Track based vertexing at level 3

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Improvements

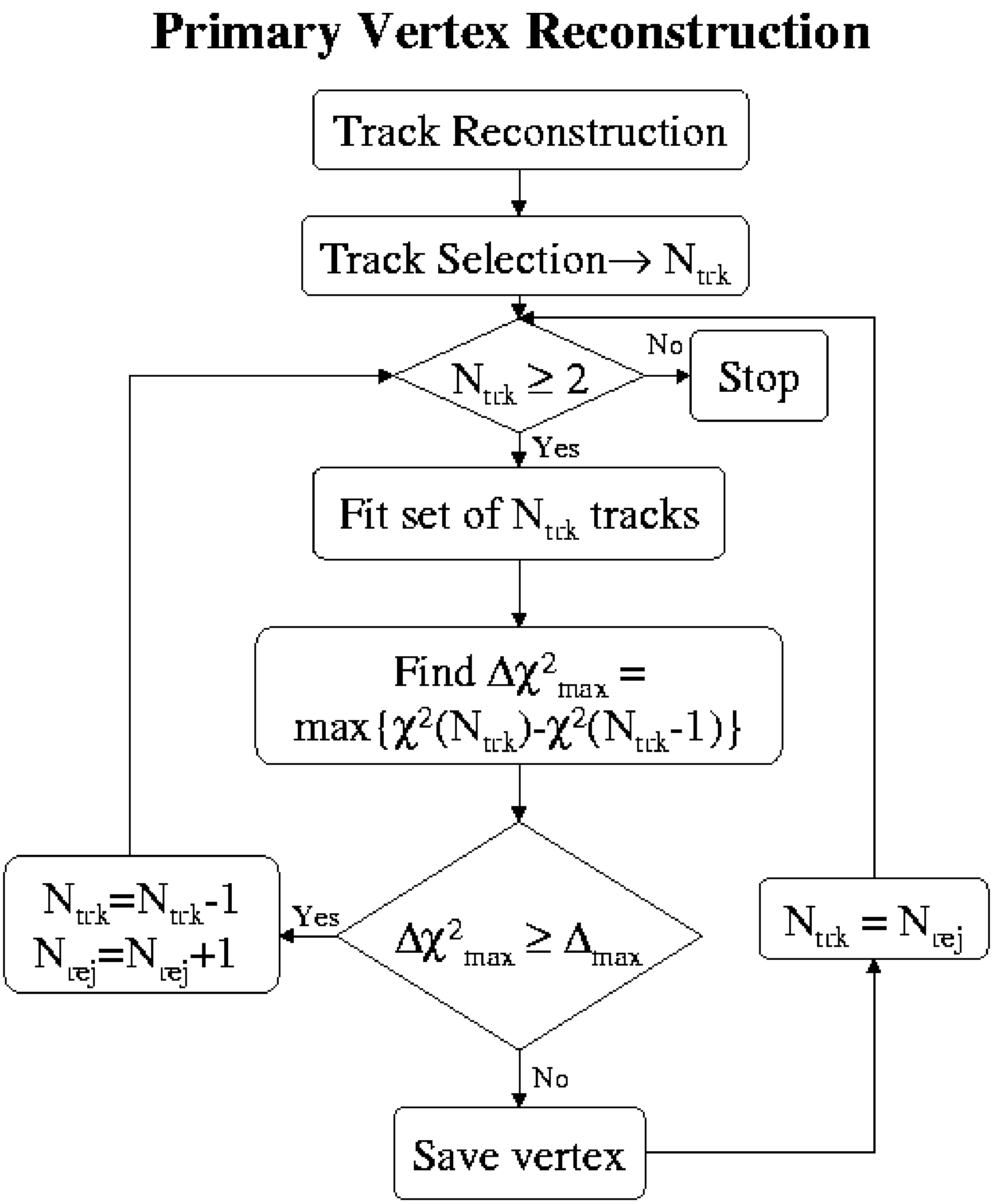
- Implemented offline primary and secondary vertex finding algorithms (DØNote 3560)
- DCA track error as a function of smt hits and p_t
- Retuned track selection parameters

Track selection

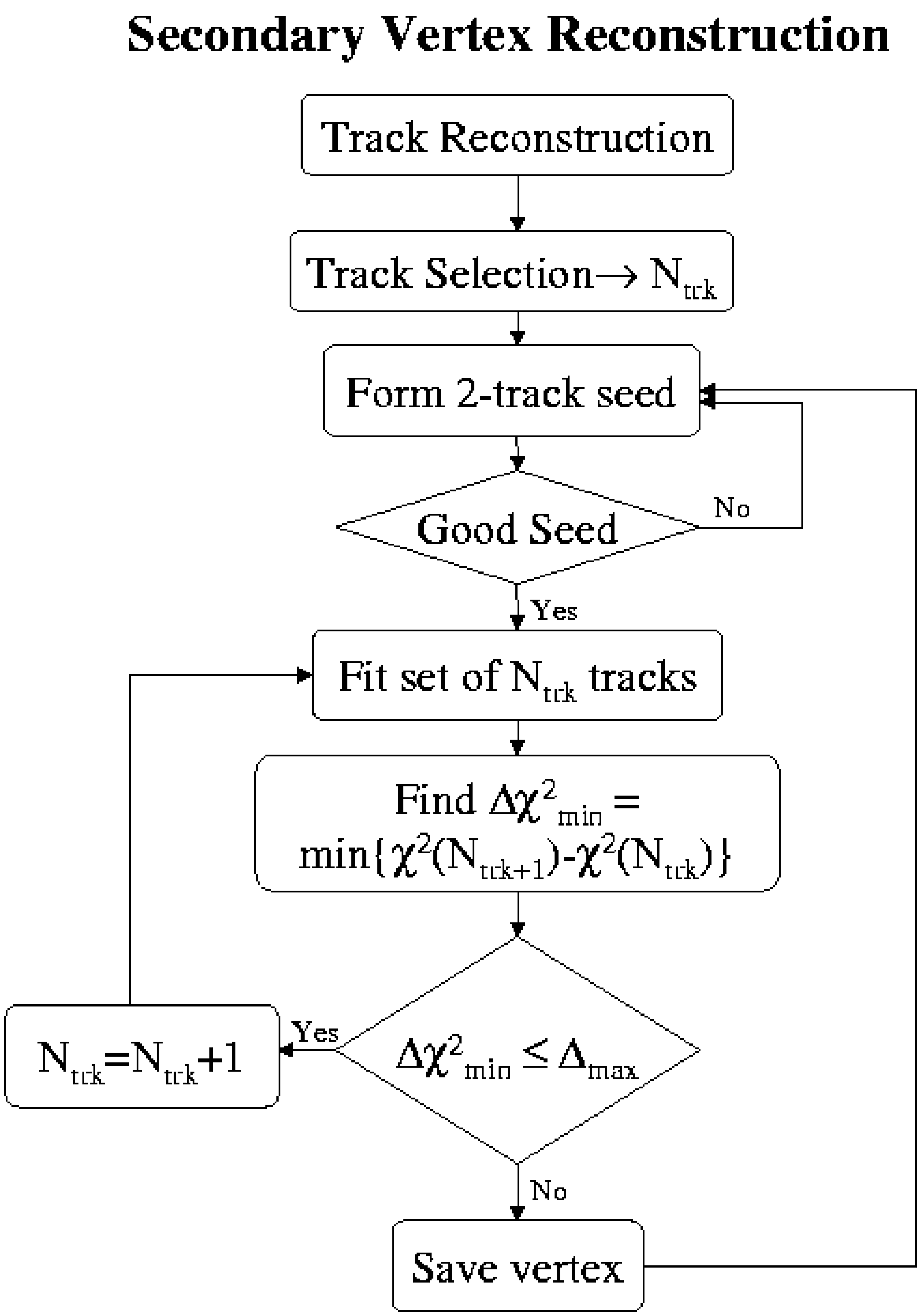
1. $\boldsymbol{\chi^2_{xy}} < 50.0$
2. $\boldsymbol{\chi^2_{z}} < 50.0$
3. $\boldsymbol{N_{SMThitsxy}} \geq 3$
4. $\boldsymbol{Z_0 - Z_{vertex}} < 1\text{cm}$
5. DCA PV $< 100\boldsymbol{\mu}$m
6. DCA SV < 1mm

PV algorithm takes tracks with DCA $< 100\mu$m.
SV algorithm takes tracks with a DCA < 1mm $+$ tracks rejected by PV algorithm

Primary vertexing algorithm



Secondary vertexing algorithm



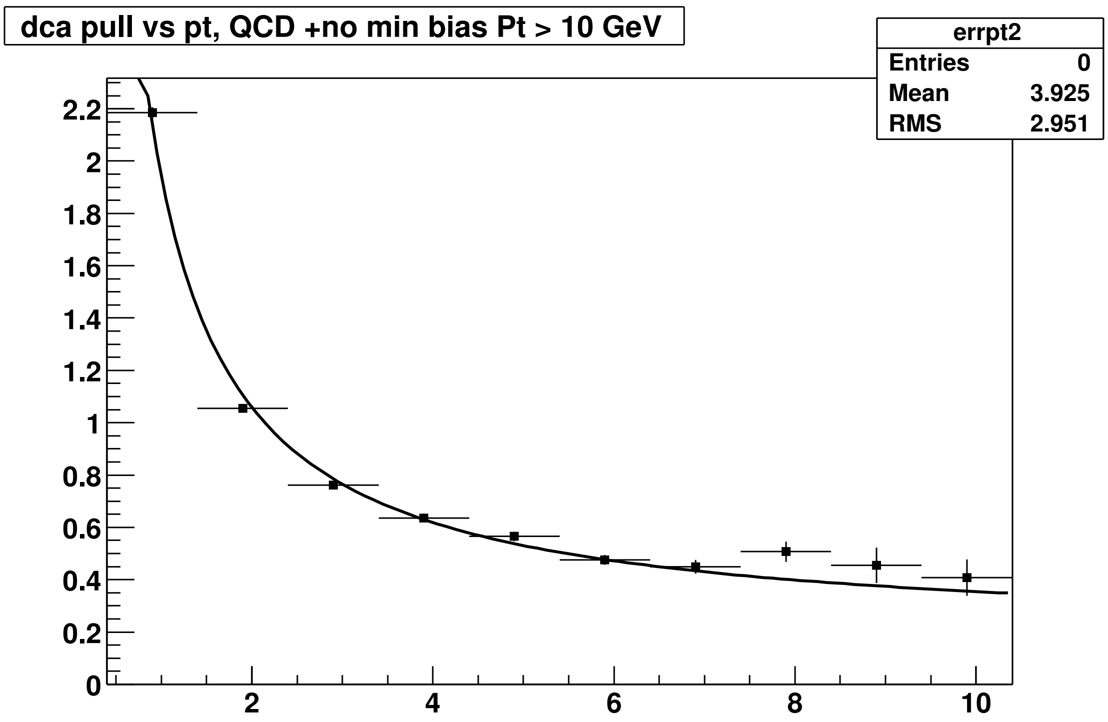
DCA errors

Error described by

$$\sigma_{tot}{}^2 = \sigma_{SMThits}{}^2 F(p_t)^2$$

where

$$F(p_t) = F_0 + F_{-1}/p_t$$



Data samples

MC - smeared by 30 μm

- QCD $p_t > 10$ Gev + 0.5 min bias, 50000 events
- $b\bar{b}$ $p_t > 2$ Gev + 0.5 min bias, 12000 events
- $b\bar{b}$ $p_t > 100$ Gev + 0.5 min bias, 19000 events

Efficiency Number good vertices (residual < 100 μm)/Number findable vertices

Purity Number good vertices (residual < 100 μm)/Number returned vertices

Findable vertex has at least two charged tracks with

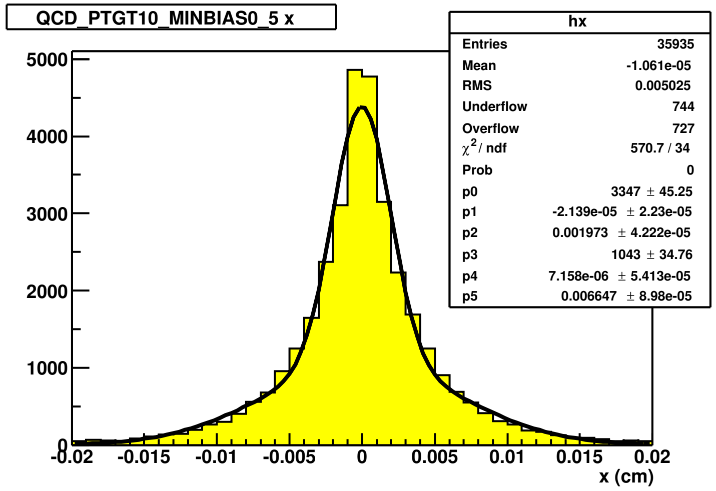
- $p_t > 0.4$
- $\eta < 1.6$

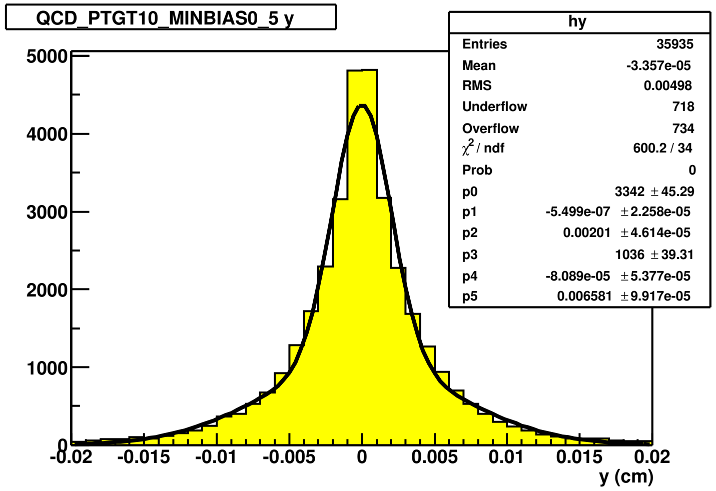
in addition, I require a correct Z vertex (residual $<$ 1cm)

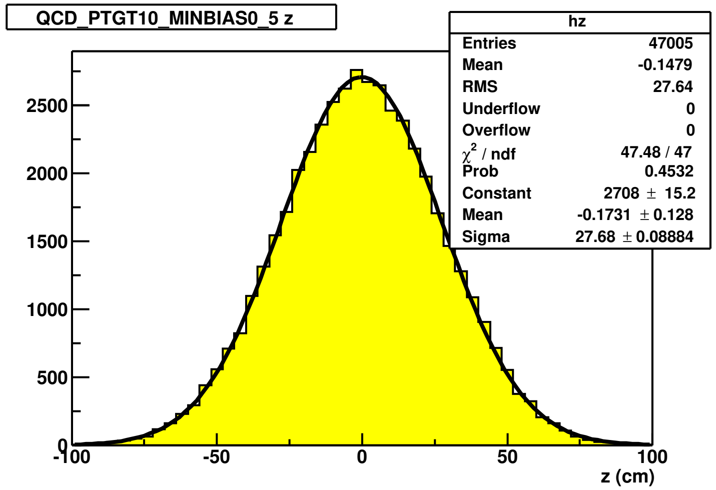
REAL DATA

run 166892, 50000 events, no particular trigger selected

MC QCD $p_t > 10$GeV + 0.5 minbias



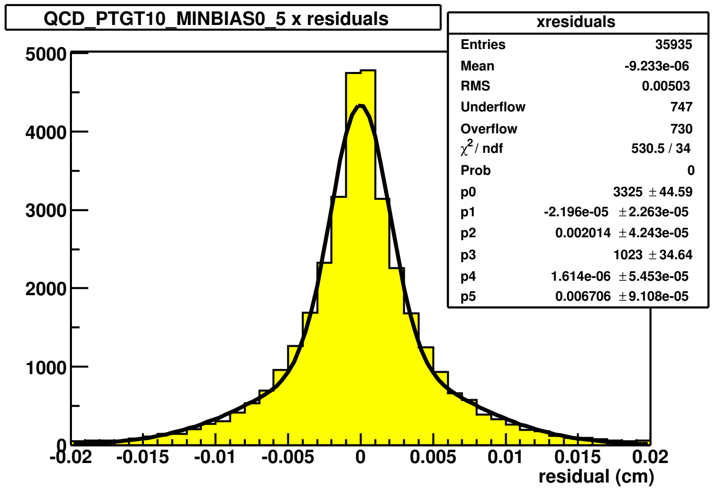


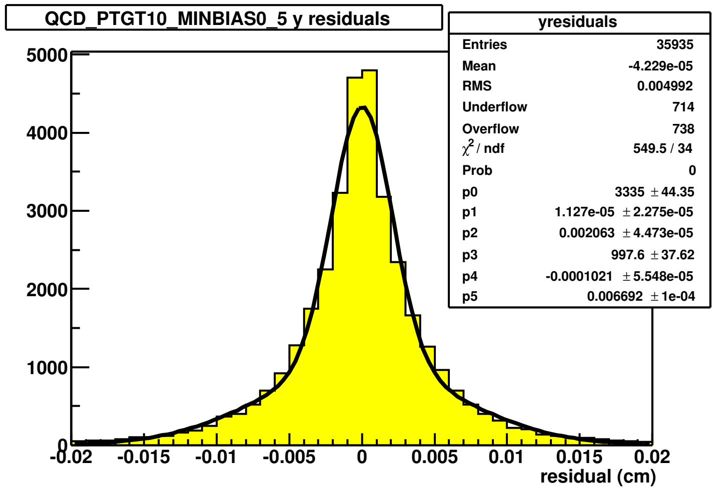


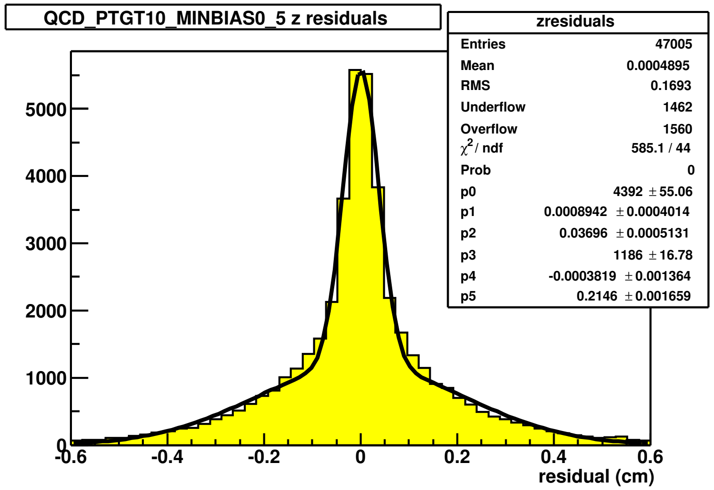
Ratio of z vertices = 0.9401

Ratio of xy vertices = 0.7187

MC QCD $p_t > 10\text{GeV} + 0.5$ minbias





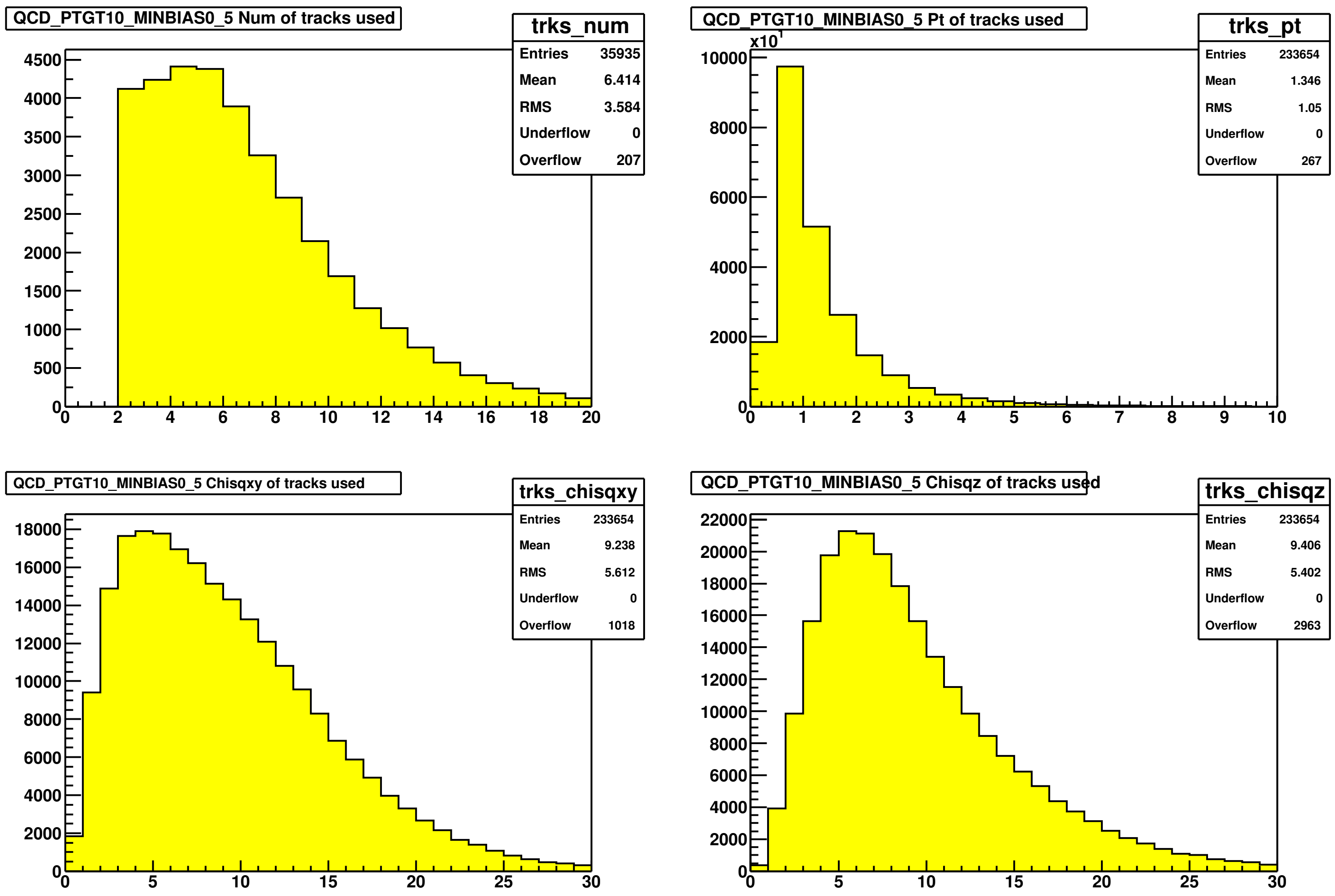


Efficiency in Z = 0.901134

Purity in Z = 0.958494

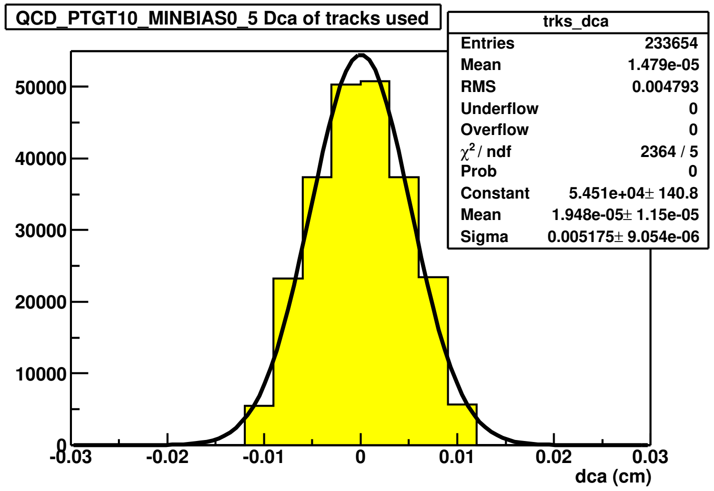
Efficiency in XY = 0.65204

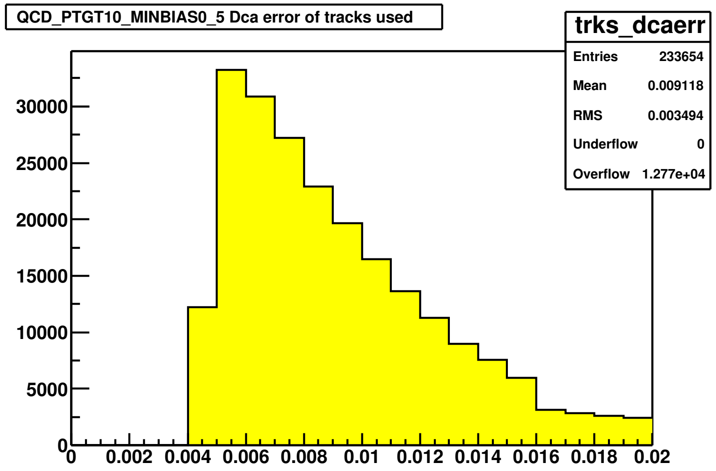
Purity in XY = 0.817504

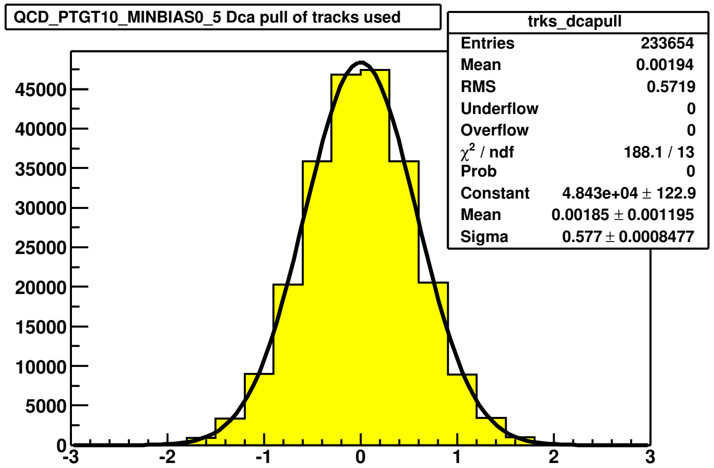


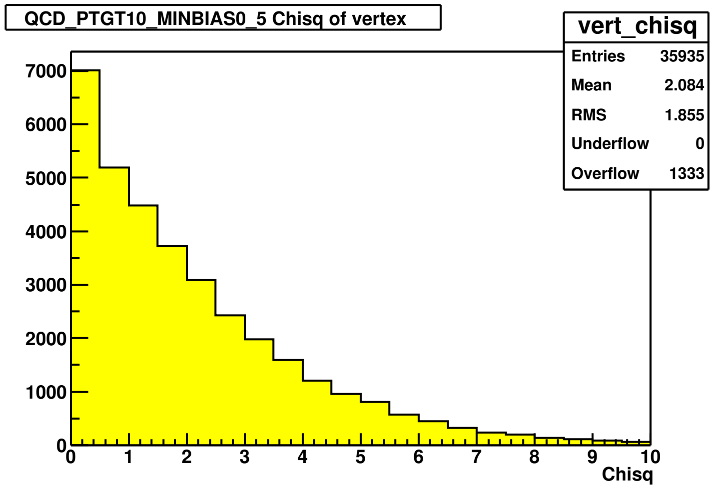
MC QCD $p_t > 10$GeV + 0.5 minbias

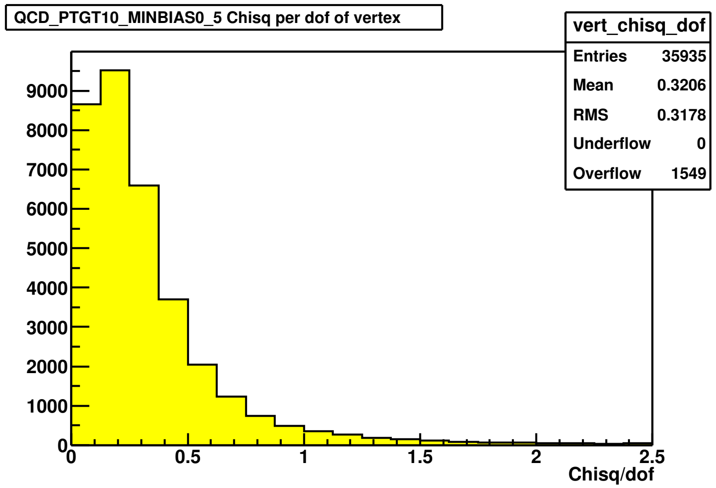
MC QCD $p_t > 10$GeV + 0.5 minbias



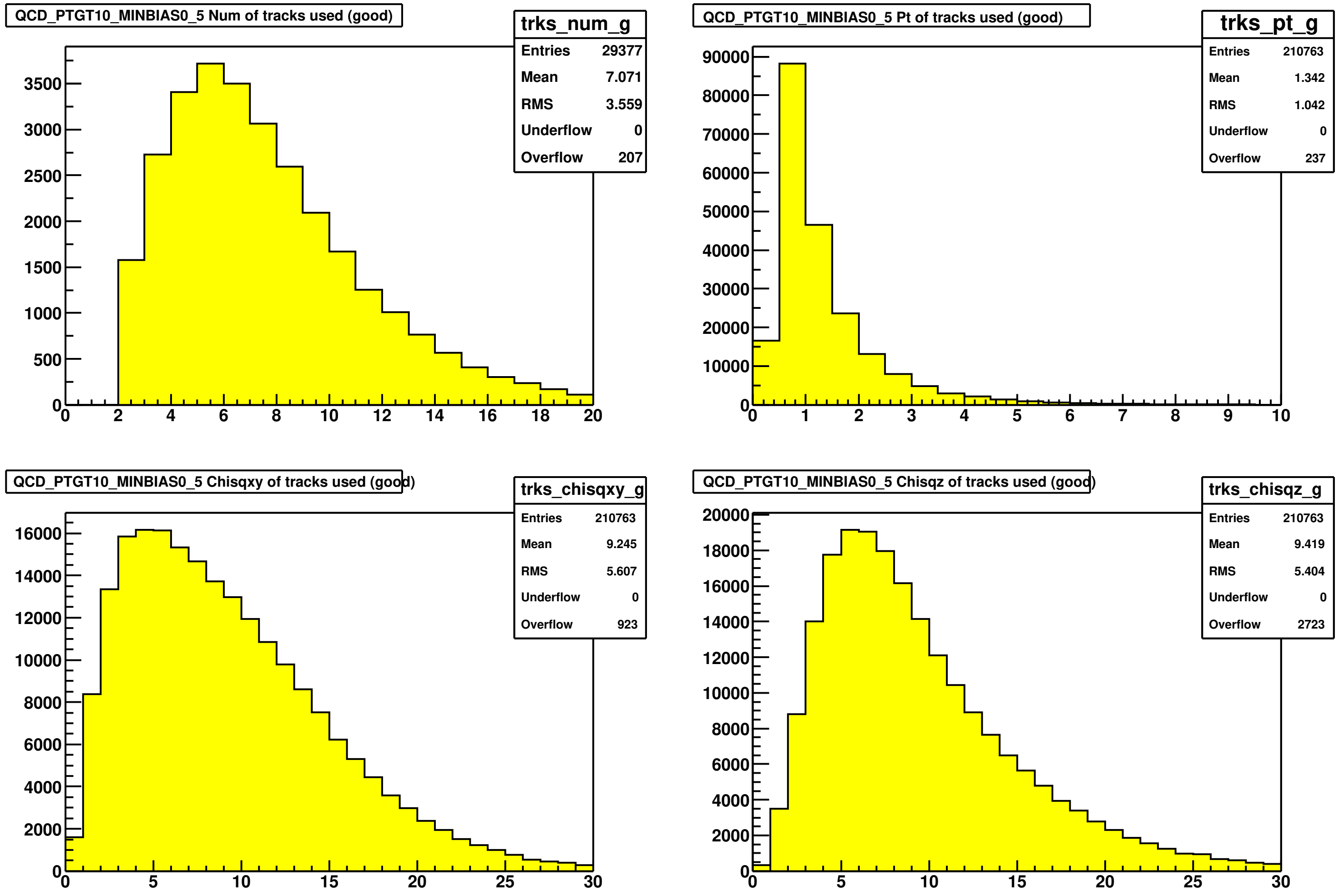




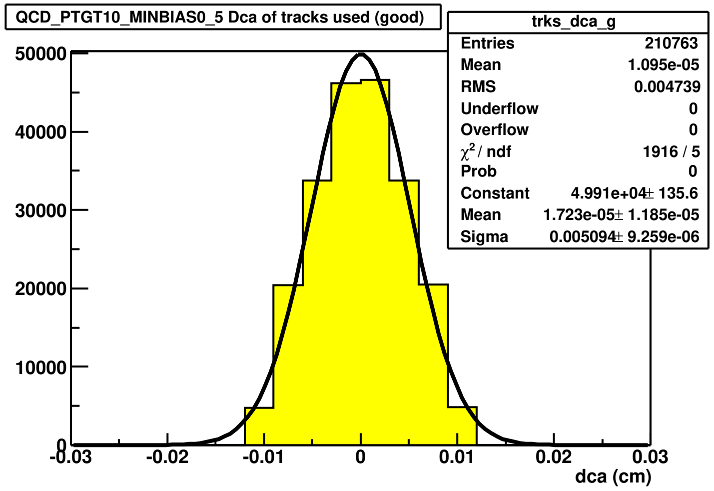


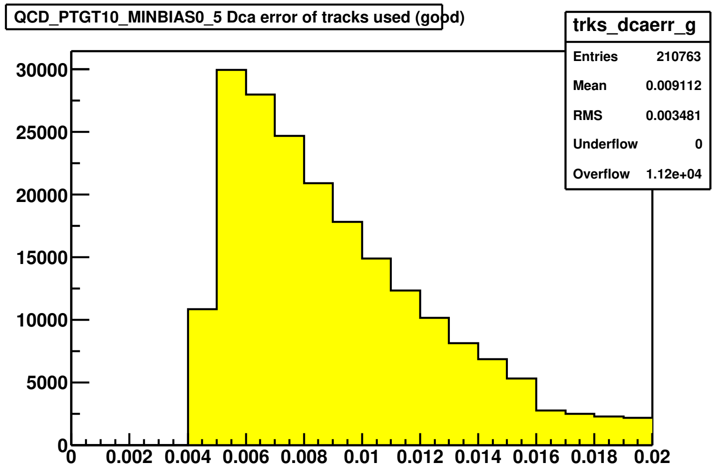


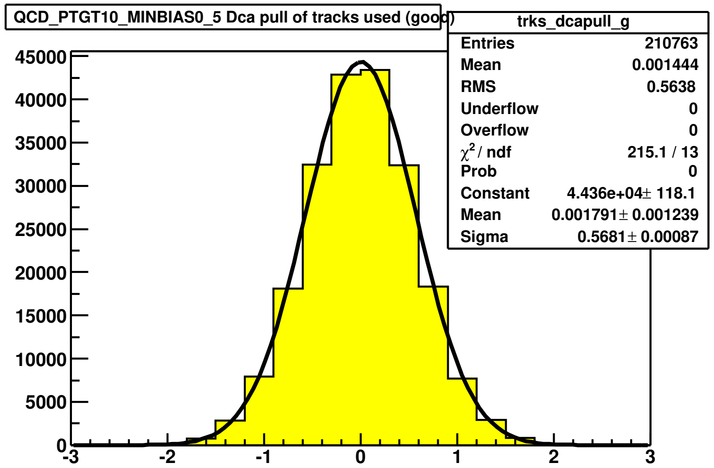
MC QCD $p_t > 10$GeV $+$ 0.5 minbias



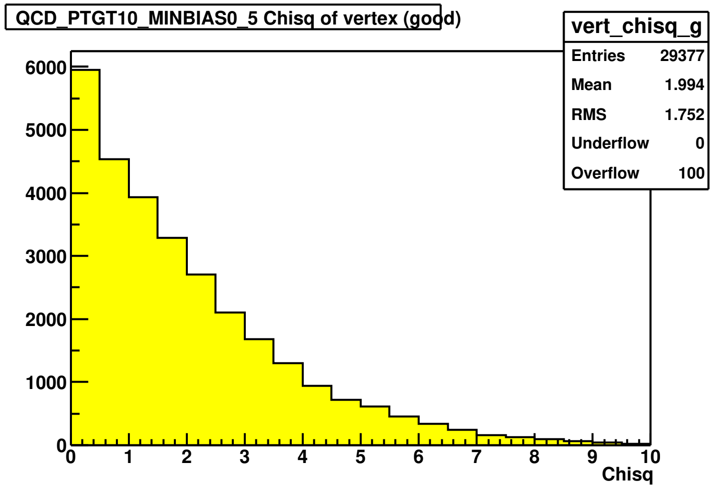
MC QCD $p_t > 10$GeV + 0.5 minbias

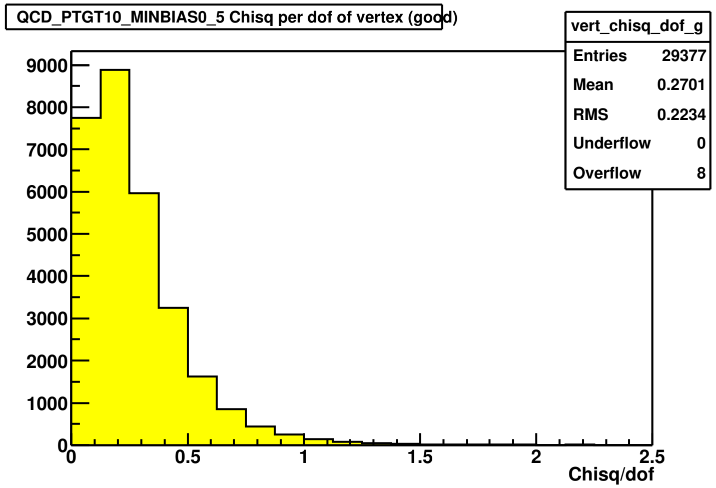




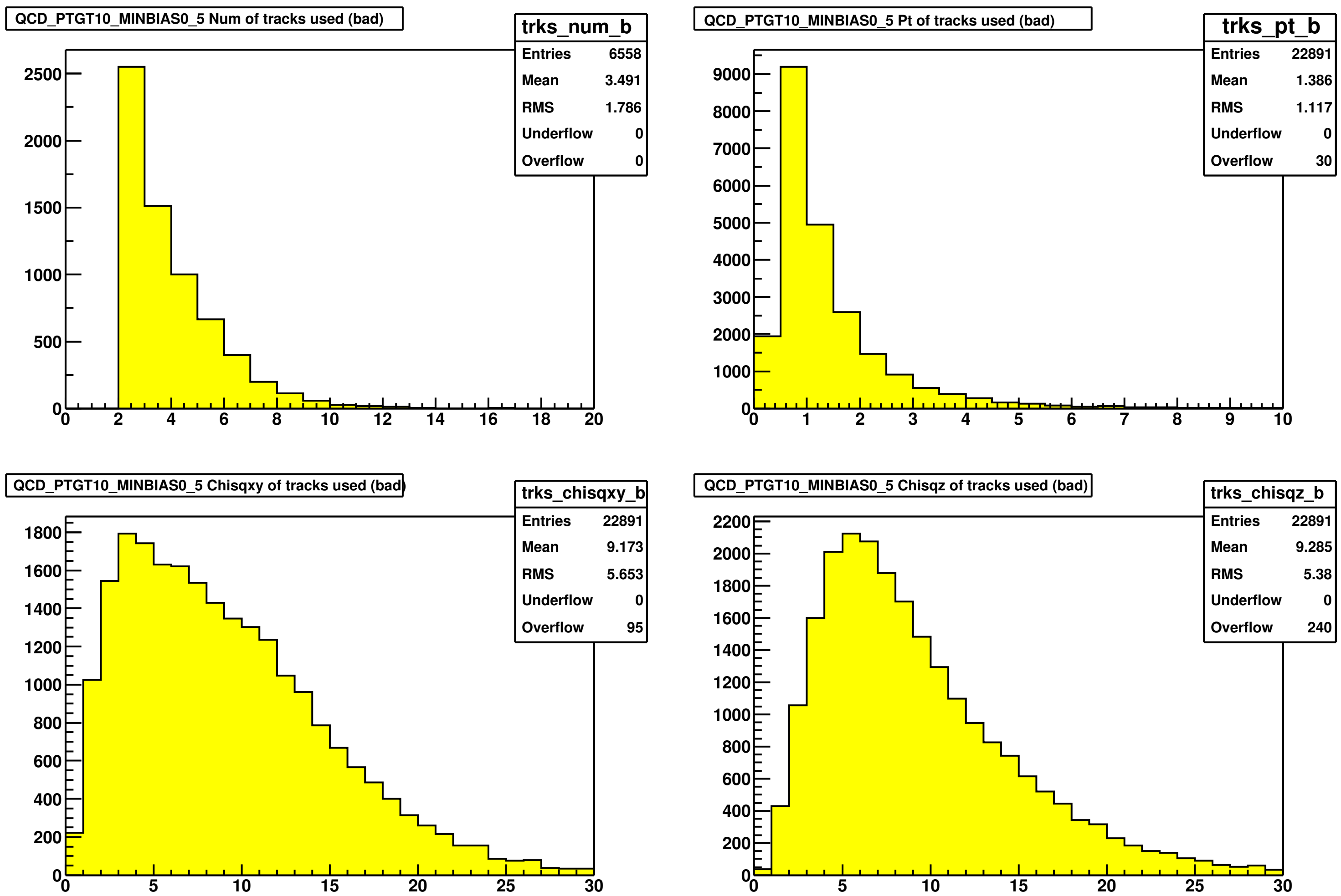


MC QCD $p_t > 10$GeV + 0.5 minbias



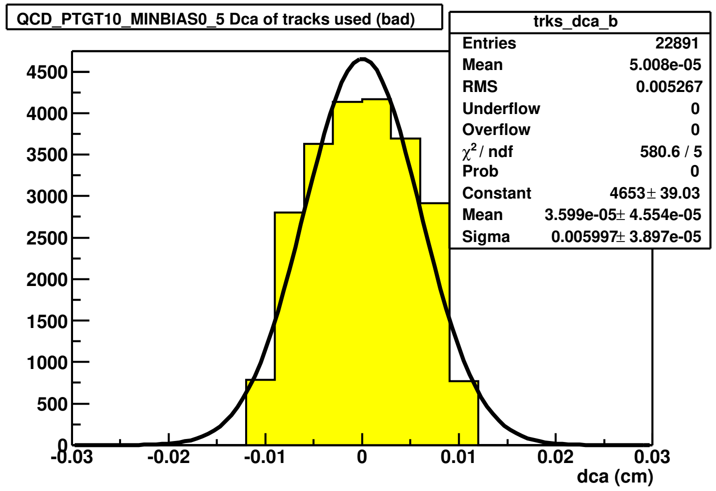


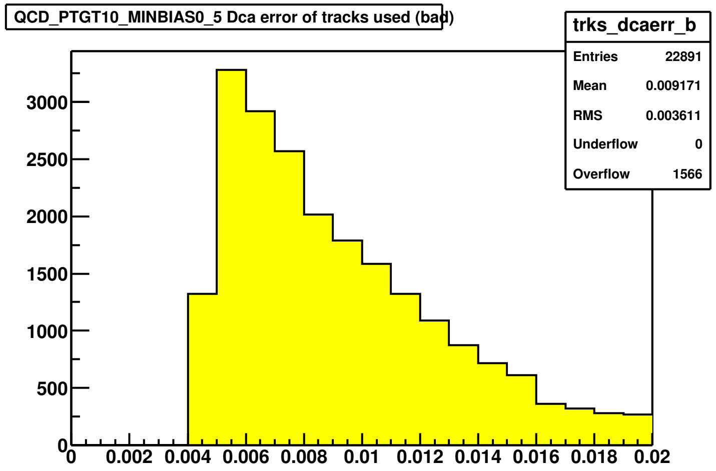
MC QCD $p_t > 10\mathrm{GeV} + 0.5$ minbias

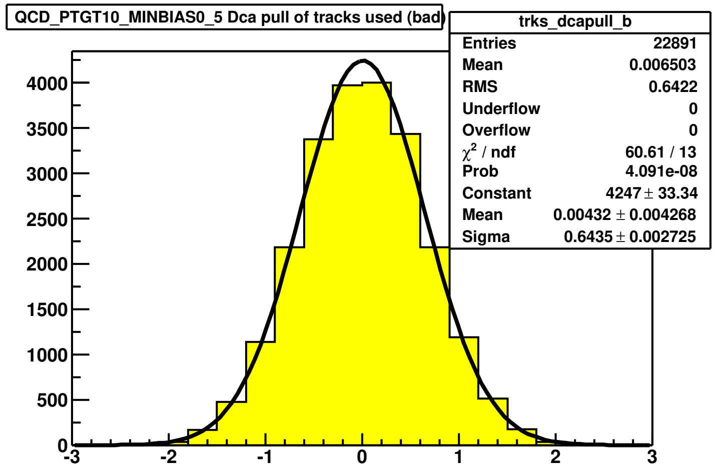


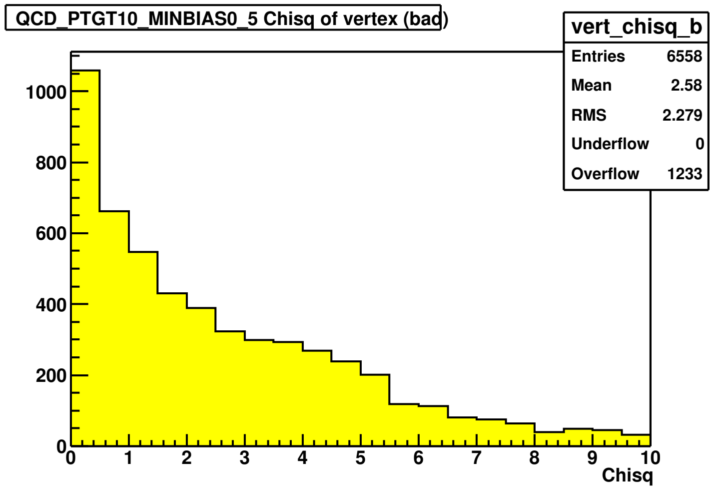
MC QCD $p_t > 10\text{GeV} + 0.5$ minbias

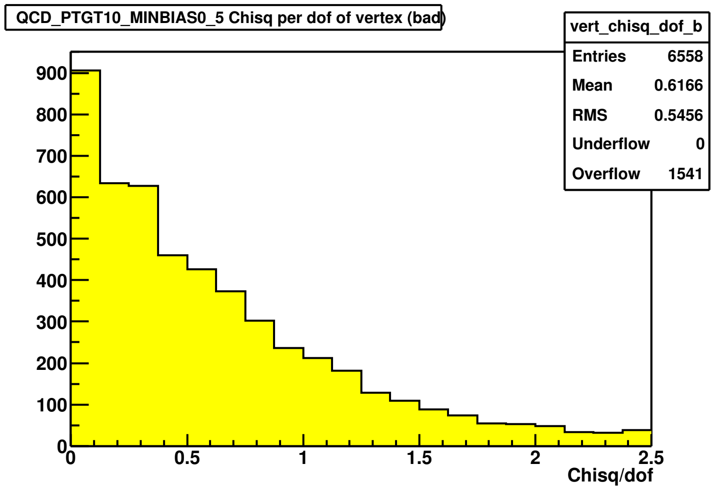
MC QCD $p_t > 10$GeV + 0.5 minbias



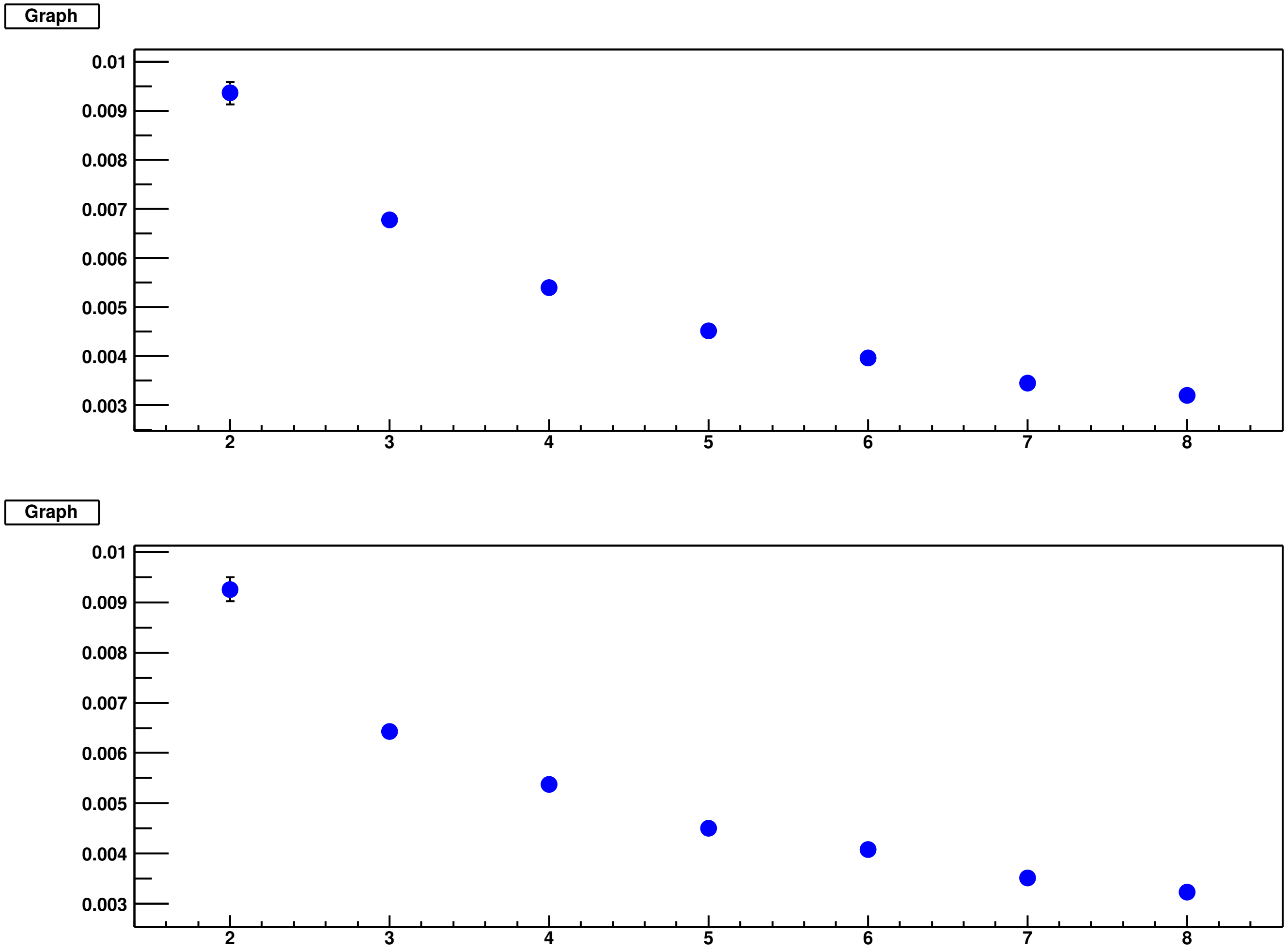






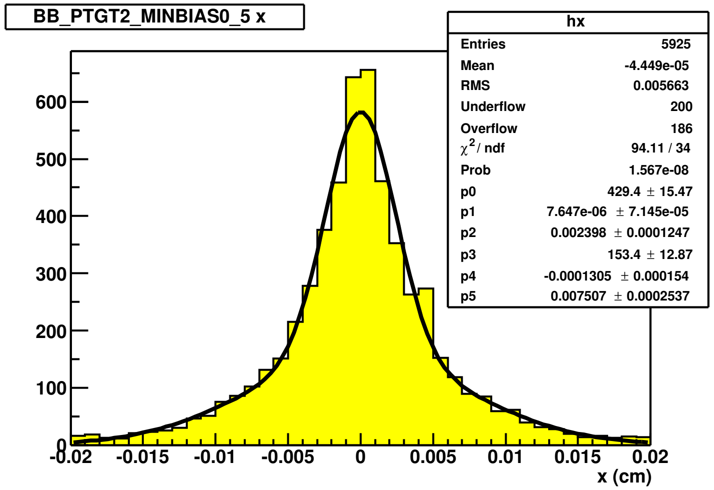


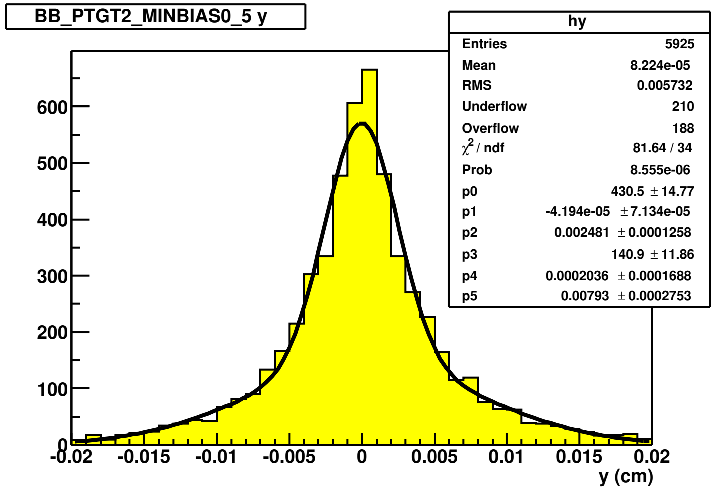
MC QCD $p_t > 10$GeV + 0.5 minbias

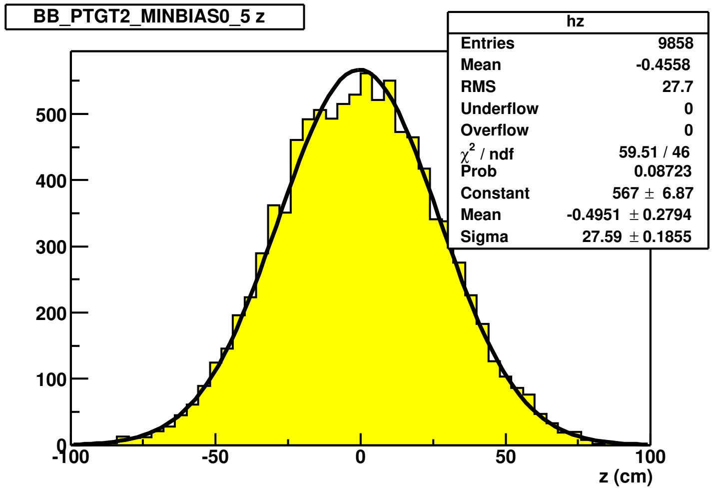


MC QCD $p_t > 10\mathrm{GeV} + 0.5$ minbias

MC $b\bar{b}$ $p_t > 2\mathrm{GeV} + 0.5$ minbias



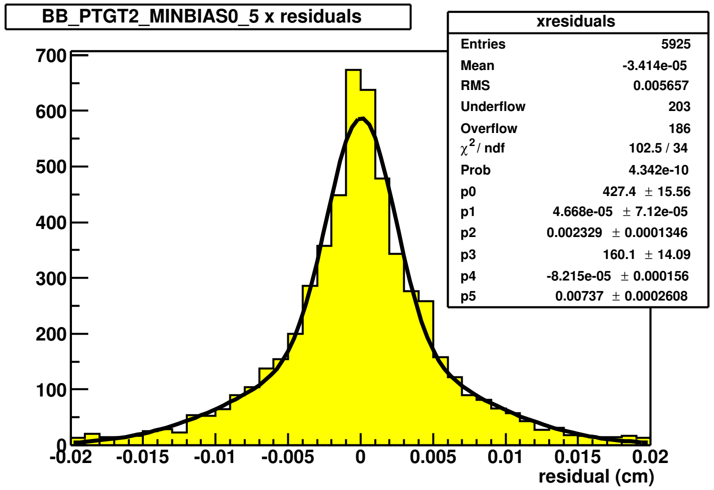


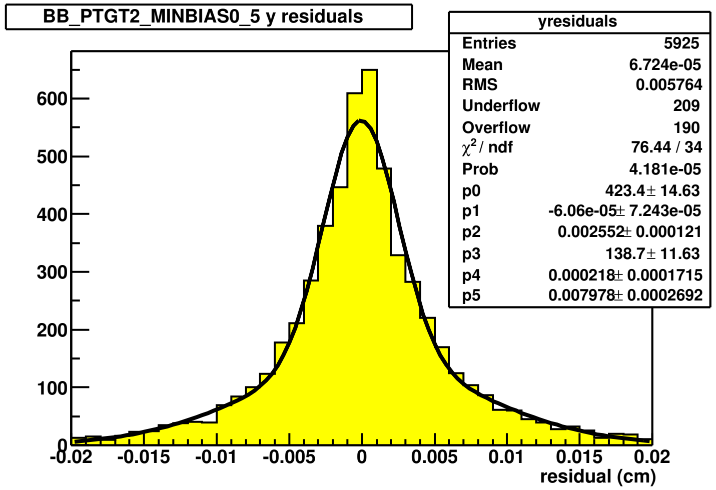


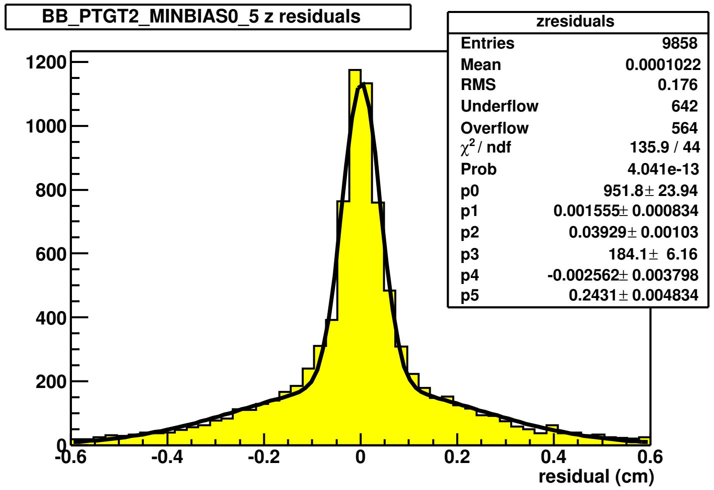
Ratio of z vertices = 0.8215

Ratio of xy vertices = 0.49375

MC $b\bar{b}$ $p_t > 2\text{GeV} + 0.5$ minbias





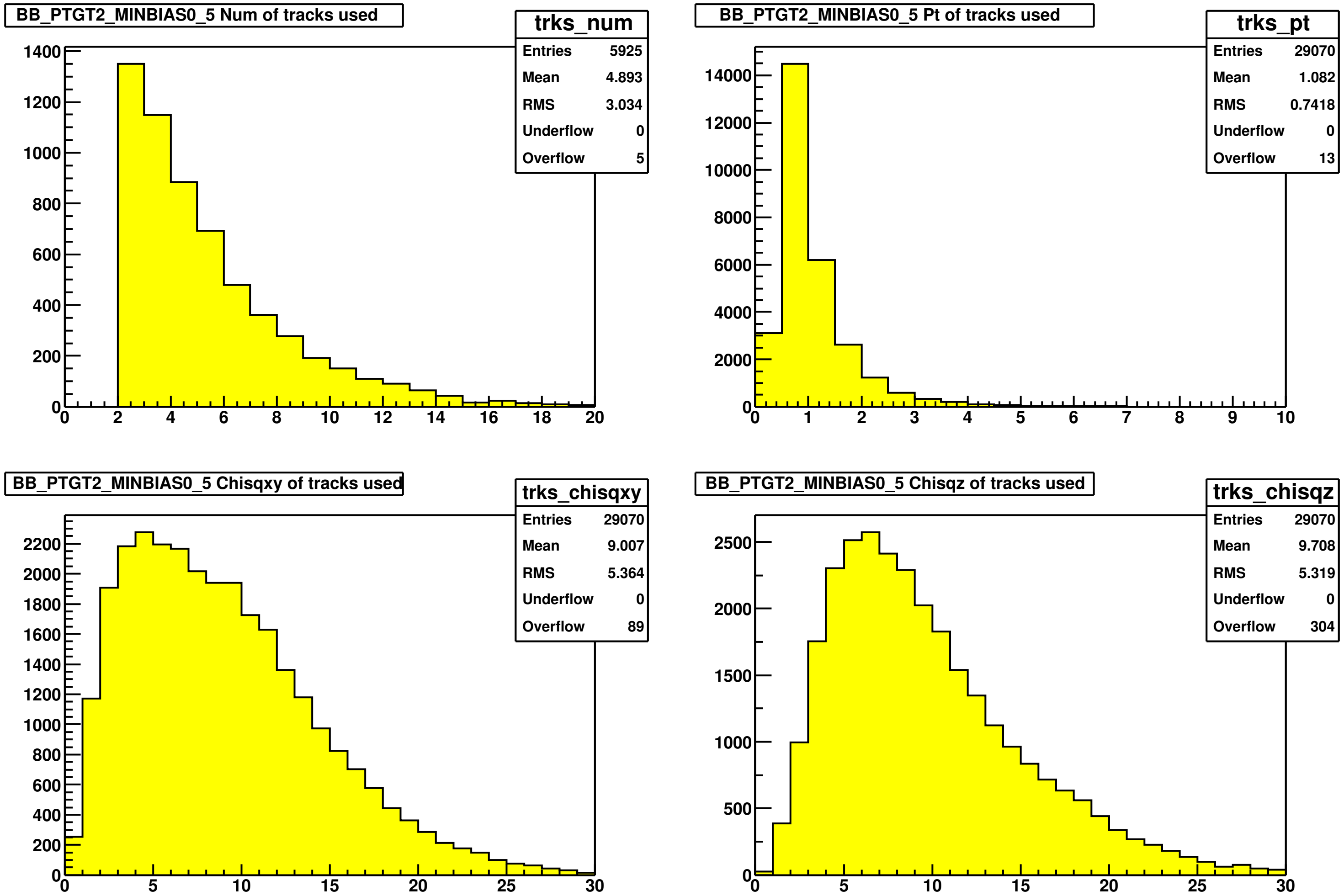


Efficiency in Z = 0.747249

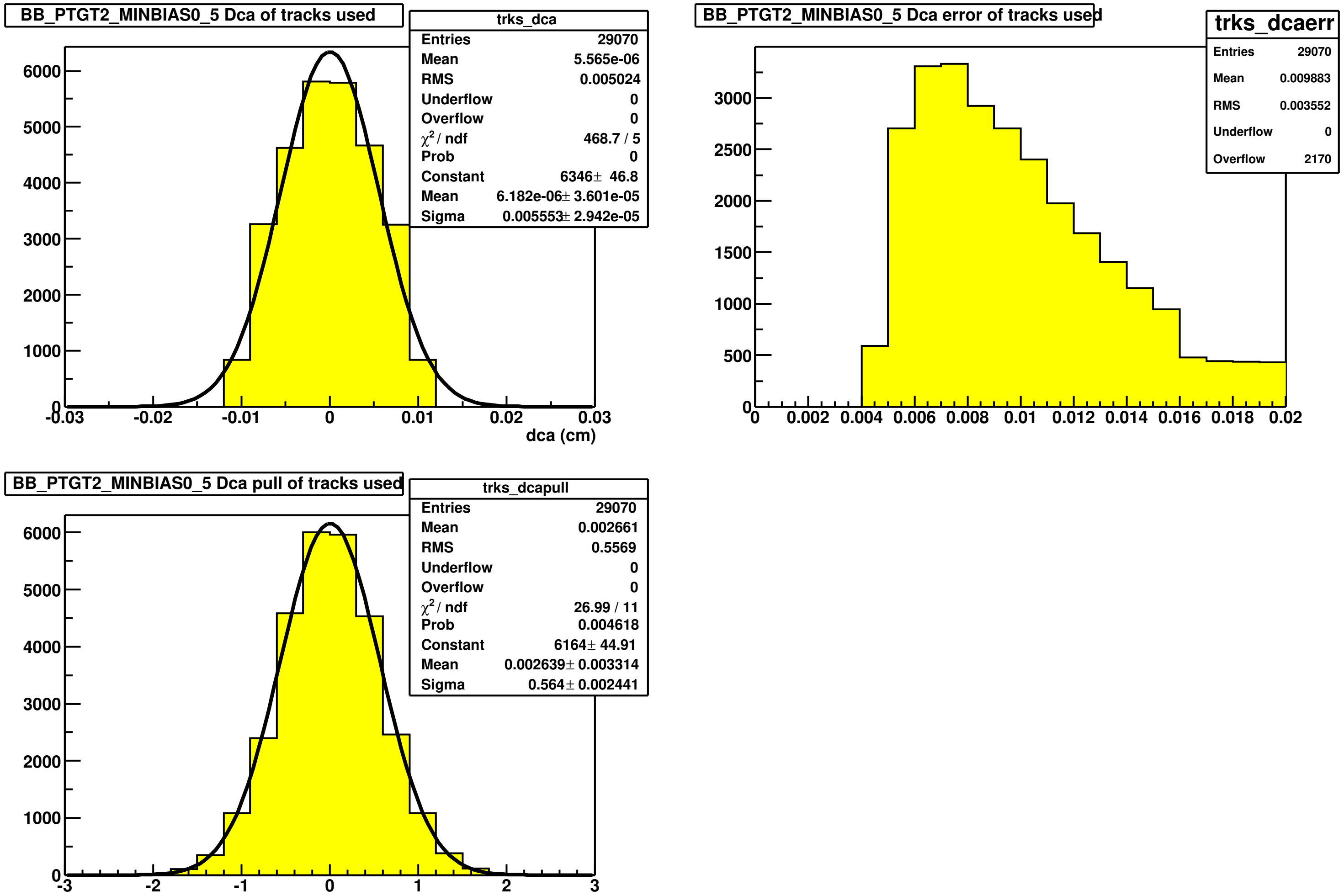
Purity in Z = 0.909312

Efficiency in XY = 0.491633

Purity in XY = 0.743797

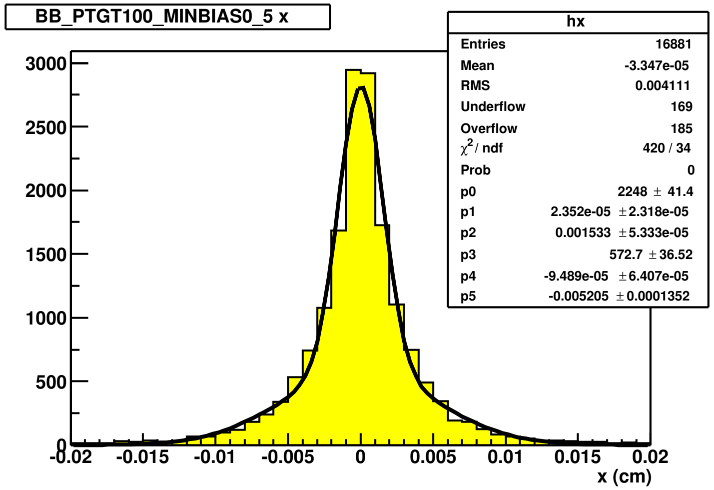


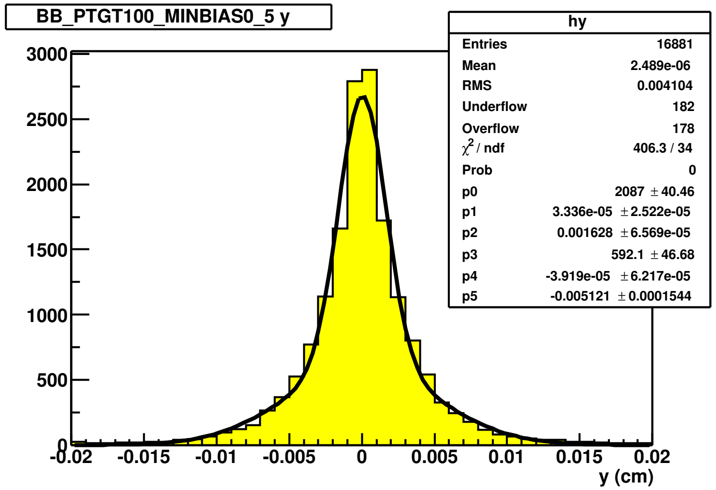
MC $b\bar{b}$ $p_t > 2$GeV + 0.5 minbias

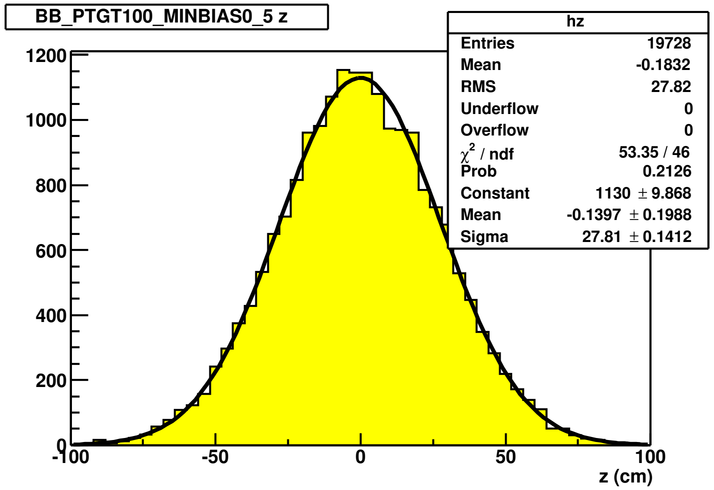


MC $b\bar{b}$ $p_t > 2$GeV + 0.5 minbias

MC $b\bar{b}$ $p_t > 100$GeV + 0.5 minbias



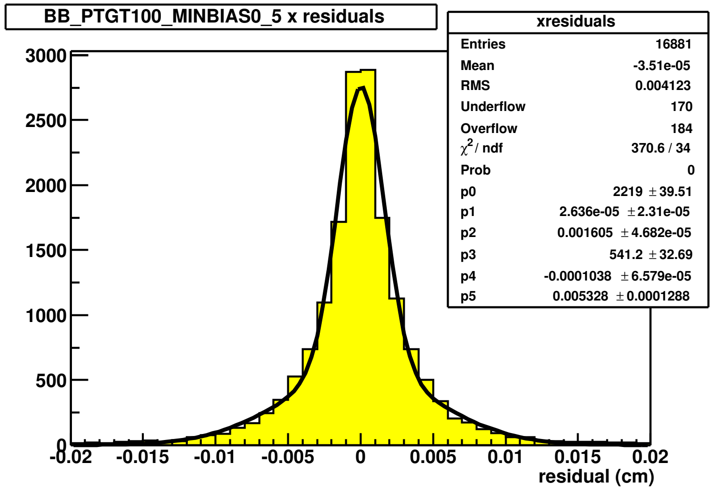


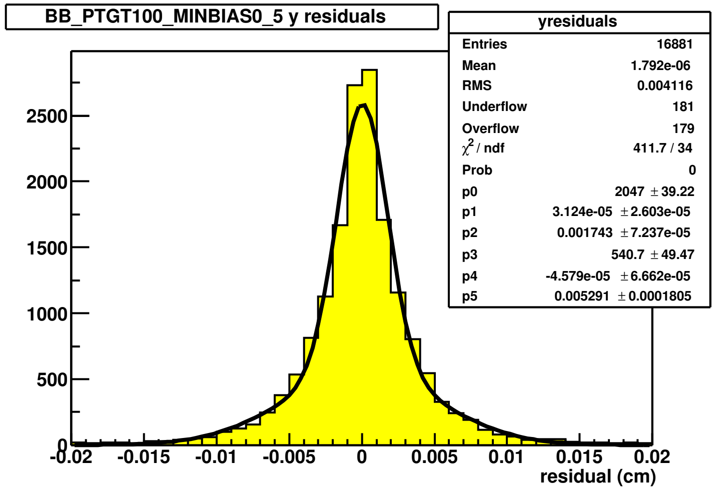


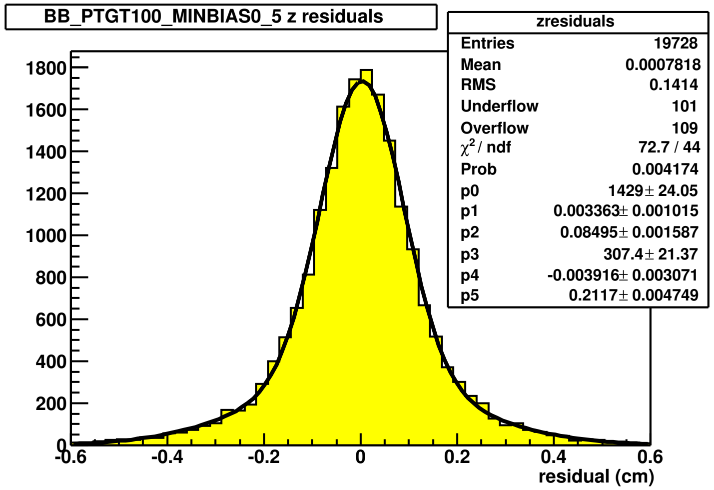
Ratio of z vertices = 0.998886

Ratio of xy vertices = 0.854734

MC $b\bar{b}$ $p_t > 100$GeV + 0.5 minbias





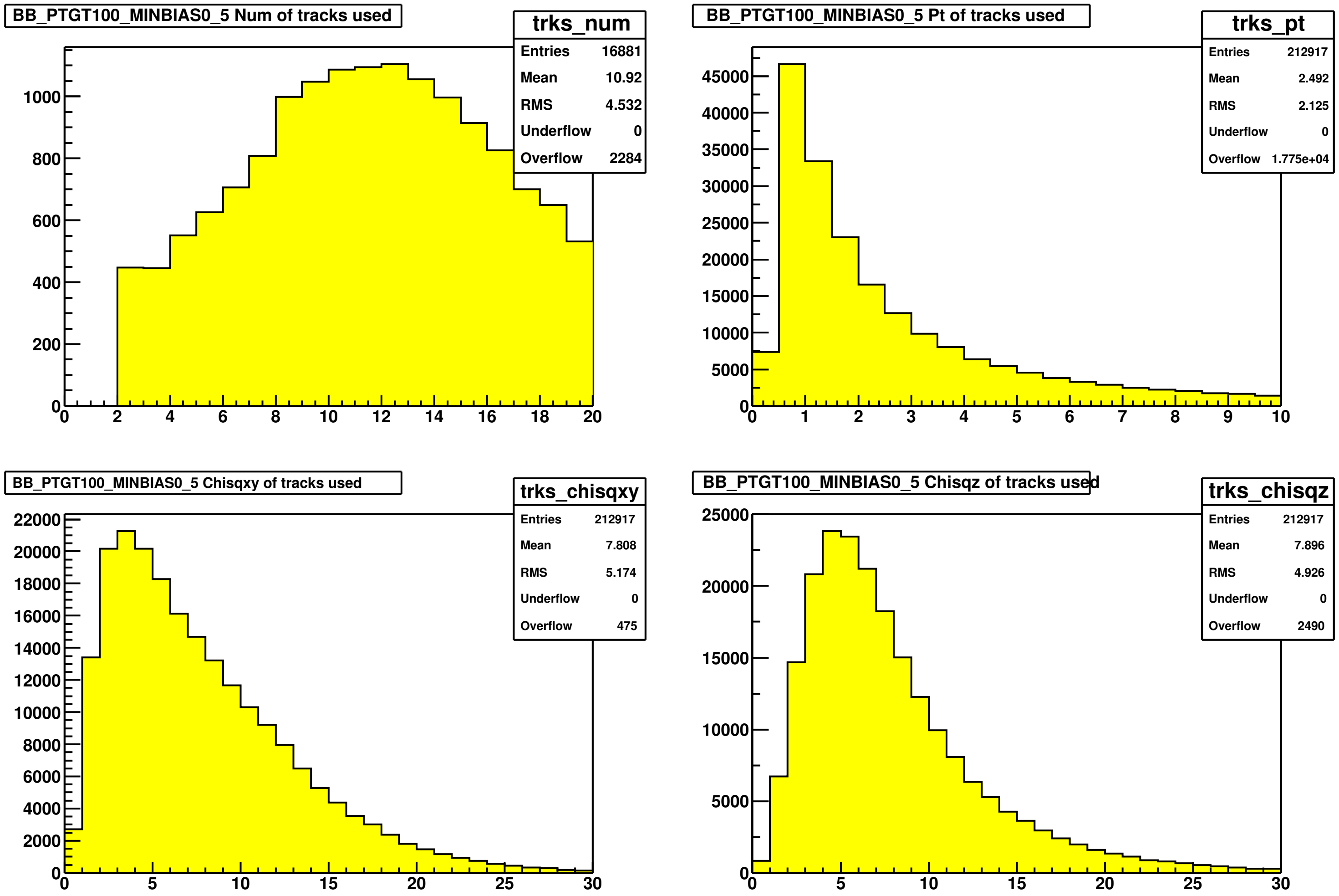


Efficiency in Z = 0.994025

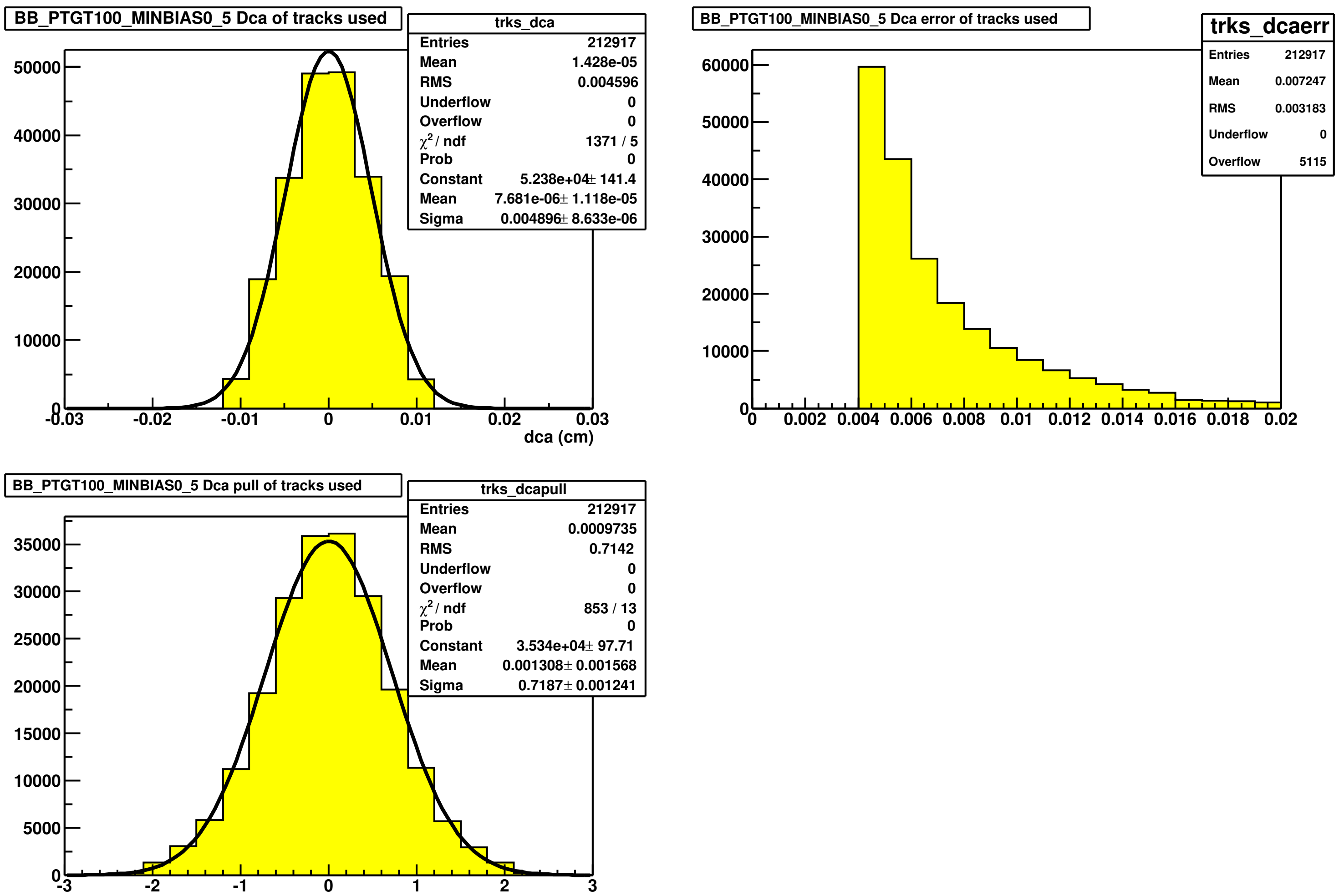
Purity in Z = 0.995134

Efficiency in XY = 0.769

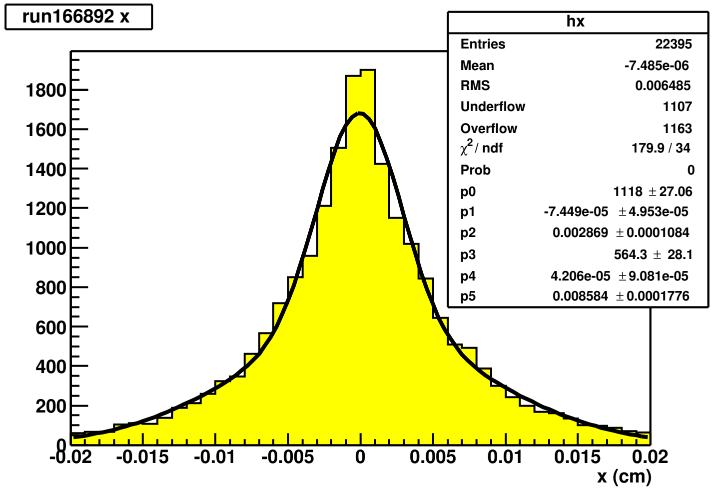
Purity in XY = 0.894319

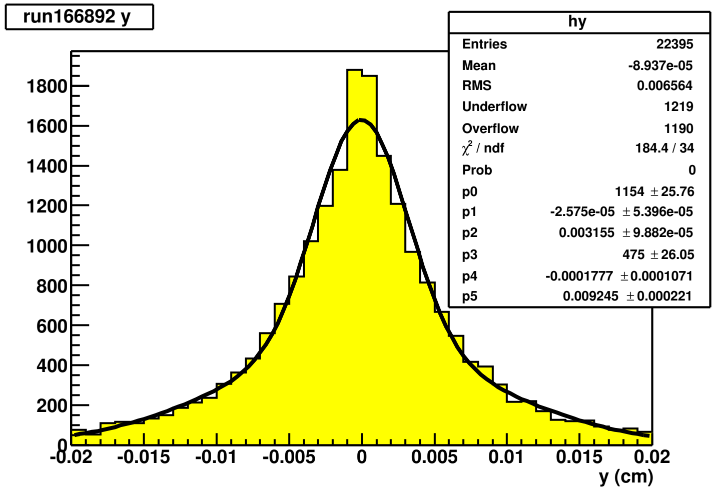


MC $b\bar{b}$ $p_t > 100$GeV $+ 0.5$ minbias

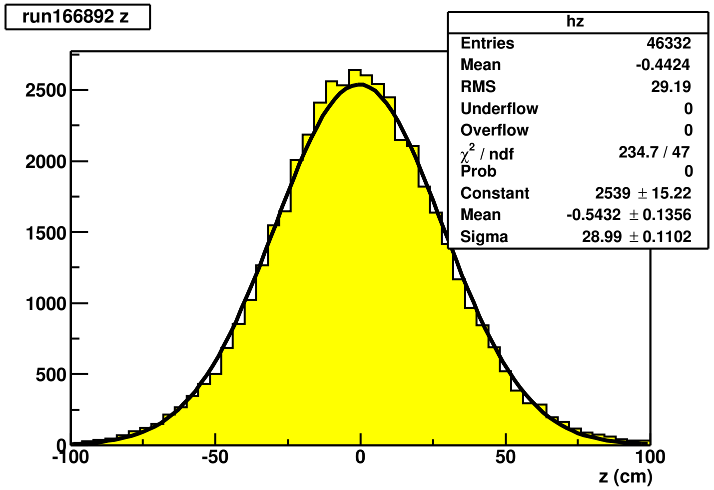


MC $b\bar{b}$ $p_t > 100$GeV + 0.5 minbias





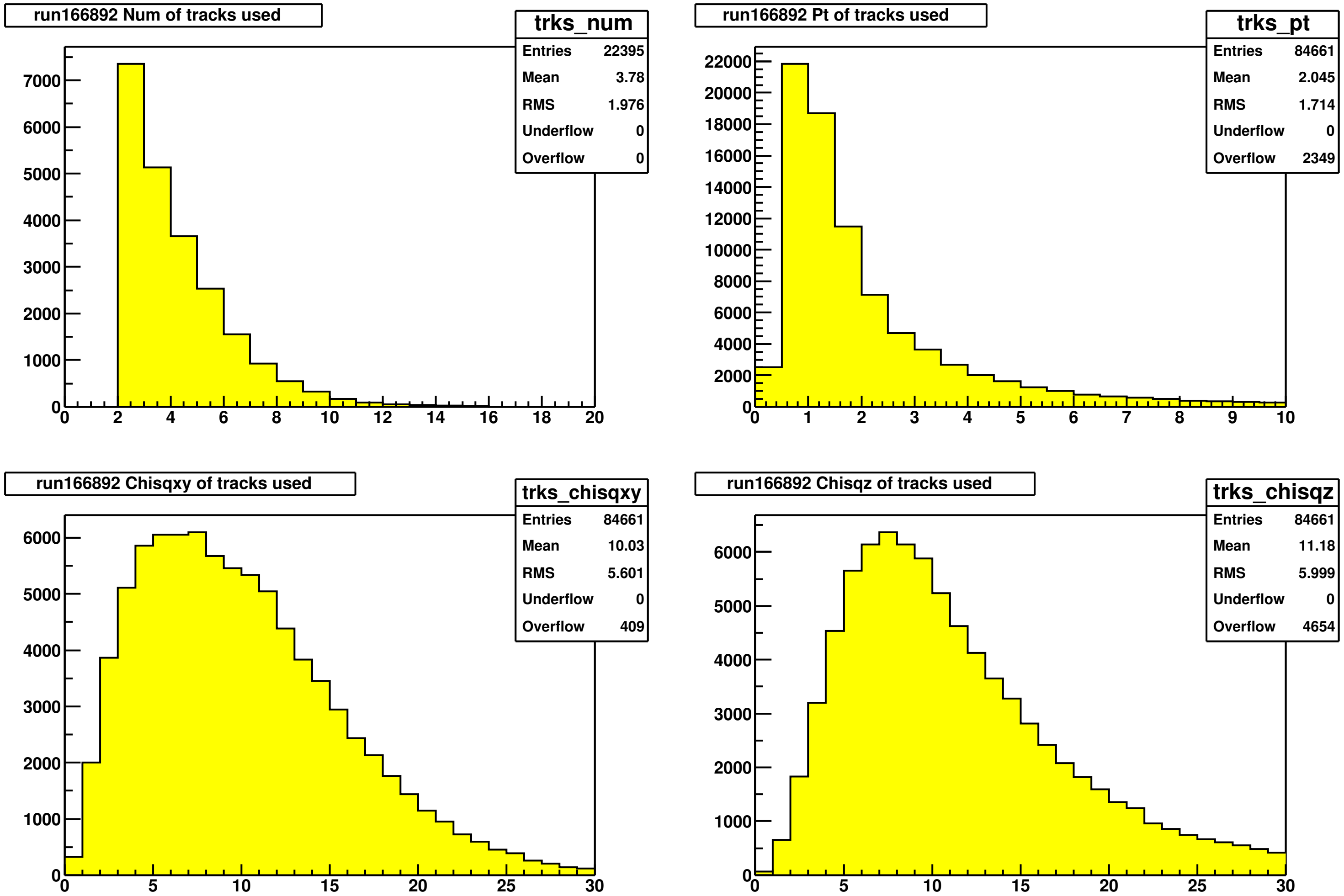
DATA Run 166892



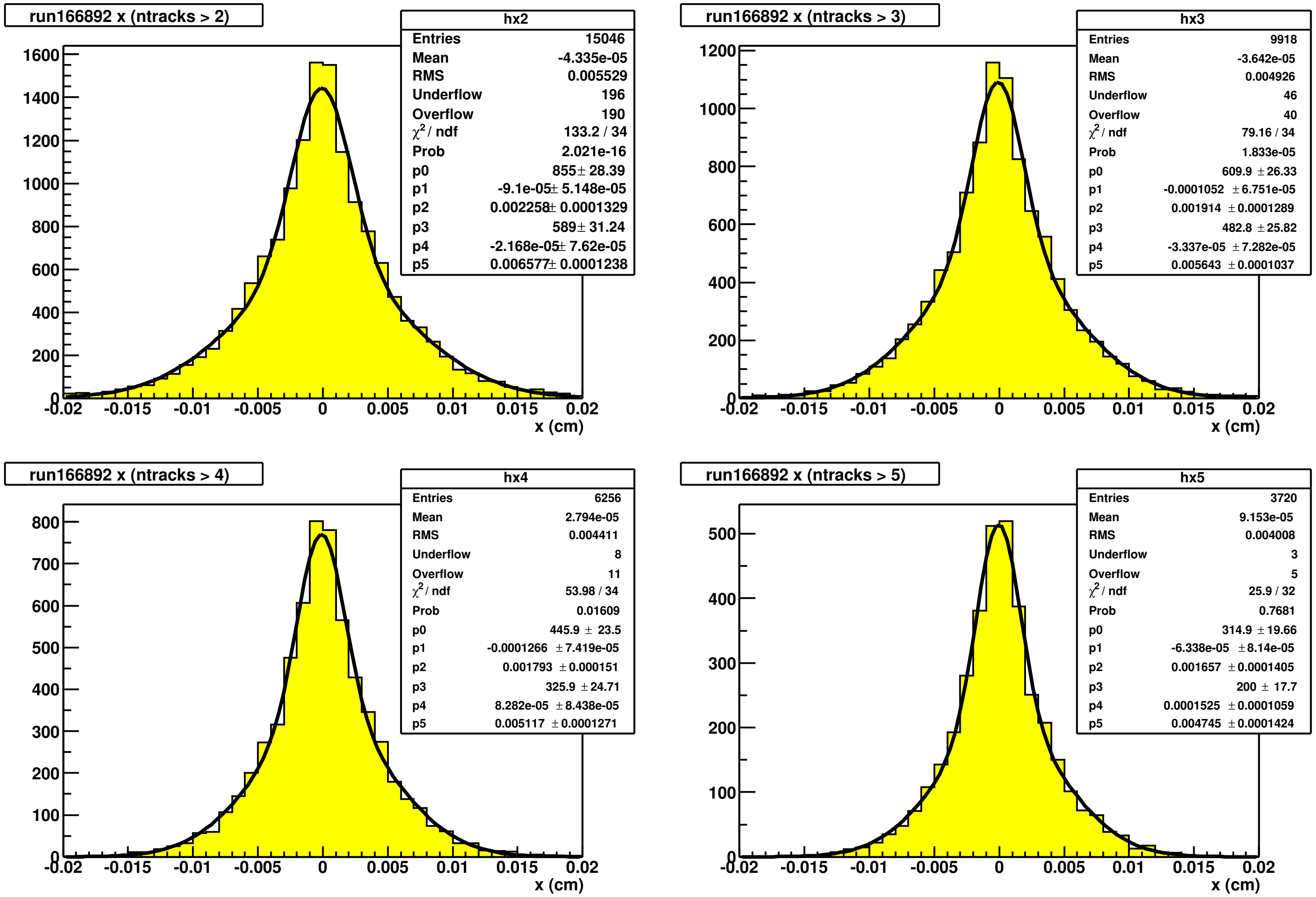
Ratio of z vertices = 0.92664

Ratio of xy vertices = 0.4479

DATA Run 166892



DATA Run 166892



Summary

Need to understand low ratio of returned vertices - try and increase this

Need to look at whether finding secondary vertices at L3 is practical

Moving into low p_t b tagging
starting B physics analysis