

Marcin Kasztelan

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**NARODOWE
CENTRUM
BADAŃ
JĄDROWYCH
ŚWIERK**



Do you know that...

...CREDO had a cousin?





EuroCosmics

List of projects:

HiSPARC – Netherlands

SEASA – Sweden

CZELTA – Czech Rep.

SkyView – Germany

EEE – Italy

CRTGPS – Portugal

RELYC – France

MAZE – Poland

- Around 2005, a project of a cosmic ray detector network (CR) on the school roofs was initiated,
- The project covered the whole Europe,
- There were several meetings, biggest in time of 20 ECRS, Lisbon, Portugal,
- The construction of pilot projects in individual countries has begun.

The Polish contribution was the Roland Maze Project



Project MAZE

A network of cosmic ray detectors distributed on the roofs of high schools in Łódź, Poland.

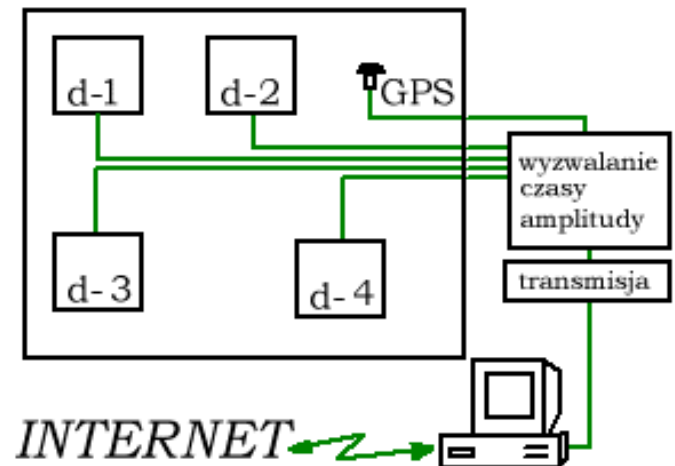
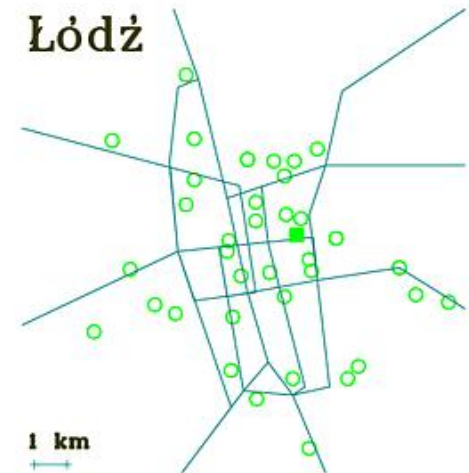
Each school in the network = independent station consisted of 4 plastic scintillation detectors of the area nearly 1m^2 each.

The Internet gather independent stations into extensive array

Use of urban infrastructures: Internet, power supply, school staff

THE ROLAND MAZE PROJECT

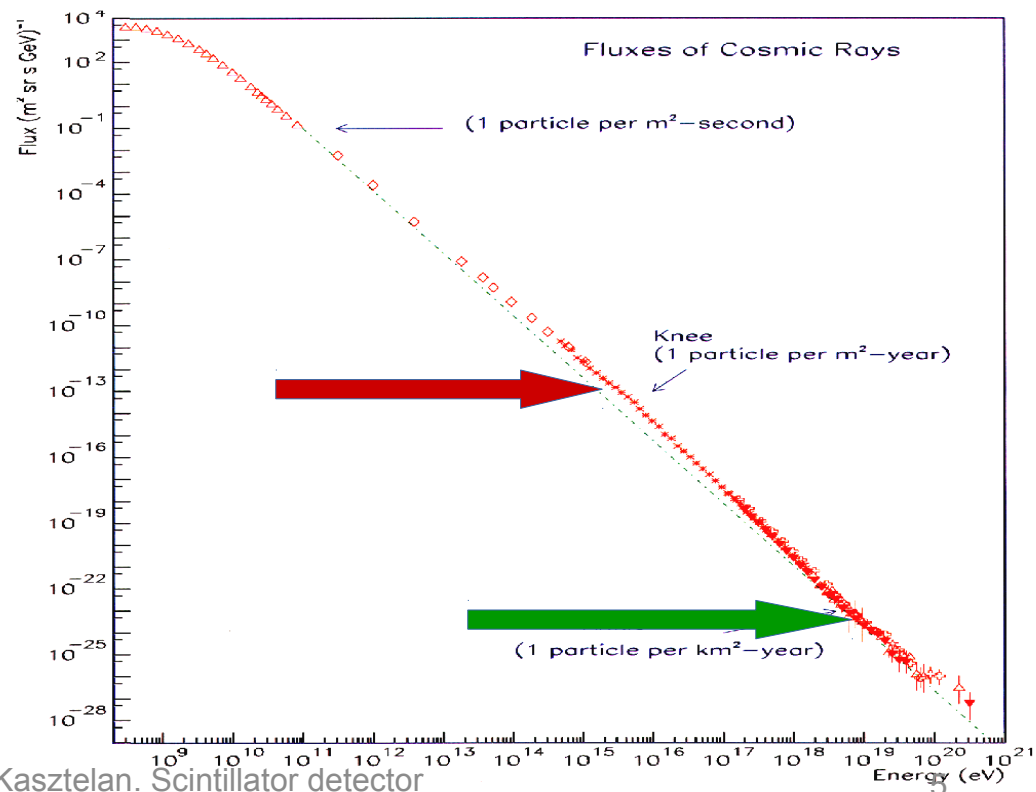
J.Gawin, I.Kurp, K.Jedrzejczak, P.Plucinski, B.Szabelska, J.Szabelski, T.Wibig
Acta Phys. Pol. B 33(2002)349



Project MAZE: The layers of scale:

single detector
single school
single city
single planet

- muon flux variation
- cosmic ray about 10^{15} eV (knee)
- cosmic ray about 10^{19} eV (ankle)
- large-scale phenomena



Marcin Kasztelan. Scintillator detector

And what has remained?





Maze project remnants

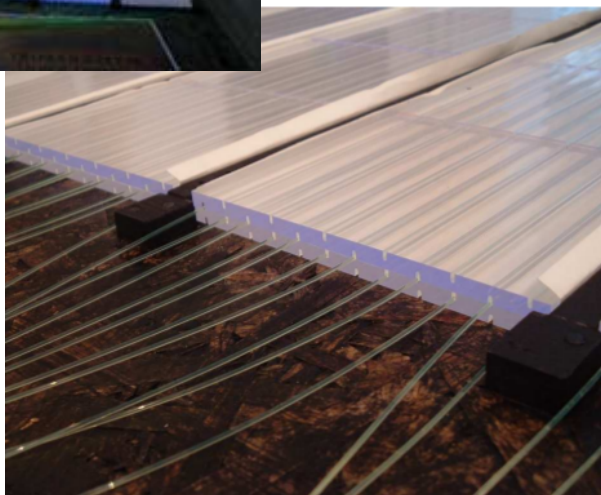
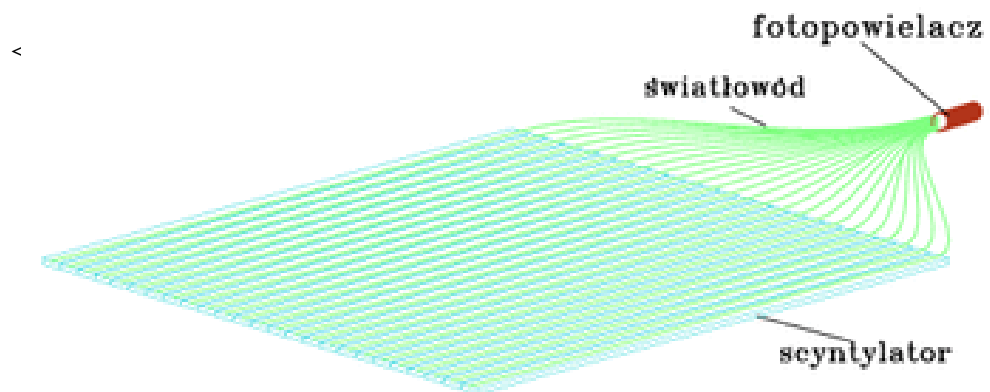
- 1) 40 scintillation counters
 - a) surface area 1m^2
 - b) front-end electronics (fast signal, anode, 6-th dynode)
 - c) HV power supplies
 - c) weather proof housing
- 2) Know-how: we can build more detectors!

Detector properties

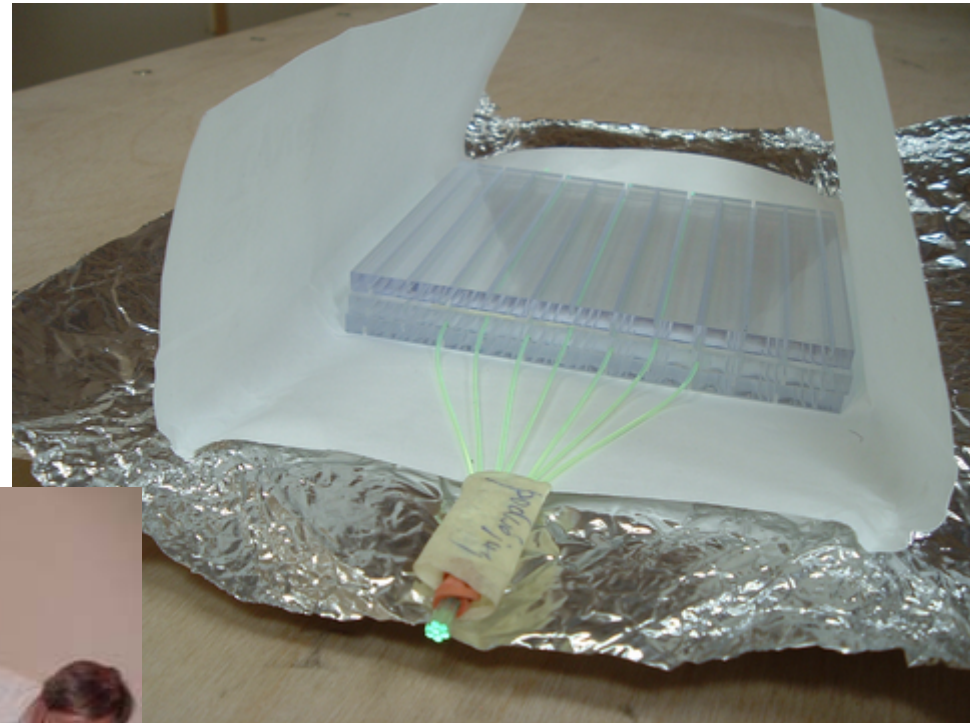
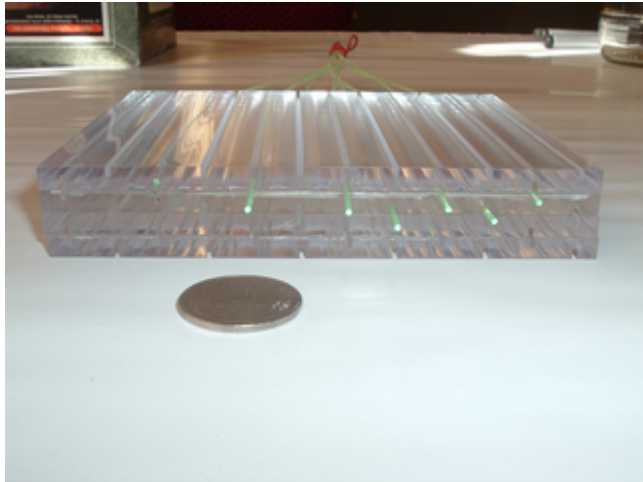
- Detectors were assembled by High School Students.
- Tiles have dimensions **10cm x 12cm x 0.5cm**
- Two layers of tiles form **1cm** thick scintillator.
- Light is collected by 12 WSL fibers (BCF 91A, 1mm diameter) from one row of 10 pairs of tiles.
- There are 8 rows.
- In total $2 \times 10 \times 8 = \mathbf{160}$ tiles and **96** fibers
- All fibers are viewed on one side by Photonics XP1912 PMT



Detector structure



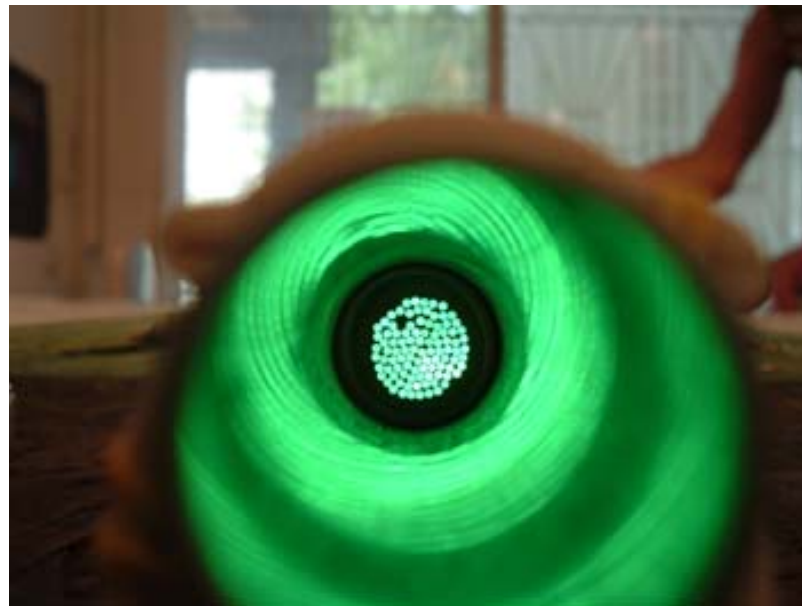
Detector structure



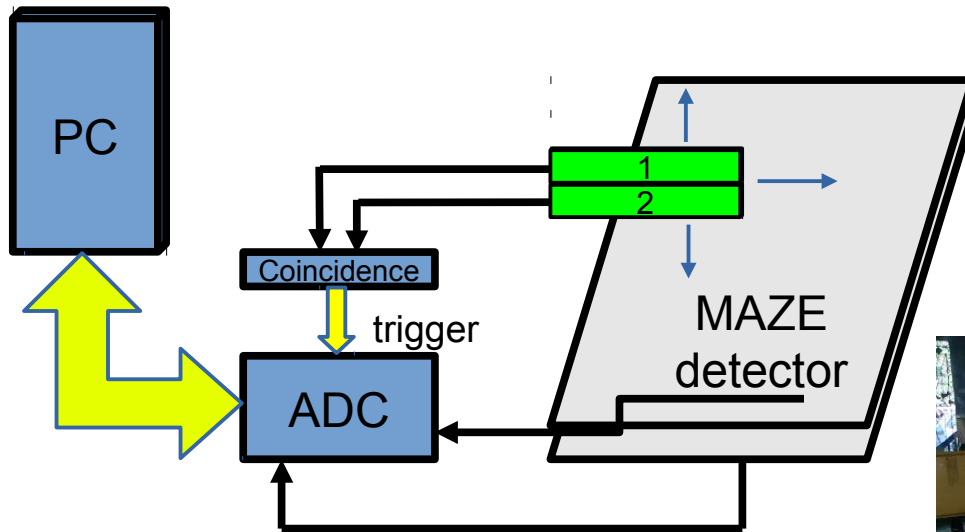
Idea of the detector is similar to MINOS neutrino detector

Detector housing





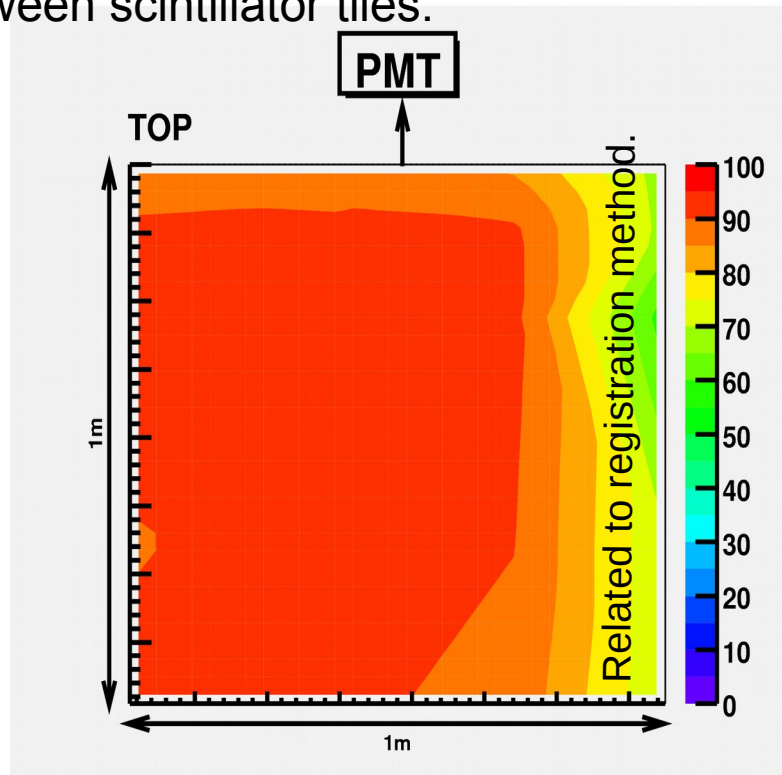
Detector tests



(in)efficiency

Detector is inefficient when the coincidence in triggering system indicates passage of charged particle and there is no signal from 1m² detector.

The inefficiency on about 10% level is expected, since 1/13-th of the total area are the spaces between scintillator tiles.

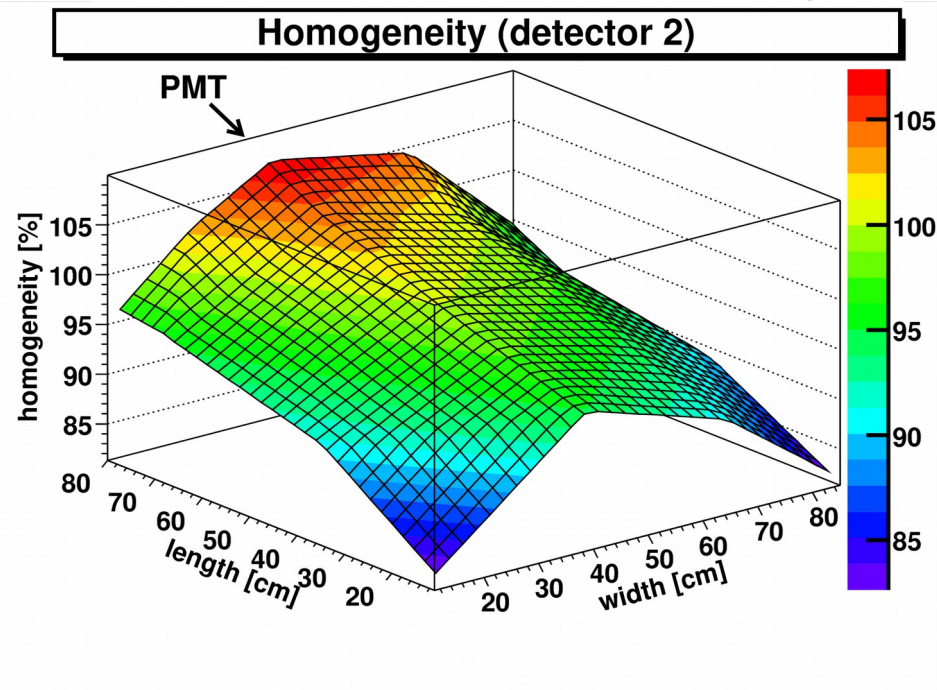
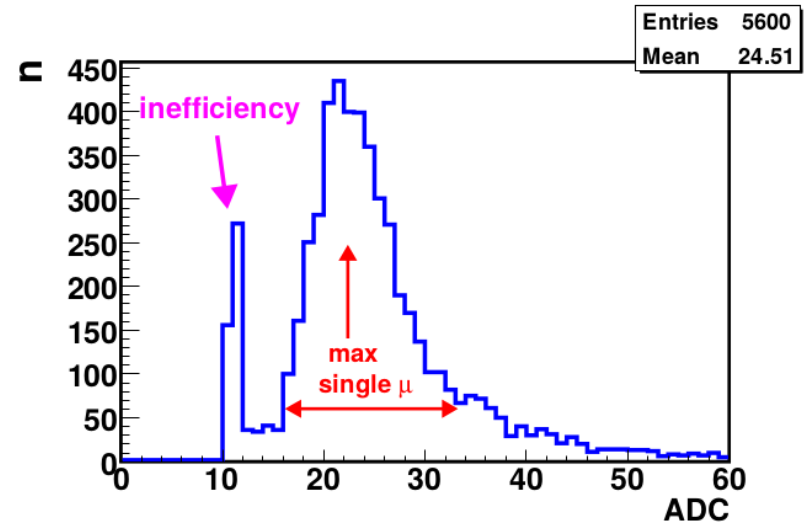
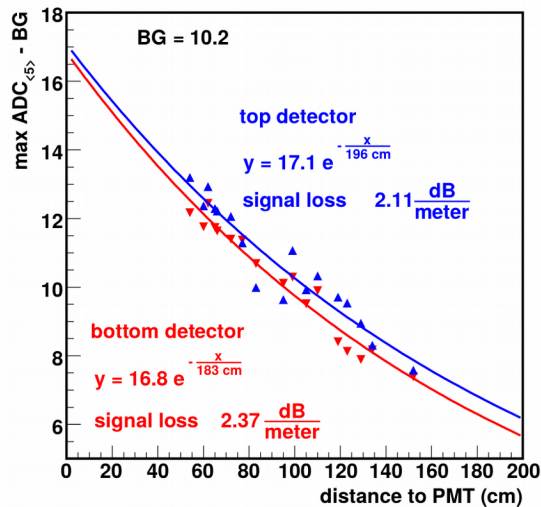


Homogeneity

PMT collected light from WSL fibre.
Some light is being attenuated in the fibre.

Signals from particles might be different in amount of light at PMT

This is observed as changes of most probable ADC value corresponding to single penetrating particle





Summary

- We have 40 professional detectors of cosmic ray (CR)
- We have know-how about CR detectors
- Note that professional array can test and calibrate non-professional methods, (e.g. smartphones)

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