

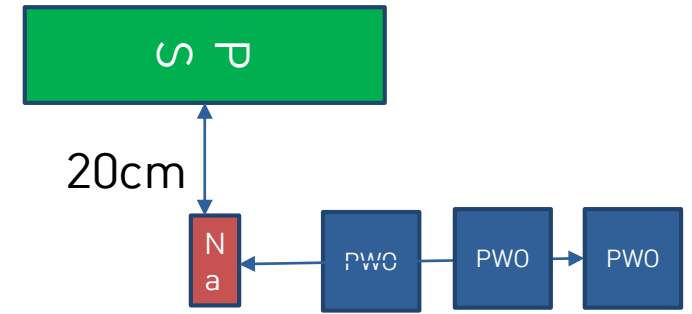
Positronium intensity measurement preparation (GBAR)

SNU

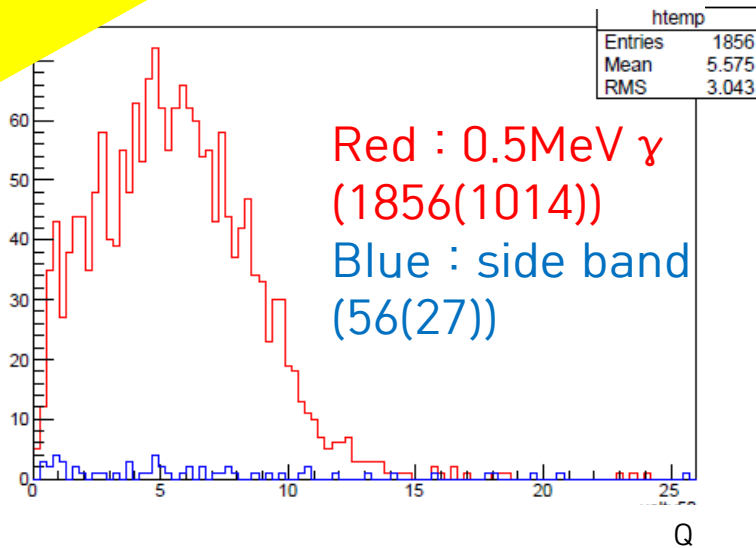
Bongho Kim

Last slide

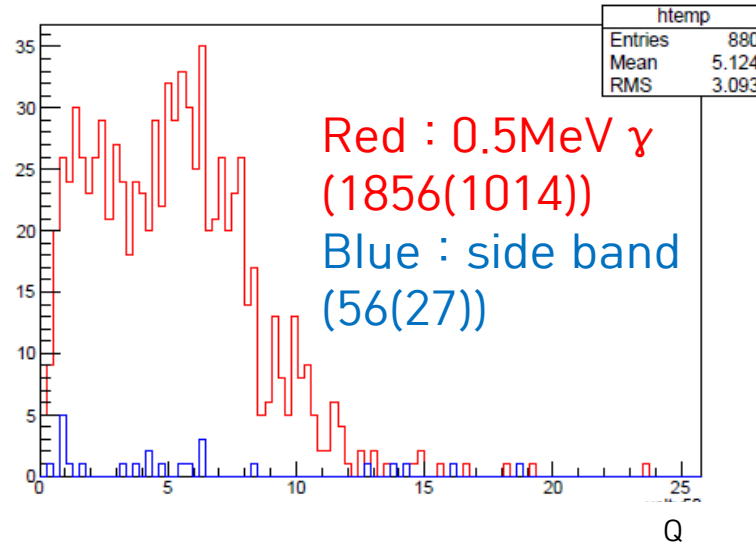
Efficiency check



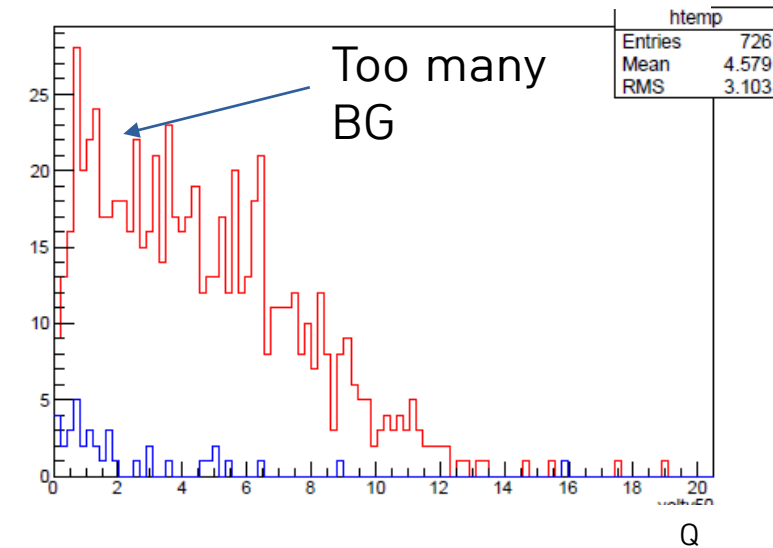
PWO (2.5cm)



PWO (5cm)



PWO (10cm)



- d(PS-source) : 20cm, d(PWO-source) : 2.5cm, 5cm, 10cm

- $Eff(2.5cm) = \frac{1014 - 27/0.57}{13625 * 0.255 * 0.943} = 52.9\% \pm > 1.8\%$

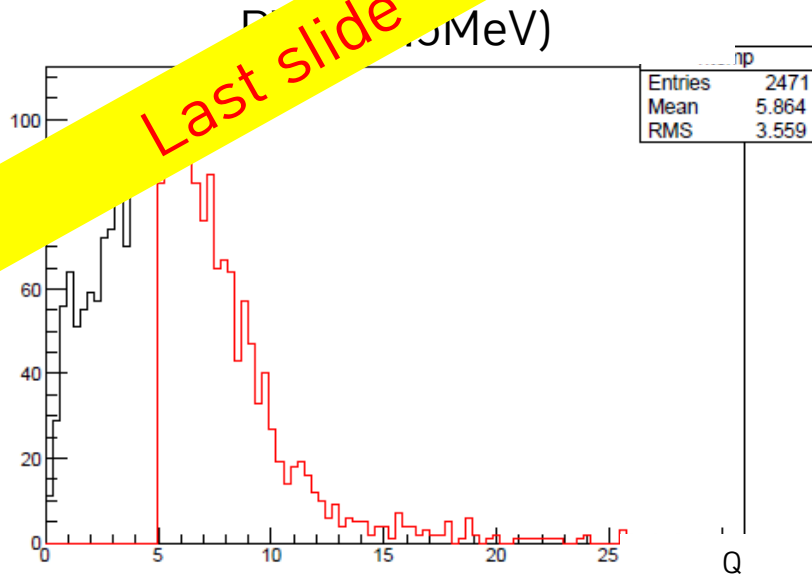
- $Eff(5cm) = \frac{(441 - 12)/0.57}{13607 * 0.08809 * 0.943} = 66.6\% \pm > 3.2\%$

x 0.906 (poistron emission fraction missing)

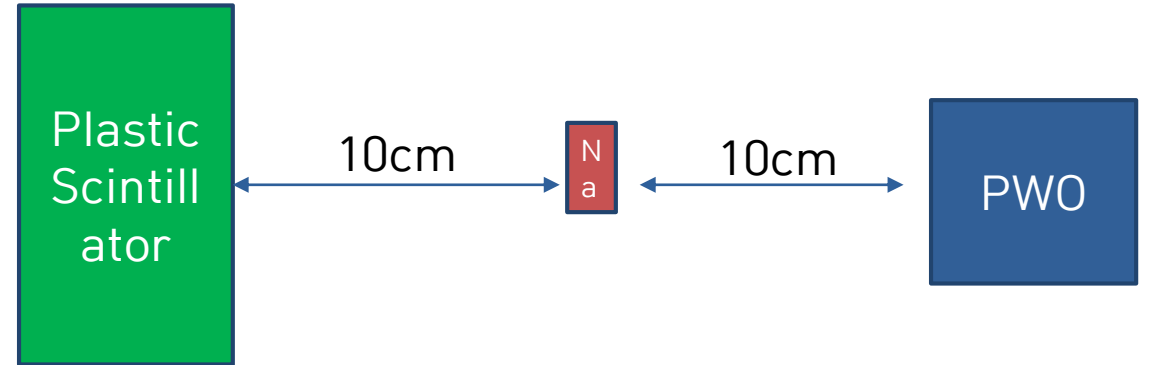
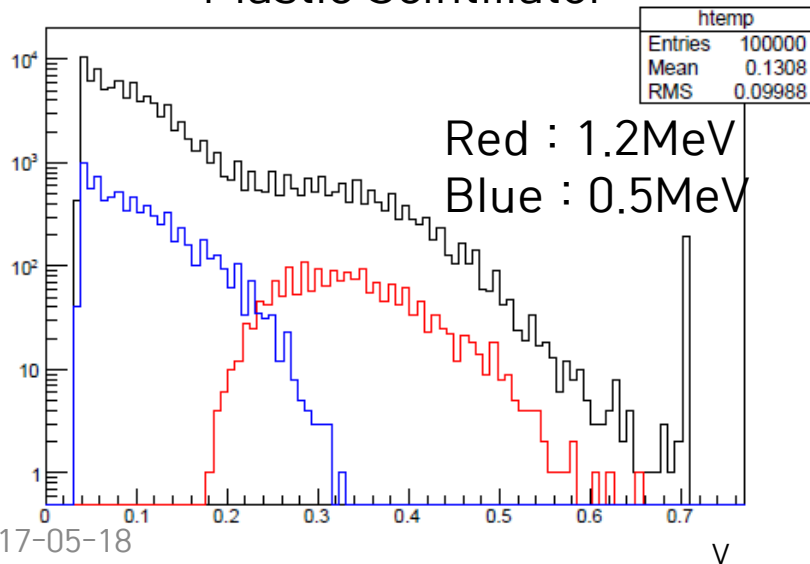
- $Eff(2.5cm) = \frac{(299 - 5)/0.57}{27381 * 0.02449 * 0.943} = 81.6\% \pm > 4.8\%$

Corrections

Last slide



Plastic Scintillator



- Fraction (red/all) = $(1402-5)/(2471-24)=0.57$

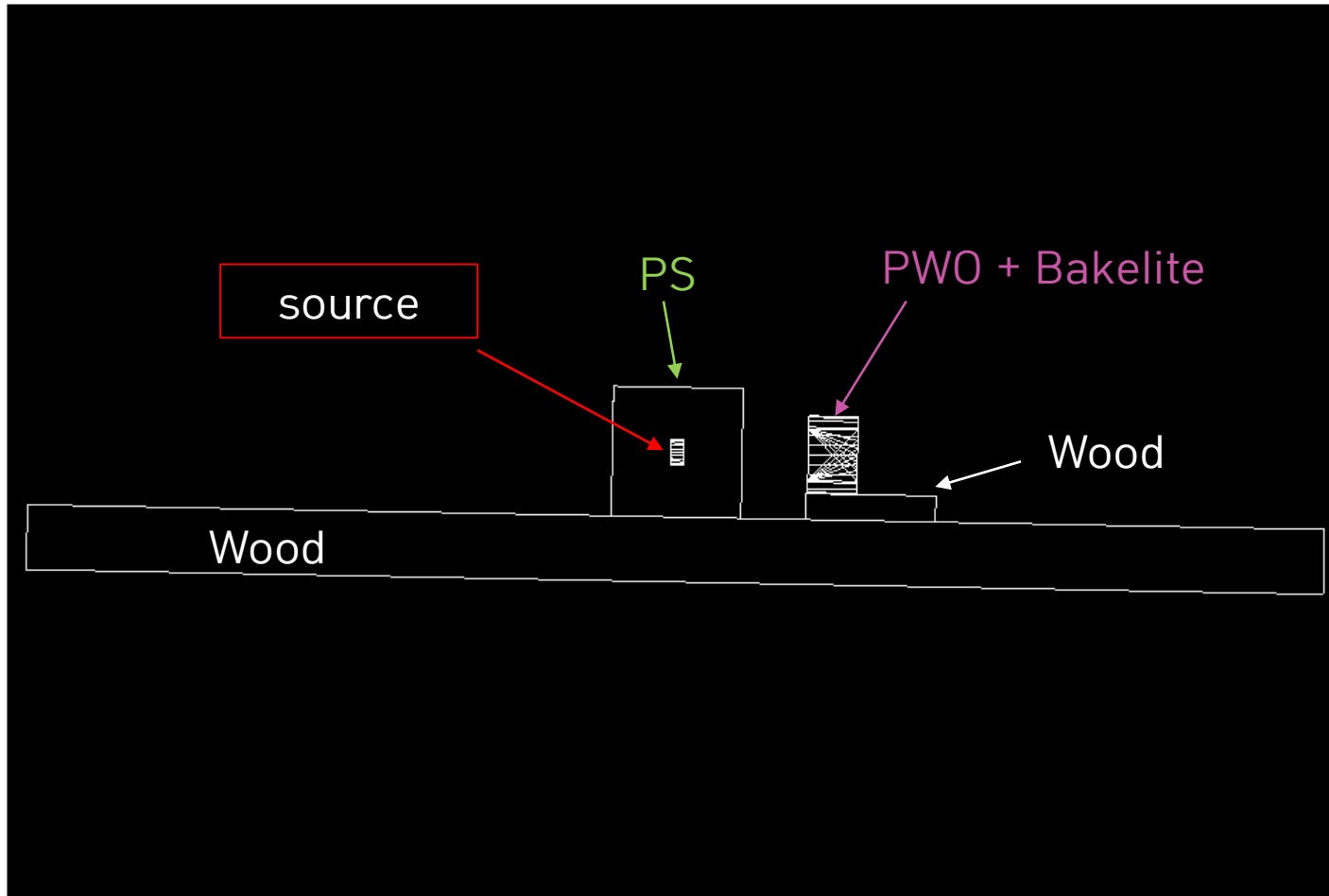
Signal rate : 0.943

← Count rate

- 75.76#/s for 1.2MeV (height>0.3V)

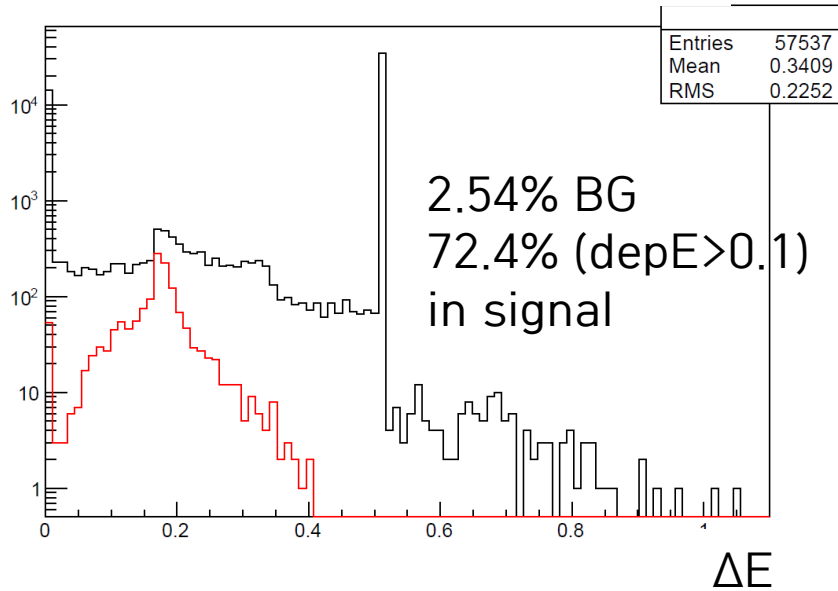
- 4.55#/s for no source

Simulation check

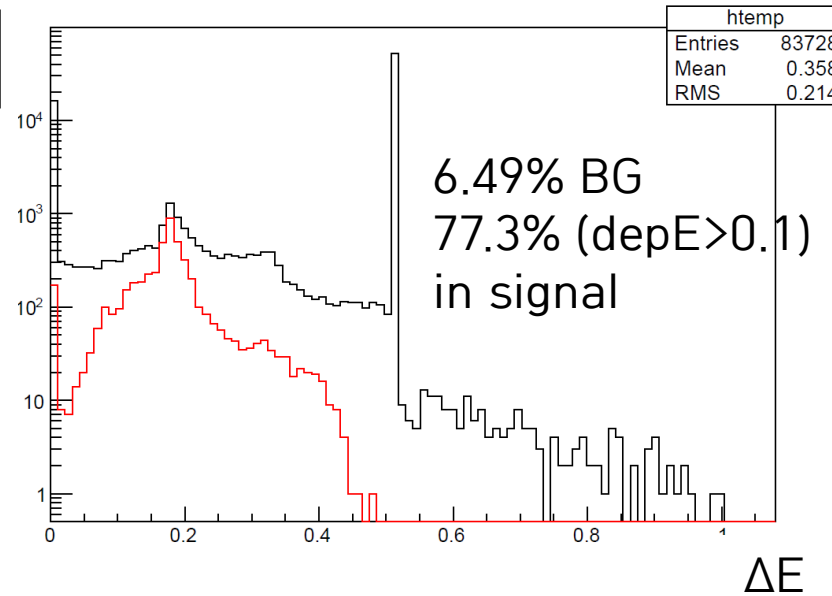


Simulation check

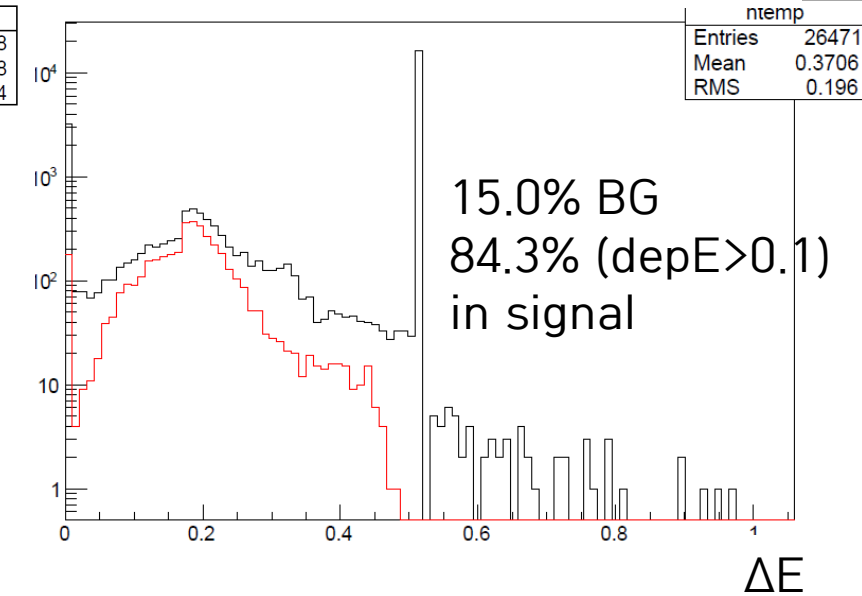
Total deposit E (2.5cm dist)



Total deposit E (5cm dist)

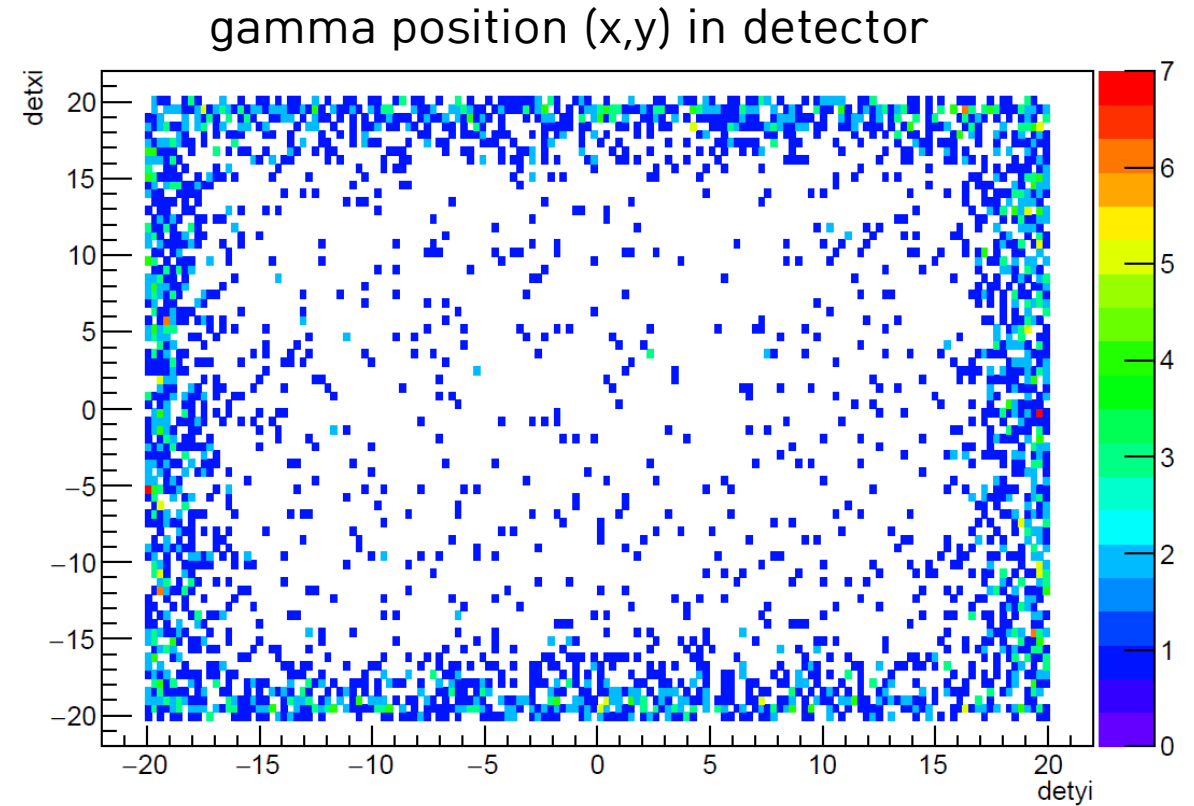
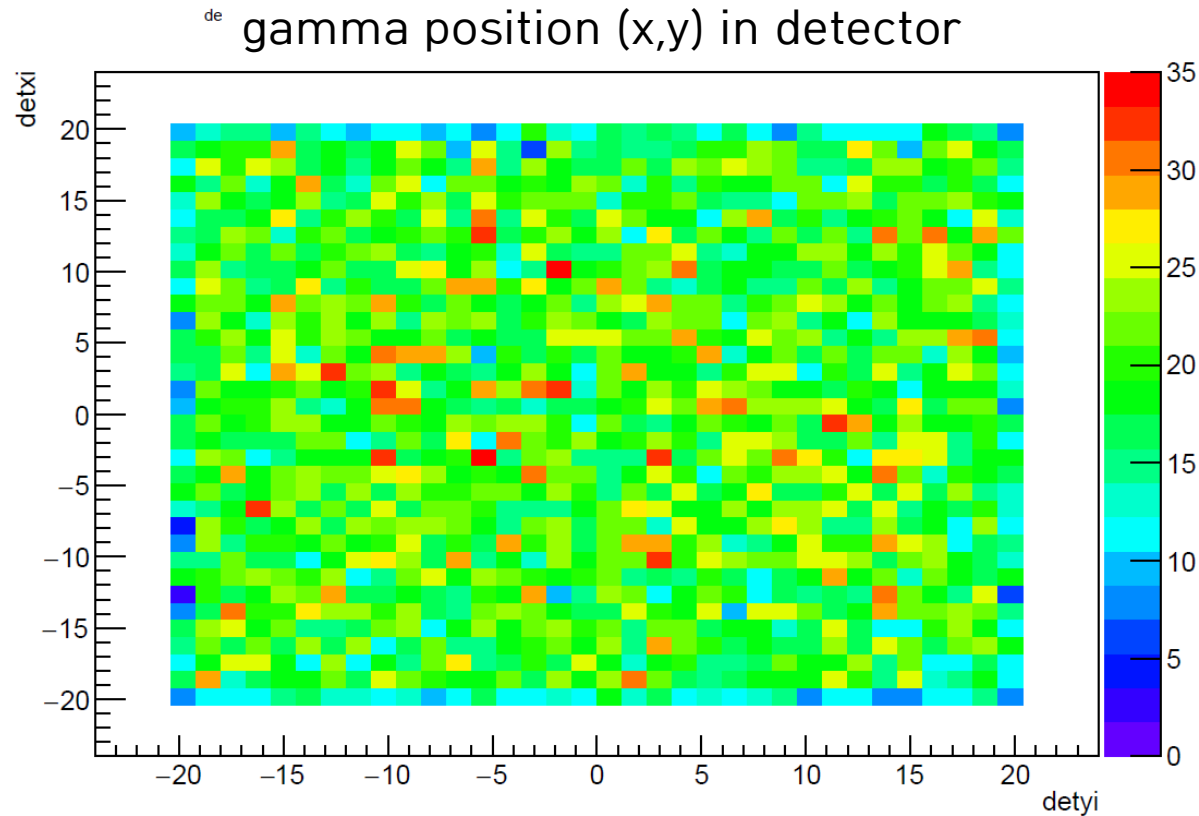


Total deposit E (10cm dist)



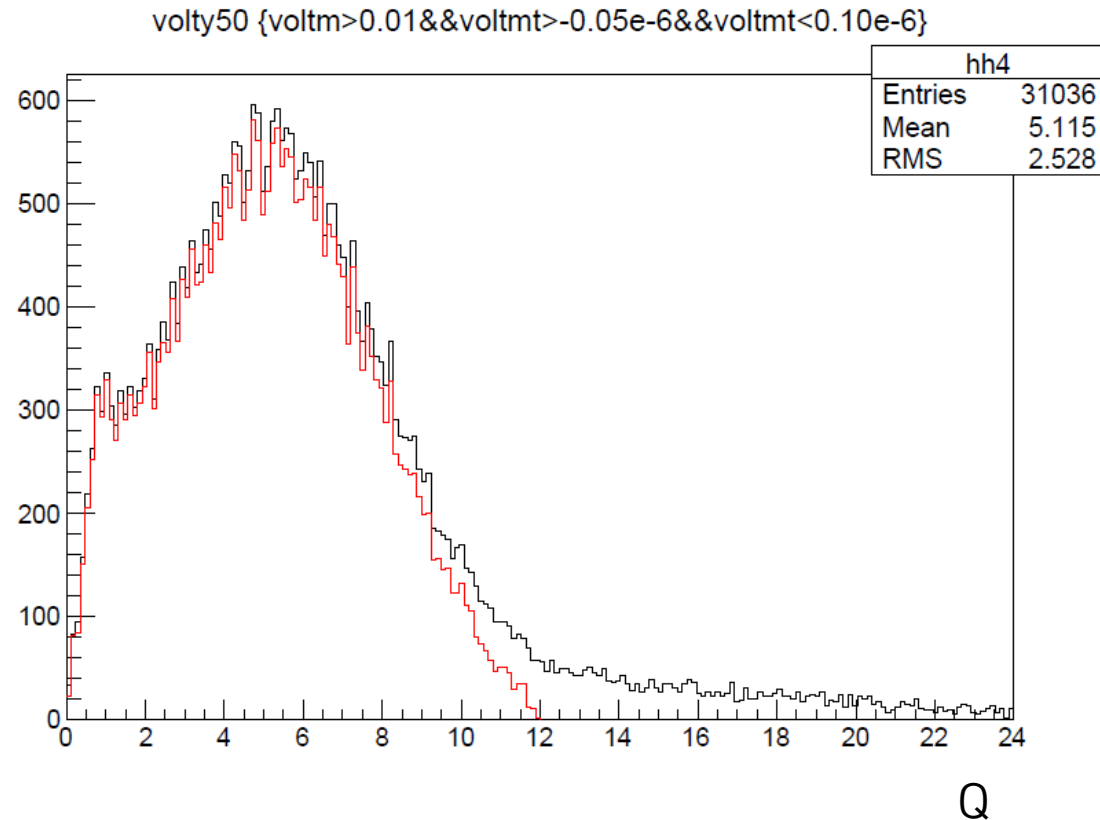
- Black : Total deposit E (from 0.5MeV gamma)
- Red : Total deposit E (0.5MeV after compton scattering)

Simulation check



- Left : without compton BG
- Right : Total deposit $E < 0.1\text{MeV}$ without compton BG

Correction



- Last correction factor has 1.2MeV contamination

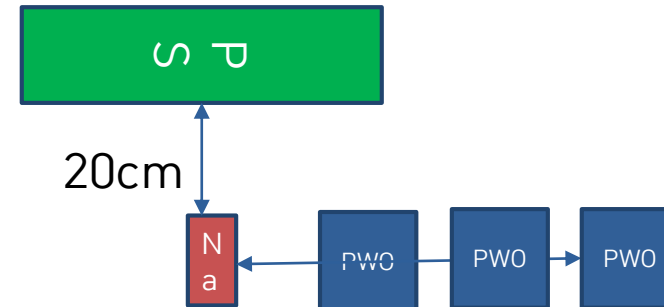
Red histogram :

$\text{Hist}(\text{total } Q) - \text{Hist}(24 - Q(Q > 12))$

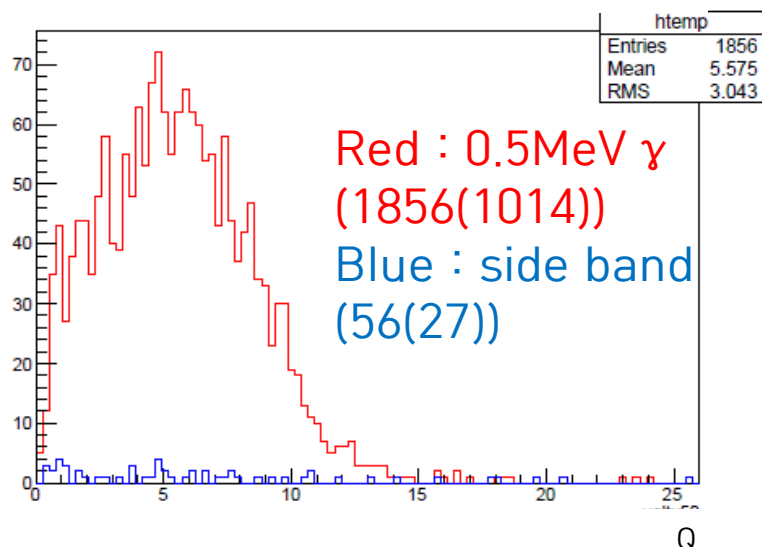
$\text{Frac}[\#(Q > 5)/\#(\text{all})] = 0.522$

$\text{Frac}[\#(Q > 6)/\#(\text{all})] = 0.385$

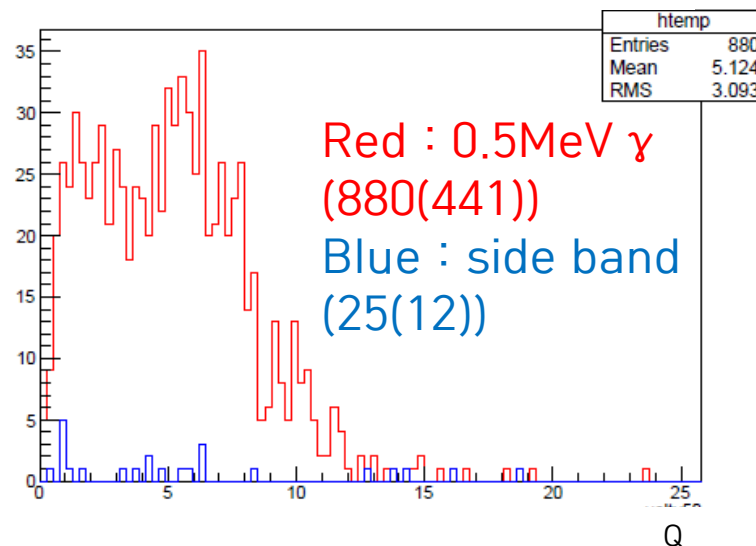
Efficiency check



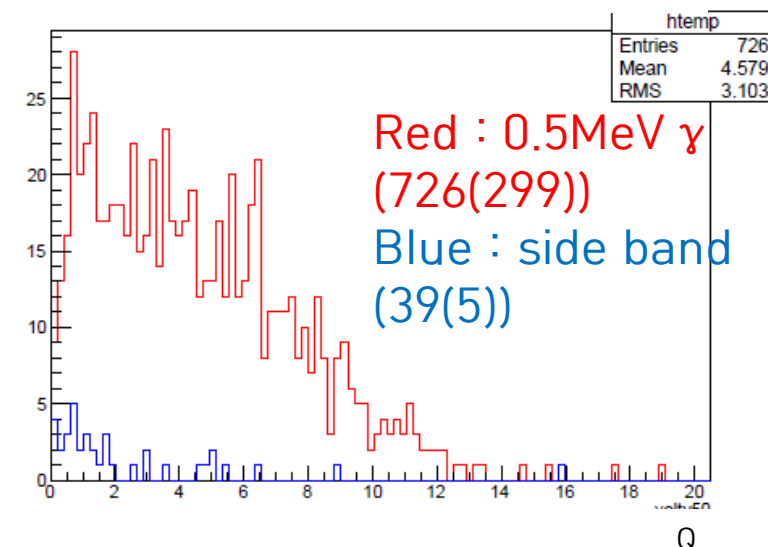
PWO (2.5cm)



PWO (5cm)



PWO (10cm)



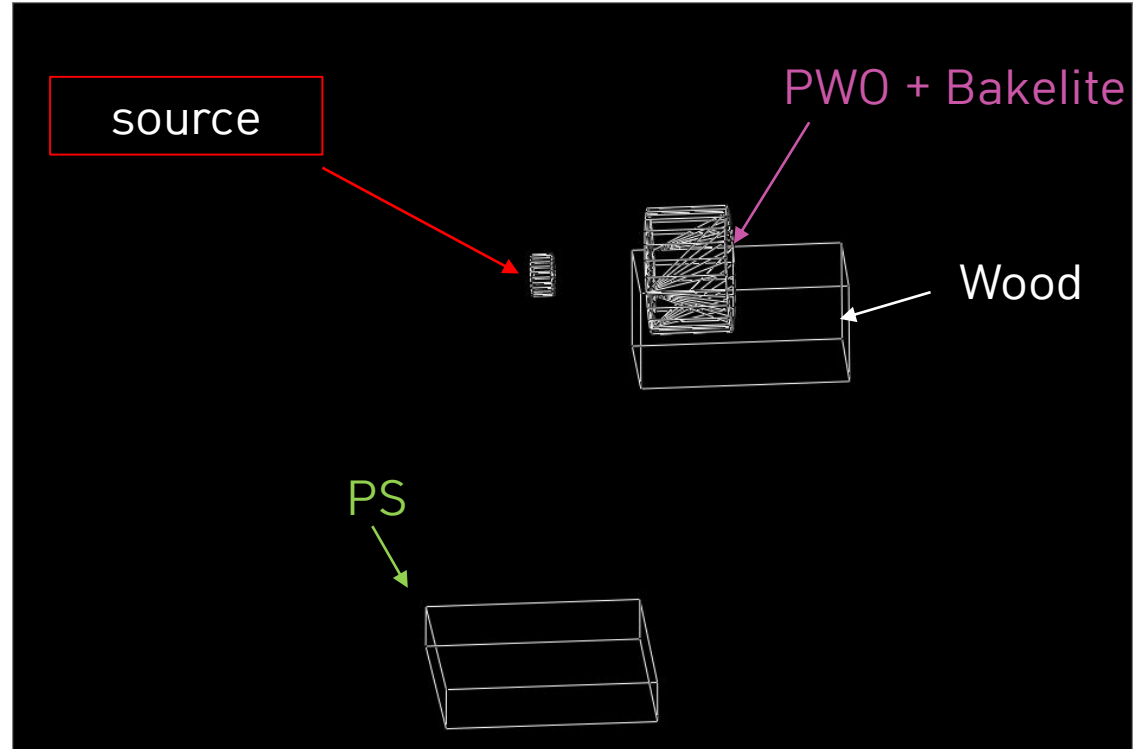
- d(PS-source) : 20cm, d(PWO-source) : 2.5cm, 5cm, 10cm

- $Eff(2.5cm) = \frac{1014 - 27/0.522}{13625 * 0.255 * 0.943 * 0.906} = 63.7\% \pm > 2.0\%(stat)$

- $Eff(5cm) = \frac{(441 - 12)/0.57}{13607 * 0.08809 * 0.943 * 0.906} = 80.3\% \pm > 3.9\%(stat)$

- $Eff(10cm) = \frac{(299 - 5)/0.57}{27381 * 0.02449 * 0.943 * 0.906} = 98.3\% \pm > 5.7\%(stat)$

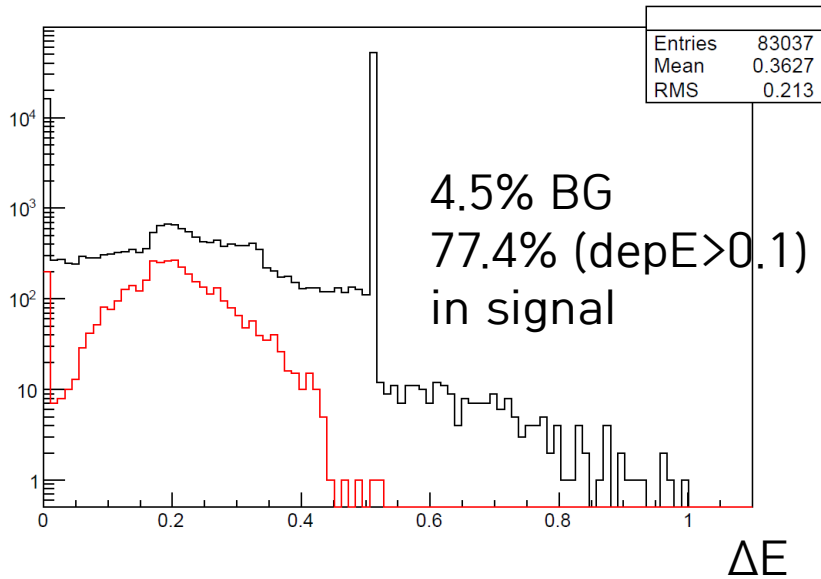
Setup changed



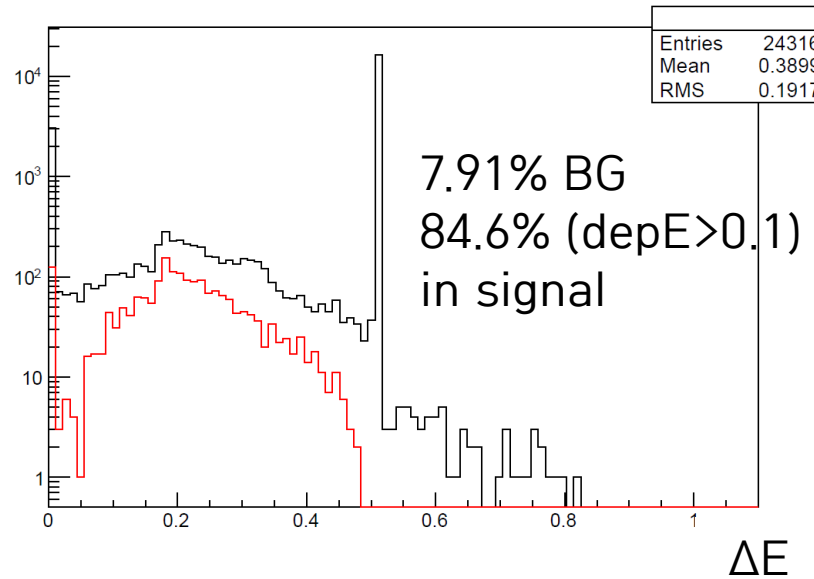
- Compton BG is decrease.
- Linac is turned off

Simulation check

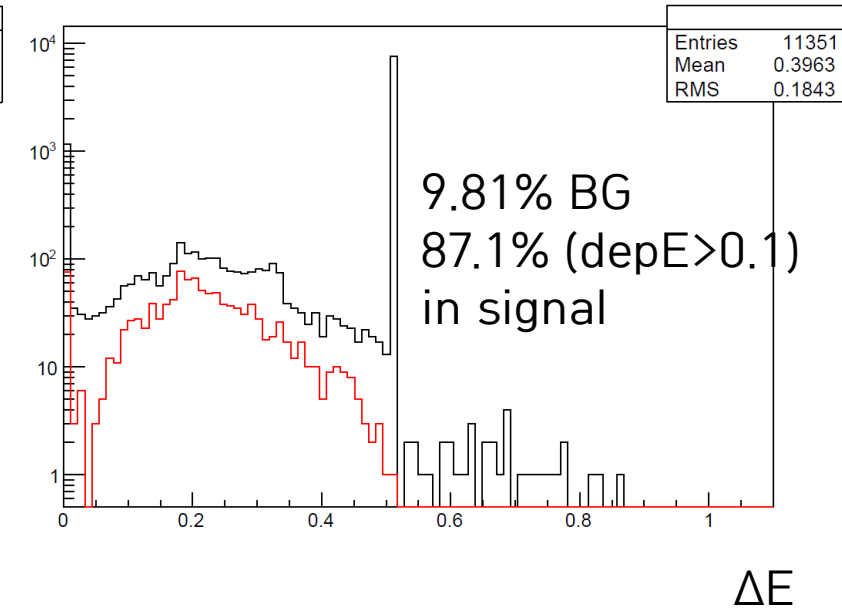
Total deposit E (5cm dist)



Total deposit E (10cm dist)



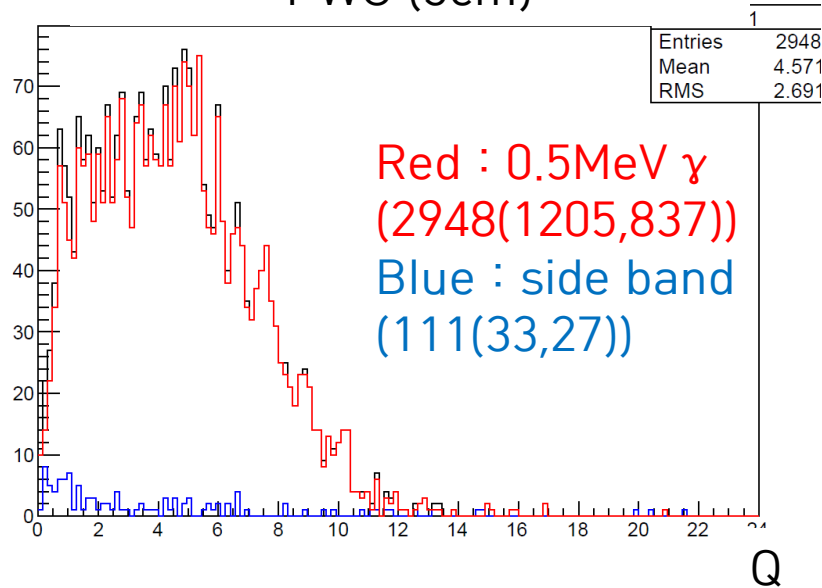
Total deposit E (15cm dist)



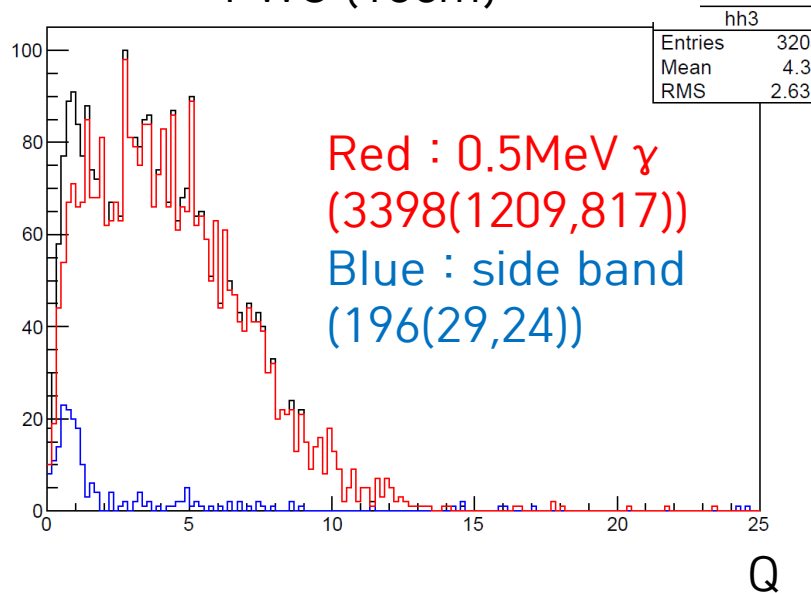
- Compton BG is stable (AI support frame also move)
 - As distance is increased, edge effect is decreased.
 - But more time is required for data taking
- (Plan to increase Plastic scintillator trigger threshold in Oscilloscope)

Efficiency check

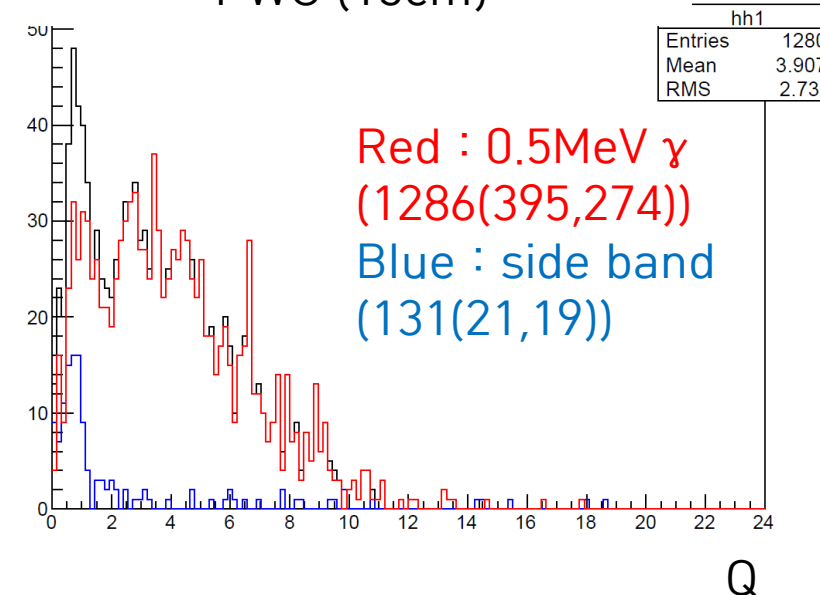
PWO (5cm)



PWO (10cm)



PWO (15cm)



- Signal shape become stable
- BG (Cosmic + linac) count rate is decreased
- d(PS-source) : ~10cm, d(PWO-source) : 5.2cm, 10cm, 15cm (+ 2mm (Bakelite(1mm)+blacksheet(1mm)))
- $Eff(5cm) = \frac{(837-27)/0.385}{39615*0.07698*0.983*0.906} = 77.5\% \pm 2.7\%(stat) \pm 9.5\%(syst) \leftarrow \Delta d(2mm)= 6.6\%, \text{ correction } f = 6.9\%$
- $Eff(10cm) = \frac{(817-24)/0.385}{108155*0.02358*0.983*0.906} = 90.7\% \pm 3.2\%(stat) \pm 10.7\%(syst) \leftarrow \Delta d(2mm)= 3.9\%, \text{ correction } f = 10.0\%$
- $Eff(15cm) = \frac{(274-19)/0.385}{77914*0.01084*0.983*0.906} = 88.1\% \pm 5.5\%(stat) \pm 8.2\%(syst) \leftarrow \Delta d(2mm)= 2.6\%, \text{ correction } f = 7.8\%$

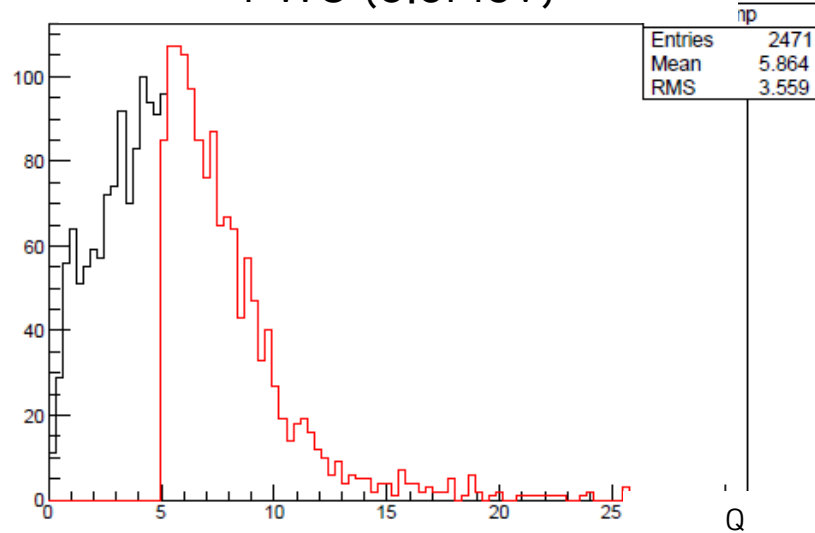
So

- I discuss with Laszlo but he want higher precision..
- Before too late, light guide test will be prepared.
(Soon Antion chamber will be usable and we need to decide which one is better)
- We would get better precision with higher statistics and better support frame.

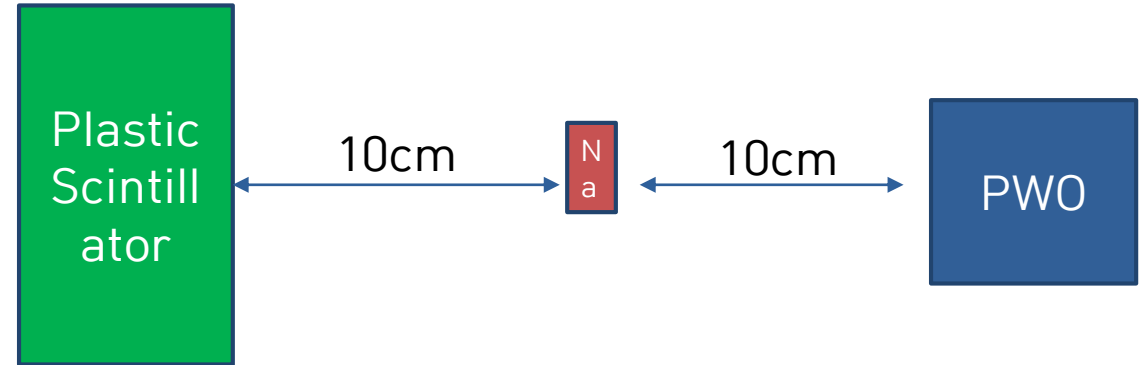
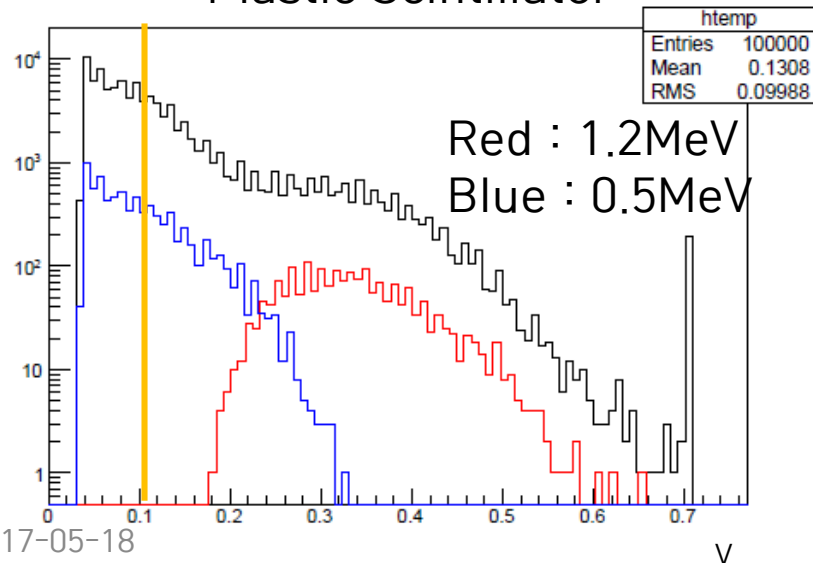
Backup

Corrections

PWO (0.5MeV)



Plastic Scintillator



- Fraction (red/all) = $(1402-5)/(2471-24)=0.57$

Signal rate : 0.943

← Count rate

- 75.76#/s for 1.2MeV (height>0.3V)

- 4.55#/s for no source