MC based comparisons & performances.

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Outlook

- This analysis is based on MuDst.
- All plots can be found at http://www4.rcf.bnl.gov/~fisyak/star/RECO/Eval/MC.

Herein I will only flush the most interesting part of them.

(It was found by Duncan that for Stv there is a problem with global tracks on MuDst. For this reason all plots for global tracks are dropped for the moment).

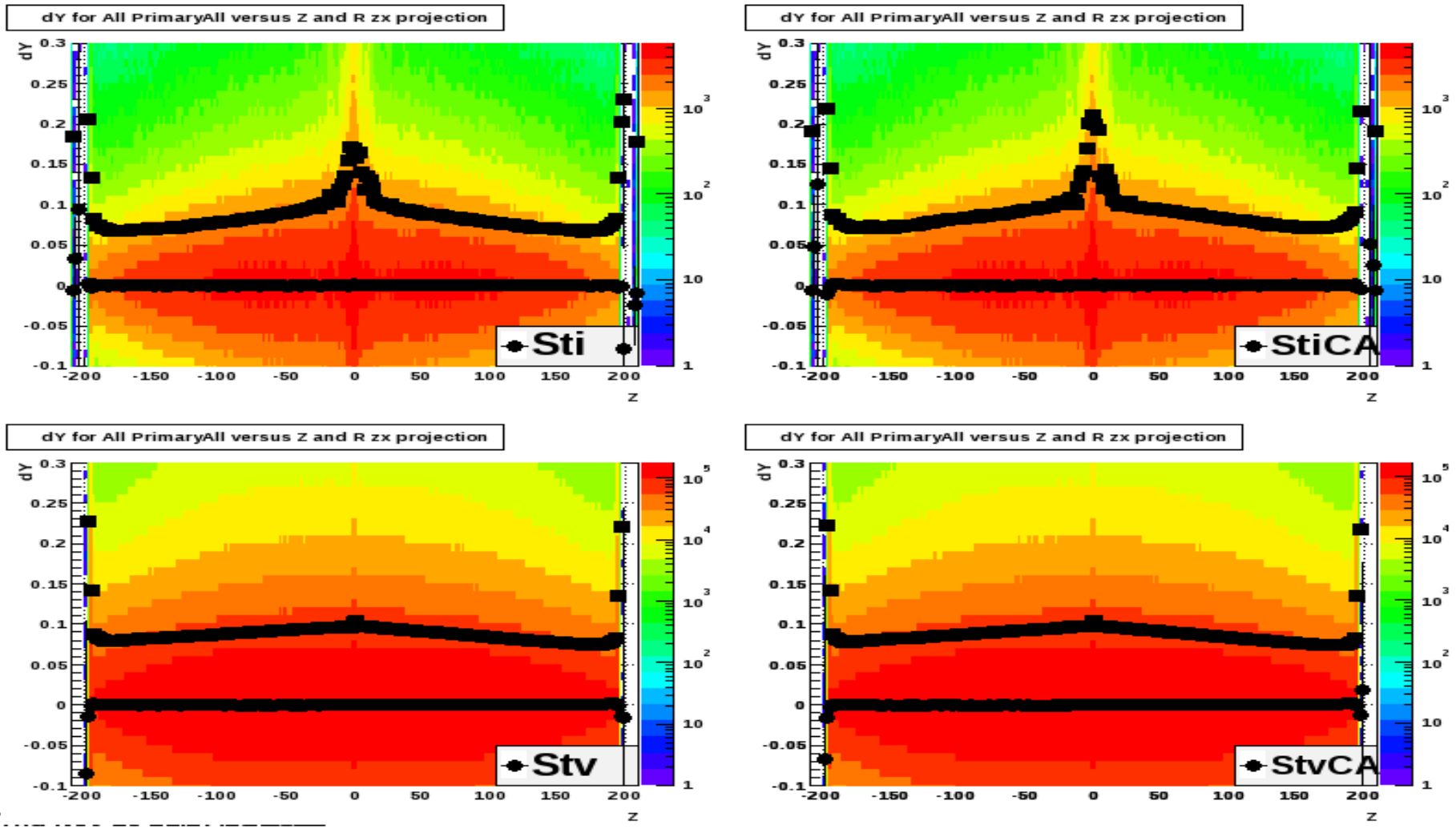
- The presentation has 2 blocks:
  - Fit quality,
    - Hit residuals and pulls,
    - DCA @Vertex
    - Track parameters resolution and pulls:
      - Versus No. of fitted points and No. of bad fitted points,
      - Versus ψ, λ or η, p_T.
  - Track reconstruction efficiencies dependence on ψ, λ or η, p_T.
- Summary

Notations, Cuts, Data samples

The plots are designed to answer on the following questions:

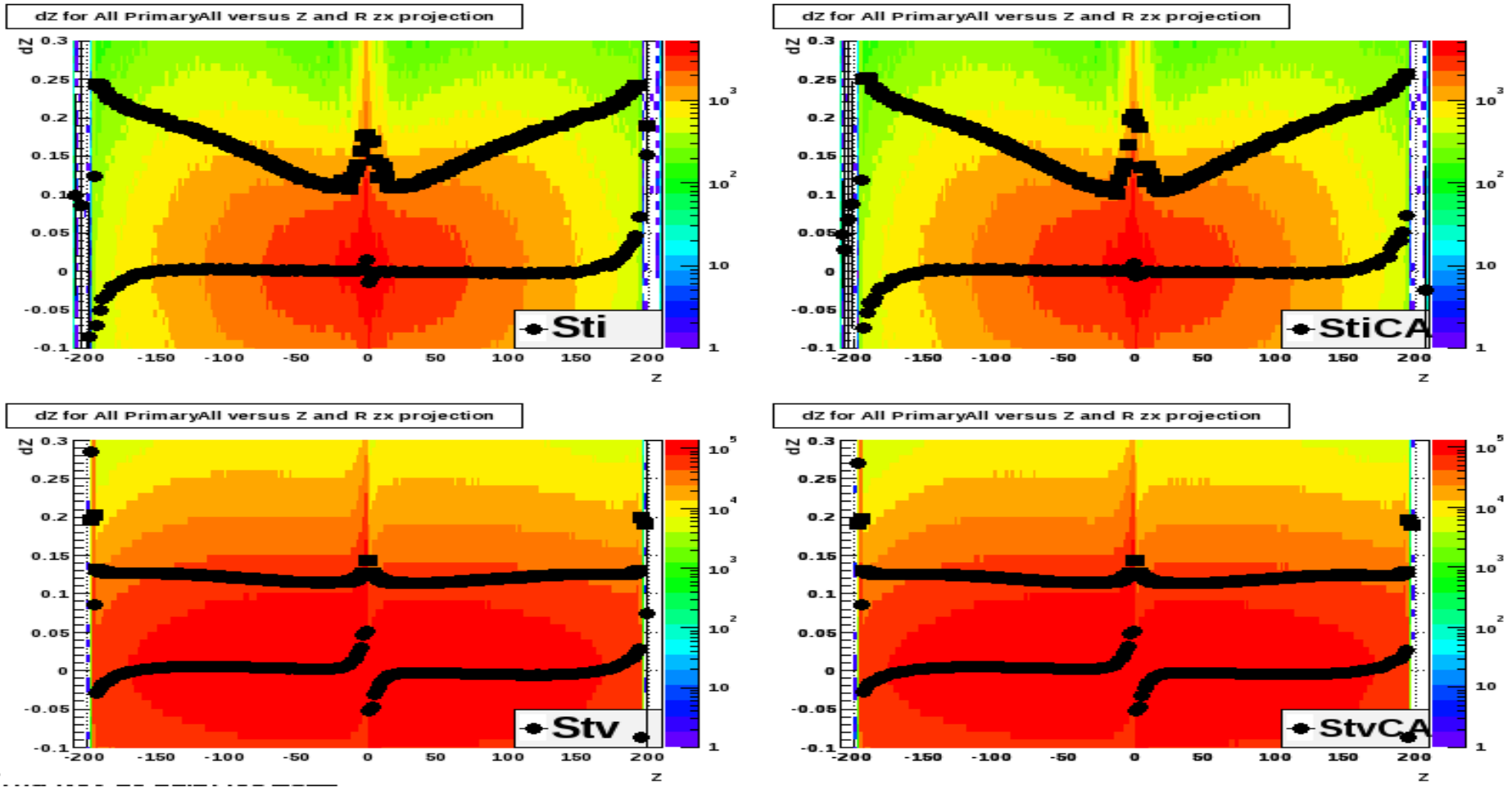
- What tracks (globals and primaries) can be considered as "good" ones depending on total no. of fit points and no. of bad hits ?
- What is the track parameters and their errors dependence on the track kinematic parameters(ψ, η, p_T) ?
- What is the track parameter pulls dependence on above kinematics ?
- What is the track reconstruction efficiencies for :
  - Geometrical acceptance (MC only),
  - Reconstruction efficiency for track with only match between MC and RC
  - Clones, for multiple (>1) match between single MC track to RC one,
  - Lost tracks, MC tracks which have no RC partner.
  - Ghost tracks, RC tracks which have no MC partner.
- Color scheme: • Positive and • Negative Tracks.
- Results of Gauss fit for slices are presented as • for μ and as ■ for σ.
- Y stands for measurement in TPC $\rho\varphi$ direction, Z in drift direction.
- Pull (X) = $(X_{measured} - X_{predicted})/\sqrt{(\sigma^2_{measured} + \sigma^2_{predicted})}$, herein it is supposed that $\sigma_{predicted}=0$.
- The most of plots presented herein are obtained from 2011 AuAu200 sample. Other samples (2008 dAu200, 2009 AuAu11, 2009 pp500 pile-up, 2009 pp500 W pile-up, and 2010 AuAu 200) can be seen at http://www4.rcf.bnl.gov/~fisyak/star/RECO/Eval/MC
- If it is not exactly pointed then it is supposed that the left plot is Sti(CA) and the right plot is Stv(CA).

Hit residuals (Δy versus Z) for primary tracks



Sti and StiCA are very similar. The same is true for Stv and StvCA.
For Stv Δy looks better. There is no Sti spike in σ(■) at Z = 0.

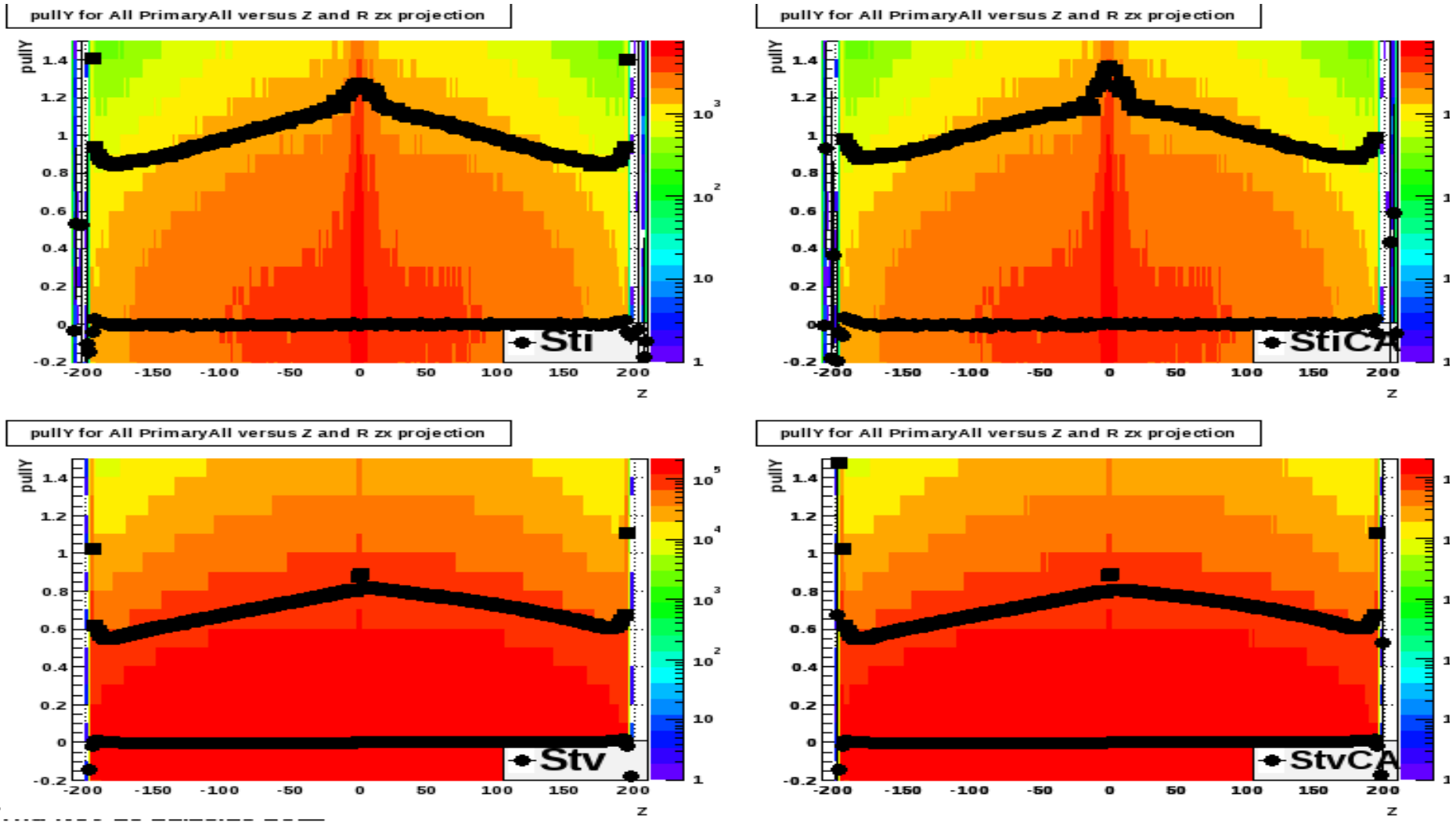
Hit residuals (Δz versus Z) for primary tracks



Again residuals in Δz for Stv looks better than for Sti. In Stv σ is flat versus Z and smaller than Sti one.

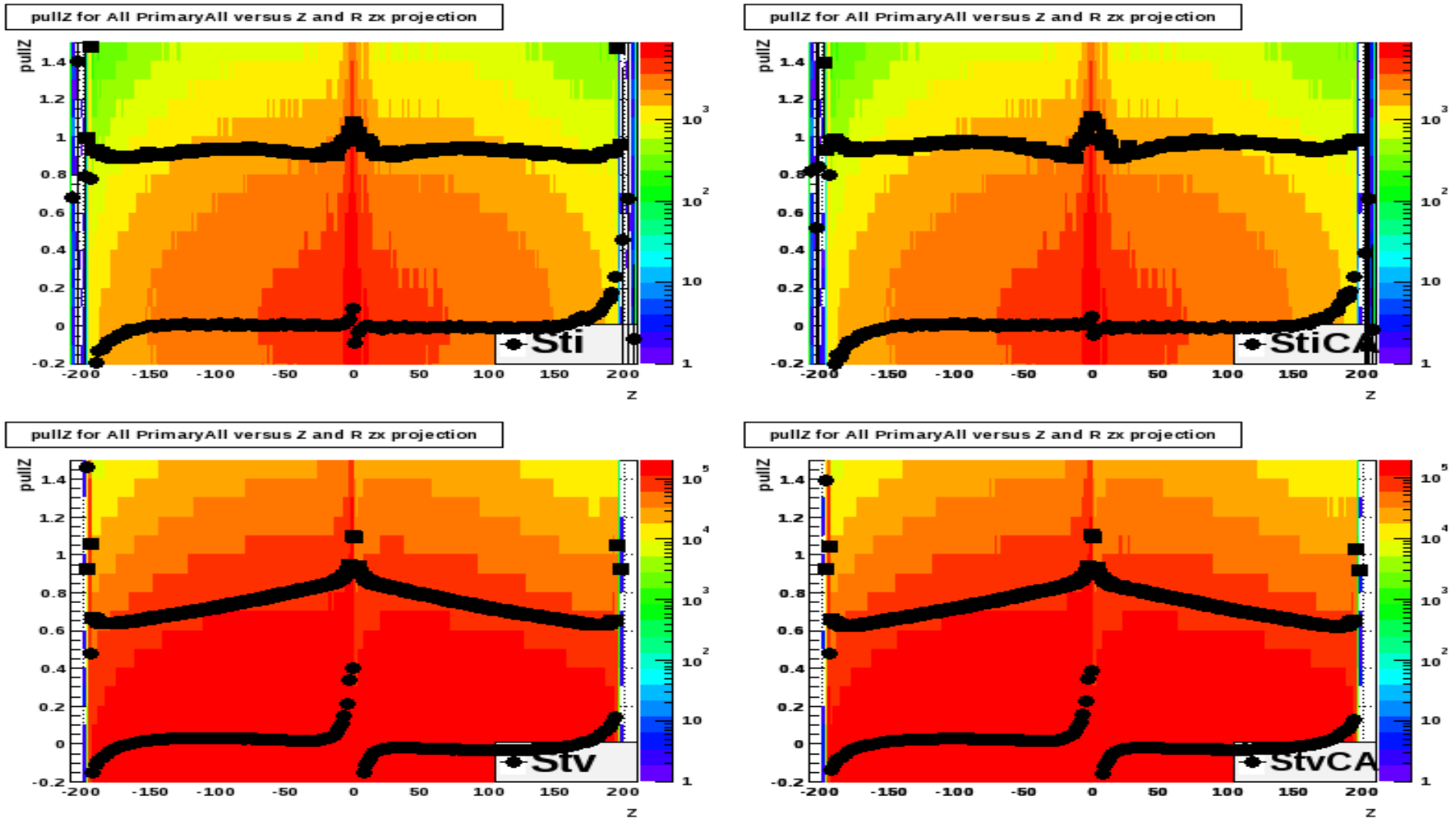
Conclusion from the above two slides that the Stv fitter does work and works better than Sti one.

Hit Pulls (y) versus Z for primary tracks



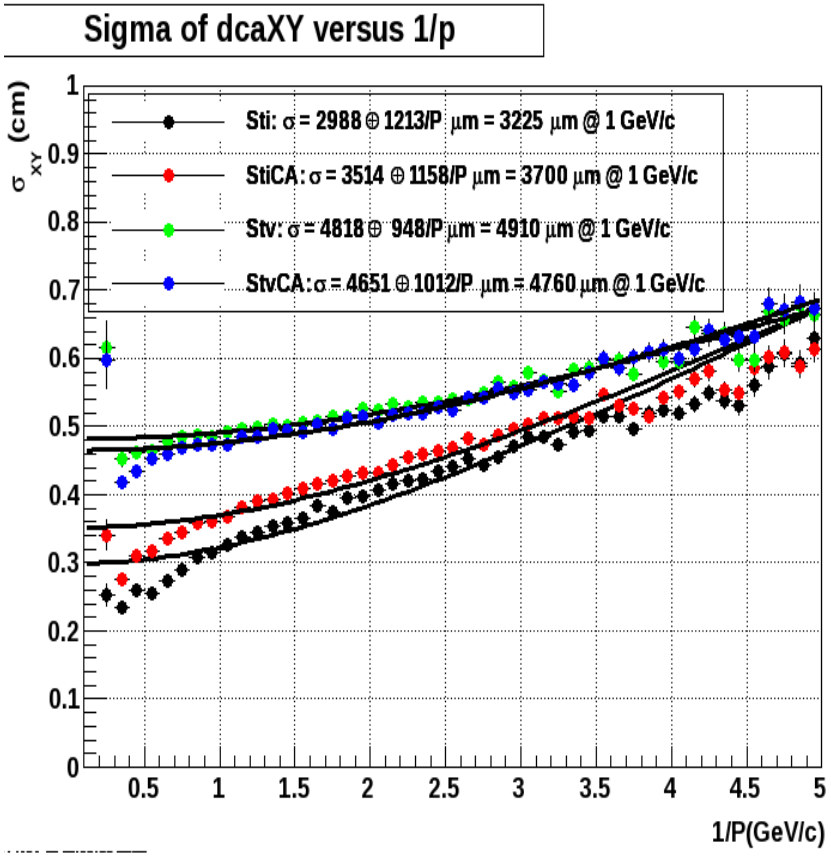
It looks like that hit errors in Stv are overestimated by 50%.

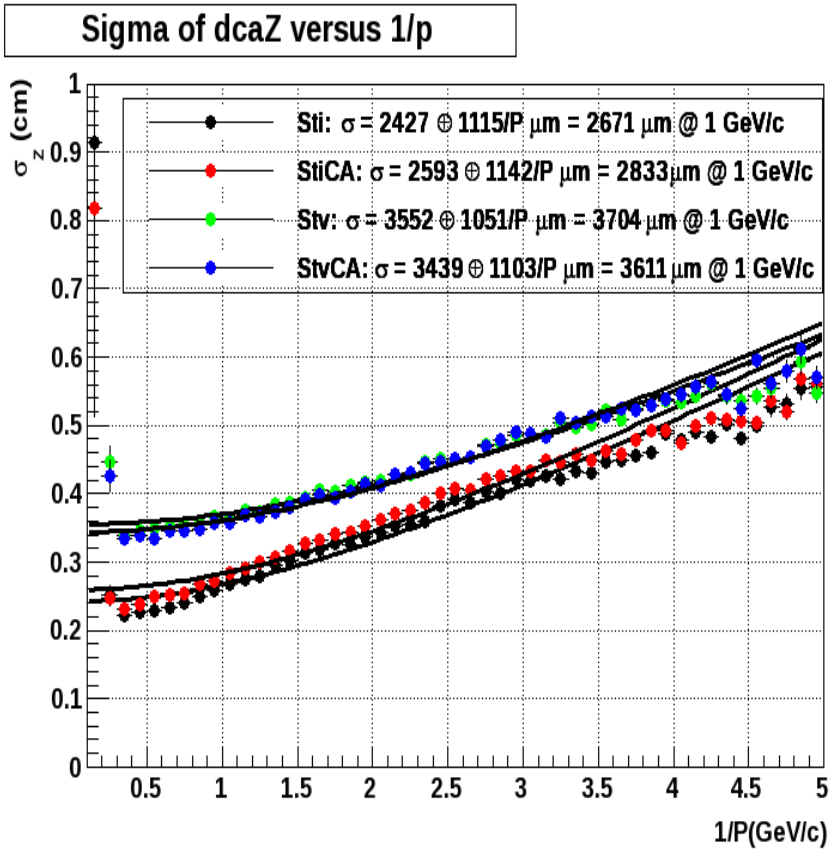
Hit Pulls (z) versus Z for primary tracks



The same story for z-pulls.

DCA σ for global track to (MC) primary vertex for tracks which were fitted as primaries versus $1/p_T$.

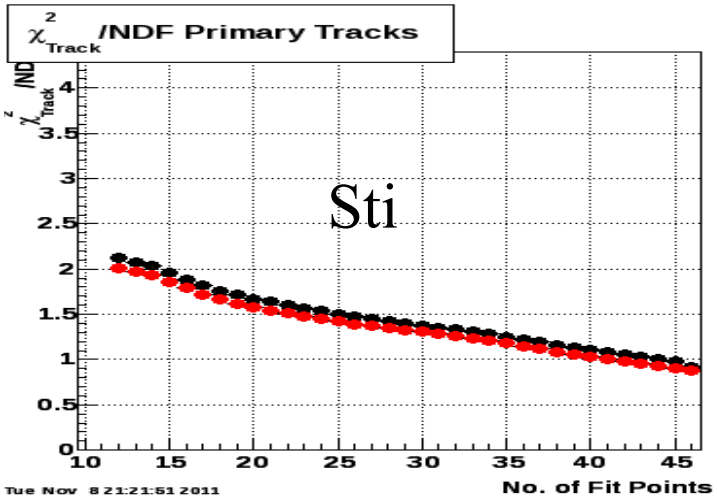


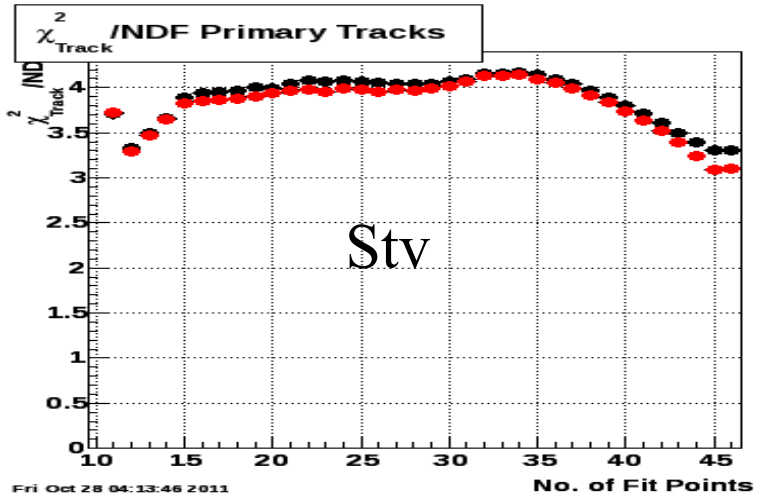


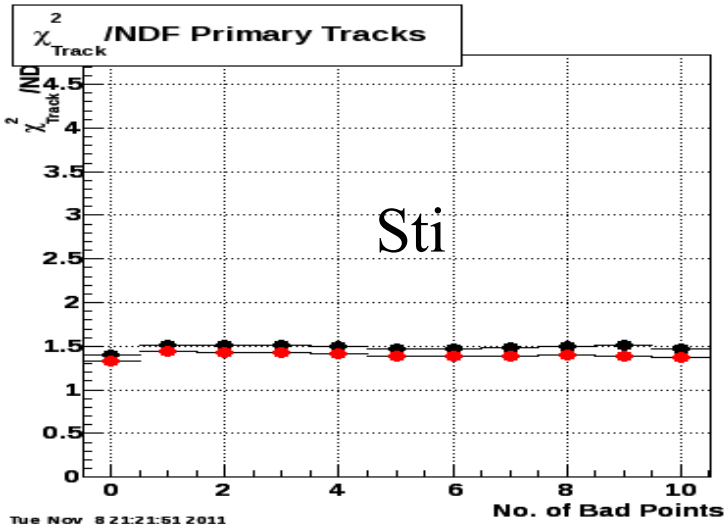
A small difference between CA and non CA I don't understand (my guess is due to vertex ranking problems) and propose to ignore for the moment.

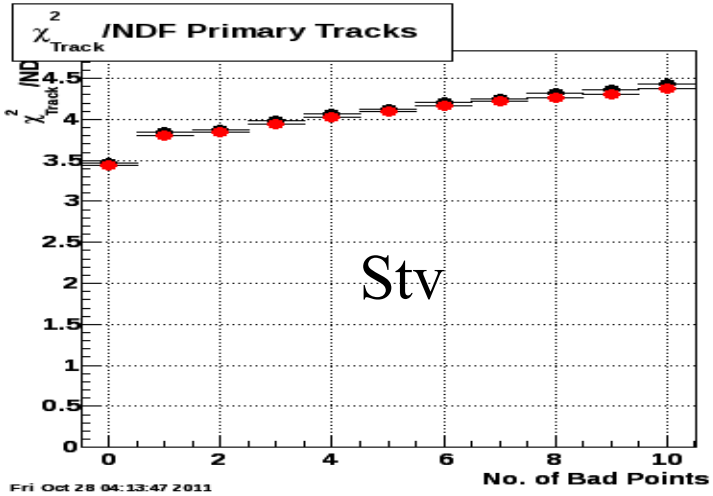
There is significant difference between Sti and Stv : ~50% for pT ➔∞

Dependence of χ^2 /NDF versus no. of fit points (nfp).



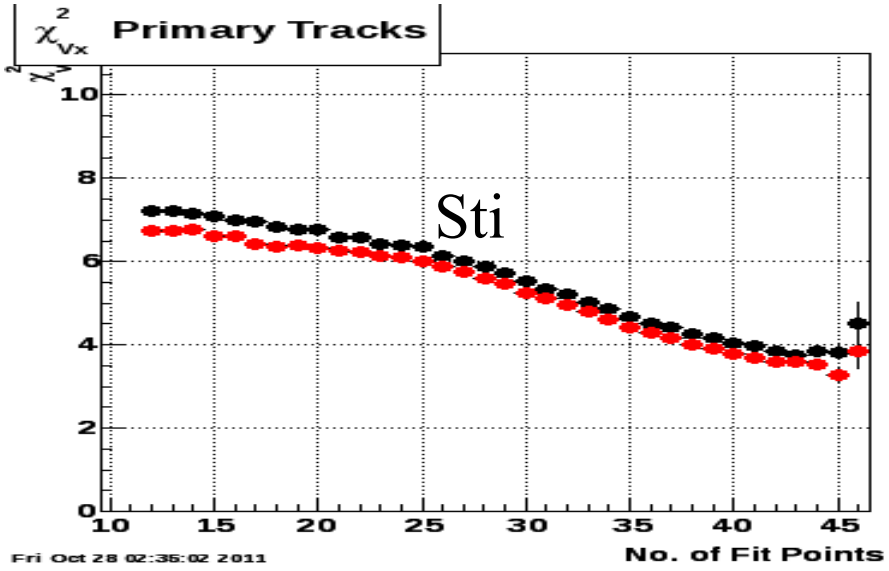


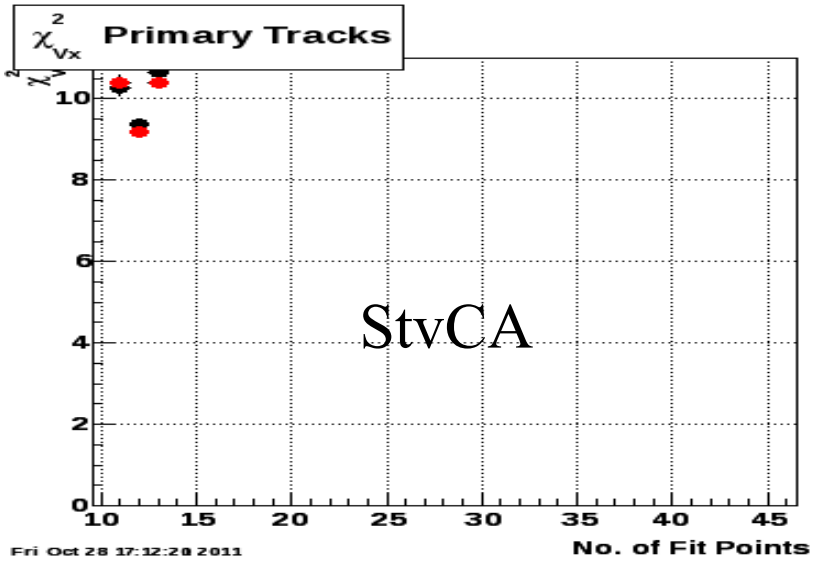


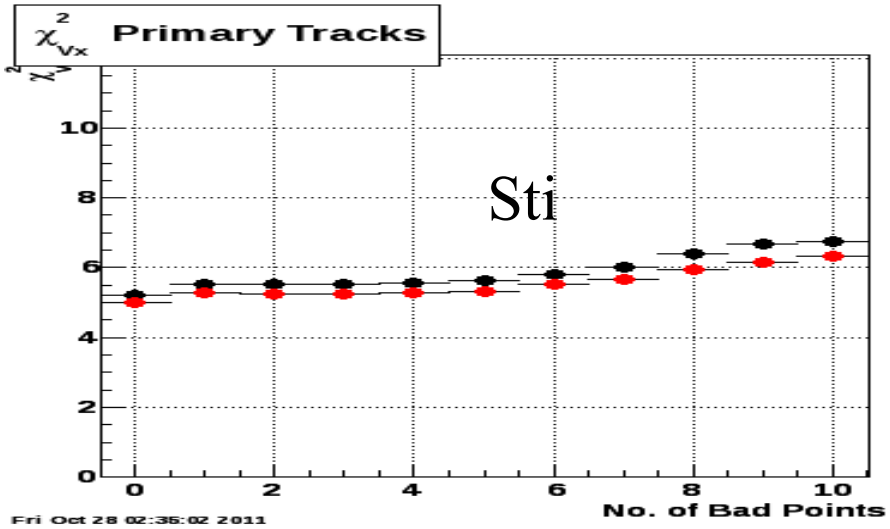


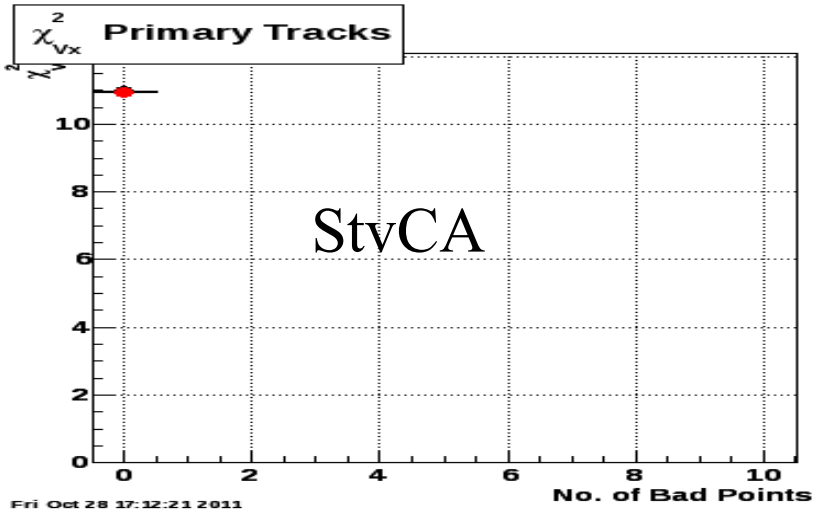
Sti has a strange dependence on nfp. It does not depend on No. of bad fit points (?).
Stv χ^2 /NDF is too big (~3). Stv is more sensitive to bad points.

Vertex χ^2



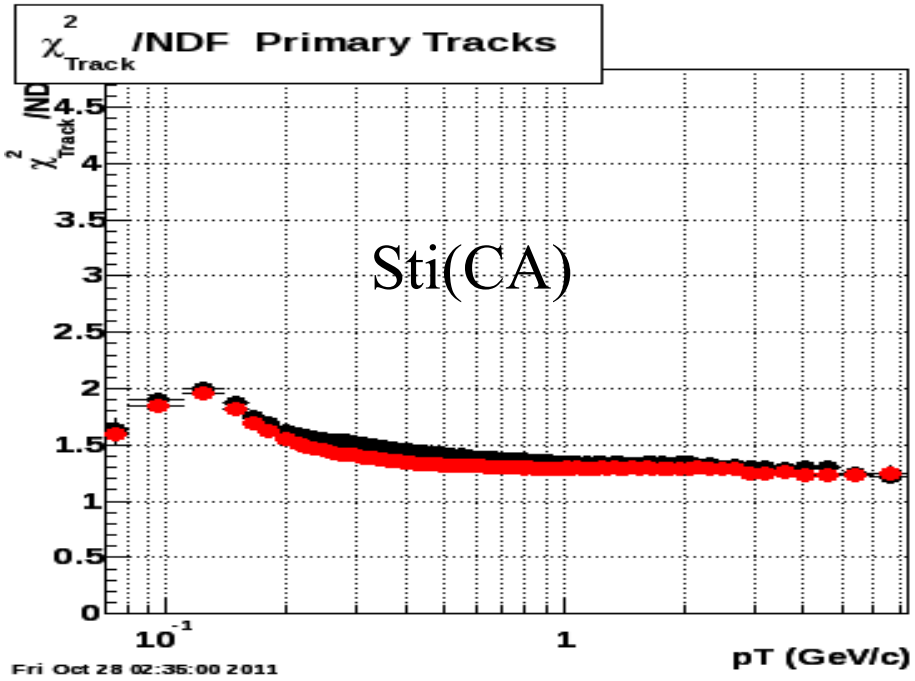


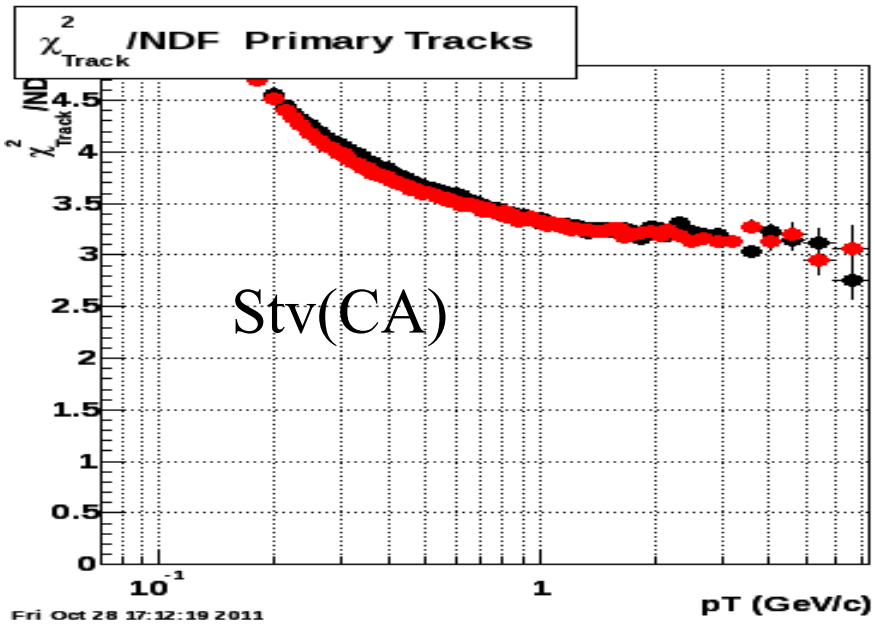




StvCA has overestimated χ^2 at Vertex by a factor > 3.

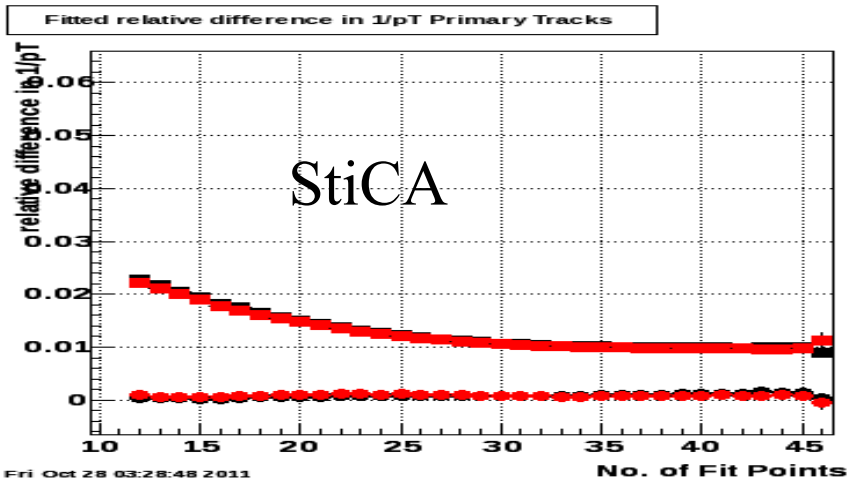
Dependence of χ^2 /NDF versus p_T

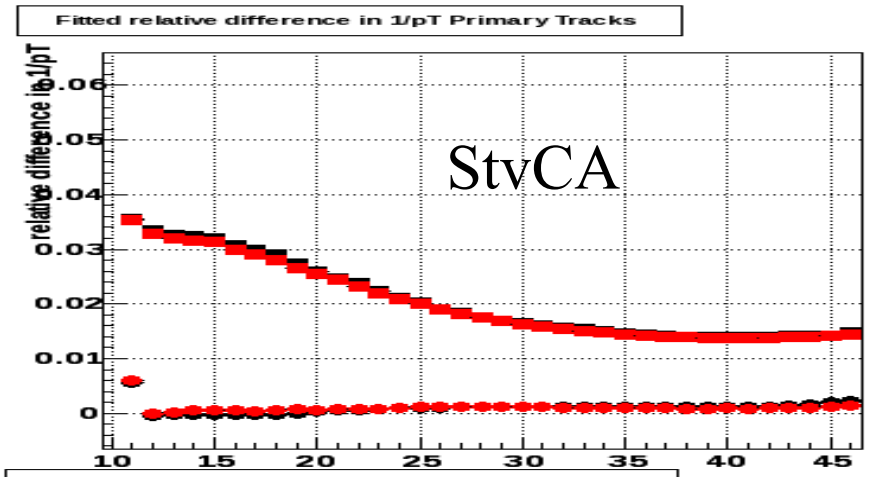


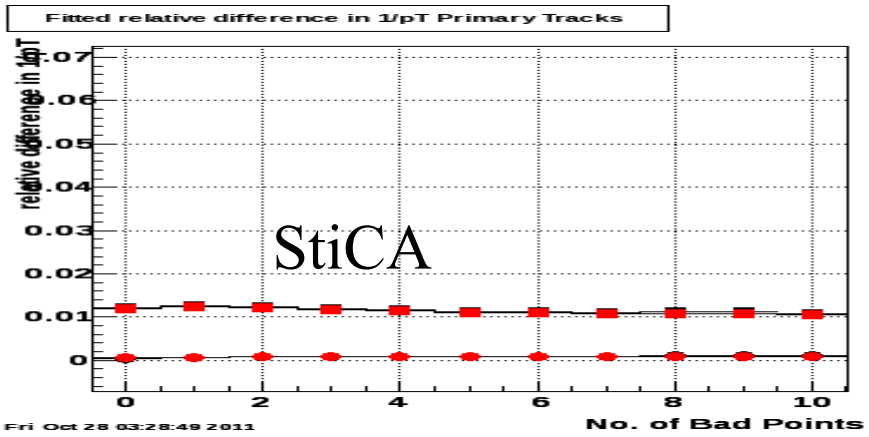


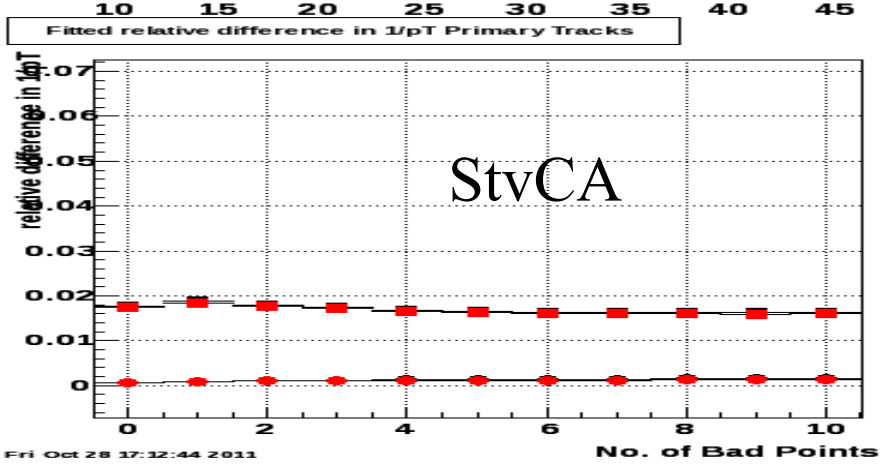
Again χ^2 /NDF is overestimated in Stv by a factor of ~3.
The dependence on p_T points on a possible problem with accounting of material.

Momentum resolution versus no. fit points









Stv(CA) shows a factor of 1.5 worse p_T resolution.

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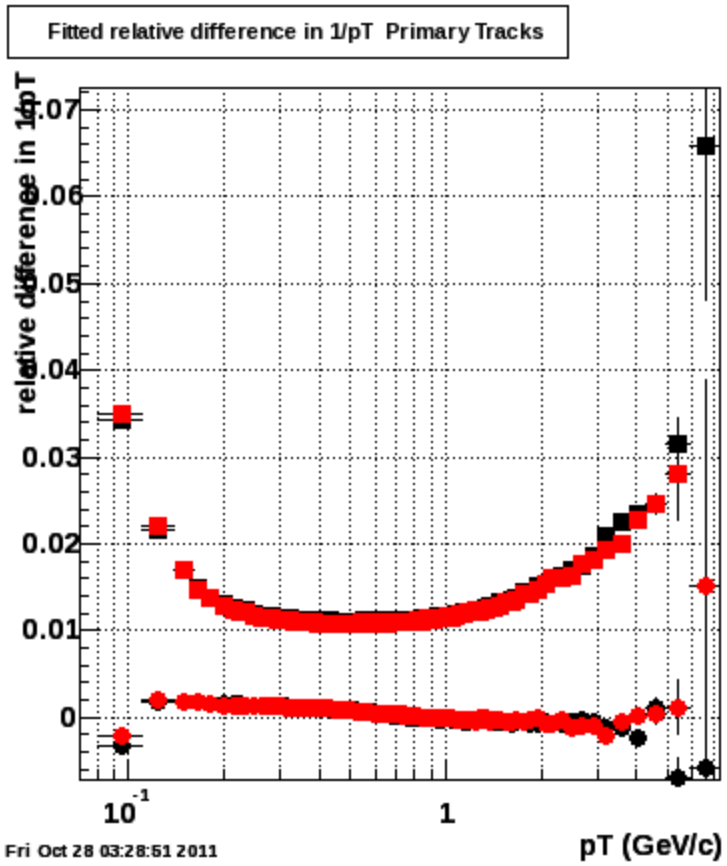
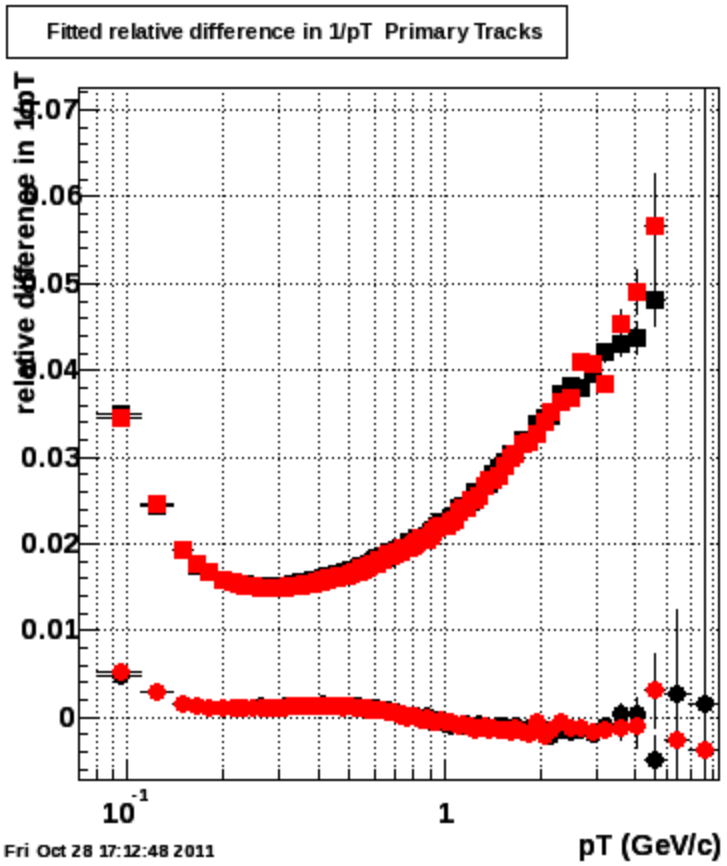
Momentum resolution versus p_T





- There are small systematical shifts in $1/p_T$ measurement for both StiCA and StvCA and these shifts are different. It could be a clue to understand momentum differences observed in TbyT analysis.
- StvCA has a factor 1.5 worse momentum resolution than StiCA. This factor has a p_T dependence.

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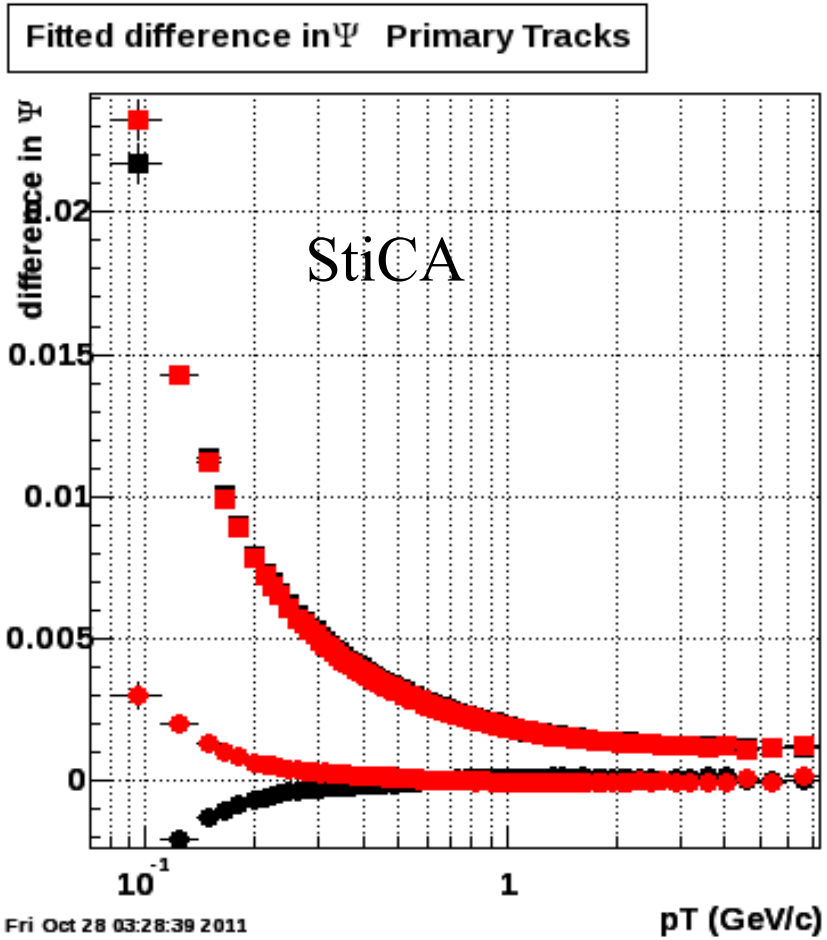
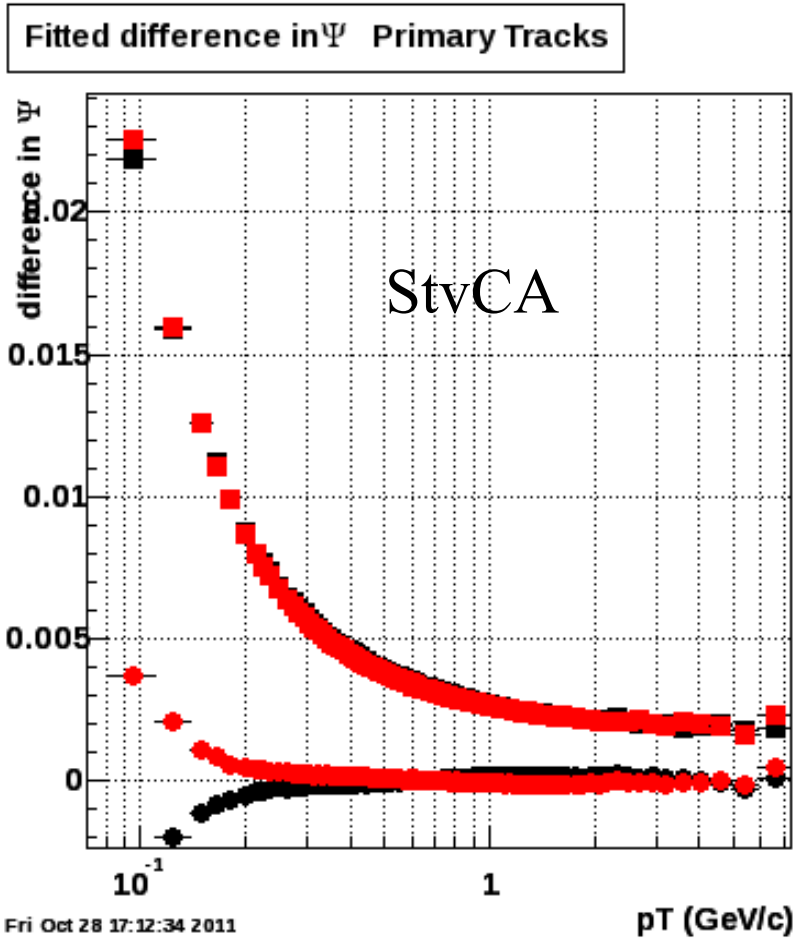
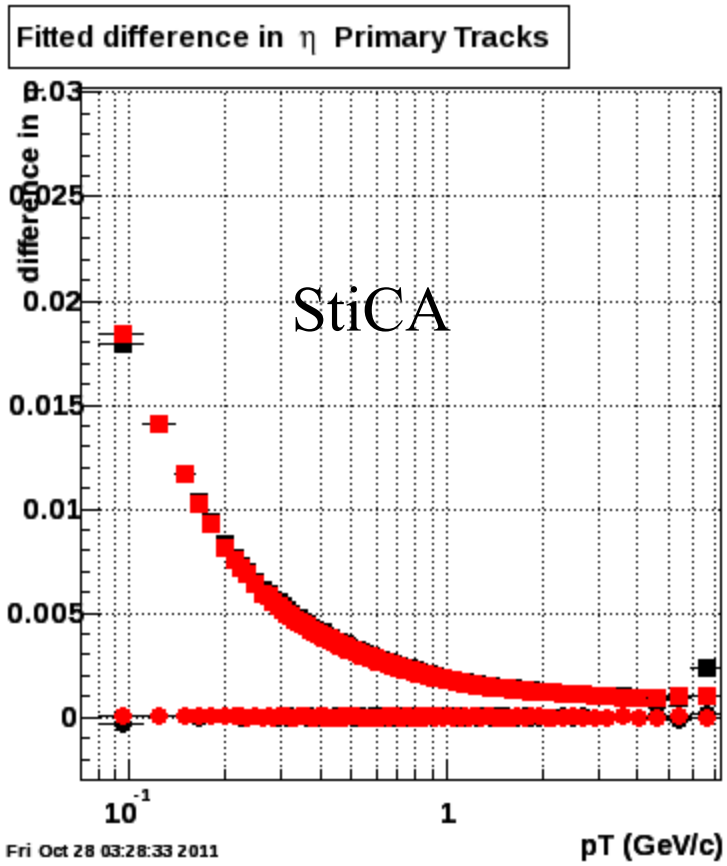
Resolution in ψ versus p_T

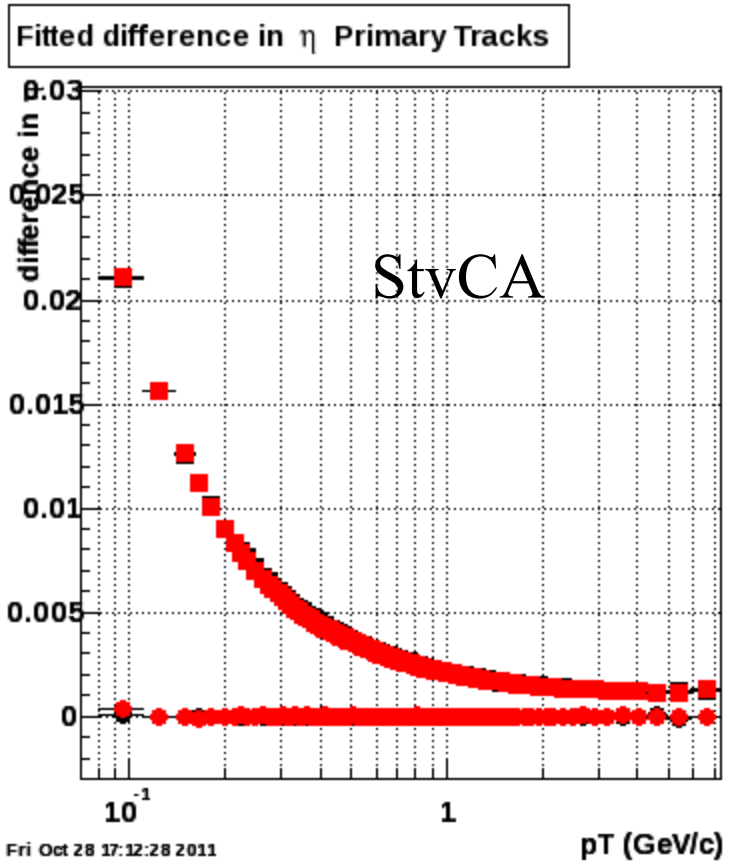




Stv resolution in ψ is slightly worse than Sti

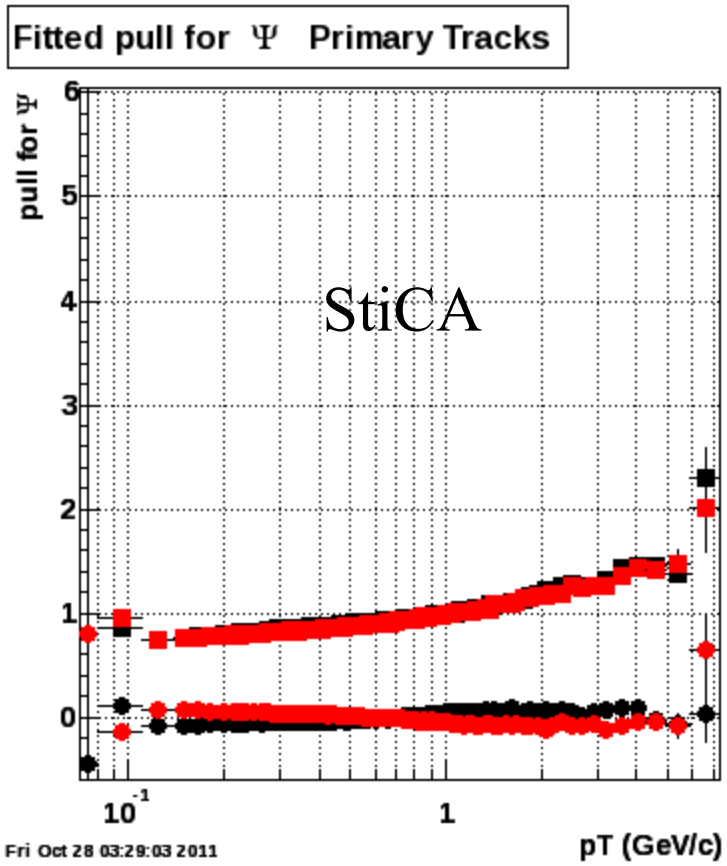
Resolution in η versus p_T

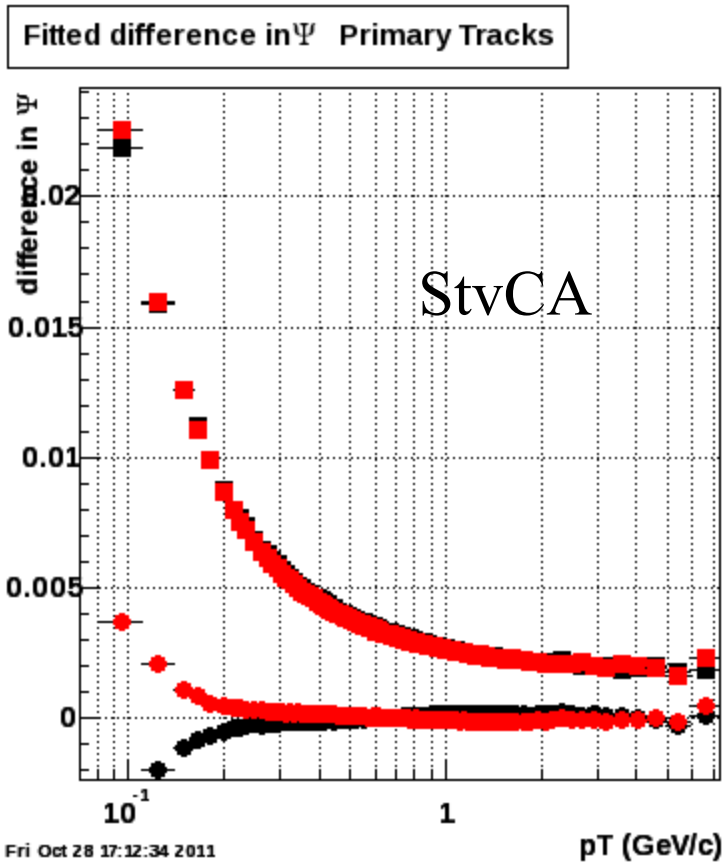




Sti and Stv do not show difference.

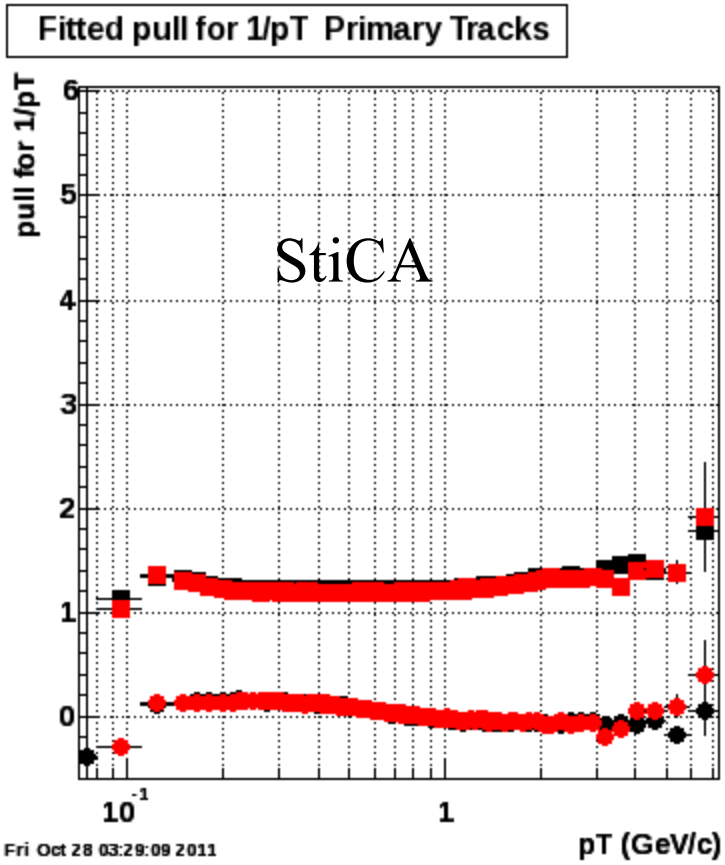
Pulls in ψ versus p_T

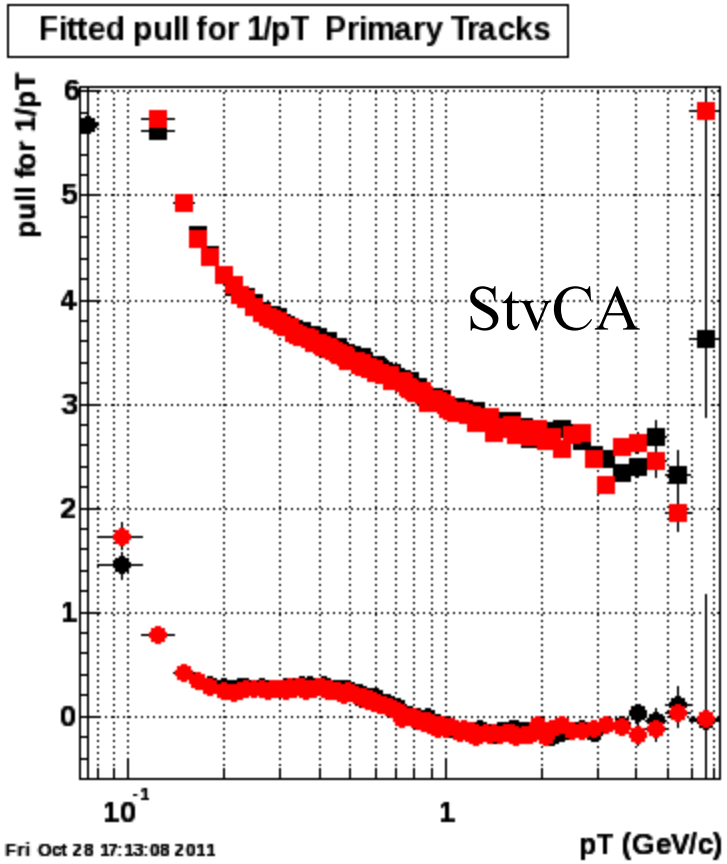




Stv has weird pull ψ dependence on p_T. This might indicate a problem with material accounting.

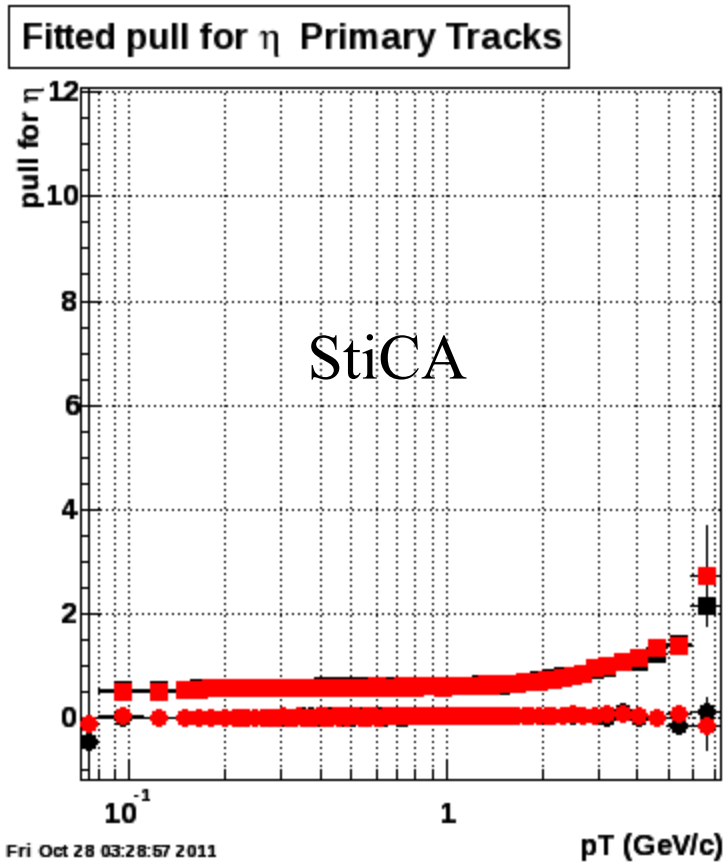
Pulls in $1/p_T$ versus p_T

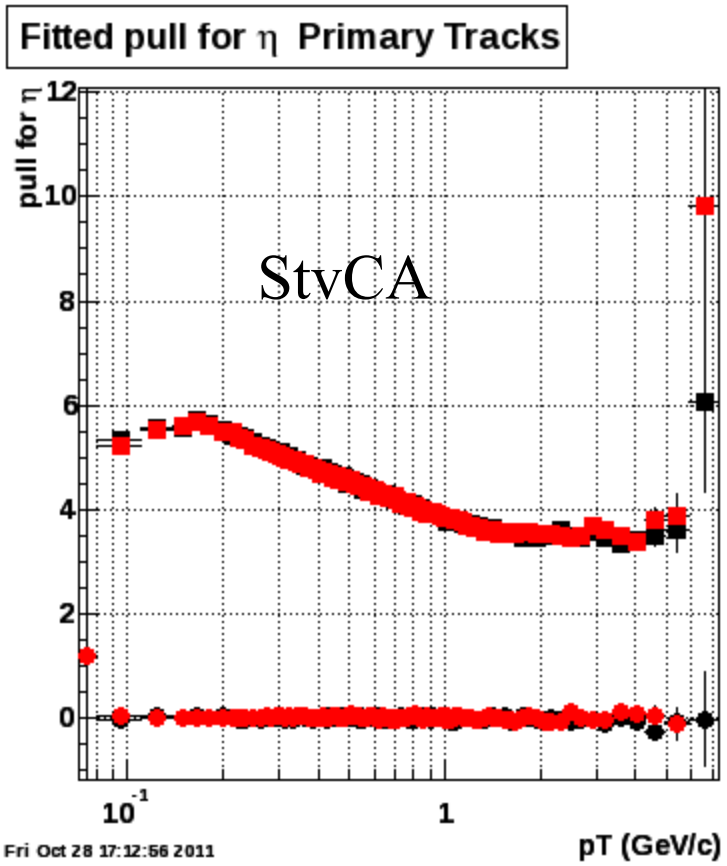




StvCA pull for p_T shows clear p_T dependence which is not seen for StiCA.

Pulls in η versus p_T





Pull σ in η for StvCA is a factor ~4 higher than it is expected. The momentum dependences for StiCA and StvCA have opposite trends.

Track parameters summary

	StiCA/Sti	Stv(CA)/StiCA
Hit residuals	(+) the same	(+) looks better
Hit pulls	(+) the same	(-) Measurement σ is over estimated by 50%
DCA σ	(+)	(-) +50%
All: χ^2 /NDF dependences	(?)	(-) overestimated by a factor of ~3
NFP: χ_{Vx}^2 /NDF	(+)	(-) overestimated by a factor > 3
$1/p_T$ resolution	(+) the same	(-) ~50 % worse
Resolution in ψ	(+) the same	(-) slightly worse
Pulls	(+) the same	(-) looks worse

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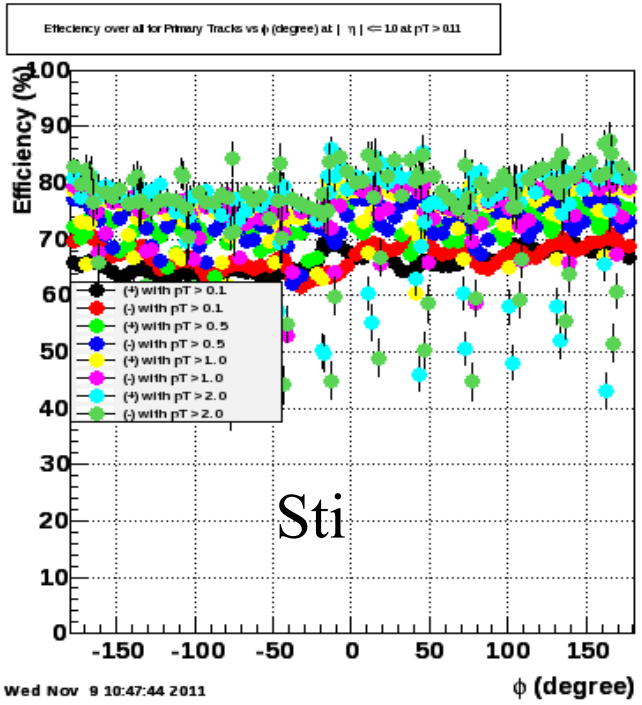
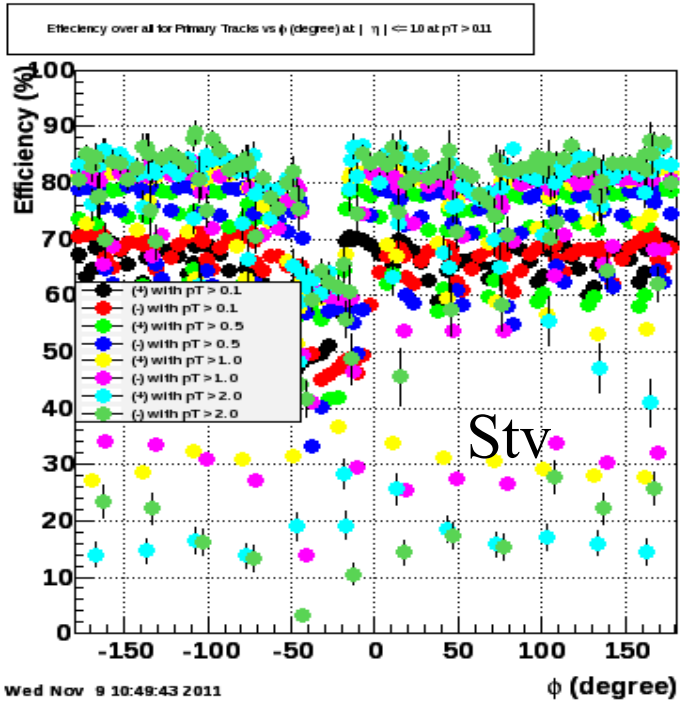
Primary track reconstruction efficiencies

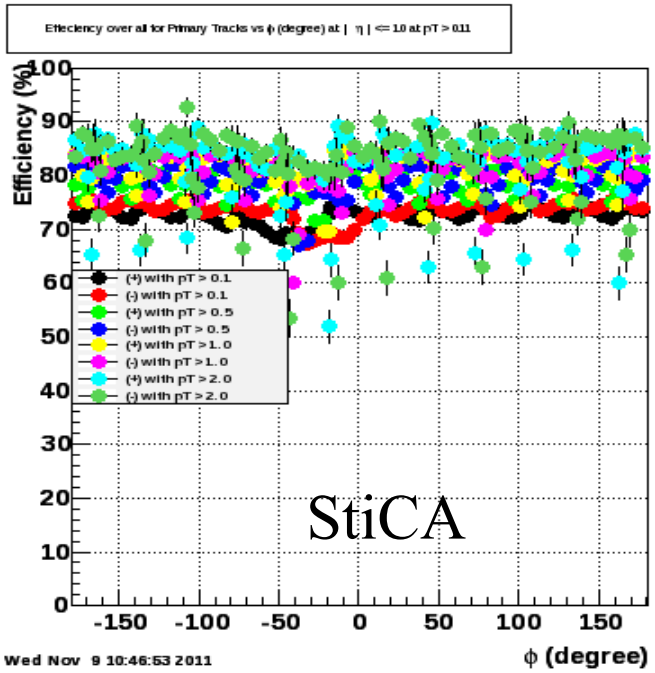
- Efficiency for track with only match between MC and RC
- Clones, for multiple (>1) match between single MC track to RC one,
- Lost tracks, MC tracks which have no RC partner.
- Ghost tracks, RC tracks which have no MC partner.

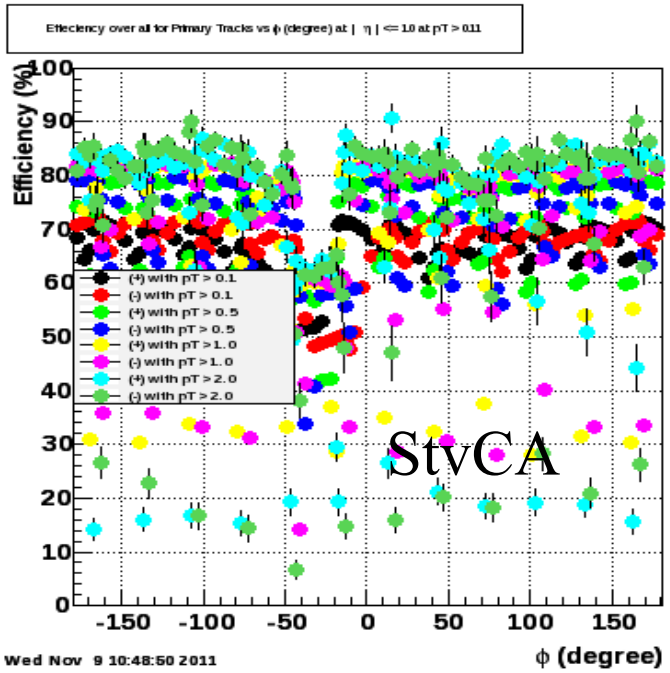
Herein it will be presented efficiency with respect to all MC tracks (on the Web site mentioned above there are plots for efficiency with respect to TPC geometrical acceptance).

φ



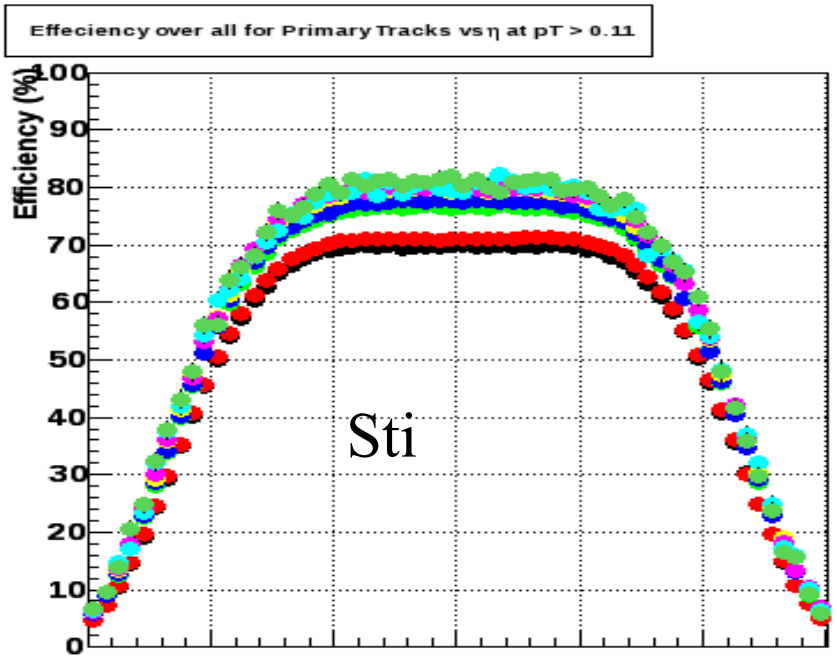


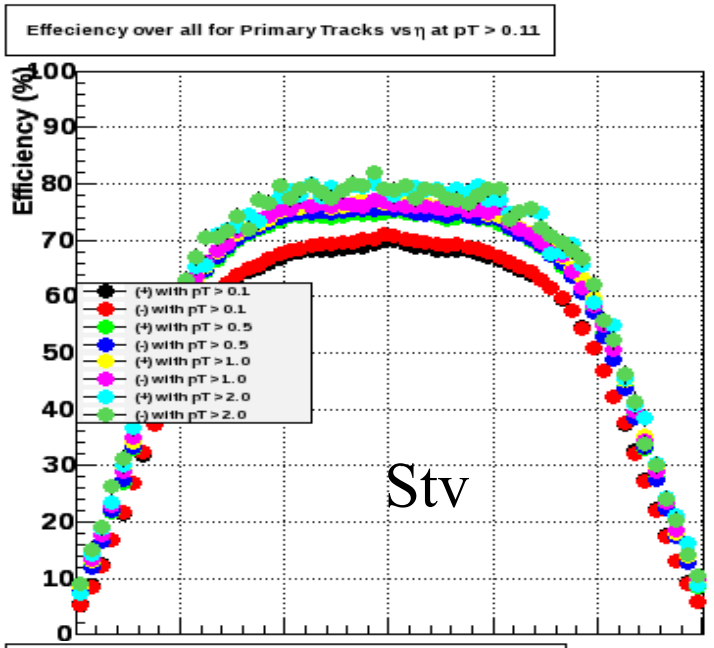




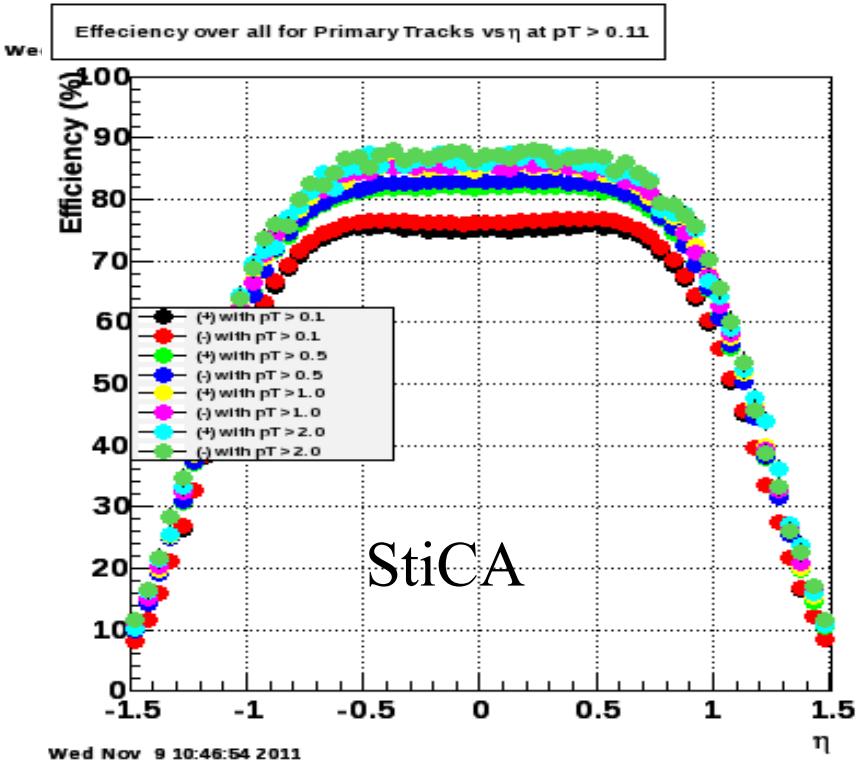
Colors are specified p_T Cut from (0.1 to 2GeV/c) => (**black** to light green).

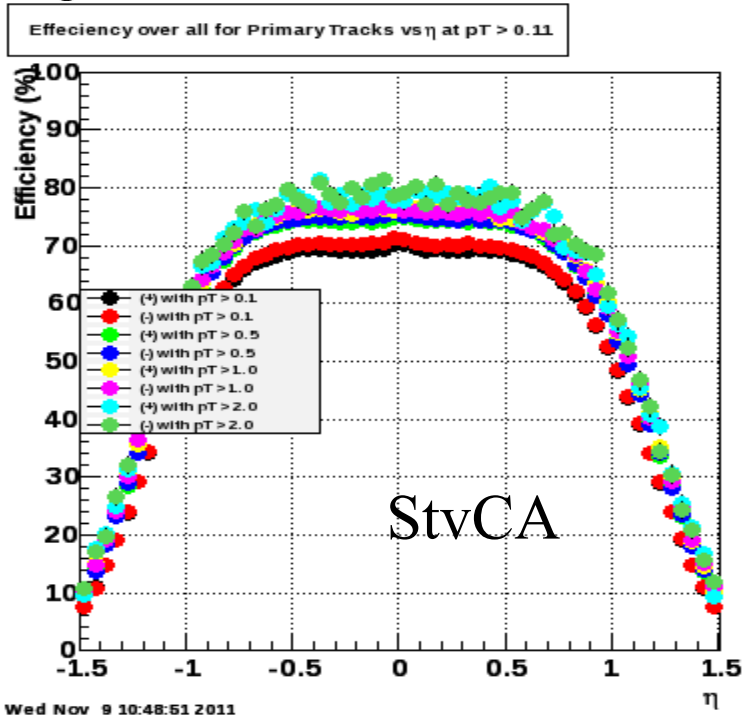
StiCA > Sti.
Stv & StvCA have gap at φ ~45°.
Stv ≅ StvCA.
Stv(CA) are more sensitive to sector edges.
Stv(CA) < StiCA

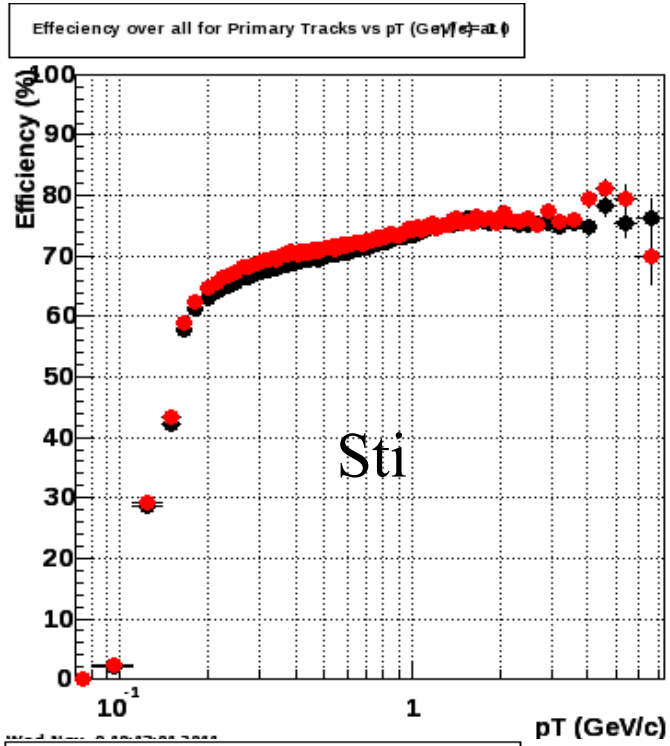


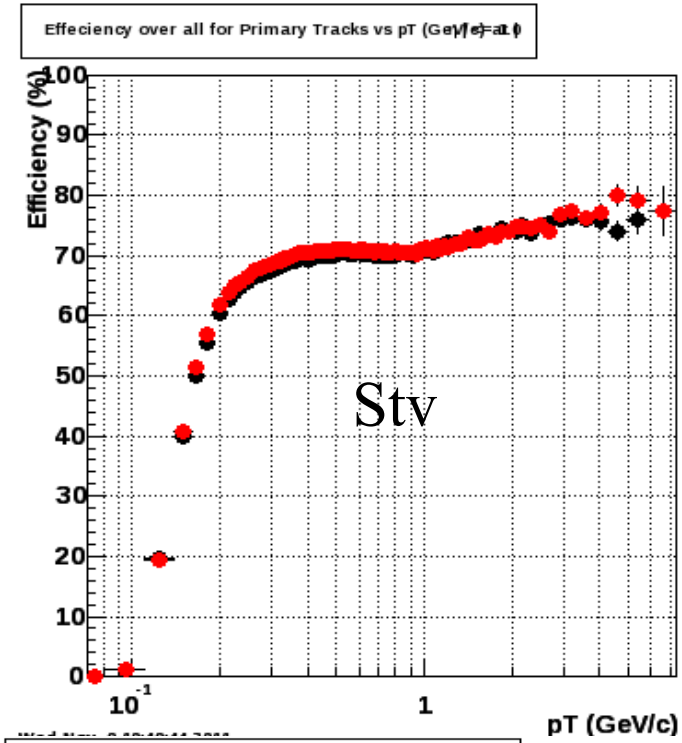


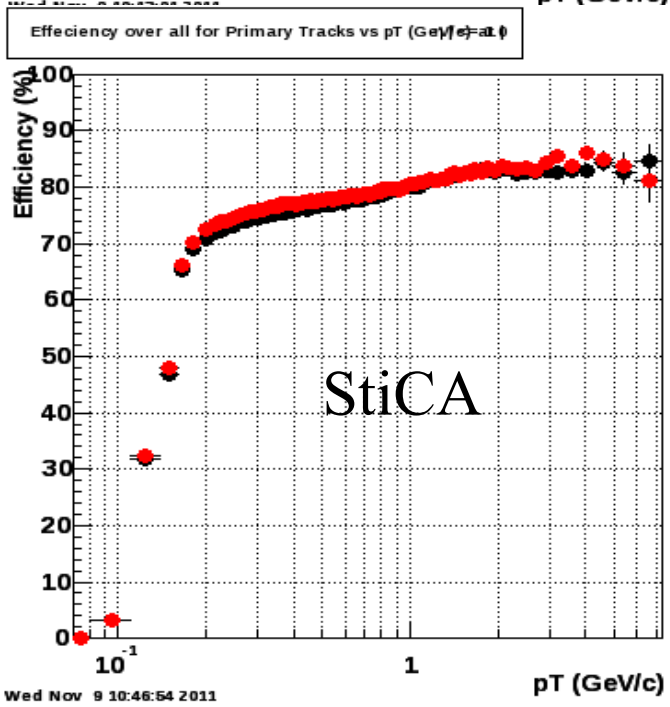
StiCA > Sti,
StvCA >Stv,
StiCA >
StvCA

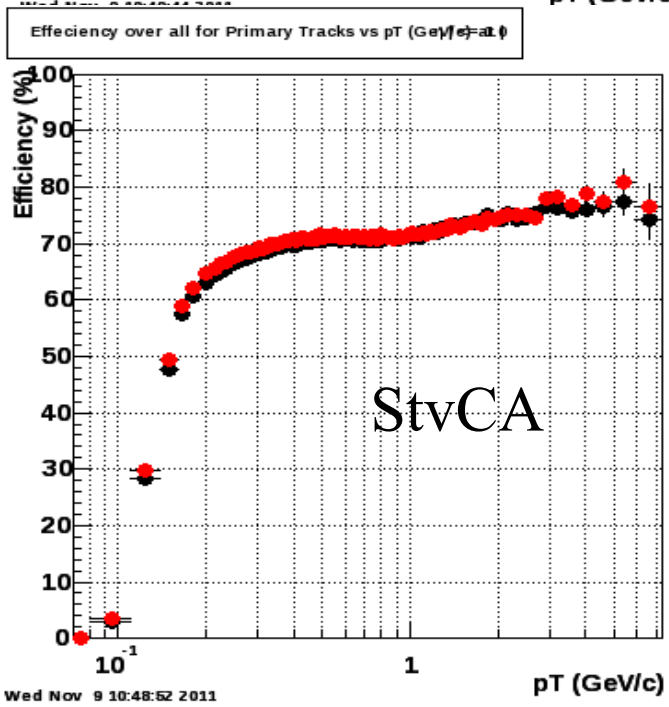






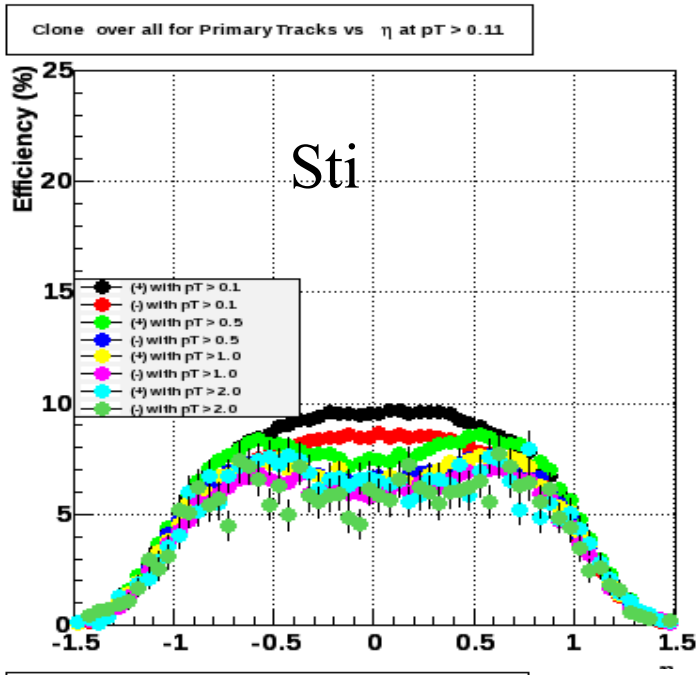


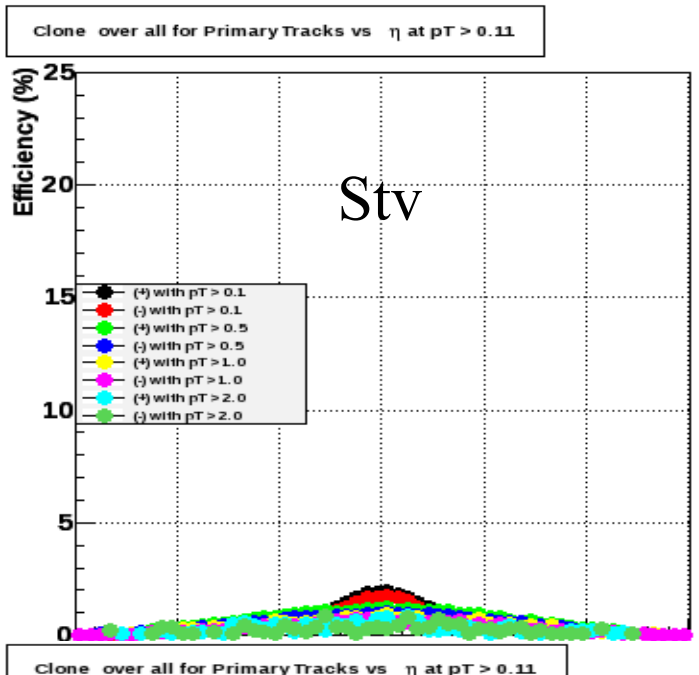


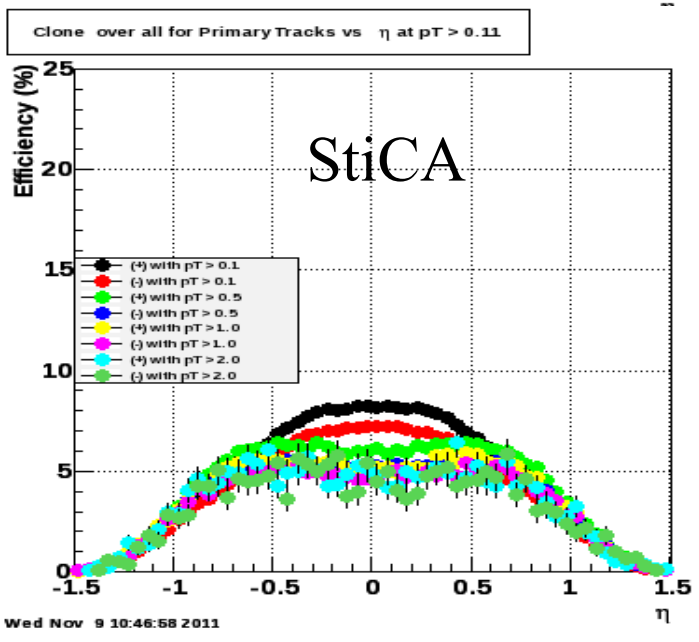


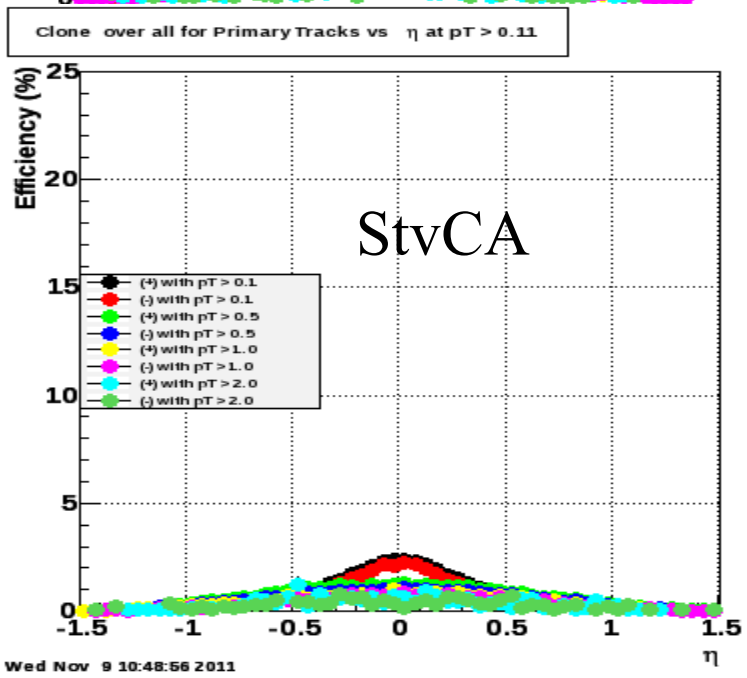
StiCA > Sti,
Sti > Stv,
Stv ~ StvCA
StiCA > StvCA

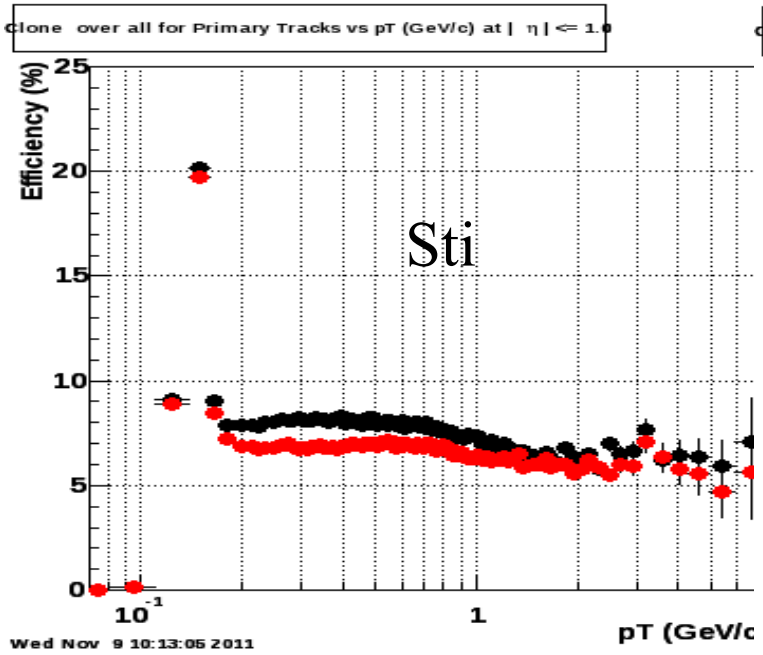
Clones

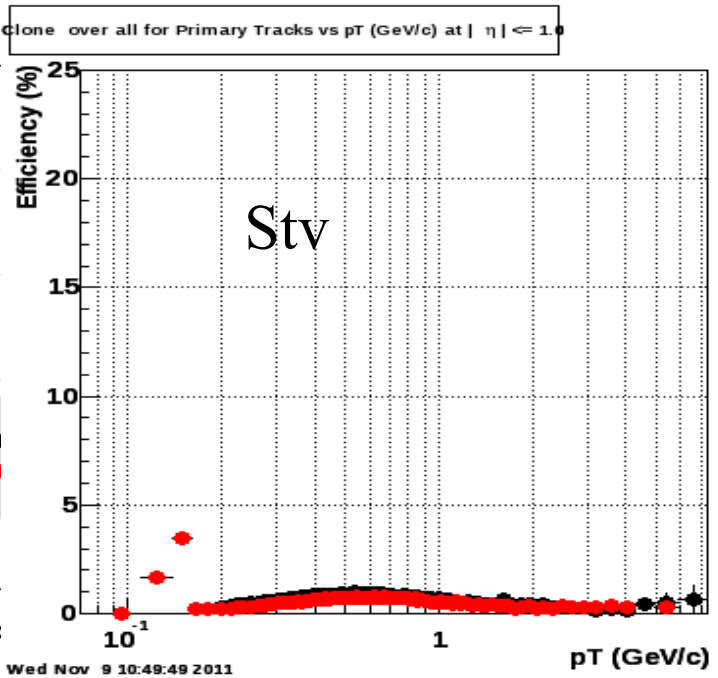

Clone over all for Primary Tracks vs η at pT > 0.11
Efficiency (%)
Sti
(+) with pT > 0.1
(-) with pT > 0.1
(+) with pT > 0.5
(-) with pT > 0.5
(+) with pT > 1.0
(-) with pT > 1.0
(+) with pT > 2.0
(-) with pT > 2.0

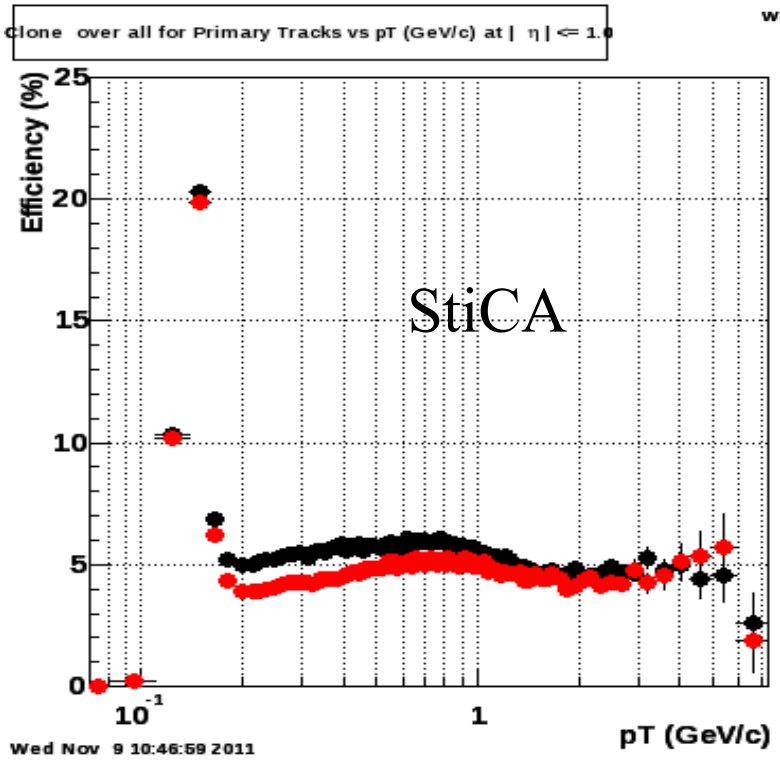

Clone over all for Primary Tracks vs η at pT > 0.11
Efficiency (%)
Stv
(+) with pT > 0.1
(-) with pT > 0.1
(+) with pT > 0.5
(-) with pT > 0.5
(+) with pT > 1.0
(-) with pT > 1.0
(+) with pT > 2.0
(-) with pT > 2.0

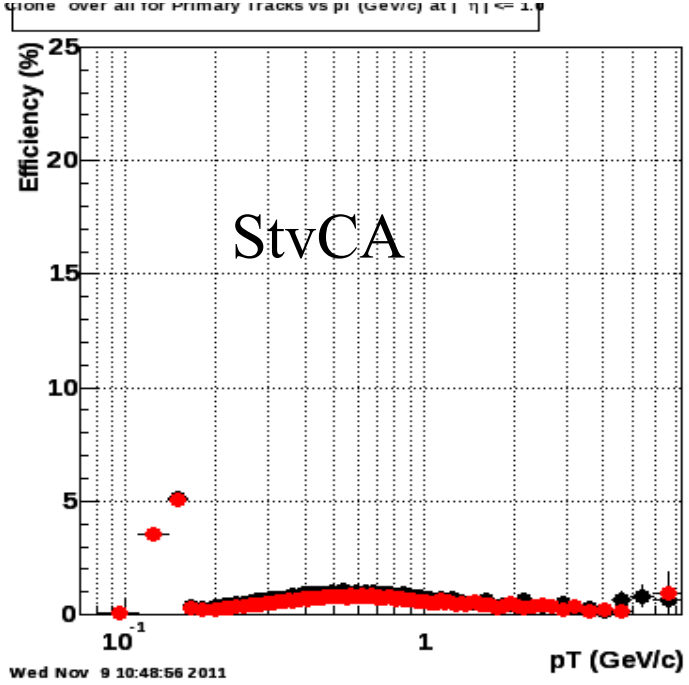

Clone over all for Primary Tracks vs η at pT > 0.11
Efficiency (%)
StiCA
(+) with pT > 0.1
(-) with pT > 0.1
(+) with pT > 0.5
(-) with pT > 0.5
(+) with pT > 1.0
(-) with pT > 1.0
(+) with pT > 2.0
(-) with pT > 2.0
η
Wed Nov 9 10:46:58 2011


Clone over all for Primary Tracks vs η at pT > 0.11
Efficiency (%)
StvCA
(+) with pT > 0.1
(-) with pT > 0.1
(+) with pT > 0.5
(-) with pT > 0.5
(+) with pT > 1.0
(-) with pT > 1.0
(+) with pT > 2.0
(-) with pT > 2.0
η
Wed Nov 9 10:48:56 2011



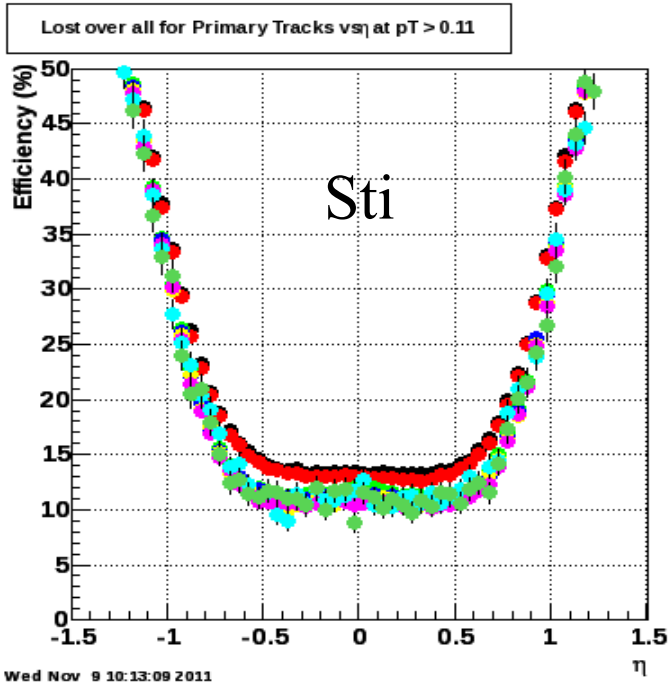


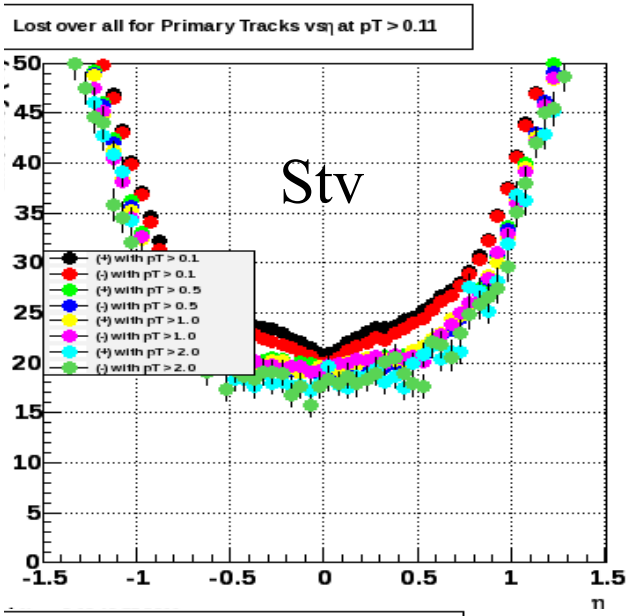


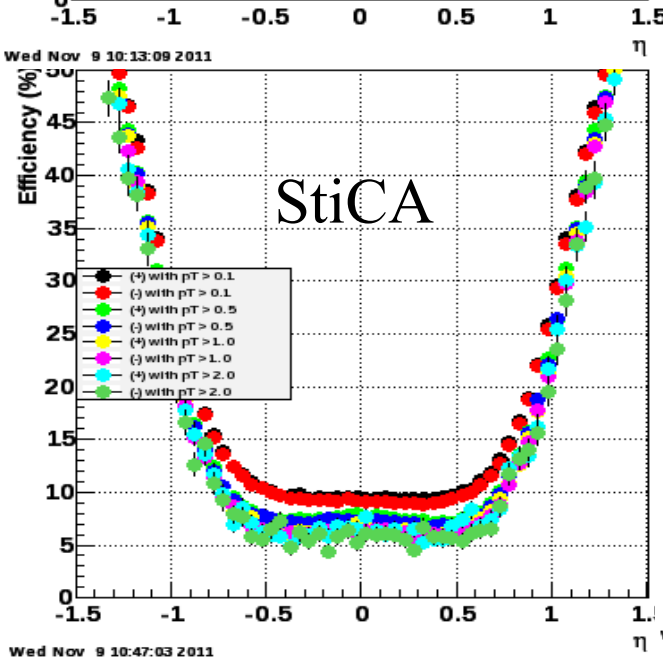


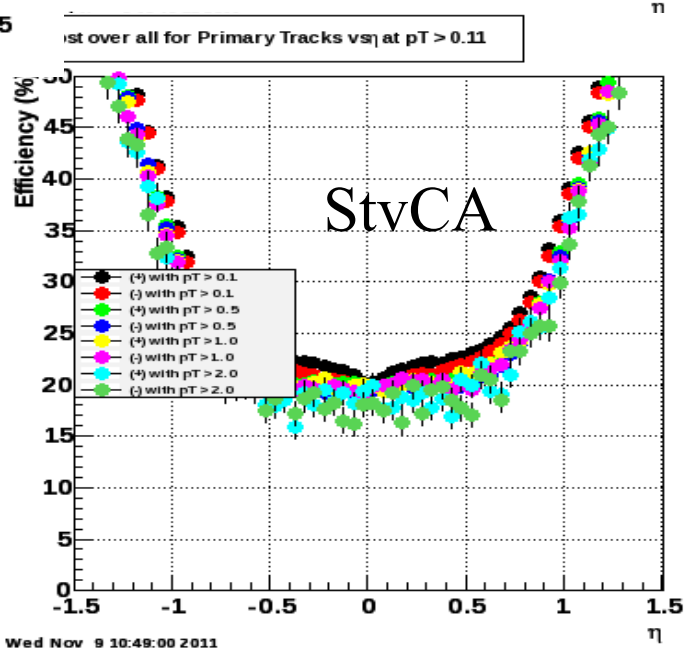
Clones are splitted tracks and loopers. Loopers have p_T < 200 MeV/c. Both Sti and StiCA have the same no. of loopers. No. of splitted tracks in StiCA has reduced. Stv(CA) has smaller amount of loopers and splitted tracks.

Lost tracks ➔ Overall track reconstruction inefficiency

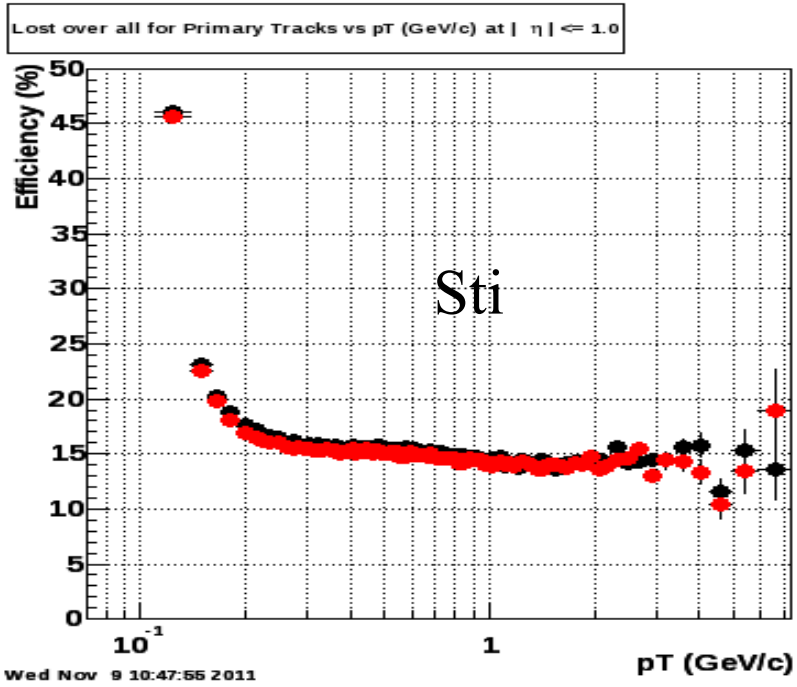


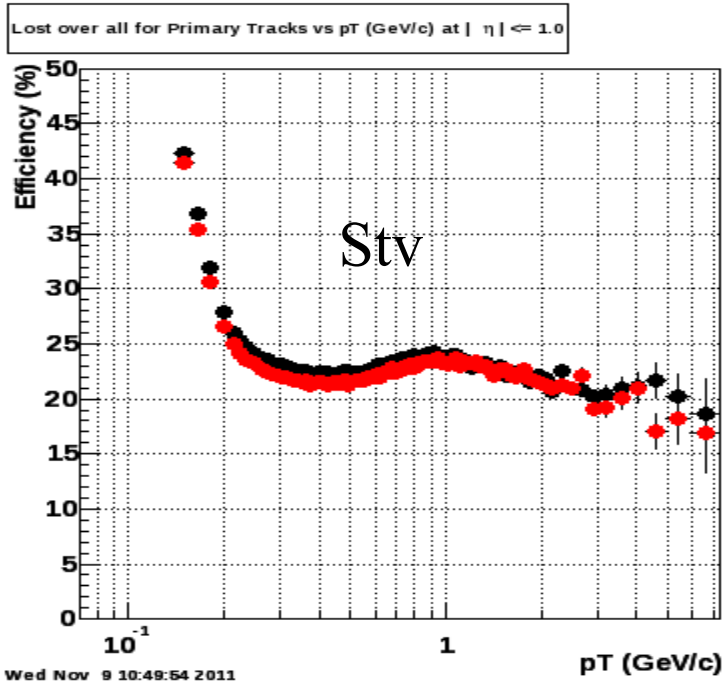




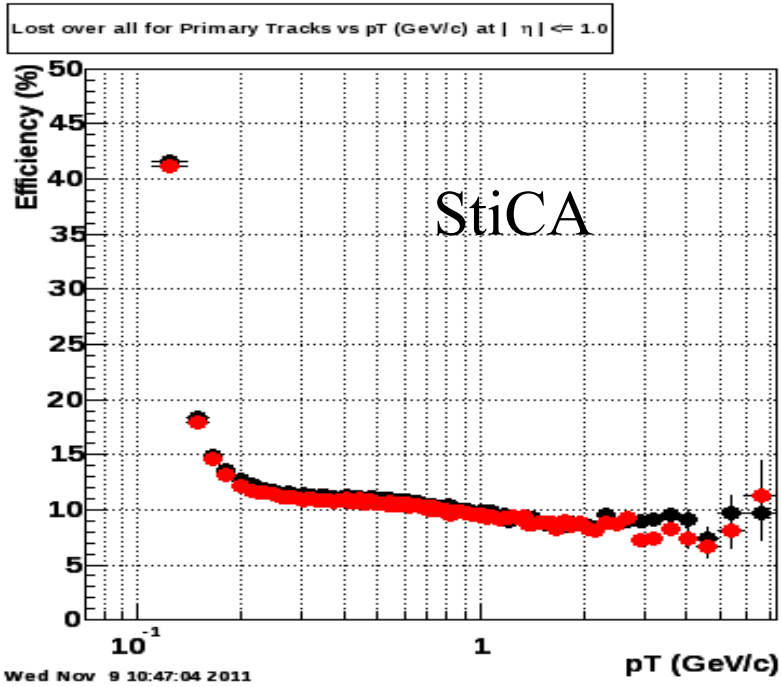


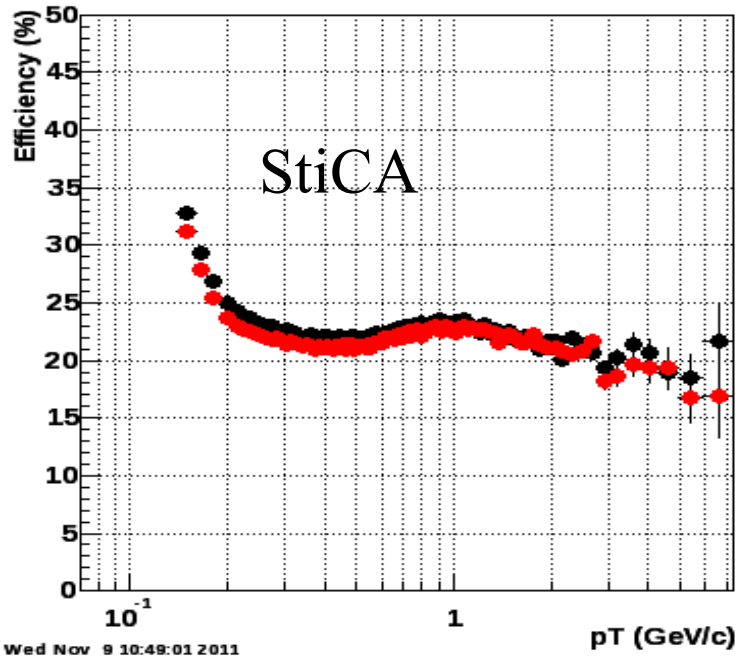
Stv ~ StvCA
Stv > Sti > StiCA





Stv > StvCA > Sti > StiCA





Track efficiency summary

	StiCA/Sti	Stv(CA)/StiCA
Efficiency	(+) ~5%	(-) – 5%

time	StiCA/Sti	Stv/Sti	StvCA/Sti
CPU/event	(+) 0.75	(-) 2	(-) 2

TbyT	StiCA/Sti	Stv/StiCA
No. fit points	(+) 1	(+1)
Efficiency for global tracks	(+) 7%	(+) 2%
Efficiency for primary tracks	(+) 2%	(+) 1%
$1/p_T$ difference for globals	(+) No	(+) < 0.1 %
$1/p_T$ difference for primaries	(+) No	(?) ~0.5 %

MC	StiCA/Sti	Stv(CA)/ StiCA
Efficiency	(+) ~5%	(-) – 5%

MC	StiCA/Sti	Stv(CA)/StiCA
Hit residuals	(+) the same	(+) looks better
Hit pulls	(+) the same	(-) Measurement σ is over estimated by 50%
DCA σ	(+)	(-) +50%
All: χ^2 / NDF dependences	(?)	(-) overestimated by a factor of ~3
NFP: χ_{Vx}^2 / NDF	(+)	(-) overestimated by a factor > 3
$1/p_T$ resolution	(+) the same	(-) ~50 % worse
Resolution in ψ	(+) the same	(-) slightly worse
Pulls	(+) the same	(-) looks worse