

# STATISTICAL and COMPUTATIONAL METHODS IN GAMMA RAY SPECTROSCOPY



*Presented By*

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# Gamma-Ray Spectroscopy

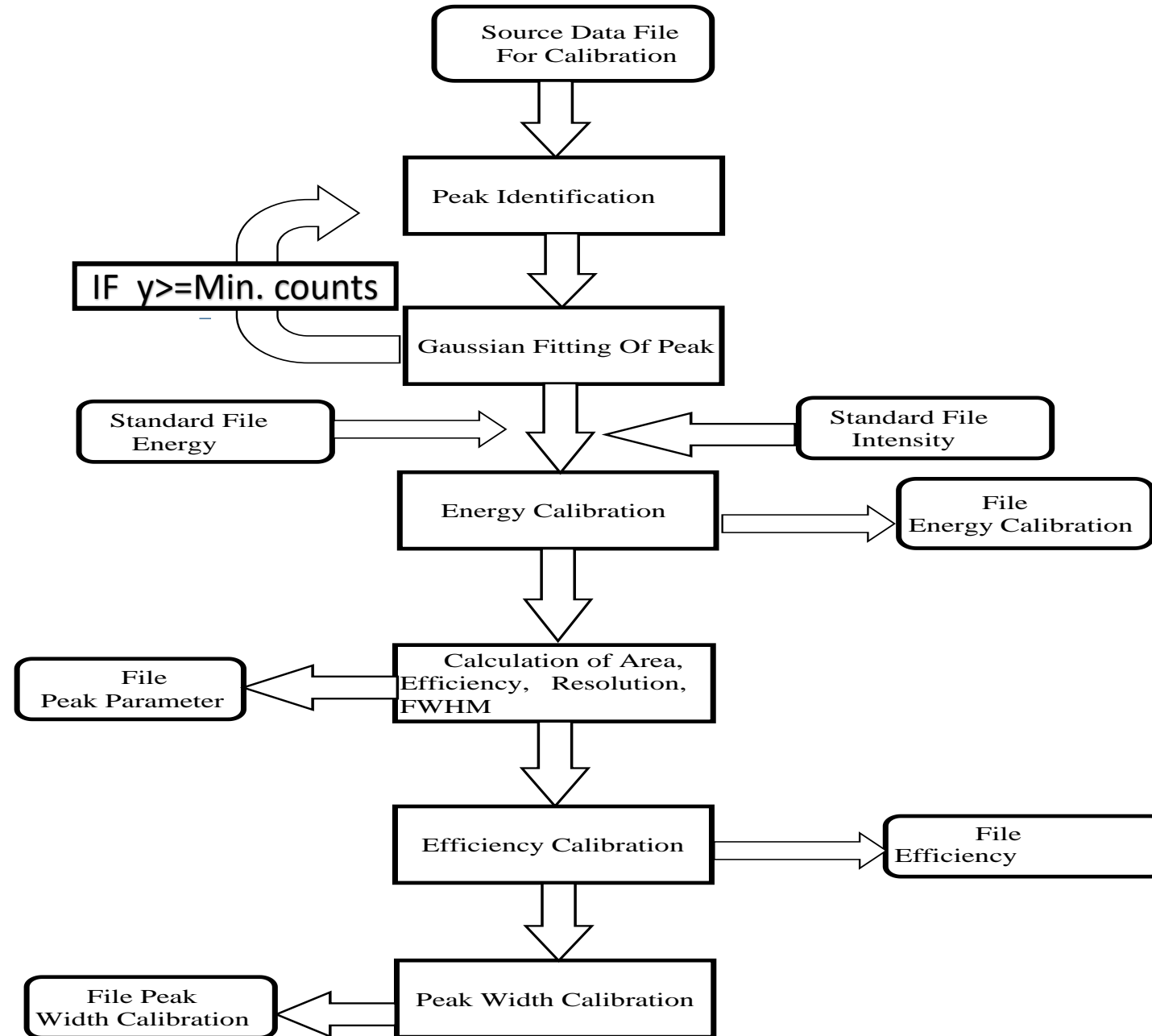
To quantitative study of the energy spectra of gamma-ray sources  
- energy and intensity for investigation of level scheme of nuclei

## Fitting of peaks and Calibration

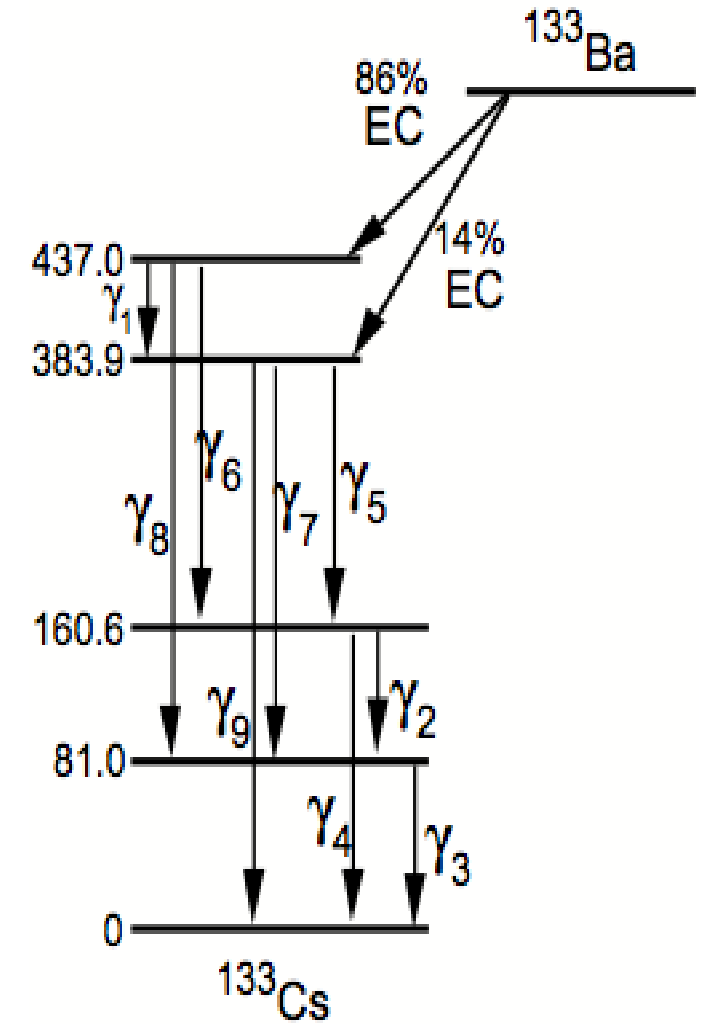
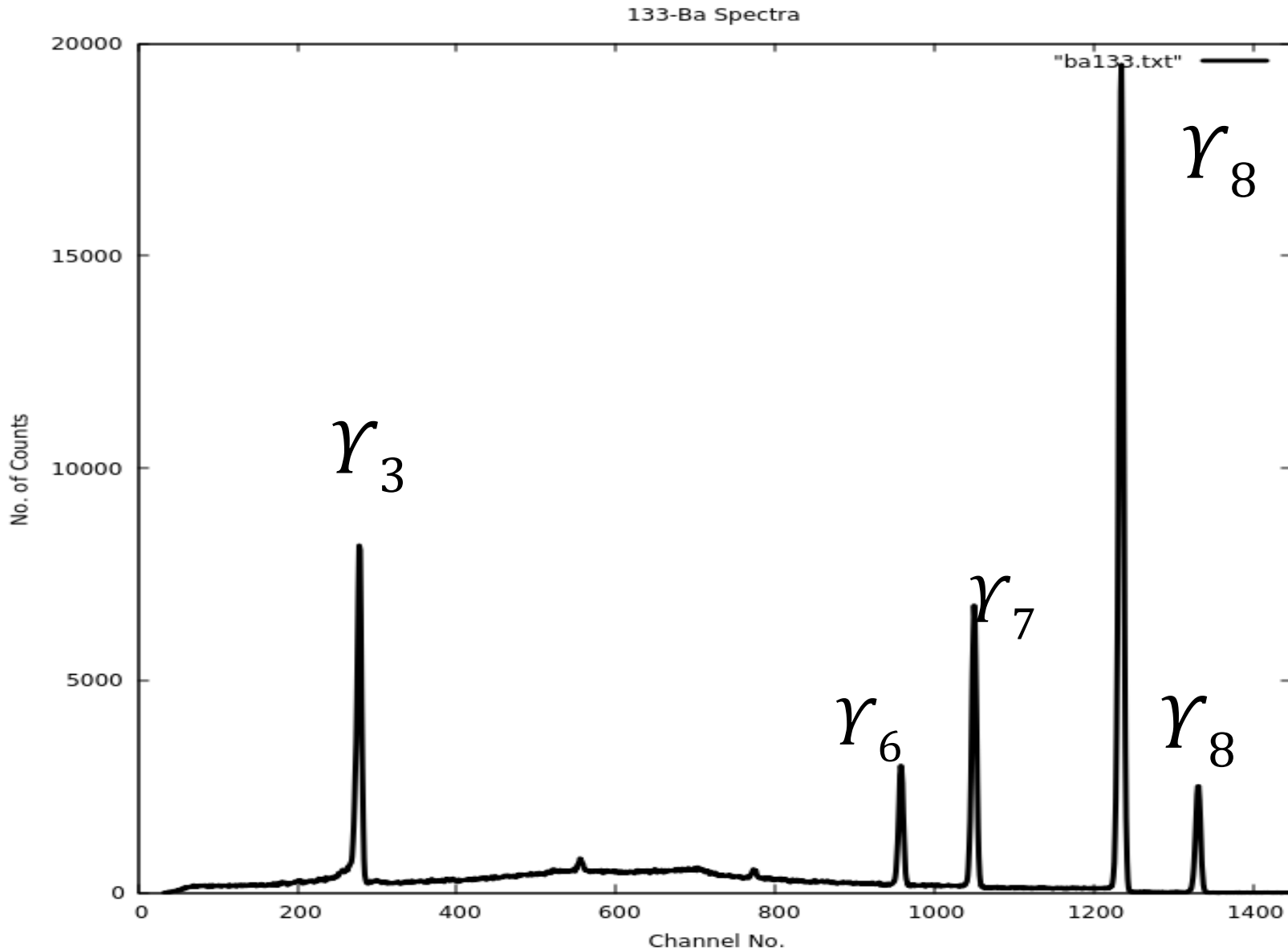
- Fitting of the peaks 0
- Energy Calibration
- Efficiency calibration
- Peak width calibration
- Find the energy and intensity of unknown gamma ray

# Flow Chart of Project Work

Fitting of the peaks and all calibration are done step-to-step by the code.



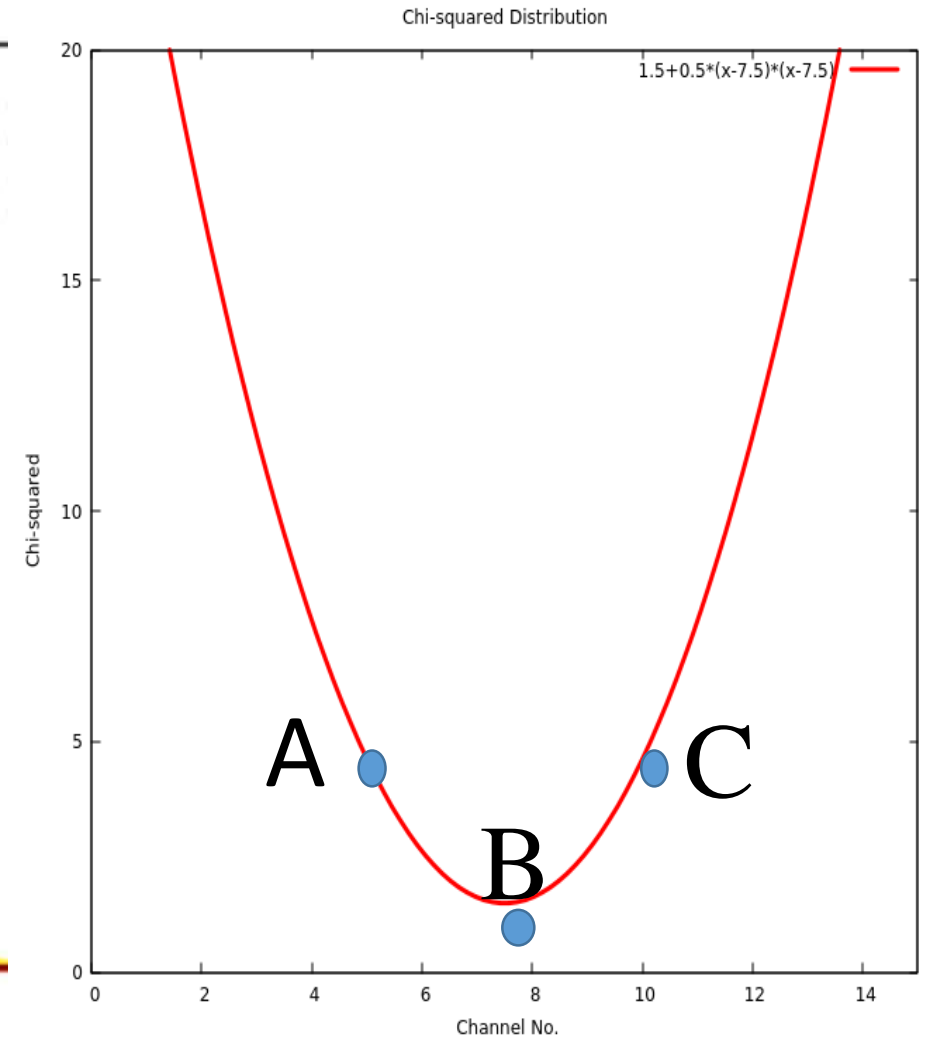
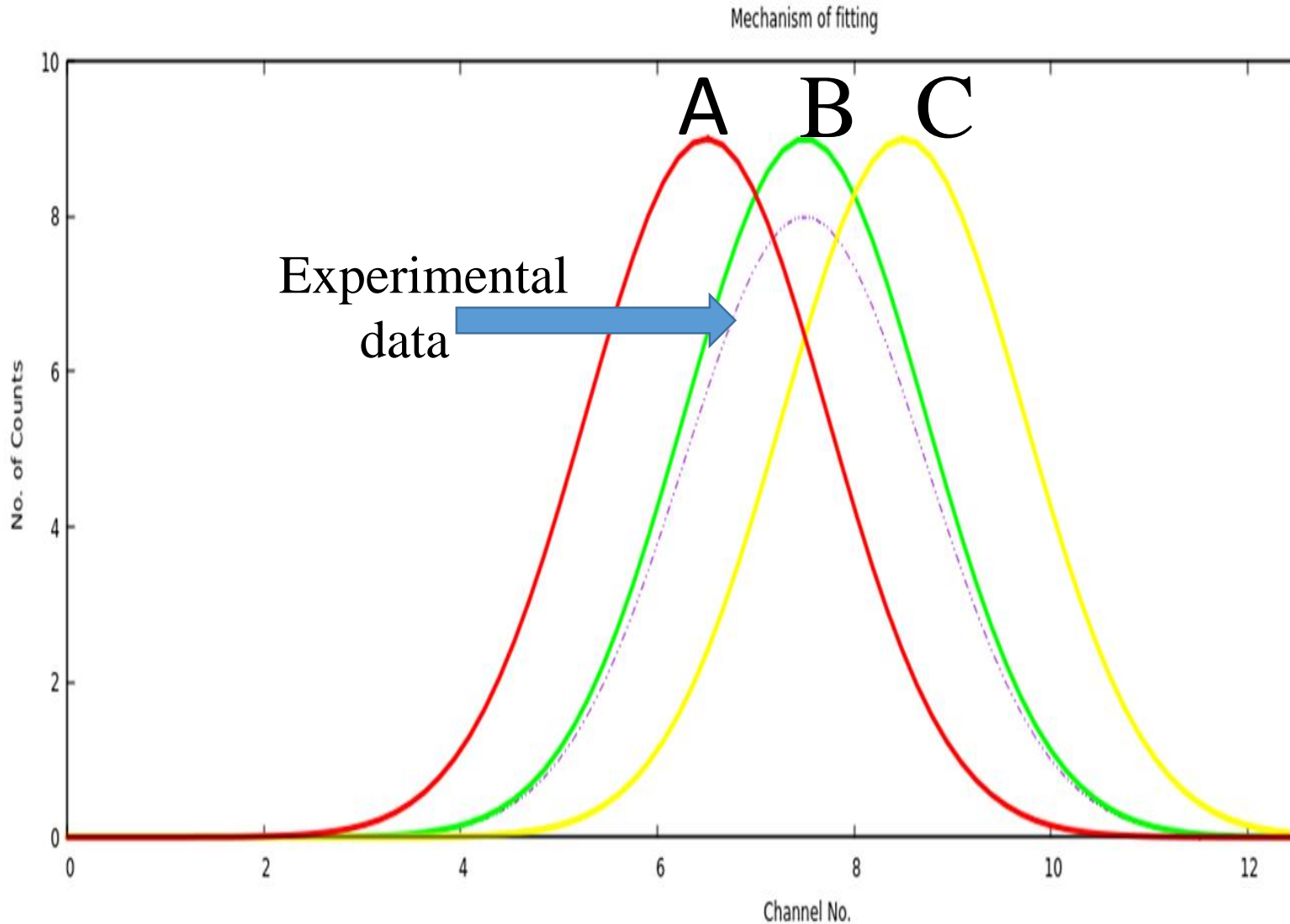
# Spectrum of Reference source for calibration $^{133}\text{Ba}_{56}$



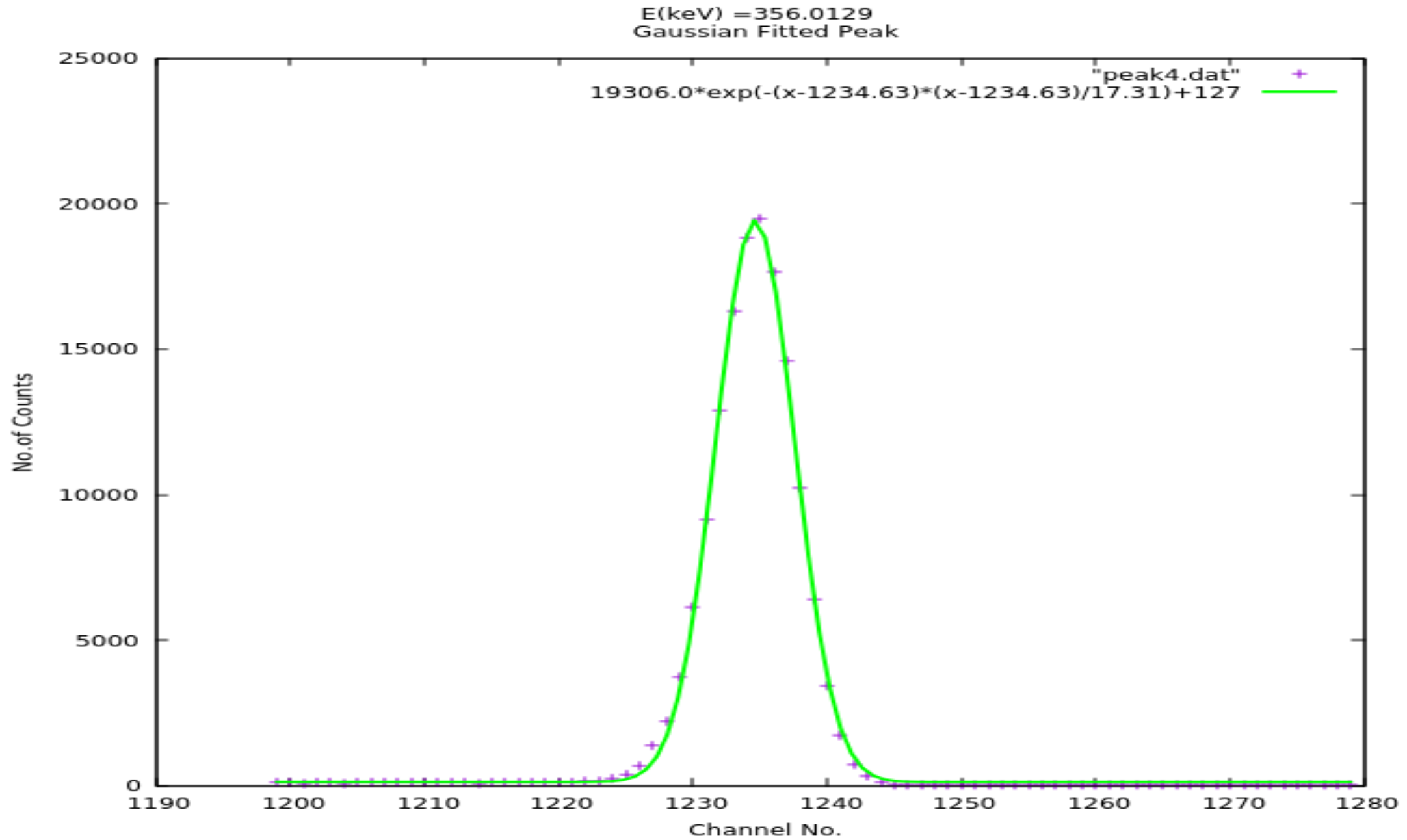
# Mechanism of fitting peaks (Example)

Fitting of peak by minimization of  $\chi^2$

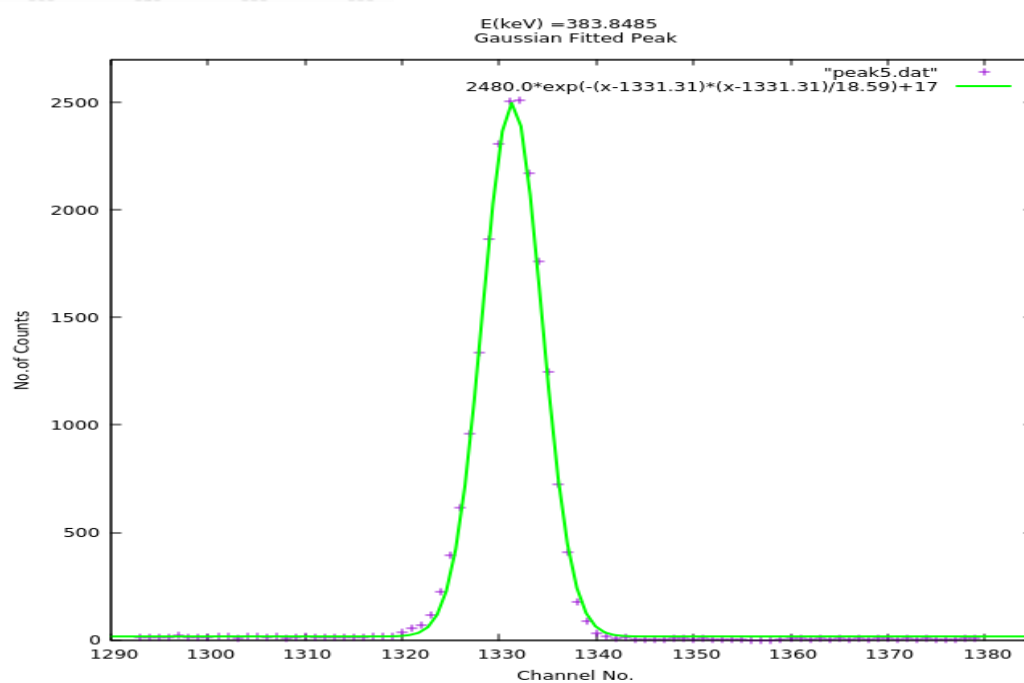
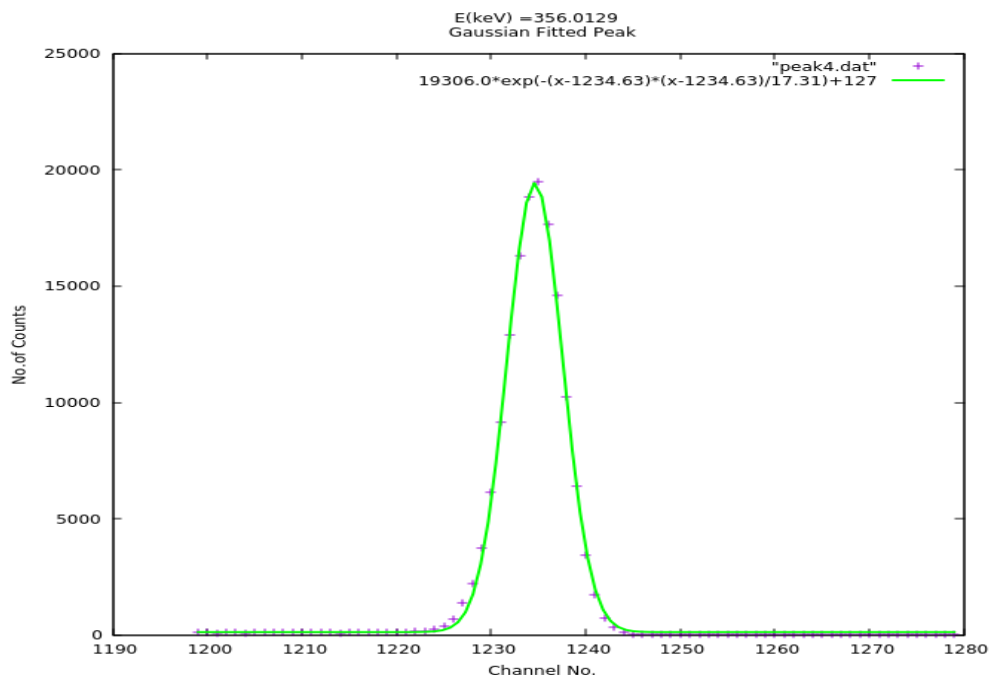
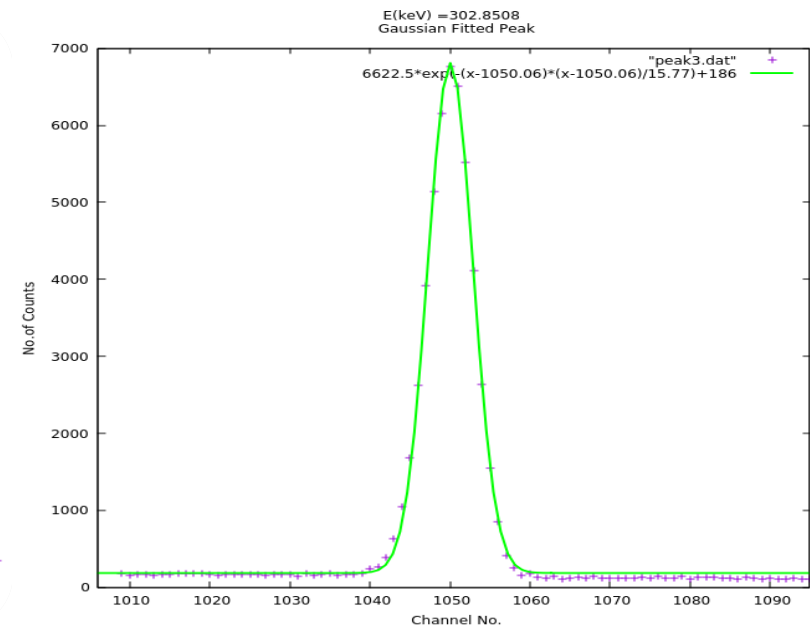
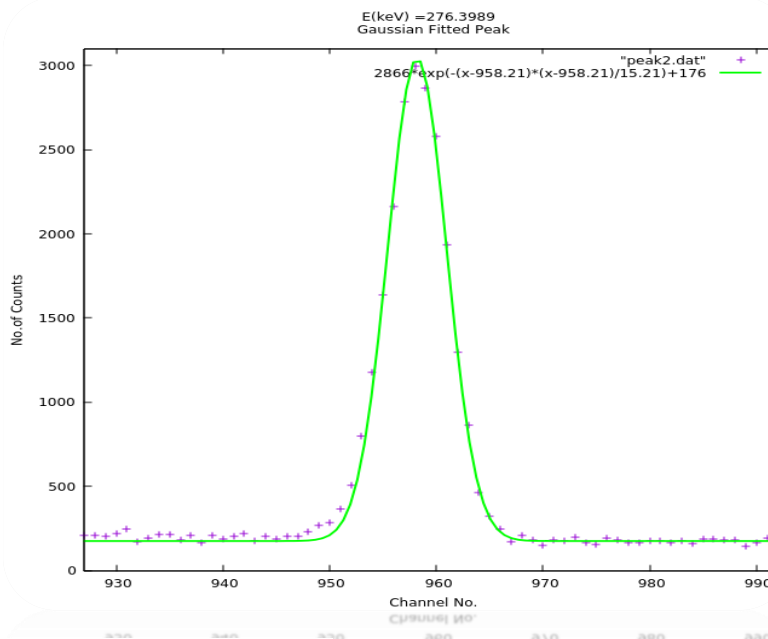
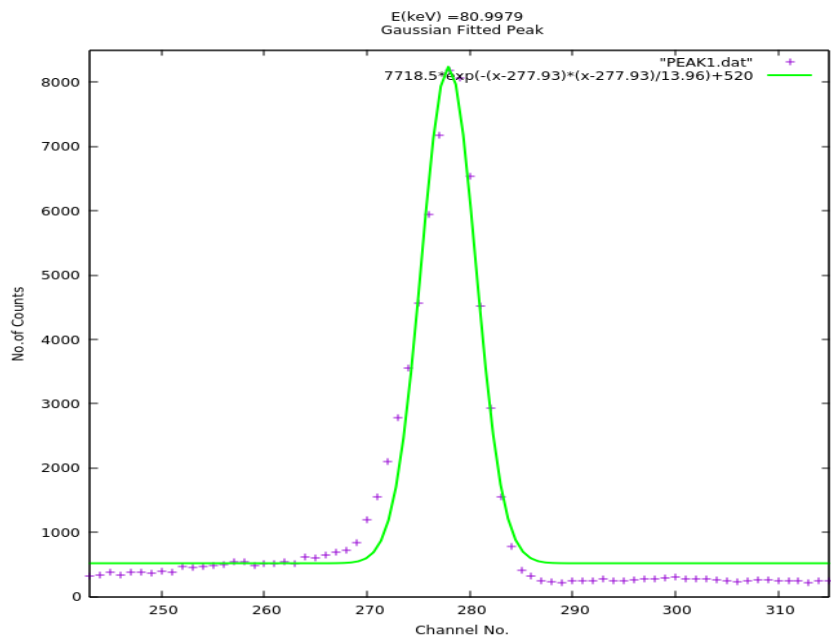
$$y = a * e^{\frac{-(x-b)^2}{c}} + s$$



# Gaussian Fitted peak

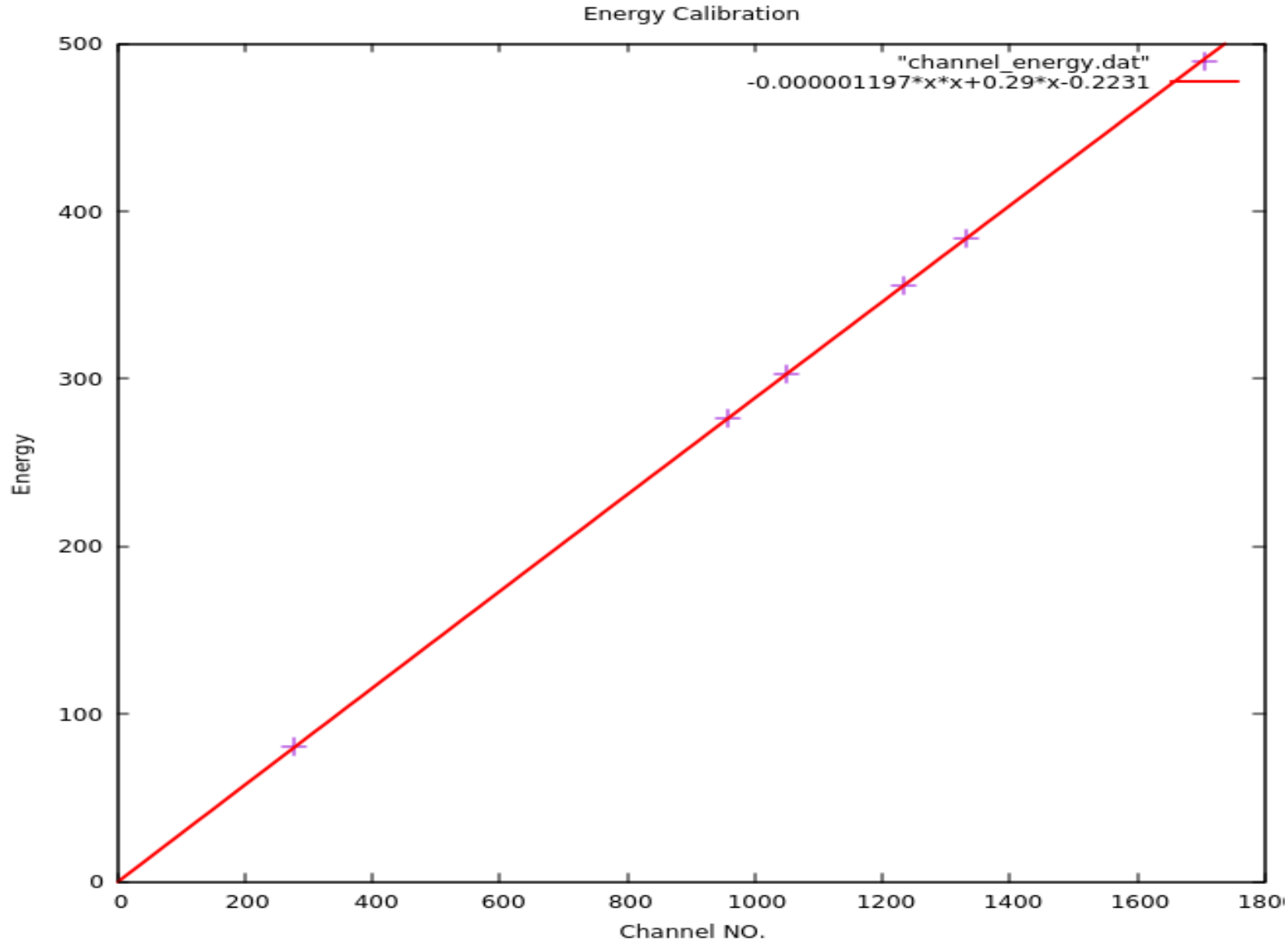


# Gaussian Fitted Peaks



# Energy calibration

$$y = ax^2 + bx + c$$

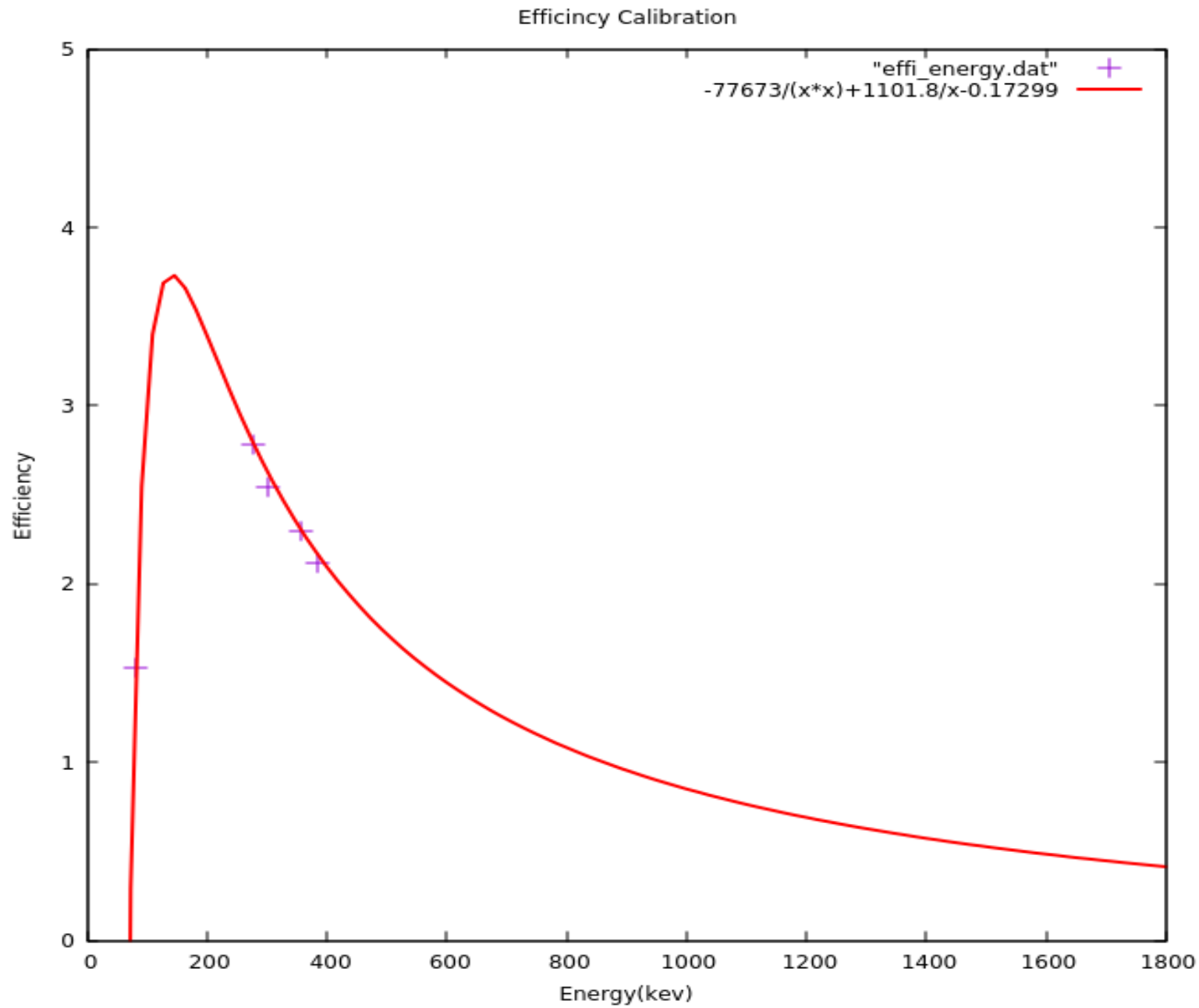


$$y = \text{Energy}(keV)$$

$$x = \text{Channel No.}$$



# Efficiency calibration

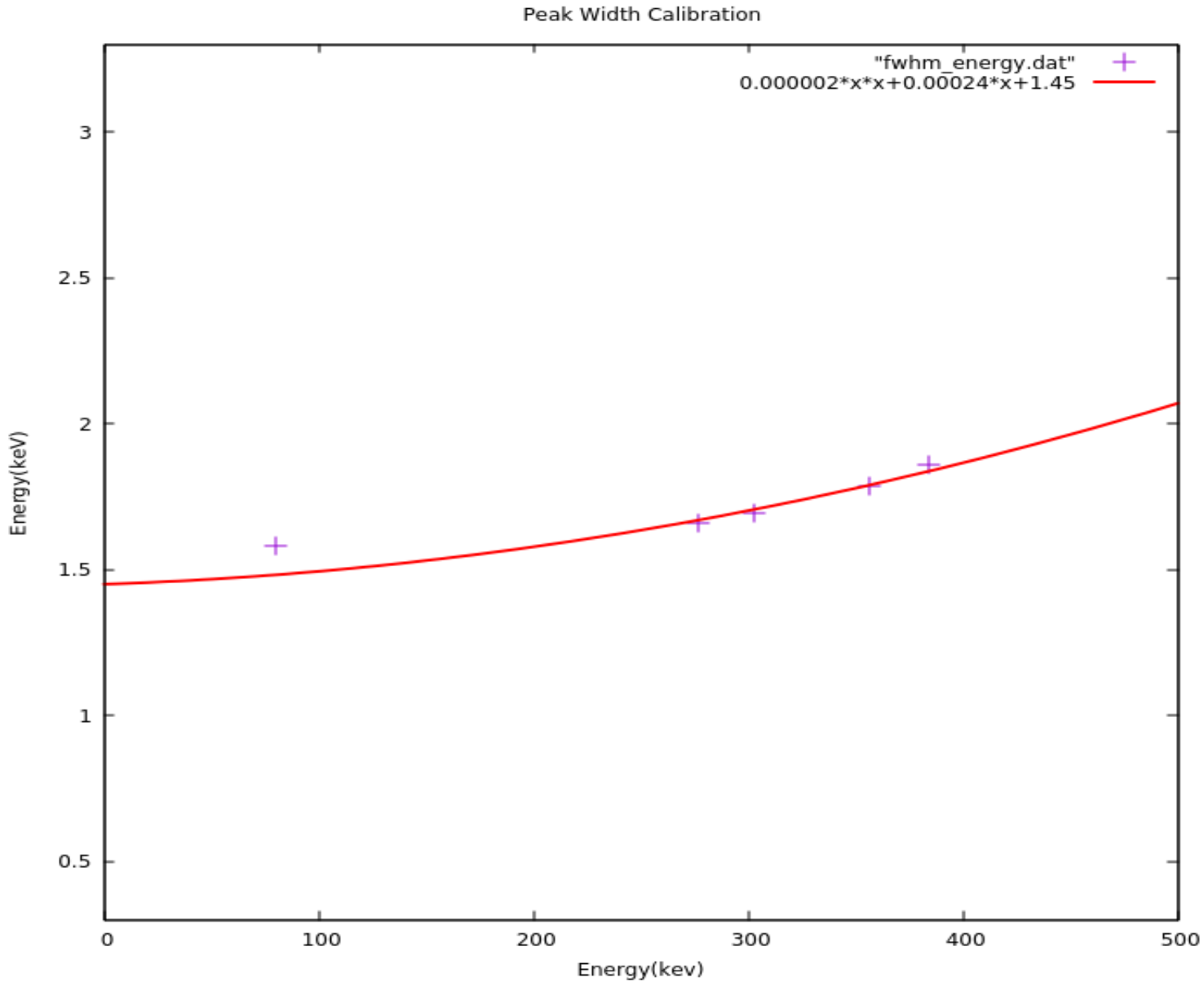


$$Y = \frac{a}{x^2} + \frac{b}{x} + c$$

$$y = \textit{Efficiency}$$

$$x = \textit{Energy(keV)}$$

# Peak width calibration

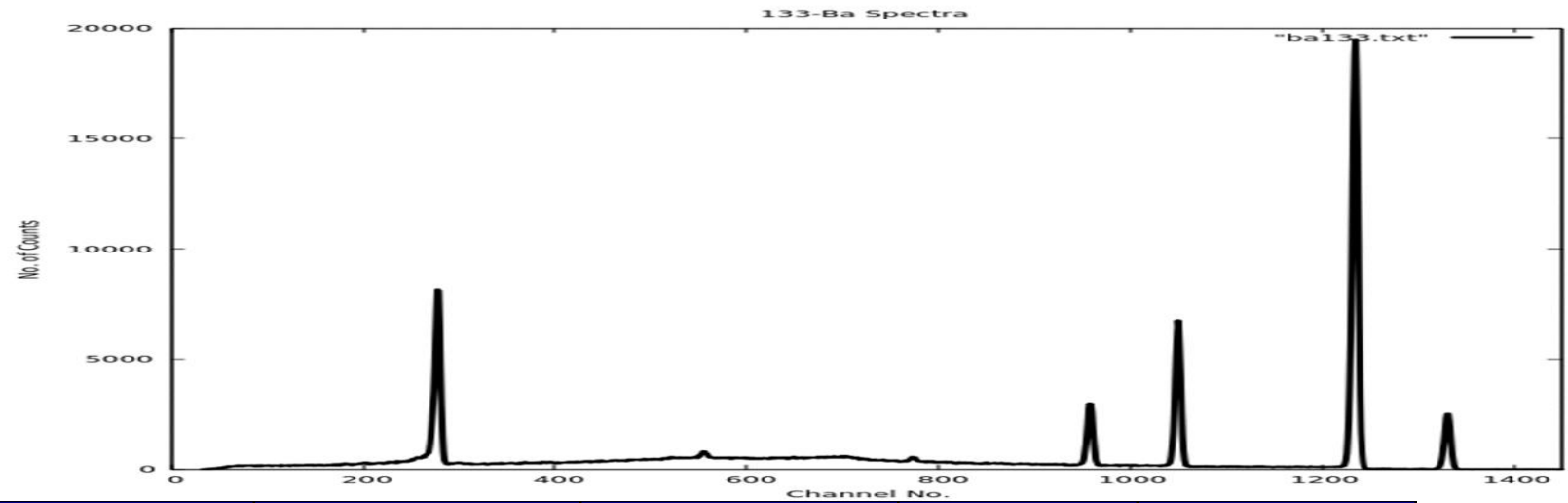


$$y = ax^2 + bx + c$$

$$y = FWHM(keV)$$

$$x = Energy(keV)$$

# Results of spectra



Peak No.	Energy (keV)	$\Delta E$	FWHM (keV)	Area of peak	$\Delta A$	Resolution	Efficiency
1	80.284138	0.030864	1.580930	51115.257621	87.854994	0.019692	1.534532
2	276.558755	0.099716	1.659965	19811.425673	53.535035	0.006002	2.778601
3	302.974457	0.109083	1.694315	46613.611259	81.378744	0.005592	2.545801
4	355.994999	0.127958	1.785754	142369.110663	138.946033	0.005016	2.294426
5	383.735254	0.137872	1.858700	18952.491567	49.799598	0.004844	2.119965

# Limitation and Future scope

- Addition of skewness in Gaussian
- Quadratic subtraction of background
- Variable sensitivity
- Fitting of multiple peaks
- Initialization of parameters according to detector
- Graphical Interface
- Error in the parameters of calibrations

**Hence extend to other detector**

Thanks you!!