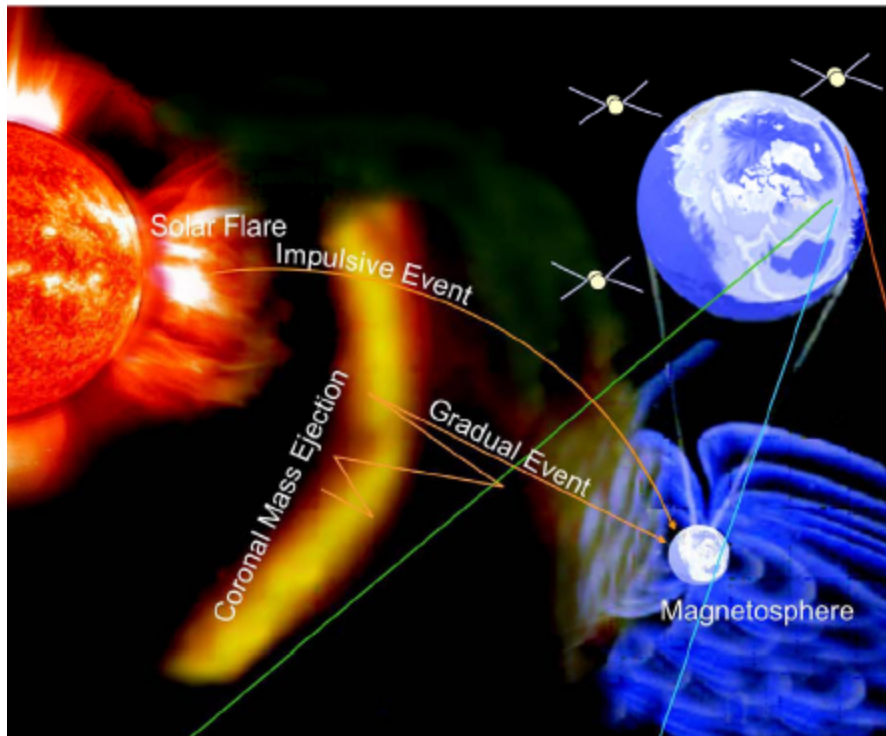
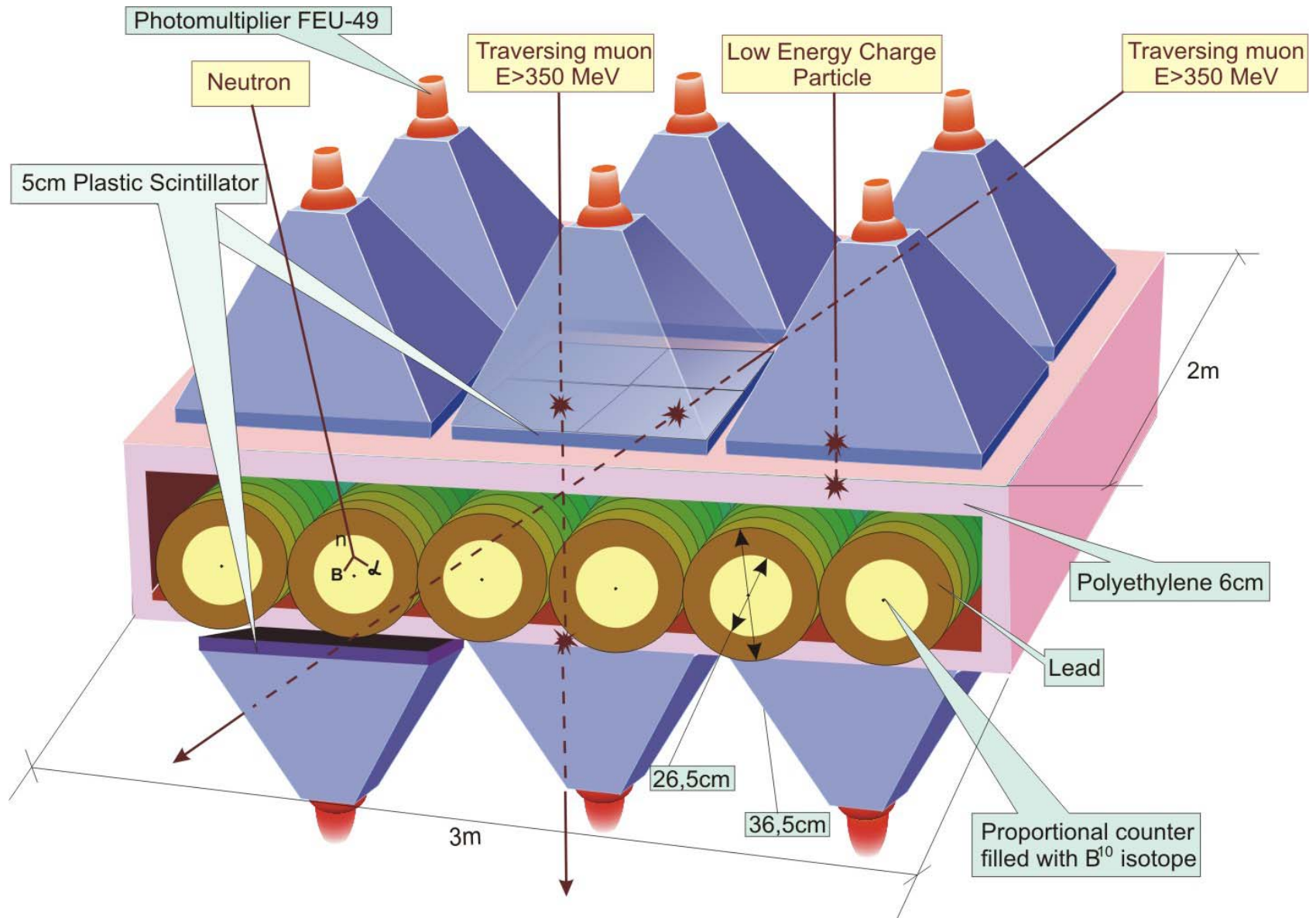


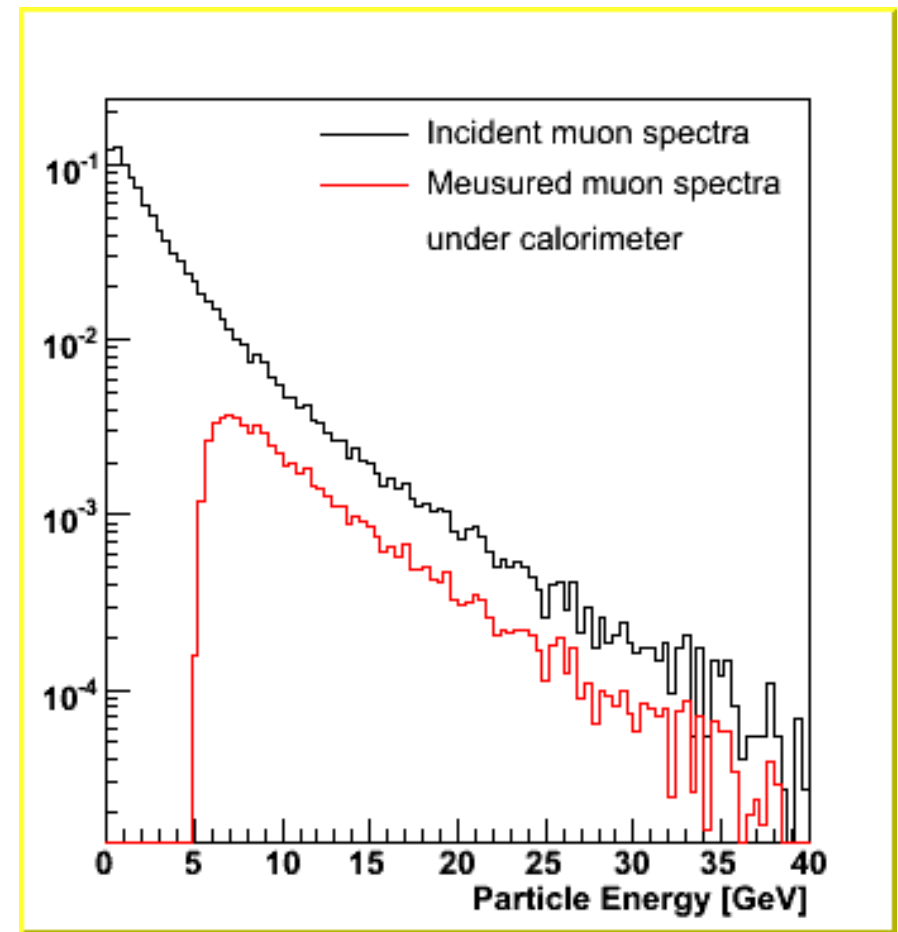
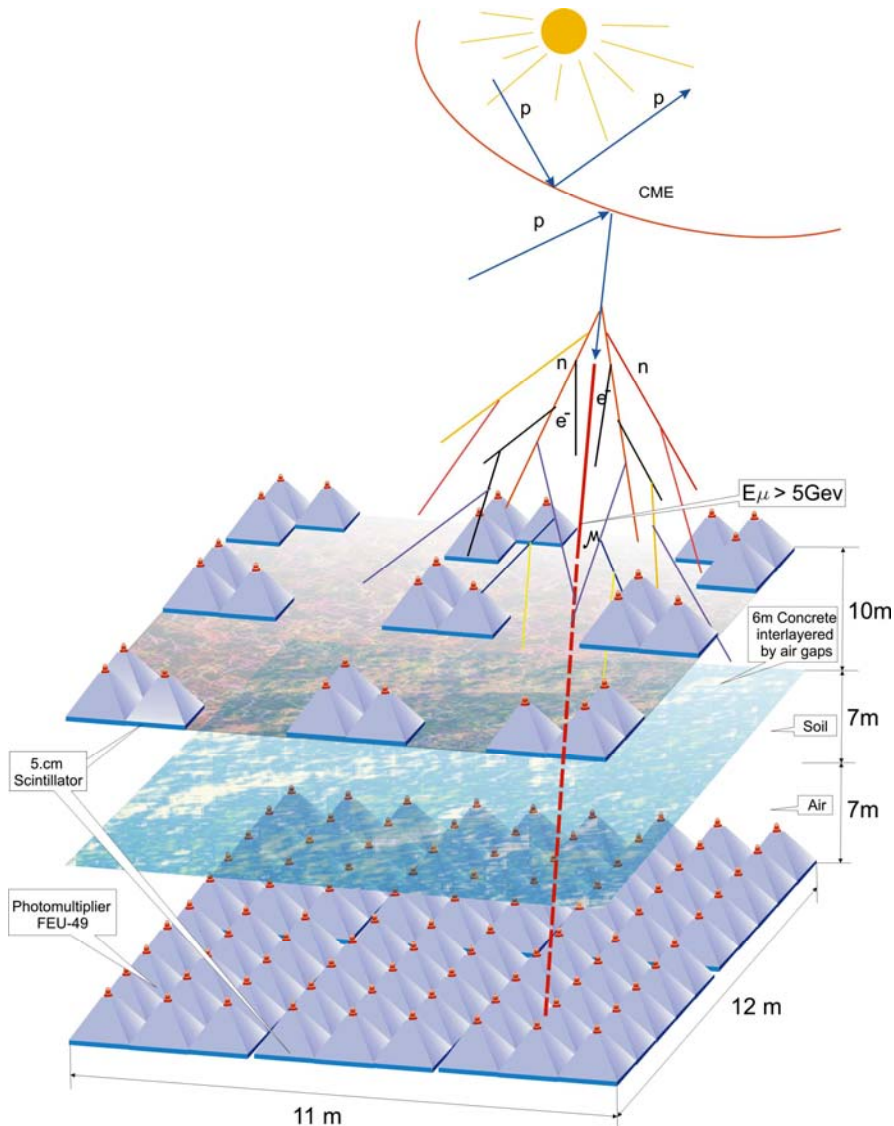
Space Environment Viewing and Analysis Network (SEVAN)



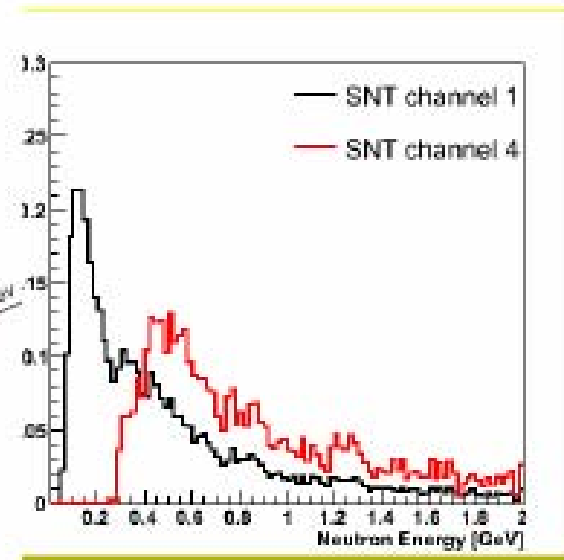
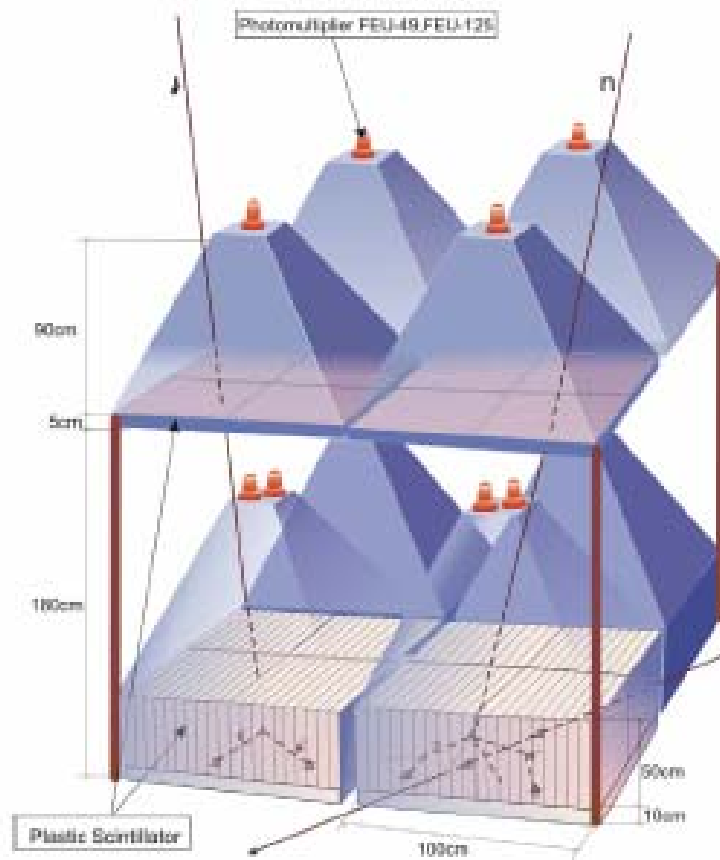
Nor Amberd Multidirectional Muon Monitor (NAMMM) – 2,000 m



Aragats Multidirectional Muon Monitor (AMMM) – 3,200 m



Solar Neutron Telescope



Armenian monitors

Detector	Altitude <i>m</i>	Surface m^2	Threshold(s) <i>MeV</i>	Operation	Count rate (min^{-1})
NANM (18NM64)	2000	18	50	1996	2.7×10^4
ANM (18NM64)	3200	18	50	2000	6.1×10^4
SNT-4channels + veto	3200	4 (60cm thick) 4 (5 cm thick)	120, 200, 300, 500 7	1998	$5.2 \times 10^{4*}$ 1.2×10^5
NAMMM	2000	5 + 5	7 ; 350 ^{***}	2002	7.0×10^4
AMMM	3200	45	5000	2002	$1.3 \times 10^{5**}$

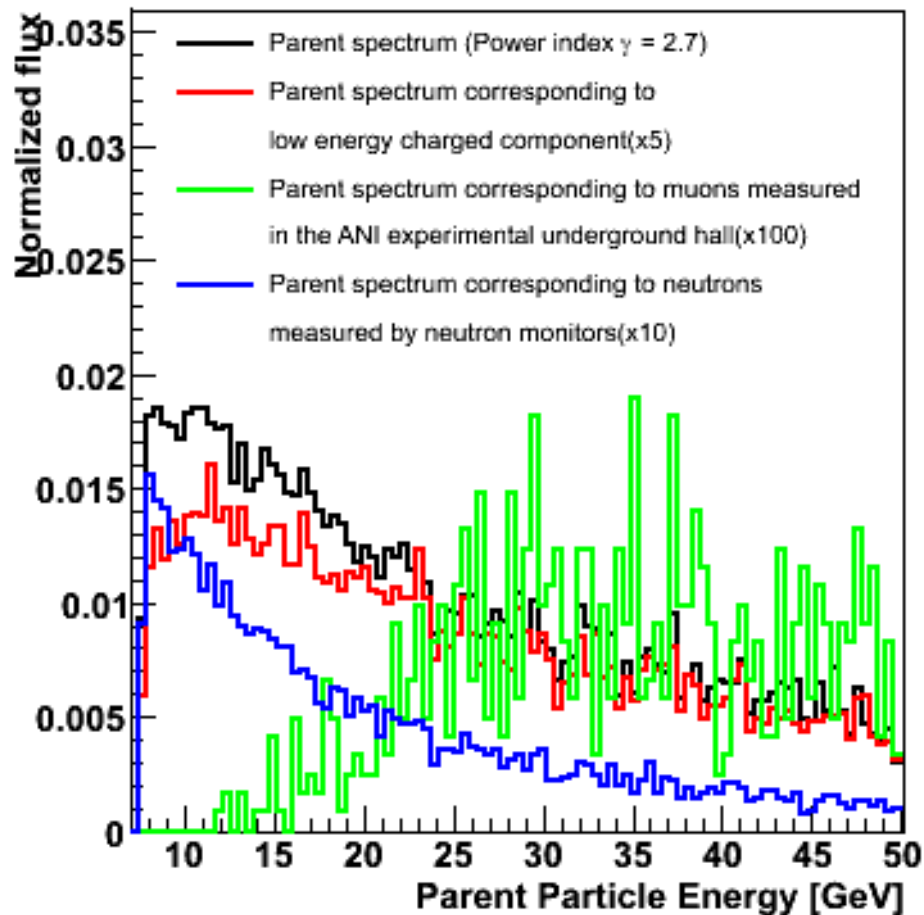
*Count rate for the first threshold; near vertical charged particles are excluded

**Total count rate of 45 muon detectors from 150 (100 to be put in operation in 2006)

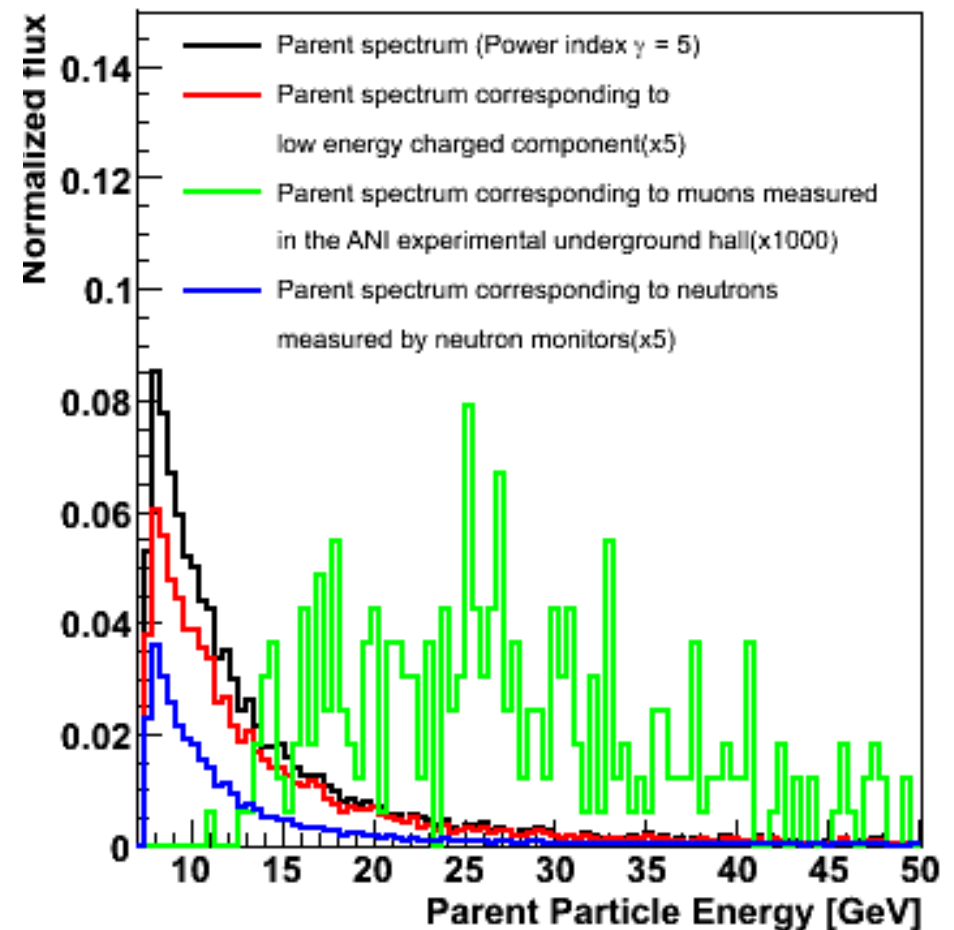
*** First number – energy threshold for the upper detector, second number – bottom detector.

Energy range of Aragats Monitors

GCR



SCR



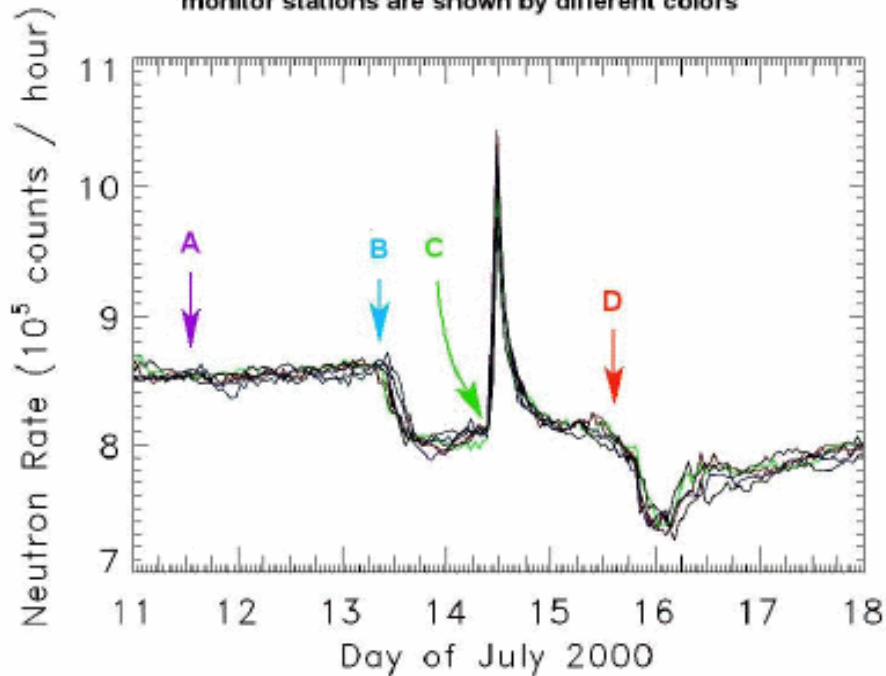
Solar Transient Events influencing count rate of surface particle detectors

- Ground Level Enhancements GLE, only some of SEP events produce GLEs, and only most energetic ones at middle and low latitudes ~ 10 per cycle
- Fd – abrupt decrease of the monitor count rates better pronounced at high latitudes; ~100 per cycle;
- Cutoff Rigidity decrease, produce relative enhancement of count rate of middle latitude particle detectors, appear on the recovering phase of Fd coincides with strong GMS

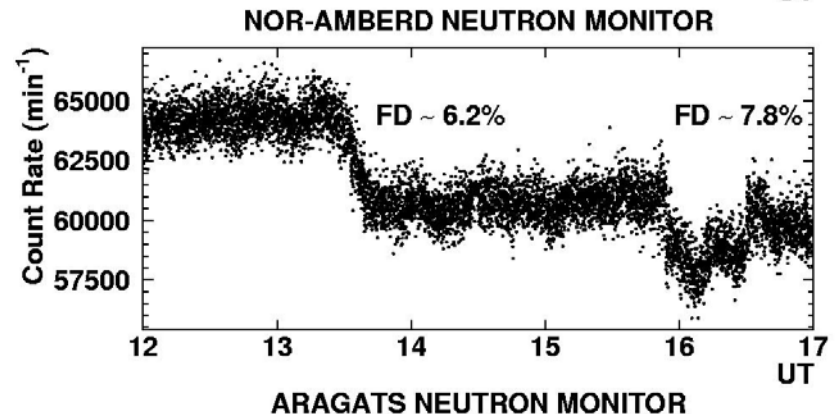
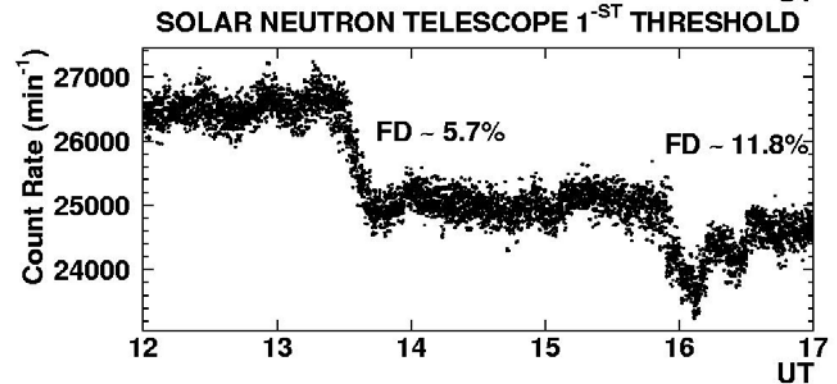
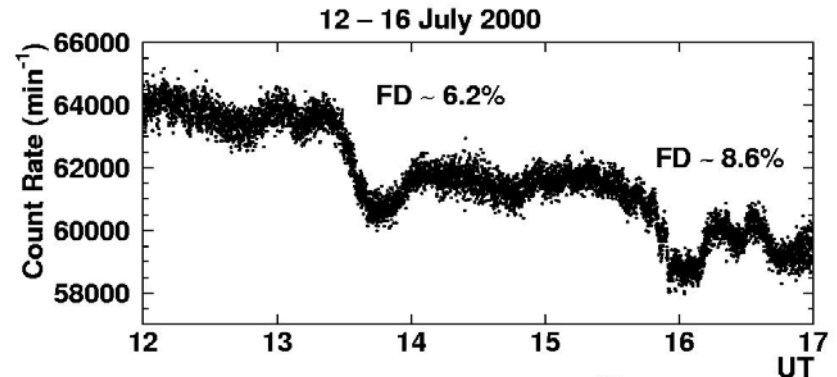
An example during high solar activity

Cosmic Rays during High Solar Activity

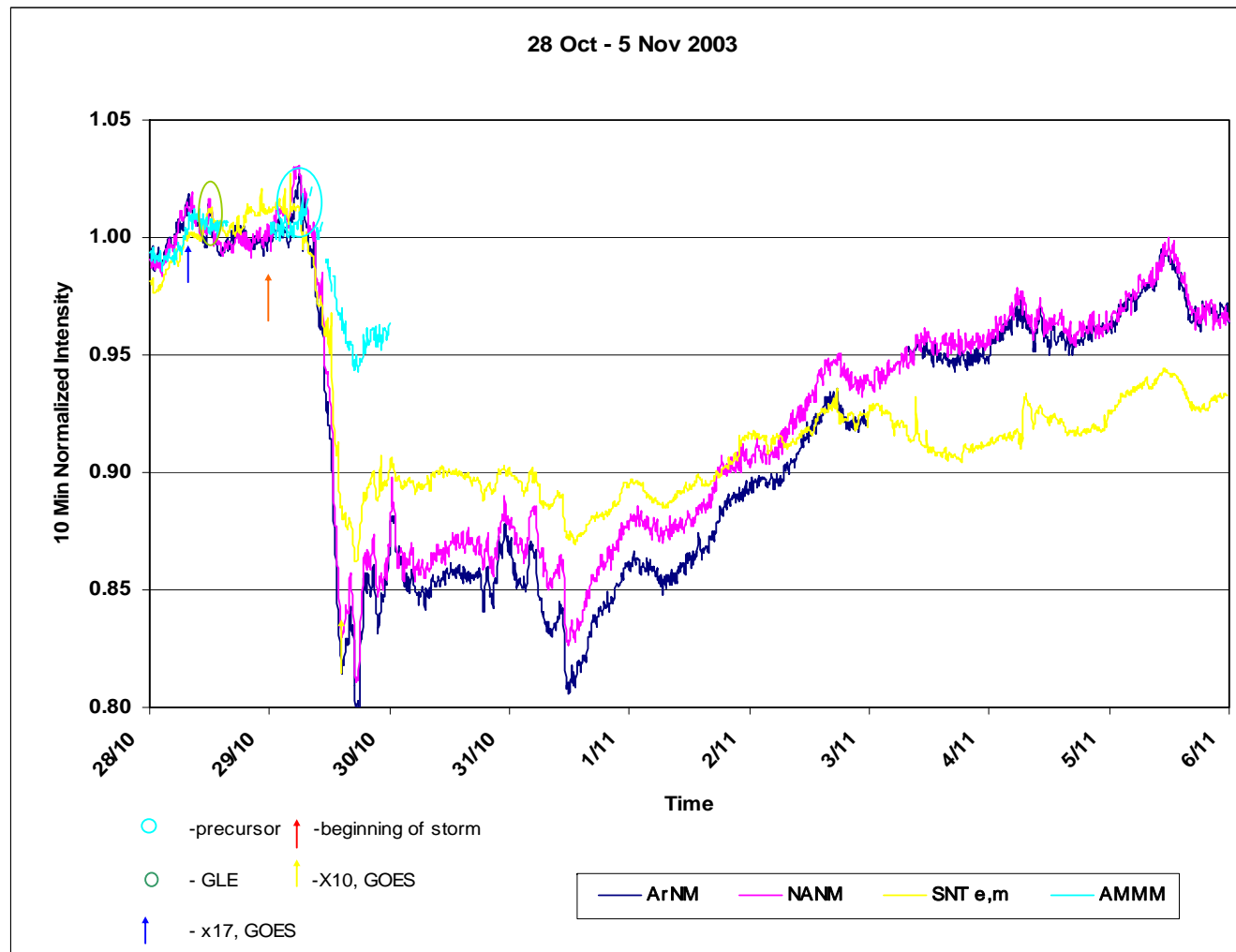
Cosmic ray variations recorded at 7 different neutron monitor stations are shown by different colors



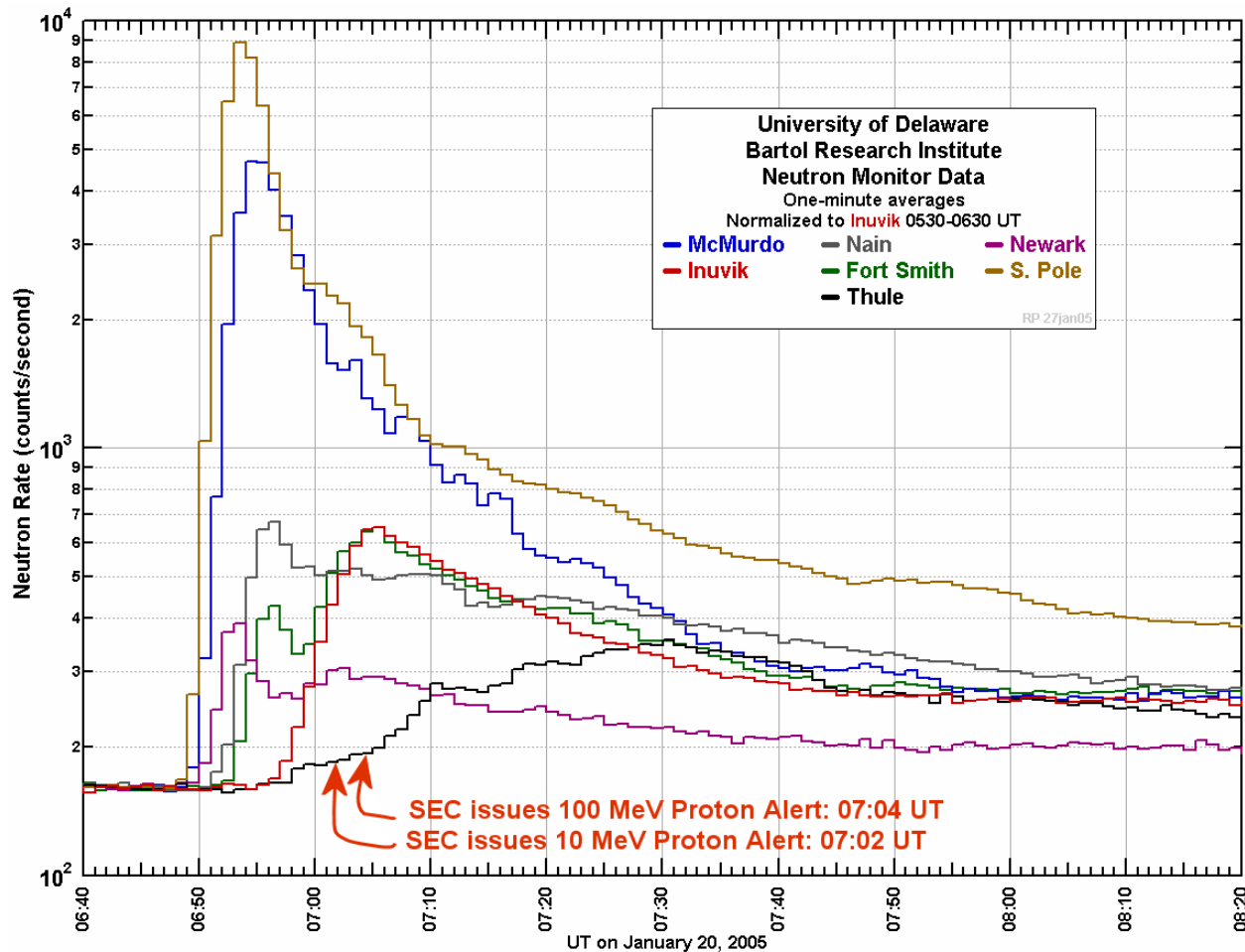
- A:** First coronal mass ejection (CME) at Sun.
- B:** First CME arrives at Earth. Cosmic rays decrease suddenly — a "Forbush decrease."
- C:** Second CME at Sun. This one accelerates high energy particles that reach Earth minutes later. The sudden increase recorded by the neutron monitor is a "ground level enhancement."
- D:** Second CME arrives at Earth. Cosmic rays decrease again. This CME produces the largest geomagnetic storm in 10 years. Aurora observed as far south as Georgia.



Famous “Halloween” events of 2003, detected in electron & muon and neutron fluxes by ASEC monitors at different altitudes



Neutron Monitors Can Provide the Earliest Alert of a Solar Energetic Particle Event



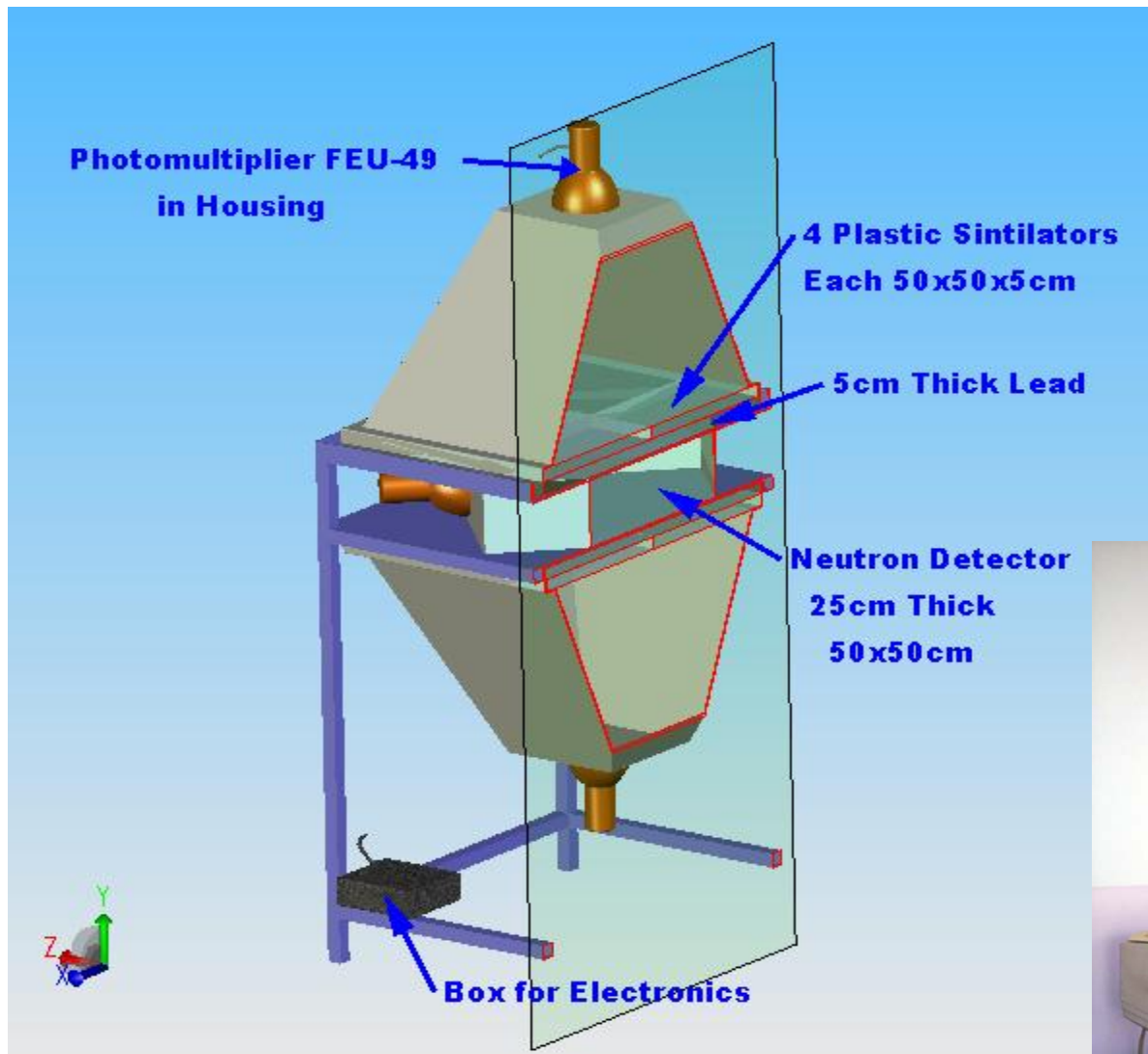
- In the January 20, 2005 GLE, the earliest neutron monitor onset preceded the earliest Proton Alert issued by the Space Environment Center **by 14 minutes.**

Courtesy John Bieber

Aims:

- Cosmic ray flux as a diagnostic tool for Space Weather predictions.
- Variations of climatic factors and biological systems related to changes of cosmic ray flux (short term, solar cycle and secular changes).

Sevan Detector



SEVAN Count Rates

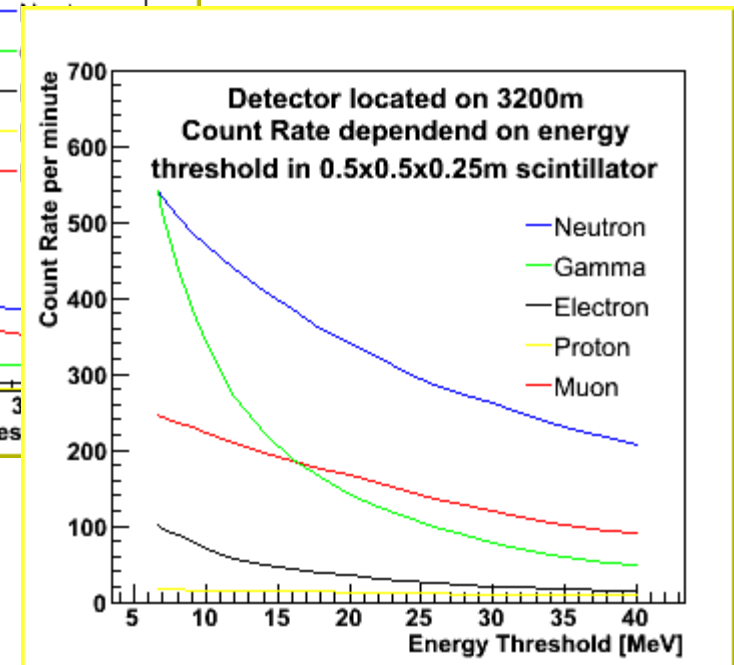
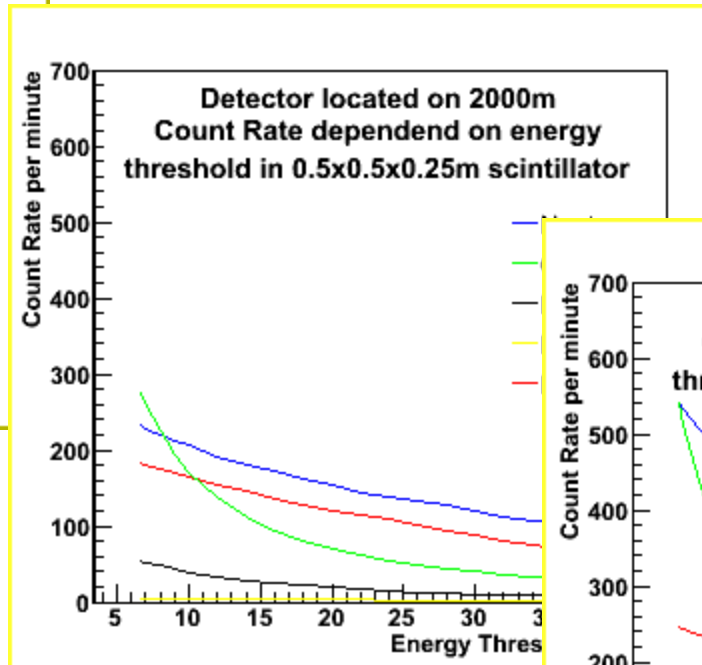
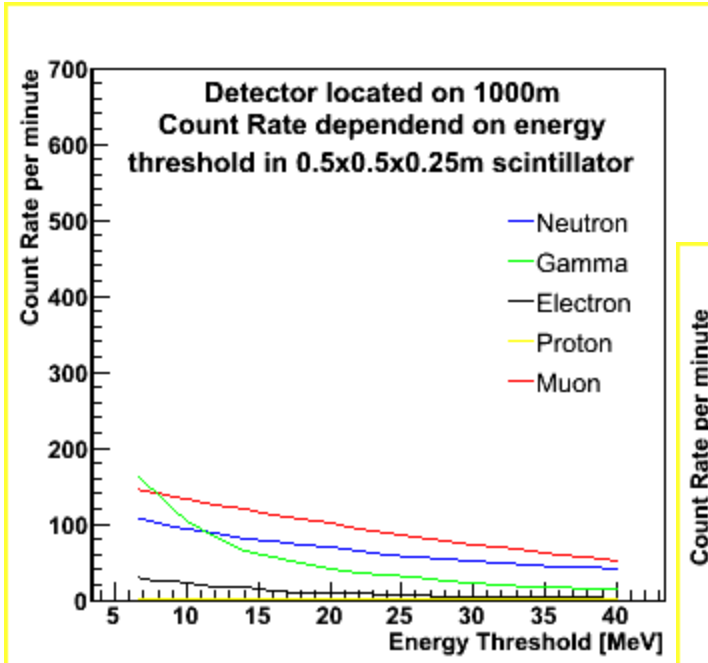
Per Minute

	All	Electrons	Muons	Gamma	Neutrons	Protons
0 m	10078	1583	7959	383	53	95
1000 m	13033	2472	9619	572	154	209
2000 m	17583	3986	11670	1038	333	544
3200 m	26766	7696	14959	2002	787	1297

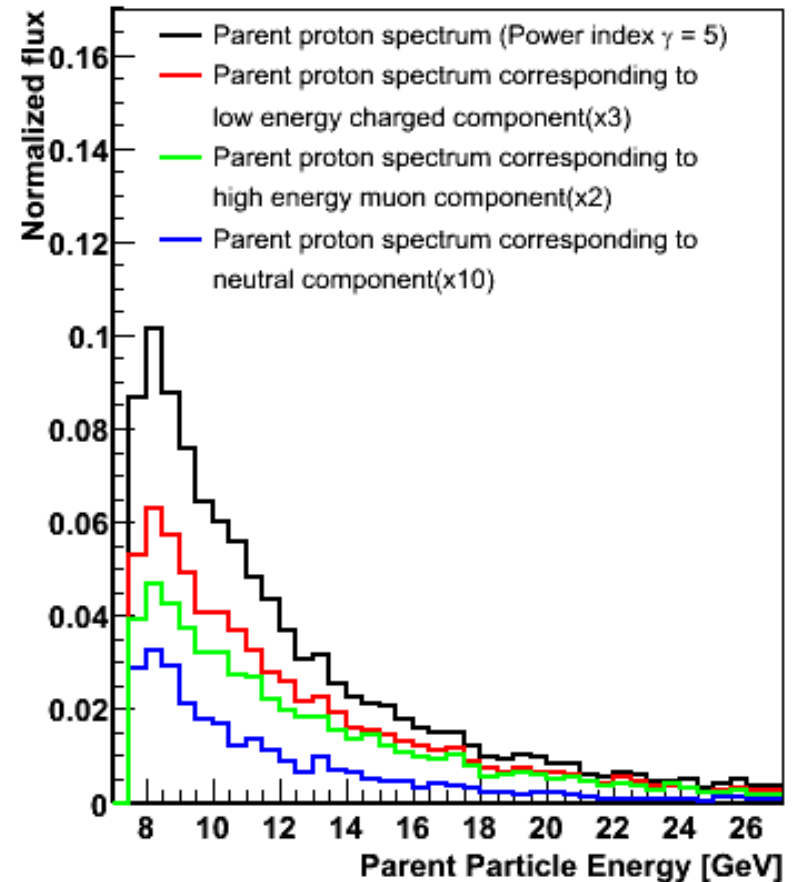
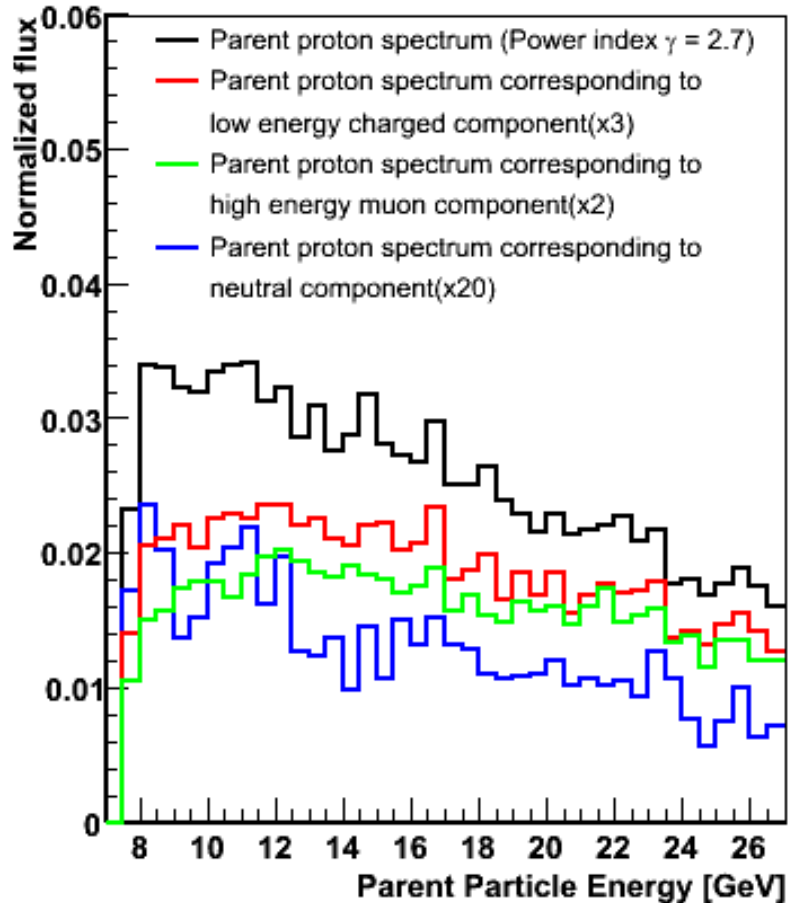
Per Second

	All	Electrons	Muons	Gamma	Neutrons	Protons
0 m	168	26	133	6	1	2
1000 m	217	41	160	10	3	3
2000 m	293	66	195	17	6	9
3200 m	446	128	249	33	13	22

Expected Count Rates at Different Altitudes



SEVAN Response to GCR and SCR



Space Environment Viewing and Analysis Network (SEVAN)



Bulgaria - Peak Mussala



- 25°35'E, 42°11'N
altitude 2925 m
- mean annual temperature
-3.1°C (from - 31°C to
+18.7°C);
- precipitation 1300 mm
- sunny days - 150;
- snow period 8 months;
- wind velocity 70m/s

Mussala station



- Cerenkov light telescope;
- gamma background control;
- measurements of the Earth's magnetic field;
- UV and ozone measurements;
- automatic weather station
- acidity of clouds;

Ashot Chilingarian chili@crdlx5.yerphi.am



Liulin

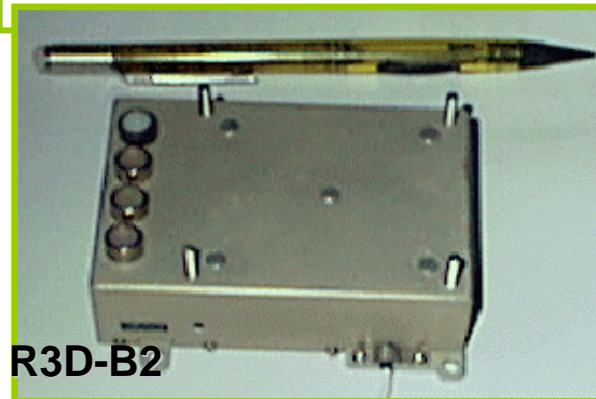
Internet based portable instrument measuring in real time the variations of the spectra and the flux of secondary particles from galactic and solar cosmic rays inside of the Earth atmosphere including GLE and the Forbush decreases developed on the base of space devices in the Solar-Terrestrial Influences Laboratory at Bulgarian Academy of Sciences.

Liulin internet based instruments are successors of Liulin-E094 instrument, flown on American Laboratory module of ISS, and of R3D-B2 instrument, flown on Foton M2 satellite and of number of instruments on aircrafts

**Liulin
Control
And
Interface
Unit
(CIU)**



**Liulin
Mobile
Dosimetry
Unit
(MDU)**



STIL-BAS spin-off produced Liulin type spectrometers for measurements of the space radiation on aircrafts are used by scientists from Japan, USA, Germany, France, Canada, Spain, Australia, Poland, Russia, Czech Republic and others

More than 80 days working time from Li-Ion batteries



Weight: 320 g*
Size: 100x100x50 mm

More than 30 days working time from accumulator



Weight: 280 g*
Size: 95x85x55 mm

More than 4 days working time from accumulator



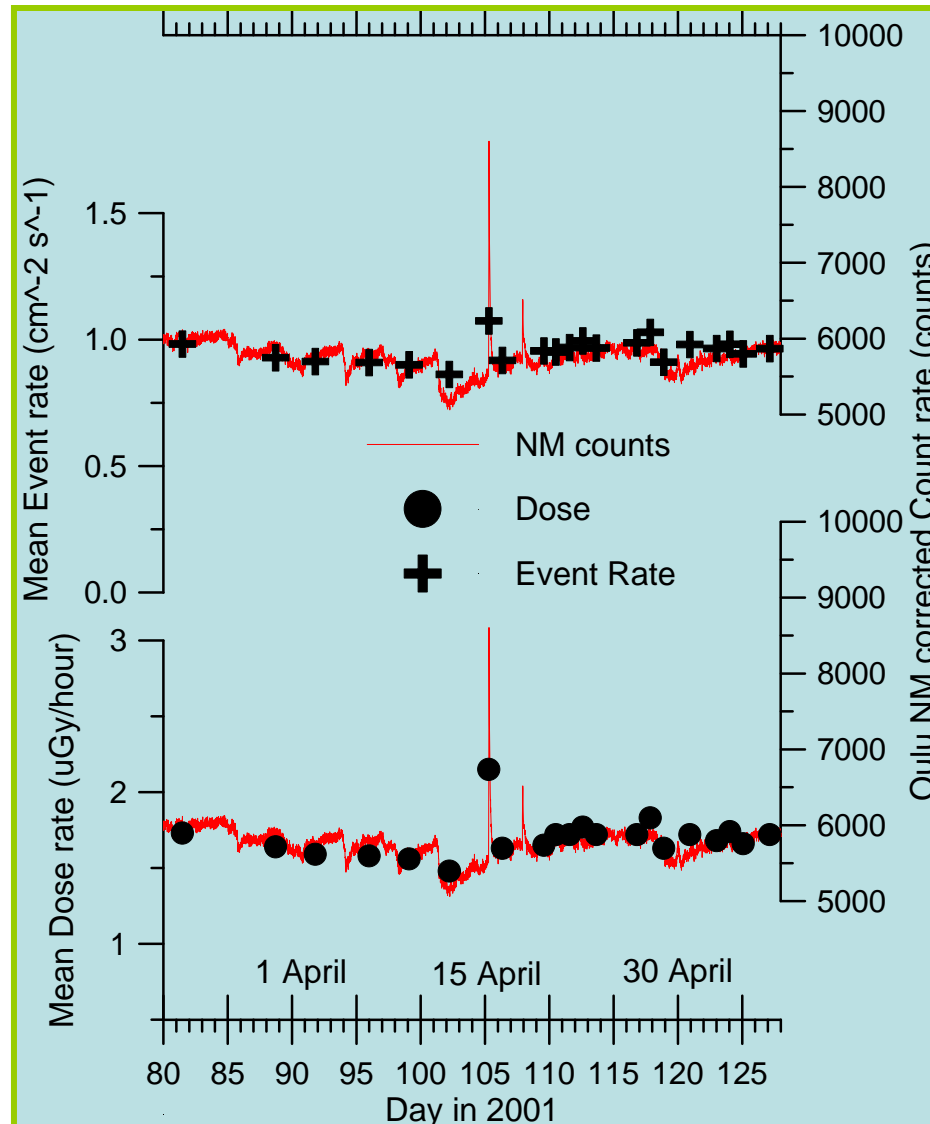
Weight: 95 g*
Size: 84x40x20 mm

Spectrometer with GPS receiver and display for monitoring of the space radiation doses by aircraft pilots

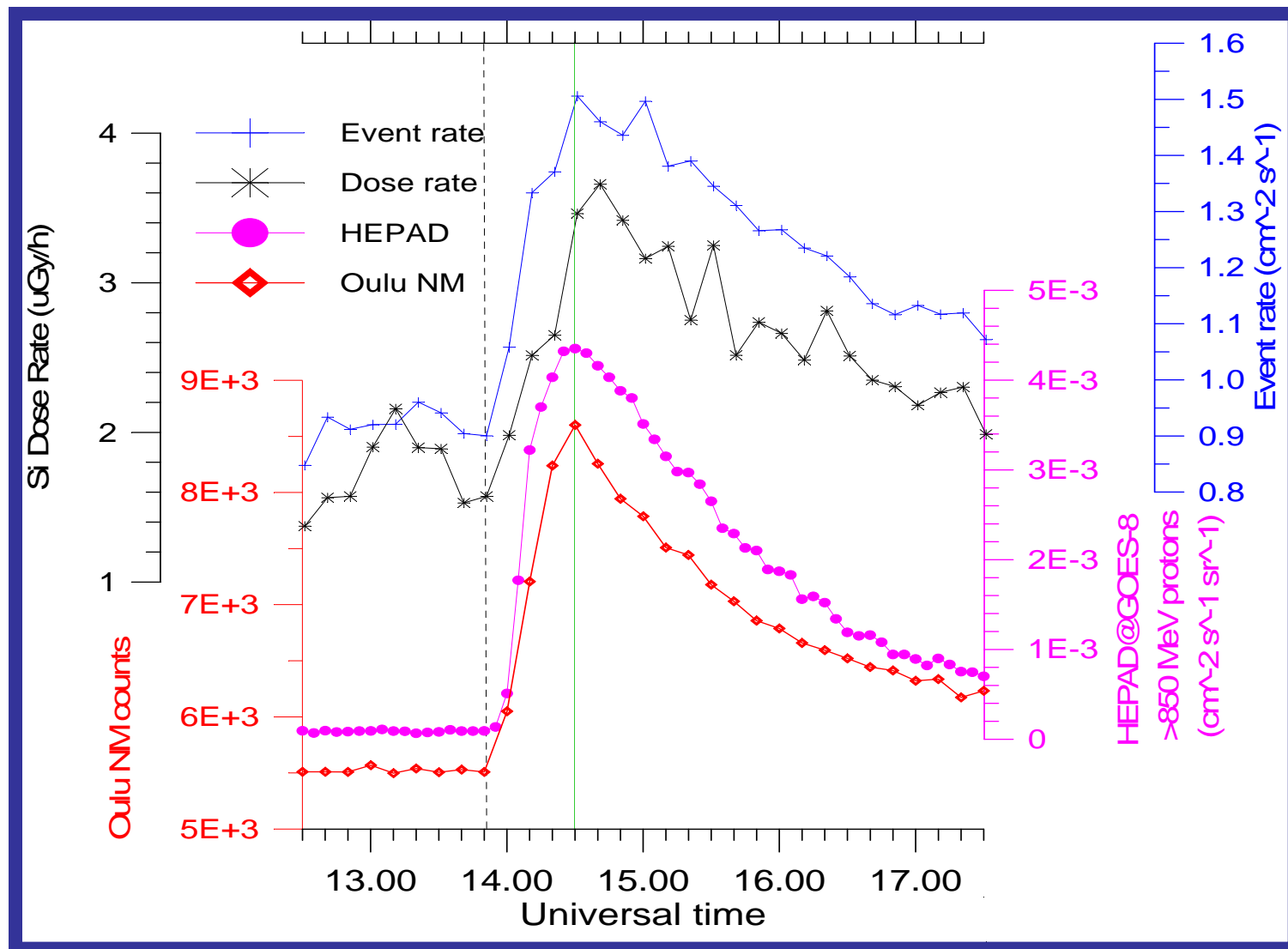


Weight: 280 g
Size: 110x80x45 mm

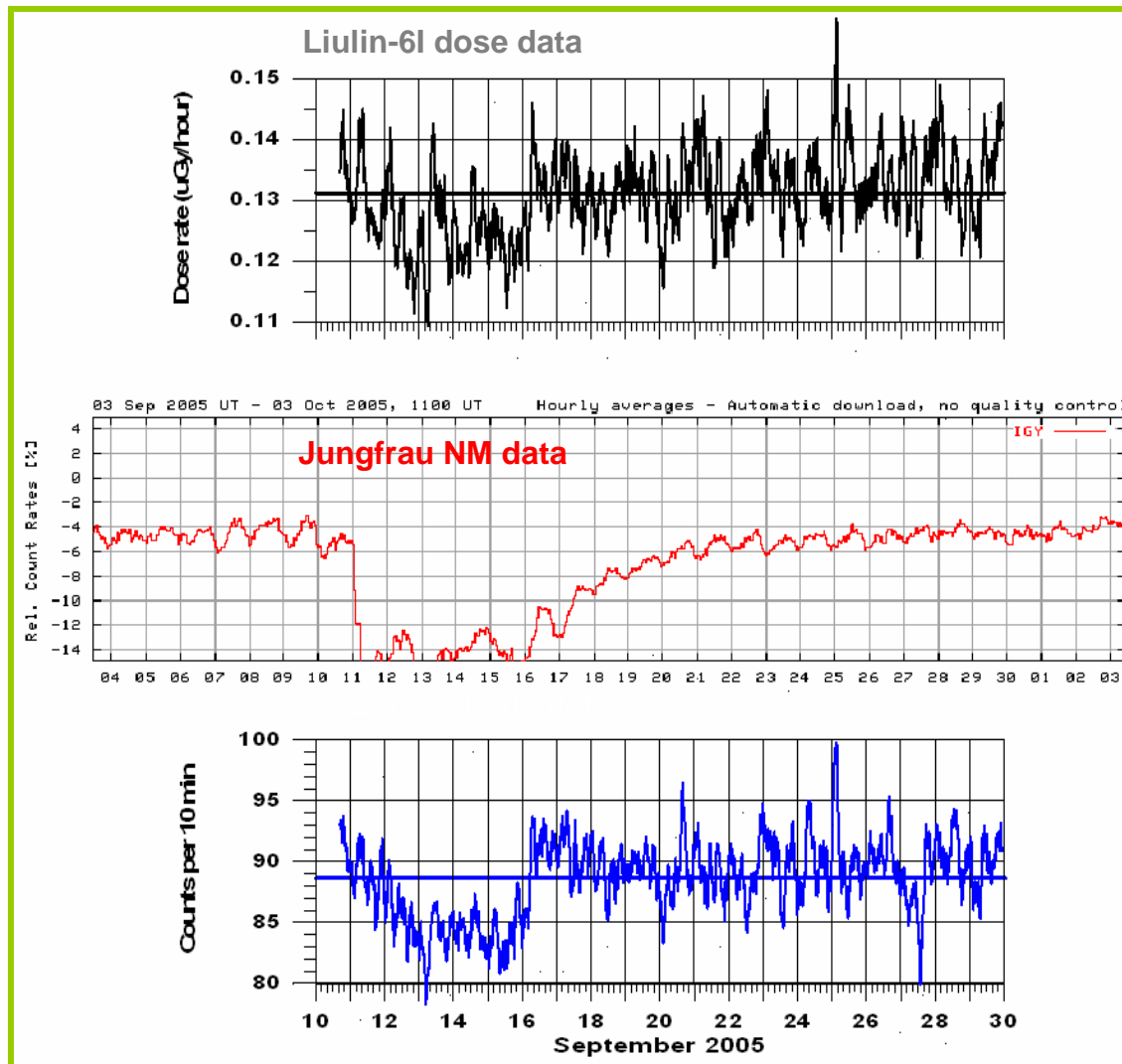
Variations of mean doses and fluxes at about 10.5 km altitude as seen by Liulin data on CSA aircraft during Prague to New-York flights in comparison with Oulu neutron monitor data



Comparisons of the Liulin data with Oulu NM and HEPAD (GOES-8) protons during the Ground level event number 60 on 15.04.2001



Comparison of Liulin-6I at Jungfrau peak (3475 m asl) dose and flux data with Neutron monitor data at same peak for the Forbush decrease in September 2005



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