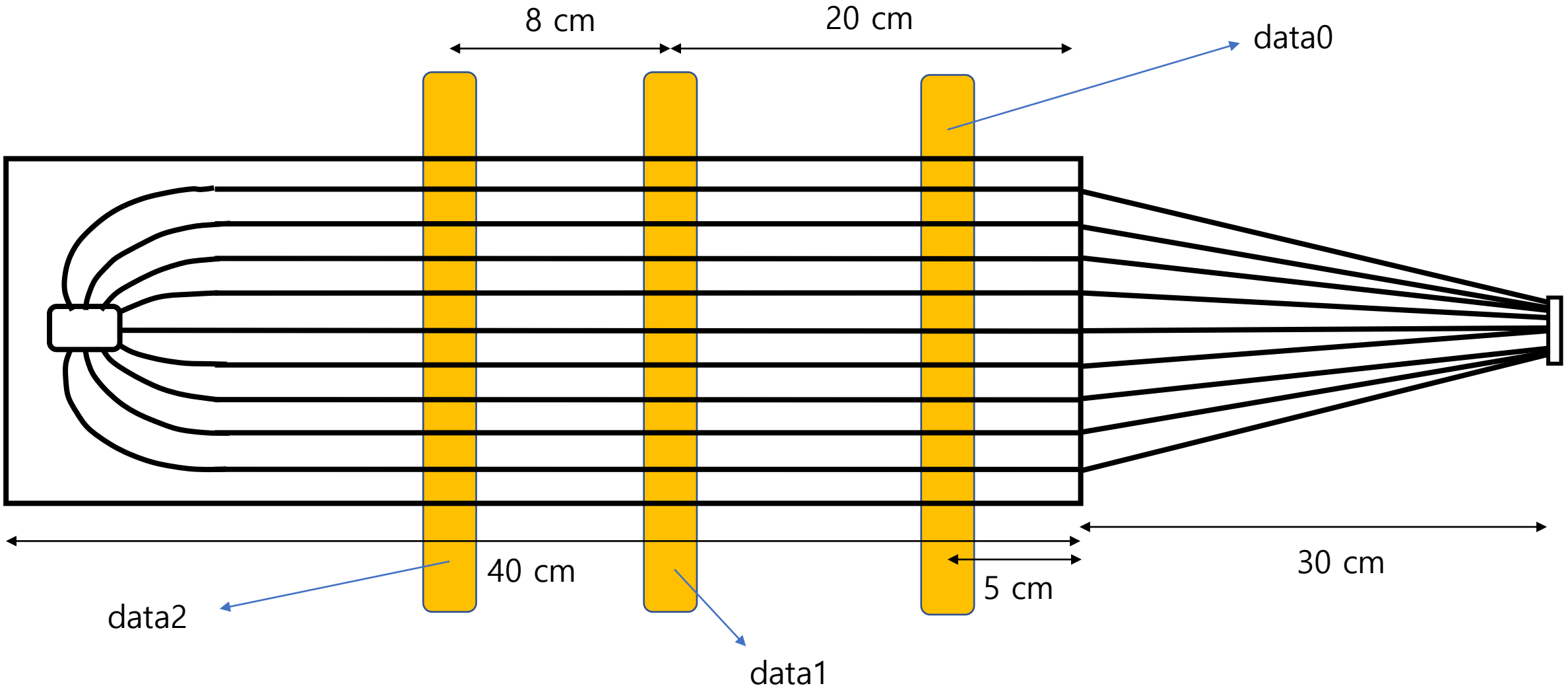
200408

Data point

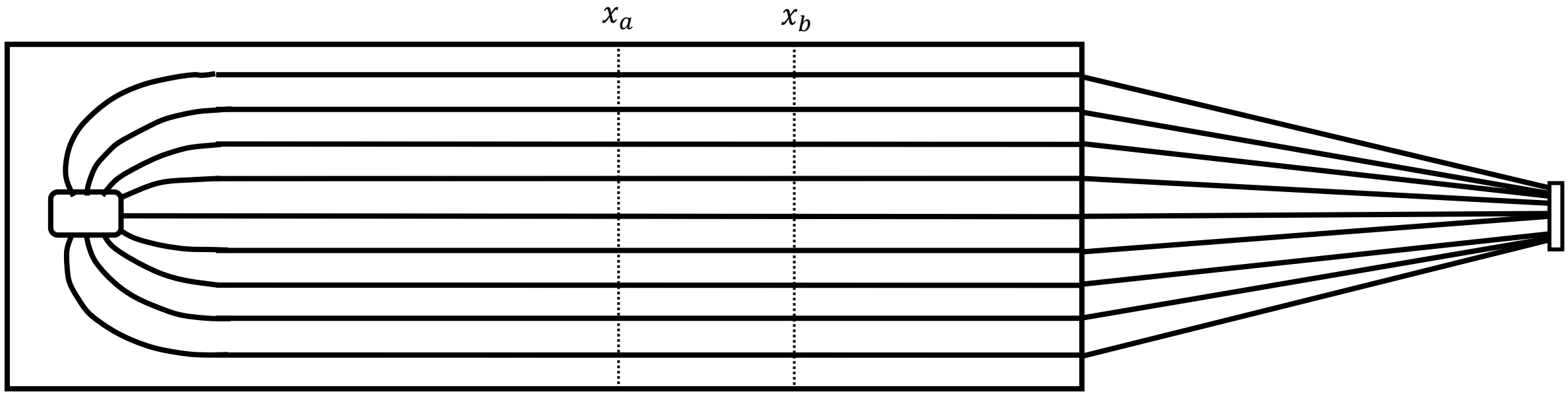


Propagation velocity

- 각 MPPC에서 신호가 도착한 시간은, 높이의 최고점으로부터 ½ 되는 지점을 시간으로 정하였다.
- 실험 할 때, electronics의 변화는 없었고 오직 source의 위치만 변경시켜줬으므로 MPPC에 도착하는 시간의 차이는 source의 위치에만 영향을 받는다고 할 수 있다.
- 또한 MPPC에 들어오는 photon은 WLS fiber를 통해서만 들어오게 되므로 fiber내에서의 전파 속도는 일정하다.
- 전체 길이를 L, Source의 위치를 x_a, x_b 그 때 도착한 MPPC의 시간 차이를 Δt_a, Δt_b 라고 할 때, 아래와 같은 식을 만족한다.

$$\Delta t_a = \frac{2\,x_a - L}{v} \quad \text{and } \Delta t_b = \frac{2\,x_b - L}{v}$$

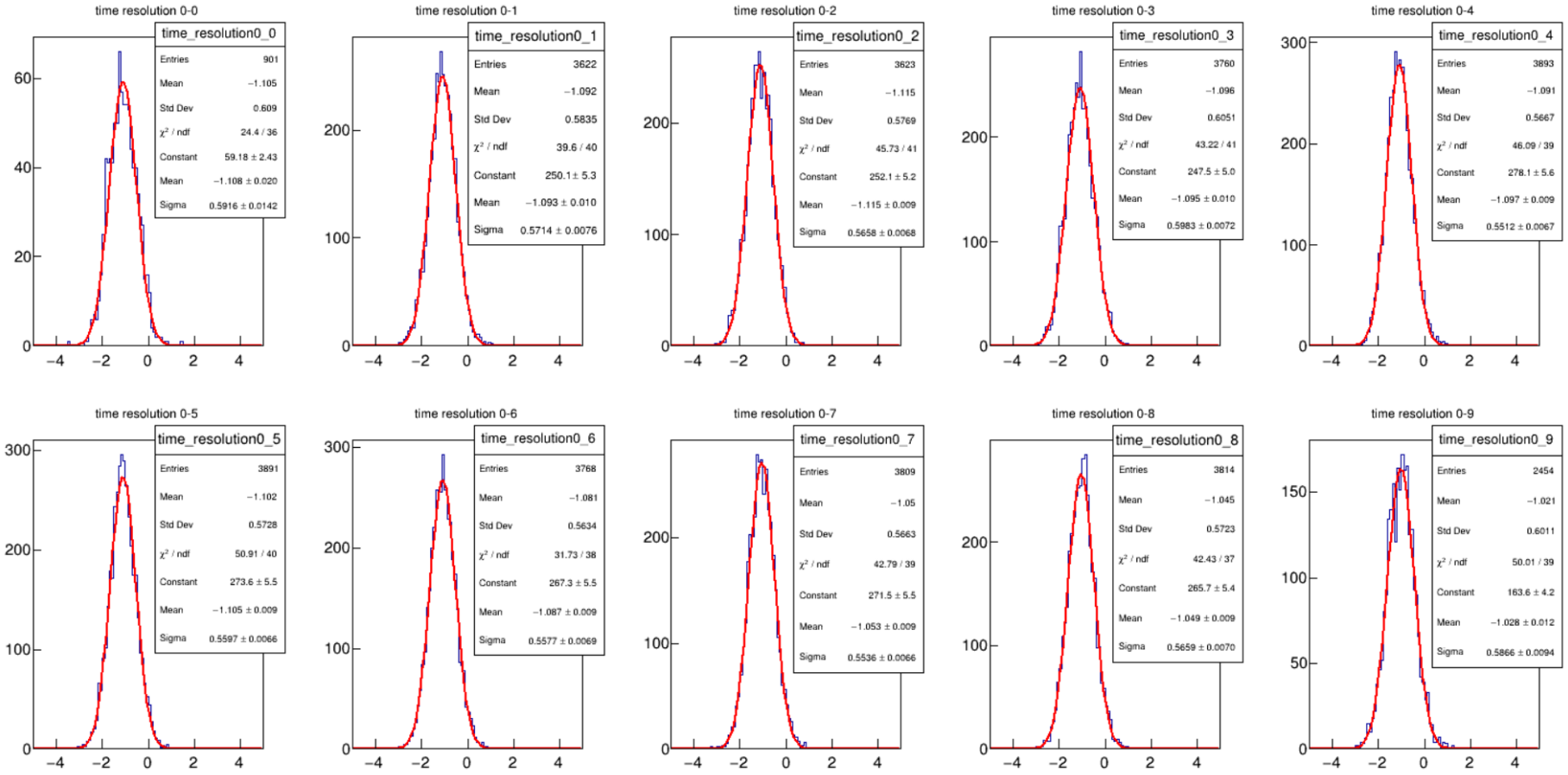
Propagation velocity



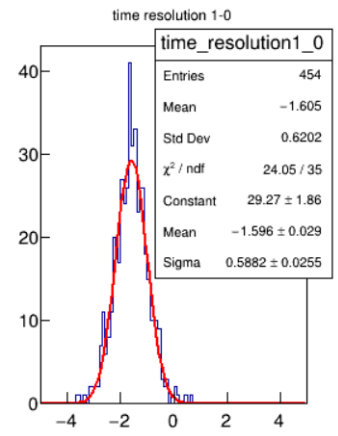
- 위의 두 식을 빼서 정확히 알고 있는 Source의 위치를 x_a, x_b 와 그 때 도착한 MPPC의 시간 차이를 Δt_a, Δt_b로 WLS fiber 직선 부분에서의 propagation velocity을 만들면 아래와 같은 식이 나타난다.

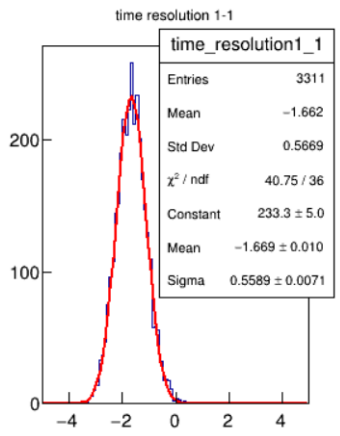
$$v = \frac{2\,(x_b - x_a)}{\Delta t_b - \Delta t_a}$$

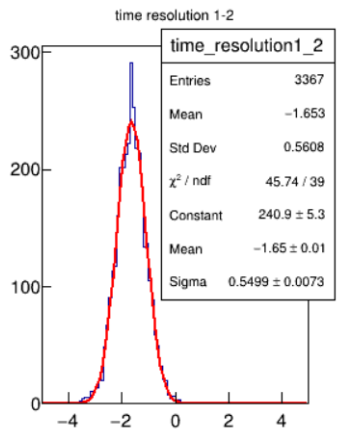
-15 cm

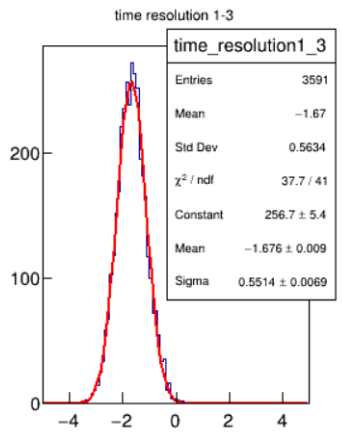

time resolution 0-0
time_resolution0_0
Entries 901
Mean −1.105
Std Dev 0.609
χ² / ndf 24.4 / 36
Constant 59.18 ± 2.43
Mean −1.108 ± 0.020
Sigma 0.5916 ± 0.0142
time resolution 0-1
time_resolution0_1
Entries 3622
Mean −1.092
Std Dev 0.5835
χ² / ndf 39.6 / 40
Constant 250.1 ± 5.3
Mean −1.093 ± 0.010
Sigma 0.5714 ± 0.0076
time resolution 0-2
time_resolution0_2
Entries 3623
Mean −1.115
Std Dev 0.5769
χ² / ndf 45.73 / 41
Constant 252.1 ± 5.2
Mean −1.115 ± 0.009
Sigma 0.5658 ± 0.0068
time resolution 0-3
time_resolution0_3
Entries 3760
Mean −1.096
Std Dev 0.6051
χ² / ndf 43.22 / 41
Constant 247.5 ± 5.0
Mean −1.095 ± 0.010
Sigma 0.5983 ± 0.0072
time resolution 0-4
time_resolution0_4
Entries 3893
Mean −1.091
Std Dev 0.5667
χ² / ndf 46.09 / 39
Constant 278.1 ± 5.6
Mean −1.097 ± 0.009
Sigma 0.5512 ± 0.0067
time resolution 0-5
time_resolution0_5
Entries 3891
Mean −1.102
Std Dev 0.5728
χ² / ndf 50.91 / 40
Constant 273.6 ± 5.5
Mean −1.105 ± 0.009
Sigma 0.5597 ± 0.0066
time resolution 0-6
time_resolution0_6
Entries 3768
Mean −1.081
Std Dev 0.5634
χ² / ndf 31.73 / 38
Constant 267.3 ± 5.5
Mean −1.087 ± 0.009
Sigma 0.5577 ± 0.0069
time resolution 0-7
time_resolution0_7
Entries 3809
Mean −1.05
Std Dev 0.5663
χ² / ndf 42.79 / 39
Constant 271.5 ± 5.5
Mean −1.053 ± 0.009
Sigma 0.5536 ± 0.0066
time resolution 0-8
time_resolution0_8
Entries 3814
Mean −1.045
Std Dev 0.5723
χ² / ndf 42.43 / 37
Constant 265.7 ± 5.4
Mean −1.049 ± 0.009
Sigma 0.5659 ± 0.0070
time resolution 0-9
time_resolution0_9
Entries 2454
Mean −1.021
Std Dev 0.6011
χ² / ndf 50.01 / 39
Constant 163.6 ± 4.2
Mean −1.028 ± 0.012
Sigma 0.5866 ± 0.0094

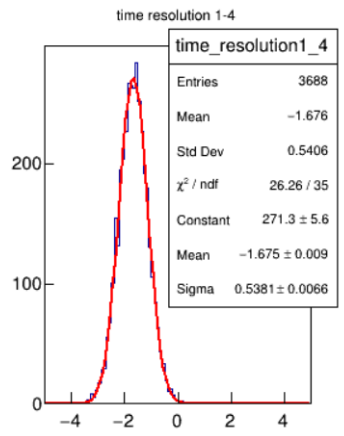
0 cm

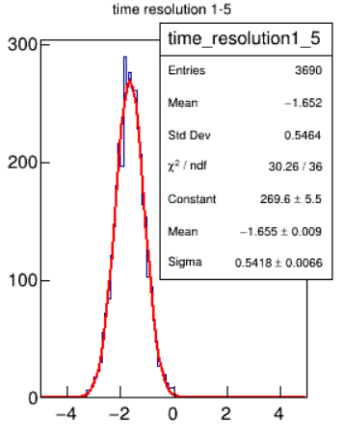

time resolution 1-0
time_resolution1_0
Entries 454
Mean −1.605
Std Dev 0.6202
χ² / ndf 24.05 / 35
Constant 29.27 ± 1.86
Mean −1.596 ± 0.029
Sigma 0.5882 ± 0.0255

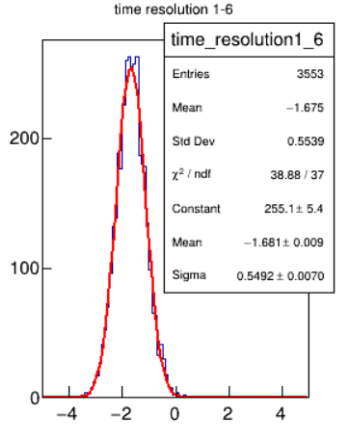

time resolution 1-1
time_resolution1_1
Entries 3311
Mean −1.662
Std Dev 0.5669
χ² / ndf 40.75 / 36
Constant 233.3 ± 5.0
Mean −1.669 ± 0.010
Sigma 0.5589 ± 0.0071

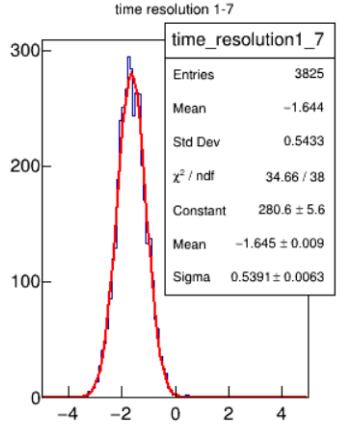

time resolution 1-2
time_resolution1_2
Entries 3367
Mean −1.653
Std Dev 0.5608
χ² / ndf 45.74 / 39
Constant 240.9 ± 5.3
Mean −1.65 ± 0.01
Sigma 0.5499 ± 0.0073

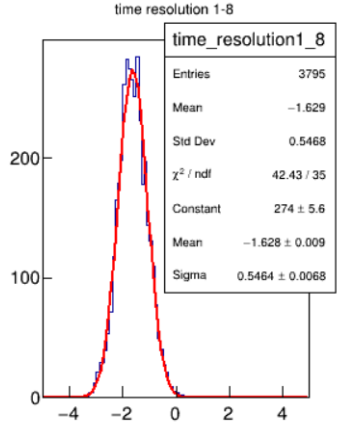

time resolution 1-3
time_resolution1_3
Entries 3591
Mean −1.67
Std Dev 0.5634
χ² / ndf 37.7 / 41
Constant 256.7 ± 5.4
Mean −1.676 ± 0.009
Sigma 0.5514 ± 0.0069

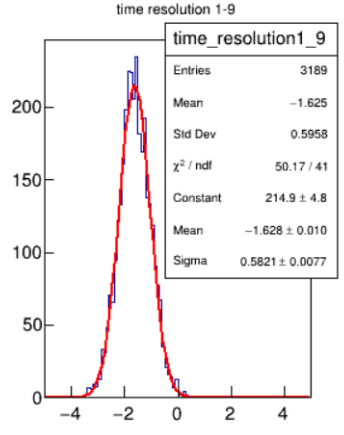

time resolution 1-4
time_resolution1_4
Entries 3688
Mean −1.676
Std Dev 0.5406
χ² / ndf 26.26 / 35
Constant 271.3 ± 5.6
Mean −1.675 ± 0.009
Sigma 0.5381 ± 0.0066


time resolution 1-5
time_resolution1_5
Entries 3690
Mean −1.652
Std Dev 0.5464
χ² / ndf 30.26 / 36
Constant 269.6 ± 5.5
Mean −1.655 ± 0.009
Sigma 0.5418 ± 0.0066

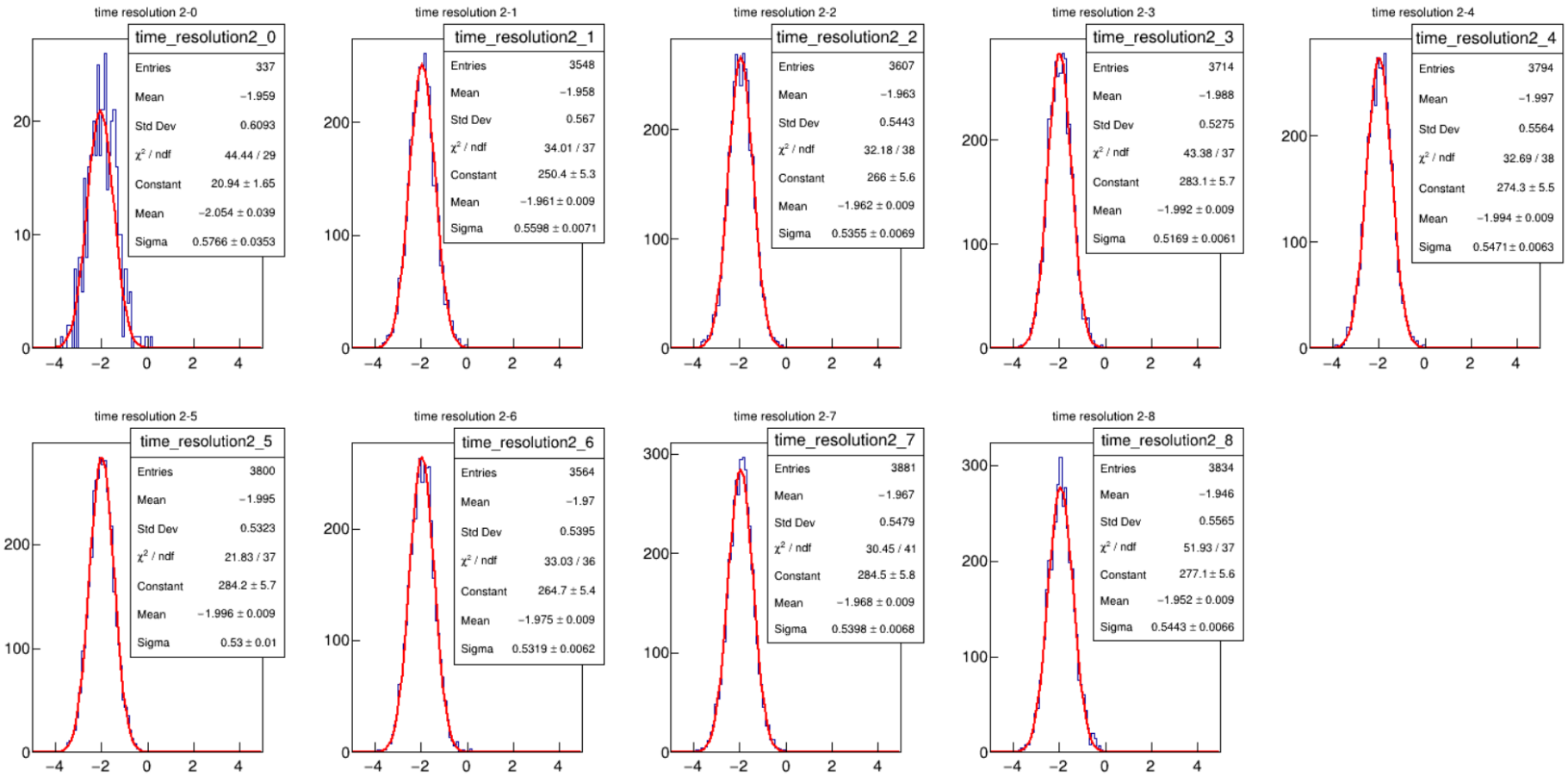

time resolution 1-6
time_resolution1_6
Entries 3553
Mean −1.675
Std Dev 0.5539
χ² / ndf 38.88 / 37
Constant 255.1 ± 5.4
Mean −1.681 ± 0.009
Sigma 0.5492 ± 0.0070


time resolution 1-7
time_resolution1_7
Entries 3825
Mean −1.644
Std Dev 0.5433
χ² / ndf 34.66 / 38
Constant 280.6 ± 5.6
Mean −1.645 ± 0.009
Sigma 0.5391 ± 0.0063

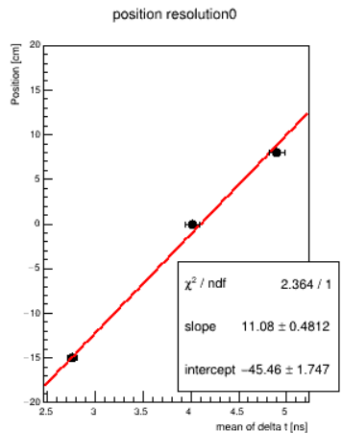

time resolution 1-8
time_resolution1_8
Entries 3795
Mean −1.629
Std Dev 0.5468
χ² / ndf 42.43 / 35
Constant 274 ± 5.6
Mean −1.628 ± 0.009
Sigma 0.5464 ± 0.0068

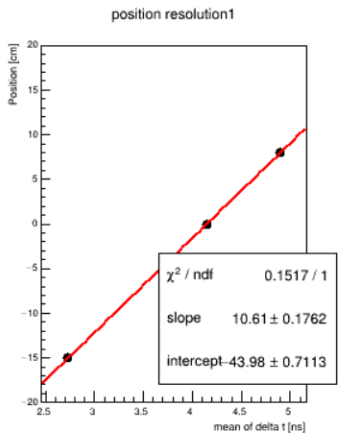

time resolution 1-9
time_resolution1_9
Entries 3189
Mean −1.625
Std Dev 0.5958
χ² / ndf 50.17 / 41
Constant 214.9 ± 4.8
Mean −1.628 ± 0.010
Sigma 0.5821 ± 0.0077

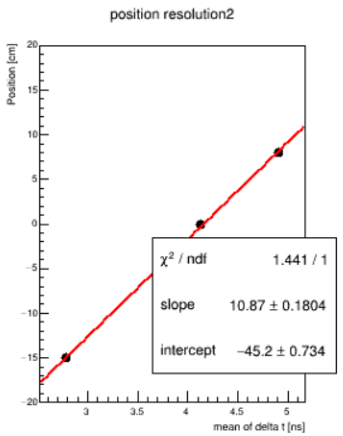
8 cm

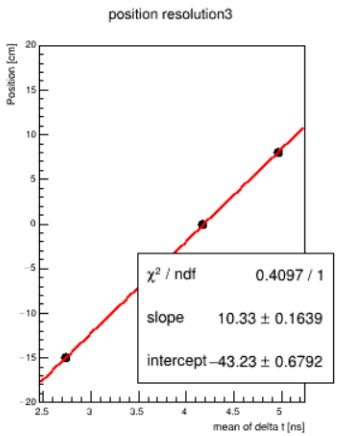

time resolution 2-0
time_resolution2_0
Entries 337
Mean −1.959
Std Dev 0.6093
χ² / ndf 44.44 / 29
Constant 20.94 ± 1.65
Mean −2.054 ± 0.039
Sigma 0.5766 ± 0.0353
time resolution 2-1
time_resolution2_1
Entries 3548
Mean −1.958
Std Dev 0.567
χ² / ndf 34.01 / 37
Constant 250.4 ± 5.3
Mean −1.961 ± 0.009
Sigma 0.5598 ± 0.0071
time resolution 2-2
time_resolution2_2
Entries 3607
Mean −1.963
Std Dev 0.5443
χ² / ndf 32.18 / 38
Constant 266 ± 5.6
Mean −1.962 ± 0.009
Sigma 0.5355 ± 0.0069
time resolution 2-3
time_resolution2_3
Entries 3714
Mean −1.988
Std Dev 0.5275
χ² / ndf 43.38 / 37
Constant 283.1 ± 5.7
Mean −1.992 ± 0.009
Sigma 0.5169 ± 0.0061
time resolution 2-4
time_resolution2_4
Entries 3794
Mean −1.997
Std Dev 0.5564
χ² / ndf 32.69 / 38
Constant 274.3 ± 5.5
Mean −1.994 ± 0.009
Sigma 0.5471 ± 0.0063
time resolution 2-5
time_resolution2_5
Entries 3800
Mean −1.995
Std Dev 0.5323
χ² / ndf 21.83 / 37
Constant 284.2 ± 5.7
Mean −1.996 ± 0.009
Sigma 0.53 ± 0.01
time resolution 2-6
time_resolution2_6
Entries 3564
Mean −1.97
Std Dev 0.5395
χ² / ndf 33.03 / 36
Constant 264.7 ± 5.4
Mean −1.975 ± 0.009
Sigma 0.5319 ± 0.0062
time resolution 2-7
time_resolution2_7
Entries 3881
Mean −1.967
Std Dev 0.5479
χ² / ndf 30.45 / 41
Constant 284.5 ± 5.8
Mean −1.968 ± 0.009
Sigma 0.5398 ± 0.0068
time resolution 2-8
time_resolution2_8
Entries 3834
Mean −1.946
Std Dev 0.5565
χ² / ndf 51.93 / 37
Constant 277.1 ± 5.6
Mean −1.952 ± 0.009
Sigma 0.5443 ± 0.0066

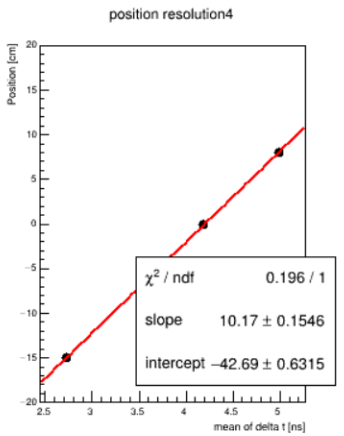
Linear fitting

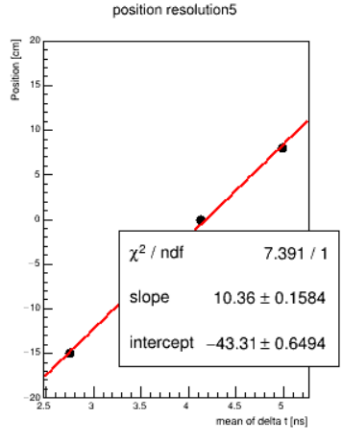


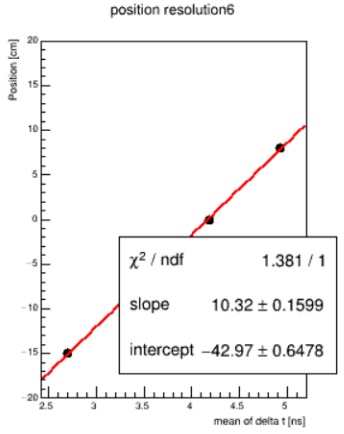


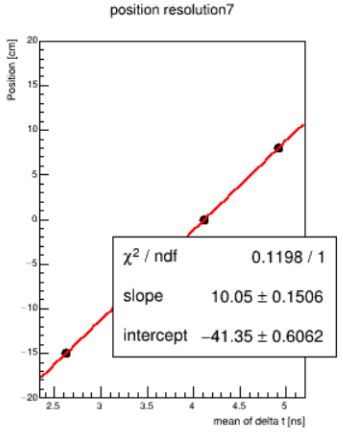


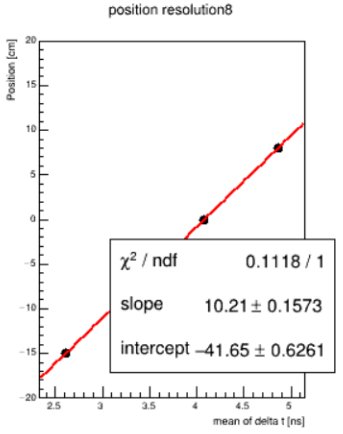


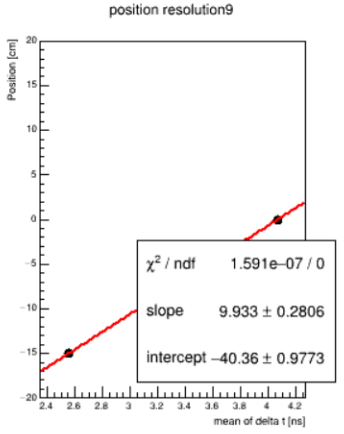




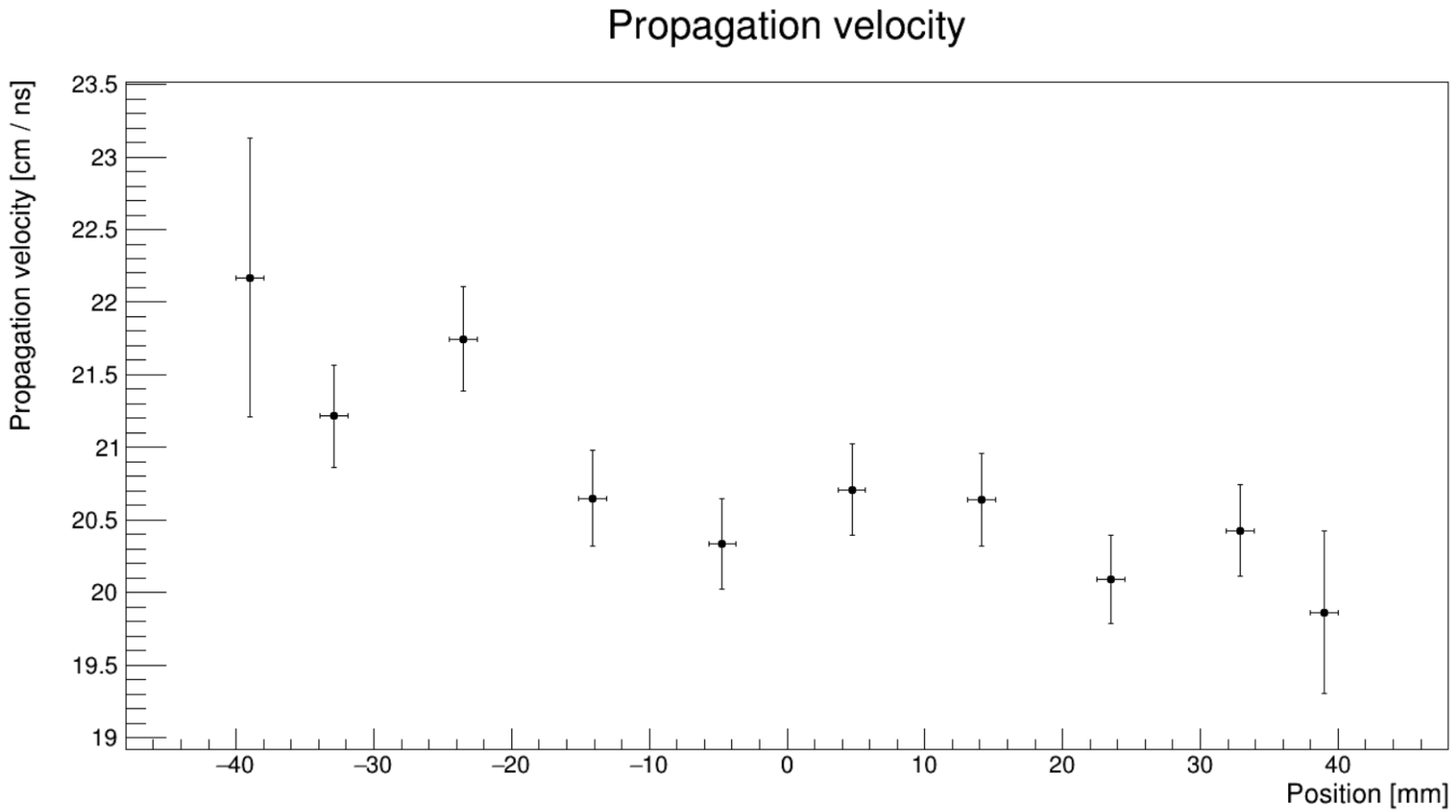




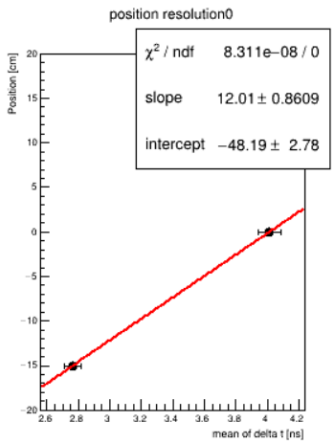


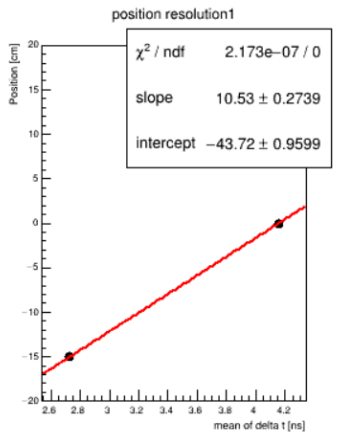


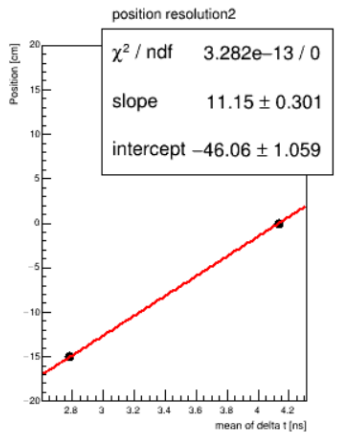
Propagation velocity

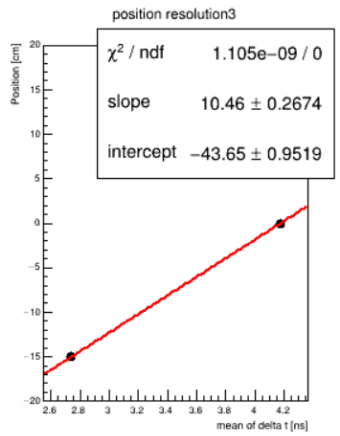


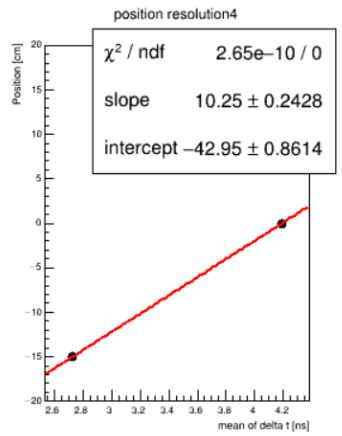
Linear fitting

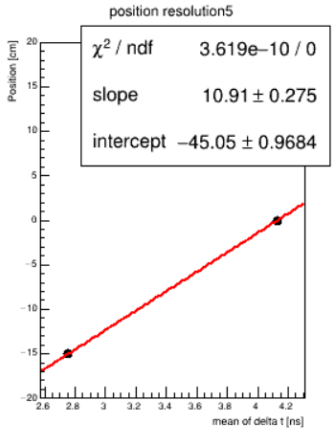


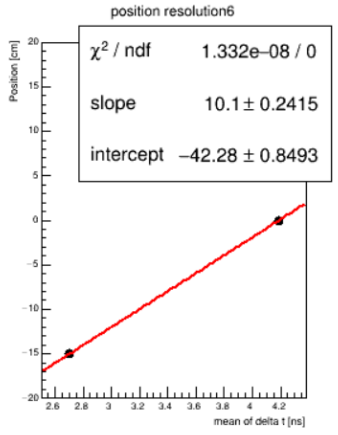


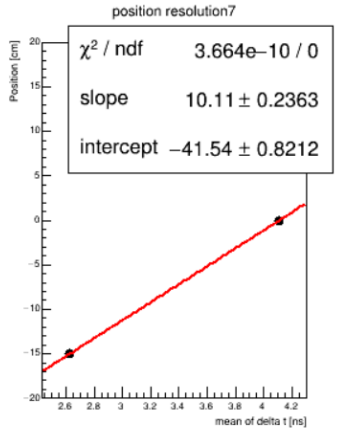


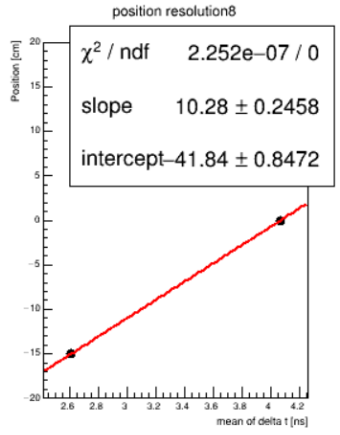


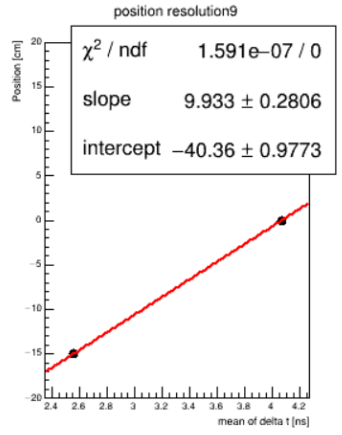




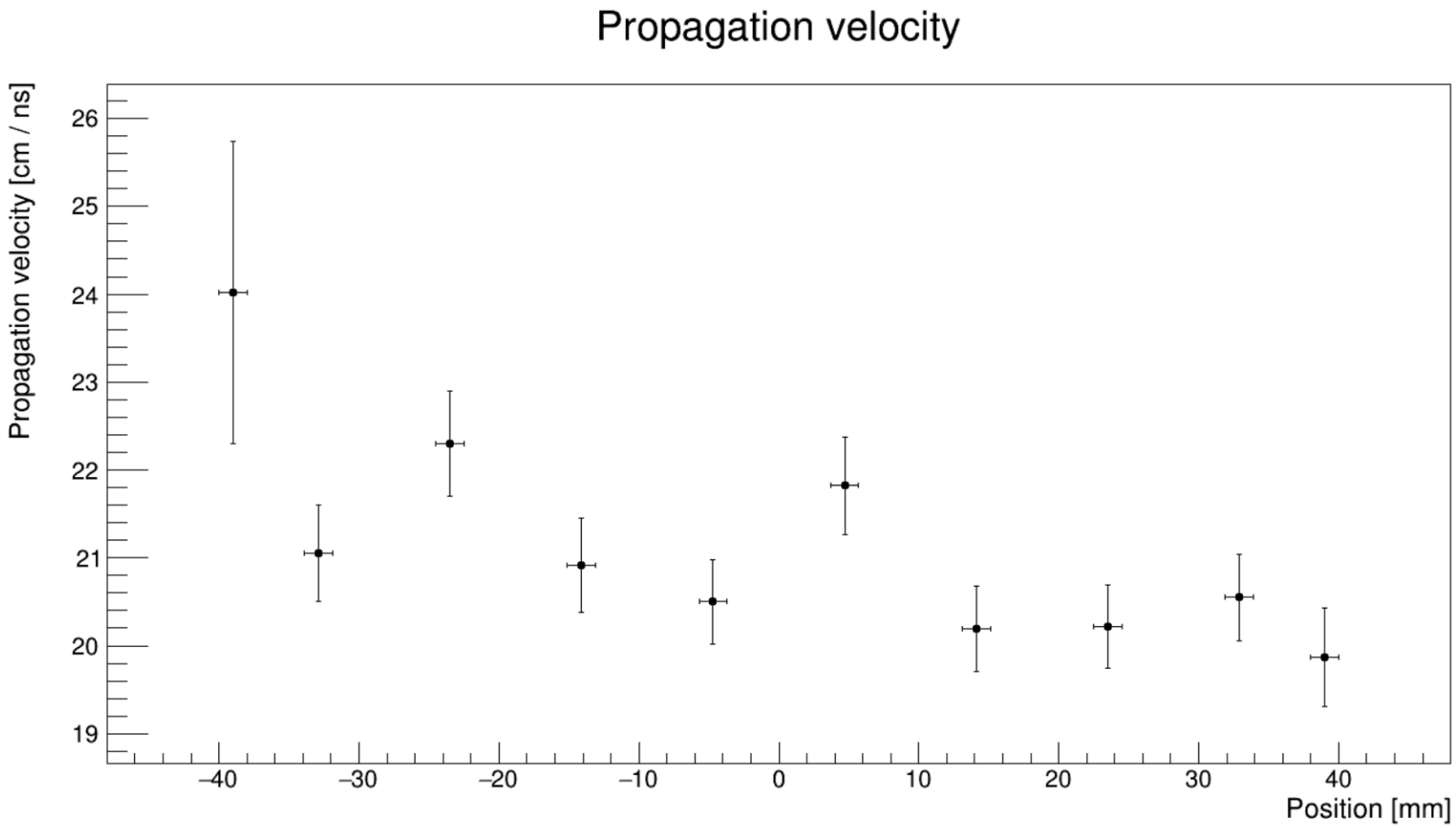






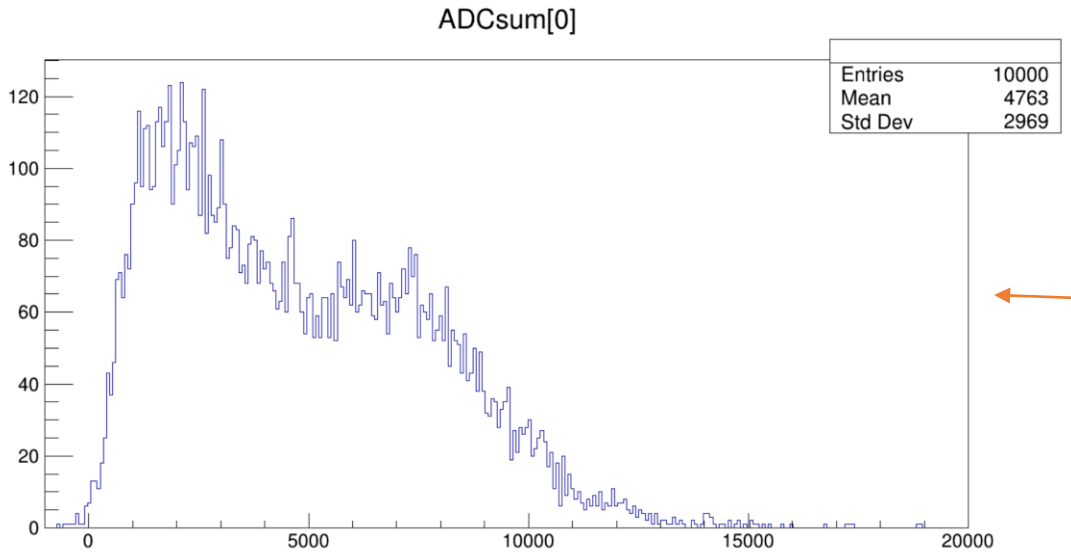


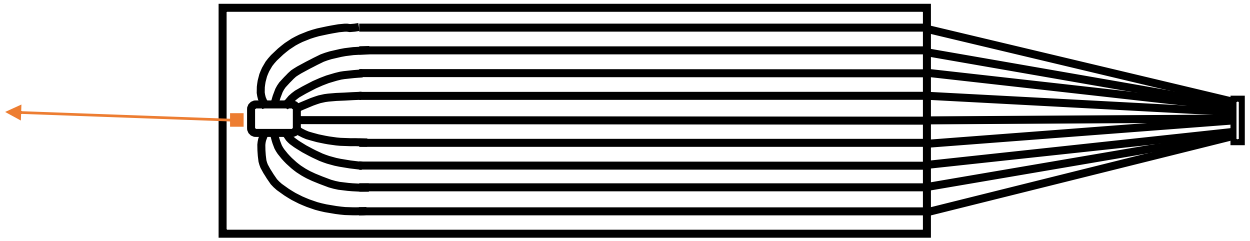
Propagation velocity



At edge of DCV

ADCsum


ADCsum[0]
Entries 10000
Mean 4763
Std Dev 2969
120
100
80
60
40
20
0
0
5000
10000
15000
20000



Fitting

<Fitting Function>
Landau convoluted with Gaussian(Signal) + Gaussian(Pedestal)