

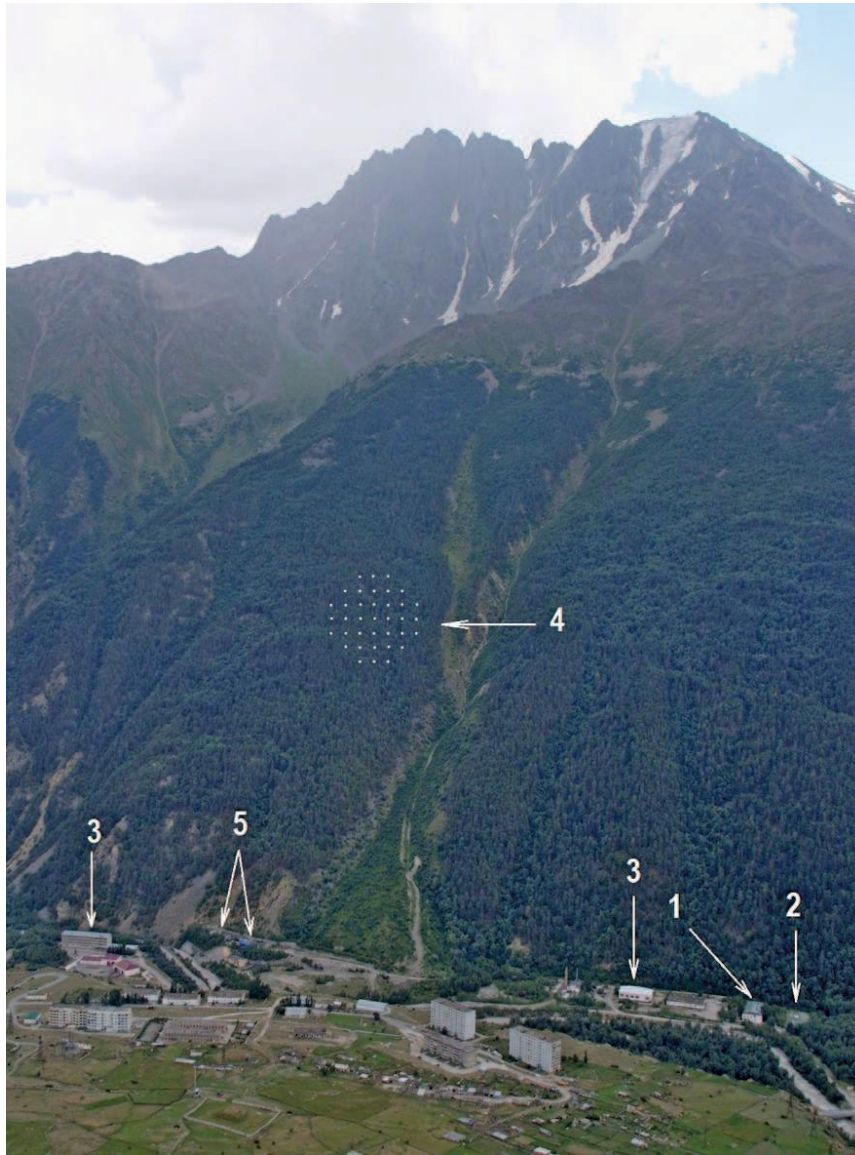
Low-background setup for measurement of the intrinsic background of CaMoO_4 scintillation crystals

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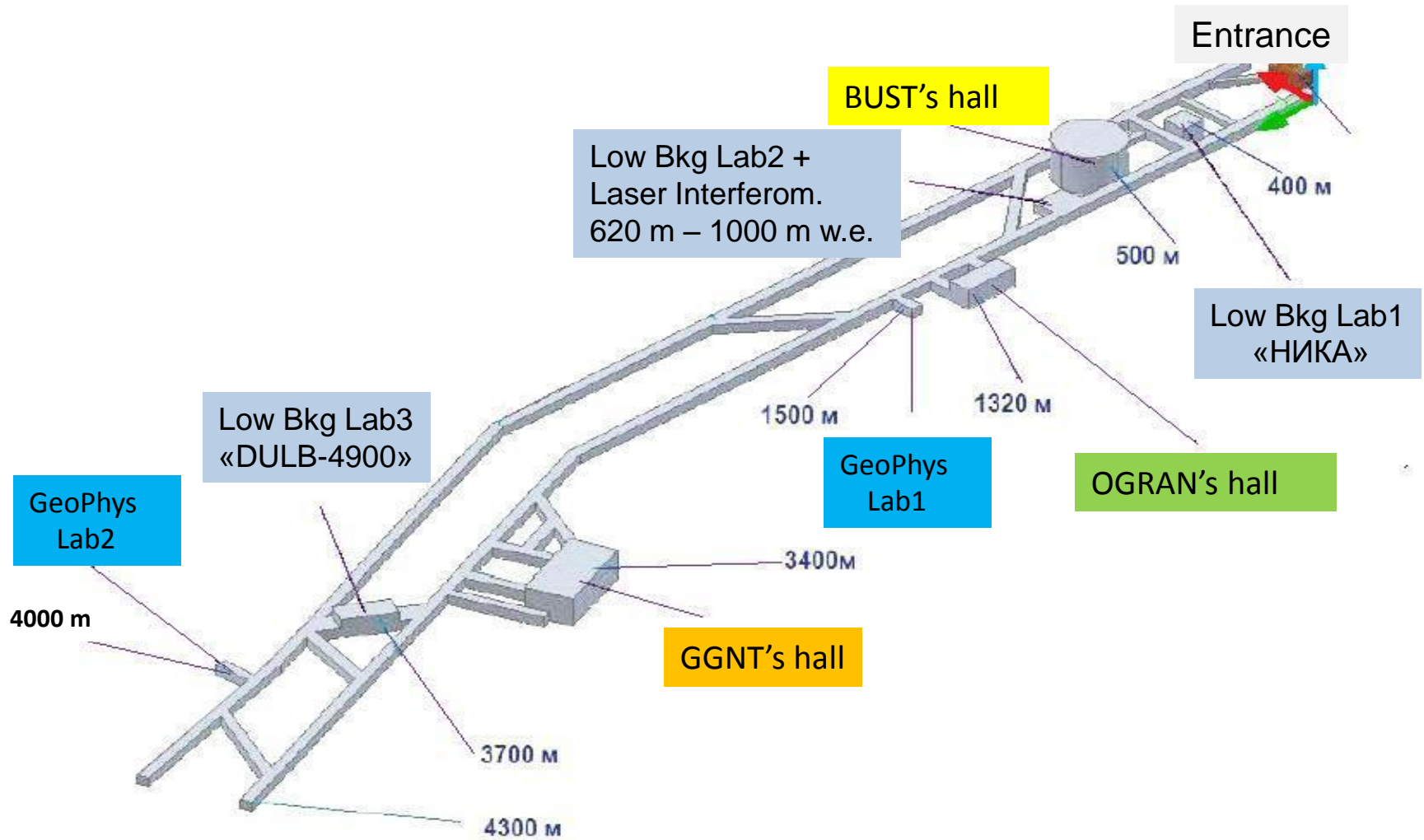
RPSCINT 2013
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The overview of the BNO INR RAS and Neutrino village



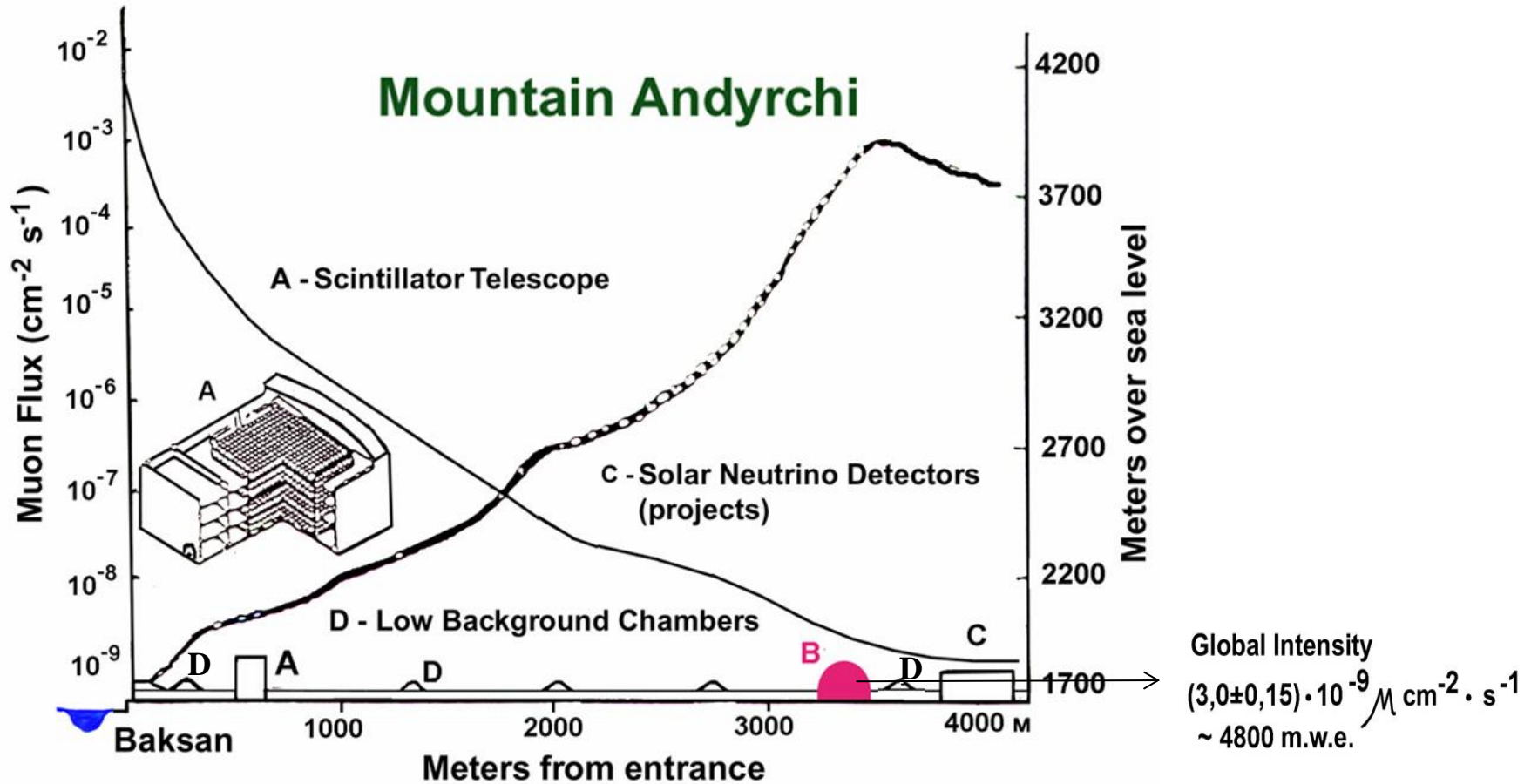
1) Elling building with Carpet detection facility; 2) shallow underground hall with Carpet-2 detection facility; 3) laboratory's buildings; 4) schematic view of Andyrchy-array at the mountain slope; 5) entrances to the Main and Auxiliary adits.

General view of underground objects of BNO



Underground Laboratories of the BNO INR RAS

General view of underground objects of BNO



Schematic view of a section of the Andyrchy slope along the adit (write scale) and dependence of underground muon flux on the laboratory location depth (left scale).

Characteristics of deep underground low-background laboratory (DULB-4900)



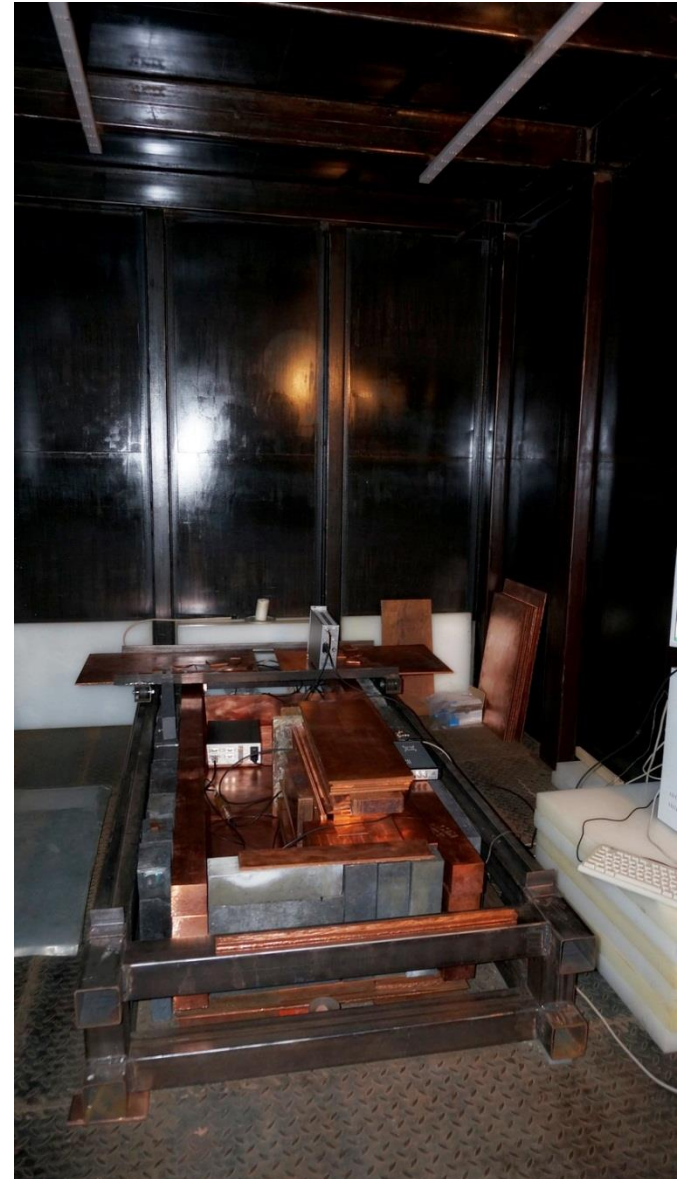
General view of auxiliary and low-background boxes.



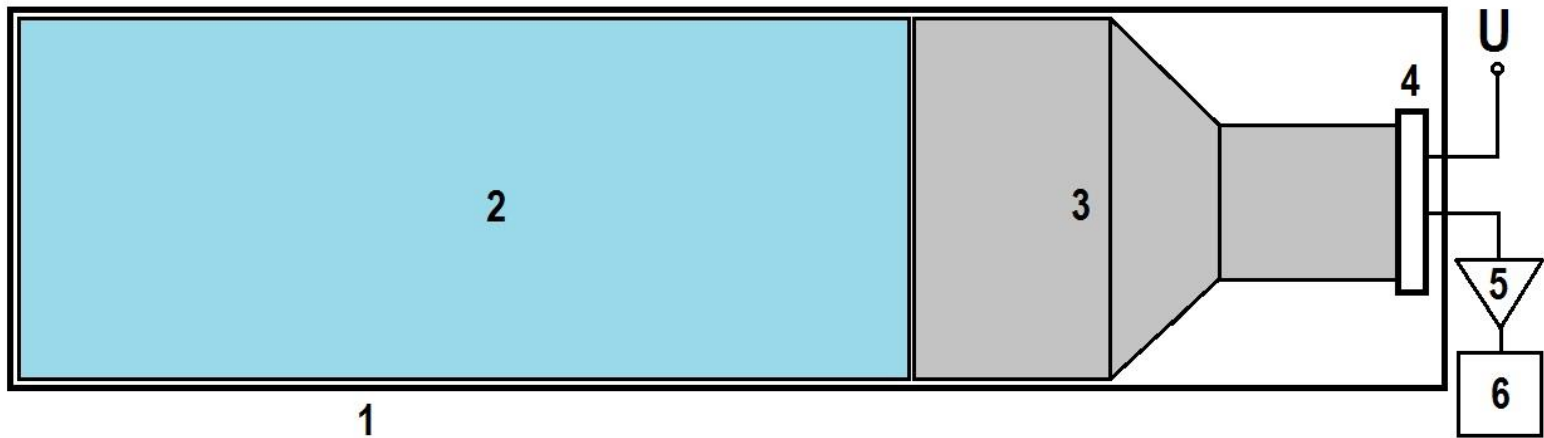
Interior view of the low-background box with the door opened.

The walls, doors, floors and ceilings of the two low-background boxes are composed of 250 mm polyethylene+1mm Cd+150 mm high-purity Pb with the total mass of the shielding material 30 t, 1 t and 190 t, respectively.

Low-background box



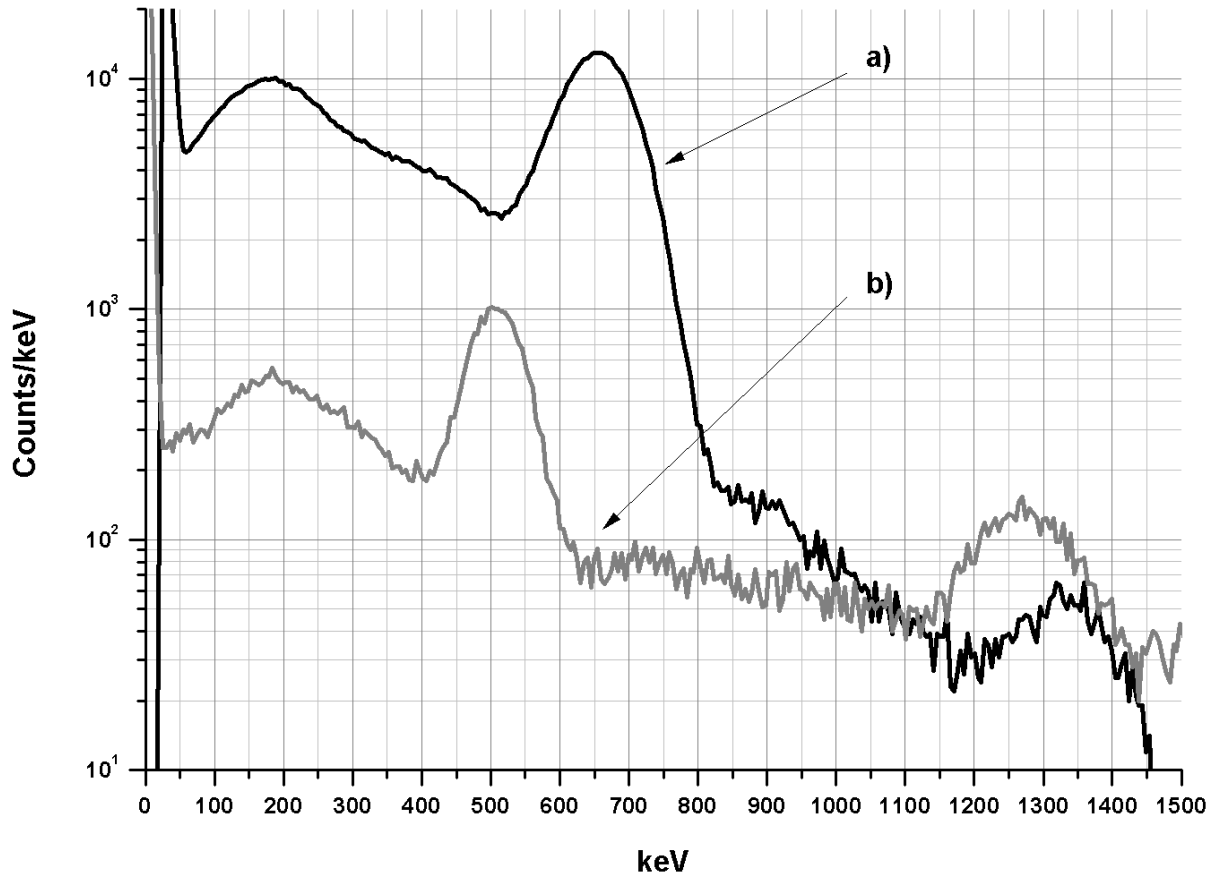
A Test Low-background scintillation detector



1 – stainless steel case 102x500mm; 2 – crystal NaI(Tl) 80x250 mm; 3 – PMT-110;
4 – PMT divider; 5 – preamplifier; 6 – recorder.

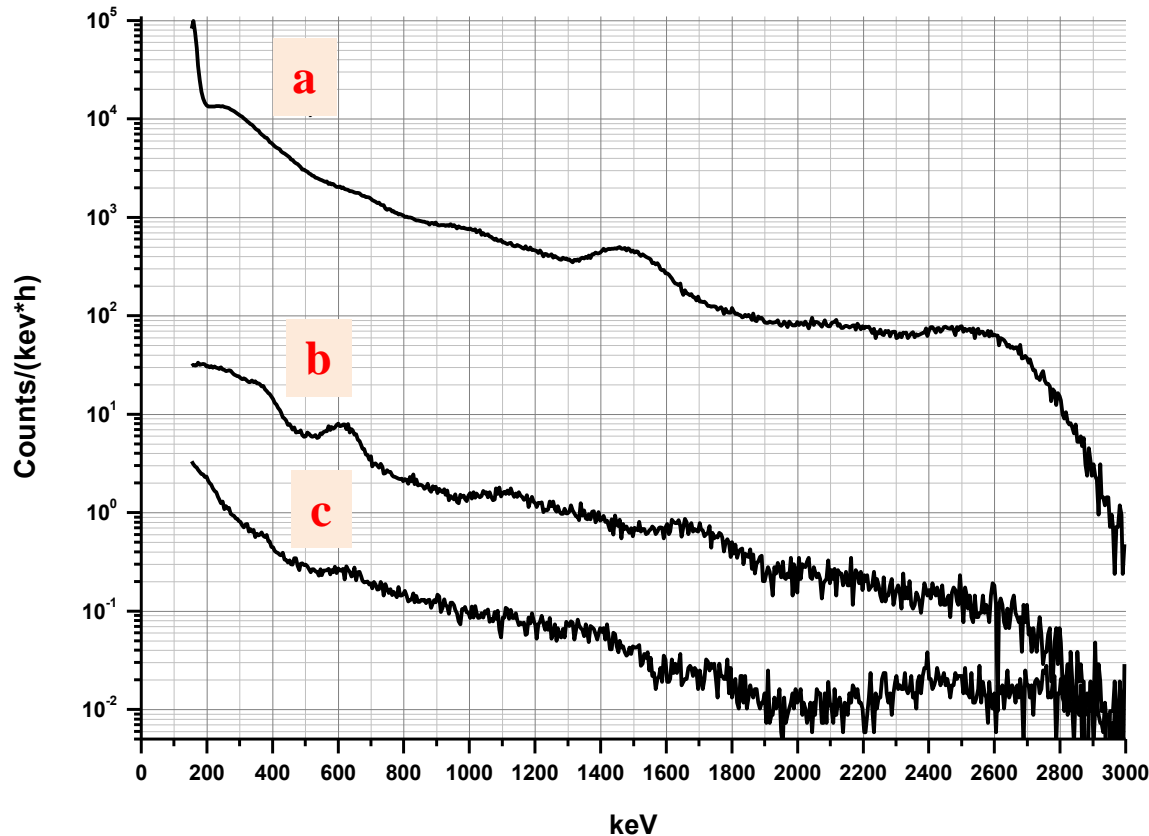
Crystal NaI(Tl) with a diameter (d) 80mm and height (h) of 250 mm (weight of 4.6 kg), packed into the stainless steel cylindrical casing closed from one end with the maximum sizes $d = 91$ mm and $h = 267$ mm. Output window 12 mm thick made of an optical quartz. Crystal stored in underground conditions ~ 20 years.

The spectra of calibration sources ^{137}Cs - (a) and ^{22}Na - (b).



Resolution of 662 keV (spectrum "a") is 17.6%, and the lines of 1275 keV (spectrum "b") - 13.5%.

Characteristics of deep underground low-background laboratory (DULB-4900)



**Background spectra in the unshielded room of DULB (a), in a low-background box (b), in a low-background box with additional 10 cm Cu shield(c).
Crystal NaI(Tl) d=80 mm, h=250 mm, m=4.61 kg**

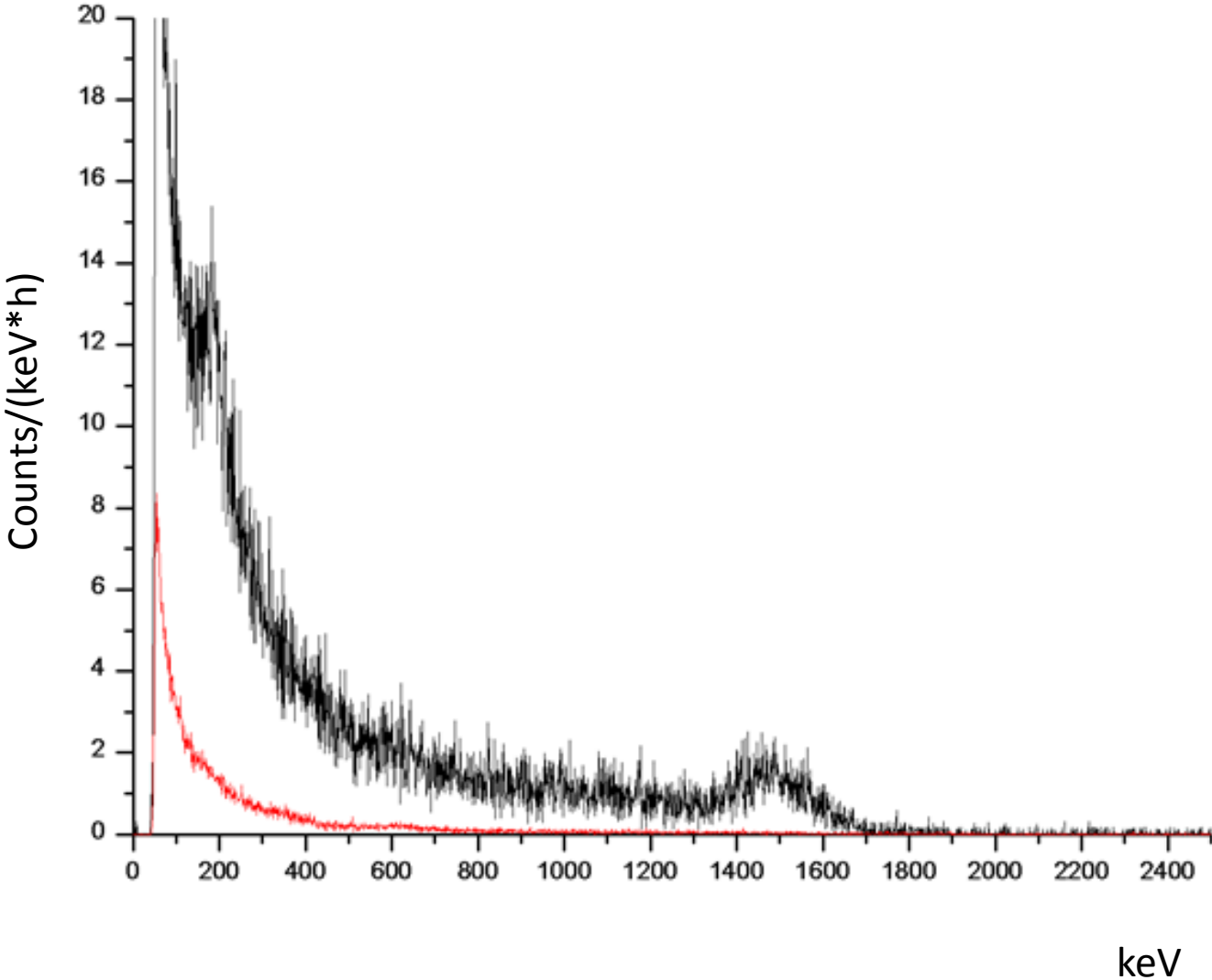
Count rate [0.15-3.00 MeV]

a. 270 [1/(s·kg)]

b. 0.753 [1/(s·kg)]

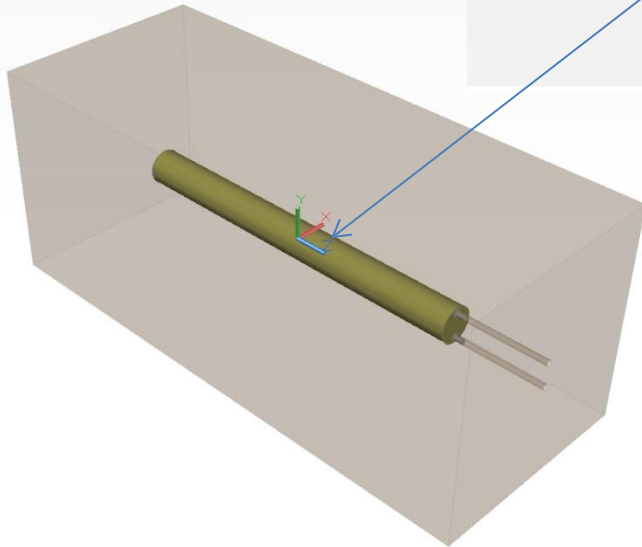
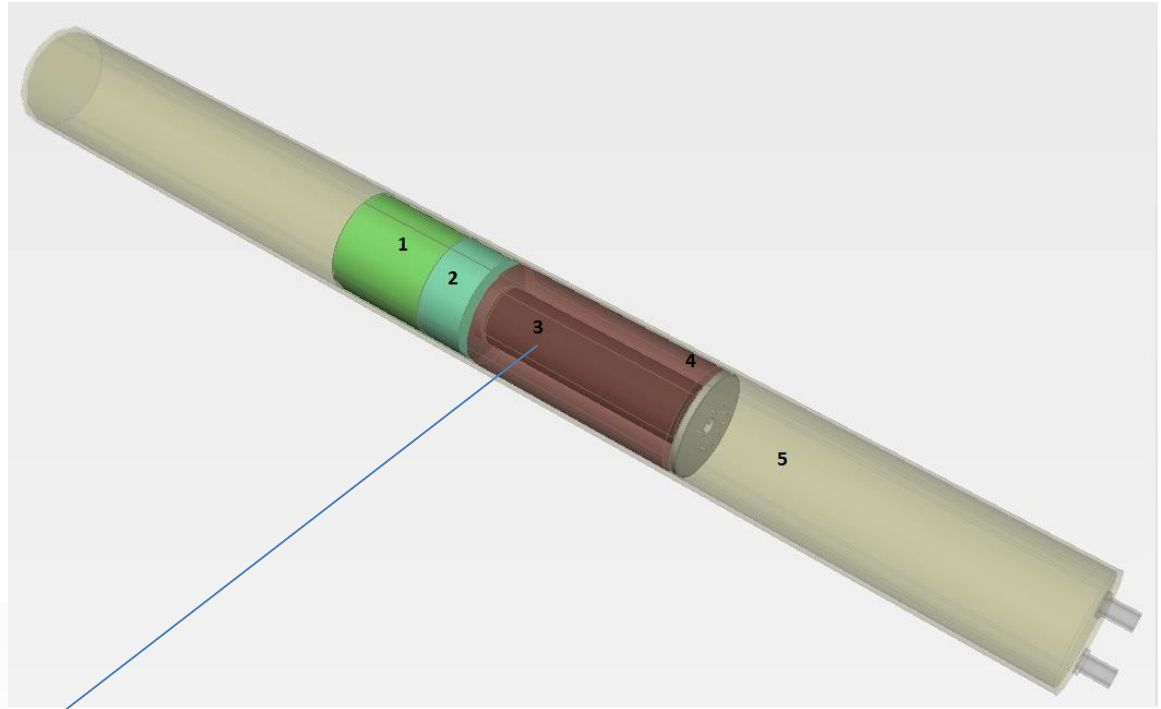
c. 0.0542 [1/(s·kg)]

Background spectra in box+copper shield and human body



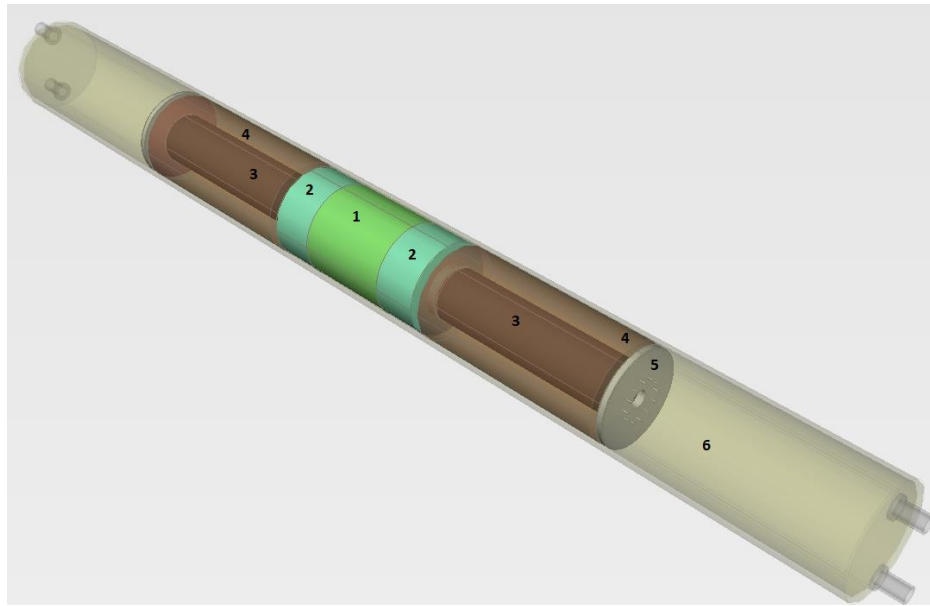
The scintillation module

1. CMO crystal
2. Light guide
3. PMT-85
4. PMT holder
5. Stainless-steel Case

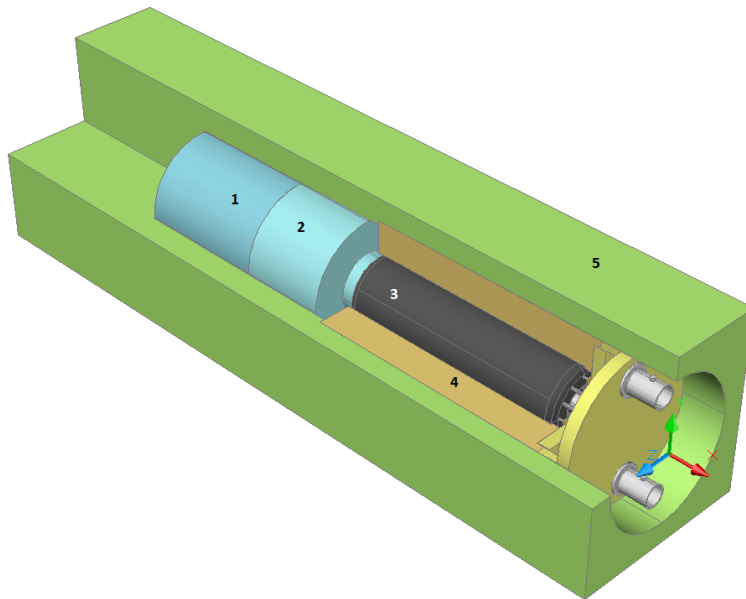


The scintillation module in copper shield (15 cm)

Variants of scintillation module

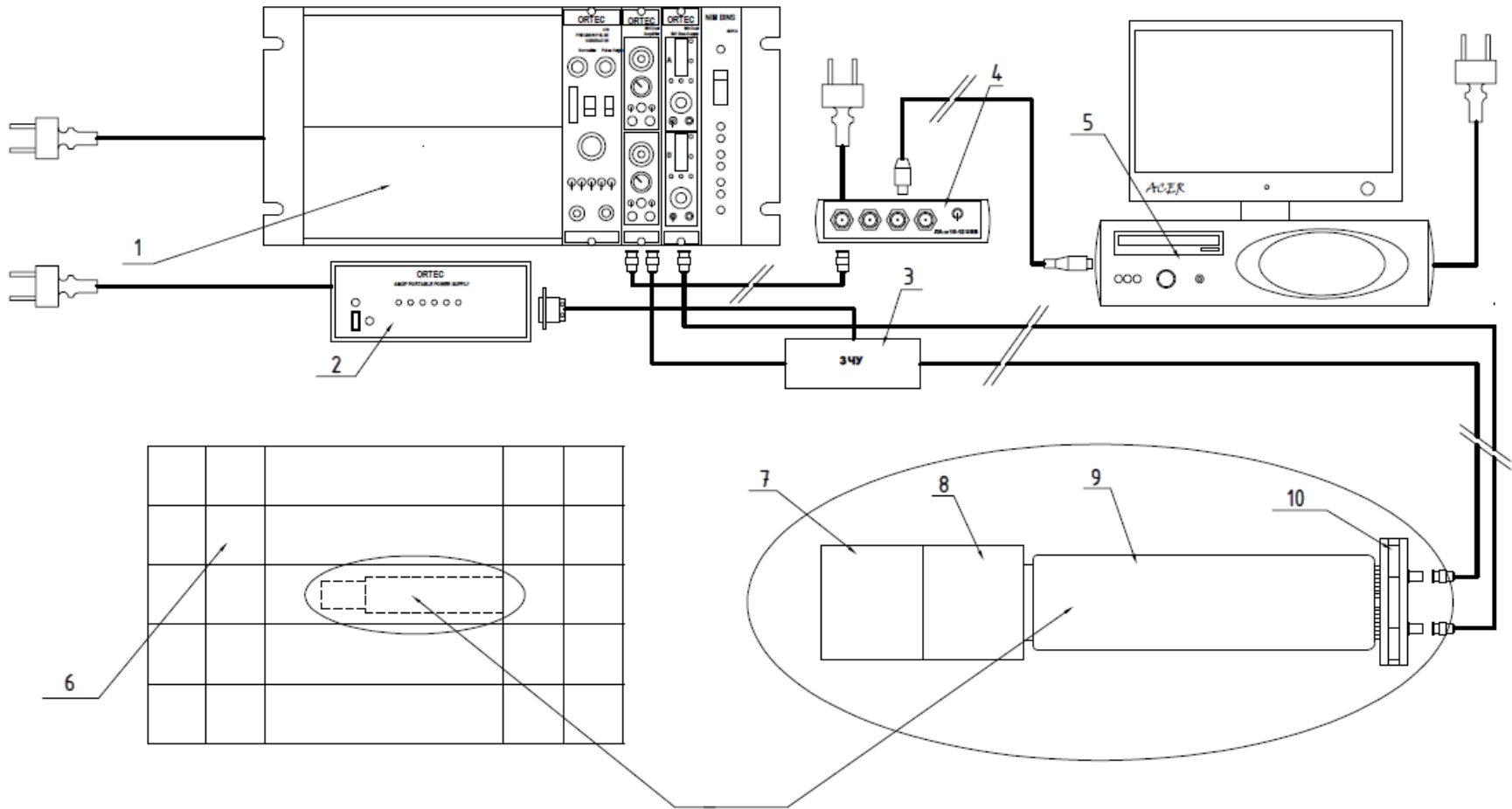


1. CMO crystal
2. Light guide
3. PMT
4. PMT holder
5. PMT HV divider
6. Stainless-steel Case



1. CMO crystal
2. Light guide
3. PMT
4. PMT holder
5. Plastic Case

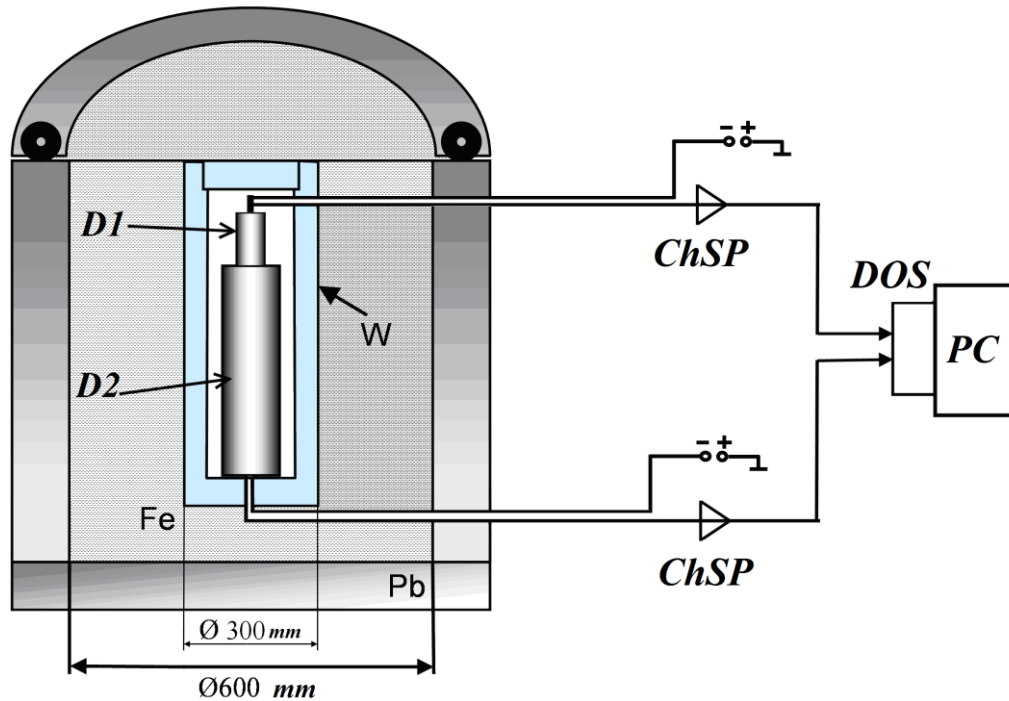
Low-background setup for measurement of the intrinsic background of CaMoO_4 scintillation crystals



1. Spectroscopy electronics
2. Portable power supply
3. Charge sensitive preamplifier
4. Digitizer
5. PC
6. Low-background shield (15cm Cu + 15cm Pb)

7. CMO crystal
8. Lightguide
9. PMT-85
10. PMT divider

Schematic section of the low-background setup and the electronic block diagram.



Low-background shield consists of 12 cm Pb + 15 cm Fe + 3 cm W. The setup includes a test detector D1 and coincidence detector D2, made from a large low-background scintillation crystal NaI (Tl) $d = 150$ mm, $h = 150$ mm, with a well $d = 90$ mm, $h = 120$ mm. Face of detector D1, which is a CMO crystal, is inserted into the well. In the proposed scheme, the detector D2 allows to register with some efficiency γ -rays accompanying the decay of radioactive impurities in the CMO crystal.

Thank you very much for your
attention!