Full Status Report
Gap-X-Gap studies
for √s = 1960GeV, 900GeV, 300GeV
X = 2 hadrons

M. Żurek, A. Święch
Jagiellonian University, Krakow

D. Lontkovskyi, I. Makarenko
University of Kyiv

M. Albrow, J.Lewis
FNAL

Contents

- Data sample
- Gap cuts
- Exclusivity cuts
- 2 Exclusive tracks on primary vertex
  - Additional cuts
  - Background estimation
  - Acceptance calculation
  - Systematic uncertainties

Data sample

- Datasets used:
  - gdifap – 1960 GeV
  - gdifar – 900/300 GeV
- Same trigger requirement: DIFF_TWO_CJET0.5_PLUGVETO_0.75
  - 2 central ($|\eta|<1.32$) towers with Et > 0.5 GeV
  - Plug ($2.11<|\eta|<3.64$) in veto (Et <0.75 GeV)
  - BSC1 and CLC in veto
  - L=6.98/pb – 1960 GeV and L=0.075/pb – 900 GeV
  - Gaps at least from $|\eta|=1.3$ to $|\eta|=5.9$

Gap cuts – idea

- To determine noise levels in sub-detectors we divide zero-bias sample from same periods into two sub-samples:
  - No Interaction:
    - No tracks
    - No CLC hits
    - No muon stubs
  - Interaction:
    - Opposite

Cut values:

Sum of ADC counts in Bsc1 West < 1500 counts

Sum of ADC counts in Bsc1 East < 1500 counts

Sum of ADC counts in CLC West < 4000 counts

Sum of ADC counts in CLC East < 4000 counts

Sum of Em Energy in West Plug < 3.0 GeV

Sum of Em Energy in East Plug < 3.0 GeV

Sum of Had Energy in West Plug < 3.5 GeV

Sum of Had Energy in East Plug < 3.5 GeV

Variations for systematics estimation:

Sum of ADC counts in Bsc1 West: 1350 – 1650 c.

Sum of ADC counts in Bsc1 East: 1350 – 1650 c.

Sum of ADC counts in CLC West: 3800 – 4400 c.

Sum of ADC counts in CLC East: 3800 – 4400 c.

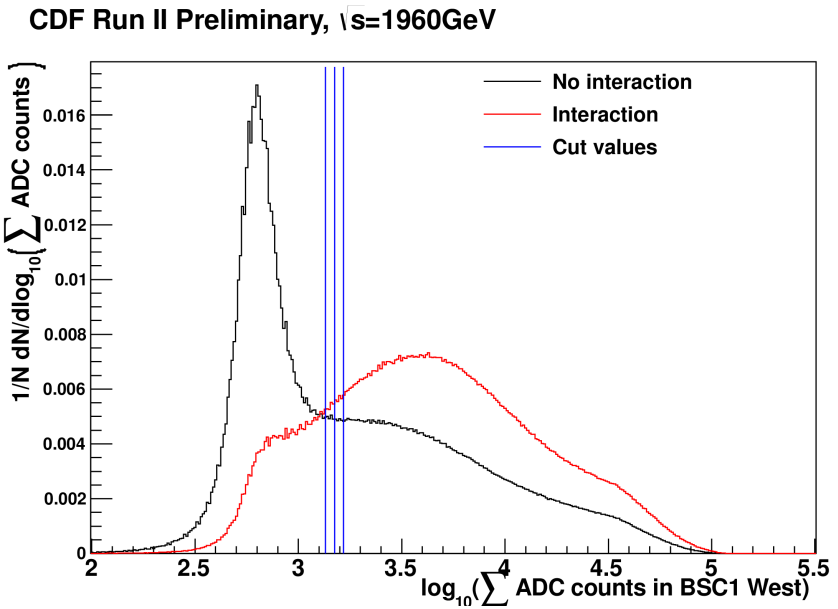
Sum of Em Energy in West Plug: 2.5 – 4.0 GeV

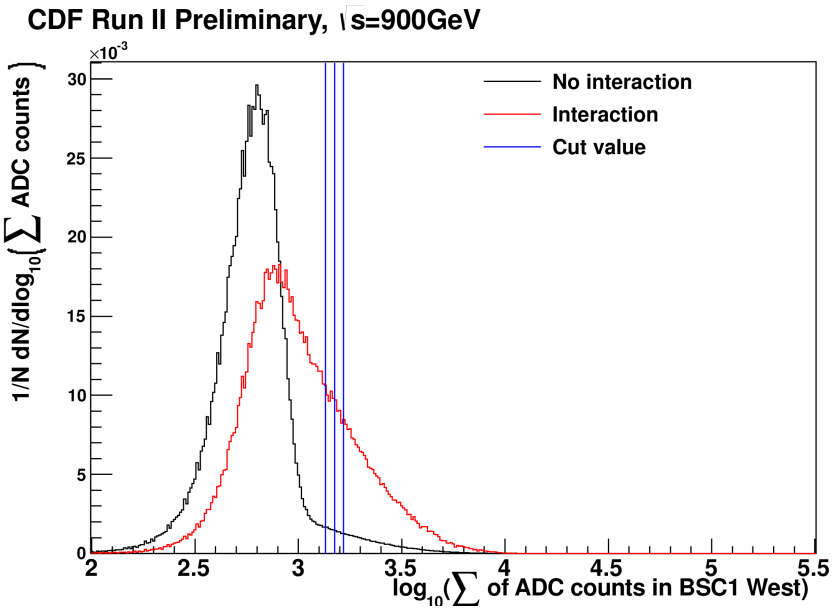
Sum of Em Energy in East Plug: 2.5 – 4.0 GeV

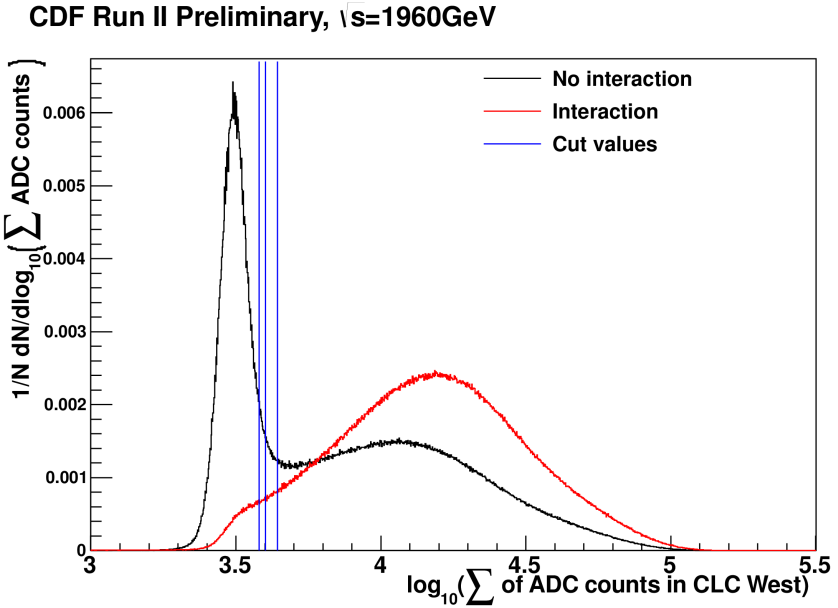
Sum of Had Energy in West Plug: 3.0 – 4.0 GeV

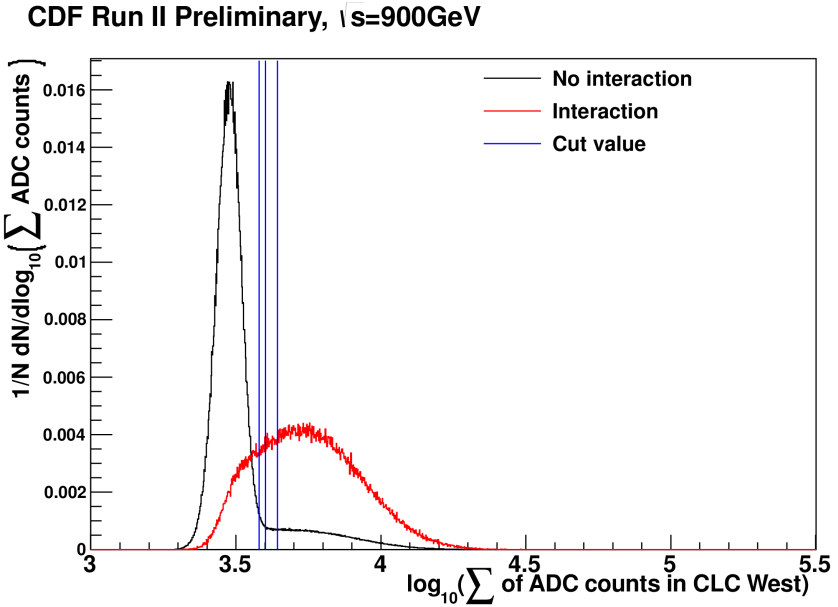
Sum of Had Energy in East Plug: 3.0 – 4.0 GeV

Bsc1 West and CLC West

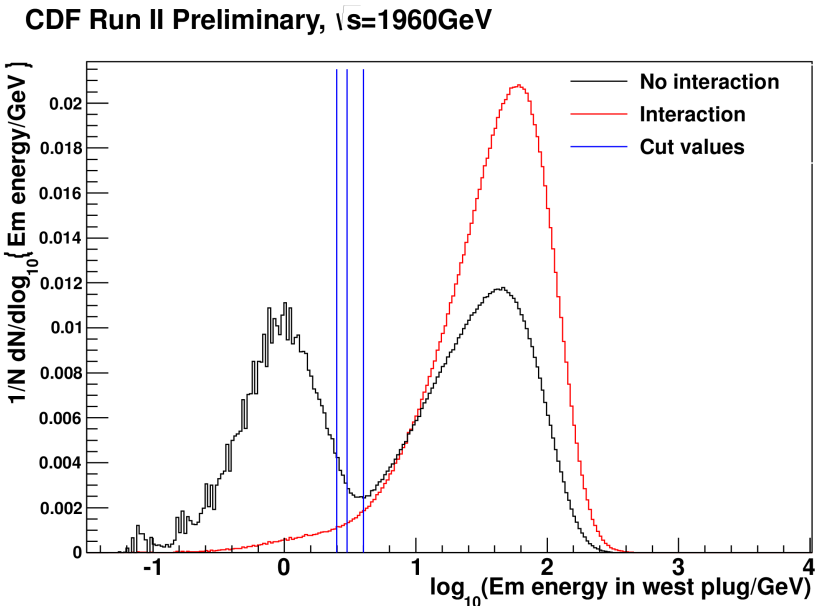


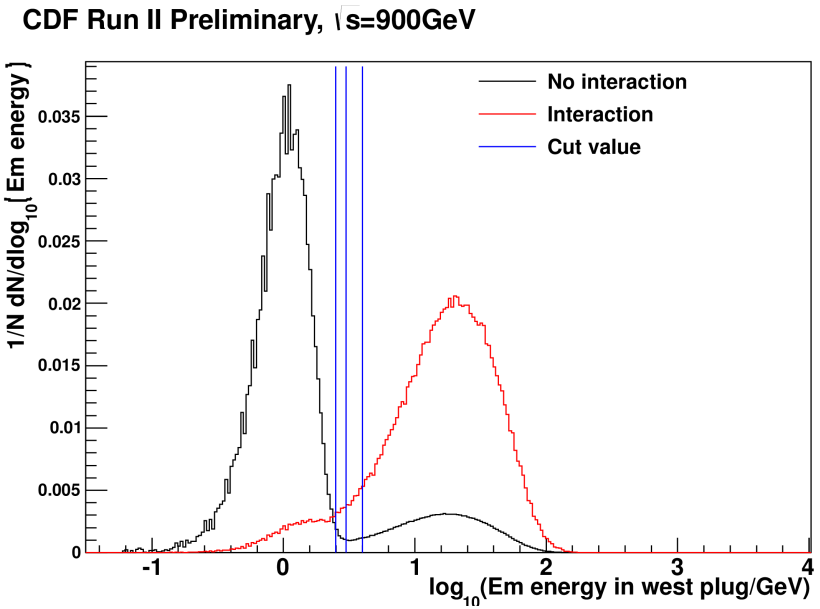


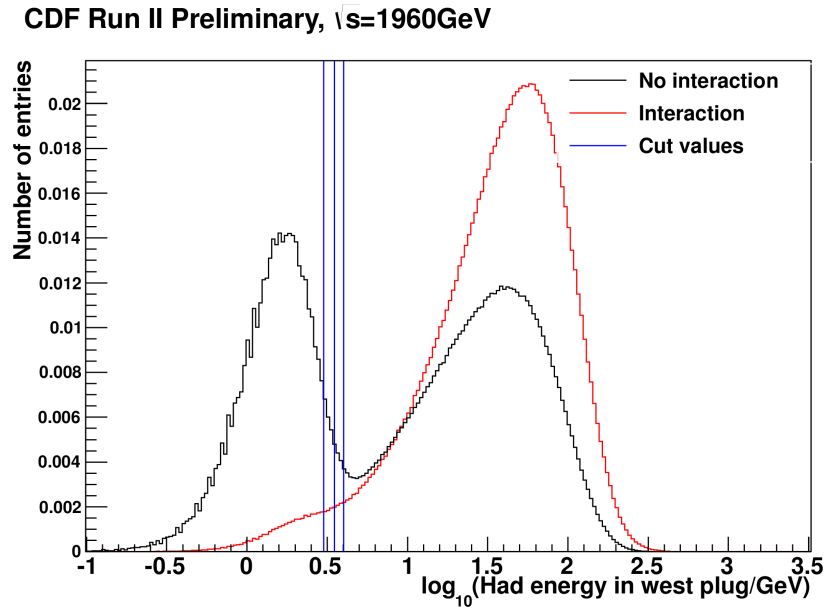


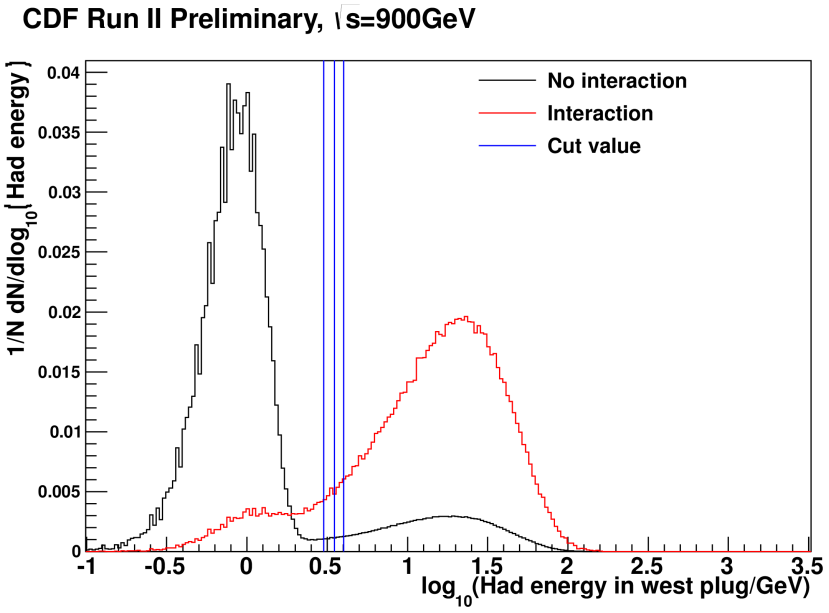


Fwd Plug Em and Had West







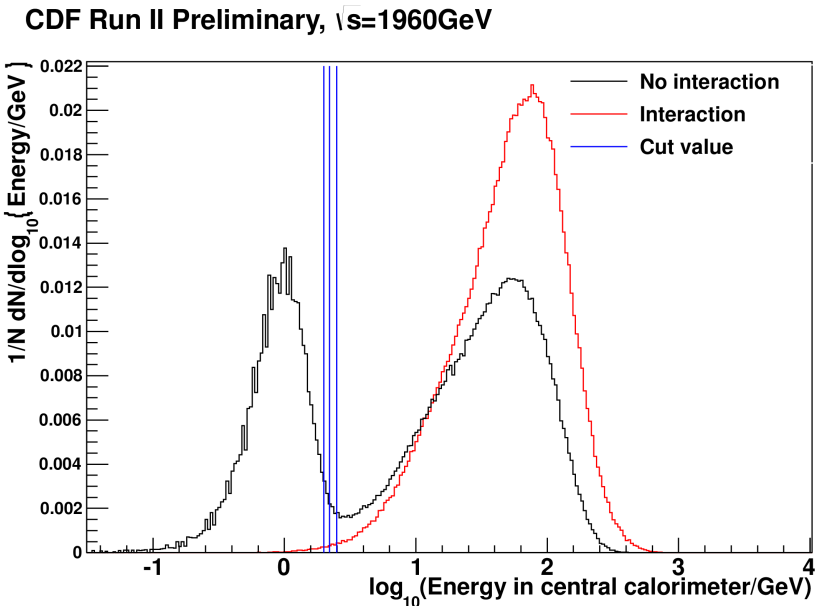


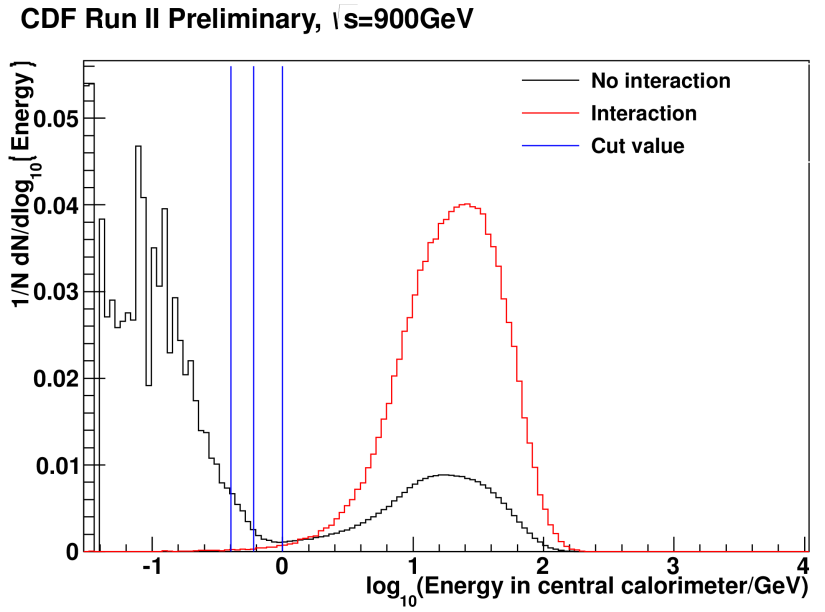
Exclusivity cuts in central region

- To determine exclusive 2-4 tracks we apply similar technique in central region, excluding cones of radius 0.3 in eta-phi space around each track extrapolation.

Cuts:

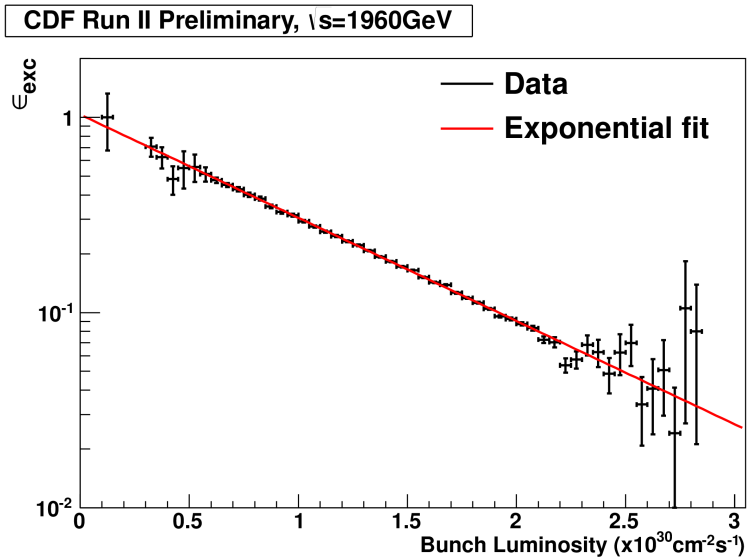
- 2.2 (2.0-2.5) GeV - 1960
- 0.6 (0.4-1.0) GeV - 900

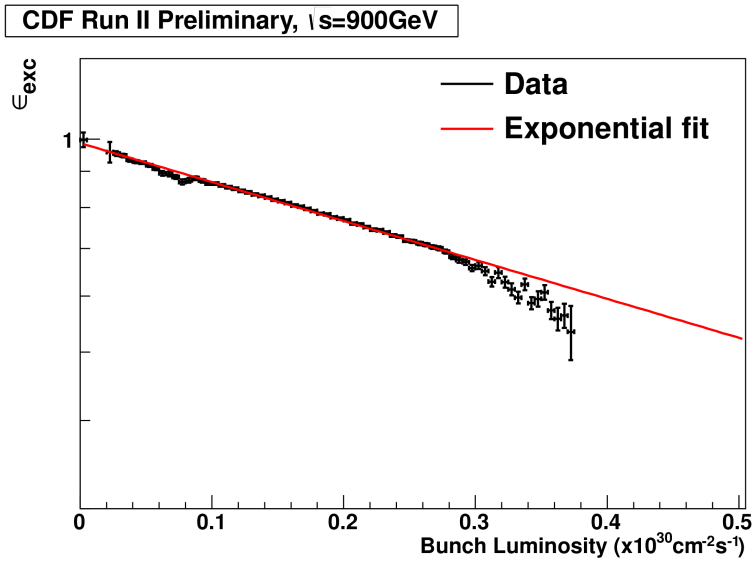




Effective exclusive luminosity

- We determine efficiency of having no-pileup using zero-bias sample. We measure ratio of empty events (all detectors on noise level) to all events.
- Should drop exponentially with bunch luminosity and be equal 1 at L=0. Slope corresponds to total inelastic cross section:
  - 56.7 mb – 1960 GeV
  - 59.0 mb – 900 GeV
- Effective luminosities:
  - 1.16/pb – 1960 GeV
  - 0.06/pb – 900 GeV

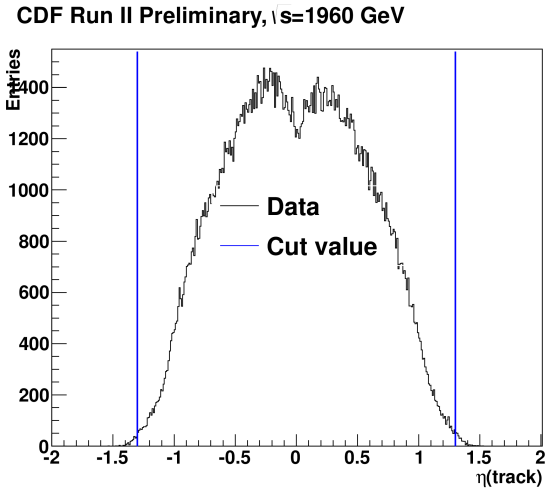


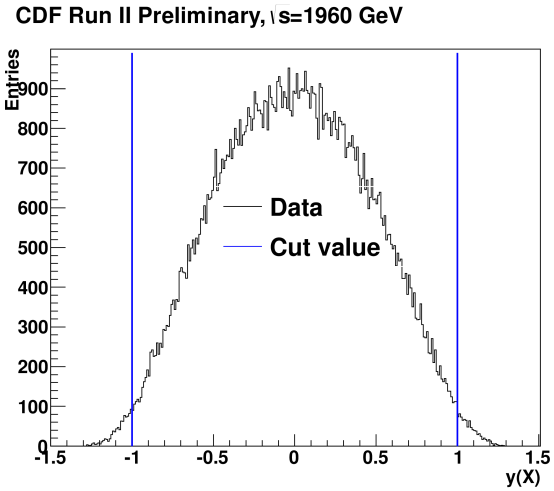


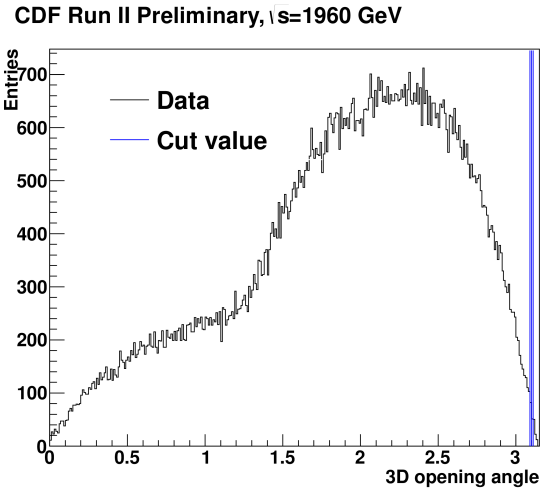
2 Exclusive tracks: additional cuts

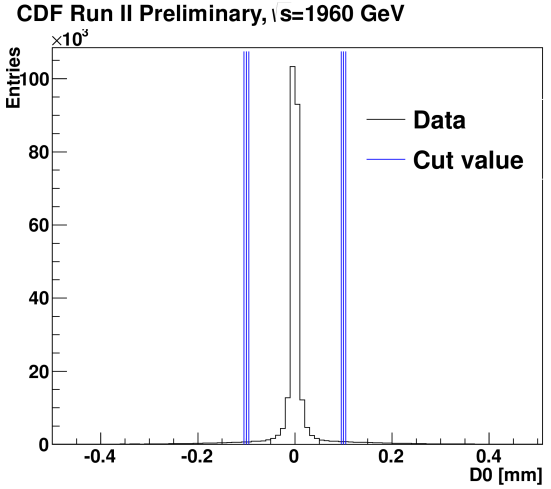
CUTS		Variations for systematics estimation
• Track Eta	< 1.3	1.297 – 1.303
• Central state rapidity	< 1.0	0.998 – 1.002
• Number of muons	= 0	No systematics
• 3D opening angle	< 3.1 rad	3.09 – 3.11
• Track D0	< 0.1 mm	0.095 – 0.105 mm
• Track Pt	> 0.4 GeV/c	0.39 – 0.41 GeV/c
• Tracks matching triggered towers		No systematics
• $\Delta Z0$	< 1.0 cm	0.8 – 1.2 cm
• COT Axial hits	>= 25 hits	24 – 26 hits
• COT Stereo hits	>= 25 hits	24 – 26 hits
• Track $\chi 2$/Ndof	< 2.5	2.4 – 2.6
• Total charge	= 0	No systematics

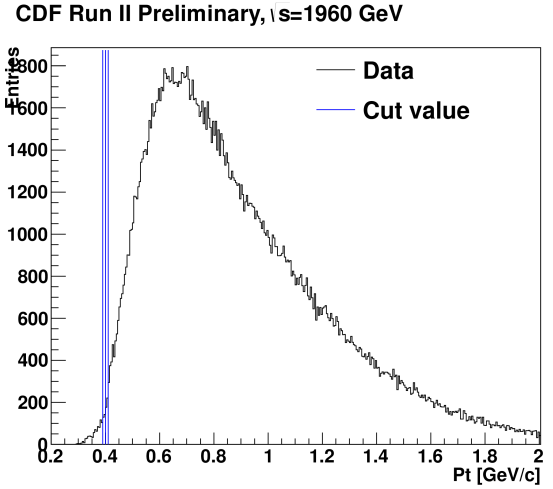
Cuts and variations (1)

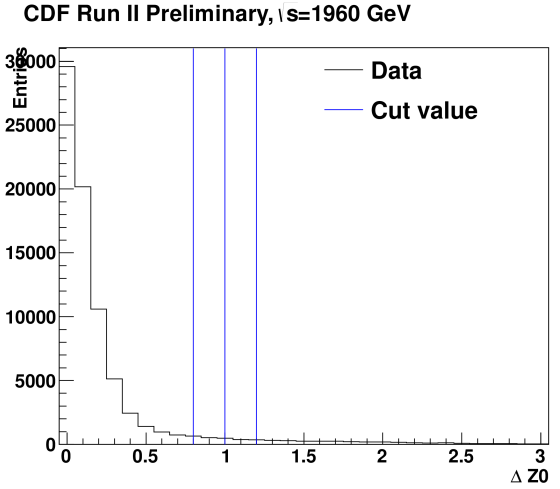




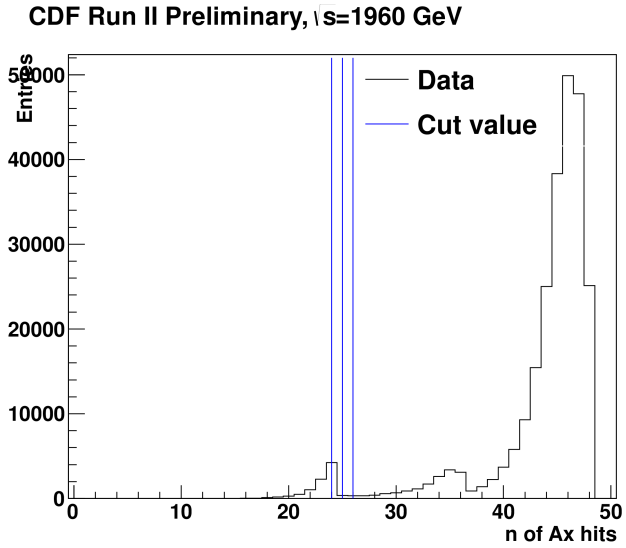


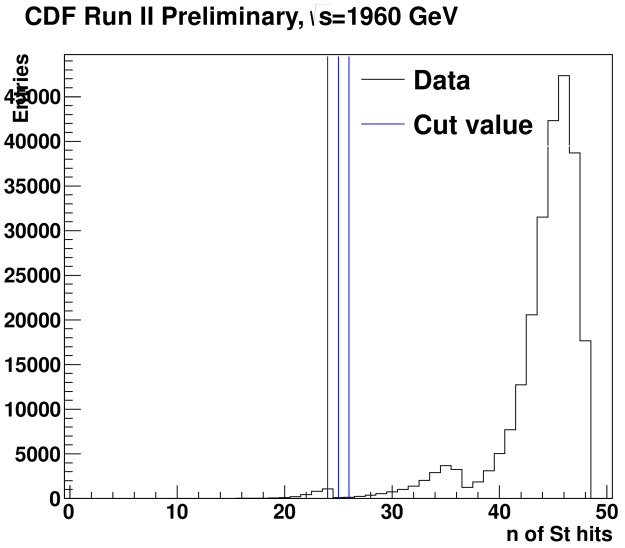


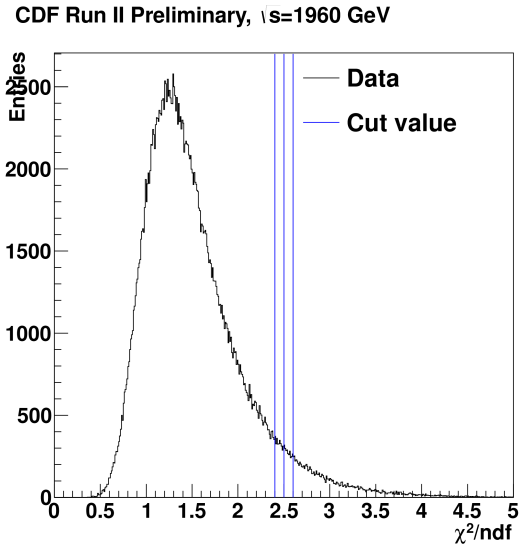


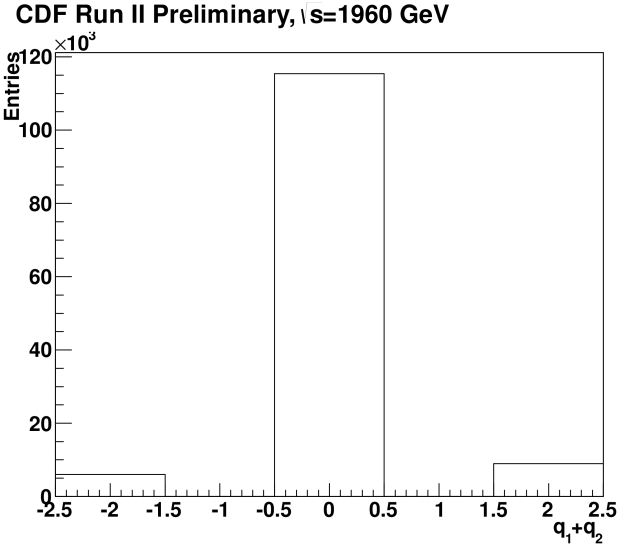


Cuts and variations (2)

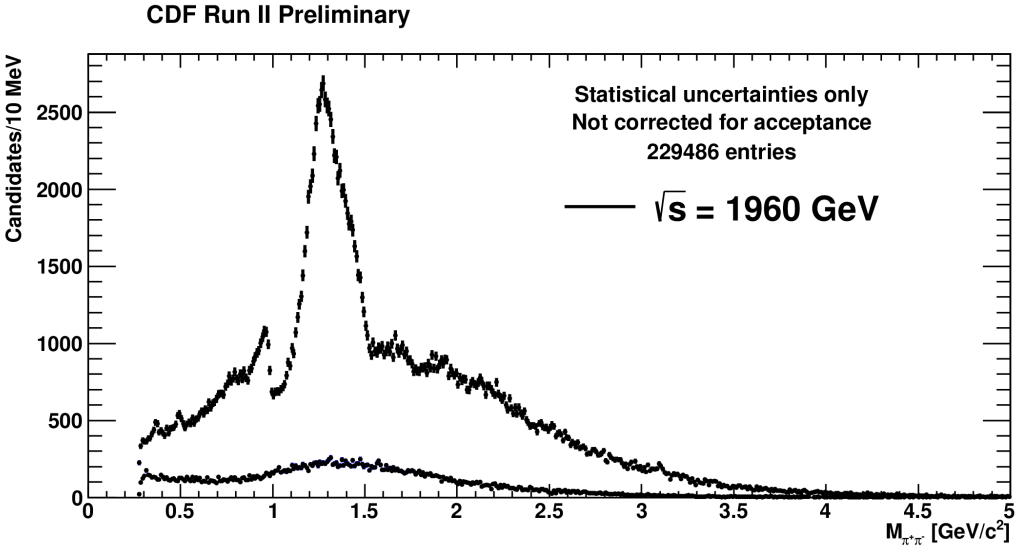


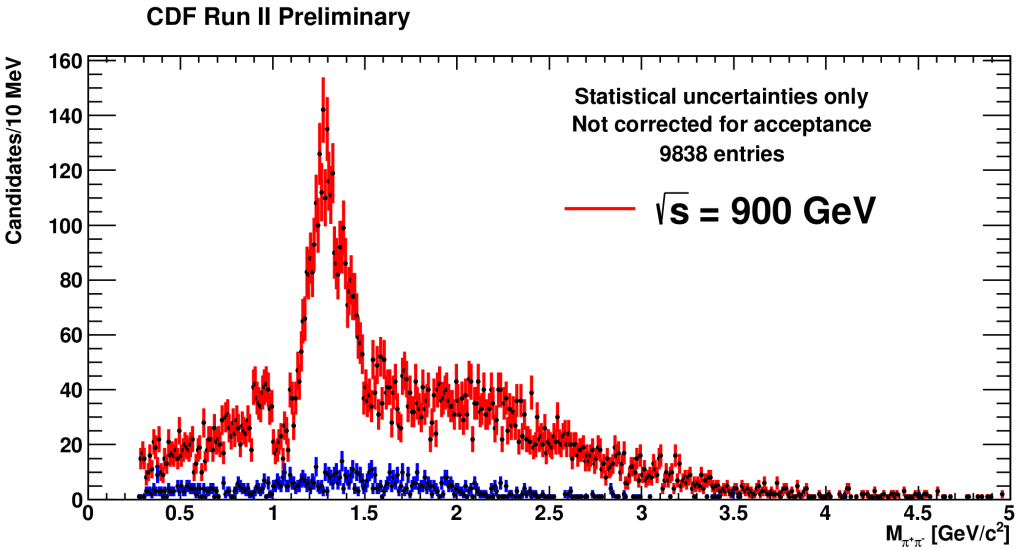




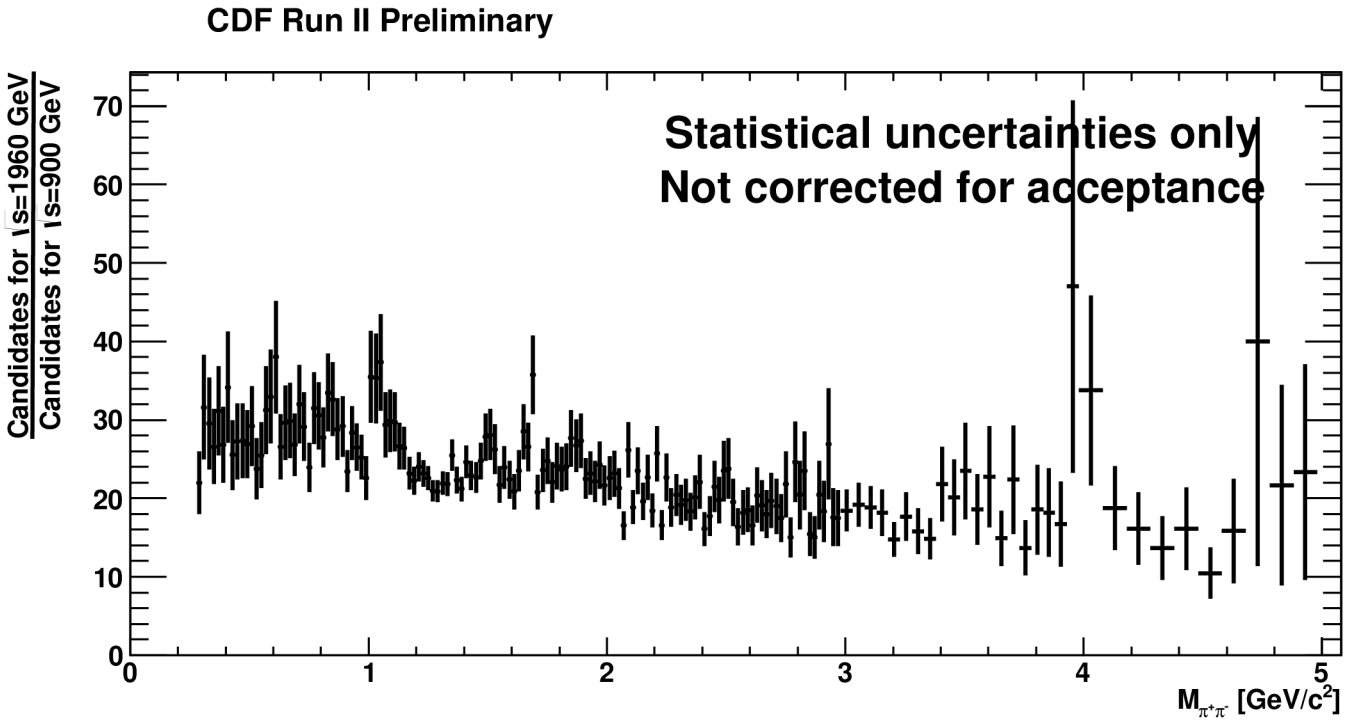


Non-exclusive background estimation – same sign pairs





Ratio of energies



Acceptance:

1. Generation (X->pi+pi-)

   Flat distribution in rapidity of X - 1.0 – 1.0

   Flat distribution in mass of X - 0 – 5.0 GeV/c2

   Flat distribution in Pt of X - 0 – 2.5 GeV/c

   Decay according to J=0 (S-wave) phase space

2. Detector simulation

3. Acceptance calculation

Acceptance calculation

1. Application of trigger efficiency

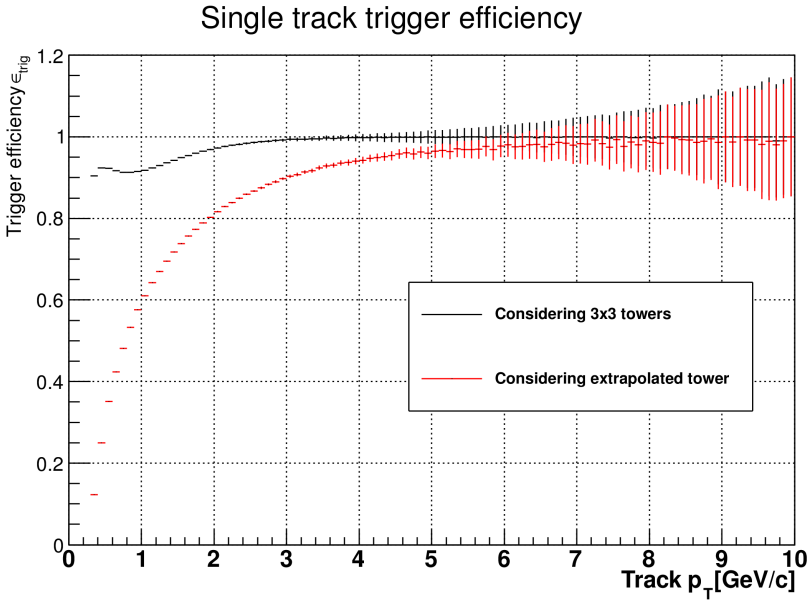
(fitted 3 ranges with polynomials)

2. Forward offline cuts

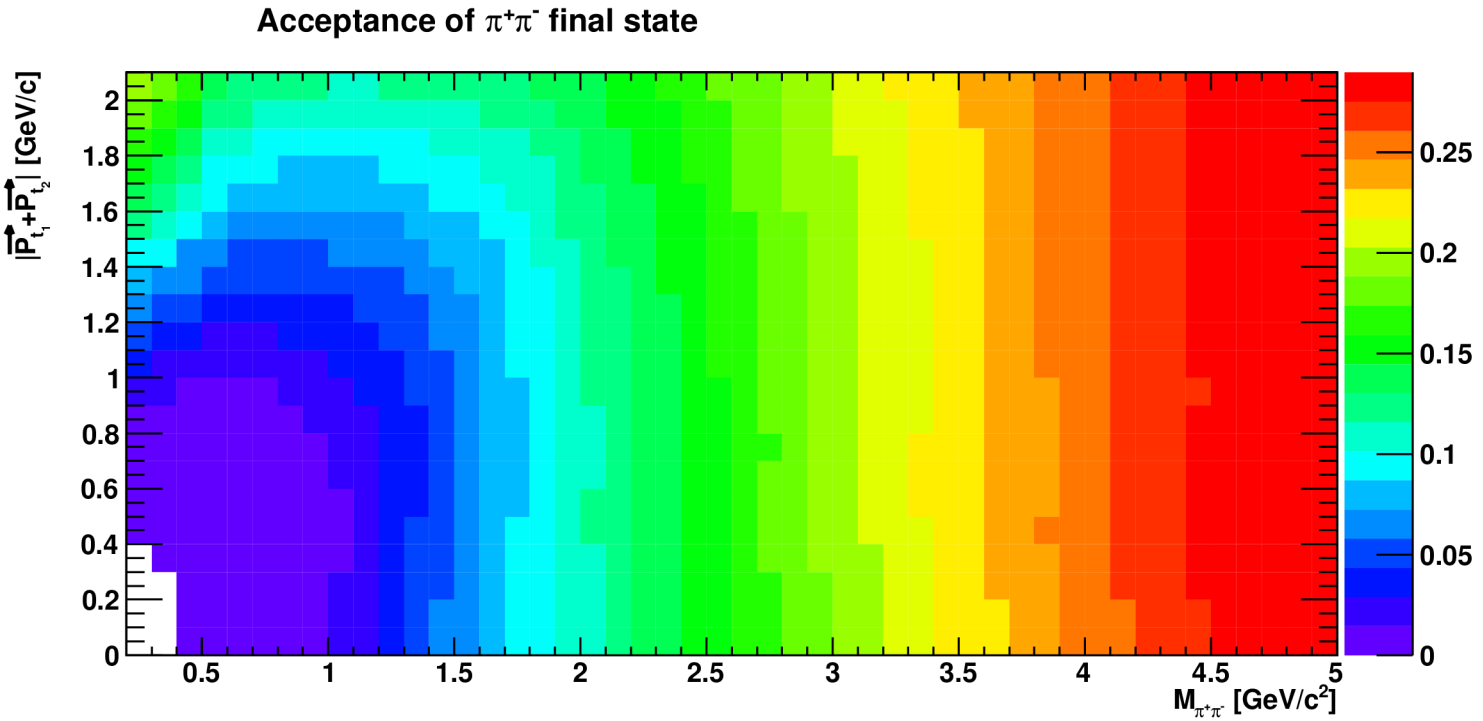
   BSC, CLC, FwdPlug

3. Additional 2 track cuts

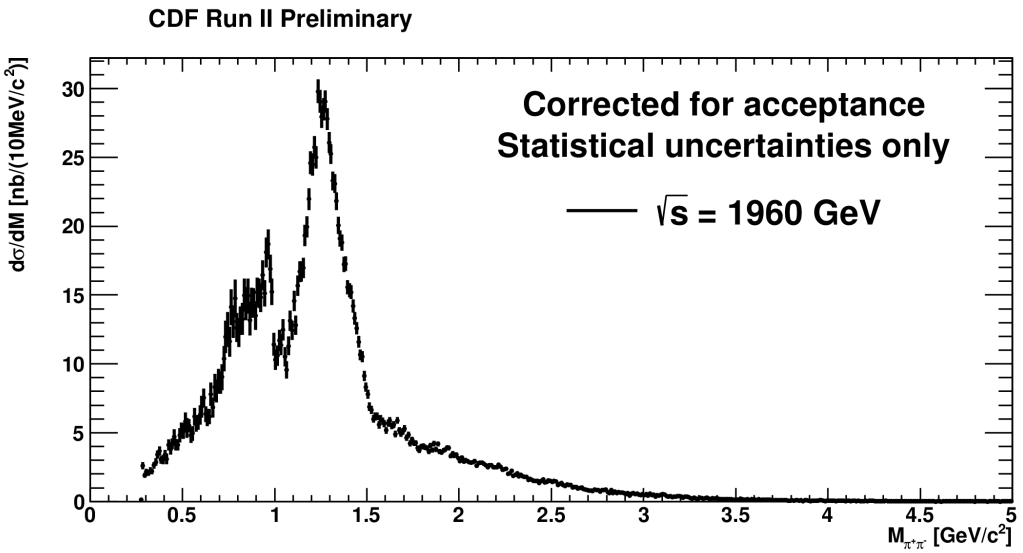
4. Smoothing

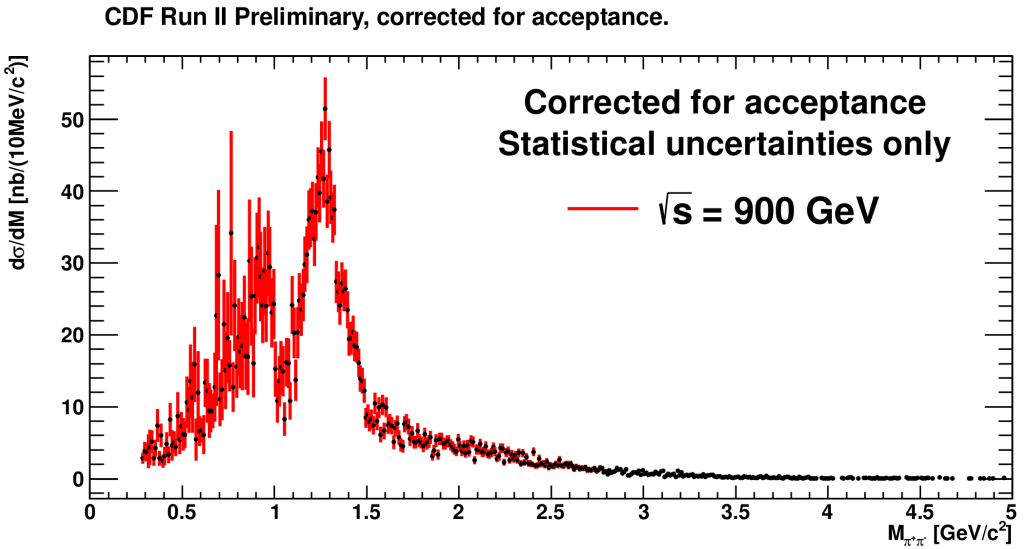


Acceptance – result

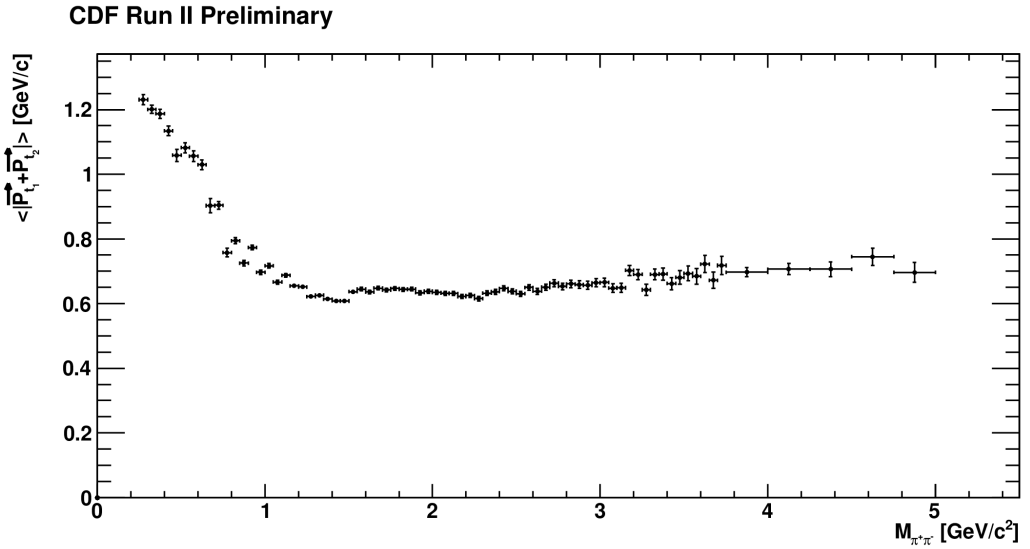


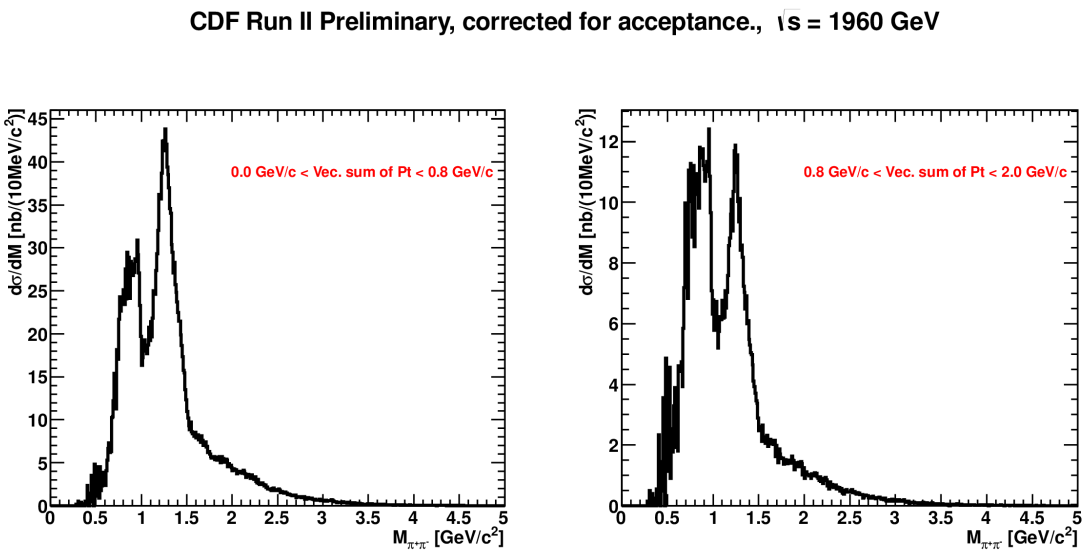
Mass corrected for acceptance





Pt of central state





Systematics - principles

1. All cut parameters varied by

   ~ 1 standard deviation (gaus-like) or

   ~ 0.5 of FWHM width (Lorentz like)

   what looked resonable (others)

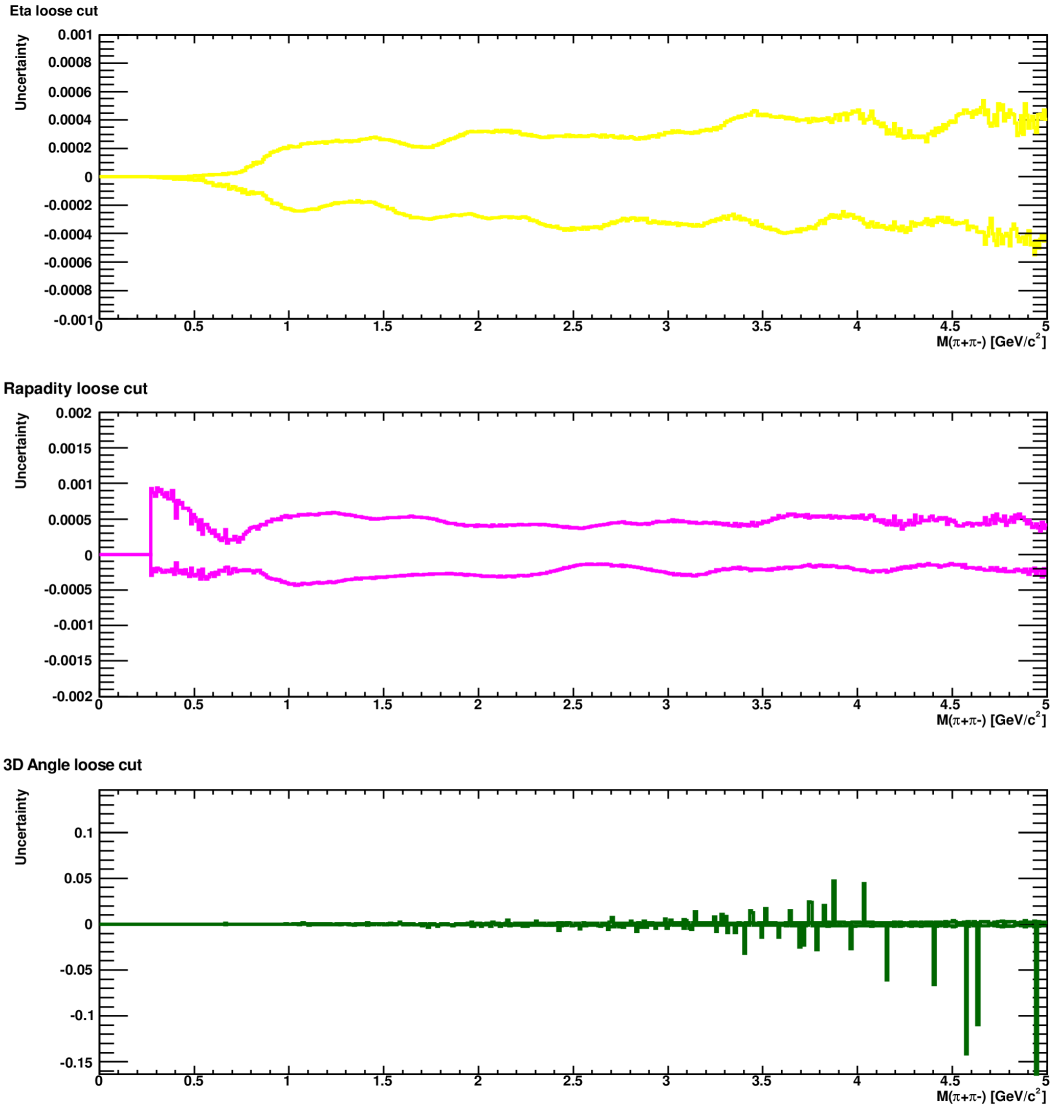
2. Trigger efficiency – fitted polynomials of degree smaller by 1 than in efficiency approximation.

3. Same value of cut for E-W forward detectors.

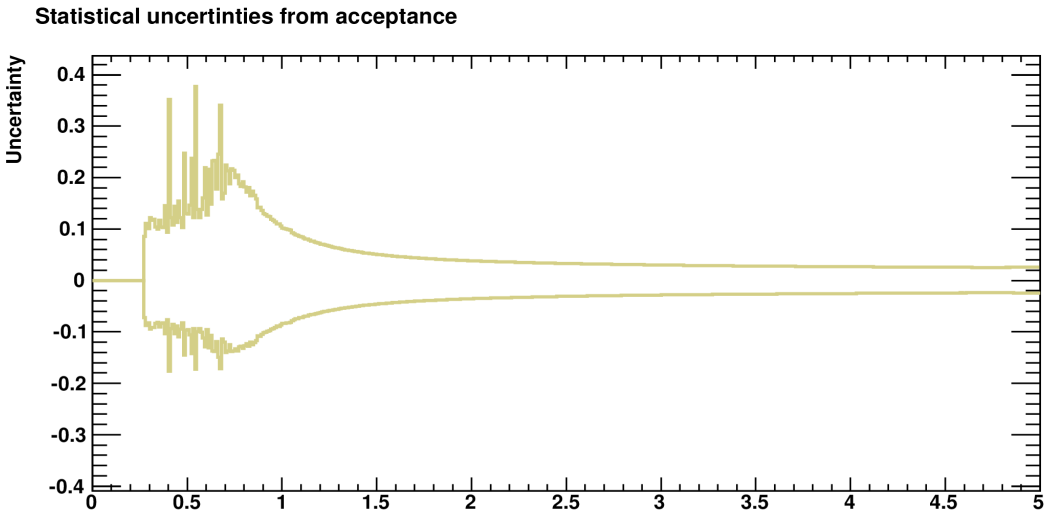
4. Assumed independence of such systematics.

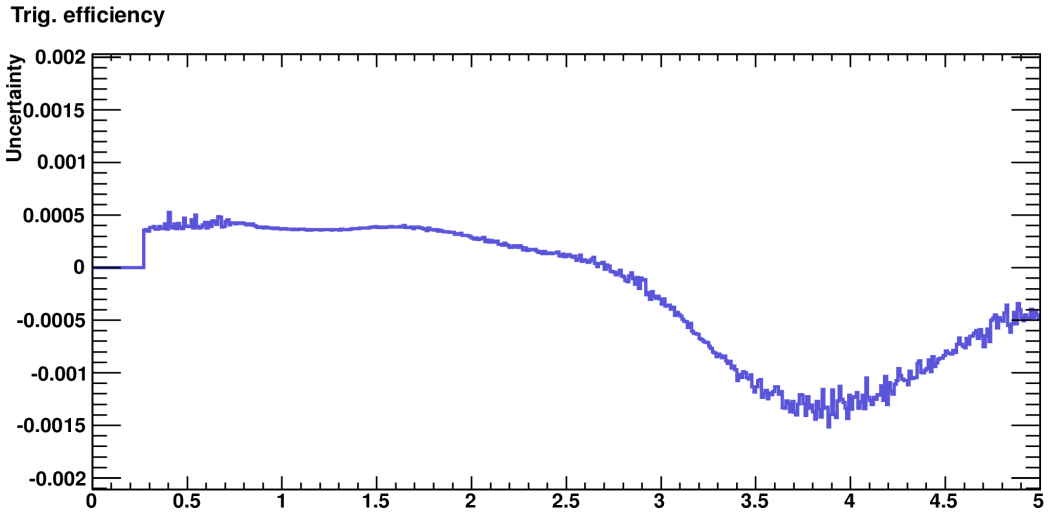
5. Applied simultanously in data/MC

Systematics (1)

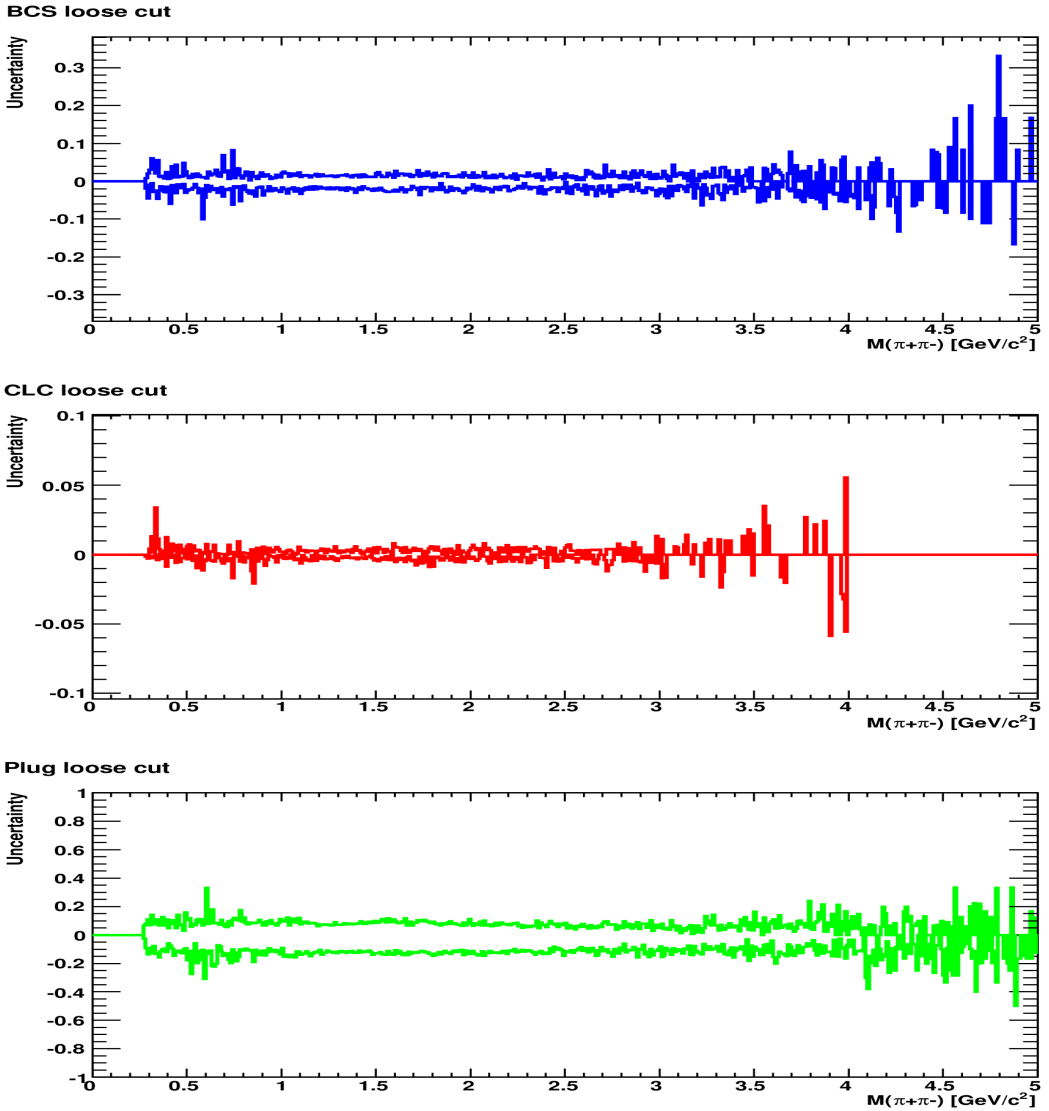


Systematics (2)

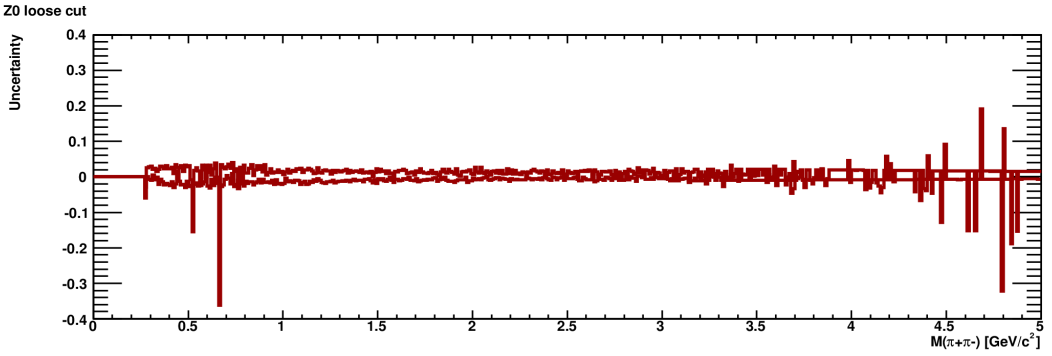


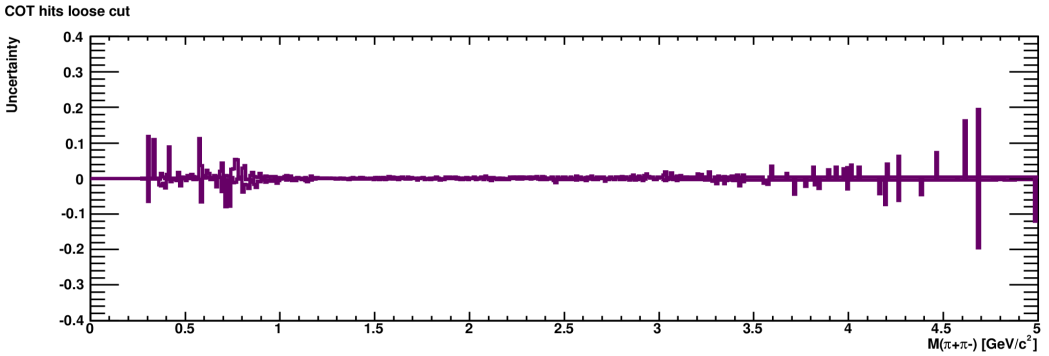


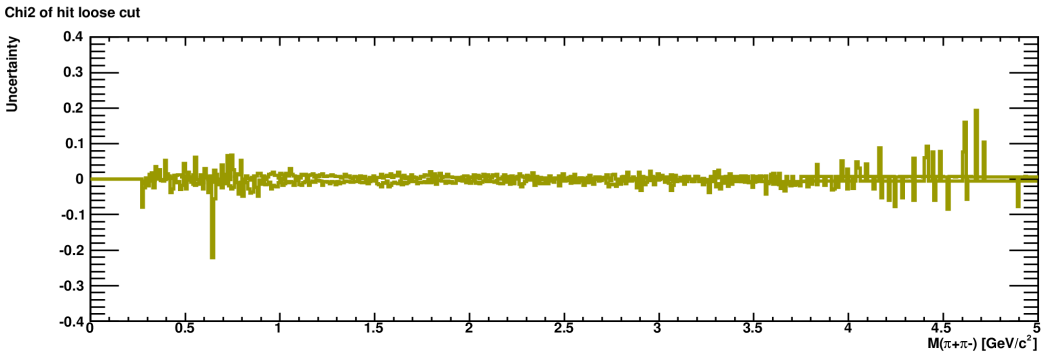
Systematics (3)



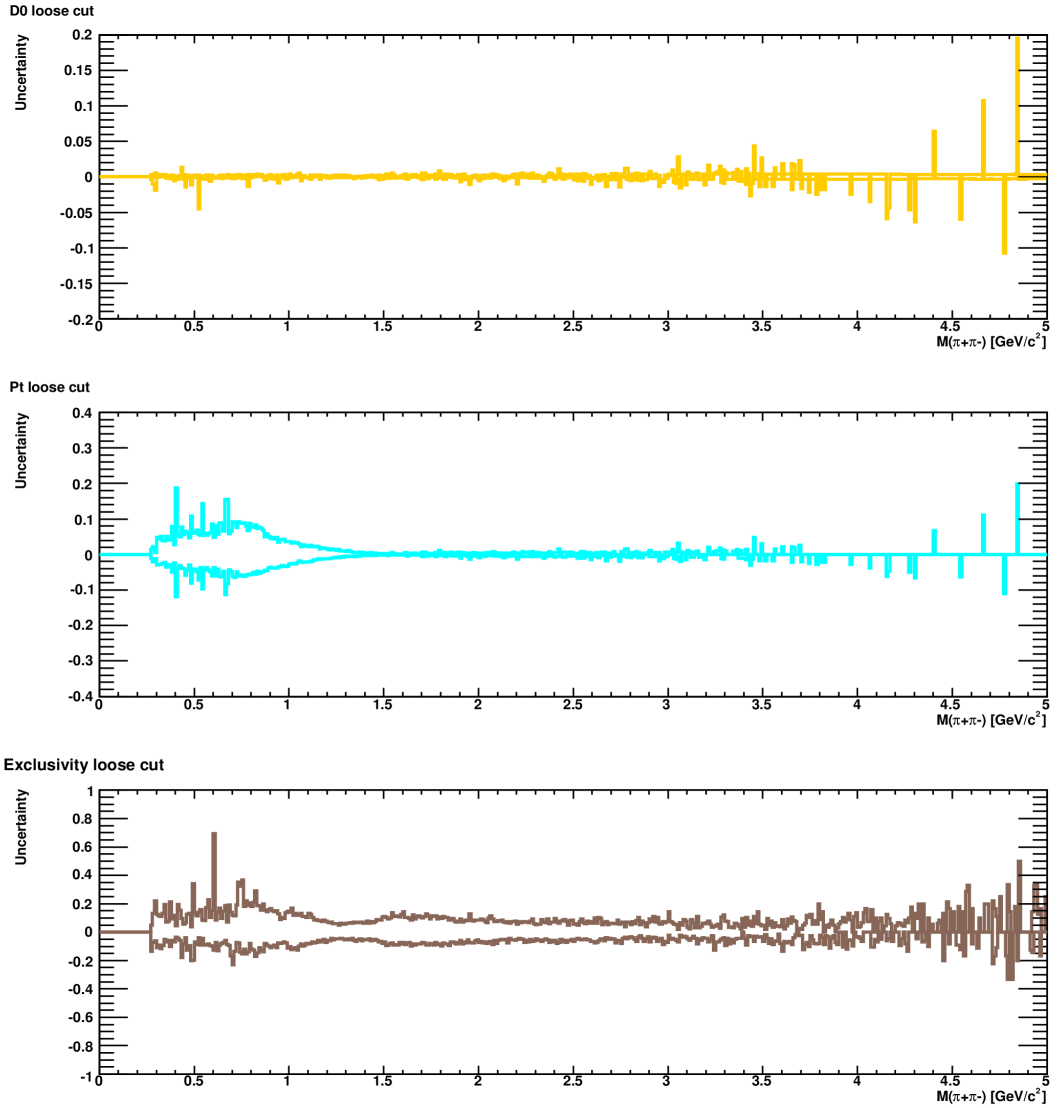
Systematics (4)







Systematics (5)



More to be done (timescale):

Finalize systematics
(today, jobs on CAF finished ~ 8AM)

Apply COT/SI soft track cleanup
(today-tomorrow, new ntuples on finish)

Add 2 additional cuts for χ_c
(monday-tuesday minor changes)

Include 2 tracks > 2 GeV/c trigger to enhance χ_c
(tuesday-wednesday minor changes)

Partial wave analysis
(next weeks)

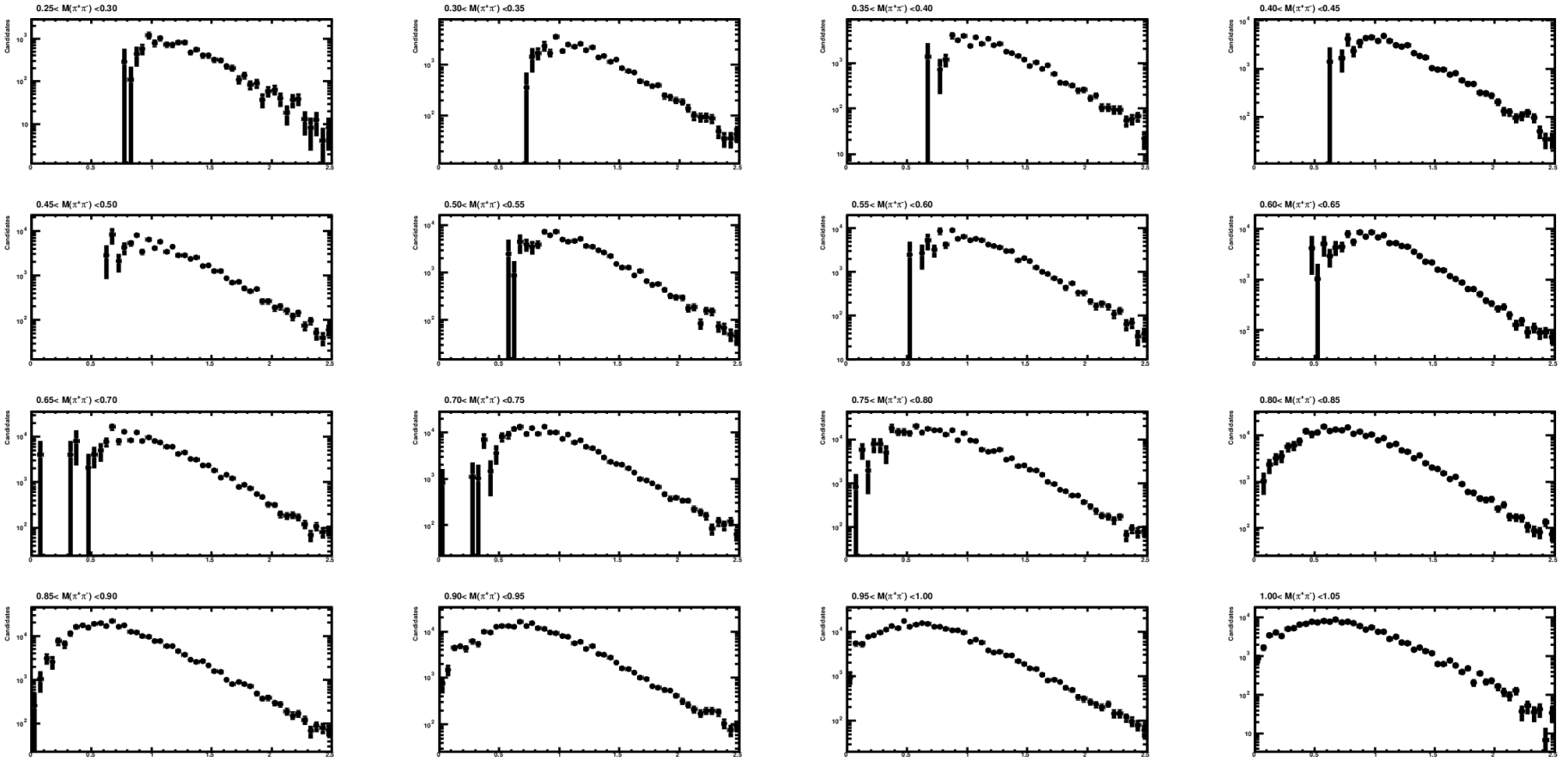
Compare with Monte Carlo (?)

Normalize 300GeV data (?)

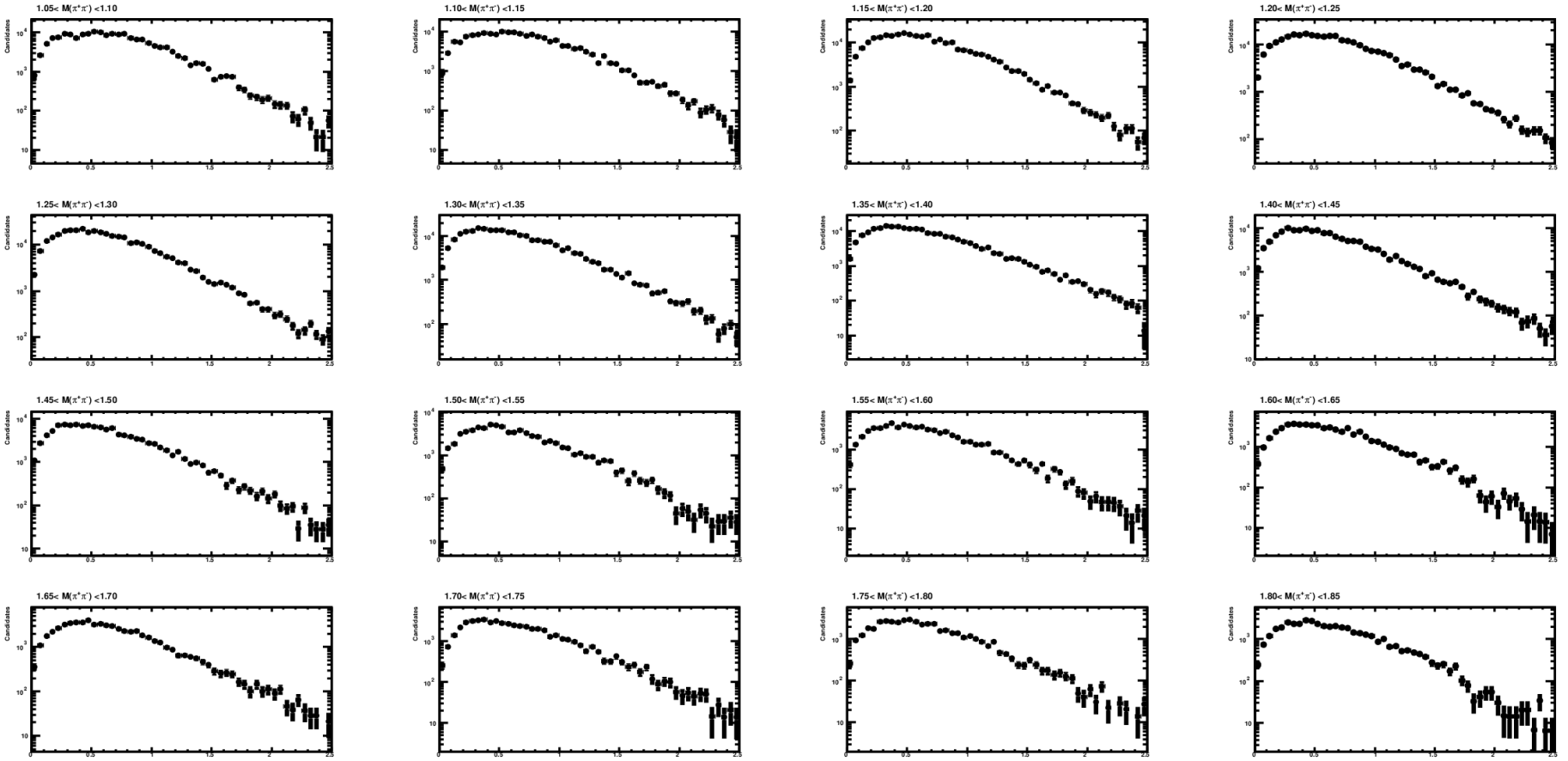
Complete by late August-September

Thank you

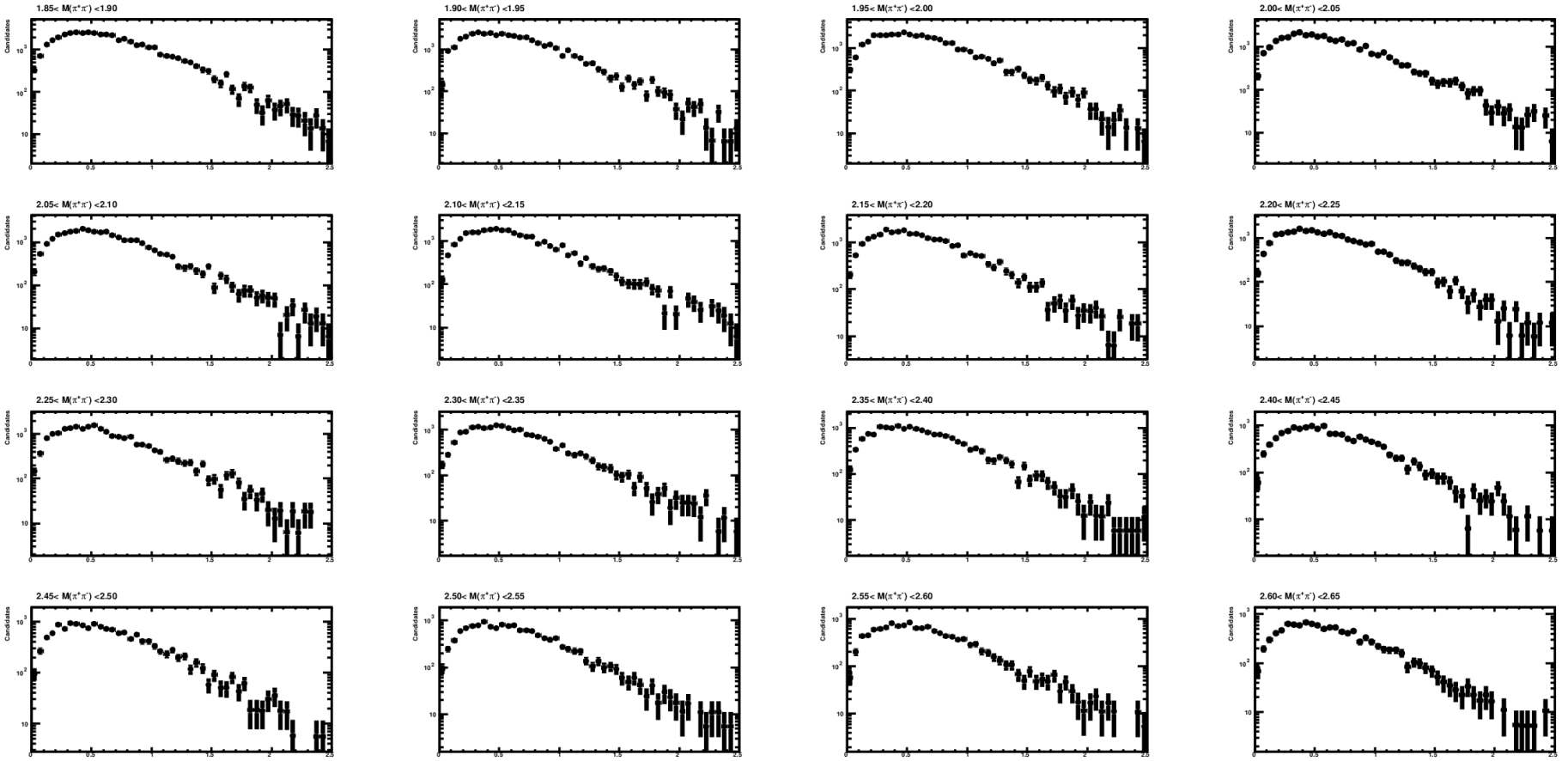
Backup


0.25< M(π⁺π⁻) <0.30
0.30< M(π⁺π⁻) <0.35
0.35< M(π⁺π⁻) <0.40
0.40< M(π⁺π⁻) <0.45
0.45< M(π⁺π⁻) <0.50
0.50< M(π⁺π⁻) <0.55
0.55< M(π⁺π⁻) <0.60
0.60< M(π⁺π⁻) <0.65
0.65< M(π⁺π⁻) <0.70
0.70< M(π⁺π⁻) <0.75
0.75< M(π⁺π⁻) <0.80
0.80< M(π⁺π⁻) <0.85
0.85< M(π⁺π⁻) <0.90
0.90< M(π⁺π⁻) <0.95
0.95< M(π⁺π⁻) <1.00
1.00< M(π⁺π⁻) <1.05
Candidates

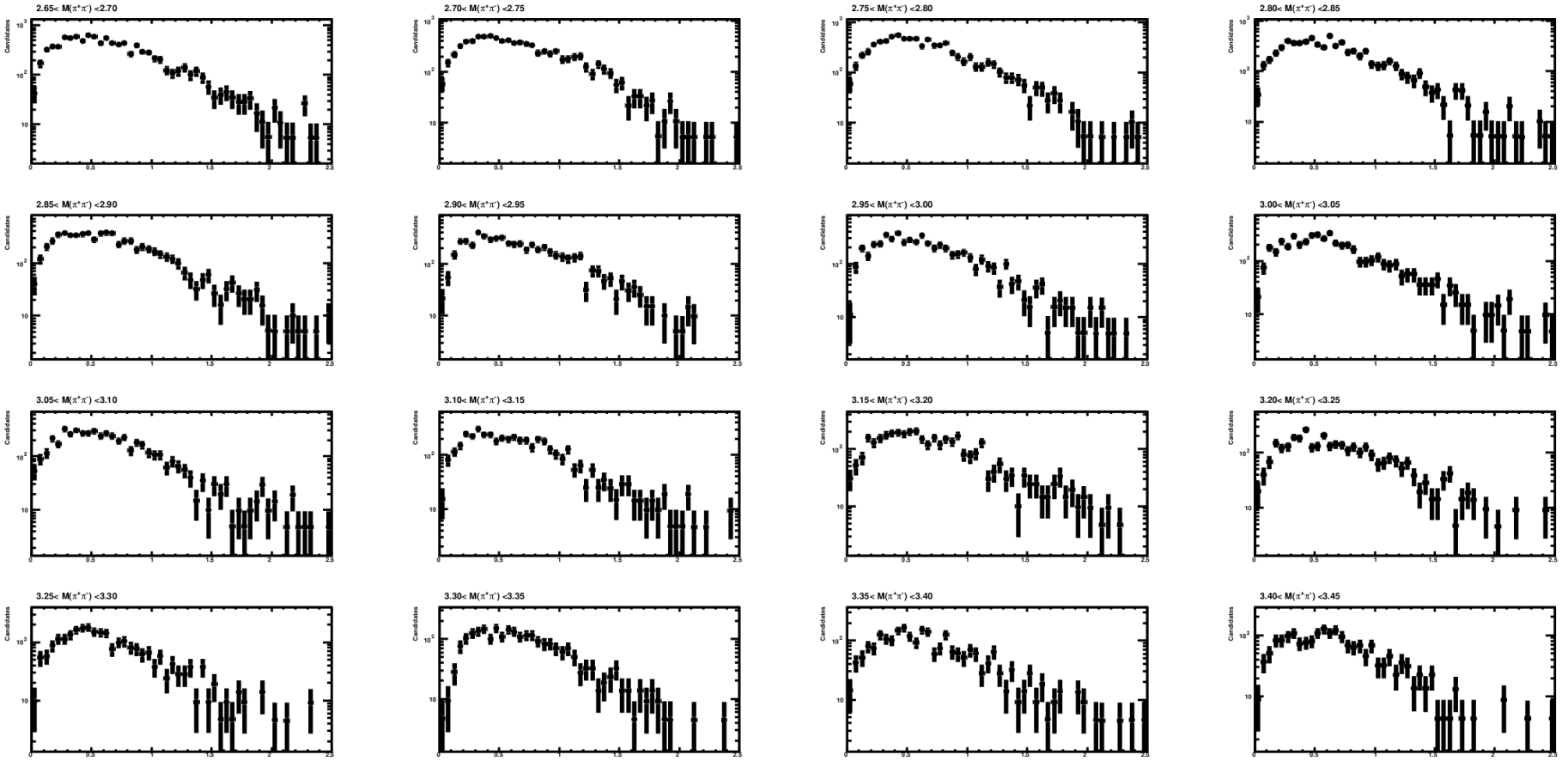
Backup


1.05< M(π⁺π⁻) <1.10
1.10< M(π⁺π⁻) <1.15
1.15< M(π⁺π⁻) <1.20
1.20< M(π⁺π⁻) <1.25
1.25< M(π⁺π⁻) <1.30
1.30< M(π⁺π⁻) <1.35
1.35< M(π⁺π⁻) <1.40
1.40< M(π⁺π⁻) <1.45
1.45< M(π⁺π⁻) <1.50
1.50< M(π⁺π⁻) <1.55
1.55< M(π⁺π⁻) <1.60
1.60< M(π⁺π⁻) <1.65
1.65< M(π⁺π⁻) <1.70
1.70< M(π⁺π⁻) <1.75
1.75< M(π⁺π⁻) <1.80
1.80< M(π⁺π⁻) <1.85
Candidates

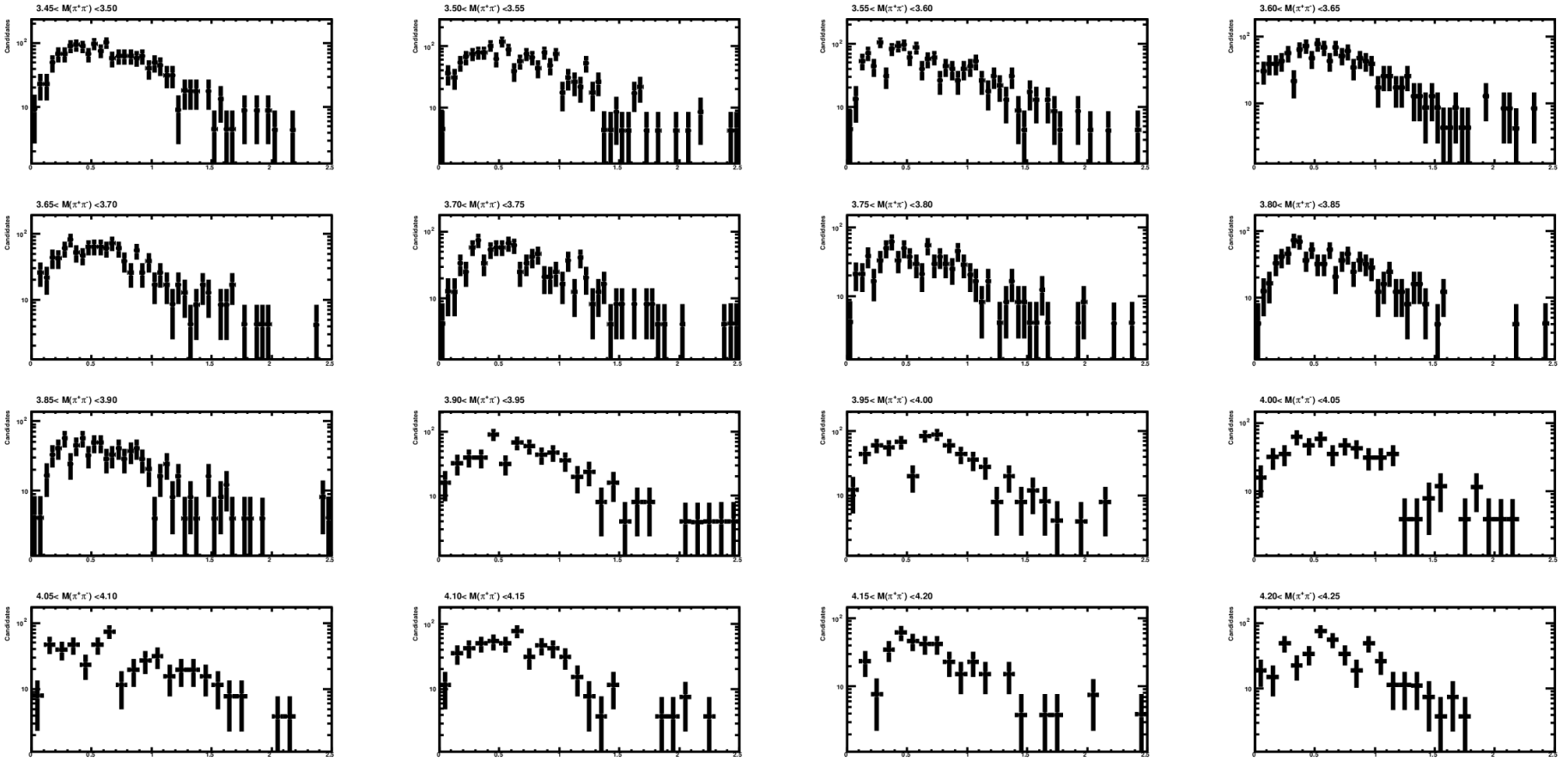
Backup


1.85< M(π⁺π⁻) <1.90
1.90< M(π⁺π⁻) <1.95
1.95< M(π⁺π⁻) <2.00
2.00< M(π⁺π⁻) <2.05
2.05< M(π⁺π⁻) <2.10
2.10< M(π⁺π⁻) <2.15
2.15< M(π⁺π⁻) <2.20
2.20< M(π⁺π⁻) <2.25
2.25< M(π⁺π⁻) <2.30
2.30< M(π⁺π⁻) <2.35
2.35< M(π⁺π⁻) <2.40
2.40< M(π⁺π⁻) <2.45
2.45< M(π⁺π⁻) <2.50
2.50< M(π⁺π⁻) <2.55
2.55< M(π⁺π⁻) <2.60
2.60< M(π⁺π⁻) <2.65
Candidates

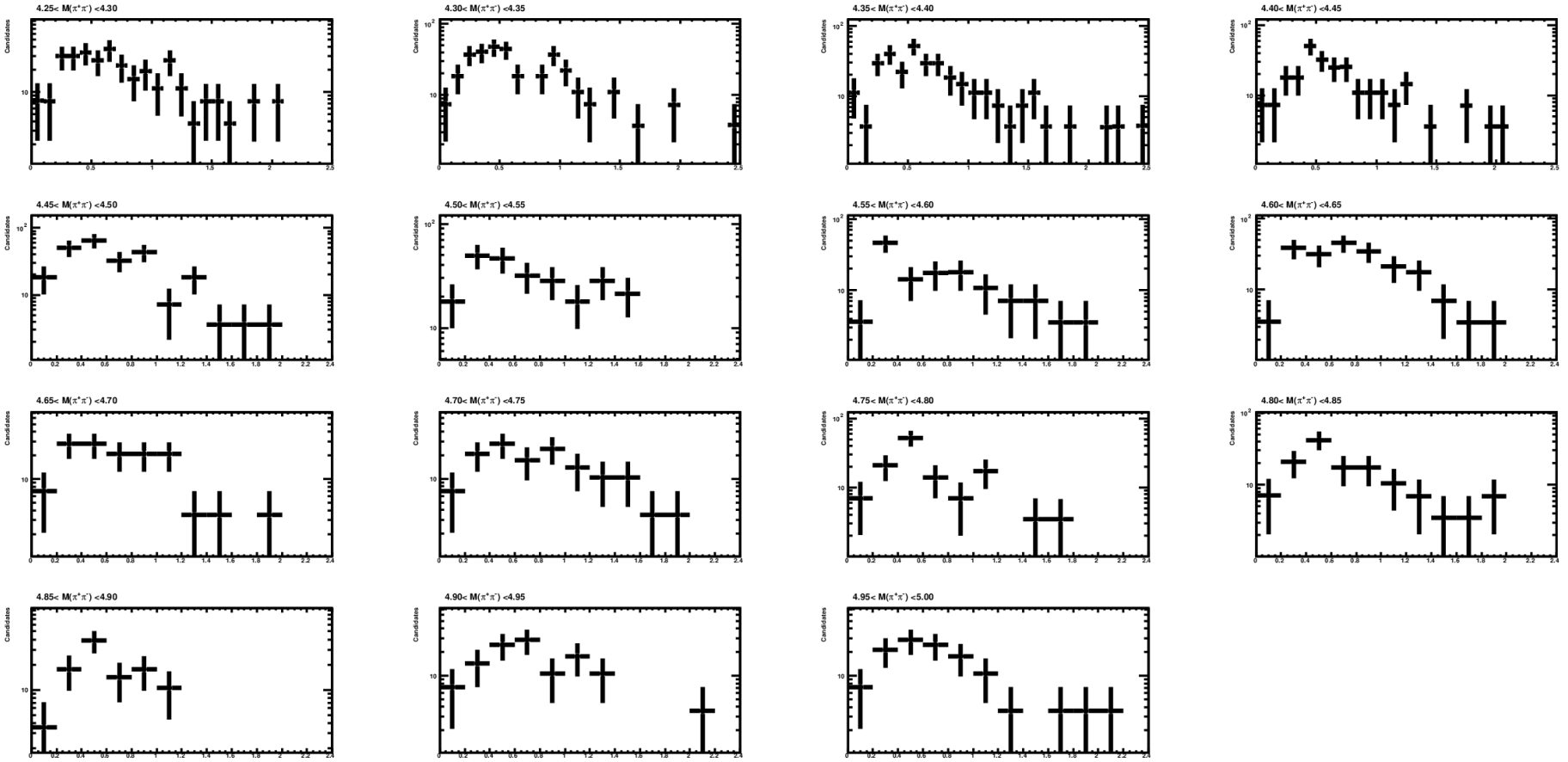
Backup


2.65< M(π⁺π⁻) <2.70
2.70< M(π⁺π⁻) <2.75
2.75< M(π⁺π⁻) <2.80
2.80< M(π⁺π⁻) <2.85
2.85< M(π⁺π⁻) <2.90
2.90< M(π⁺π⁻) <2.95
2.95< M(π⁺π⁻) <3.00
3.00< M(π⁺π⁻) <3.05
3.05< M(π⁺π⁻) <3.10
3.10< M(π⁺π⁻) <3.15
3.15< M(π⁺π⁻) <3.20
3.20< M(π⁺π⁻) <3.25
3.25< M(π⁺π⁻) <3.30
3.30< M(π⁺π⁻) <3.35
3.35< M(π⁺π⁻) <3.40
3.40< M(π⁺π⁻) <3.45
Candidates

Backup


3.45< M(π⁺π⁻) <3.50
3.50< M(π⁺π⁻) <3.55
3.55< M(π⁺π⁻) <3.60
3.60< M(π⁺π⁻) <3.65
3.65< M(π⁺π⁻) <3.70
3.70< M(π⁺π⁻) <3.75
3.75< M(π⁺π⁻) <3.80
3.80< M(π⁺π⁻) <3.85
3.85< M(π⁺π⁻) <3.90
3.90< M(π⁺π⁻) <3.95
3.95< M(π⁺π⁻) <4.00
4.00< M(π⁺π⁻) <4.05
4.05< M(π⁺π⁻) <4.10
4.10< M(π⁺π⁻) <4.15
4.15< M(π⁺π⁻) <4.20
4.20< M(π⁺π⁻) <4.25
Candidates

Backup


4.25< M(π⁺π⁻) <4.30
4.30< M(π⁺π⁻) <4.35
4.35< M(π⁺π⁻) <4.40
4.40< M(π⁺π⁻) <4.45
4.45< M(π⁺π⁻) <4.50
4.50< M(π⁺π⁻) <4.55
4.55< M(π⁺π⁻) <4.60
4.60< M(π⁺π⁻) <4.65
4.65< M(π⁺π⁻) <4.70
4.70< M(π⁺π⁻) <4.75
4.75< M(π⁺π⁻) <4.80
4.80< M(π⁺π⁻) <4.85
4.85< M(π⁺π⁻) <4.90
4.90< M(π⁺π⁻) <4.95
4.95< M(π⁺π⁻) <5.00
Candidates