Local Meeting(LTM)

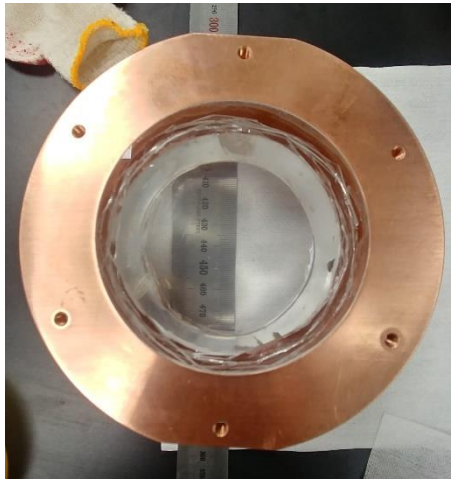
2019/06/24

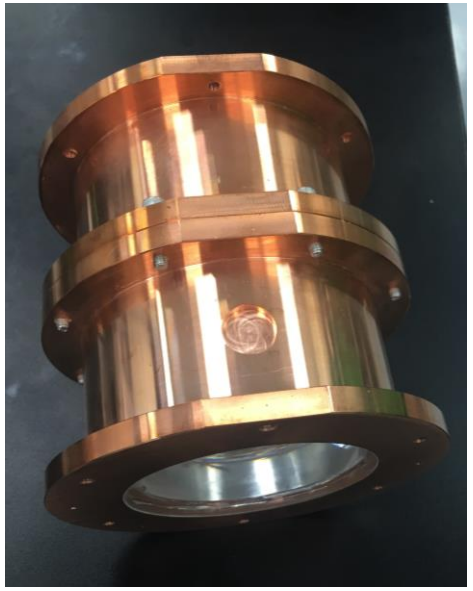
Jae Jin Choi

Purpose of Low Temperature Experiment

- To check light yield of NaI crystal according to temperature change
- To observe PSD(alpha, neutron, beta/gamma) when temperature goes down
- To measure PMT noise as a function of temperature

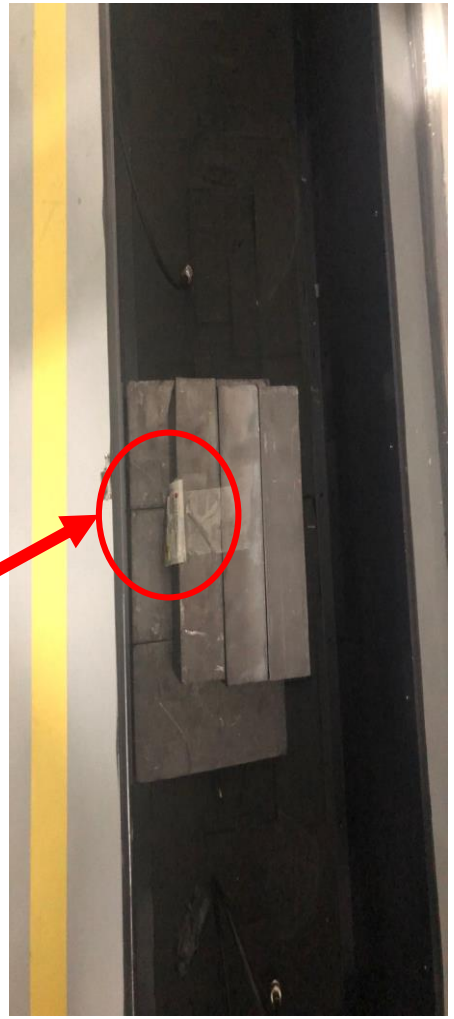
Low Temperature R&D NaI(Tl) Crystal(NaI-031)





- NaI-031(SICCAS)
  - diameter : 75mm, height : 75mm
  - Weight(expected) : 1.2 ± 0.12 kg
  - Alpha Activity : 0.73 ± 0.16 mBq/kg
- PMT(SIDE A) : FA0056
- PMT(SIDE B) : FA0158

Experiment Setup(Neutron)

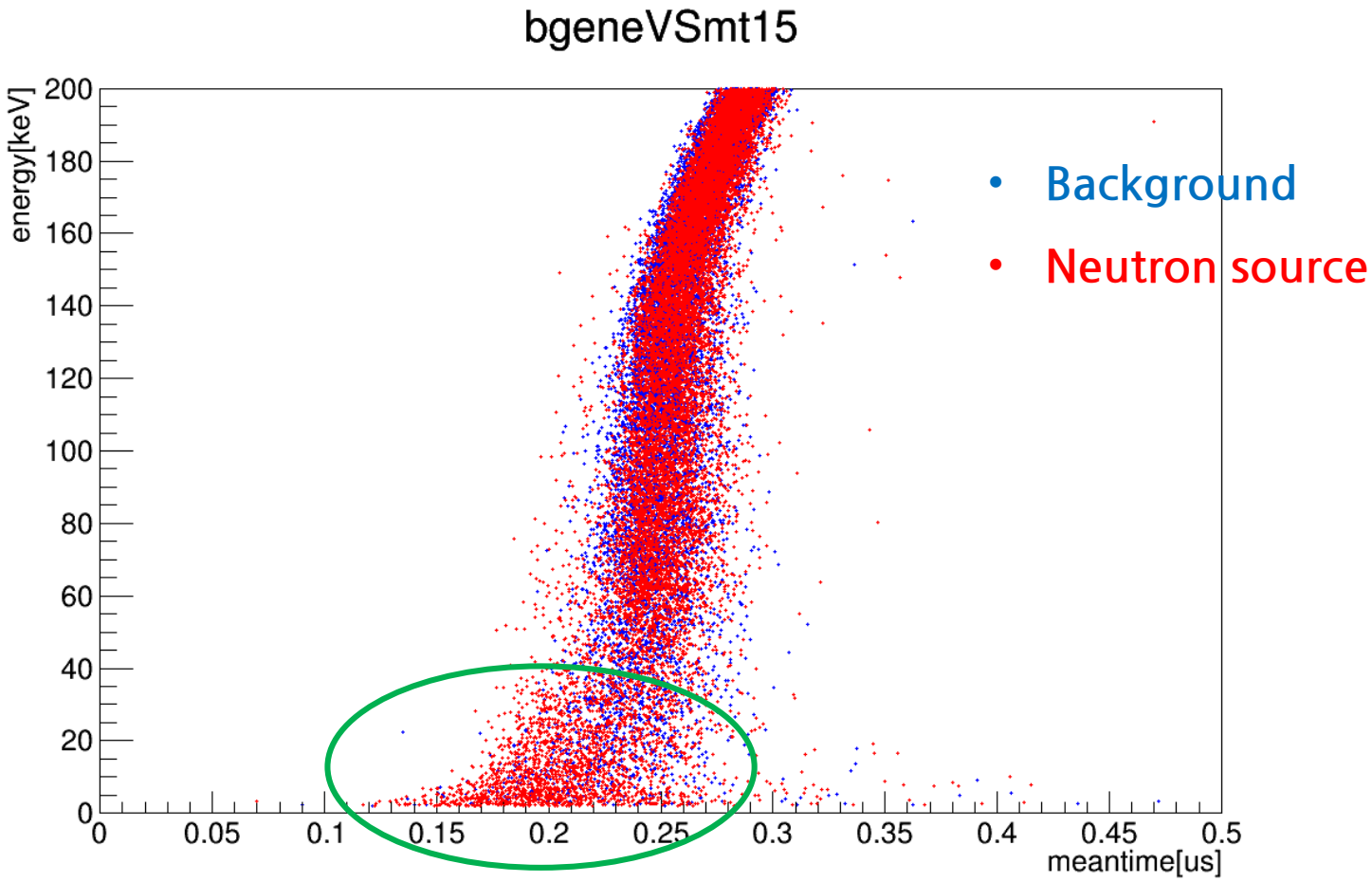


- Outside(in dark box)

- Refrigerator(-33 ℃)

- Neutron source : Cf-252
- Shielding thickness : Pb 20cm
- We took data at 20 ℃ and -33 ℃
- Comparing neutron source with background

PSD(neutron, gamma)

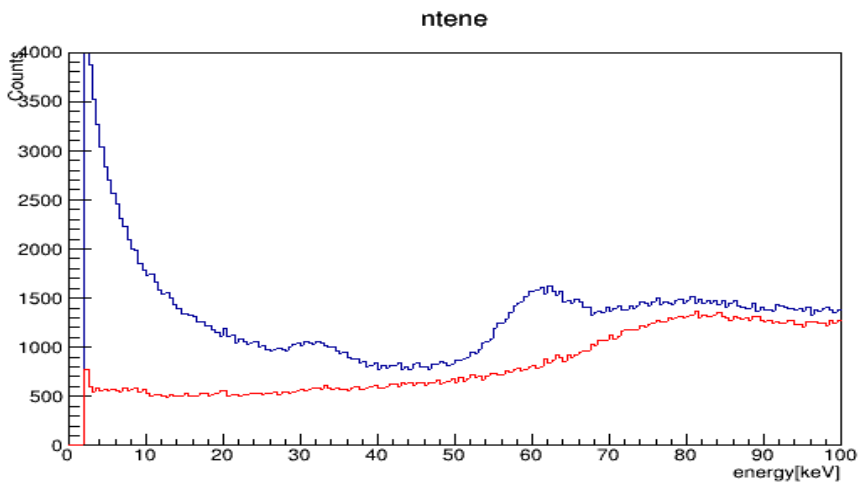


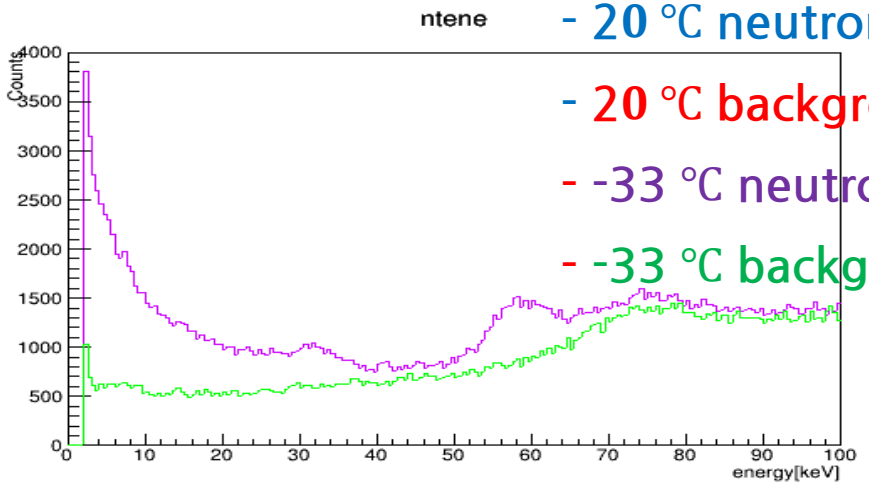
- Background
- Neutron source

- Neutron events

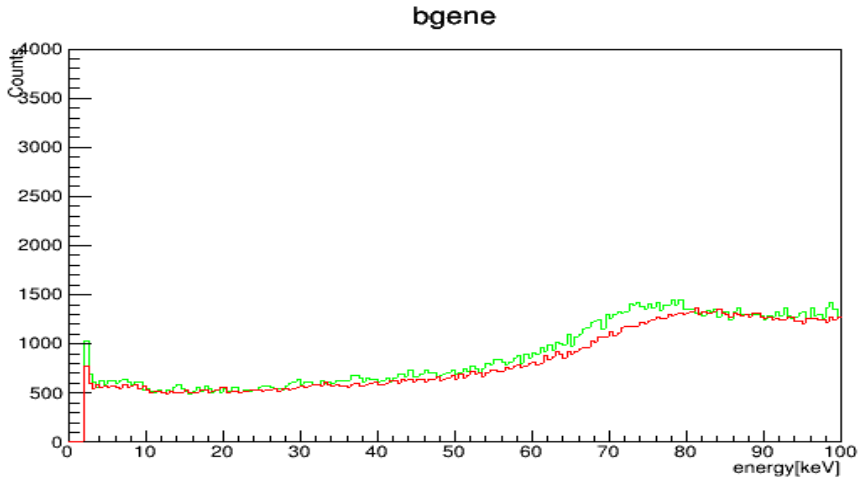
- Comparing neutron source data with background data

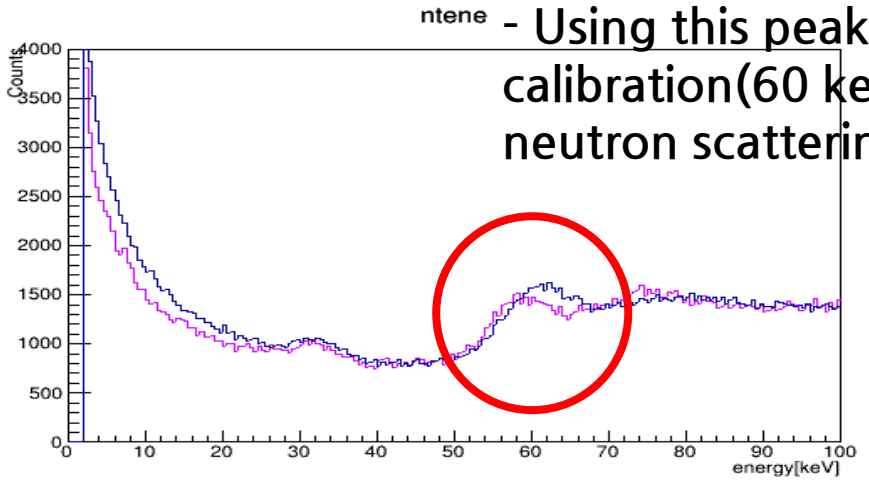
LTM Neutron





- 20 ℃ neutron(25.1 Hz)
- 20 ℃ background(23.2 Hz)
- -33 ℃ neutron(48.2 Hz)
- -33 ℃ background(43.4 Hz)

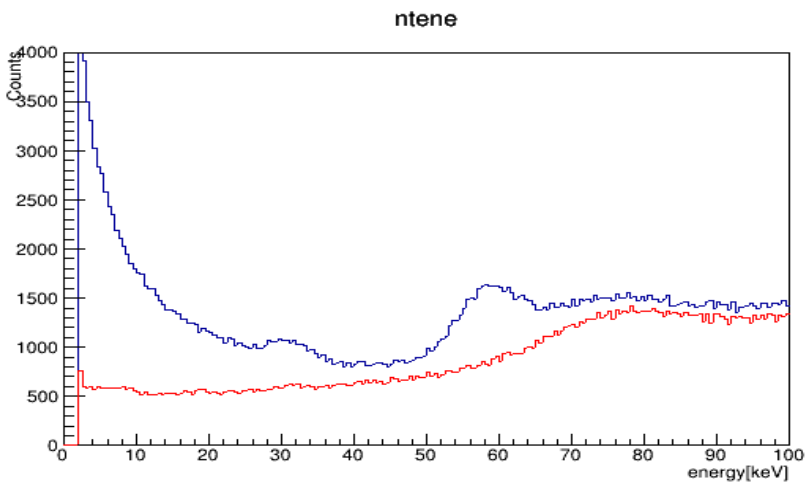


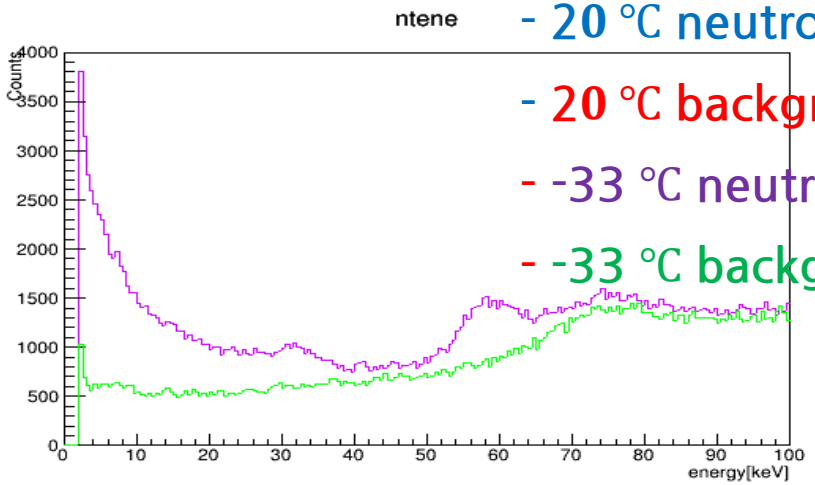


- Using this peak for calibration(60 keV, inelastic neutron scattering

-energy spectrum

LTM Neutron





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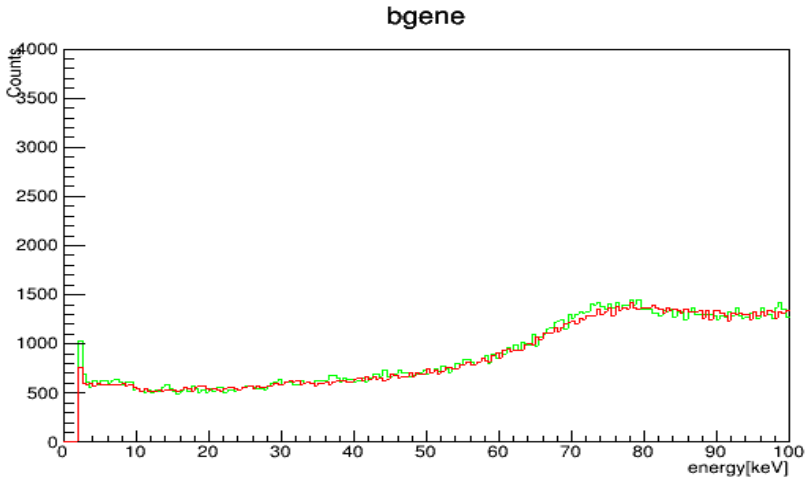
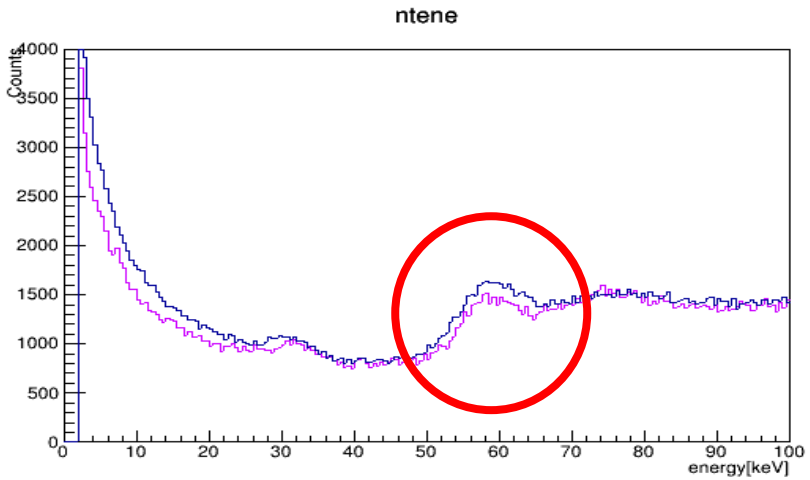




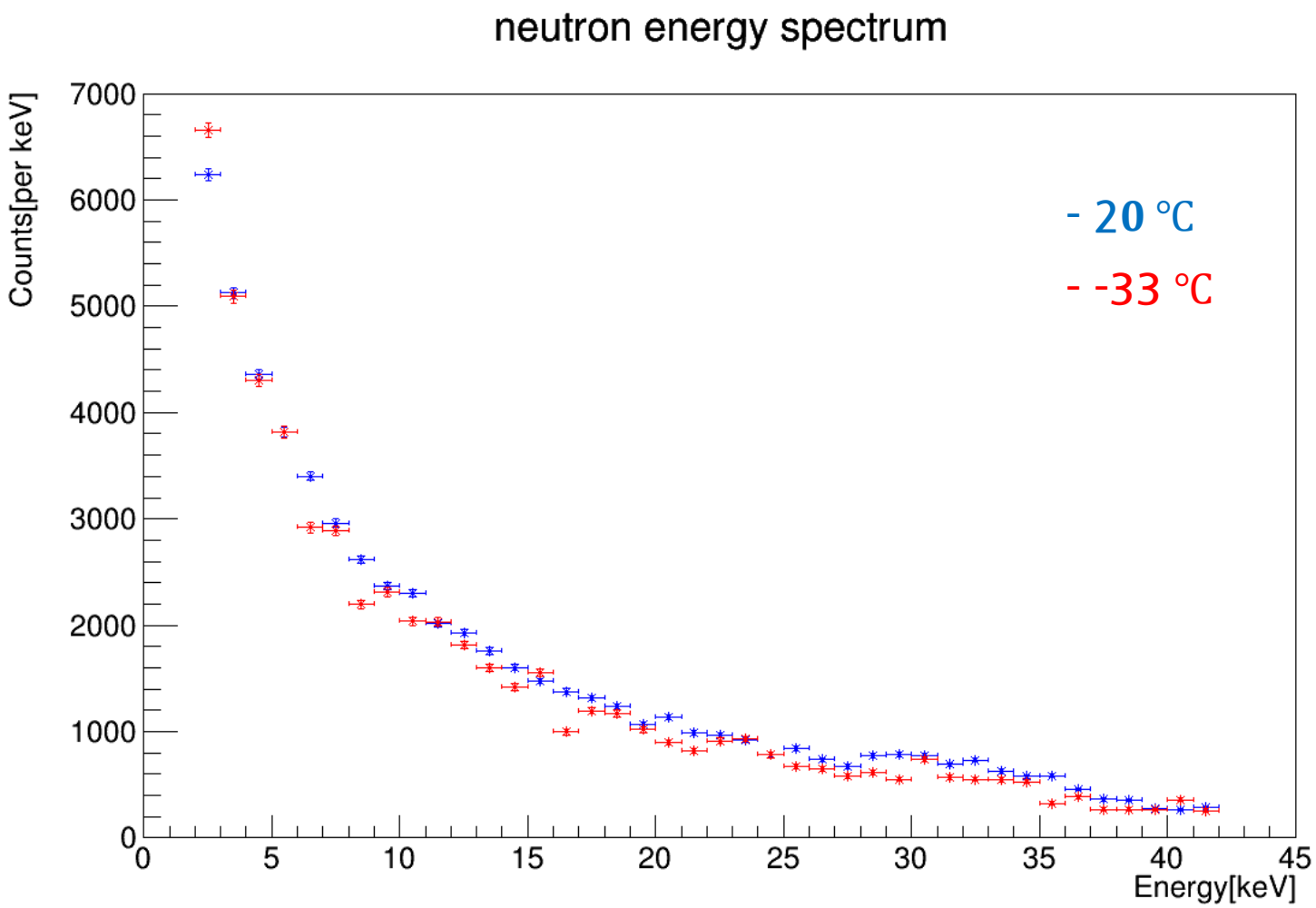
-after calibration

LTM Neutron

- 20 ℃ neutron
- 20 ℃ background
- -33 ℃ neutron
- -33 ℃ background

-after calibration

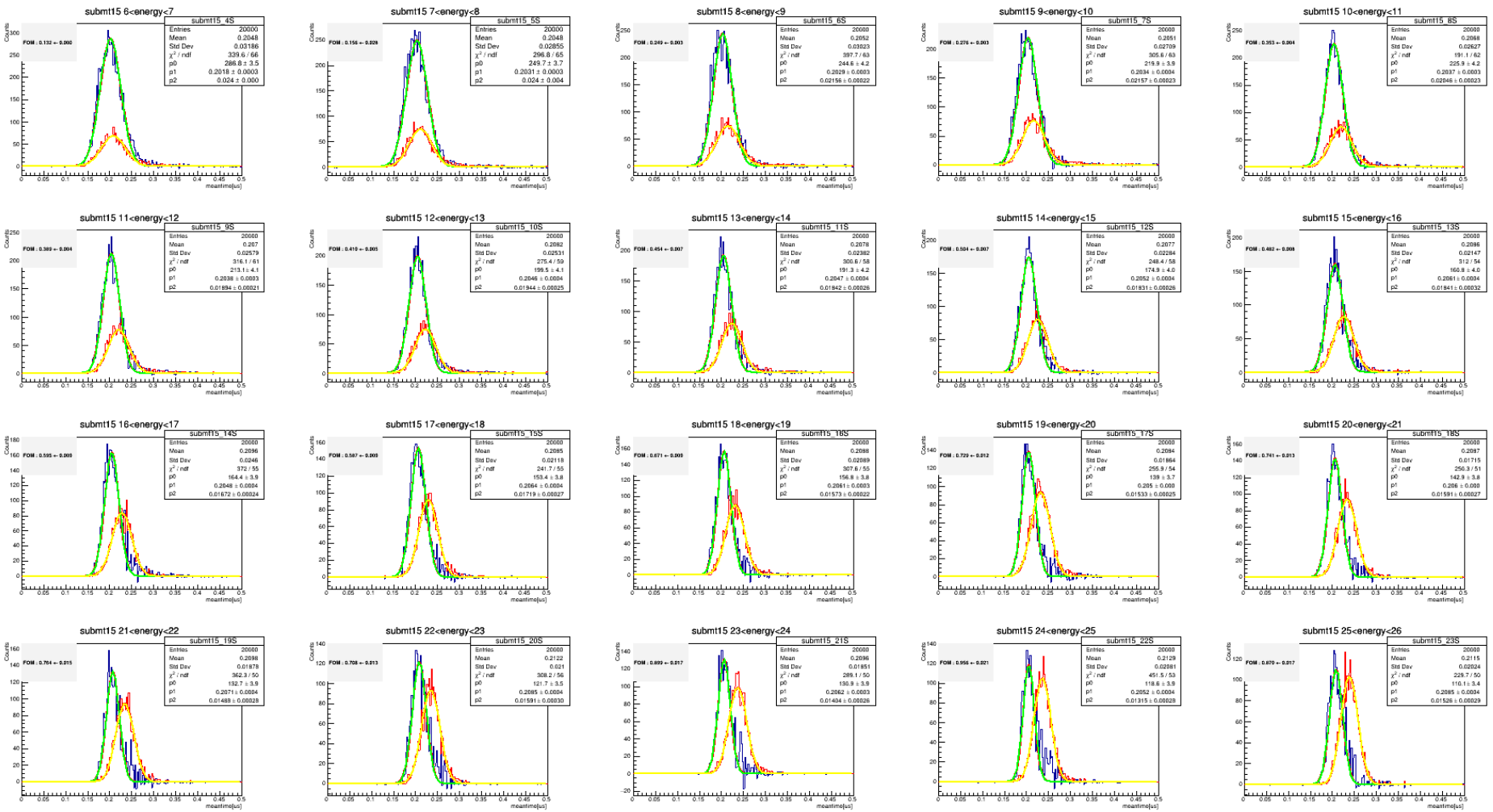
LTM Neutron



-*neutron energy spectrum* 2 keV ~ 42 keV(per 1keV)(nmt1500)
- Scaling using 5 keV matched

Backup

LTM Neutron

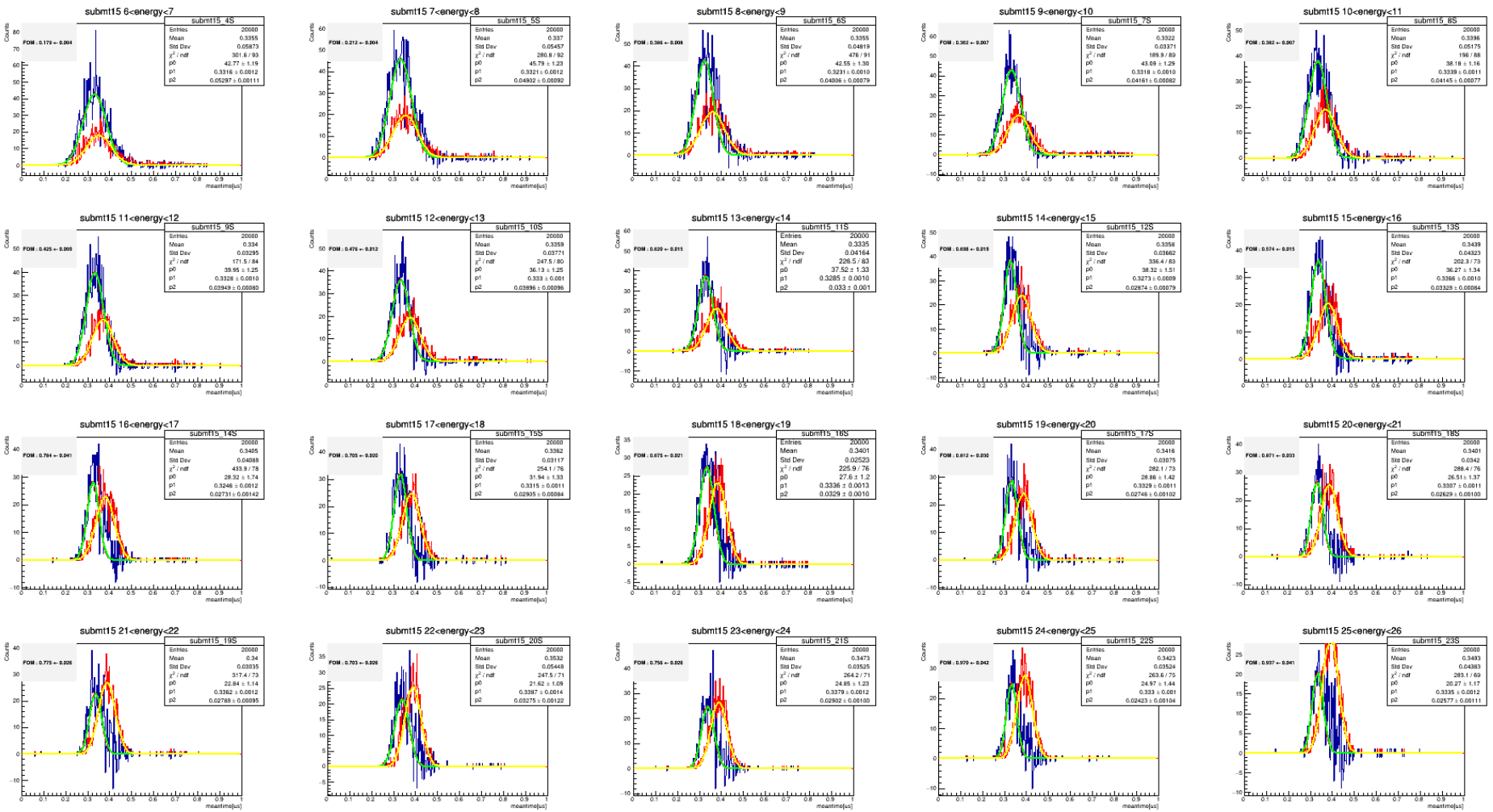


- sub

- bkg

20 ℃ data : 6 keV ~ 25 keV(per 1keV)(nmt1500)

LTM Neutron



- sub

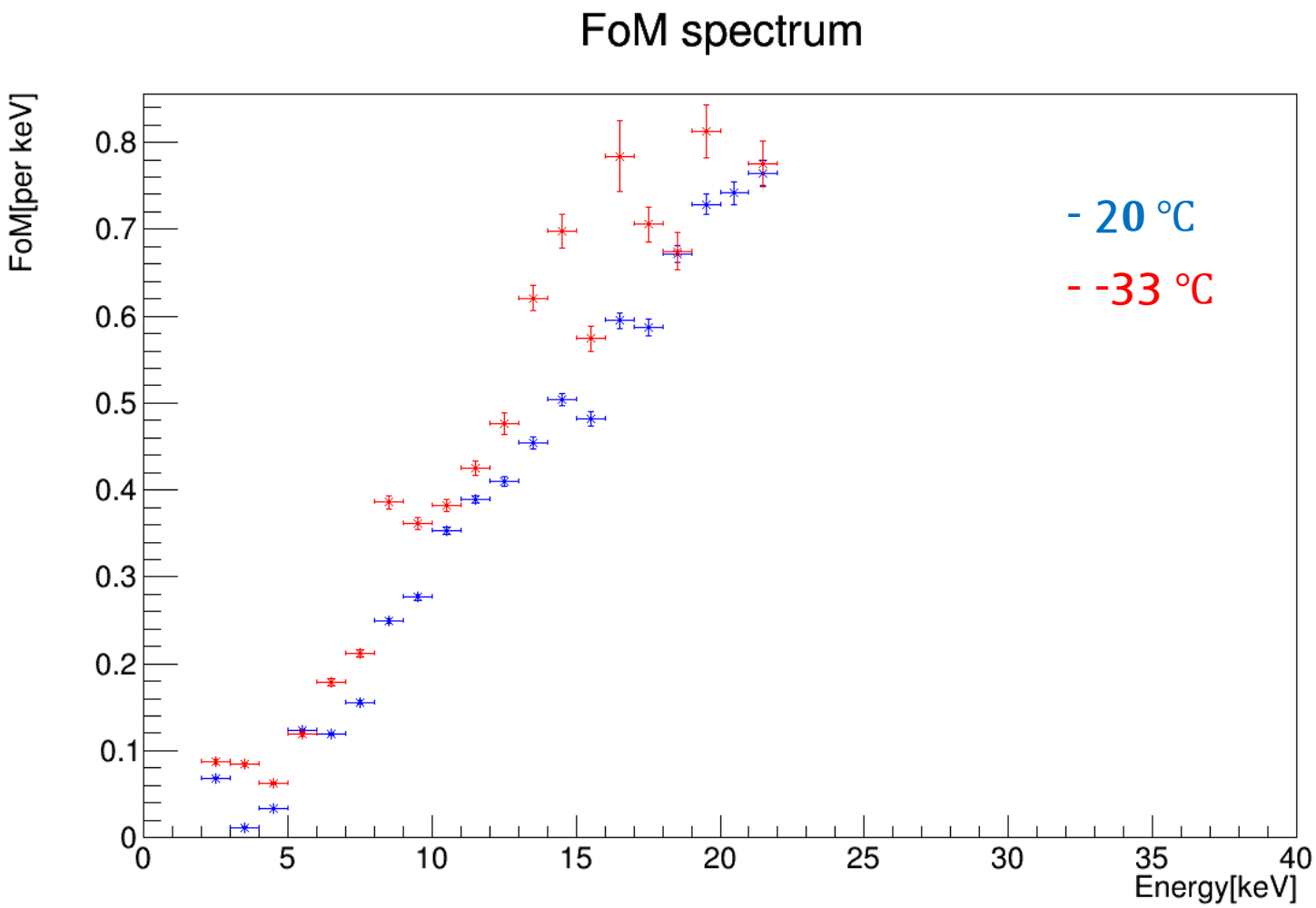
- bkg

-33 ℃ data 6 keV ~ 25 keV(per 1keV)(nmt1500)

LTM Neutron

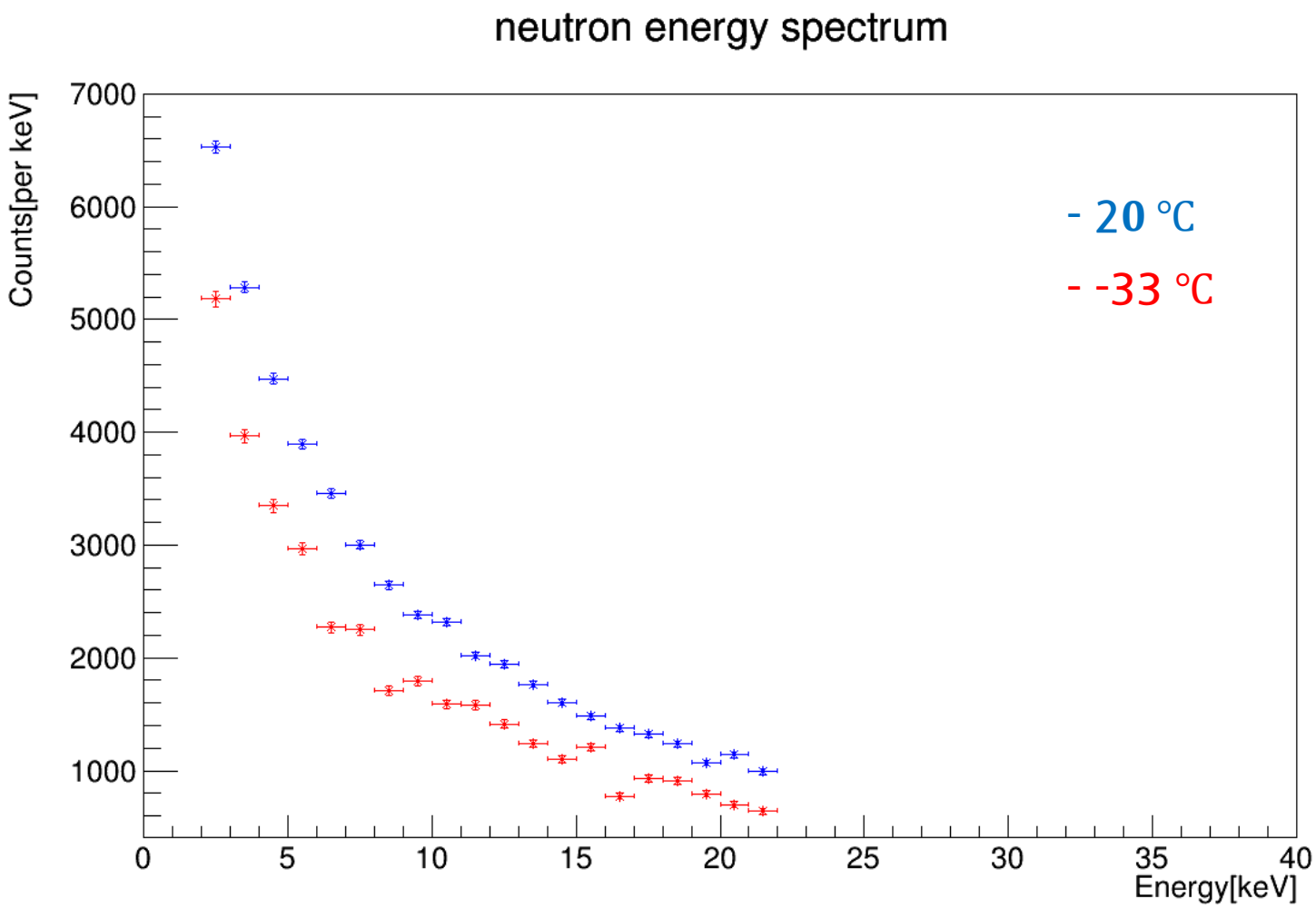
Energy[keV]	FoM(20 ℃)	FoM(-33 ℃)	Energy[keV]	FoM(20 ℃)	FoM(-33 ℃)
6	0.13±0.00026	**0.18±0.0038**	16	0.59±0.0086	**0.78±0.041**
7	0.16±0.028	**0.21±0.0041**	17	0.59±0.0094	**0.71±0.02**
8	0.25±0.0026	**0.39±0.0077**	18	0.67±0.0093	0.67±0.021
9	0.28±0.003	**0.36±0.0072**	19	0.73±0.012	**0.81±0.03**
10	0.35±0.004	**0.38±0.0072**	20	0.74±0.013	**0.87±0.033**
11	0.39±0.0043	**0.43±0.0087**	21	0.76±0.015	**0.78±0.026**
12	0.41±0.0054	**0.48±0.012**	22	0.71±0.013	0.7±0.026
13	0.45±0.0066	**0.62±0.015**	23	**0.9±0.017**	0.76±0.026
14	0.5±0.0073	**0.7±0.019**	24	0.96±0.021	0.97±0.042
15	0.48±0.0083	**0.57±0.015**	25	0.87±0.017	**0.94±0.041**

LTM Neutron



-FoM graph 2 keV ~ 22 keV(per 1keV)(nmt1500)

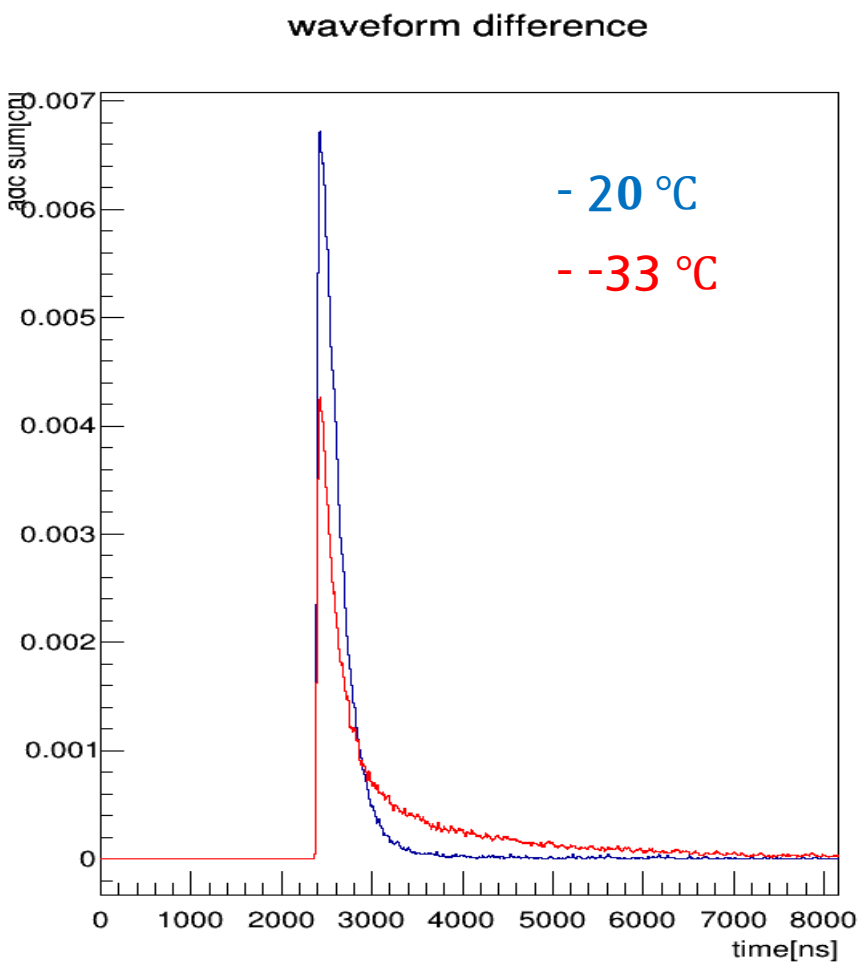
LTM Neutron

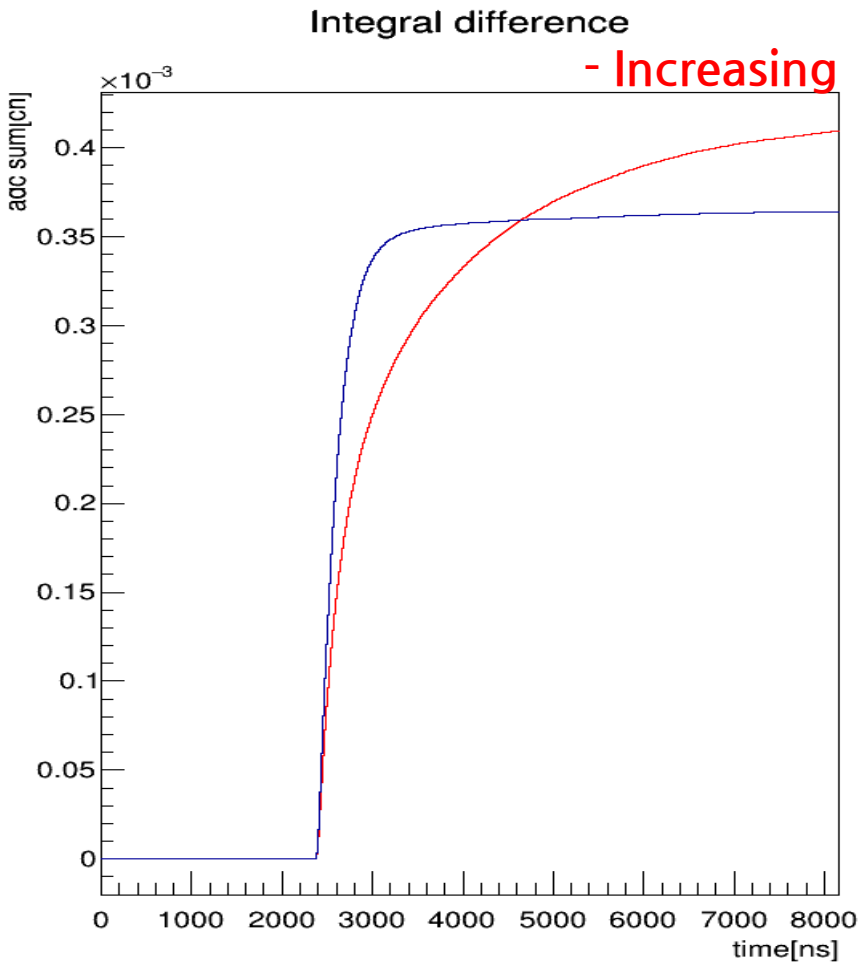


-*neutron energy spectrum* 2 keV ~ 22 keV(per 1keV)(nmt1500)

LTM Neutron

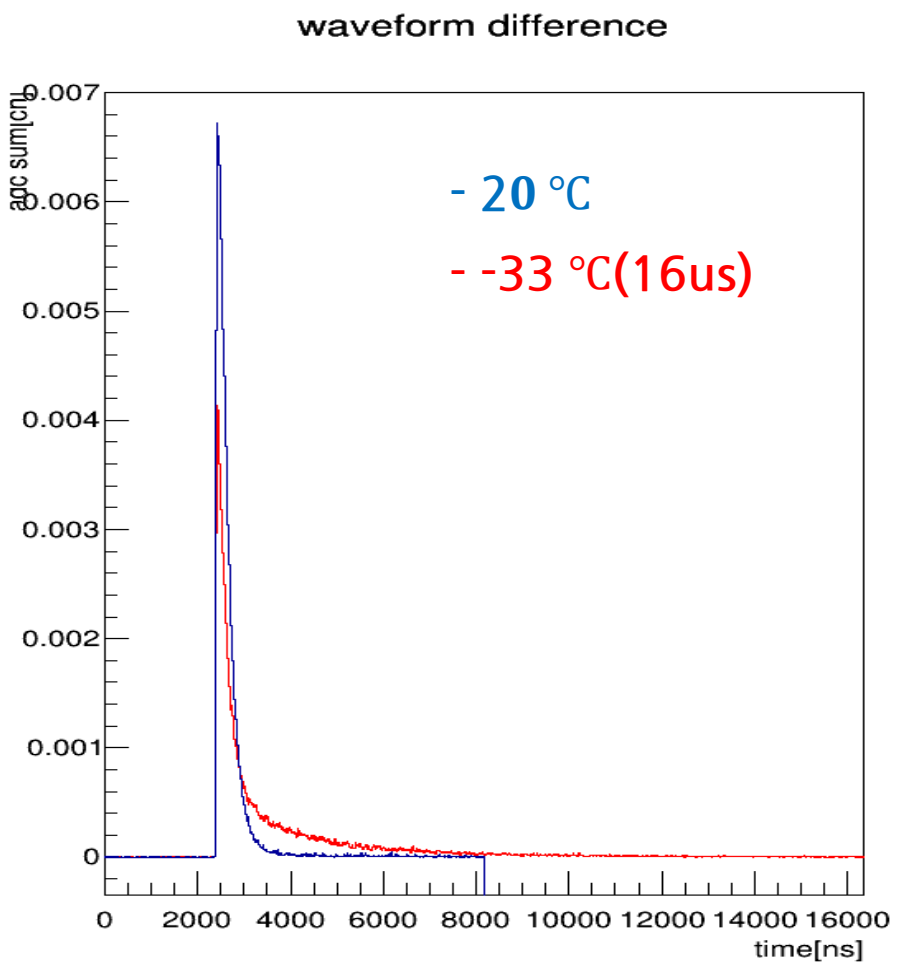
- RAW waveform

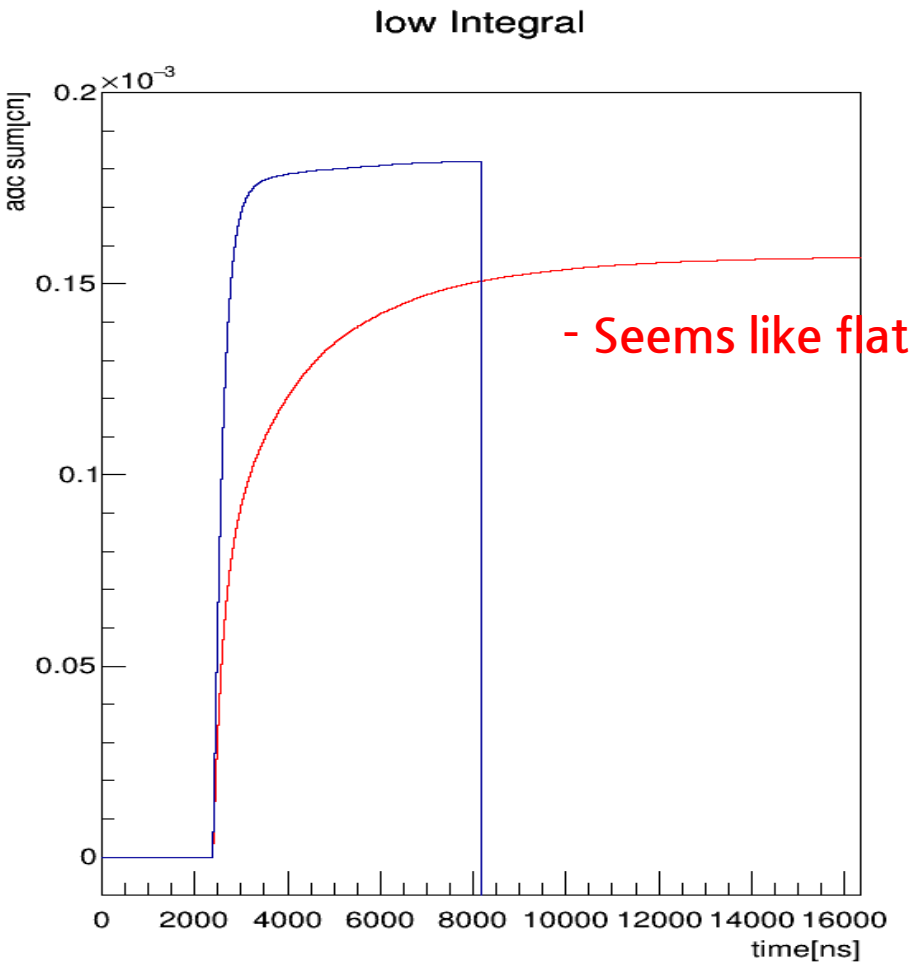




LTM Neutron

- RAW waveform





LTM Neutron

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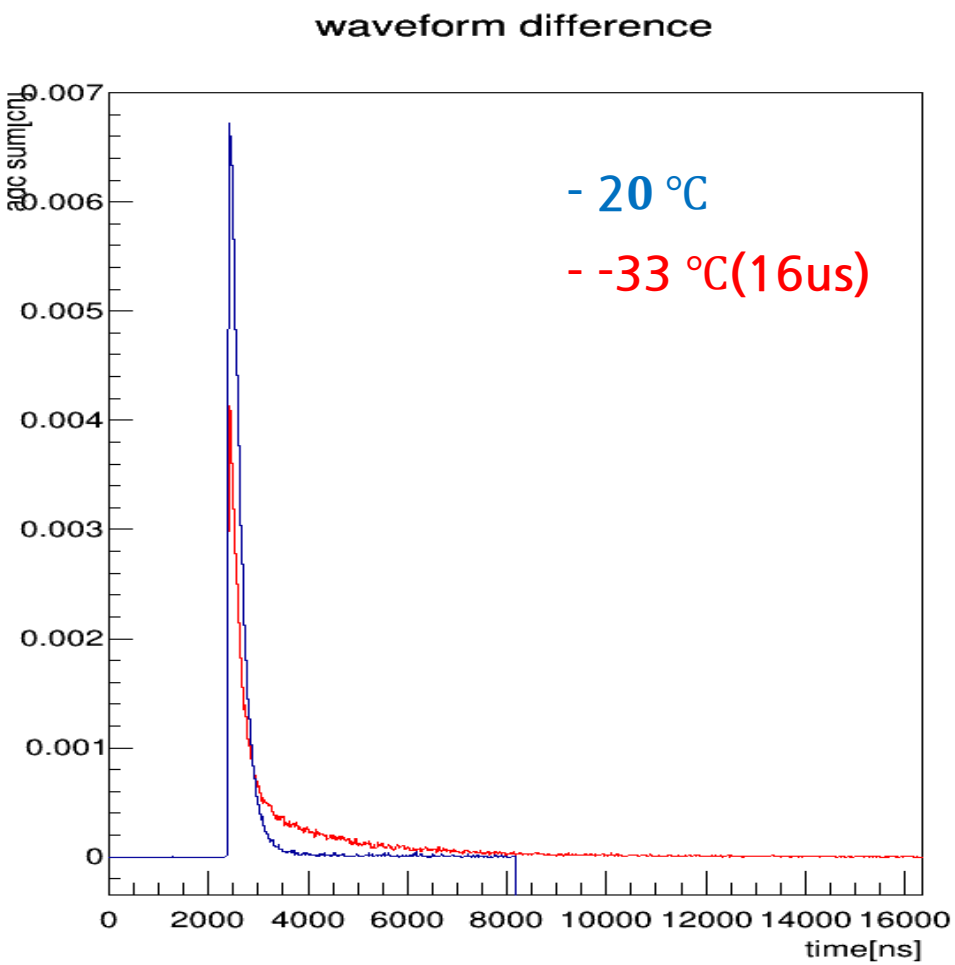
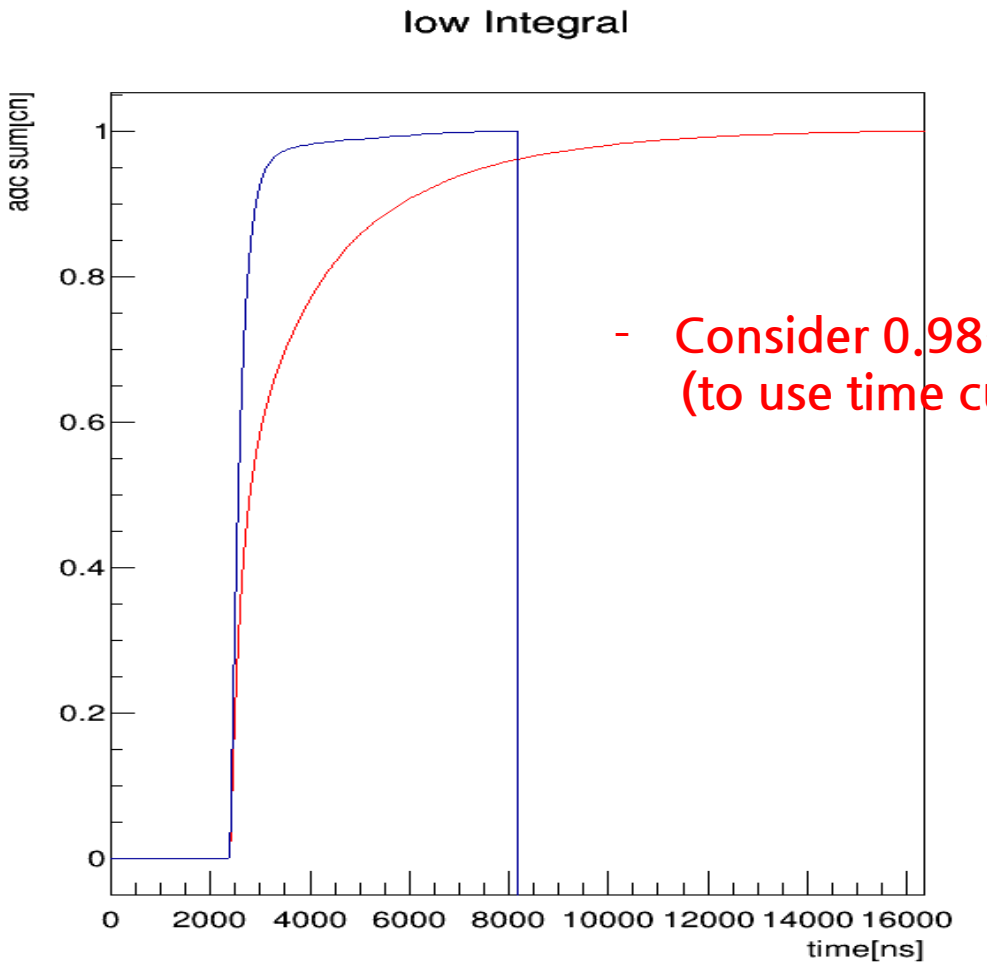
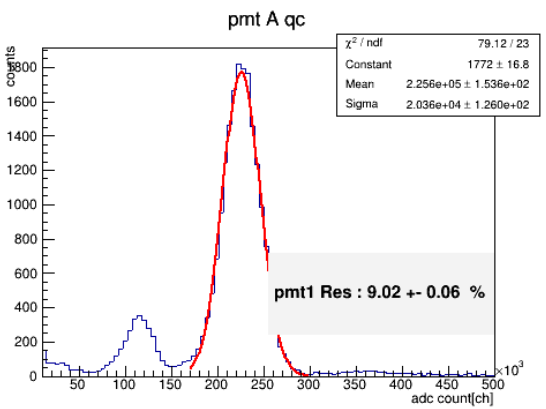


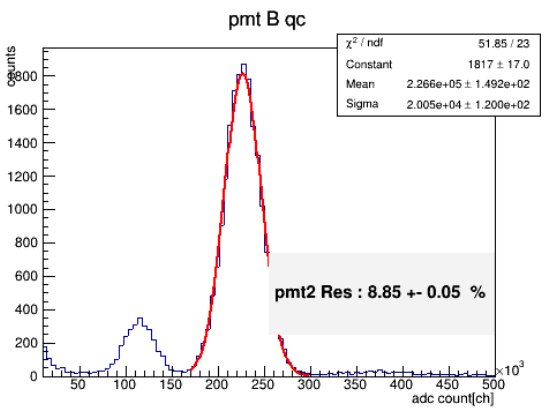


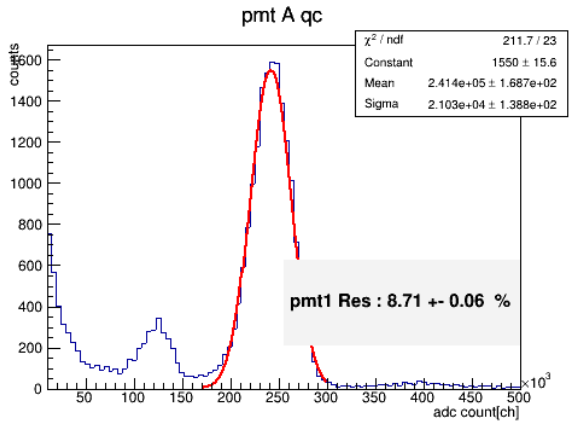
- Consider 0.98~0.99
(to use time cut for SPE)

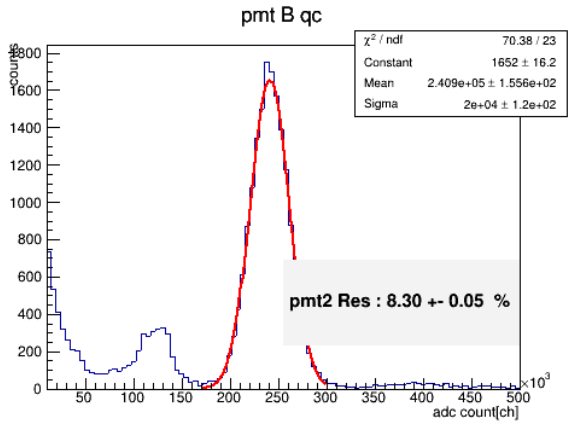
LTM Neutron

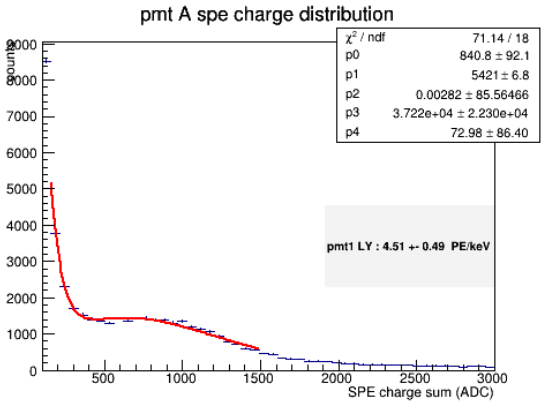
- Light Yield

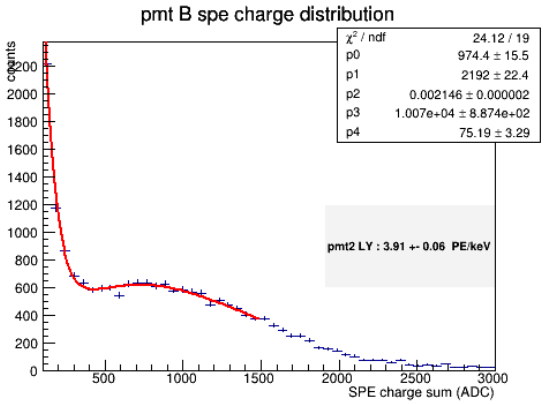


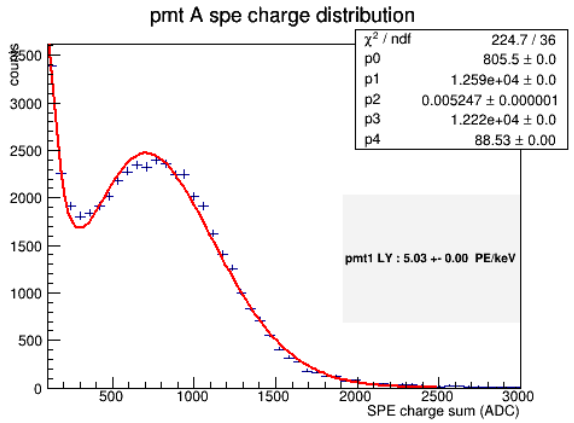


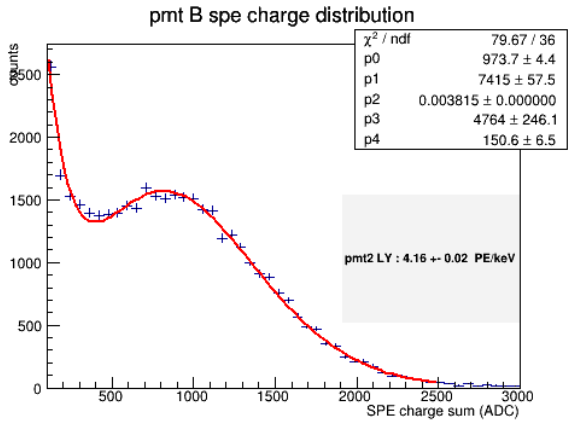










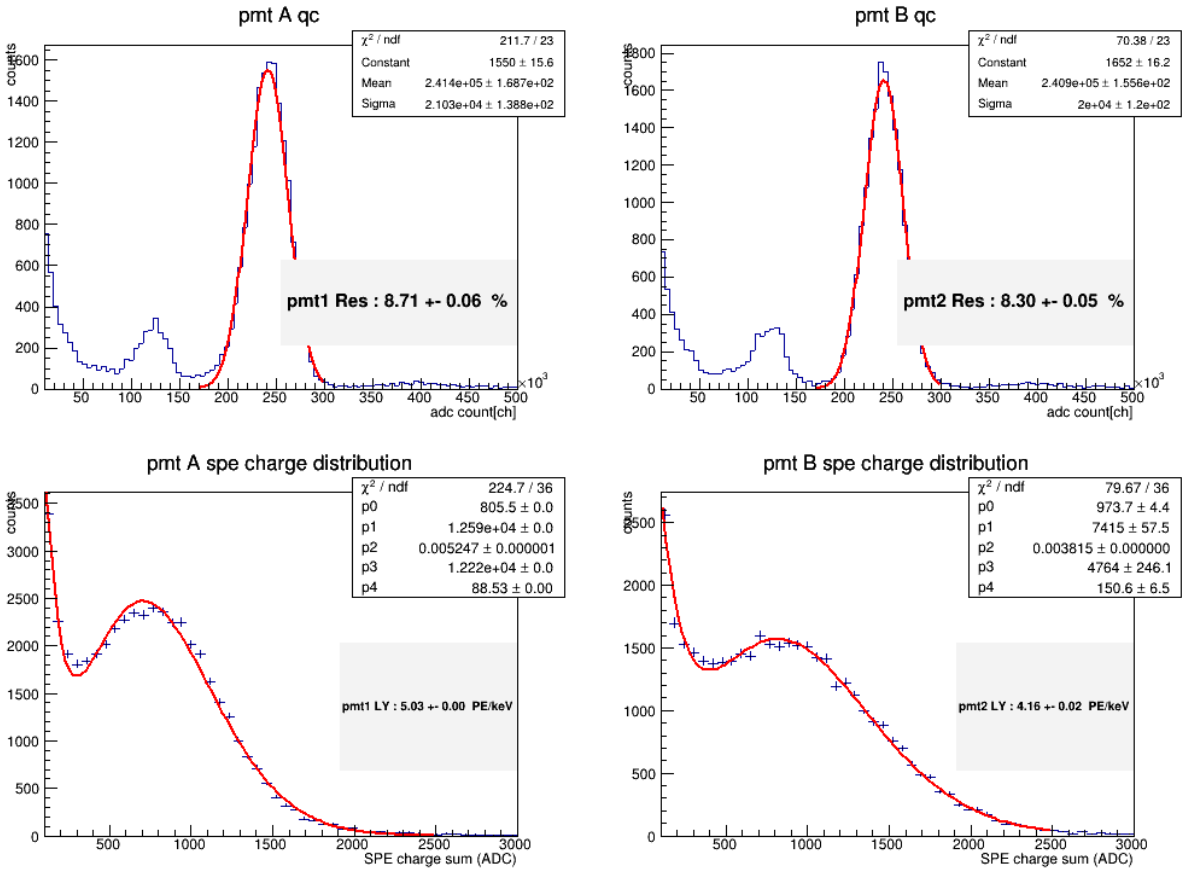


- 20 ℃
- Crysltal light yield : 8.42 Pe/keV

- -33 ℃(16us)
- Crysltal light yield : 9.19 Pe/keV

LTM Neutron

- Light Yield



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