TOF Analysis (1)

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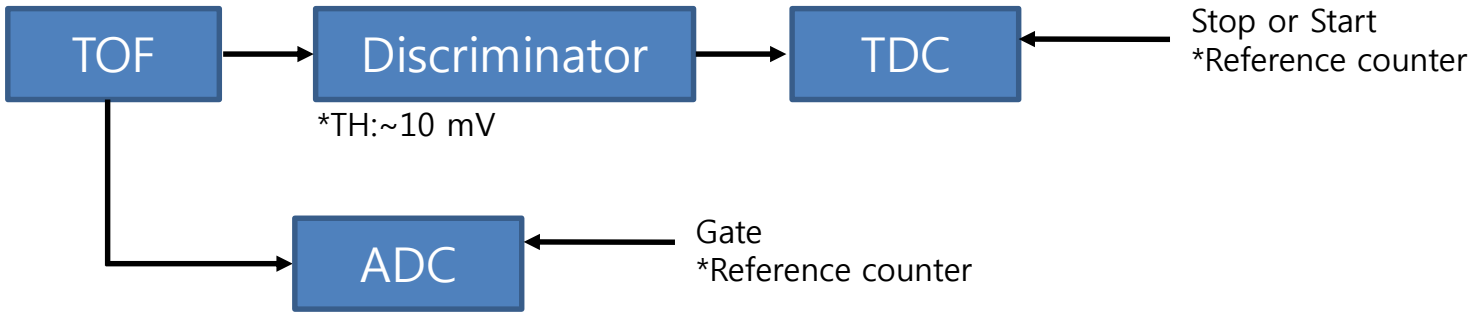
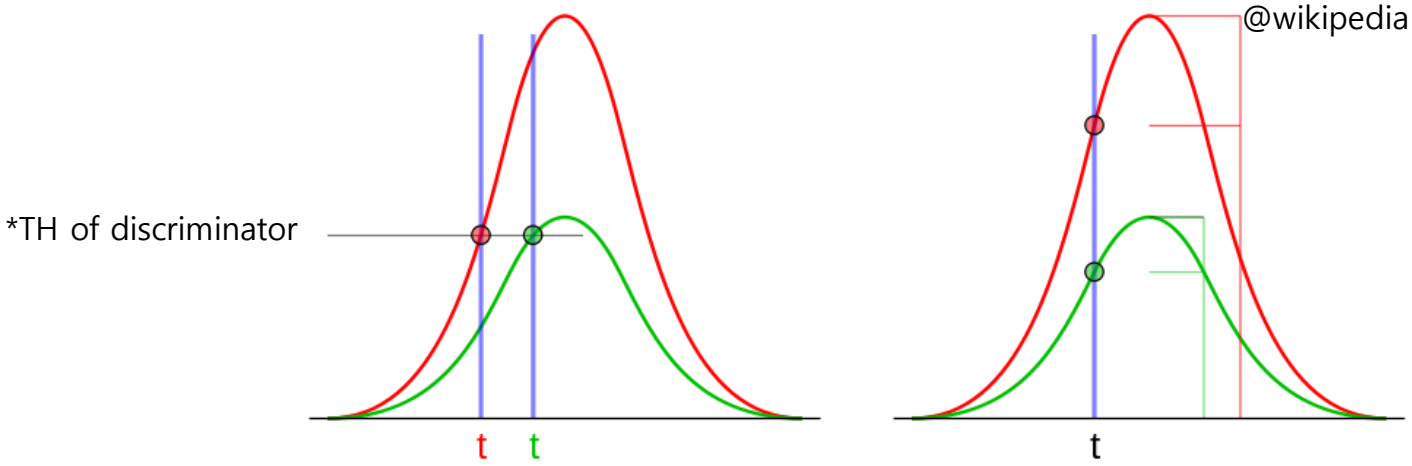
■ TOF electric logic with TDC and ADC



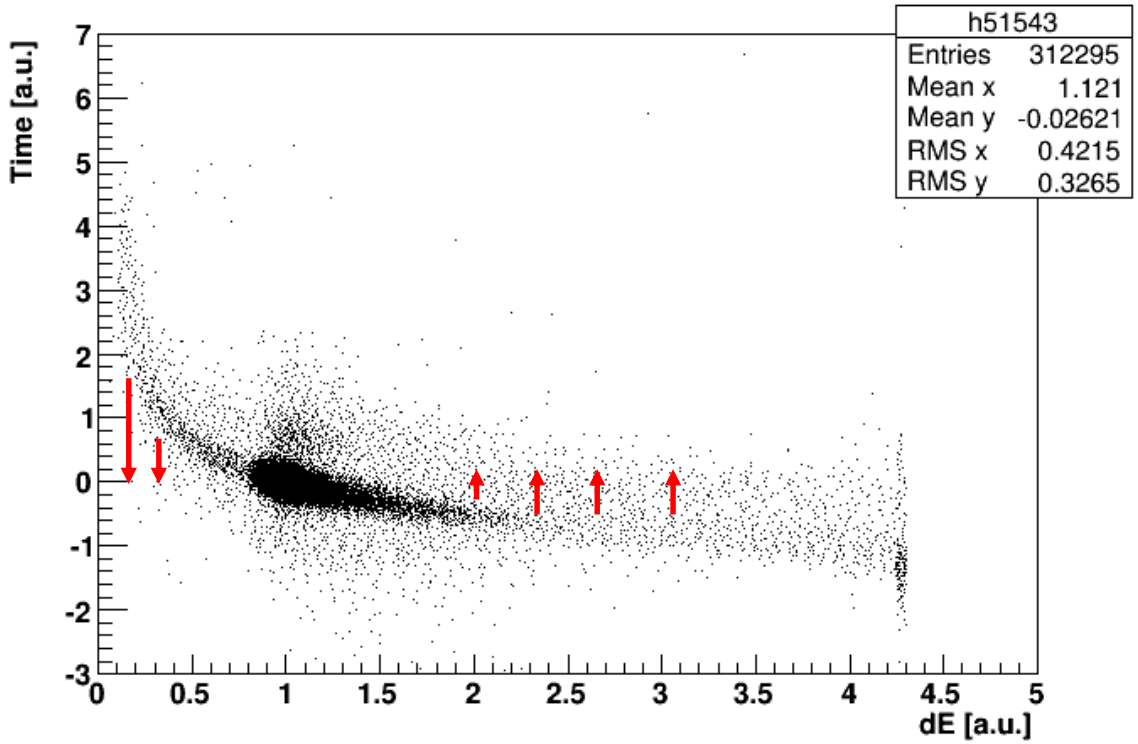
■ Time walk correction



In discriminator case,
timing depends on pulse size
→Time walk correction is required.

Same timing at same height fraction
*constant fraction discriminator

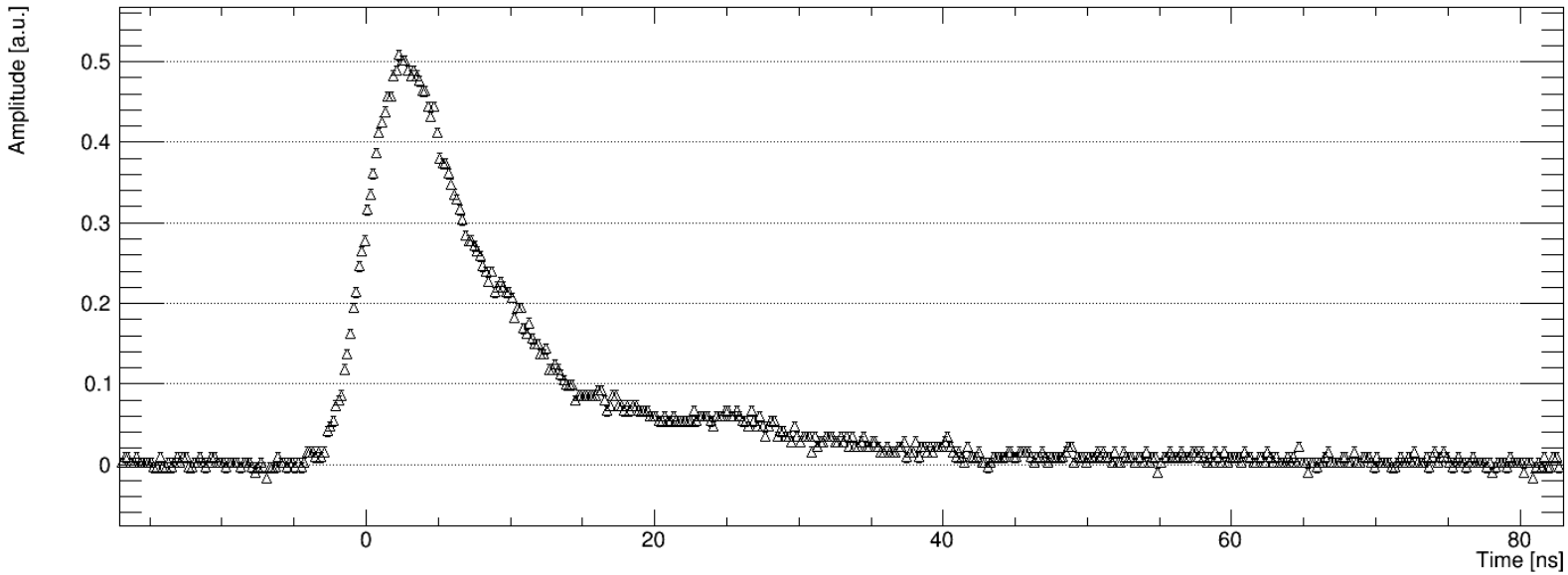
Ex) TOF at J-PARC SKS



*For FADC, timing independent of pulse size can be determined.

■ Pulse shape of plastic scintillator and PMT

#By using oscilloscope, sampling every 200 ps



*Error of time: +-100 ps

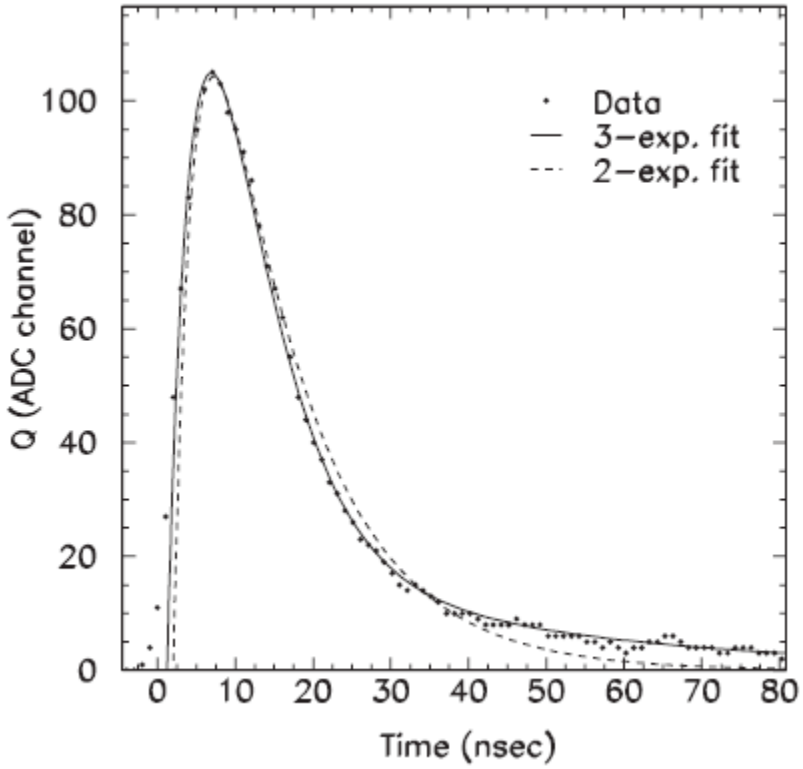
*Error of amplitude: +-0.006 a.u.

■ Fit functions to represent the pulse shape

1. Exponential functions

→ Used to represent signals from RC circuits

→ $F(x) = A\left(e^{-(t-t_0)/a} - e^{-(t-t_0)/b}\right) + Be^{-(t-t_0)/c}$

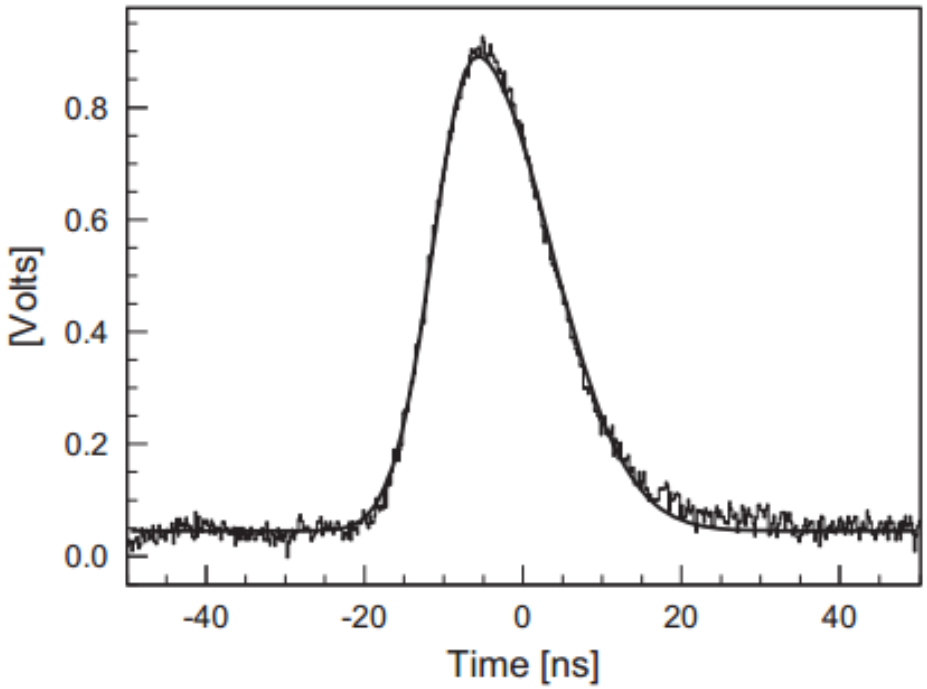


*NIM A 490 (2002) 299.

2. Bifurcated Gaussian

→ Powerful to fit edge regions

→ $F(x) = Ae^{-\frac{(t-t_p)^2}{2\sigma_k^2}} + B; k = \begin{matrix} 1 & t < t_p \\ 2 & t \geq t_p \end{matrix}$



*NIM A 622 (2010) 225.

3. Landau function

→ FTOF at CLAS12

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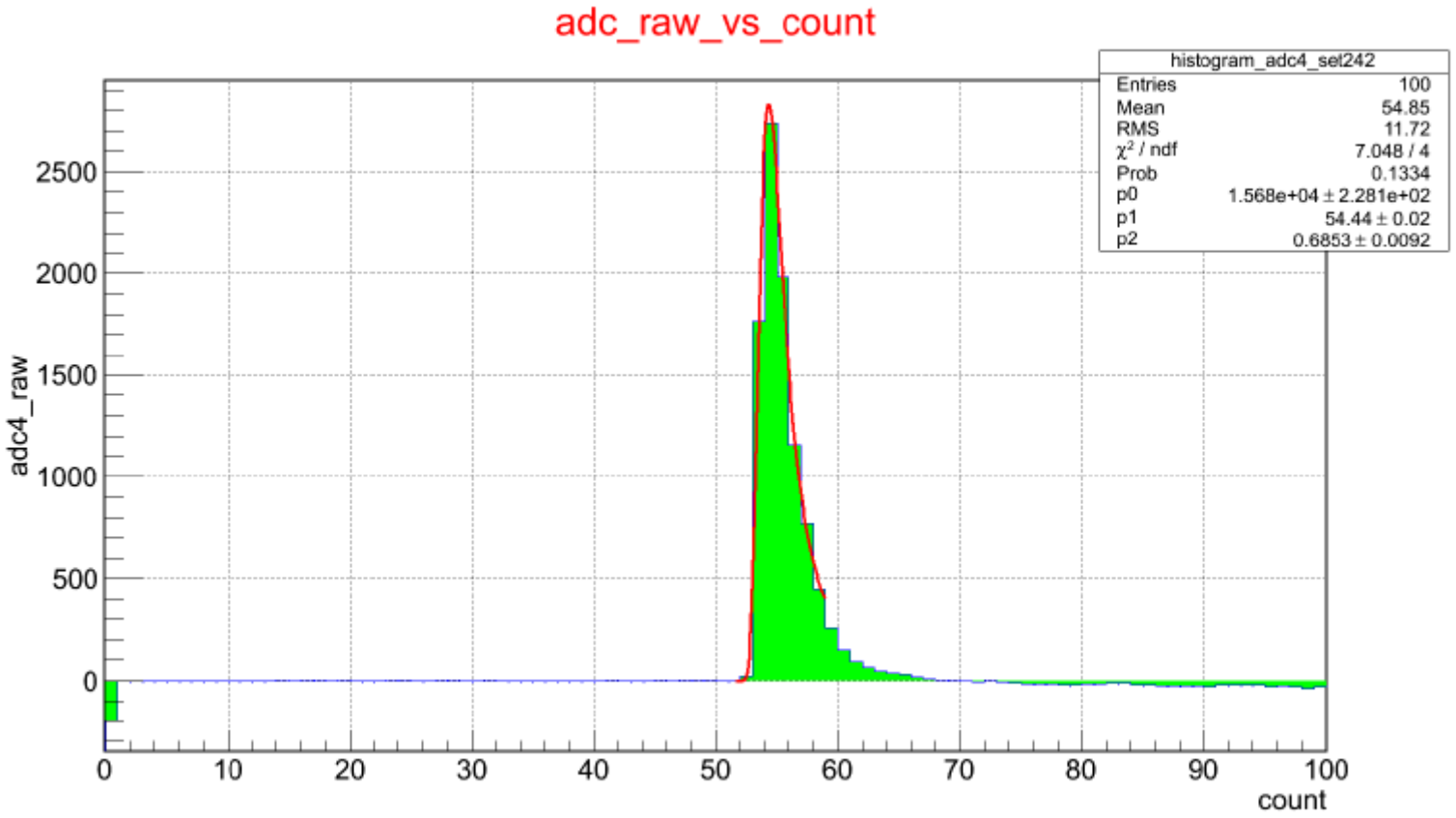
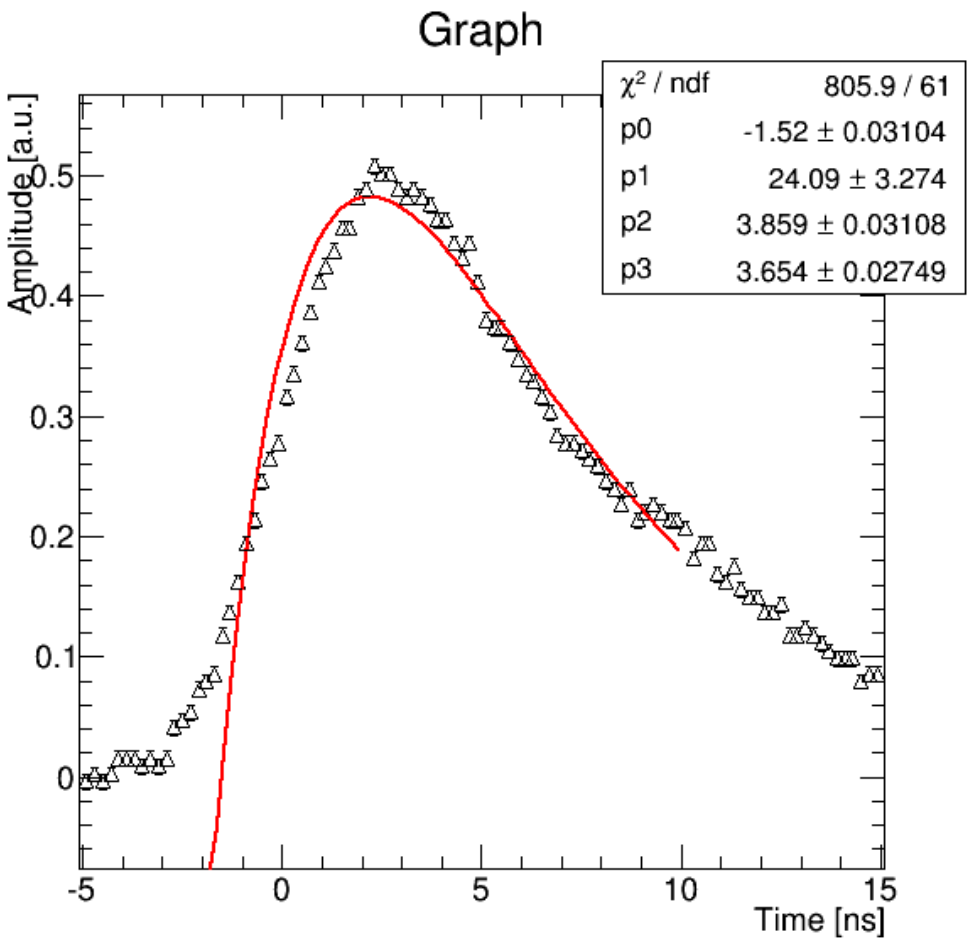


*S. Chaudhuri, University of South Carolina

■ Fit by using various functions

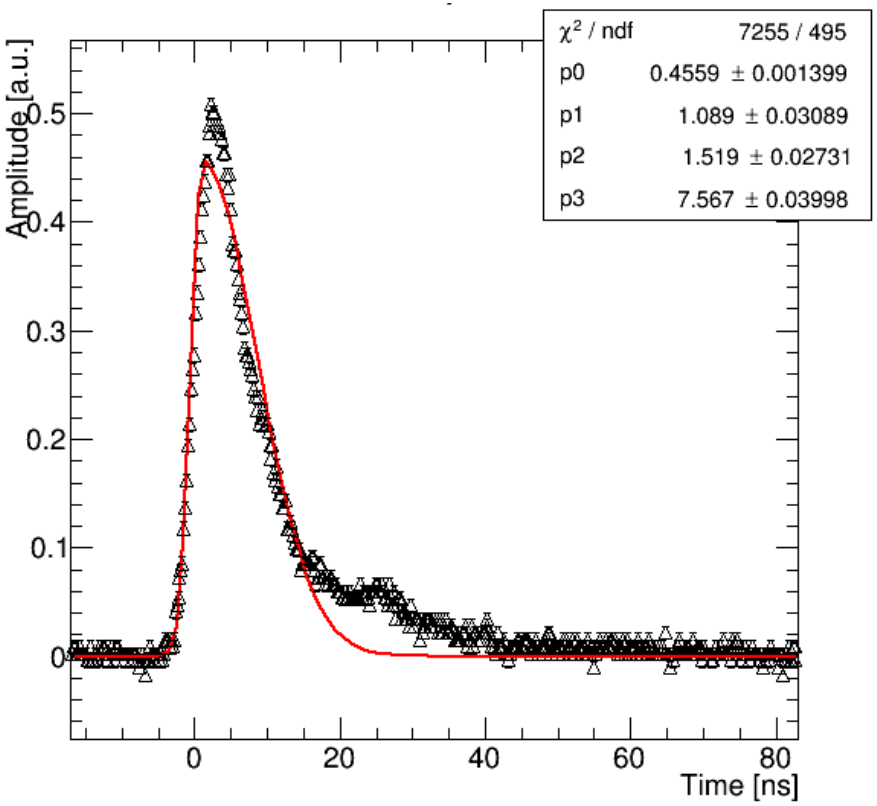
1. Two exponential function



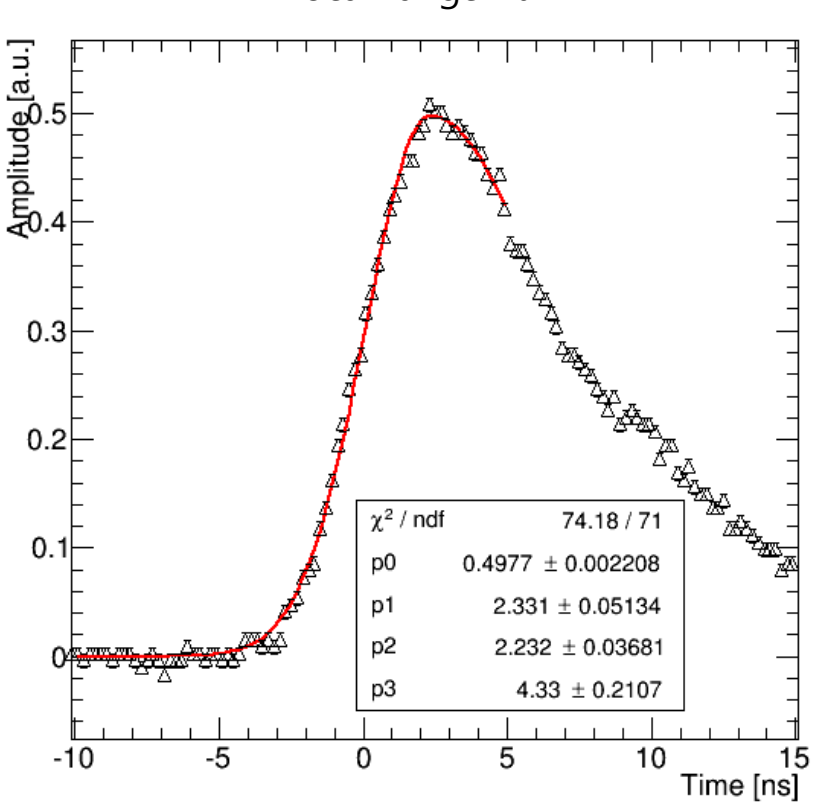
→ Not matched well.

2. Bifurcated Gaussian

Wide range fit



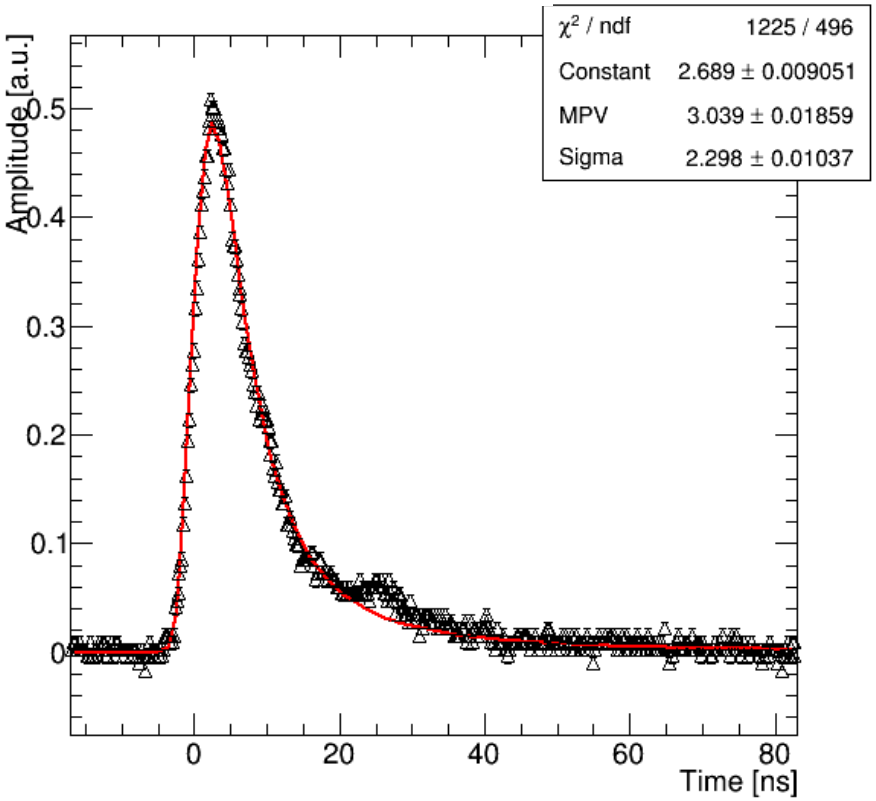
Local range fit



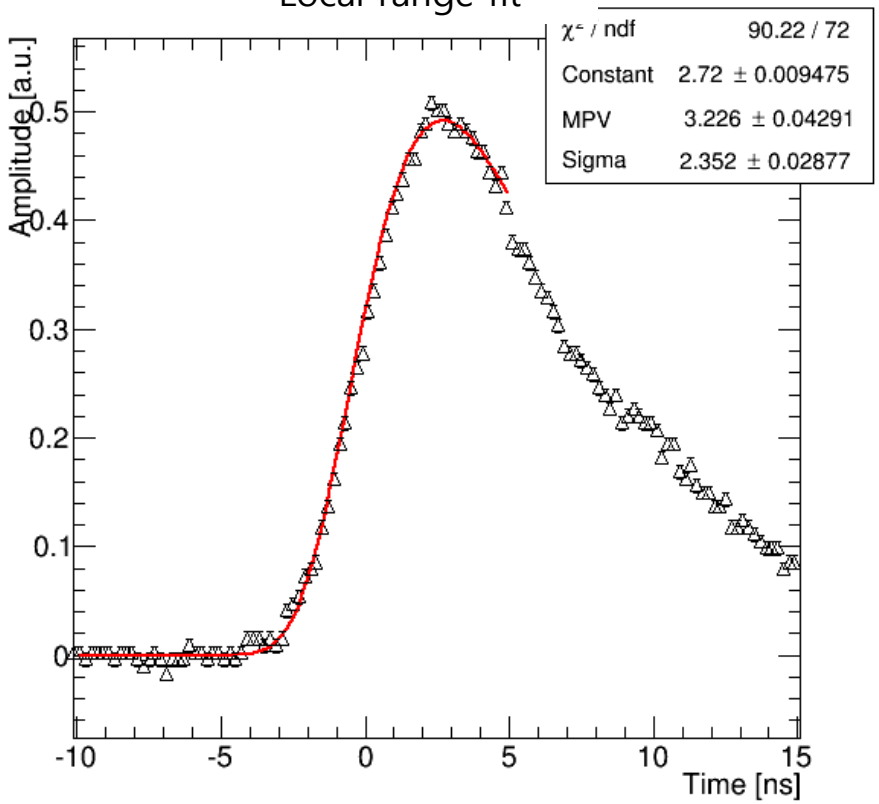
→ Not good for charge integration, but excellent for rising time analysis.

3. Landau function

Wide range fit



Local range fit



→ Good for charge integration and rising time analysis.

1. Bifurcated Gaussian and Landau functions can be used for determining TOF timing.

2. Next step

   → Compare timing resolution, when using each functions.