

Software, MIPs and SSF

Wrap-Up

Daniel Heuchel
AHCAL Testbeam Analysis Workshop
Hamburg, 18. December, 2018

HELMHOLTZ RESEARCH FOR
GRAND CHALLENGES



UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386



CaliceSoft

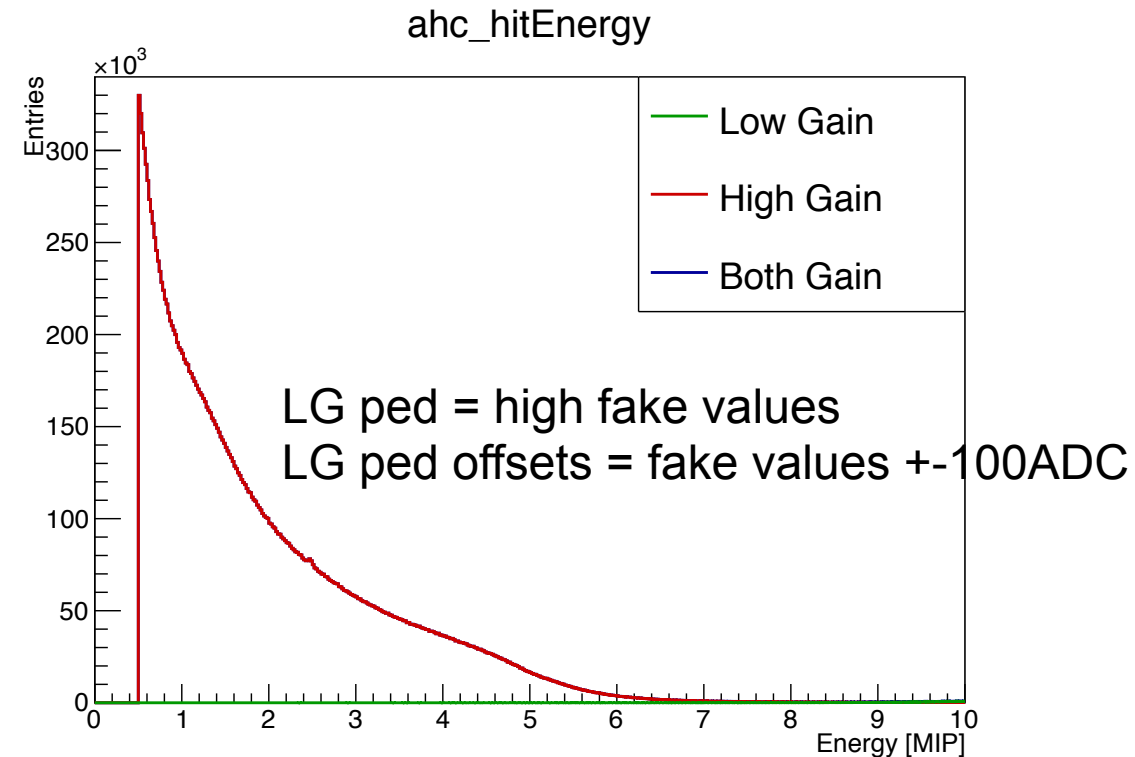
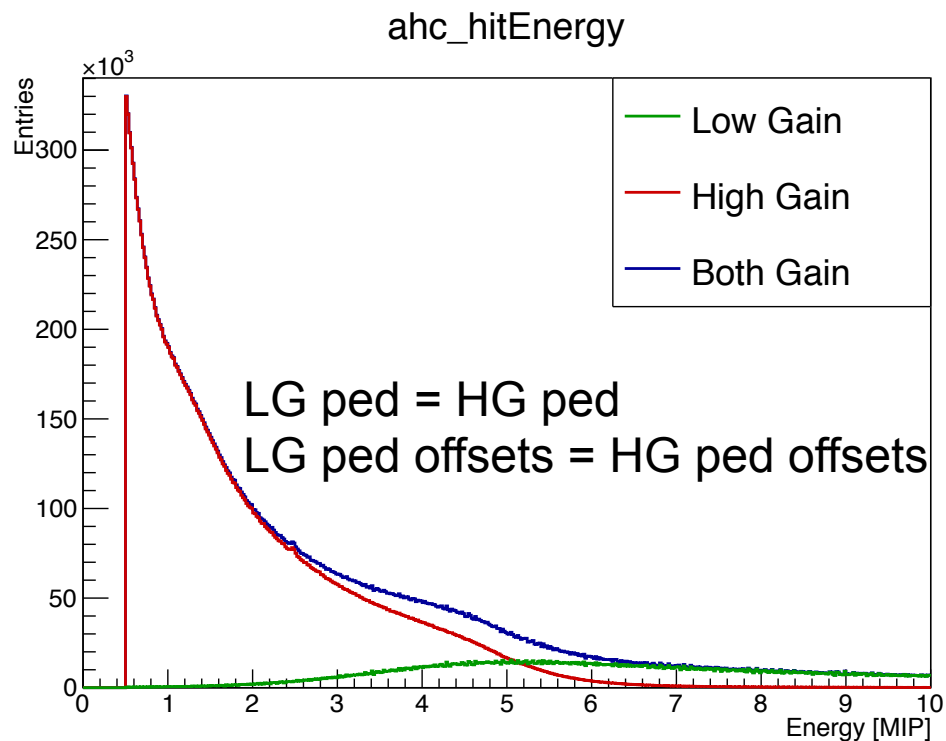
Implemented HG/LG Pedestal feature

- Feature was implemented to treat HG and LG Pedestals and their corresponding offsets in individual DB collections!
 - ➔ Treat HG/LG hits individually in terms of pedestal subtraction!
 - ➔ Environment to test new LG pedestals set

CaliceSoft

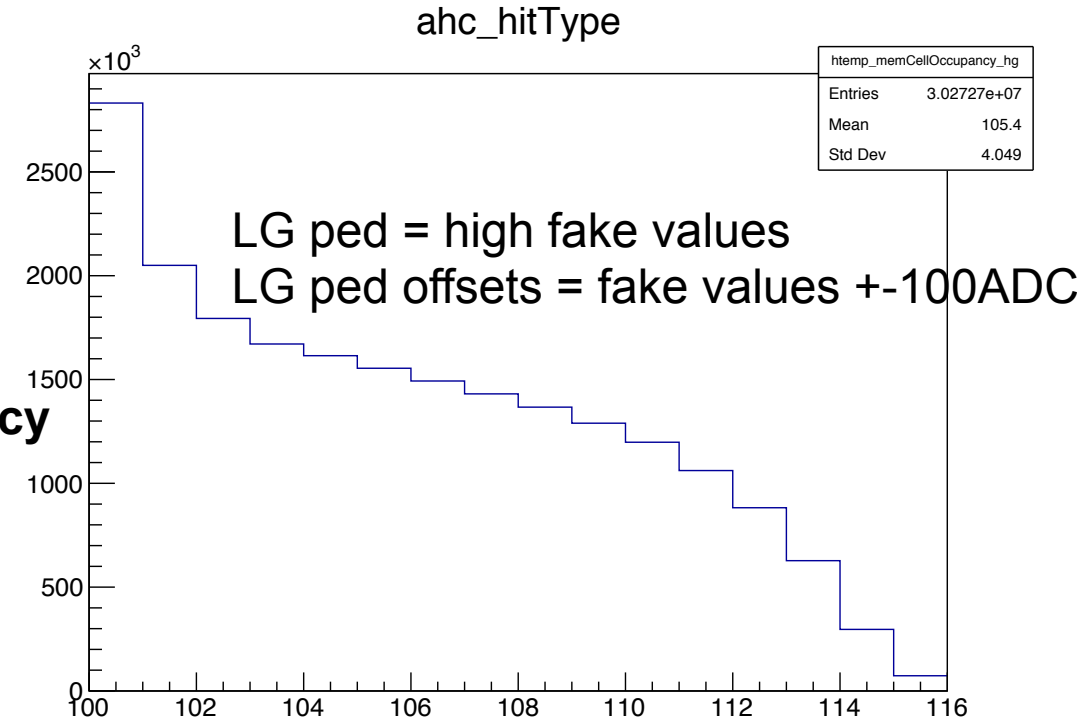
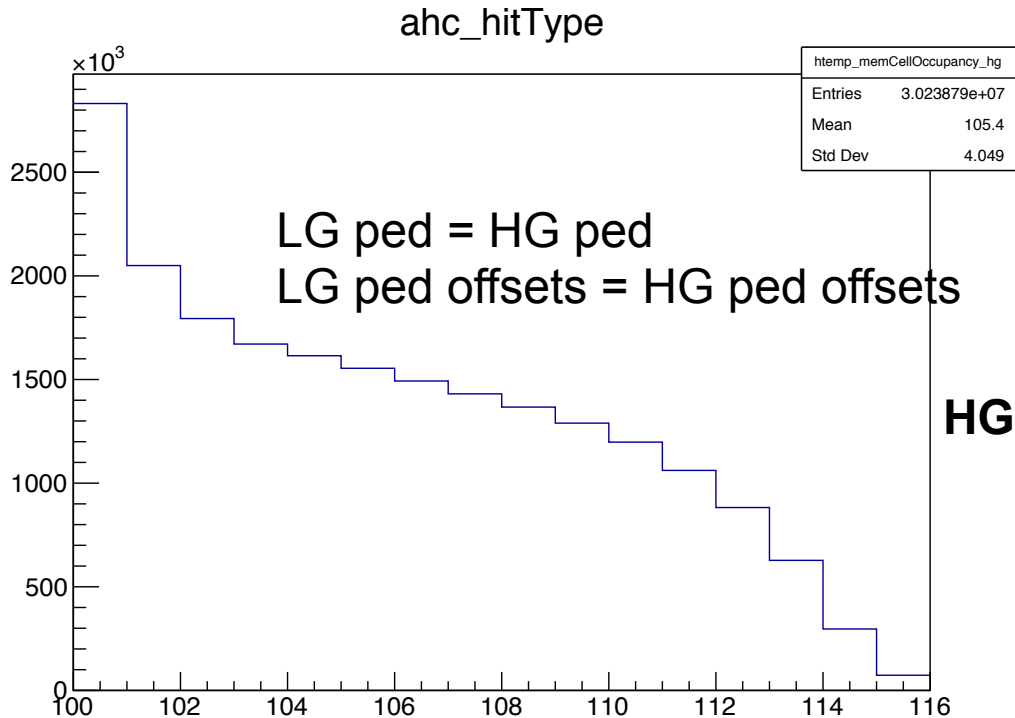
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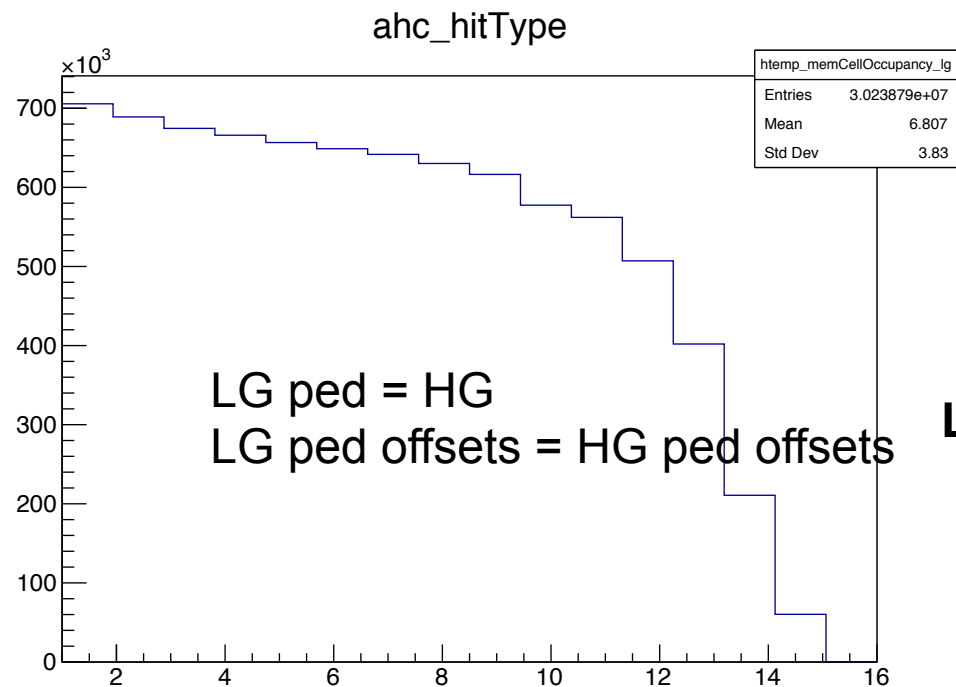
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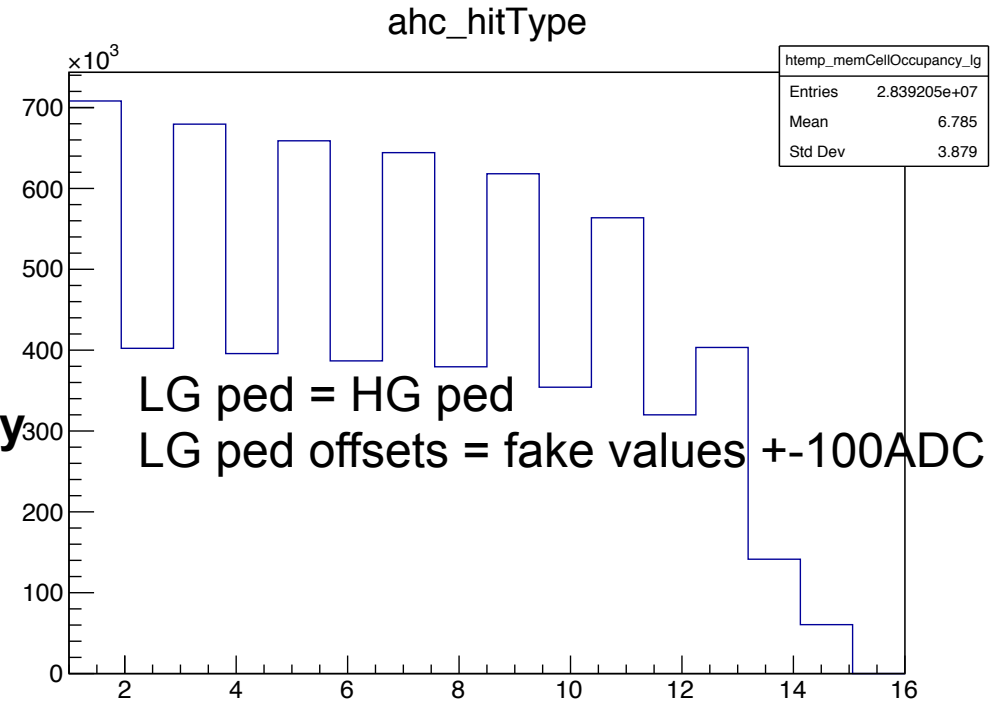


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LG Cell Occupancy

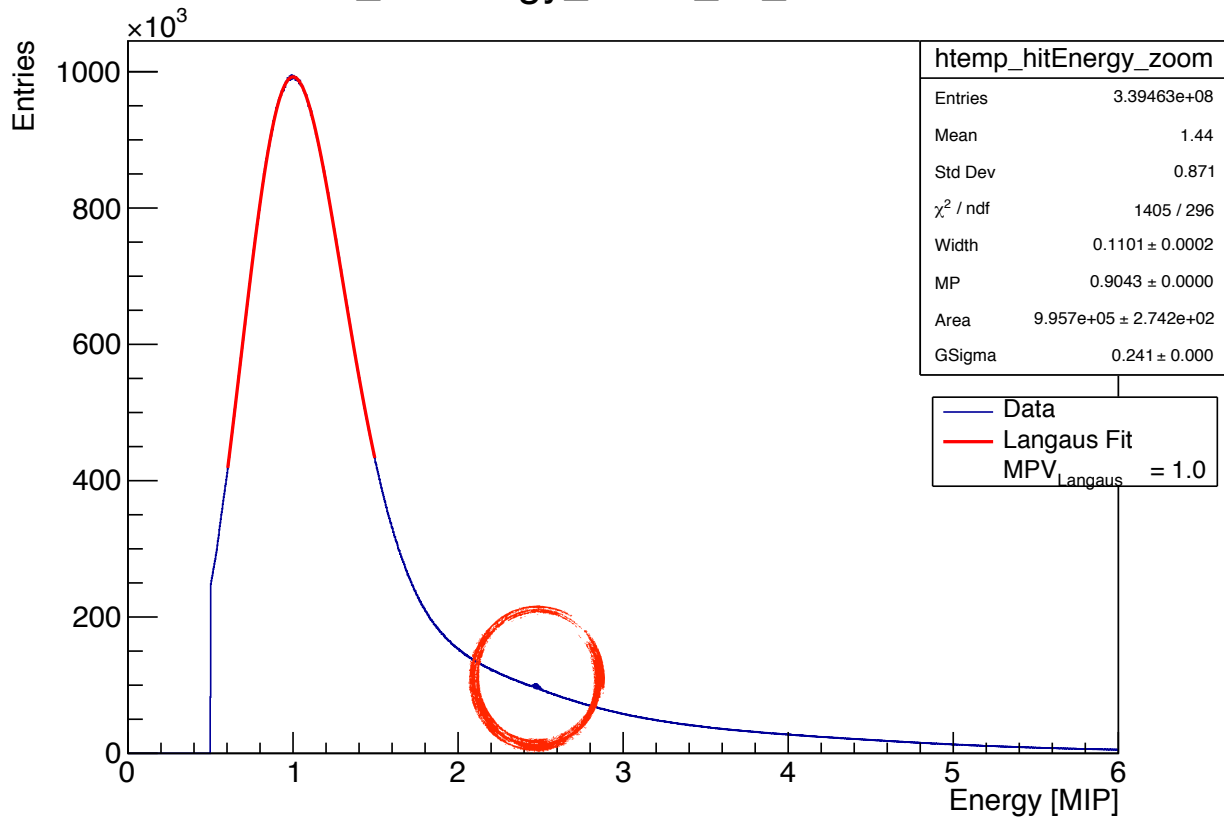


Memory-Cell Pedestal Correction

Observed „feature“ - Bump at 2.5 MIP for Module 23

- ➔ Bump appears at 2.5 MIP with latest memory-cell pedestal correction feature in reco of hit energy in global scale for all type of data!

ahc_hitEnergy_zoom_all_channels

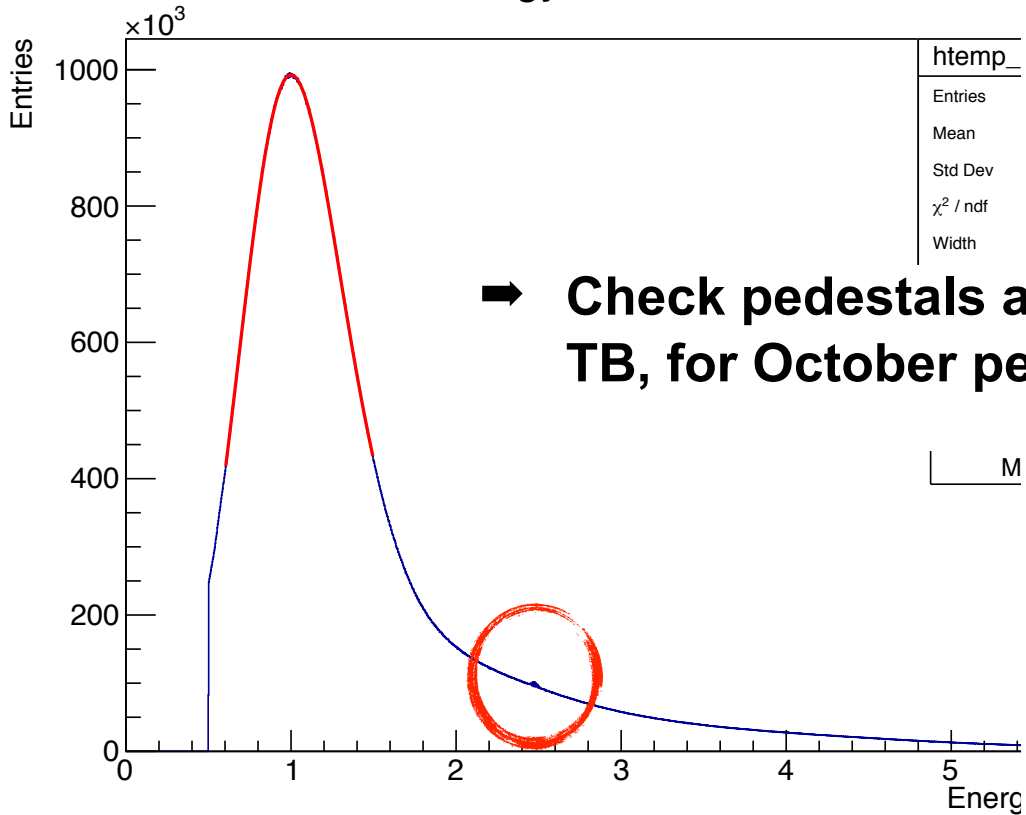


Memory-Cell Pedestal Correction

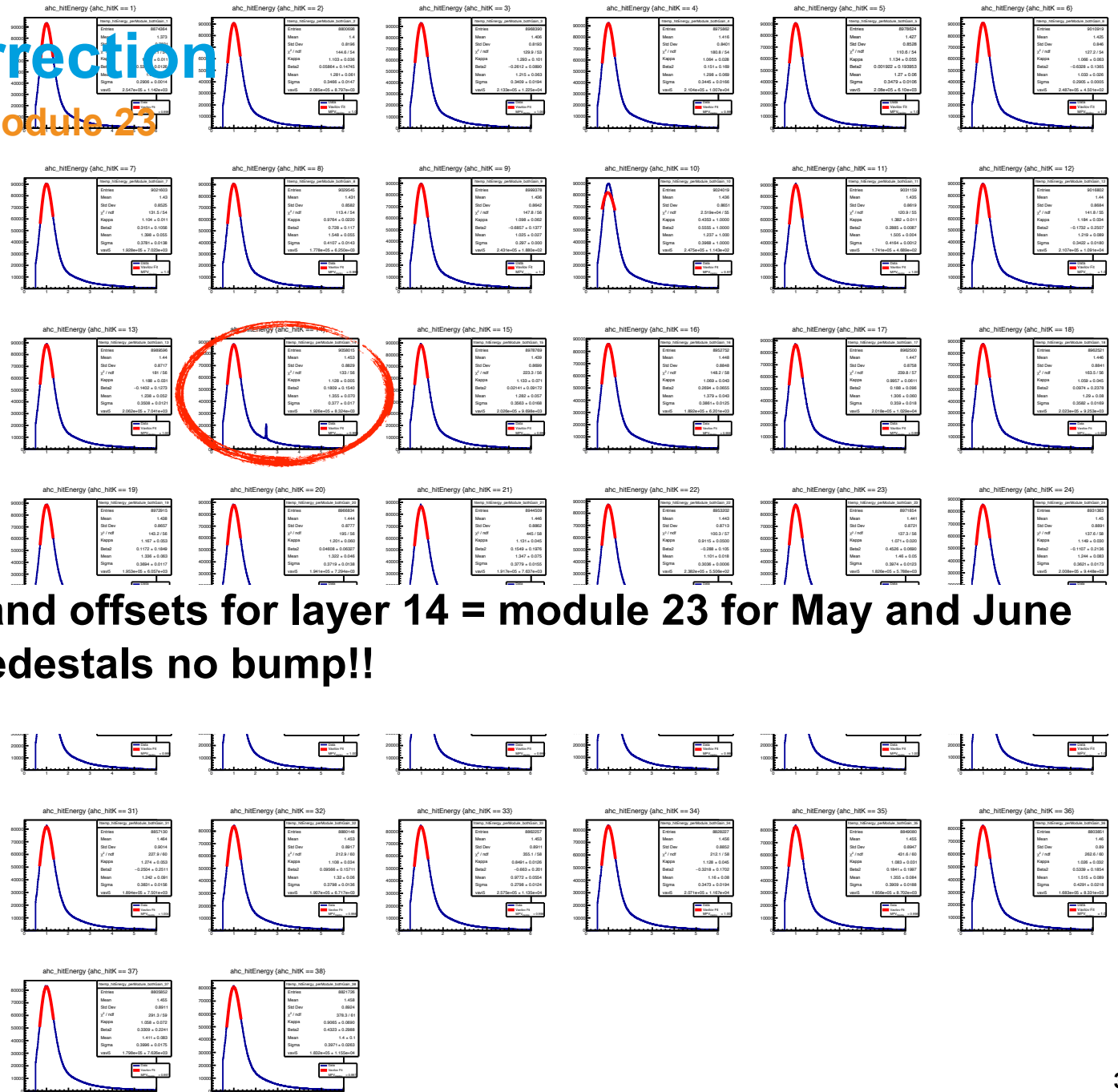
Observed „feature“ - Bump at 2.5 MIP for Module 23

➔ Bump appears at 2.5 MIP with late reco of hit energy in global scale 1

ahc_hitEnergy_zoom_all_channels



➔ Check pedestals and offsets for layer 14 = module 23 for May and June TB, for October pedestals no bump!!



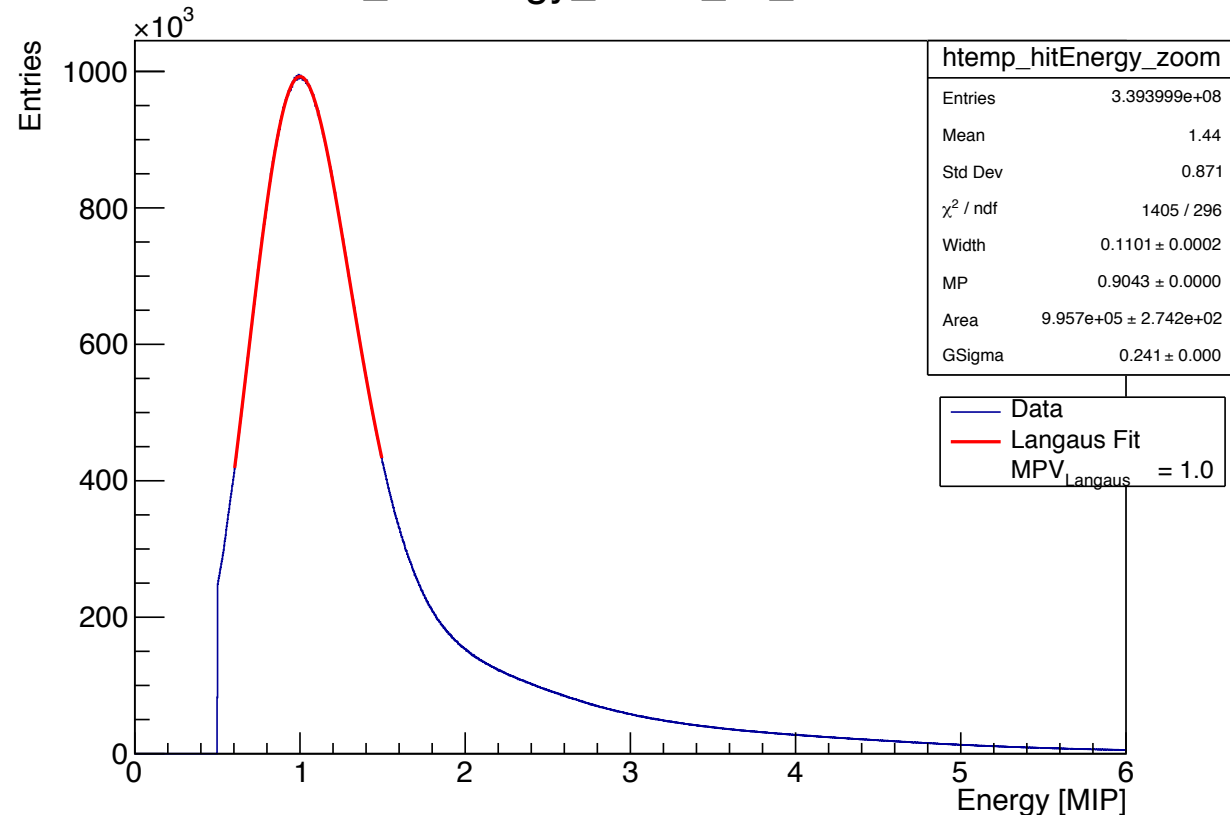
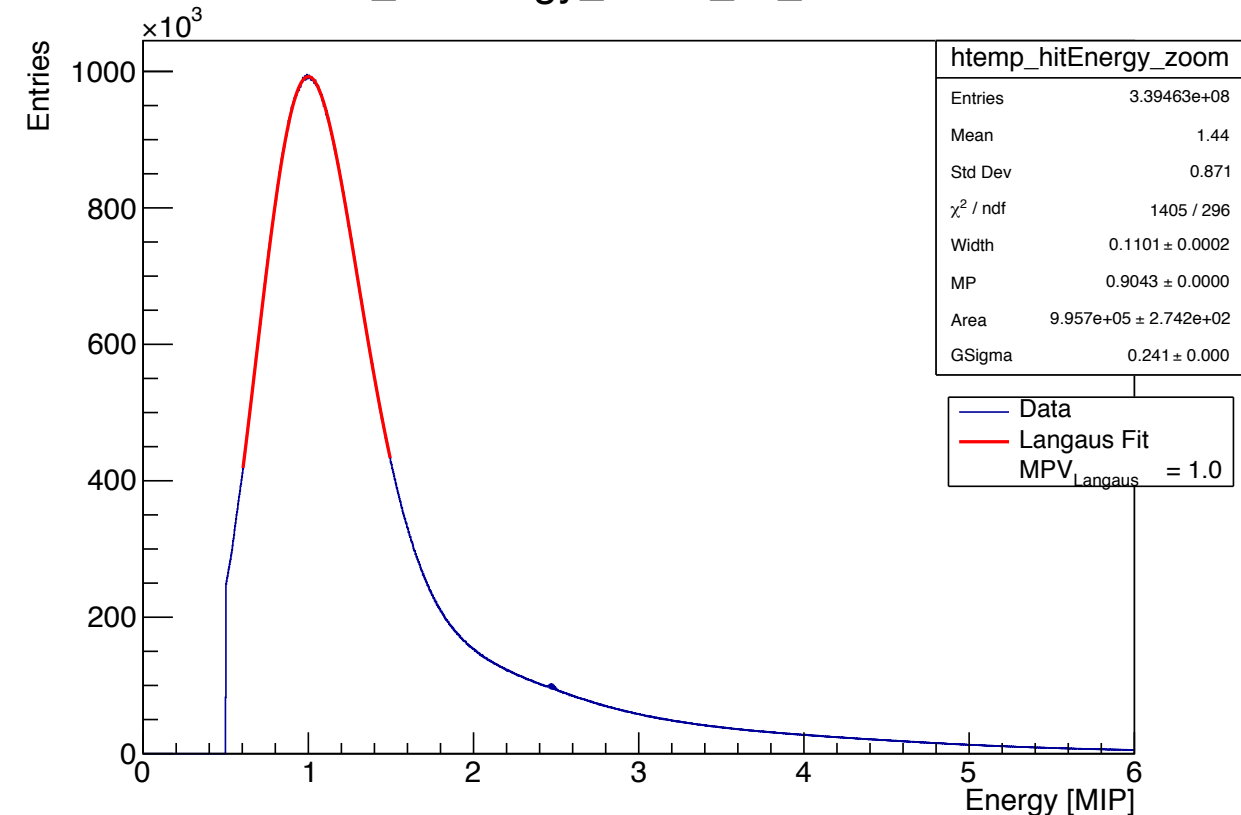
Memory-Cell Pedestal Correction

Global MIP Energy Spectra for May, June, October

May

ahc_hitEnergy_zoom_all_channels

ahc_hitEnergy_zoom_all_channels

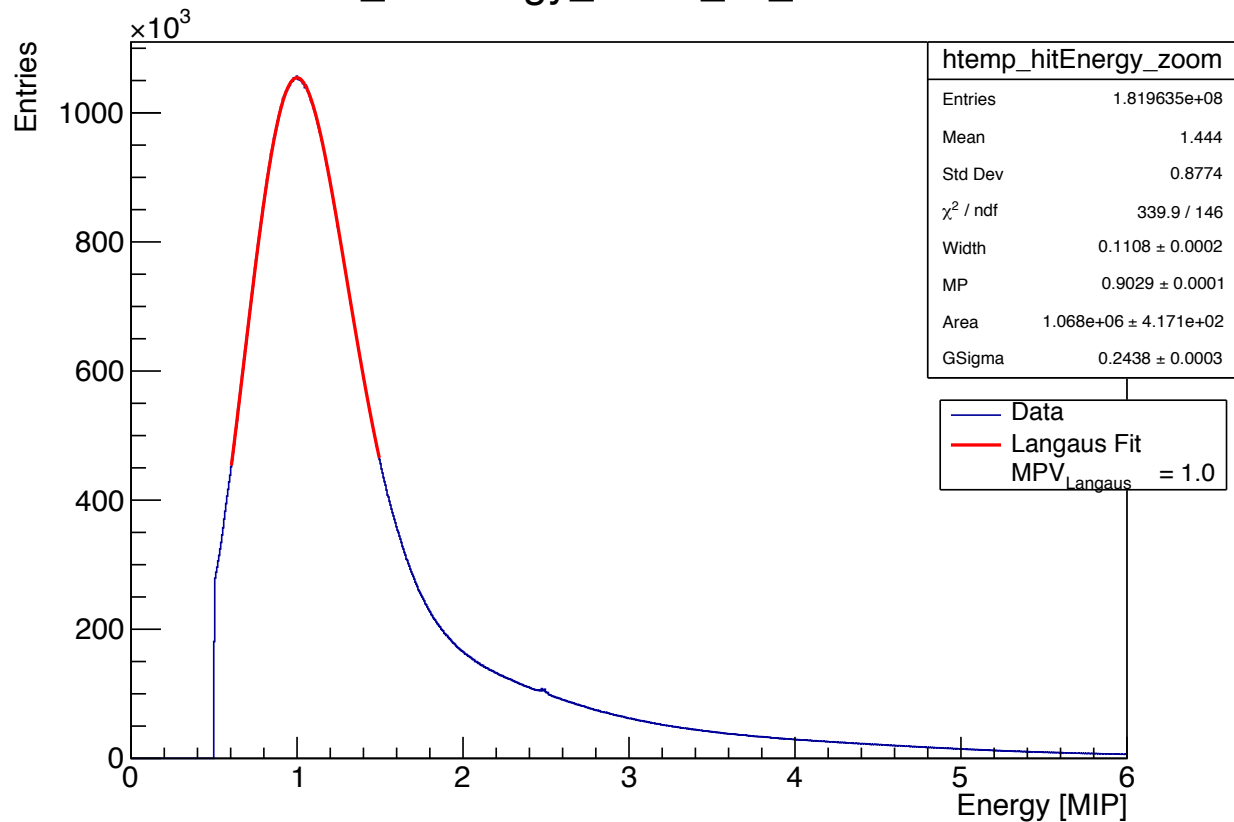


Memory-Cell Pedestal Correction

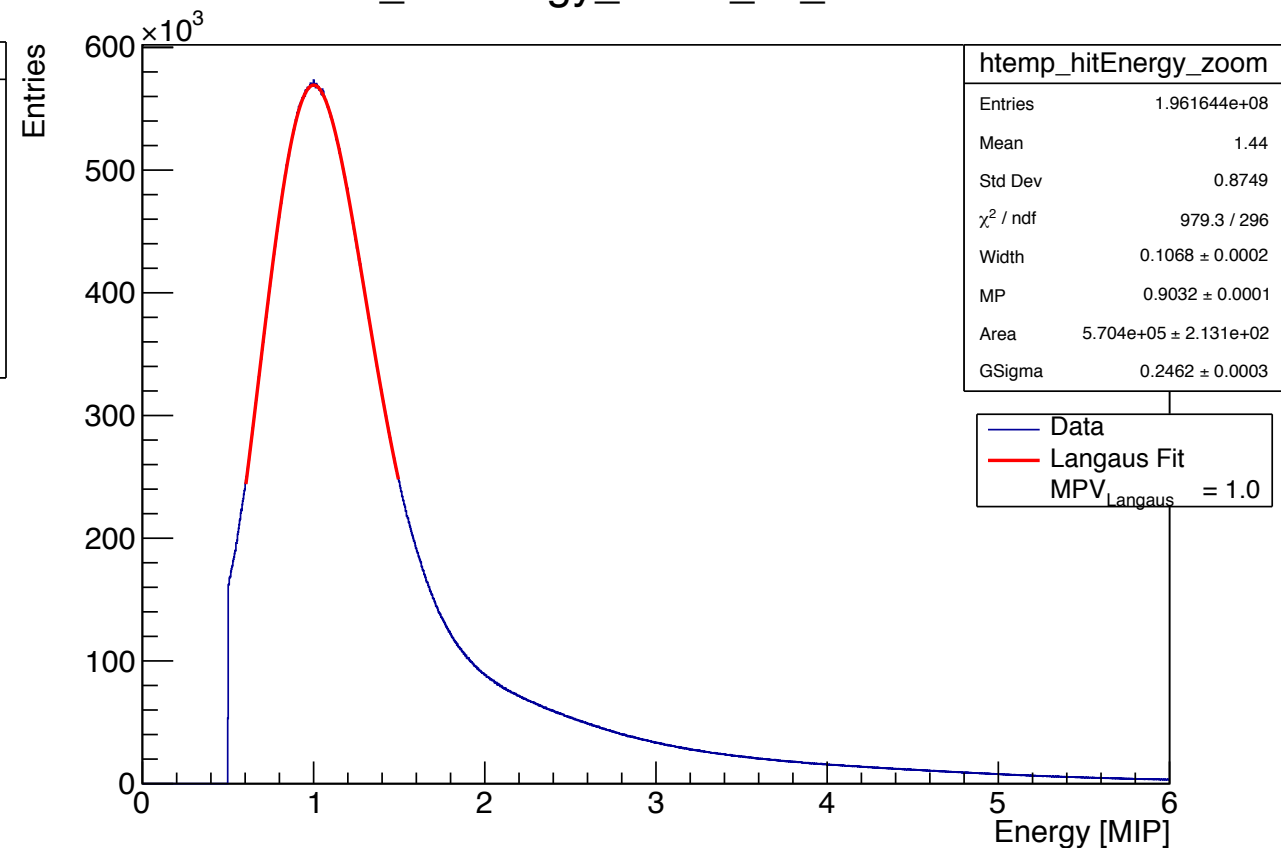
Global MIP Energy Spectra for May, June, October

June

ahc_hitEnergy_zoom_all_channels



ahc_hitEnergy_zoom_all_channels

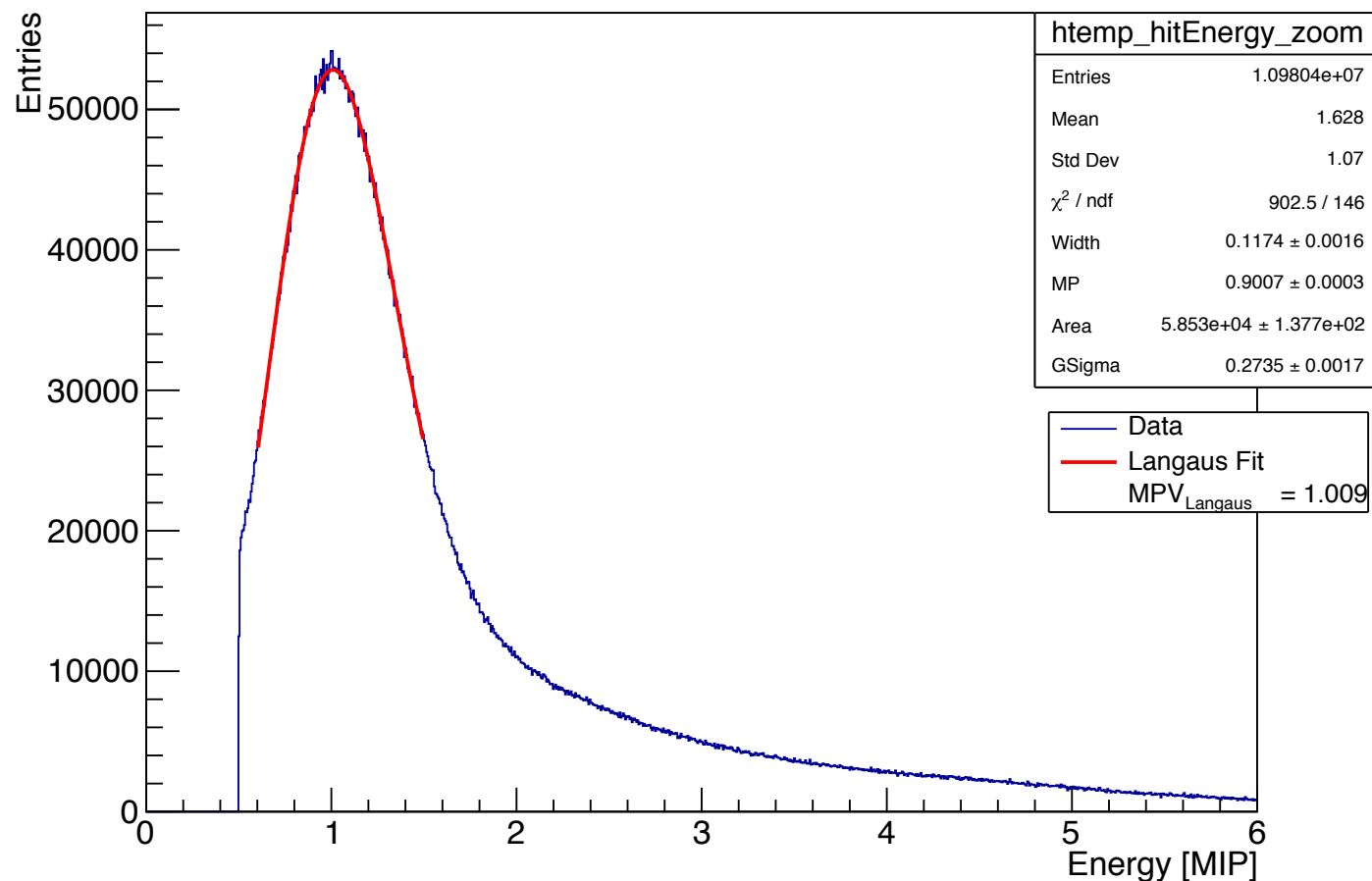


Memory-Cell Pedestal Correction

Global MIP Energy Spectra for May, June, October

October

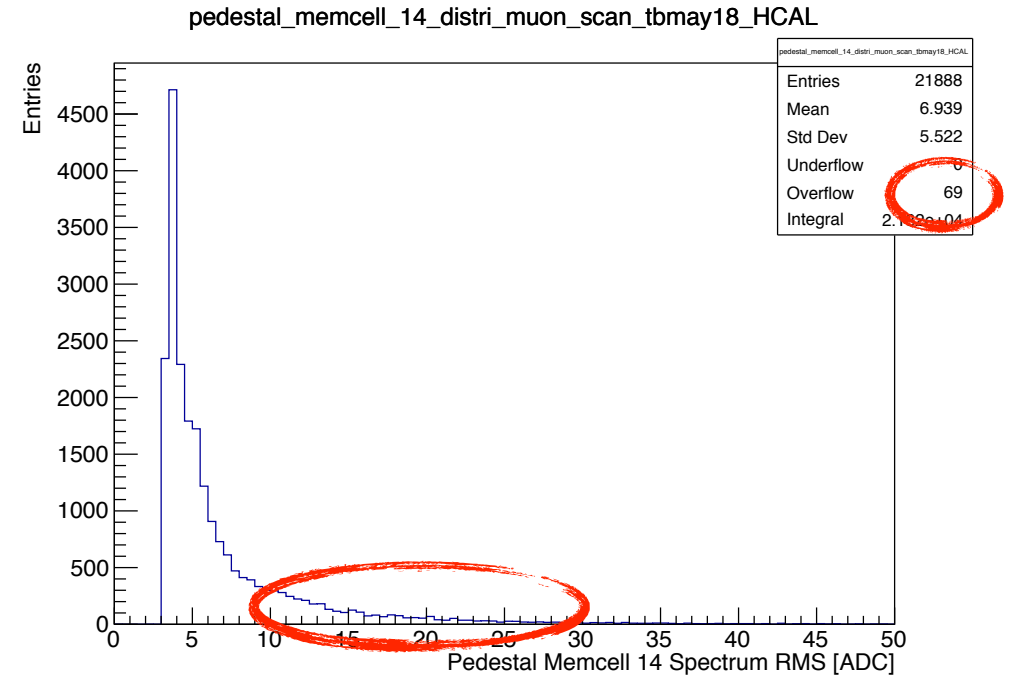
ahc_hitEnergy_zoom_all_channels



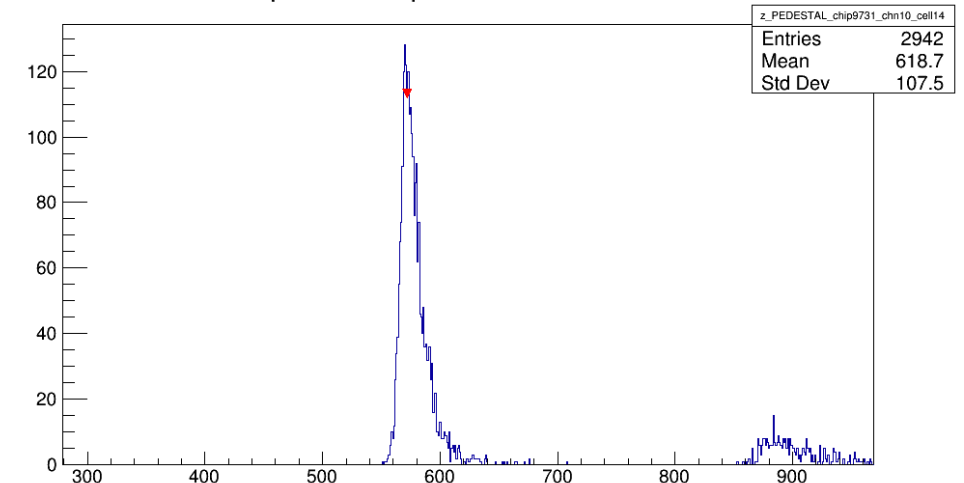
Raw ADC MIP Spectra

MIP Calibration - Memory Cell-wise

- MIP Calibration code modified so that one can choose individual memory cells to be calibrated only, spectra filled only for a specific memory cell!:
- ➔ For May full muon scan: Enough statistics to perform MIP calibration for memcell 0, memcell 2 and memecell 5 only for all channels ($n\text{Hits} > 1000$)
- ➔ Compare to channel extracted values!
- ➔ Do we observe ADC jumps also in physics spectra as for pedestals? Check MIP spectra for specific memory cells, especially **cell 14**!



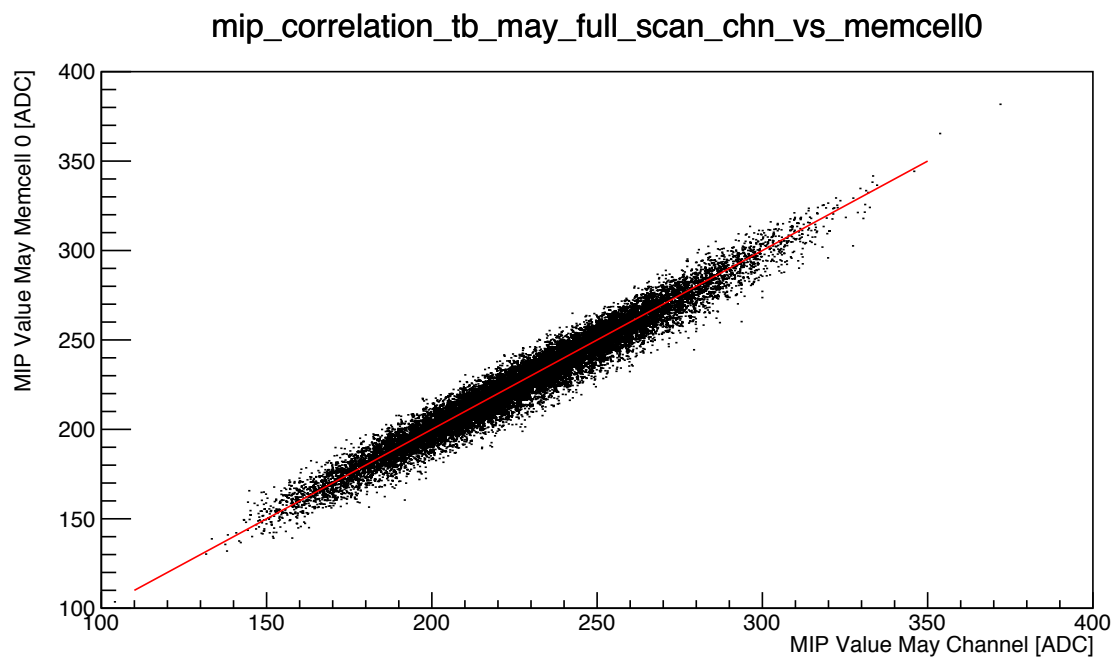
Pedestal Spectrum Chip 9731, Channel 10, MemCell 14



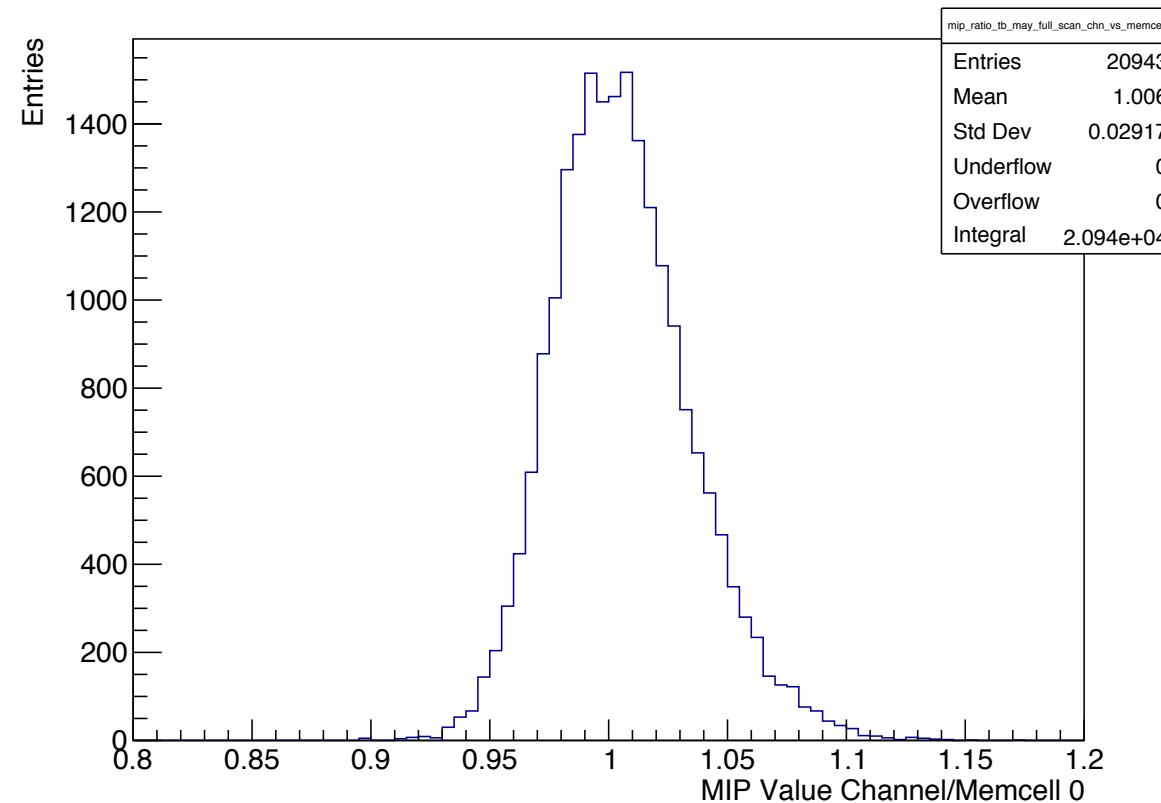
Raw ADC MIP Spectra

MIP Calibration - Memory Cell-wise

MIP Channel vs. MIP MemCell 0



mip_ratio_tb_may_full_scan_chn_vs_memcell0

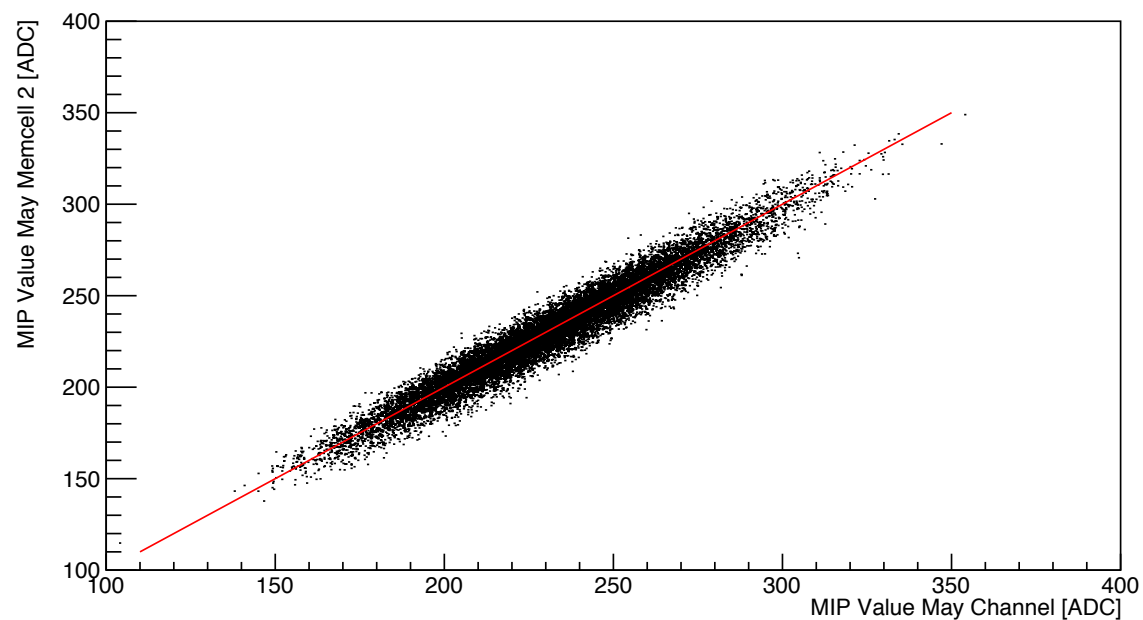


Raw ADC MIP Spectra

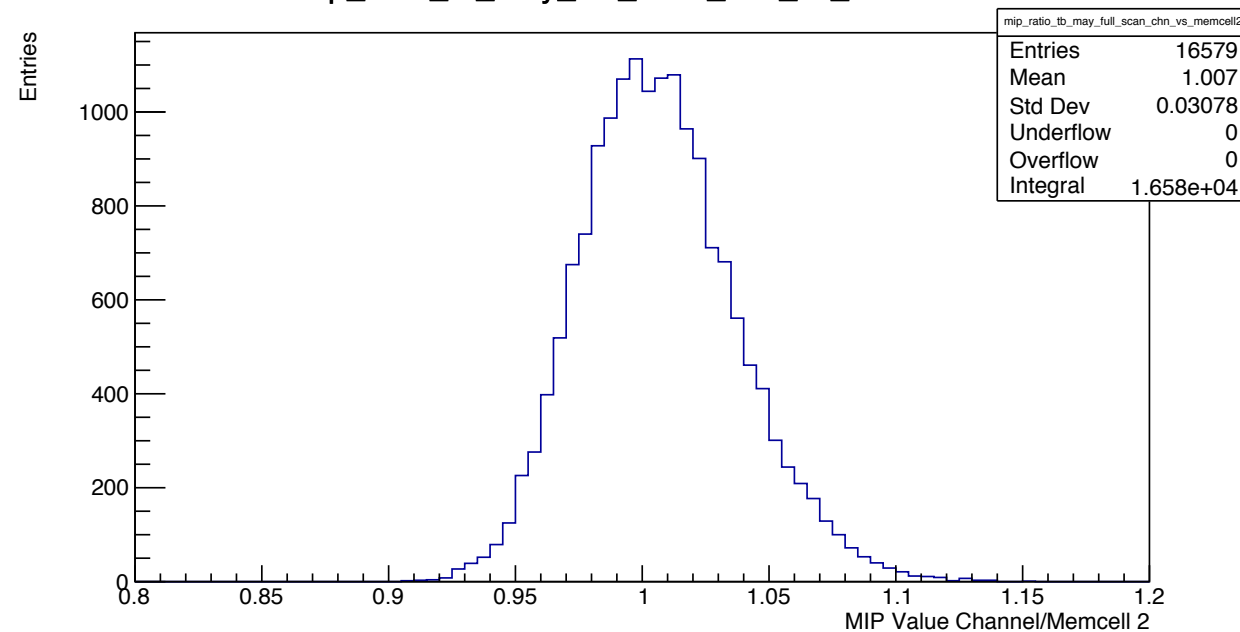
MIP Calibration - Memory Cell-wise

MIP Channel vs. MIP MemCell 2

mip_correlation_tb_may_full_scan_chn_vs_memcell2



mip_ratio_tb_may_full_scan_chn_vs_memcell2

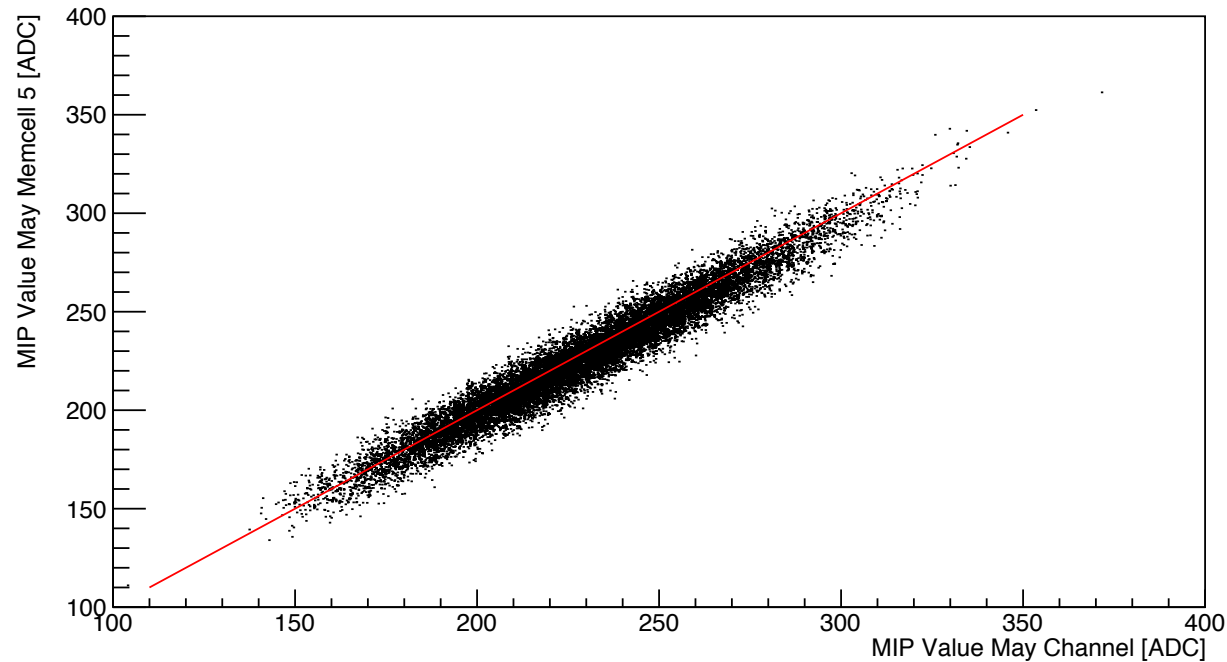


Raw ADC MIP Spectra

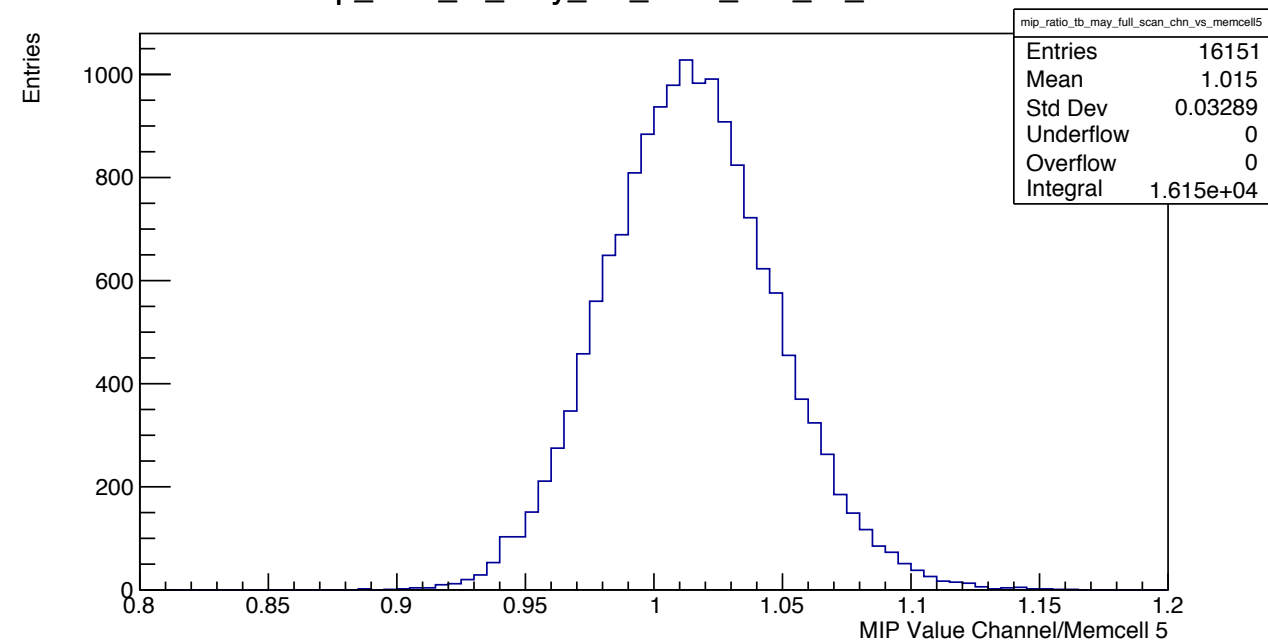
MIP Calibration - Memory Cell-wise

MIP Channel vs. MIP MemCell 5

mip_correlation_tb_may_full_scan_chn_vs_memcell5



mip_ratio_tb_may_full_scan_chn_vs_memcell5



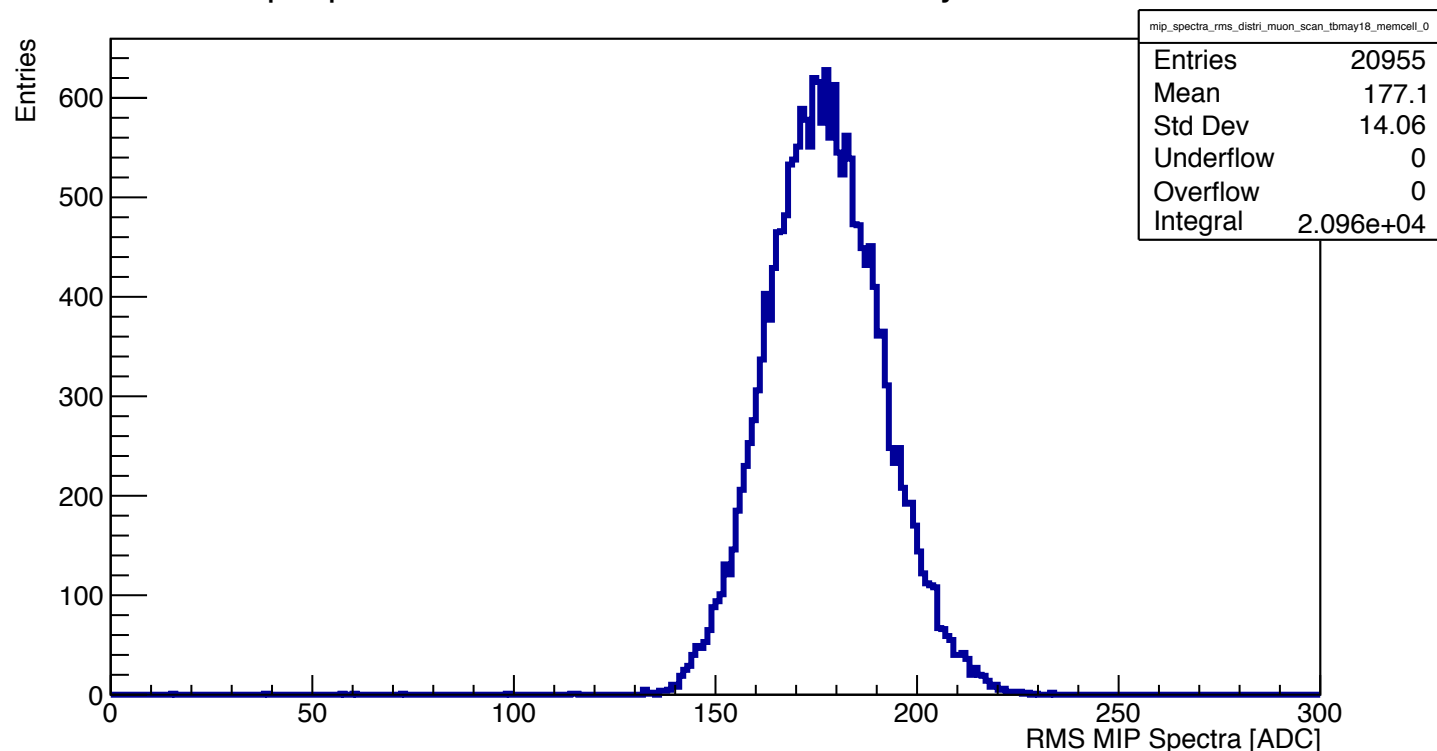
- Good agreement for lower memory cell MIPs!

Raw ADC MIP Spectra

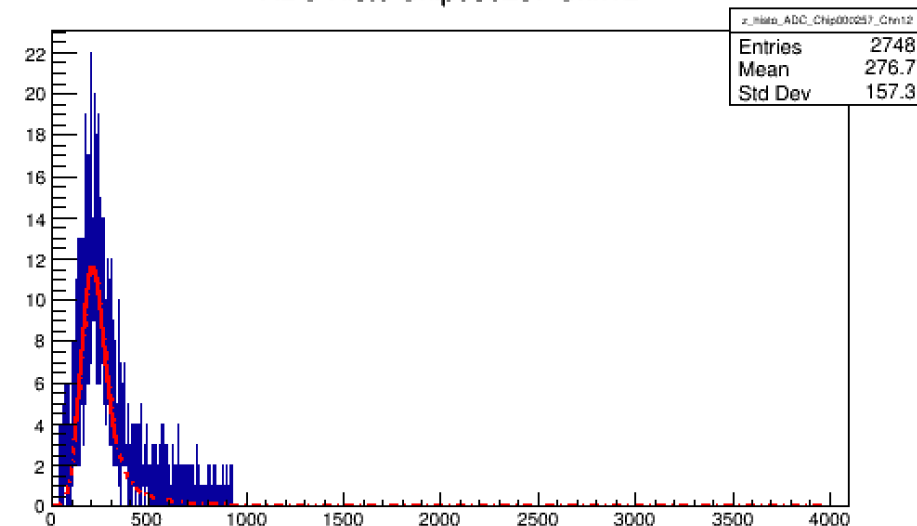
RMS for different Memory Cells

- Extract the RMS of MIP spectra for a specific memory cell to check for outliers, which would indicate bumps in Landau-Gaussian spectrum:

mip_spectra_rms_distri_muon_scan_tbmay18_memcell_0



ADC Histo Chip000257 Chn12

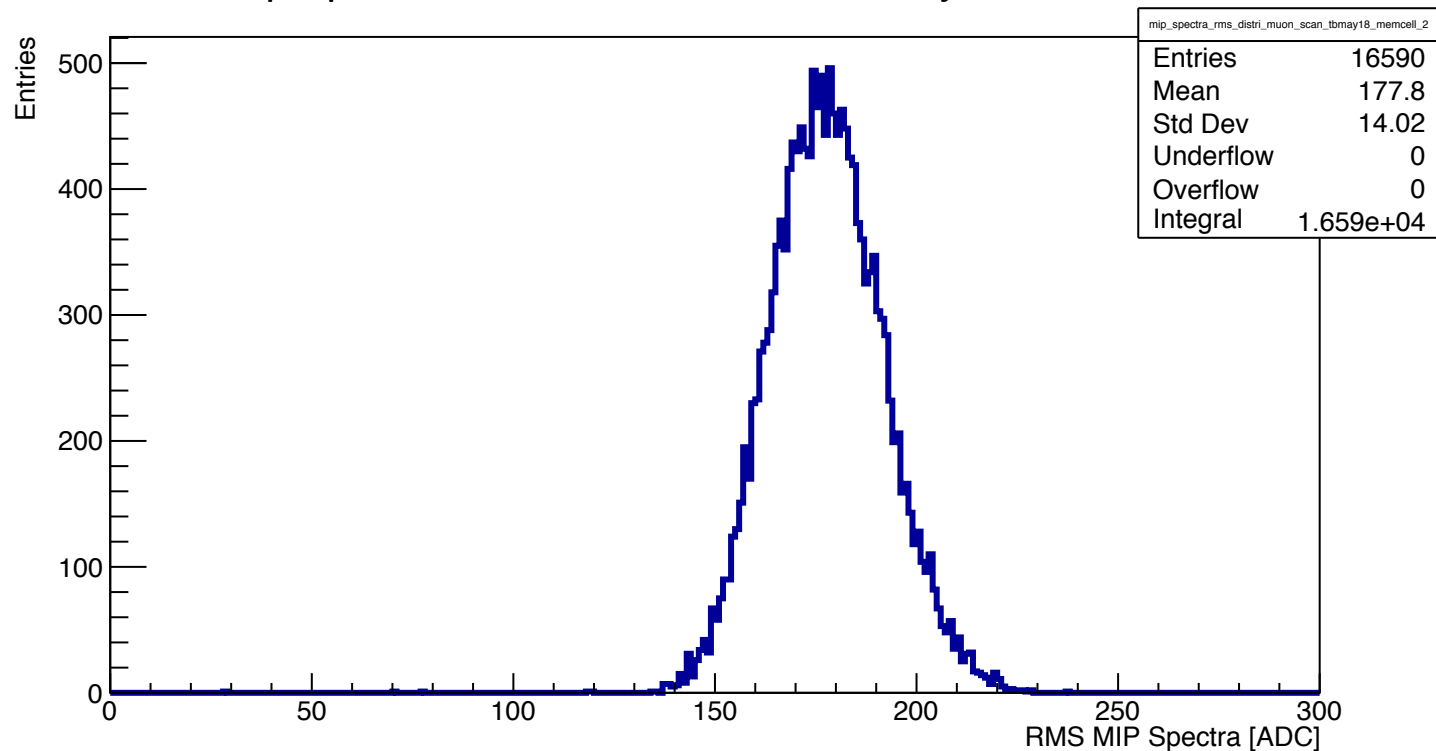


Raw ADC MIP Spectra

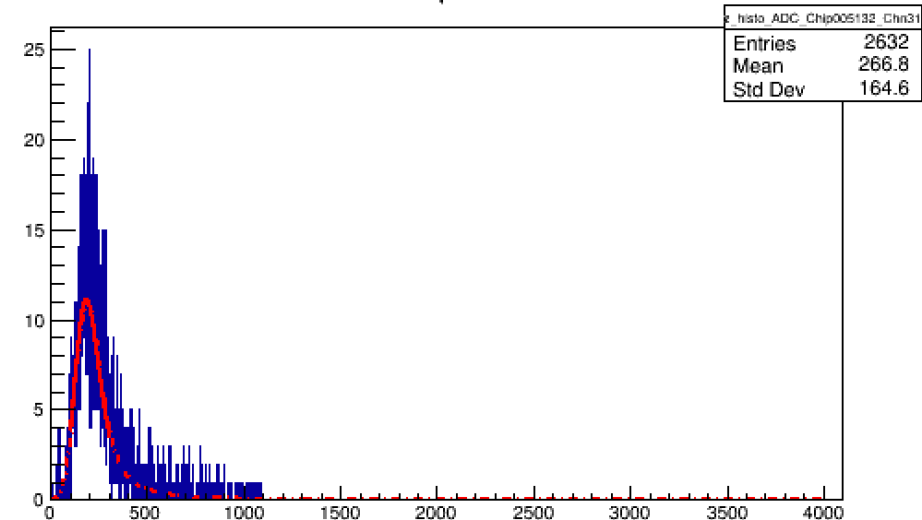
RMS for different Memory Cells

- Extract the RMS of MIP spectra for a specific memory cell to check for outliers, which would indicate bumps in Landau-Gaussian spectrum:

mip_spectra_rms_distri_muon_scan_tbmay18_memcell_2



ADC Histo Chip005132 Chn31

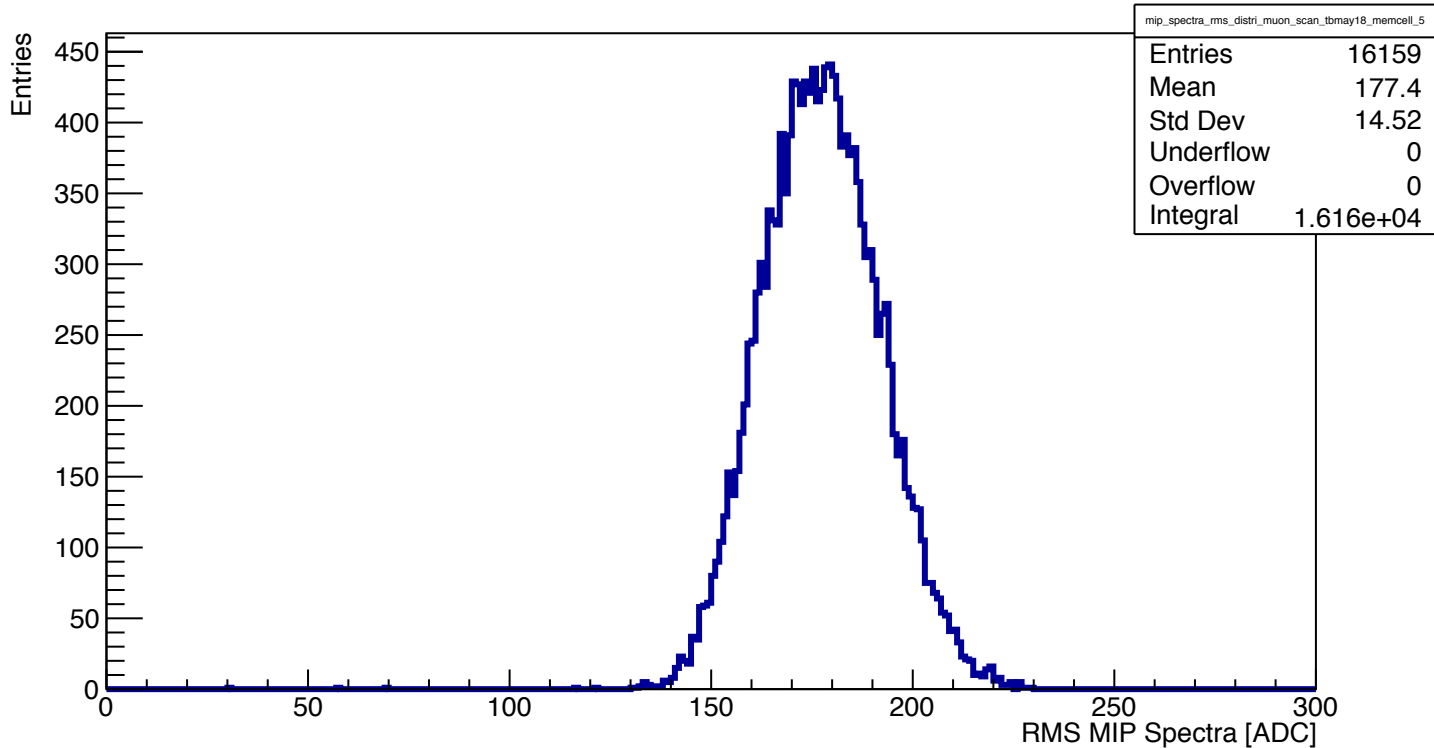


Raw ADC MIP Spectra

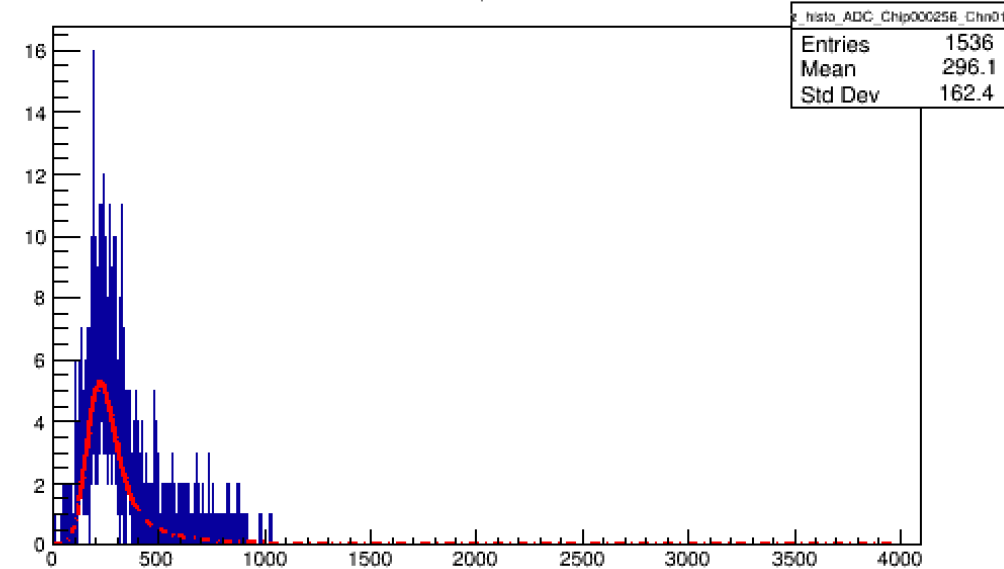
RMS for different Memory Cells

- Extract the RMS of MIP spectra for a specific memory cell to check for outliers, which would indicate bumps in Landau-Gaussian spectrum:

mip_spectra_rms_distri_muon_scan_tbmay18_memcell_5



ADC Histo Chip000256 Chn01

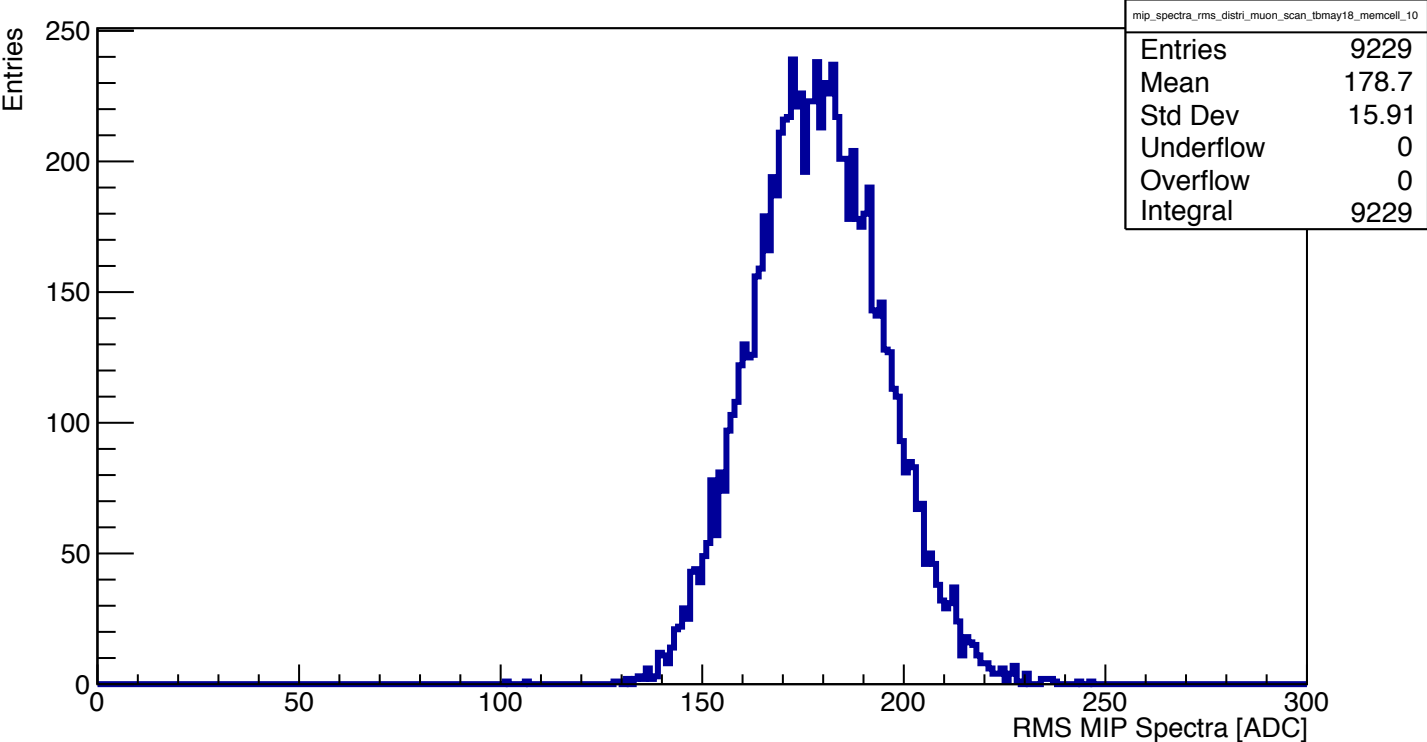


Raw ADC MIP Spectra

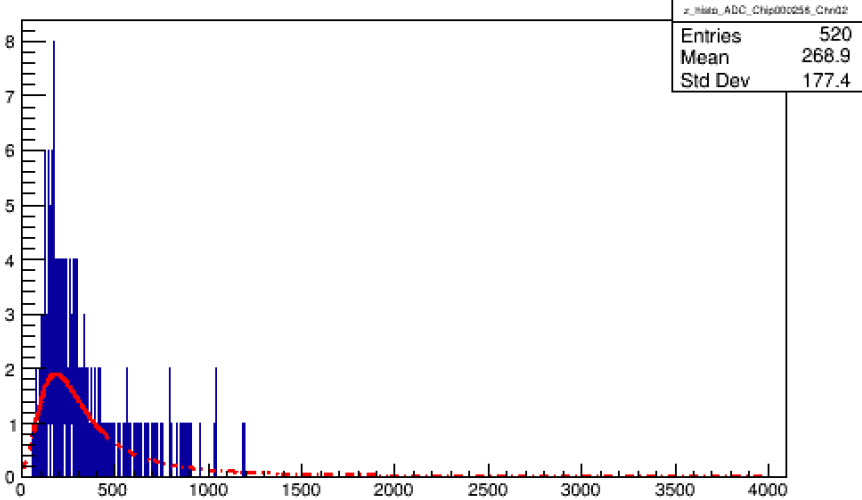
RMS for different Memory Cells

- Extract the RMS of MIP spectra for a specific memory cell to check for outliers, which would indicate bumps in Landau-Gaussian spectrum:

mip_spectra_rms_distri_muon_scan_tbmay18_memcell_10



ADC Histo Chip000258 Chn02

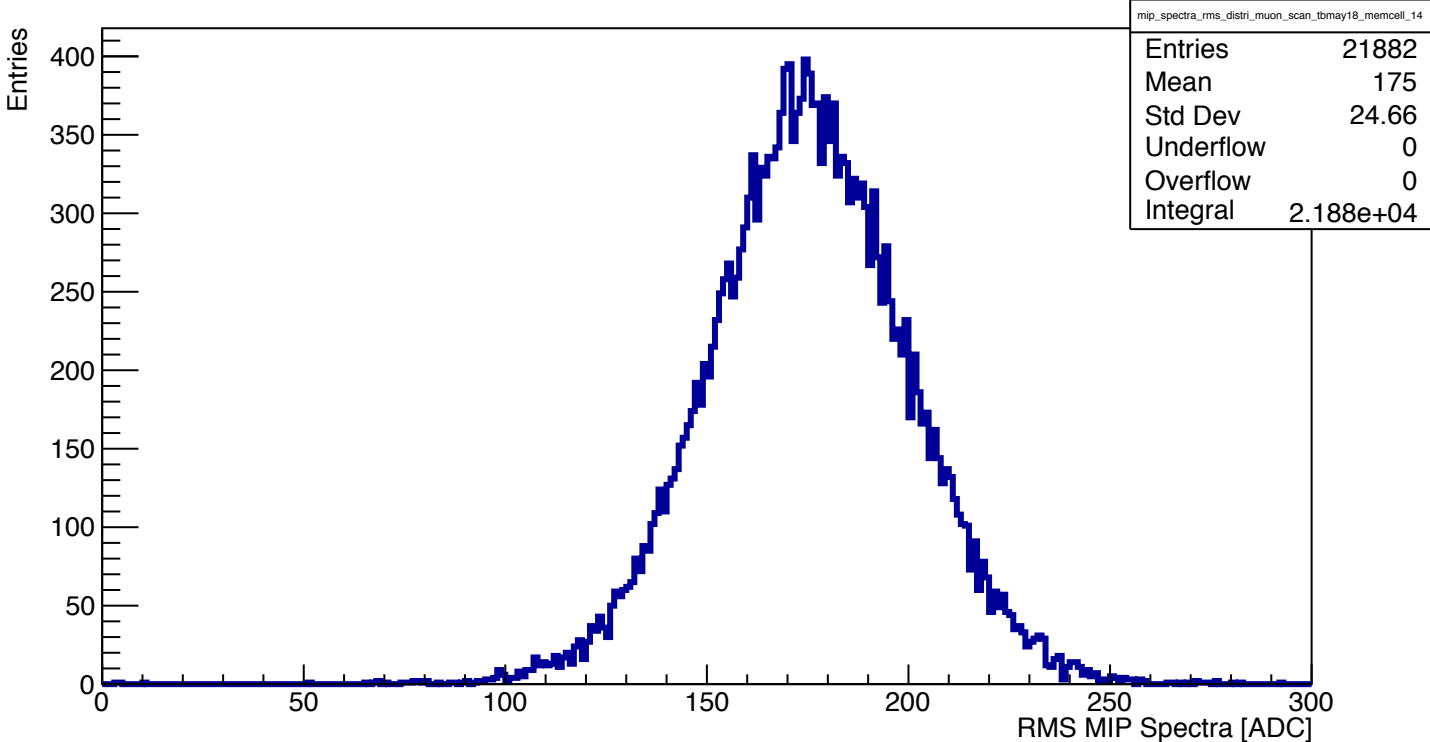


Raw ADC MIP Spectra

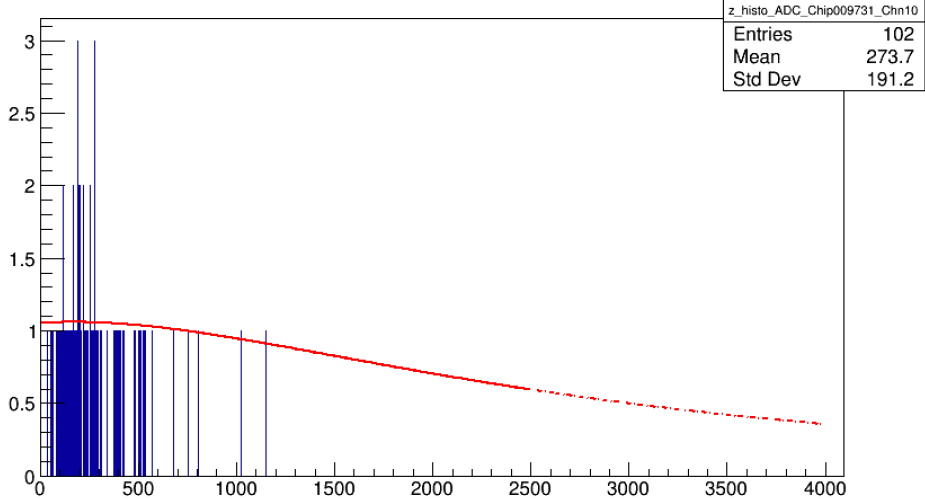
RMS for different Memory Cells

- Extract the RMS of MIP spectra for a specific memory cell to check for outliers, which would indicate bumps in Landau-Gaussian spectrum:

mip_spectra_rms_distri_muon_scan_tbmay18_memcell_14



ADC Histo Chip009731 Chn10

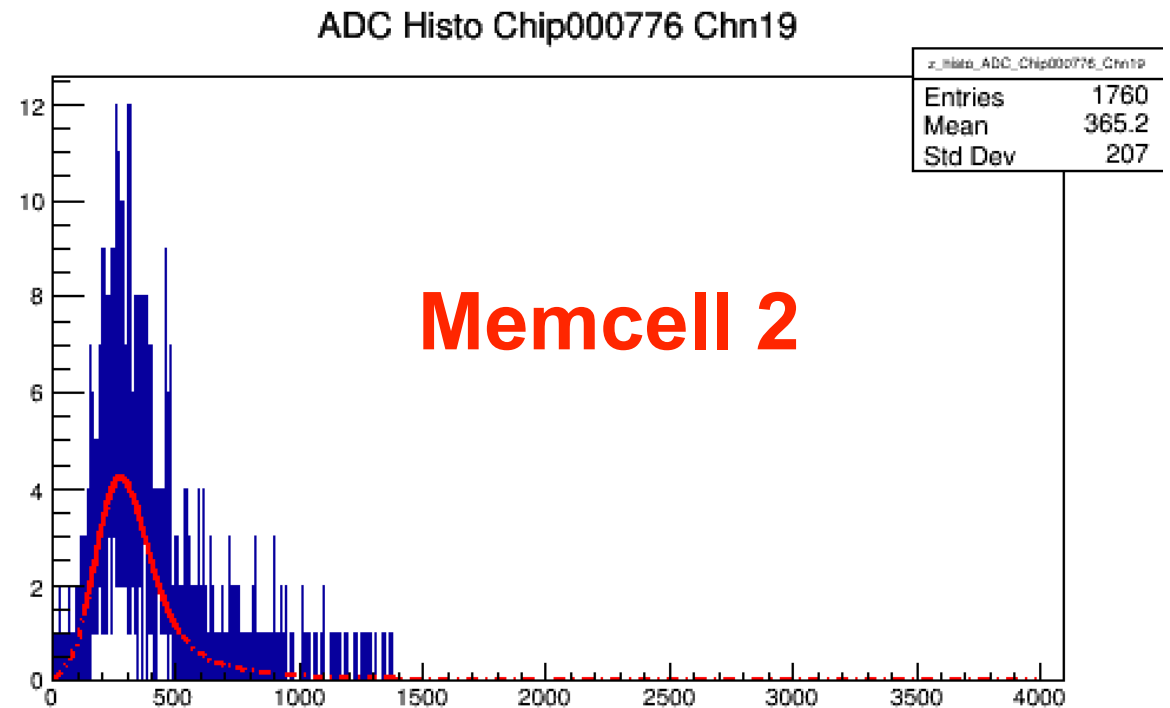


Raw ADC MIP Spectra

Individual Spectra Investigation

- Also cross-checked individual MIP spectra for very problematic pedestal spectra:

26	259	26	14	577.602665983	35.6547938588
27	259	27	14	568.151546392	38.265920111
28	259	28	14	557.671086181	22.4464783633
29	259	29	14	550.476299694	26.0776637245
30	259	30	14	574.491975928	21.7697715806
31	259	32	14	552.938977879	22.3982137303
32	259	33	14	540.930875576	26.8755230074
33	263	19	14	517.957417582	20.2016510024
34	268	3	14	455.40430622	27.1588307318
35	268	4	14	442.394084255	24.4962220514
36	268	8	14	450.252476734	20.9056626978
37	268	14	14	451.358935591	20.0715151955
38	268	22	14	447.194335643	24.1377839974
39	268	26	14	438.733515649	25.7481862561
40	268	30	14	441.665268205	23.5826583621
41	776	19	2	537.150942399	34.4591942433
42	779	22	7	598.643974378	27.1990247168
43	779	22	10	596.803421282	27.2166613841
44	779	22	12	603.546900713	21.7184573917
45	2572	11	14	554.688736682	23.913875361
46	2572	20	14	540.331670823	21.5632116555

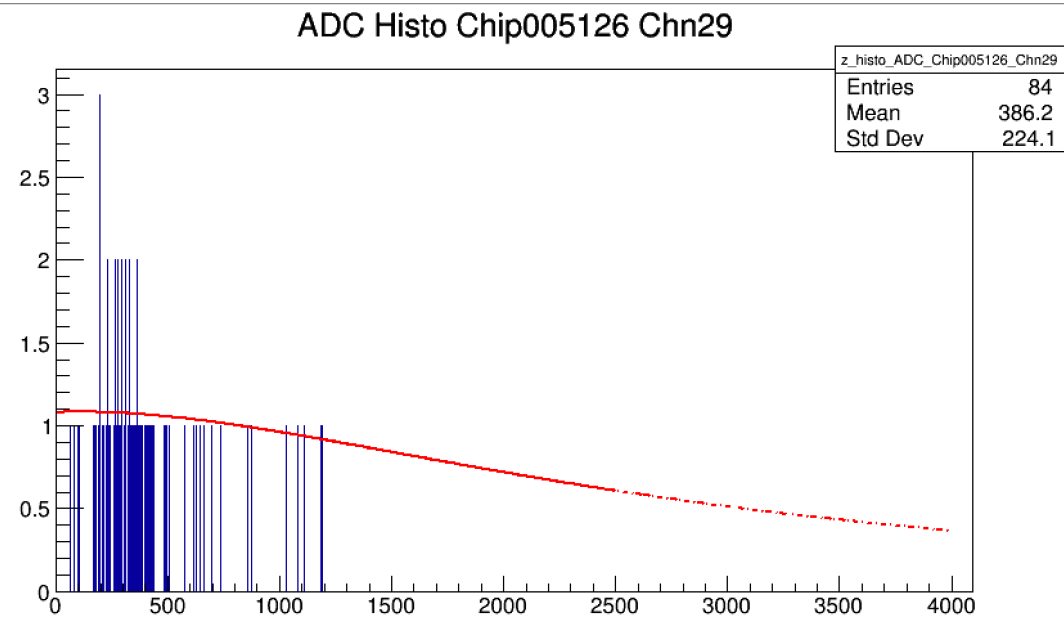


Raw ADC MIP Spectra

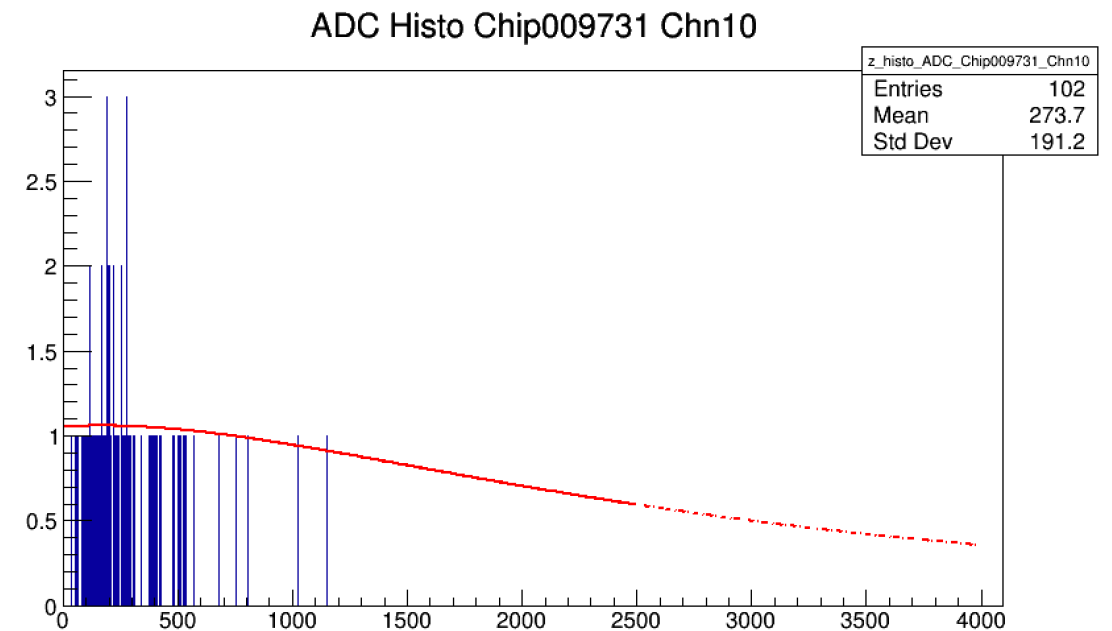
Individual Spectra Investigation

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Pedestal RMS ~80 ADC



Pedestal RMS ~120 ADC

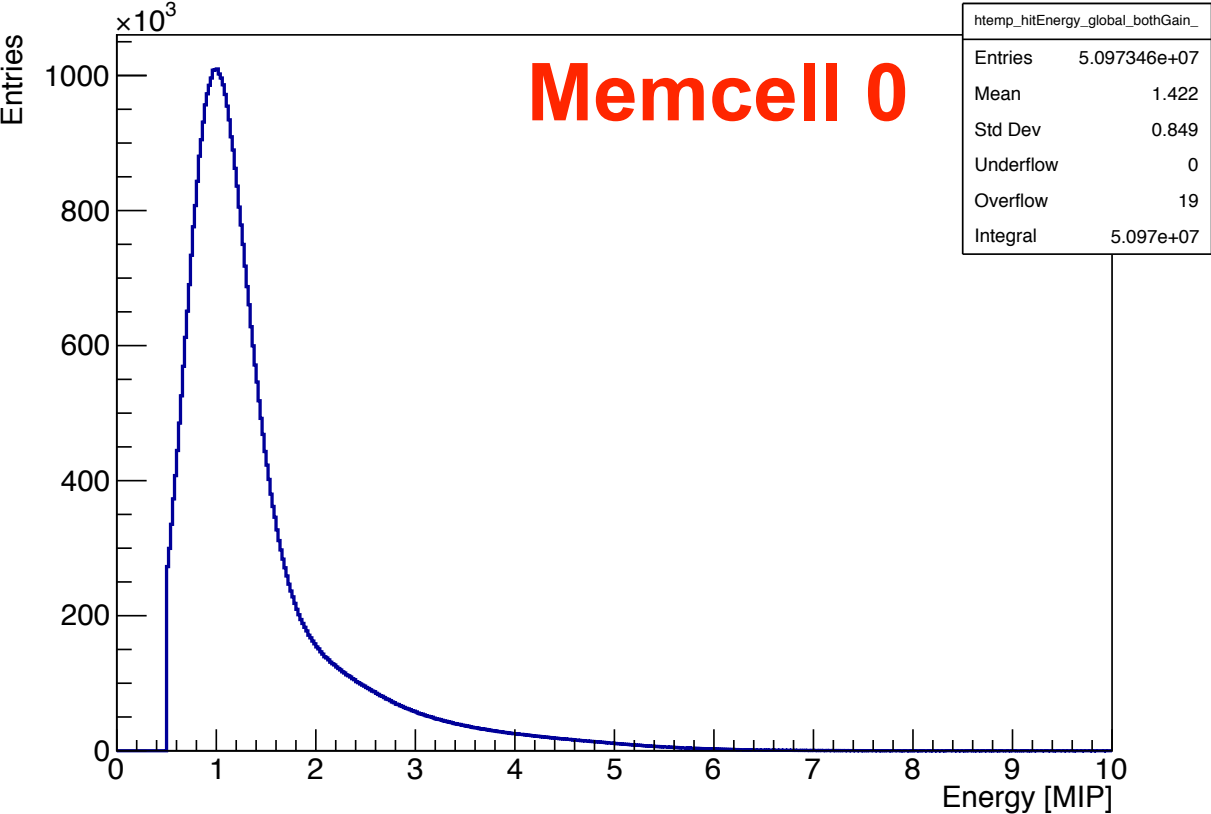


Reconstructed MIP Spectra

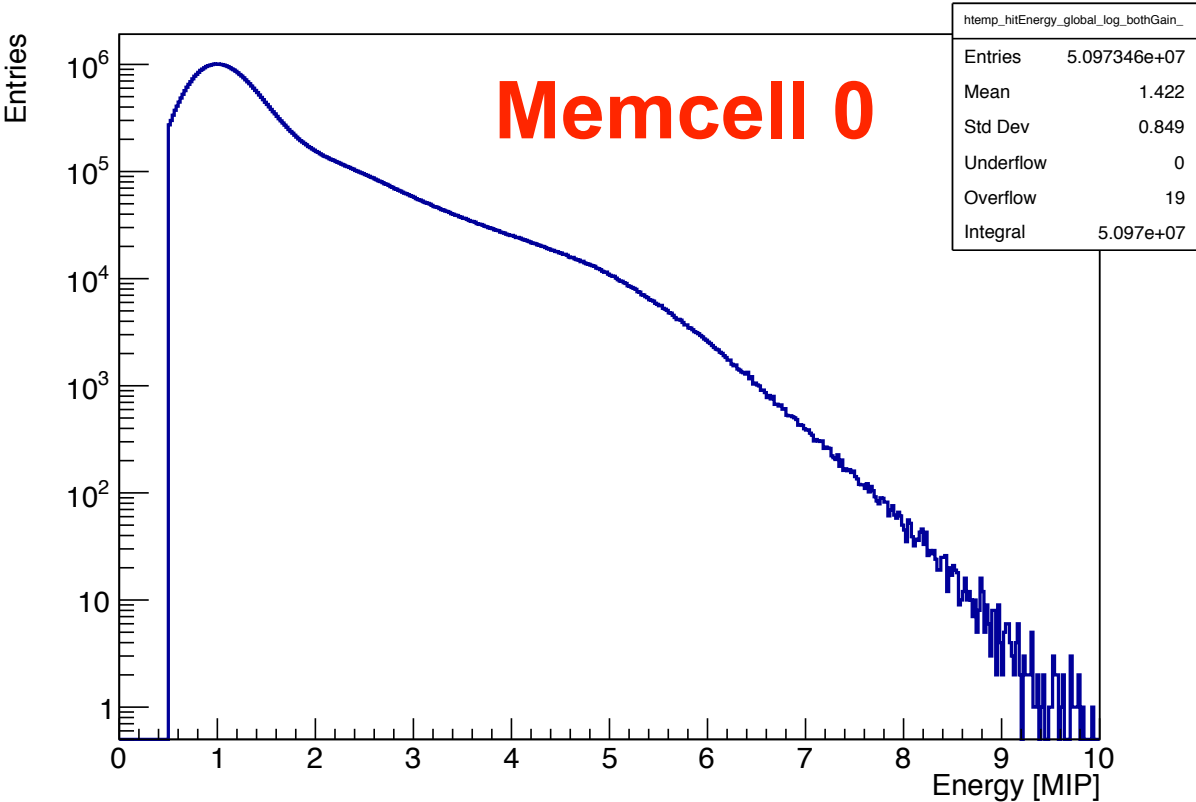
Global Energy Deposition for Memory-Cells

- Plot the global hit energy spectra for muon runs memory cell-wise and check for bumps

ahc_hitEnergy {ahc_hitType == 100}



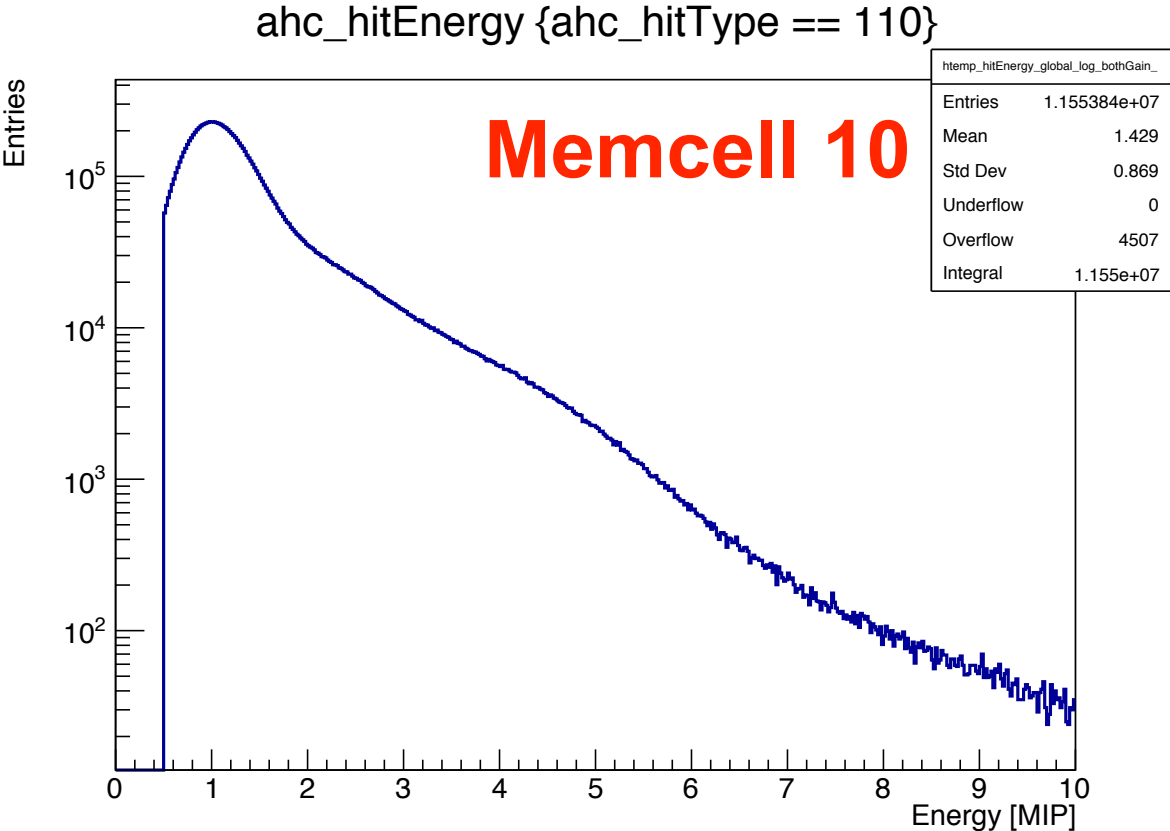
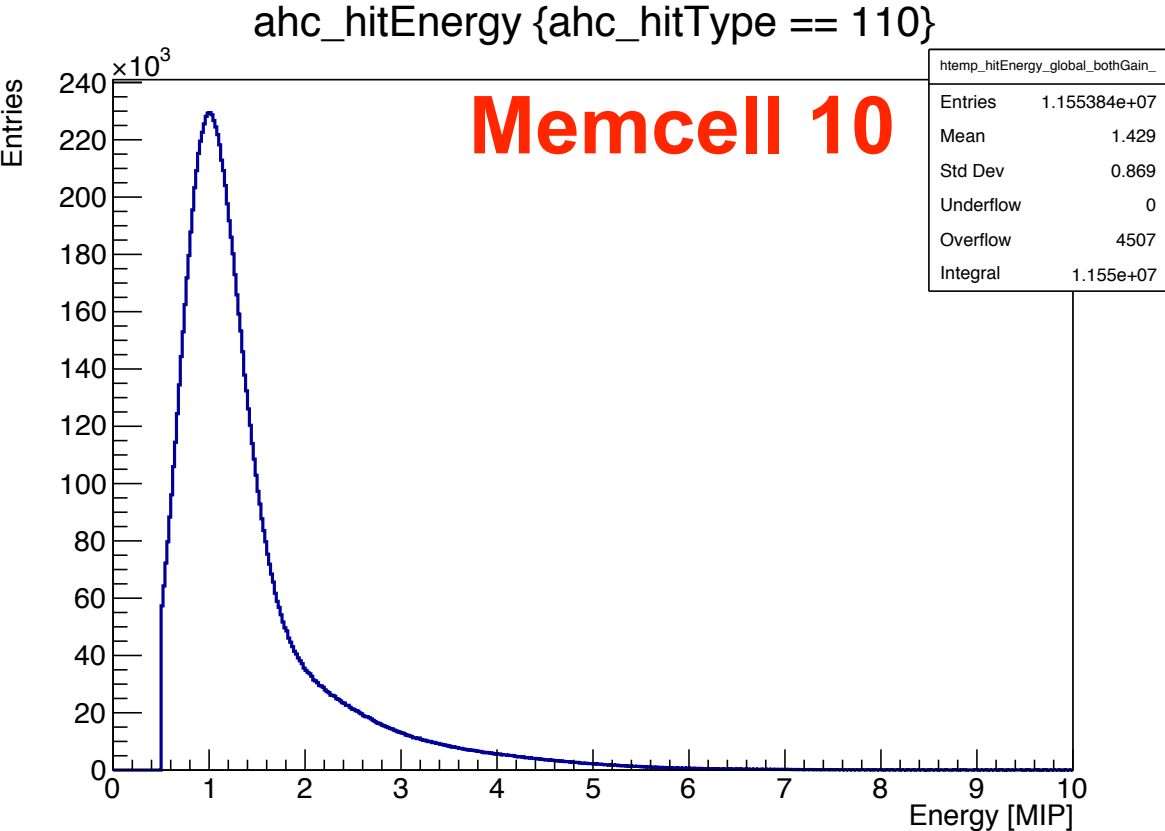
ahc_hitEnergy {ahc_hitType == 100}



Reconstructed MIP Spectra

Global Energy Deposition for Memory-Cells

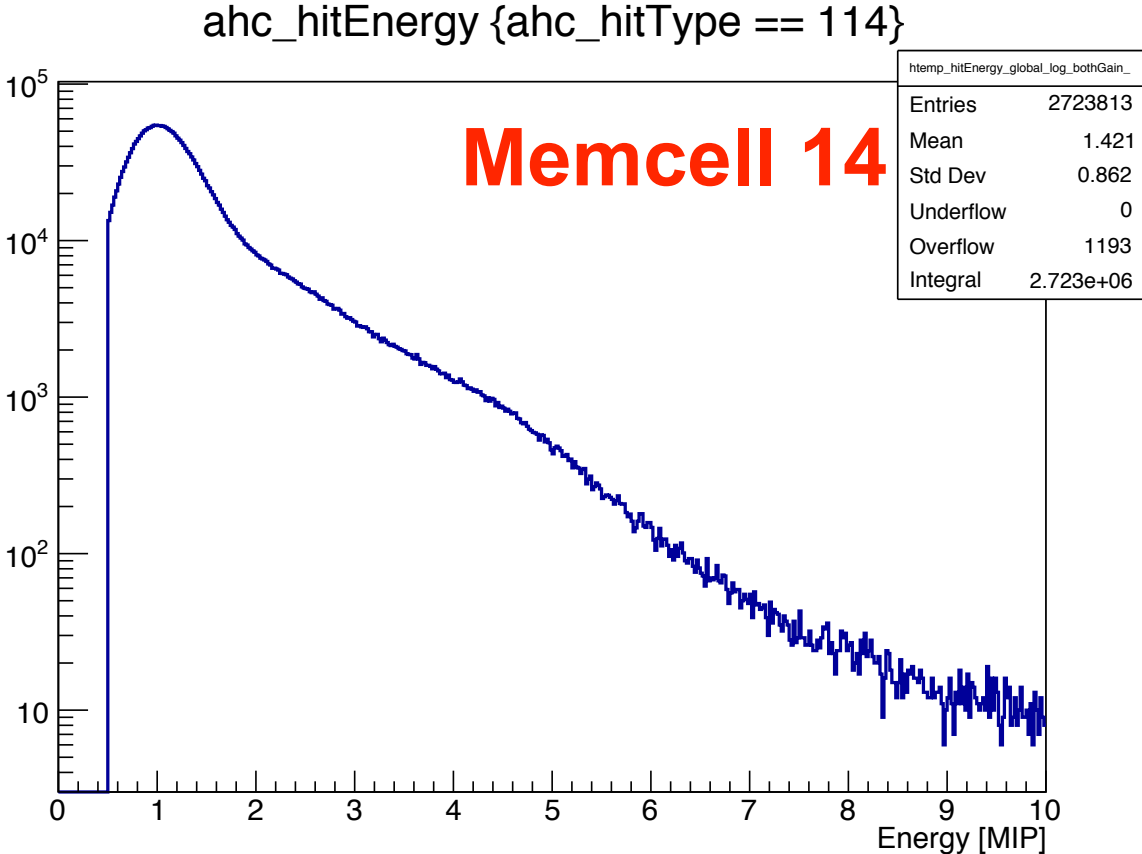
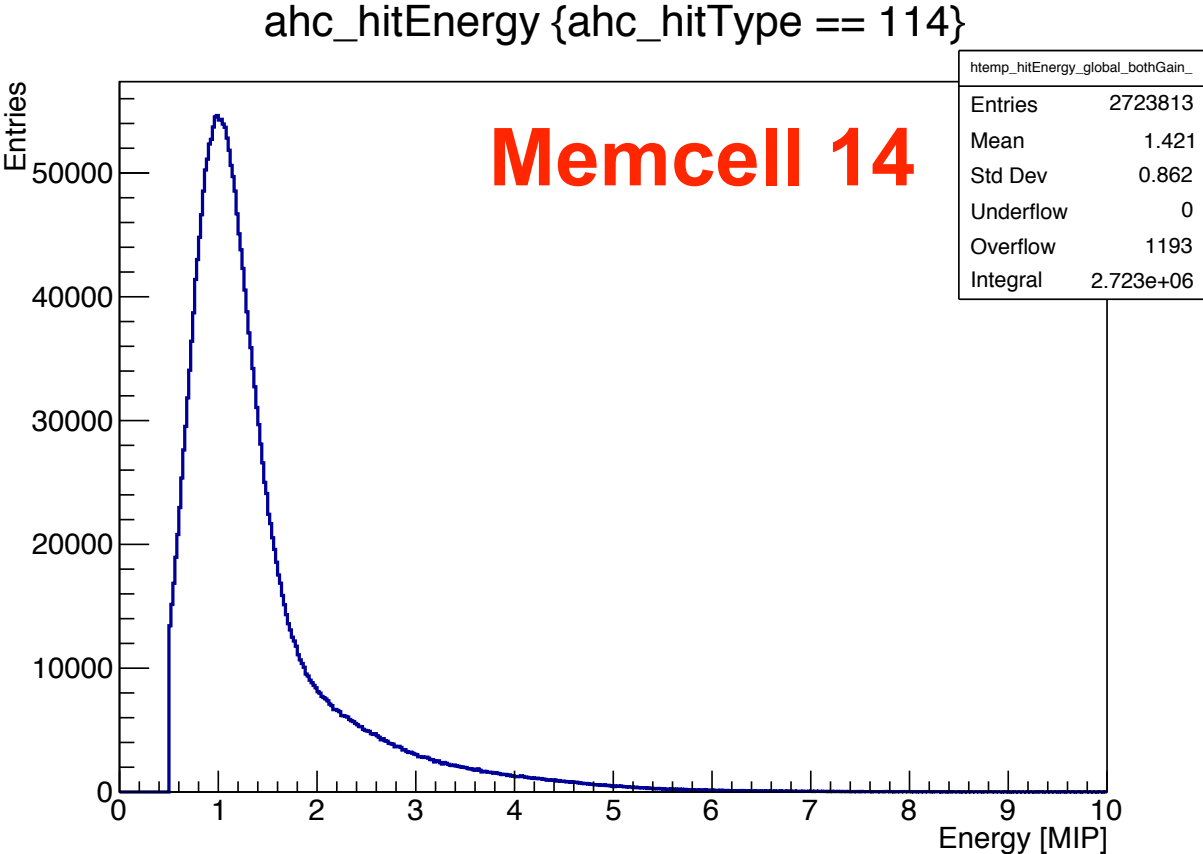
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Reconstructed MIP Spectra

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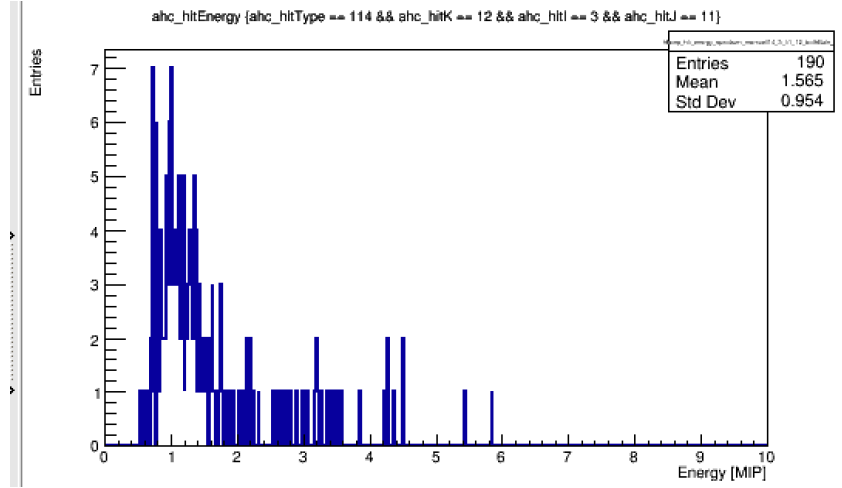
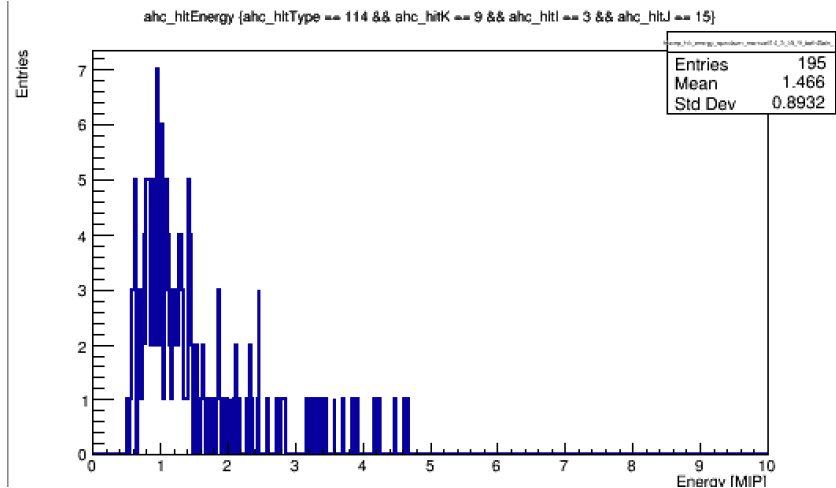
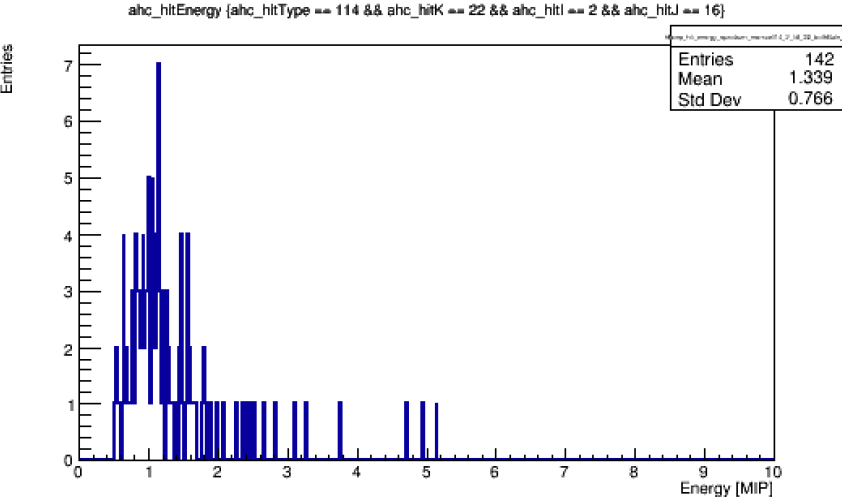
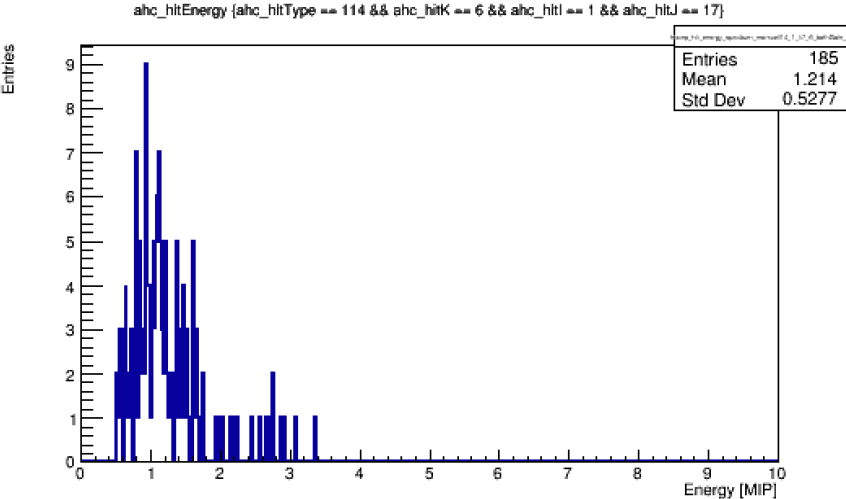
- Plot the global hit energy spectra for muon runs memory cell-wise and check for bumps



Reconstructed MIP Spectra



Individual Memory Cell Spectra

- Checked also problematic individual memory cell spectra for memory cell 14




Summary and ToDo's

Software and DB:

- HG/LG Pedestal + Memory Cell Offsets Software feature implemented and tested for all possible configurations 
 - ➔ Can be implemented in next CaliceSoft release
- DB up-to-date for May, June (October -> Gain?) 
 - ➔ 2.5 MIP bump gone for Memory Cell Offset feature, energy spectra for muons looks reasonable

ADC jumps:

- MIP spectra investigated in terms of ADC jumps for raw and reconstructed data: 
 - ➔ Correlation for channel to cell 0, cell2 and cell5 MIP constants looks fine, higher cells lack of statistics
 - ➔ **Good news: No observed jumps in MIP memory cell spectra as for pedestal!**

SSF:

- Started to look into SSF with Vladimir and Linghui: Defined plans, get it running 

Next/ToDo:

- Test Yujis first iteration of extracted LG pedestals to check HG/LG
- Repeat MIP spectra studies for June PP muon data
- SSF: Modify for large prototype, define proper variable for Vlad's StdVariables processor; GEANT4 true shower start, etc..

Thank you, merry X-mas and a safe trip back home!



Copyright: Samarkand



Backup

CaliceSoft

Latest implemented feature to treat HG/LG pedestals individually

- Feature was implemented to treat HG and LG Pedestals and their corresponding offsets in individual DB collections!
 - ➔ Treat HG/LG hits individually in terms of pedestal subtraction!

```
<processor name="GeoConditions" type="ConditionsProcessor">
  <parameter name="DBInit" type="string" value="flccaldb02.desy.de:calice:caliceon:Delice.1:3306"/>
  <parameter name="DBCondHandler" type="StringVec">
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    Ahc2ModuleConnection      /cd_calice_Ahc2/TestbeamMay2018/ModuleConnection      ahc2_ModuleConnection_180822
    Ahc2ModuleLocationReference /cd_calice_Ahc2/TestbeamMay2018/ModuleLocationReference ahc2_ModuleLocationReference_180822
    Ahc2HardwareConnection     /cd_calice_Ahc2/TestbeamMay2018/Ahc2HardwareConnection ahc2_HardwareConnection_180822
    Ahc2DetectorTransformation  /cd_calice_Ahc2/TestbeamMay2018/DetectorTransformation HEAD
    E4DPedestal                /cd_calice_Ahc2/TestbeamMay2018/Pedestal                ahc2_pedestal_180906
    E4DPedestalMemoryCellOffset /cd_calice_Ahc2/TestbeamMay2018/PedestalMemoryCellOffset ahc2_pedestalmemorycelloffset_180906
    E4DLowGainPedestal         /cd_calice_Ahc2/Test/LowGainPedestal                     ahc2_lg_pedestal_hg_181130
    E4DLowGainPedestalMemoryCellOffset /cd_calice_Ahc2/Test/LowGainPedestalMemoryCellOffset ahc2_lg_pedestalmemorycelloffset_fake_1
    E4DGainConstants           /cd_calice_Ahc2/TestbeamMay2018/gain_constants           ahc2_gainconstant_180827
    E4DGainSlopes              /cd_calice_Ahc2/TestbeamMay2018/gain_slopes              HEAD
    E4DMipConstants            /cd_calice_Ahc2/TestbeamMay2018/mip_constants            ahc2_mip_constants_180925
    E4DMipSlopes               /cd_calice_Ahc2/TestbeamMay2018/mip_slopes               HEAD
    E4DDeadCellMap             /cd_calice_Ahc2/TestbeamMay2018/DeadCellMap             HEAD
    E4DSaturationParameters    /cd_calice_Ahc2/TestbeamMay2018/SaturationParameters    ahc2_SaturationParameters_180824
    E4DIntercalibration        /cd_calice_Ahc2/TestbeamMay2018/Intercalibration        ahc2_Intercalibration_180824
    E4DPhysicsCalibIntercalibration /cd_calice_Ahc2/TestbeamMay2018/PhysicsCalibIntercalibration HEAD
    E4DTimeSlopes              /cd_calice_Ahc2/TestbeamMay2018/TimeSlopes              HEAD
    E4DTimeOffset              /cd_calice_Ahc2/TestbeamMay2018/TimeOffset              HEAD
    E4DTimeOffsetMem_Even      /cd_calice_Ahc2/TestbeamMay2018/TimeOffsetMem_Even      ahc2_005
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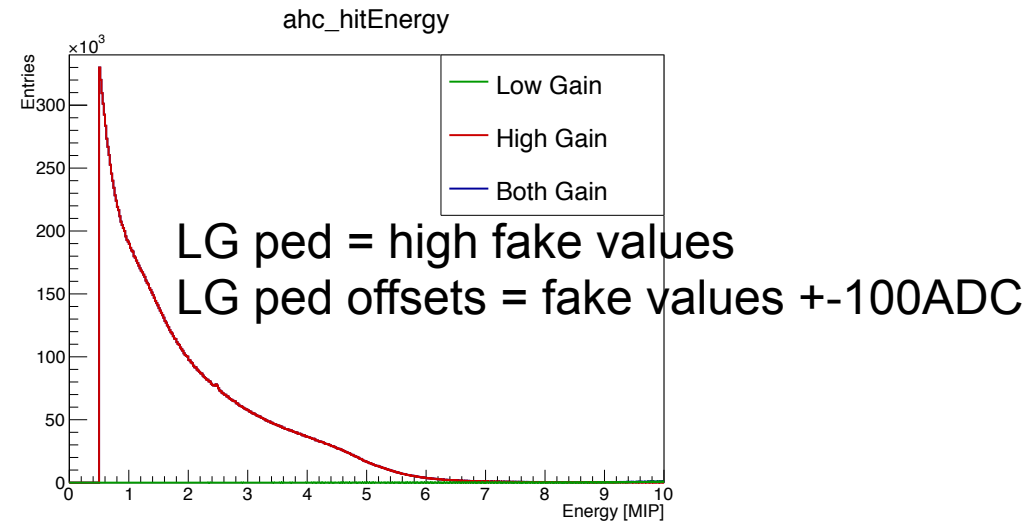
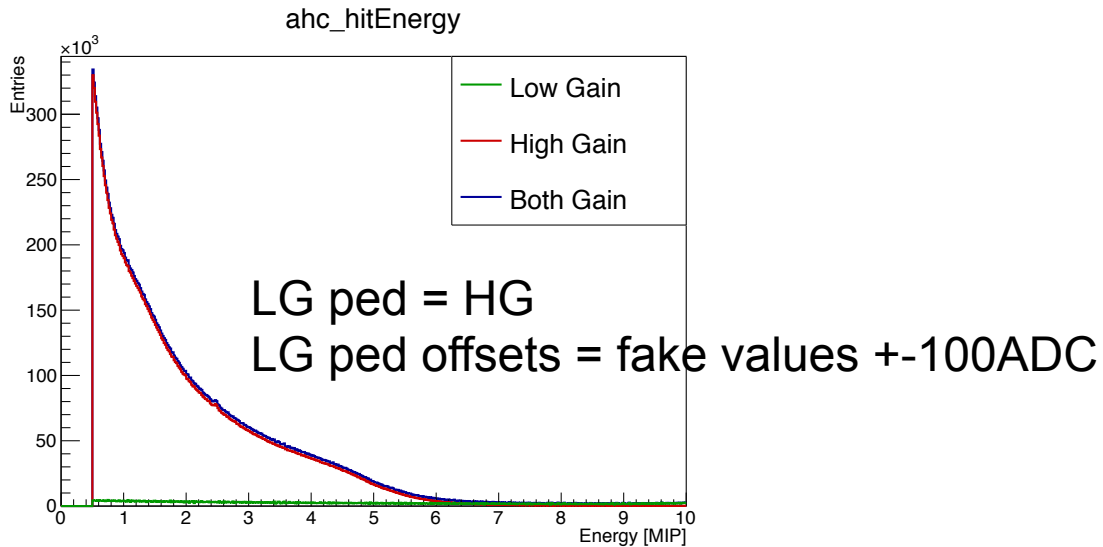
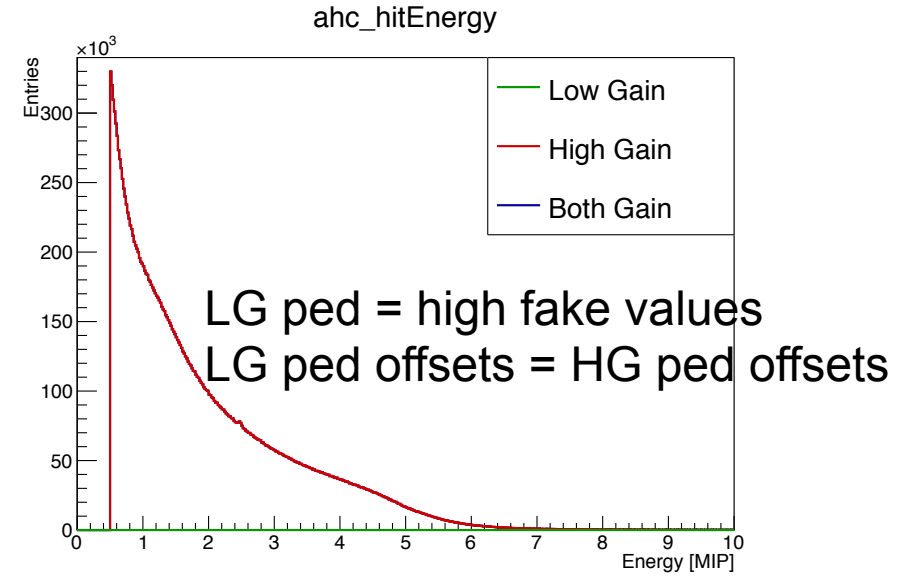
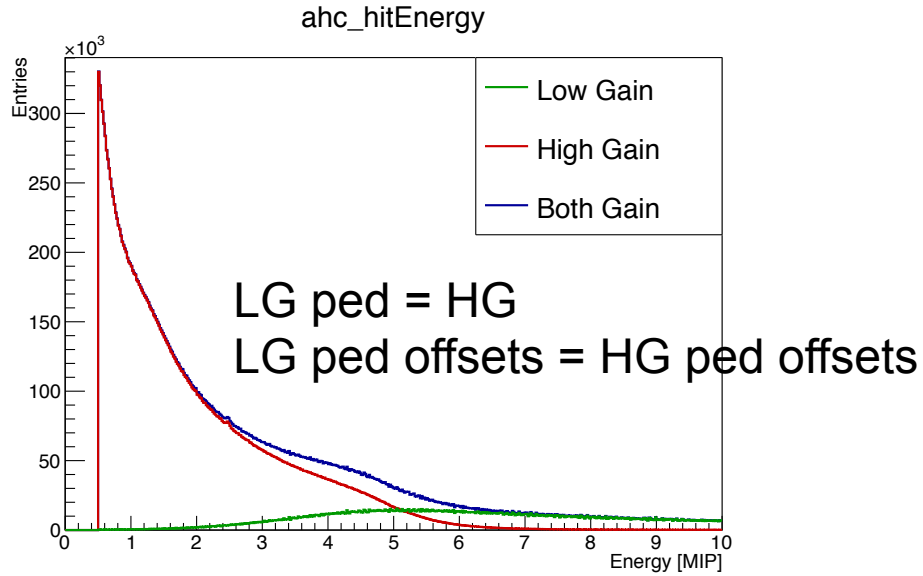
CaliceSoft

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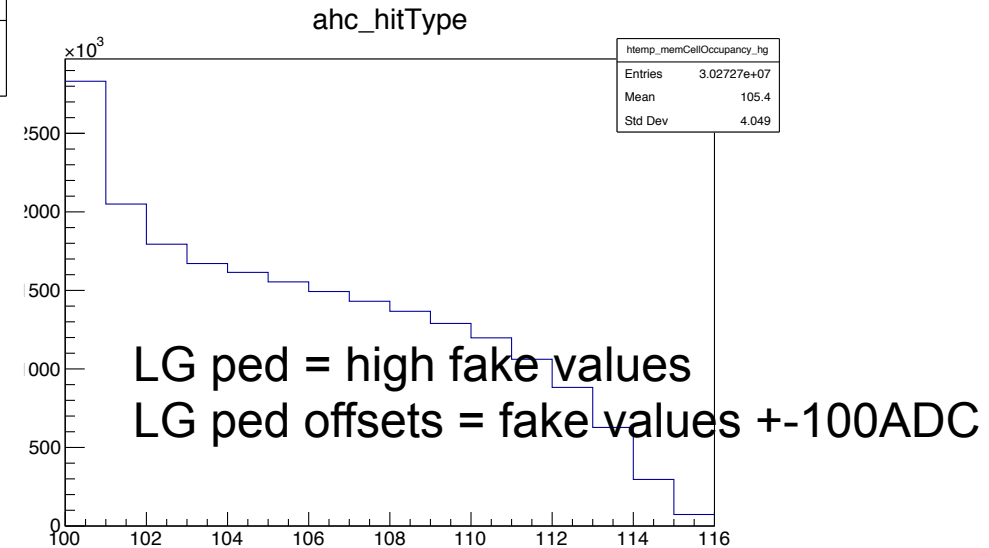
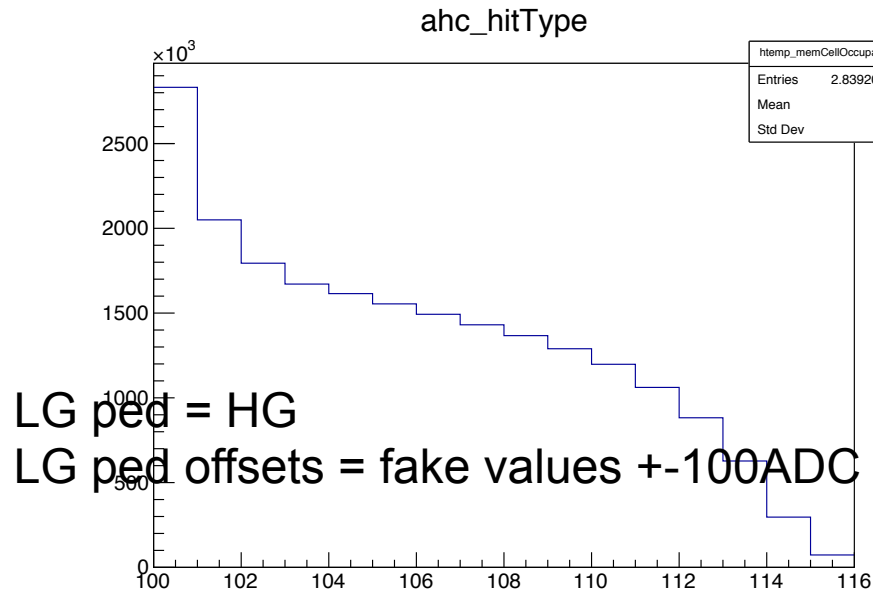
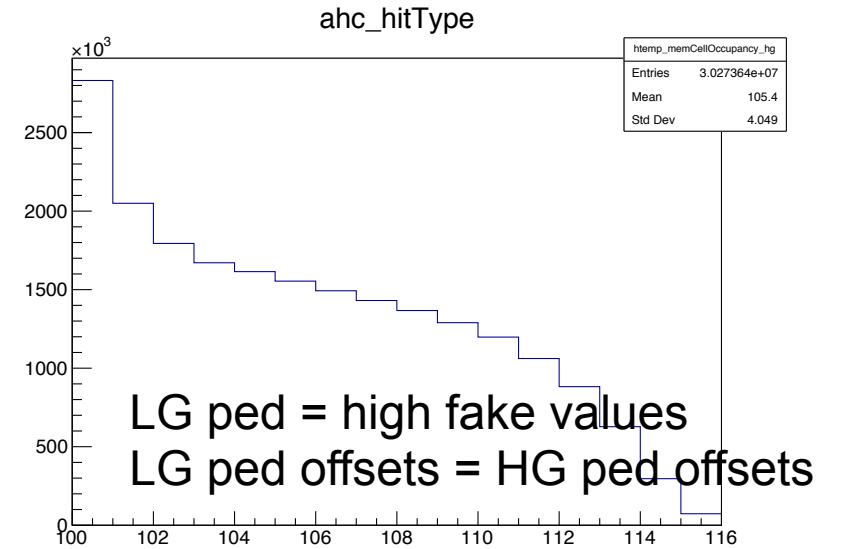
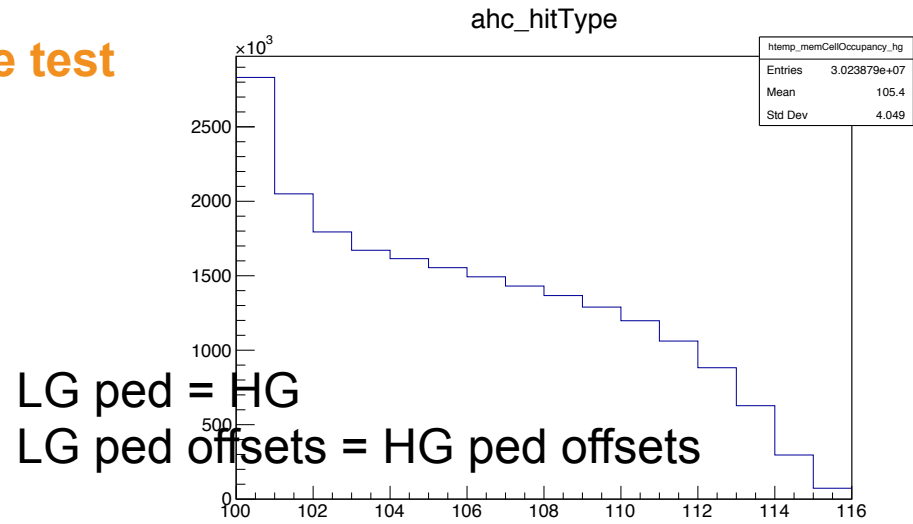
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<!--Name of the Pedestal Memory Cell Offset constants collection-->
<parameter name="LowGainPedestalCollection" type="string" lcioInType="LCGenericObject"> E4DLowGainPedestal </parameter>
<!--Name of the memory cell offset pedestal collection-->
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<!--Name of the MIP constants collection-->
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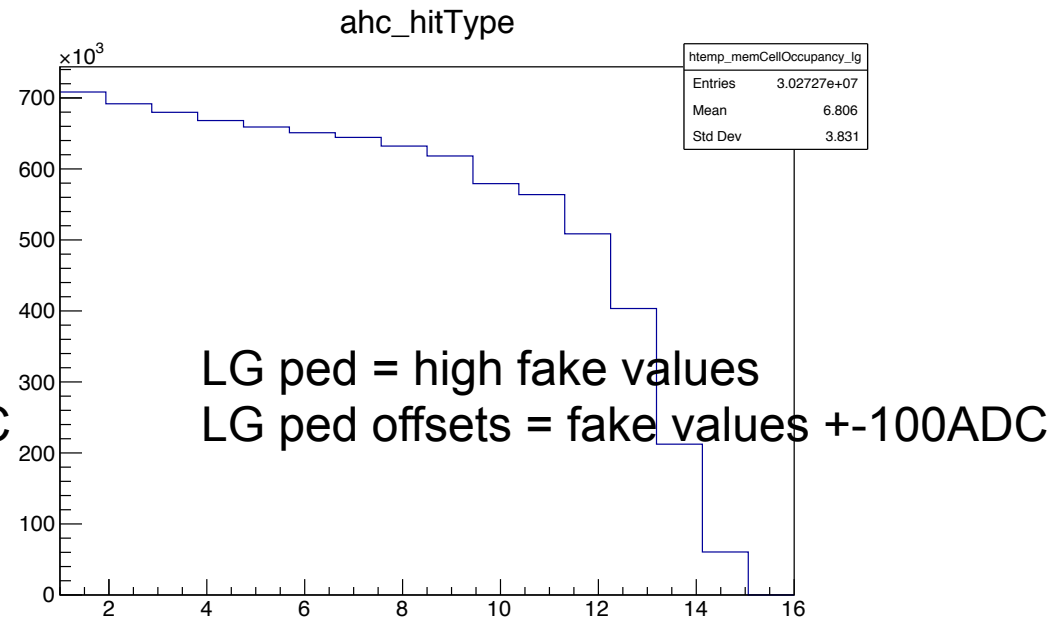
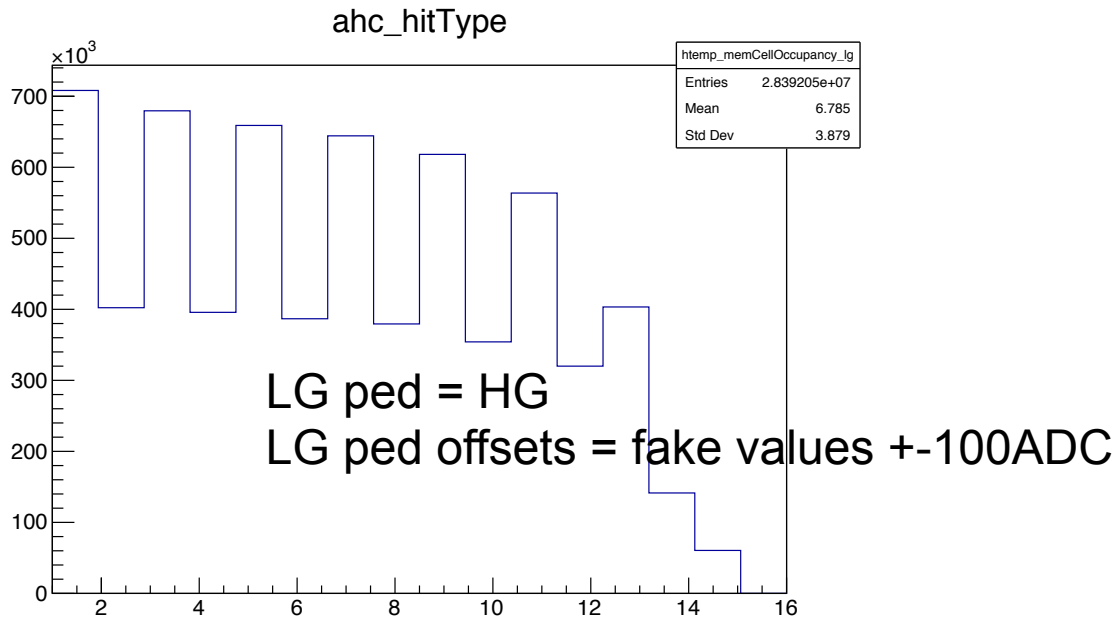
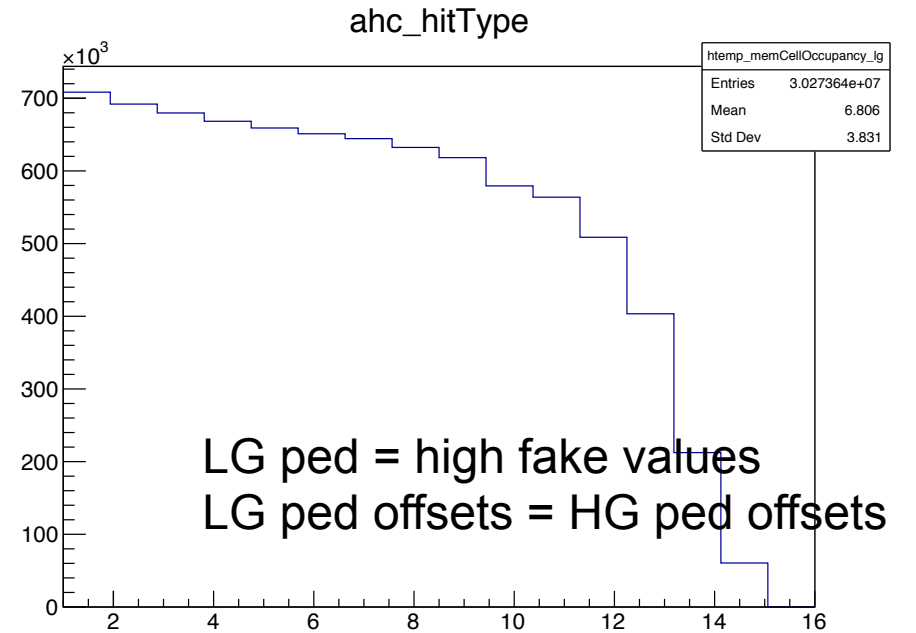
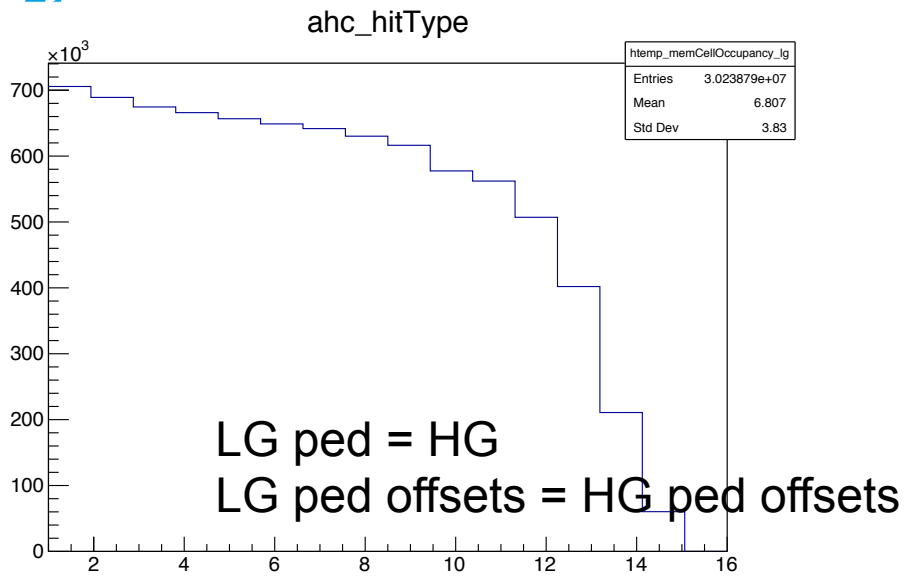
- Procedure of testing new feature:
 - ➔ Upload fake constants to DB test folder and reconstruct with different combinations of constants:
 - ➔ HG pedestals as LG Pedestals, spectrum the same?
 - ➔ Fake LG Pedestals very wrong values, Fake LG pedestal offset
 - ➔ Check hit energy and cell occupancy in HG and LG individually

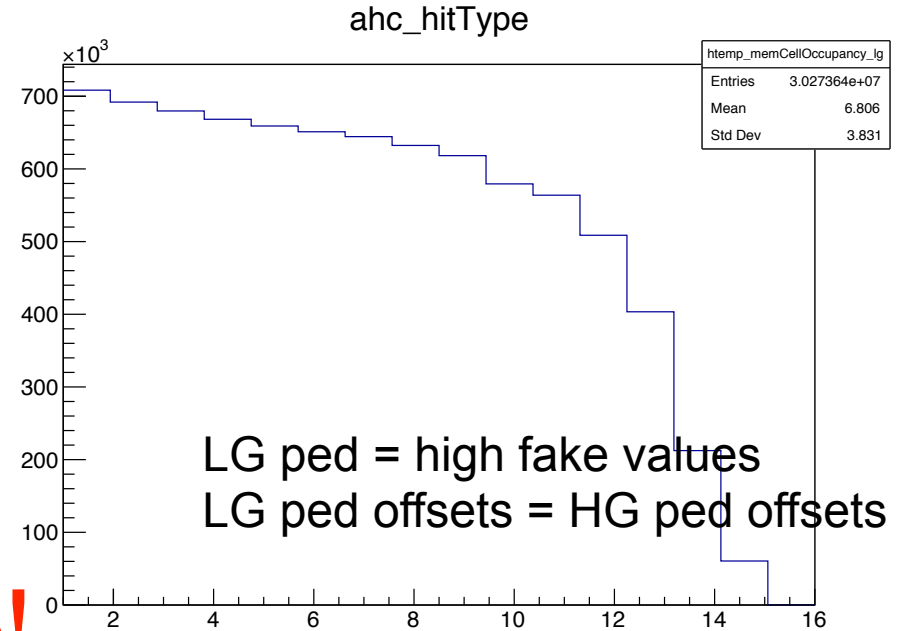
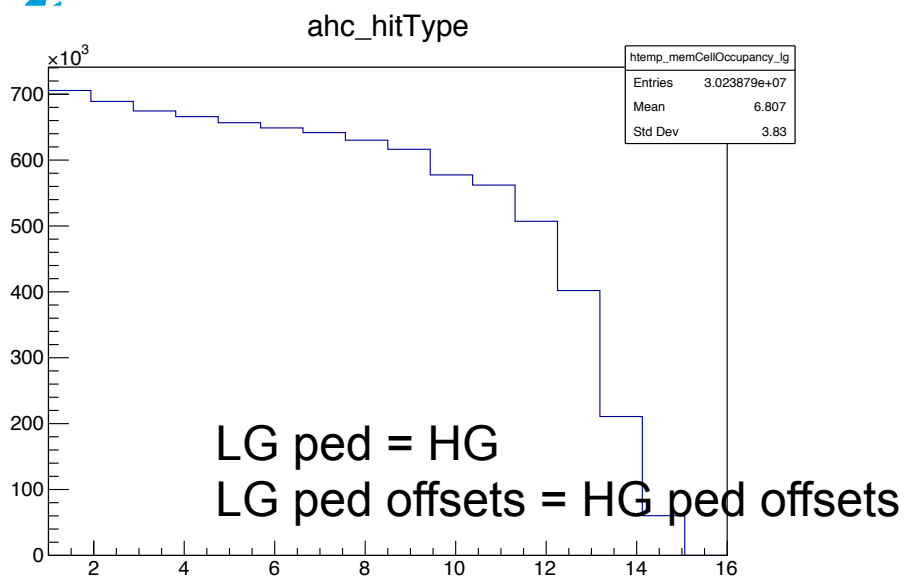


CaliceSoft

HG/LG Pedestal feature test







Works!

