LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia

STUDY OF NEW SCINTILLATOR SAMPLES FOR FUTURE DETECTORS

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Goals of the project:

- Study and develop plastic scintillator based on new materials, with competitive light yield

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- Future experiments require plastic scintillating materials with high scintillation efficiency, long-term stability & high radiation hardness

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p-p collision at 100 TeV of mass energy (instead of 14 TeV LHC)

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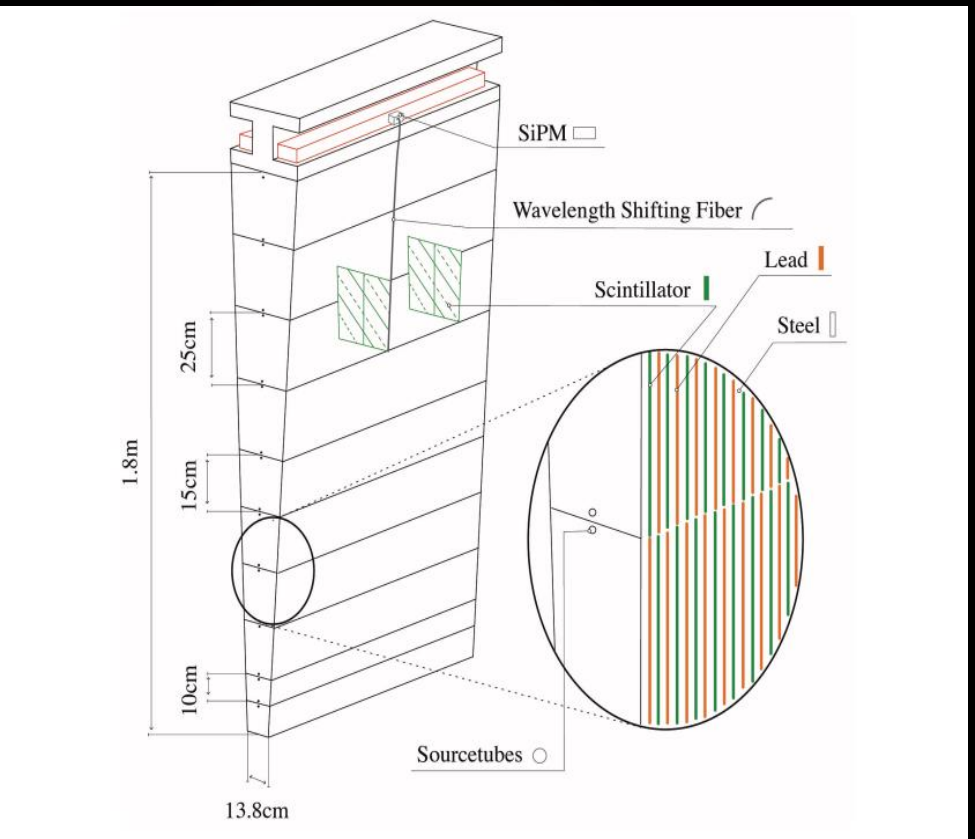


The proposal calorimeter consists of steel and lead absorbers, and of plastic scintillator tiles as the active material.

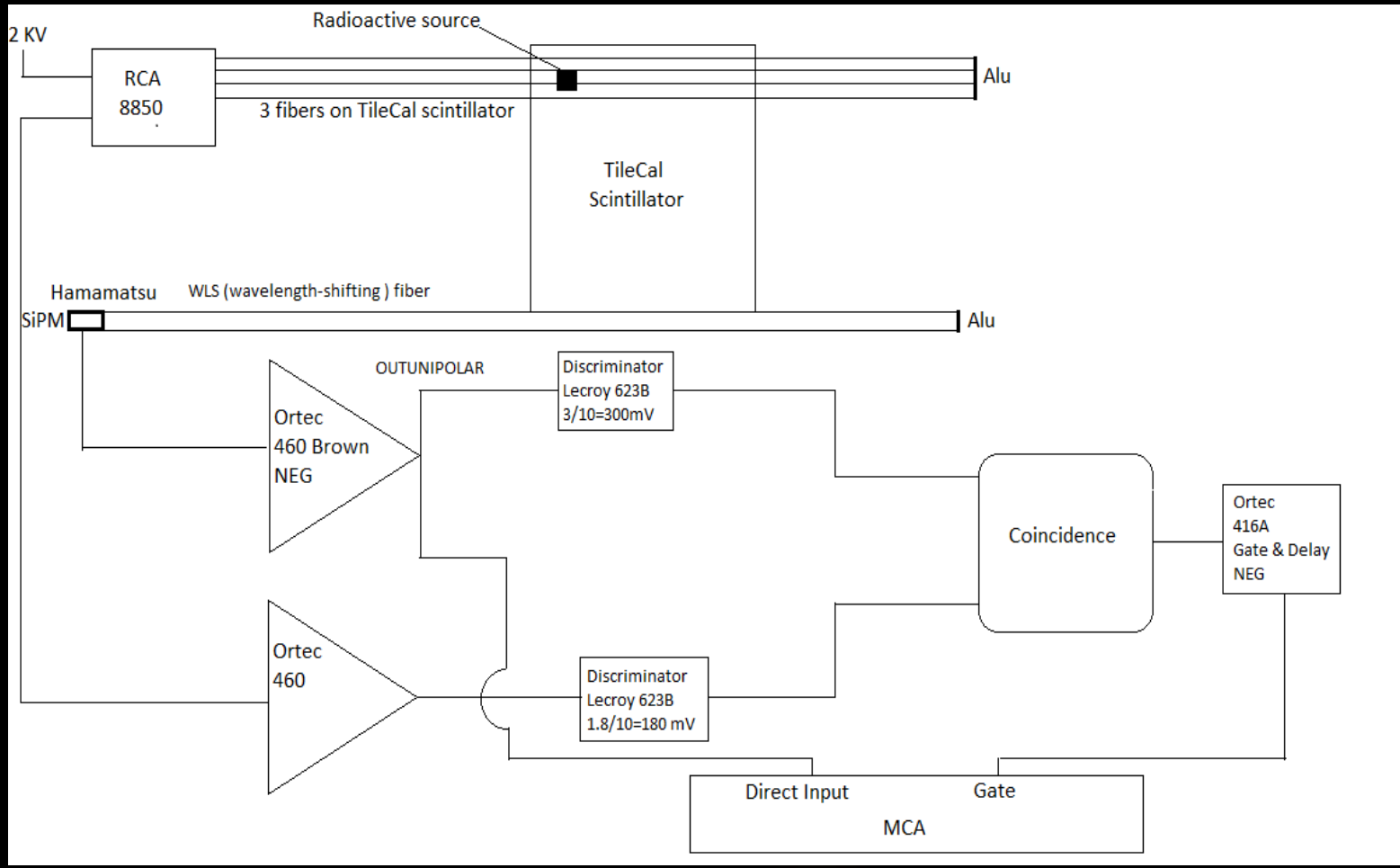
My Goal:

- SiPM calibration for the measurement of the absolute light yield of scintillator: #γ/MeV

Experimental setup to measure #photons/MeV

All components of the general setup are shown:

- Radioactive source: ^{90}Sr



Experimental setup to measure #photons/MeV

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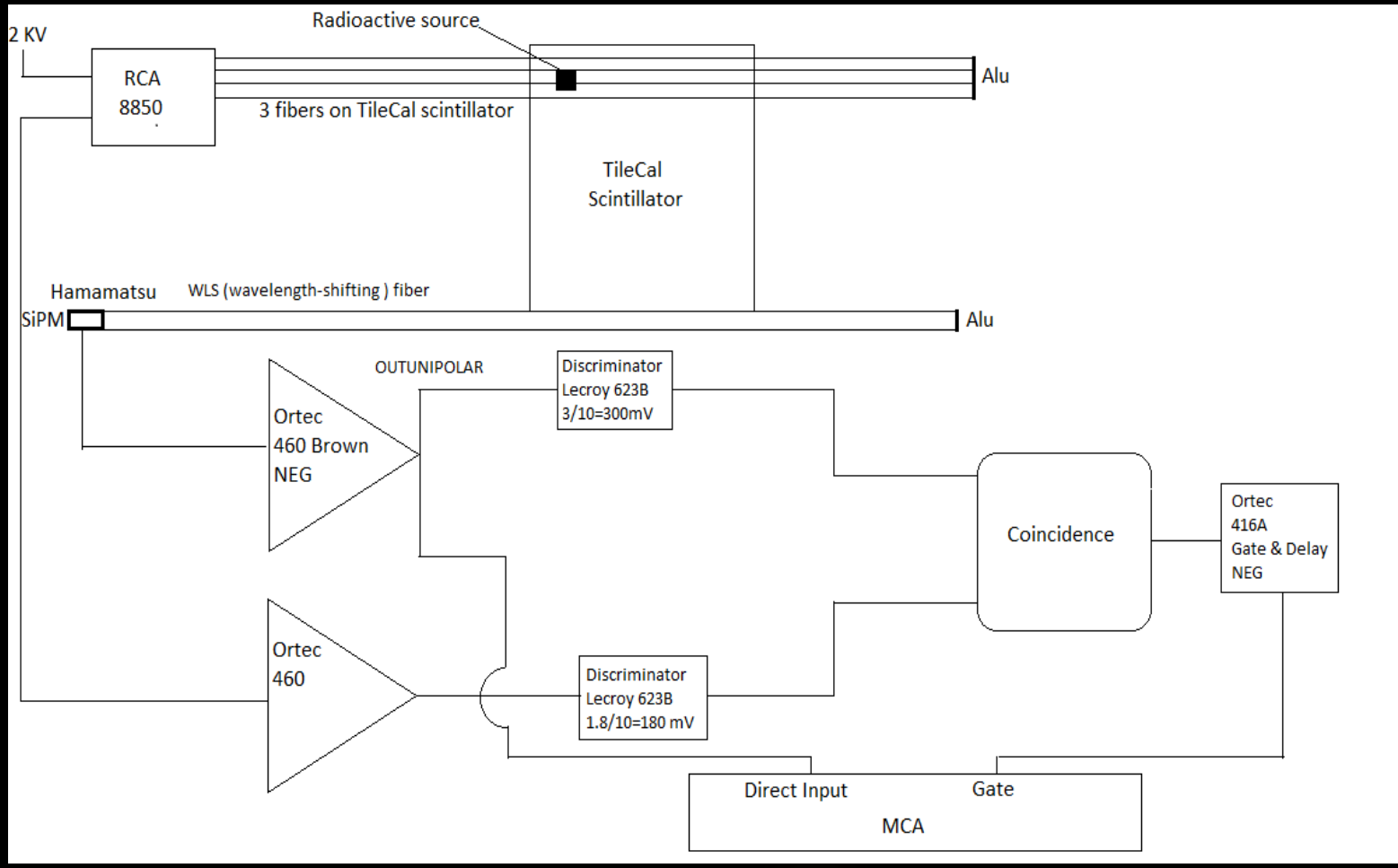

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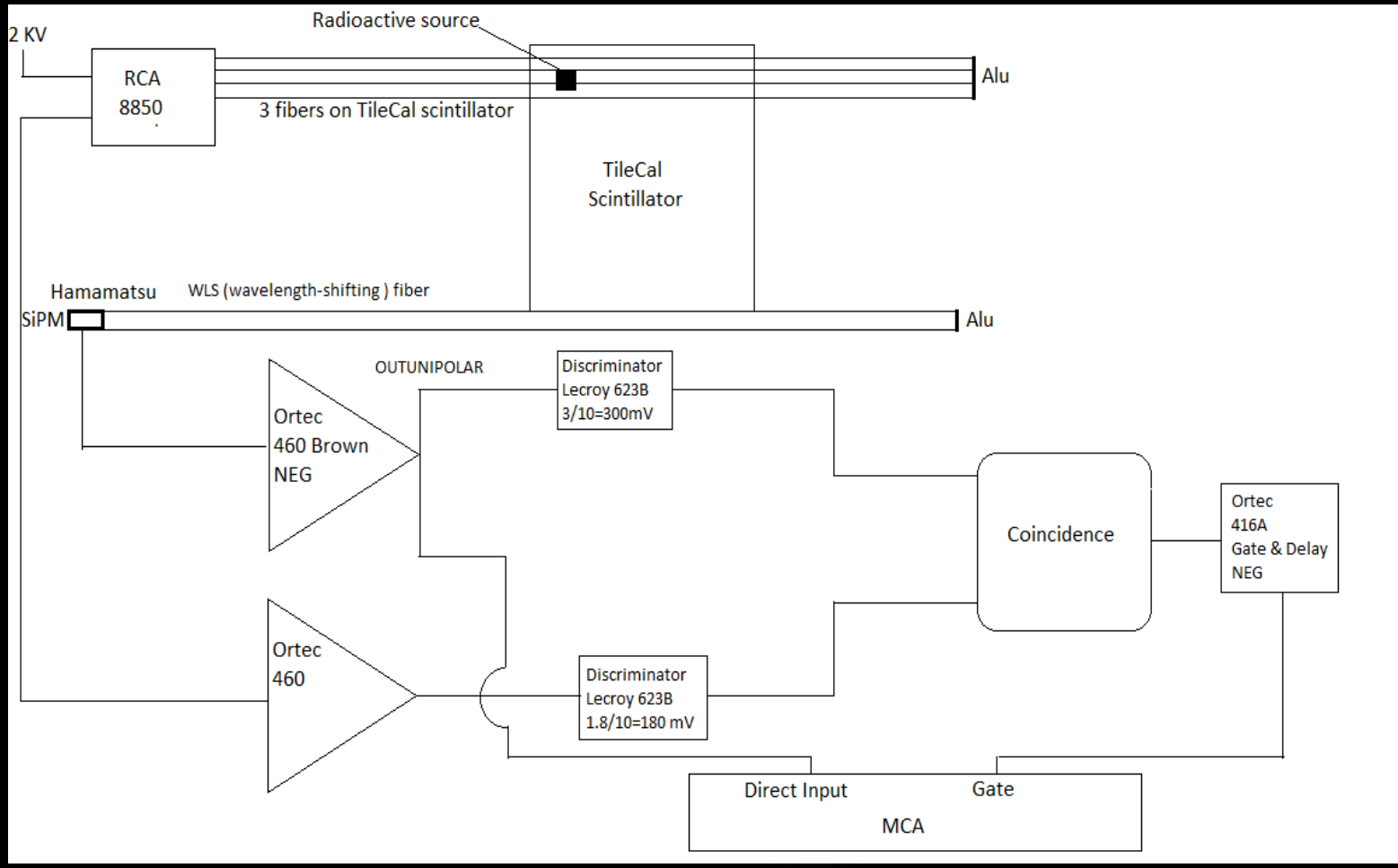

Experimental setup to measure #photons/MeV

All components of the general setup are shown:

- Radioactive source: ^{90}Sr
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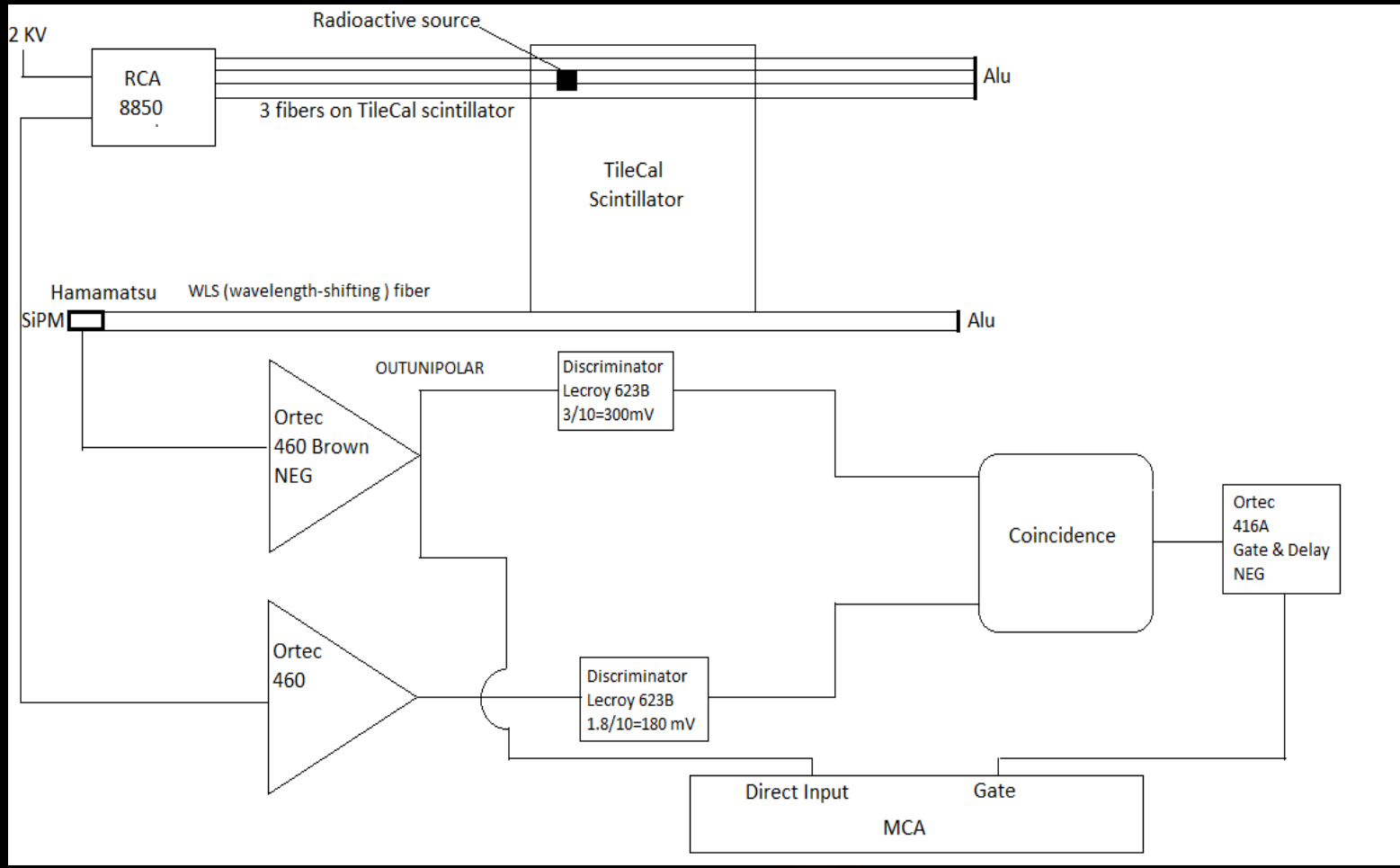
- Silicon Photomultiplier (SiPM)
- 3 scintililating fibers



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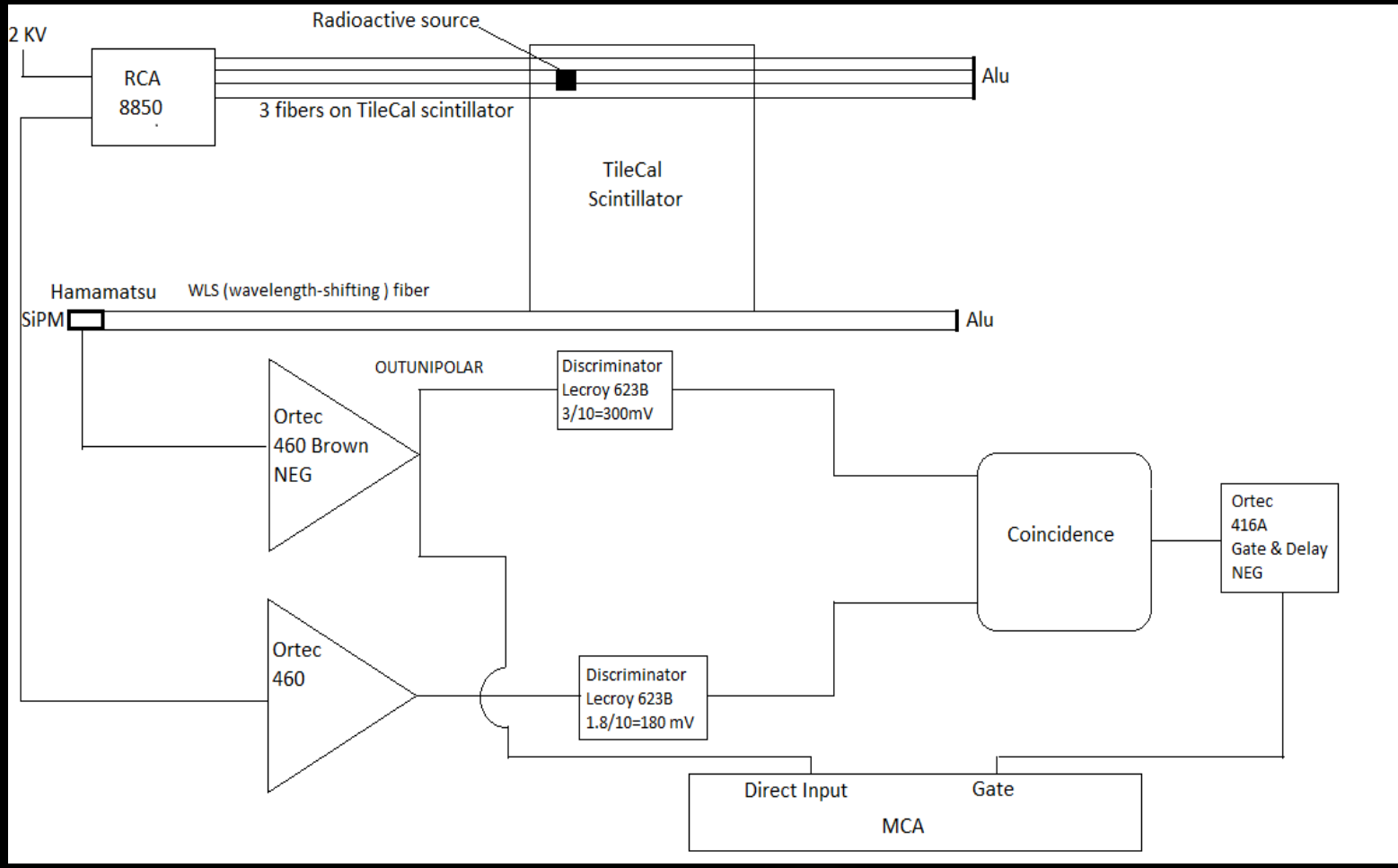

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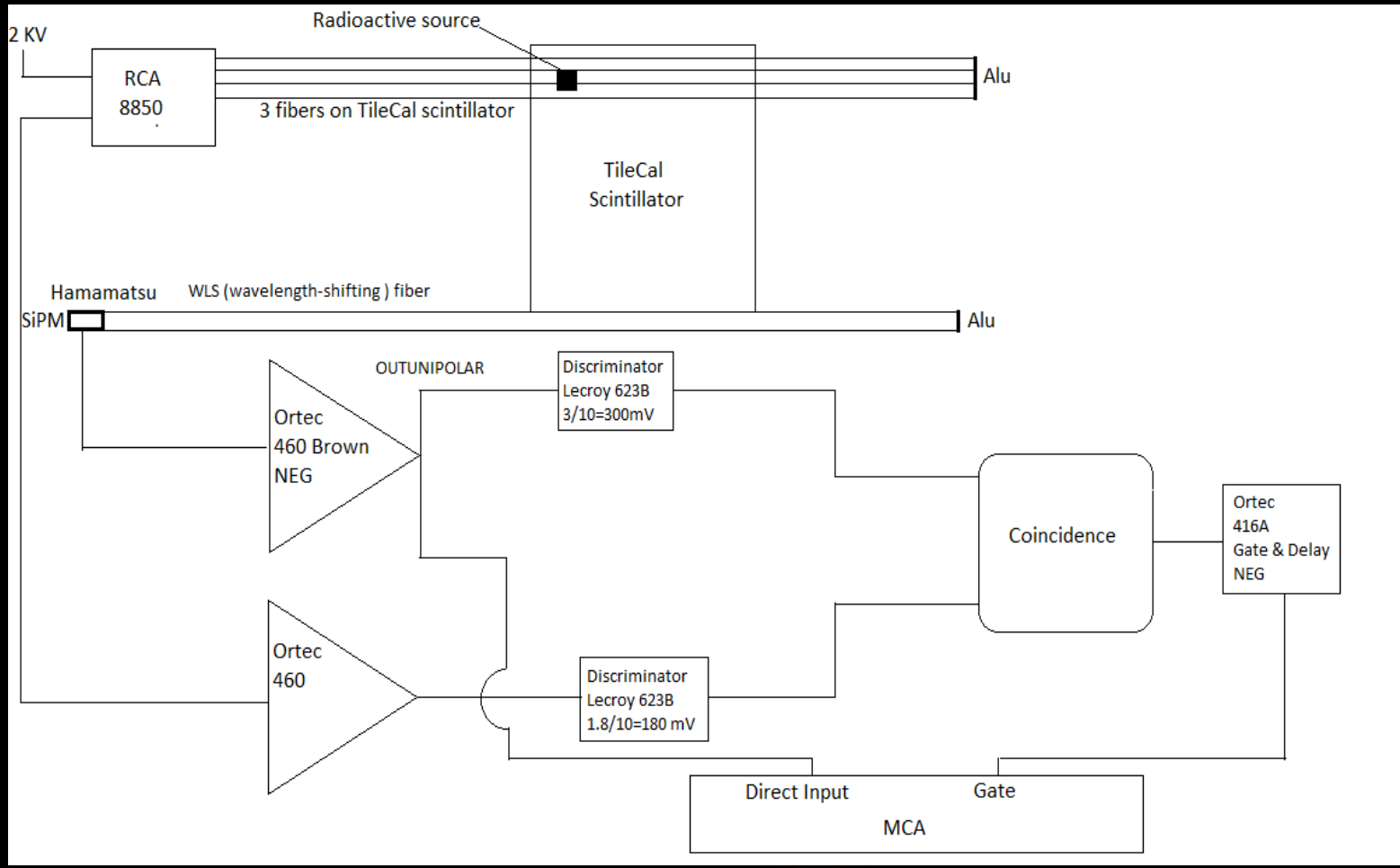
- Amplifier, Discriminator, Coincidence



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- Silicon Photomultiplier (SiPM)
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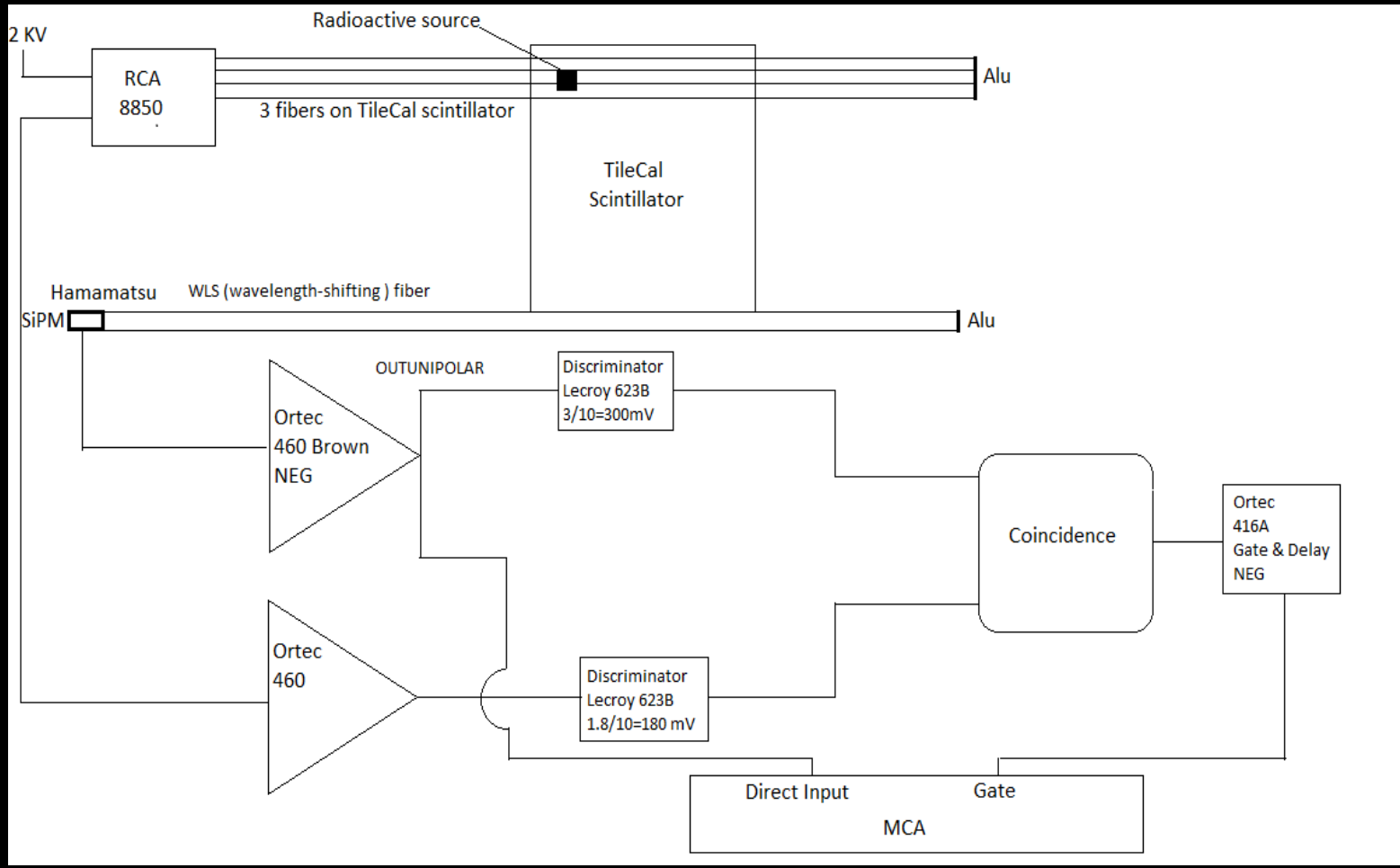
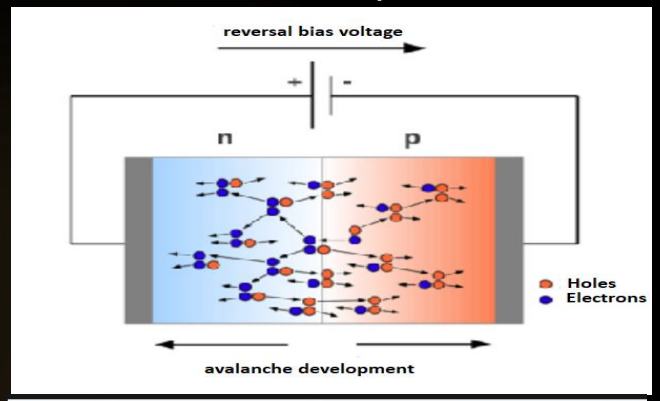
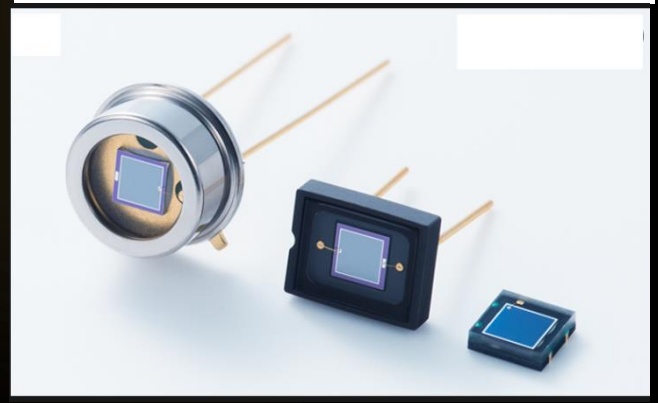
- Amplifier, Discriminator, Coincidence
- Multichannel Analyzer (MCA)

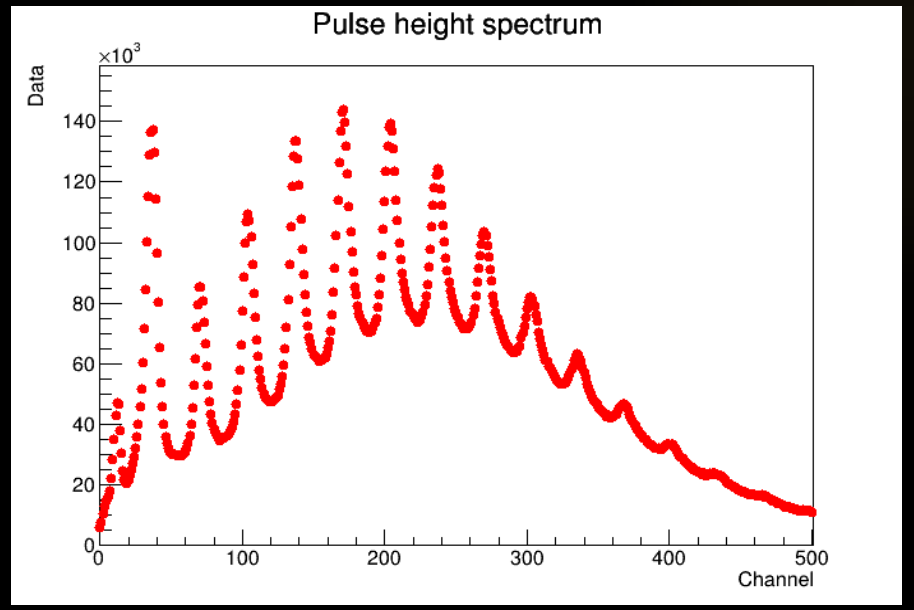


Silicon Photomultipliers

Semiconductor-based photosensors with very fast time response properties and single-photon resolution capabilities.







SiPM Calibration

$$N_{photons} = \frac{S - Pedestal}{\varepsilon_{geom}\varepsilon_{coll}\varepsilon_{trans}\varepsilon_{PD}} \times \frac{1}{p_0}$$

From measurement:

- S =Signal [ADC]

SiPM Calibration

$$N_{photons} = \frac{S - Pedestal}{\varepsilon_{geom}\varepsilon_{coll}\varepsilon_{trans}\varepsilon_{PD}} \times \frac{1}{p_0}$$

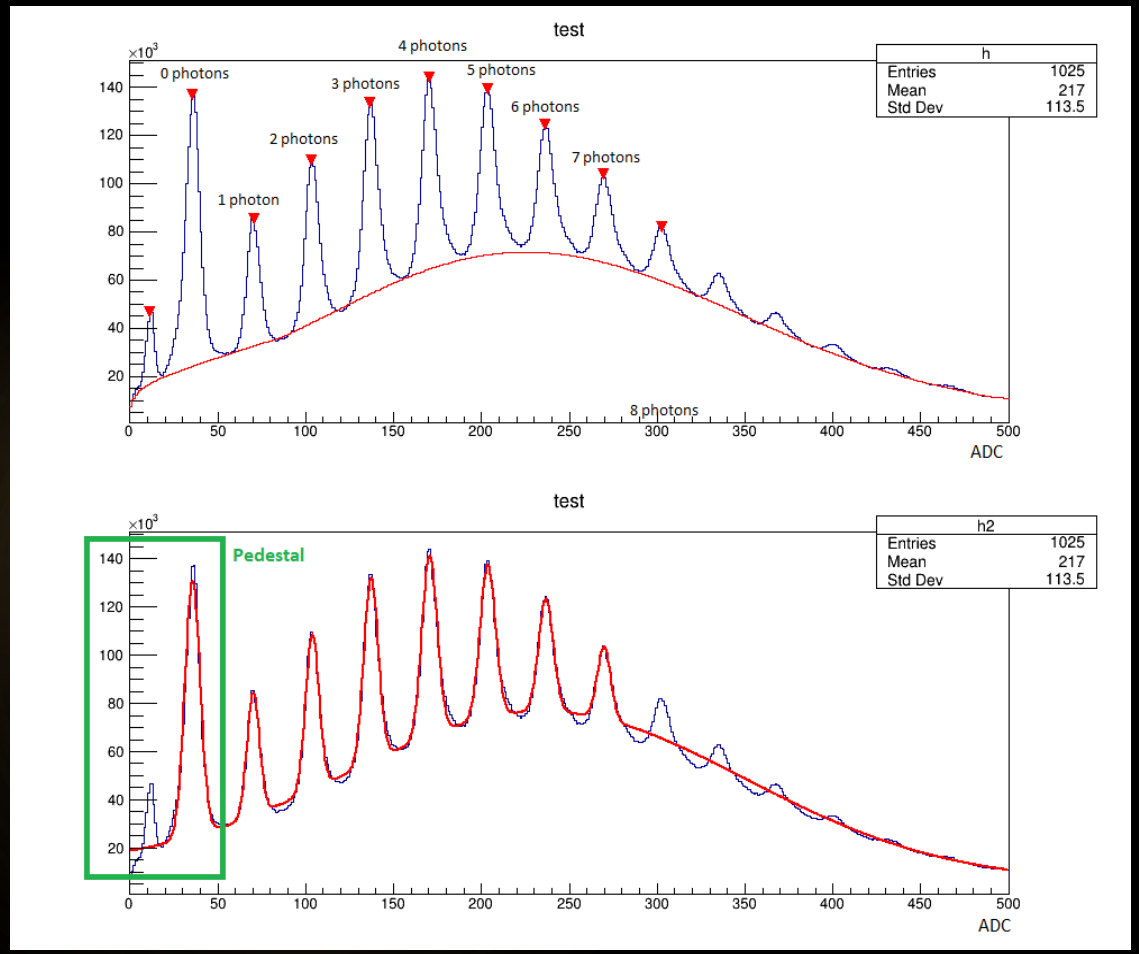
From simulation:

- ε_{geom}: geometrical efficiency
- ε_{coll}: collection efficiency
- ε_{trans}: transmission efficiency

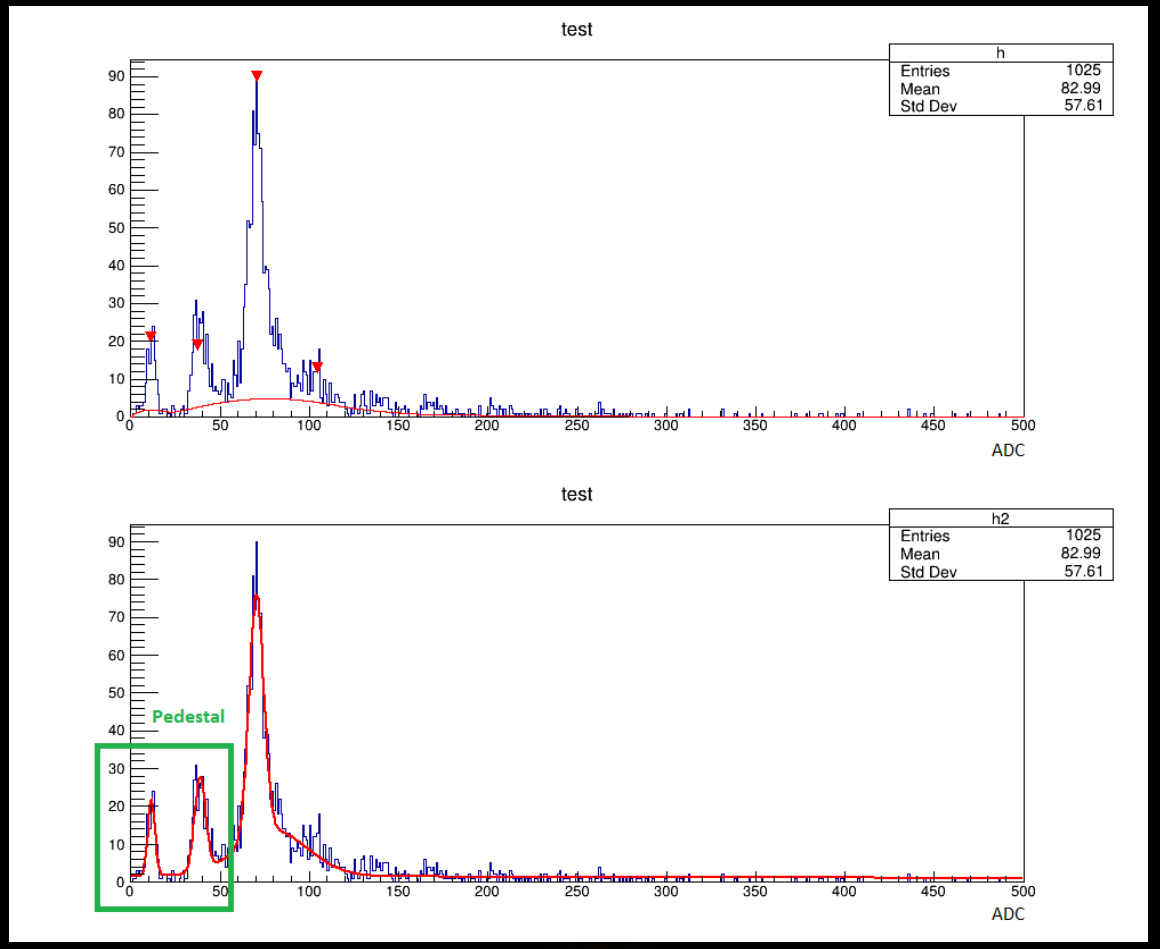
Characteristics of the instrument:

ε_{PD} =photo detection efficiency

Pulse-height spectrum at different positions of the radioactive source

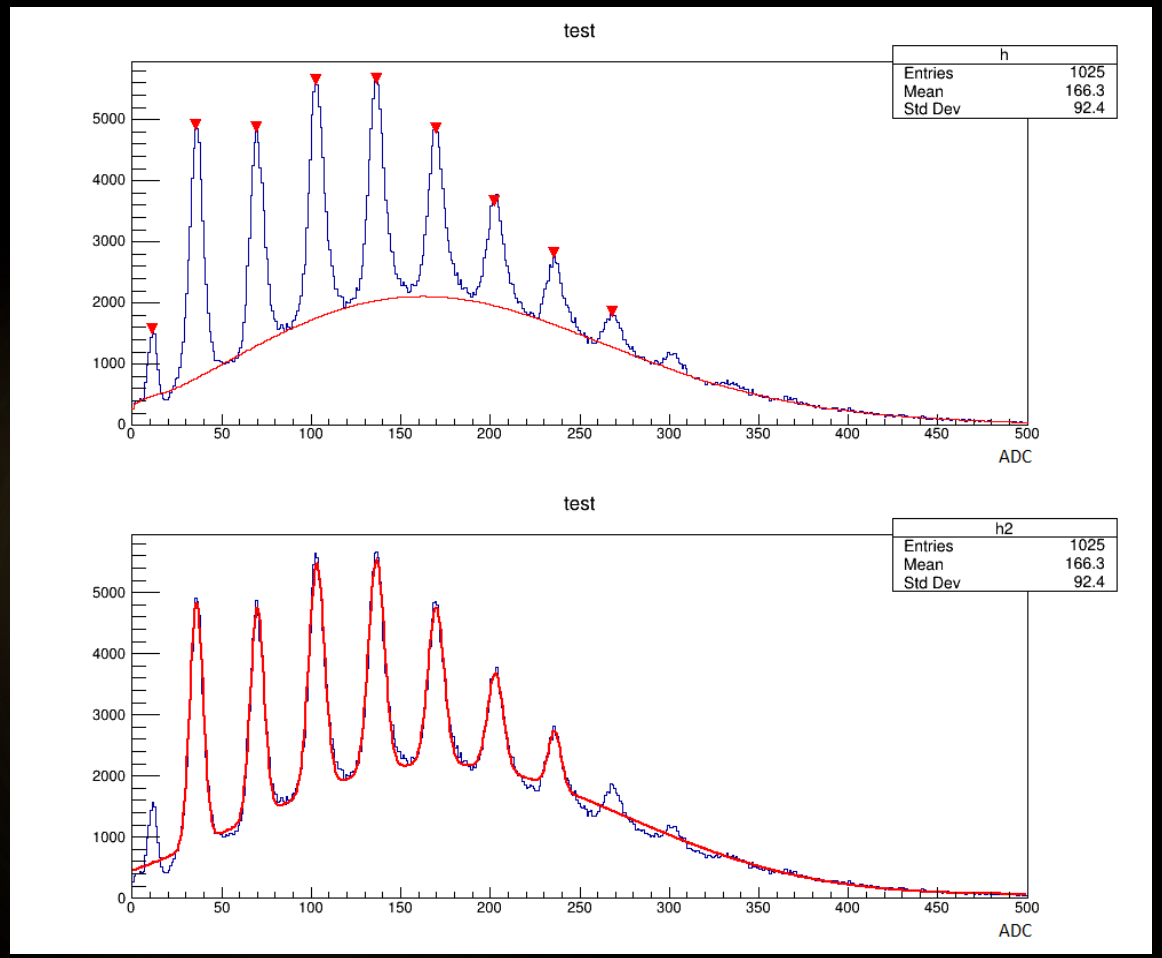


x=2400

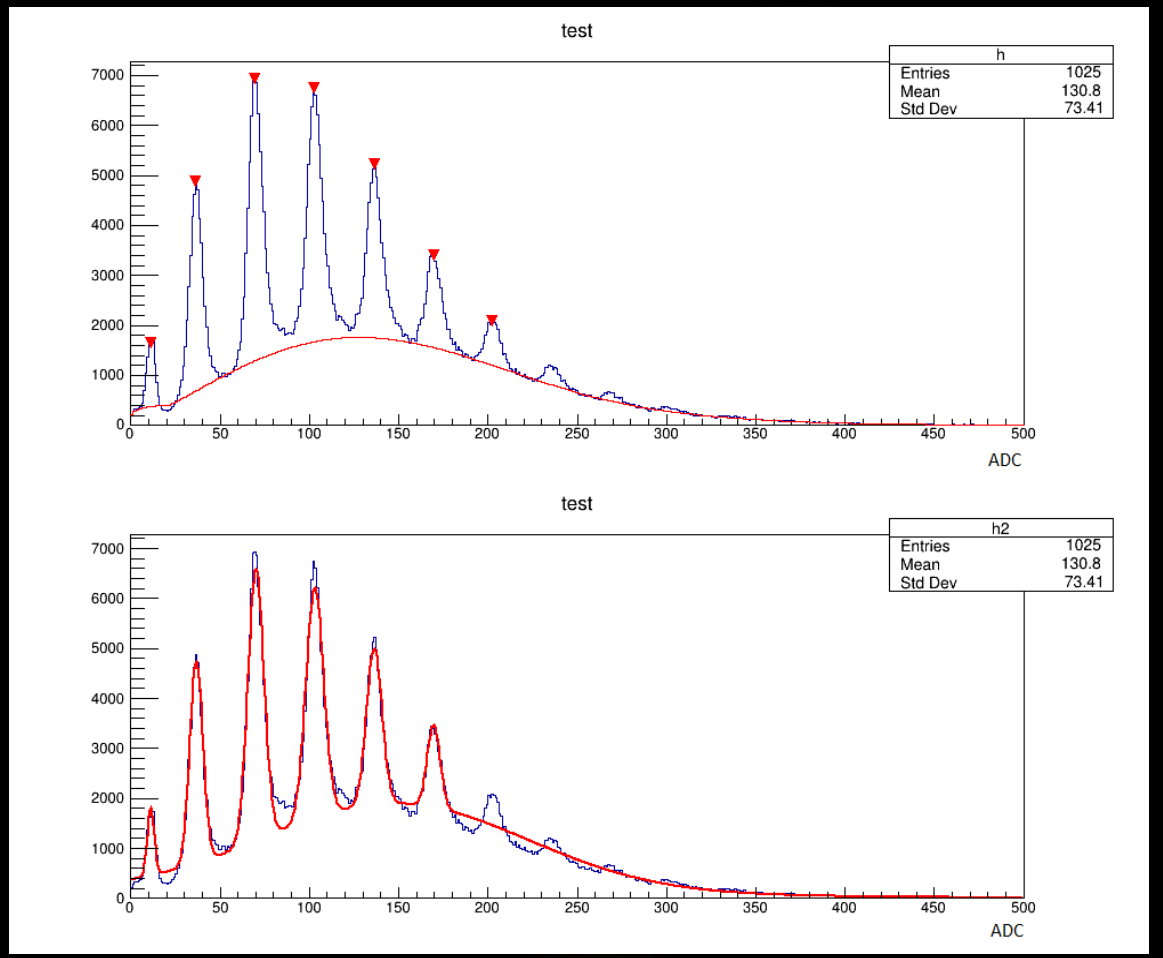


x=16400

Pulse-height spectrum at different positions of the radioactive source

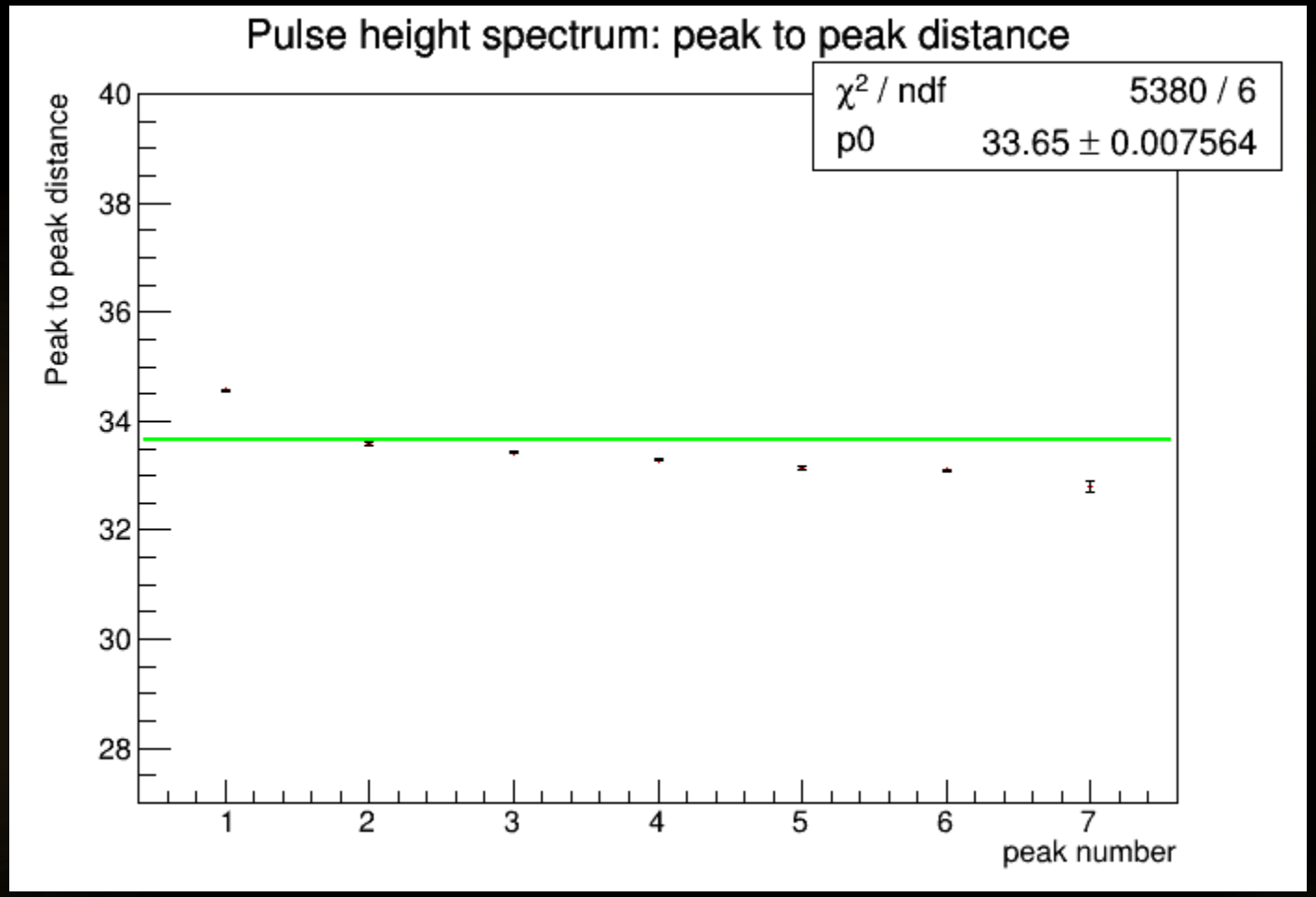


x=7400



x=11400

SiPM Calibration



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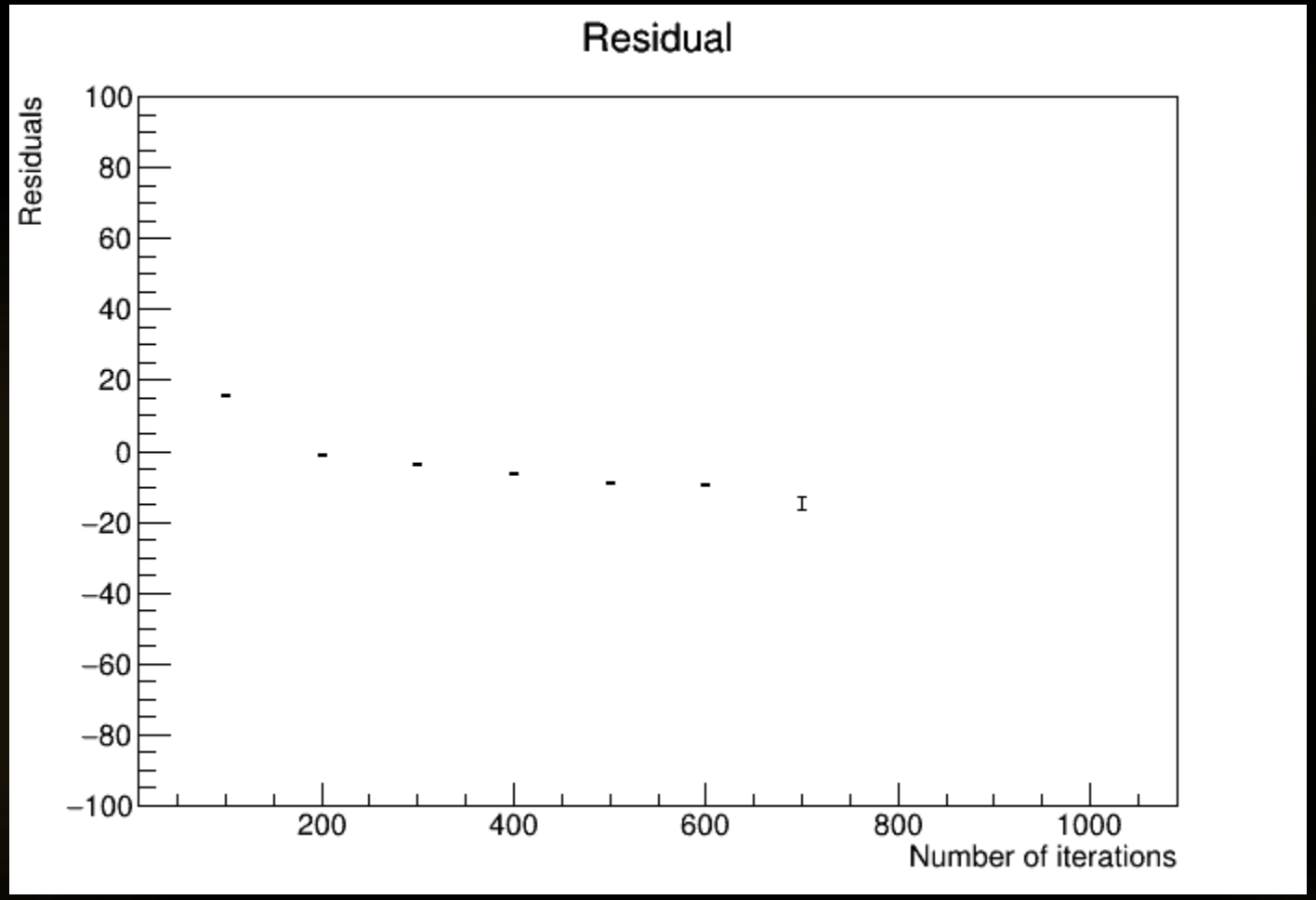

SiPM Calibration

The obtained result of the converting factor p_0 is

$$p_0 = 33.647 \quad \pm \quad 0.007 \ \frac{ADC}{\#\gamma}$$

Conclusions

- Obtained signal spectrum with Multi Channel Analyzer (MCA)
- Developed an analysis code of the MCA spectrum, plotted and fitted the spectrum
- Obtained Calibration Signal → #γ

Thanks for the attention!