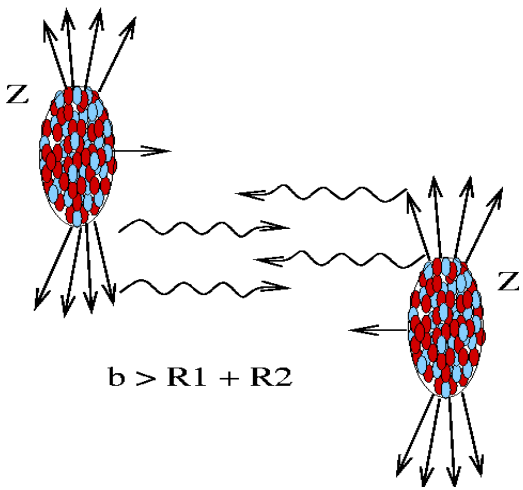
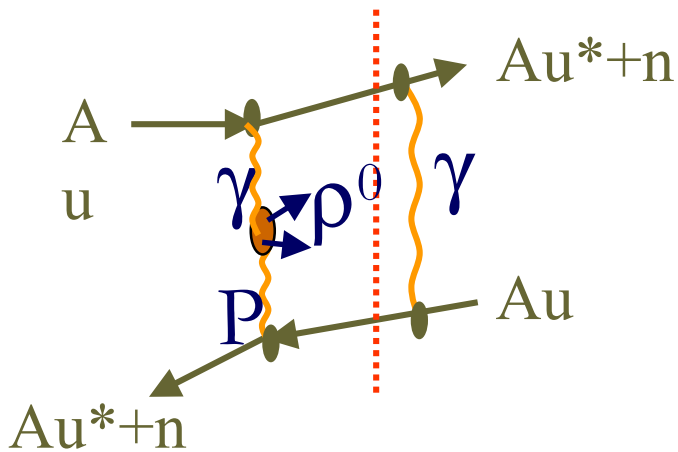
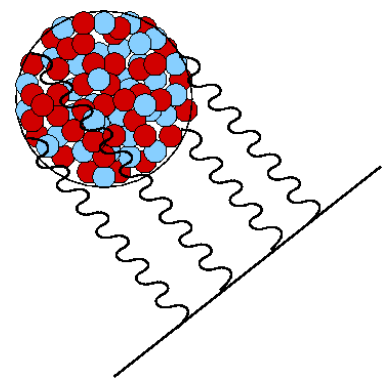
News from UPC Separating Coulomb and Hadronic Interactions

Falk Meissner

for the UPC-Group: Janet Seger, Akio Ogawa, Pablo Yepes, Vladimir Morozov, Spencer Klein, Jim Thomas, Sergey Timoshenko







What's New:

- Systematic Studies

Progress

Goals

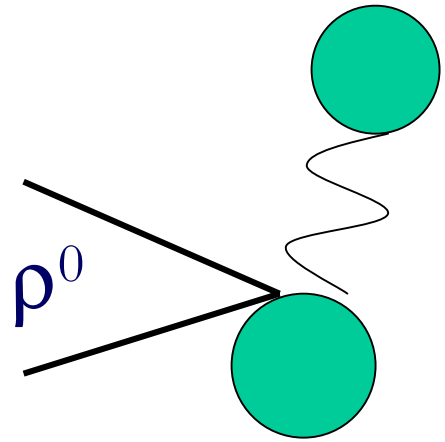
- Publish first observation of rho production in UPC
- Relative cross section measurement w.r.t. hadronic AuAu x-section from minimum bias data

Many details of the event extraction were studied

- Overlap region Coulomb/hadronic
- Extrapolation into unmeasured region –rapidity
- Systematic studies for acceptance correction
- Event selection cuts are settled
- Stability studies for luminosity normalization
- Background subtraction hadronic/e+e-

Separation Coloumb/Hadronic

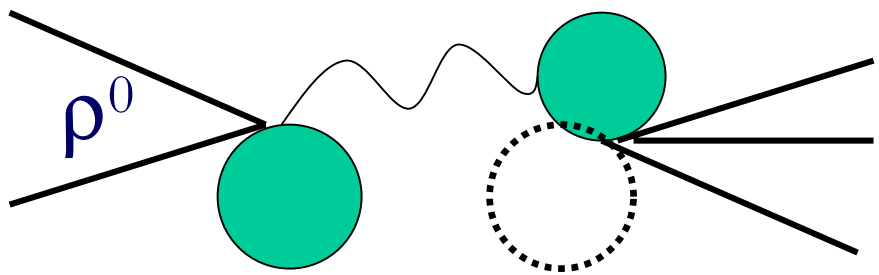
UPC b>2R



Have to clearly define which cross section we are measuring, but:

- **Coherent rho-events (pT<0.15) with additional primary tracks from overlap with peripheral hadronic AuAu collisions**
- **Hard to model in MC**
- **Need to quantify/separate the effect**
- **Separation by ZDC signals => Impact parameter tagging.**
- **UPC: GDR->single neutron emission**
- **Events with hadronic AuAu:**
  multiple neutron ZDC signal !

UPC+peripheral b~2R

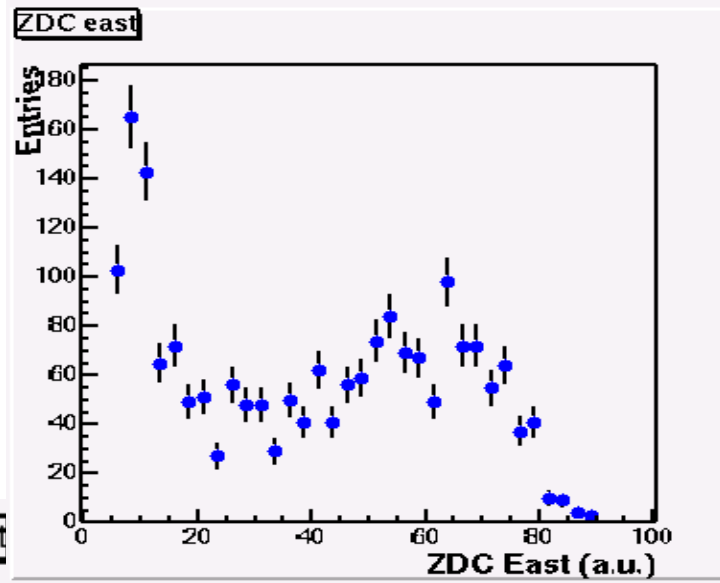


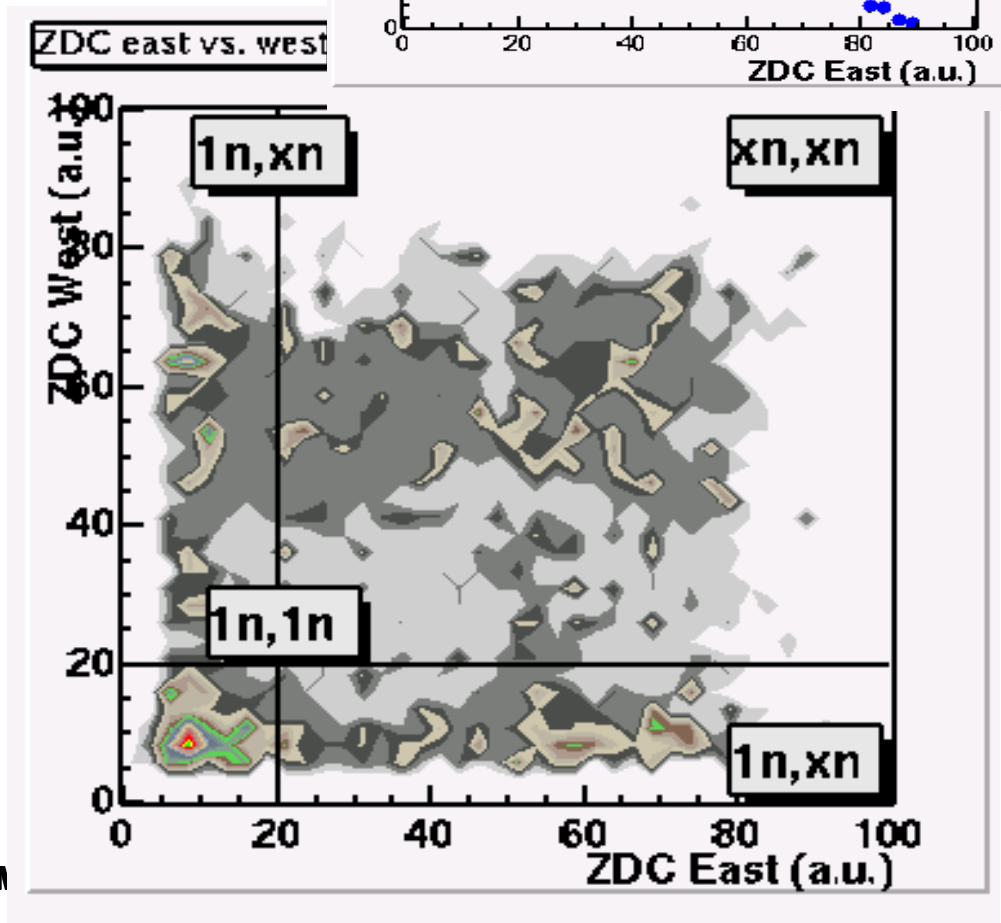
ZDC Response

Define 3 regions with ZDC East/West

- **1n,1n (single neutron)**
- **1n,xn (single, multiple)**
- **xn,xn (hadronic)**
- **Summary (plots follow):**
  - **for 1n1n only events with exactly two primary tracks contain rhos (pT<0.15)**

    =>Pure UPC
  - **For 1nxn, xnxn events with 3<=nPrimary<10 contain also rhos = overlap region**

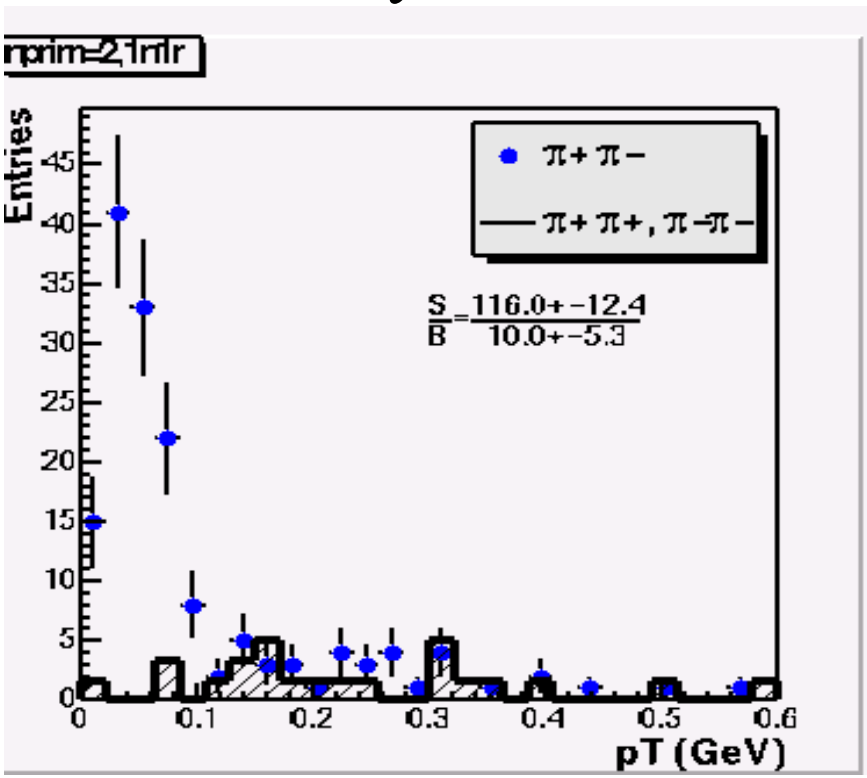




Single Neutron ZDC<20

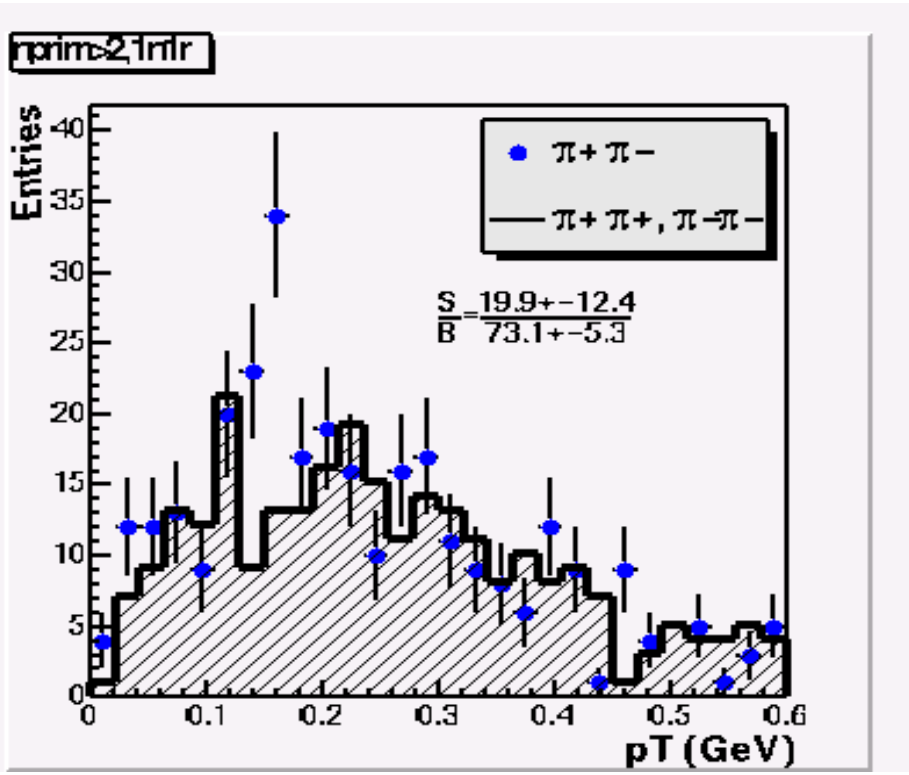
Nprim==2

Rhos only



Nprim>2

No additional rhos



Clean UPC sample -> Definable Cross Section

Overlap 1n,xn; xnxn

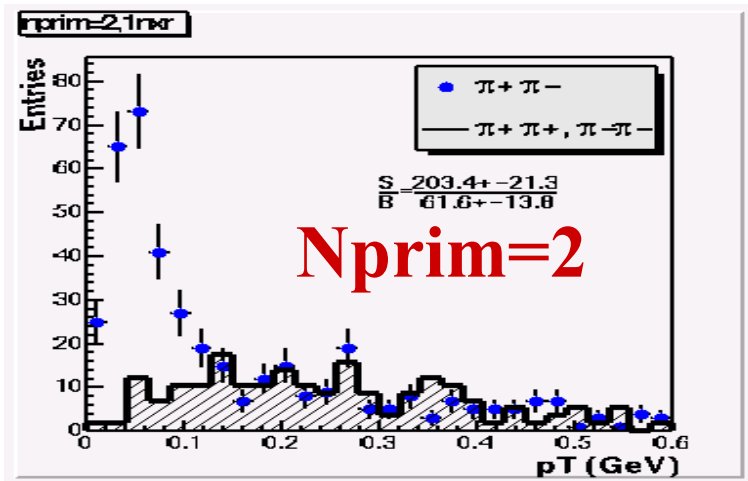
Combinatorial backgrounds are large for Nprim>2

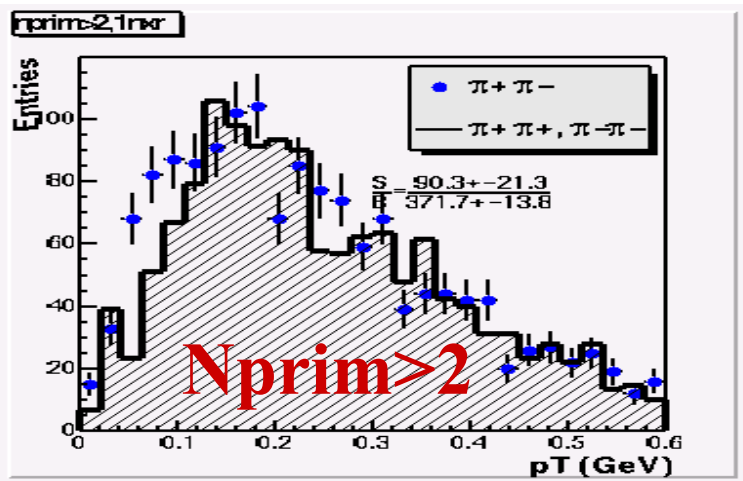
30% of rho events have additional primary tracks

Can quote separate cross sections 1nxn and xnxn

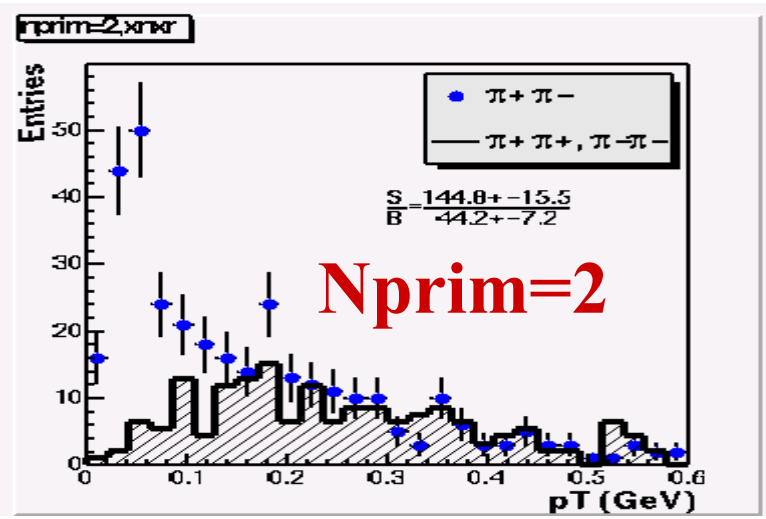
Contributions from Nprim>2 systematic uncertainty

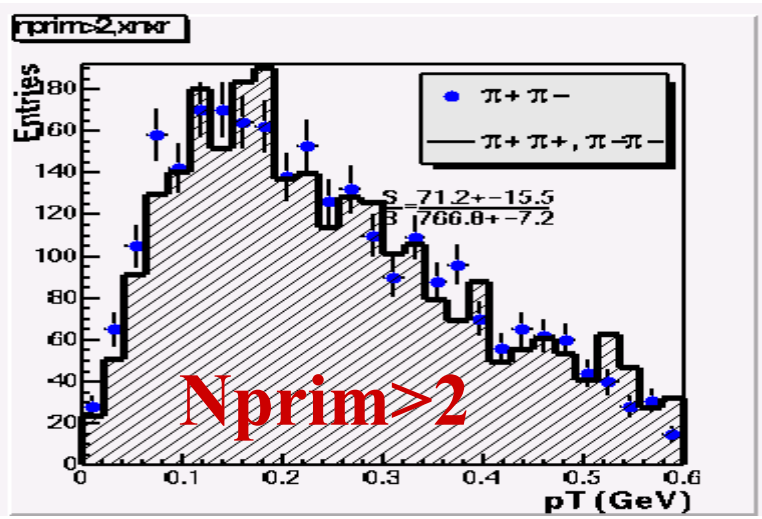
1nxn





xnxn

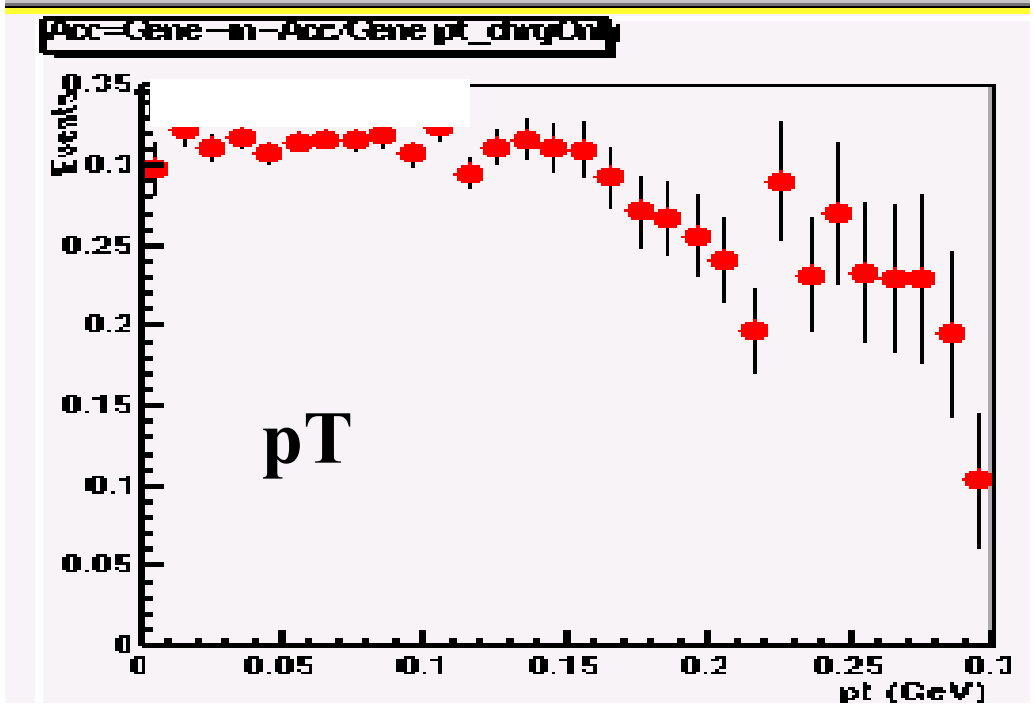


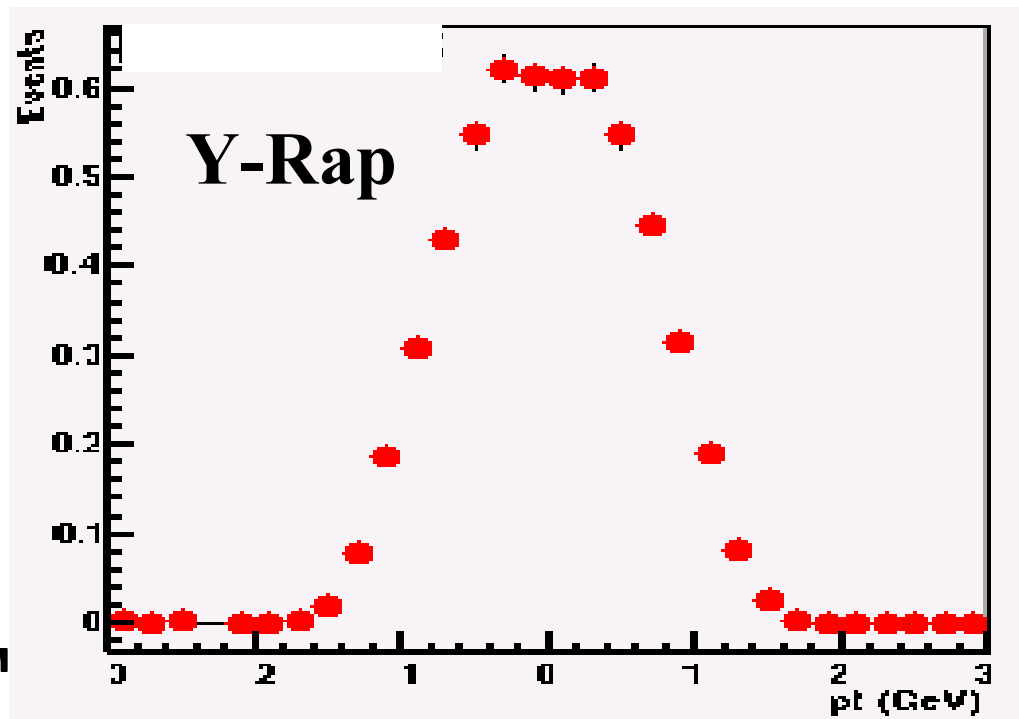


STAR, I

Rho Acceptance

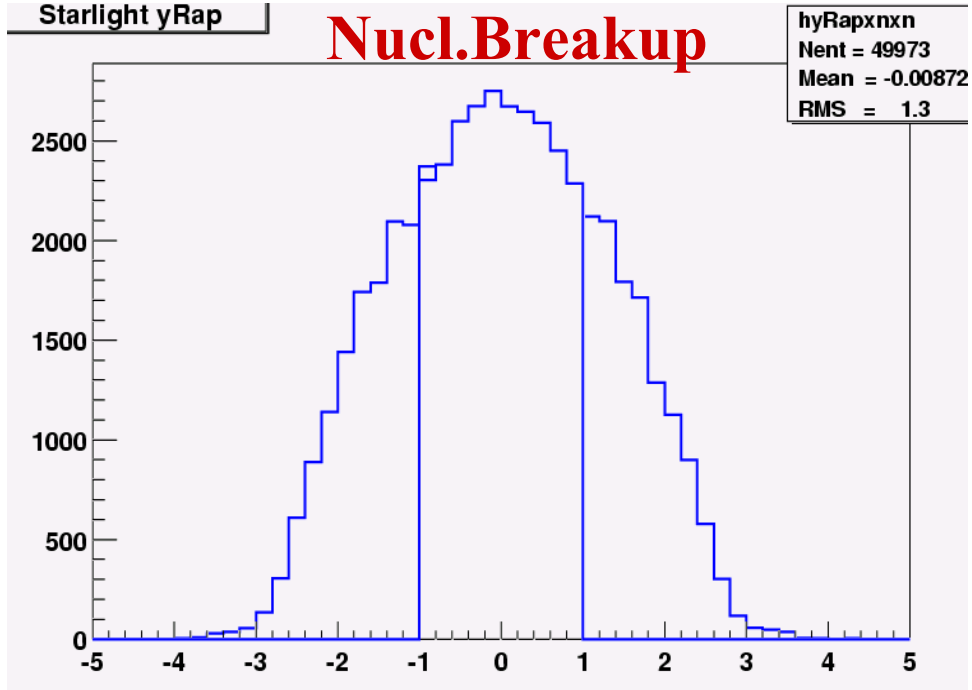
- Acceptance is flat in pT and Mass
- Rapidity Acceptance only |y|<1
- Acceptance& Efficiency
  |y| < 1 = 0.55
  all rapidity = 0.28
- Need to extrapolate into unmeasured region !

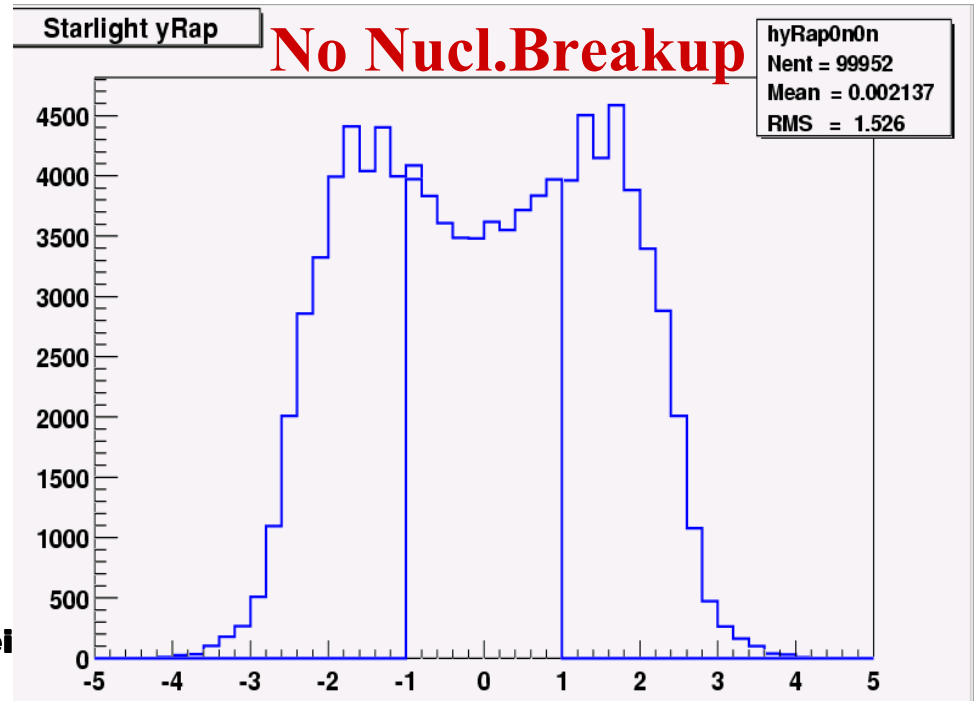




Extrapolation

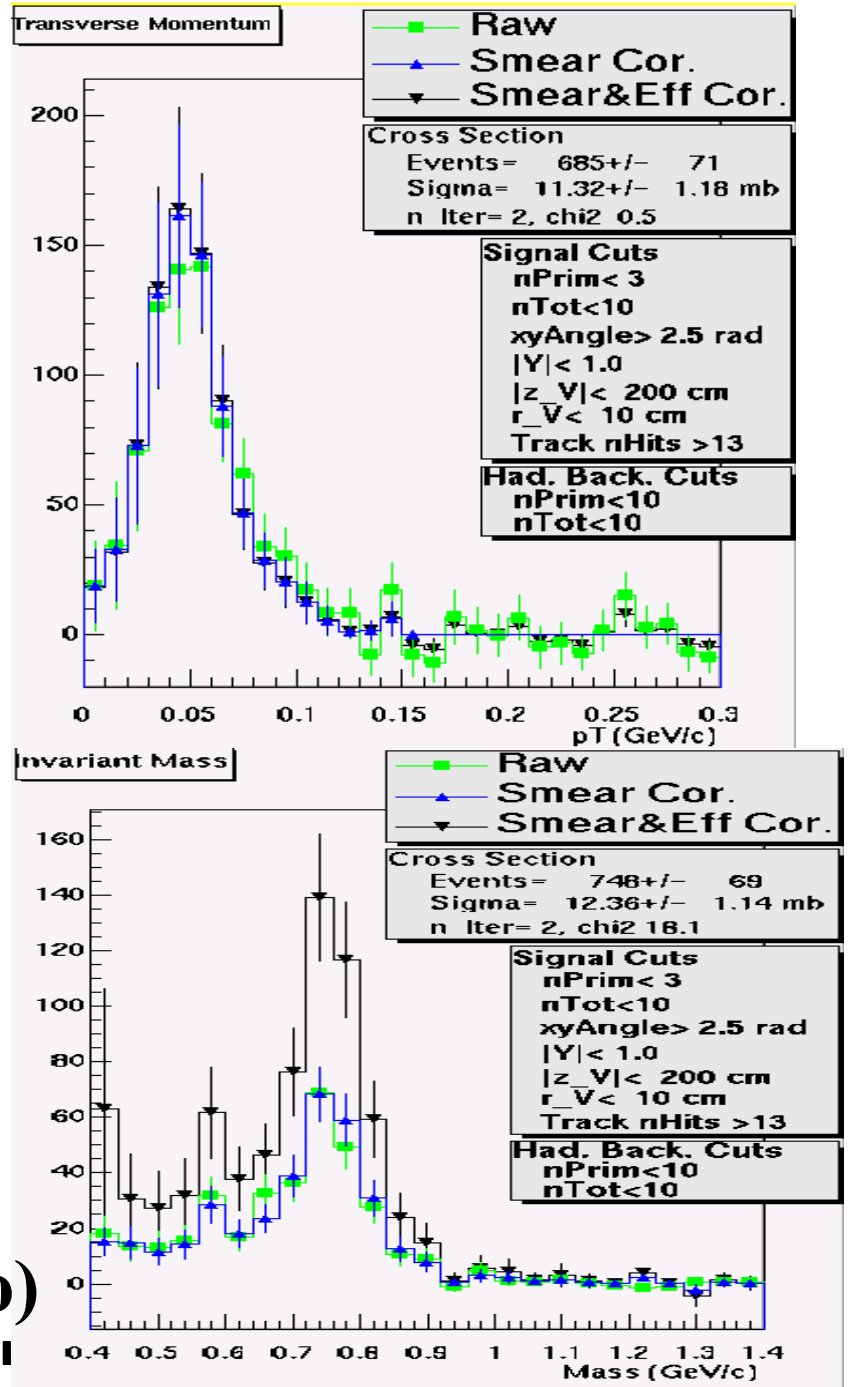
- StarLight MC simulation contains now nuclear breakup
  (Theory to Compare: Klein,Nystrand,Balz)
- Nuclear breakup (=ZDC signal) tags small impact parameters
- Rapidity Distribution differs between rho prod. with and without breakup
- All/|y|<1 = 1.9 for breakup
- All/|y|<1 = 2.6 without





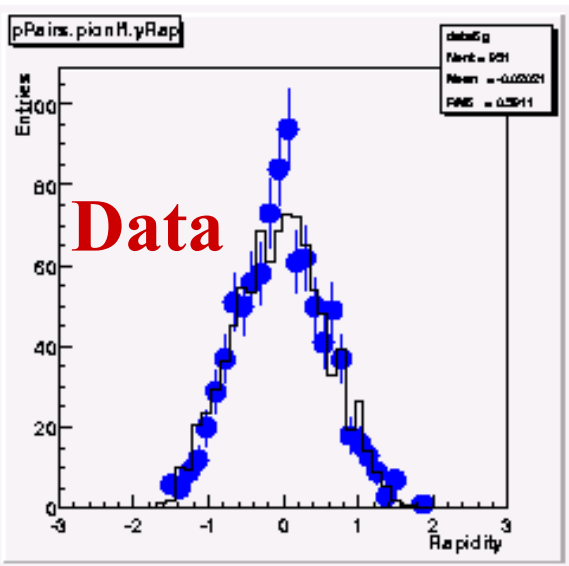
Acceptance Correction Iterative

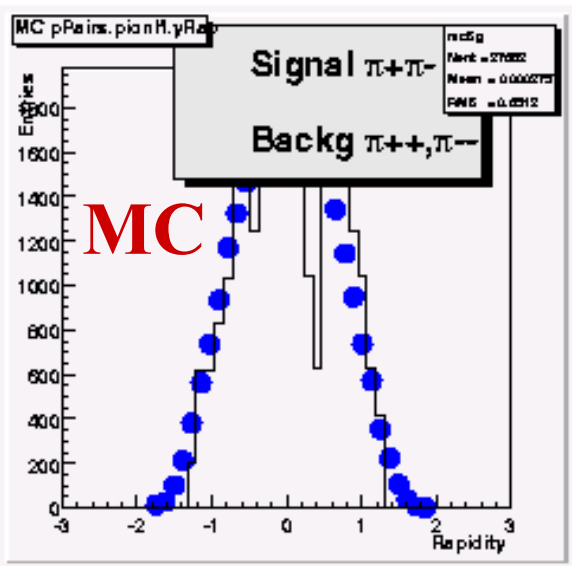
- Acceptance correction with MC needs correct shape of input distributions (Mass, Rapidity, Pt)
- If input distributions are not correctly known need iterative procedure to correct for acceptance
- Critical for limited acceptance in Rapidity
- Effects are small

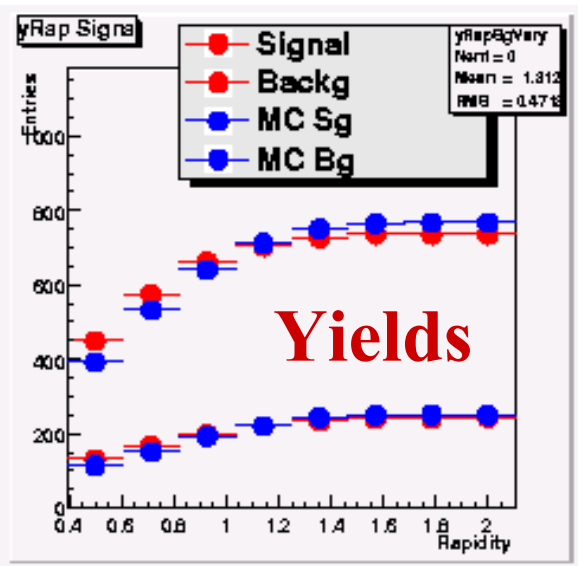


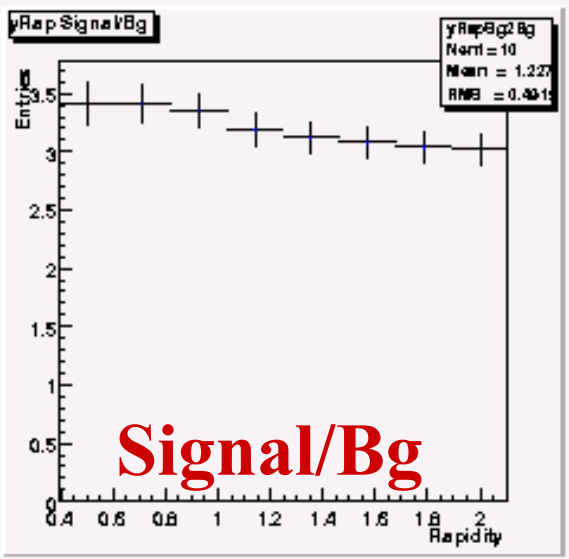
(Pablo)

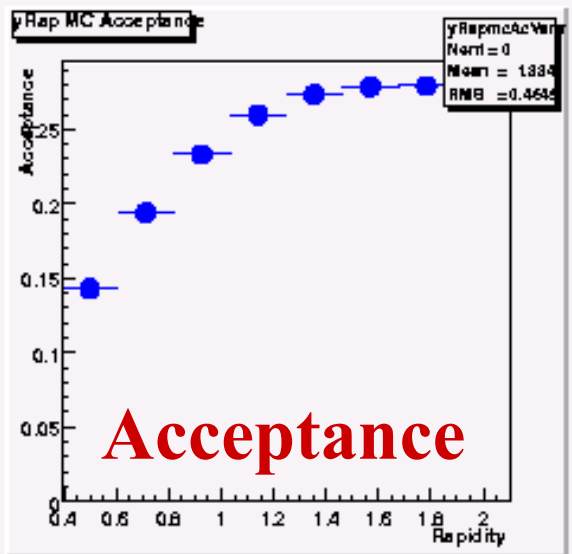
Systematics e.g. Rapidity

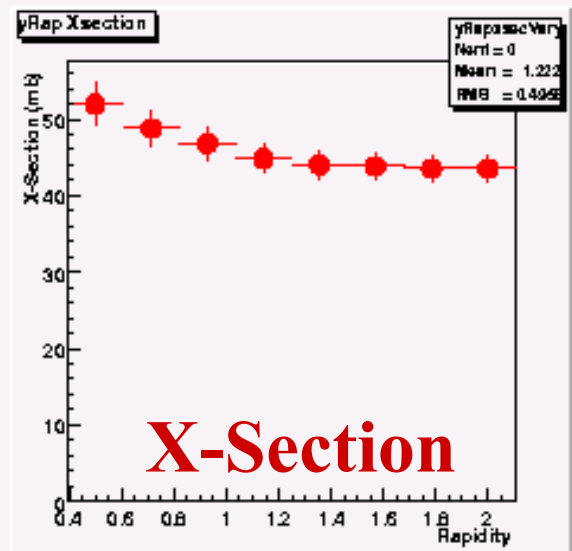












First Results for UPC from 2001 Data

- Two basic trigger Sets
- 'UPC-Minbias' = Minimum Bias

  Low multiplicity minimum bias* Vertex cut* CTB<75

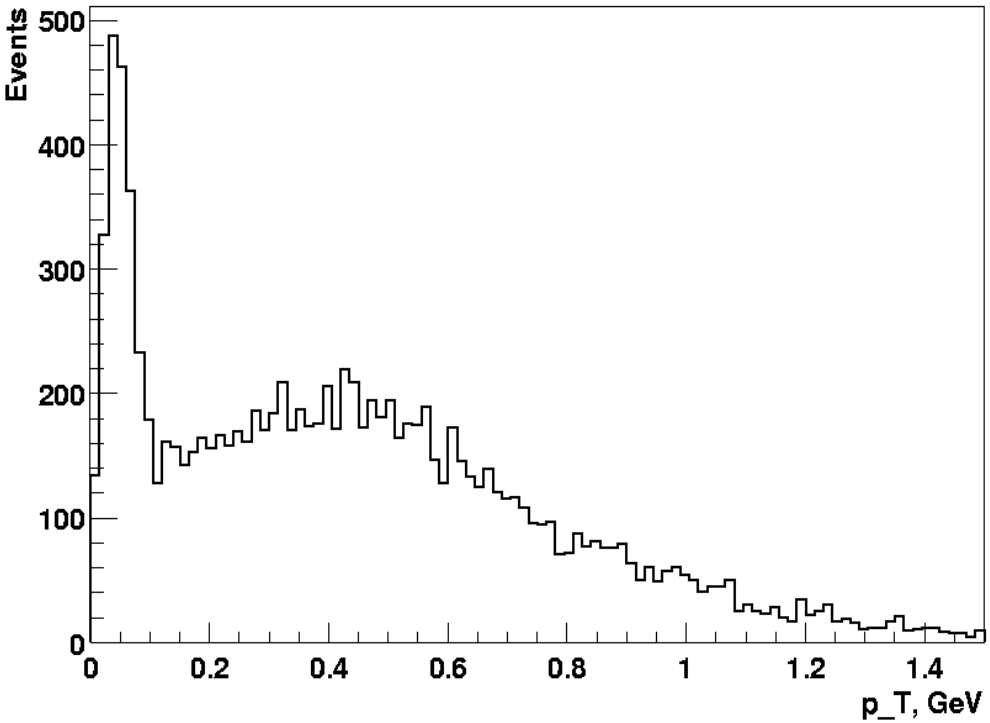
  No SVT to keep event size and readout time down
- Topology Trigger

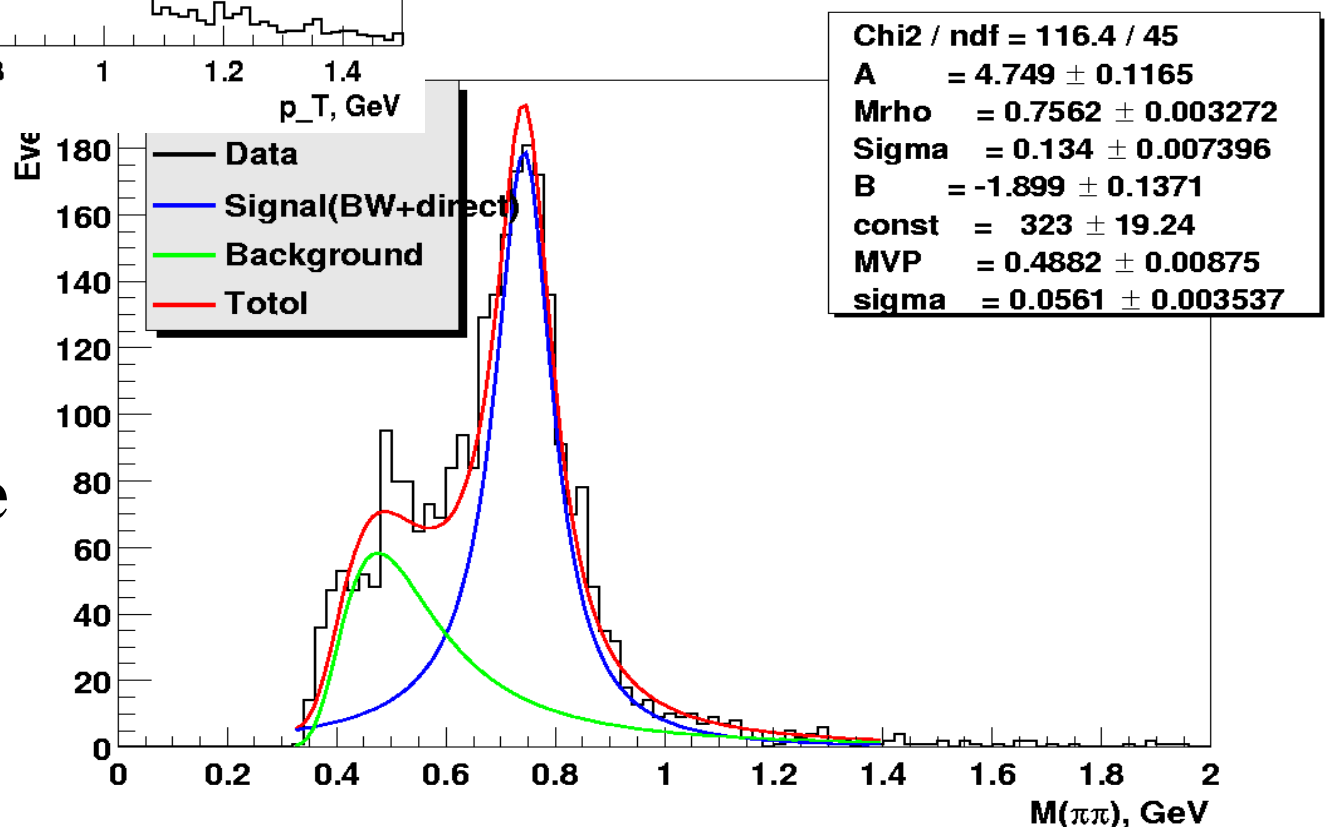
  In parallel to central trigger use up available bandwidth

  No interference with central trigger

Minimum Bias Data Set

- ‘UPC-Minbias’ 2.0M events



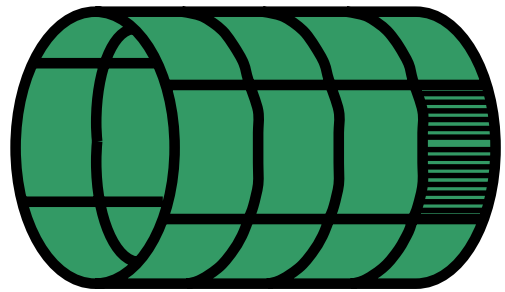


Plots sub-sample of data

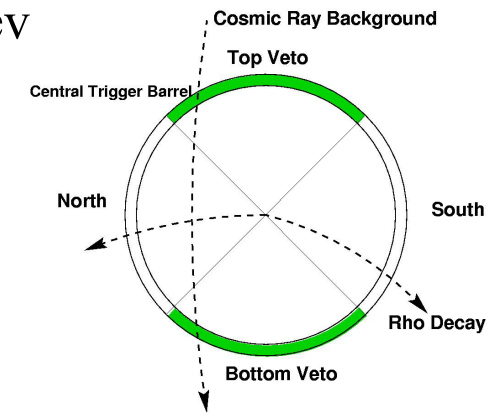
(Sergey Timoshenkov)

STAR, Dec 2001

Topology Trigger Data Set



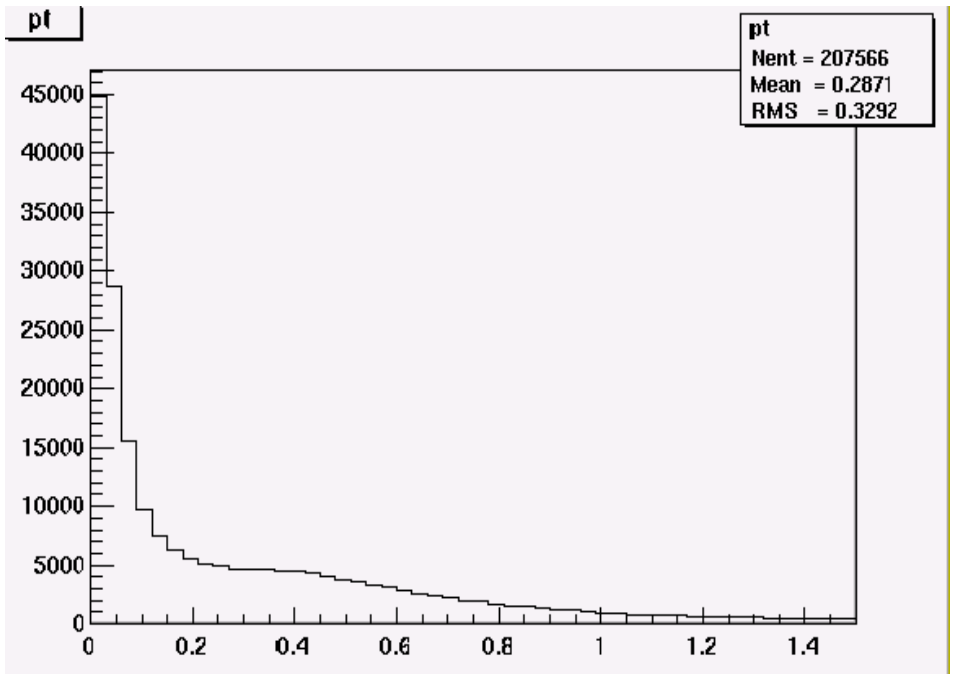
- **'Topo' 0x3001 1.55M events**
  - Topology bit, low multiplicity-N-S coincidence
  - 16 'pixels' of phi*eta = 1.5 * 0.5
  - CTB killer bit (1 us deat time after a slat is hit)
  - L0 rate ~ 2*central rate (20-40Hz)
  - L3 trigger ~85-90% rejection of L0 events
  - 5% of L0 untriggered through L3 = about half of ev
- **'Topo & ZDC' 0x3002 21k events**
  - Same as above & ZDC coincidence (1Hz)
  - Very clean events 50% of L0 pass L3 trigger !
- **'Topo Efficiency' 0x3011 1.0M events**
  - Minimum bias, CTB<15 mips, no Vertex cut, no Topology bit, prescaled
  - Also used for monitoring the interaction diamond



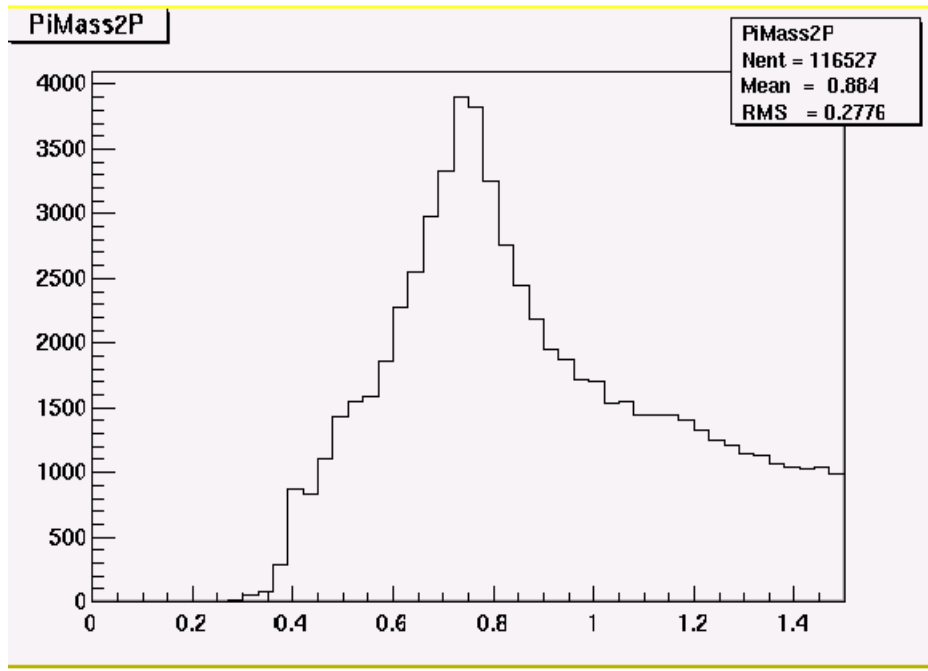
Online Look at Topology Data

L3 online histograms (Pablo Yepes)

Transverse Momentum



Inv. Mass



25-50k rho, 50-100x w.r.t. last year!

Summary

- Separation of Coulomb/Hadronic in hand
  (i.e how to deal with additional primary tracks)
- Todo: put pieces together, finalize numbers
- Analysis of 2000 data close to be finished (paper by x-mas ?!)

- 2001 successful data taking

=>two track events-we got about what we wanted

- ~1.5M Topology triggered events on tape (750k passed L3) (about 50-100x last year)
- 2M low multiplicity minimum bias events (10x last year)
- Thanks to Trigger/DAQ/L3
  esp. Eleanor, Jack, Jeff, Hank, Jens, Bill