Update on the combined analysis

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CALICE Analysis &Software Meeting

March 10th, 2008

Overview

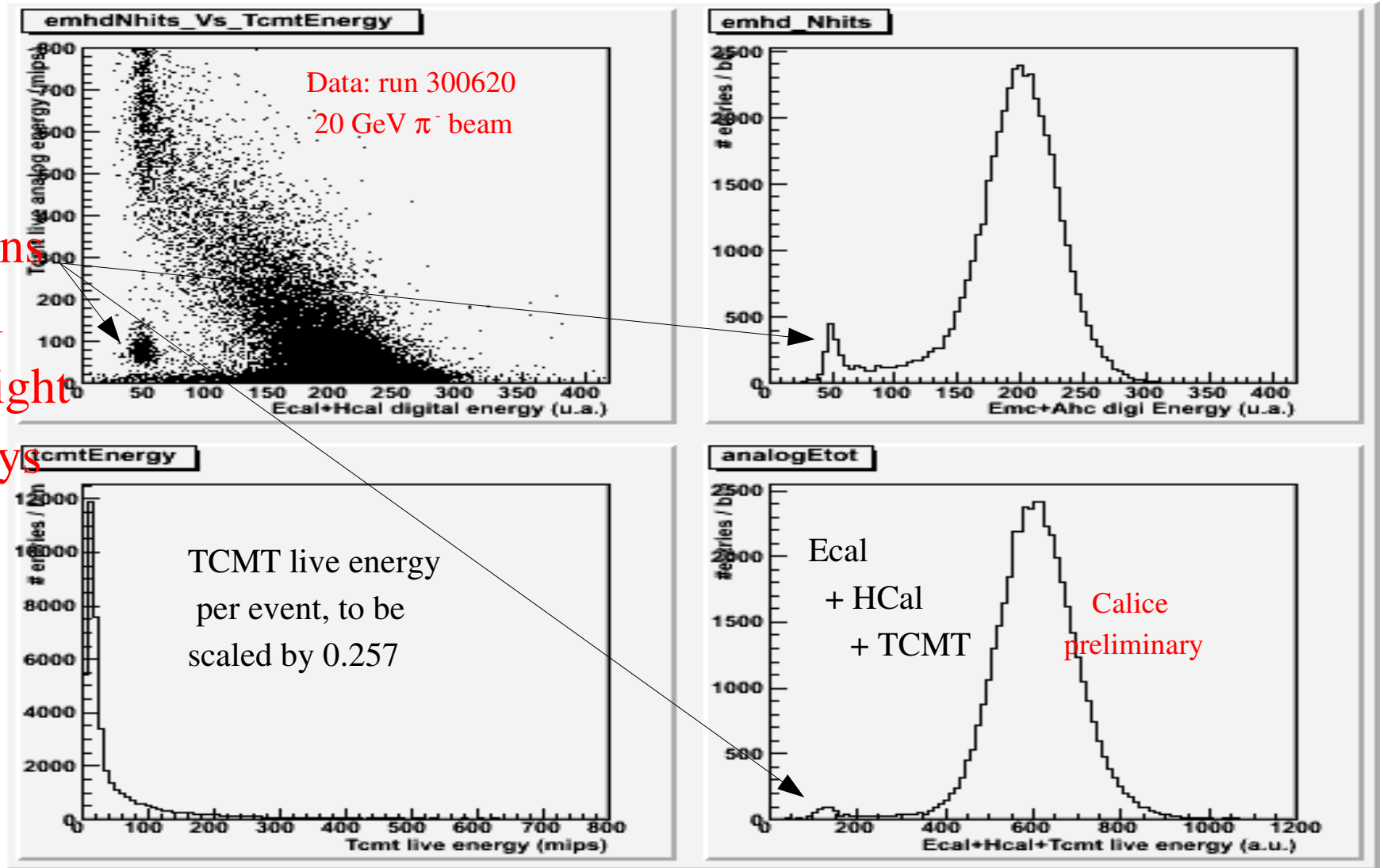
- Combined analysis: first complete version of note + presentation at LCWS in spring/summer 2007)
  Preliminary results of energy resolutions (pions 10-20 GeV).
  Further studies require improved agreement with simulations.
  - Detailed MC vs. data comparisons
  - Simulation of digitization effects
  - Sample cleanup
  - Clustering

Today's update

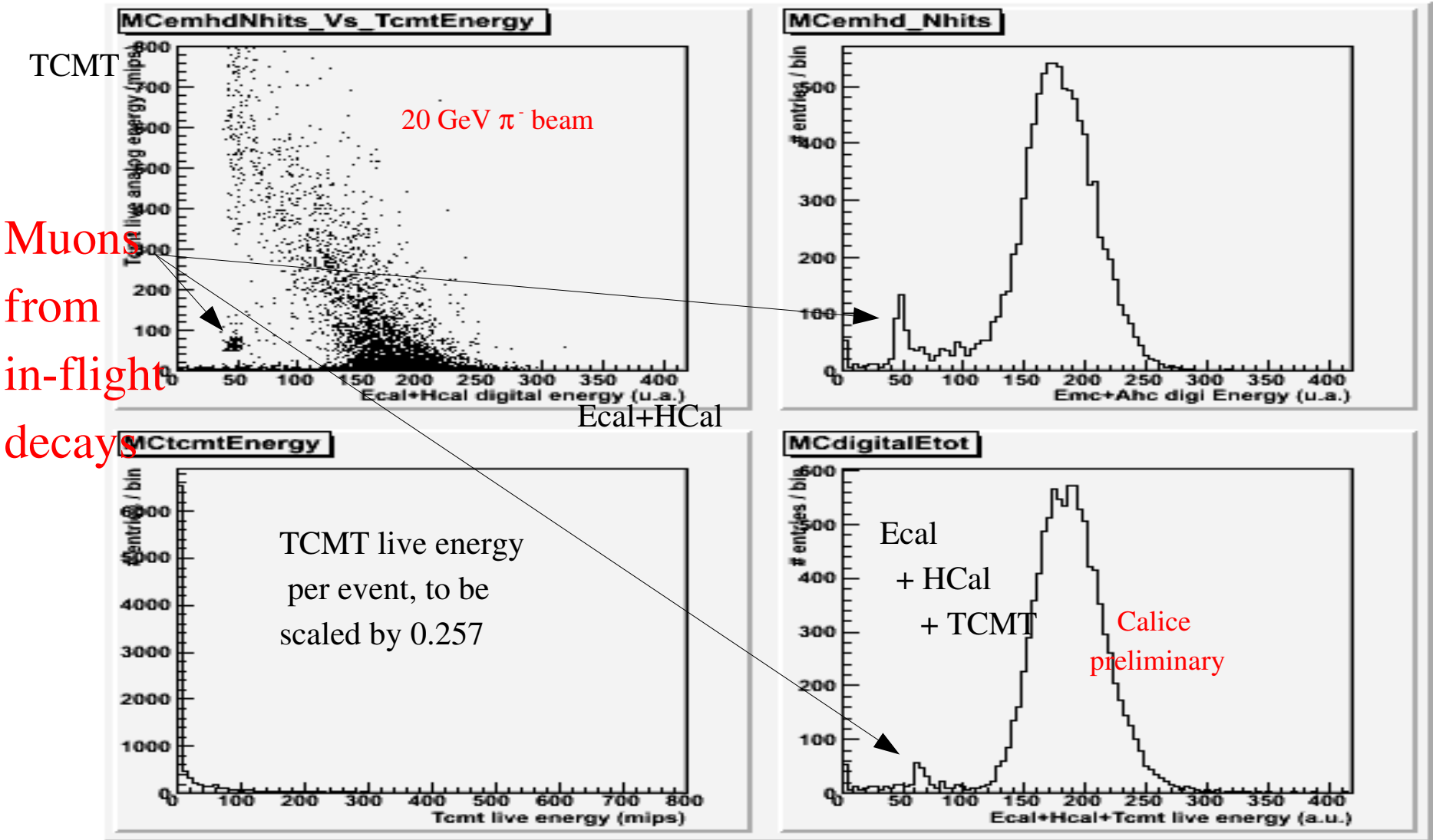
- Approaching a new round of results, with much better MC-data agreement
- In this talk:
  - Use Efrac10mips for event topology
  - Remove pion decays and early interactions from MC sample
    - require endPoint of original pions to be between Ecal and Tcmt
  - Updating to latest Hcal digitization + reconstruction software
  - Outlook

Combining EM+HD and TCMT (hit counting) – TB data

Muons from in-flight decays

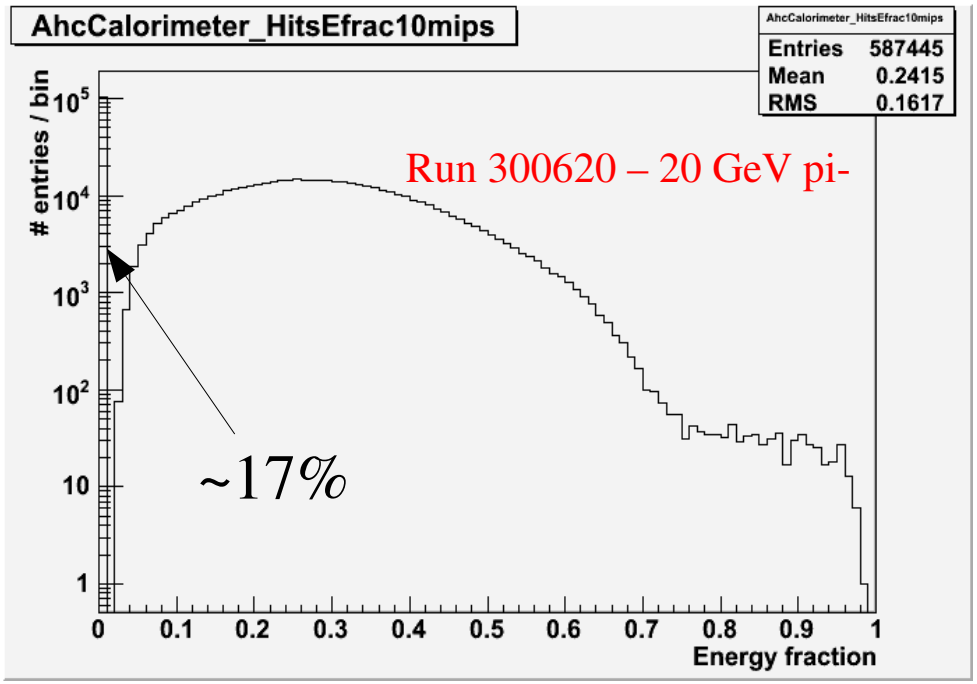


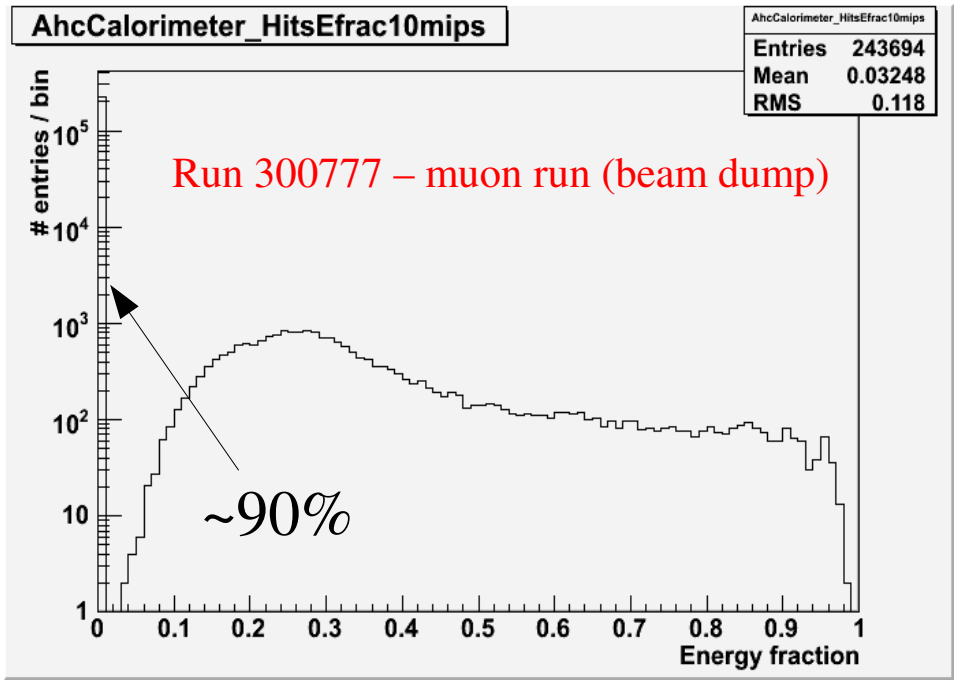
Combining EM+HD and TCMT (hit counting) - MC



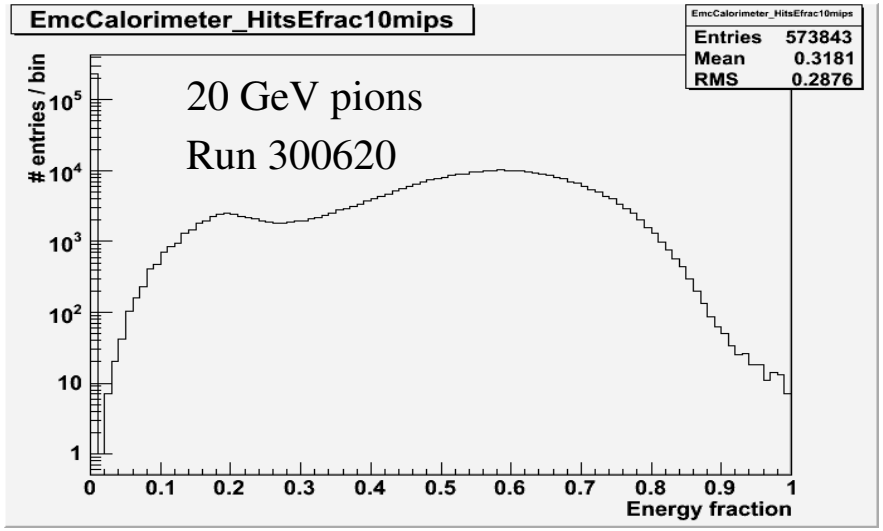
Beam cleanup and event topologies

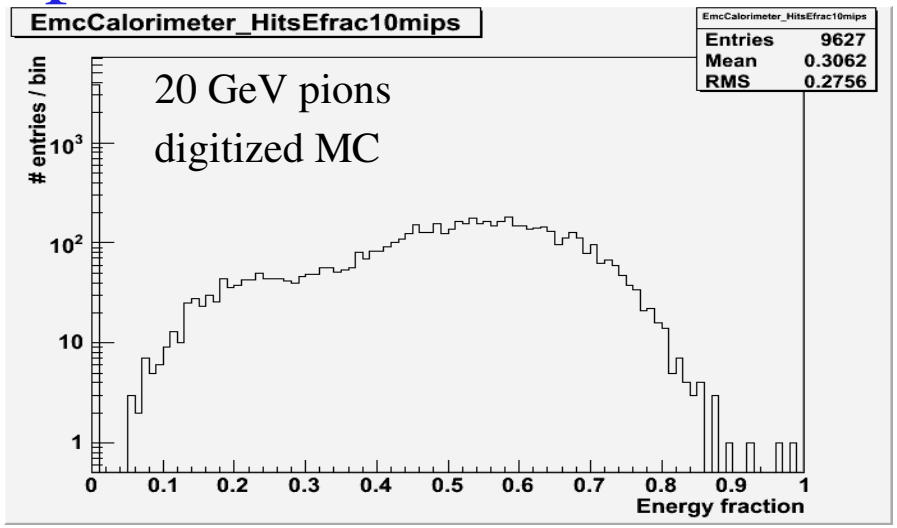
- For beam cleanup (remove muons and noise events from the pion samples), we used frac10mips = Esum(hits > 10mips) / Esum(hits > 0.5 mip), requiring that frac10mips > 0.02 for each one of Ecal, Hcal and TCMT

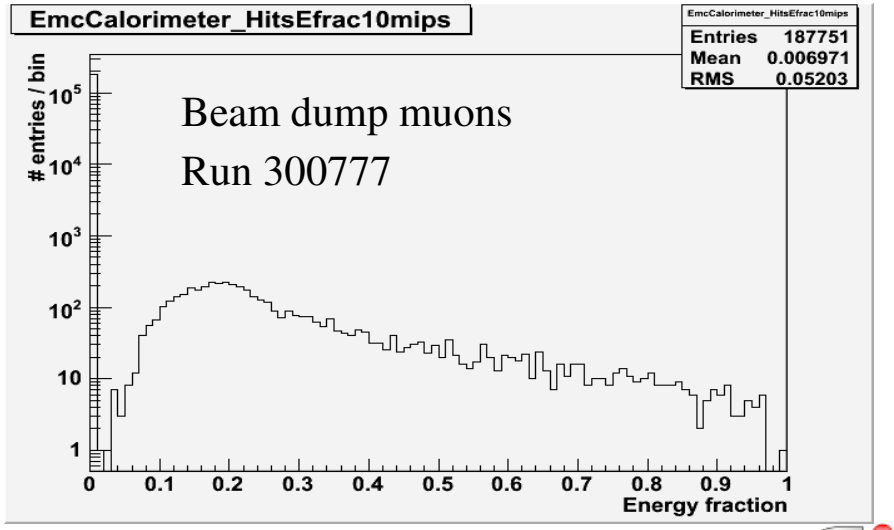




Efrac10mips in Ecal

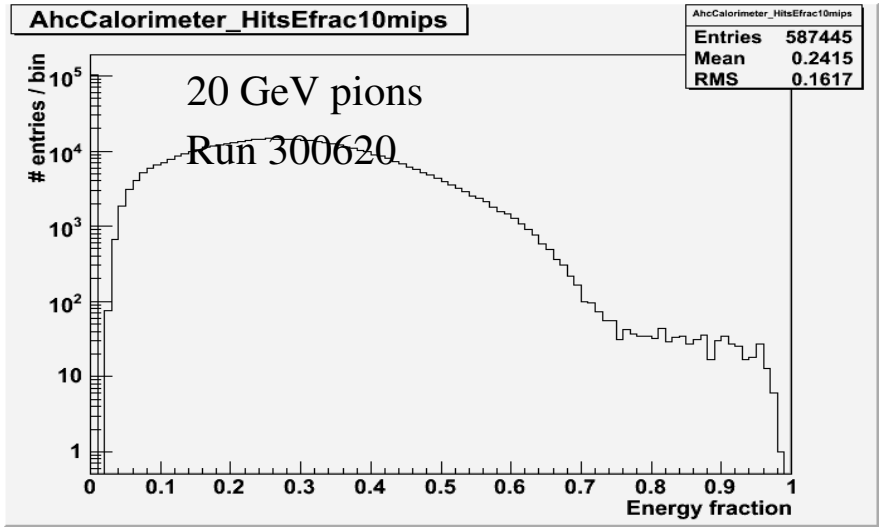


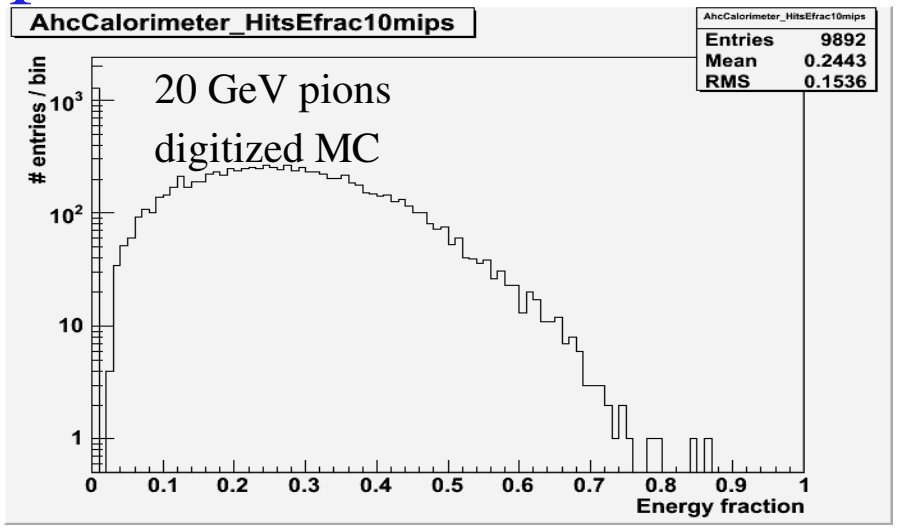


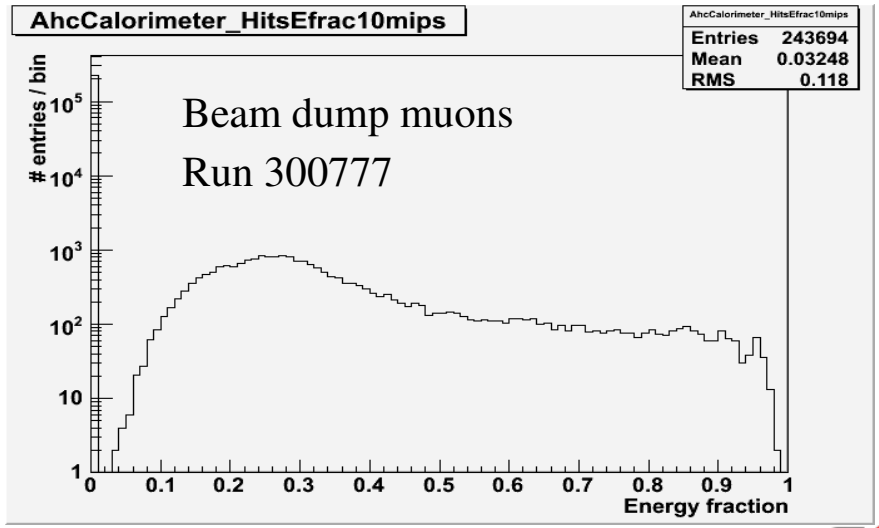


No digitized MC muon sample available yet :-(

Efrac10mips in AHcal







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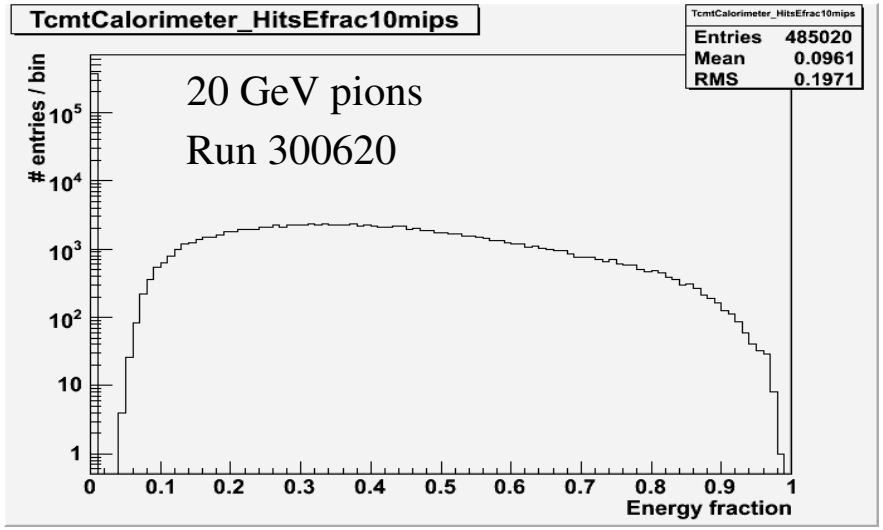
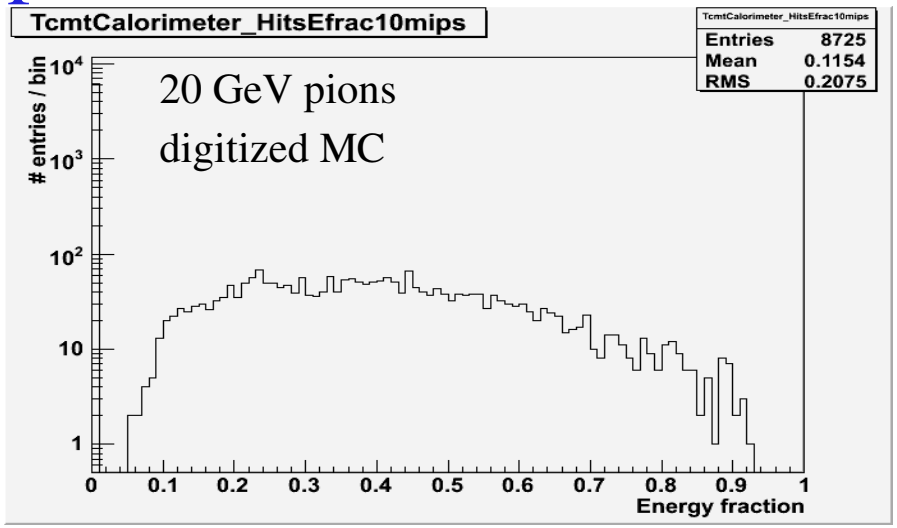
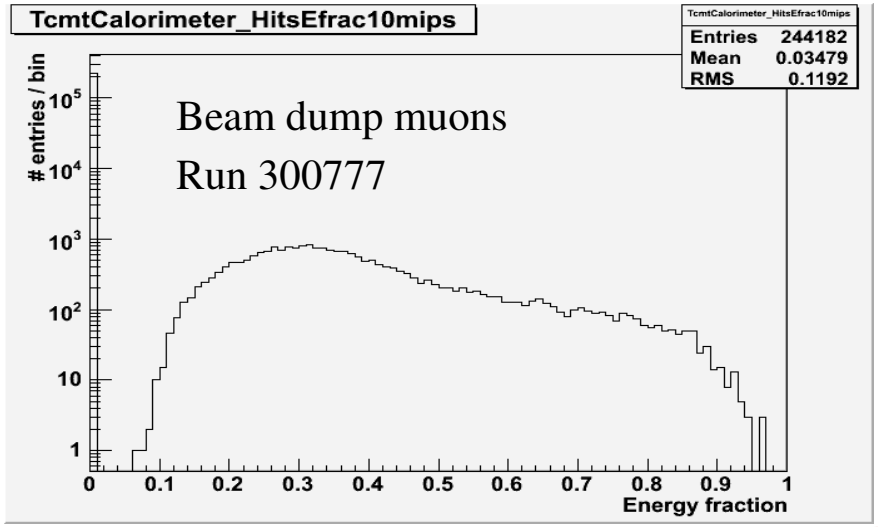
Efrac10mips in TCMT







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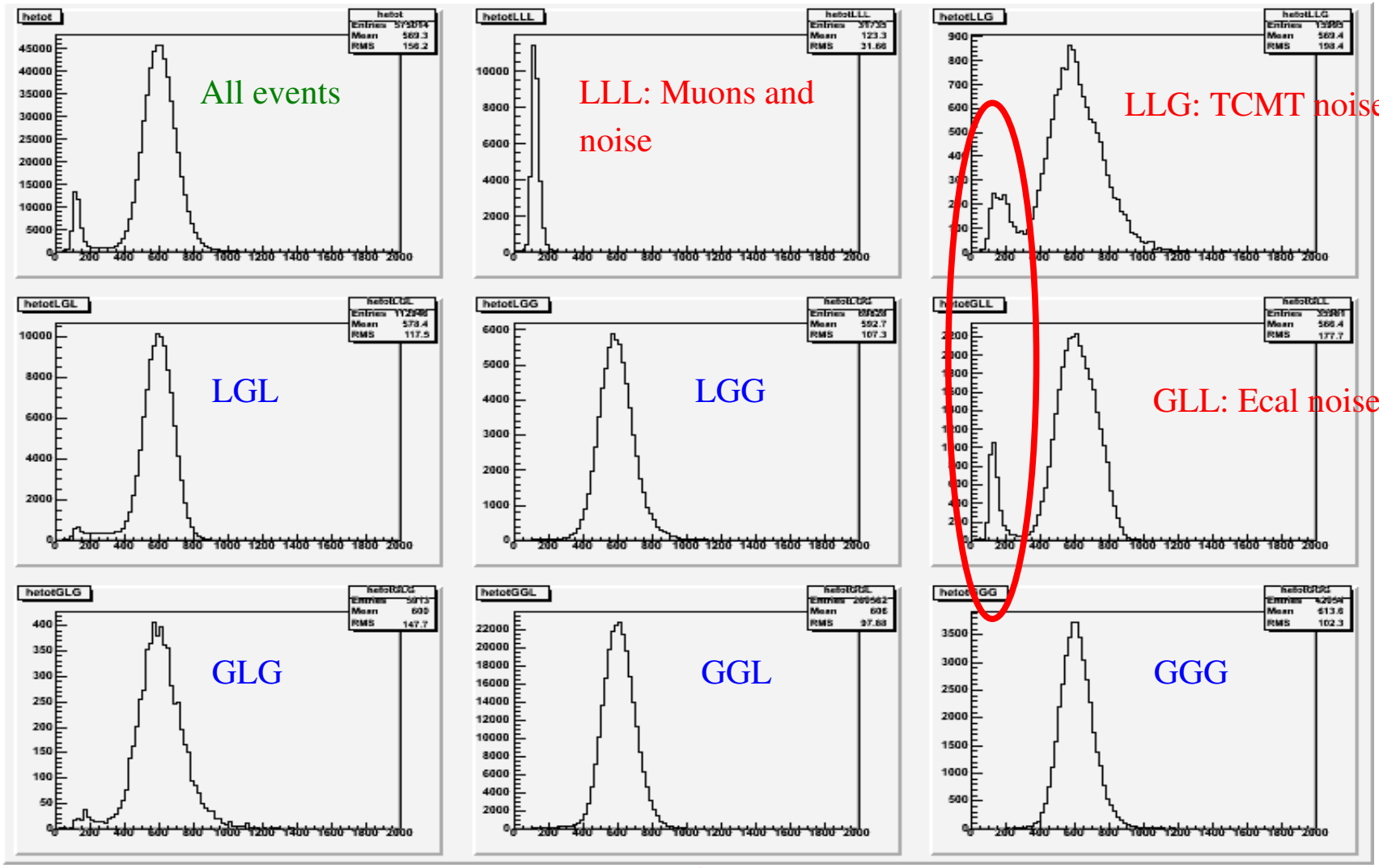
20 GeV pions – run 300620

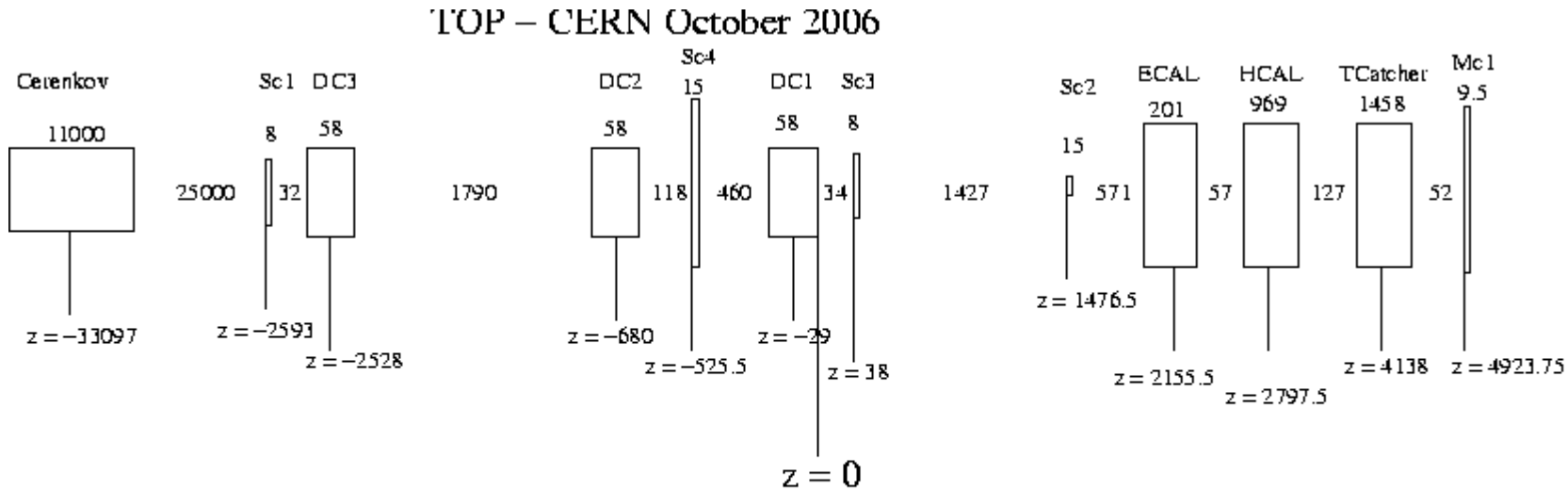


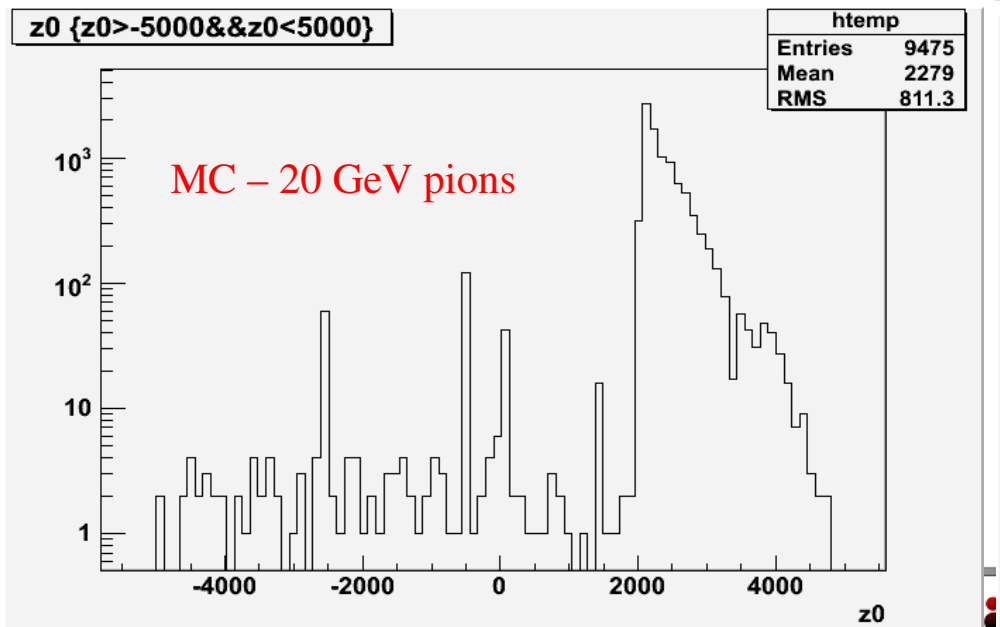
Topological separation

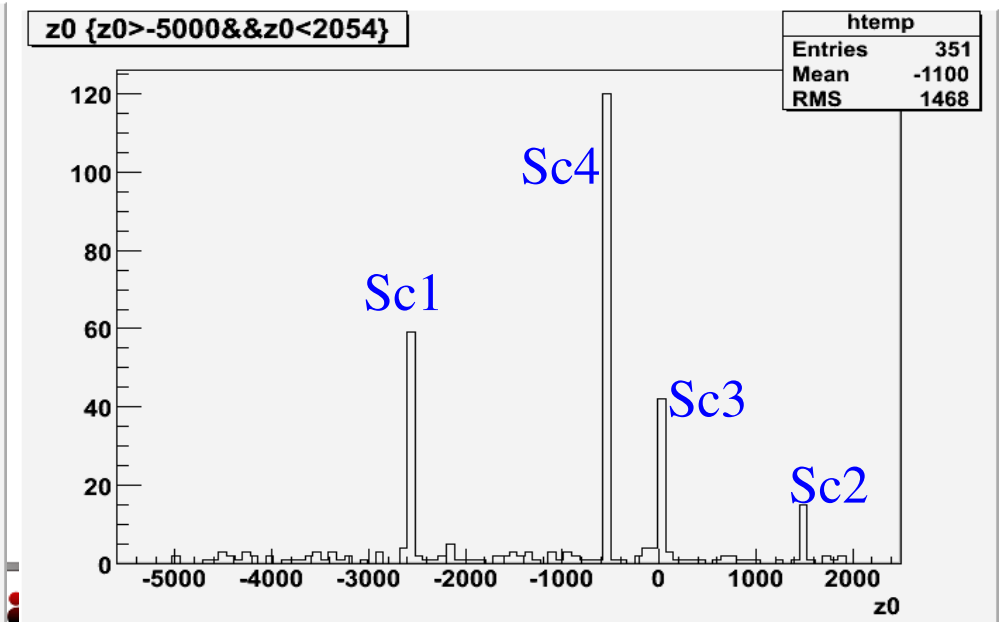
- LLL, GLL, GGL, GGG, etc. Order means (Emc, Ahc, Tcmt)
  - L for frac10mips < 0.02
  - G for frac10mips > 0.02
- Some statistics:

	Real data	Digitized MC
LLL	28809 (5.53%)	454 (4.54%)
GLG	5388 (1.04%)	114 (1.14%)
GLL	32563 (6.26%)	494 (4.94%)
GGL	236714 (45.5%)	4279 (42.8%)
LGL	101044 (19.4%)	1879 (18.8%)
LGG	63221 (12.1%)	1548 (15.5%)
GGG	38297 (7.36%)	929 (9.29%)
LLG	14519 (2.79%)	303 (3.03%)
	520555	10000

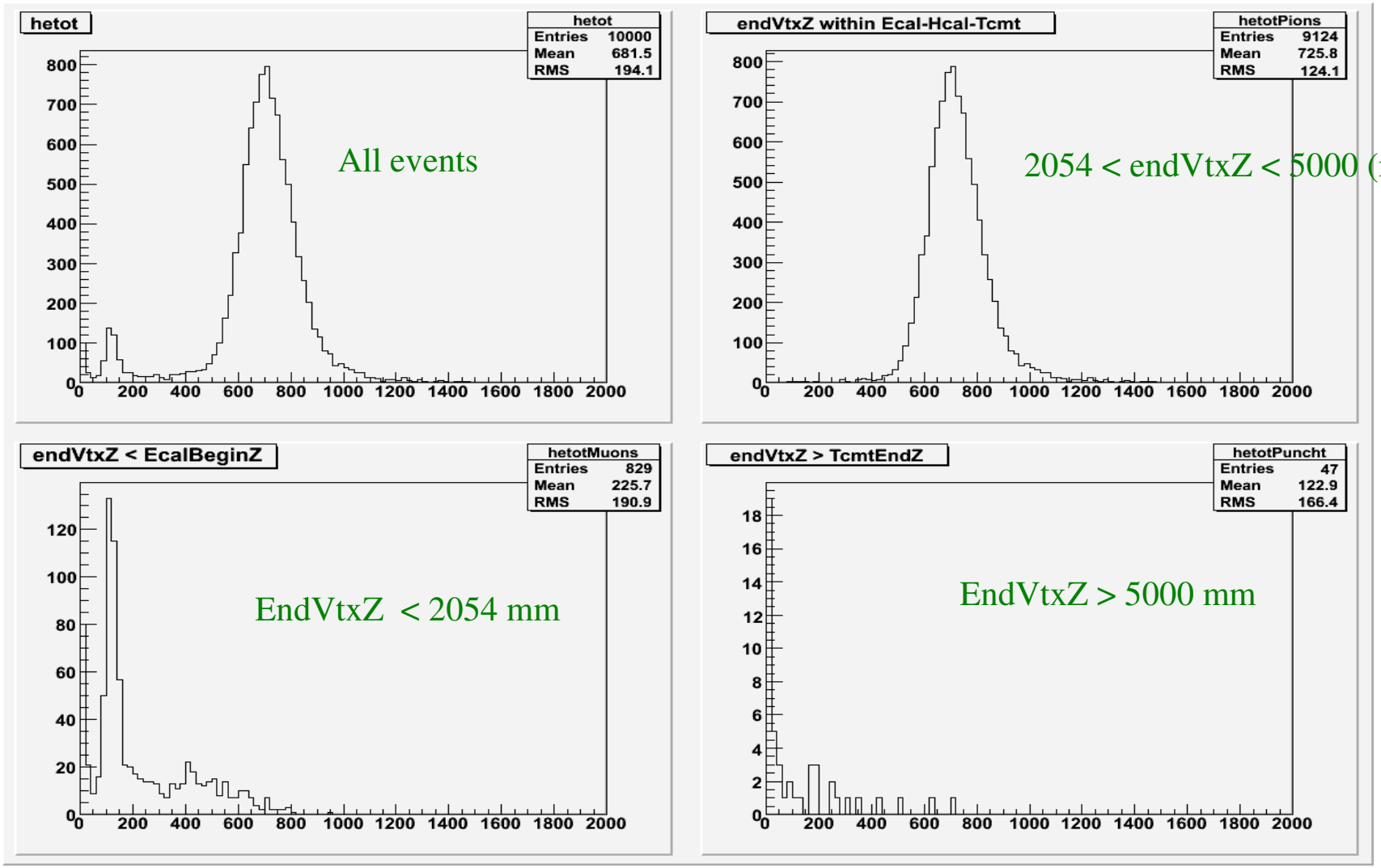
MC cleanup - EndVtxZ distribution



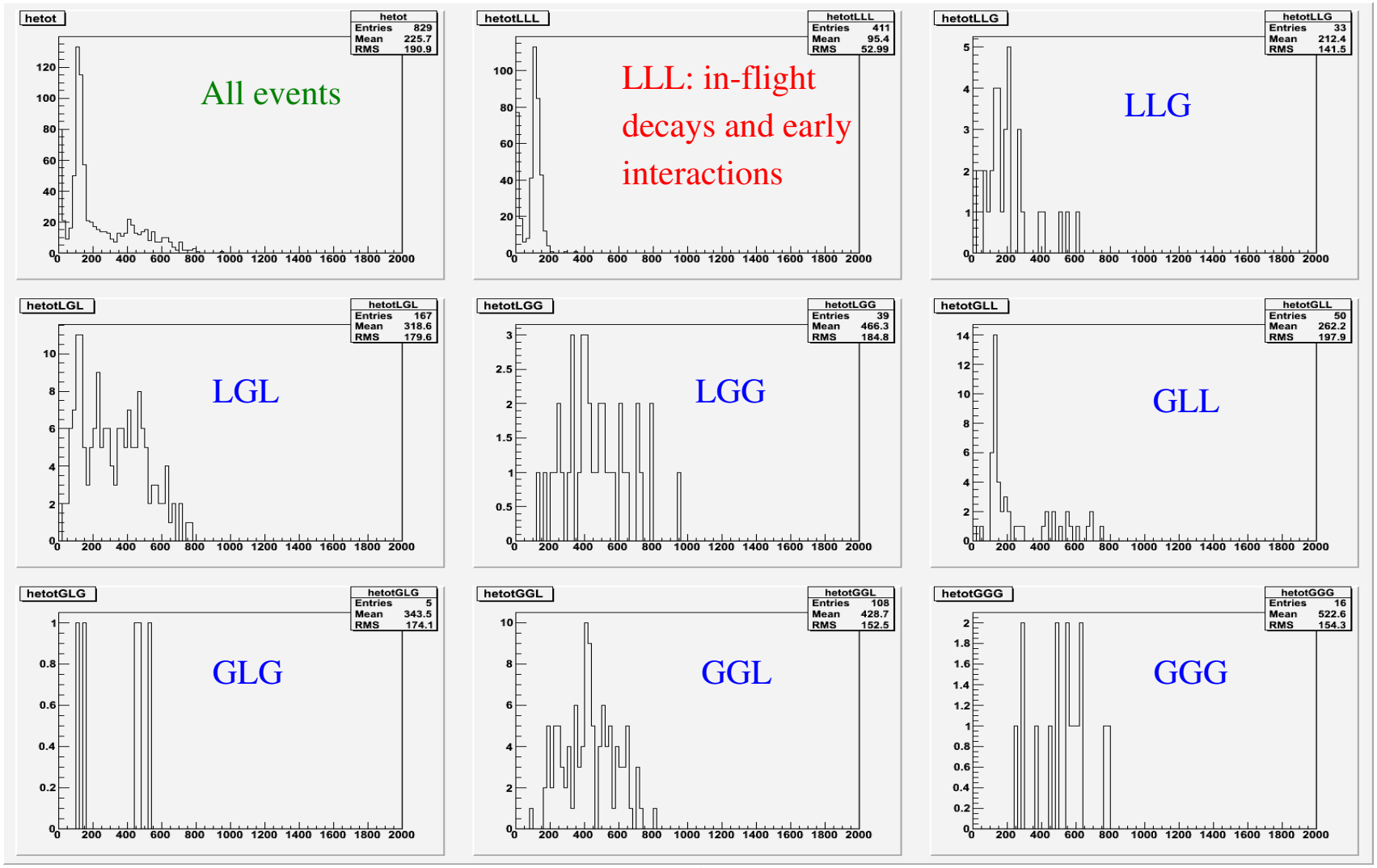




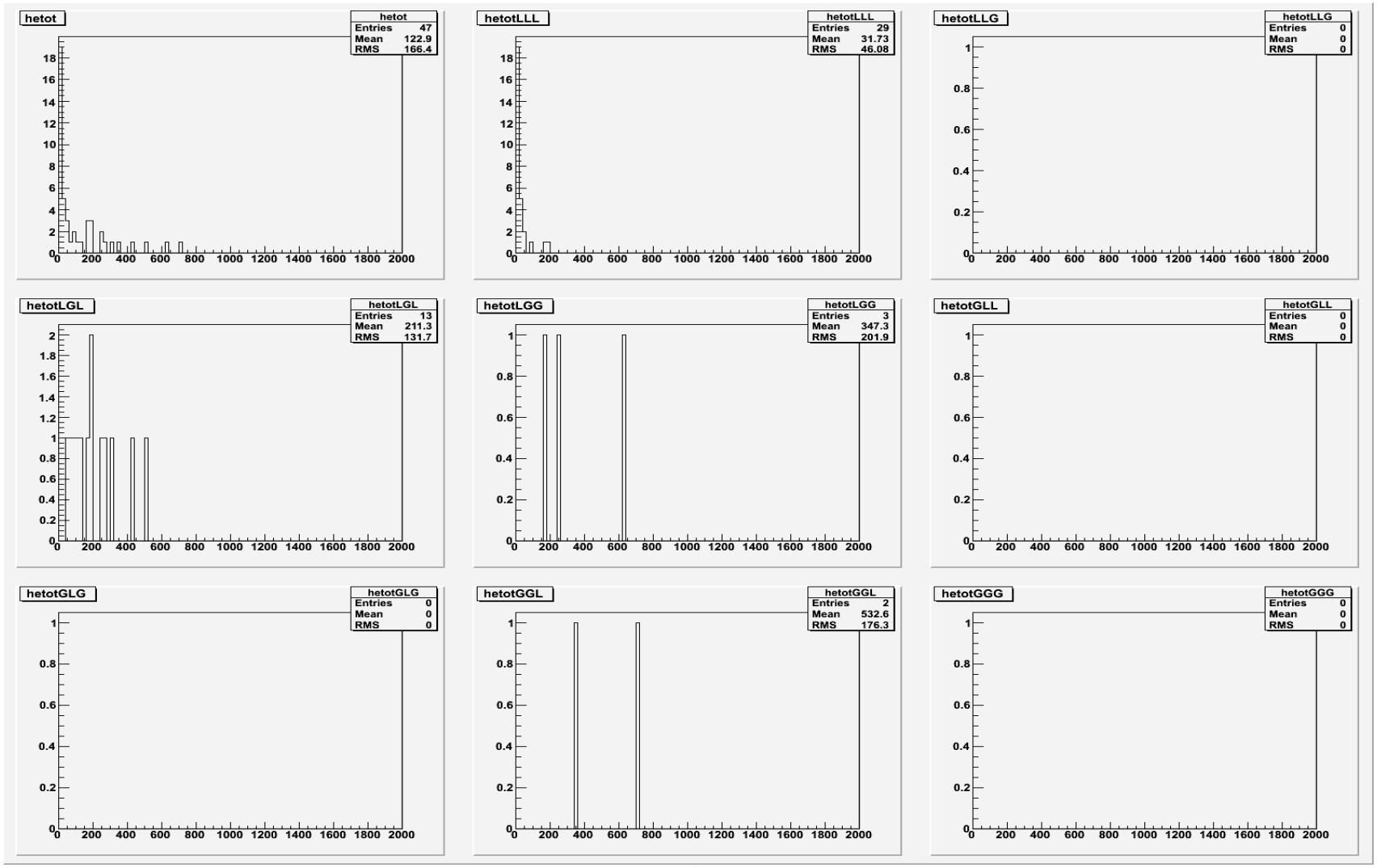
MC pions 20GeV – Ereco as f(endVtxZ)



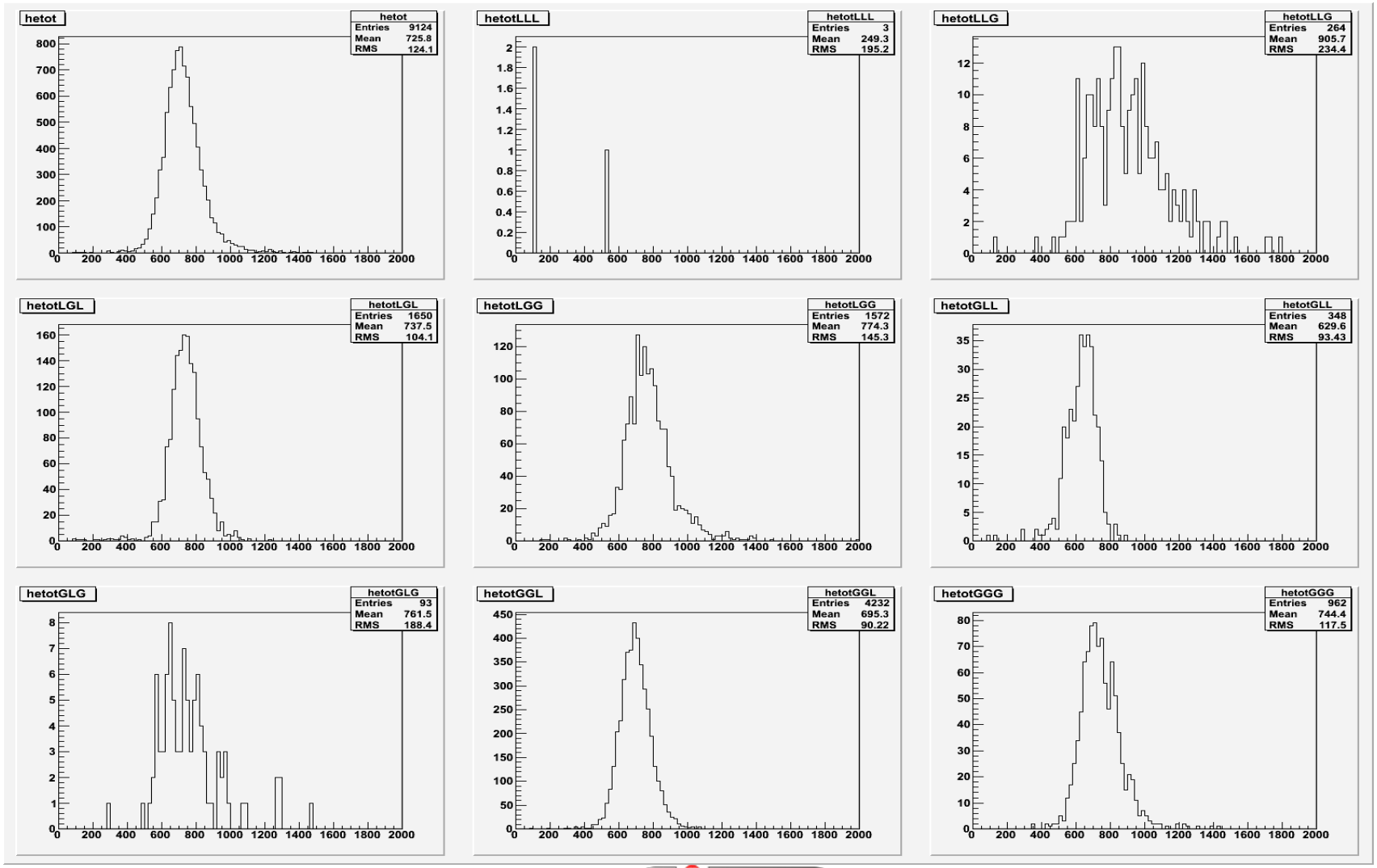
MC pions 20GeV – endVtxZ < EcalBeginZ



MC pions 20GeV – endVtxZ > TcmtEndZ



MC pions 20GeV – “good events”



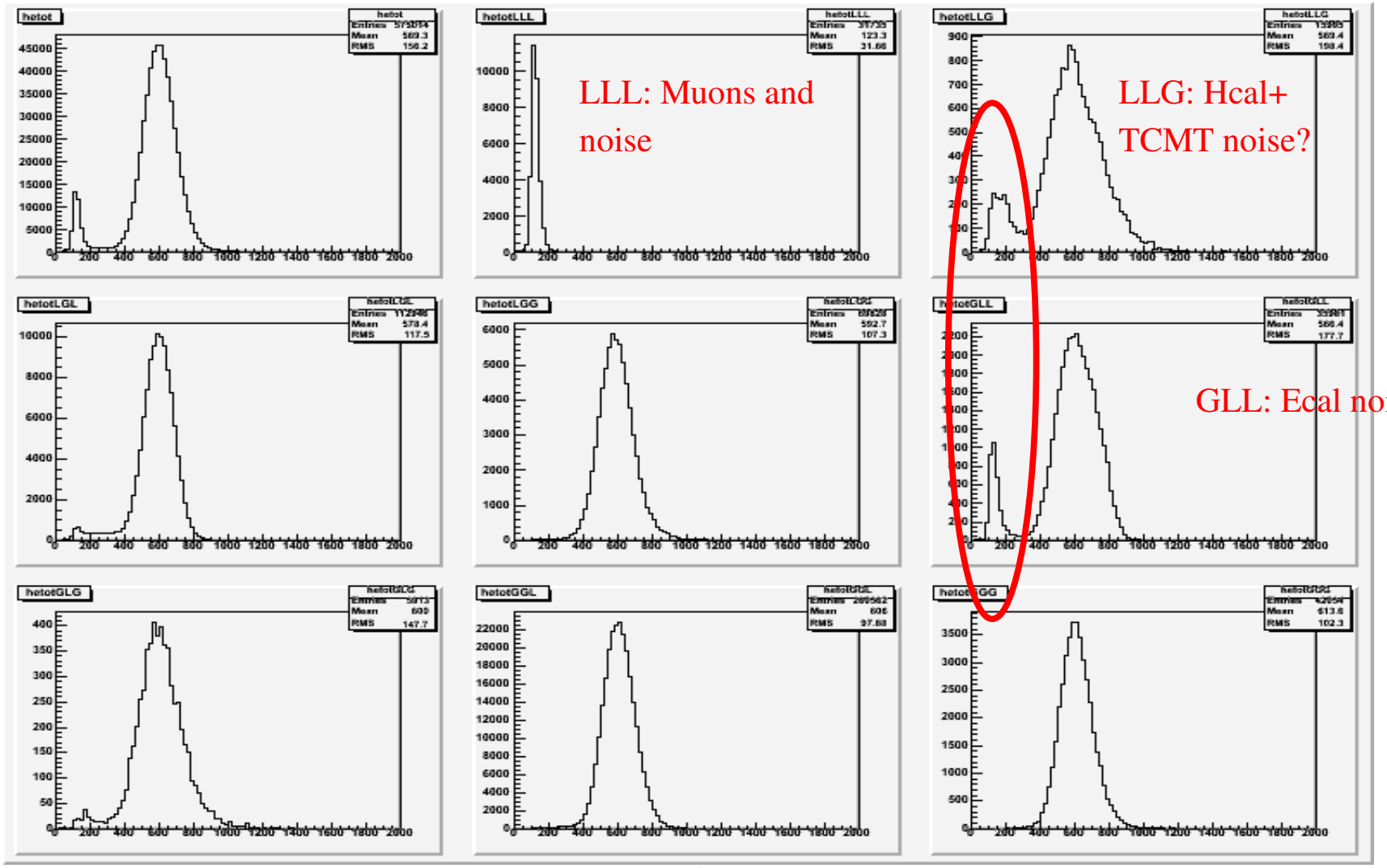
Statistics

	------ 20 GeV pions --------				---- Muons -----	
	Run300620	(%)	MC	(%)	Run300777	(%)
LLL	31735	(5.52)	3	(0.03)	185083	(80.48)
GLL	35981	(6.26)	348	(3.81)	3616	(1.57)
GGL	260562	(45.31)	4232	(46.38)	484	(0.21)
GGG	42054	(7.31)	962	(10.54)	55	(0.02)
LGG	69828	(12.14)	1572	(17.23)	2453	(1.07)
LLG	15995	(2.78)	264	(2.89)	19249	(8.37)
LGL	112946	(19.64)	1650	(18.08)	18609	(8.09)
GLG	5913	(1.03)	93	(1.02)	429	(0.19)
Total	575014		9124		229978	

- Efficiency ~ (100-0.03)% = 99.97%
- Muon rejection > 80.5% (noise in data sample?)

No digitized MC muon sample available yet :-(

20 GeV pions – run 300620



Updates to digitization

- Detailed MC vs. data comparisons, for different topologies.
  - TCMT digitization includes readout smearing and average crosstalk
  - Correction for saturation effects (Kurt) to be included soon
  - Latest updates to Hcal ganging and digitization
    problems in local installation prevented the availability of new results for this presentation.

Summary

- Current studies show that a simple LLL algorithm for muon tagging is about 99.97% efficient for 20GeV pions, while rejecting at least 80% of the muons from pion decays.
- Next steps:
  - Improve muon/noise rejection at GLL and LLG?
  - Install Hcal digitization software locally for a MC muon sample, or get such a sample from official production
  - Updates to the MC vs. data comparisons
  - Port Directed Tree clustering algorithm to Marlin / C++