# CsI(Tl) Waveform Model Development

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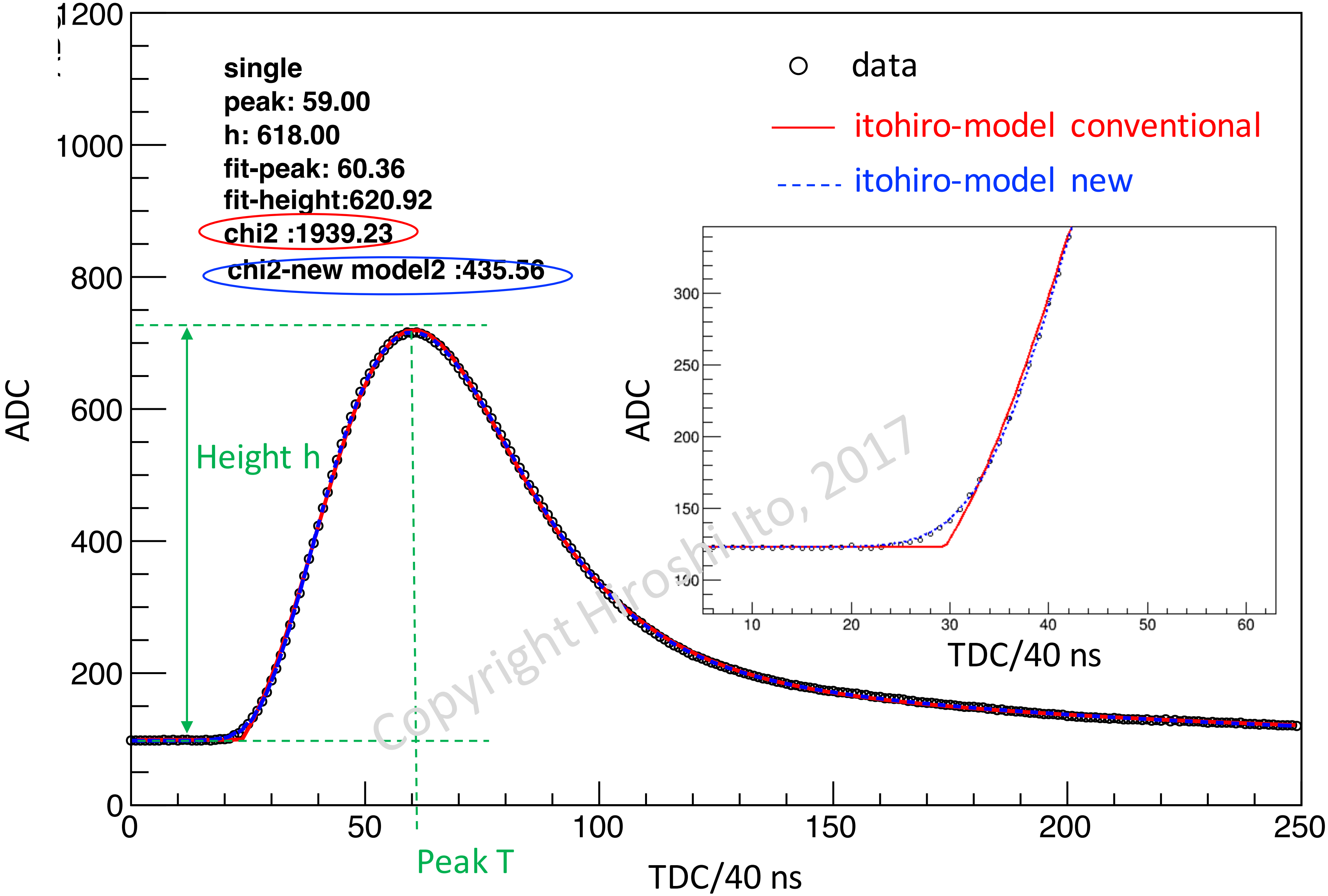
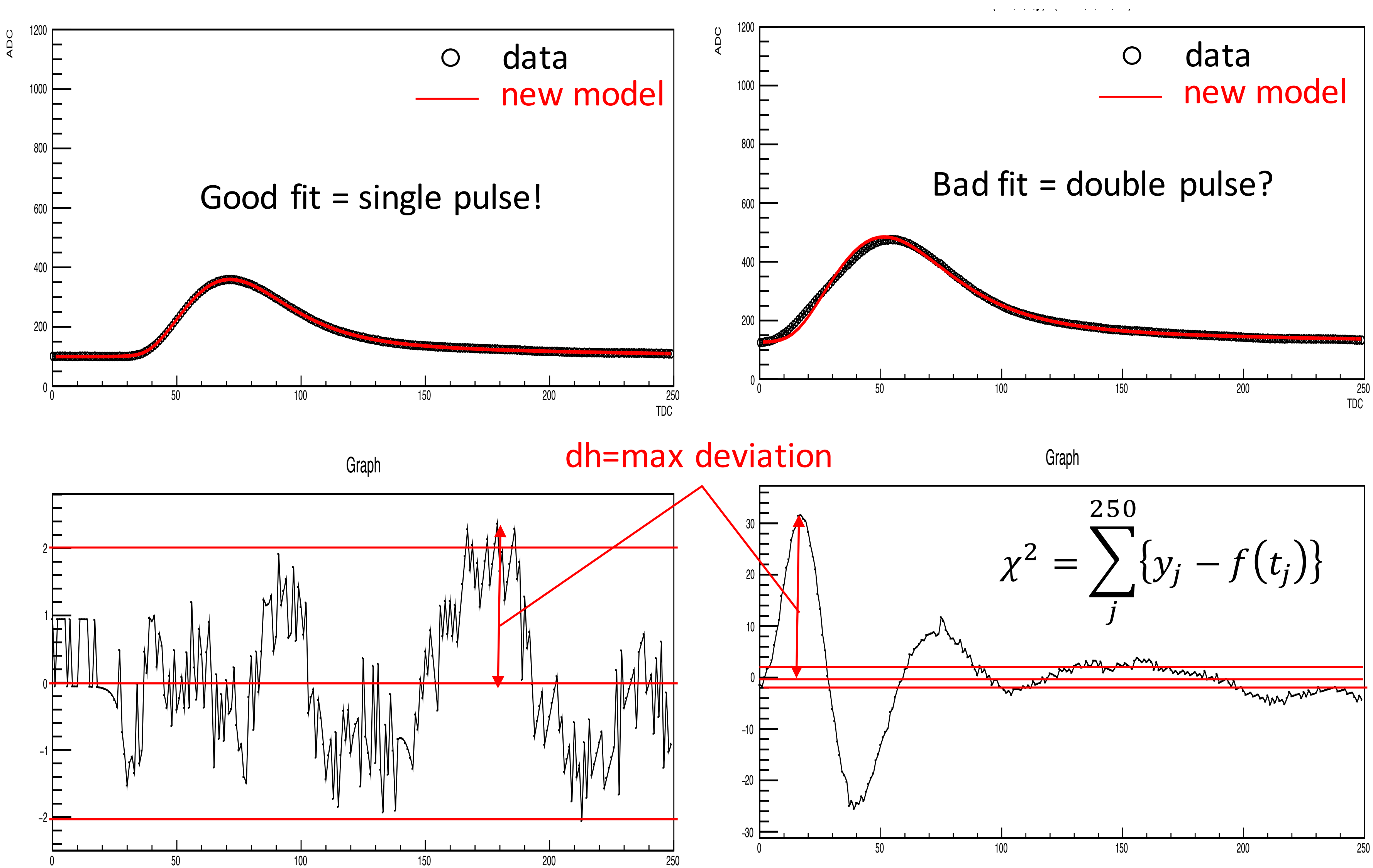
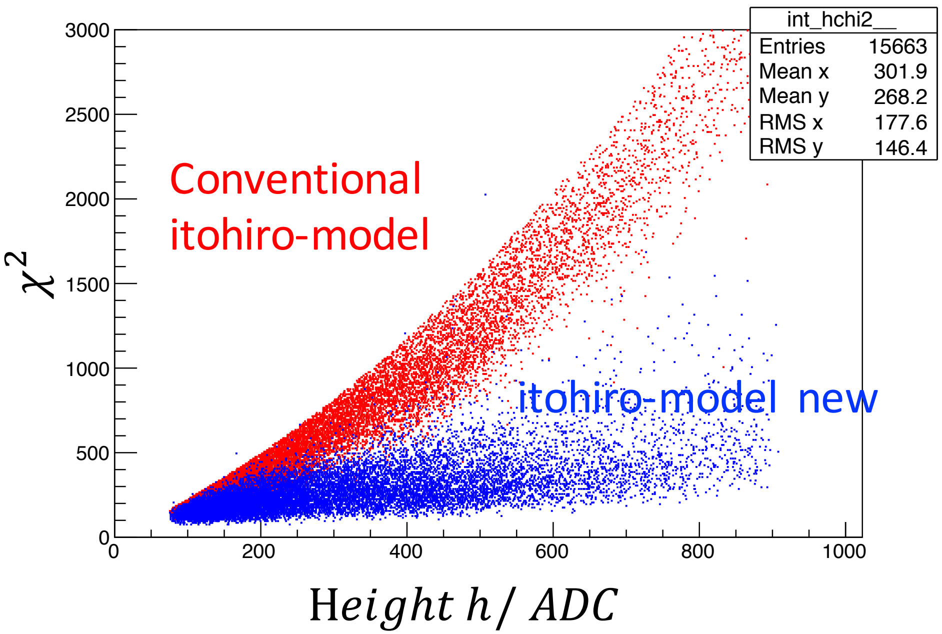
# CsI(Tl) Waveform Fitting

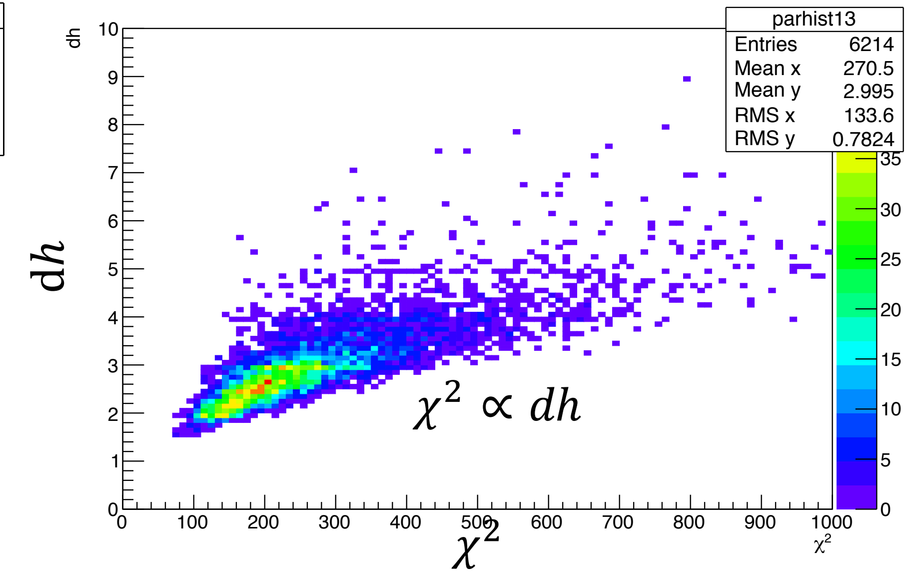


# Deviation with the fitting function and data



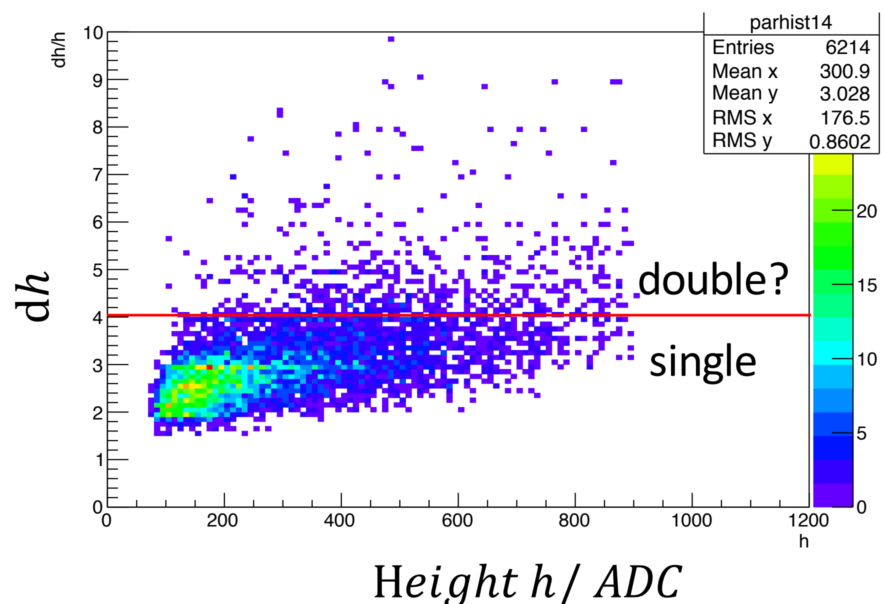
# Single Pulse by Conventional Model



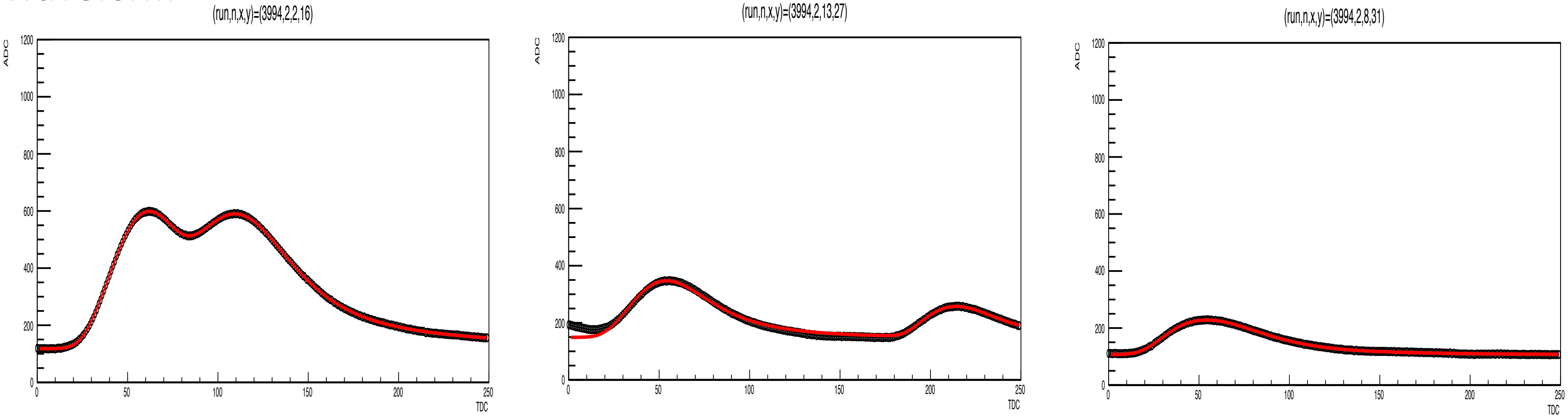

double pulse threshold

$dh > 4$

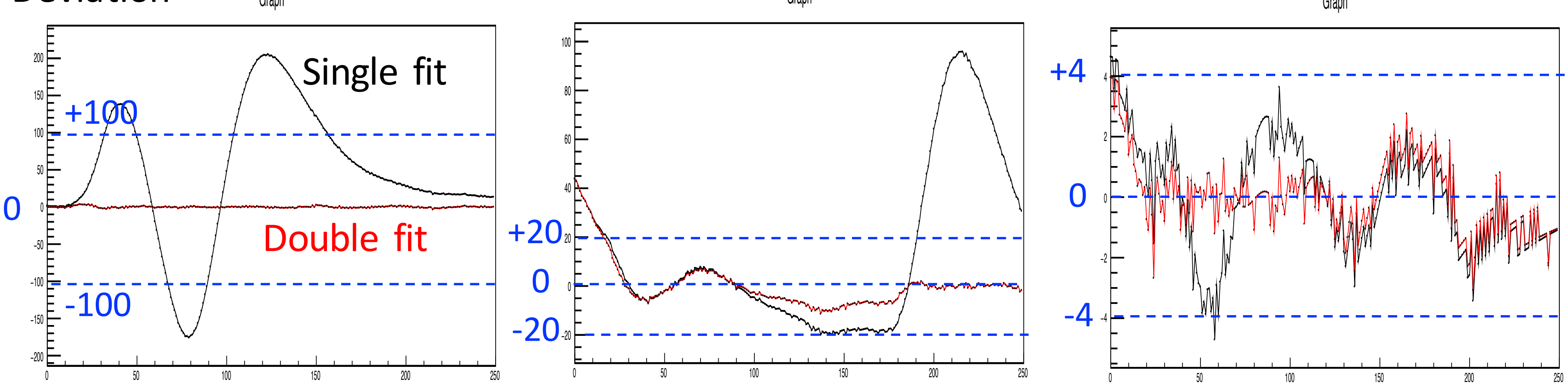


# Double pulse Fitting

Waveform

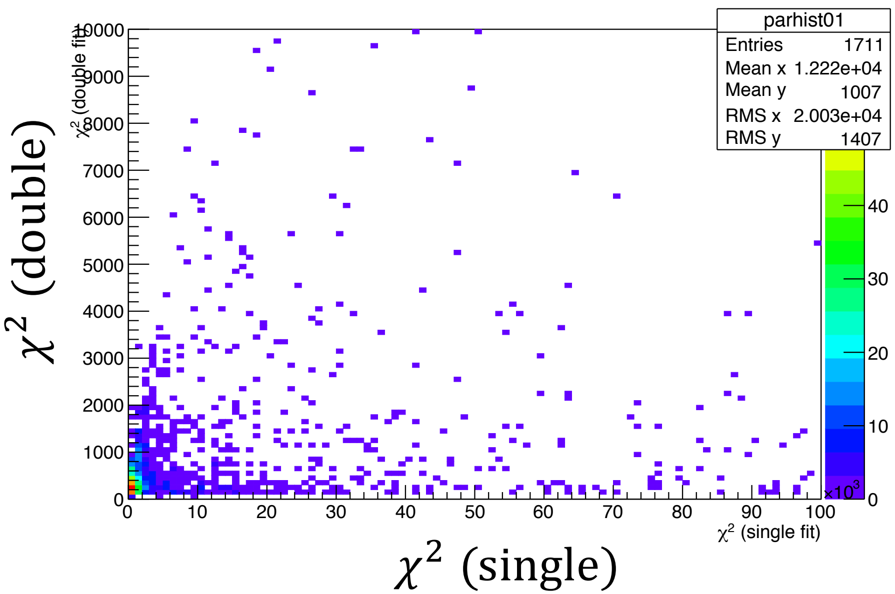


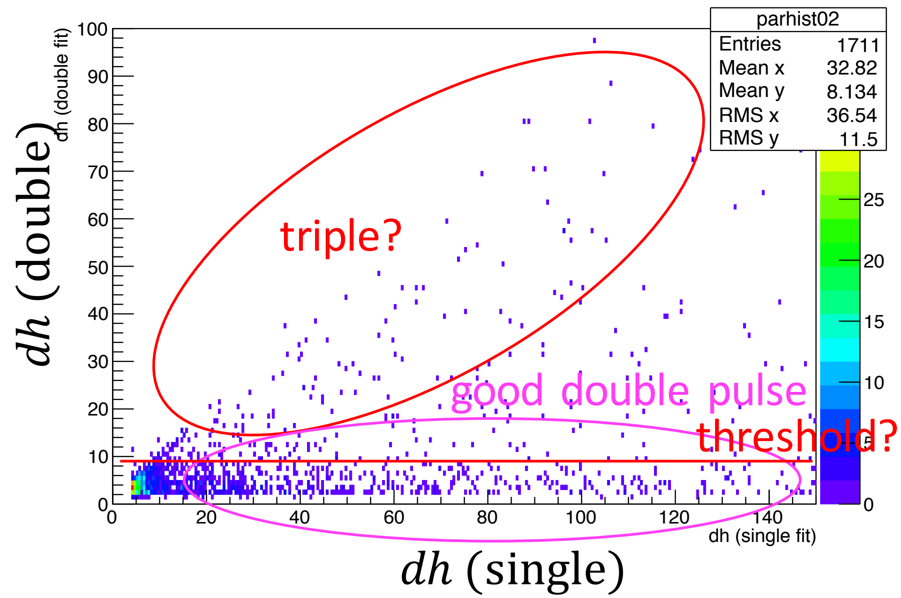

Deviation

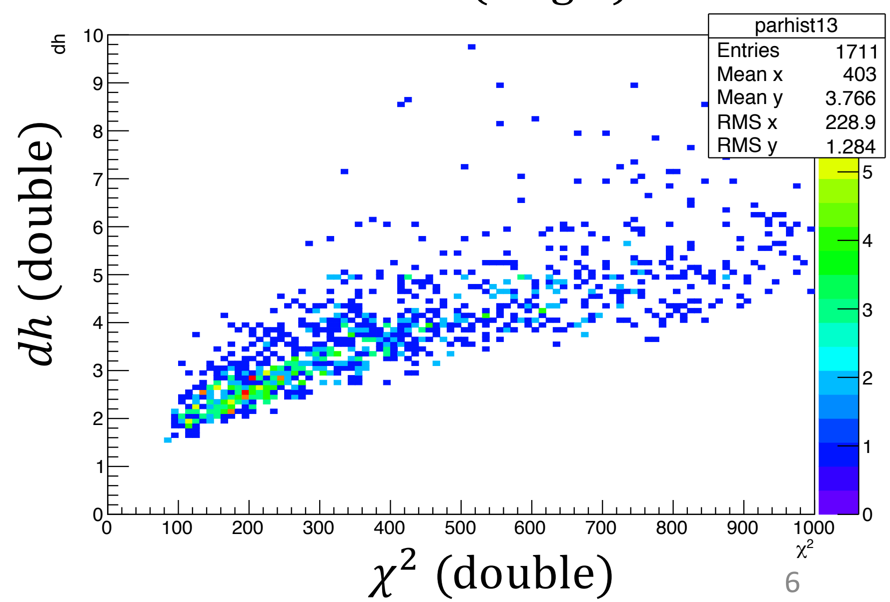



| | | |
|---|---|---|
| Single fit × | Single fit × | Single fit △ |
| Double fit ◯ | Double fit × | Double fit △ |
| =>Double pulse | T=>riple pulse | =>Single pulse? |

# New Model Fitting function



# Summary

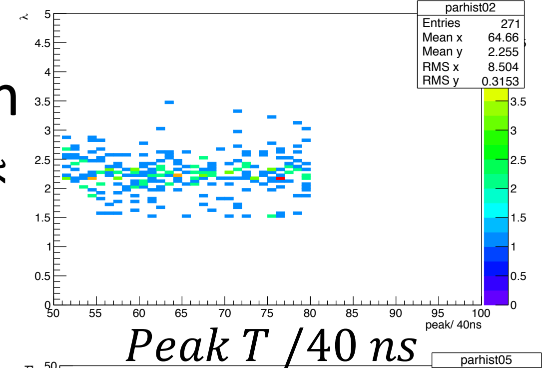
- New waveform model was developed, its $\chi^2$ is lower than conventional model.
- The new model has not stepping term.
- Good fit can be identified by determination as max of the deviation (dh) less than 4.
- The model was imported to KEKCC based Fortran.
- Time resolution and energy calibration will be performed for new model.

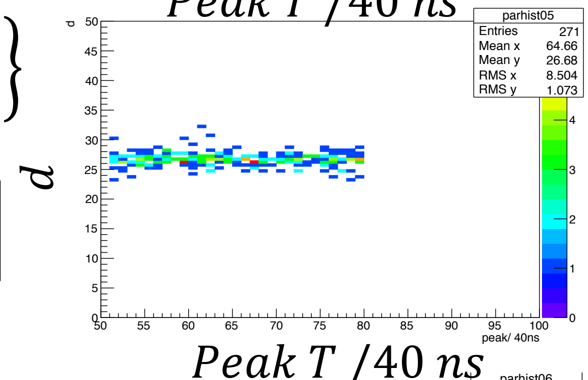
Backup

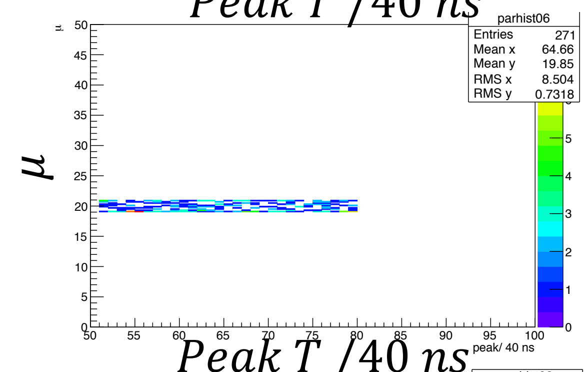
# New Model Fitting function

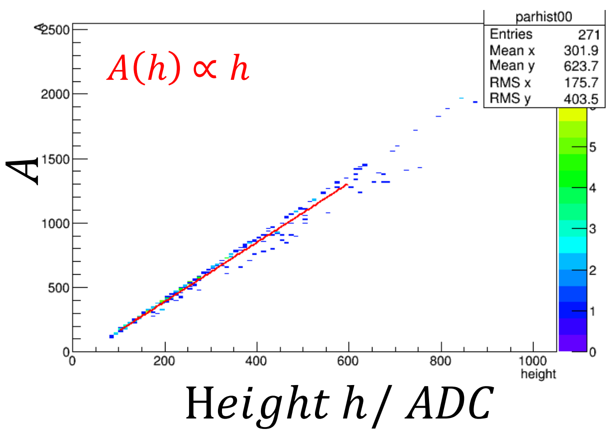
$$F(t) = \frac{A}{1 - \exp\left(-\frac{t-t_0}{\lambda}\right)} \cdot Freq\left(\frac{t-t_0-d}{\mu}\right) \cdot$$

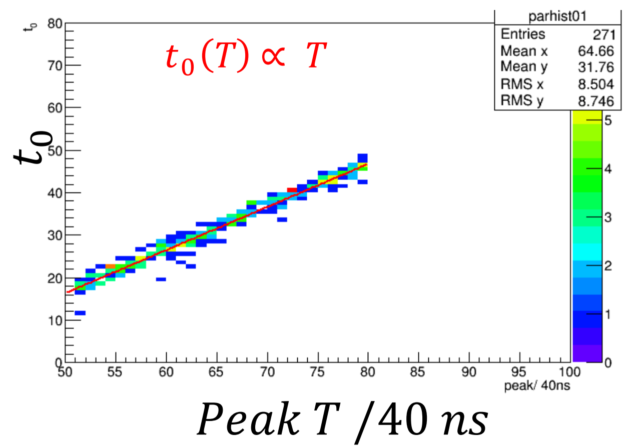
$$\left\{\frac{t-t_0}{\tau_1}\exp\left(1-\frac{t-t_0}{\tau_1}\right) + \varepsilon\frac{t-t_0}{\tau_2}\exp\left(1-\frac{t-t_0}{\tau_2}\right)\right\}$$

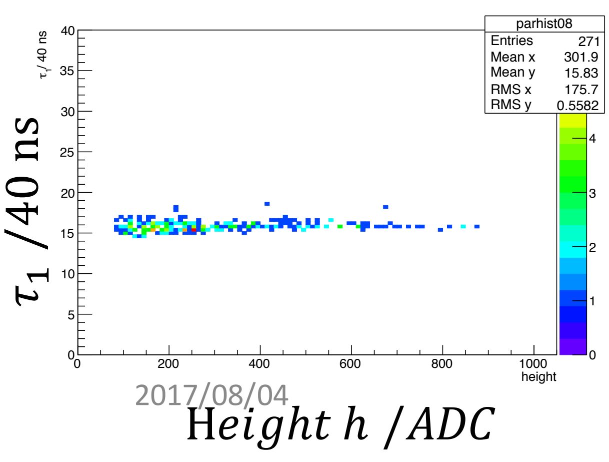


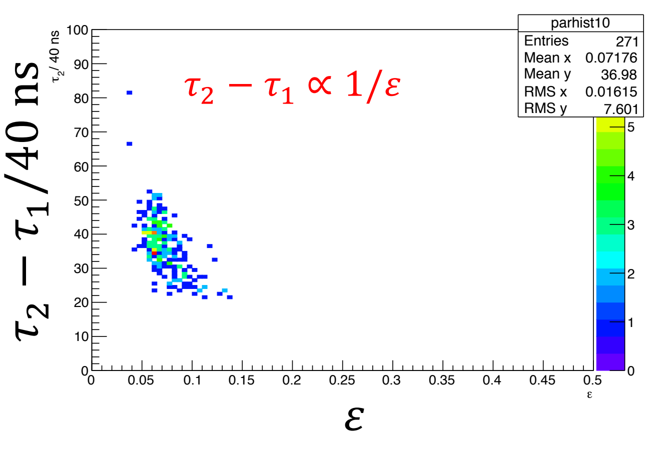



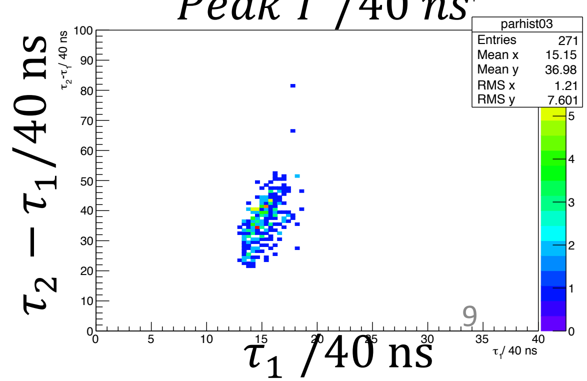



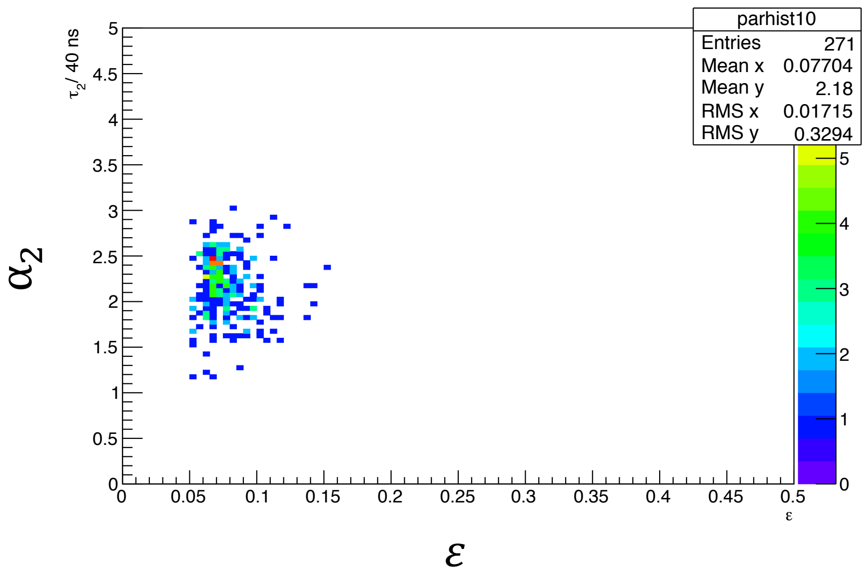



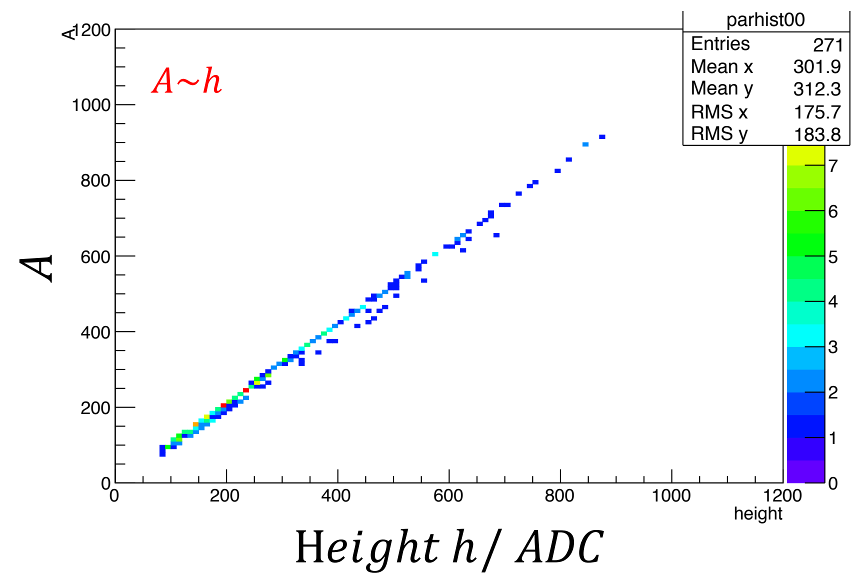
# New Model Fitting function

$$F(t) = \frac{\tilde{A}\,(A,h)}{1-\exp\left(-\frac{t-t_0(T)}{\lambda}\right)} \cdot Freq\left(\frac{t-t_0(T)-d}{\mu}\right) \cdot$$

$$\left\{\frac{t-t_0(T)}{\tau_1}\exp\left(1-\frac{t-t_0(T)}{\tau_1}\right)+\varepsilon\,\frac{t-t_0(T)}{\tau_2(\varepsilon,\alpha_2)}\exp\left(1-\frac{t-t_0(T)}{\tau_2(\varepsilon,\alpha_2)}\right)\right\}$$

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



$$F(t) = \frac{A}{1-\exp\left(-\frac{t-t_0}{\lambda}\right)} \cdot Freq\left(\frac{t-t_0-d}{\mu}\right) \cdot$$

$$\left\{\frac{t-t_0}{\tau_1}\exp\left(1-\frac{t-t_0}{\tau_1}\right)+\varepsilon\frac{t-t_0}{\tau_2}\exp\left(1-\frac{t-t_0}{\tau_2}\right)\right\}$$

$t=t_0$の場合の発散問題

$$\frac{t-t_0}{1-\exp\left(-\frac{t-t_0}{\lambda}\right)}$$

$$\frac{x}{1-e^x} = \frac{x}{1-\left\{1-x+\frac{x^2}{2!}-\frac{x^3}{3!}\right\}}$$

$$= 1$$