Update on Two track resolution

Lina Galtieri with Bill Lockman and Andrei Gaponenko

MC on MC Validation

The two-track resolution is studied in the Overlay mode and compared with the G4-Hit_merge mode

Results are shown for:

Complete overlap of tracks and for tracks separated by a number of ΔR values

100 GeV muons signal and background generated at the same primary vertex (Syncronized)

A few plots are shown for lack of time. More plots are available in my WEB page

http://www-cdf.lbl.gov/~galtieri/overlay/

Event Samples Generation

Samples generated by Bill Lockman

We chose the release and other conditions used for the May reprocessing.

- *Release: 15.6.9.8*
  DBRelease-10.7.1
  OFLCOND-DR-BS7T-ANom-15
  ATLAS-GEO-10-00-00
  Beam spot from conditions database

15.6.9.8:

- *OverlayValidation-trunk*
- *EventOverlayJobTransforms-00-02-24-branch*
- *OverlayCommonAlgs-00-02-14*
- *Generators/ParticleGenerator-00-00-49*
  - locally modified to set_signal_process_vertex (set pointer to primary vertex)
    - Savannah bug report #70892

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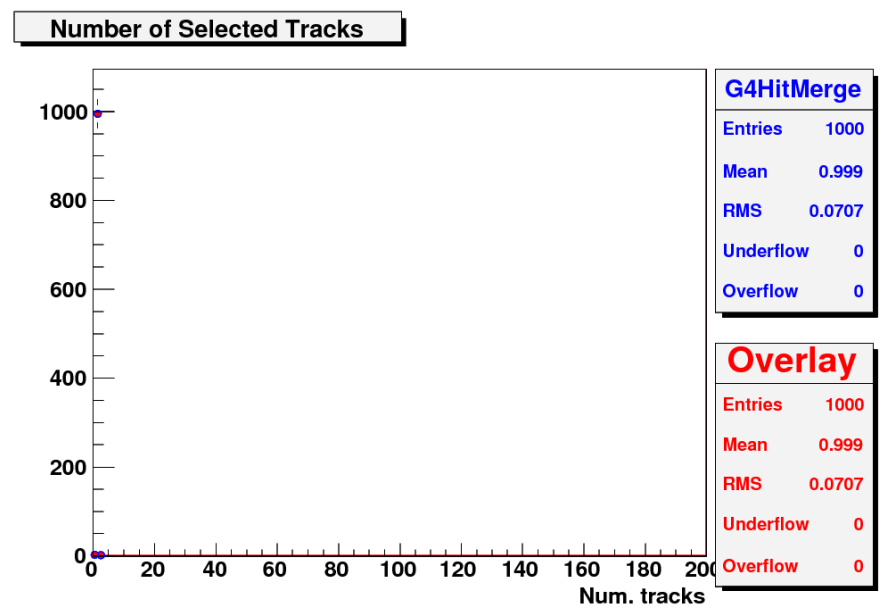
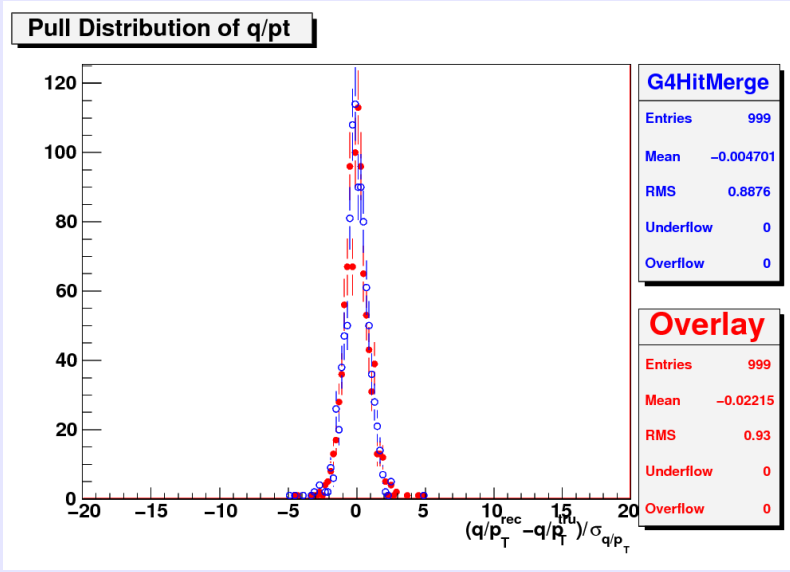
Tracks with ΔR=0.0

Overlay and G4HitMerge are compared in all the plots

distribution of number of tracks/event



Reconstructed q/PT for each track in the event



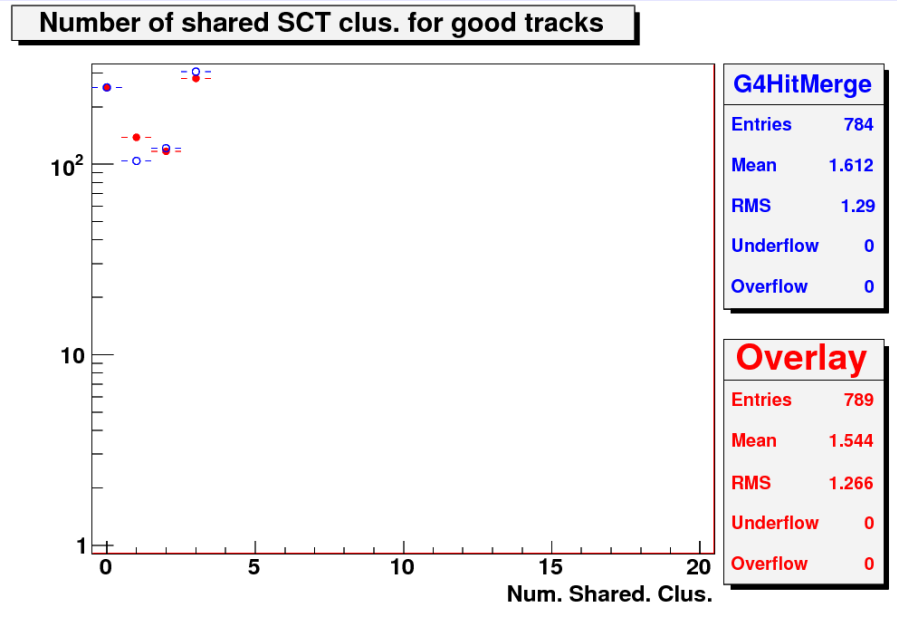
We see that very only one track per event is reconstructed. This is for maximum overlap, i.e., the case for which background and signal at\re the same.

The q/PT resolution for the two cases differs by a few percent

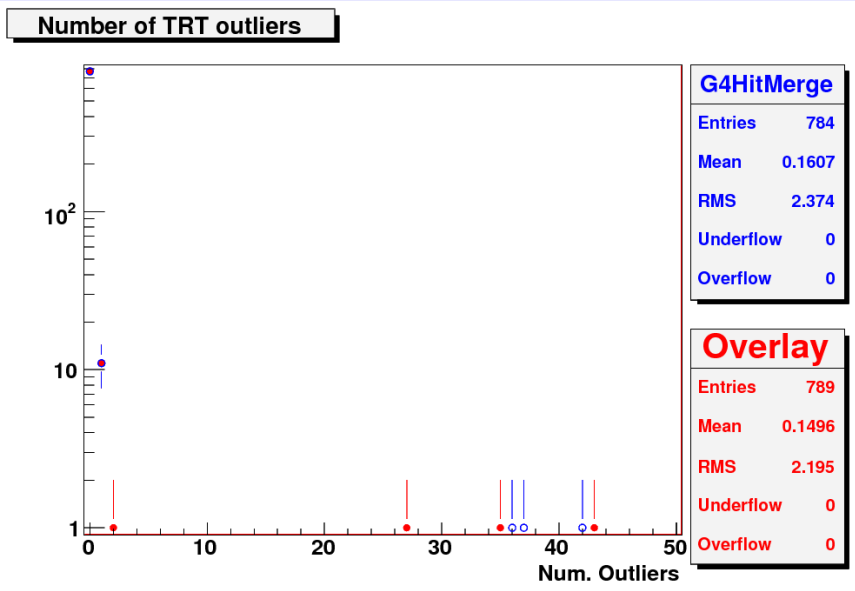
More track parameters

Look at more quantities that can help understand the effect of overlapping tracks for DeltaR . ne. 0.0

Shared SCT clusters



Number of TRT Outliers



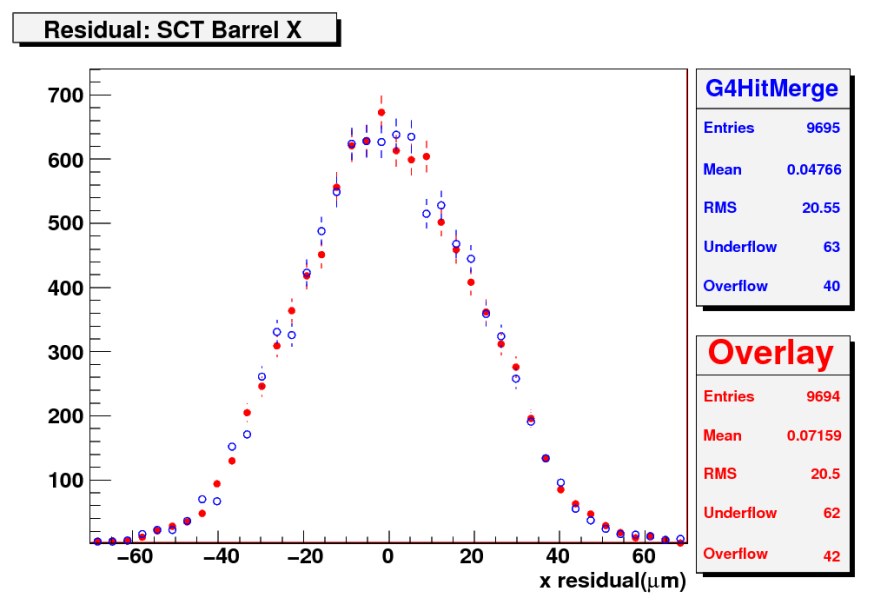
Some shared clusters are seen in the SCT

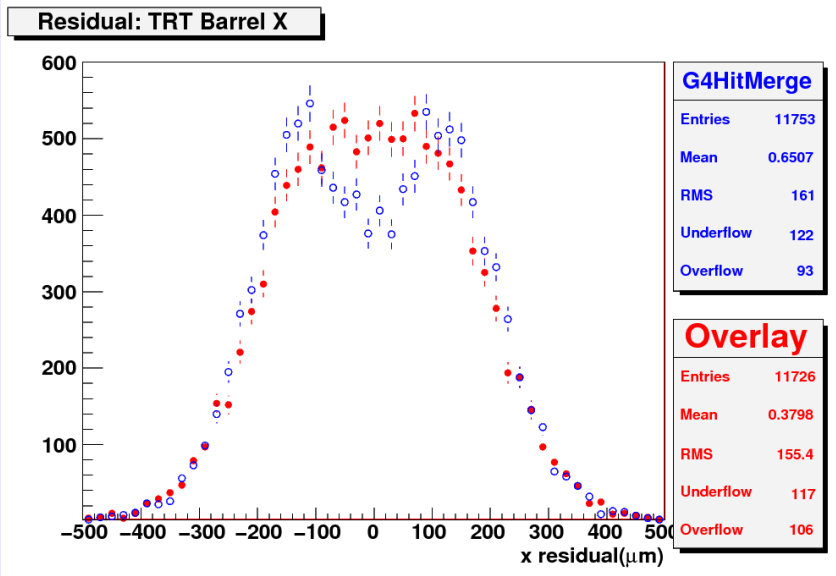
Some Outlier in the TRT are present, they can spoil the resolution

100 GeV Muons on Muons
MC on MC

Using the same primary vertex for the background and signal track and various DR between the two tracks

WARNING: Samples were obtained yesterday, need further checking



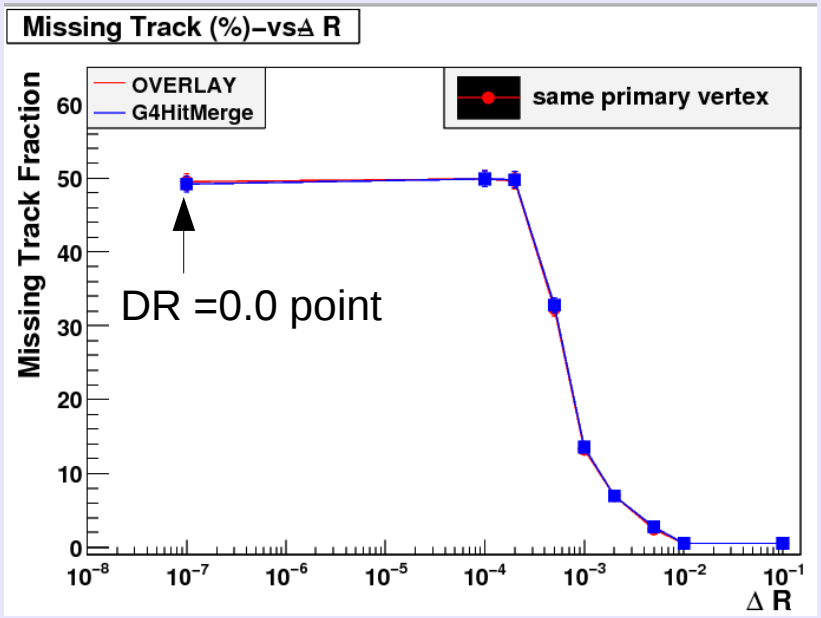


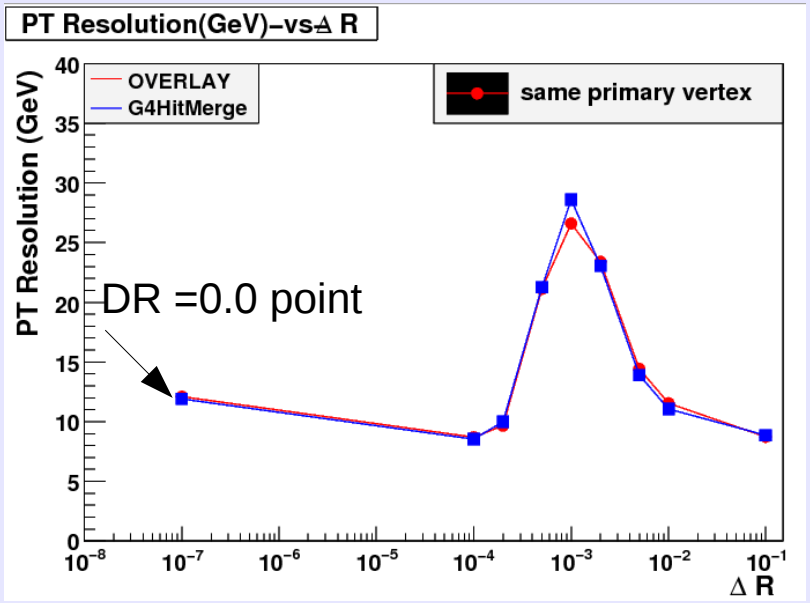
DR = 0.01: understood
Little overlap

DR = 0.0001: not understood
Large overlap

DR dependence: same PV

Two plots: how often we do not see two tracks
PT resolution of tracks



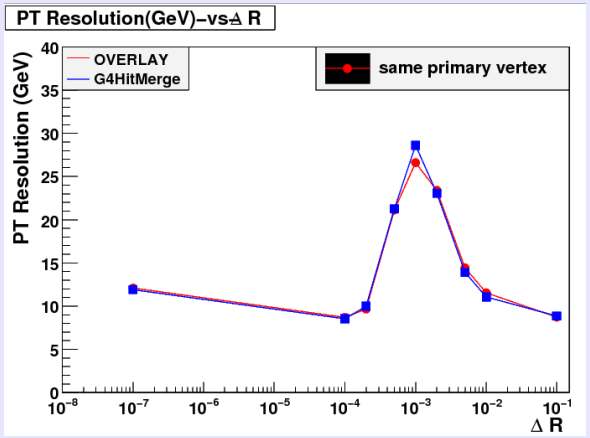


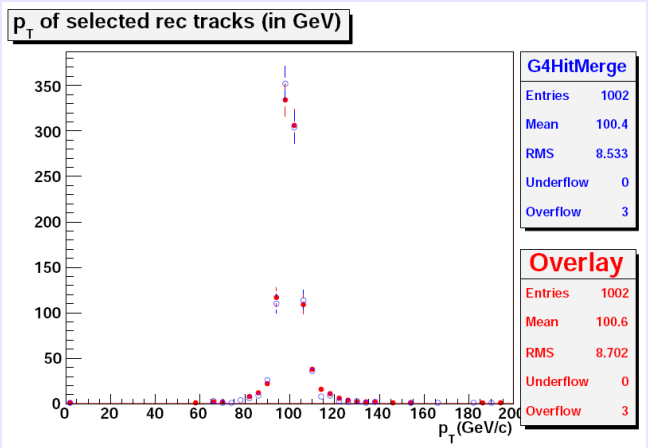
1. Resolution is good when the two tracks are on top of each other: DR up to 0.0002
2. Resolution gets bad when tracks start being separated DR range 0.0005 – 0.005
3. Resolution gets good again, when the two tracks are definitely separated DR > 0.01

Track PT for same PV tracks

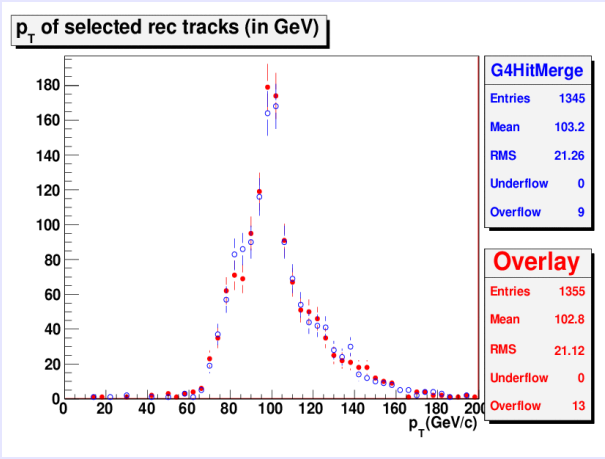
Note that overlay and G4HitMerge are the same!

ΔR=0.0001

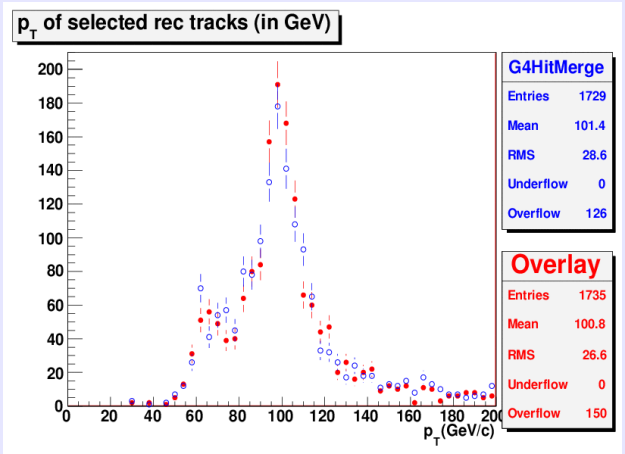




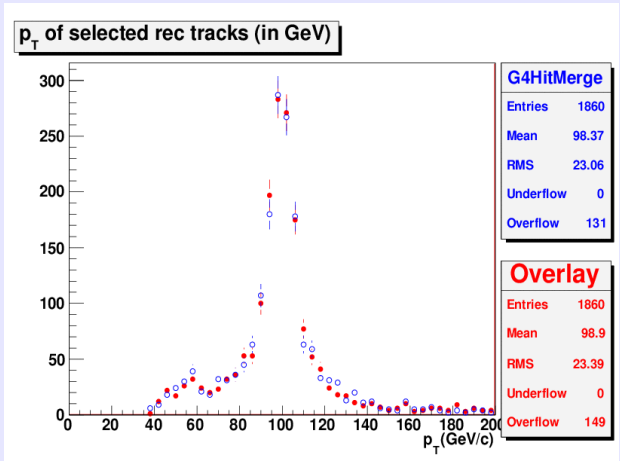
ΔR=0.0005



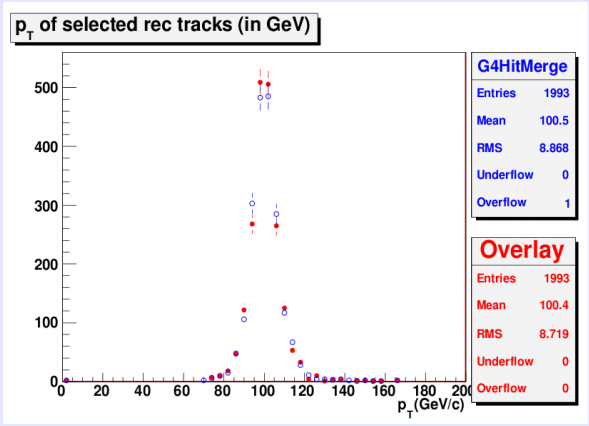
ΔR=0.001



ΔR=0.002



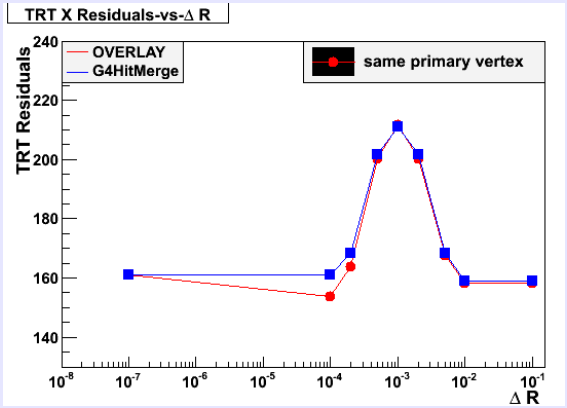
ΔR=0.001



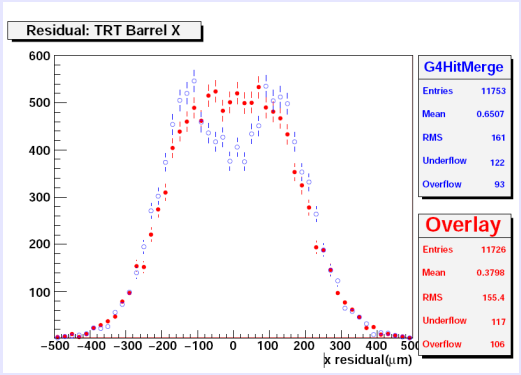
TRT Barrel X Residuals

TRT Residuals increase up to Dr=0.001 and get down again as the tracks are separated

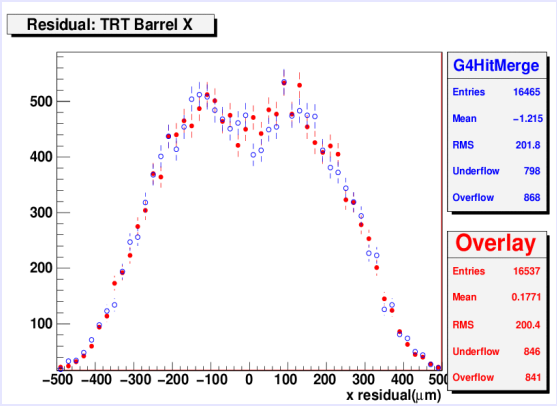
Function of DR



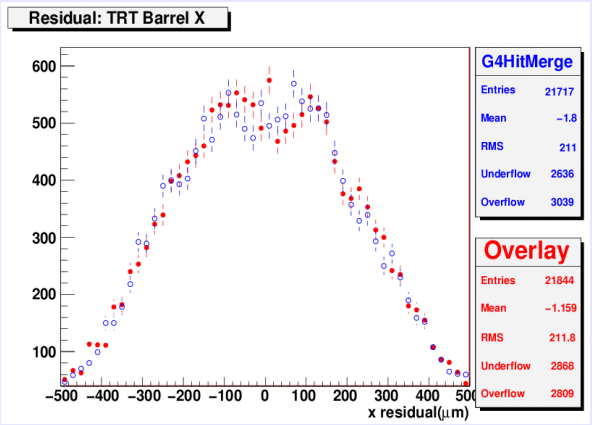
ΔR=0.0001



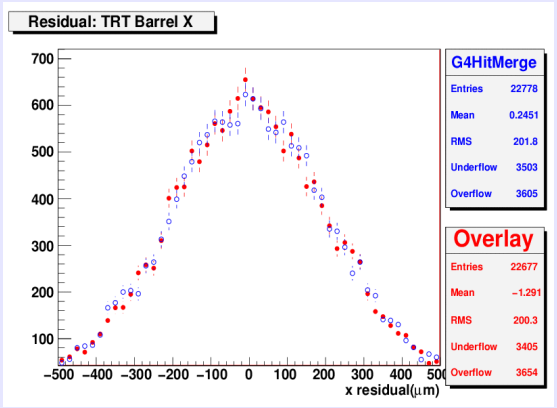
ΔR=0.0005



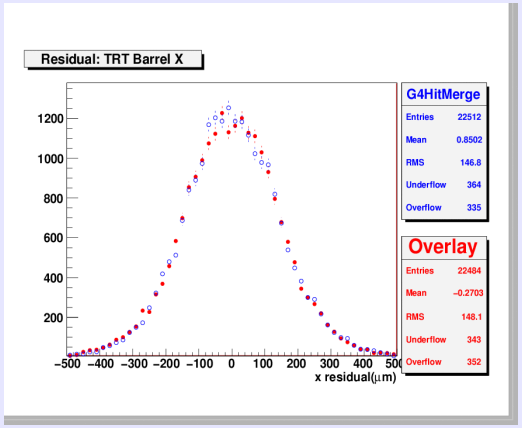
ΔR=0.001



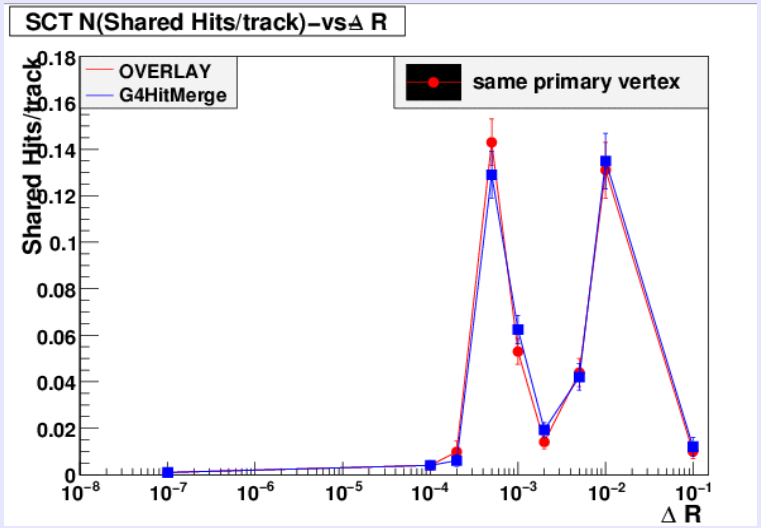
ΔR=0.002



ΔR=0.01



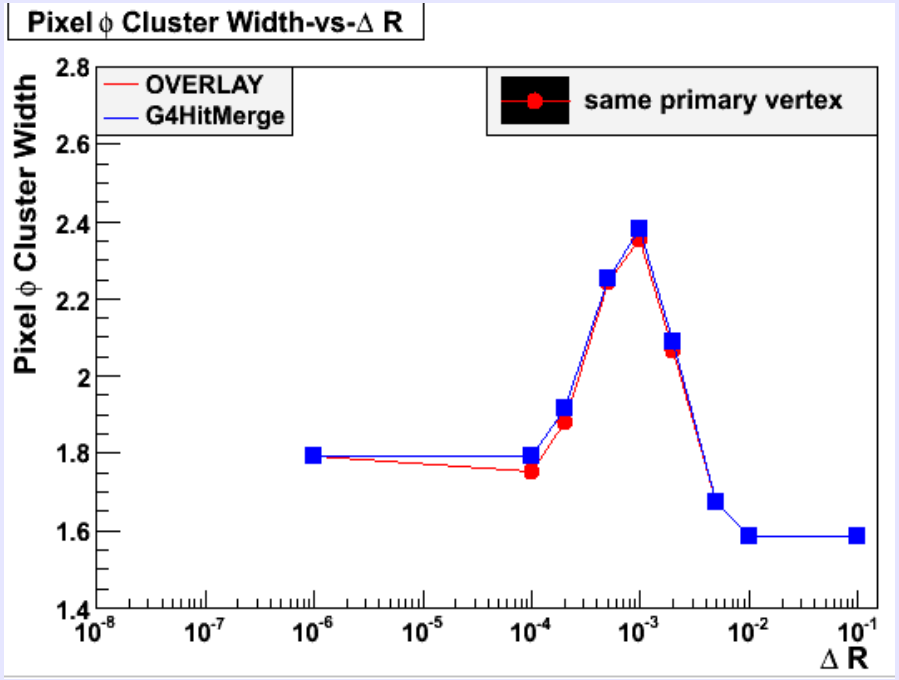
Shared Clusters



There are two peaks here:

The one on the left is related to the phi resolution,
the one on the right is due to the eta resolution

Pixel Cluster width



Summary

Same primary vertex tracks at different values of Delta R, interfere with each other in different way for different values of DR.:

HOWEVER, OVERLAY and G4HitMerge (pileup) behave very much the same!!

There are lots of plots to look at. Sorry I am out of time. They are in the WEB page!

ADDITIONAL SLIDES

Backup Slides

Tracking Requirements

Analysis done using InDetRecExample /InDetRec_All.py

Track Quality Requirements:

Ptmin = 500 MeV
d0MaxPreselection = 10 mm
IPd0Max = 2.0 mm
Ipz0Max = 10000
etaMax = 2.5
nHitSi = 7
nHitBLayer = 0
nHitPix = 0
TrtMaxEtaAcceptance = 1.9
nHitTRTHighEFractionMax =1
nHitTRTHighEFractionWithOutliersMax = 1