AT Pedestals and MIP Constants

Summary

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HELMHOLTZ RESEARCH FOR GRAND CHALLENGES
UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386
HGSFP
E-JADE
CALICE Calorimeter for ILC
DESY.

Outline

- Reminder: AT pedestals and MIP constants
- Overview: Calibration procedure

- Initial Plans/ToDos
  - ➡ Memorycell-wise investigation of pedestals
  - ➡ Pedestal quality/outliers/dead channel checks
  - ➡ Changes of procedures/pedestal memory cell offsets and uploads to DB
  - ➡ MIP constants quality/outliers/dead channel checks
  - ➡ Example reconstructed muon run with new AT pedestals and MIP constants

- Outlook/ToDos

Reminder: AT Pedestals and MIP Constants

From ADC to MIP

- Both constants are used in the formula to do the ADC to MIP conversion for the individual channels:

  ➡ AT Pedestals (Pedestal (electronic noice) in Auto Trigger mode) are subtracted from the raw ADC amplitudes in a first step

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  - ➡ The MIP constants (most probable energy deposition of a minimum ionizing particle in the units of ADC) are needed to calculate the light yield

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  - ➡ AT Pedestals (Pedestal (electronic noice) in Auto Trigger mode) are subtracted from the raw ADC amplitudes in a first step
  - ➡ The MIP constants (most probable energy deposition of a minimum ionizing particle in the units of ADC) are needed to calculate the light yield
    - ➡ Enable the information of the energy deposition in the units of MIP

Overview Calibration Procedure

Schematic of Procedure

EUDAQ

EventBuilding

Raw RunX.slcio file:
- nHits
- hit energy
- ChipIDs, channels
- …

RootTreeGenerator processor

RunX.root file:
- nHits
- hit energy
- ChipIDs, channels
- …

Extraction _Pedestal

pedestal_offsets.tsv file:
- List with pedestal offsets and errors for channels

DB conversion

DB

Extraction _MIP

mip_fits.tsv file:
- List with final MIP constants, fit parameters and errors for channels

DB conversion

DB

Initial Plans and ToDo's

- Memorycell-wise investigation on pedestals
- Pedestal quality/outlier/dead channel check
  - ➡ Data base format, upload to data base
- Modify pedestal extraction and MIP extraction code for calibration:
  - ➡ Use memorycell-wise absolute pedestal values
- Infrastructure in DB: Memorycell offsets collection uploaded to DB
- Run modified MIP calibration, check results quality, outliers, width, etc.
  - ➡ Data base format, upload to data base

➡ Close the circle: Run Reco with new Pedestals (Memcell corrected) and MIP constants

  - ➡ Check energy deposition and if it peaks at 1 MIP for muon run

Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

Idea: Check individual AT pedestal spectra for every memory cell (0-15) and plot their mean and RMS based on a full may muon scan

- ➡ Characterize typical mean and width for all further studies
- ➡ In total: 38 layers * 16 chips * 36 channels * 16 memcells = 350208 spectra

AT

3 Iterations SetRangeUser(mean +- 0.3 rms),
get mean and rms

Full Muon Scan

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Full Muon Scan

Do this properly…

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AT

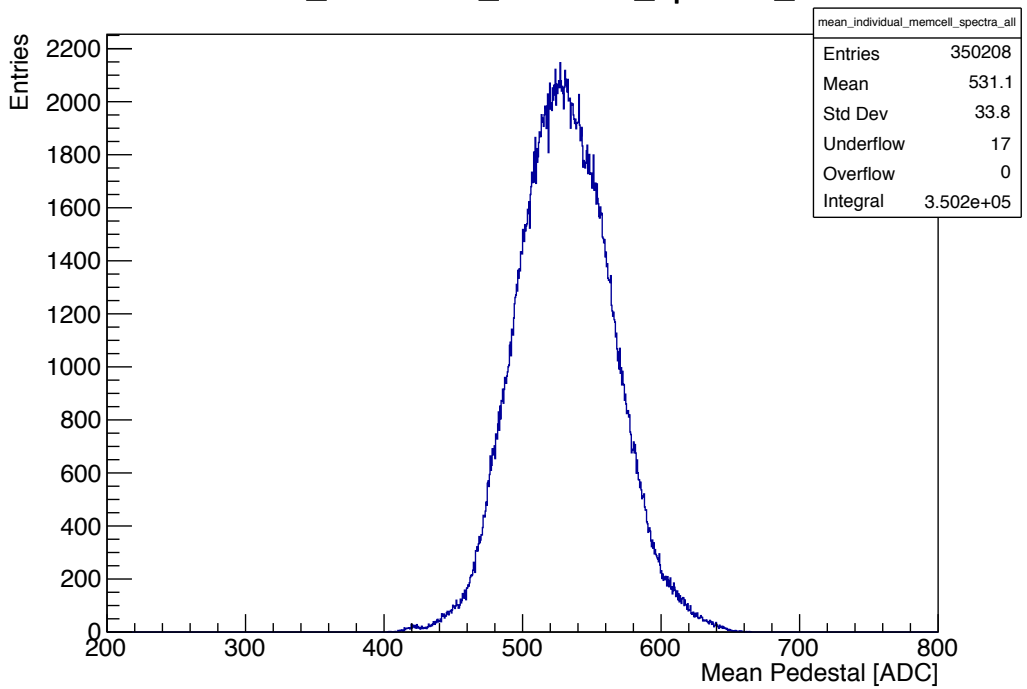
Full Muon Scan

Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

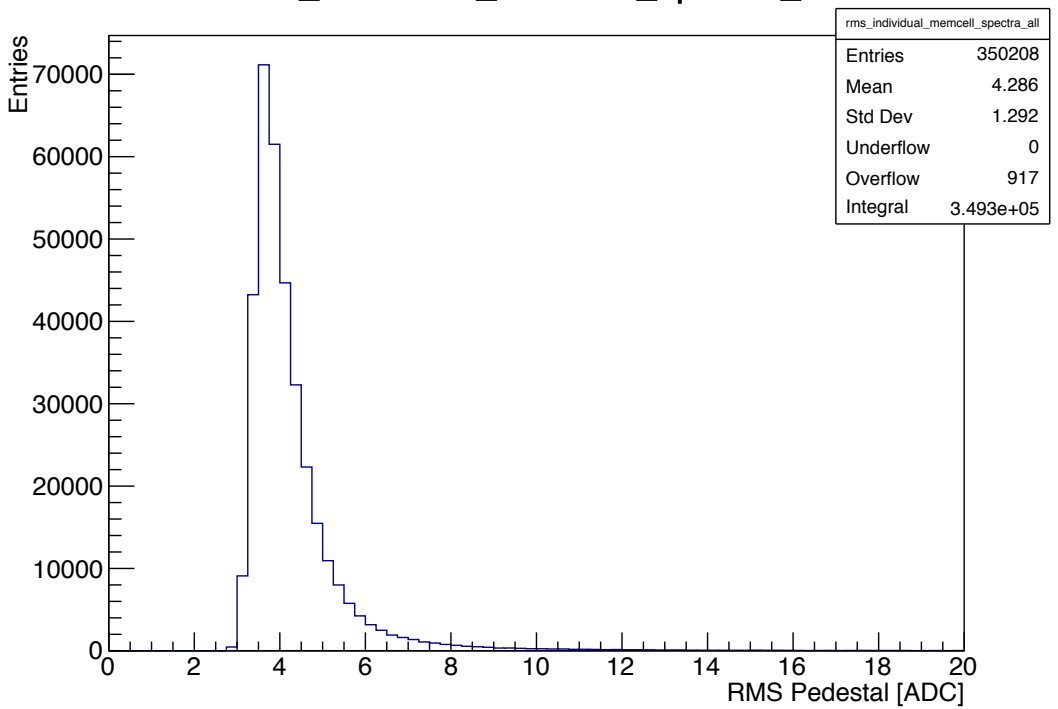
$\bar{P}_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem}$

mean_individual_memcell_spectra_all



$\sigma_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem}$

rms_individual_memcell_spectra_all



➡ As expected: AT Pedestals different from ET Pedestals

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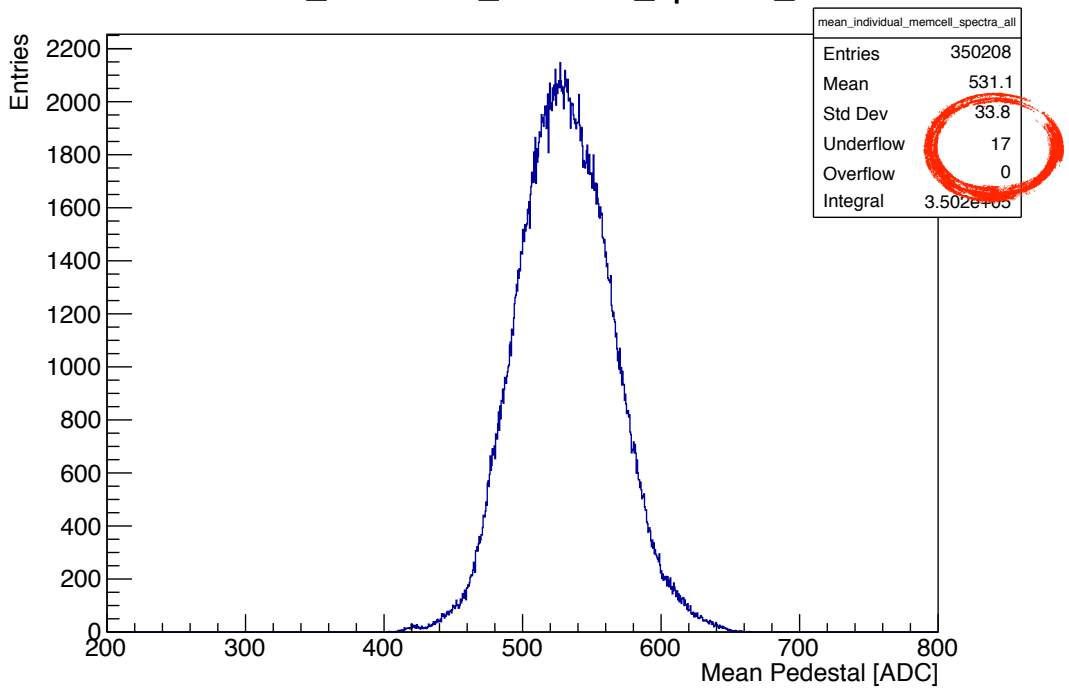
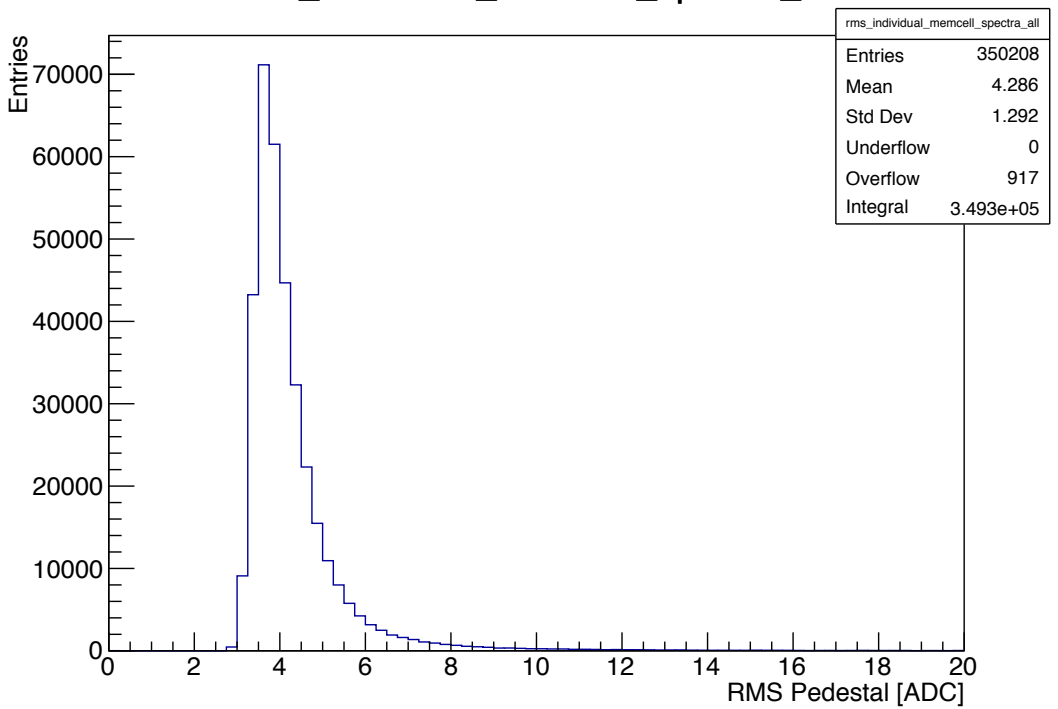


$\sigma_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem}$

rms_individual_memcell_spectra_all



➡ As expected: AT Pedestals different from ET Pedestals

➡ Completely empty memory cells observed

Pedestal Spectra for Individual Memory Cells

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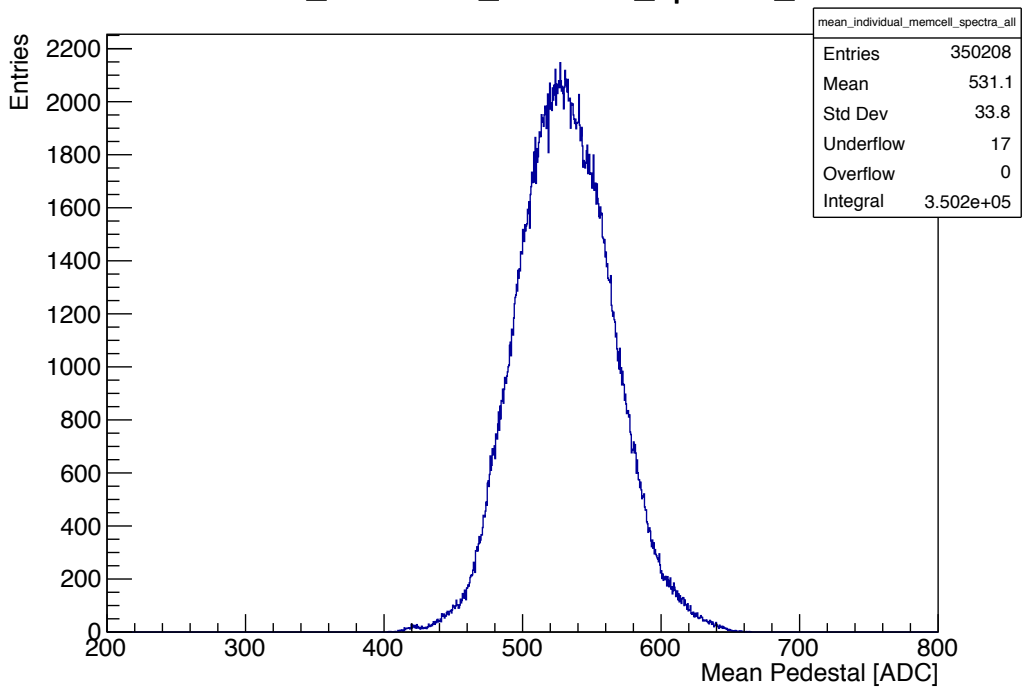
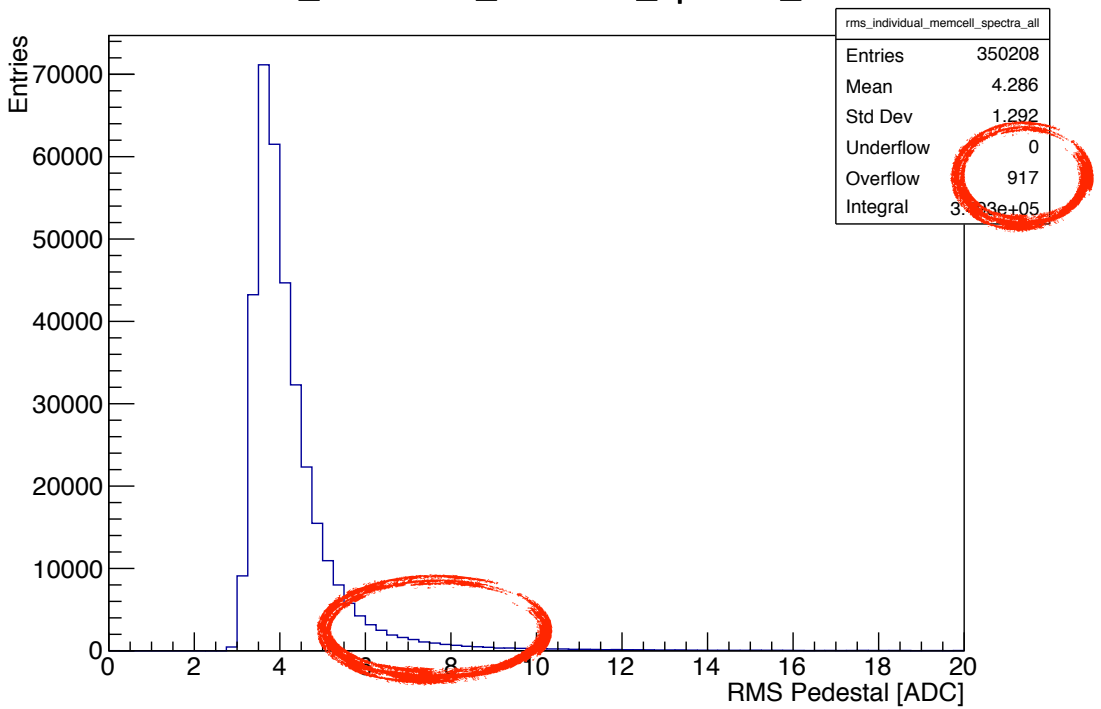
$\bar{P}_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem}$

mean_individual_memcell_spectra_all



$\sigma_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem}$

rms_individual_memcell_spectra_all

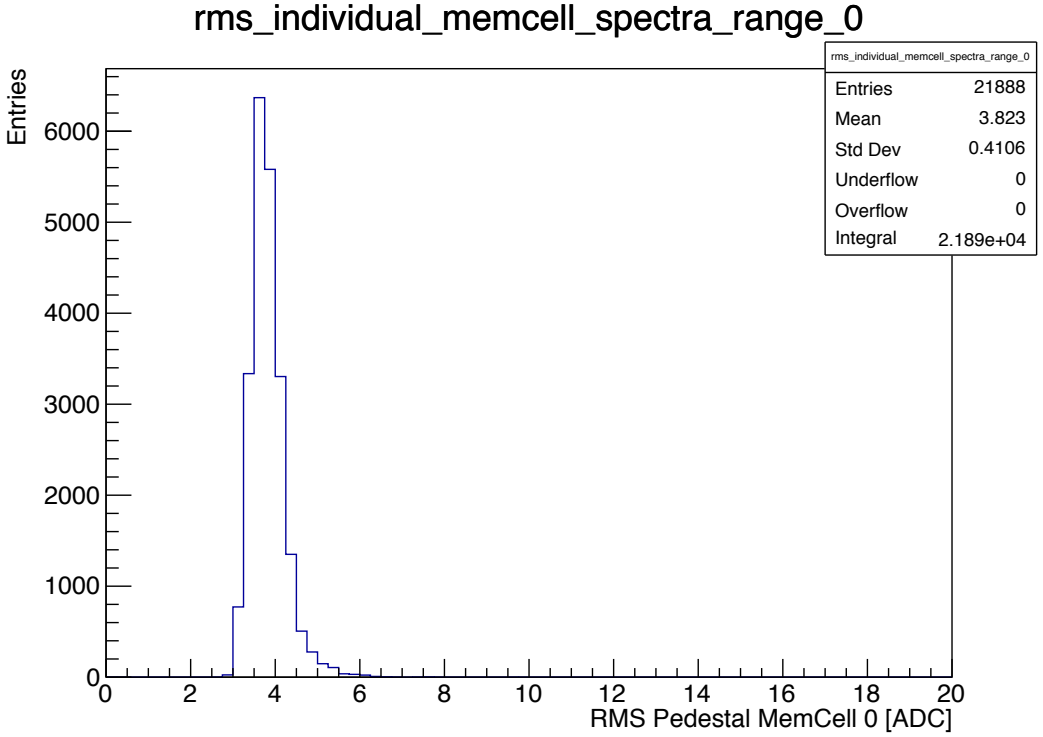


- ➡ As expected: AT Pedestals different from ET Pedestals
- ➡ Completely empty memory cells observed
- ➡ Tail to the right: Some memory cell spectra with high RMS!

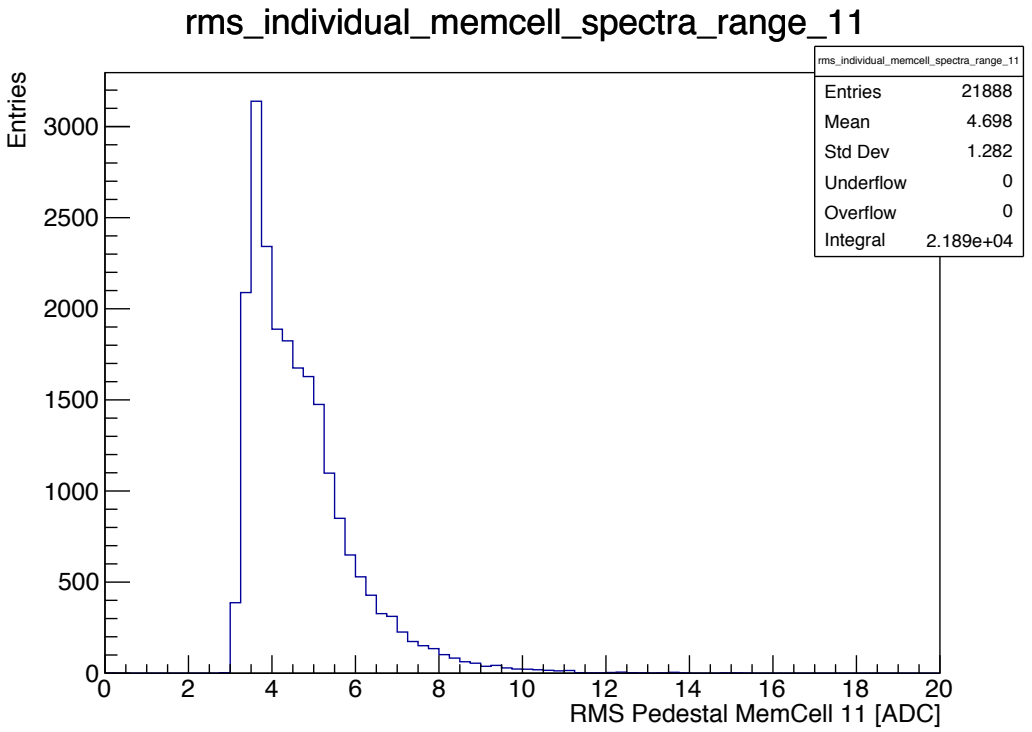
Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

$\sigma_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem=0}$



$\sigma_{Chip,Chn,Mem}, \forall_{Chip,Chn,Mem=11}$

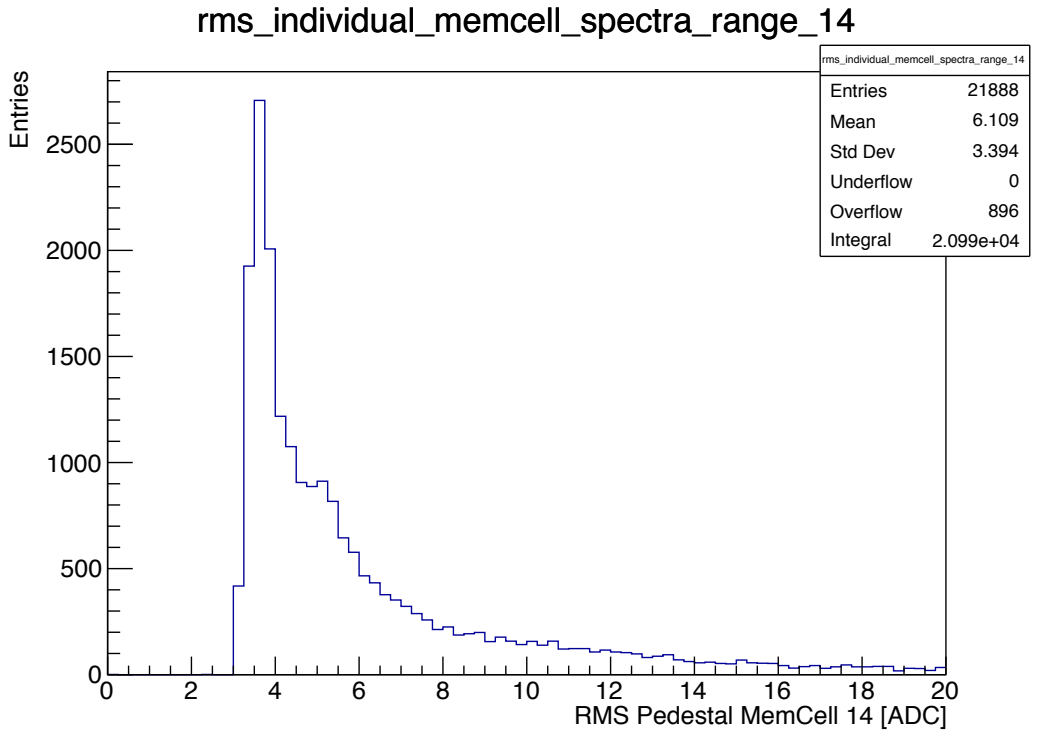


- ➡ Next step: Look at specific memory cells for all 21888 channels, which memory cell contribute to tail?
  - ➡ For increasing memory cell… the tail increases!

Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

$\sigma_{Chip,Chn,Mem}$, $\forall_{Chip,Chn,Mem=14}$



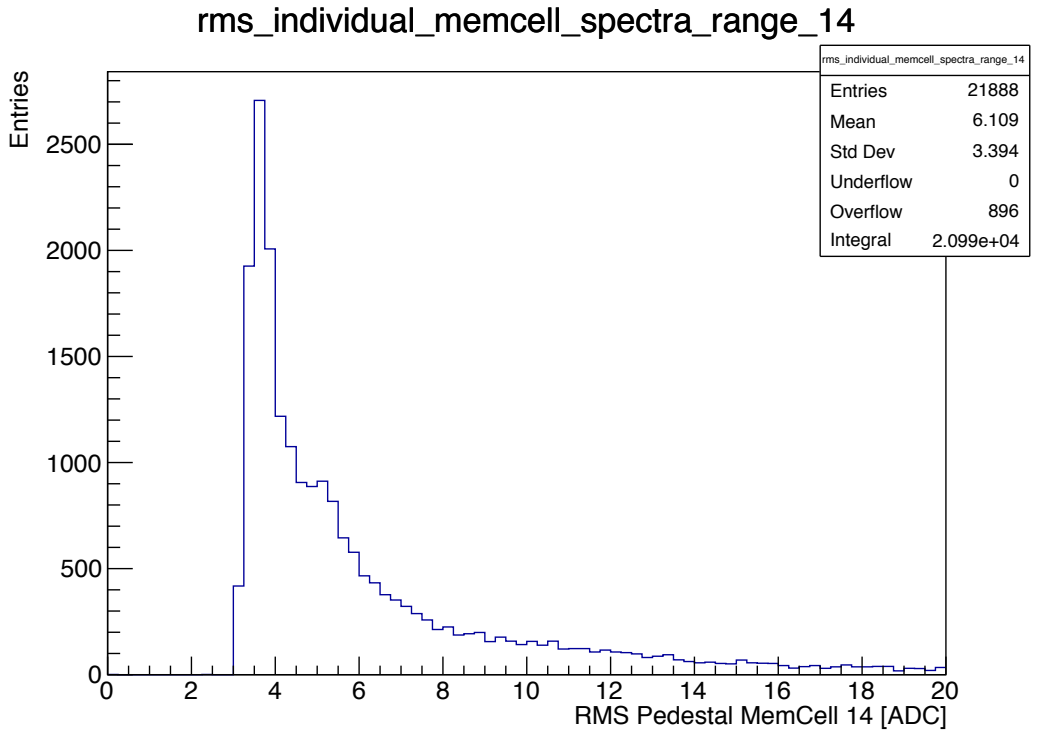
➡ Next step: Look at specific memory cells for all 21888 channels, which memory cell contribute to tail?

➡ For increasing memory cell… the tail increases!

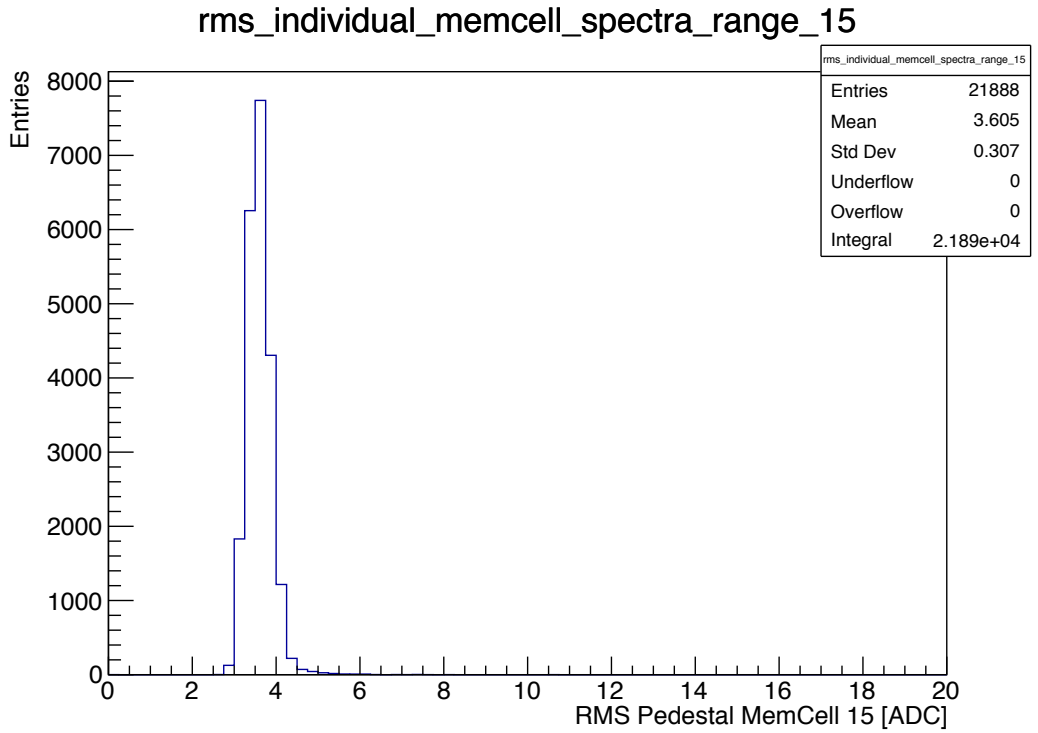
Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

$\sigma_{Chip,Chn,Mem}$, $\forall_{Chip,Chn,Mem=14}$



$\sigma_{Chip,Chn,Mem}$, $\forall_{Chip,Chn,Mem=15}$

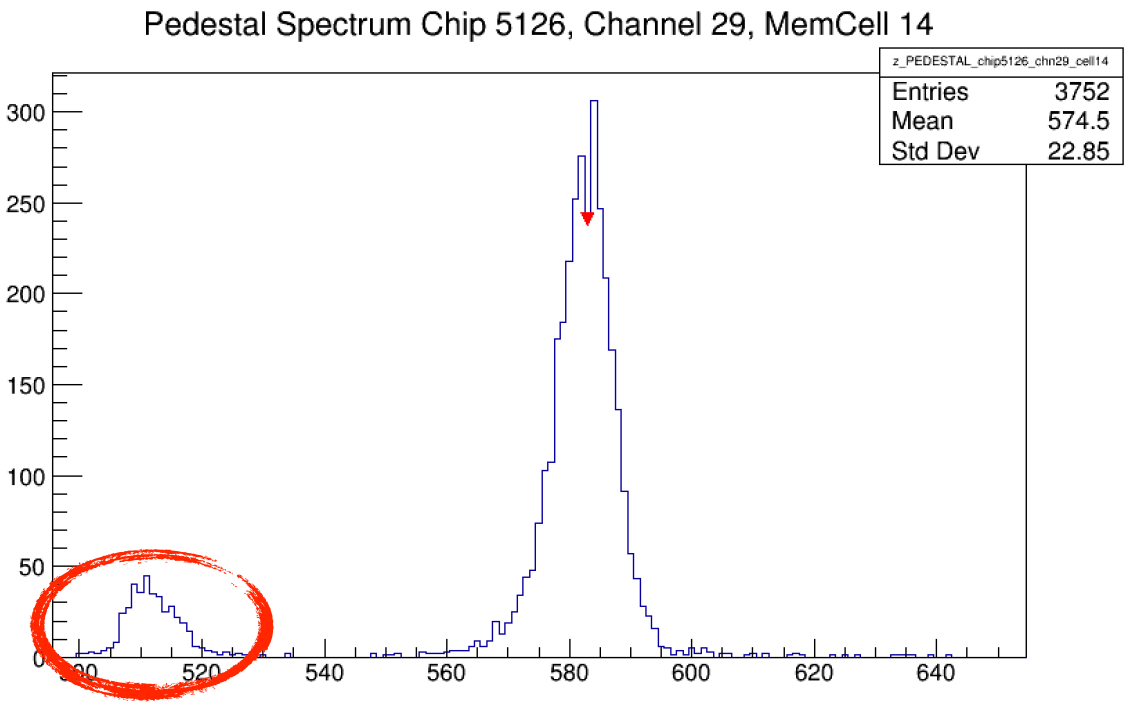


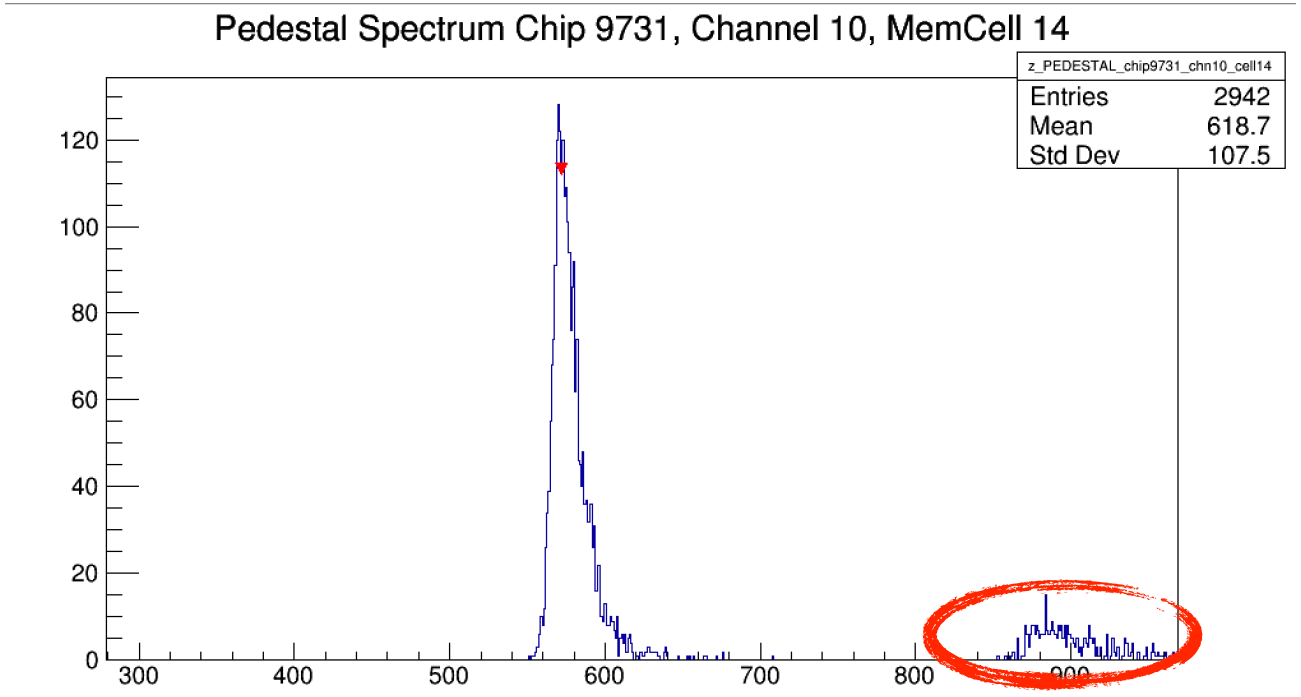
➡ Next step: Look at specific memory cells for all 21888 channels, which memory cell contribute to tail?

➡ For increasing memory cell… the tail increases! … And vanishes for memory cell 15 again!

Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals





- ➡ Next step: Look at specific memory cells for all 21888 channels, which memory cell contribute to tail?
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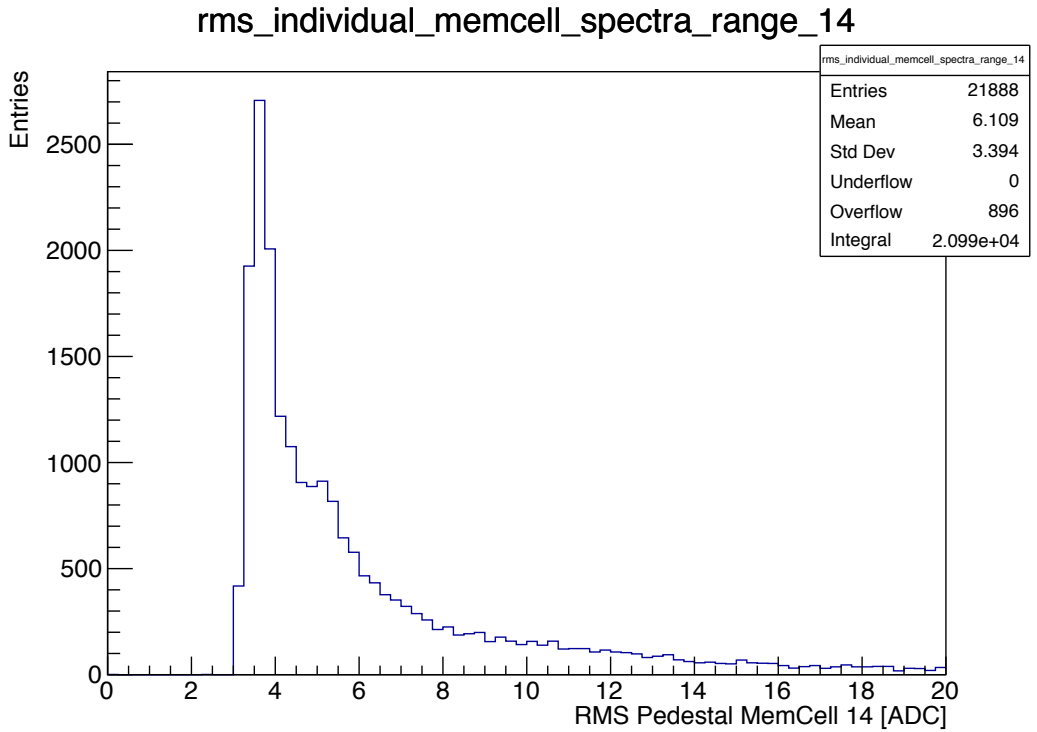
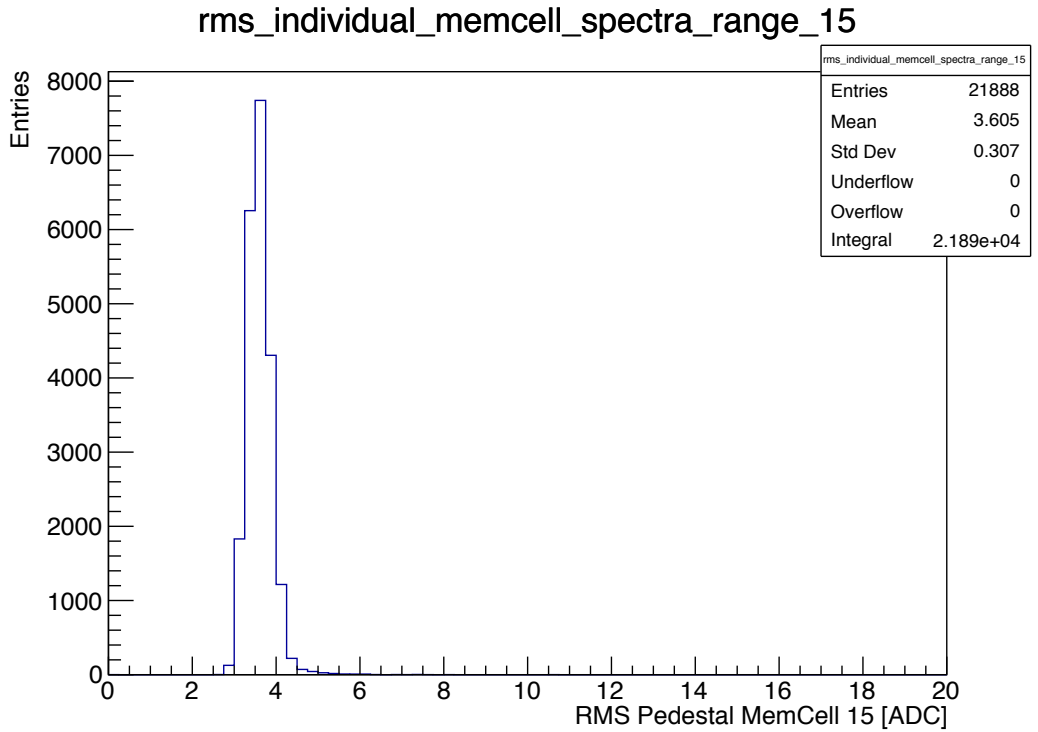
Pedestal Spectra for Individual Memory Cells

Checking Mean and RMS for AT Pedestals

$\sigma_{Chip,Chn,Mem}$, $\forall_{Chip,Chn,Mem=14}$



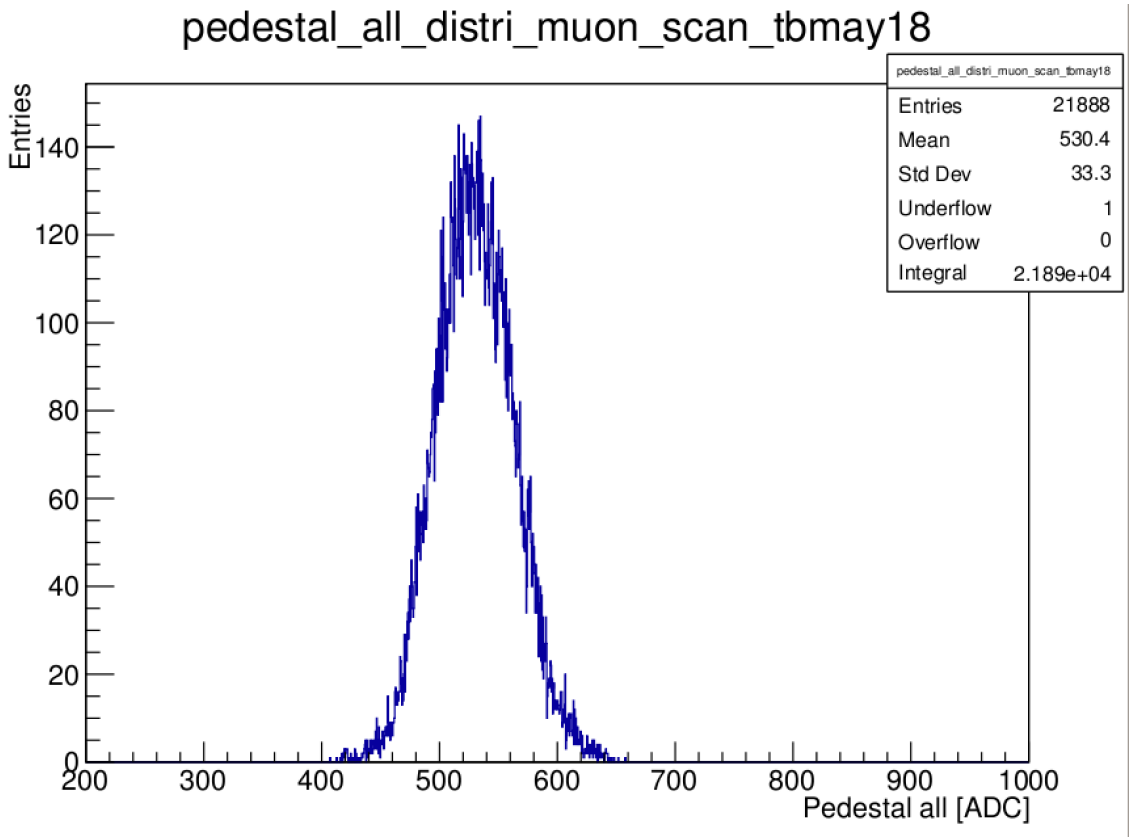
$\sigma_{Chip,Chn,Mem}$, $\forall_{Chip,Chn,Mem=15}$

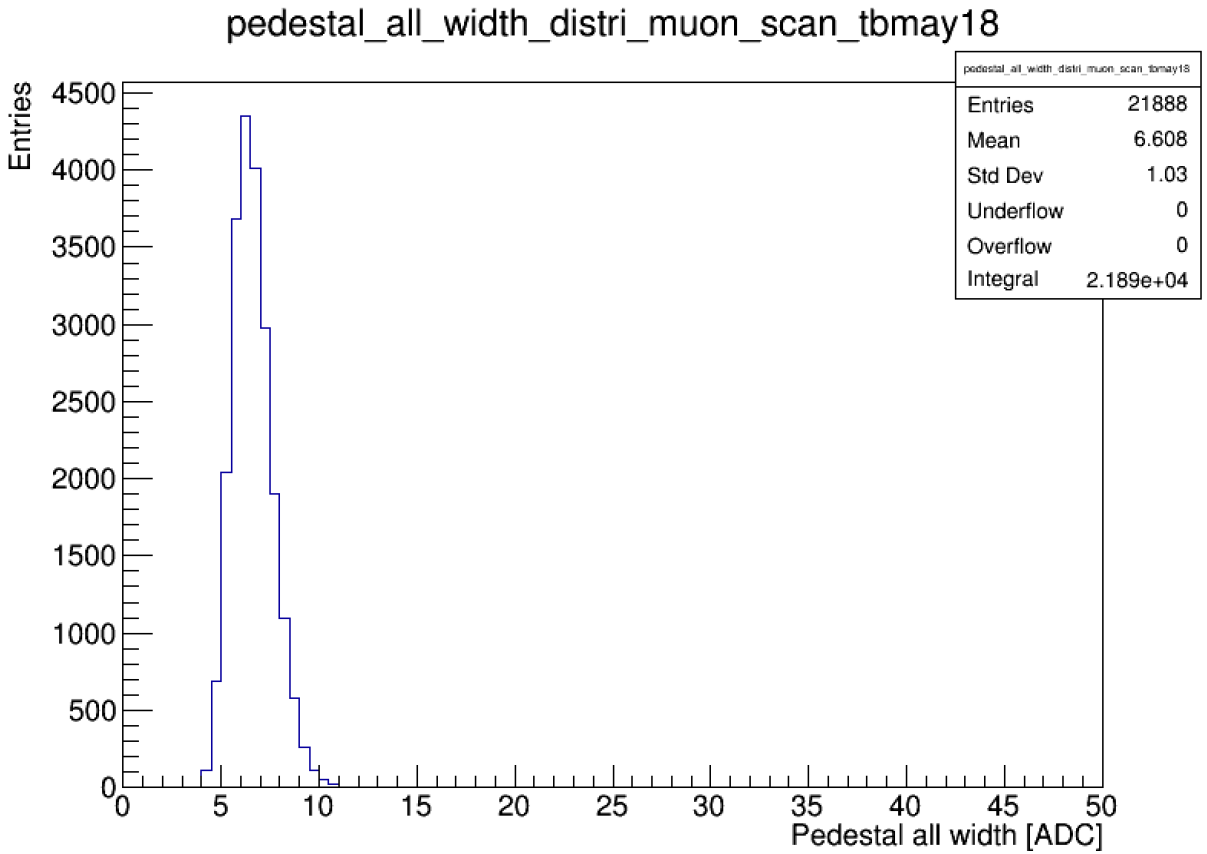


- ➡ Next step: Look at specific memory cells for all 21888 channels, which memory cell contribute to tail?
  - ➡ For increasing memory cell… the tail increases! … And vanishes for memory cell 15 again!
    - ➡ Effects to be investigated

Pedestal Spectra on Channel Level

Checking Mean and RMS for AT Pedestals





- AT Pedestal extraction for full muon scan testbeam may 2018 = table with 21888 entries for ChipID and channel

Pedestal Spectra on Channel Level

Checking Mean and RMS for AT Pedestals

- After checking of „dead channels“ and outliers: Successfully uploaded latest AT Pedestals to DB!

#Module	ChipNumber	Channel	Pedestal	Pedestal_error	status (status = 1)
1	0	0	481.785305136	0.00889661579236	1
1	0	1	491.832580856	0.00726658521666	1
1	0	2	485.582325424	0.0121490242206	1
1	0	3	493.012708251	0.00931112833414	1
1	0	4	486.898452624	0.0100909476184	1
1	0	5	498.078916064	0.00869245020741	1
1	0	6	489.97324745	0.00988652640216	1
1	0	7	483.055672201	0.00970714543338	1
1	0	8	498.00531466	0.008171518852	1
1	0	9	483.878142529	0.00921448359207	1
1	0	10	478.838142878	0.00951221150643	1
1	0	11	488.876983539	0.0103830396268	1
1	0	12	494.214402692	0.00798354212068	1
1	0	13	485.218434259	0.0106420156018	1
1	0	14	486.231247159	0.0127016574687	1
1	0	15	485.421464382	0.0101482023256	1
1	0	16	478.026694018	0.00925337109868	1
1	0	17	495.388808605	0.0101332922433	1
1	0	18	485.91379114	0.00895164260169	1
1	0	19	476.119294634	0.00893082595148	1
1	0	20	488.241596914	0.00865996606029	1
1	0	21	480.217074408	0.00969488543337	1
1	0	22	492.233192854	0.00877672892617	1
1	0	23	486.677299684	0.00954093740945	1
1	0	24	484.271467479	0.00859972385439	1
1	0	25	494.56972085	0.00934121936551	1

Tag: ahc2_pedestal_180821_003

Changes in Calibration Code

For Extraction_ATPedestals and Extraction MIP

- Instead of a memory cell offset in respect to memory cell 1 now the absolute pedestal values are saved in the AT pedestal extraction

```
#format: the ordering of memory cells is inverted for DAQ HBO
#chip   chn     pedposall       pedwidthall     ped0ffsetcell1  ped0ffsetcell2  ped0ffsetcell3  ...     ped0ffsetcell16
256     0       481.785 5.93478 489.536 478.881 485.024 478.375 478.413 482.462 476.177 475.912 477.739 485.246 483.69  483.988 488.229
485.095 489.747 478.942
256     1       491.833 4.84366 489.802 494.461 493.709 486.434 494.906 486.545 490.649 493.348 492.347 493.551 493.976 496.751 491.087
494.14  492.355 490.526
256     2       485.582 8.13804 486.576 475.169 493.617 479.001 484.427 489.664 493.742 473.036 496.672 483.822 484.29  489.681 489.315
489.281 491.04  482.625
256     3       493.013 6.24024 492.945 494.155 498.448 489.943 487.838 492.188 497.063 484.532 496.004 491.498 485.261 507.293 496.845
493.15  495.387 500.158
256     4       486.898 6.77252 491.065 488.88  491.408 478.908 486.826 478.074 492.837 488.274 479.699 481.374 487.267 485.824 500.441
490.163 487.173 491.195
256     5       498.079 5.83483 498.488 497.862 493.755 496.794 502.642 497.632 502.319 496.226 500.981 491.781 496.347 503.216 498.015
497.469 504.127 505.236
256     6       489.973 6.59932 489.716 489.286 492.282 486.524 492.372 483.05  487.44  490.67  481.008 500.867 500.877 495.942 490.642
482.978 492.702 489.859
256     7       483.056 6.48473 489.458 484.401 485.94  478.049 488.316 480.838 479.317 480.238 470.564 478.461 481.253 482.291 492.102
490.592 484.43  492.263
256     8       498.005 5.46142 497.547 500.392 498.463 492.047 494.19  497.909 499.773 503.532 492.823 502.734 497.842 495.357 501.668
508.522 498.56  502.538
256     9       483.878 6.16756 480.685 486.513 486.704 481.233 477.466 482.034 488.144 479.273 480.963 492.28  481.186 498.046 489.944
479.751 490.667 493.335
```

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256     0       481.785 5.93478 489.536 478.881 485.024 478.375 478.413 482.462 476.177 475.912 477.739 485.246 483.69  483.988 488.229
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256     2       485.582 8.13804 486.576 475.169 493.617 479.001 484.427 489.664 493.742 473.036 496.672 483.822 484.29  489.681 489.315
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493.15  495.387 500.158
256     4       486.898 6.77252 491.065 488.88  491.408 478.908 486.826 478.074 492.837 488.274 479.699 481.374 487.267 485.824 500.441
490.163 487.173 491.195
256     5       498.079 5.83483 498.488 497.862 493.755 496.794 502.642 497.632 502.319 496.226 500.981 491.781 496.347 503.216 498.015
497.469 504.127 505.236
256     6       489.973 6.59932 489.716 489.286 492.282 486.524 492.372 483.05  487.44  490.67  481.008 500.867 500.877 495.942 490.642
482.978 492.702 489.859
256     7       483.056 6.48473 489.458 484.401 485.94  478.049 488.316 480.838 479.317 480.238 470.564 478.461 481.253 482.291 492.102
490.592 484.43  492.263
256     8       498.005 5.46142 497.547 500.392 498.463 492.047 494.19  497.909 499.773 503.532 492.823 502.734 497.842 495.357 501.668
508.522 498.56  502.538
256     9       483.878 6.16756 480.685 486.513 486.704 481.233 477.466 482.034 488.144 479.273 480.963 492.28  481.186 498.046 489.944
479.751 490.667 493.335
```

- This enabled two new features:

Pull Request

1. Calculation of memory cell offsets in respect to pedestal_all
2. Implementation of a memory cell - wise pedestal subtracted MIP calibration - no pedestal_all used anymore!

PedestalMemoryCellOffsets Collection

A new Infrastructure in DB

1. Calculation of memory cell offsets in respect to pedestal_all

```
#Module ChipNumber      Channel memcell0_offset memcell0_offset_error   status (status = 1)memcell1_offset      memcell1_offset_error
status (status = 1)memcell2_offset      memcell2_offset_error   status (status = 1)memcell3_offset      memcell3_offset_error   status
(status = 1)memcell4_offset     memcell4_offset_error   status (status = 1)memcell5_offset      memcell5_offset_error   status (status =
1)memcell6_offset       memcell6_offset_error   status (status = 1)memcell7_offset      memcell7_offset_error   status (status =
1)memcell8_offset       memcell8_offset_error   status (status = 1)memcell9_offset      memcell9_offset_error   status (status =
1)memcell10_offset      memcell10_offset_error  status (status = 1)memcell11_offset     memcell11_offset_error  status (status =
1)memcell12_offset      memcell12_offset_error  status (status = 1)memcell13_offset     memcell13_offset_error  status (status =
1)memcell14_offset      memcell14_offset_error  status (status = 1)memcell15_offset     memcell15_offset_error  status (status = 1)
1       0       0       7.751   0.0191798207637 1       -2.904  0.0183161306626 1       3.239   0.0193373790115 1       -3.41
0.0205897095745 1       -3.372  0.0216296020876 1       0.677   0.0219600849448 1       -5.608  0.0223278777423 1       -5.873
0.021713797024  1       -4.046  0.0261125566276 1       3.461   0.0288800998395 1       1.905   0.0248690076202 1       2.203
0.0421186722925 1       6.444   0.036705803267  1       3.31    0.0393820129239 1       7.962   0.0555415373393 1       -2.843
0.124727824442  1
1       0       1       -2.031  0.018320504328  1       2.628   0.0172221174549 1       1.876   0.0199082916261 1       -5.399
0.0196911346544 1       3.073   0.0210563575978 1       -5.288  0.0216163210064 1       -1.184  0.0225354793044 1       1.515
0.021581372774  1       0.514   0.0255253858271 1       1.718   0.0282260726459 1       2.143   0.0249141927763 1       4.918
0.040123121584  1       -0.746  0.0368409750292 1       2.307   0.0378229149412 1       0.522   0.0549172435432 1       -1.307
0.123786893658  1
1       0       2       0.994   0.0212595893748 1       -10.413 0.0203543775909 1       8.035   0.0223405562502 1       -6.581
0.0233487418268 1       -1.155  0.023898224846  1       4.082   0.0243450213866 1       8.16    0.0257404390778 1       -12.546
0.0240605068975 1       11.09   0.0287243172915 1       -1.76   0.0304057747025 1       -1.292  0.0270163585744 1       4.099
0.0398377254202 1       3.733   0.0362536384343 1       3.699   0.0392738122017 1       5.458   0.0588283074644 1       -2.957
0.116797410144  1
1       0       3       -0.068  0.019335018054  1       1.142   0.0180146303516 1       5.435   0.0199569103349 1       -3.07
0.021093090292  1       -5.175  0.0218188966074 1       -0.825  0.0221884309019 1       4.05    0.0222706877241 1       -8.481
0.0220509091911 1       2.991   0.029026538125  1       -1.515  0.031424547589  1       -7.752  0.0252814861208 1       14.28
0.0423279857883 1       3.832   0.0349862317489 1       0.137   0.0385971328454 1       2.374   0.0561399373954 1       7.145
0.134192076332  1
1       0       4       4.167   0.0195283464582 1       1.982   0.0182630296725 1       4.51    0.0203934237946 1       -7.99
0.0207996173671 1       -0.072  0.0220188345083 1       -8.824  0.0226406181141 1       5.939   0.0234514774464 1       1.376
0.0223956793039 1       -7.199  0.0276552102012 1       -5.524  0.0290575848053 1       0.369   0.0253507741887 1       -1.074
0.0459462836796 1       13.543  0.0372588256321 1       3.265   0.0398937946637 1       0.275   0.0556304256362 1       4.297
0.131785916561  1
1       0       5       0.409   0.0231469418368 1       -0.217  0.0218316524476 1       -4.324  0.0233994171269 1       -1.285
0.0261974884238 1       4.563   0.0270882275914 1       -0.447  0.0274055607459 1       4.24    0.0305076235817 1       -1.853
0.0268635033644 1       2.902   0.034036380856  1       -6.298  0.0356277321017 1       -1.732  0.03099312376   1       5.137
0.0538740035126 1       -0.064  0.0422226989127 1       -0.61   0.0493713217281 1       6.048   0.0703847239105 1       7.157
0.148115102324  1
```

- Memory-cell wise pedestal subtraction in the reconstruction

➡ To be tested!

Tag: ahc2_pedestalmemorycelloffset_180822

+ PedestalMemCell branch in calice_calib

The MIP calibration

Status

2. Implementation of a memory cell - wise pedestal subtracted MIP calibration - no pedestal_all used anymore!

➡ Direct extraction of MPV!

- Even when HTC Bird made some problems…

The MIP calibration

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The MIP calibration

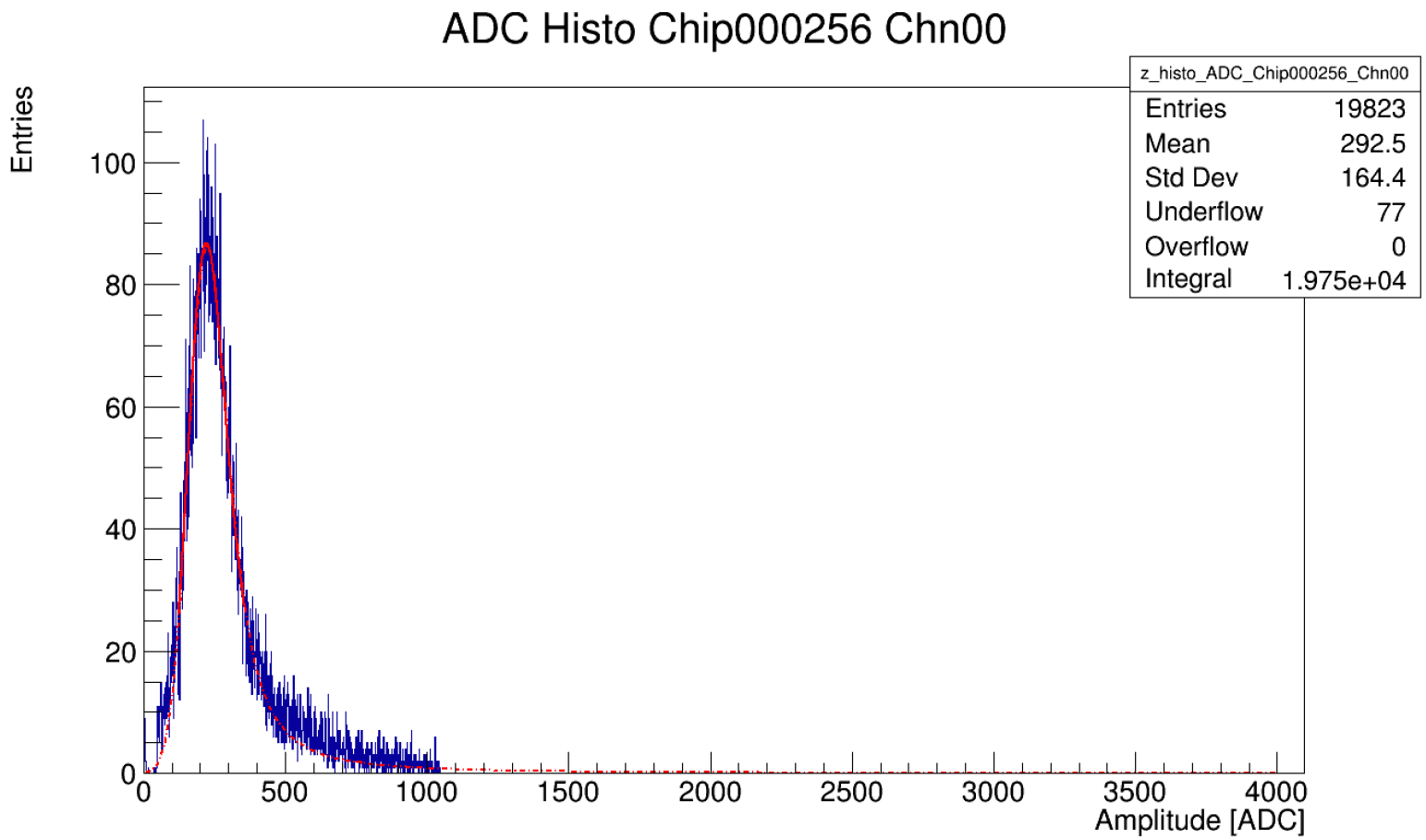
Status

2. Implementation of a memory cell - wise pedestal subtracted MIP calibration - no pedestal_all used anymore!

➡ Direct extraction of MPV!

- Even when HTC Bird made some problems…
- Yesterday finally MIP calibration successfully finished!

➡ Quality/Outlier check

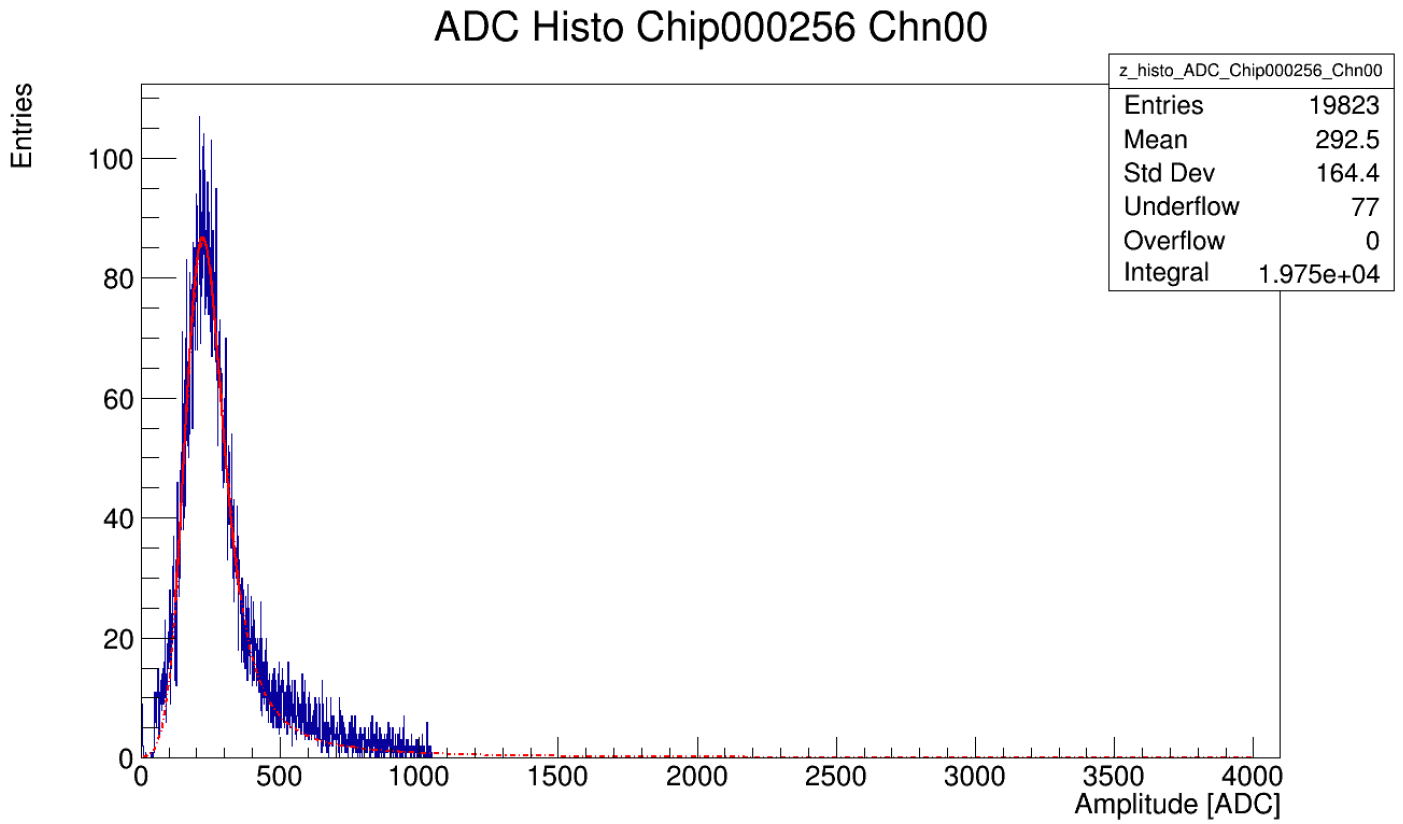


MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

➡ 21870/21888 channels fitted with chi2/ndf < 5

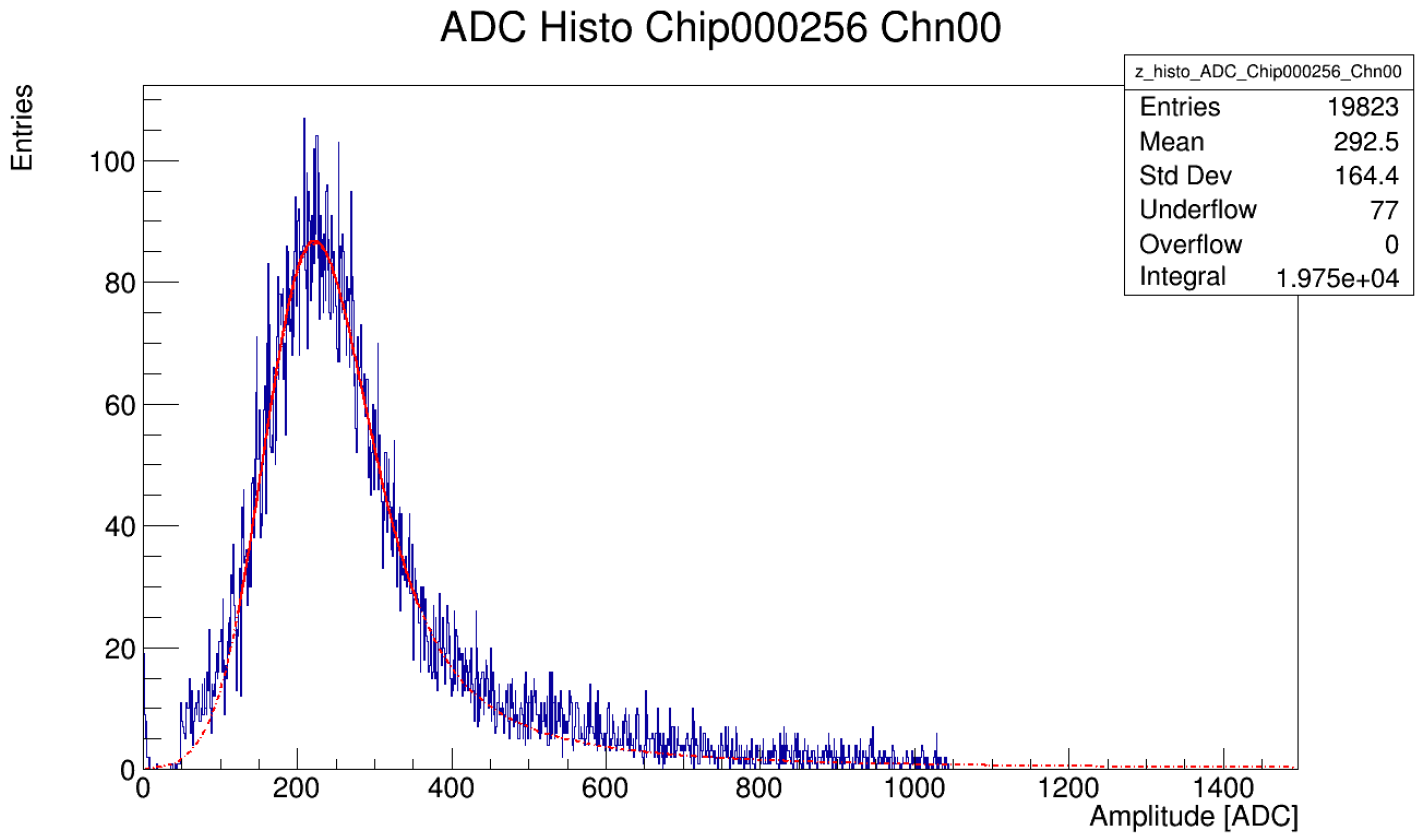


MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

➡ 21870/21888 channels fitted with chi2/ndf < 5



MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

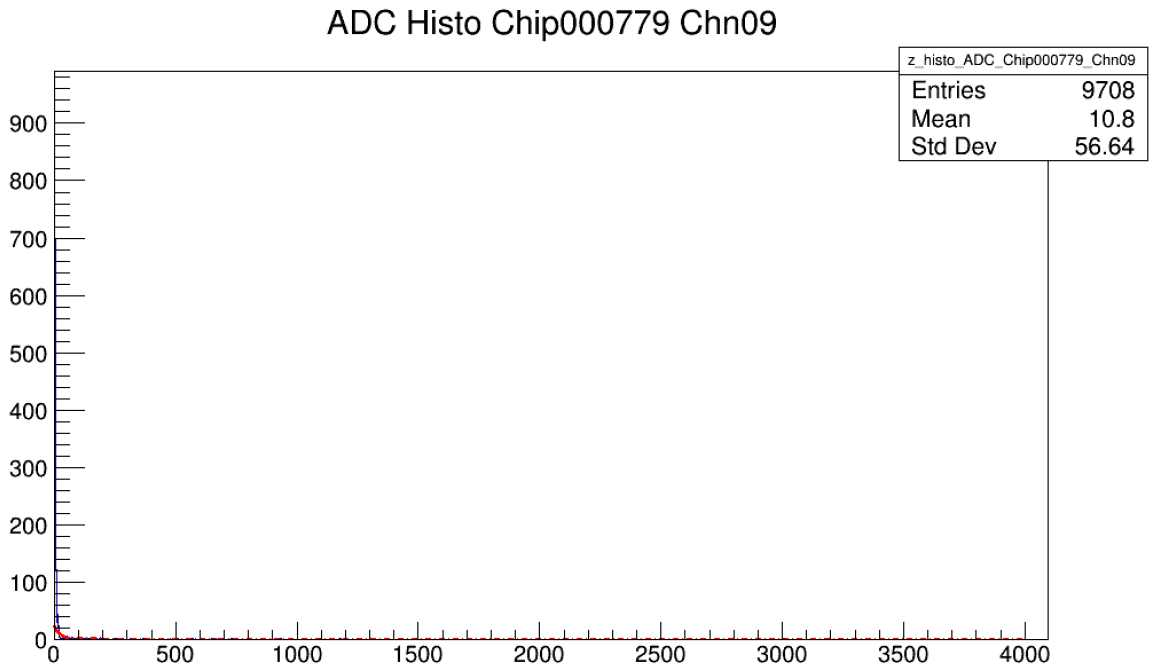
- ➡ 21870/21888 channels fitted with chi2/ndf < 5
- ➡ 12/21888 channels fitted with chi2/ndf >= 5

MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/21888 channels fitted with chi2/ndf < 5
- ➡ 12/21888 channels fitted with chi2/ndf >= 5
  - ➡ 5 channels of Chip 779: Only entries around 0..



MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

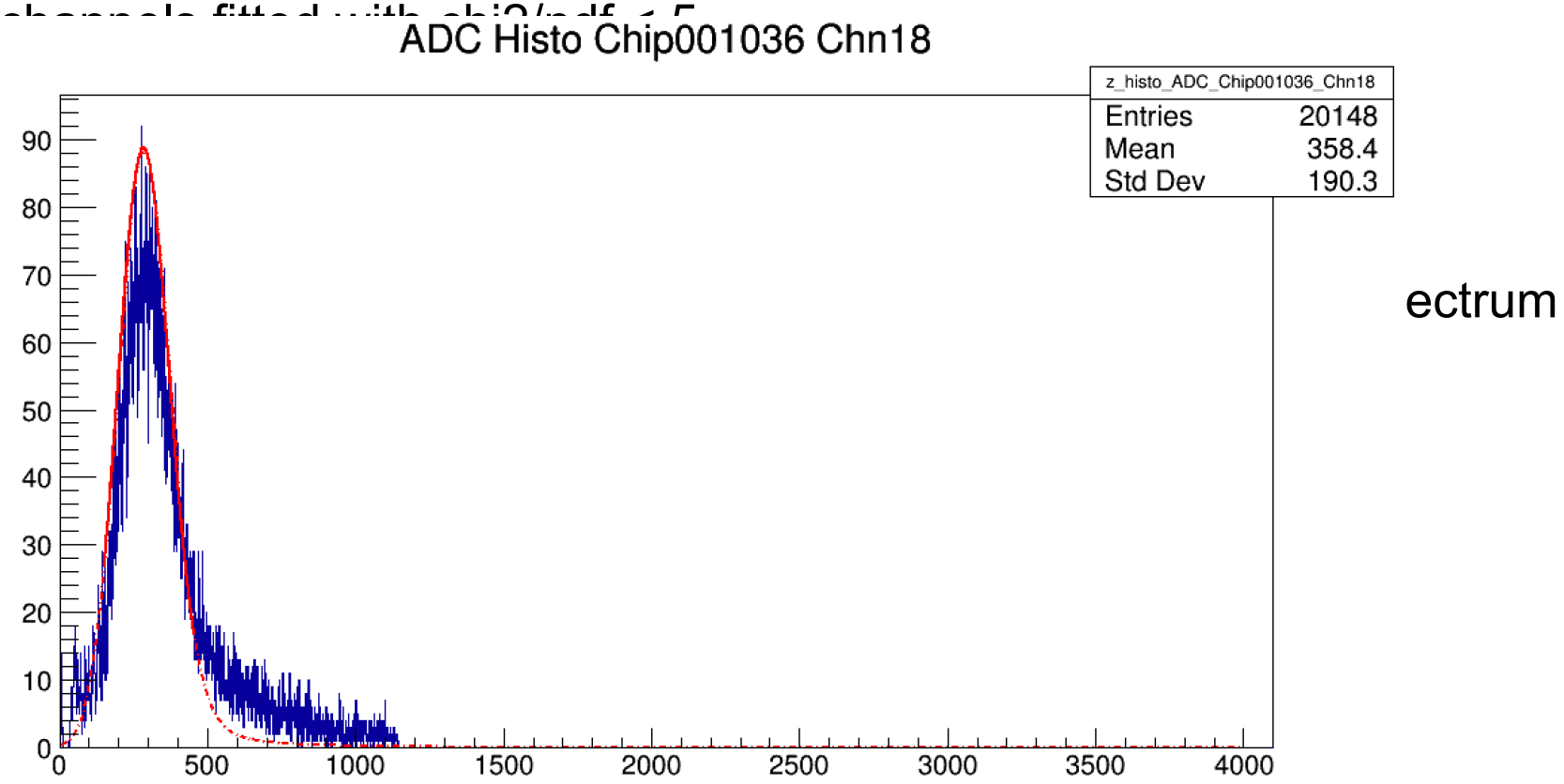
- ➡ 21870/21888 channels fitted with chi2/ndf < 5
- ➡ 12/21888 channels fitted with chi2/ndf >= 5
  - ➡ 5 channels of Chip 779: Only entries around 0..
  - ➡ 7 channels of different Chips: Bad fit result due to fit fail/bad shape of spectrum

MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/218[illegible] channels fitted with chi2/ndf < 5
- ➡ 12/21888 c[illegible]
  - ➡ 5 channe[illegible]
  - ➡ 7 channe[illegible]



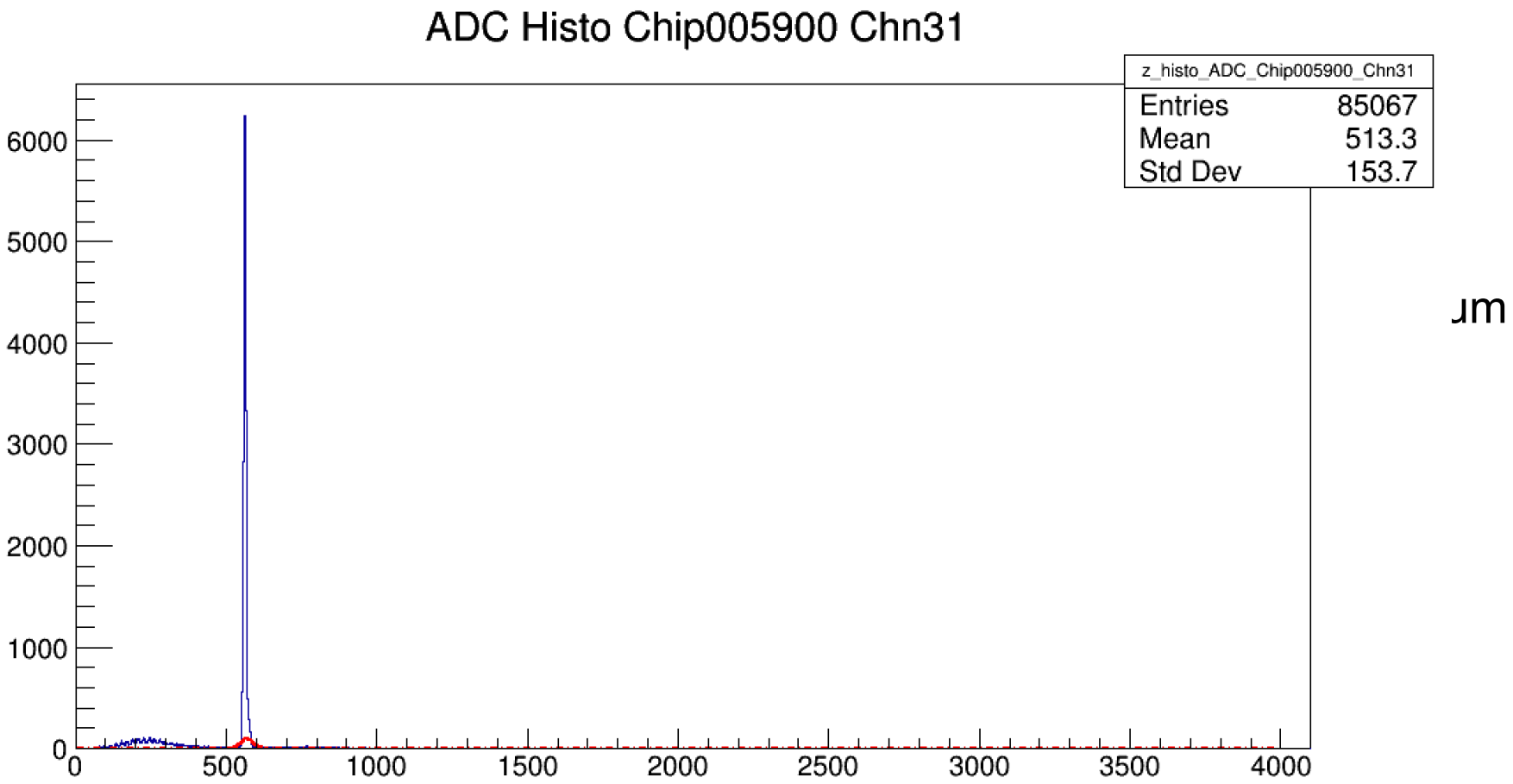
ectrum

MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/2
- ➡ 12/218
  - ➡ 5 ch
  - ➡ 7 ch



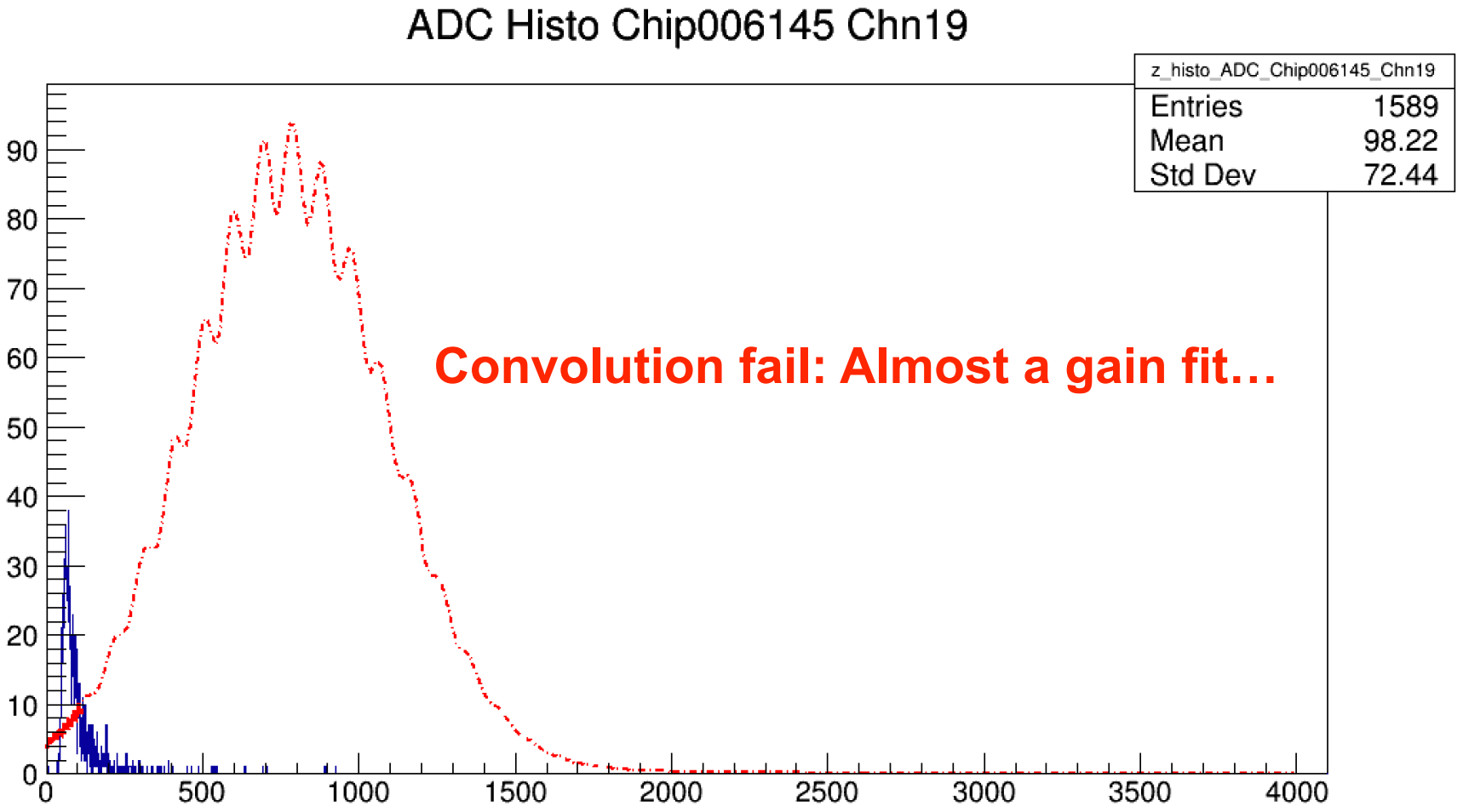
ɹm

MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870
- ➡ 12/218
  - ➡ 5 ch
  - ➡ 7 ch

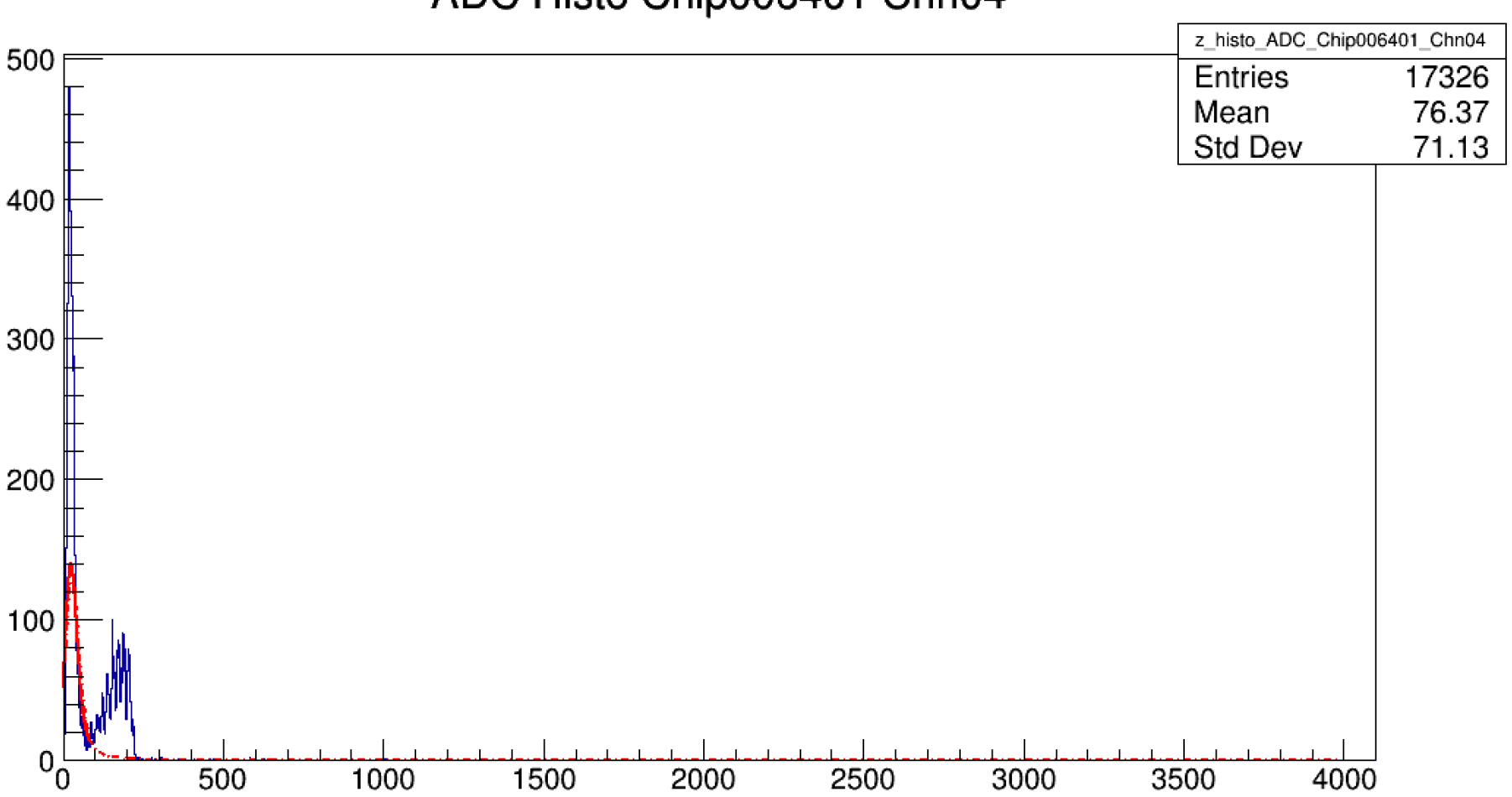


MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/2
- ➡ 12/218
  - ➡ 5 cha
  - ➡ 7 cha

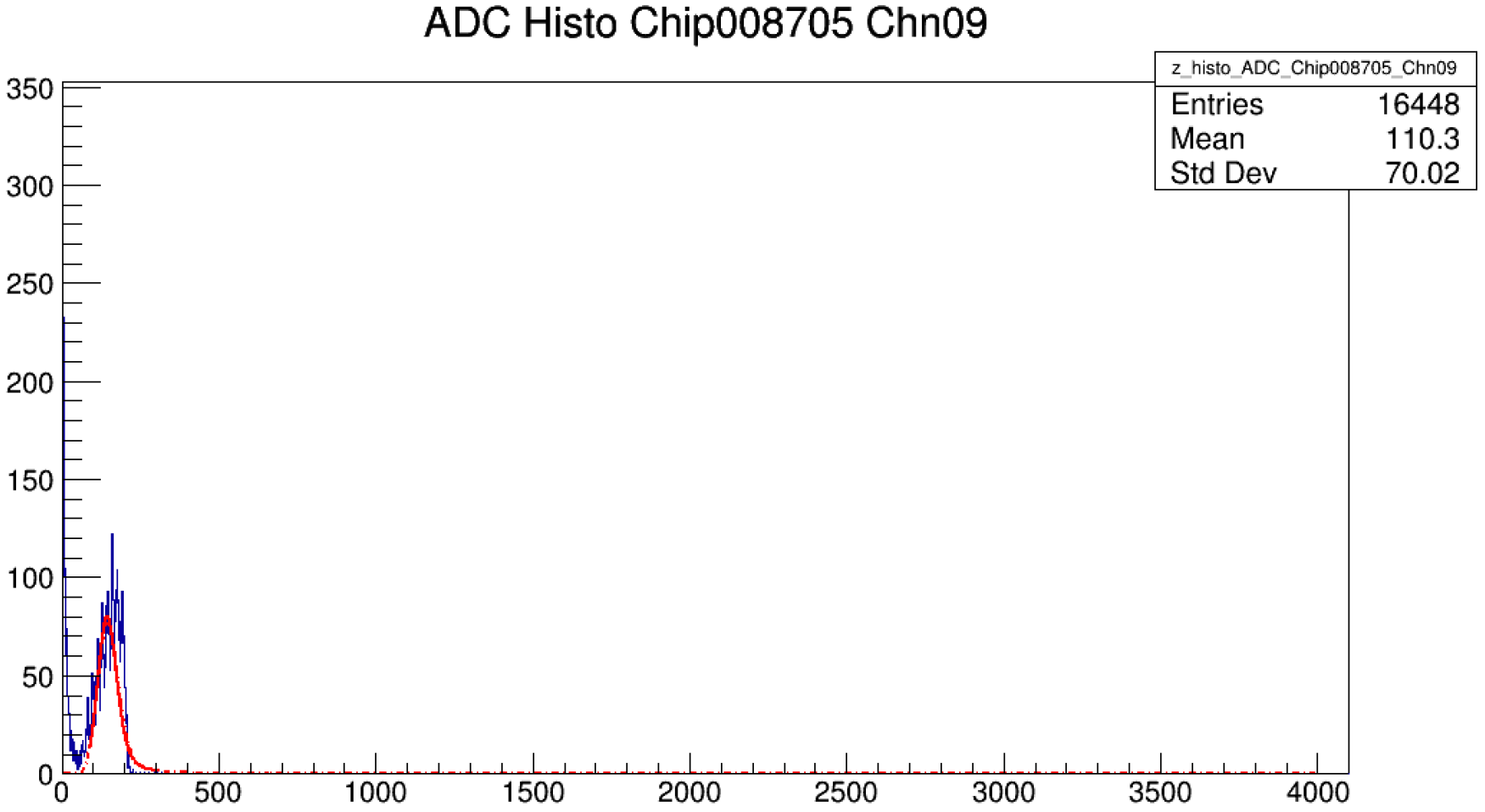


MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/
- ➡ 12/218
  - ➡ 5 ch
  - ➡ 7 ch

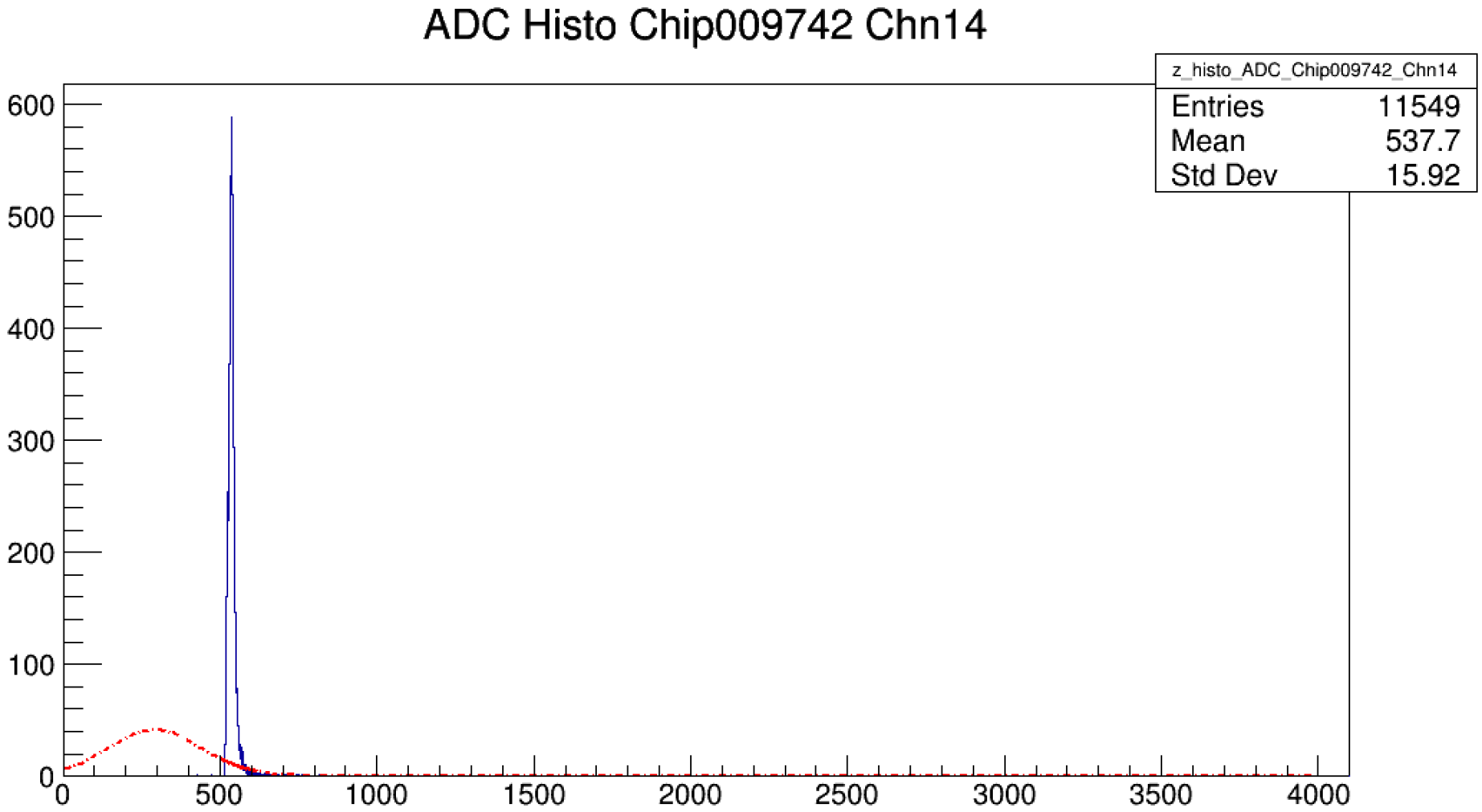


MIP Constants

Quality Checks

Status: Ex

- ➡ 218
- ➡ 12/2
  - ➡ 5
  - ➡ 7

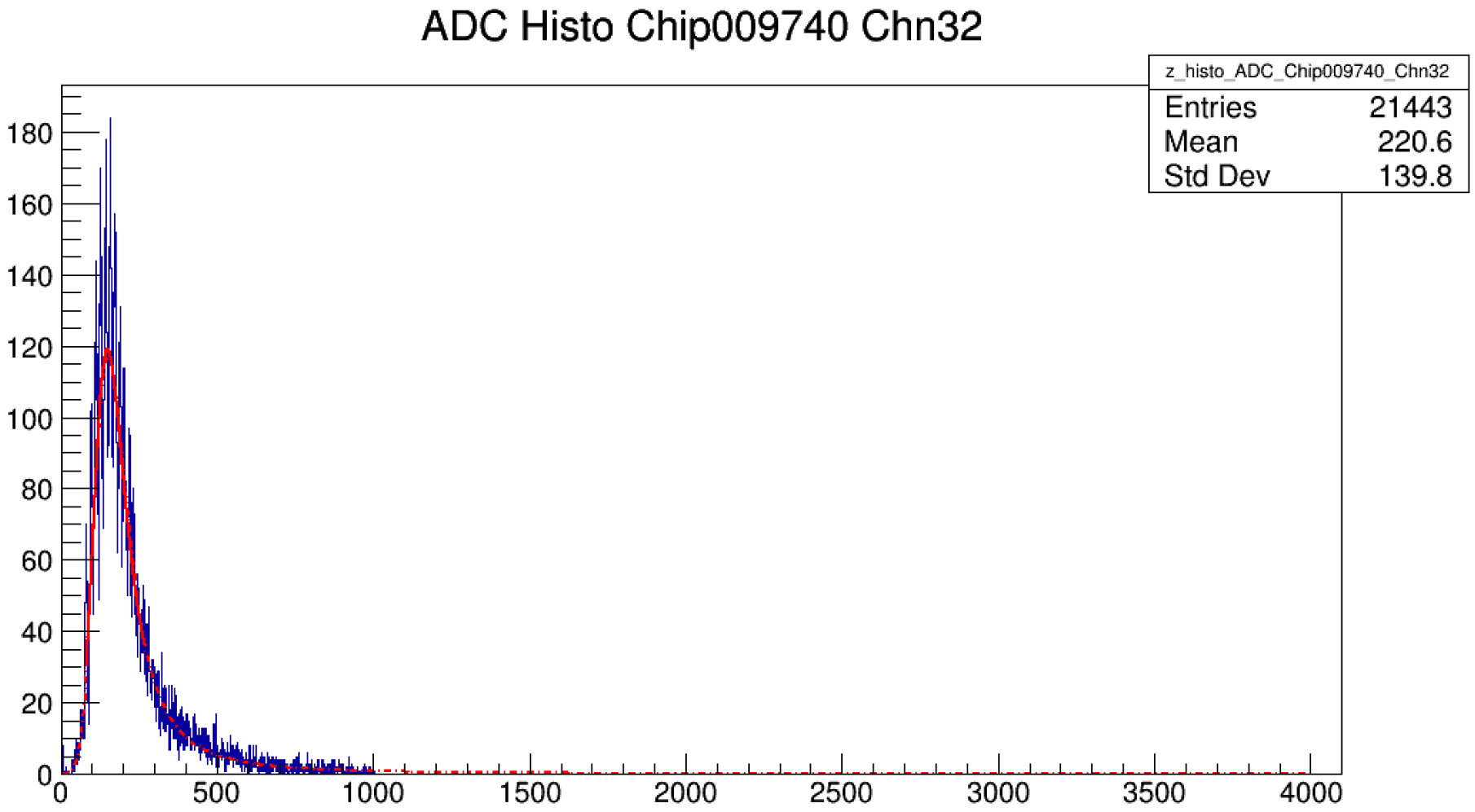


MIP Constants

Quality Checks

Status: E

- ➡ 218
- ➡ 12/2
  - ➡ 5
  - ➡ 7



MIP Constants

Quality Checks

Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- 21870/21888 channels fitted with chi2/ndf < 5
- 12/21888 channels fitted with chi2/ndf >= 5
- 6/21888 channels not fitted, dead/low statistics (nHits < 1000)

MIP Constants

Quality Checks

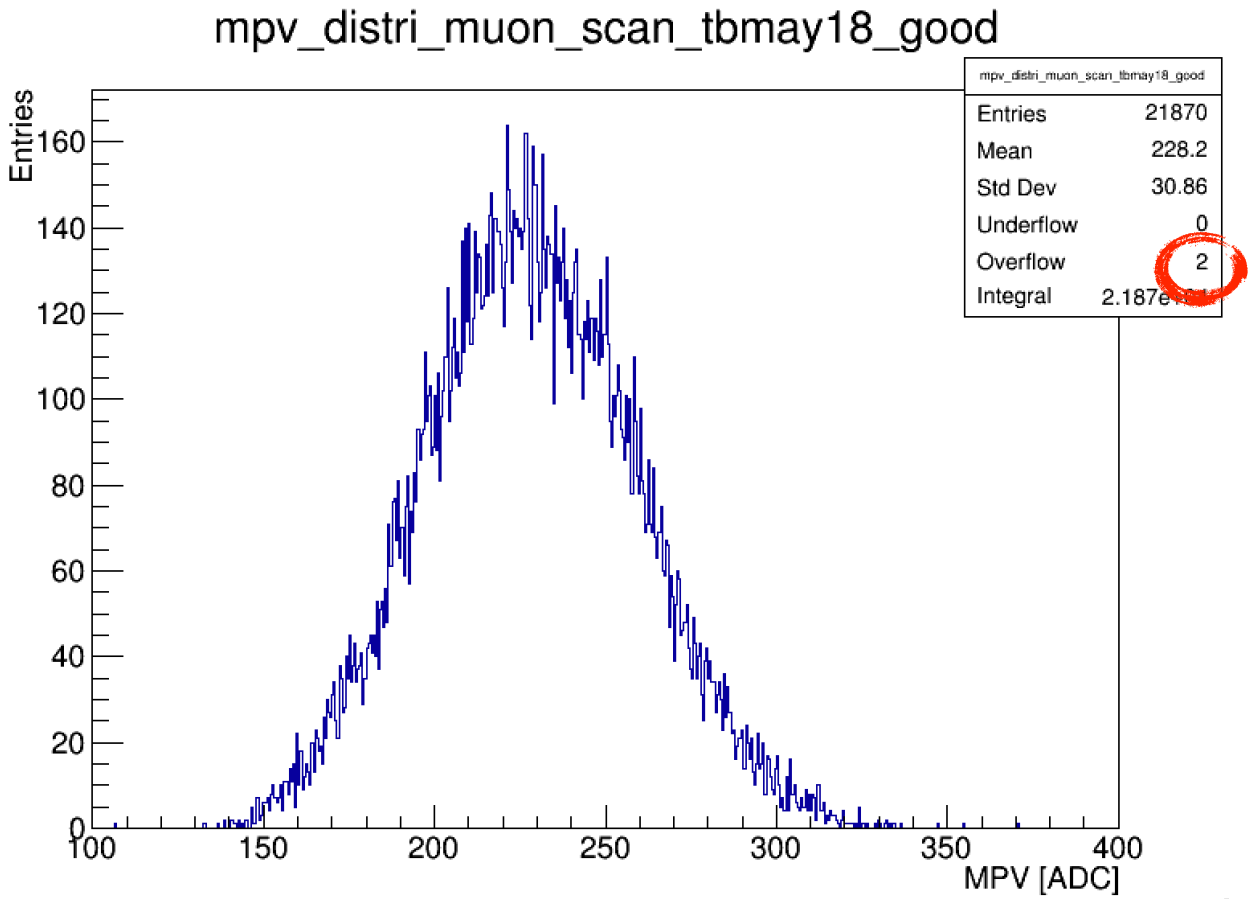
Status: Extraction of MIP constants finally done for full muon scan of May2018 testbeam

- ➡ 21870/21888 channels fitted with chi2/ndf < 5
- ➡ 12/21888 channels fitted with chi2/ndf >= 5
- ➡ 6/21888 channels not fitted, dead/low statistics (nHits < 1000)
  - ➡ 3 channels (12,17,32) of Chip 779 **NEW!**
  - ➡ 3 channels (Chip: 1538 Channel: 3, Chip: 3848 Channel: 32, Chip: 8455 Channel: 5)

Already found by Yuji!

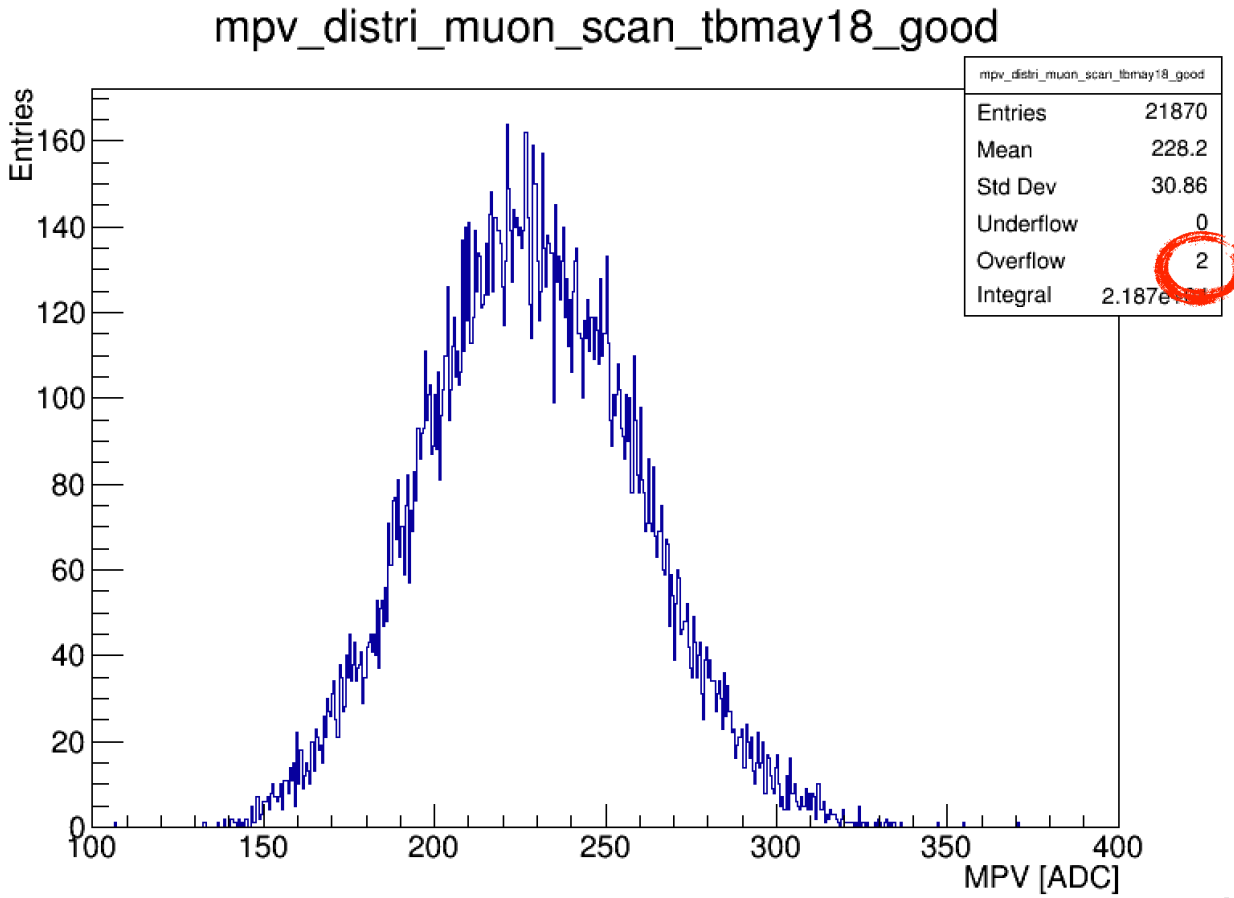
MIP Constants

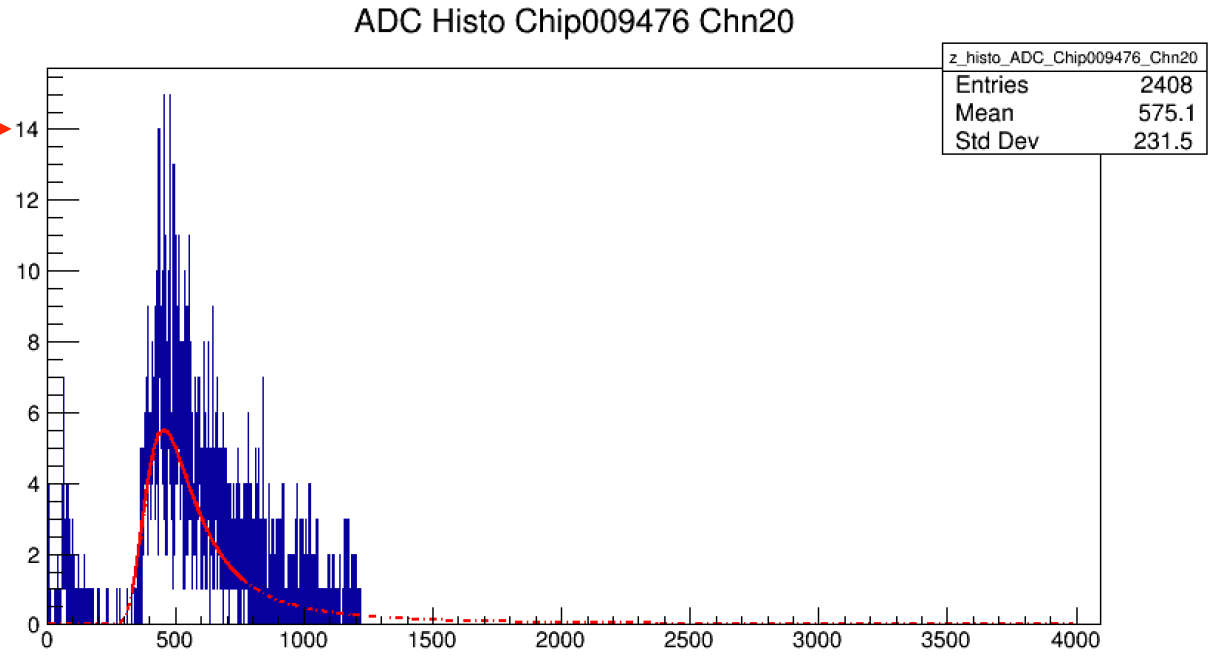
Quality Checks for Fit Results „good“ spectra 21870/21888



MIP Constants

Quality Checks for Fit Results „good“ spectra 21870/21888

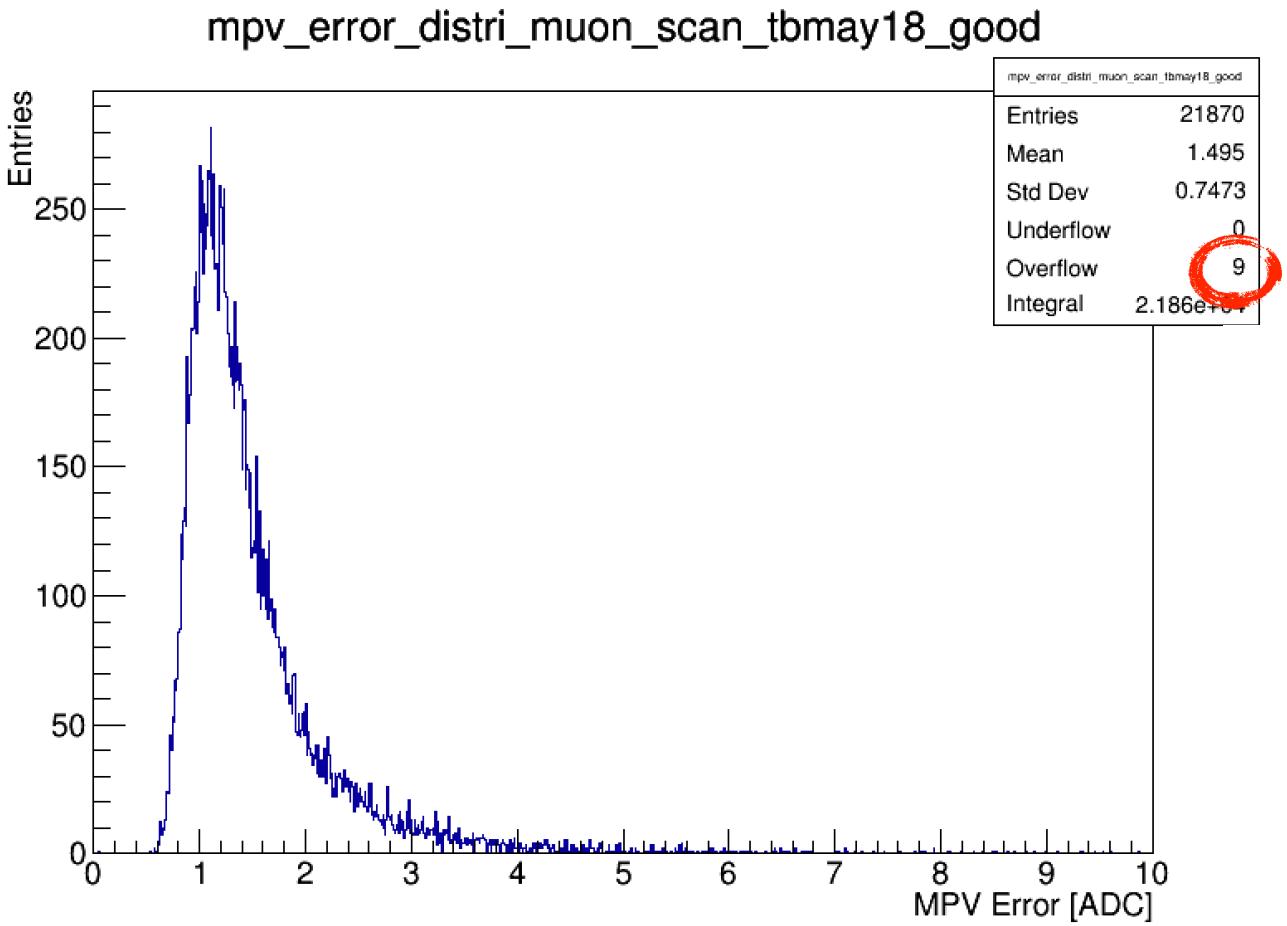


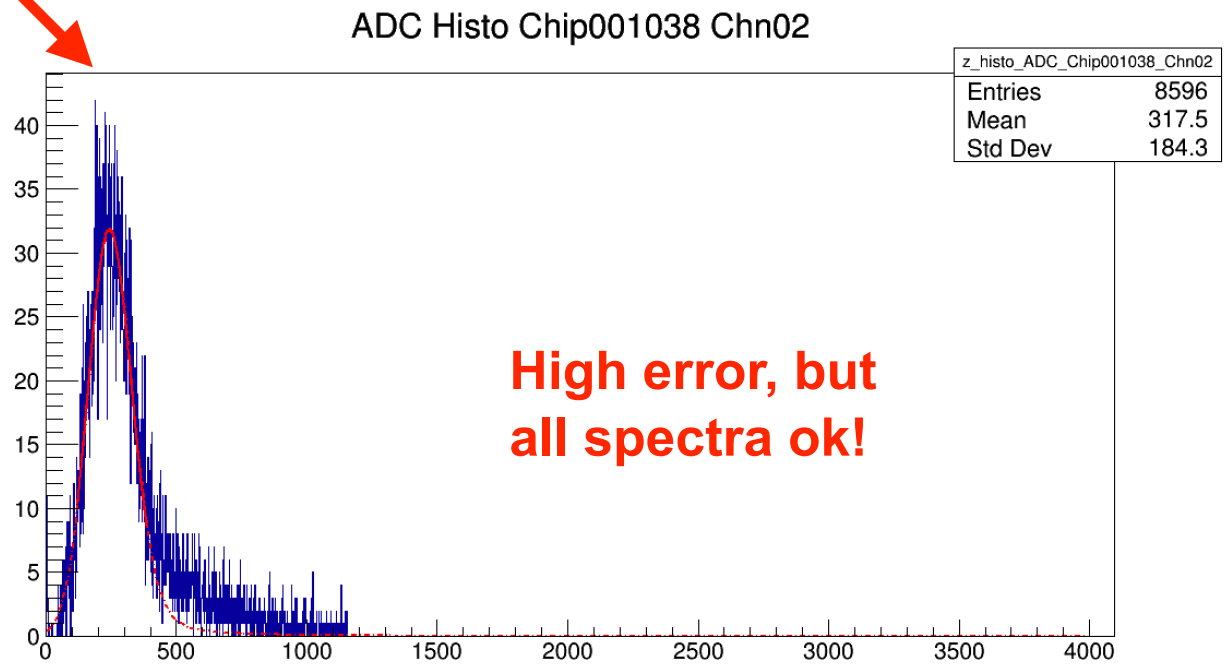


Excluded for DB

MIP Constants

Quality Checks for Fit Results „good“ spectra 21870/21888

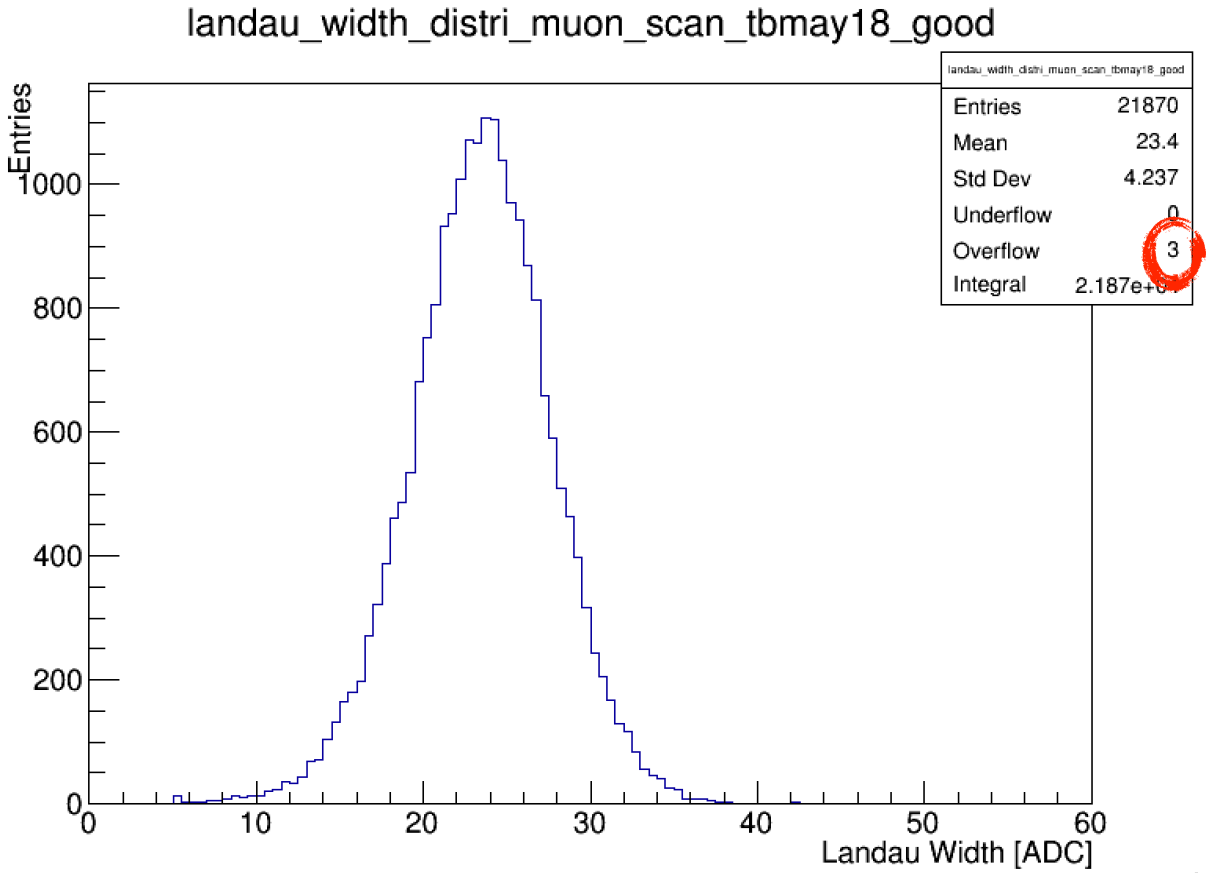


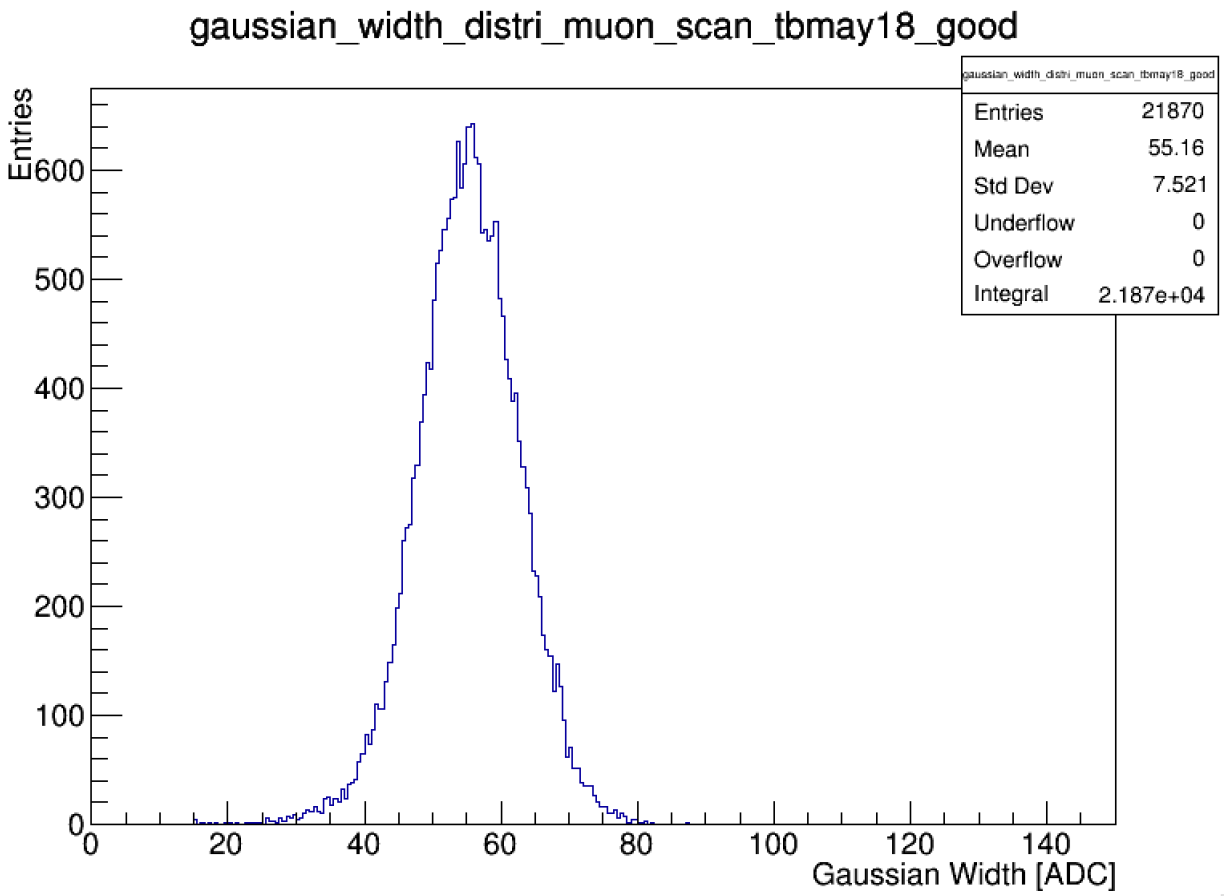


High error, but all spectra ok!

MIP Constants

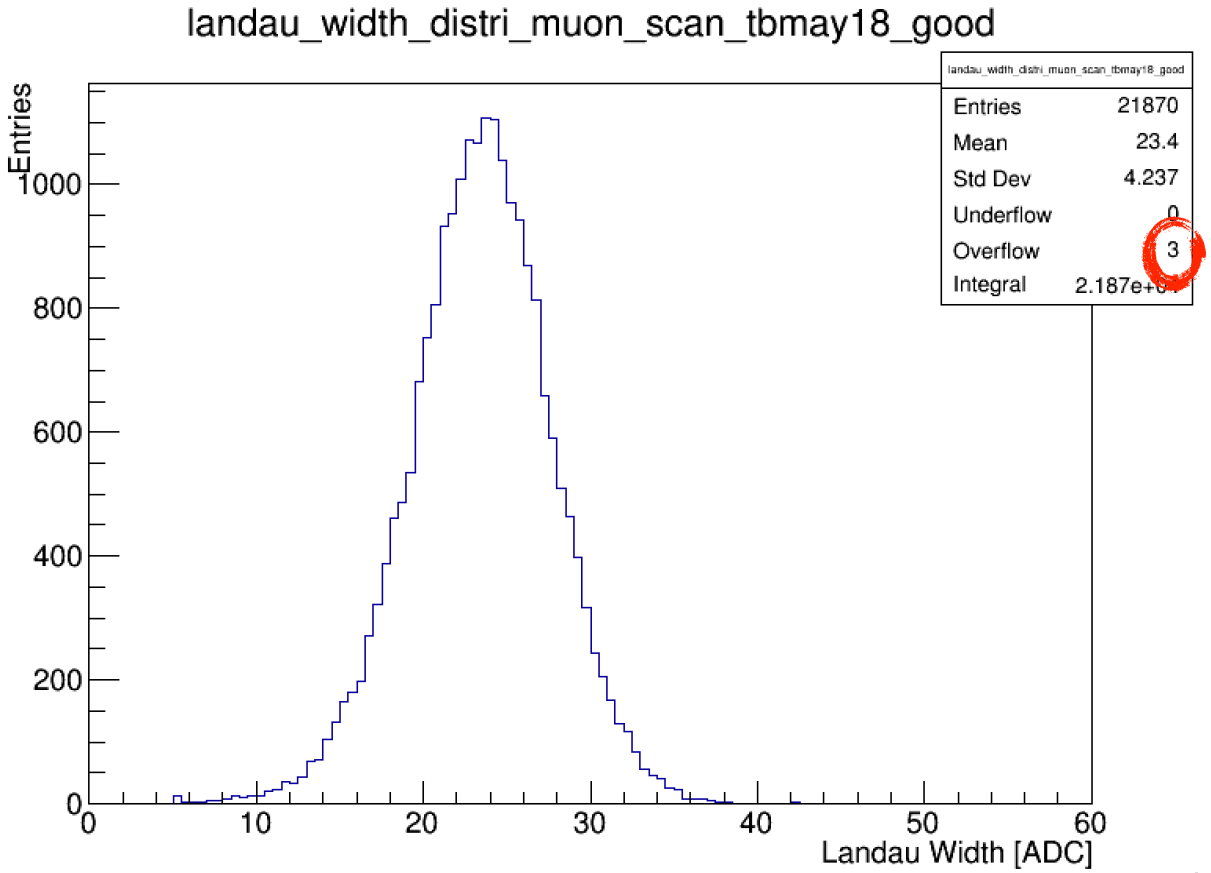
Quality Checks for Fit Results „good“ spectra 21870/21888

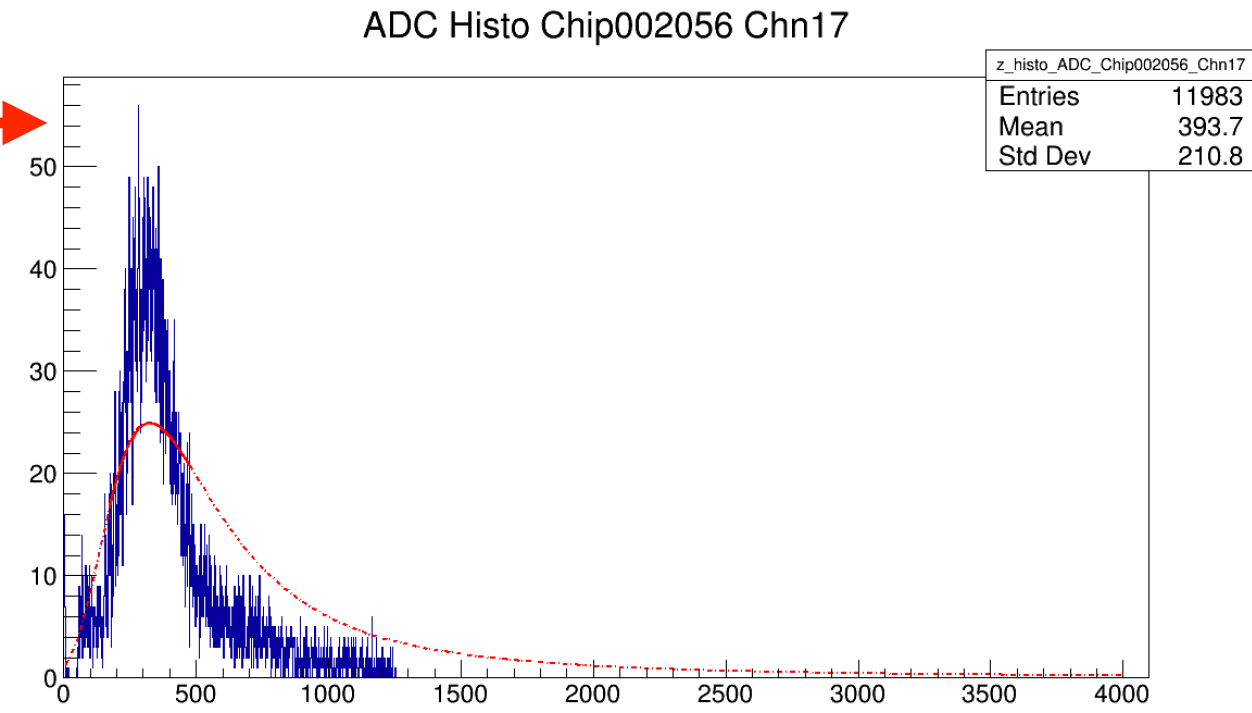




MIP Constants

Quality Checks for Fit Results „good“ spectra 21870/21888

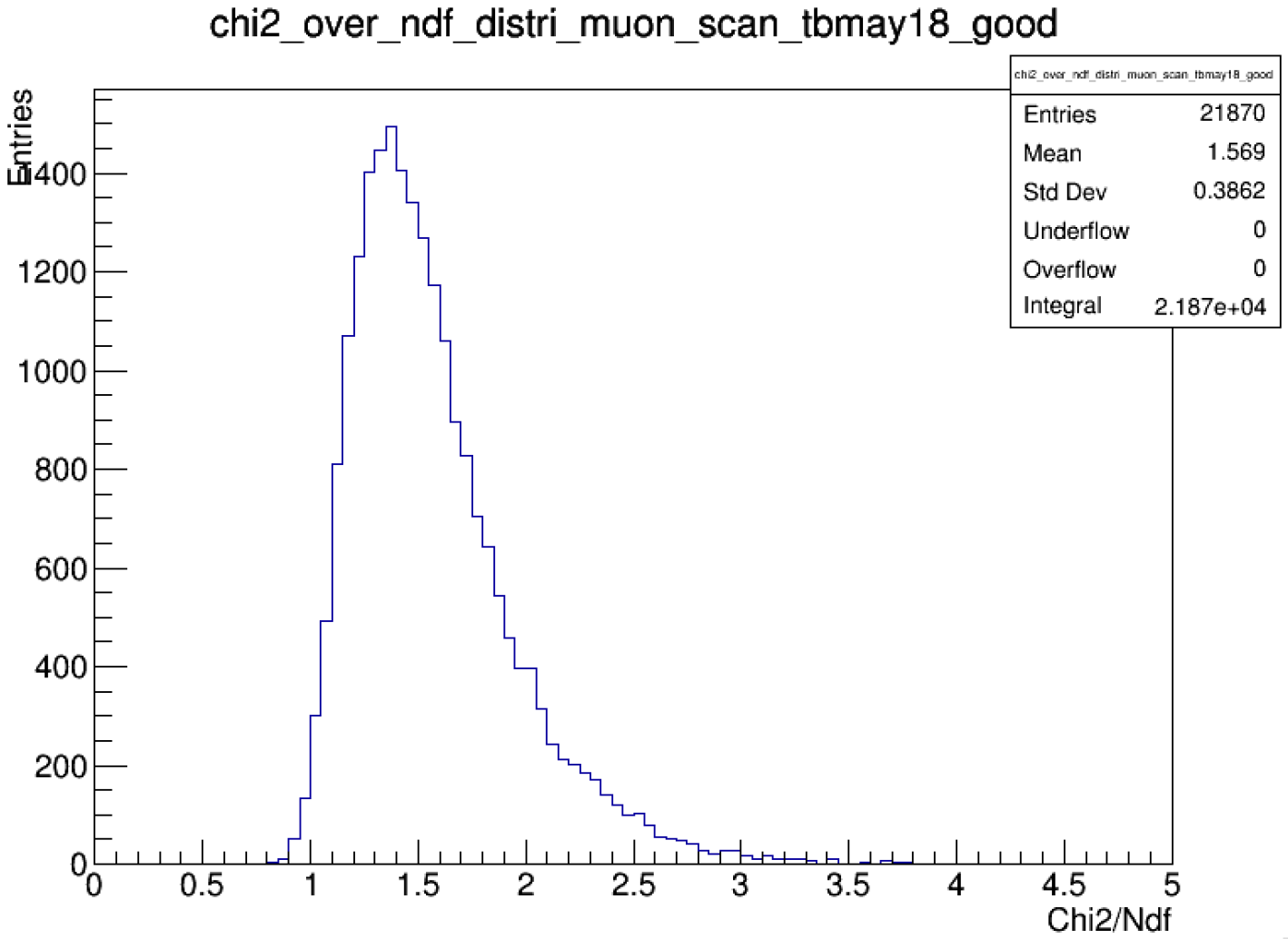




Excluded for DB

MIP Constants

Quality Checks for Fit Results „good“ spectra 21870/21888



MIP Constants

What is uploaded into the DB?

Status: After dead channel and outliers investigation:

- ➡ 6 dead channels
- ➡ 5 not filled/dead channel?
- ➡ 9 fit fail channels

➡ MIP constant of 19 channels not into DB! Dead or dummy value instead

MIP Constants

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➡ 21869/21888 MIP constants considered as „good“ = ~99,91 %!!

MIP Constants

What is uploaded into the DB?

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- ➡ 6 dead channels
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- ➡ 9 fit fail channels

➡ MIP constant of 19 channels not into DB! Dead or dummy value instead

➡ 21869/21888 MIP constants considered as „good“ = ~99,91 %!!

First Check!

MIP Constants

What is uploaded into the DB?

➡ 21869/21888 MIP constants considered as „good“ = ~99,91 %!!

First Check!

➡ Tonight: DB - converted and uploaded in DB test-folder:

In: /cd_calice_Ahc2/Test

Collection: E4Dmip_constants

TAG: ahc2_mip_constants_180824

```
#Module ChipNumber  Channel MPV MPV_error
1 0 0 222.43  0.968521  0 0
1 0 1 225.342 1.54883 0 0
1 0 2 226.289 1.14834 0 0
1 0 3 210.192 1.59014 0 0
1 0 4 241.146 1.30751 0 0
1 0 5 230.5 2.09303 0 0
1 0 6 256.606 1.23397 0 0
1 0 7 223.452 1.22144 0 0
1 0 8 228.89  1.16448 0 0
1 0 9 229.862 1.07306 0 0
1 0 10  233.133 1.41386 0 0
1 0 11  228.172 1.40845 0 0
1 0 12  235.288 1.03834 0 0
1 0 13  252.328 1.34282 0 0
1 0 14  231.917 0.938549  0 0
1 0 15  233.805 1.08705 0 0
1 0 16  252.631 2.52419 0 0
1 0 17  225.499 1.11148 0 0
1 0 18  189.136 1.01629 0 0
1 0 19  243.098 1.0217  0 0
1 0 20  219.032 1.5285  0 0
1 0 21  244.354 1.50569 0 0
1 0 22  249.238 1.6507  0 0
1 0 23  220.207 1.15314 0 0
1 0 24  213.785 1.06801 0 0
1 0 25  230.828 1.80295 0 0
1 0 26  188.968 1.0275  0 0
```

Summary and Outlook

- Memorycell-wise investigation on pedestals
- Pedestal quality/outlier/dead channel check
  - ➡ Data base format, upload to data base
- Modify pedestal extraction and MIP extraction code for calibration:
  - ➡ Use memorycell-wise absolute pedestal values
- Infrastructure in DB: Memorycell offsets collection uploaded to DB
- Run modified MIP calibration, check results quality, outliers, width, etc.
  - ➡ Data base format, upload to data base

➡ Close the circle: Run Reco with new Pedestals (Memcell corrected) and MIP constants

  - ➡ Check energy deposition and if it peaks at 1 MIP for muon run

Ongoing

Summary and Outlook

- Memorycell-wise investigation on pedestals
- Pedestal quality/outlier/dead channel check
  - ➡ Data base format, upload to data base
- Modify pedestal extraction and MIP extraction code for calibration:
  - ➡ Use memorycell-wise absolute pedestal values
- Infrastructure in DB: Memorycell offsets collection uploaded to DB
- Run modified MIP calibration, check results quality, outliers, width, etc.
  - ➡ Data base format, upload to data base
- ➡ Close the circle: Run Reco with new Pedestals (Memcell corrected) and MIP constants
  - ➡ Check energy deposition and if it peaks at 1 MIP for muon run

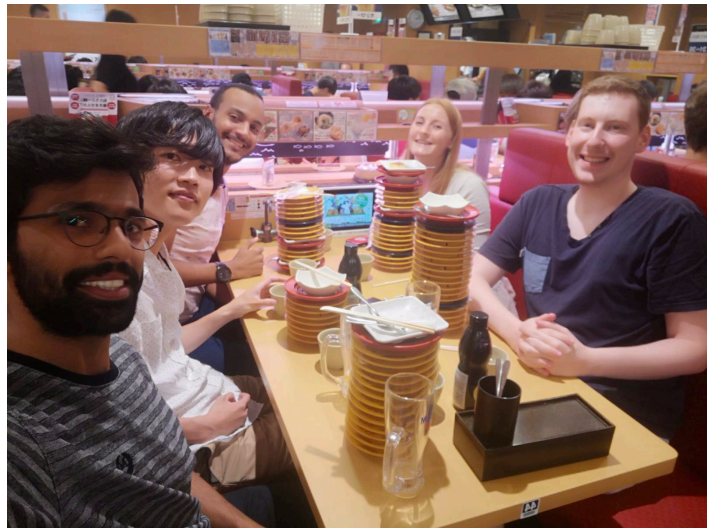
Ongoing

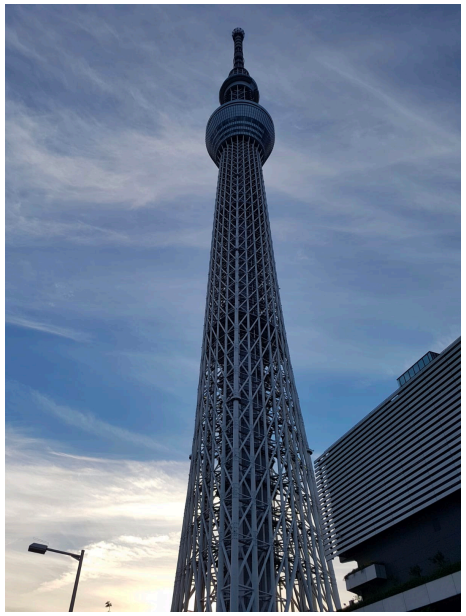
We have new AT pedestals(+memory cell offsets) and MIP constants for the 38 HCAL layers to test for reconstruction!

Summary and Outlook

- Further studies:
  - ➡ Optimize Landau-Gaussian fitting parameters
  - ➡ Run vs. Run comparison pedestal (also LG/HG mode vs. HG/TDC mode) and MIP
  - ➡ DB: Low Gain Pedestals
  - ➡ Investigation of pedestal effects? Observed shifts?
  - ➡ MIP constant for different memory-cells, dependence?
  - ➡ T-influence on pedestal/mip-constant?

Thank you!





Thank you!

Backup

Pedestal Extraction Details

Mode Selection to Fill Histograms

```
if(this->getTriggerMode() == 0)
{
        if(this->getMode() == 1)
        {
                if (ADC->at(i) > 150 && GainBit->at(i) == 1){
                        histos[ChipID->at(i)][chn->at(i)]->Fill(ADC->at(i), EvtNr->at(i));
                }
        }
        else
        {
                if (TDC->at(i) > 150 && GainBit->at(i) == 1){
                        histos[ChipID->at(i)][chn->at(i)]->Fill(TDC->at(i), EvtNr->at(i));
                }
        }
}

if(this->getTriggerMode() == 1)
{
        if(HitBit->at(i) != 0) continue;

        //Should be running by default in HG/TDC
        if (ADC->at(i) > 150 && GainBit->at(i) == 1){
                histos[ChipID->at(i)][chn->at(i)]->Fill(ADC->at(i), EvtNr->at(i));
        }
}
```

MIP Extraction Details

Landau-Gauss-Fit, last iteration

```
// 3rd fit with corrected range
TH1F tmp("tmp", "tmp", 2501, -.5, 2500.5);
max = landau_gauss_function->GetMaximum();
tmp.Eval(landau_gauss_function);
lower_bound = tmp.GetBinCenter(tmp.FindFirstBinAbove(.30*max));
upper_bound = tmp.GetBinCenter(tmp.FindLastBinAbove (.30*max));
landau_gauss_function->SetRange(lower_bound, upper_bound);

// correct parameters landau and gauss width
landau_gauss_function->GetParameters(parameters);
if(parameters[3] >= 90. || parameters[3] <= 35.) parameters[3] = 50;
if(parameters[0] < 30.) parameters[3] = 30;
landau_gauss_function->SetParameters(parameters);
landau_gauss_function->SetParLimits(0, 5, 1000);
landau_gauss_function->SetParLimits(3, 15, 500);
TFitResultPtr result = hist.Fit(landau_gauss_function, "RQBS");

landau_gauss_function->GetParameters(parameters);
landau_gauss_nobound ->SetParameters(parameters);

// add functions to histograms to be saved in root file
//hist.GetListOfFunctions()->Add(landau_gauss_iterations[0]);
//hist.GetListOfFunctions()->Add(landau_gauss_iterations[1]);
//hist.GetListOfFunctions()->Add(landau_gauss_iterations[2]);
hist.GetListOfFunctions()->Add(landau_gauss_nobound);
hist.GetListOfFunctions()->Add(landau_gauss_function, "R");

return result;
```

MIP Extraction Details

Landau-Gauss-Fit, illustration different fit iterations

Landau-Gauss vs. Vavilov

MIP check - Run 60247 - All channels, Hits