An experimental sample of a scintillation detector with a photodetector based on SiPM matrices.

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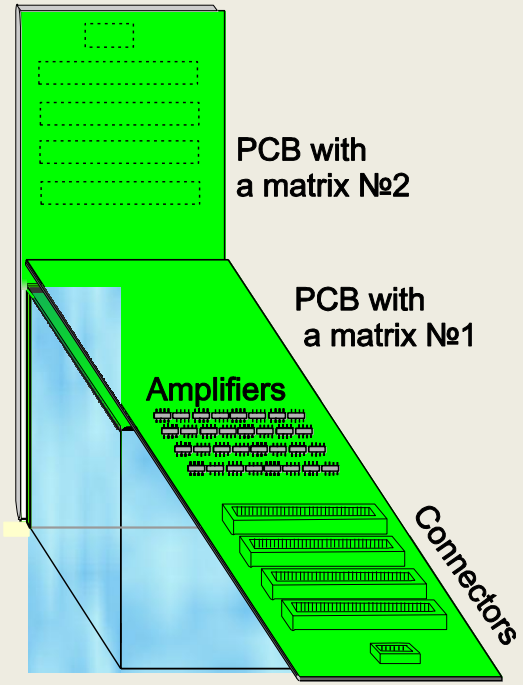
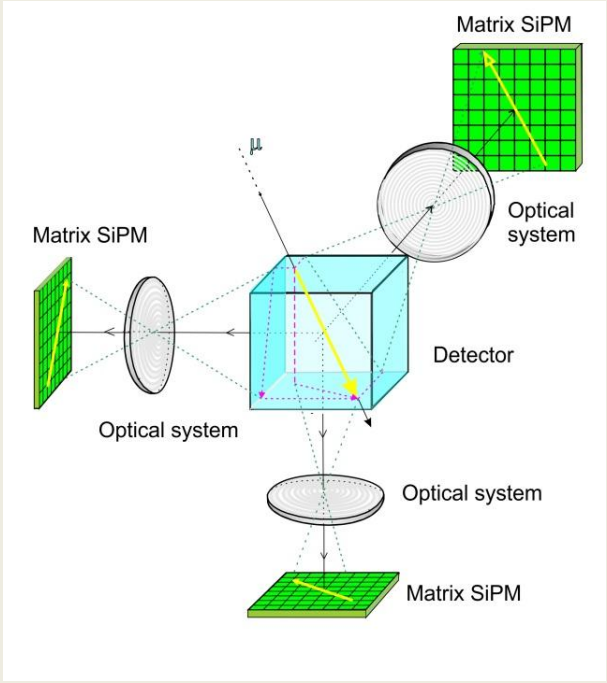
The matrices formed of silicon photomultipliers (SiPMs) as multi-channel photosensors for the scintillation detectors.

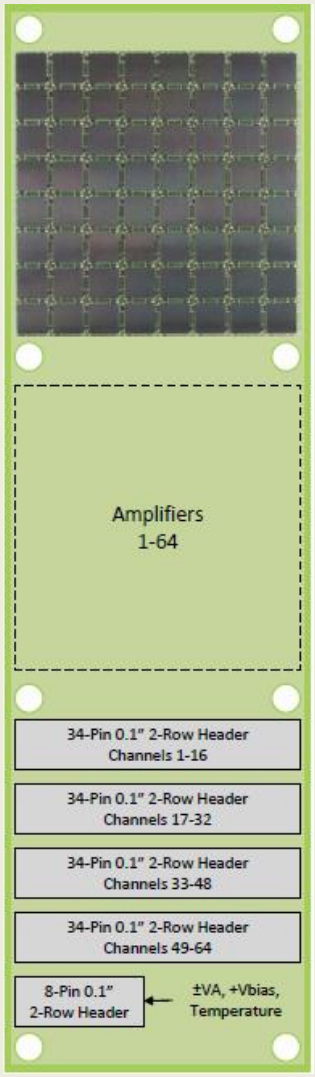




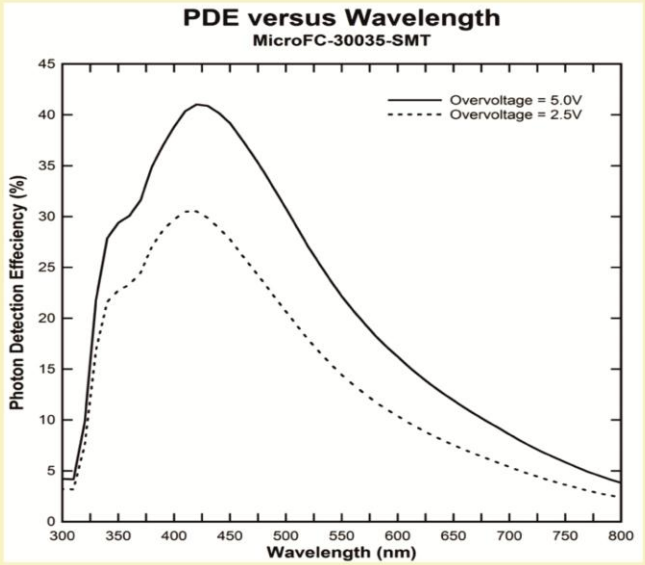
- A sketch of scintillation detector with SiPM matrices placed closely on the plastic scintillator.

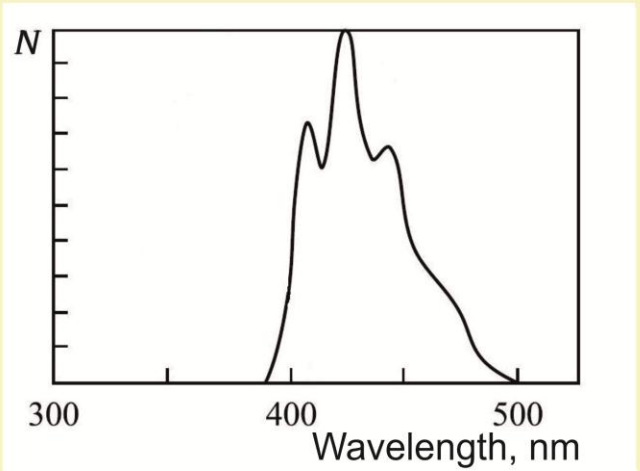
- Scintillation detector with a photosesor based on SiPM matrices with appropriate optical collector gives a possibility to obtain an image of an event.
- Benefits: determination of direction(s) of the particle(s), measurement of the energy release along the tracks, separation of different classes of events.

Matrix ArrayC-60035-64P-PCB (SensL)



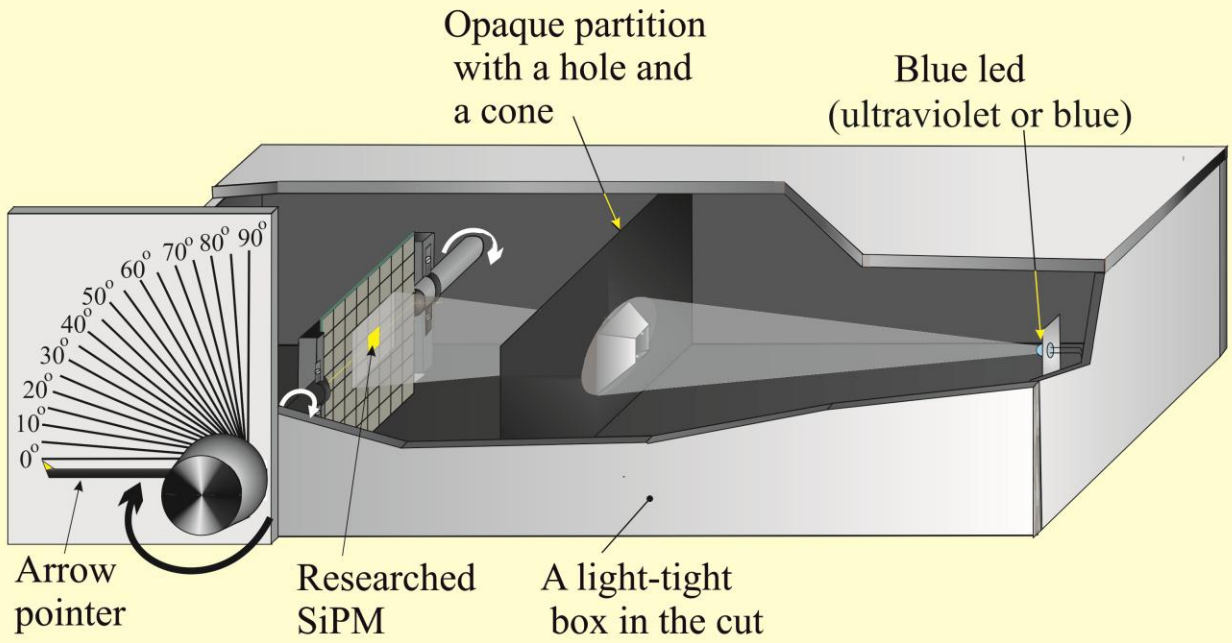
8x8 SiPM array (57.4 x 57.4 mm ^{2})
Dark count rate 1 MHz
SiPM: active area 36 mm , consists of
18980 of micropixel (size 35x35 μm^2),
PDE 31 - 41 %





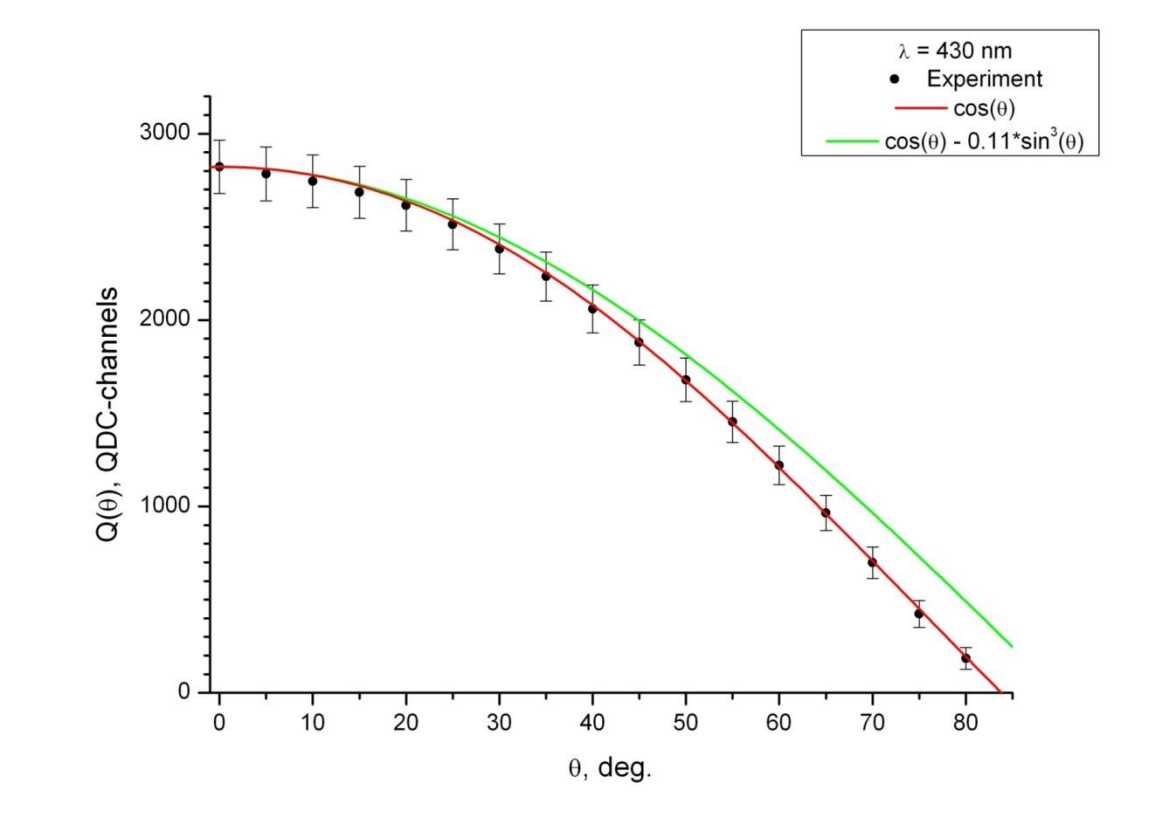
A plastic scintillator:
polystyrene + PPO ($C_{15}H_{11}NO$) + POPOP($C_{24}H_{16}N_2O$)

Sketch design for measuring response of SiPM-length dependencies wavelength and angle of incidence of the photons



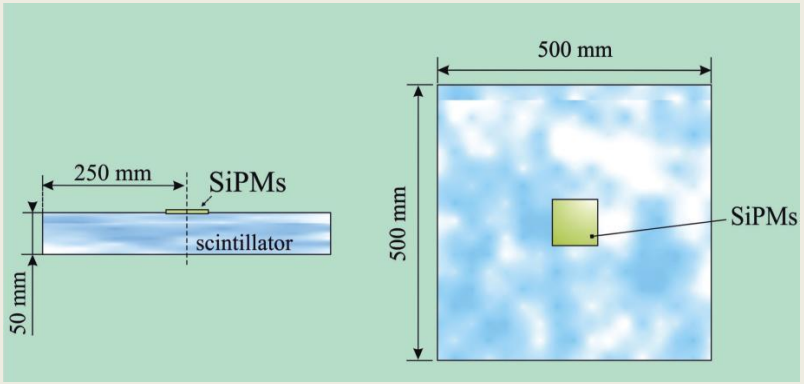
The measurements were carried out with LEDs operating in the wavelength ranges: λ = 400 nm, λ = 430 nm, λ = 470 nm.

The dependence of the SiPM response on the angle of incidence of photons (Blue color radiation)



$I(\theta) = \cos(\theta) - \kappa \times \sin^3(\theta)$

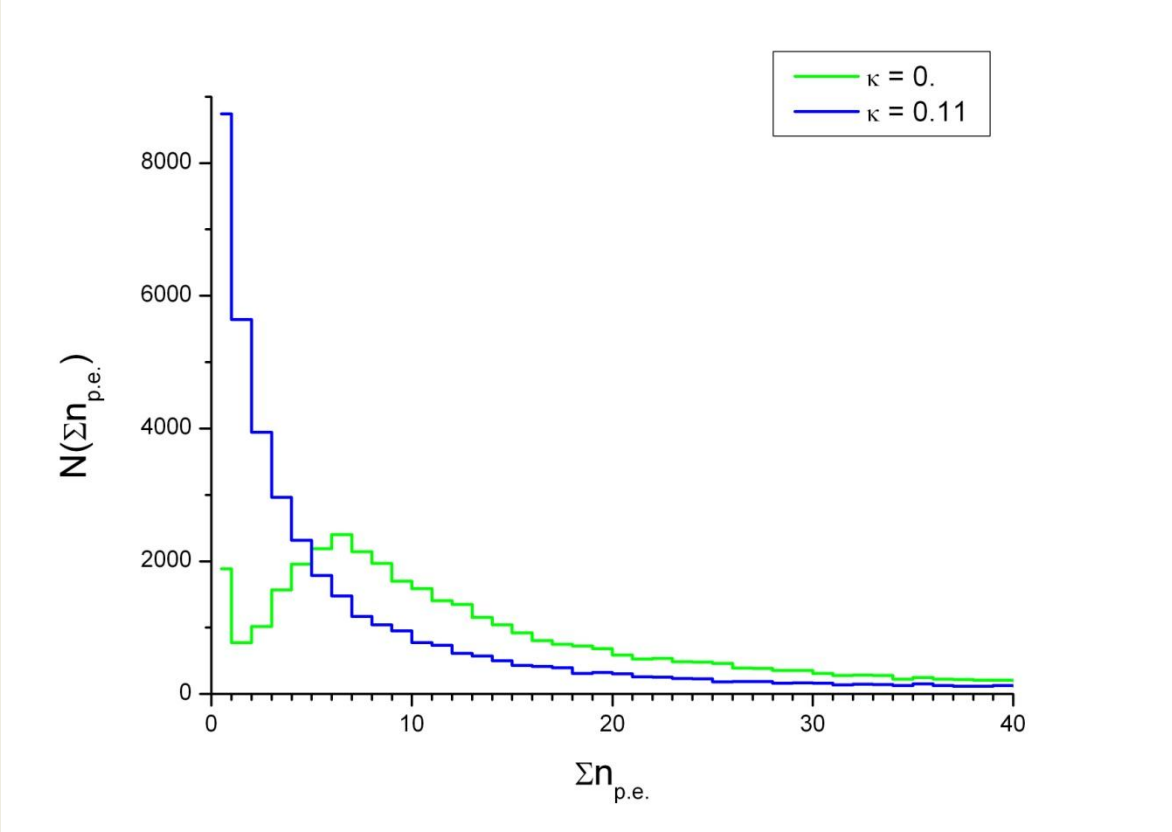
$\lambda = 470$ nm	$\kappa = 0.07$
$\lambda = 430$ nm	$\kappa = 0.11$
$\lambda = 400$ nm	$\kappa = 0.11$



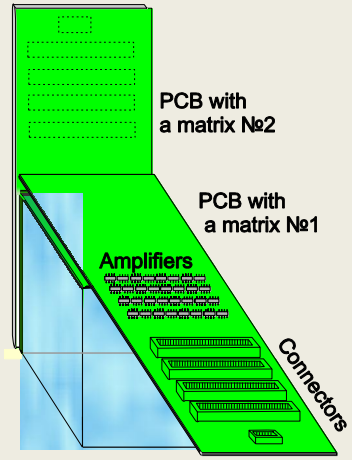
SiPM matrix on the plastic scintillator plate

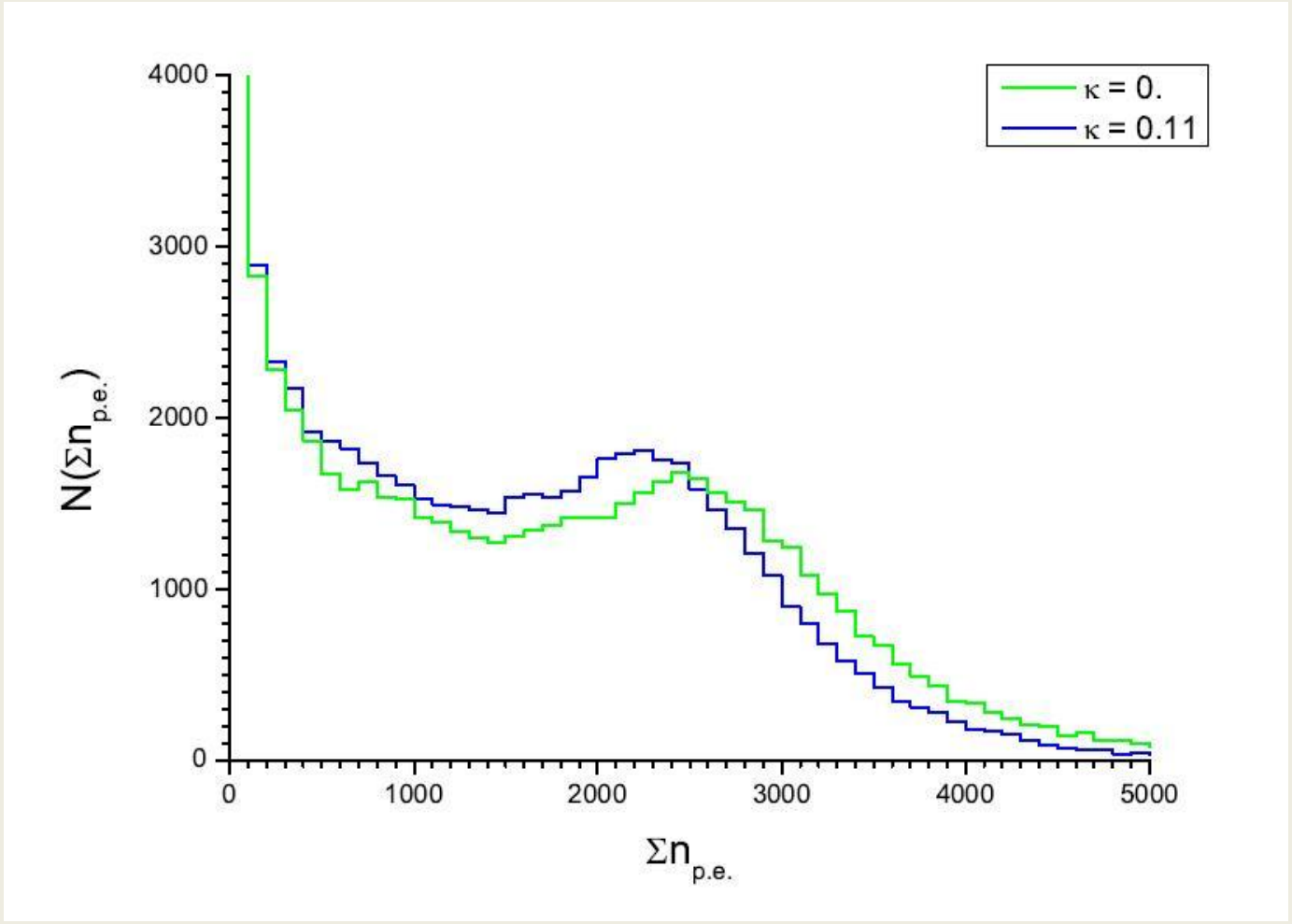
$$n_{p.e.} = N_{ph} \times q_{eff}$$

$$q_{eff} = 0.37$$



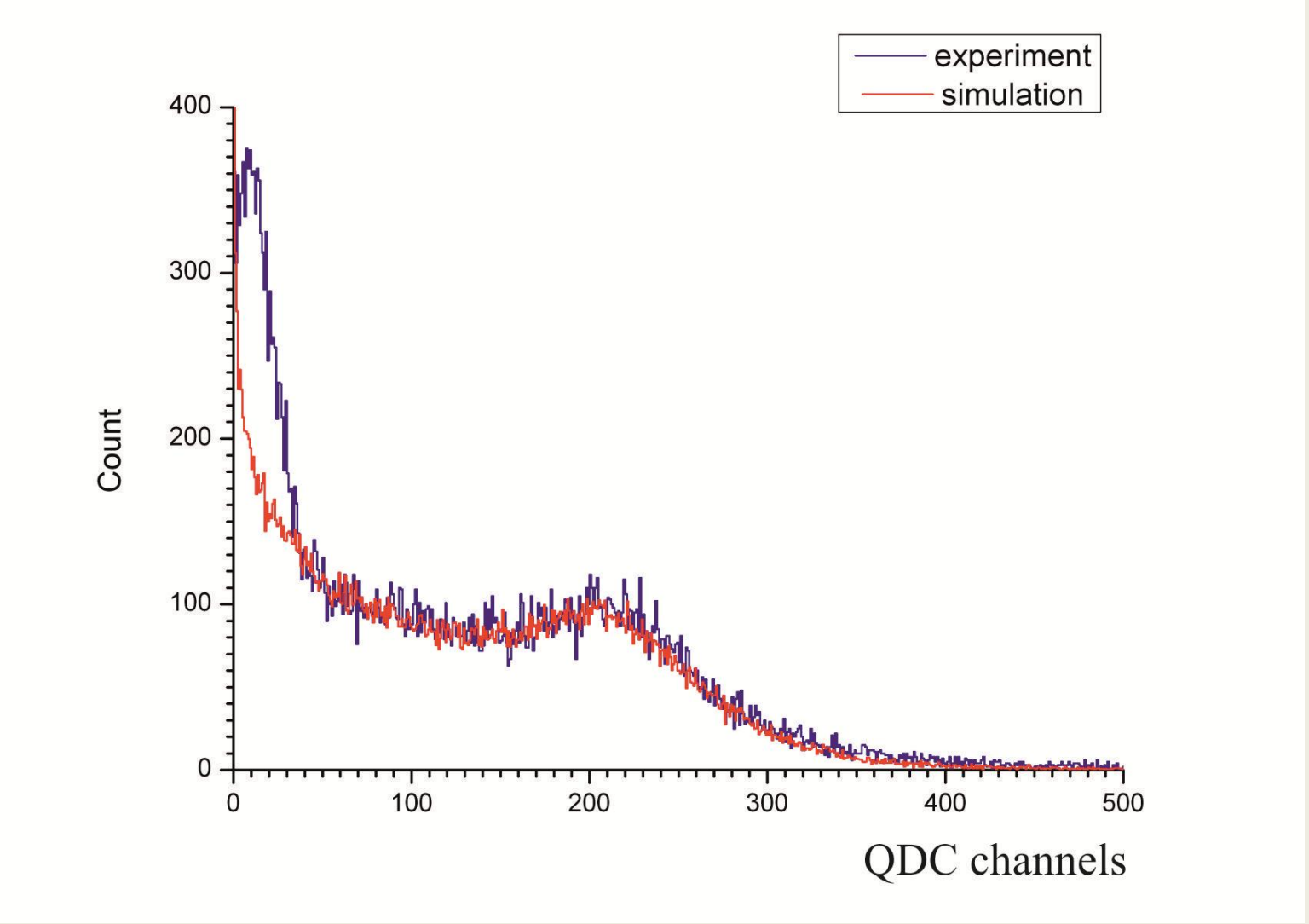
Calculated spectra of the matrix on the number of photoelectrons from cosmic ray muons.



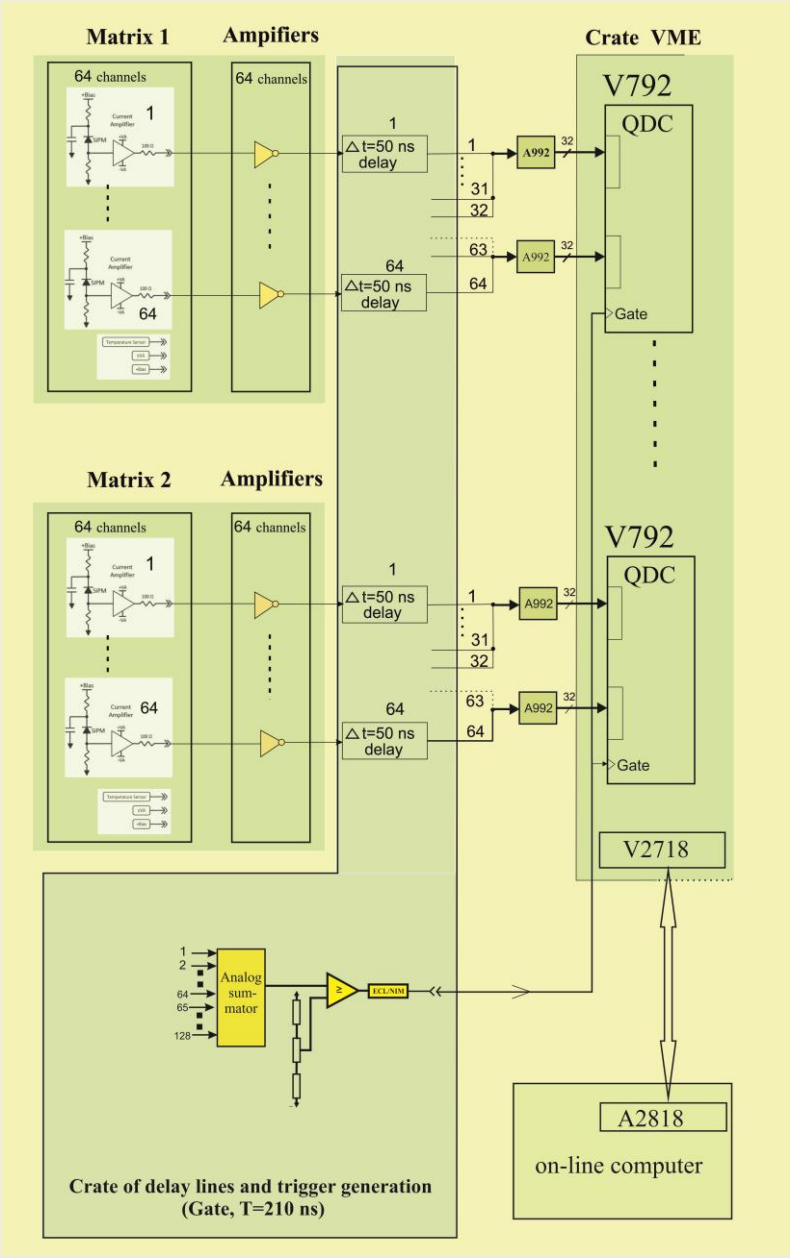


Calculated spectra of the matrix № 1 on the number of photoelectrons from cosmic ray muons.

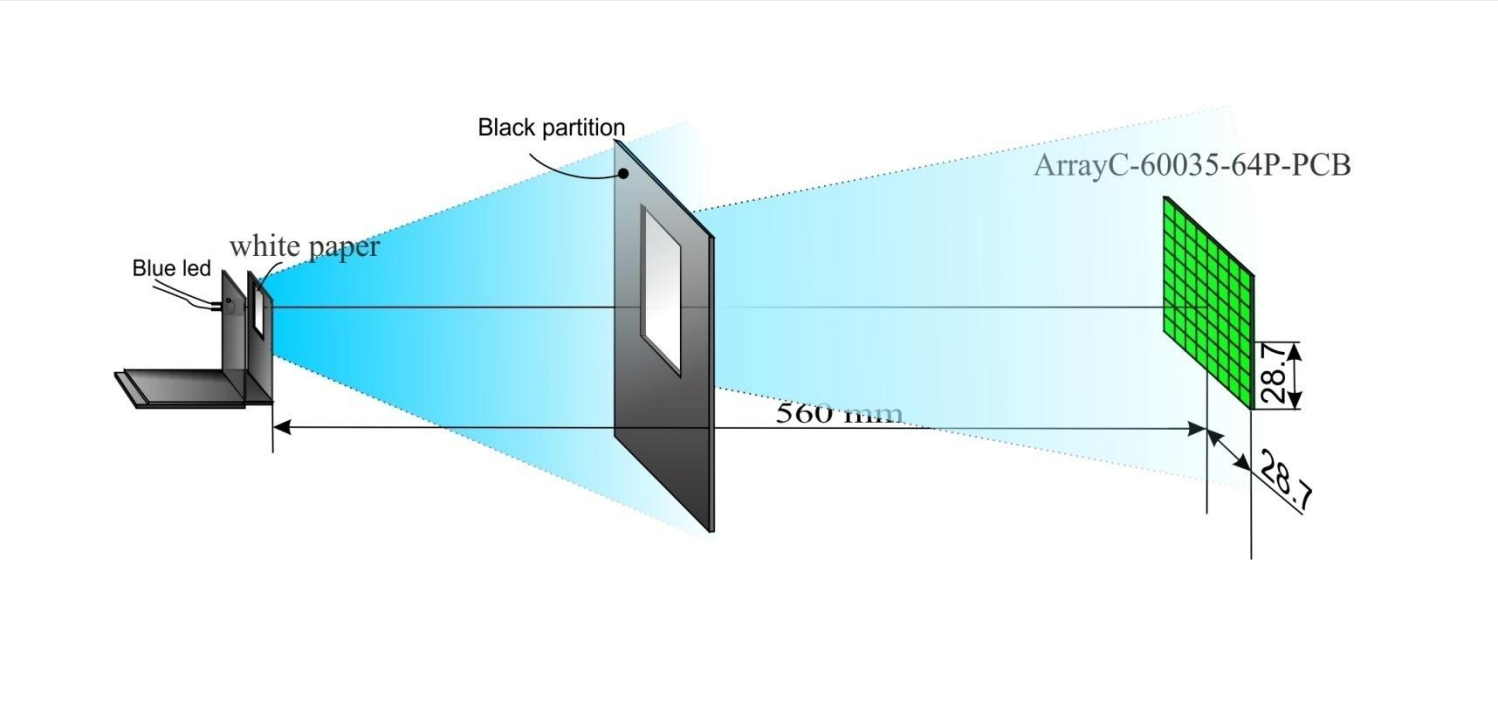
Comparison between calculated and measured spectra.



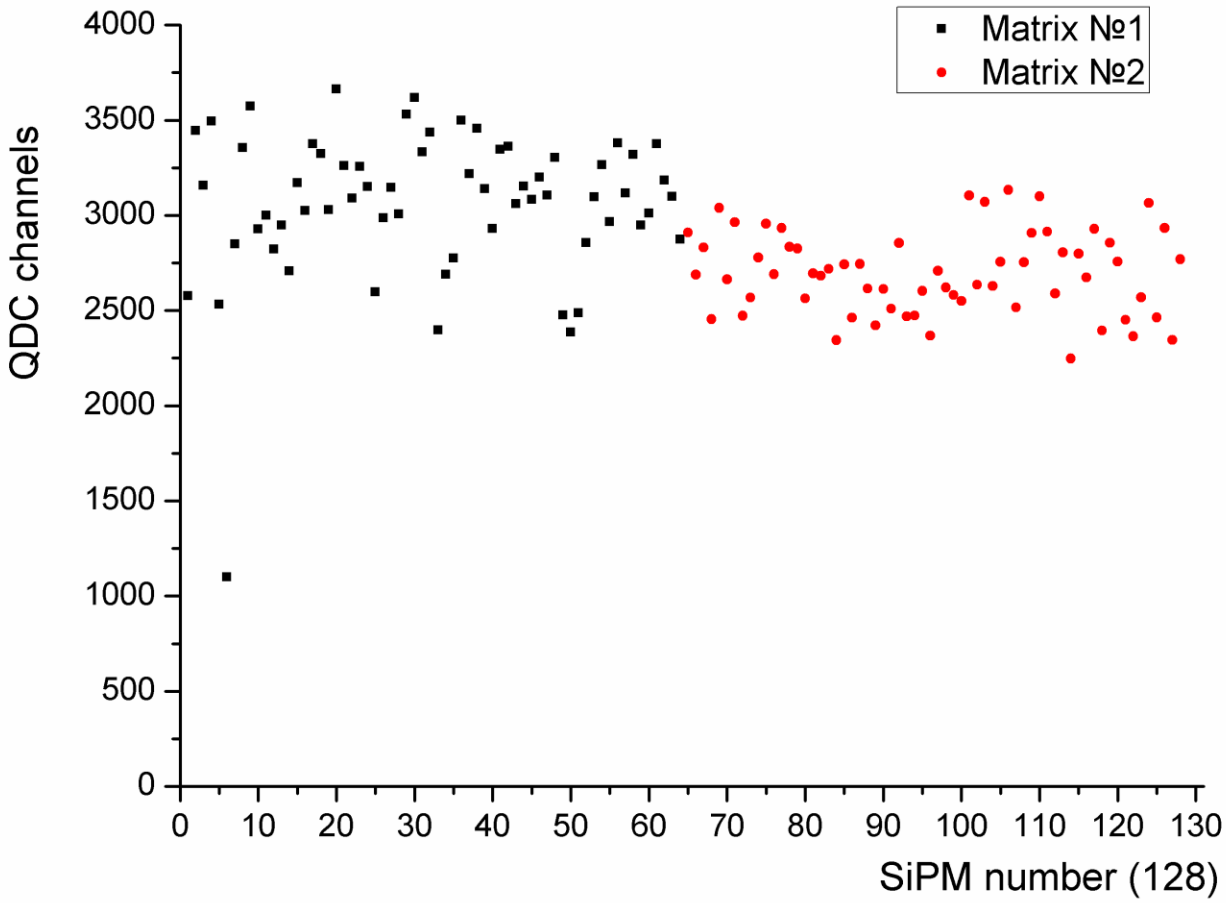
Block diagram of the data acquisition system



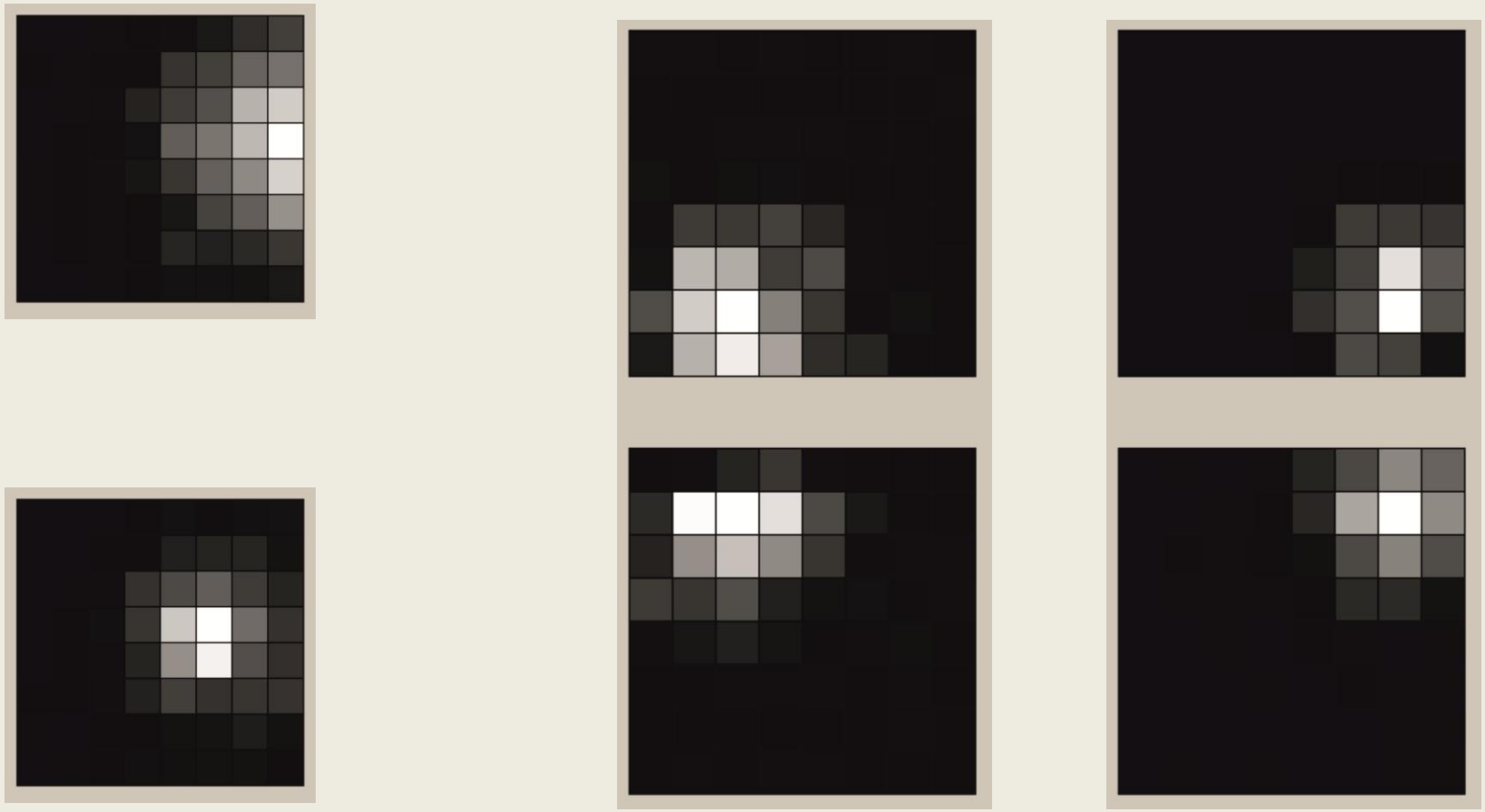
Calibration of the SiPMs by weak emission of light from the led



The response of all 128 SiPM on the stable light pulses.



Visualized recorded events for the sheet 500x500x50 mm^3 (a) and for the scintillator cube 59x59x50 mm^3 (b).



a **b**

The visualized images of the simulated (a) and registered (b) events for a detector with matrices attached directly to the plastic scintillator