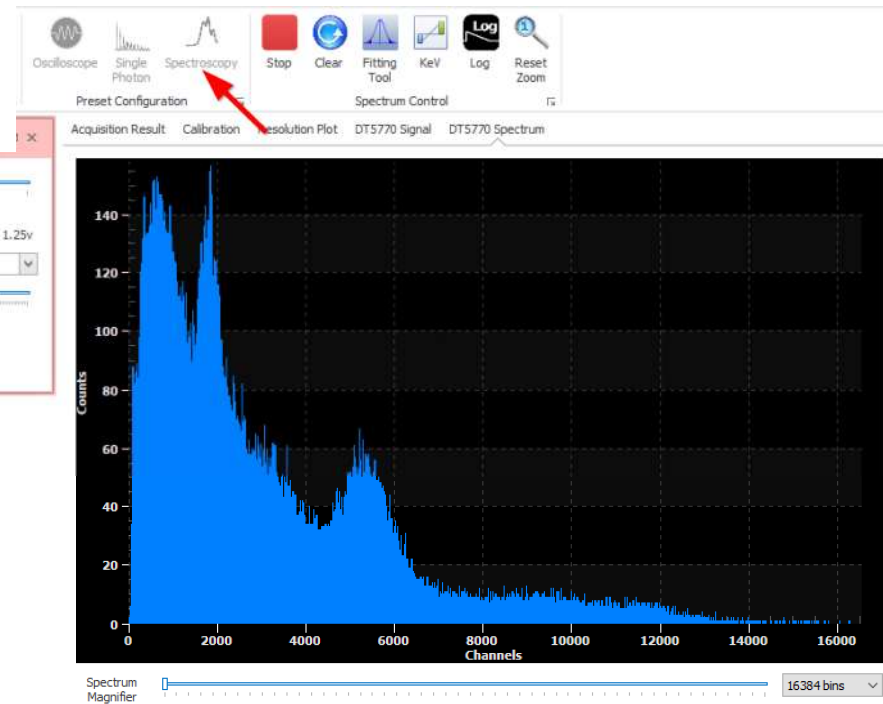
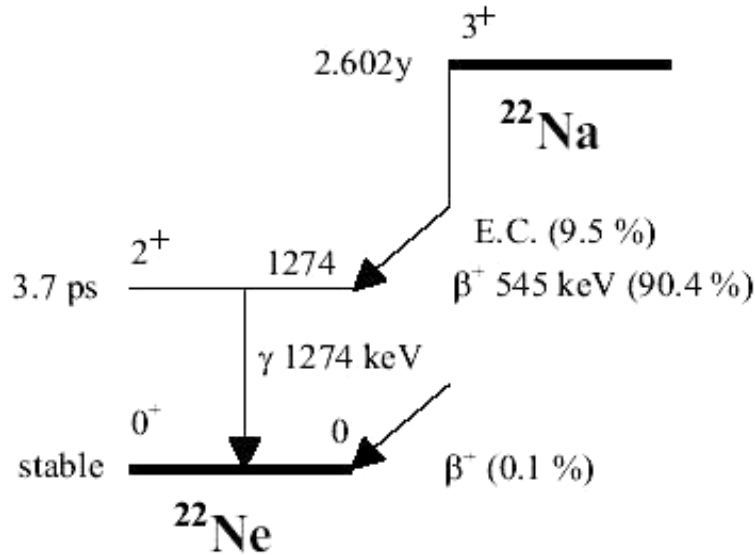
# What can be done?

- SiPM characteristics: Multi Photon Spectrum (without source)



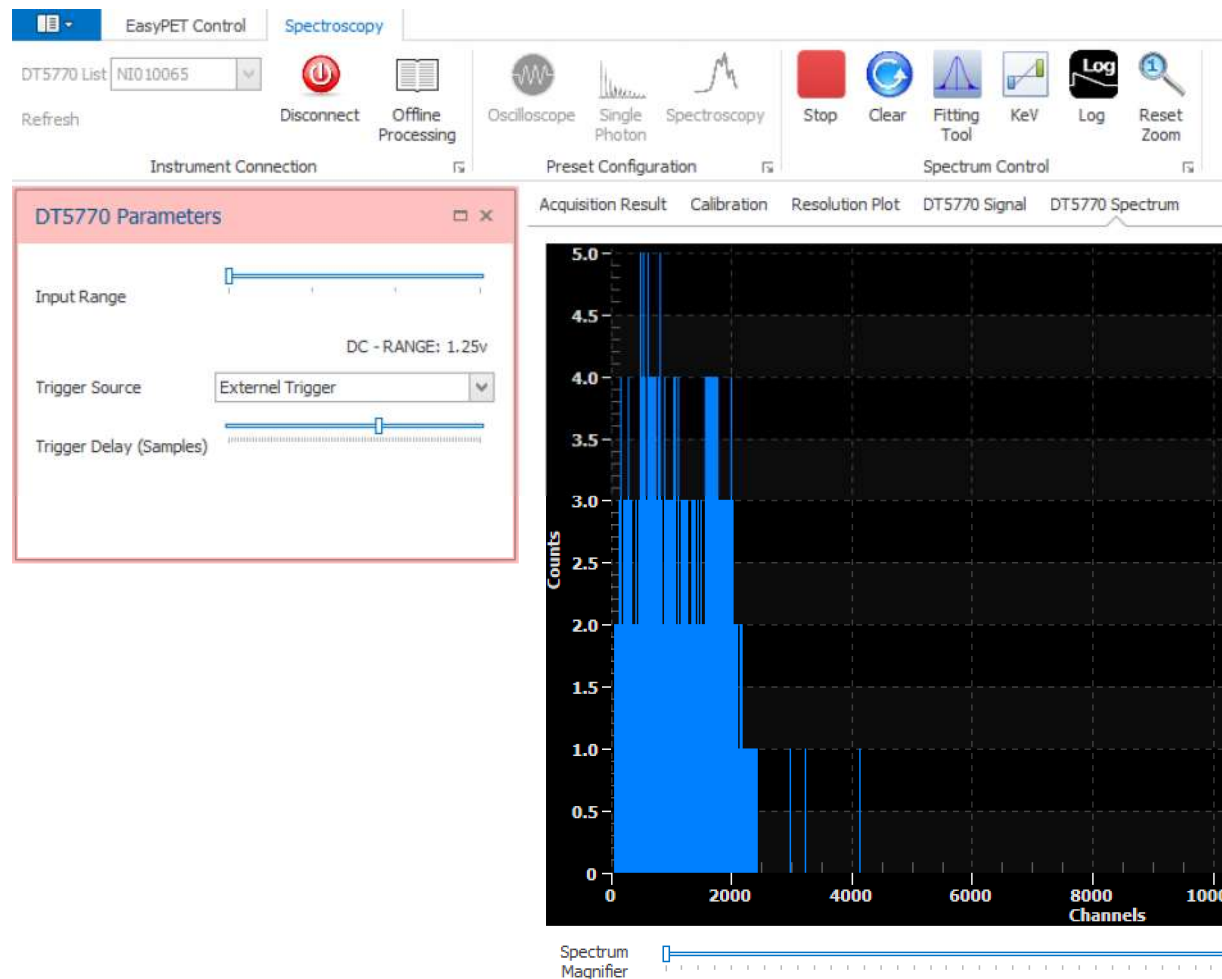
# What can be done?

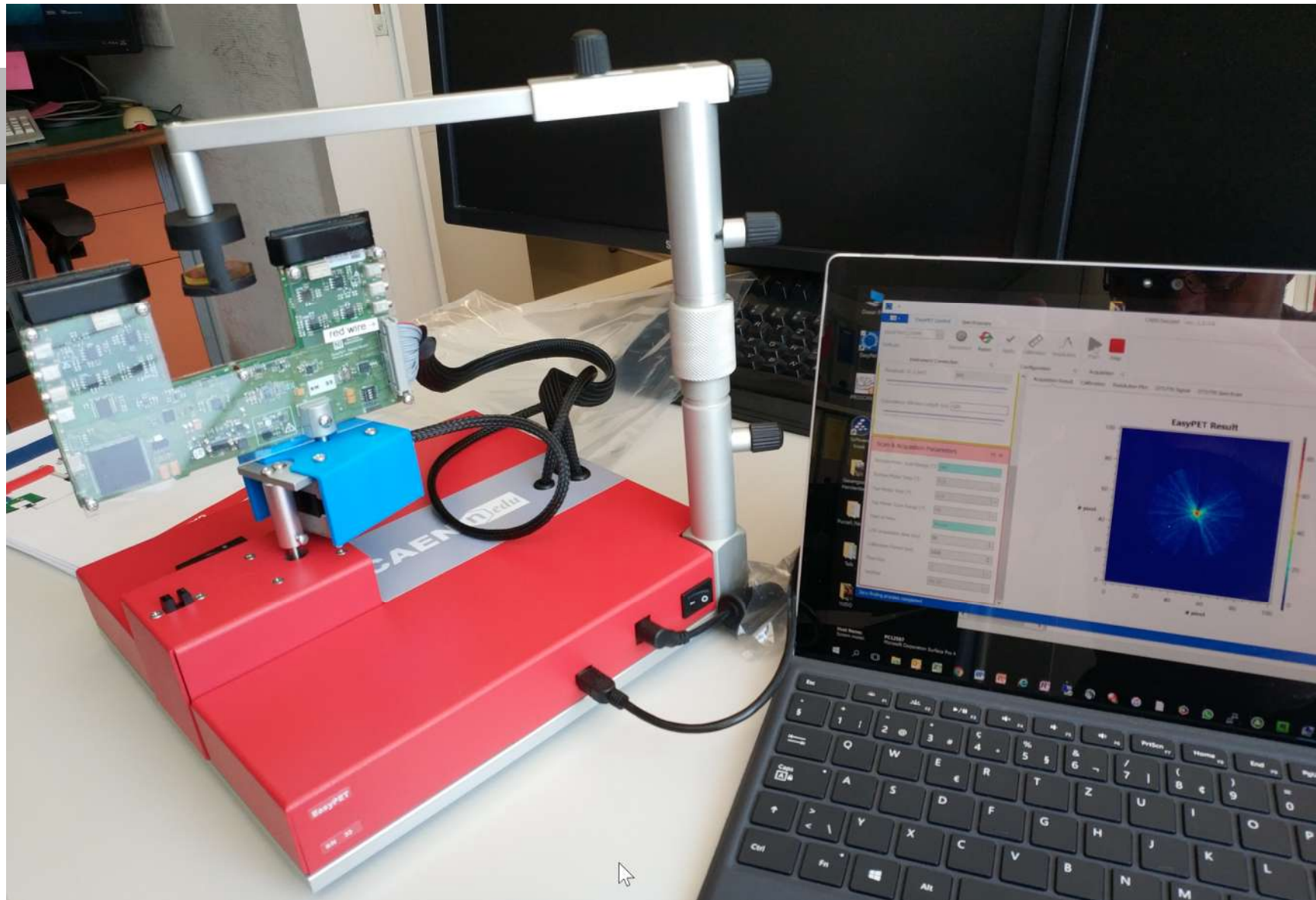
- Gamma Spectrum (with source)



# What can be done?

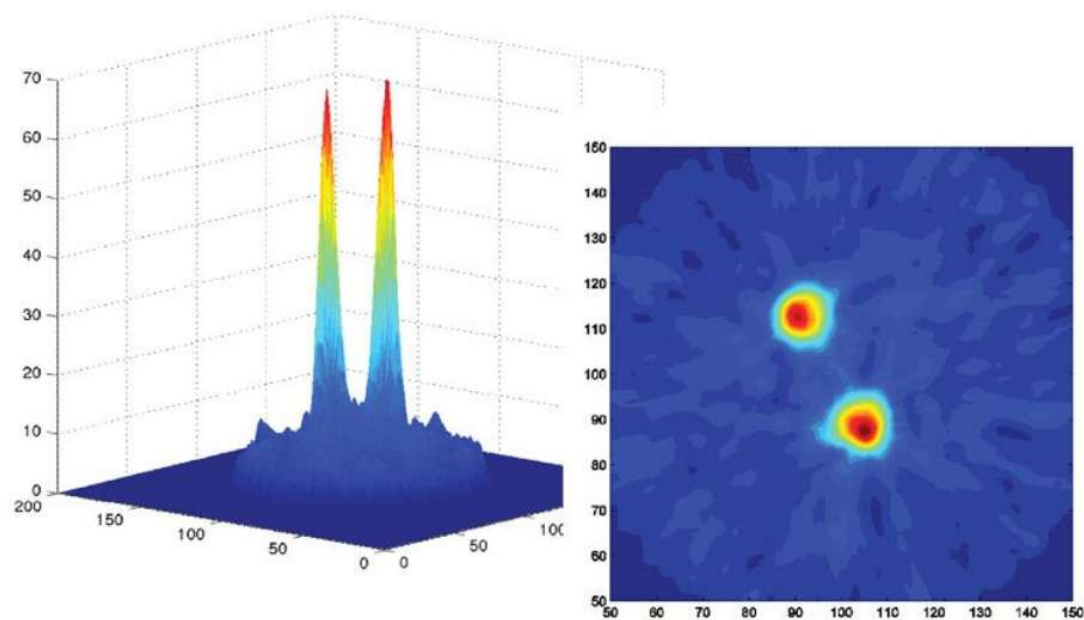
- Coincidence Spectrum (with source)
- → suppress Compton background







# Two sources resolution



**$^{22}\text{Na}$  sources, 5  $\mu\text{Ci}$ , 2.7 mm  $\varnothing$  and 9 mm apart.**

- Very nice experiment involving different fields of knowledge:
  - Nuclear physics
  - Detectors
  - Silicon PMs
  - Electronics
  - PET imaging
  - Relationship with other modalities
- Acquire yourself a real PET image on the table top – amazing!
- Good support from CAEN
  - Provide kits on loan
  - 1 day training for Patrick and myself in Pisa
  - Skype support during school in South Africa

## Feedback on Experience ☹️

- Mechanics
  - Mechanical alignment of source is very critical
  - Some other minor improvements → suggested to CAEN



- Some features need more documentation
  - Better explanation on bias voltage, thresholds, gains
  - → suggested to CAEN
- A couple of other technical issues
  - Mostly concerning interplay EasyPET / MCA
  - Look like SW and FW issues which can probably be fixed
  - → suggested to CAEN
- Not really cheap
  - Price in Switzerland:
    - EasyPET EUR 7'000
    - MCA EUR 2'500

- Quite some logistics
  - Packaging of kit quite large; needed to repack to bring 4 kits in normal luggage to South Africa



- Need radioactive sources



## Conclusion

- Very nice kit
- Some features can be improved for easier use
- The students really liked it!
  - School had 6 different laboratory exercises
  - For final presentation, 4 out of 8 student groups choose to present EasyPET
- Thank you to CAEN for support!

