The Project of Space Experiment with Wide Field Gamma-Ray Telescope ("GAMMASCOPE")

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Scientific objectives:

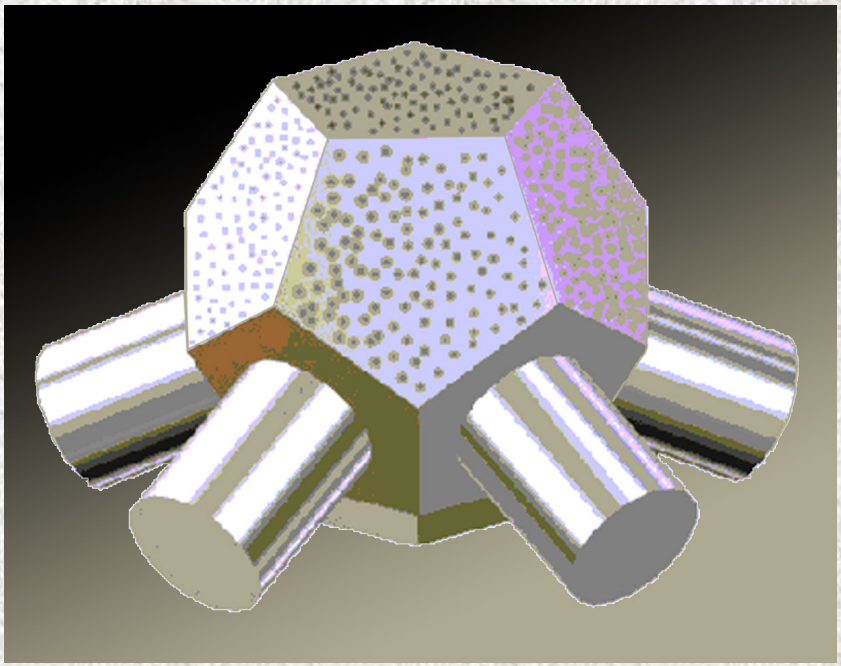
- **Temporal phenomena in hard x-rays and soft gamma-rays (0.05-1.0 MeV)**
  - **X-ray Novaes and Transients**
  - **Gamma-ray Bursts**
  - **SGR**
- **Sky mapping**
- **Search of new sources:**

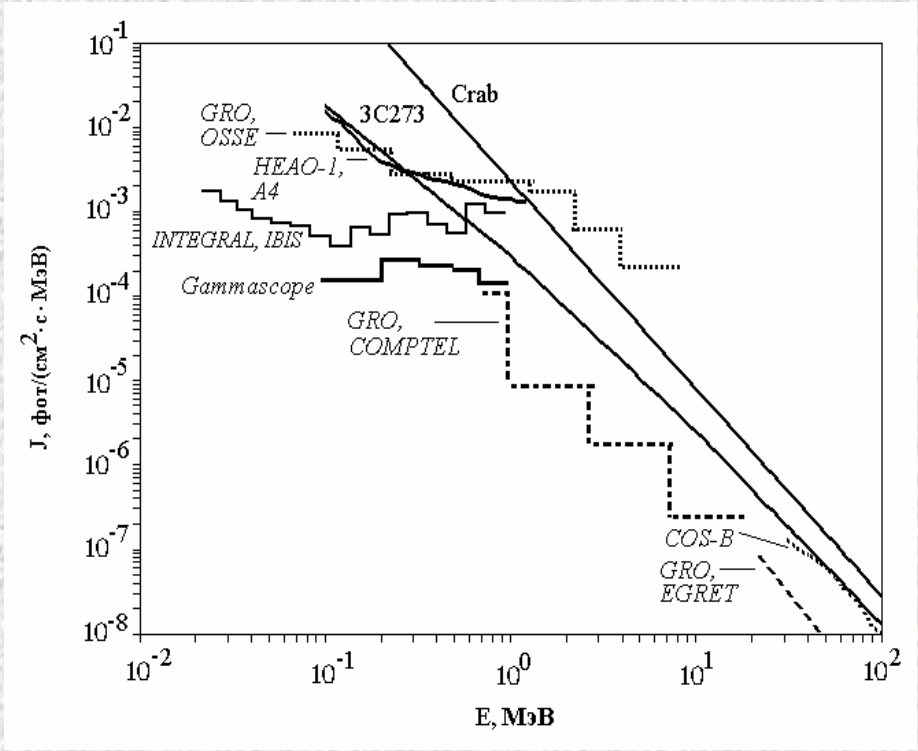
  deep all-sky survey at the sensitivity level about an order higher than INTEGRAL IBIS
- **Timing of X-ray and Gamma-ray sources**
  - **Active Galactic Nuclei**
  - **X-ray and gamma-ray pulsars**
  - **NS and BH binaries**

The basic instrumental principles:

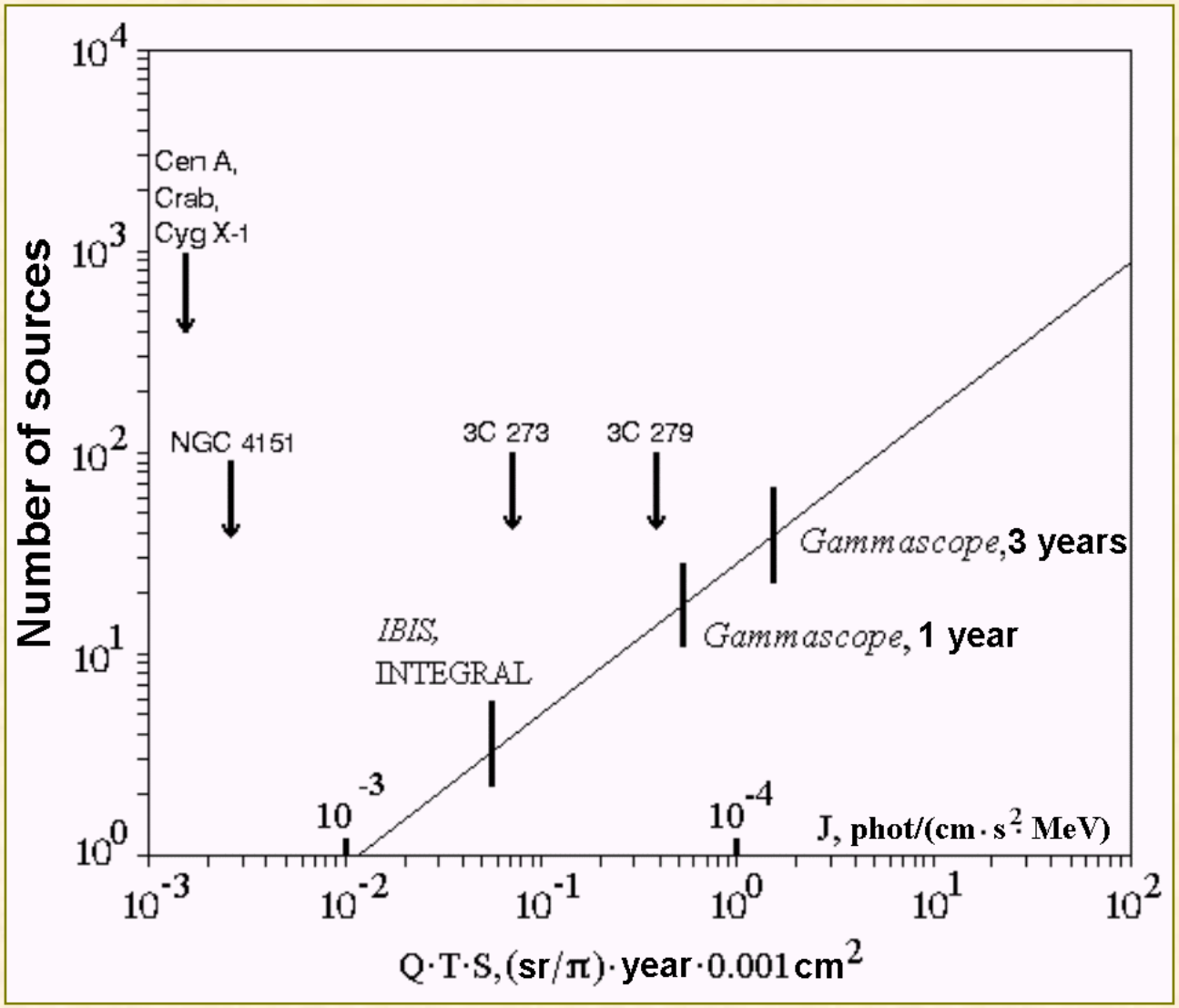
- **Coding-mask imaging telescope;**
- **Quasy-spherical (dodecaedron) configuration providing field of view about 2π sr;**
- **Module construction: 6 identical pentagonal mask plates and 6 PSD units.**
- **NaI-CsI active-shielded position-sensitive detector (PSD);**
- **Tungsten coding mask with pseudorandom pattern;**

The view of “Gammascope” instrument





The comparison of “Gammascope” sensitivity with other experiments

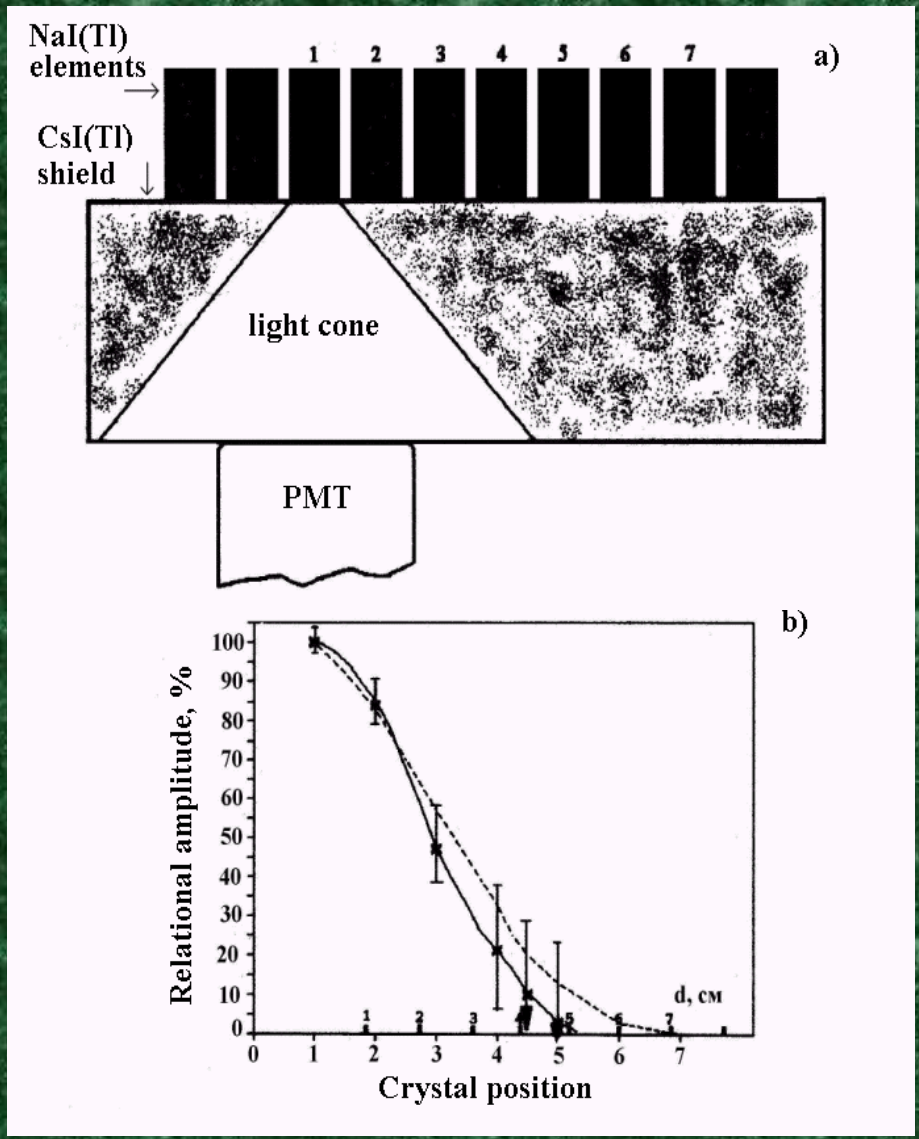


The number of detectable AGN-like sources versus $\Omega \times T \times S$ (Ω in π sr, T in years, S in 1000 cm^2)

The technical parameters of the "Gammascope" instrument:

The total mass of the instrument; the mass of the detecting part of the instrument	≤ 160 kg ≤ 130 kg
The applied power	≤95 W
The day informativity	
Geometry factor	
Angular resolution	2-3^{o}
Energy range	
	≤ 15%
Effective area	

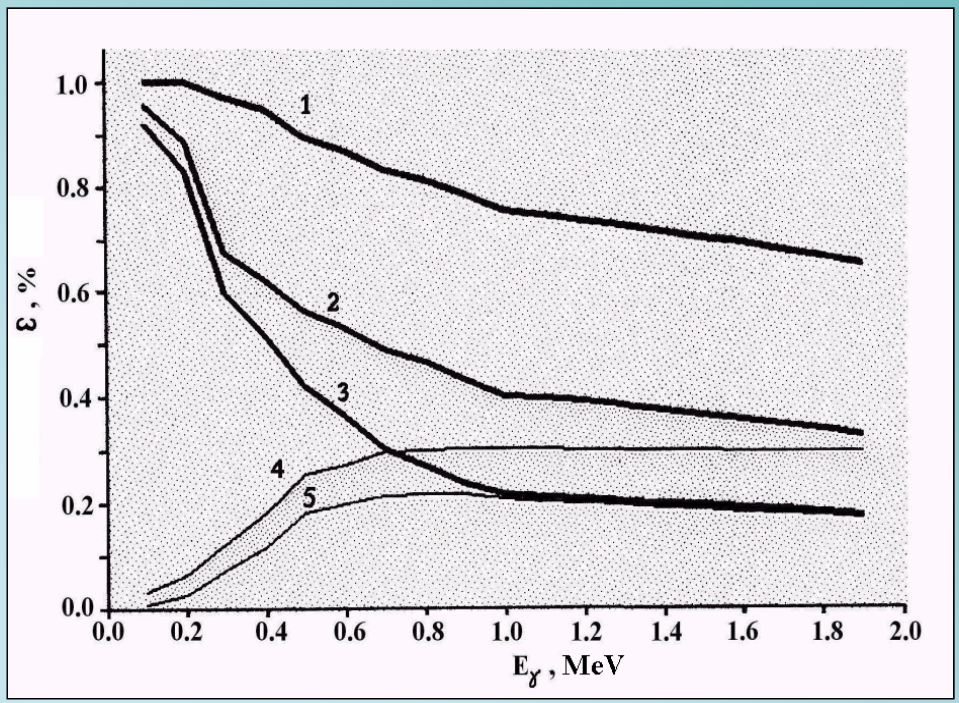
The Principle of Pixel Identification



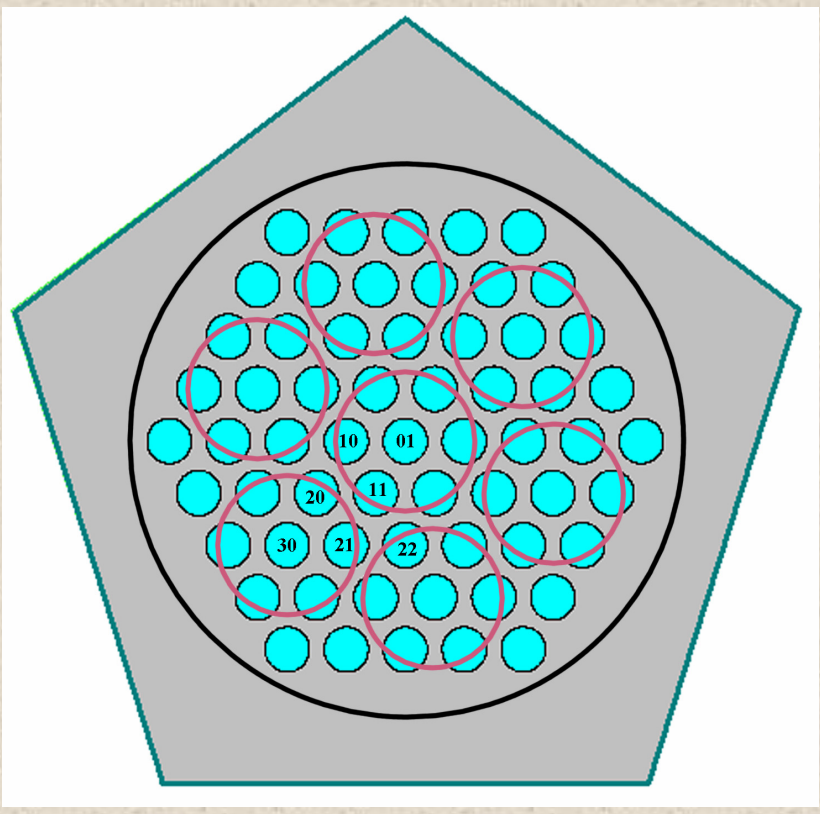
A) The sketch of PSD module construction

B) The PMT signal amplitude versus the detecting crystal position. Dashed line is for the result of the calculations, solid line is for the approximation of measured values. Numbers under the X axis correspond to the NaI(Tl) crystal number (see (a))

Energy dependencies of PSD efficiency for different variants of active shield logic:

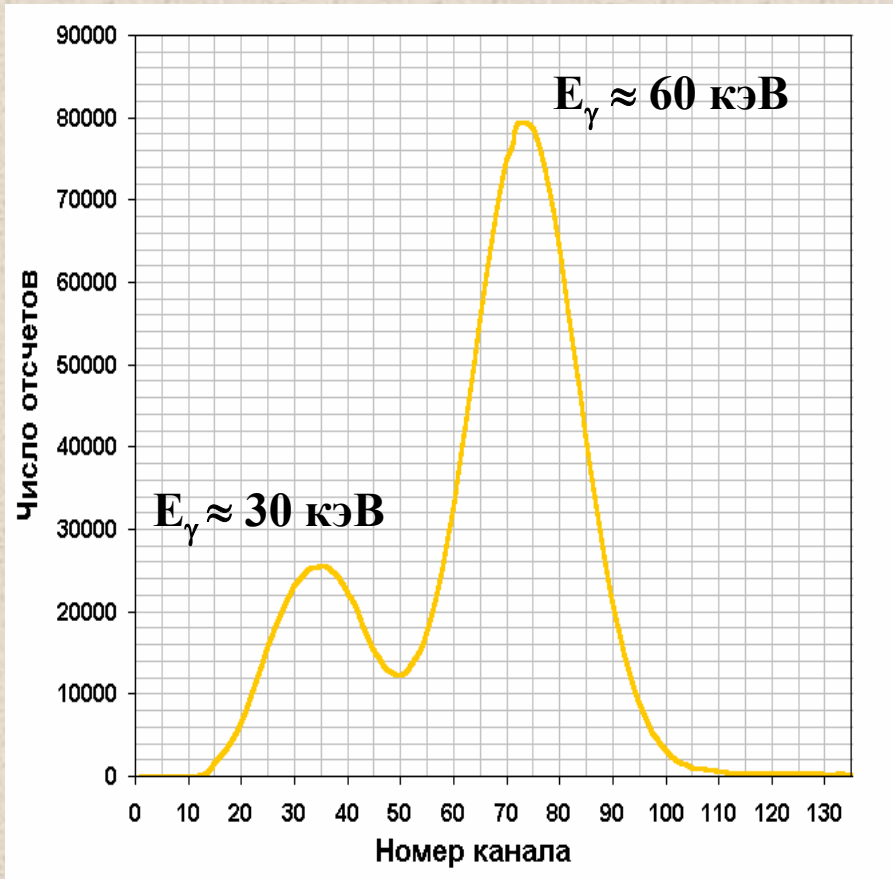


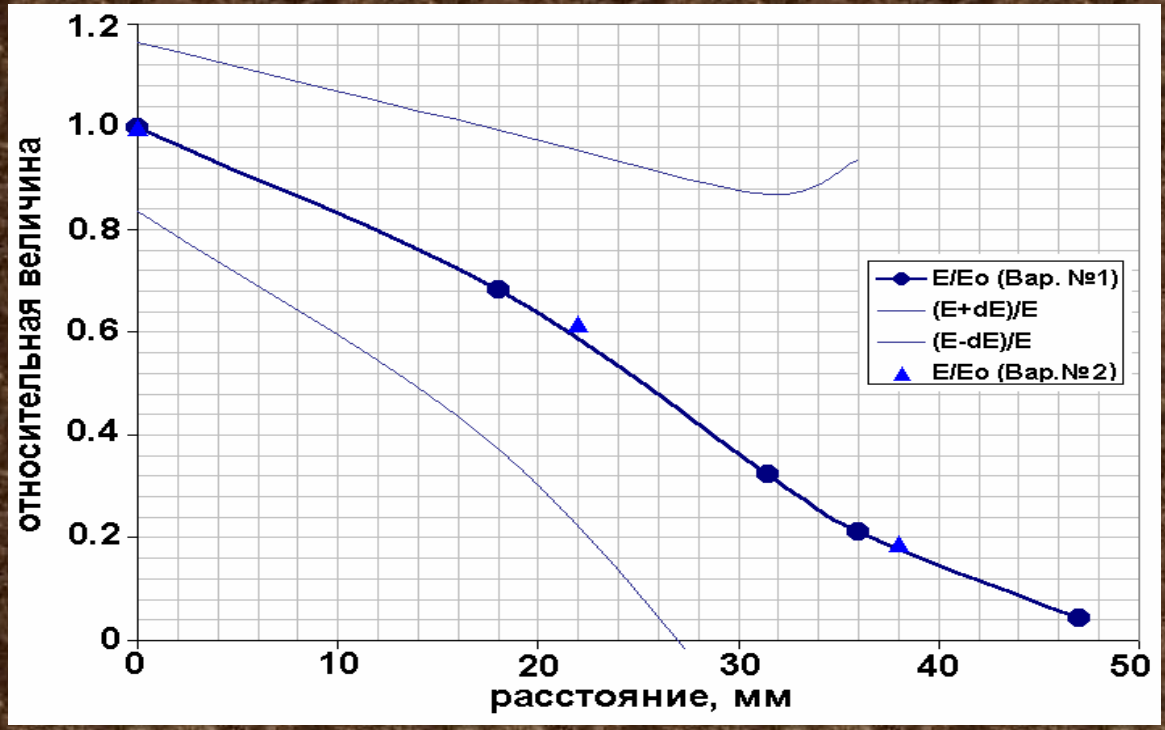
1. All interactions in NaI(Tl) and CsI(Tl) are detected;
2. The gamma-quanta inside the FOV are detected if the energy lost in NaI(Tl) is greater than in CsI(Tl) shield;
3. The gamma-quanta inside the FOV are detected if the energy lost in CsI(Tl) is zero;
4. The gamma-quanta outside the FOV are detected if the energy lost in NaI(Tl) is greater than in CsI(Tl) shield;
5. The gamma-quanta outside the FOV are detected if the energy lost in CsI(Tl) is zero;



PSD module. NaI(Tl) and photomultiplier positions are shown.

Energy spectrum of Am^{241}, measured for central position of detecting NaI(Tl) crystal.



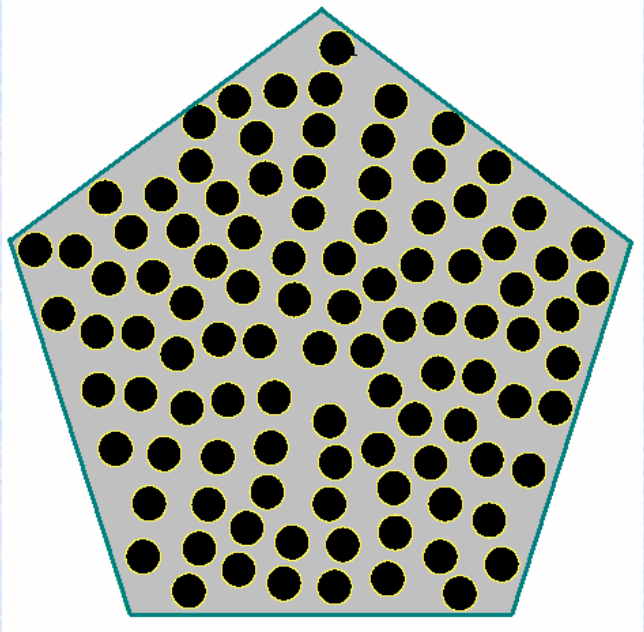


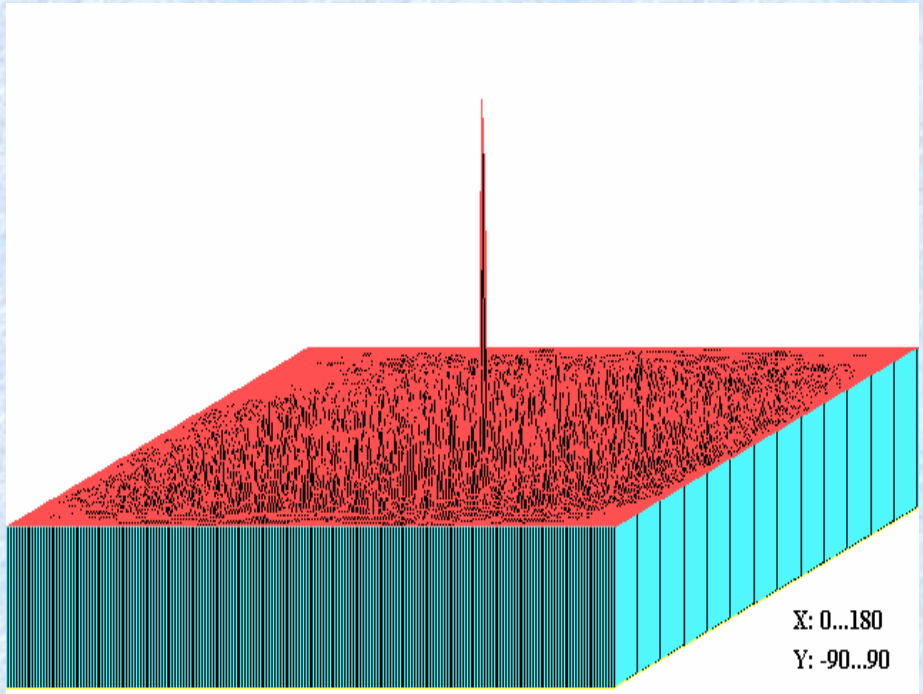
The dependence of the part of the light produced in NaI(Tl) collected by the PMT on the distance between the detecting crystal and the photomultiplier's center. Thin lines show the value of the energy resolution (measured with Am^{241} (E_γ=60) isotope.

The dependence of the value of energy resolution on the distance between the detecting crystal and the photomultiplier's center measured with Am^{241} (E_γ=60) isotope.

The image reconstruction:

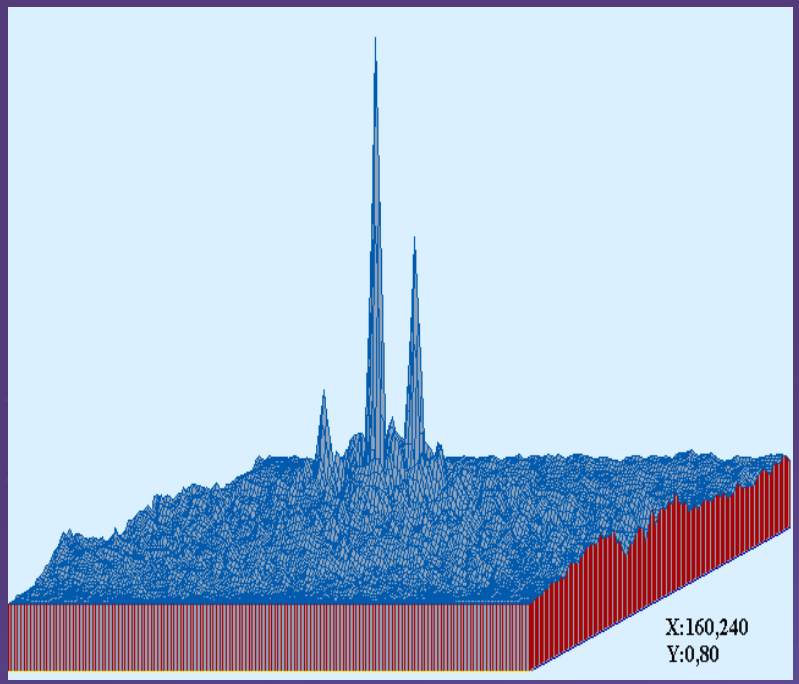
Coding mask element

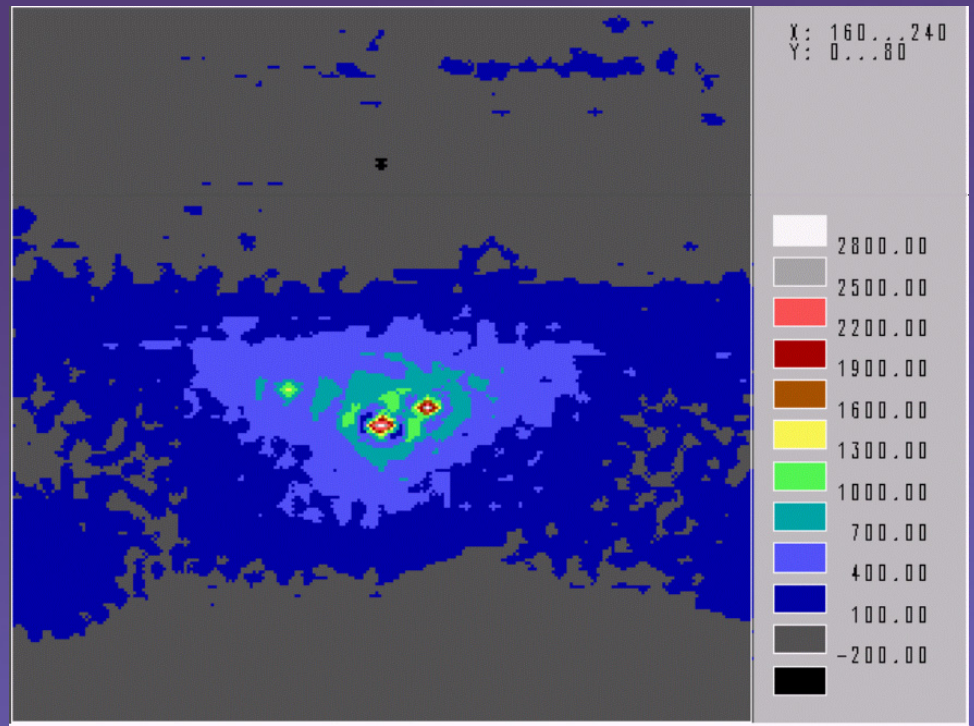




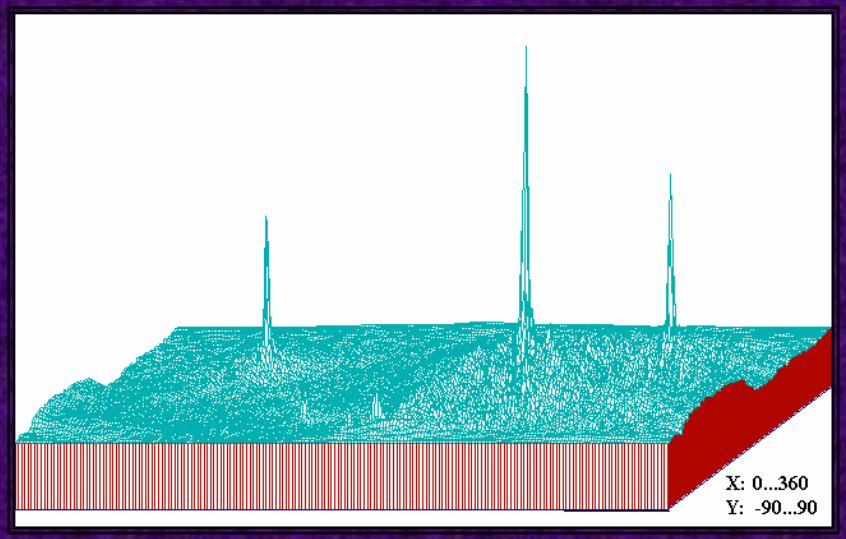
The image of a point source (from 1 frame)

The reconstructed image of three nearby sources with different brightness: the result of modeling of the sky scanning by the orbital motion (1 orbit)

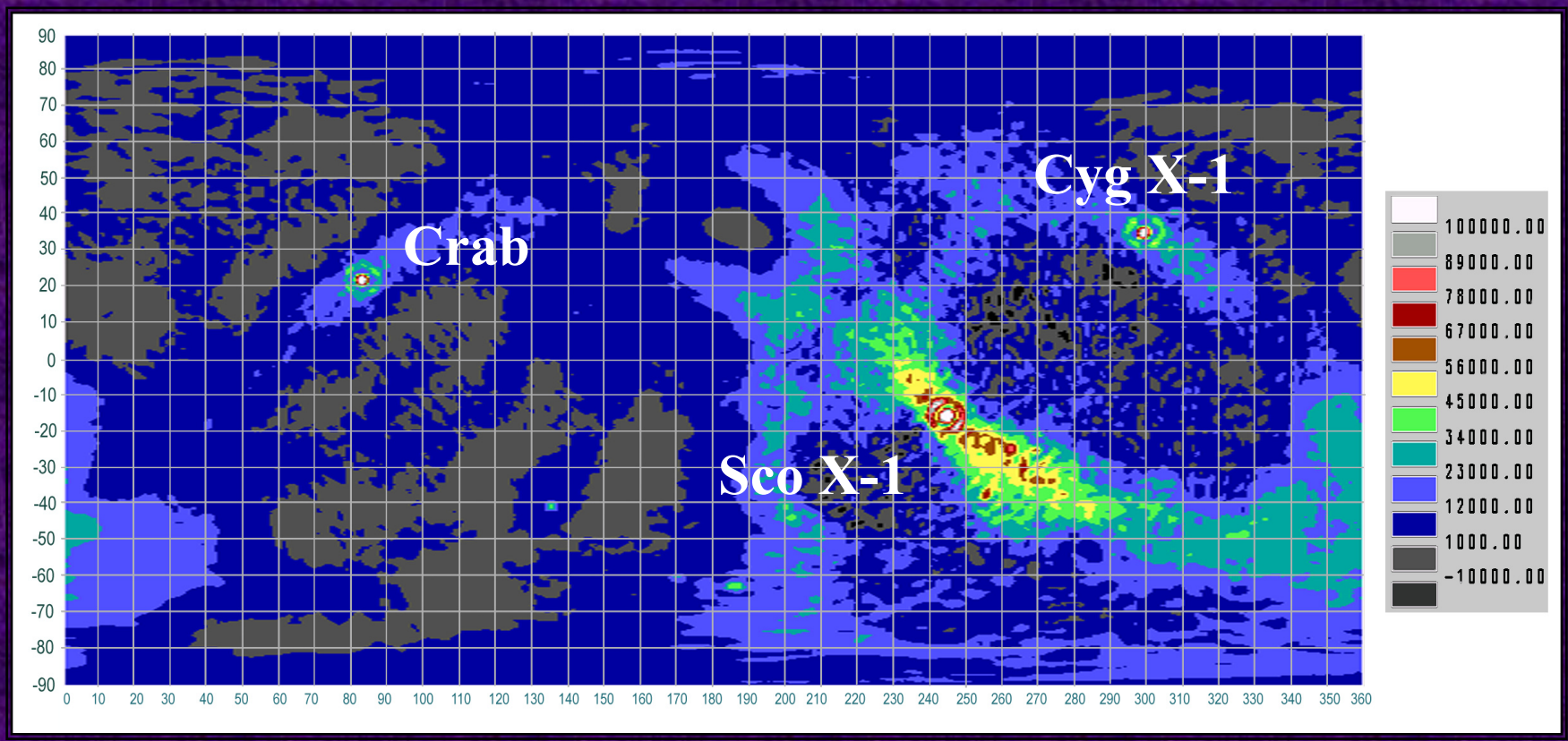


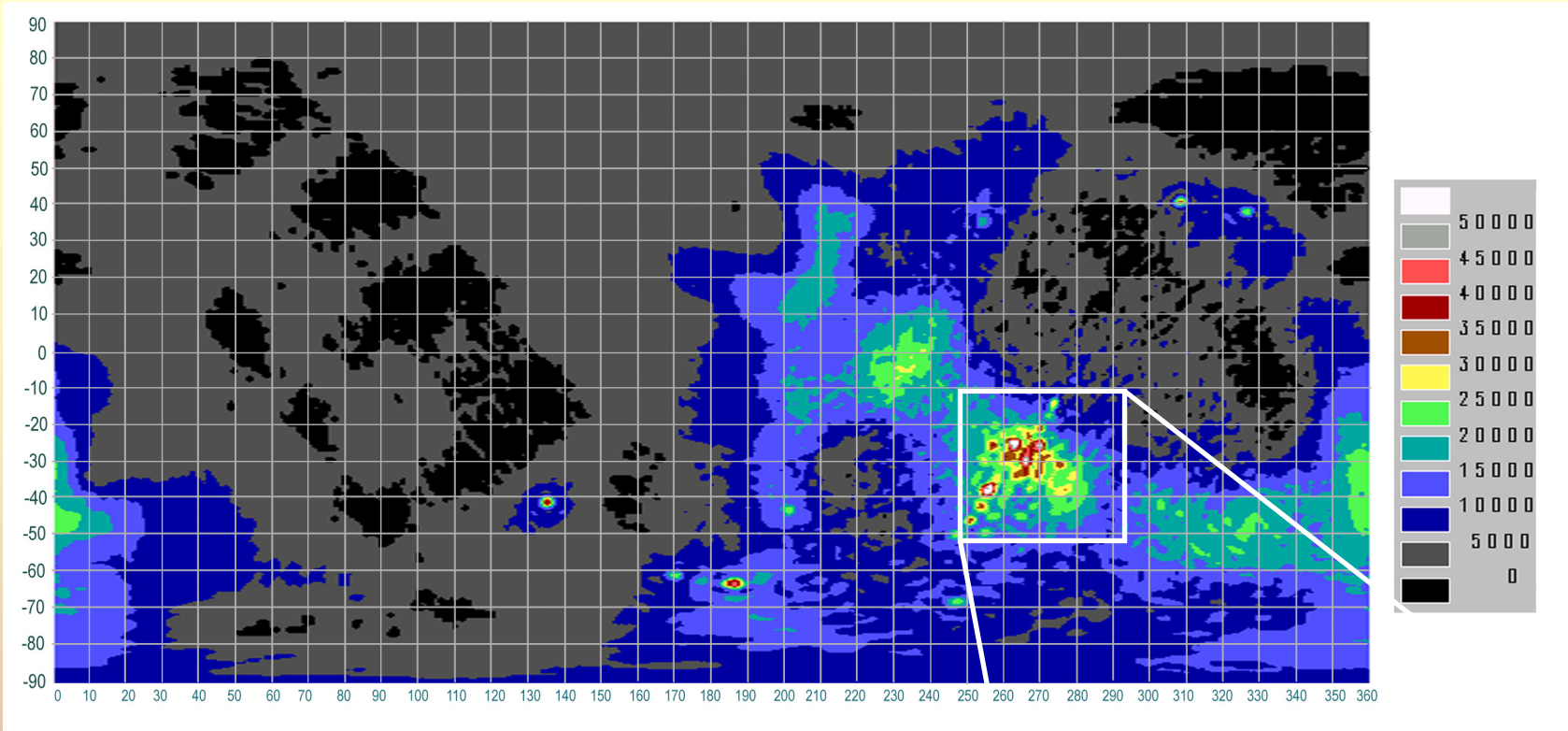


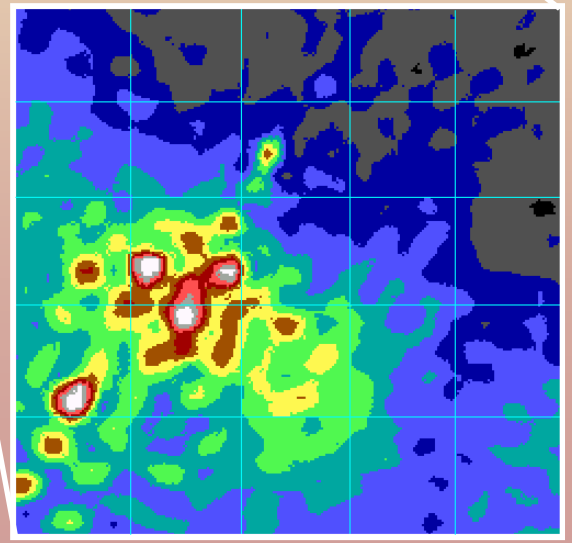
Sources: 200,33(J=10); 205,35(J=5); 190,37(J=2)
Peak amplitudes: 5290, 3180, 1540



The sky map reconstructed for the gamma-ray sources from HEAO-1 A4 catalog (3D relief and color map).







The sky map reconstructed for the gamma-ray sources from HEAO-1 A4 catalog after the "whittening" of three brightest sources Sco X-1, Cyg X-1 and Crab. Detailed map corresponds to the Galactic Center region $\alpha \in [250^o, 300^o]$, $\delta \in [-50^o, 50^o]$.