

Driver and PhysicsList performance comparison for AHCAL Simulation

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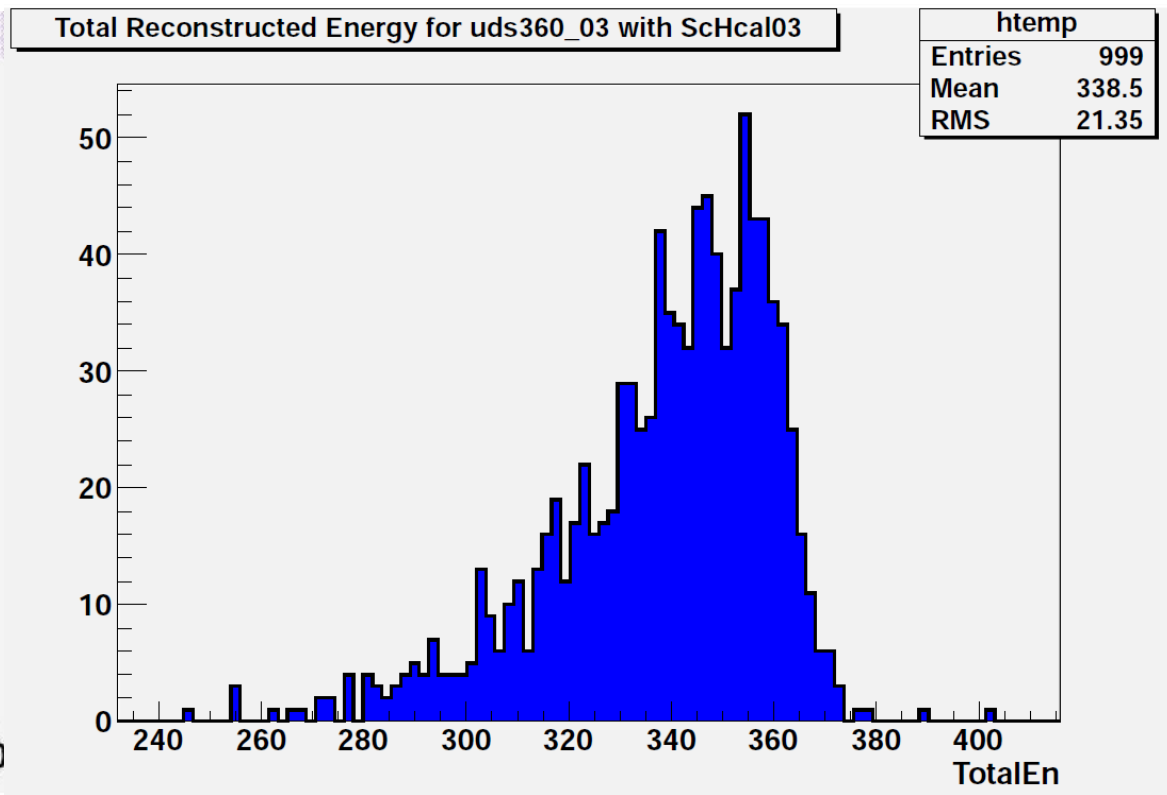
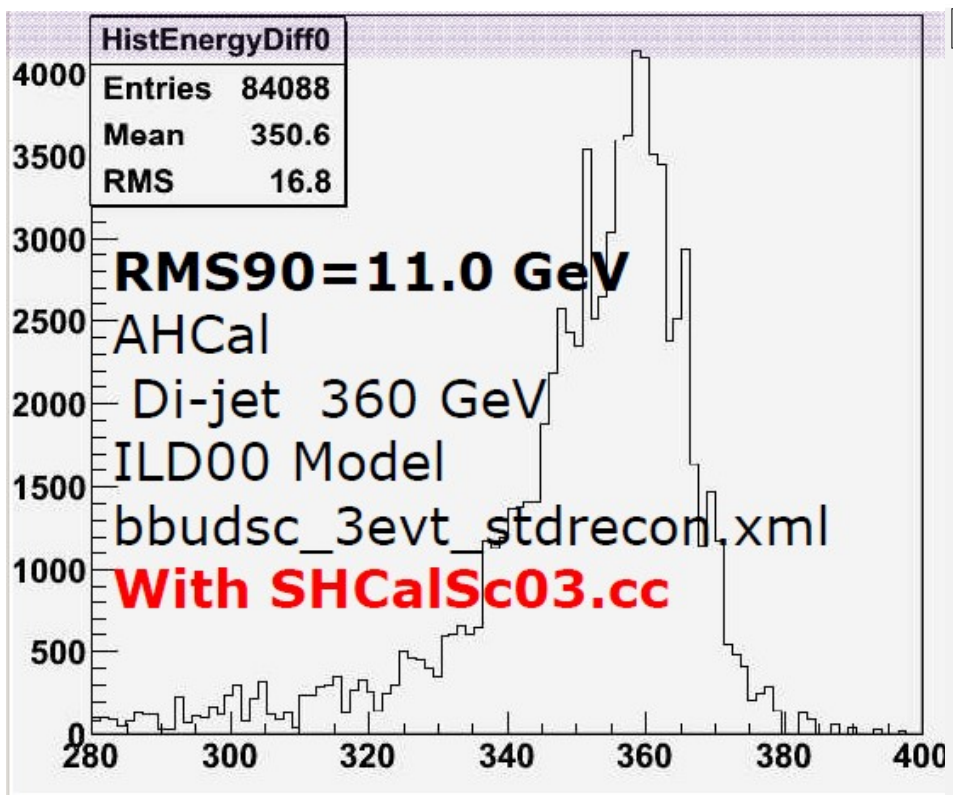
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Outline



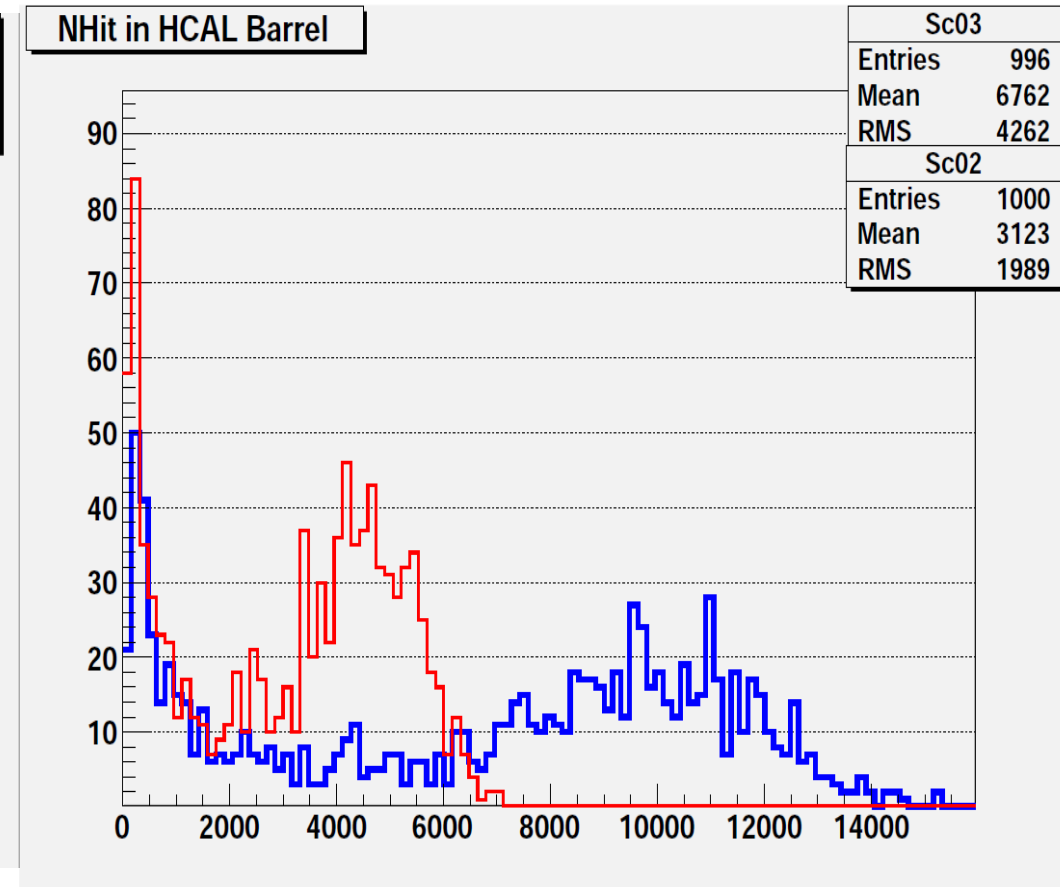
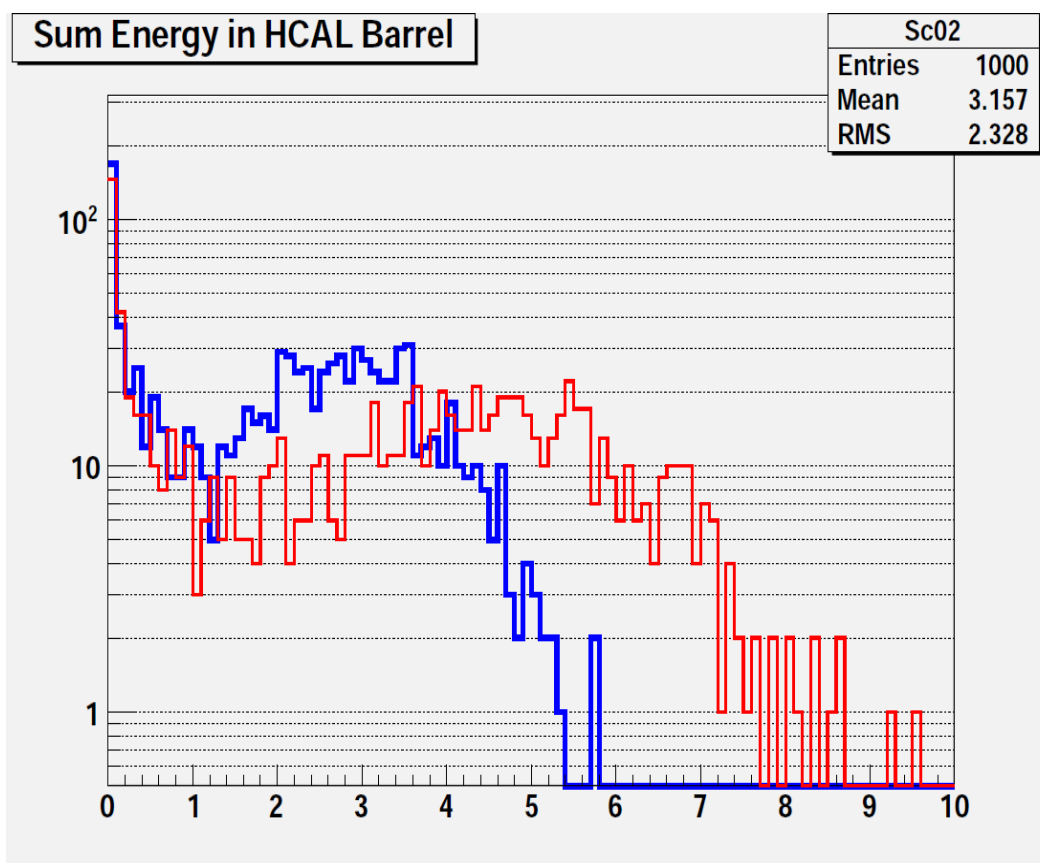
- AHCAL Simulation: SHcalSc03 (QGSP_BERT) Vs SHcalSc02 (LCPhys)
 - Jet energy resolution get much worse
 - Observed by R. Han & Xchecking
- Comparison of Physics List and Drivers
- Summary

Total Reconstructed E



- Ran: 360GeV QQ event simulated with ShcalSc03 & QGSP_BERT: much worse performance than the official simulation (SHcalSc02 & LCPhys)
- *Xchecked by me: same generator used in those comparison (uds360_03.stdhep)*

Total energy/hits @ HCAL Barrel



03 Vs **02**: more hits (> factor of 2), but significantly low energy at simulation level

Similar behaviour in ring & endcap

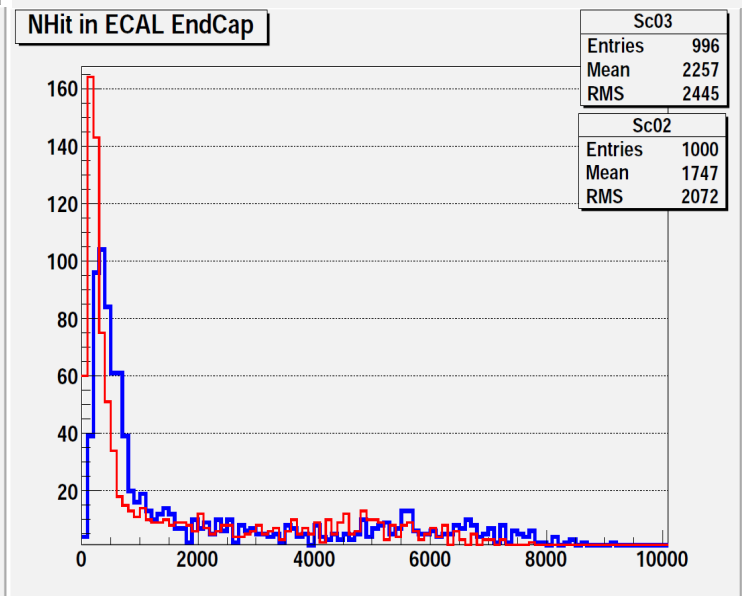
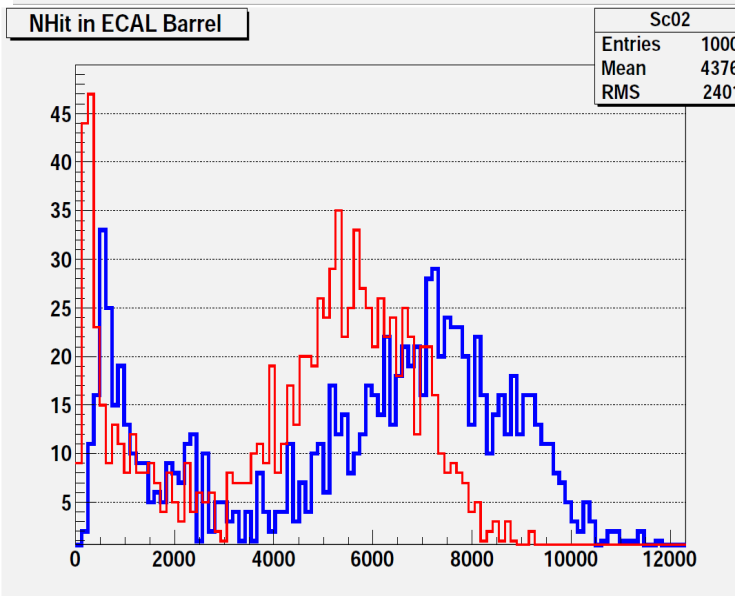
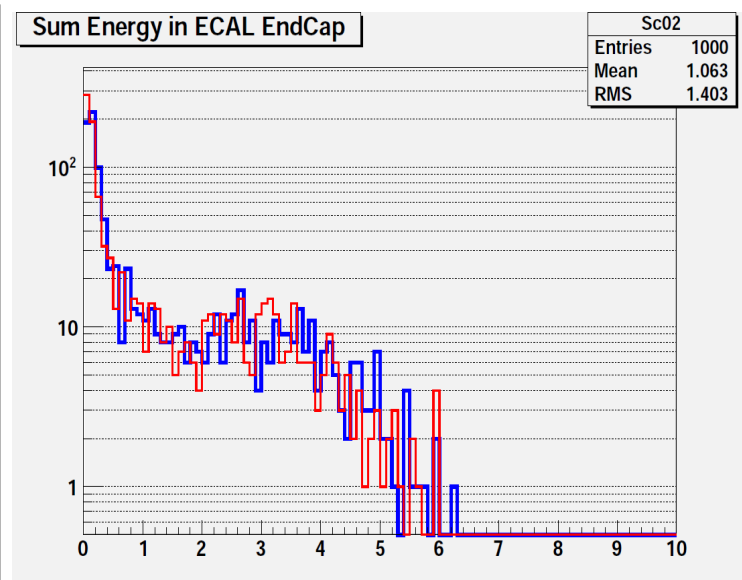
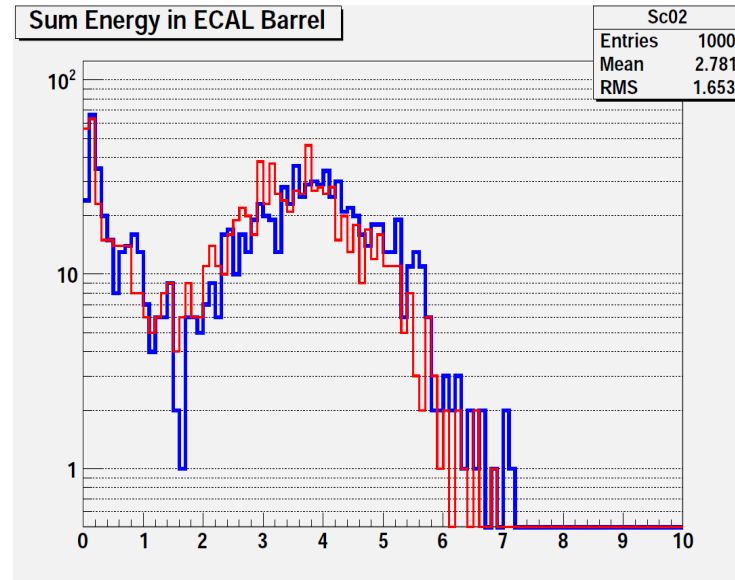
Red : ScHCAL02
Blue : ScHCAL03

Affect ECAL also...

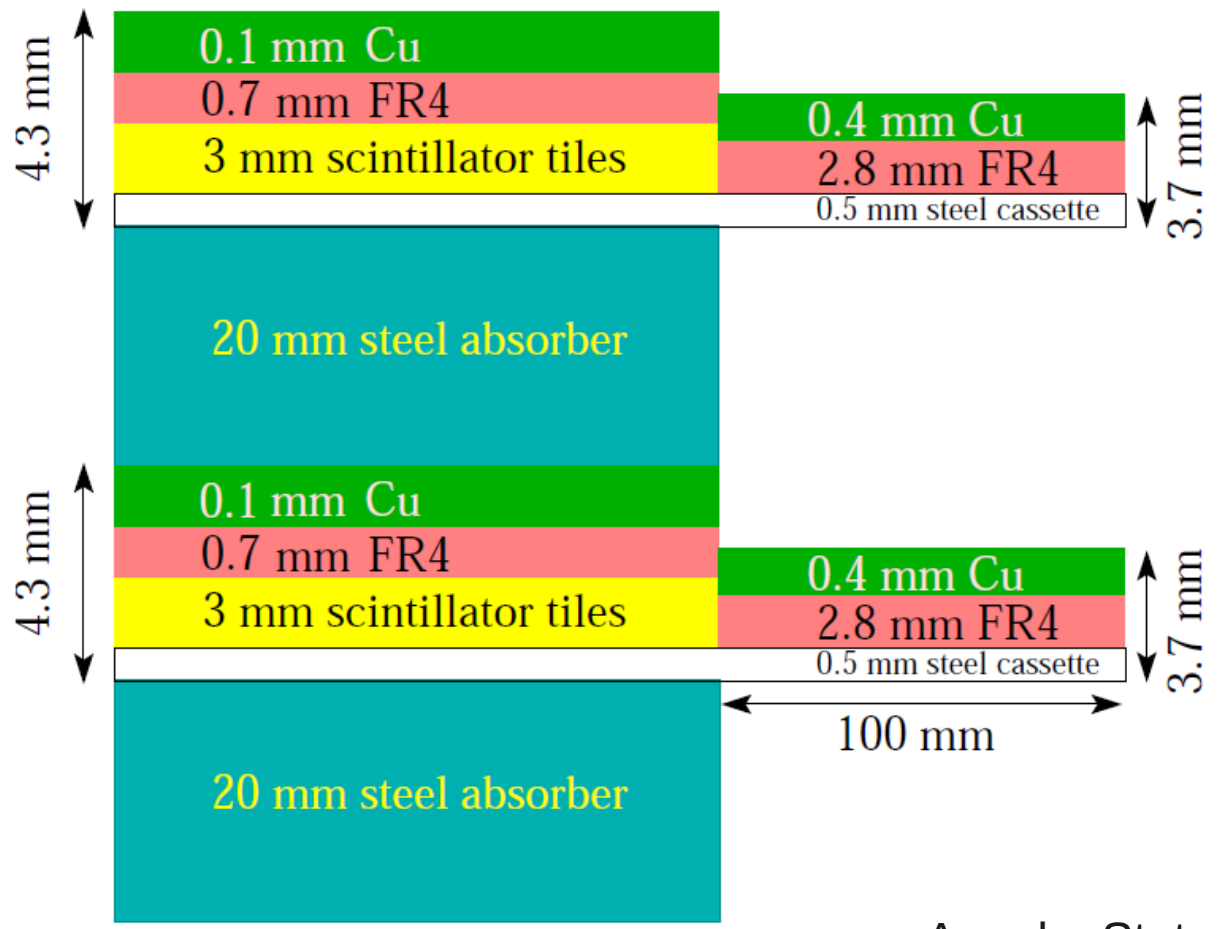


ECAL:

Similar total energy deposition,
But significantly more hits in model with **ScHCAL03**....



Diver Difference



Angela: Status of AHCAL Simulation @Casa

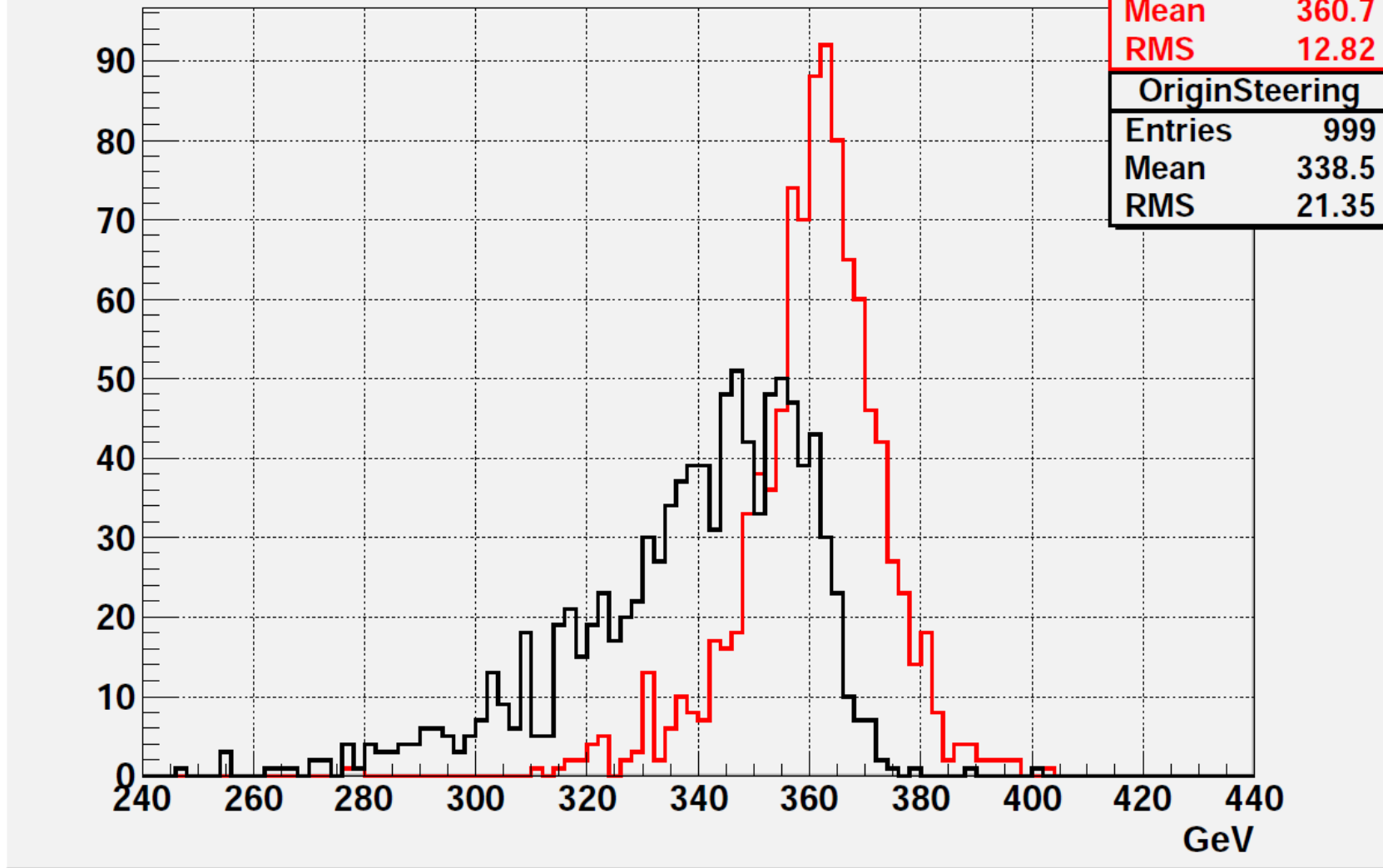
SHcalSc02: 5.0mm Scintillator + 1.5mm Gas gap;

ShcalSc03: 3.0mm Scintillator + 0.1mm Copper + 0.7mm RPC

Calibration Constant Tuning

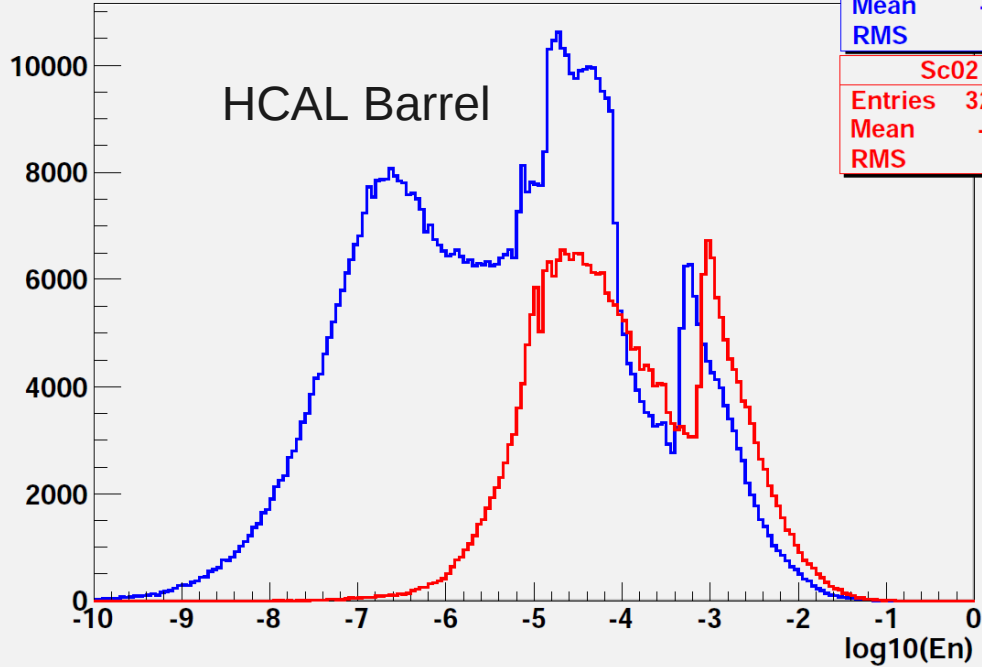


Energy Resolution of 360GeV qq at SHcalSc03 & QGSP_BERT

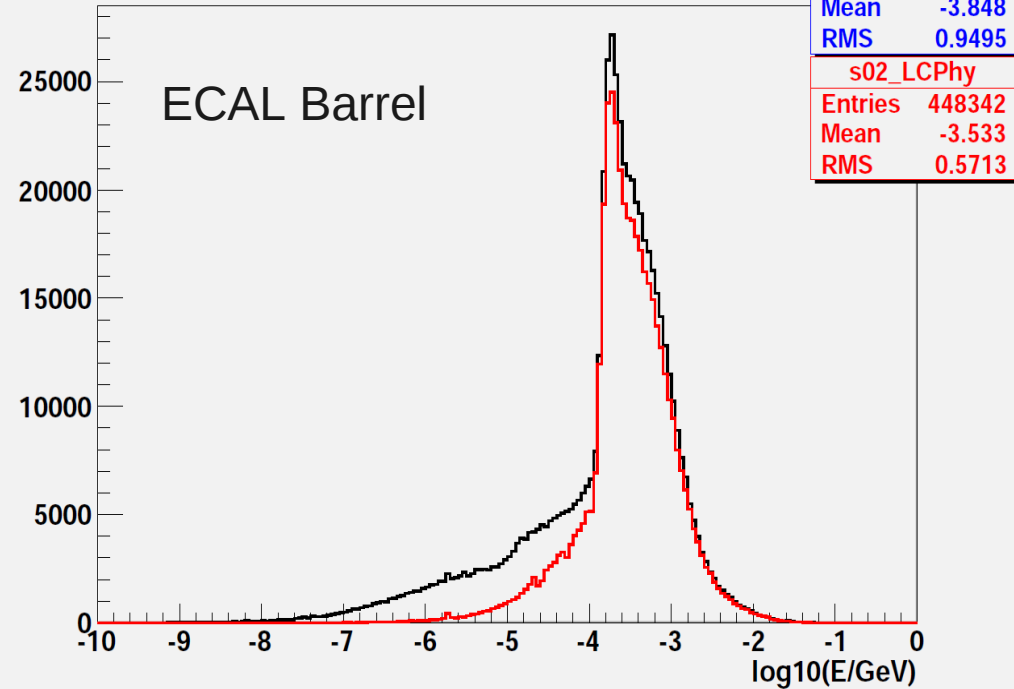


Increase HCAL Calibration constant by a factor of 5/3: RMS90 = 8.62GeV
 With Default Setting: RMS90 = 15.77GeV
 RMS90 @ SHcalSc02 & LCPhys: 8.33GeV

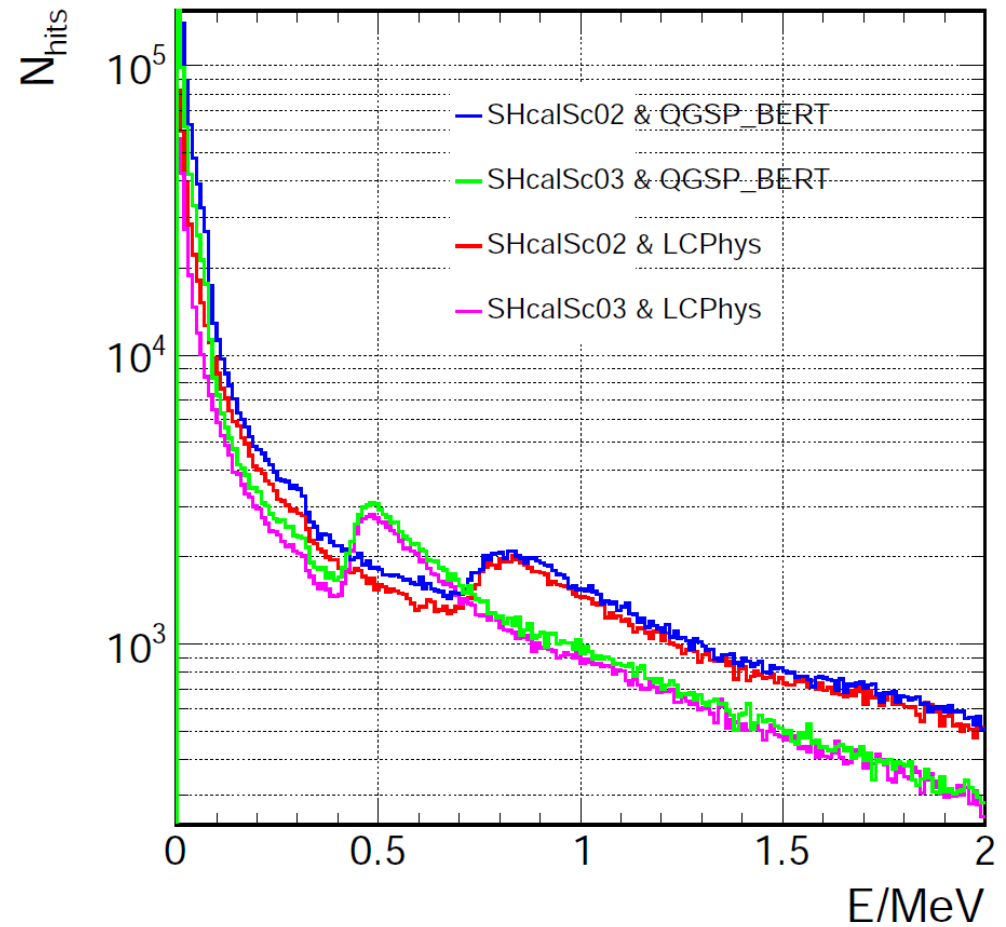
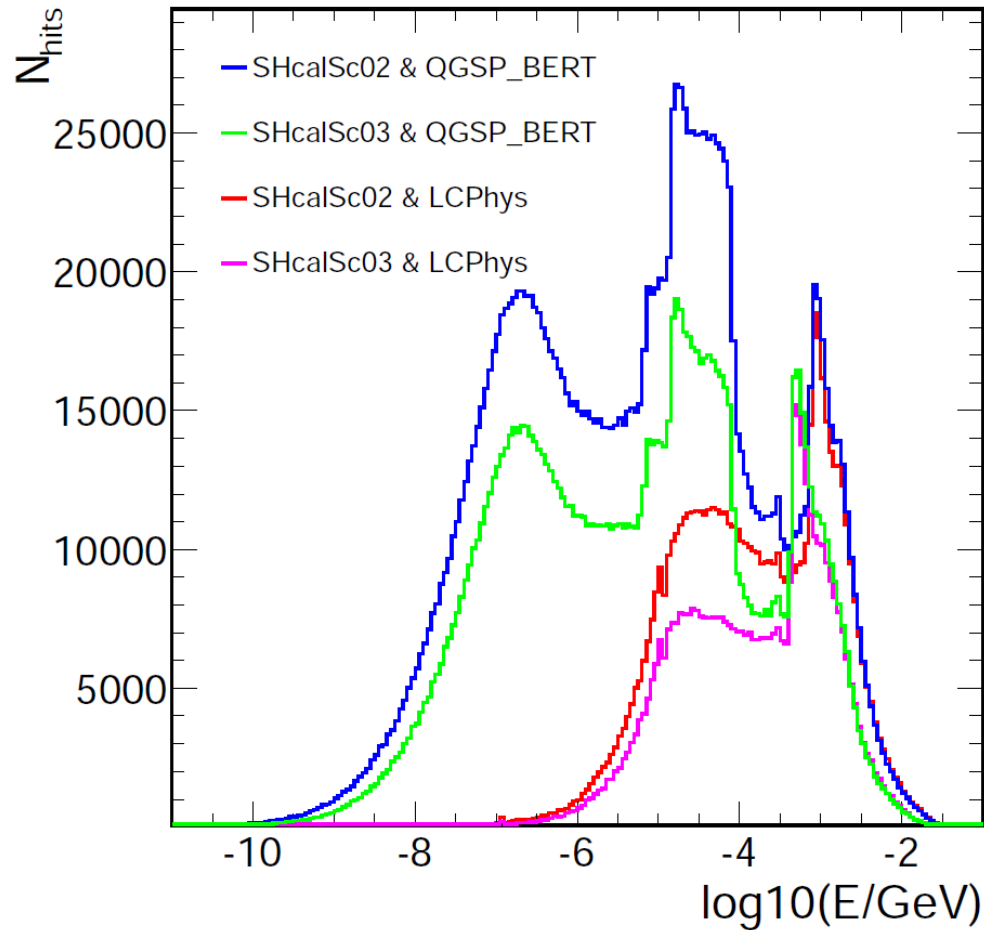
Hit Energy Spectrum (100 evts)



Hit Energy Spectrum in ECAL Barrel for 360GeV QQ evts, 100 evts



Much more low energy hits in SHcalSc03 (QGSP_BERT) Vs SHcalSc02 @ (LCPhys), for both ECAL & HCAL;
Slightly more high energy hits in Sc03@QGSP

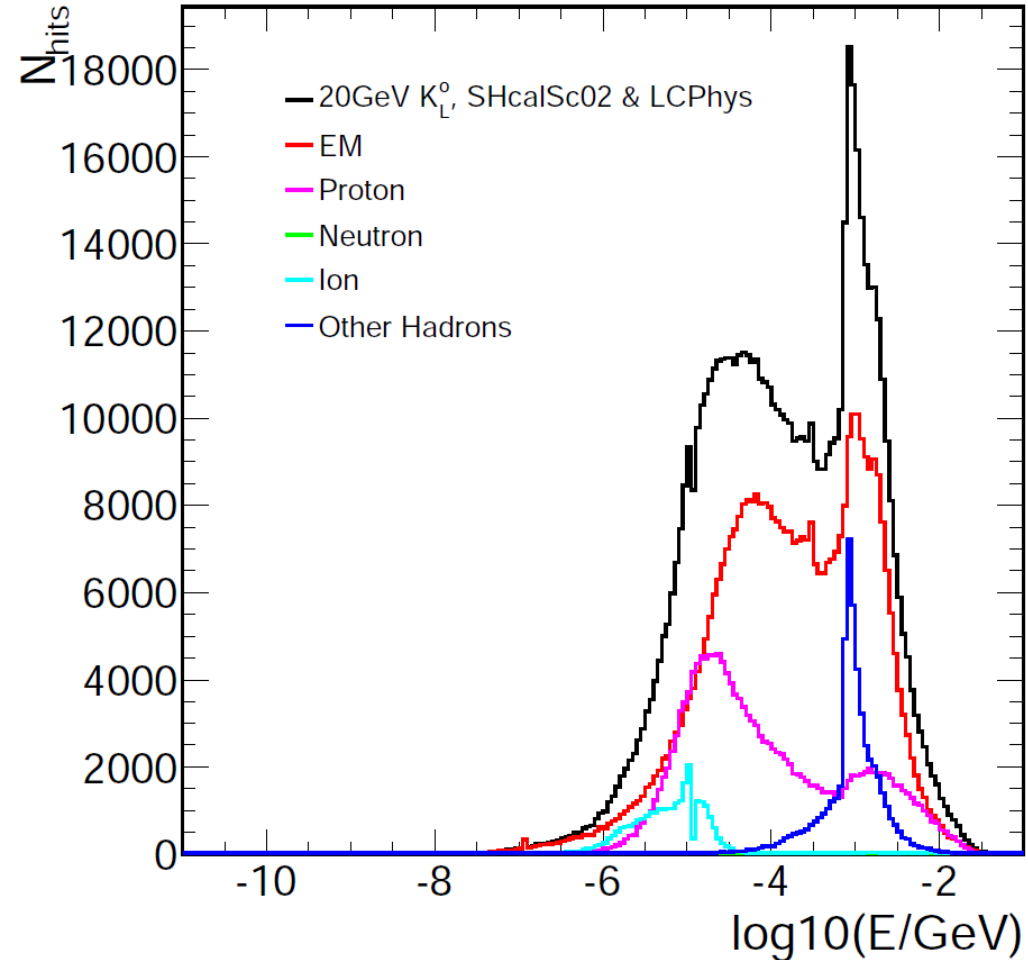
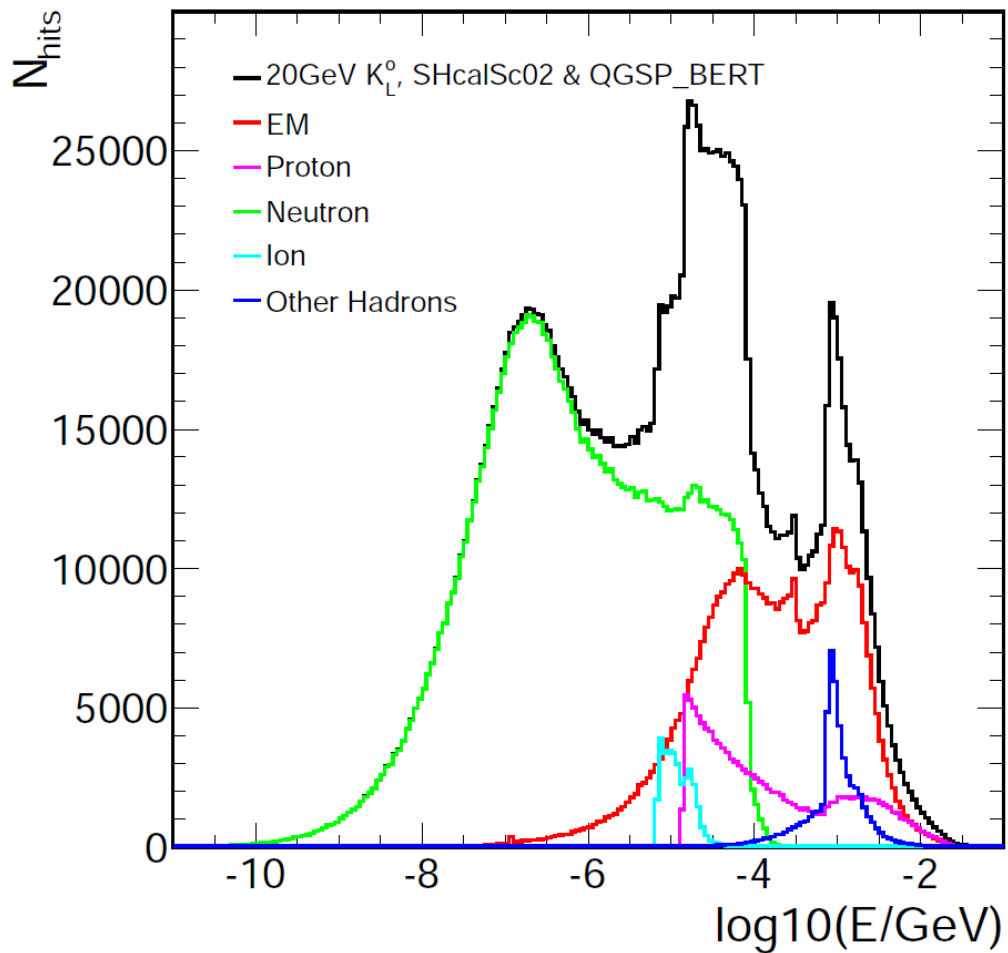


20GeV Klong sample (1k evts) with different Drivers and different Physics Lists:

QGSP_BERT Vs LCPhys: Much more low energy hits & Similar high energy hits;

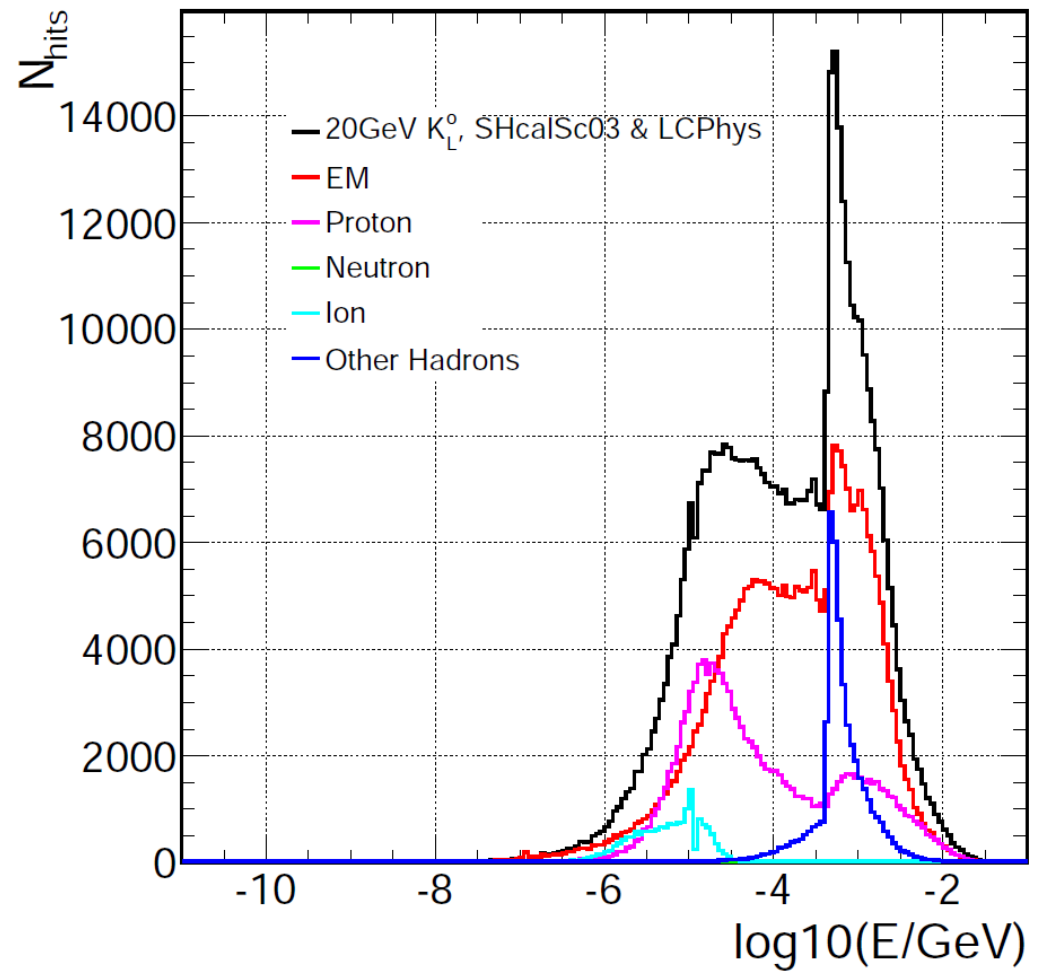
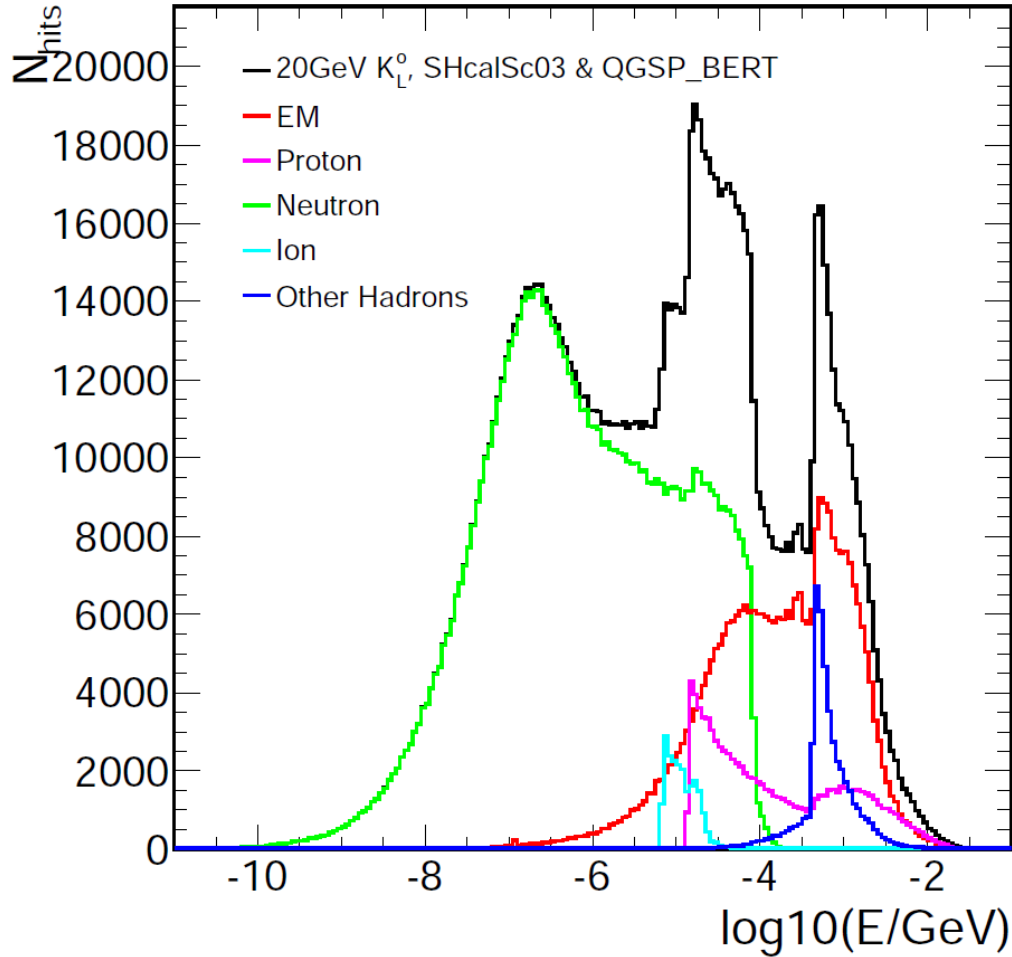
Sc02 Vs Sc03: high energy spectrum shifted ~ 60%: different saintillator thickness

Geometry: HCAL + B Field

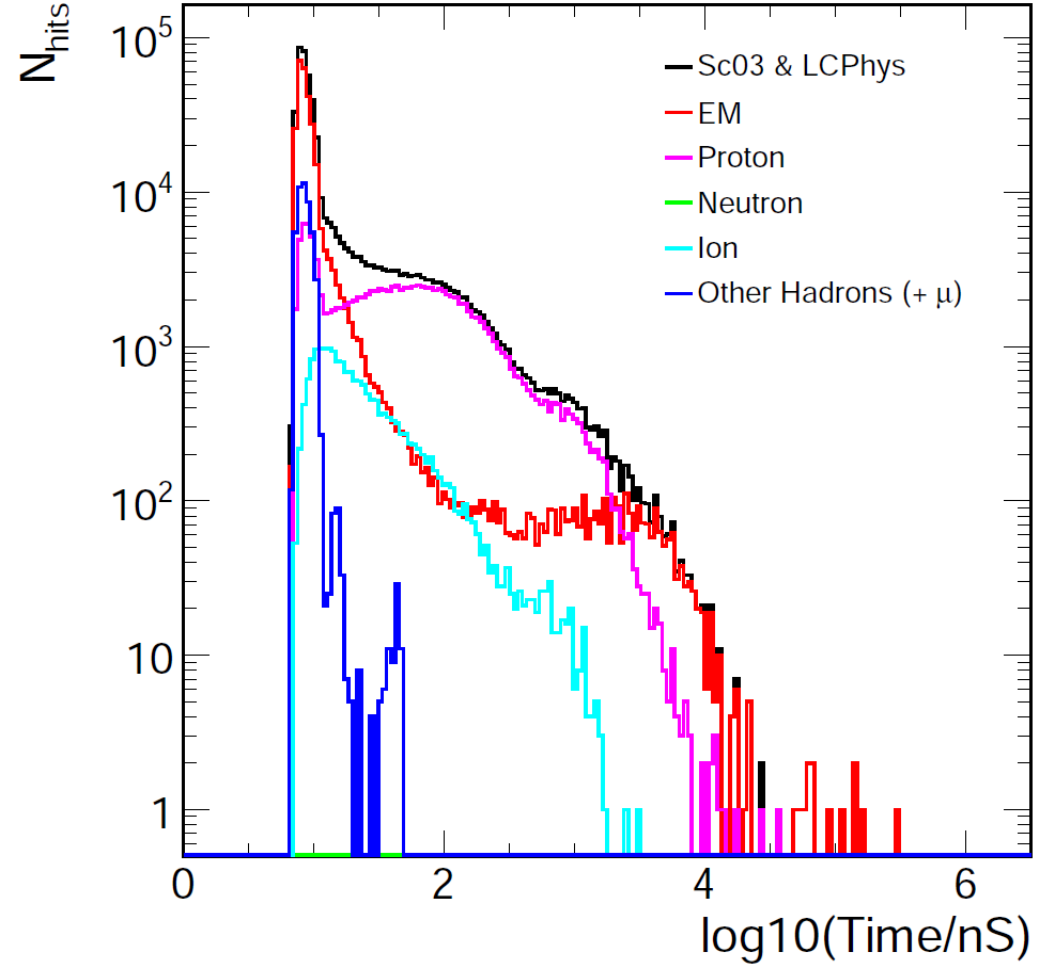
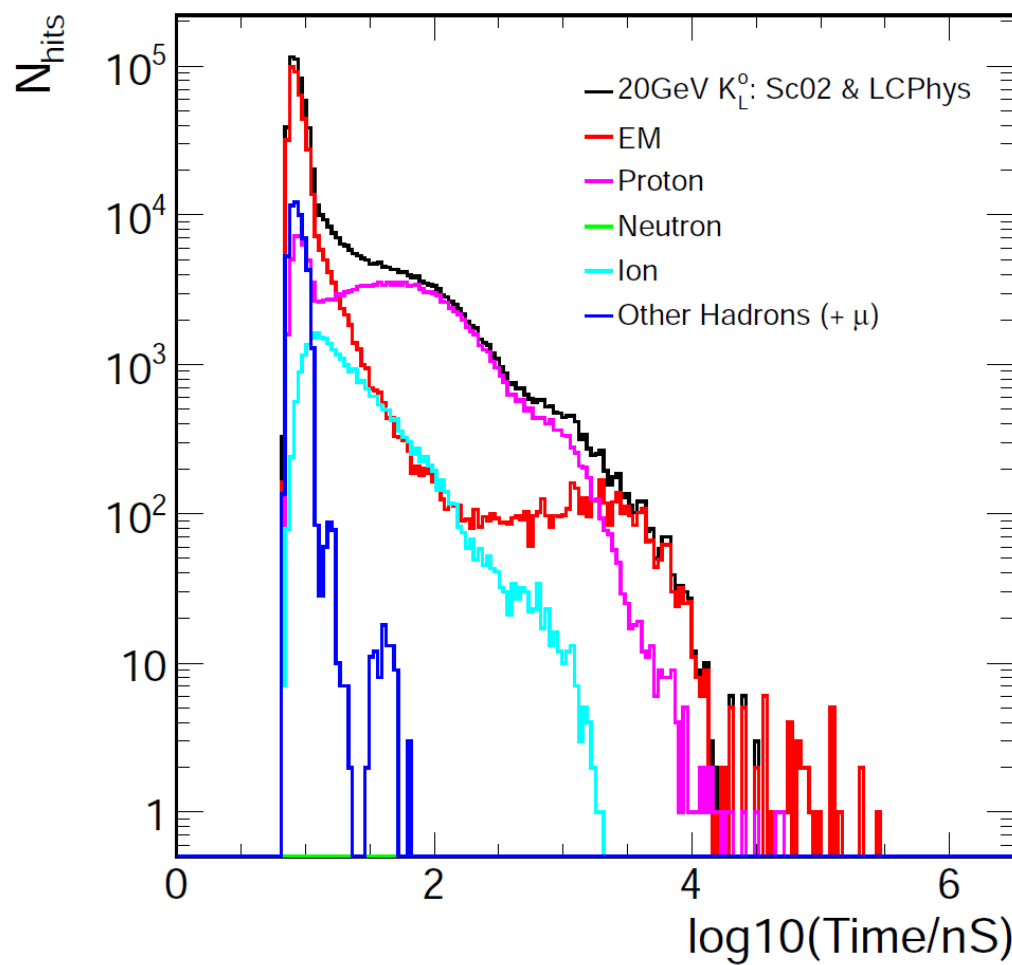


No Neutron hits in LCPhys

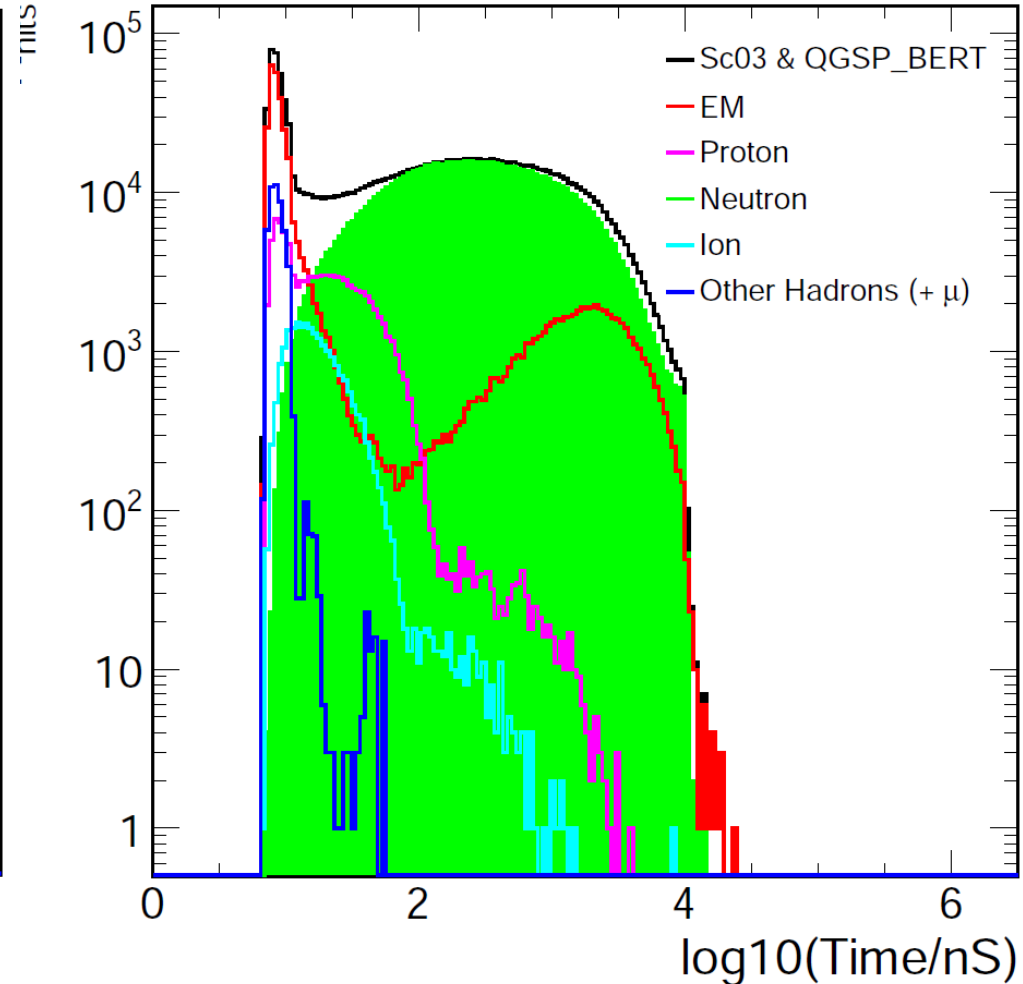
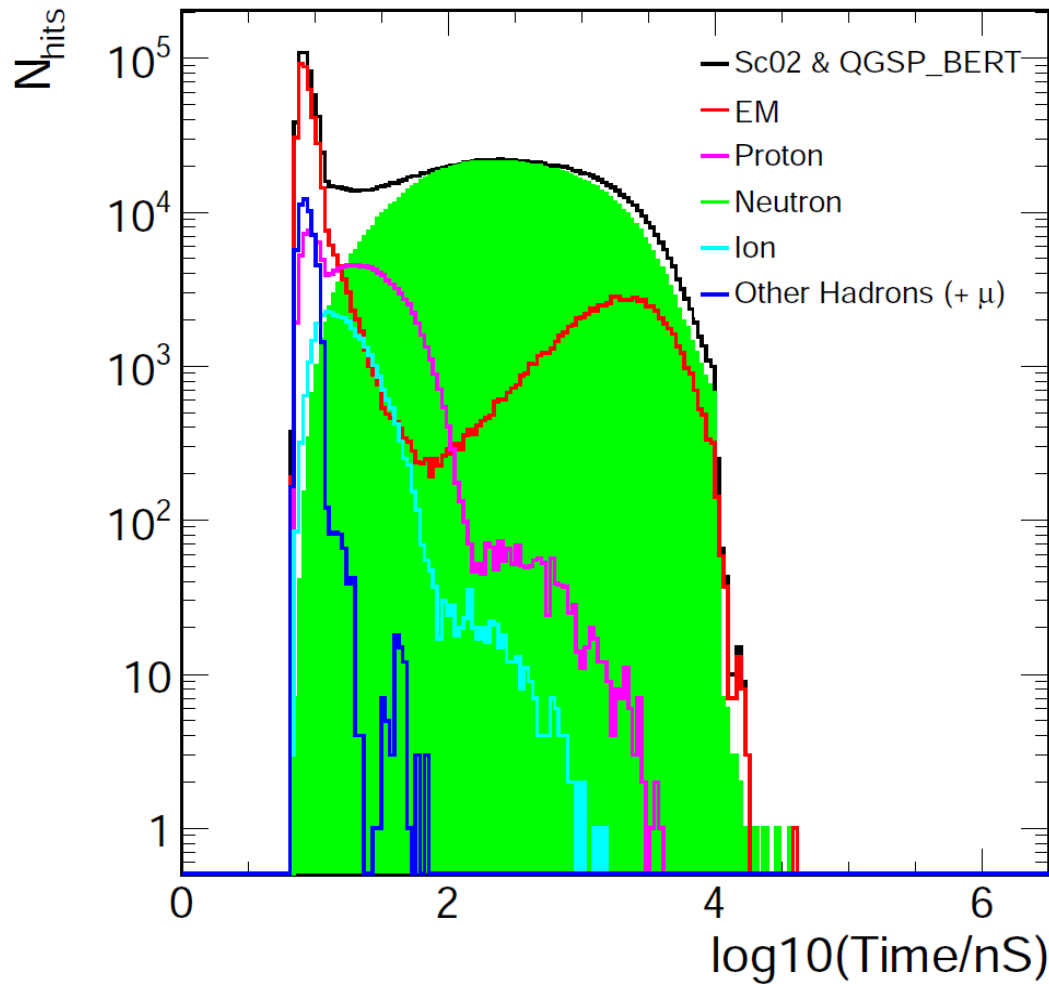
Energy cut off at 10keV for proton hits at QGSP_BERT?



Similar to SHcalSc02

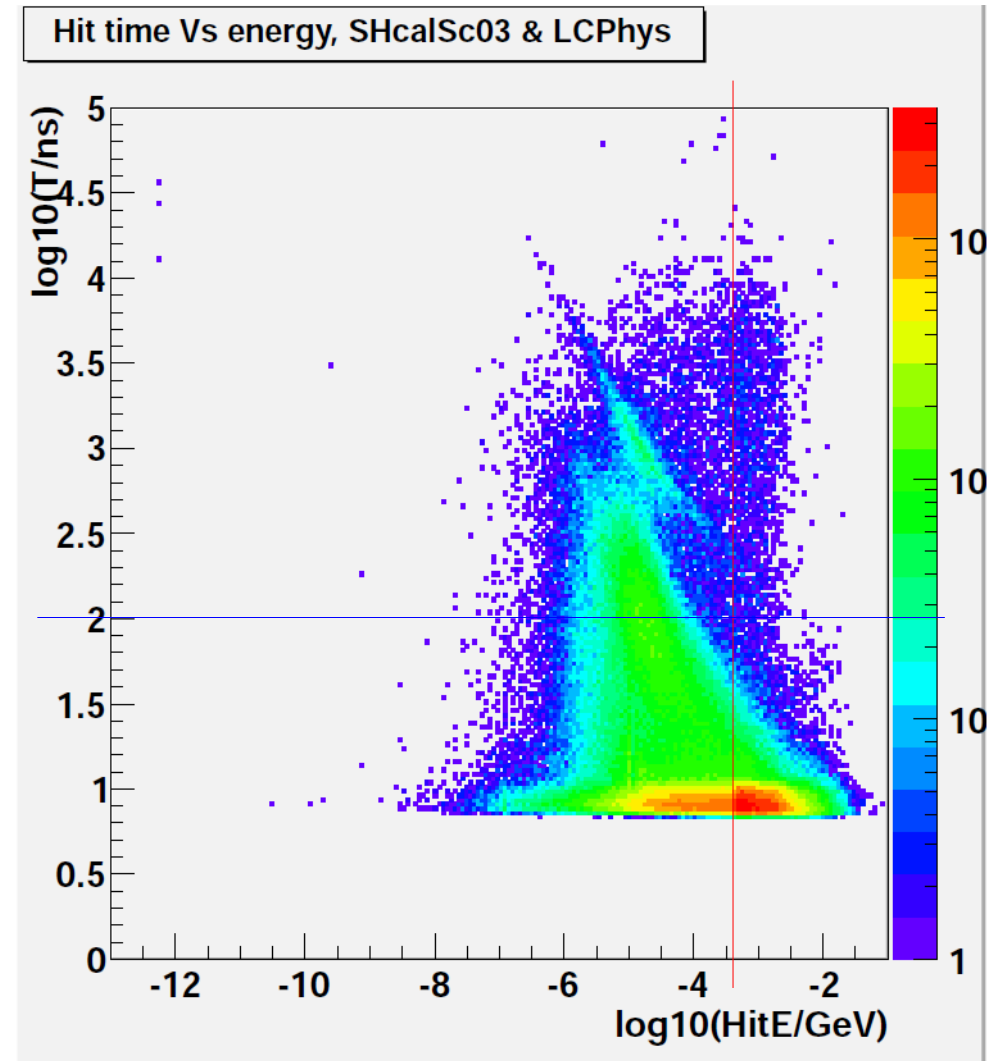
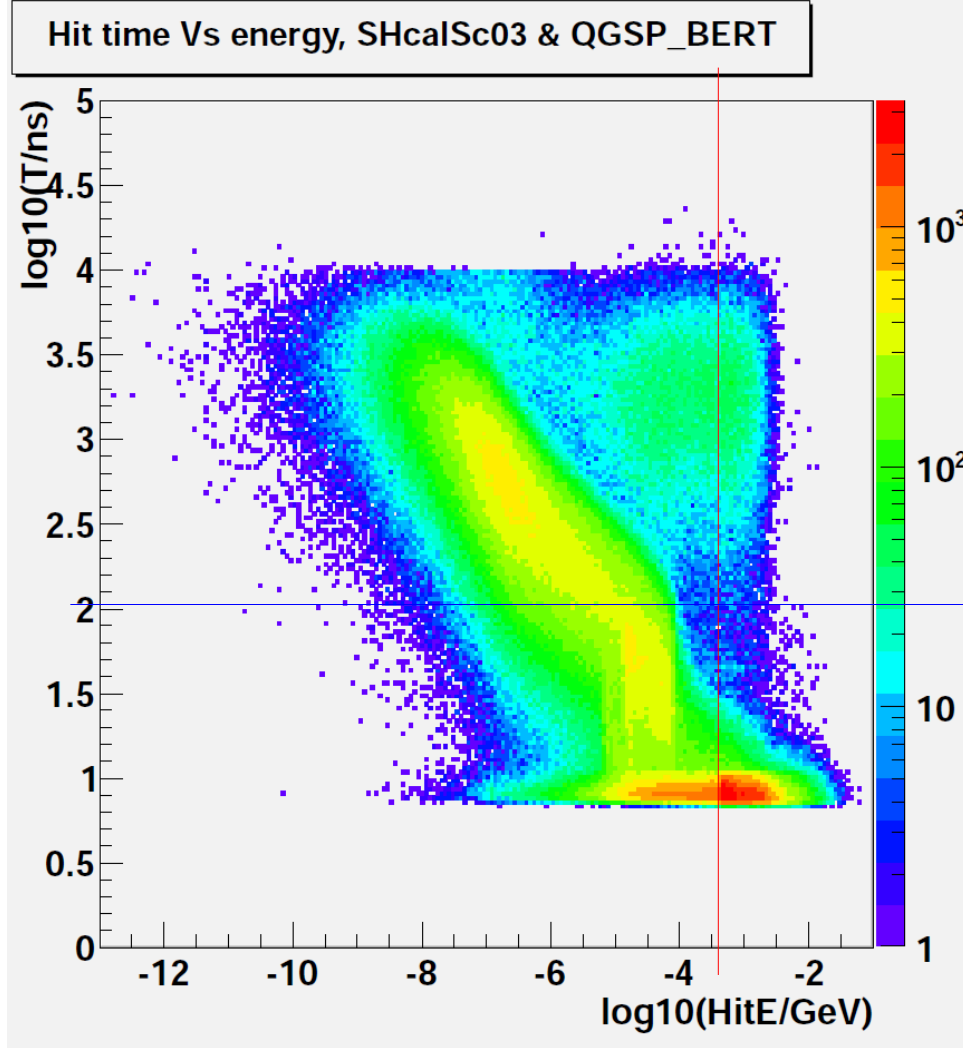


Hits created after 100 ns @ LCPhys: 7.1% @ Sc02 & 8.3% @ Sc03.

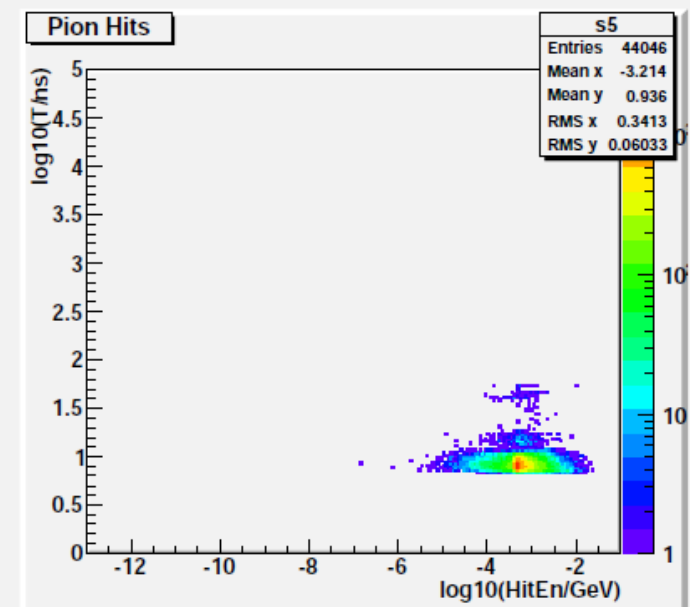
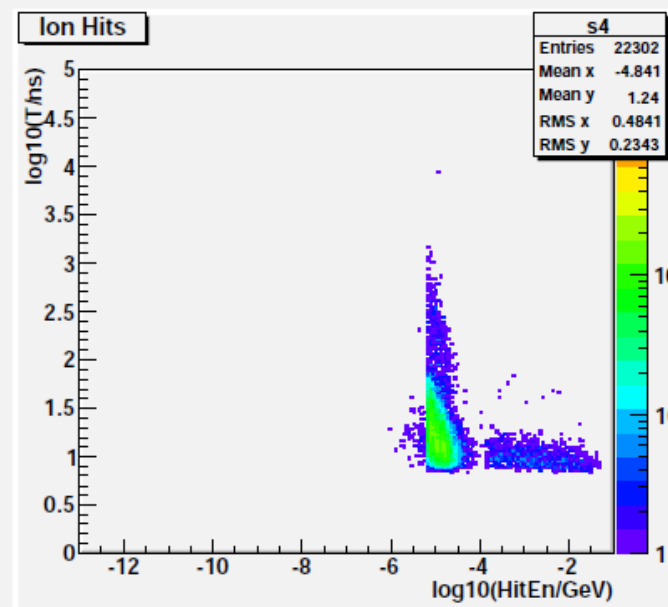
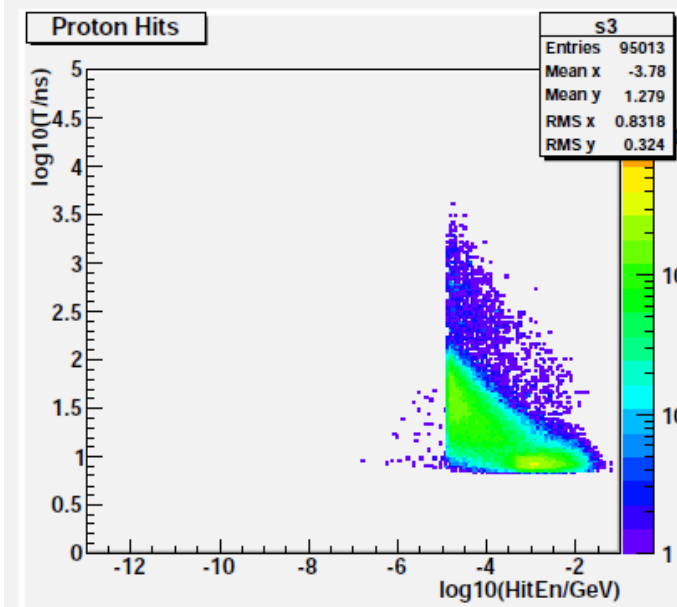
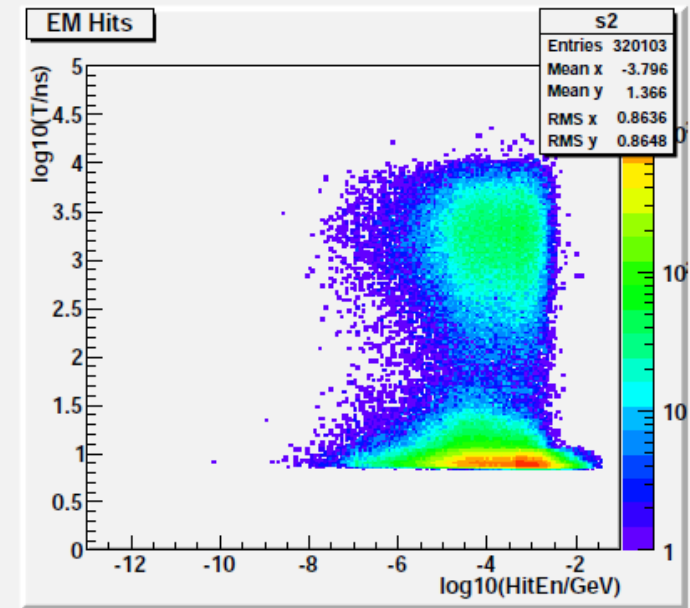
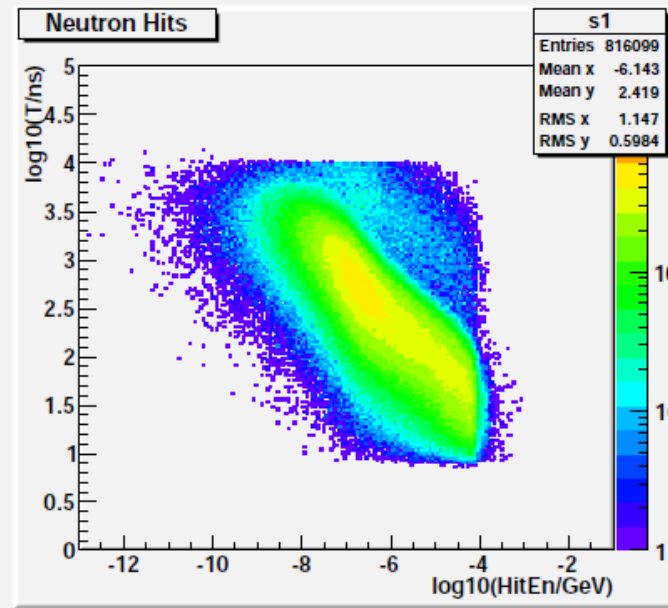
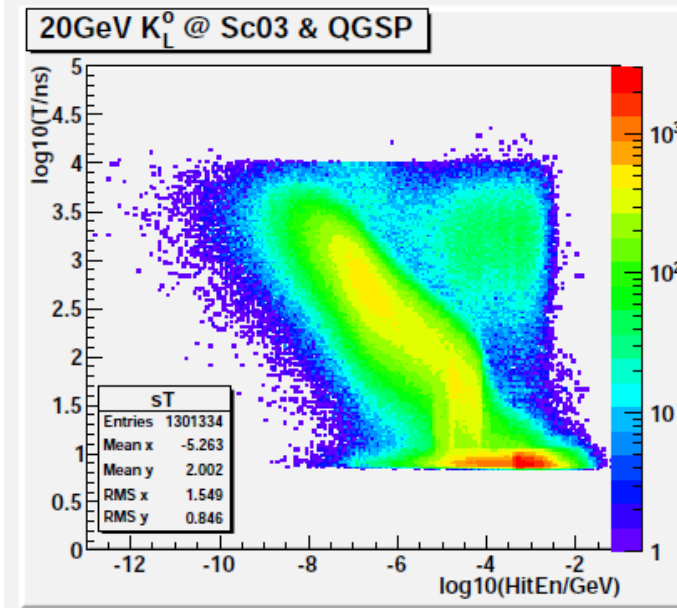


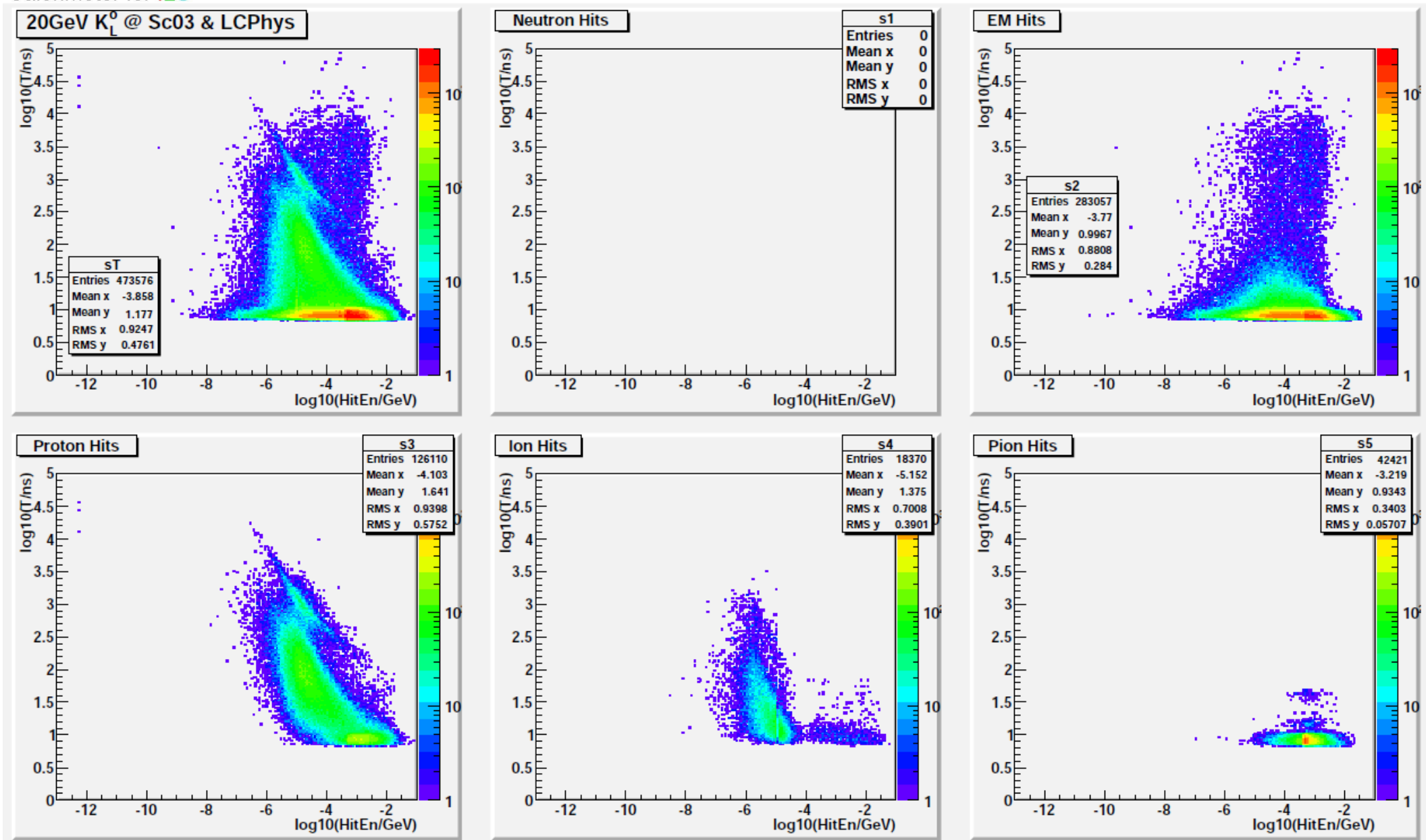
Half of the Hits comes after 100 ns (49.9% @ Sc02, 51.0% @ Sc03)
Neutron hits, comes late: create quite some secondary EM hits & proton hits

Timing information



*Neutron Hits: $E \cdot T^2 = \text{Constant} \dots$
High energy hits: fast
Square boundary...*





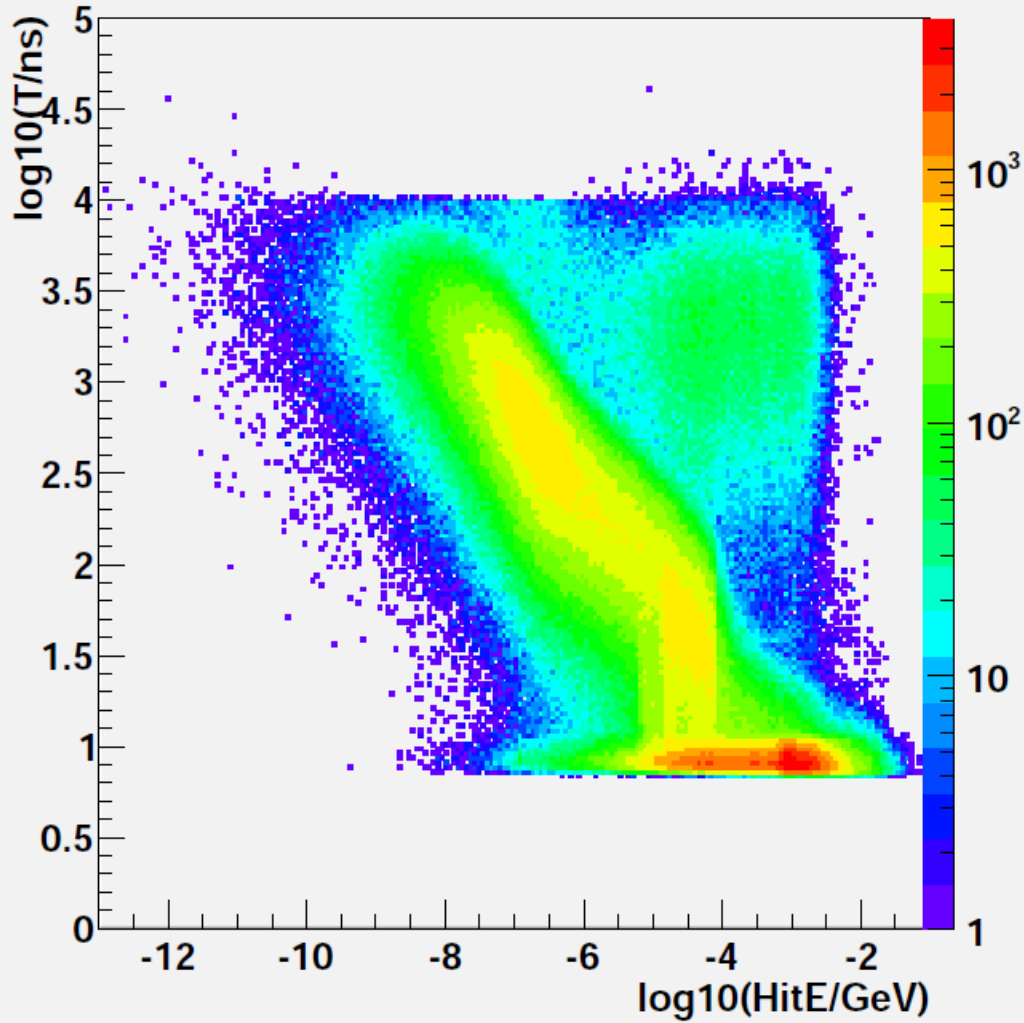
- AHCAL Drivers: SHcalSc02 & SHcalSc03:
 - Different sensor thickness: re-tune Calibration constant
 - Need a systematic study on Sc03 performance, from single particle level
 - *Geometry need to be checked... (only 0.7 mm for the PCB + electronics & no spacing ...)*
- Physics list
 - *No neutron hits in LCPhys & Slightly more hits in QGSP_BERT at high E*
 - Huge amount of low energy hits in QGSP_BERT:
 - *Detailed low energy behaviour: overkilling? & Xcheck with TB data*
 - *With Noise fluctuation: affection need to be carefully estimated*

Back UP Slides

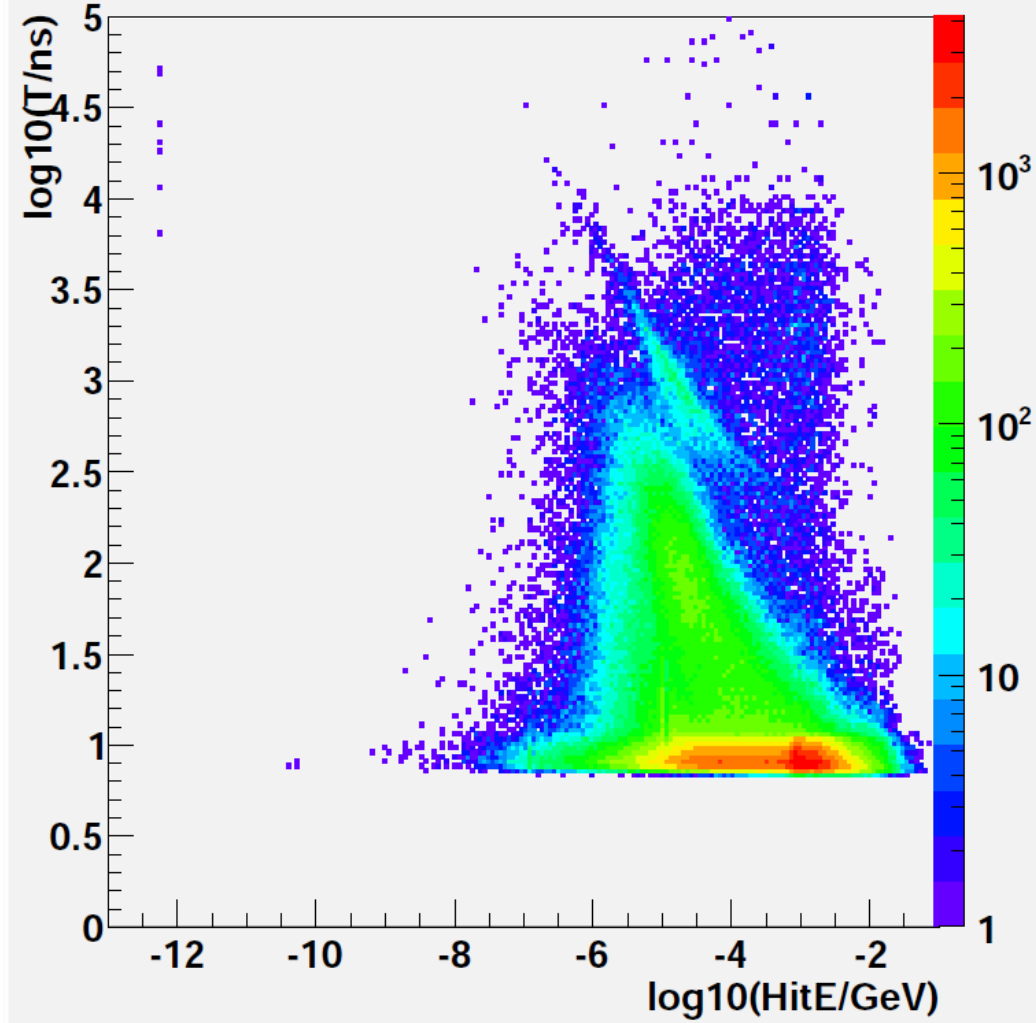
Timing information @ SHcalSc02

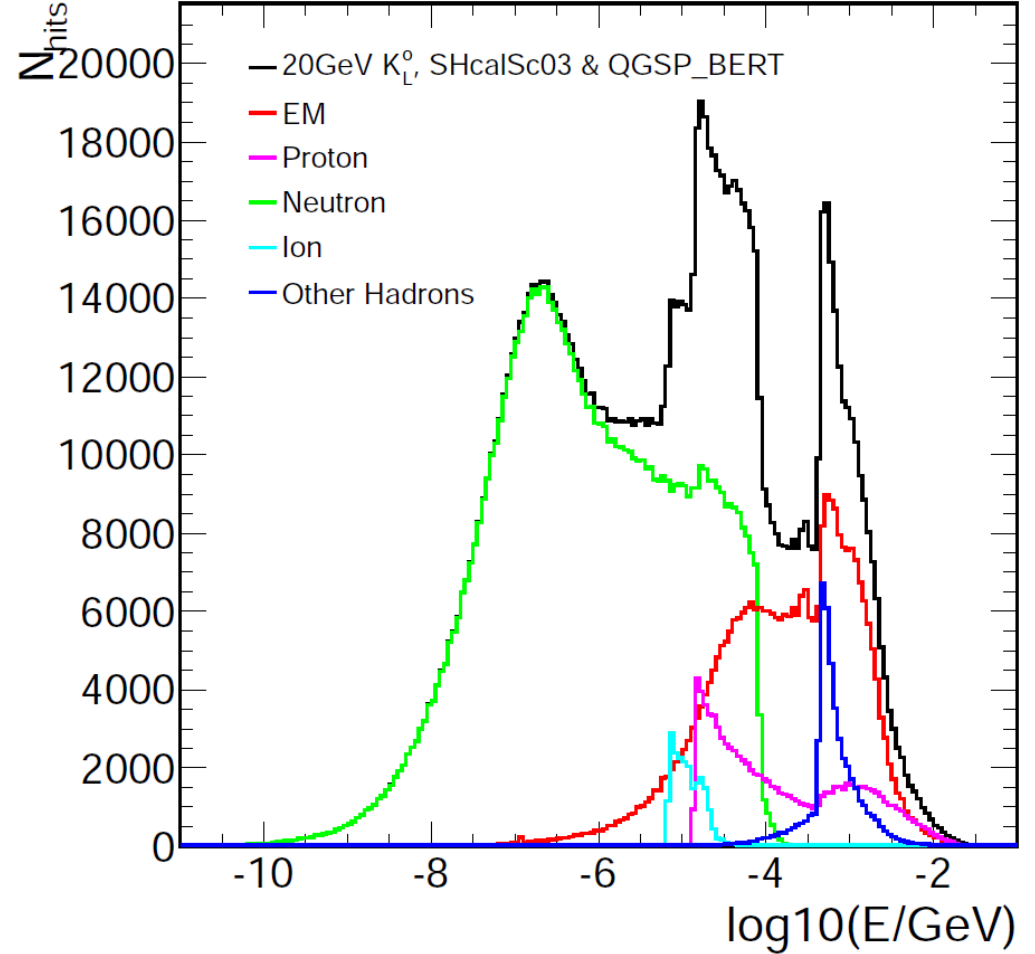
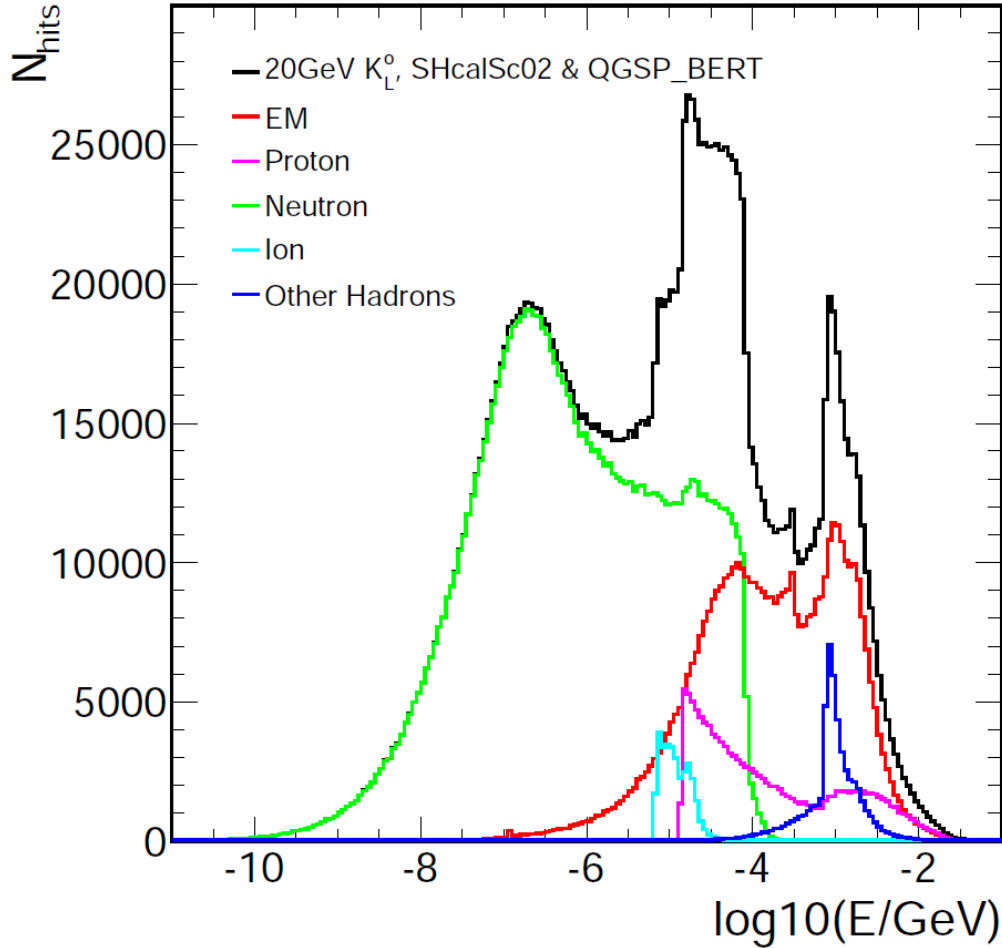


Hit time Vs energy, SHcalSc02 & QGSP_BERT



Hit time Vs energy, SHcalSc02 & LCPhys



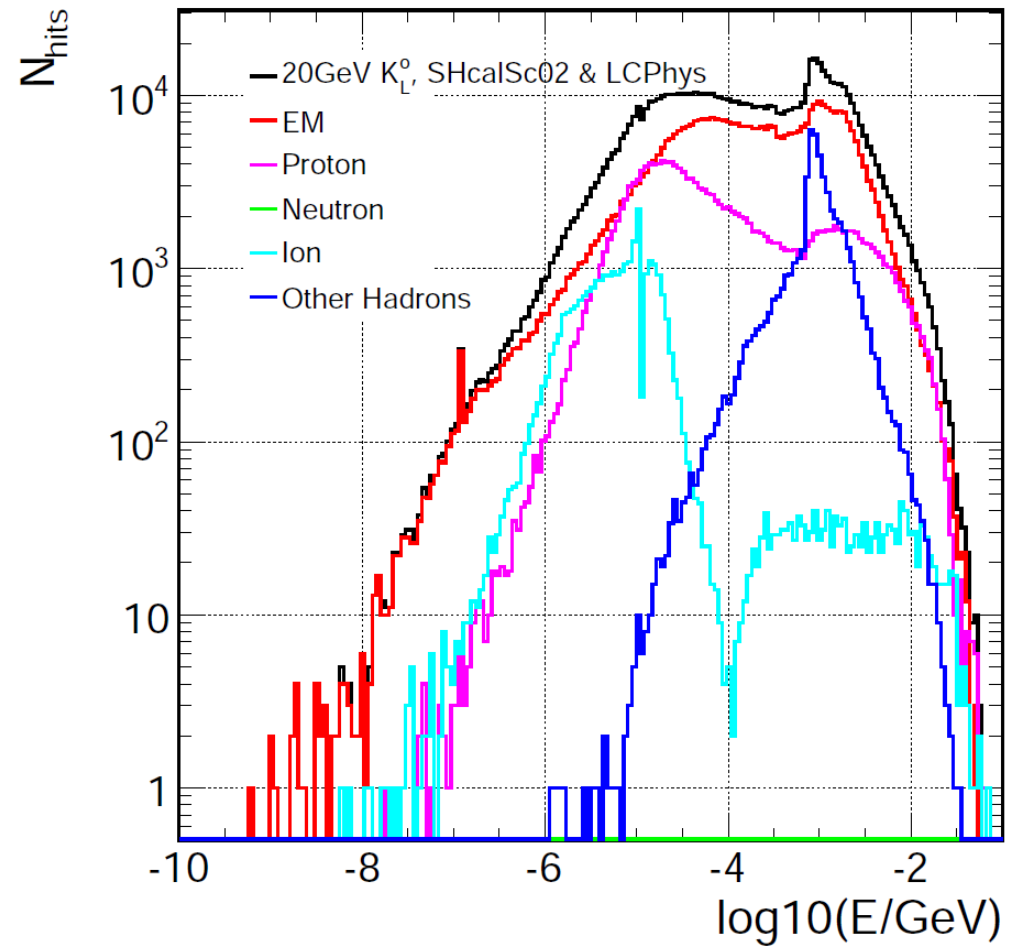
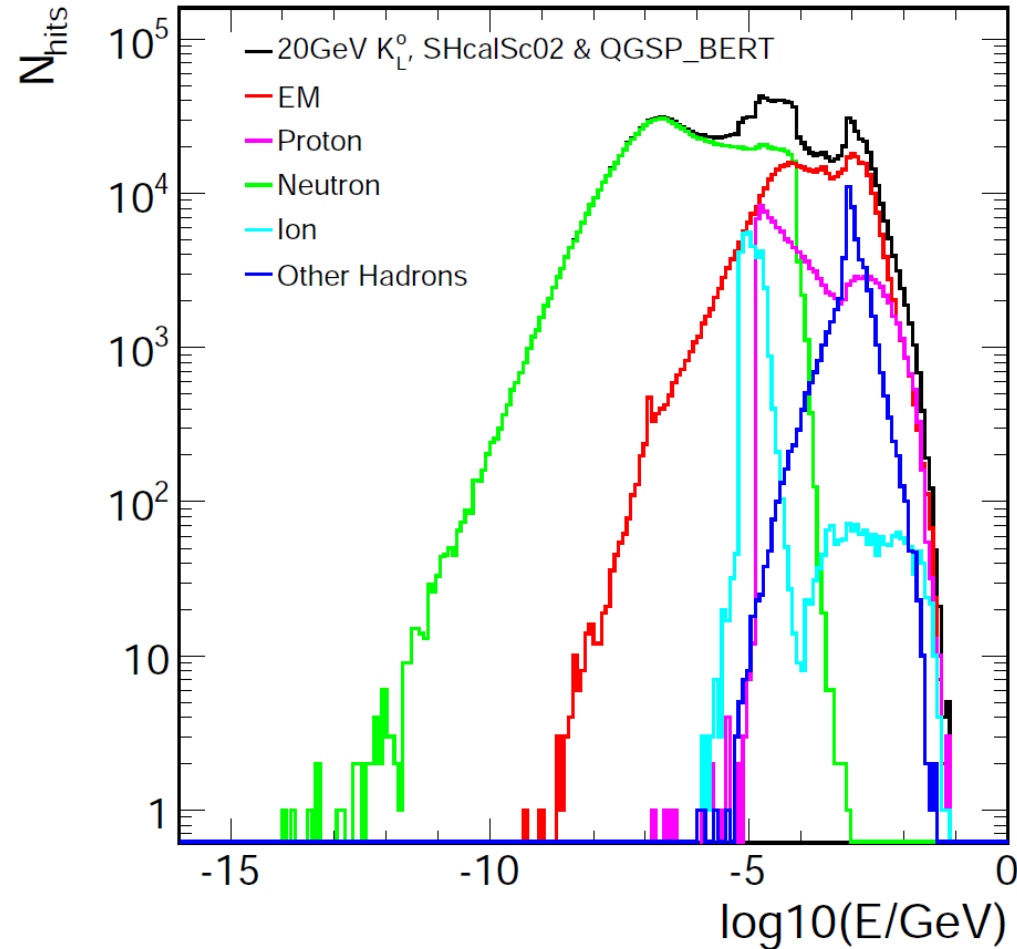


Similar high energy hit spectrum

No Neutron hits in LCPhys

Energy cut off at 10keV for proton hits at QGSP_BERT

Physics list comparison @ ShcalSc02 (logarithm)

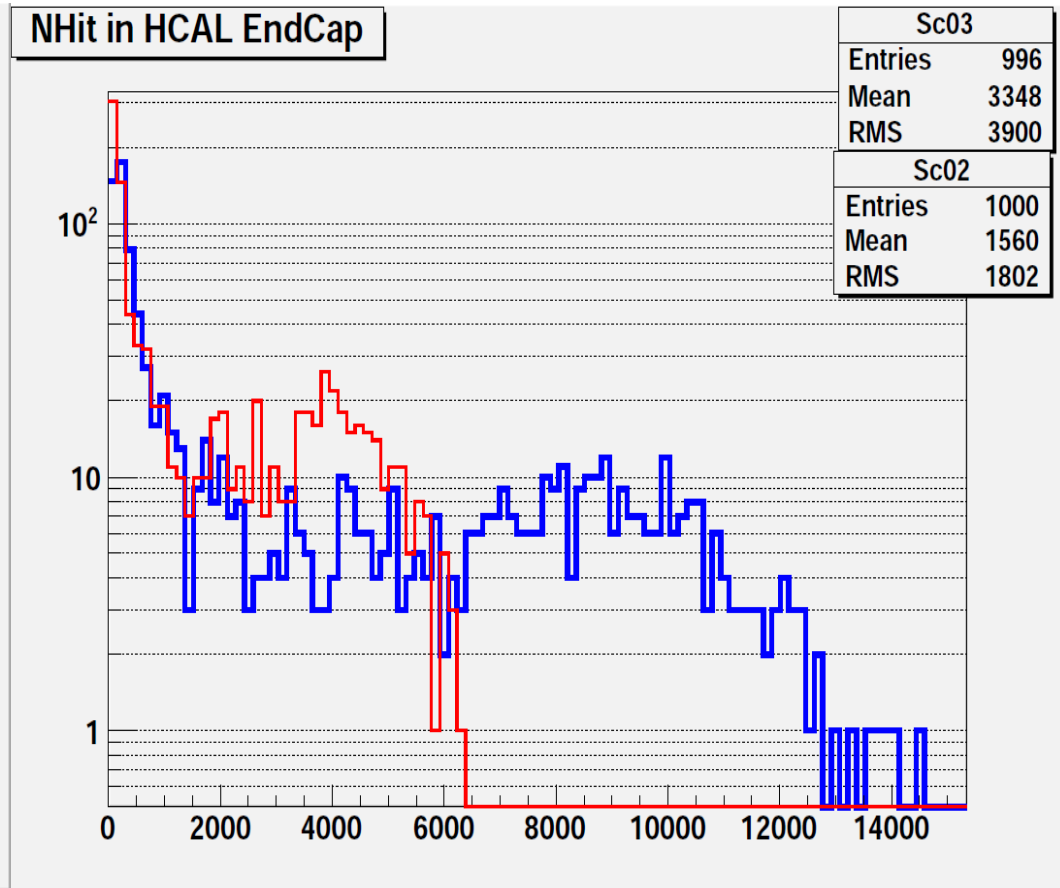
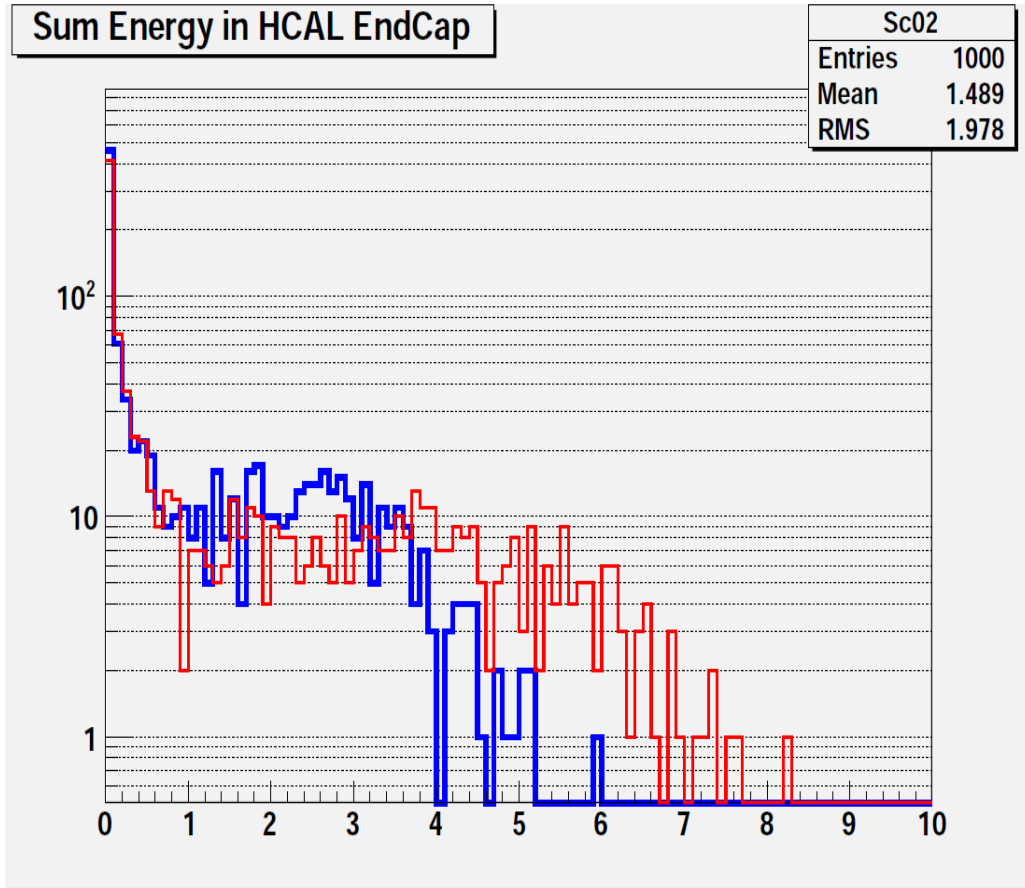


Similar high energy hit spectrum

No Neutron hits in LCPhys

Energy cut off at 10keV for proton hits at QGSP_BERT

HCAL EndCap



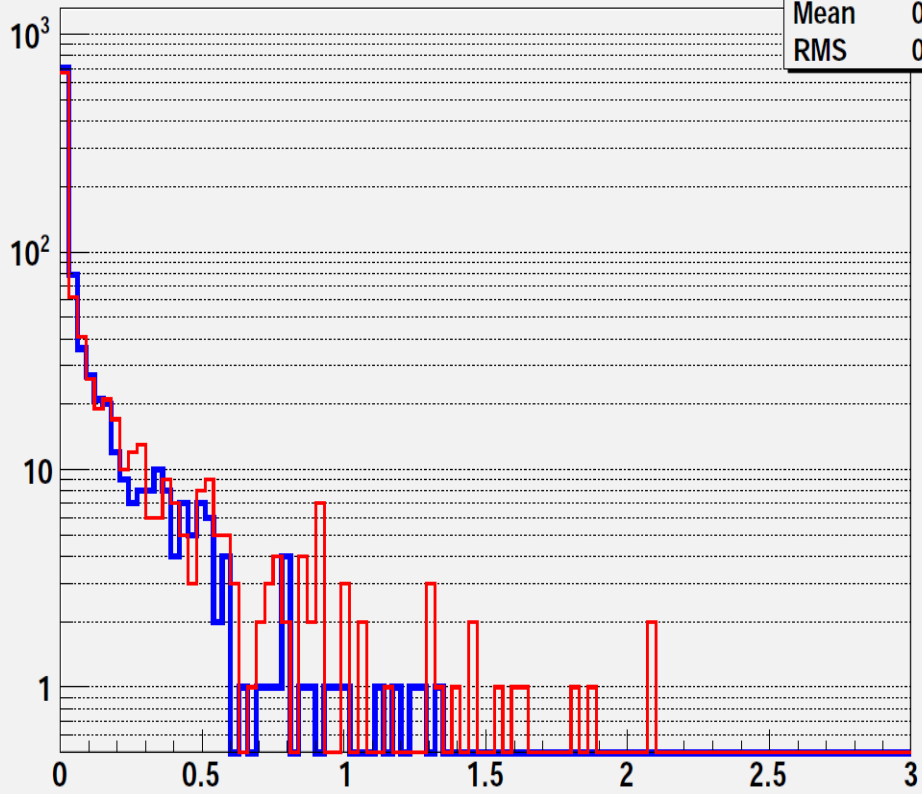
03 Vs 02: Much More Hits (> factor of 2), but Significantly Low Energy

HCAL Ring



Sum Energy in HCAL Ring

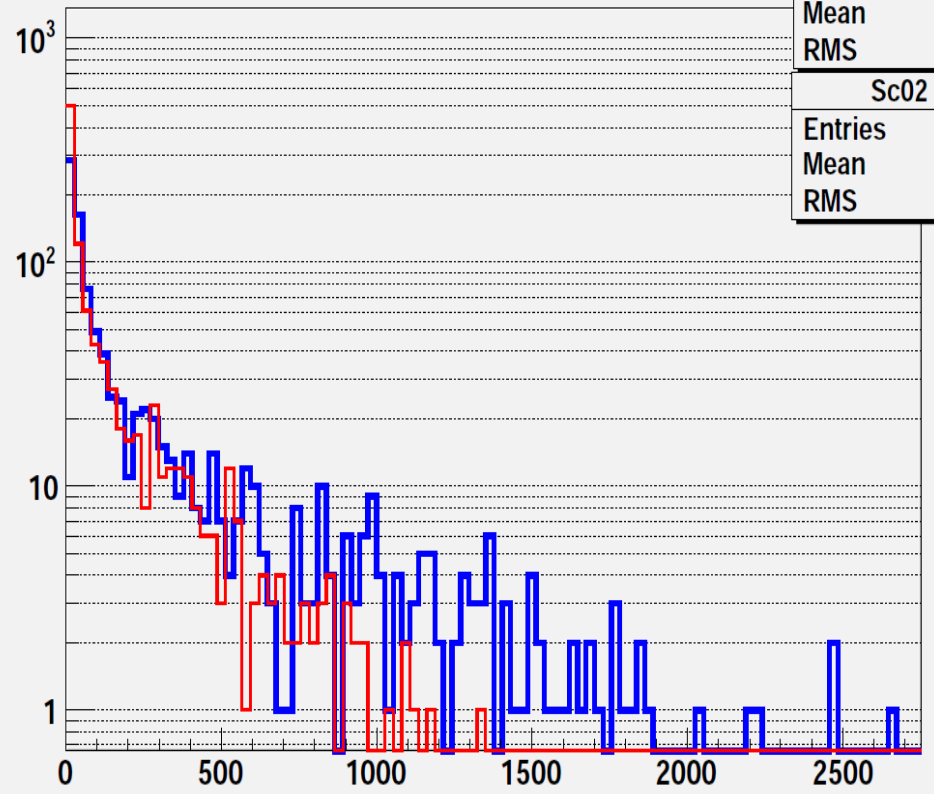
Sc02	
Entries	1000
Mean	0.1087
RMS	0.2583



NHit in HCAL Ring

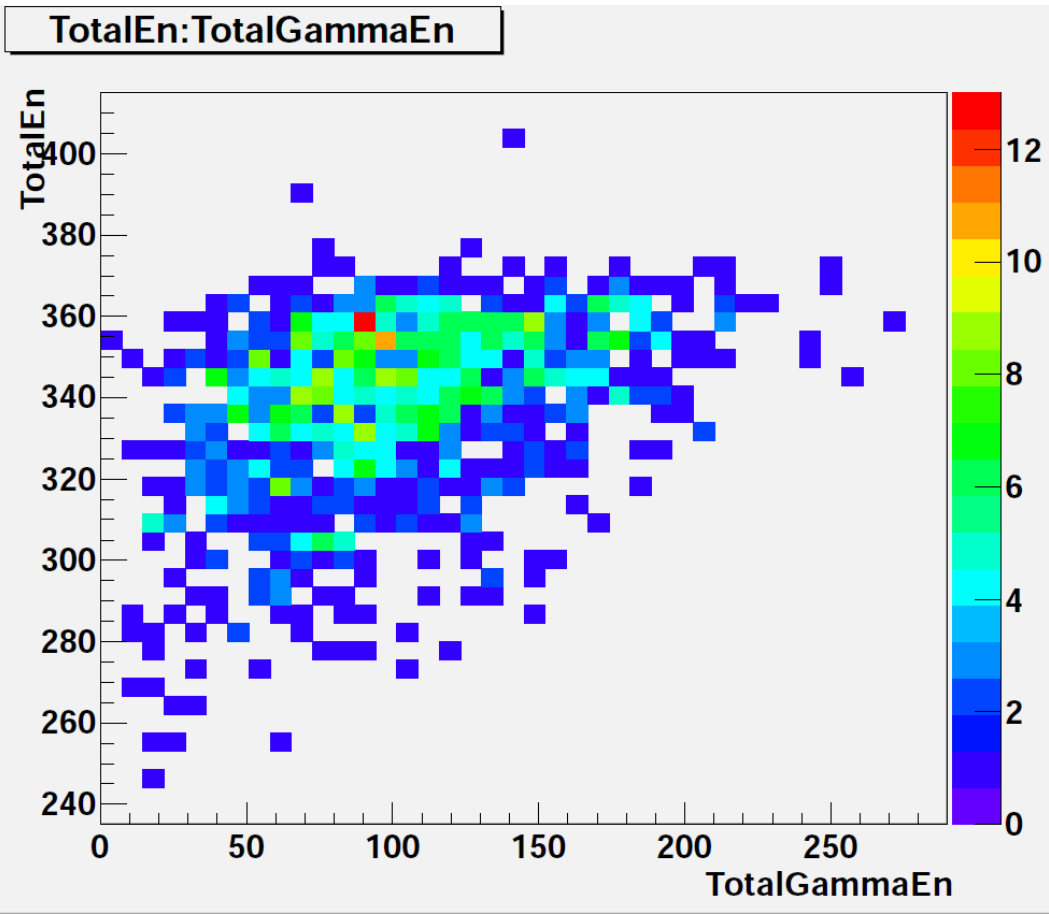
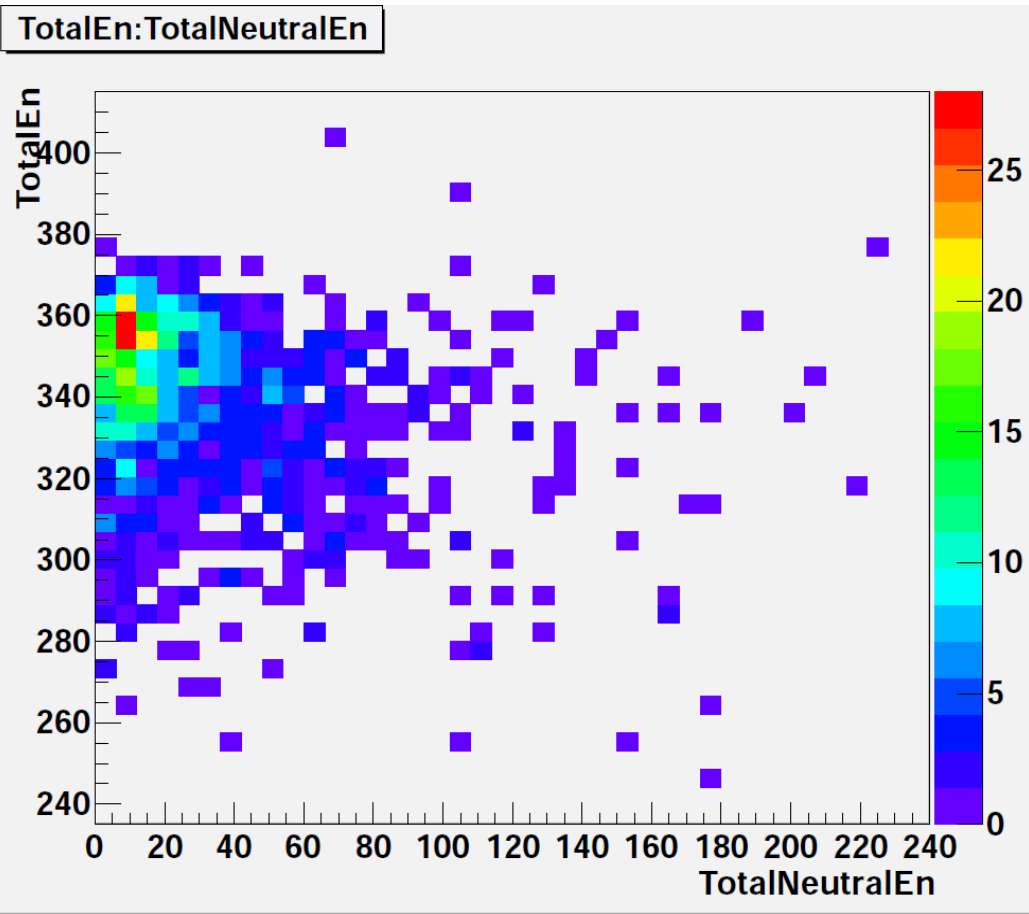
Sc03	
Entries	996
Mean	269.3
RMS	420

Sc02	
Entries	1000
Mean	117.9
RMS	197.3



03 Vs **02**: Much More Hits (> factor of 2), but Significantly Low Energy

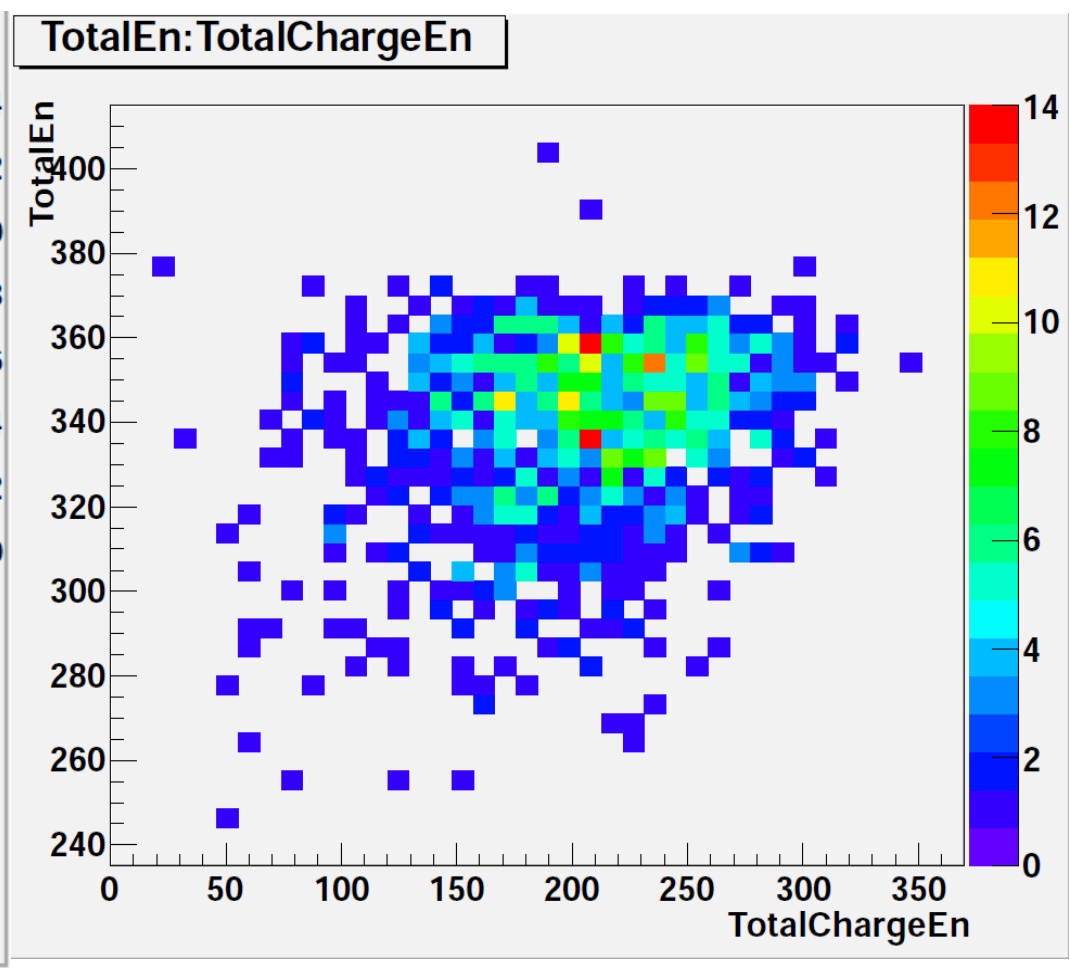
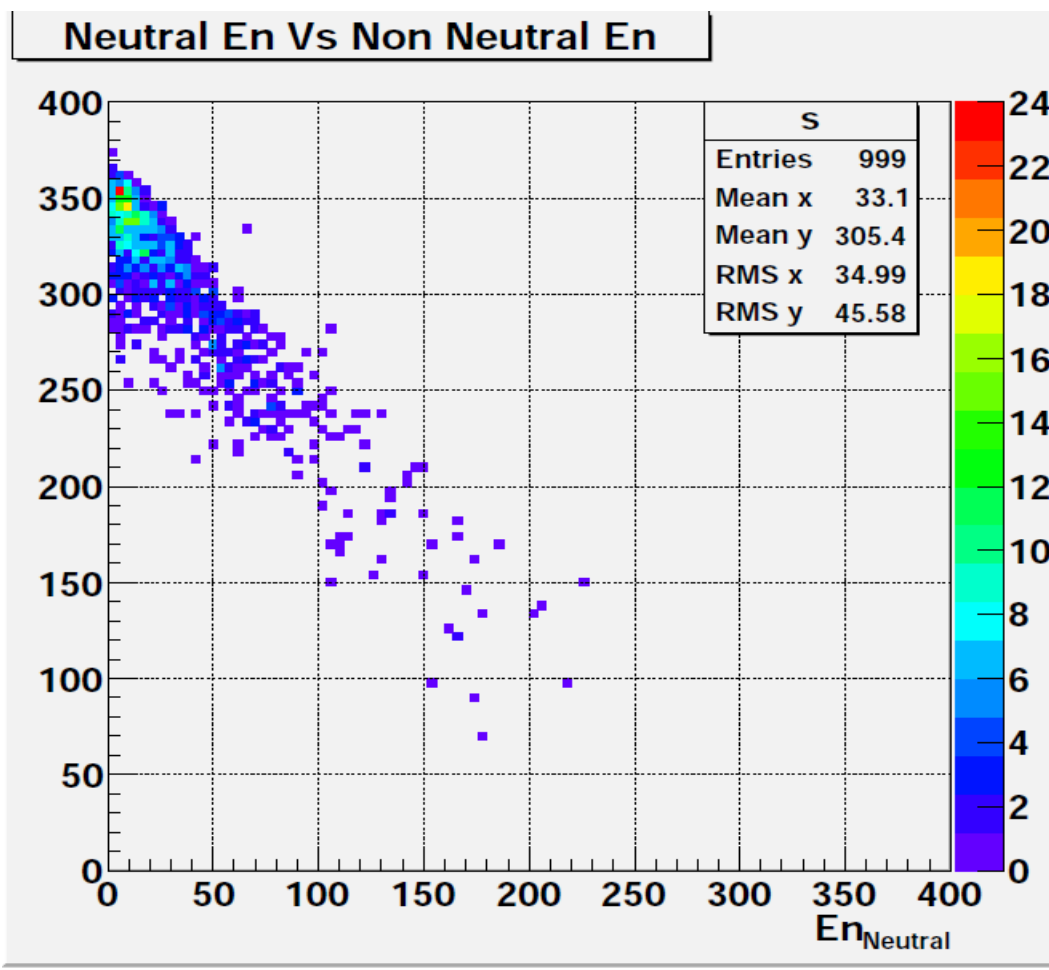
TotalEn Vs X



To verify the calibration constant:

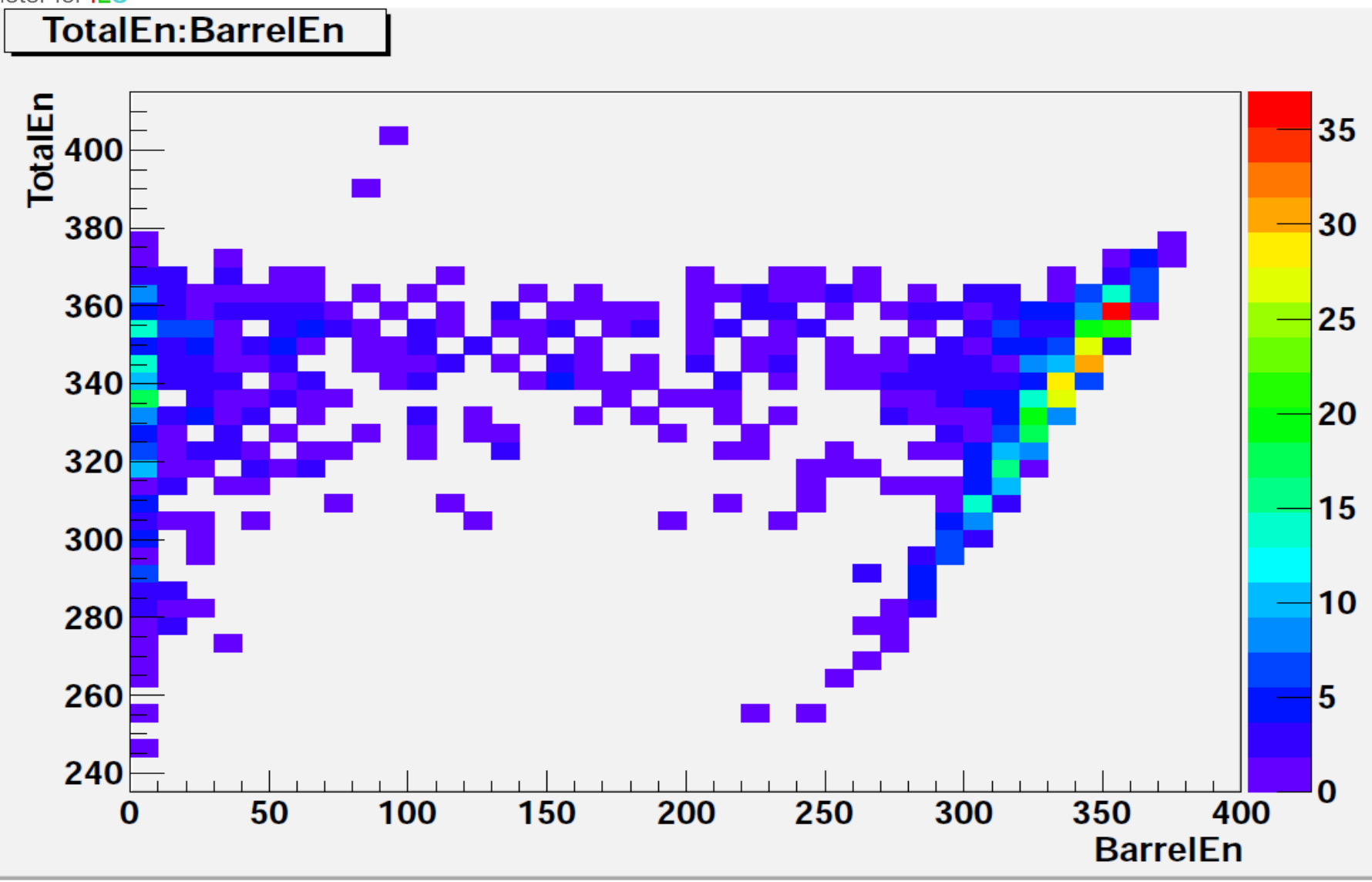
X: Total Neutral Hadron Energy, Total Gamma Energy and Total Charged Particle Energy

TotalEn Vs X



HCAL Calibration Constant: Slightly small

TotalEn Vs X



Total E: No Significant Dependency on any above quantities