HCAL Analysis

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Introduction

- We will present analysis of new PMTs and HF noise and also Mid-week GR8.
- HF noise analysis:
  - We have updated the code for HF noise analysis.
  - PMTs were upgraded to new models in HF- iphi43 during 2011/2012 year-end Technical Stop (YETS)
    - Reduce anomalous signals
  - Comparing the response of the old and new PMTs.
- MWGR8 Analysis:
  - Show rechits energy for the HE, HB, HO using MWGR-8

Info for the analysis

- We use
  - CMSSW_7_1_7
  - /MinimumBias/Run2012D-22Jan2013-v1/RECO
  - RunList:

203912, 203987, 203992, 203994, 204100, 204101, 204113, 204250, 204541, 204544, 204553, 204555, 204563, 204564, 204576, 204577, 204599, 204601,205111, 205158, 205193, 205217, 205311, 205233, 205236, 205238, 205303, 205311, 205339, 205344, 205519, 205526, 205617, 205620, 205666, 205667, 205683, 205694, 205718, 205781, 205826, 205833, 205921,206187, 206208, 206210, 206246, 206302, 206304, 206331, 206389, 206401, 206446, 206448, 206466, 206476, 206478, 206484, 206512, 206542, 206595, 206745, 206476, 206595, 206745, 206869, 206897, 206906, 206940, 207099, 207231, 207233, 207269, 207273, 207279, 207372, 207454, 207488, 207491, 207886, 207898, 207905, 207921, 208339, 208351, 208353, 208427, 208428, 208487, 208541, 208551

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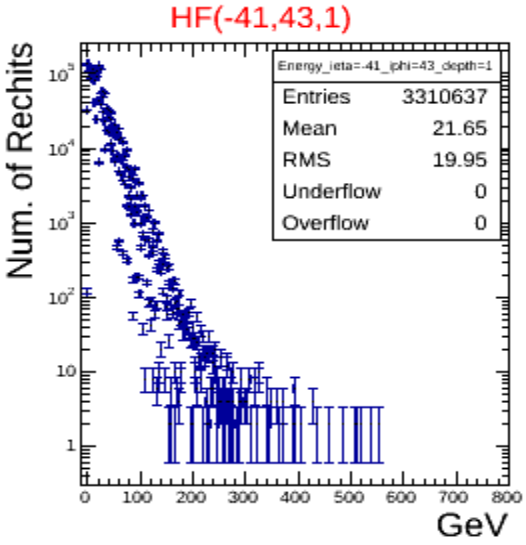
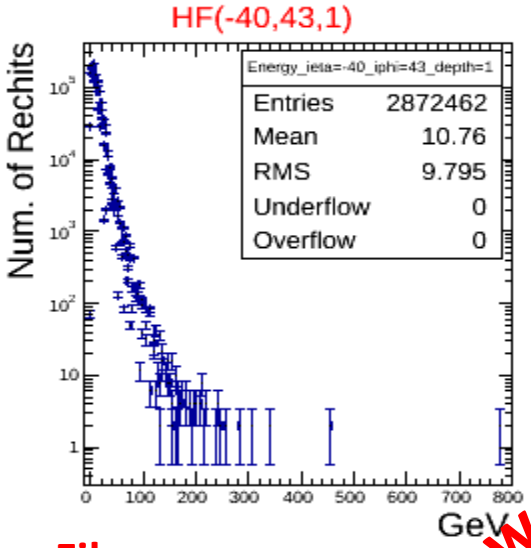
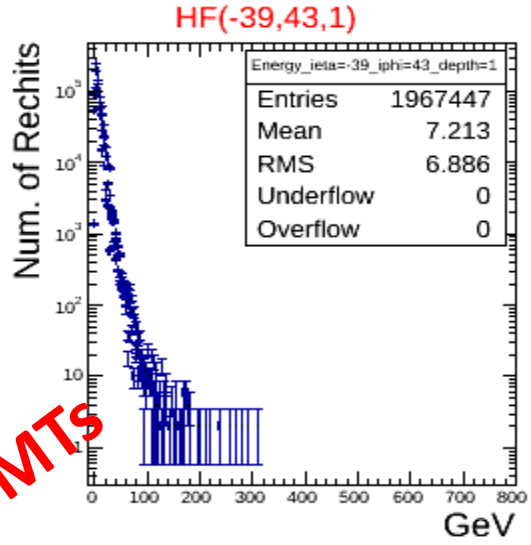
24 new PMTs is at HF- (iphi= 43)

seqId	eta	phi	depth
0001	-41	43	1
0002	-40	43	1
0003	-39	43	1
0004	-38	43	1
0005	-37	43	1
0006	-36	43	1
0007	-35	43	1
0008	-34	43	1
0009	-33	43	1
0010	-32	43	1
0011	-31	43	1
0012	-30	43	1
0013	-29	43	1
0014	-41	43	2
0015	-40	43	2
0016	-39	43	2
0017	-38	43	2
0018	-37	43	2
0019	-36	43	2
0020	-35	43	2
0021	-34	43	2
0022	-33	43	2
0023	-32	43	2
0024	-31	43	2
0025	-30	43	2
0026	-29	43	2

Energy distribution for iphi=43 idepth=1 (HF-)

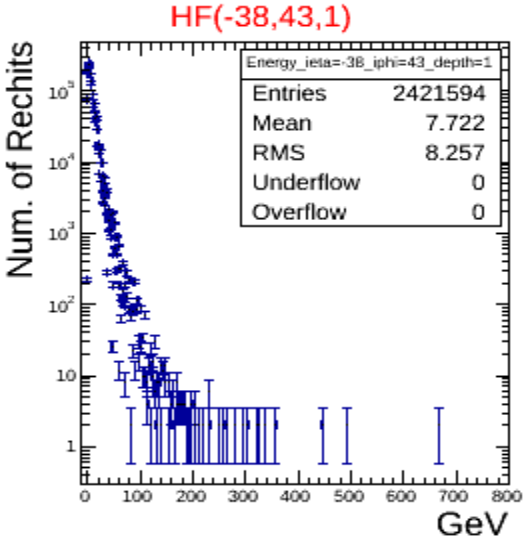


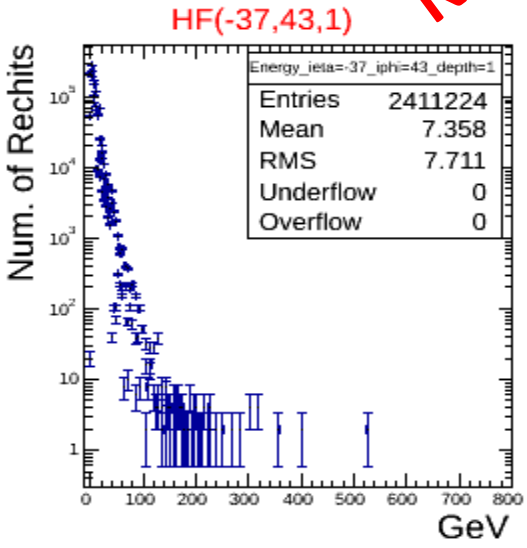


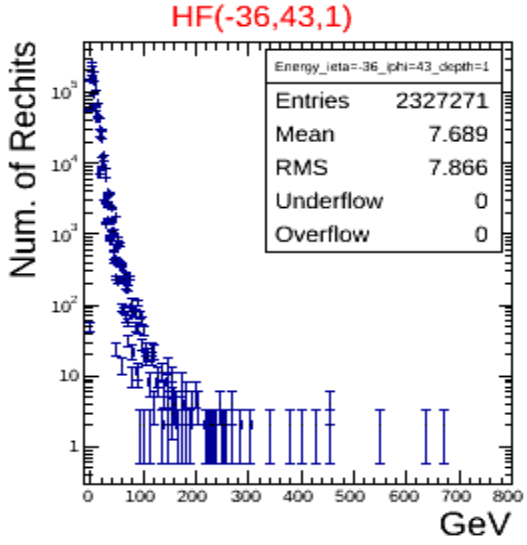


Long Fiber

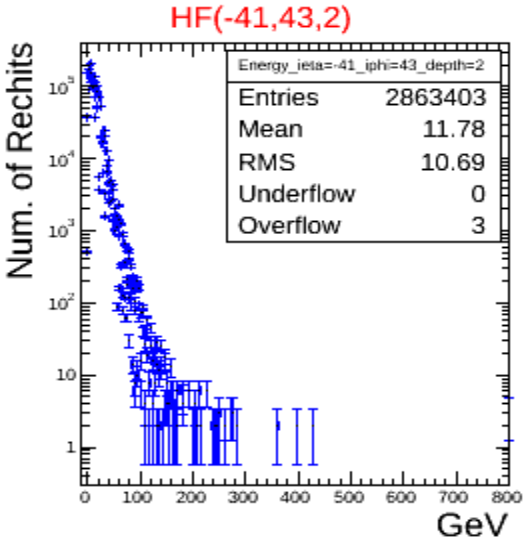
New PMTs

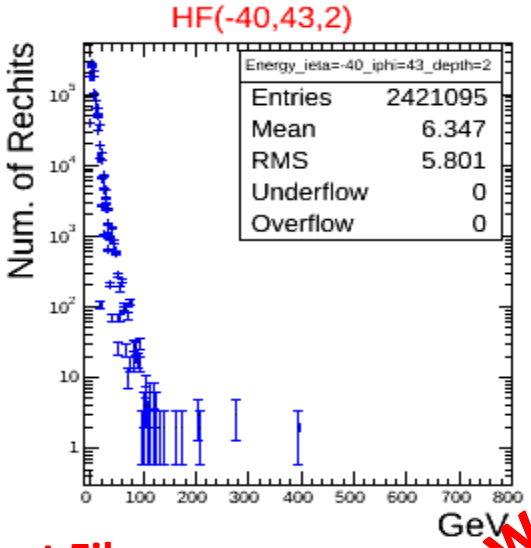


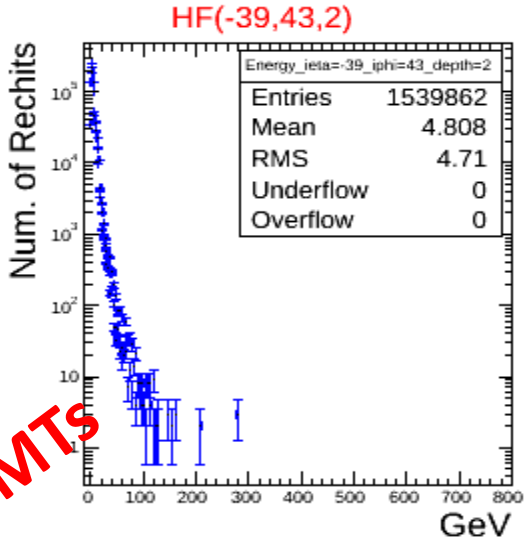




Energy distribution for iphi=43 idepth=2 (HF-)

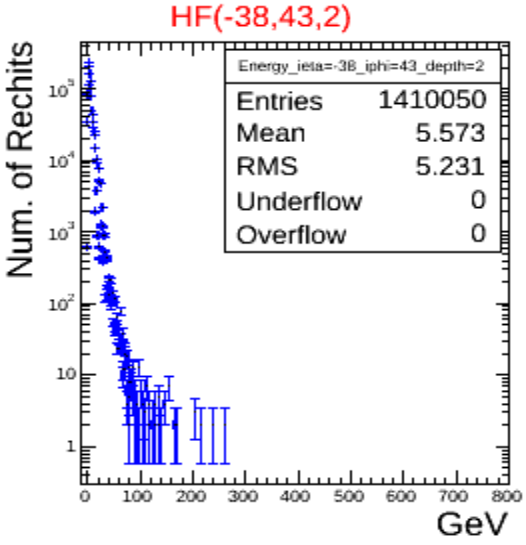


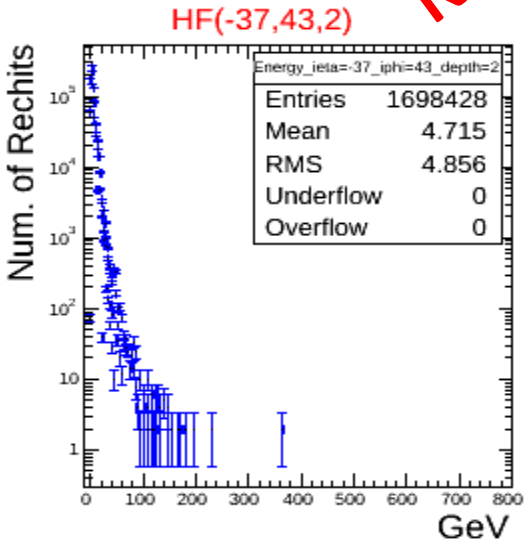


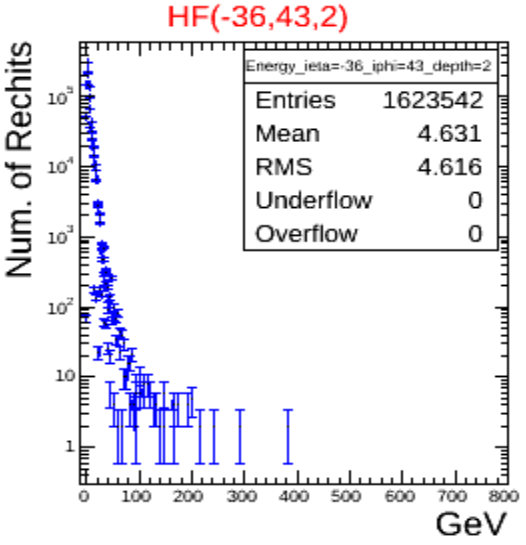


Short Fiber

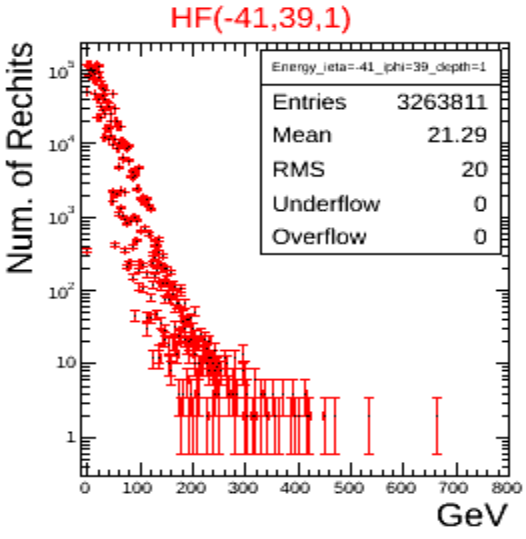
New PMTs

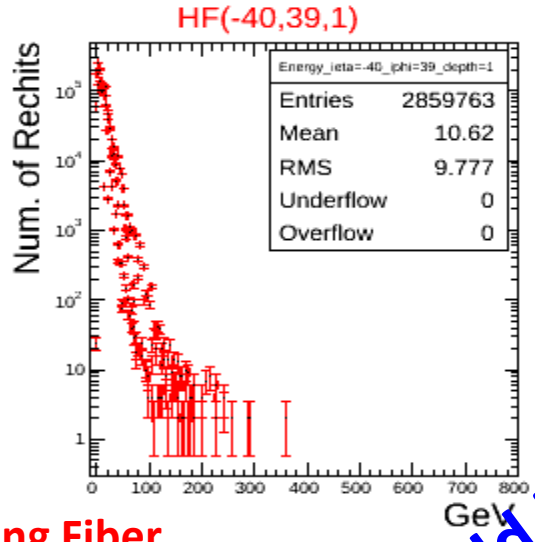


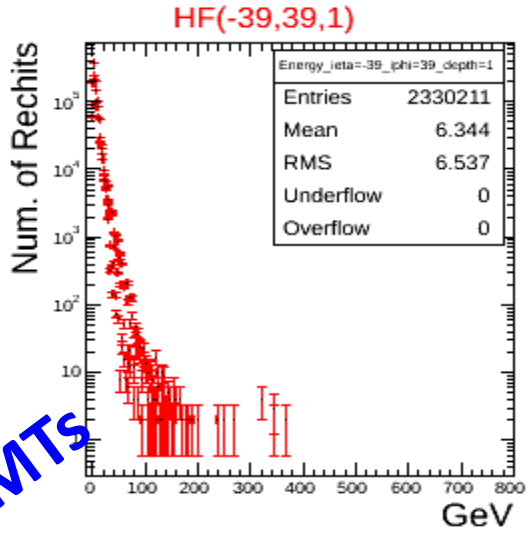




Energy distribution for iphi=39 idepth=1 (HF-)

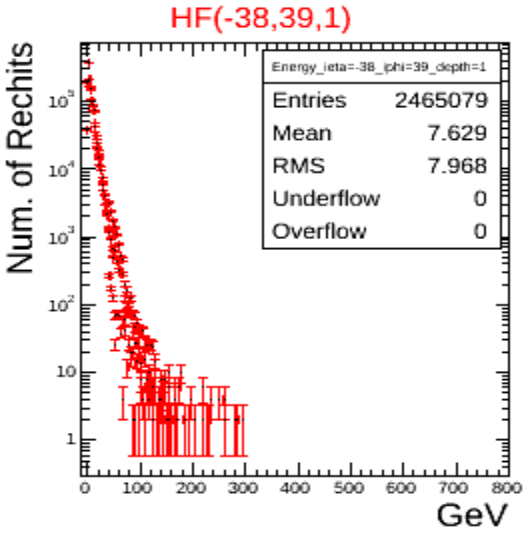


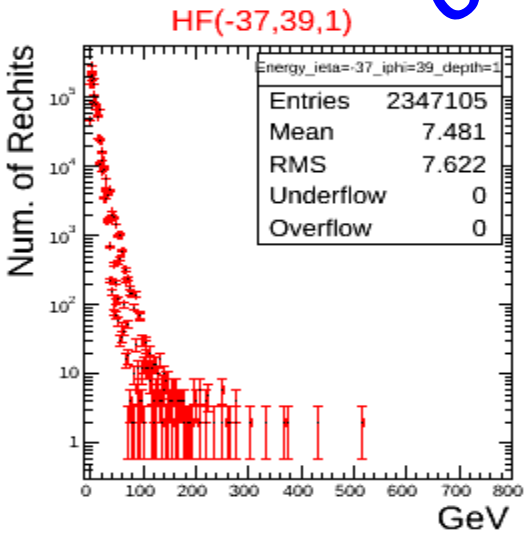


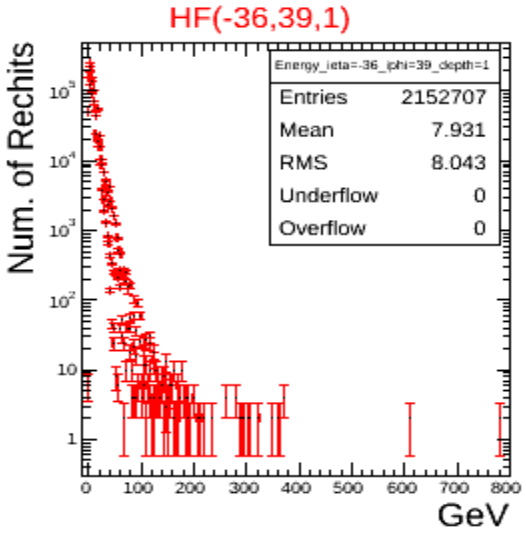


Long Fiber

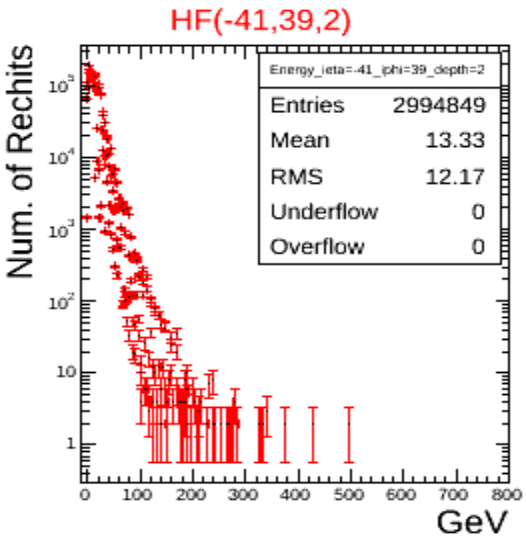
Old PMTs

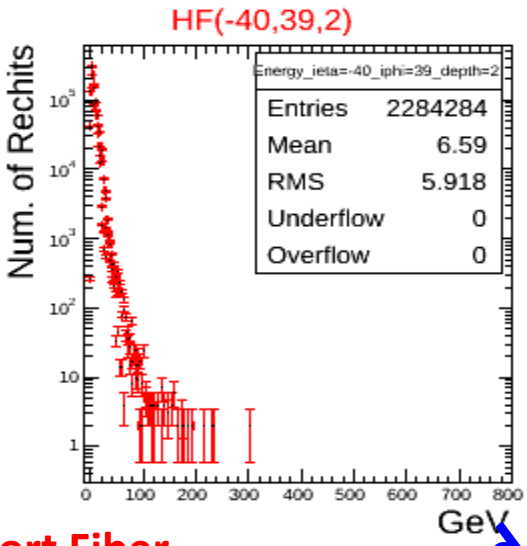


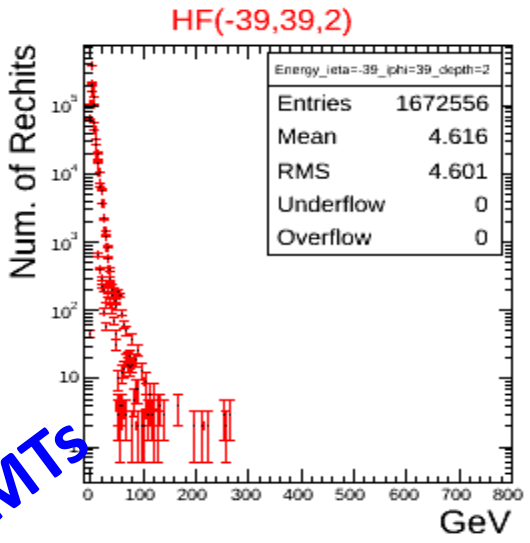




Energy distribution for iphi=39 idepth=2 (HF-)

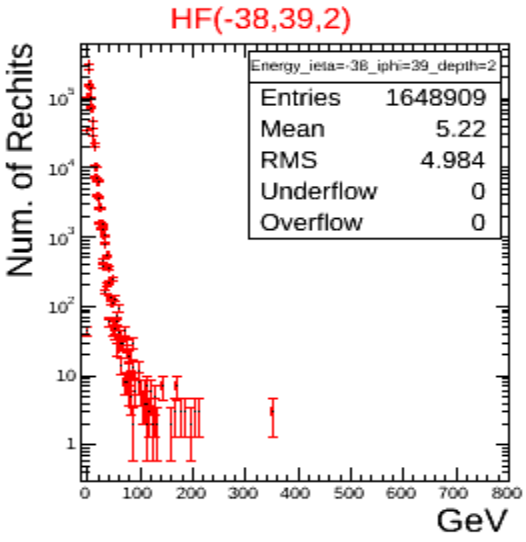


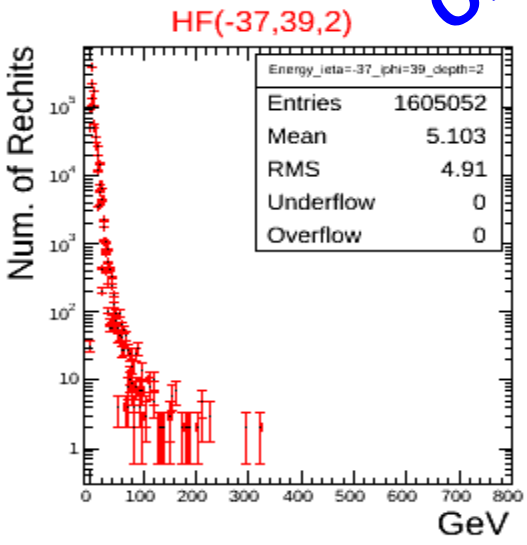


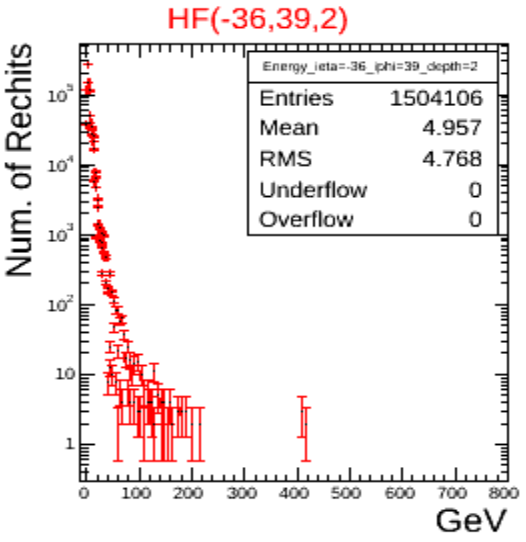


Short Fiber

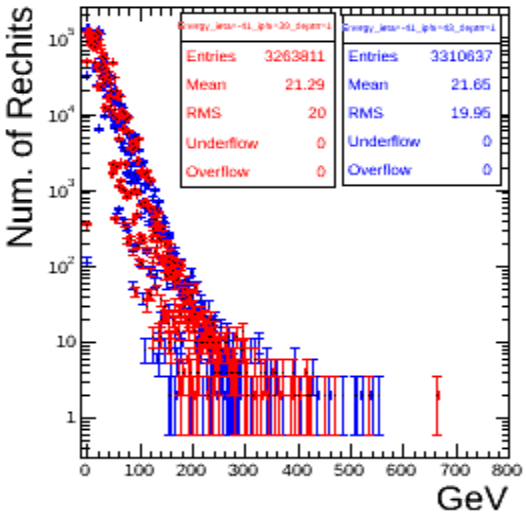
Old PMTs

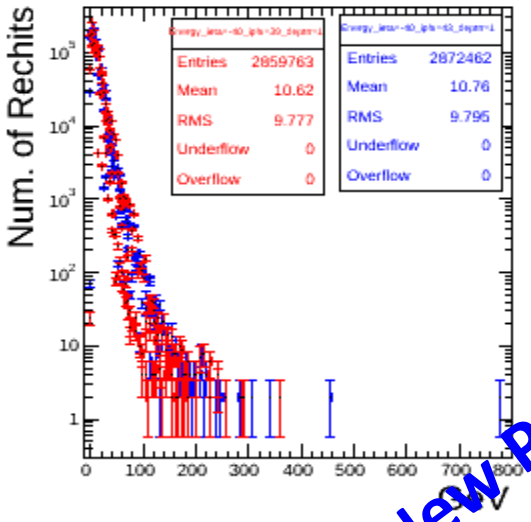


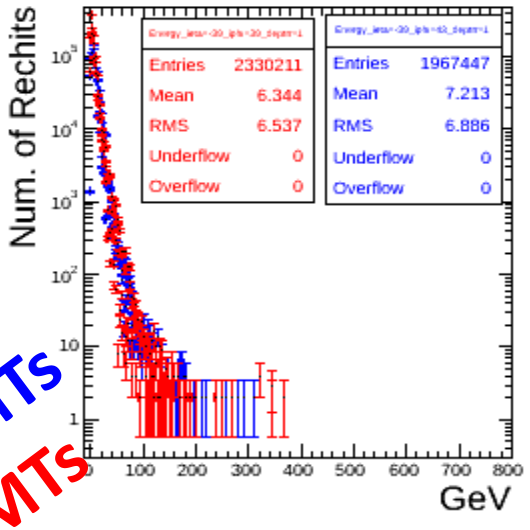




Comparison of Energy distributions with superposing



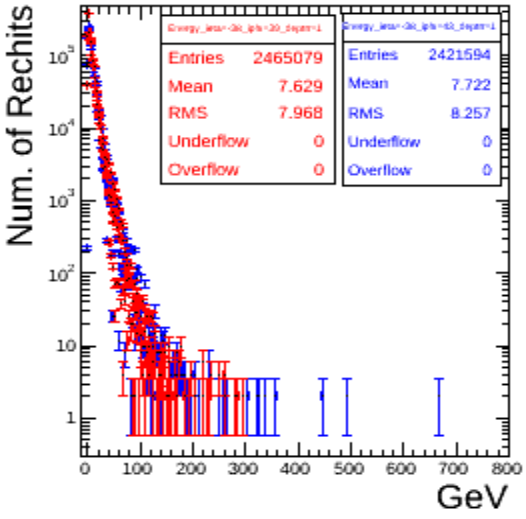


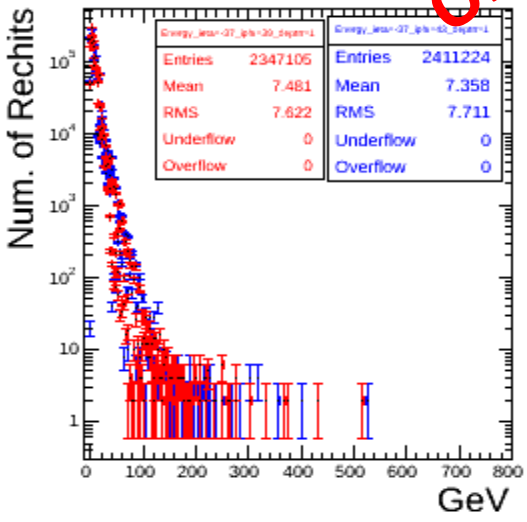


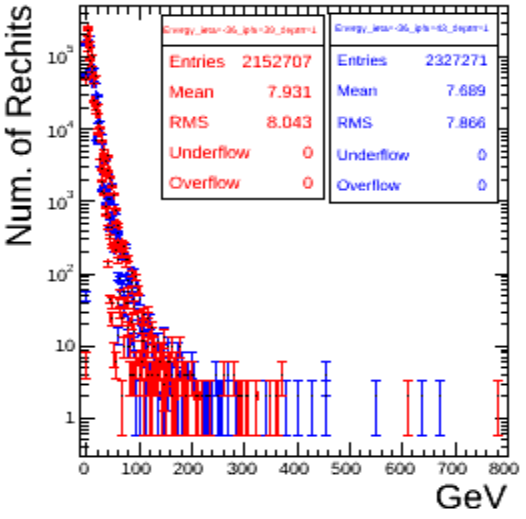
Long Fiber

New PMTs

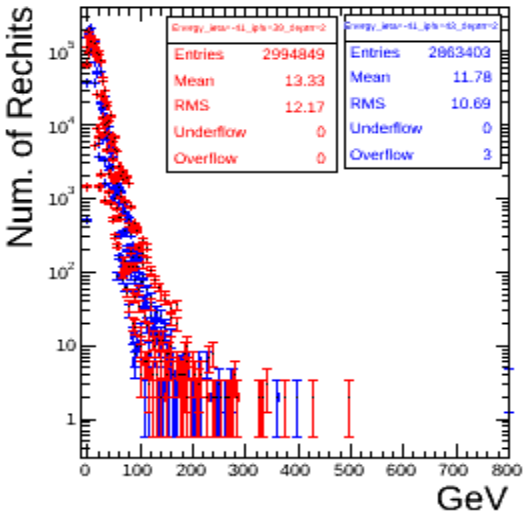
Old PMTs

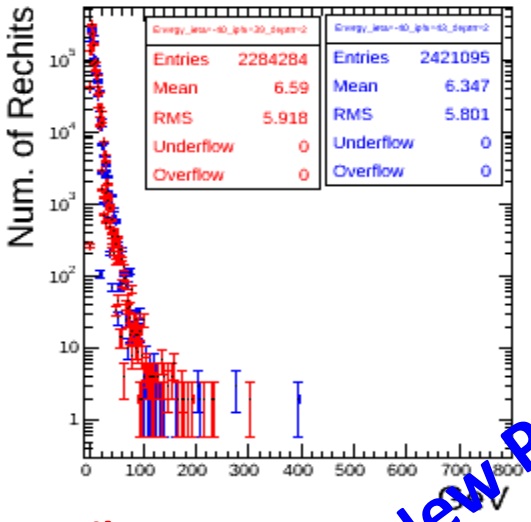


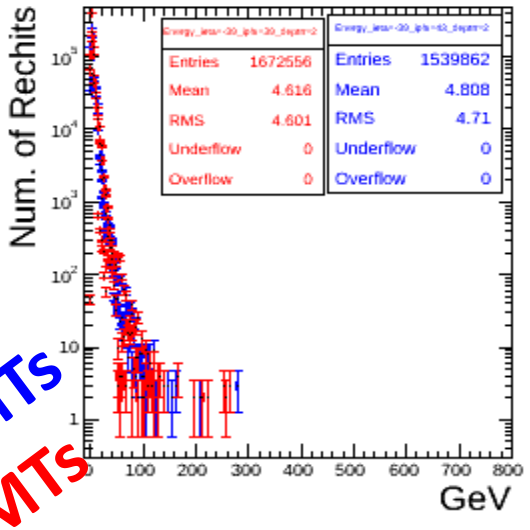




Comparison of Energy distributions with superposing



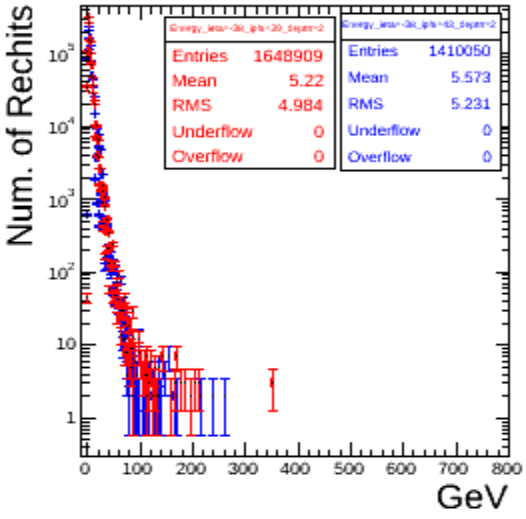


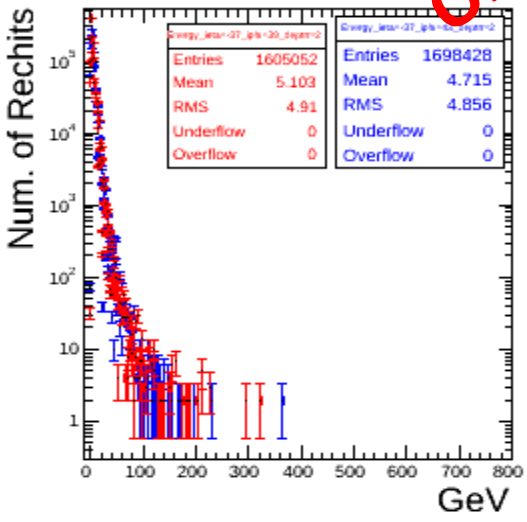


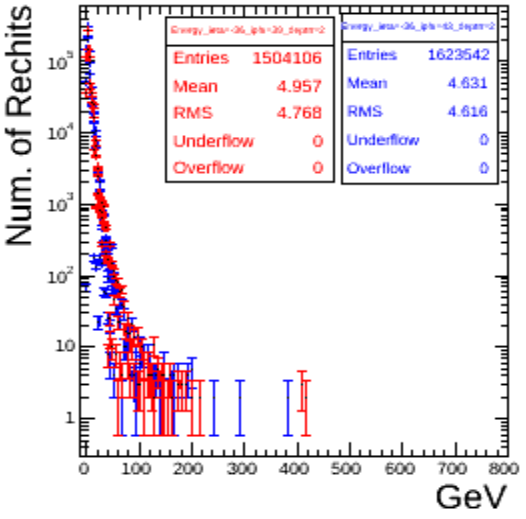
Short Fiber

New PMTs

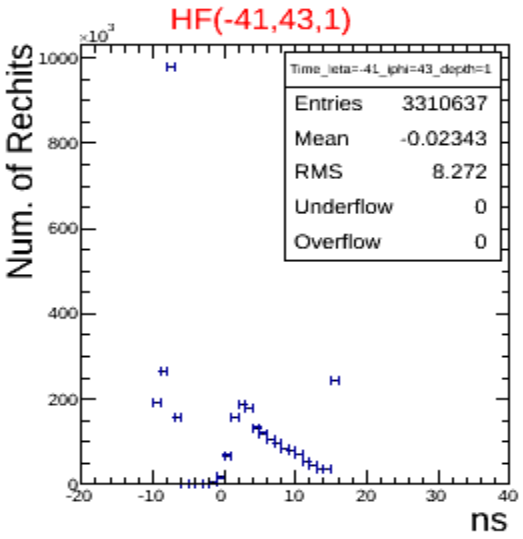
Old PMTs

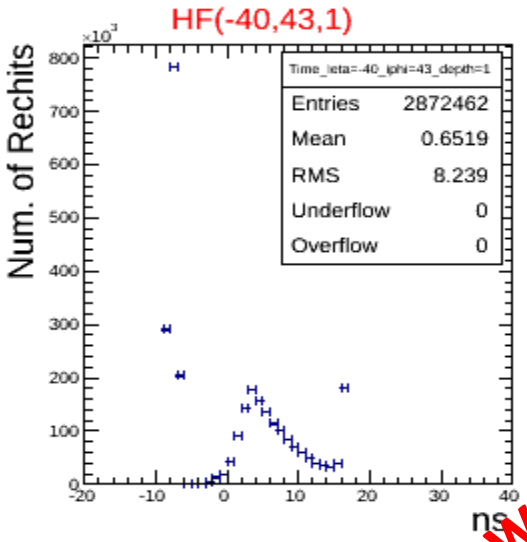


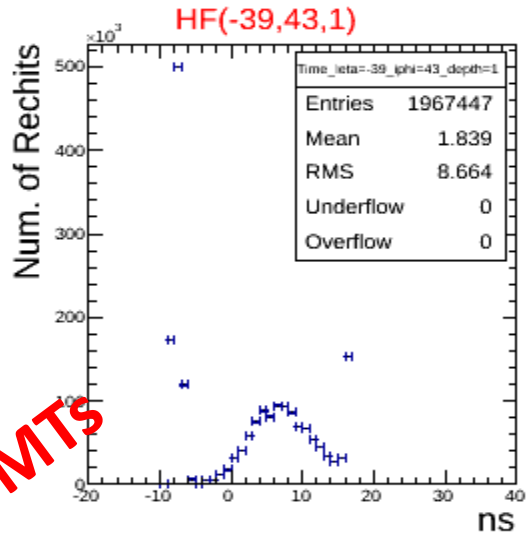




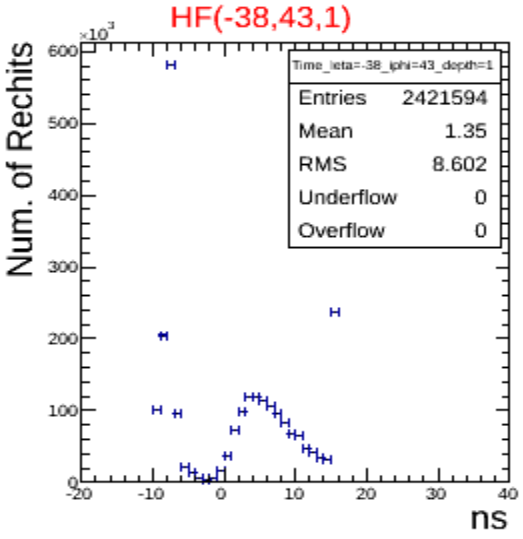
Time distribution for iphi=43 (HF-)

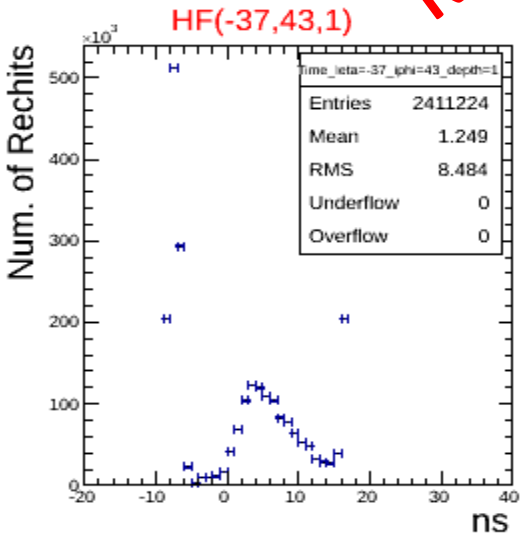


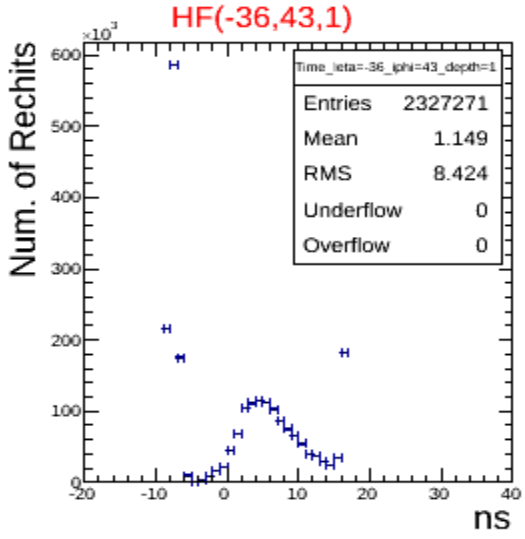




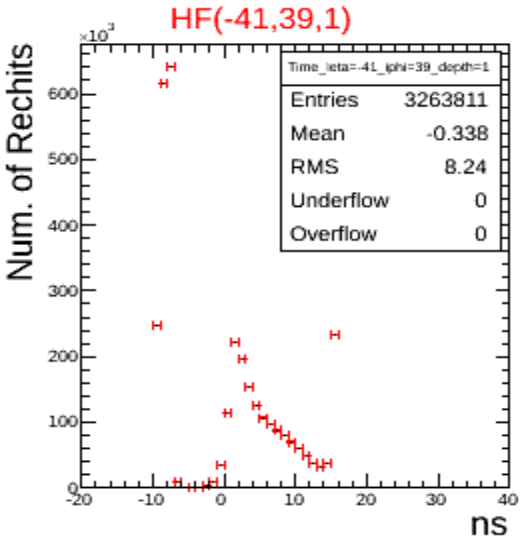
New PMTs

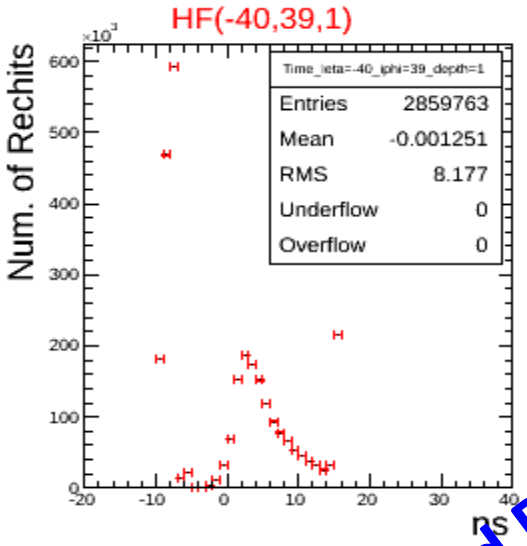


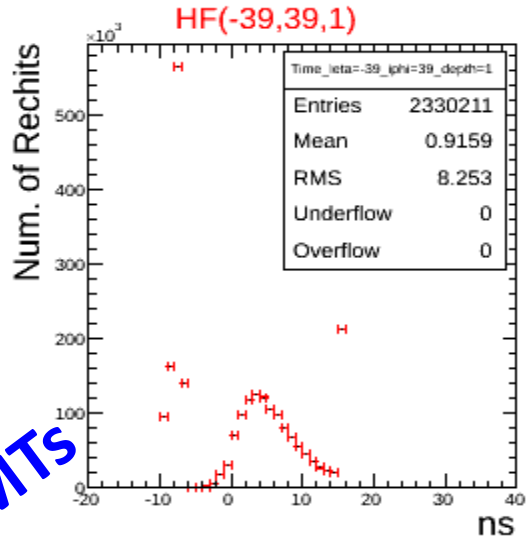




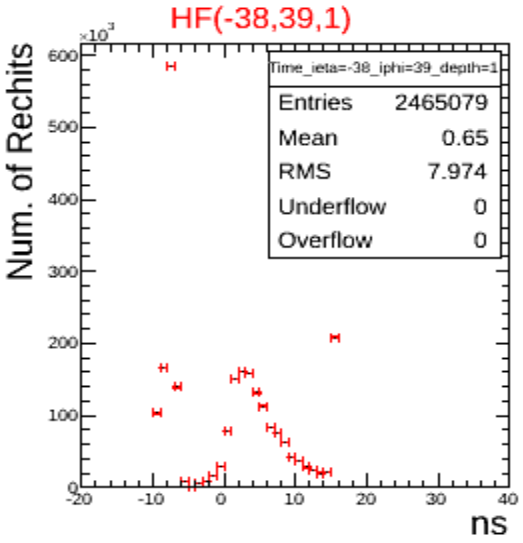
Time distribution for iphi=39(HF-)

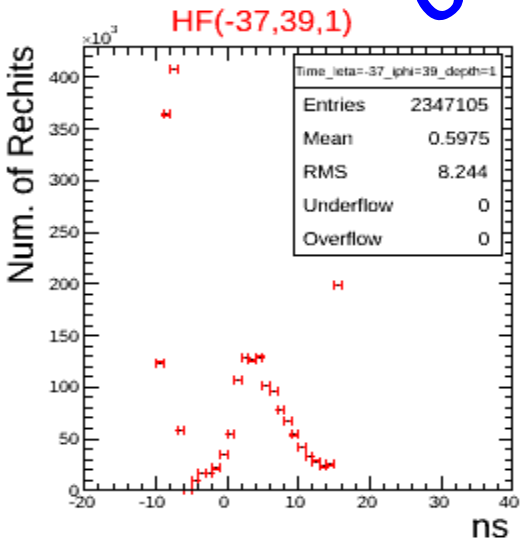


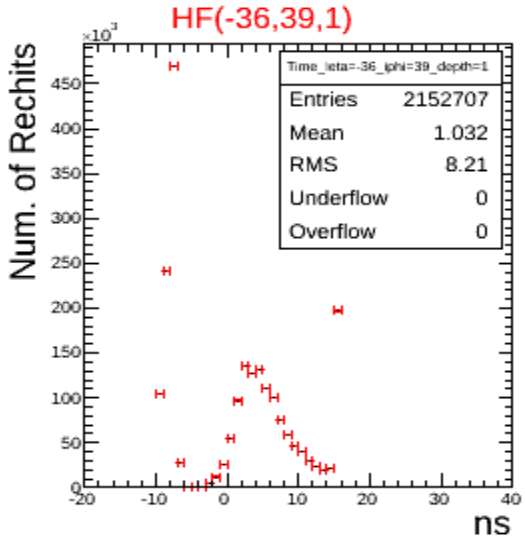




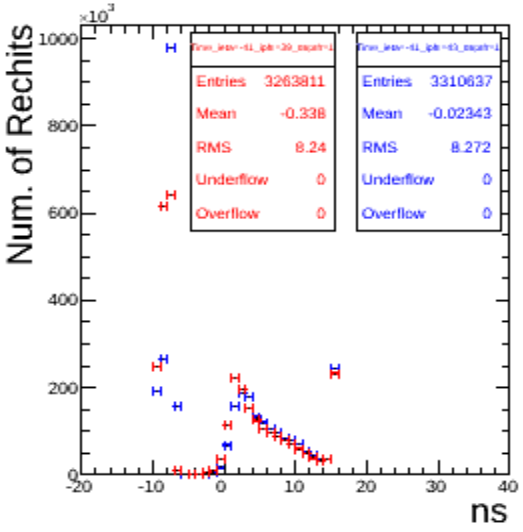
Old PMTs

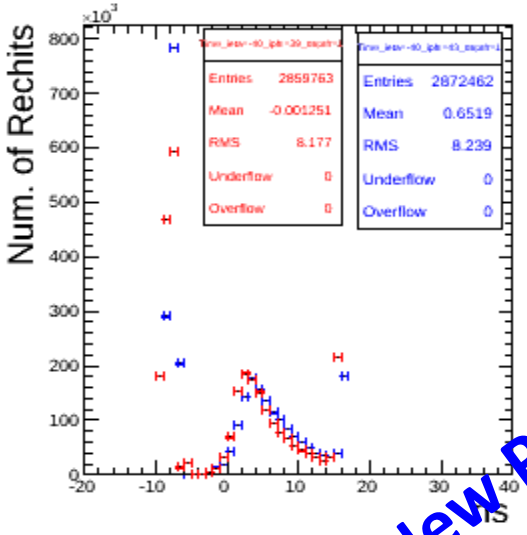


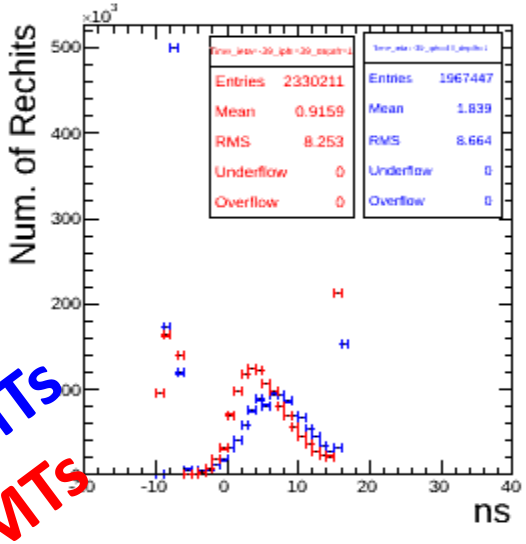




Comparison of Time distributions with superposing



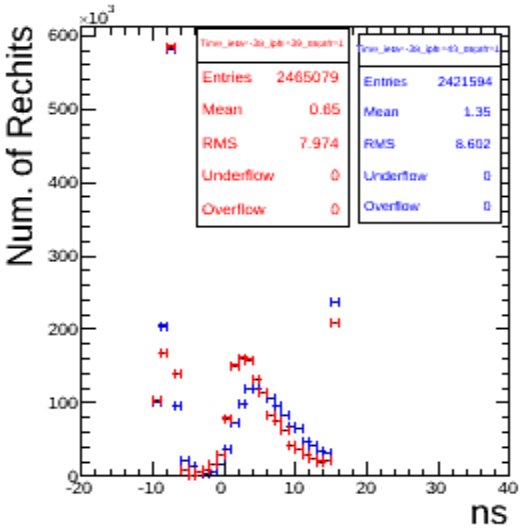


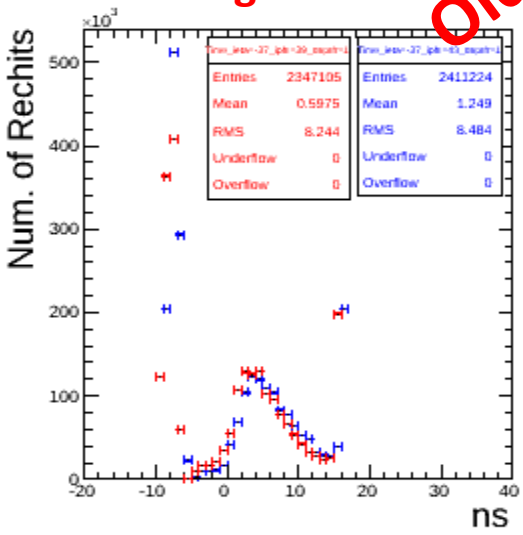


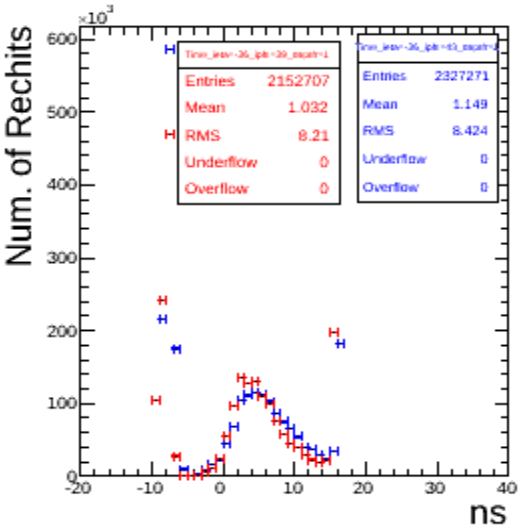
Long Fiber

New PMTs

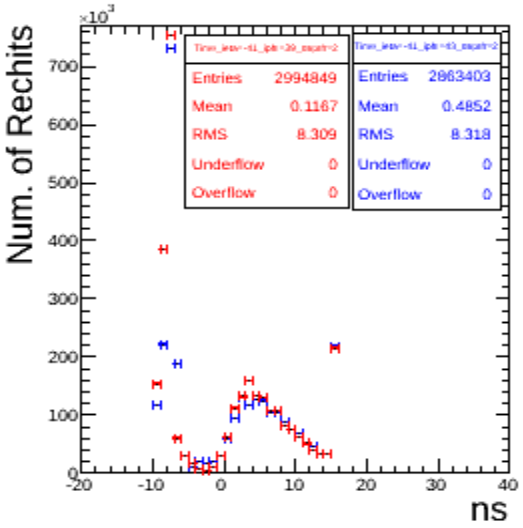
Old PMTs

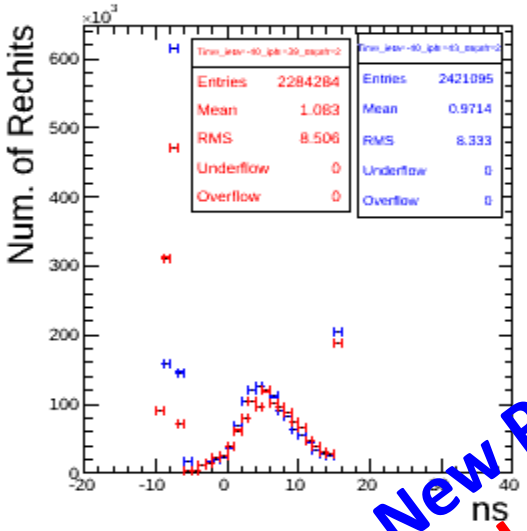


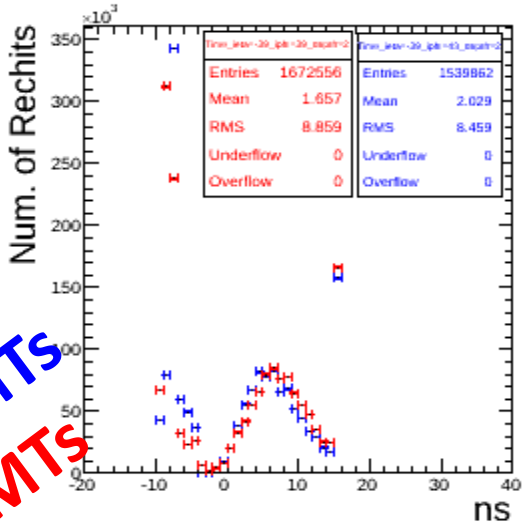




Comparison of Time distributions with superposing



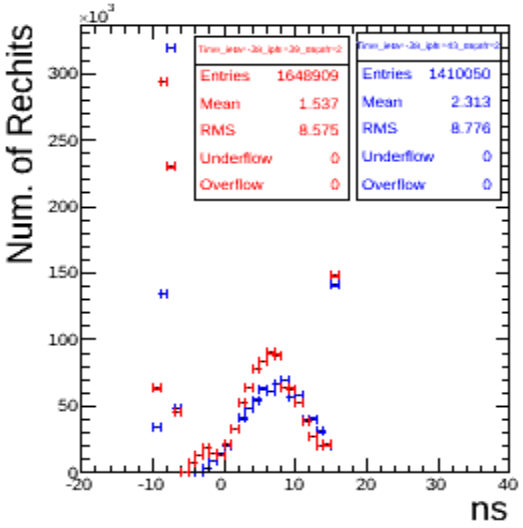


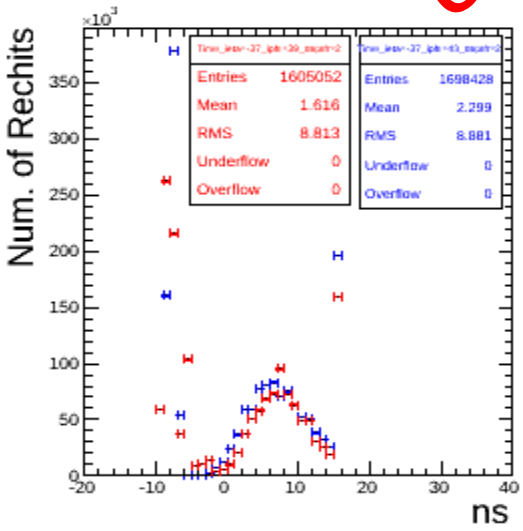


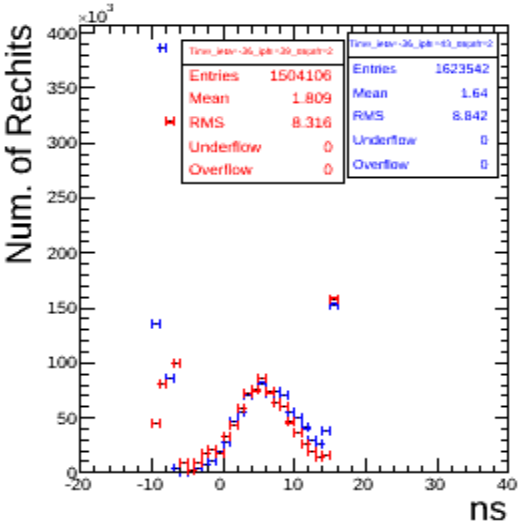
New PMTs

Old PMTs

Short Fiber







Noise Clean Method

We use noise flag as fPMTHitLS, fPMTHitS8S1, fTimingError.

fTimingError

The timing based cleaning algorithm is defined as follows:

Long fiber RecHits are flagged if E > 40 GeV AND (t < −10 ns OR t > 10 ns);

Short fiber RecHits are flagged if E > 40 GeV AND (t < −12 ns OR t > 10 ns).

flag fPMTHitLS

“polynomial energy threshold” (PET)

$$R = \frac{E_{\mathrm{L}} - E_{\mathrm{S}}}{E_{\mathrm{L}} + E_{\mathrm{S}}},$$

- Long fiber RecHits are flagged if R > R_L AND $E_L > E_{PET,L}(|i|) = 162.4 - 10.19||i|| + 0.21(|i|)2118$,119 where R_L is the R cut applied to the long fiber RecHits;
- Short fiber RecHits are flagged if R < R_S AND $E_S > E_{PET,S}(|i|) = 129.9 - 6.61||i|| + 0.1153(|i|)2120$,121 where R_S is the R cut applied to the short fiber RecHits.

https://twiki.cern.ch/twiki/bin/viewauth/CMS/HcalRecHitFlagAssignments

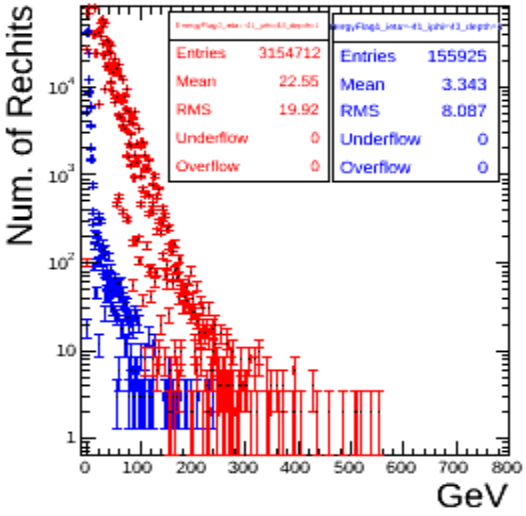
fPMTHitS8S1

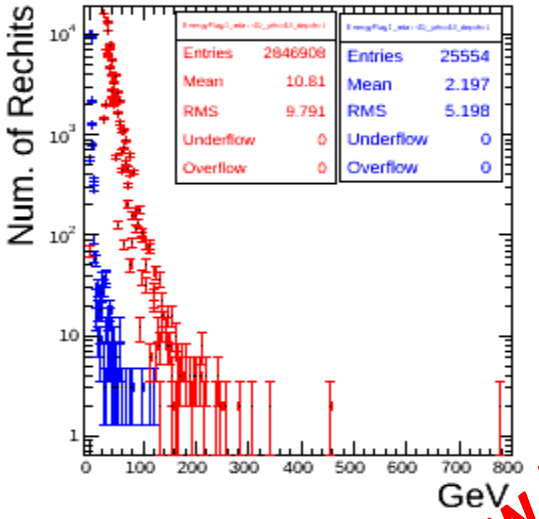
$$\left(\frac{\mathrm{S9}}{\mathrm{S1}}\right)_{\mathrm{L}} = \frac{E_{\mathrm{S}} + \sum_{i=1}^{4} E_{\mathrm{L},i} + \sum_{i=1}^{4} E_{\mathrm{S},i}}{E_{\mathrm{L}}},$$

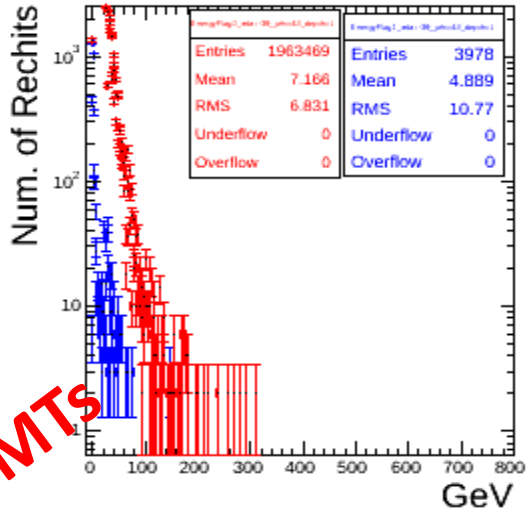
- The S9/S1 cleaning algorithm is only applied to the long fiber RecHits and it uses the same energy threshold parametrization as the PET algorithm. Long fiber RecHits are flagged by the S9/S1 algorithm if:
  - 1. $E_L > E_{PET,L}(i)$ AND
  - 2. S9/S1 < Y (E_L, i), where Y (E_L, i) is a variable threshold value. $Y(E_{\mathrm{L}}, i\eta) = a(i\eta)\ln(E_{\mathrm{L}}/b(i\eta)),$

(more information is in CMS DN-2010/008)

Clean Energy , Noise Energy for iphi43

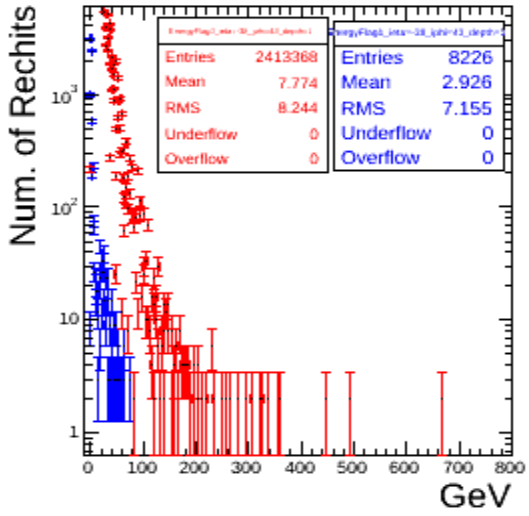


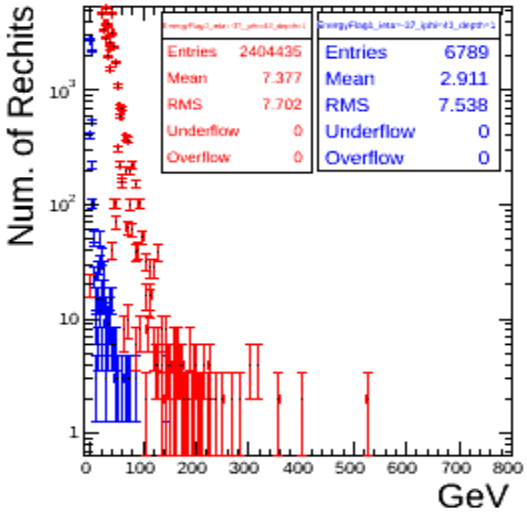


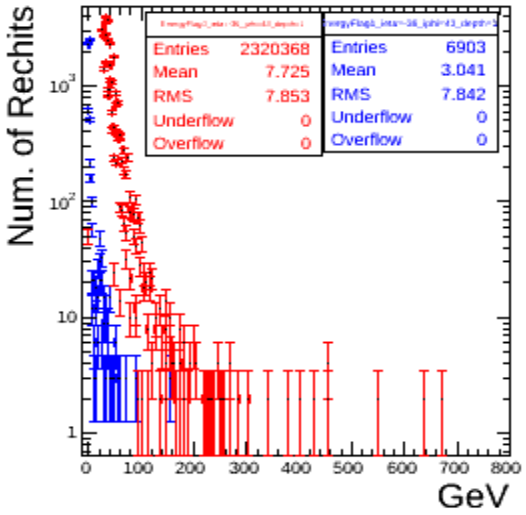


Long Fiber

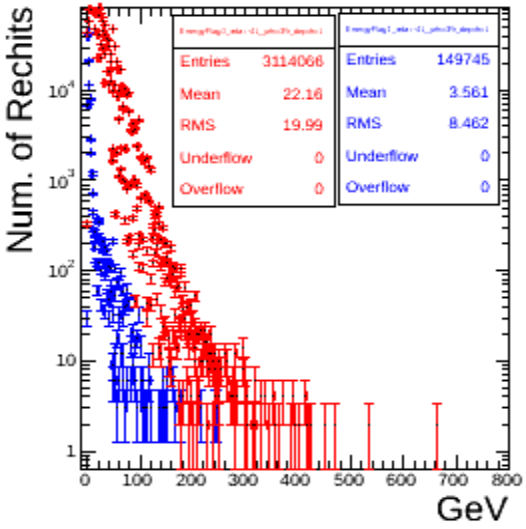
New PMTs

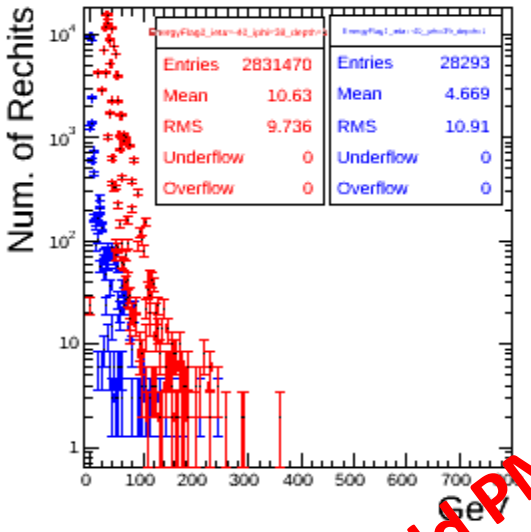


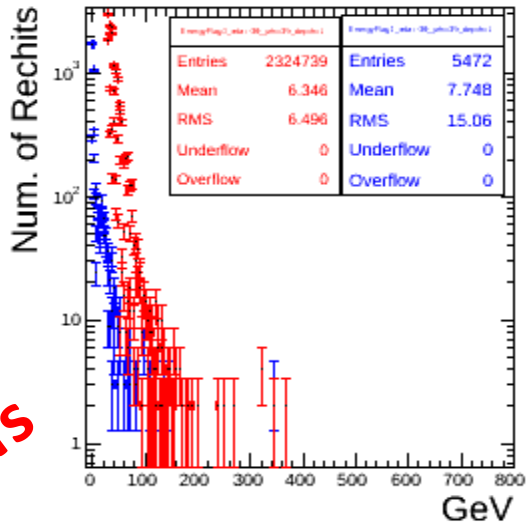




Clean Energy , Noise Energy for iphi39

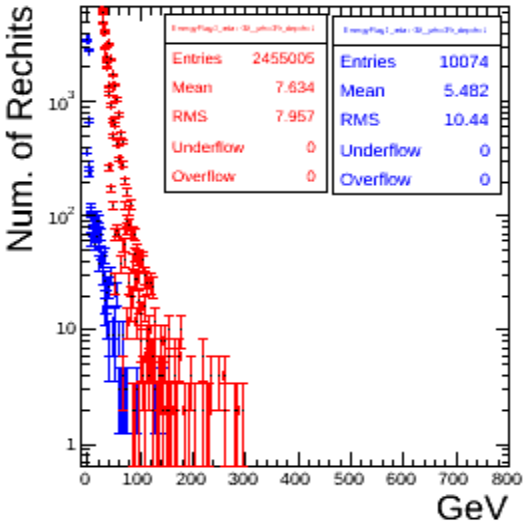


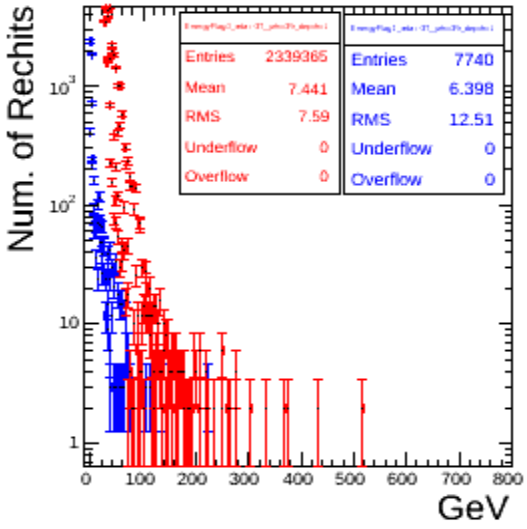


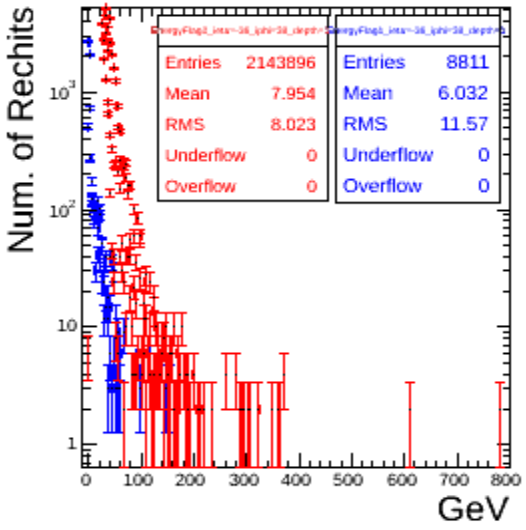


Long Fiber

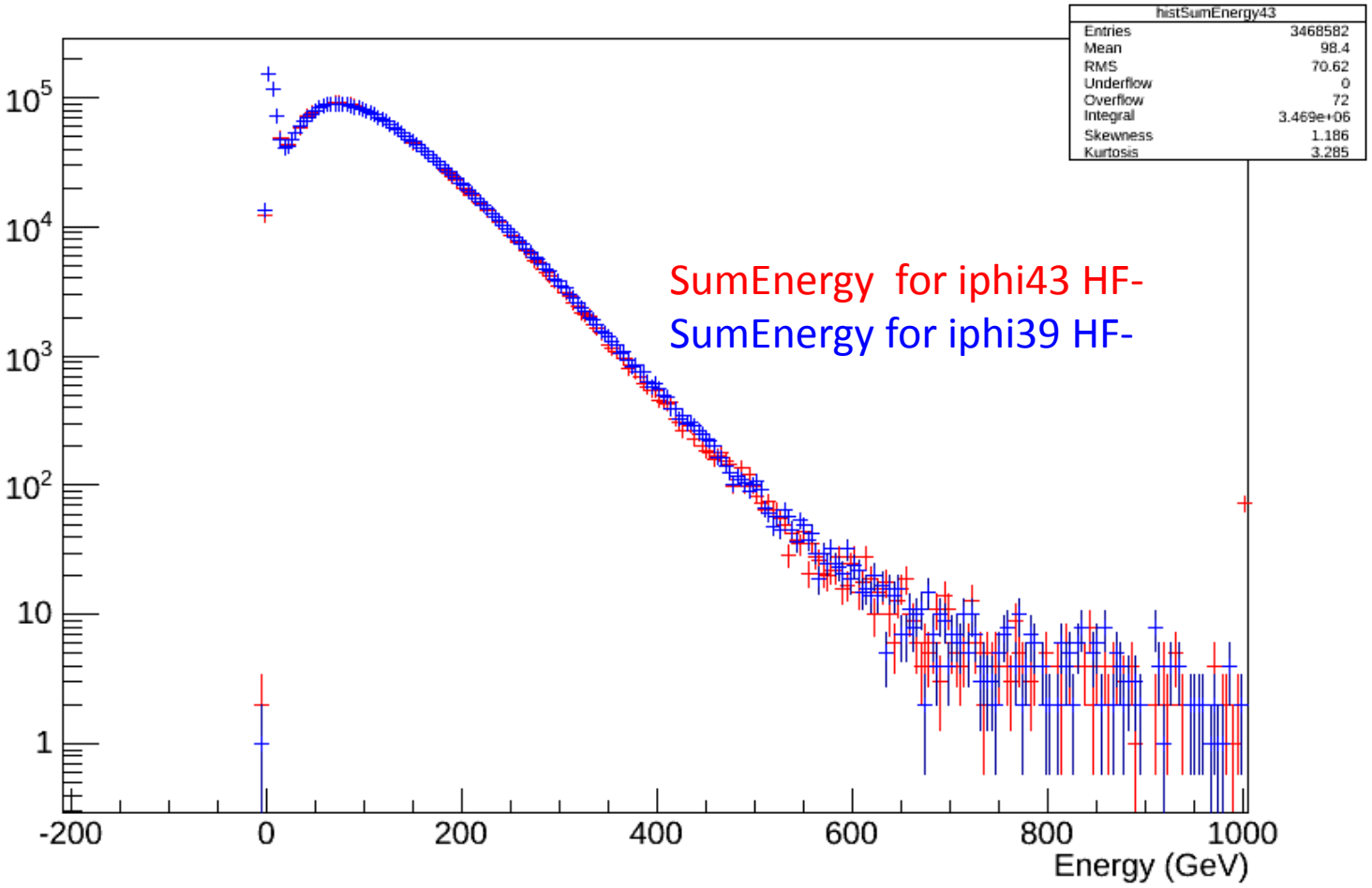
Old PMTs



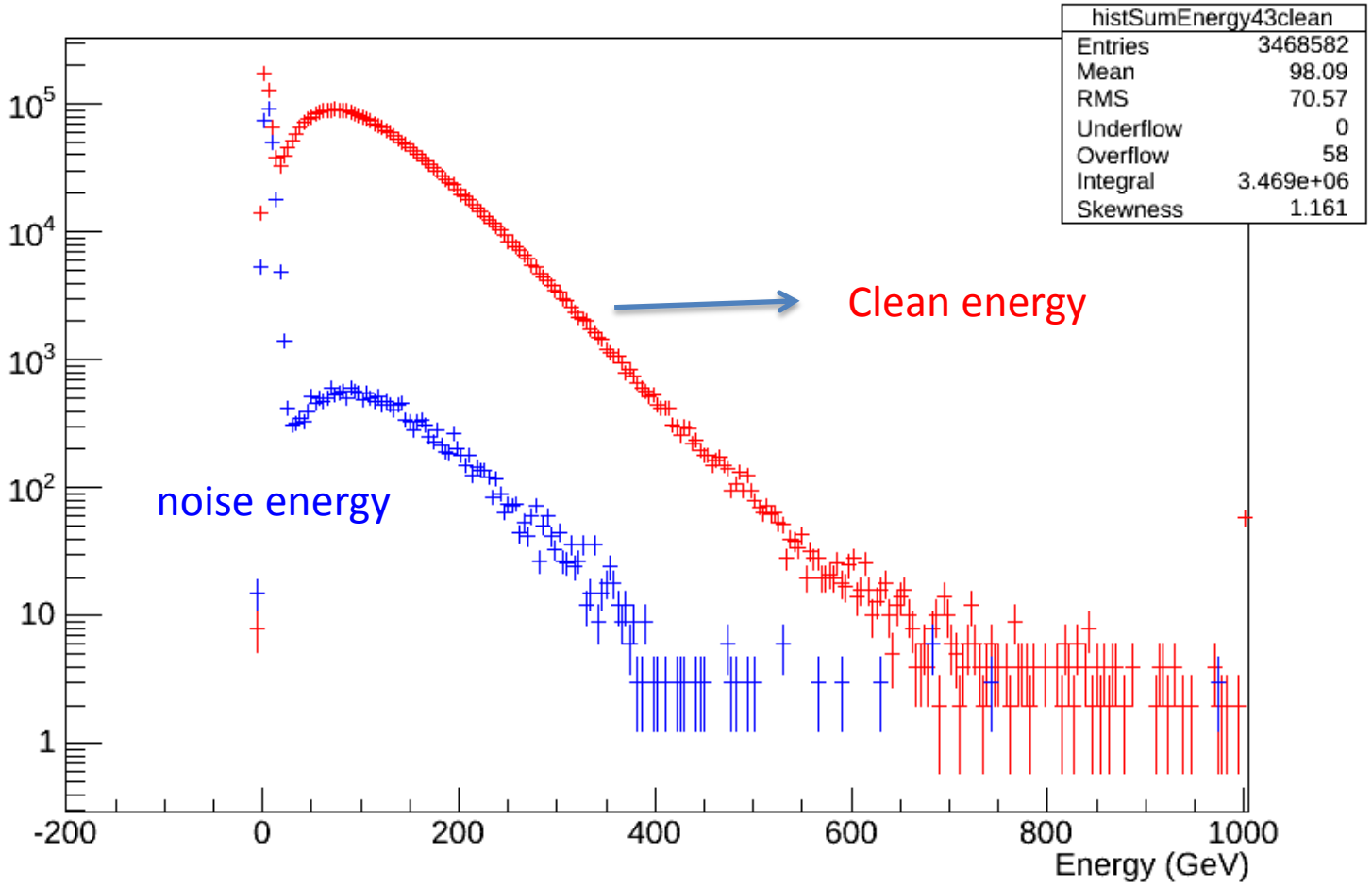




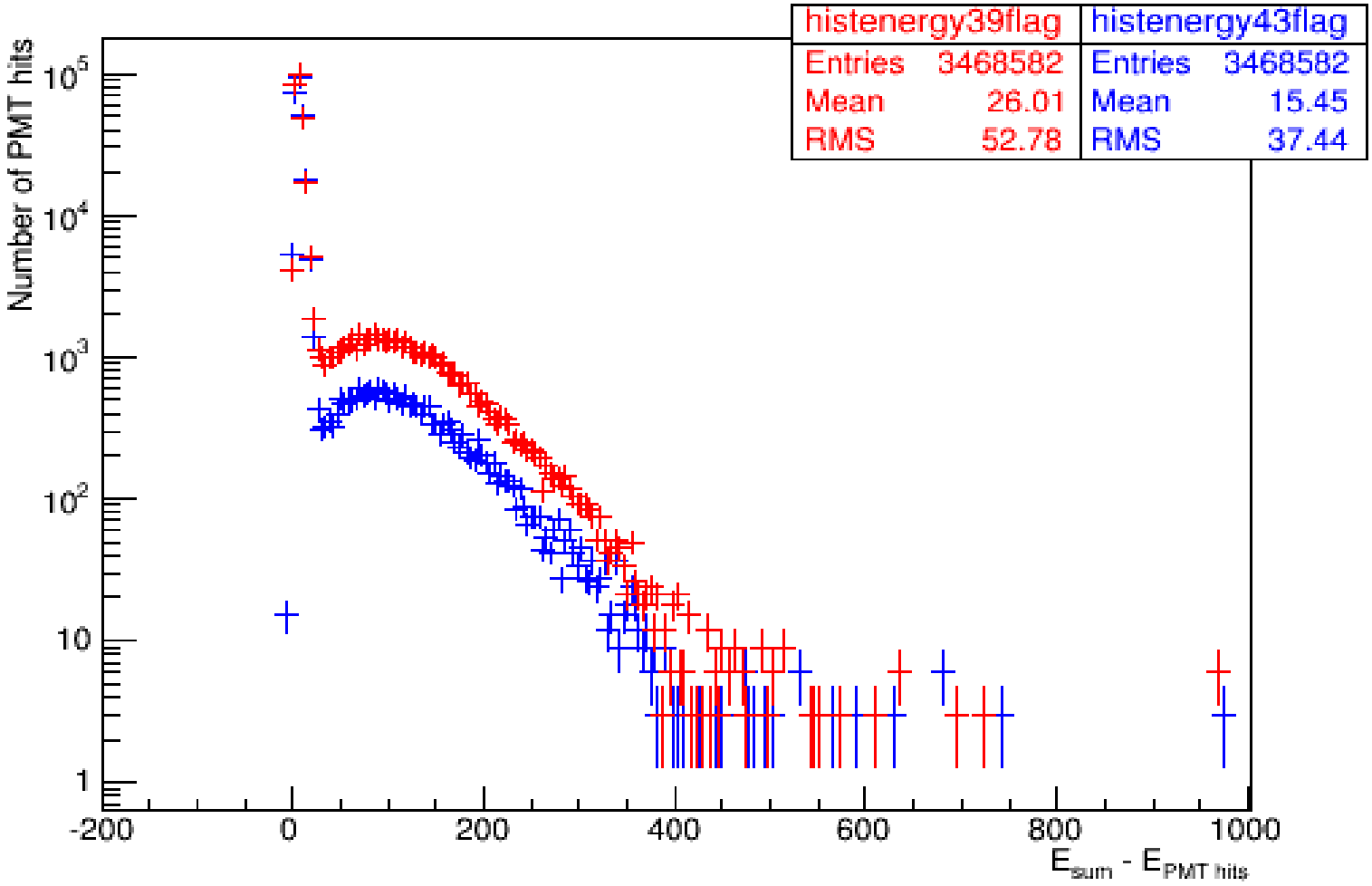
Sum Energy for new pmt(iphi 43 HF-) vs old pmt(iphi 39 HF-)



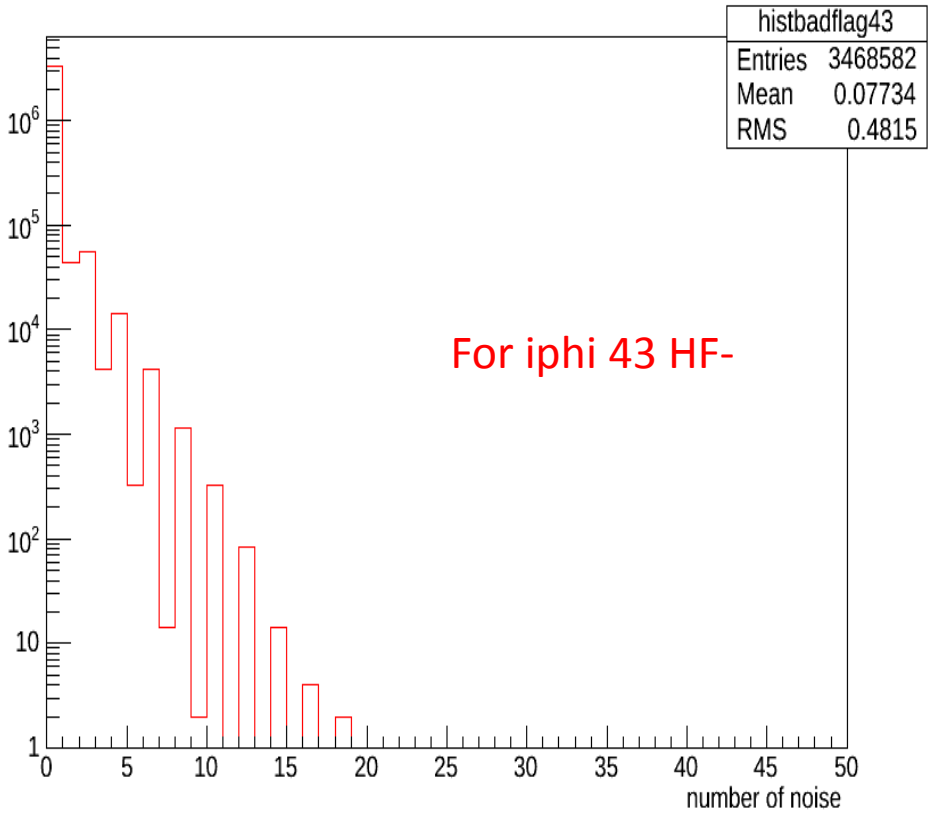
After Noise Clean RecHit Energy for new pmt (iphi 43 HF-)

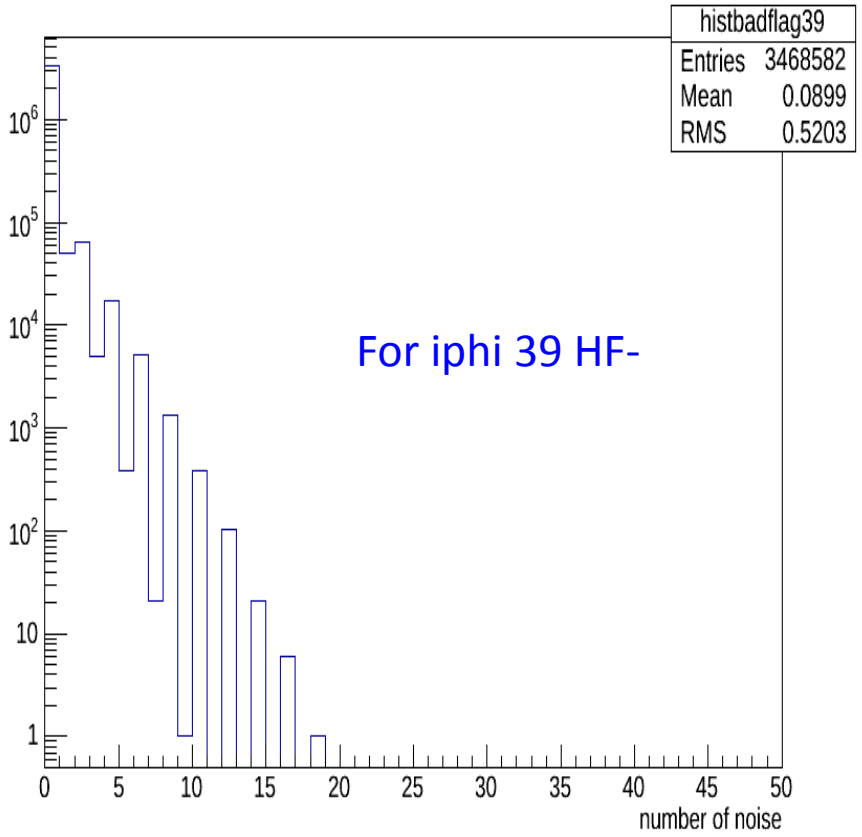


Comparison of Energy in iphi 43 and iphi39 After Noise Clean

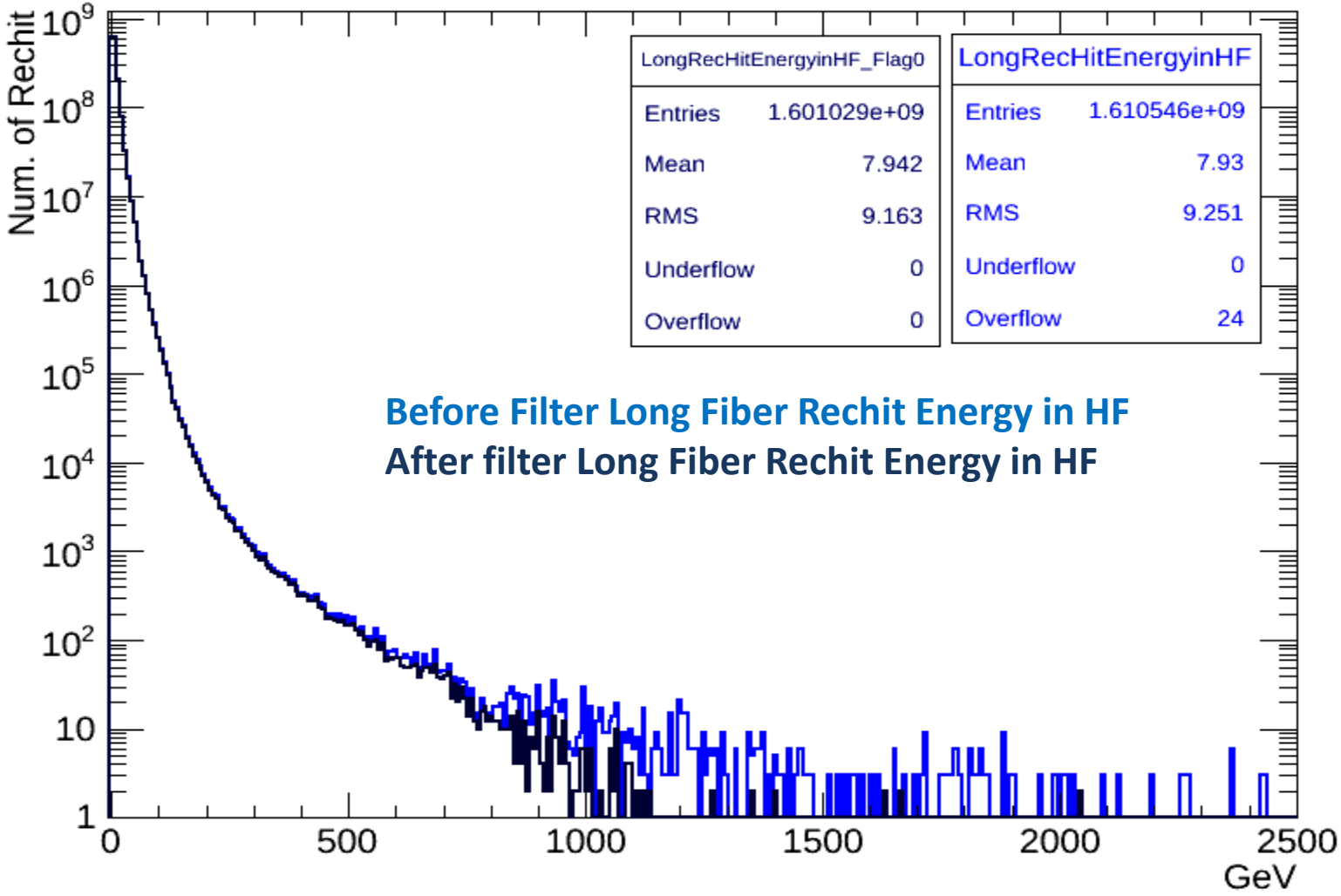


Noise events for iphi 43 and 39 HF-

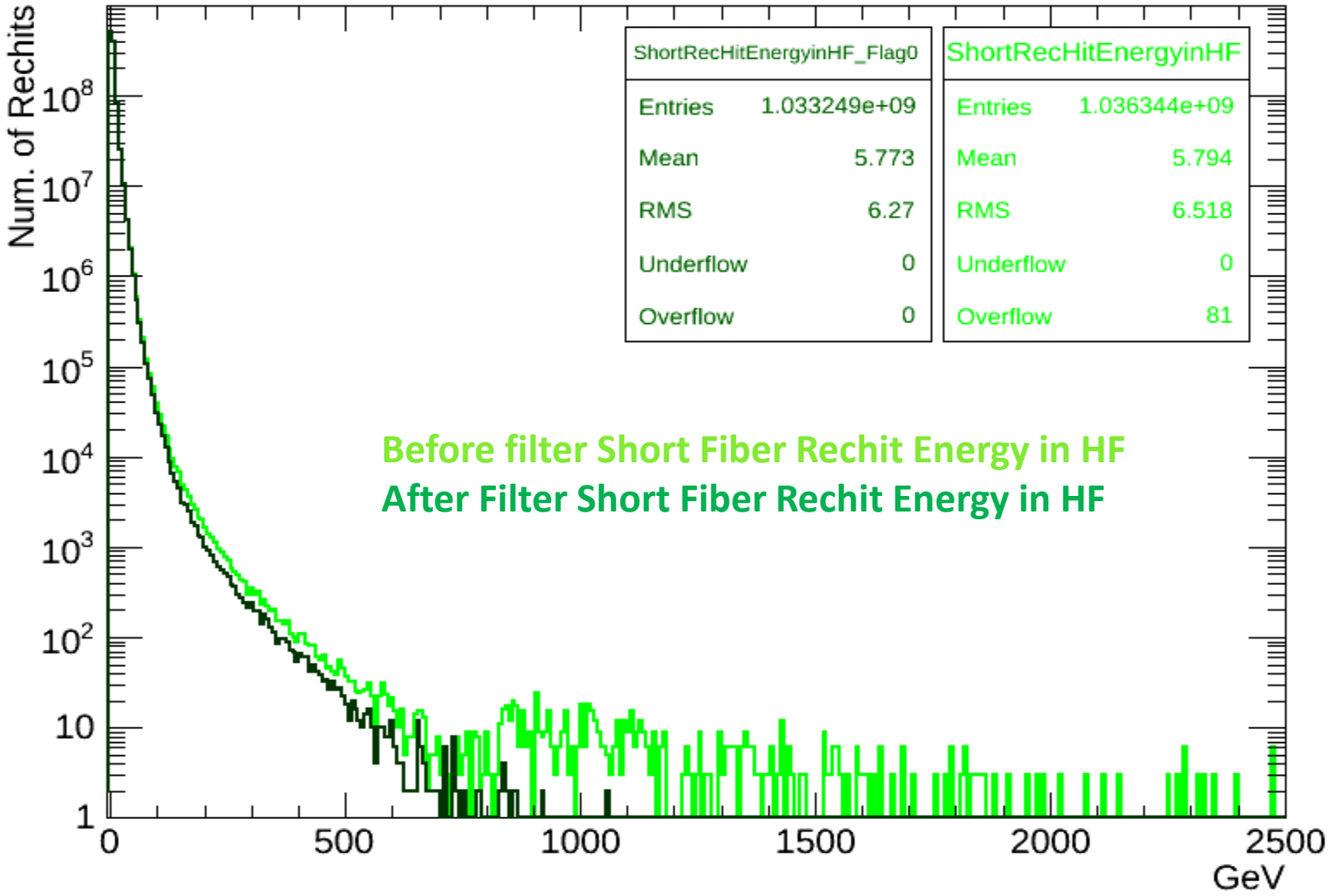




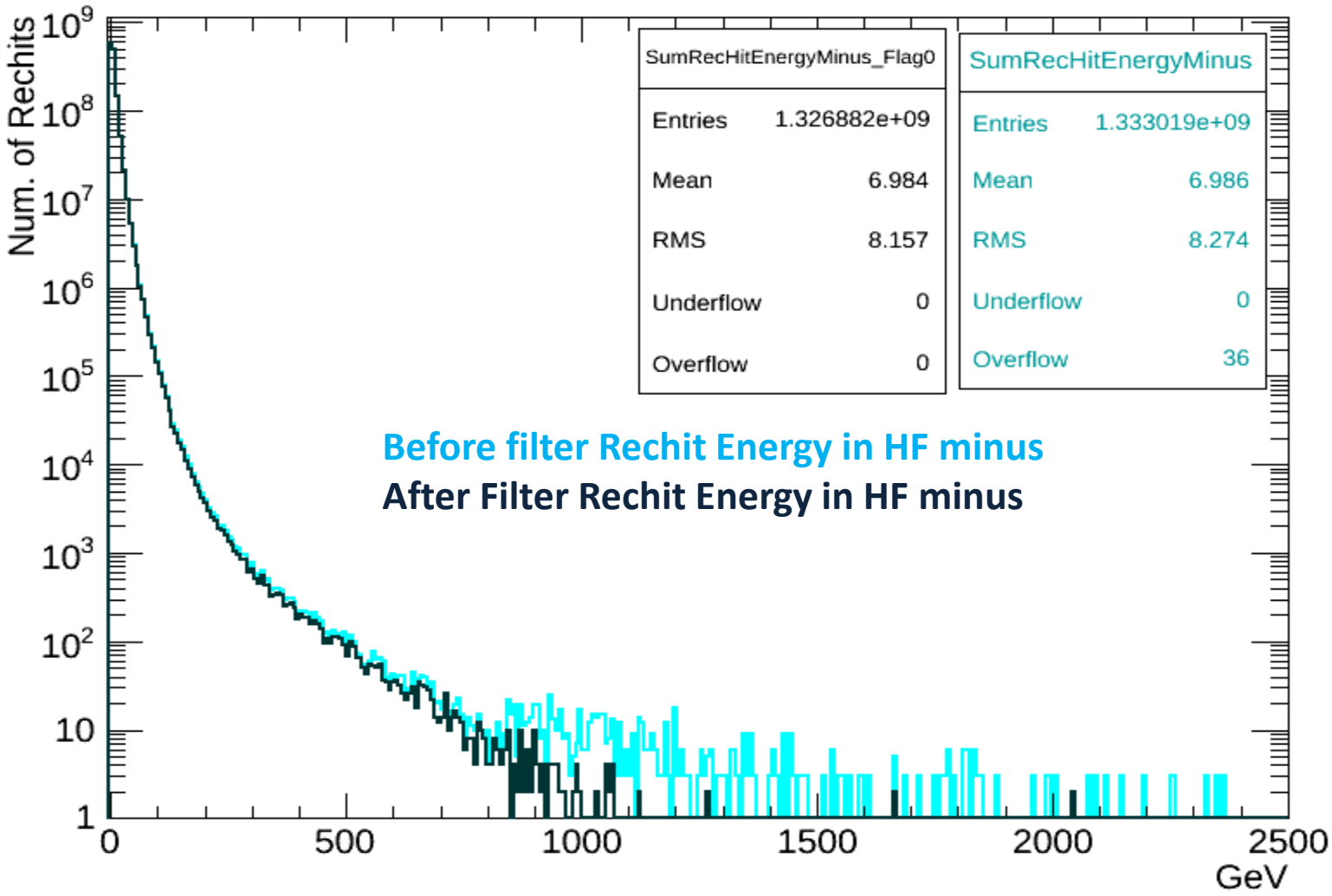
Comparison of Long Fiber RecHit Energy in HF



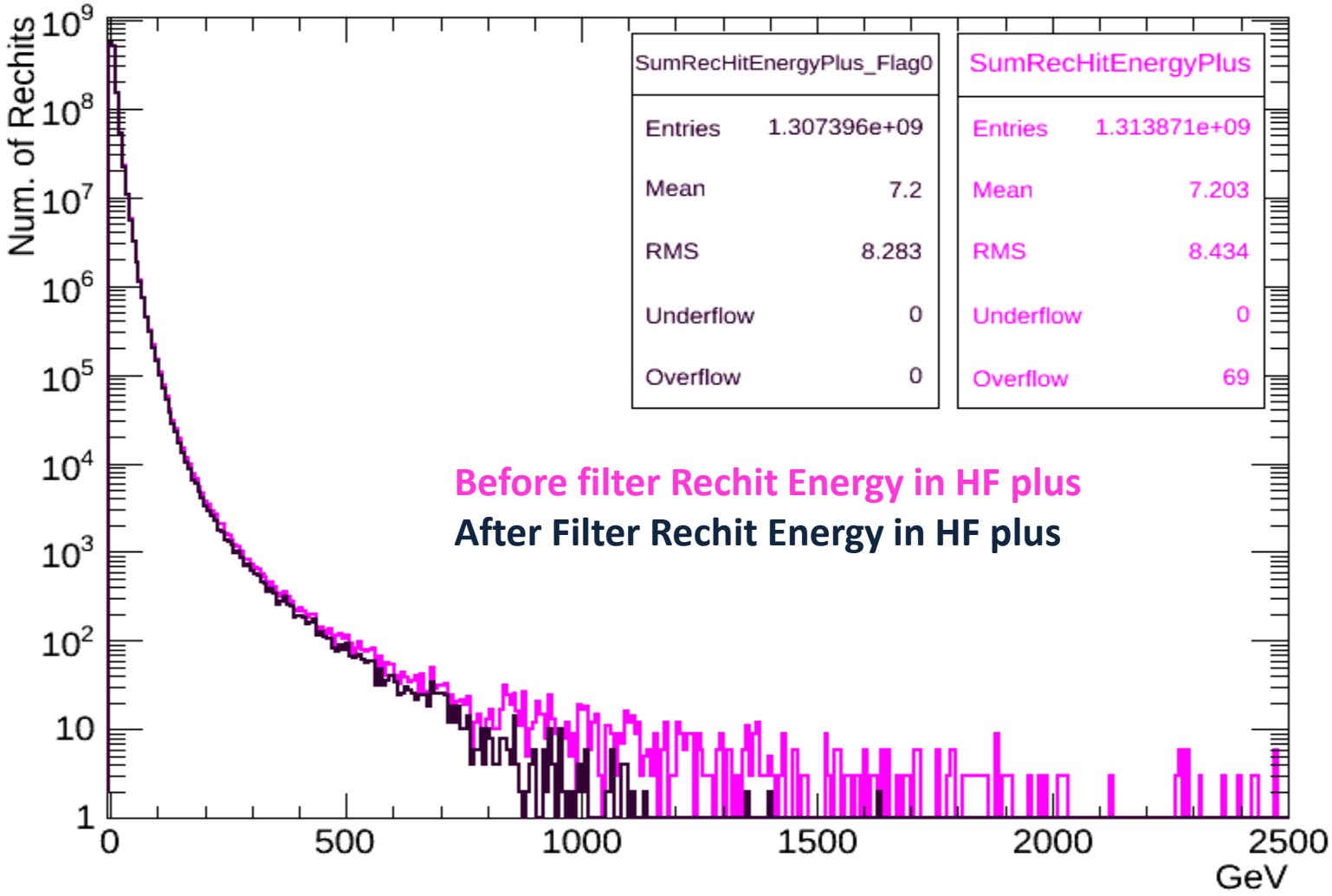
Comparison of Short FiberRecHit Energy in HF



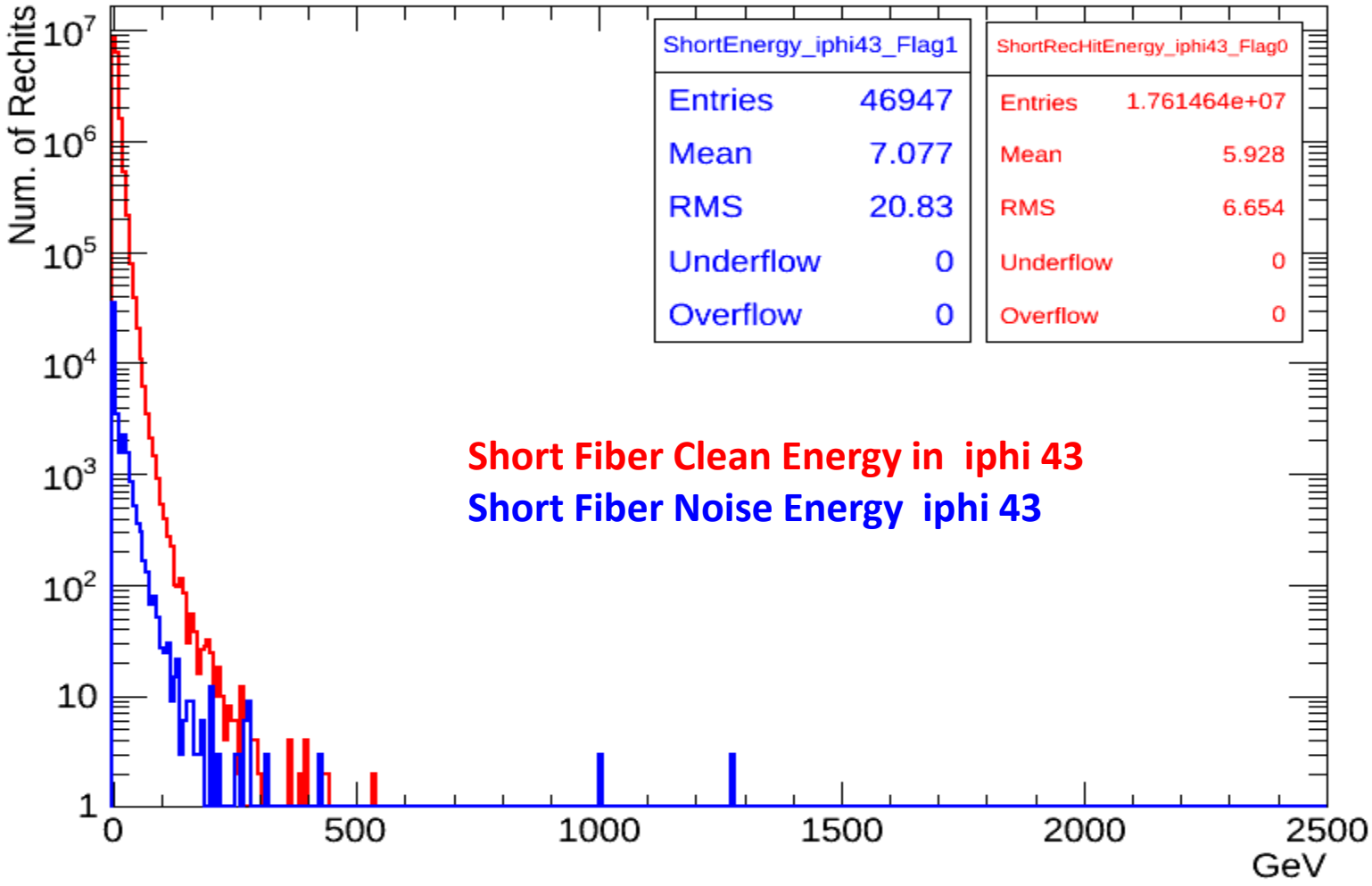
Comparison of RecHit Energy for HF-



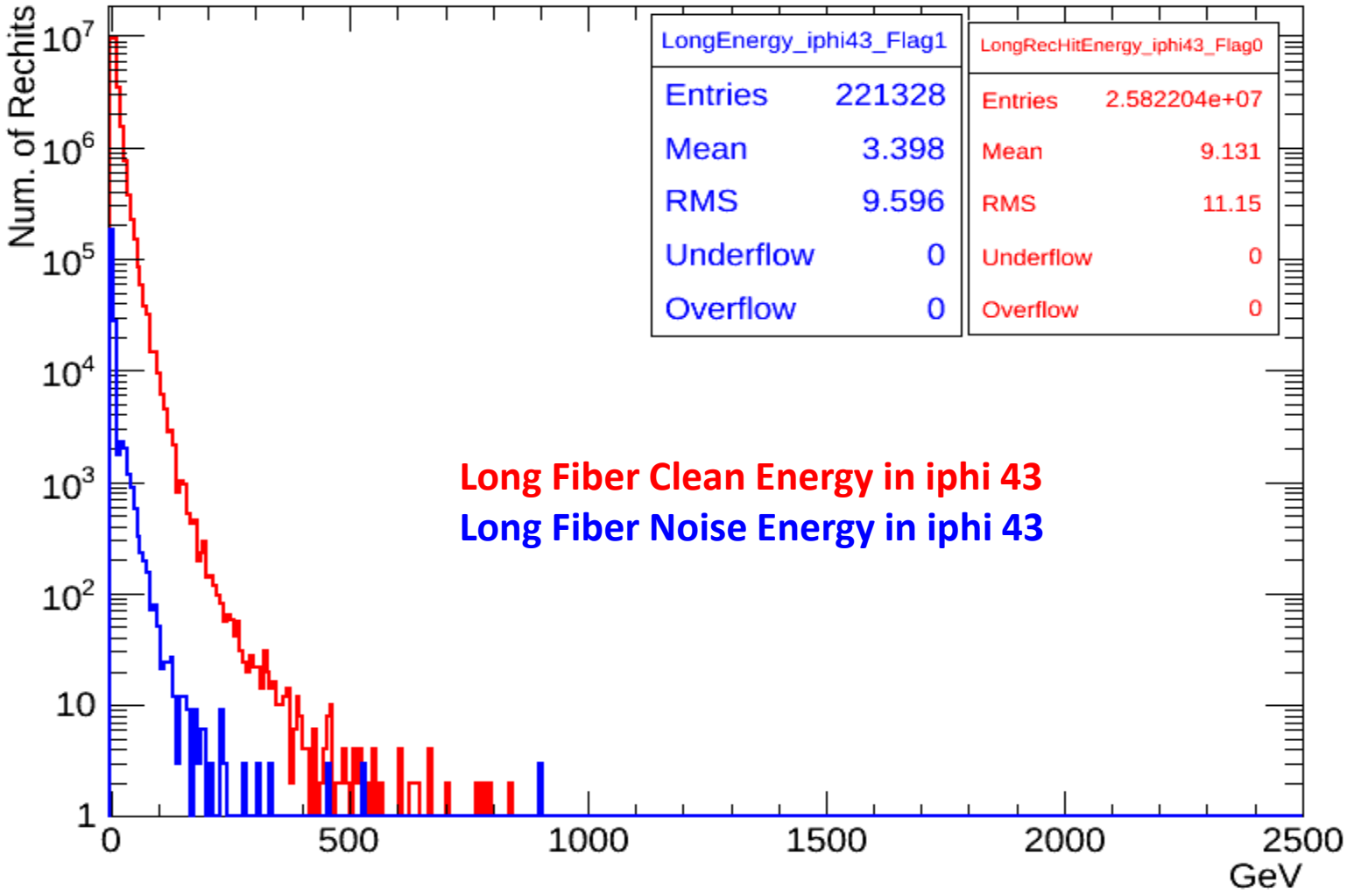
Comparison of RecHit Energy for HF+



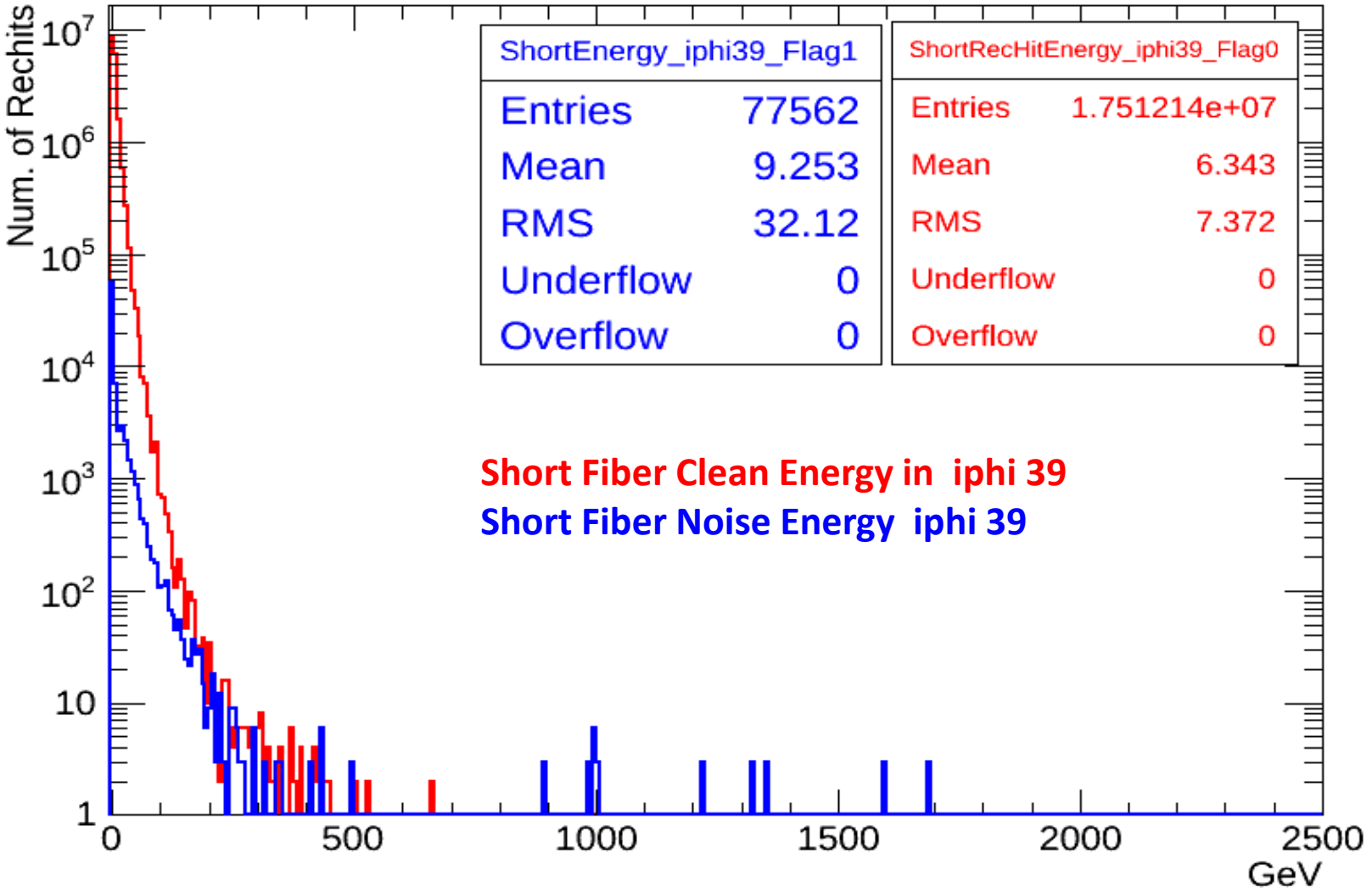
Comparison of short Fiber RecHit Energy for iphi43



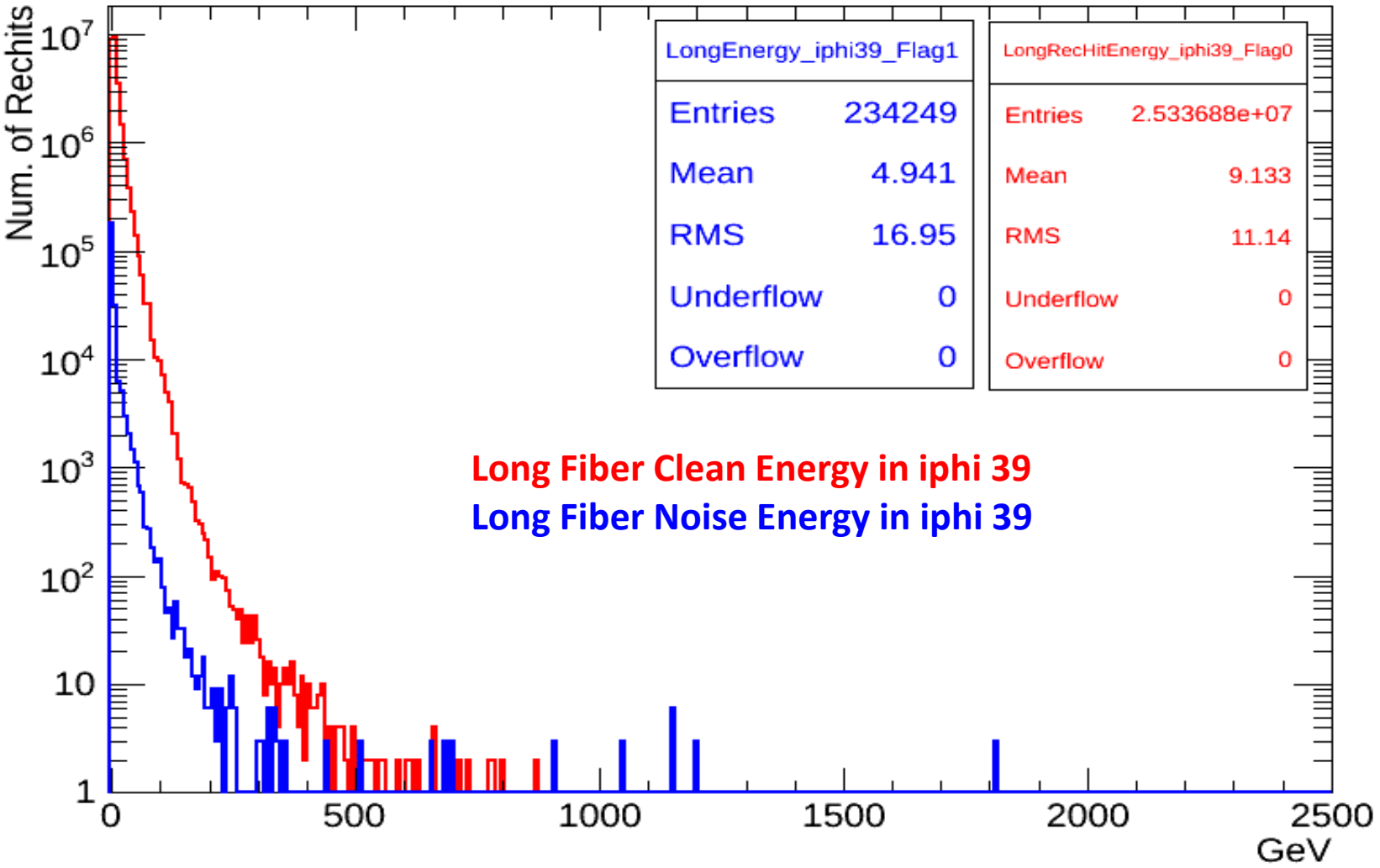
Comparison of Long Fiber RecHit Energy for iphi43



Comparison of Short Rechit Energy with superposing for iphi39

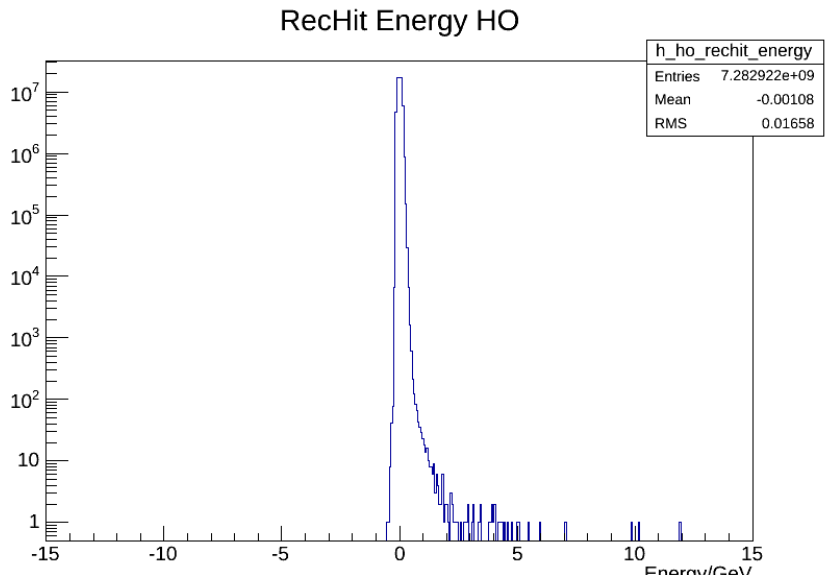


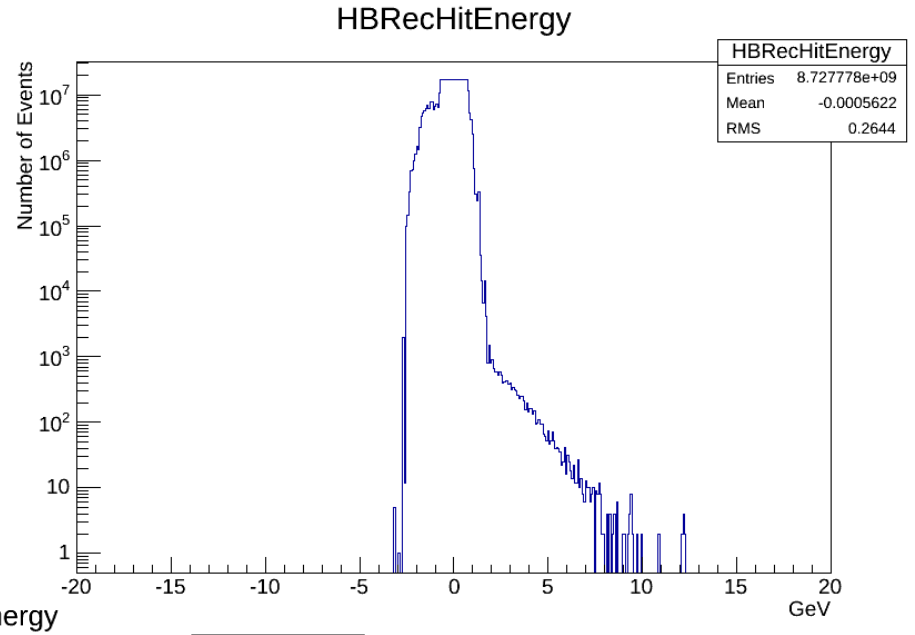
Comparison of Long Fiber Rechit Energy with superposing for iphi39

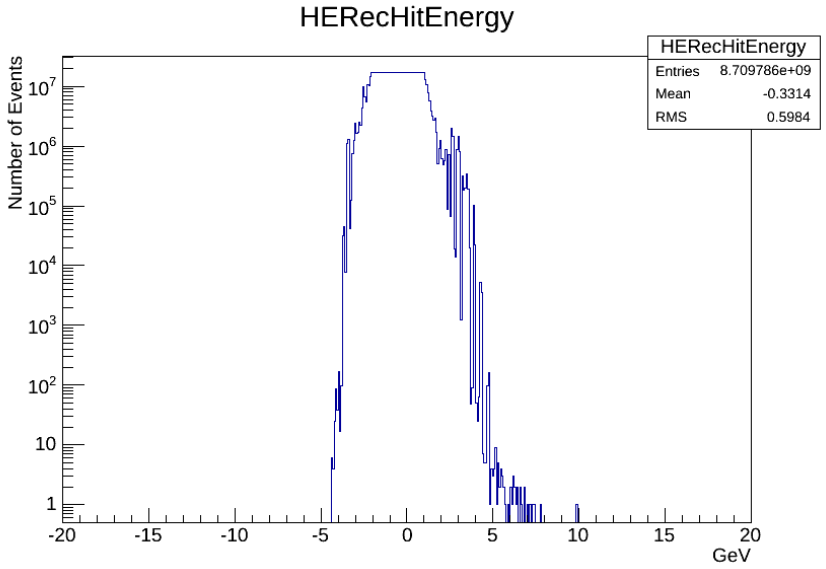


MWGR-8 Analysis

Rechits Energy for HO, HB, HE







Conclusion

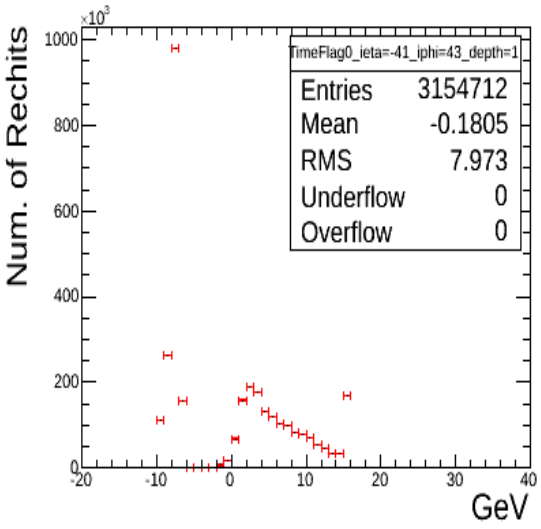
- We analyzed the new PMTs using 2012_D data.
- We compared the energy resolution and time of new PMTs and others PMTs (iphi=43 vs iphi= 39 for HF-).

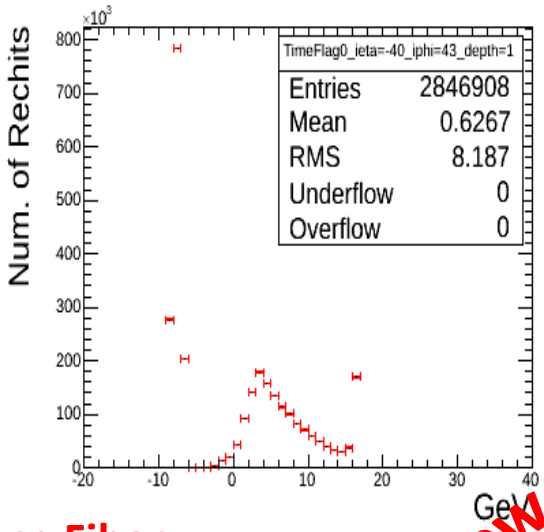
- MWGR-8 data analyzed for HCAL Rechits energy.

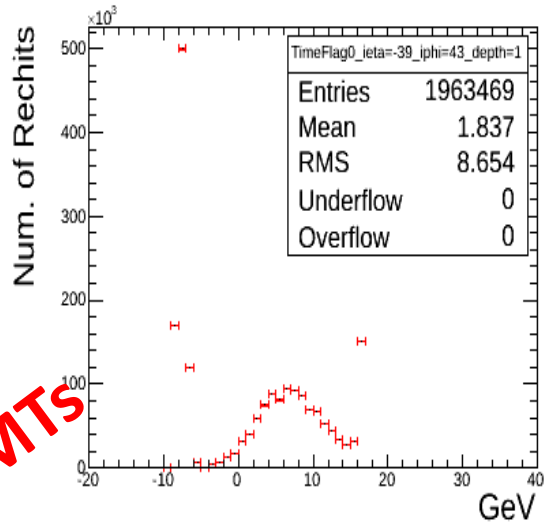
- We need to check with more events to Noise clean Algorithm.
- To do list
  - Run to jet data set to analyze the new PMTs.
  - Compare min-bias versus jet data set

Back up

Time distributions for Phi43 after filter

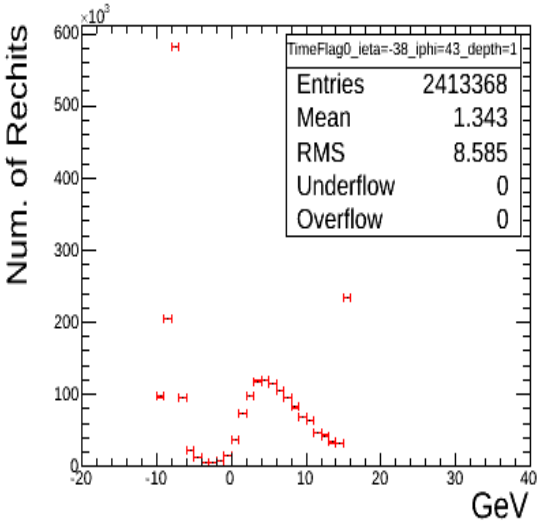


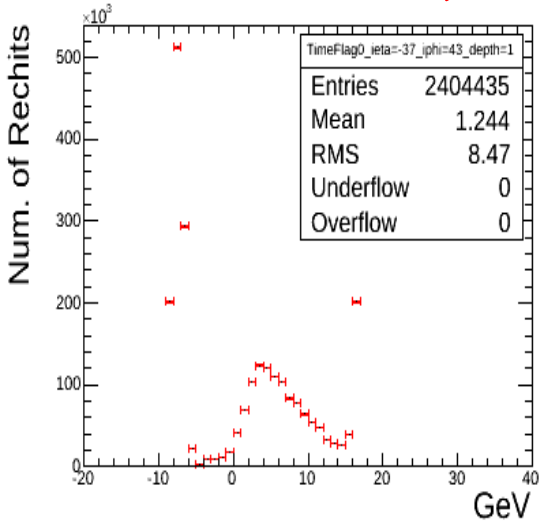


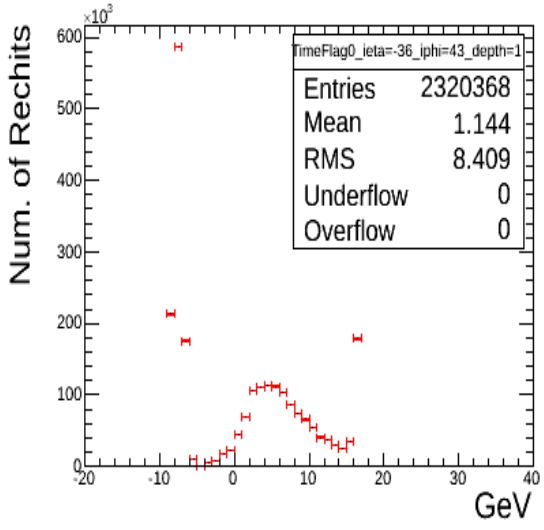


Long Fiber

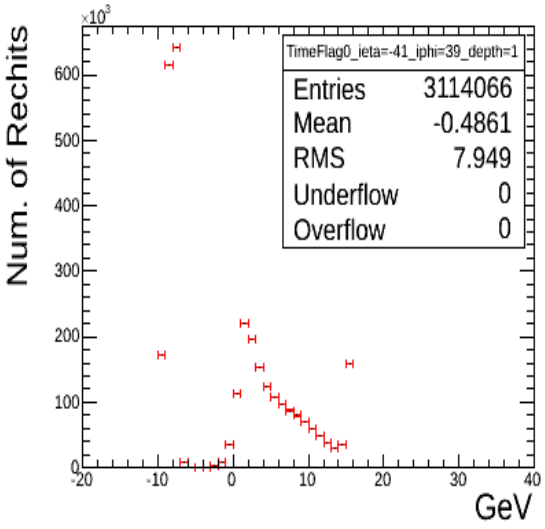
New PMTs

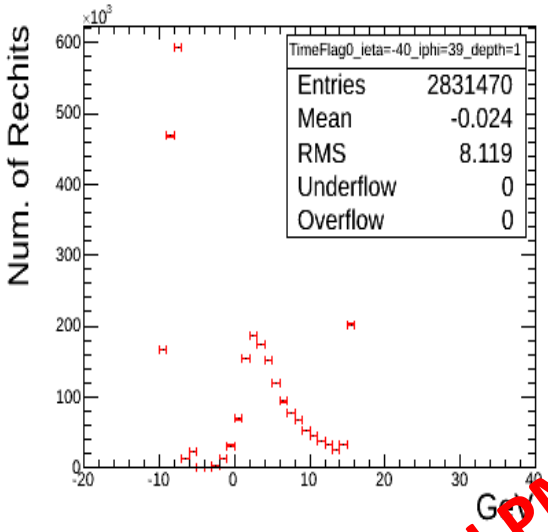


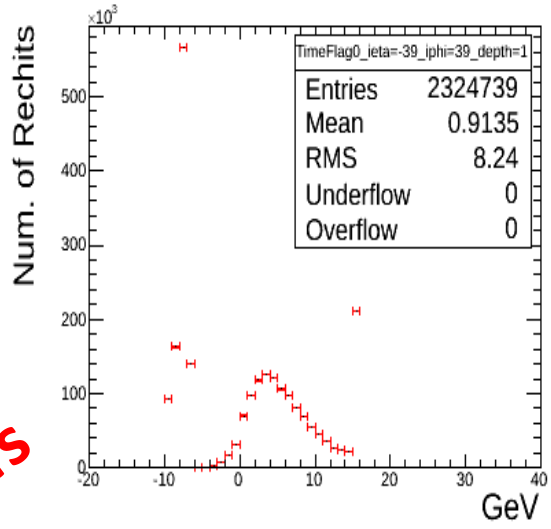




Time distributions for iphi39 after Filter

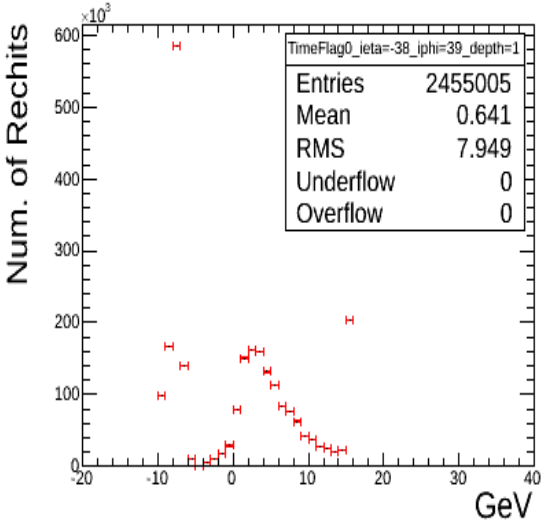


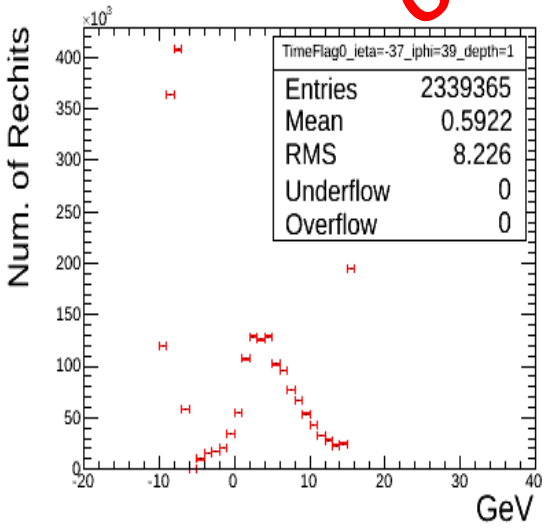


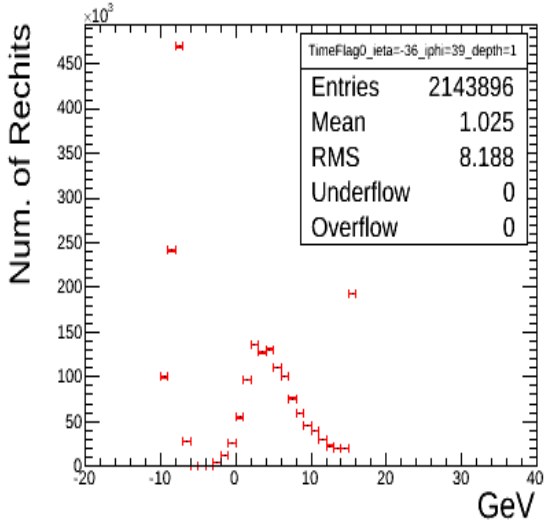


Long Fiber

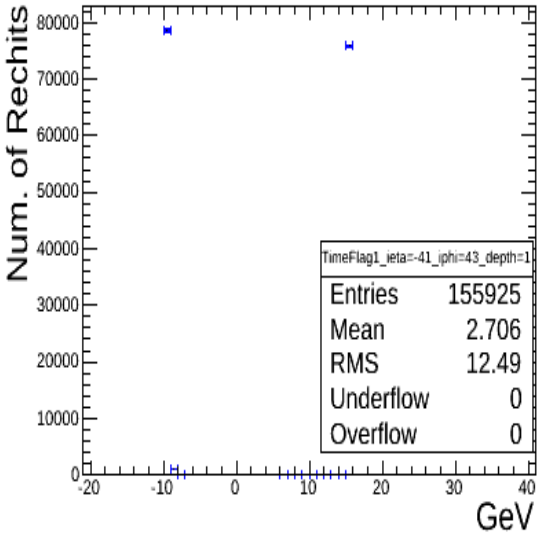
Old PMTs

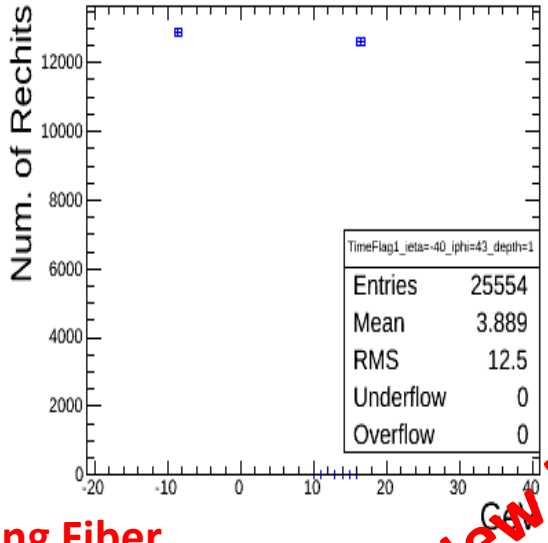






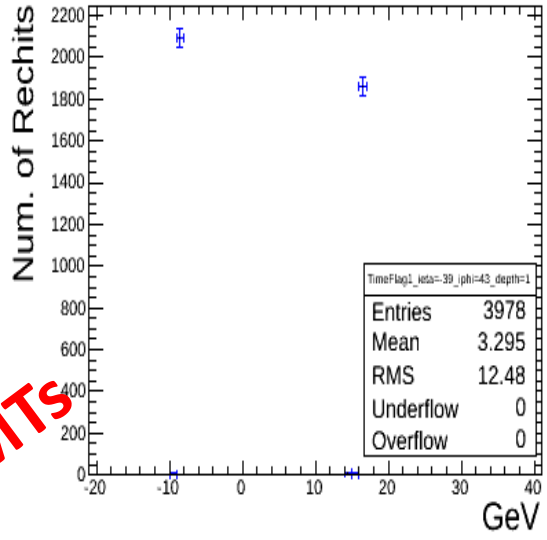
Time distributions for iphi43 not pass through the filter

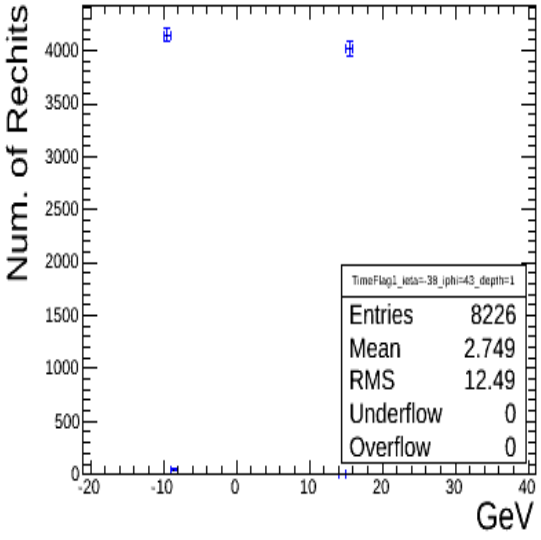


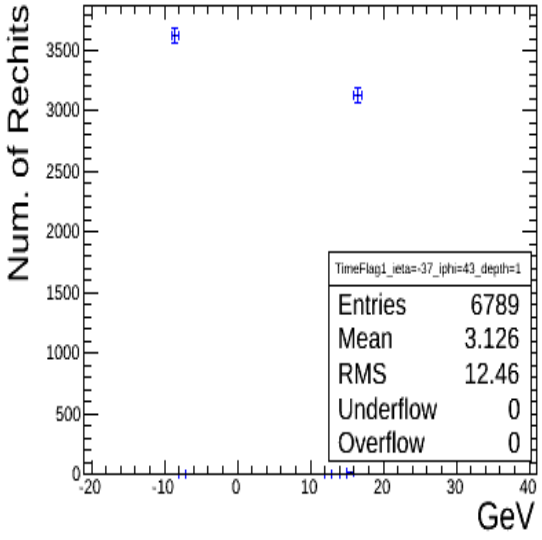


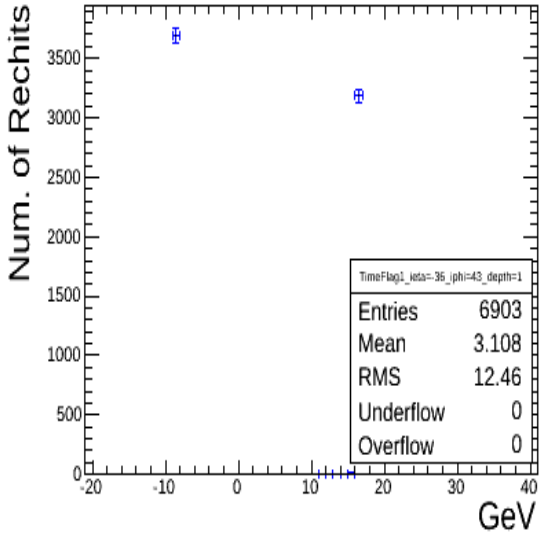
Long Fiber

New PMTs

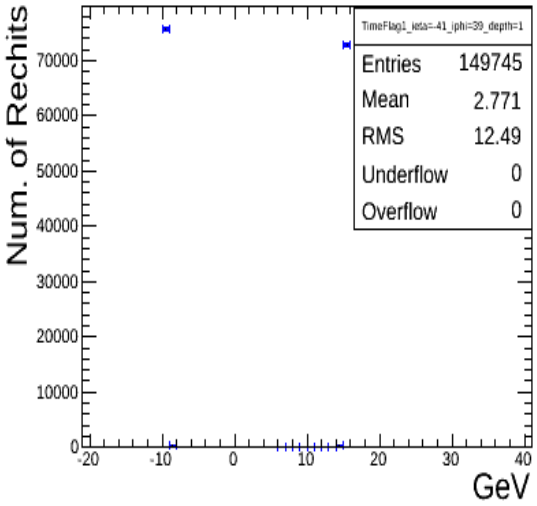


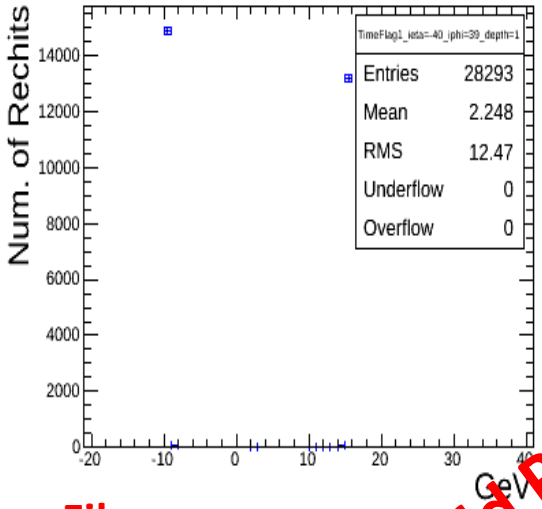


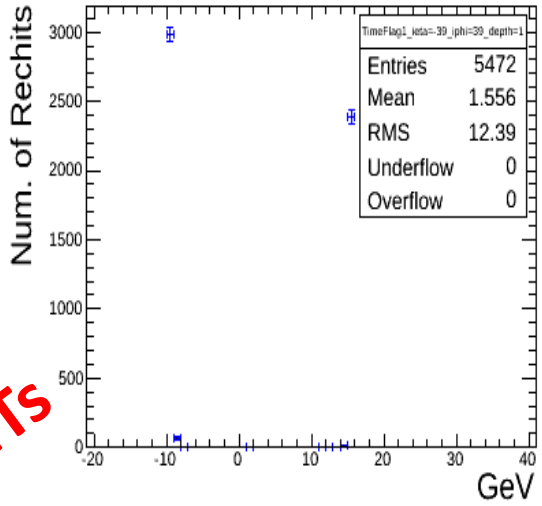




Time distributions for iphi39 not pass through the filter







Long Fiber

Old PMTs