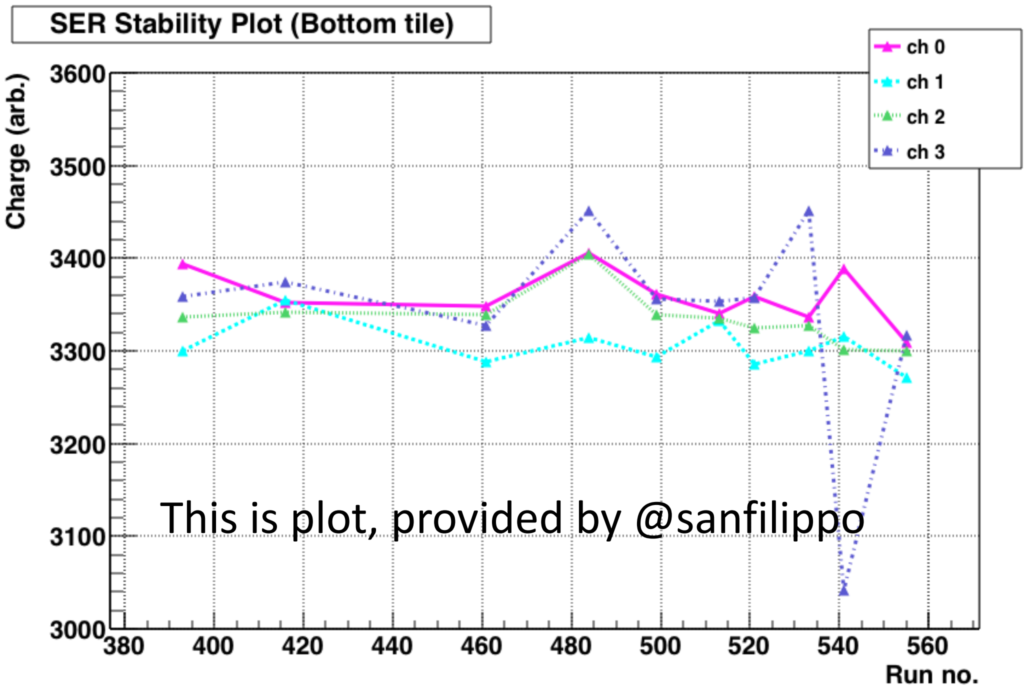
Report about month activity in Naples (5 Nov – 7 Dec)

Oleynikov Vladislav

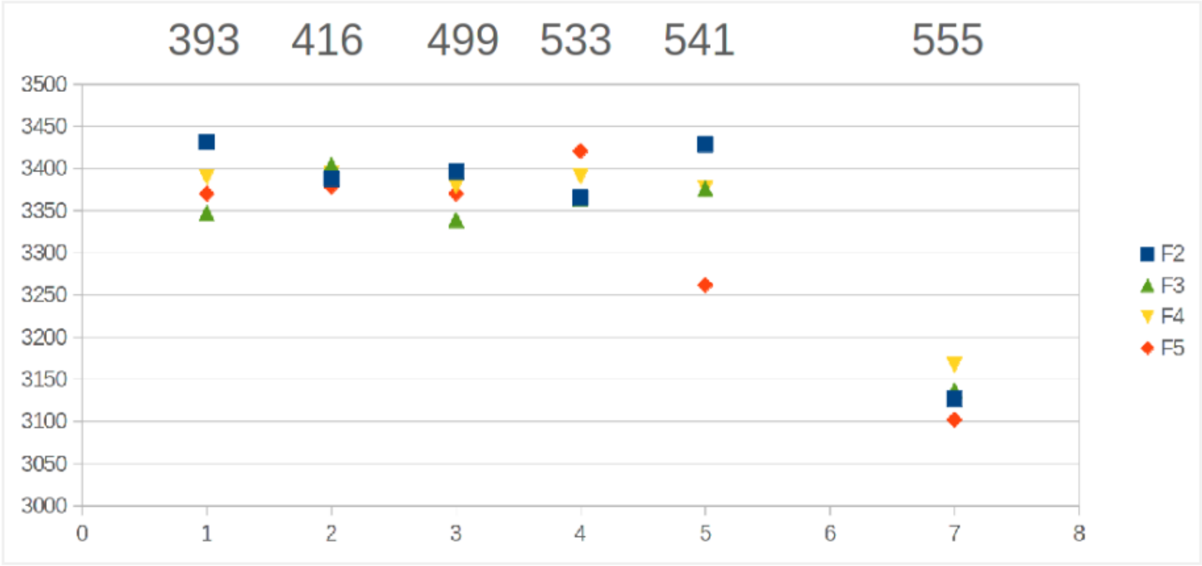
19 Dec 2018

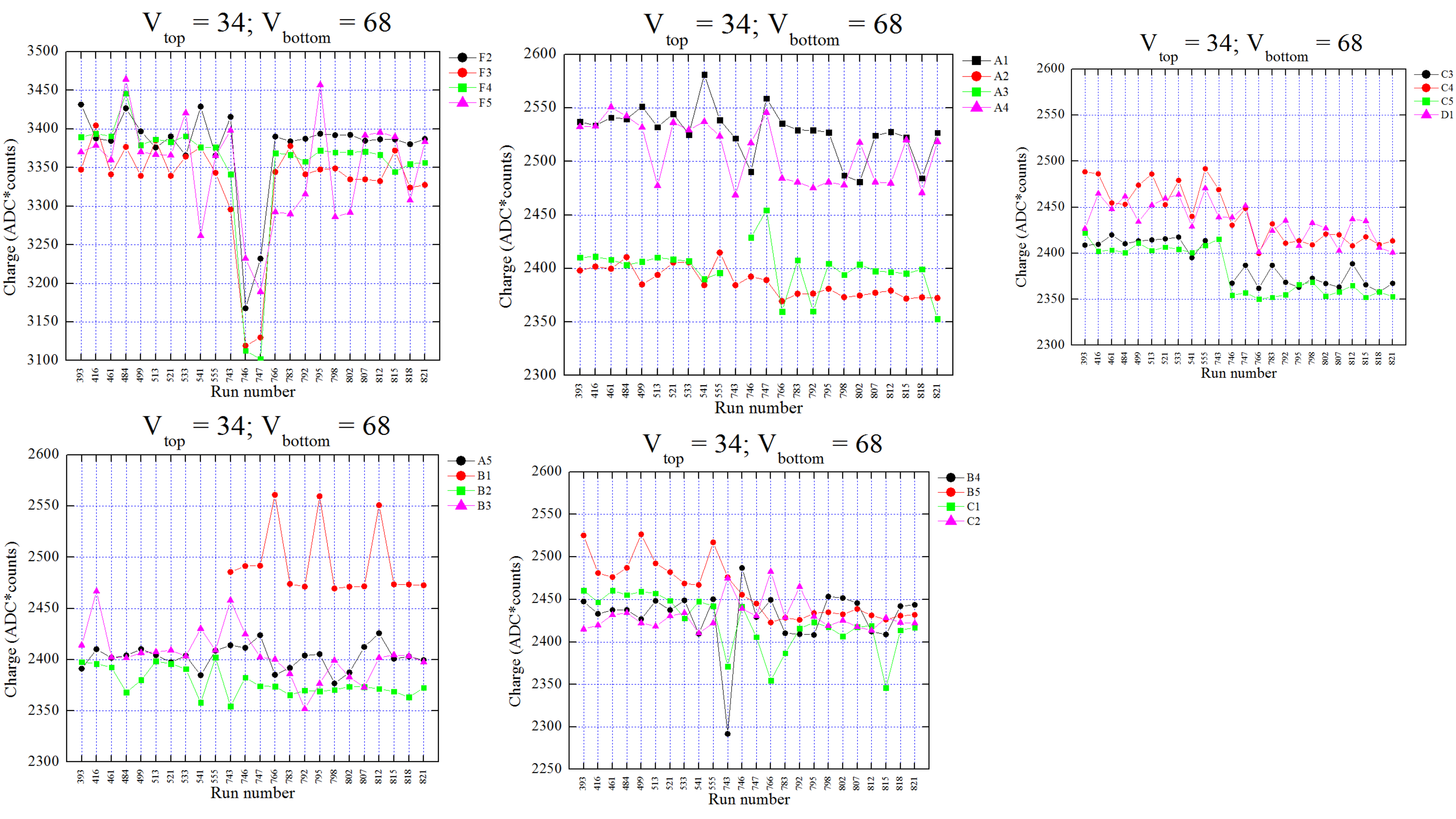
Part1: SER stability

SER stability

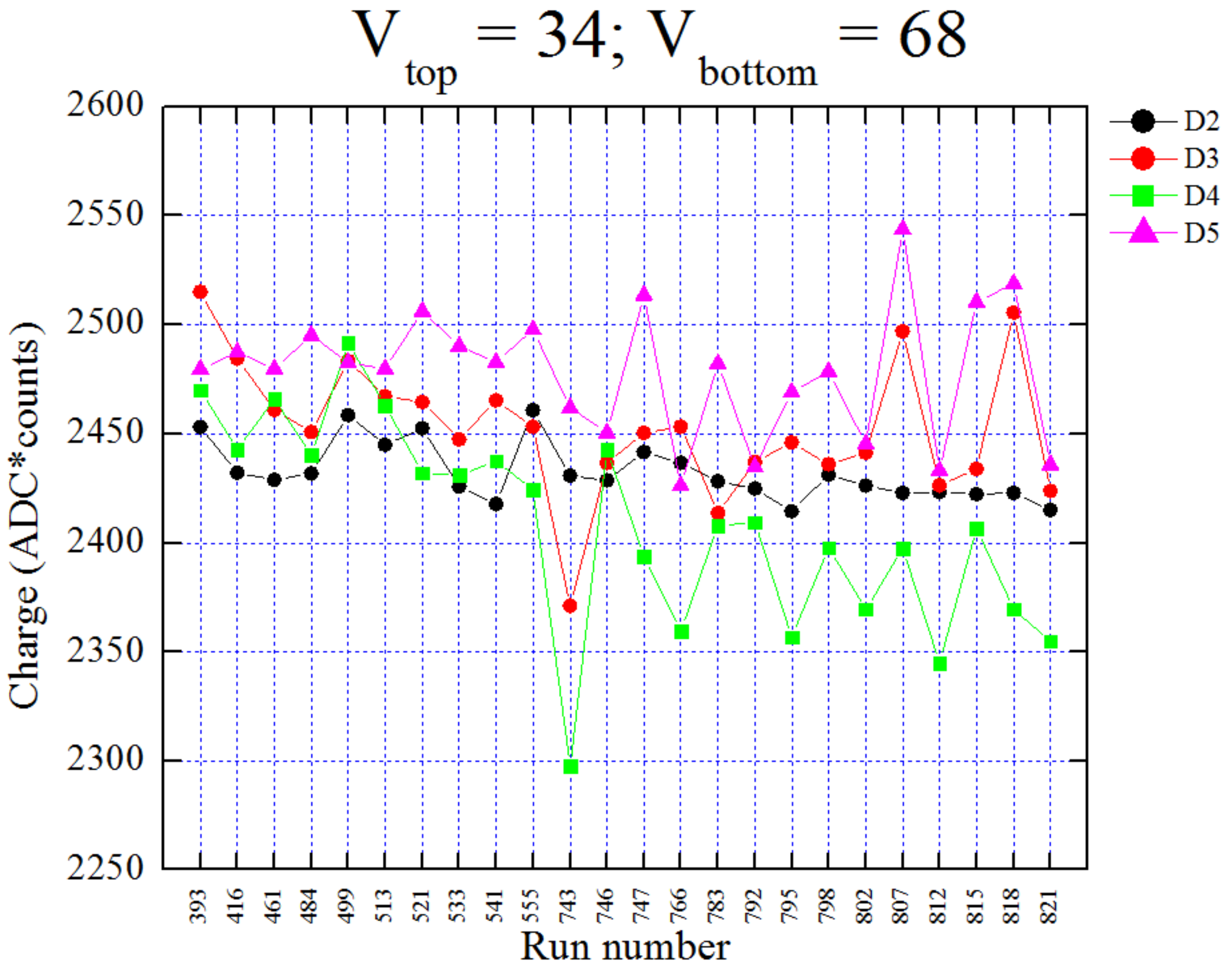


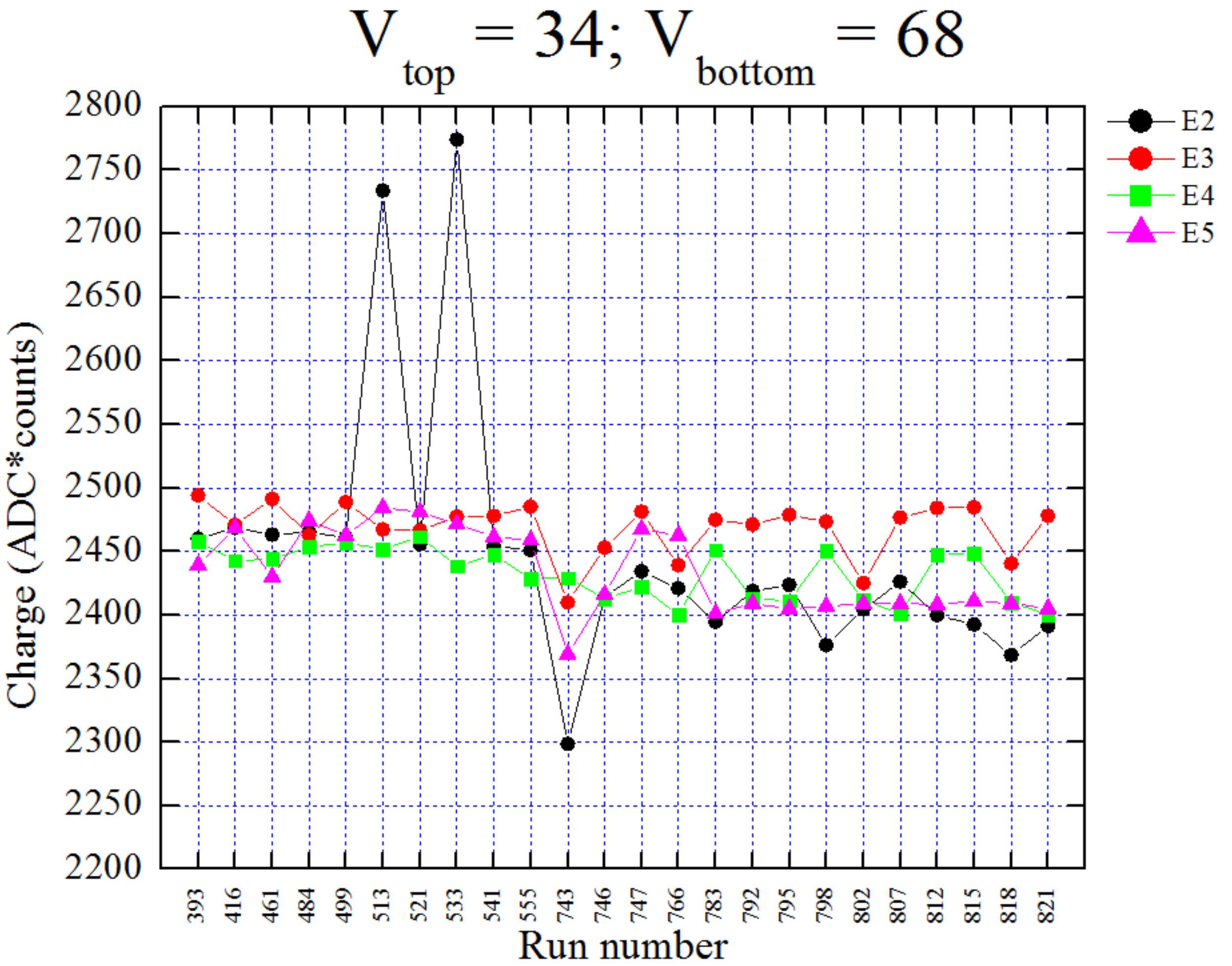
This is mine, using SER values from https://baltig.infn.it/pandola/red-daq-light/





$V_{top} = 34; V_{bottom} = 68$
Charge (ADC*counts)
Run number
F2
F3
F4
F5
$V_{top} = 34; V_{bottom} = 68$
Charge (ADC*counts)
Run number
A1
A2
A3
A4
$V_{top} = 34; V_{bottom} = 68$
Charge (ADC*counts)
Run number
C3
C4
C5
D1
$V_{top} = 34; V_{bottom} = 68$
Charge (ADC*counts)
Run number
A5
B1
B2
B3
$V_{top} = 34; V_{bottom} = 68$
Charge (ADC*counts)
Run number
B4
B5
C1
C2
393 416 461 484 499 513 521 533 541 555 743 746 747 766 783 792 795 798 802 807 812 815 818 821



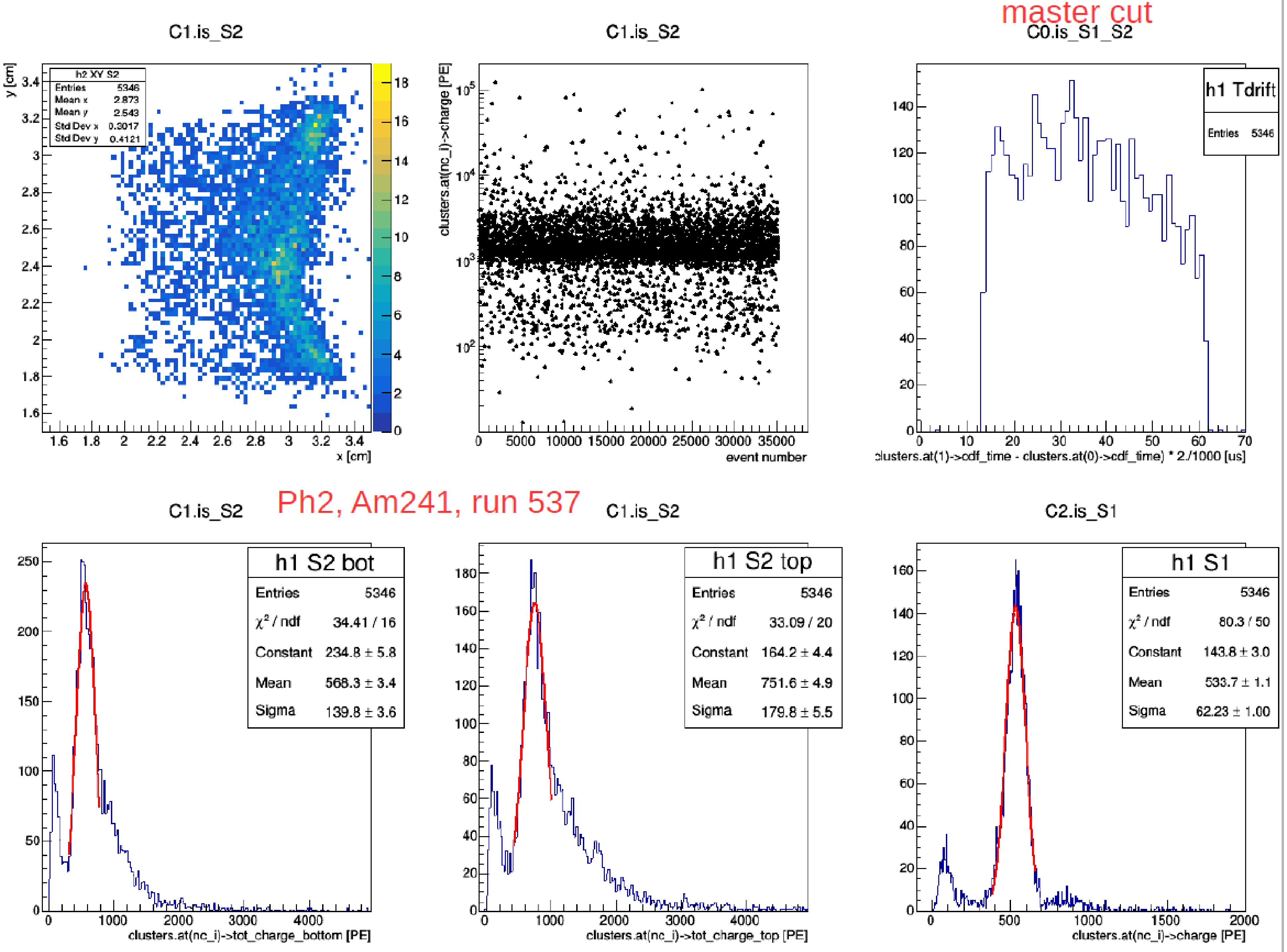


Conclusions:

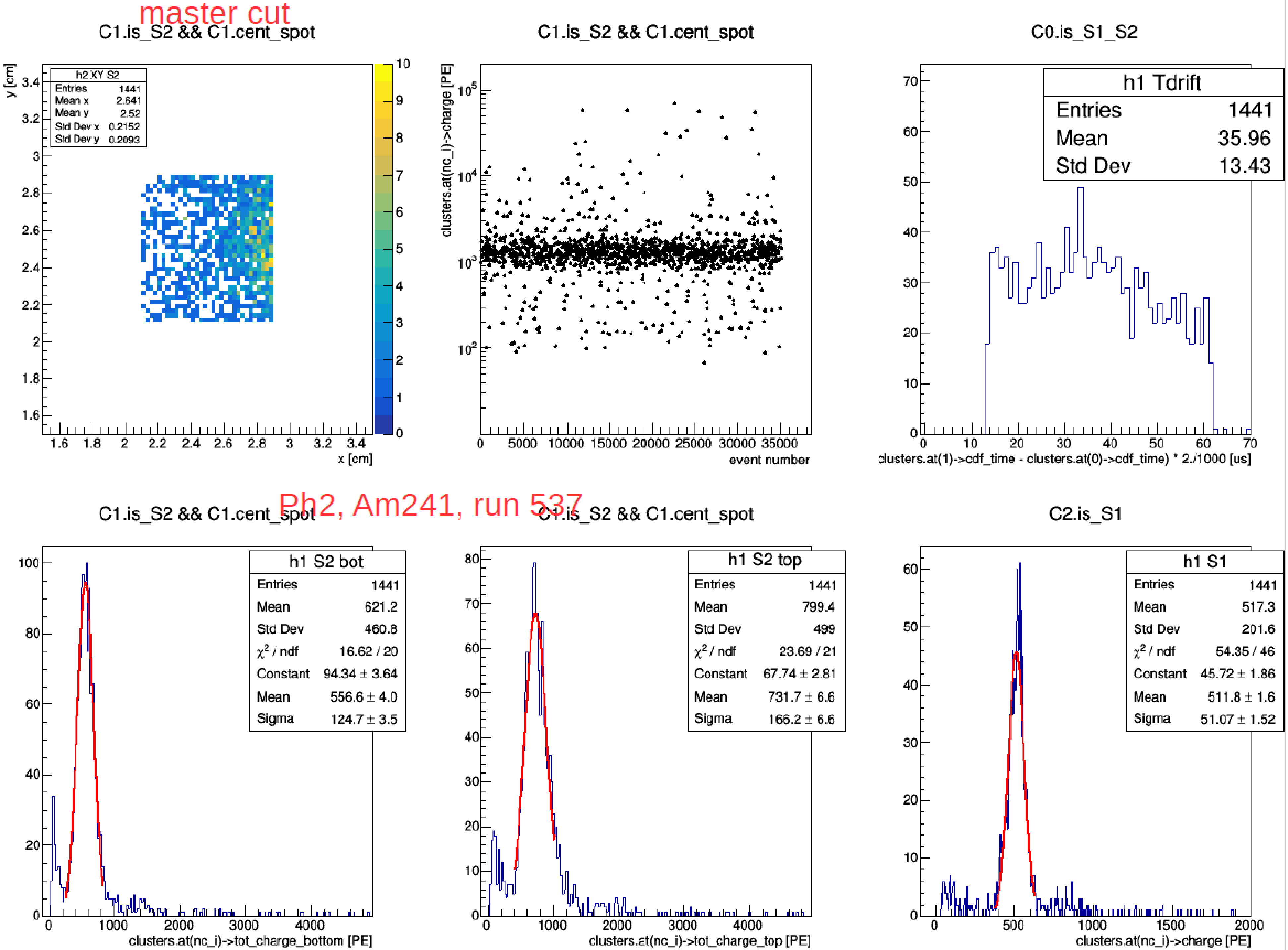
There are several “jumps”, that should be understood and fixed.

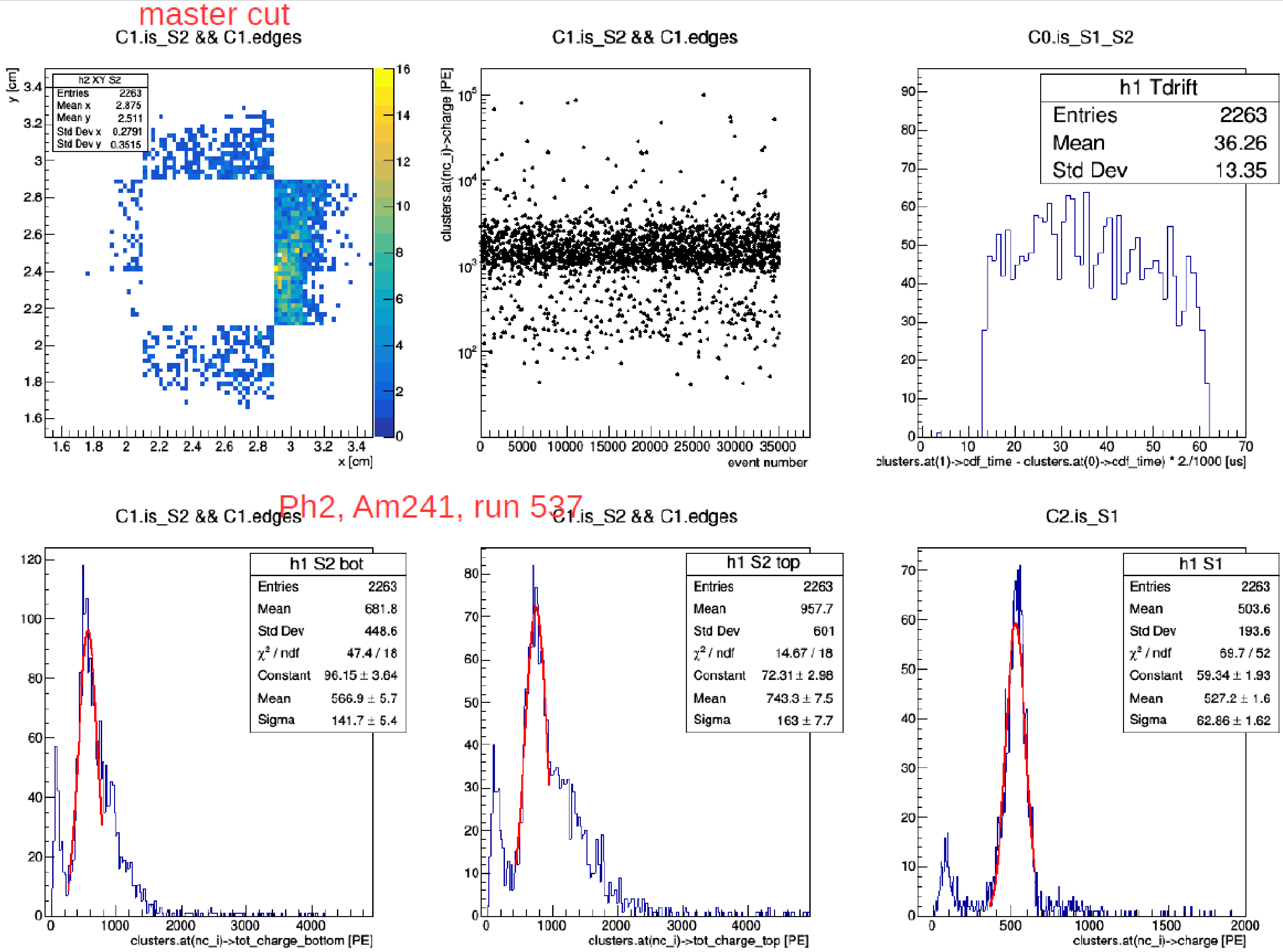
There is small constant slope: temperature instability?

Part2.1(run 537): S2 non-uniformity



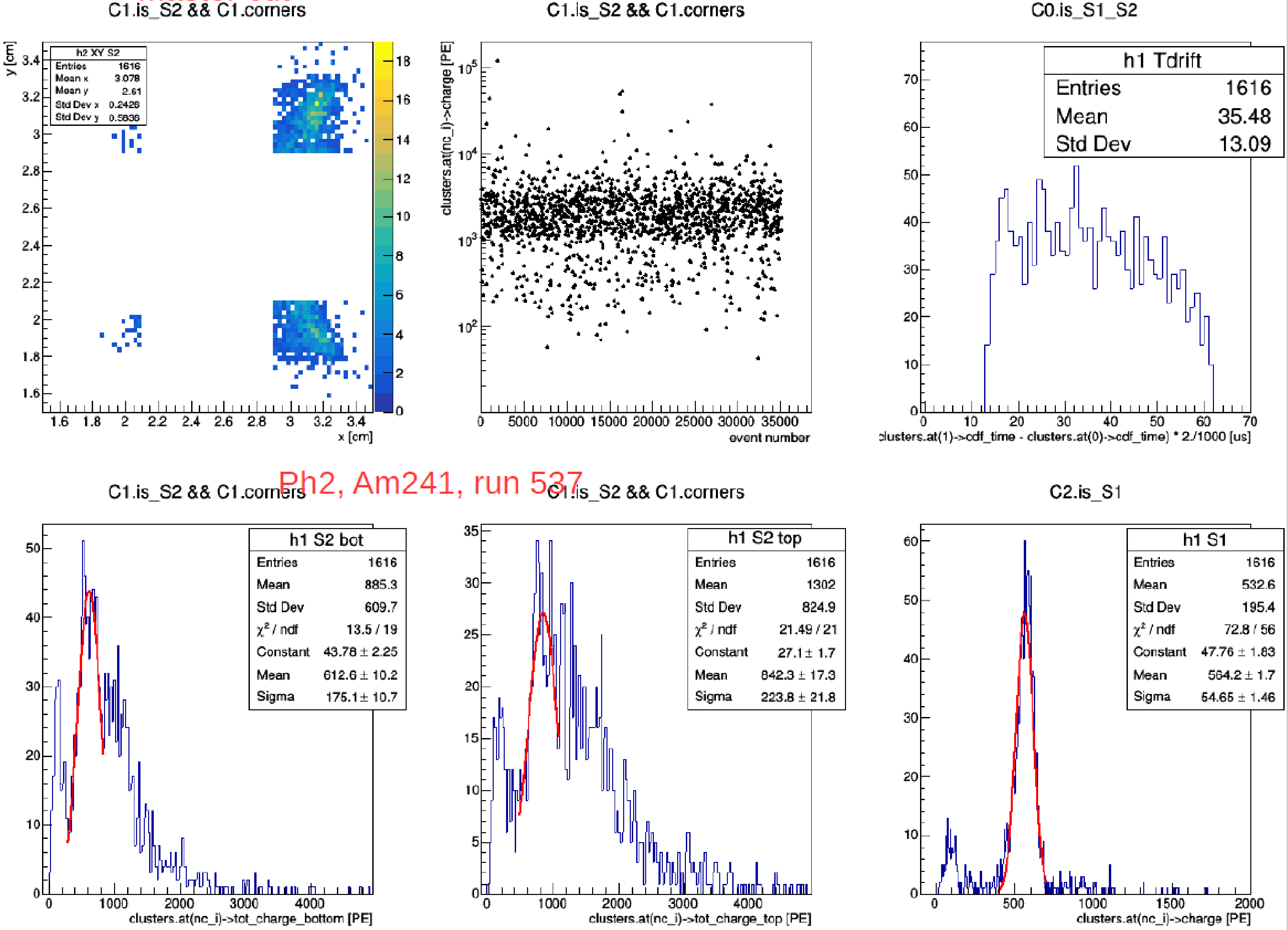
master cut
Ph2, Am241, run 537
C1.is_S2
h2 XY S2
Entries 5346
Mean x 2.873
Mean y 2.543
Std Dev x 0.3017
Std Dev y 0.4121
y [cm]
x [cm]
C1.is_S2
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 5346
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2
h1 S2 bot
Entries 5346
χ² / ndf 34.41 / 16
Constant 234.8 ± 5.8
Mean 568.3 ± 3.4
Sigma 139.8 ± 3.6
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2
h1 S2 top
Entries 5346
χ² / ndf 33.09 / 20
Constant 164.2 ± 4.4
Mean 751.6 ± 4.9
Sigma 179.8 ± 5.5
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 5346
χ² / ndf 80.3 / 50
Constant 143.8 ± 3.0
Mean 533.7 ± 1.1
Sigma 62.23 ± 1.00
clusters.at(nc_i)->charge [PE]

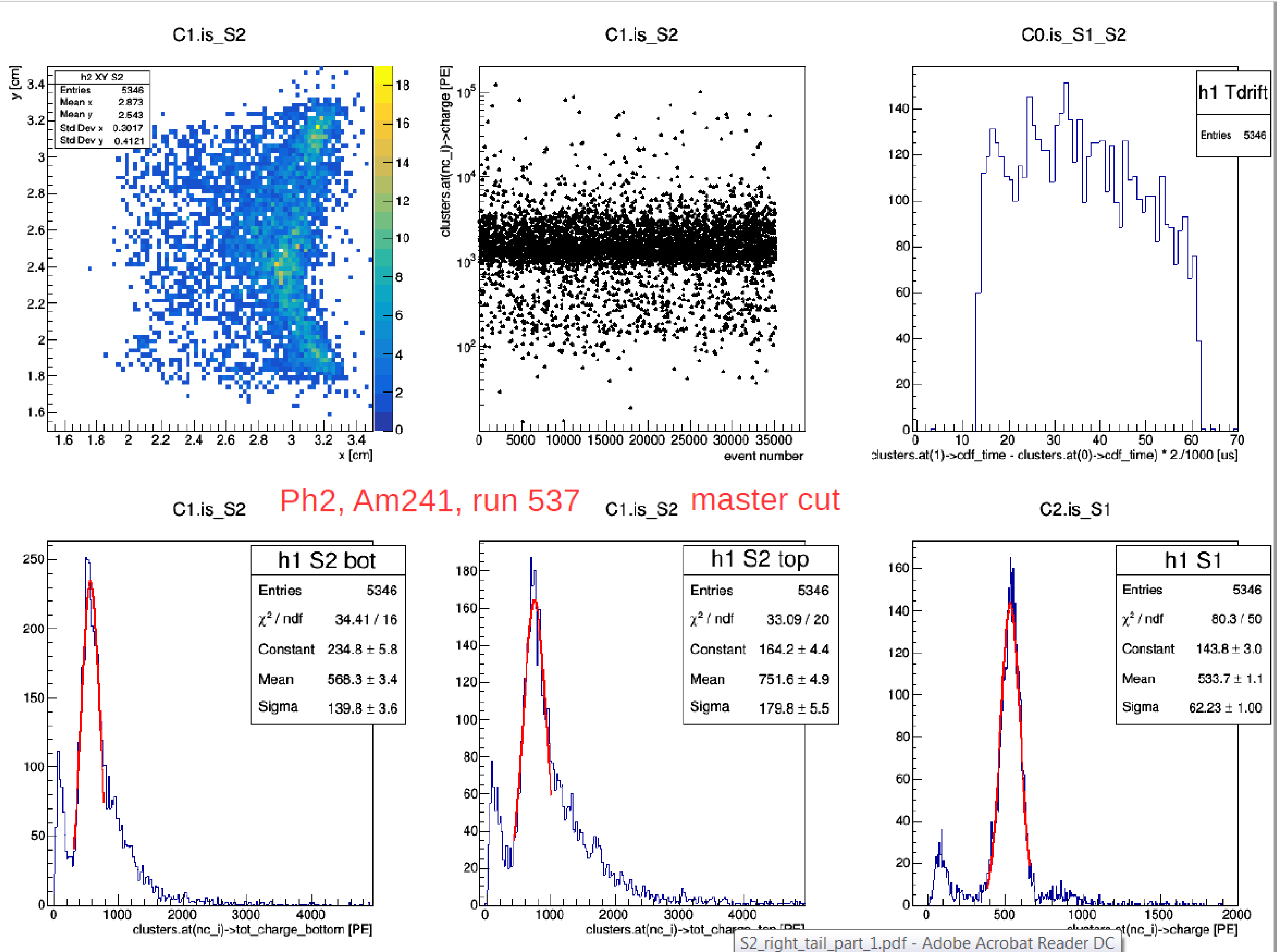

master cut
C1.is_S2 && C1.cent_spot
h2 XY S2
Entries 1441
Mean x 2.641
Mean y 2.52
Std Dev x 0.2152
Std Dev y 0.2093
y [cm]
x [cm]
C1.is_S2 && C1.cent_spot
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 1441
Mean 35.96
Std Dev 13.43
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 537
C1.is_S2 && C1.cent_spot
h1 S2 bot
Entries 1441
Mean 621.2
Std Dev 460.8
χ2 / ndf 16.62 / 20
Constant 94.34 ± 3.64
Mean 556.6 ± 4.0
Sigma 124.7 ± 3.5
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2 && C1.cent_spot
h1 S2 top
Entries 1441
Mean 799.4
Std Dev 499
χ2 / ndf 23.69 / 21
Constant 67.74 ± 2.81
Mean 731.7 ± 6.6
Sigma 166.2 ± 6.6
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 1441
Mean 517.3
Std Dev 201.6
χ2 / ndf 54.35 / 46
Constant 45.72 ± 1.86
Mean 511.8 ± 1.6
Sigma 51.07 ± 1.52
clusters.at(nc_i)->charge [PE]

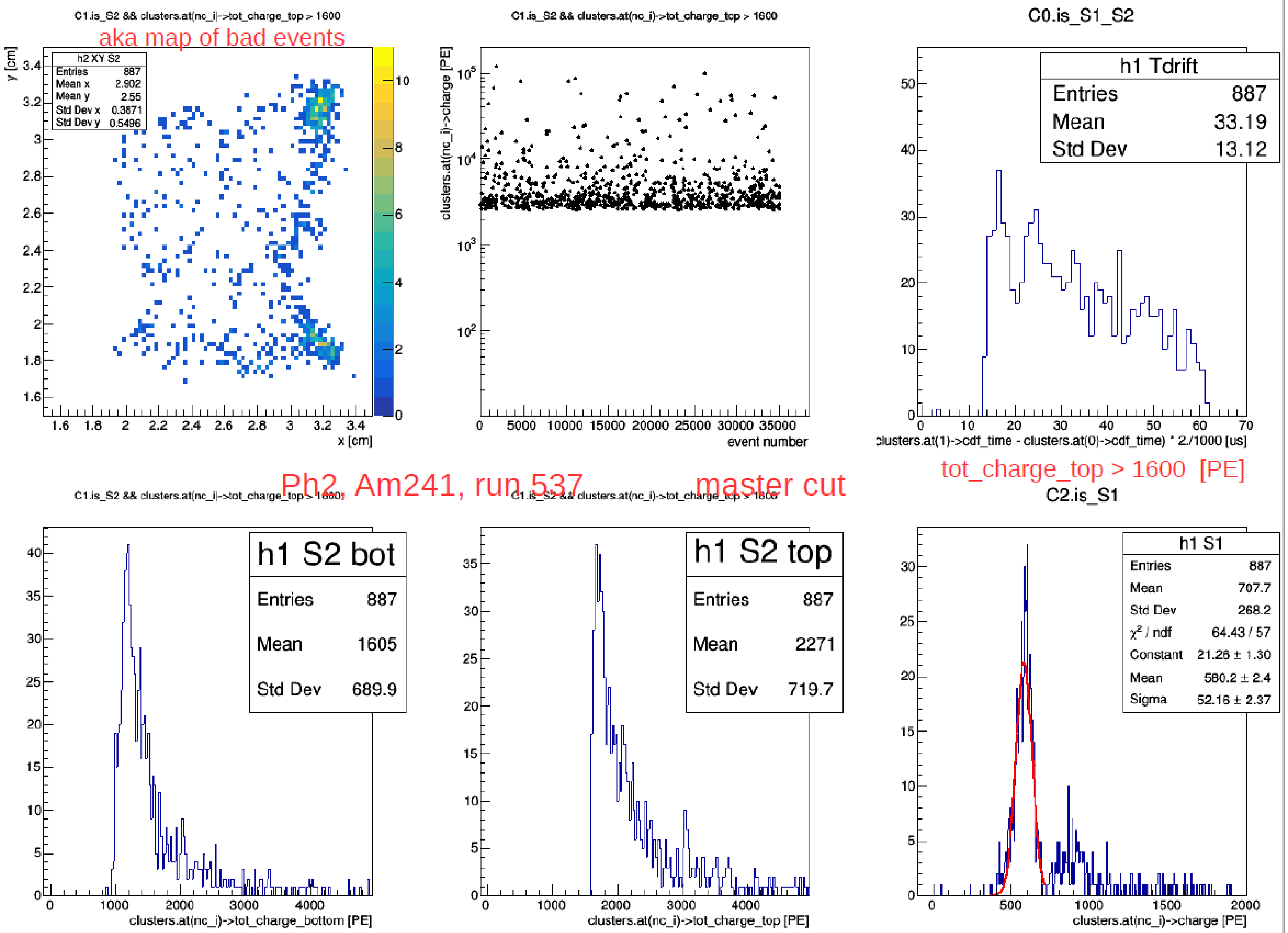

master cut
Ph2, Am241, run 537
C1.is_S2 && C1.edges
h2 XY S2
Entries 2263
Mean x 2.875
Mean y 2.511
Std Dev x 0.2791
Std Dev y 0.3515
y [cm]
x [cm]
C1.is_S2 && C1.edges
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 2263
Mean 36.26
Std Dev 13.35
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2 && C1.edges
h1 S2 bot
Entries 2263
Mean 681.8
Std Dev 448.6
χ² / ndf 47.4 / 18
Constant 96.15 ± 3.64
Mean 566.9 ± 5.7
Sigma 141.7 ± 5.4
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2 && C1.edges
h1 S2 top
Entries 2263
Mean 957.7
Std Dev 601
χ² / ndf 14.67 / 18
Constant 72.31 ± 2.98
Mean 743.3 ± 7.5
Sigma 163 ± 7.7
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 2263
Mean 503.6
Std Dev 193.6
χ² / ndf 69.7 / 52
Constant 59.34 ± 1.93
Mean 527.2 ± 1.6
Sigma 62.86 ± 1.62
clusters.at(nc_i)->charge [PE]

master cut

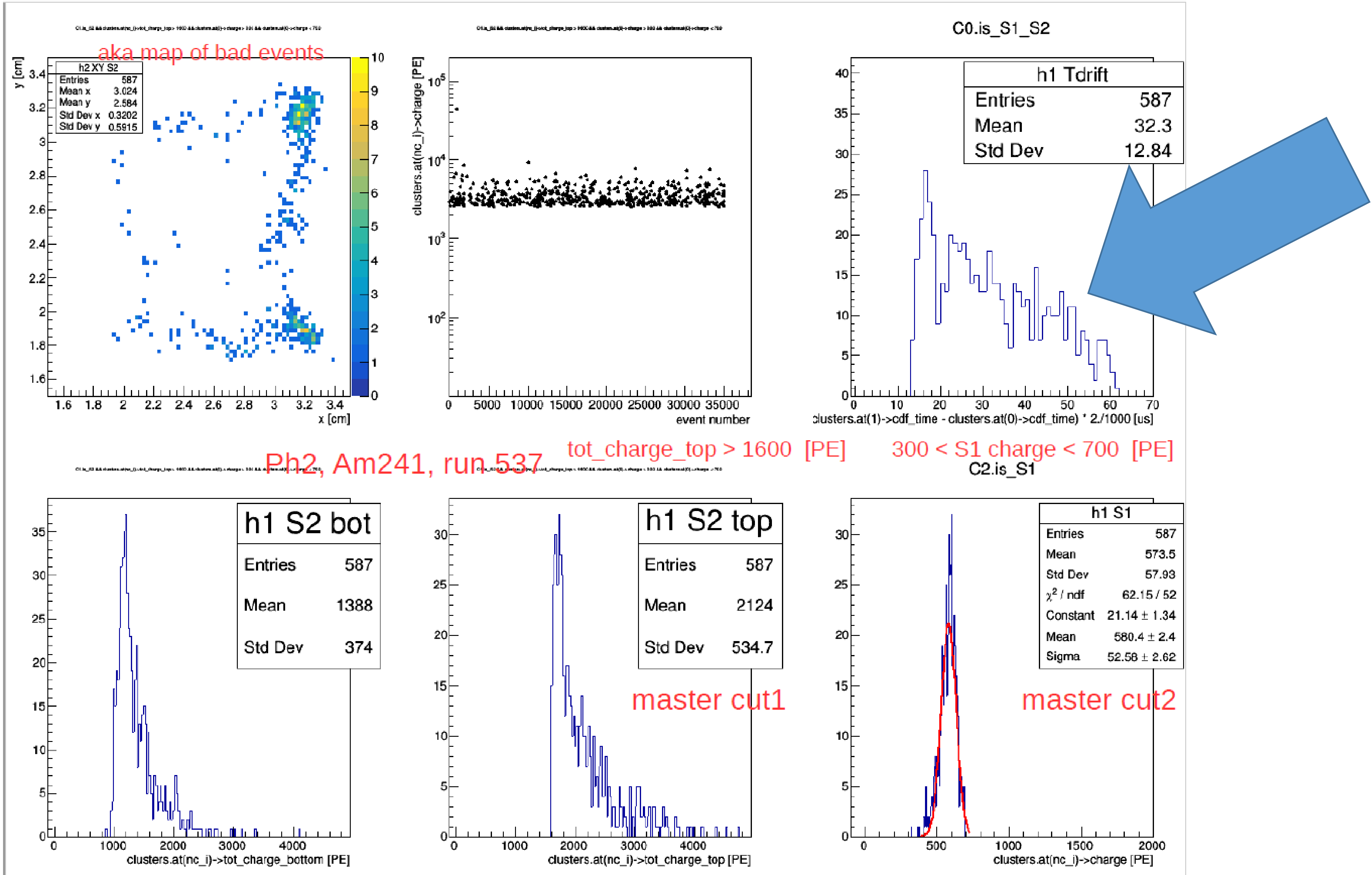
Ph2, Am241, run 537



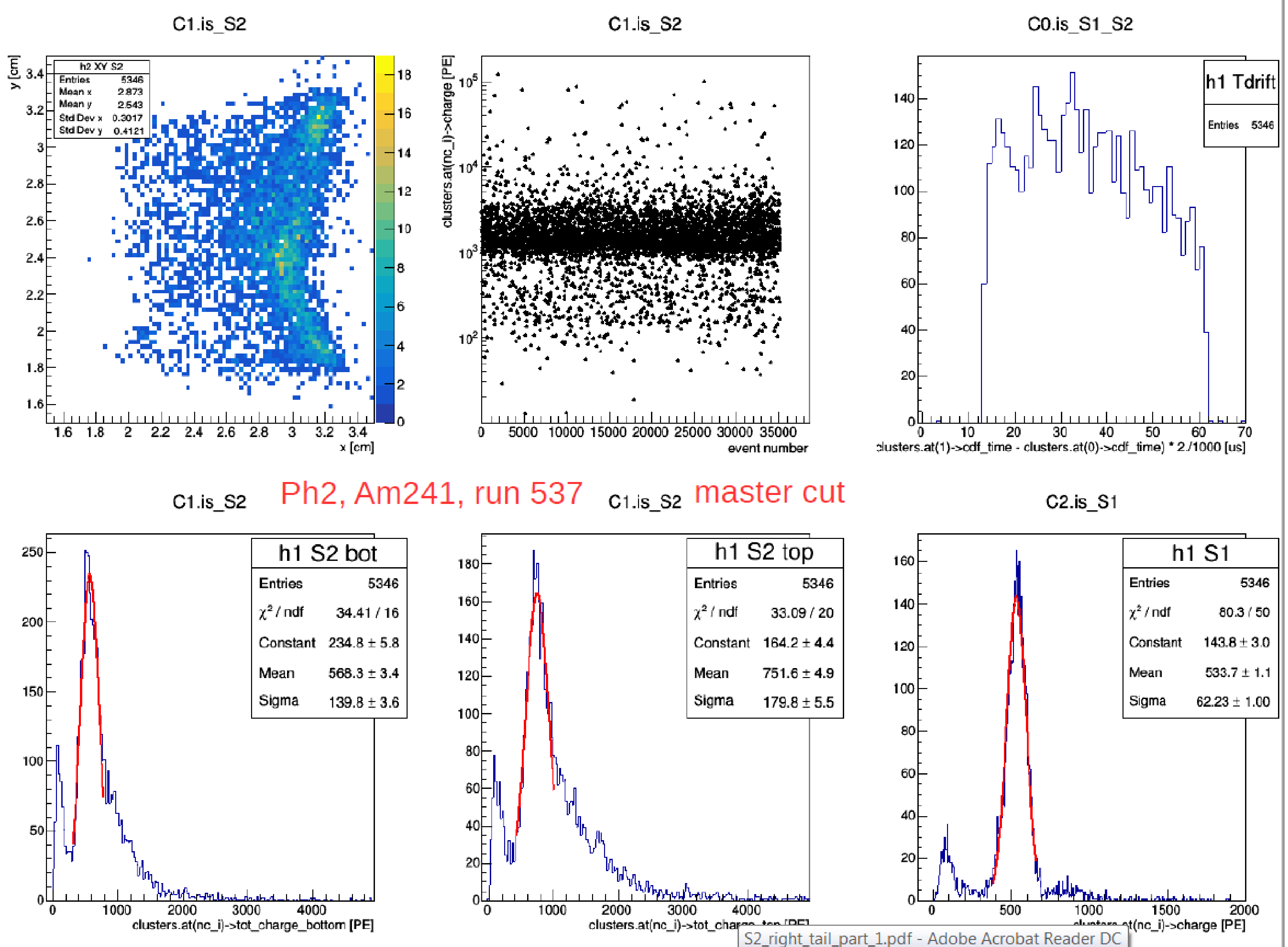

Ph2, Am241, run 537
master cut
C1.is_S2
h2 XY S2
Entries 5346
Mean x 2.873
Mean y 2.543
Std Dev x 0.3017
Std Dev y 0.4121
y [cm]
x [cm]
C1.is_S2
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 5346
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2
h1 S2 bot
Entries 5346
χ² / ndf 34.41 / 16
Constant 234.8 ± 5.8
Mean 568.3 ± 3.4
Sigma 139.8 ± 3.6
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2
h1 S2 top
Entries 5346
χ² / ndf 33.09 / 20
Constant 164.2 ± 4.4
Mean 751.6 ± 4.9
Sigma 179.8 ± 5.5
C2.is_S1
h1 S1
Entries 5346
χ² / ndf 80.3 / 50
Constant 143.8 ± 3.0
Mean 533.7 ± 1.1
Sigma 62.23 ± 1.00
S2_right_tail_part_1.pdf - Adobe Acrobat Reader DC



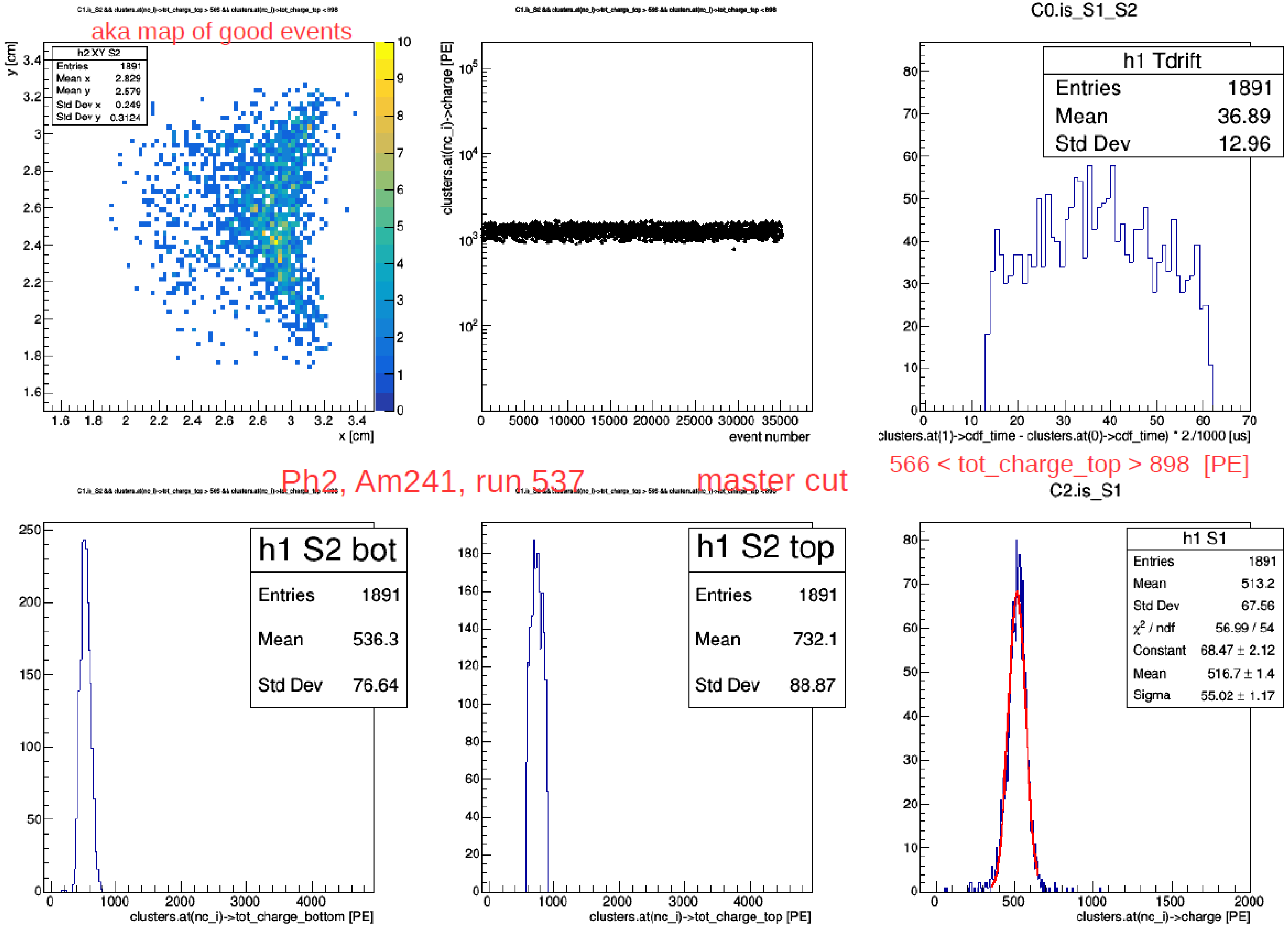
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 1600
aka map of bad events
h2 XY S2
Entries 887
Mean x 2.902
Mean y 2.55
Std Dev x 0.3871
Std Dev y 0.5496
y [cm]
x [cm]
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 1600
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 887
Mean 33.19
Std Dev 13.12
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
tot_charge_top > 1600 [PE]
Ph2, Am241, run 537
master cut
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 1600
h1 S2 bot
Entries 887
Mean 1605
Std Dev 689.9
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 1600
h1 S2 top
Entries 887
Mean 2271
Std Dev 719.7
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 887
Mean 707.7
Std Dev 268.2
χ² / ndf 64.43 / 57
Constant 21.26 ± 1.30
Mean 580.2 ± 2.4
Sigma 52.16 ± 2.37
clusters.at(nc_i)->charge [PE]



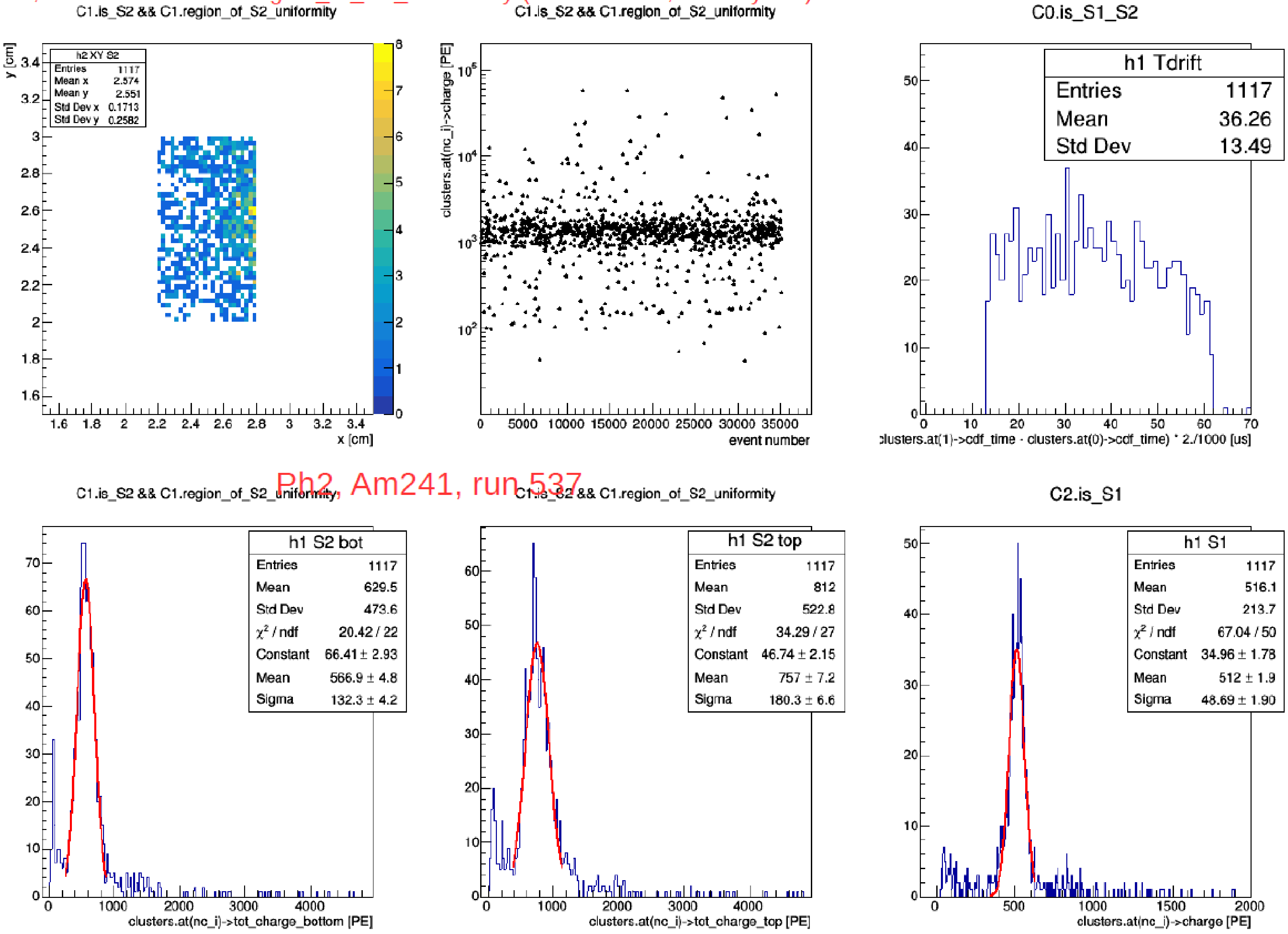
aka map of bad events
h2 XY S2
Entries 587
Mean x 3.024
Mean y 2.584
Std Dev x 0.3202
Std Dev y 0.5915
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 587
Mean 32.3
Std Dev 12.84
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 537
tot_charge_top > 1600 [PE]
300 < S1 charge < 700 [PE]
C2.is_S1
h1 S2 bot
Entries 587
Mean 1388
Std Dev 374
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 587
Mean 2124
Std Dev 534.7
master cut1
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 587
Mean 573.5
Std Dev 57.93
χ² / ndf 62.15 / 52
Constant 21.14 ± 1.34
Mean 580.4 ± 2.4
Sigma 52.58 ± 2.62
master cut2
clusters.at(nc_i)->charge [PE]



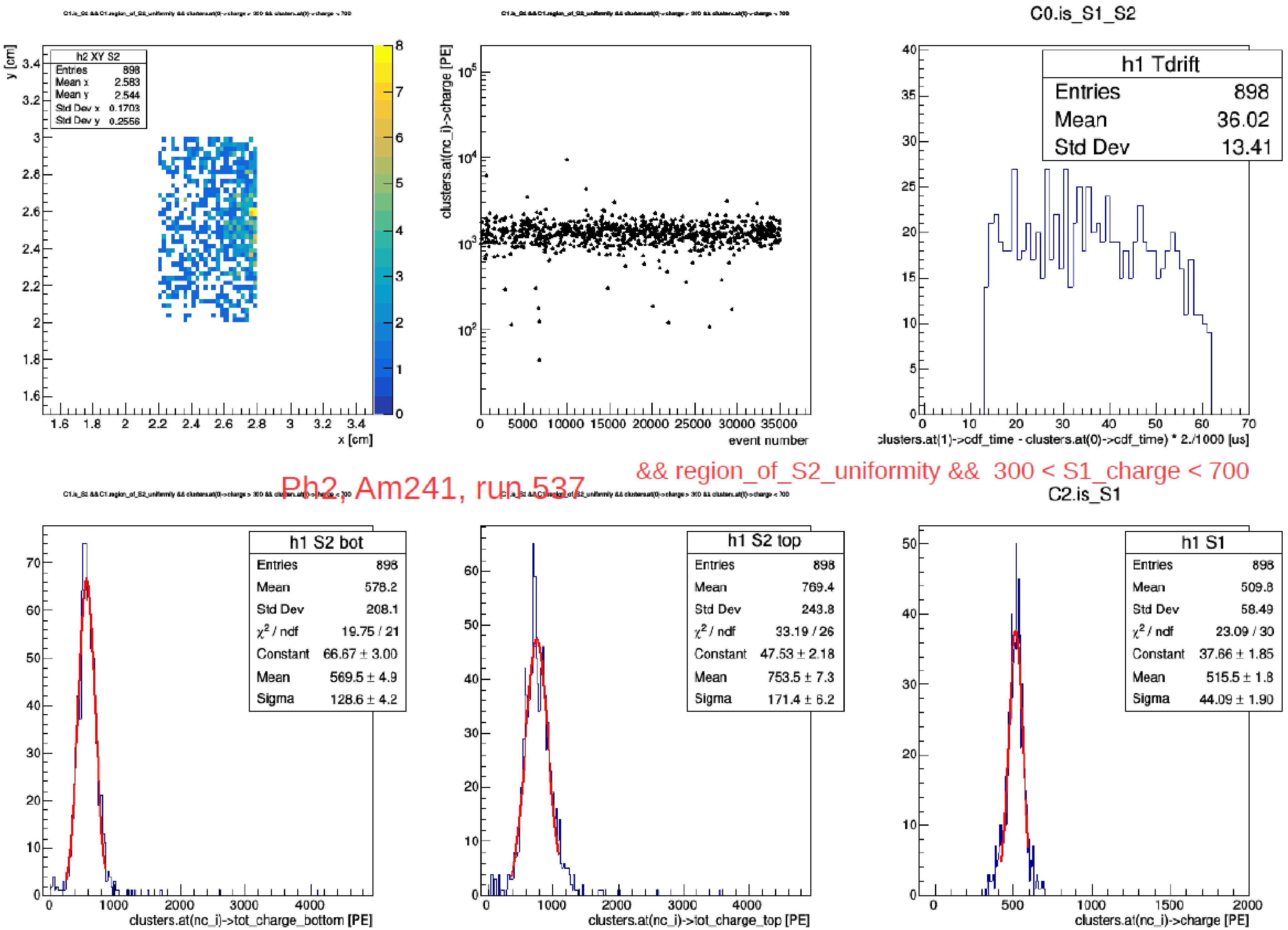
Ph2, Am241, run 537
master cut
C1.is_S2
h2 XY S2
Entries 5346
Mean x 2.873
Mean y 2.543
Std Dev x 0.3017
Std Dev y 0.4121
x [cm]
y [cm]
C1.is_S2
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 5346
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2
h1 S2 bot
Entries 5346
χ² / ndf 34.41 / 16
Constant 234.8 ± 5.8
Mean 568.3 ± 3.4
Sigma 139.8 ± 3.6
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2
h1 S2 top
Entries 5346
χ² / ndf 33.09 / 20
Constant 164.2 ± 4.4
Mean 751.6 ± 4.9
Sigma 179.8 ± 5.5
C2.is_S1
h1 S1
Entries 5346
χ² / ndf 80.3 / 50
Constant 143.8 ± 3.0
Mean 533.7 ± 1.1
Sigma 62.23 ± 1.00
S2_right_tail_part_1.pdf - Adobe Acrobat Reader DC


aka map of good events
h2 XY S2
Entries 1891
Mean x 2.829
Mean y 2.579
Std Dev x 0.249
Std Dev y 0.3124
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 1891
Mean 36.89
Std Dev 12.96
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
566 < tot_charge_top > 898 [PE]
Ph2, Am241, run 537
master cut
C2.is_S1
h1 S2 bot
Entries 1891
Mean 536.3
Std Dev 76.64
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 1891
Mean 732.1
Std Dev 88.87
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 1891
Mean 513.2
Std Dev 67.56
χ2 / ndf 56.99 / 54
Constant 68.47 ± 2.12
Mean 516.7 ± 1.4
Sigma 55.02 ± 1.17
clusters.at(nc_i)->charge [PE]

So, I created new cut: region_of_S2_uniformity (2.2 < x < 2.8;   2 < y < 3)

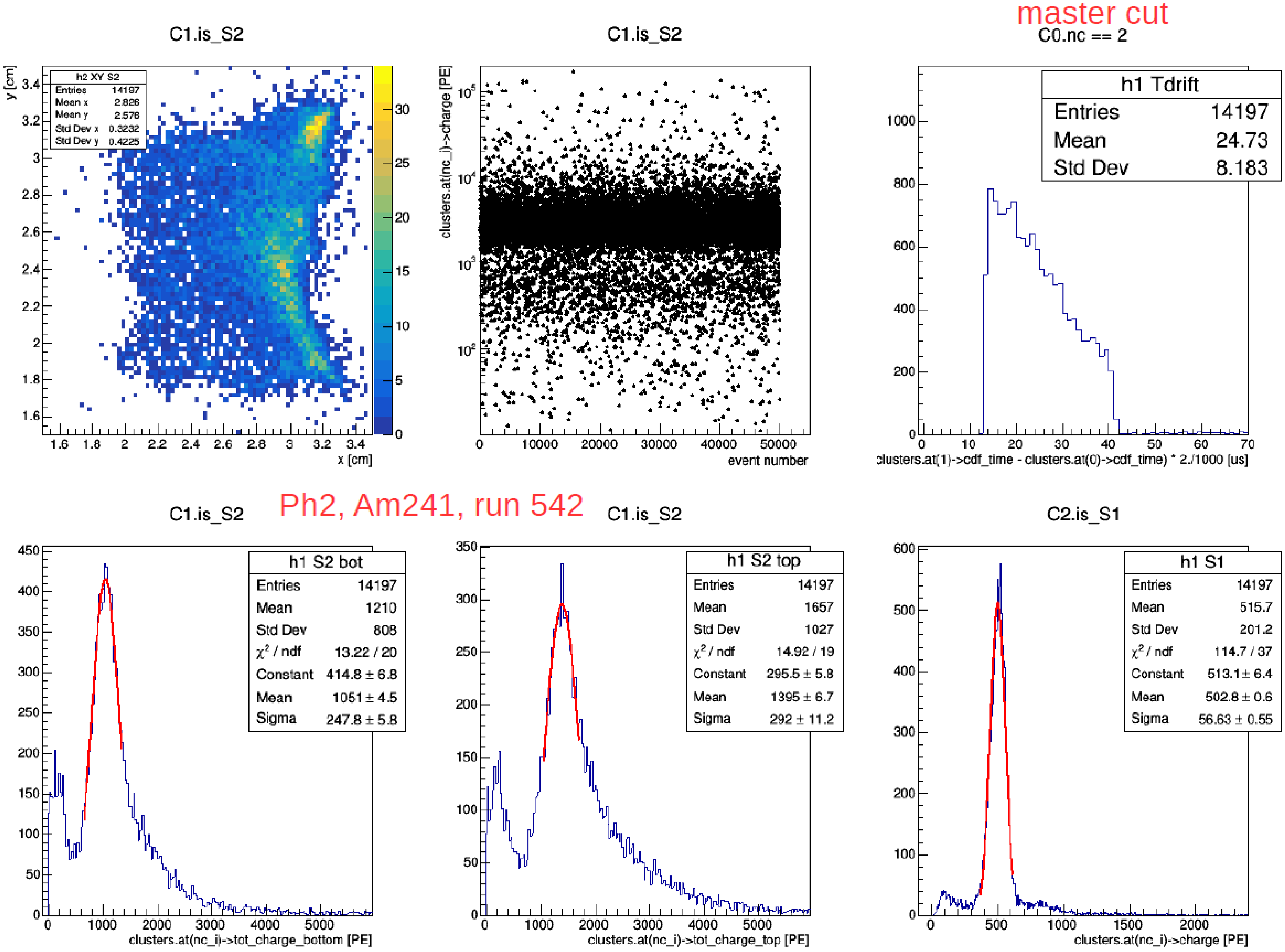


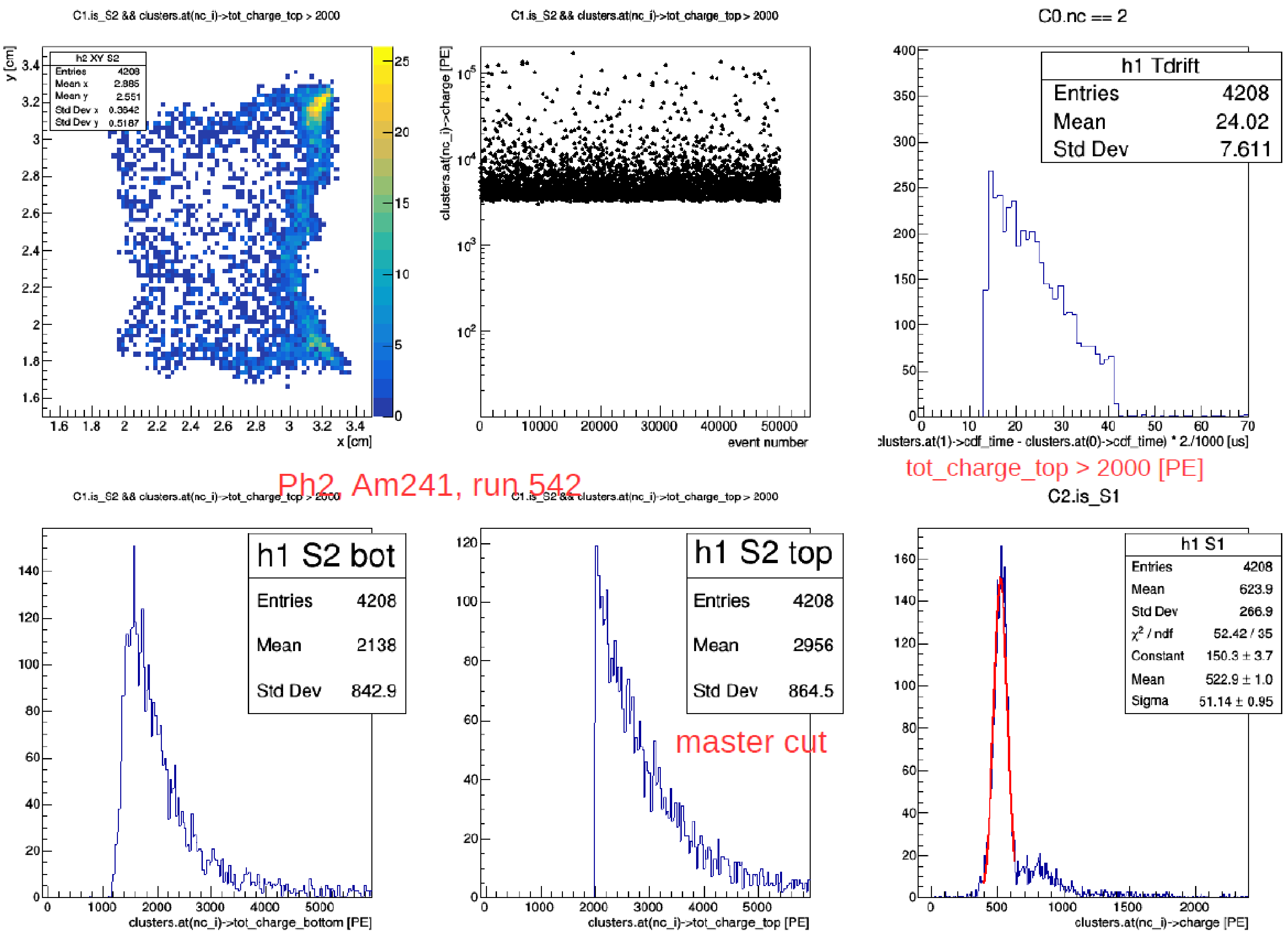
Ph2, Am241, run 537

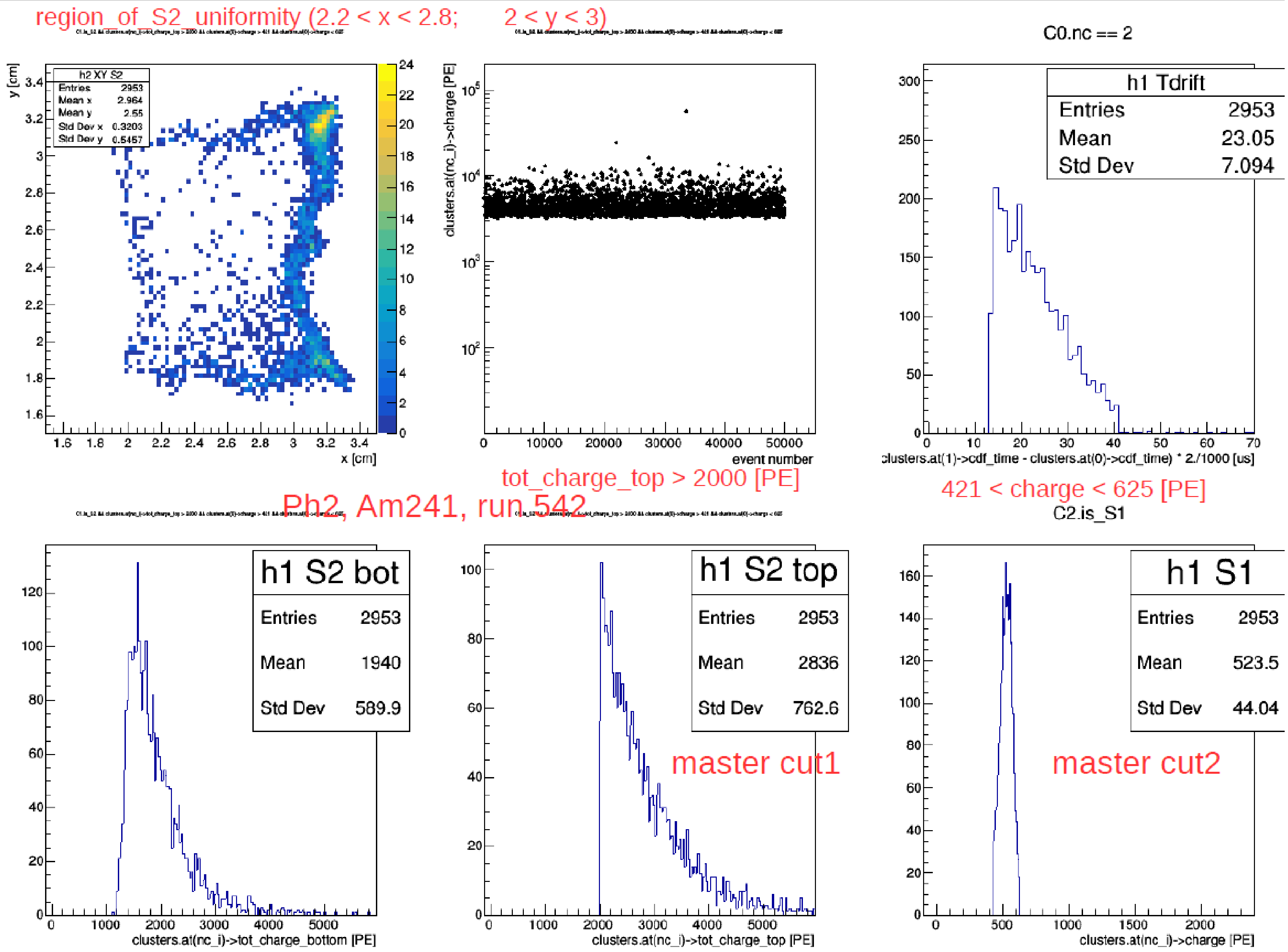


Ph2, Am241, run 537
&& region_of_S2_uniformity && 300 < S1_charge < 700
h2 XY S2
Entries 898
Mean x 2.583
Mean y 2.544
Std Dev x 0.1703
Std Dev y 0.2556
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
C0.is_S1_S2
h1 Tdrift
Entries 898
Mean 36.02
Std Dev 13.41
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
h1 S2 bot
Entries 898
Mean 578.2
Std Dev 208.1
χ2 / ndf 19.75 / 21
Constant 66.67 ± 3.00
Mean 569.5 ± 4.9
Sigma 128.6 ± 4.2
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 898
Mean 769.4
Std Dev 243.8
χ2 / ndf 33.19 / 26
Constant 47.53 ± 2.18
Mean 753.5 ± 7.3
Sigma 171.4 ± 6.2
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 898
Mean 509.8
Std Dev 58.49
χ2 / ndf 23.09 / 30
Constant 37.66 ± 1.85
Mean 515.5 ± 1.8
Sigma 44.09 ± 1.90
clusters.at(nc_i)->charge [PE]

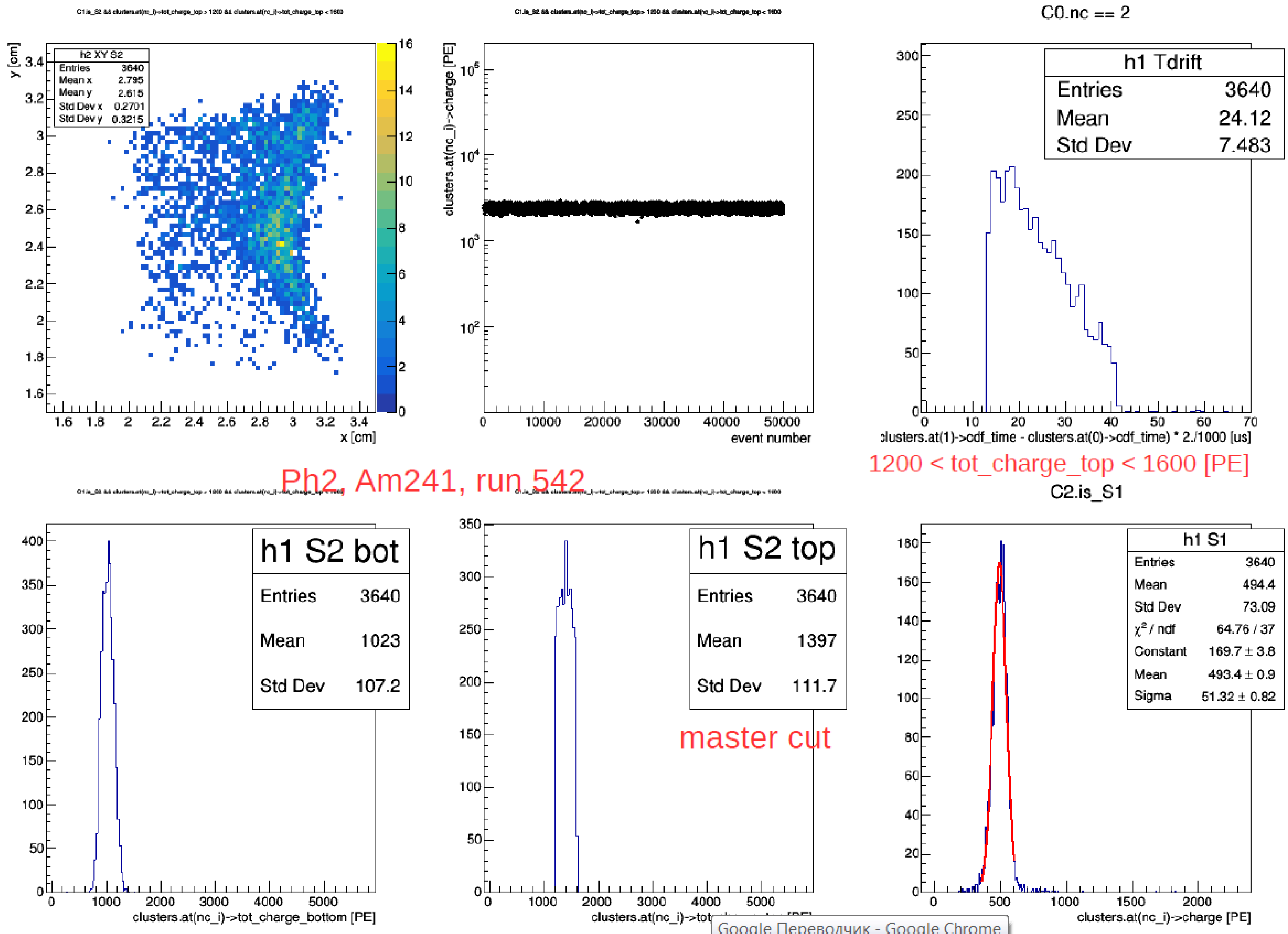
Part2.2 (run 542): S2 non-uniformity

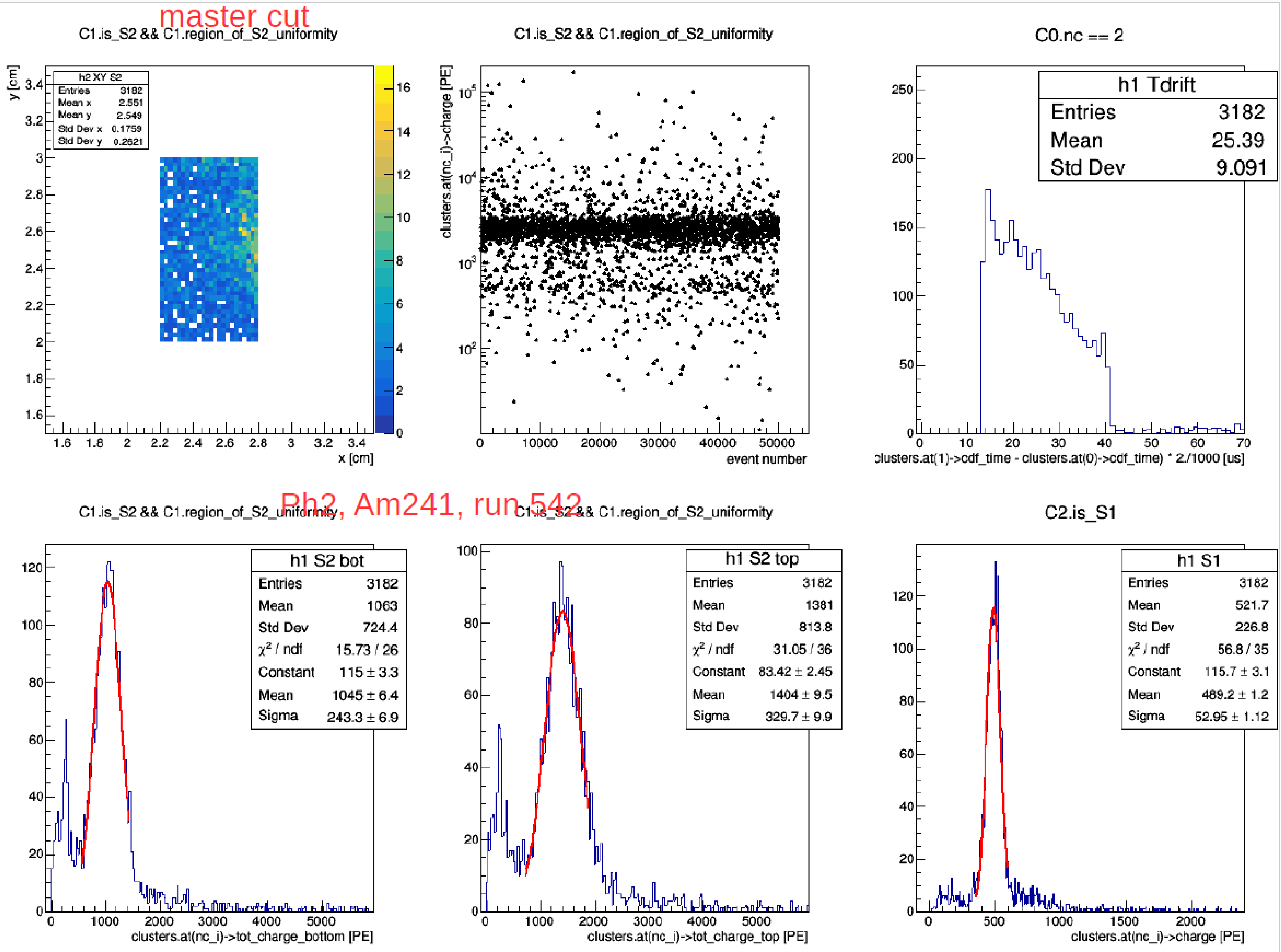

master cut
C0.nc == 2
C1.is_S2
h2 XY S2
Entries 14197
Mean x 2.826
Mean y 2.576
Std Dev x 0.3232
Std Dev y 0.4225
y [cm]
x [cm]
C1.is_S2
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 14197
Mean 24.73
Std Dev 8.183
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 542
C1.is_S2
h1 S2 bot
Entries 14197
Mean 1210
Std Dev 808
χ² / ndf 13.22 / 20
Constant 414.8 ± 6.8
Mean 1051 ± 4.5
Sigma 247.8 ± 5.8
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2
h1 S2 top
Entries 14197
Mean 1657
Std Dev 1027
χ² / ndf 14.92 / 19
Constant 295.5 ± 5.8
Mean 1395 ± 6.7
Sigma 292 ± 11.2
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 14197
Mean 515.7
Std Dev 201.2
χ² / ndf 114.7 / 37
Constant 513.1 ± 6.4
Mean 502.8 ± 0.6
Sigma 56.63 ± 0.55
clusters.at(nc_i)->charge [PE]

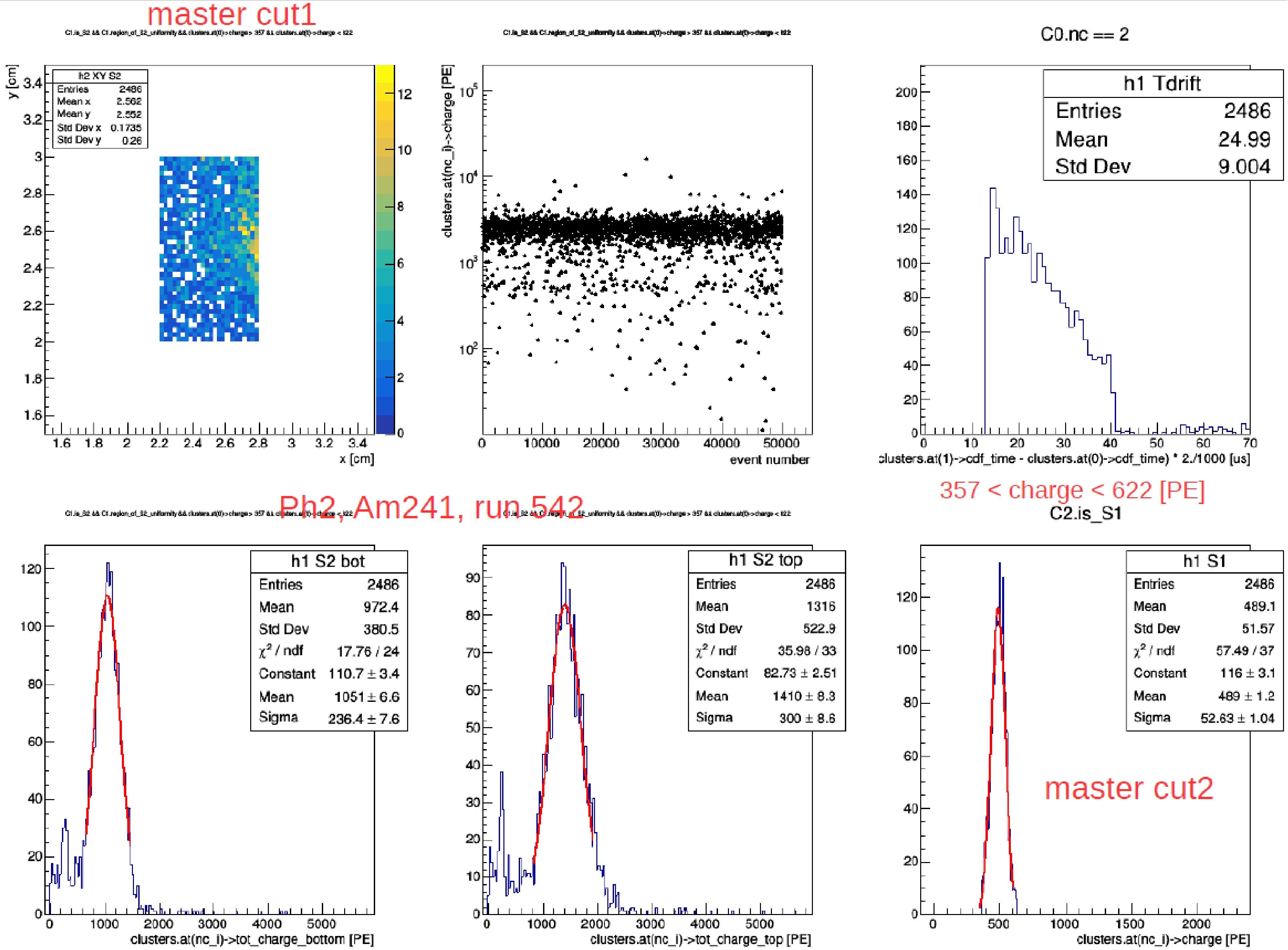

Ph2, Am241, run 542
tot_charge_top > 2000 [PE]
master cut
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 2000
h2 XY S2
Entries 4208
Mean x 2.886
Mean y 2.551
Std Dev x 0.3642
Std Dev y 0.5187
y [cm]
x [cm]
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 2000
clusters.at(nc_i)->charge [PE]
event number
C0.nc == 2
h1 Tdrift
Entries 4208
Mean 24.02
Std Dev 7.611
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 2000
h1 S2 bot
Entries 4208
Mean 2138
Std Dev 842.9
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2 && clusters.at(nc_i)->tot_charge_top > 2000
h1 S2 top
Entries 4208
Mean 2956
Std Dev 864.5
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 4208
Mean 623.9
Std Dev 266.9
χ2 / ndf 52.42 / 35
Constant 150.3 ± 3.7
Mean 522.9 ± 1.0
Sigma 51.14 ± 0.95
clusters.at(nc_i)->charge [PE]



region_of_S2_uniformity (2.2 < x < 2.8; 2 < y < 3)
C0.nc == 2
h2 XY S2
Entries 2953
Mean x 2.964
Mean y 2.55
Std Dev x 0.3203
Std Dev y 0.5457
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 2953
Mean 23.05
Std Dev 7.094
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
tot_charge_top > 2000 [PE]
421 < charge < 625 [PE]
Ph2, Am241, run 542
C2.is_S1
h1 S2 bot
Entries 2953
Mean 1940
Std Dev 589.9
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 2953
Mean 2836
Std Dev 762.6
master cut1
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 2953
Mean 523.5
Std Dev 44.04
master cut2
clusters.at(nc_i)->charge [PE]

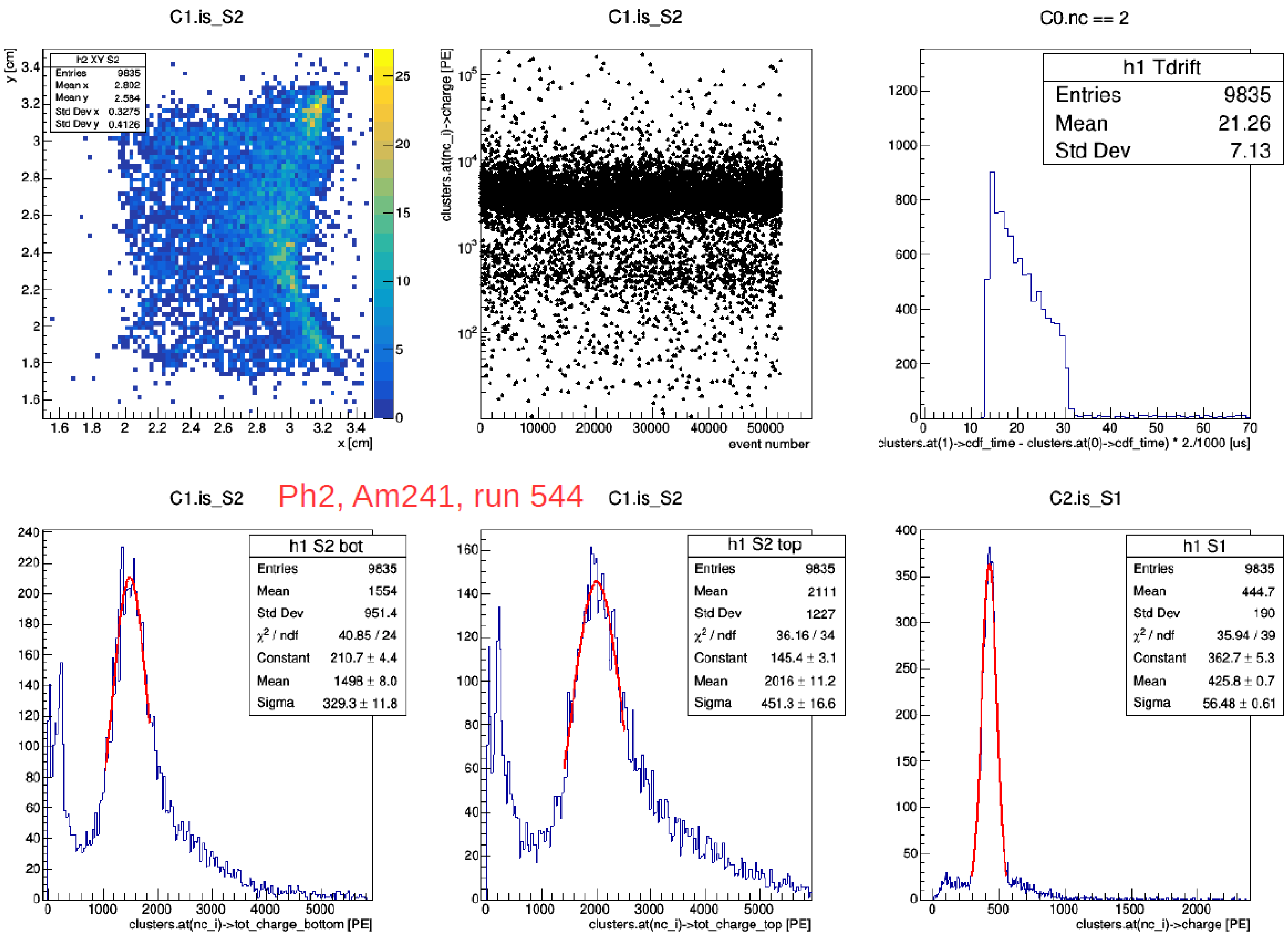

h2 XY S2
Entries 3640
Mean x 2.795
Mean y 2.615
Std Dev x 0.2701
Std Dev y 0.3215
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
C0.nc == 2
h1 Tdrift
Entries 3640
Mean 24.12
Std Dev 7.483
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
1200 < tot_charge_top < 1600 [PE]
Ph2, Am241, run 542
C2.is_S1
h1 S2 bot
Entries 3640
Mean 1023
Std Dev 107.2
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 3640
Mean 1397
Std Dev 111.7
master cut
h1 S1
Entries 3640
Mean 494.4
Std Dev 73.09
χ² / ndf 64.76 / 37
Constant 169.7 ± 3.8
Mean 493.4 ± 0.9
Sigma 51.32 ± 0.82
clusters.at(nc_i)->charge [PE]
Google Переводчик - Google Chrome


master cut
Ph2, Am241, run 542
C1.is_S2 && C1.region_of_S2_uniformity
h2 XY S2
Entries 3182
Mean x 2.551
Mean y 2.549
Std Dev x 0.1759
Std Dev y 0.2521
y [cm]
x [cm]
C1.is_S2 && C1.region_of_S2_uniformity
clusters.at(nc_i)->charge [PE]
event number
C0.nc == 2
h1 Tdrift
Entries 3182
Mean 25.39
Std Dev 9.091
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
C1.is_S2 && C1.region_of_S2_uniformity
h1 S2 bot
Entries 3182
Mean 1063
Std Dev 724.4
χ² / ndf 15.73 / 26
Constant 115 ± 3.3
Mean 1045 ± 6.4
Sigma 243.3 ± 6.9
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2 && C1.region_of_S2_uniformity
h1 S2 top
Entries 3182
Mean 1381
Std Dev 813.8
χ² / ndf 31.05 / 36
Constant 83.42 ± 2.45
Mean 1404 ± 9.5
Sigma 329.7 ± 9.9
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 3182
Mean 521.7
Std Dev 226.8
χ² / ndf 56.8 / 35
Constant 115.7 ± 3.1
Mean 489.2 ± 1.2
Sigma 52.95 ± 1.12
clusters.at(nc_i)->charge [PE]

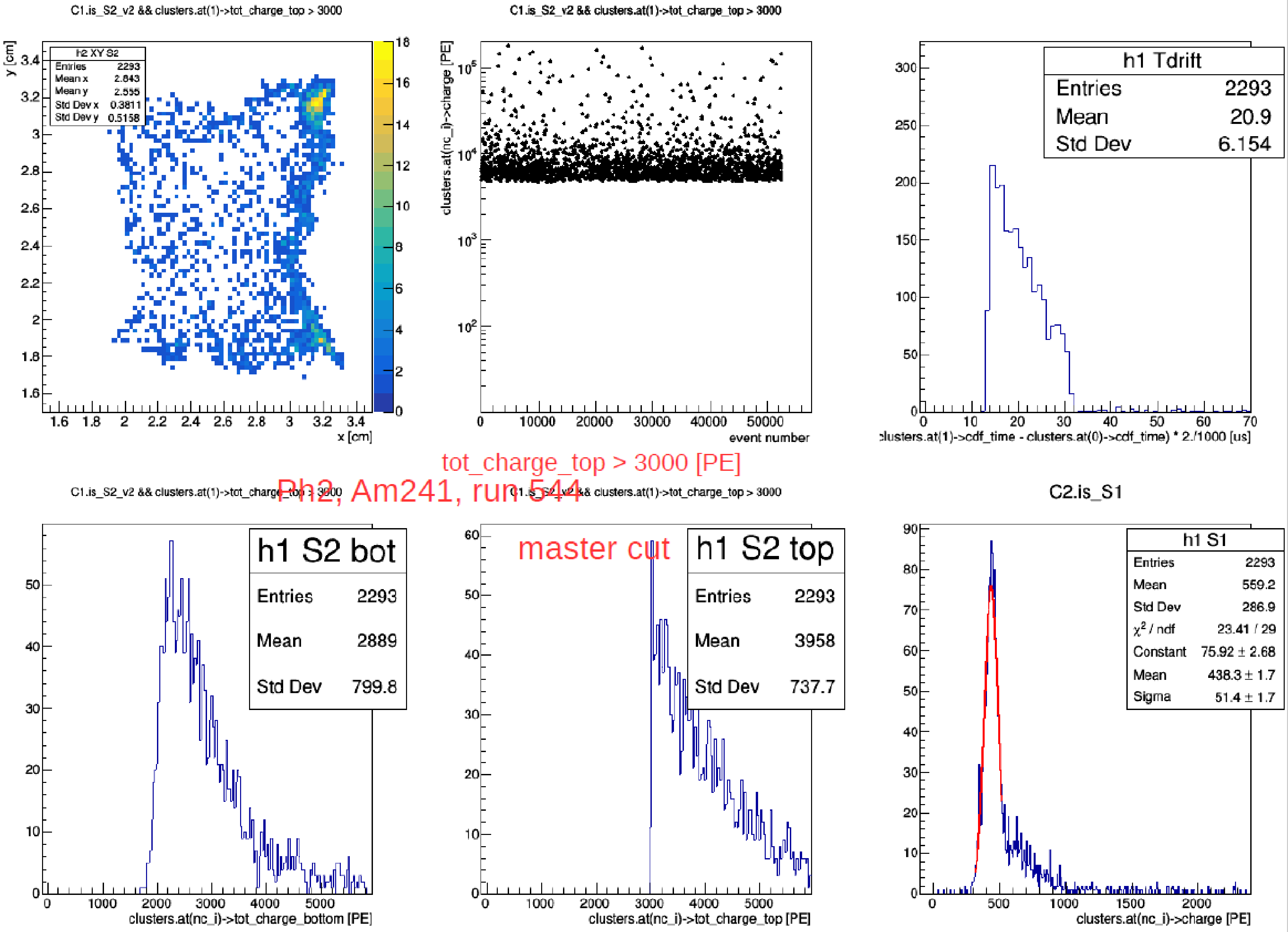


master cut1
h2 XY S2
Entries 2486
Mean x 2.562
Mean y 2.552
Std Dev x 0.1735
Std Dev y 0.26
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
C0.nc == 2
h1 Tdrift
Entries 2486
Mean 24.99
Std Dev 9.004
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
357 < charge < 622 [PE]
Ph2, Am241, run 542
C2.is_S1
h1 S2 bot
Entries 2486
Mean 972.4
Std Dev 380.5
χ² / ndf 17.76 / 24
Constant 110.7 ± 3.4
Mean 1051 ± 6.6
Sigma 236.4 ± 7.6
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 2486
Mean 1316
Std Dev 522.9
χ² / ndf 35.98 / 33
Constant 82.73 ± 2.51
Mean 1410 ± 8.3
Sigma 300 ± 8.6
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 2486
Mean 489.1
Std Dev 51.57
χ² / ndf 57.49 / 37
Constant 116 ± 3.1
Mean 489 ± 1.2
Sigma 52.63 ± 1.04
master cut2
clusters.at(nc_i)->charge [PE]

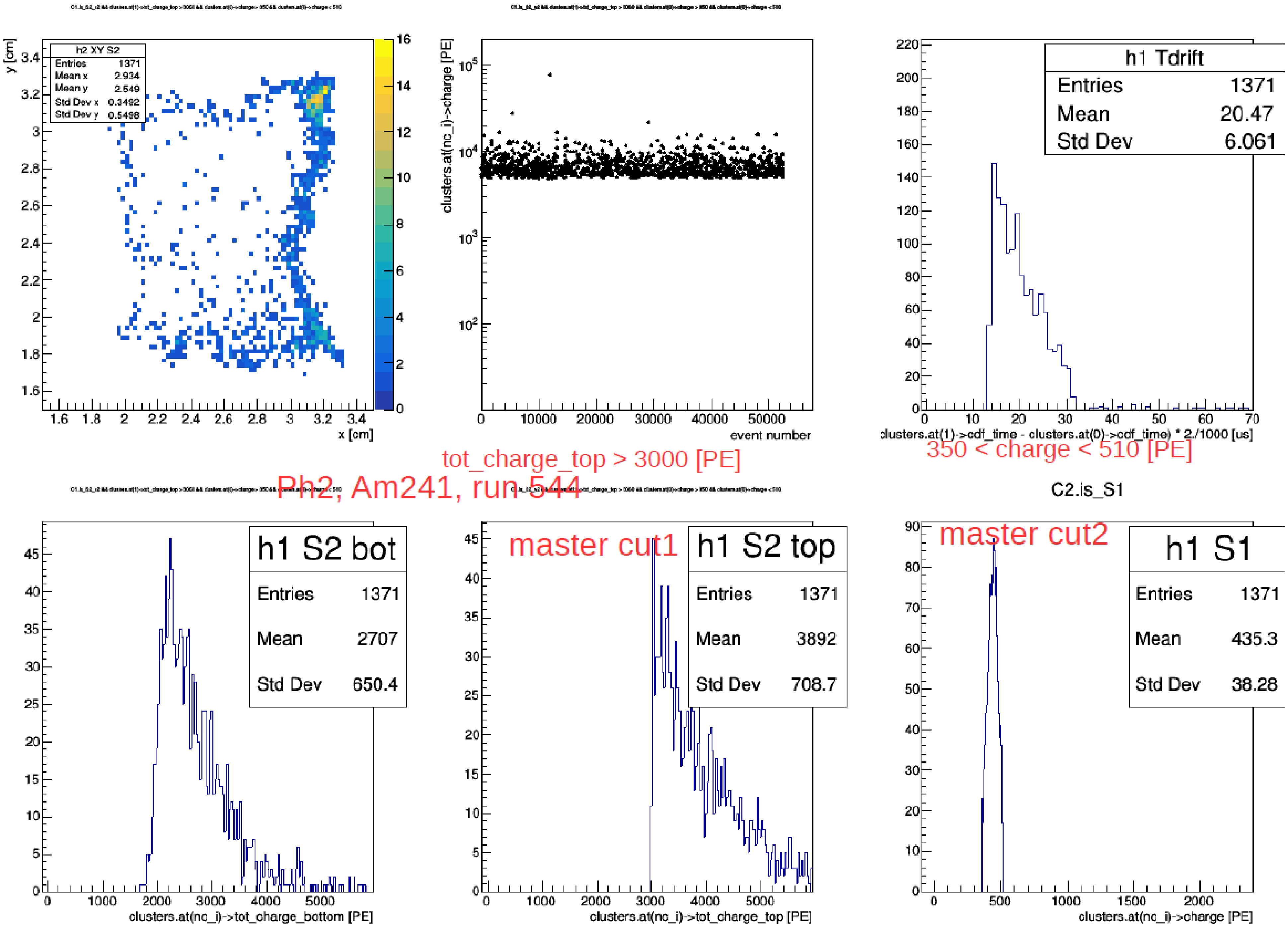
Part2.3 (run 544): S2 non-uniformity

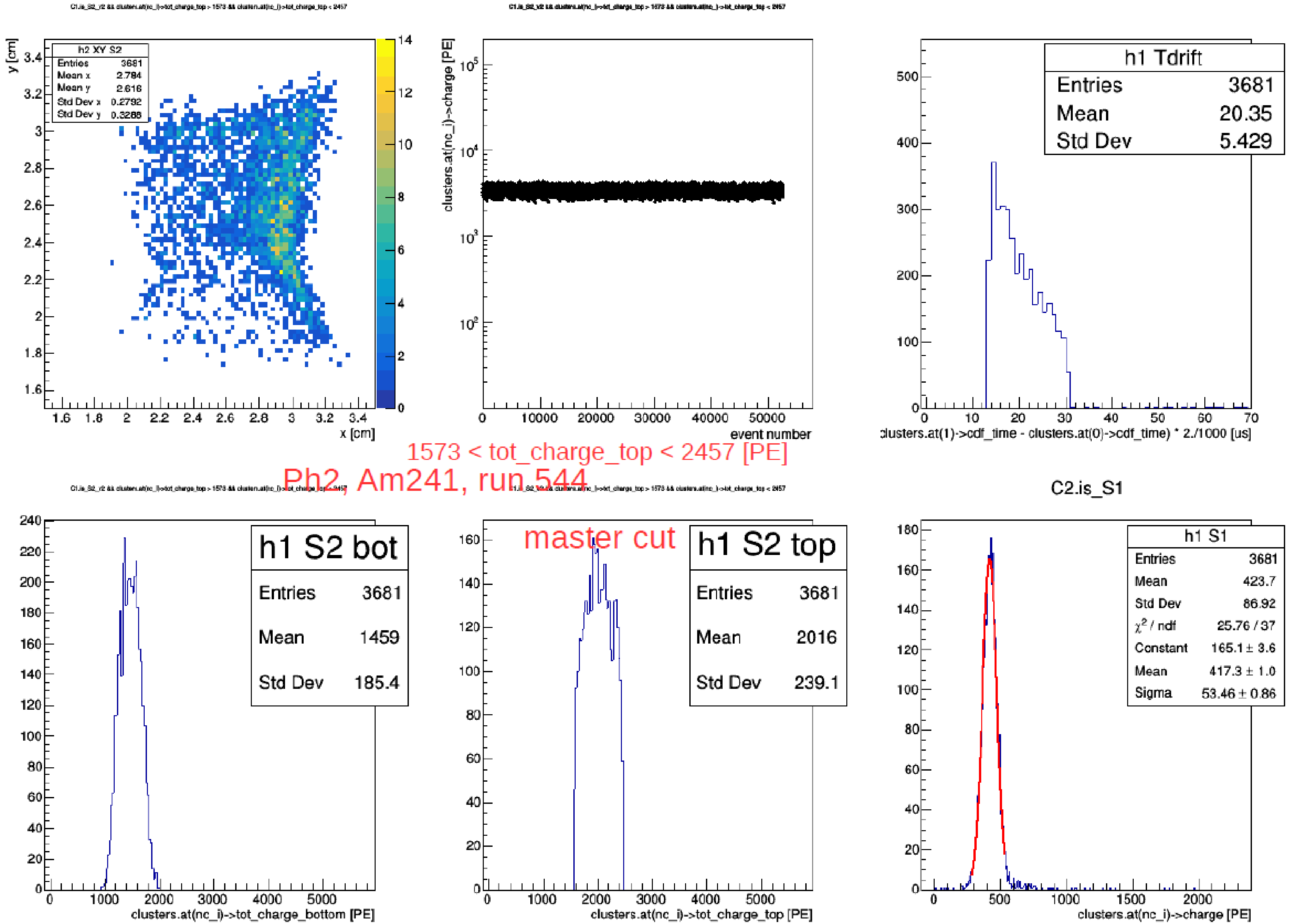


C1.is_S2
h2 XY S2
Entries 9835
Mean x 2.802
Mean y 2.584
Std Dev x 0.3275
Std Dev y 0.4126
y [cm]
x [cm]
C1.is_S2
clusters.at(nc_i)->charge [PE]
event number
C0.nc == 2
h1 Tdrift
Entries 9835
Mean 21.26
Std Dev 7.13
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 544
C1.is_S2
h1 S2 bot
Entries 9835
Mean 1554
Std Dev 951.4
χ² / ndf 40.85 / 24
Constant 210.7 ± 4.4
Mean 1498 ± 8.0
Sigma 329.3 ± 11.8
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2
h1 S2 top
Entries 9835
Mean 2111
Std Dev 1227
χ² / ndf 36.16 / 34
Constant 145.4 ± 3.1
Mean 2016 ± 11.2
Sigma 451.3 ± 16.6
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 9835
Mean 444.7
Std Dev 190
χ² / ndf 35.94 / 39
Constant 362.7 ± 5.3
Mean 425.8 ± 0.7
Sigma 56.48 ± 0.61
clusters.at(nc_i)->charge [PE]

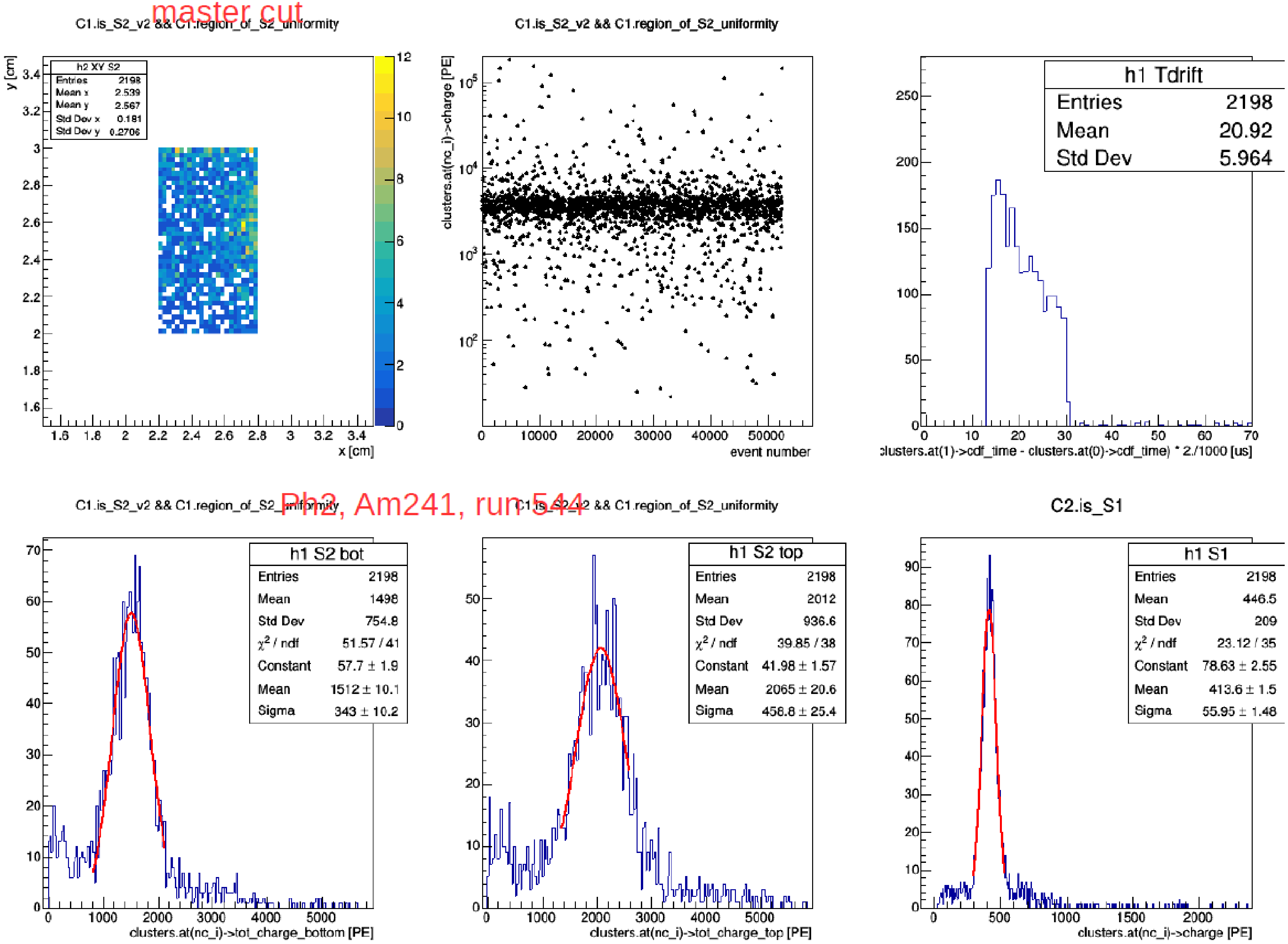


C1.is_S2_v2 && clusters.at(1)->tot_charge_top > 3000
h2 XY S2
Entries 2293
Mean x 2.843
Mean y 2.555
Std Dev x 0.3811
Std Dev y 0.5158
y [cm]
x [cm]
C1.is_S2_v2 && clusters.at(1)->tot_charge_top > 3000
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 2293
Mean 20.9
Std Dev 6.154
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
tot_charge_top > 3000 [PE]
Ph2, Am241, run 544
C1.is_S2_v2 && clusters.at(1)->tot_charge_top > 3000
h1 S2 bot
Entries 2293
Mean 2889
Std Dev 799.8
clusters.at(nc_i)->tot_charge_bottom [PE]
C1.is_S2_v2 && clusters.at(1)->tot_charge_top > 3000
master cut
h1 S2 top
Entries 2293
Mean 3958
Std Dev 737.7
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 2293
Mean 559.2
Std Dev 286.9
χ2 / ndf 23.41 / 29
Constant 75.92 ± 2.68
Mean 438.3 ± 1.7
Sigma 51.4 ± 1.7
clusters.at(nc_i)->charge [PE]

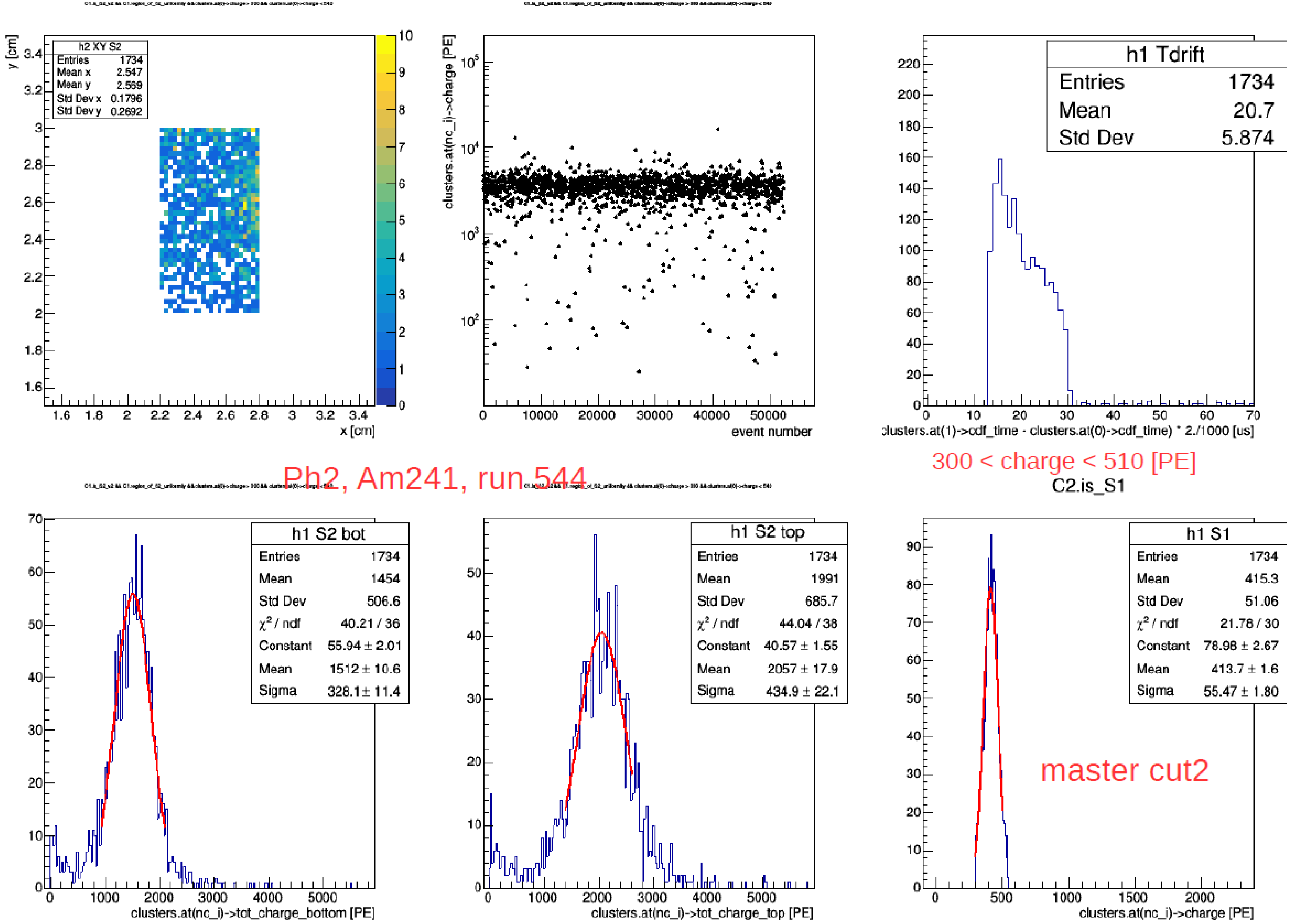

Ph2, Am241, run 544
tot_charge_top > 3000 [PE]
350 < charge < 510 [PE]
master cut1
master cut2
h2 XY S2
Entries 1371
Mean x 2.934
Mean y 2.549
Std Dev x 0.3492
Std Dev y 0.5498
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 1371
Mean 20.47
Std Dev 6.061
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
h1 S2 bot
Entries 1371
Mean 2707
Std Dev 650.4
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 1371
Mean 3892
Std Dev 708.7
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 1371
Mean 435.3
Std Dev 38.28
clusters.at(nc_i)->charge [PE]



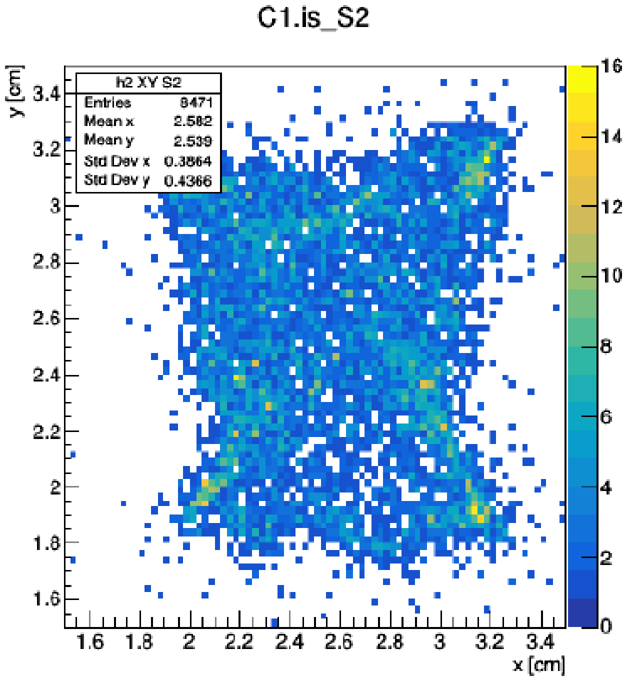
h2 XY S2
Entries 3681
Mean x 2.784
Mean y 2.616
Std Dev x 0.2792
Std Dev y 0.3288
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 3681
Mean 20.35
Std Dev 5.429
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
1573 < tot_charge_top < 2457 [PE]
Ph2, Am241, run 544
C2.is_S1
h1 S2 bot
Entries 3681
Mean 1459
Std Dev 185.4
clusters.at(nc_i)->tot_charge_bottom [PE]
master cut
h1 S2 top
Entries 3681
Mean 2016
Std Dev 239.1
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 3681
Mean 423.7
Std Dev 86.92
χ2 / ndf 25.76 / 37
Constant 165.1 ± 3.6
Mean 417.3 ± 1.0
Sigma 53.46 ± 0.86
clusters.at(nc_i)->charge [PE]

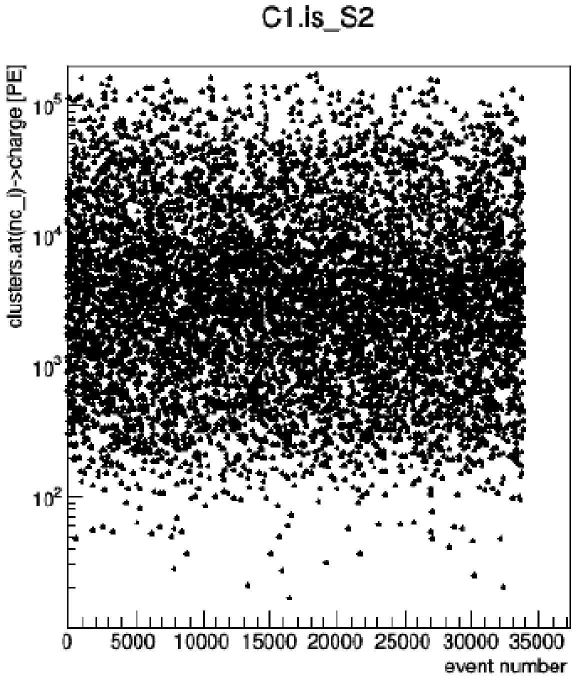

master cut
Ph2, Am241, run 544
C1.is_S2_v2 && C1.region_of_S2_uniformity
h2 XY S2
Entries 2198
Mean x 2.539
Mean y 2.567
Std Dev x 0.181
Std Dev y 0.2706
x [cm]
y [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 2198
Mean 20.92
Std Dev 5.964
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
h1 S2 bot
Entries 2198
Mean 1498
Std Dev 754.8
χ² / ndf 51.57 / 41
Constant 57.7 ± 1.9
Mean 1512 ± 10.1
Sigma 343 ± 10.2
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 2198
Mean 2012
Std Dev 936.6
χ² / ndf 39.85 / 38
Constant 41.98 ± 1.57
Mean 2065 ± 20.6
Sigma 456.8 ± 25.4
clusters.at(nc_i)->tot_charge_top [PE]
C2.is_S1
h1 S1
Entries 2198
Mean 446.5
Std Dev 209
χ² / ndf 23.12 / 35
Constant 78.63 ± 2.55
Mean 413.6 ± 1.5
Sigma 55.95 ± 1.48
clusters.at(nc_i)->charge [PE]

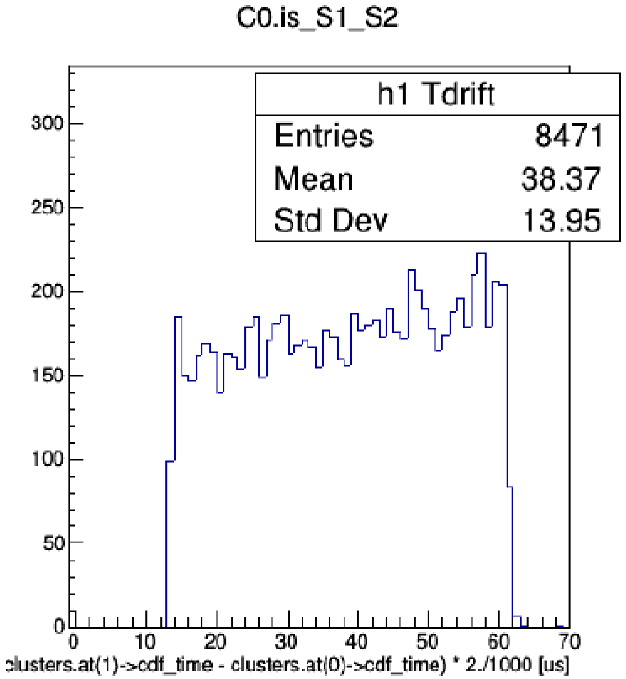
master cut1


h2 XY S2
Entries 1734
Mean x 2.547
Mean y 2.569
Std Dev x 0.1796
Std Dev y 0.2692
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 1734
Mean 20.7
Std Dev 5.874
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 544
300 < charge < 510 [PE]
C2.is_S1
h1 S2 bot
Entries 1734
Mean 1454
Std Dev 506.6
χ² / ndf 40.21 / 36
Constant 55.94 ± 2.01
Mean 1512 ± 10.6
Sigma 328.1 ± 11.4
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 1734
Mean 1991
Std Dev 685.7
χ² / ndf 44.04 / 38
Constant 40.57 ± 1.55
Mean 2057 ± 17.9
Sigma 434.9 ± 22.1
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 1734
Mean 415.3
Std Dev 51.06
χ² / ndf 21.78 / 30
Constant 78.98 ± 2.67
Mean 413.7 ± 1.6
Sigma 55.47 ± 1.80
master cut2
clusters.at(nc_i)->charge [PE]

Part2.4 (run_534 bkg): S2 non-uniformity

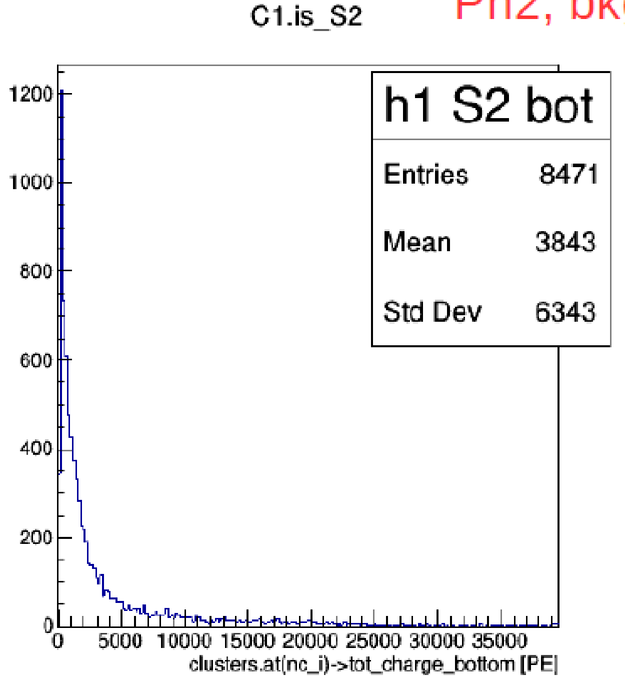


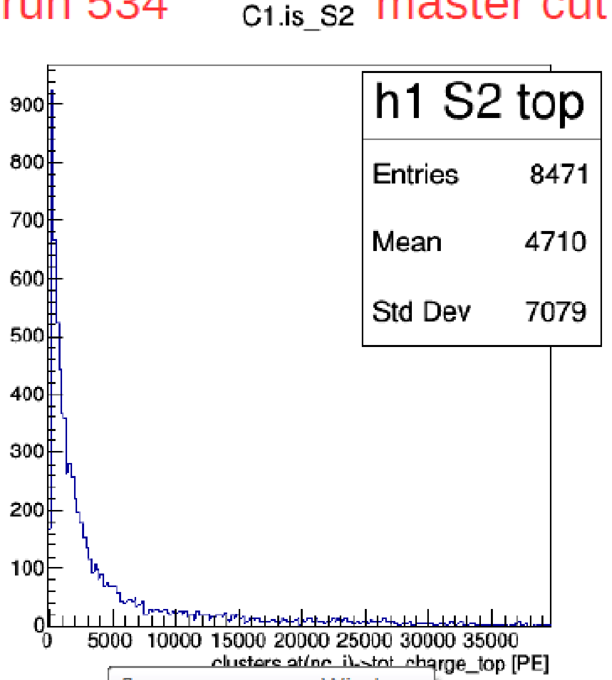


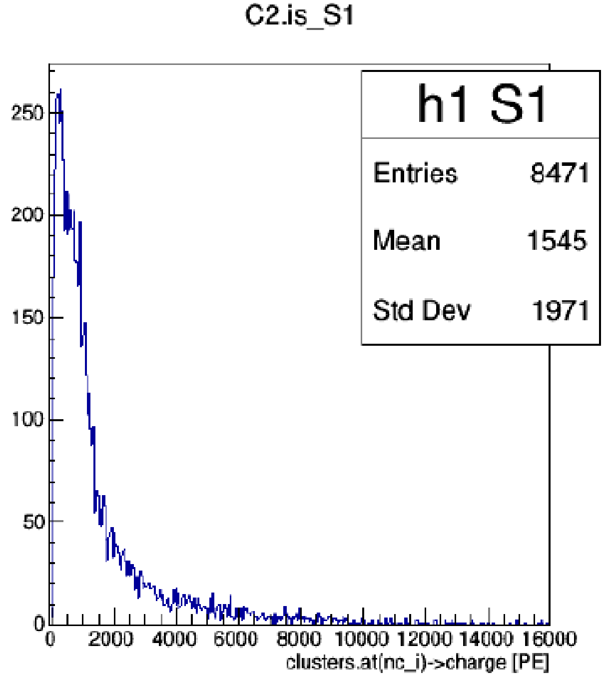


Ph2, bkg, run 534

master cut





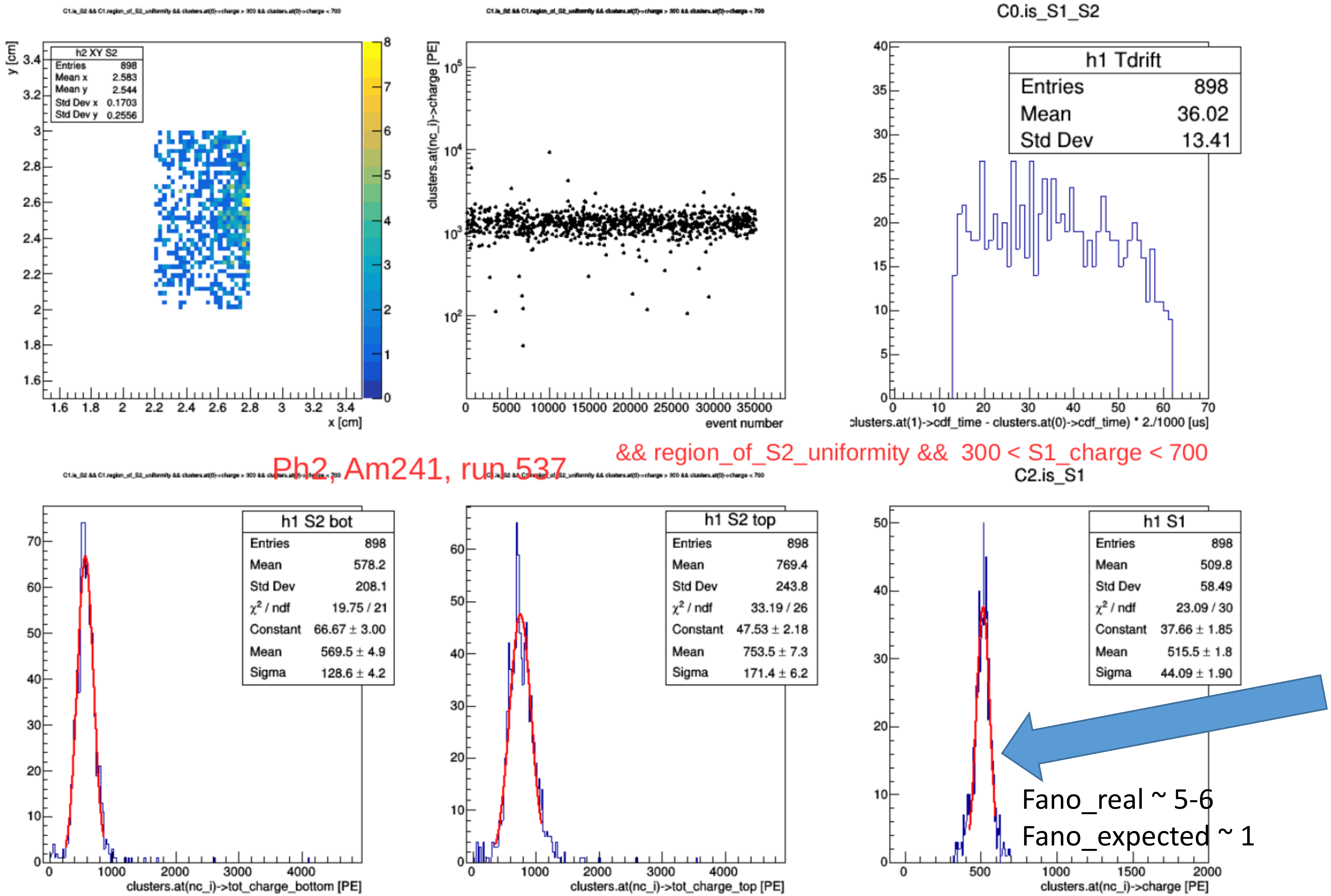


Диспетчер задач Windows

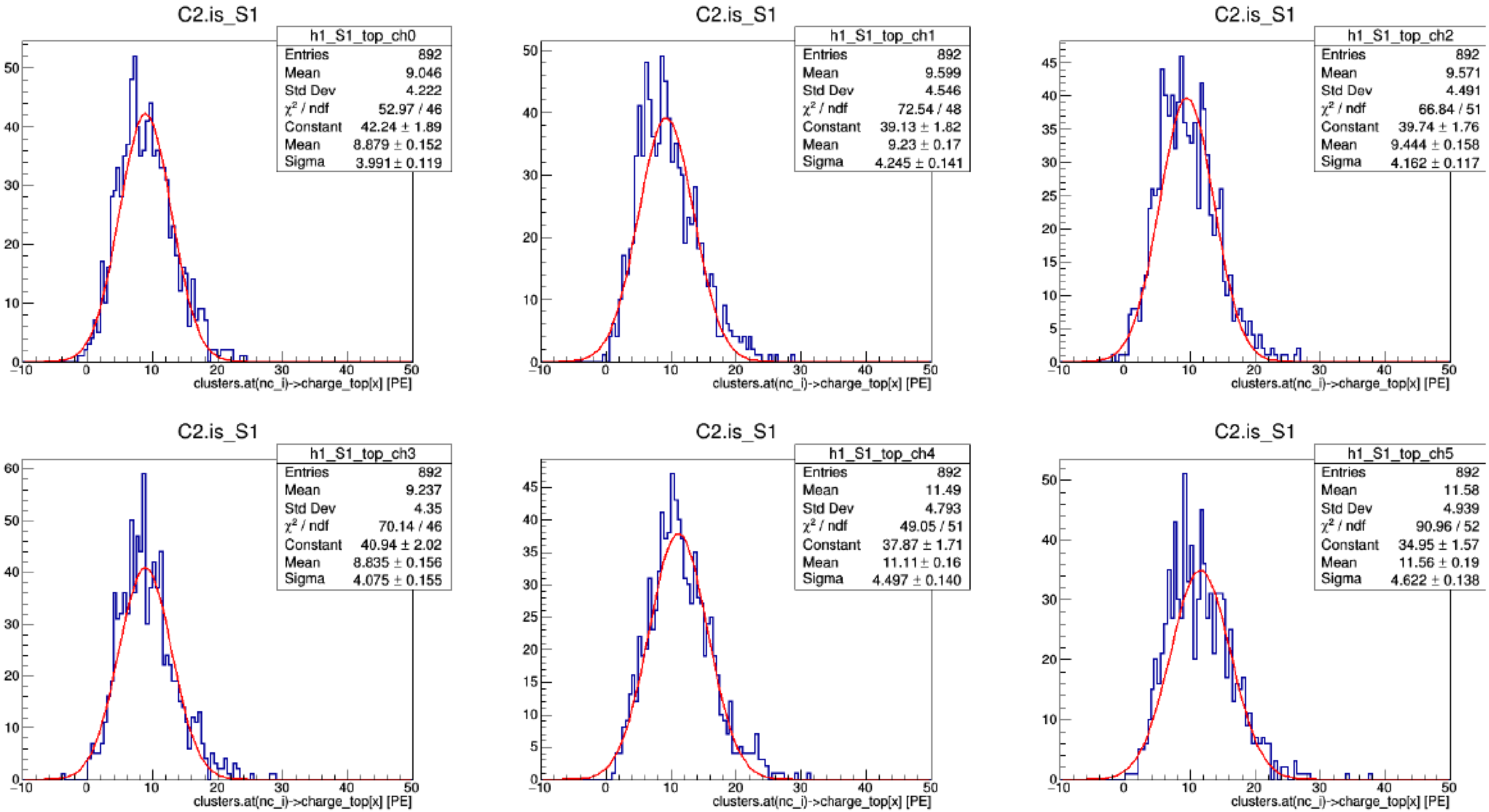
Part2 conclusions (for Am source):

1) S2 is stable in time
2) S2 spectrum is Gaussian for central events
3) S2 2-3 times bigger for edges-corners
4) For edges-corners drift time spectrum is non-uniform -> hint to E_drift non-uniformity

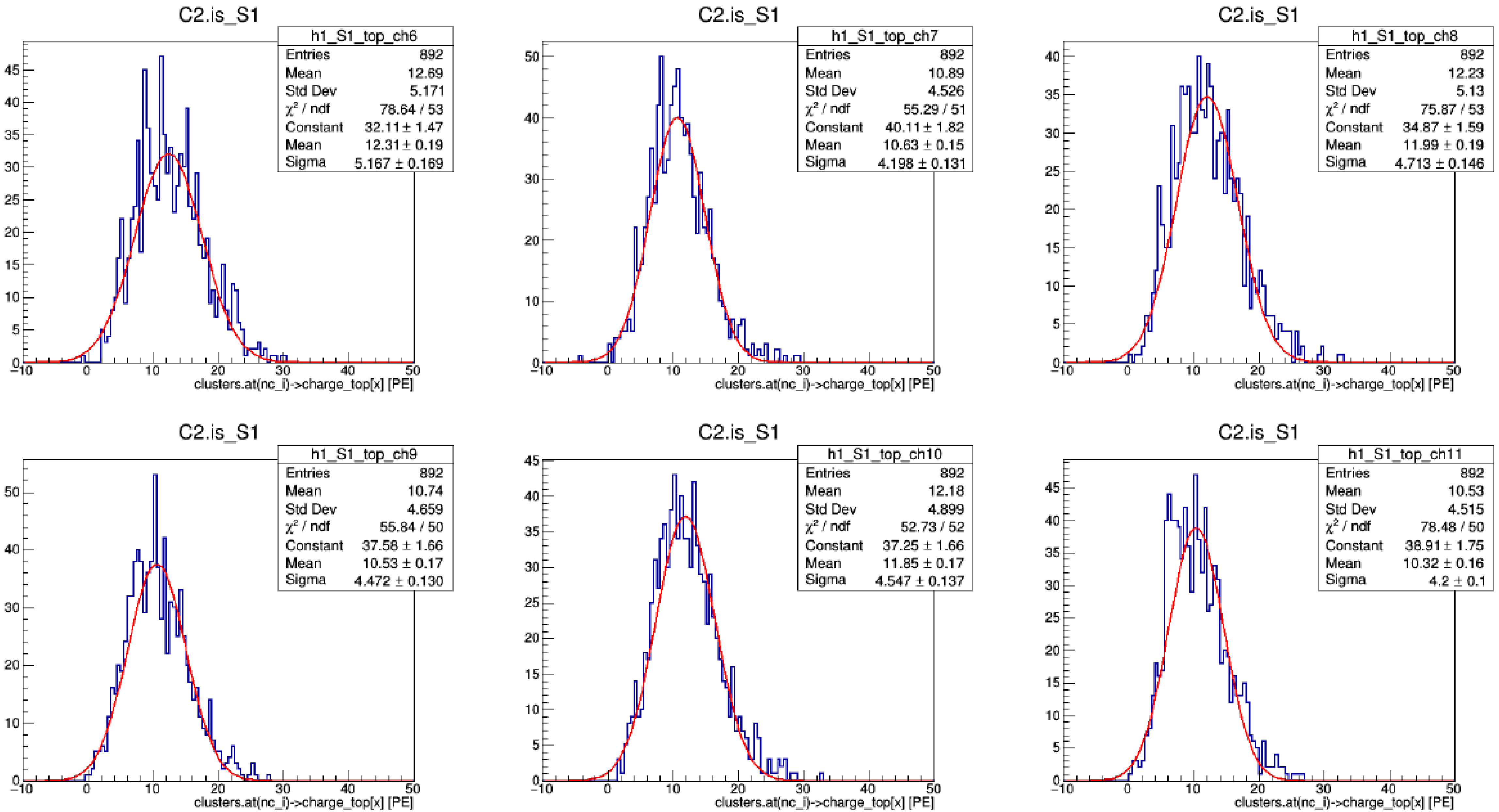
Part3: S1 resolution problem


C0.is_S1_S2
h2 XY S2
Entries 898
Mean x 2.583
Mean y 2.544
Std Dev x 0.1703
Std Dev y 0.2556
y [cm]
x [cm]
clusters.at(nc_i)->charge [PE]
event number
h1 Tdrift
Entries 898
Mean 36.02
Std Dev 13.41
clusters.at(1)->cdf_time - clusters.at(0)->cdf_time) * 2./1000 [us]
Ph2, Am241, run 537
&& region_of_S2_uniformity && 300 < S1_charge < 700
C2.is_S1
h1 S2 bot
Entries 898
Mean 578.2
Std Dev 208.1
χ² / ndf 19.75 / 21
Constant 66.67 ± 3.00
Mean 569.5 ± 4.9
Sigma 128.6 ± 4.2
clusters.at(nc_i)->tot_charge_bottom [PE]
h1 S2 top
Entries 898
Mean 769.4
Std Dev 243.8
χ² / ndf 33.19 / 26
Constant 47.53 ± 2.18
Mean 753.5 ± 7.3
Sigma 171.4 ± 6.2
clusters.at(nc_i)->tot_charge_top [PE]
h1 S1
Entries 898
Mean 509.8
Std Dev 58.49
χ² / ndf 23.09 / 30
Constant 37.66 ± 1.85
Mean 515.5 ± 1.8
Sigma 44.09 ± 1.90
clusters.at(nc_i)->charge [PE]
Fano_real ~ 5-6
Fano_expected ~ 1

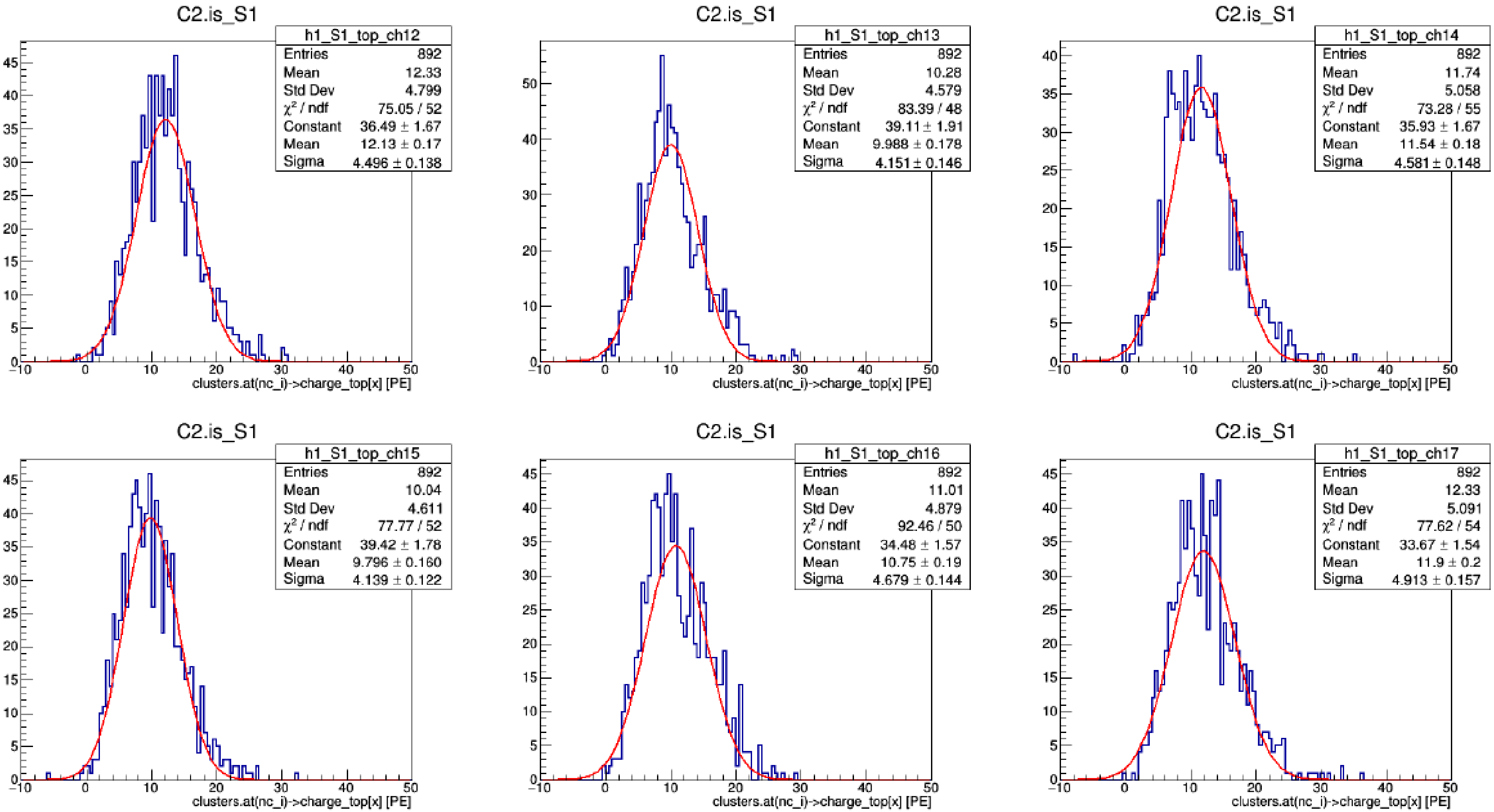
Ph2, Am241, run 537



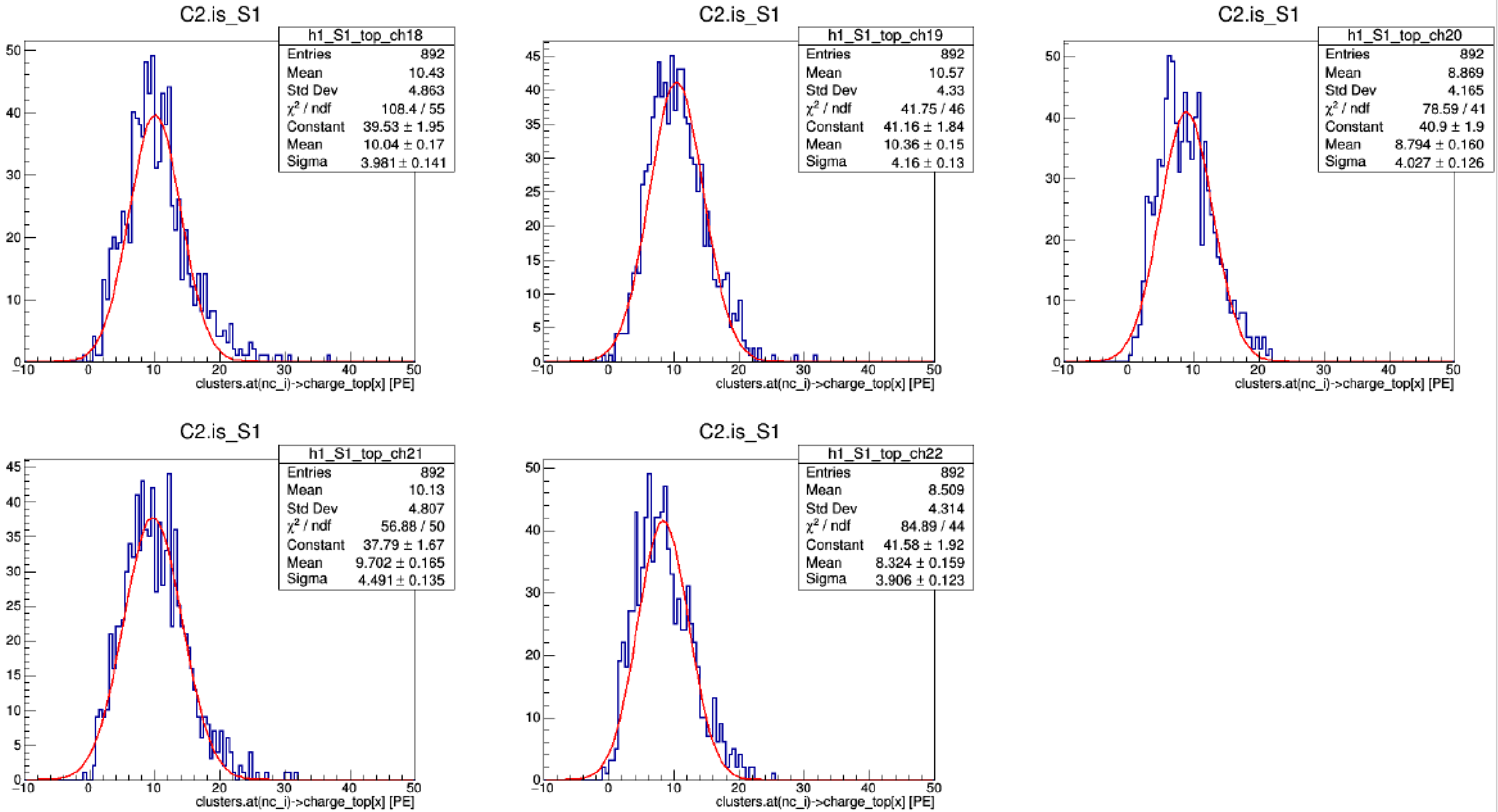
Ph2, Am241, run 537

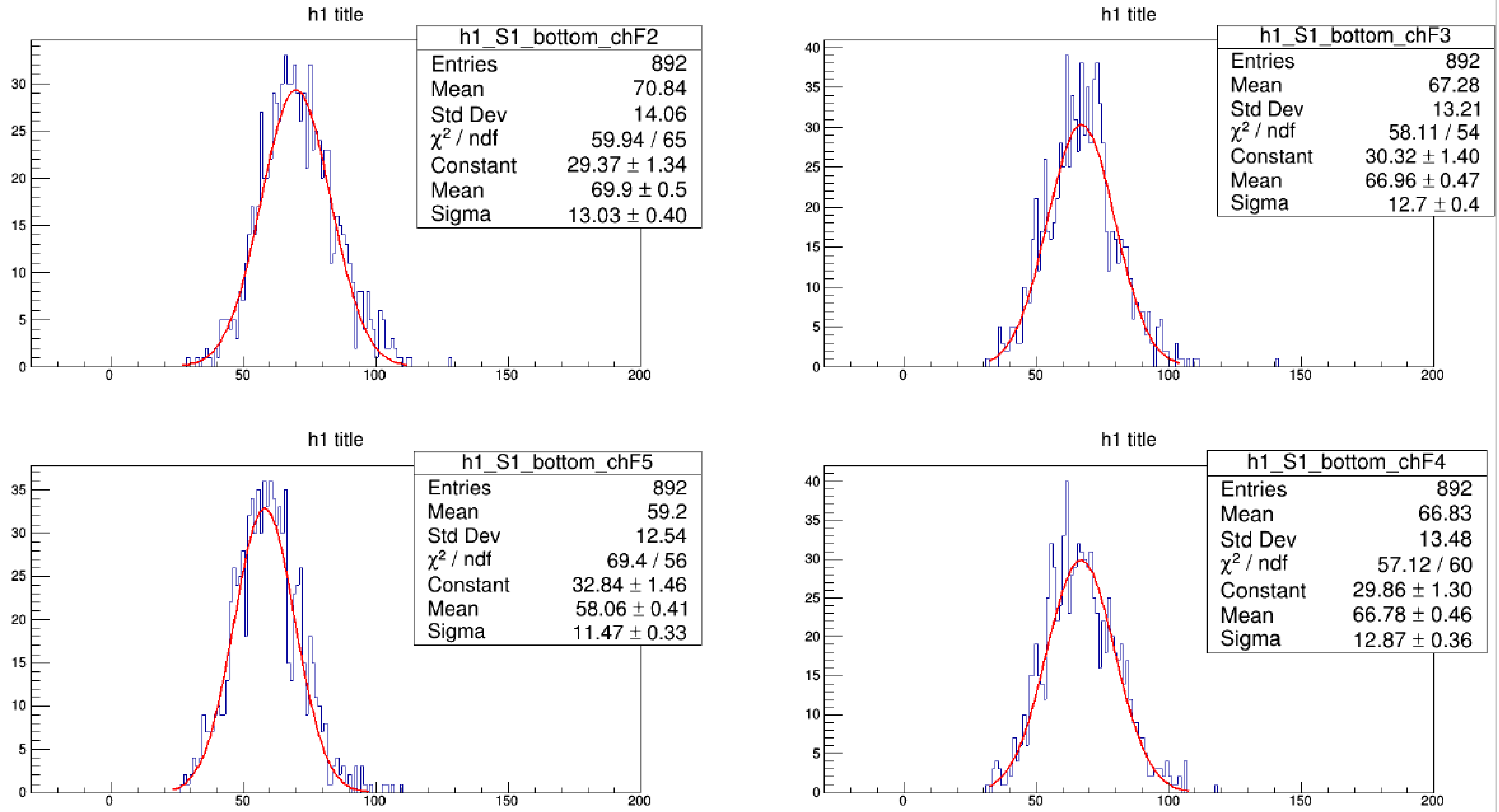


Ph2, Am241, run 537

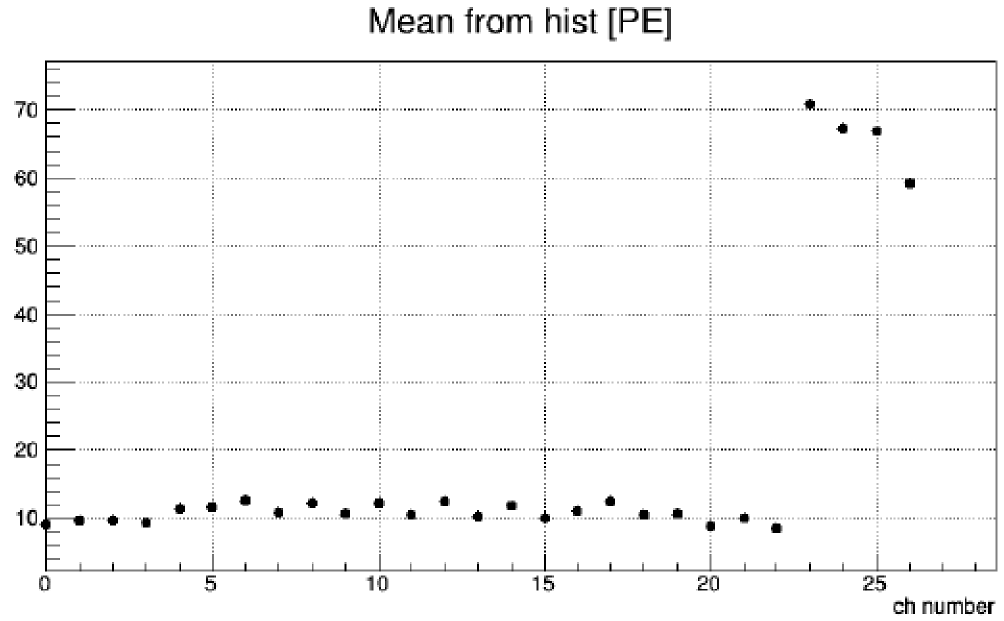


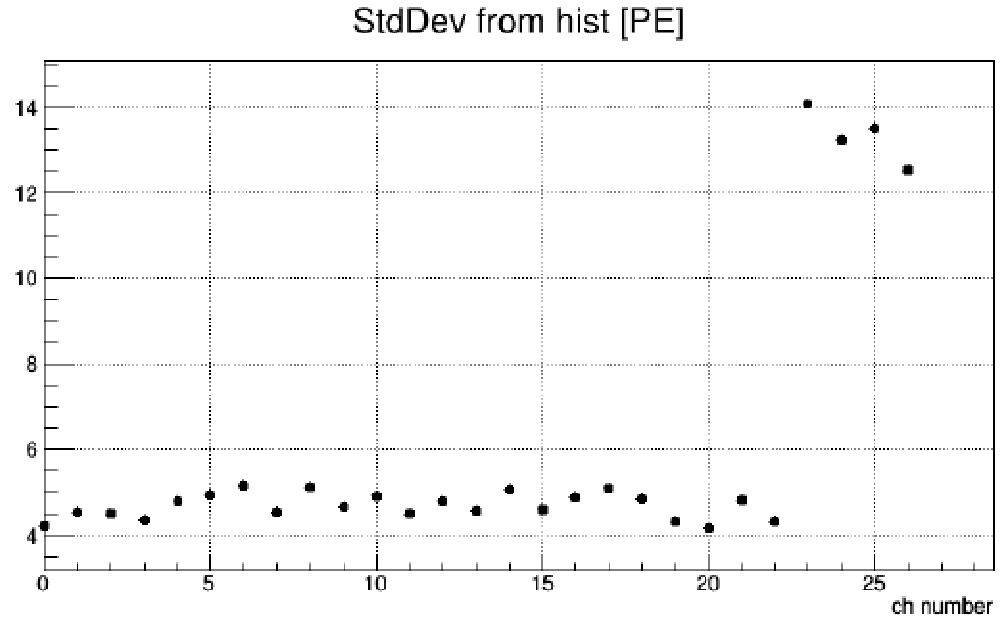
Ph2, Am241, run 537

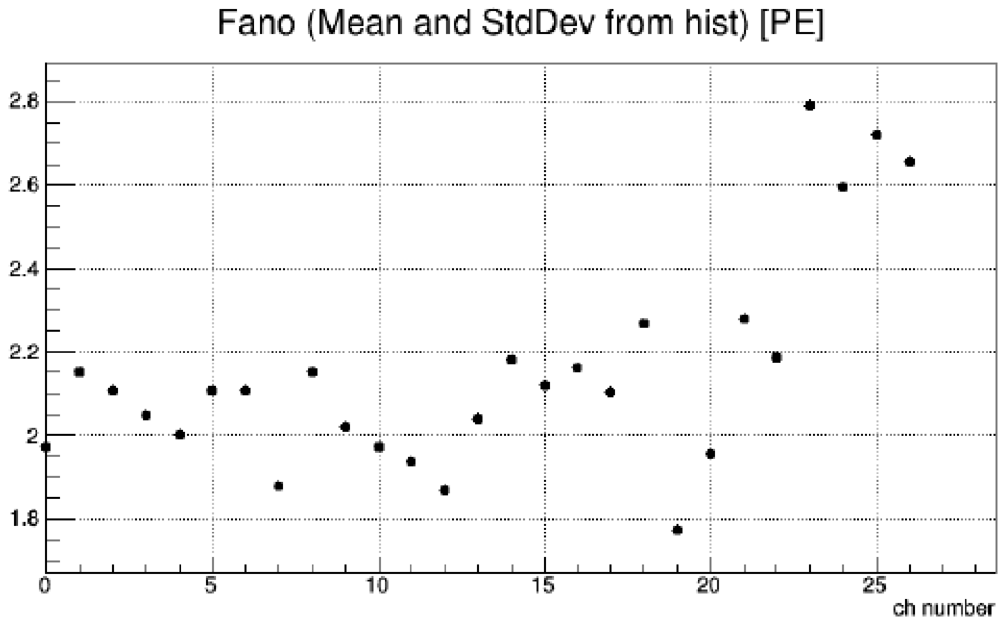



h1 title
h1_S1_bottom_chF2
Entries 892
Mean 70.84
Std Dev 14.06
χ^2 / ndf 59.94 / 65
Constant 29.37 ± 1.34
Mean 69.9 ± 0.5
Sigma 13.03 ± 0.40
0 5 10 15 20 25 30
0 50 100 150 200
h1 title
h1_S1_bottom_chF3
Entries 892
Mean 67.28
Std Dev 13.21
χ^2 / ndf 58.11 / 54
Constant 30.32 ± 1.40
Mean 66.96 ± 0.47
Sigma 12.7 ± 0.4
0 5 10 15 20 25 30 35 40
0 50 100 150 200
h1 title
h1_S1_bottom_chF5
Entries 892
Mean 59.2
Std Dev 12.54
χ^2 / ndf 69.4 / 56
Constant 32.84 ± 1.46
Mean 58.06 ± 0.41
Sigma 11.47 ± 0.33
0 5 10 15 20 25 30 35
0 50 100 150 200
h1 title
h1_S1_bottom_chF4
Entries 892
Mean 66.83
Std Dev 13.48
χ^2 / ndf 57.12 / 60
Constant 29.86 ± 1.30
Mean 66.78 ± 0.46
Sigma 12.87 ± 0.36
0 5 10 15 20 25 30 35 40
0 50 100 150 200

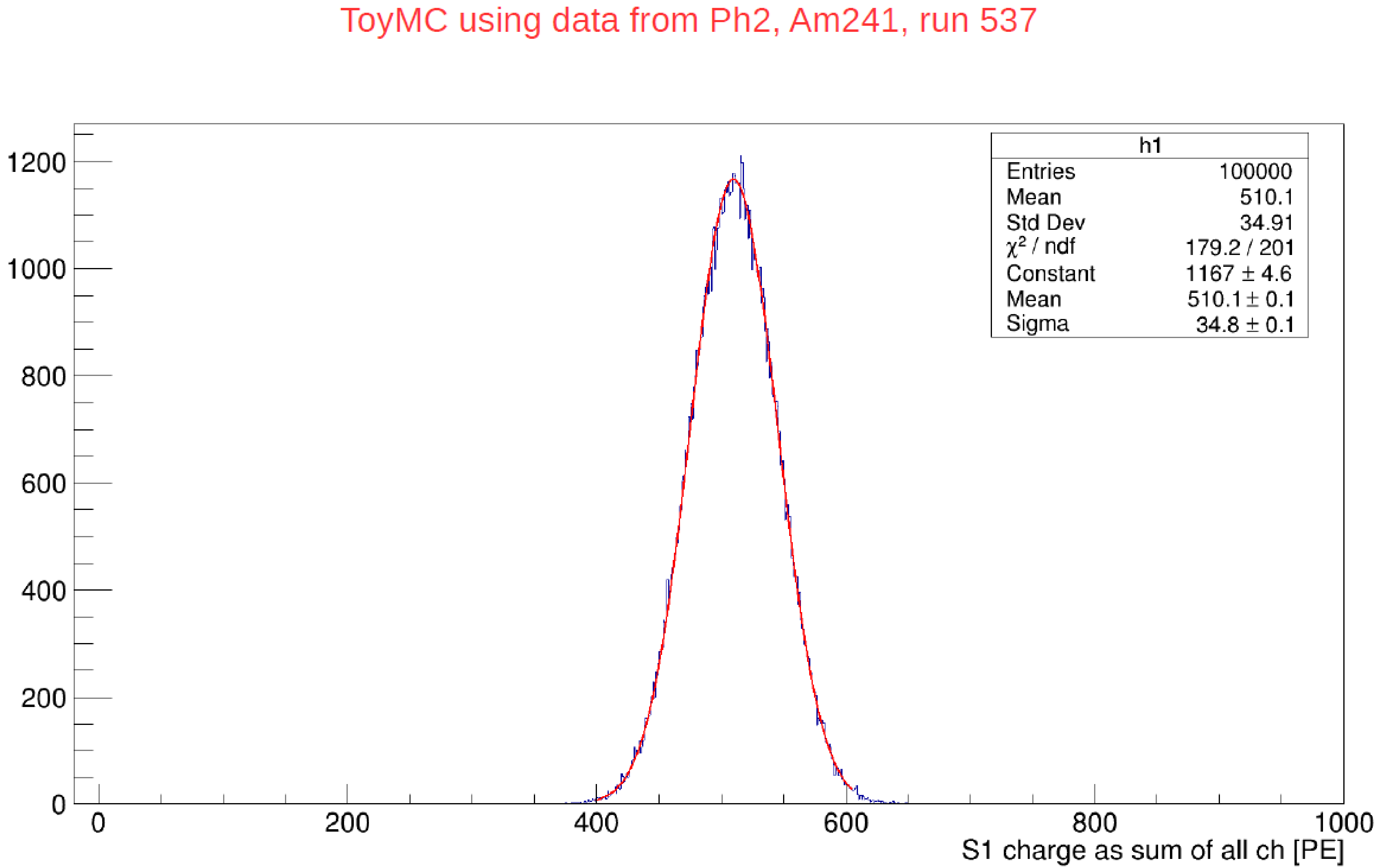
Ph2, Am241, run 537







Ch 0 – 22: top SiPMs
Ch 23 – 26: bottom SiPMs


ToyMC using data from Ph2, Am241, run 537
h1
Entries 100000
Mean 510.1
Std Dev 34.91
χ² / ndf 179.2 / 201
Constant 1167 ± 4.6
Mean 510.1 ± 0.1
Sigma 34.8 ± 0.1
S1 charge as sum of all ch [PE]
0
200
400
600
800
1000
1200

If we have random variables X1 and X2 with mean1 and mean2, sigma1 and sigma2, Fano1 and Fano2 accordingly, Fano factor of new random variable X12 = X1 + X2 will be

Fano12 = sigma^2/mean = (Fano1 * w1 + Fano2 * w2) + 2*cov(X1, X2)/(mean1 + mean2)

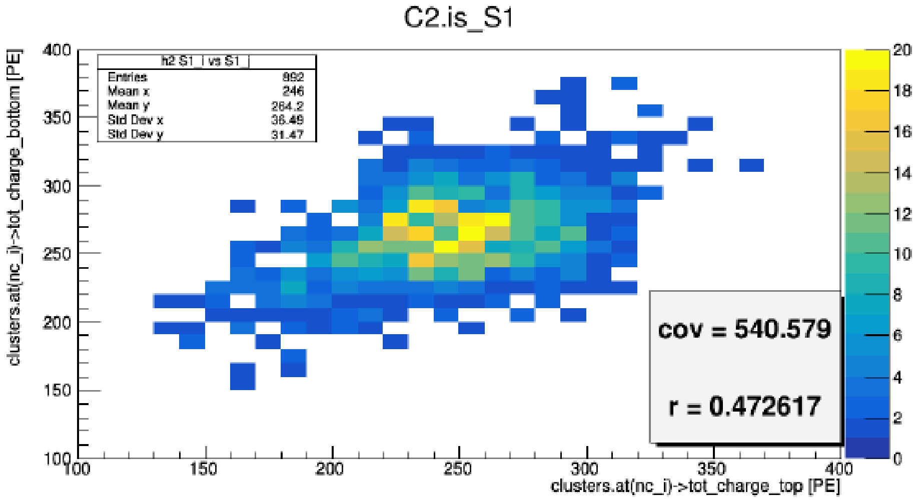
,where w1 = mean1/(mean1 + mean2) and w2 = mean2/(mean1 + mean2)

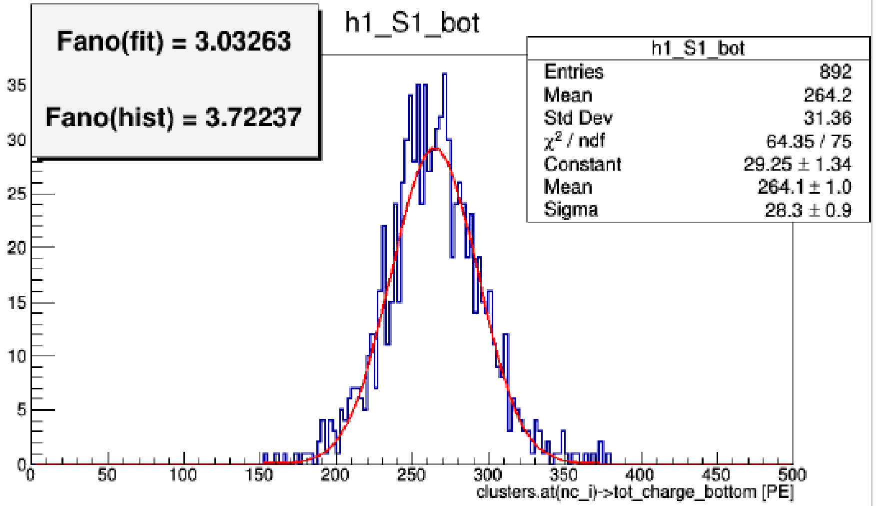
So, if we sum channels with positive correlation, we will observe increasing of Fano factor. It is exactly what happen in our experiment, because we clearly see correlation between channels.

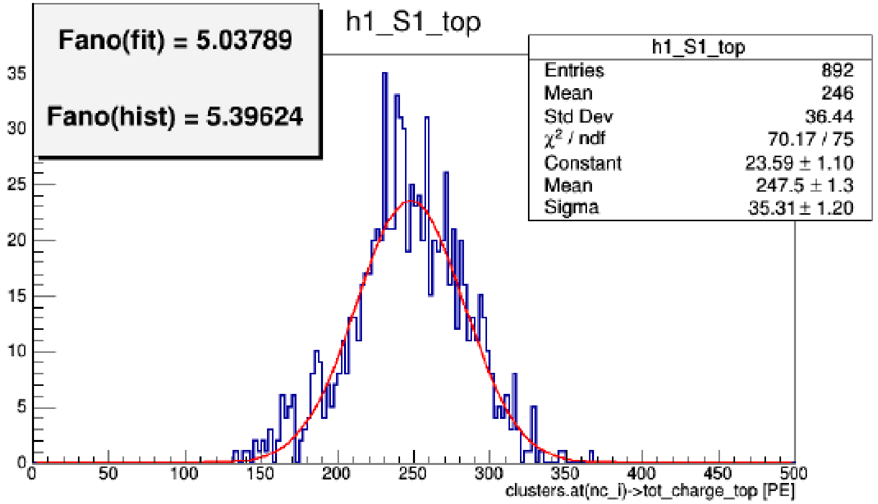
M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5

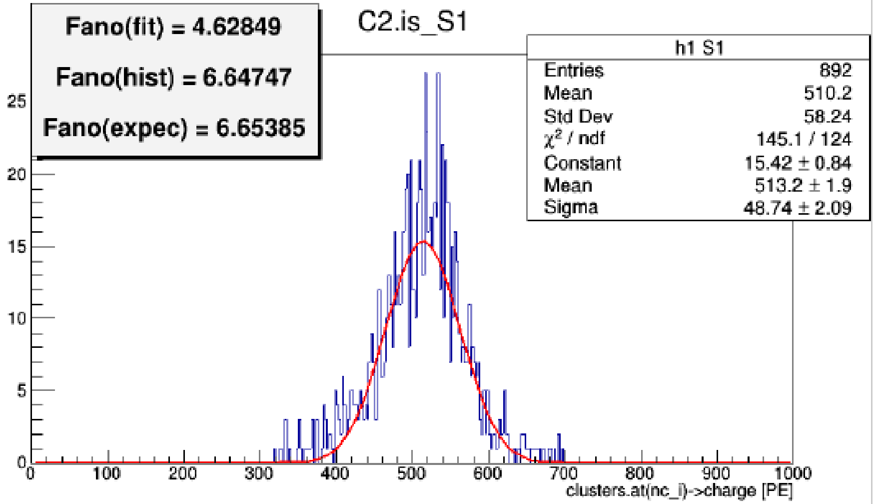
Ph2, Am241, run 537

F2	**F3**
F5	**F4**







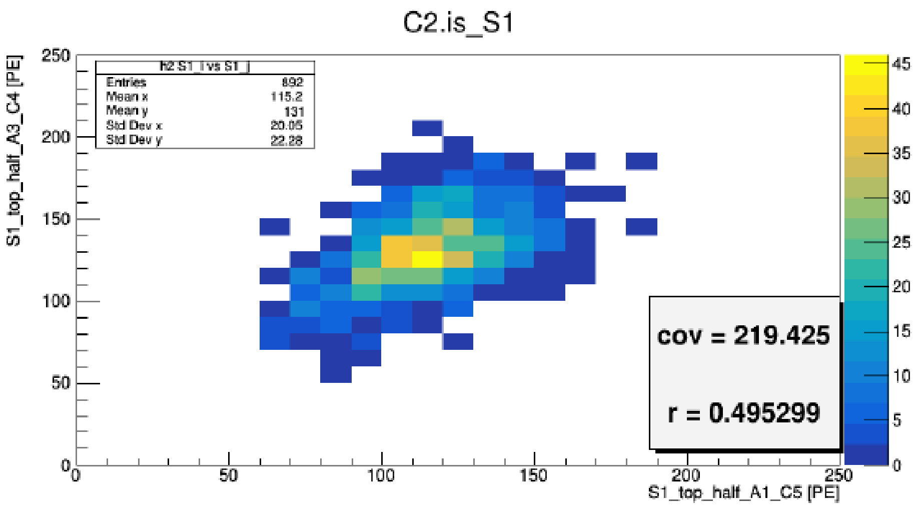


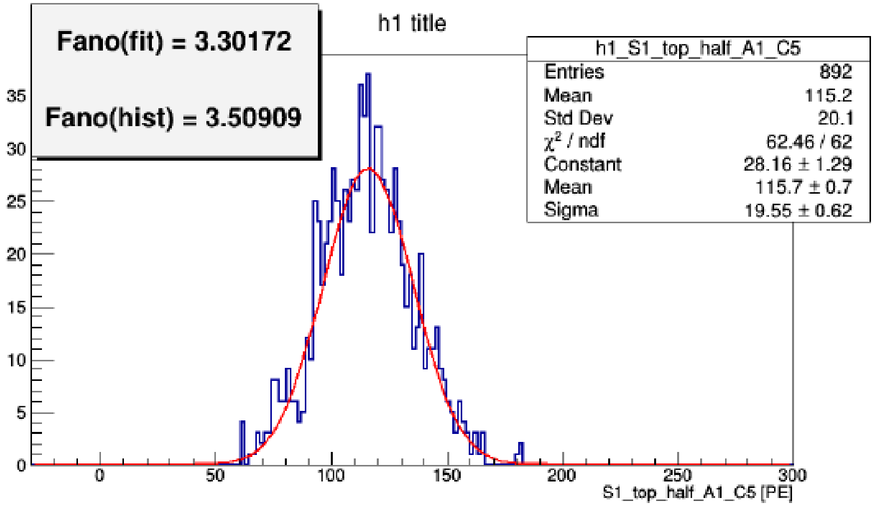

```
fano_expec = (pow(rms_i, 2.0) + pow(rms_j, 2.0) + 2*cov_r[0])/(mean_i + mean_j);
```

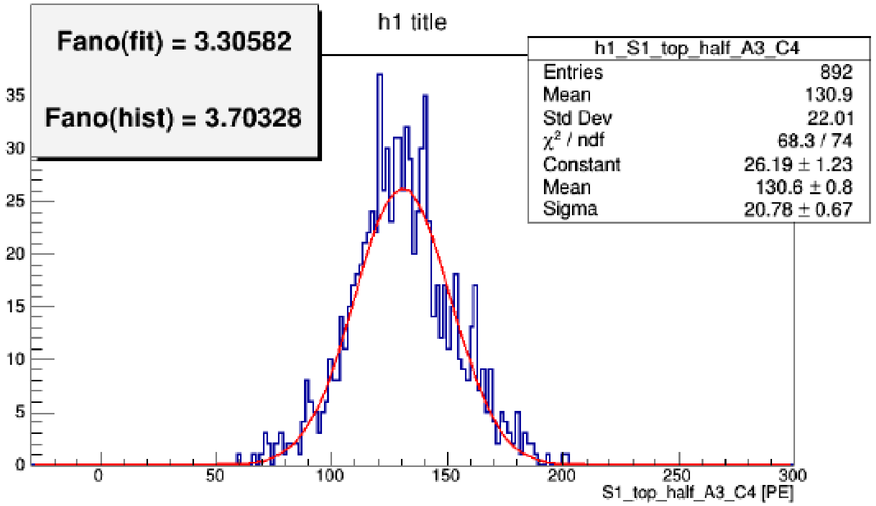
Ph2, Am241, run 537

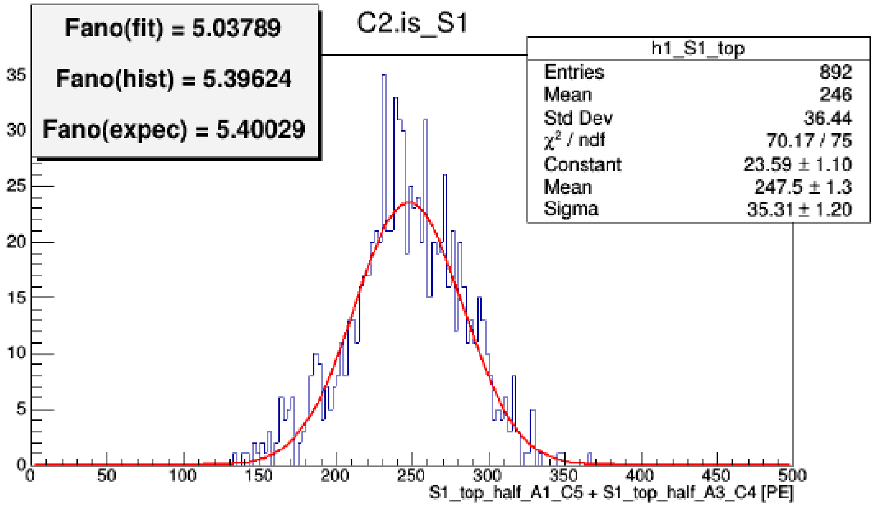
M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5

M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5





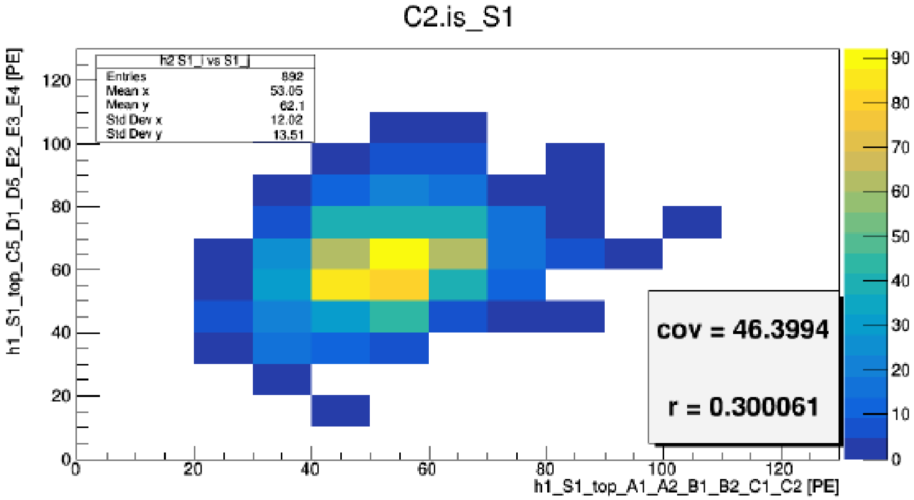


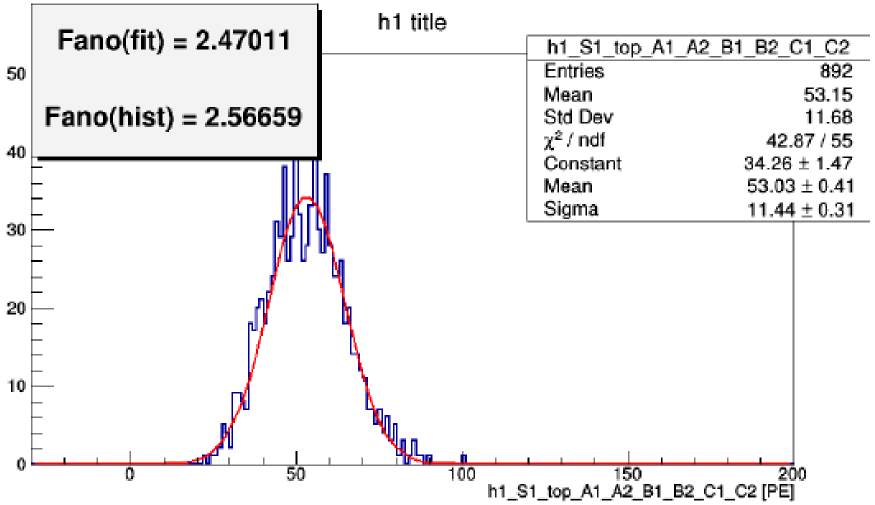


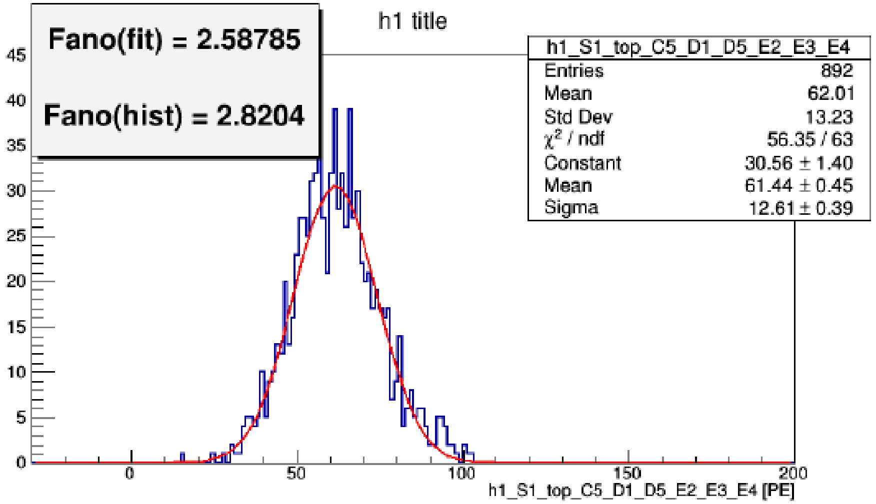
M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5

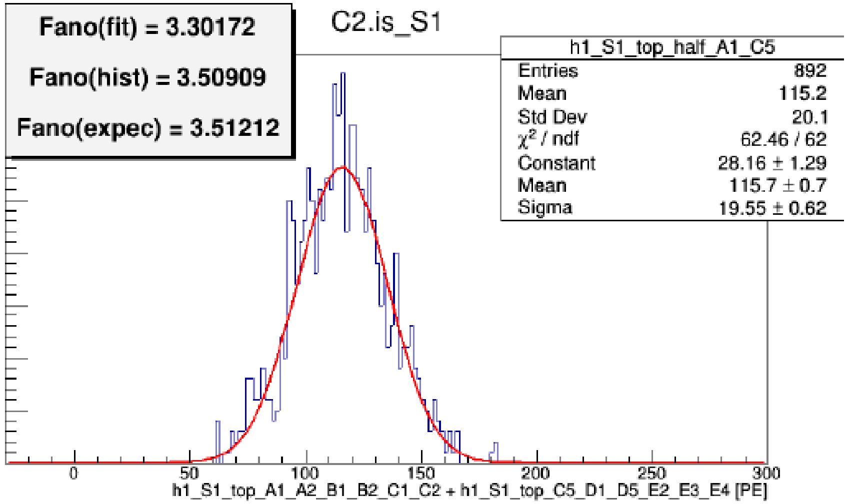
Ph2, Am241, run 537

M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5









M01 == A1	M02 == A2	M03 == A3	M04 == A4
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Ph2, Am241, run 537

M01 == A1	M02 == A2	M03 == A3	M04 == A4
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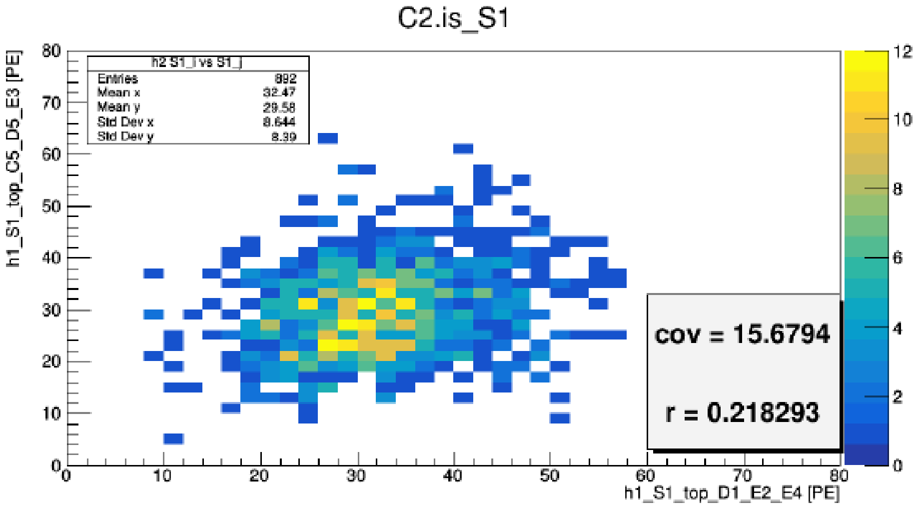

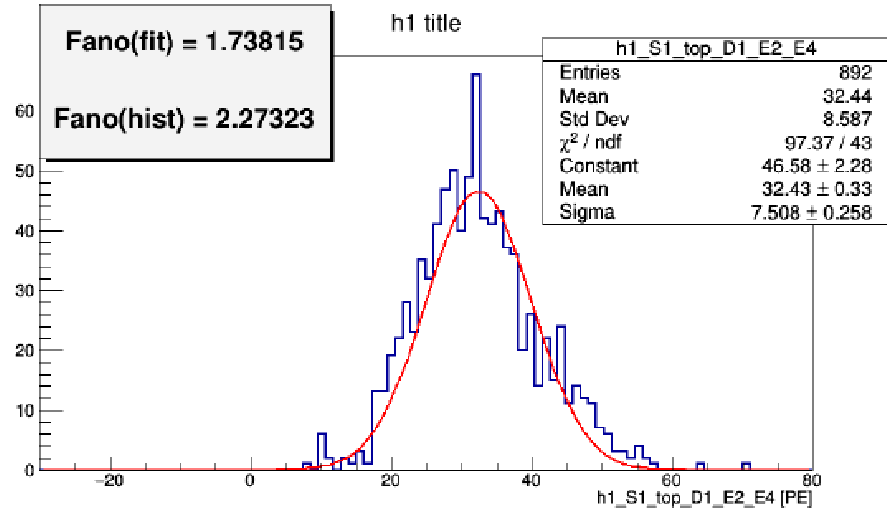

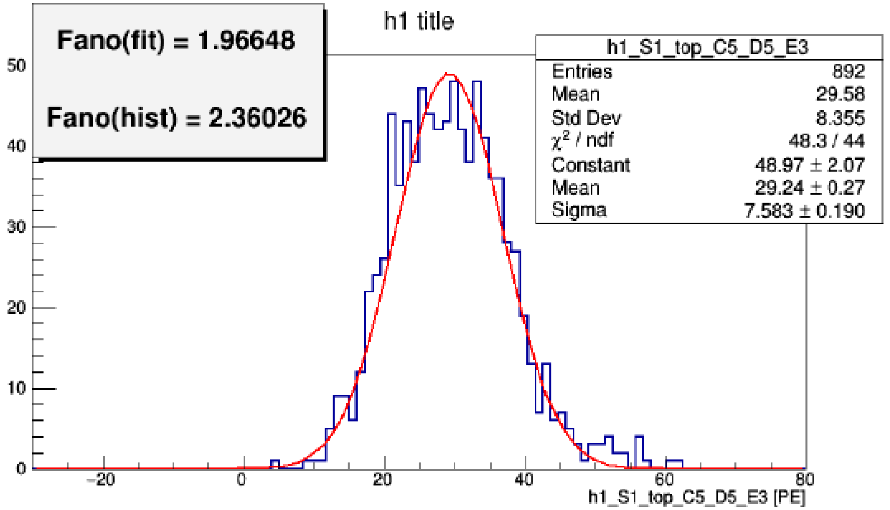

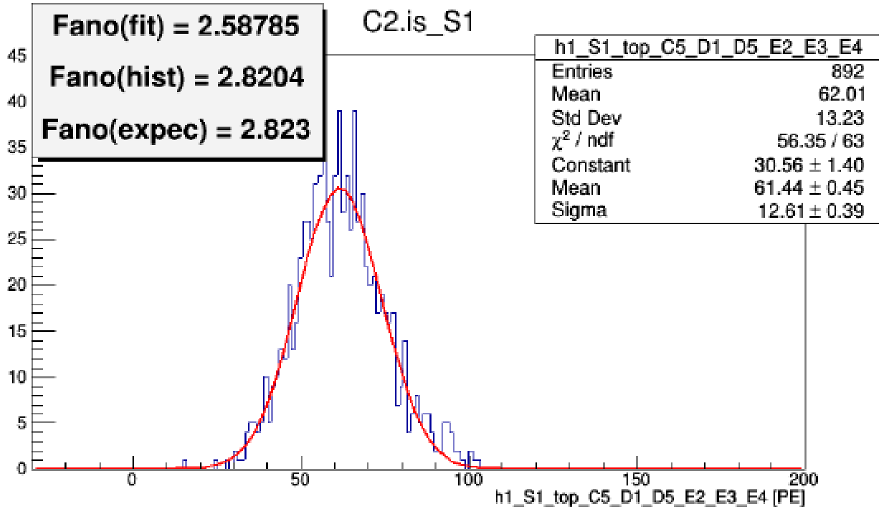

M01 == A1	M02 == A2	M03 == A3	M04 == A4
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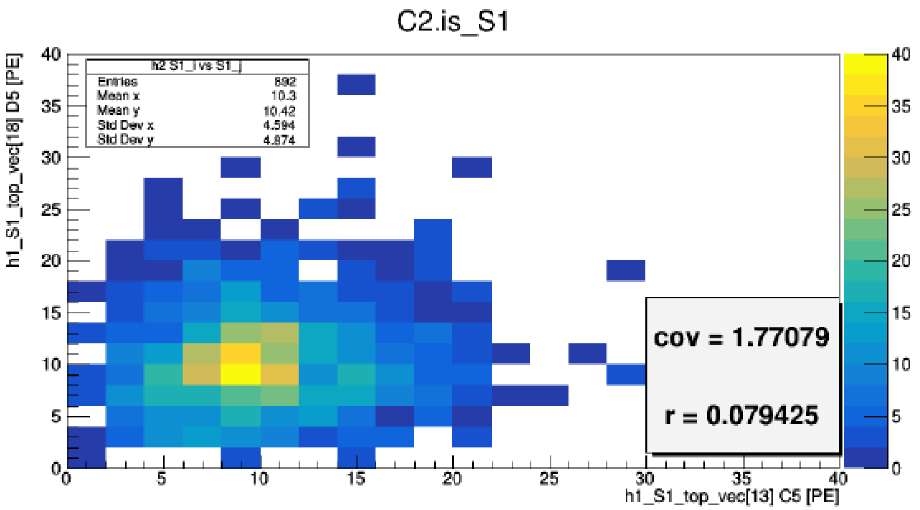
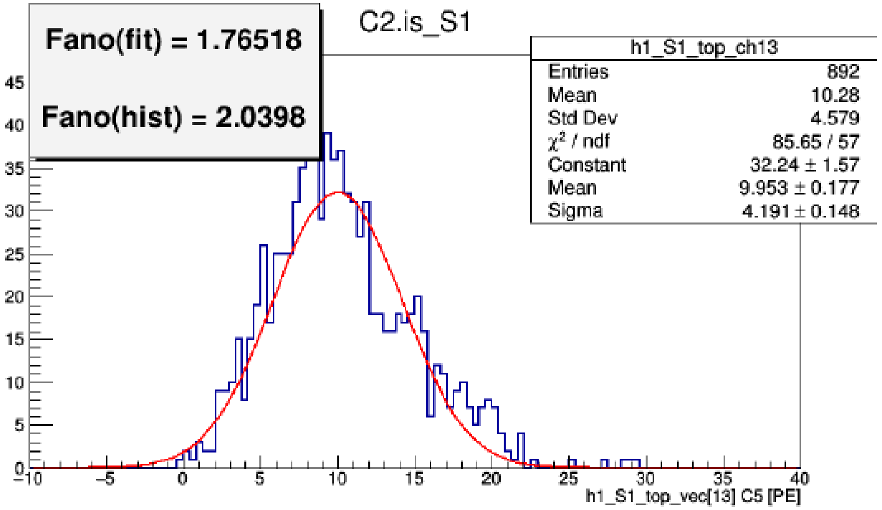
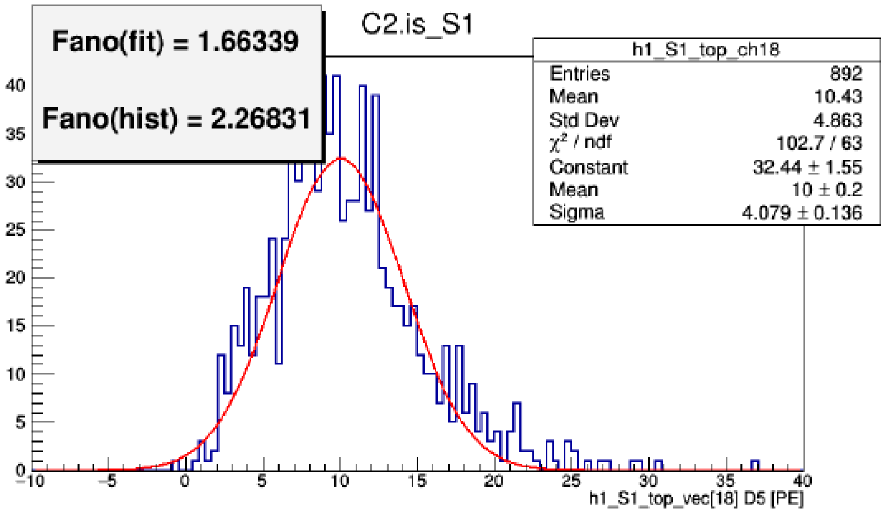
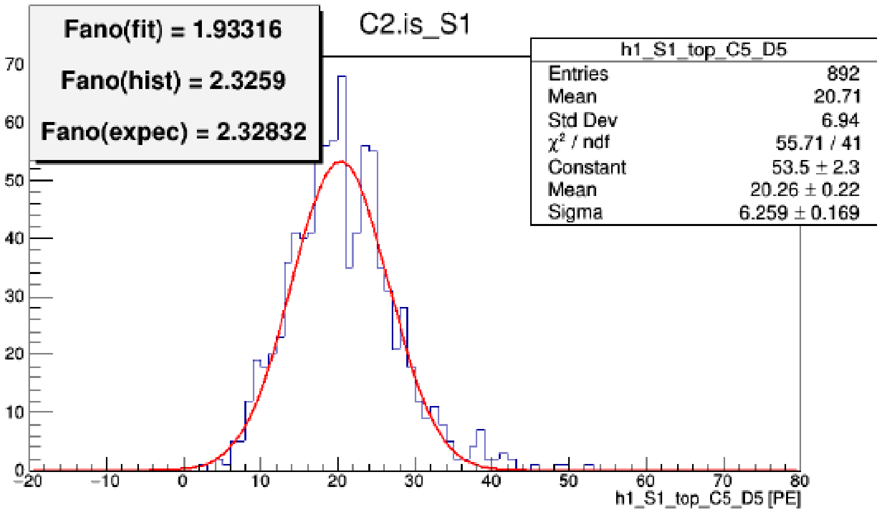
Ph2, Am241, run 537

M01 == A1	M02 == A2	M03 == A3	M04 == A4
M06 == B1	M07 == B2	M05 == A5	M09 == B4
M11 == C1	M12 == C2	M08 == B3	M10 == B5
M16 == C5	M17 == D1	M15 == C4	M14 == C3
M21 == D5	M22 == E2	M20 == D4	M19 == D3
M23 == E3	M24 == E4	M18 == D2	M25 == E5

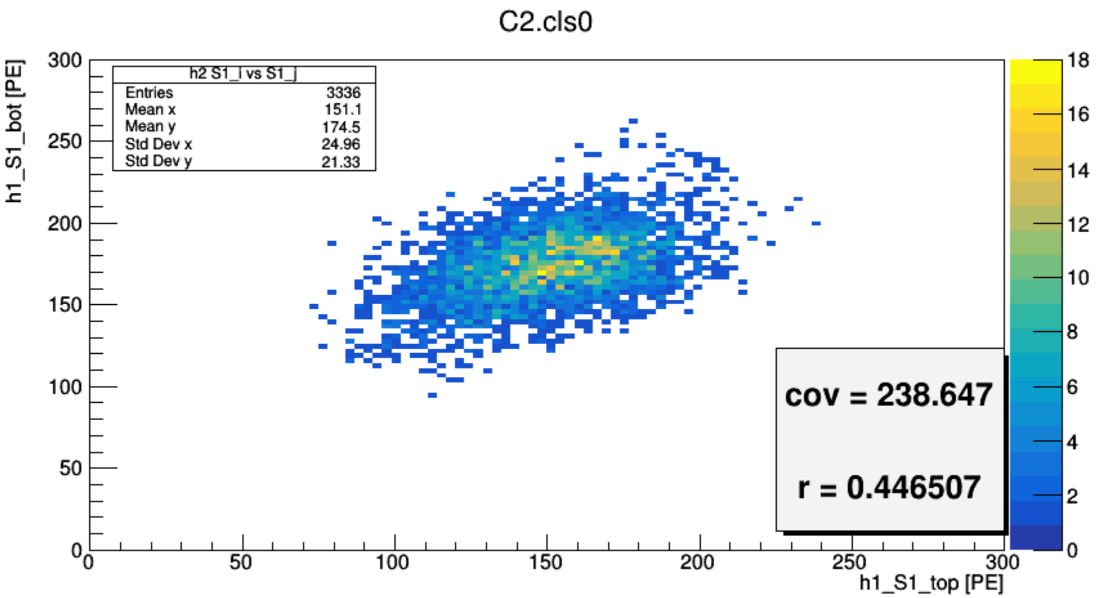


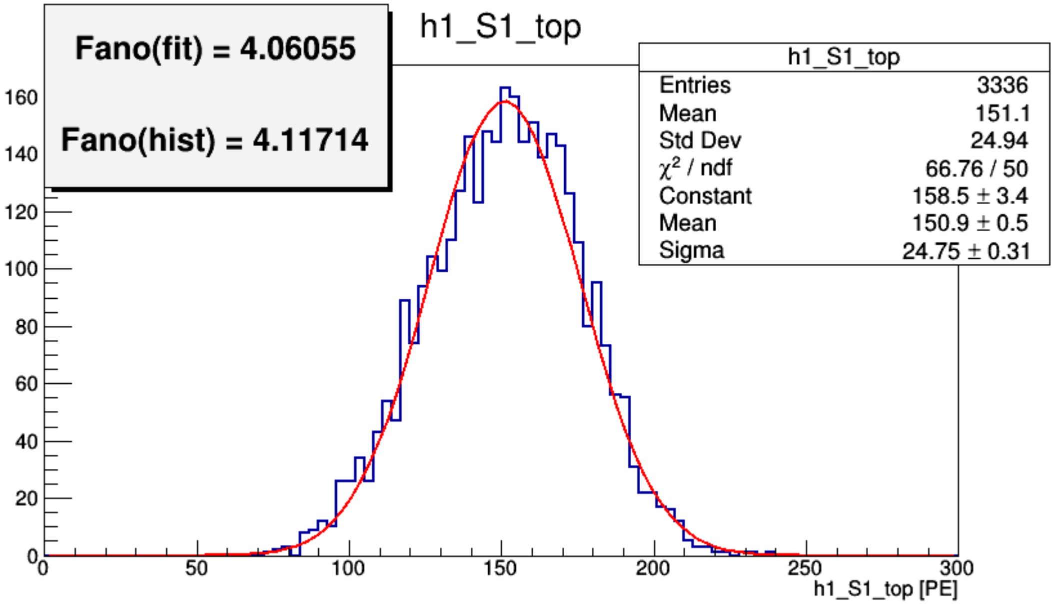


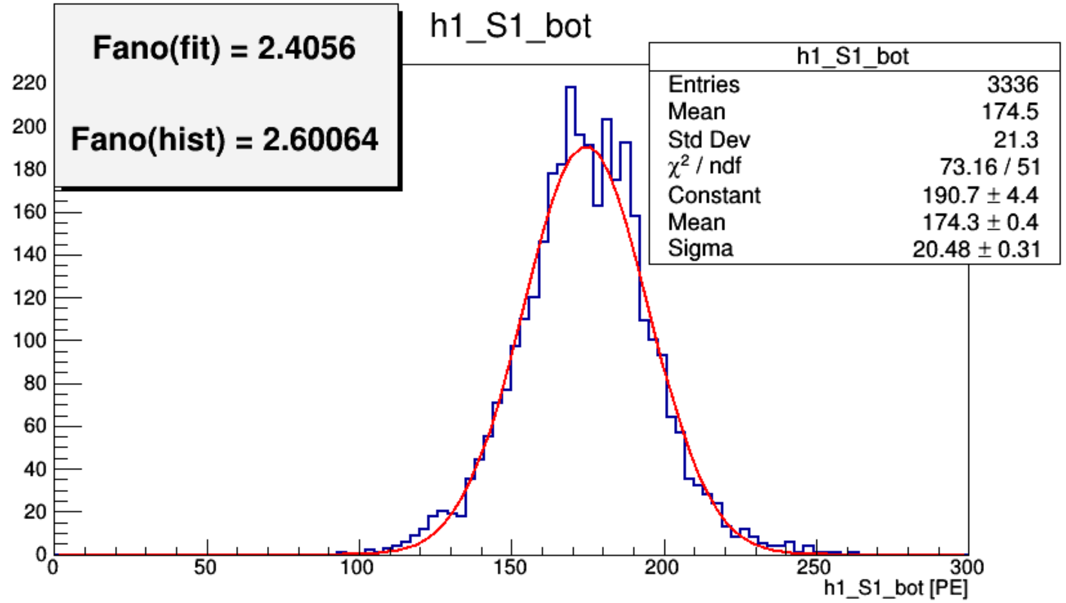


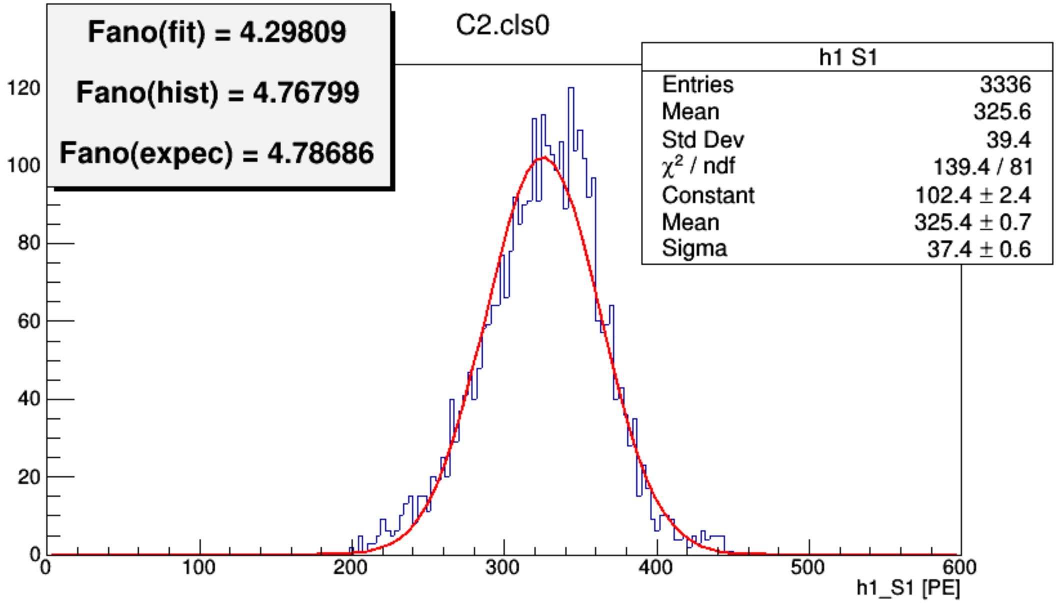


Process data for runs 548 and 550 where there was lower overvoltage on SiPMs.



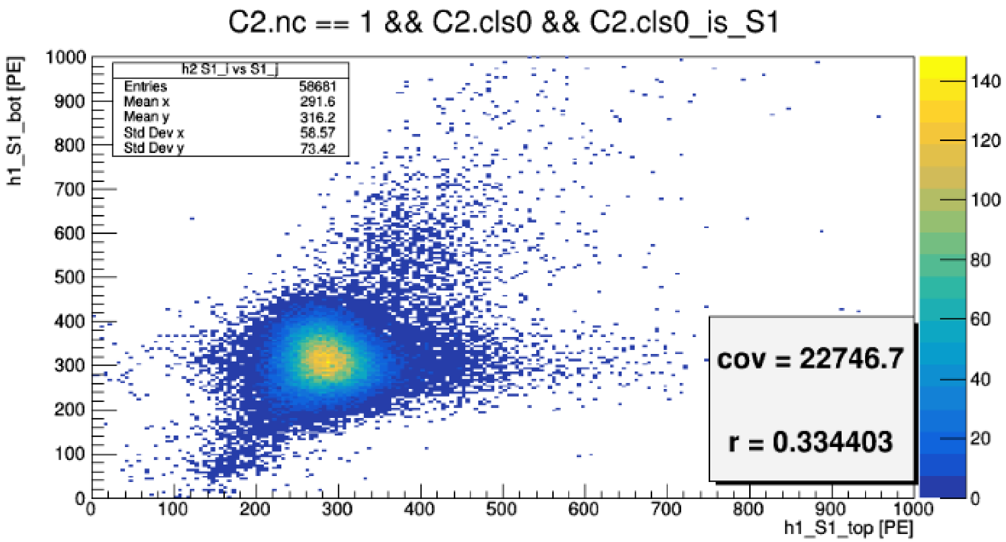


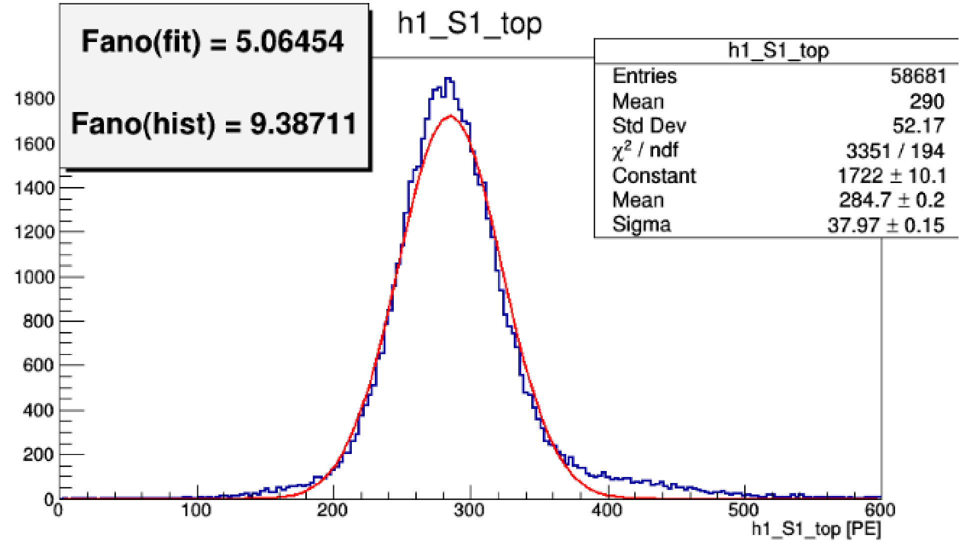


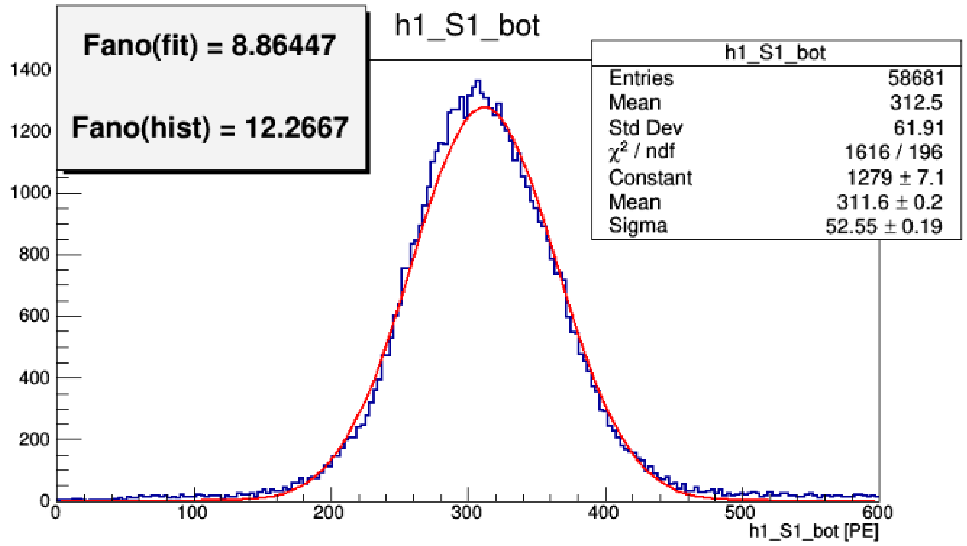


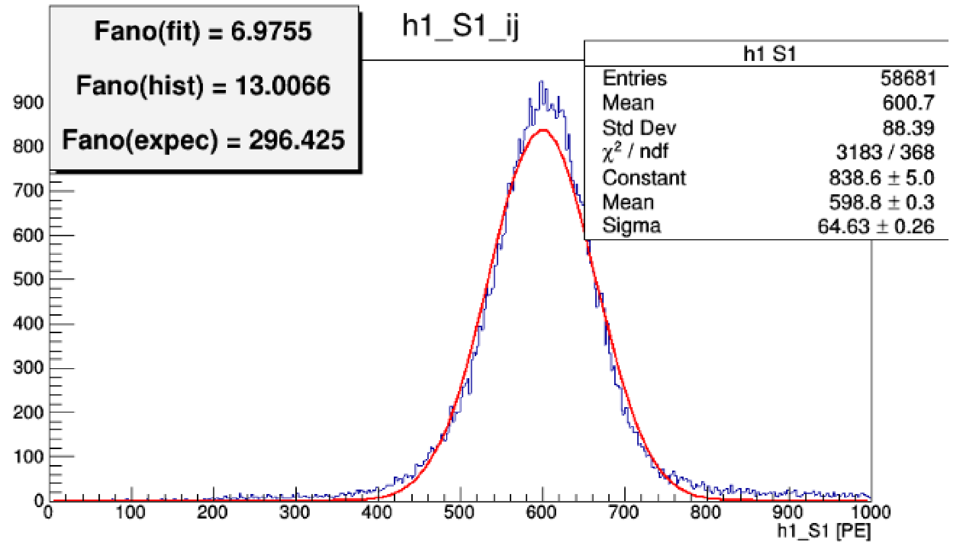
Very preliminary result from runs in Naples (singal phase, Am241, SiPM_OV = 7V, active top and bottom)

Ph1, Am241, run 744



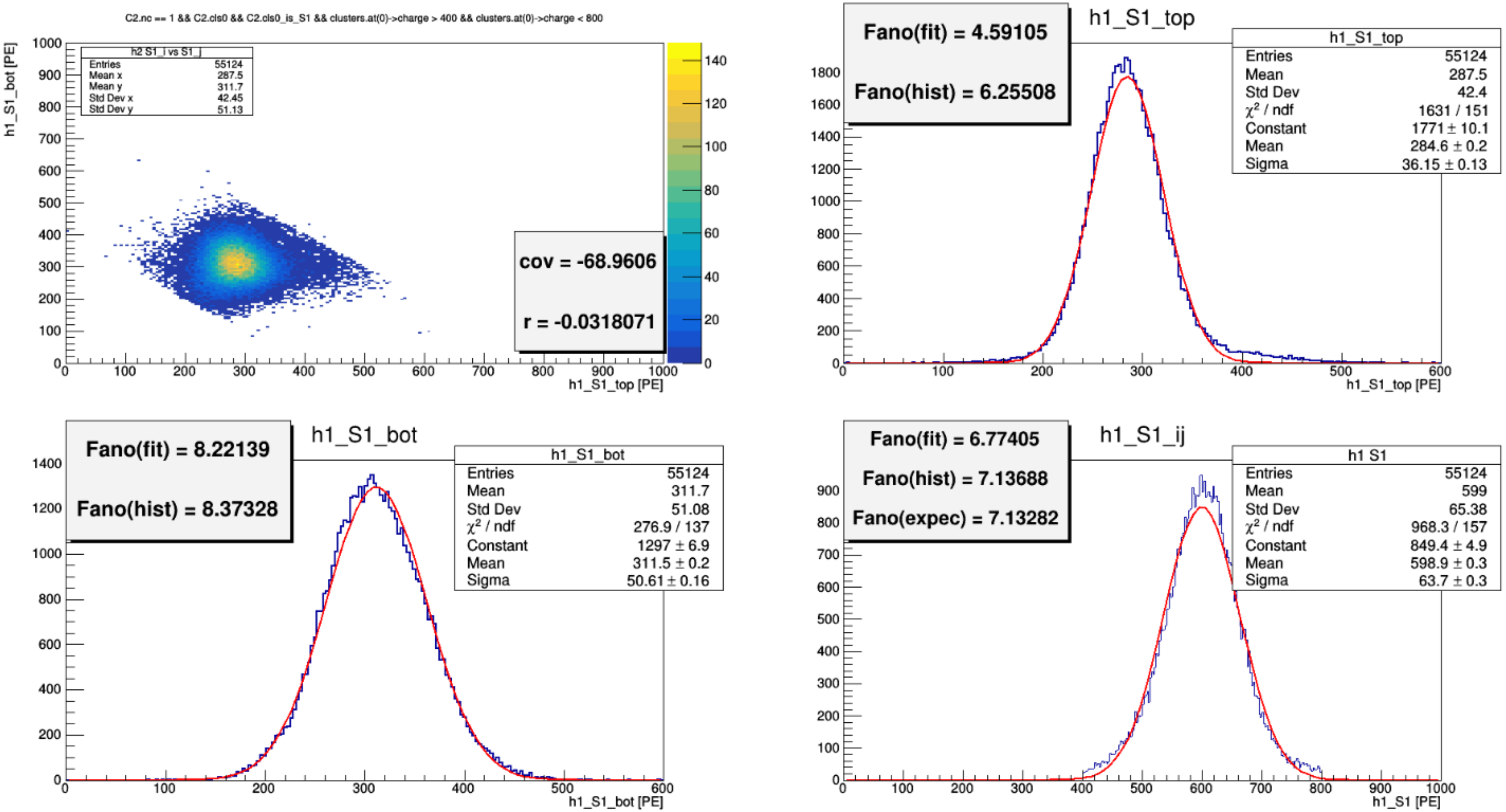






add cuts to exclude bkg

Ph1, Am241, run 744

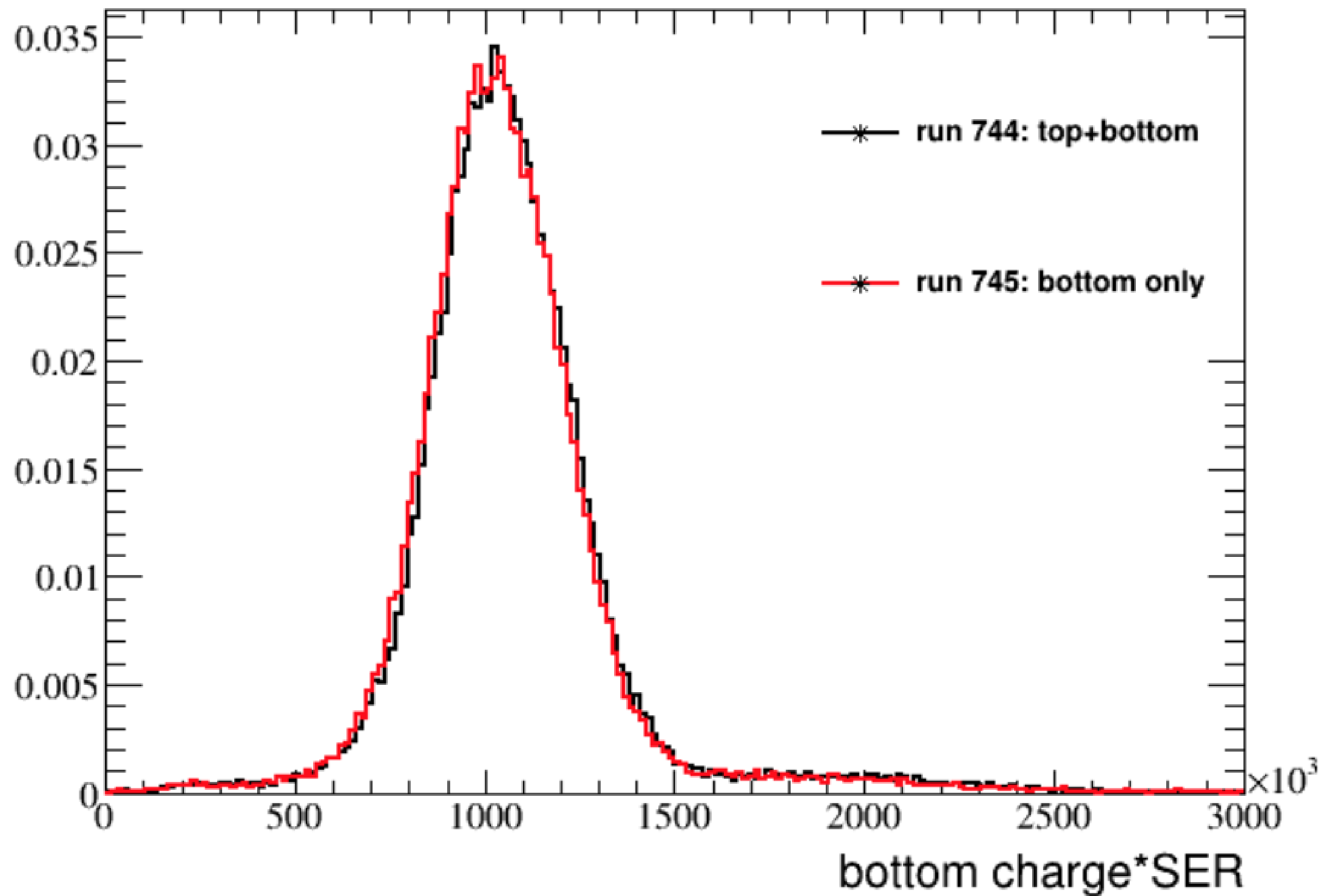


400 < S1 < 800 [PE]

Davide Franco @dfranco commented 1 week ago Developer

Dear all,

after the today discussion, I've repeated the test of comparing 241Am runs taken with bottom+top and bottom only tiles. This time I have multiplied each bottom channel charge by the corresponding SER found in metadata. Since run 744 and 745 are taken close in time, I don't expect differences in the gains.



Nicola Rossi @rossin commented 3 days ago

Maintainer

Am 241 source runs with different OV

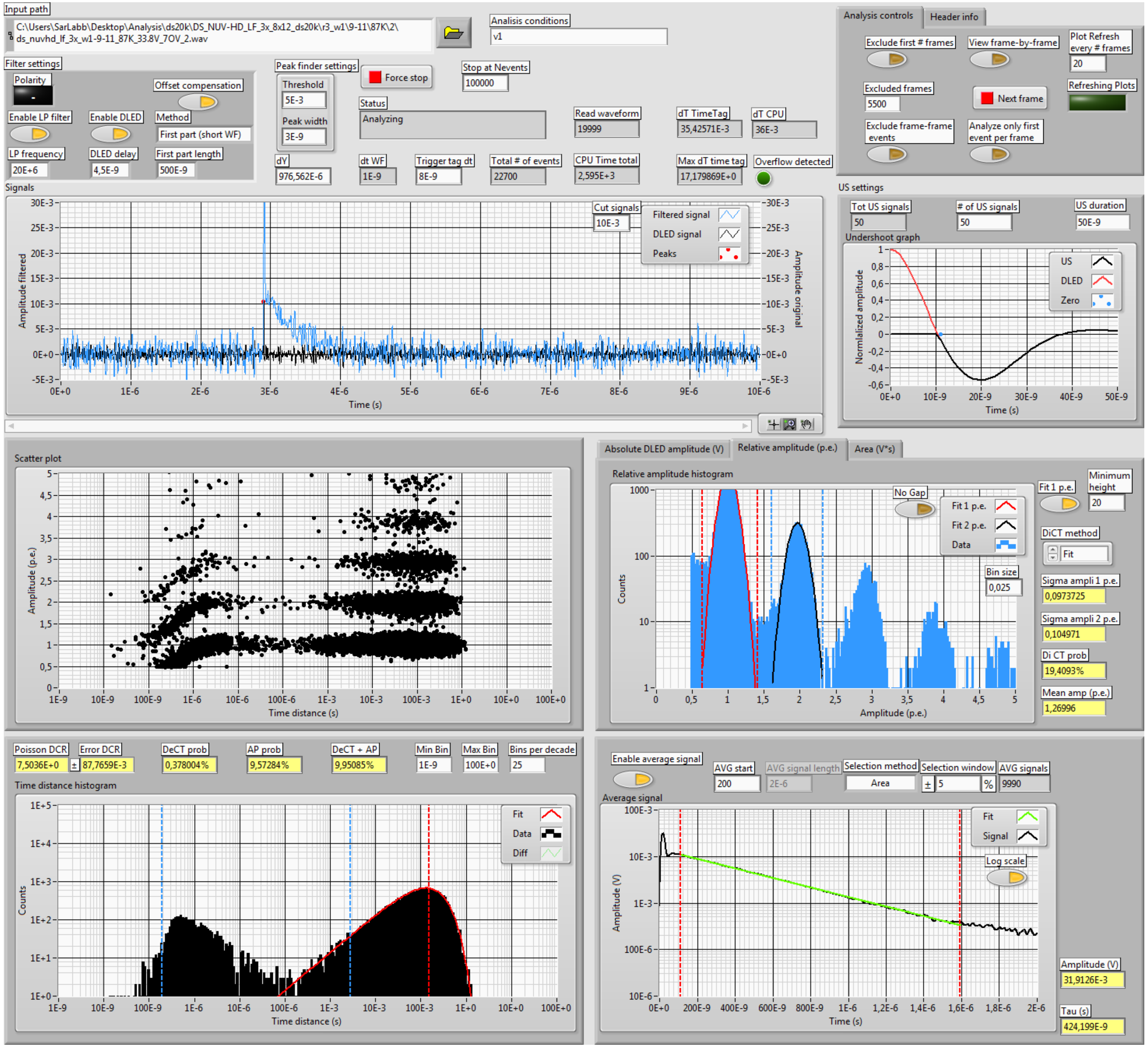
TOTAL	VOV (+)	mu	sigma	Kdup (SER) (Likelihood)	LY gross	LY net	Resolution	Fano	Expected Fano
779	5,00	505,75	37,93	0,19	8,50	7,14	7,50	2,90	1,38
782	6,00	559,30	40,83	0,27	9,40	7,40	7,30	3,10	1,54
785	7,00	672,35	49,75	0,40	11,30	8,07	7,40	3,70	1,80
789	8,00	773,50	56,47	0,55	13,00	8,39	7,30	4,20	2,10

Fano Ratio	LY gros/Fano
2,10	2,93
2,01	3,03
2,06	3,05
2,00	3,10

True LY (???)
4,36
4,59
4,81
5,00

	VOV (+)	mu	sigma	Kdup (SER)	LY gross	LY net	Resolution	Fano	Expected Fano	Fano Ratio
TOP	5,00	254,10	26,90	**0,19**	4,27	3,59	0,11	**2,85**	1,38	2,06
	6,00	292,7	30,30	**0,26**	4,92	3,90	0,10	**3,14**	1,52	2,06
	7,00	337,80	34,20	**0,43**	5,68	3,97	0,10	**3,46**	1,86	1,86
	8,00	390,9	39,50	**0,48**	6,57	4,44	0,10	**3,99**	1,96	2,04
BOTTOM	5,00	244,20	43,10	**0,19**	4,10	3,45	0,18	**7,61**	1,38	5,51
	6,00	280,40	51,20	**0,27**	4,71	3,71	0,18	**9,35**	1,54	6,07
	7,00	322,40	59,00	**0,36**	5,42	3,98	0,18	**10,80**	1,72	6,28
	8,00	369,80	68,70	**0,58**	6,22	3,93	0,19	**12,76**	2,16	5,91

here there is the VOV scan analysis for top/bottom separately.



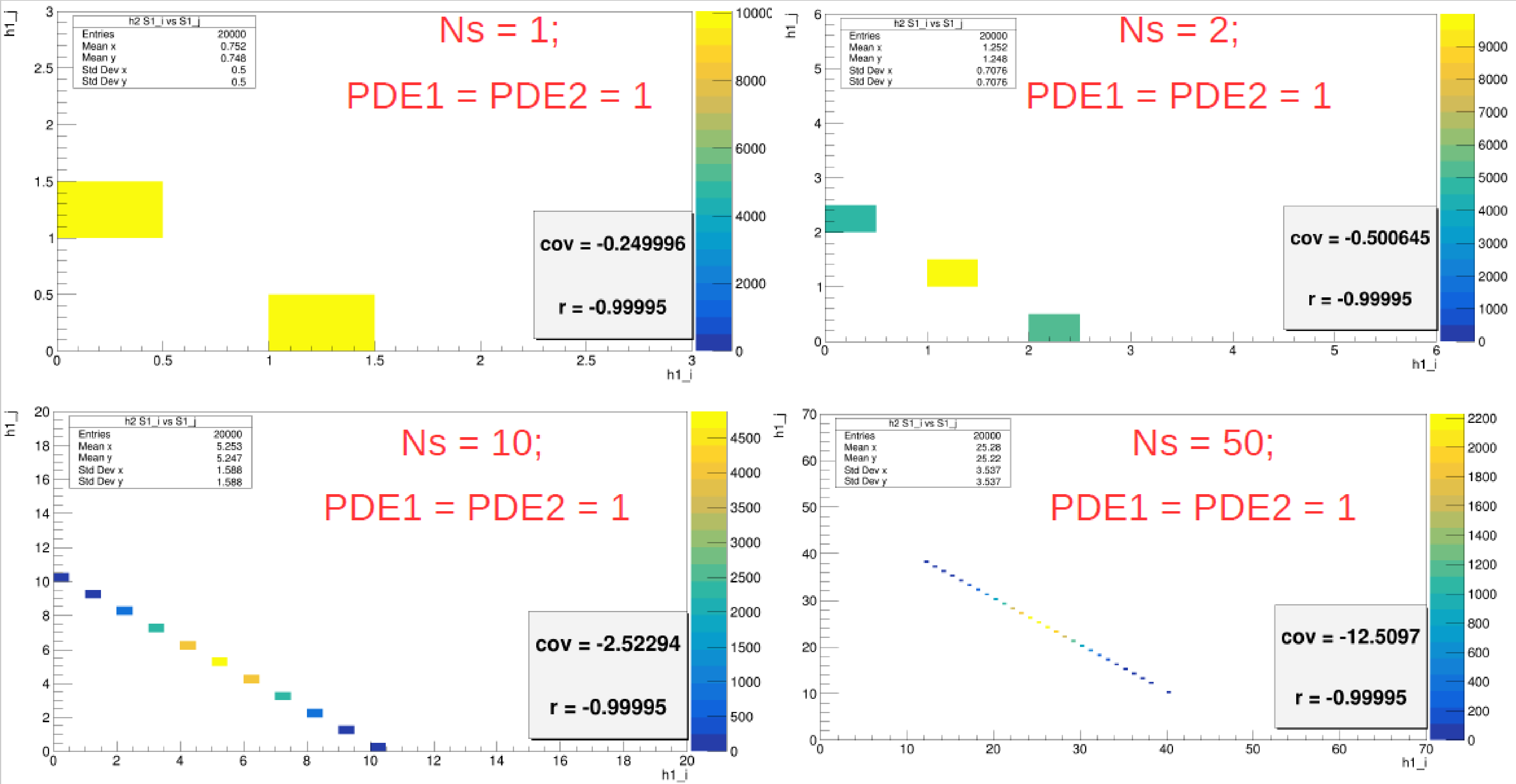
Thanks to Marco Rescigno and A.Razeto for this plot

```
double solid_angle_part = 0.5;
 double PDE1 = 1;
 double PDE2 = 1;

 int Ns = 1;//sourse intensity and distribution
 //int Ns = rndm3.Binomial(1, 0.5);
 //int Ns = rndm3.Poisson(30);

 double Ni0 = rndm3.Binomial(Ns, solid_angle_part);//num of photons emitted in the left part
 double Nj0 = Ns - Ni0;//num of photons emitted in the right part

 double Ni = rndm3.Binomial(Ni0, PDE1);//num of photons detected by the left part
 double Nj = rndm3.Binomial(Nj0, PDE2);//num of photons detected by the right part
```

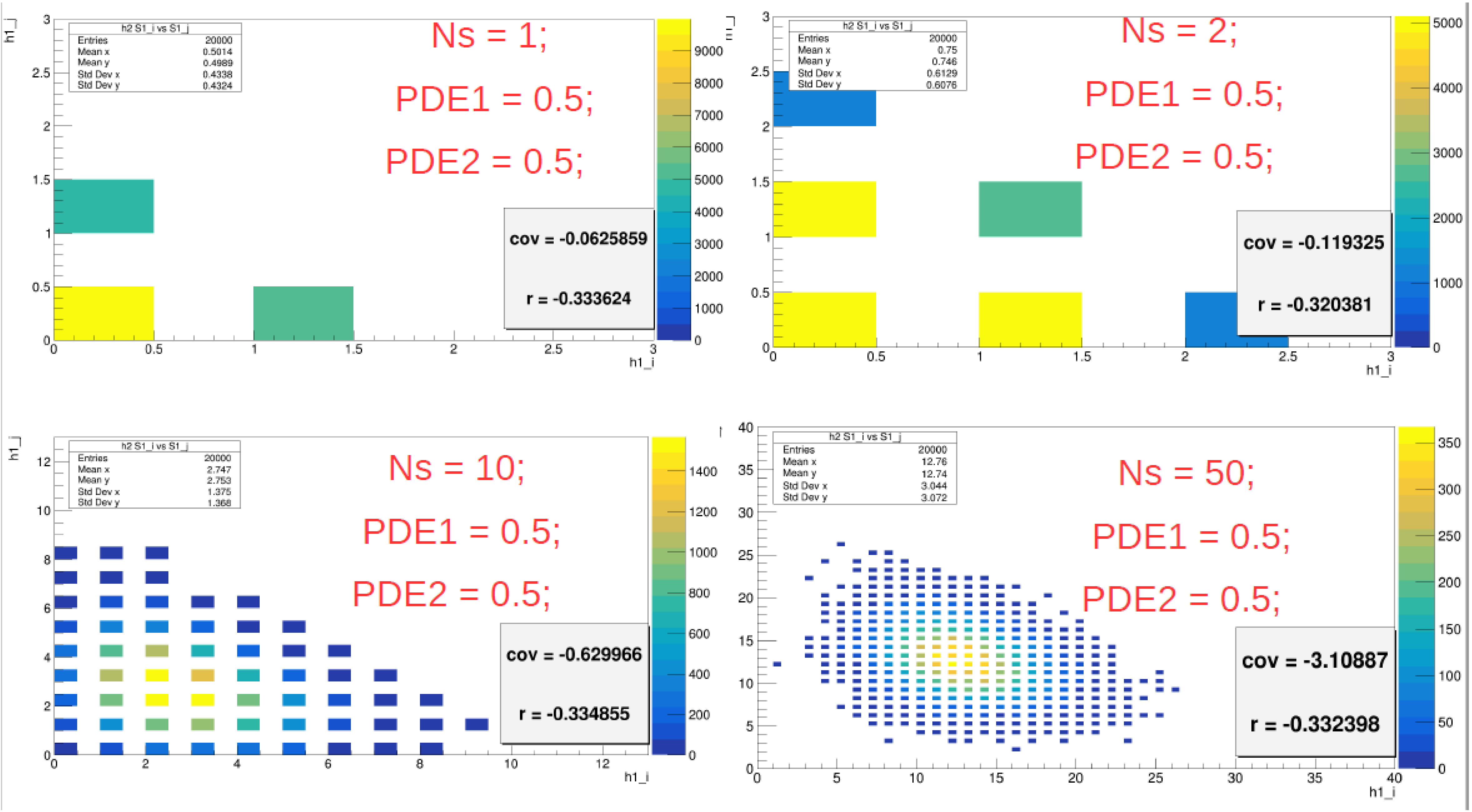


Ns = Ni + Nj;   eff1 = PDE1 * solid_angle_part;

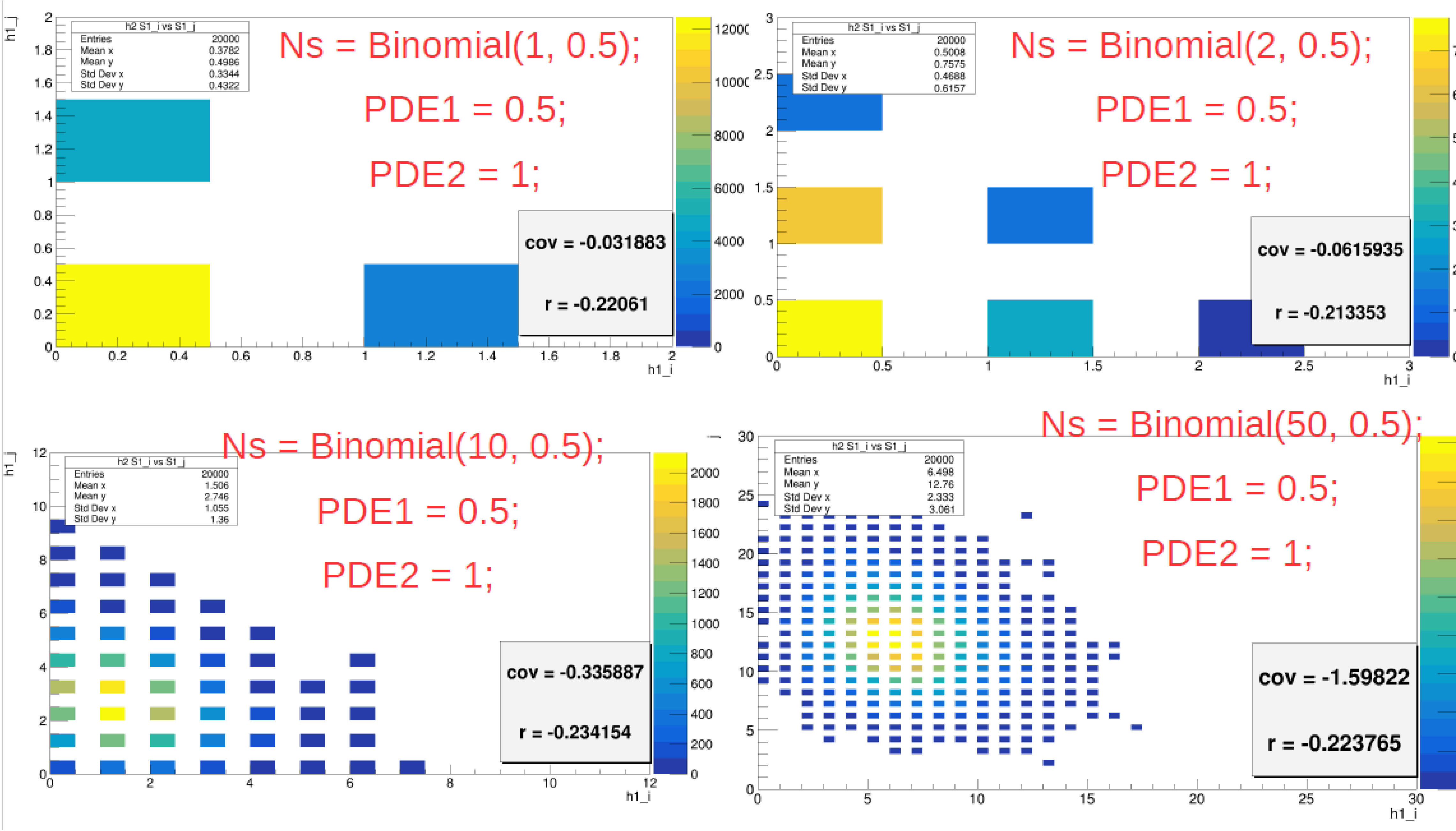
r(i, j) = - sqrt(eff1 * eff2) / sqrt((1 – eff1) * (1 – eff2))

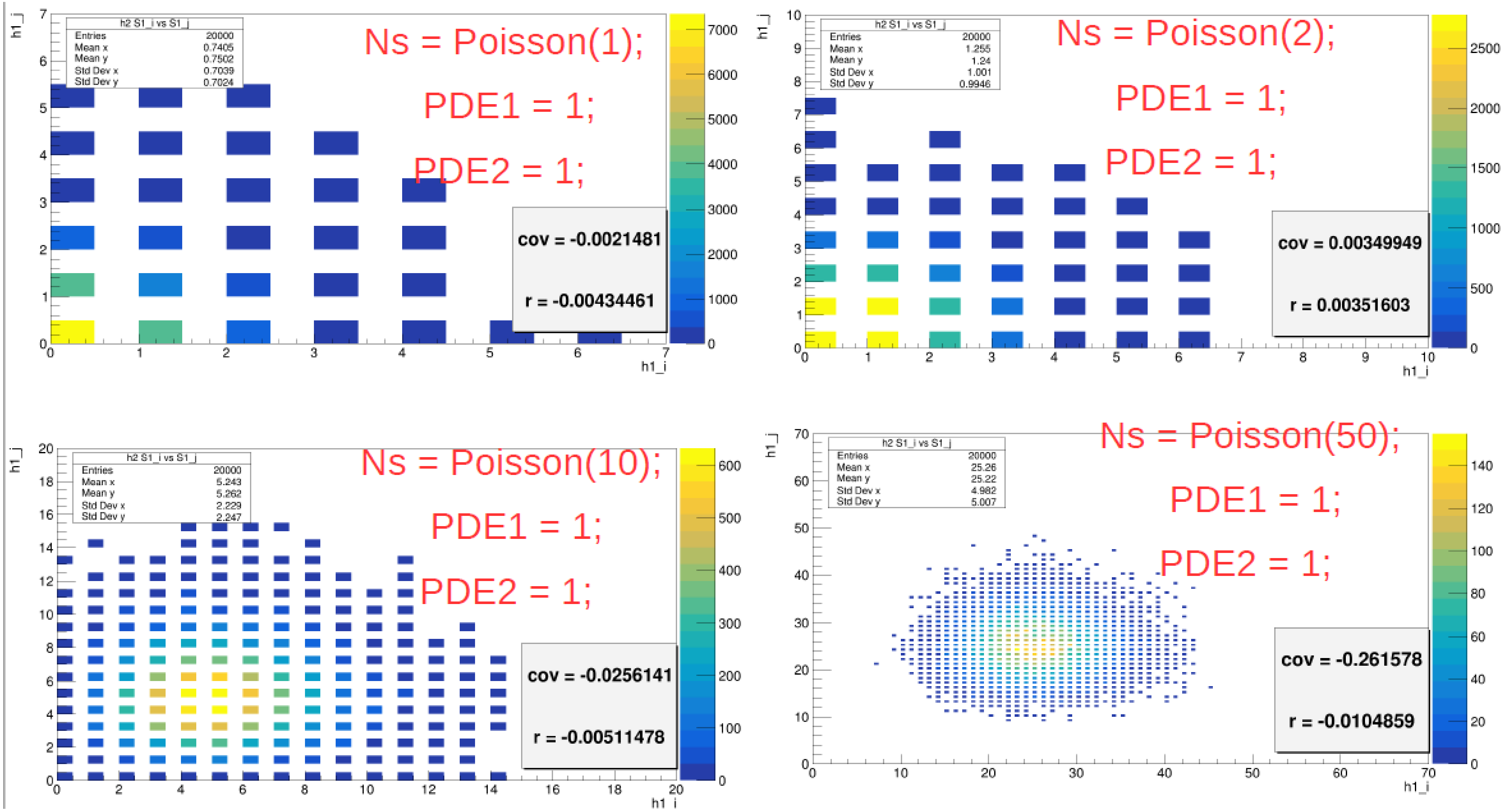
If eff1 = eff2 = 0.5, then

r(i, j) = -1



h2 S1_i vs S1_j
Entries 20000
Mean x 0.5014
Mean y 0.4989
Std Dev x 0.4338
Std Dev y 0.4324
Ns = 1;
PDE1 = 0.5;
PDE2 = 0.5;
cov = -0.0625859
r = -0.333624
h1_i
h1_j
h2 S1_i vs S1_j
Entries 20000
Mean x 0.75
Mean y 0.746
Std Dev x 0.6129
Std Dev y 0.6076
Ns = 2;
PDE1 = 0.5;
PDE2 = 0.5;
cov = -0.119325
r = -0.320381
h1_i
h2 S1_i vs S1_j
Entries 20000
Mean x 2.747
Mean y 2.753
Std Dev x 1.375
Std Dev y 1.368
Ns = 10;
PDE1 = 0.5;
PDE2 = 0.5;
cov = -0.629966
r = -0.334855
h1_i
h1_j
h2 S1_i vs S1_j
Entries 20000
Mean x 12.76
Mean y 12.74
Std Dev x 3.044
Std Dev y 3.072
Ns = 50;
PDE1 = 0.5;
PDE2 = 0.5;
cov = -3.10887
r = -0.332398
h1_i


Ns = Binomial(1, 0.5);
PDE1 = 0.5;
PDE2 = 1;
h2 S1_i vs S1_j
Entries 20000
Mean x 0.3782
Mean y 0.4986
Std Dev x 0.3344
Std Dev y 0.4322
cov = -0.031883
r = -0.22061
h1_i
h1_j
Ns = Binomial(2, 0.5);
PDE1 = 0.5;
PDE2 = 1;
h2 S1_i vs S1_j
Entries 20000
Mean x 0.5008
Mean y 0.7575
Std Dev x 0.4688
Std Dev y 0.6157
cov = -0.0615935
r = -0.213353
h1_i
Ns = Binomial(10, 0.5);
PDE1 = 0.5;
PDE2 = 1;
h2 S1_i vs S1_j
Entries 20000
Mean x 1.506
Mean y 2.746
Std Dev x 1.055
Std Dev y 1.36
cov = -0.335887
r = -0.234154
h1_i
h1_j
Ns = Binomial(50, 0.5);
PDE1 = 0.5;
PDE2 = 1;
h2 S1_i vs S1_j
Entries 20000
Mean x 6.498
Mean y 12.76
Std Dev x 2.333
Std Dev y 3.061
cov = -1.59822
r = -0.223765
h1_i



h2 S1_i vs S1_j
Entries 20000
Mean x 0.7405
Mean y 0.7502
Std Dev x 0.7039
Std Dev y 0.7024
Ns = Poisson(1);
PDE1 = 1;
PDE2 = 1;
cov = -0.0021481
r = -0.00434461
h1_i
h1_j
h2 S1_i vs S1_j
Entries 20000
Mean x 1.255
Mean y 1.24
Std Dev x 1.001
Std Dev y 0.9946
Ns = Poisson(2);
PDE1 = 1;
PDE2 = 1;
cov = 0.00349949
r = 0.00351603
h1_i
h1_j
h2 S1_i vs S1_j
Entries 20000
Mean x 5.243
Mean y 5.262
Std Dev x 2.229
Std Dev y 2.247
Ns = Poisson(10);
PDE1 = 1;
PDE2 = 1;
cov = -0.0256141
r = -0.00511478
h1_i
h1_j
h2 S1_i vs S1_j
Entries 20000
Mean x 25.26
Mean y 25.22
Std Dev x 4.982
Std Dev y 5.007
Ns = Poisson(50);
PDE1 = 1;
PDE2 = 1;
cov = -0.261578
r = -0.0104859
h1_i
h1_j

The most fragile part???

```
double solid_angle_part = 0.5;
 double PDE1 = 1;
 double PDE2 = 1;

 int Ns = 1;//sourse intensity and distribution
 //int Ns = rndm3.Binomial(1, 0.5);
 //int Ns = rndm3.Poisson(30);

 double Ni0 = rndm3.Binomial(Ns, solid_angle_part);//num of photons emitted in the left part
 double Nj0 = Ns - Ni0;//num of photons emitted in the right part

 double Ni = rndm3.Binomial(Ni0, PDE1);//num of photons detected by the left part
 double Nj = rndm3.Binomial(Nj0, PDE2);//num of photons detected by the right part
```

Part3 conclusions:

1) Expected Am_S1_Fano ~ 1, but real is ~5-6 at 7VOV. Fano increase from 1 to 2 because x-talk and from 2 to 5-6 because of positive correlation between channels.
2) Effect can’t be explained by channel-channel x-talk, because the same resolution if we switch off top or bottom matrix.
3) My personal opinion about this problem:

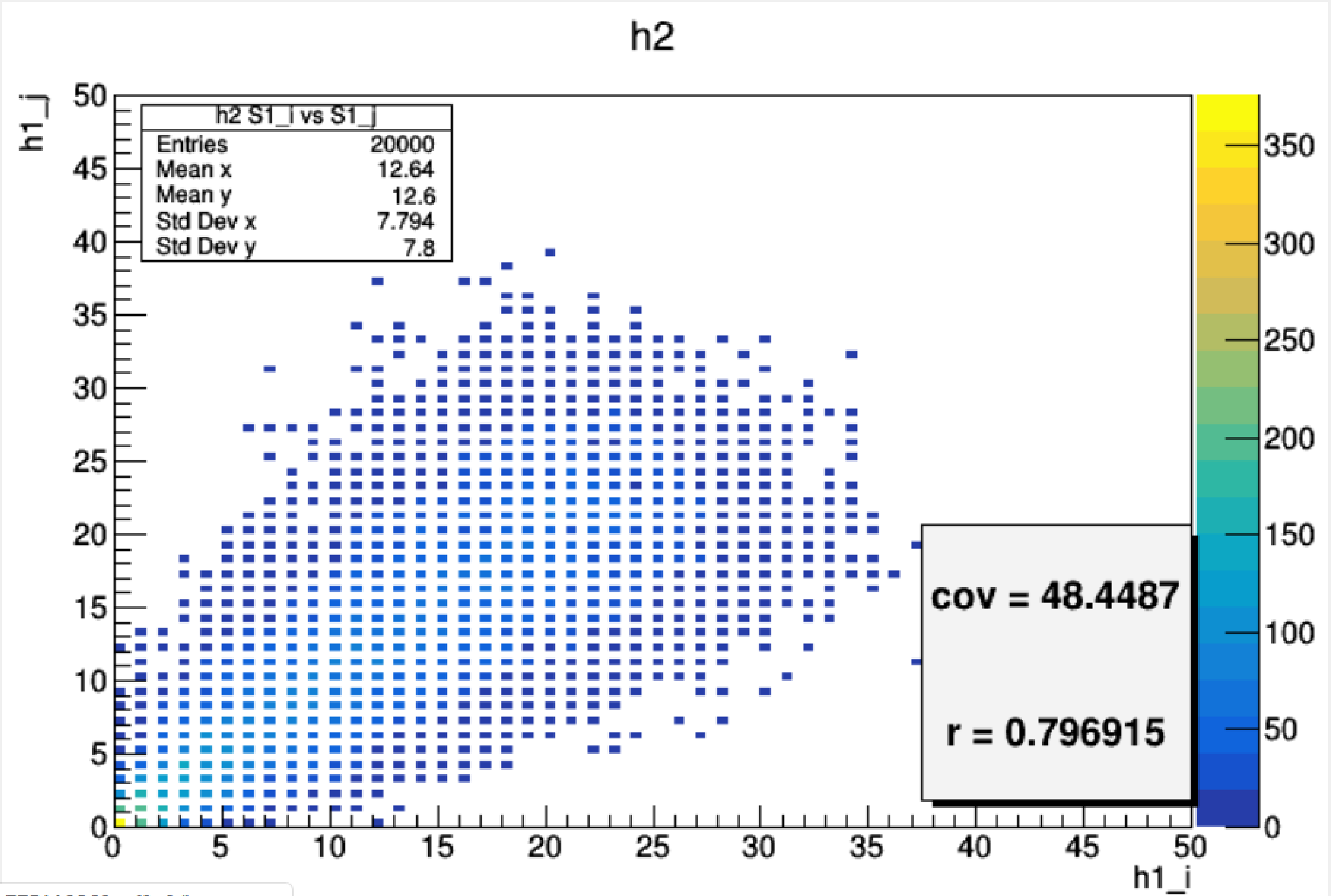
    3.1) correlated noise

    3.2) wide distribution of detected photons with Fano > 1, because of some non-uniformity

    3.3) my simulation is wrong or model too simply to reproduce effect of positive correlation

    3.4) WE NEED FULL MC WITH OPTICAL PHOTONS

I checked: in case of light source with uniform distribution of emitted photons, channels will be in positive correlation.



4cc775119269aef0e0/image.png

Conclusions:

Part1: SER stability

1) There are several “jumps”, that should be understood and fixed.
2) There is small constant slope: temperature instability?

Part2: S2 non-uniformity

1) S2 is stable in time
2) S2 spectrum is Gaussian for central events
3) S2 2-3 times bigger for edges-corners
4) For edges-corners drift time spectrum is non-uniform -> hint to E_drift non-uniformity

Part3: S1 resolution problem

1) Am_S1_Fano for each individual channel is in good agreement with Fano, extracted from Vinogradov’s theory. Expected Am_S1_Fano ~ 1, but real is ~5-6 at 7VOV. Fano increase from 1 to 2 because x-talk and from 2 to 5-6 because of positive correlation between channels.

2) Effect can’t be explained by channel-channel x-talk, because the same resolution if we switch off top or bottom matrix.

3) My personal opinion about this problem:

3.1) correlated noise

3.2) wide distribution of detected photons with Fano > 1, because of some non-uniformity

3.3) my simulation is wrong or model too simply to reproduce effect of positive correlation

3.4) WE NEED FULL MC WITH OPTICAL PHOTONS