Status Report #37

2020. 07. 24 (Fri)

Tohoku Univ. M1

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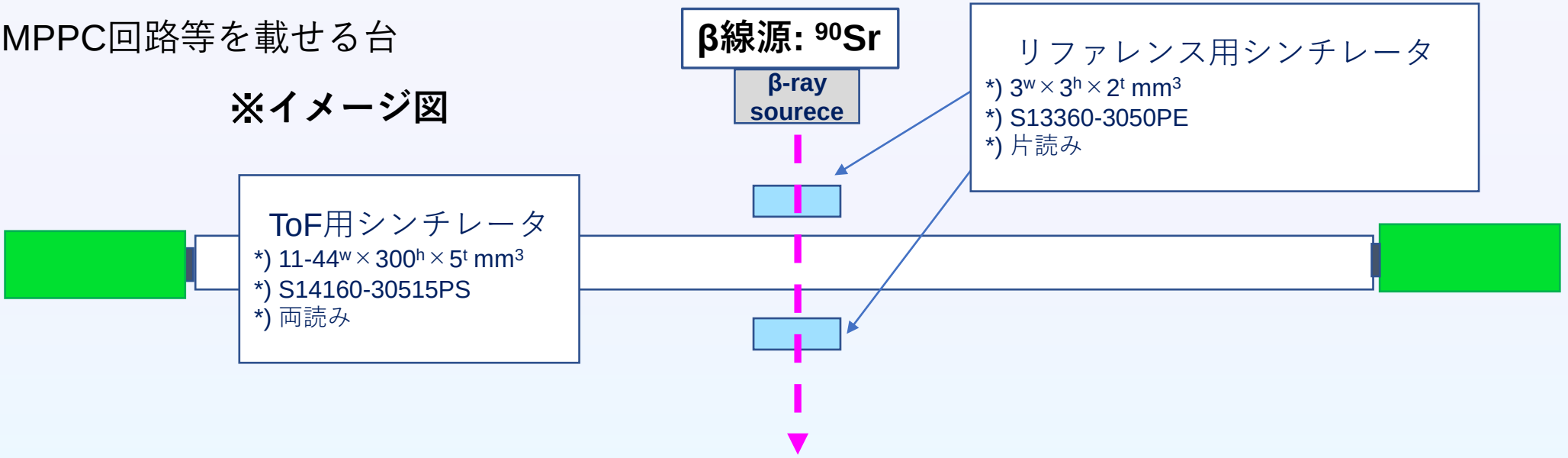
- ✓ Start data taking at new testbench

New testbench

- カウンター部屋(B棟637)でテストベンチの準備をしていた

- シンチ, MPPC回路等を載せる台

※イメージ図

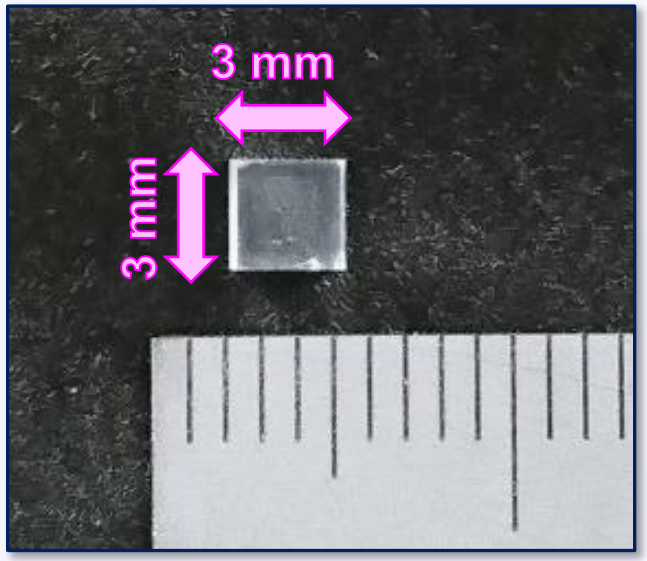


- リファレンス用検出器(プラスチックシンチレーター+MPPC)の用意

New reference counters

✓ **使用するシンチレータ**

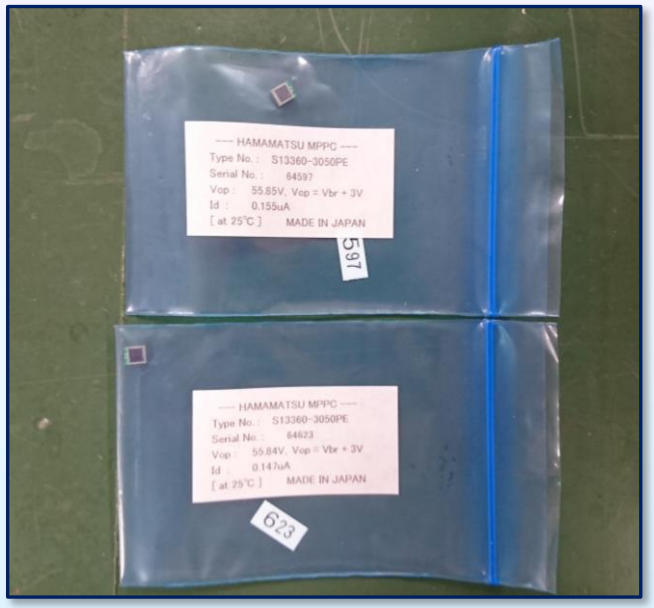
- $3^w \times 3^h \times 2^t$ mm^3

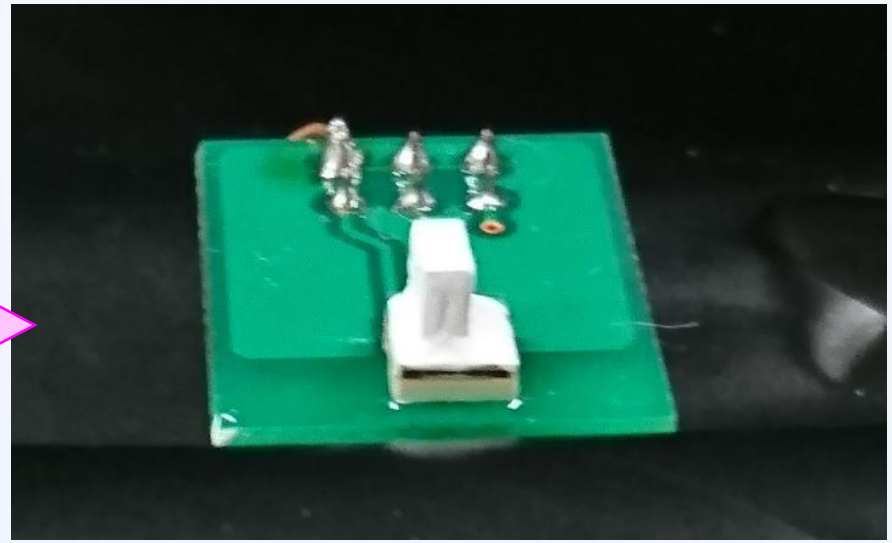


✓ **MPPC**

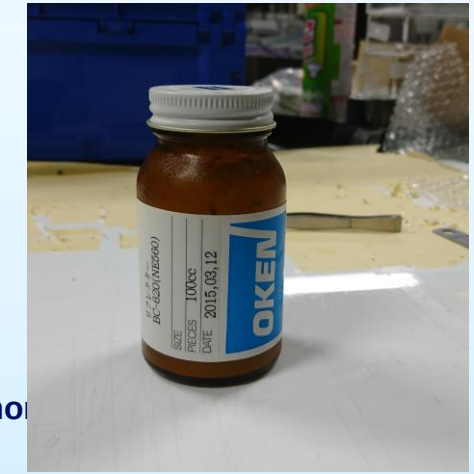
- S13360-3050PS
- Vop[V] = 55.85, 55.84

  → ほぼ同じとみなして使用

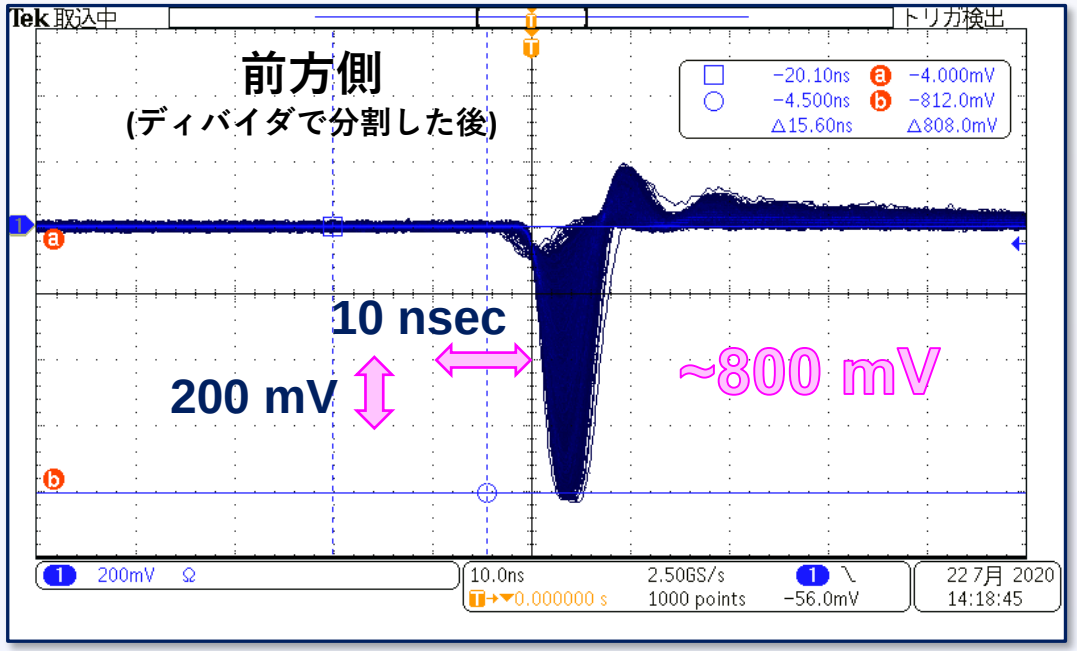


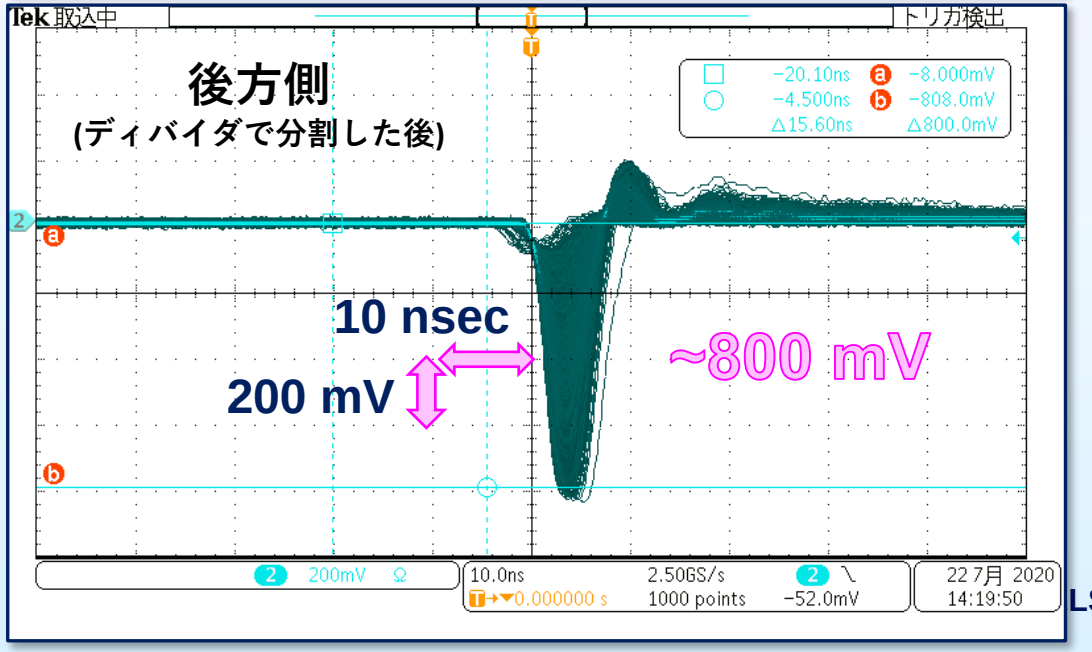


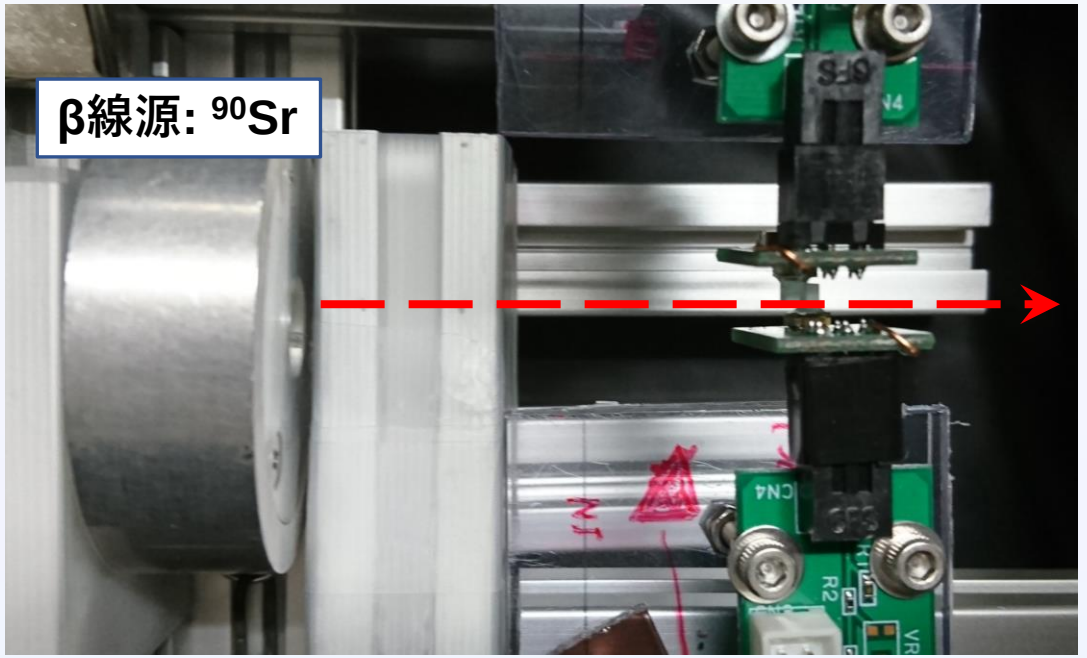
*オプティカルセメントでMPPCと接続
*反射材を塗布



Reference counters test







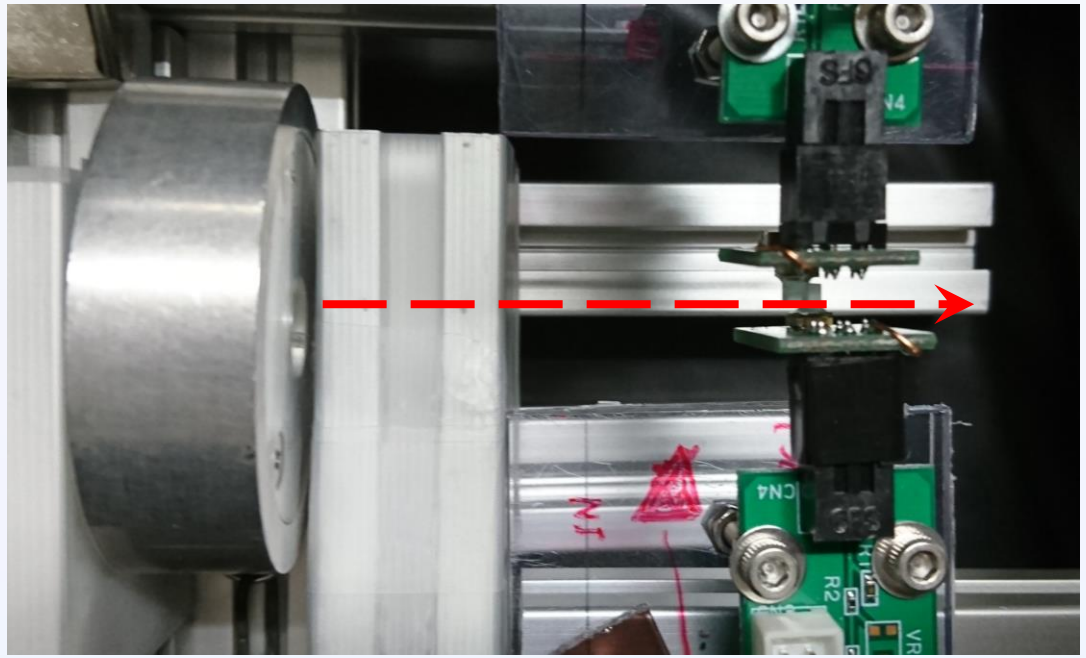
上からみた図

V_b = 55.8 V (V_b-V_{op} ~ 0.0 V) での信号

Reference counters test

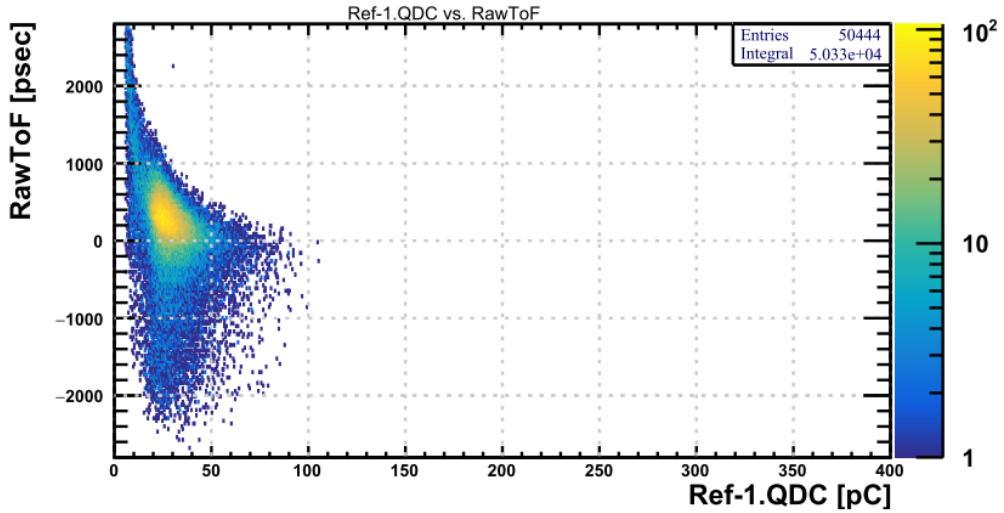
- リファレンスカウンター2個のみでデータ取得
- トリガー: 双方の信号のコインシデンス
- オフセット調整のため, QDCラインの信号は16dB減衰させたのち, PMアンプを経由
- コインシデンスのレート ~ 150 Hz
- 同じシンチレータ, 同じMPPC(型番/駆動電圧), 同じアンプ回路

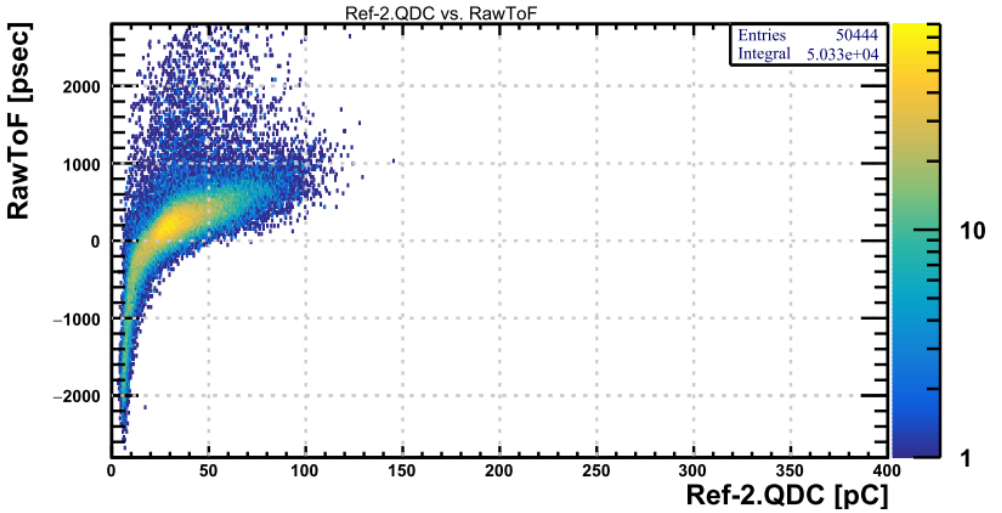
  ⇒ 2つのカウンターが等価な性能として固有時間分解能を調べる.

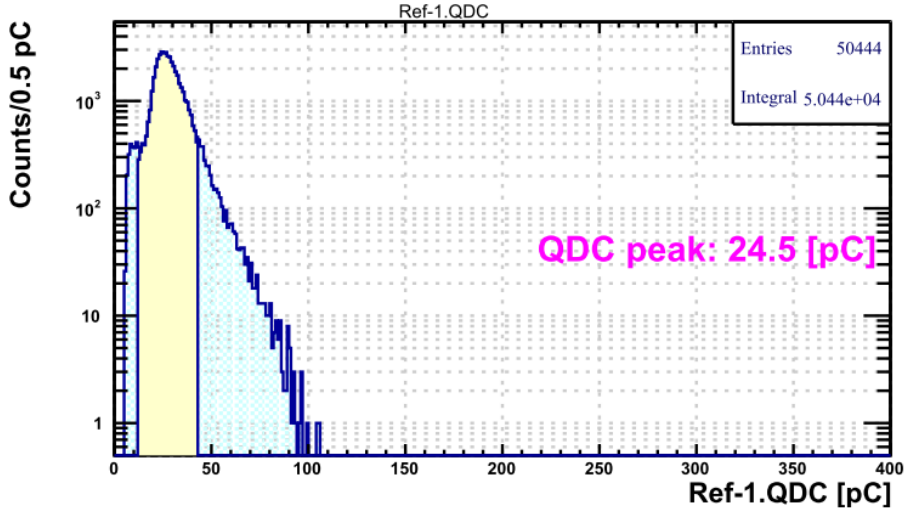


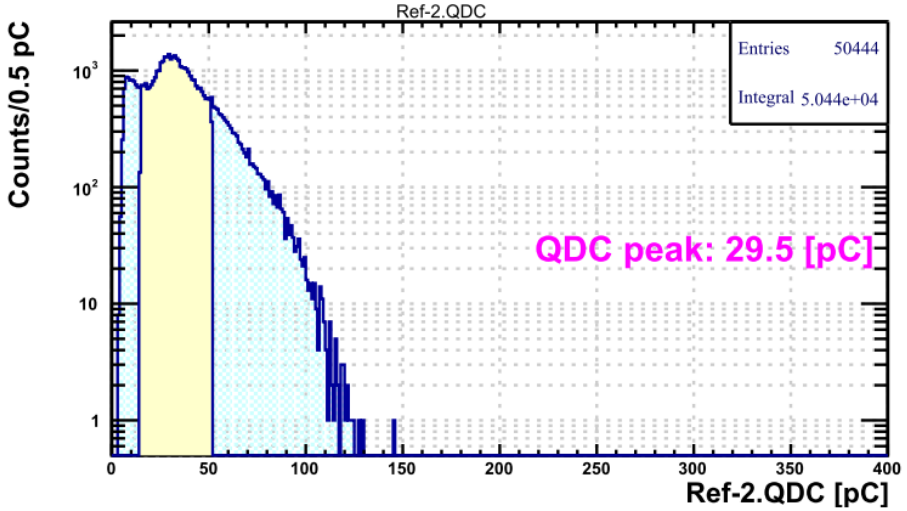
上からみた図

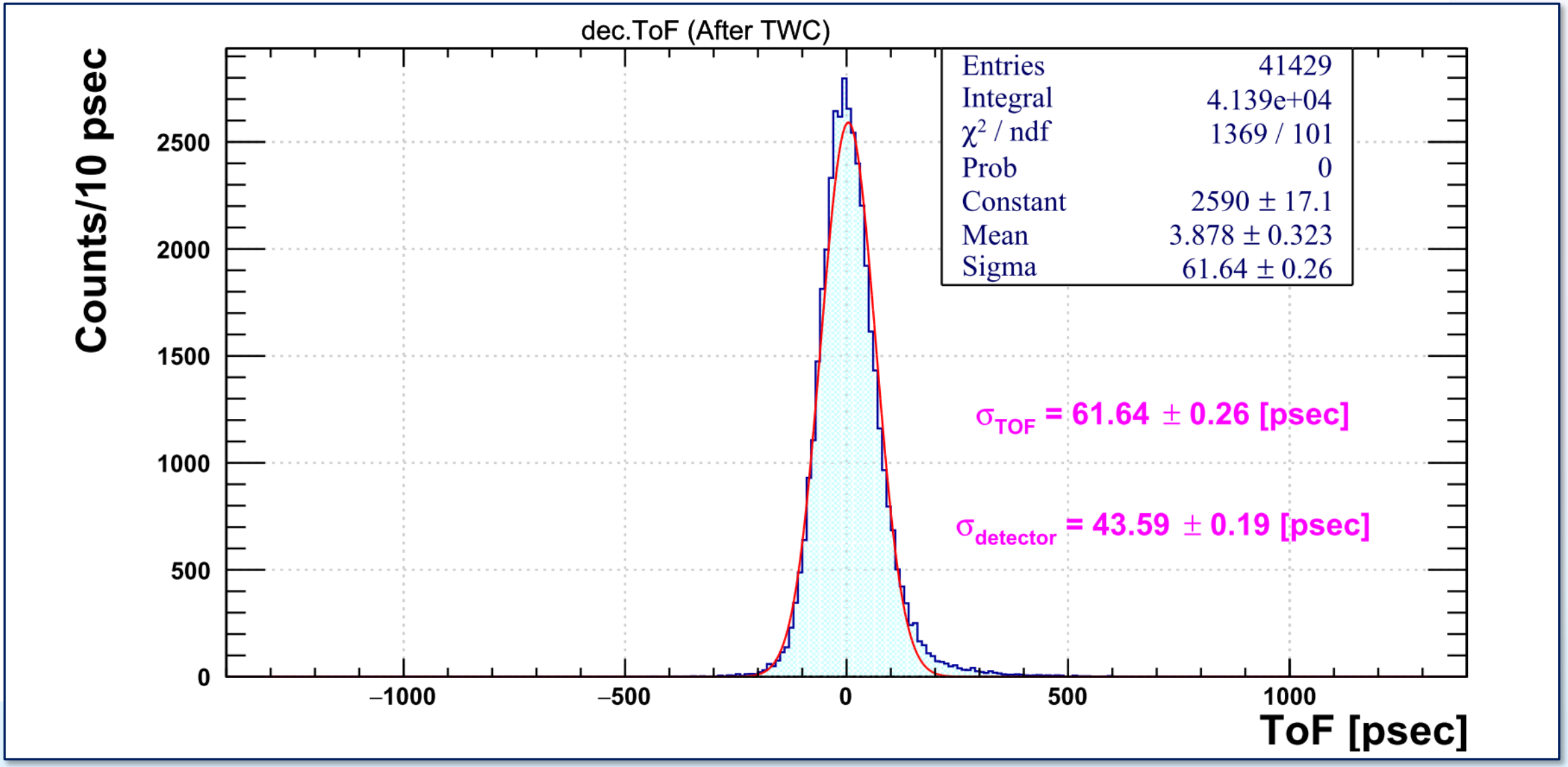
run200_AnaRef_Mod00.pdf (V_b-V_{op} ~ 0.0)







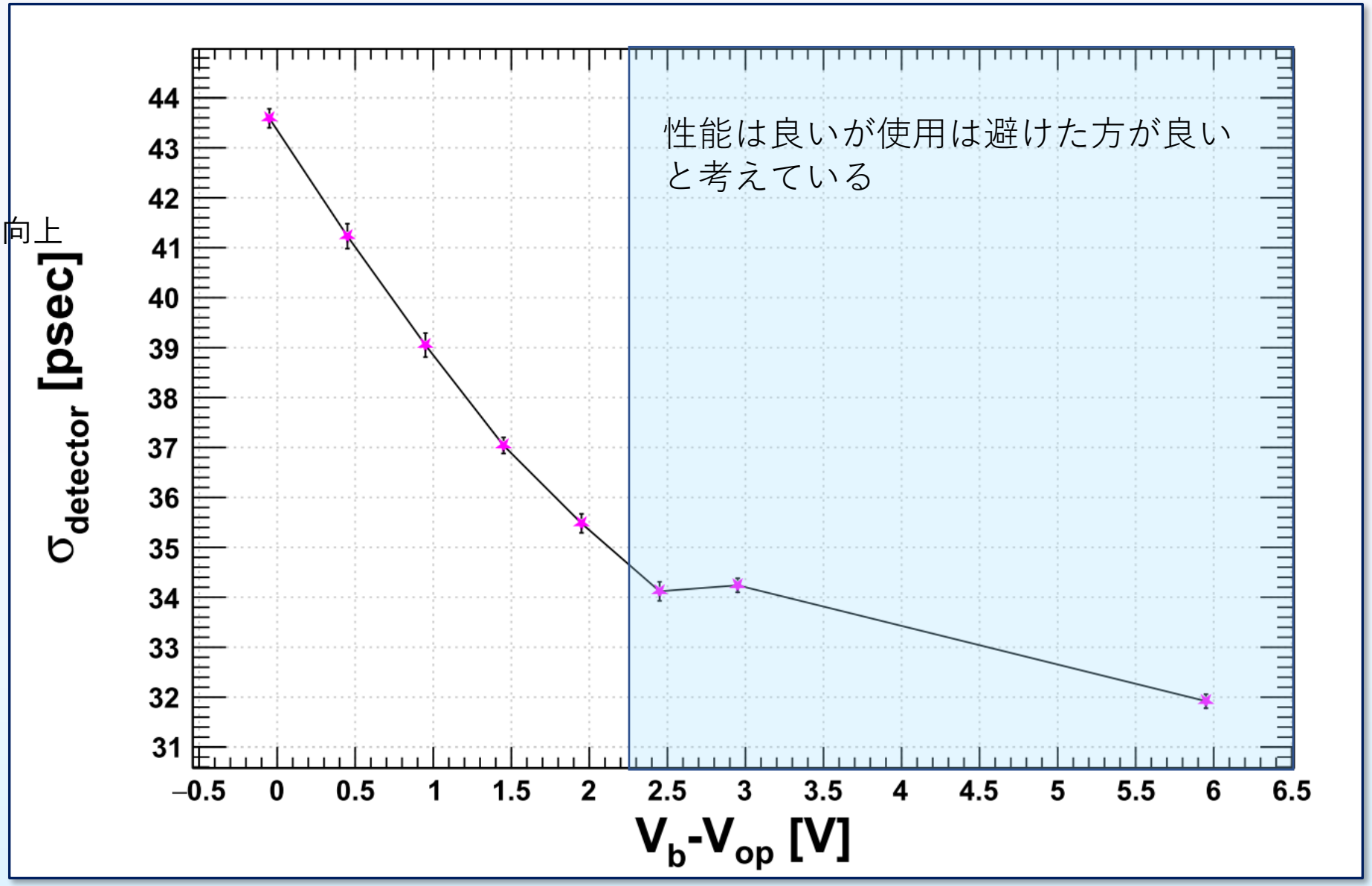



dec.ToF (After TWC)
Counts/10 psec
ToF [psec]
Entries 41429
Integral 4.139e+04
χ² / ndf 1369 / 101
Prob 0
Constant 2590 ± 17.1
Mean 3.878 ± 0.323
Sigma 61.64 ± 0.26
σTOF = 61.64 ± 0.26 [psec]
σdetector = 43.59 ± 0.19 [psec]

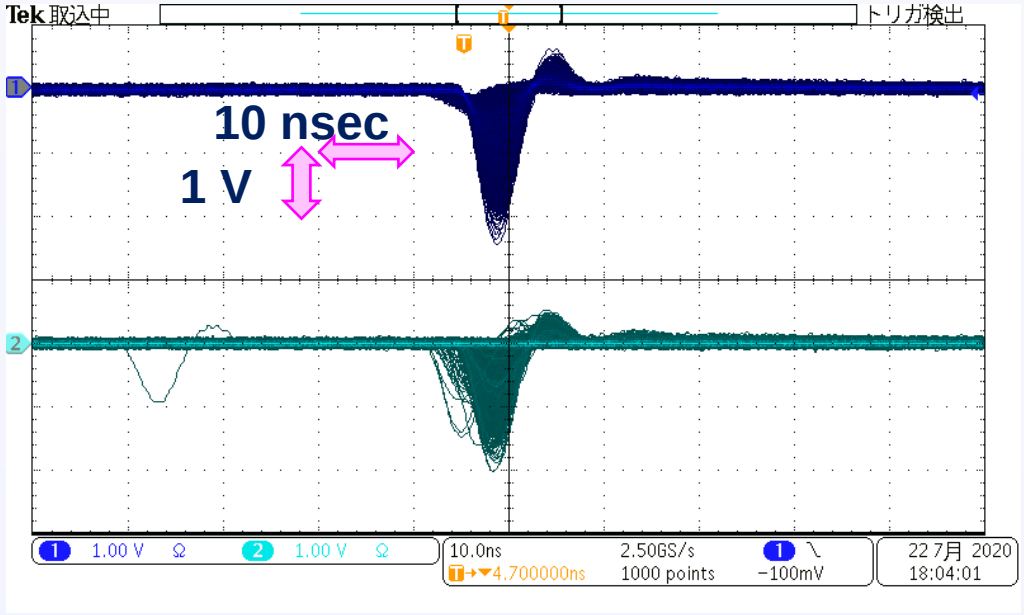
Reference counters test

- 固有時間分解能の電圧依存性

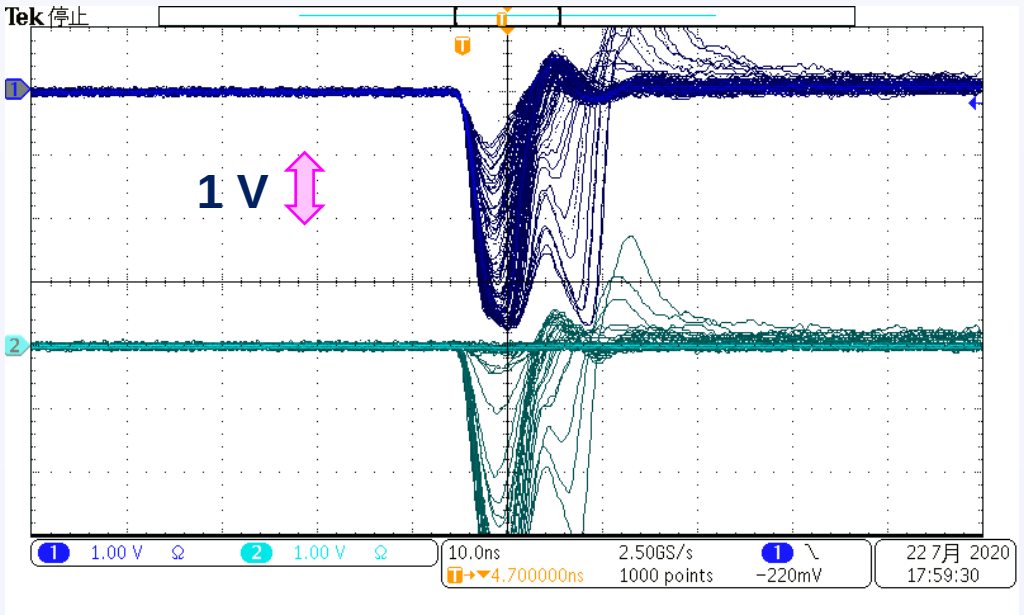
- バイアスを上げると分解能は向上
- が, <+1.5 V
  での使用を考えている
  (次のスライド)



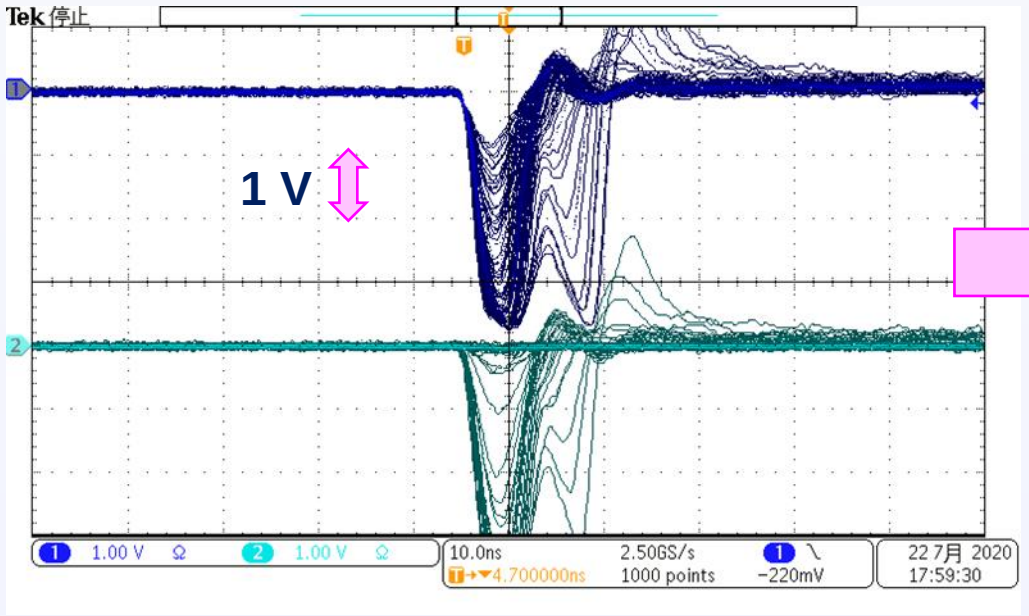
Reference counters test



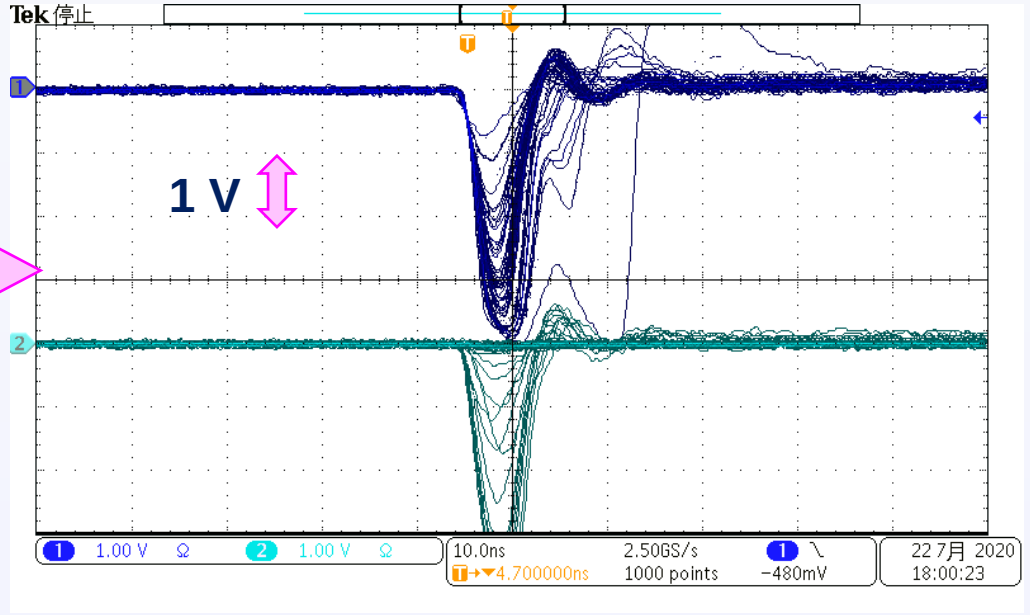
分割前の各シンチでの信号
Vb-Vop ~ 0.0 V



分割前の各シンチでの信号
Vb-Vop ~ +6.0 V



分割前の各シンチでの信号
V_b-V_{op} ~ +6.0 V



$V_{\pm}$ 調節後(±10.0 V)
V_b-V_{op} ~ +6.0 V

$V_{\pm}$ [V]	V_+ 側 Current [A]	V_- 側 Current [A]
10.0	**0.09**	**0.087**
8.0	0.04	0.039

Beta-ray measurement

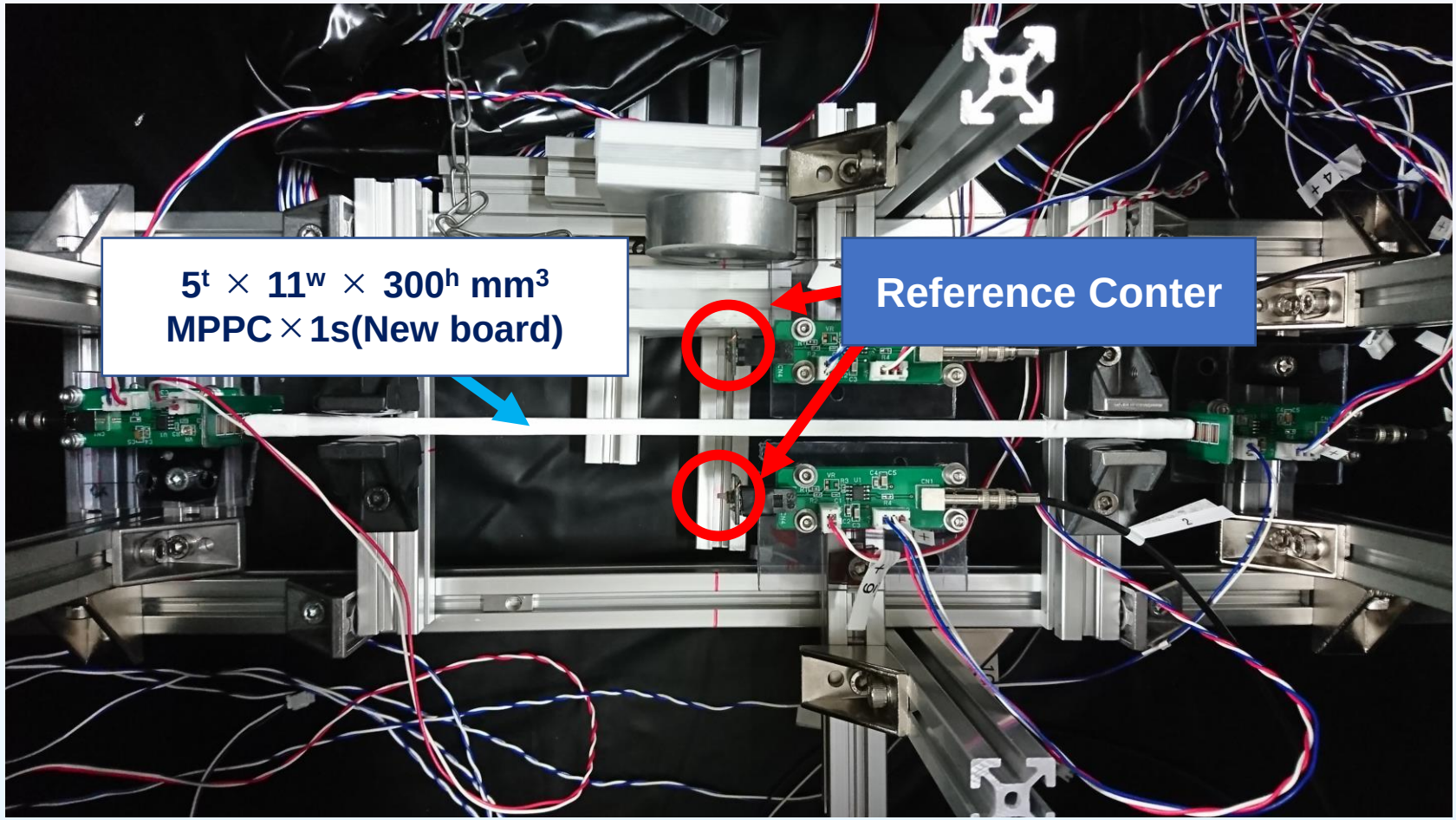
- Ref×2 + ToF用シンチ

でコインシデンスが取れるか確認した

- ToF用シンチ無し ⇒ ~130 counts/min
  ⇒ ~2 Hz
- ToF用シンチありだと全くならない
  ⇒ 離しすぎている??
  リファレンスの配置は再検討が必要
  (もしRef×2で取得するなら)

まずRef×1 + ToF用シンチでデータを取得

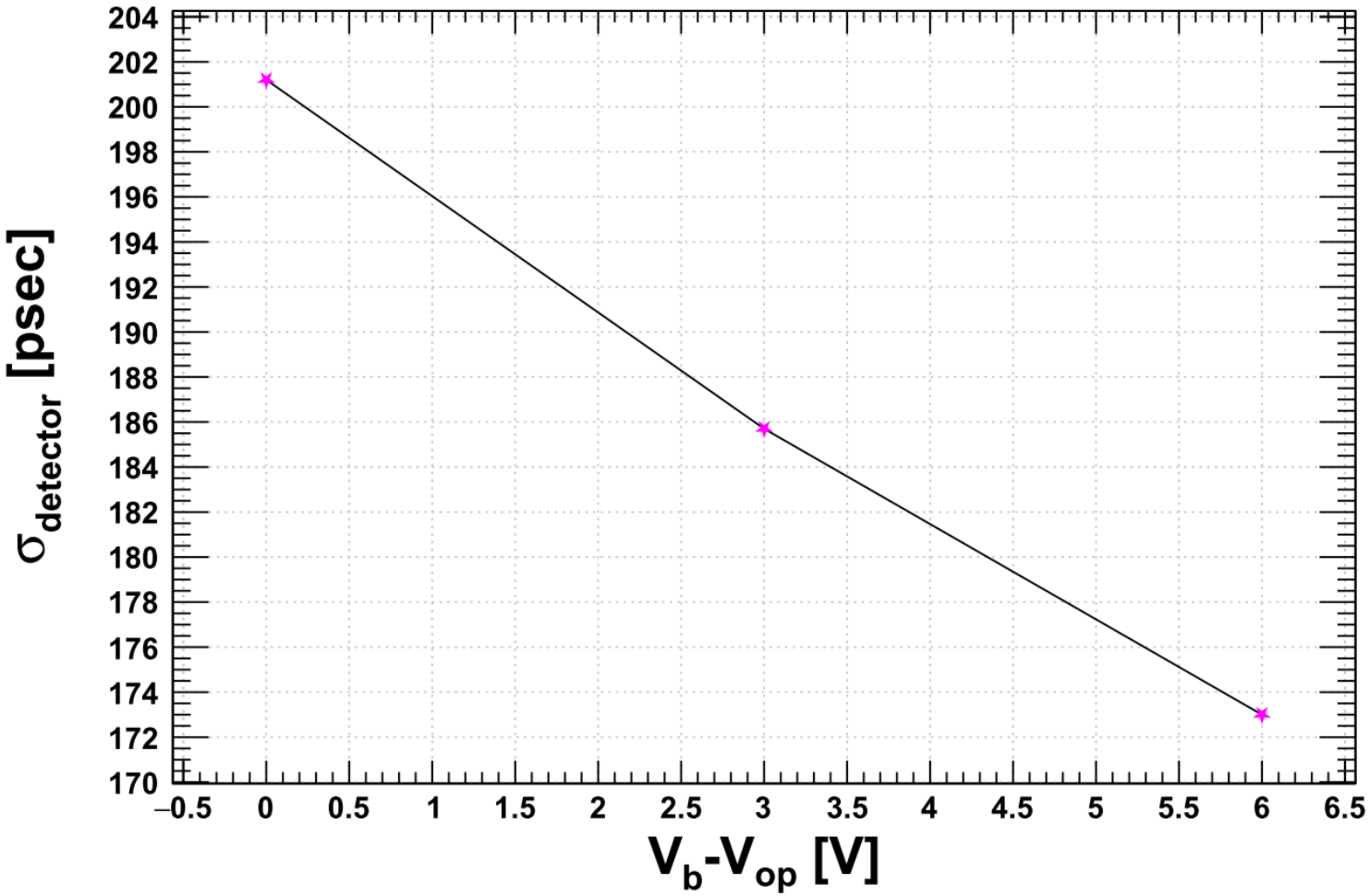
Vb – Vop = 0.0, 3.0, 6.0 [V]



(急ぎだったのでタイムウォークコレクション等は適当)

- +3.0 V 時で ~ 185 psec
- 以前の宇宙線より~20 psecくらい悪い

- 2個でもデータの取得は可能と考えられる



To do

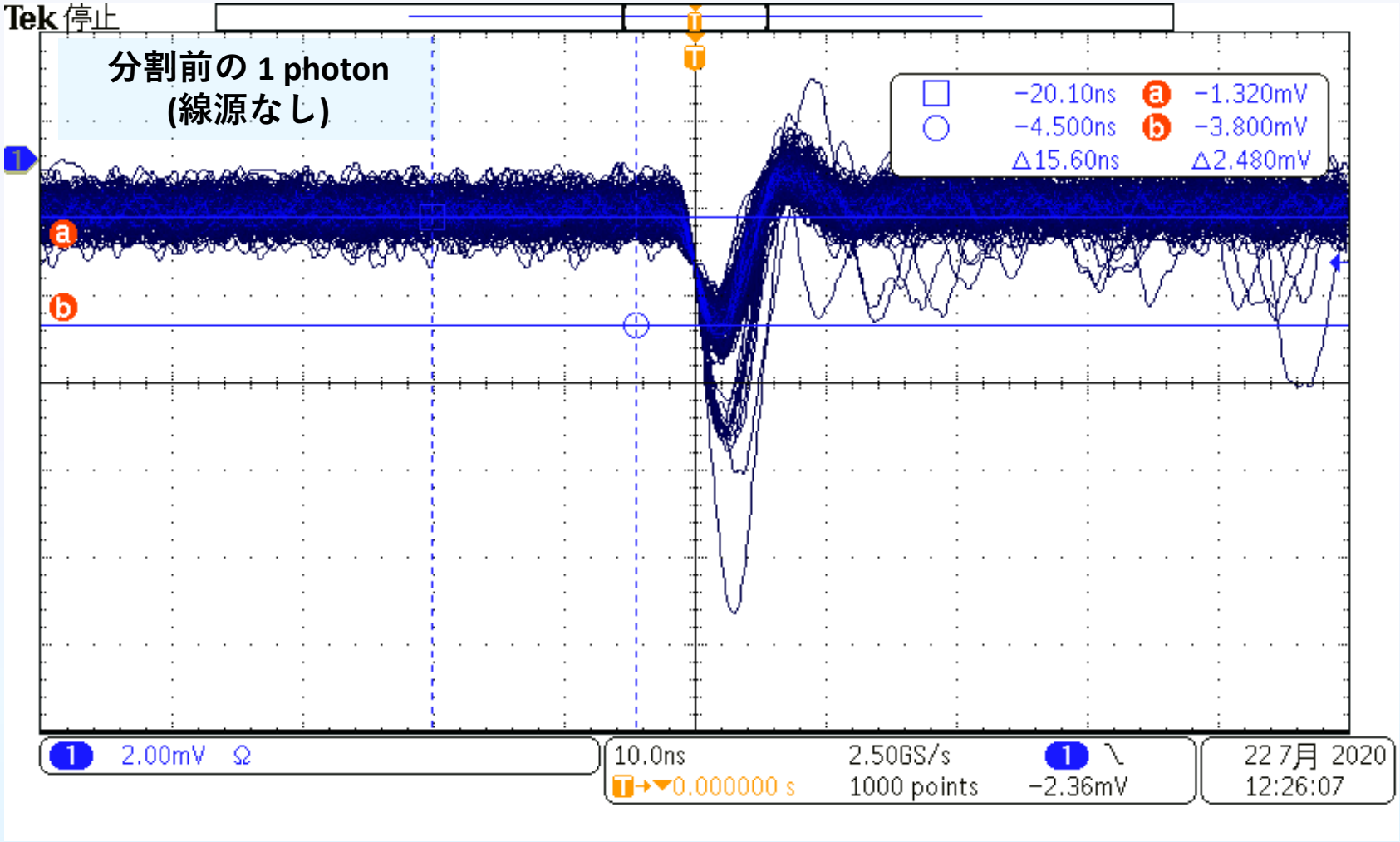
- 引き続きβ線源を使用しデータ取得を続ける
- リファレンスカウンターの配置の再検討

  ⇒ 2個のシンチレータ+回路をToF用シンチ等との干渉を避けて近付けるように

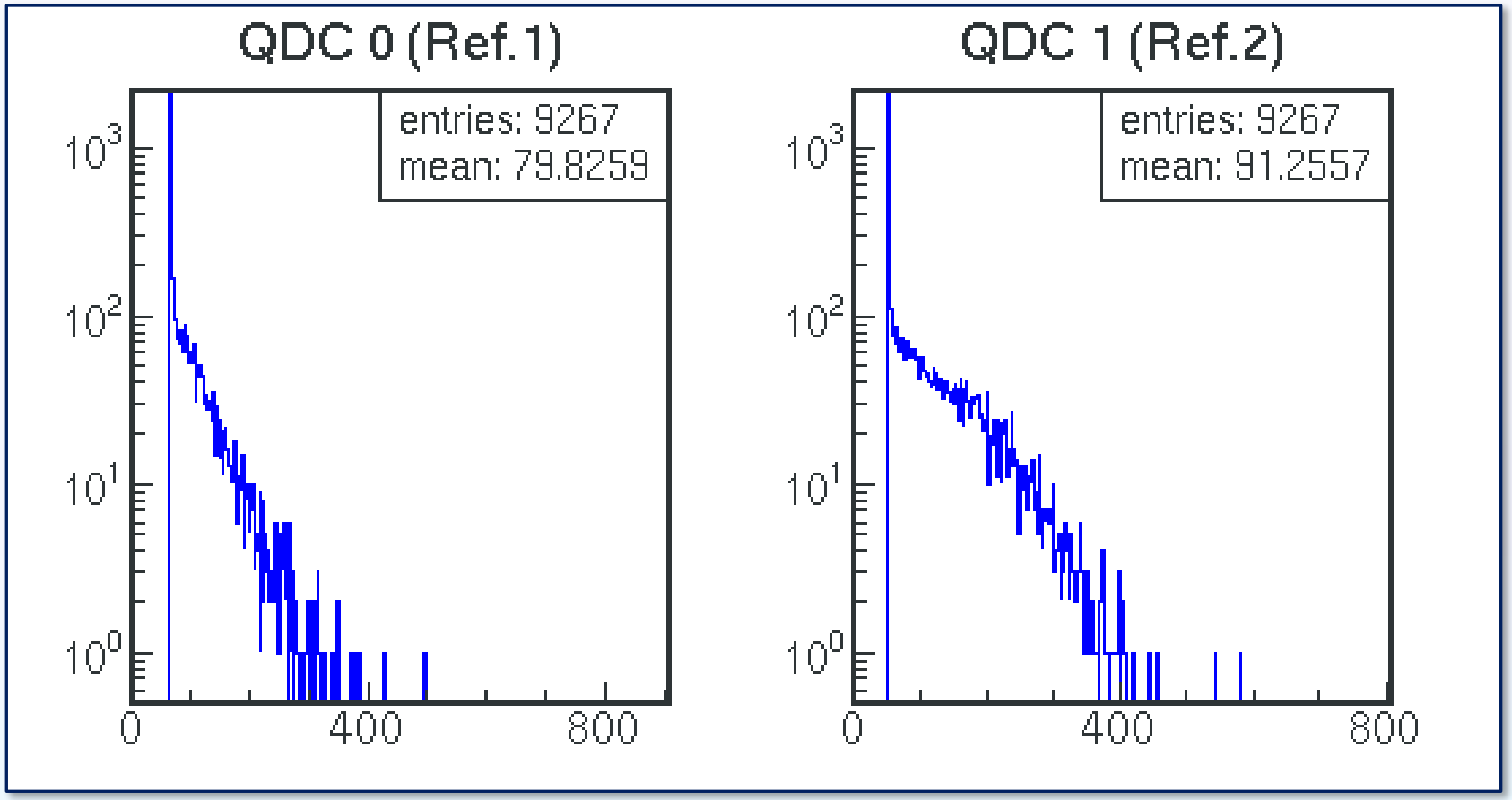
- 期末レポート

(固体分光物理学基礎×2, 物質物理学基礎×2, 場の量子論基礎, 素粒子物理学基礎, GPPU概論)

Backup

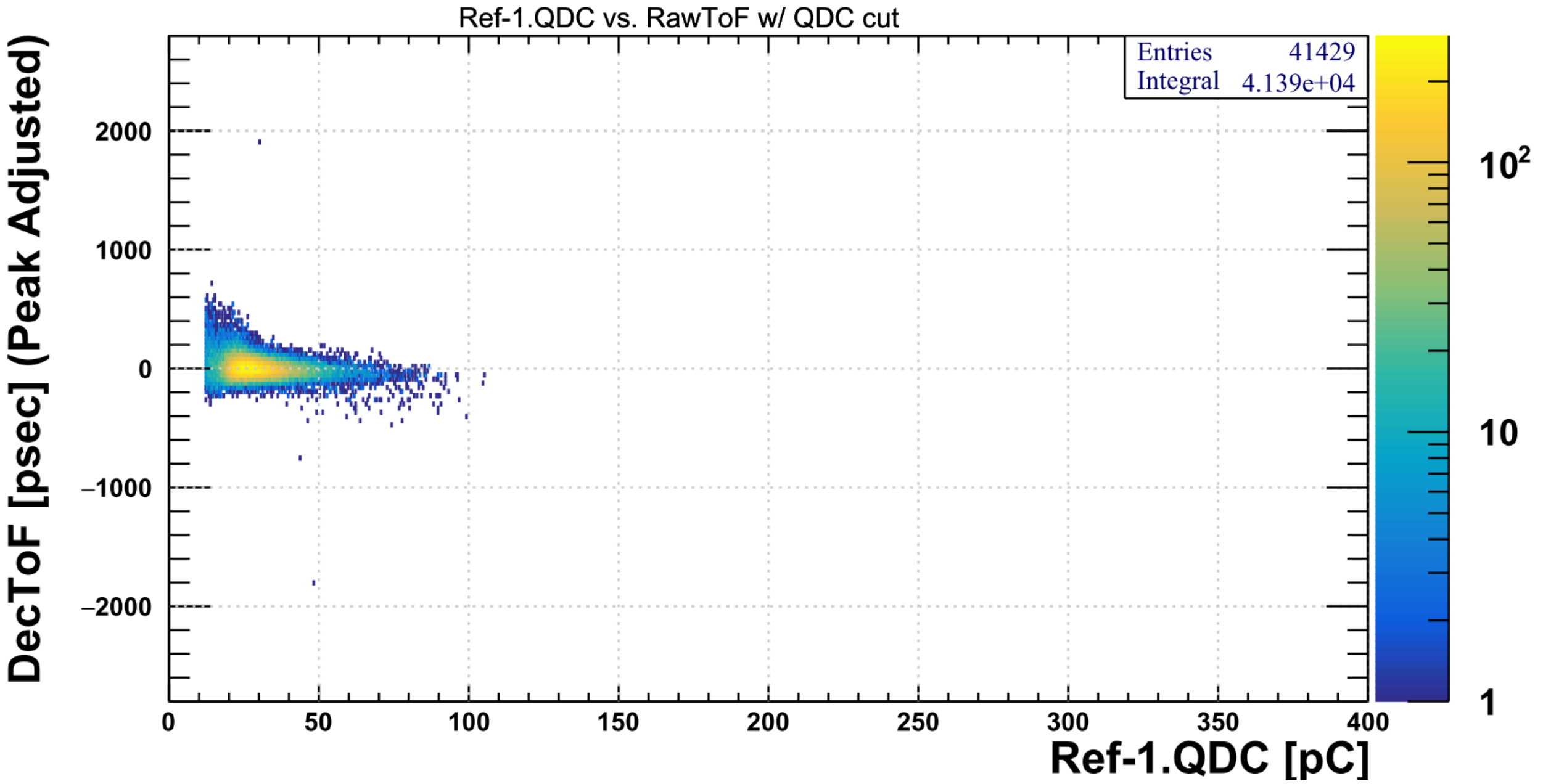

Tek 停止
分割前の 1 photon
(線源なし)
−20.10ns
−4.500ns
Δ15.60ns
−1.320mV
−3.800mV
Δ2.480mV
2.00mV Ω
10.0ns
2.50GS/s
0.000000 s
1000 points
−2.36mV
22 7月 2020
12:26:07

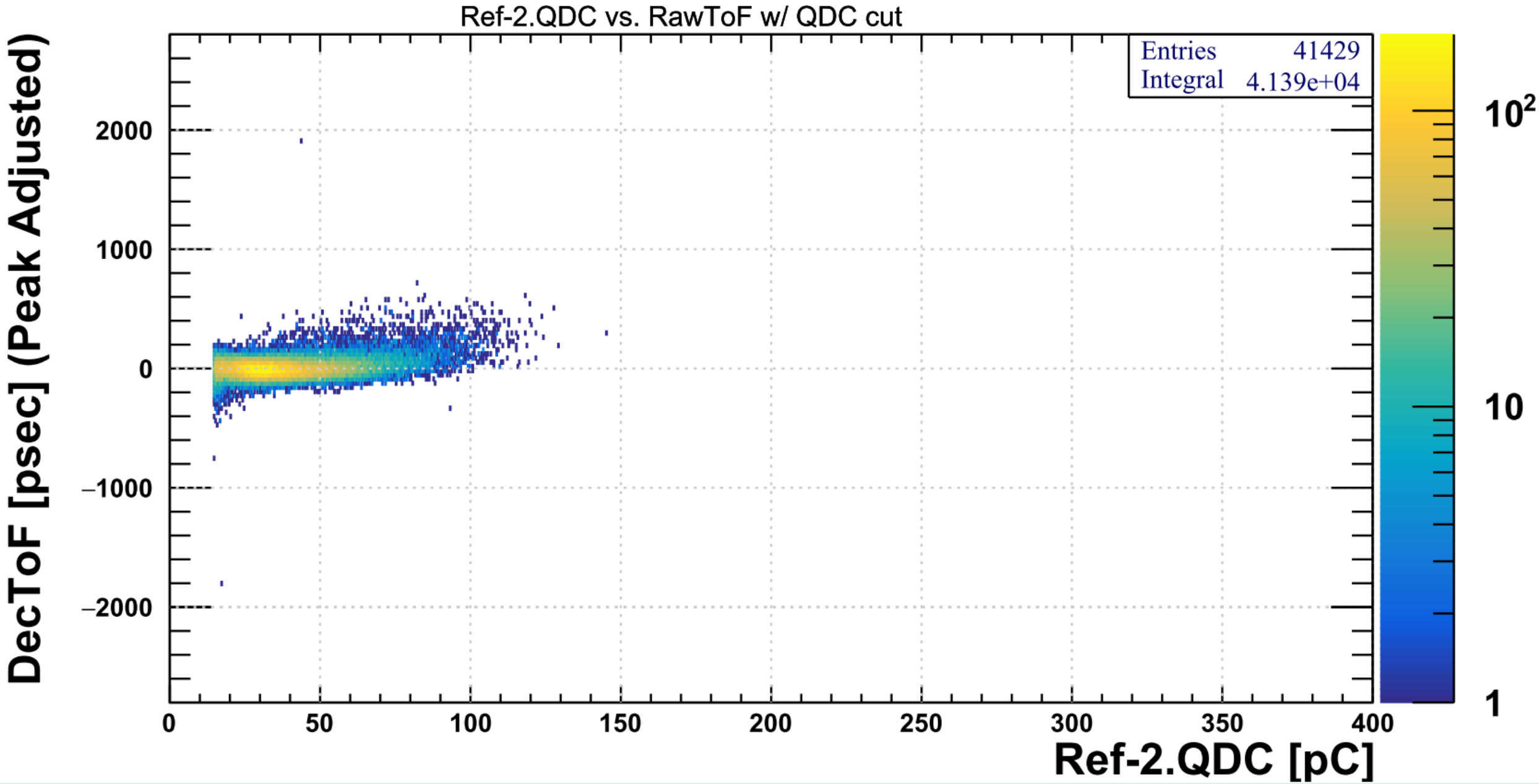
Reference counter test



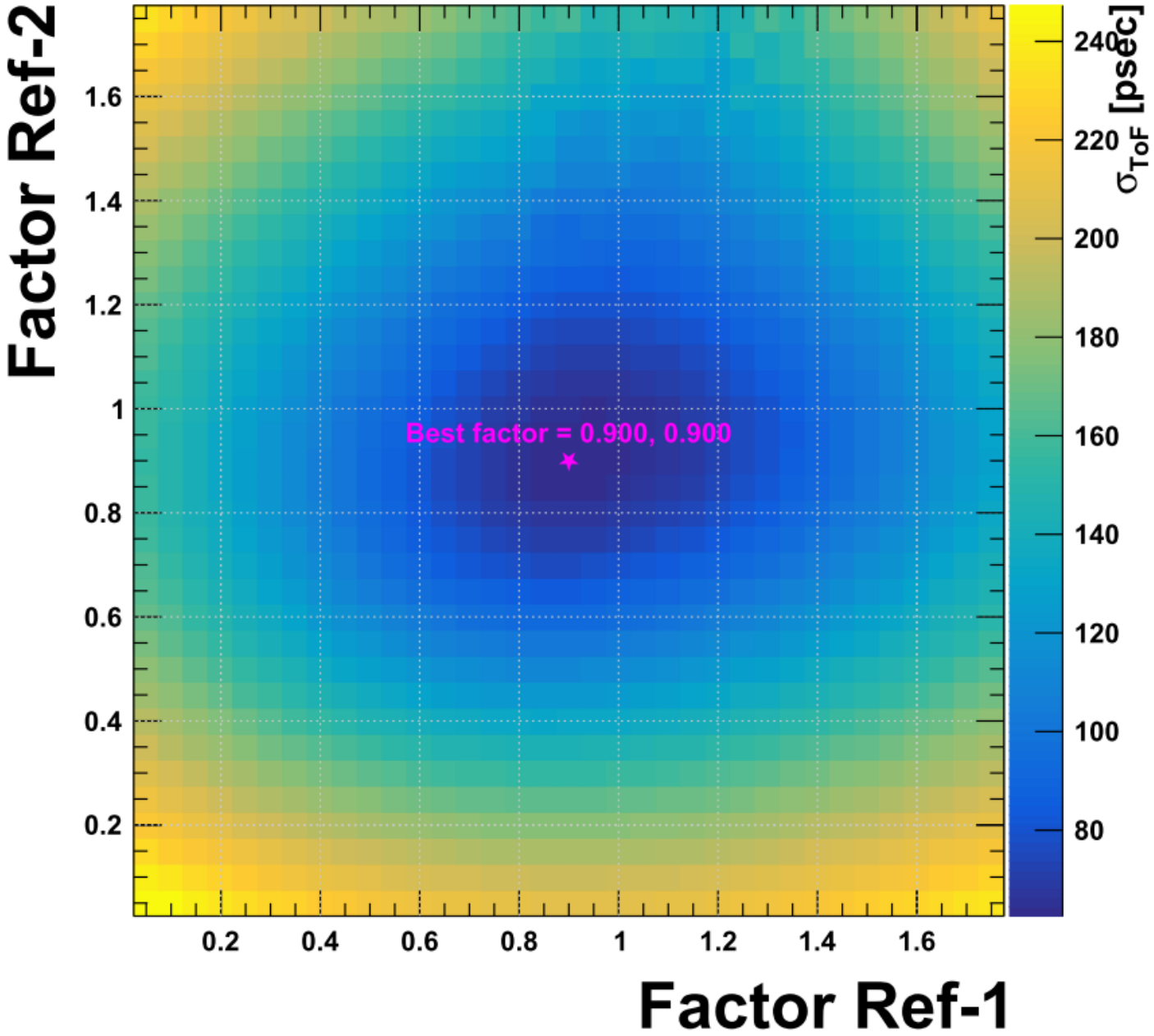
光量(信号の波高) は十分だが,
pedestal に張り付いてしまっている

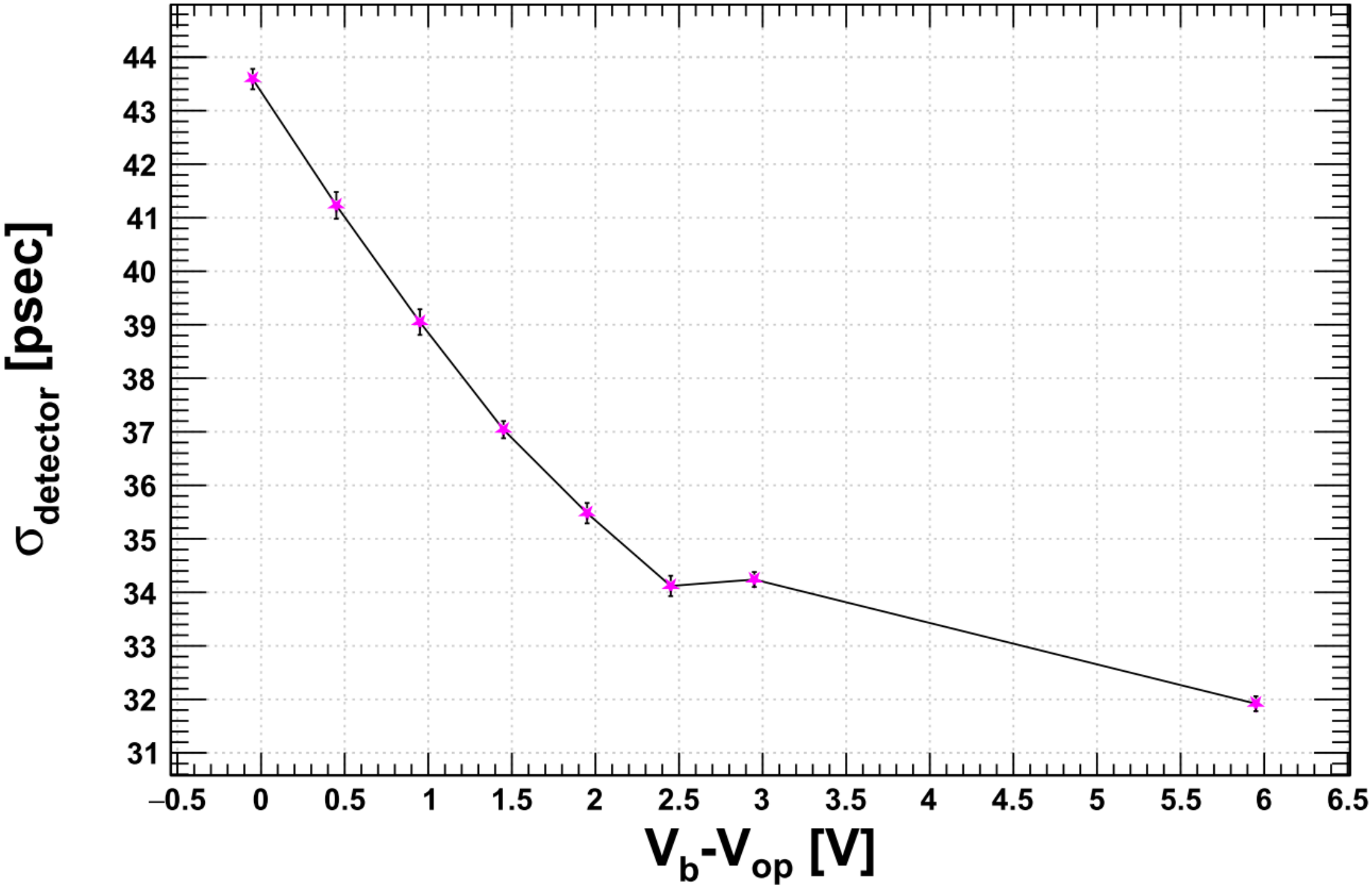
→ Divider で分割した後のQDCに入れる信号を
一旦 Attenetor に入れ, 16dB減衰させたのち,
PMアンプでオフセット調整
→ その後 100 nsec delay させてV792へ入力

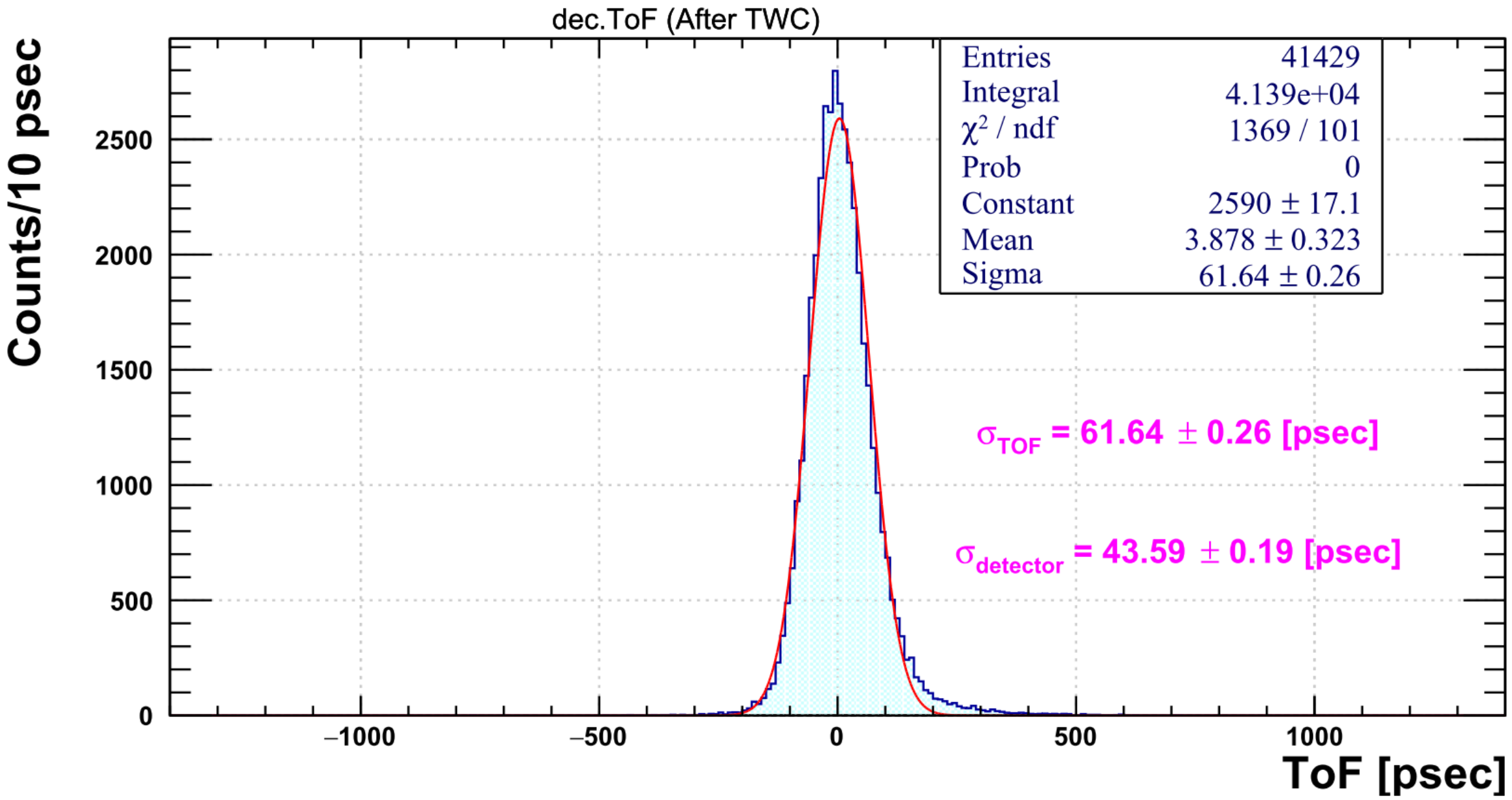

Ref-1.QDC vs. RawToF w/ QDC cut
Entries 41429
Integral 4.139e+04
DecToF [psec] (Peak Adjusted)
2000
1000
0
−1000
−2000
0
50
100
150
200
250
300
350
400
Ref-1.QDC [pC]
10^2
10
1

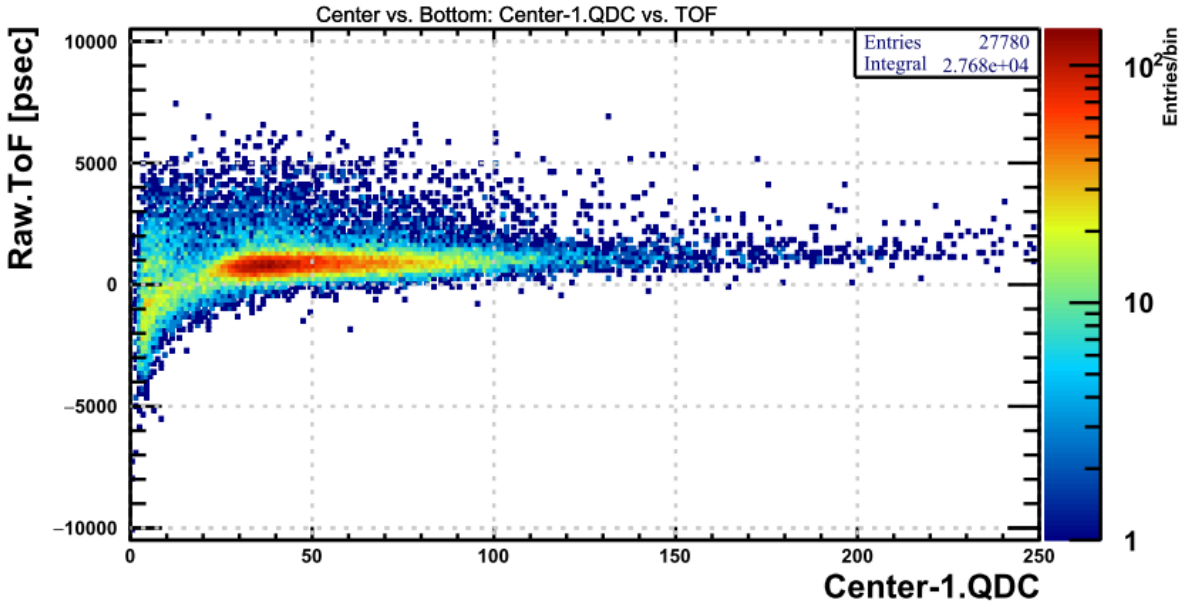

Ref-2.QDC vs. RawToF w/ QDC cut
Entries 41429
Integral 4.139e+04
DecToF [psec] (Peak Adjusted)
2000
1000
0
−1000
−2000
0
50
100
150
200
250
300
350
400
Ref-2.QDC [pC]
10^2
10
1

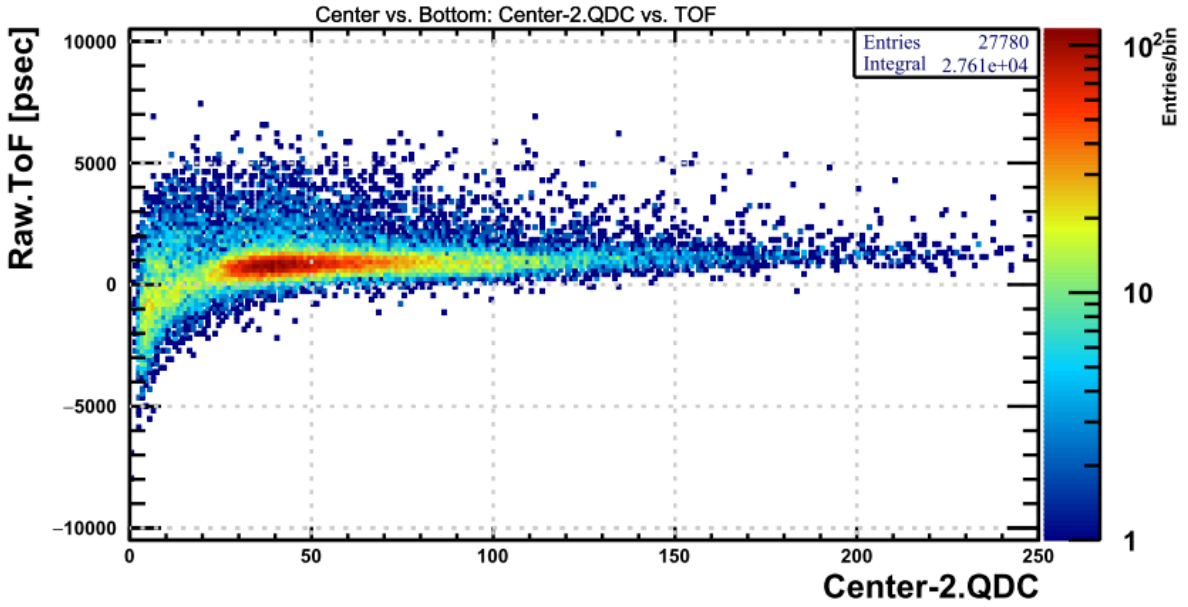
Ref-1 vs. Ref-2

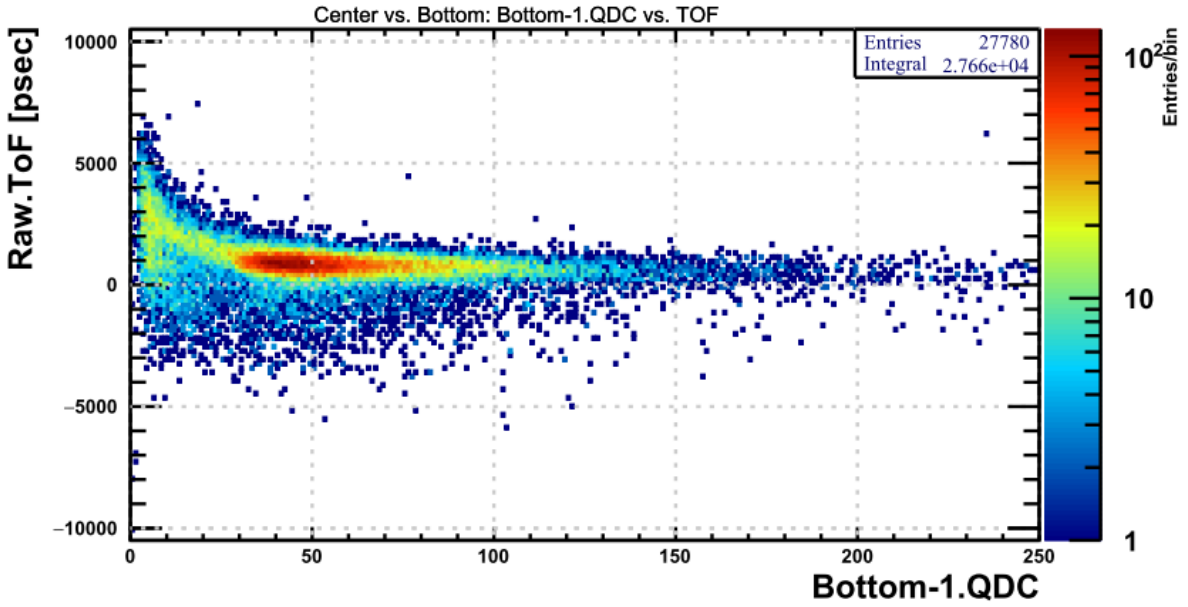

Factor Ref-2
Factor Ref-1
Best factor = 0.900, 0.900
σ_{ToF} [psec]
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
80
100
120
140
160
180
200
220
240

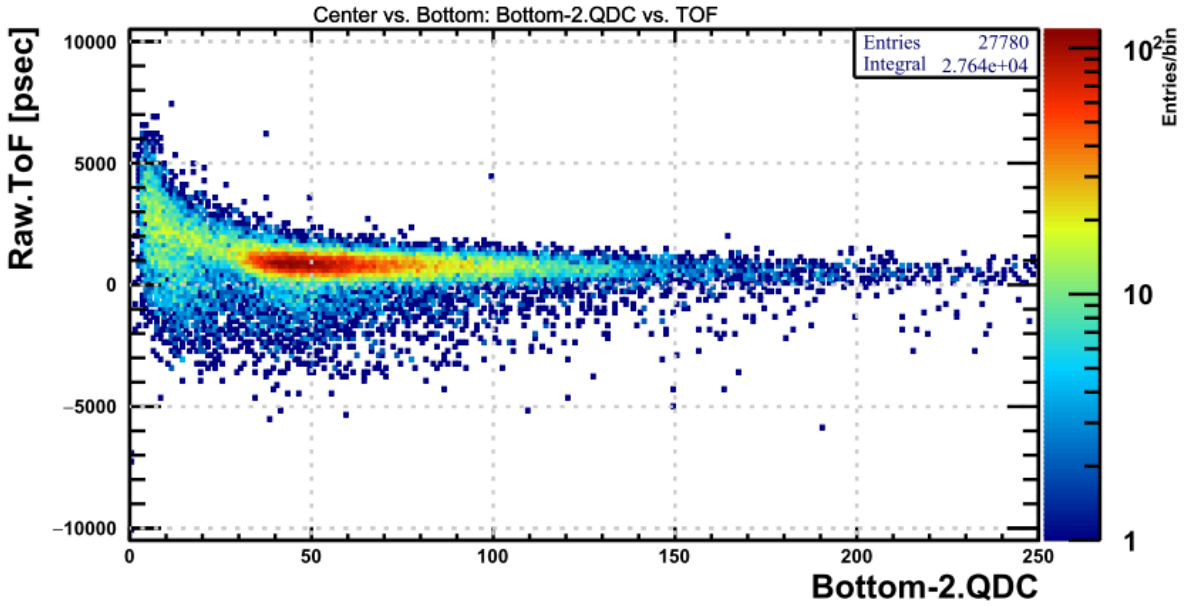

$\sigma_{detector}$ [psec]
44
43
42
41
40
39
38
37
36
35
34
33
32
31
–0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
V_b-V_{op} [V]

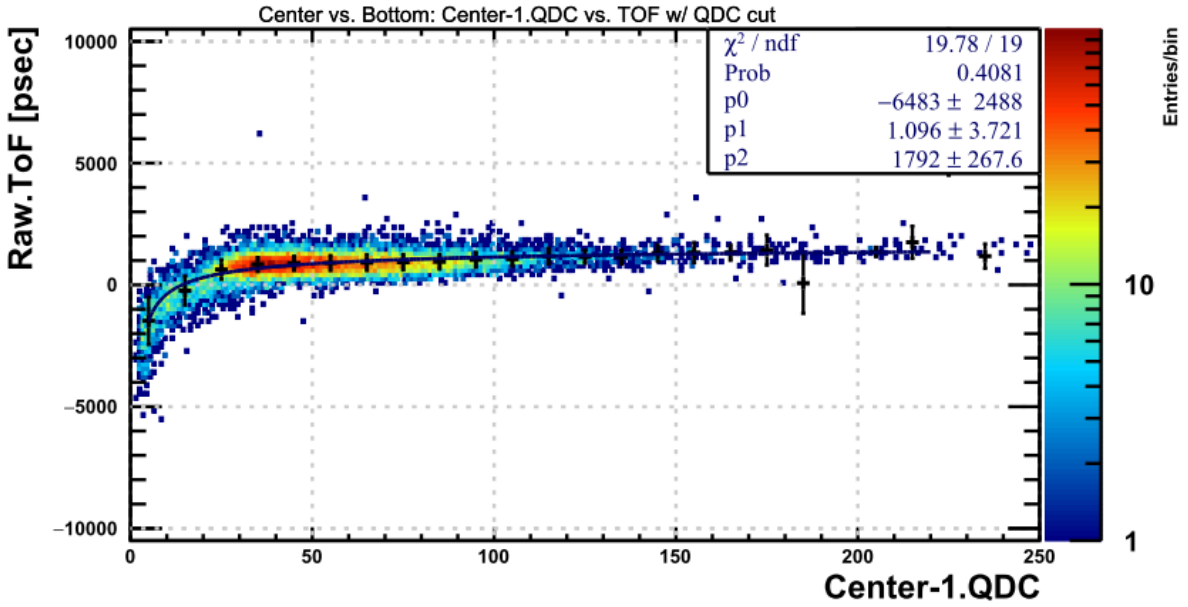

dec.ToF (After TWC)
Counts/10 psec
ToF [psec]
Entries 41429
Integral 4.139e+04
χ² / ndf 1369 / 101
Prob 0
Constant 2590 ± 17.1
Mean 3.878 ± 0.323
Sigma 61.64 ± 0.26
σTOF = 61.64 ± 0.26 [psec]
σdetector = 43.59 ± 0.19 [psec]

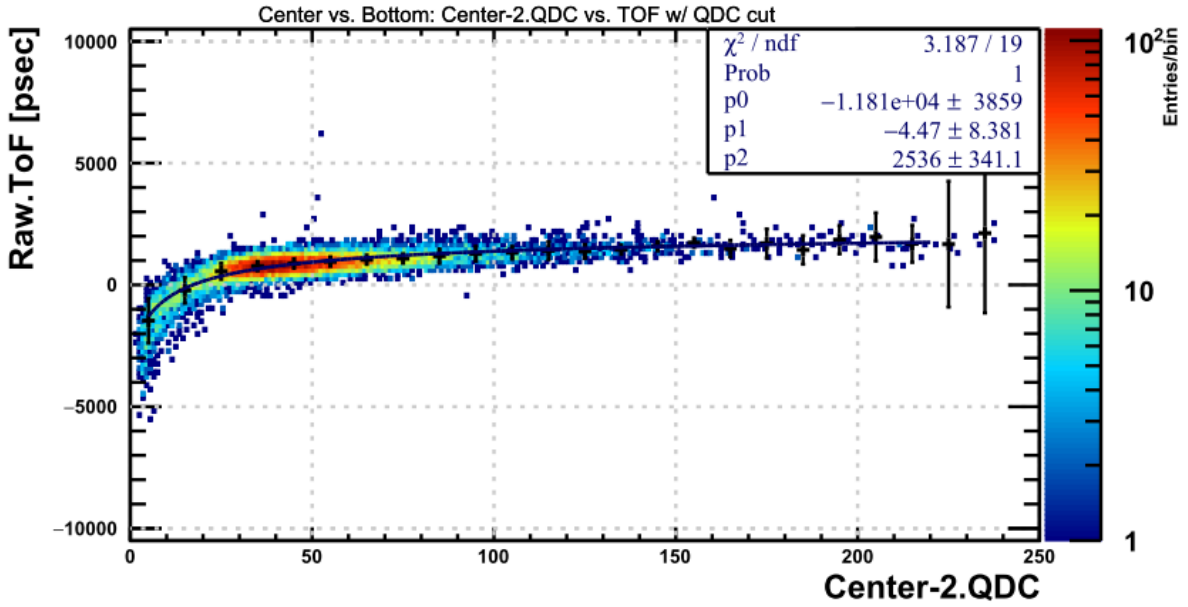

Center vs. Bottom: Center-1.QDC vs. TOF
Entries 27780
Integral 2.768e+04
Raw.ToF [psec]
Center-1.QDC
Entries/bin

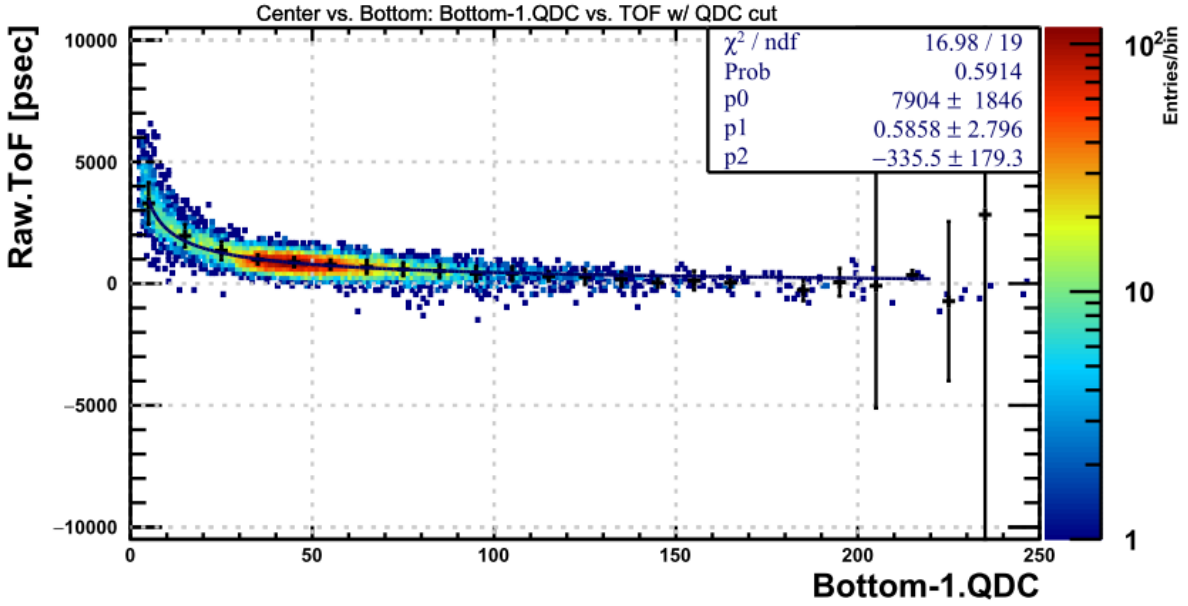

Center vs. Bottom: Center-2.QDC vs. TOF
Entries 27780
Integral 2.761e+04
Raw.ToF [psec]
Center-2.QDC
Entries/bin

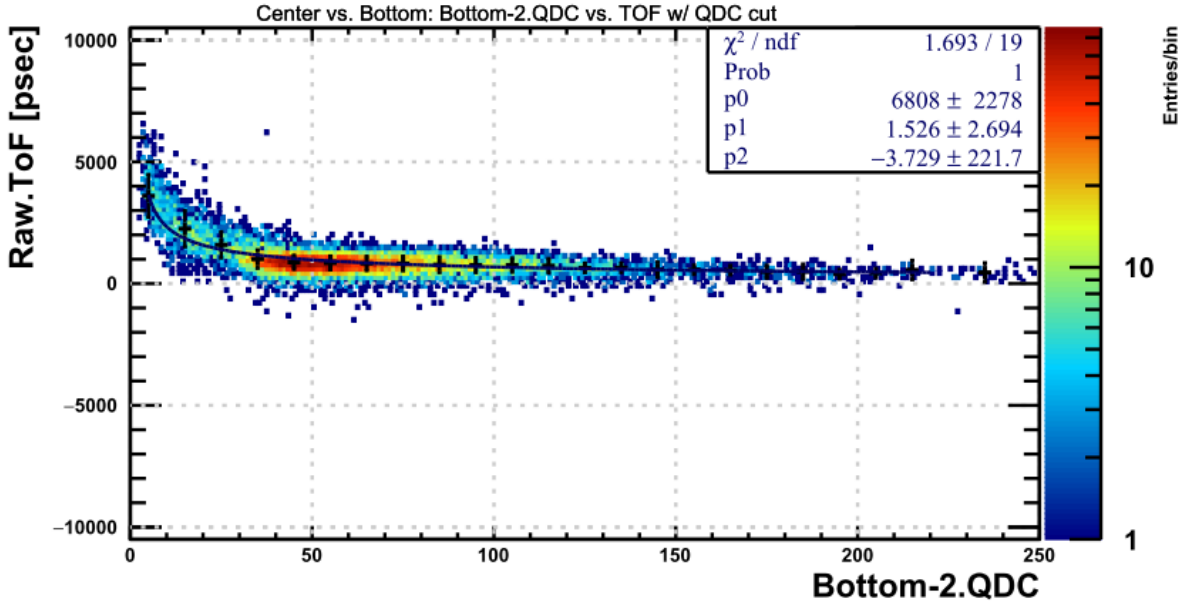

Center vs. Bottom: Bottom-1.QDC vs. TOF
Entries 27780
Integral 2.766e+04
Raw.ToF [psec]
Bottom-1.QDC
Entries/bin

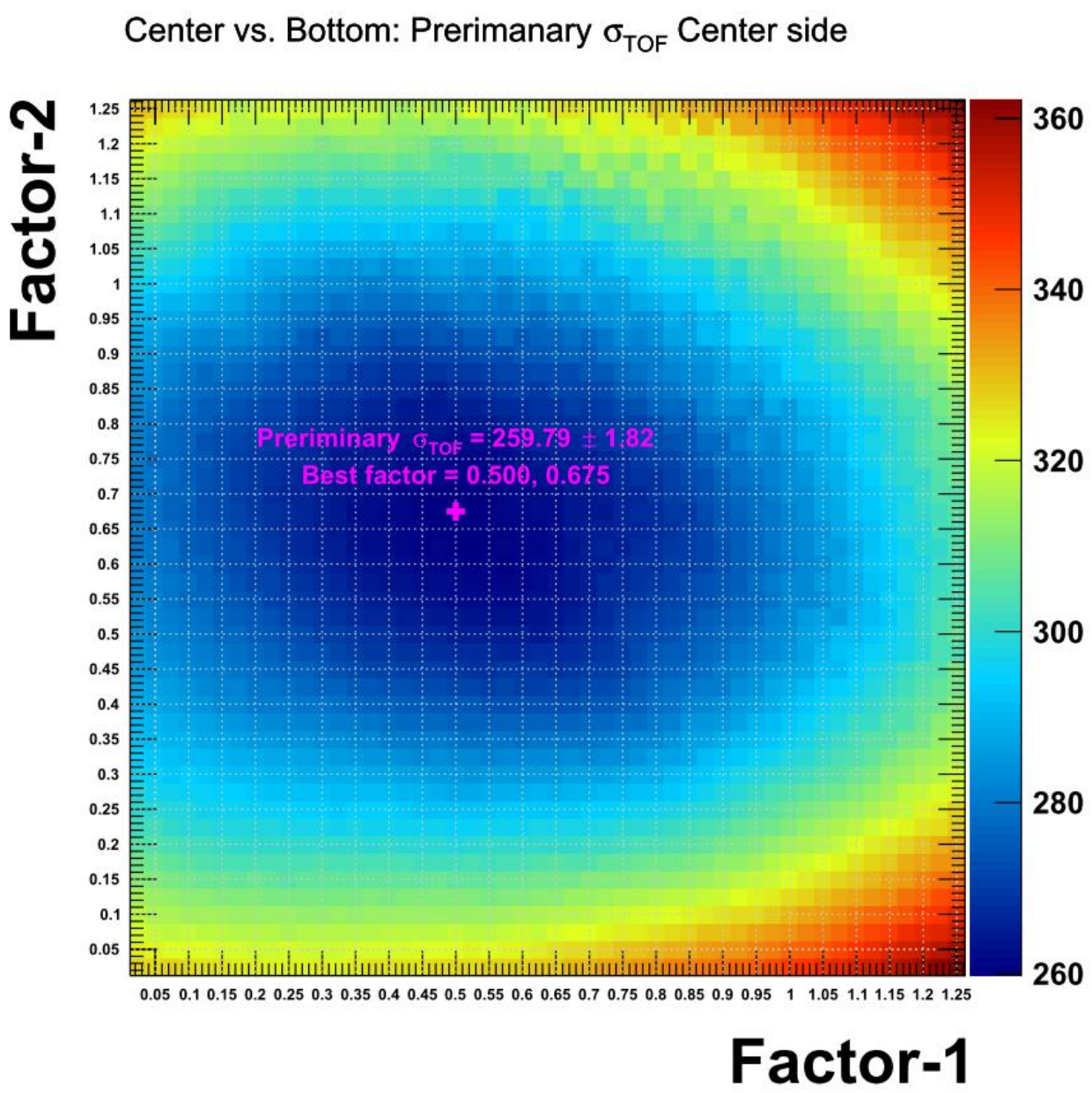

Center vs. Bottom: Bottom-2.QDC vs. TOF
Entries 27780
Integral 2.764e+04
Raw.ToF [psec]
Bottom-2.QDC
Entries/bin

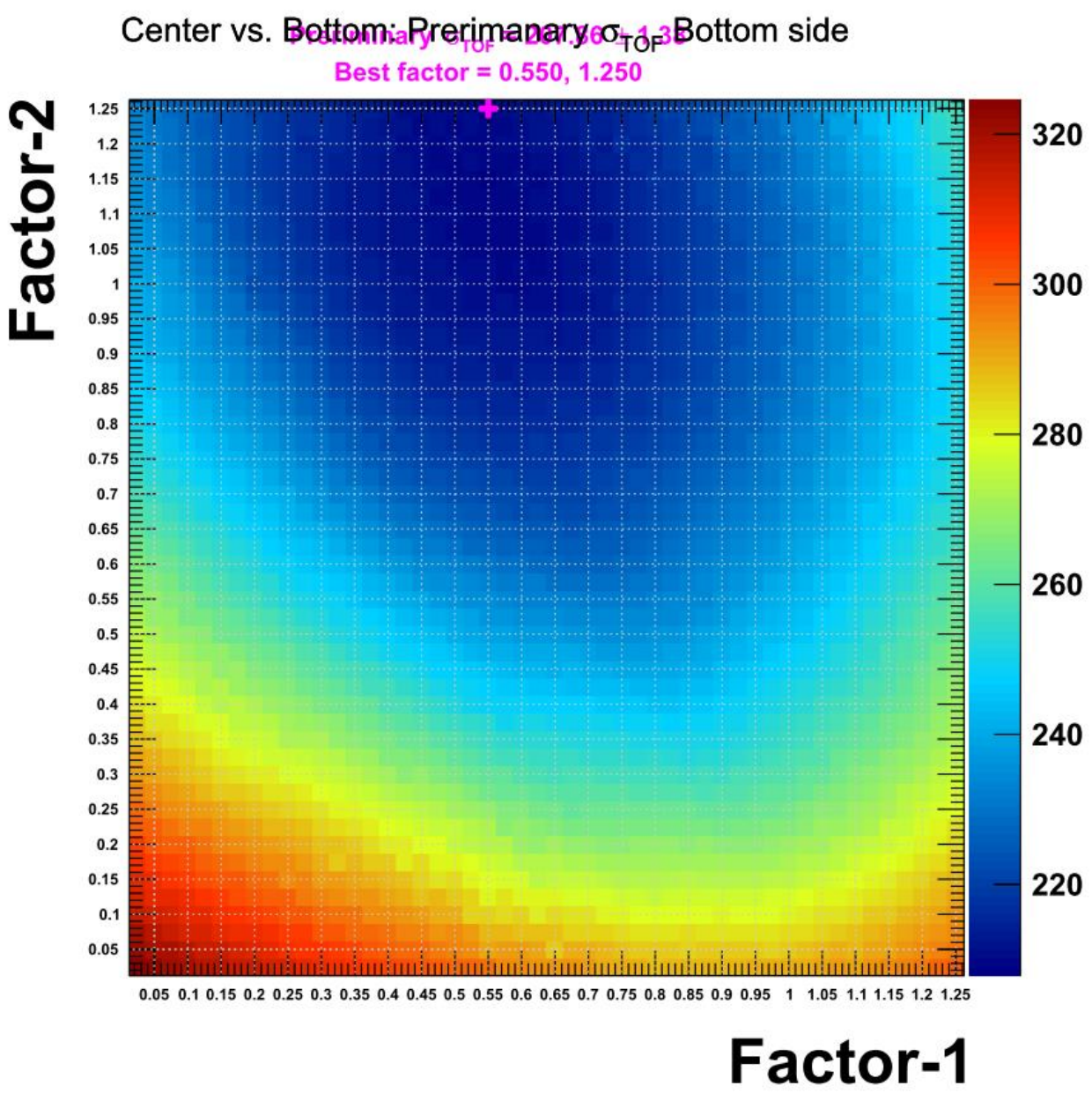

Center vs. Bottom: Center-1.QDC vs. TOF w/ QDC cut
χ² / ndf 19.78 / 19
Prob 0.4081
p0 −6483 ± 2488
p1 1.096 ± 3.721
p2 1792 ± 267.6
Raw.ToF [psec]
Center-1.QDC
Entries/bin

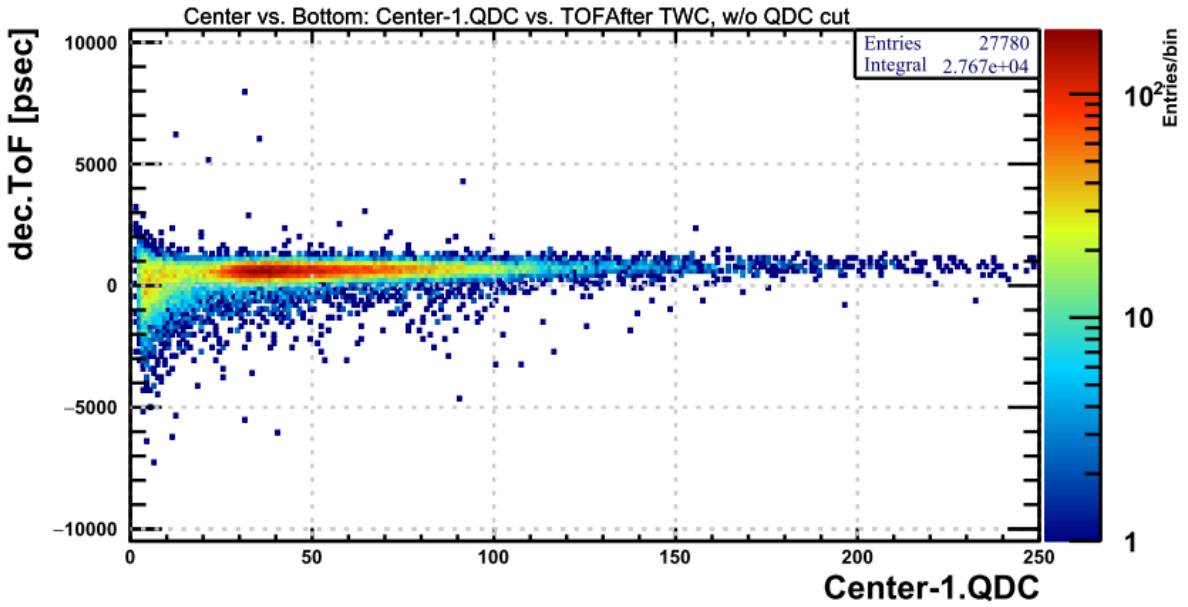

Center vs. Bottom: Center-2.QDC vs. TOF w/ QDC cut
χ² / ndf 3.187 / 19
Prob 1
p0 −1.181e+04 ± 3859
p1 −4.47 ± 8.381
p2 2536 ± 341.1
Raw.ToF [psec]
Center-2.QDC
Entries/bin

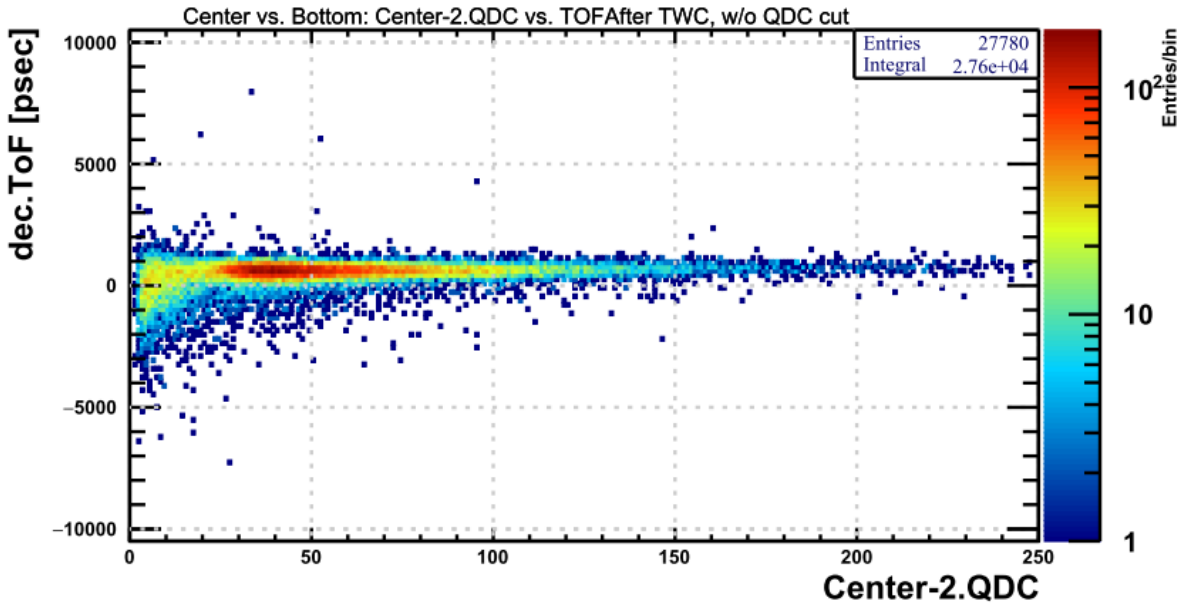

Center vs. Bottom: Bottom-1.QDC vs. TOF w/ QDC cut
χ² / ndf 16.98 / 19
Prob 0.5914
p0 7904 ± 1846
p1 0.5858 ± 2.796
p2 −335.5 ± 179.3
Raw.ToF [psec]
Bottom-1.QDC
Entries/bin

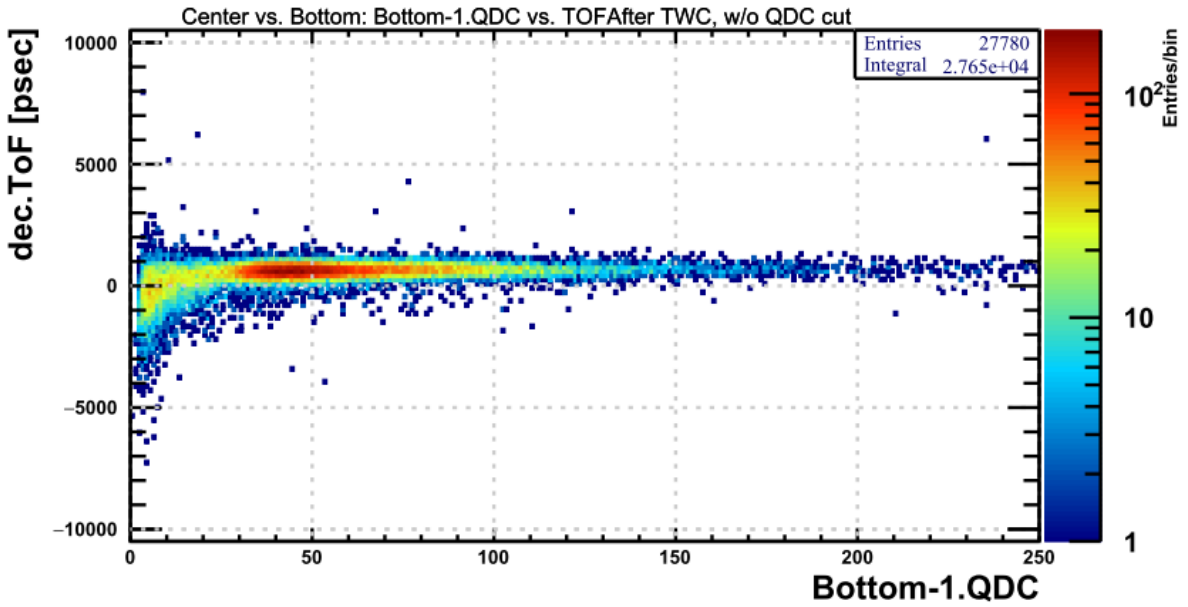

Center vs. Bottom: Bottom-2.QDC vs. TOF w/ QDC cut
χ² / ndf 1.693 / 19
Prob 1
p0 6808 ± 2278
p1 1.526 ± 2.694
p2 −3.729 ± 221.7
Raw.ToF [psec]
Bottom-2.QDC
Entries/bin

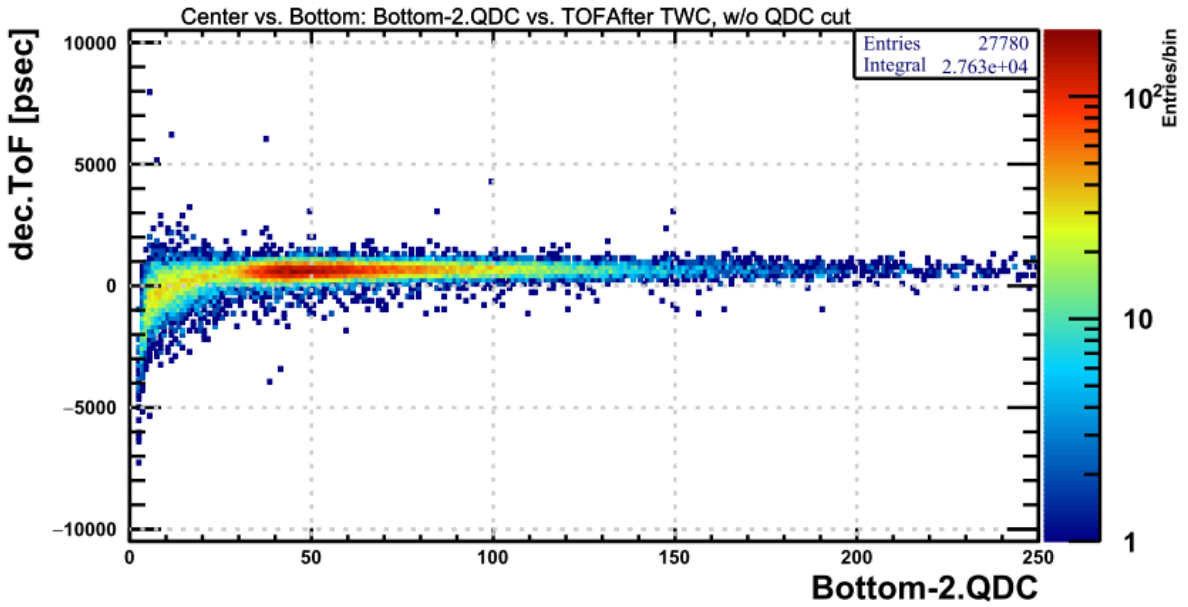

Center vs. Bottom: Preriminary σ_{TOF} Center side
Preriminary σ_{TOF} = 259.79 ± 1.82
Best factor = 0.500, 0.675
Factor-2
Factor-1

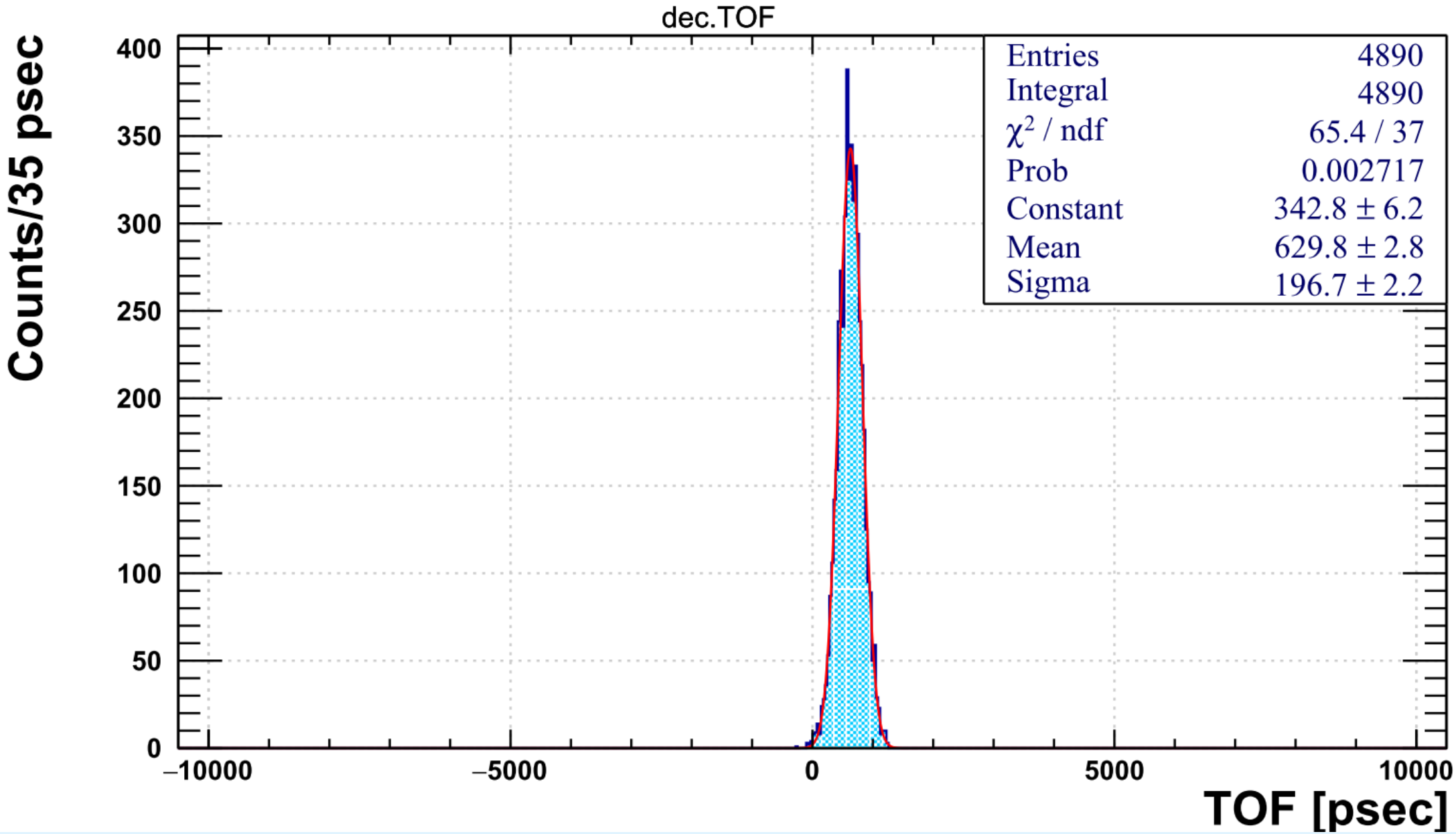

Center vs. Bottom: Preriminary σ_{TOF} Bottom side
Best factor = 0.550, 1.250
Factor-2
Factor-1


Center vs. Bottom: Center-1.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.767e+04
dec.ToF [psec]
Center-1.QDC
Entries/bin

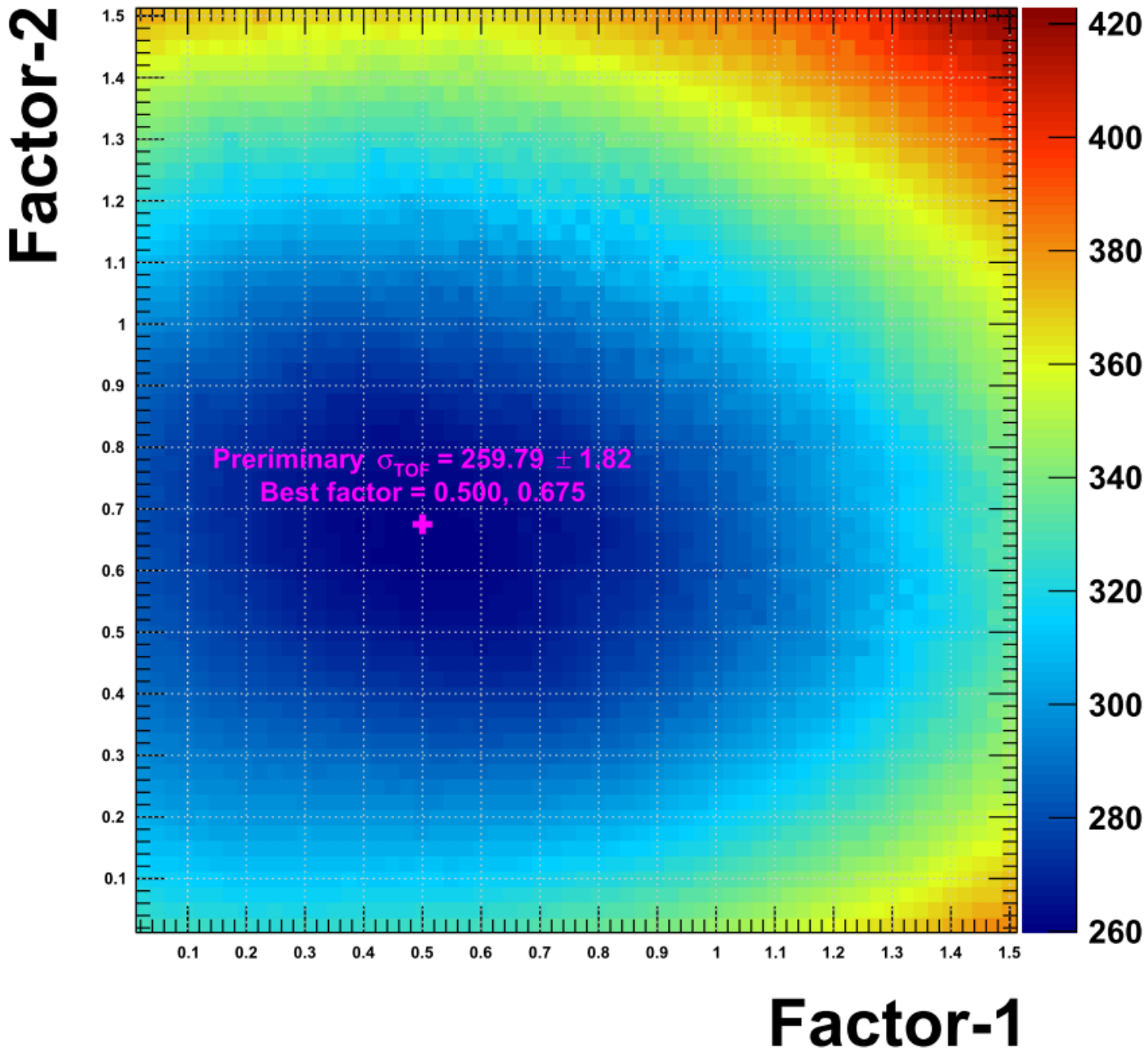

Center vs. Bottom: Center-2.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.76e+04
dec.ToF [psec]
Center-2.QDC
Entries/bin

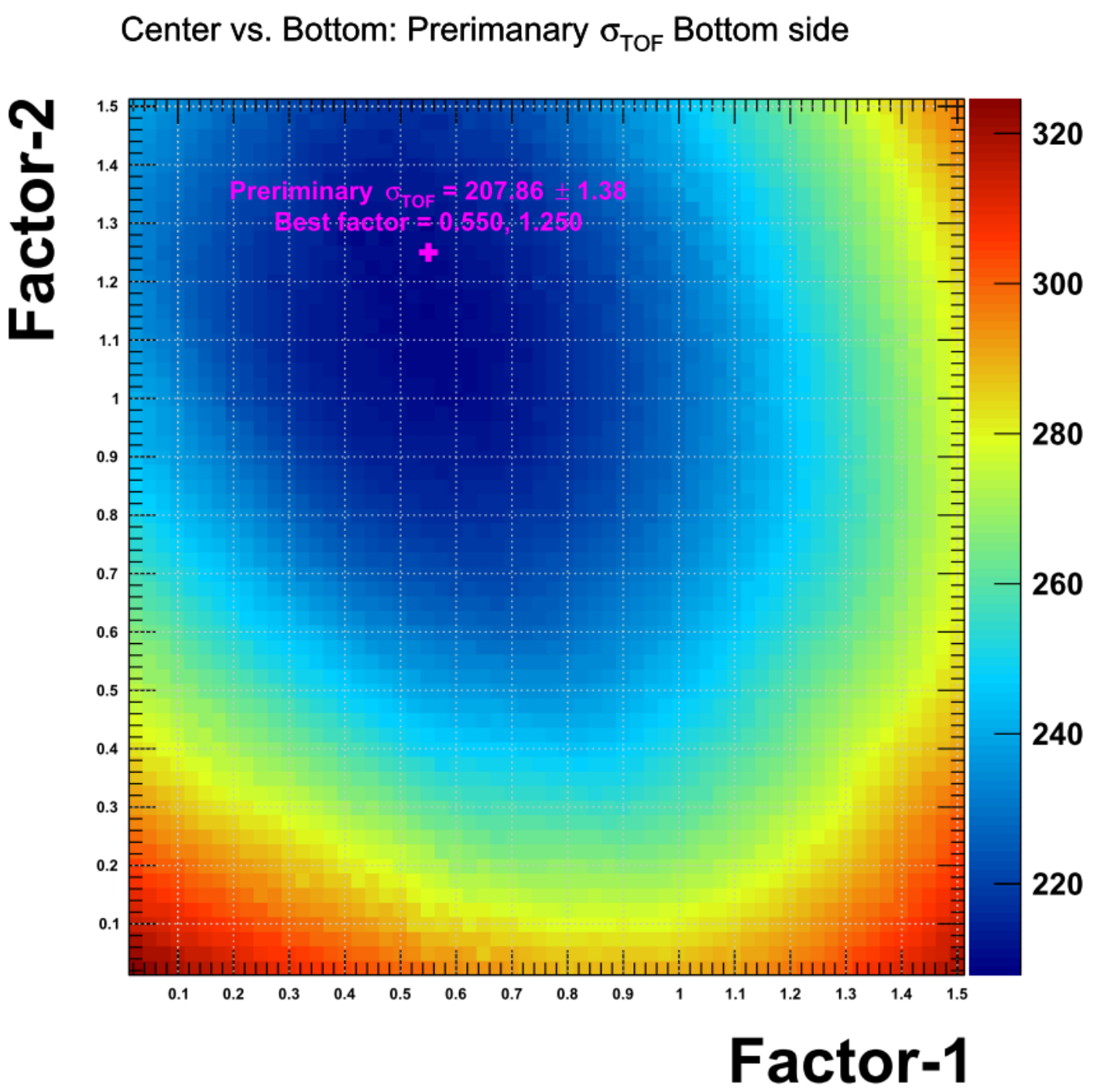

Center vs. Bottom: Bottom-1.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.765e+04
dec.ToF [psec]
Bottom-1.QDC
Entries/bin


Center vs. Bottom: Bottom-2.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.763e+04
dec.ToF [psec]
Bottom-2.QDC
Entries/bin

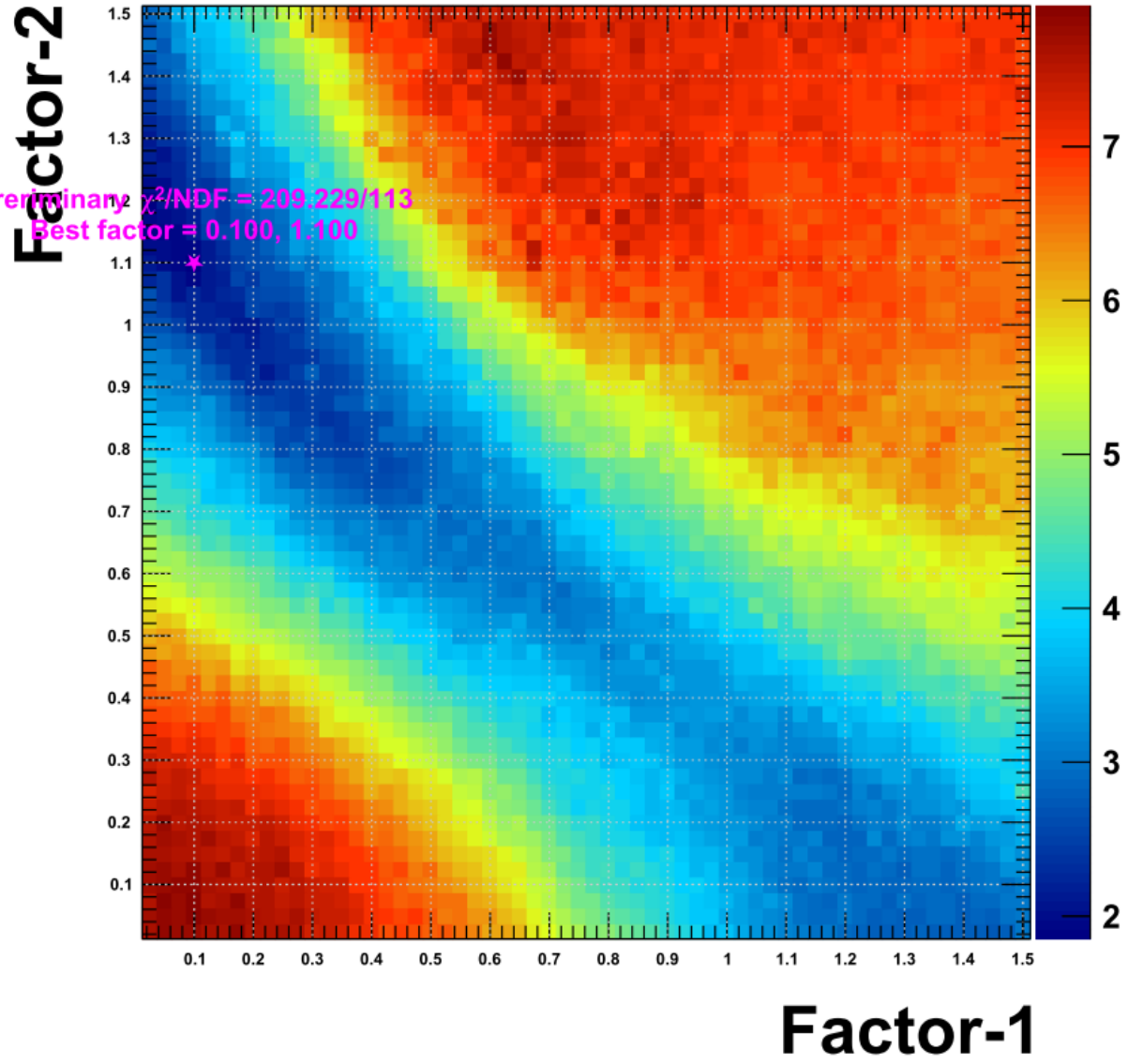

dec.TOF
Counts/35 psec
TOF [psec]
Entries 4890
Integral 4890
χ² / ndf 65.4 / 37
Prob 0.002717
Constant 342.8 ± 6.2
Mean 629.8 ± 2.8
Sigma 196.7 ± 2.2
400
350
300
250
200
150
100
50
0
−10000
−5000
0
5000
10000

Center vs. Bottom: Prerimanary σ_{TOF} Center side

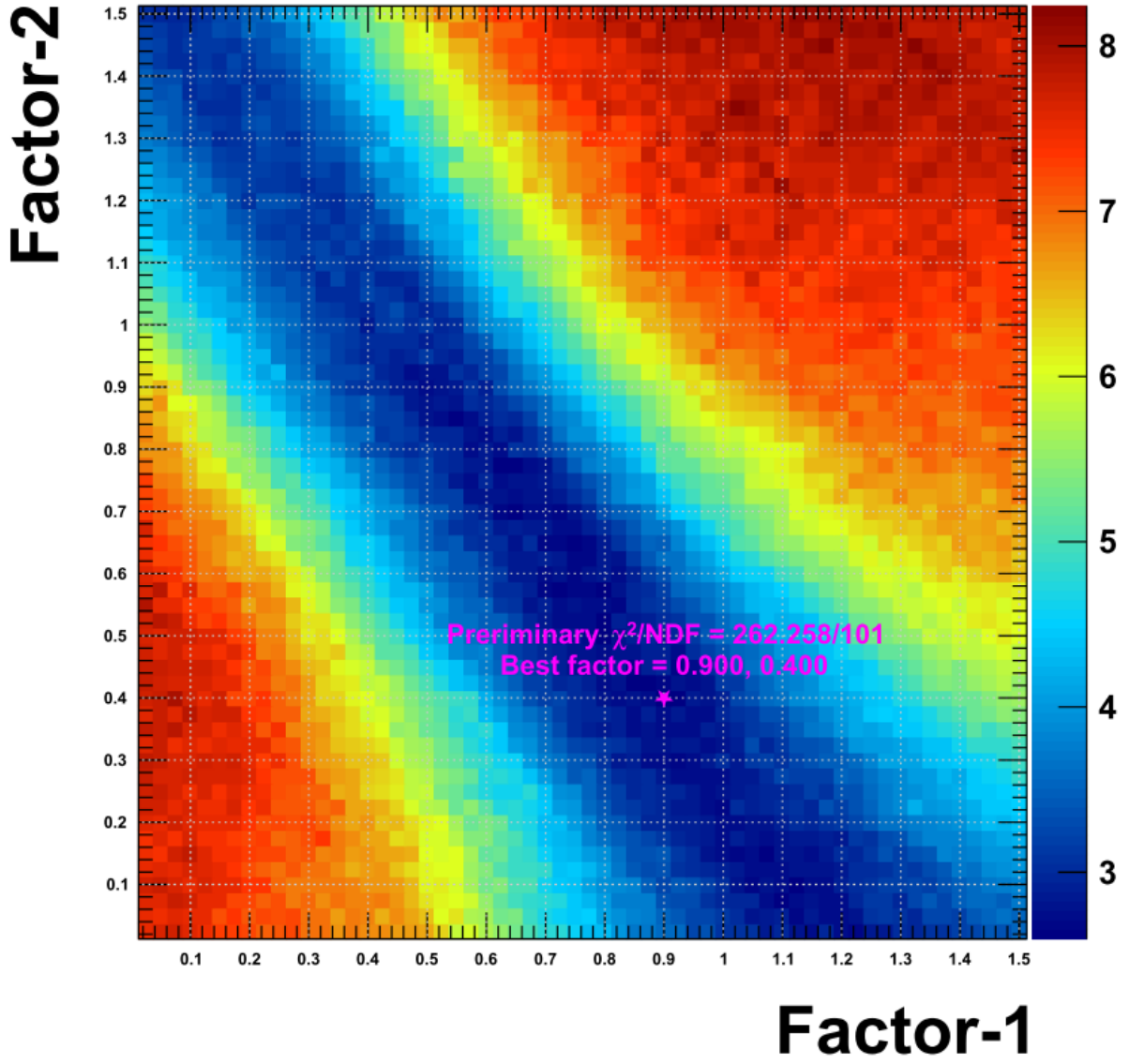


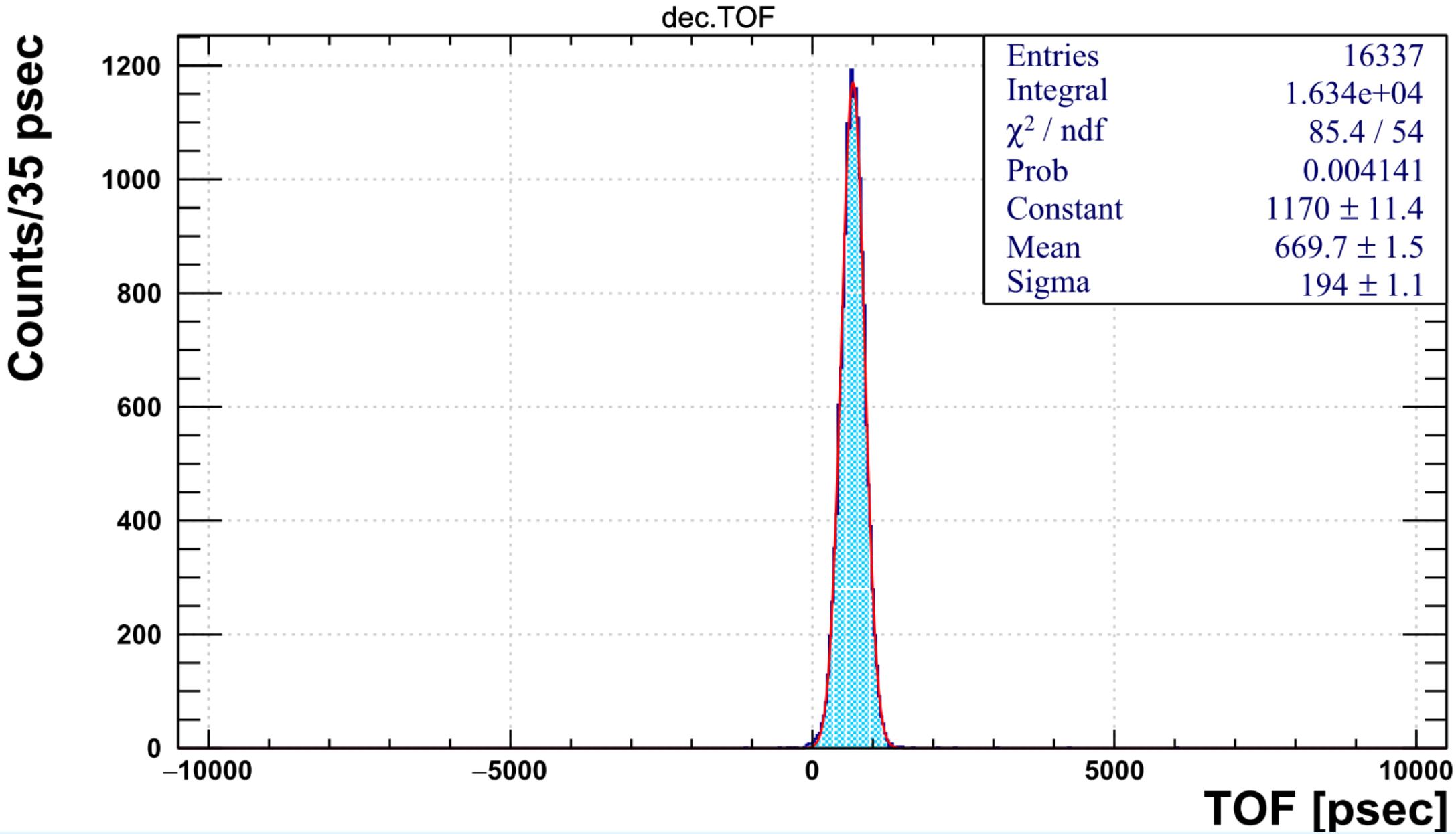

Center vs. Bottom: Preriminary σ_{TOF} Bottom side
Preriminary σ_{TOF} = 207.86 ± 1.38
Best factor = 0.550, 1.250
Factor-2
Factor-1
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5
320
300
280
260
240
220

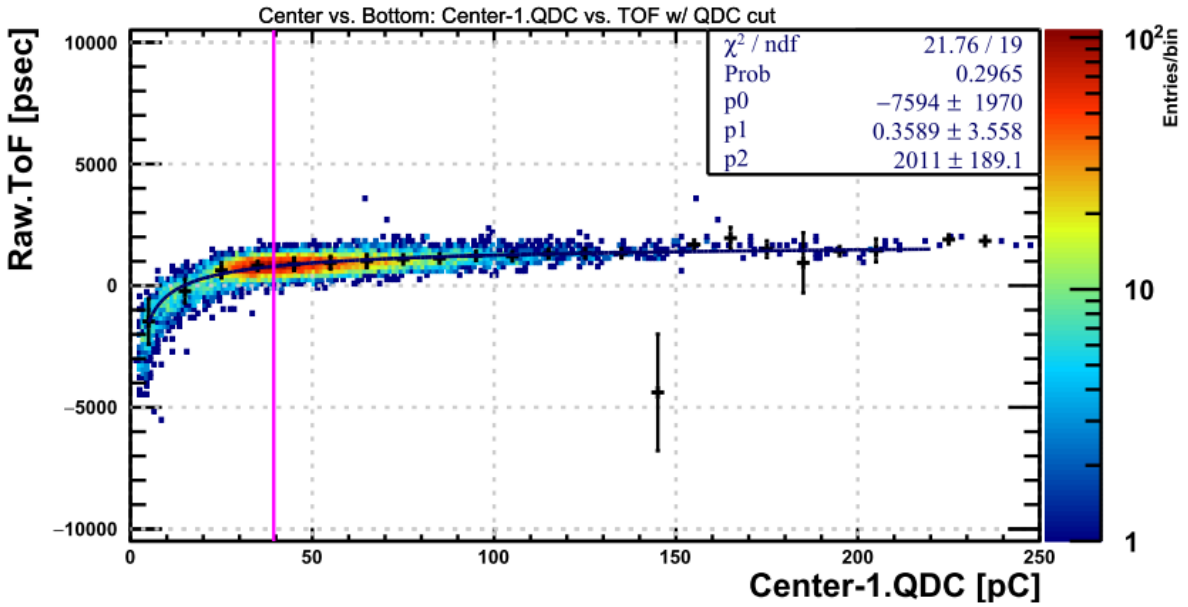
Center vs. Bottom: Prerimanary χ^2/NDF Center side

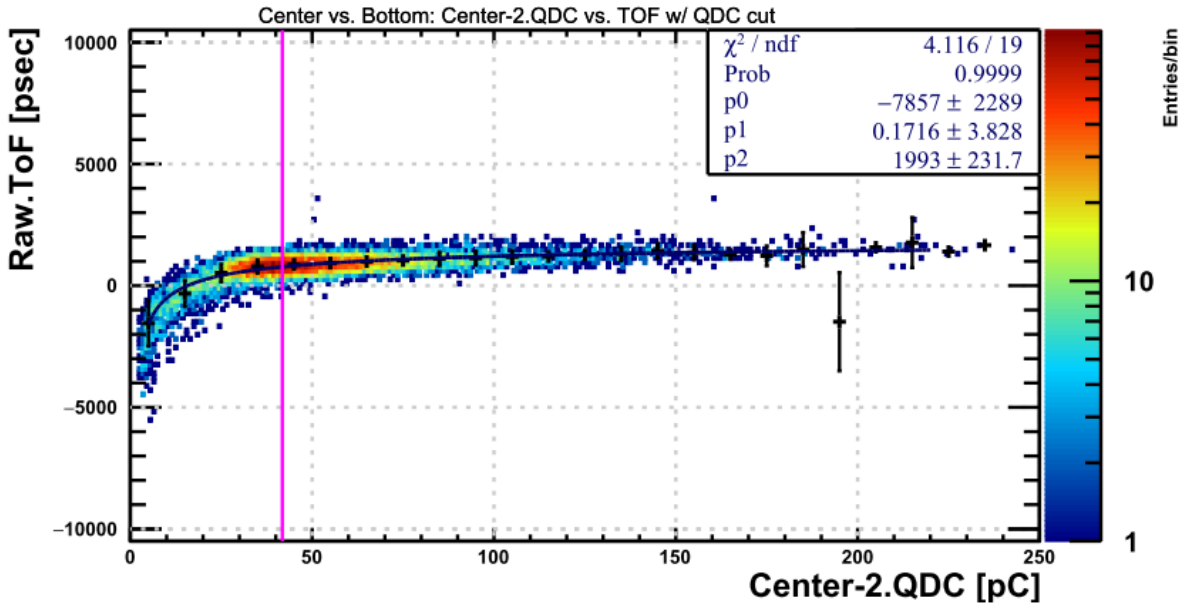


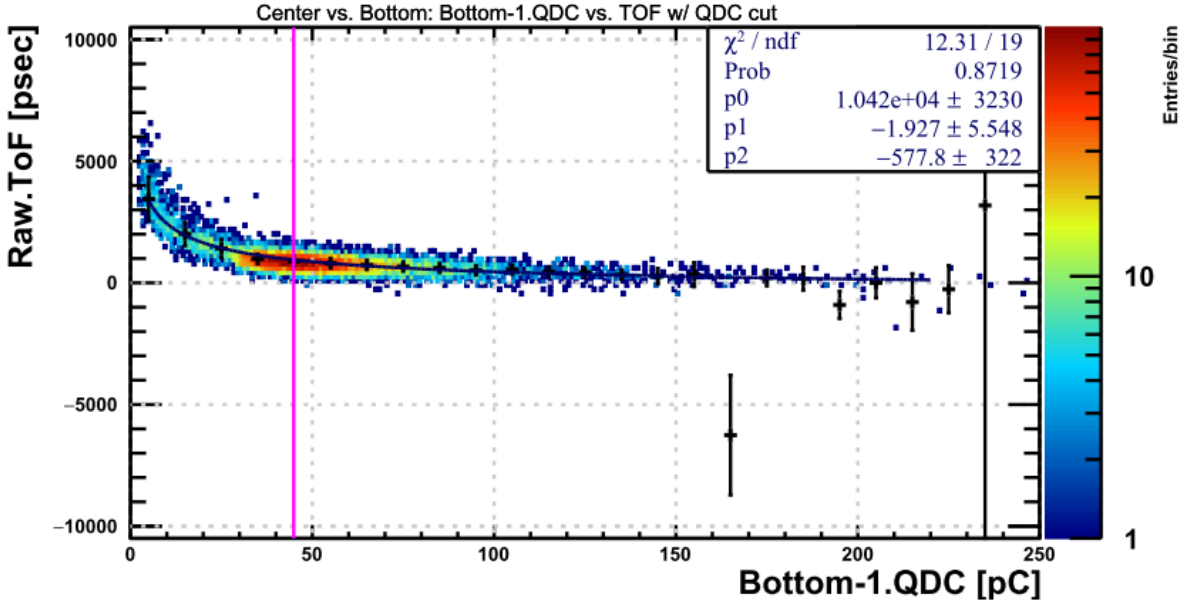
Center vs. Bottom: Prerimanary χ_2/NDF Bottom side

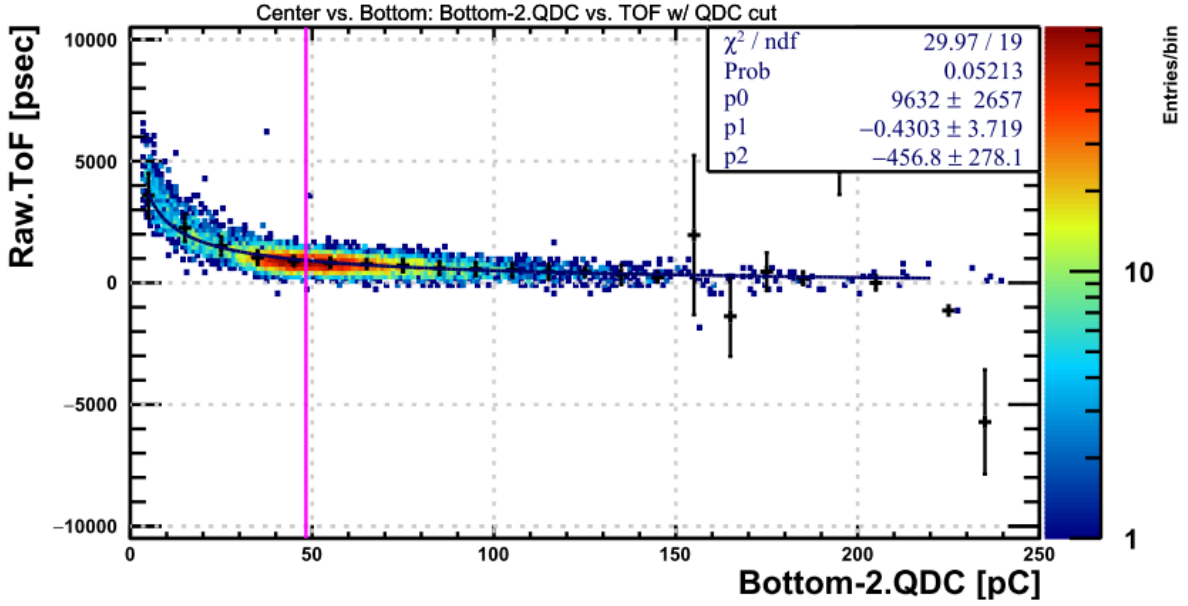


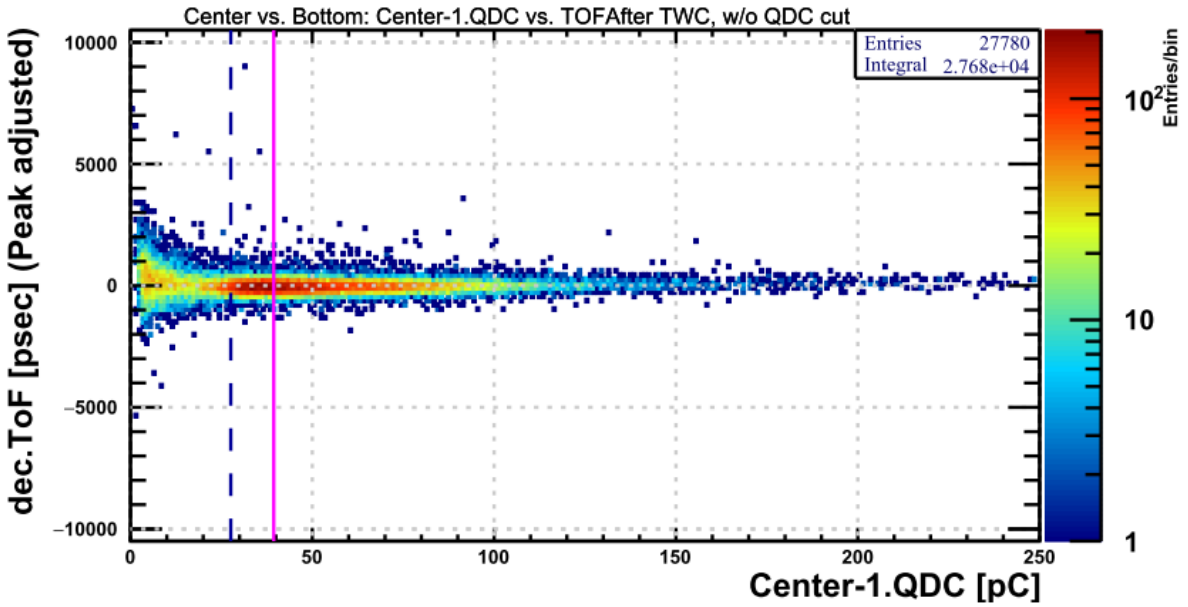

dec.TOF
Entries 16337
Integral 1.634e+04
χ² / ndf 85.4 / 54
Prob 0.004141
Constant 1170 ± 11.4
Mean 669.7 ± 1.5
Sigma 194 ± 1.1
Counts/35 psec
TOF [psec]
0
200
400
600
800
1000
1200
−10000
−5000
0
5000
10000

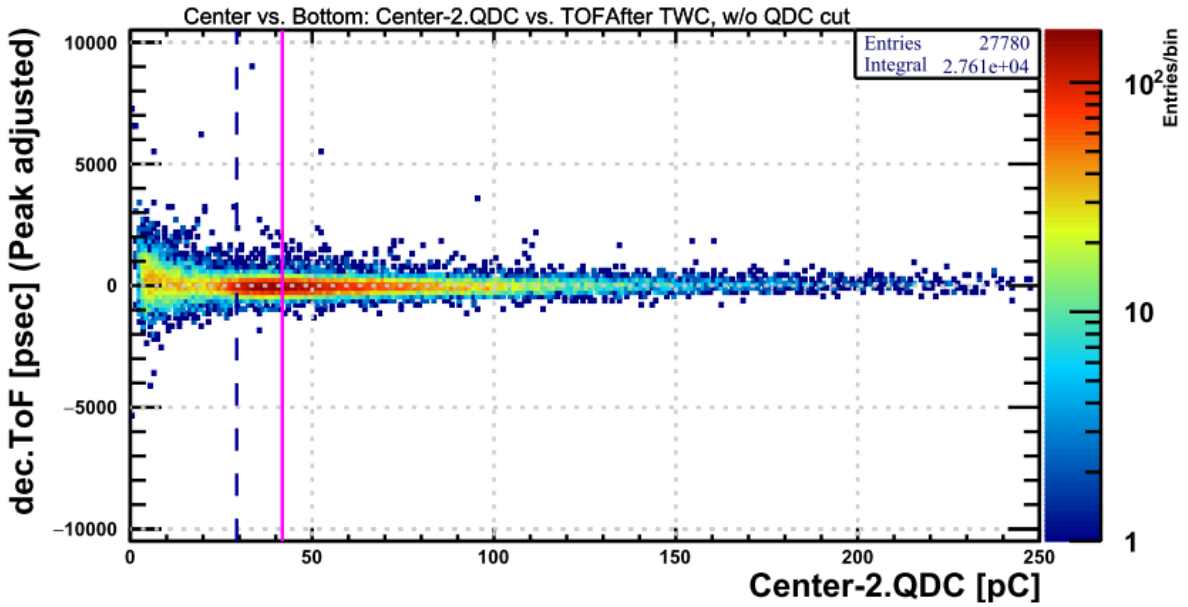

Center vs. Bottom: Center-1.QDC vs. TOF w/ QDC cut
χ² / ndf 21.76 / 19
Prob 0.2965
p0 −7594 ± 1970
p1 0.3589 ± 3.558
p2 2011 ± 189.1
Raw.ToF [psec]
Center-1.QDC [pC]
Entries/bin

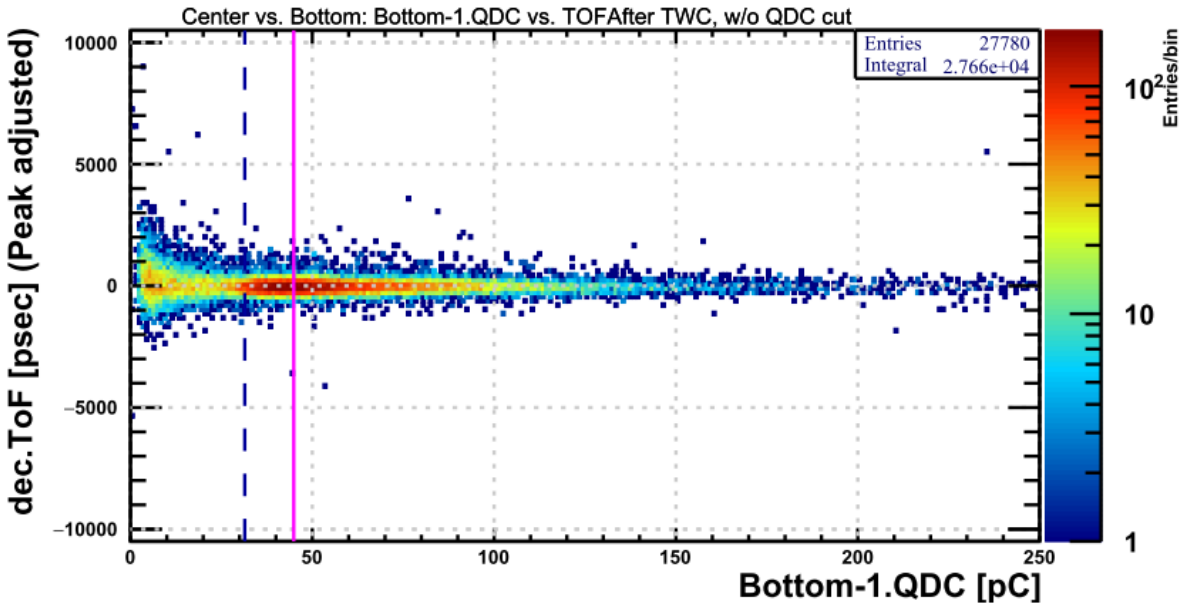

Center vs. Bottom: Center-2.QDC vs. TOF w/ QDC cut
χ² / ndf 4.116 / 19
Prob 0.9999
p0 −7857 ± 2289
p1 0.1716 ± 3.828
p2 1993 ± 231.7
Raw.ToF [psec]
Center-2.QDC [pC]
Entries/bin

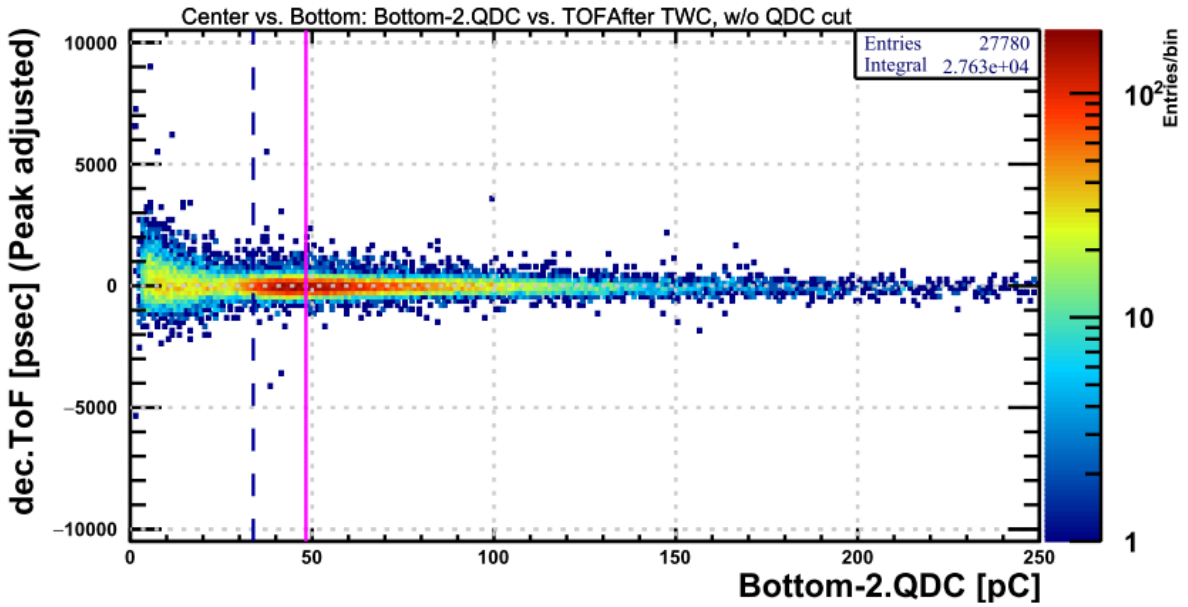

Center vs. Bottom: Bottom-1.QDC vs. TOF w/ QDC cut
χ² / ndf 12.31 / 19
Prob 0.8719
p0 1.042e+04 ± 3230
p1 −1.927 ± 5.548
p2 −577.8 ± 322
Raw.ToF [psec]
Bottom-1.QDC [pC]
Entries/bin

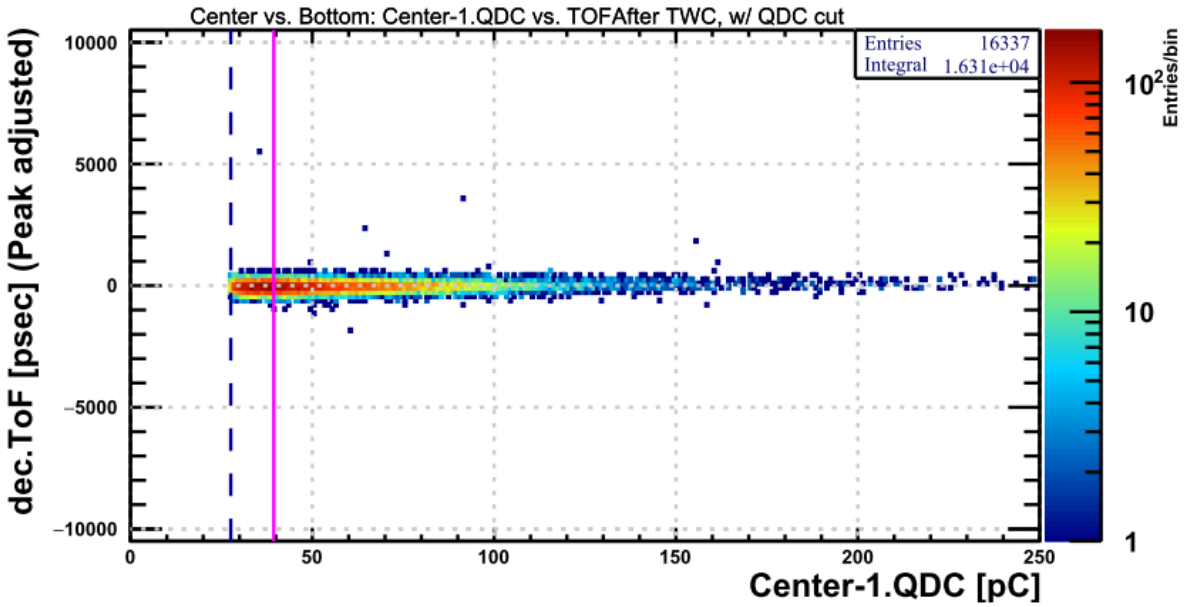

Center vs. Bottom: Bottom-2.QDC vs. TOF w/ QDC cut
χ² / ndf 29.97 / 19
Prob 0.05213
p0 9632 ± 2657
p1 −0.4303 ± 3.719
p2 −456.8 ± 278.1
Raw.ToF [psec]
Bottom-2.QDC [pC]
Entries/bin

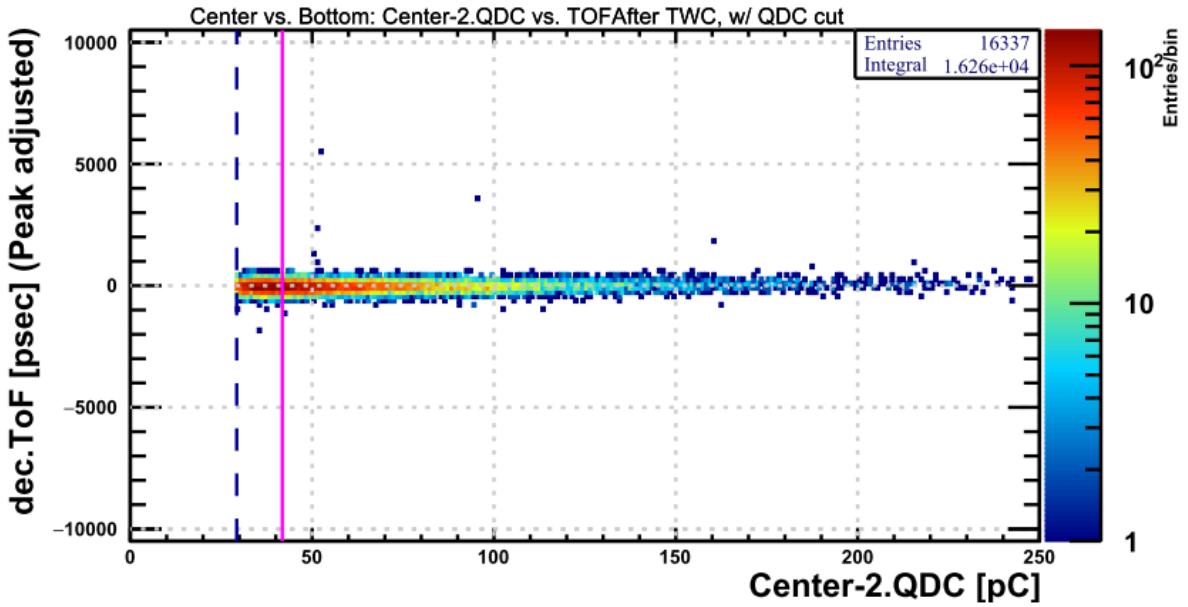

Center vs. Bottom: Center-1.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.768e+04
dec.ToF [psec] (Peak adjusted)
Center-1.QDC [pC]
Entries/bin

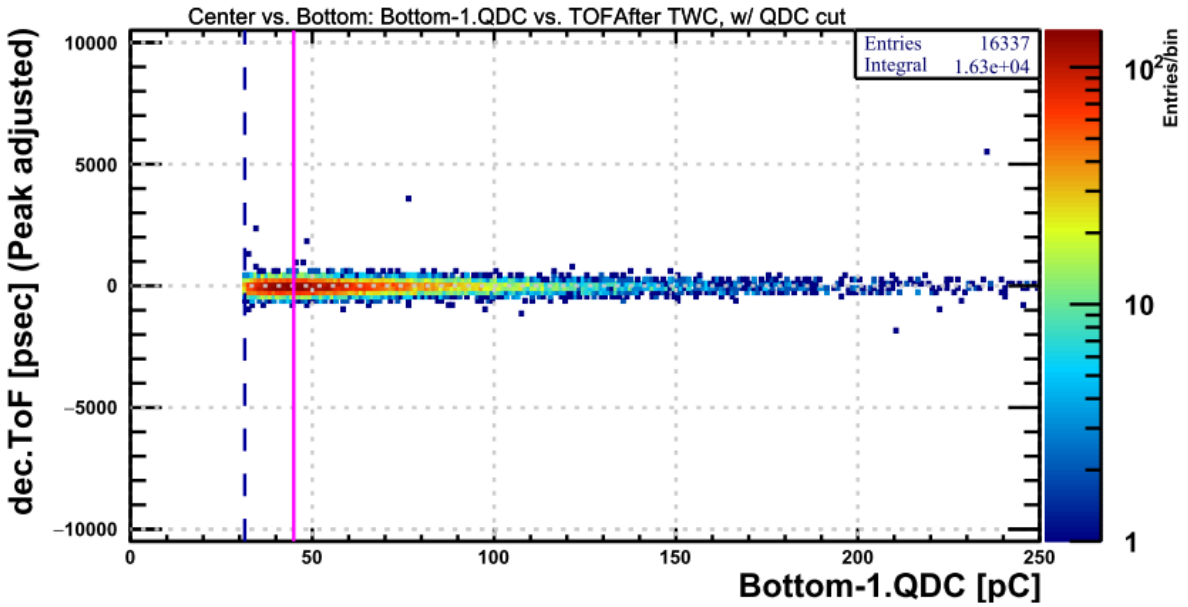

Center vs. Bottom: Center-2.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.761e+04
dec.ToF [psec] (Peak adjusted)
Center-2.QDC [pC]
Entries/bin

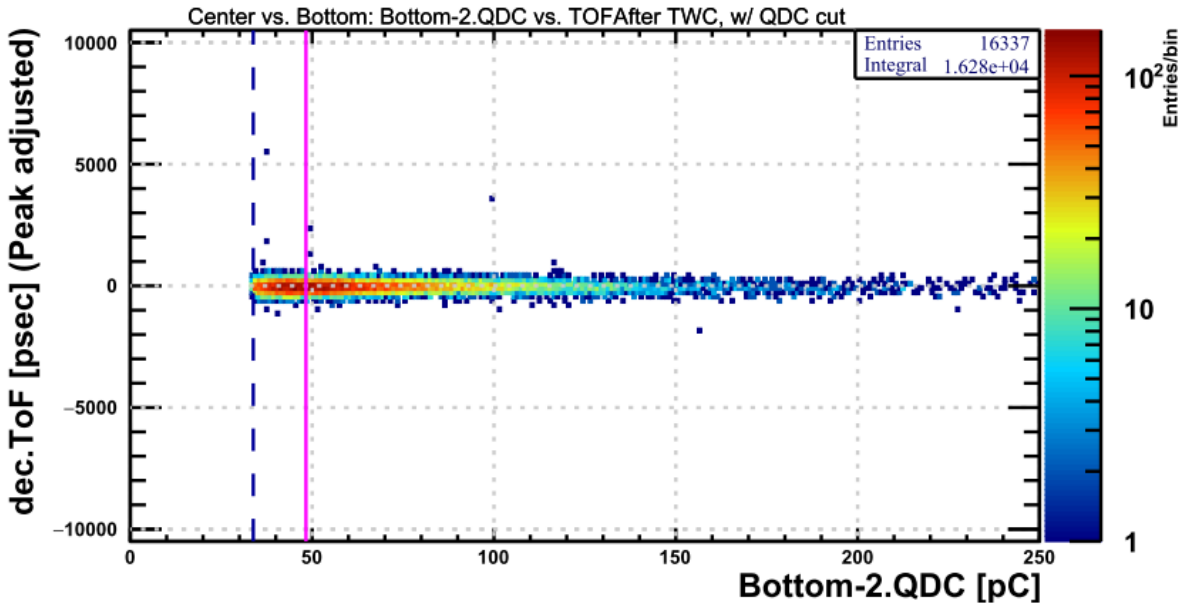

Center vs. Bottom: Bottom-1.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.766e+04
dec.ToF [psec] (Peak adjusted)
Bottom-1.QDC [pC]
Entries/bin

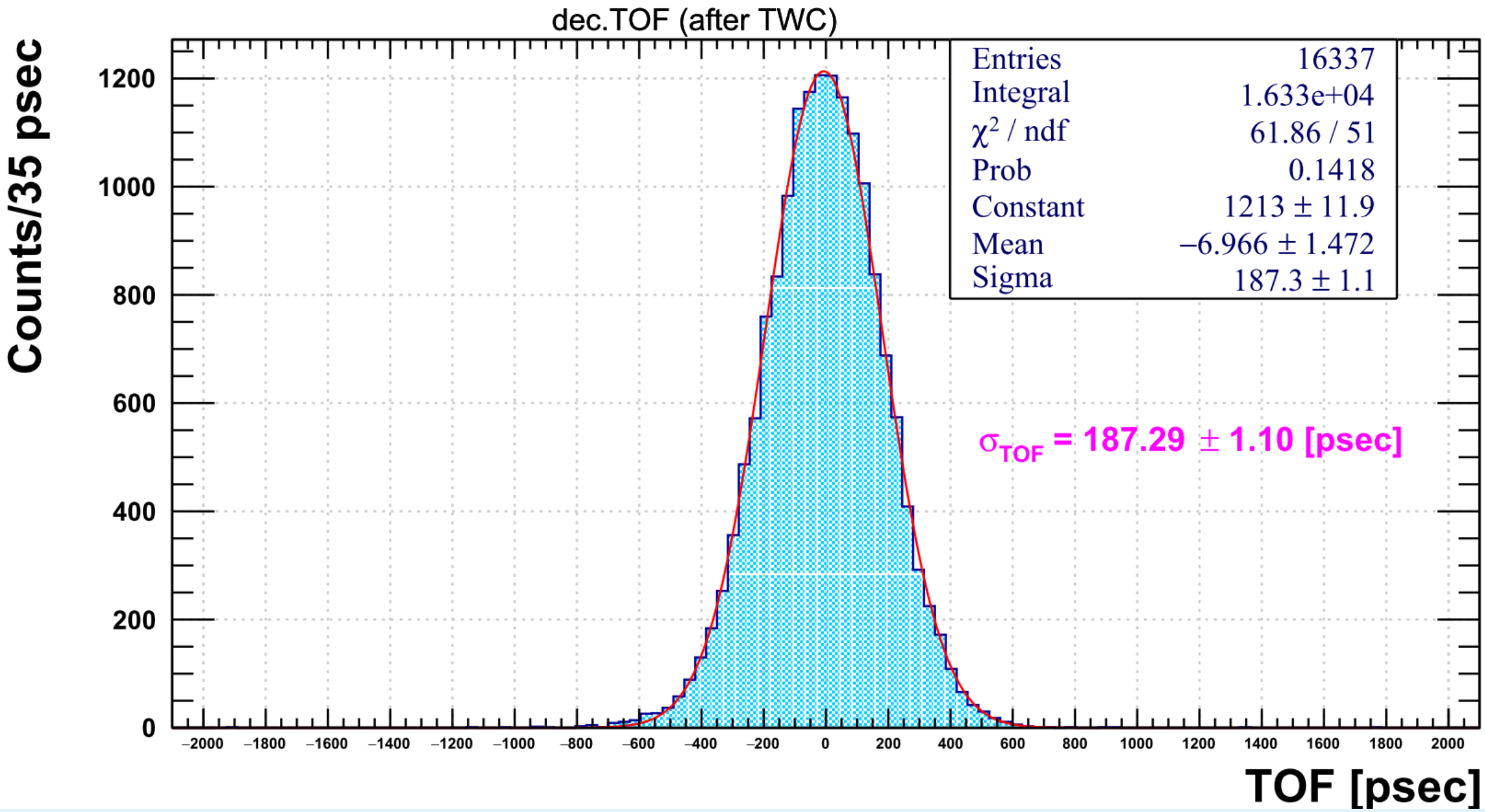

Center vs. Bottom: Bottom-2.QDC vs. TOFAfter TWC, w/o QDC cut
Entries 27780
Integral 2.763e+04
dec.ToF [psec] (Peak adjusted)
Bottom-2.QDC [pC]
Entries/bin

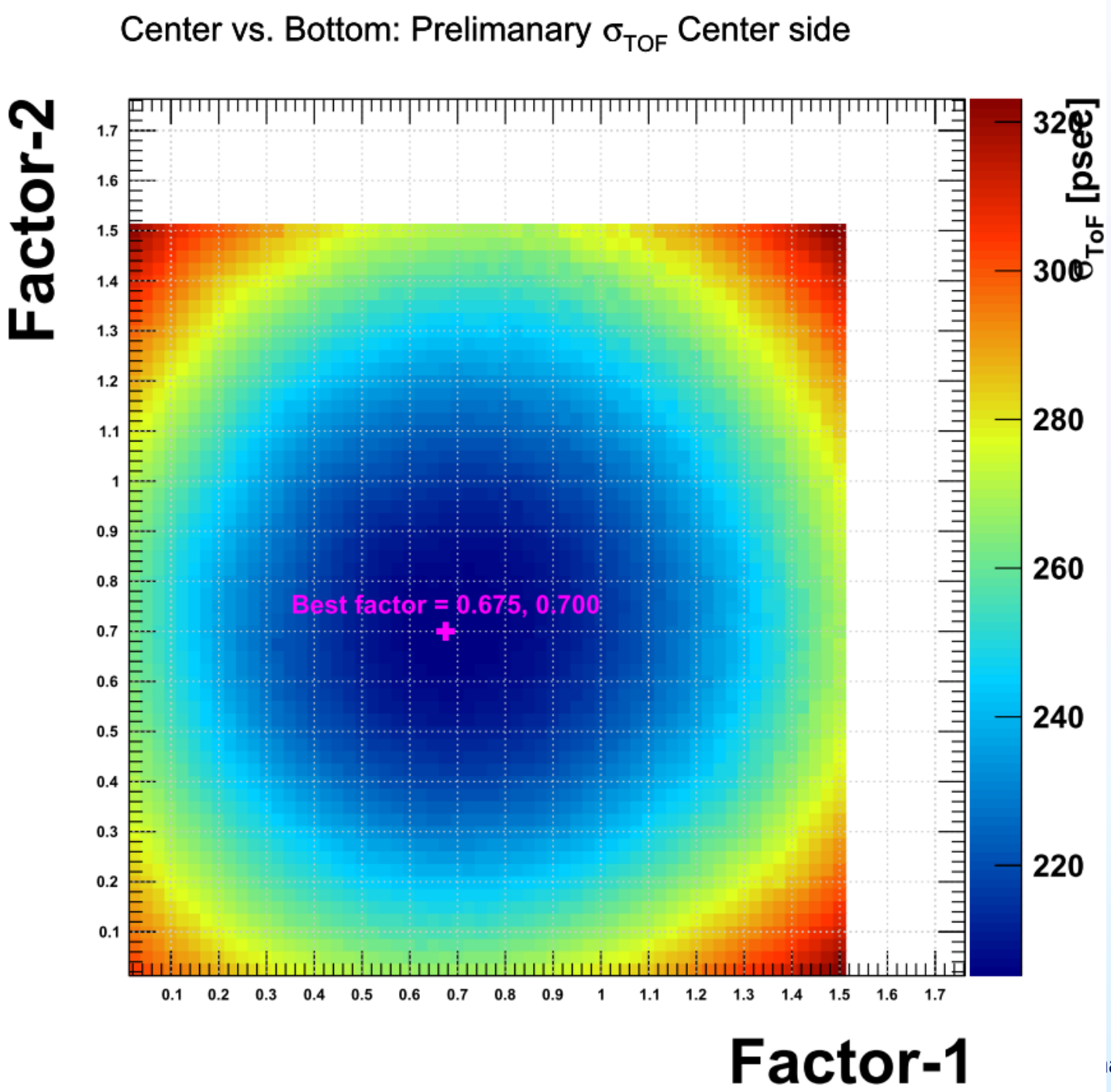

Center vs. Bottom: Center-1.QDC vs. TOFAfter TWC, w/ QDC cut
Entries 16337
Integral 1.631e+04
dec.ToF [psec] (Peak adjusted)
Center-1.QDC [pC]
Entries/bin


Center vs. Bottom: Center-2.QDC vs. TOFAfter TWC, w/ QDC cut
Entries 16337
Integral 1.626e+04
dec.ToF [psec] (Peak adjusted)
Center-2.QDC [pC]
Entries/bin

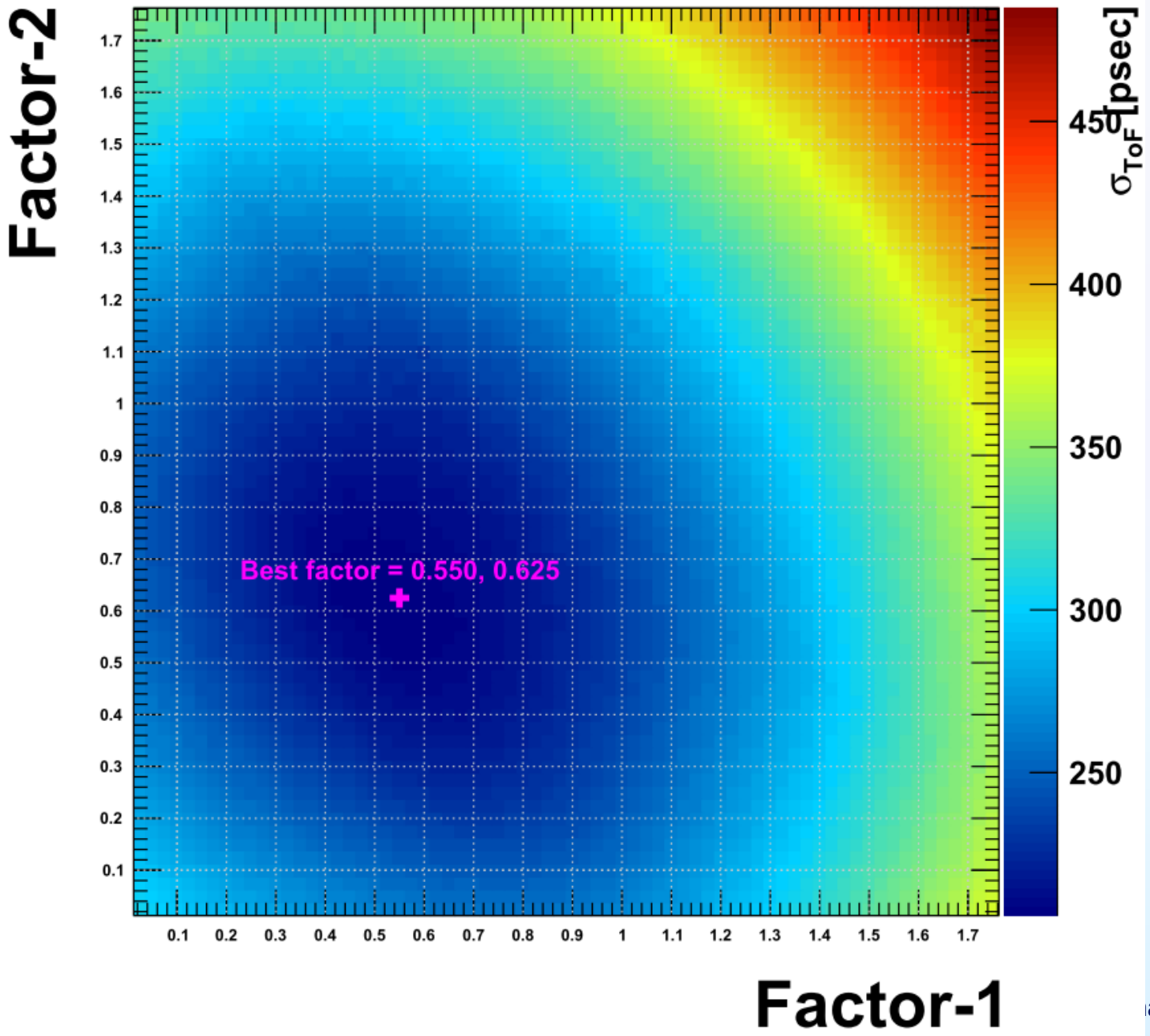

Center vs. Bottom: Bottom-1.QDC vs. TOFAfter TWC, w/ QDC cut
Entries 16337
Integral 1.63e+04
dec.ToF [psec] (Peak adjusted)
Bottom-1.QDC [pC]
Entries/bin

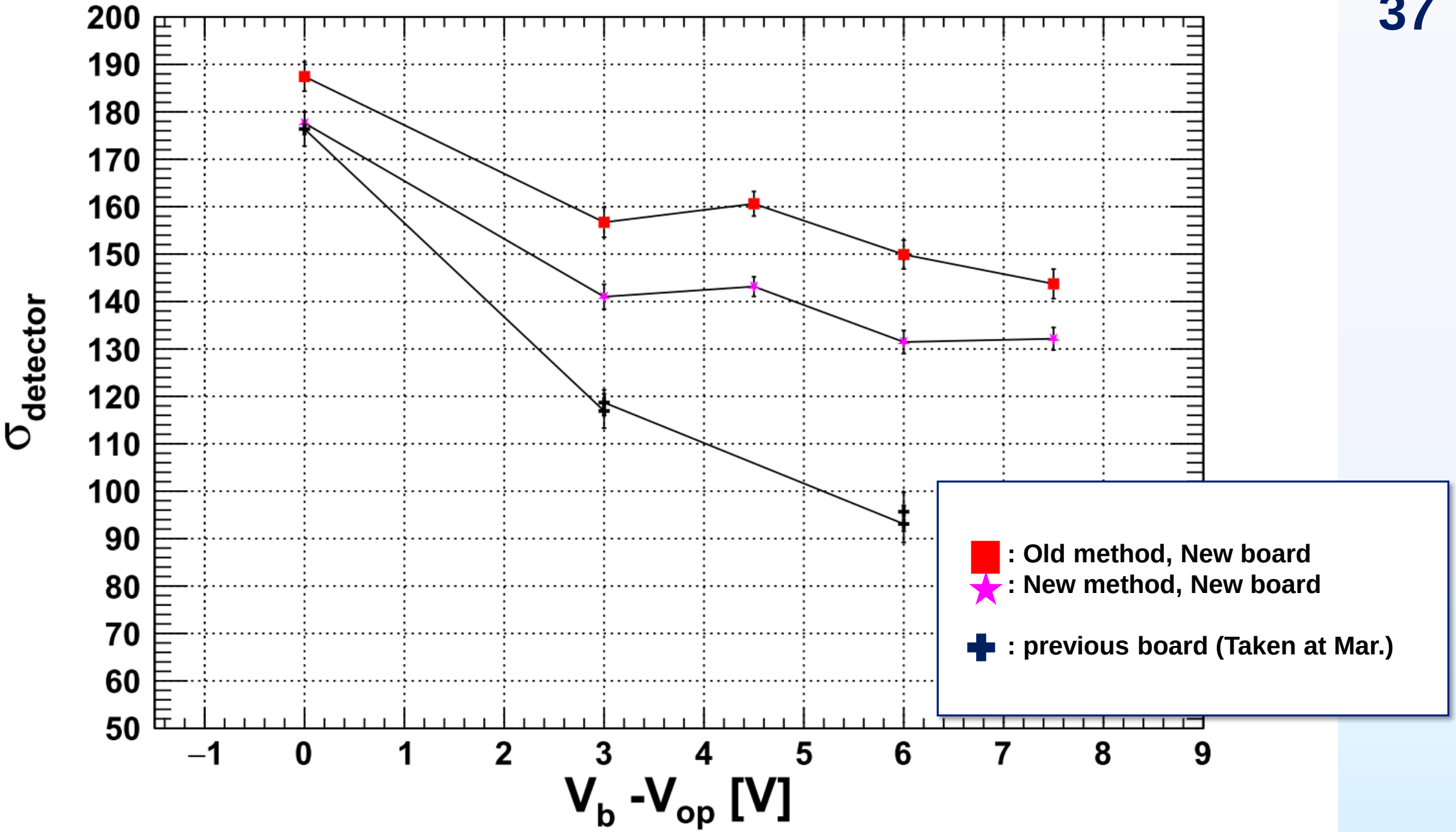

Center vs. Bottom: Bottom-2.QDC vs. TOFAfter TWC, w/ QDC cut
Entries 16337
Integral 1.628e+04
dec.ToF [psec] (Peak adjusted)
Bottom-2.QDC [pC]
Entries/bin

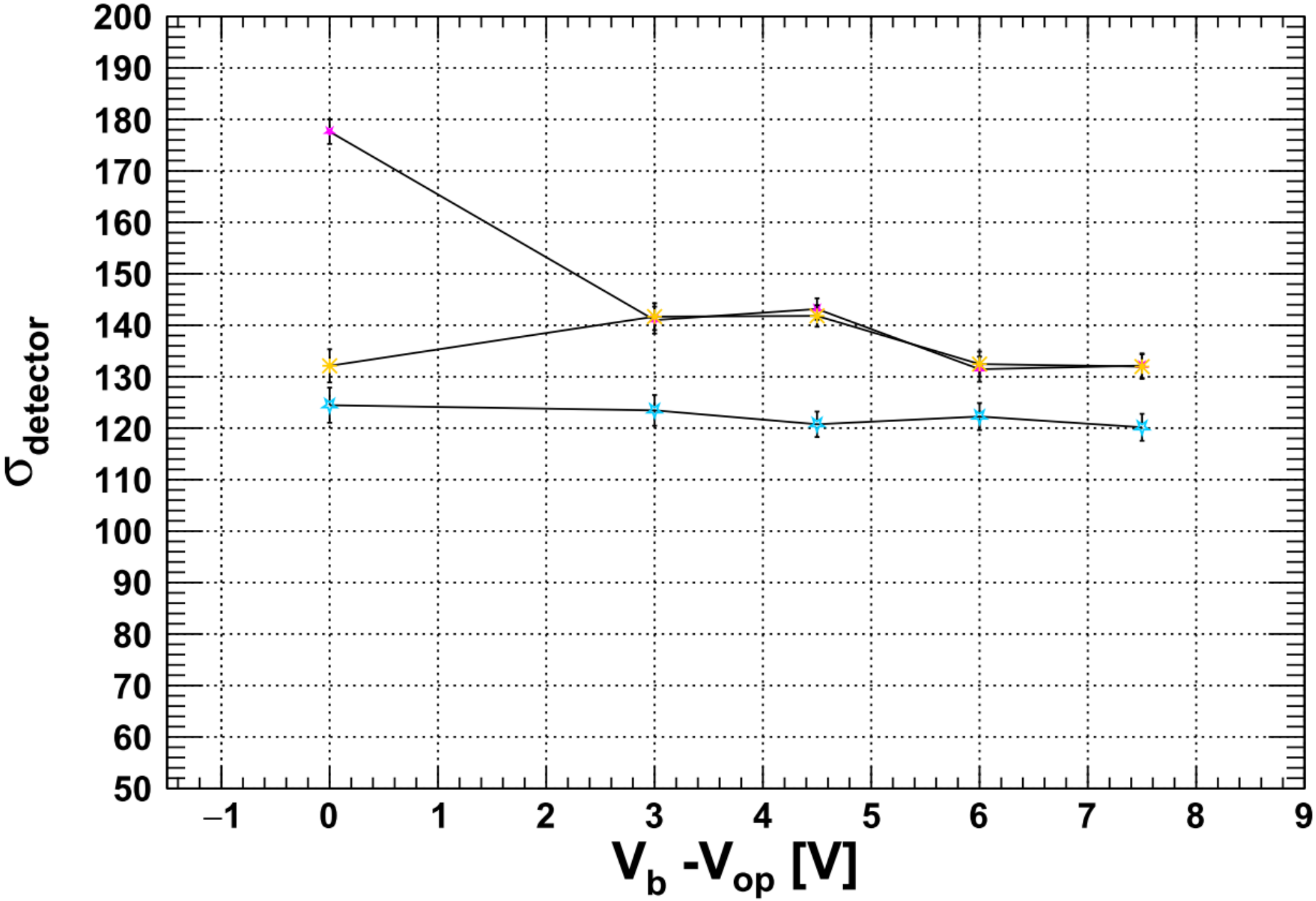

dec.TOF (after TWC)
Counts/35 psec
TOF [psec]
Entries 16337
Integral 1.633e+04
χ² / ndf 61.86 / 51
Prob 0.1418
Constant 1213 ± 11.9
Mean −6.966 ± 1.472
Sigma 187.3 ± 1.1
σTOF = 187.29 ± 1.10 [psec]

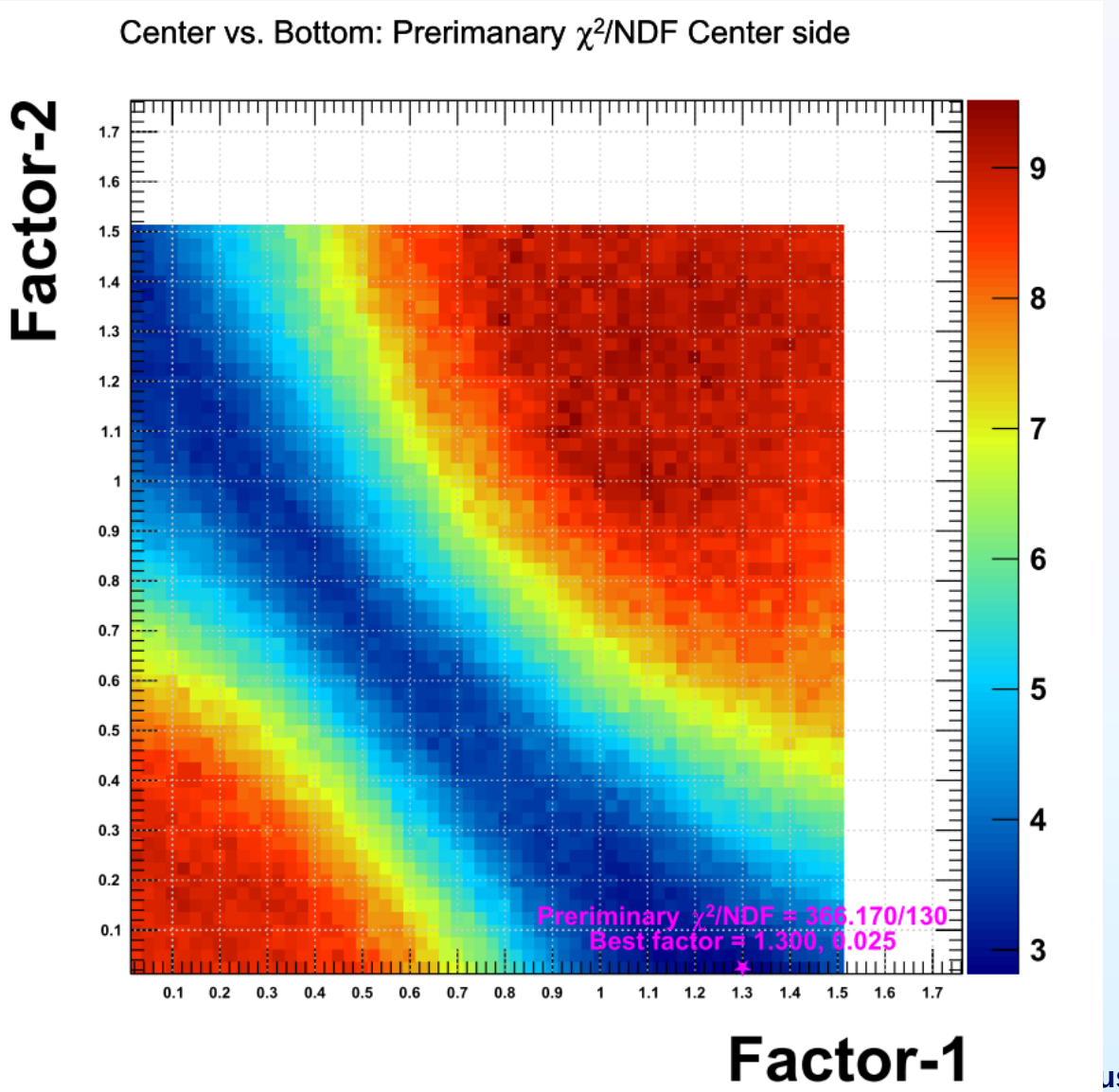

Center vs. Bottom: Prelimanary σ_{TOF} Center side
Factor-2
Factor-1
Best factor = 0.675, 0.700
σ_{ToF} [psec]
320
300
280
260
240
220
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7

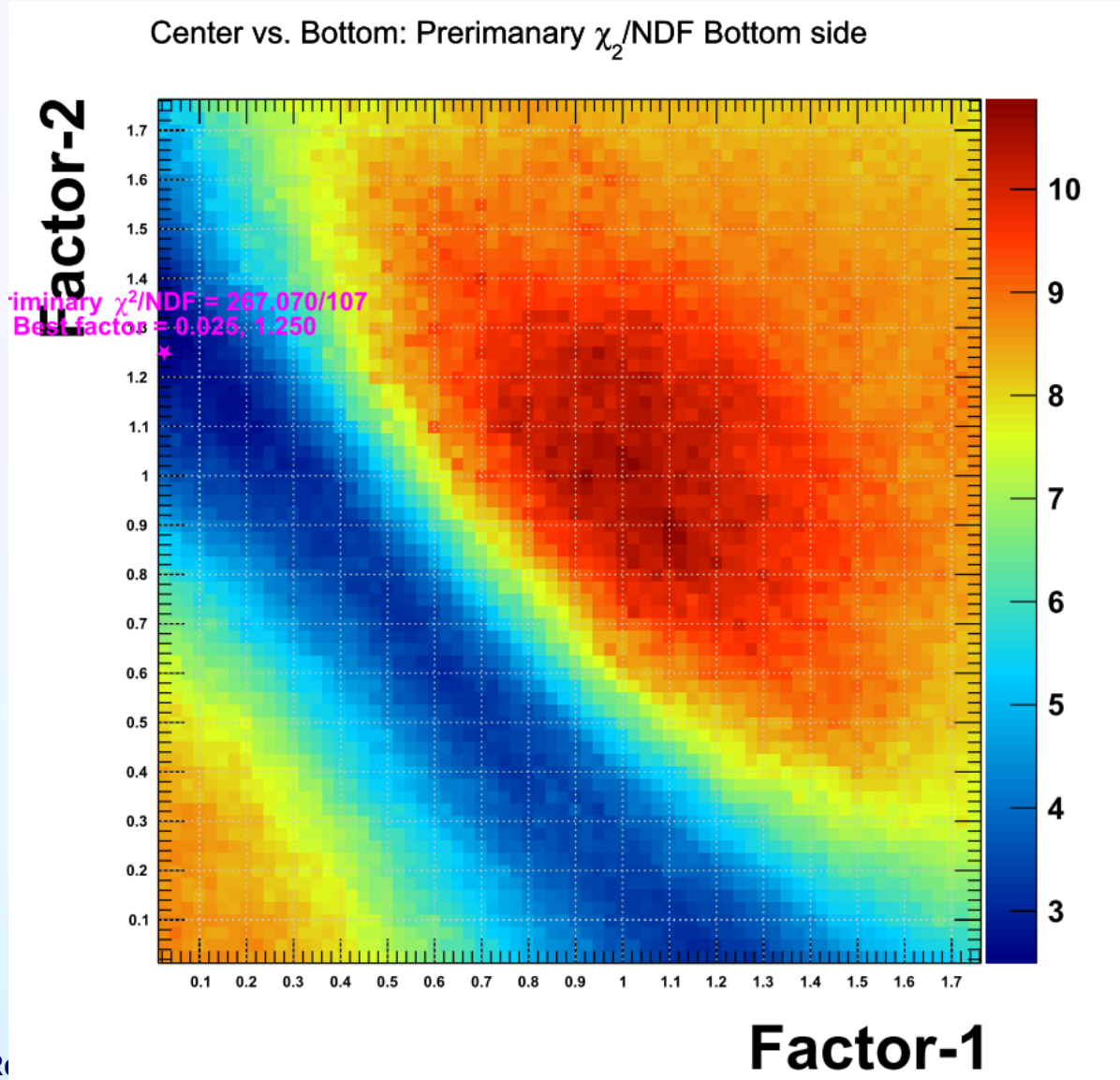
Center vs. Bottom: Preliminary σ_{TOF} Bottom side



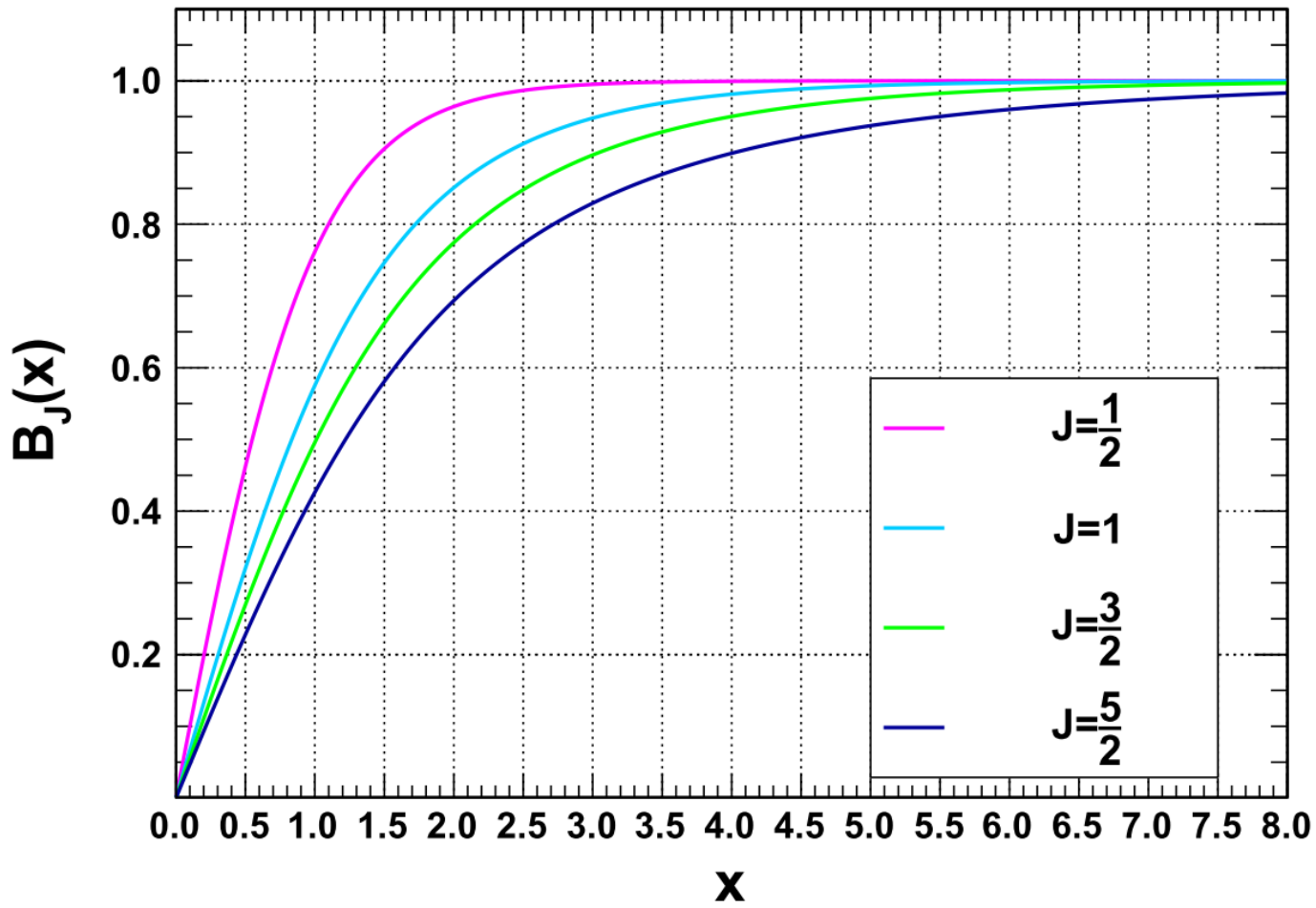

σdetector
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
–1
0
1
2
3
4
5
6
7
8
9
Vb -Vop [V]
: Old method, New board
: New method, New board
: previous board (Taken at Mar.)

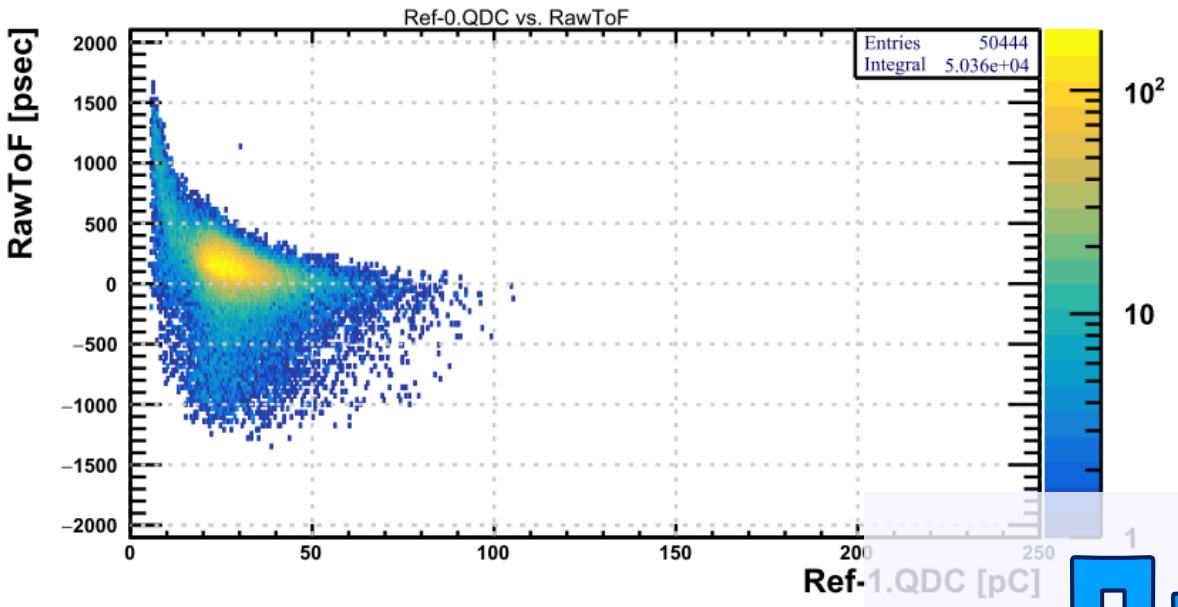

200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
σdetector
–1
0
1
2
3
4
5
6
7
8
9
Vb -Vop [V]

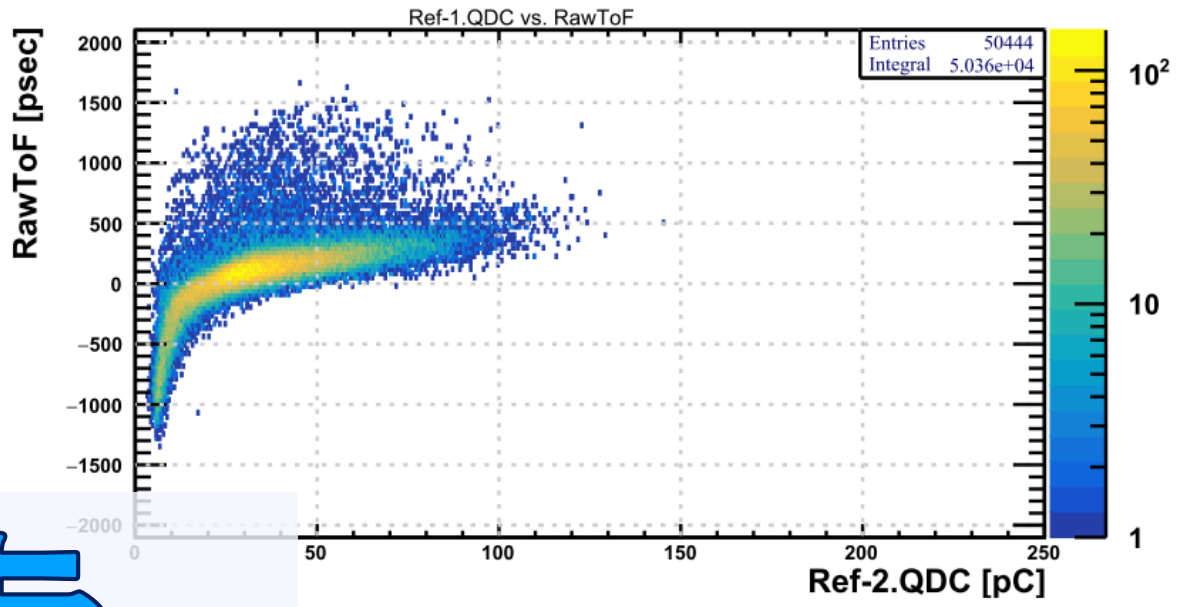

Center vs. Bottom: Prerimanary χ²/NDF Center side
Factor-2
Factor-1
Preriminary χ²/NDF = 366.170/130
Best factor = 1.300, 0.025


Center vs. Bottom: Prerimanary χ2/NDF Bottom side
Factor-2
Factor-1
iminary χ²/NDF = 267.070/107
Best factor = 0.025, 1.250

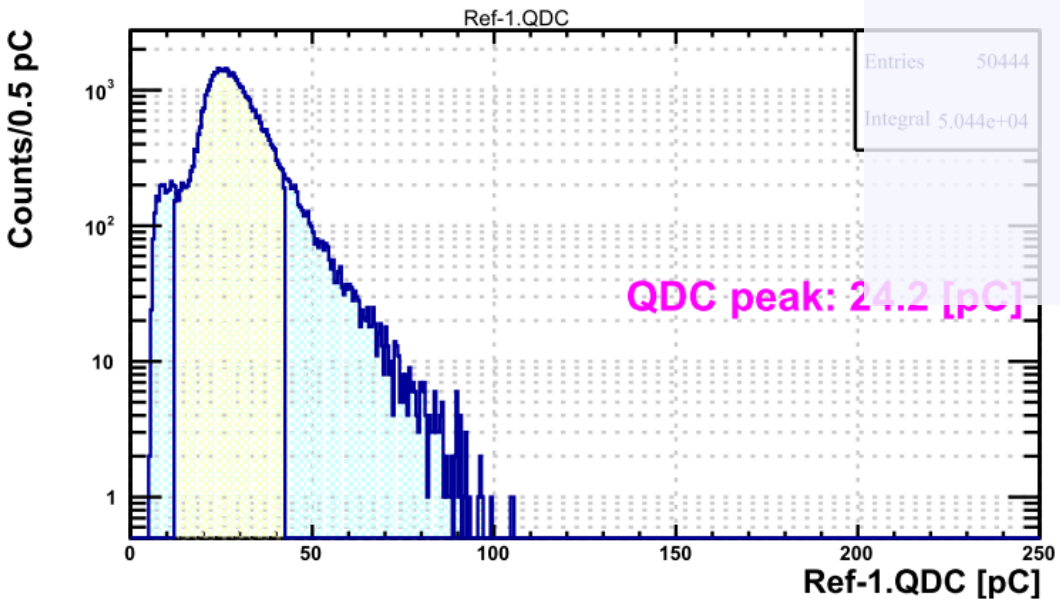
Brillouin function for J=1/2, 1, 3/2, 5/2

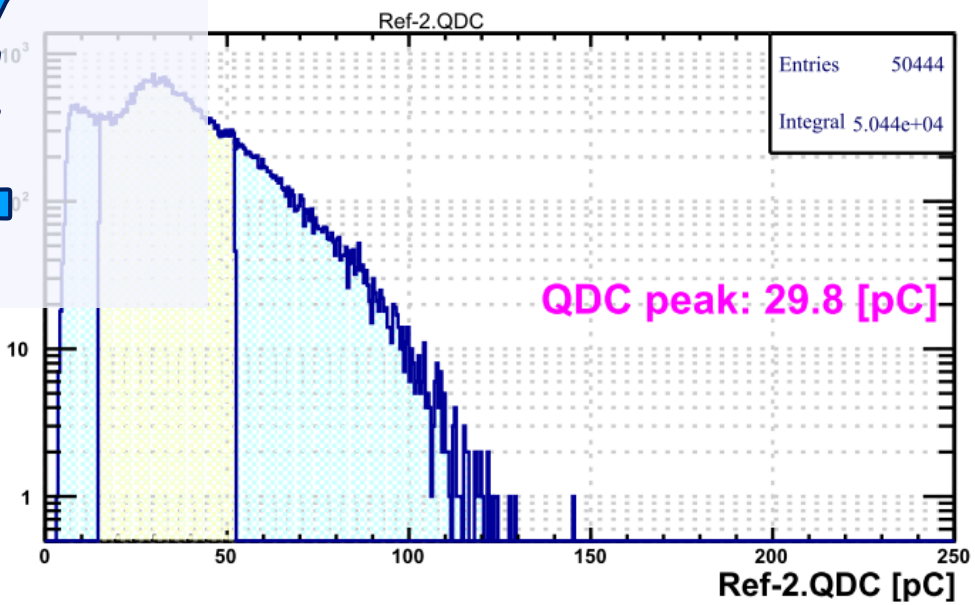


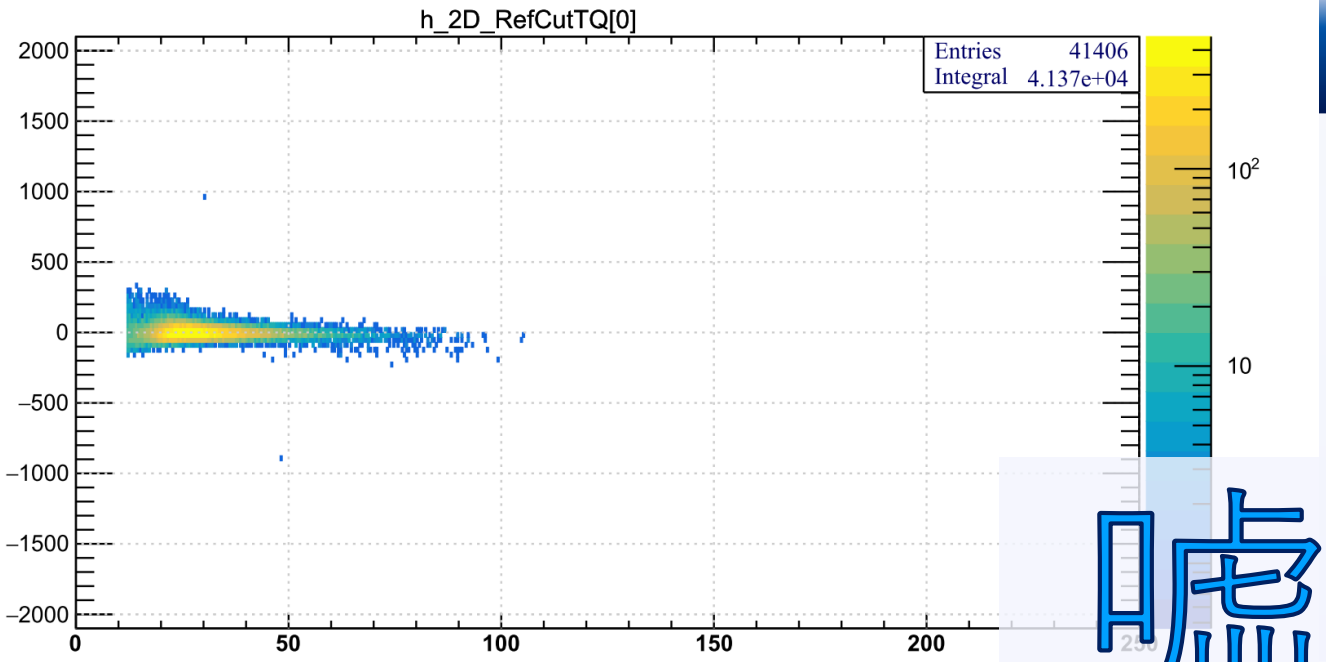

Ref-0.QDC vs. RawToF
Entries 50444
Integral 5.036e+04
RawToF [psec]
Ref-1.QDC [pC]


Ref-1.QDC vs. RawToF
Entries 50444
Integral 5.036e+04
RawToF [psec]
Ref-2.QDC [pC]

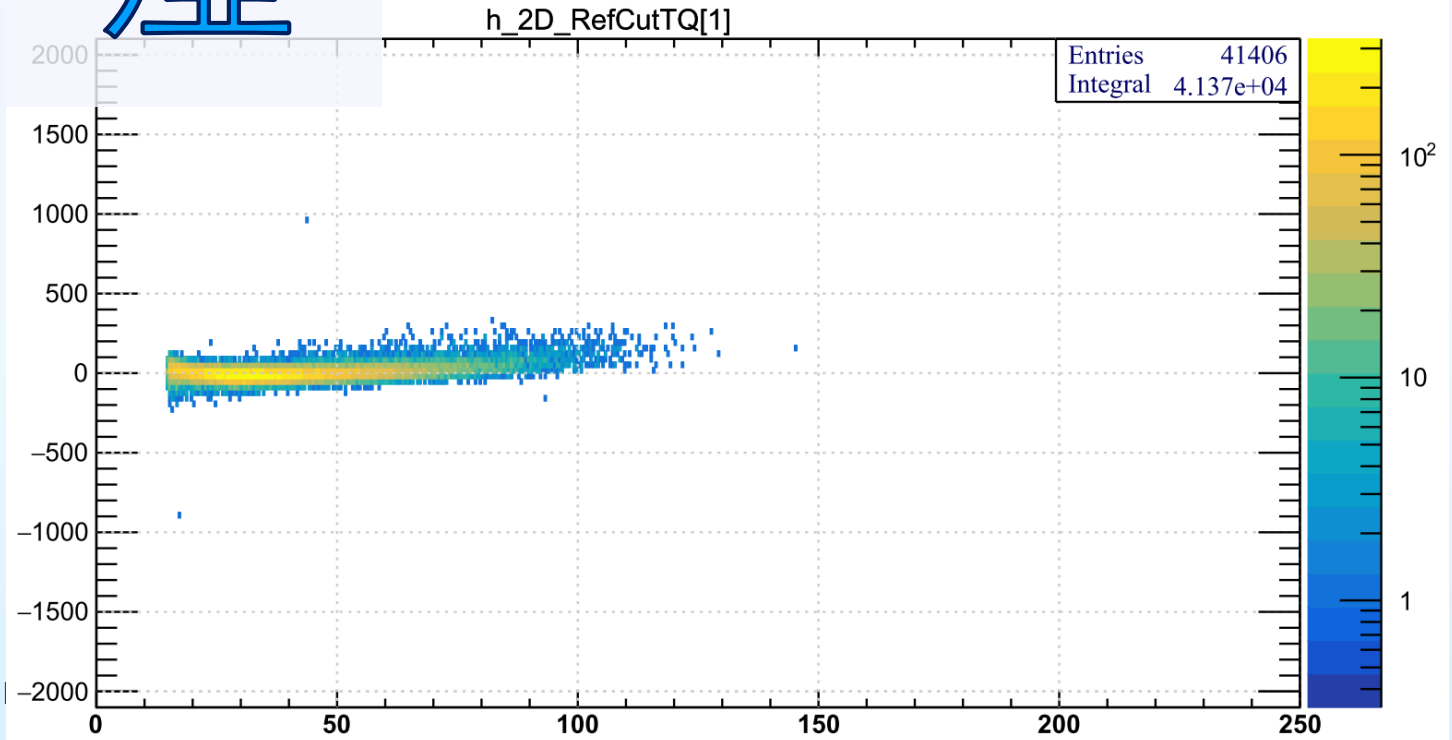
嘘

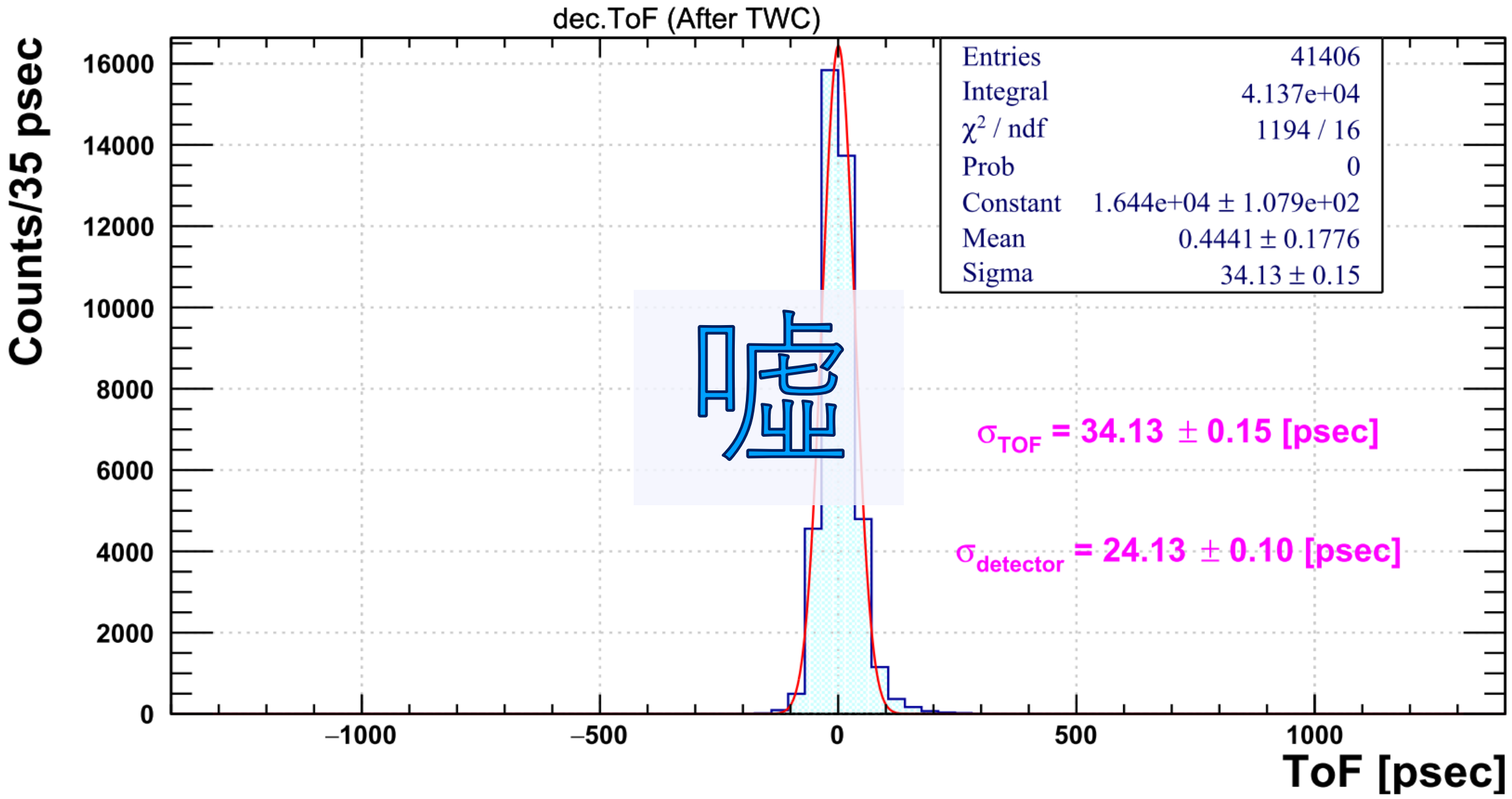

Ref-1.QDC
Entries 50444
Integral 5.044e+04
Counts/0.5 pC
Ref-1.QDC [pC]
QDC peak: 24.2 [pC]

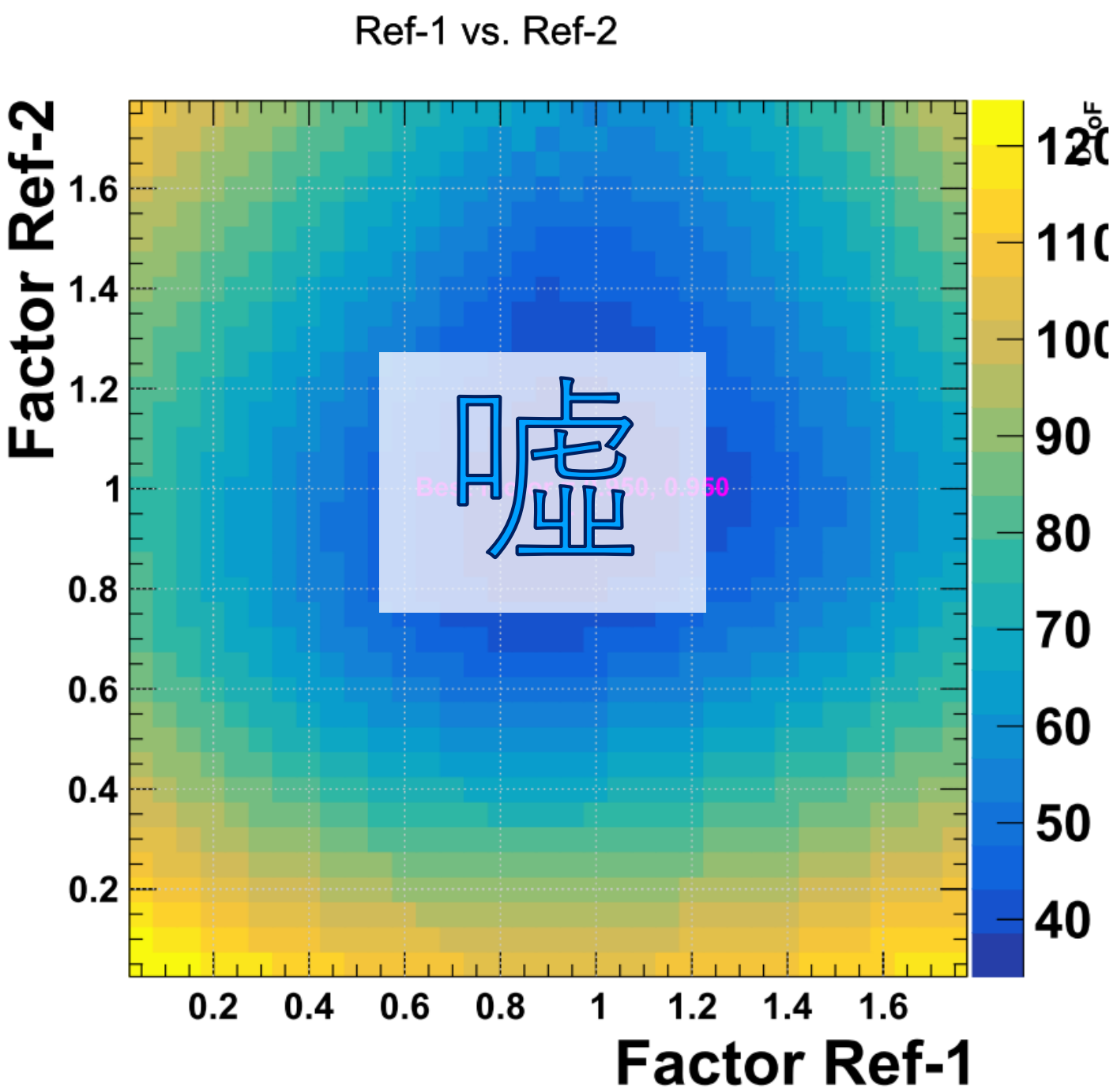

Ref-2.QDC
Entries 50444
Integral 5.044e+04
Ref-2.QDC [pC]
QDC peak: 29.8 [pC]

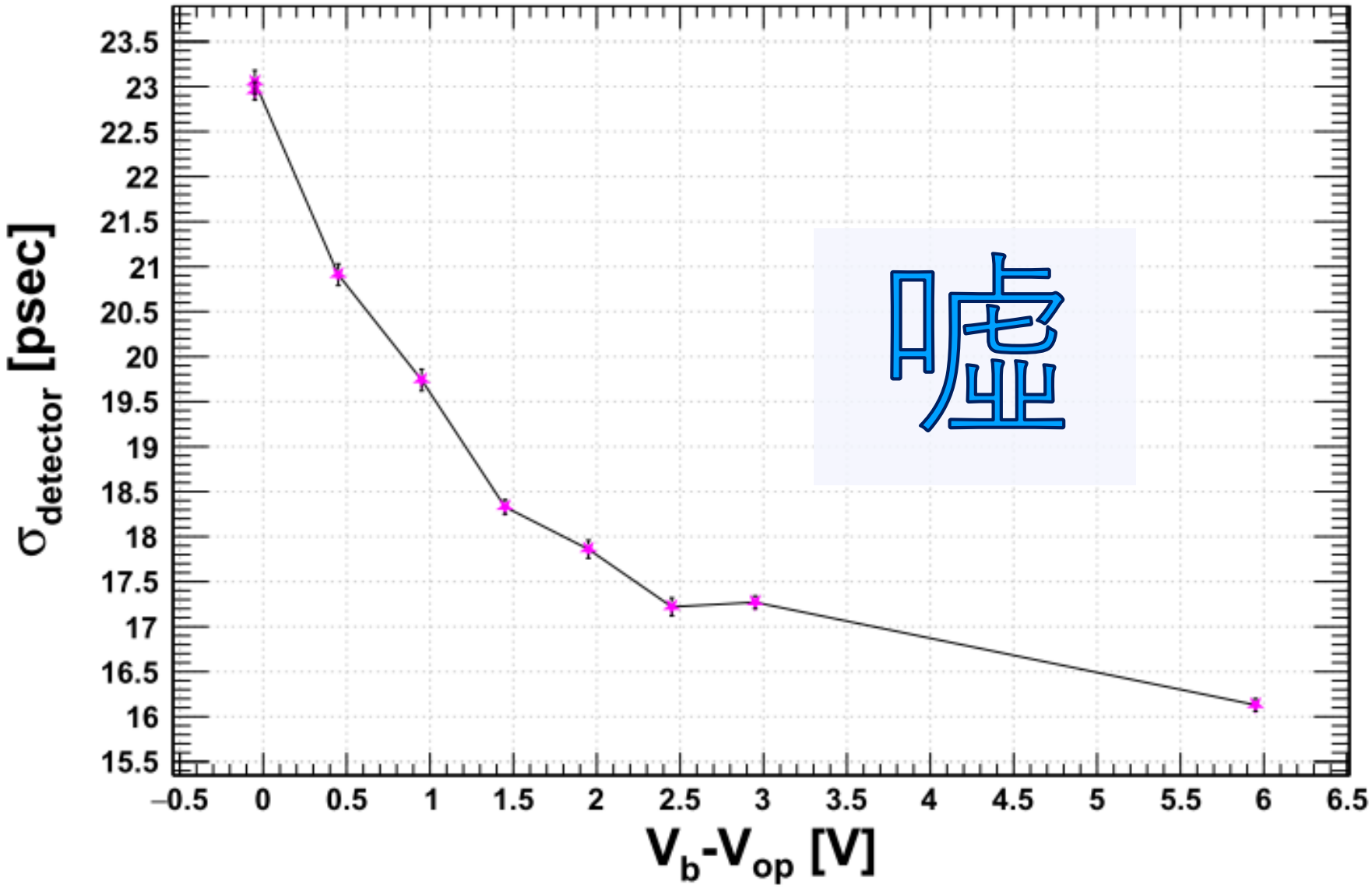

h_2D_RefCutTQ[0]
Entries 41406
Integral 4.137e+04
2000
1500
1000
500
0
−500
−1000
−1500
−2000
0
50
100
150
200
10^2
10

虚


h_2D_RefCutTQ[1]
Entries 41406
Integral 4.137e+04
2000
1500
1000
500
0
−500
−1000
−1500
−2000
0
50
100
150
200
250
10^2
10
1


dec.ToF (After TWC)
Counts/35 psec
ToF [psec]
Entries 41406
Integral 4.137e+04
χ² / ndf 1194 / 16
Prob 0
Constant 1.644e+04 ± 1.079e+02
Mean 0.4441 ± 0.1776
Sigma 34.13 ± 0.15
嘘
σTOF = 34.13 ± 0.15 [psec]
σdetector = 24.13 ± 0.10 [psec]


Ref-1 vs. Ref-2
Factor Ref-2
Factor Ref-1
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
40
50
60
70
80
90
100
110
120
NoF
嘘


$\sigma_{detector}$ [psec]
23.5
23
22.5
22
21.5
21
20.5
20
19.5
19
18.5
18
17.5
17
16.5
16
15.5
−0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
V_b-V_{op} [V]
嘘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