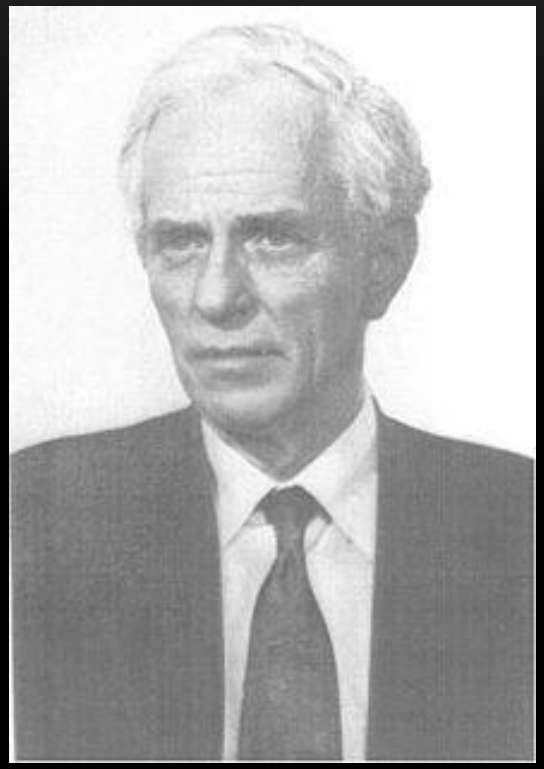
Results on reflected EAS Cherenkov light registration in balloon-borne experiment SPHERE-II

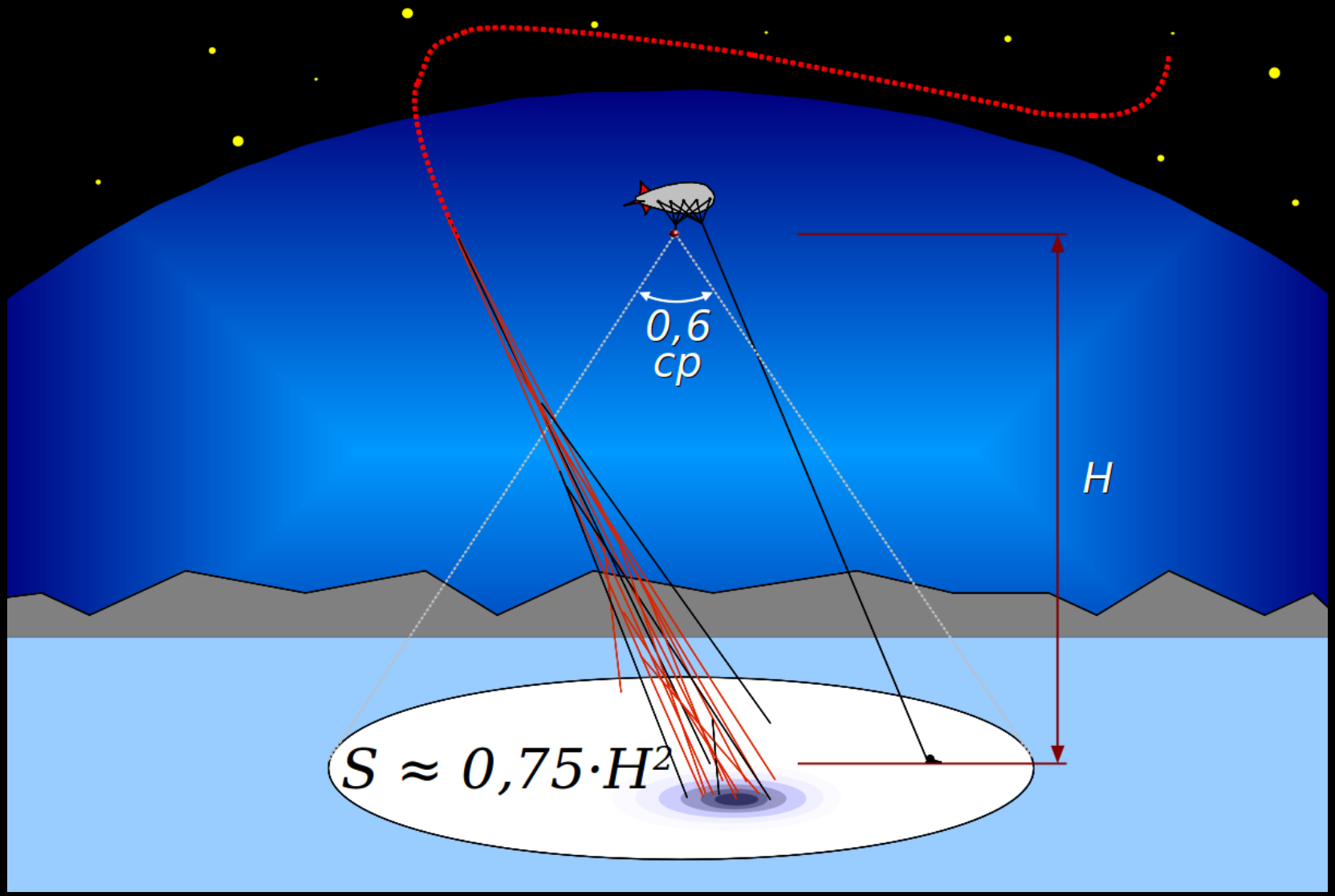
Dmitry Podgrudkov
On behalf of SPHERE-2 Collaboration

http://sphere.sinp.msu.ru/

«POSSIBLE METHOD OF REGISTRATION OF EAS BY CHERENKOV LIGHT, REFLECTED FROM THE SNOW-COVERED SURFACE OF EARTH» (1972)



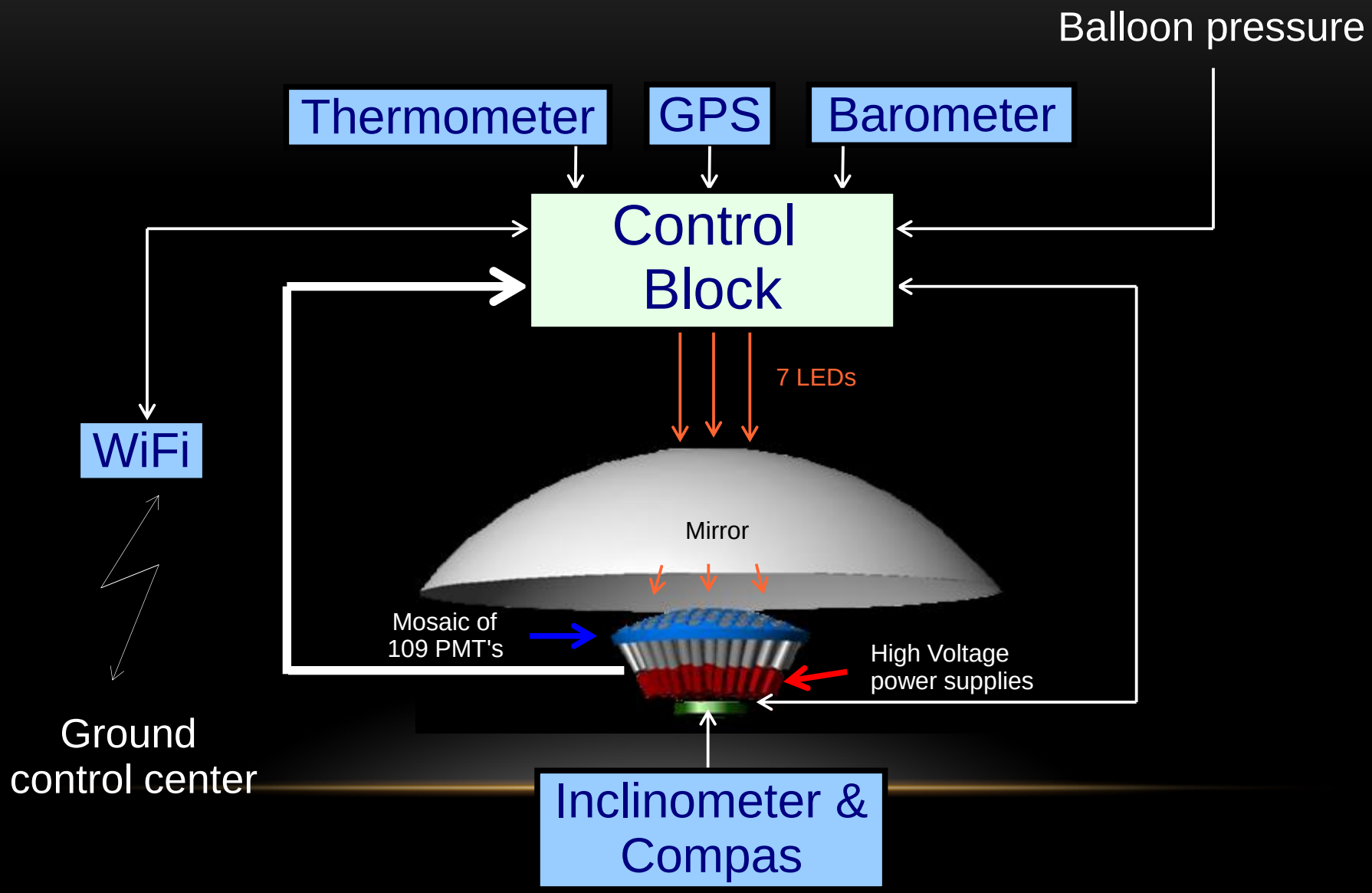
A.E. Chudakov


0,6
ср
H
S ≈ 0,75·H²

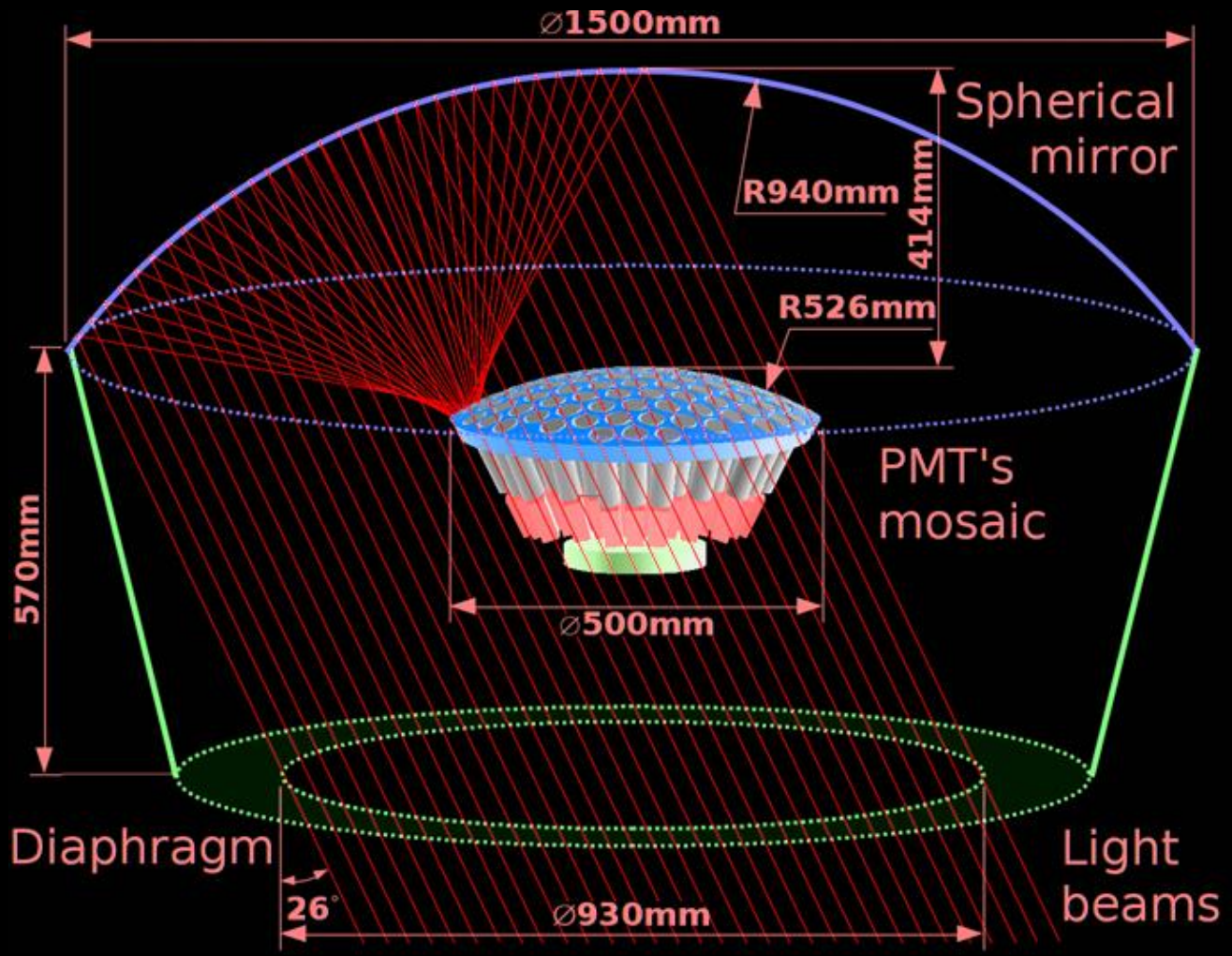
SPHERE PROJECT OVERVIEW

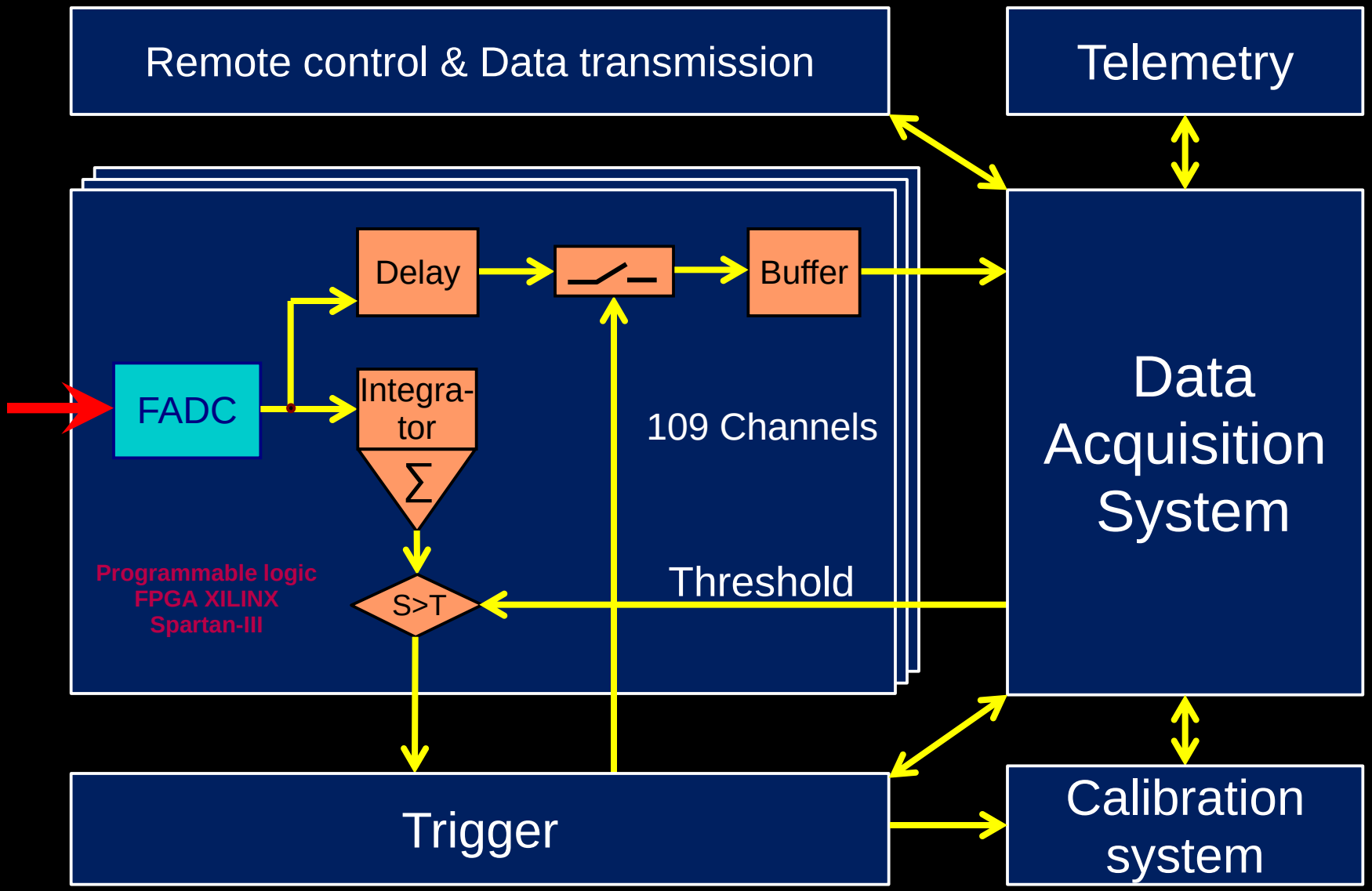
- 1990-1995 SPHERE land based prototype construction and measurements in Tian Shan mountains, SPHERE-I construction
- 1997-2000 SPHERE-I measurement series with tethered balloon near Volsk
- 2000 test launch of SPHERE-I on tethered balloon in Antarctic
- 2004-2007 SPHERE-II construction and tests
- 2008-2010 SPHERE-II test flights at Baikal Lake
- 2011-2013 SPHERE-II measurement flights at Baikal Lake

SPHERE-II DETECTOR SCHEME



SPHERE-II OPTICS




Remote control & Data transmission
Telemetry
Delay
Buffer
FADC
Integra-
tor
Σ
109 Channels
Data
Acquisition
System
Programmable logic
FPGA XILINX
Spartan-III
S>T
Threshold
Trigger
Calibration
system

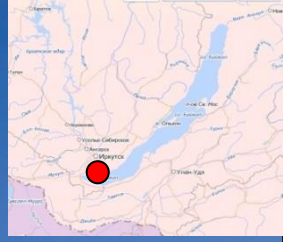
CALIBRATION

- Linearity check and correction
- Relative on-line calibration for each event (3%)
- Absolute off-line calibration (3% statistical + 2% systematical)

STATISTICS

- 3 seasons of measurements
- 5-6 flights each
- Total 98 hours of measurements
- Around 1000 of reconstructed events

Balloon launch pad on ice of Baikal lake



Balloon «BAPA»
250 m^3

Box for SPHERE-2 detector

Internet antenna

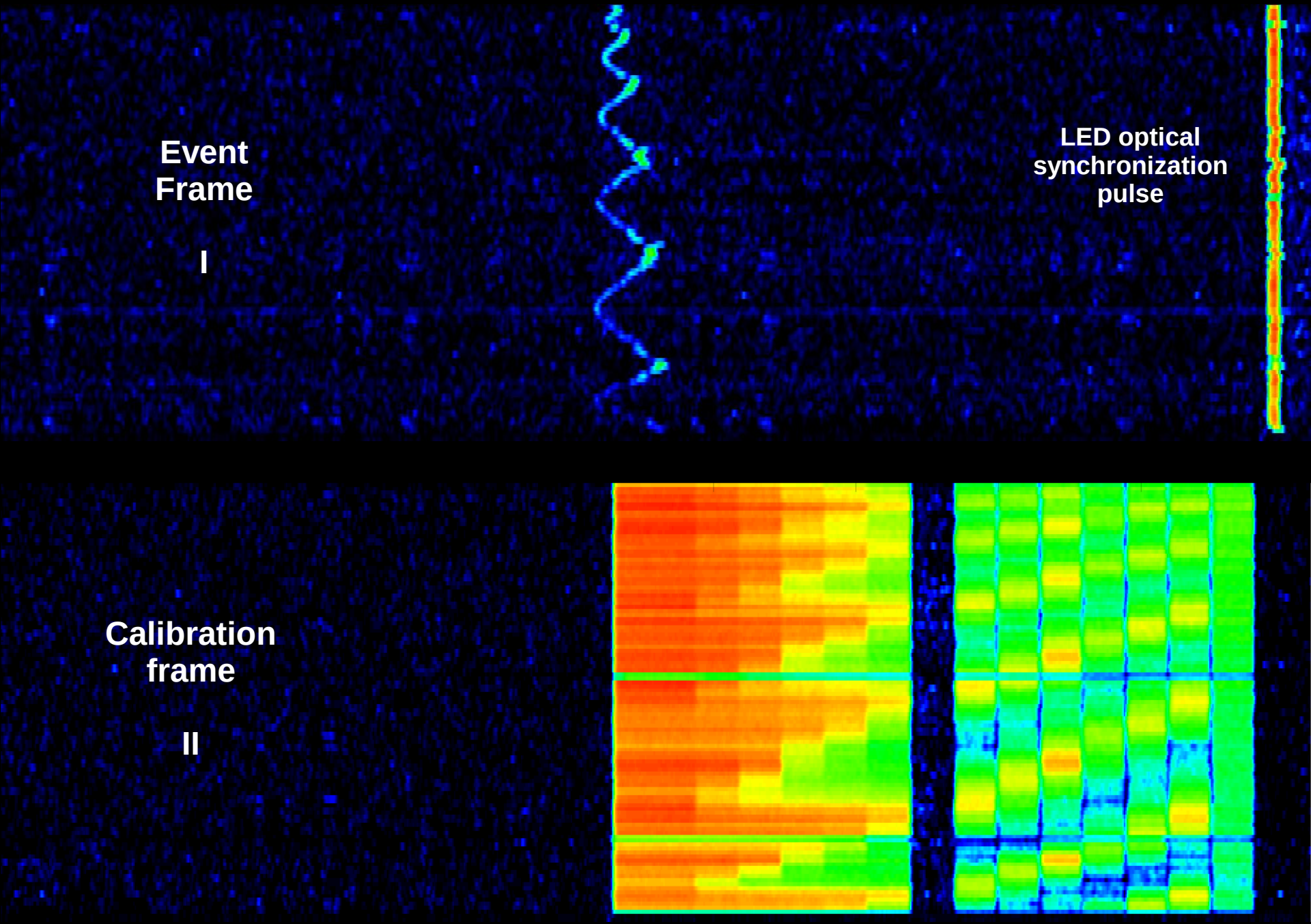
Winch

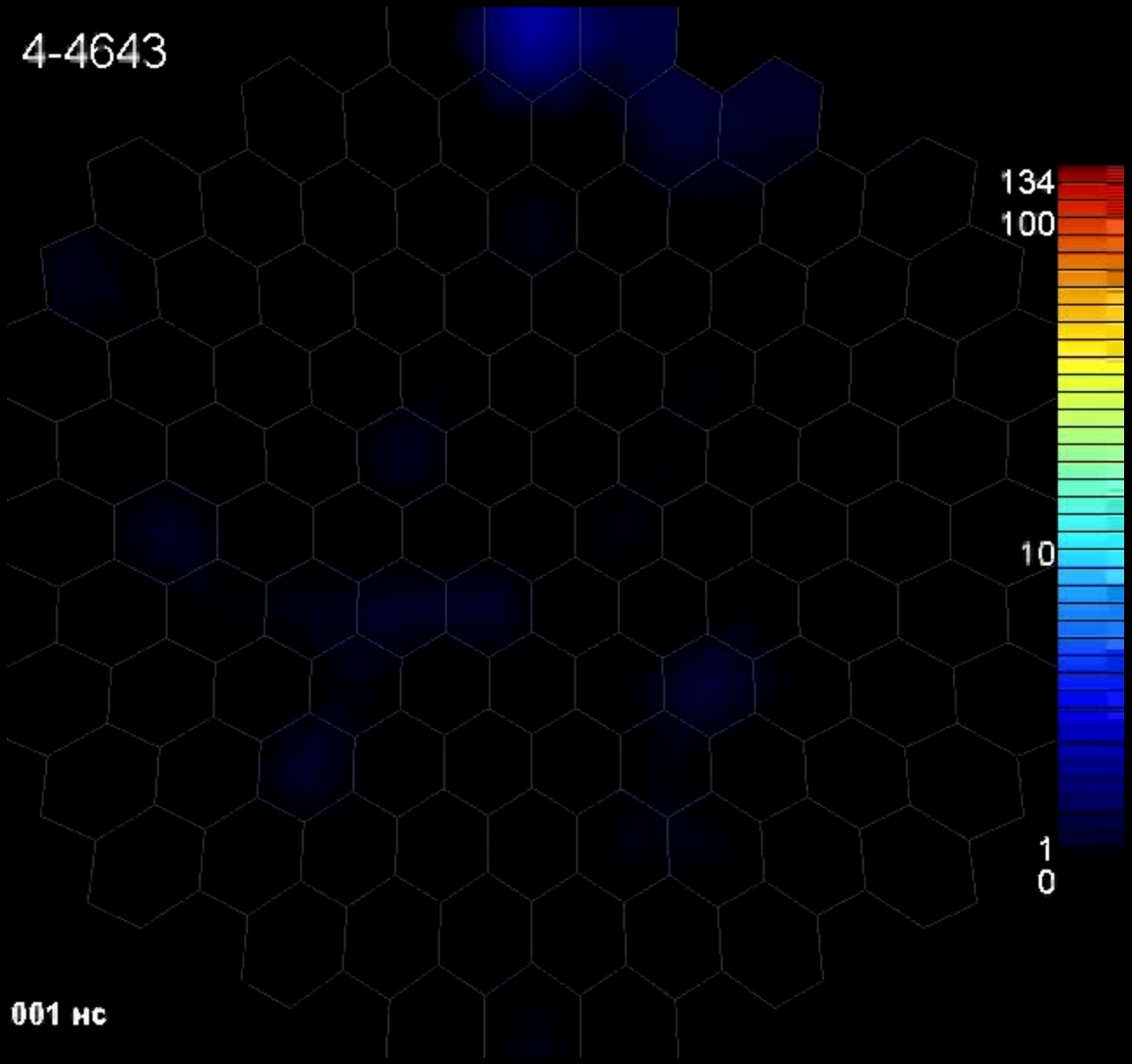
The load block for a steel rope and launch pad

Power supply cable to the lake coast (1 km) and the reserve generator.

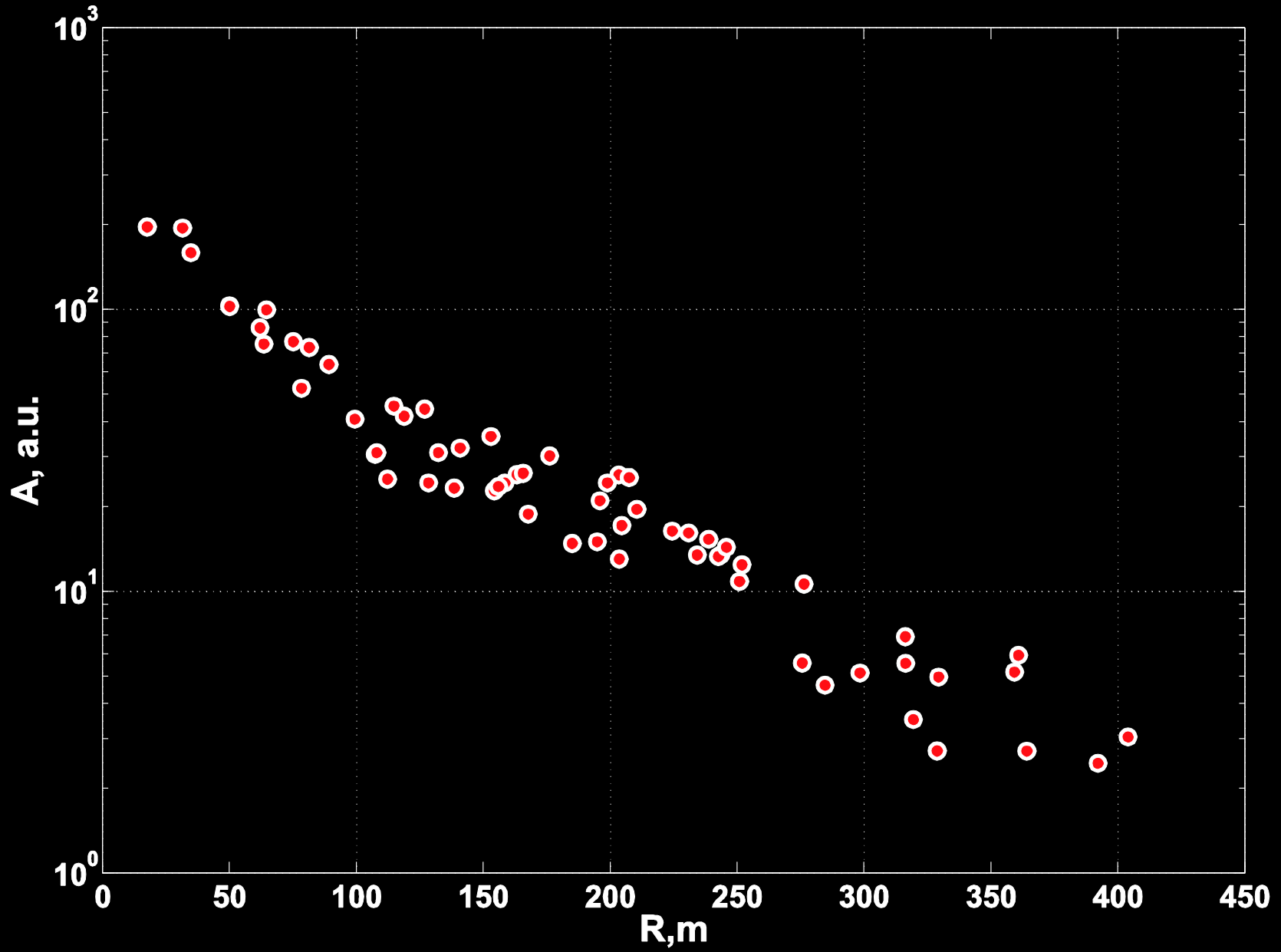
Control room

Trial launch of the balloon with an equivalent load for adjustments of the balloon attack angle.

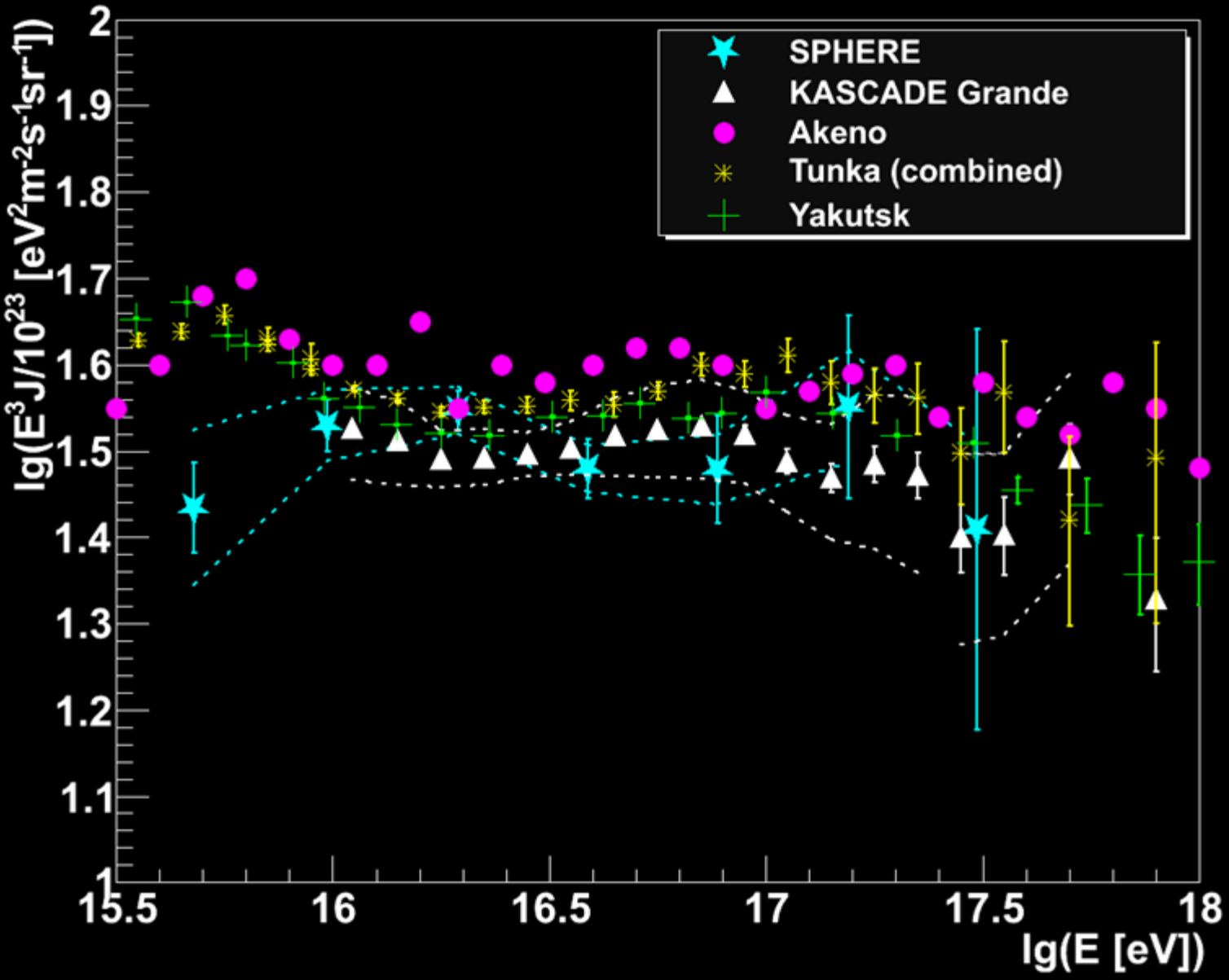

Event
Frame
I
LED optical
synchronization
pulse
Calibration
frame
II


4-4643
134
100
10
1
0
001 нс

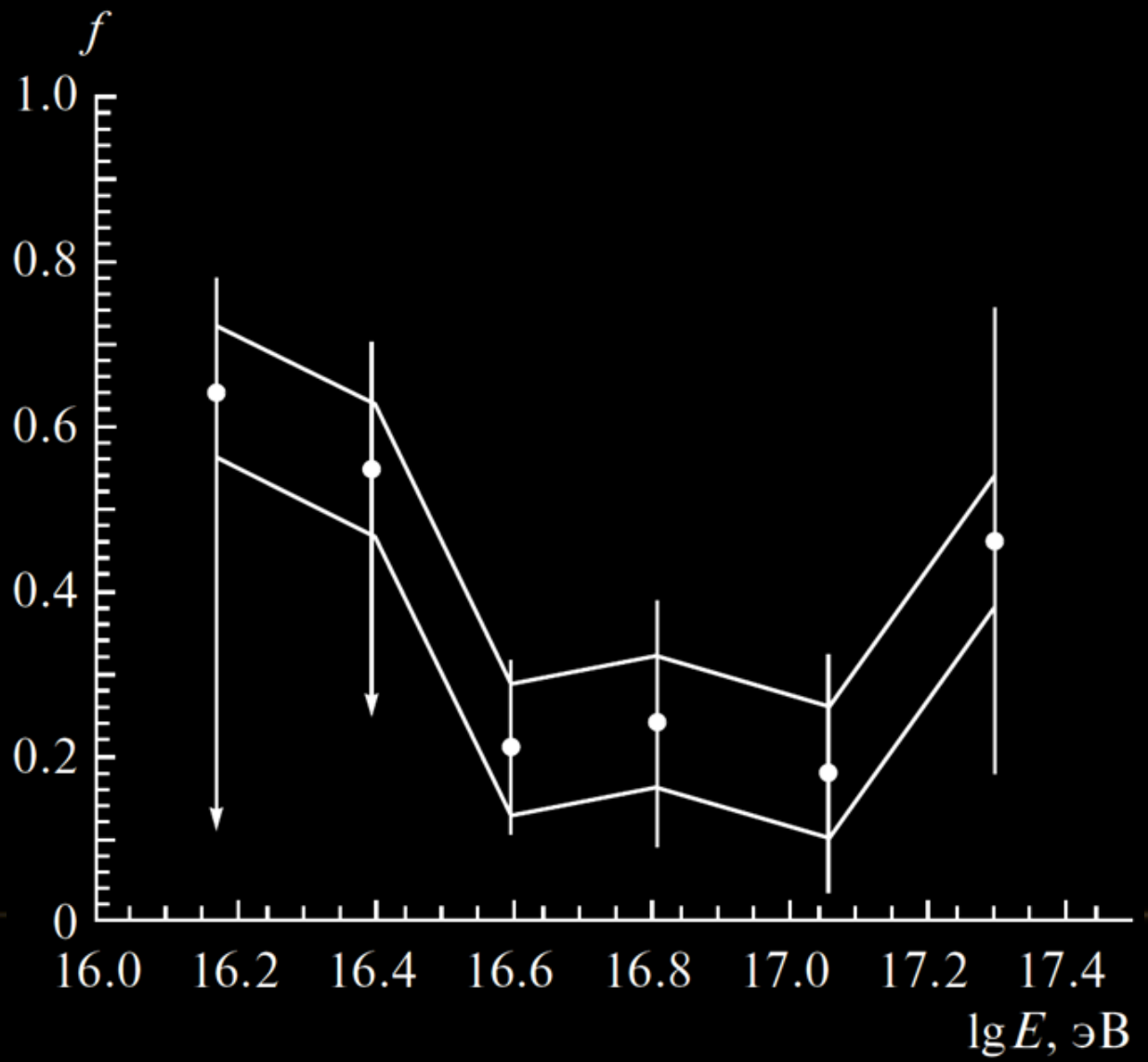
RECONSTRUCTED LDF EXAMPLE



SPHERE-II SPECTRUM



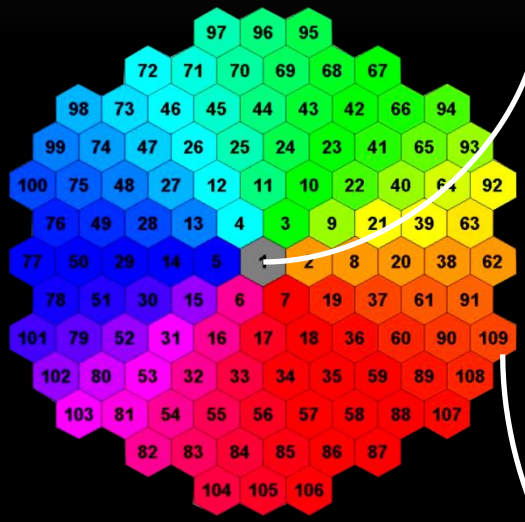
SPHERE-II MASS COMPOSITION

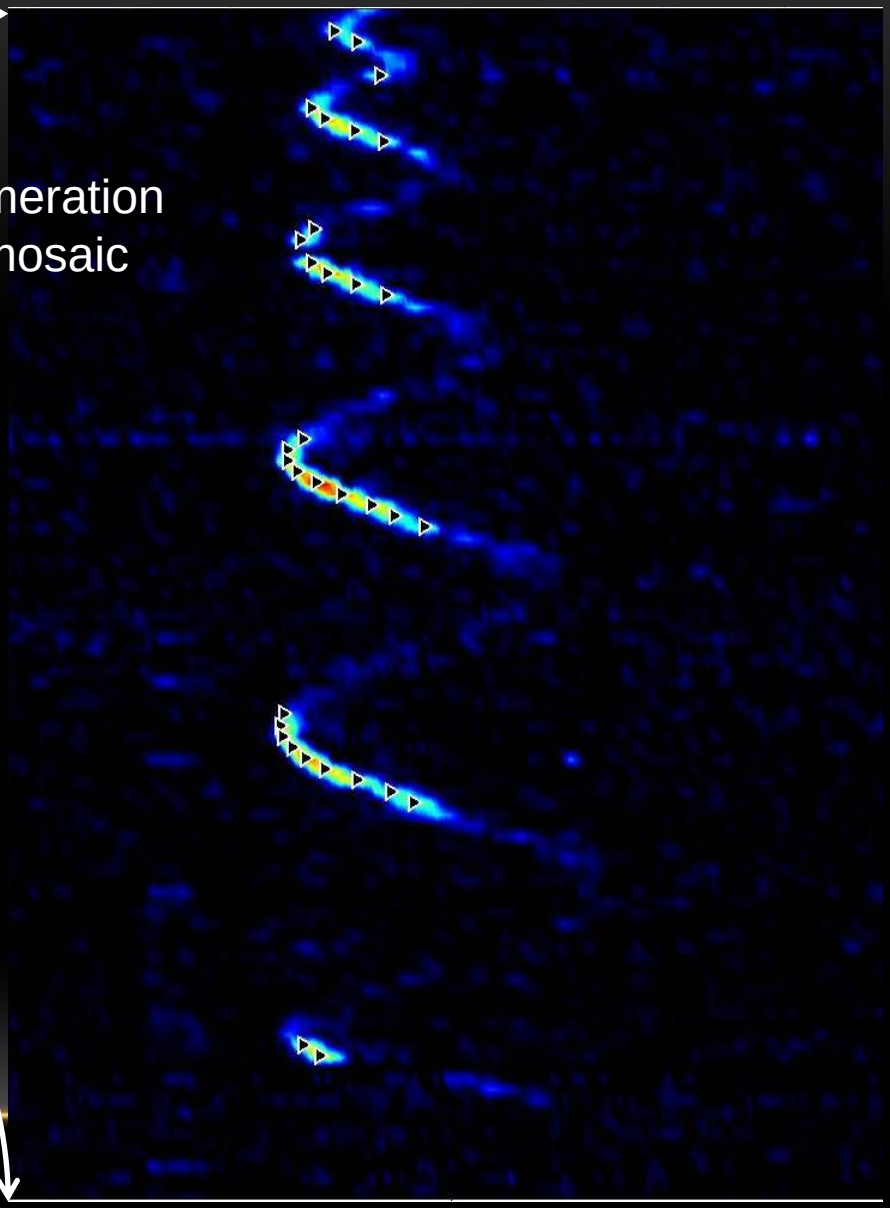


Thank you!

Channels numbering

PMT numeration
in the mosaic





SPECTRAL AND ABSOLUTE CALIBRATION

LED`s characteristic:

1) FYL-L5013VC1C - 405 nm
2) BL-L314VC - 405 nm (wide dispersion)
3) BL-L324BC - 430 nm
4) BL-L314UBC - 470 nm
5) BL-L314PGC - 525 nm
6) BL-L314UYC - 590 nm
7) BL-L314URC - 660 nm