



Istituto Nazionale di Fisica Nucleare
LABORATORI NAZIONALI DI LEGNARO



Laboratorio Gamma UniBo – INFN

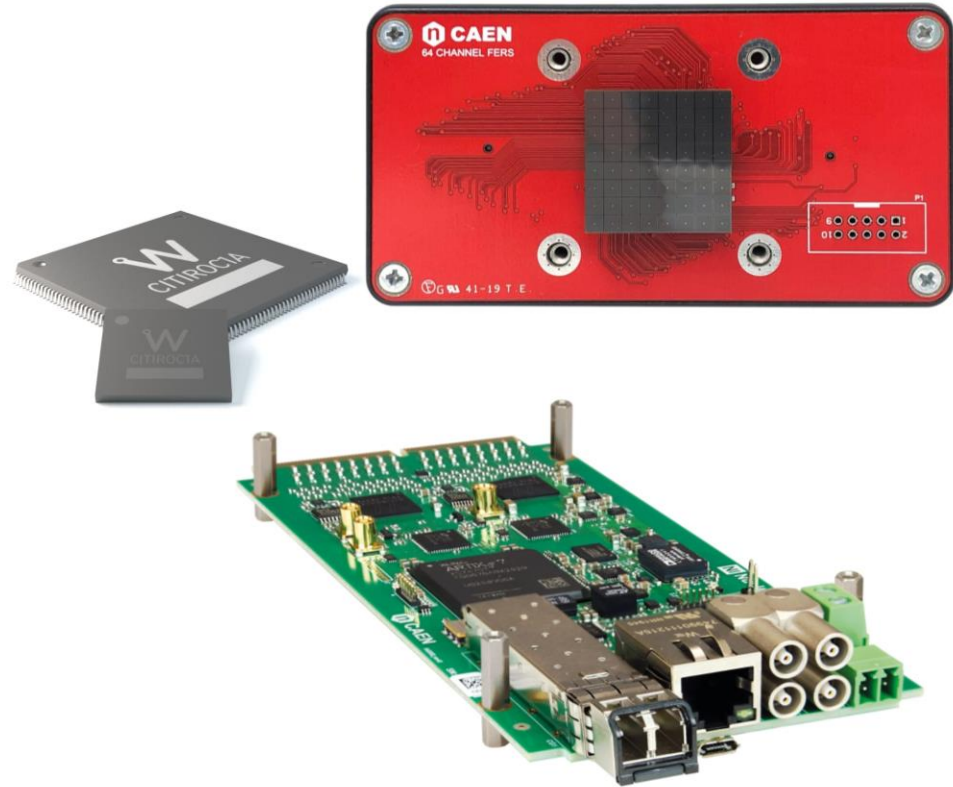
WP3 state of art on FERS+SiPM characterization

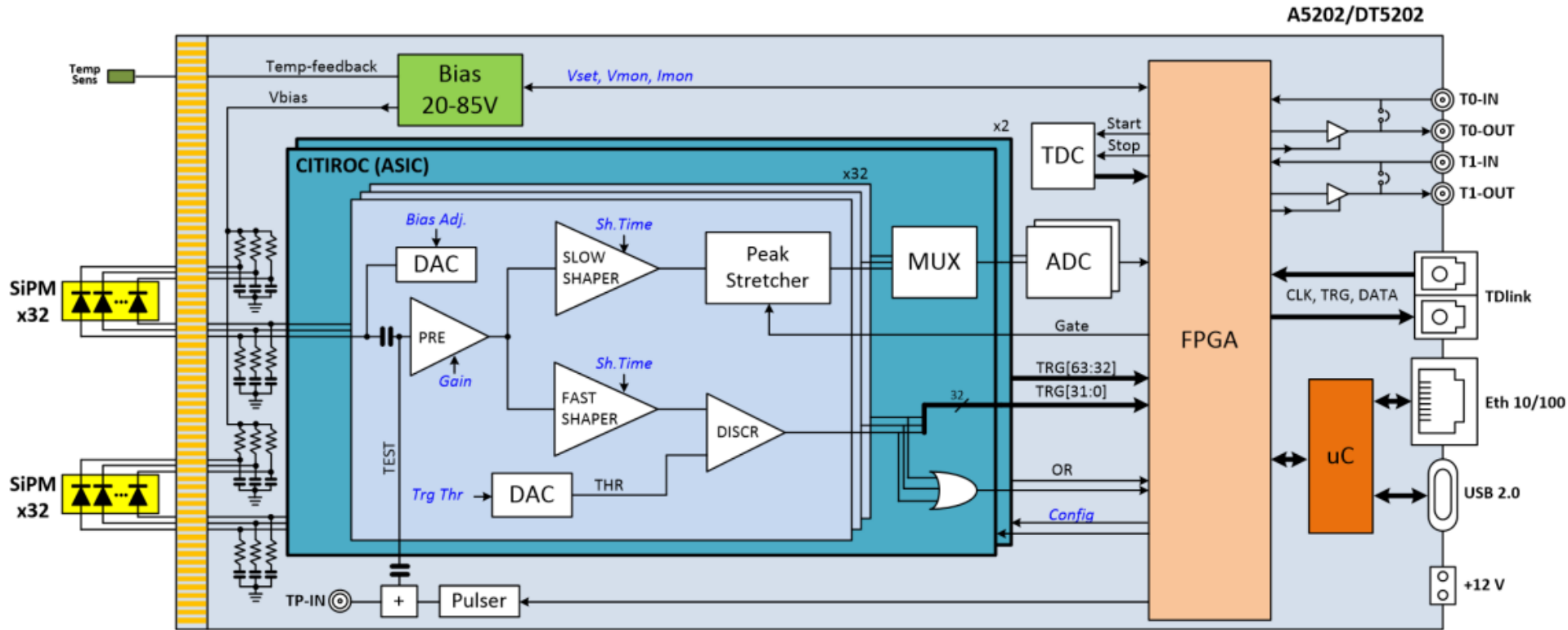
E. Borciani, S. Spadano

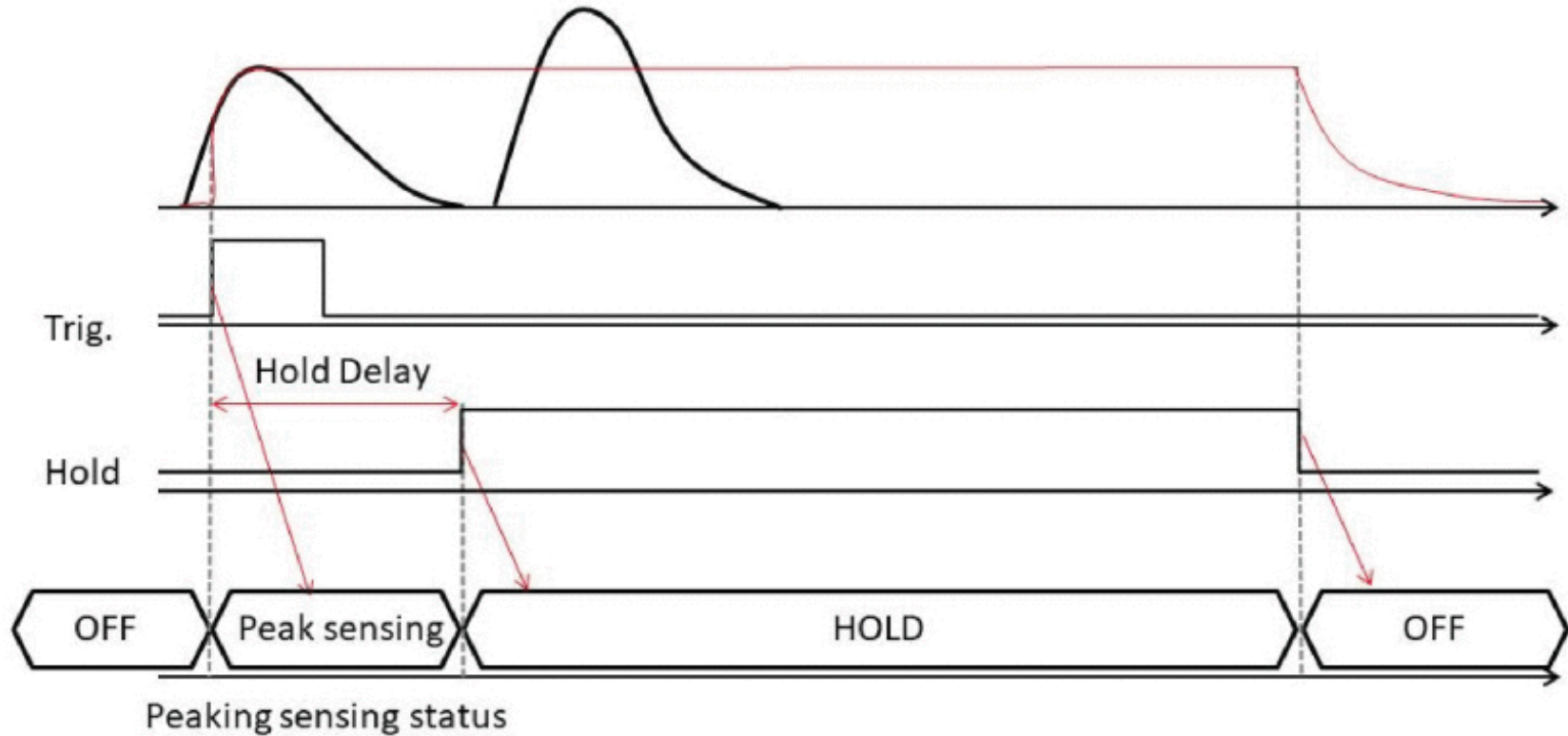
June 4th, 2024

The readout system we are using is the A5202/DT5202, belonging to the FERS-5200 family, it's based on Citiroc-1A ASICs and designed for the readout of Si-PMs. This board has 64 readout channels consisting of:

- pre-amplifier, shaper, peak sensing and discriminator;
- multiplexed ADC (analog to digital converter);
- FPGA for acquisition management and readout interfaces (USB, Ethernet).

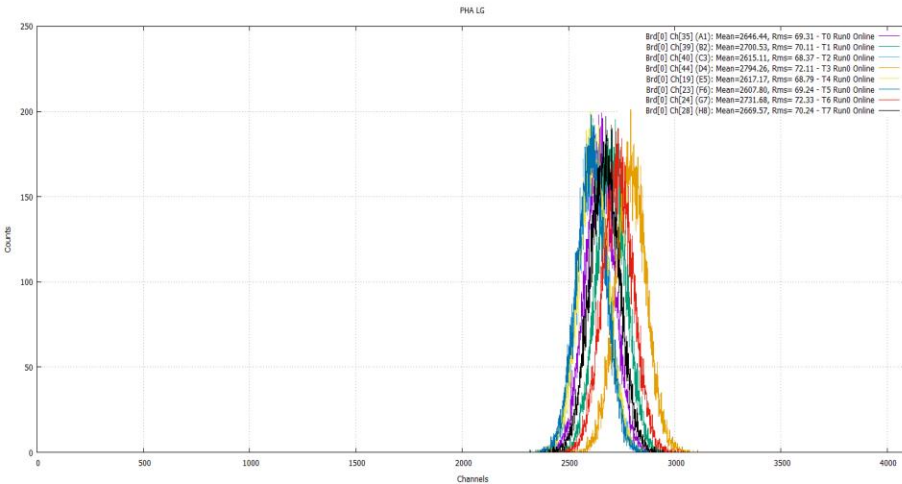




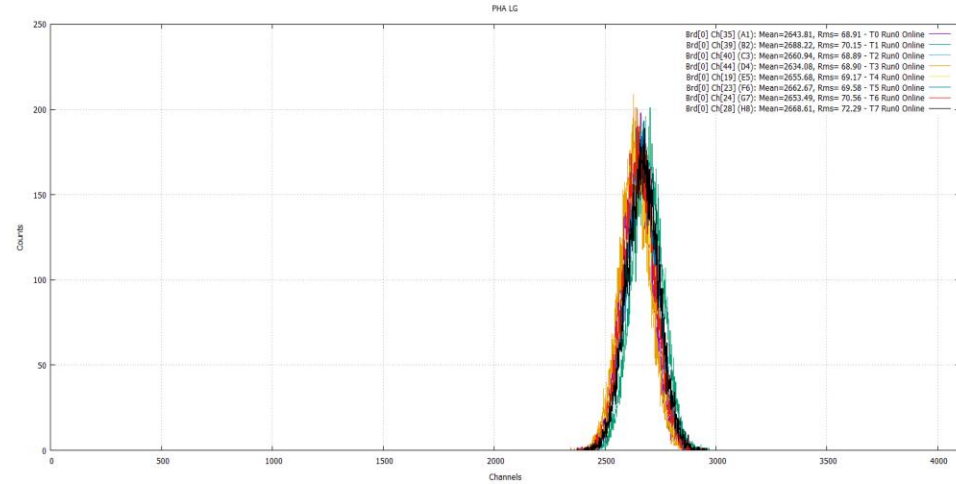


First flat field attempt

Using the flat field setup and the linear fit computed earlier we try to adjust the gain on some channels in order to have an uniform output in terms of channels.



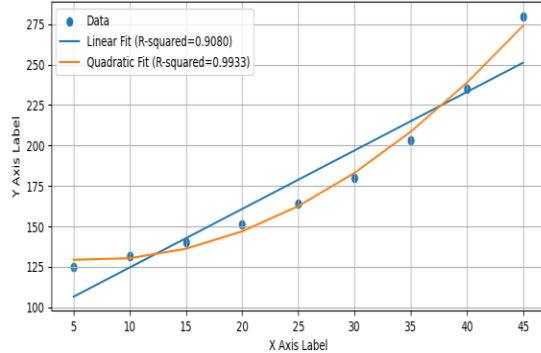
Matrix response at 25 low gain.



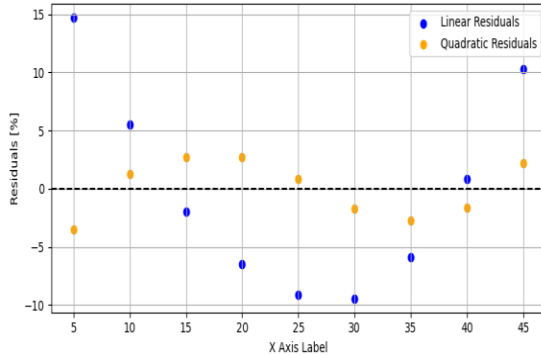
Flat field 25 low gain adjusted.

Laser flat field correction

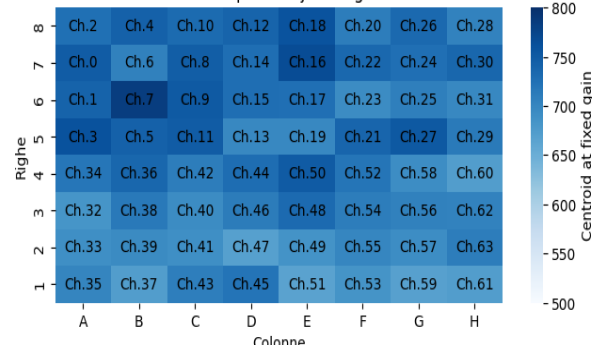
Linear vs Quadratic Fit Comparison



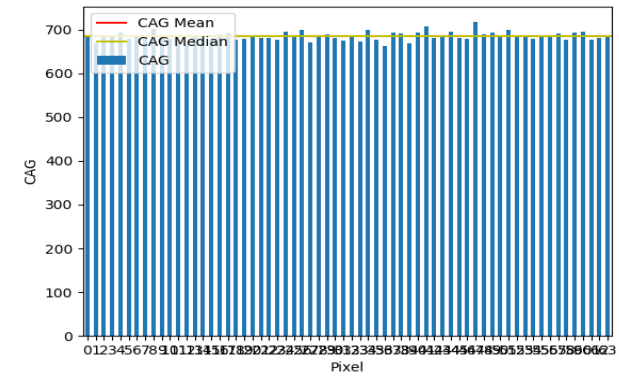
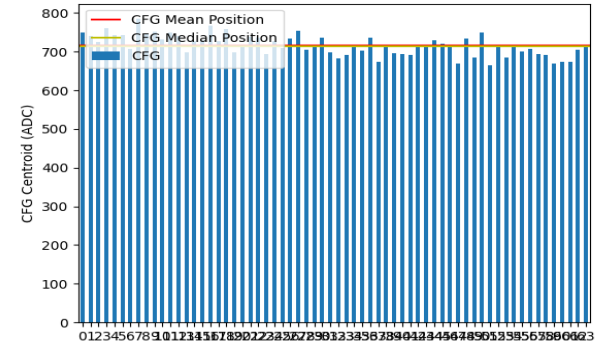
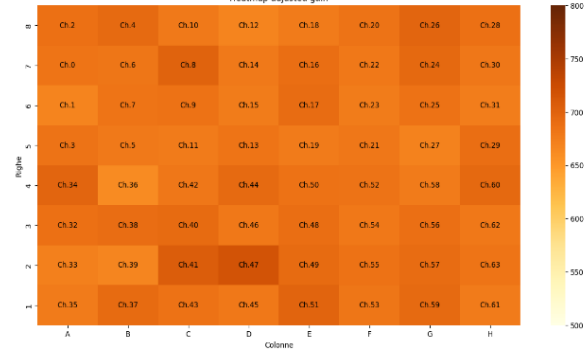
Residuals Comparison



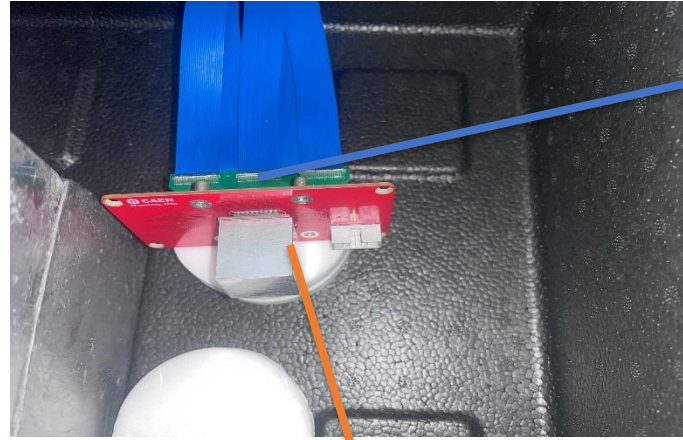
Heat map not adjusted gain



Heatmap adjusted gain

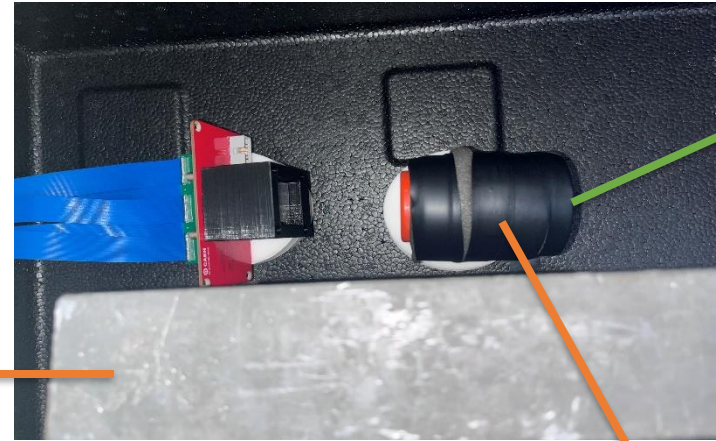


Experimental set-up



SiPm

GAGG
scintillator



gamma source

Lead
bricks



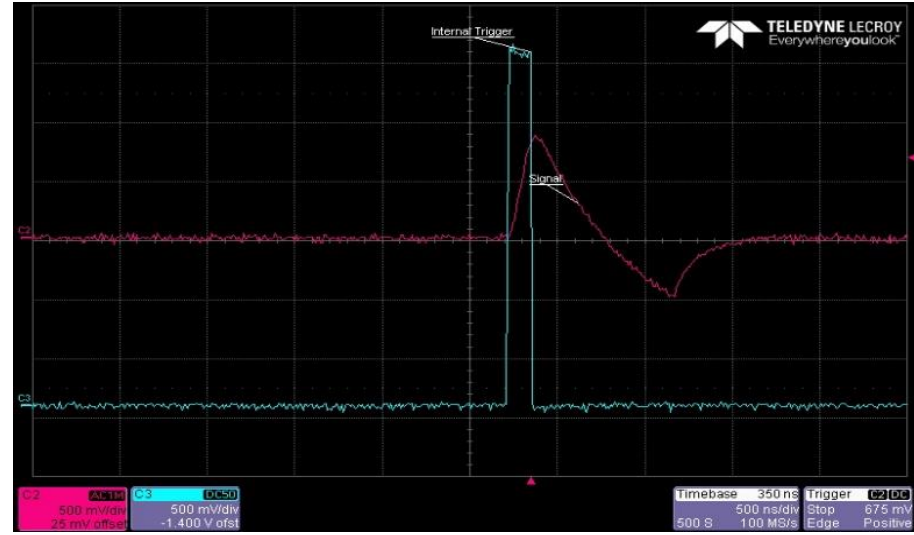
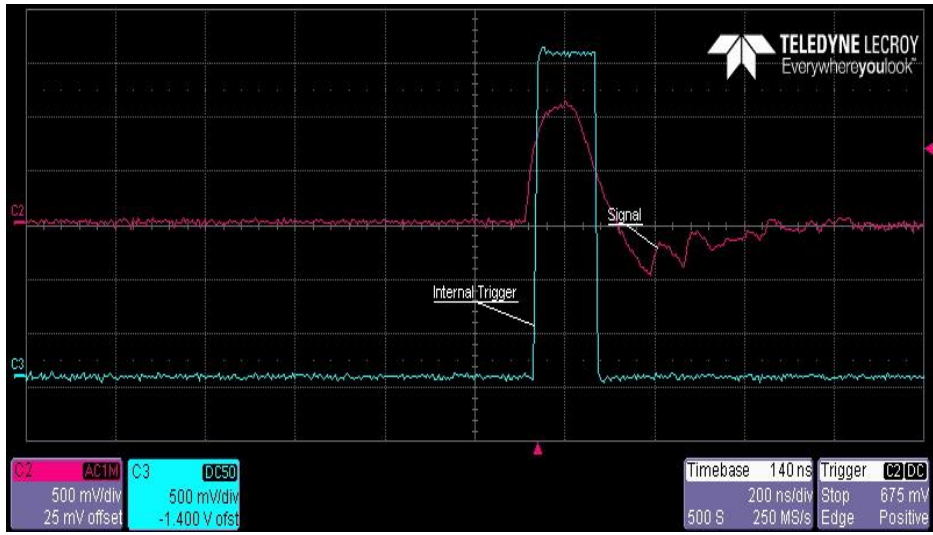
Rudimentary
collimator

work desk

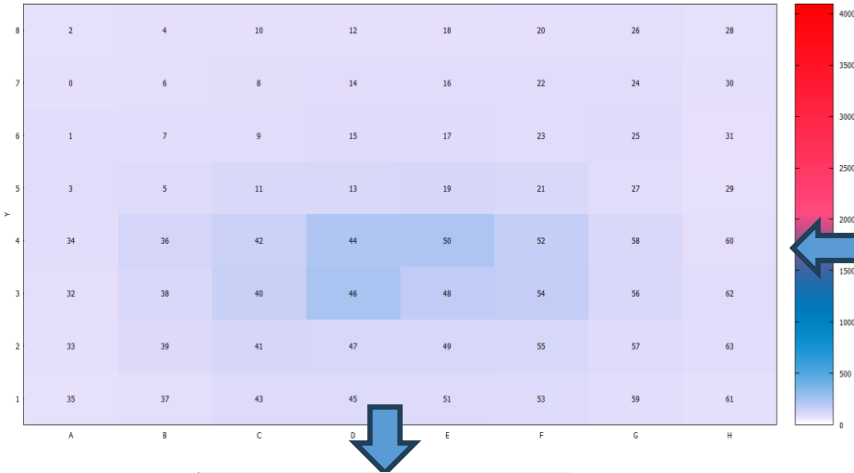
First we check for the correct
correspondence between
triggers and analog signals

Fast shaper = LG preamplifier

Slow shaper LG



Charge LG (Board 0)

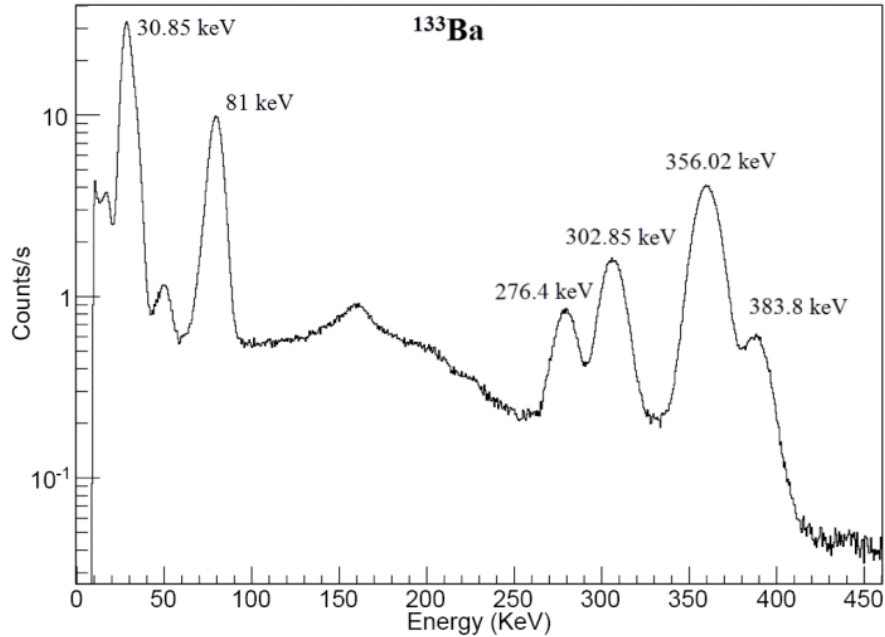


Ba-133

Enable all				Disable all			
2	4	10	12	18	20	26	28
0	6	8	14	16	22	24	30
1	7	9	15	17	23	25	31
3	5	11	13	19	21	27	29
34	36	42	44	50	52	58	60
32	38	40	46	48	54	56	62
33	39	41	47	49	55	57	63
35	37	43	45	51	53	59	61

- Check for proper correspondence between triggers and analog signals;
- select one of the two pre-amplifier to feed into the fast shaper;
- gain scan over both pre-amplifiers;
- threshold scan over both pre-amplifiers.

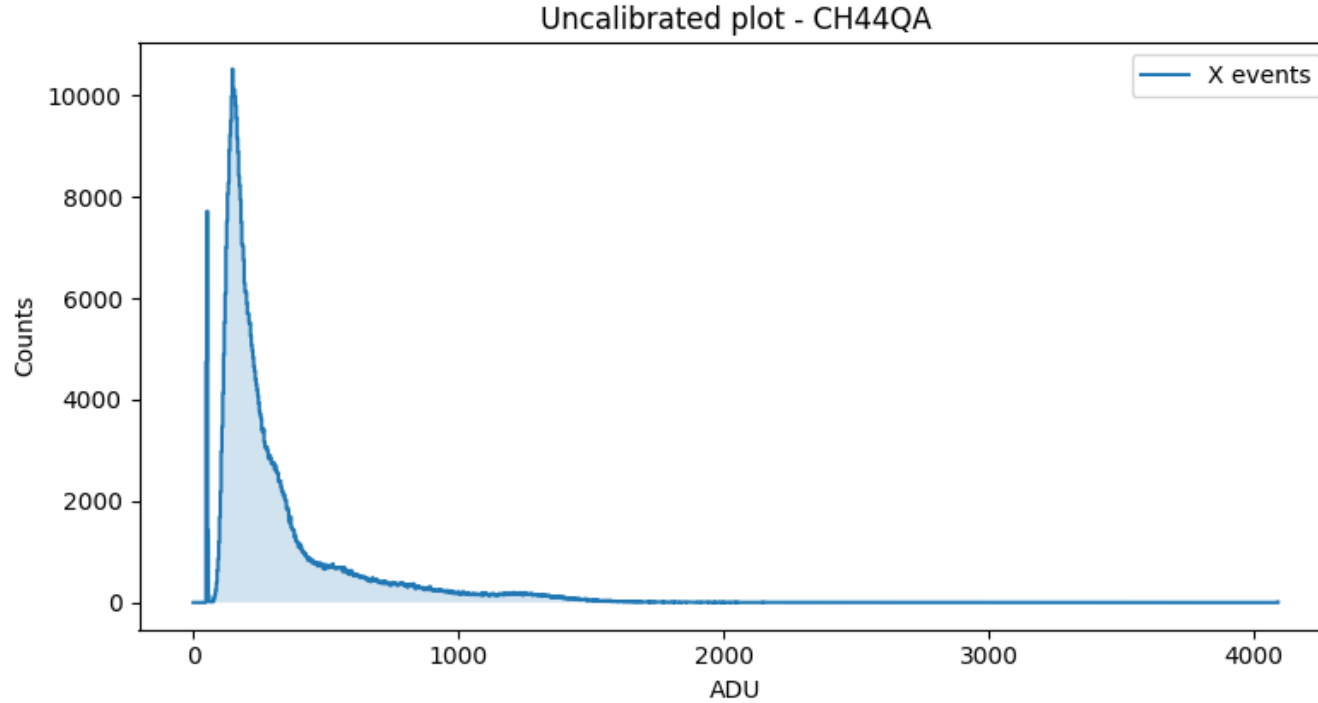
Ba-133 Theory



E_γ (keV)	I_γ (%)
356	62.05
383	8.94
303	18.33
81	30.06
30.6	34.9
30.9	64.5
34.92	5.99

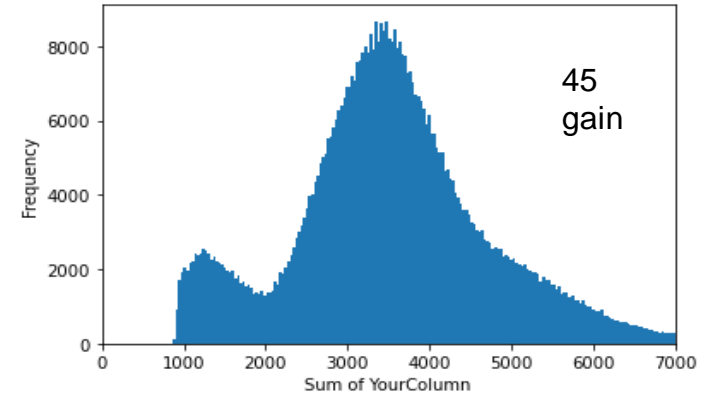
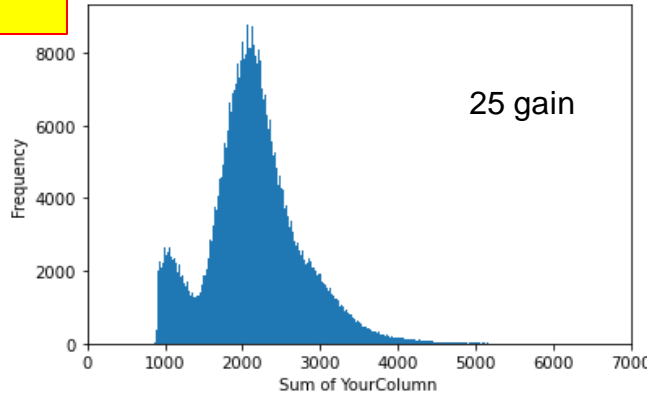
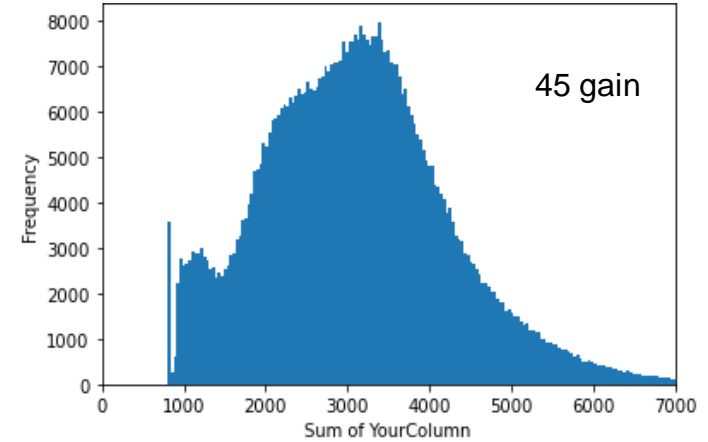
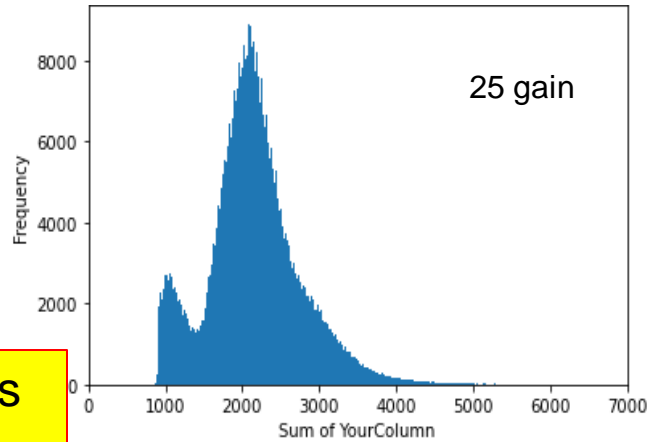
Data inspection

1 -Channel



LG preamplifier,
threshold at 250

Trigger on 4 channels
Integration on 16.



HG preamplifier,
threshold at 600

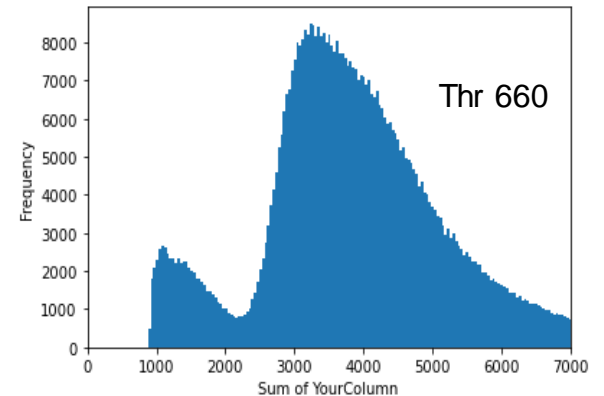
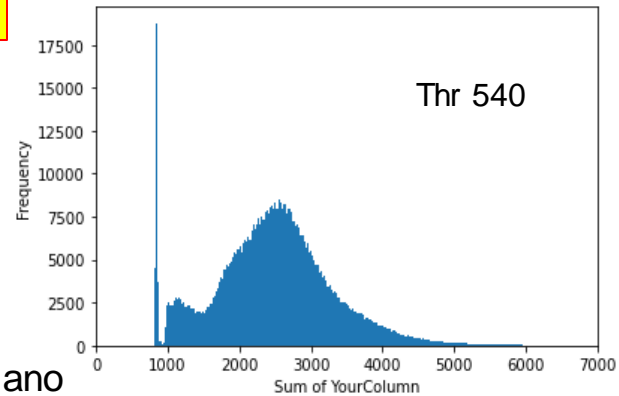
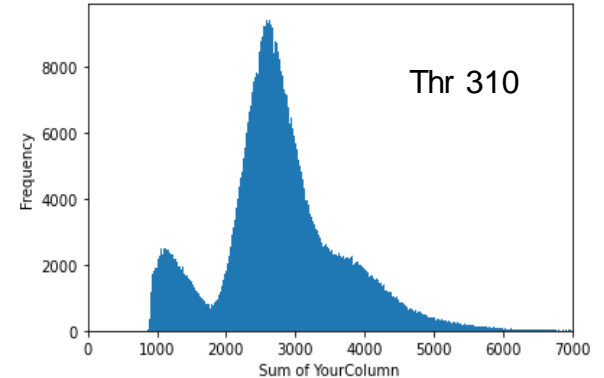
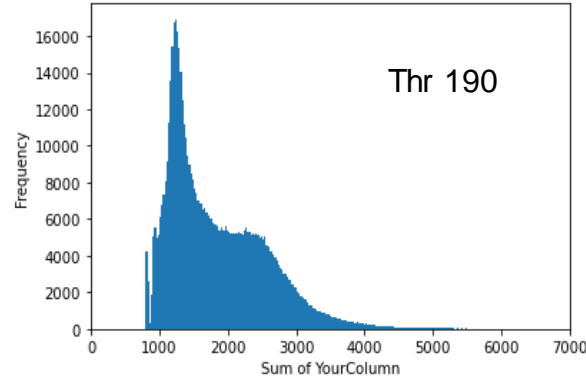
Data inspection - Thr Variation

LG preamplifier,
gain at 35

Trigger on 4 channels
Integration on 16.

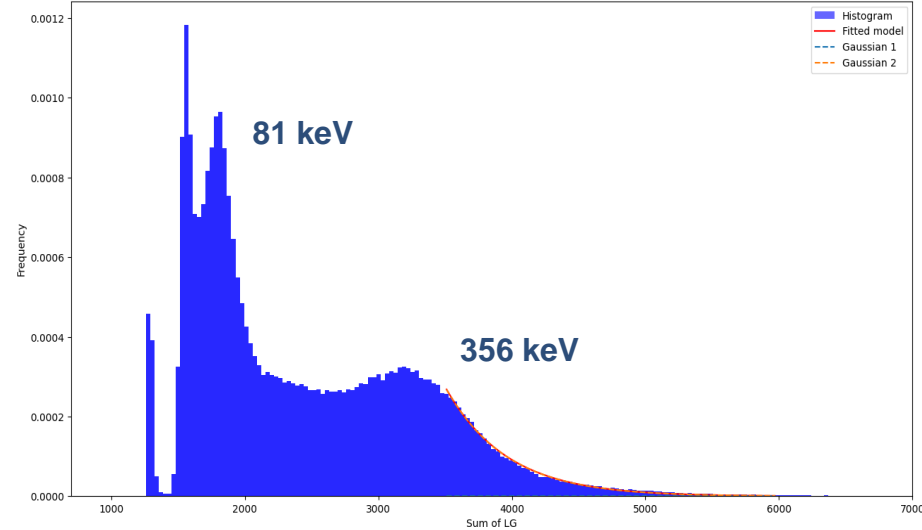
HG preamplifier,
gain at 35

Plots obtained by Stefano Spadano



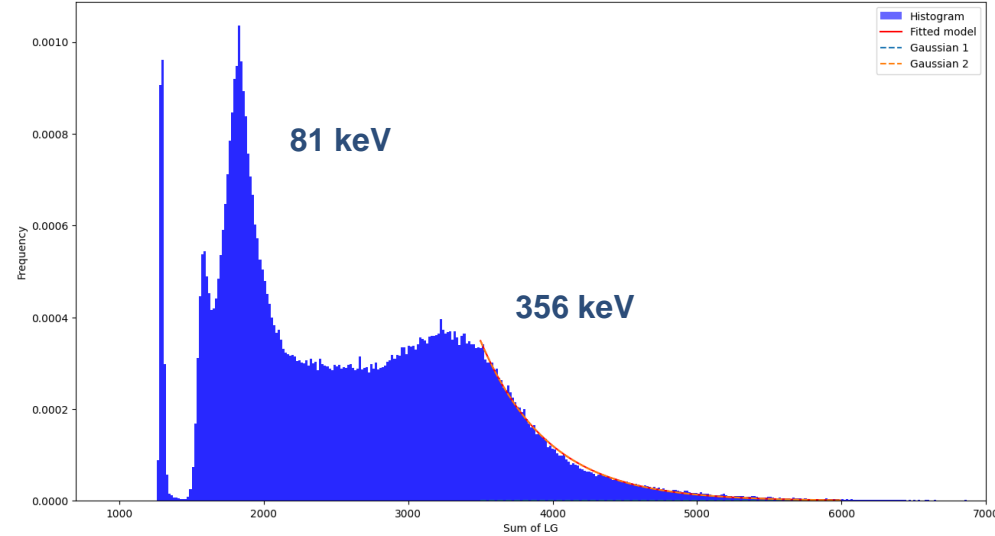
25 Channels – 1 Ch Trg

Histogram and Gaussian Fits



Gain 35 Thr 180

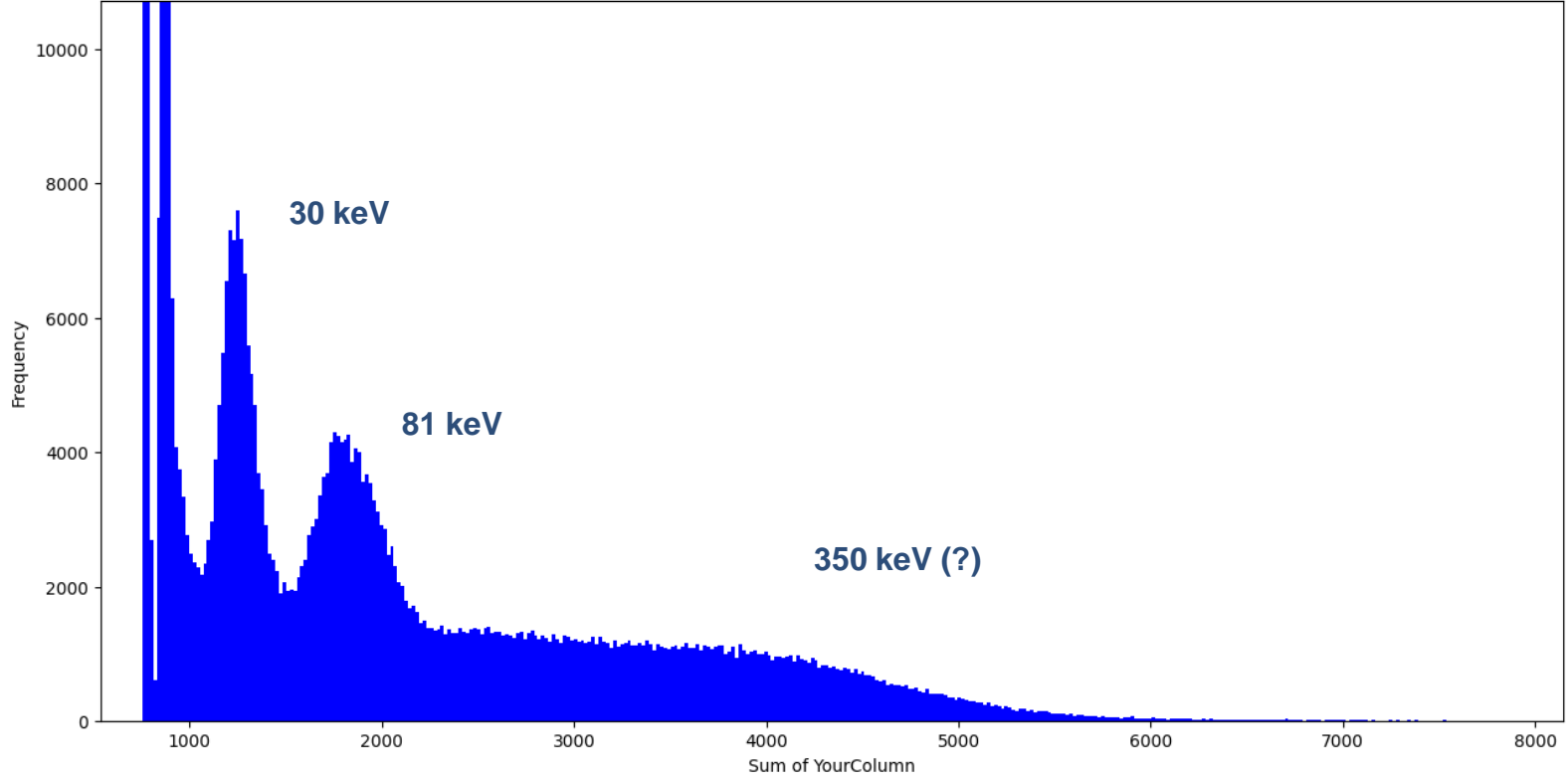
Histogram and Gaussian Fits



Gain 35 Thr 190

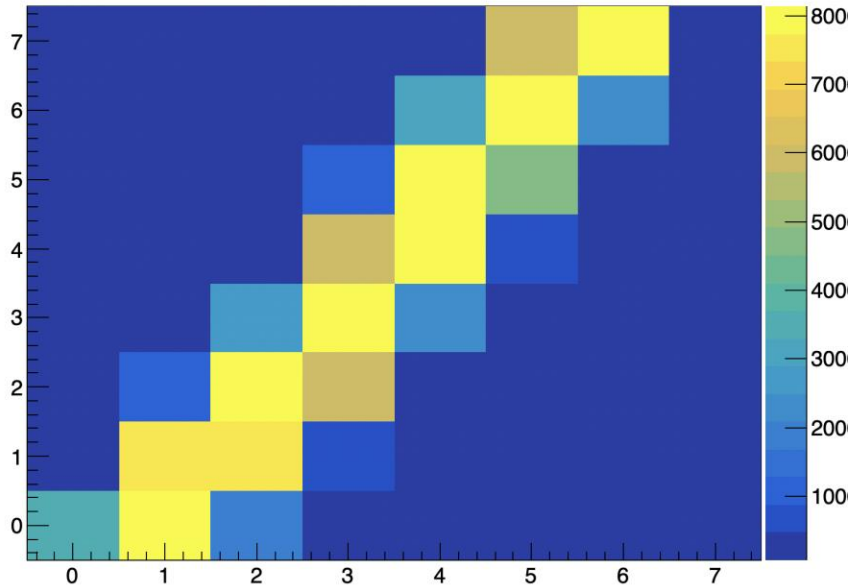
From the SiPM

Histogram of Sum of YourColumn (Optimized Bins)

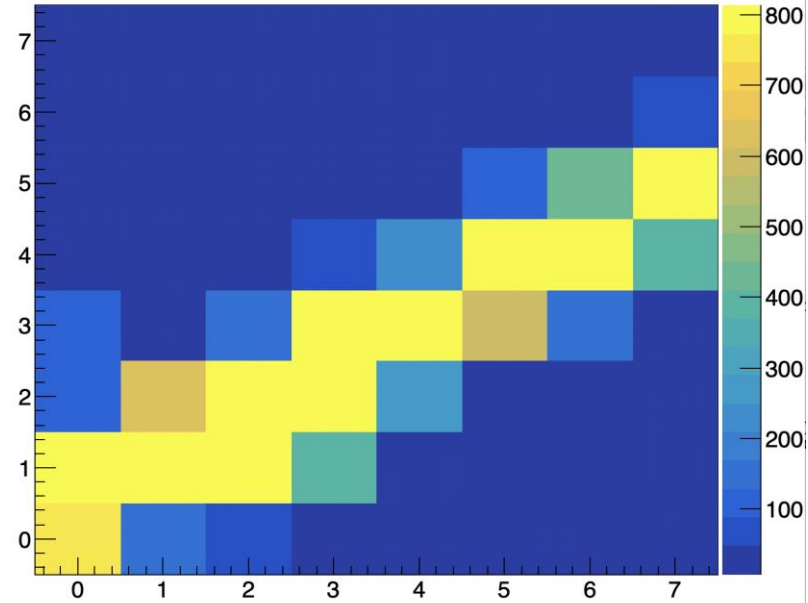


Muons Detections

MapLG



MapLG



Plot obtained by Carla Sbarra

Still in development:

- gain adjustments for each channel;
- noise correction for spectra;
- gaussian fit of at least two peaks in Ba-133 spectrum;
- acquisition with collimator;
- Flat Field.

