Basic Track Distributions Pre-Approval

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Outline

- Dataset and Event Selection
- Track Multiplicity
- Basic Tracking Distributions Normalized by Number of Tracks
- BACKUP: Tracking Distributions Normalized by Events

Basic Tracking Variables:

http://indico.cern.ch/getFile.py/access?contribId=5&resId=2&materialId=slides&confId=76801
http://home.fnal.gov/~ygao/CMS/Tracking/LhcTrackAnalyzer/CMSSW_3_3_6_patch3/

Data sets and Event Selection

- Dec19thReReco:

  /MinimumBias/BeamCommissioning09-BSCNOBEAMHALO-Dec19thSkim_336p3_v1

- MinBias STARTUP MC Samples

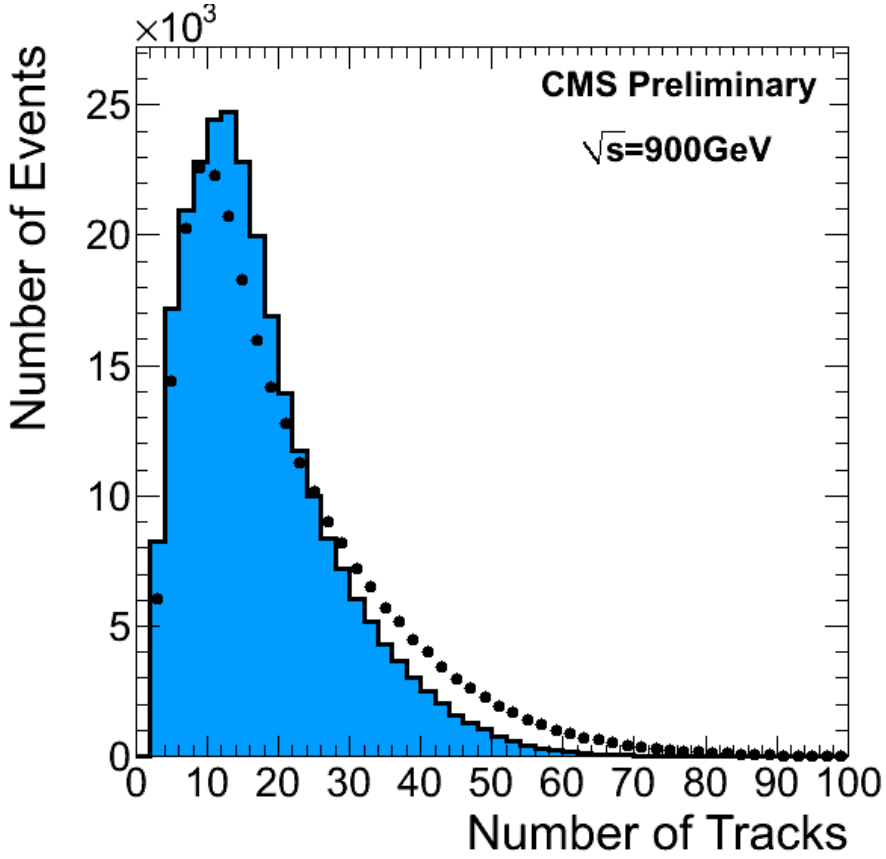
  /MinBias/Summer09-STARTUP3X_V8K_900GeV-v1/
  /MinBias/Summer09-STARTUP3X_V8L_2360GeV-v1/

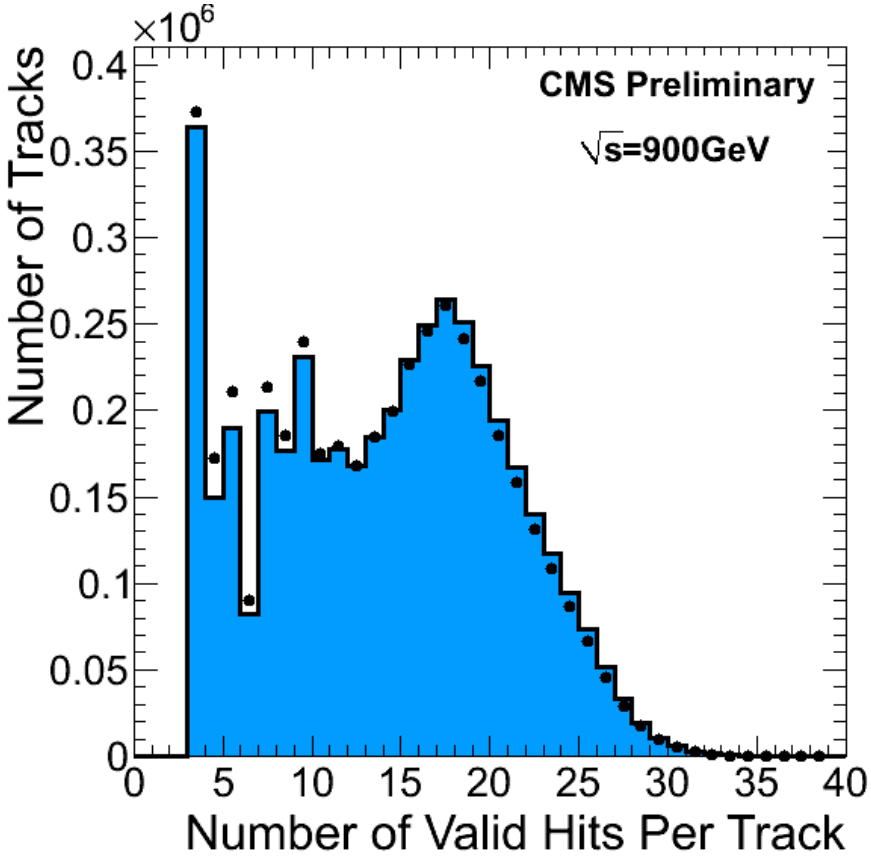
- Dec19th ReReco data use new CMS global position and reference frame, while all MC samples are generated in the old CMS frame

1. Select good run/lumi in data from Andrea Venturi's Study:
   https://twiki.cern.ch/twiki/bin/view/CMS/TRK10001#Run_and_Lumi_Section_Selections
2. TechBit 0 && (40||41) && !(36-39) for Data
3. TechBit (40||41) for MC
4. At least one real primary vertex
5. Fraction of HighPurity tracks > 0.2

Number of Tracks and Valid Hits

- Pythia D6T is a reasonable tune, but not very well tuned for 900 GeV, data has more tracks pT< 0.2 GeV.

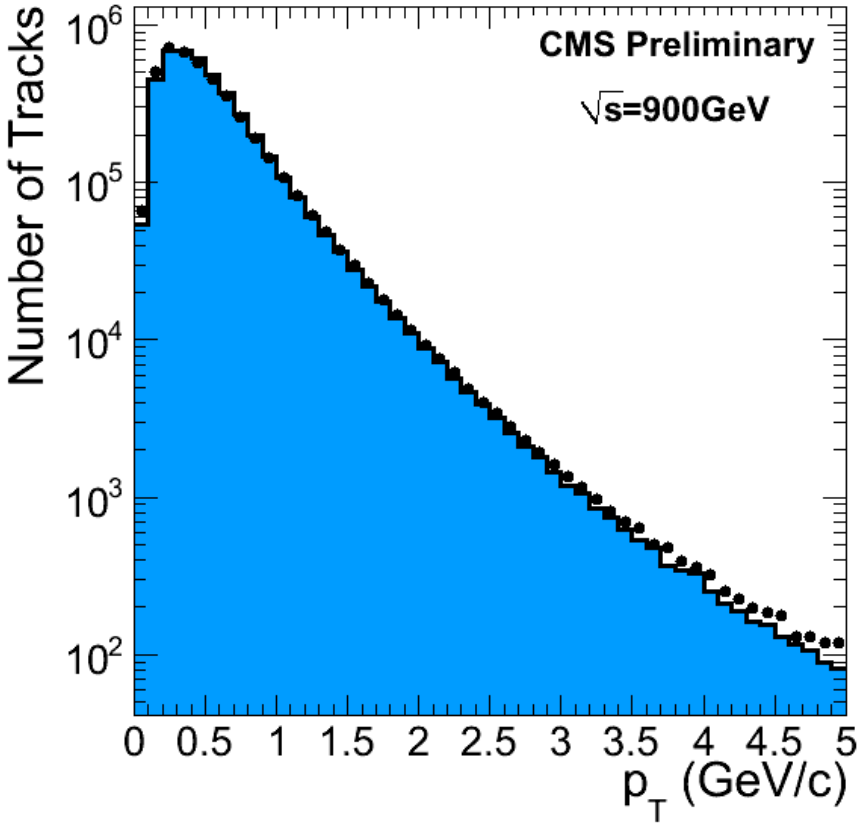


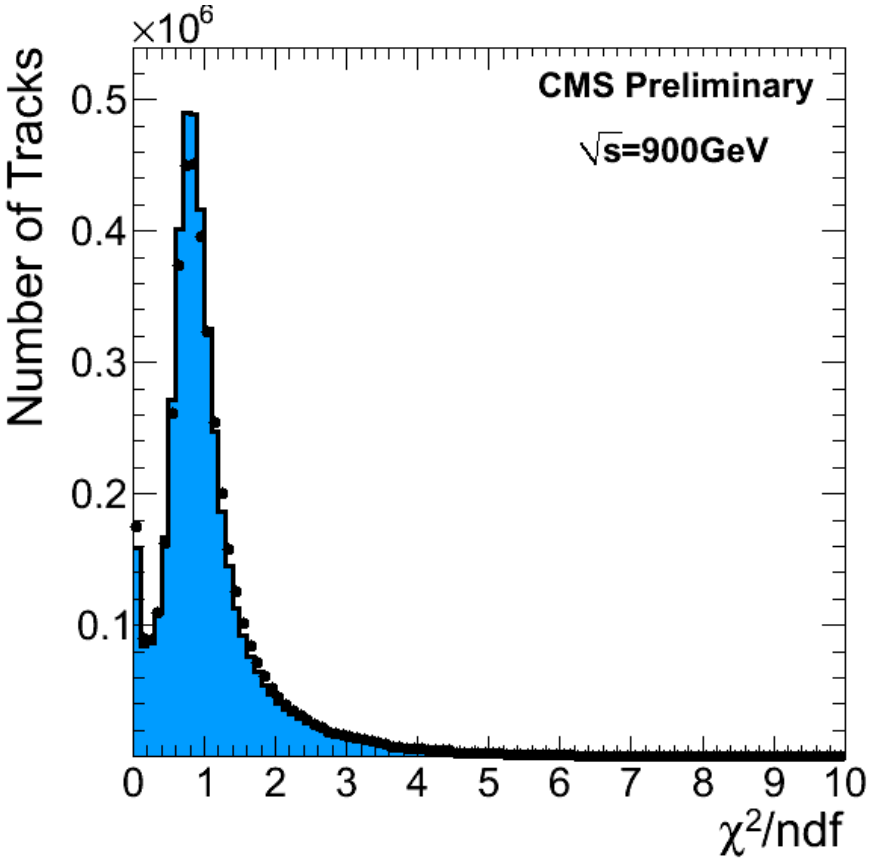


More study on track multiplicity follows in support material section

High Purity Track pT and chi2/ndf

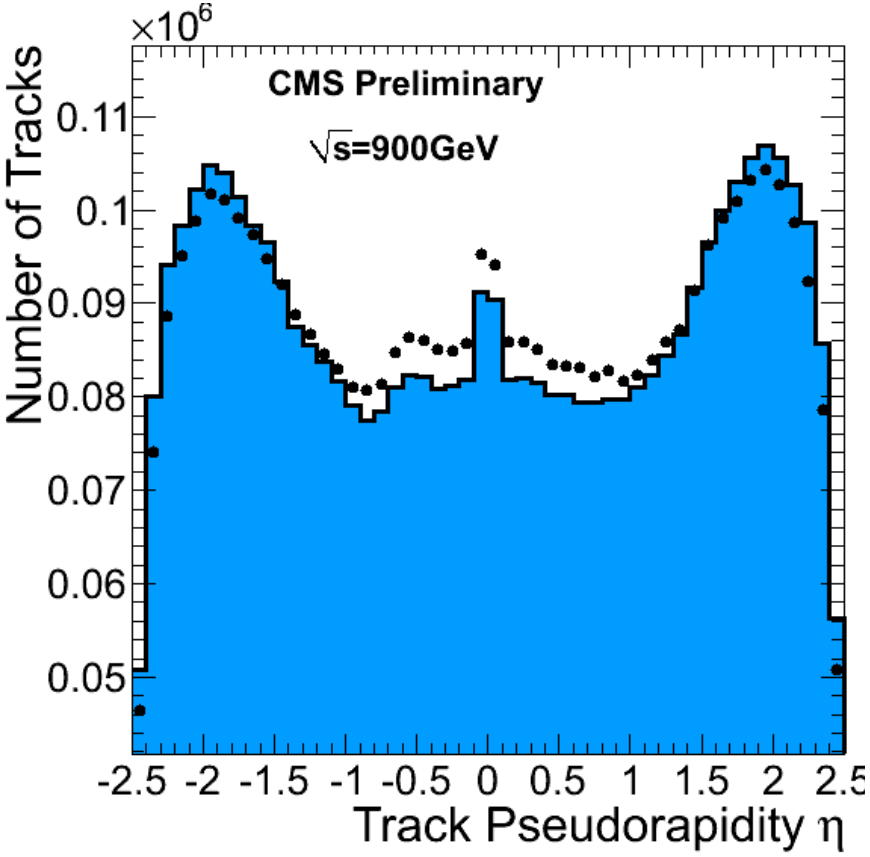
- Data and MC are normalized by the number of Tracks.

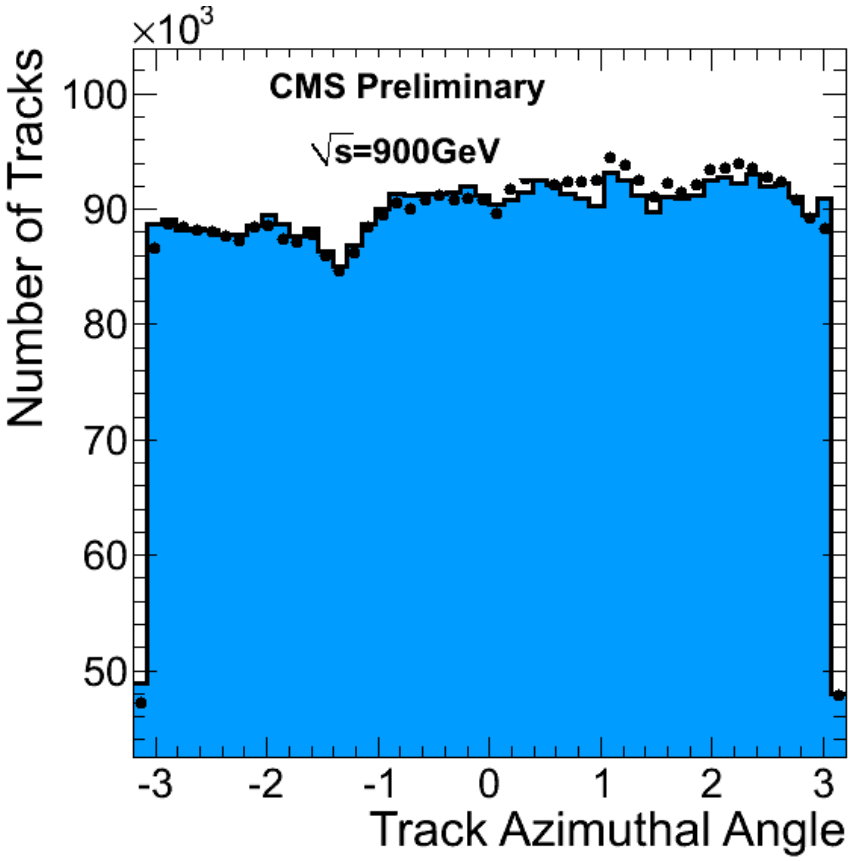




See support material for the plots normalized by events

High Purity Track Eta and Phi

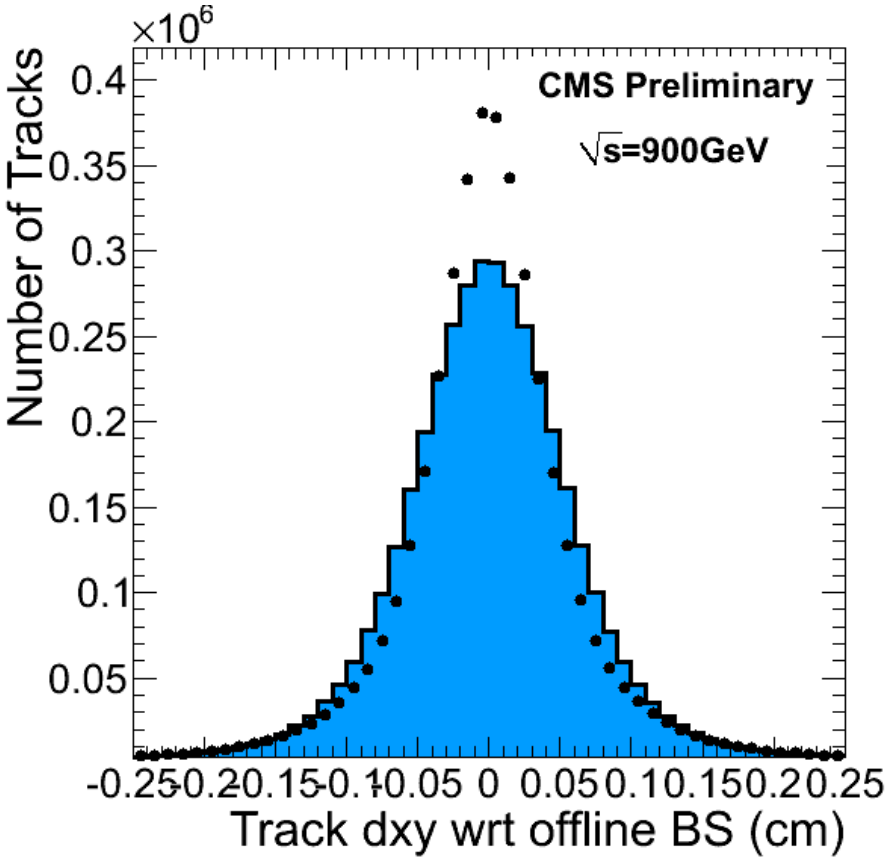


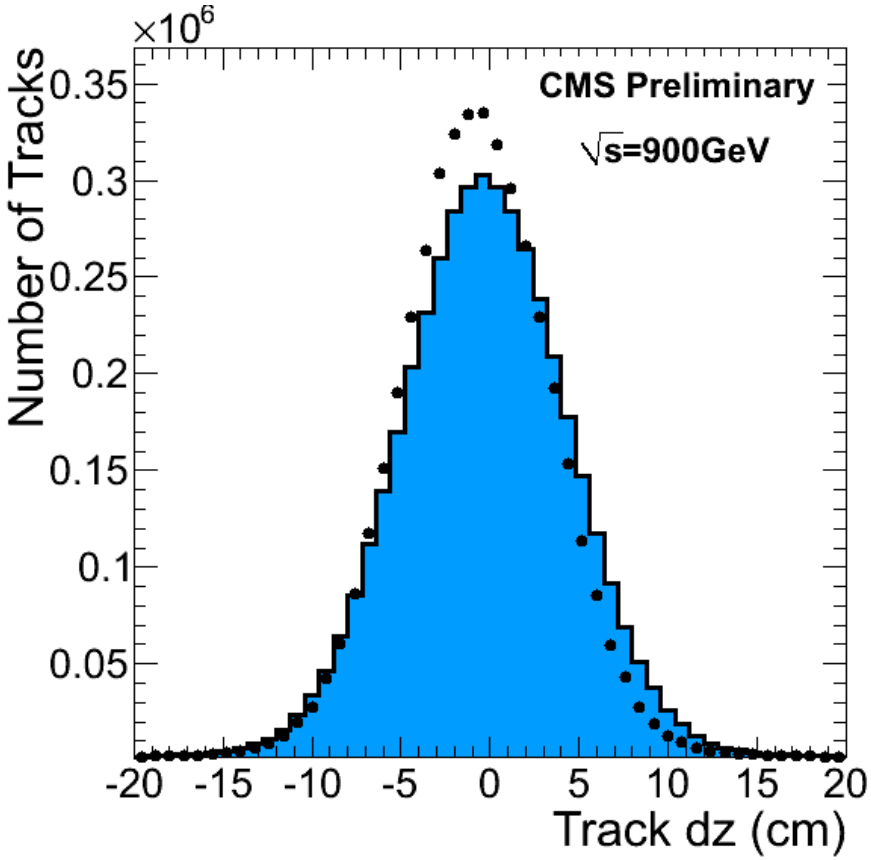


See support material for the plots normalized by events

High Purity Track Impact Parameter

- MC has larger dxy width because the transverse beam size is 400 mum, compared to 290 in data
- The shift in dz mean reflect the change of origin in the reference frame in data





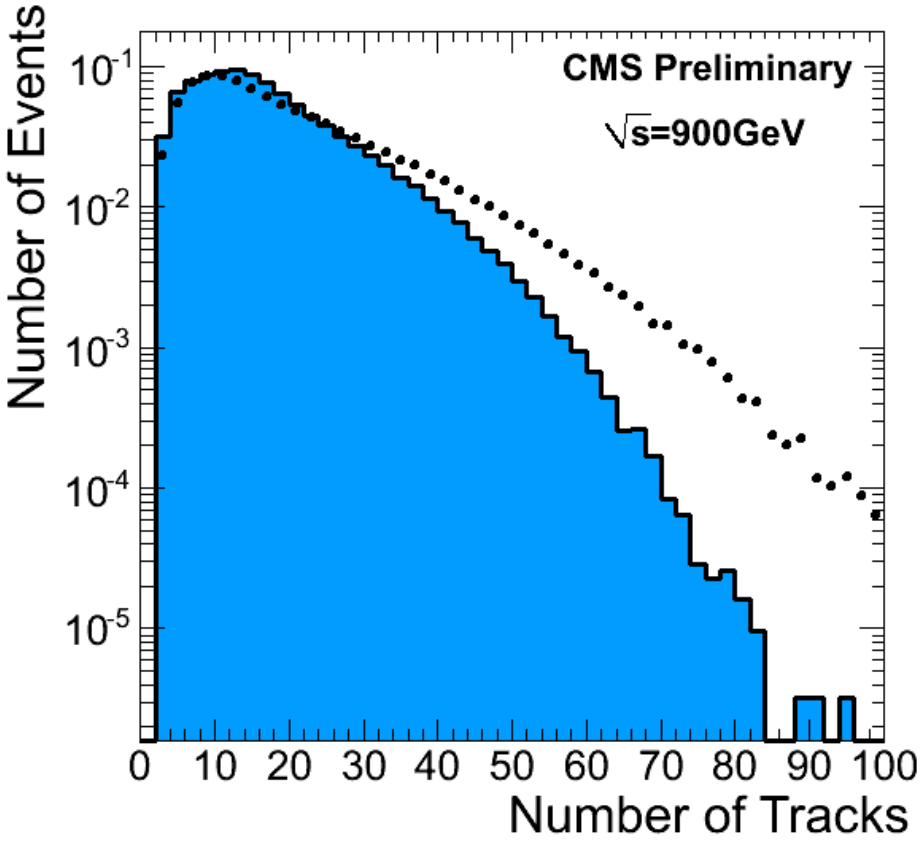
See support material for the plots normalized by events

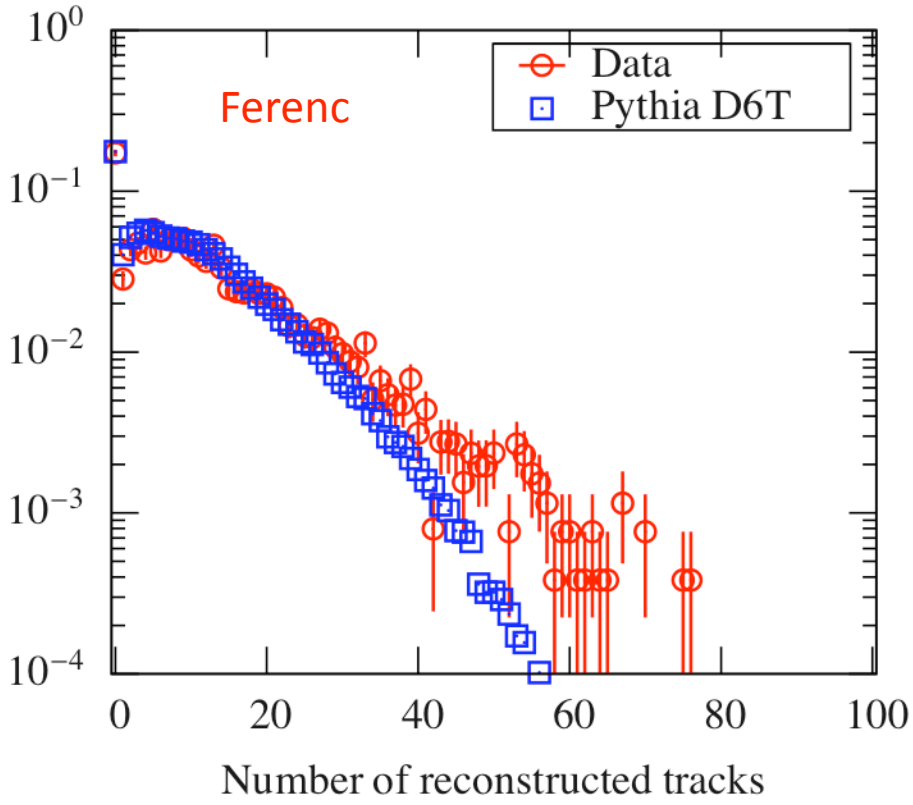
Support Material (NOT FOR APPROVAL)

- Closer look at the track multiplicity
- Track distributions normalized by number of Events

Closer look on Track Multiplicity

- Similar excess in data observed by QCD group, see Ferenc's talk
  http://indico.cern.ch/conferenceDisplay.py?confId=76852

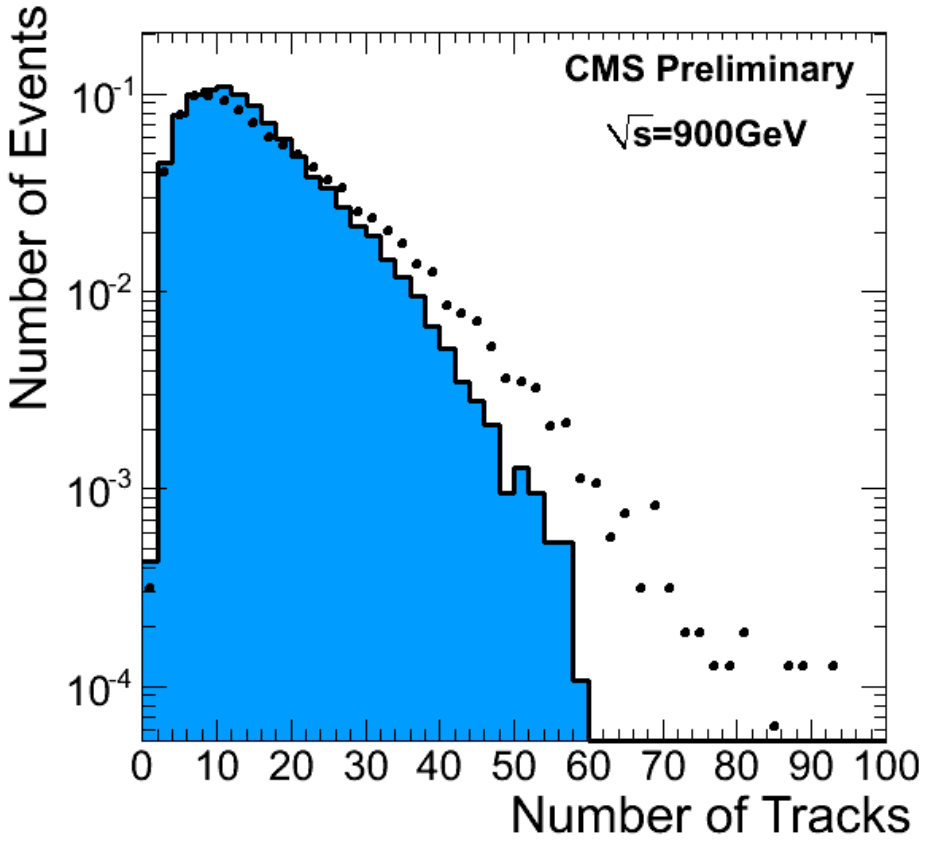


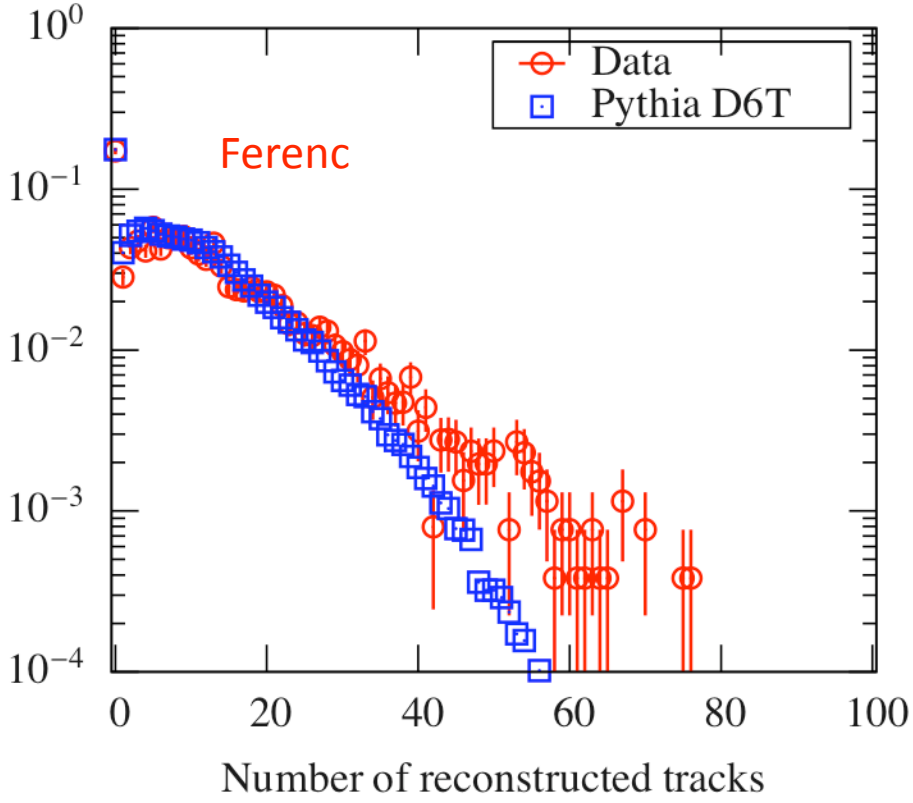


The discrepancy is likely due to standard tracking reco and pixel triplet tracking (Ferenc).

High Purity Track Multiplicity

- A quick check: *count only the high purity tracks*

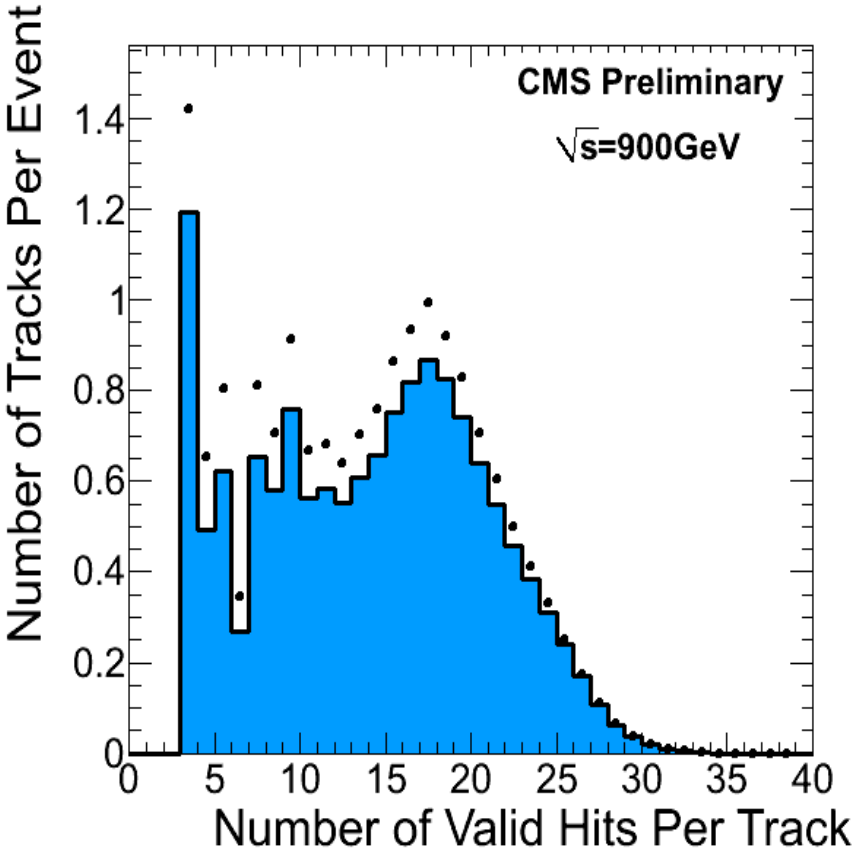


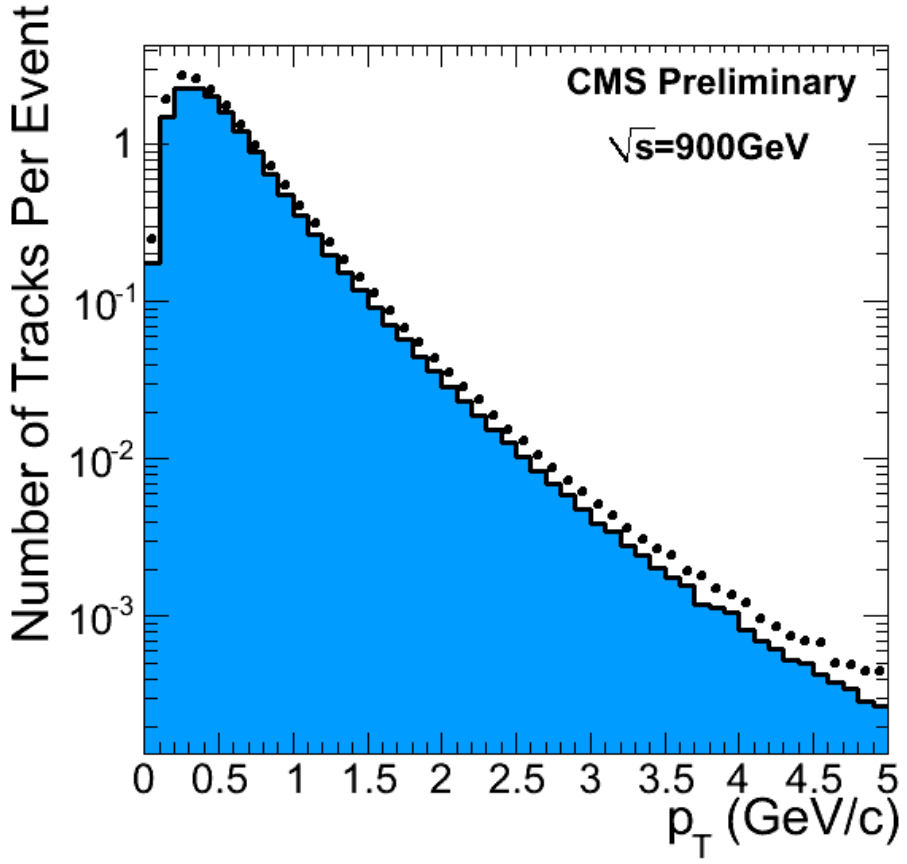


- Better agreement in Data/MC, mean is (14.8 vs 14.0)
- Results using tracking also agree with QCD results using tracking method
- However, now the dn/deta would be scaled down accordingly

Number of Tracks and Valid Hits

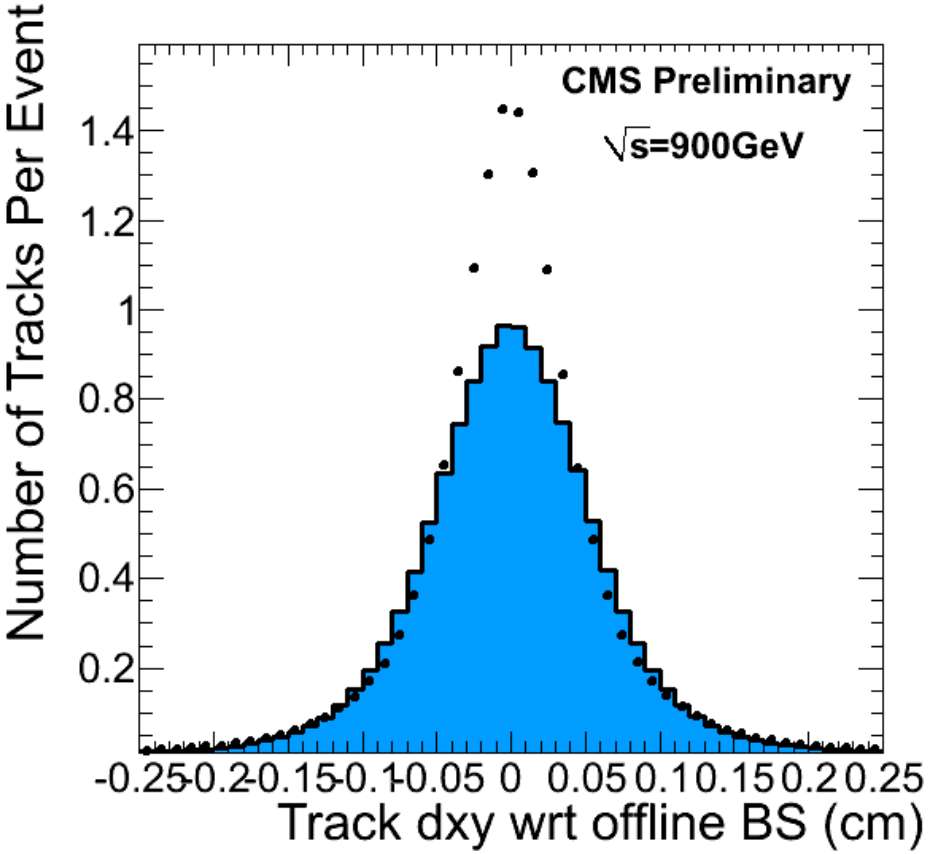
- The nHit tail match better than the low hits
- Excess tracks show up in both low and high pT region

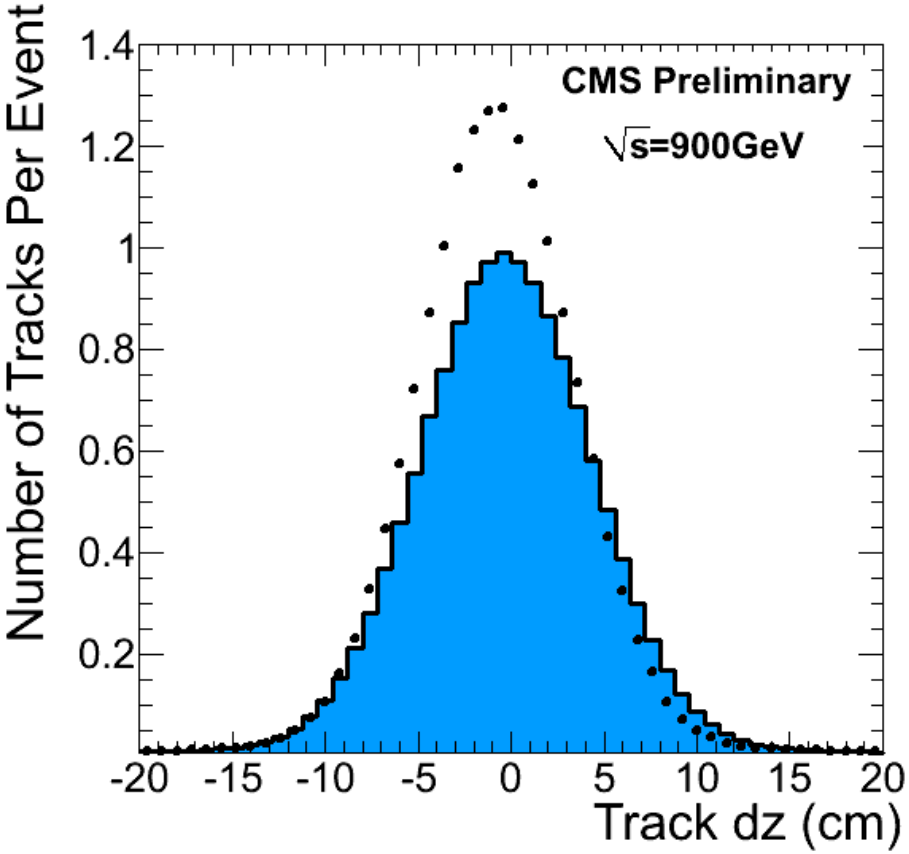




Track Distribution Normalized By Events

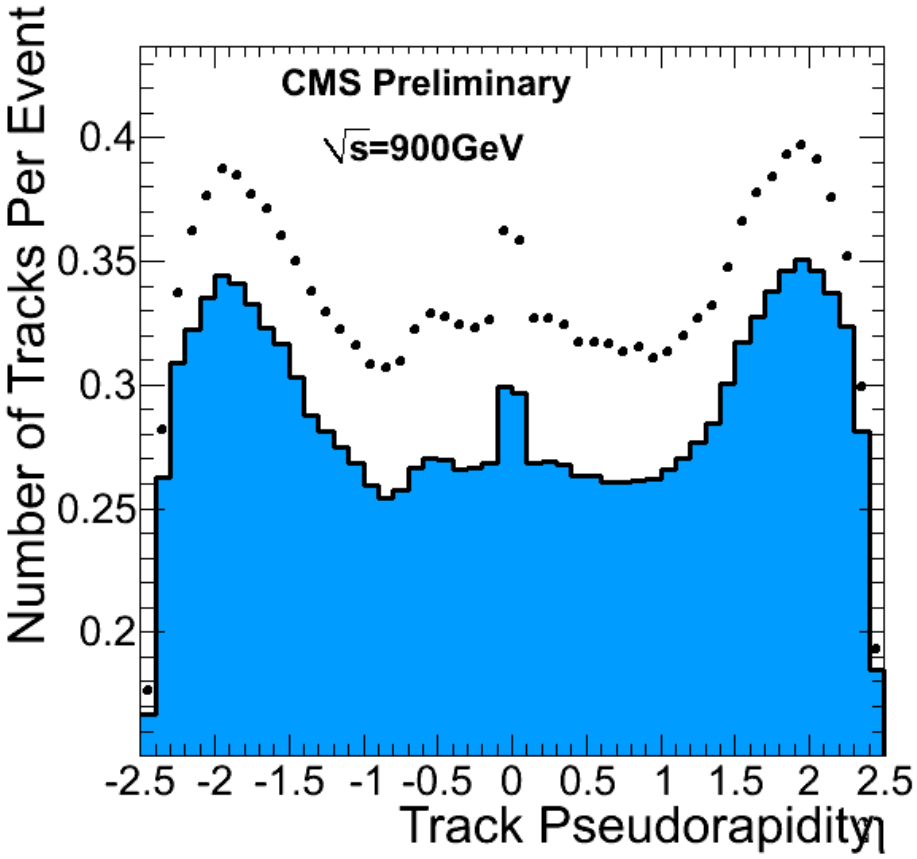
- Data has extra tracks in the central region

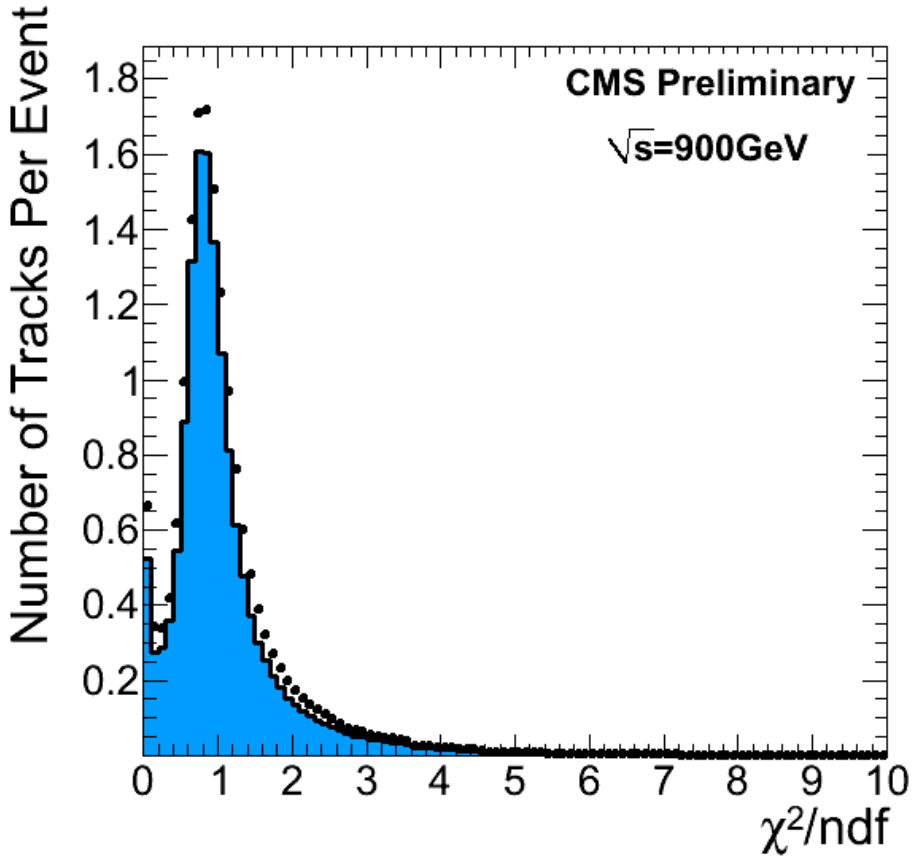




Track Distribution Normalized By Events

- Extra tracks are almost uniformly spread over the eta range





- Sanity dn/deta ~ 3.3 (50 bin histogram), recall QCD paper measures 3.48.

Conclusion

- We have seen reasonably consistent Data/MC
- The main discrepancy is the track multiplicity

  -All tracks: Data (mean = 20) MC (mean = 17)
  -High Purity tracks: Data (mean = 14.8) MC (mean = 14.0)

- The track distributions normalized by #tracks agree well between data/mc

  small difference in central eta region, hard to pin done the source

- Counting all tracks, dn/deta at|eta|<1 is about 3.3

  CMS QCD-09-010 measures 3.48+/-0.02+/-0.12