

Detection of cosmic rays in the SKALTA experiment

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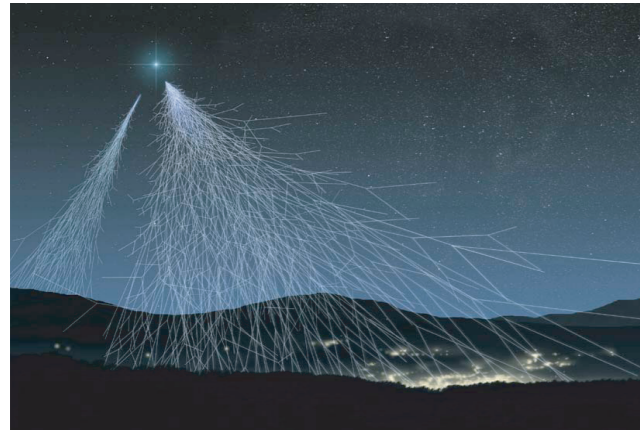
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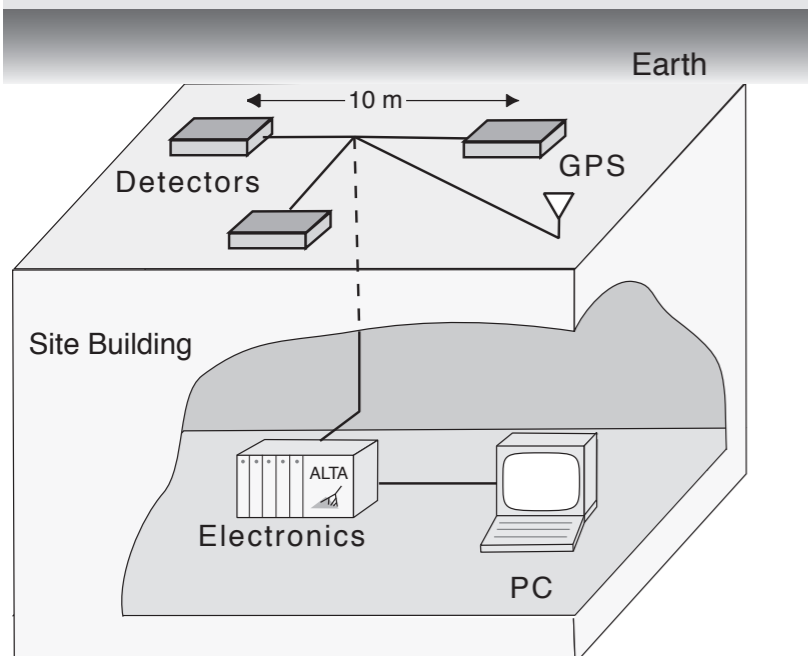
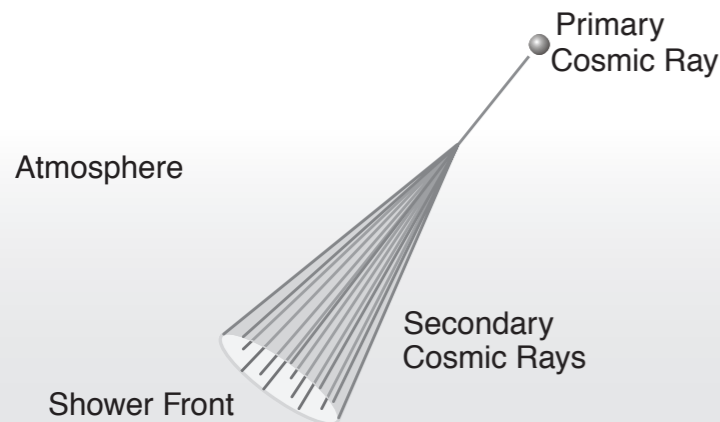
Marek Bombara, IPPOG 2011, 16. 04. 2011

SKALTA as a detector



The SKALTA (SlovaKiAn Large-area coincidence Time Array) experiment measures secondary cosmic rays originating from an interaction of primary cosmic ray particle with atmosphere.

The working station is composed of three scintillation detectors each with the dimensions 60x60 cm. All three detectors are connected in coincidence. The detectors are arranged into a triangle with side length of 10 m. The area of the triangle defines a minimal size of the shower and therefore a minimal energy of original primary particle ($> 10^{14}$ eV).



Using the time difference among the signals from the detectors the point in the sky can be localized (up to a certain resolution) from which the original primary particle came from. By the measuring of the exact time by GPS (Global Positioning System) the data from other workstations (i.e. CZELTA in Czech Republic) can be compared and long distance correlations can be studied.



SKALTA as a team member

SKALTA is a part of sparse network of similar detector stations covered huge area of Globe north hemisphere.

CZELTA: Czech Republic

NALTA: Canada

RoLTA: Romenia

All data are stored at one place (ČVUT, Prague), the data format is the same and data access is enabled to the all stations - very useful for shower correlation analysis

[CZELTA] Pardubice - Gymnázium

[CZELTA] Opava - Gymnázium

[CZELTA] Opava - Slezská Univerzita

[CZELTA] Střední průmyslová škola Kladno

[CZELTA] Ústav technické a experimentální fyziky

[CZELTA] Opava - Slezská Univerzita 2

[\[SKALTA\] Košice UPJŠ](#)

[CZELTA] Ústav technické a experimentální fyziky - Experimental

[CZELTA] Pardubice - SPŠE

[NALTA] Edmonton - O'Leary

[NALTA] Edmonton - O'Brien

[NALTA] Edmonton - Holy Trinity

[NALTA] Edmonton - MacDonald

[NALTA] Edmonton - Maddock

[NALTA] Thorhild

[NALTA] Grande Prairie

[NALTA] Edmonton - Norbuck

[NALTA] Victoria - AltaBC

[NALTA] Vergeville

[NALTA] Medicine Hat

[NALTA] Edmonton - Physroofe

[NALTA] Edmonton - L. St. Laurent

[NALTA] Edmonton - J. Percy Page

[NALTA] Edmonton - McNally

[NALTA] Edmonton - Beaumont

[UK] London - Rickmansworth School

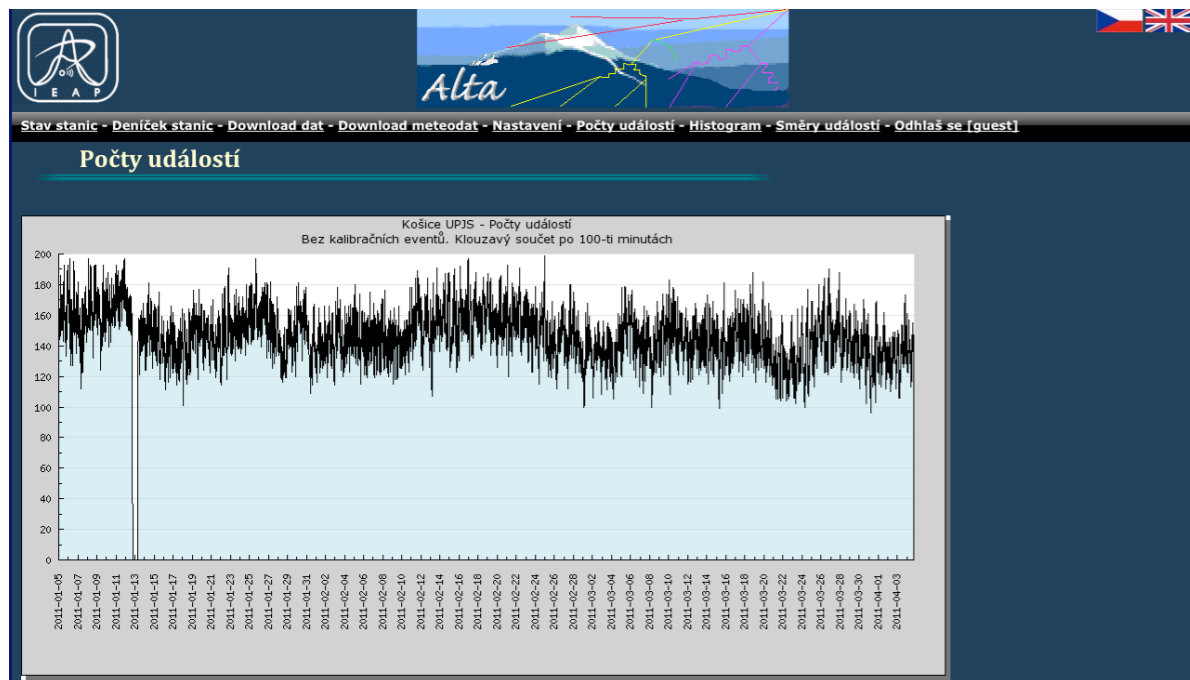
[UK] London - Highgate school

[RoLTA] Bucharest - Magurele

SKALTA as a student's lab

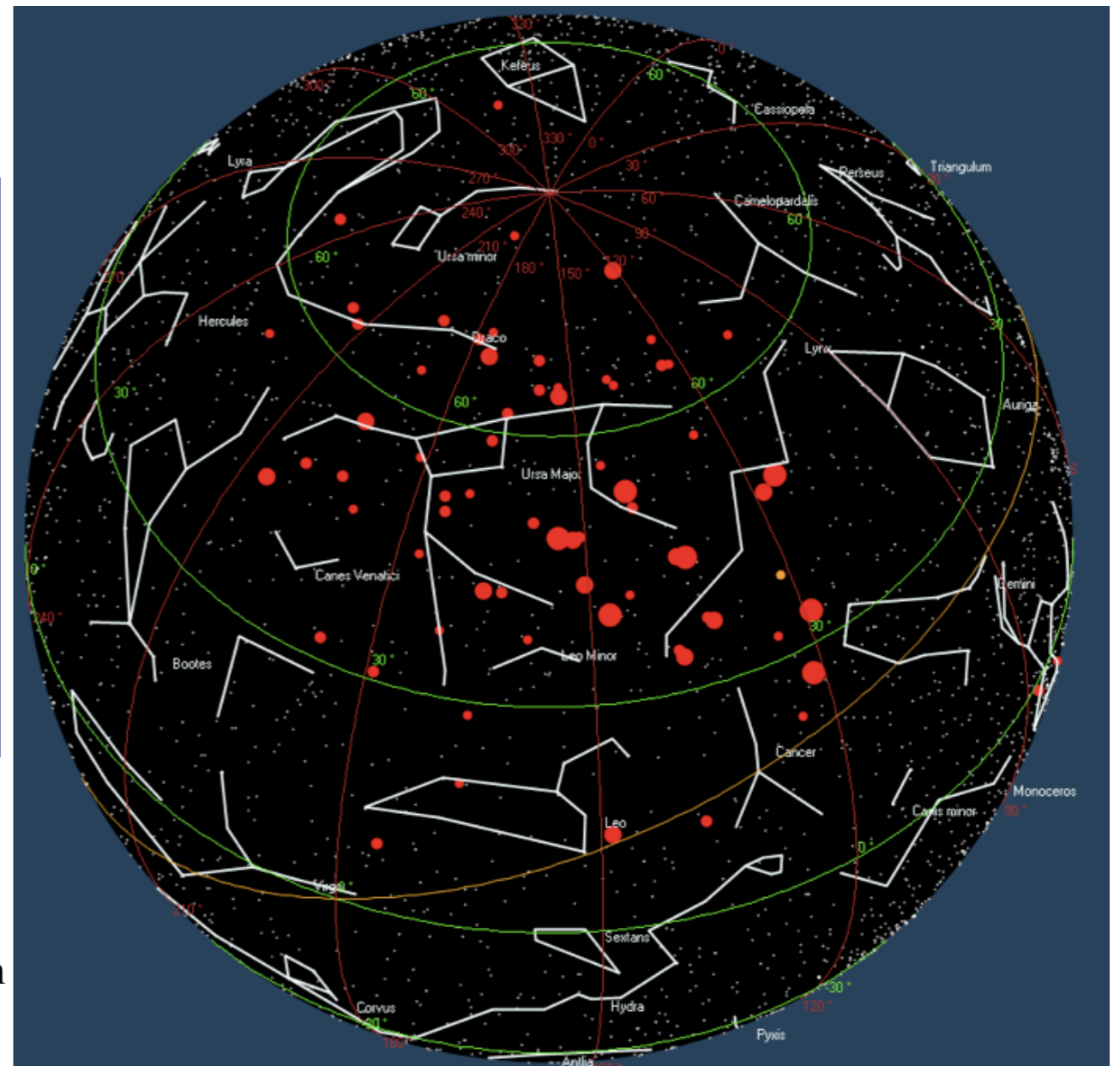
One of the main purposes of SKALTA project (and the other projects as well) is installing the stations on the roofs of Grammar Schools - the students can work with real scientific data which makes the educational process much more attractive.

Example of student's work in CZELTA:



web interface for data access

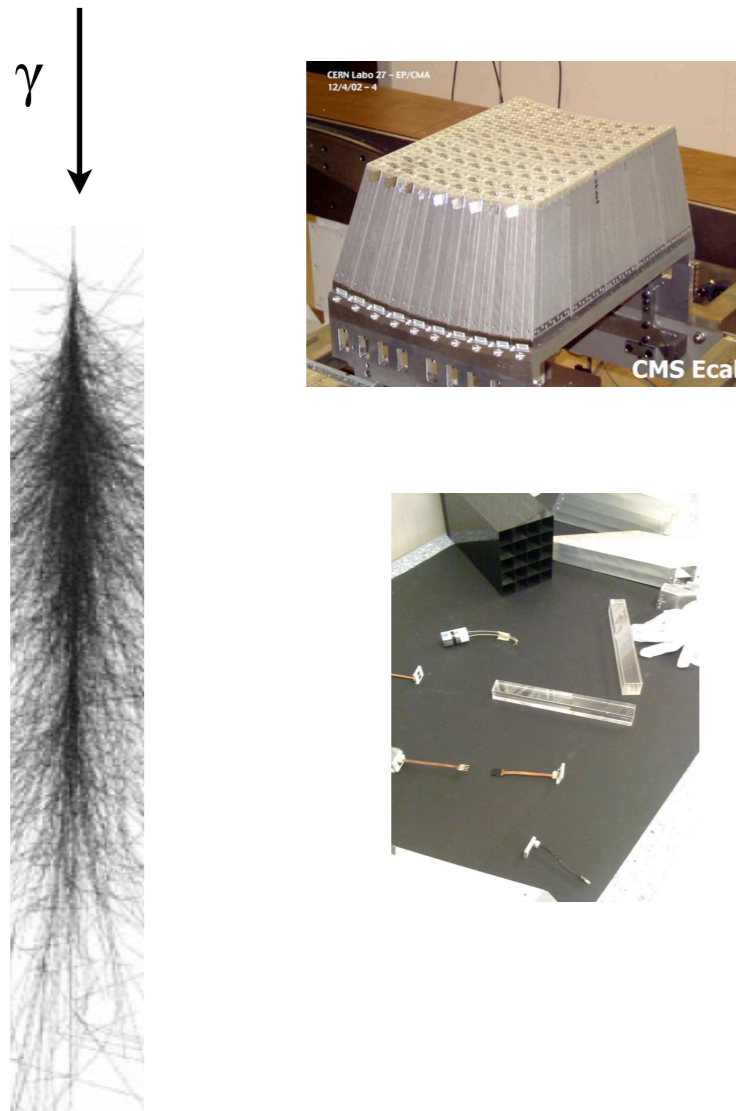
measurement of event direction



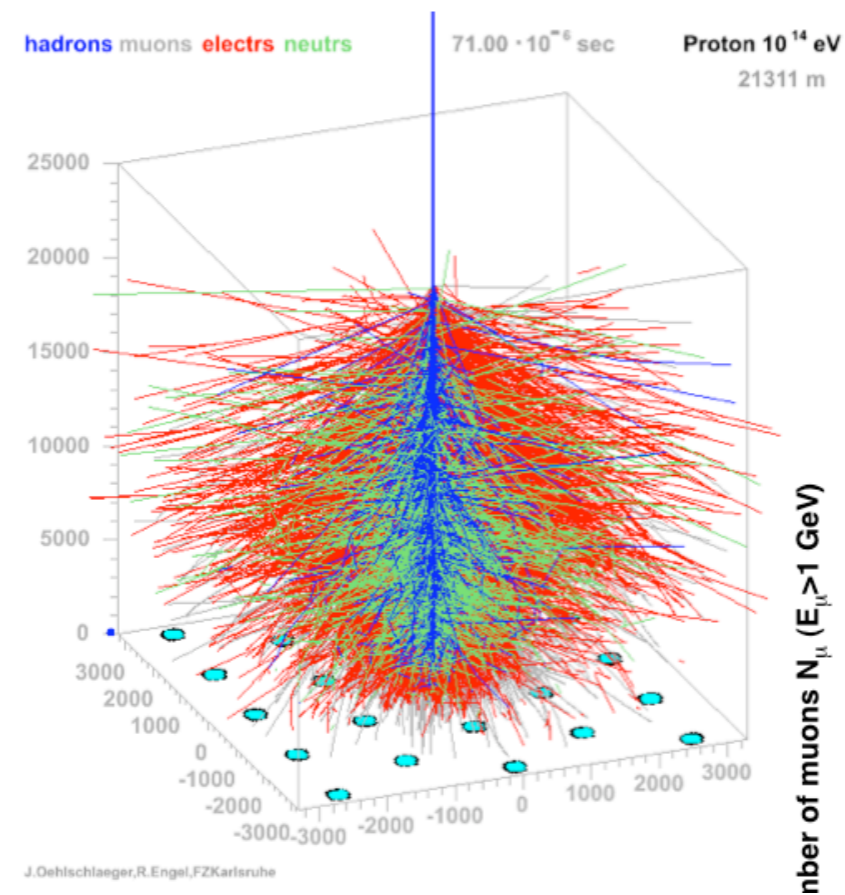
Jakub Čermák, Pardubice ©

Shower absorption in different materials

ECAL CMS - PbWO4



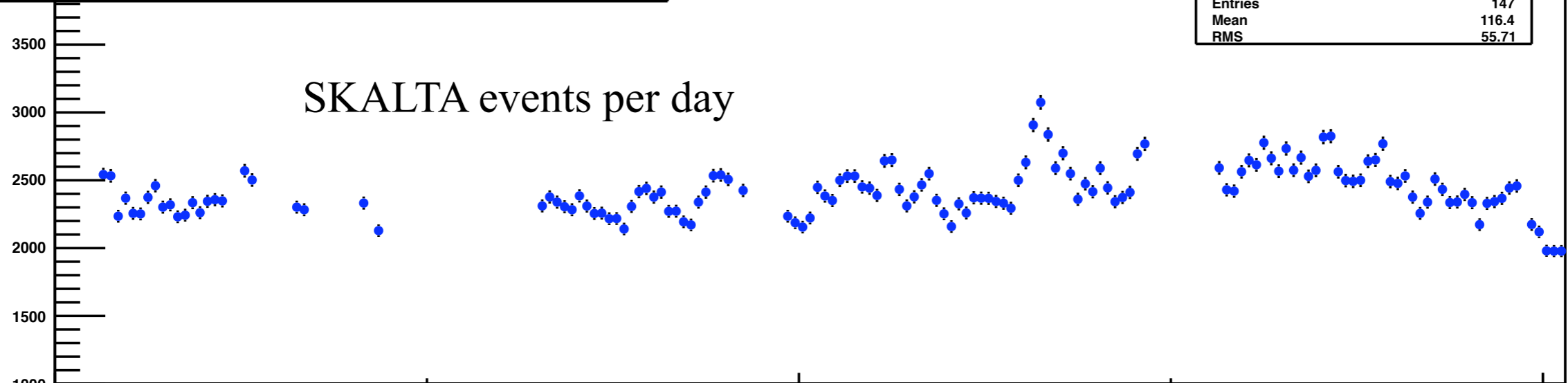
Atmosphere as a calorimeter



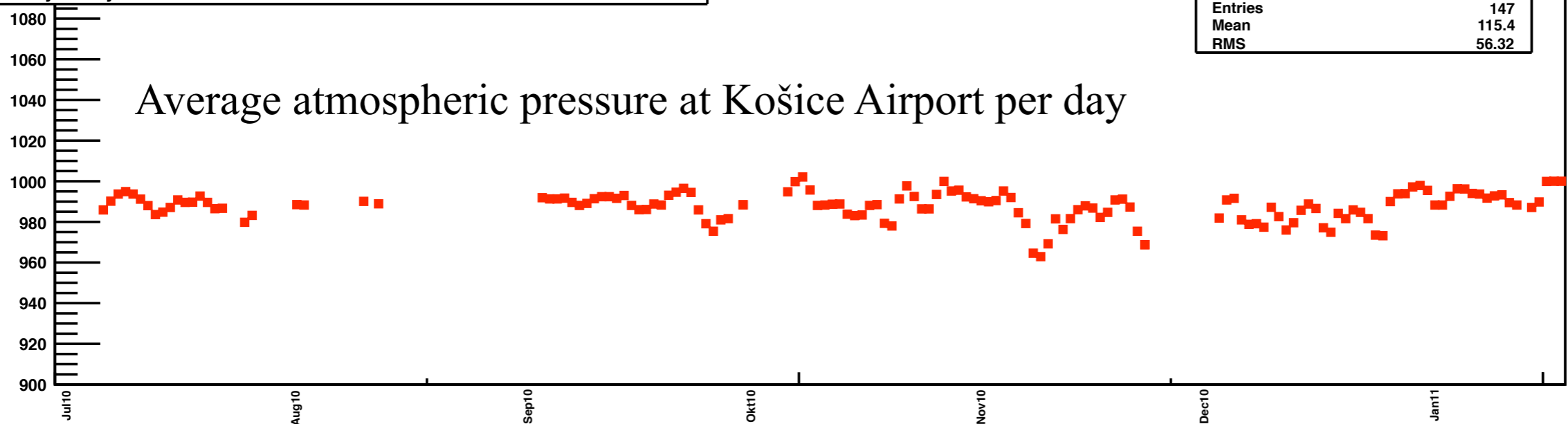
The absorption capability of atmosphere changes with air density, air temperature, altitude, etc. Hence the shower absorption in atmosphere changes according to the actual air absorption capability.

SKALTA as a barometer

Pocet udalosti za den meranych experimentom SKALTA od 30.6.2010 do 17.1.2011



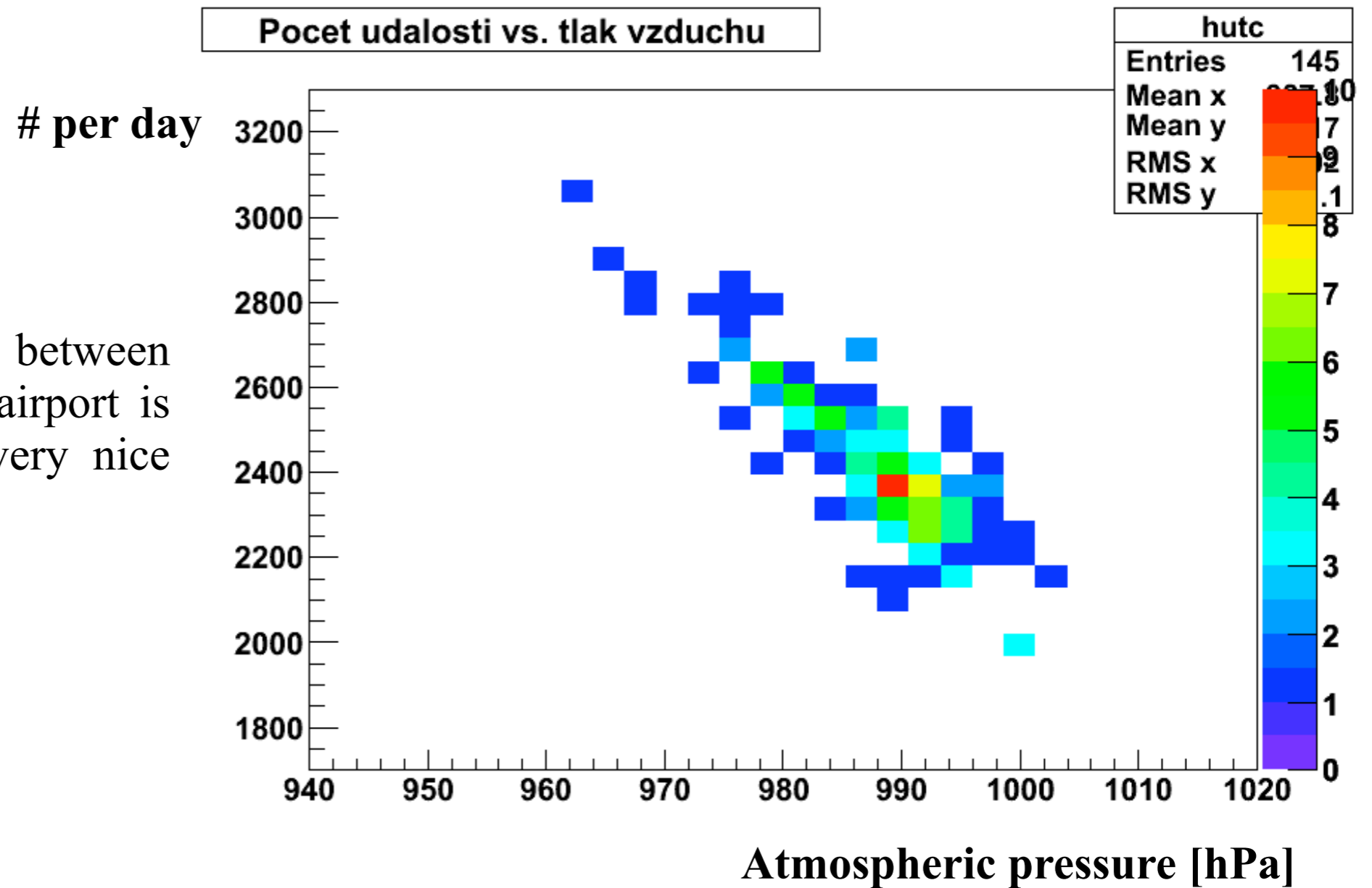
Priemerny denný tlak vzduchu od 30.6.2010 do 17.1.2011 na kosickom letisku



We can see anti-correlation by eye, even the distance between those places is about 7 km.
The bigger atmospheric pressure \Rightarrow the bigger air density above the place \Rightarrow the higher probability of the shower absorption \Rightarrow the less particles from the shower reach the ground \Rightarrow the less particles detected by SKALTA

SKALTA as a barometer

Even if the distance between SKALTA and Košice airport is about 7 km we see very nice anti-correlation.



In the near future we plan to install meteorological station at SKALTA in order to have much more precise measurement of temperature and atmospheric pressure of the place.

Summary

- SKALTA - the only one of its kind (for detecting showers with energy of original primary particle bigger than 10^{14} eV and for educational purposes) in Slovakia so far
- big educational potential
- in the future - installing more SKALTA stations on the grammar school roofs