Parameters of the Aragats Space-Environmental Center monitors as measured at start of 24thSolar Cycle

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Overview

- Calculation of Mean Multiplicity Coefficients for ASEC Neutron Monitors – **PP02.** PARAMETERS OF THE ARAGATS SPACE-ENVIRONMENTAL CENTER MONITORS AS MEASURED AT START OF 24 -TH SOLAR CYCLE

  A.Chilingarian, A.Hovhannisyan, T.Karapetyan, B.Mailyan, A.Reymers
- Daily variation in intensity of different species of secondary cosmic rays as measured by the particle detectors of Aragats Space Environmental Center at minimum of solar activity – **HCR9.** DAILY VARIATION IN INTENSITY OF DIFFERENT SPECIES OF SECONDARY

  COSMIC RAYS AS MEASURED BY THE PARTICLE DETECTORS OF ARAGATS SPACE

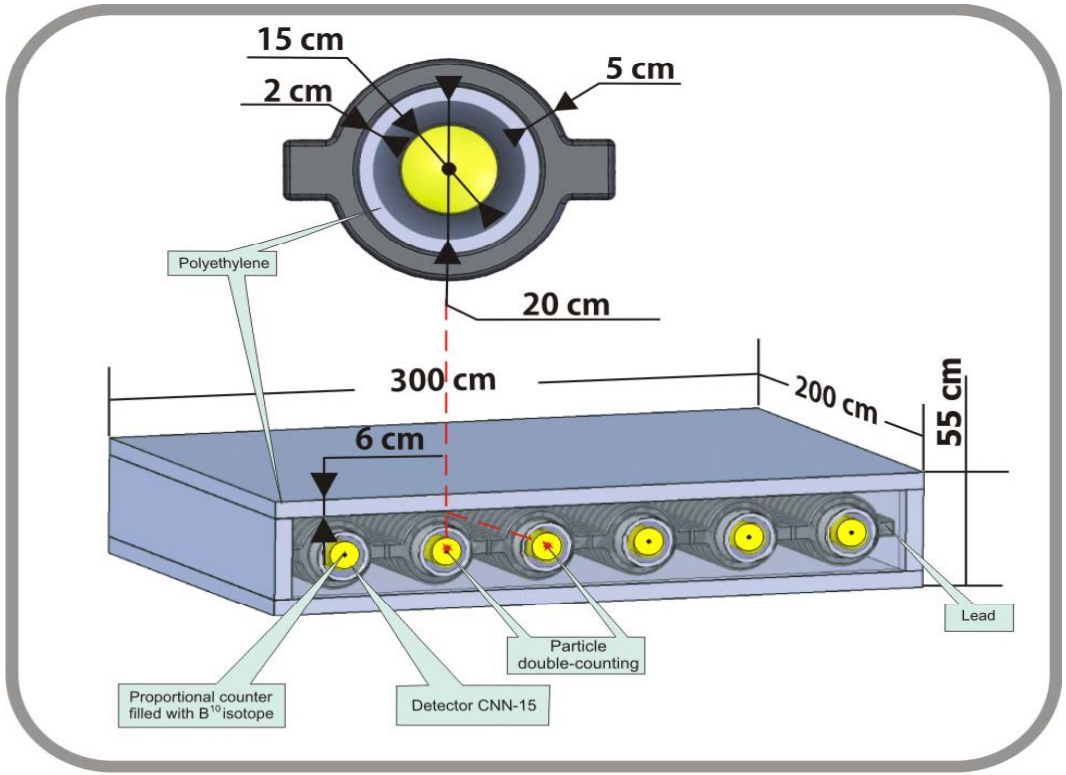
  ENVIRONMENTAL CENTER AT MINIMUM OF SOLAR ACTIVITY

  A.Chilingarian, V.Eganov, A.Hovhanissyan, T.Karapetyan, B.Mailyan, A.Reymers
- Barometric coefficients for different dead times neutron monitors electronics and for different energy threshold of muon scintillation detectors – **HCR8.** BAROMETRIC COEFFICIENTS OF THE NEUTRON MONITORS LOCATED AT SLOPES OF MOUNTAIN ARAGATS CORRESPONDING TO THE TIMES OF TERMALIZED NEUTRON COLLECTION

  A.Chilingarian, A.Hovhanissyan, T.Karapetyan, B.Mailyan, A.Reymers

Calculation of Mean Multiplicity Coefficients for ASEC Neutron Monitors

Aragats Neutron Monitor 18NM64, consisting of 3 separate sections 6 proportional chambers in each



$$\overline{m} = \frac{\sum_{m=1}^{M} m\, N_m}{\sum_{m=1}^{M} N_m}$$

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Time series of Nor-Amberd Neutron Monitor, Different Dead-Times

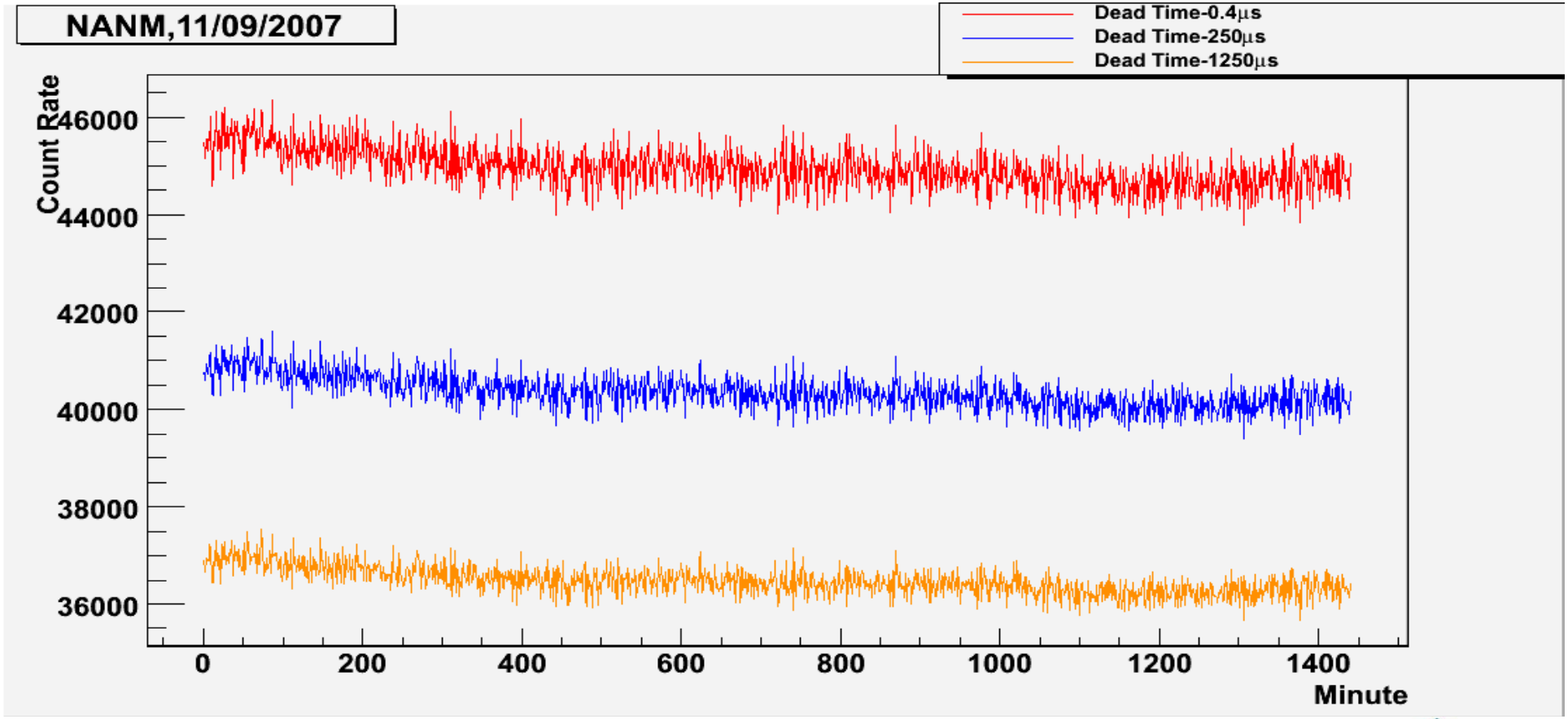


Table 1 NANM, Dead Time-1250mus, Correlation Matrix (%)

Det	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	100	15	4	3	3	5	1	-2	0	4	4	-1	-2	8	-1	2	3	1
2	15	100	14	4	4	-1	-1	0	2	3	3	1	1	3	0	5	3	2
3	4	14	100	12	5	3	1	2	3	2	0	6	2	1	-1	3	5	3
4	3	4	12	100	14	2	2	2	2	0	3	2	3	0	-2	2	2	4
5	3	4	5	14	100	16	4	3	5	0	6	2	7	1	6	6	6	2
6	5	-1	3	2	16	100	5	1	3	-1	2	1	2	3	8	3	1	4
7	1	-1	1	2	4	5	100	14	2	-1	-2	2	0	1	-2	0	0	0
8	-2	0	2	2	3	1	14	100	15	2	4	-1	3	2	-3	1	1	-1
9	0	2	3	2	5	3	2	15	100	18	6	5	-2	0	5	5	-3	0
10	4	3	2	0	0	-1	-1	2	18	100	16	4	1	2	3	3	2	-1
11	4	3	0	3	6	2	-2	4	6	16	100	17	6	3	3	3	2	4
12	-1	1	6	2	2	1	2	-1	5	4	17	100	3	0	1	-2	0	-1
13	-2	1	2	3	7	2	0	3	-2	1	6	3	100	17	5	3	-1	3
14	8	3	1	0	1	3	1	2	0	2	3	0	17	100	11	6	0	1
15	-1	0	-1	-2	6	8	-2	-3	5	3	3	1	5	11	100	12	5	5
16	2	5	3	2	6	3	0	1	5	3	3	-2	3	6	12	100	15	3
17	3	3	5	2	6	1	0	1	-3	2	2	0	-1	0	5	15	100	15
18	1	2	3	4	2	4	0	-1	0	-1	4	-1	3	1	5	3	15	100

Investigation of multiple detection of thermalized neutrons by neighboring proportional chambers

The model of experimental situation can be described as follows:

- Simulate 2 independent time series (**X** and **Y**) with means and variances equal to ones measured by Neutron Monitor proportional chambers; check that there is no correlation between counts.
- Change initial time series according to equations:

$$A = x + z$$

$$B = y + z$$

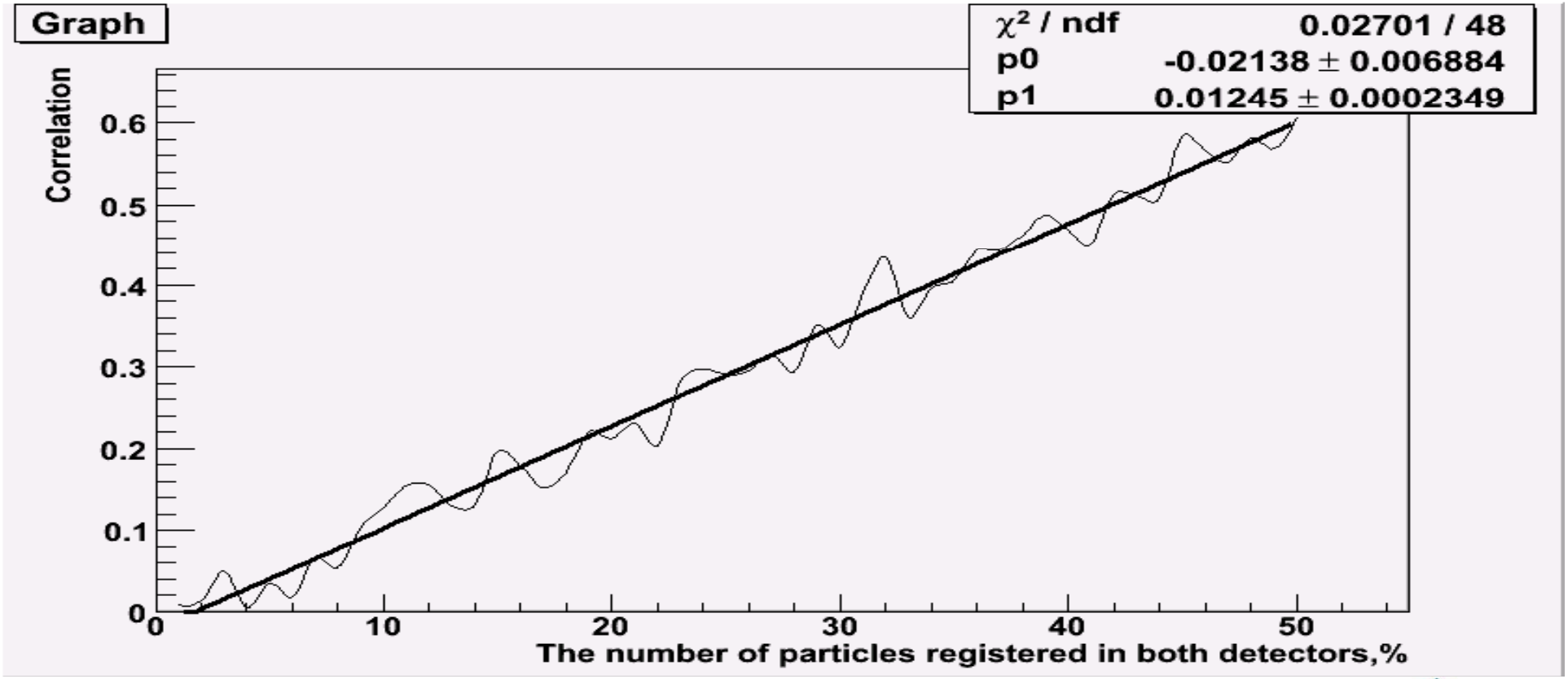
Where x and y belongs to X and Y and z is small constant addition (proxy of events registered by both counters). Instead of changing z value, it is more appropriately to change the p value-addition scaled to the mean count rate:

$$z = \frac{A+B}{2} * \frac{p}{100}$$

Where means of the random processes **X** and **Y** (proxies of 1 minute means of proportional chamber count rates).

- Calculate time series A and B for different values of p.
- Calculate the correlation coefficient for each value of p.

Dependence of correlation and p-value for ARNM and NANM

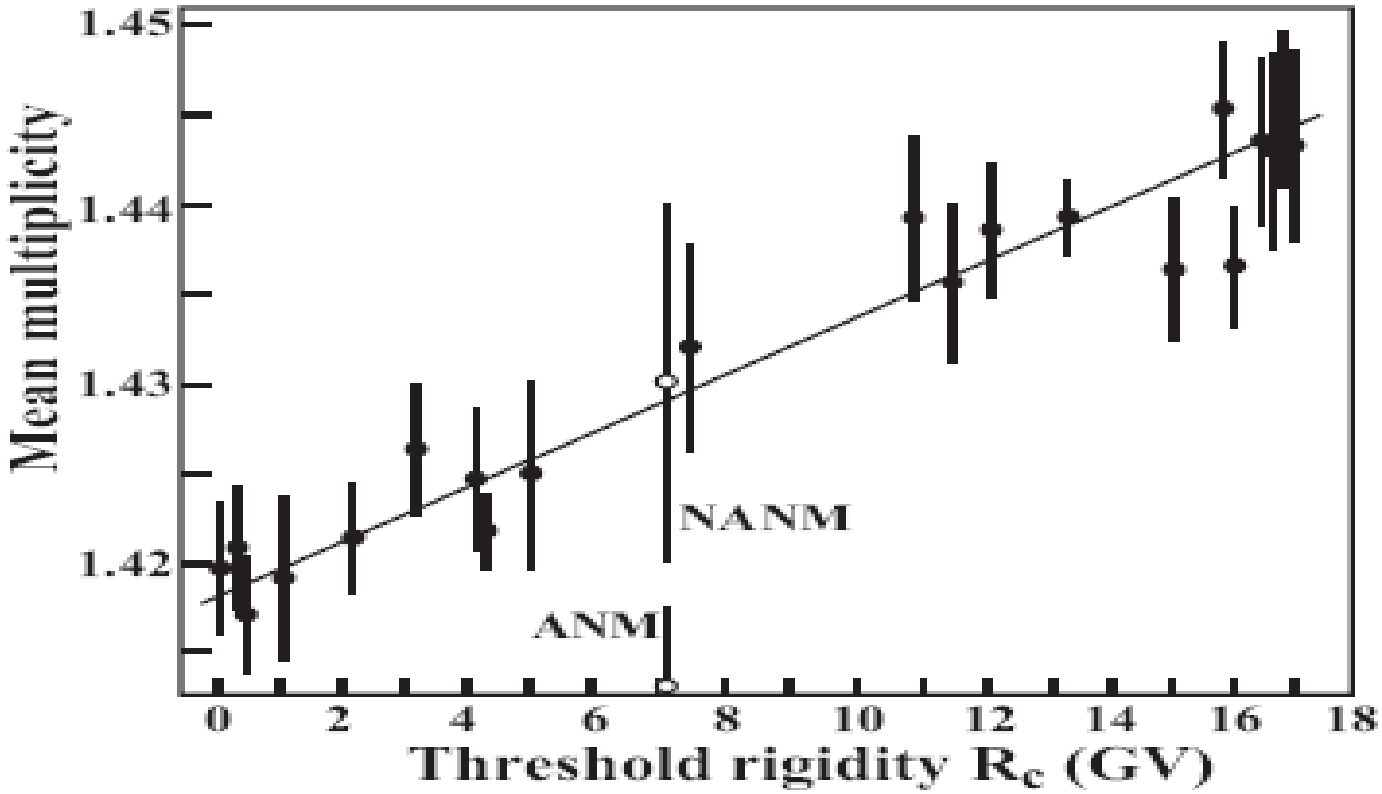


Mean Multiplicity Coefficients of Neutrons

$$\overline{m}^{i} = \frac{N^{i}_{0.4}}{N^{i}_{1250} - N^{i}_{double}}$$

	Section1	Section2	Section3	NM Median
ANM	1.41±0.009	1.40±0.008	1.37±0.009	1.40
NANM	1.44±0.013	1.43±0.012	1.42±0.012	1.43

The dependence of mean multiplicity on the cutoff rigidity with Aragats and Nor Amberd neutron monitors mean multiplicities superimposed (measurements by ship borne 3NM-64 of IQSY type in December 1966 – April 1967, Kodama & Ishida, 1967)



Daily variation in intensity of different species of secondary cosmic rays as measured by the particle detectors of Aragats Space Environmental Center at minimum of solar activity

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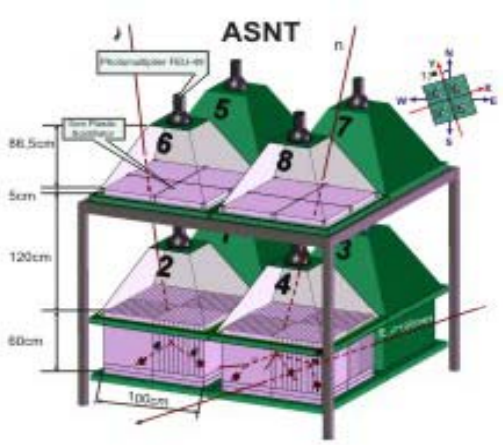
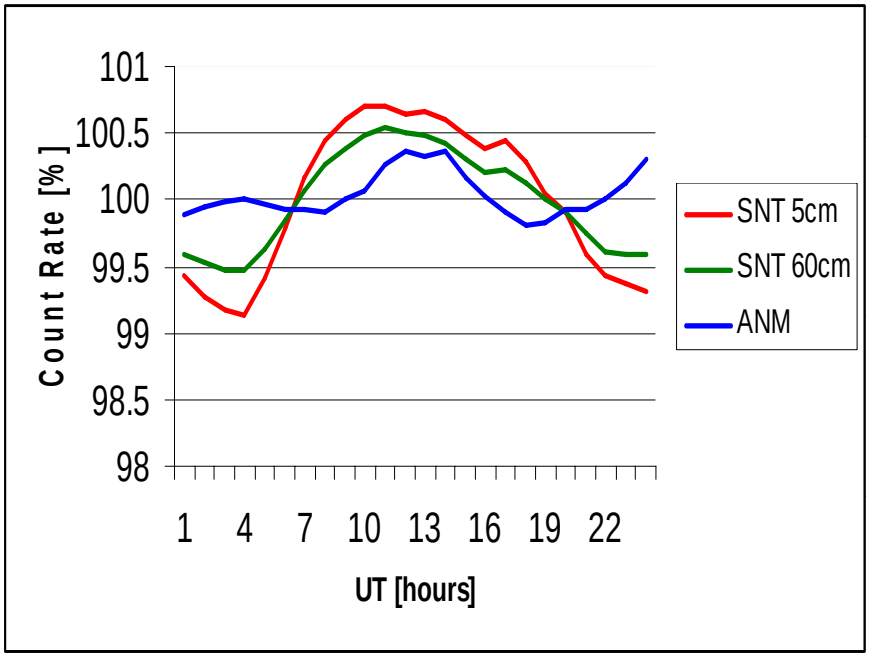
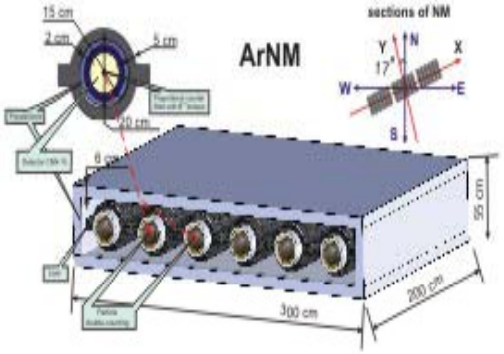
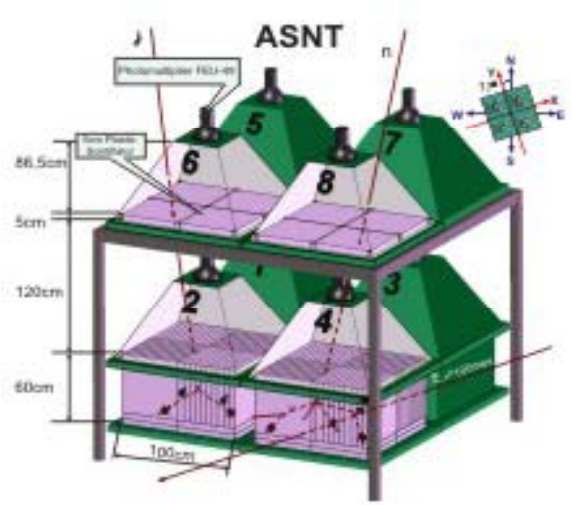
Comparison of daily changes of secondary cosmic rays detected by detectors sensetive to neutral (ANM, SNT 60 cm) and charged (SNT 5 cm) fluxes. Aragats, 3200 m

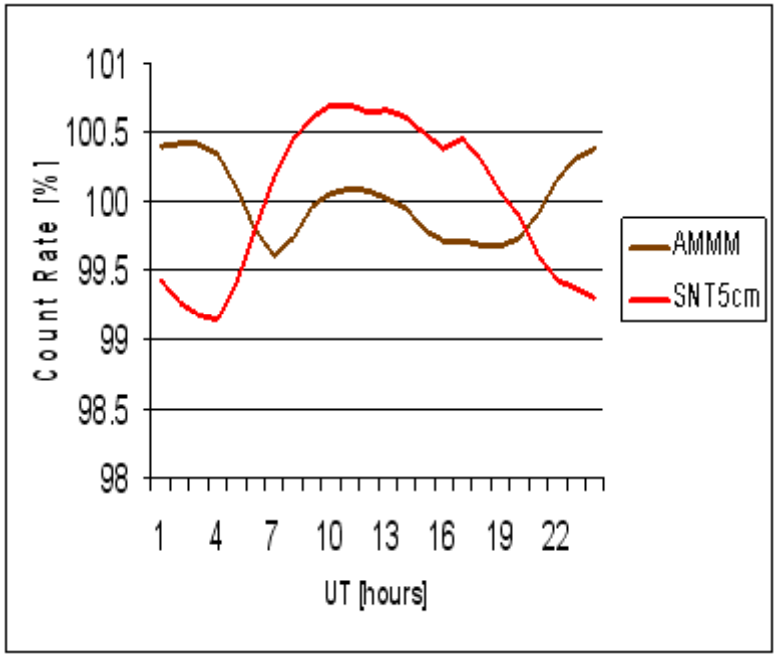


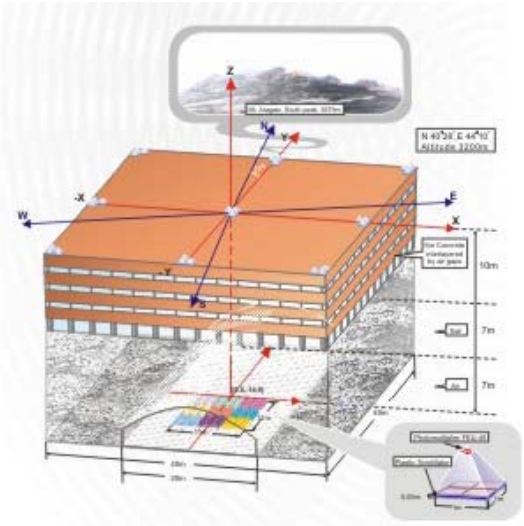




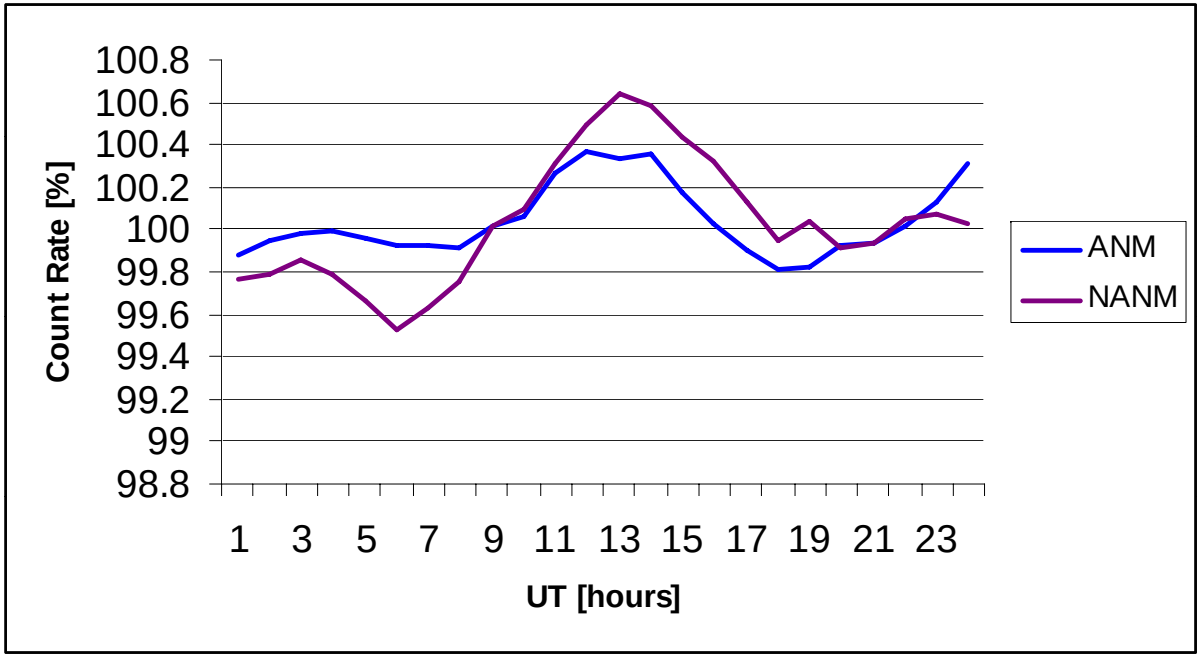
Comparison of daily changes of secondary cosmic rays detected by detectors sensetive to high (AMMM) and low energy charged (SNT 5 cm) fluxes. Aragats, 3200 m







Comparison of daily changes of neutrons at 3200m and 2000m above sea level



Maximum and minimum of daily variations of all monitors in percents and corresponding times in UT

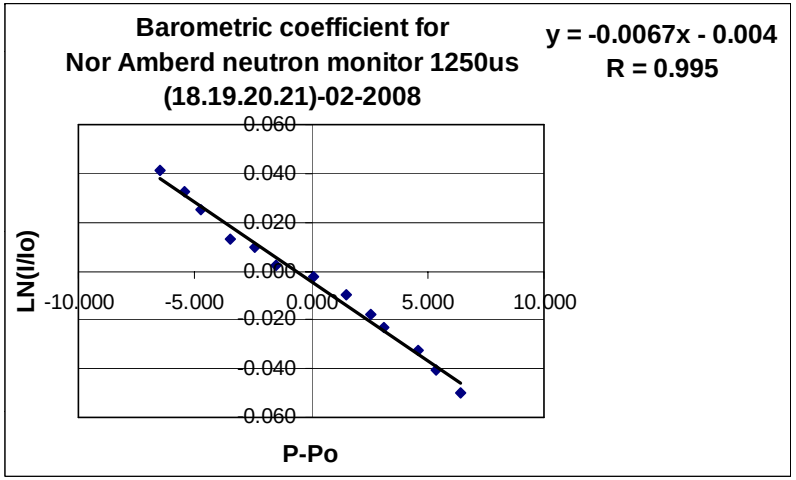
Monitor	Amplitude and time of minimum (s)	Amplitude and time of maximum(s)
AMMM	07:00, -0.39%	01:00, 0.41% 12:00, 0.15%
SNT 5cm	04:00, -0.86%	11:00, 0.7%
SNT 60 cm	04:00, -0.53%	11:00, 0.53%
ANM	08:00, -0.12% 18:00, -0.18%	12:00, 0.36%
NANM	06:00, -0.47% 20:00, -0.15	13:00, 0.64%

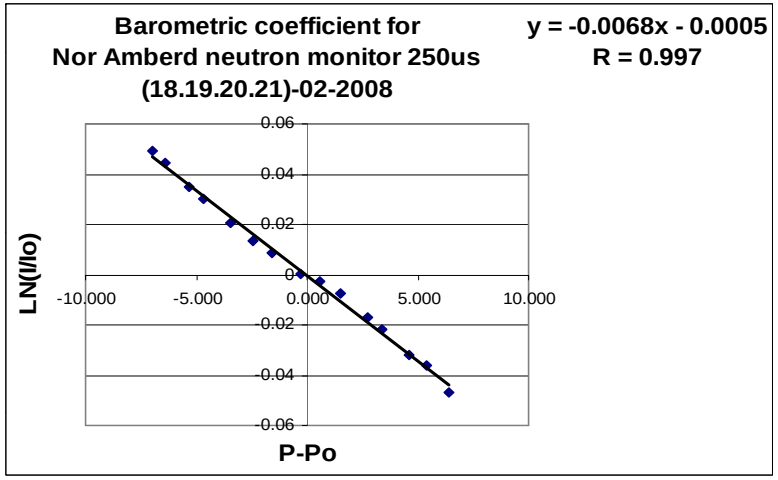
Barometric coefficients for different dead times neutron monitors electronics and for different energy threshold of muon scintillation detectors

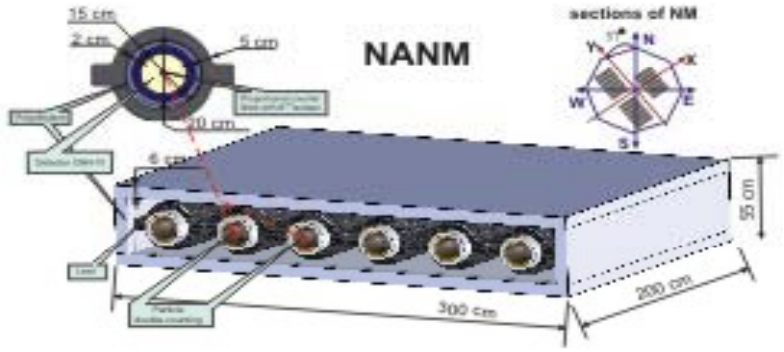
Barometric Coefficient Estimation Method

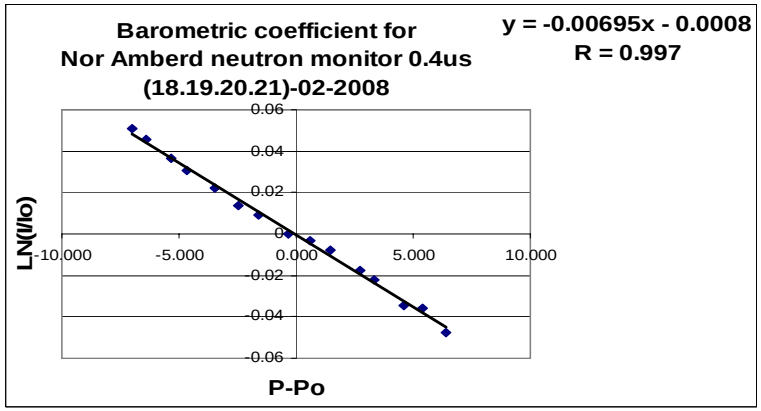
We have estimated barometric coefficient by following method. Changes in intensity secondary cosmic rays,where pressure changes from P0 to P, can be presented in a following way` $I = I_0 e^{\mu(P - P_0)}$ where μ is barometric coefficient .

Calculation of Barometric Coefficient for Nor-Amberd Neutron Monitor

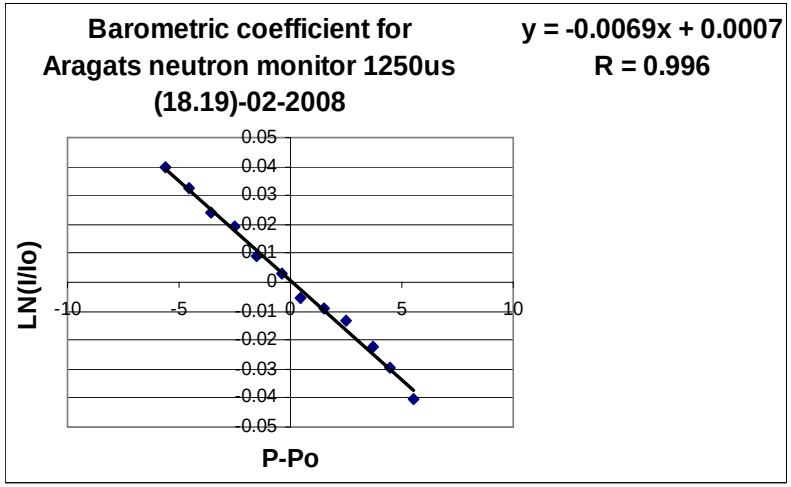


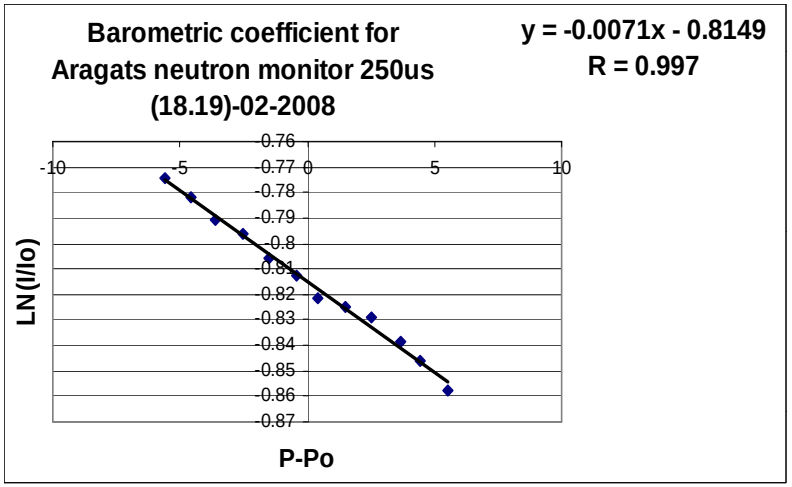


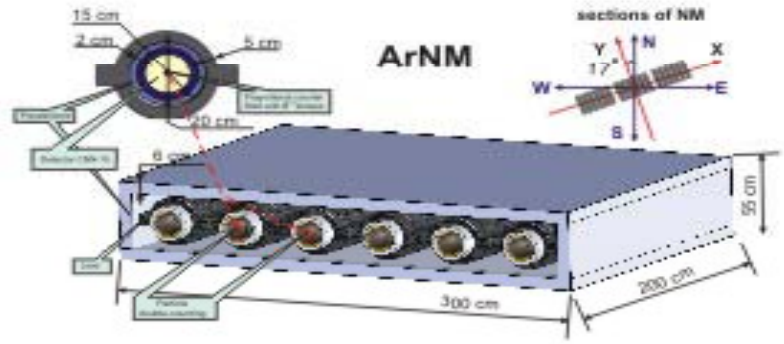


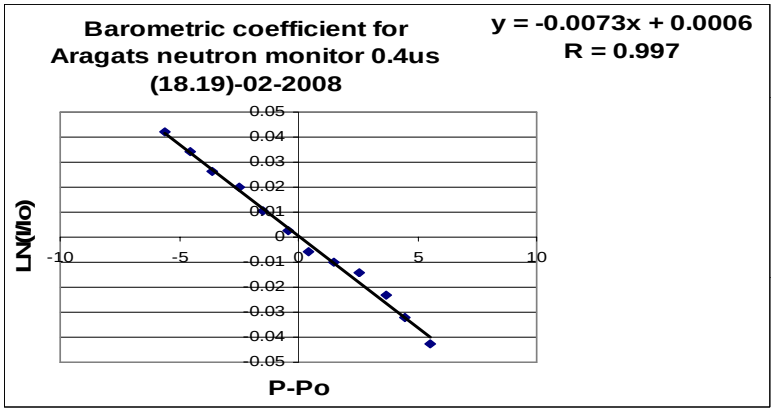


Calculation of Barometric Coefficient for Aragats Neutron Monitor

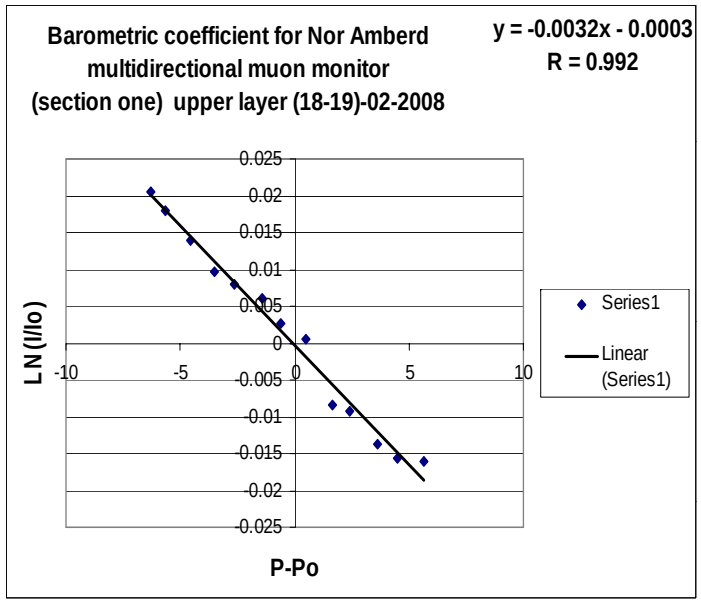


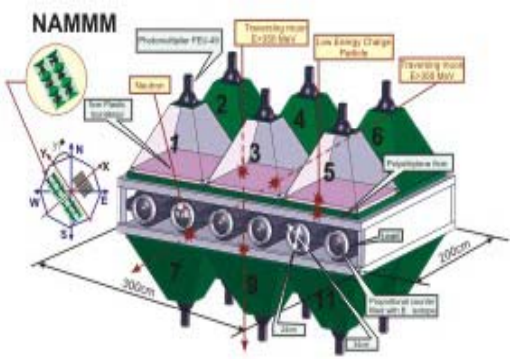


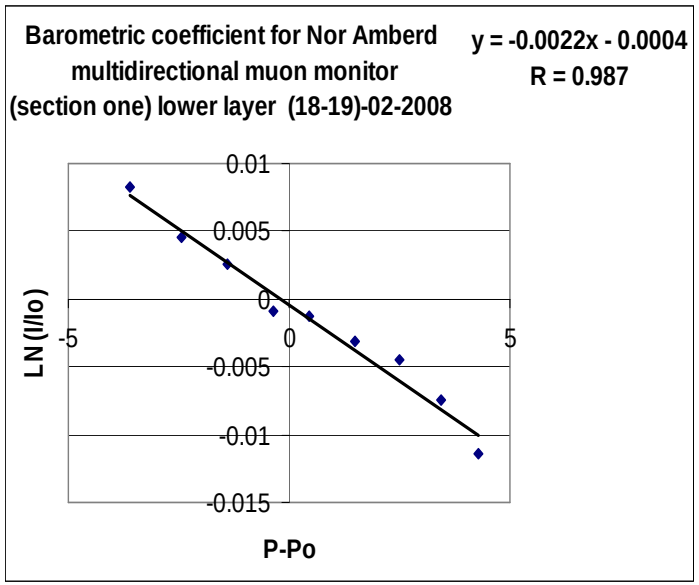




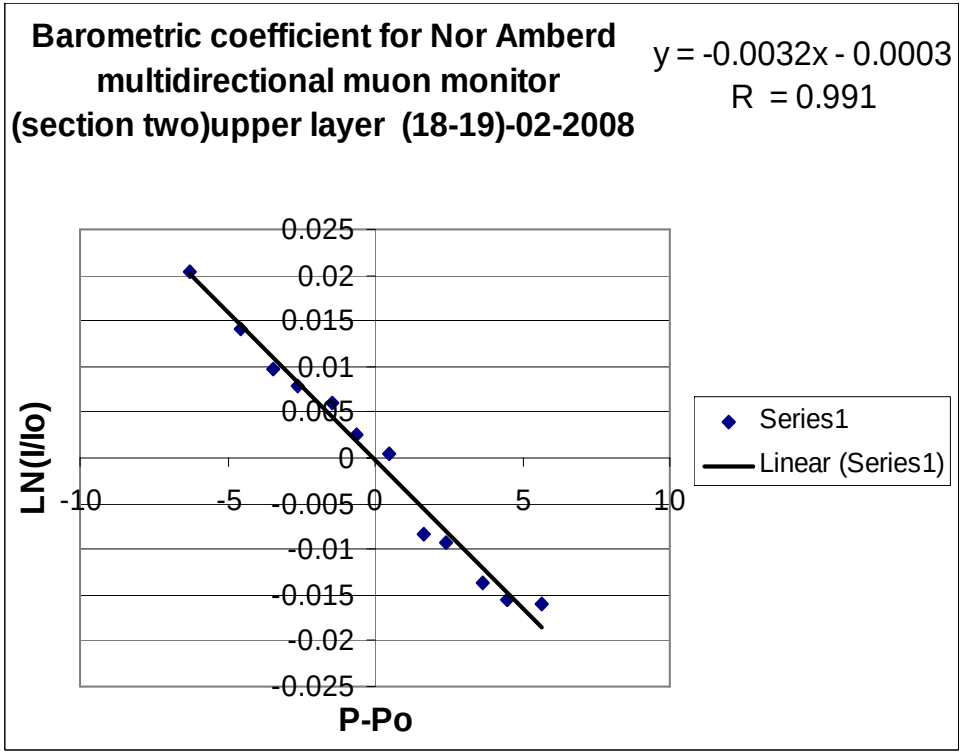
Calculation of Barometric Coefficient for Nor-Amberd Multidirectional Muon Monitor Section1

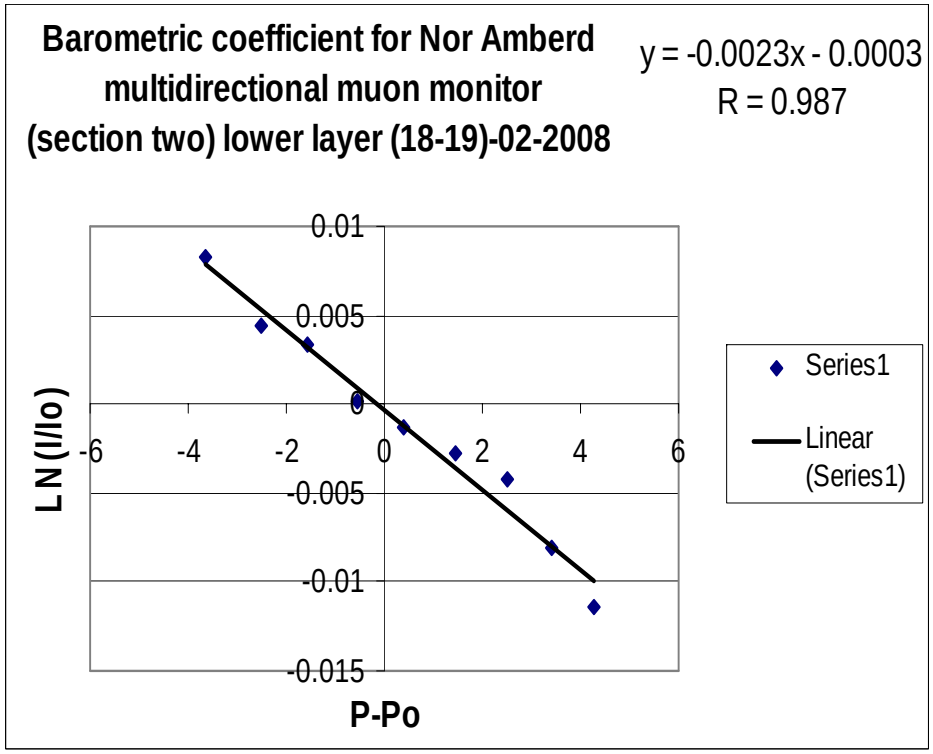




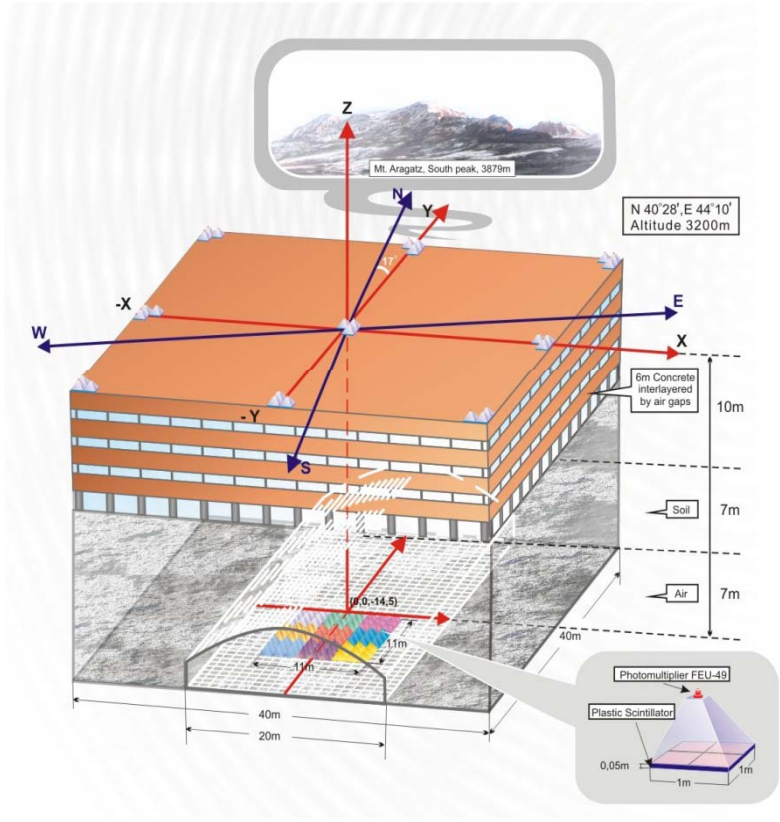


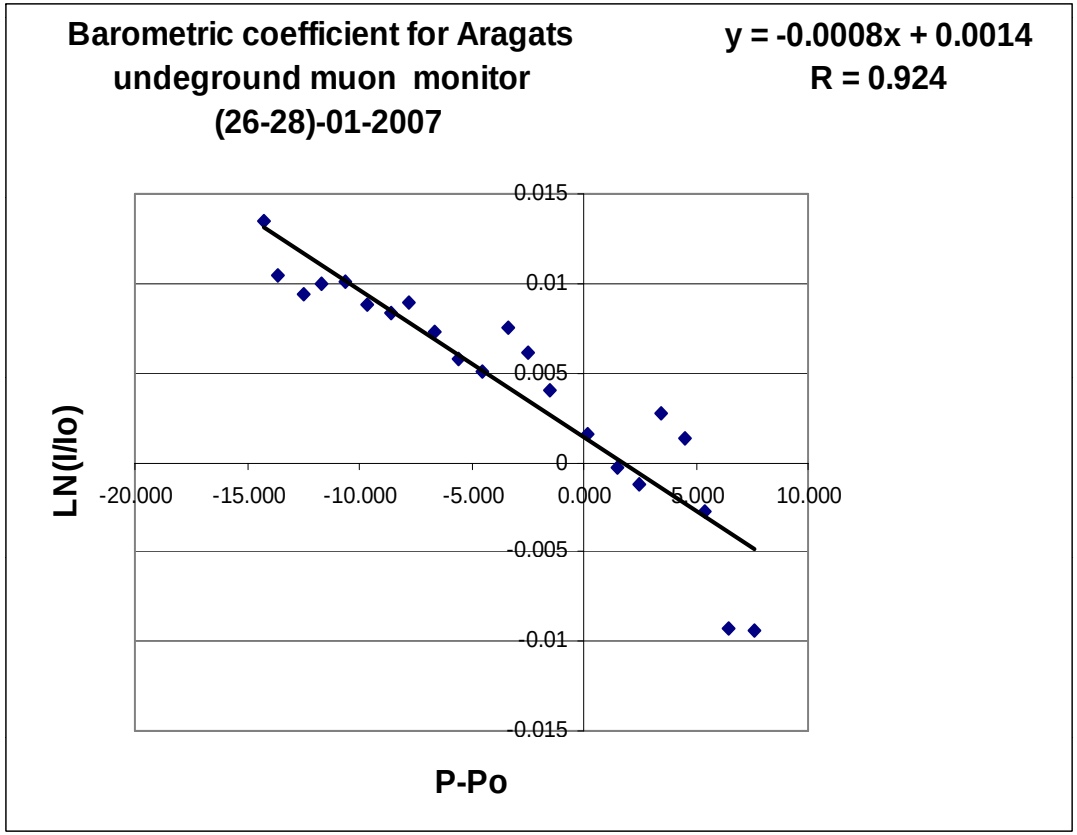
Calculation of Barometric Coefficient for Nor-Amberd Multidirectional Muon Monitor Section2





Calculation of Barometric Coefficient for Aragats Underground Moun Monitor

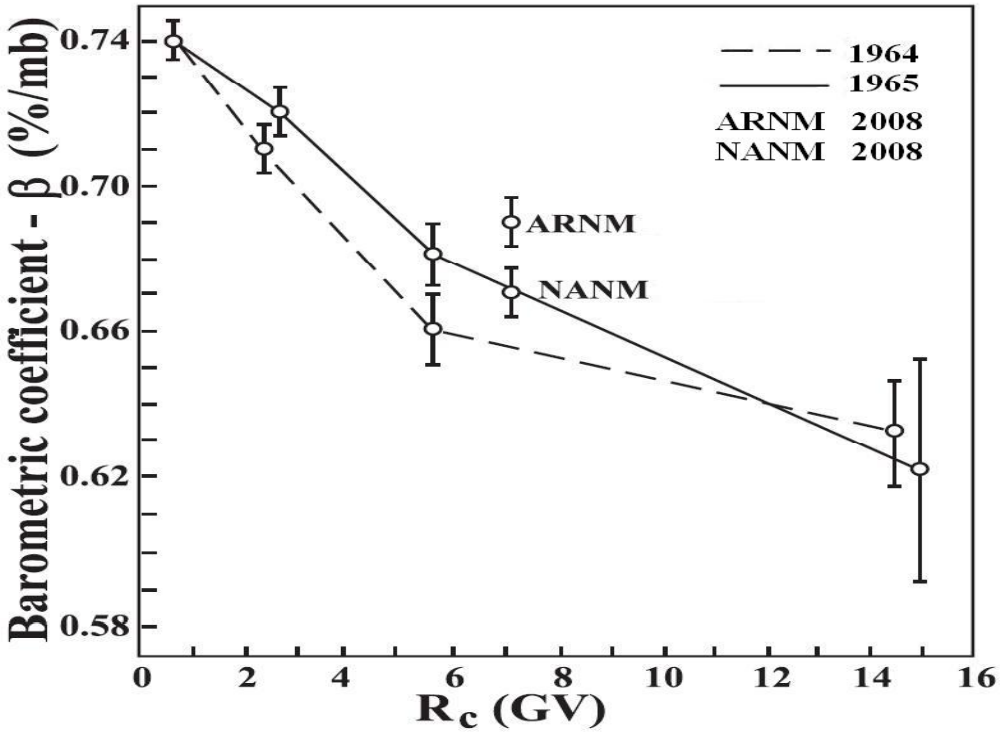




Barometric Coefficients of ASEC Monitors

MONITORS	BAROMETRIC COEFFICIENT	ERROR	CORRELATION COEFFICIENT
Nor Amberd neutron monitor 0.4us	-0.695 %/mb	± 0.0133	0.997
Nor Amberd neutron monitor 250us	-0.678 %/mb	± 0.0127	0.997
Nor Amberd neutron monitor 1250us	-0.670 %/mb	± 0.0216	0.995
Aragats neutron monitor 0.4us	-0.730 %/mb	±0.0185	0.997
Aragats neutron monitor 250us	-0.713%/mb	±0.0183	0.997
Aragats neutron monitor 1250us	-0.688%/ mb	±0.0182	0.996
Nor Amberd multidirectional muon monitor(1) (upper layer)	-0.324%/mb	±0.012	0.992
Nor Amberd multidirectional muon monitor(1) (lower layer)	-0.223%/mb	±0.0135	0.987
Nor Amberd multidirectional muon monitor(2) (upper layer)	-0.323%/mb	±0.0136	0.991
Nor Amberd multidirectional muon monitor(2) (lower layer)	-0.225%/mb	±0.0135	0.987
Aragats underground muon monitor E>5 **Gev**	-0.08%/mb	±7.57E-05	0.924

Comparison of obtained barometric coefficients with survey of Dorman and Kovalenko



Conclusions

- Calculated multiplicities, barometric coefficients and daily variations of the cosmic ray fluxes measured at the start of the 24 solar activity cycle will allow precise research of the upcoming solar events;
- The diapason of variation of the barometric coefficient from -0.73 to -0.08 demonstrates rather wide possibilities of the ASEC particle detectors to access primary rigidities from 7 till 50 GV