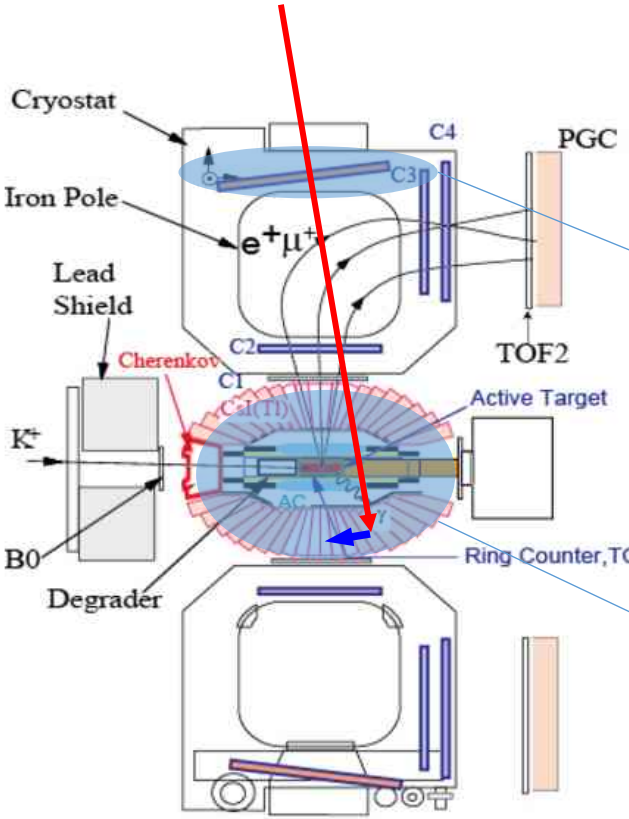
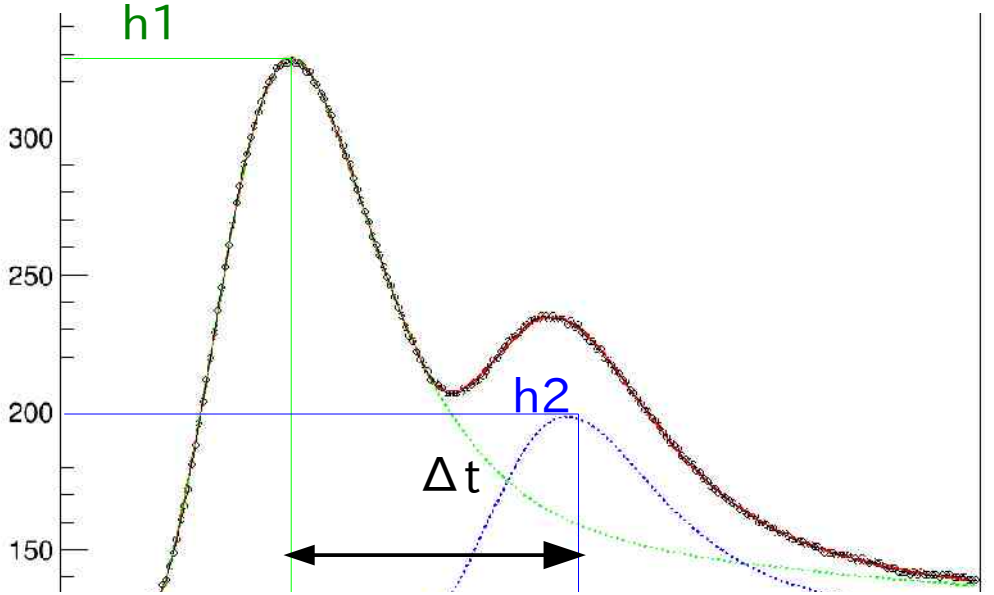
Calibration of the CsI(Tl) detector using Cosmic muons

2016.03.25
H. Ito



Trigger

Muon Stop & e^+ emission

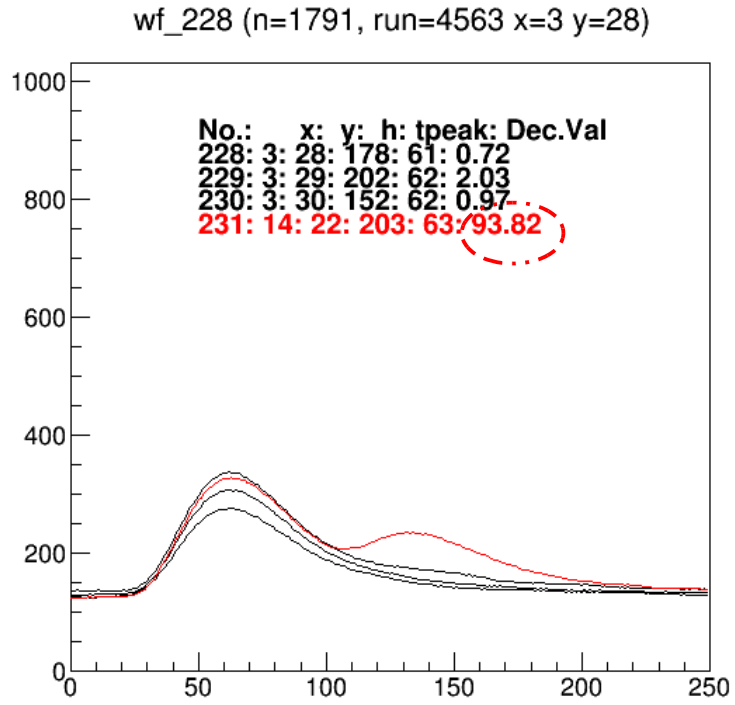


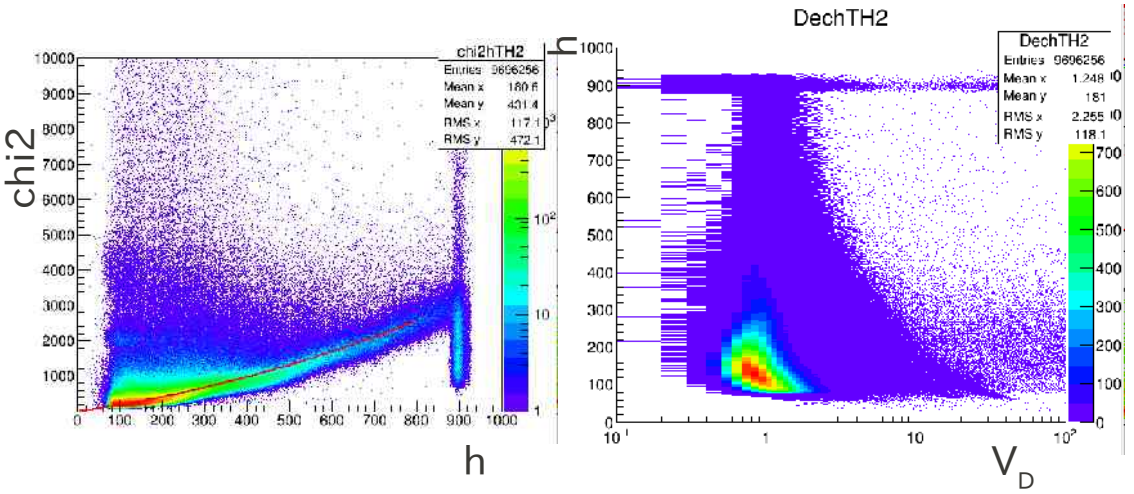
$$Model(x) = p_0 Freq\left[\frac{x-p_1-p_2}{p_3}\right]\frac{1}{f(x_0)}\times \left(\frac{x-p_1}{p_4}exp\left[1-\frac{x-p_1}{p_4}\right]+p_5\frac{x-p_1}{p_4+p_6}exp\left[1-\frac{x-p_1}{p_4+p_6}\right]\right)\theta(x-p_1)+p_7$$

$$f(x_0) = \frac{\varepsilon\tau_1(\varepsilon\tau_1+\tau_2)}{\varepsilon\tau_1^2+\tau_2^2}exp\left(1-\frac{\tau_1(\varepsilon\tau_1+\tau_2)}{\varepsilon\tau_1^2+\tau_1^2}\right)+\frac{\tau_2(\varepsilon\tau_1+\tau_2)}{\varepsilon\tau_1^2+\tau_2^2}exp\left(1-\frac{\tau_2(\varepsilon\tau_1+\tau_2)}{\varepsilon\tau_1^2+\tau_2^2}\right)$$

$$Freq(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x} exp(-t^2/2)dt$$

Analysis Step.





Step. 1: Single waveform fitting

Step. 2: V_D>2

Step. 3: Double waveform fitting

Step. 4: chi2<500

Step. 5: 2D-hist (h2 vs. Δt)

Step. 6: Rejected Noise event

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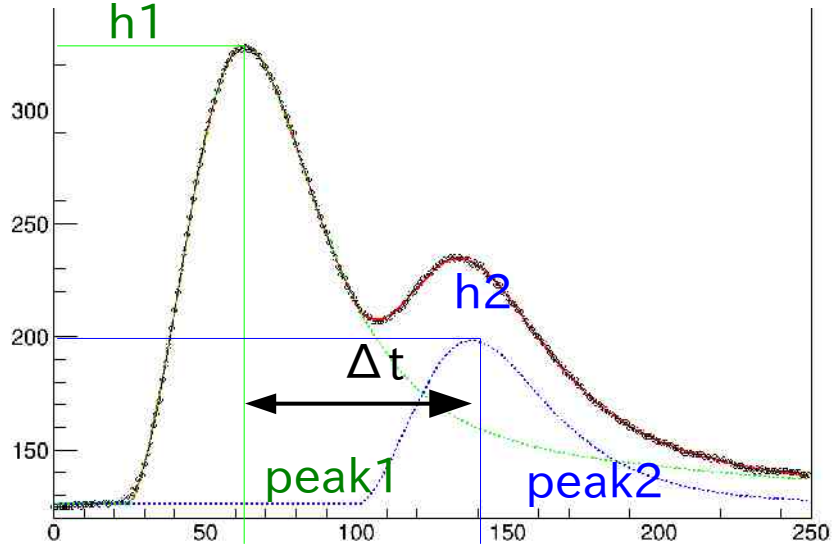

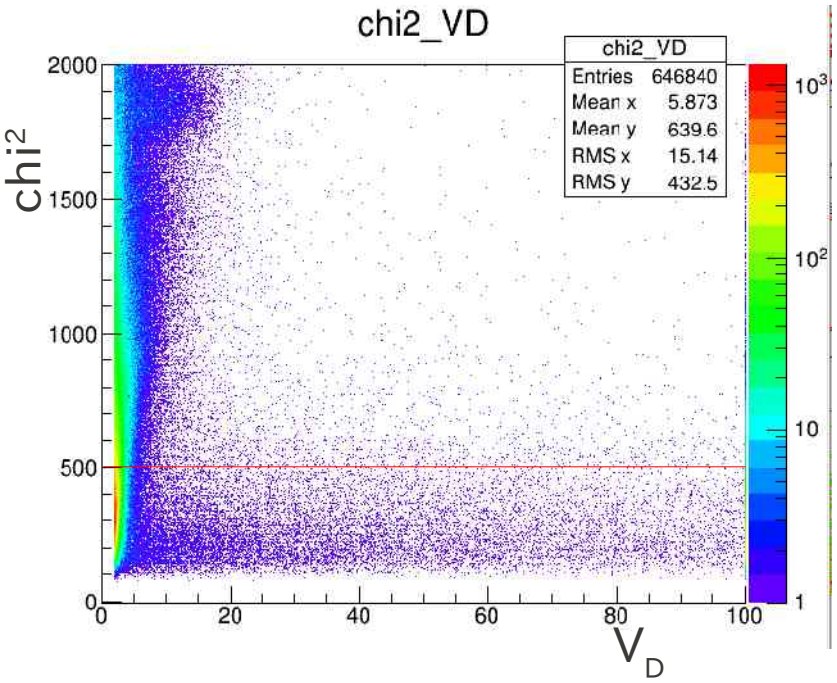

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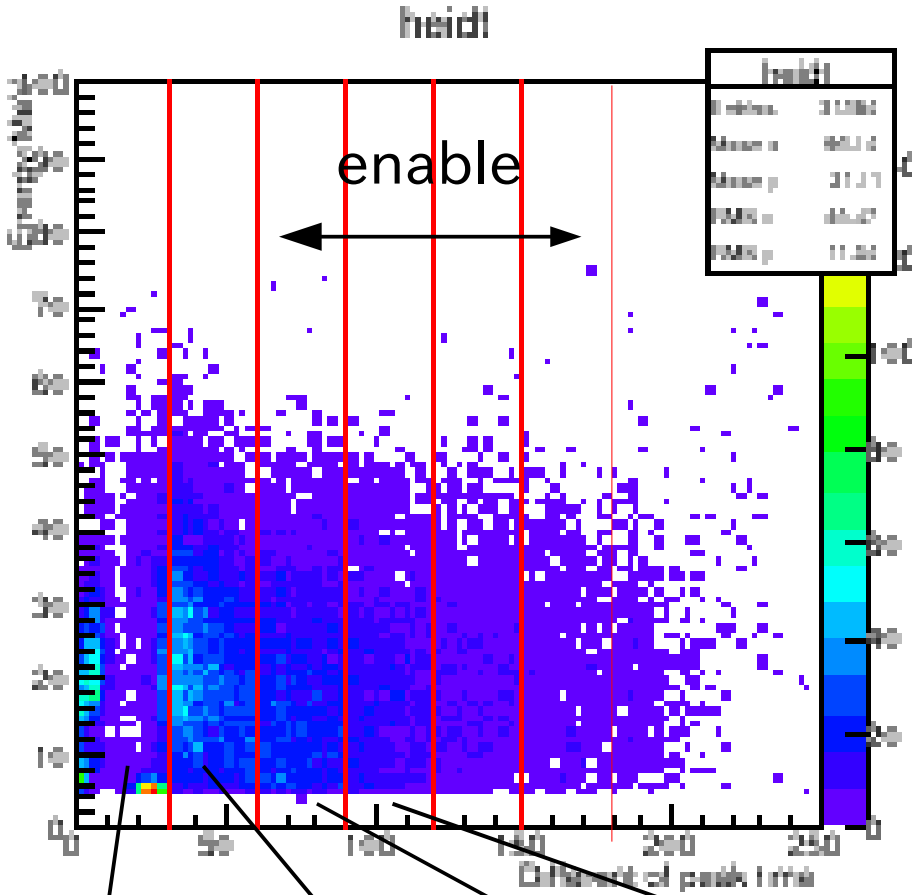

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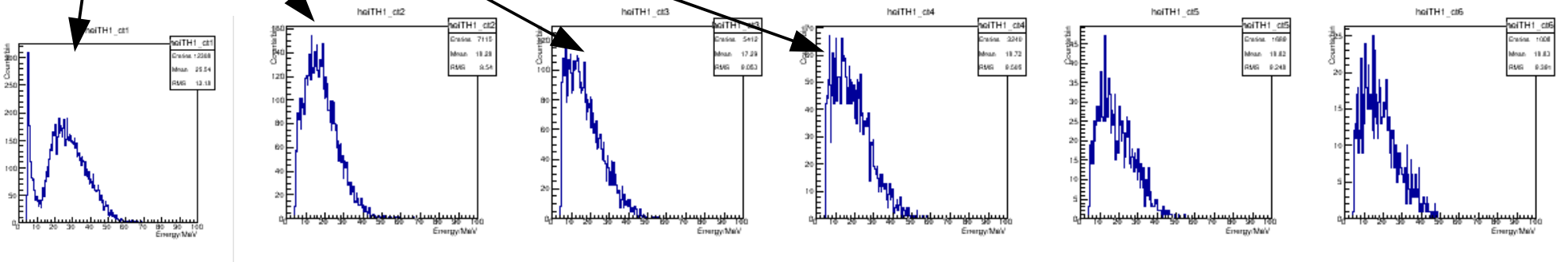
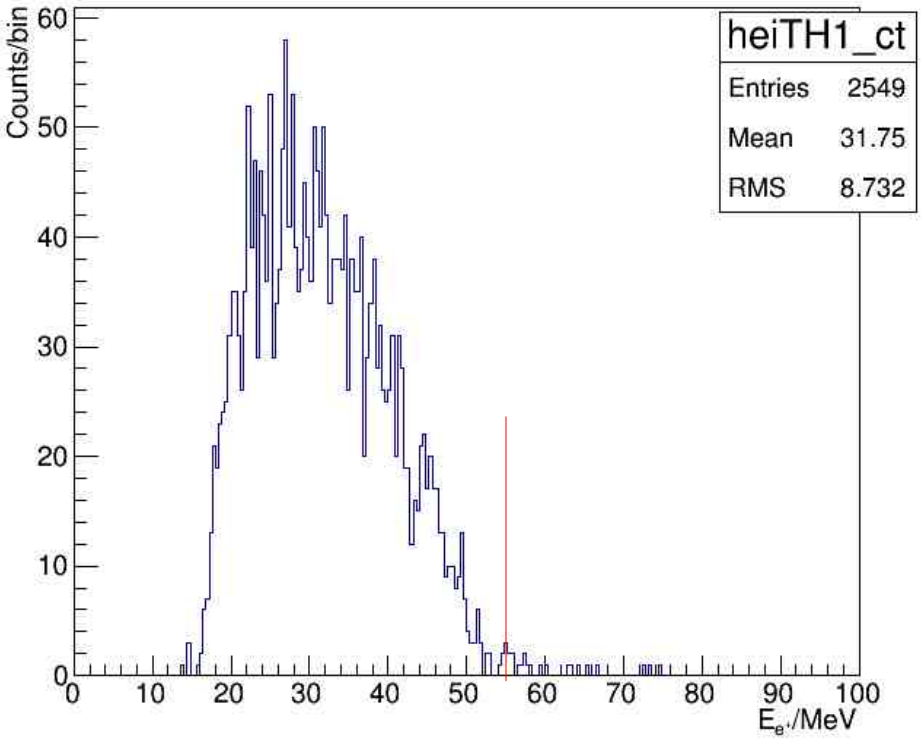
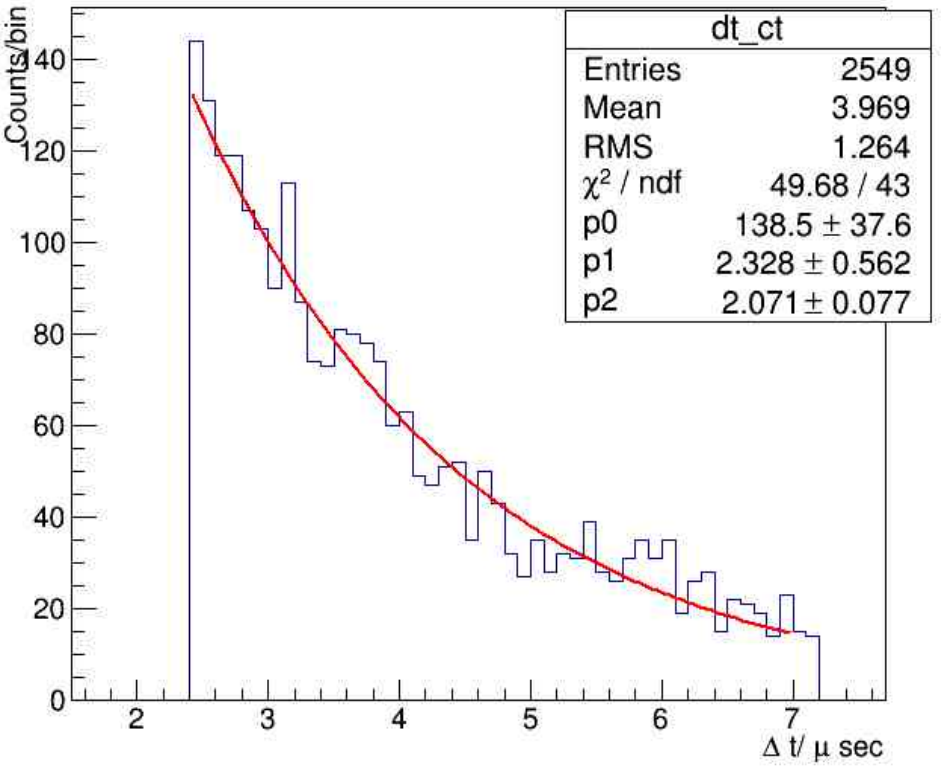


Result



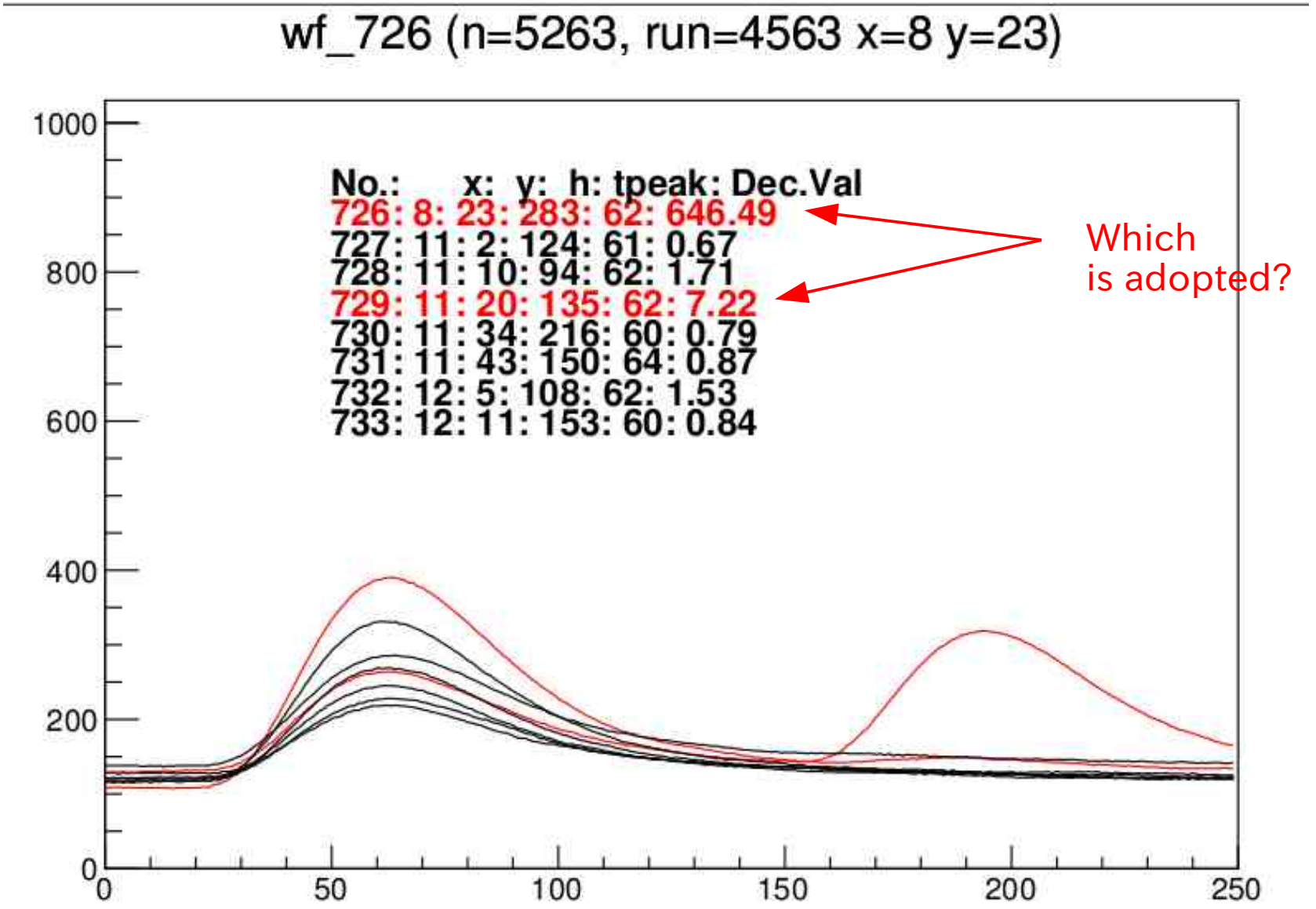
Ee+ is an energy of e^+ decayed from μ, maximum 53 MeV.

It is consists in comparison with calibration with Kmu2 (153 MeV).



Fitting f(x)= p0*exp(-(x-p1)/p2)
p2=mean life time of μ is 2.07±0.08 us.
(τ_μ=2.19 us in vacuum)

Next work


wf_726 (n=5263, run=4563 x=8 y=23)
No.: x: y: h: tpeak: Dec.Val
726: 8: 23: 283: 62: 646.49
727: 11: 2: 124: 61: 0.67
728: 11: 10: 94: 62: 1.71
729: 11: 20: 135: 62: 7.22
730: 11: 34: 216: 60: 0.79
731: 11: 43: 150: 64: 0.87
732: 12: 5: 108: 62: 1.53
733: 12: 11: 153: 60: 0.84
Which is adopted?
1000
800
600
400
200
0
0
50
100
150
200
250