

Status Report #5

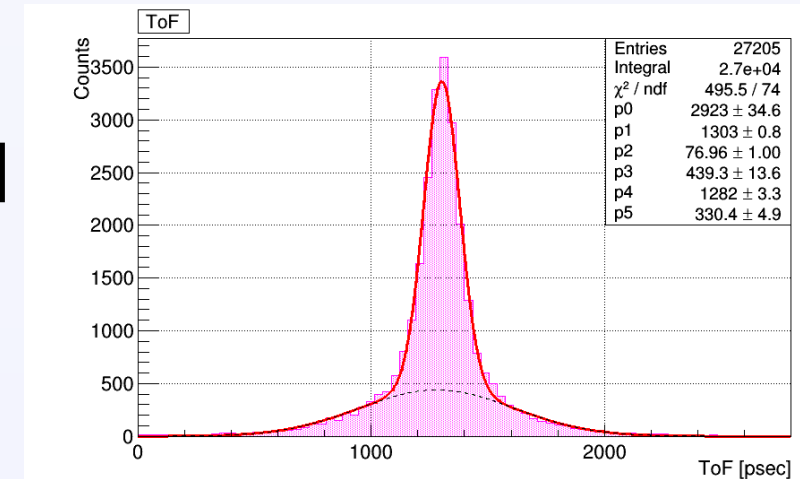
What I have done

- ROOT&G4 Seminar
- Evaluate timing resolution MPPC

2019.11.22 (Fri)

B4 FUJIWARA Tomomasa

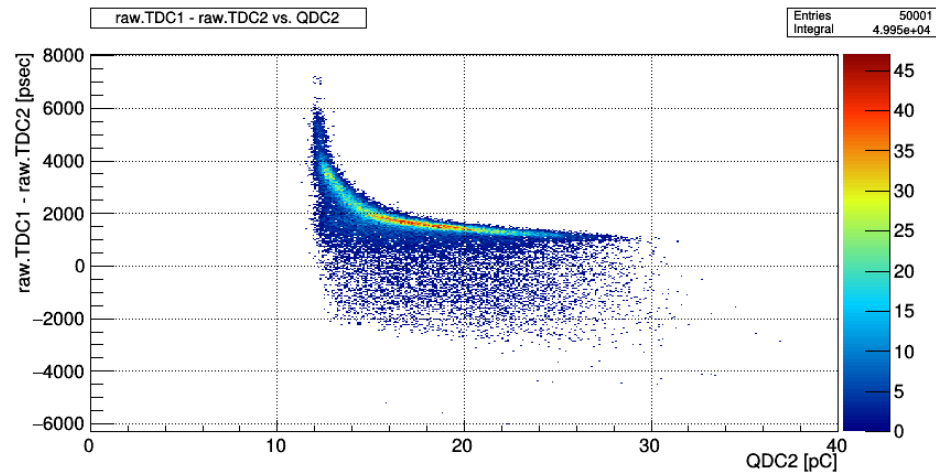
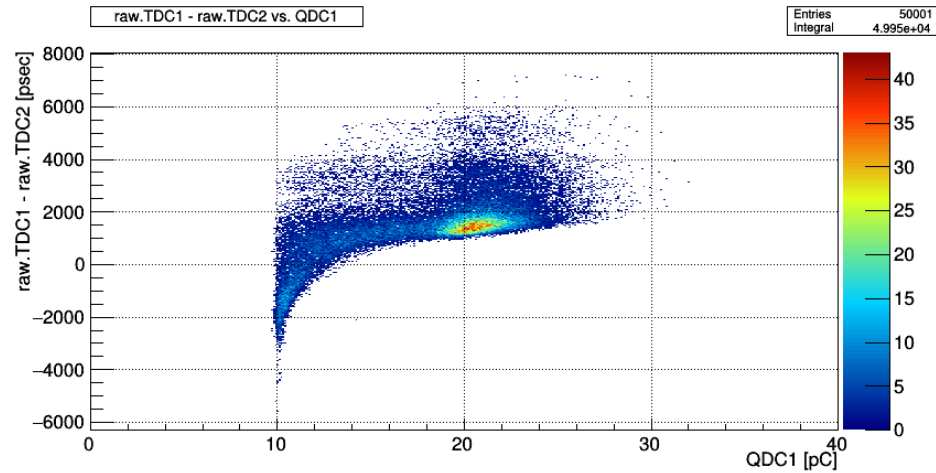
- analyze timing resolution of MPPC under different conditions
 - Focus on value of " V_b "
- Before: beta0046(data) & 0047(Pedestal) $\Rightarrow V_b = 47.7$ [V]
- This time :
 - $V_b = 41.7V$ (0042 & 0043)
 - $V_b = 44.7V$ (0044 & 0045)
 - $V_b = 50.7V$ (0049 & 0048)
 - $V_b = 53.7V$ (0050 & 0051)



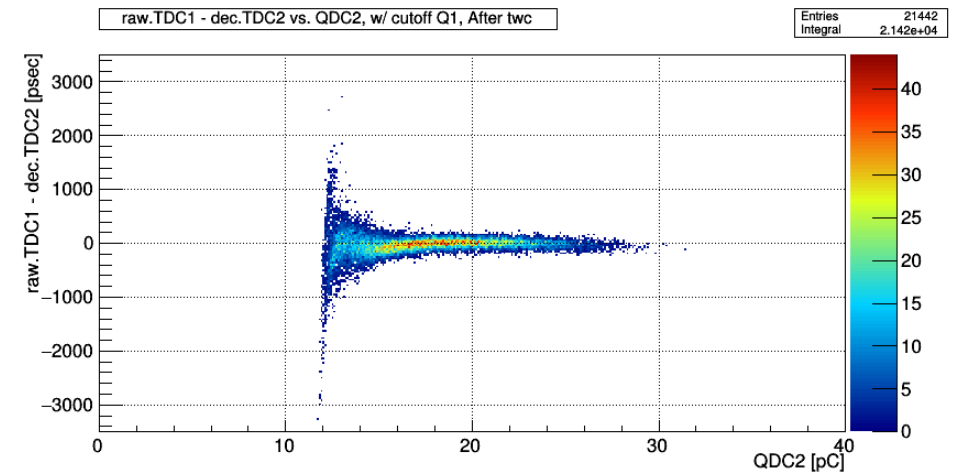
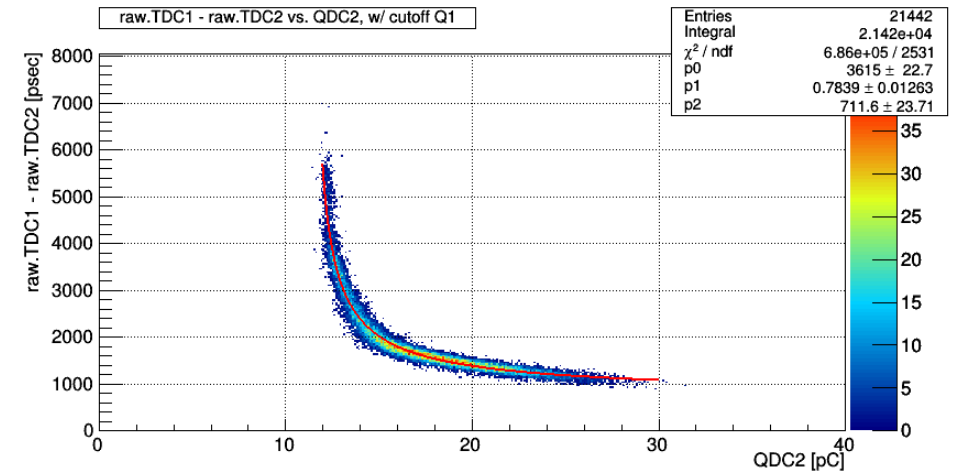
$$\sigma_{\text{MPPC}} = 54 \text{ psec}$$

Evaluate timing resolution MPPC: case of $V_b = 44.7V$ 3

↓ $(r.T1 - r.T2)$ vs. Q1&Q2



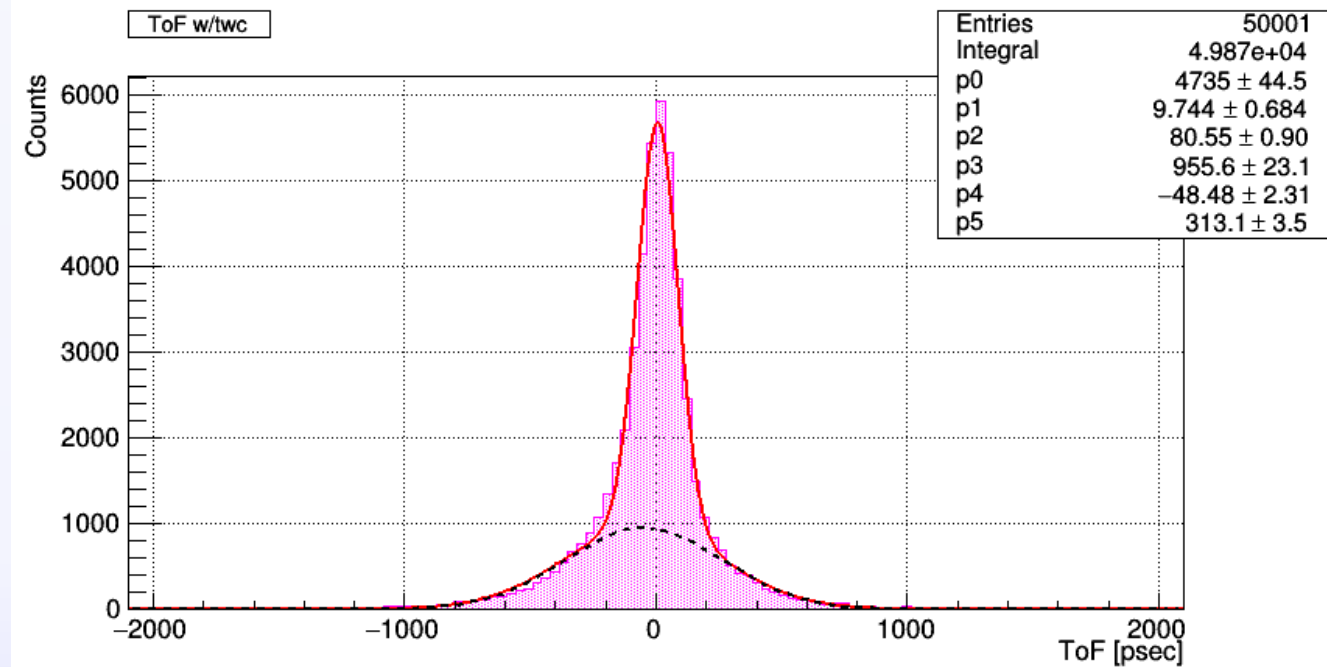
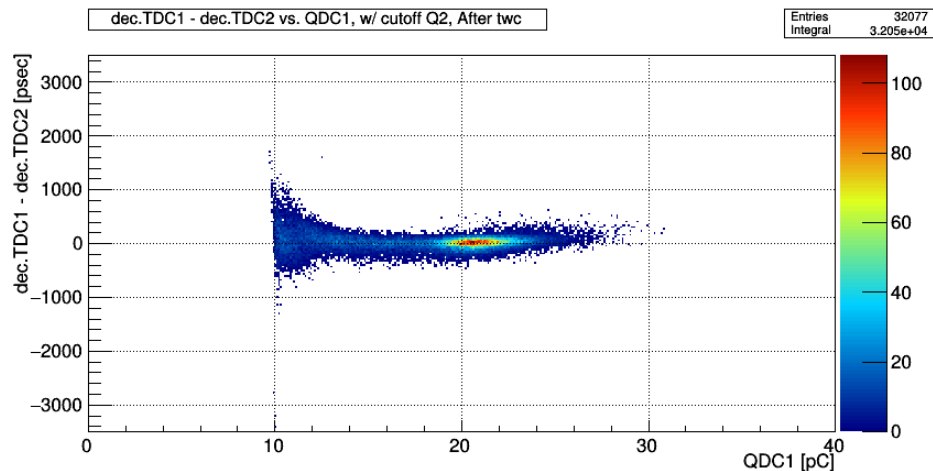
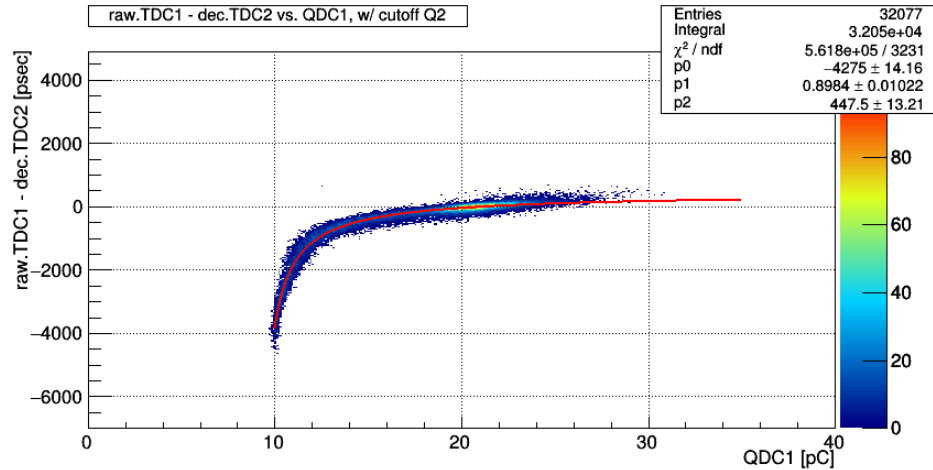
Cutoff: $18.7 < Q1$ [pC] < 22.4 , after twc



Evaluate timing resolution MPPC: case of $V_b = 44.7V$ 4

- Cutoff: $14.0 < Q2 \text{ [pC]} < 22.7$

- Result: ToF dist.



$$V_b = 44.7V$$

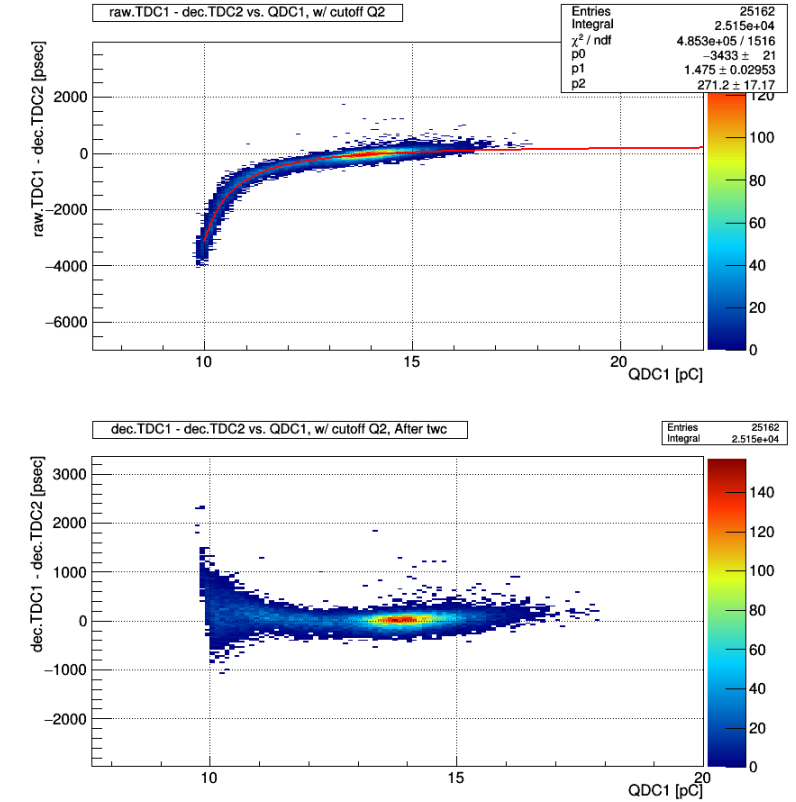
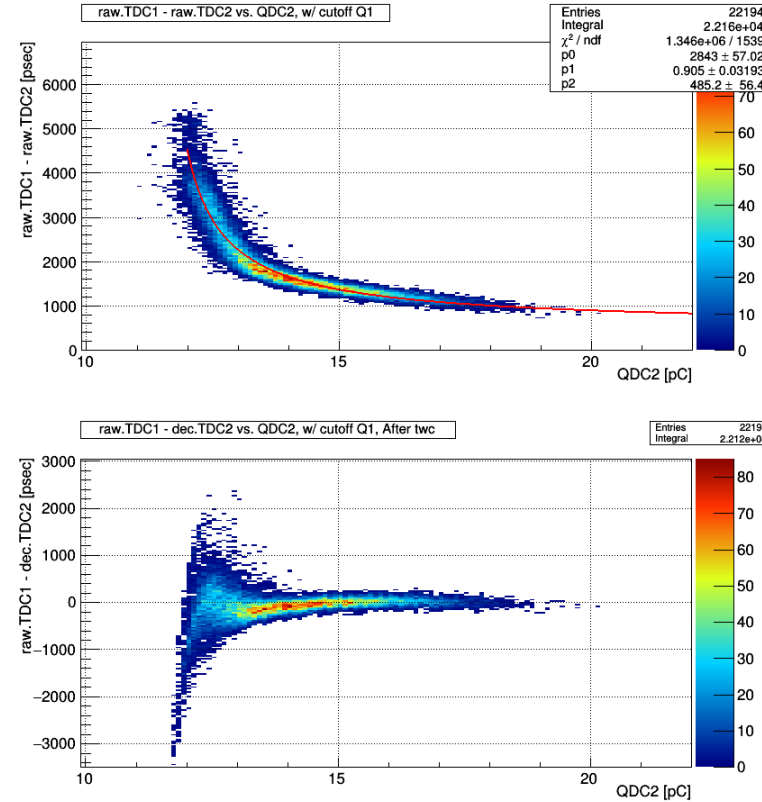
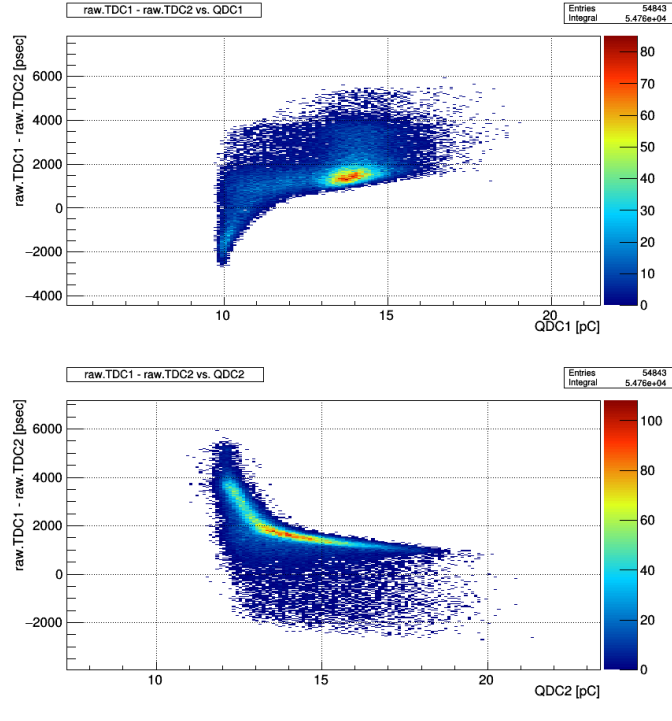
$$\sigma_{\text{ToF}} = 81 \text{ [psec]}$$

$$\Rightarrow \sigma_{\text{MPPC}} = 57 \text{ [psec]}$$

Evaluate timing resolution MPPC: case of $V_b = 41.7V$ 5

- ↓ $(r.T1 - r.T2)$ vs. Q1&Q2

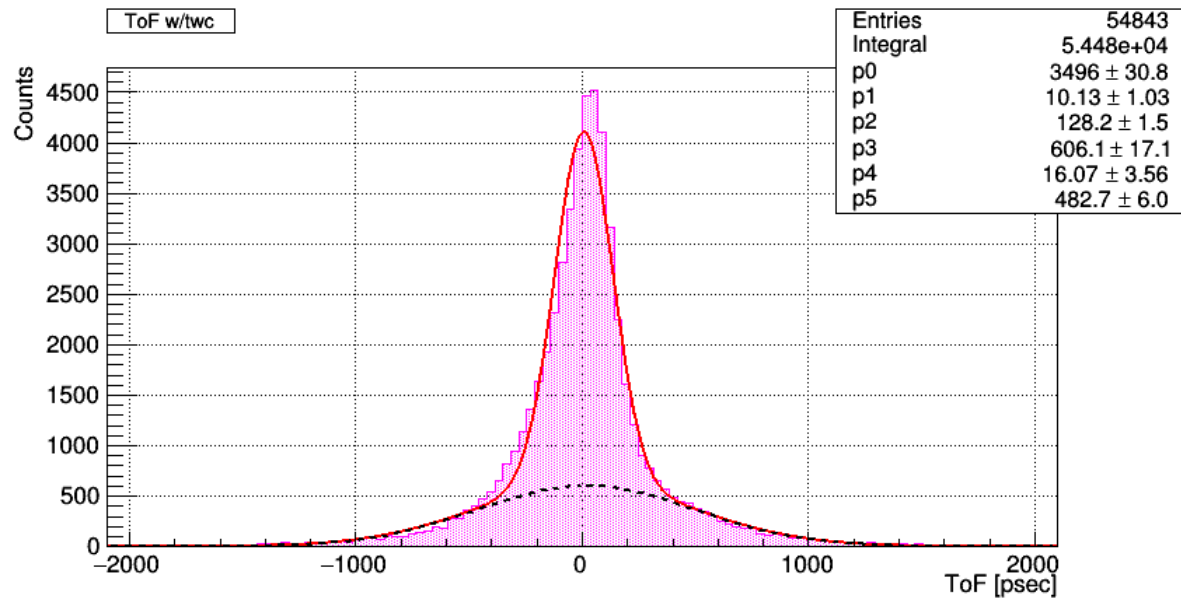
After Q1 selection



Evaluate timing resolution MPPC: case of $V_b = 41.7V$

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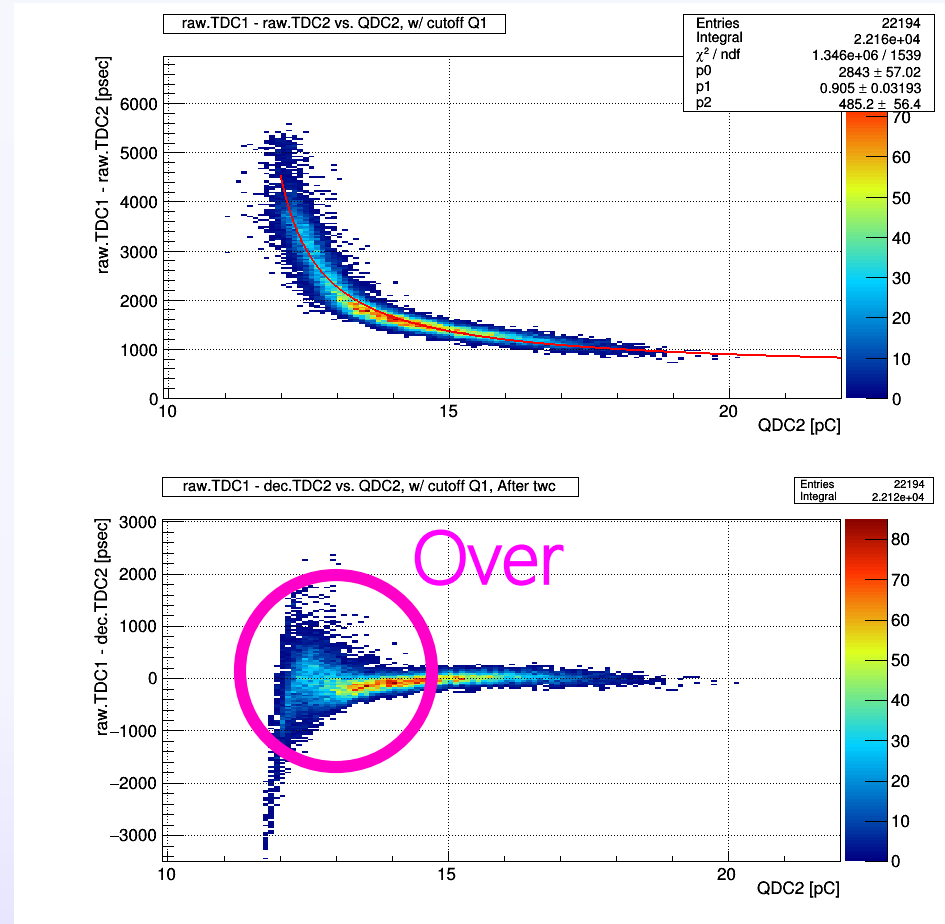
- Result: ToF dist.



$$V_b = 41.7V$$

$$\sigma_{\text{ToF}} = 128 \pm 2 \Rightarrow 1.3 \times 10^2 [\text{psec}]$$
$$\Rightarrow \sigma_{\text{MPPC}} = 91 \pm 1.1 [\text{psec}]$$

Bad resolution... Really??



Evaluate timing resolution MPPC: case of $V_b = 41.7V$

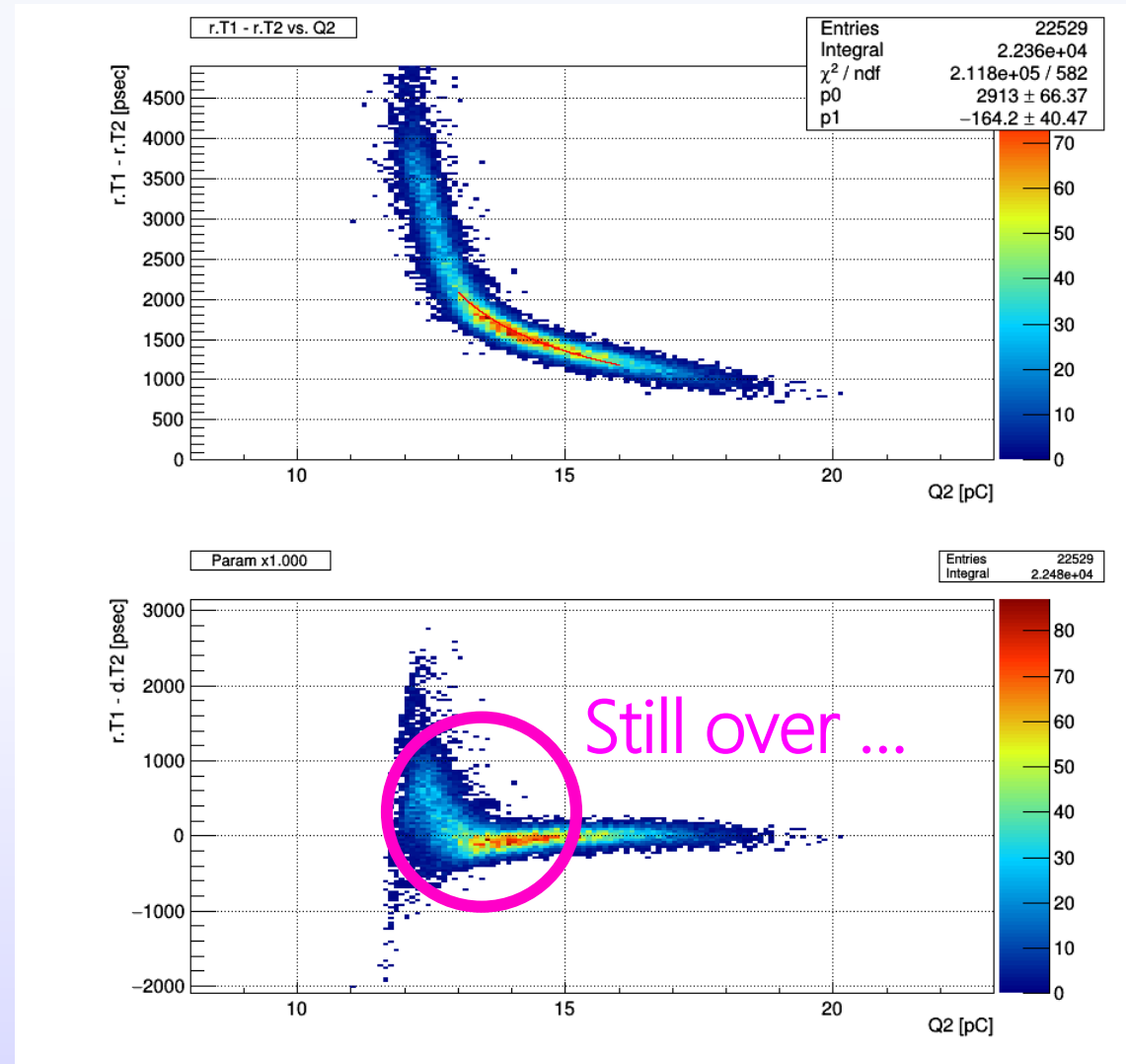
7

- Modify twc functional type:

$$f(QDC) = \frac{p_0}{\sqrt{QDC - Ped}} + p_1$$

- Constrain fit range:

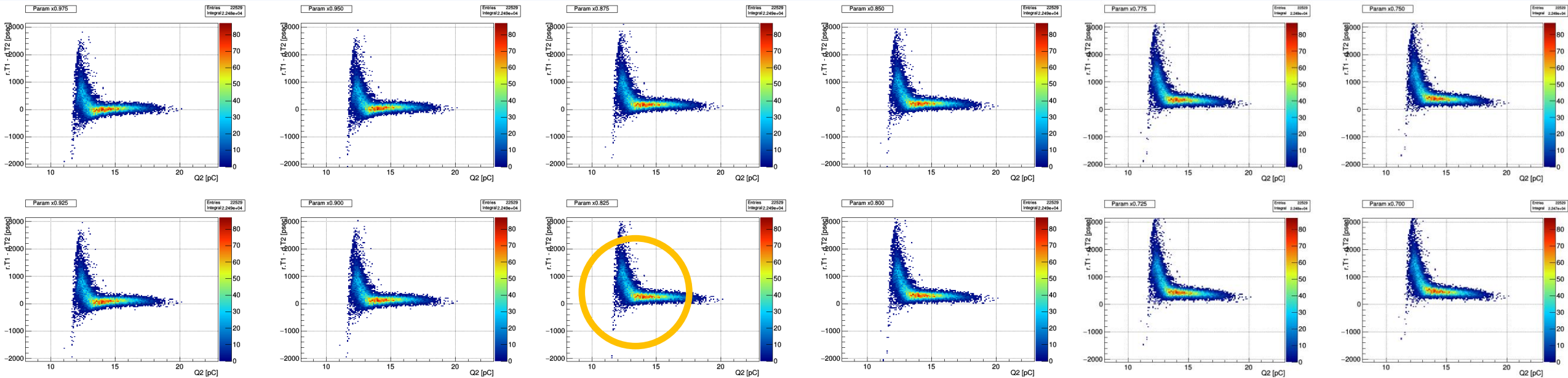
$$13.0 < Q2 \text{ [pC]} < 16.0$$



Evaluate timing resolution MPPC: case of $V_b = 41.7V$ 8

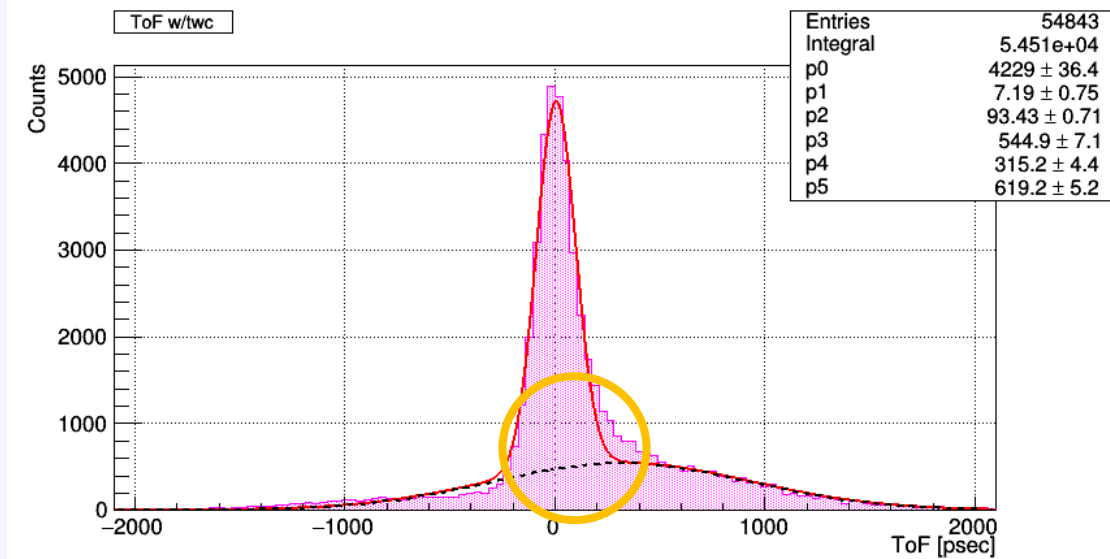
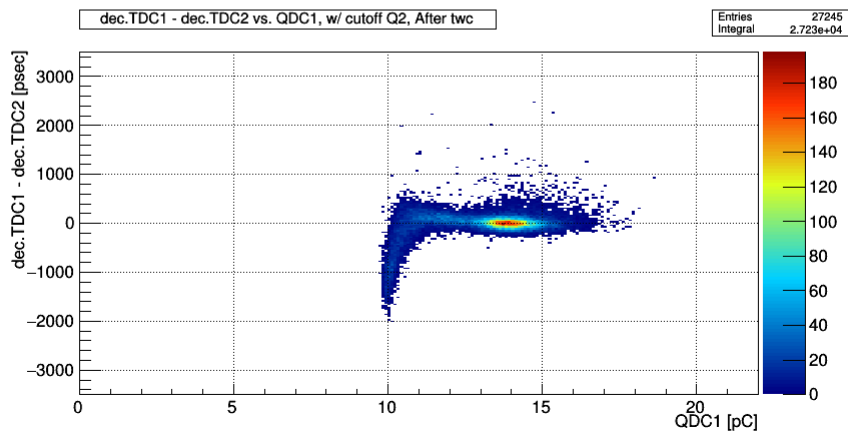
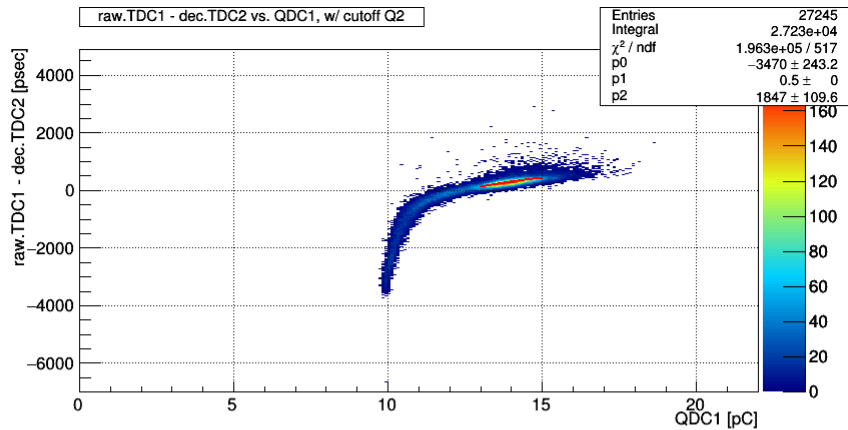
- Modify fit parameter twc function: ϵp_0
- Search good ϵ for 1.00~0.700 in step with 0.025

$$f(QDC) = \frac{p_0}{\sqrt{QDC - Ped}} + p_1$$



⇒ x0.825 is good?

Evaluate timing resolution MPPC: case of $V_b = 41.7V$ 9



Result

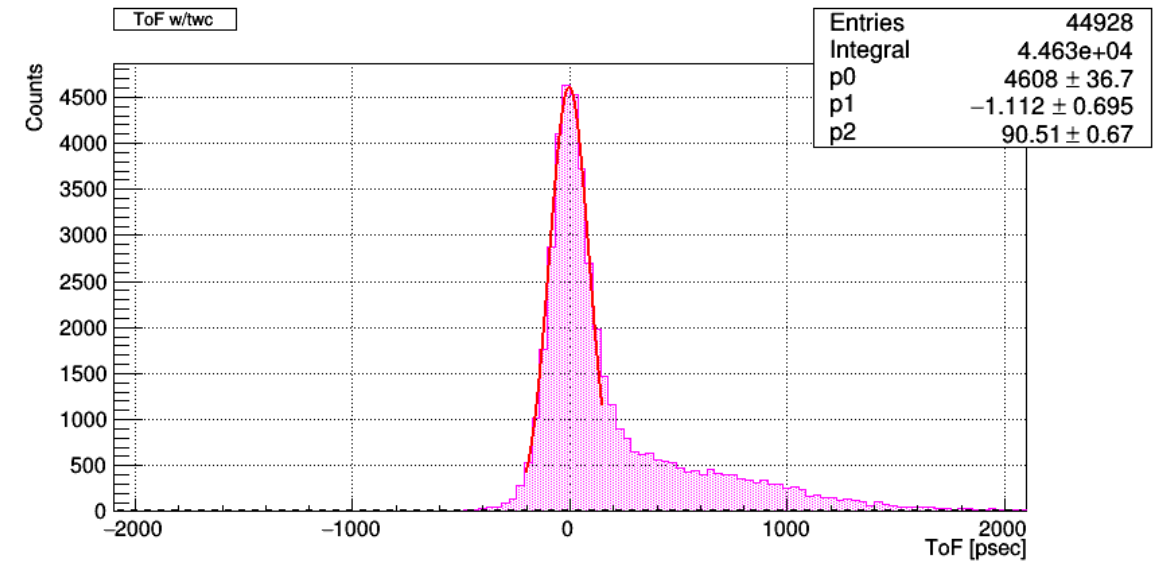
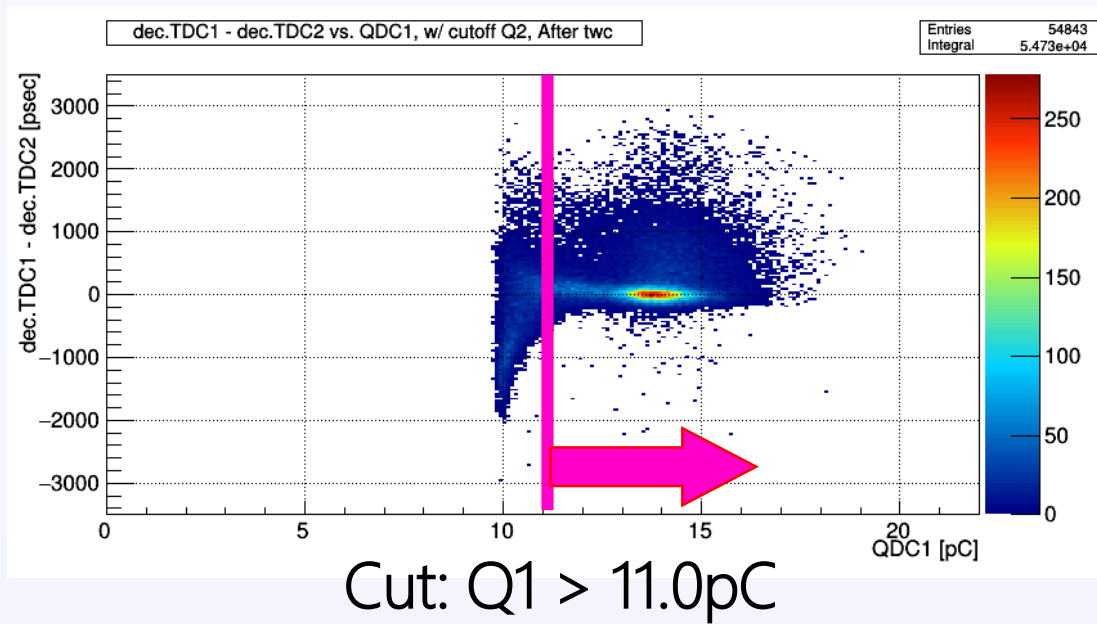
Rundata: beta0042

Fit Param x0.825

$$\sigma_{\text{ToF}} = 93.4 \pm 0.7 \text{ [psec]}$$

$$\sigma_{\text{MPPC}} = \frac{1}{\sqrt{2}} \sigma_{\text{ToF}} = 66.1 \pm 0.5 \text{ [psec]}$$

Evaluate timing resolution MPPC: case of $V_b = 41.7V$ 10



Result

Rundata: beta0042

Fit Param x0.825

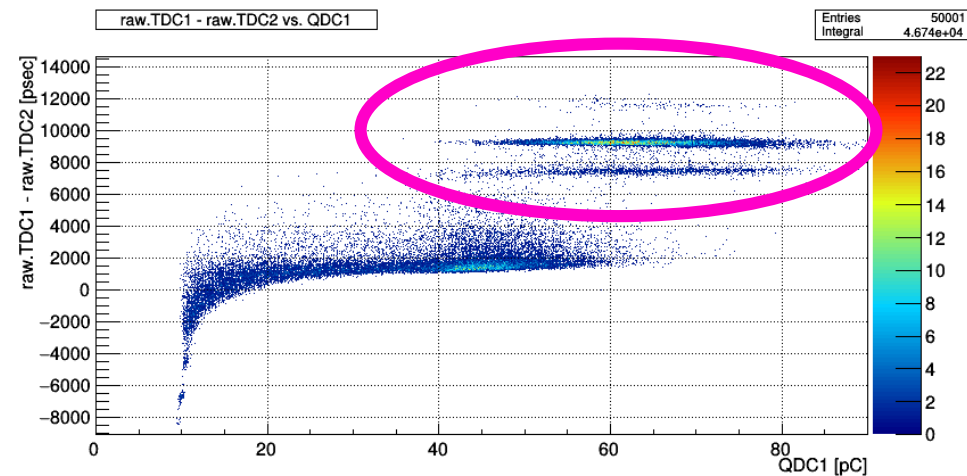
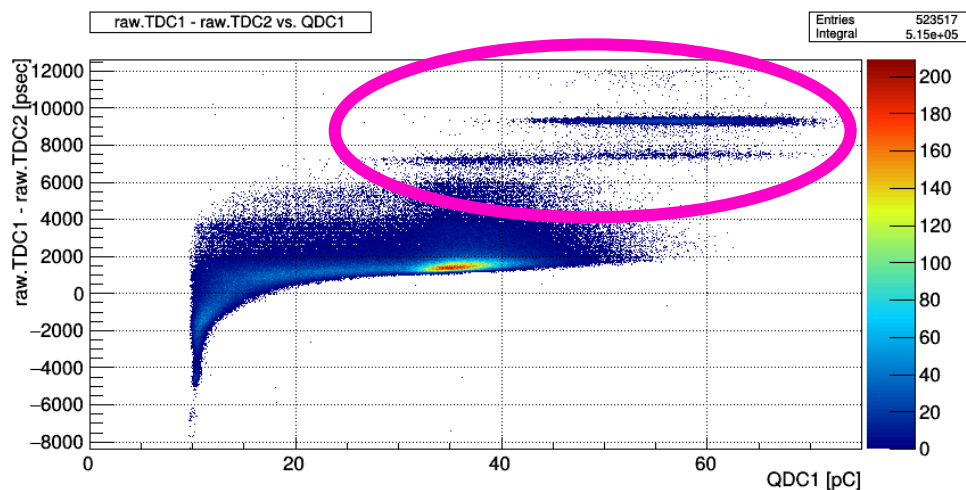
$$\sigma_{\text{ToF}} = 90.5 \pm 0.7 \text{ [psec]}$$

$$\sigma_{\text{MPPC}} = \frac{1}{\sqrt{2}} \sigma_{\text{ToF}} = 64.0 \pm 0.5 \text{ [psec]}$$

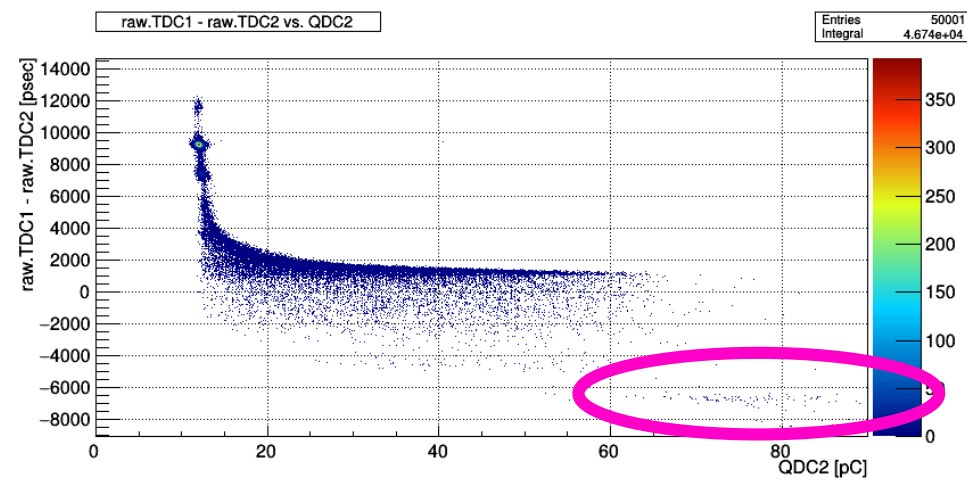
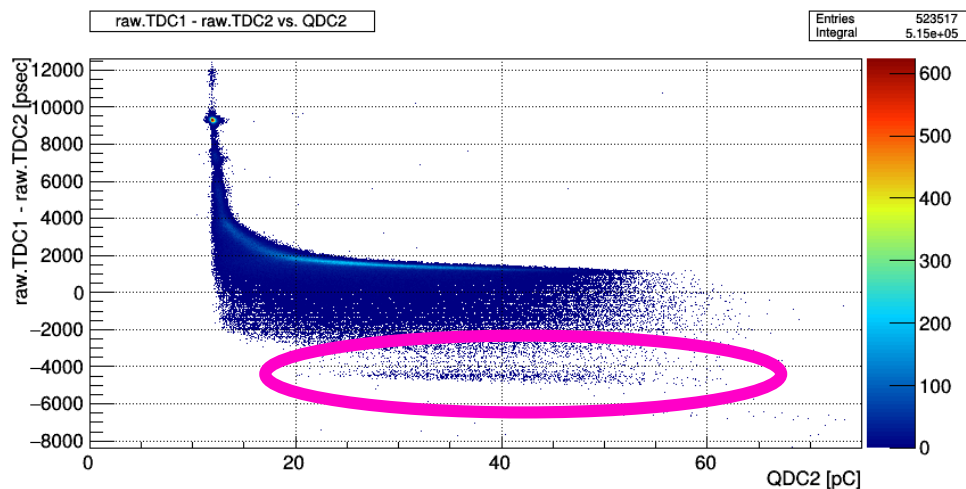
Case of high V_b region

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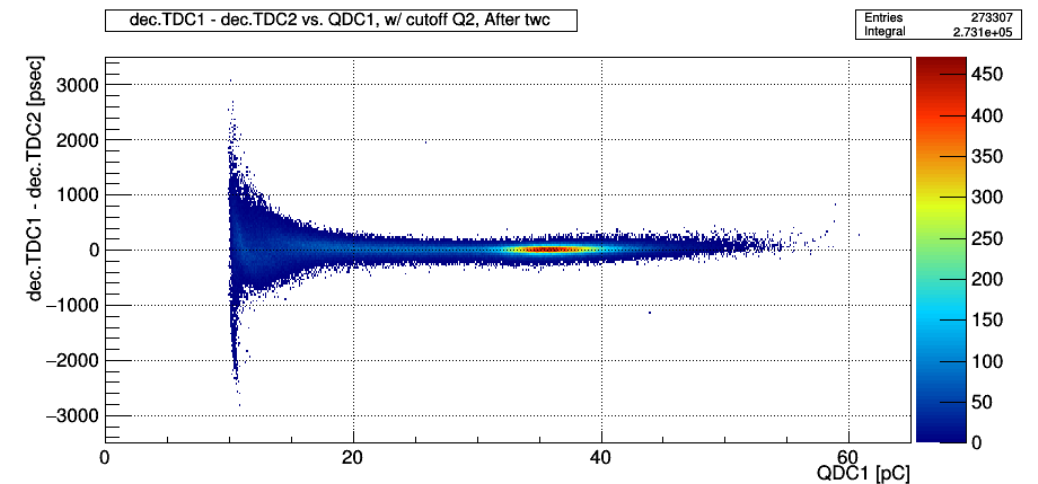
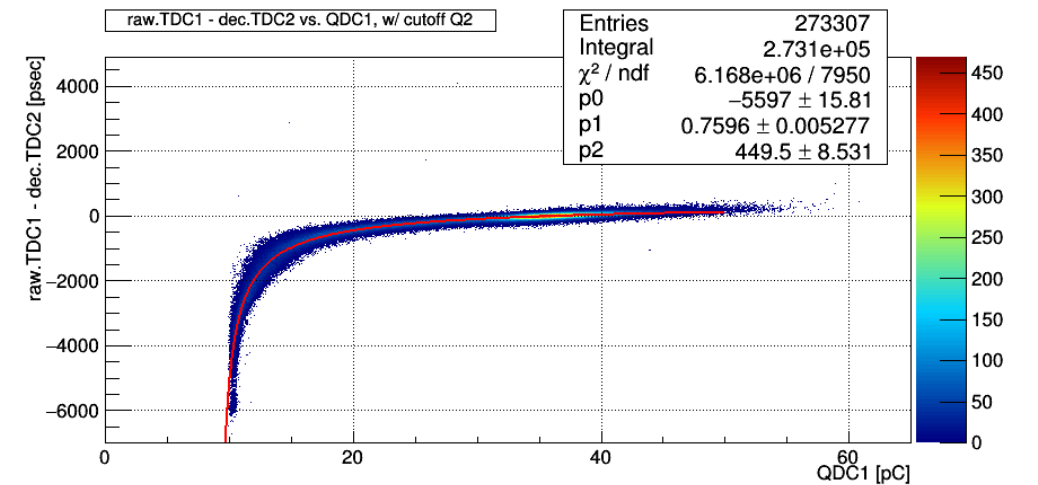
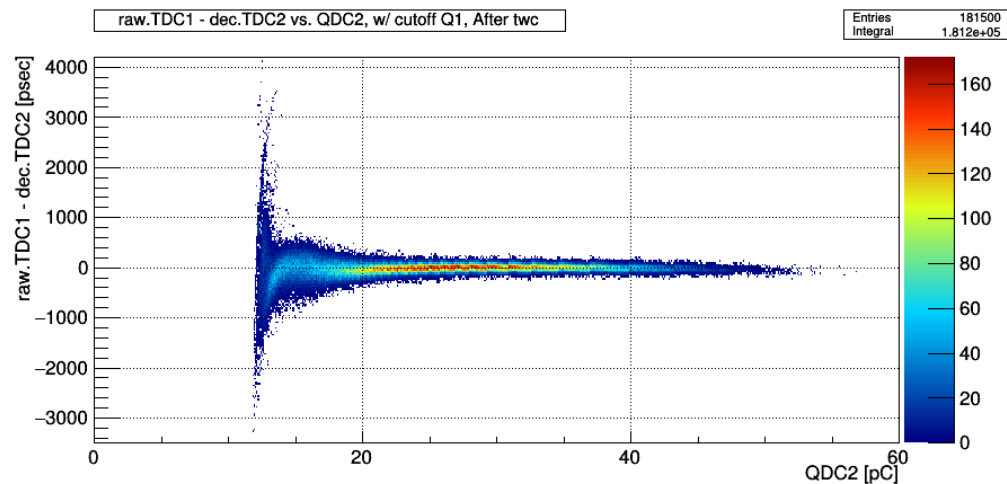
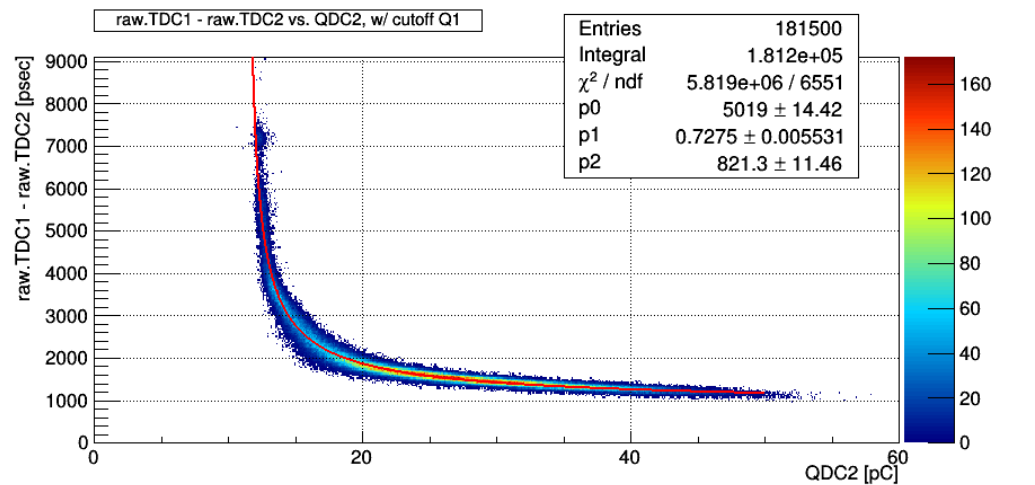
- Strange structure



???

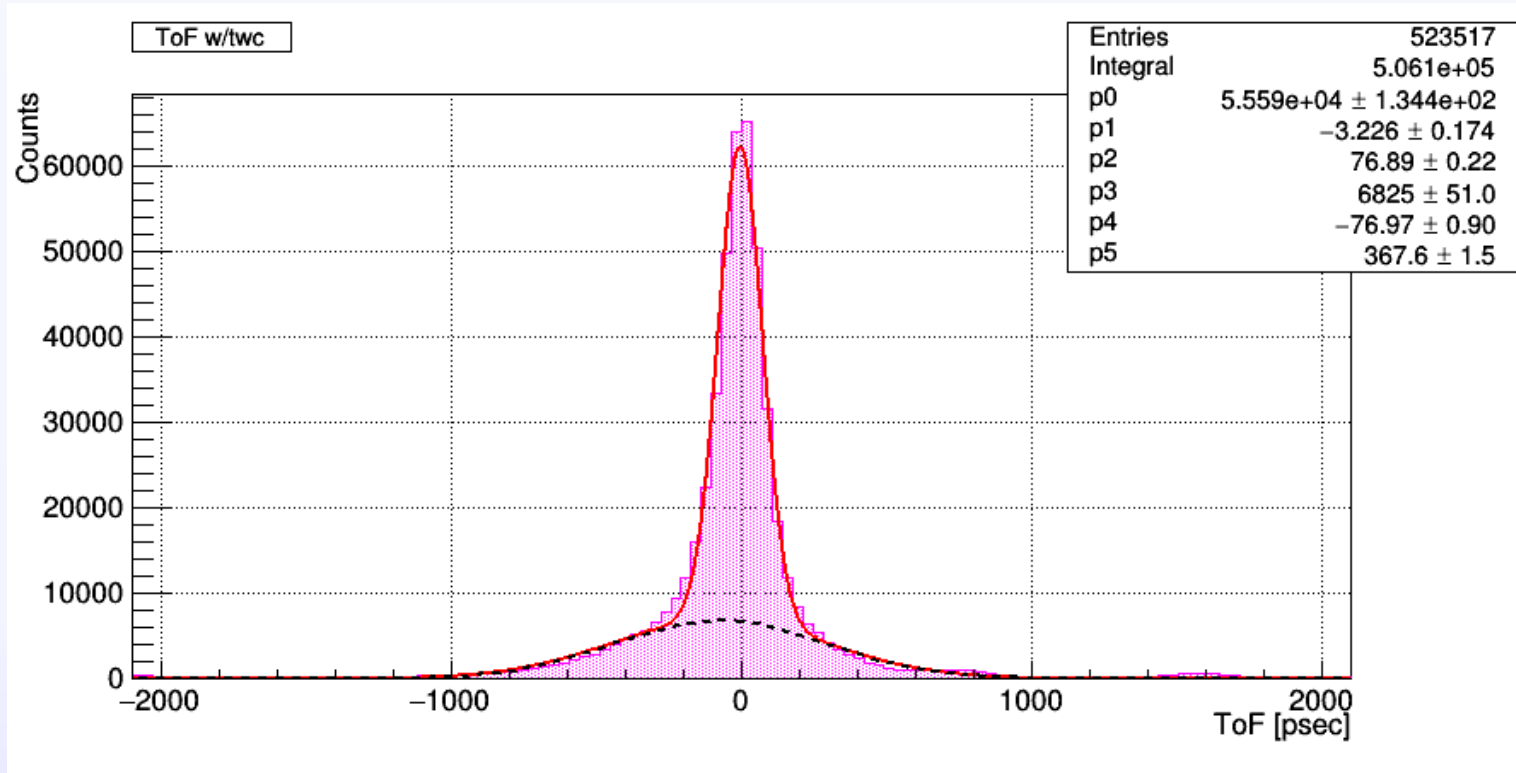


Evaluate timing resolution MPPC: case of $V_b = 50.7V$ 12



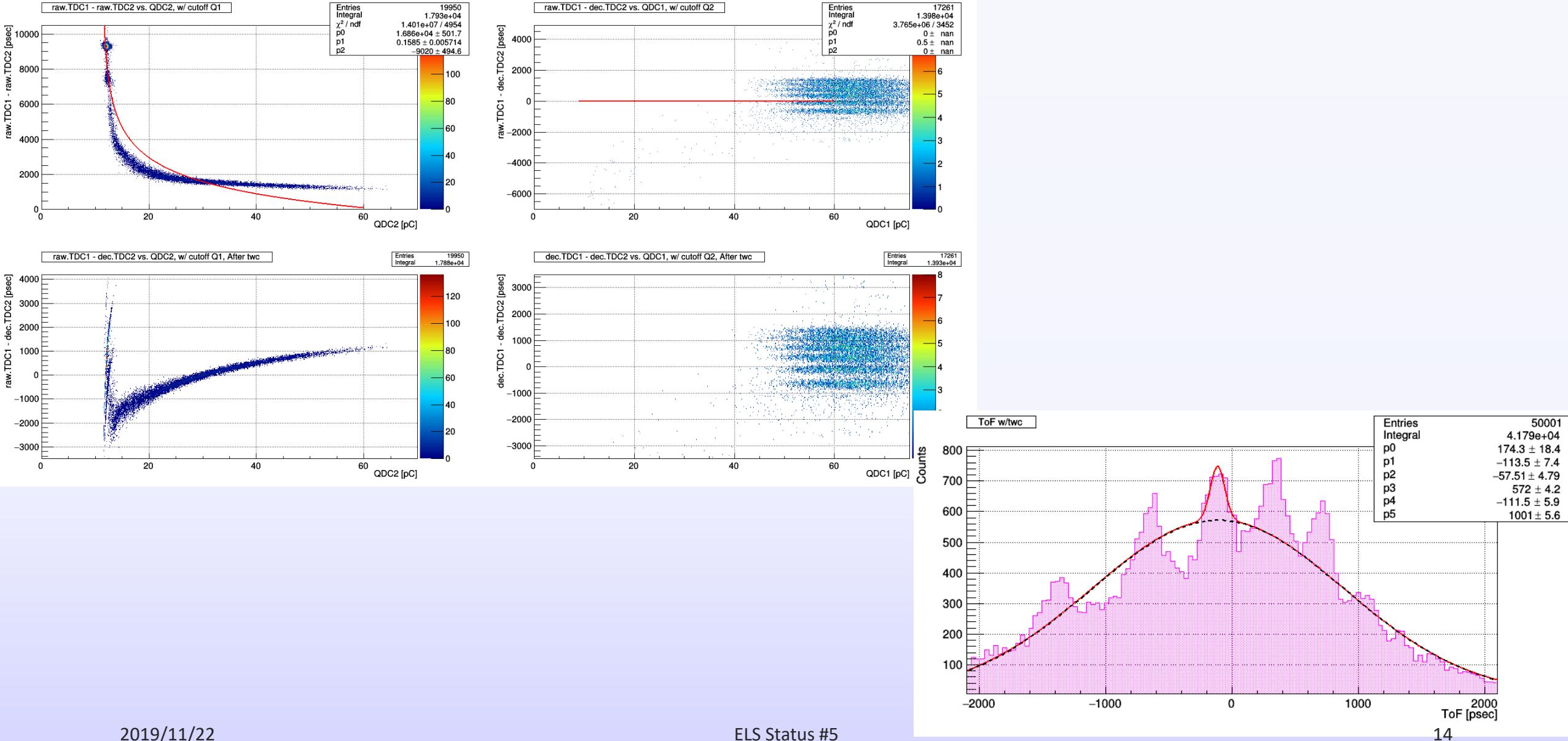
Evaluate timing resolution MPPC: case of $V_b = 50.7V$

13

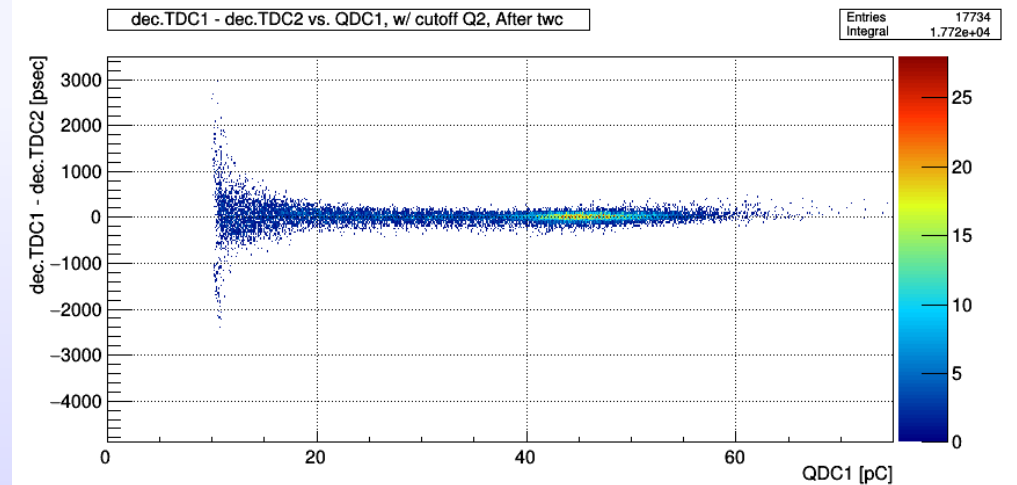
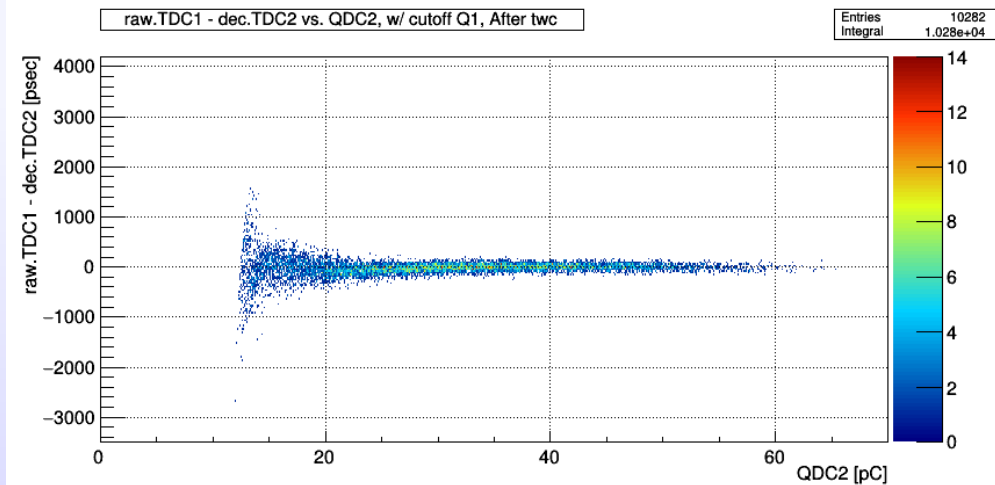
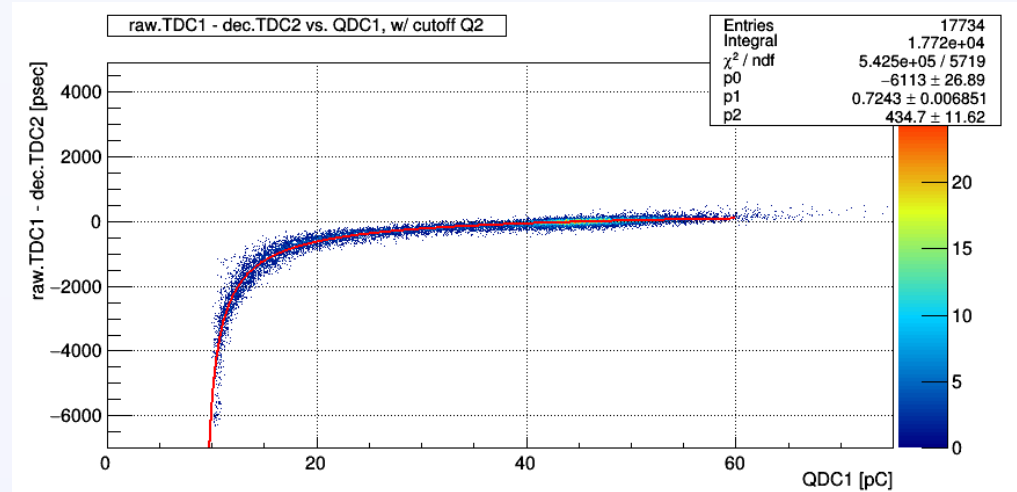
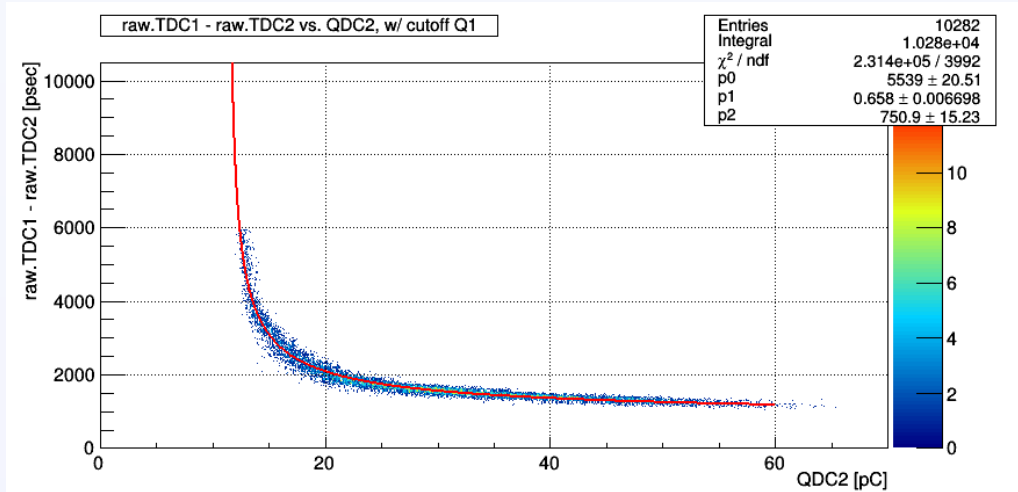


$$\sigma_{\text{ToF}} = 76.9 \text{ psec}$$
$$\sigma_{\text{MPPC}} = 54.4 \text{ psec}$$

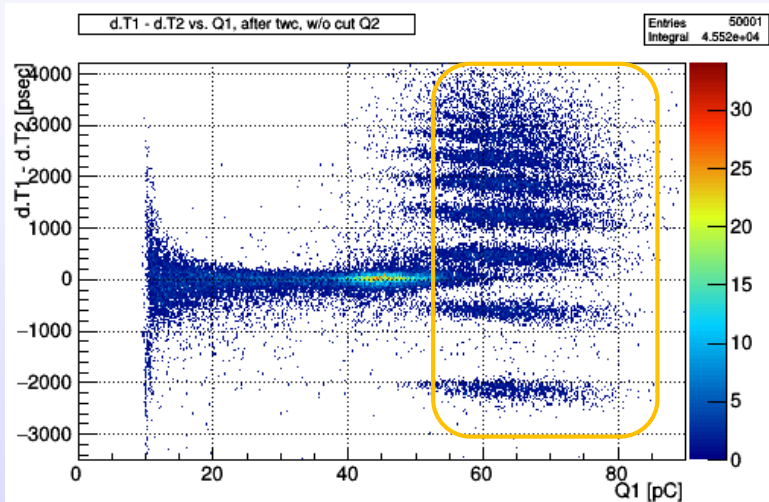
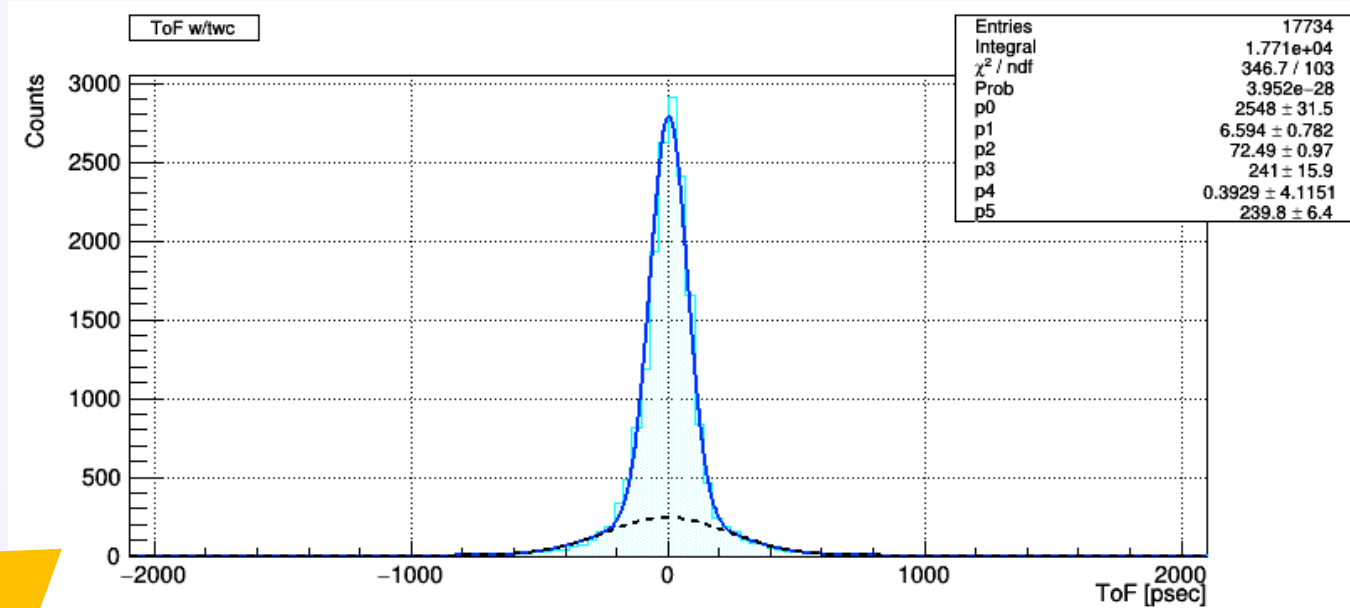
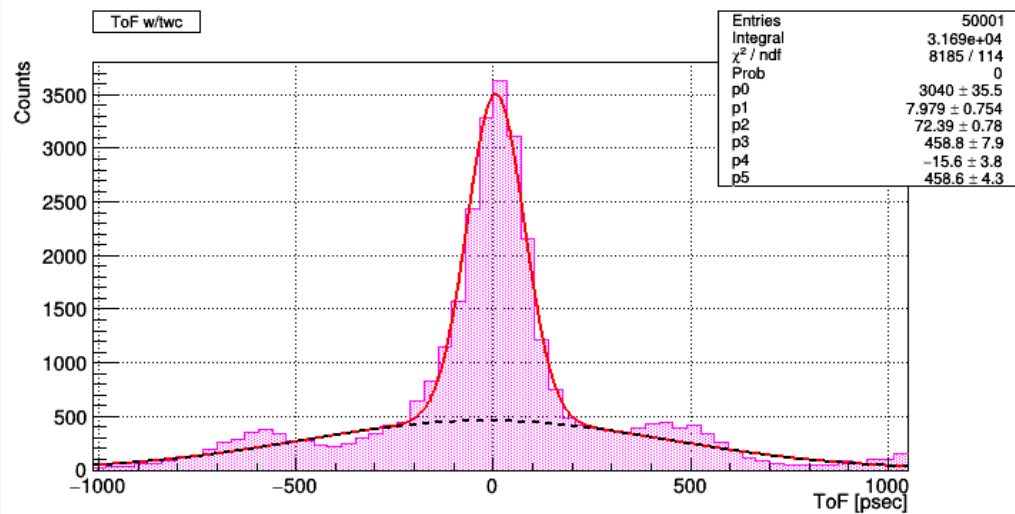
Evaluate timing resolution MPPC: case of $V_b = 53.7V$ 14



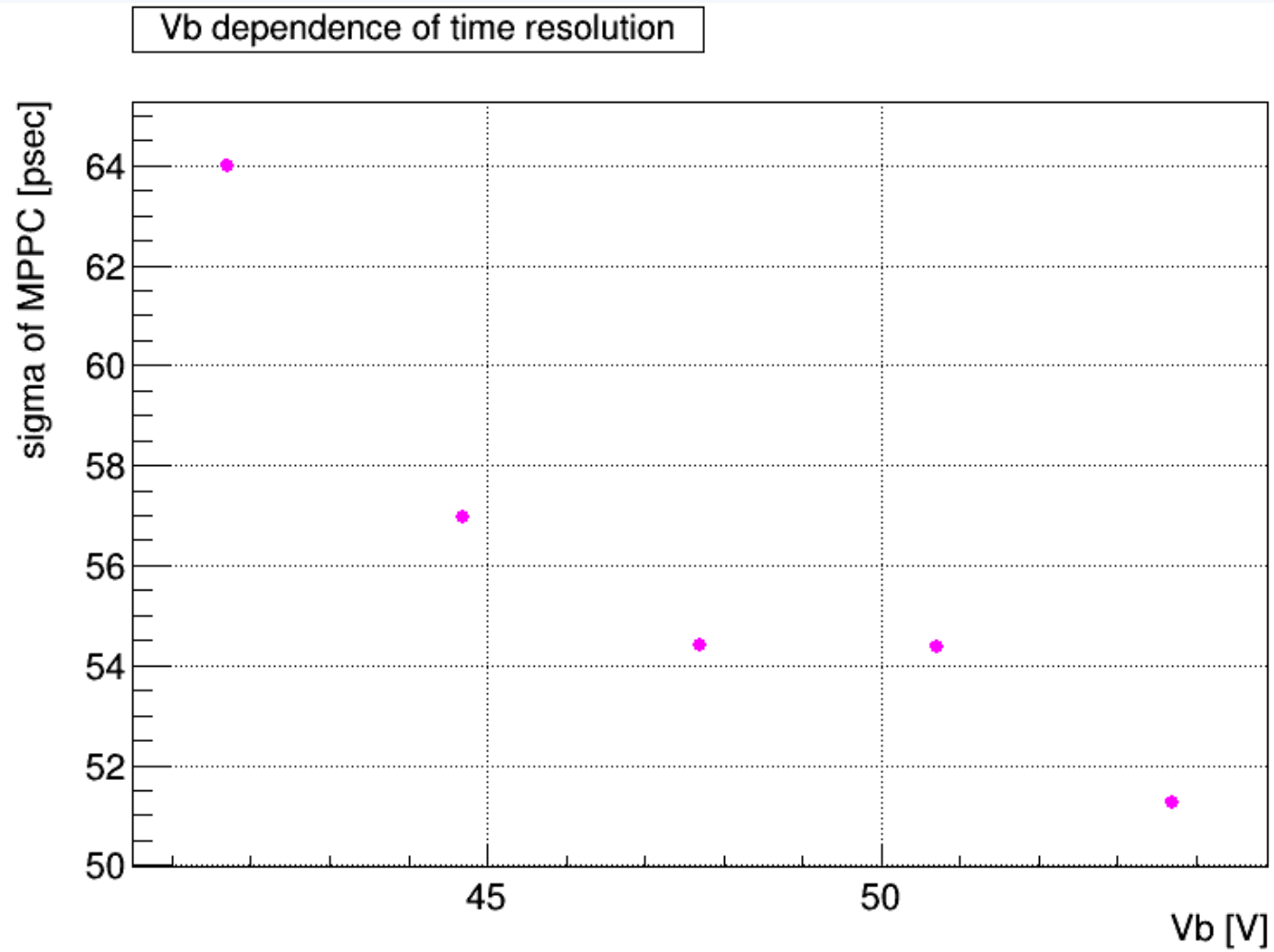
Evaluate timing resolution MPPC: case of $V_b = 53.7V$ 15



Evaluate timing resolution MPPC: case of $V_b = 53.7V$ 16



$$\sigma_{\text{ToF}} = 72 \text{ psec}$$
$$\sigma_{\text{MPPC}} = 51 \text{ psec}$$



- Continue analyzing time resolution of MPPC
- ROOT & G4 seminar
- Report of lecture(deadline: 12.6)
- Prepare for detector seminar