

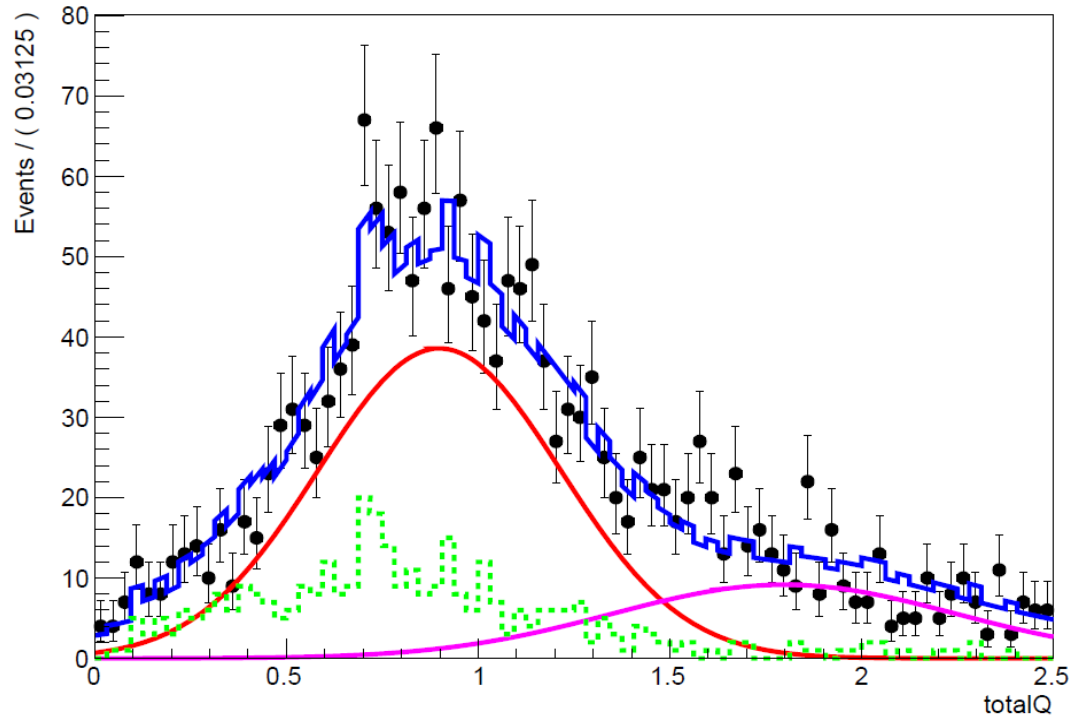
Positronium intensity measurement preparation (GBAR)

SNU

Bongho Kim

1. Single photoelectron fitting

A RooPlot of "totalQ"



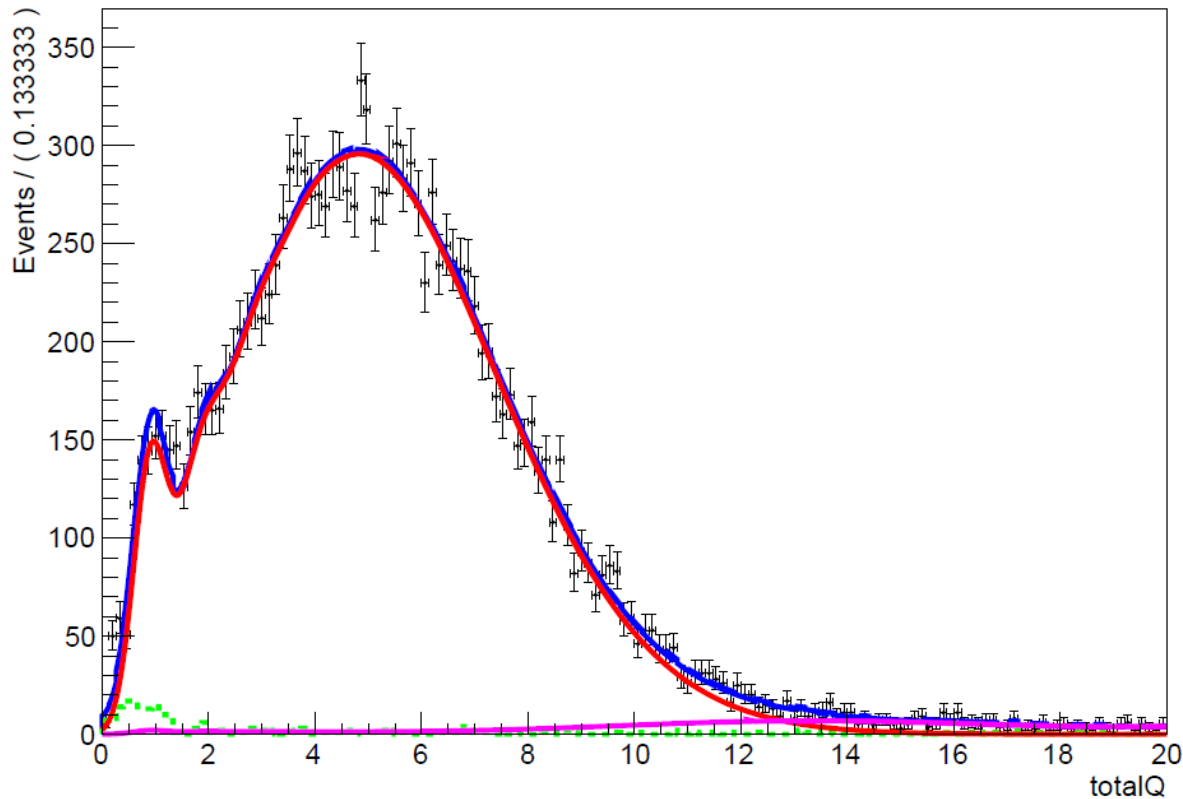
Function : $\text{gaus}_1(m,s) \times \text{fr}(\text{gaus}_1) + \text{gaus}_2(2m,\sqrt{2}\sigma) \times \text{fr}(\text{gaus}_2) + \text{poly}(0)$

NAME	VALUE	ERROR
fr	5.40277e-01	3.64910e-02
fr2	1.71413e-01	2.97146e-02
m	8.99073e-01	2.78583e-02
s	3.16598e-01	2.79243e-02
$\chi^2 = 1.039808\text{e}+00$		

- Single p.e is selected by signal width (double p.e looks shown)
- Data from 10cm + 15cm data

Fitting results (back to back)

PWO Back to back (with PS)



Blue : All PDF

Red : Signal PDF

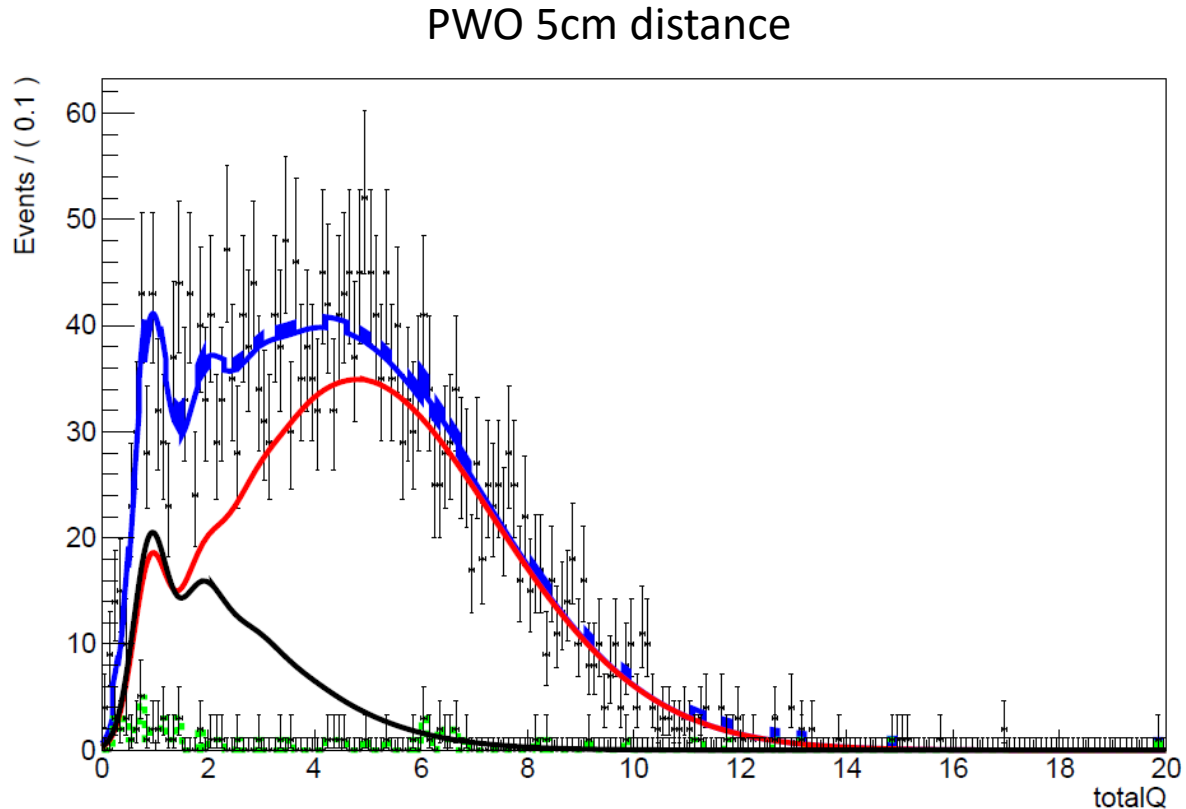
Pink : 1.27MeV gamma PDF

Green : side band

NAME	VALUE	ERROR
a	6.25207e+00	3.00571e-02
fr12	3.51832e-02	2.44627e-03

$$\chi^2 = 9.542727e-01$$

Fitting results (5cm)



Blue : All PDF

Red : Signal PDF

Black : Compton BG PDF

Green : side band

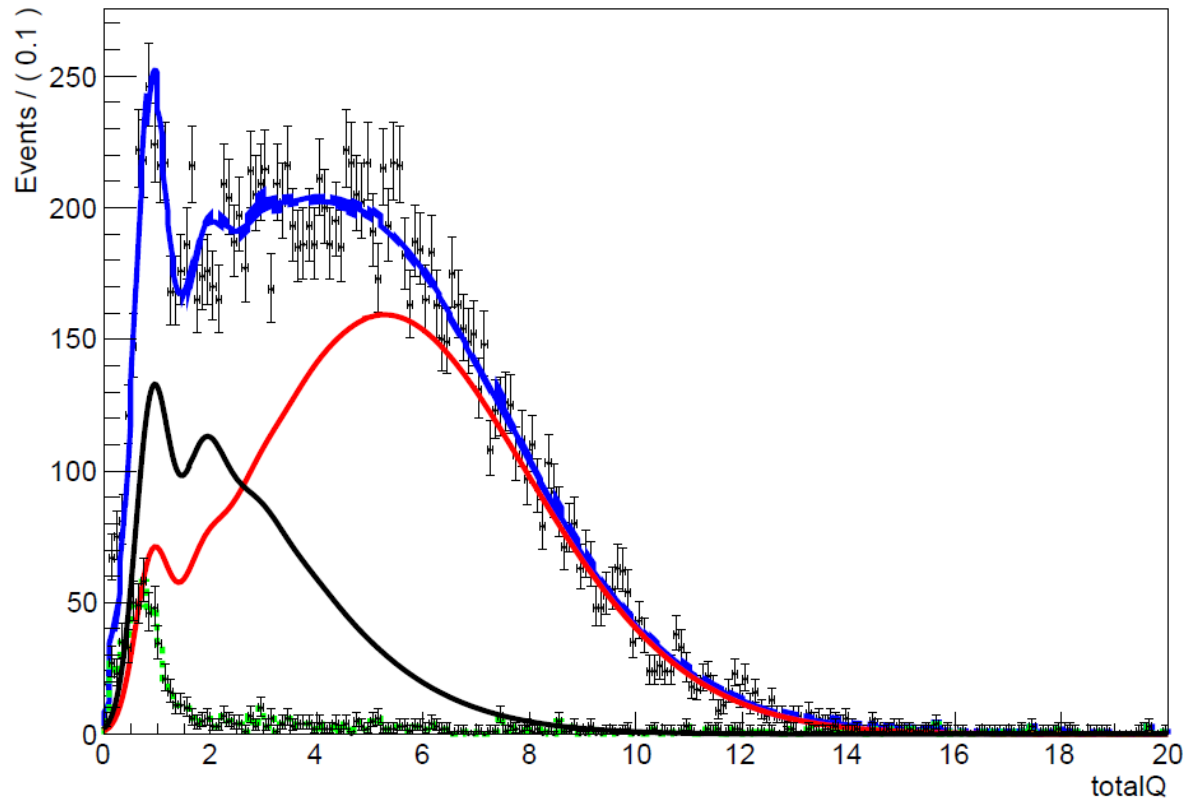
NAME	VALUE	ERROR
a	6.24512e+00	1.02182e-01
sf	7.81634e-01	2.49731e-02

• Efficiency = 7.759227e-01

χ^2 = 9.232441e-01

Fitting results (10cm)

A RooPlot of "totalQ"



Blue : All PDF

Red : Signal PDF

Black : Compton BG PDF

Green : side band

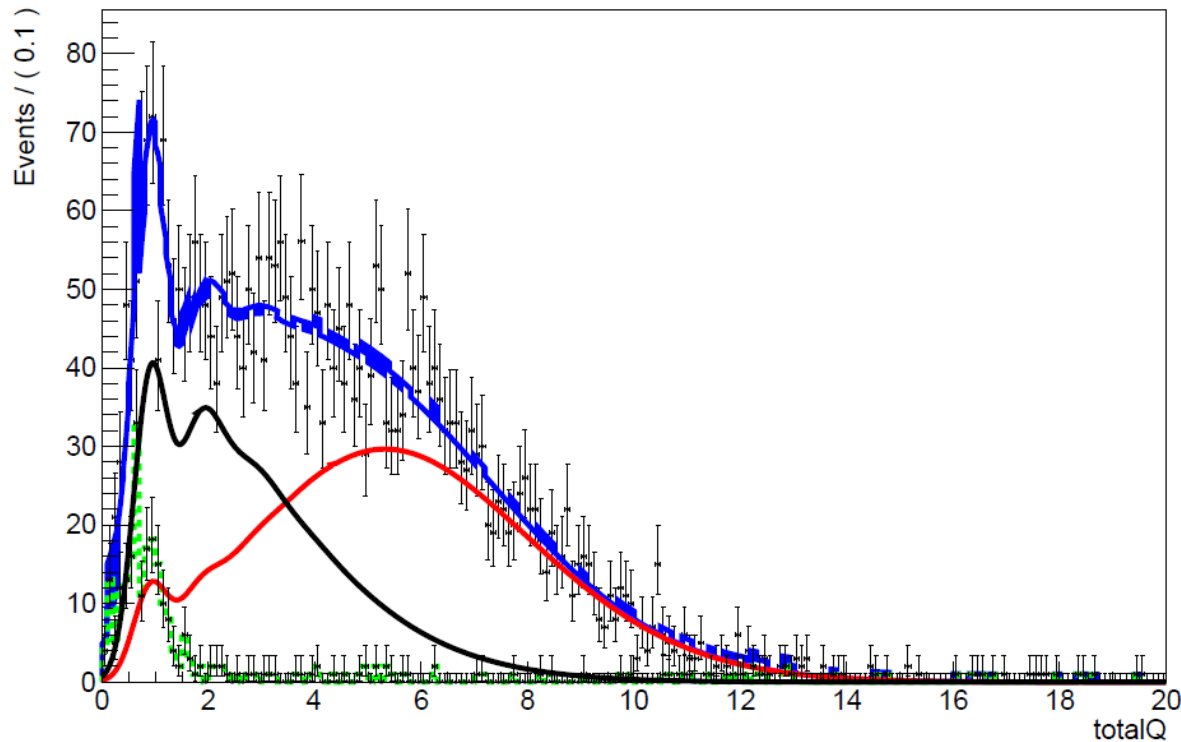
NAME	VALUE	ERROR
a	6.77117e+00	5.33251e-02
sf	6.73642e-01	1.21379e-02

• Efficiency = 8.422419e-01

$\chi^2 = 1.190825e+00$

Fitting results (15cm)

A RooPlot of "totalQ"



Blue : All PDF

Red : Signal PDF

Black : Compton BG PDF

Green : side band

NAME	VALUE	ERROR
a	6.80951e+00	1.35080e-01
sf	5.50084e-01	2.84000e-02

• Efficiency = 7.879501e-01

$\chi^2 = 9.443214e-01$

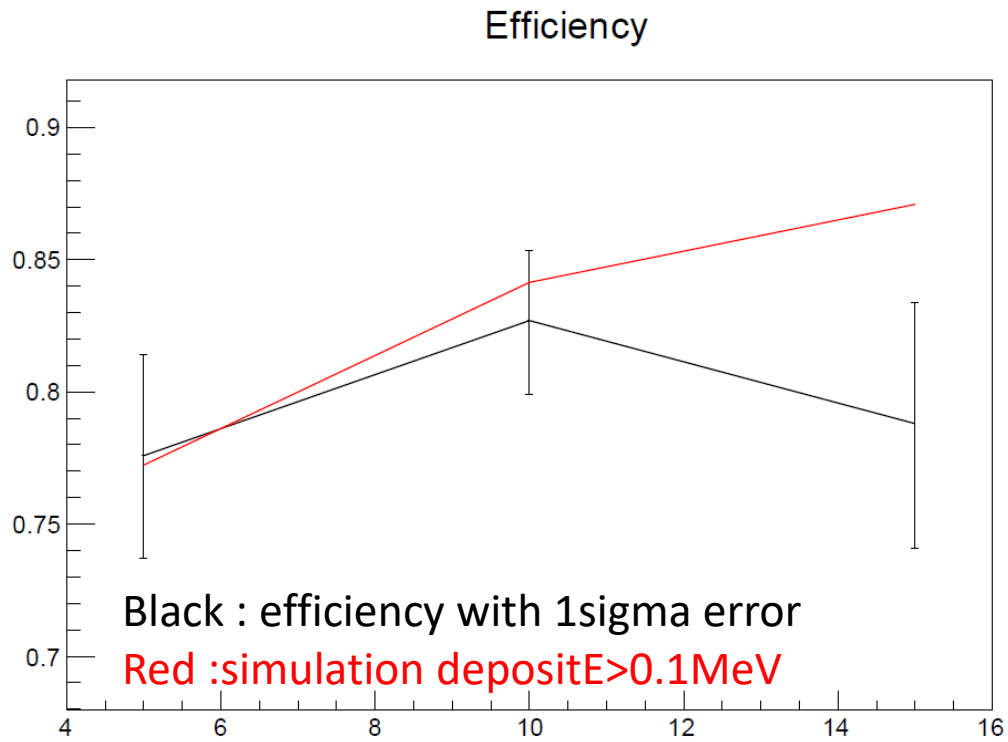
Final Efficiency

- $$Eff(10.1cm) = \frac{\#_{det}(PWO) \times f_{sig}}{\#_{det}(PS(1.27MeV)) \times acc \times f(e^+) \times f_{sub}(cosmic)} =$$
$$\frac{(16012) \times 0.674}{619925 \times 0.02403 \times 0.967 \times 0.906} = 82.65 \pm 1.49(stat) + 2.35 - 2.22(sys)\%$$

- $Eff(5.1cm) = 77.59 \pm 2.48(stat) + 2.99 - 2.90(sys)\%$

- $Eff(15.1cm) = 78.80 \pm 4.07(stat) + 2.33 - 2.15(sys)\%$

Efficiency



For 5cm 5.0%(7.9%) error
For 10cm 3.3%(4.7%) error
For 15cm 6.0%(6.3%) error

	5cm	10cm	15cm
efficiency	0.7759	0.8265	0.788
$\sigma_{\text{tot}}(+,1\text{mm})$	0.038815	0.027867	0.04691
$\sigma_{\text{tot}}(+,2\text{mm})$	0.060952	0.039219	0.050061
$\sigma_{\text{tot}}(-,1\text{mm})$	0.038128	0.026729	0.046006
$\sigma_{\text{tot}}(-,2\text{mm})$	0.059006	0.037966	0.049261
stat	0.0248	0.0149	0.0407

$\sigma_{\text{sys}}(+,1\text{mm})$	0.029859	0.023549	0.023324
$\sigma_{\text{sys}}(+,2\text{mm})$	0.055679	0.036279	0.029147
gaus σ	0.0089	0.0103	0.0125
gaus m	0.0097	0.0141	0.0164
accept(1mm)	0.0268	0.0158	0.0109
accept(2mm)	0.0541	0.0318	0.0206

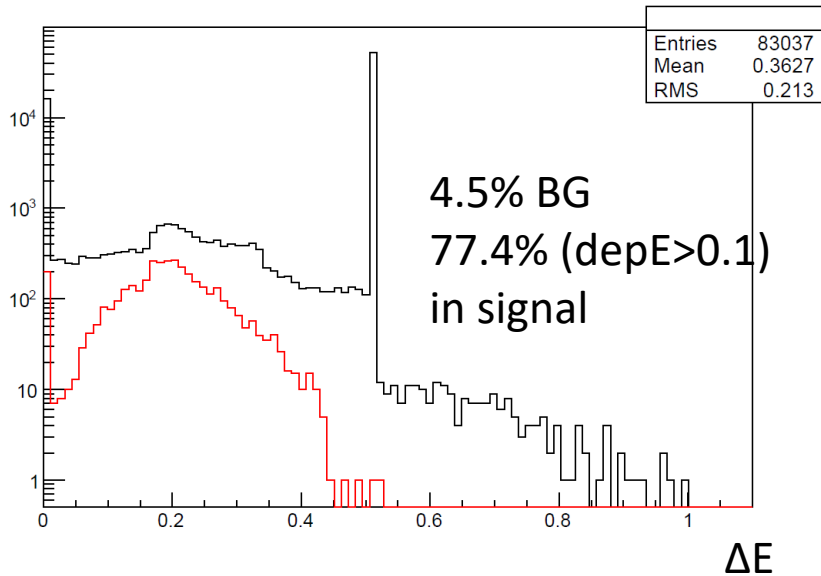
$\sigma_{\text{sys}}(-,1\text{mm})$	0.028961	0.022191	0.02145
$\sigma_{\text{sys}}(-,2\text{mm})$	0.053542	0.03492	0.027751
gaus σ	0.0075	0.0082	0.0103
gaus m	0.0098	0.0136	0.016
accept(1mm)	0.0262	0.0155	0.0099
accept(2mm)	0.0521	0.0311	0.0202

BACK UP

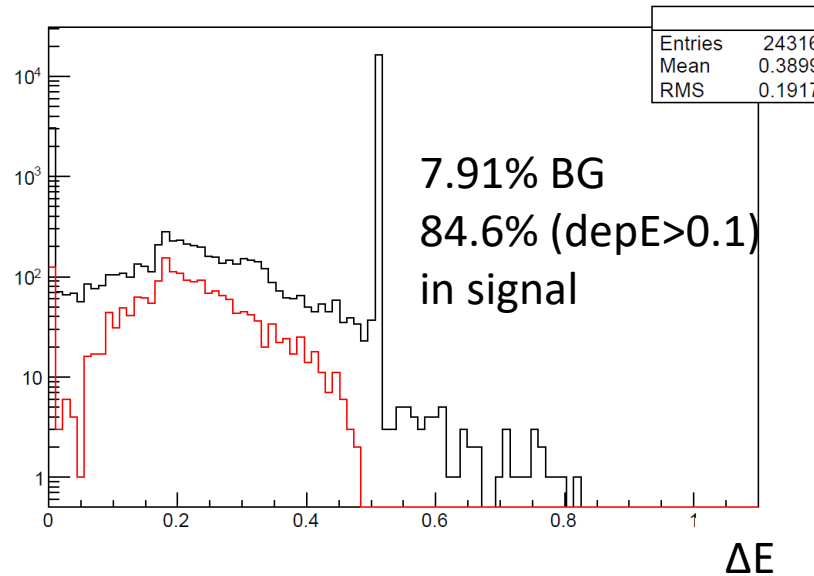
Simulation check

Last slide

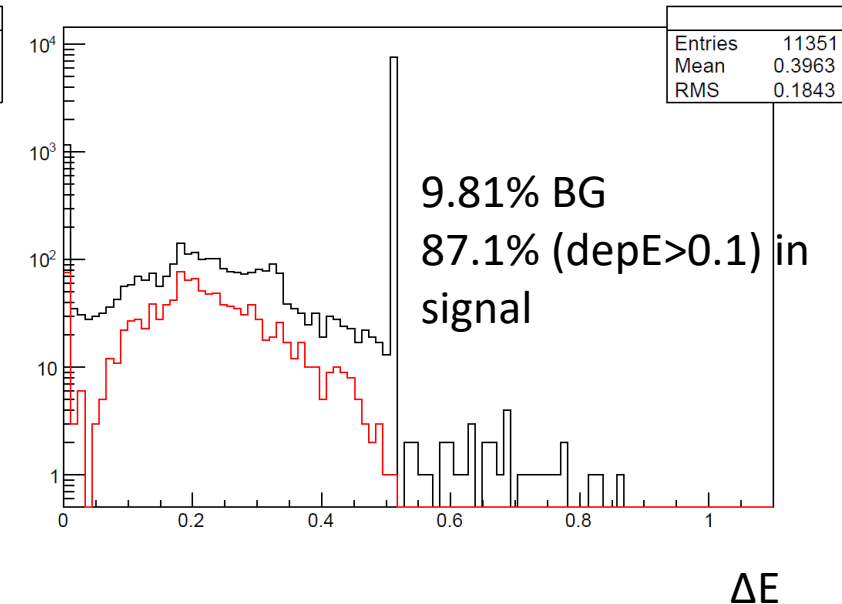
Total deposit E (5cm dist)



Total deposit E (10cm dist)



Total deposit E (15cm dist)



- Compton BG is stable (Al 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)