Embedding QA

embedding + real

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Cuts :

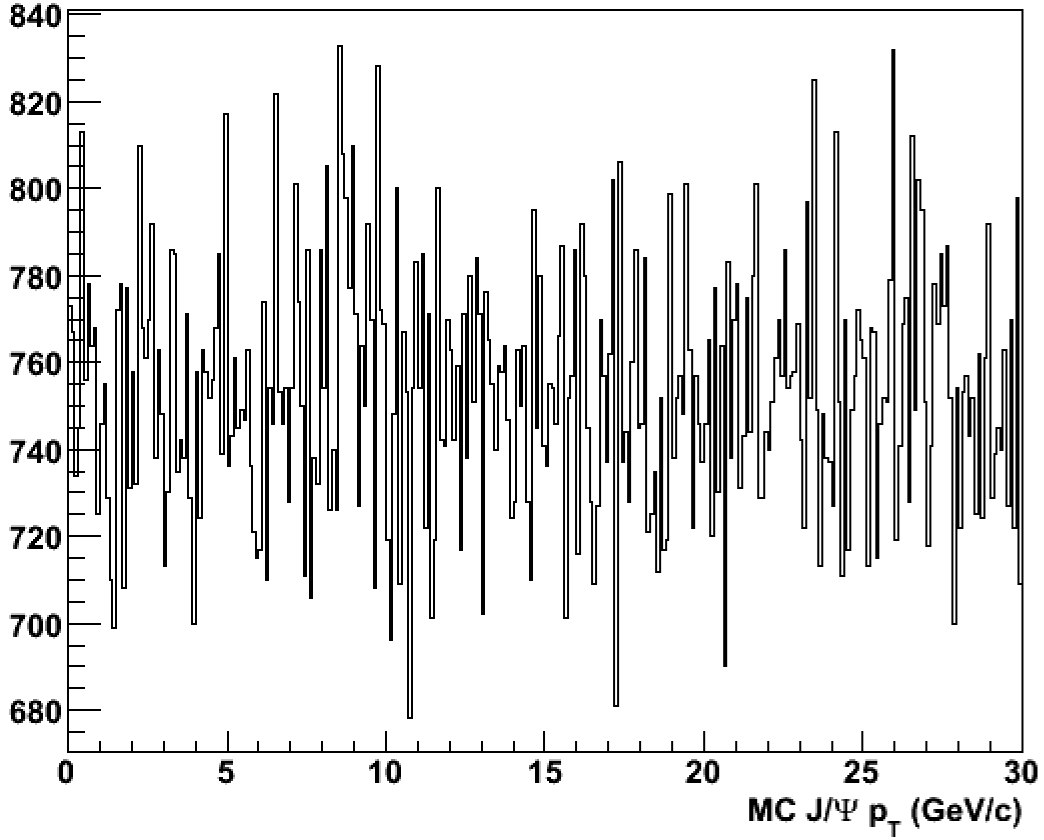
$$nHitsFit > 25$$

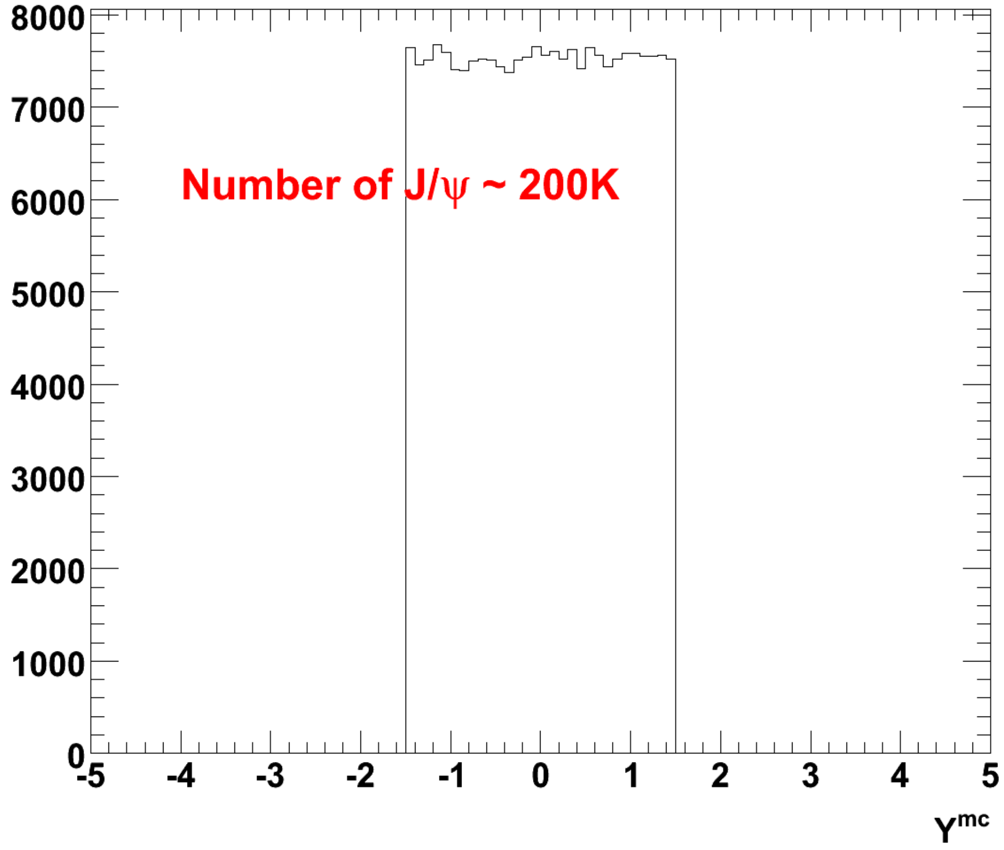
$$dca < 3cm$$

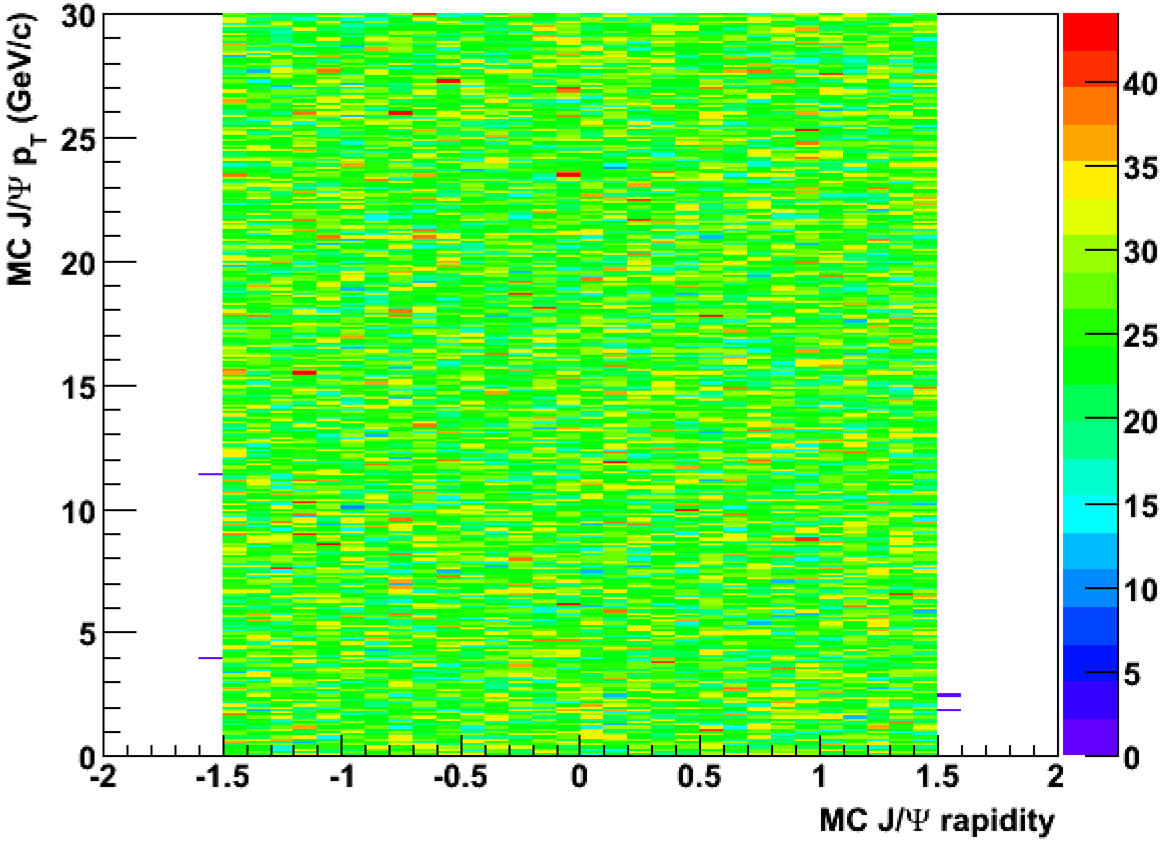
$$0.3 < p/energy < 1.5$$

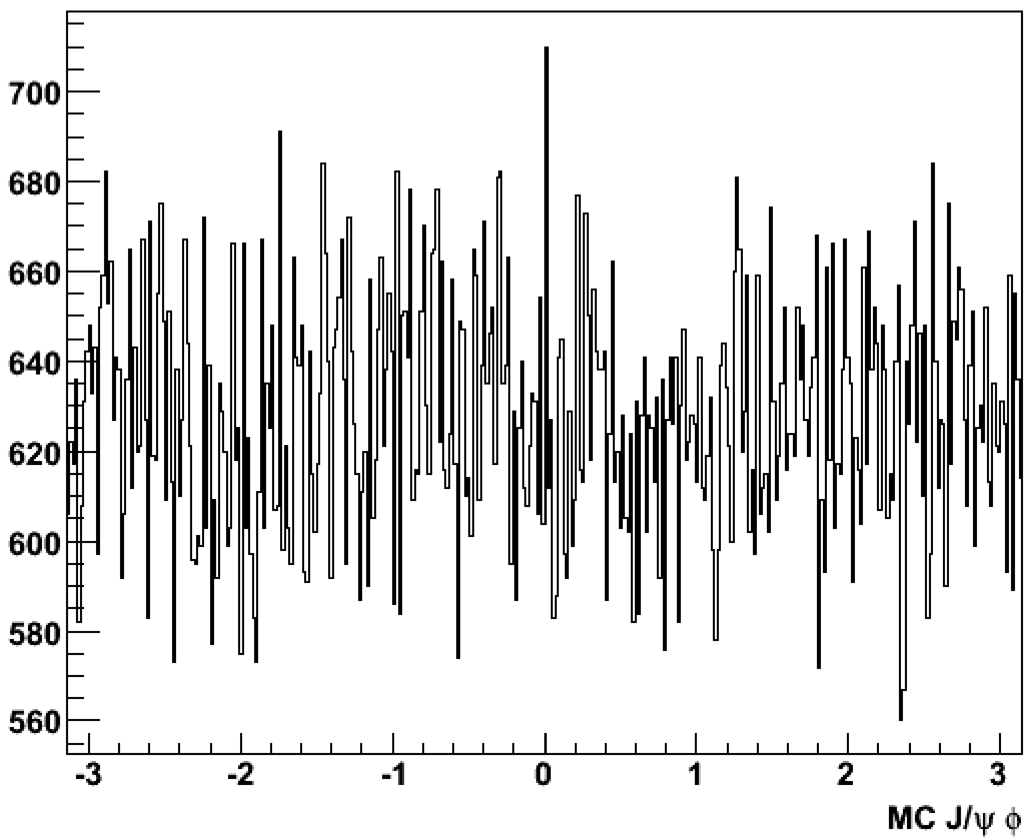
$$-1 < \eta < 1$$

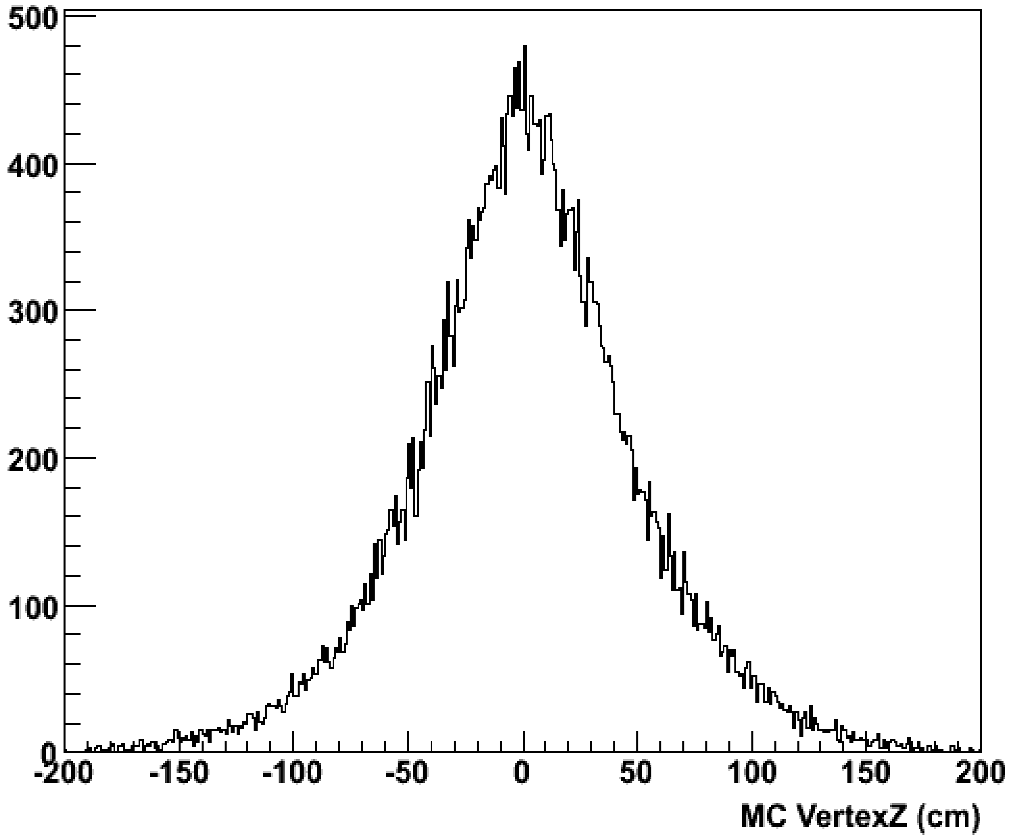
$$\mathrm{N}_{events} = 45.197\mathrm{K} \quad \mathrm{MC}= \; J/\psi\,,\ \mathrm{P11id(2011)}$$

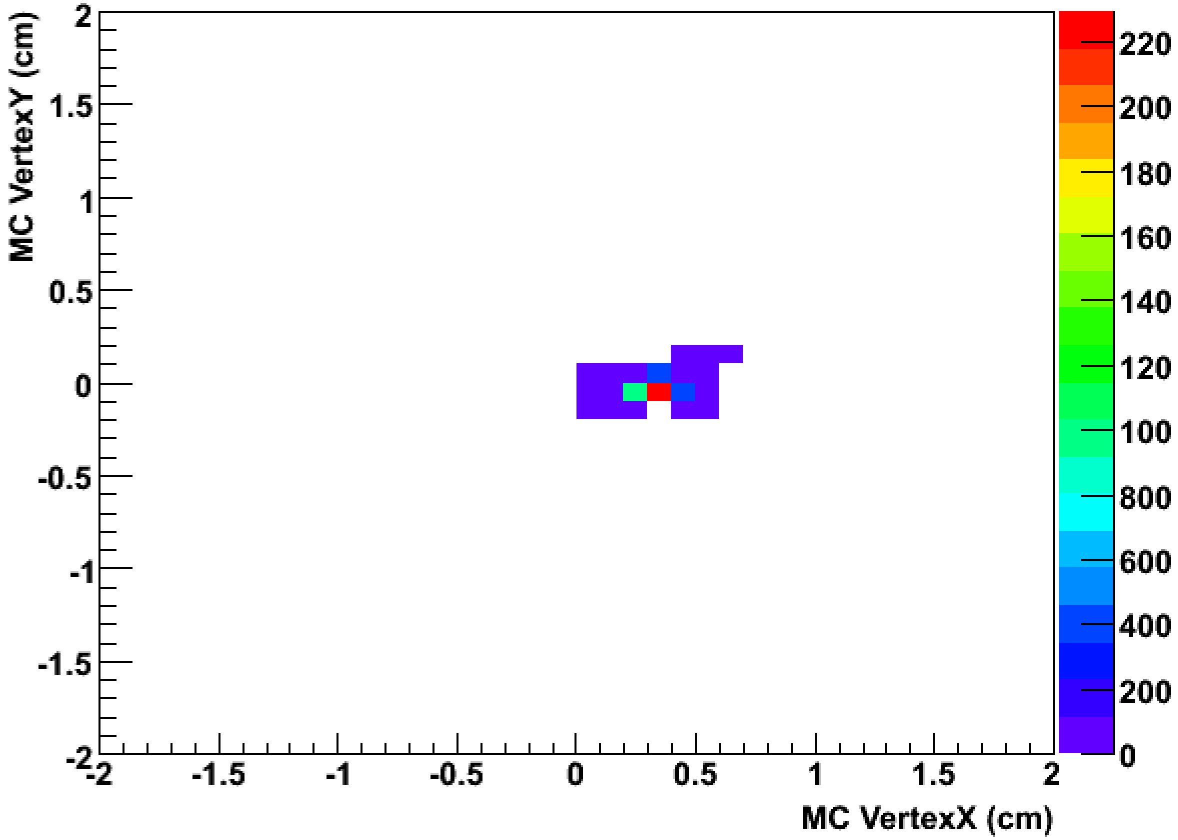

MC J/Ψ p_T (GeV/c)

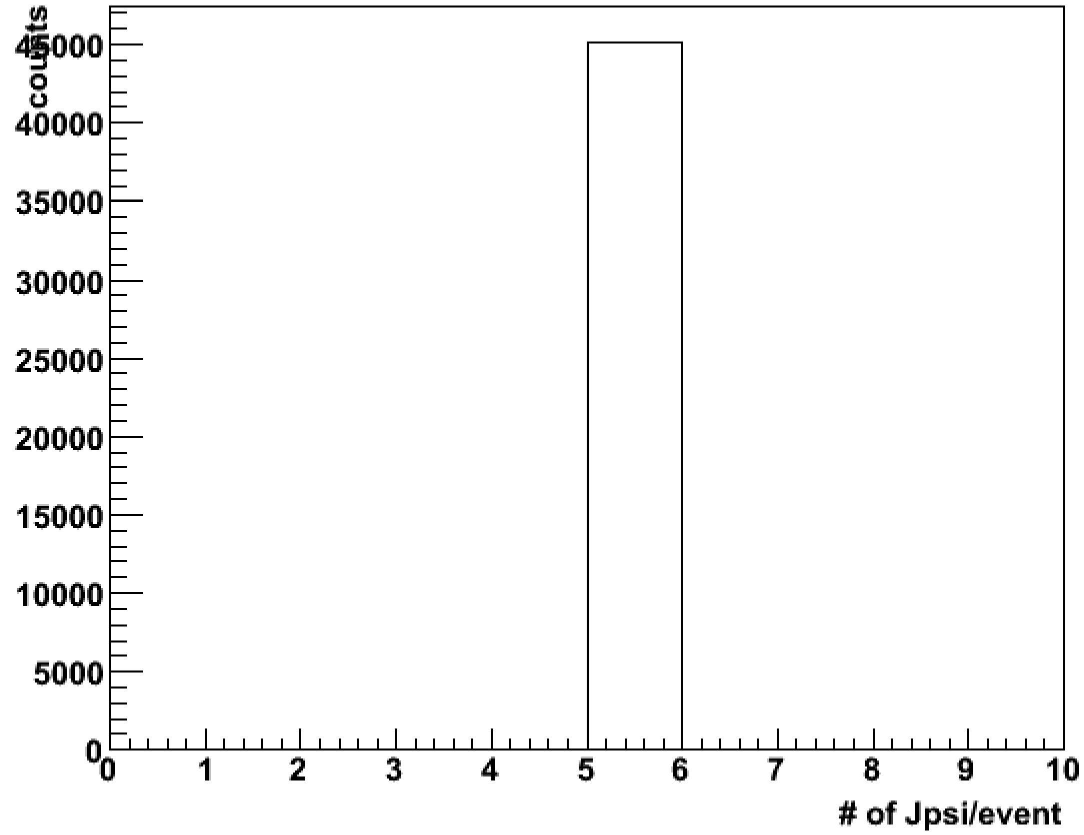

Number of J/ψ ~ 200K
Y^{mc}

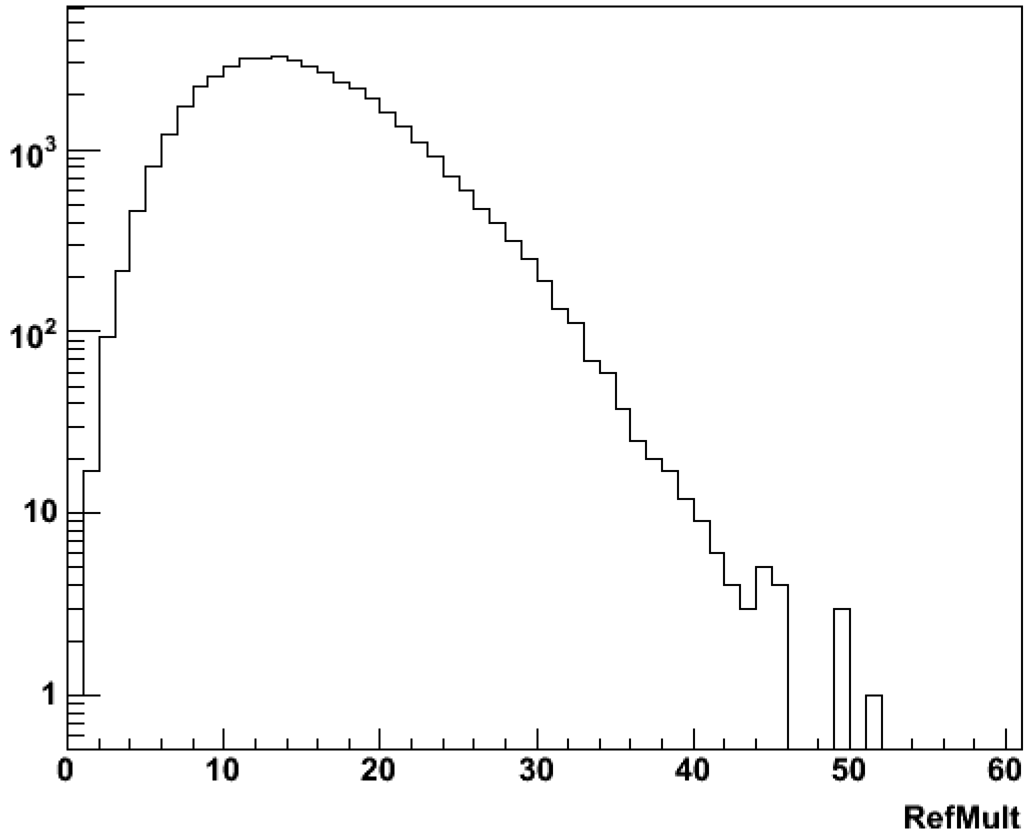

MC J/Ψ p_T (GeV/c)
MC J/Ψ rapidity


MC J/ψ φ

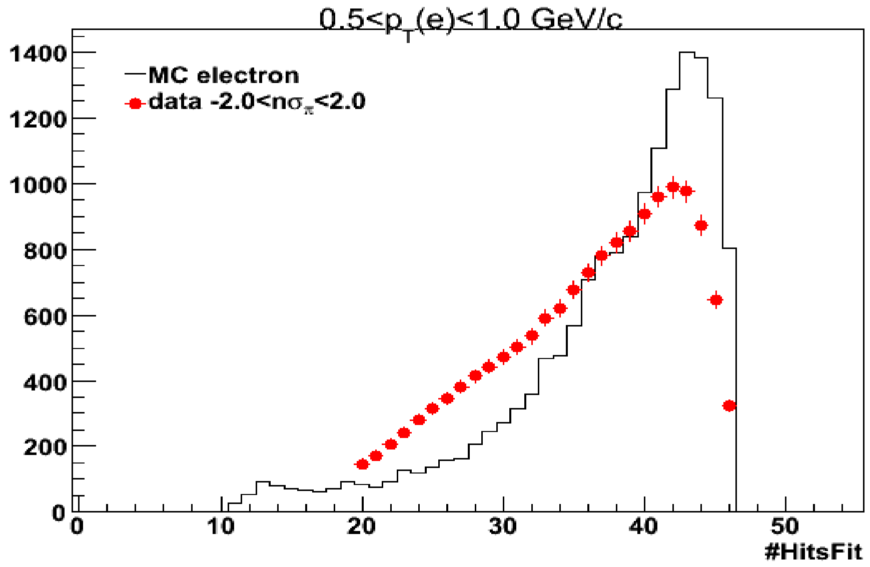

500
400
300
200
100
0
-200
-150
-100
-50
0
50
100
150
200
MC VertexZ (cm)

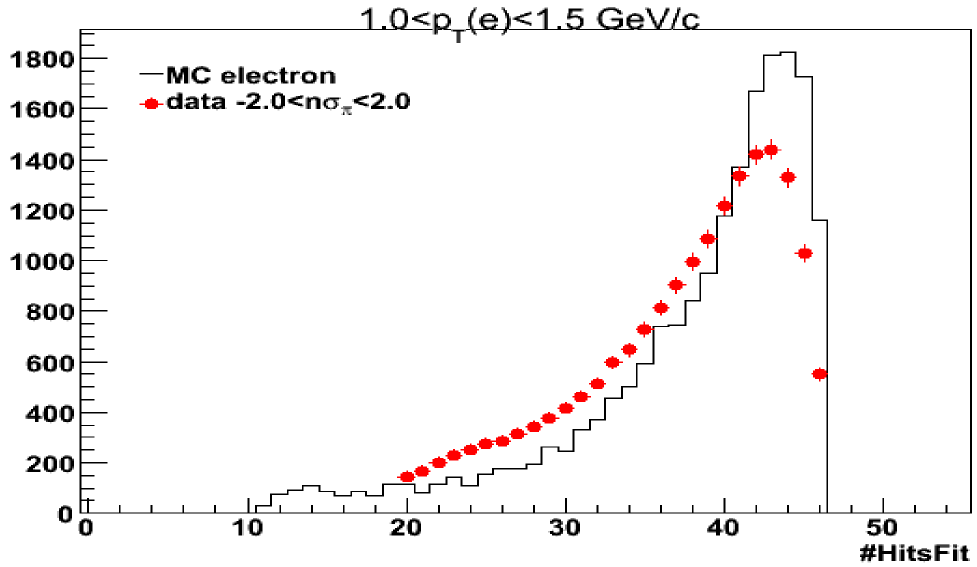

MC VertexY (cm)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
MC VertexX (cm)
220
200
180
160
140
120
100
800
600
400
200
0

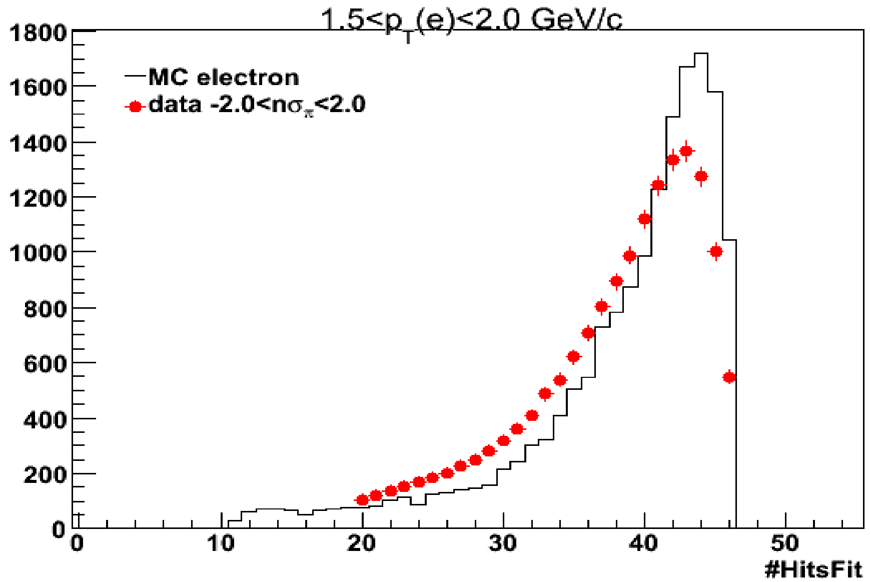

counts
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
7
8
9
10
# of Jpsi/event

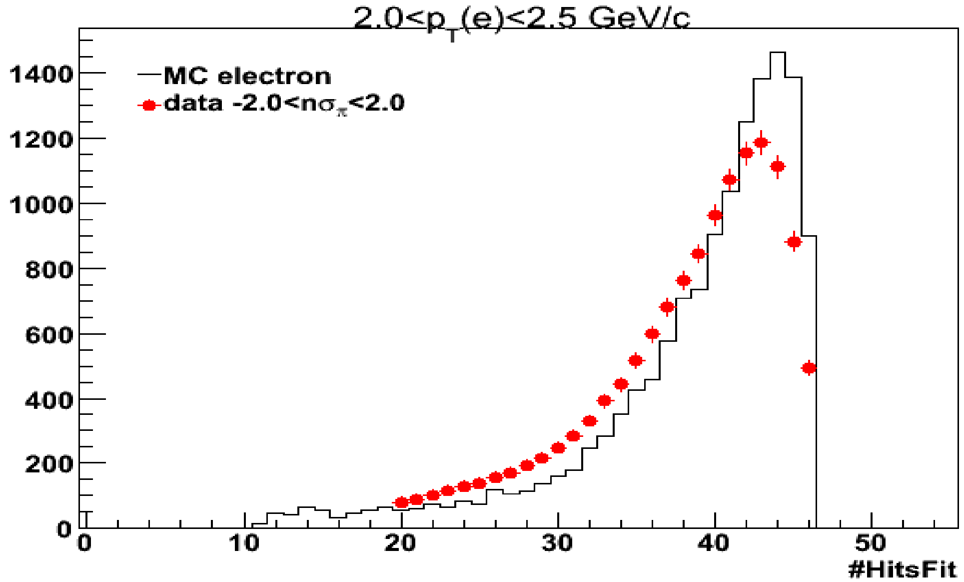

10^3
10^2
10
1
0
10
20
30
40
50
60
RefMult

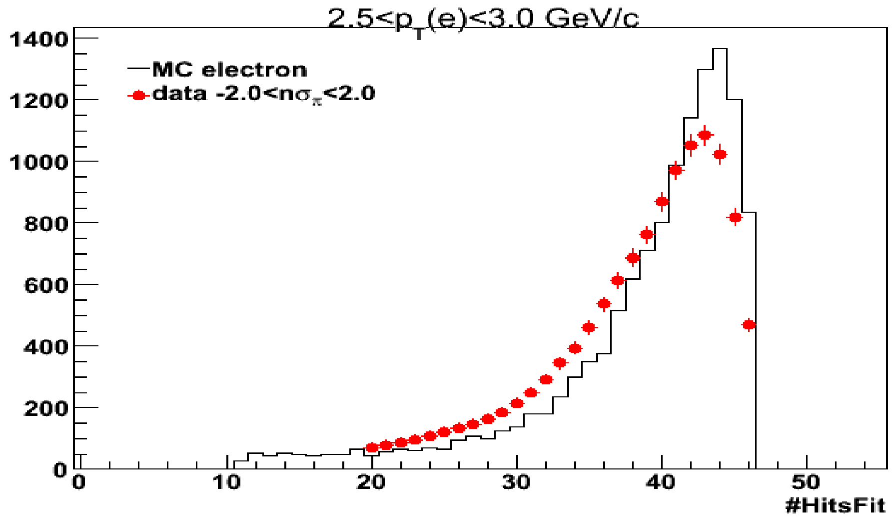
$$pions: -2. < nSigmaPion < 2.$$

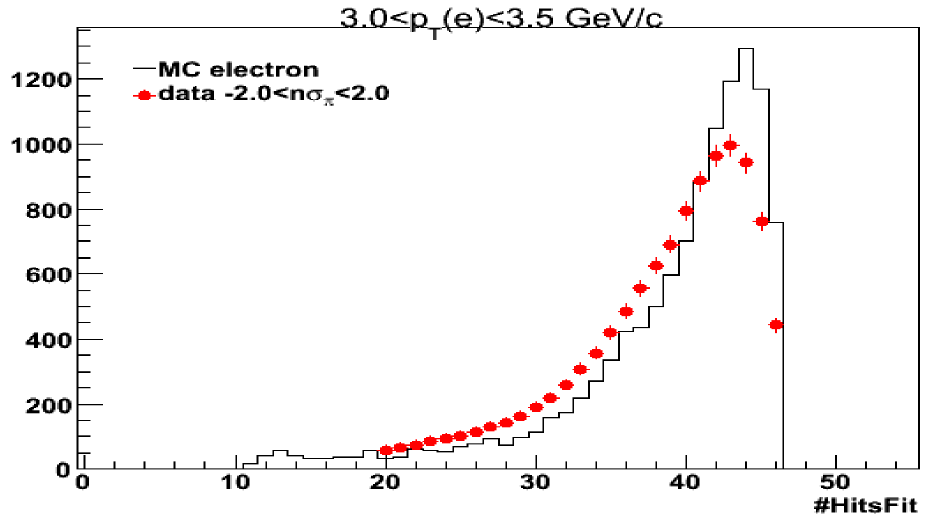


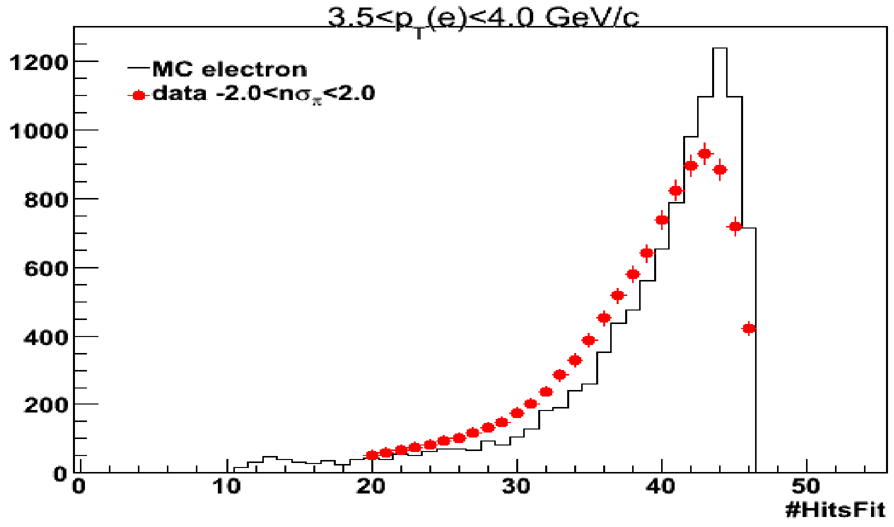


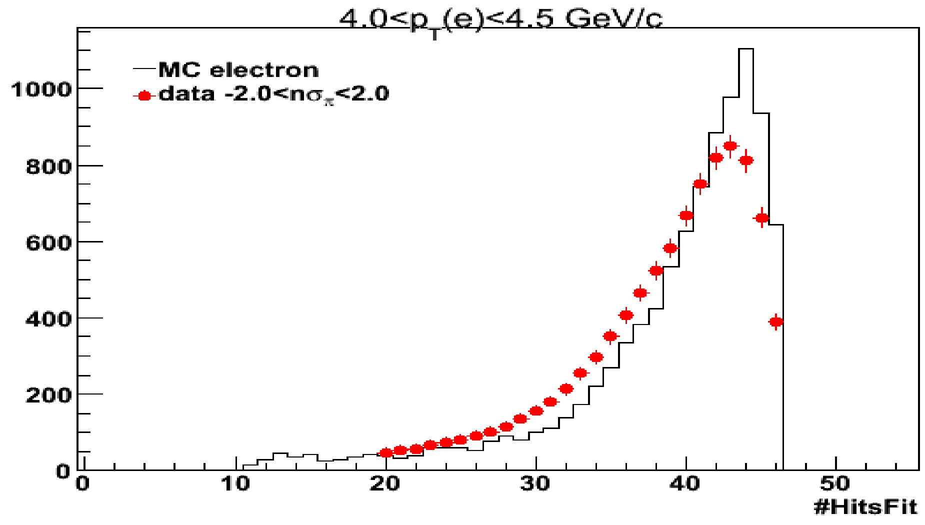


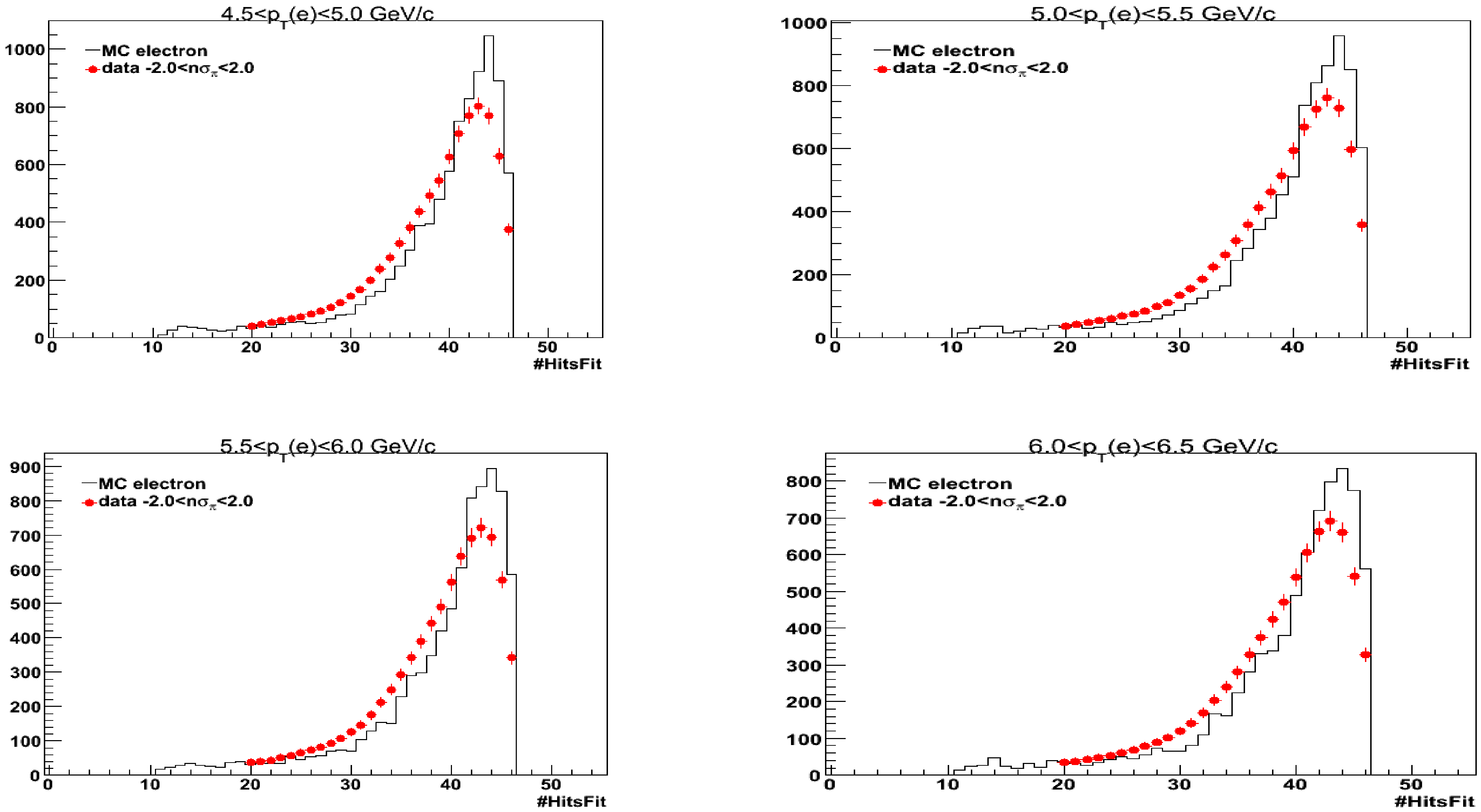



2.5<p_T(e)<3.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

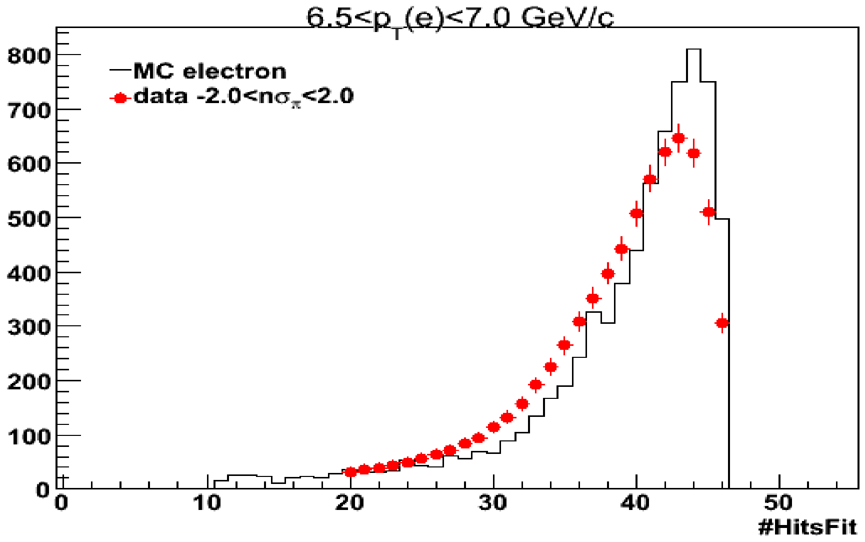

3.0<p_T(e)<3.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

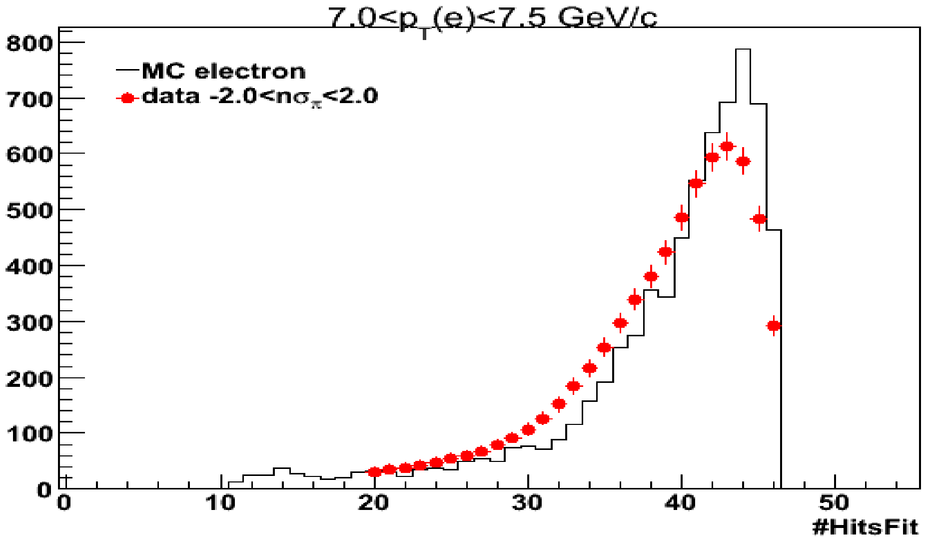

3.5<p_T(e)<4.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

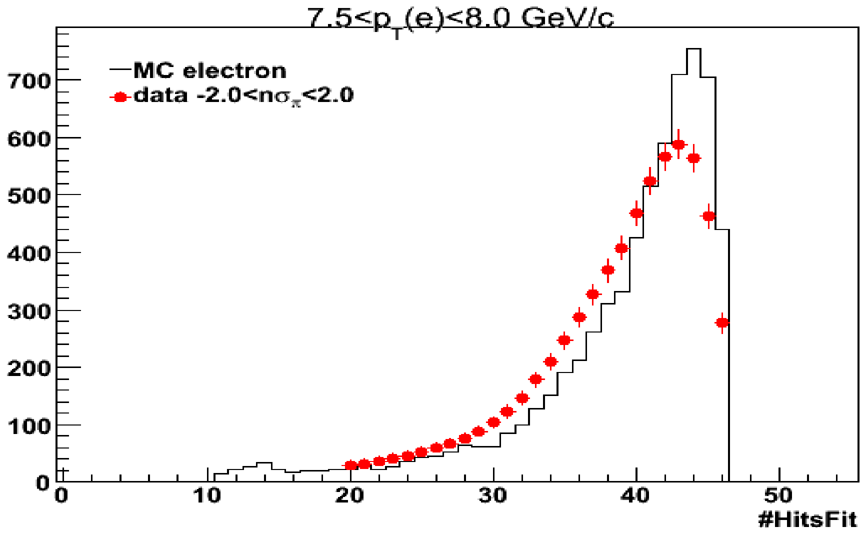

4.0<p_T(e)<4.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

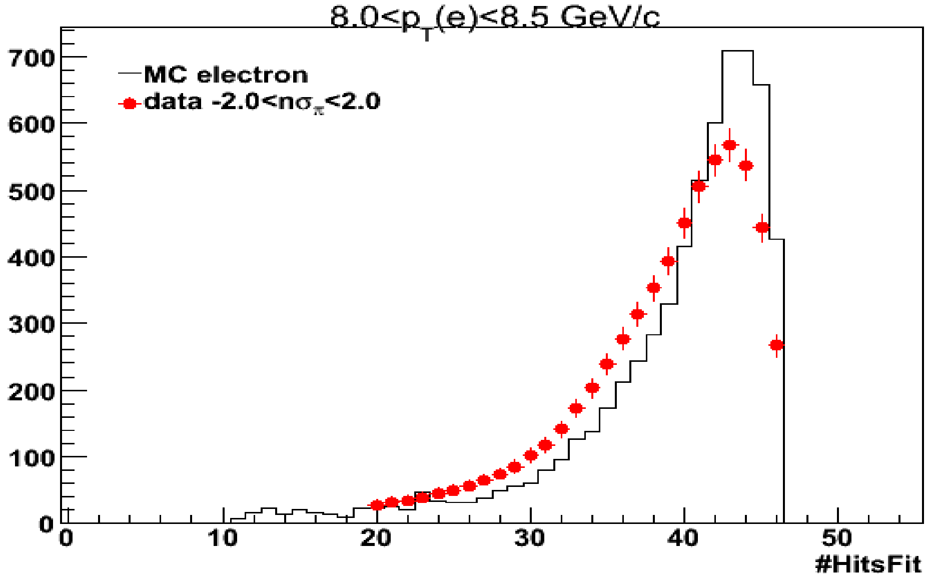


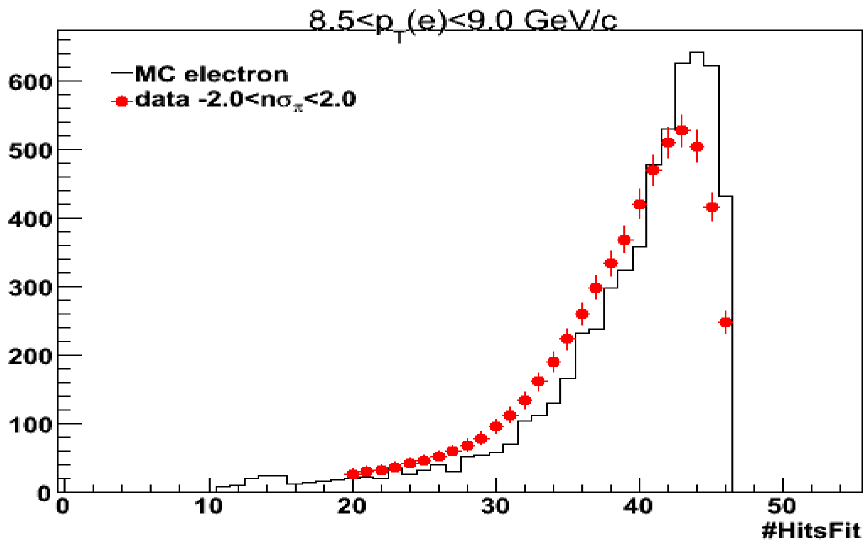
4.5<p_T(e)<5.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit
5.0<p_T(e)<5.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit
5.5<p_T(e)<6.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit
6.0<p_T(e)<6.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

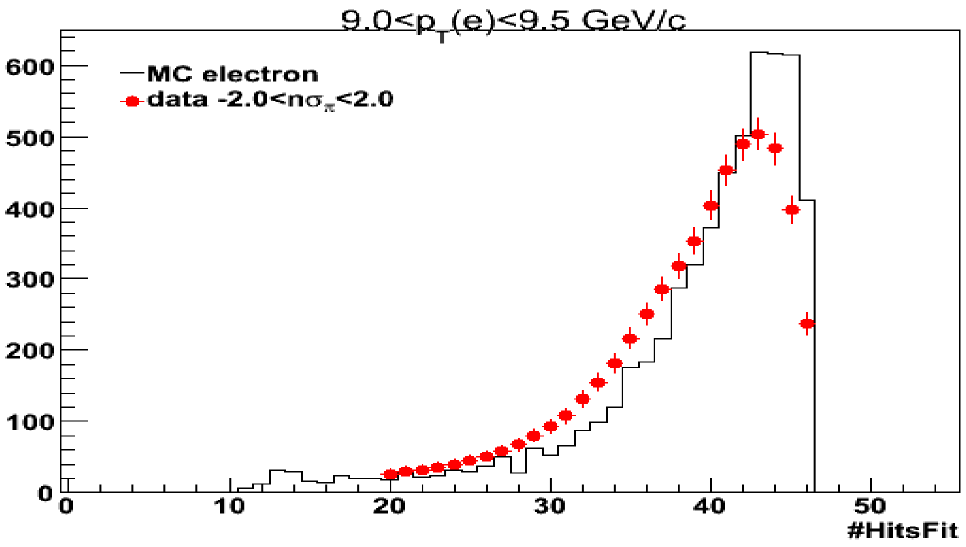

6.5<p_T(e)<7.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

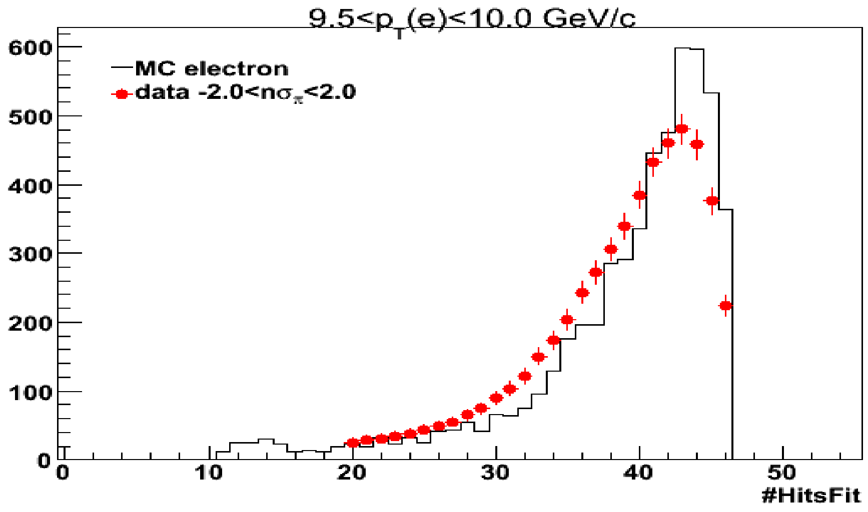

7.0<p_T(e)<7.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

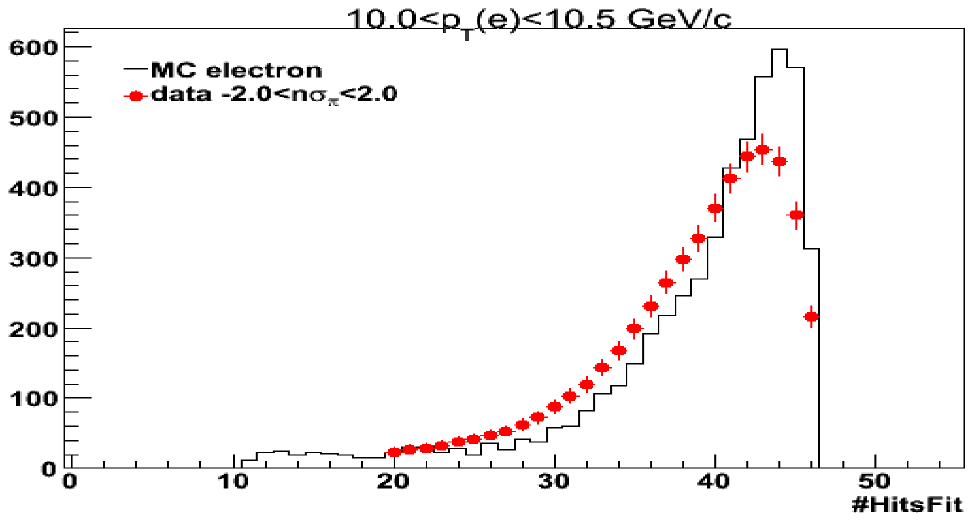

7.5<p_T(e)<8.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

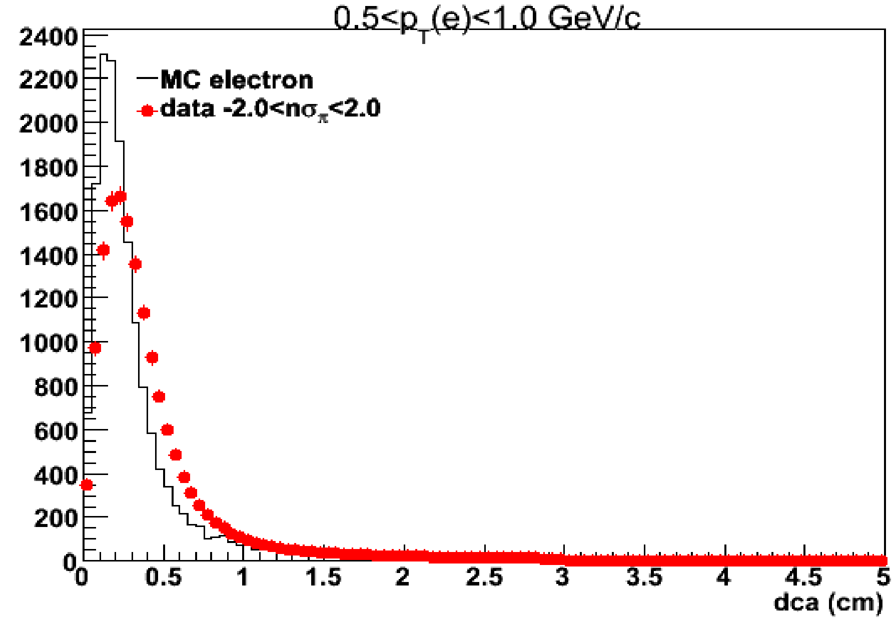

8.0<p_T(e)<8.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

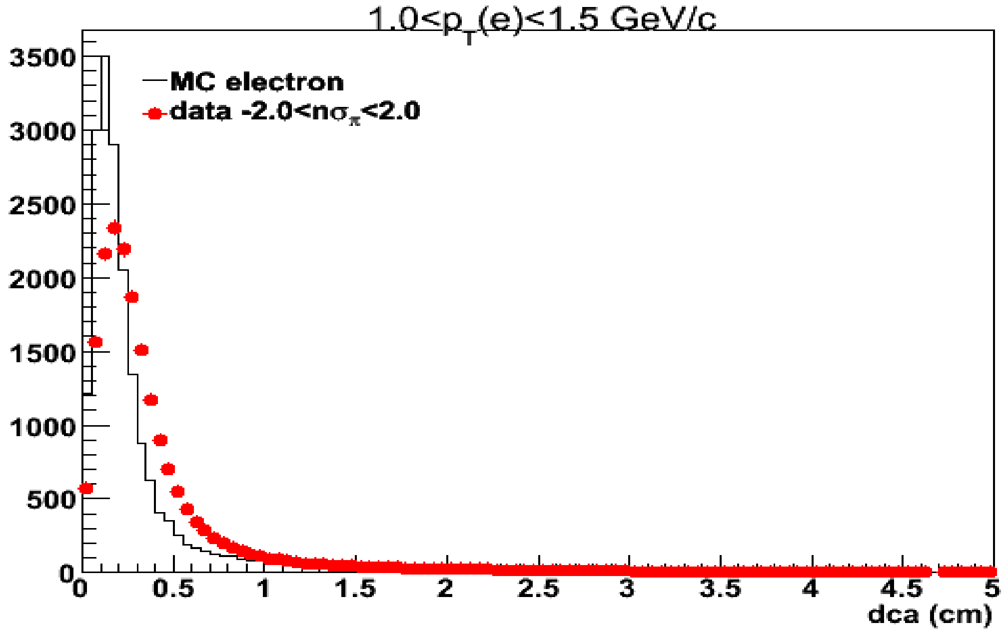

8.5<p_T(e)<9.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

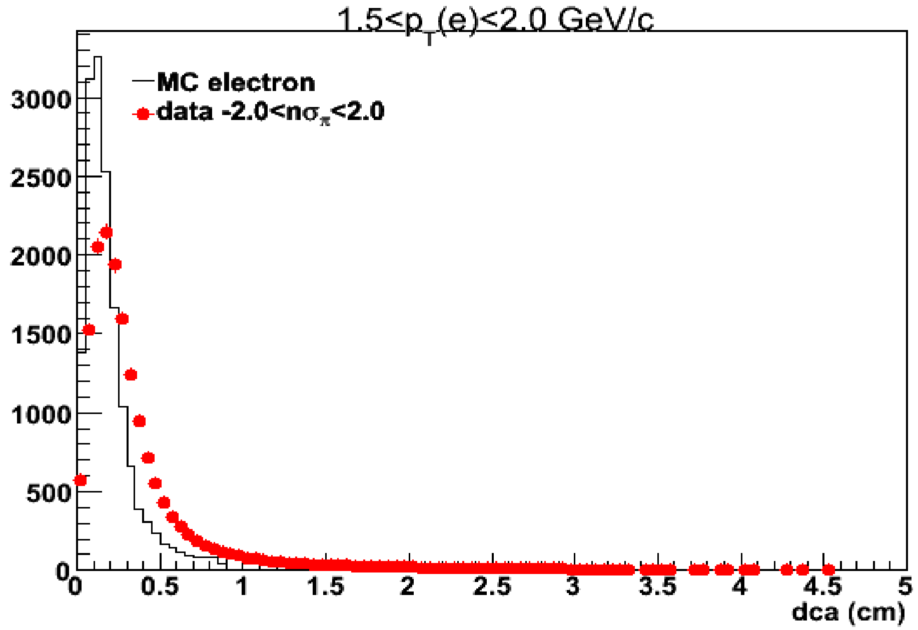

9.0<p_T(e)<9.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

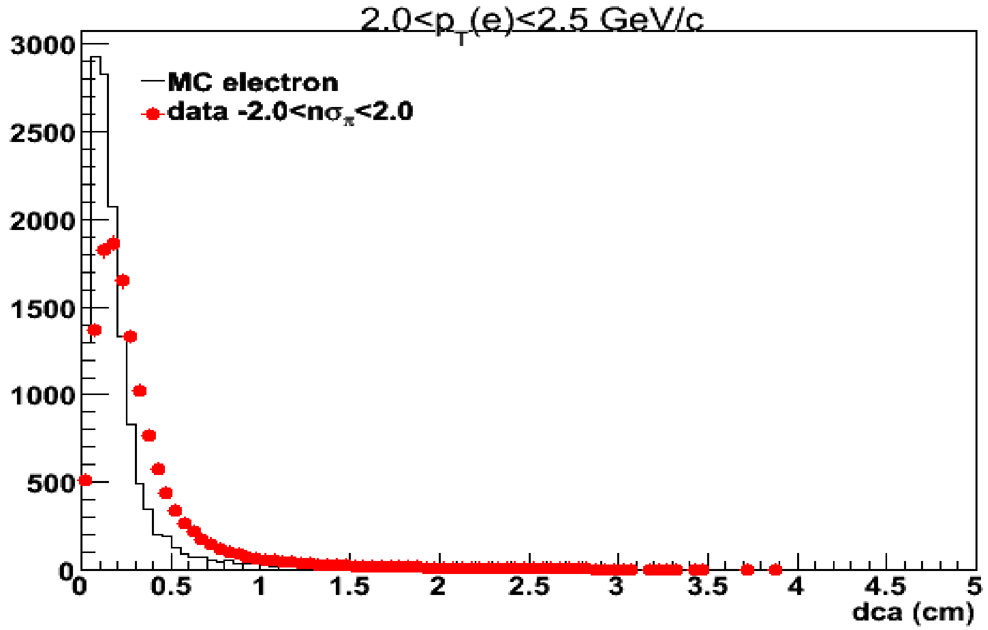

9.5<p_T(e)<10.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit

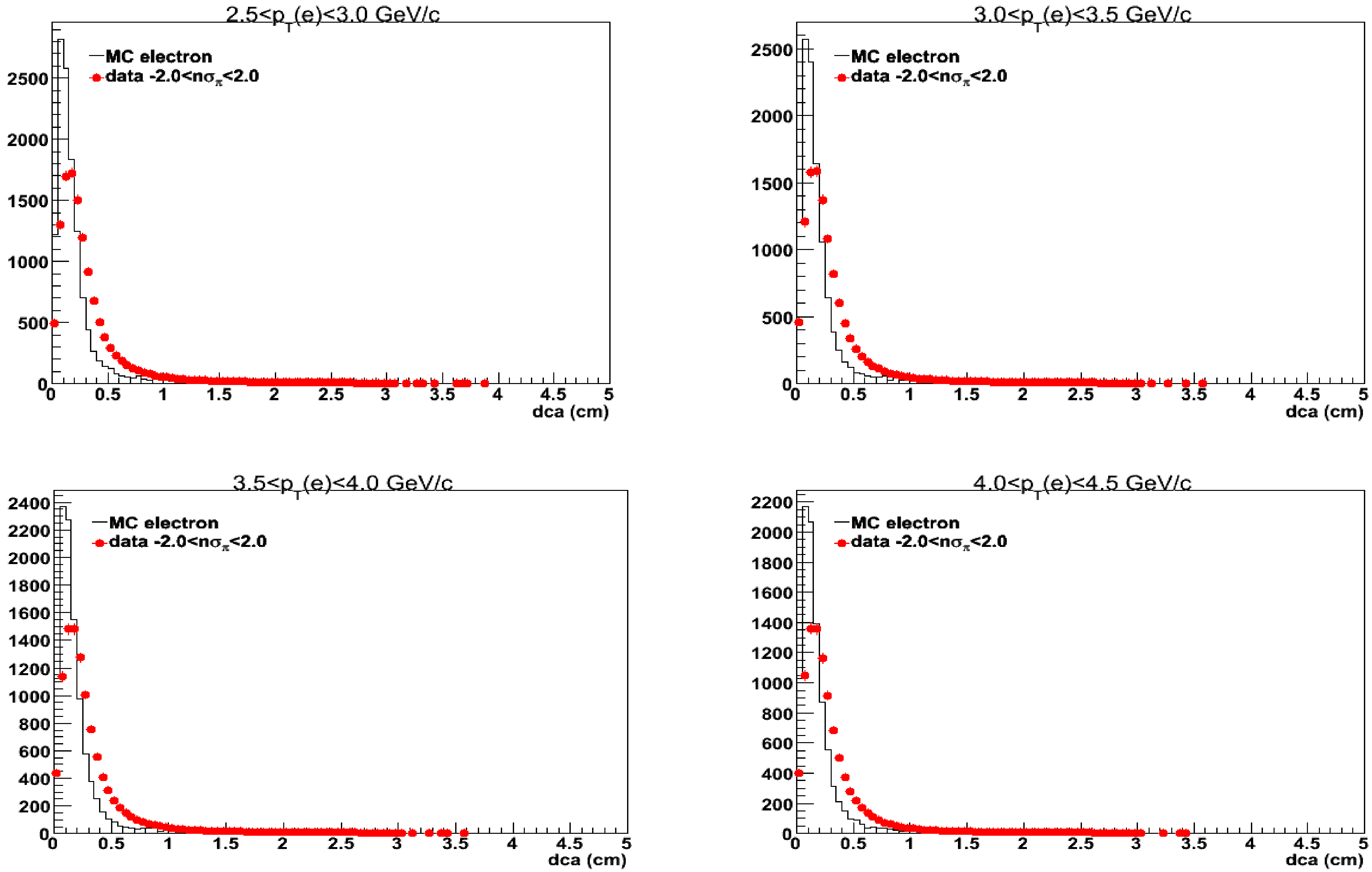

10.0<p_T(e)<10.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
#HitsFit


$0.5<p_T(e)<1.0$ GeV/c
MC electron
data $-2.0<n\sigma_\pi<2.0$
dca (cm)

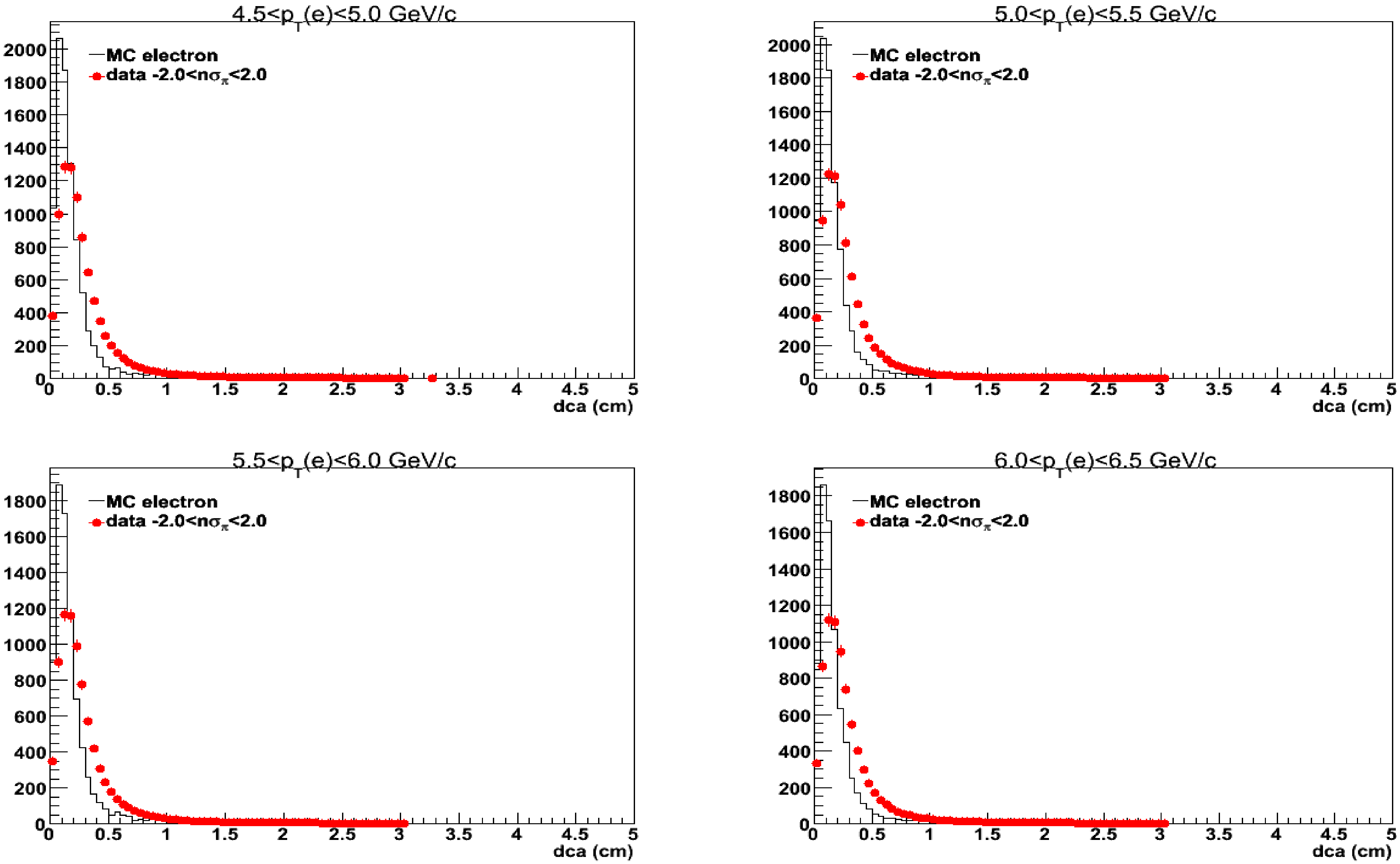

$1.0<p_T(e)<1.5$ GeV/c
MC electron
data $-2.0<n\sigma_\pi<2.0$
dca (cm)

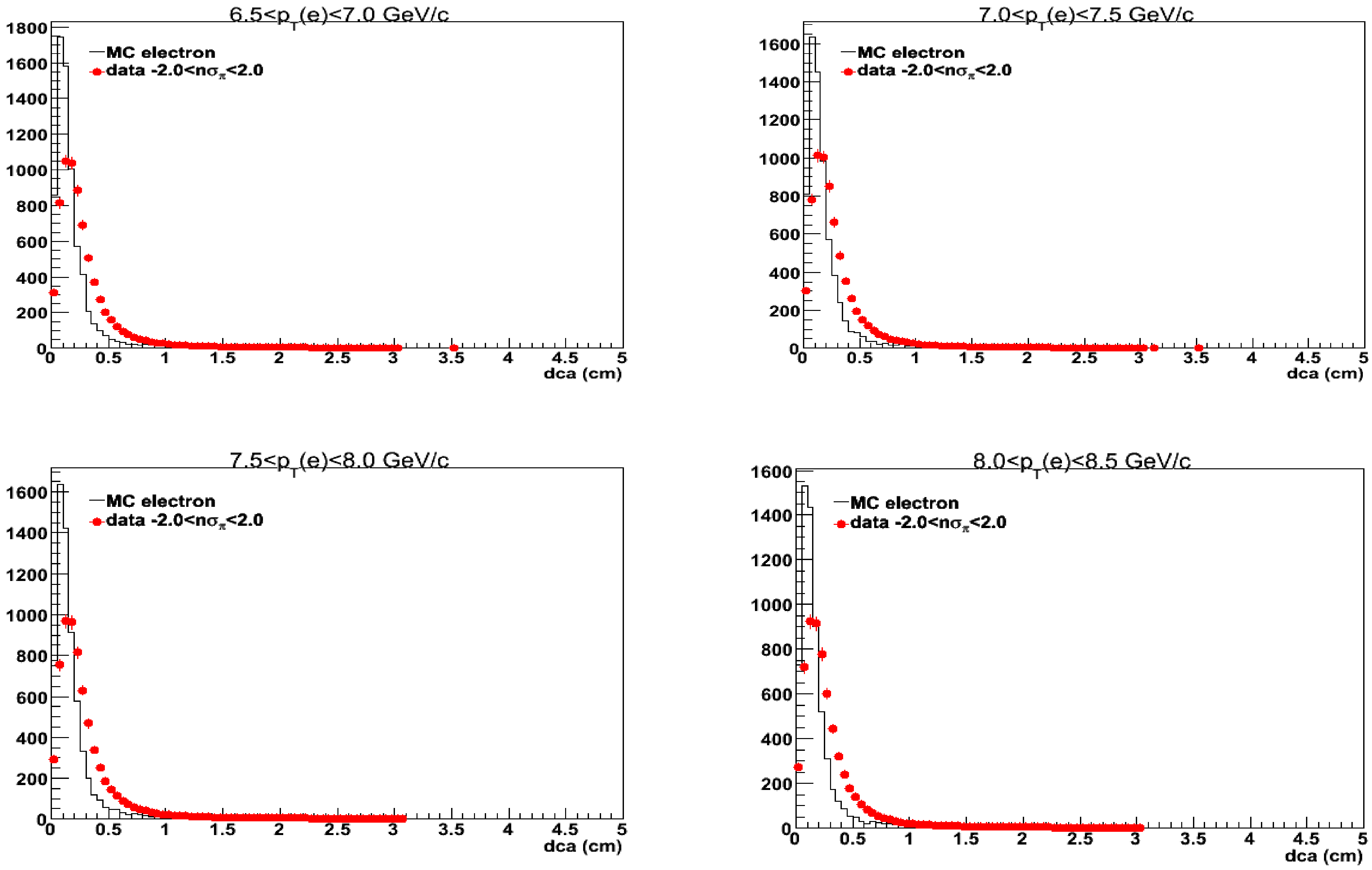

$1.5<p_T(e)<2.0$ GeV/c
MC electron
data $-2.0<n\sigma_\pi<2.0$
dca (cm)


$2.0<p_T(e)<2.5$ GeV/c
MC electron
data $-2.0<n\sigma_\pi<2.0$
dca (cm)

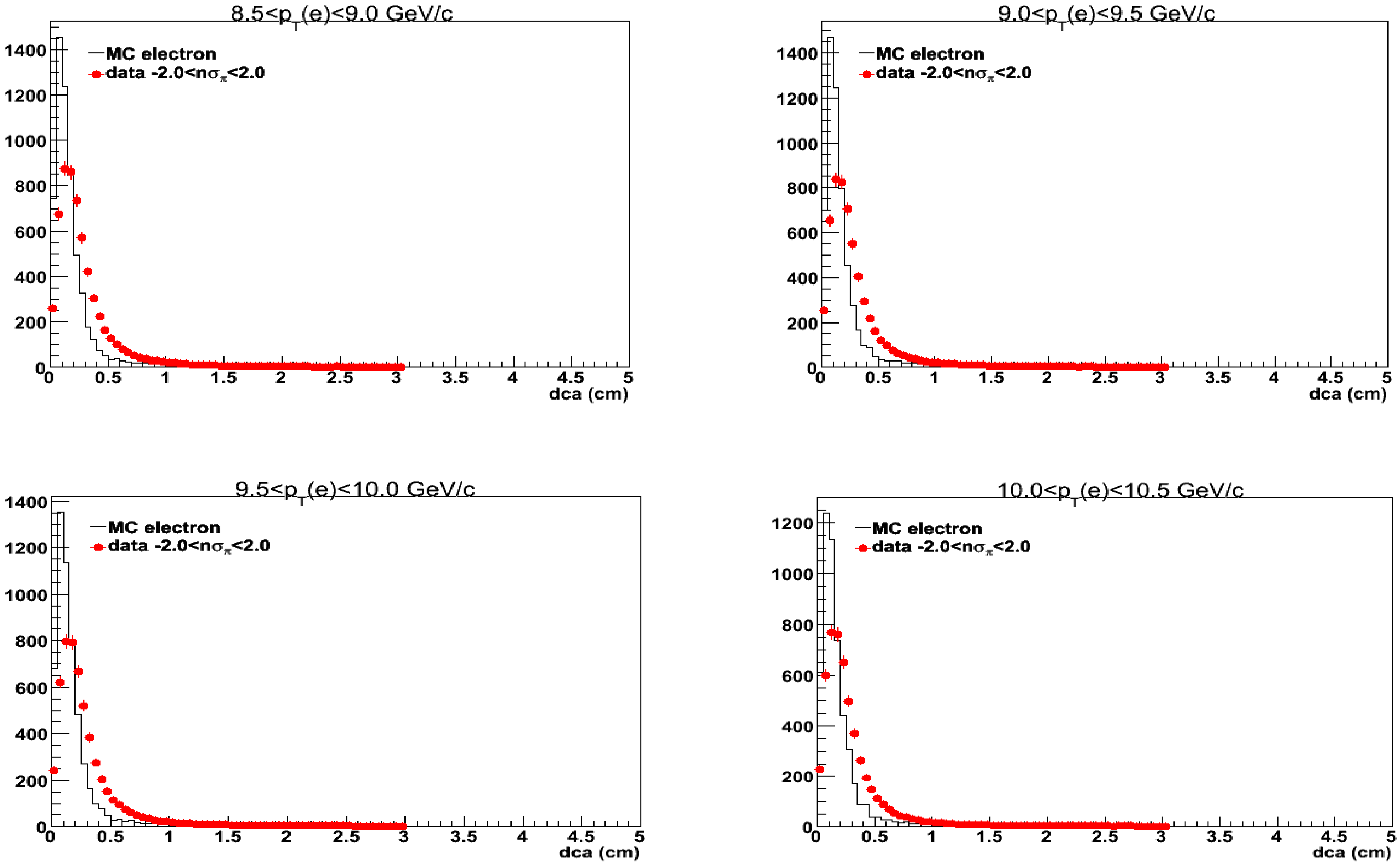


2.5<p_T(e)<3.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
3.0<p_T(e)<3.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
3.5<p_T(e)<4.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
4.0<p_T(e)<4.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)


4.5<p_T(e)<5.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
5.0<p_T(e)<5.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
5.5<p_T(e)<6.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
6.0<p_T(e)<6.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)

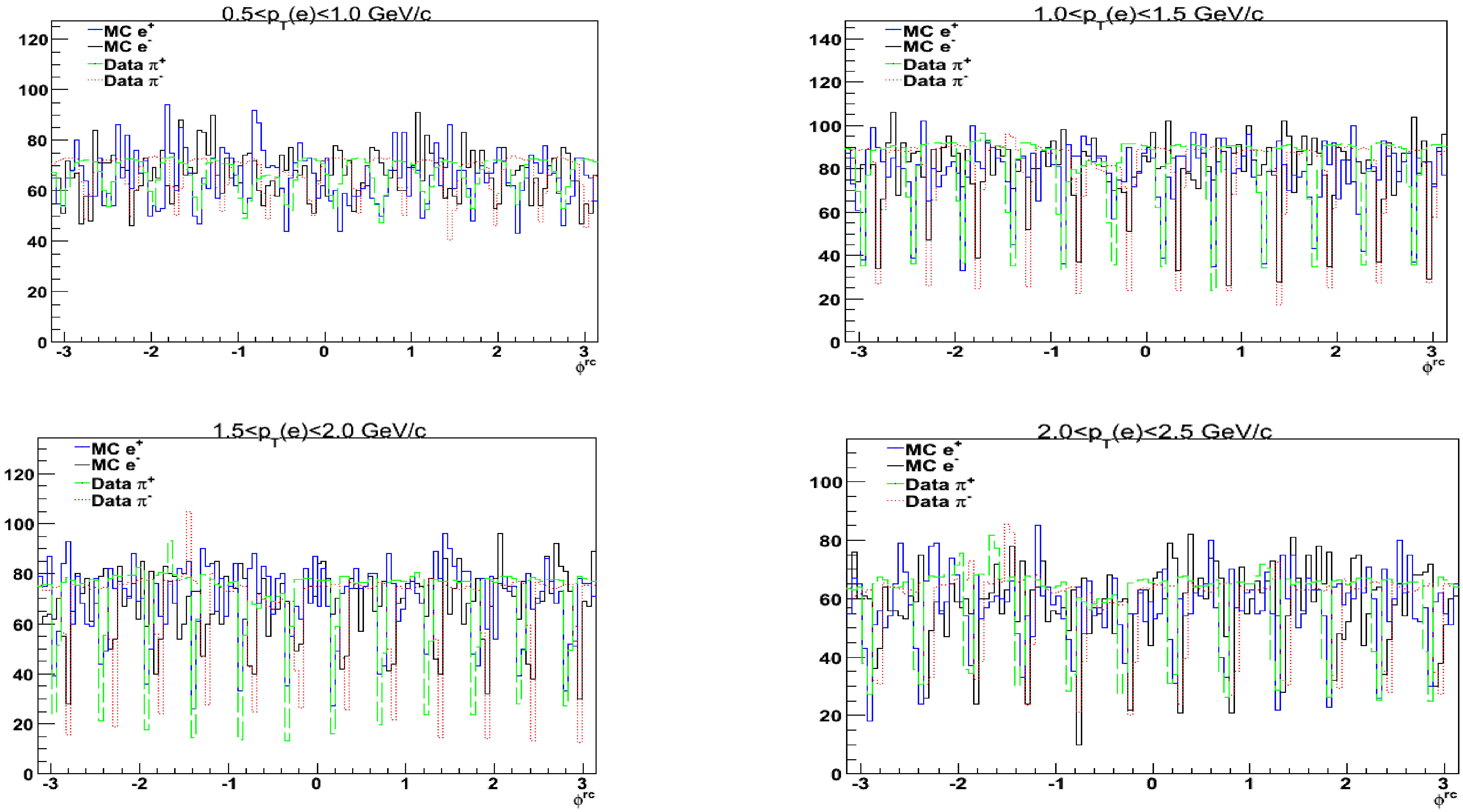


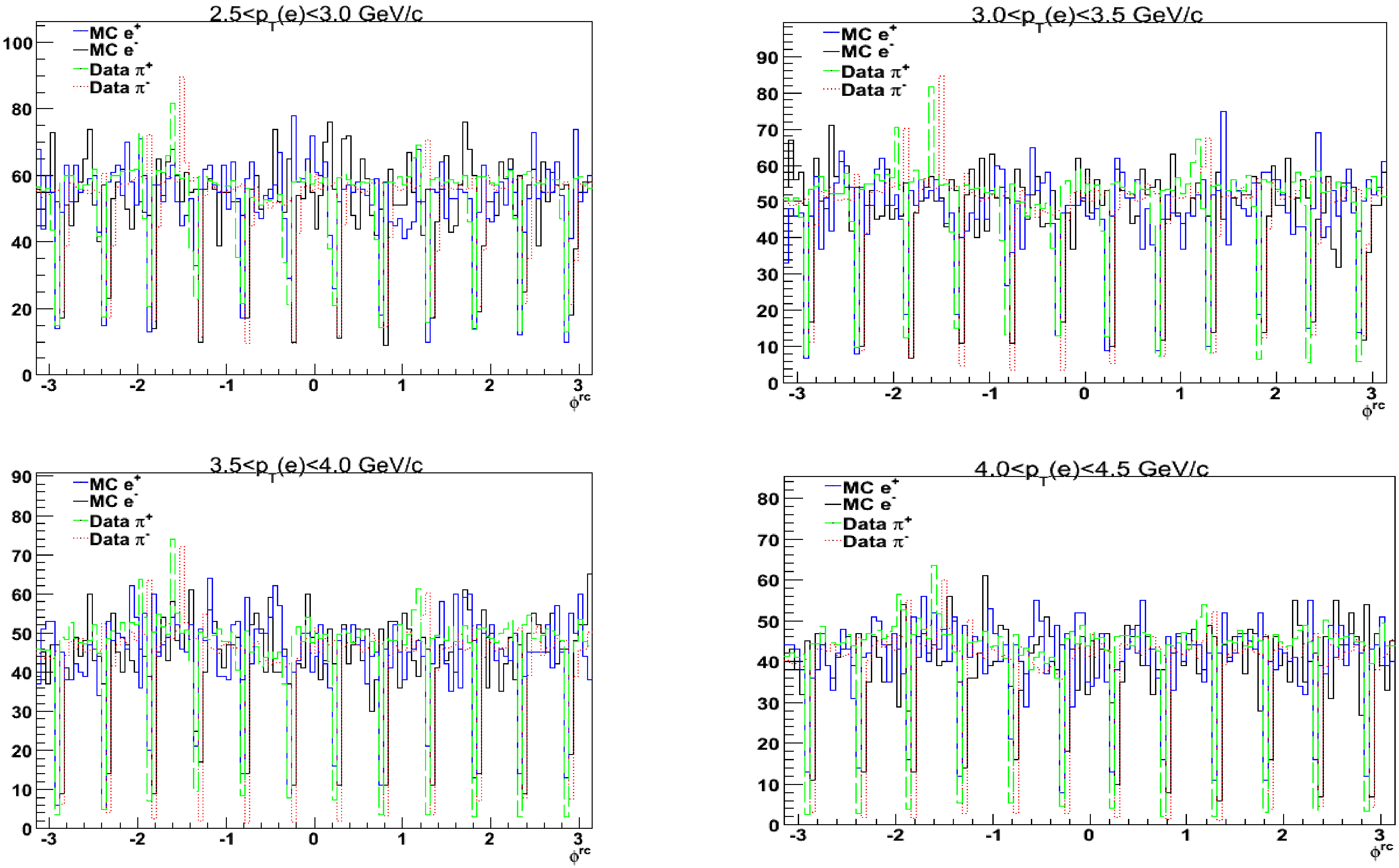
6.5<p_T(e)<7.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
7.0<p_T(e)<7.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
7.5<p_T(e)<8.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
8.0<p_T(e)<8.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)

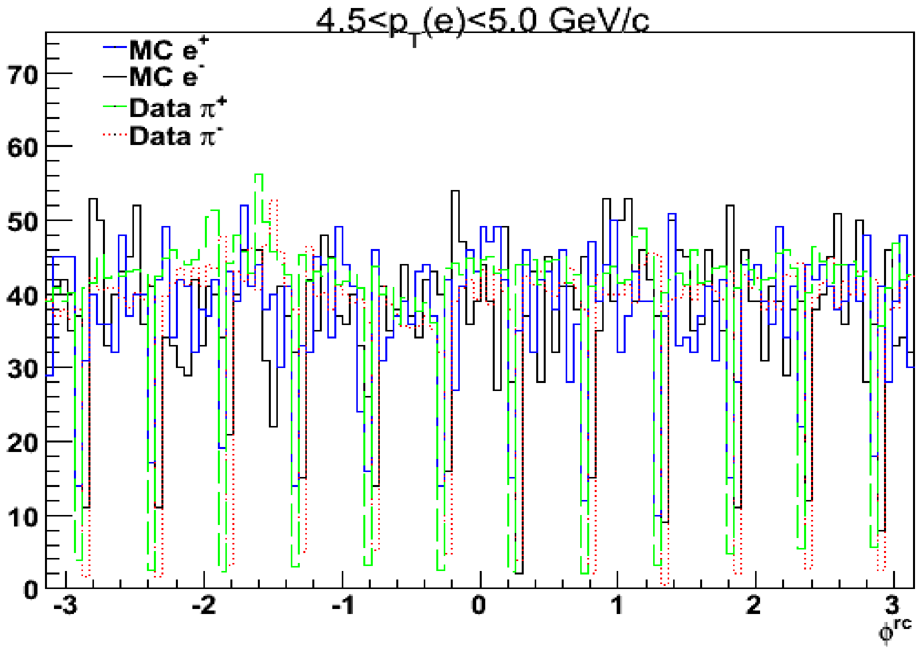


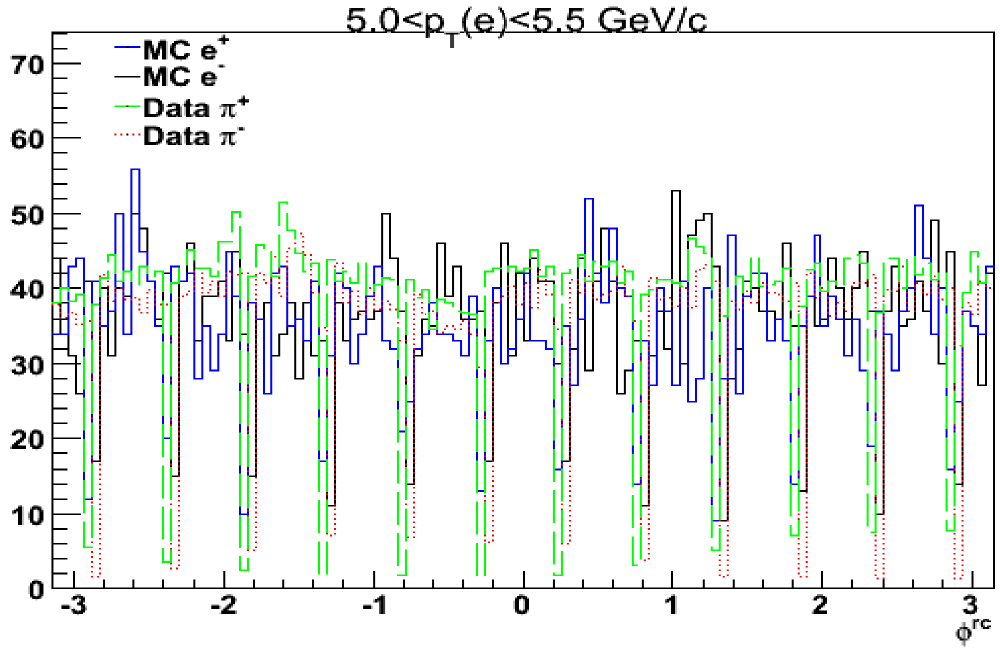
8.5<p_T(e)<9.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
9.0<p_T(e)<9.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
9.5<p_T(e)<10.0 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)
10.0<p_T(e)<10.5 GeV/c
MC electron
data -2.0<nσ_π<2.0
dca (cm)

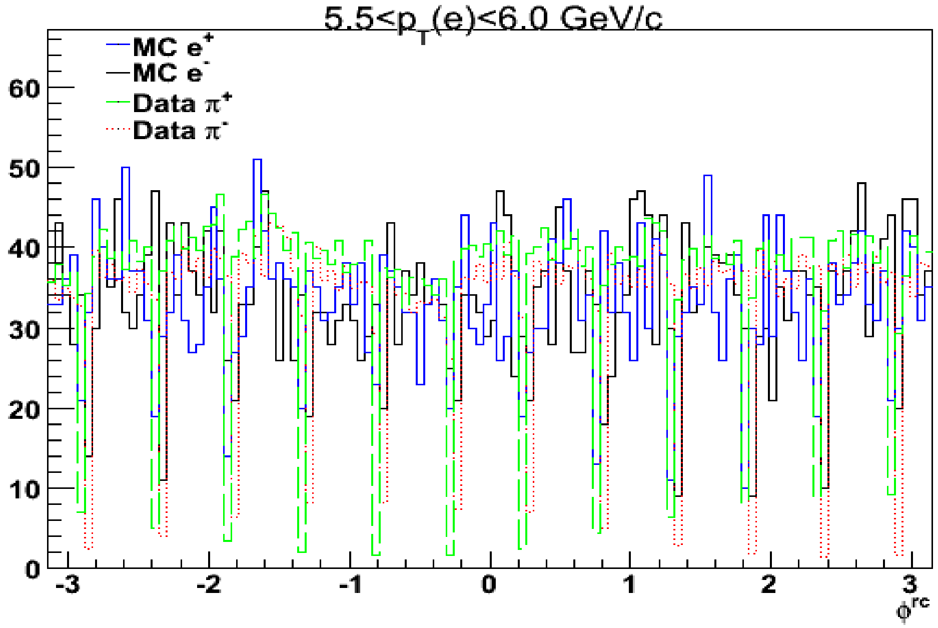
$$pions: -2. < nSigmaPion < 2.$$

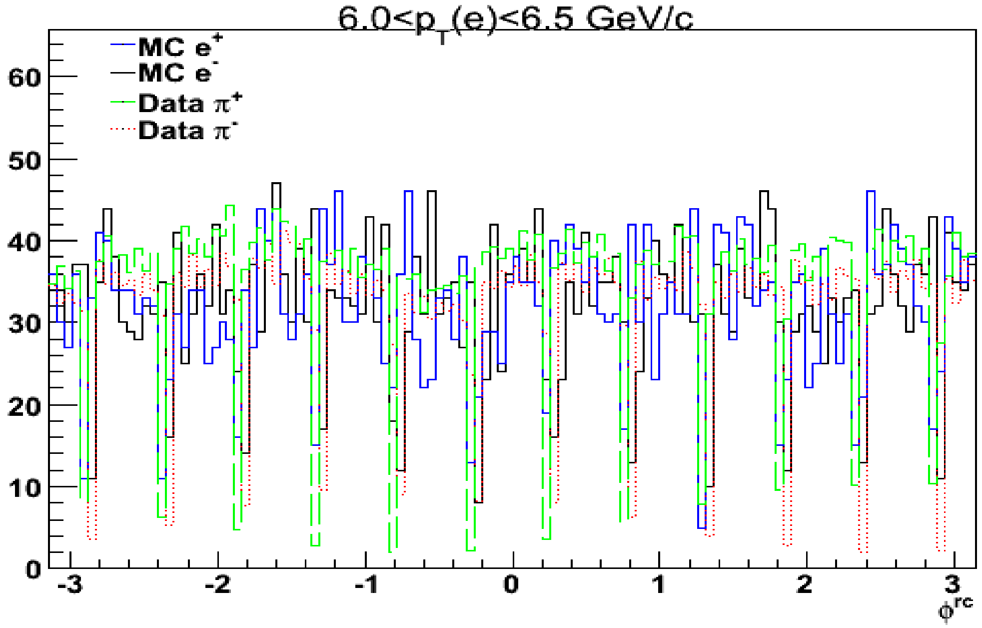


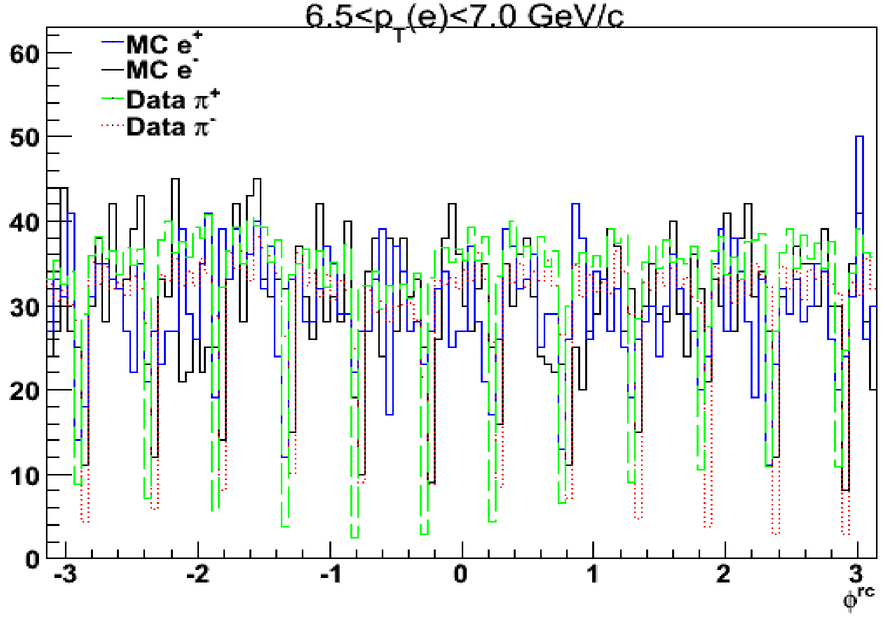

2.5<p_T(e)<3.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc
3.0<p_T(e)<3.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc
3.5<p_T(e)<4.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc
4.0<p_T(e)<4.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc


4.5<p_T(e)<5.0 GeV/c
MC e+
MC e-
Data π+
Data π-
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
φ^rc

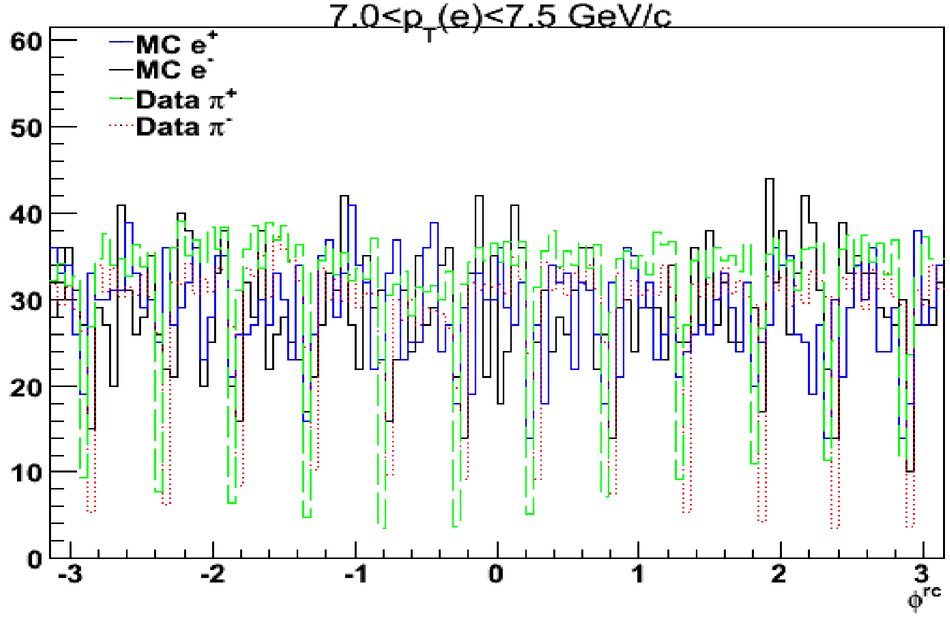

5.0<p_T(e)<5.5 GeV/c
MC e+
MC e-
Data π+
Data π-
0
10
20
30
40
50
60
70
-3
-2
-1
0
1
2
3
φ^rc


5.5<p_T(e)<6.0 GeV/c
MC e+
MC e-
Data π+
Data π-
0
10
20
30
40
50
60
-3
-2
-1
0
1
2
3
φ^rc

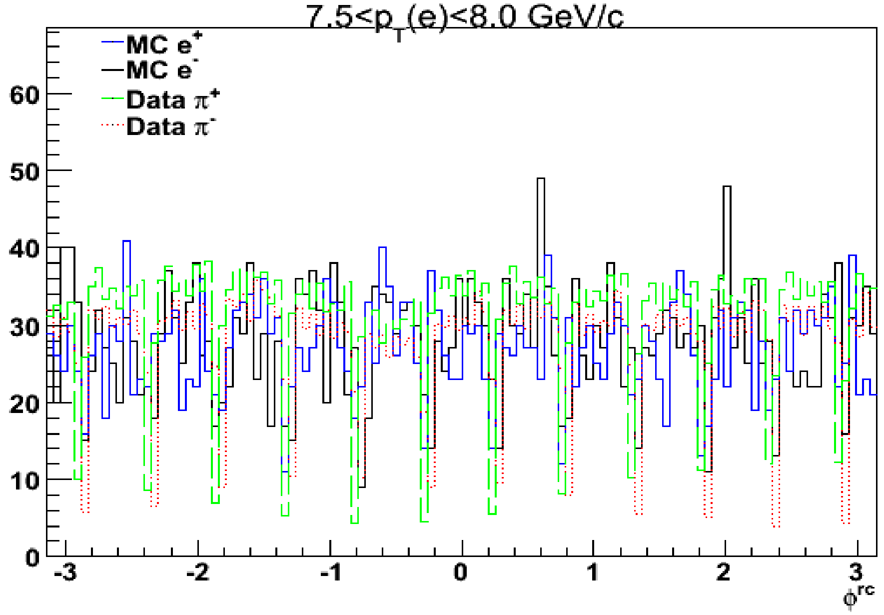

6.0<p_T(e)<6.5 GeV/c
MC e+
MC e-
Data π+
Data π-
0
10
20
30
40
50
60
-3
-2
-1
0
1
2
3
φ^rc



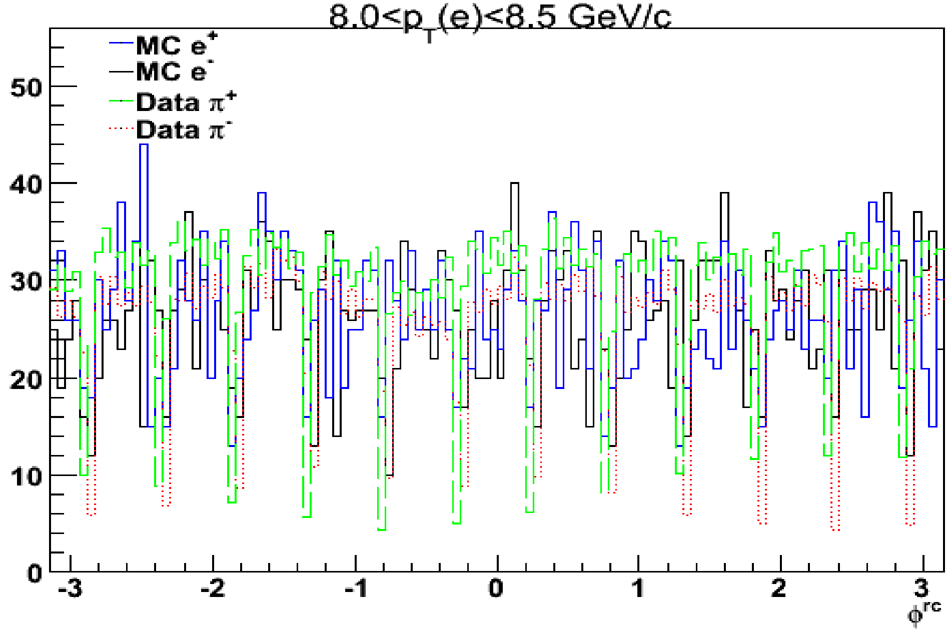
6.5<p_T(e)<7.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φ^rc



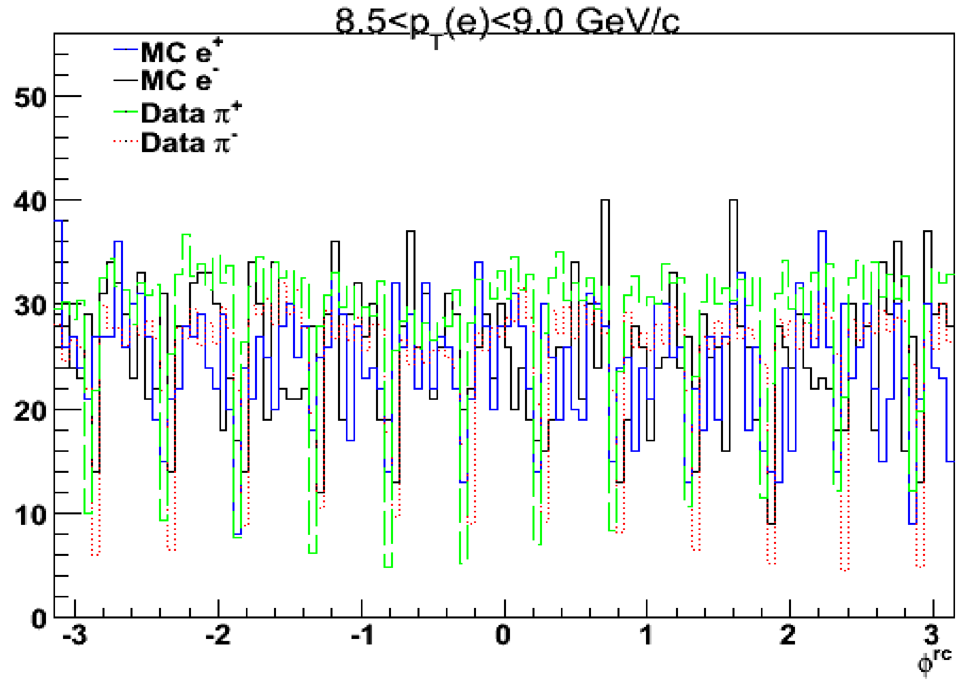
7.0<p_T(e)<7.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φ^rc

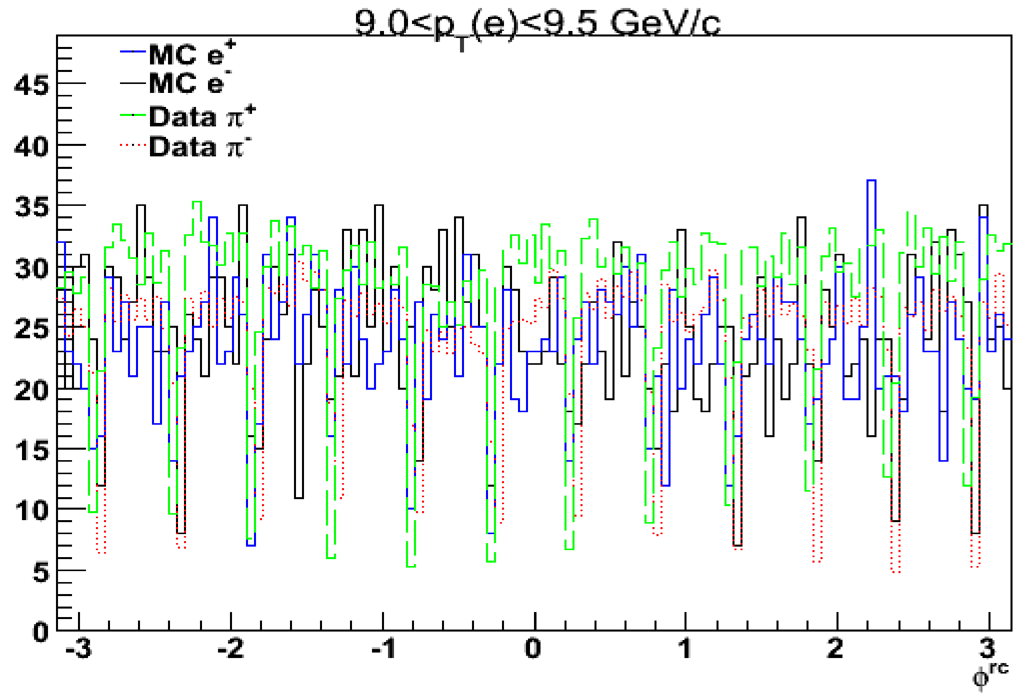


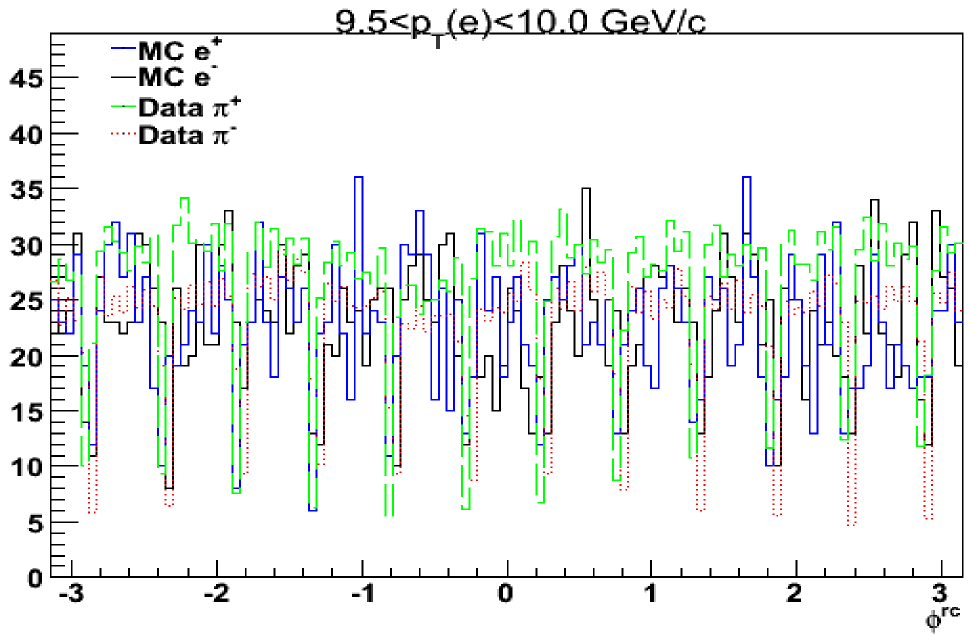
7.5<p_T(e)<8.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φ^rc

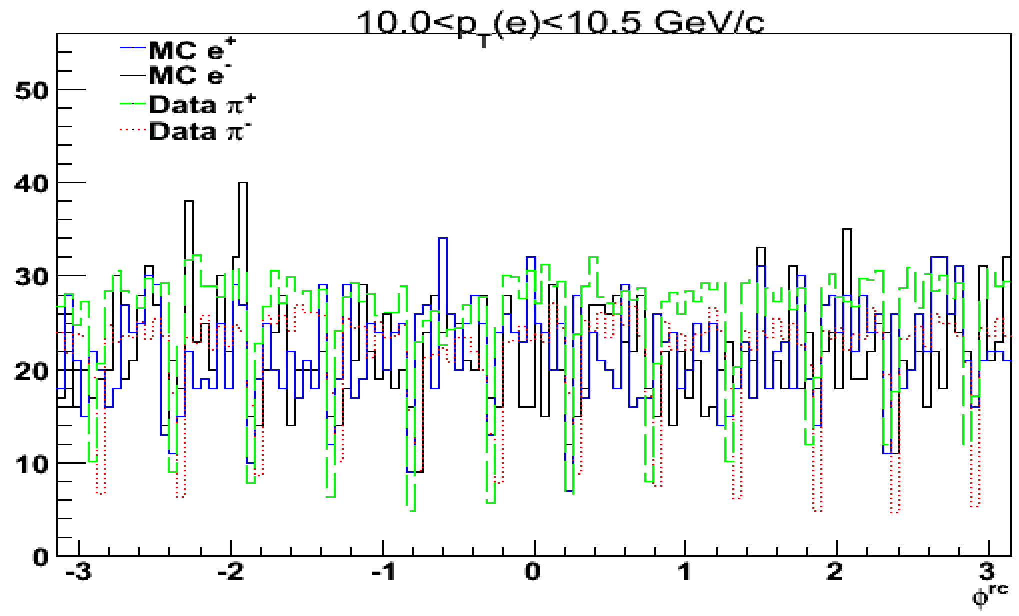


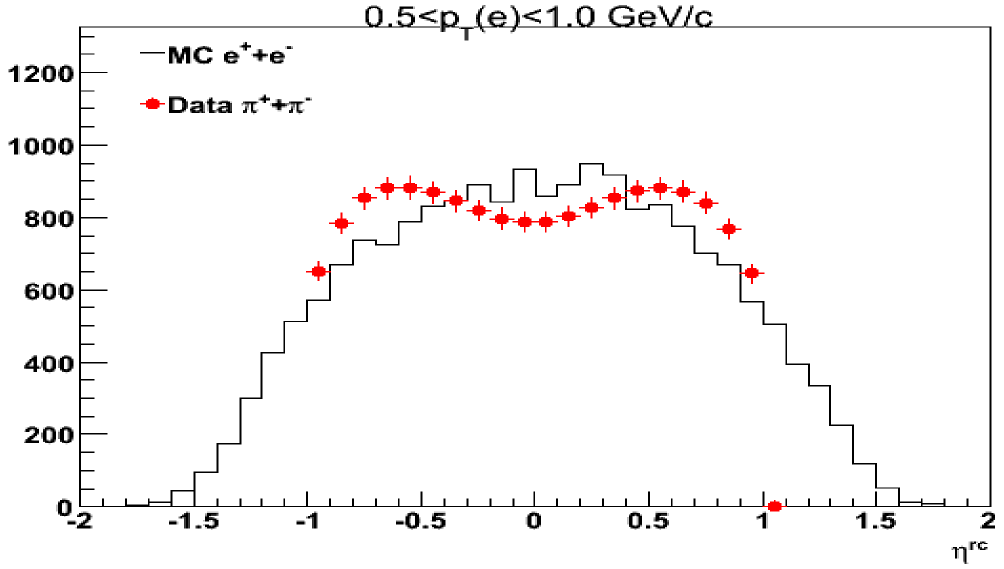
8.0<p_T(e)<8.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φ^rc

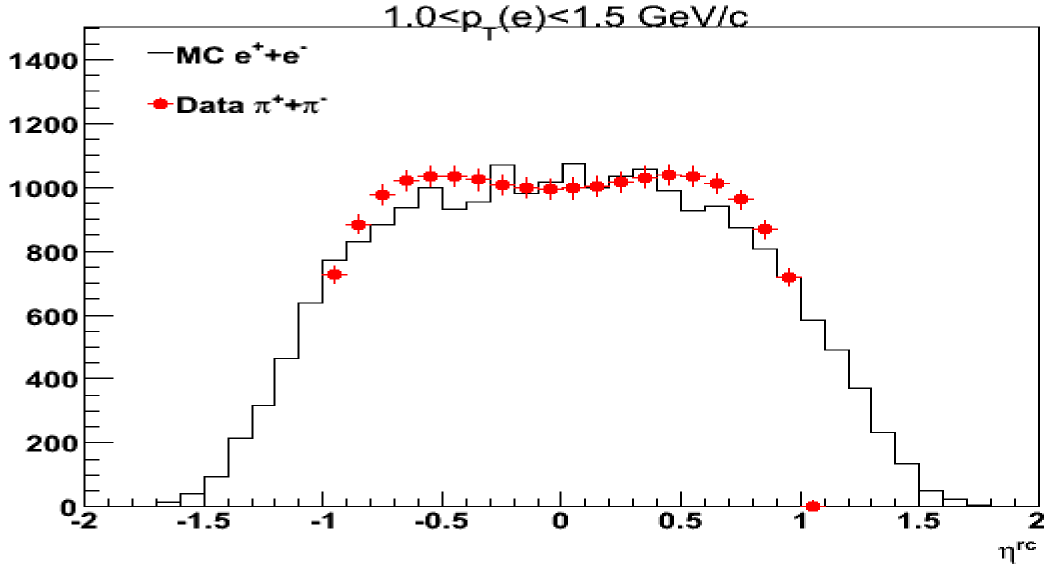

8.5<p_T(e)<9.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc

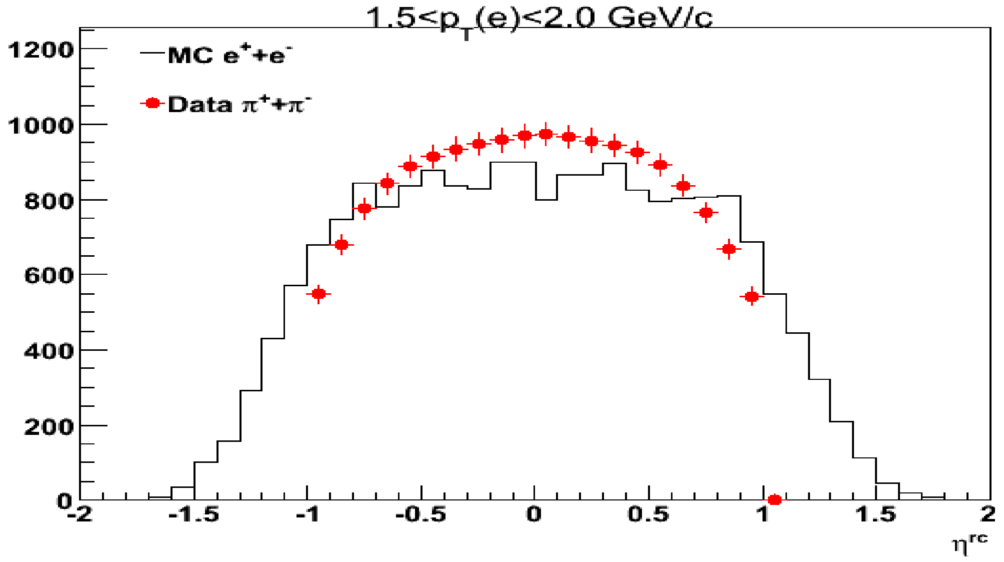

9.0<p_T(e)<9.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc

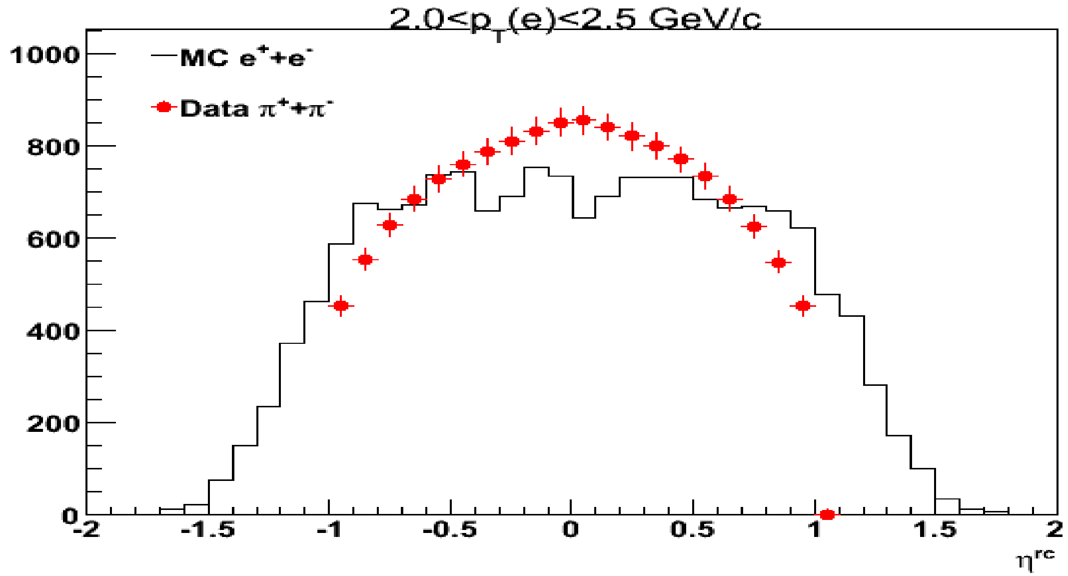

9.5<p_T(e)<10.0 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc

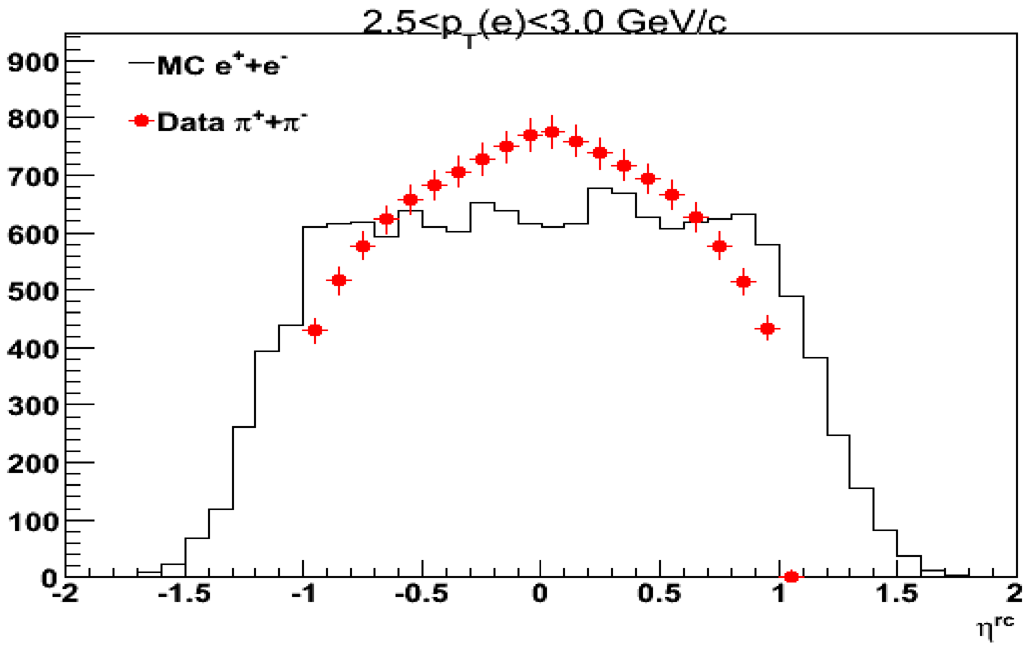

10.0<p_T(e)<10.5 GeV/c
MC e+
MC e-
Data π+
Data π-
φrc

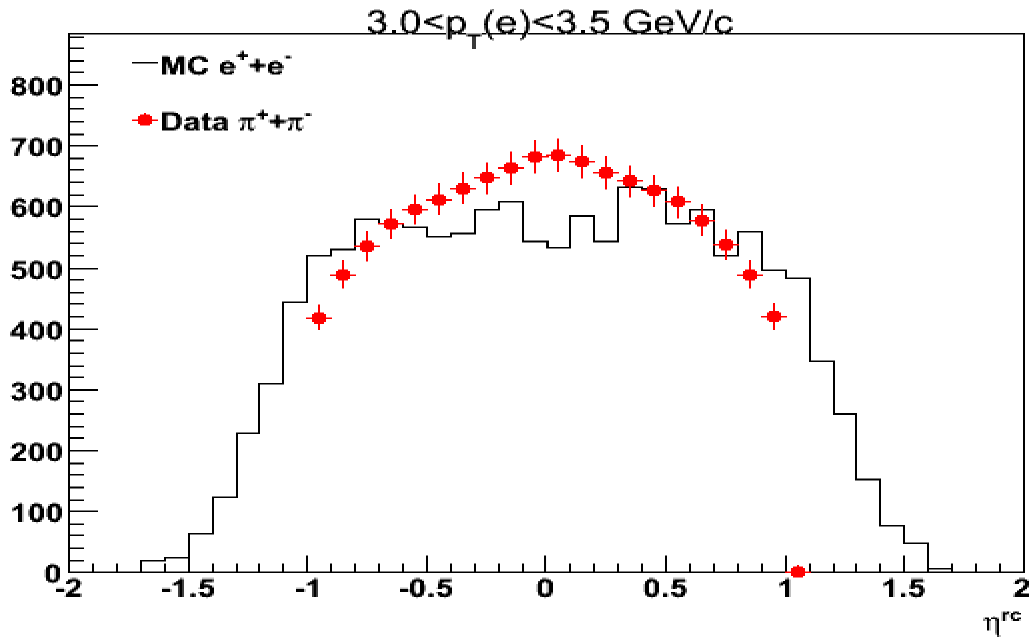

0.5<p_T(e)<1.0 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

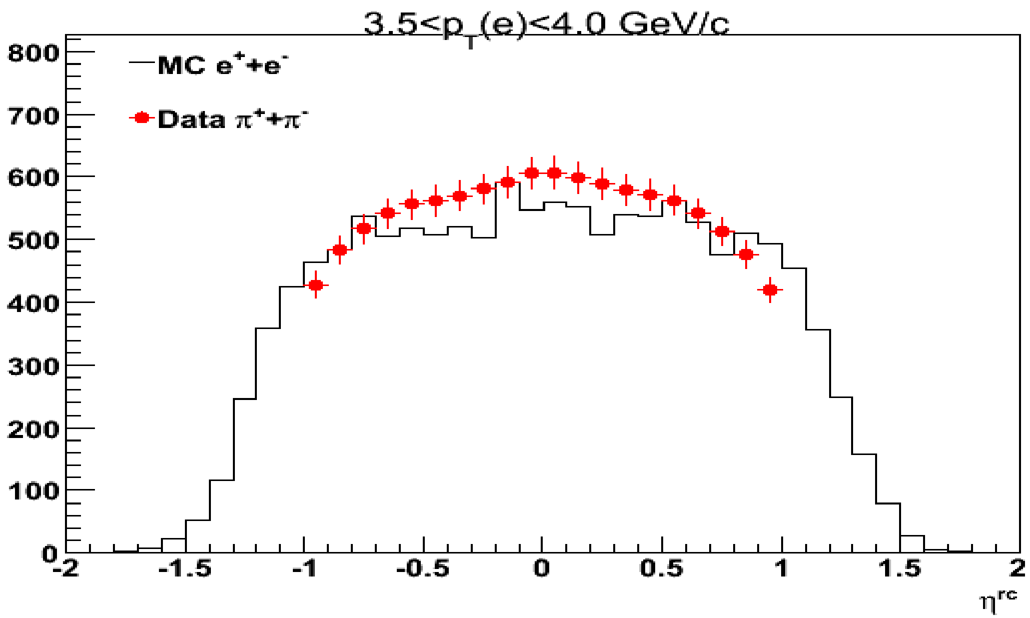

1.0<p_T(e)<1.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

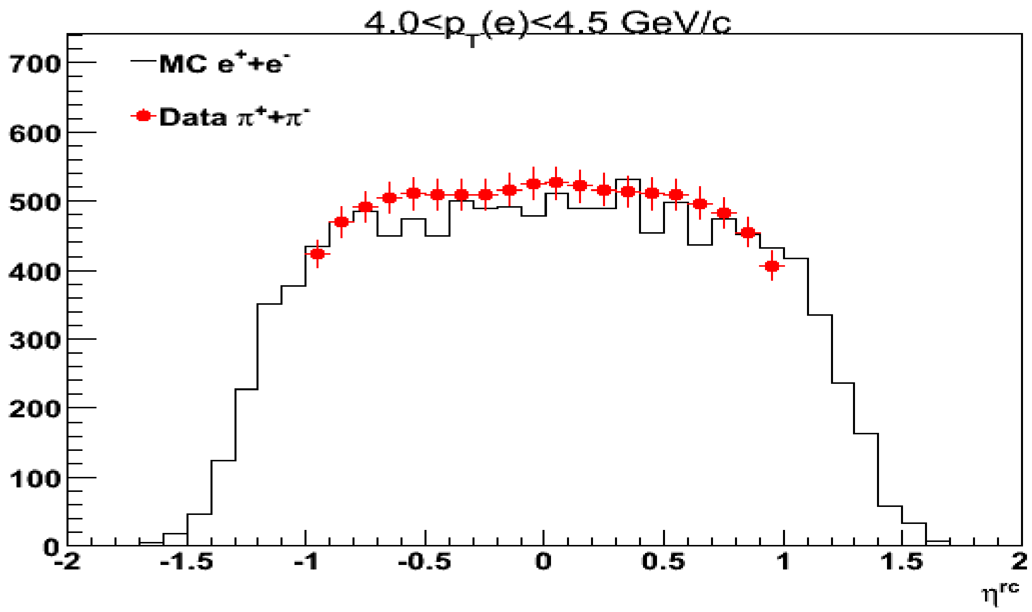

1.5<p_T(e)<2.0 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

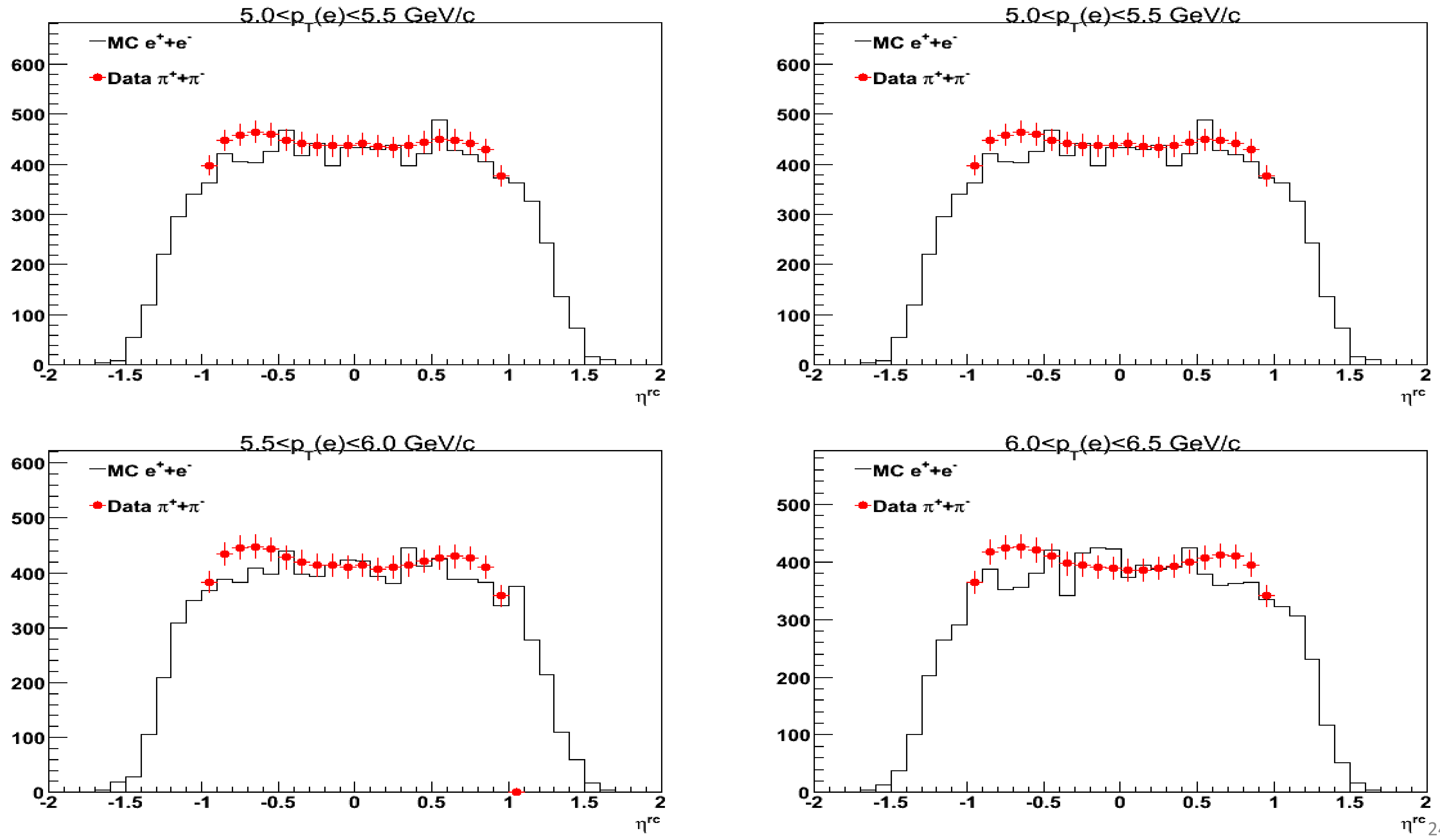

2.0<p_T(e)<2.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc


2.5<p_T(e)<3.0 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

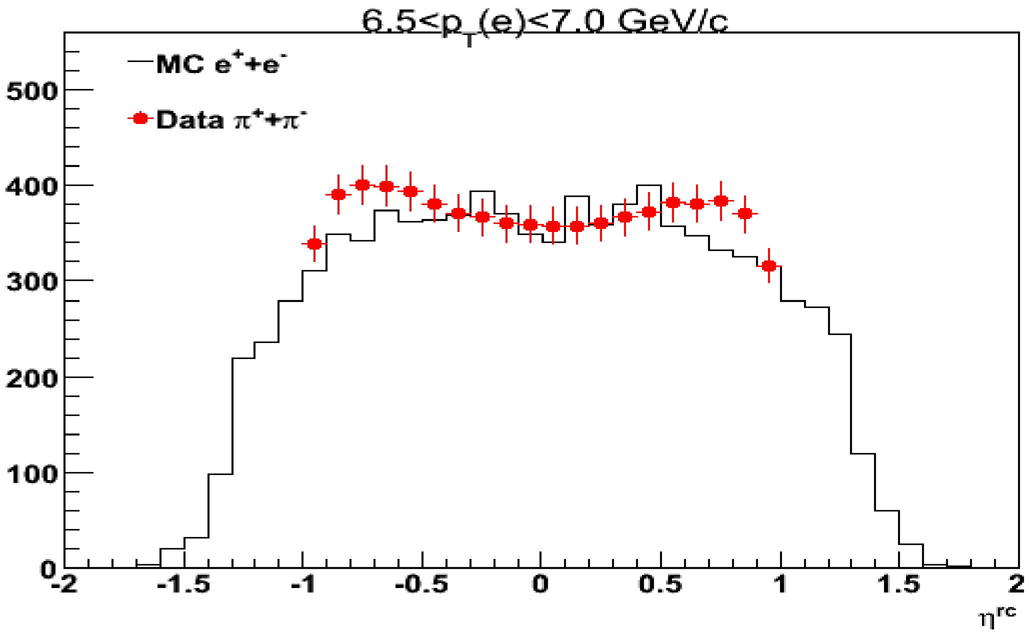

3.0<p_T(e)<3.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc


3.5<p_T(e)<4.0 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

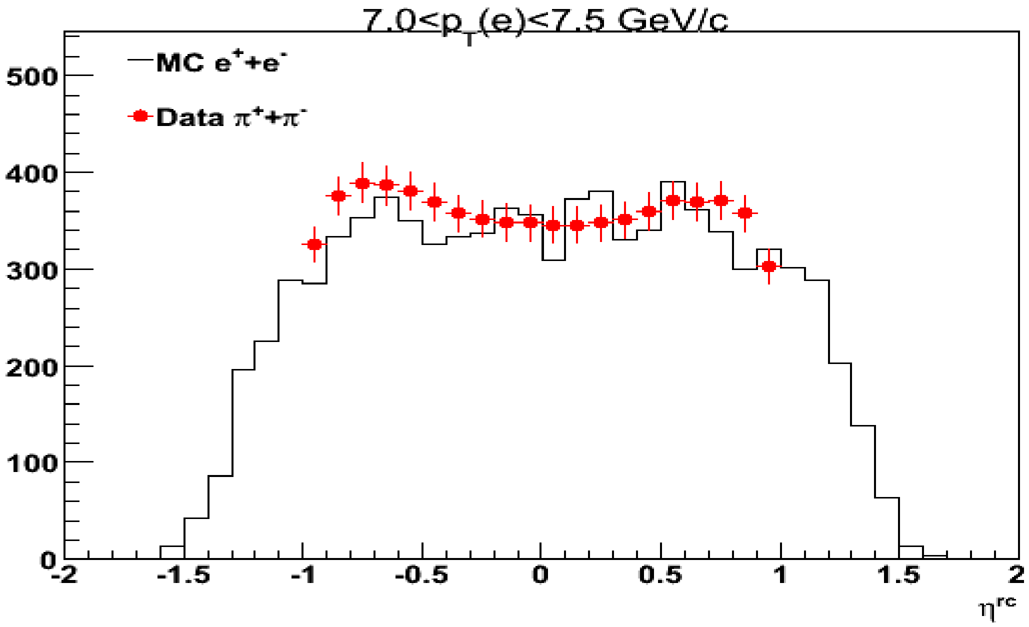

4.0<p_T(e)<4.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc



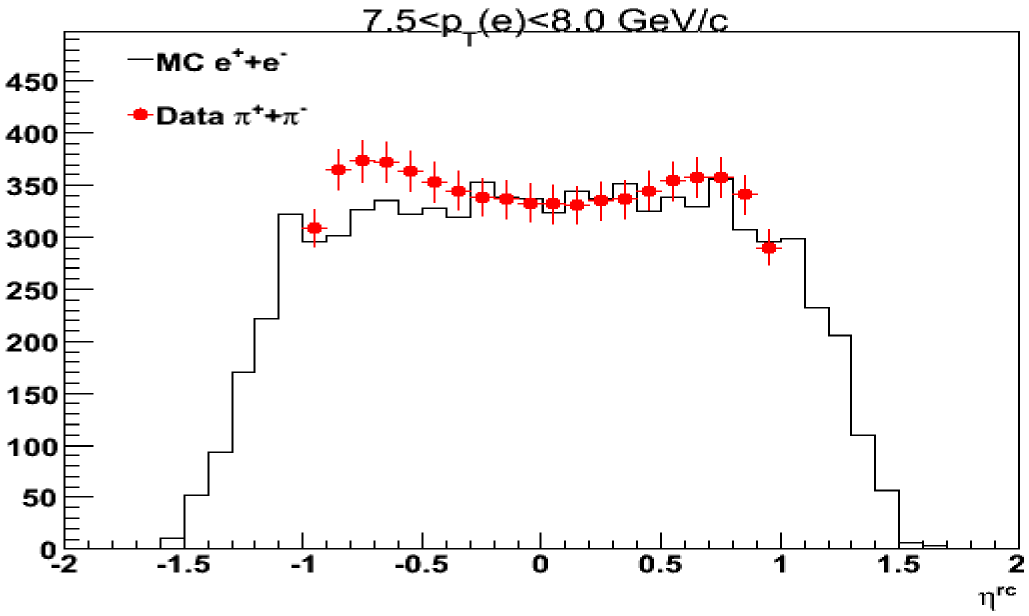
5.0<p_T(e)<5.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc
5.0<p_T(e)<5.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc
5.5<p_T(e)<6.0 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc
6.0<p_T(e)<6.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc



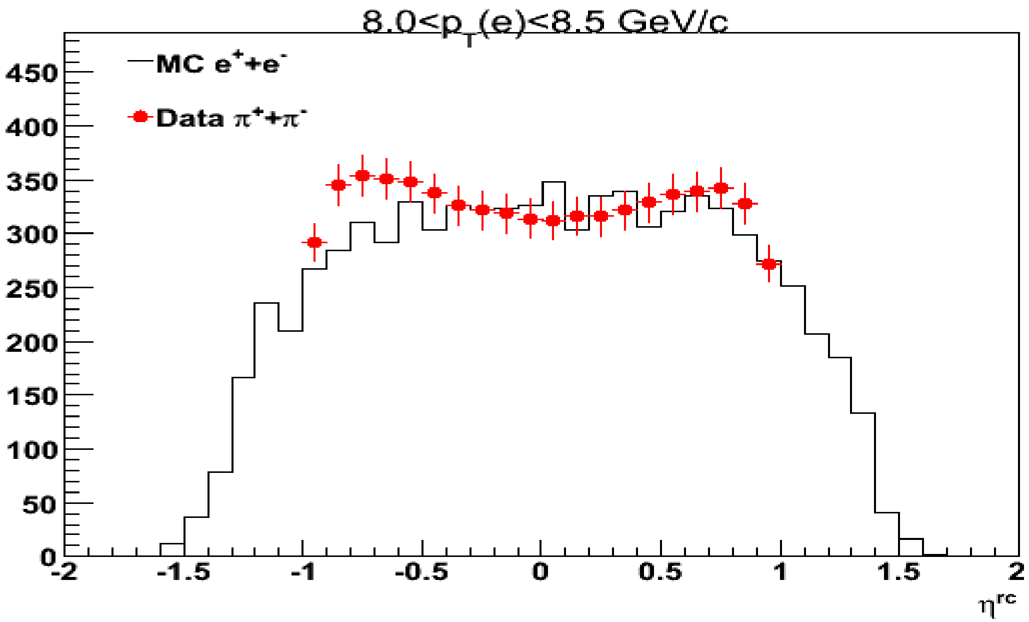
$6.5<p_T(e)<7.0$ GeV/c
MC $e^+ + e^-$
Data $\pi^+ + \pi^-$
0 100 200 300 400 500
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
η^{rc}



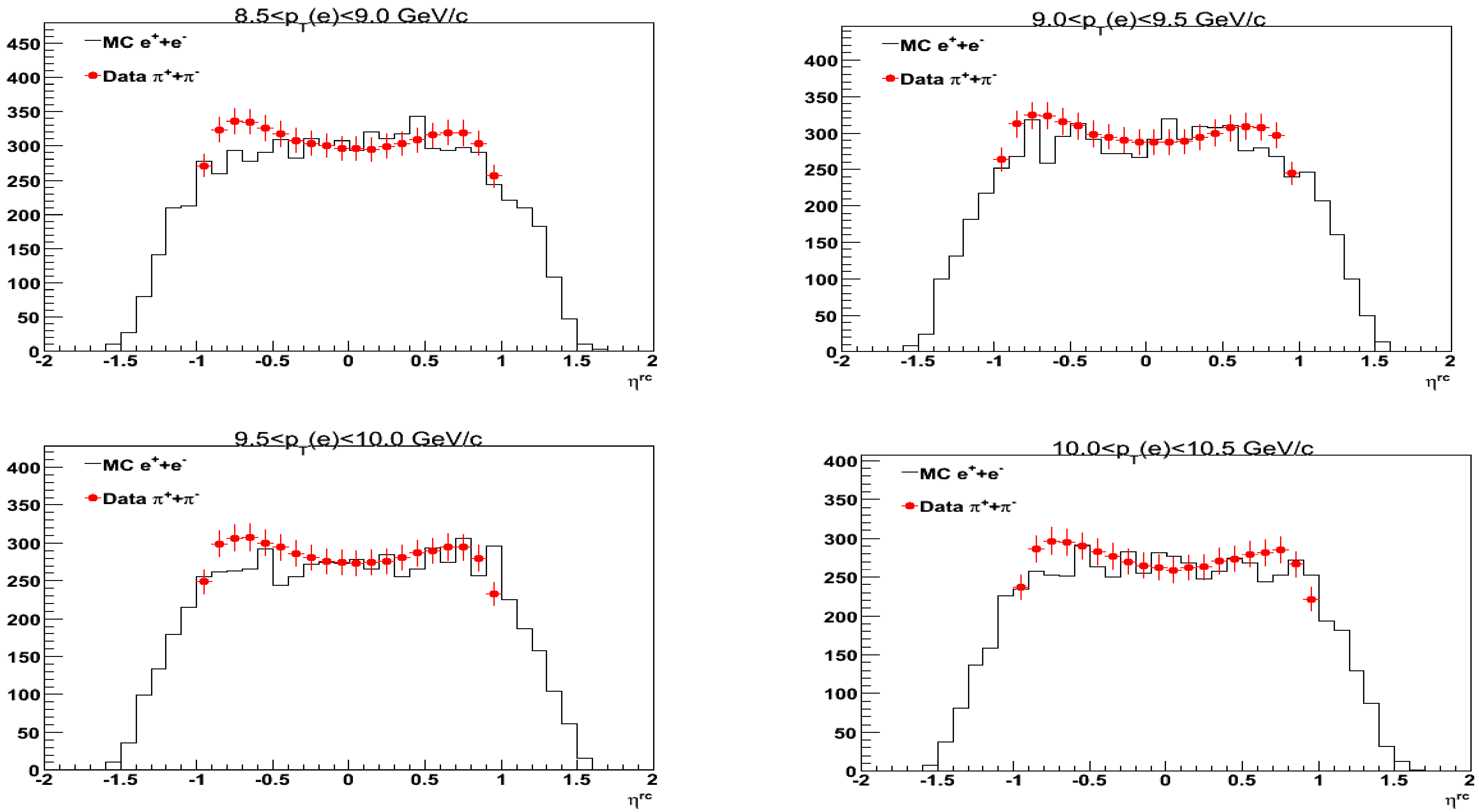
$7.0<p_T(e)<7.5$ GeV/c
MC $e^+ + e^-$
Data $\pi^+ + \pi^-$
0 100 200 300 400 500
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
η^{rc}



$7.5<p_T(e)<8.0$ GeV/c
MC $e^+ + e^-$
Data $\pi^+ + \pi^-$
0 50 100 150 200 250 300 350 400 450
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
η^{rc}



$8.0<p_T(e)<8.5$ GeV/c
MC $e^+ + e^-$
Data $\pi^+ + \pi^-$
0 50 100 150 200 250 300 350 400 450
-2 -1.5 -1 -0.5 0 0.5 1 1.5 2
η^{rc}


8.5<p_T(e)<9.0 GeV/c
9.0<p_T(e)<9.5 GeV/c
9.5<p_T(e)<10.0 GeV/c
10.0<p_T(e)<10.5 GeV/c
MC e⁺+e⁻
Data π⁺+π⁻
η^rc

p/E

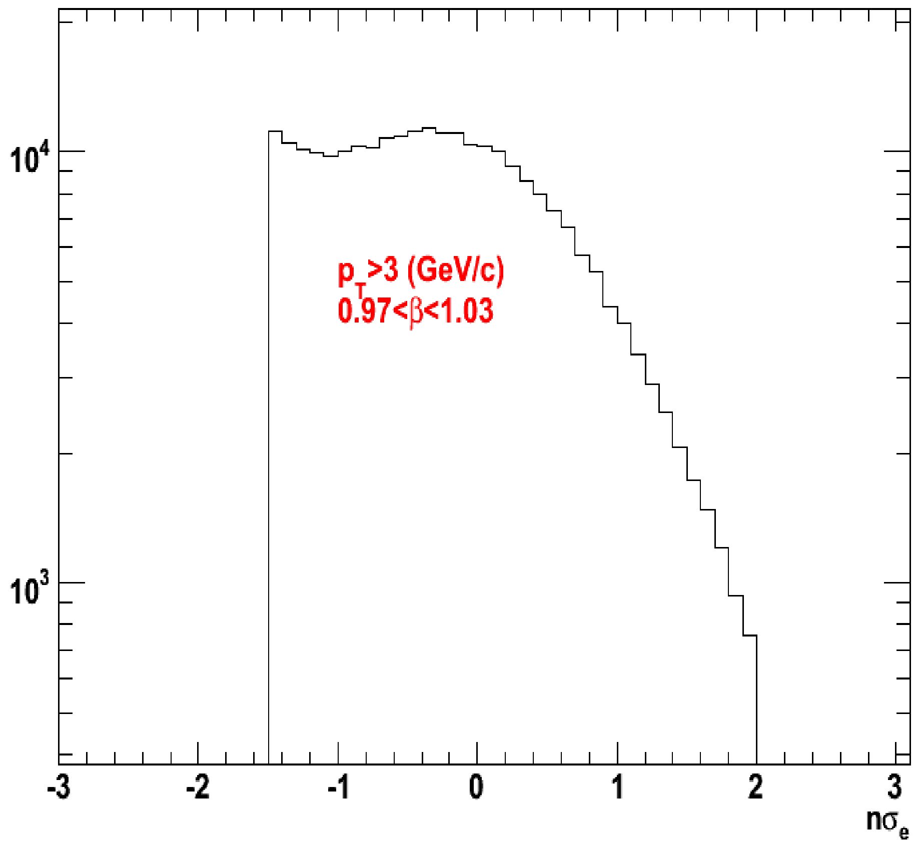
- 1)To get a pure electron sample ,we have two different ways (pT>3 we used Tofmatchflag>0)
- 1.Combine the information from different detectors

  a) at low pT (pT<3 GeV/c), combine nSigma and TOF to get a relative pure electron sample. And to reject trigger bias, we set a adc cut too.

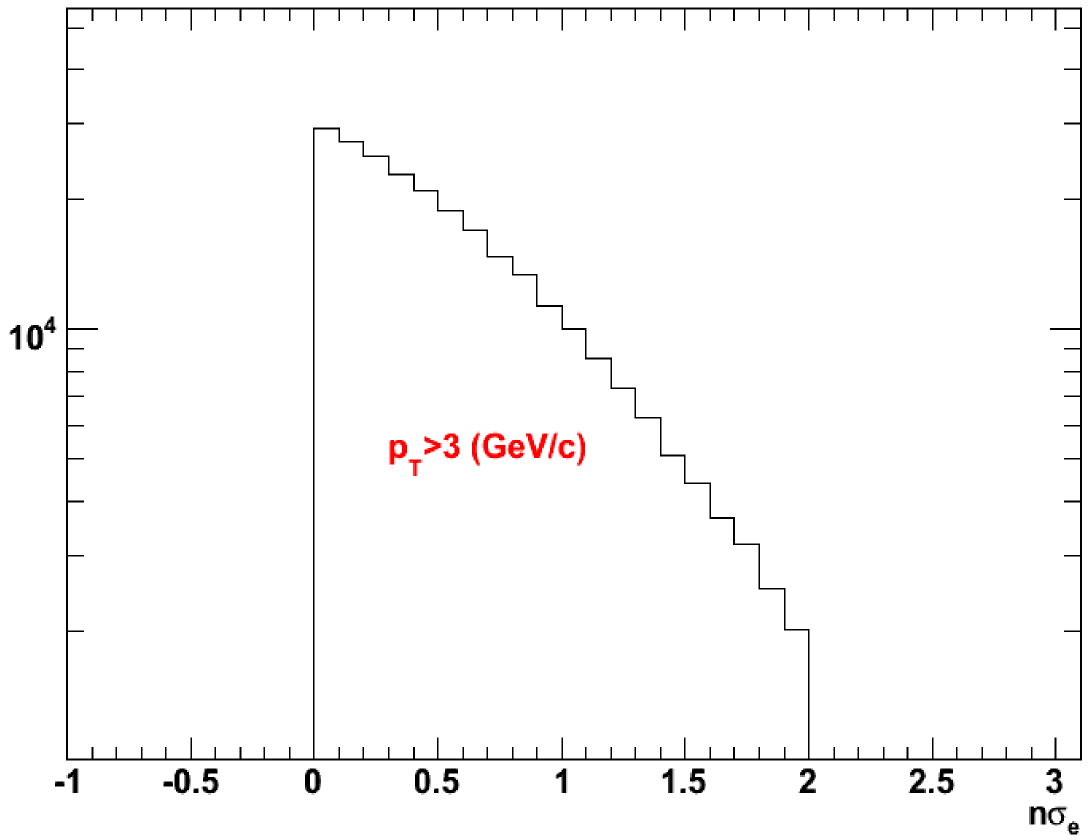
  $$-2.0 < n\sigma_e < 2. \ \&\&0.97 < \beta < 1.03 \qquad \mathrm{p_T} < 3.0\,\mathrm{GeV/c}$$
  $$adc<400 \qquad \mathrm{BHT2}$$

  b) at high pT(pT>3GeV/c), use a very tight dE/dx cut to get a electron-rich sample.

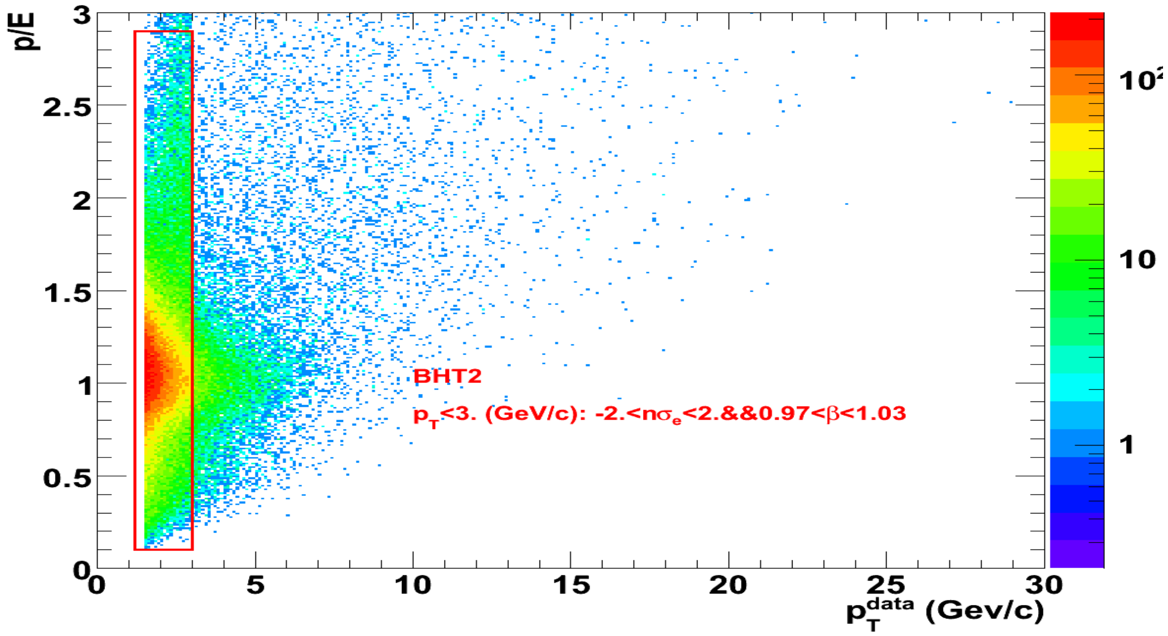
  $$0. < n\sigma_e < 2. \qquad \mathrm{p_T} > 3.0\,\mathrm{GeV/c}$$
  $$adc > 180(290) \qquad \mathrm{BHT0}\,(\mathrm{BHT1})$$

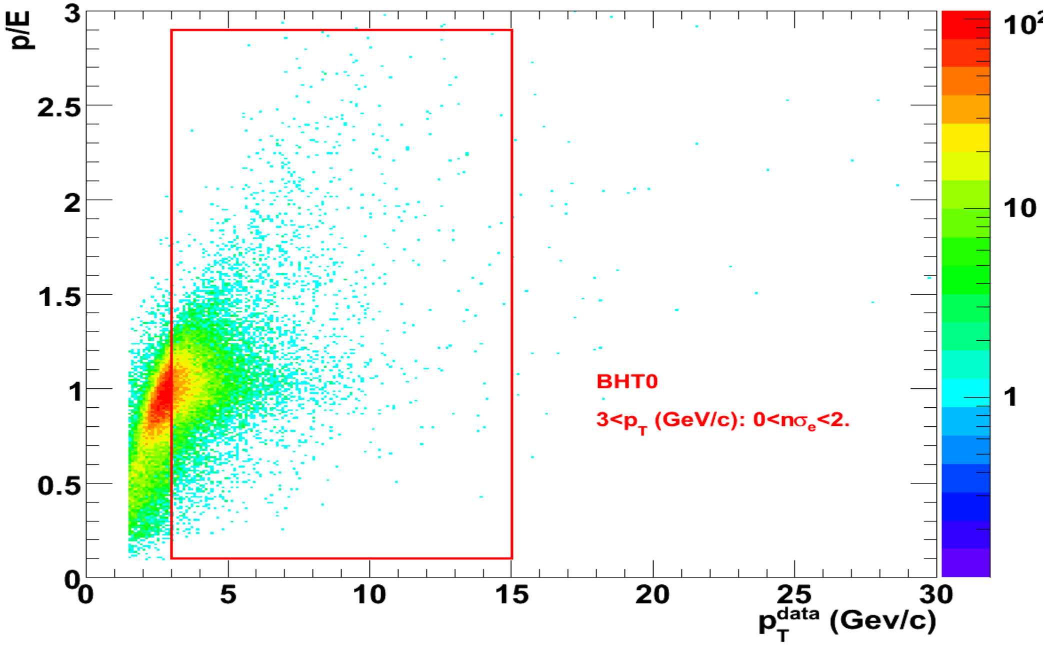


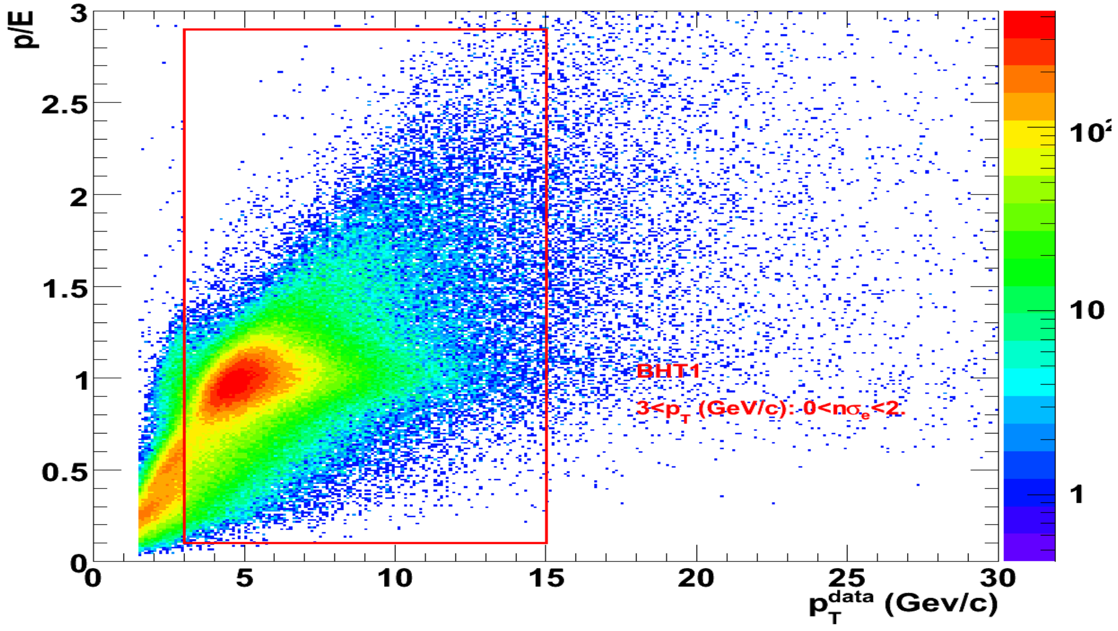
p_T>3 (GeV/c)
0.97<β<1.03
10^4
10^3
-3 -2 -1 0 1 2 3
$n\sigma_e$



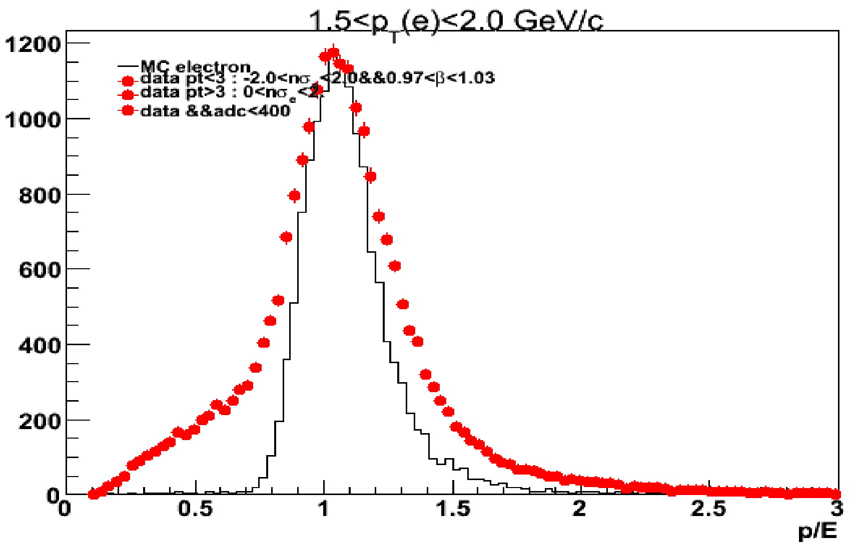
p_T>3 (GeV/c)
10^4
-1 -0.5 0 0.5 1 1.5 2 2.5 3
$n\sigma_e$

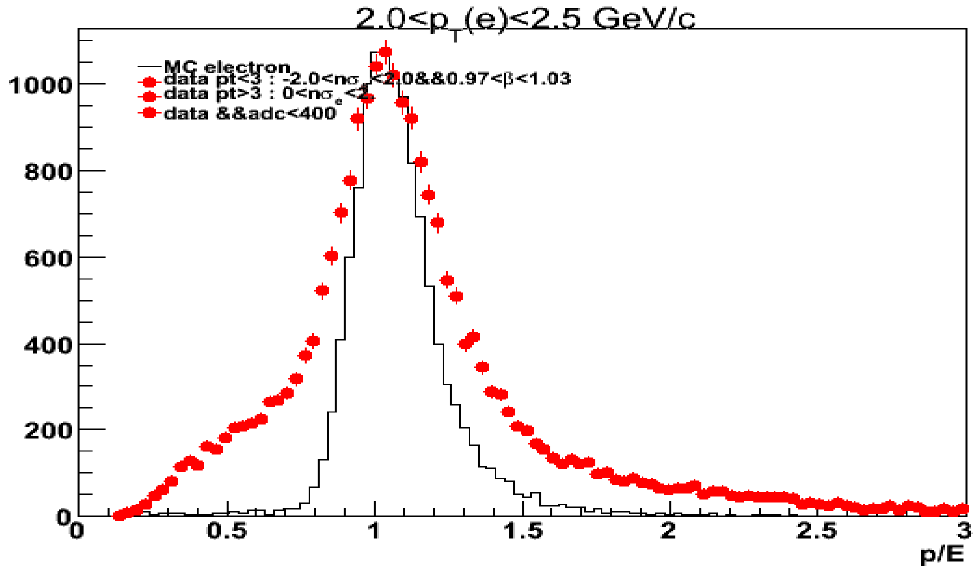

p/E
BHT2
p_T<3. (GeV/c): -2.<nσ_e<2.&&0.97<β<1.03
p_T^data (Gev/c)
10²
10
1

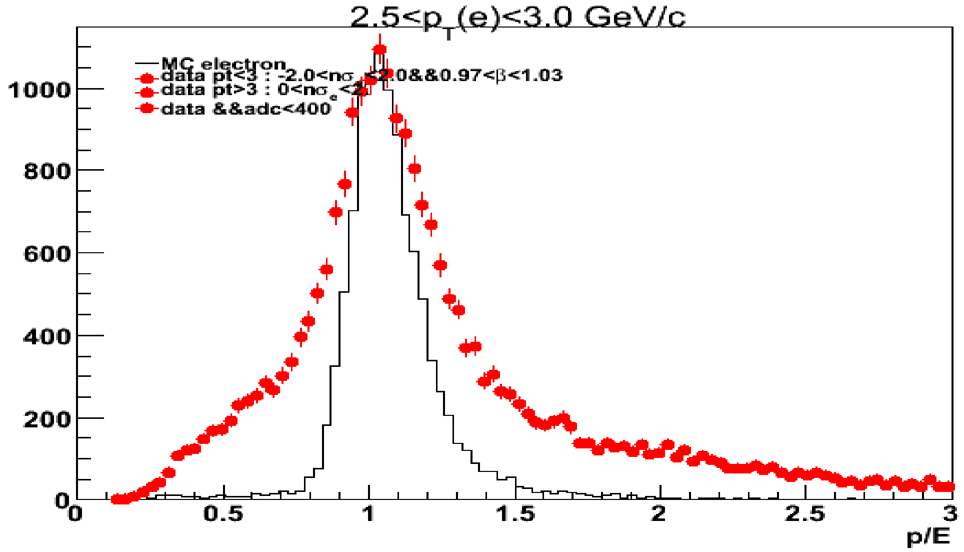

p/E
BHT0
3<p_T (GeV/c): 0<nσ_e<2.
p_T^data (Gev/c)
10²
10
1


p/E
BHT1
3<p_T (GeV/c): 0<nσ_e<2
p_T^data (Gev/c)
10²
10
1

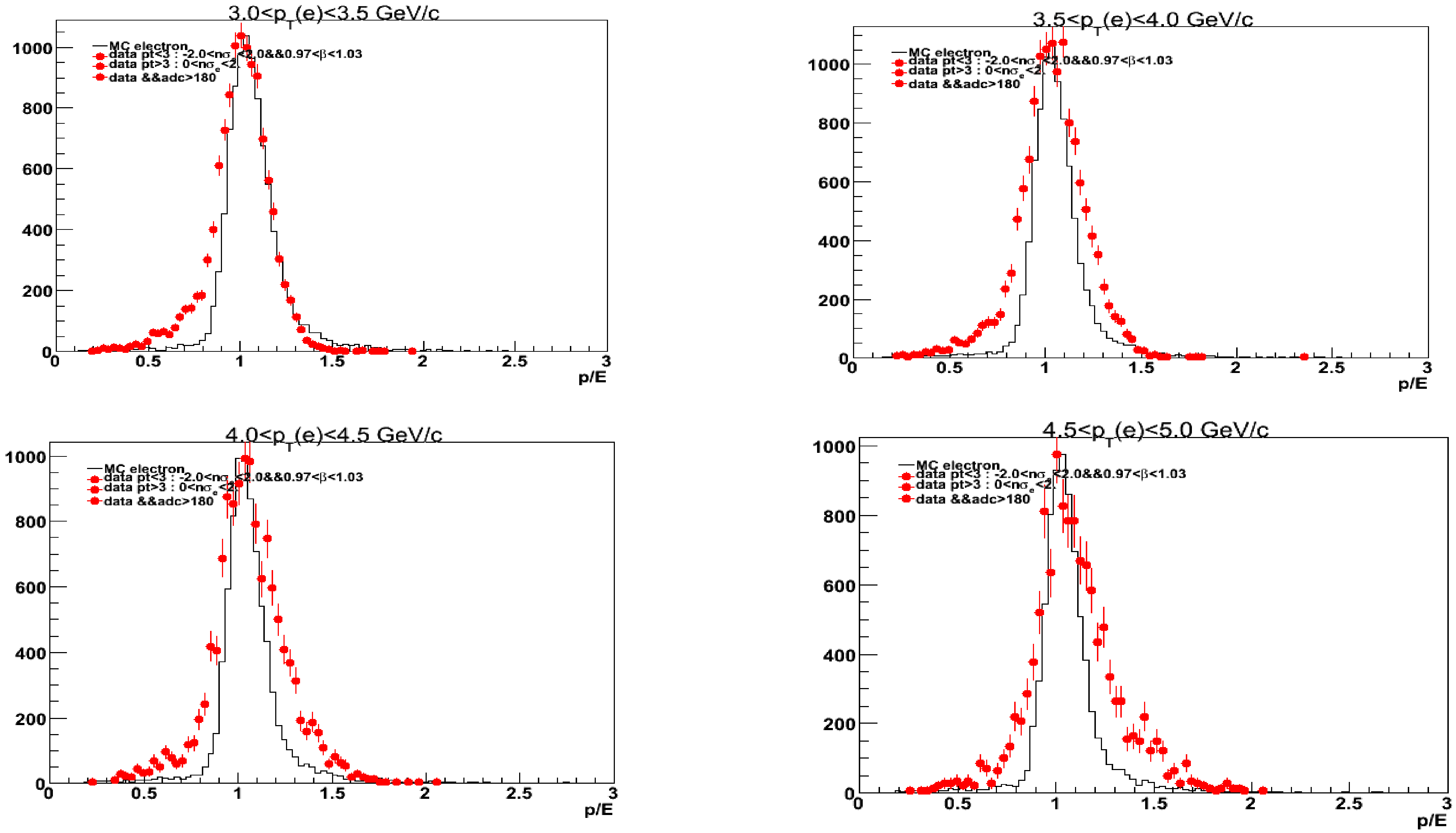
BHT2


1.5<p_T(e)<2.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc<400
p/E

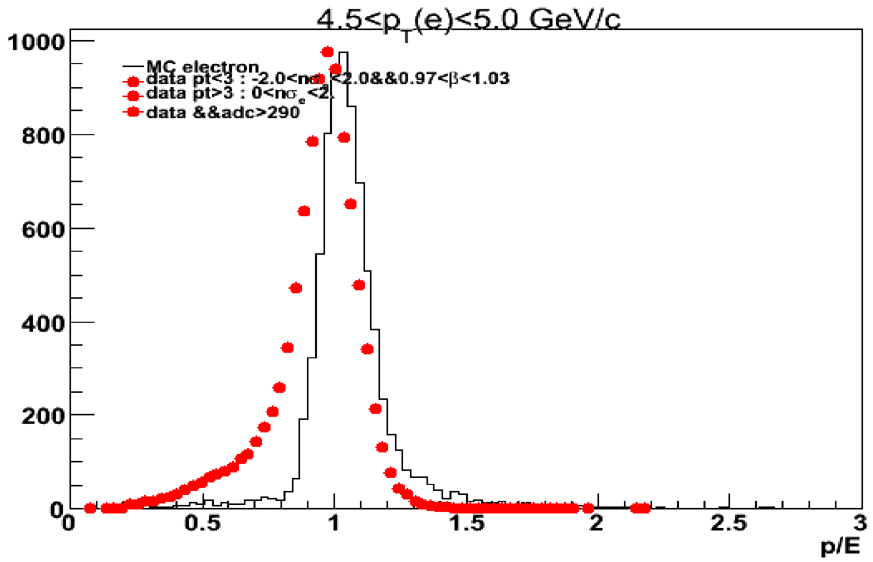

2.0<p_T(e)<2.5 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc<400
p/E

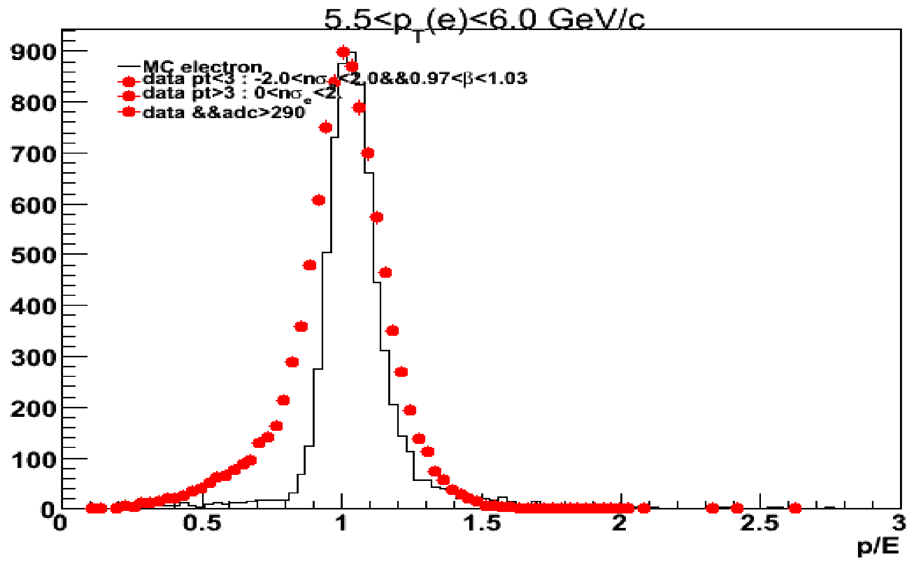

2.5<p_T(e)<3.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc<400
p/E

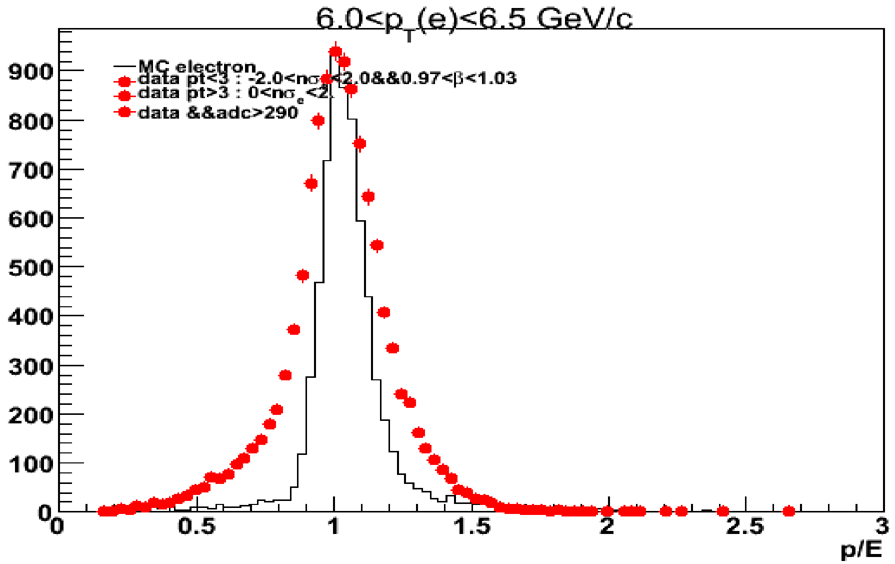
BHT0

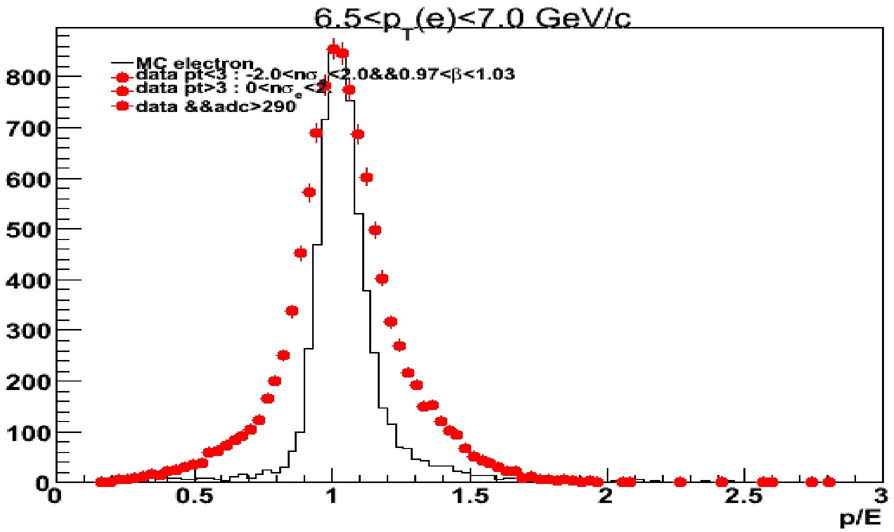

3.0<p_T(e)<3.5 GeV/c
3.5<p_T(e)<4.0 GeV/c
4.0<p_T(e)<4.5 GeV/c
4.5<p_T(e)<5.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>180
p/E

BHT1

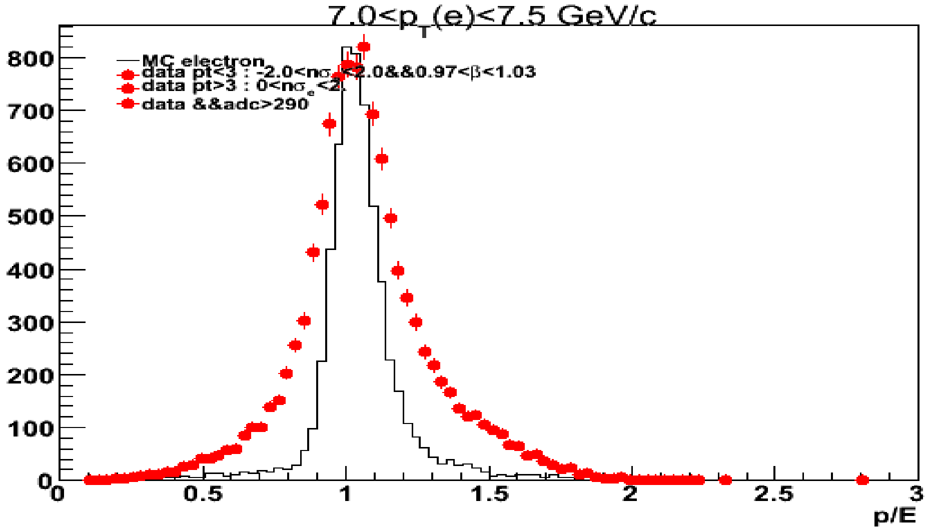

4.5<p_T(e)<5.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E


5.5<p_T(e)<6.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E

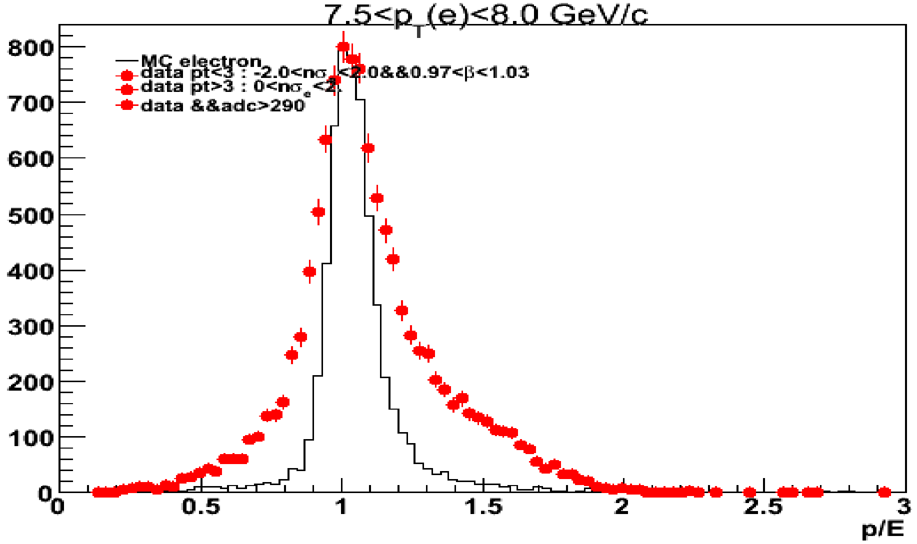

6.0<p_T(e)<6.5 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E


6.5<p_T(e)<7.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E

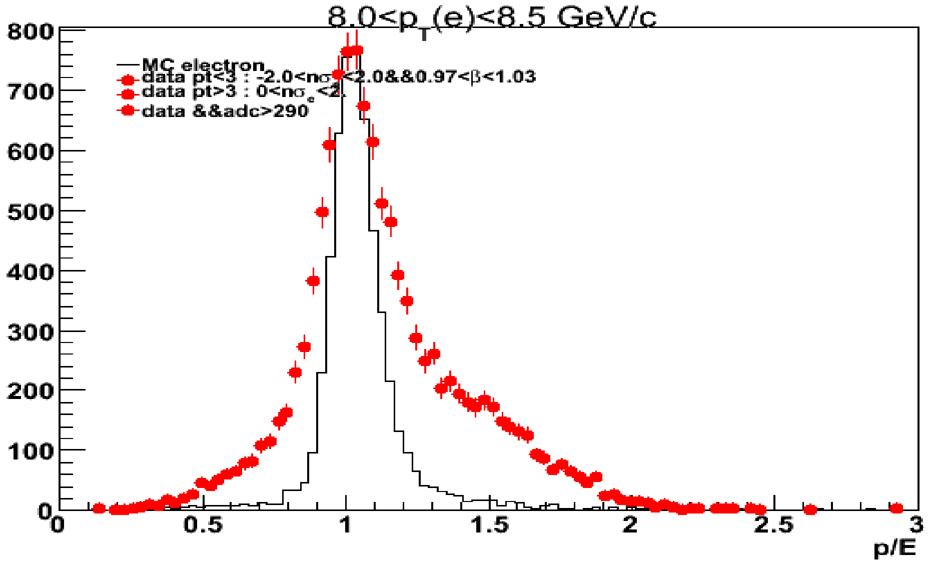
BHT1



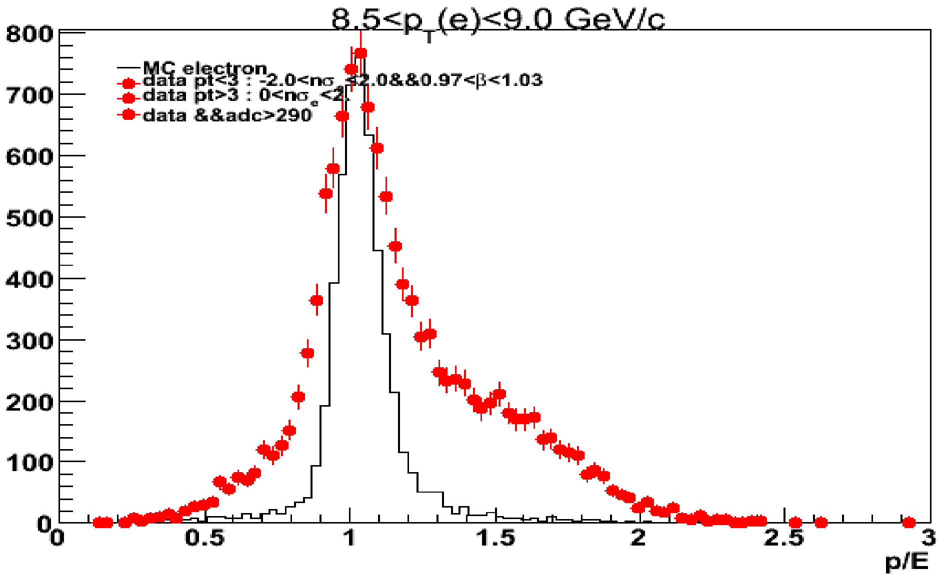
7.0<p_T(e)<7.5 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E



7.5<p_T(e)<8.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E

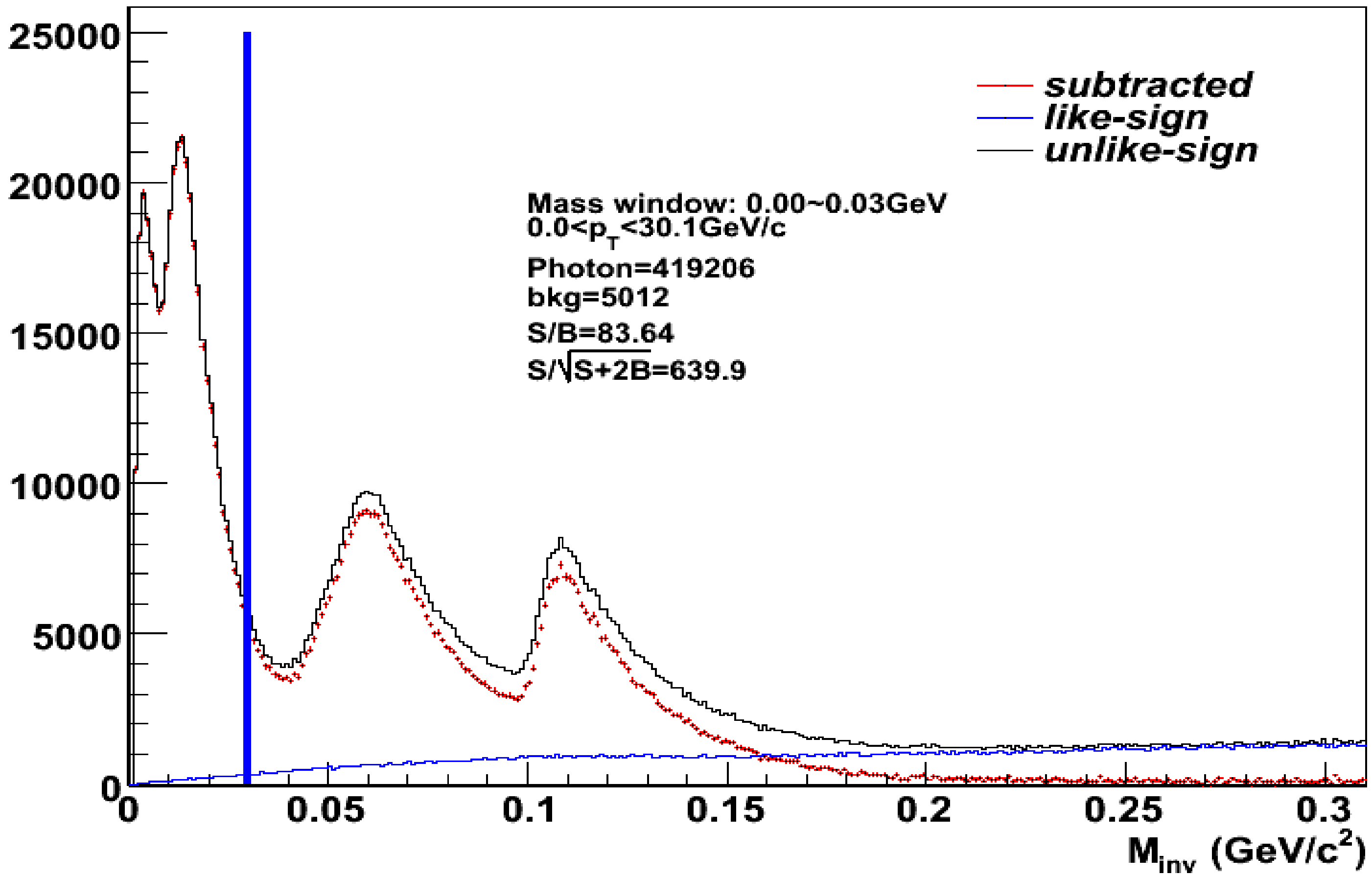


8.0<p_T(e)<8.5 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E



8.5<p_T(e)<9.0 GeV/c
MC electron
data pt<3 : -2.0<nσ_e<2.0&&0.97<β<1.03
data pt>3 : 0<nσ_e<2
data &&adc>290
p/E

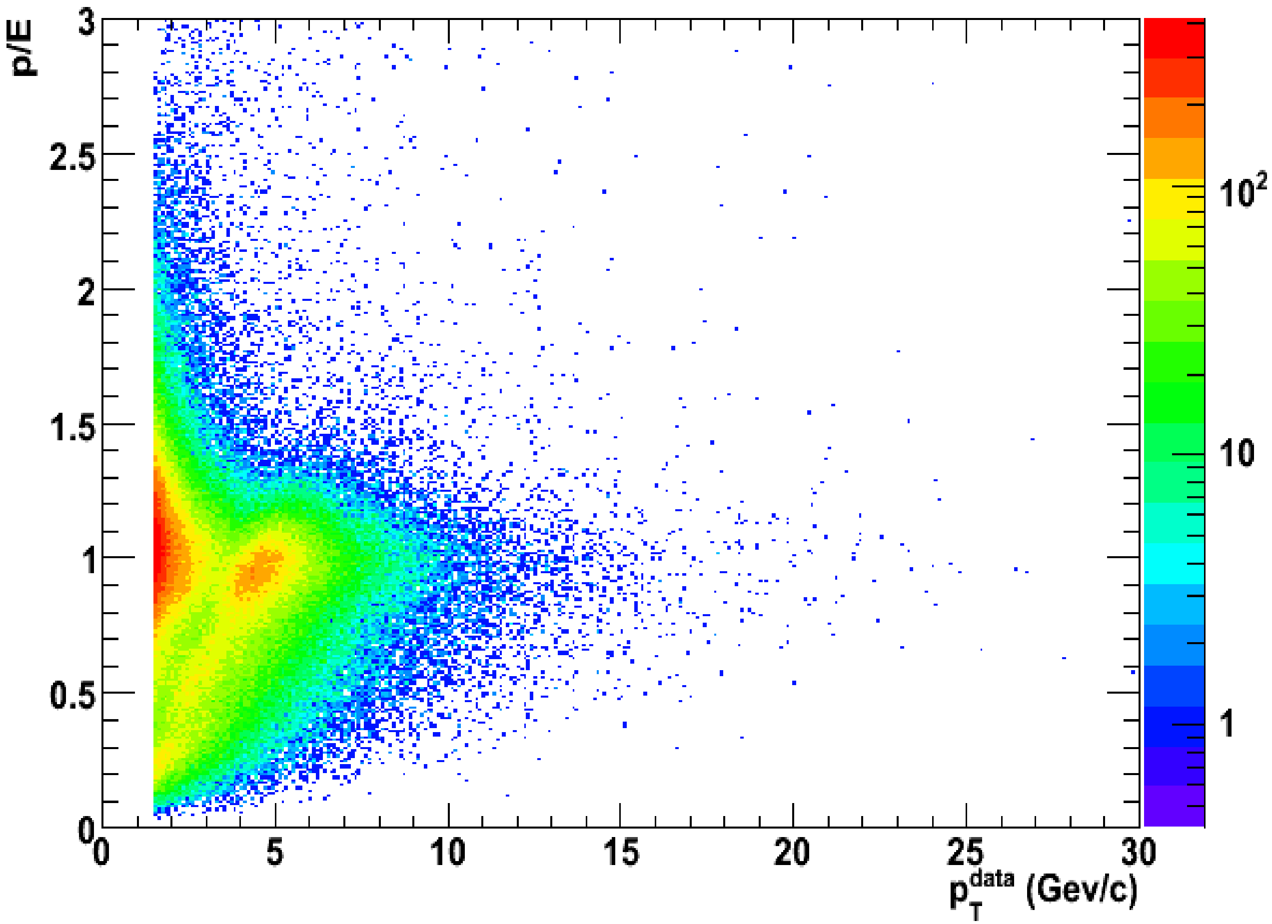
2) Getting a pure photonic electron sample from the dielectron invariant mass distribution.

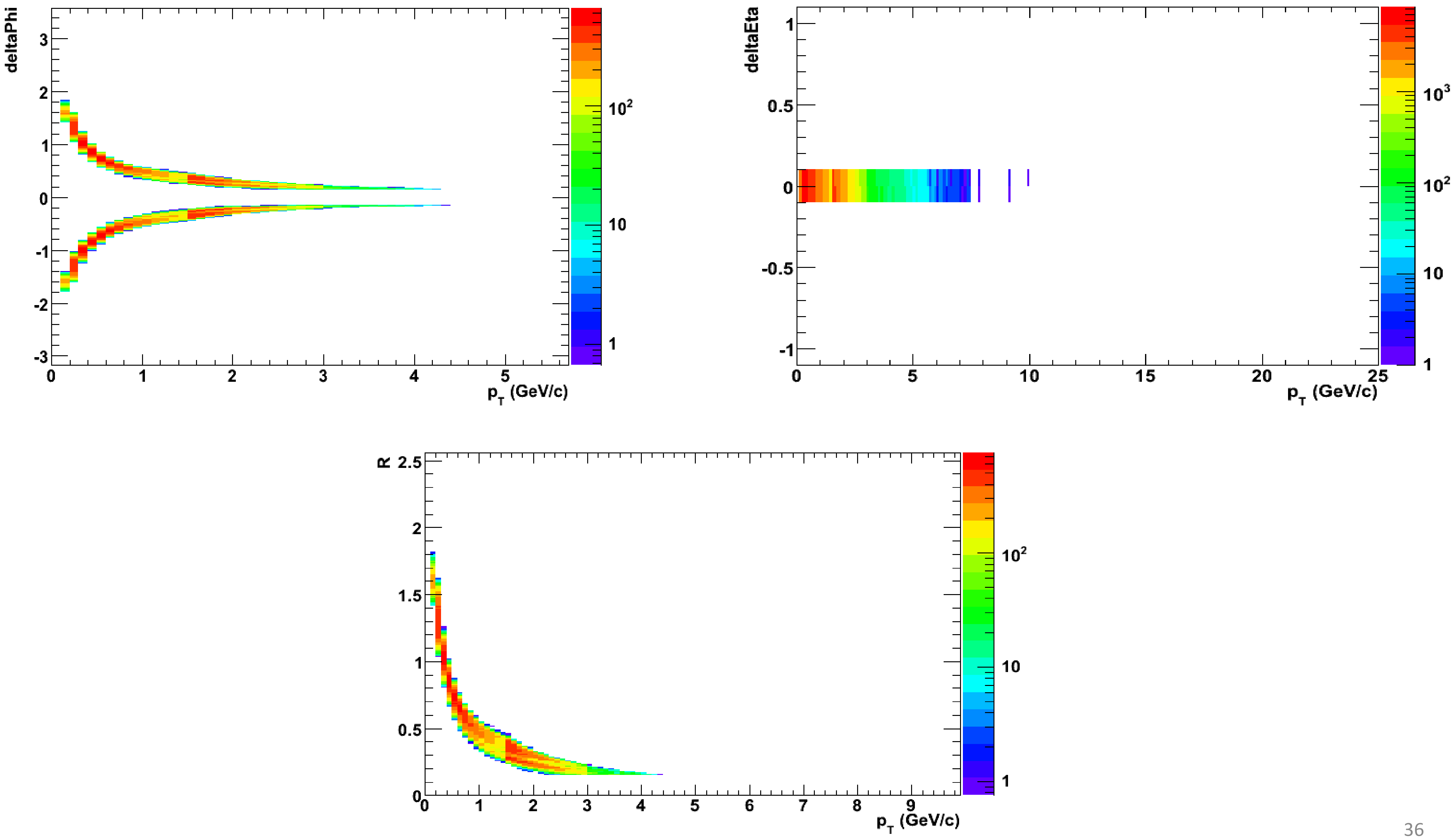


The band may comes from:

1) Trigger bias
2) To reject those events , electron and positron hits on the same tower, we use these cuts.

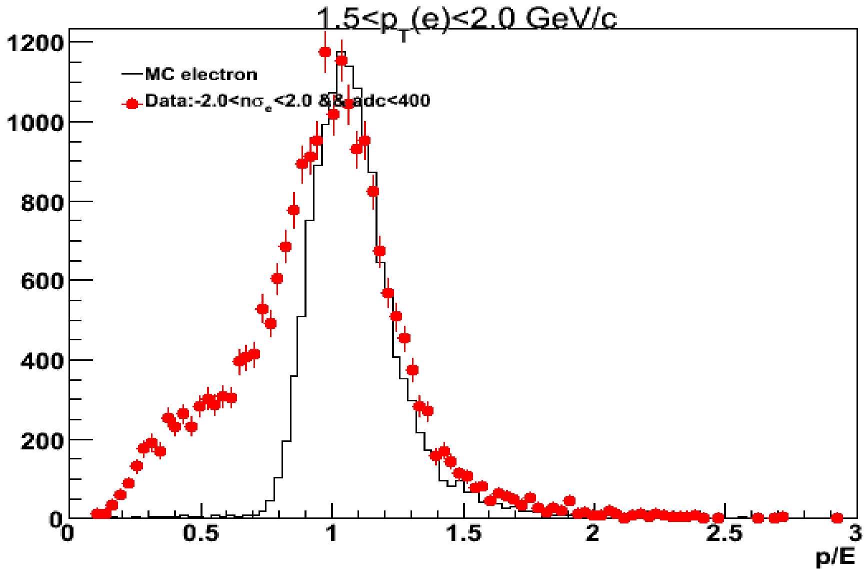
$$\Delta\eta > 0.15 \,\|\, \Delta\phi > 0.15$$

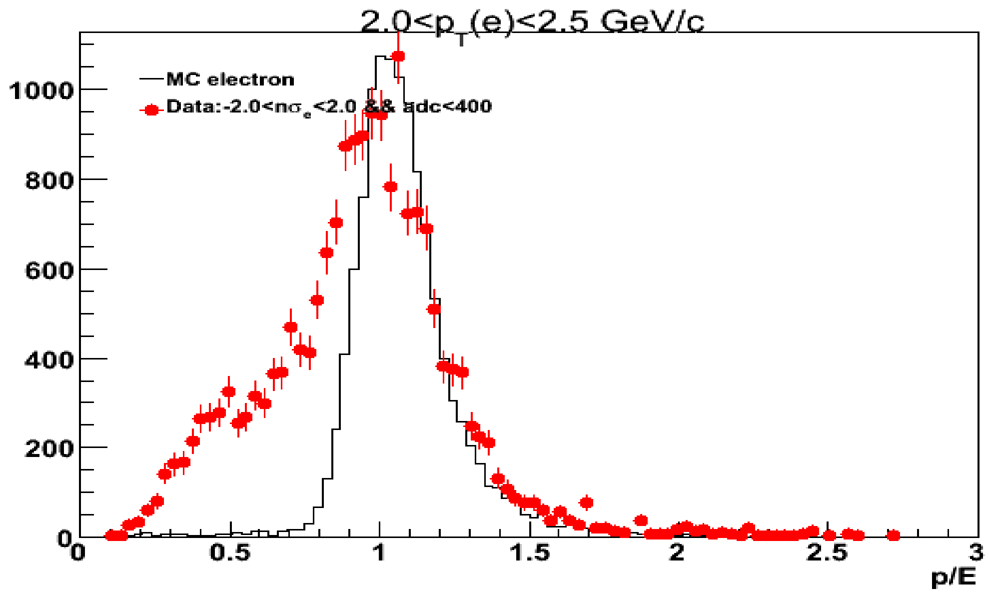


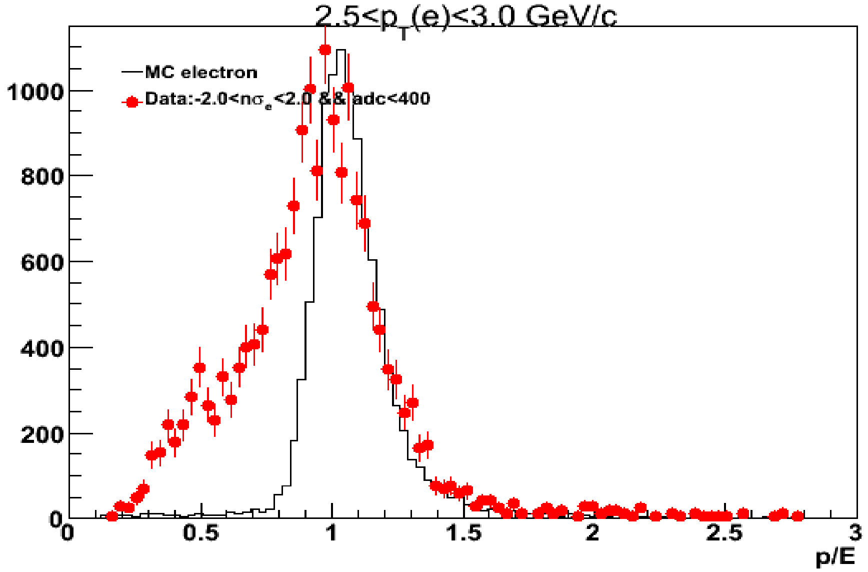


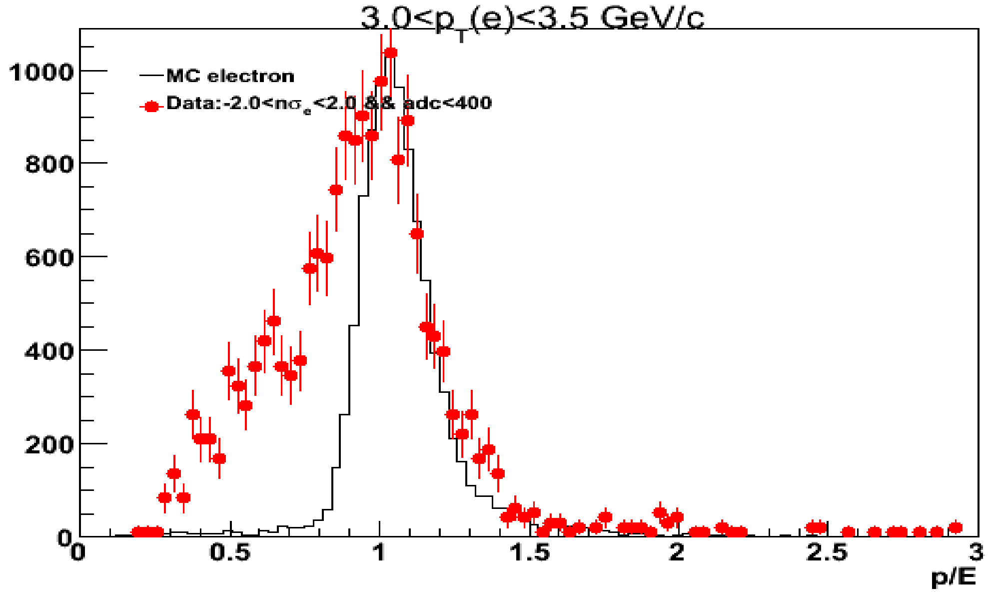
deltaPhi
3
2
1
0
-1
-2
-3
0
1
2
3
4
5
p_T (GeV/c)
10^2
10
1
deltaEta
1
0.5
0
-0.5
-1
0
5
10
15
20
25
p_T (GeV/c)
10^3
10^2
10
1
R
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
7
8
9
p_T (GeV/c)
10^2
10
1

BHT2

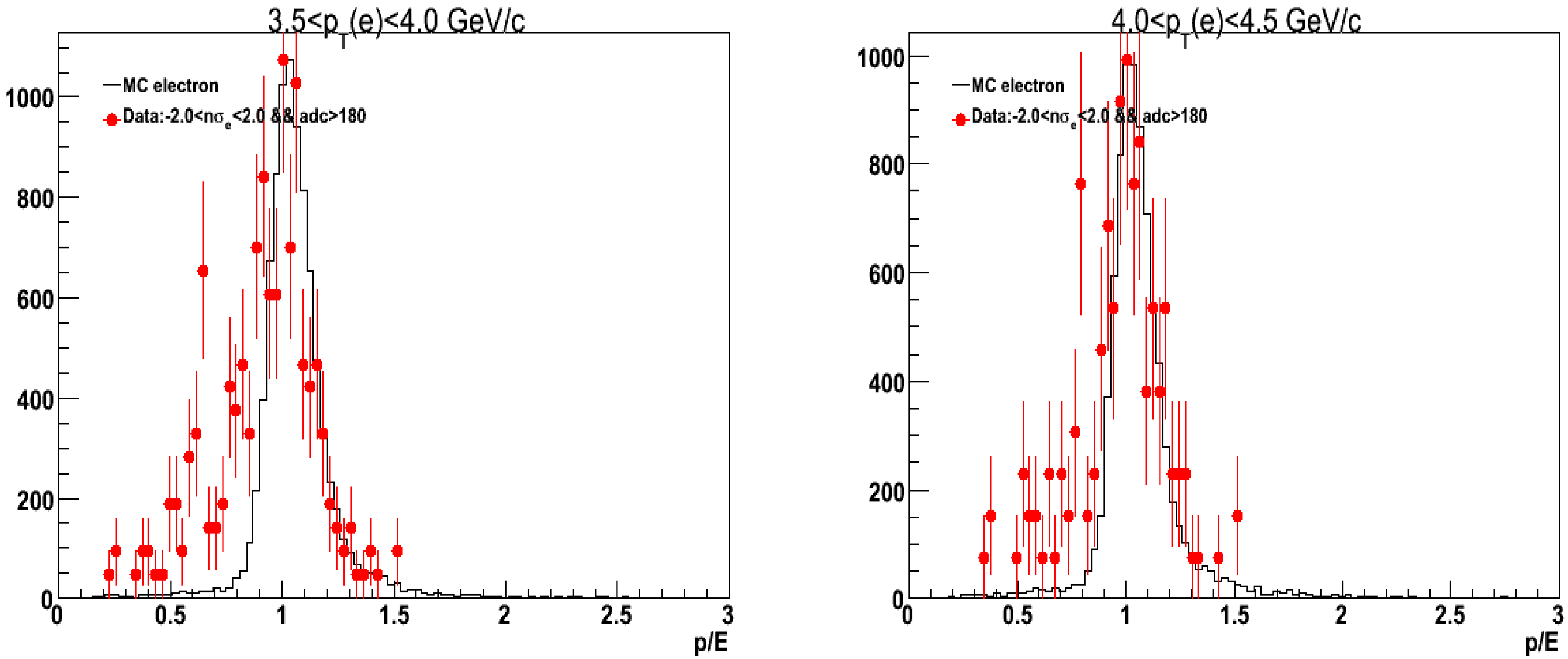

1.5<p_T(e)<2.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc<400
p/E


2.0<p_T(e)<2.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc<400
p/E


2.5<p_T(e)<3.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc<400
p/E

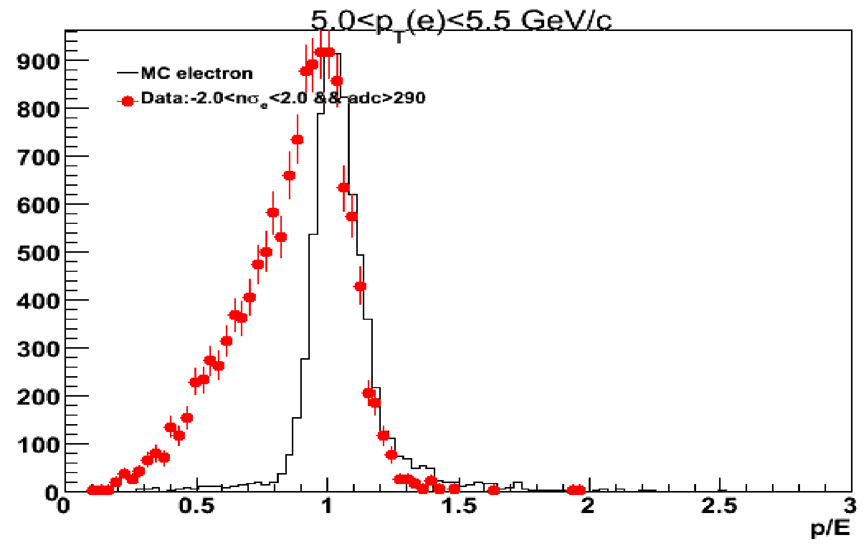

3.0<p_T(e)<3.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc<400
p/E

BHT0

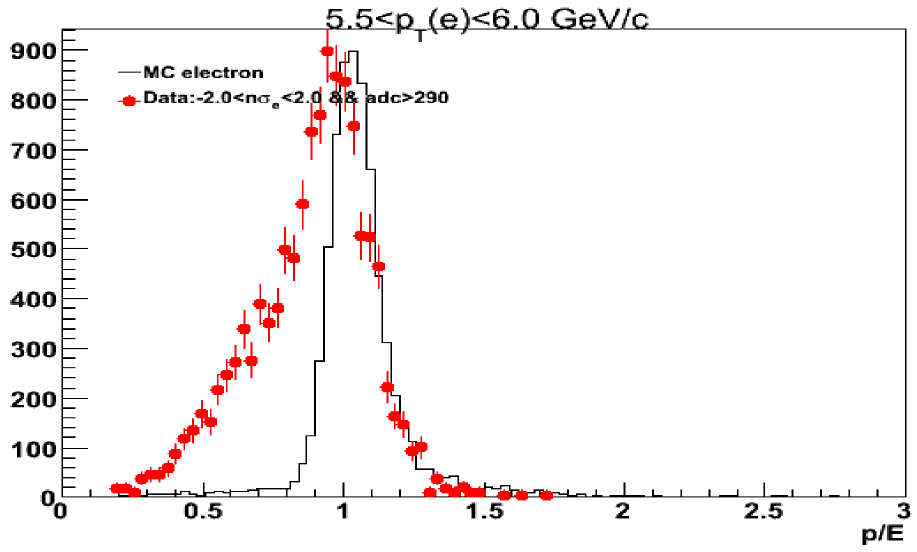


3.5<p_T(e)<4.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>180
p/E
4.0<p_T(e)<4.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>180
p/E

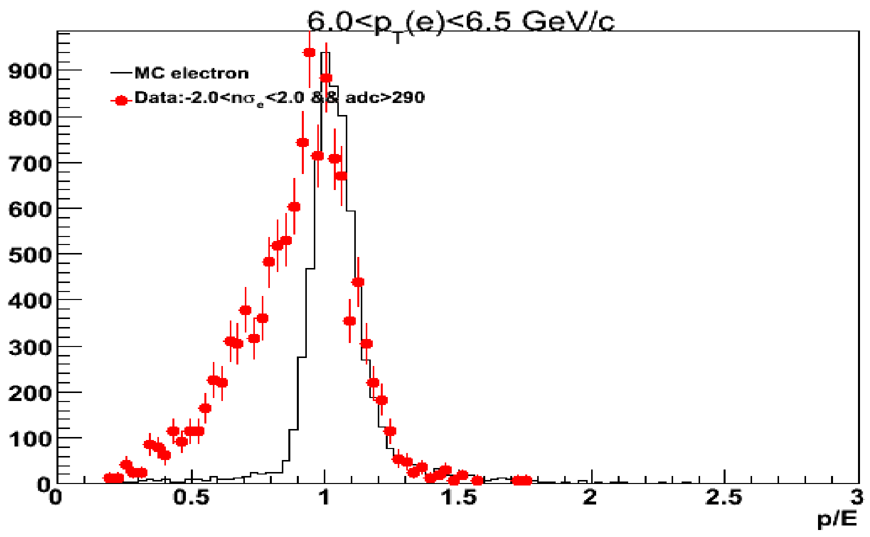
BHT1



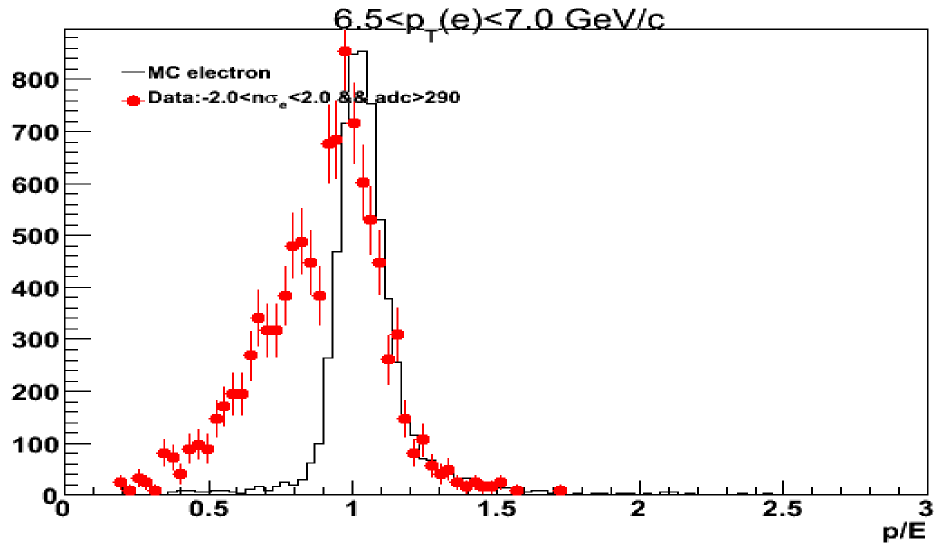
5.0<p_T(e)<5.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E



5.5<p_T(e)<6.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E

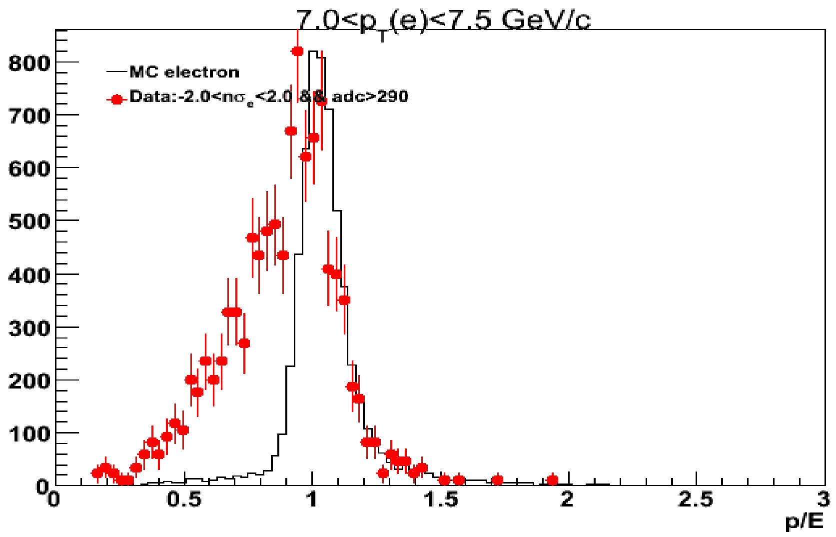


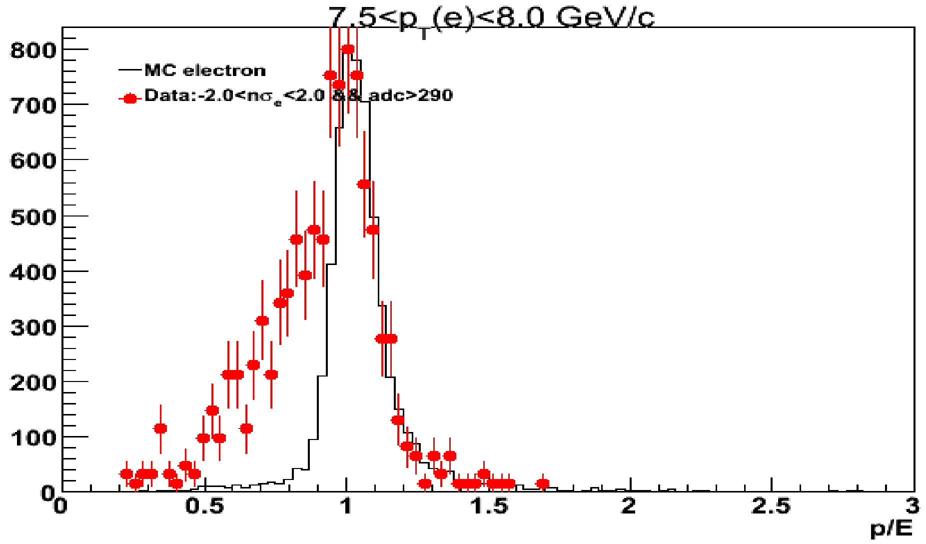
6.0<p_T(e)<6.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E

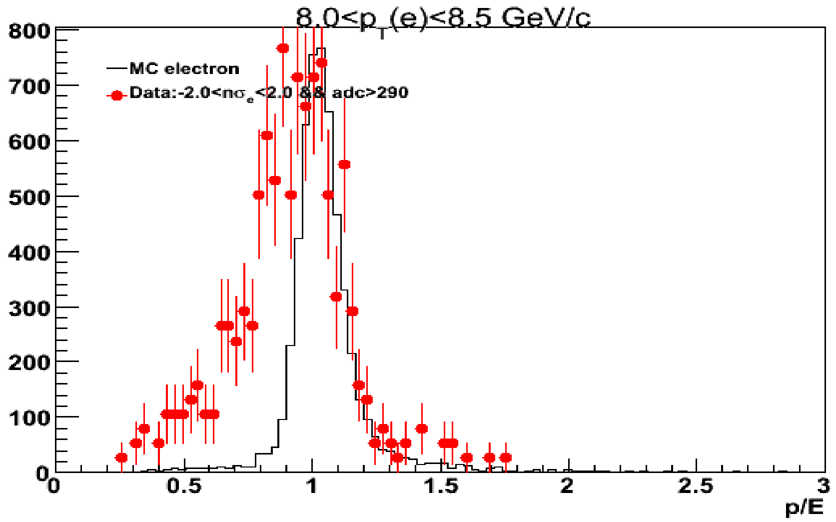


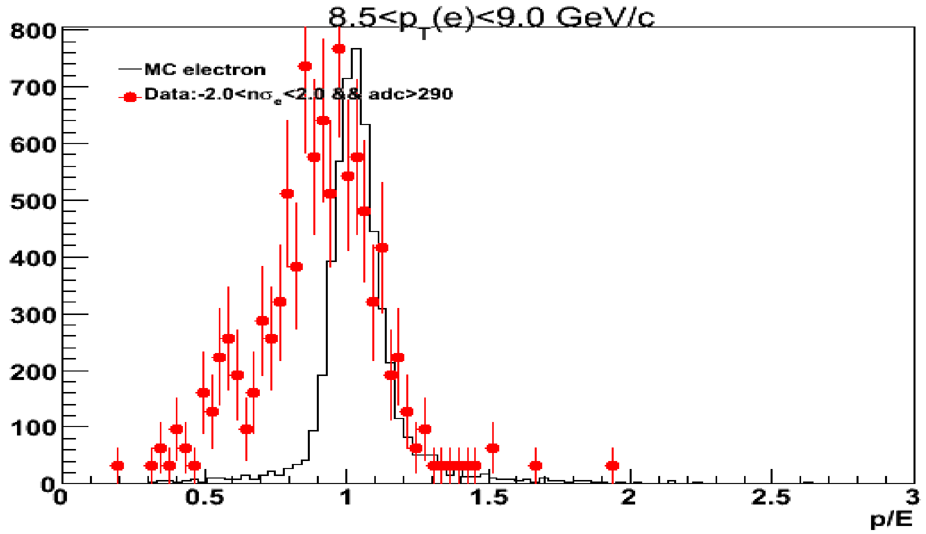
6.5<p_T(e)<7.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E

BHT1


7.0<p_T(e)<7.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E


7.5<p_T(e)<8.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E


8.0<p_T(e)<8.5 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E


8.5<p_T(e)<9.0 GeV/c
MC electron
Data:-2.0<nσ_e<2.0 && adc>290
p/E

Conclusion

- the MC data(Jpsi 100) are acceptable, with Jpsi pT from 0-30GeV/c, rapidity for -1.5 to 1.5, and an uniform distribution on phi.
- nHitsFit, Dca, Phi distribution are agree with MC.
- Regarding the p/E distribution, The mean value from MC and Data is the same. The excess at p/E big than 1 coming from the hadron contamination, cause TOF disabled at high pT, as you can see from 1) . The excess at p/E less than 1 coming from several particle hitting on the same tower, as you can see from 2). So we conclude the p/E is good.