# Plots of Nuclear physics experiment

## 1 In-lab Plots list.

This experiment consists of four parts.

### 1.1 Plateau experiment

- First plot is the response of the GM tube. $(Voltage, Counts)$, to see the plateau region. Recall the import function in Python.

### 1.2 Inverse square law

- You need to present a plot of $(distance, rate^{-1/2})$. The rate is the measured rate minus background rate. Start from small distances. You don't need to use the same measuring time. Rather aim at the same number of counts if possible. The points above 2 cm need to be fitted, and show the fitted curve. Record distance $a$.

### 1.3 Alpha particle range

Measure the rate from alpha particles source and present the following:

- Calculate the range, and from that the energy of the alpha particle (remember the parameter a).
- Normalize the measured rate of the $\alpha$-particles by the solid angle (multiply it by $(d+a)^2$), where $d$ is the nominal distance between the source and GM counter. Use $a$ determined above.
- Calculate the range, and from that the energy of the alpha particle (recall the parameter $a$).

### 1.4 Statistics of nuclear decay

- Create function that calculate the third moment of a set of data:

```python
def K3(data):
    n=np.mean(data)
    K3=np.sum((data-n)**3)
    K3=K3/(len(data)-1)
    return K3
```

- Plot the histogram of the counts. Using for example:

```python
counts, bins = np.histogram(x)
plt.stairs(counts, bins)
```

On top of the data histogram put the Gaussian and Poisson distributions with dedicated mean calculated from the data.

## 1.5 BETA DECAY ENERGY AND THE ABSORPTION COEFFICIENT

- Present the measured rate as function of absorber thickness. In linear - log scale. For example, using the python function.

```
matplotlib.pyplot.yscale('log ')
```

- Use linear regression on the data, excluding the background, in order to calculate the absorption coefficient.
- Present  the measured rate as function of absorber density thickness. Also, in linear – log scale.
- Calculate the energy as described in the brief document.

Look at the mass attenuation coefficient for electrons. Better in Al.