

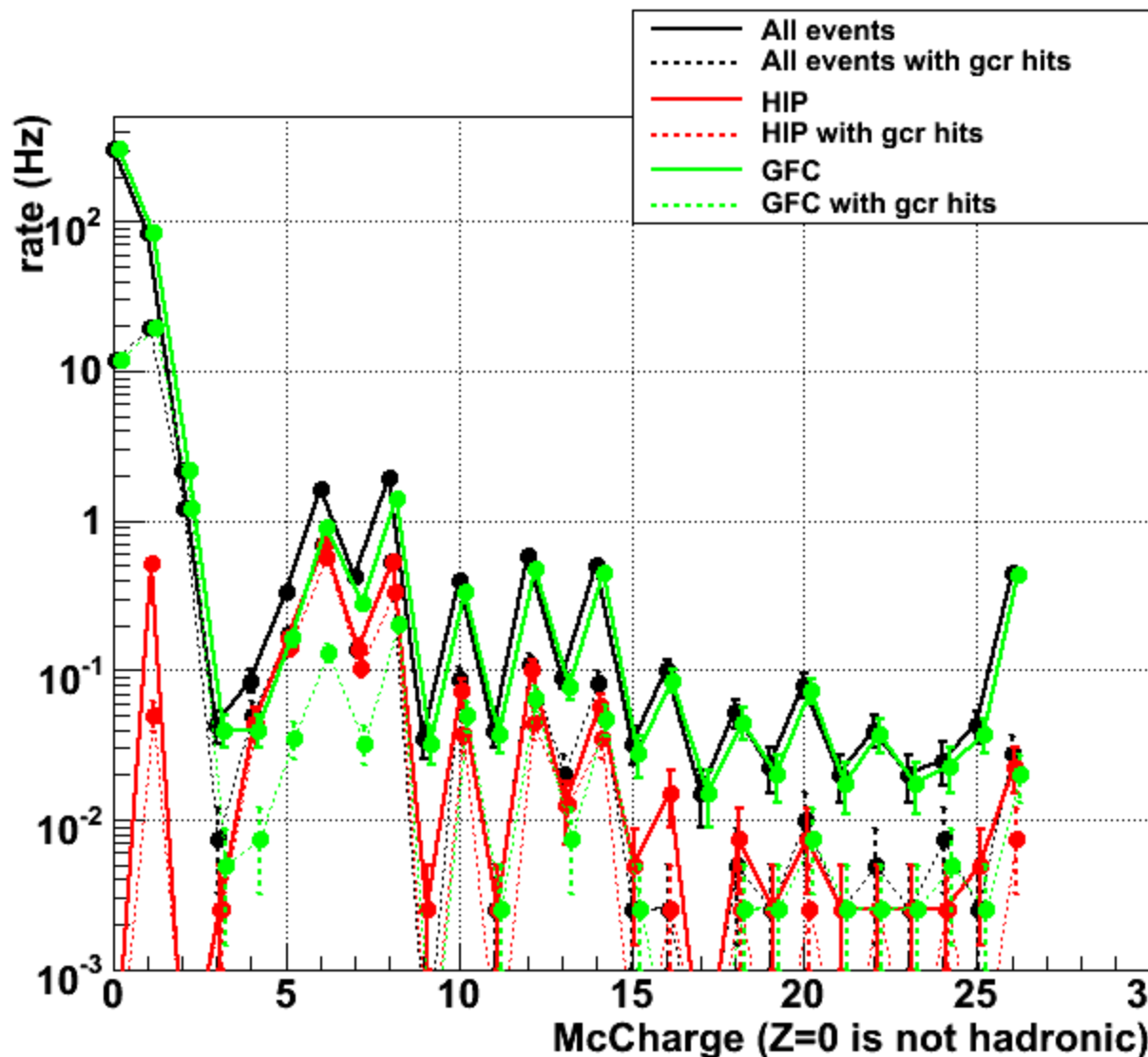
Including all filters in GCRCalib

- Brief reminder of GCRcalib algorithms
 - **GCRRecon** (1st stage of GCRcalib) extrapolates tkr1 track to the CAL: finds CAL hits potentially useful for calibration and computes the exact path-length in each of them
 - **GCRSelect** (2nd stage) selects layers (starting from the top of the CAL) which have a low hit multiplicity: not more than 1 set of adjacent hits above Eth, with <3 hits in that “cluster”
- Including all filters
 - Old version of GCRCalib processed HIP events only
 - New version processes HIP, GFC, DFC and MIP events
- Choice of energy threshold
 - Sequence for choosing Eth is based on Johann's preliminary study (see March 25 CAL meeting)
 - If (HIP), then Eth=100 (heavy ions)
 - Else if (GFC), then
 - If CalEnergyRaw>10^{3.5}, then Eth=100 (heavy ions)
 - Else Eth=5 (p + He)
 - Else if (DFC || MIP), then Eth=5 (p+He)
 - As we have now learned (see next slides), a better criterion would be
 - If (trigger engine 4), then Eth=100, else Eth=5
- Code status and simulation
 - GR tag in preparation
 - Simulations at Lyon CC: 400 sec (200 jobs) with same JO as for the big run

CPU usage (we process all events now!)

- GcrSelectAlg:ex... INFO Time User : Tot= 50 [ms] Ave/Min/Max= 65.8(+ 808)/ 0/1e+04 [us] #=760
- GcrReconAlg:exe... INFO Time User : Tot= 200 [ms] Ave/Min/Max= 263(+1.6e+03)/ 0/1e+04 [us] #=760
- ChronoStatSvc INFO Time User : Tot= 60.8[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 20 [ms] Ave/Min/Max= 24.1(+ 490)/ 0/1e+04 [us] #=830
- GcrReconAlg:exe... INFO Time User : Tot= 200 [ms] Ave/Min/Max= 241(+1.53e+03)/ 0/1e+04 [us] #=830
- ChronoStatSvc INFO Time User : Tot= 62.2[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 20 [ms] Ave/Min/Max= 24.6(+ 496)/ 0/1e+04 [us] #=812
- GcrReconAlg:exe... INFO Time User : Tot= 340 [ms] Ave/Min/Max= 419(+2e+03)/ 0/1e+04 [us] #=812
- ChronoStatSvc INFO Time User : Tot= 63.5[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 40 [ms] Ave/Min/Max= 50.4(+ 708)/ 0/1e+04 [us] #=793
- GcrReconAlg:exe... INFO Time User : Tot= 160 [ms] Ave/Min/Max= 202(+1.41e+03)/ 0/1e+04 [us] #=793
- ChronoStatSvc INFO Time User : Tot= 43.6[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 10 [ms] Ave/Min/Max= 12.5(+ 353)/ 0/1e+04 [us] #=801
- GcrReconAlg:exe... INFO Time User : Tot= 180 [ms] Ave/Min/Max= 225(+1.48e+03)/ 0/1e+04 [us] #=801
- ChronoStatSvc INFO Time User : Tot= 64[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 20 [ms] Ave/Min/Max= 24.8(+ 498)/ 0/1e+04 [us] #=806
- GcrReconAlg:exe... INFO Time User : Tot= 160 [ms] Ave/Min/Max= 199(+1.39e+03)/ 0/1e+04 [us] #=806
- ChronoStatSvc INFO Time User : Tot= 60[min] #= 1
- GcrSelectAlg:ex... INFO Time User : Tot= 30 [ms] Ave/Min/Max= 37.8(+ 614)/ 0/1e+04 [us] #=794
- GcrReconAlg:exe... INFO Time User : Tot= 150 [ms] Ave/Min/Max= 189(+1.36e+03)/ 0/1e+04 [us] #=794
- ChronoStatSvc INFO Time User : Tot= 61[min] #= 1
- ...

Event rates



Z= 1: 0.526 +- 0.036 Hz in HIP

Z= 1: 0.050 +- 0.011 Hz in HIP w/ GCR hits

Z= 1: 84.739 +- 0.461 Hz in GFC

Z= 1: 19.337 +- 0.220 Hz in GFC w/ GCR hits

Z= 2: 0.000 +- 0.000 Hz in HIP

Z= 2: 0.000 +- 0.000 Hz in HIP w/ GCR hits

Z= 2: 2.191 +- 0.074 Hz in GFC

Z= 2: 1.221 +- 0.055 Hz in GFC w/ GCR hits

Z= 6: 0.697 +- 0.042 Hz in HIP

Z= 6: 0.566 +- 0.038 Hz in HIP w/ GCR hits

Z= 6: 0.912 +- 0.048 Hz in GFC

Z= 6: 0.130 +- 0.018 Hz in GFC w/ GCR hits

Z=12: 0.100 +- 0.016 Hz in HIP

Z=12: 0.045 +- 0.011 Hz in HIP w/ GCR hits

Z=12: 0.481 +- 0.035 Hz in GFC

Z=12: 0.065 +- 0.013 Hz in GFC w/ GCR hits

Z=26: 0.023 +- 0.008 Hz in HIP

Z=26: 0.008 +- 0.004 Hz in HIP w/ GCR hits

Z=26: 0.431 +- 0.033 Hz in GFC

Z=26: 0.020 +- 0.007 Hz in GFC w/ GCR hits

Total trigger engine 4 (TE4): 13.7 Hz

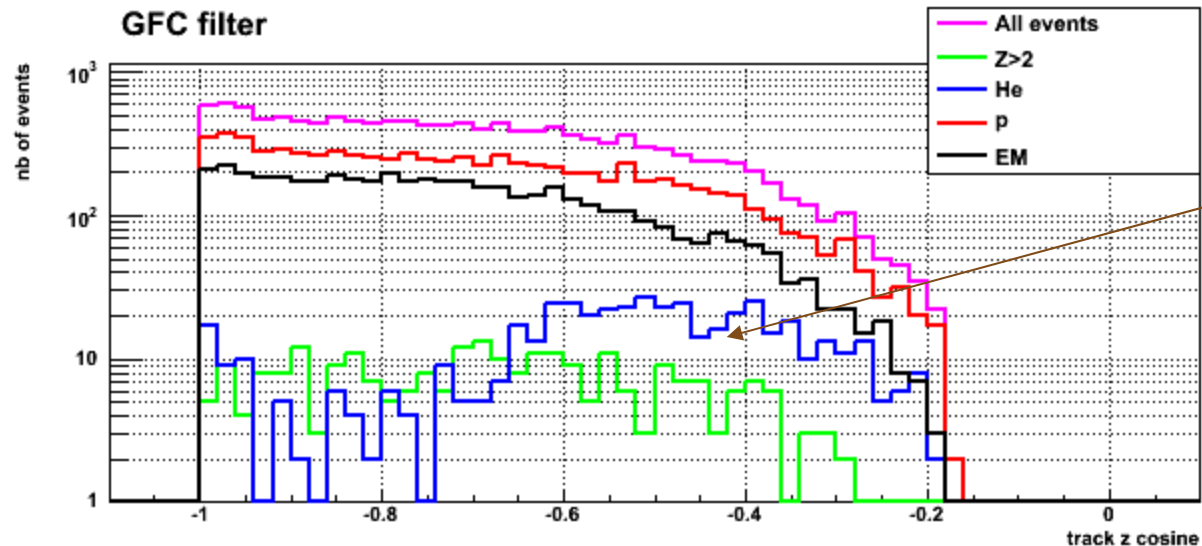
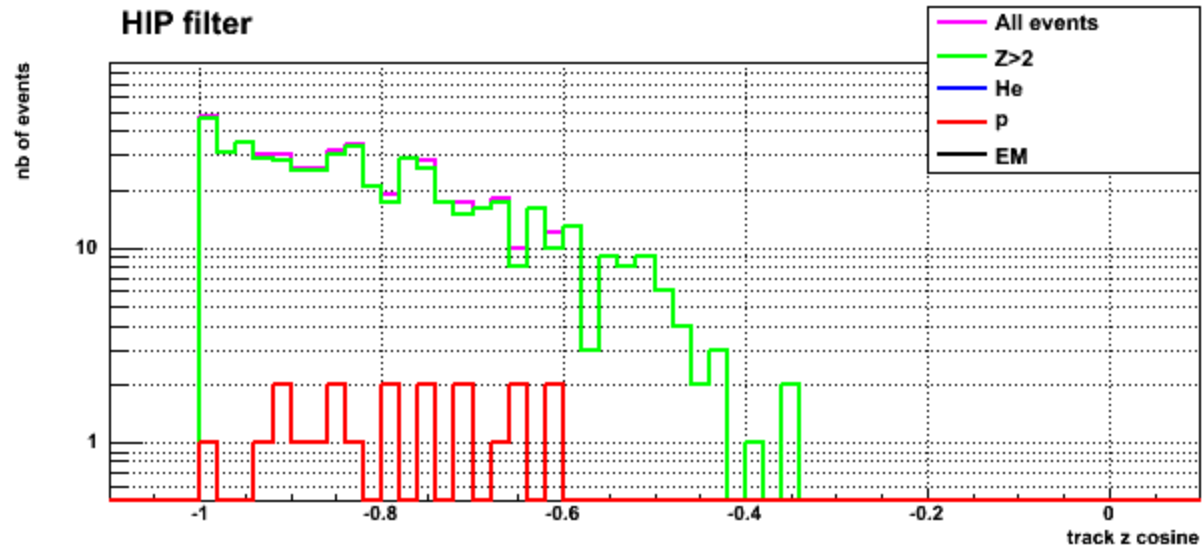
TE4 > 20GeV (FilterEnergy): 9.4 Hz

TE4 > 20GeV (CalEnergyRaw): 8.8 Hz

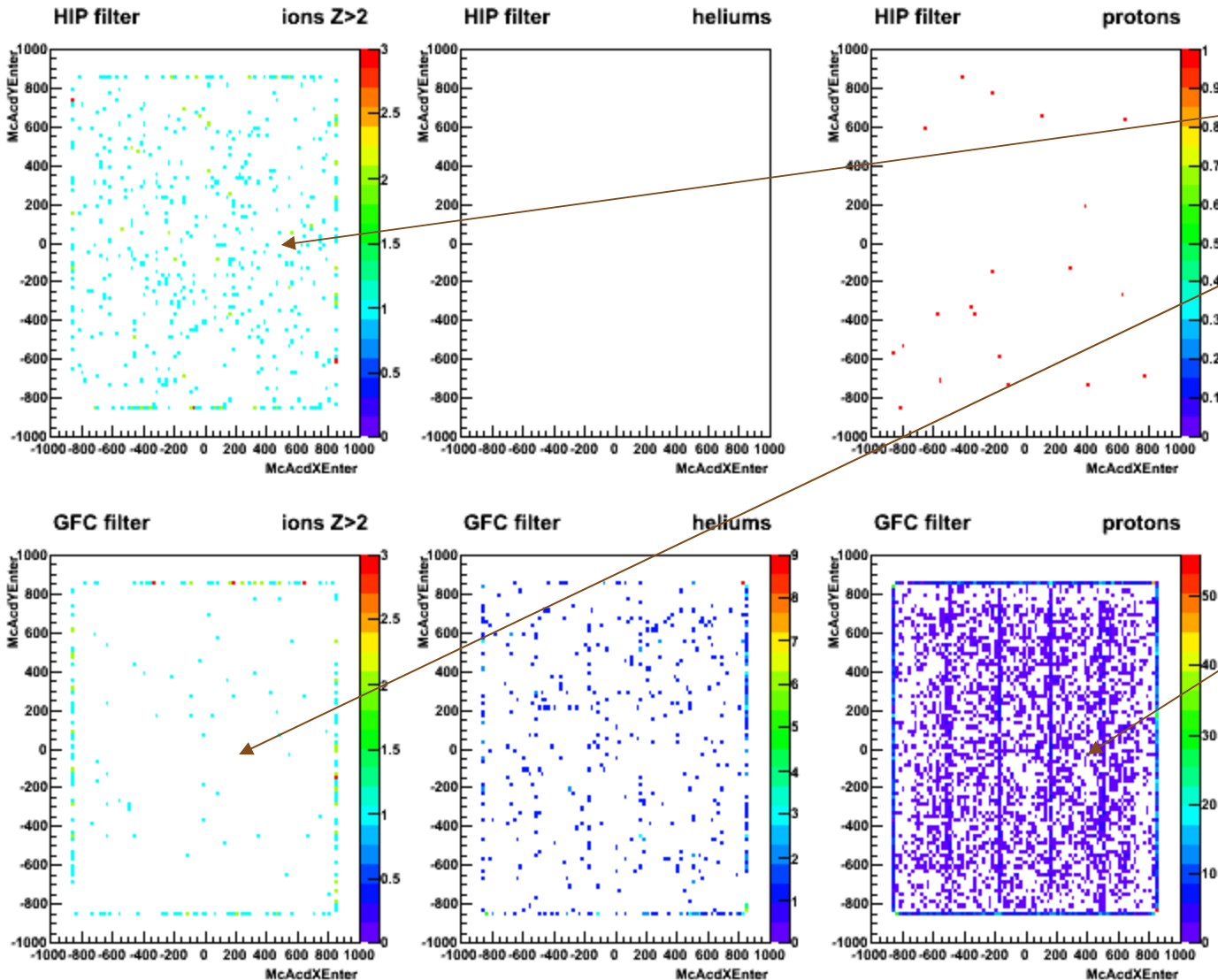
TE4 out of HIP filter: 2.4 Hz

TE4 out of GFC 11.5 Hz

Direction (z cosine)



McAcidYEnter vs McAcidXEnter

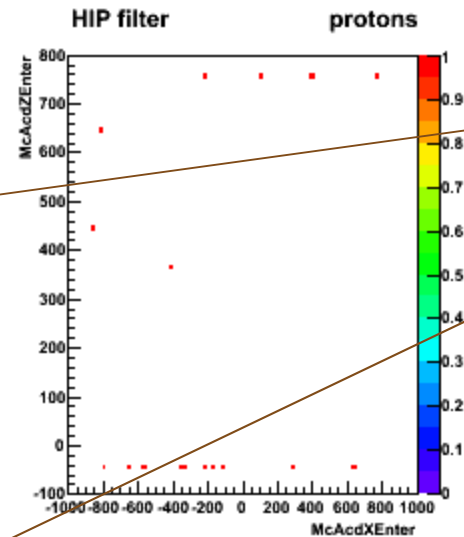
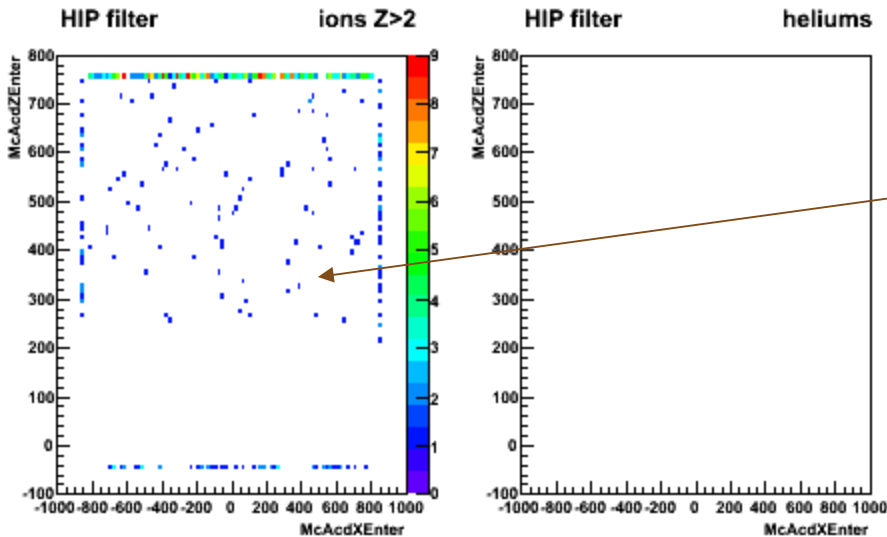


Heavy ions in HIP come rather from the top

Heavy ions in GFC come rather from the sides

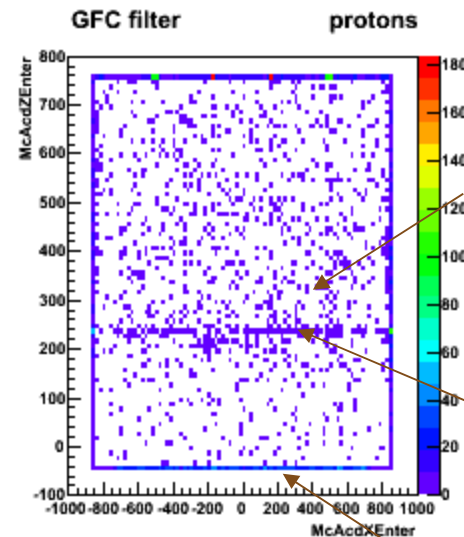
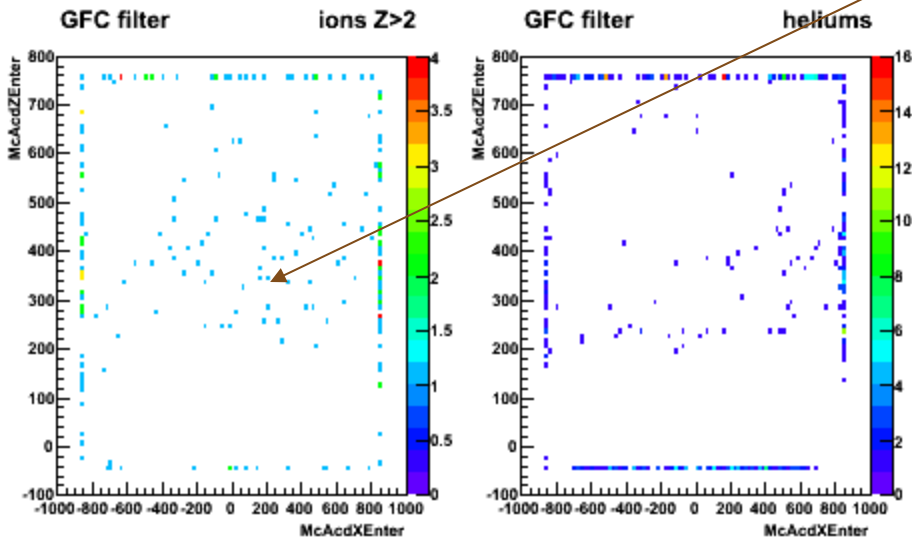
Protons and heliums in GFC passed through the ACD (e.g., ribbons)

McAcidZEnter vs McAcidXEnter



Heavy ions in HIP come rather from the top

Heavy ions in GFC come rather from the sides

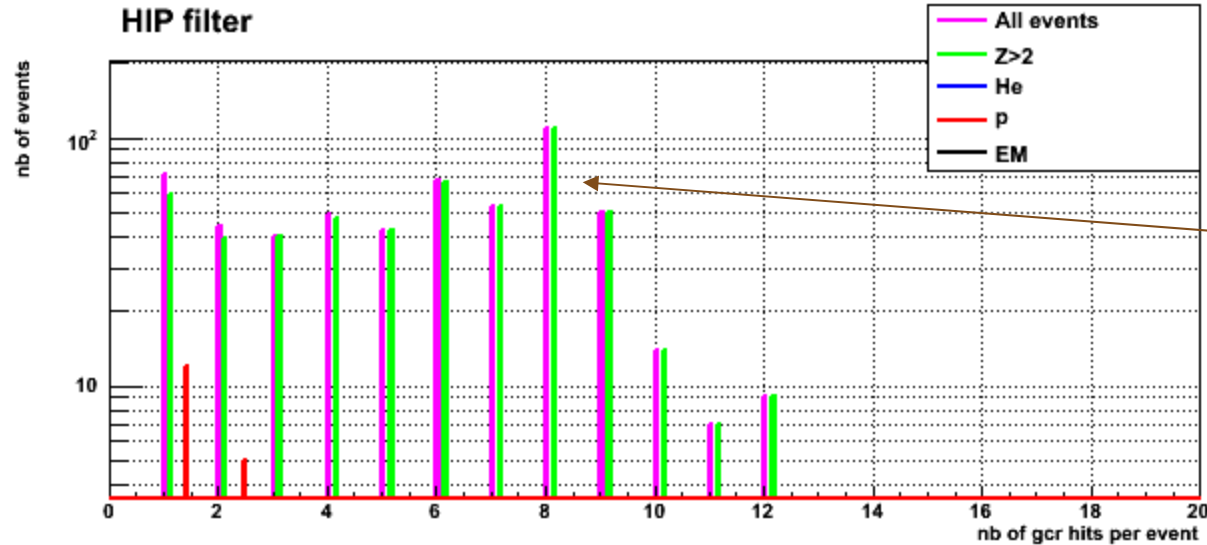


Protons and heliums in GFC passed through the ACD (e.g., ribbons)

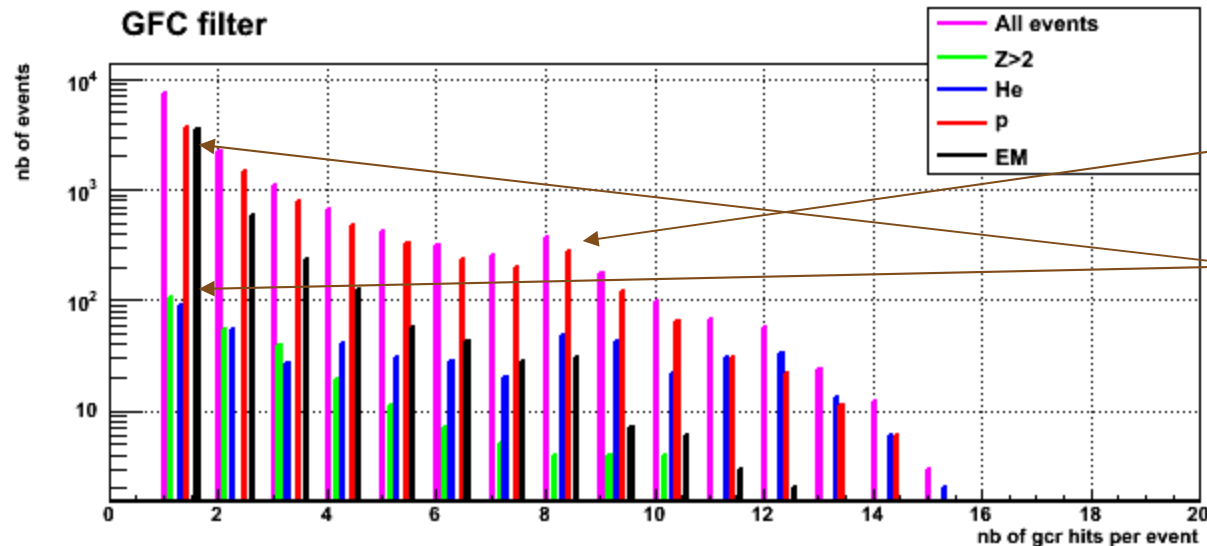
??

CAL top is at $z=-50\text{mm}$

Number of GCR hits selected per event

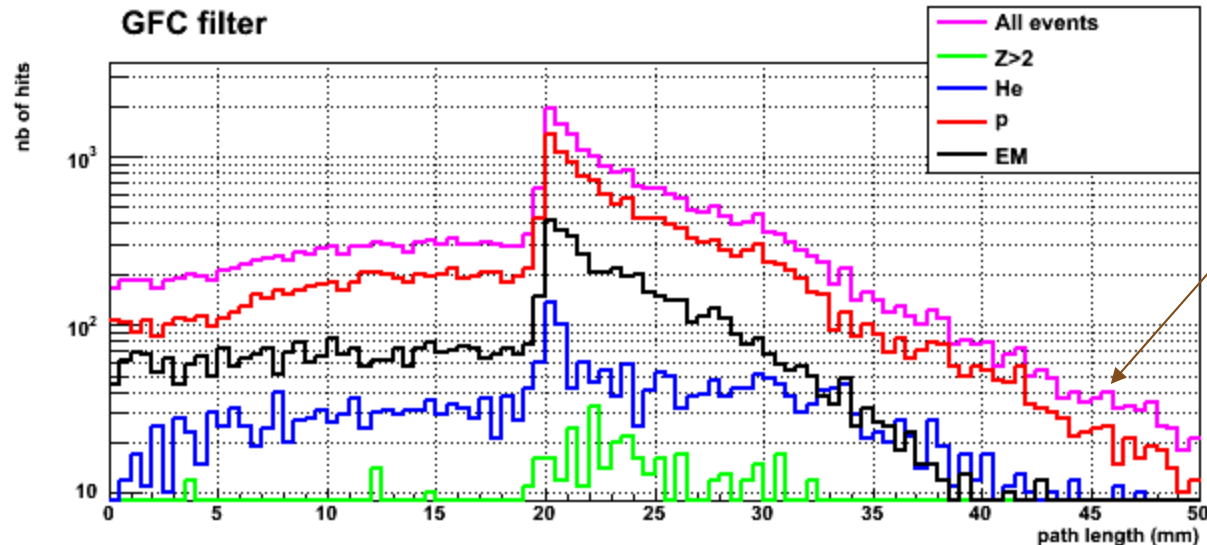
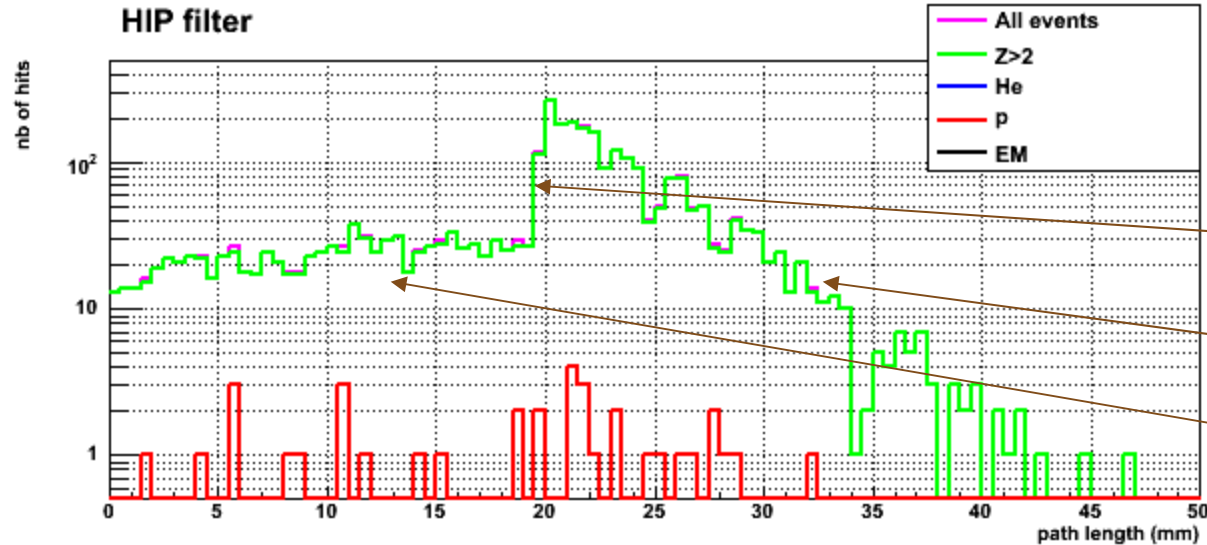


Peak at 8 for ~ vertical events

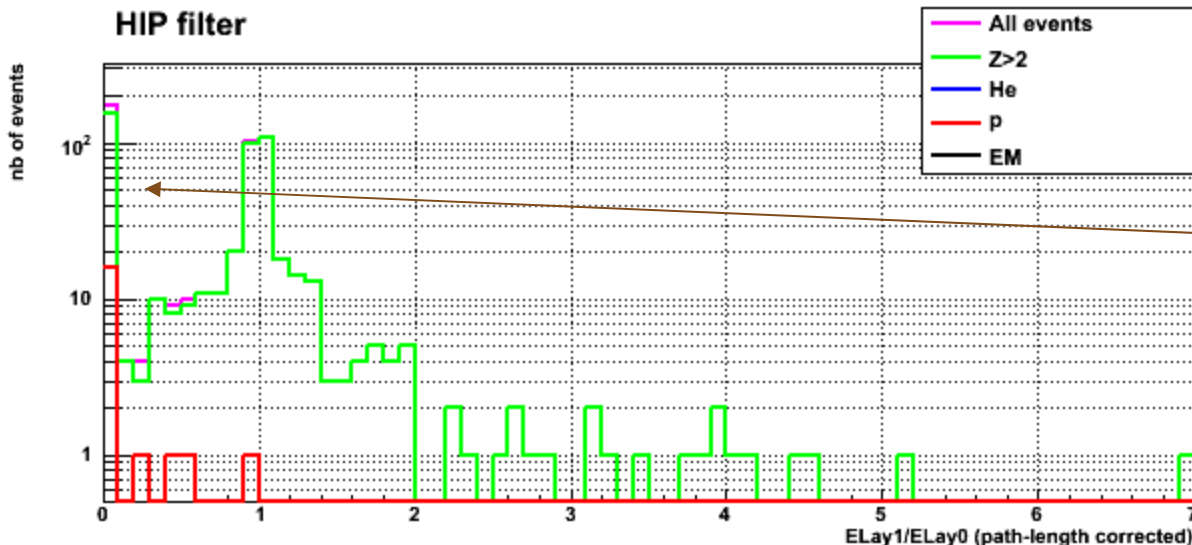


Peak at 8 still here for protons, BUT
protons and ions have only a few hits per event

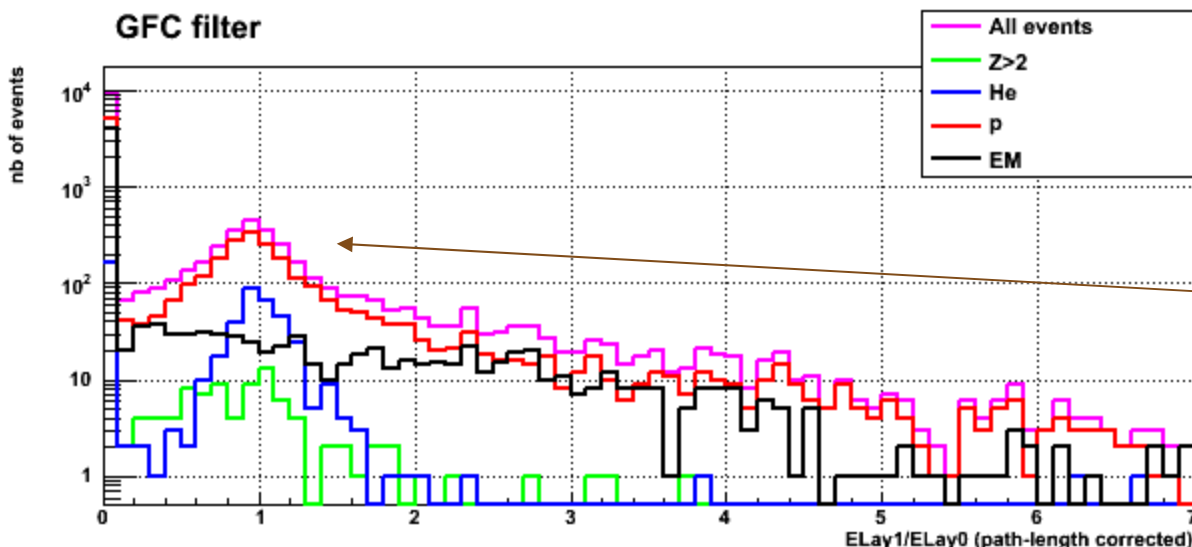
Distribution of path length in each crystal



Ratio of layer energies after path-length correction

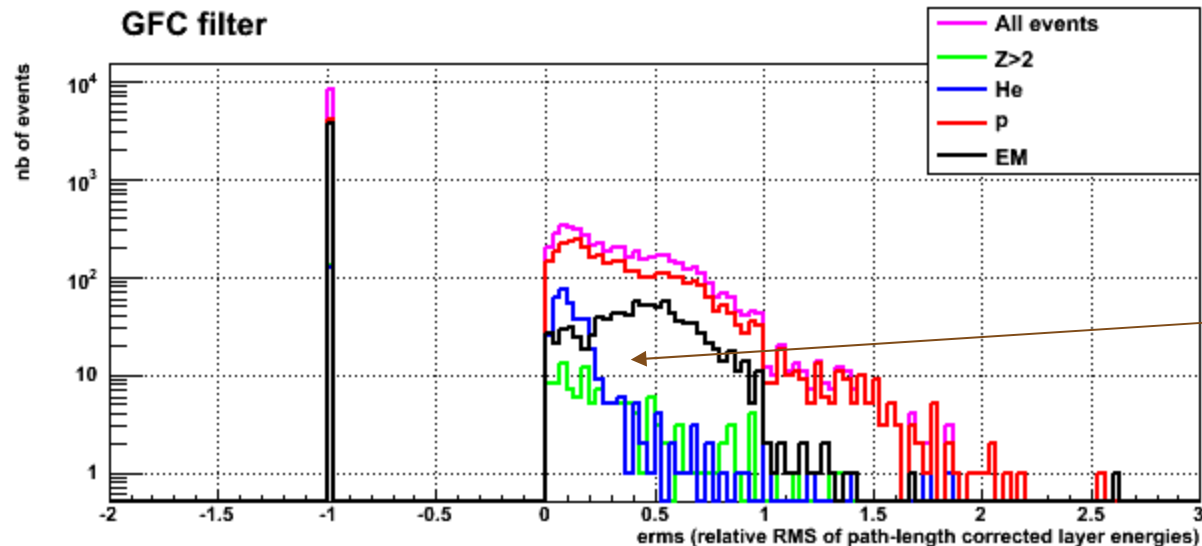
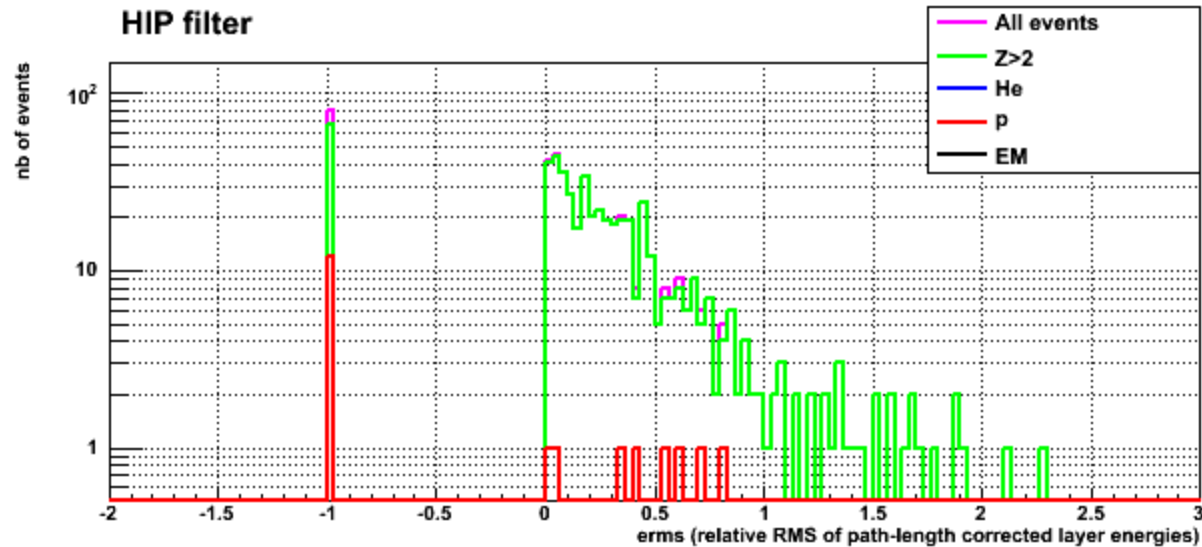


Ratio is -1 when only first layer has a GCR hit



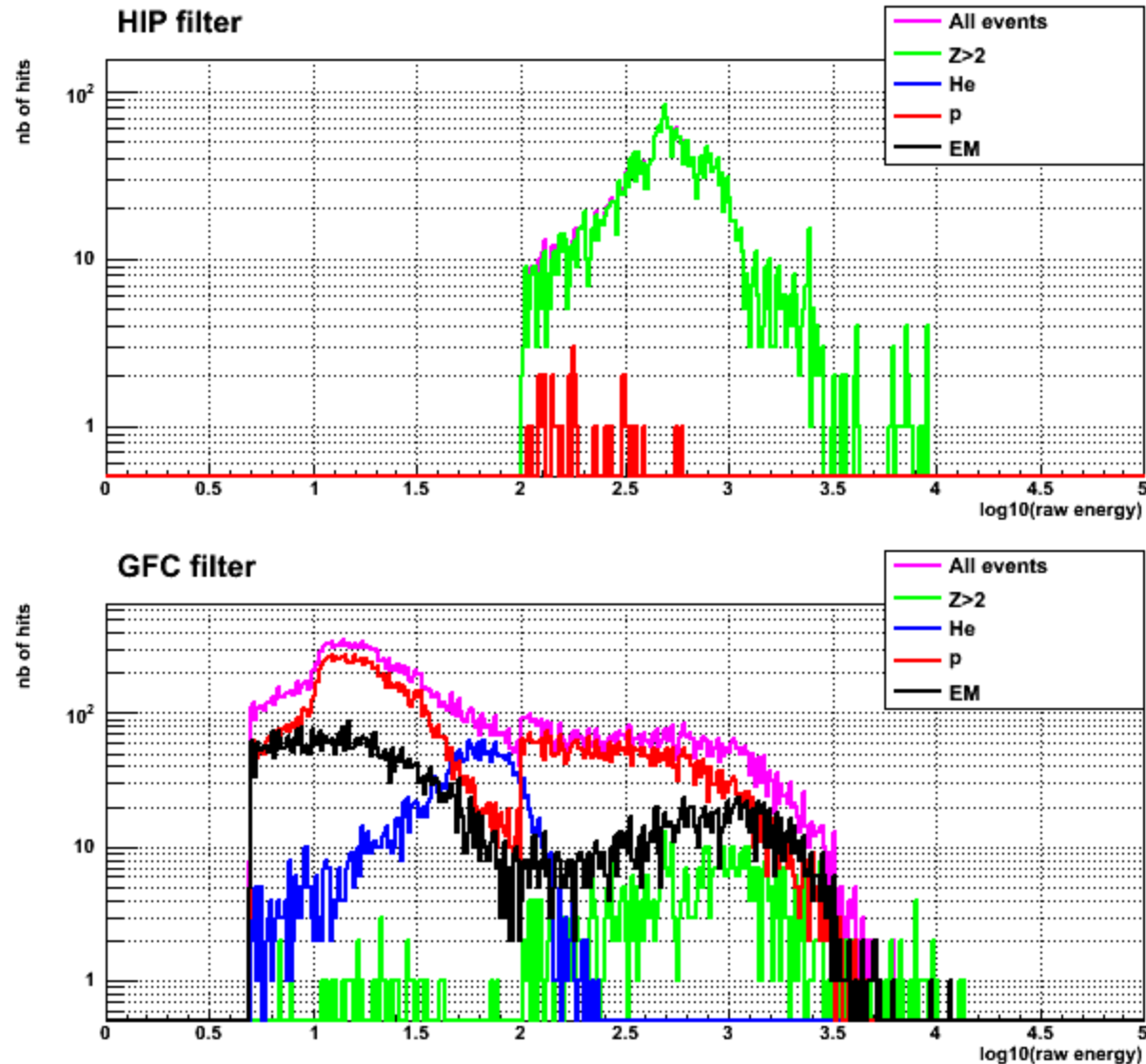
Wide distribution, not useful to select hadronic events at MIP

RMS of layer energies after path-length correction

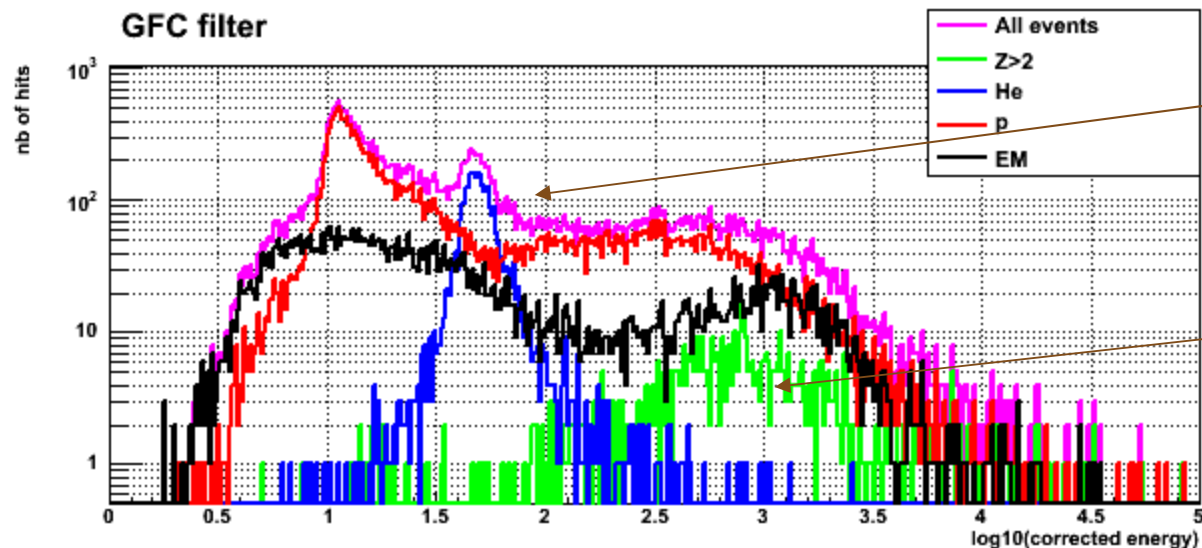
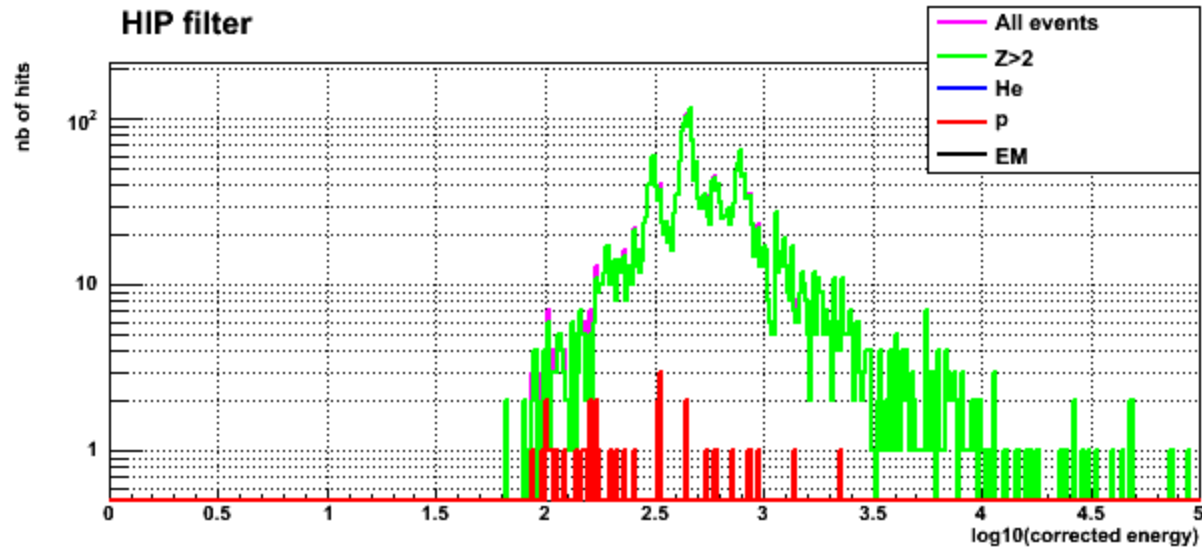


A cut $erms < 0.3$ should better select hadronic events at MIP

Hit raw energy distribution



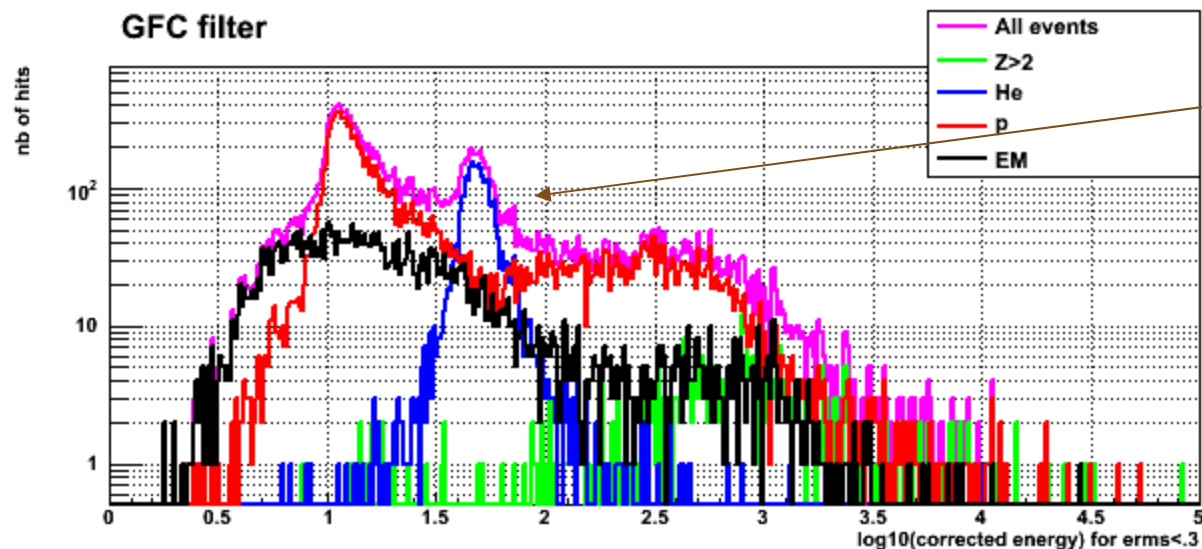
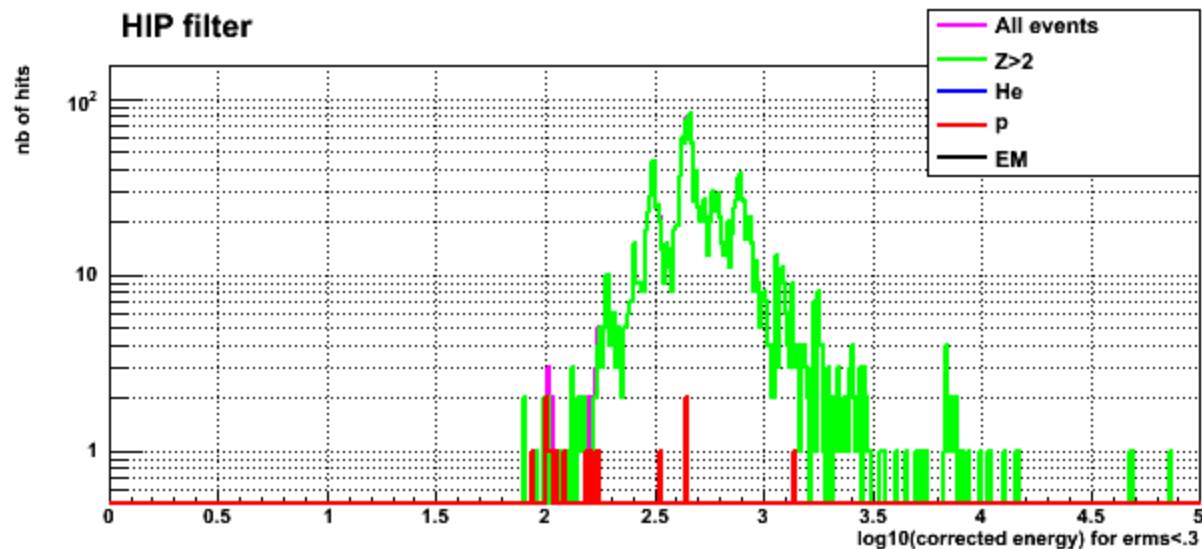
Hit corrected energy distribution



Helium peak is contaminated by proton tail and EM events

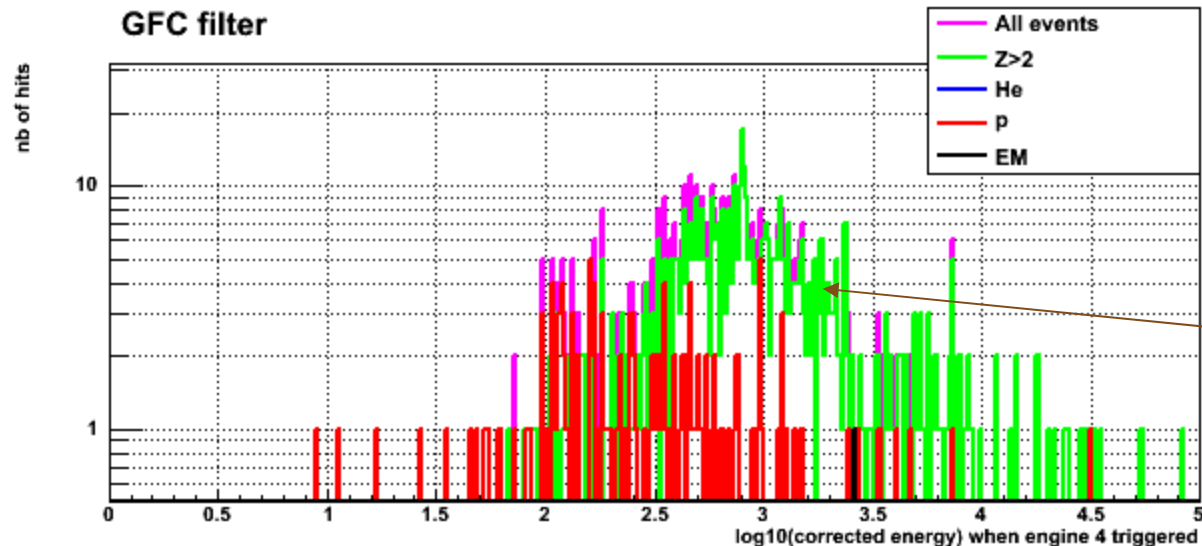
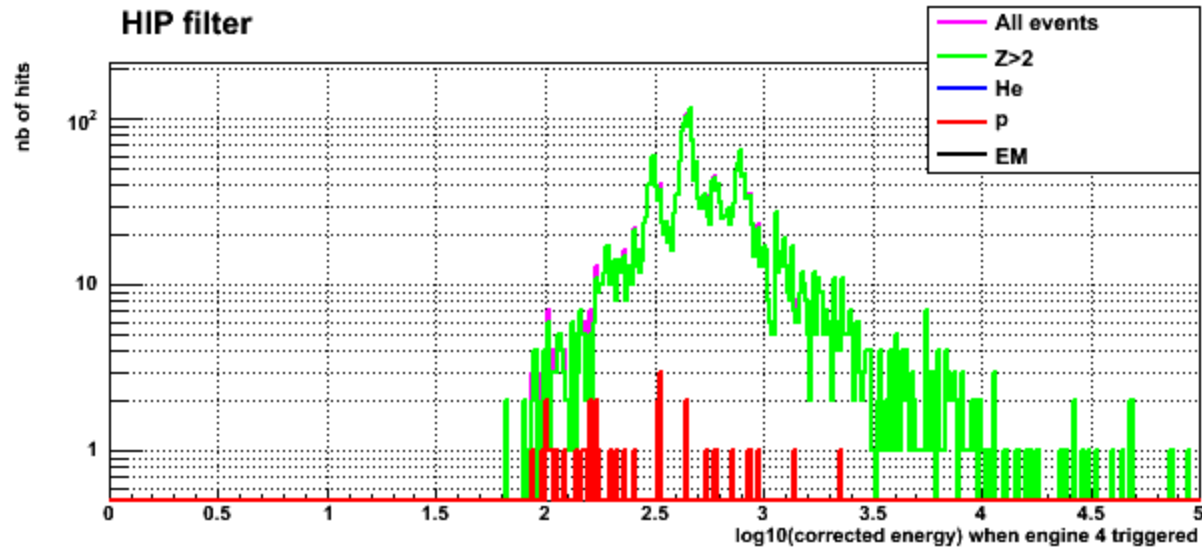
Heavy ions are hidden by (interacting?) protons and EM events

Cutting on $\text{erms} < 0.3$



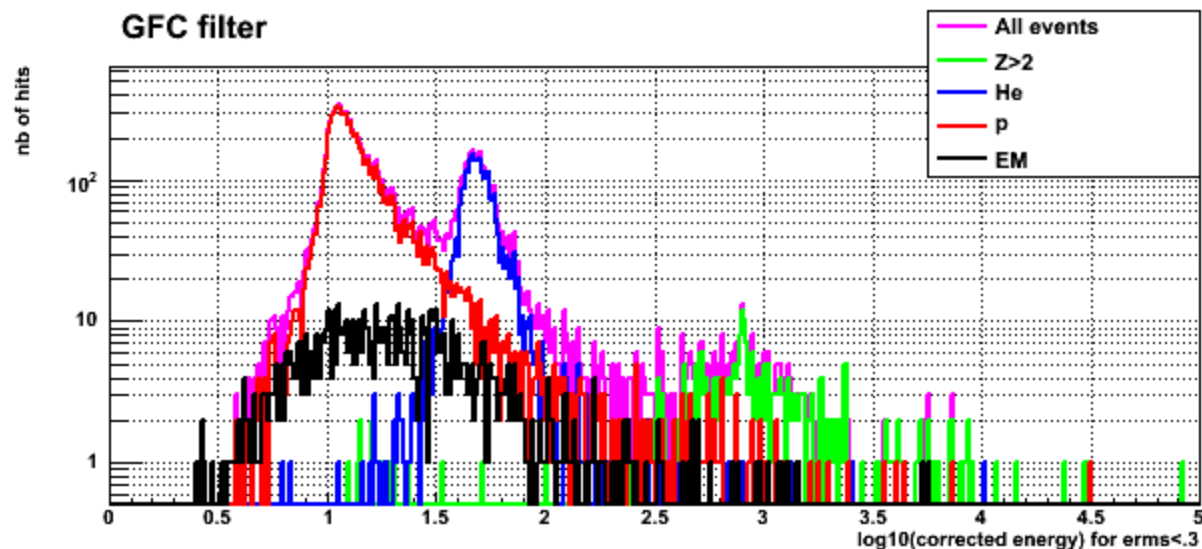
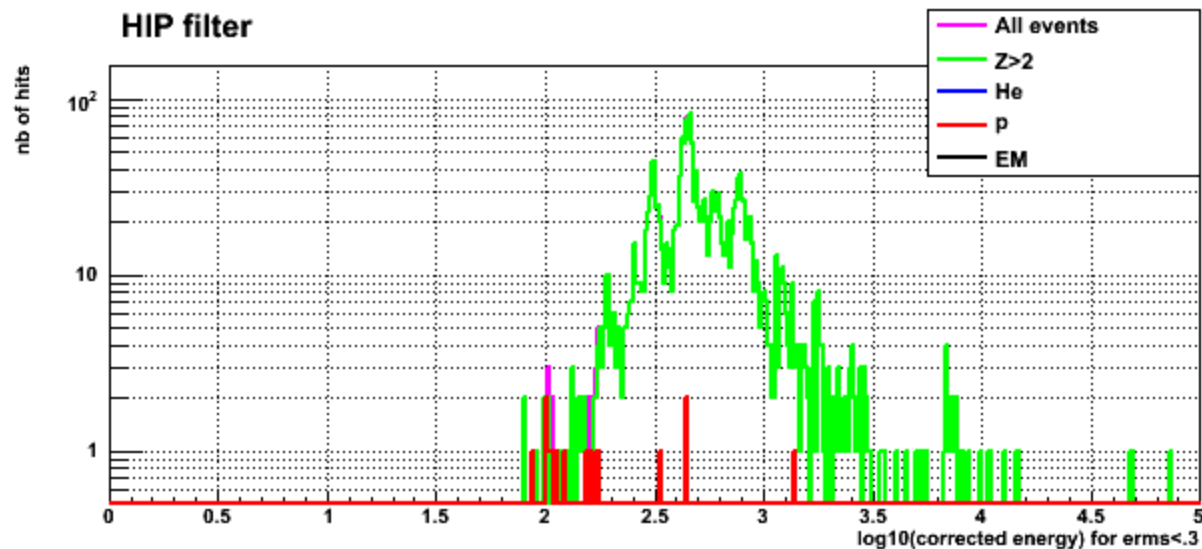
Helium peak contamination
is strongly reduced
**CTBCPF* variables should
help a lot here!**

Requiring trigger engine 4!



Almost only heavy ions survive

Final spectrum



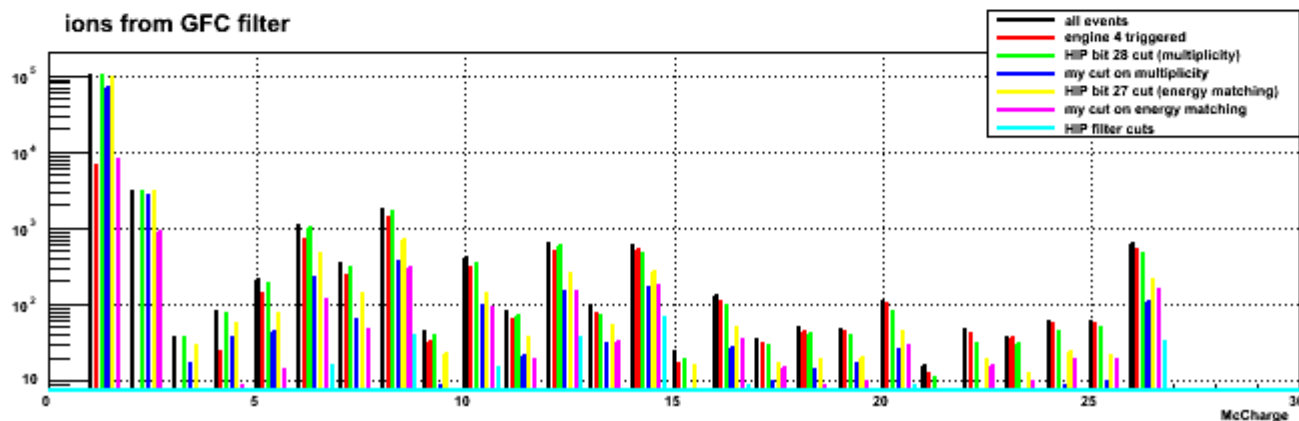
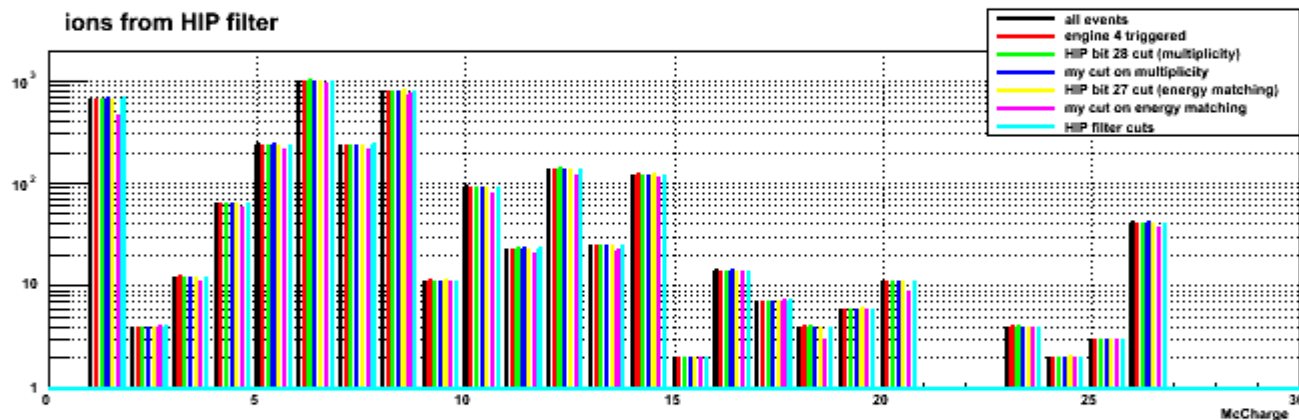
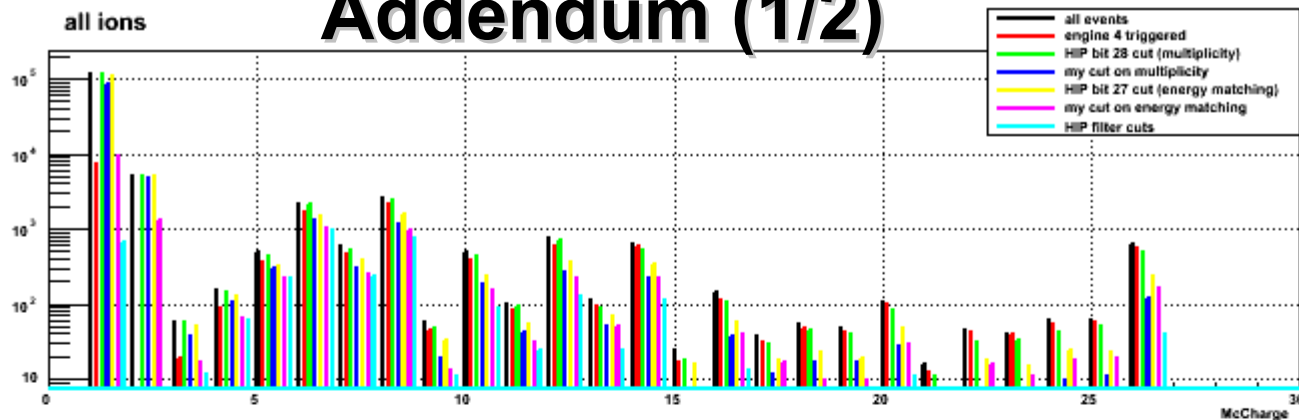
For DFC, require

- >1 GCR hits found
- erms<0.3
- Trigger engine 4 fired for events with CalEnergyRaw>3 GeV

Conclusions

- GCRCalib code now handles HIP, DFC, DGN and MIP events
 - `const Tobject *gsv=gcrSelect->getGcrSelectVals()`
 - `UInt_t ObfStatusWord=gsv->getGcrOBFStatusWord()`
- Rates are encouraging...
 - Protons: ~20Hz
 - He: ~1.2 Hz
 - Heavy ion rate is larger in GFC than in HIP
- ...but low number of hits per event
 - Must check available statistics per crystal
 - Need for a larger simulation (1-day background sample at SLAC?)
 - To better understand the heavy ions in GFC filter
 - See next slides (last week plots were wrong)
- Need to include DFC in simulation
 - current output is empty, why?

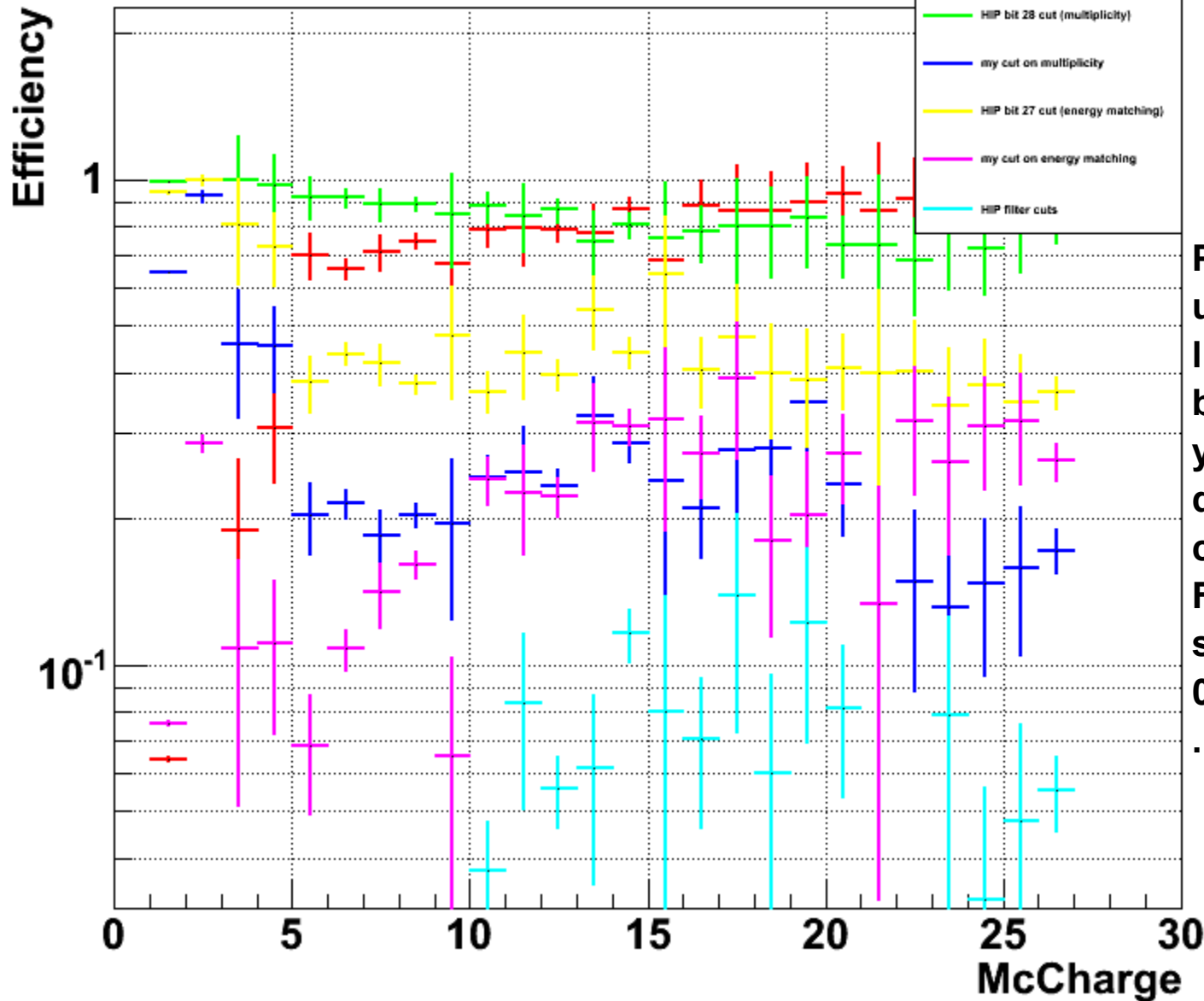
Addendum (1/2)



Most of heavy ions in GFC triggered engine 4

Addendum (2/2)

ions from GFC filter



Problem in understanding the bits:
 light blue value should be above red * green * yellow (since HIP filter does not include ROI condition).
 For Carbon, light blue should be above $0.65 \times 0.9 \times 0.45 = 0.26$
