



Comparison between PFlow algorithms using ZHH channel

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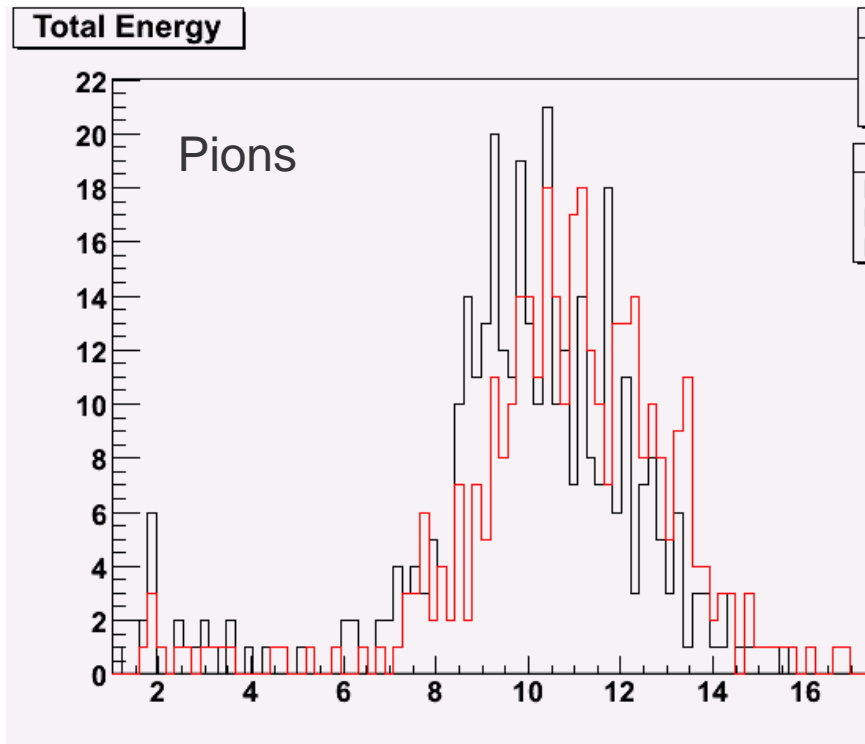
Manchester
CALICE-UK Meeting
3 November 2006

- ZHH Channel, summary of reconstruction and software used.
- Check of calibration constants
- Comparison between ClusterWise+Wolf and Pandora.
- Conclusions

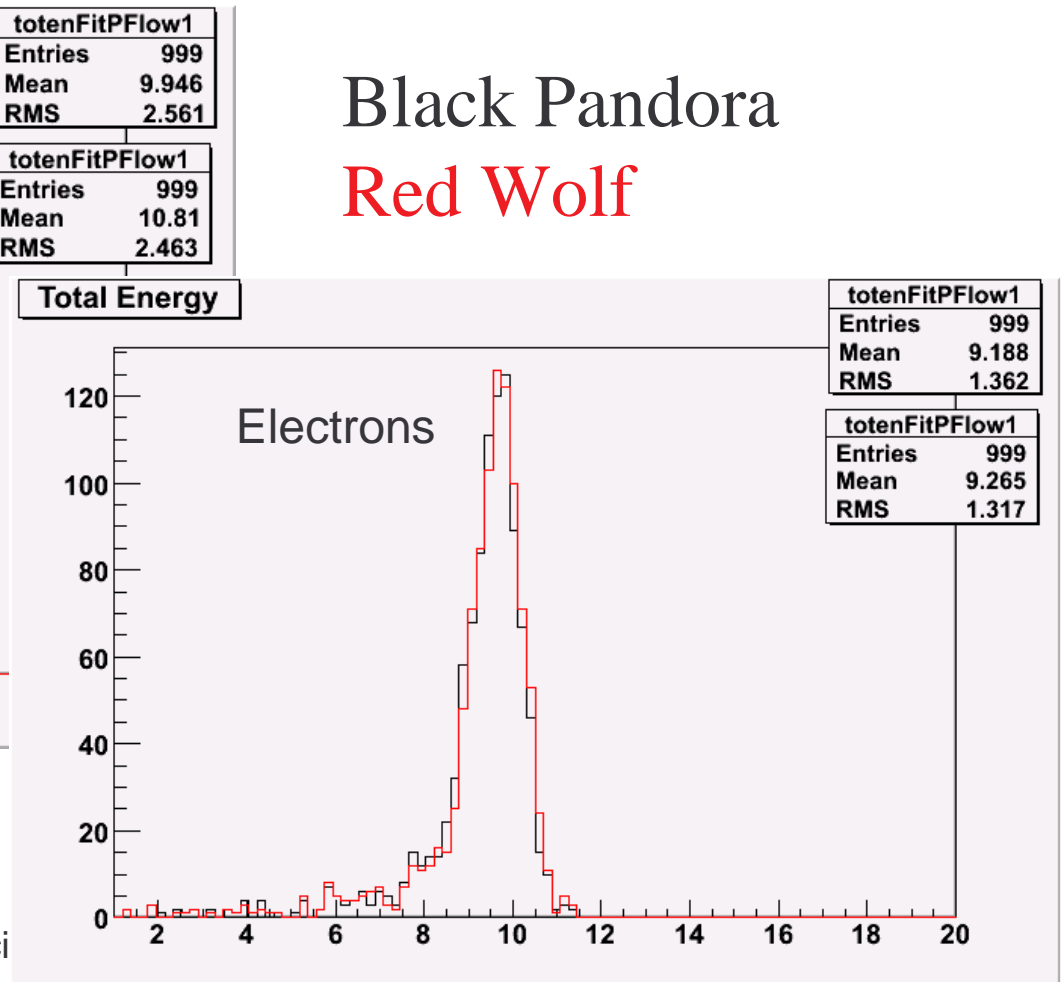
- ZHH is an excellent benchmark for all detectors thus can be used to compare PFlow algorithms performances.
- Some information:
 - $E_{\text{CM}} = 500 \text{ GeV}$
 - $M(\text{Higgs}) = 120 \text{ GeV}$
 - Polarized 80% electron beam
 - Two detector model (LDC00Sc and LDC01Sc)
 - $Z \rightarrow \mu^+ \mu^-$ (muons and electrons)

- Marlin 0.9.4 with MarlinReco 0.2
 - Processors used:
 - VTXDigi
 - FTDDigi
 - SimpleCaloDigi
 - TPCDigi
 - CurlKiller
 - LEPTracking
 - TrackwiseClustering
 - Wolf
 - PairSelector
 - SatoruJetFinder
 - BosonSelector
 - MyROOTProcessor & analysis
- } Trackcheater
- } PandoraPFA

- Need to check calibration for pions and electrons

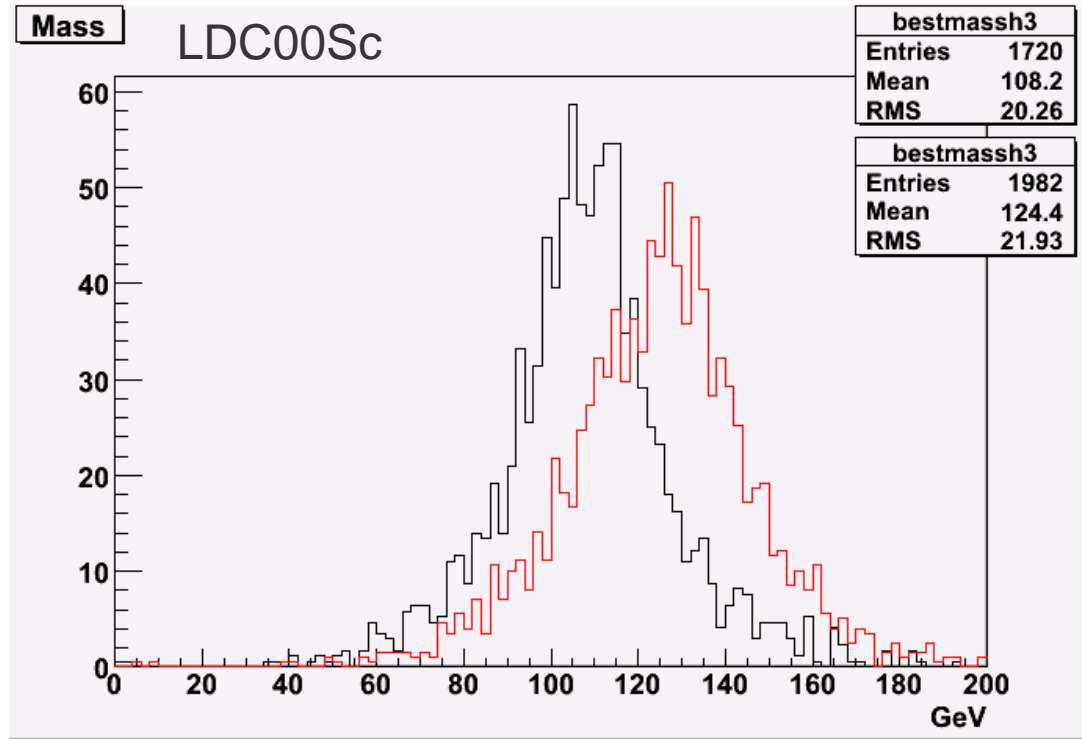


LDC01Sc

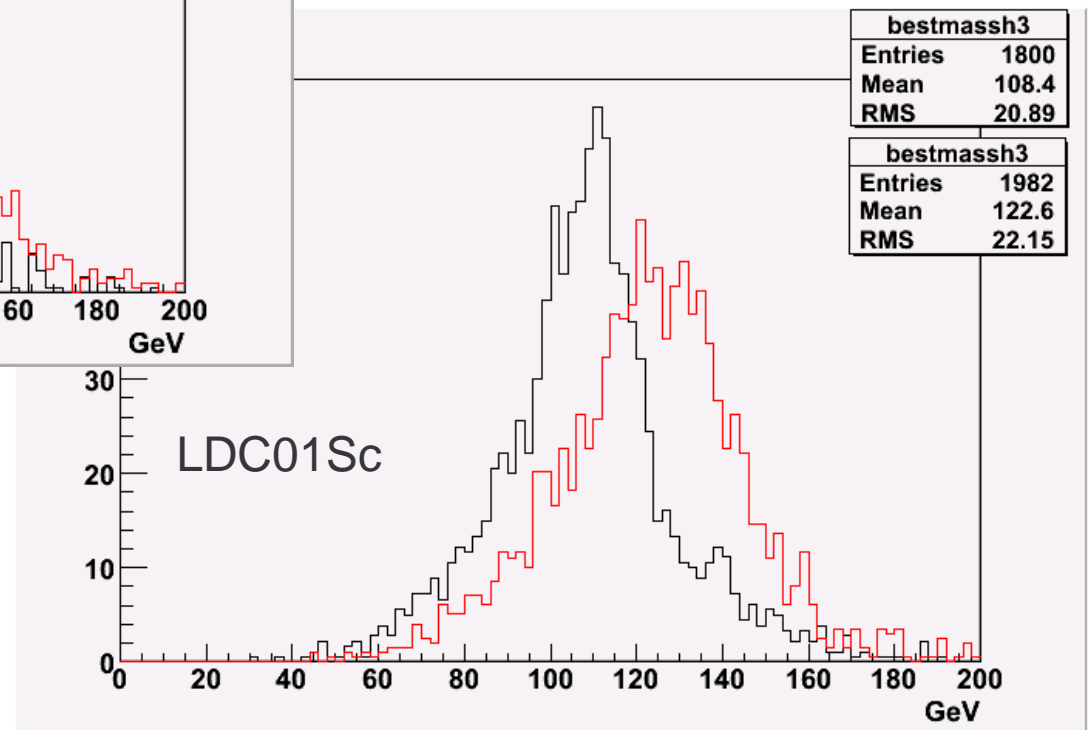


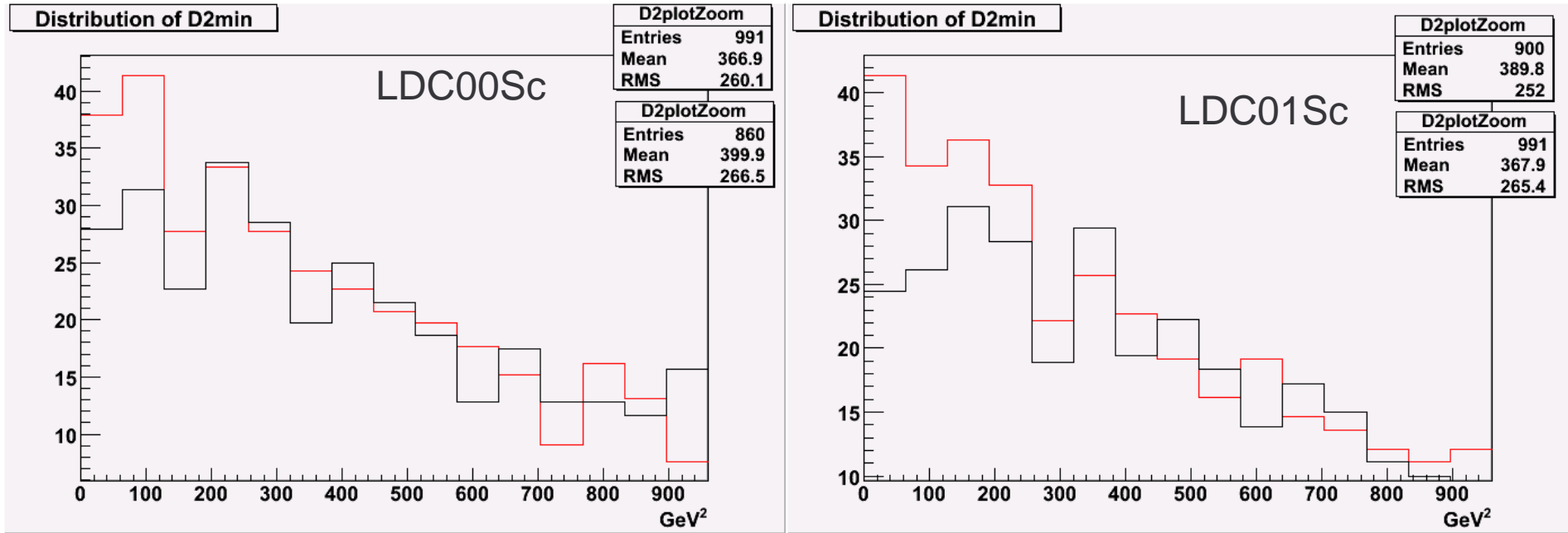
- Look for two leptons to reconstruct the Z.
- Combine all the other particles in 4 jets.
- Reconstruct the two Higgs minimizing the quantity $D_h^h = \left(m_{21}^h - m_{22}^h \right) + \left(m_{34}^h - m_{35}^h \right)$.
- Look at different variables to compare the two algorithms:
 - # and energy of neutral particle
 - Look at ECAL and HCAL separately
 - D^2 and other combinations of H masses

Higgs Mass



Black Pandora
Red Wolf



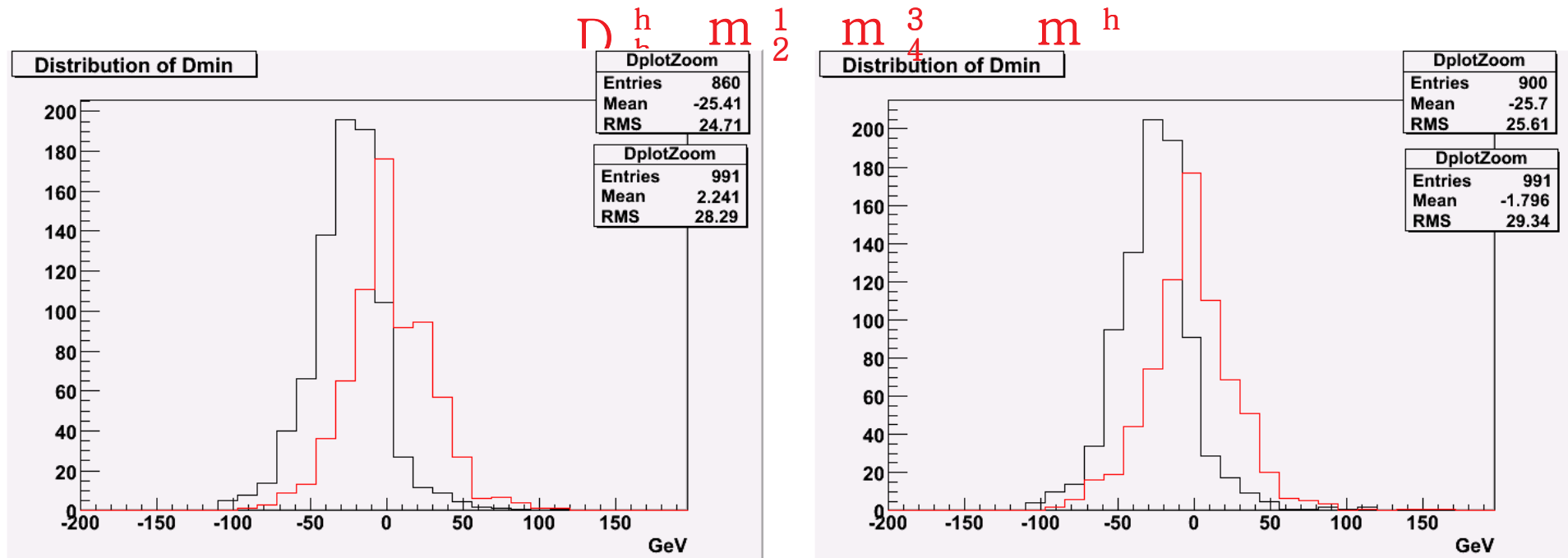


- Plot of $D_h^2 = \left(\frac{m_1}{2} - m_h^2 \right) + \left(\frac{m_3}{4} - m_h^2 \right)$

Black Pandora
Red Wolf

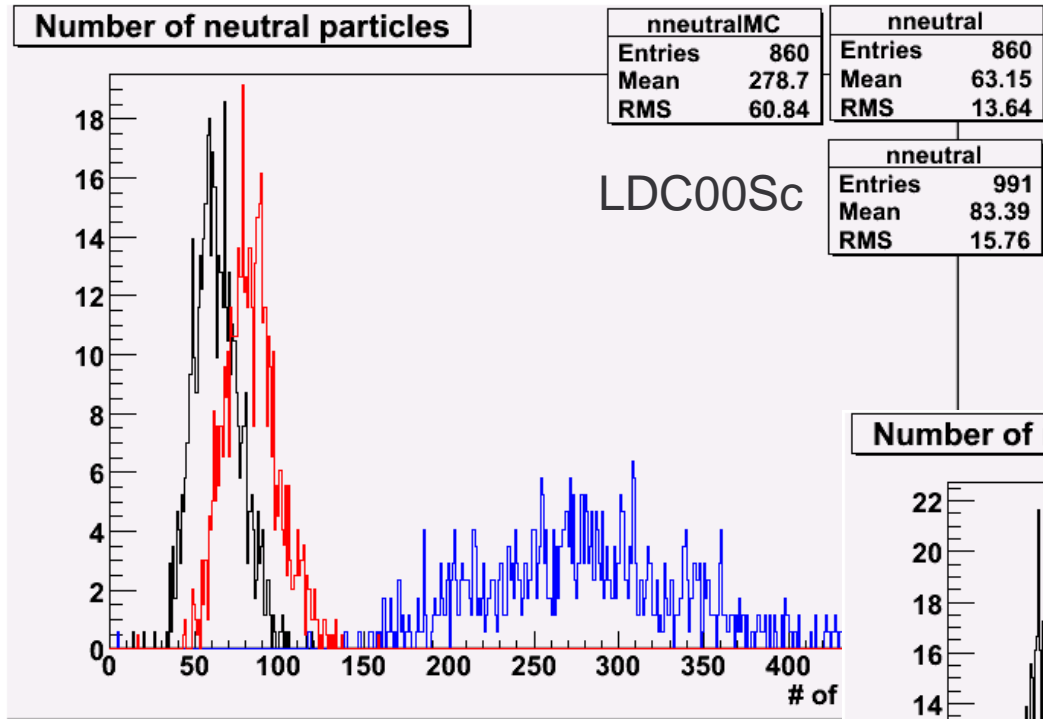
D plot

- D is defined as $D = m_h + m_{\frac{1}{2}} - 2 * m_{\frac{3}{4}} + m_h$

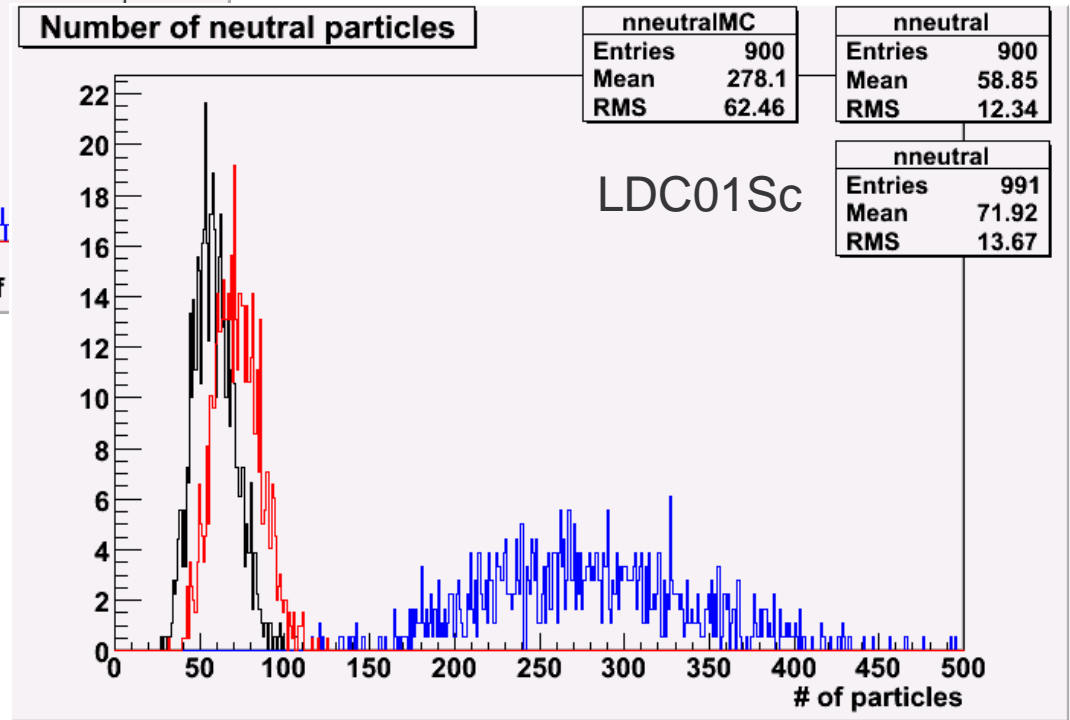


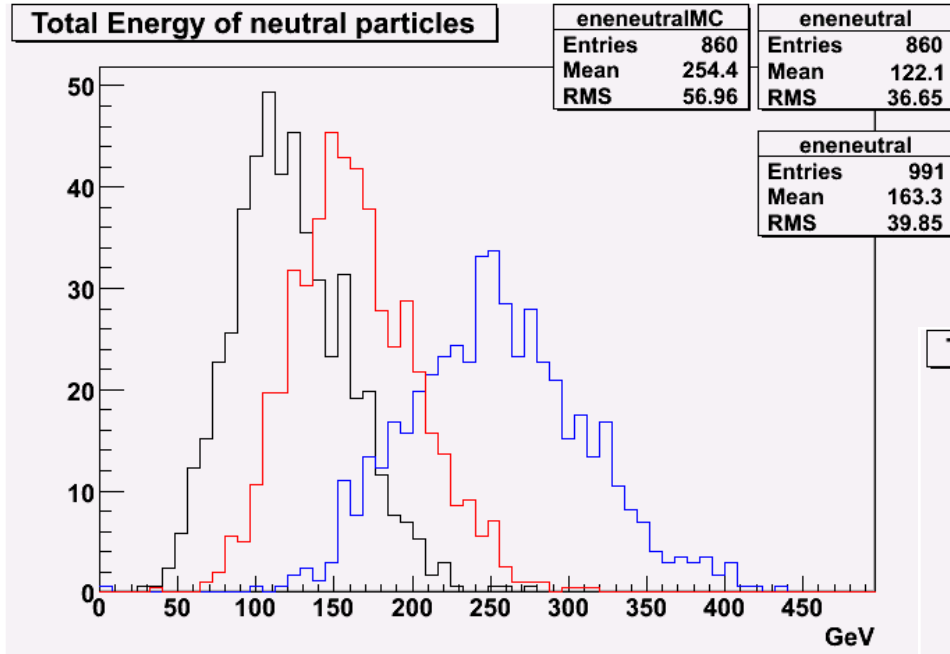
Black Pandora
Red Wolf

of neutral particles

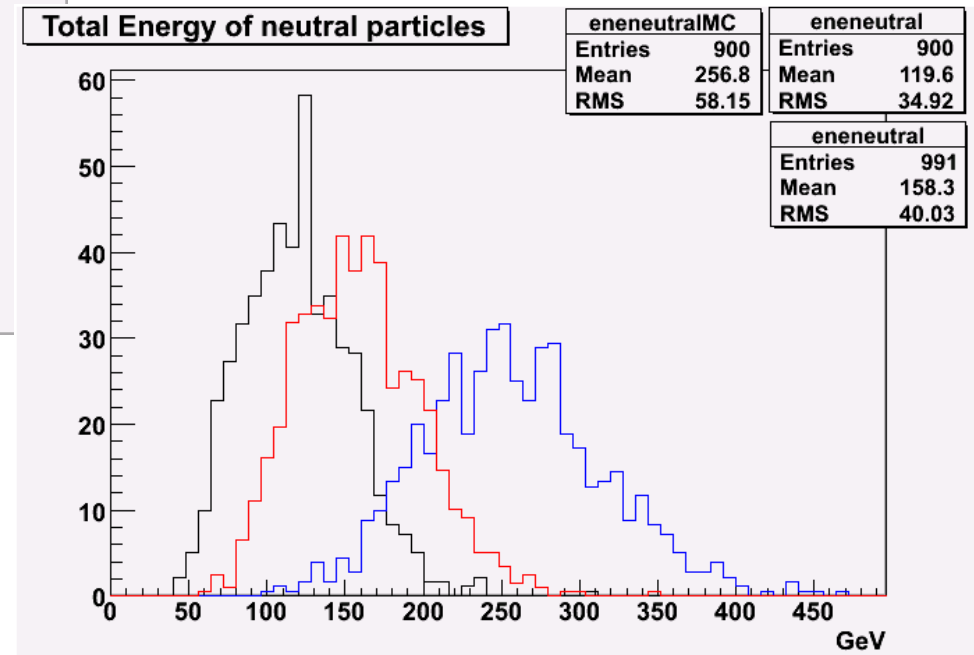


Black Pandora
Red Wolf

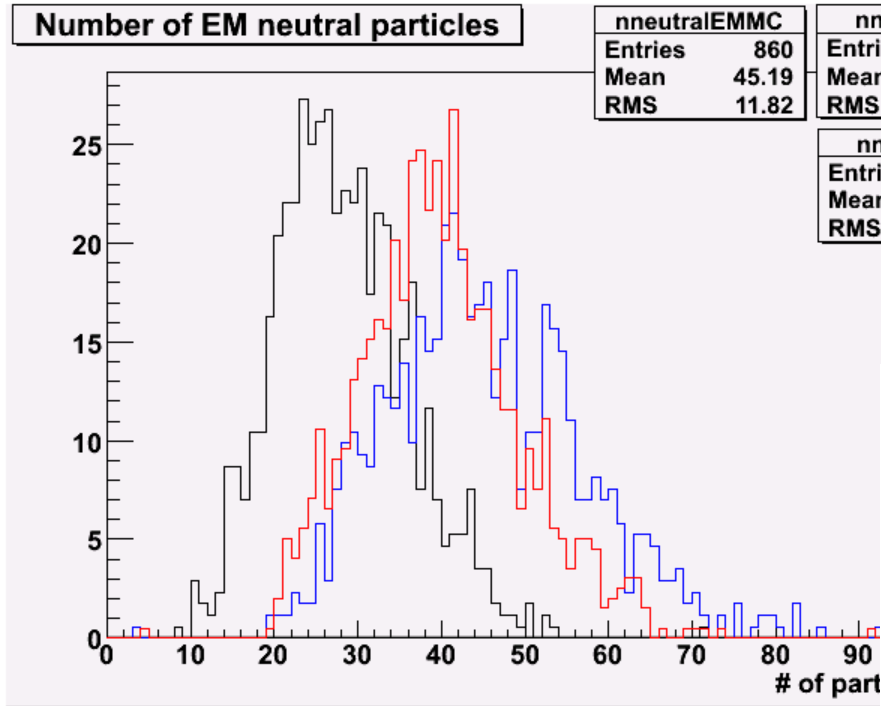




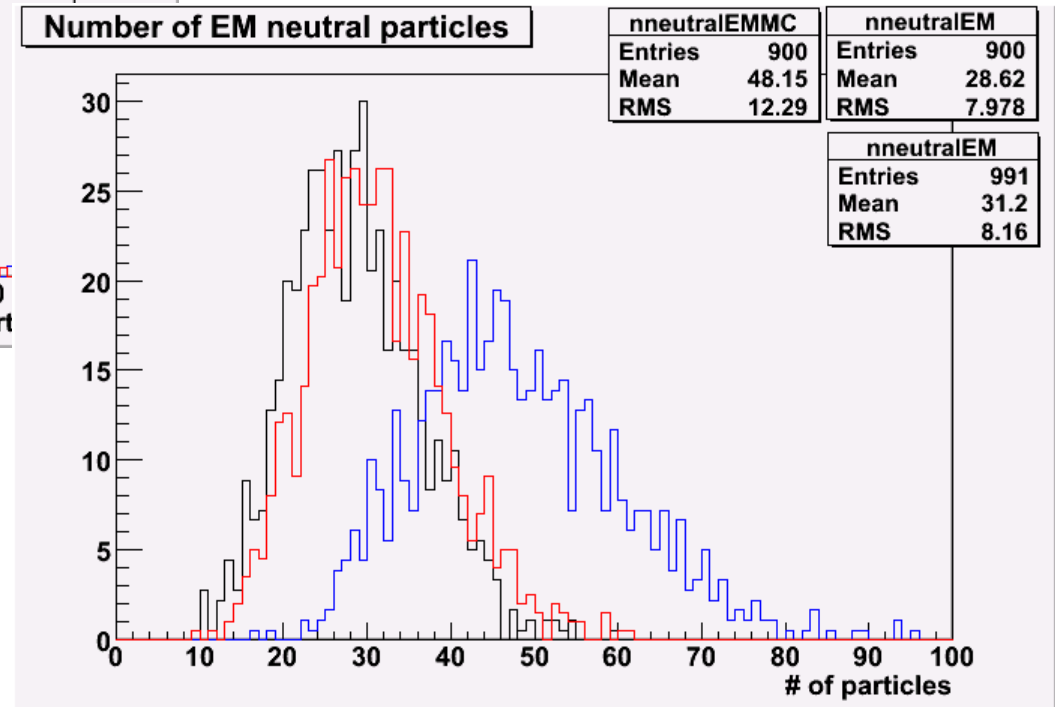
Black Pandora
Red Wolf

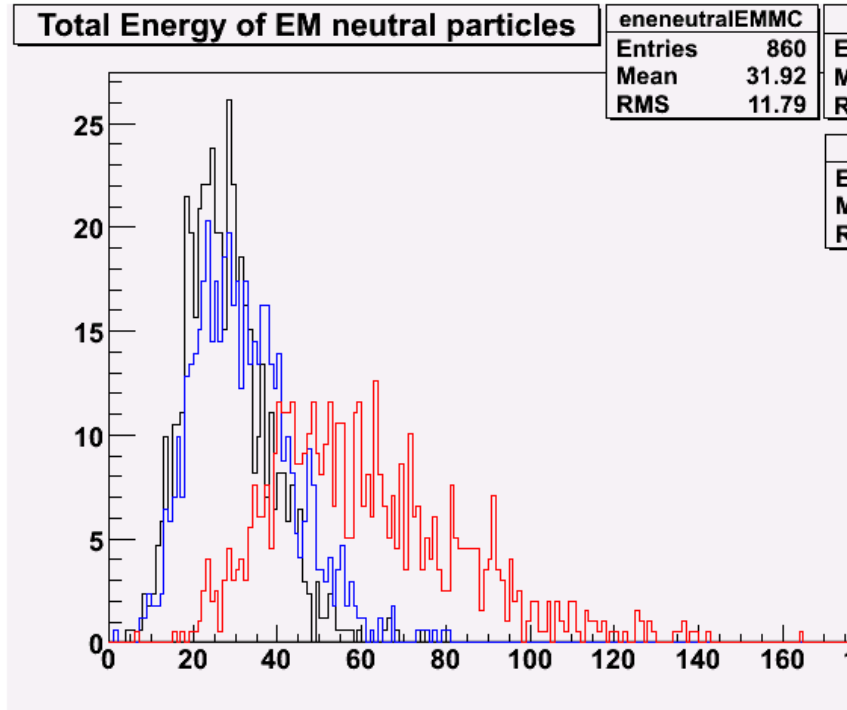


of EM neutral particles

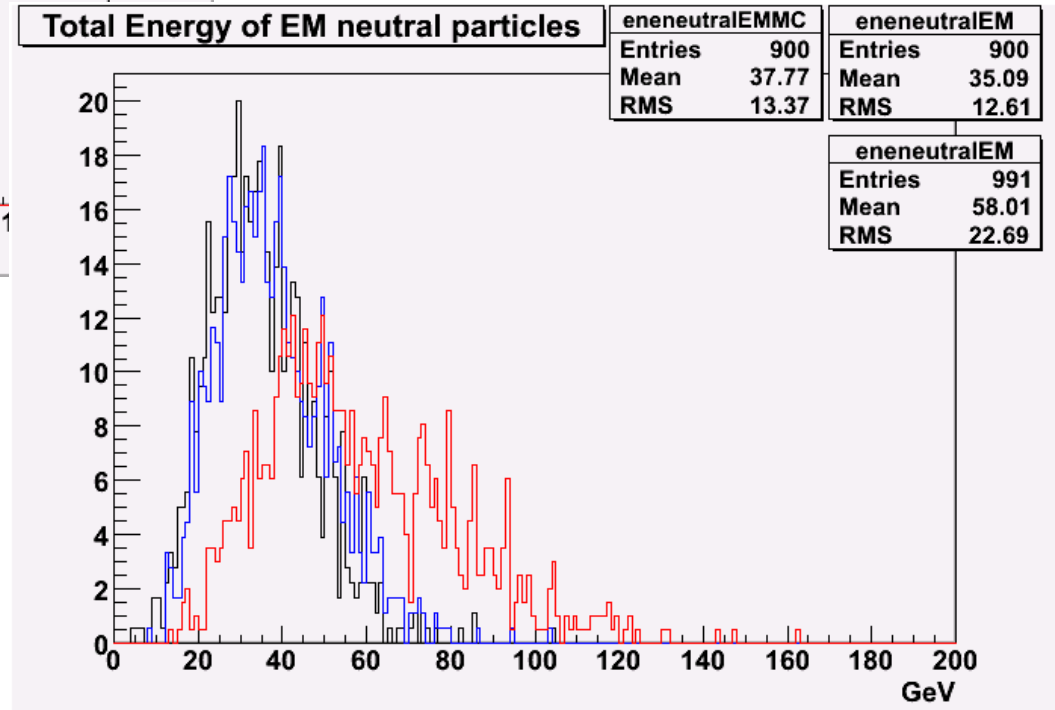


Black Pandora
Red Wolf



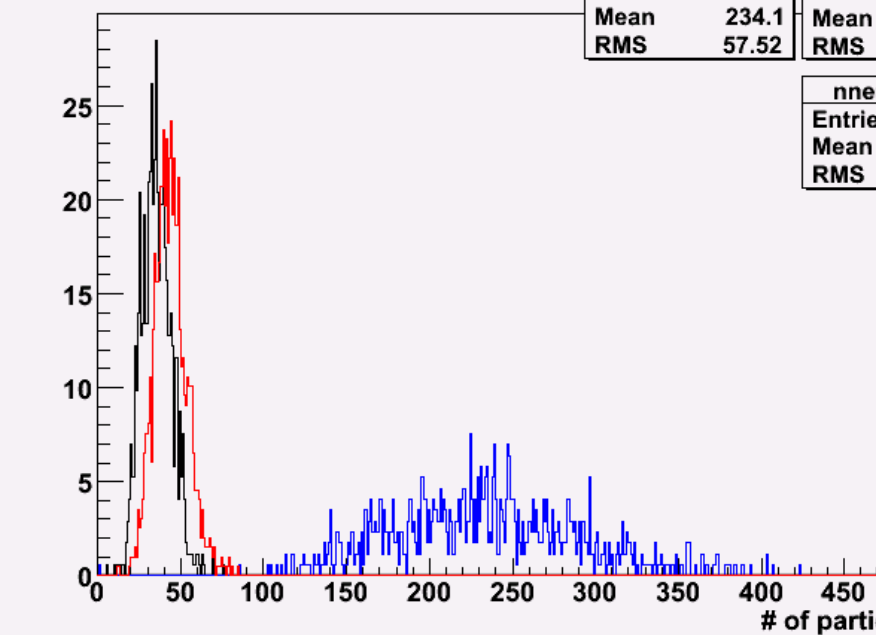


Black Pandora
Red Wolf



of HAD neutral particles

Number of HAD neutral particles

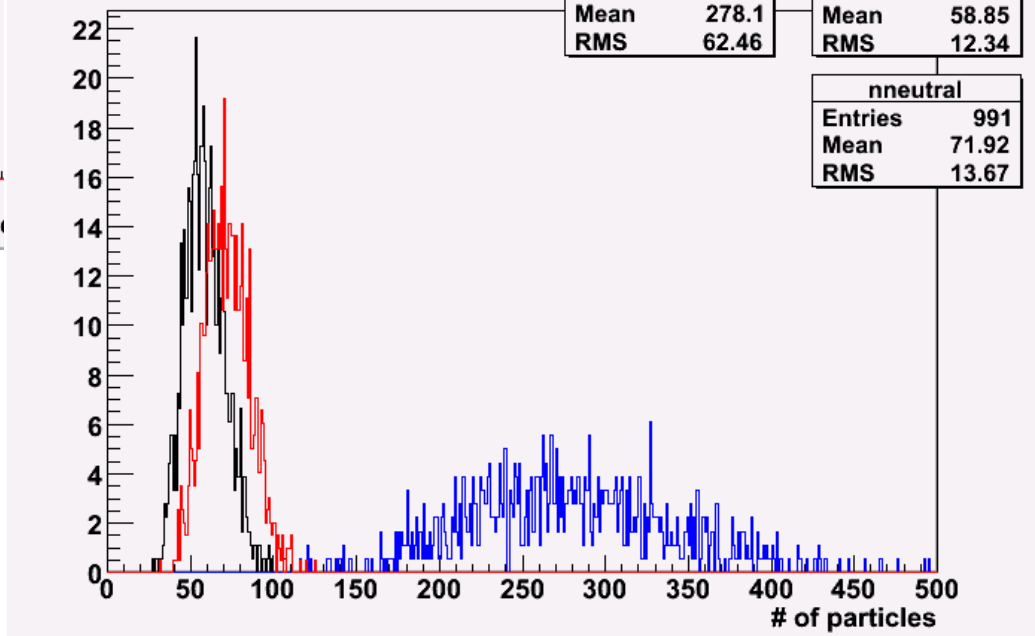


nneutralHADMC	nneutralHAD
Entries 860	Entries 860
Mean 234.1	Mean 35.46
RMS 57.52	RMS 9.048

nneutralHAD
Entries 991
Mean 44
RMS 9.956

Black Pandora
Red Wolf

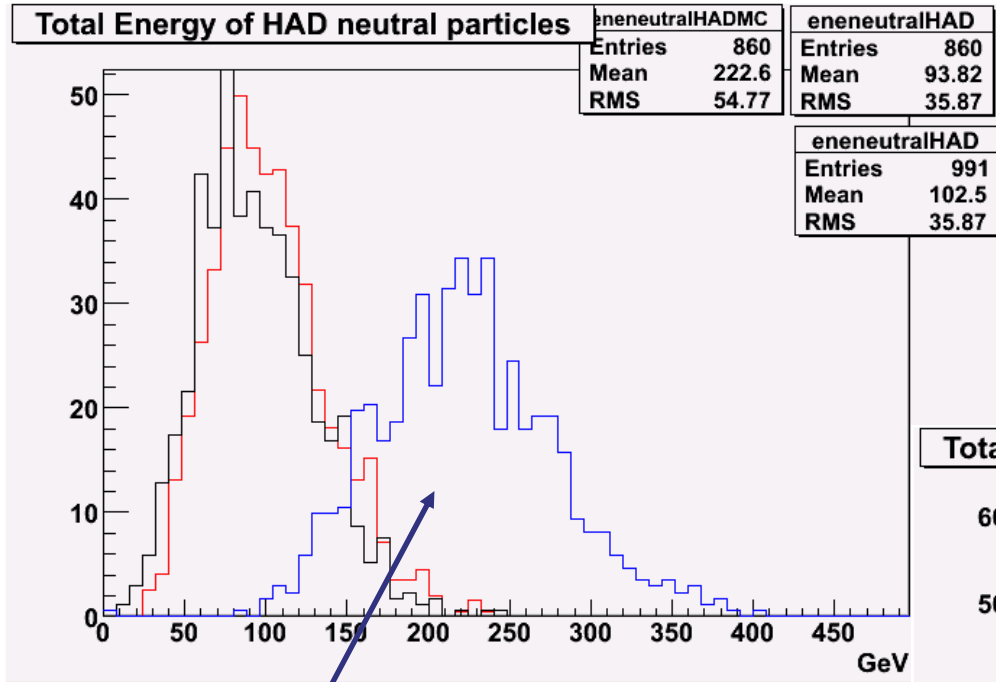
Number of neutral particles



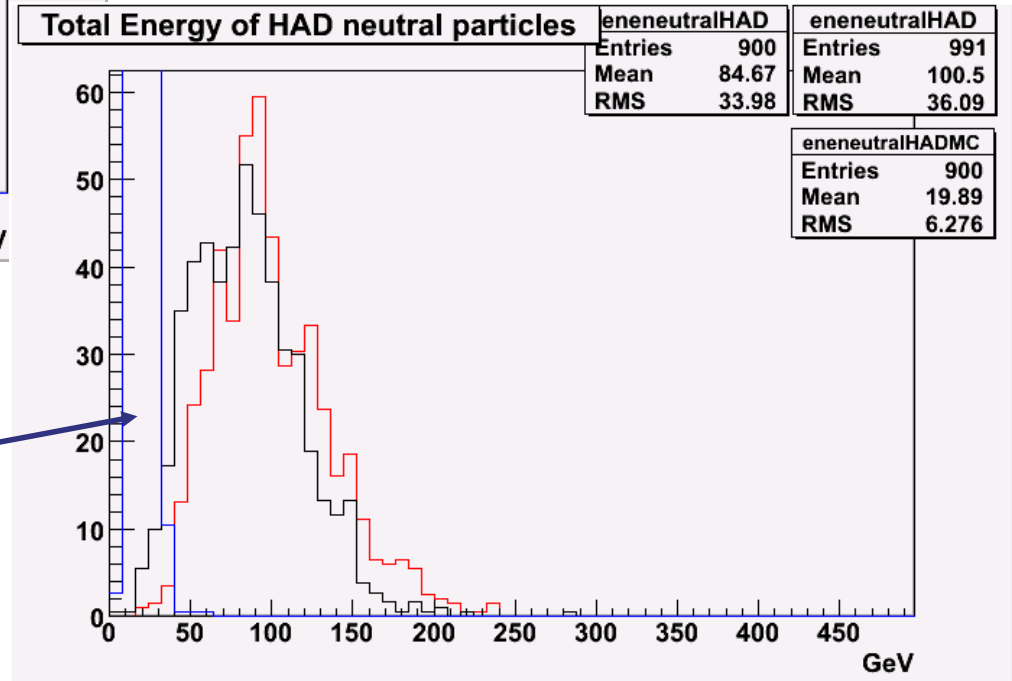
nneutralMC
Entries 900
Mean 278.1
RMS 62.46

nneutral
Entries 900
Mean 58.85
RMS 12.34

nneutral
Entries 991
Mean 71.92
RMS 13.67

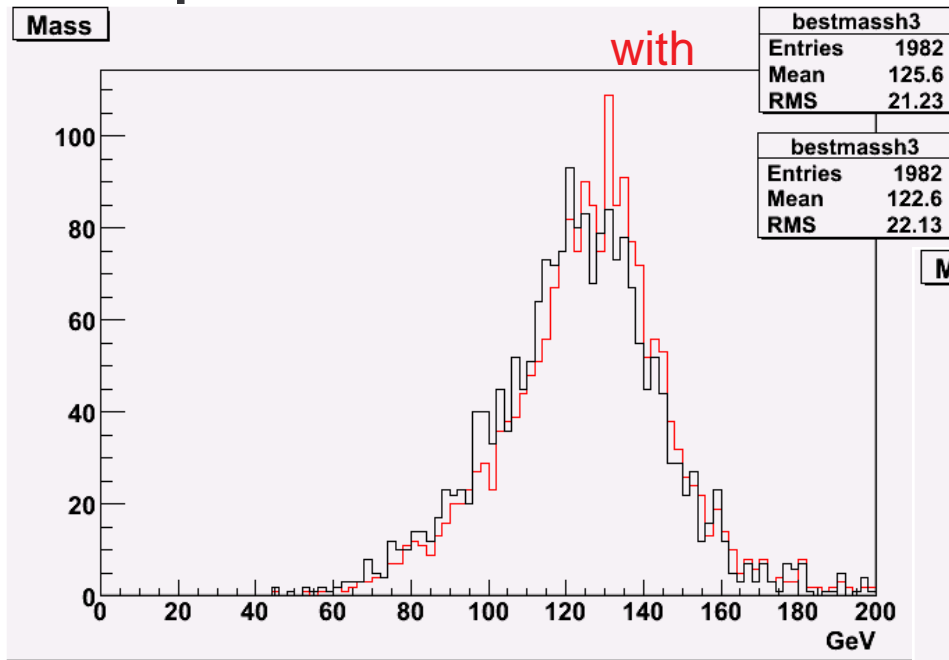


- MC selection:
- 0 daughters
 - Energy > 20 MeV



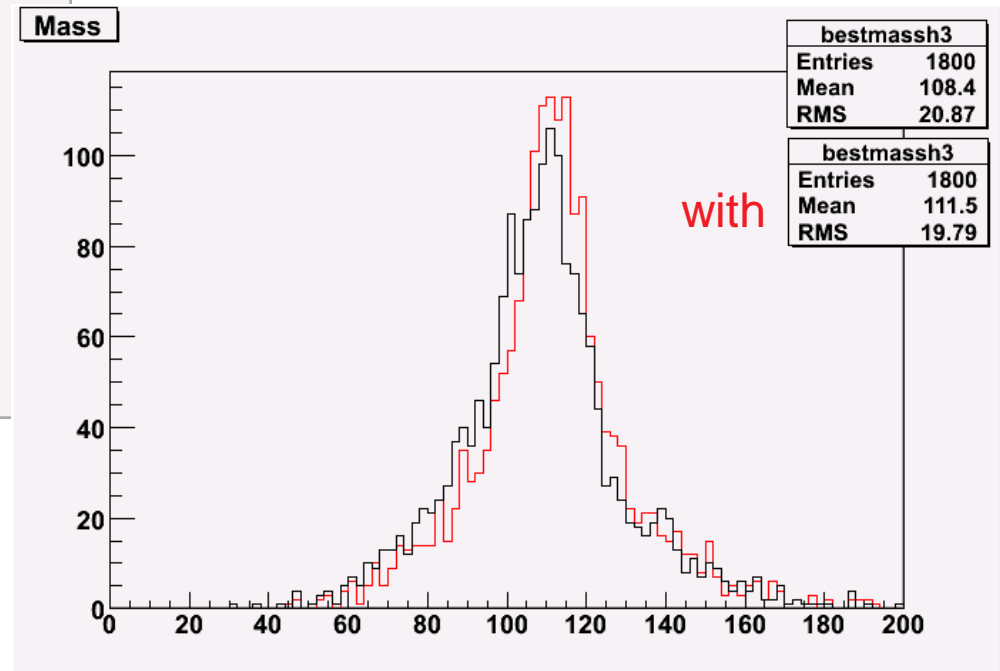
Black Pandora
Red Wolf

- Neutrinos from MC are added to the list of particles in Satoru JetFindingAlg.



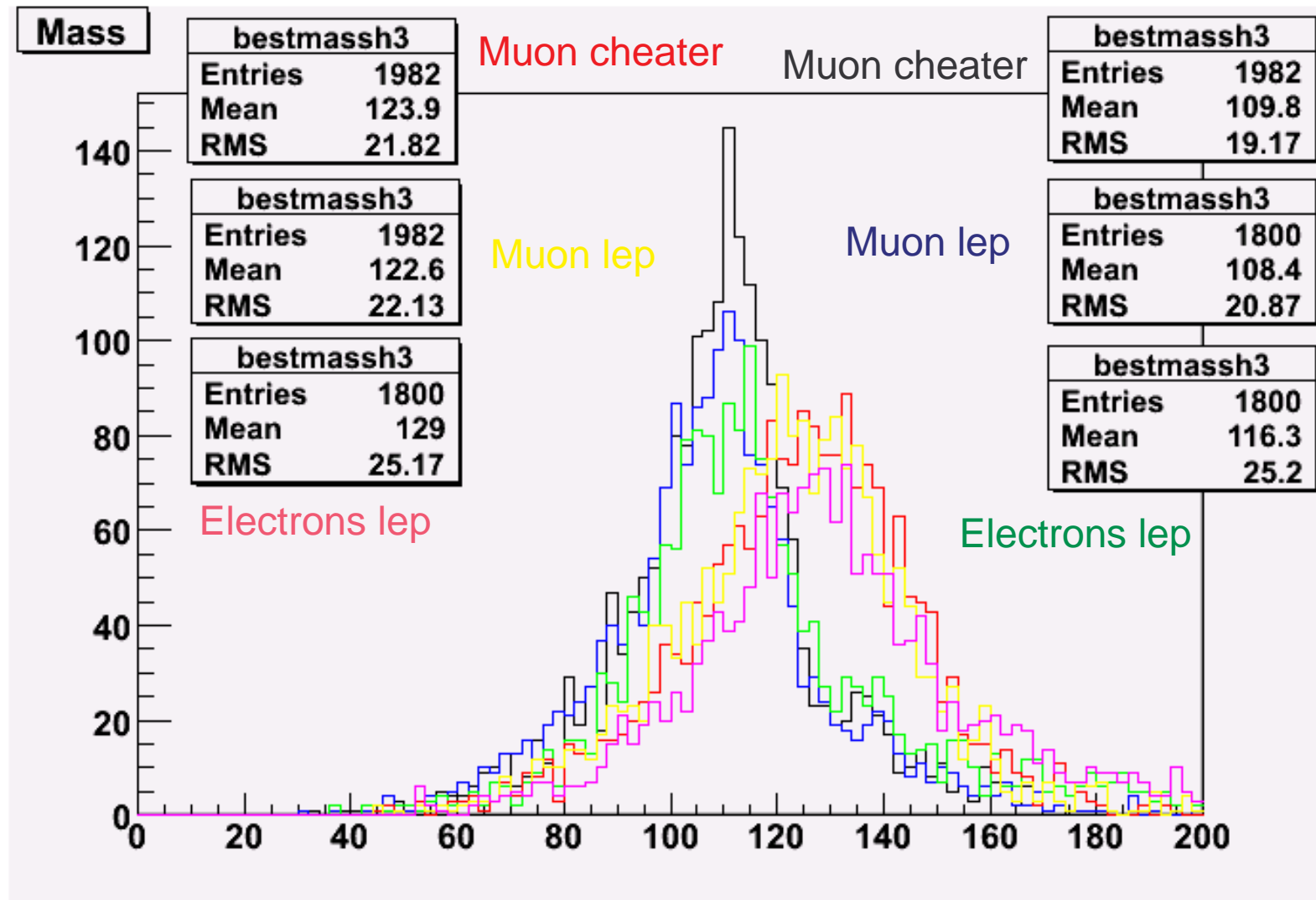
LDC01Sc

Black: normal reconstruction
Red: with neutrinos



WOLF

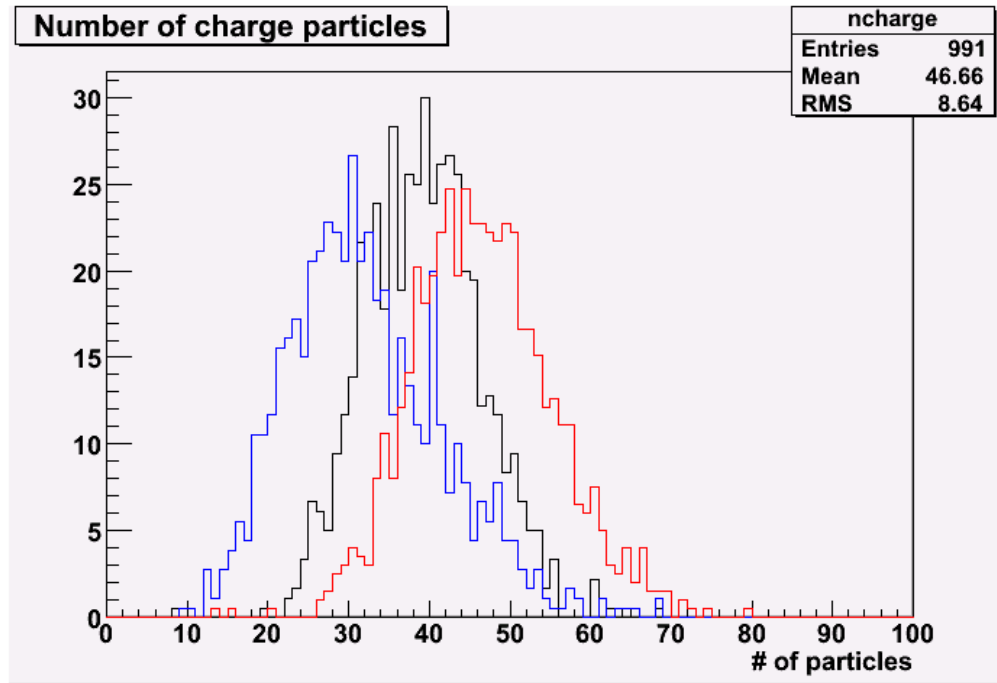
PANDORA



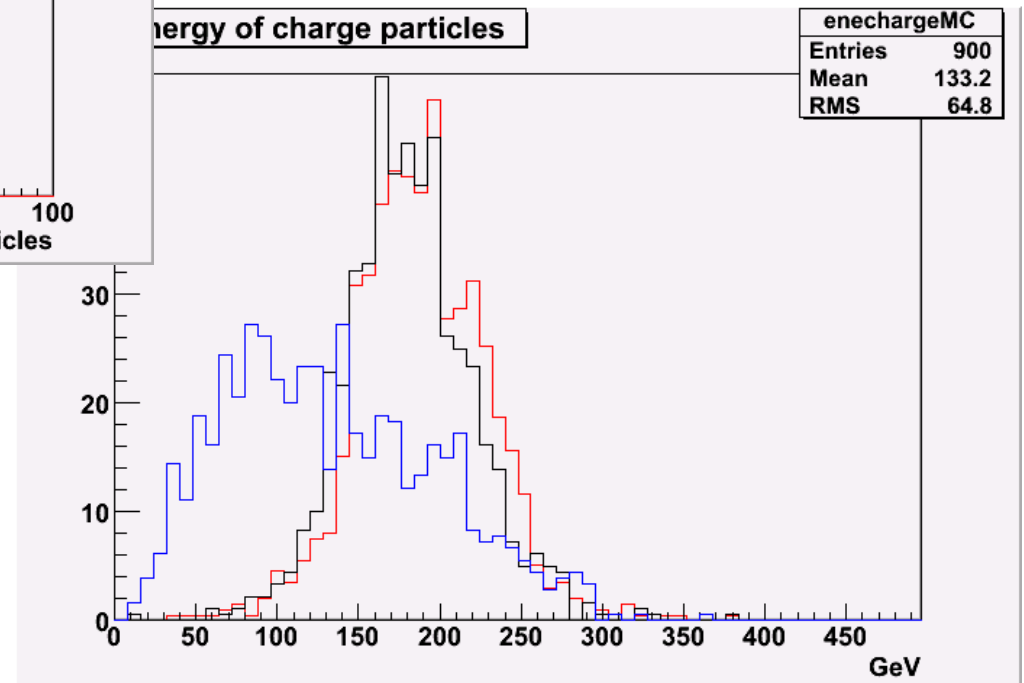
- Pandora is clearly narrower but Wolf is better centered on 120 GeV.
- Neutrinos contribution is ~ 3 GeV on the Higgs mass.
- Problems with MC, it's difficult to obtain the true information. More work needed to select the correct MC Particles.
- EM total energy is the crucial difference between Pandora and Wolf, Pandora is much closer to MC (but is it correct?)
- Results confirmed using cheater and for $Z \rightarrow ee$

Backup slides

Charge # and energy



Black Pandora
Red Wolf



Neutrino spectrum

