Forbush decreases influence on registered high energy muon flux

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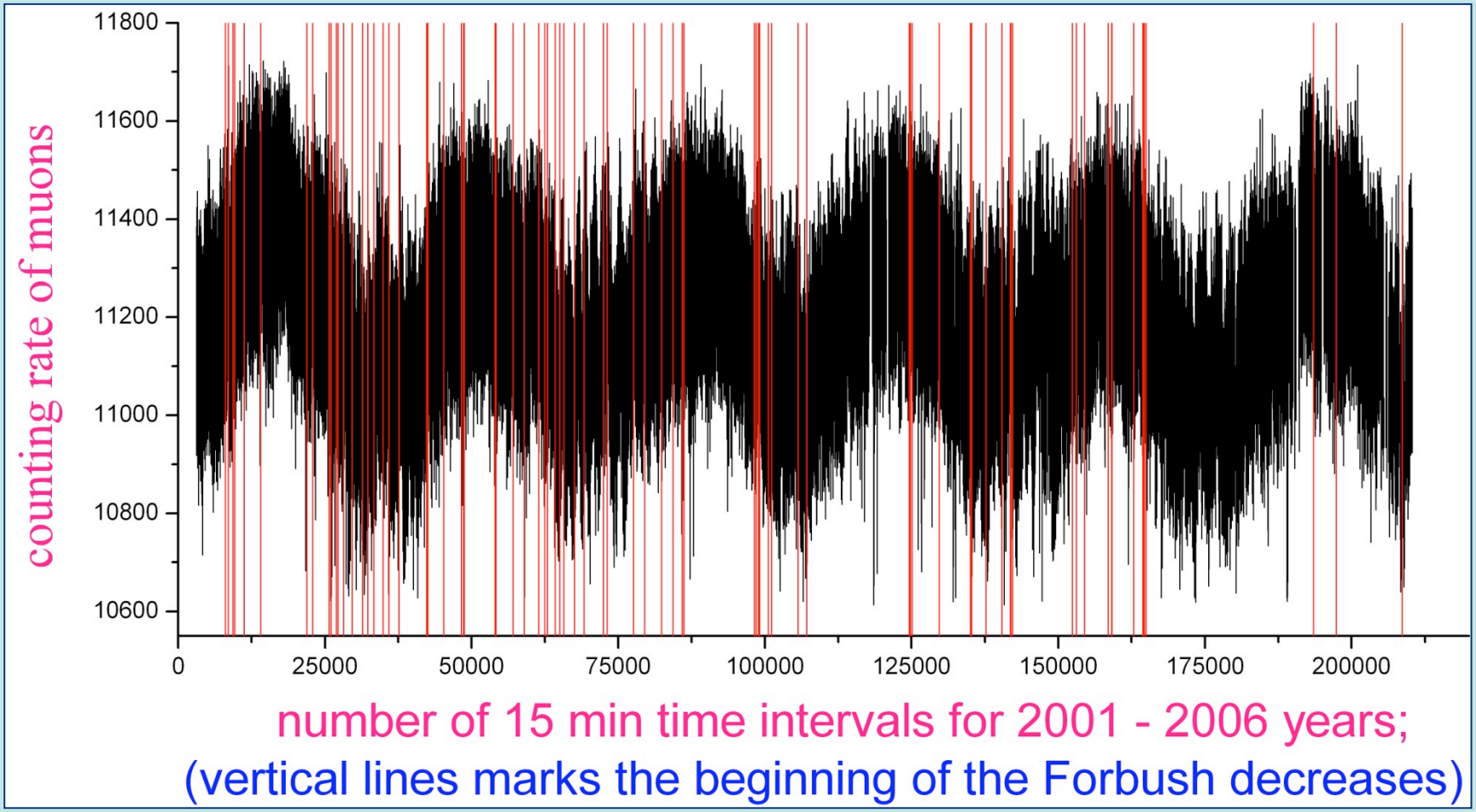
Abstract

The influence of Forbush decreases on high energy muon flux has been investigated. The flux of the high energy muons with energy threshold 220 GeV has been measured by the Baksan Underground Scintillation Telescope (BUST)[1].

The correlations between muon flux and data of the Baksan Neutron Monitor (BNM) [2] have been studied.

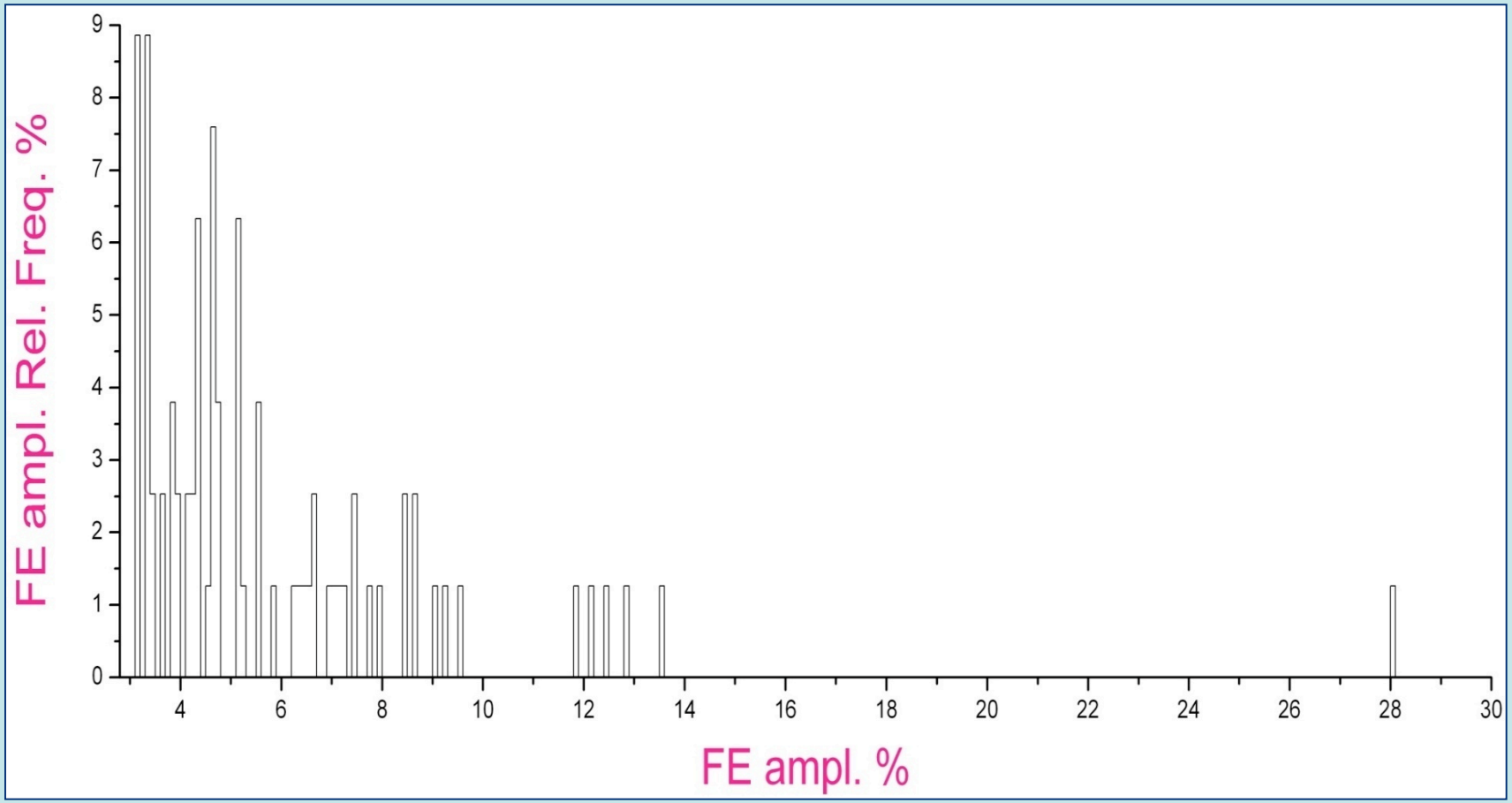
1. E.N. Alexeyev et al., Proc. 16th ICRC, Kyoto, v.10, p.276, 1979.
2. S.N. Karpov et al., International Journal of Modern Physics A, v. 20, No.29, 6696, 2005.

Vertical axis: counting rate of muons (CRM) Baksan underground scintillation telescope (BUST) per15 min.,
horizontal axis: number of 15 min. time intervals for 2001 - 2006 years.
Vertical lines marks the beginning of the identified Forbush decreases.



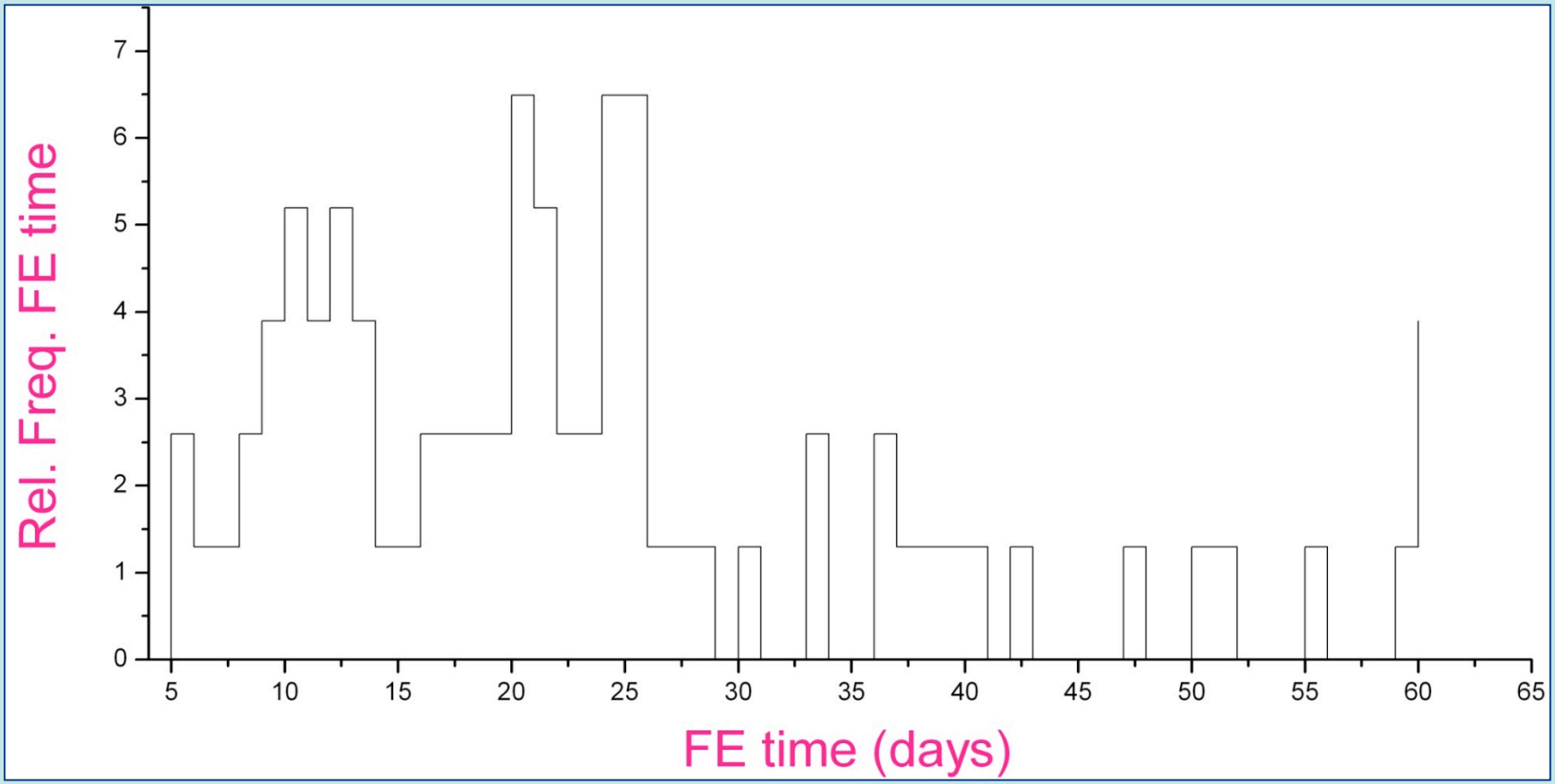
Statistical characteristics of identified Forbush decreases.

Horizontal axis: the amplitude of the Forbush effect (in percentage).
Vertical axis: relative frequency of the amplitudes of the Forbush effect (in percentage).



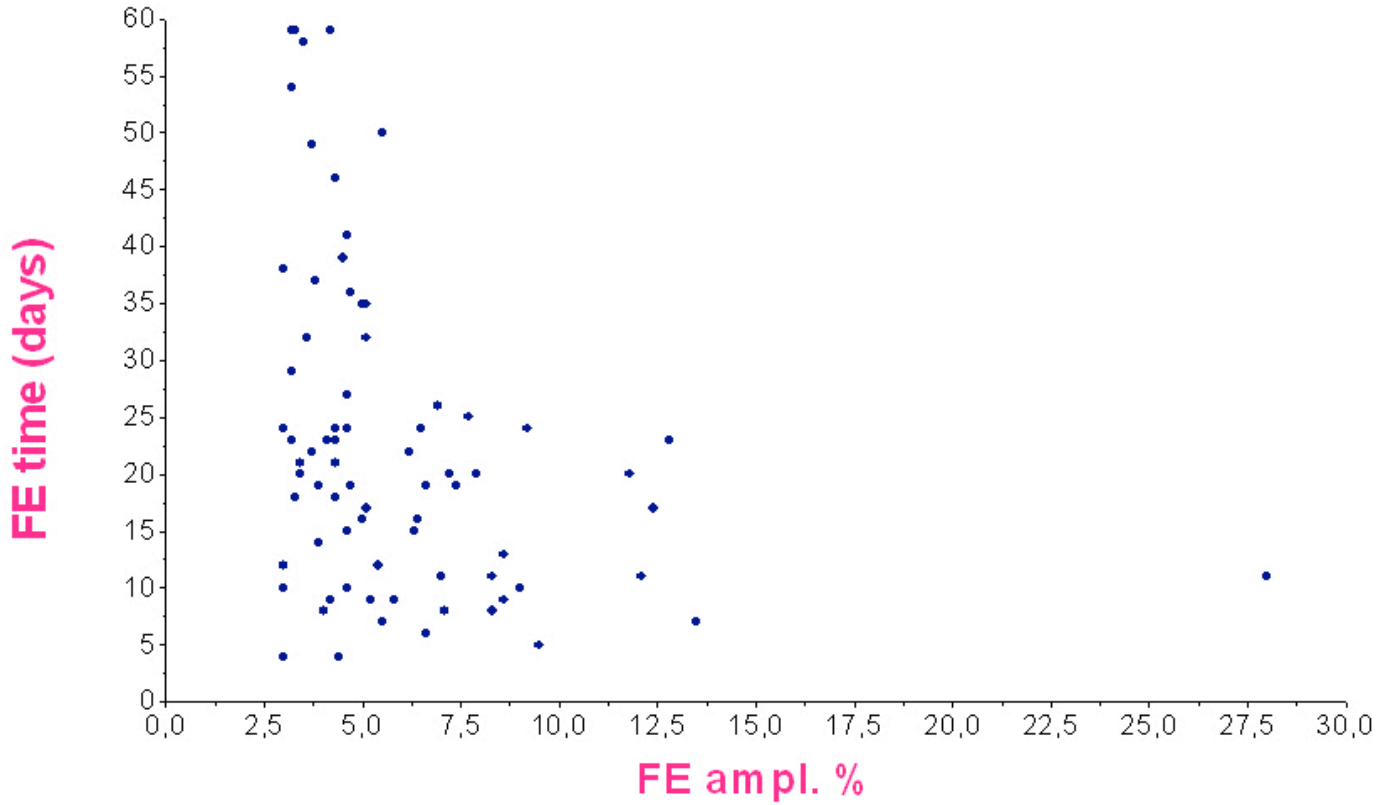
Statistical characteristics of identified Forbush decreases.

Horizontal axis: the time of the Forbush effect (the time needed to restore the Forbush decrease, days),
vertical axis: relative frequency of the times of the Forbush effects (in percentage).

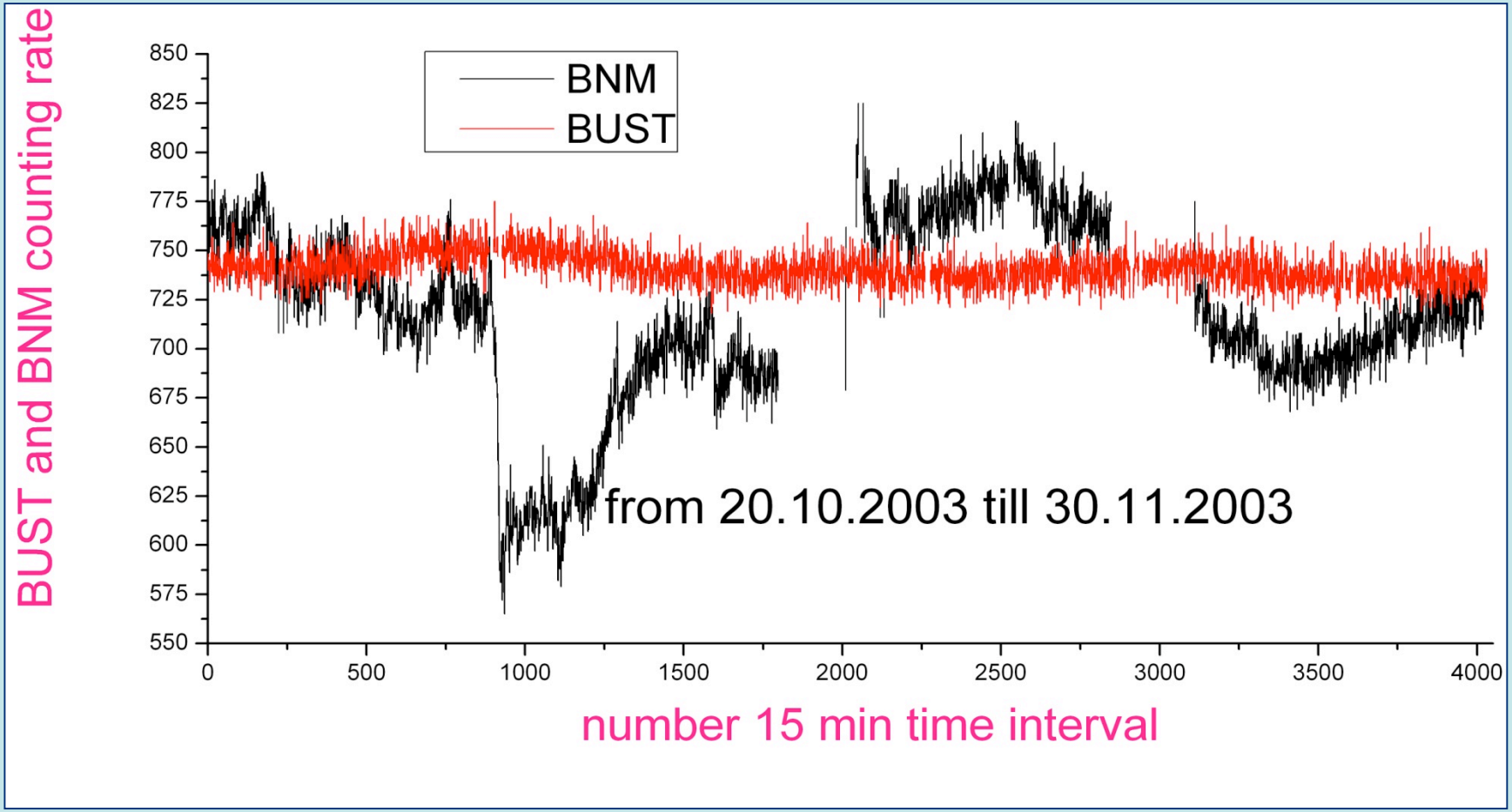


Correlations between the time and amplitude of the Forbush effect.

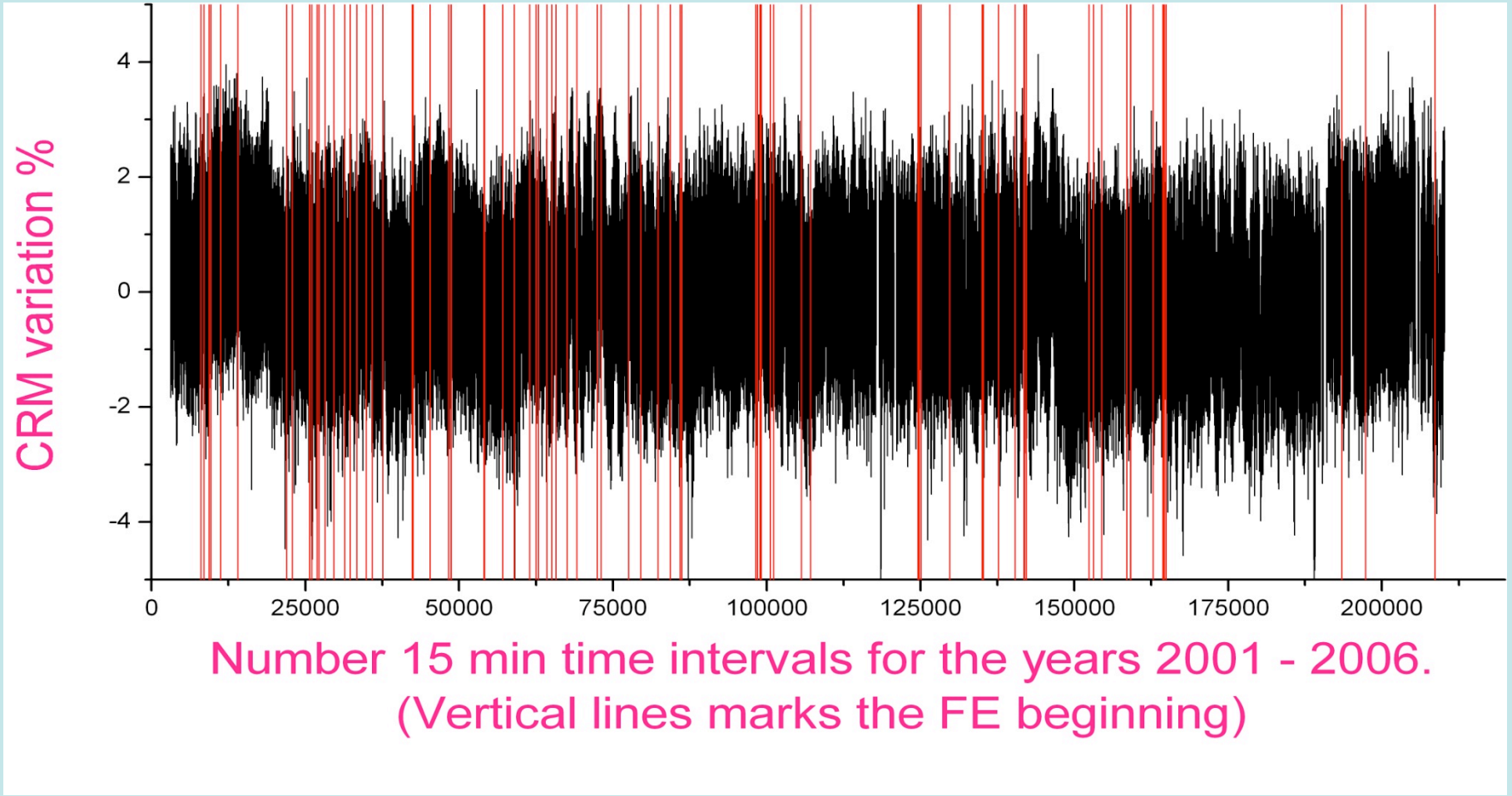
Pearson Corr .= -0,30543



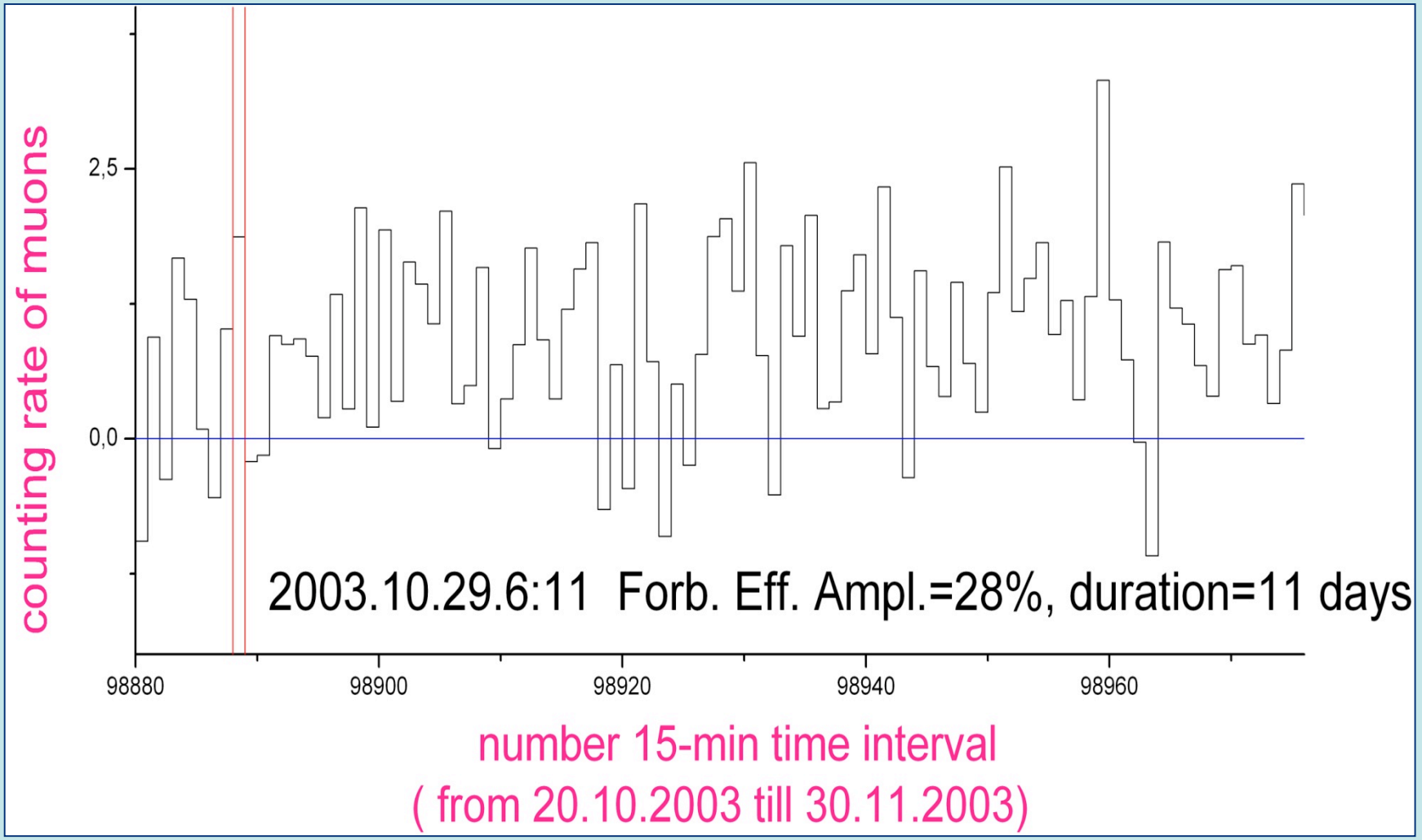
Horizontal axis: number 15 min time intervals for the period from 20.10.2003 till 30.11.2003, in the during of which take place the 28%-Forbush decrease. Vertical axis: counting rate of BUST and Baksan neutron monitor (BNM) per 1 min with a resolution of 15 min. BNM data are pressure-corrected.



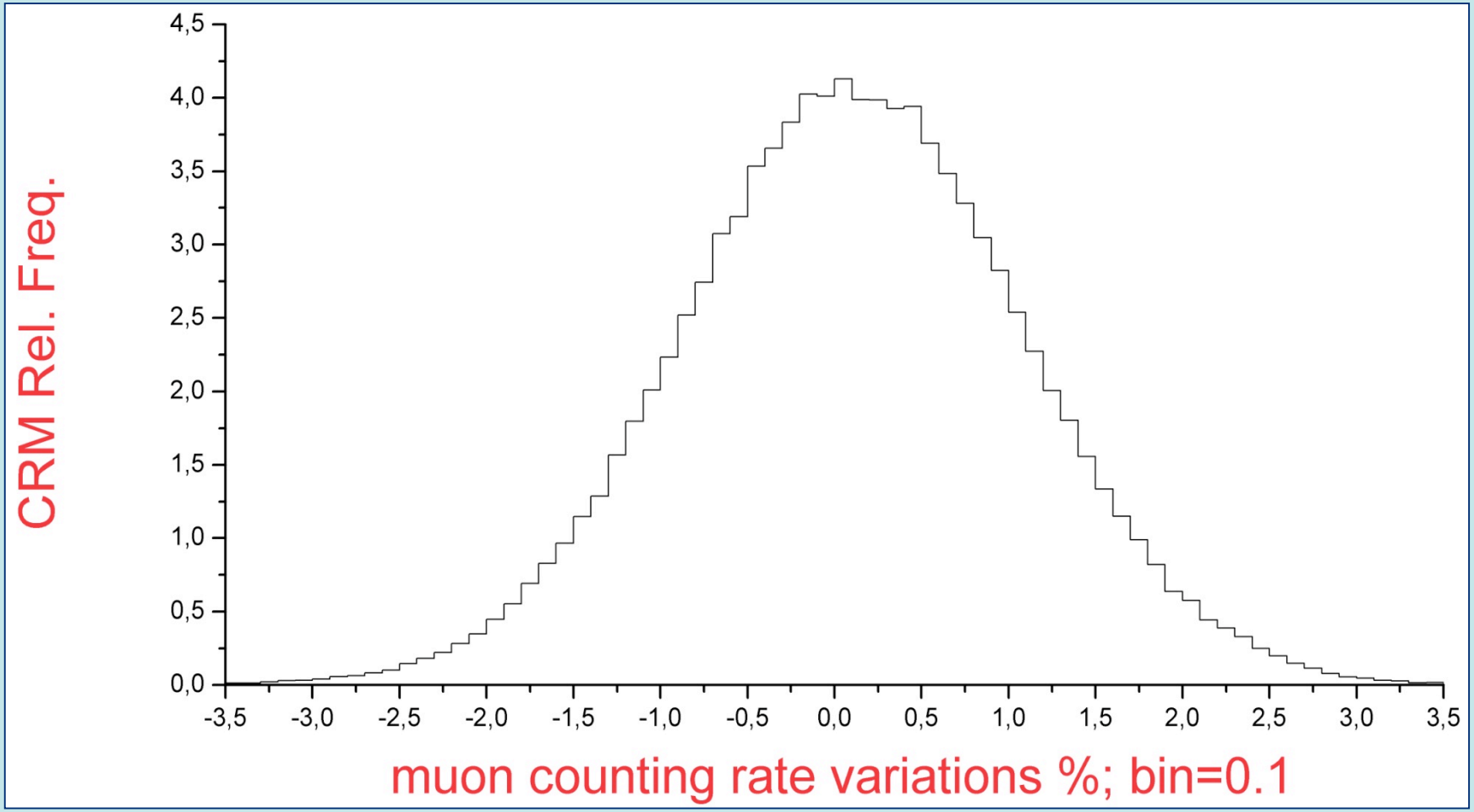
Vertical axis: variation (in percentage) of counting rate of muons BUST per 15 minutes (after deducting a trend, in which year was replaced by mean year of the summation epoch method), the horizontal axis: number of 15 min time intervals for the years 2001 - 2006.
Verticall lines marks the beginning of the Forbush effect.



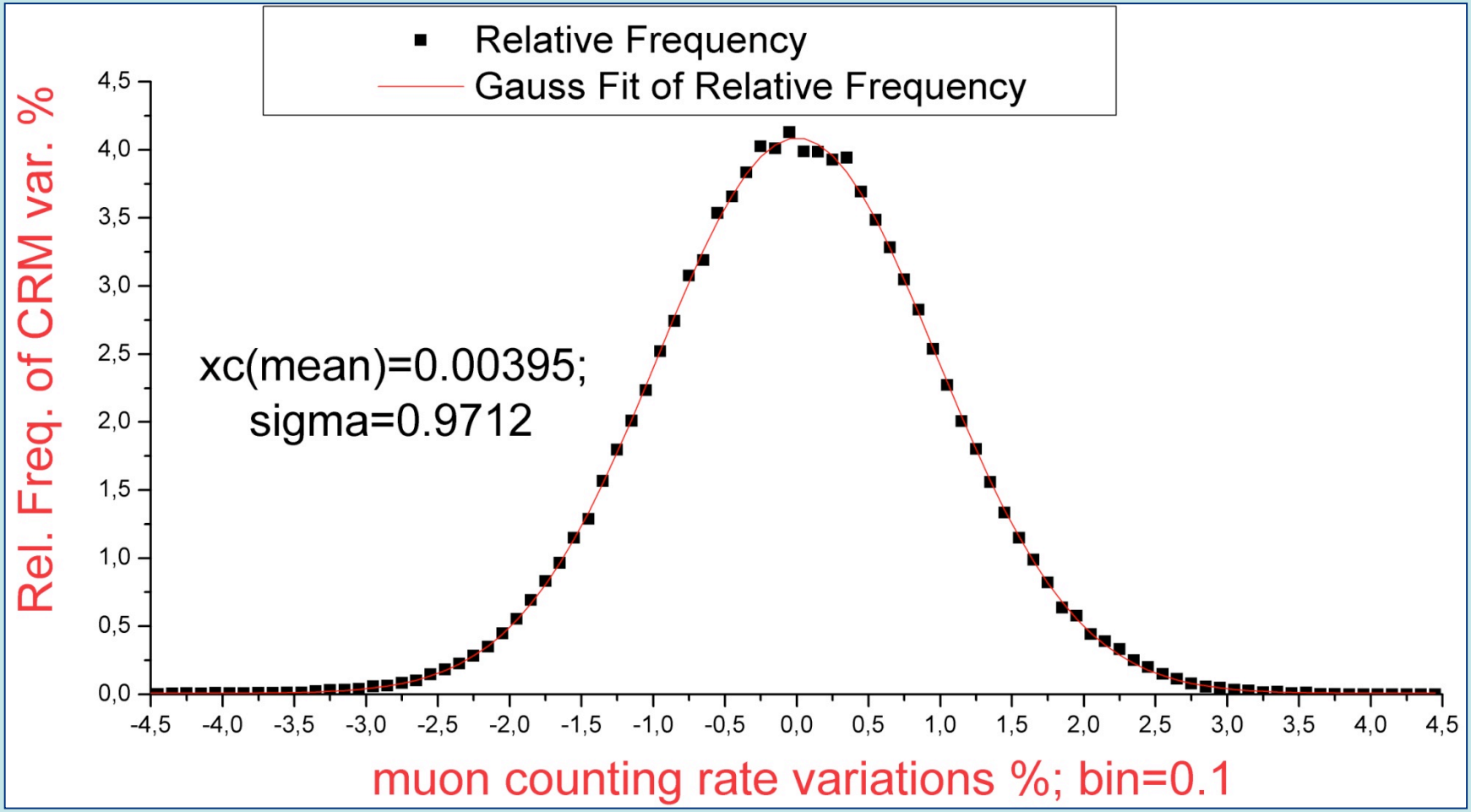
The behavior of the variations in the vicinity of a concrete (of maximal intensity: 28%) Forbush decrease:



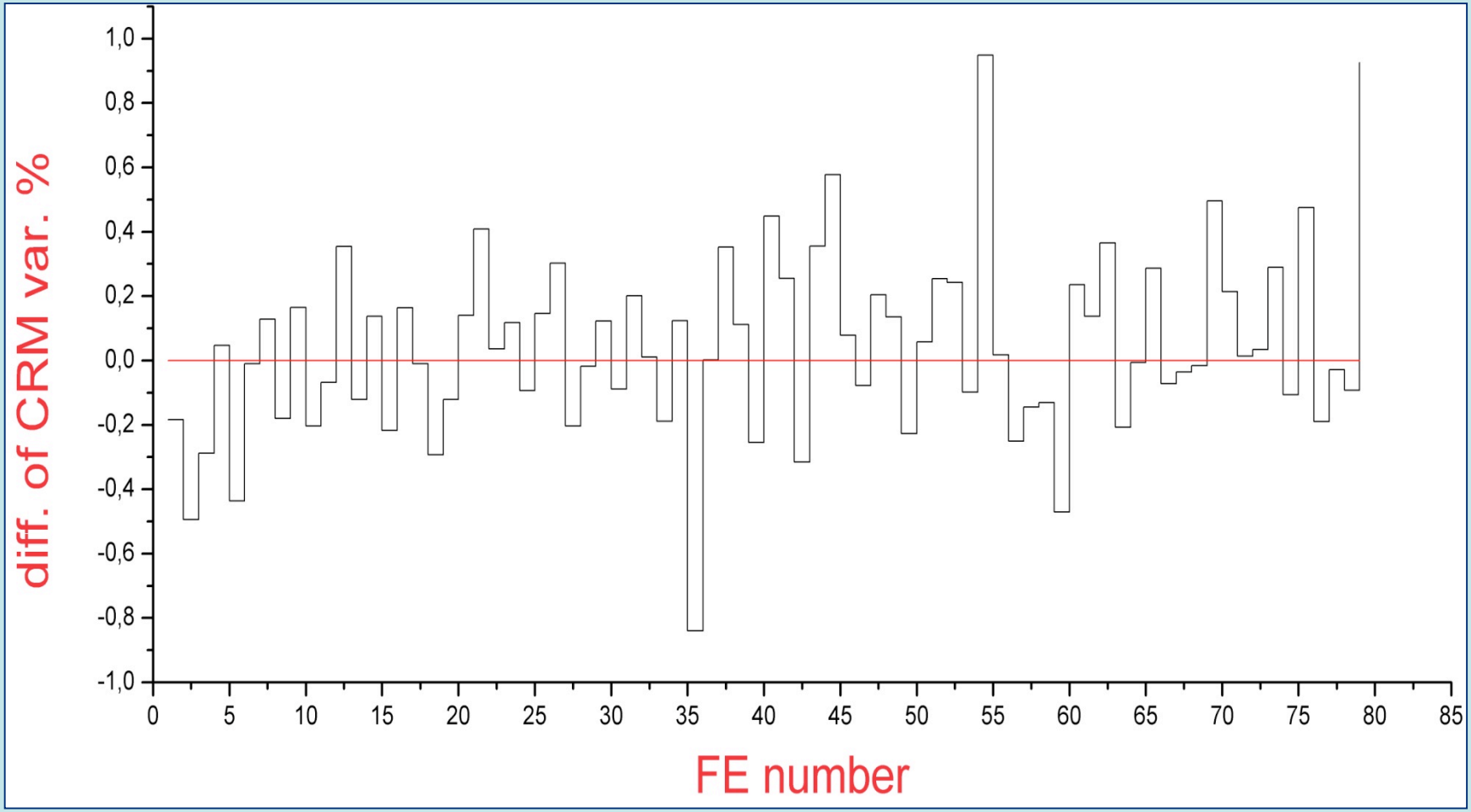
The frequencies of different values of variations CRM



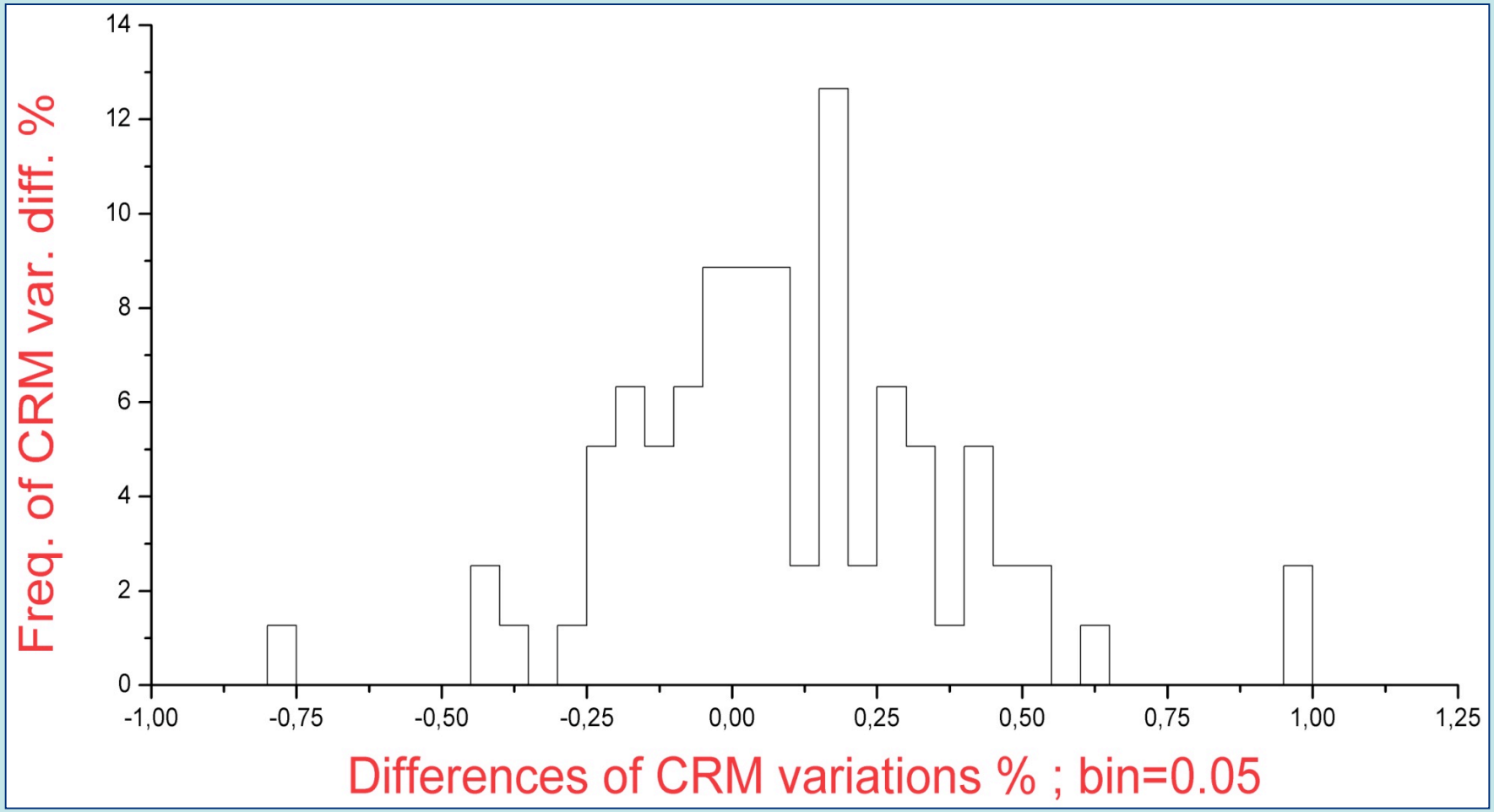
Ilustration of the proximity of the frequency distribution of CRM variations to normal:
mean = 0.00395; σ = 0.9712.

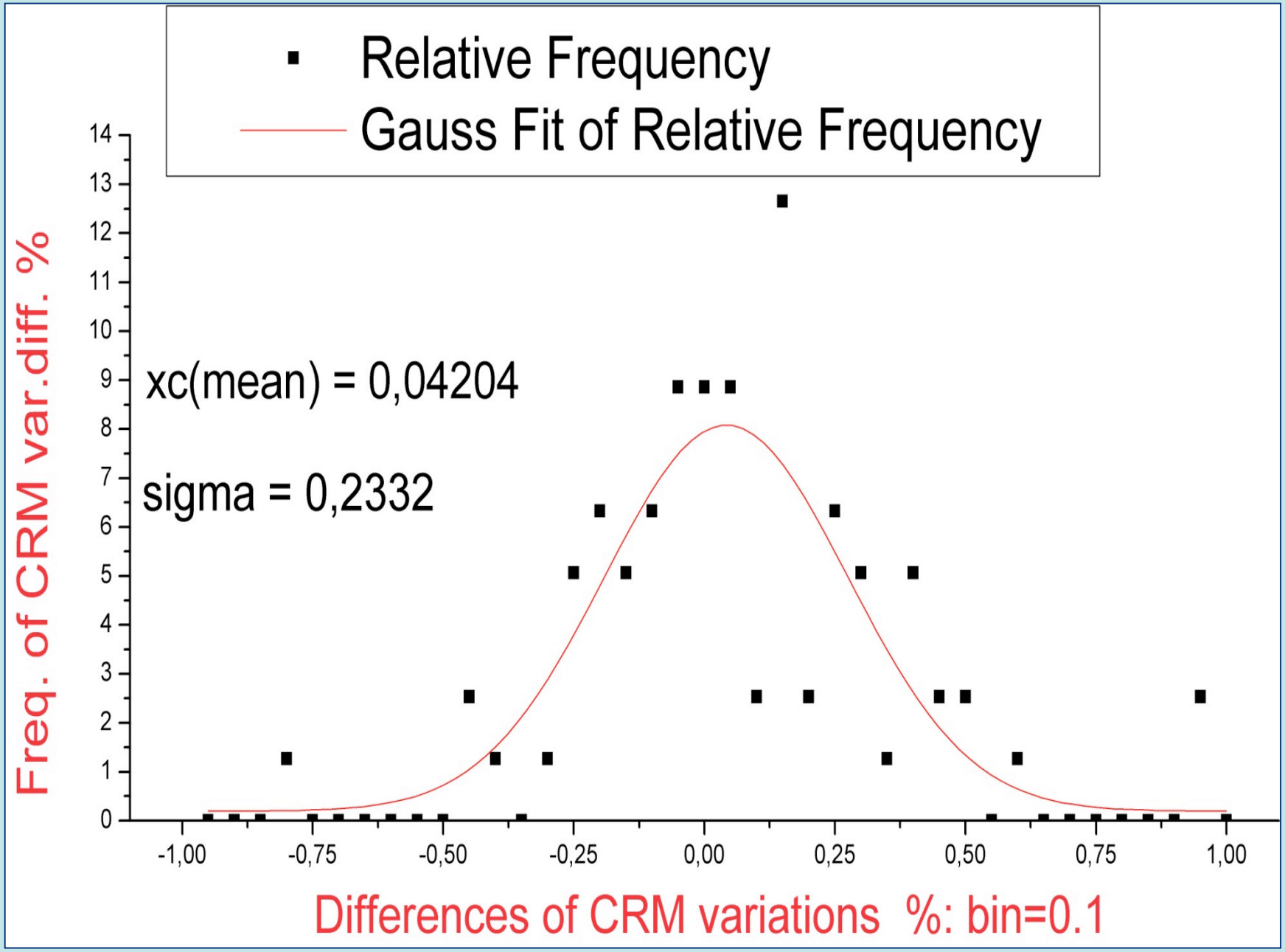


The dependence of the differences (averaged over 1 day) of the CRM variations before and after the Forbush effect for all Forbush effects.

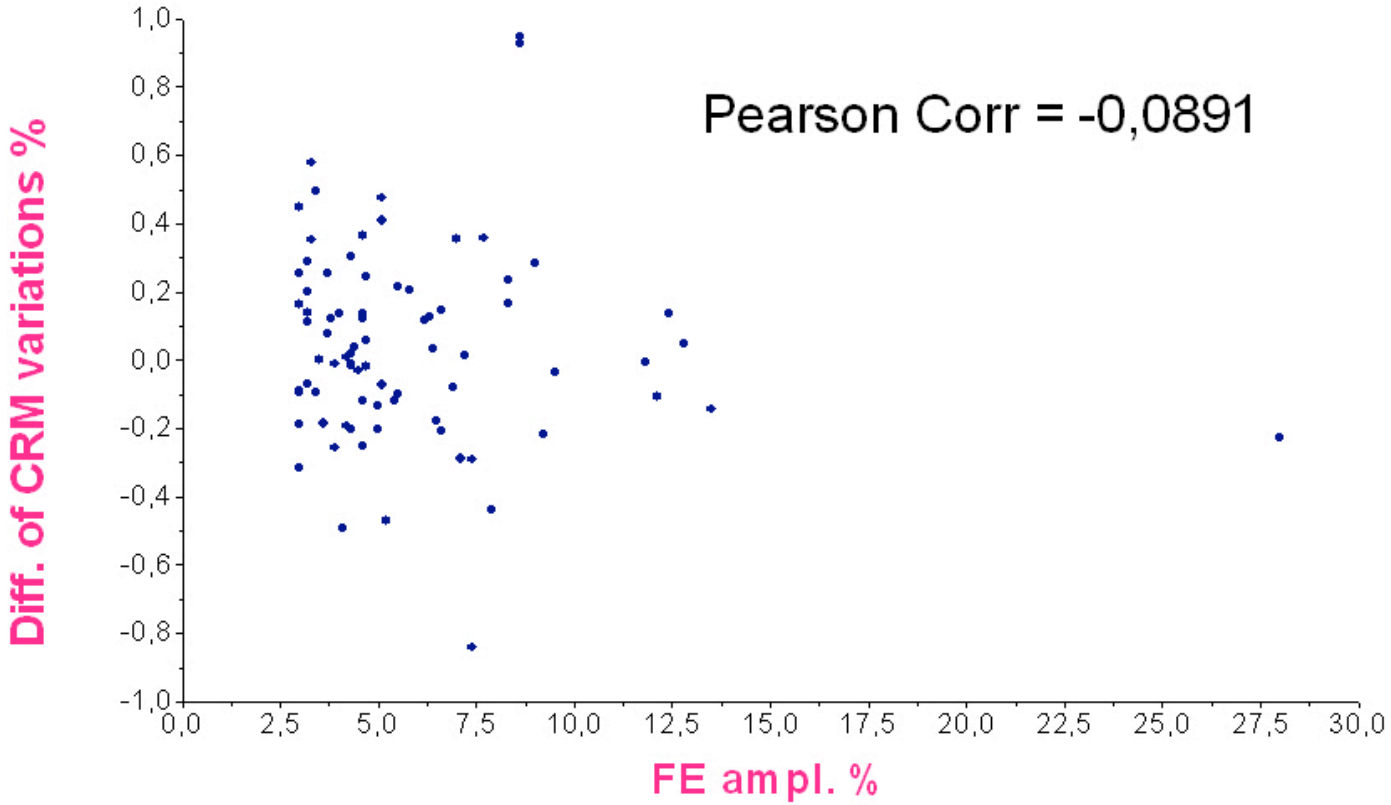


Frequency of differences of variations CRM in the vicinity of the Forbush-effects




Relative Frequency
Gauss Fit of Relative Frequency
xc(mean) = 0,04204
sigma = 0,2332
Freq. of CRM var.diff. %
Differences of CRM variations %: bin=0.1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
-1,00
-0,75
-0,50
-0,25
0,00
0,25
0,50
0,75
1,00

Correlation between the differences of CRM variations and the amplitudes of Forbush effects; scatter of points



Conclusion

1. Visually, the Forbush effect on CRM of high energy is not identified.

2. After selecting the trend, in which year was replaced by an average year in the frame of the summation epoch method, Forbush effect is also not visually identified, the distribution of values of variation of CRM is close to normal.

3. In the distribution of differences of variations before and after Forbush effect is not illustrated trends to the prevalence of decreases.Constraint (limitation): differences smaller then 1% are not observed.

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4. Within the statistical accuracy of the experiment on the BUST Forbush effects in the study of variations of the CRM may be neglected.