



# SEARCH STRUCTURES IN THE DISTRIBUTIONS OF PARTICLES FROM THE CENTRAL AREA OF EAS CONDUCTED ON THE “ADRON-55”

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The ionization calorimeter “Adron-55”, located at an altitude of 3340 meters above sea level, is part of the unified registration system for the shower installation of the Tian-Shan high-mountain station.

### Installation geometry

The schematic arrangement of the installation "Hadron-55", consisting of central and peripheral parts is shown. The central part consists of gamma and hadron units of the ionization calorimeter and scintillation carpet. The peripheral part consists of 8 SC-detectors located in circles of 40 and 100 m. Geographic coordinates of installation center: N: 43°02' 32"; E: 76° 56' 45".

### Physical and technical characteristics of the installation

#### "Hadron-55"

- 1) Area of the ionization calorimeter - 55 sq. m.
- 2) Number of rows with ionization detectors- 8
- 3) Thickness of the iron and lead target -1150 g/cm<sup>2</sup>
- 4) Total number of measuring channels -1140
- 5) Effective area of the inner carpet of SC. detectors -300 sq. m
- 6) Number of SC-detectors - 30
- 7) Number of SC-detectors in the radius of 40-and 8-meter- 8
- 8) Time resolution of the delay measurement channel -2 nsec
- 9) Effective register area of peripheral SC-detectors in the radius R=100 m - 31000 sq. m
- 10) Measuring accuracy of the angles of inclination of EAS center- 0.2 deg

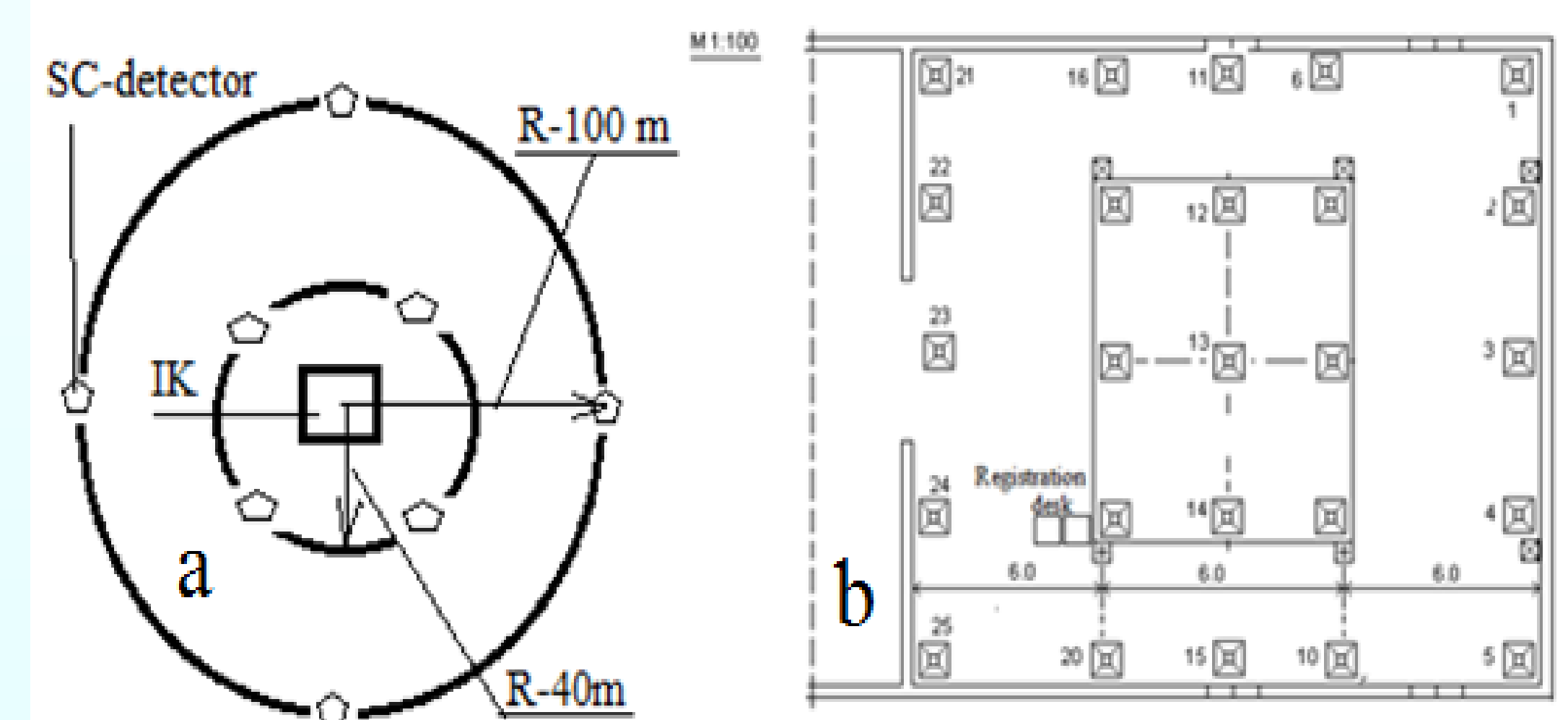


Figure 1. Schematic plan of the location of the installation "Hadron-55" consisting of a - peripheral and b - central parts.

### AdRON 55

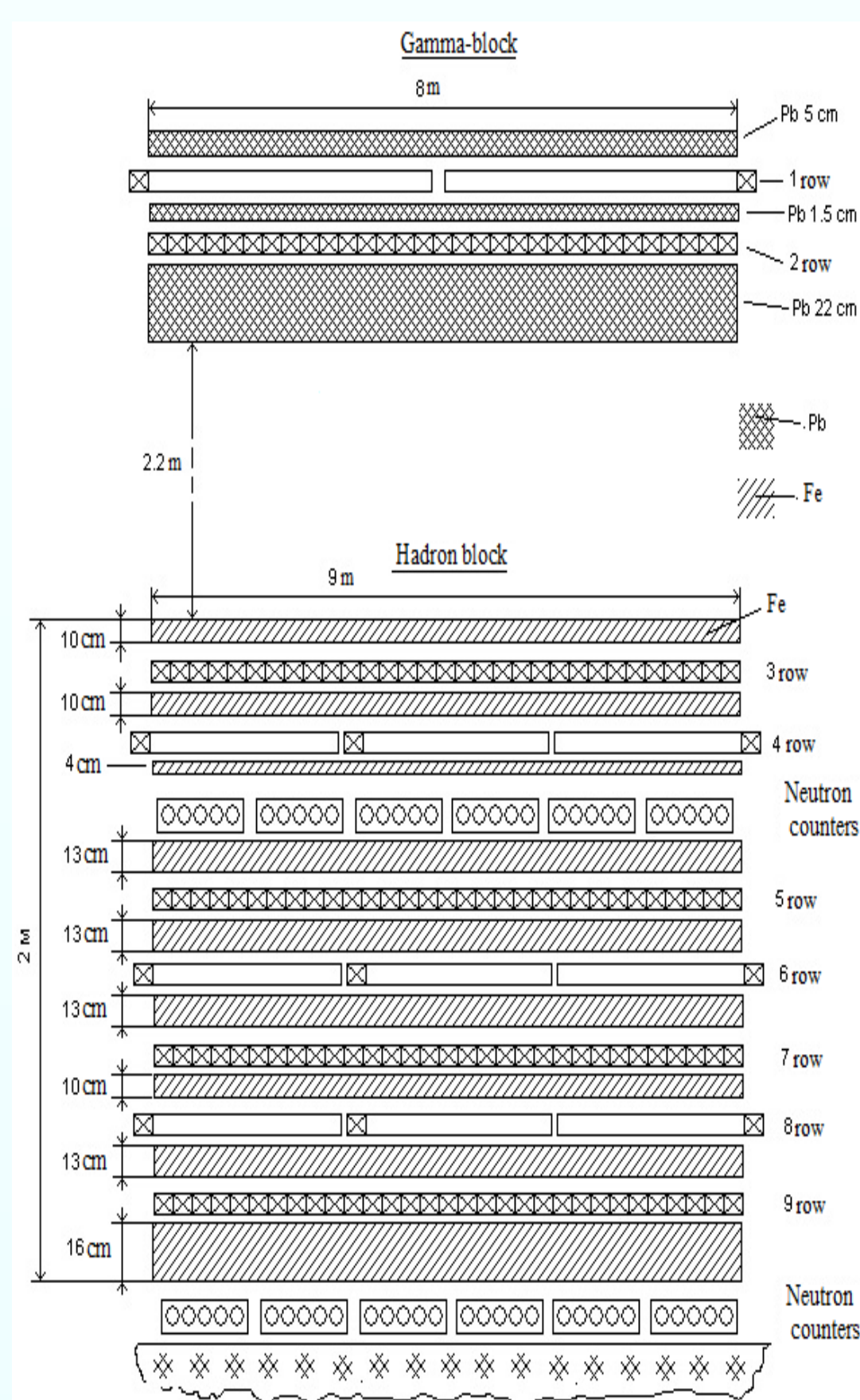


Figure 2. The two-tier ionization calorimeter "Hadron-55"

The ionization calorimeter consists of two parts – the upper gamma block and the lower hadron block. The gamma block registers i.e. absorbs the electron-photon component (EFK) of cosmic rays, the hadron component due to the small thickness of the gamma block passes without interaction through the gamma block and begins to interact and generate particles in the hadron block. • The idea of the project is to select events when there are interactions in the gamma block and there are no interactions in the hadron block.



Figure 3. Gamma blok



Figure 4. Adron blok

### Results

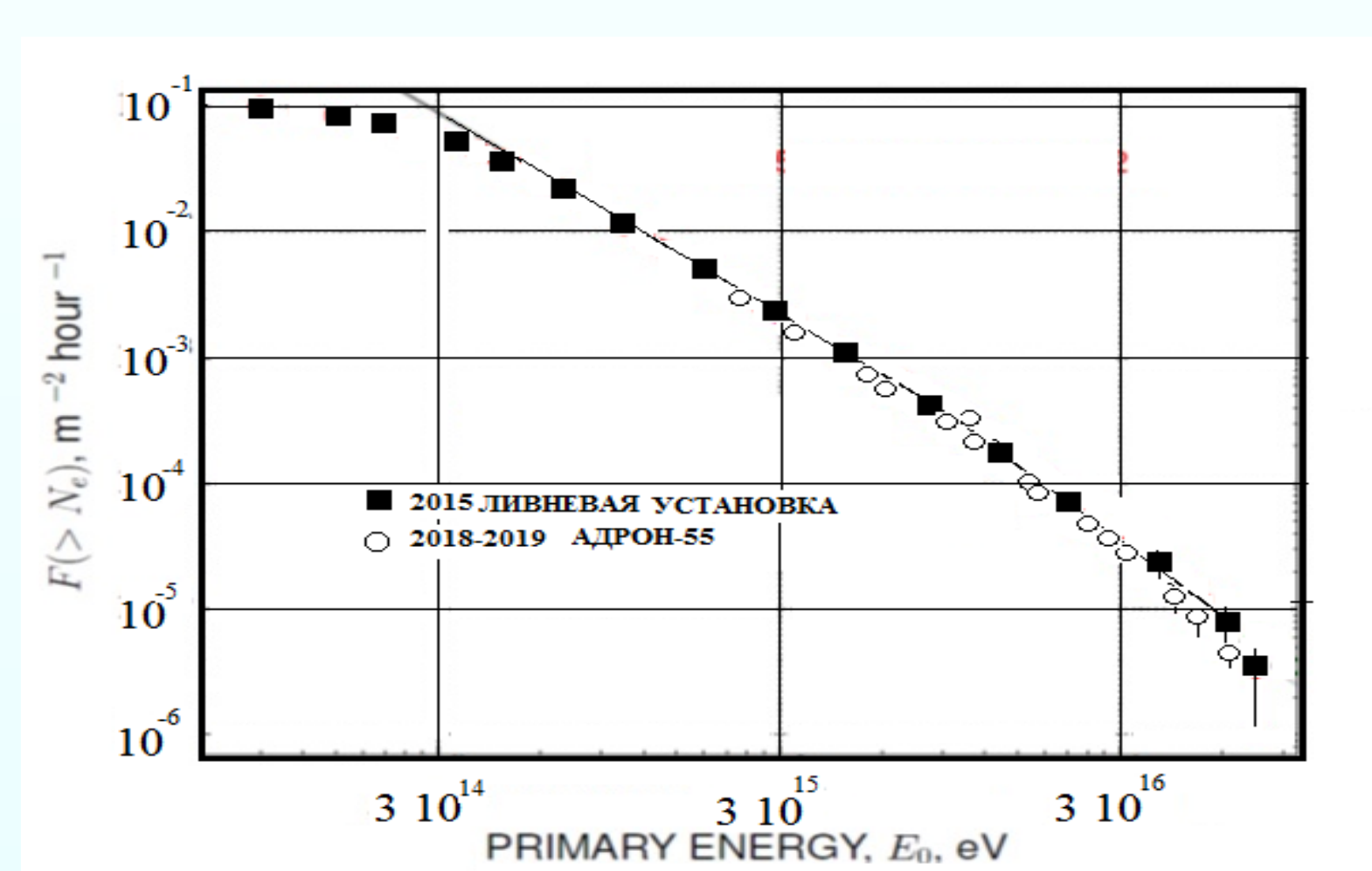


Figure 5. Energetic Spectrum

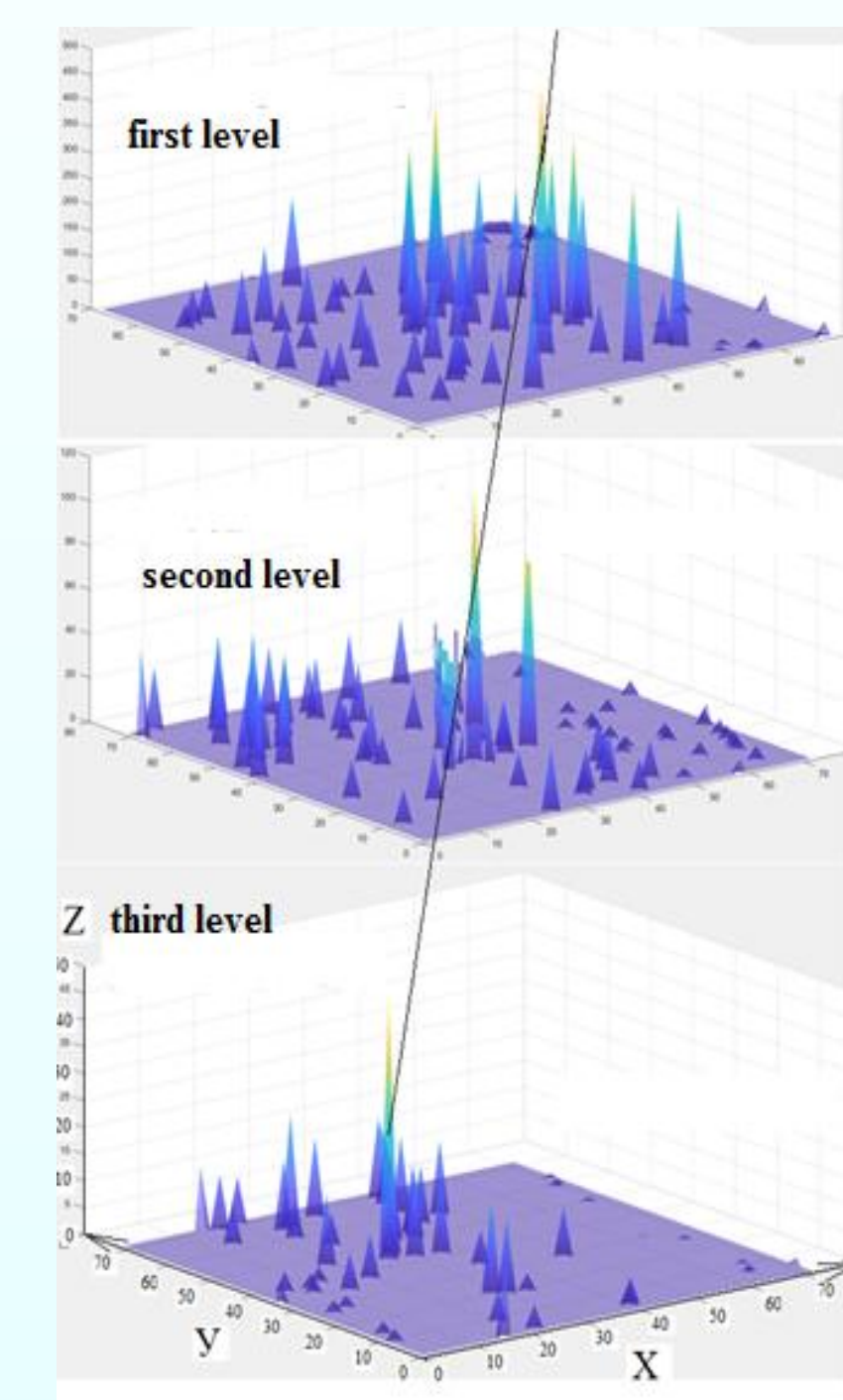


Figure 6. Illustration of the position of the axes of EAS event №9 in the plane of the "carpet" of the ionization calorimeter.

### Conclusions

Currently, the facility operates: eight rows of ionization chambers or four levels; twenty-five scintillation detectors inside the building; four scintillators outside the building located at a distance of 40 meters from the center of the calorimeter. In 2019, about six thousand events with energies greater than  $2 \cdot 10^{15}$  eV were recorded. The interactions when the share of primary energy is transferred only to the neutral component is 6%. Currently, mathematical programs are created taking into account the design features of the installation for registration, processing and analysis of events. The results of several preprocessed events are shown in the table.

№	Energy. 10 <sup>15</sup> eV	Angles in degrees		Right ascension	Declination	Galactic		Constellation
		Zenith.	Azimuth.			Latitude	Longitude	
1	2.17	23.7	333.4	4h 29m 59s	62°48'56"	9.8°	145.2°	Giraffe
2	0.56	53.2	167.0	2h 39m 04s	-9°01'56"	-58.8°	182.6°	Whale
3	1.93	37.7	101.3	0h 37m 28s	27°05'33"	-35.6°	119.1°	Andromeda
4	2.72	15.6	206.6	3h 08m 58s	29°02'56"	-18.0°	165.1°	Taurus
5	3.95	27.2	113.2	1h 34m 31s	28°36'55"	-33.3°	134.3°	Triangle

Using the methodology for processing data obtained in studies cosmic rays on the installation of ADRON-55 searches for similar structures in the data obtained at high-energy accelerators.

The data obtained at the installation will be used to study the relationship of seismic activity from cosmic rays (high-energy cosmic origin muons)

The installation “Hadron-55” is aimed at solving a number of astrophysical and nuclear physics problems: the study of interactions of high-energy hadrons in the central part of EAS trunks; search for sources of high-energy cosmic rays.

#### References:

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