



# Central Calorimeter E/p Response



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**University of Chicago  
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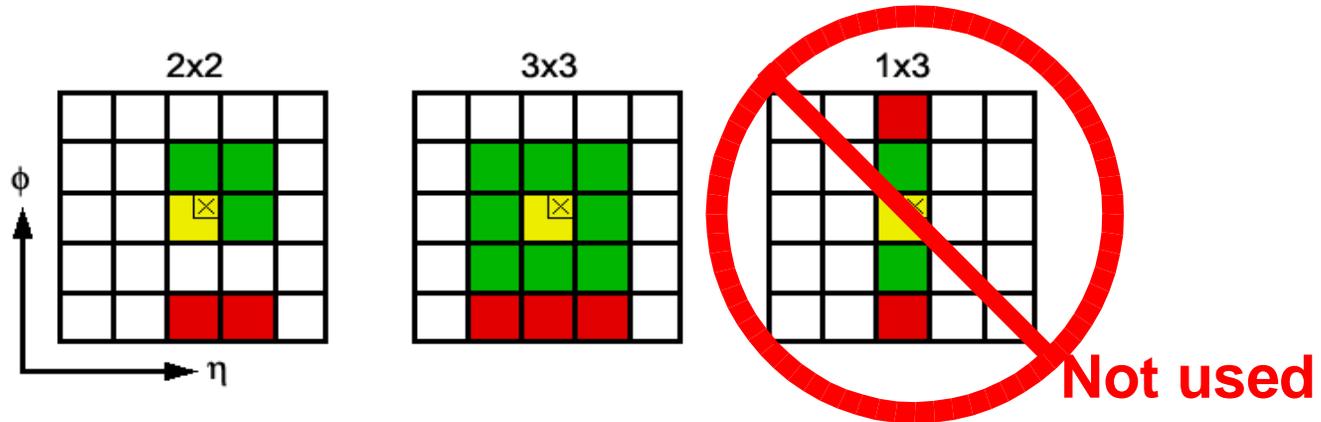


# Introduction

- **What we are doing is measuring the central calorimeter response to single particle isolated tracks.**
  - Isolated in a 7x7 block around the target tower
- **Measure the E/p of each track. P is just the track momentum**
- **For different components of the calorimeter there are different definitions of E.**
  - EM: 2x2 block
  - Hadron: 3x3 block
- **Background energy is defined as the Nx1 strip furthest away from the extrapolation position**
  - EM: 2x1 strip
  - Hadron: 3x1 strip



# A picture is worth...



- The 1x3 strip definition is not used in these histograms
- Color Definitions
  - Target tower in yellow
  - Neighboring towers in green
  - Background towers in Red
  - X marks the track extrapolation position
- Ref: CDF Note 7060



# Data sets

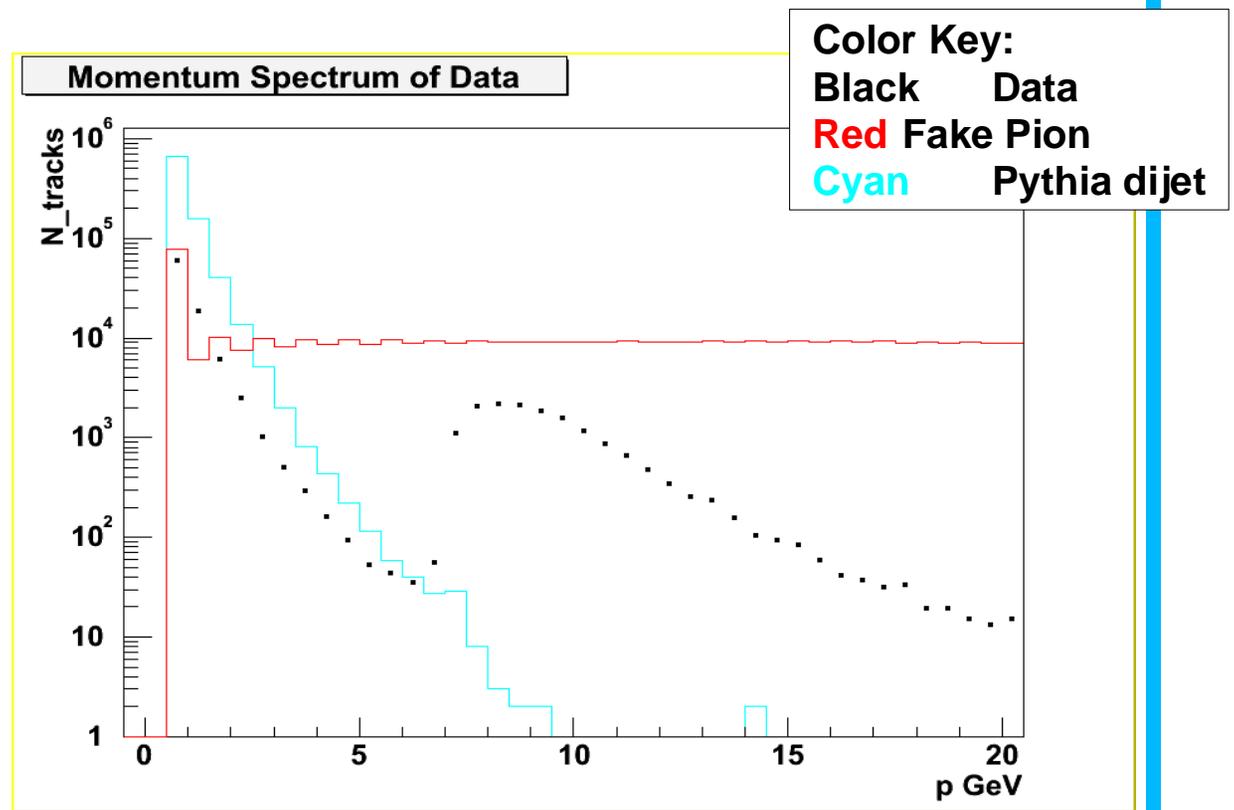


- **We looked at three different types of data**
  - **Special Track Trigger**
    - **Stntuple Fileset: gjtc01** Runs 185598 and 185599
    - **Physics Table: JET\_CALIB\_TEST**
      - **7 GeV Trigger for jet calibration**
      - **L1**
        - **ONE\_TRACK XFT\_CHARGE = 0**
        - **ONE\_TRACK XFT\_LAYERS = 4**
        - **ONE\_TRACK XFT\_PT = 7.11 GeV/c**
      - **L2**
        - **XftTrack DELTA\_PHI0\_MAX = 30 degrees** MIN = 0 degrees
        - **XftTrack NUMBER = 1**
        - **XftTrack TRACK\_ISO\_TYPE = 2**
  - **Fake Pion Data**
    - **Stntuple Fileset: fakpipa**
  - **Pythia Dijet 0**
    - **Stntuple Fileset: pydj000**



# Momentum Spectrum

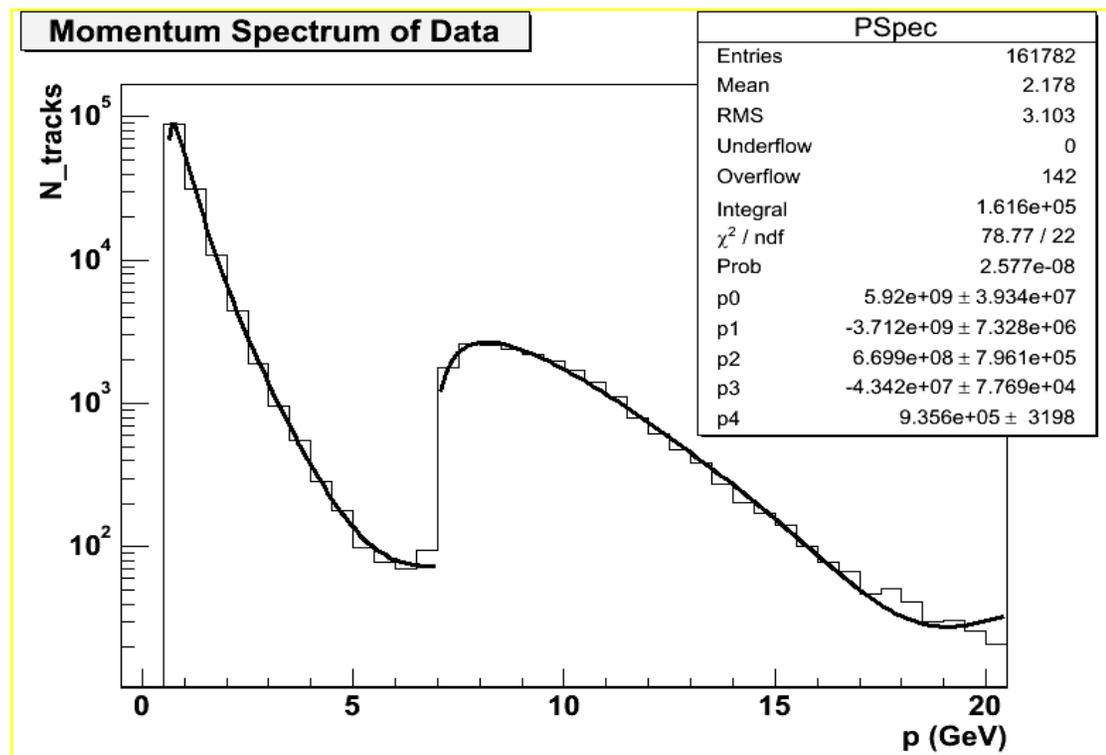
- Momentum Spectrum of the three datasets shown below. The flat momentum fake pion data needs to be weighted.





# Momentum Weighting

- Since the momentum distributions for each of three datasets are very different from one another, the fake pion and Pythia dijet datasets were weighted to the jet calibration data
- Two different fits were made to take into account the 7 GeV trigger turn on.





## More Definitions

- In the following plots Total Energy is just EM + Hadron energies
- Minimum Ionizing Particle (MIP) is the Hadron energy when the EM energy is less than 670 MeV.
- Momentum Bins are defined as follows:
  - 0 All momentum, 0-20 GeV
  - 1 0-3 GeV
  - 2 3-6 GeV
  - 3 6-9 GeV
  - 4 9-12 GeV
  - 5 12-15 GeV
  - 6 15-20 GeV



# Track Cuts

- **The Track must pass...**
  - **Track hit cuts, i.e. COT stereo & axial hits (too many to list)**
  - **Vertex cuts:**
    - **number of vertex = 1**
    - **total number of tracks < 50**
    - **z-vertex < 60**
    - **track  $d_0$  < 1.0** & **track  $z_0$  < 60**
  - **Momentum cuts**
    - **$p > 1.0$  GeV** - To eliminate soft tracks
  - **Isolation cuts**
    - **no other tracks in a 7x7 EM/HAD block**
    - **no extra CES clusters outside  $\Delta R=0.03$**
  - **Contour cut**
    - **Track must enter only the central 81% of the target tower**
  - **Tower cut**
    - **only use target towers 1 through 6** - remove wall and crack regions



# Histogram Layout

- Two type of histograms are being shown.
  - Distribution hists. plot the number of tracks as a function of E/p
  - There are four 'compartments' each with signal and background

Total Energy	EM	HAD	MIP
Signal	Signal	Signal	Signal
Total Energy	EM	HAD	MIP
Background	Background	Background	Background

- Profile histograms plot the E/p vs p
- The layout is similar but we subtract the background from the signal to get the corrected signal
- Pythia error bars are wrong due to weighting and how ROOT defines error bars for Profile histograms

Total Energy	EM	HAD	MIP
Signal & Bkgnd	Signal & Bkgnd	Signal & Bkgnd	Signal & Bkgnd
Total Energy	EM	HAD	MIP
Corrected En	Corrected En	Corrected En	Corrected En



# Histogram Colors

- **Special Track Trigger (gjtc01)**
  - Signal: **Black**
  - Background: **Gray**
- **Fake Pion Events (fakepipa)**
  - Signal: **Red**
  - Background: **Dark Red**
- **Pythia Dijet 0 (pydj000)**
  - Signal: **Cyan**
  - Background: **Blue-Gray**

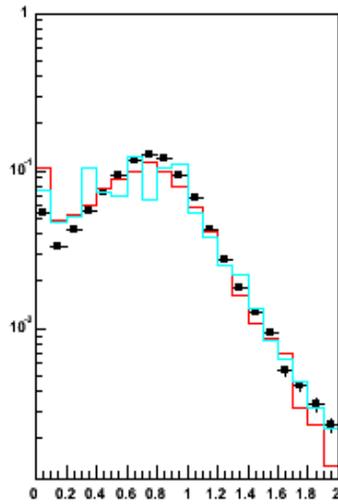


# Histograms

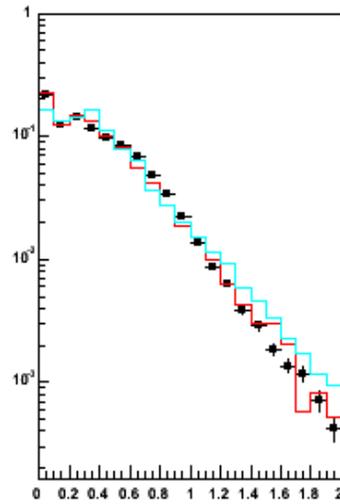
- Histograms are available on a Web page I made. There are multiple directories corresponding to different cuts.
- In each directory there is an AllPlots.ps file which lists the cuts and contains all the histograms
- URL: <http://www-cdf.fnal.gov/~skwang/JetCorrections/>

# Distribution Canvas 0: Momentum Range 0: All

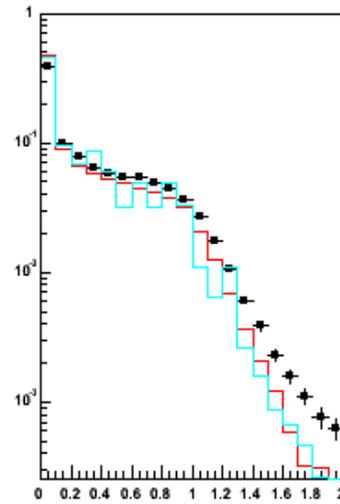
BoP Distribution: Def 1 Comp 0 Mom Range



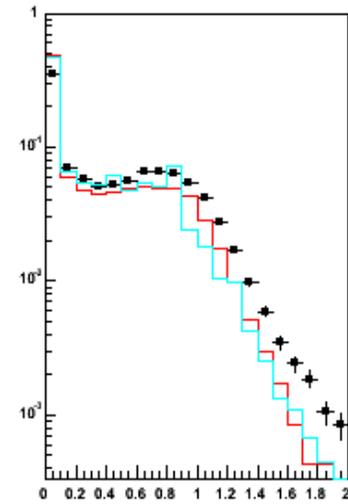
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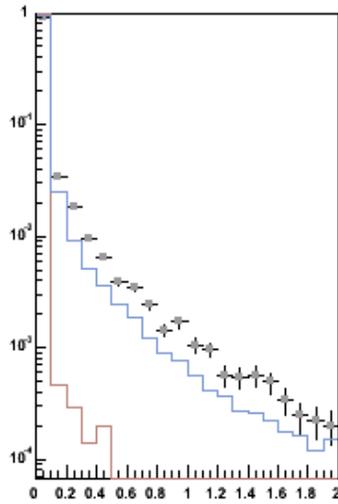
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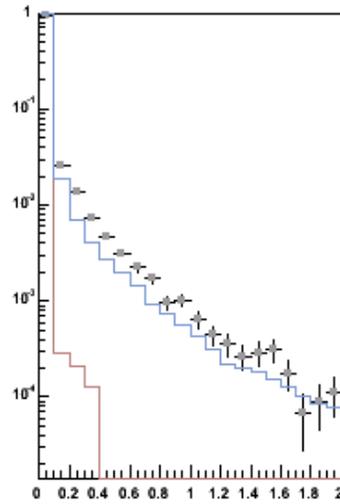
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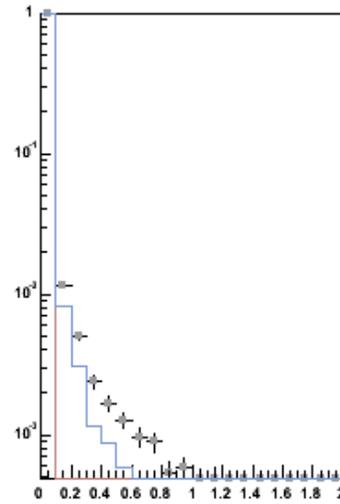
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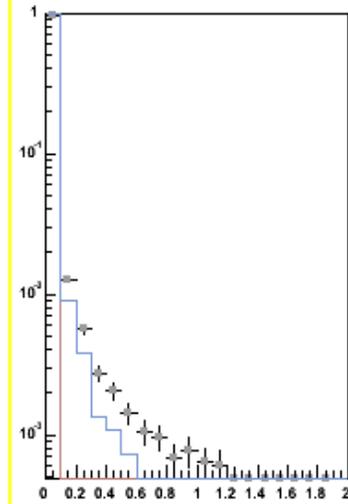
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BoP Distribution: Def 2 Comp 2 Mom Range

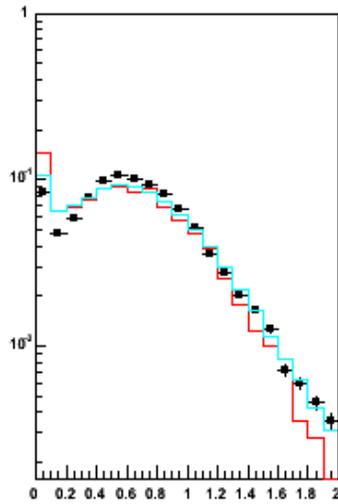


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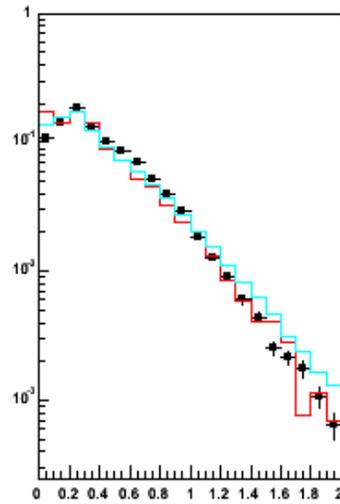


# Distribution Canvas 1: Momentum Range 1: 0 to 3 GeV

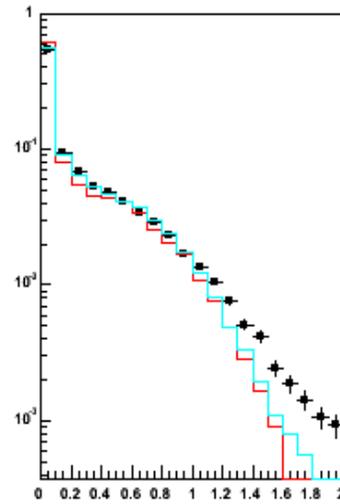
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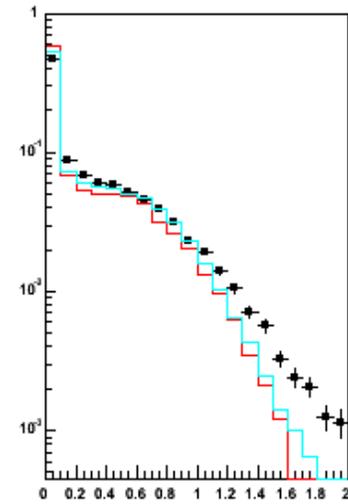
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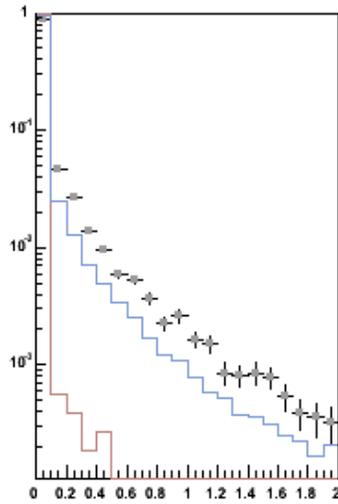
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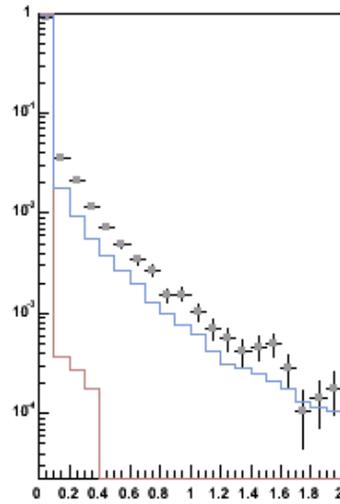
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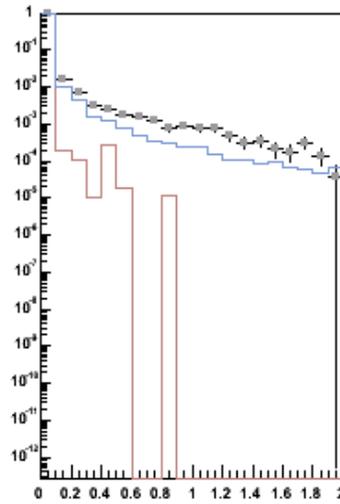
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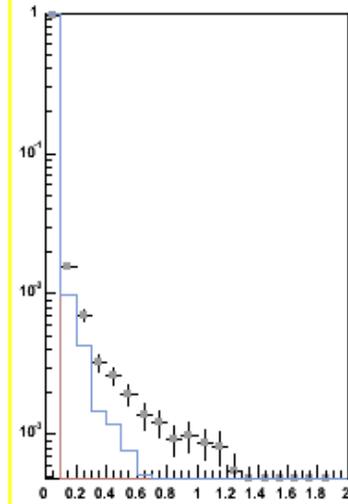
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EtP Distribution: Def 2 Comp 2 Mom Range

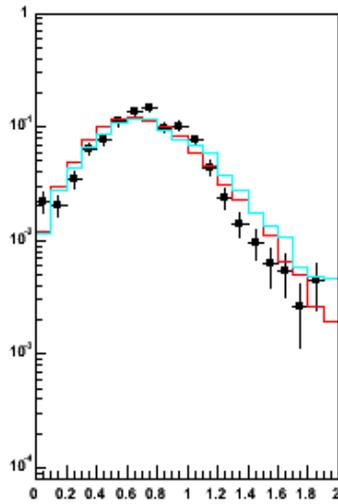


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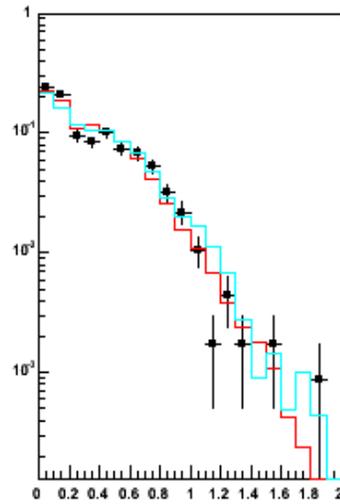


# Distribution Canvas 2: Momentum Range 2: 3 to 6 GeV

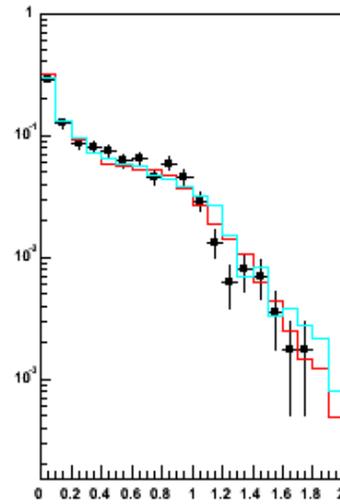
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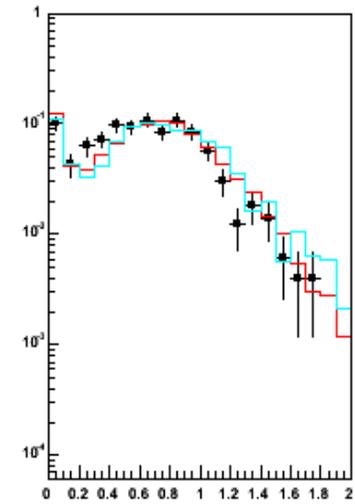
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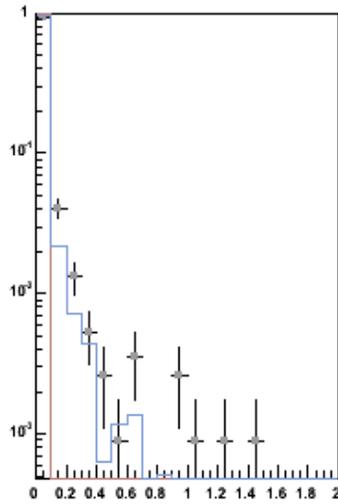
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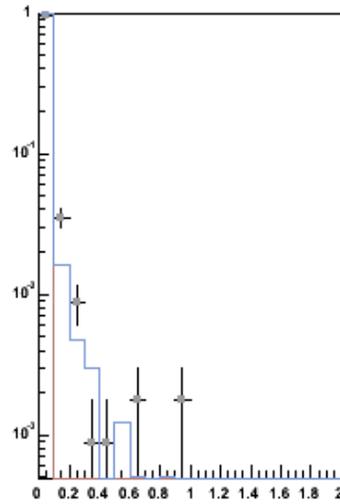
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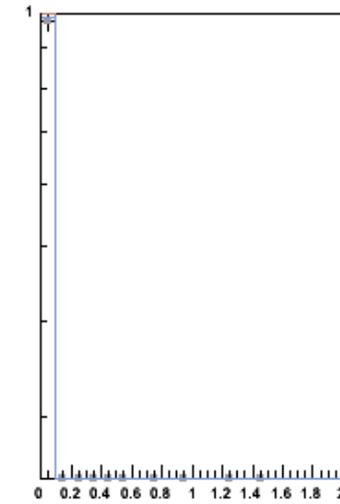
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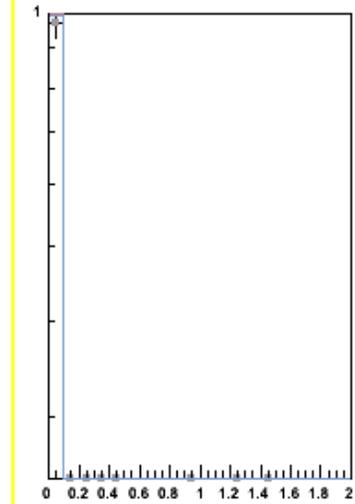
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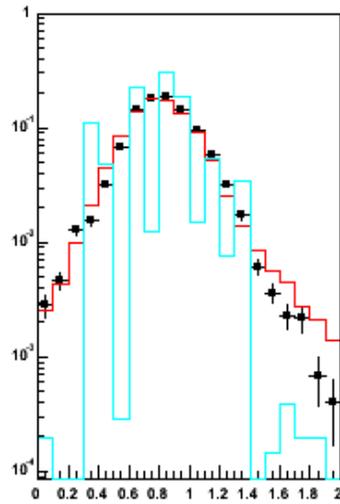


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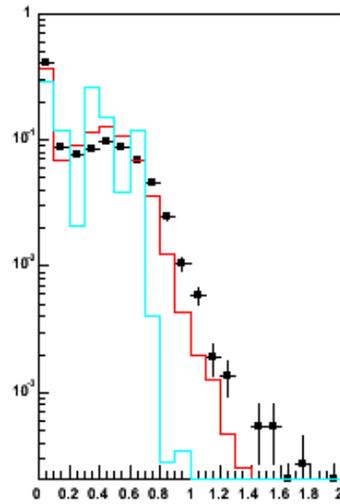


# Distribution Canvas 3: Momentum Range 3: 6 to 9 GeV

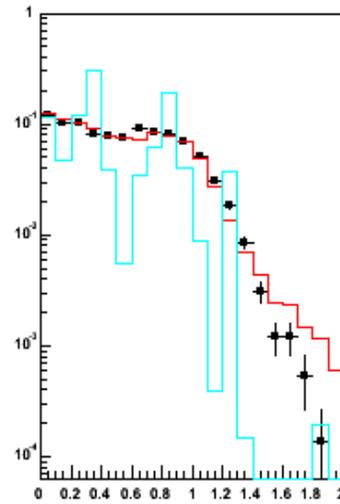
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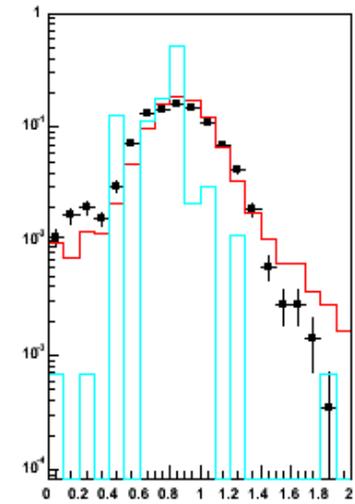
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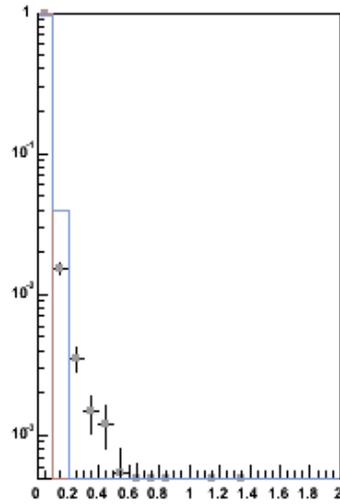
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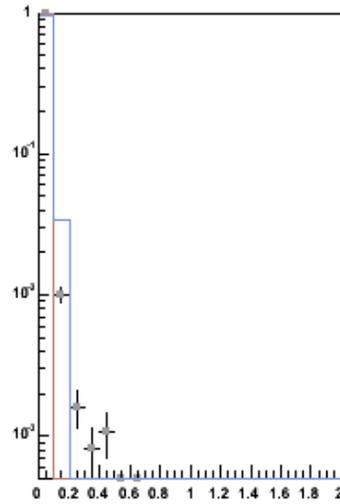
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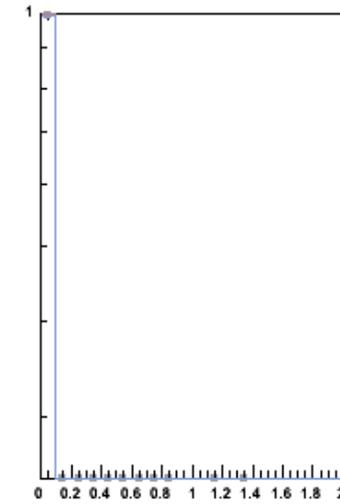
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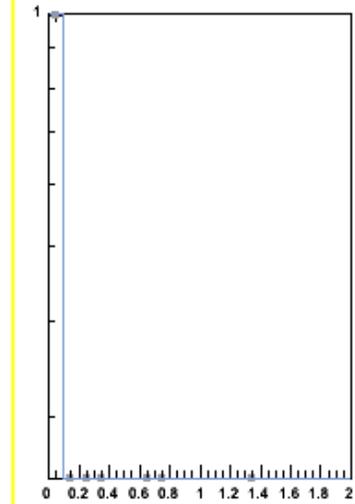
BoP Distribution: Def 2 Comp 1 Mom Range



BoP Distribution: Def 2 Comp 2 Mom Range

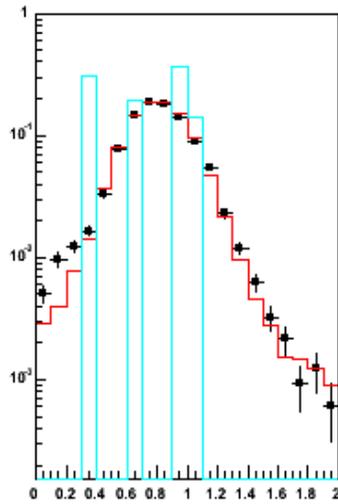


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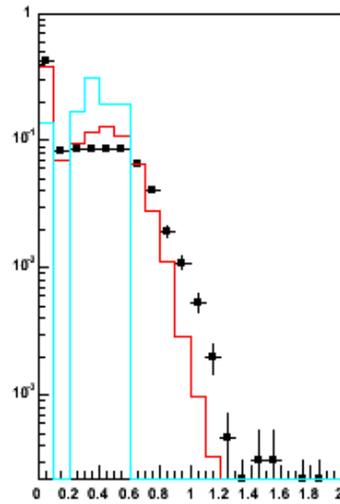


# Distribution Canvas 4: Momentum Range 4: 9 to 12 GeV

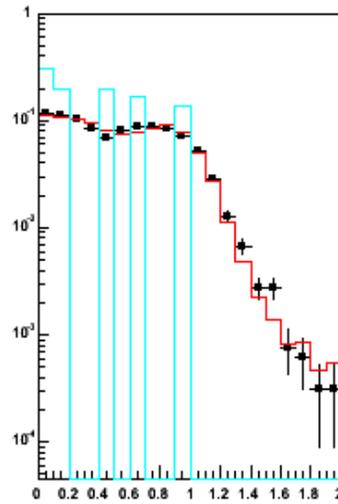
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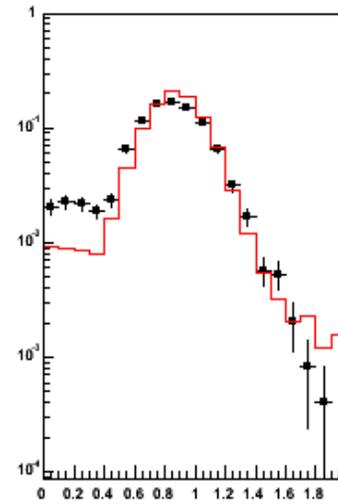
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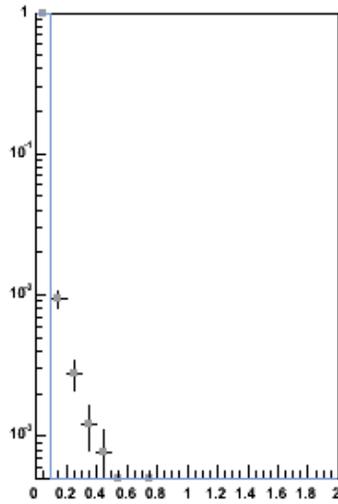
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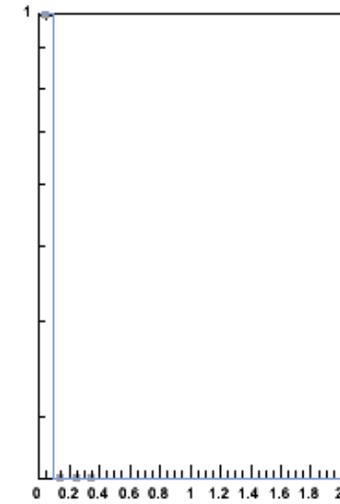
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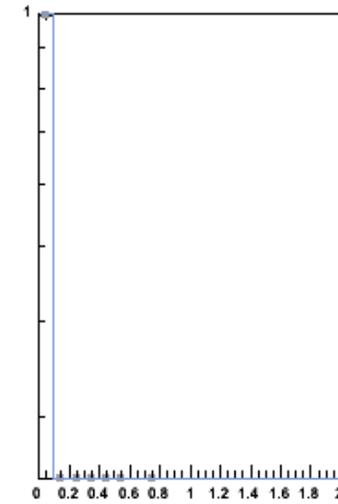
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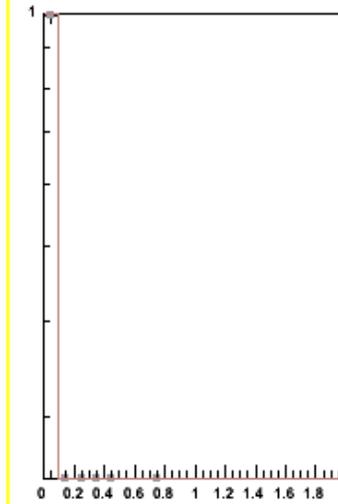
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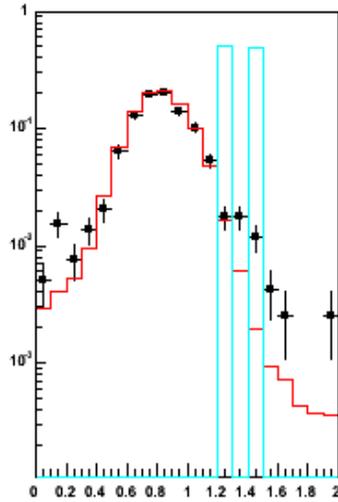


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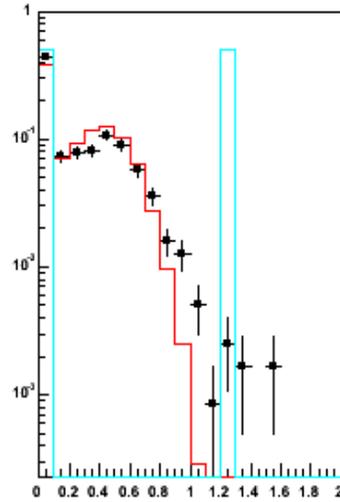


# Distribution Canvas 5: Momentum Range 5: 12 to 15 GeV

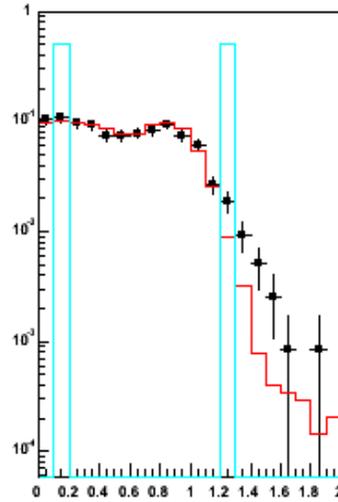
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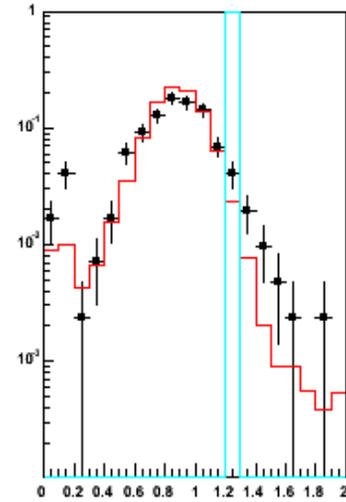
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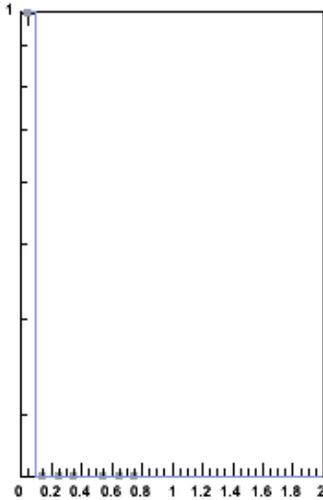
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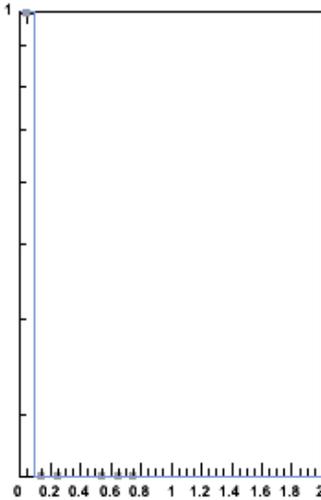
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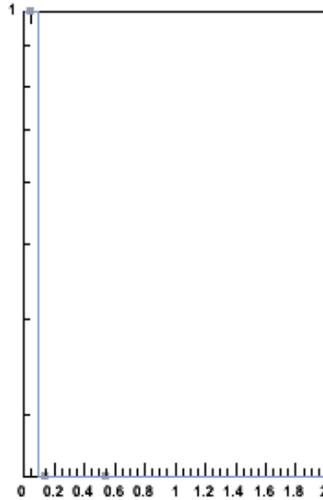
BoP Distribution: Def 2 Comp 0 Mom Range 5



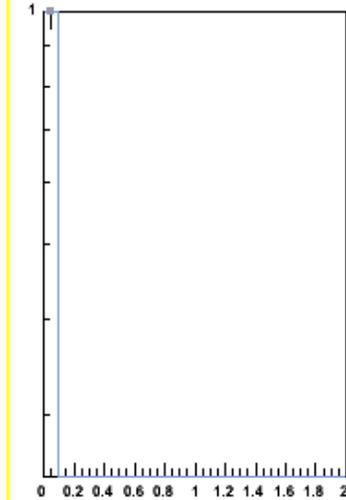
BoP Distribution: Def 2 Comp 1 Mom Range 5



BoP Distribution: Def 2 Comp 2 Mom Range 5

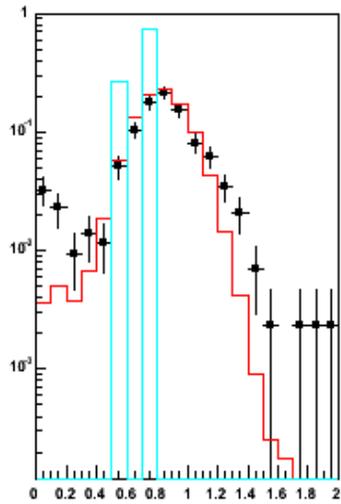


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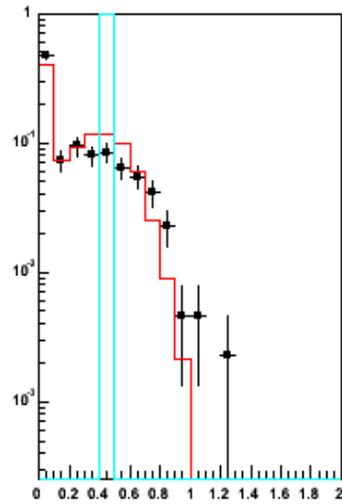


# Distribution Canvas 6: Momentum Range 6: 15 to 20 GeV

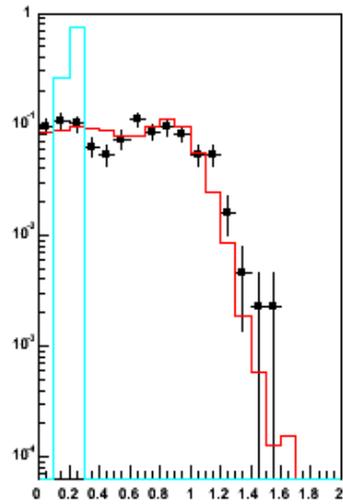
BoP Distribution: Def 1 Comp 0 Mom Range 6



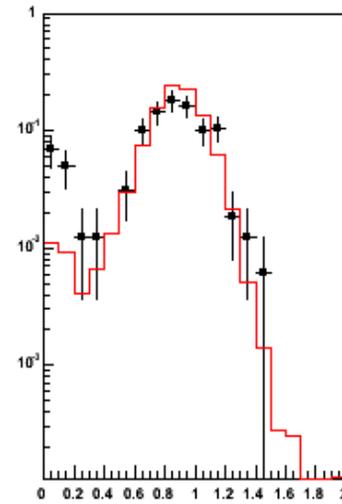
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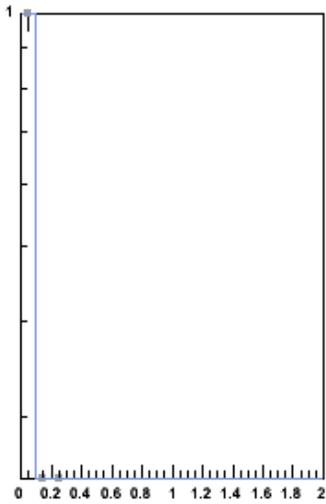
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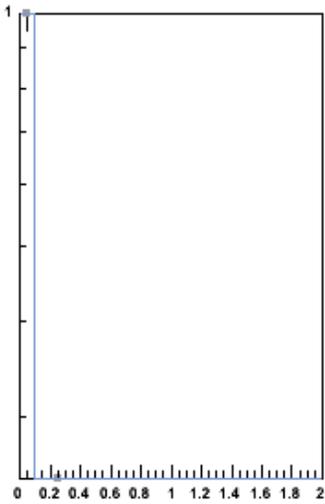
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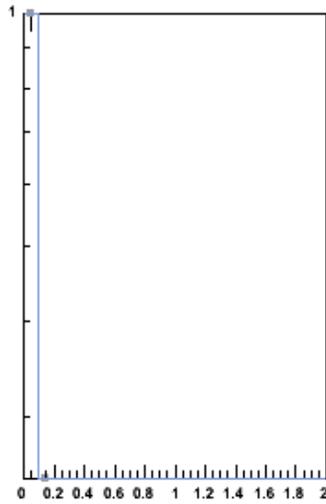
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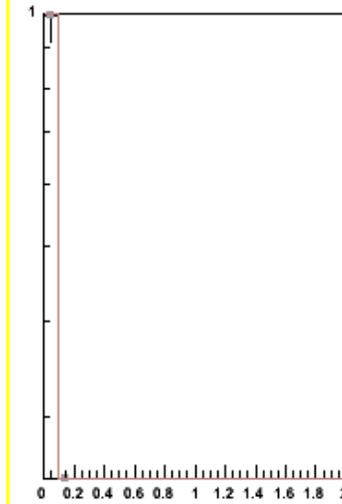
BoP Distribution: Def 2 Comp 1 Mom Range 6



BoP Distribution: Def 2 Comp 2 Mom Range 6

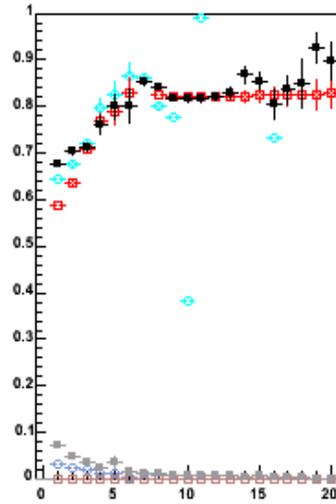


BoP Distribution: Def 2 Comp 3 Mom Range 6

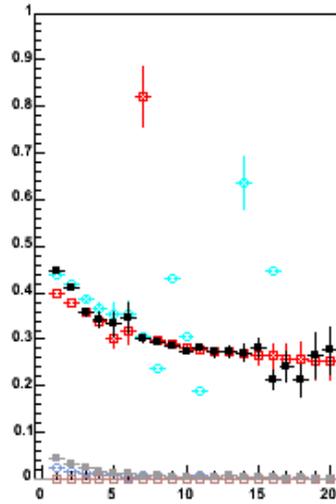


# Profile Canvas 0: Momentum Range 0: All

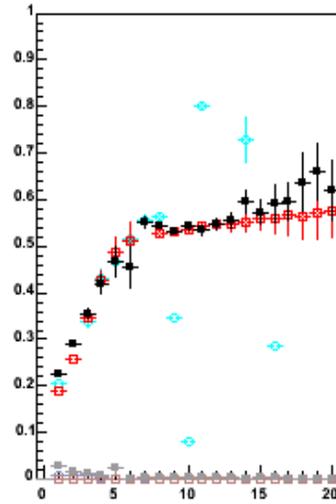
EoP Profile: Def 1 Comp 0 Mom Range 0



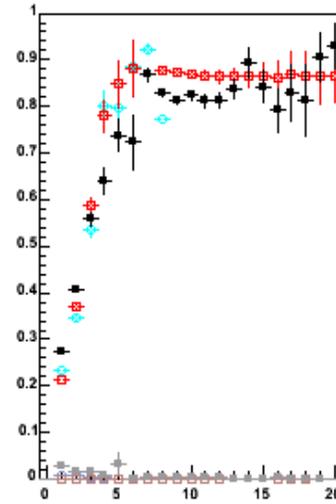
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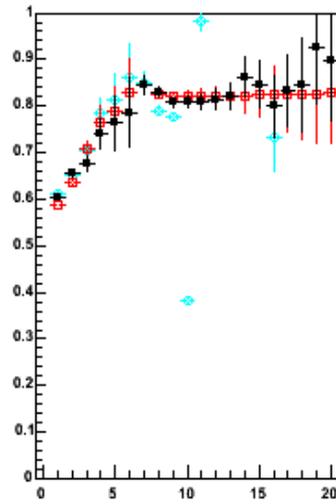
EoP Profile: Def 1 Comp 2 Mom Range 0



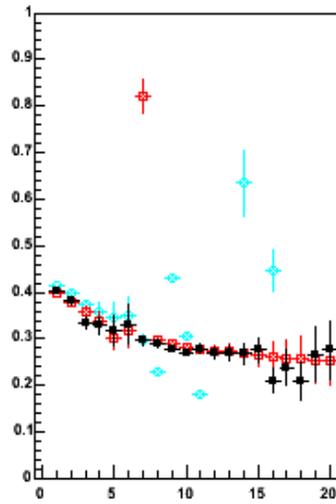
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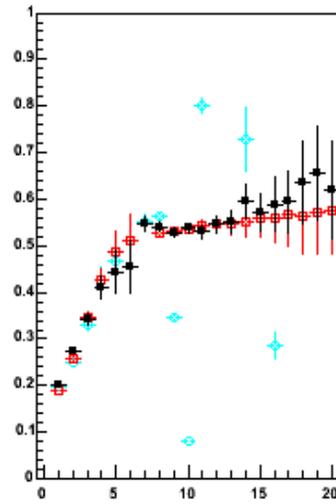
EoP Profile: Def 0 Comp 0 Mom Range 0



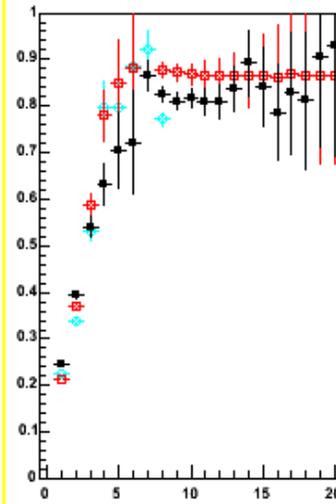
EoP Profile: Def 0 Comp 1 Mom Range 0



EoP Profile: Def 0 Comp 2 Mom Range 0

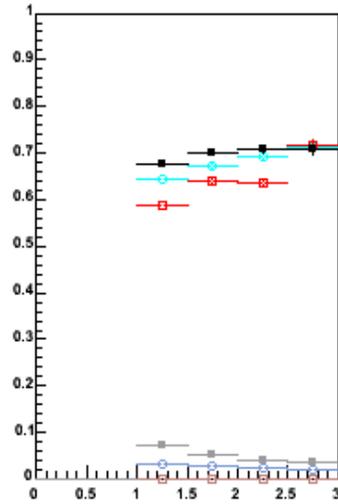


EoP Profile: Def 0 Comp 3 Mom Range 0

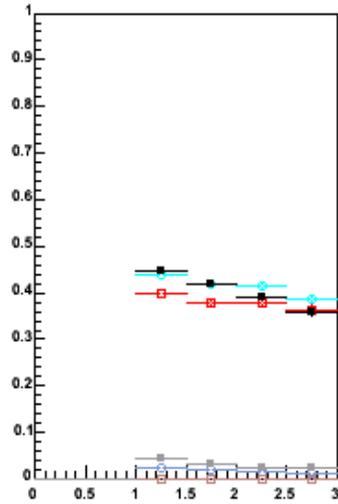


# Profile Canvas 1: Momentum Range 1: 0 to 3 GeV

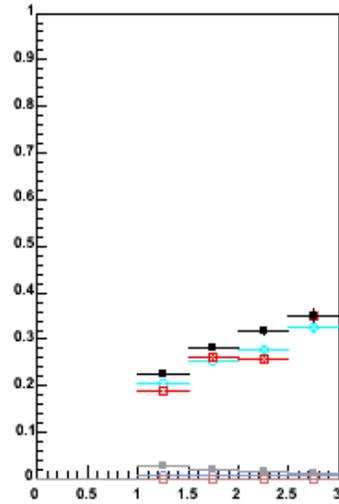
EoP Profile: Def 1 Comp 0 Mom Range 1



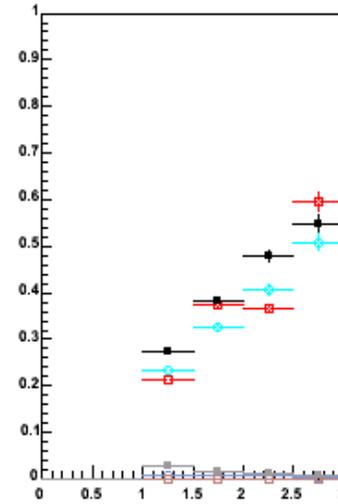
EoP Profile: Def 1 Comp 1 Mom Range 1



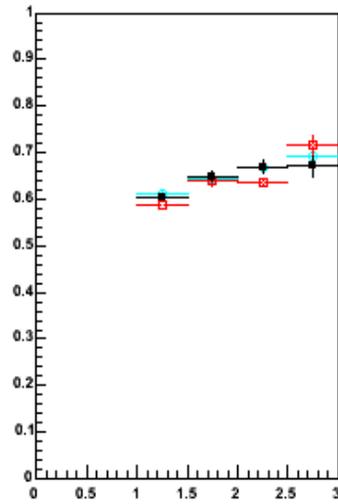
EoP Profile: Def 1 Comp 2 Mom Range 1



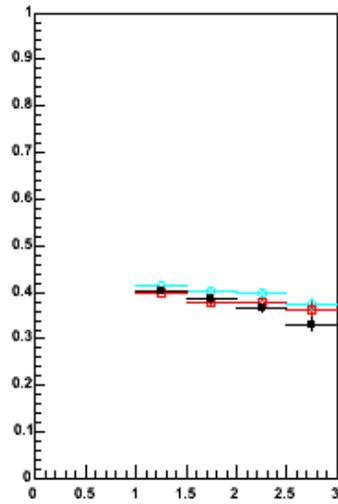
EoP Profile: Def 1 Comp 3 Mom Range 1



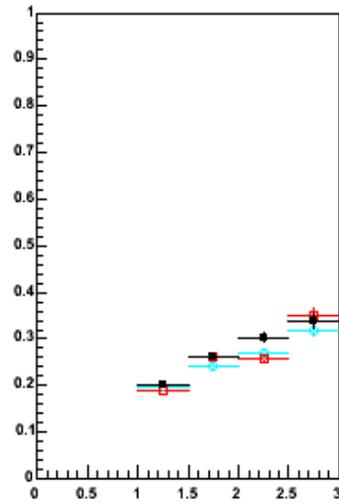
EoP Profile: Def 0 Comp 0 Mom Range 1



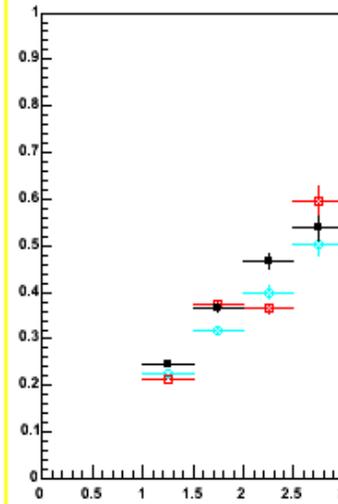
EoP Profile: Def 0 Comp 1 Mom Range 1



EoP Profile: Def 0 Comp 2 Mom Range 1

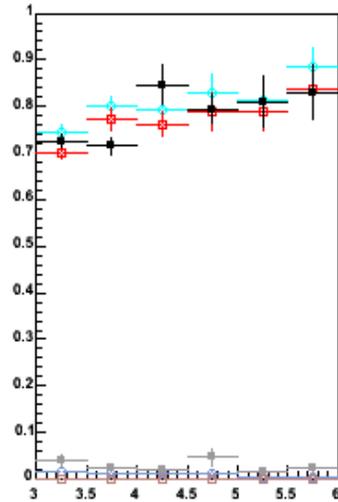


EoP Profile: Def 0 Comp 3 Mom Range 1

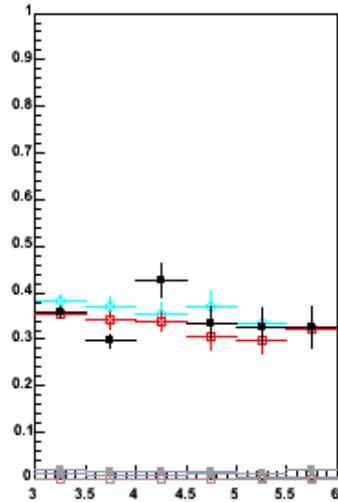


# Profile Canvas 2: Momentum Range 2: 3 to 6 GeV

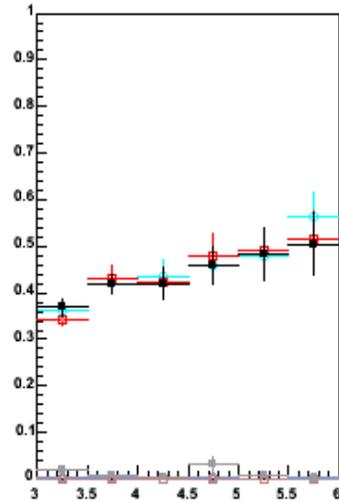
EoP Profile: Def 1 Comp 0 Mom Range 2



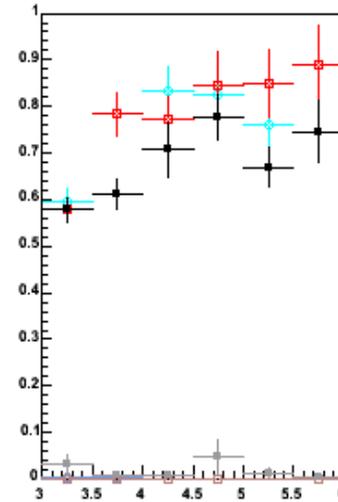
EoP Profile: Def 1 Comp 1 Mom Range 2



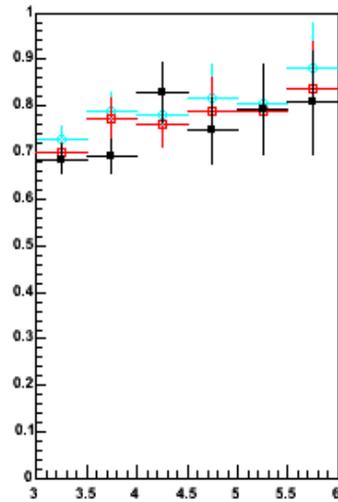
EoP Profile: Def 1 Comp 2 Mom Range 2



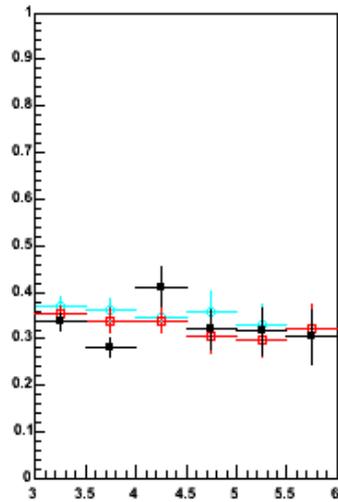
EoP Profile: Def 1 Comp 3 Mom Range 2



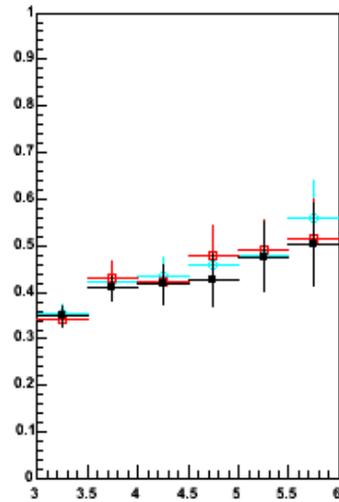
EoP Profile: Def 0 Comp 0 Mom Range 2



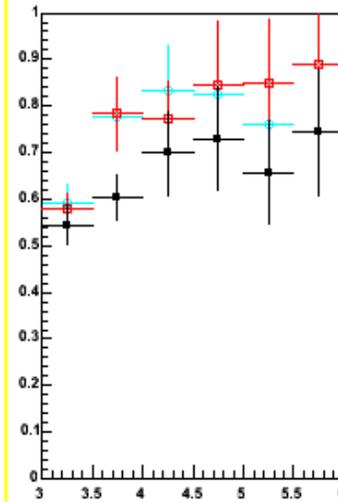
EoP Profile: Def 0 Comp 1 Mom Range 2



EoP Profile: Def 0 Comp 2 Mom Range 2

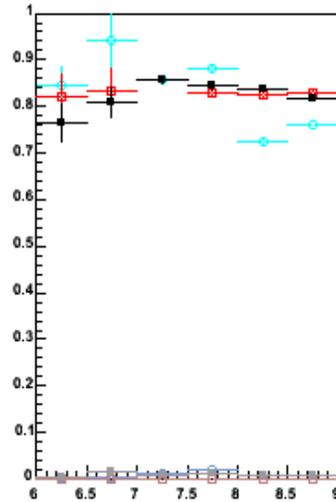


EoP Profile: Def 0 Comp 3 Mom Range 2

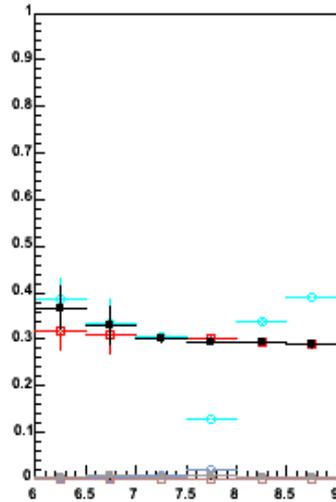


# Profile Canvas 3: Momentum Range 3: 6 to 9 GeV

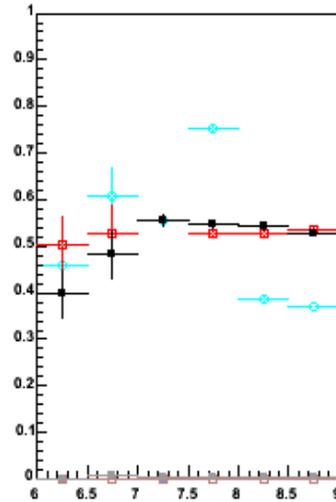
EoP Profile: Def 1 Comp 0 Mom Range 3



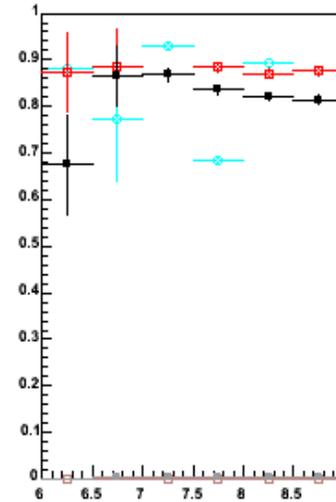
EoP Profile: Def 1 Comp 1 Mom Range 3



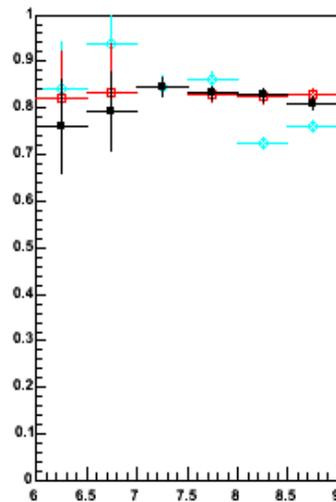
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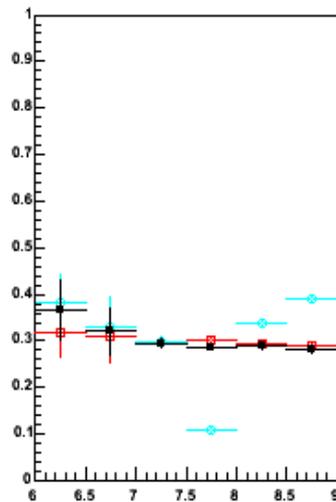
EoP Profile: Def 1 Comp 3 Mom Range 3



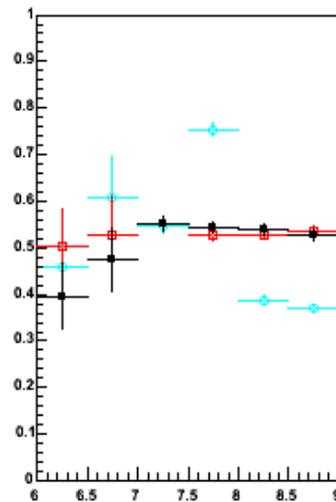
EoP Profile: Def 0 Comp 0 Mom Range 3



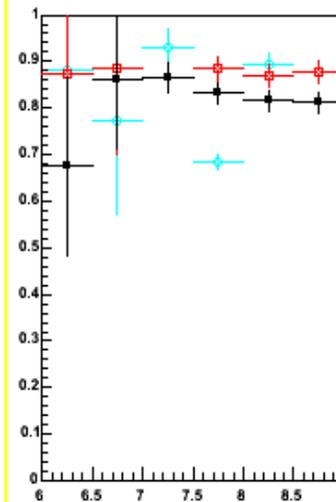
EoP Profile: Def 0 Comp 1 Mom Range 3



EoP Profile: Def 0 Comp 2 Mom Range 3

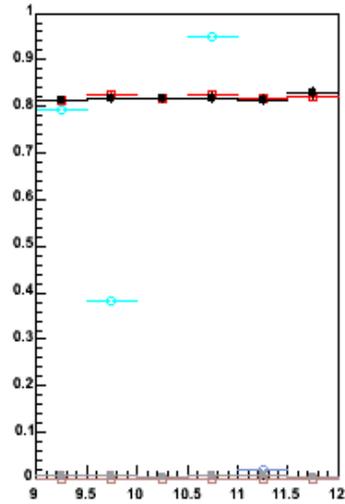


EoP Profile: Def 0 Comp 3 Mom Range 3

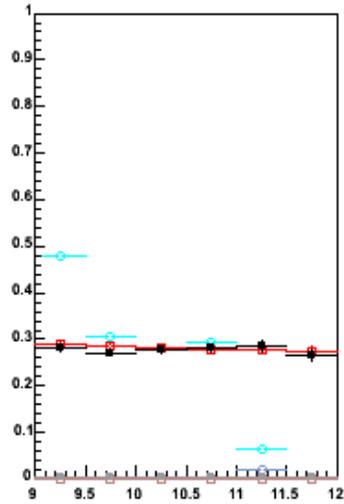


# Profile Canvas 4: Momentum Range 4: 12 to 15 GeV

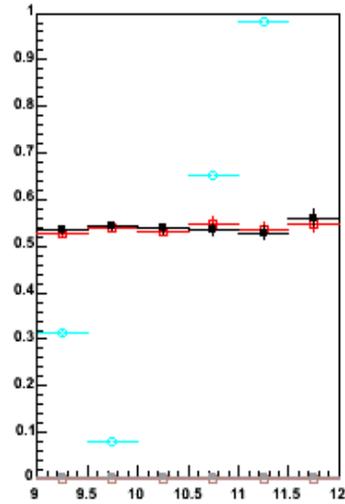
EoP Profile: Def 1 Comp 0 Mom Range 4



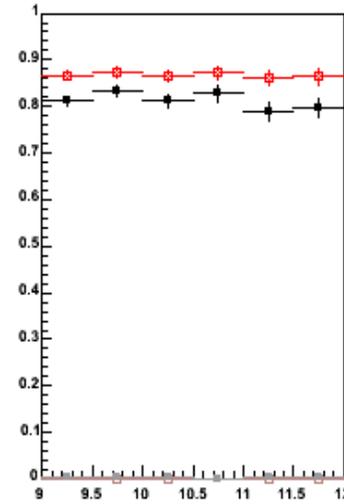
EoP Profile: Def 1 Comp 1 Mom Range 4



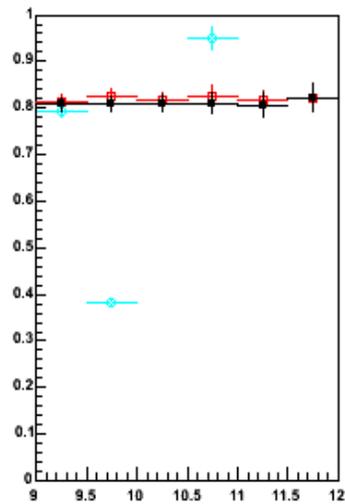
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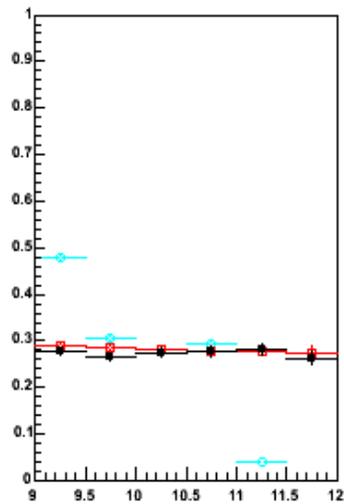
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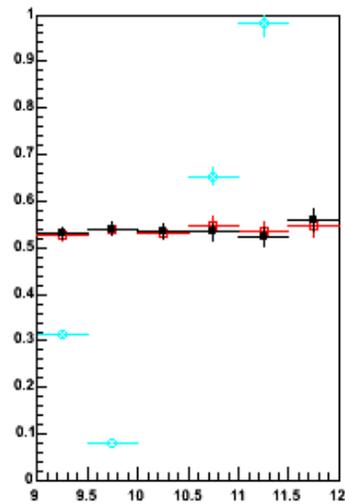
EoP Profile: Def 0 Comp 0 Mom Range 4



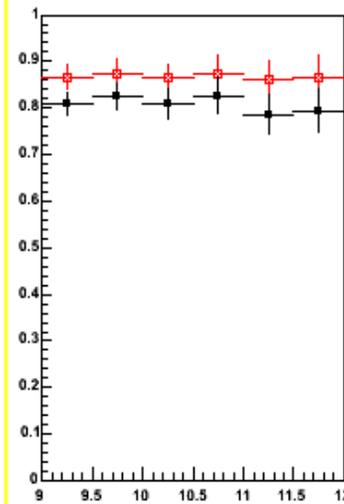
EoP Profile: Def 0 Comp 1 Mom Range 4



EoP Profile: Def 0 Comp 2 Mom Range 4

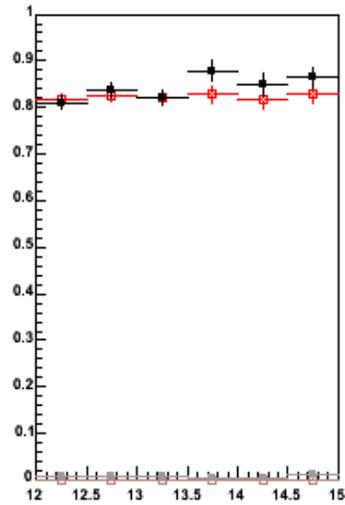


EoP Profile: Def 0 Comp 3 Mom Range 4

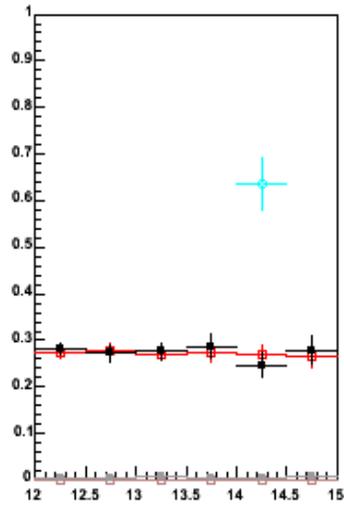


# Profile Canvas 5: Momentum Range 5: 12 to 15 GeV

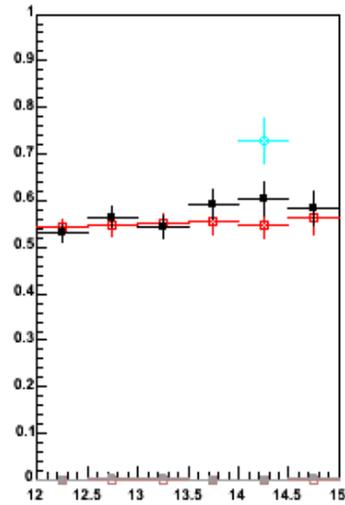
EoP Profile: Def 1 Comp 0 Mom Range 5



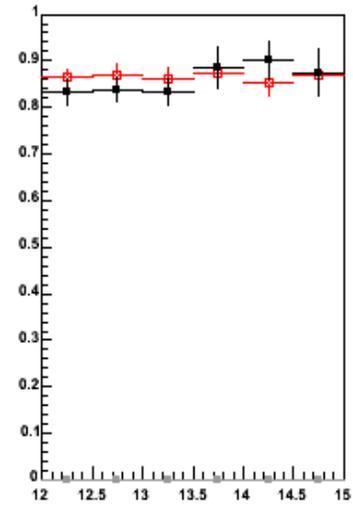
EoP Profile: Def 1 Comp 1 Mom Range 5



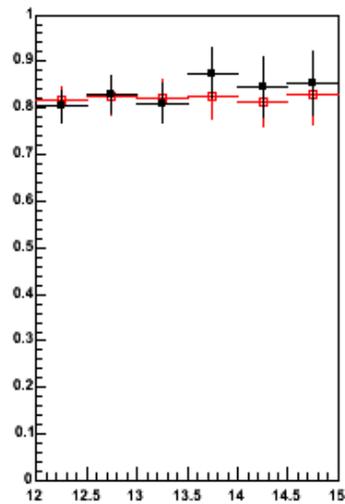
EoP Profile: Def 1 Comp 2 Mom Range 5



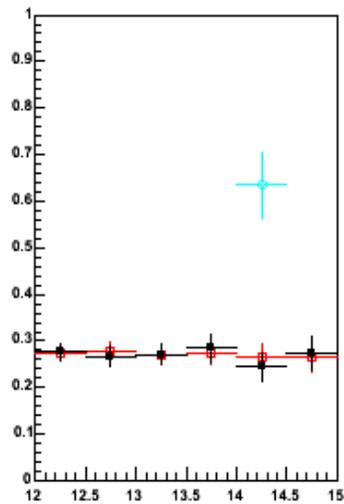
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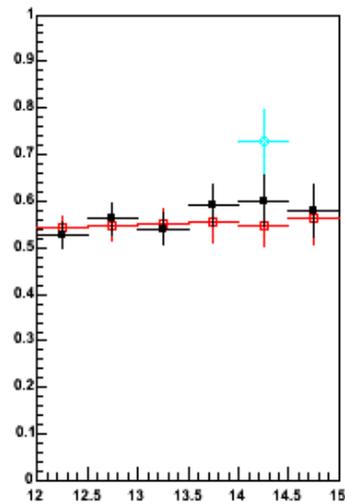
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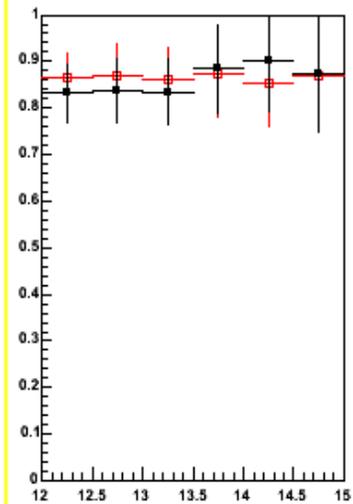
EoP Profile: Def 0 Comp 1 Mom Range 5



EoP Profile: Def 0 Comp 2 Mom Range 5

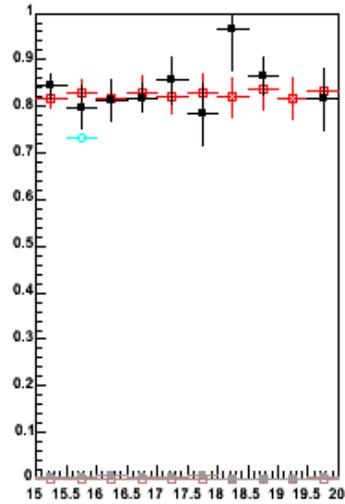


EoP Profile: Def 0 Comp 3 Mom Range 5

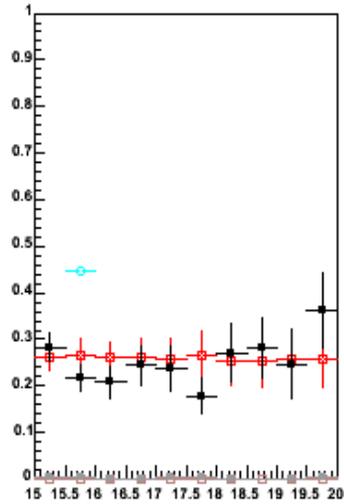


# Profile Canvas 6: Momentum Range 6: 15 to 20 GeV

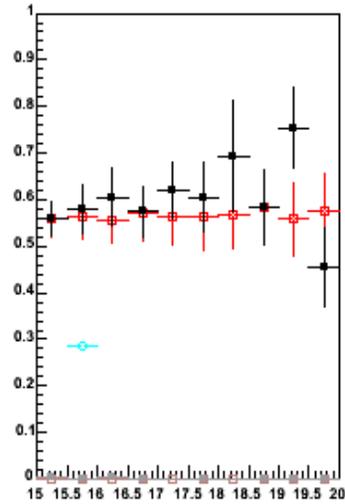
EoP Profile: Def 1 Comp 0 Mom Range 6



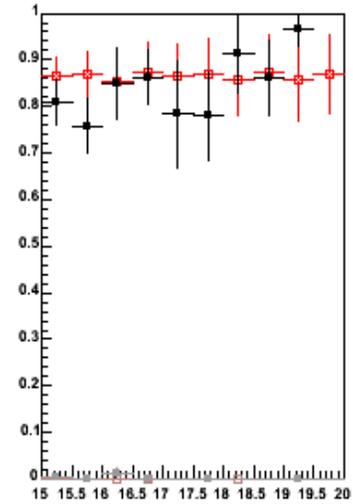
EoP Profile: Def 1 Comp 1 Mom Range 6



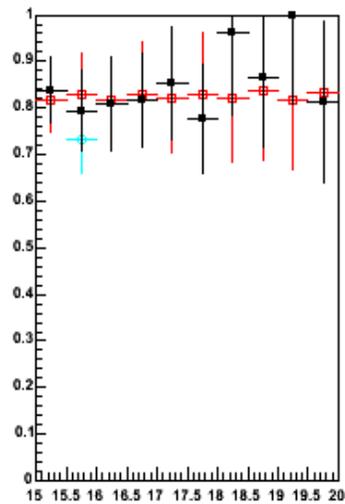
EoP Profile: Def 1 Comp 2 Mom Range 6



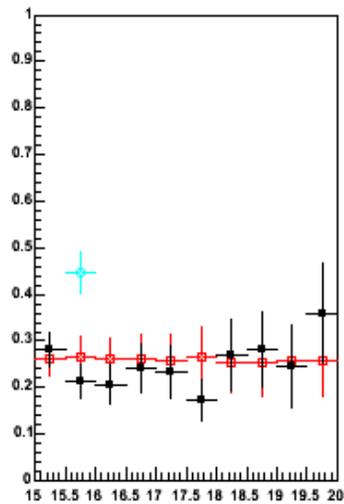
EoP Profile: Def 1 Comp 3 Mom Range 6



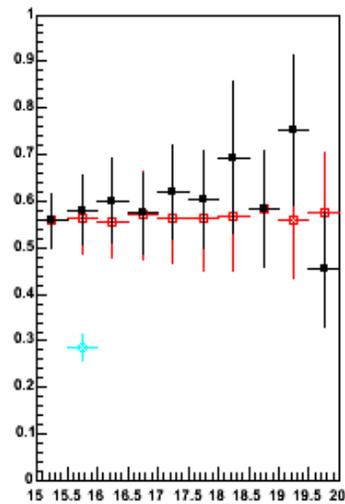
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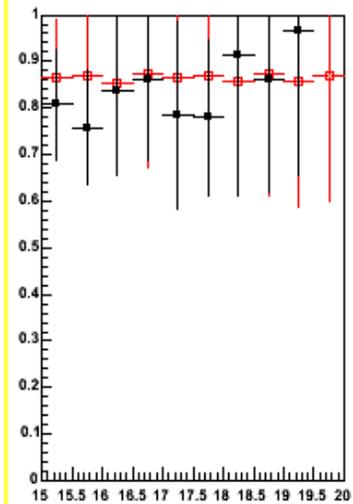
EoP Profile: Def 0 Comp 1 Mom Range 6



EoP Profile: Def 0 Comp 2 Mom Range 6



EoP Profile: Def 0 Comp 3 Mom Range 6





# Conclusions



- **We want to understand and tune the MC simulations to the single hadron data.**
- **Most of the plots look very good, there are some discrepancies**
  - e.g. in the 0 to 3 GeV Distribution histograms.
- **More statistics, especially in the Pythia dijet sample**
- **Lateral Profiles Soon!**