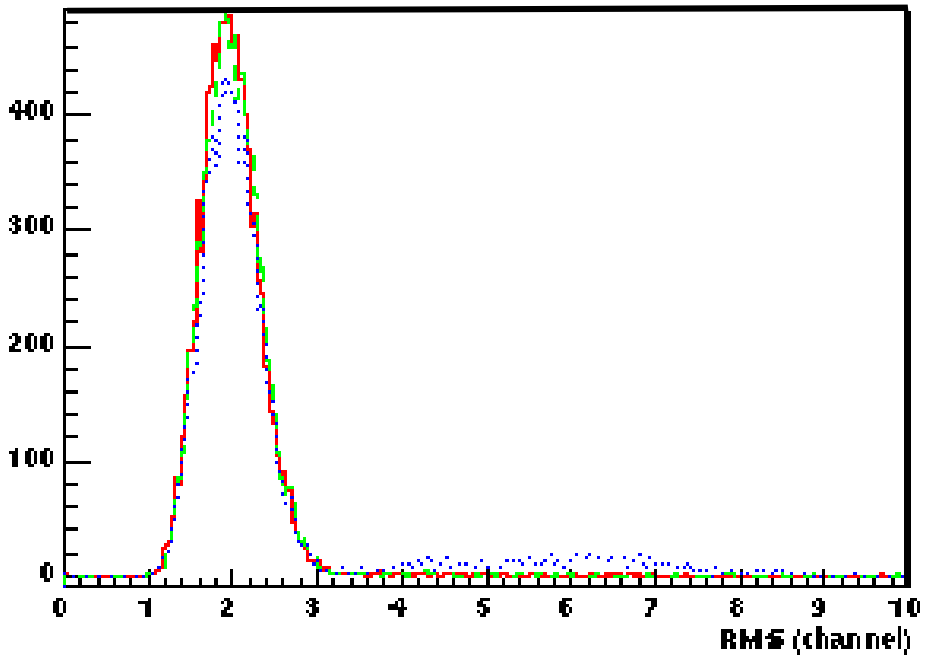
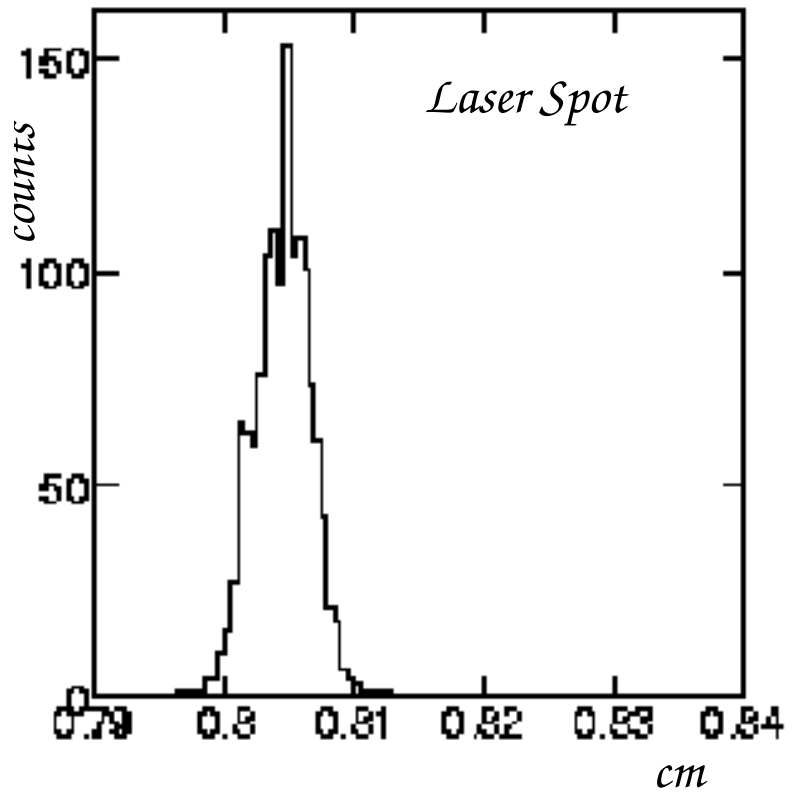
SVT and p-p and d-Au

Helen Caines for the SVT group

SVT Performance



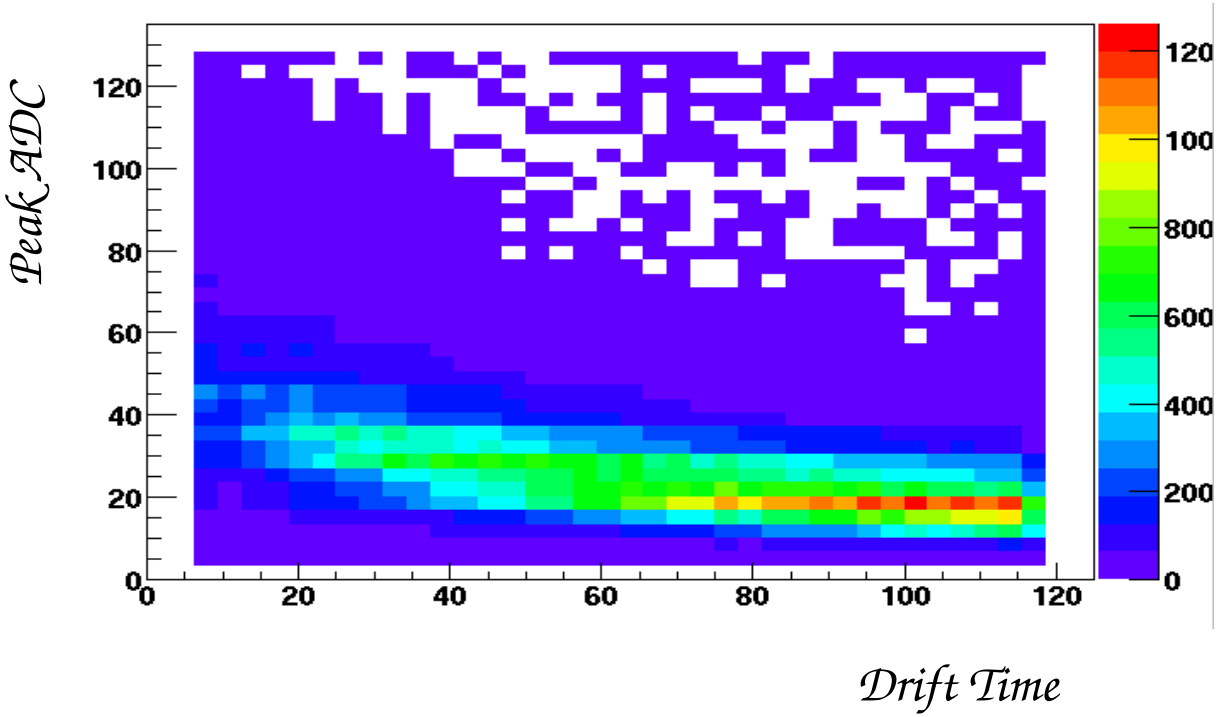


Noise:

- *7 mV for pp*
- *12 mV for Au+Au (due to a grounding problem now fixed)*
- *4 mV design (<7 mV aim)*

- *~30 μm resolution reproducibility*

Hit Finding



Find	~ 150 hits/event
Good	~ 33 hits/event
Used by EST	~ 12 hits/event
Tracks projected onto SVT	~ 21 hits/event

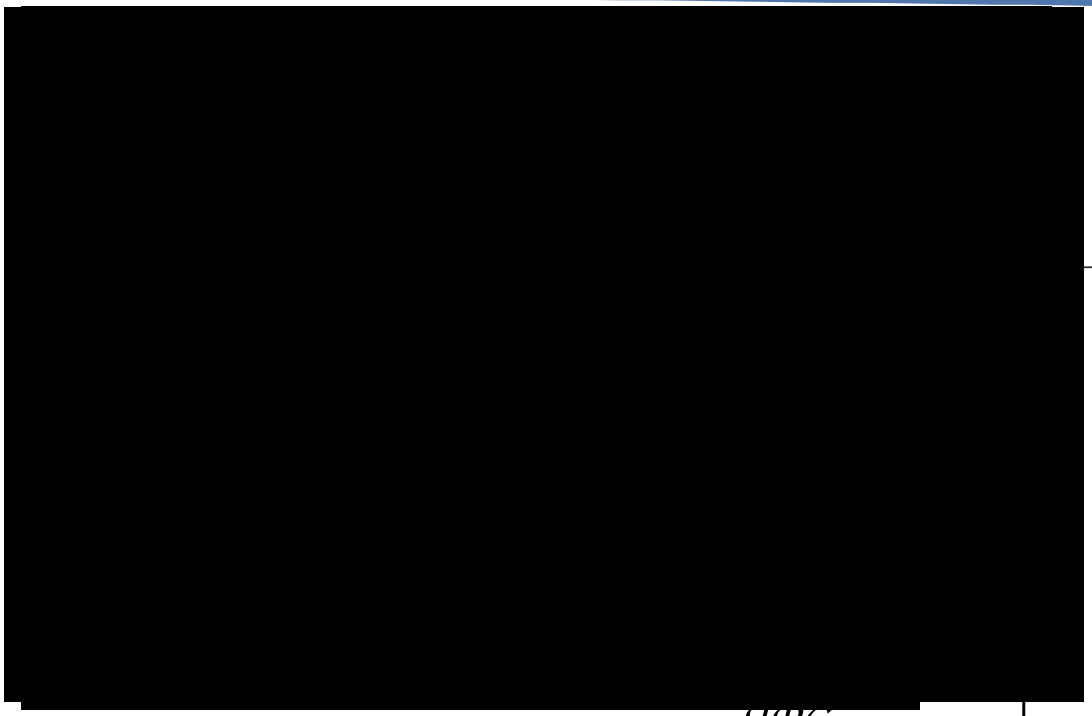
Alignment

delta_x = 0.4582

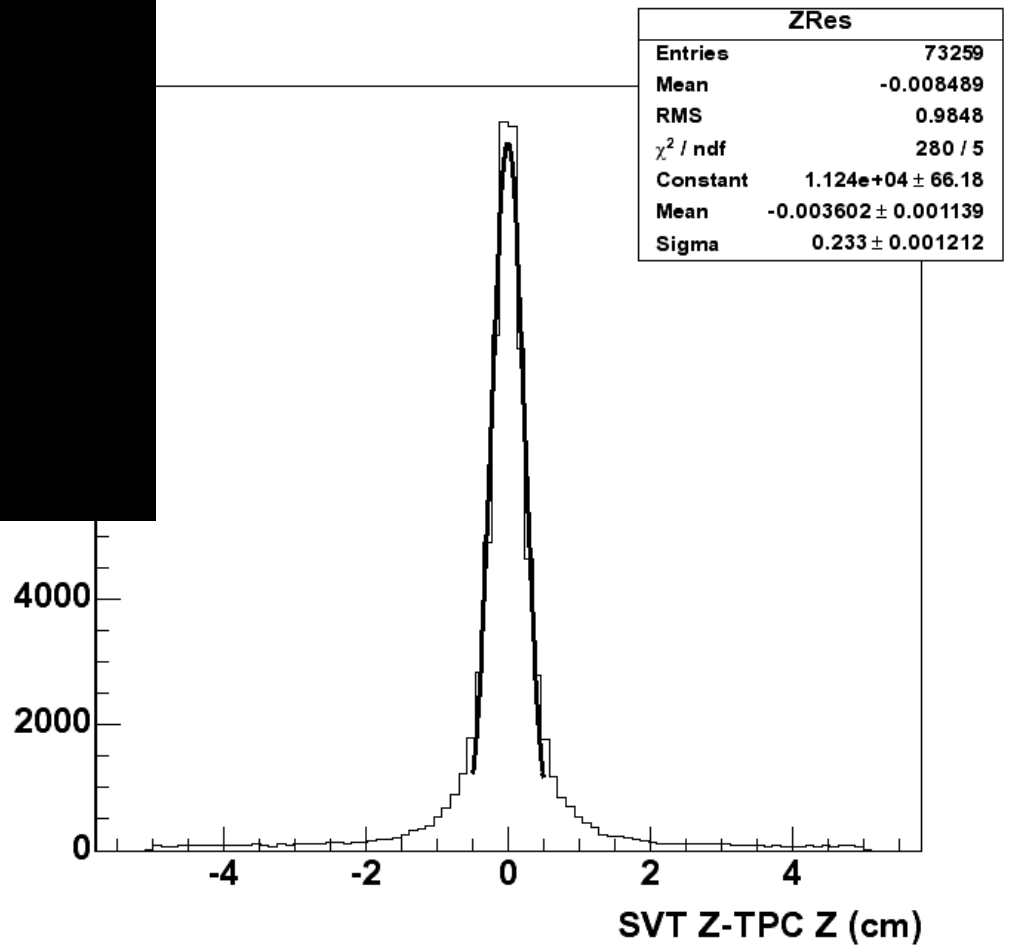
delta_y = 0.169

- mean residual = -delta_x*sin(theta) + delta_y*cos(theta) + delta_theta*barrel_radius
-
- where, delta_x and delta_y are shifts on the X and Y directions, respectively, and delta_theta is a rotation on the XY-plane.

Vertex Finding - Data

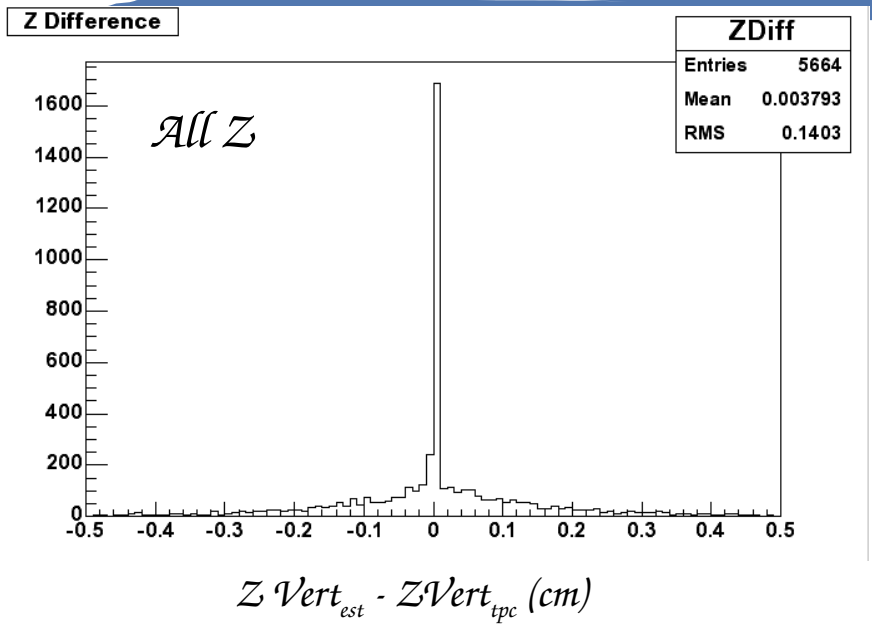


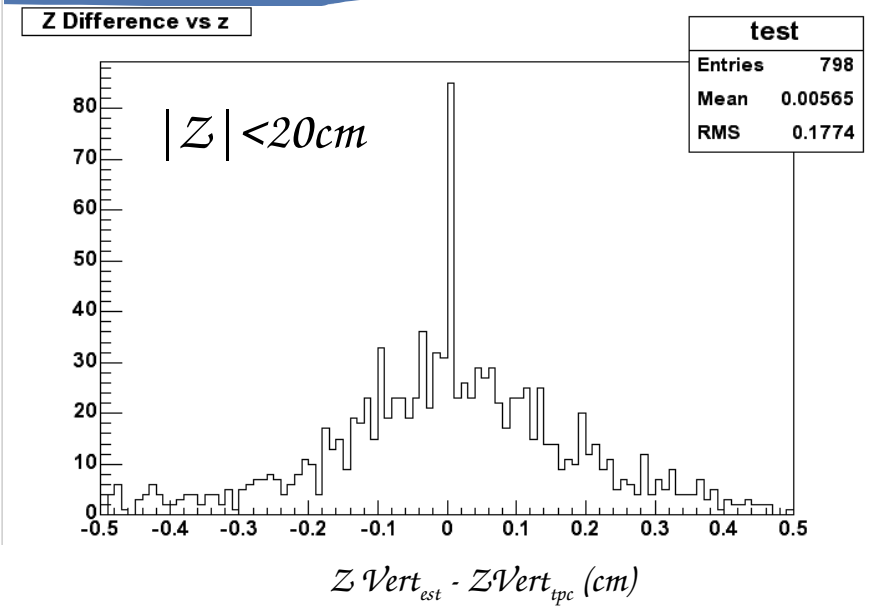
TPC

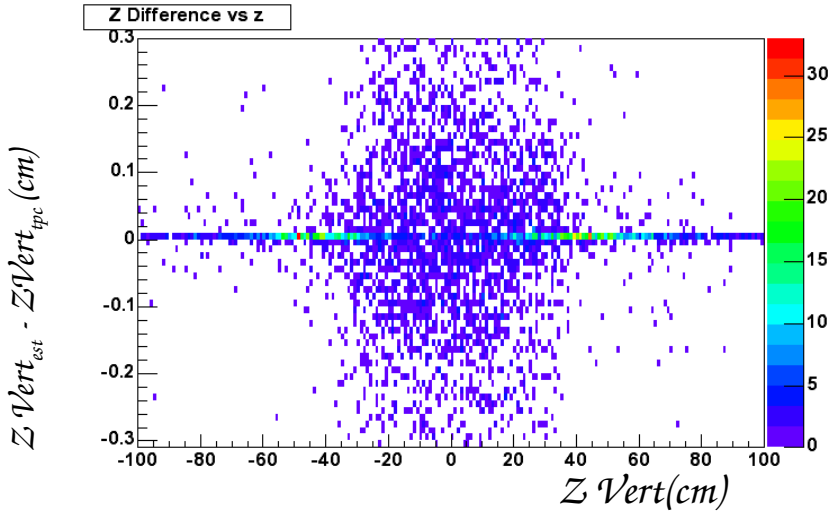


SVT and TPC aligned in Z to within 30 μm

Vertex Finding – pplmv & EST







Survey Numbers Comparison

Survey says: $x = -4.3mm$

$y = -2.0\ mm$

$z = -1.9\ mm$

rotation in xy $= 4\text{-}6\ mradians$

We Get :

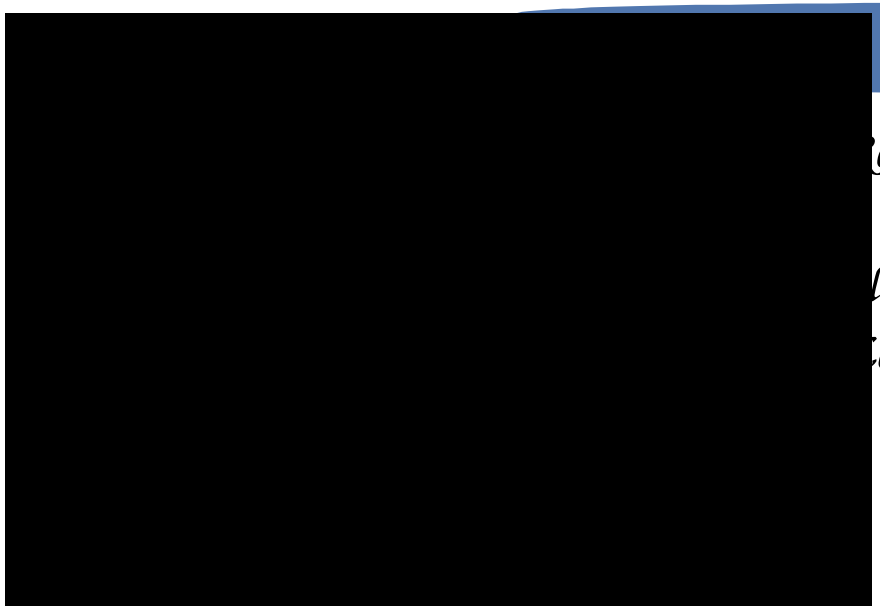
$x = -4.5mm$

$y = -1.7\ mm$

$z = -0.67\ mm$

Rotation in xy $= 5\ mradians$

Correct T0 and Drift Vel?



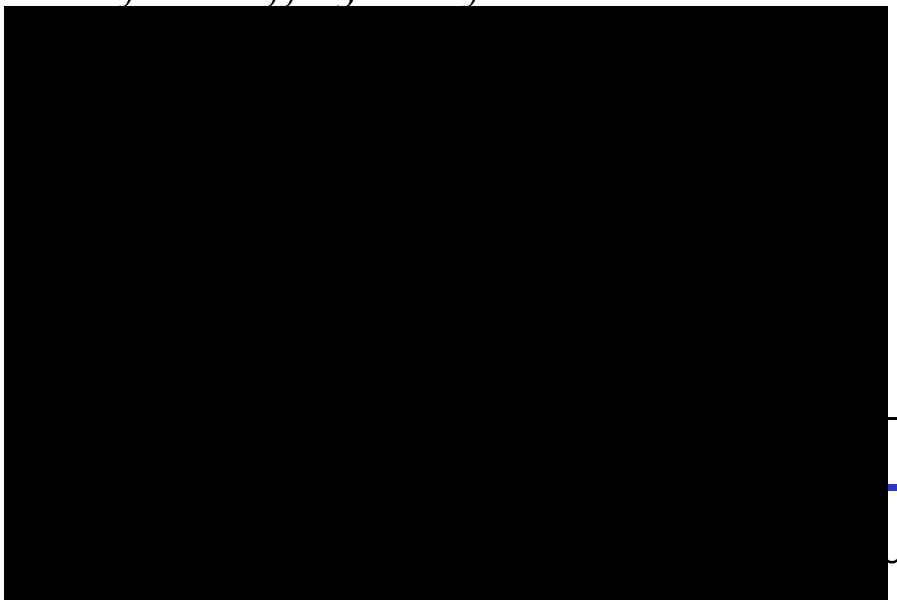
esiduals as function of drift distance

lope = drift vel error

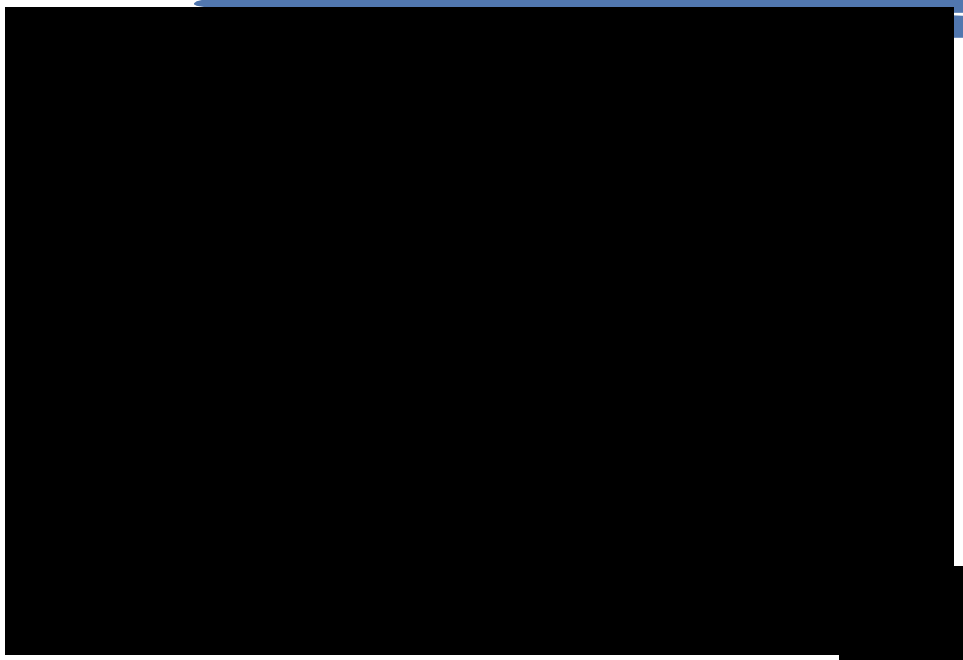
dge offset = T0 error

Linear fit to each wafer showed
Drift vel. off by ~5% for each

T0 off by ~2 timebuckets



After Corrections



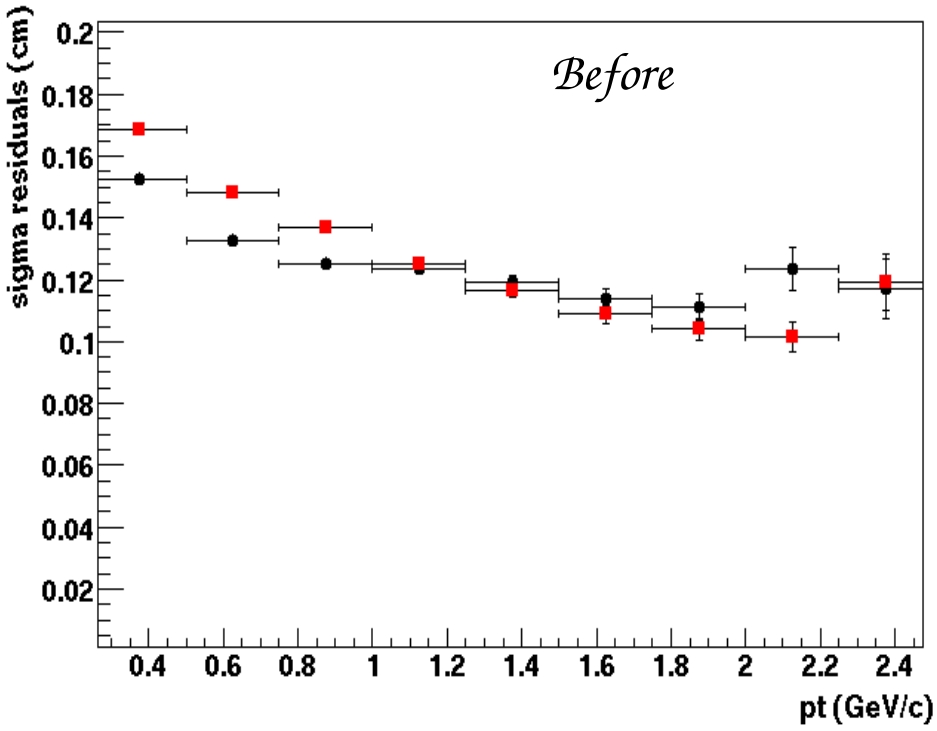
Drift Vel. good

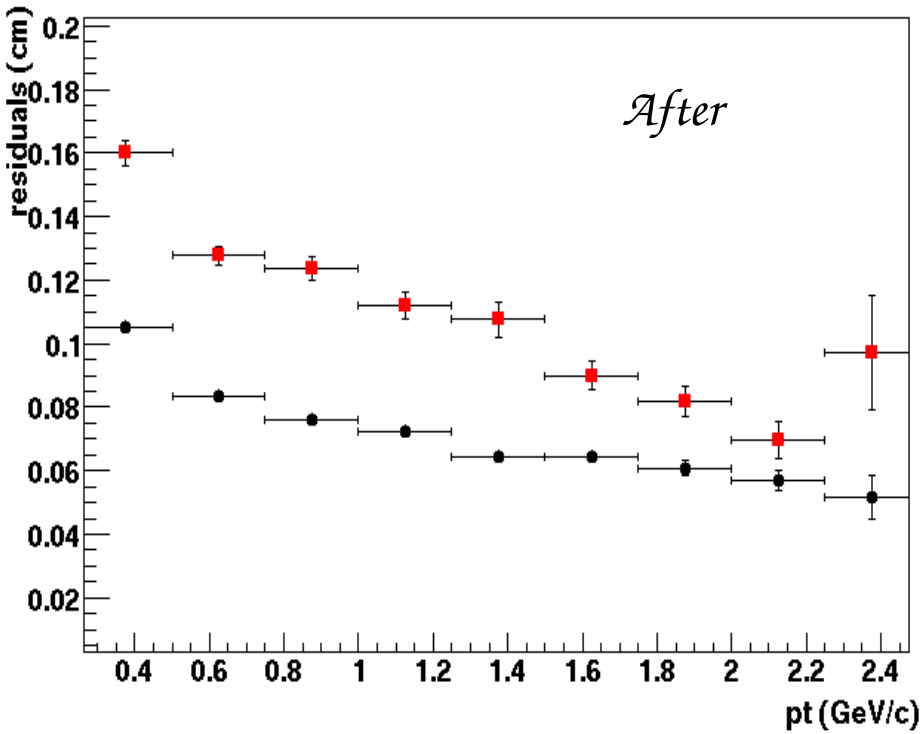
T0 good

Residual as a function of p_t

Black – Drift Direction

Red – Anode Direction





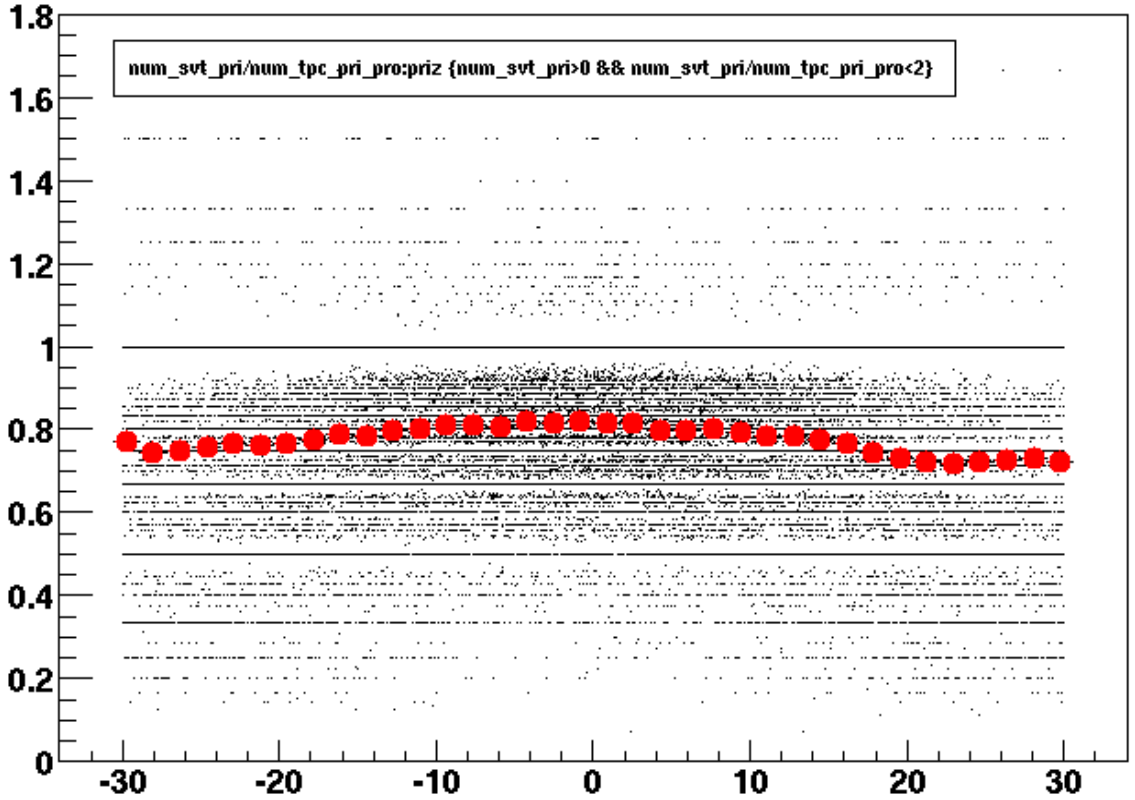
Note not "real" residual
Yet as track not refit with
SVT hits just use closest
Point after projection to SVT

Principle of EST

- *Take TPC tracks*
- *Using primary vertex location refit tracks*
- *Project to SVT layers*
- *Use several loops sorting by pt to match tracks to SVT hits – increase search area each time.*
- *First insist on one hit on each layer then 2 hits total*
- *Using unmatched tracks search again not using primary vertex*

IMPORTANT – SVT DOES NOT CREATE TRACKS

Primary Matching "efficiency"

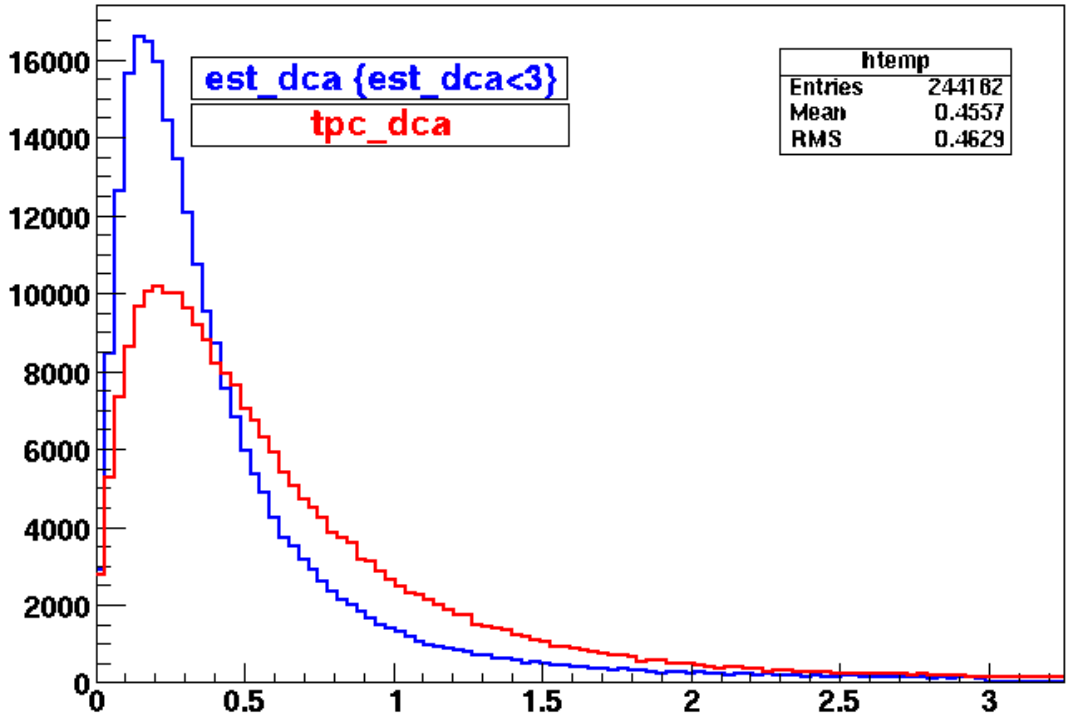


Z Primary Vertex

Primary Track matching Efficiency 80%

1 hit placed on track from SVT

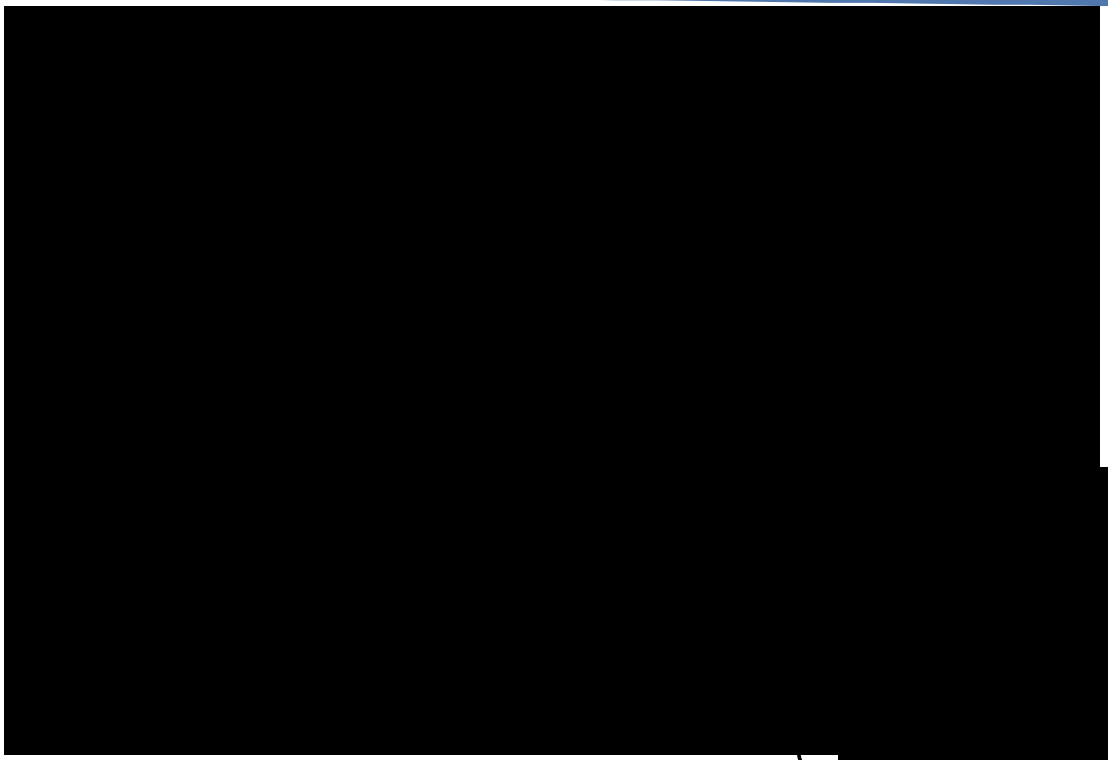
Impact Parameter Improvement



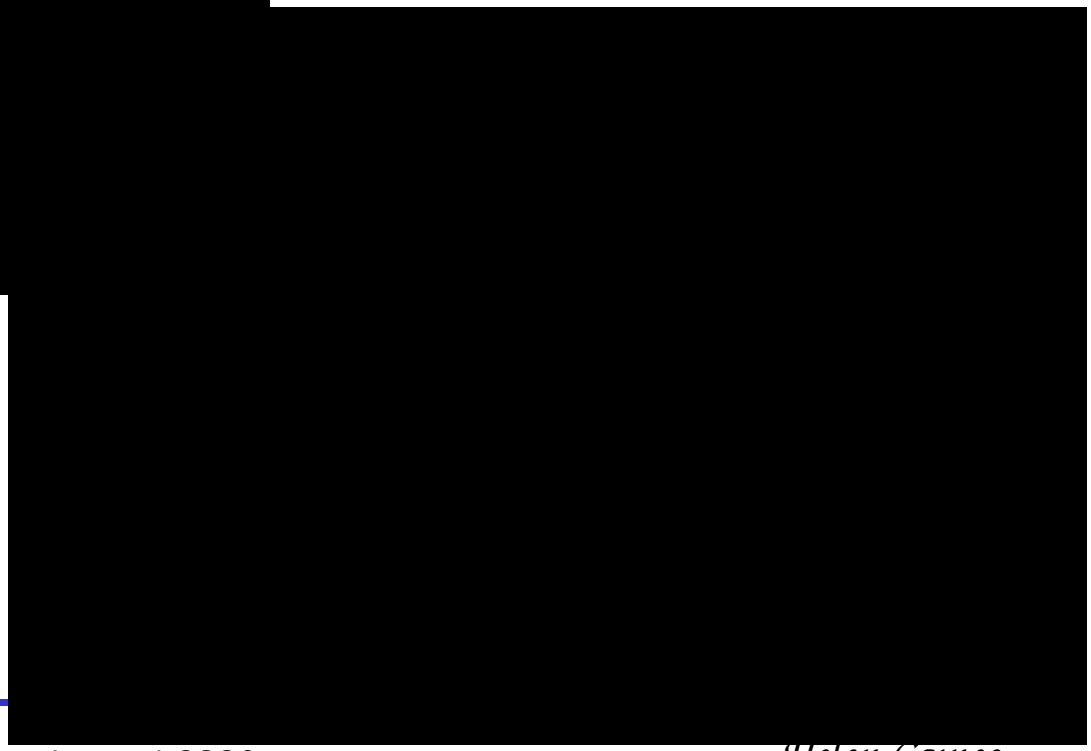
Same tracks – different node

Adding the SVT hits improves the impact parameter of the primary tracks

Residuals after Final Alignment tweaks



(Z hit – Z Track) for
Primary tracks for
Hits in 2nd SVT barrel



Appears to still be slight
Dip angle offset

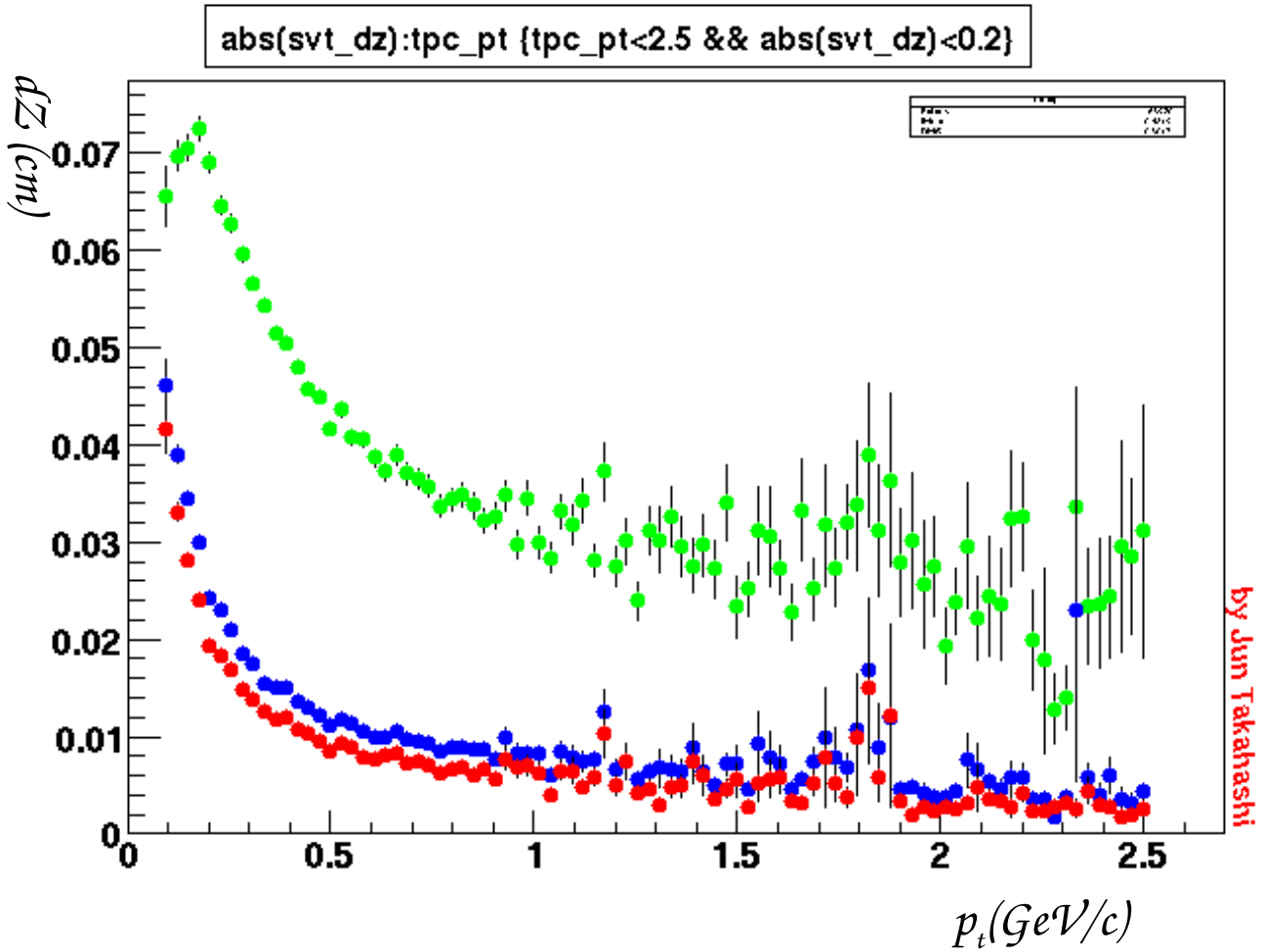
Sensitive to TPC T0 error

Track dip angle

< 0.1

Shift in Z + TPC T0/V_{drift} wrong

Estimating Errors - Simulation



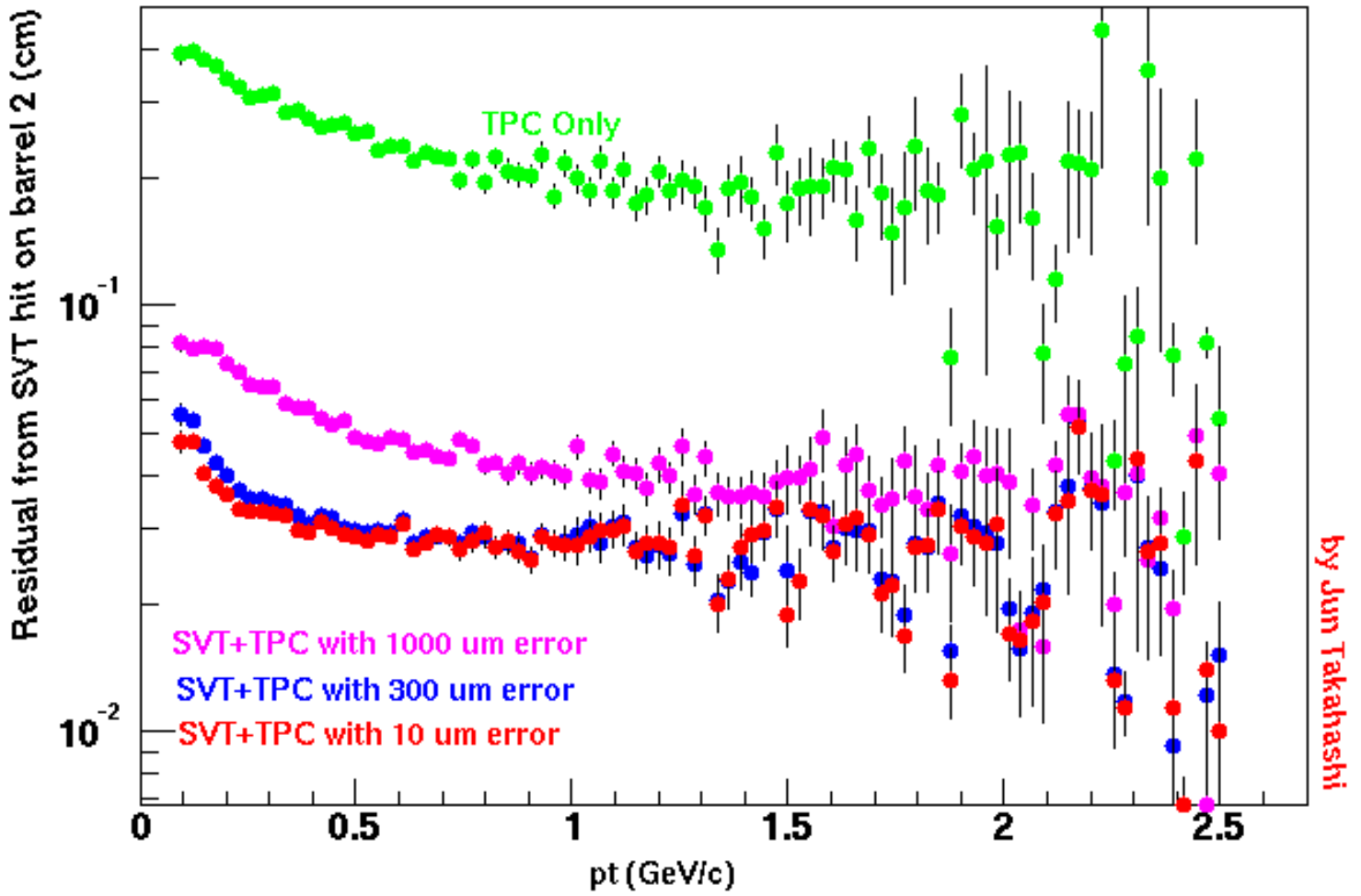
Take simulated hits and refit with errors assumed Below. Use only tracks That have 3 hits in SVT. Look at residual of middle SVT hit.

Red – 10 μm SVT

Blue – 300 μm SVT

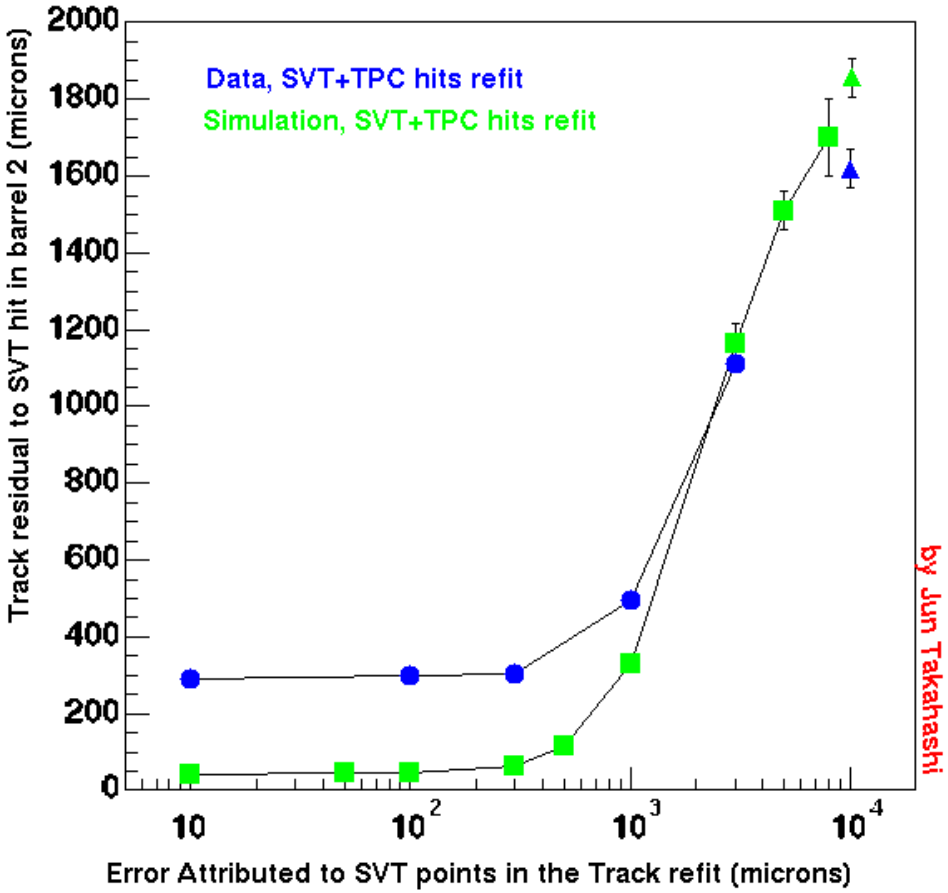
Green – Using TPC hits only

Estimating Errors – Real Data



Reach limiting case when true error reached (300 μm)

Estimating SVT Errors



Green – SVT Fast Sim (20 μm errors)

TPC Slow Sim.

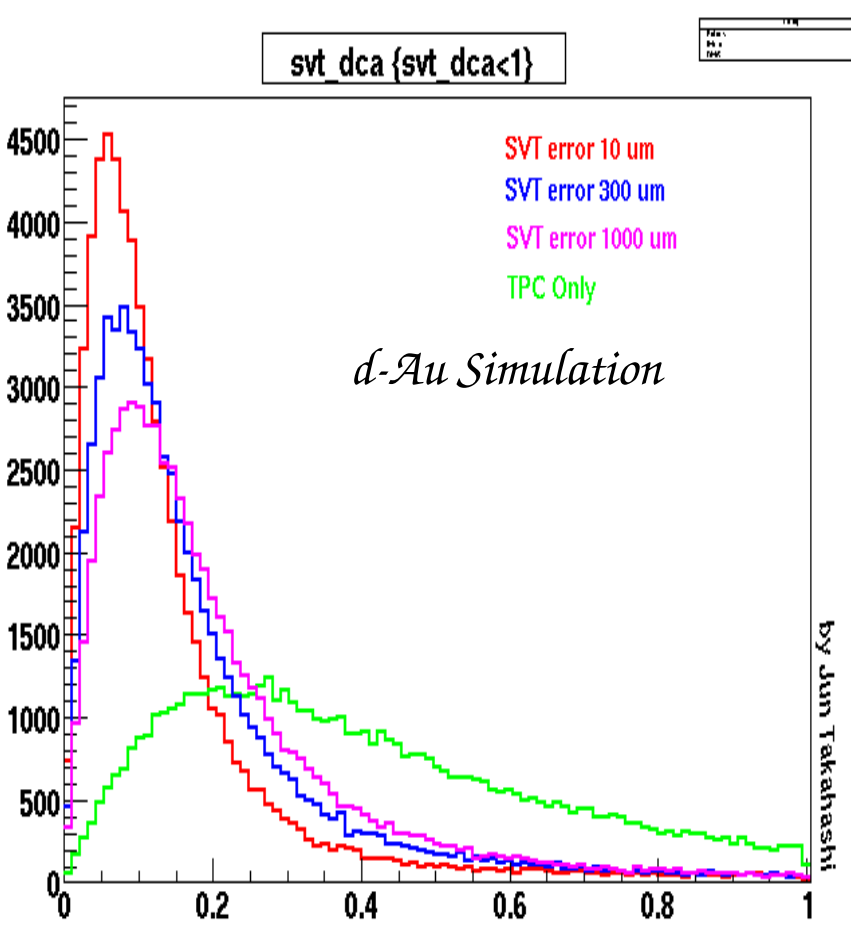
Blue – Real data – TPC T0 wrong

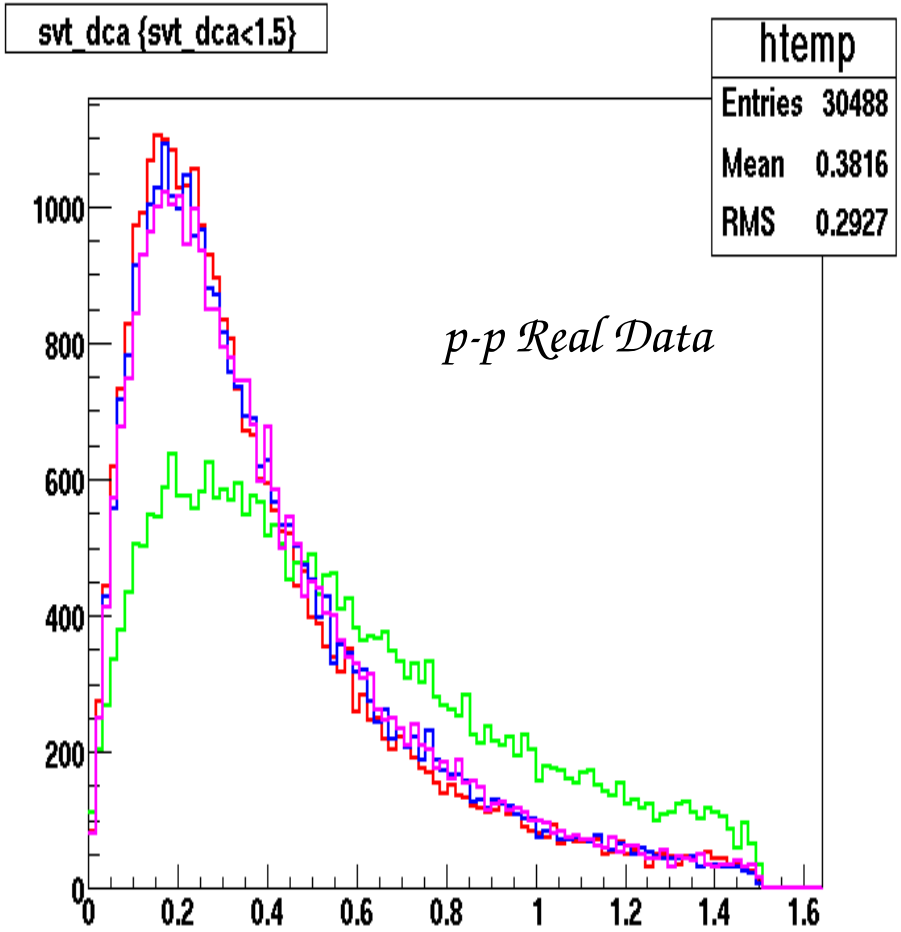
Take tracks and refit using a perfect helix assumption but ignoring middle barrel SVT hit. Then look at z residual for this hit

Take plateau as correct error:

Real data errors are~ 300μm

Do Correct Errors Matter?





Integration into ITS

SVT barrel 2
pt > 2GeV/c

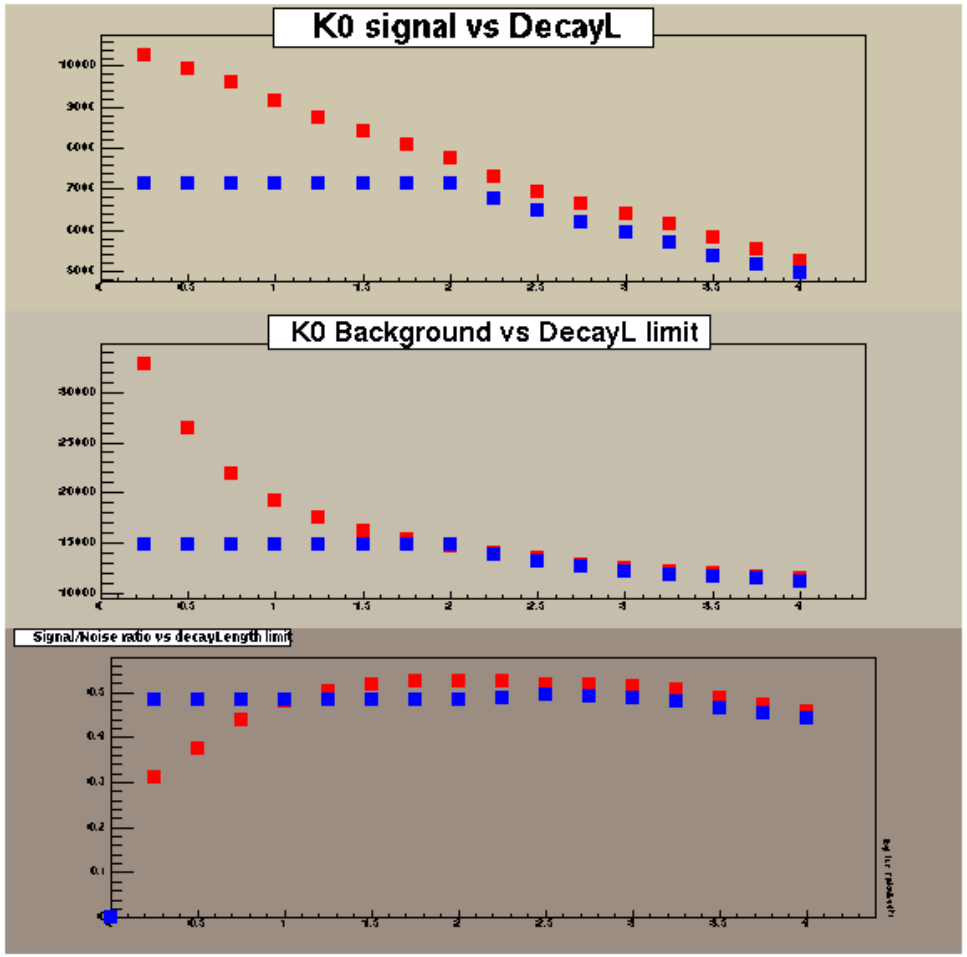
Throw 100 π flat phase space
Look at residual in 2nd barrel

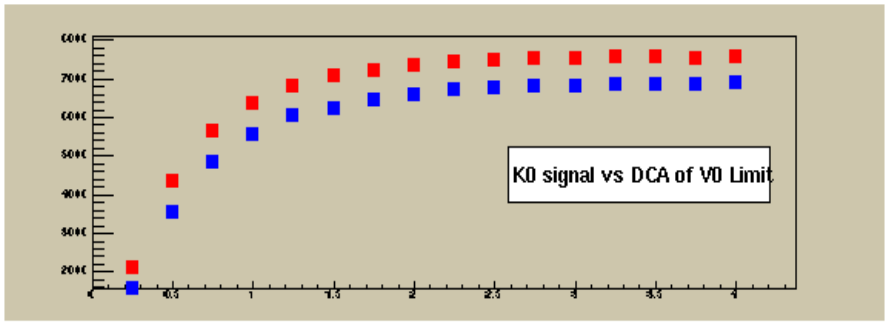
See 30 μm simulate 20 μm.

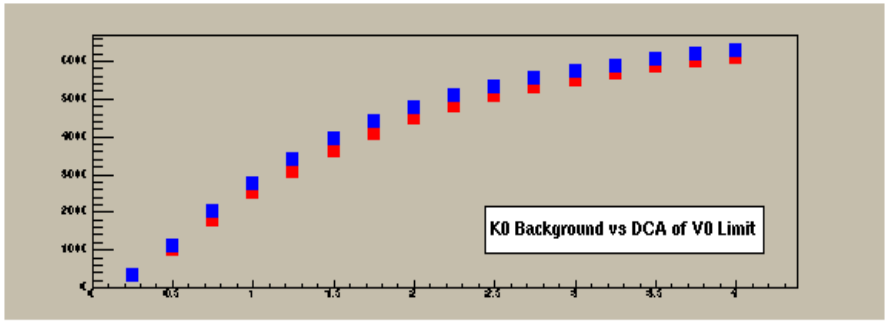
SVT tracking working
SVT material in correctly
SVT geometry in correctly

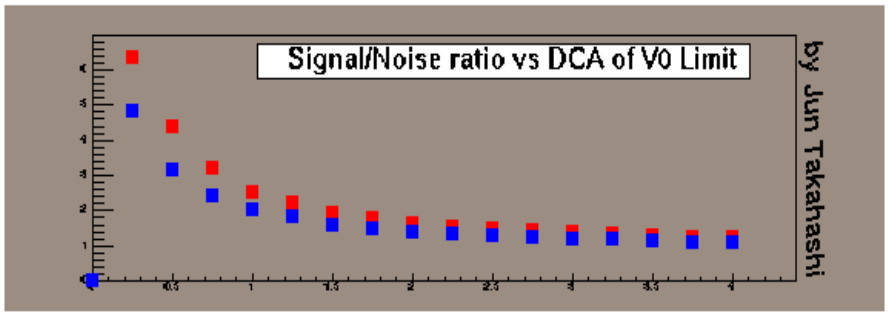
By Bum Choi

Cut Tuning for K^0_s

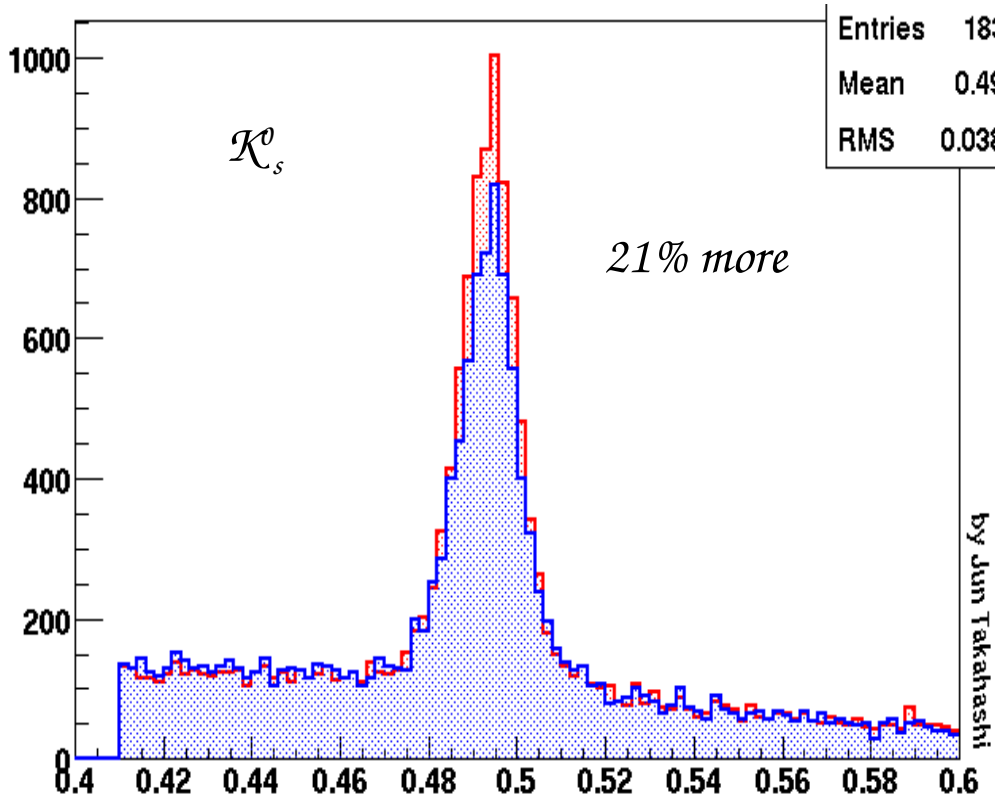








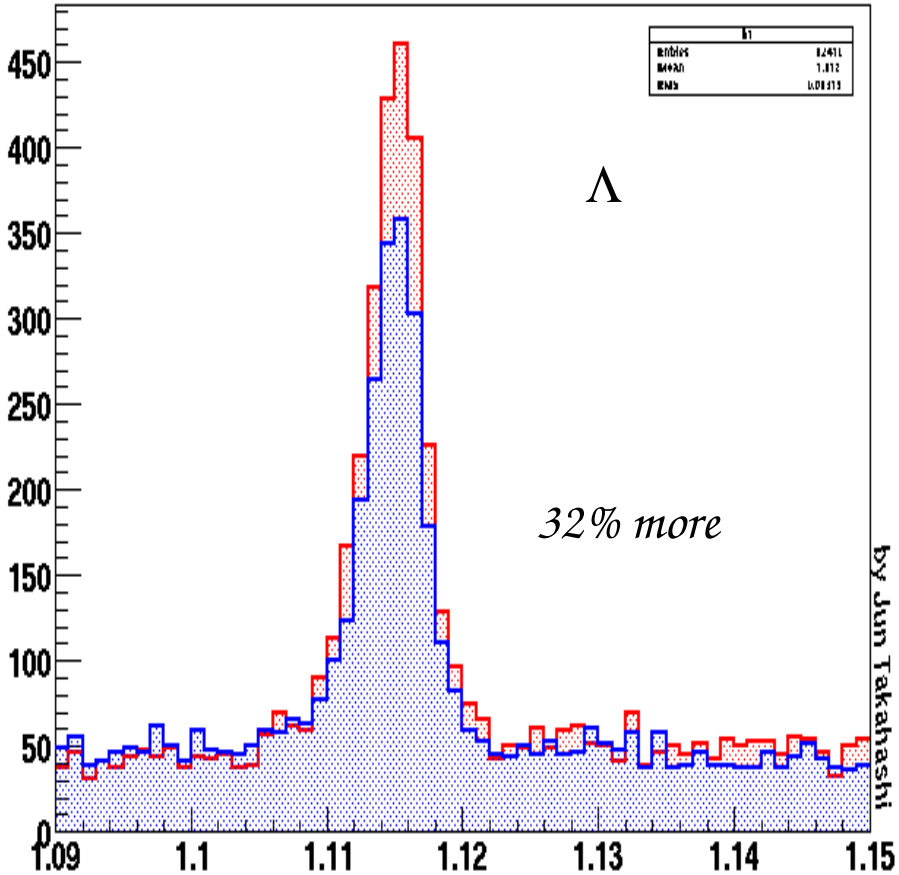
Strangeness Enhancement



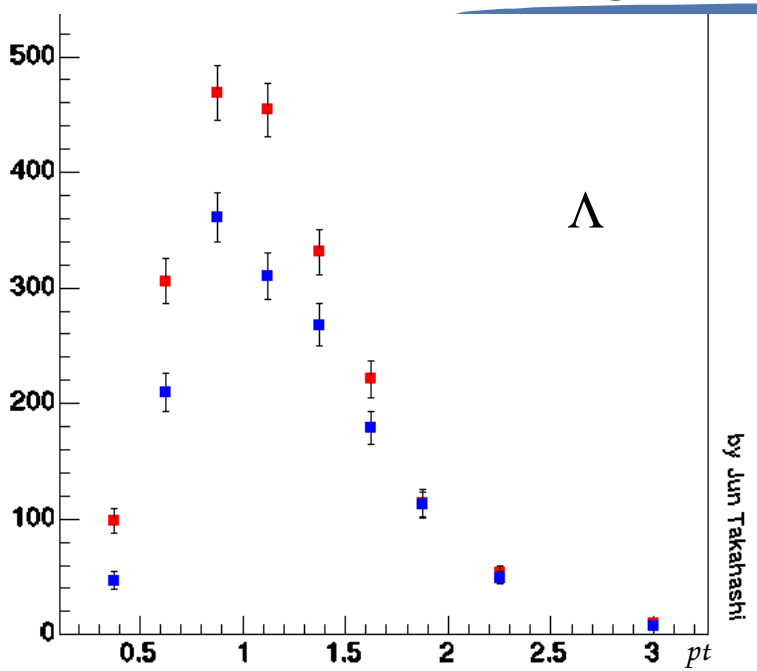
Red – SVT

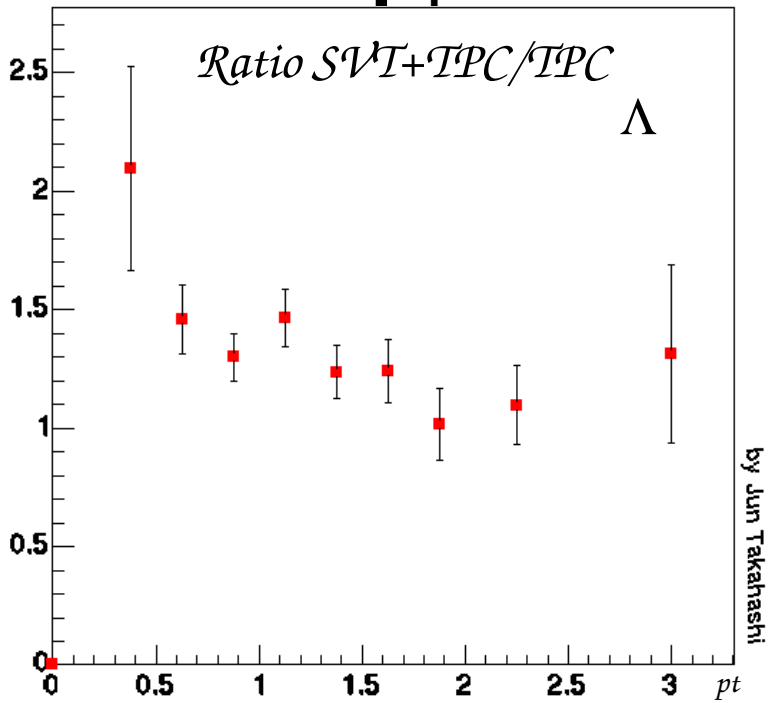
Blue - TPC

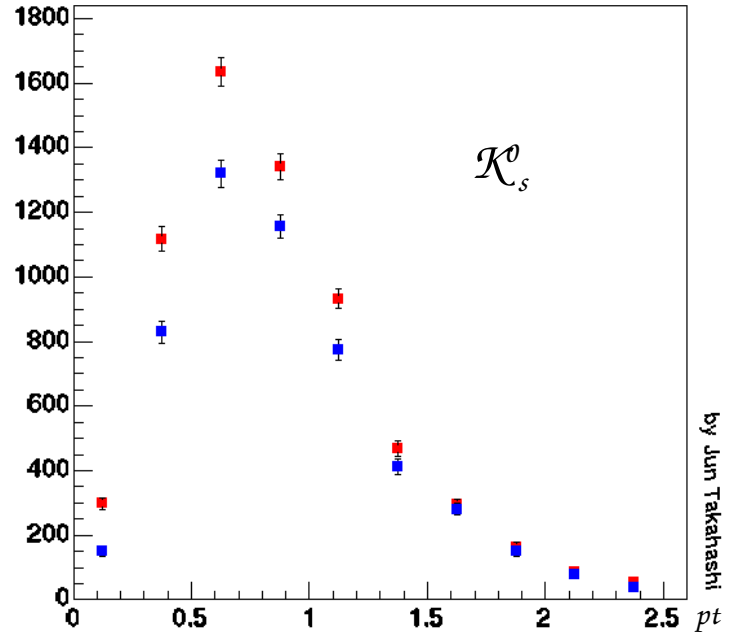
Keeping backgrounds constant

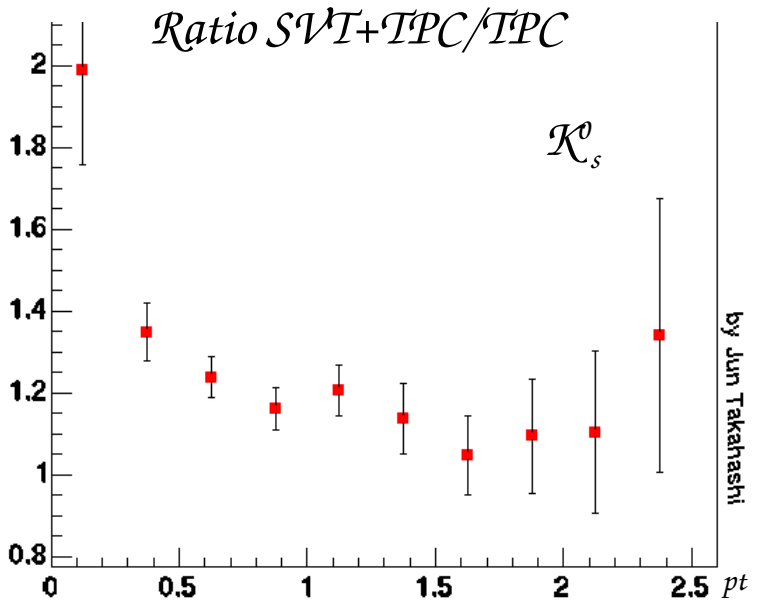


Strangeness - Function p_t



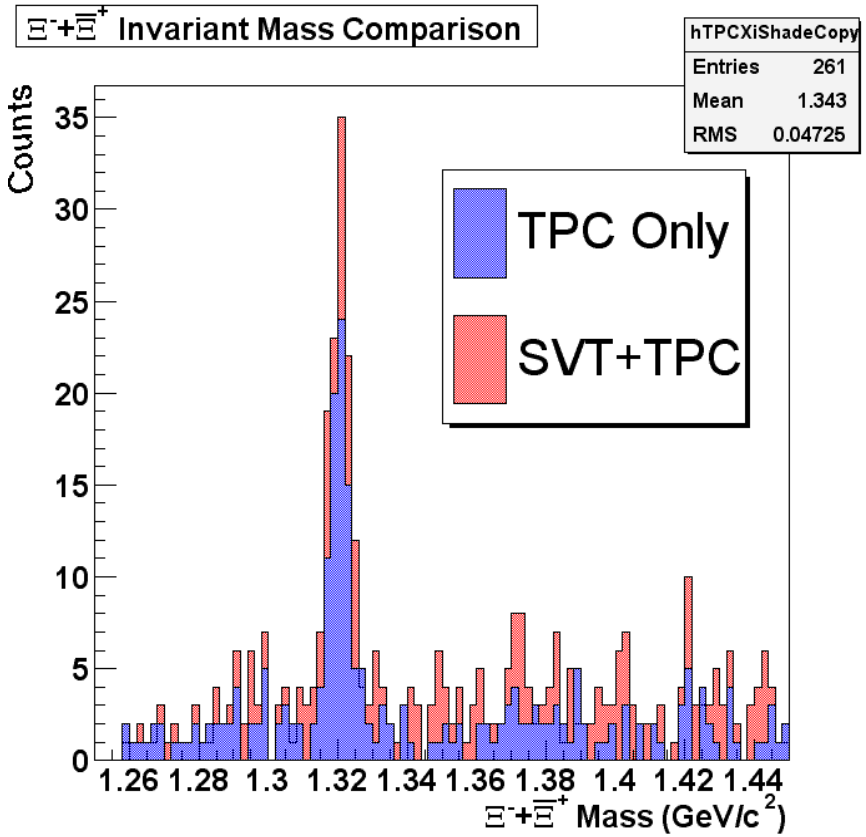


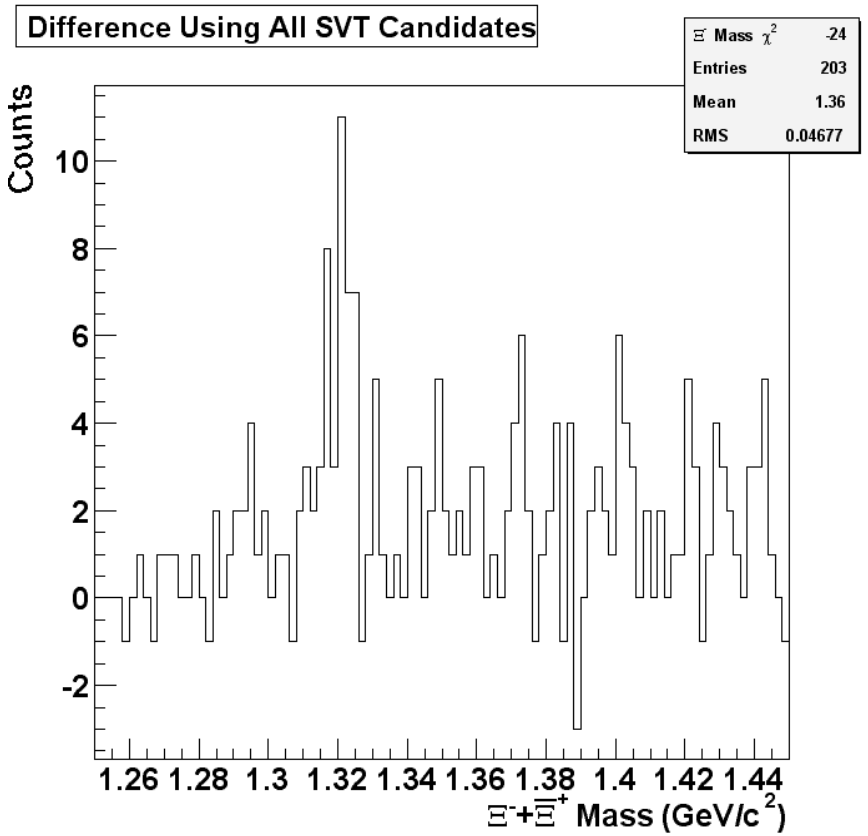




Multi-strange Improvement

33% Improvement using the same cuts for SVT+TPC as TPC





Slow Simulator

Picks up from database:

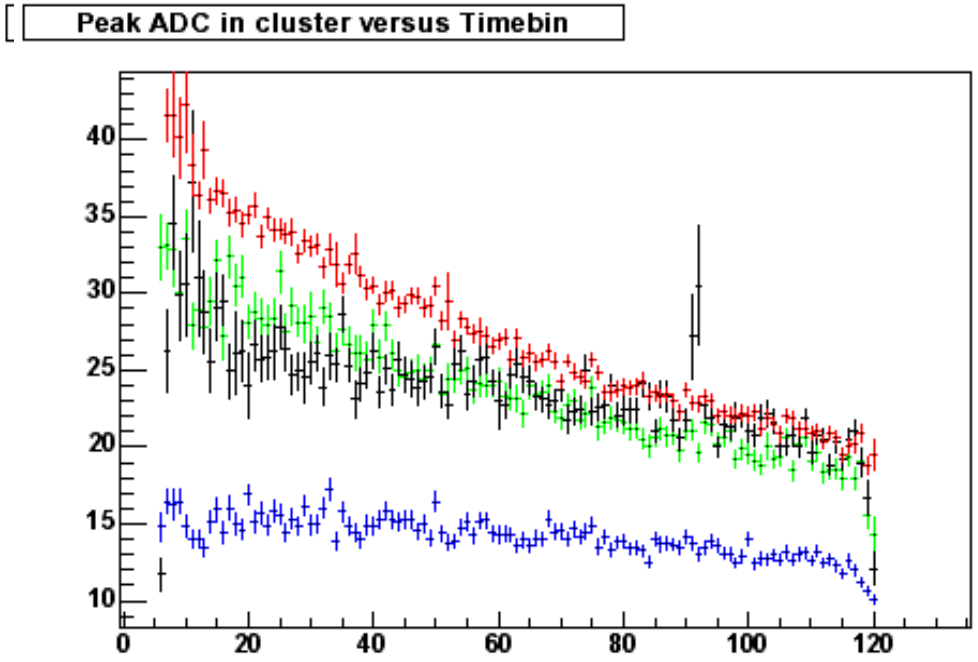
T0 - *So get correct value for run*
Drift Velocity – *So get correct value for each wafer*
Bad Anode list – *So only simulates active detector area for that period*
Mean ADC count - *So get correct white noise value*

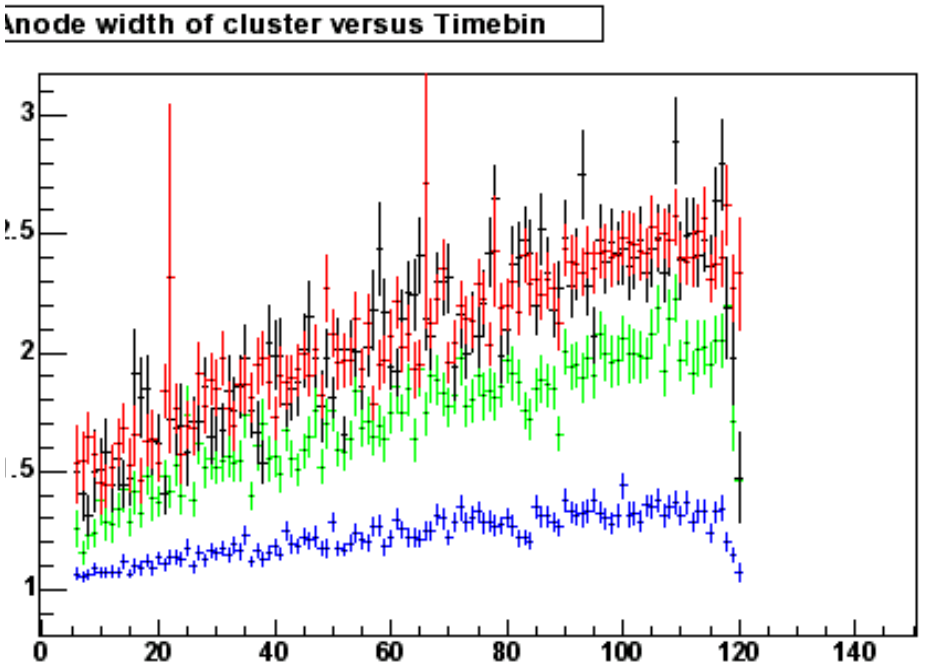
Then Simulates:

Drift of e- to anodes
PASA response
10 to 8 bit conversion

Slow Simulator - Tuning

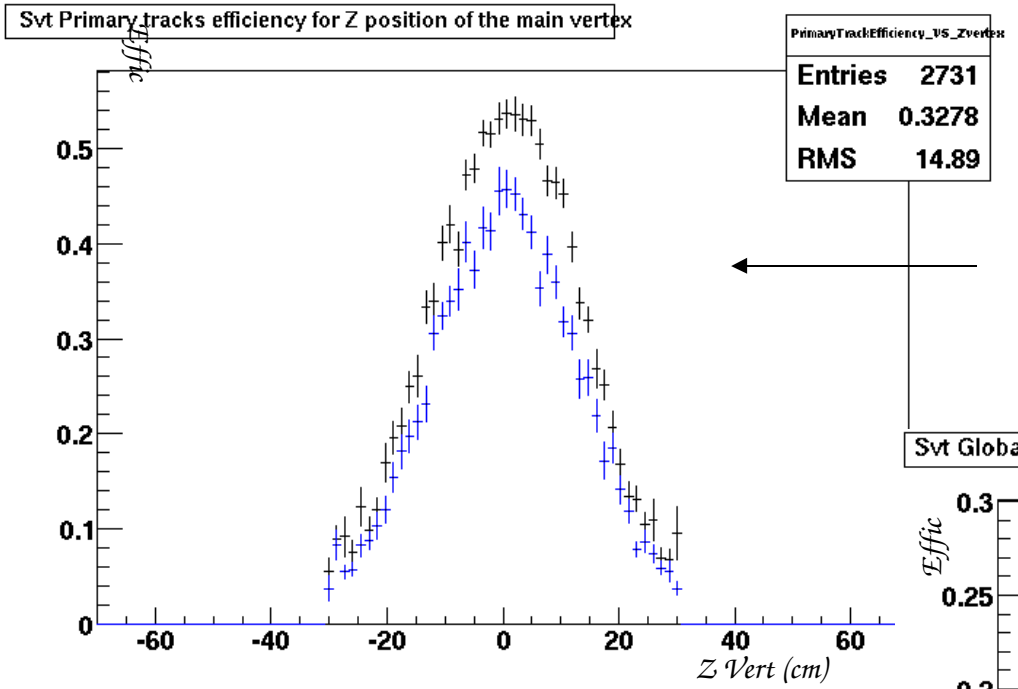
Black – Data, Red – Sim -No Noise, Green – Sim + White Noise, Blue – Sim + Too much noise





Doing a reasonable job of simulating SVT
Still need some more fine tuning but not bad

Slow Simulator – Compare to real data



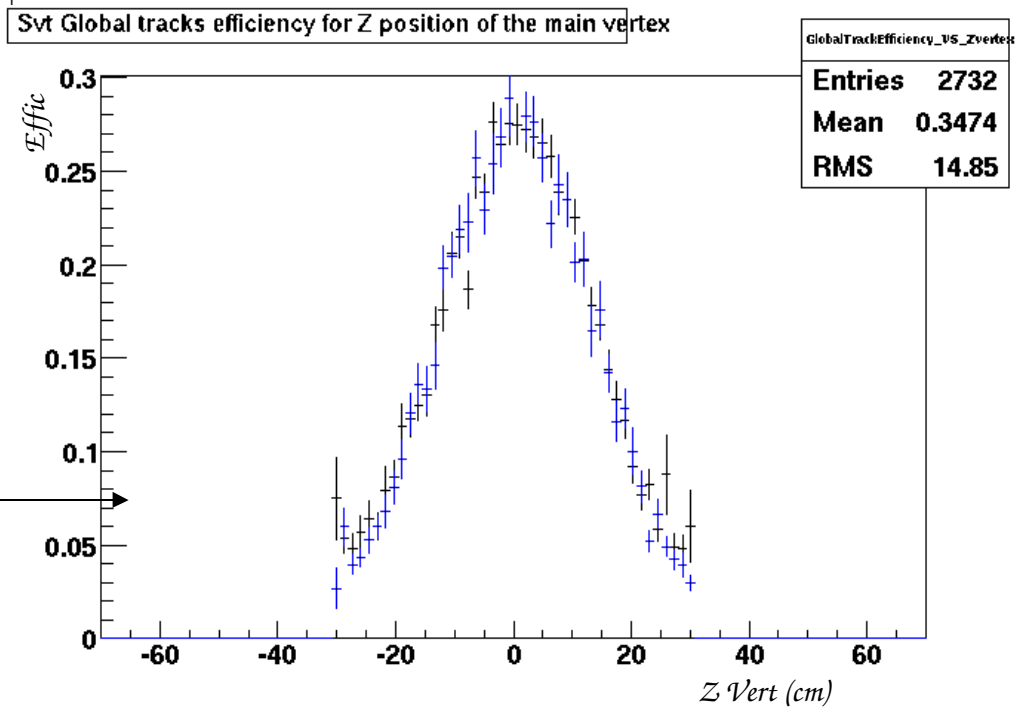
Blue – Simulation

Black – Real data

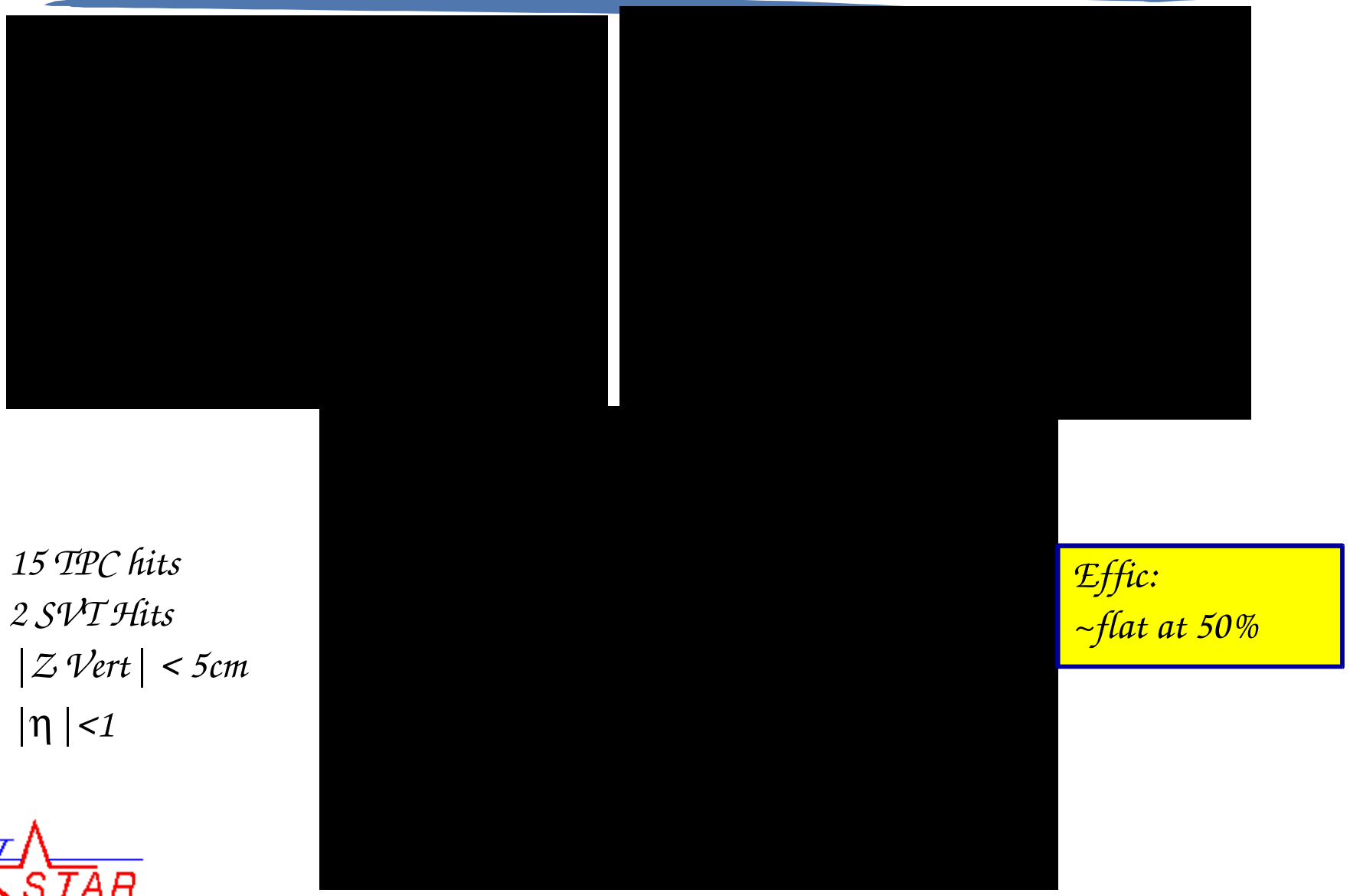
Primary Tracks

Effic = Matched/Projected

Global Tracks



Tracking Effic II – dAu Hijing

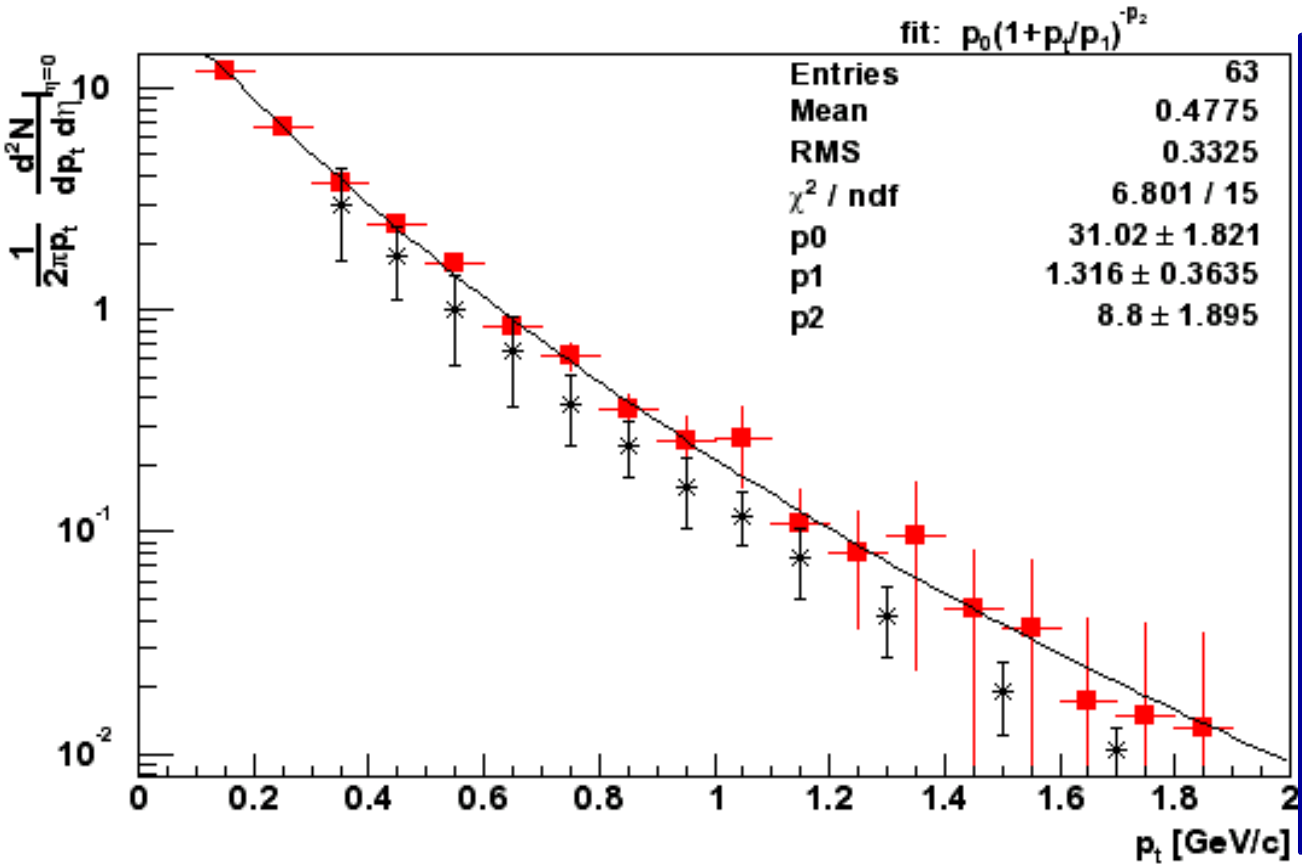


15 TPC hits
2 SVT Hits
|Z Vert| < 5cm
|η|<1

Effic:
~flat at 50%

Corrected d-Au Spectra

Red – SVT h⁻, Black – TOF π⁻



SVT:

dN/dy = 6.36

$\langle p_t \rangle$ = 0.45 GeV

TOF:

dN/dy_{π} = 6.2 ±0.1

$dN/dy_{(\pi+K+p)}$ = 7.5±0.1

$\langle p_t \rangle_{\pi}$ =0.39 GeV

$\langle p_t \rangle_{K}$ =0.61 GeV

$\langle p_t \rangle_{p}$ =0.74 GeV

Next

Full reproduction of the p-p 2001 data just started

Running SVT in the chain

Saving out hits to continue alignment/calibration studies for d-Au and preparing to next Au-Au

Running C++ V0 and Xi finder

Running BOTH TPC and SVT+TPC for comparison studies

Opening up the V0 and Xi online cuts

If improvements continue into the Omega can get NEW physics Not achievable with TPC only

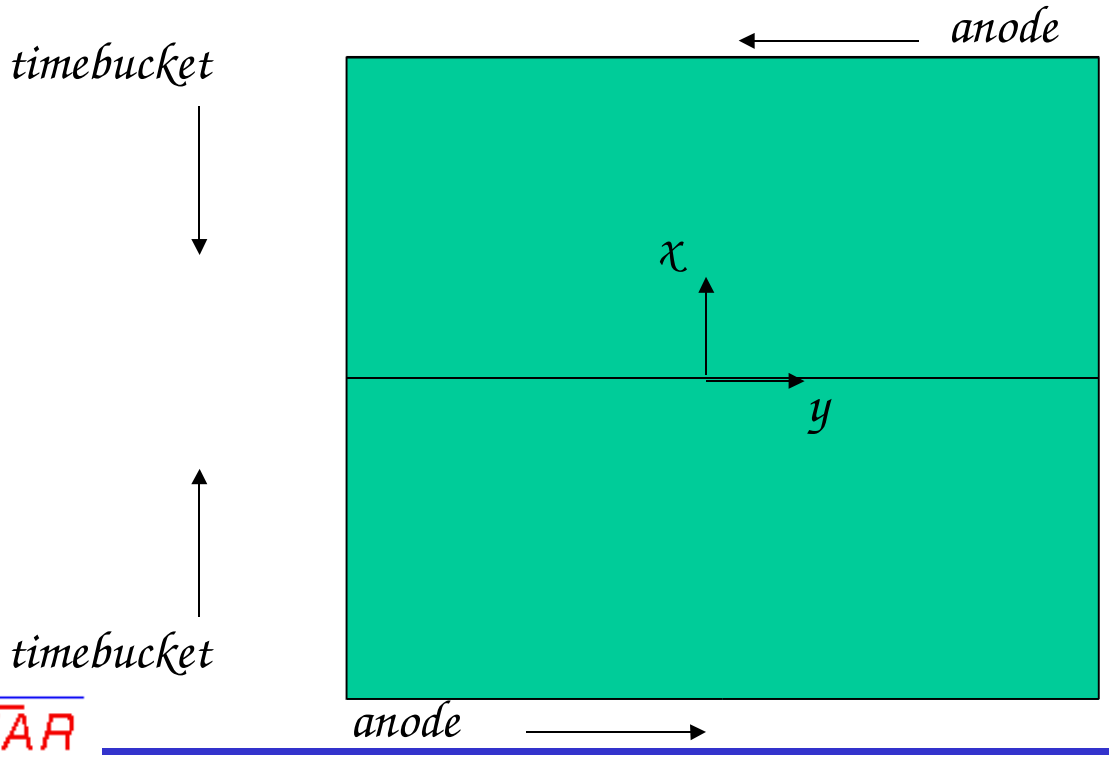
The SVT Coordinate Systems

3 coordinate frames:

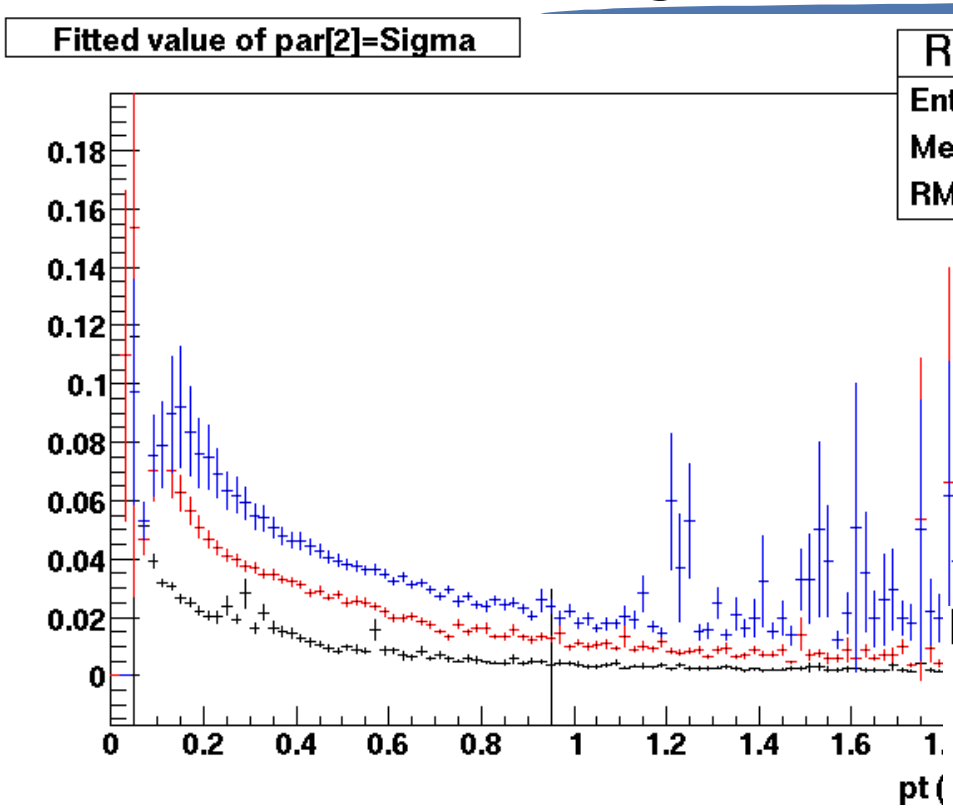
Wafer : layer, ladder, wafer, hybrid,timebucket, anode

Local : layer, ladder, wafer, cm from center of WAFER
in OUR x (drift) and y (anode) frames

Global : x, y, z in STAR magnet system



Estimating Hit Errors- Perfect tracks

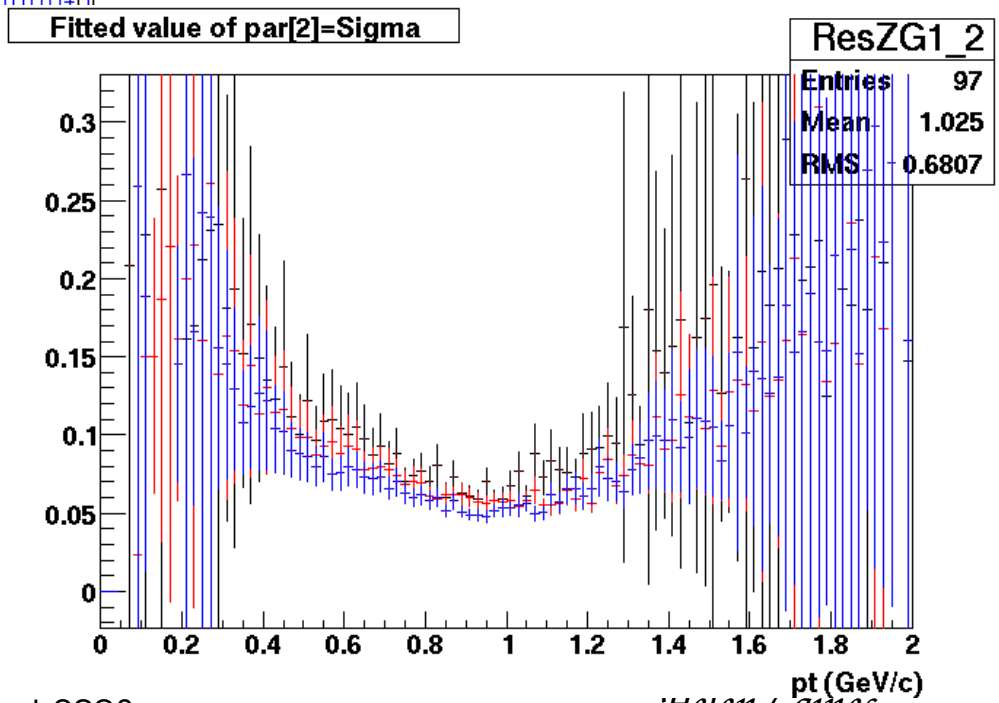


Projecting from Primary vertex to SVT layers

Black – Layer 1

Red – Layer 2

Blue – Layer 3



Projecting from TTPC inner radius to SVT layers

Black – Layer 1

Red – Layer 2

Blue – Layer 3