

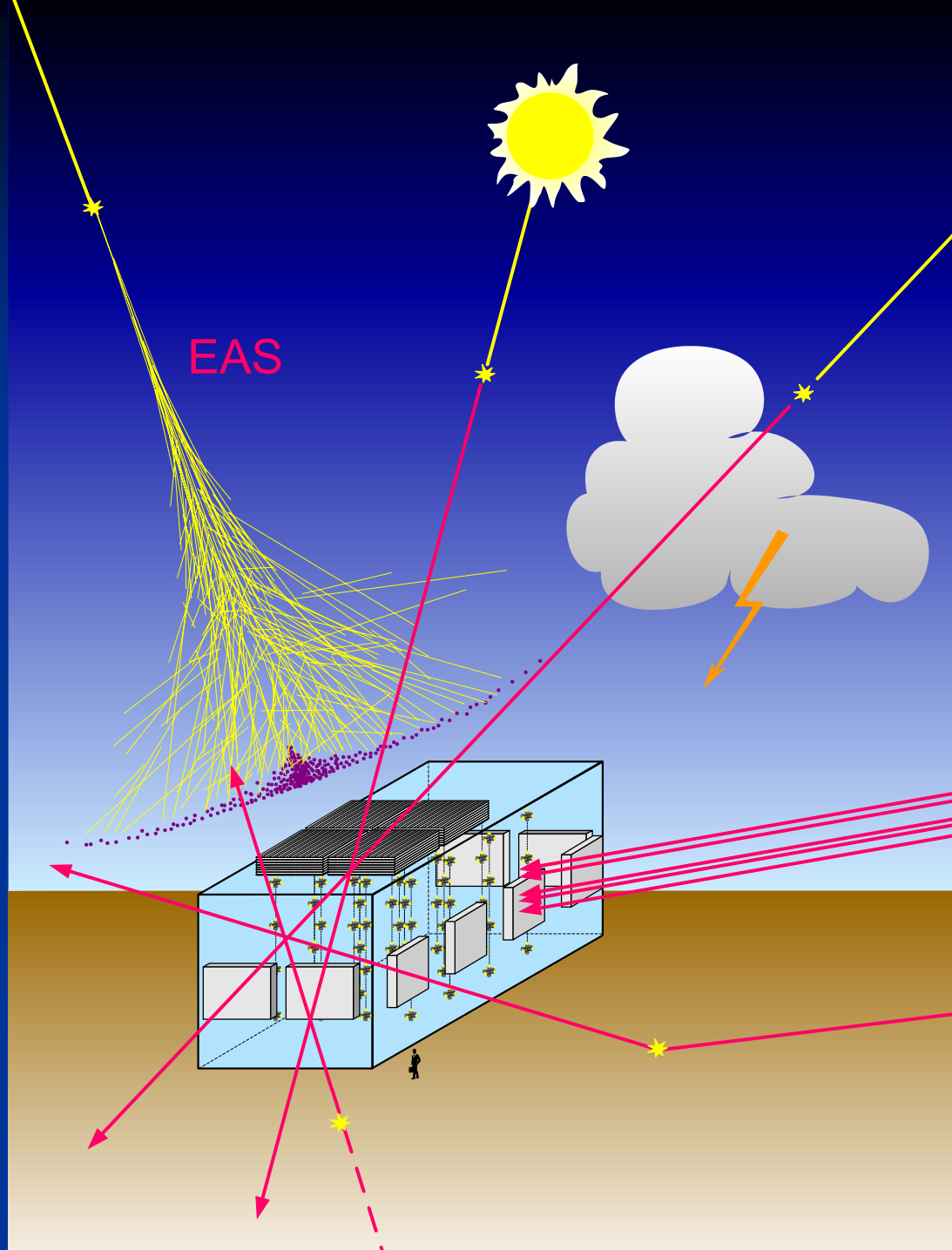
Further development of Russian-Italian Project DECOR: basic and applied investigations

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for DECOR Collaboration

1. *Introduction.*
2. *Basic researches (theoretical and experimental aspects).*
3. *Applied researches (some results and further plans).*

Introduction

1. The main results of basic researches were presented by O.Saavedra.
2. Applied researches began last year only, therefore I will speak about some first results and then about our further plans.
3. The new policy of Russian Ministry of Education and Science is the support mainly of applied researches. Therefore we need to look for various possibilities to use our unique scientific equipment and vast experience in applied purposes.



EAS

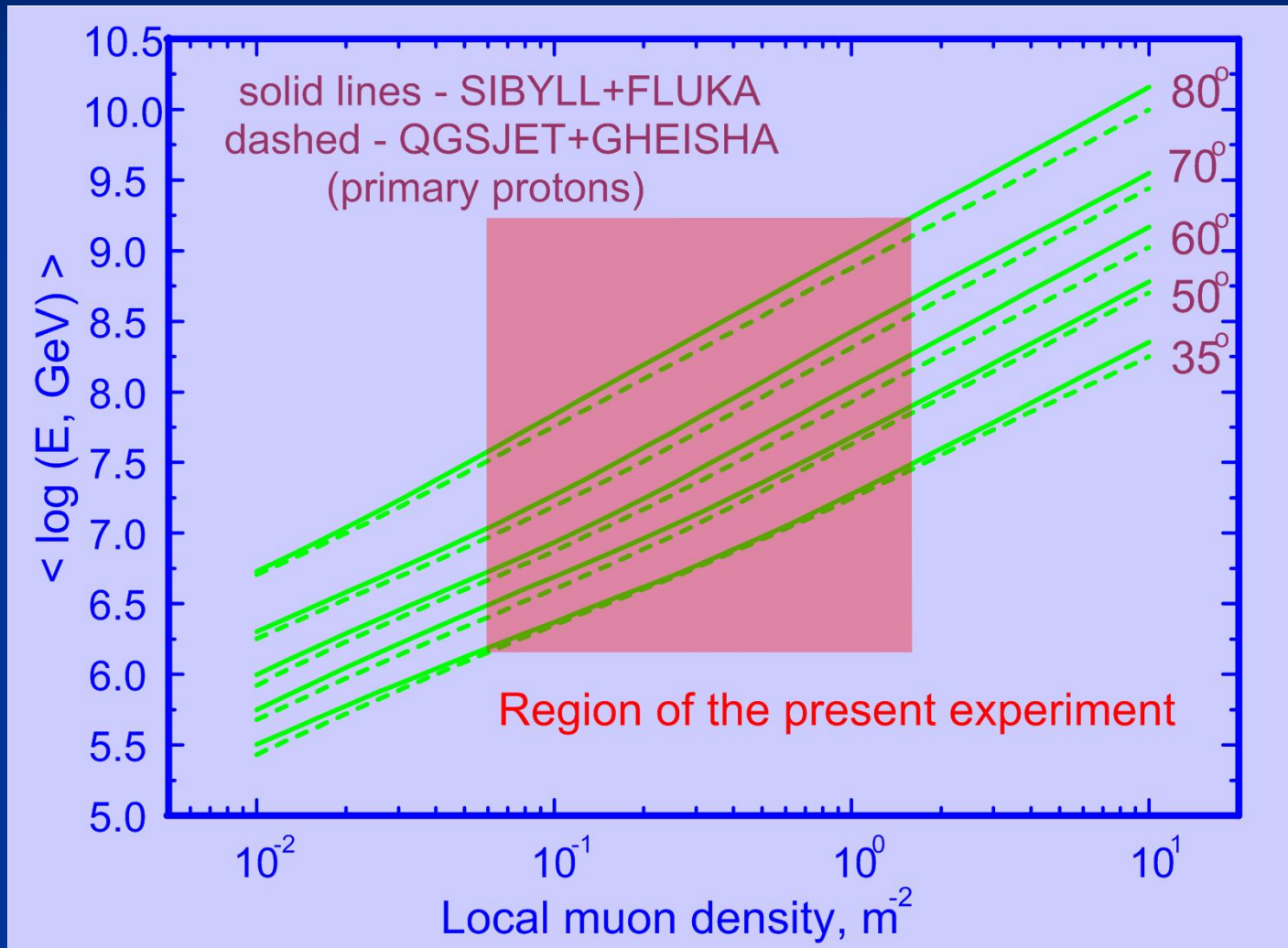
Cosmic

Basic researches

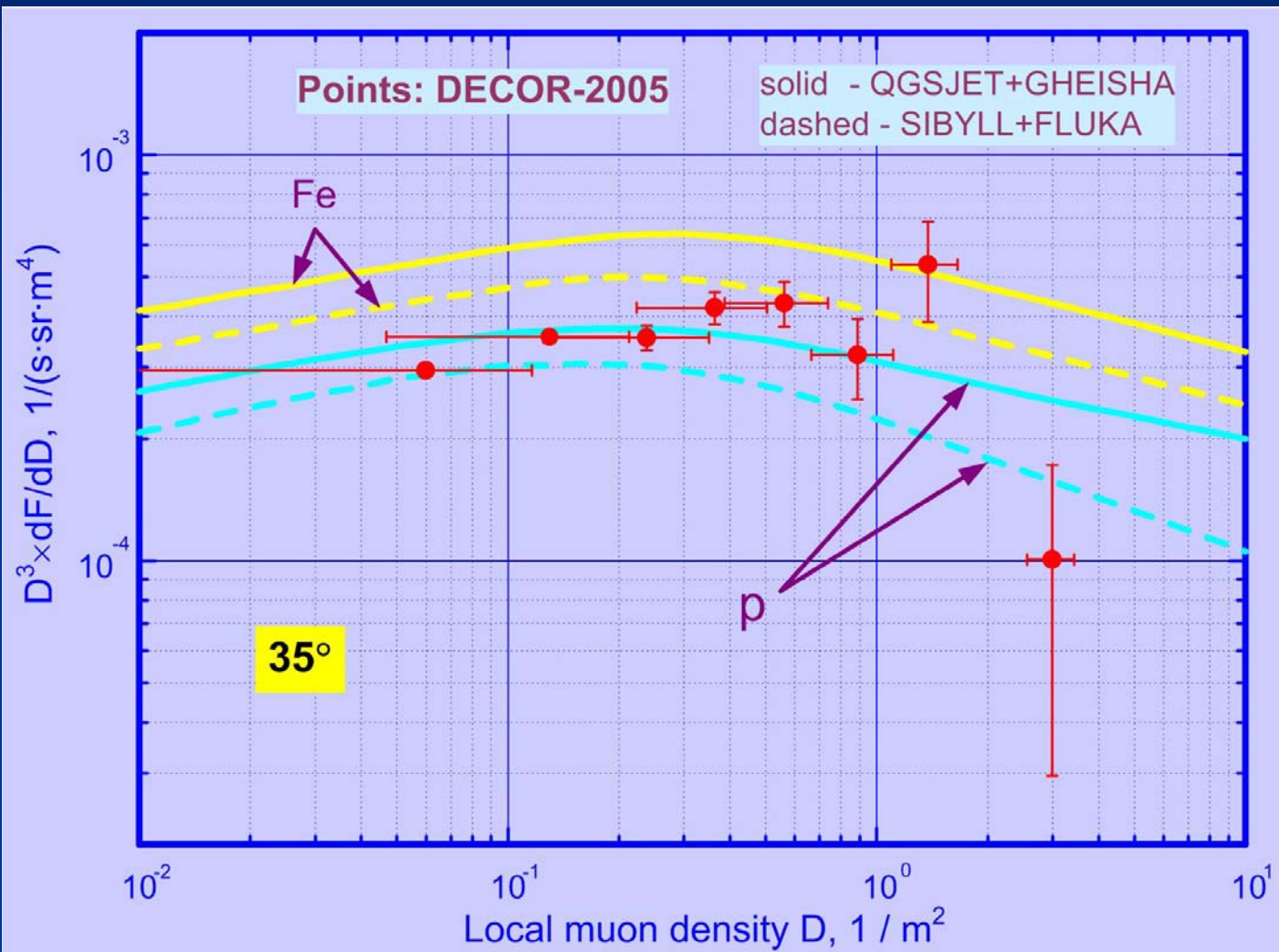
Two most important results obtained by DECOR collaboration:

1. It is shown that cosmic rays with energies up to 10^{18} eV can be investigated by means of relatively small detector (several tens sq. m) if to use the horizontal flux (EAS arrays for such energies have sizes of order of sq. km).
2. Experimental data contradict theoretical calculations by means CORSIKA code at large zenith angles.

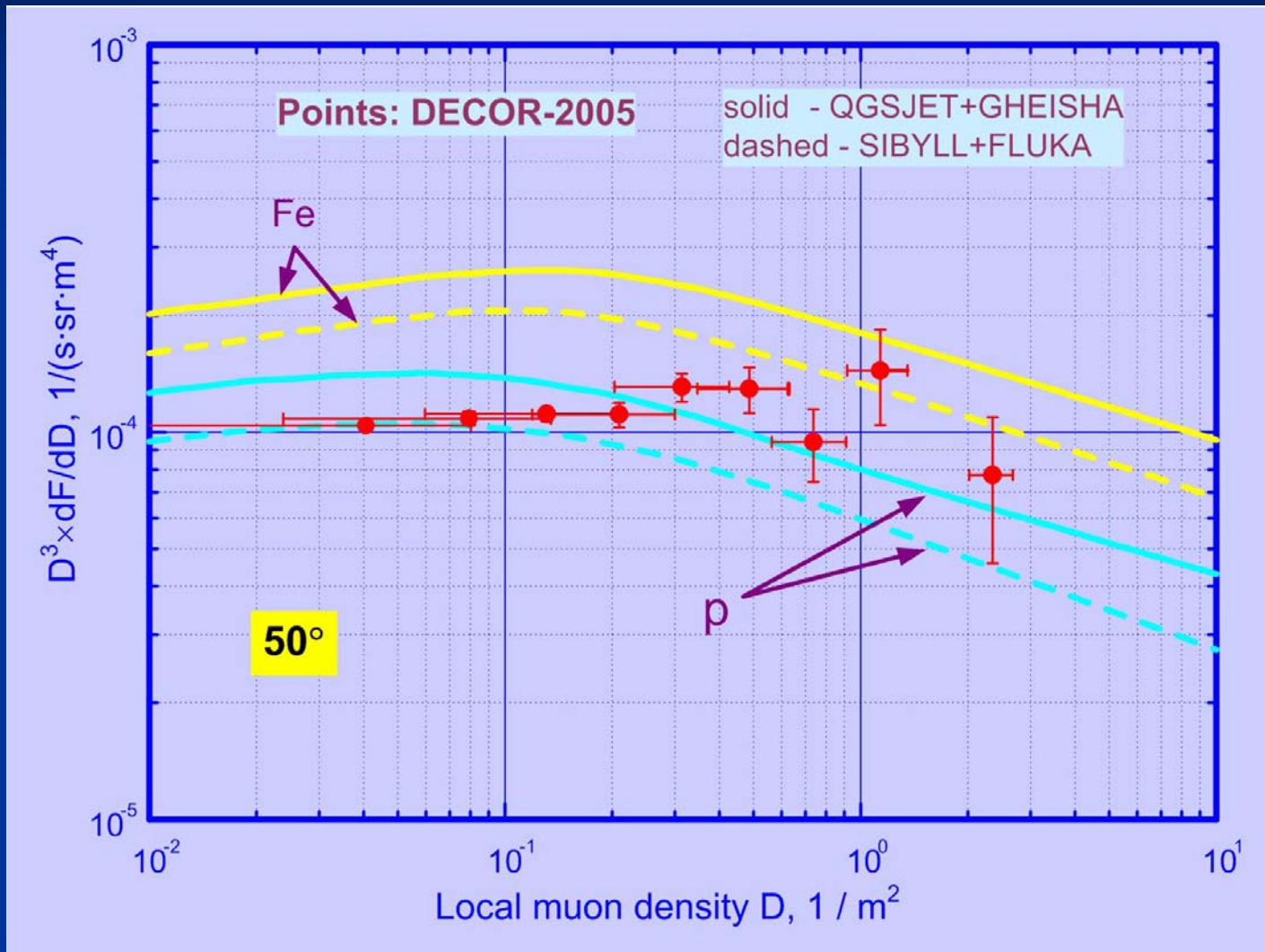
Effective primary energies for different muon densities and zenith angles



Local muon density spectrum - 35°

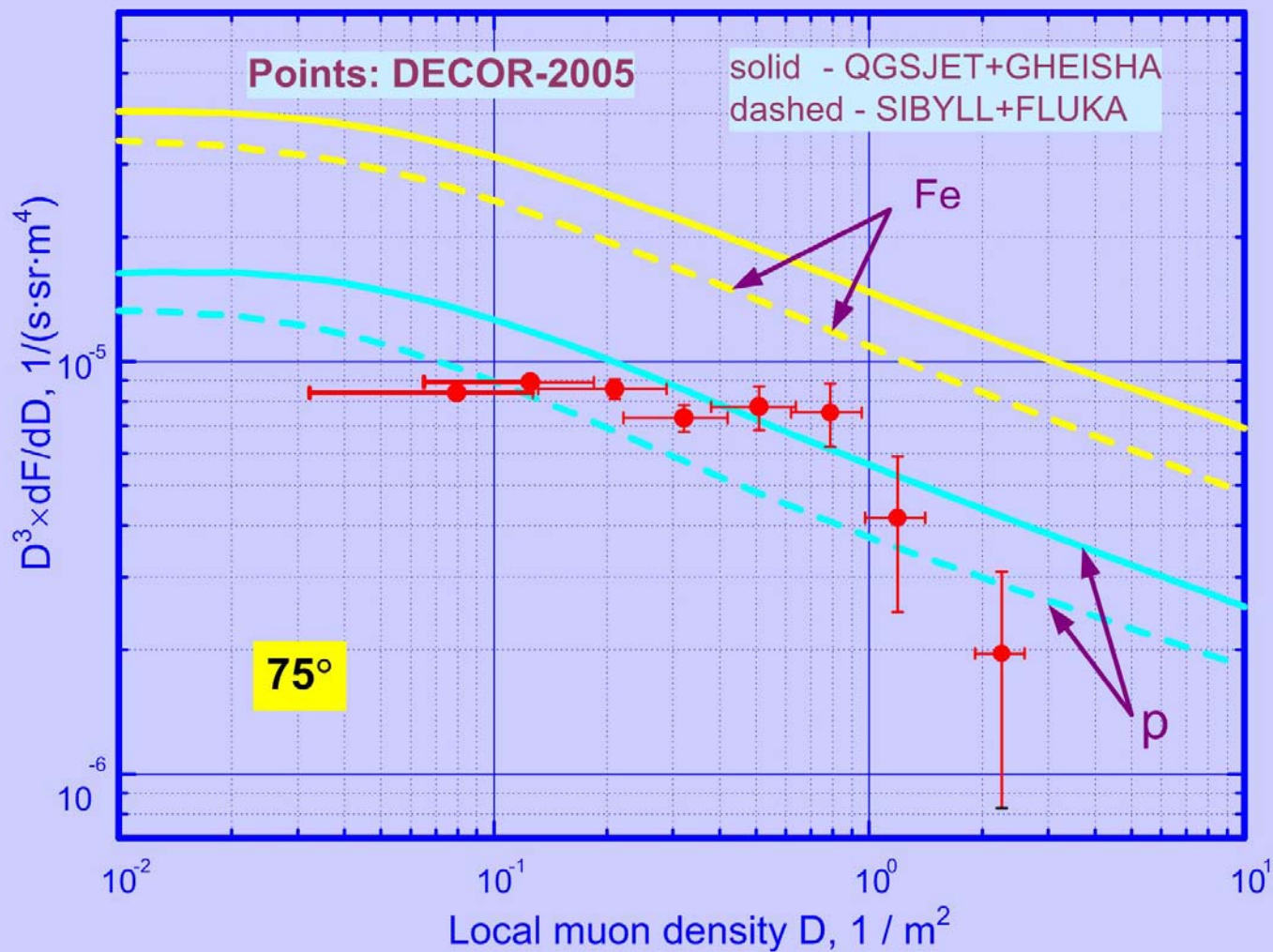


Local muon density spectrum - 50°



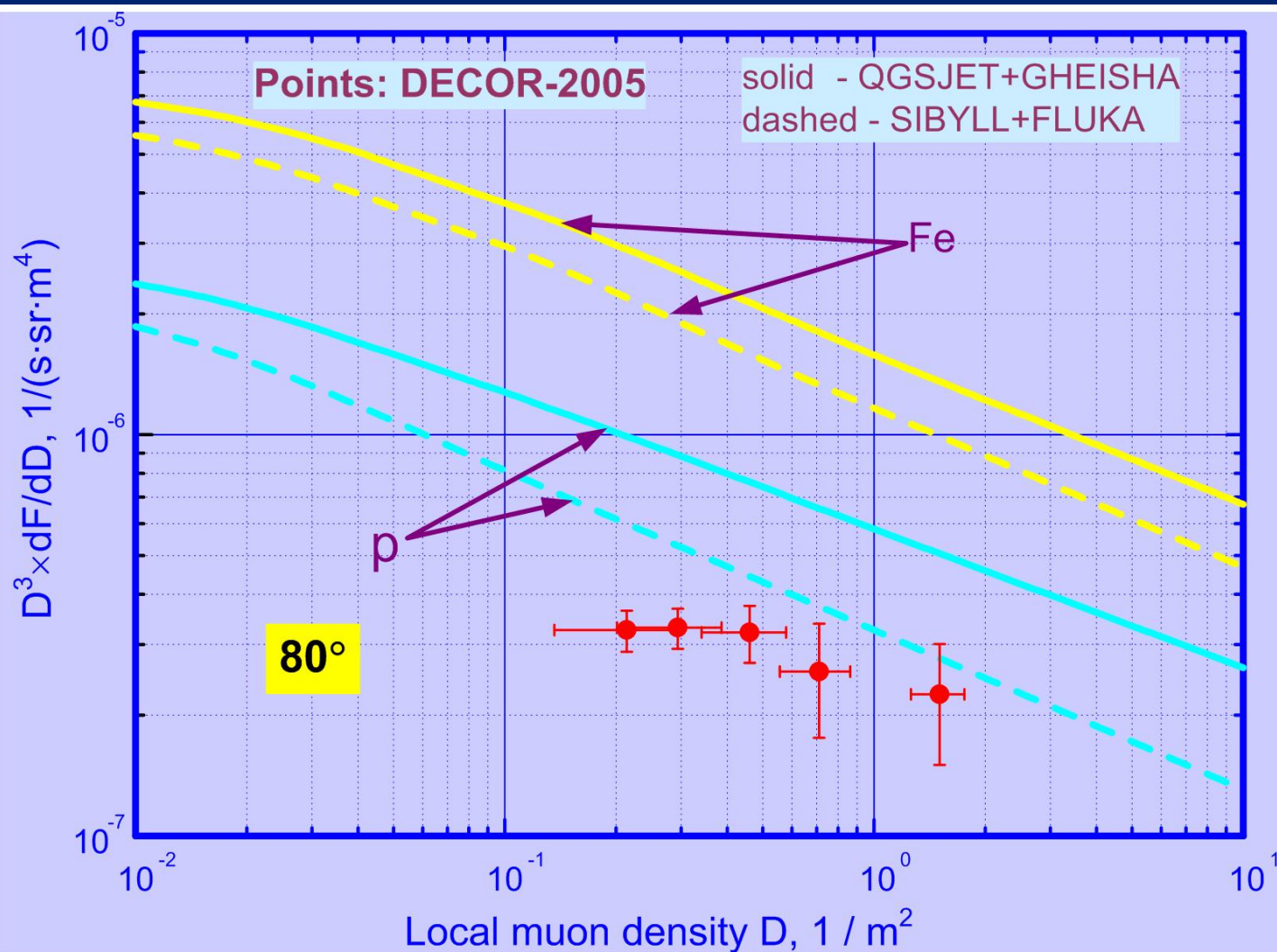
preliminary

Local muon density spectrum - 75°



preliminary

Local muon density spectrum - 80°



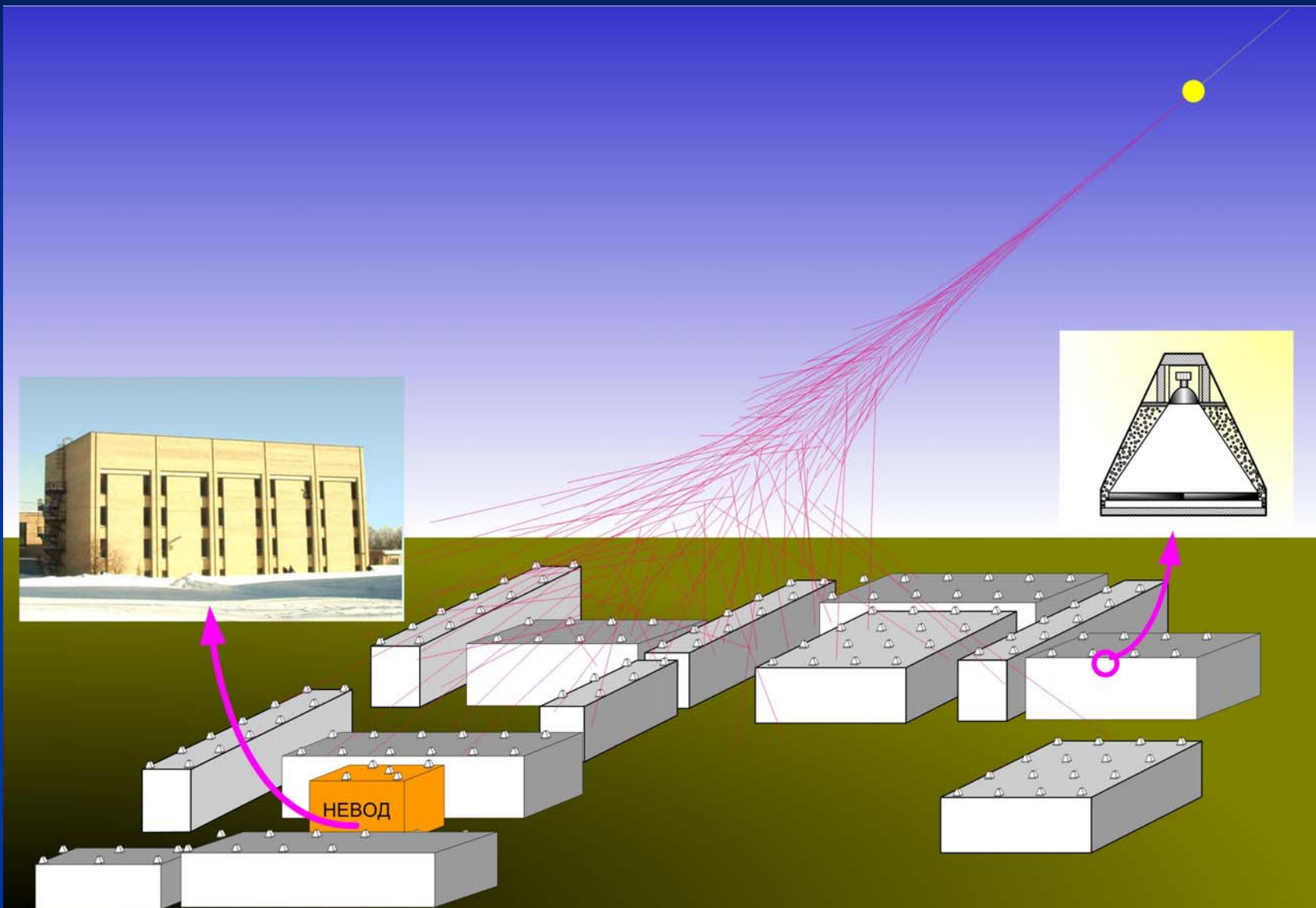
Further Plans of Basic Investigations

- To continue data taking and their analysis to increase statistics.
- To search for possible methodical uncertainties.
- To verify the CORSIKA code for horizontal cosmic rays.
- To check interaction model uncertainties (including comparison with future LHC data).

Further development of complex NEVOD-DECOR

- Possible explanation of disagreement between experimental and theoretical data is an increase of P_{\perp} at energies $>10^{17}$ eV. Similar evidences were obtained earlier in some EAS experiments.
- To check this and other possibilities, additional information about EAS is required.
- Possible way is to construct a shower array around the complex NEVOD-DECOR.

Shower array around complex NEVOD-DECOR



Applied researches

The main idea:

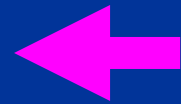
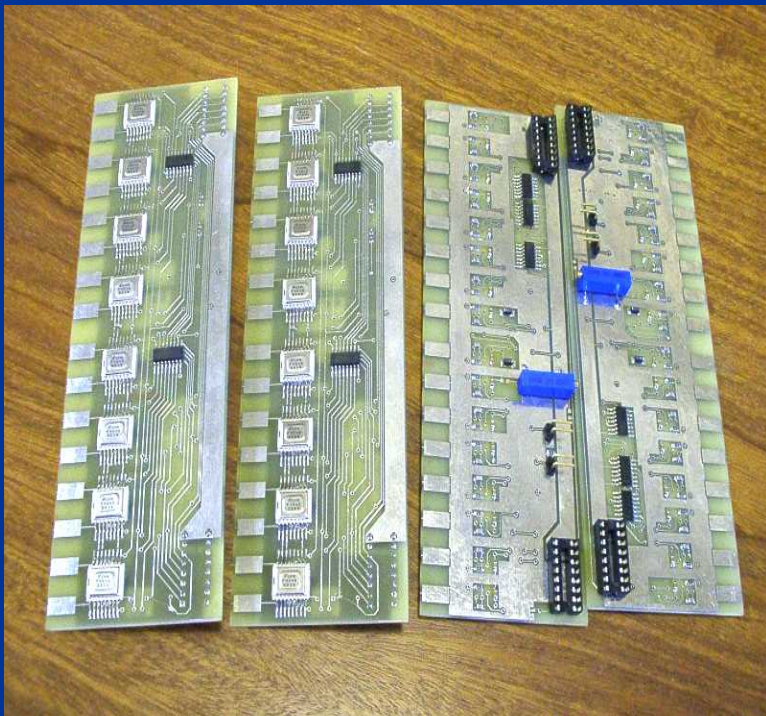
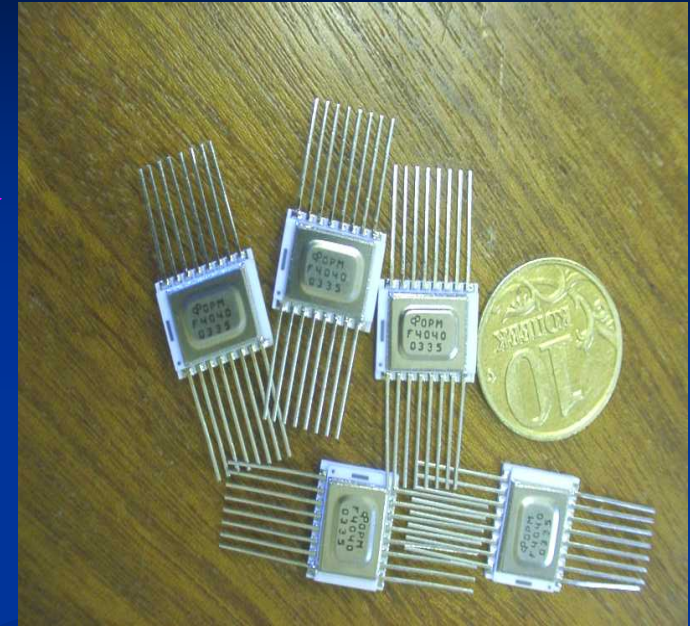
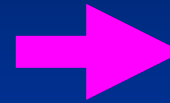
1. Muon flux at the Earth depends on conditions in the magnetosphere and in the atmosphere.
2. In principle, it is possible to evaluate these conditions from muon flux measurements (muon diagnostics).
3. To solve this task a wide aperture coordinate detectors with good spatial and angular resolution to measure each muon track are required.

TOP-DECOR



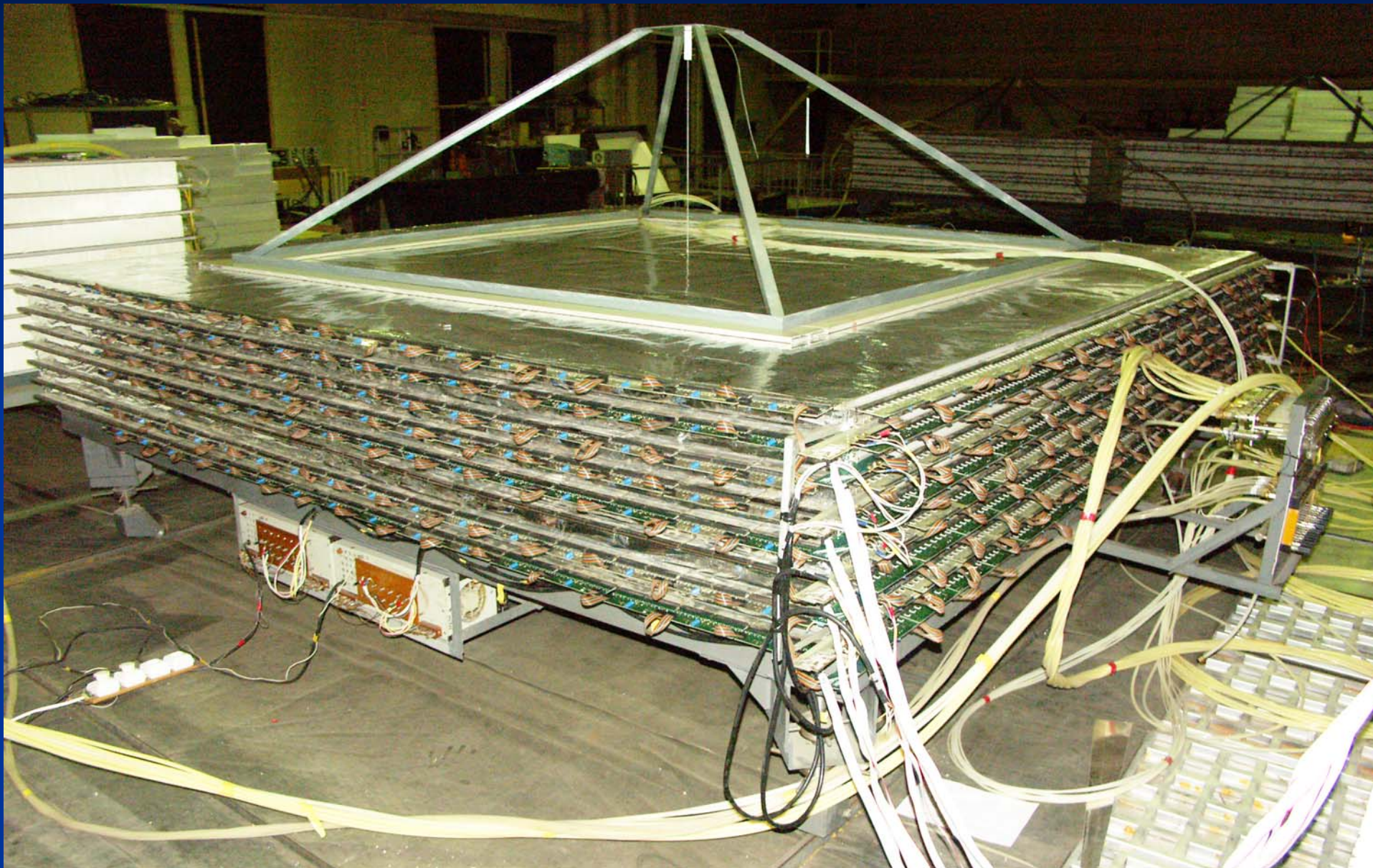
Development of fast electronics

New specialized microcircuit
(amplifier – pulse-former)

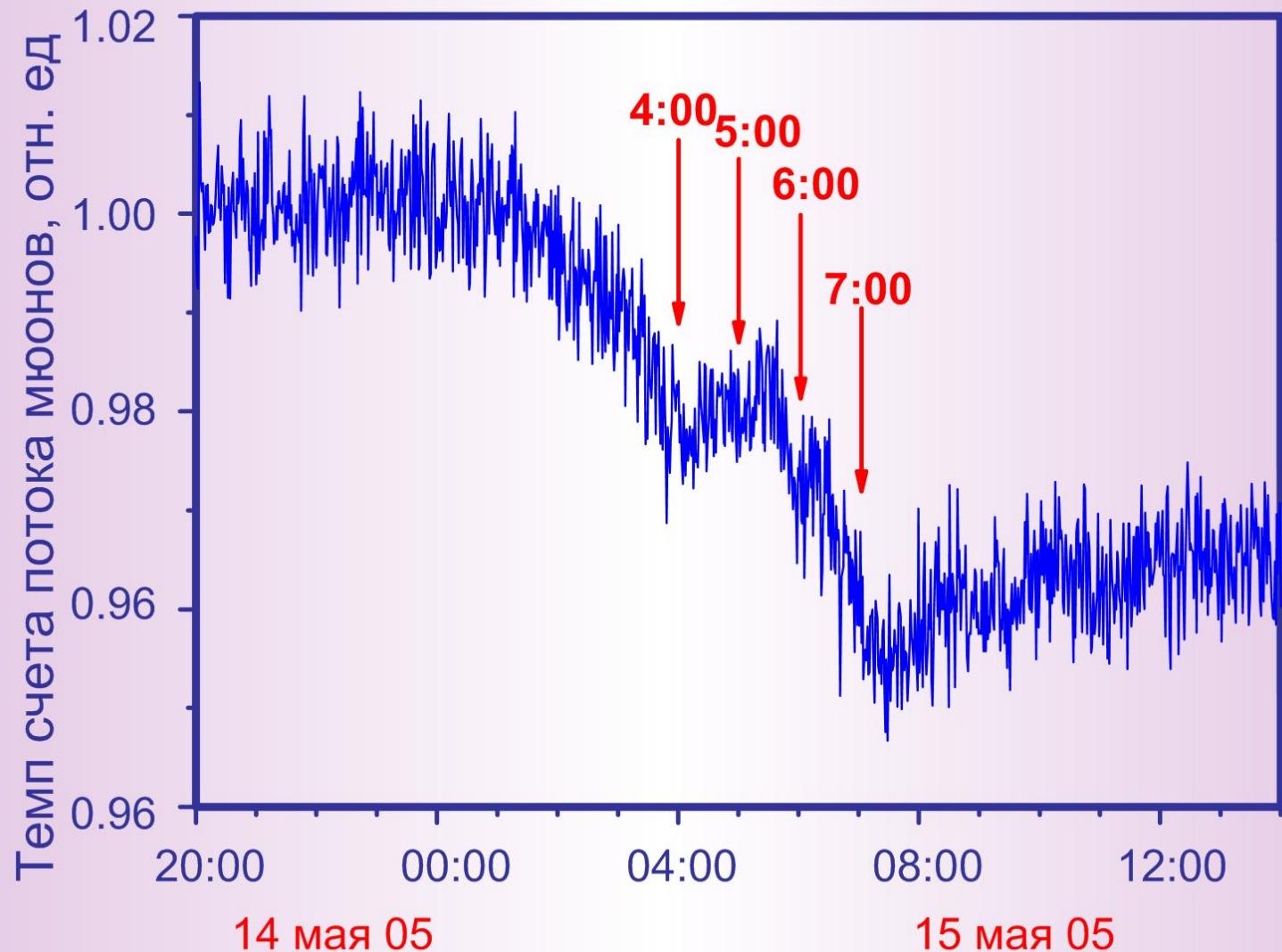


New multi-channel readout cards

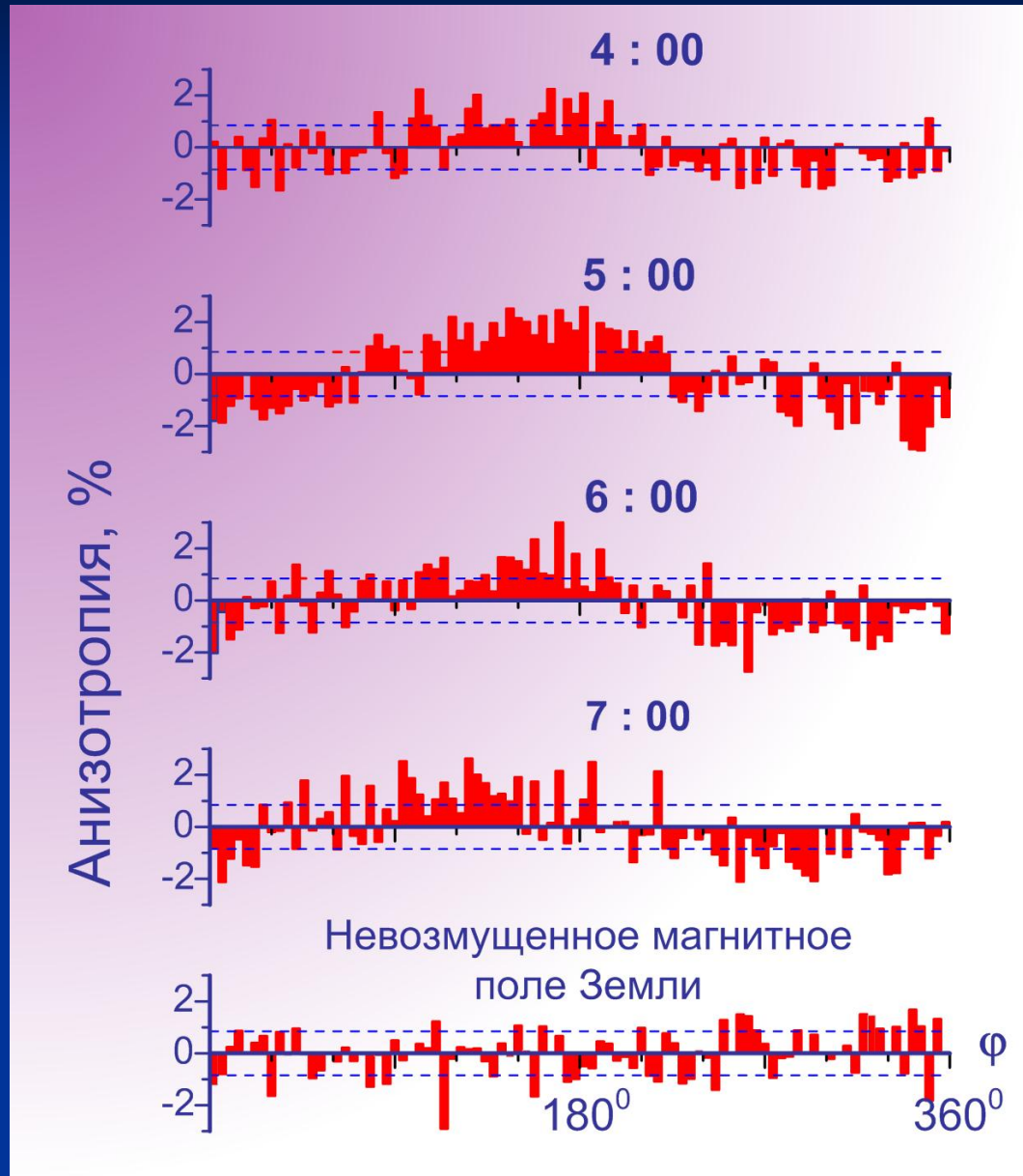
Supermodule with new electronics



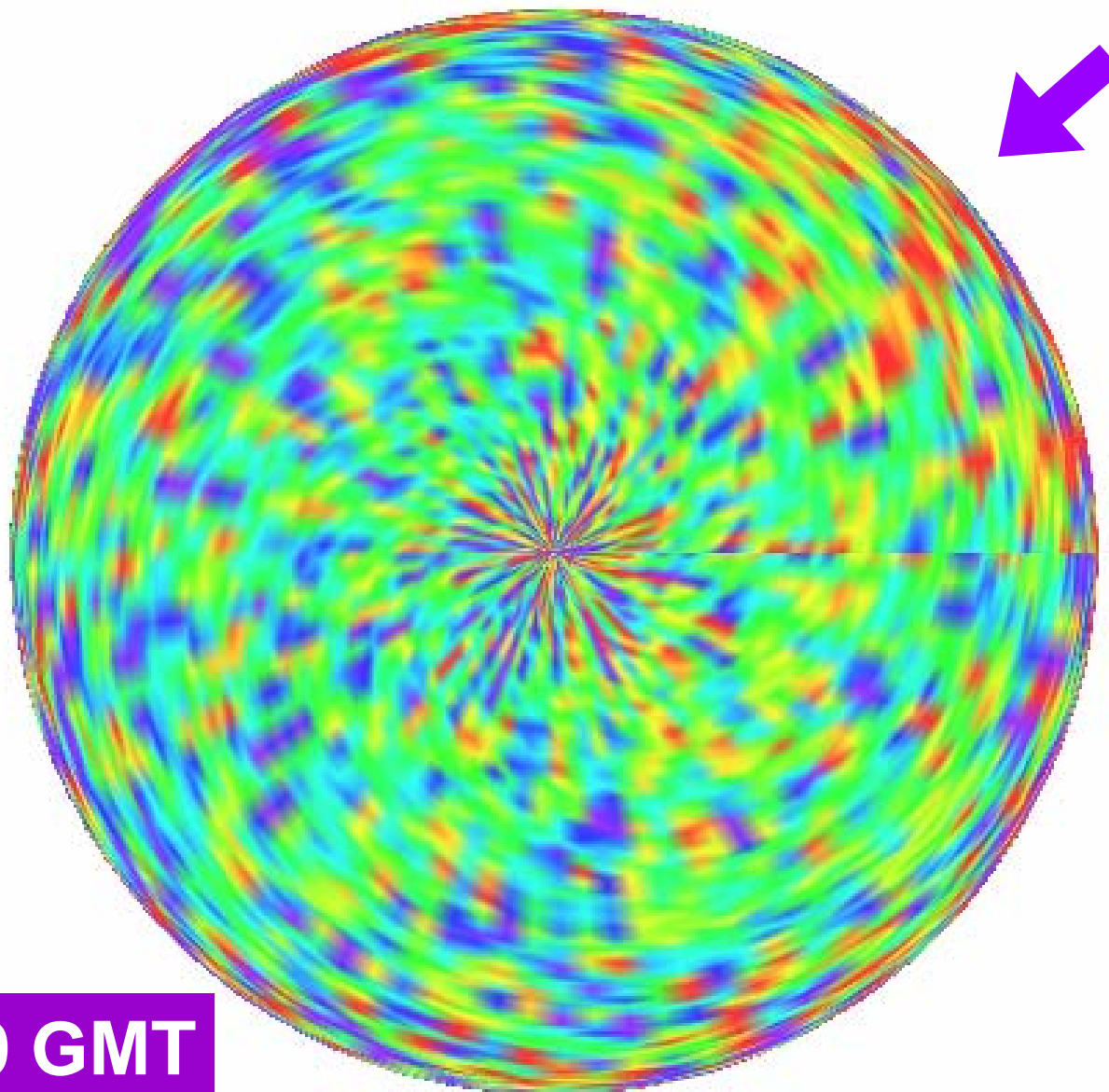
Monitoring of the magnetosphere during magnetic storm of May 15, 2005



Dynamics of spatial and time anisotropy of muon flux

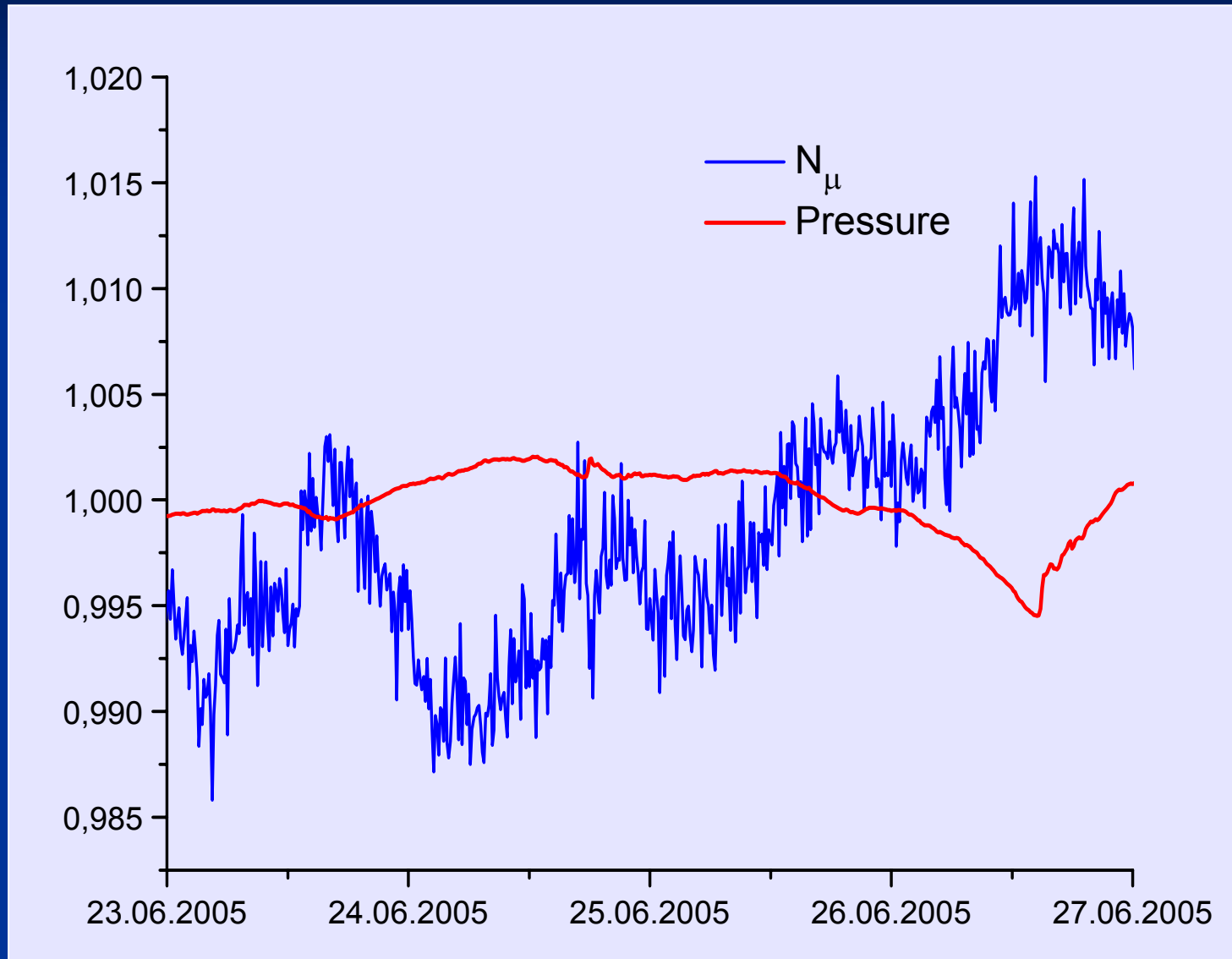


Dynamics of spatial and time anisotropy of muon flux

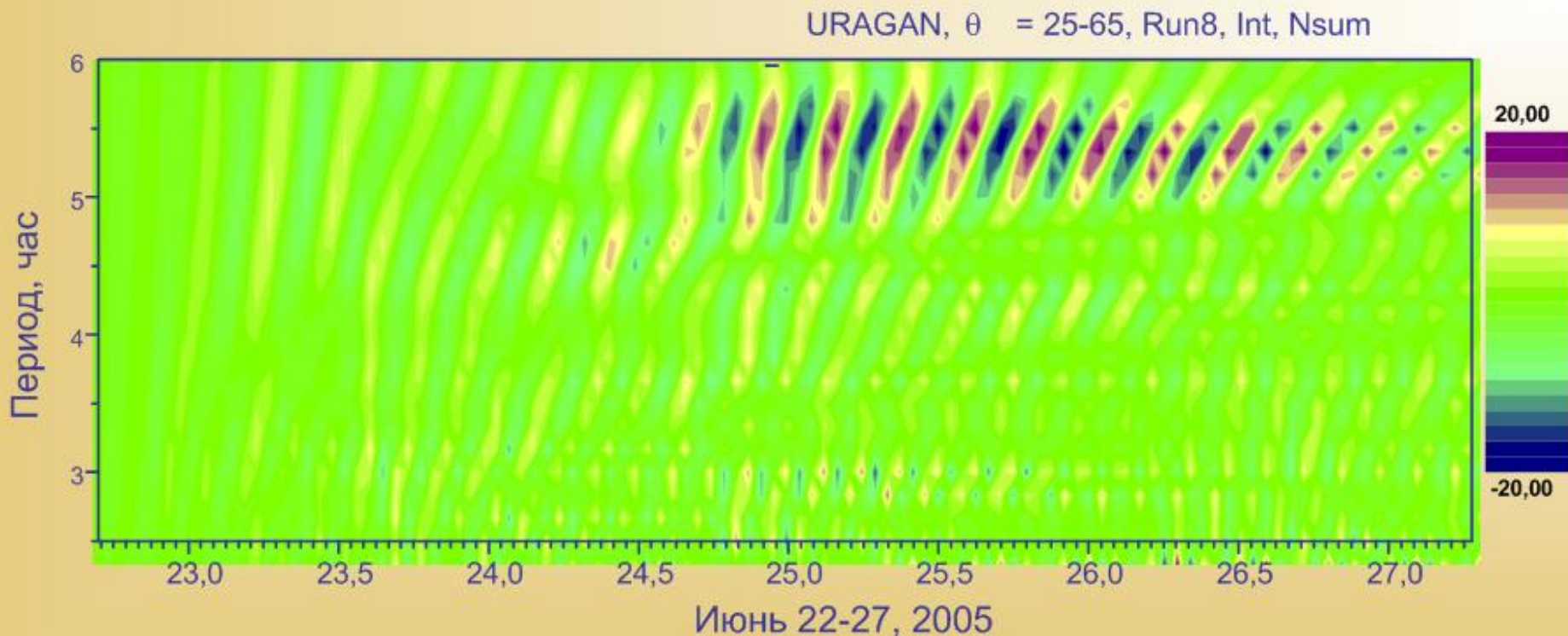


7:00 GMT

Monitoring of atmospheric phenomena during June 23 – 27, 2005

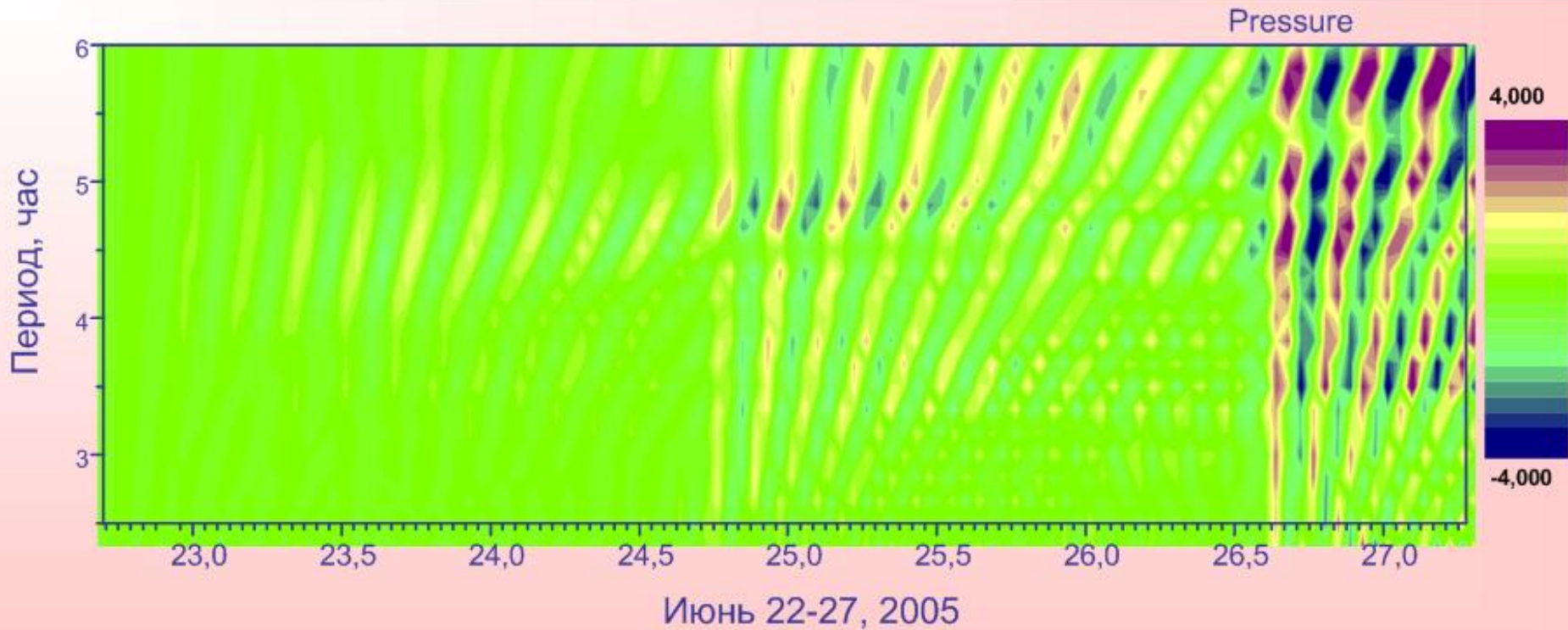


Wavelet analysis of muon data during June 23 – 27, 2005

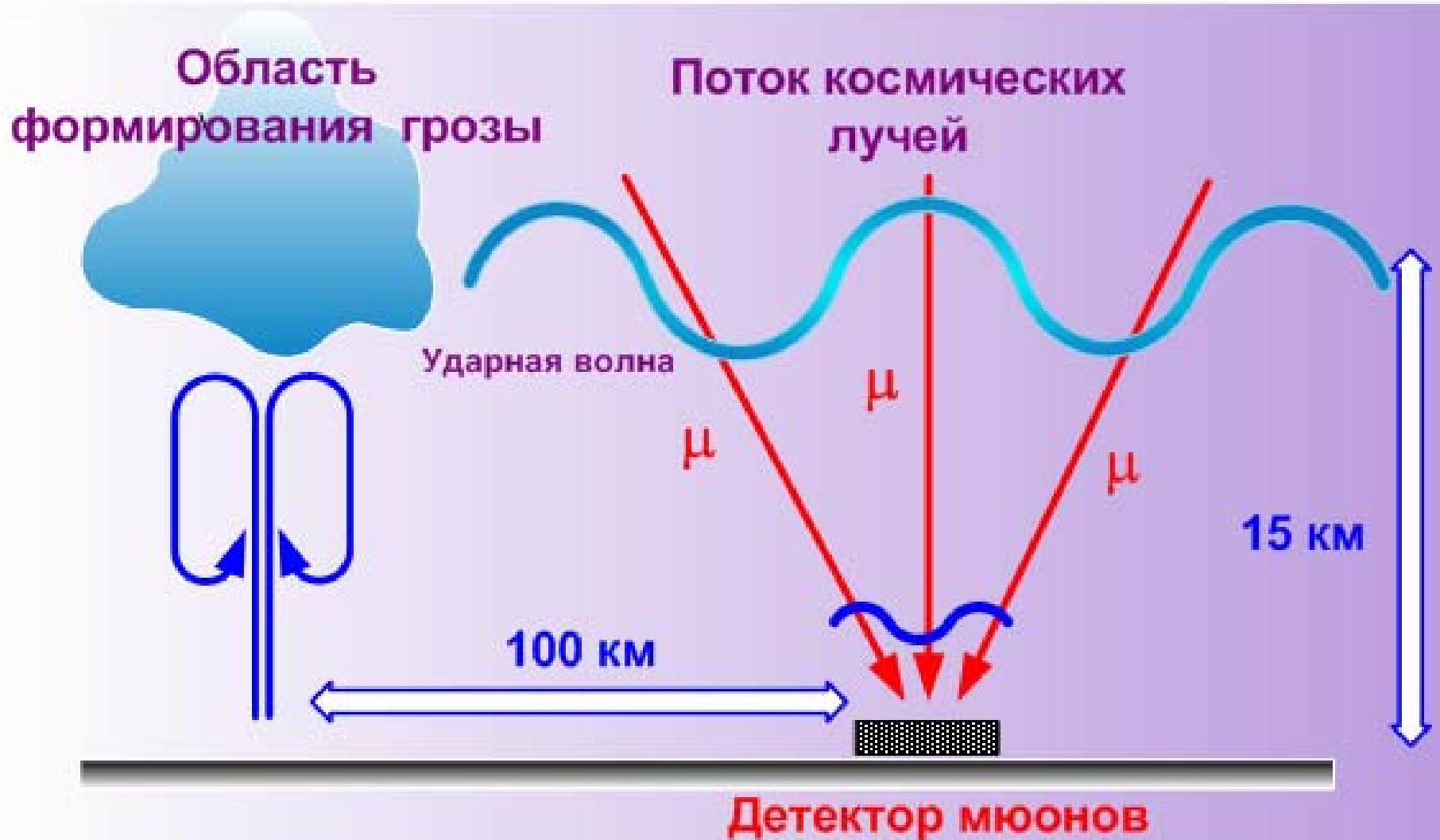


Wave process related with atmospheric front approaching Moscow

Wavelet analysis of atmospheric pressure during June 23 – 27, 2005



Thunderstorms and waves



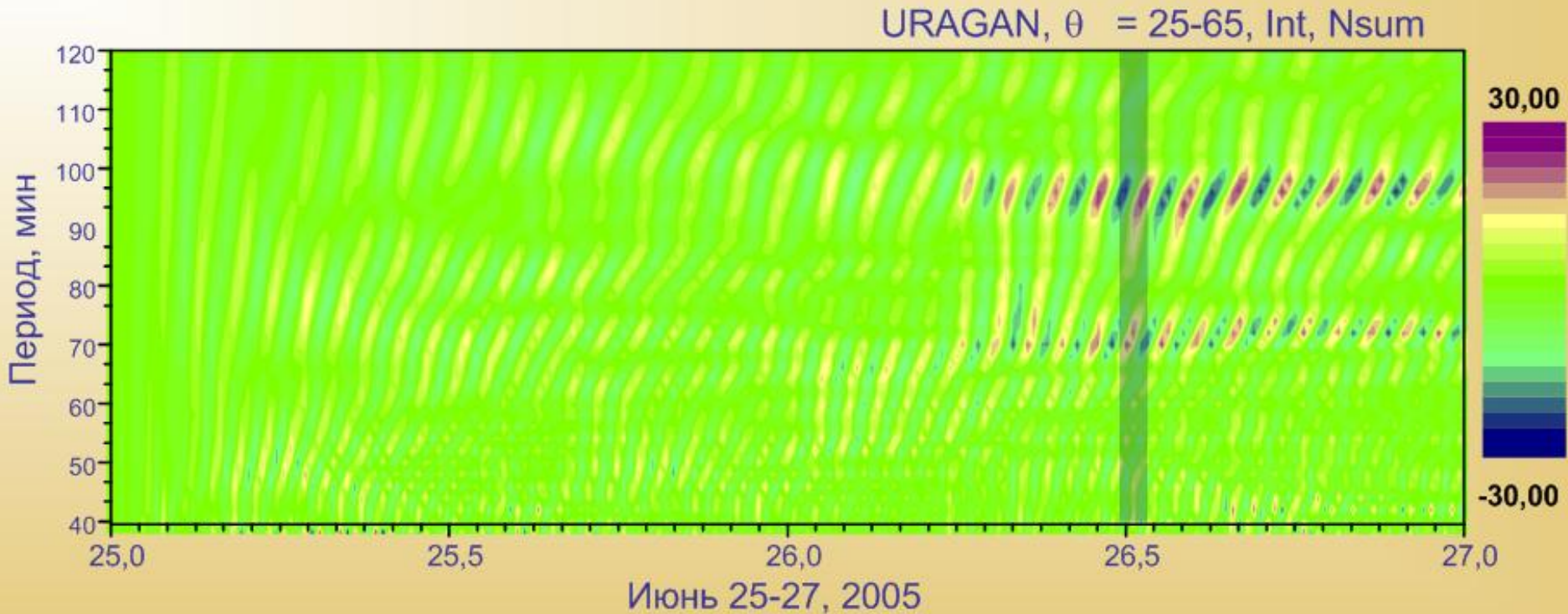
Hurricane in Dubna, June 26, 2005

Distance from the setup was about 140 km, however :

- 1. The setup registered azimuthal asymmetry of the muon flux in the direction of the hurricane.*
- 2. Wavelet analysis revealed a wave process in the atmosphere, which appeared before the occurrence of the hurricane in Dubna.*



Wavelet analysis of muon data during June 25 – 27, 2005



Wave process from hurricane in Dubna on June 26, 2005, which appeared in muon flux 4 hours earlier the hurricane occurrence in the town (about 12:00)

Further plans of applied researches

1. Development and investigation of methods of various effects separation.
2. Study of possibility of predictions of anomalous atmospheric phenomena (as hurricane, tornado, etc.) especially of local origin.
3. Development of typical arrangement for muon diagnostics of the atmosphere, which could operate near big cities and dangerous industrial objects.

We invite
Italian and Russian colleagues
to be involved
in this applied activity.