JOINT INSTITUTE
FOR NUCLEAR RESEARCH

Radiation Protection and the Safety of the Radiation Sources

INTEREST: **INTER**national **Re**mote **S**tudent **T**raining at JINR
Wave **5**

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CONTENTS OF THE REPORT

Here's the tasks we have learned during the project:

1. **BGO** detectors:
    1. The relation between **the resolution** and **applied Voltage** for **BGO.**
    2. Energy **calibration** for **BGO**
2. **NaI** detectors:
    1. The relation between **the resolution** and **applied Voltage** for **NaI** detectors.
    2. Energy **calibration** for **NaI**
    3. Identification of **unknown sources**
3. **Attenuation coefficient.**
4. **SRIM simulation**

01

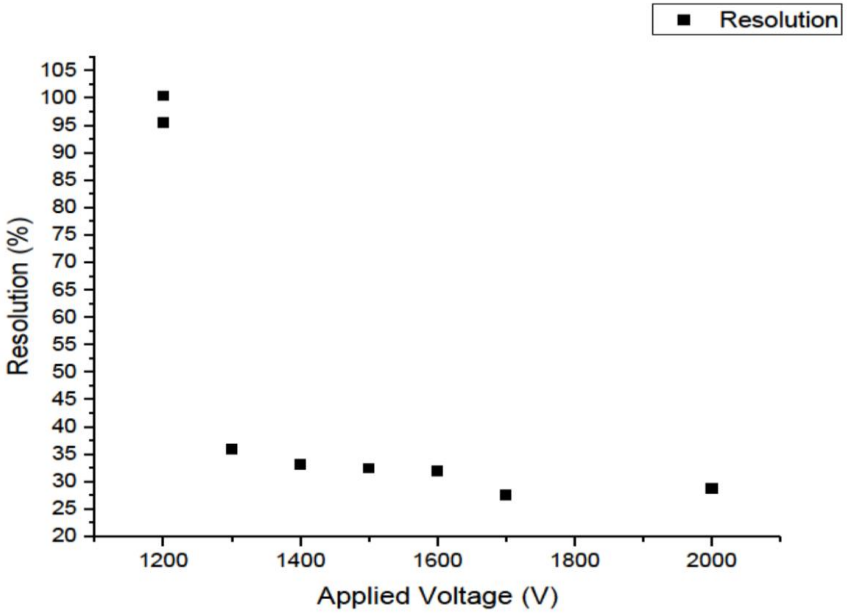
BGO detectors

The relation between the resolution and applied Voltage for BGO detector

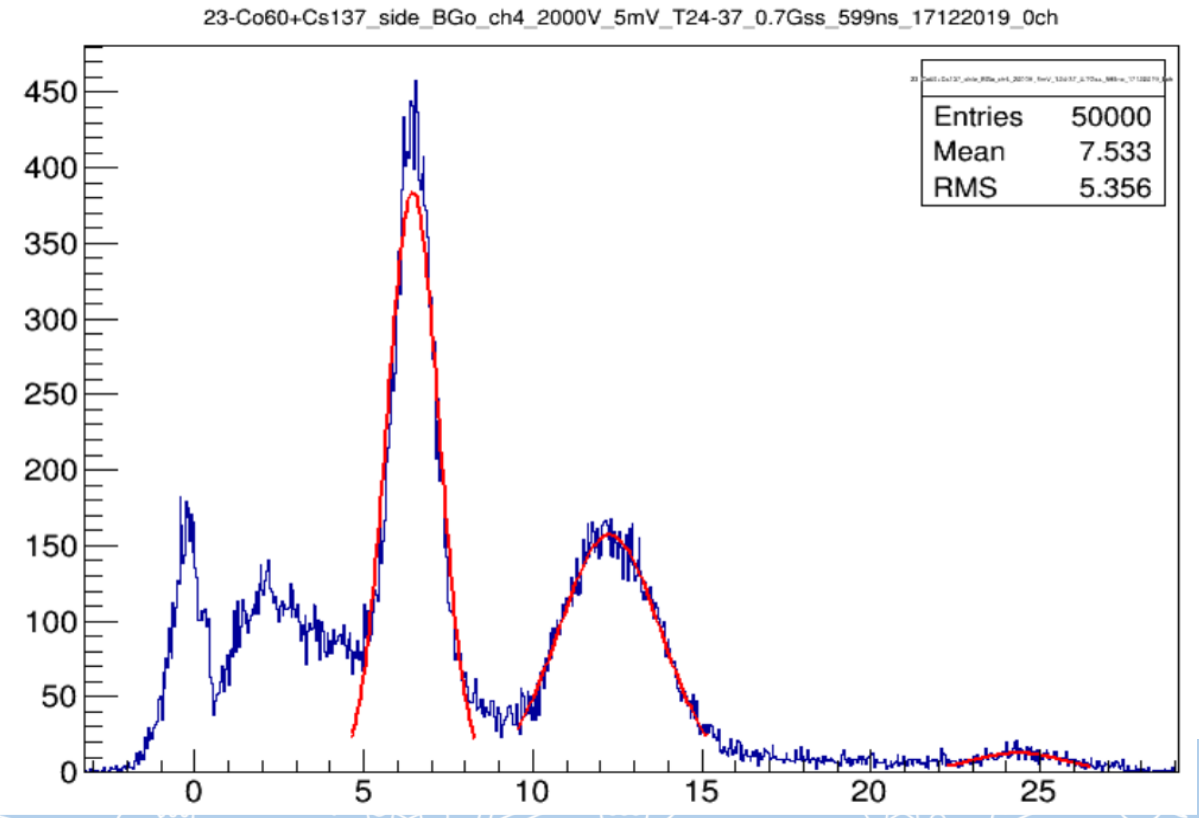
Formula: $R = \frac{\sigma}{Mean} \times 2.35$

N_0	Sigma	Mean	Resolution (R)	Applied Voltage
12	0.60307	1.4118	100.3835	1200
13	0.7421	1.8271	95.4483	1300
14	0.2945	1.924	35.9706	1400
15	0.4203	2.9839	33.1011	1500
16	0.6106	4.4211	32.4559	1600
17	0.8272	6.0925	31.9067	1700
19	1.2484	10.654	27.5365	1900
20	1.6575	13.562	28.7208	2000

The relation between the resolution and applied Voltage for BGO detector

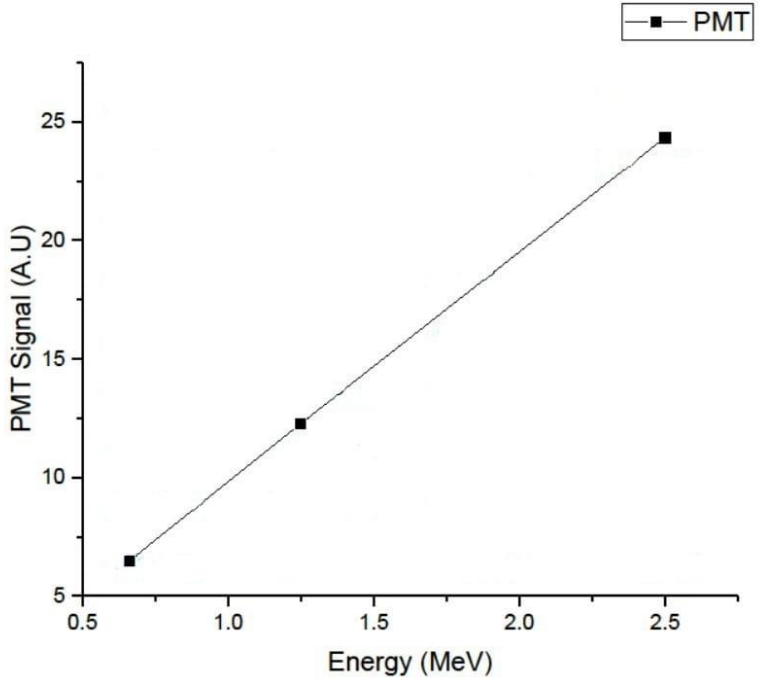


Energy calibration for BGO



Cs 137 and Co 60 spectrum from measurements with BGO detector at 2000 V

Energy calibration for BGO



Equation of calibration:

$$y = 0.05179 + 9.73835x$$

Where y=PMT signal A.U,

x= Energy of unknown source

02

NaI detectors

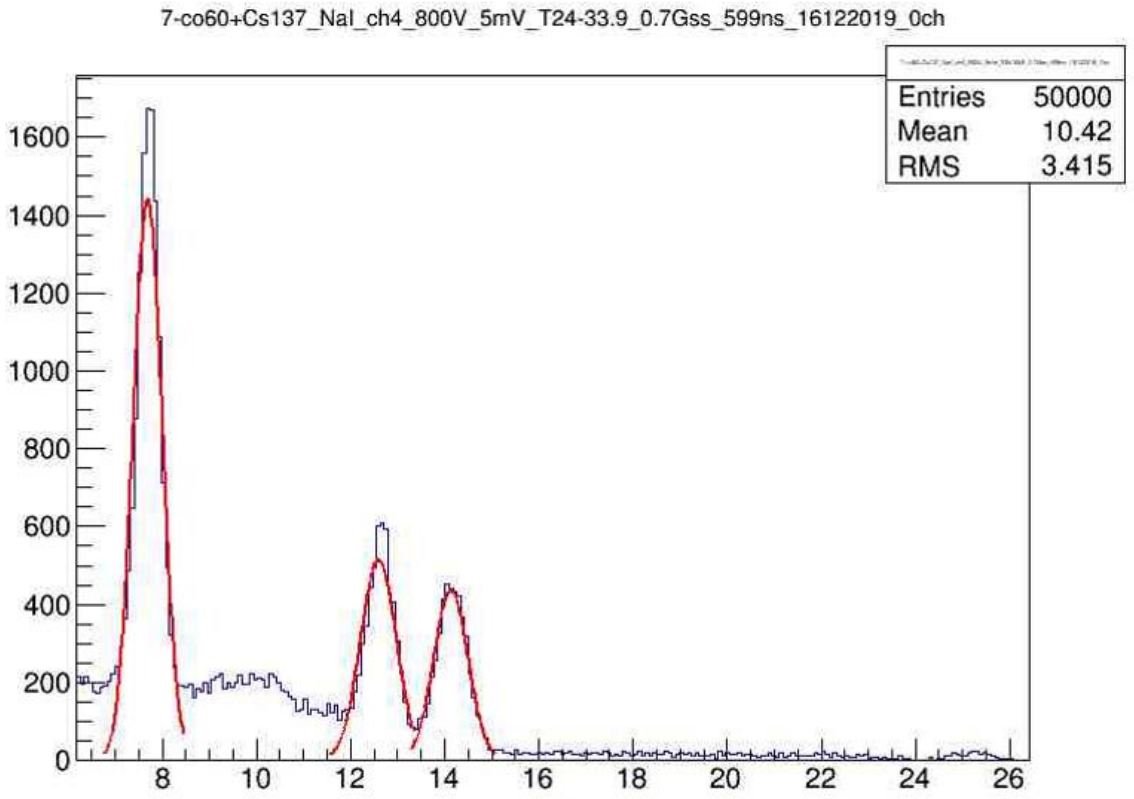
The relation between the resolution and applied Voltage for NaI detector

Formula: $R = \frac{\sigma}{Mean} \times 2.35$

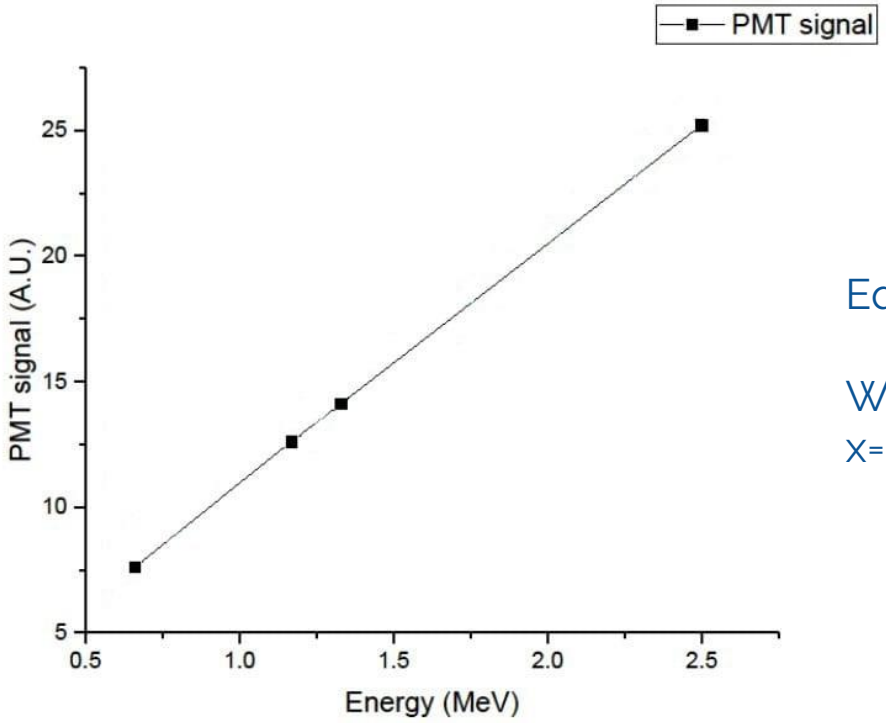
N_0	Sigma	Mean	Resolution (R)	Applied Voltage
2	0.637	22.36	6.694	900
3	1.205	41.02	6.033	1000
4	1.625	64.210	5.473	1100
5	2.013	100.619	4.701	1200
6	2.533	120.286	4.486	1300

Energy calibration for NaI

Cs 137 and Co 60 spectrum from measurements with NaI detector at 2000 V



Energy calibration for NaI



Equation of calibration:

$$y = 1.45953 + 9.50263x$$

Where y=PMT signal A.U,

x= Energy of unknown source

Identification of unknown sources

- We get the spectrum of unknown source
- We make GAUS FIT and find Mean
- From energy calibration we can determine energy
- peak of unknown source by using equation from
- calibration of NaI detector:

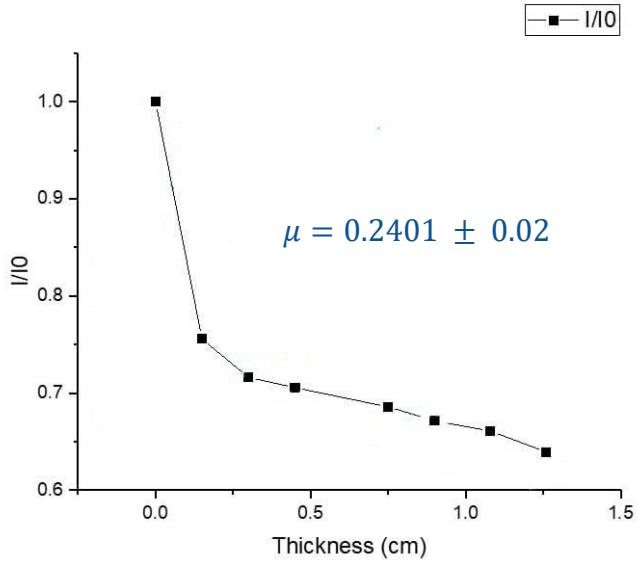
$$y = 1.45953 + 9.50263x$$

Where y=PMT signal A.U,
x= Energy of unknown source

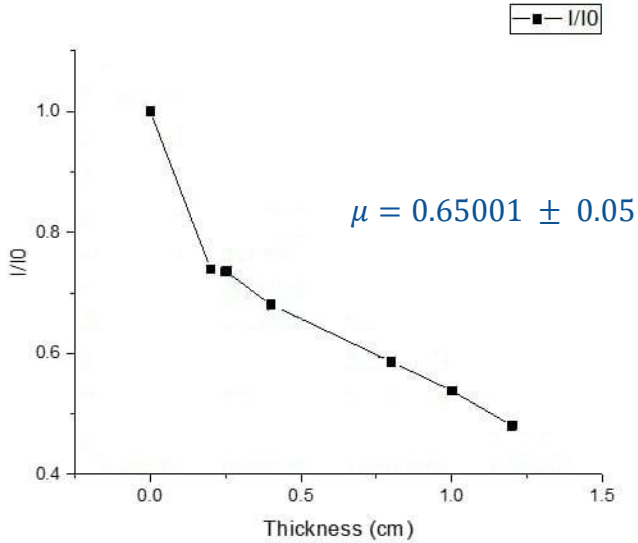
Attenuation coefficient

Attenuation coefficient describes the fraction of a beam that is absorbed or scattered per unit thickness of the absorber: $I = I_0 e^{-\mu x}$, where μ is attenuation coefficient.

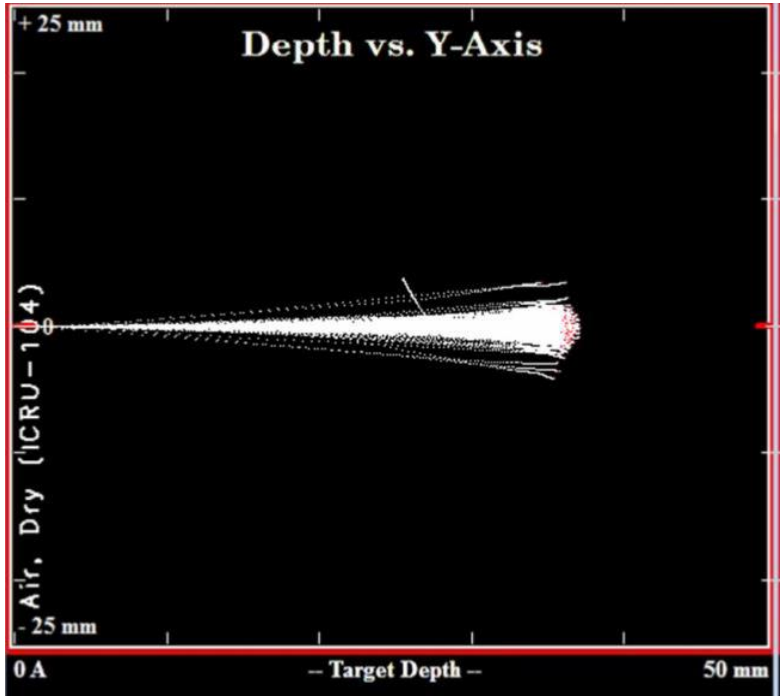
Determination of attenuation coefficient for Al



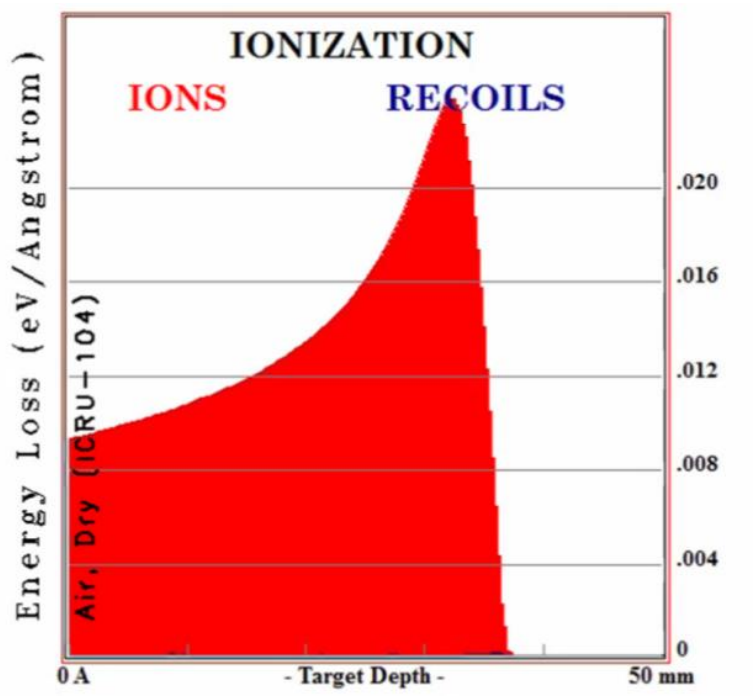
Determination of attenuation coefficient for Cu



SRIM simulation



Depth for α radiation in air



Ionization

THANKS

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