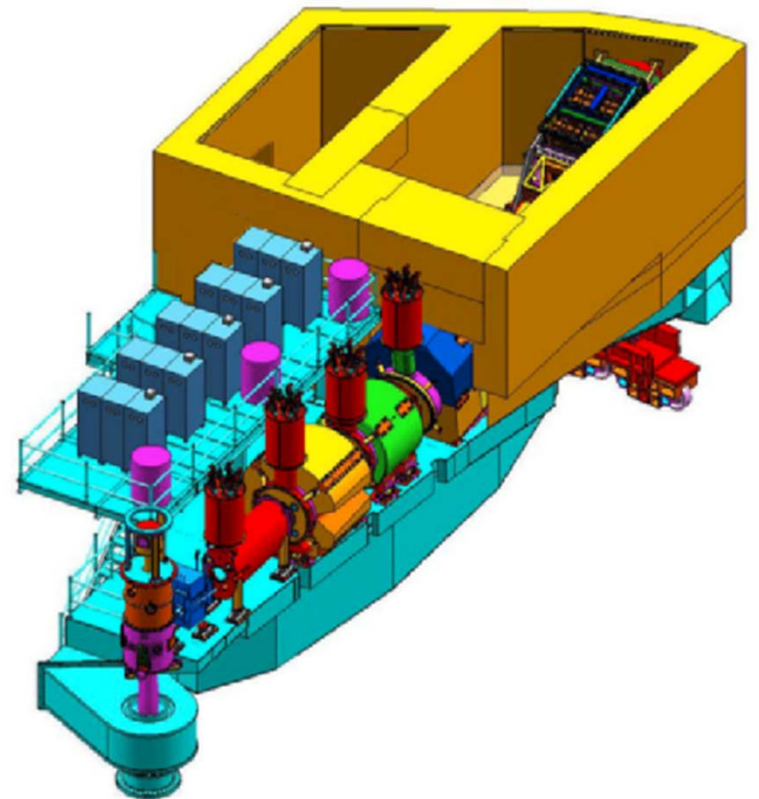




12 GeV Software Review engine/hcana comparisons

*PM Session
Hall C*

*Gabriel Niculescu
James Madison University*





Reminder *(from 06/05/2012 talk)*

- ⊕ *Hall C Fortran/Cernlib analyzer (**engine**)*
 - ⊕ *Used in the 6 GeV era*
 - ⊕ *100k+ LOC*
- ⊕ *Hall C ROOT/C++ analyzer (**hcana**)*
 - ⊕ *Moving into the 12 GeV era*
 - ⊕ *Built on top of Hall A's **PODD** software*
 - ⊕ *in publicly readable git repository (**github**)*
 - ⊕ ***Keep** all analysis algorithms from **engine***
 - ⊕ ***Document** analysis algorithms*



Current Status * (06/05/2013)

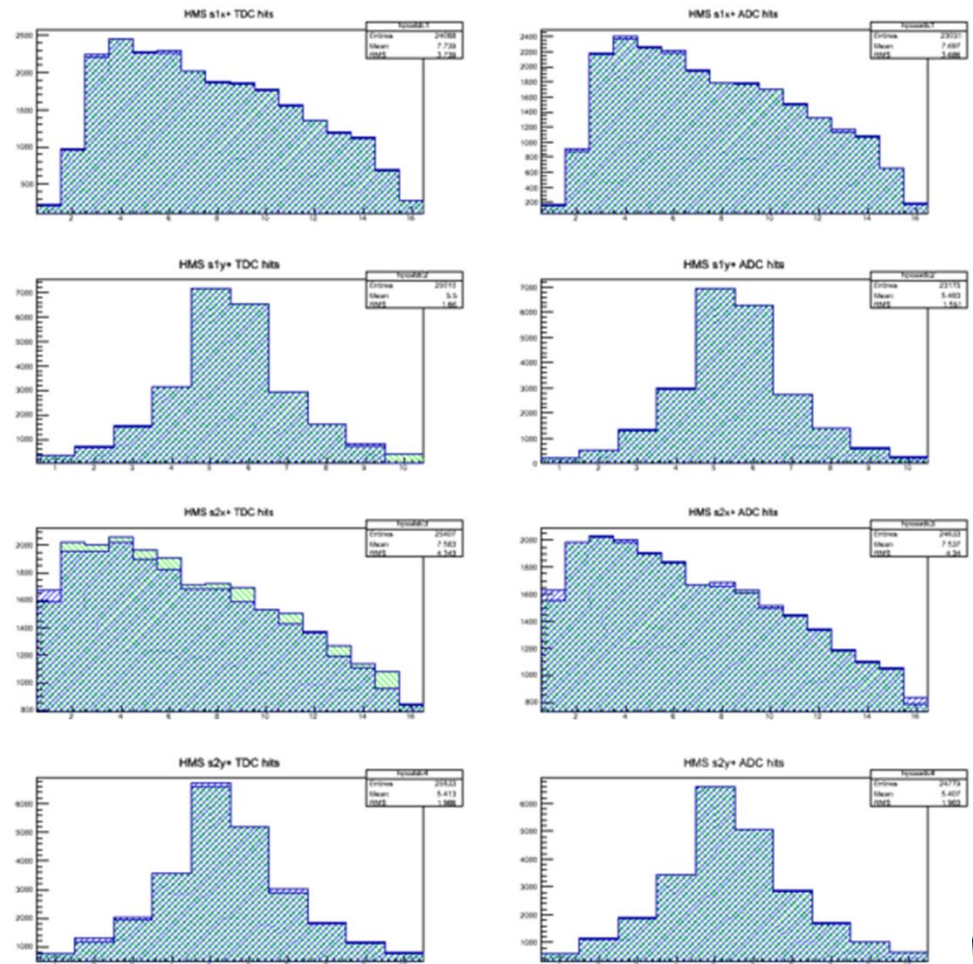
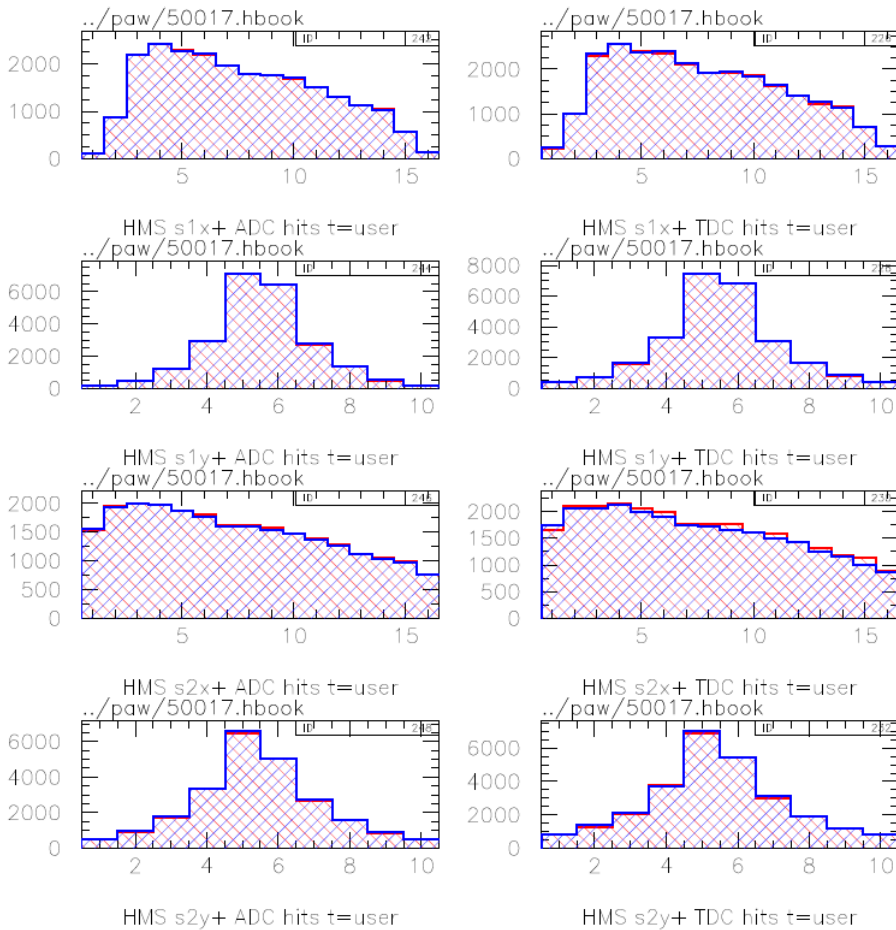
- ⊕ *Reads Hall C style parameter files*
- ⊕ *Reads Hall C style hardware (detector mapping)*
- ⊕ *Builds **engine**-style raw hit lists*
- ⊕ *Extracts hodoscope and drift chamber hit lists from HMS CODA files*
- ⊕ *Hodoscope reconstruction/rest of milestones to follow*



Also from 06/05/2012

- ⊕ **HMS hodoscope ADCs & TDC**
- ⊕ **In the engine**

- ⊕ **Same HMS hodoscope raw ADC & TDC hits**
- ⊕ **Done in hcana!**



Reminder

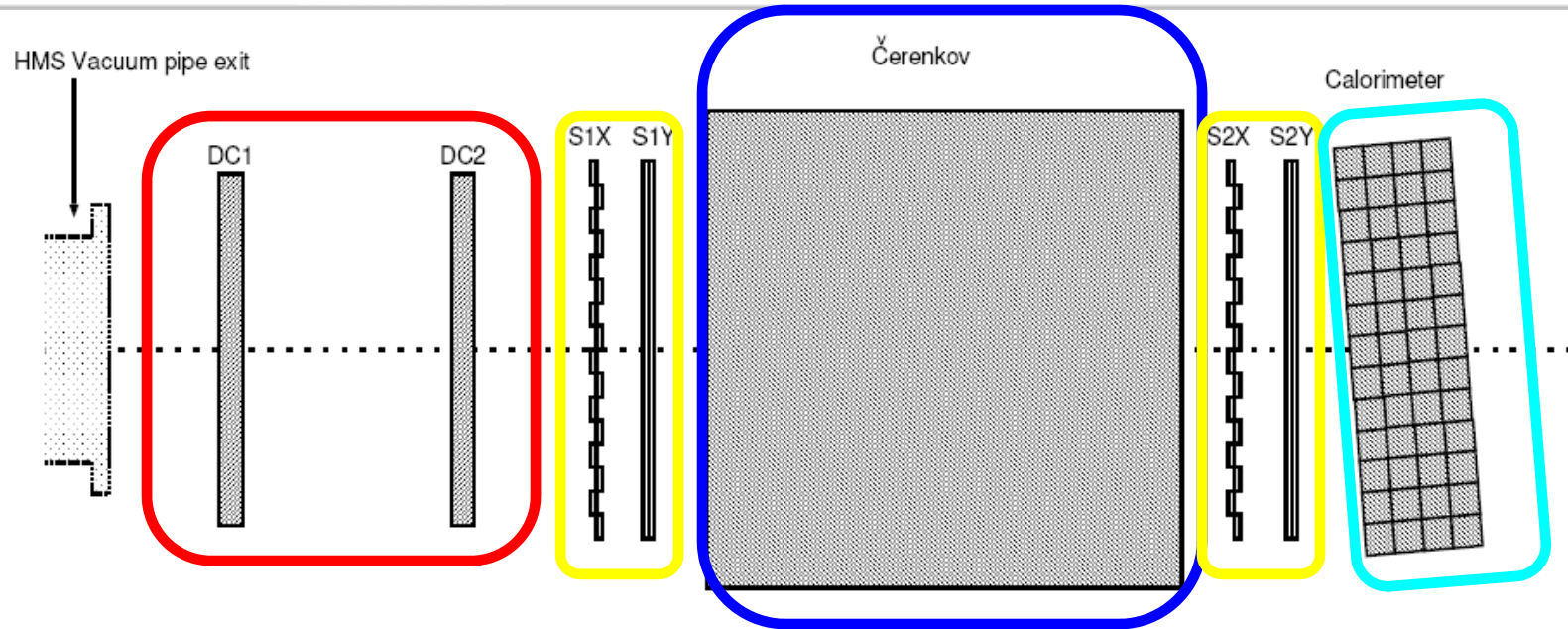


Figure 3.9: Schematic side view of the HMS detector package.

- ⊕ ***HMS (and SHMS) spectrometers have 4 main detectors:***
 - ⊕ *Drift Chambers (tracking)*
 - ⊕ *Hodoscope (trigger, PID)*
 - ⊕ *Čerenkov (PID)*
 - ⊕ *Electromagnetic calorimeter (PID)*



Current Status (11/25/2013)

- ⊕ Work has progressed in all four detector areas***
- ⊕ DC/Tracking (Steve, Mark ~80% done*)***
- ⊕ Cerenkov (Ahmed ~80%)***
- ⊕ Calorimeter (Simon, Vardan ~80%)***
- ⊕ Hodoscope/Trigger (GN ~80%)***

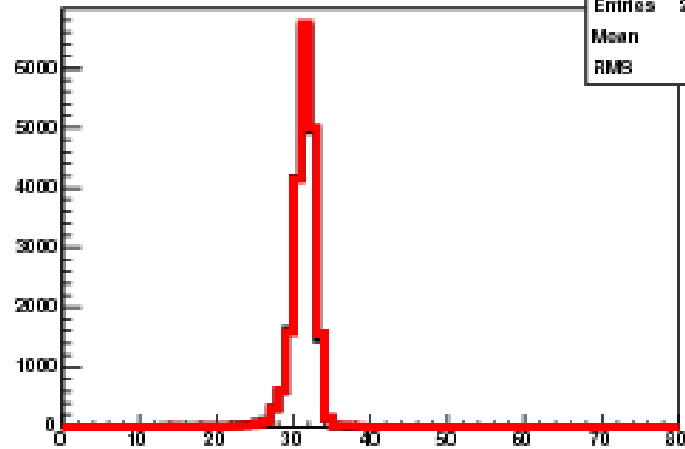
- ⊕ * done percentages are just my educated guess***
- ⊕ People working on these areas can give a better estimate***
- ⊕ You can also judge for yourselves***



Hodoscope

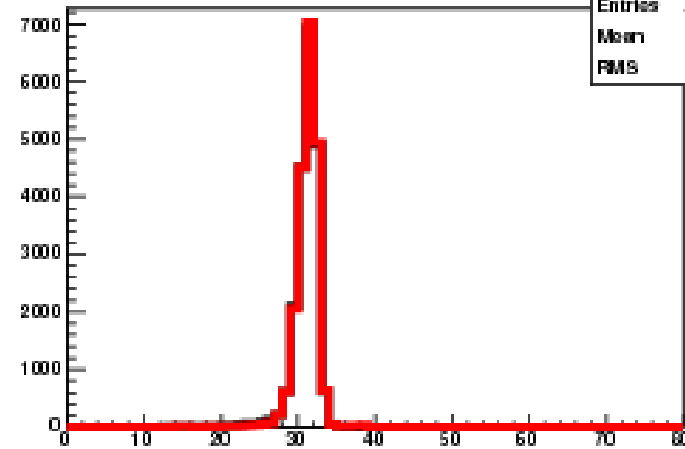
Focal plane time for all scintillator planes

HODO s1x fptime



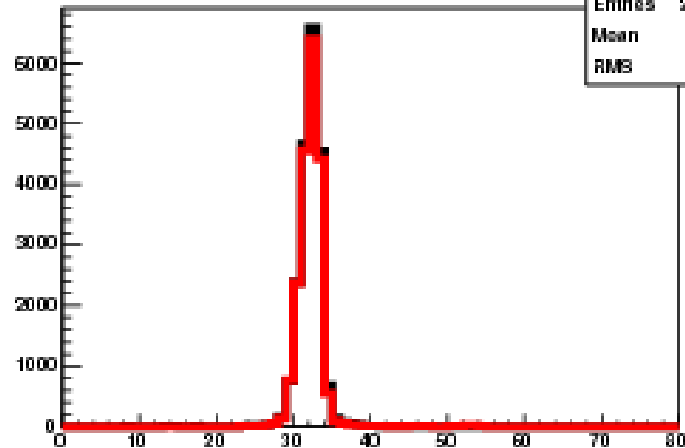
hs1xfptime	
Entries	20588
Mean	31.27
RMS	1.872

HODO s1y fptime



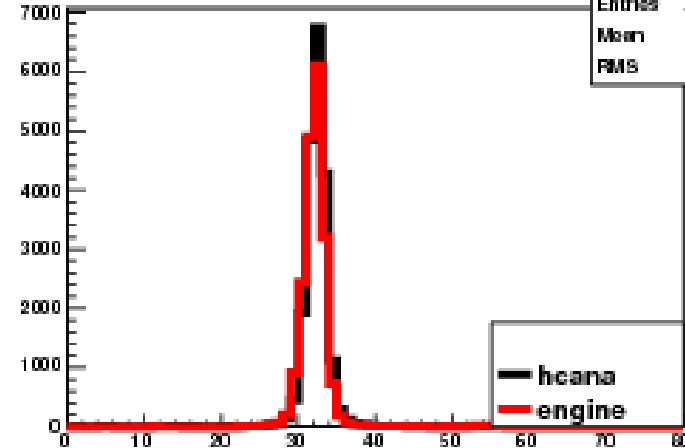
hs1yfptime	
Entries	20588
Mean	31.08
RMS	1.826

HODO s2x fptime



hs2xfptime	
Entries	20588
Mean	32.17
RMS	1.802

HODO s2y fptime



hs2yfptime	
Entries	20588
Mean	32.33
RMS	1.964

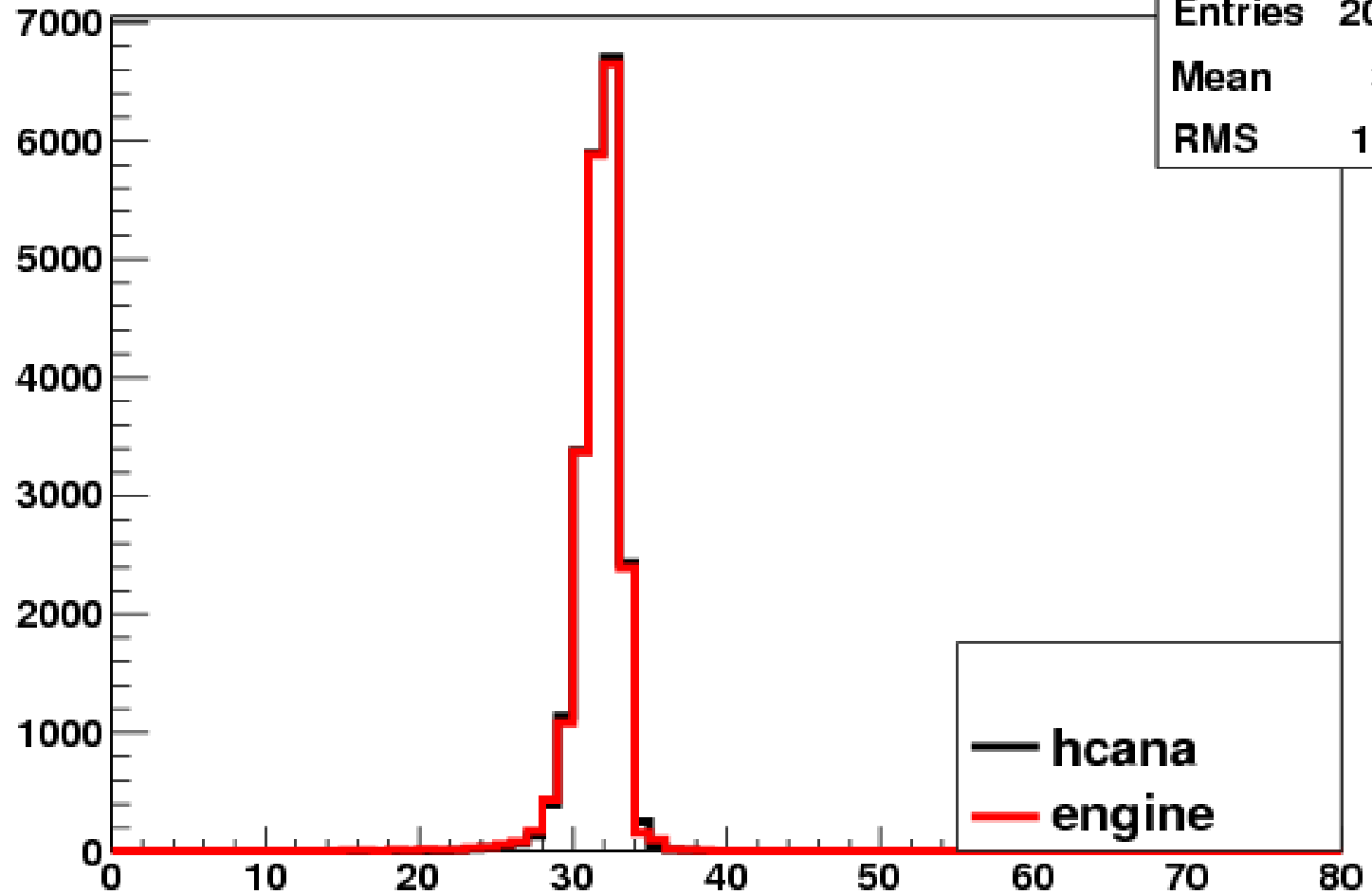




Hodoscope

⊕ *Hodoscope start time*

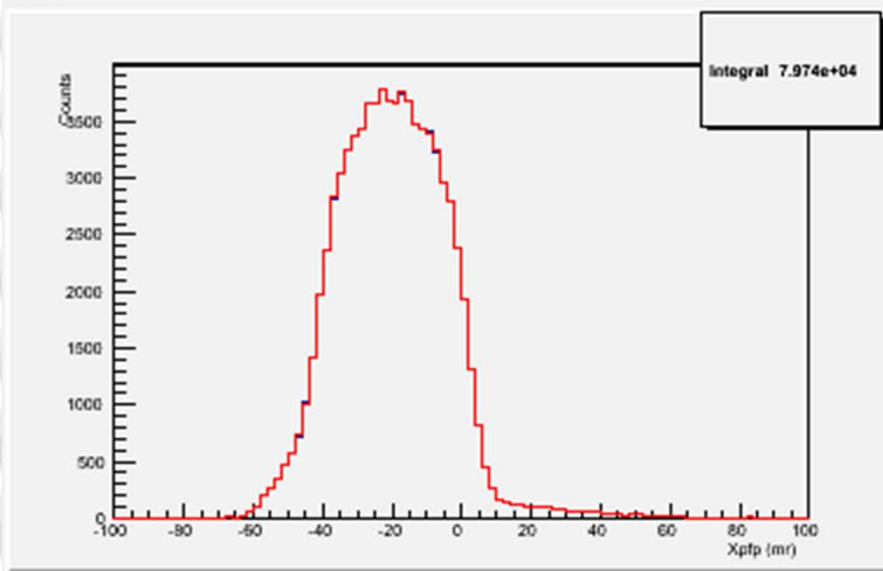
HODO start time



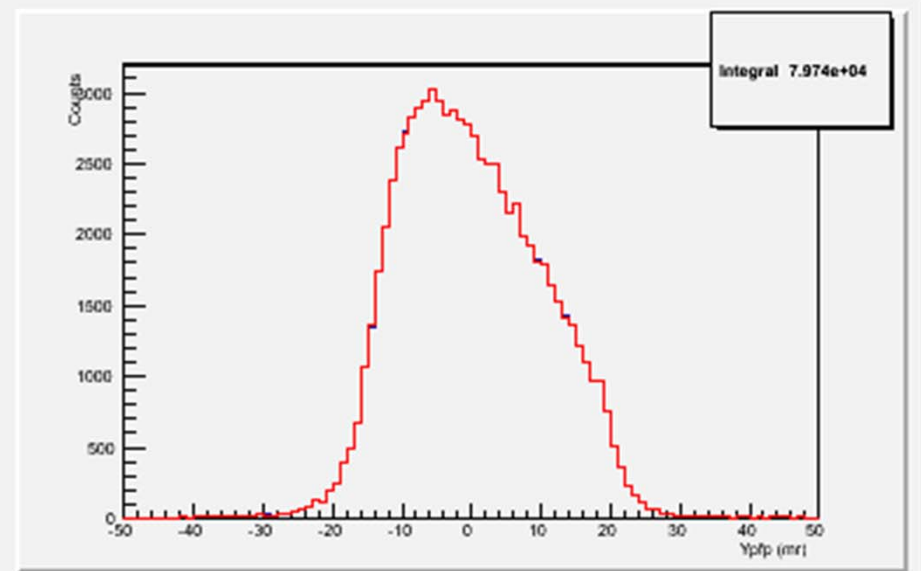


DC/Tracking

- ⊕ *Steve Wood, Mark Jones*
- ⊕ *Reconstructed focal plane quantities
(x_{fp} , y_{fp} , x_{pfp} , y_{pfp})*



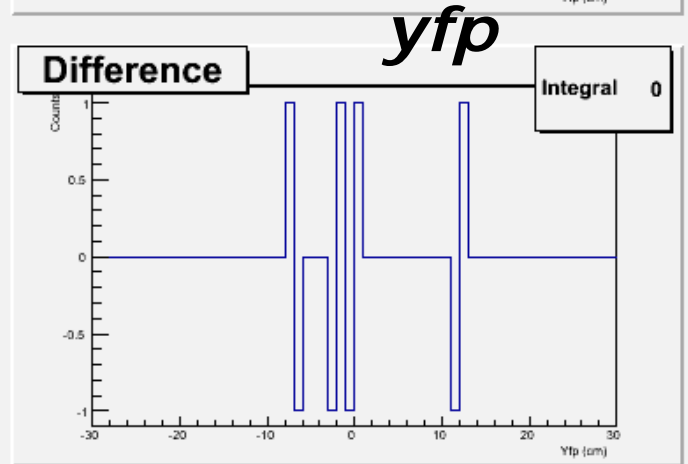
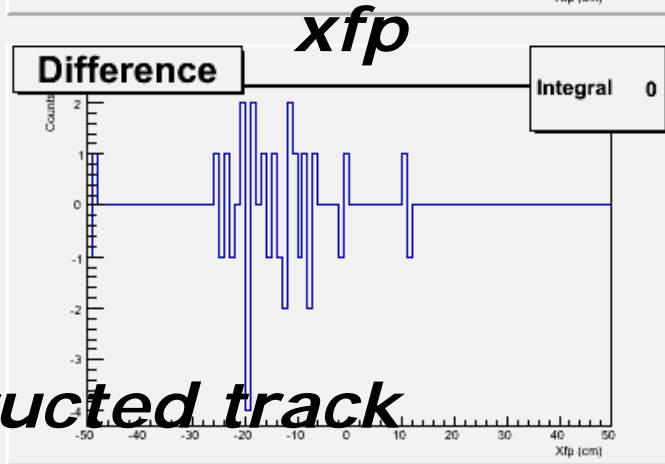
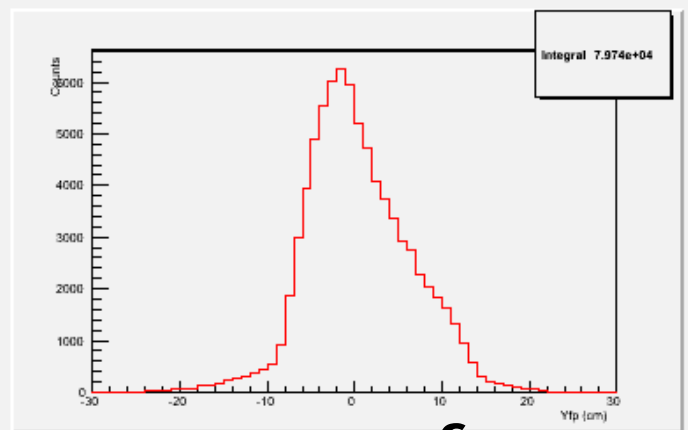
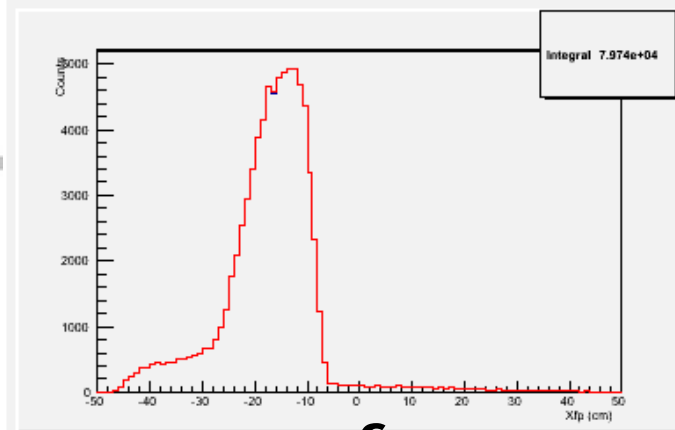
x_{pfp}



y_{pfp}



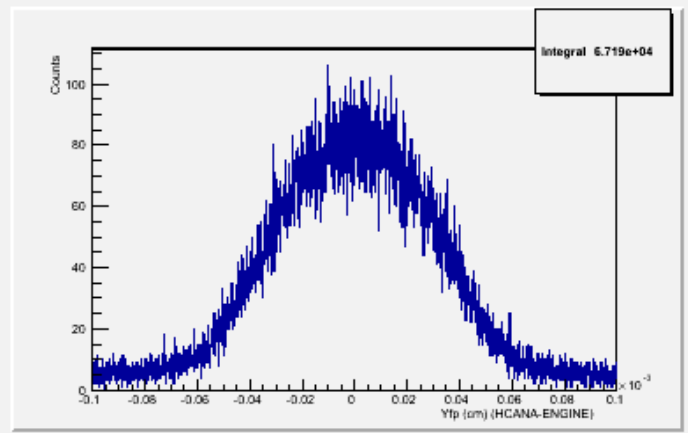
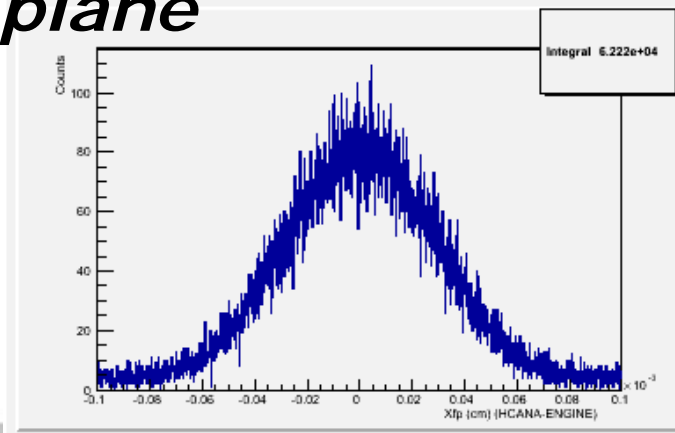
DC/Tracking



1st reconstructed track

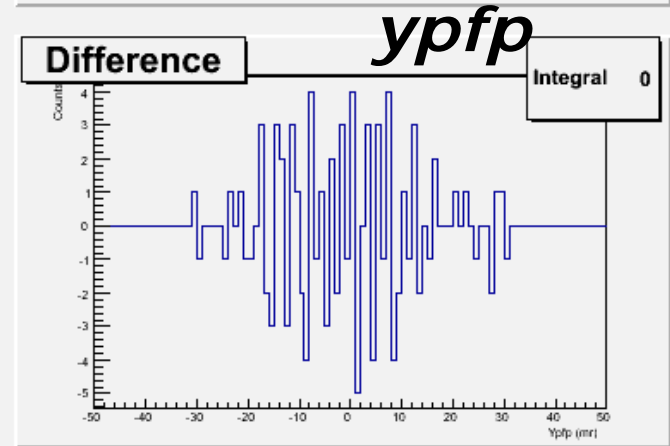
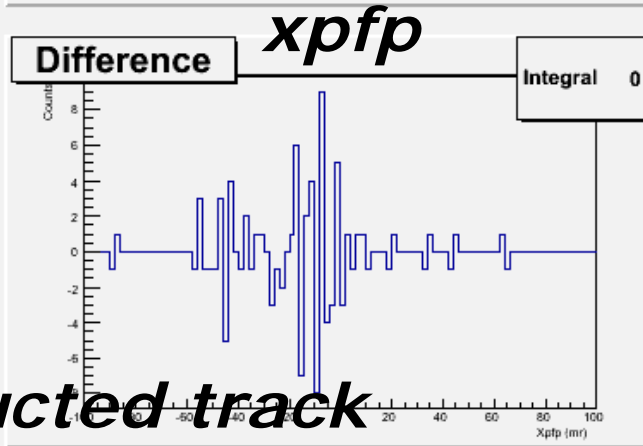
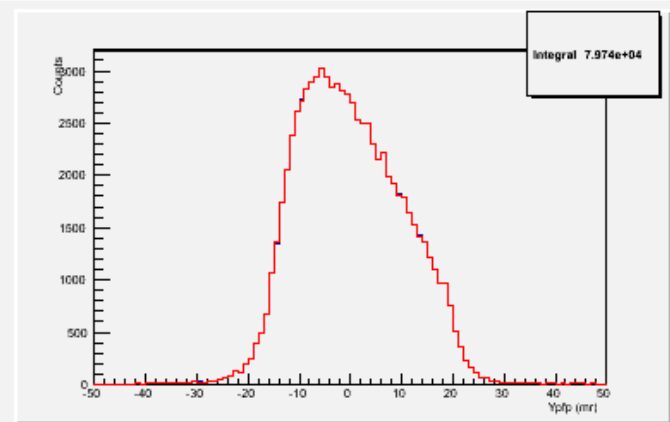
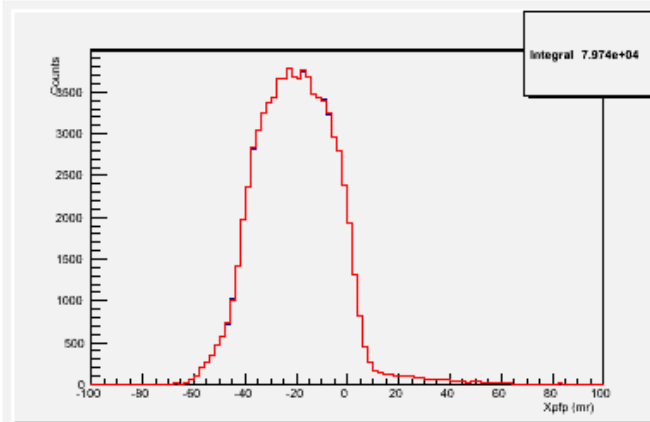


X & y focal plane position





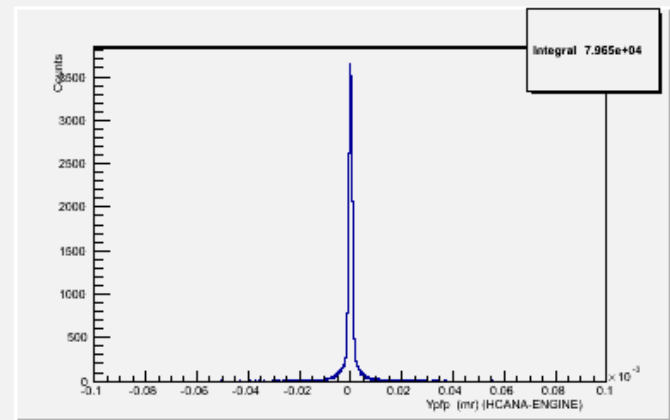
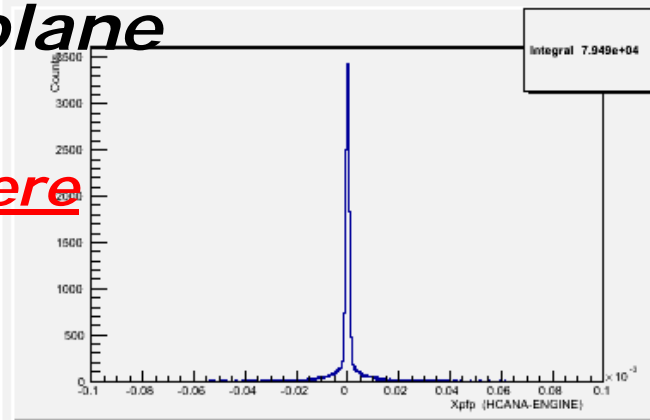
DC/Tracking



⊕ **1st reconstructed track**

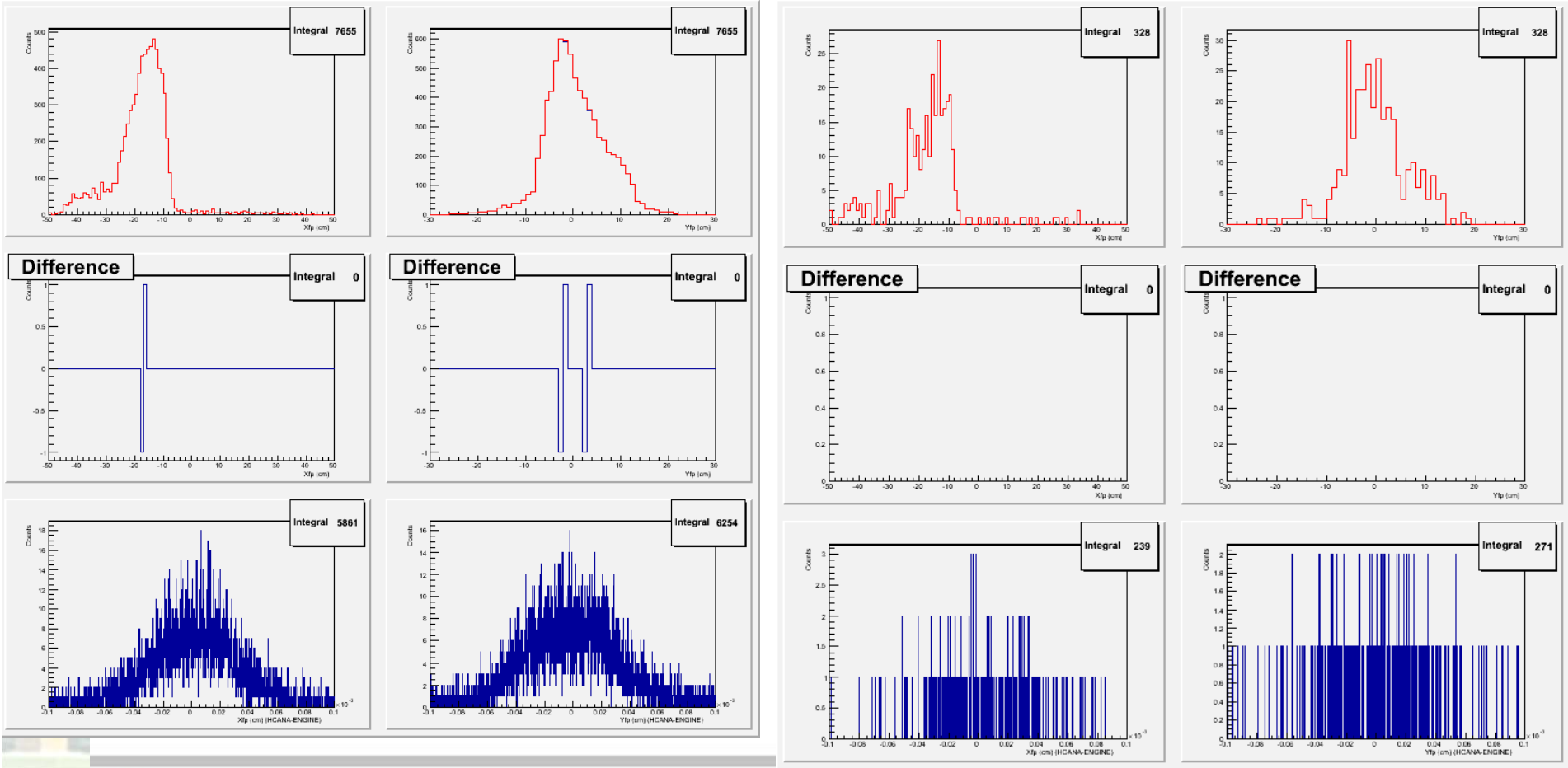
⊕ **X & y focal plane angles**

⊕ **More details [here](#)**





⊕ **2nd and 3rd track ***
⊕ **X & y focal plane positions**





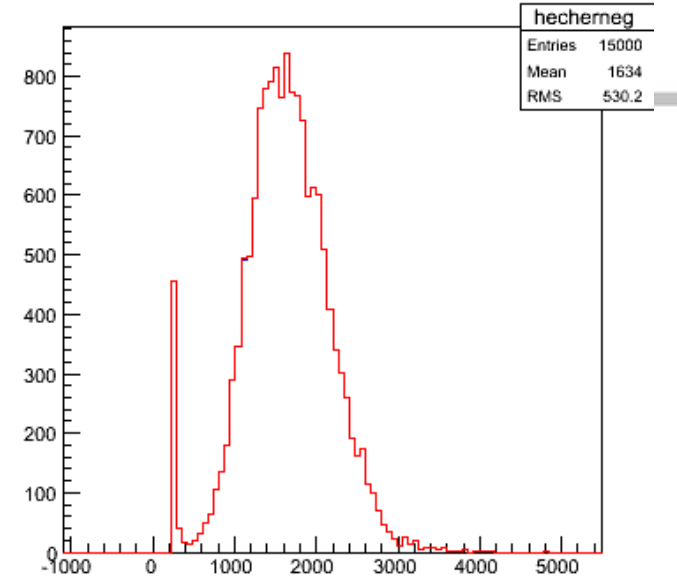
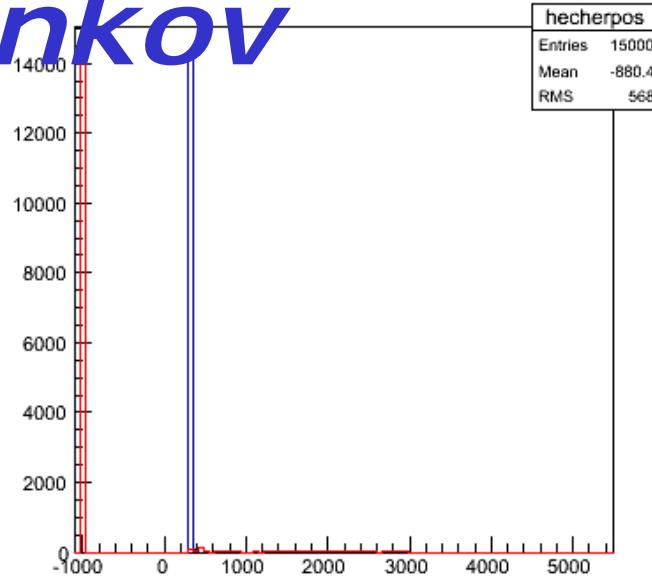
Cerenkov

- ⊕ **Ahmed Zahed (Regina)**
- ⊕ *"Started from ThcAerogel class and converted the logic of engine/HTRACKING/h_trans_cer.f to ThcCherenkov.cxx"*
- ⊕ *hcana in blue, engine in reg*

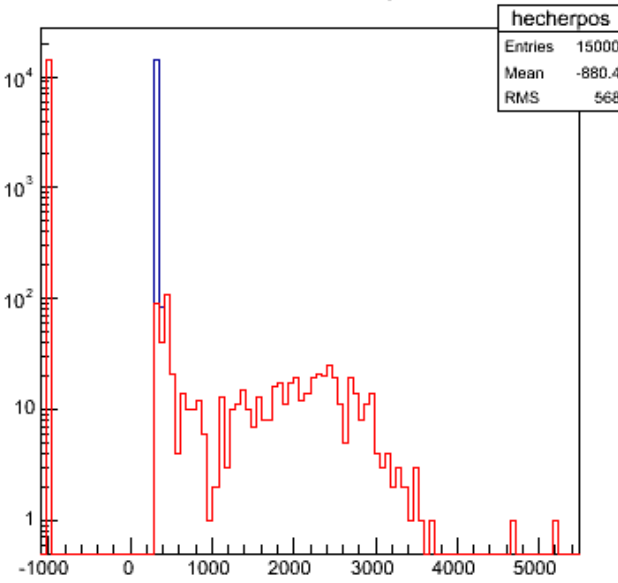


Cerenkov

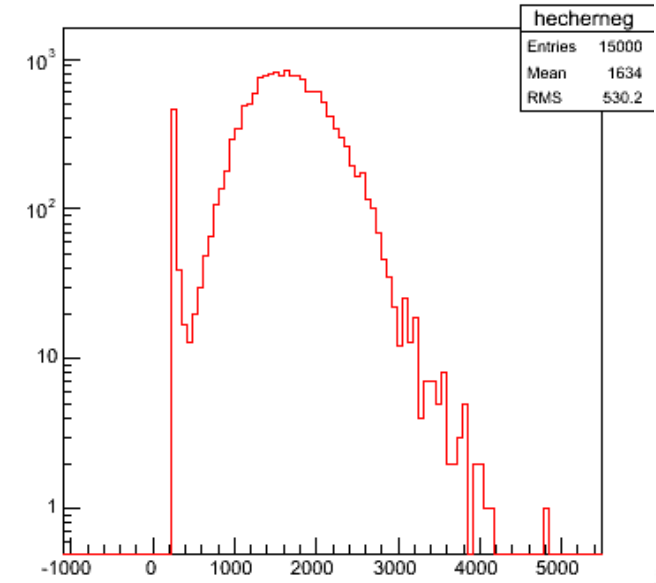
Cerenkov ADCs & TDCs



hcana adc top



hcana adc bottom

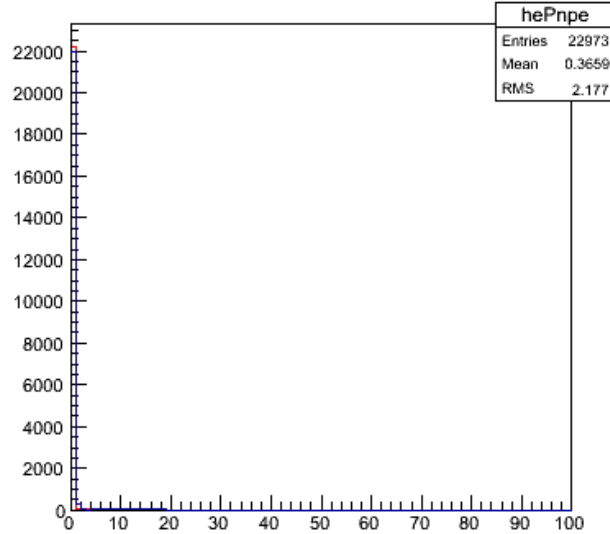




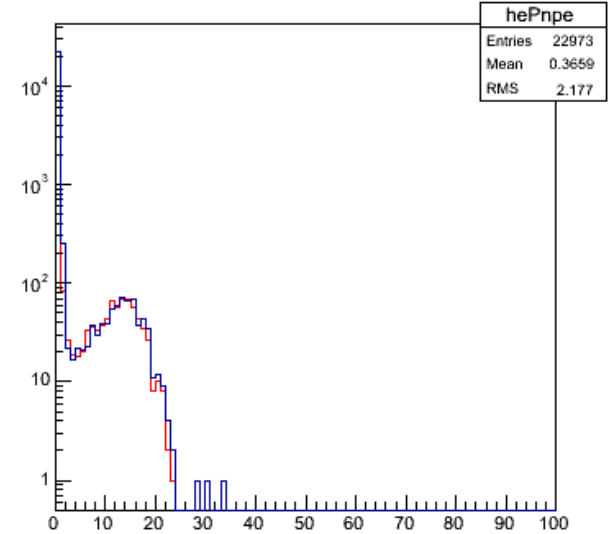
Cerenkov

- ⊕ **Cerenkov number of photoelectrons**
- ⊕ **Most of the disparity comes from the fact that at some point in the algorithm engine truncates the npe to an integer**

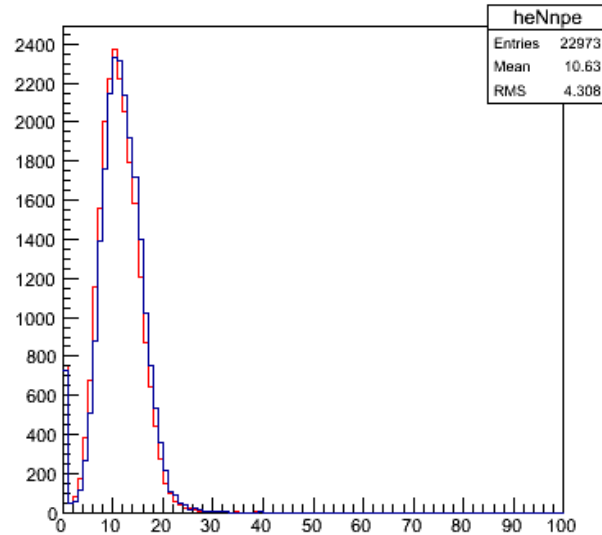
ENGINE photo electrons Positive adc(RED)



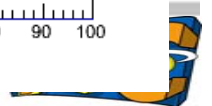
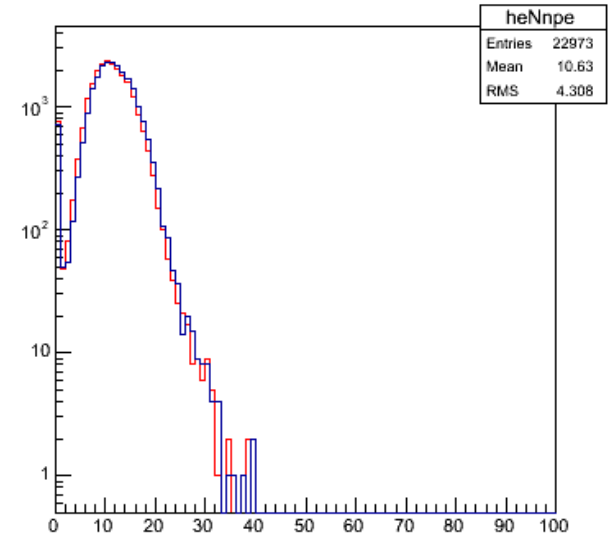
ENGINE photo electrons Positive adc(RED)



ENGINE photo electrons Negative adc(RED)



ENGINE photo electrons Negative adc(RED)

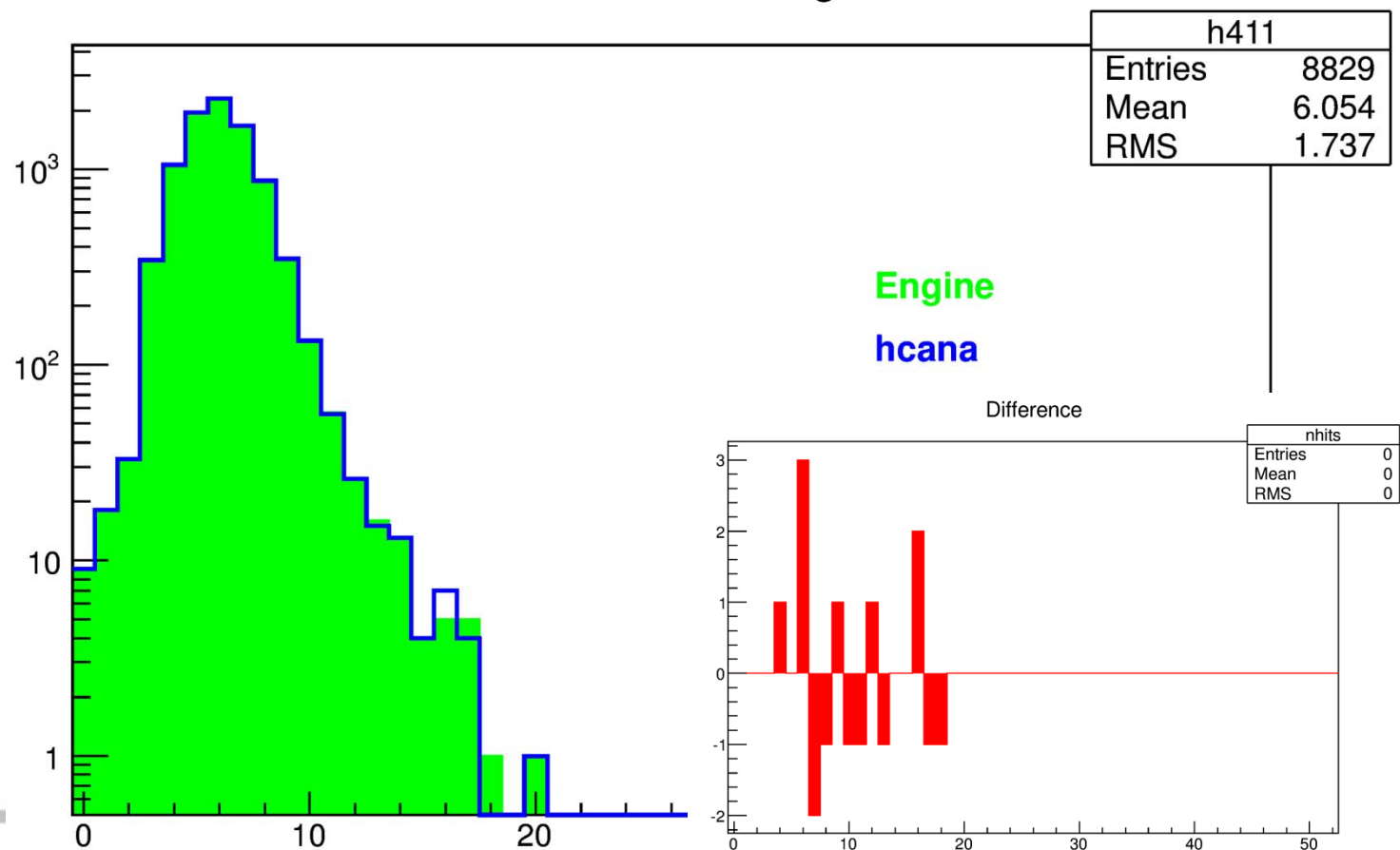




Calorimeter

- ⊕ *Yerevan group (Simon, Vardan...)*
- ⊕ *Well documented algorithm*
- ⊕ *Raw # of hits*

hcal nhits t=htrig

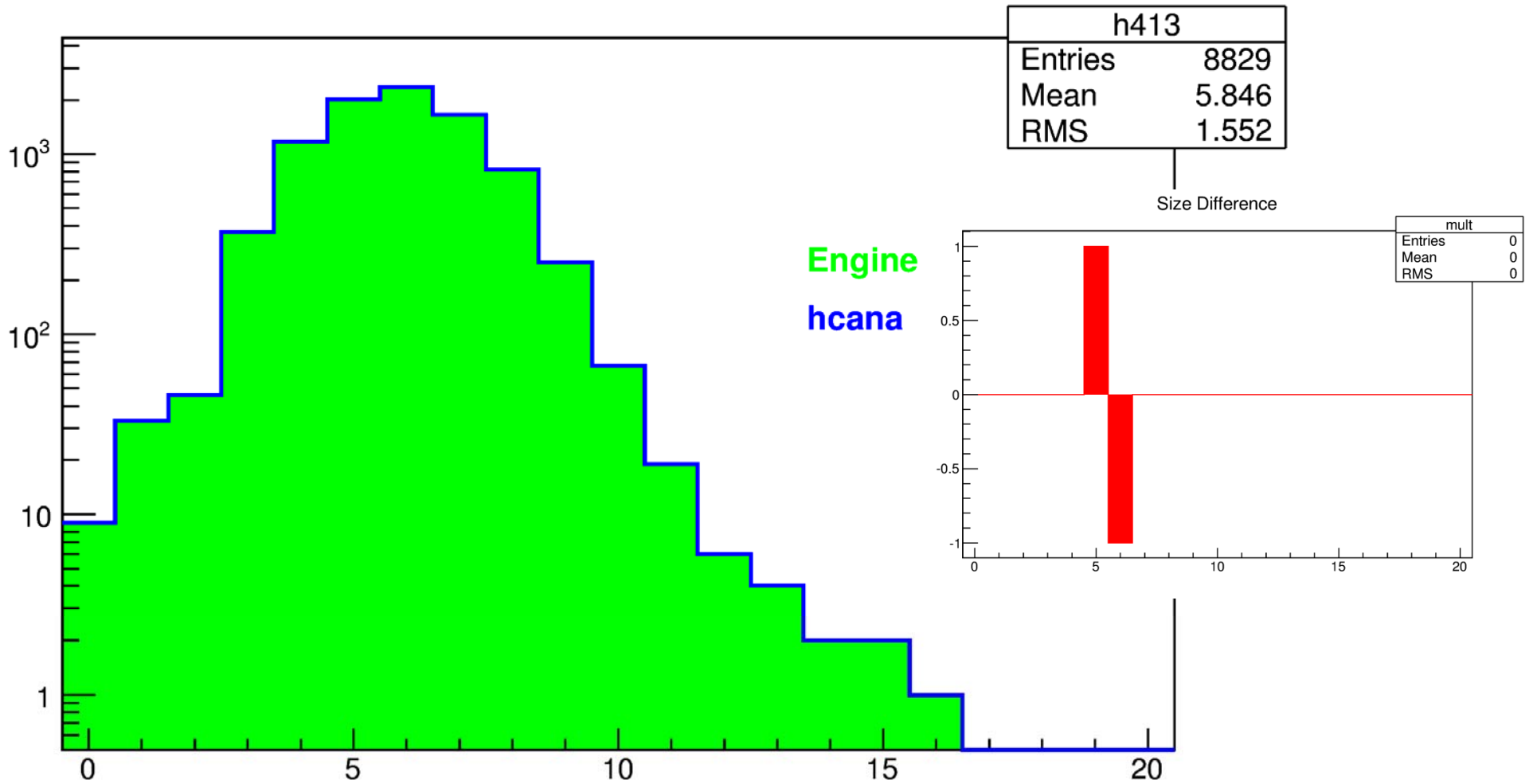




Calorimeter

⊕ *Cluster size*

hcal max.cluster size t=htrig

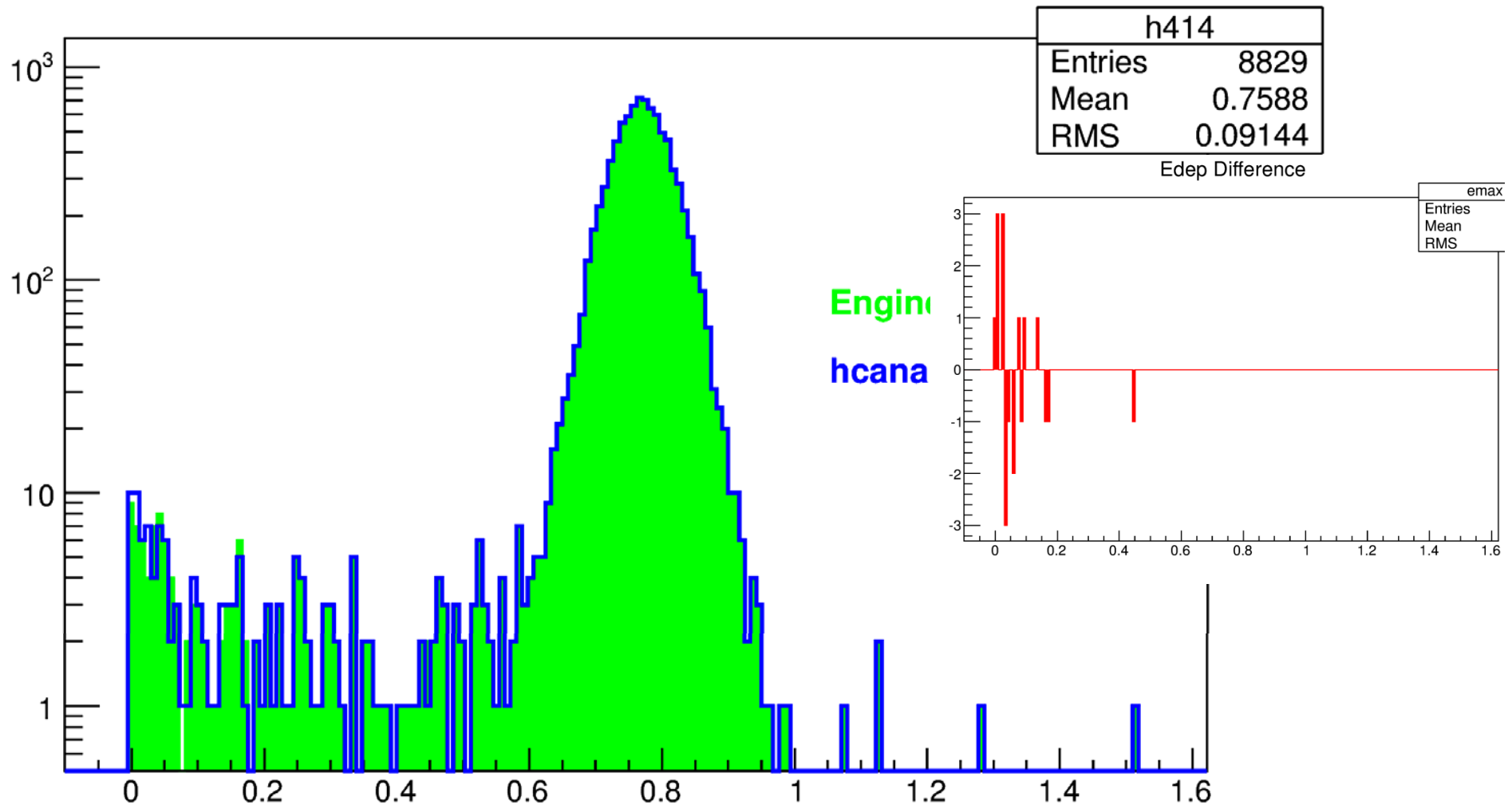




Calorimeter

⊕ Energy deposition*

hcal max.cluster Edep t=htrig



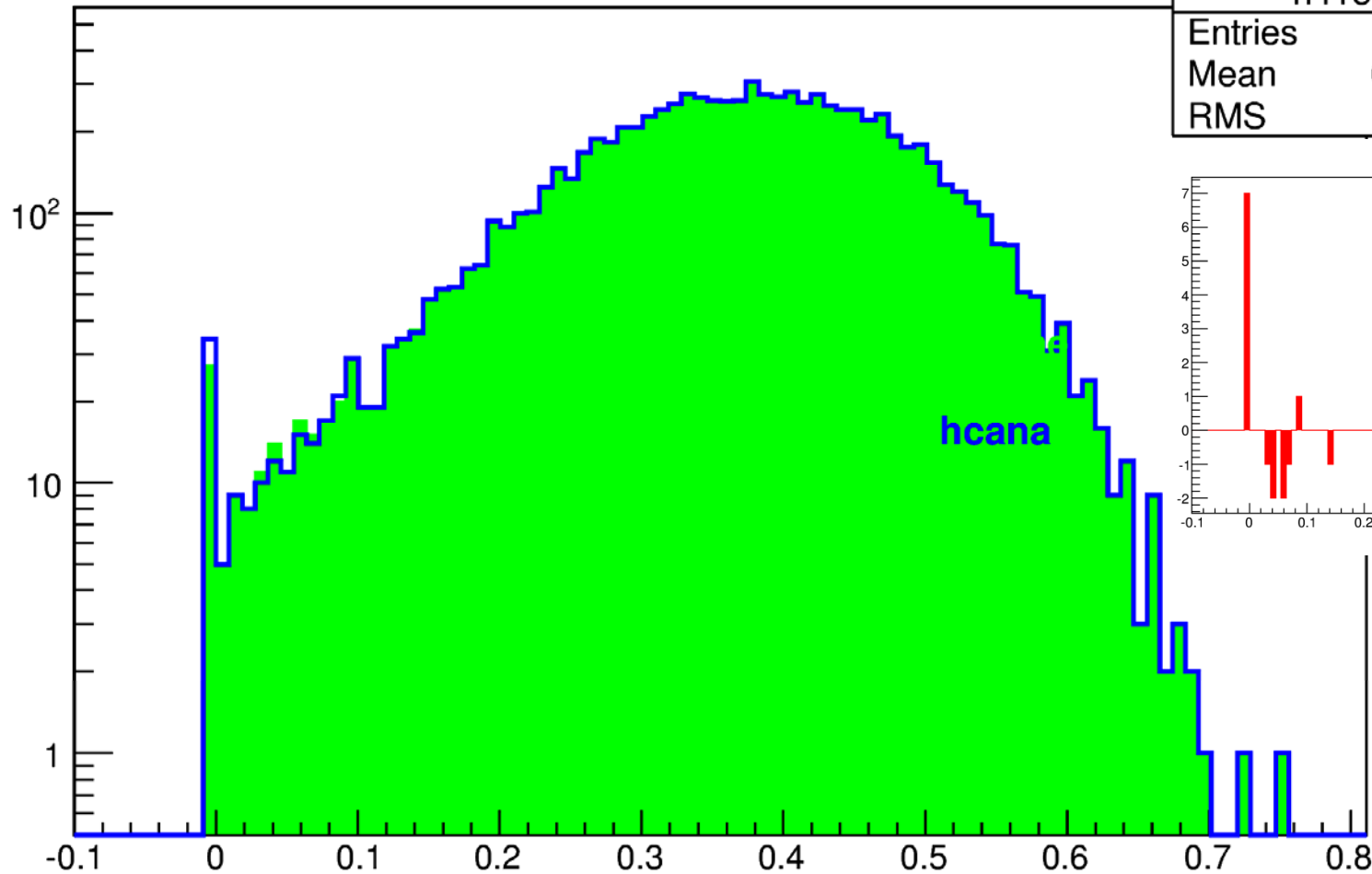


Calorimeter

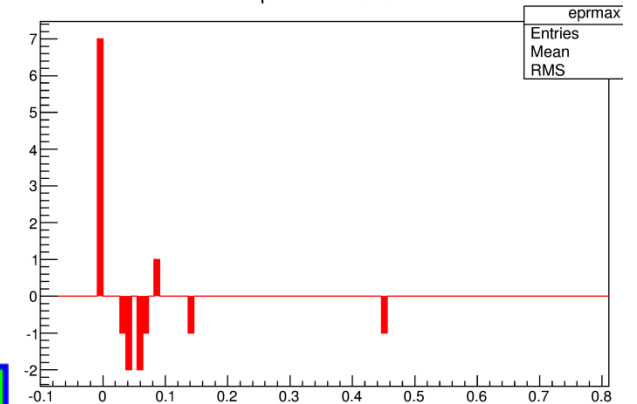
Preshower Energy Deposition

hcal max.cluster Epr t=htrig

h415	
Entries	8829
Mean	0.3679
RMS	0.1154



Eprsh Difference





Summary

- ⊕ ***Substantial, simultaneous, sustained progress in coding all Hall C detectors.***
- ⊕ ***Good (almost perfect) engine-hcana agreement on the quantities reconstructed thus far***
- ⊕ ***Finishing up code for individual detectors should allow (near future) to move on to **full track reconstruction*****

- ⊕ ***Continue documenting algorithms***
- ⊕ ***Enlist more testers/early adopters***
- ⊕ ***Perform extensive “stress tests” (more/longer runs, different beam conditions)***