TIEN-SHAN

PASTS

PRESENT

FUTURE

TIEN SHAN MOUNTAIN STATION OF P.N. LEBEDEV INSTITUTE DISPOSES AT THE DISTANCE OF 46 KM FROM THE BIG ALMA-ATA CITY

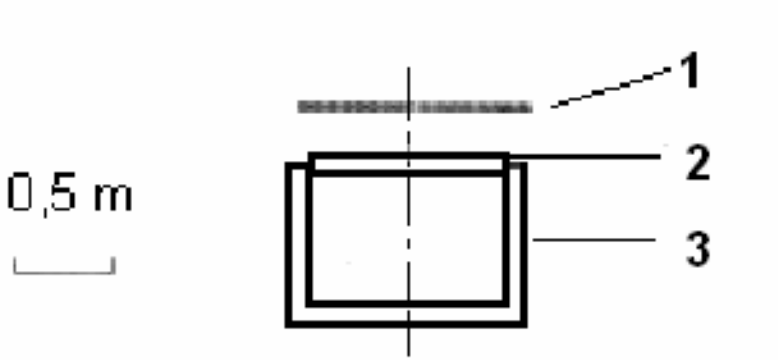
AT 3340 m ABOVE SEA LEVEL

THE BIG ALMA-ATA LAKE AND THE ROAD TO THE STATION

TIEN-SHAN:

PAST

The first complex array at Tien-Shan (1965-1970)

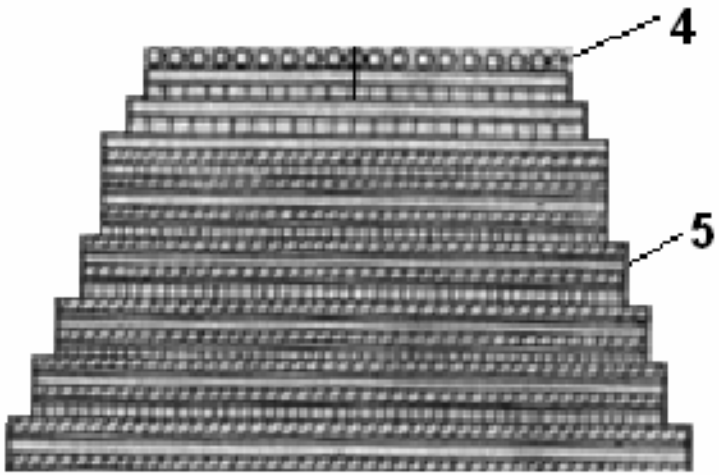


1, 4 - Geiger counters

2 - Li H target

3 - Cloud chamber in magnet field

5 - Ionization calorimeter



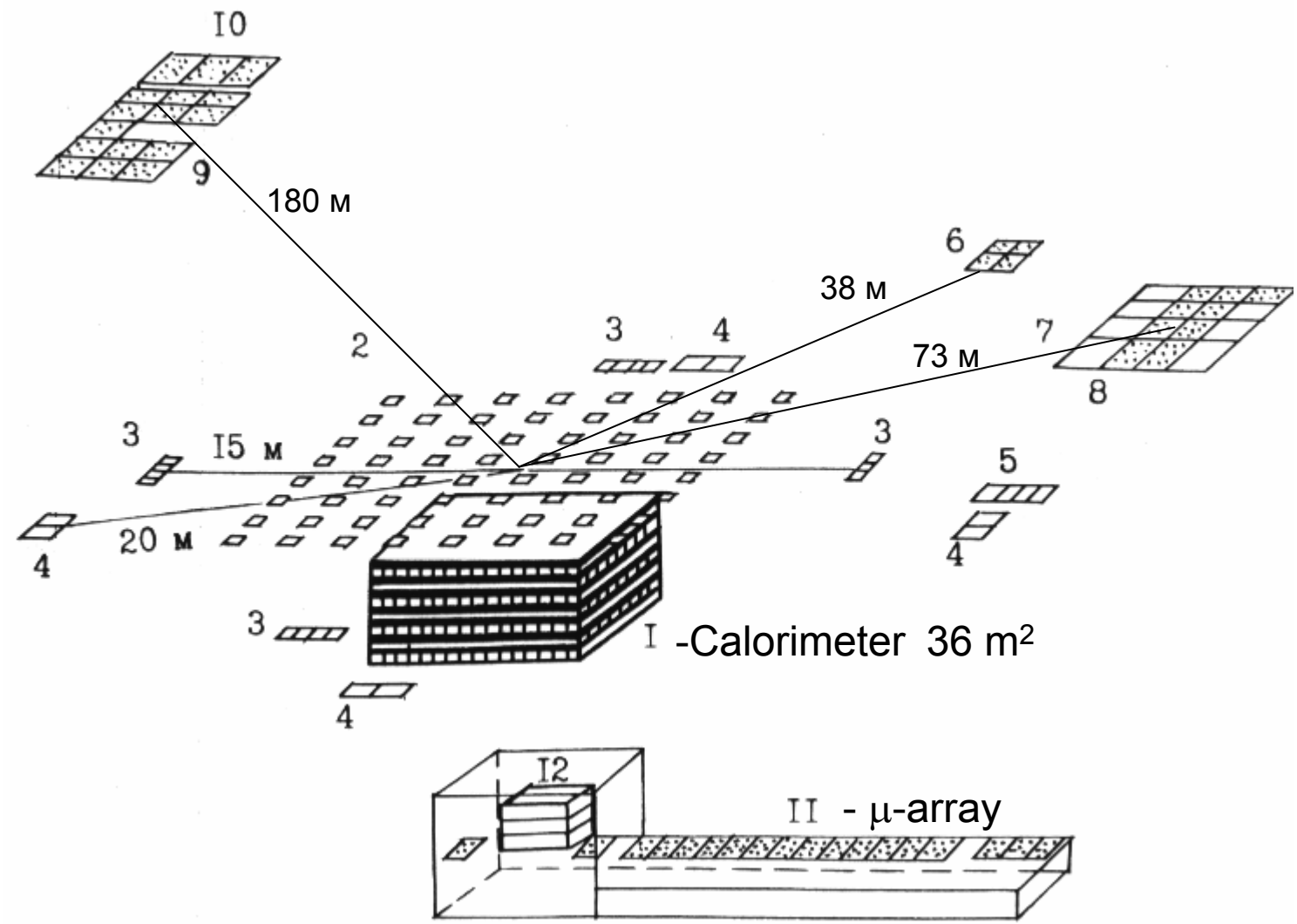
THE MAIN RESULT:

FINDING OF DISSIMETRICAL SHOWERS

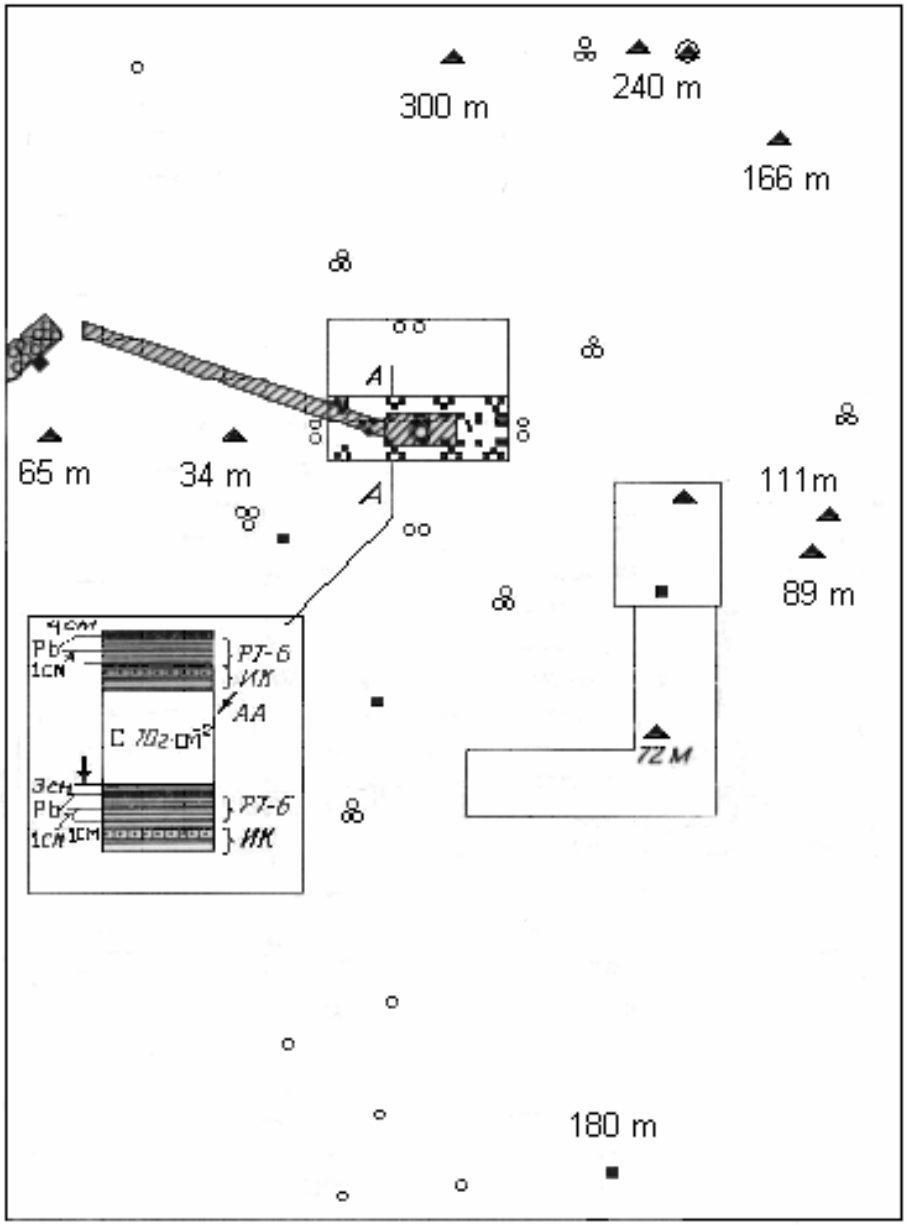
AT ENERGIES 60-1000 GeV

PRESIDENT OF SOVJET ACADEMY OF SCIENCIES M.V.KELDYSH ACQUAINTS WITH THE CLOUD CHAMBER ARRAY (1966)

COMPLEX ARRAY FOR EAS STUDY (1966-1982)



HADRON ARRAY (1985-1991)



▲ - Cherenkov Detectors

- Scintillator detectord

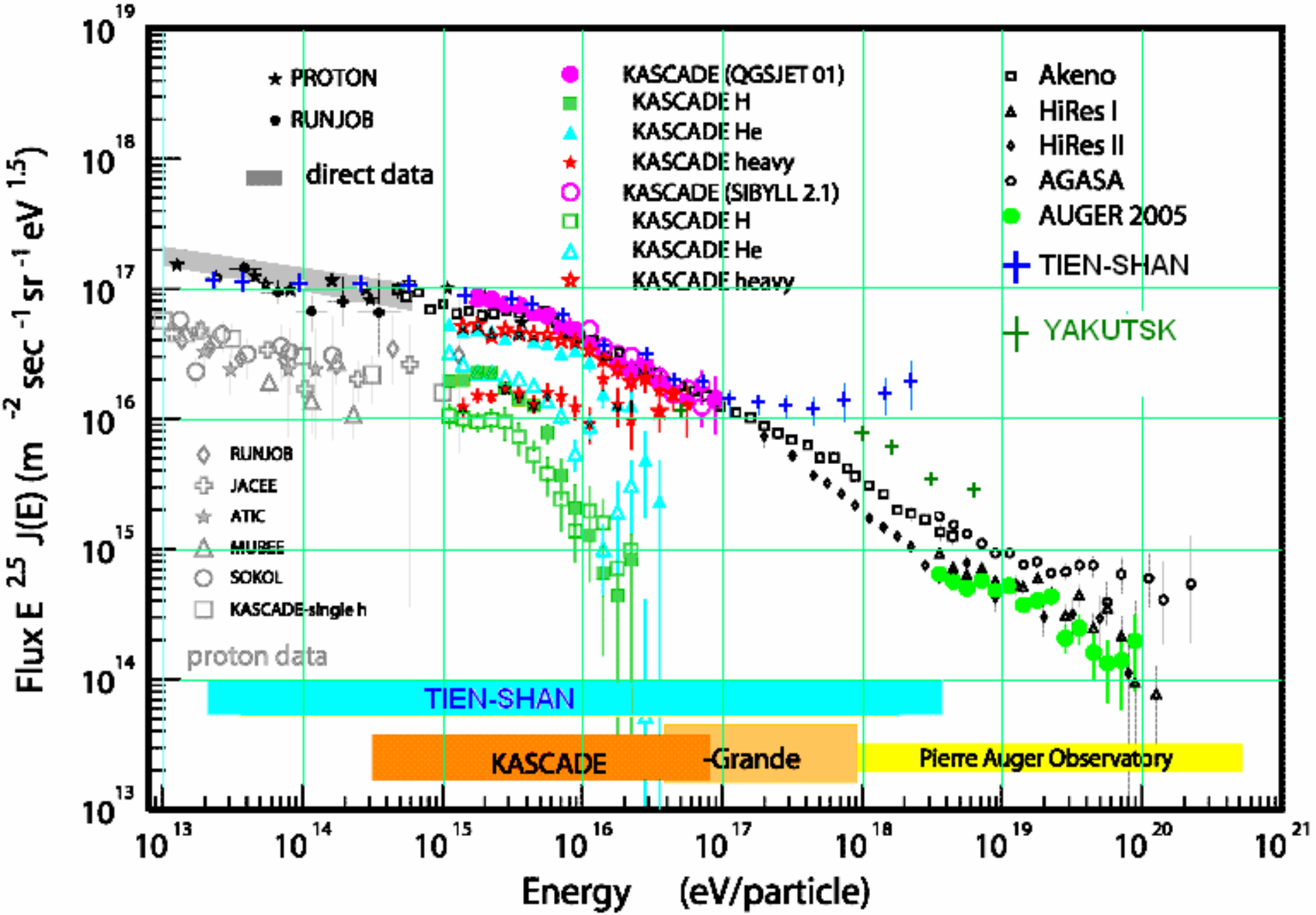
■ - Geiger counters

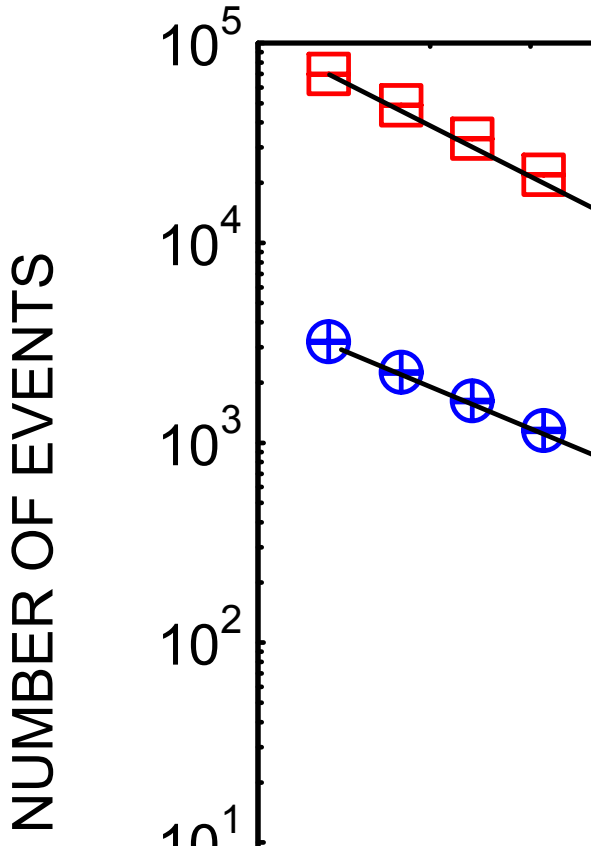
A - X-ray emulsion chamber and ionization bursts array

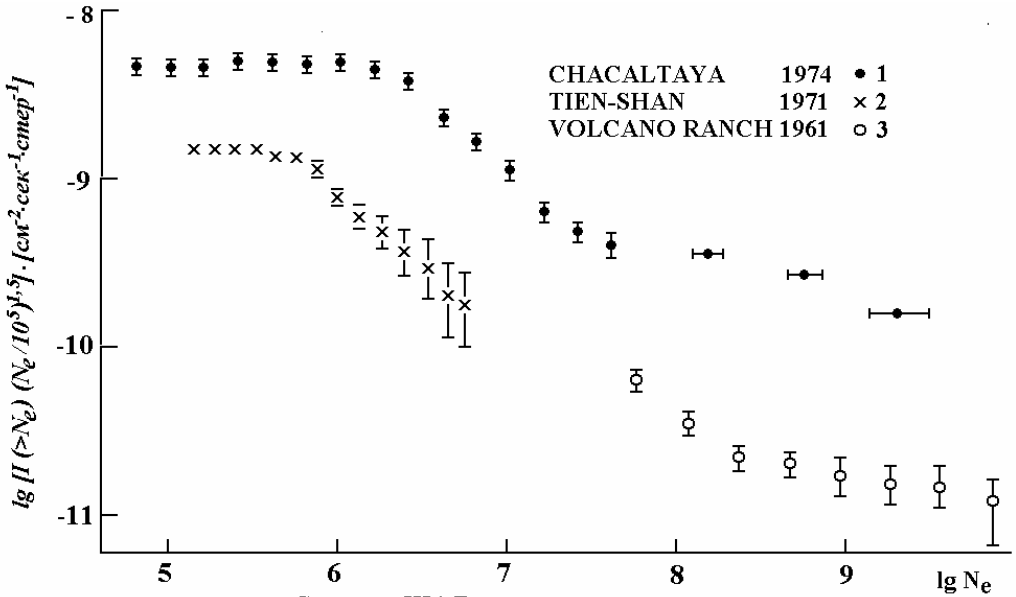
μ – Muon array

- Detector of Cherenkov pulse shape

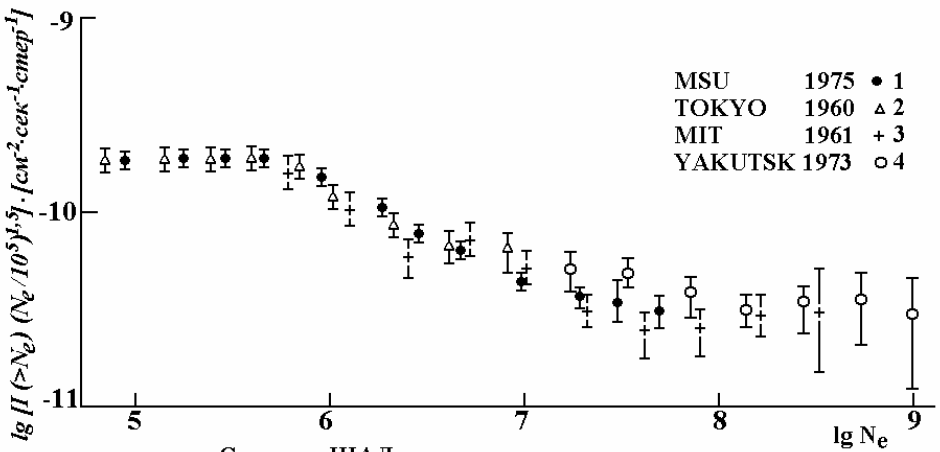
COSMIC RAYS ENERGY SPECTRUM INVESTIGATION


PROTON
RUNJOB
direct data
KASCADE (QGSJET 01)
KASCADE H
KASCADE He
KASCADE heavy
KASCADE (SIBYLL 2.1)
KASCADE H
KASCADE He
KASCADE heavy
Akeno
HiRes I
HiRes II
AGASA
AUGER 2005
TIEN-SHAN
YAKUTSK
RUNJOB
JACEE
ATIC
MUBEE
SOKOL
KASCADE-single h
proton data
TIEN-SHAN
KASCADE
-Grande
Pierre Auger Observatory
Flux E 2.5 J(E) (m -2 sec -1 sr -1 eV 1.5)
Energy (eV/particle)


NUMBER OF EVENTS
10^5
10^4
10^3
10^2
10^1



Спектры ШАЛ по числу электронов
на высоте гор: 1 - [10,13], 2 - [18], 3 - [19]



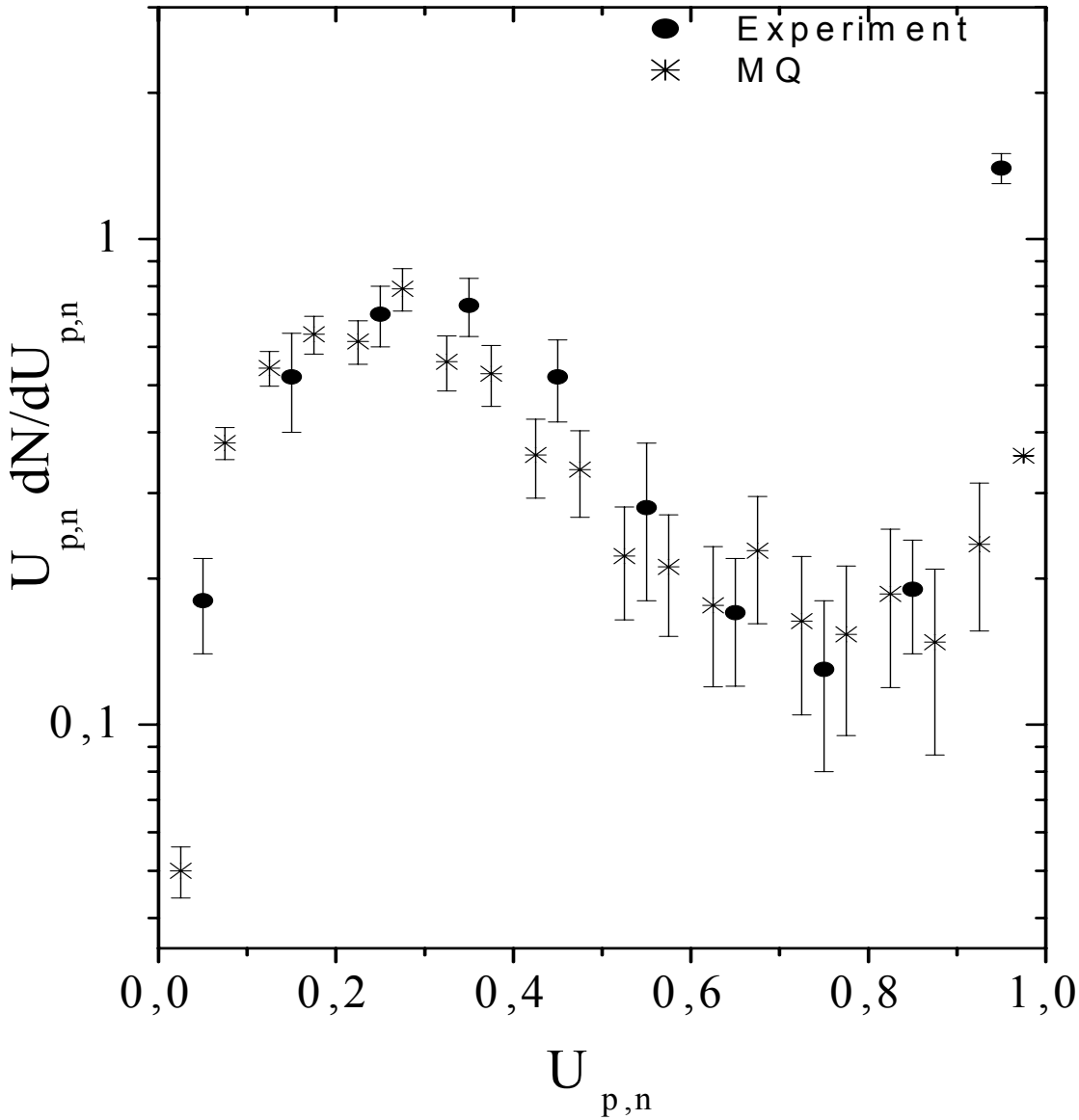
Спектры ШАЛ по числу электронов на уровне моря:
1 - [11], - [15], - [16], - [17]

ELECTRON SIZE SPECTRA OF EAS
UPPER FIGURE - MONTAIN LEVEL
LOWER FIGURE - SEA LEVEL

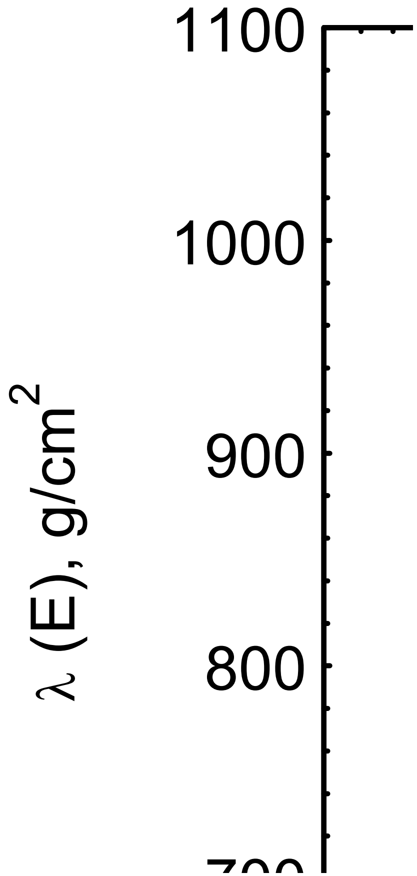
THE BIG IONIZATION CALORIMETER

TSIC had an area of 36 m^2 and consisted of 15 (finally - 19) rows of copper ionization chambers of sizes $5,5 \times 24 \times 300$ cm^3. Each row contained 48 ionization chambers. The total thickness of lead absorber (including the thickness of chamber walls and steel carcass recalculated to lead) was equal to 850 g/cm2
(1000 g/cm^2 finally).
Each chamber had its own ADC with a dynamical range 2.10^4. The signal measuring accuracy was better than 10% over the total range. The signal from a chamber was memorized in the diode-capacitor cells whereupon the series of growing pulses was fed to all ADC inputs. Each next pulse in the series was 10% greater than previous one. The first pulse with an amplitude being 10% greater than that of memorized one passed through the diode-capacitor cell and its number n was fixed. All ADC's were calibrated in such a way after each trigger pulse.
The calorimeter operation control has included the daily statisti-cal analysis of each channel: its amplitude spectrum was compared with a spectrum derived by averaging over all the chambers of the given specific row.

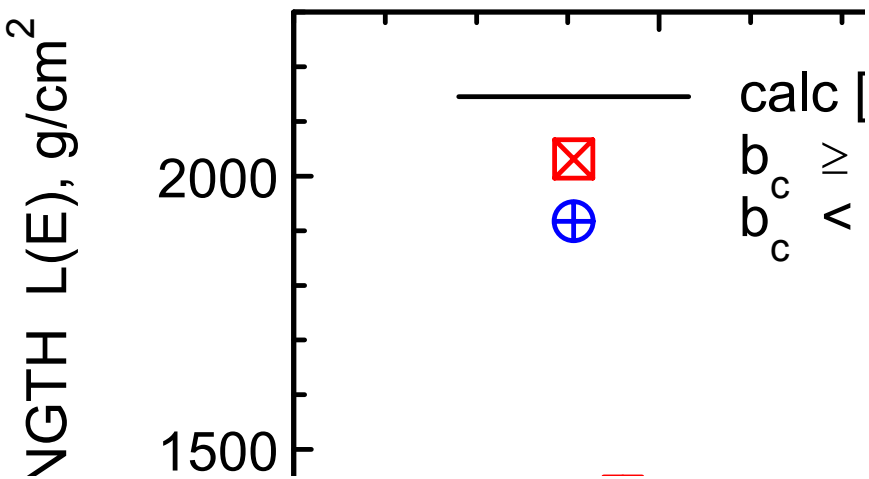
DISTRIBUTION OF ELASTICITY COEFFICIENT AT E=2 TeV RESTORED WITH THE USAGE OF INVERSE PROBLEM (1975)



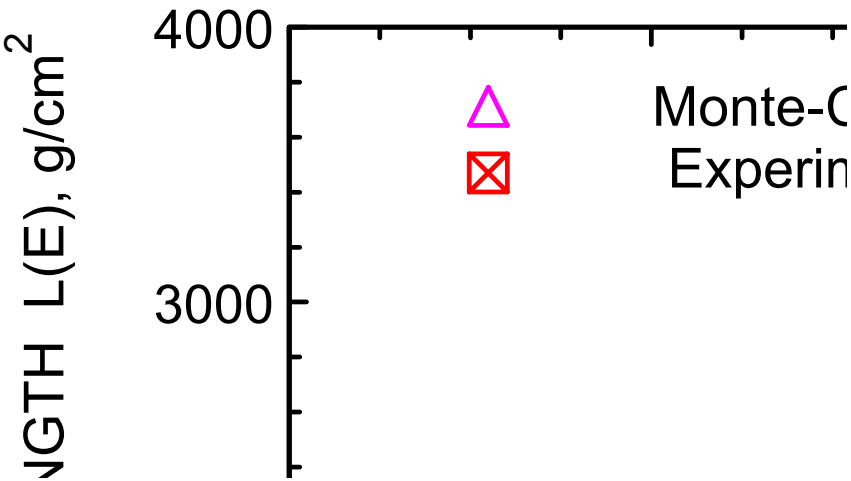
THE LONG FLYING COMPONENT

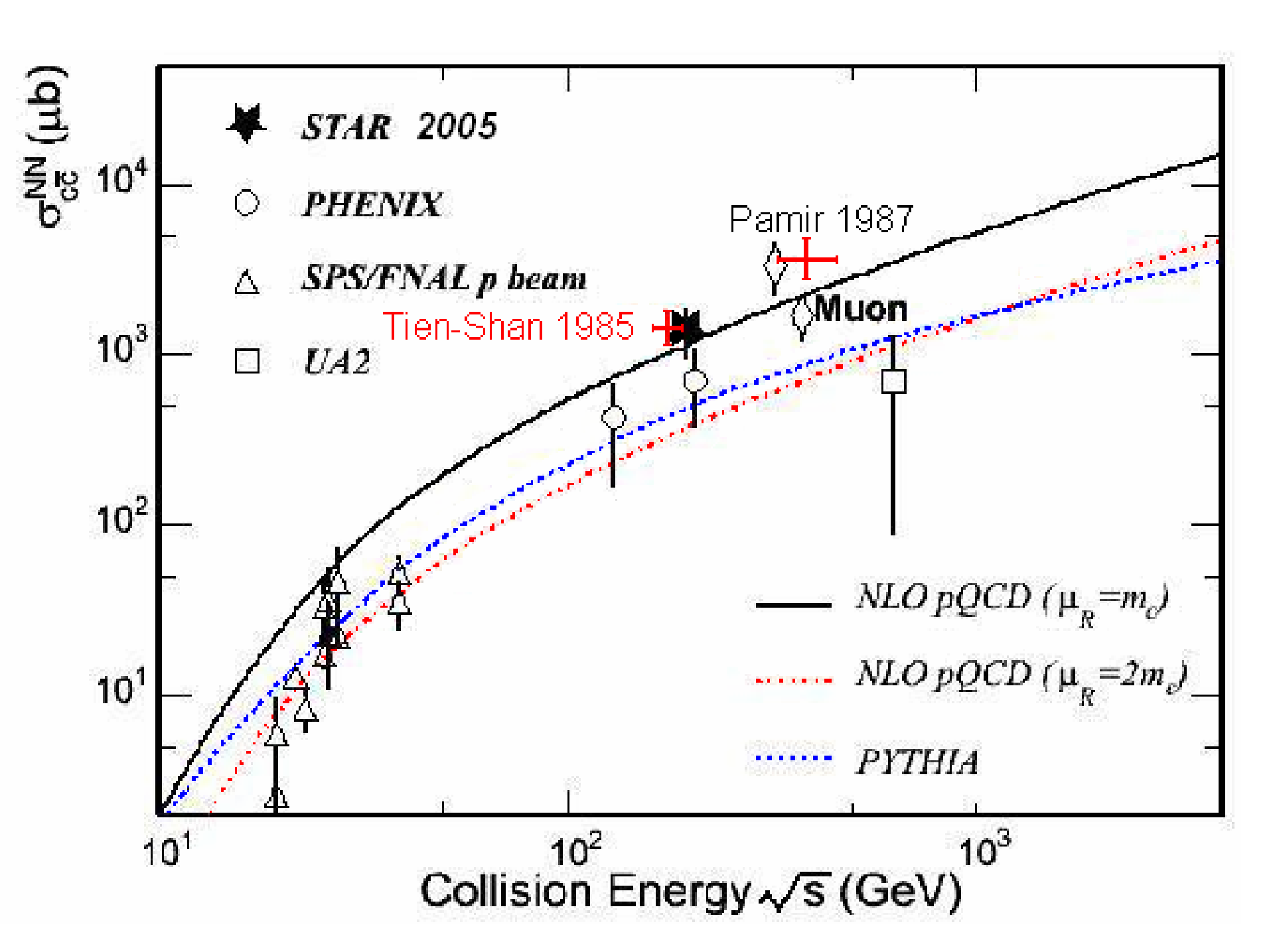

1100
1000
900
800
λ (E), g/cm2

EVENTS WERE SEPARATED ACCORDING TO THE SIGN OF b_c VALUE



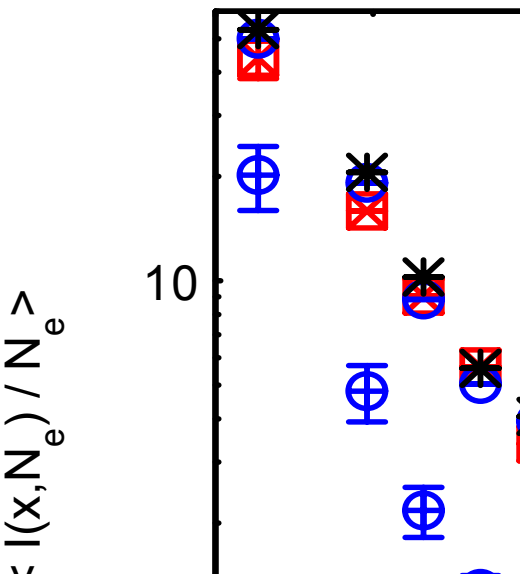
EVENTS WITH b_c>0 WERE COMPARED WITH M-C CALCULATIONS
IN ASSUMPTION OF 100% Λ_c + D IN THE FIRST INTERACTION




$\sigma_{c\bar{c}}^{NN}$ (μb)
10^4
10^3
10^2
10^1
STAR 2005
PHENIX
SPS/FNAL p beam
UA2
Pamir 1987
Muon
Tien-Shan 1985
NLO pQCD ($\mu_R = m_c$)
NLO pQCD ($\mu_R = 2m_c$)
PYTHIA
10^1
10^2
10^3
Collision Energy $\sqrt{s}$ (GeV)

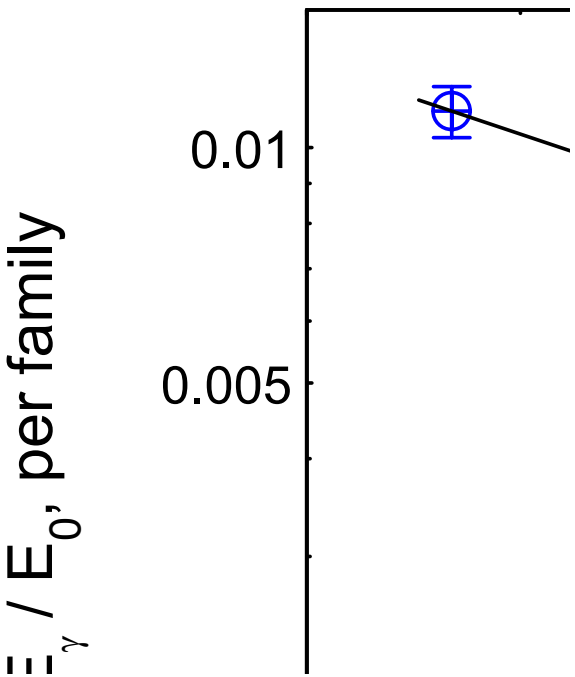
AVERAGED CASCADES IN THE CALORIMETER NORMALIZED TO EAS SIZE

JUMP LIKE DECREASE AT PRIMARY ENERGY ABOVE 10^{16} eV



ENERGY OF GAMMA FAMILIES NORMALIZED TO PRIMARY ENERGY

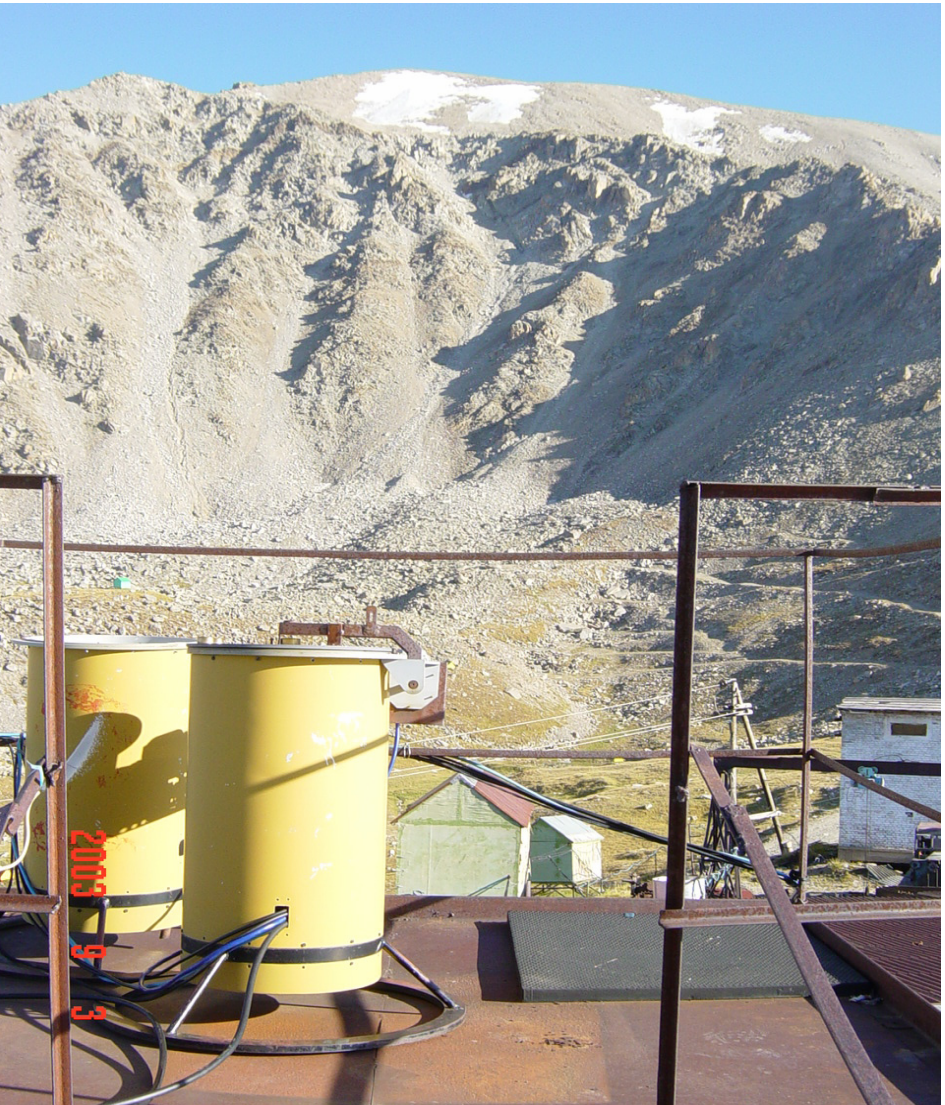
JUMP LIKE DECREASE AT ENERGY ABOVE 10^{16} eV

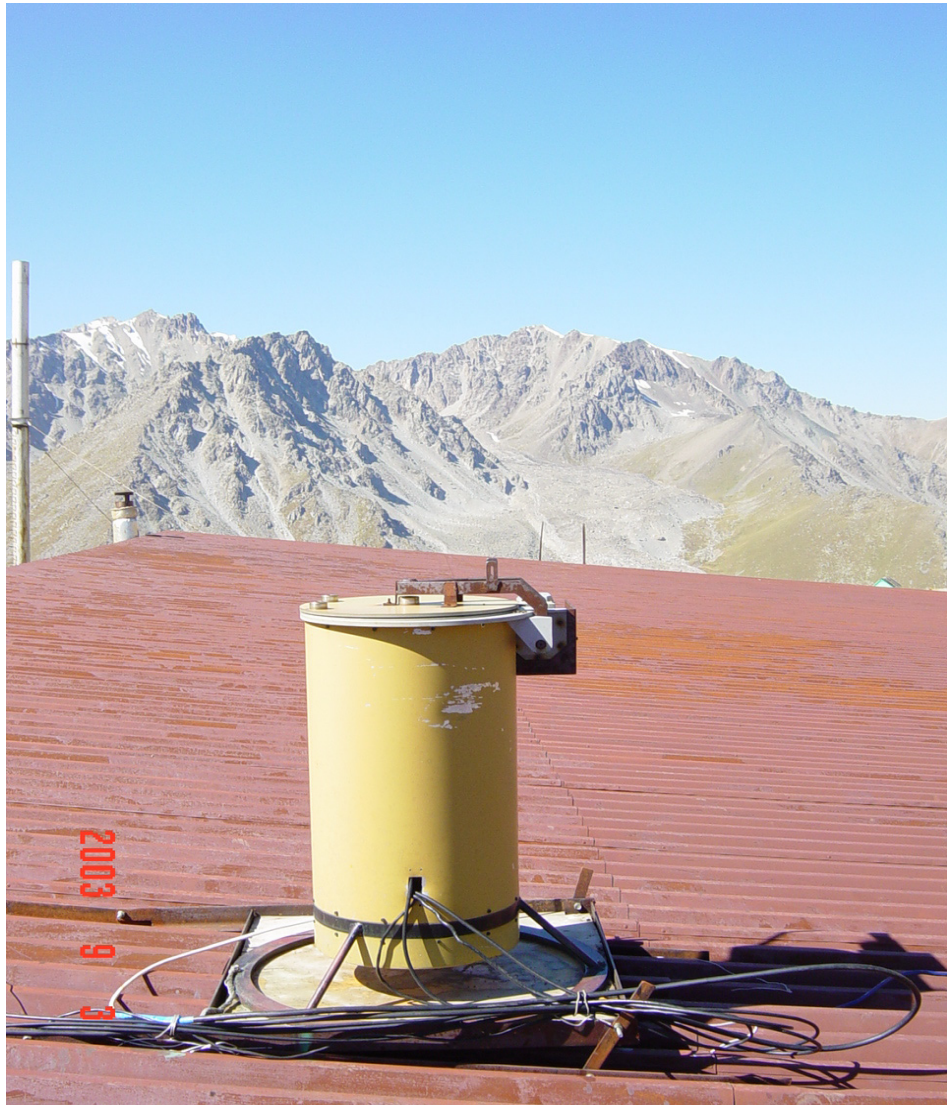


CHERENKOV ARRAY

CHERENKOV LIGHT FLUX IS THE MOST ADEQUATE MEASURE OF SHOWER ENERGY

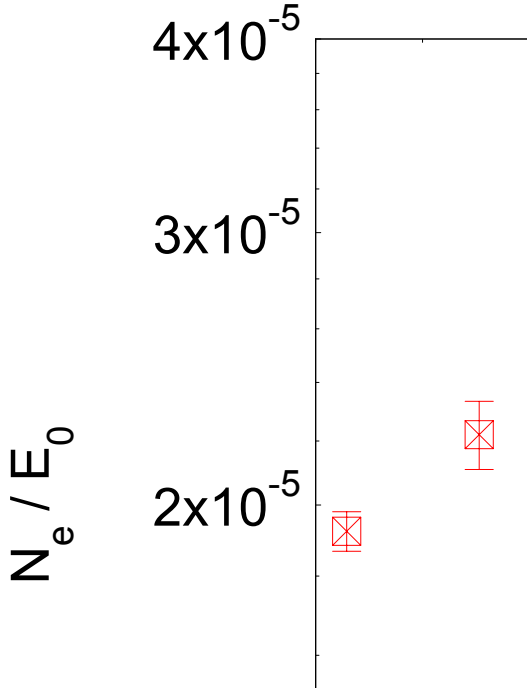
CHERENKOV DETECTORS





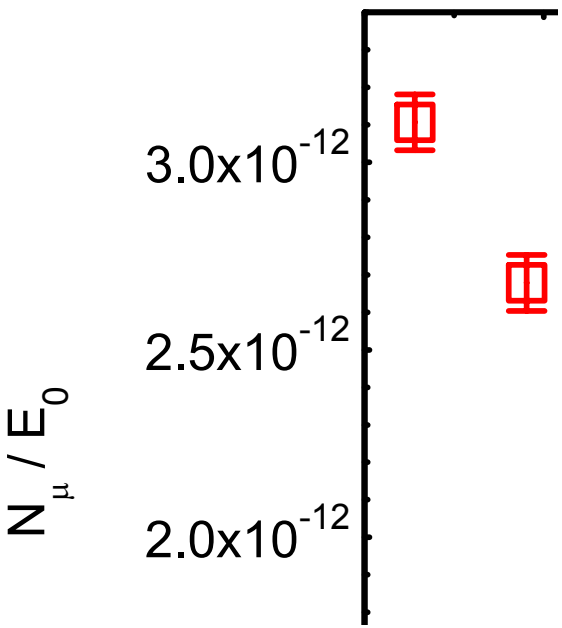
EAS SIZE NORMALIZED TO SHOWER ENERGY

JUMP LIKE DECREASE AT ENERGY ABOVE 10^{16} eV



MUON NUMBER NORMALIZED TO PRIMARY ENERGY

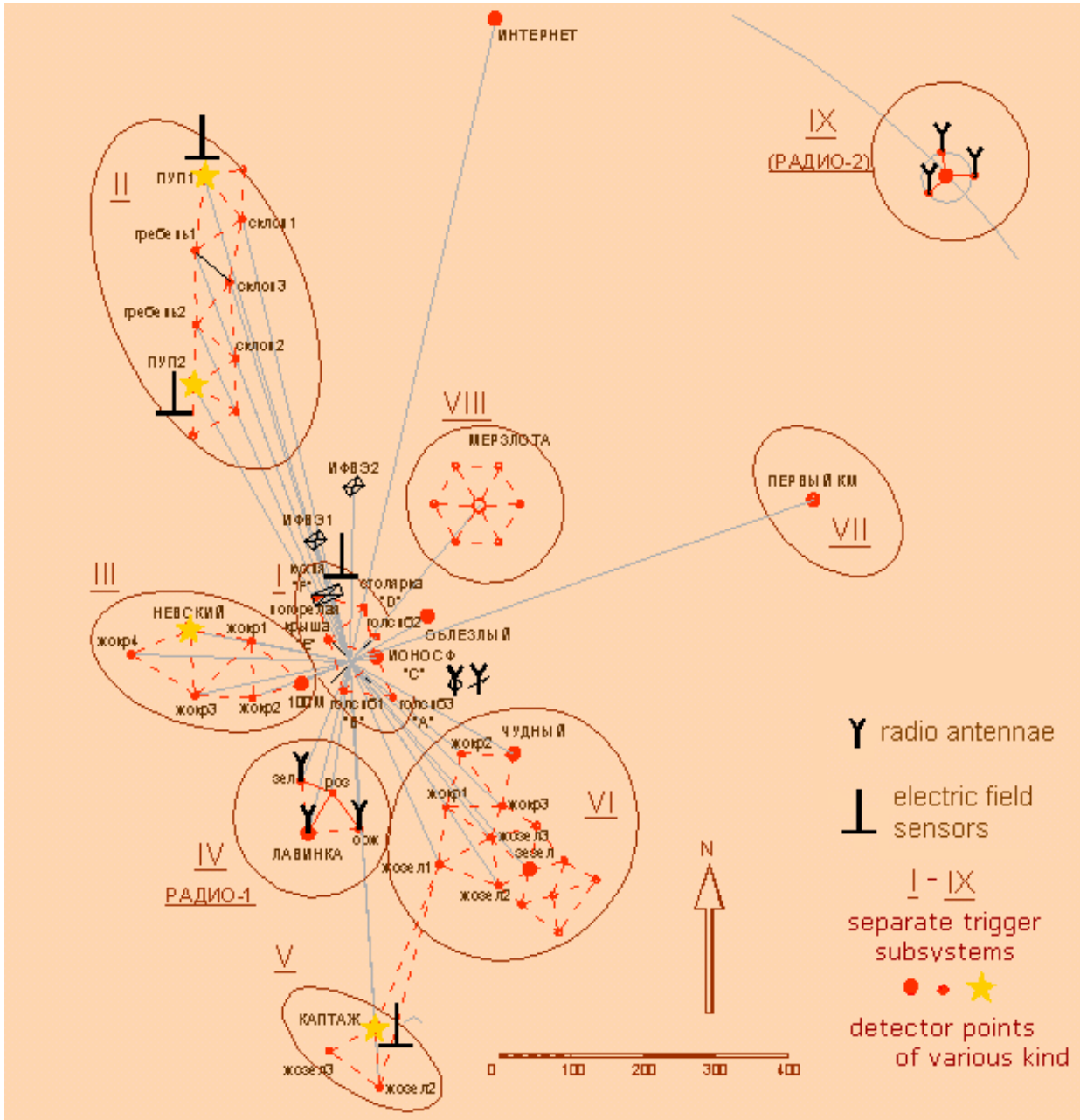
JUMP LIKE INCREASE AT ENERGY 10^{16} eV



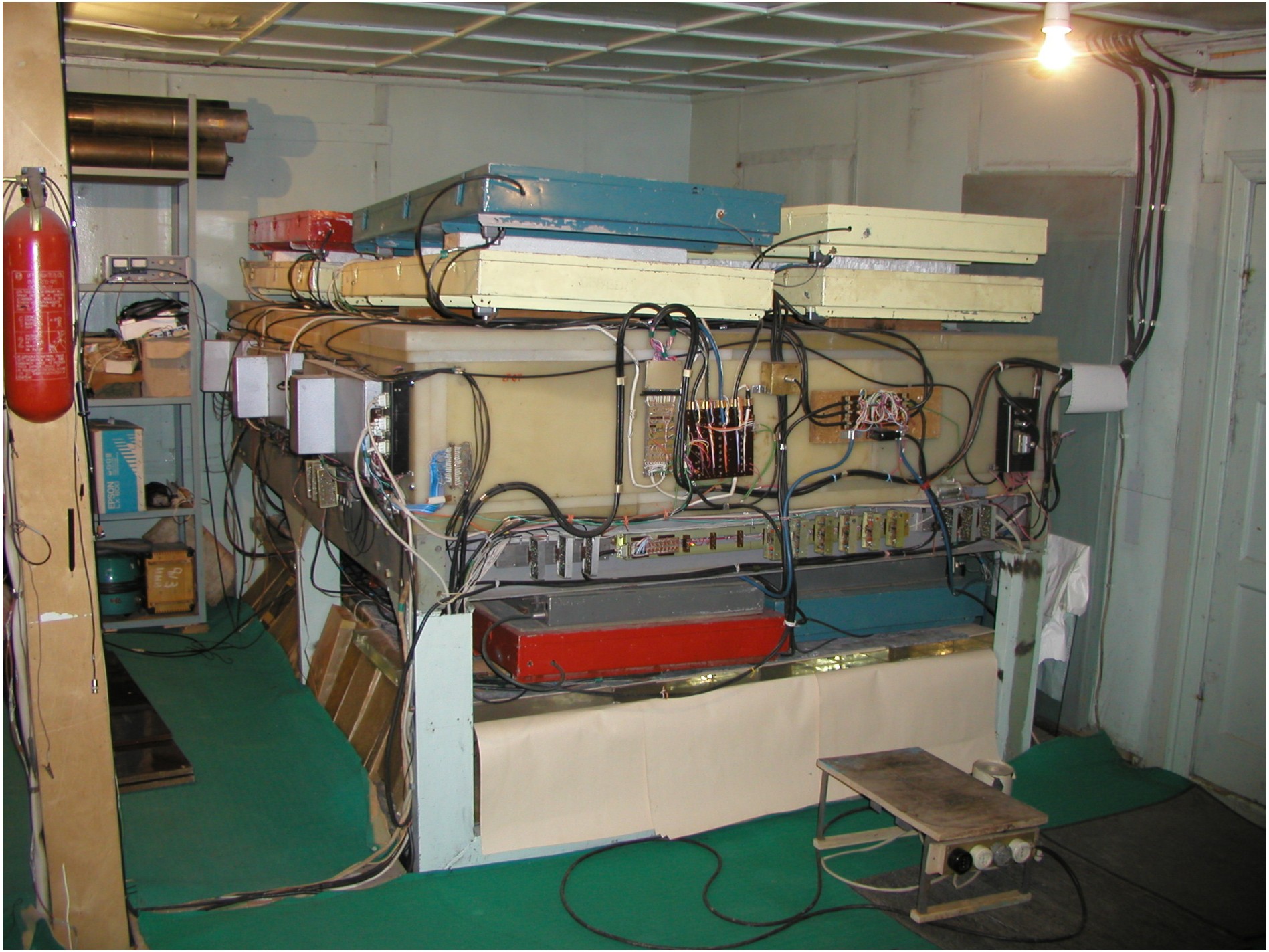
TIEN-SHAN

PRESENT

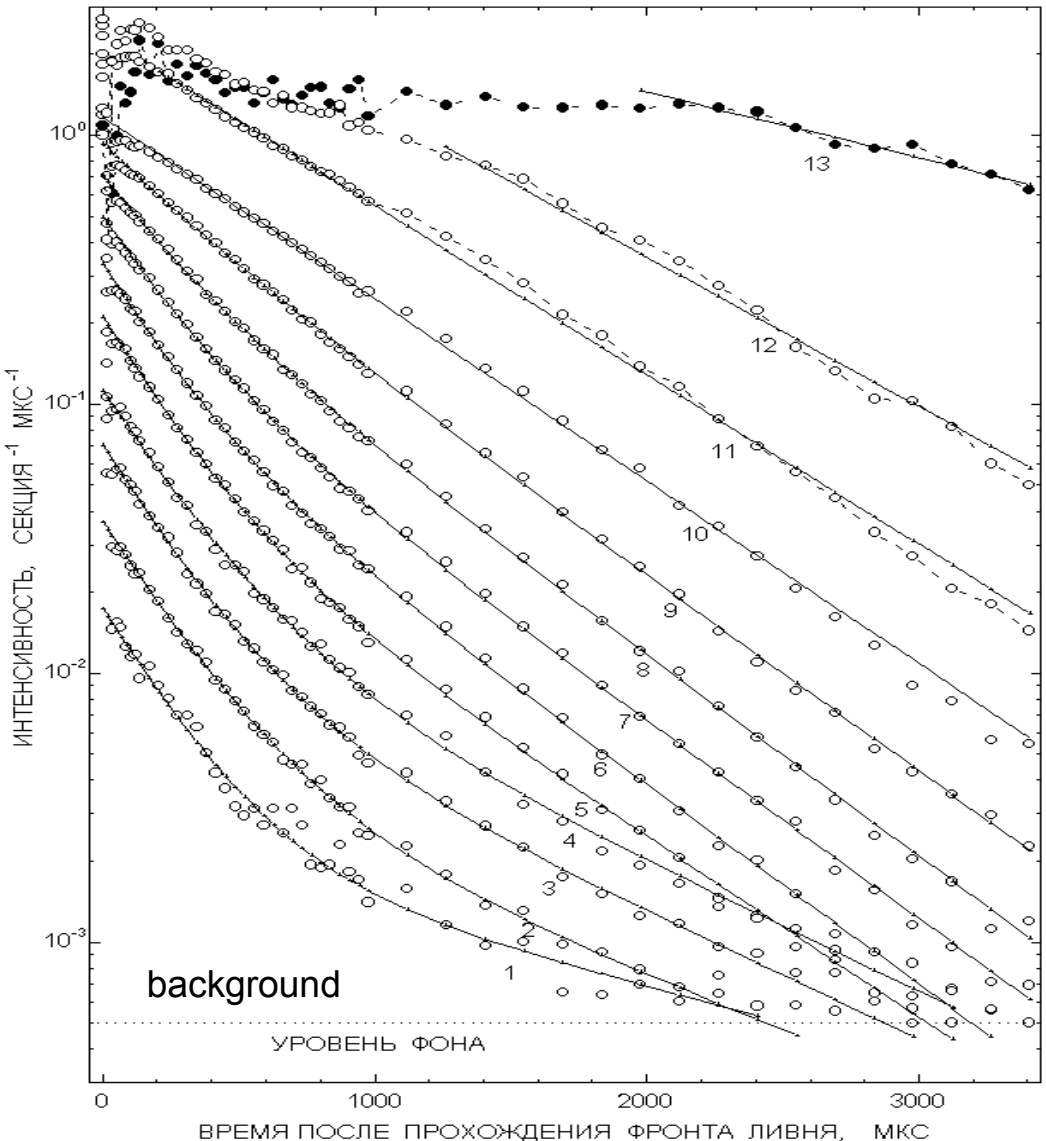
TODAY TRIGGERING SYSTEMS



INVESTIGATION OF NEUTRONS IN EAS

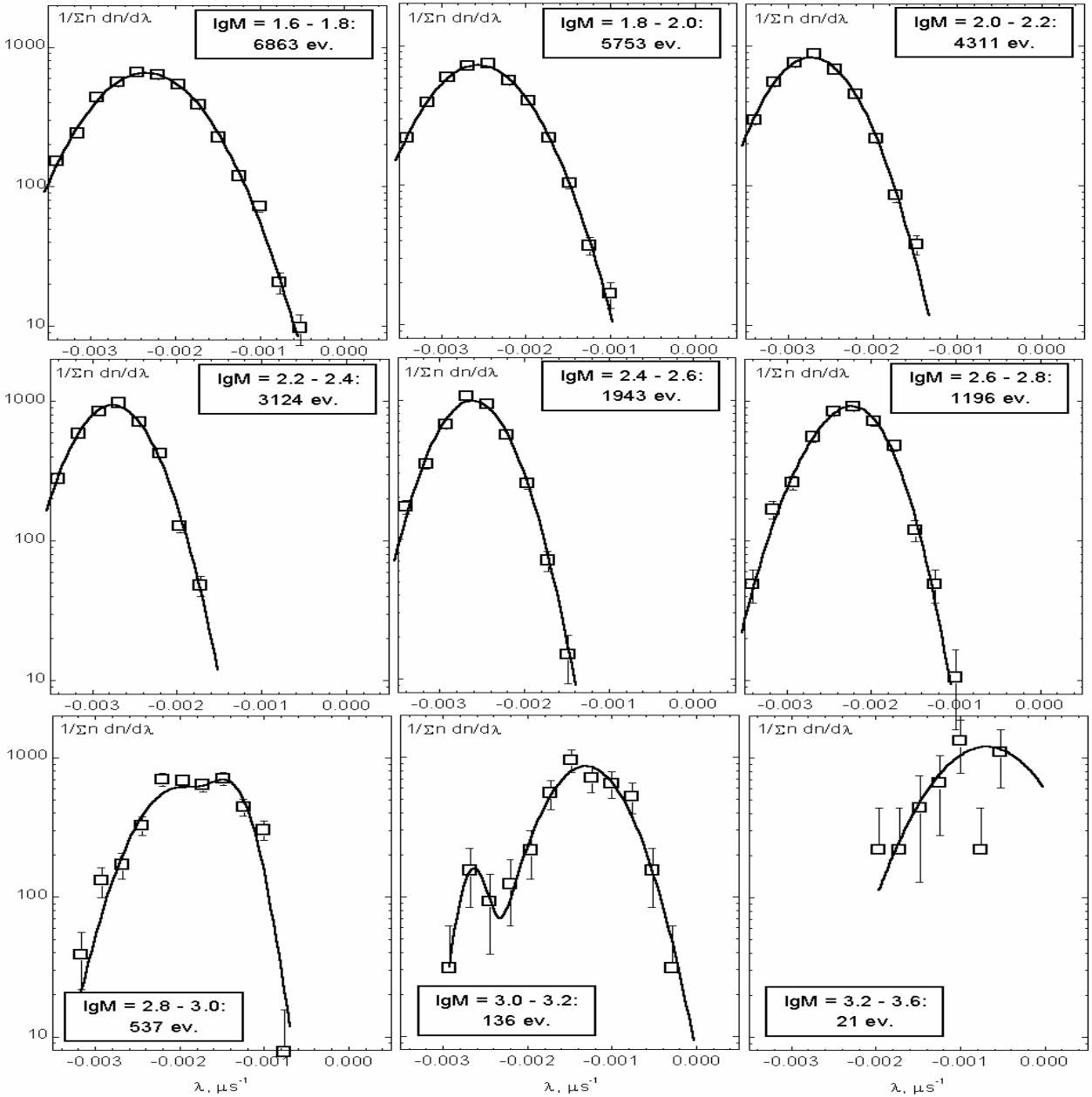


TIME DELAY OF NEUTRONS AFTER EAS FRONT AT DIFFERENT NEUTRON MULTIPLICITY



μs

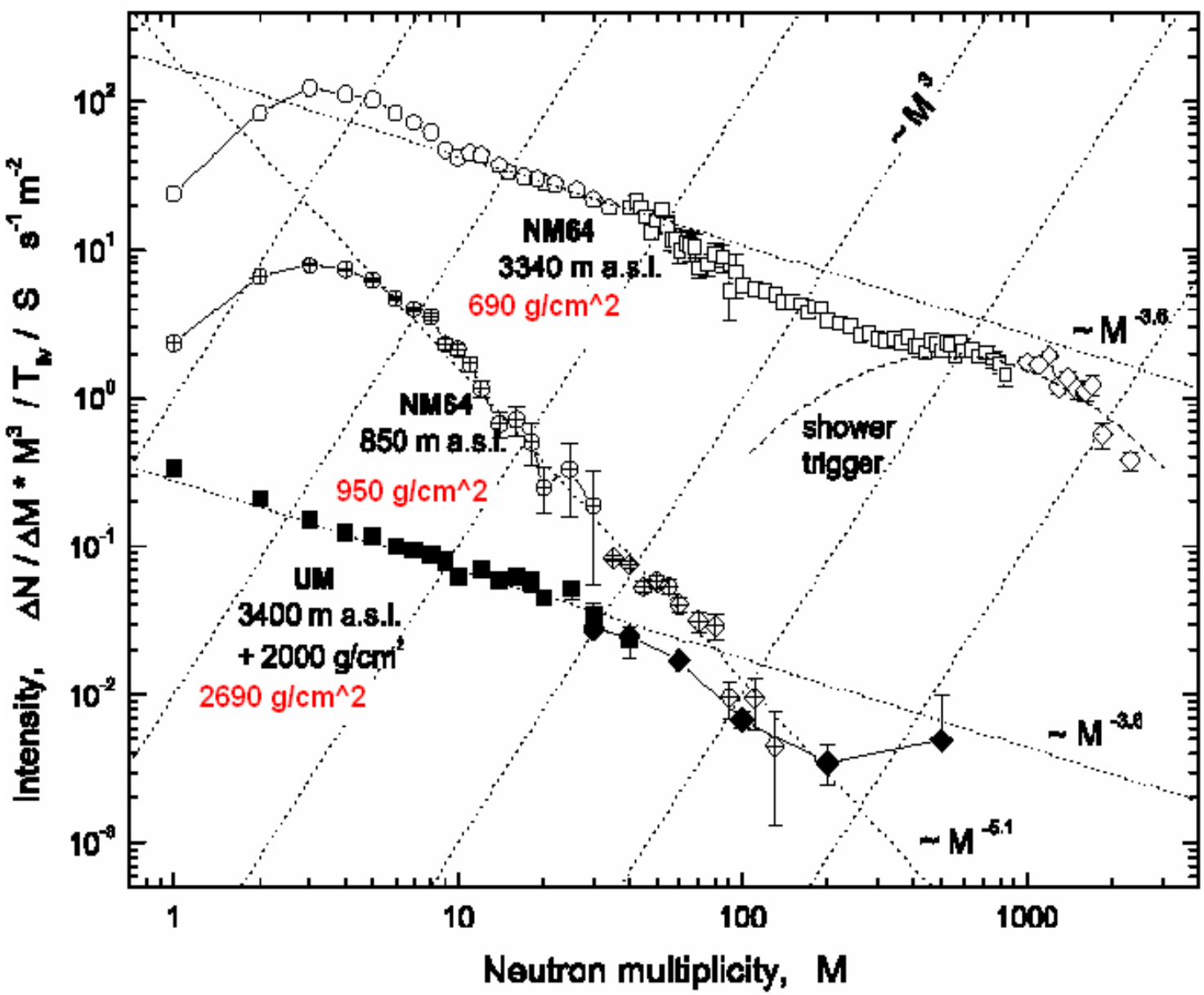
DISTRIBUTIONS OF NEUTRONS RECIPROCAL DELAY TIME AT DIFFERENT NEUTRON MULTIPLICITY



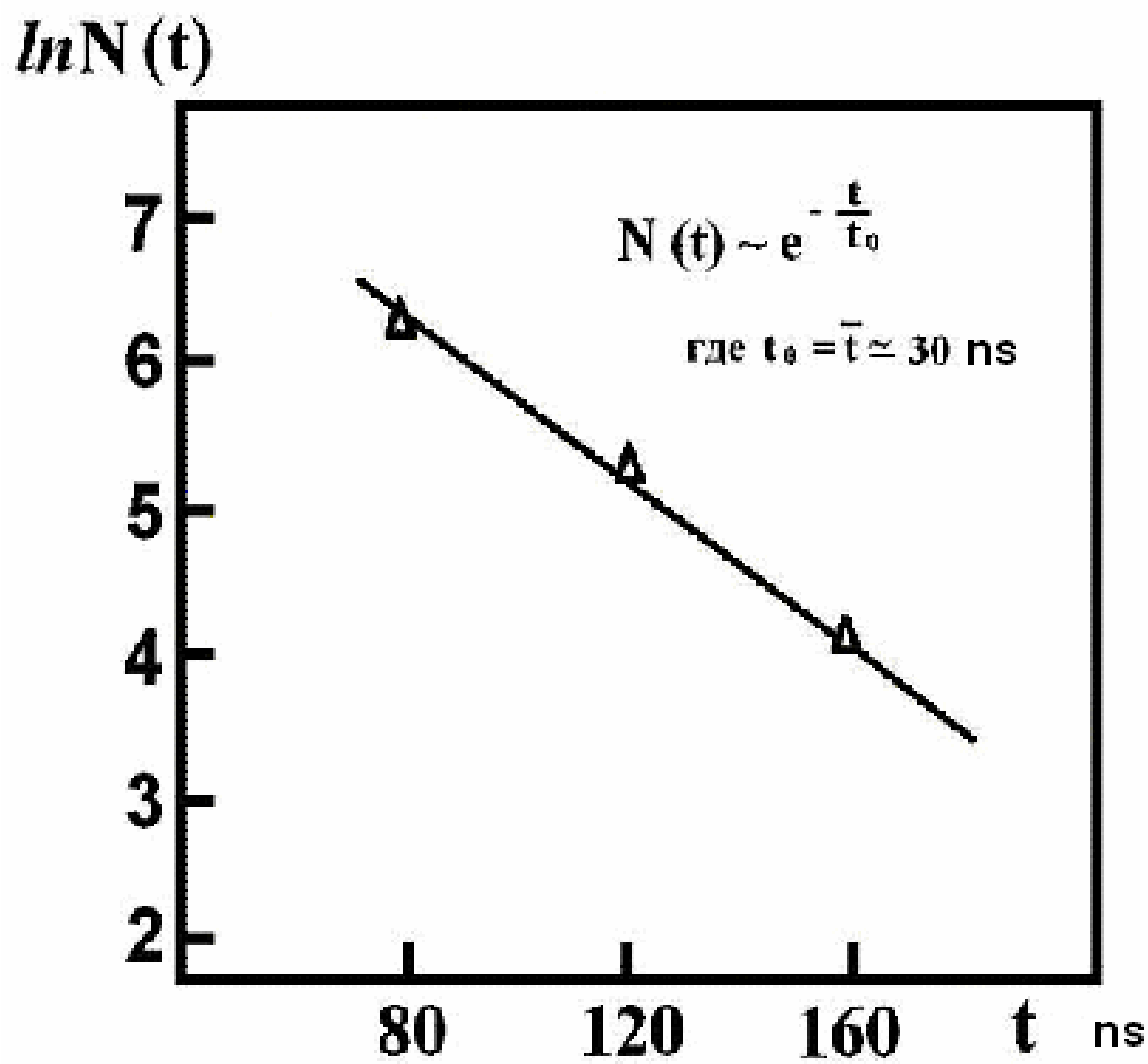
μs^{-1}

SPECTRA OF NEUTRON MULTIPLICITY AT DIFFERENT DEPTH OF OBSERVATION

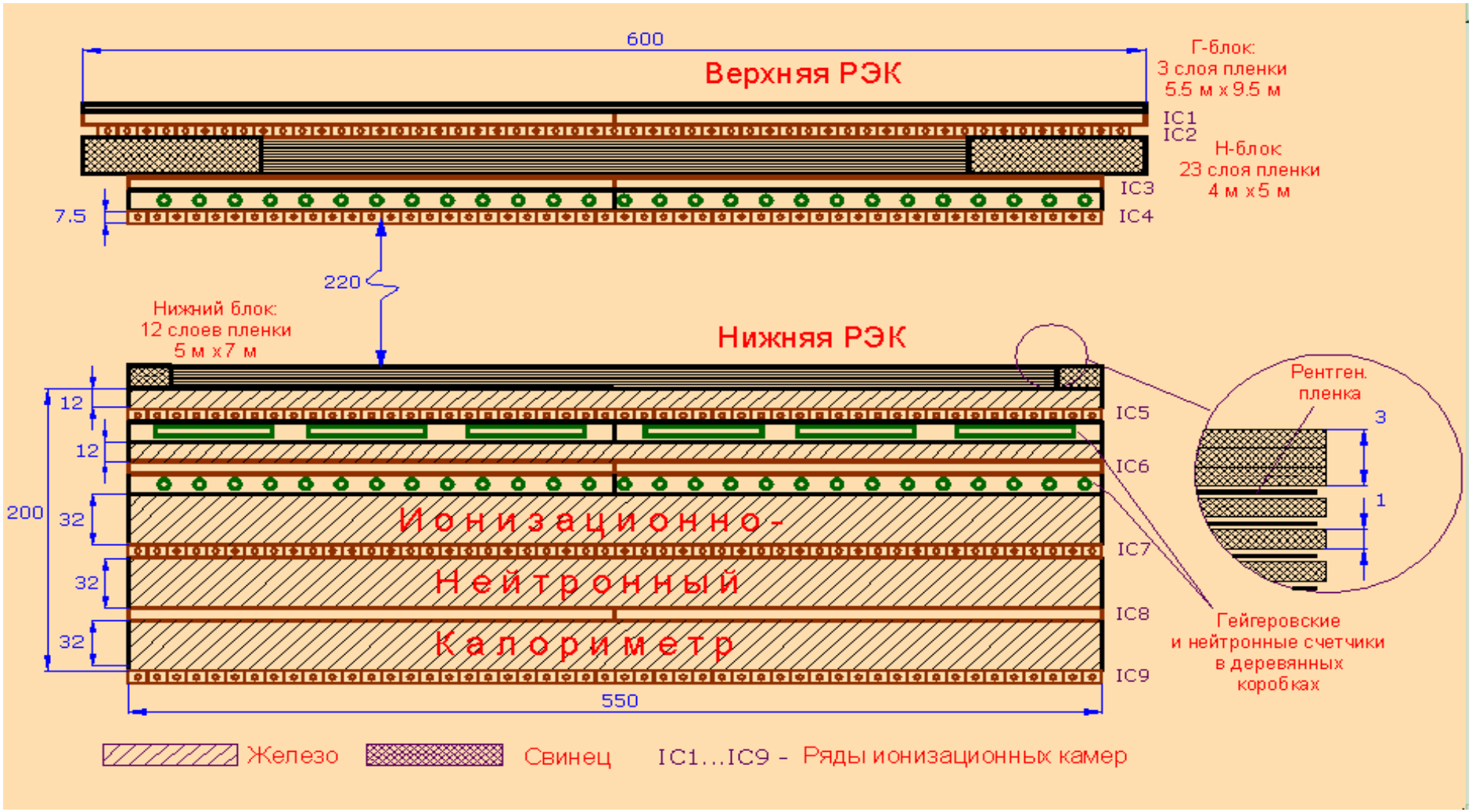
EVIDENCE OF UNSTABLE COMPONENT



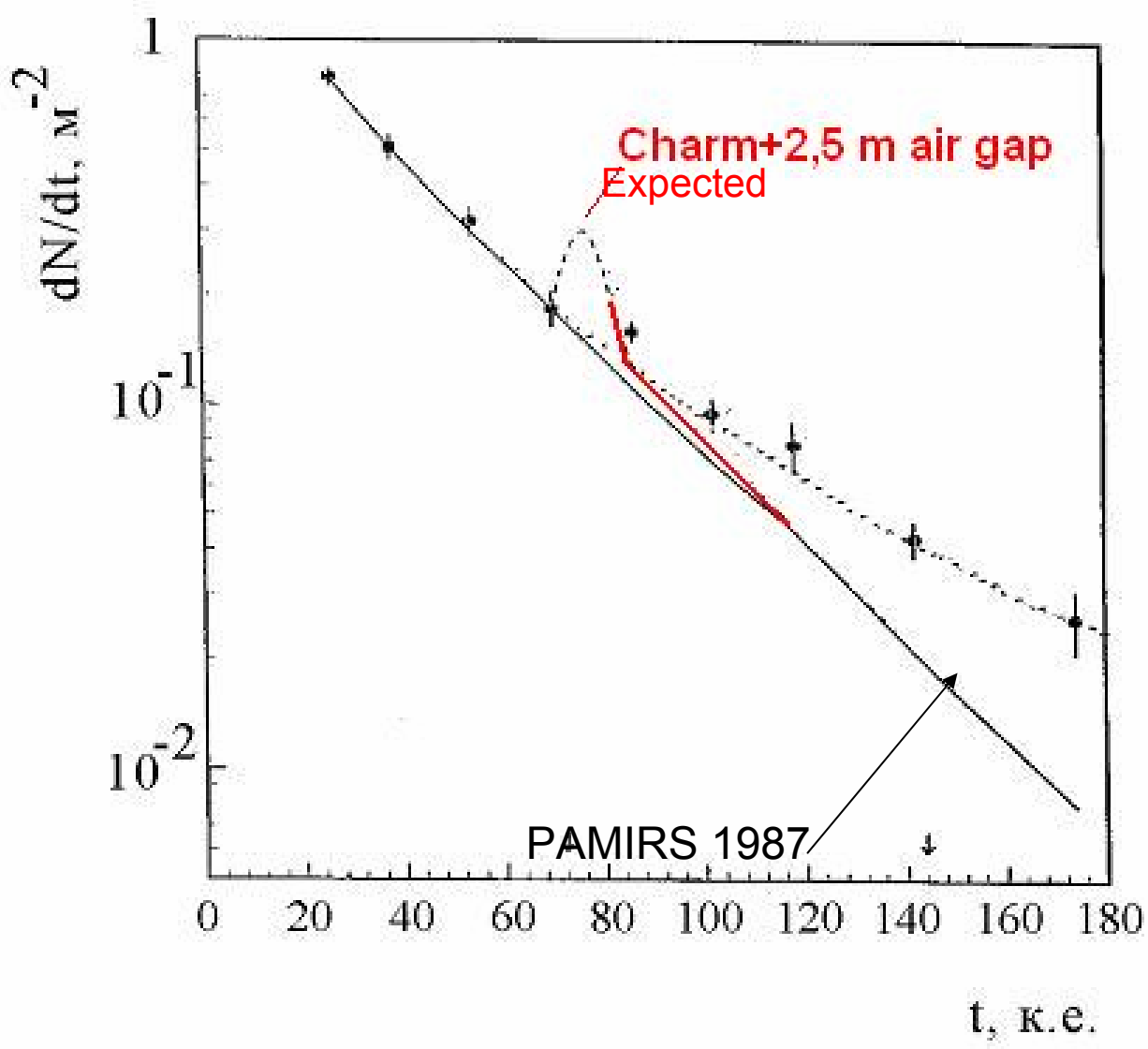
In EAS with energy ≥ 10^{15} eV delaying penetrating particles with time delay ≥ 60ns relative to shower front was found in the underground scintillator array (MUON-T).



IONIZATION-NEUTRON CALORIMETER WITH TWO-STORIED X-RAY FILM EMULSION CHAMBER WITH AIR GAP

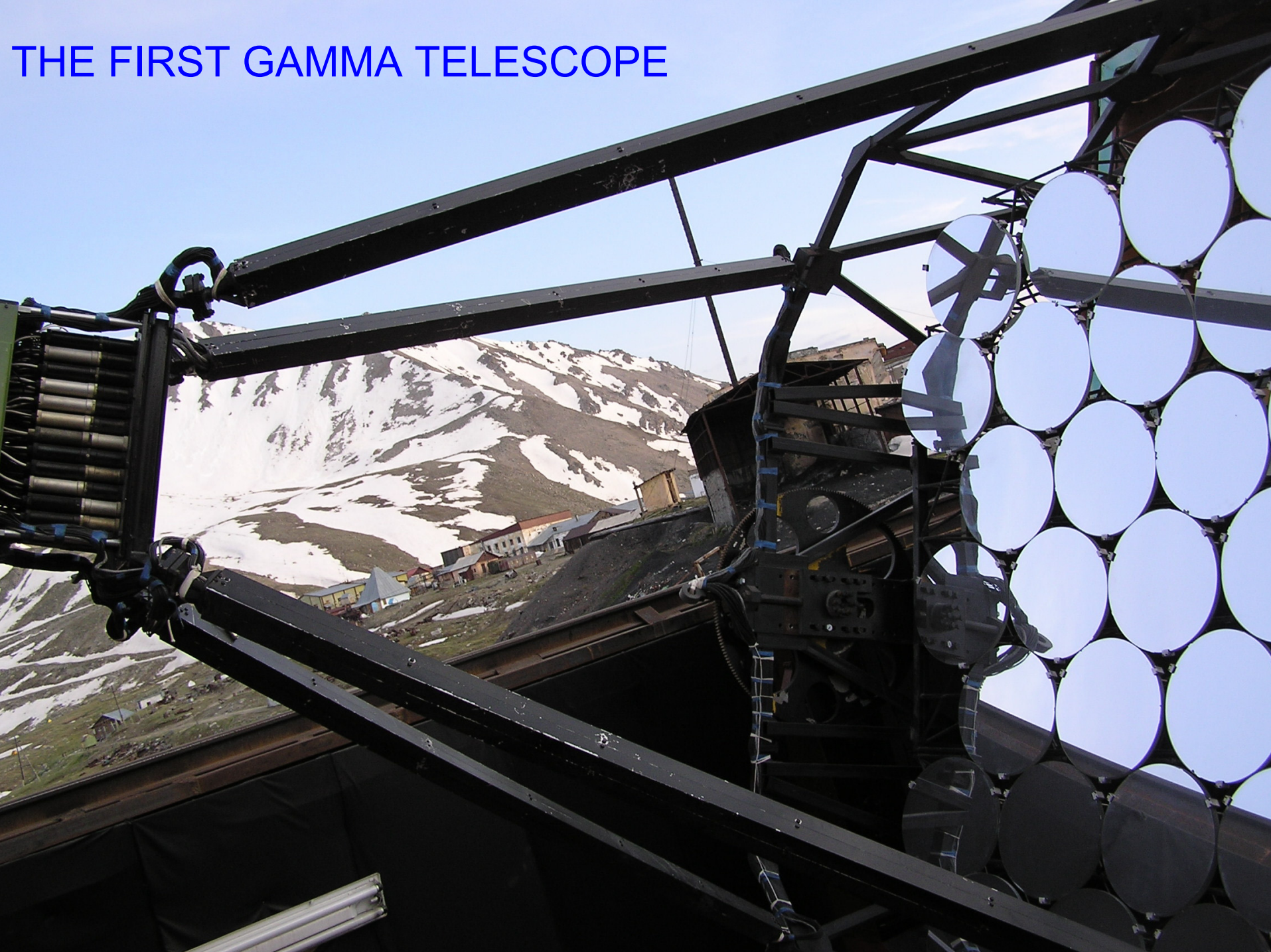


EXPERIMENTUM CRUCIS
TIEN-SHAN 2005

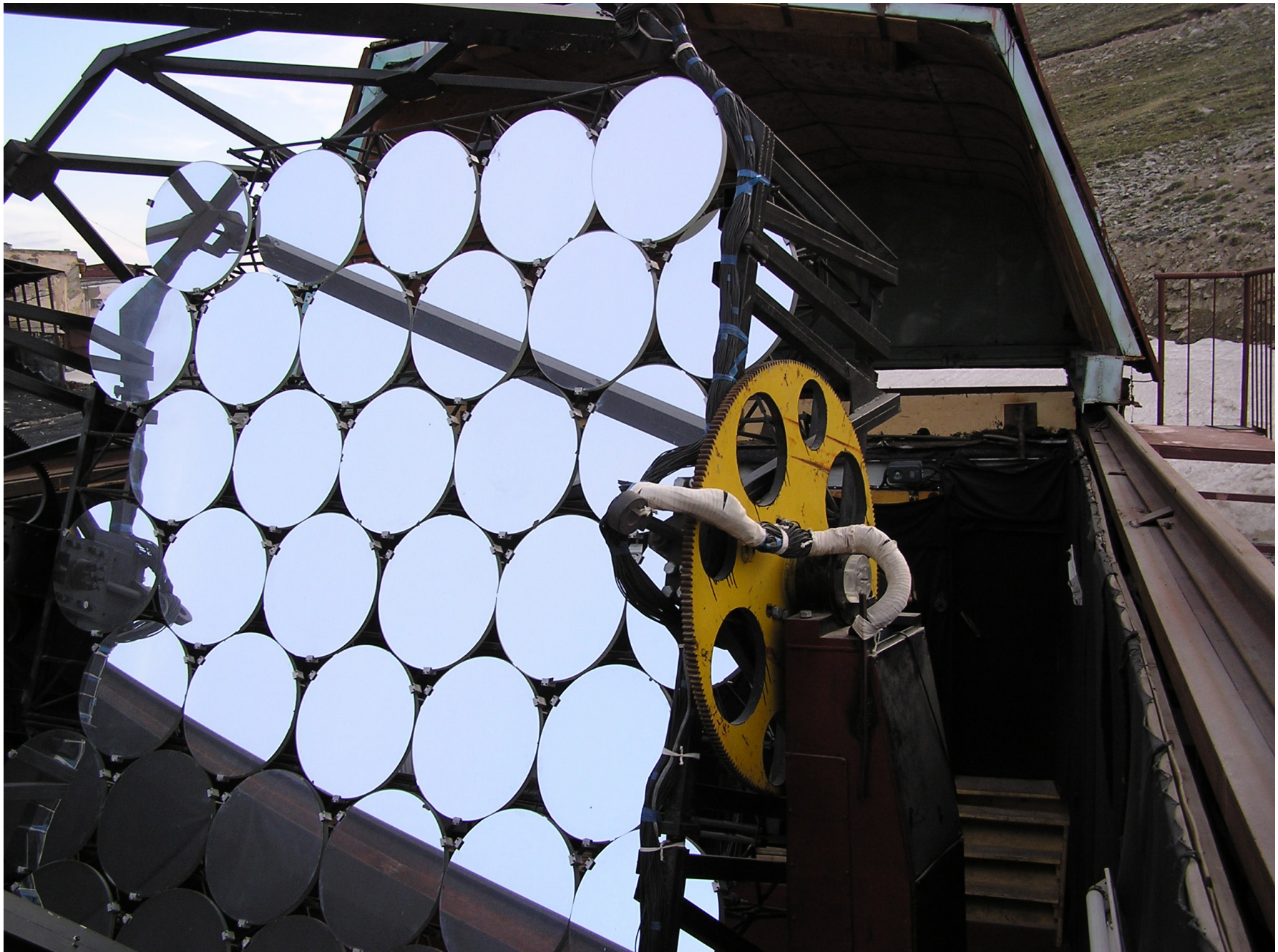


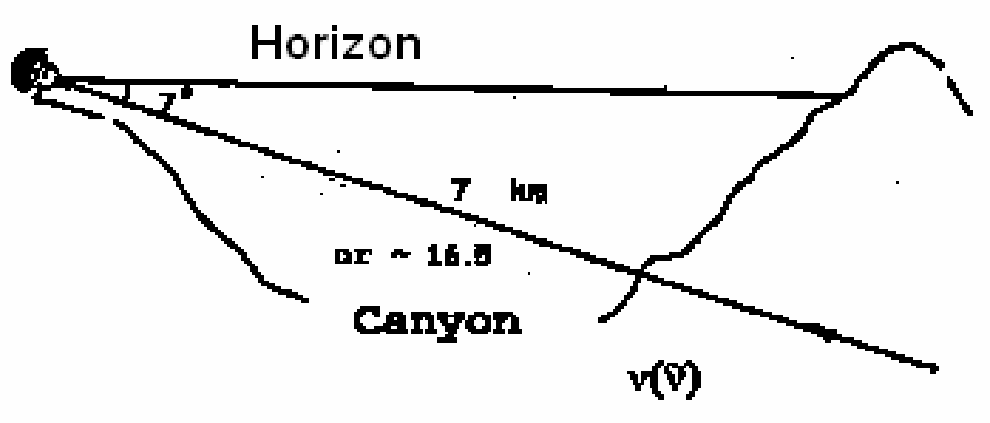
casc.units

THE FIRST GAMMA TELESCOPE

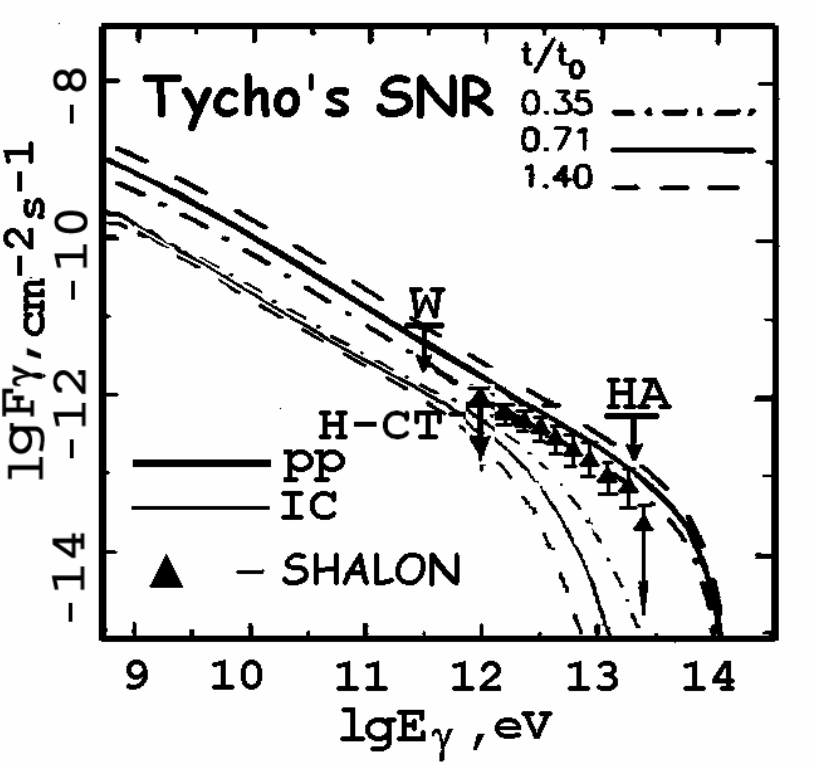


THE SECOND GAMMA TELESCOPE





INVESTIGATION OF NEUTRINO OSCILLATIONS WITH USAGE OF EAS PRODUCED IN MOUNTAIN

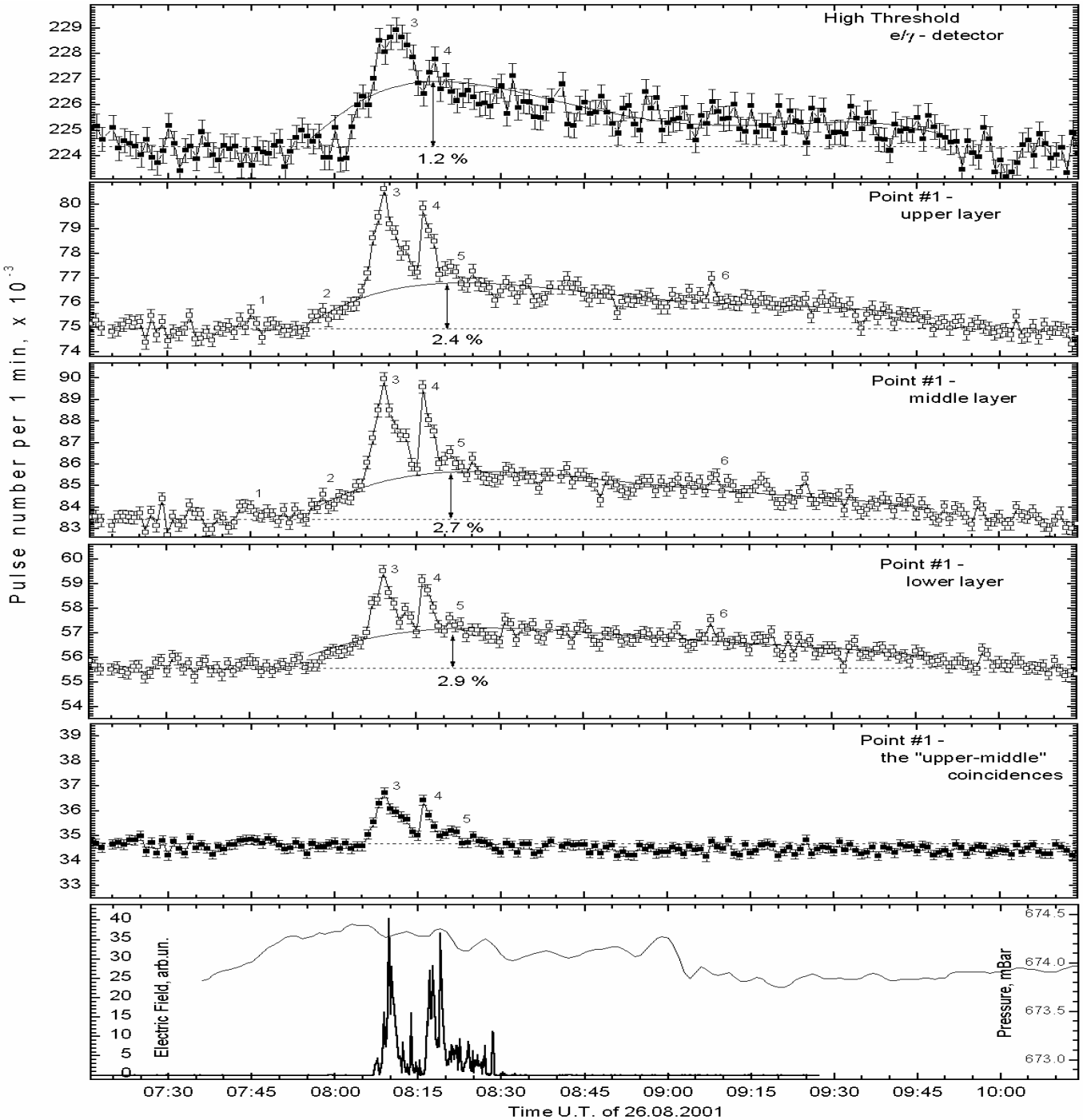


INVESTIGATION OF LOCAL GAMMA RAY SOURCES

INVESTIGATION OF THUNDESTORMS AND THEIR CORRELATIONS WITH EAS

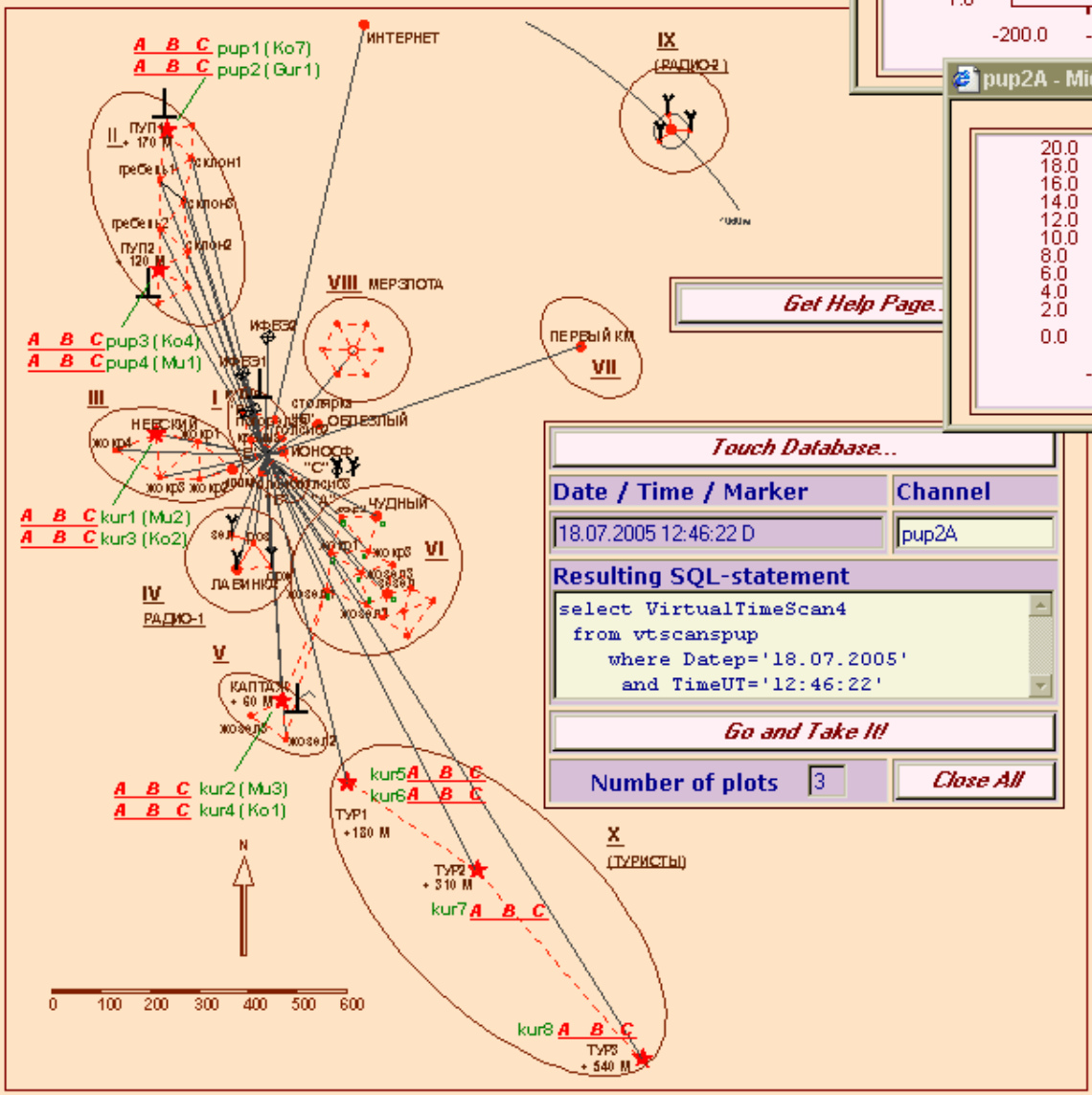

14 9 2005


14 9 2005



EXAMPLE OF CHARGED CLOUD PASSAGE ABOVE THE NOTCH

THUNDERDATA-2005:
TIME SCANS OF
NaI SCINTILLATORS



Get Help Page...

Touch Database...

Date / Time / Marker	Channel
18.07.2005 12:46:22 D	pup2A

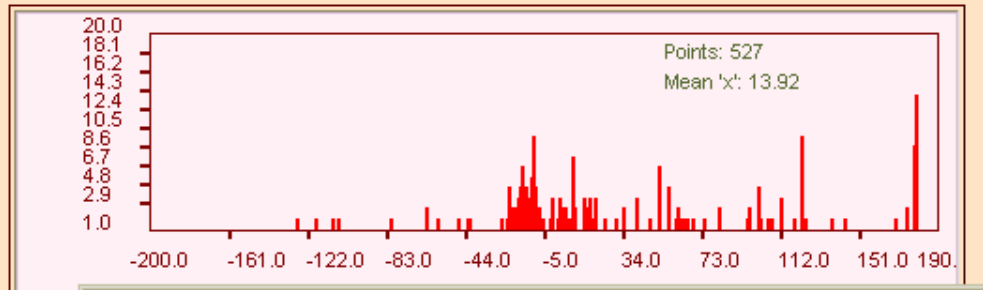
Resulting SQL-statement

```
select VirtualTimeScan4
 from vtscanspup
    where Datep='18.07.2005'
     and TimeUT='12:46:22'
```

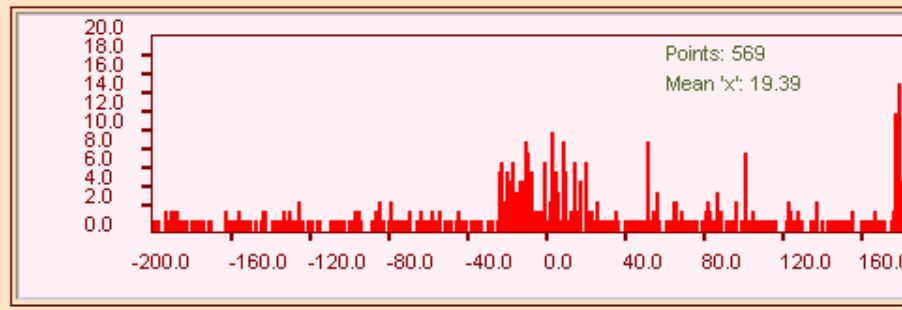
Go and Take It!

Number of plots 3 Close All

pup3C - Microsoft Internet Explorer



pup2A - Microsoft Internet Explorer



contens - Microsoft Internet E...

1	26.08.2005	10:49:31	E
2	17.07.2005	06:41:57	D
3	18.07.2005	12:30:09	D
4	18.07.2005	12:30:09	D
5	18.07.2005	12:46:22	D
6	18.07.2005	12:46:22	D
7	18.08.2005	12:46:22	D
8	22.08.2005	08:13:57	D
9	22.08.2005	08:14:59	D
10	26.08.2005	10:51:50	D
11	26.08.2005	10:42:40	D

Virtual Time Scan Data Bank -- t:\she_thunderdatabank\vtsb :: 2005pup.DB

t:\she_thunderdatab \\ 2005pup.DB | Close | Help ... | Exit

Output | Input

Date:

Август 2005

Пн	Вт	Ср	Чт	Пт	Сб	Вс
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Сегодня: 23.09.05

14.07.05	37
15.07.05	46
16.07.05	3
17.07.05	89
18.07.05	35
19.07.05	51
20.07.05	81
28.07.05	17
29.07.05	2
30.07.05	24
02.08.05	94

Hour: 10

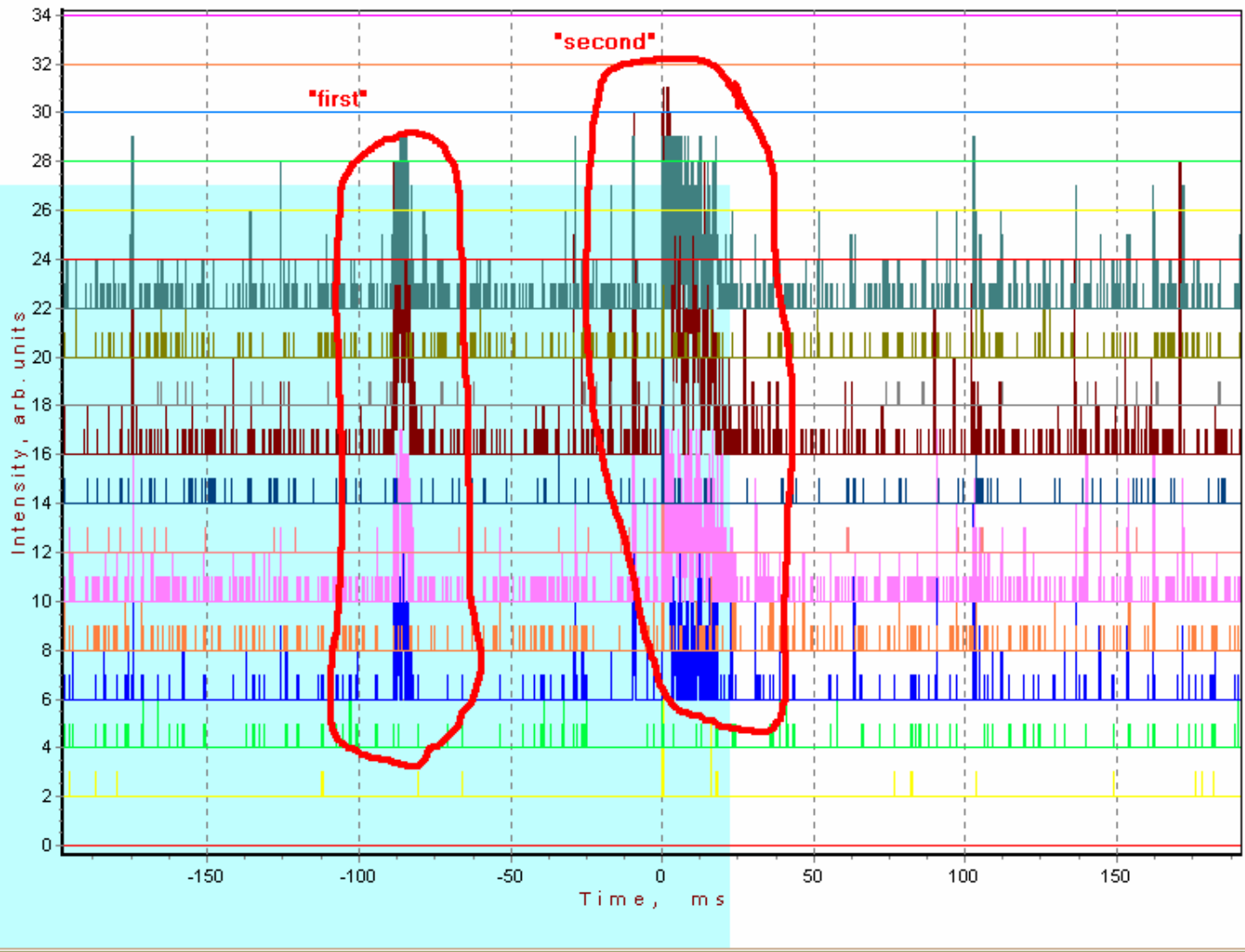
As Plot | As Text

Tmp. file:

on disk: g:

Event 15 of 30: 26.08.05 10:46:35

Select | Mark | D

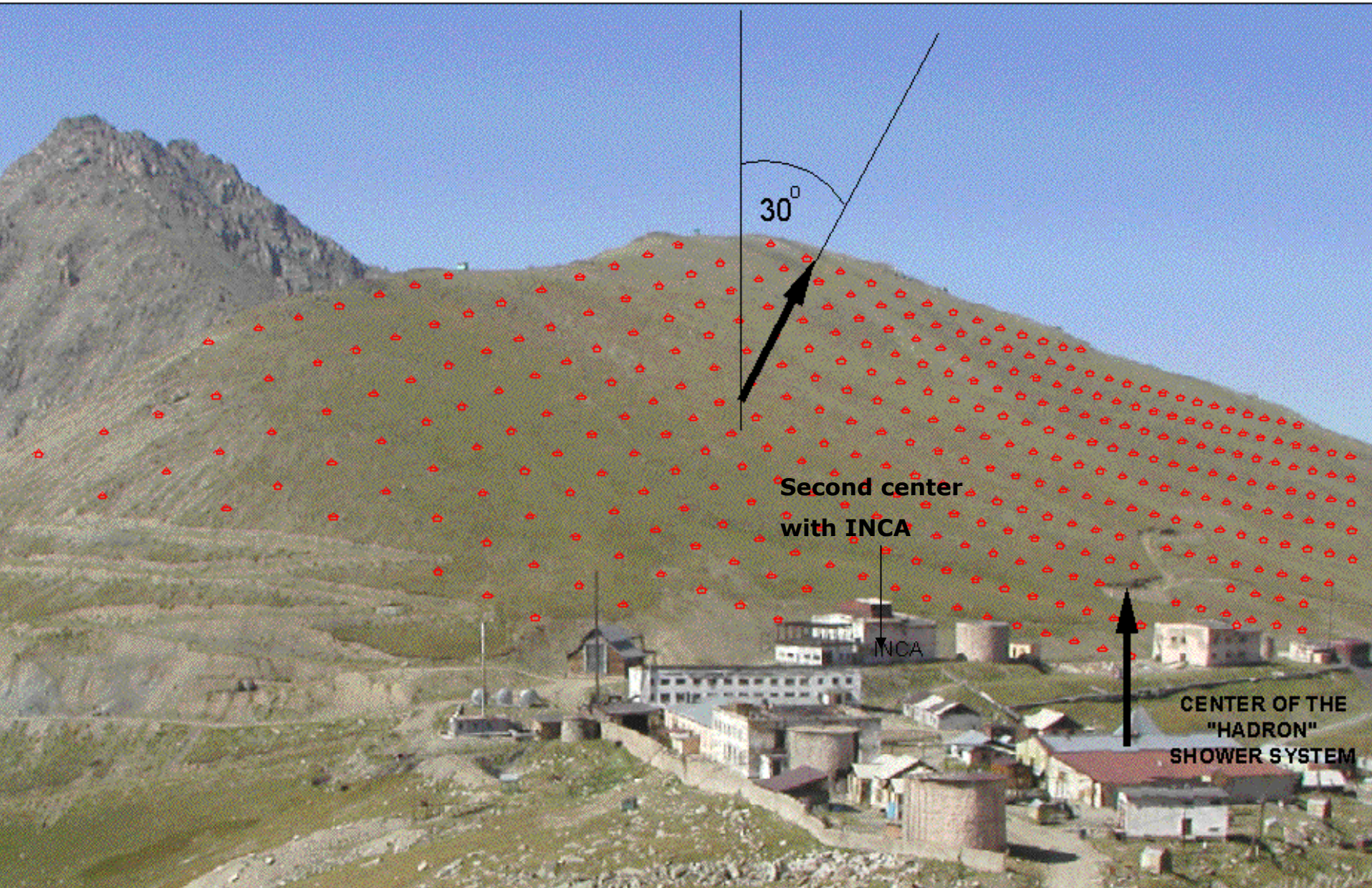


1 2 3 4 5 6 7 8 9 10 11 12

TIEN-SHAN

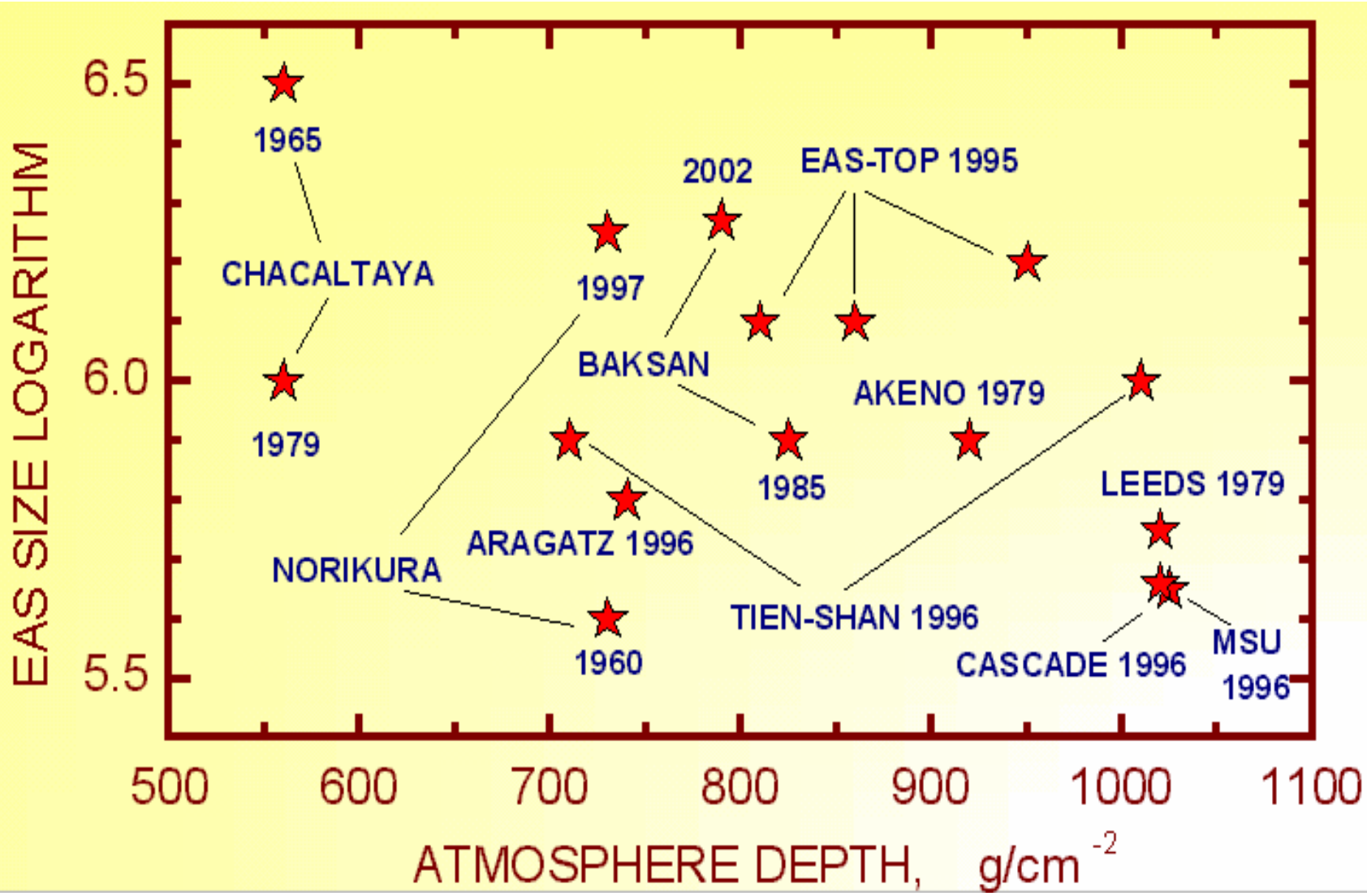
FUTURE

COMPLEX ARRAY "ATHLET"
(ALMATY THREE LEVEL EXPERIMENTAL TECHNICS)

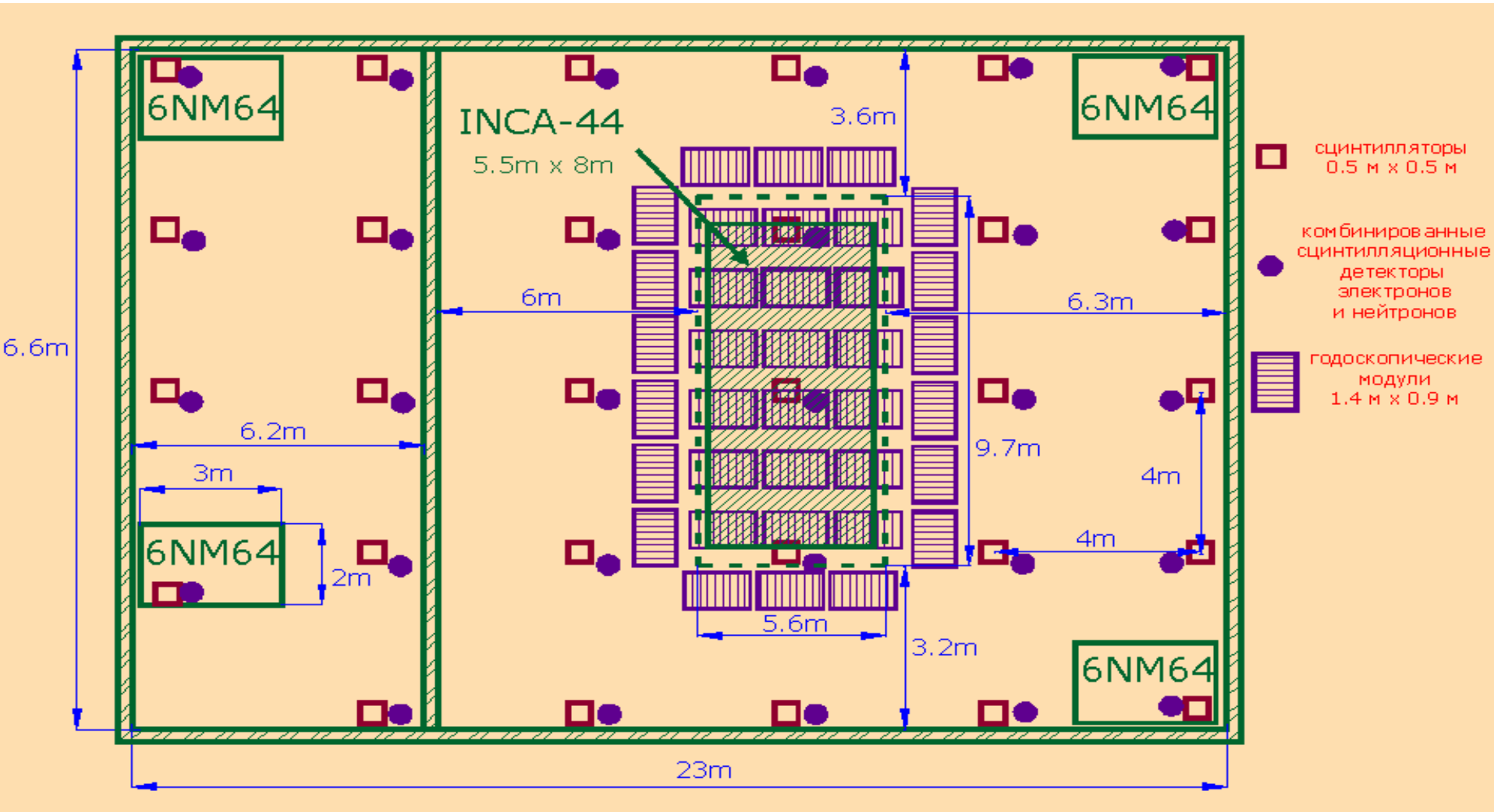

30°
Second center
with INCA
INCA
CENTER OF THE
"HADRON"
SHOWER SYSTEM

SHOWER ARRAY ALLOCATED AT 30 DEGREES TO ZENITH WILL DETECT IN EQUAL CONDITIONS VERTICAL EAS, SO AS SHOWERS INCLINED TO 60^0 AND RESOLVE THE OLD PUZZLE ON ALTITUDE DEPENDENCE OF KNEE POSITION.

ALTITUDE DEPENDENCE OF KNEE POSITION



SCHEMATIC DROWING OF THE SECOND CENTER WITH INCA ARRAY



THE MAIN GOALS OF THE EXPERIMENT

1. Searching of the correlations between different anomalous phenomena in EAS.
2. Eduction of the role of anomalous phenomena in the energetics of nuclear-cascade process and redistribution of primary particle energy between different EAS components.
3. Investigation of the reliability of modern QGS (and other) models for recalculations from measured values of EAS parameters N_e and N_μ to the primary energy E_0.
4. Investigation of the influence of anomalous phenomena on the restitution of primary cosmic rays energy spectrum and mass composition.
5. Do unusual particles (like strangelets, WIMP, etc) exist in the primary cosmic rays and can they be the reason of anomalous phenomena in EAS cores ?

COME TO ALMA-ATA CITY

ON AUGUST 25-27 2006 TO ATTEND

INTERNATIONAL WORKSHOP

“TIEN-SHAN 2006”

Contact: yakovlev@sci.lebedev.ru