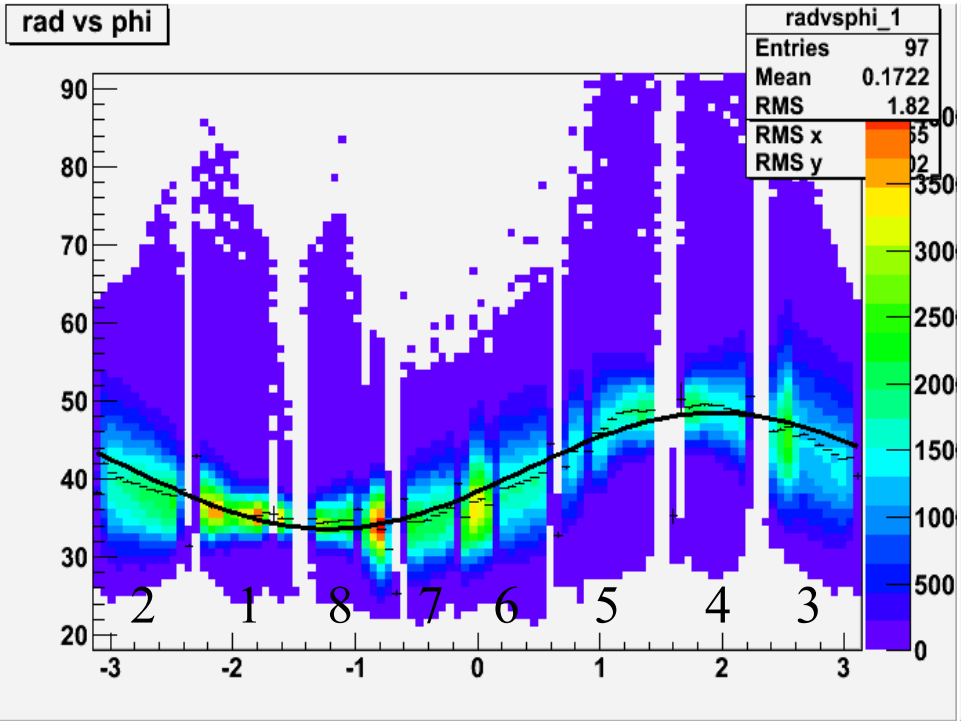
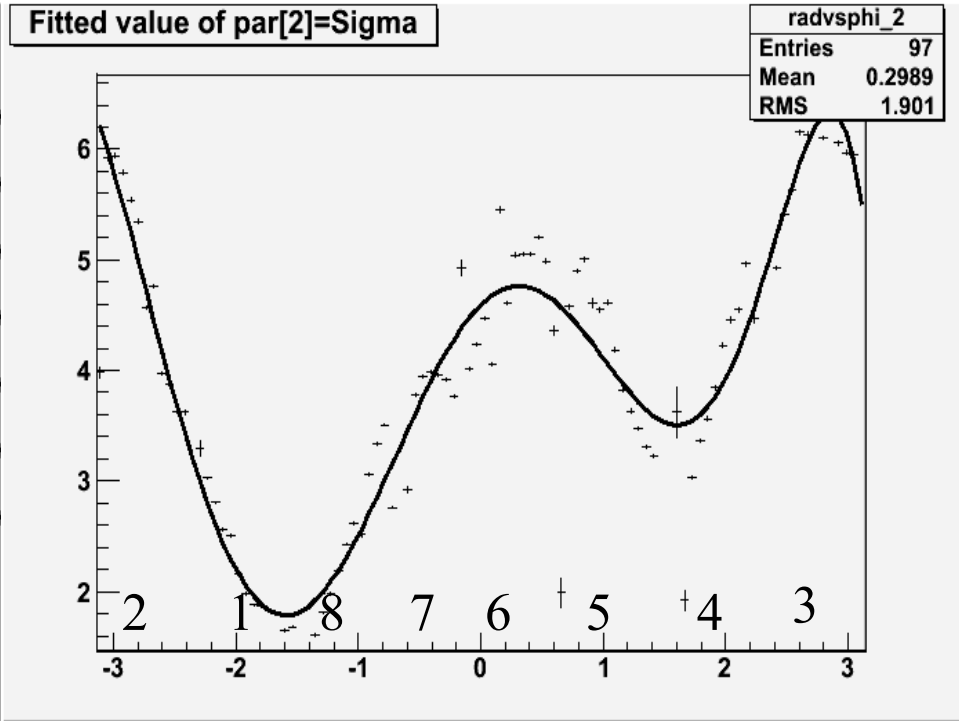
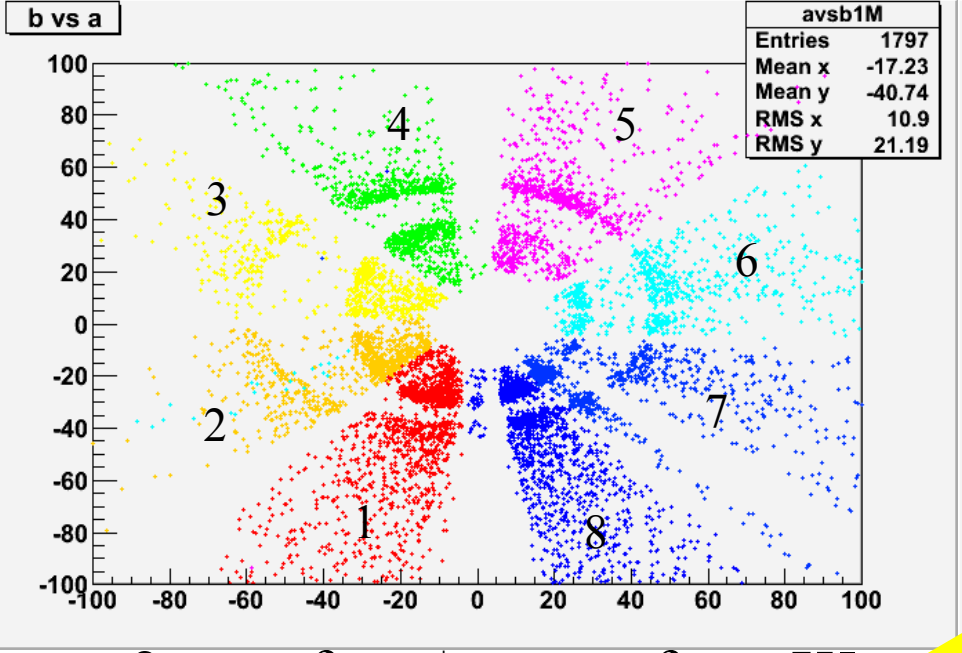
KK vertex search: cuts optimization

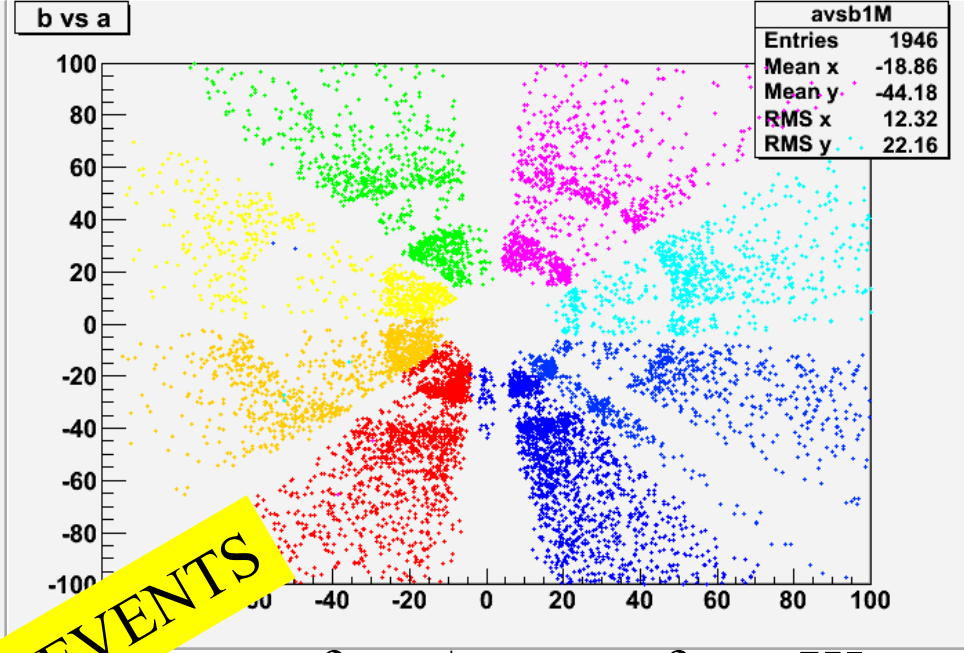
- Problem: which is the best cut on the radius from conformal mapping to enhance the rejection on μ^+/π^+ wrong tracks from K^- vertex mantaining the good signals from Σ^+
  - Reject most of μ^+
  - Keep most of π^+ from Σ^+
- Mean value and sigma evaluated on target coordinates





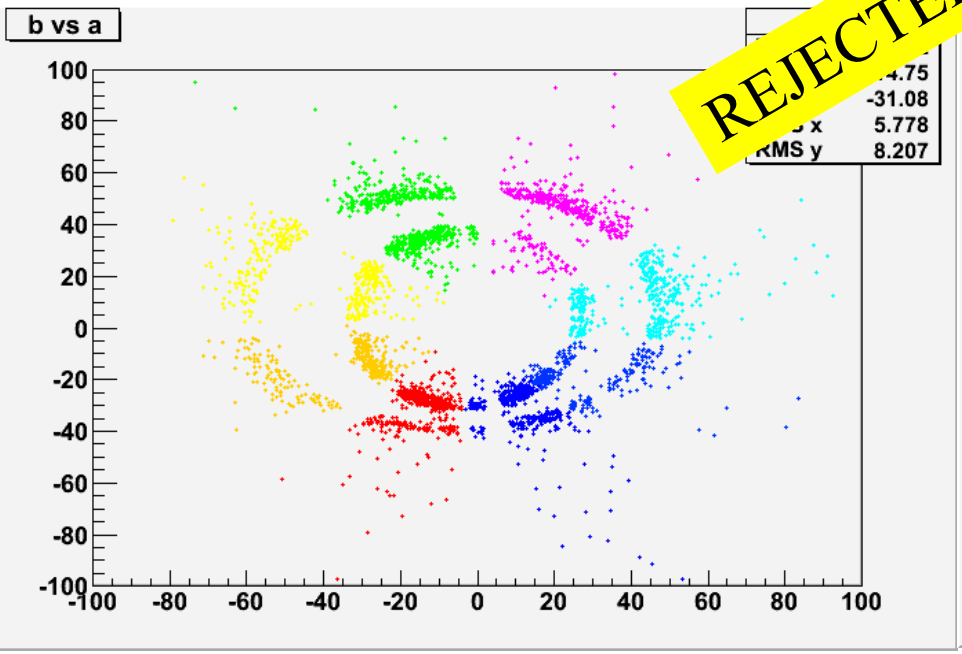


2σ cut for μ^+ events from K^-

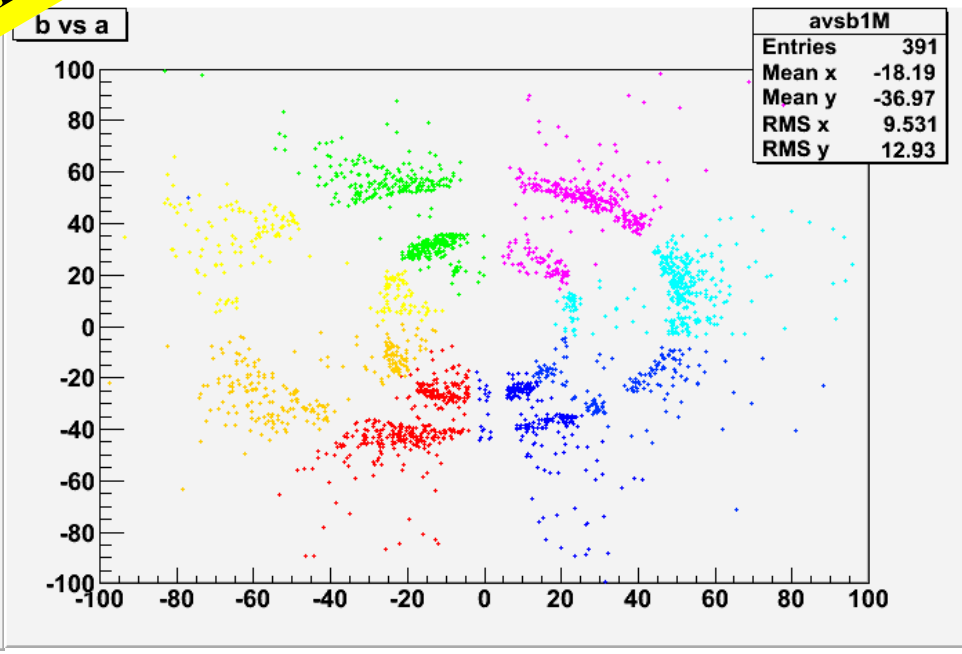


3σ cut for μ^+ events from K^-

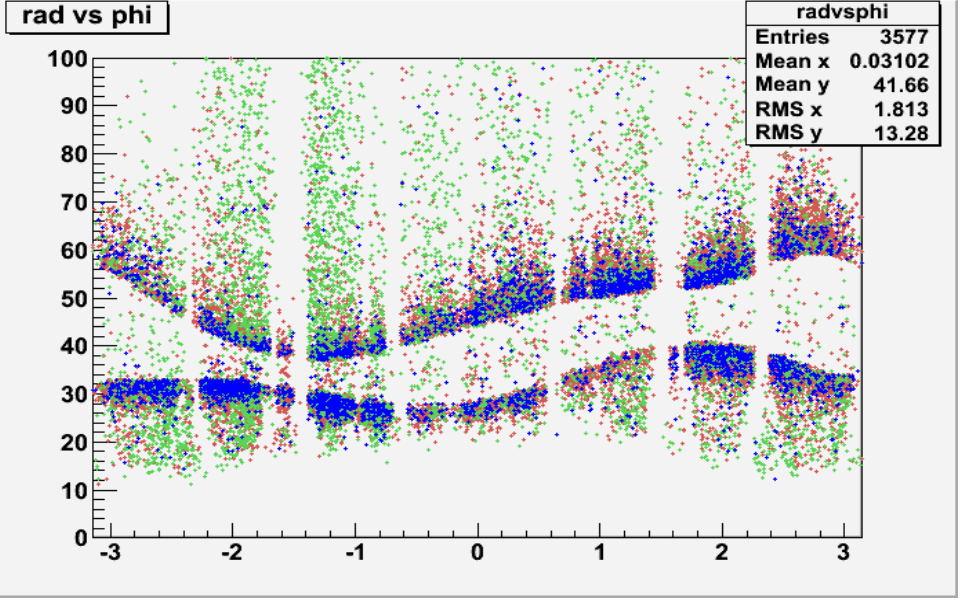
REJECTED EVENTS



2σ cut for Σ^+ events from K^-



3σ cut for Σ^+ events from K^-



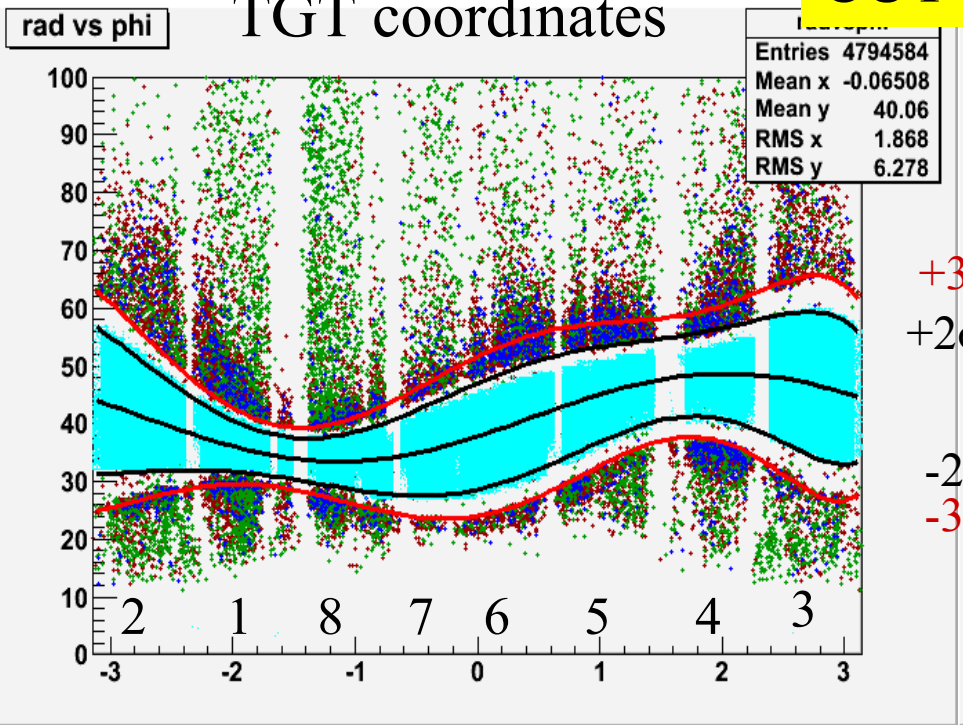
CUT at 2σ

TGT coordinates

- μ events (ok to be rejected)
- Σ events (bad rejection): TOO MANY
- p < 180 MeV/c events (bad rejection)

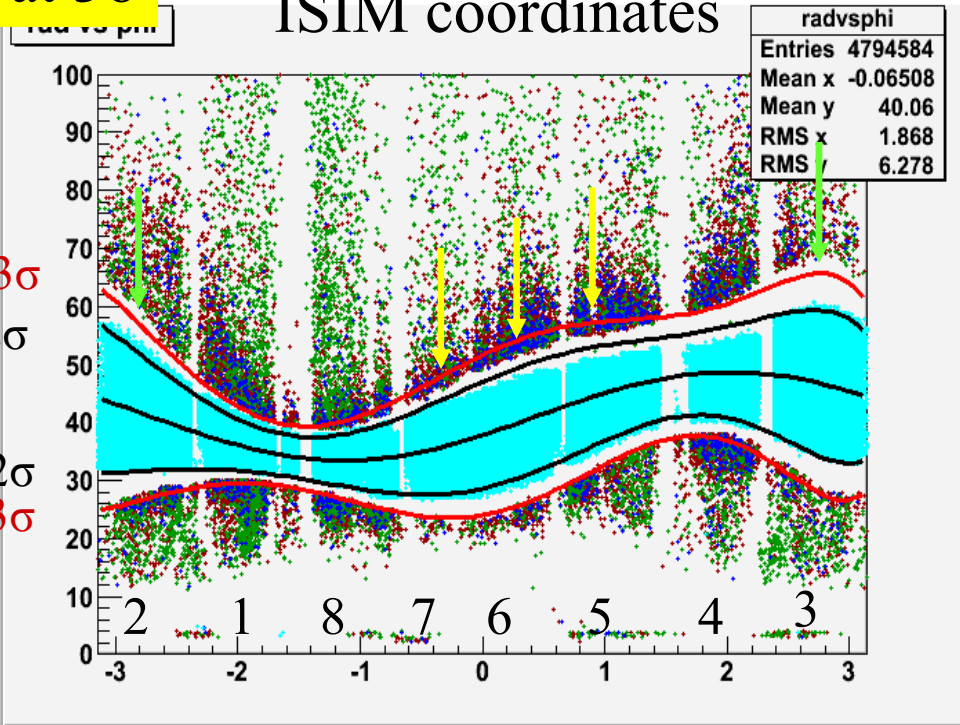
CUT at 3σ

TGT coordinates

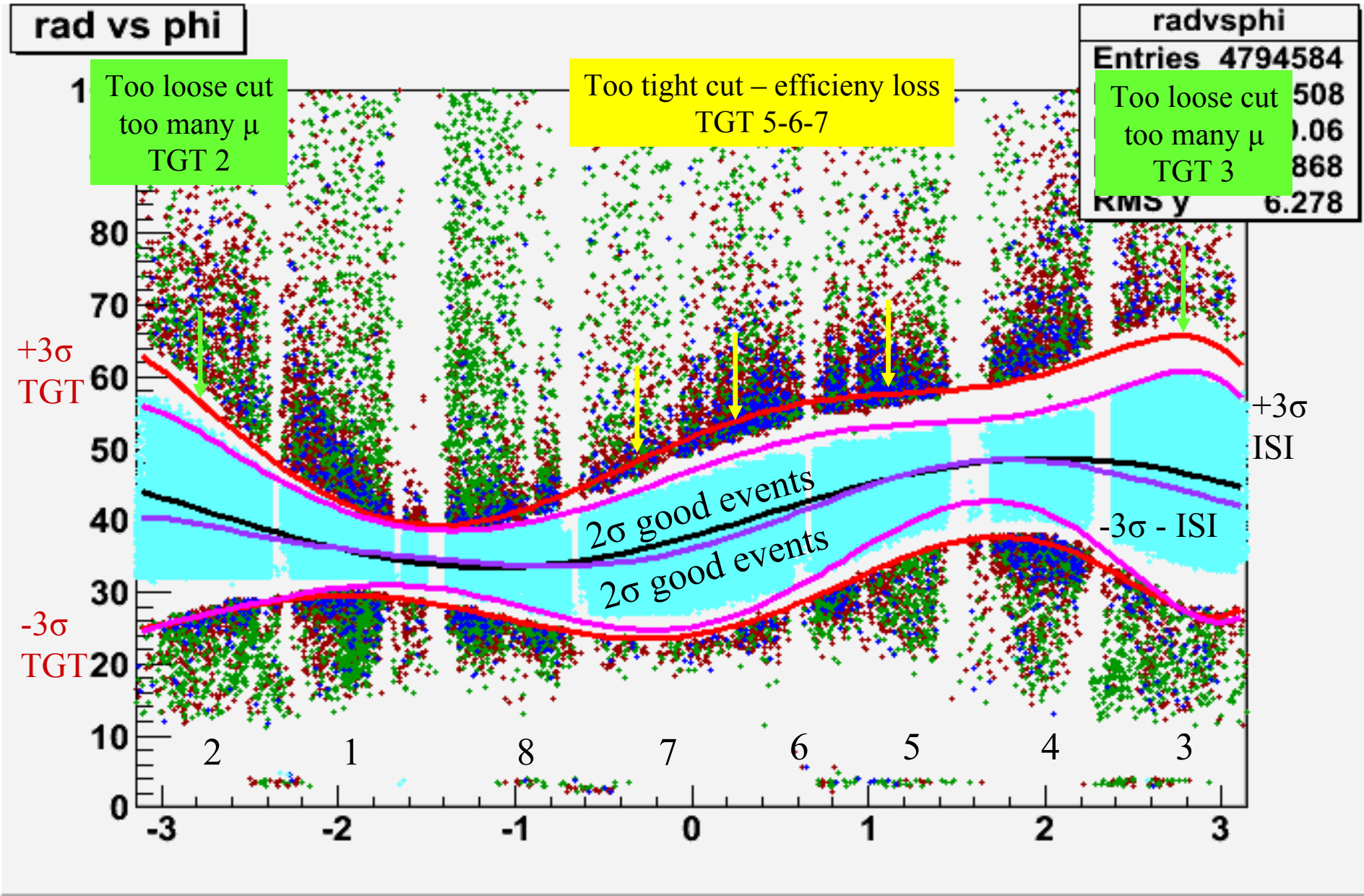


+3σ
+2σ
-2σ
-3σ

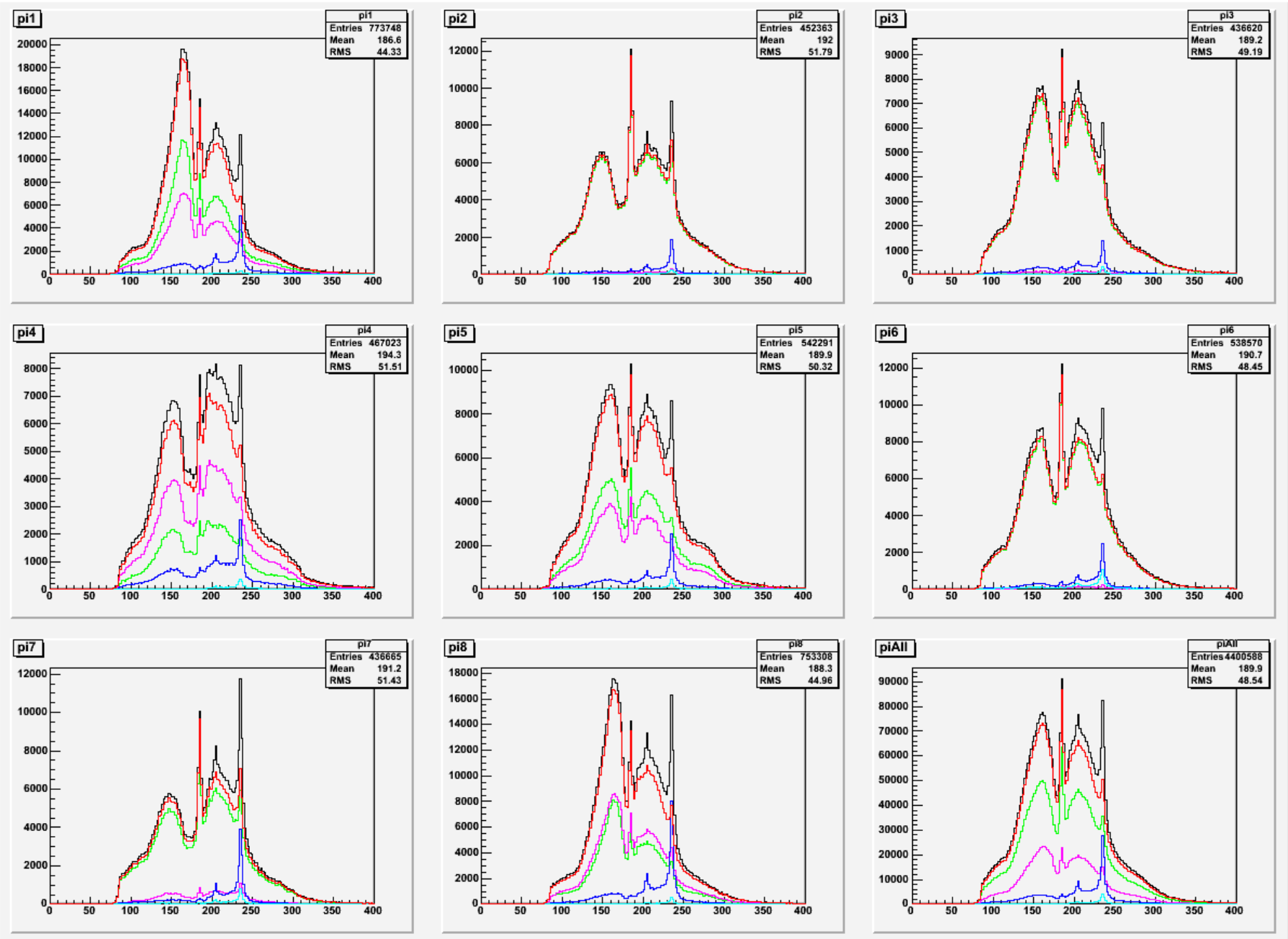
ISIM coordinates



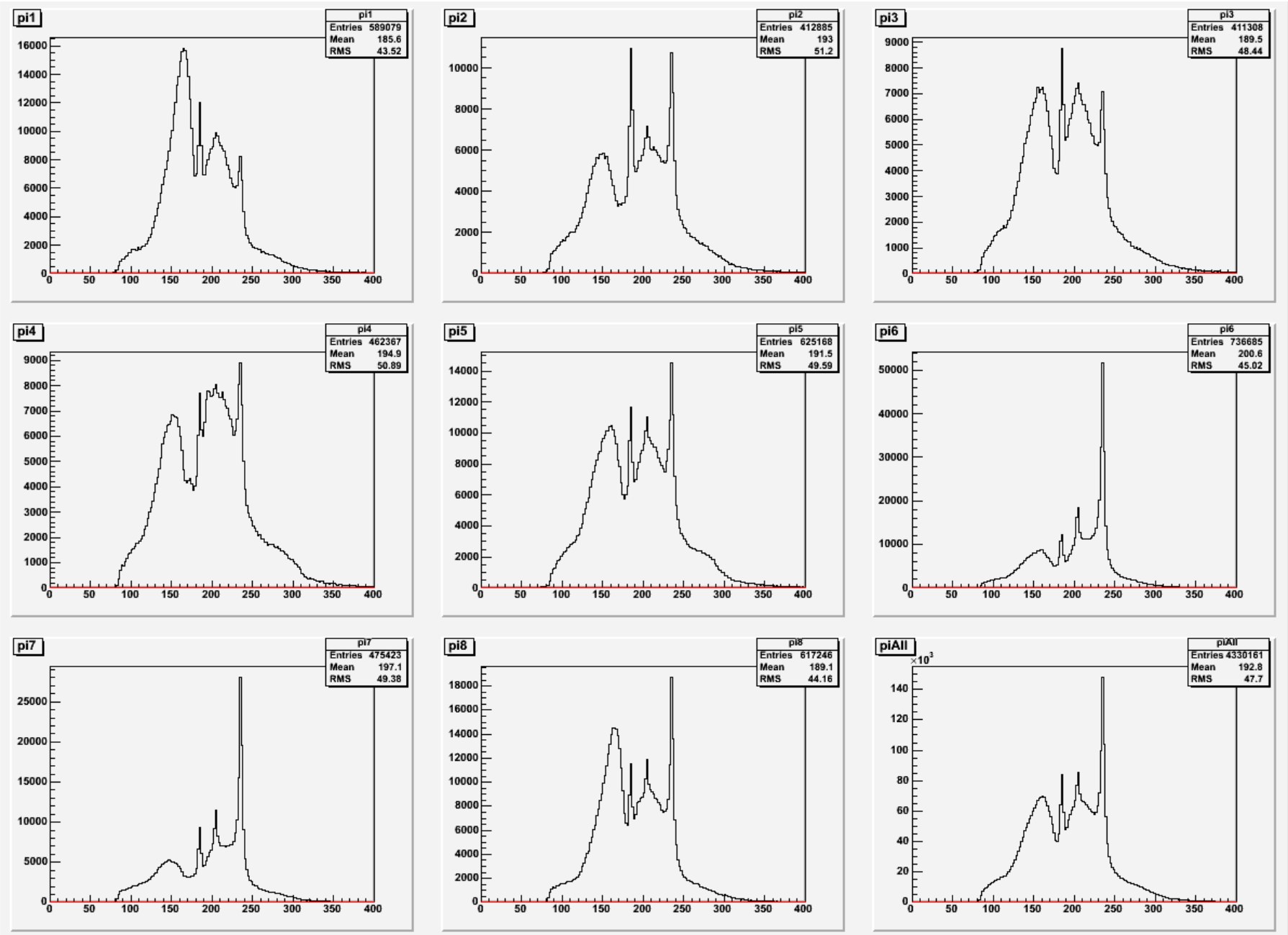
REJECTED EVENTS – ISIM COORDINATES



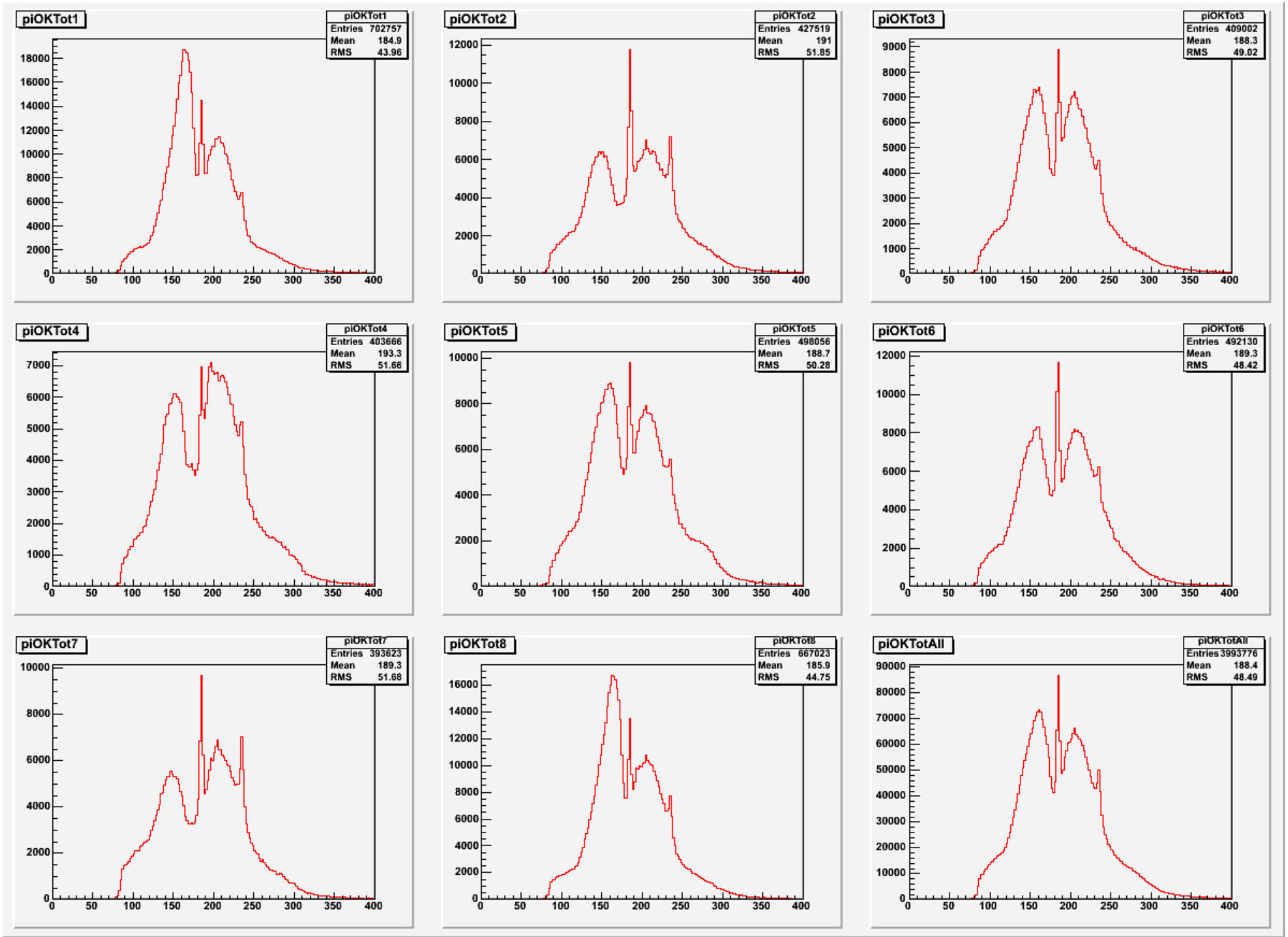
π^+ spectra: 3σ cut, diff z < 6 cm, TGT coord.



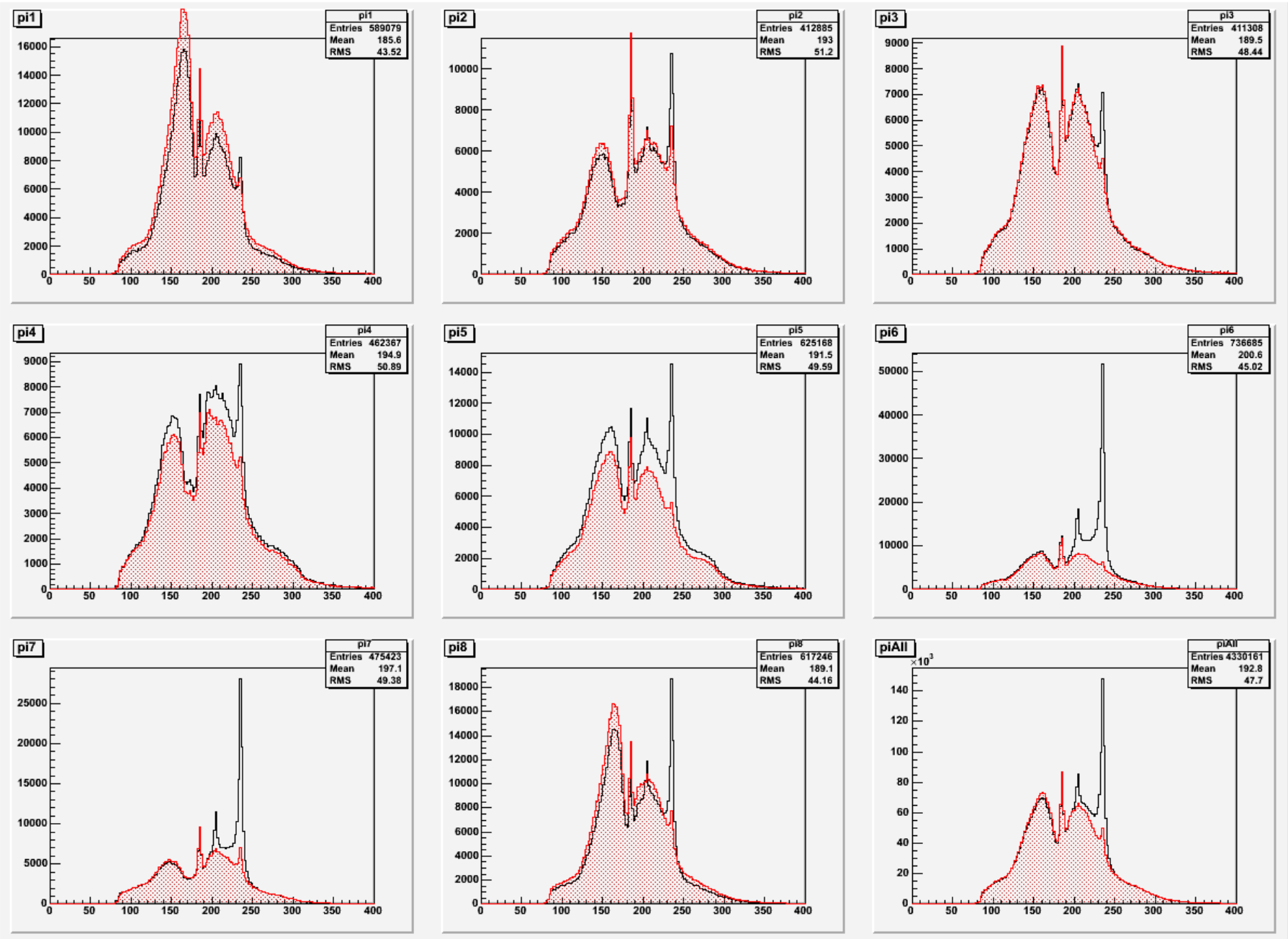
π^+ spectra: JAN09 v60504



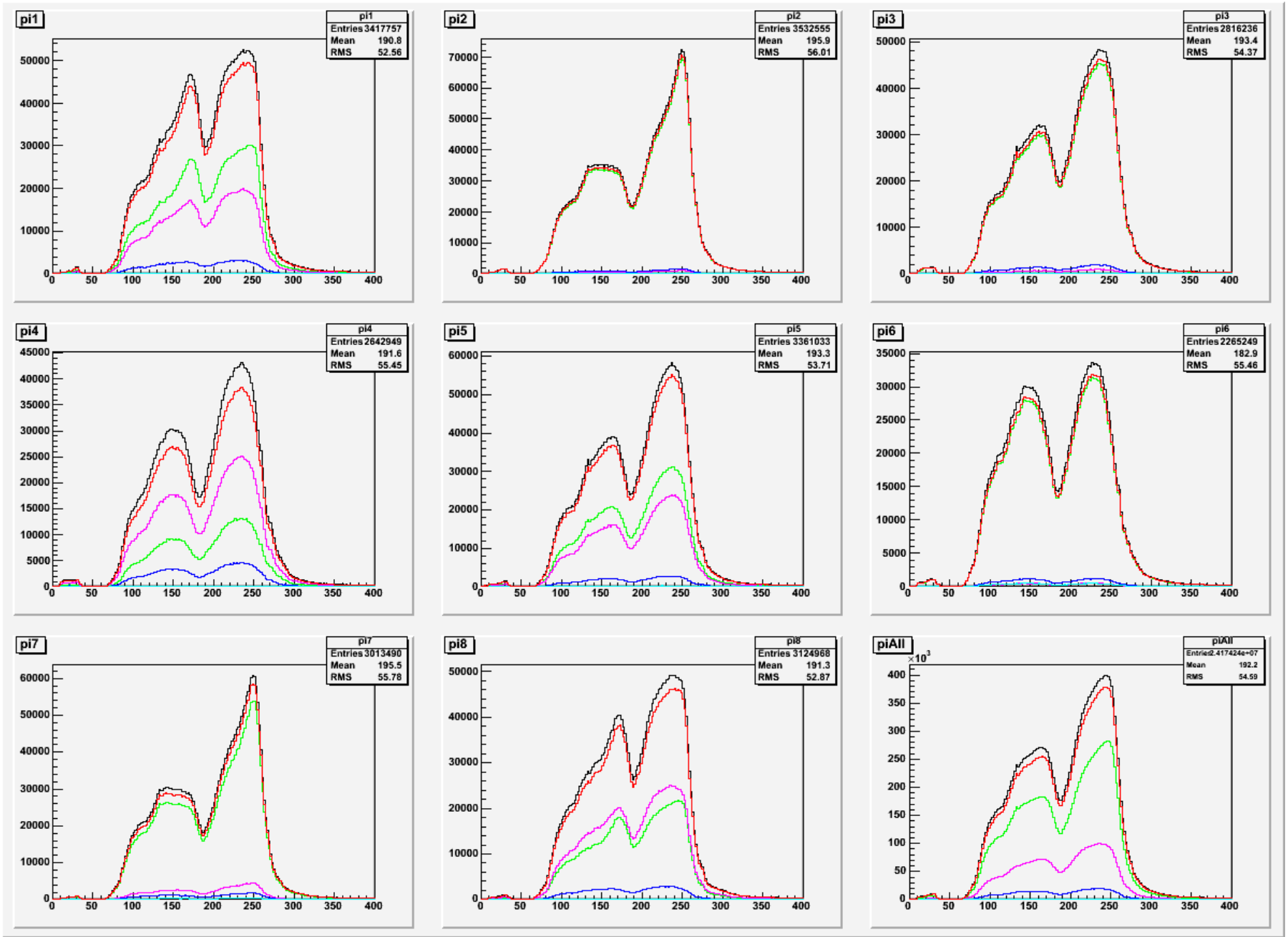
π^+ spectra: 3σ cut, diff z < 6 cm, TGT coord.



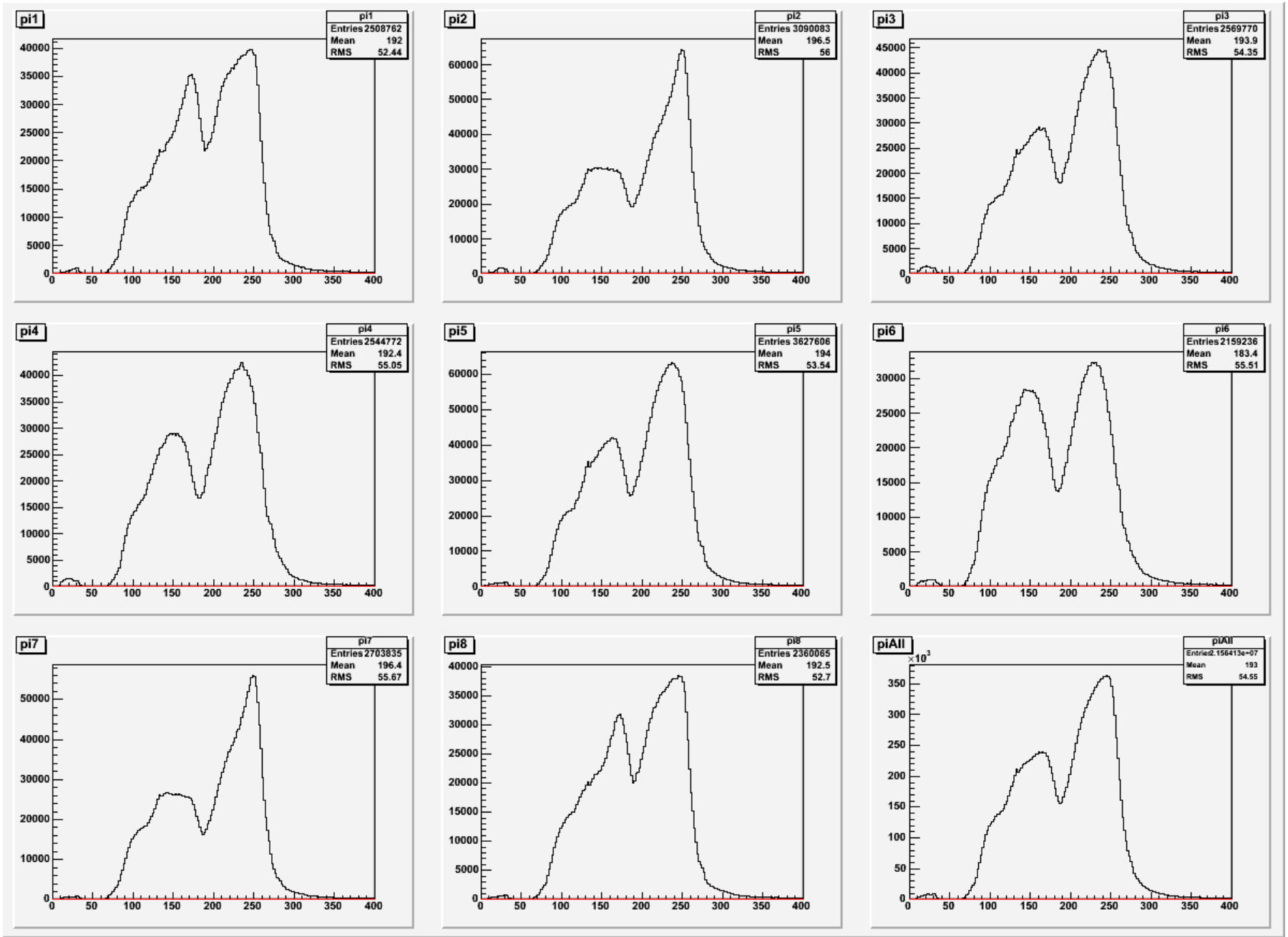
π^+ spectra: NEW vs JAN09



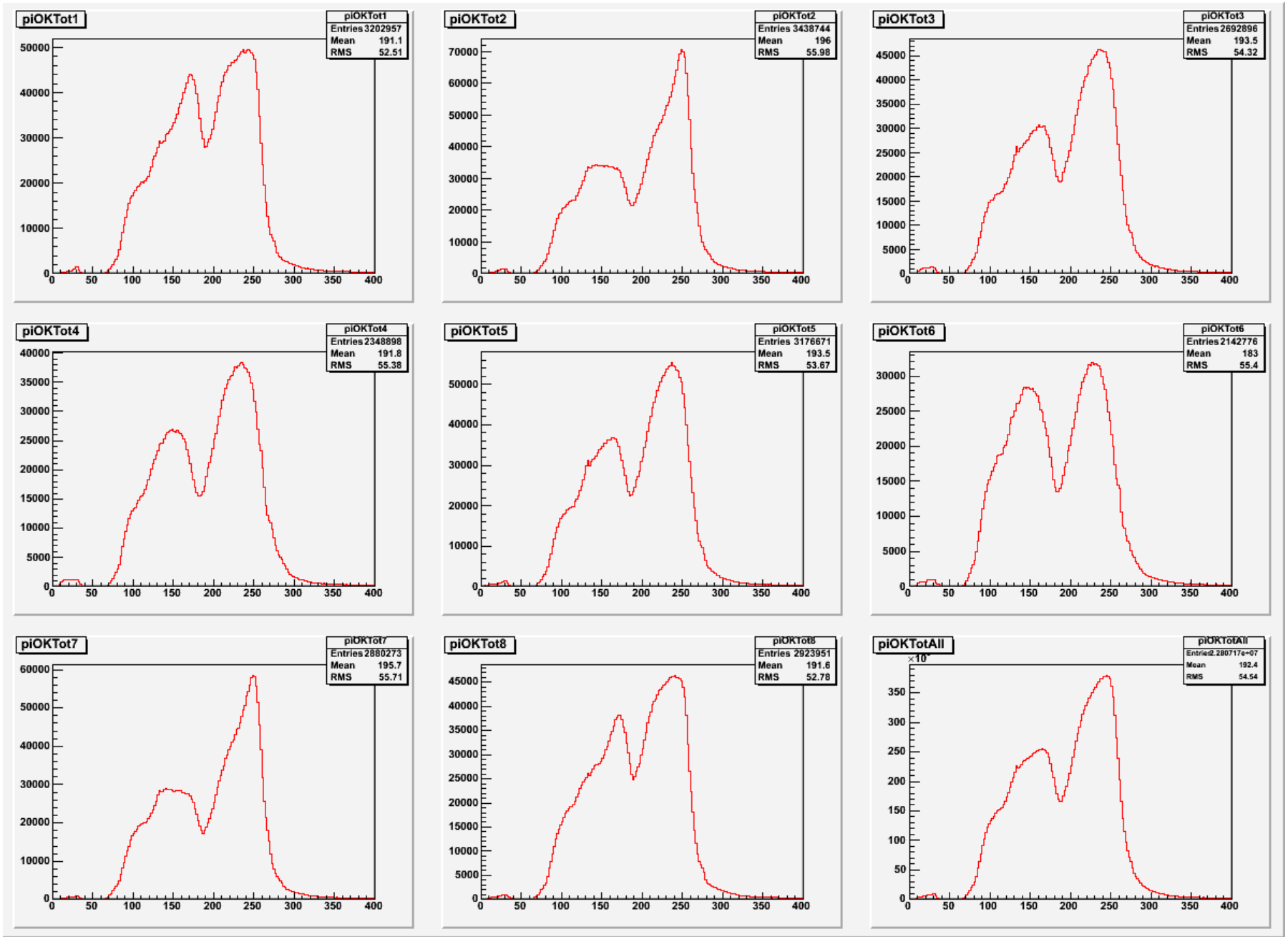
π^- spectra: 3σ cut, diff z < 6 cm, TGT coord.



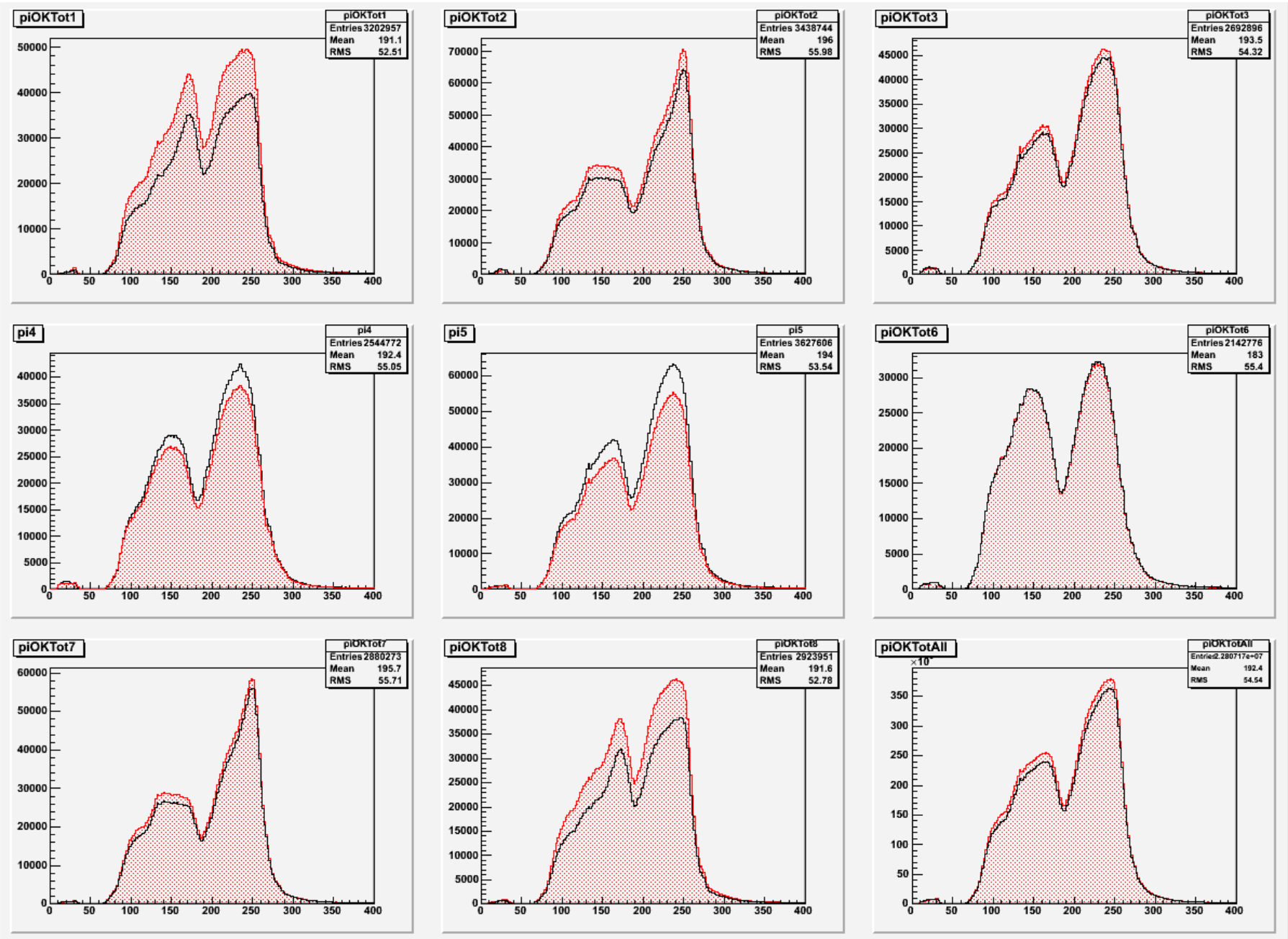
π^- spectra: JAN09 v60504



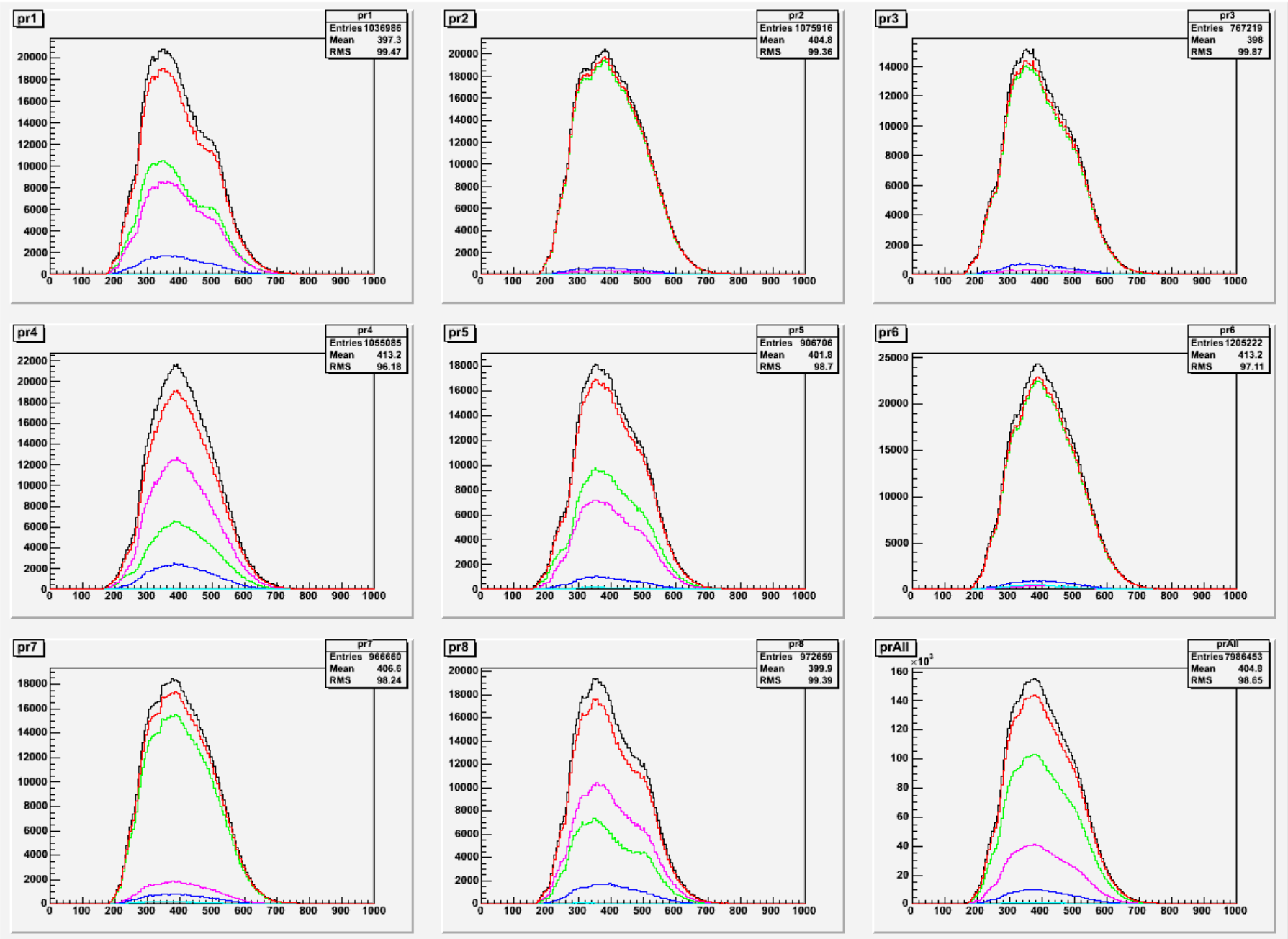
π^- spectra: 3σ cut, diff z < 6 cm, TGT coord.



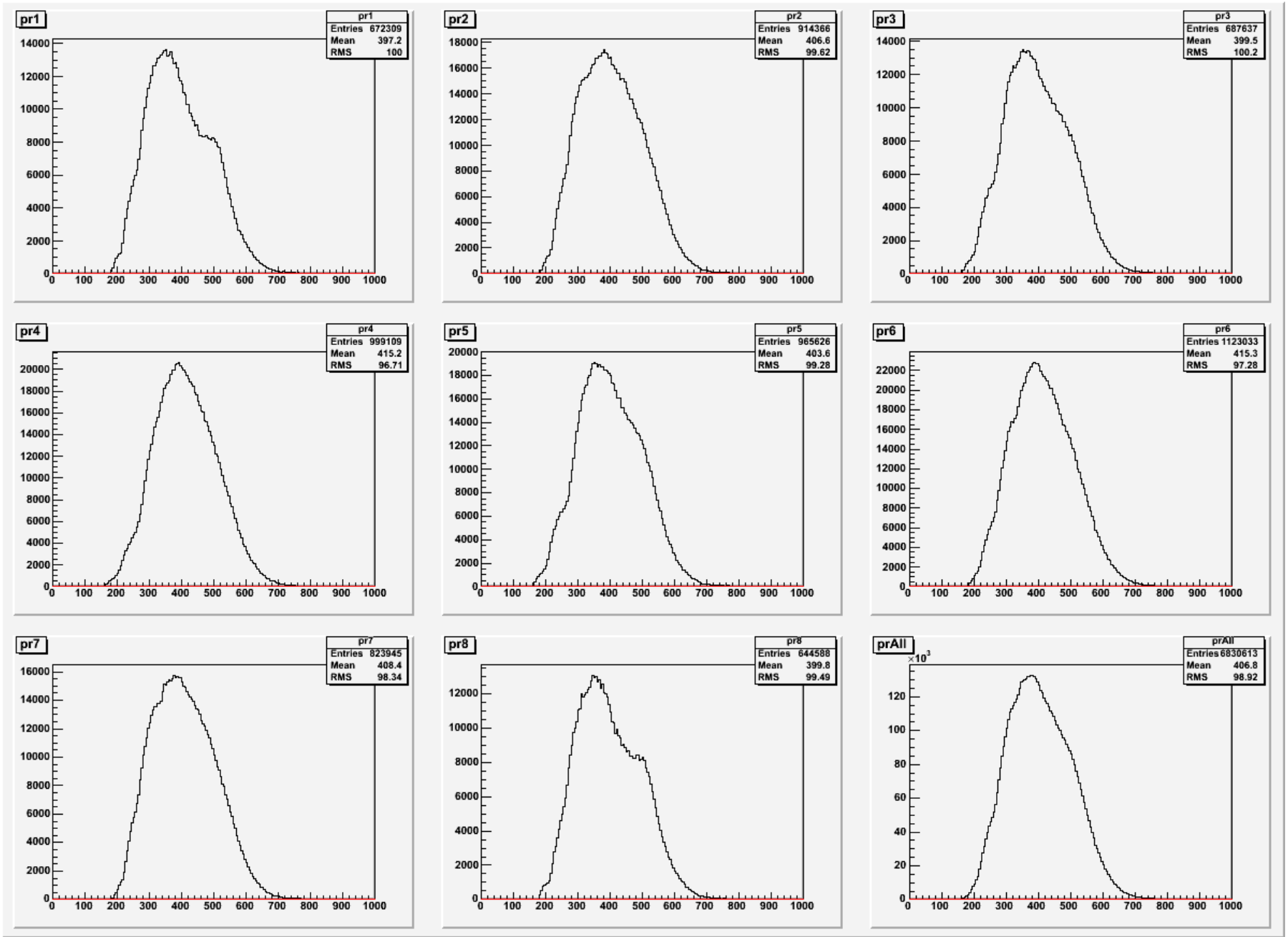
π^- spectra: NEW vs JAN09



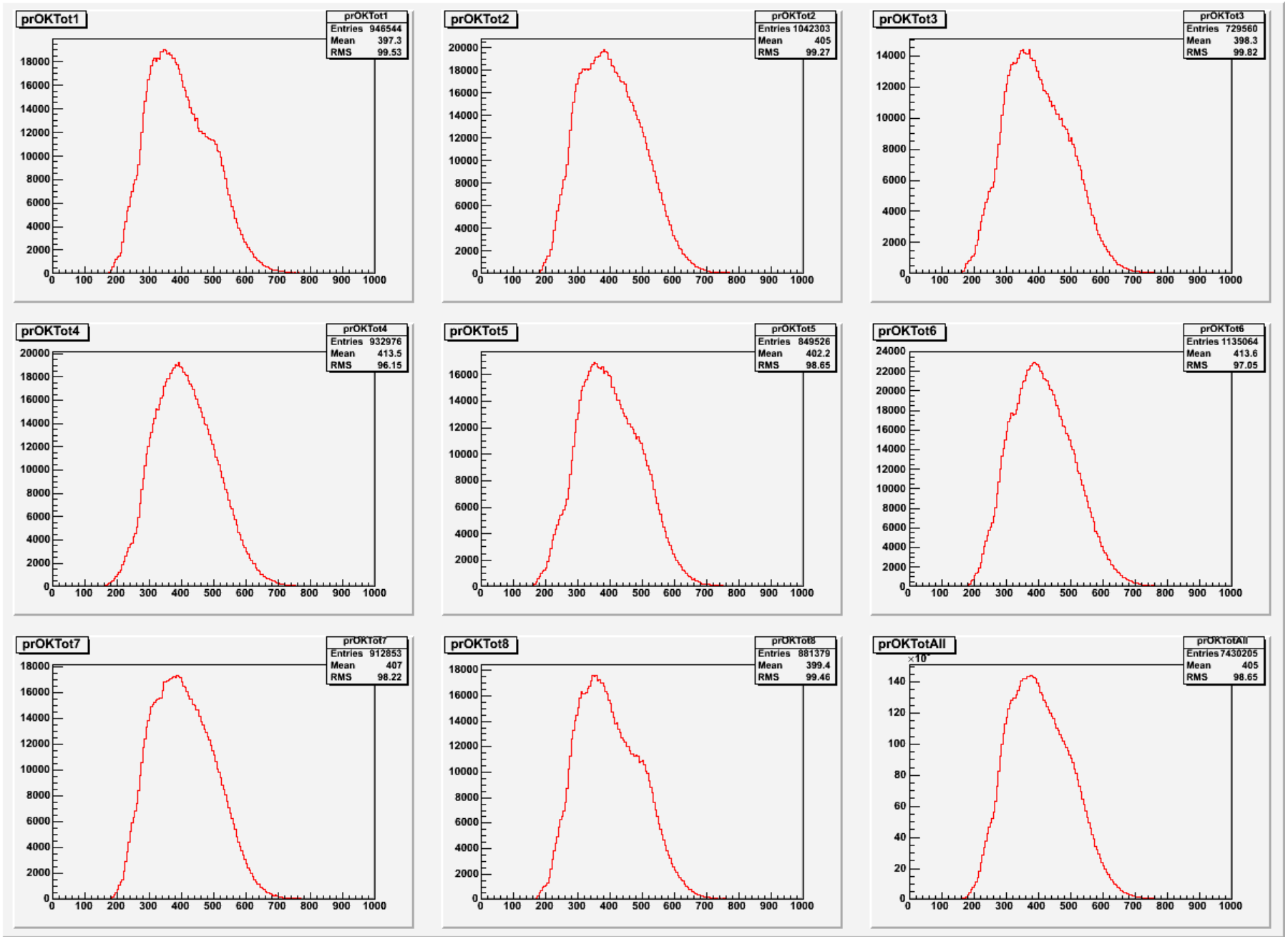
p spectra: 3σ cut, diff z < 6 cm, TGT coord.



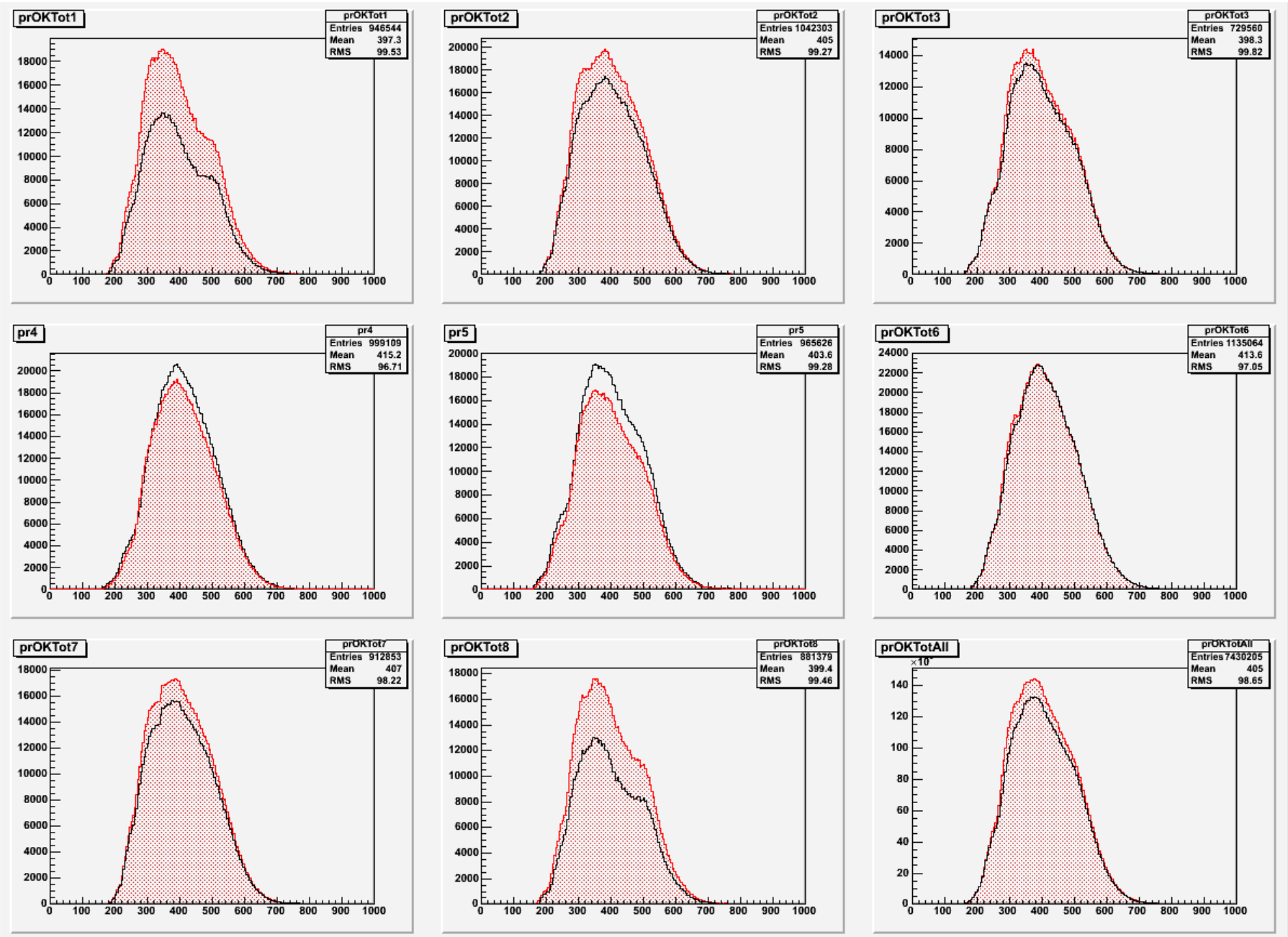
p spectra: JAN09 v60504



p spectra: 3σ cut, diff z < 6 cm, TGT coord.



p spectra: NEW vs JAN09



${}^{4}_{\Lambda}$He Rare Decay Analysis

- Summary of last time findings:
  - d+d
    - Clean the sample
    - Understand production of hyperfragments
  - p+t
    - Detected tritons are too fast
    - Analysis with missing triton necessary

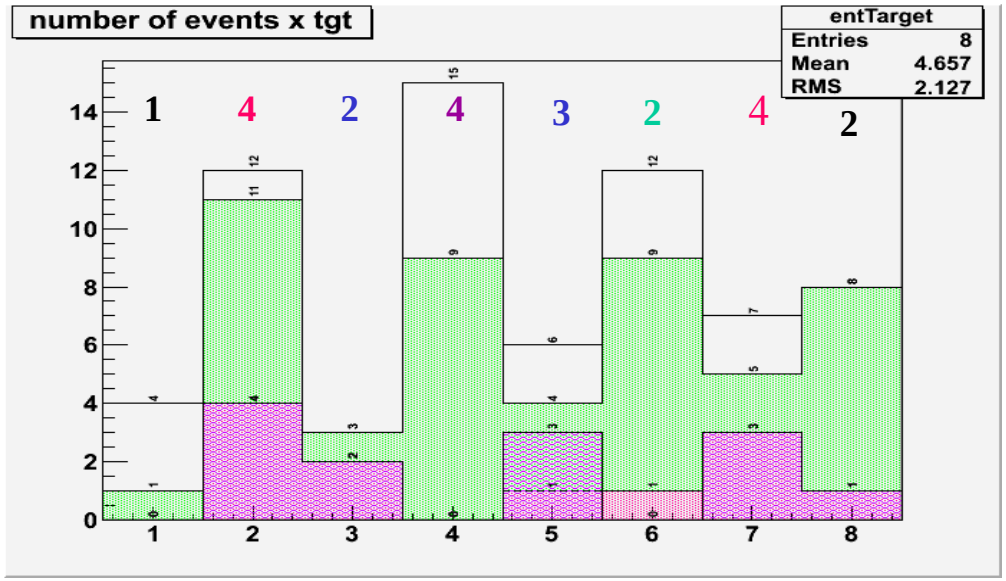
$^{4}_{\Lambda}$He hyperfragment production

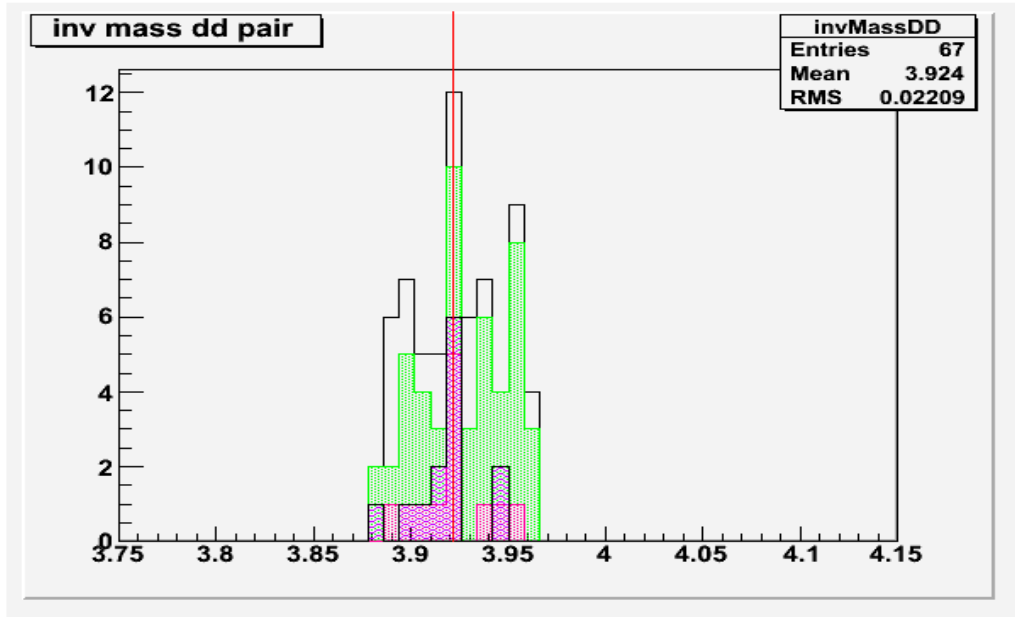
- Exclusive production: $K^- + {}^4He \rightarrow {}^4_{\Lambda}He + \pi^-$
  - π^- momentum: 255 MeV/c
- Based on $K^-p \rightarrow \Lambda + \pi^0$: $K^- + {}^AZ \rightarrow {}^4_{\Lambda}He + X + \pi^0$
  - X: system formed by (Z-3)p + (A-z-1)n
- Based on $K^-n \rightarrow \Lambda + \pi^-$: $K^- + {}^AZ \rightarrow {}^4_{\Lambda}He + X + \pi^-$
  - X: system formed by (Z-2)p + (A-Z-2)n

	π^0	π^-
^{4}He	no	excl
^{6}Li	2n	1p+1n
^{7}Li	3n	1p+2n
^{9}Be	1p+4n	2p+3n
^{13}C	3p+6n	4p+5n
16O	5p+7n	6p+6n

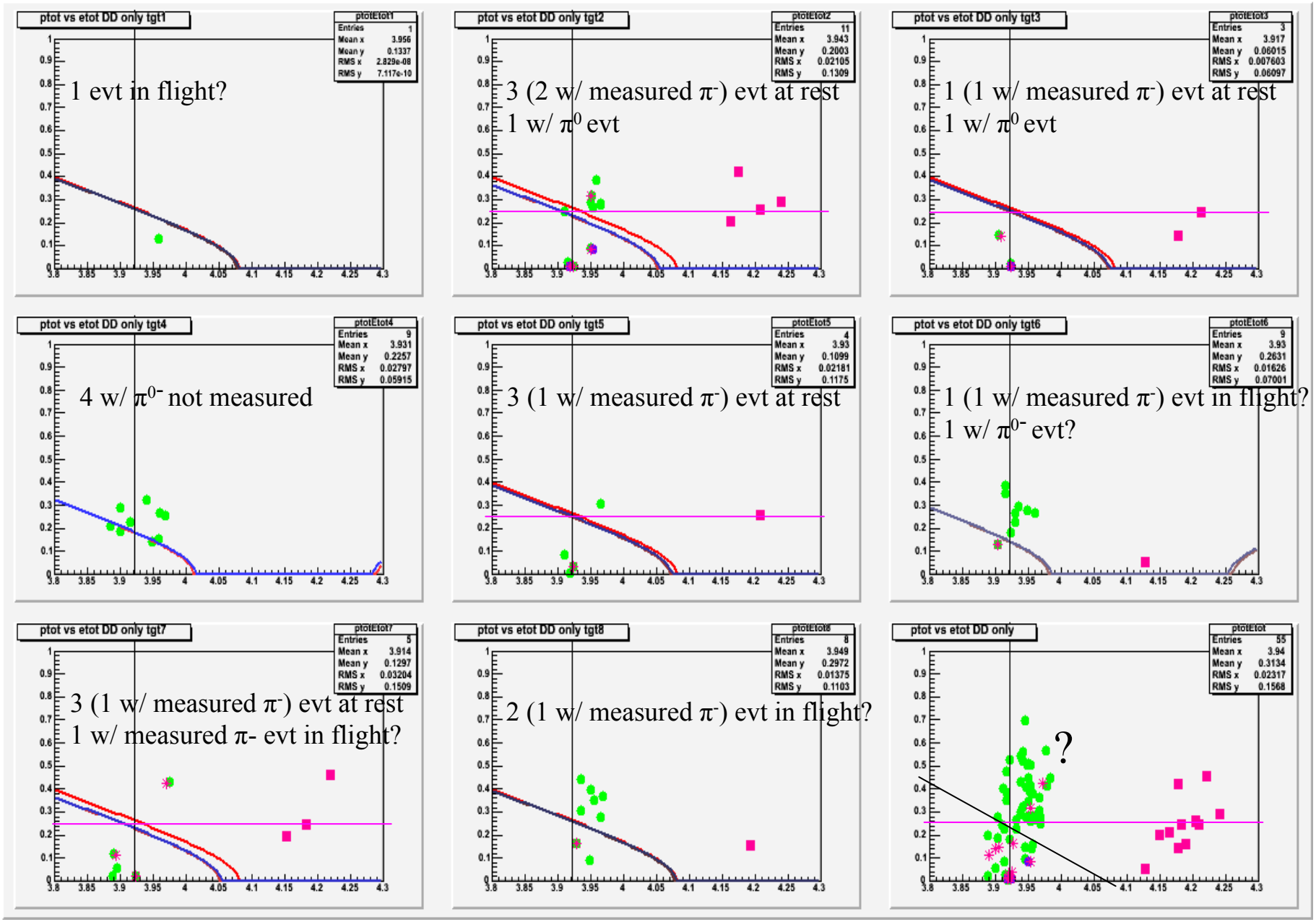
${}^{4}_{\Lambda}\mathrm{He} \rightarrow$ d+d: cuts

- Back-to-back deuterons: $\cos\theta < 0.8$
- Invariant mass of the (d+d) system between (3.88, 3.96) GeV
- Presence of a π^-
- For exclusive events:
  - Total (d+d) momentum in the lab: < 100 MeV/c
  - Presence of a π^- with momentum between (250,260) MeV/c
- For hyperfragments:
  - Follow the p vs E momentum line?





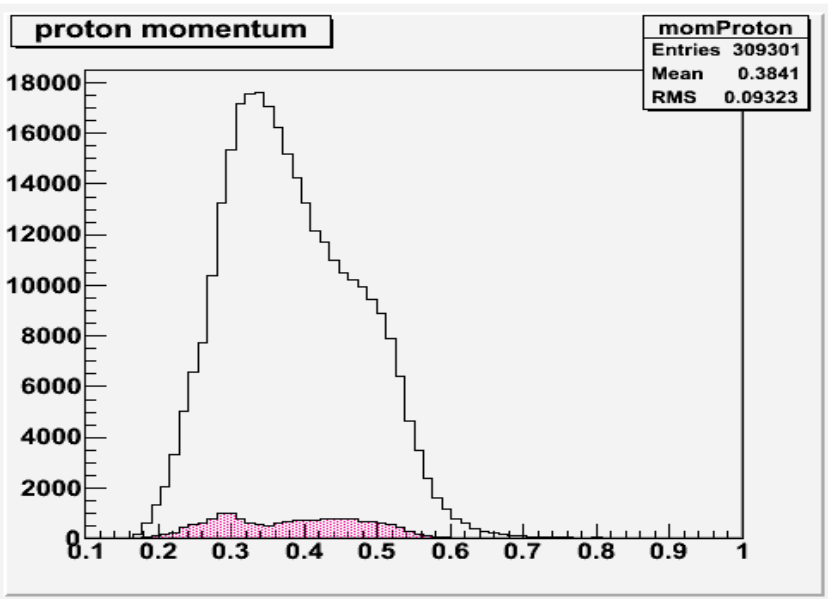
Measured momentum (d+d) vs measured energy

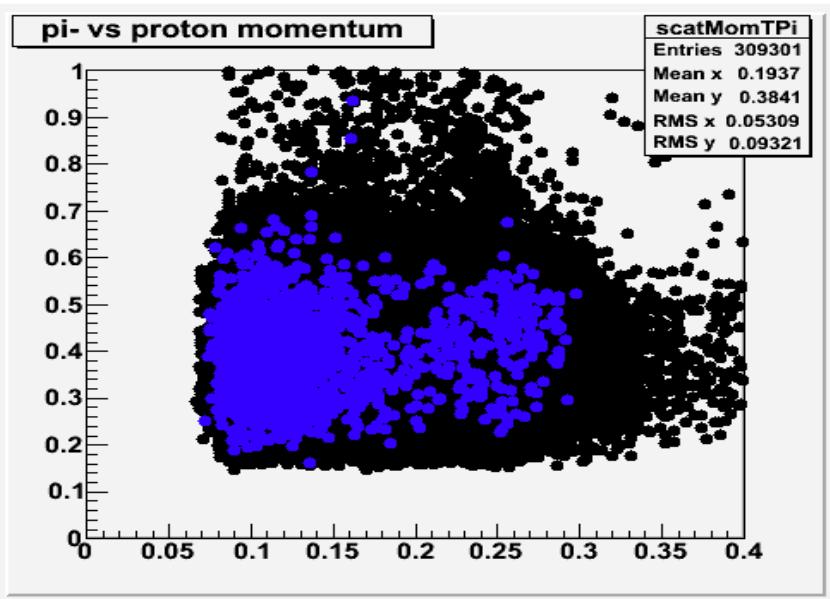


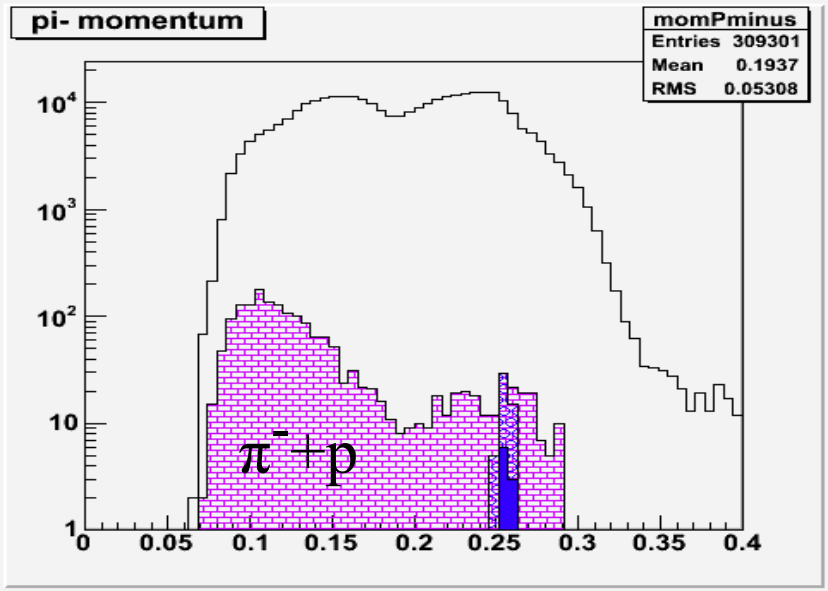
$^{4}_{\Lambda}\mathrm{He} \rightarrow \mathrm{p} + \mathrm{t}$

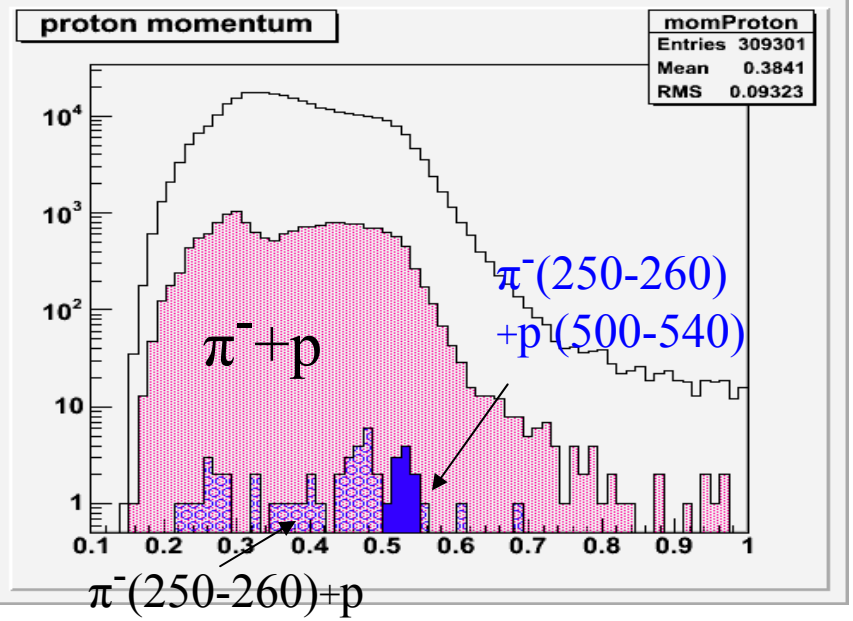
- Missing triton:
  - Events with one proton only, no other positive particles from K^-, no neutrons
    - Momentum in the range (500, 540) MeV/c
  - Energy release on isim at least as large as for measured triton tracks

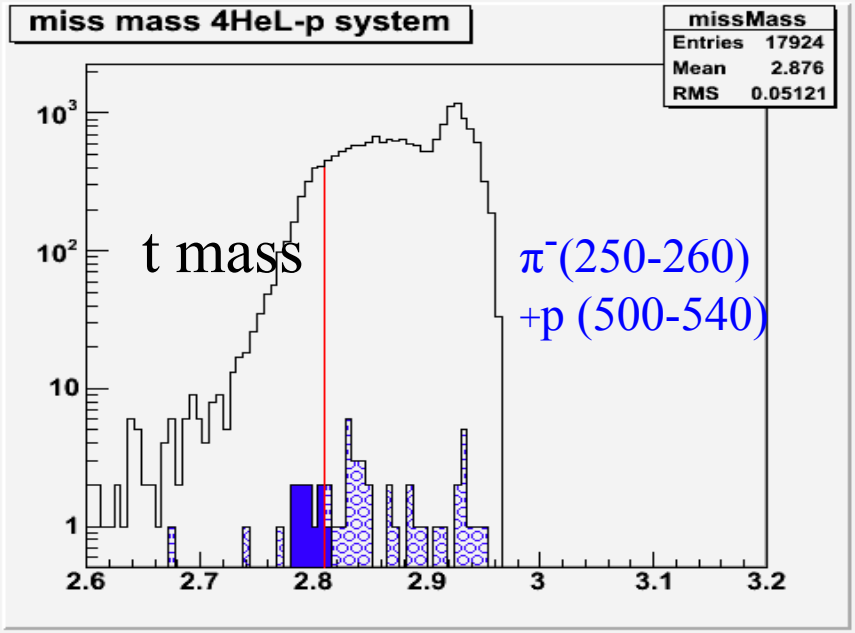
- one π^- in coincidence
    - Momentum in the range (250, 260) MeV/c

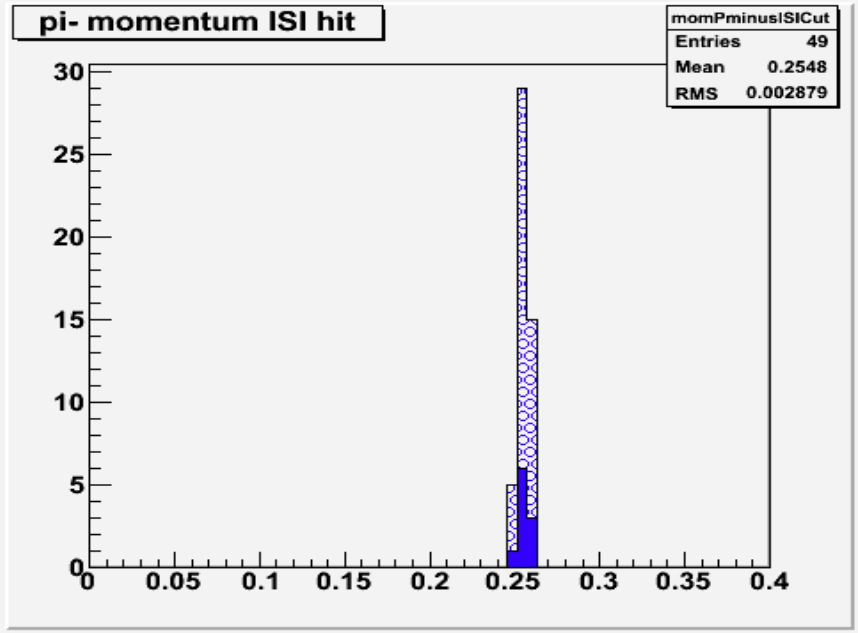

proton momentum
momProton
Entries 309301
Mean 0.3841
RMS 0.09323

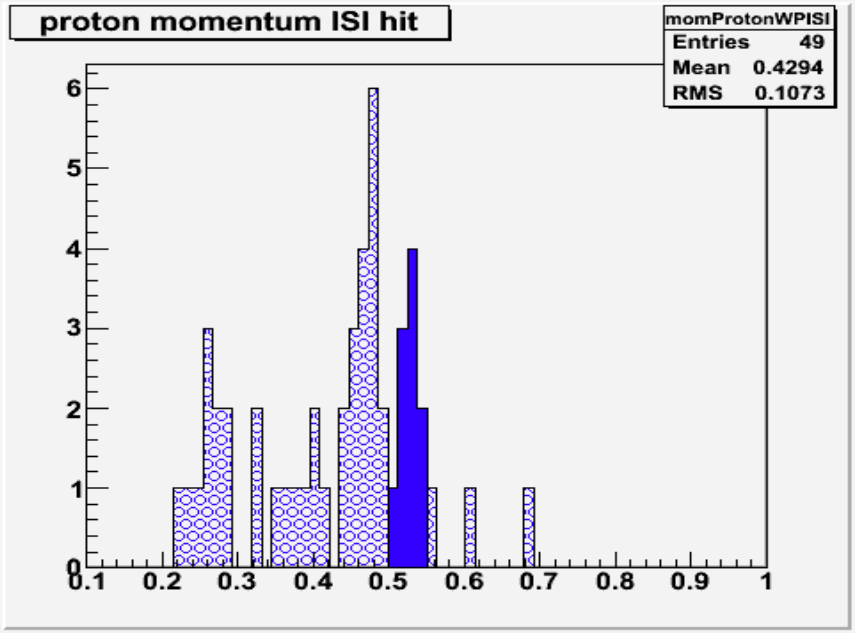

pi- vs proton momentum
scatMomTPi
Entries 309301
Mean x 0.1937
Mean y 0.3841
RMS x 0.05309
RMS y 0.09321

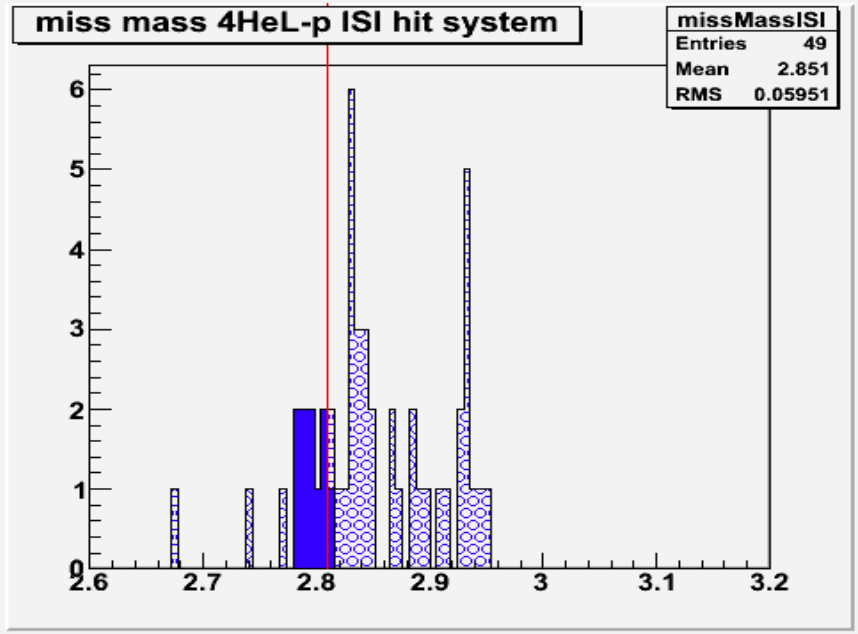

pi- momentum
momPminus
Entries 309301
Mean 0.1937
RMS 0.05308
π⁻+p

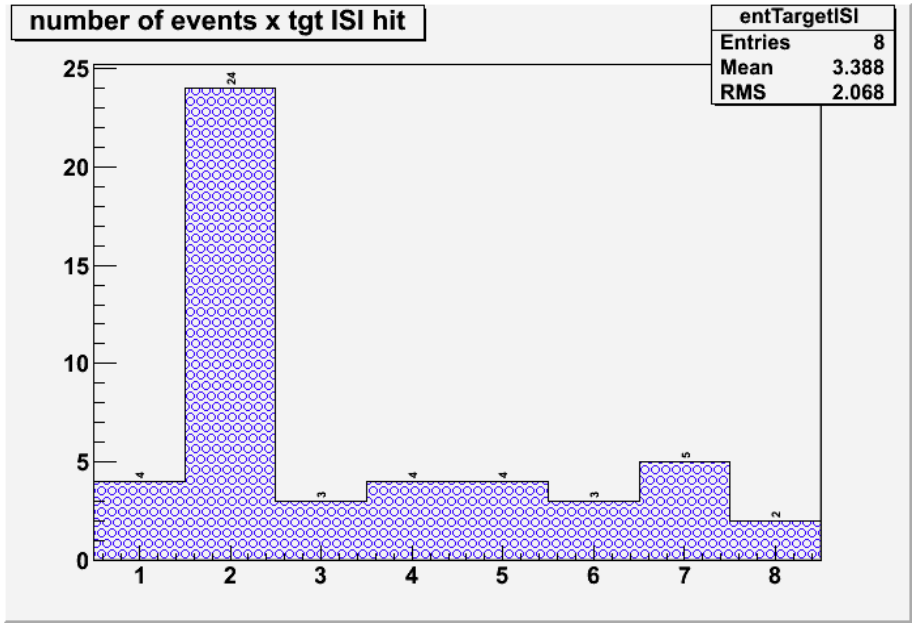

proton momentum
momProton
Entries 309301
Mean 0.3841
RMS 0.09323
π⁻+p
π⁻(250-260)
+p
π⁻(250-260)+p


miss mass 4HeL-p system
missMass
Entries 17924
Mean 2.876
RMS 0.05121
t mass
π⁻(250-260)
+p (500-540)

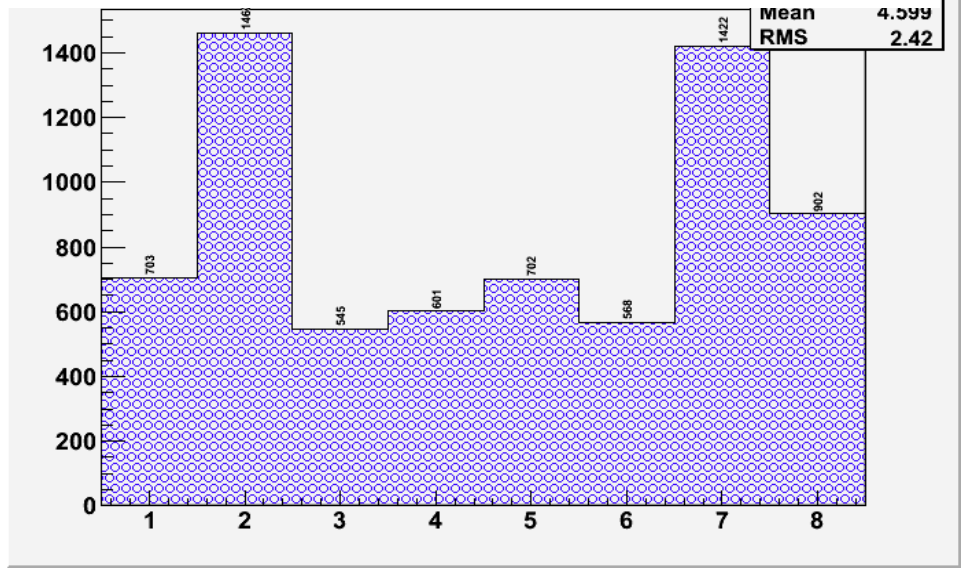

pi- momentum ISI hit
momPminusISICut
Entries 49
Mean 0.2548
RMS 0.002879


proton momentum ISI hit
momProtonWPISI
Entries 49
Mean 0.4294
RMS 0.1073


miss mass 4HeL-p ISI hit system
missMassISI
Entries 49
Mean 2.851
RMS 0.05951



No cut on energy measured in isim



- Tgt2 charge calibration?
  - Isim 2 had problems in the last part of the run
- $^{4}_{\Lambda}$He invariant mass and triton mass lower than expected
- Cuts to be optimized