Tracking quality tests at ZEUS

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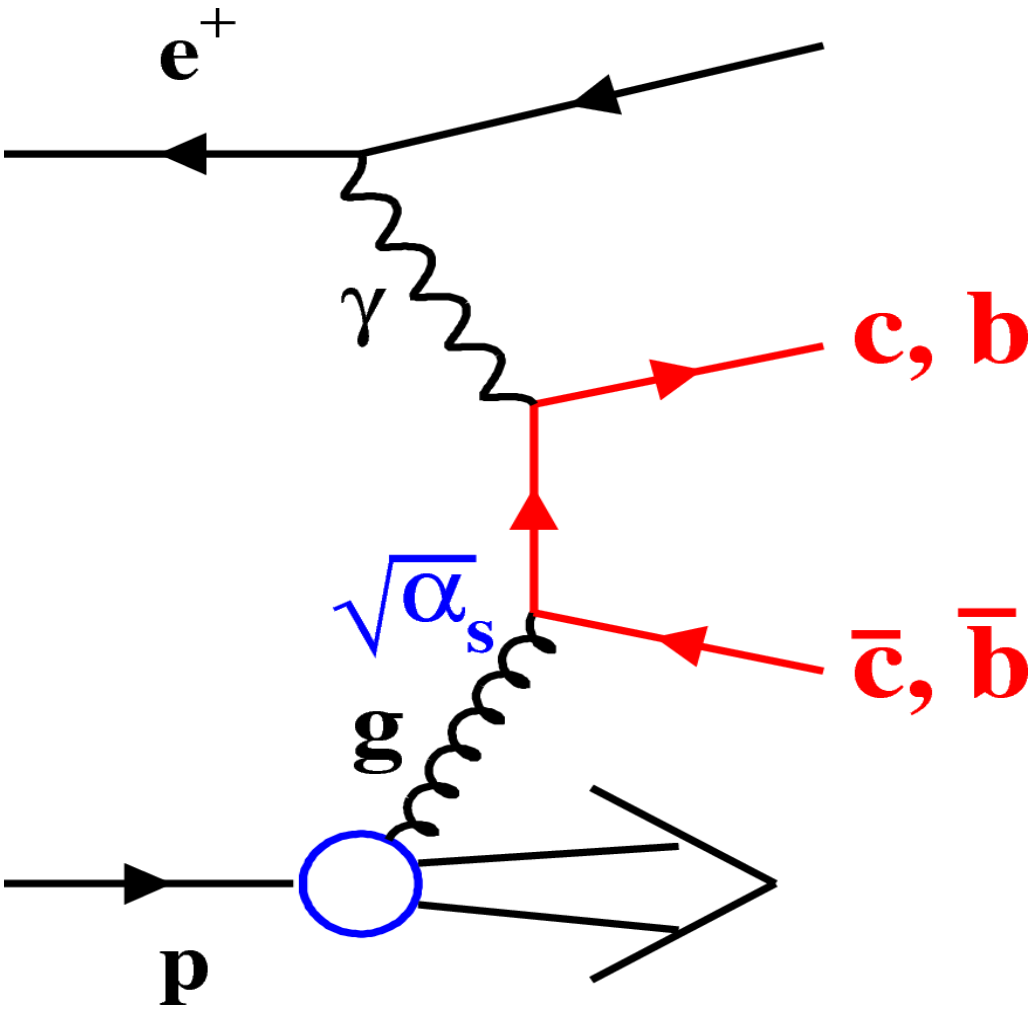
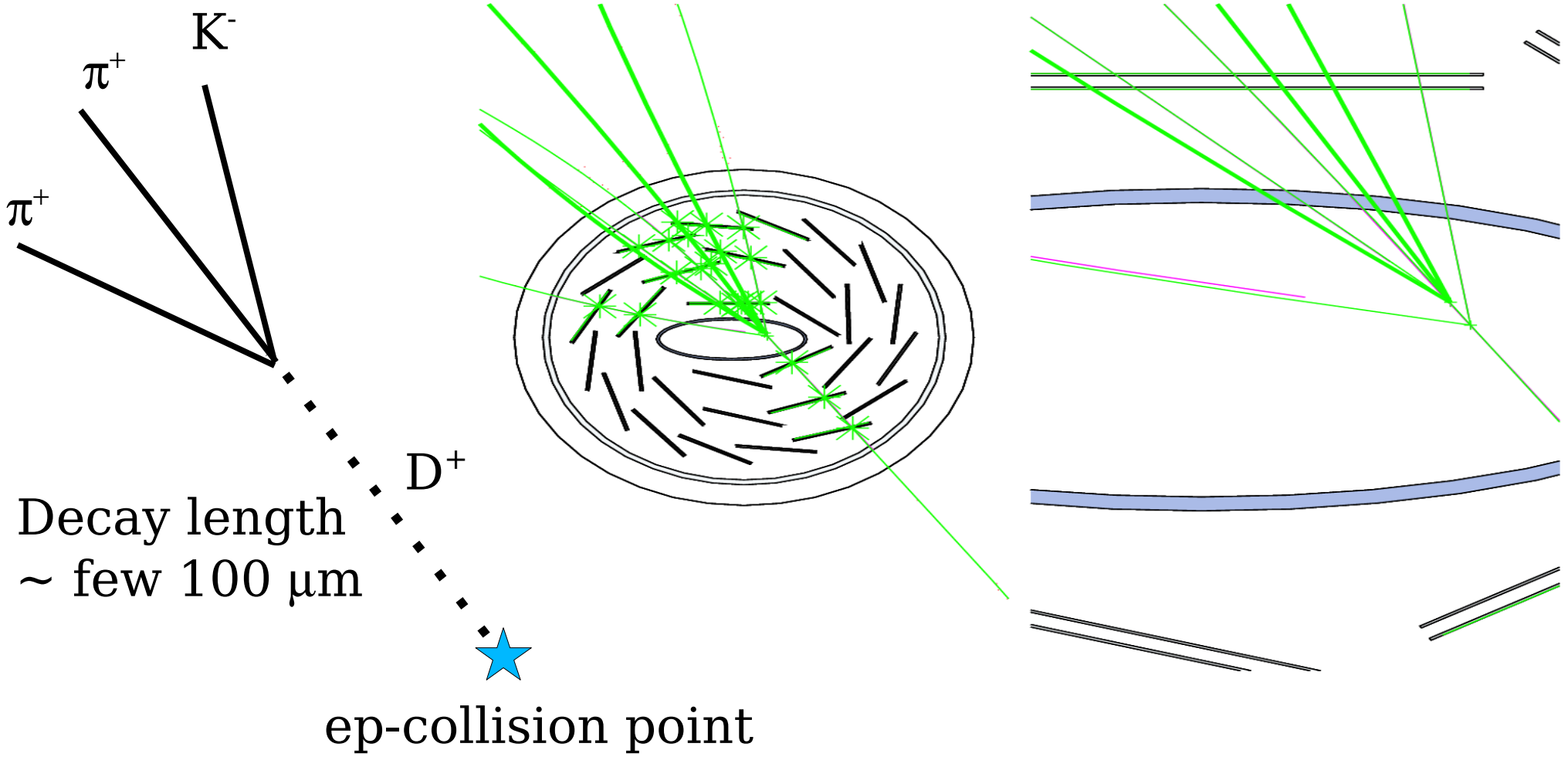
Physics Motivation



Helping to measure c and b production in HERA II

important for understanding of gluon density in proton

Motivation continued...



To identify c and b quarks by their decays
-> requires most accurate MVD calibration, check it!

Study overview

- ✔ Main idea: Check the ZEUS track quality using the latest BMVD alignment *(as determined from Monica Turcato and Olaf Behnke using ep and cosmics tracks)*
- ✔ Data set: runs 61801-61850
- ✔ *Single track tests:*
  - ✔ **Track chisquare**
  - ✔ **Track distance to the primary vertex**

Selection

- ✔ ZEUS ZTTRHL (=standard) non vertex fitted tracks
- ✔ Only tracks which are fitted to the primary vertex
- ✔ High quality track cuts: pt>5 GeV, 60<theta<120, at least 3 BMVD hits in each ($r\phi$ and rz) projection
- ✔ Event cuts: |zvtx|<20 cm, at least 10 tracks used for primary vertex fit

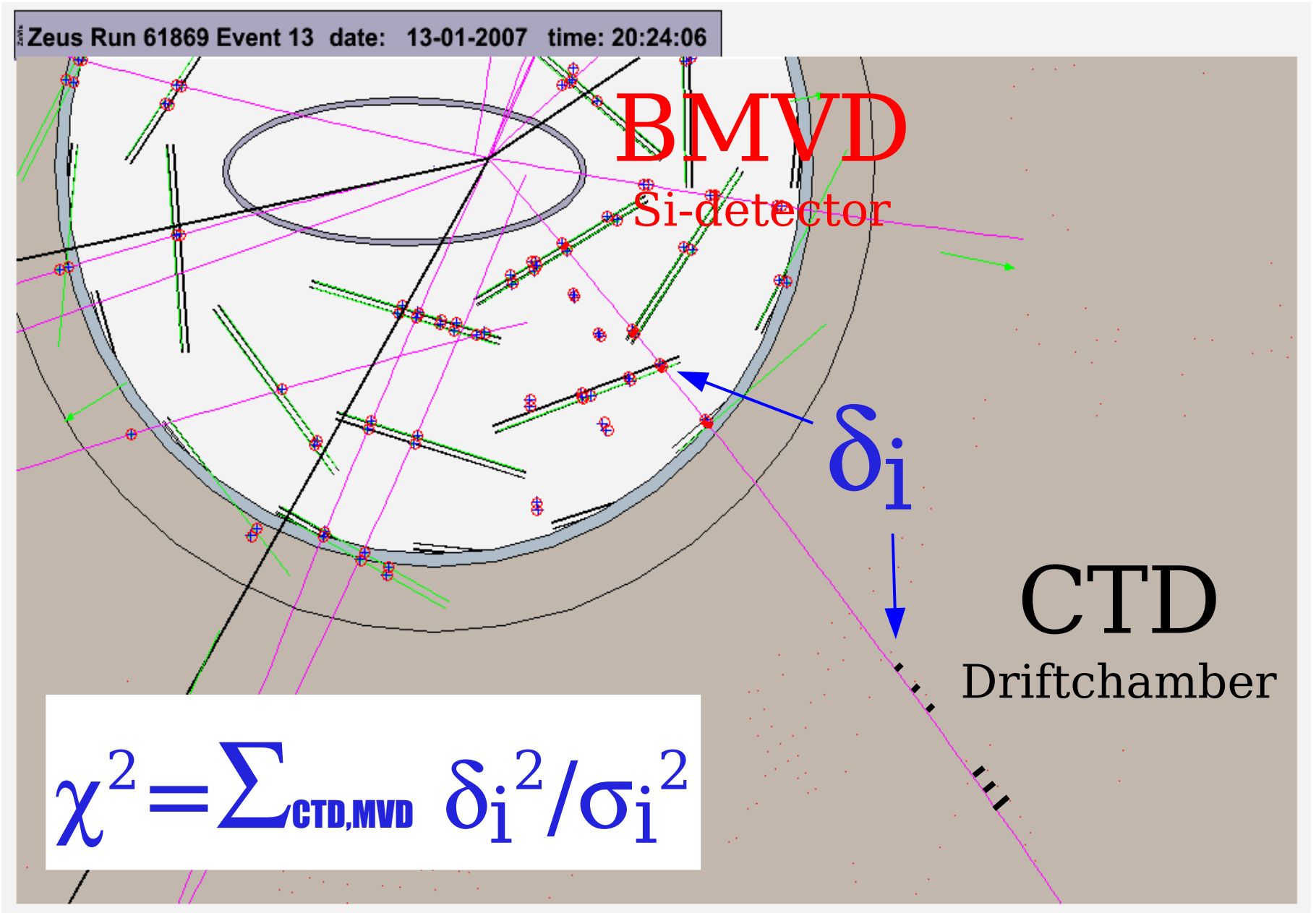
BMVD Alignments tested

Nocal = *Nominal BMVD geometry*

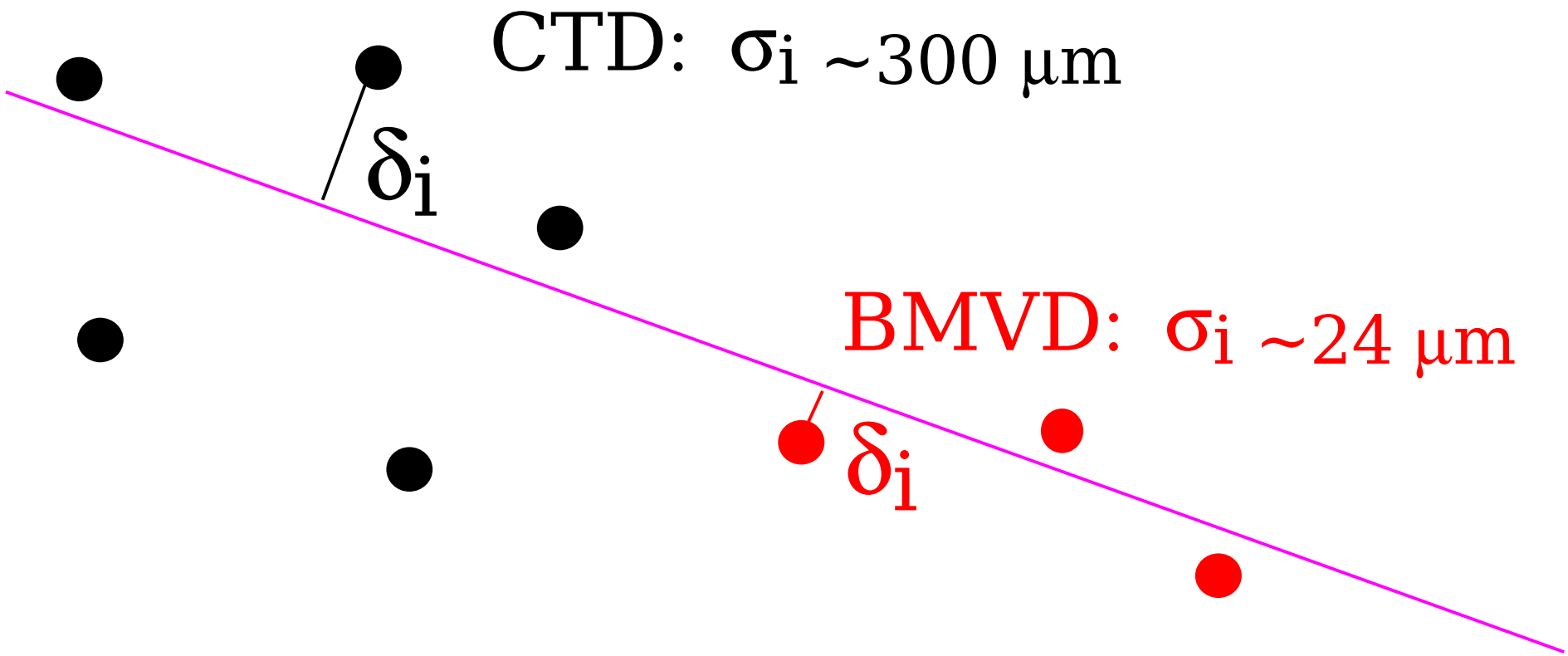
OLD = *currently on database (doalign 3), based on ep-tracks only, determined end of 2007*

New = *Using ep-tracks and additional ~200000 cosmic muons from ep06 period*

Observable 1: Standard Track Total Chisquare

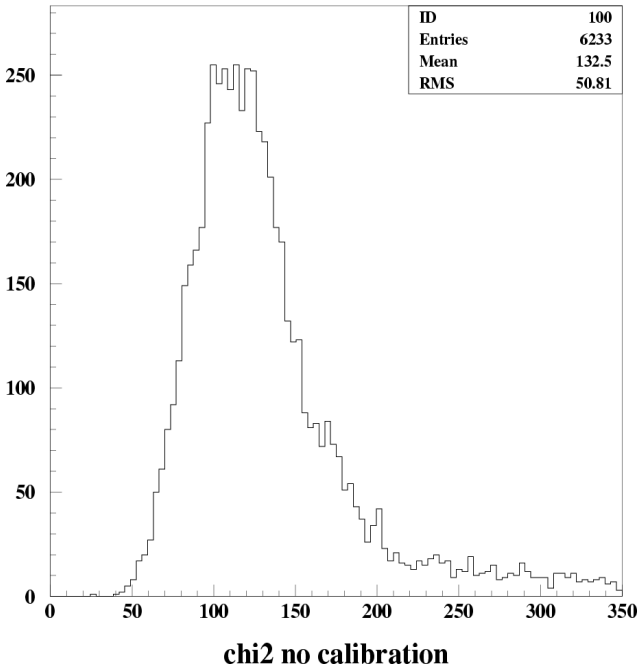


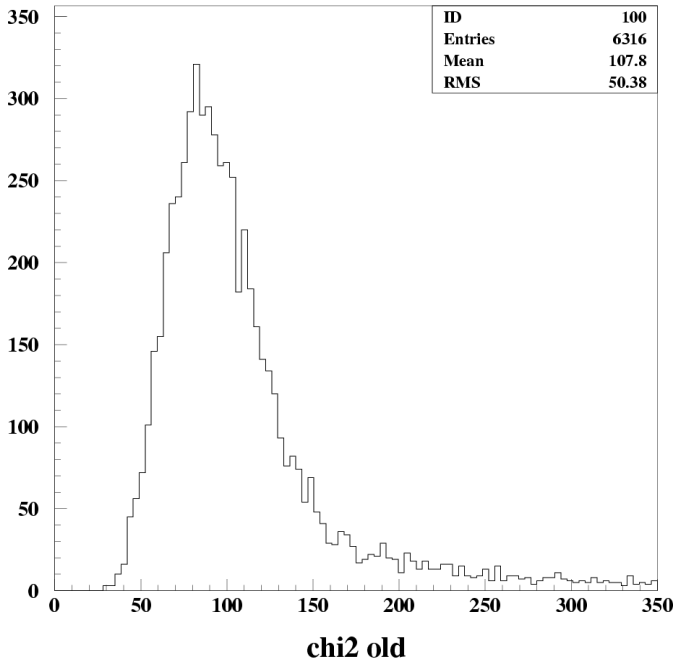
Observable 1: Standard total track chisquare

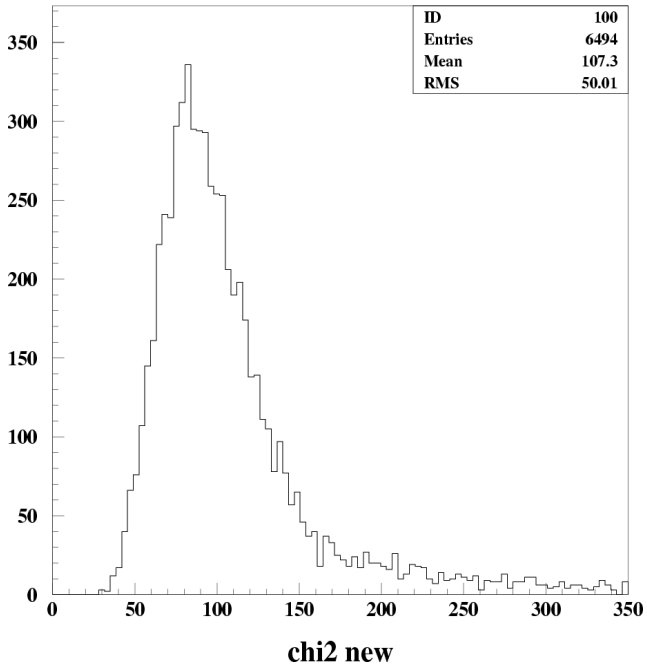


$$\chi^2 = \sum_{\mathrm{CTD,MVD}} \delta_i^2/\sigma_i^2$$

Results: Standard Total Track chisquare

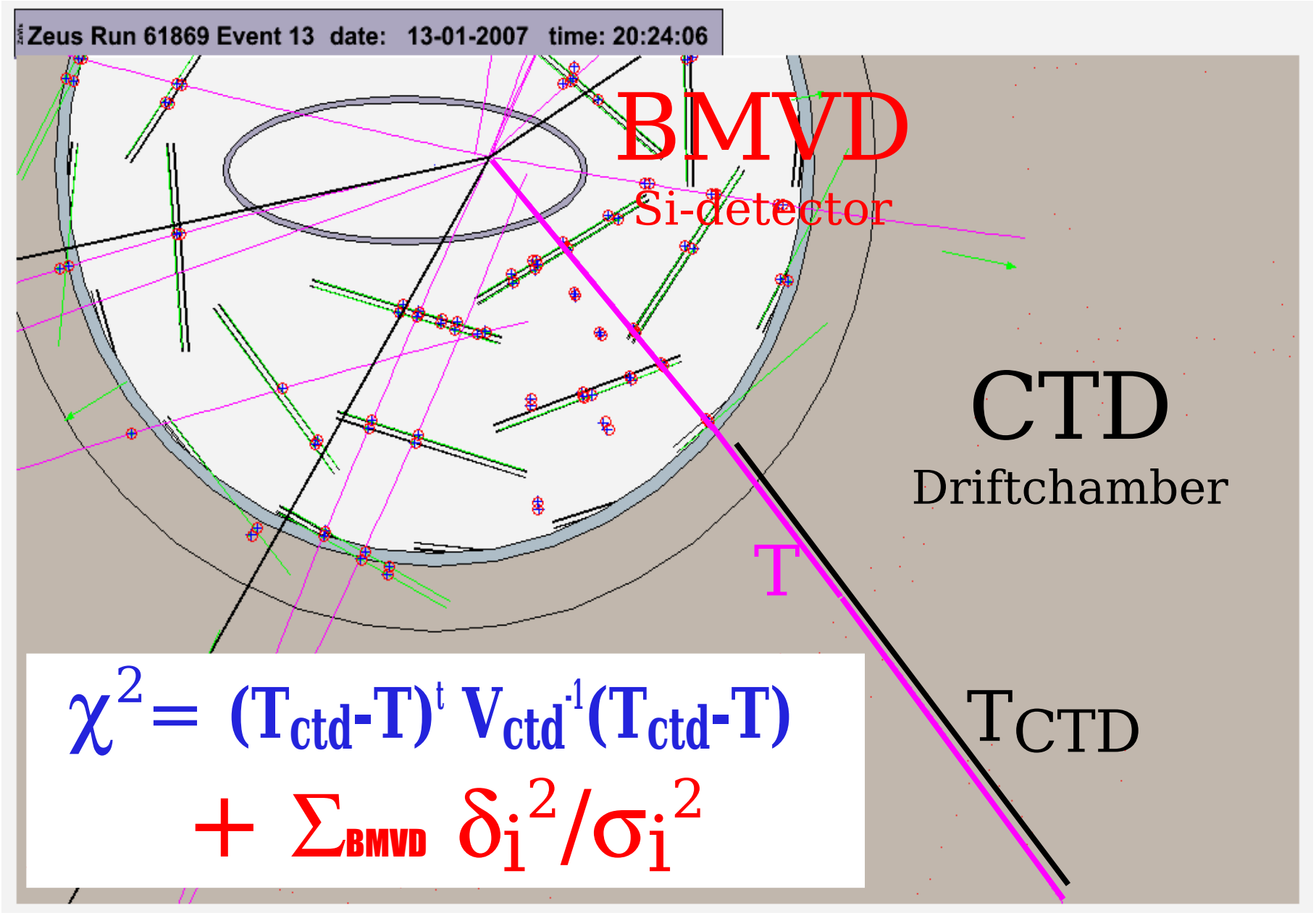






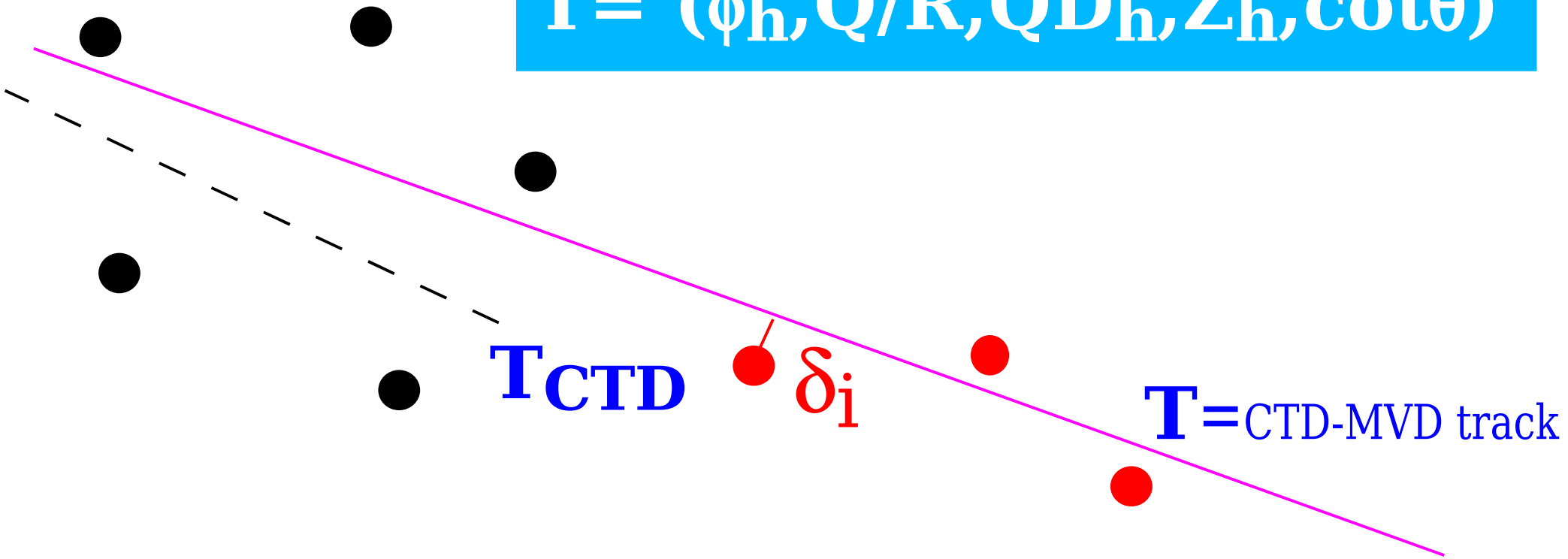
→ **Rather small differences**

Observable 2 (NEW): CTD-MVD-Chisquare



Observable 2: New CTD-MVD track chisquare

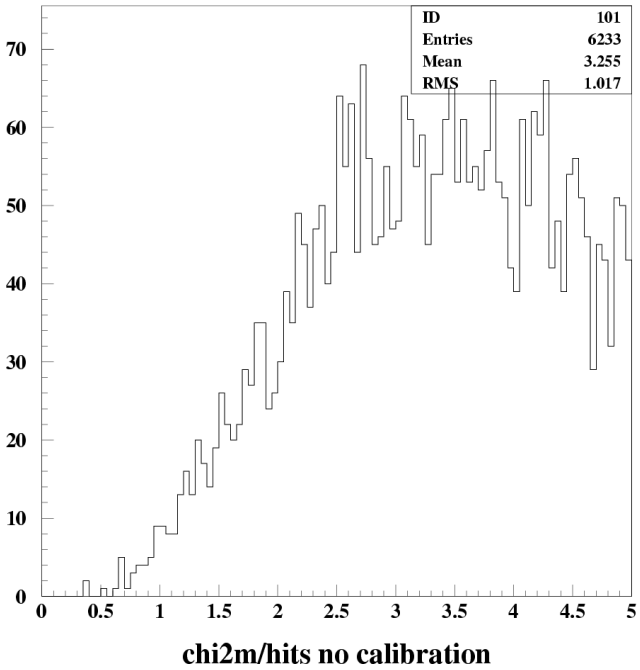
$$T = (\phi_h, Q/R, QD_h, Z_h, \cot\theta)$$

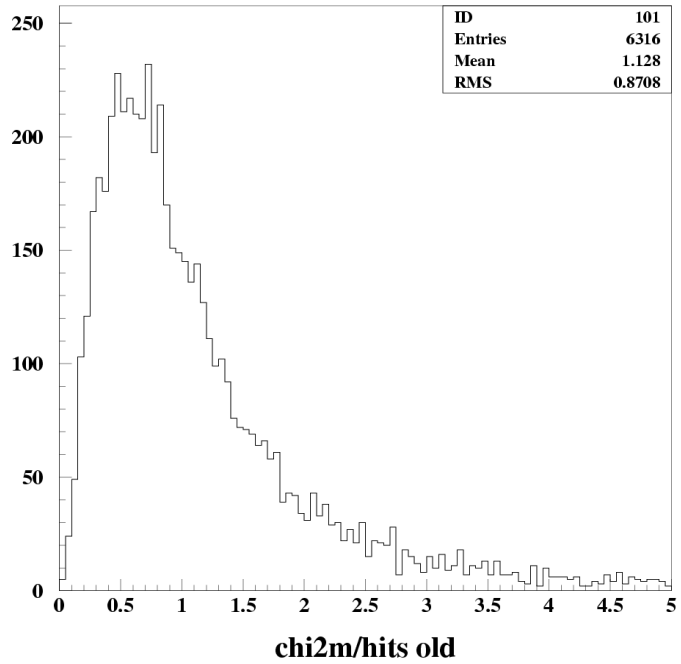


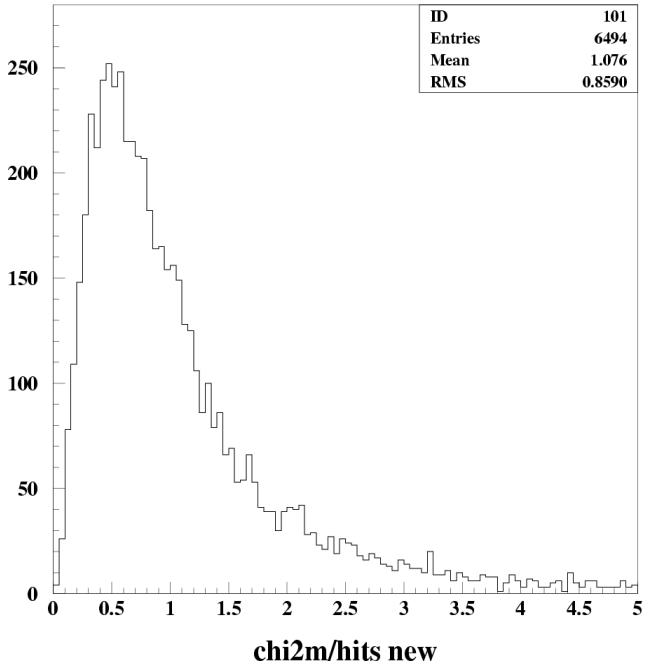
$$\chi^2 = (T_{ctd}-T)^t V_{ctd}^{-1} (T_{ctd}-T) + \Sigma_{BMVD} \delta_i^2/\sigma_i^2$$

Get rid of CTD internal affairs

Results: New CTD-MVD Track χ^2/#BMVD-hits



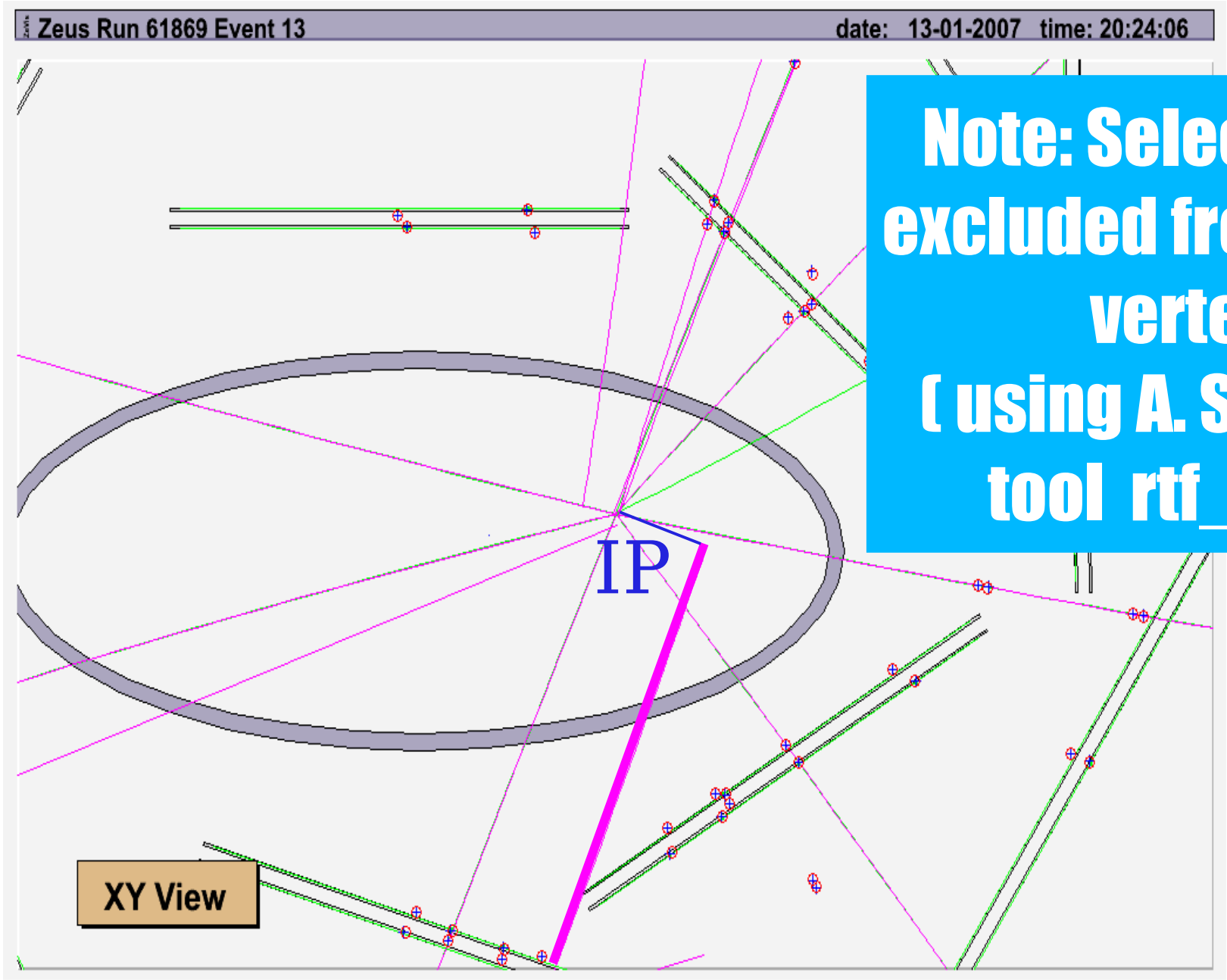




→ **Increased sensitivity to BMVD alignment,**

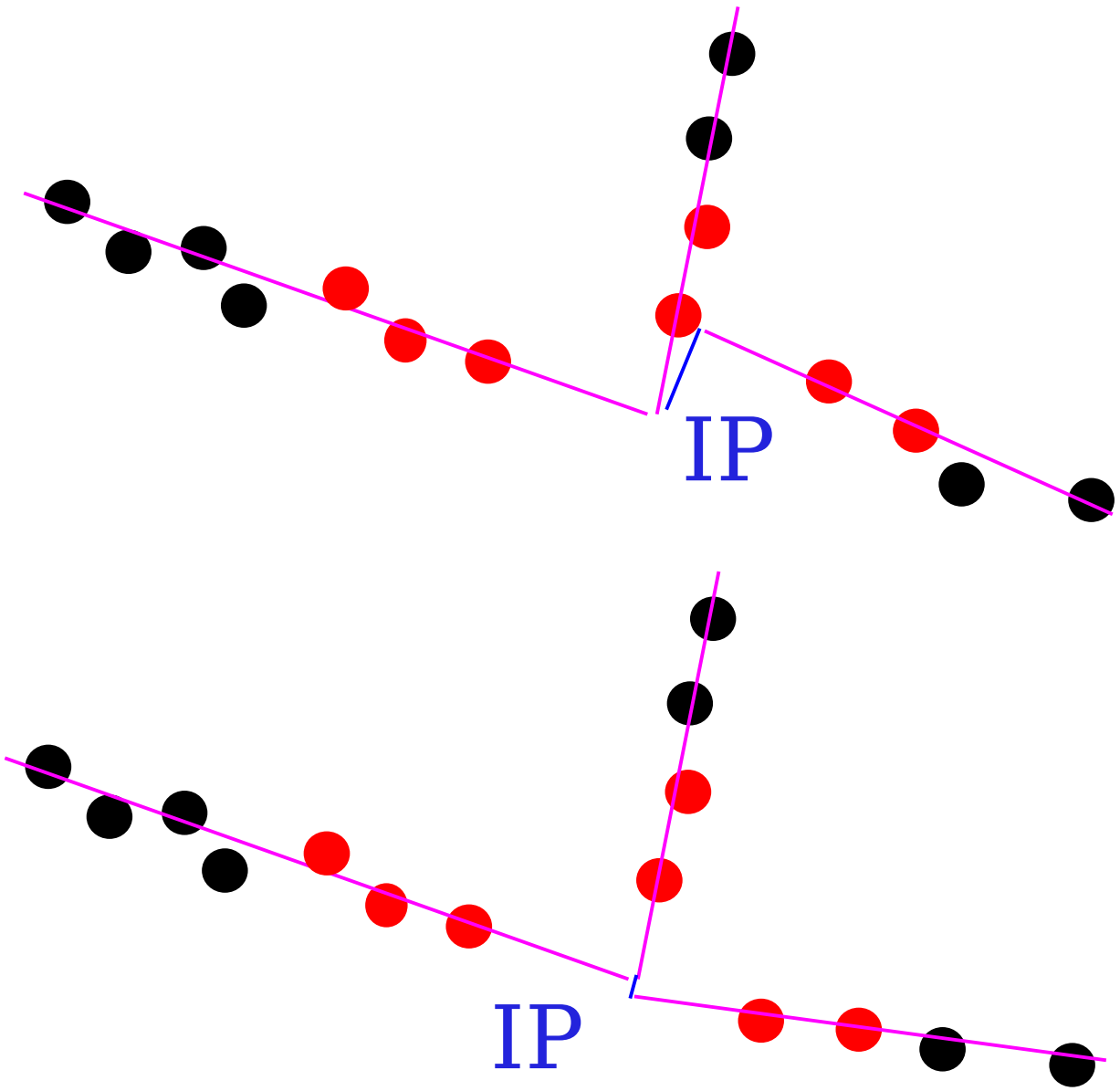
new alignment: slightly improved χ^2/hits (smaller mean value)

Observable 3: track to primary vertex distance



Note: Selected track excluded from primary vertex fit (using A. Spiridonov tool rtf_ztverc)

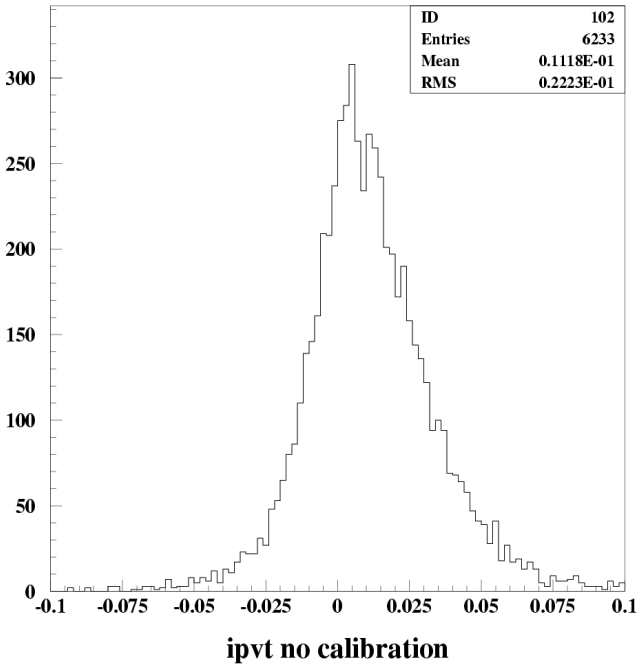
Observable 3: Track to primary vertex distance IP



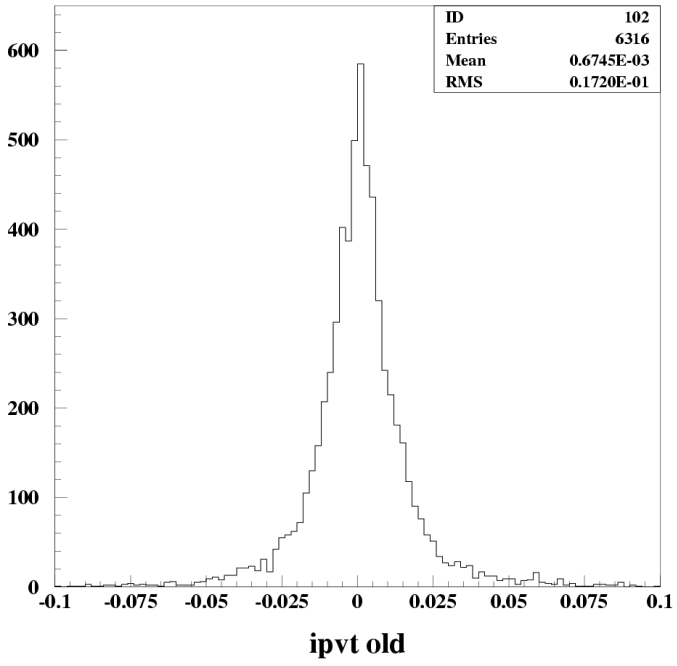
All Track fits χ^2 good, but tracks do not meet at vertex due to misalignment of right - left

With good alignment

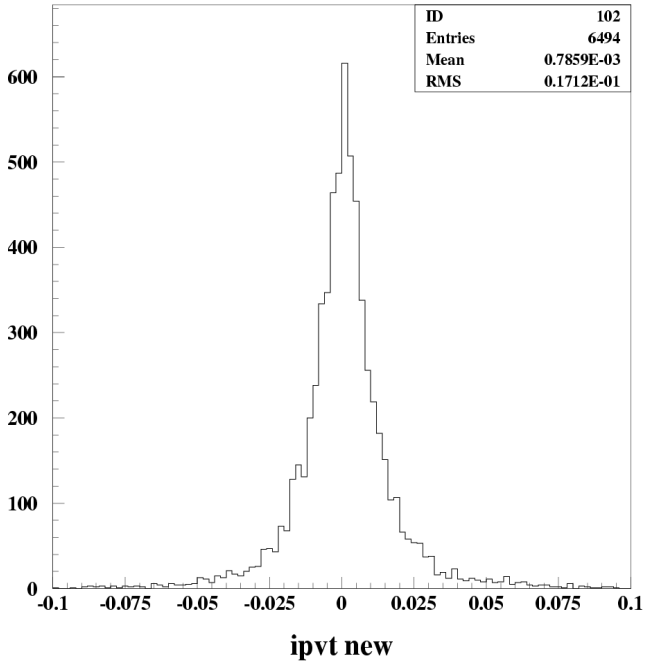
Results: IP of tracks to primary vertex (rphi)



ipvt no calibration



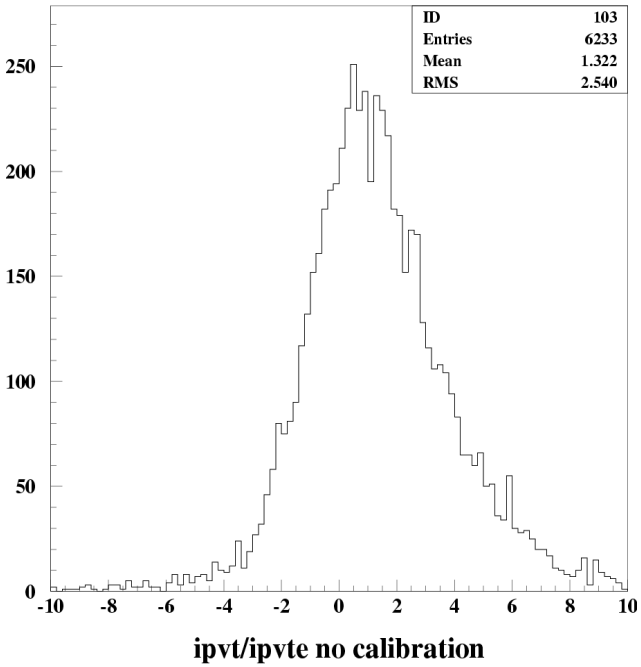
ipvt old

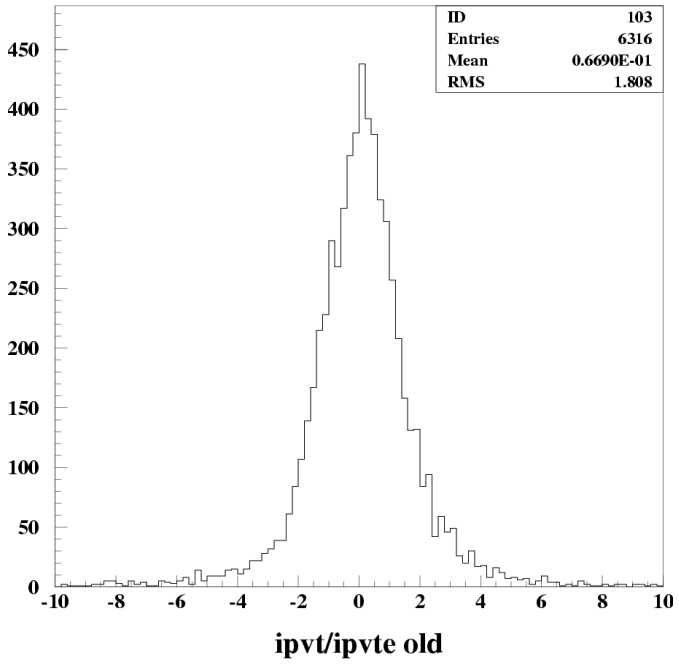


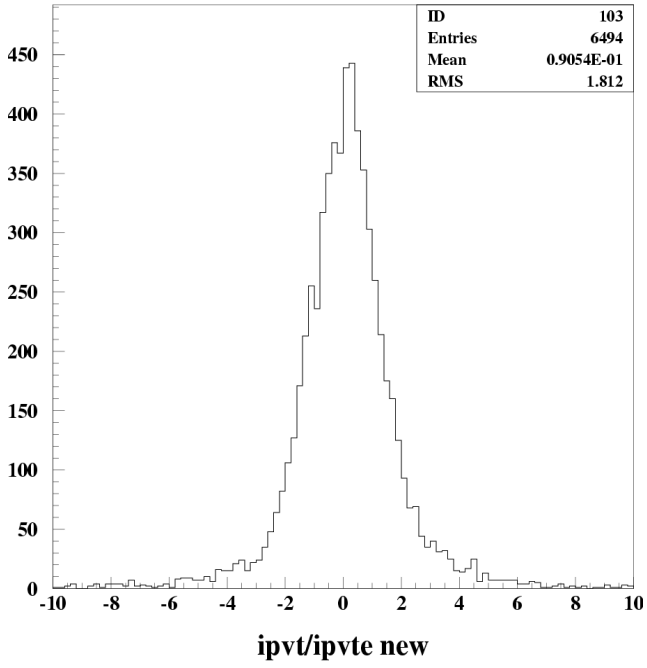
ipvt new

→ **Old ~ new**

Results: IP/σ(IP) of tracks to primary vertex (rphi)

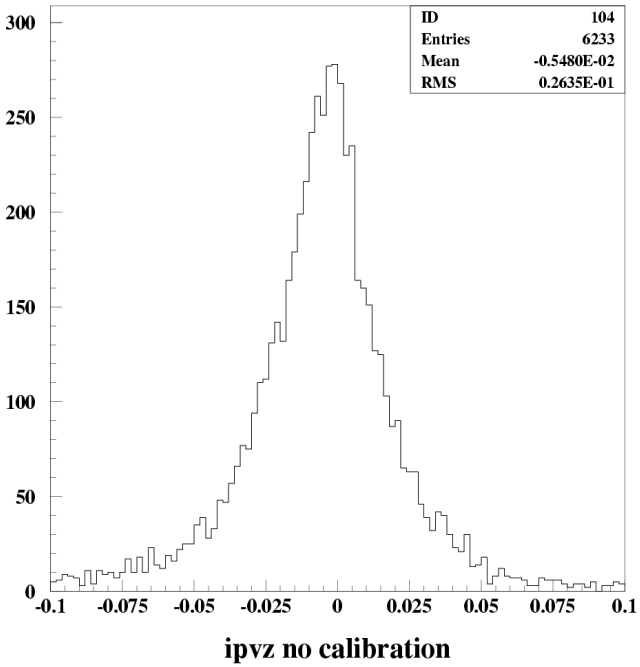




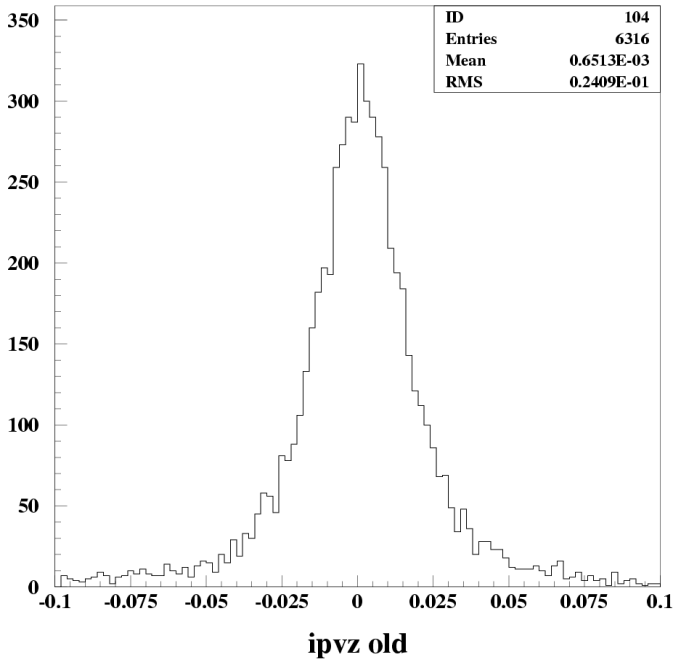


→ **Old ~ new**

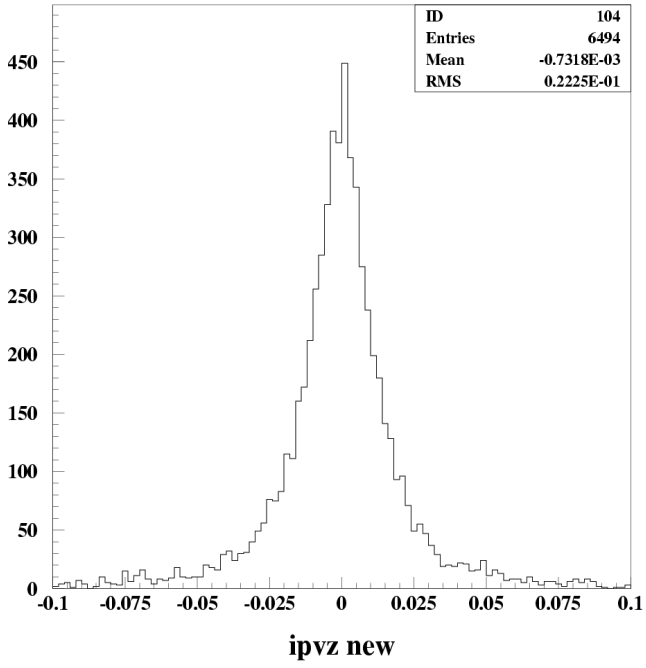
Results: IP of tracks to primary vertex (rz)



ipvz no calibration



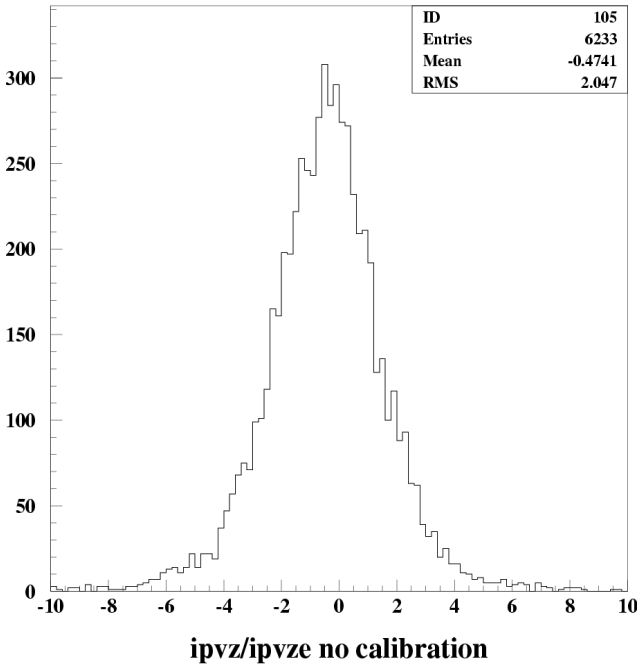
ipvz old



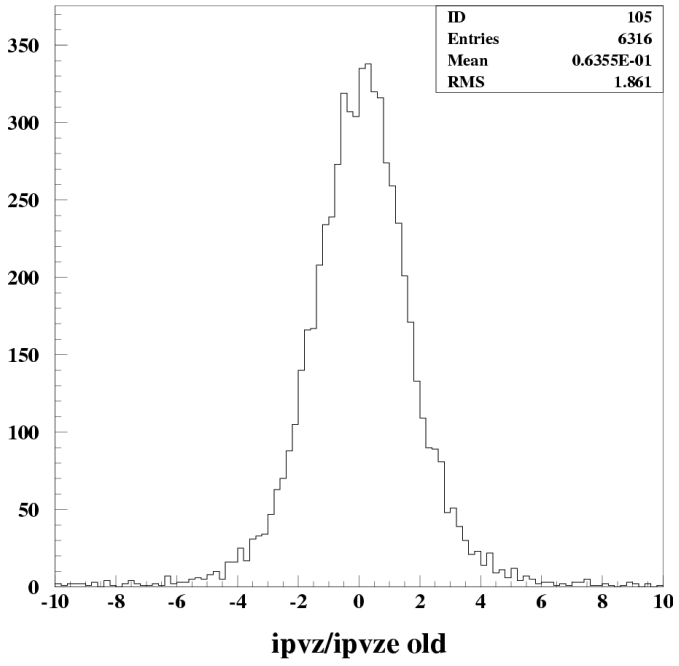
ipvz new

→ **New is somewhat better**

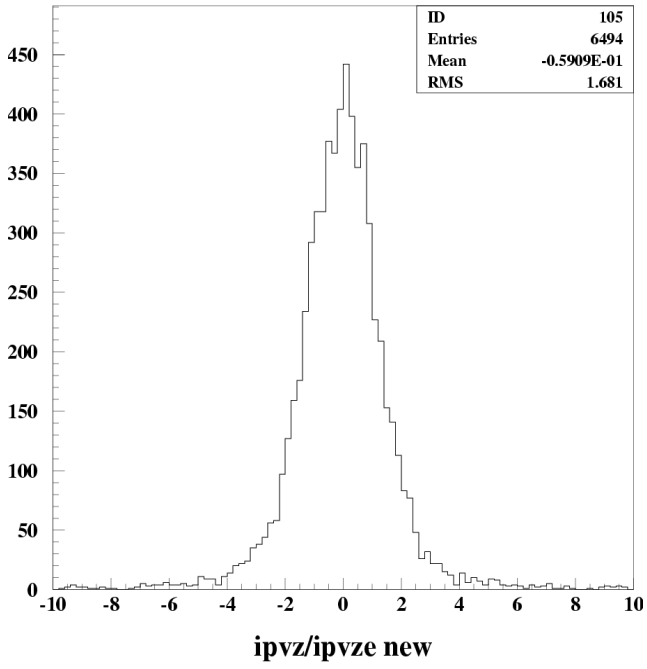
Results: IP/σ(IP) of tracks to primary vertex (rz)



ipvz/ipvze no calibration



ipvz/ipvze old



ipvz/ipvze new

→ **New is somewhat better**

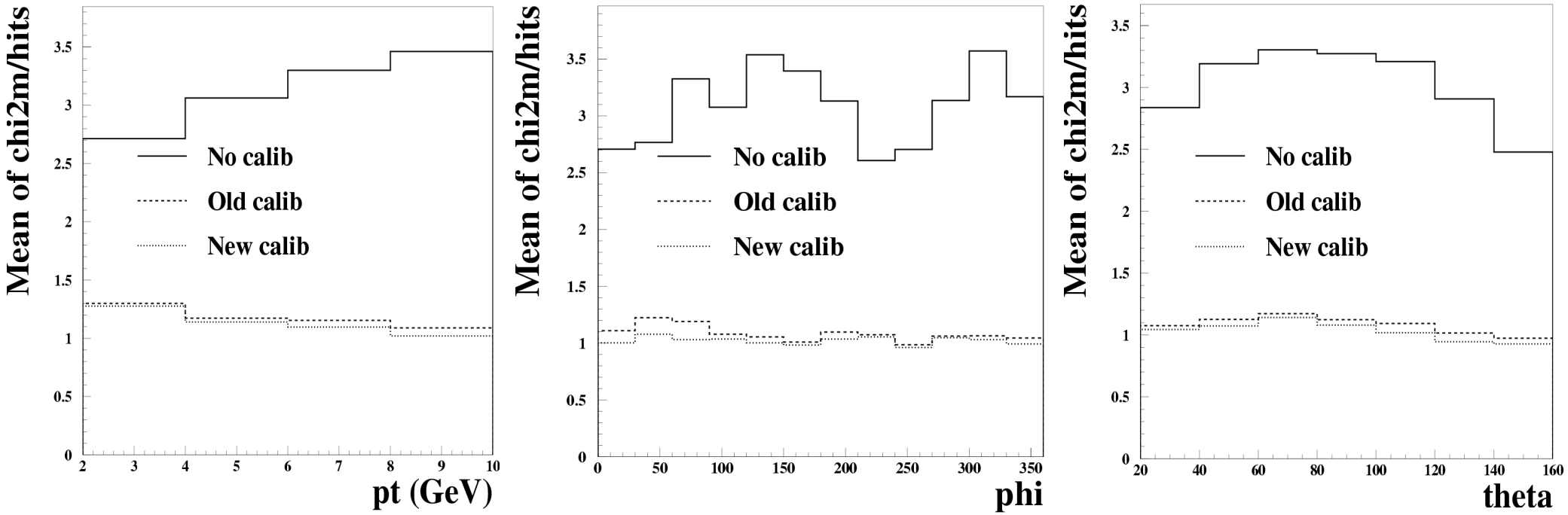
Conclusions

Single track quality tests@ZEUS:

- ✔ **New CTD-MVD chisquare sensitive to MVD alignment quality, new alignment using in addition also cosmics slightly better (=smaller) χ^2 than old**
- ✔ **Track Impact parameter to the primary vertex: New alignment improves *mainly rz , rphi much less***

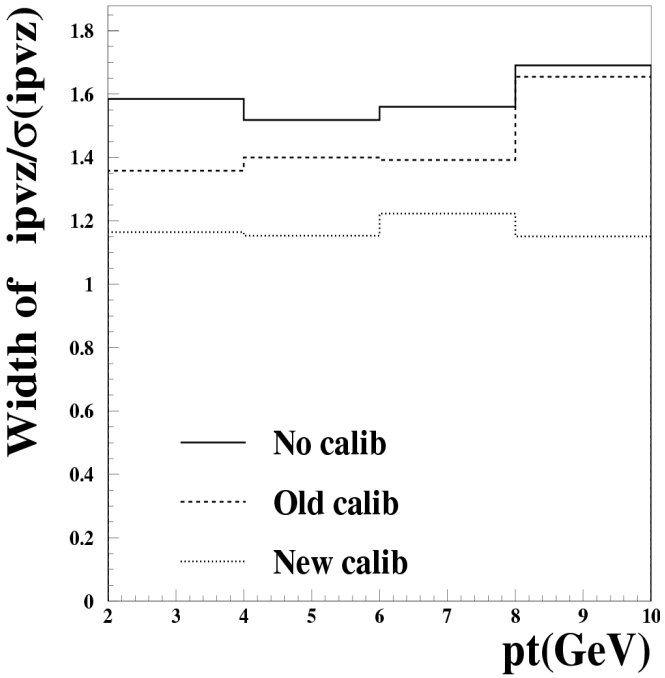
Backup slides

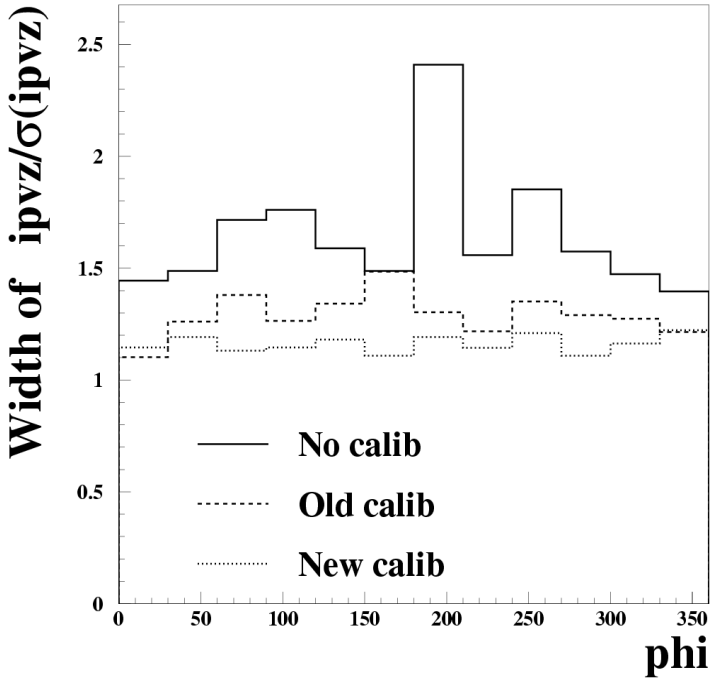
Results: Mean of χ^2/#BMVD-hits differentially

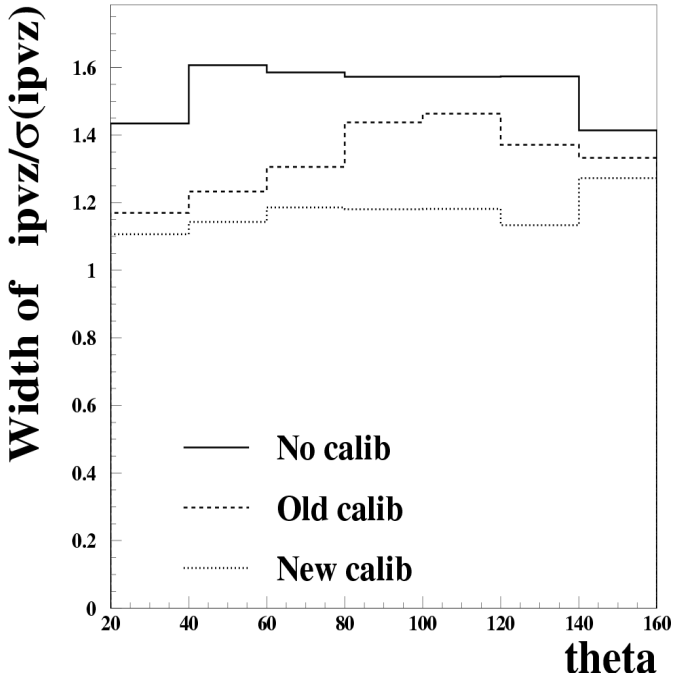


Note: pt>5 GeV cut released for pt plot, 60<theta<120 cut released for theta plot

Results: Widths of IP/σ(IP) differentially (rz)

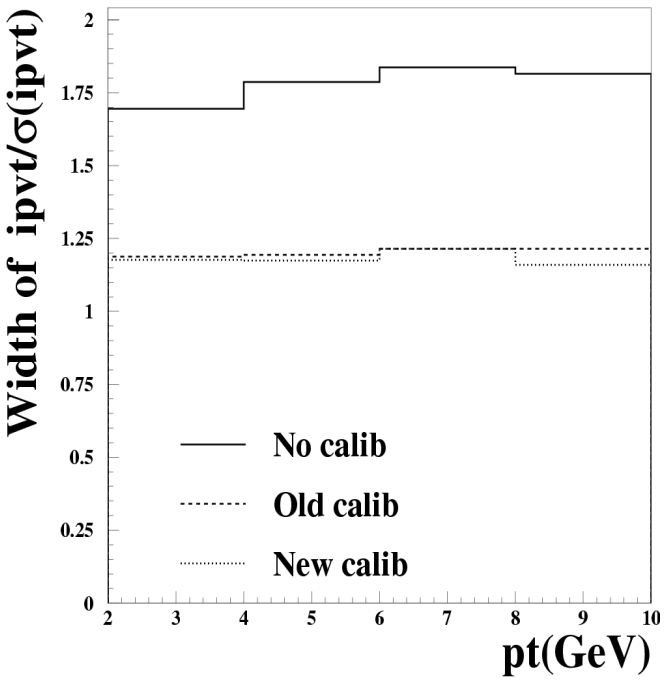


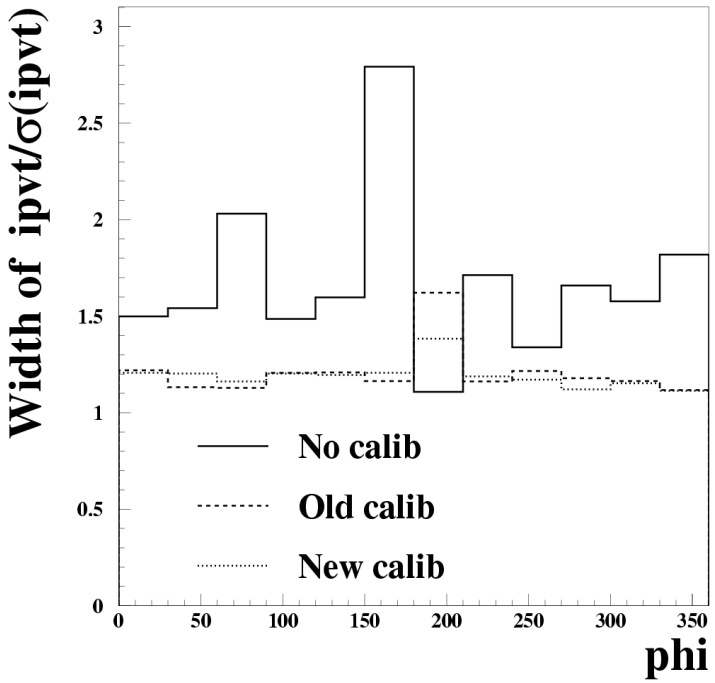


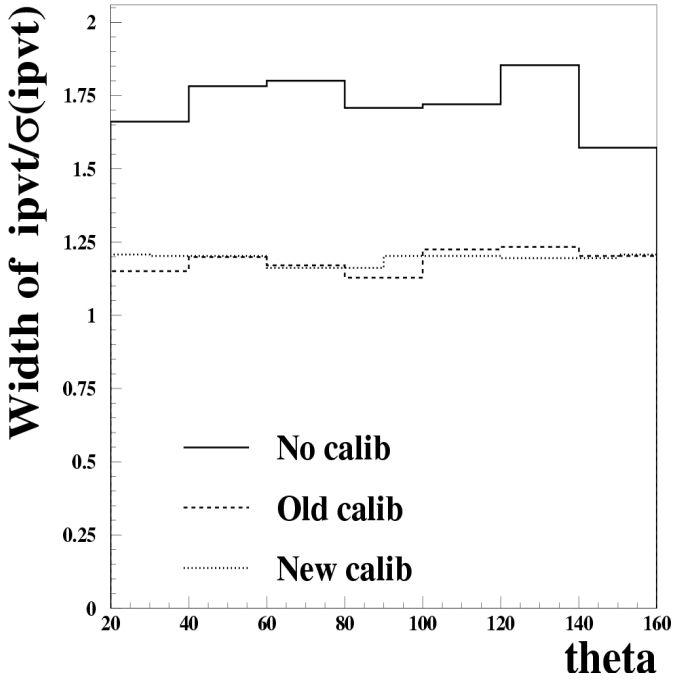


Note: pt>5 GeV cut released for pt plot, 60<theta<120 cut released for theta plot

Results: Widths of IP/σ(IP) differentially (rphi)







Note: pt>5 GeV cut released for pt plot, 60<theta<120 cut released for theta plot