

K^0_S Analysis

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Friday August 1st, 2008

Cut 1: $(\text{evt} \rightarrow \text{NTrk}() \neq 0 \mid\mid \text{evt} \rightarrow \text{NBTrk}() \neq 0)$
Events without vertex tracks are cut.

Cut 2: $(\text{evt} \rightarrow \text{NBTrk}() == 1)$
Events with 0 or more than 1 beam track are cut.

At this point, I choose the vertex in the event with the most associated tracks to be the P vtx, but for Turgun's editions (which are used for C 2% and LH2 58 in this talk), I choose my P vtx as $\text{vtx} \rightarrow \text{vtxtype} == 1$.

Cut 3: $(\text{Pvtx} \rightarrow \text{ntrk} \geq 3)$
Events that have primary vertices with less than three associated tracks are cut.

Cut 4: $(\text{trk} \rightarrow \text{gof} \geq 0.05)$ for 3 or more tracks
Events that have at least one primary vertex track that has a goodness of fit less than 0.05 are cut.

(Turgun) Cut 5: $(|\text{dxTgt}| \leq 1.0)$
 $(|\text{dyTgt} - 0.22| \leq 1.0)$

Events are cut that have the primary vertices' x and y positions not satisfying the given bounds.

$\text{dxTgt} = \text{Pvtx} \rightarrow \text{x}[0] - \text{tgt x-center}$

$\text{dyTgt} = \text{Pvtx} \rightarrow \text{x}[1] - \text{tgt y-center}$

$\text{dzTgt} = \text{Pvtx} \rightarrow \text{x}[2] - \text{tgt z-center}$

(Turgun) Cut 6: $(\text{dzTgt} \geq -4. \ \&\& \ \text{dzTgt} \leq 6.)$

Events are cut that have the primary vertices' z positions not satisfying the given bounds.

Now we begin to cut on secondary vertices within an event:

- Cut 7: $(Svtx \rightarrow ntrk == 2)$
Secondary vertices with less than or more than 2 tracks are cut.
- Cut 8: $(Svtx \rightarrow x[2] > Pvtx \rightarrow x[2])$
Secondary vertices that are not downstream of the primary vertex are cut.
- Cut 9: $(\text{Sum of } Svtx_trk \rightarrow q == 0)$
Secondary vertices that are not neutral are cut.
- Cut 10: $(postrk \rightarrow gof > 0.01 \ \&\& \ negtrk \rightarrow gof > 0.01)$
Secondary vertices that have at least one track with a goodness of fit less than 0.01 are cut.
- Cut 11: $if(|axis_angle| < pi/2) \ pT_prim = Svtx \rightarrow ptot * |\sin(axis_angle)|;$
 $(pT_prim < 0.15 \ \text{or} \ 0.10)$
Secondary vertices with a transverse momentum with respect to the primordial axis greater than or equal to the given transverse momentum are cut.
- Cut 12: $(Svtx \rightarrow ptot > 0.8)$
Secondary vertices with a momentum magnitude less than or equal to 0.8 GeV/c are cut.

(for NuMI) Cut 9:

$$\begin{aligned} &(\text{vtx} \rightarrow x[2] \geq -821.033 \ \&\& \\ &\text{vtx} \rightarrow x[2] \leq -658.193) \end{aligned}$$

Secondary vertices with z-position outside of the TPC volume are cut.

(for NuMI) Cut 14:

$$\begin{aligned} &\text{mom_asym} = (\text{postrk} \rightarrow \text{ptot} - \text{negtrk} \rightarrow \text{ptot}) / \\ &(\text{postrk} \rightarrow \text{ptot} + \text{negtrk} \rightarrow \text{ptot}); \\ &(\text{fabs}(\text{mom_asym}) < 0.8) \end{aligned}$$

Secondary vertices with a momentum asymmetry magnitude greater than or equal to 0.8 GeV/c are cut.

(for Beryllium and NuMI)

Cut 5:

$$\begin{aligned} &(\text{Pvtx} \rightarrow x[0] * \text{Pvtx} \rightarrow x[0] + \\ &\text{Pvtx} \rightarrow x[1] * \text{Pvtx} \rightarrow x[1]) \leq \text{radius}^2 \end{aligned}$$

Events with primary vertices on the boundary of or outside of a circle of the given radius in the xy-plane centered on the z-axis are cut. Each event's single primary vertex is selected by choosing the vertex from that event with the most associated tracks.

Cut 6:

$$\begin{aligned} &\text{Pvtx} \rightarrow x[2] \geq \text{upstream bound} \ \&\& \\ &\text{Pvtx} \rightarrow x[2] \leq \text{downstream bound} \end{aligned}$$

Events with the z-position of its primary vertex falling outside the given range are cut.

C 2% 120 (pass4b)

	Data	MC
2 events with 1 bmrk:	401989	1539634
3 Pvtx # trks ≥ 3	217194	992276
4 Pvtx at least 3 trks gof ≥ 0.05	173135	880184
5 $ dxTgt \leq 1, dyTgt - 0.22 \leq 1$	169862	838776
6 $-4 \leq dzTgt \leq 6$	160772	836635

Secondary vertex loop:

7 Svtx 2 trks	11180	41386
8 Svtx downstream of Pvtx	9356	35151
9 Svtx neutral	4559	18930
10 Svtx trks gof > 0.01	582	4336
11a pT prim < 0.15	373	3296
12a $ Svtx\ mom > 0.8$ GeV	177	1647
11b pT prim < 0.10	334	3060
12b $ Svtx\ mom > 0.8$ GeV	160	1540

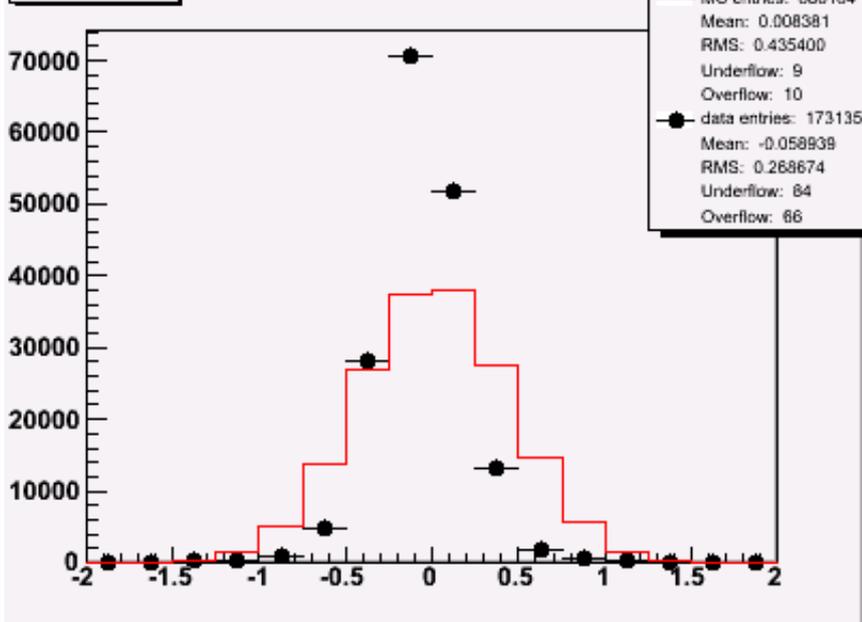
of incident particles on target: 573619 1539636 5

of generated K_shorts 346953

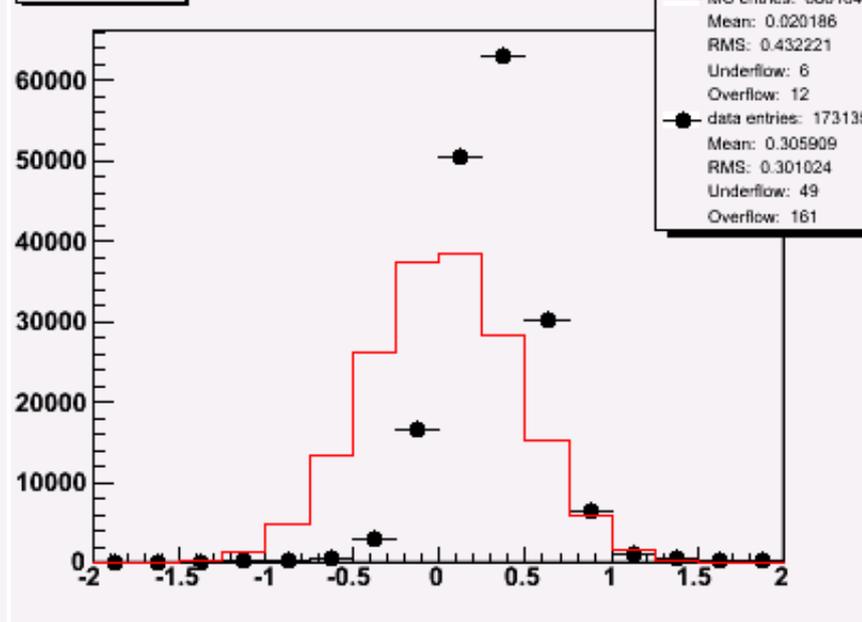
Cut Variable Plots

C 2% 120

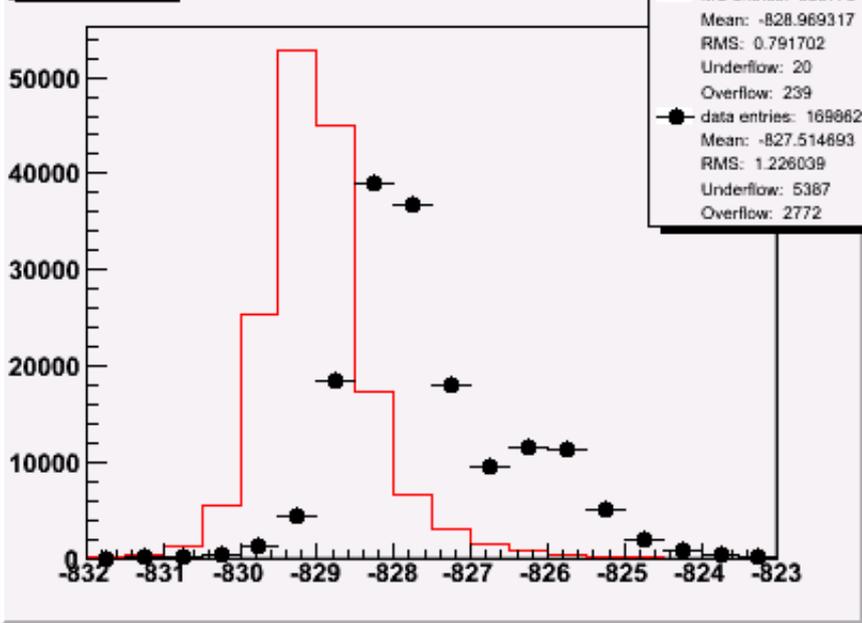
Pvtx x-pos



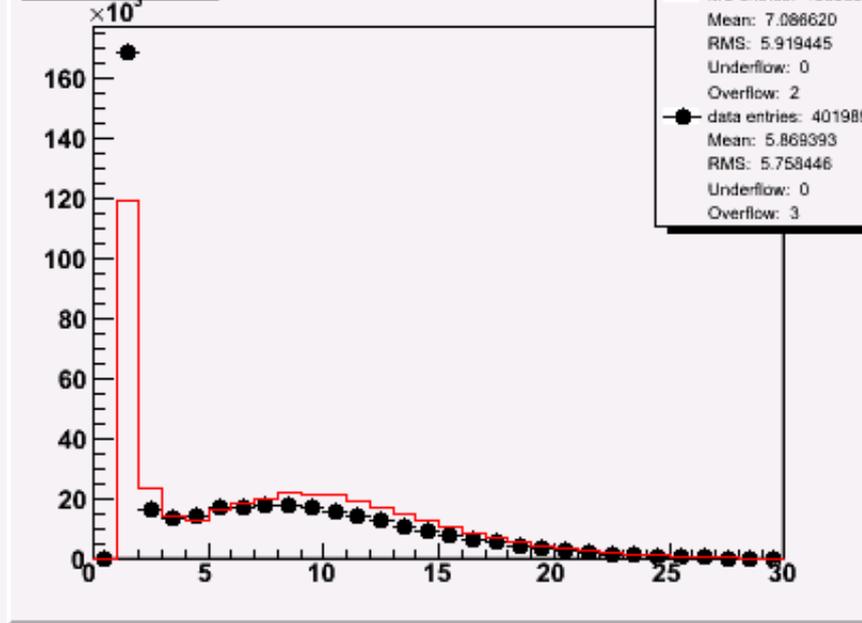
Pvtx y-pos



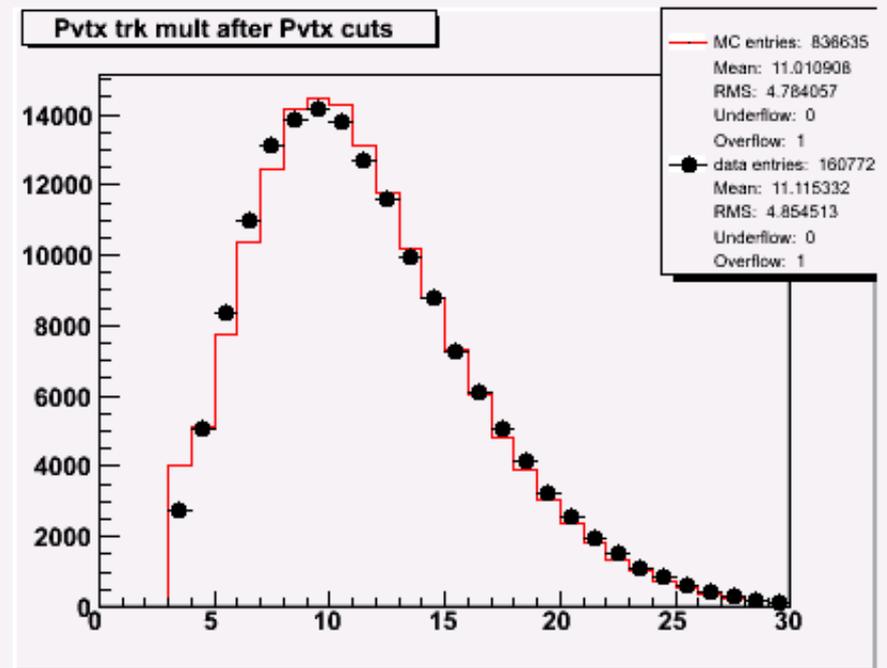
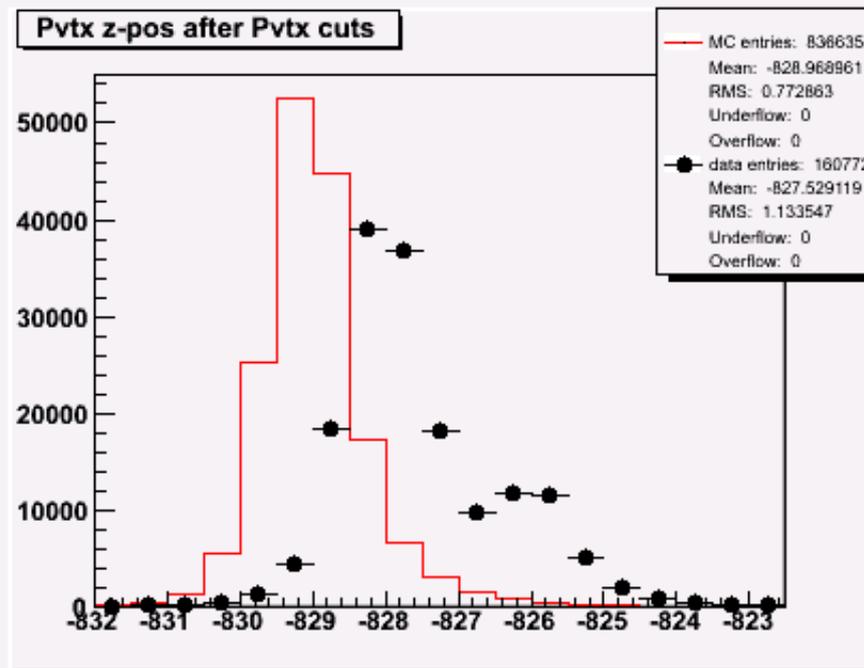
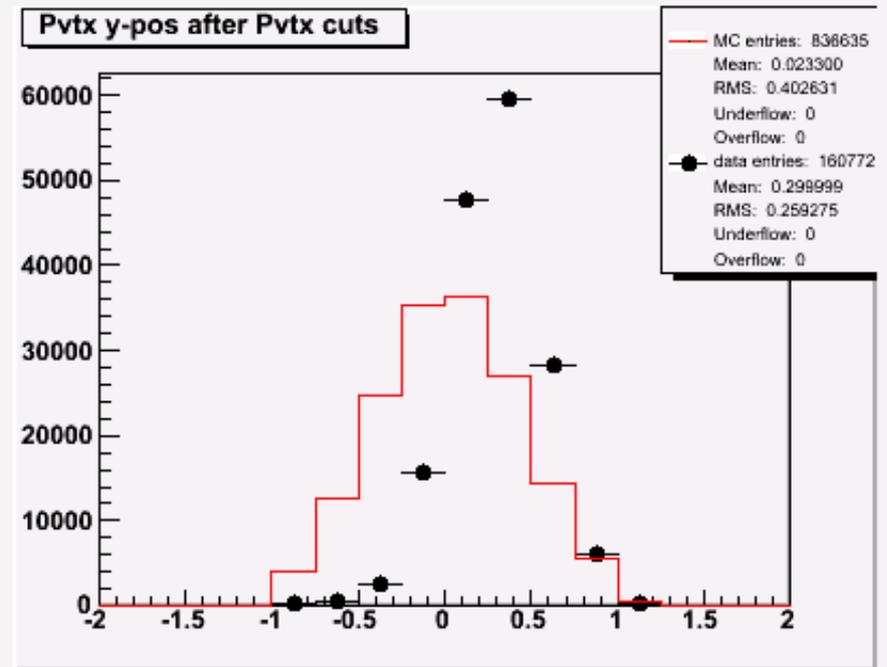
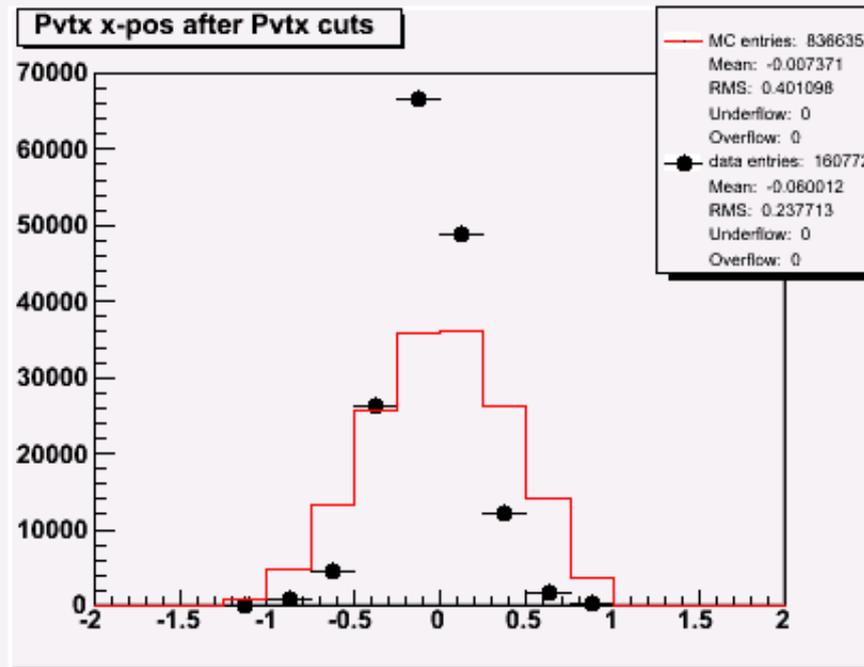
Pvtx z-pos



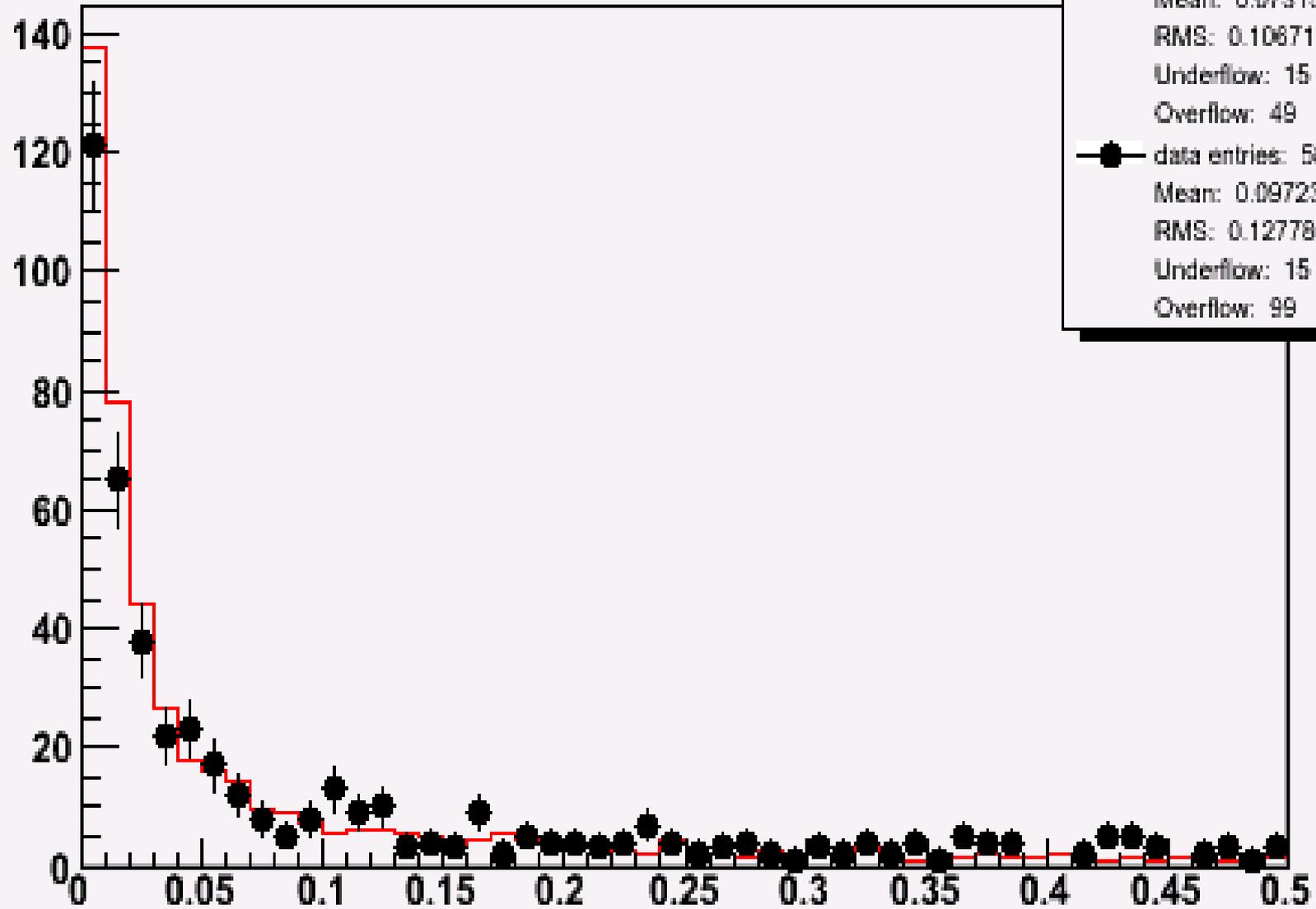
Pvtx trk mult



C 2% 120

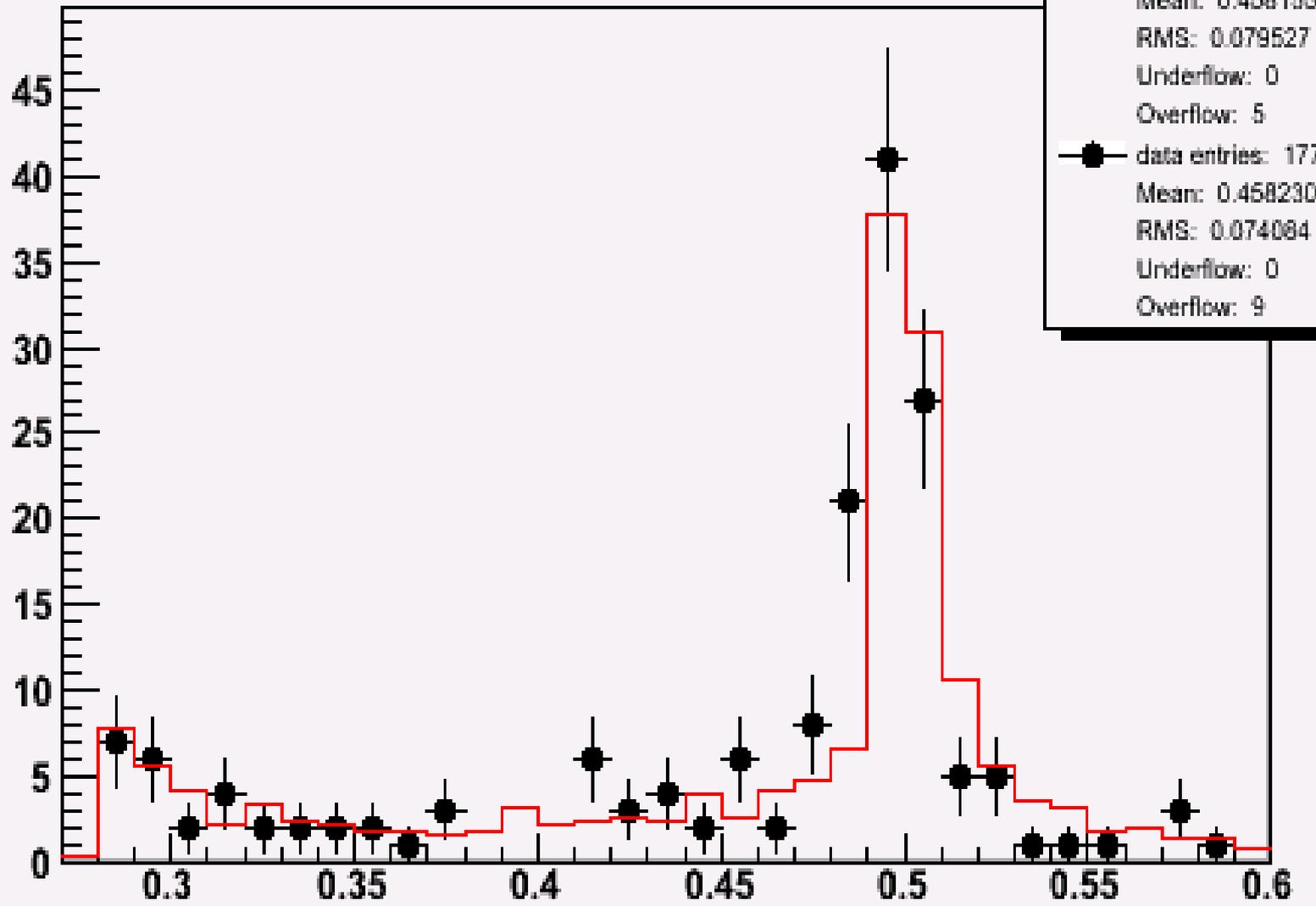


C 2% 120 GeV pT prim

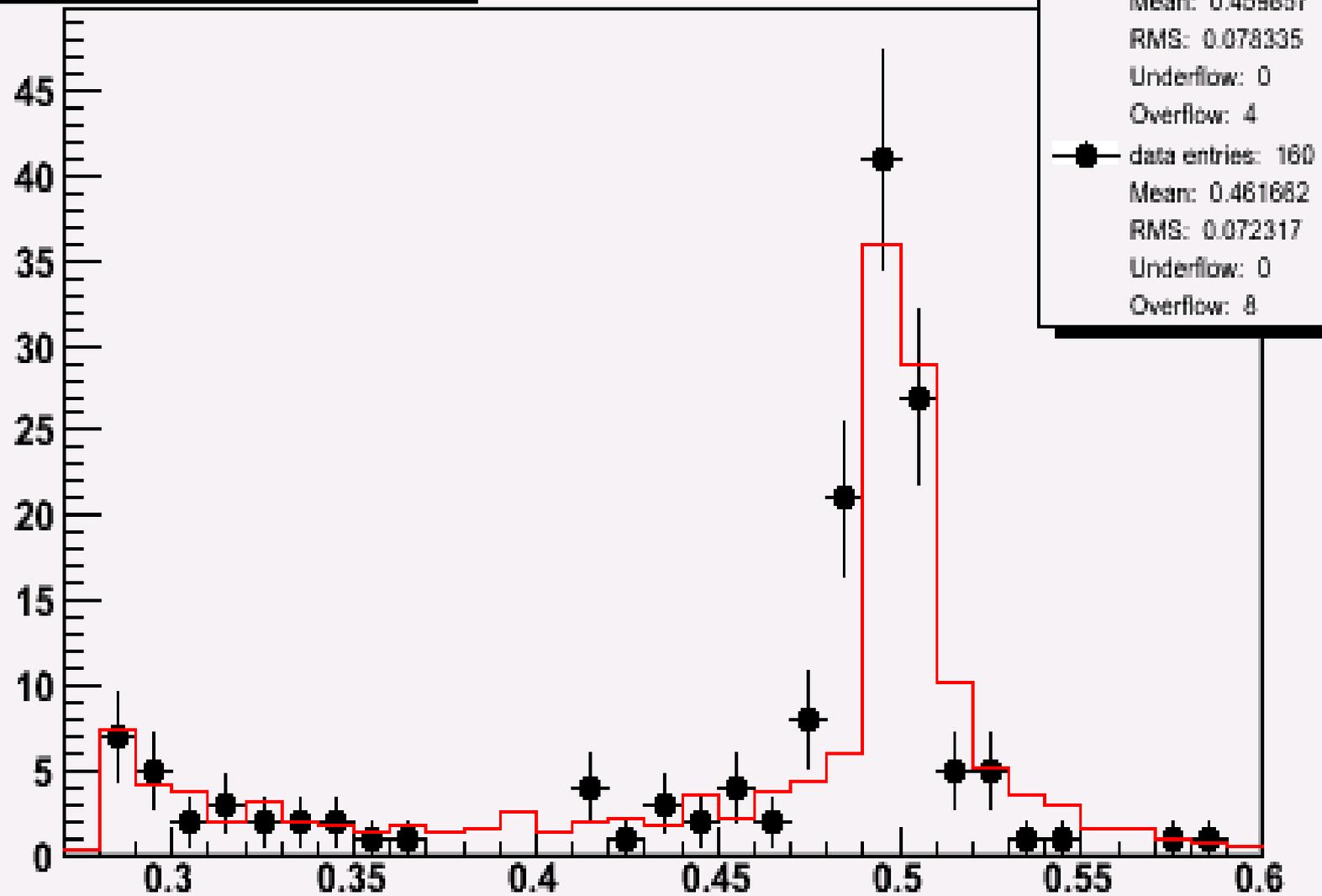


(after all cuts)
C 2% 120

C 2% 120 M-K₀^S

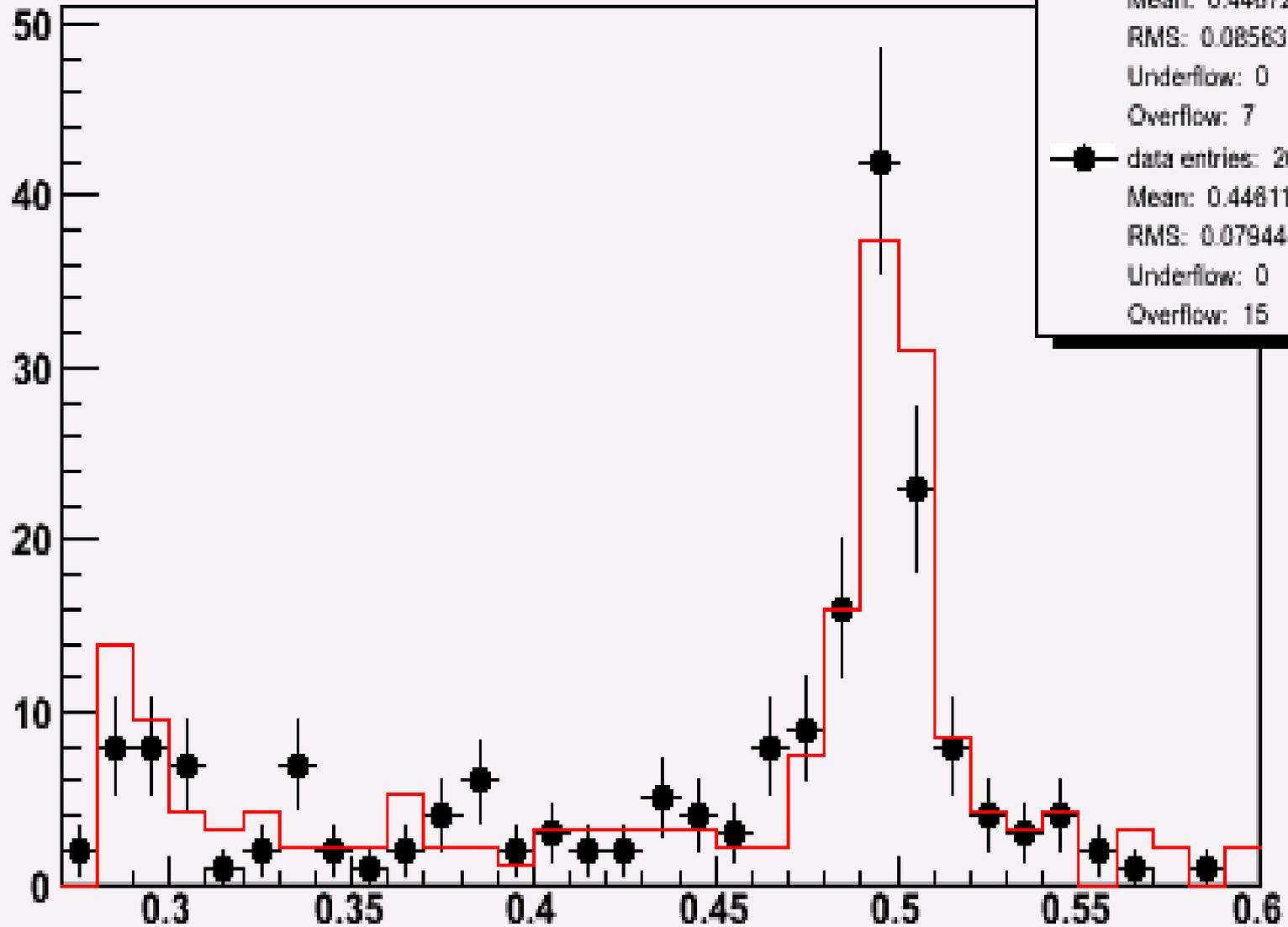


(pT < 0.10) C 2% 120 M-K₀^S

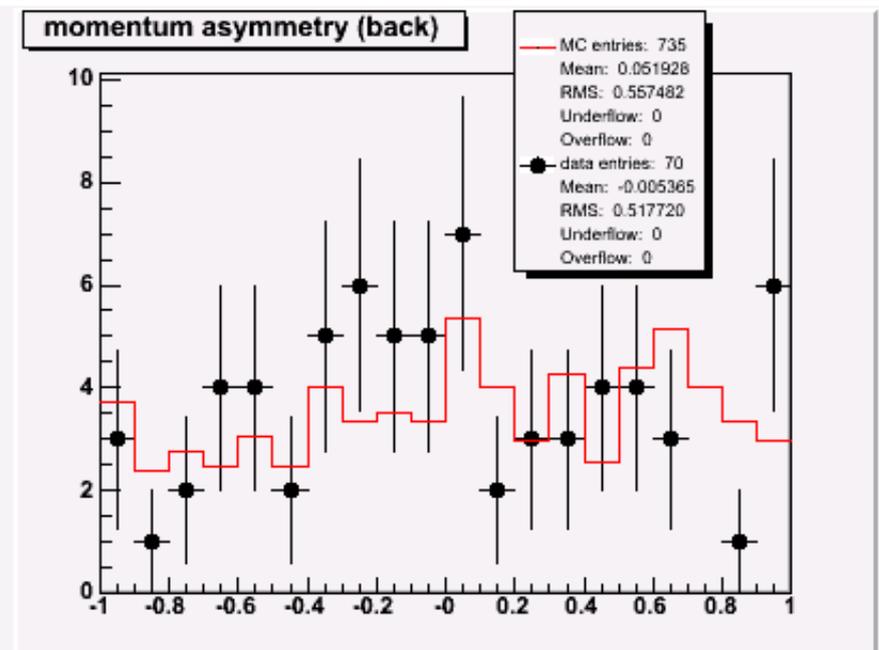
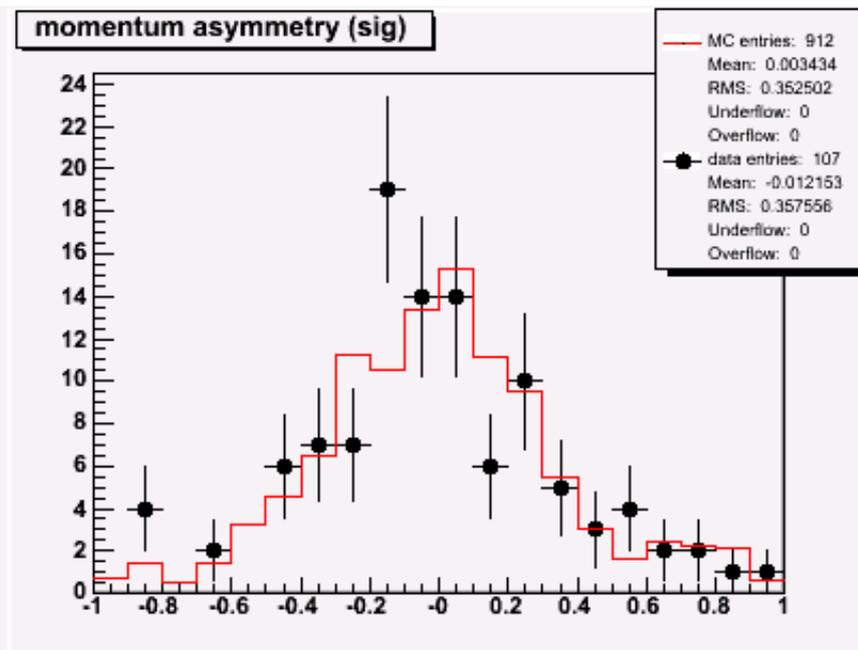
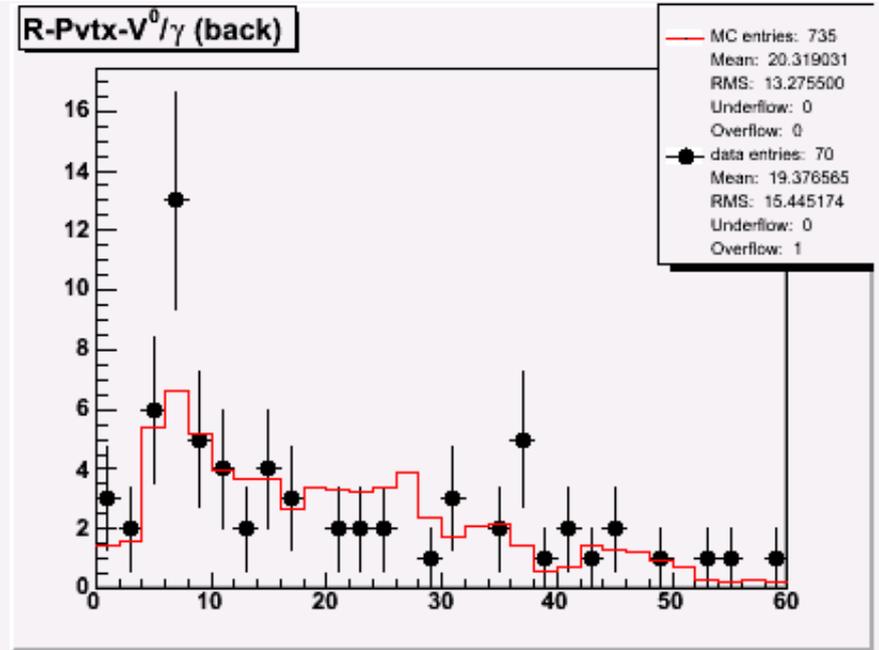
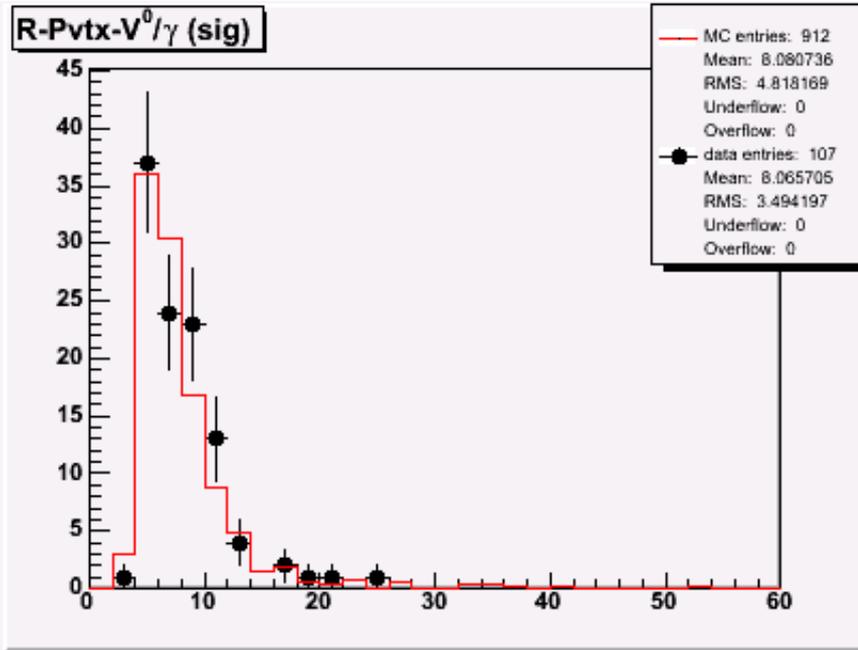


C 2% 120
old mass plot

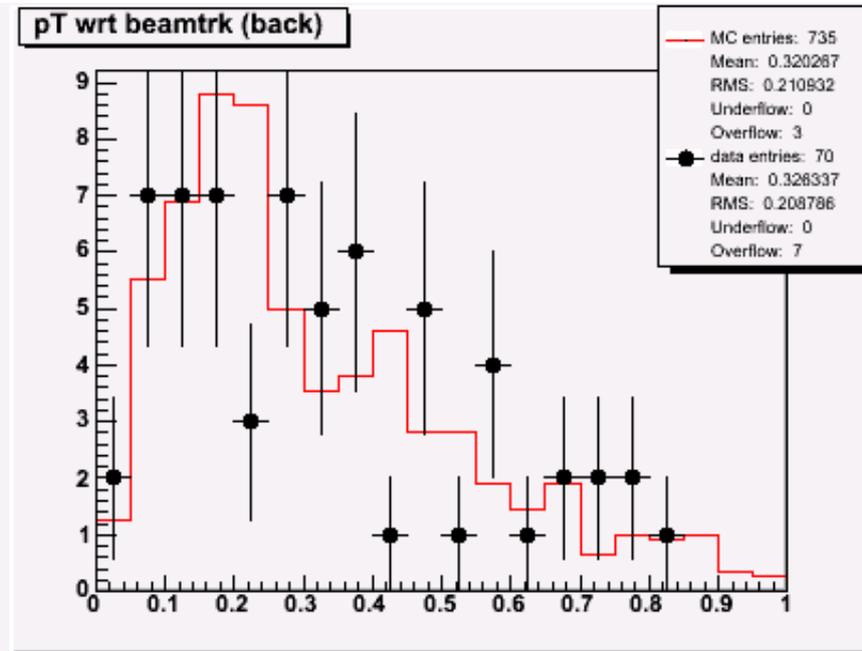
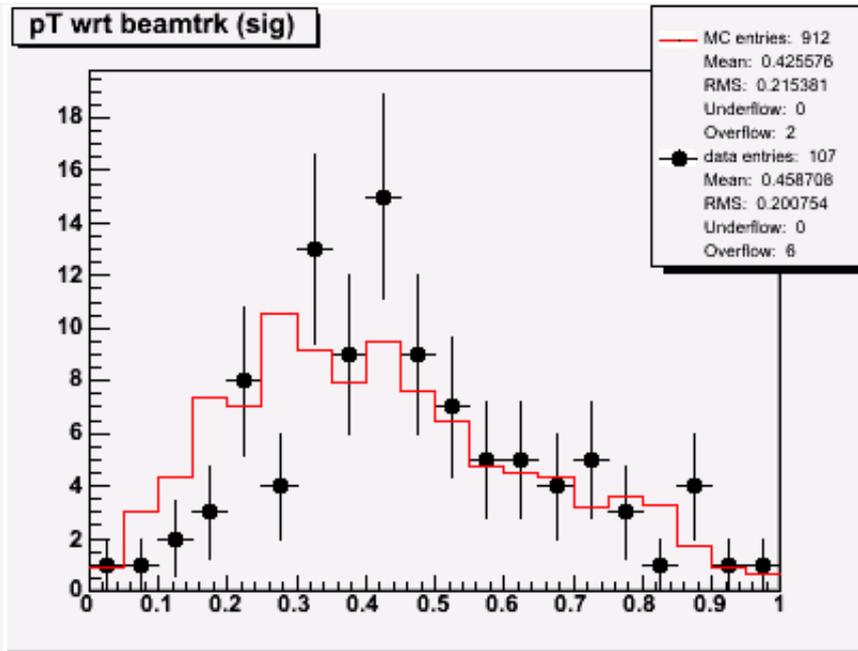
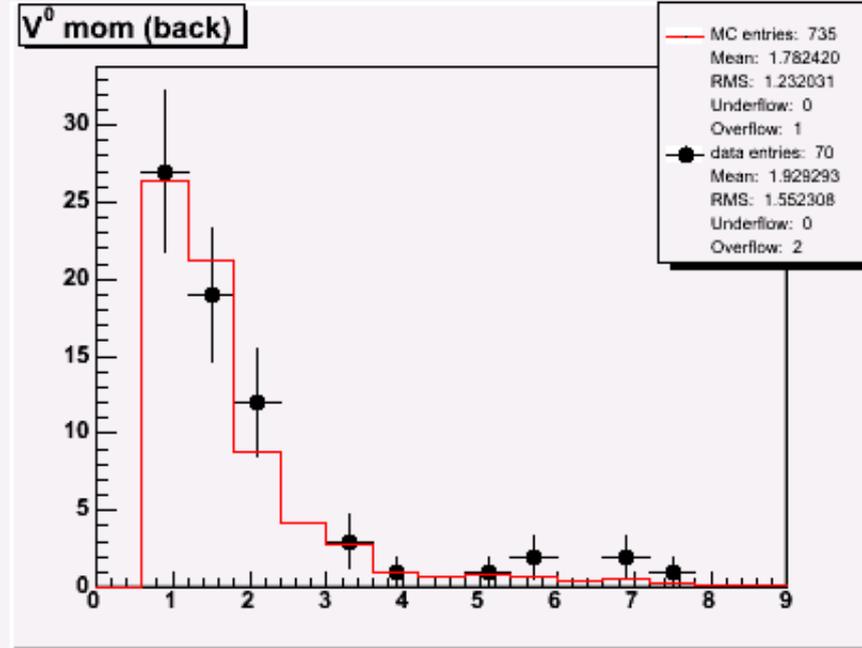
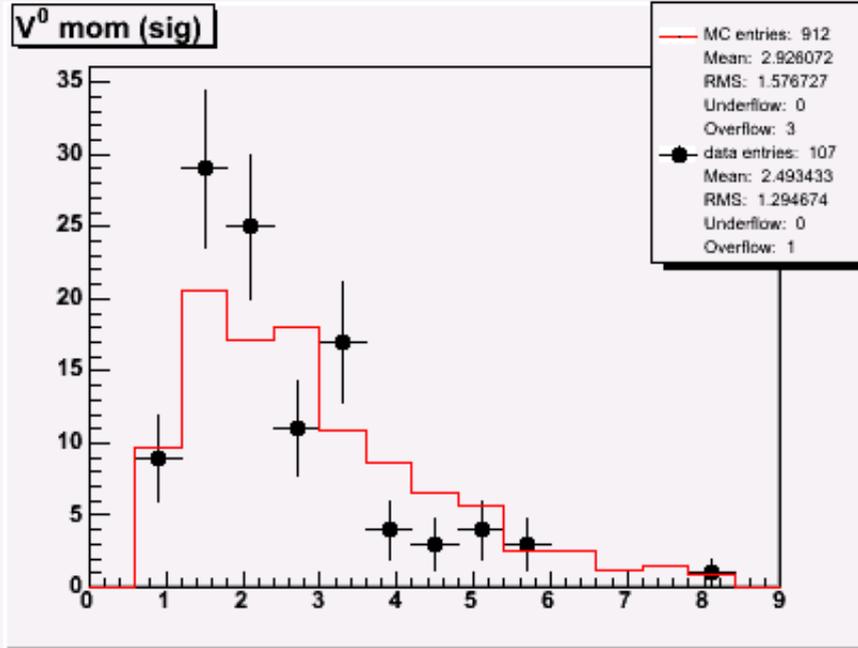
C 2% 120 GeV M-K₀⁸



C 2% 120

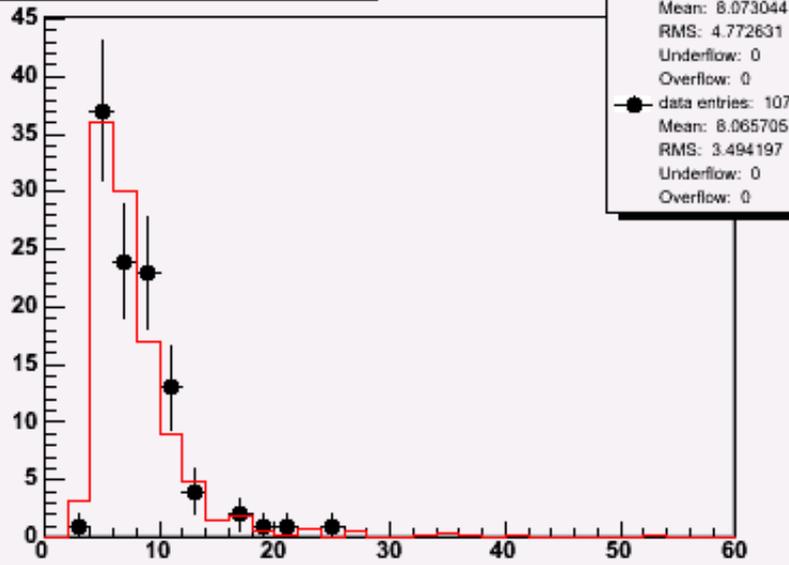


C 2% 120

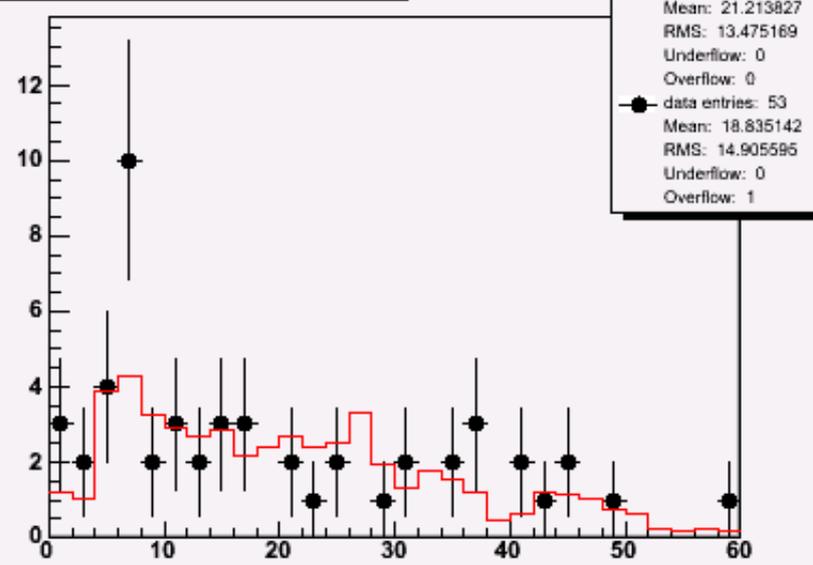


C 2% 120

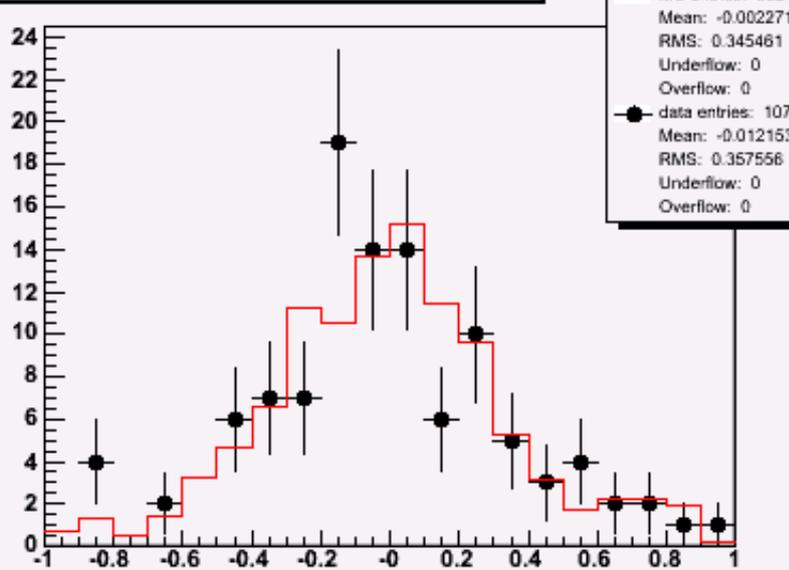
(pT < 0.10) R-Pvtx-V⁰/γ (sig)



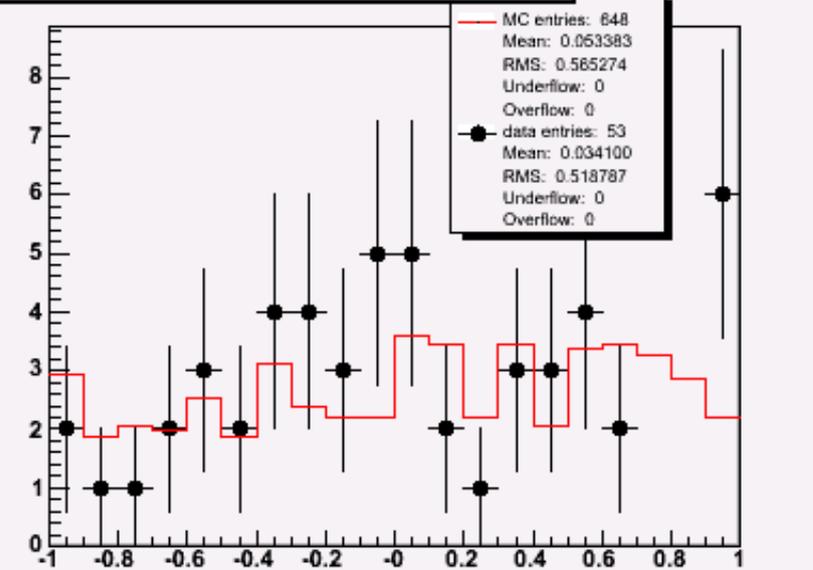
(pT < 0.10) R-Pvtx-V⁰/γ (back)



(pT < 0.10) momentum asymmetry (sig)

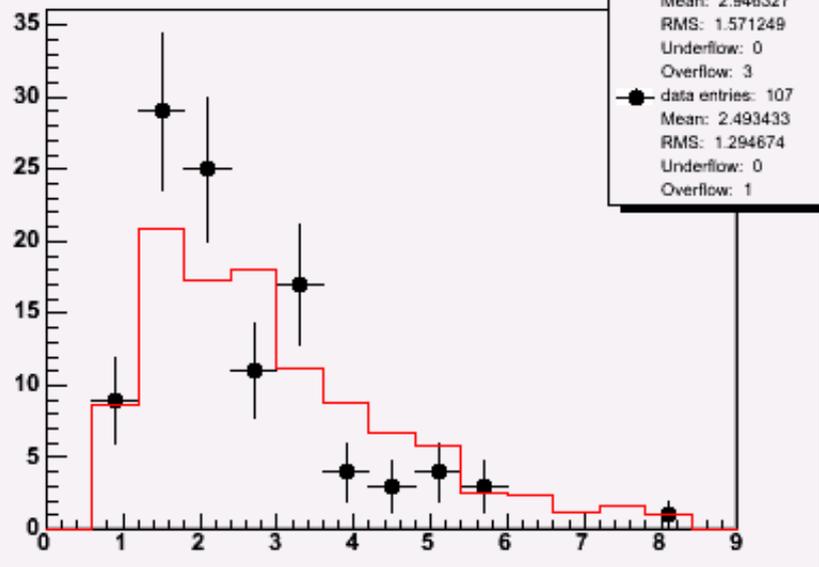


(pT < 0.10) momentum asymmetry (back)

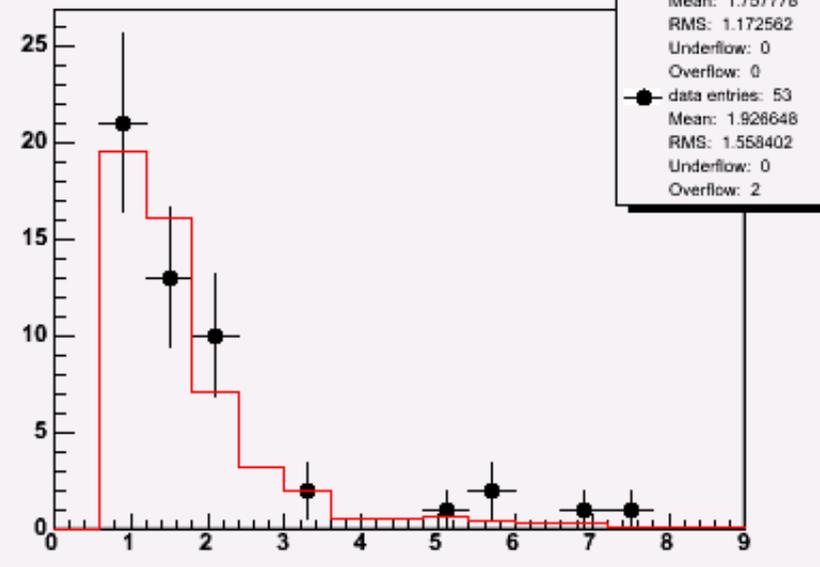


C 2% 120

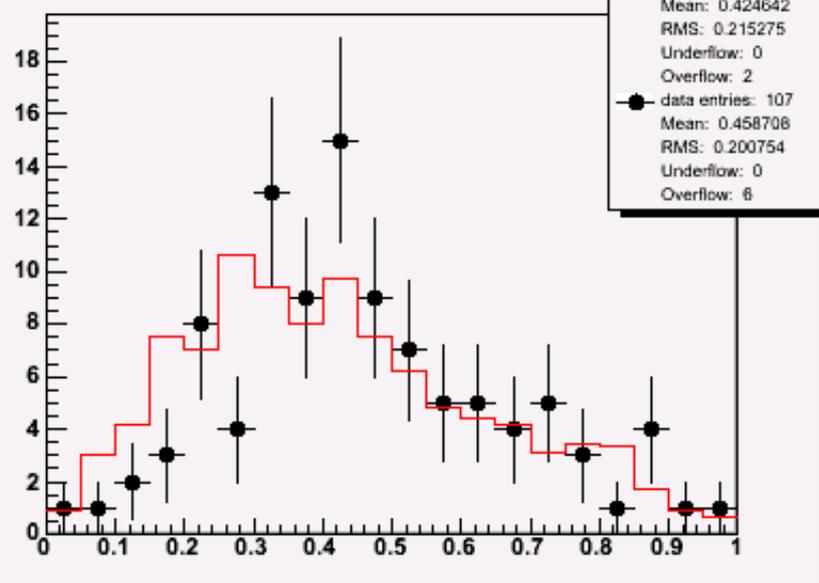
(pT < 0.10) V⁰ mom (sig)



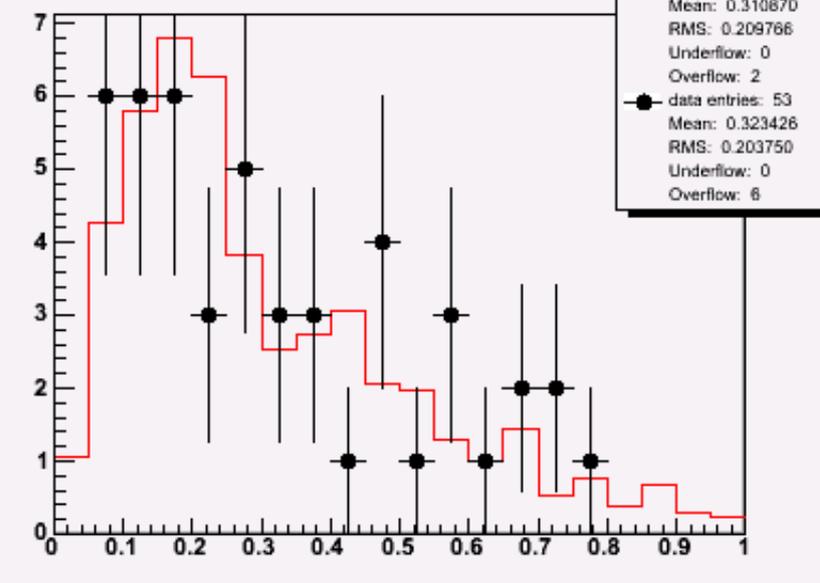
(pT < 0.10) V⁰ mom (back)



(pT < 0.10) pT wrt beamtrk (sig)



(pT < 0.10) pT wrt beamtrk (back)



Beryllium 120 (pass4b)

	Data	MC
2 events with 1 bmrk:	832479	1184300
3 Pvtx # trks ≥ 3	393501	540923
4 Pvtx at least 3 trks gof ≥ 0.05	308652	474435
5 $[(x\text{-pos})^2 + (y\text{-pos})^2] < 4.0$	307161	474321
6 Pvtx z-pos within -831 to -820	283397	468829

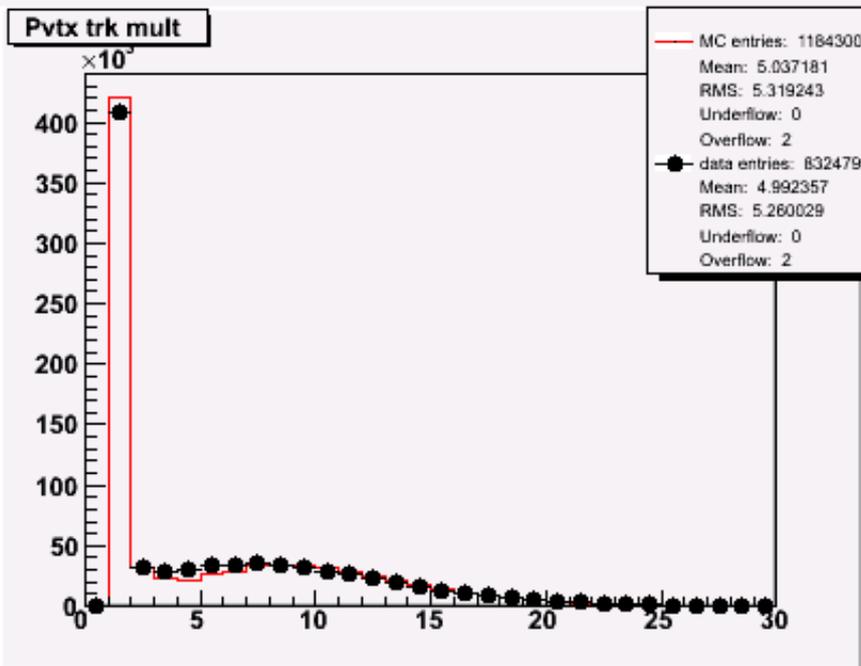
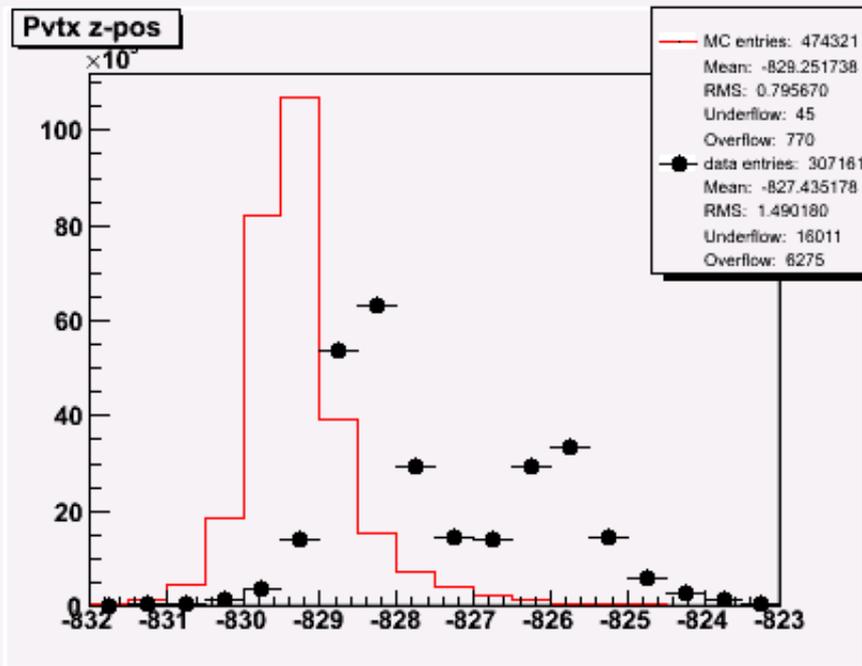
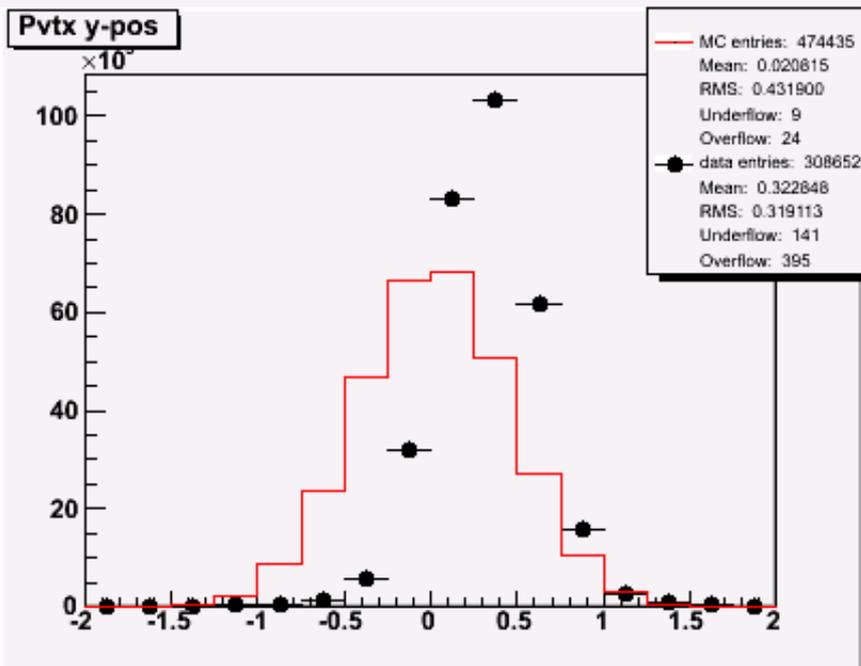
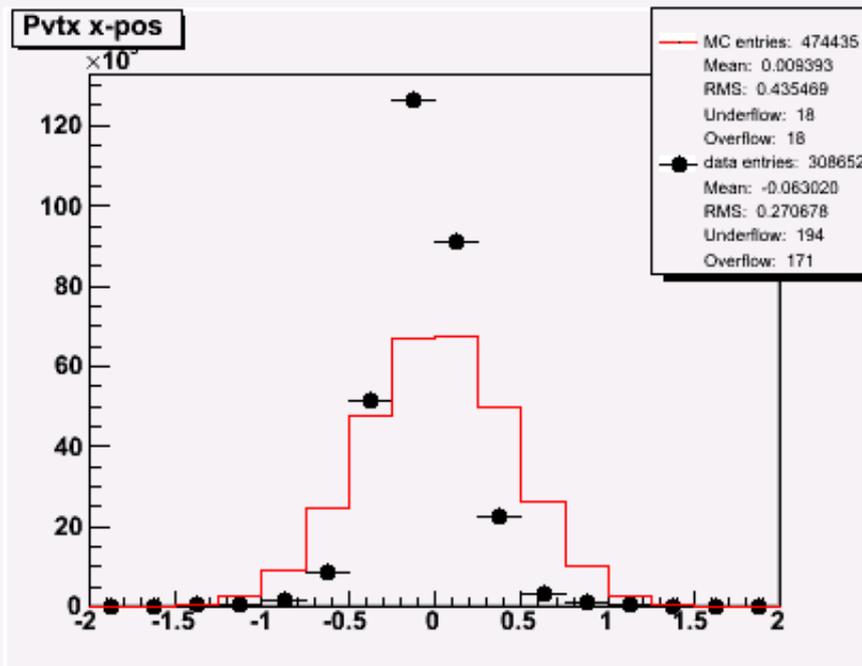
Secondary vertex loop:

7 Svtx 2 trks	19552	23904
8 Svtx downstream of prim vtx	16424	20639
9 Svtx neutral	8151	11079
10 Svtx trks gof > 0.01	1016	2522
11a pT prim < 0.15	657	1962
12a Svtx mom > 0.8 GeV	350	1058
11b pT prim < 0.10	587	1824
12b Svtx mom > 0.8 GeV	316	991

of incident particles on target: 1293438 1184302 16

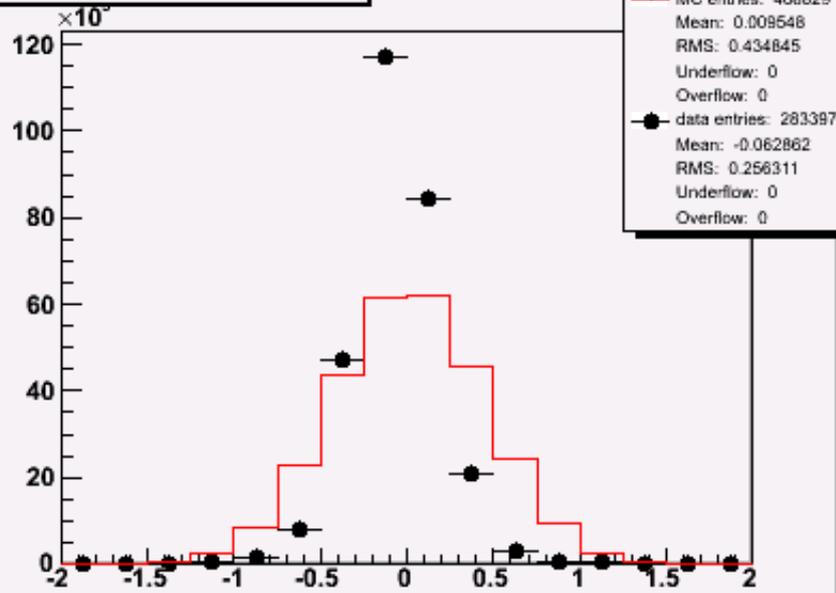
of generated K_shorts 196620

Cut Variable Plots Beryllium 120

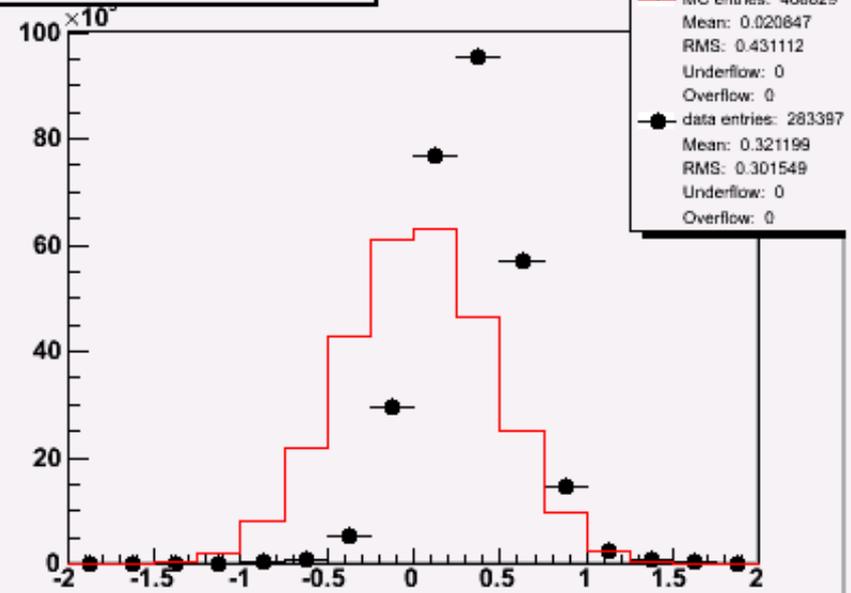


Beryllium 120

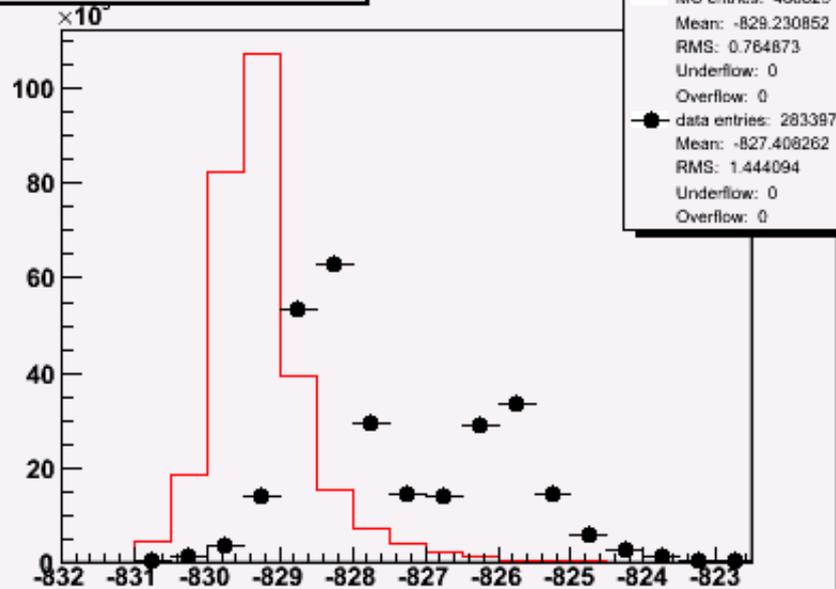
Pvtx x-pos after Pvtx cuts



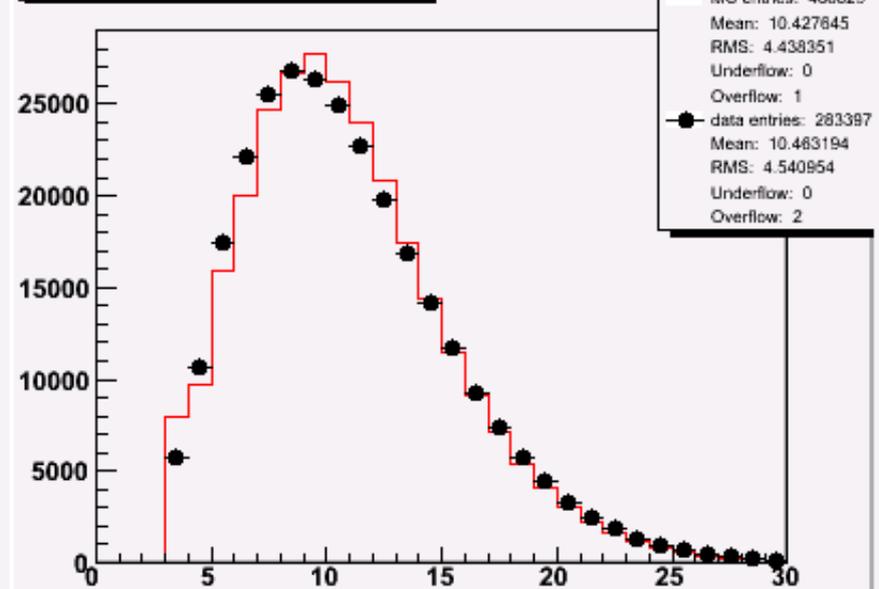
Pvtx y-pos after Pvtx cuts



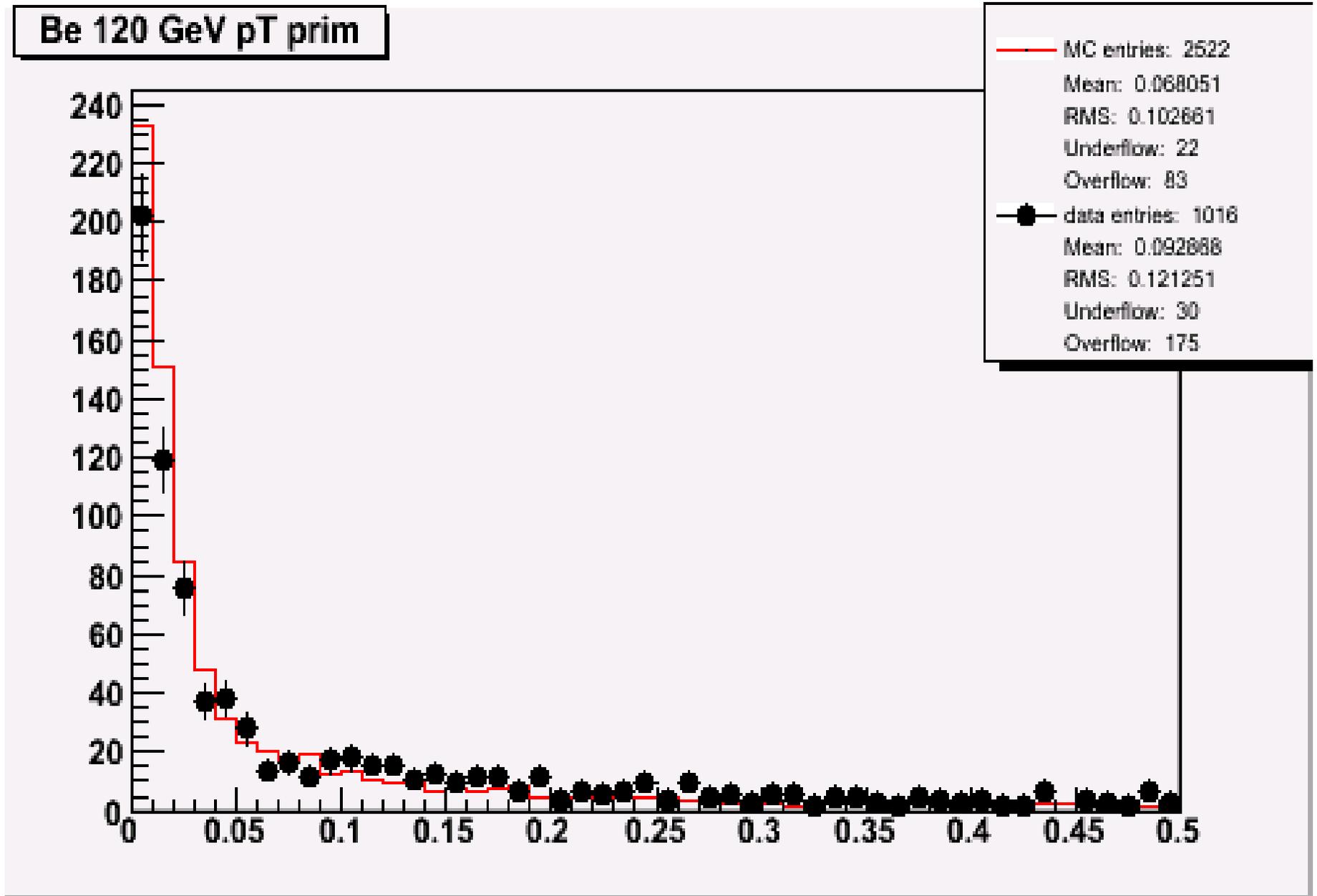
Pvtx z-pos after Pvtx cuts



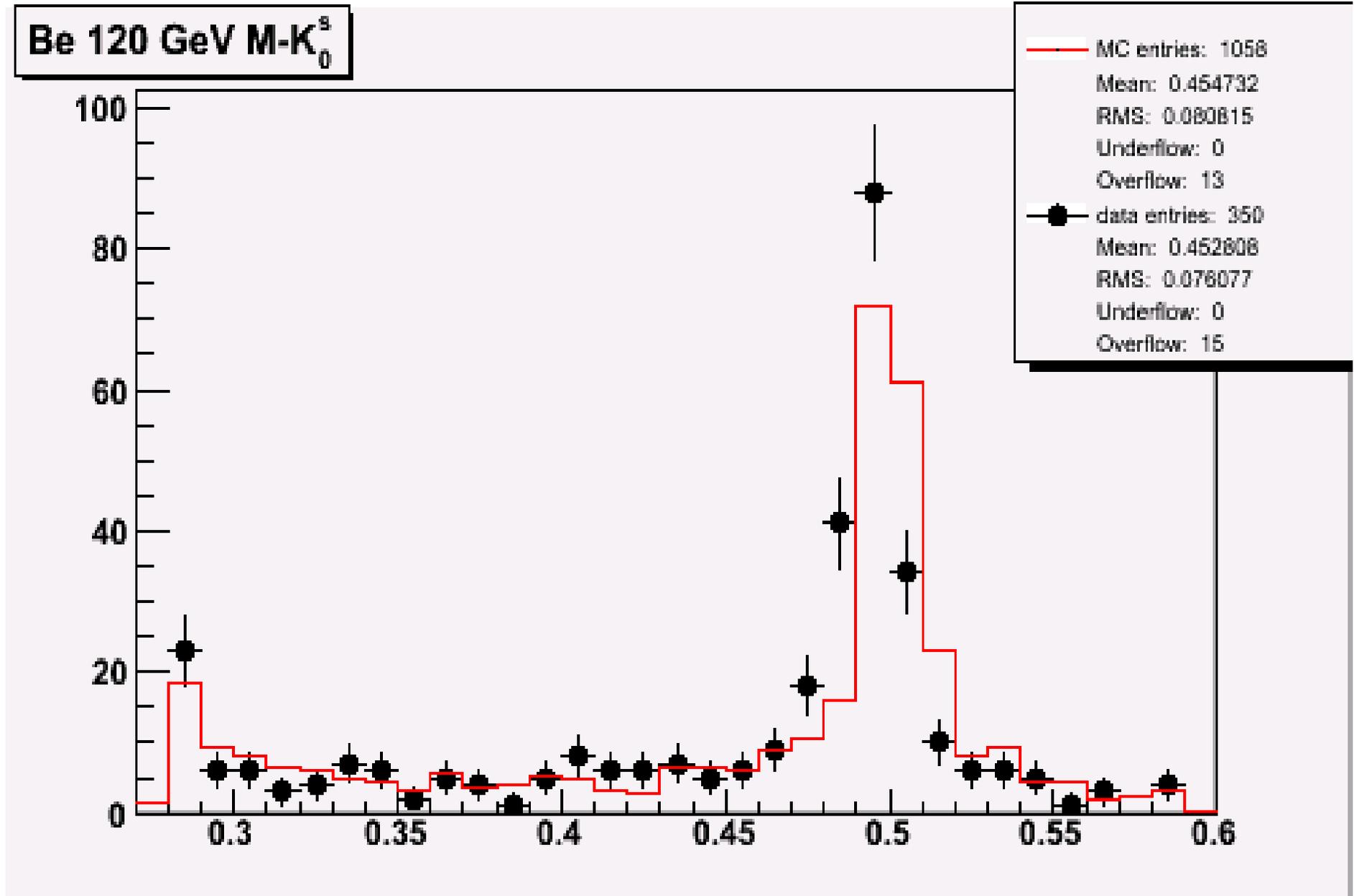
Pvtx trk mult after Pvtx cuts



Beryllium 120

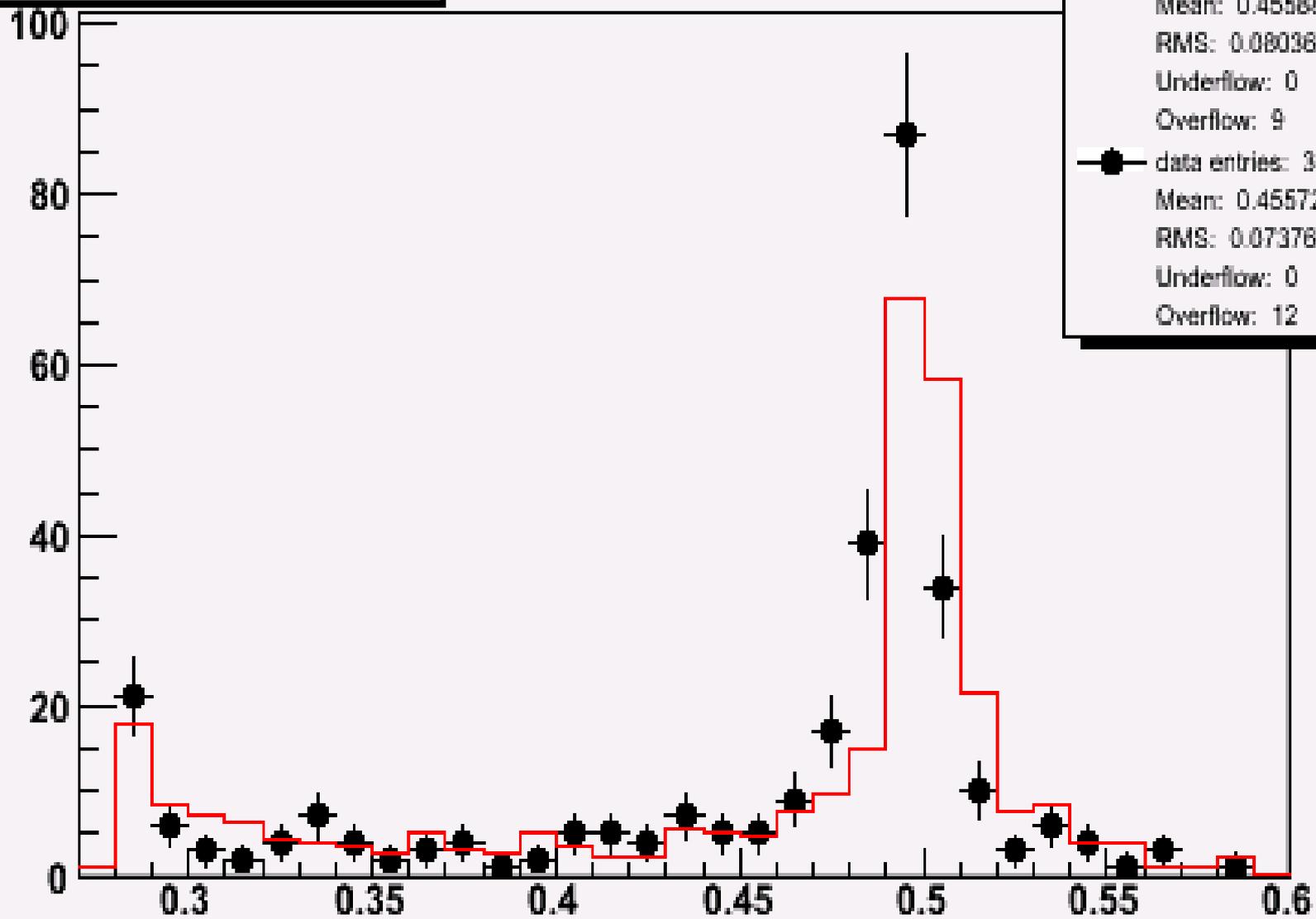


(after all cuts)
Beryllium 120



Beryllium 120

(pT < 0.10) Be 120 M-K₀^s

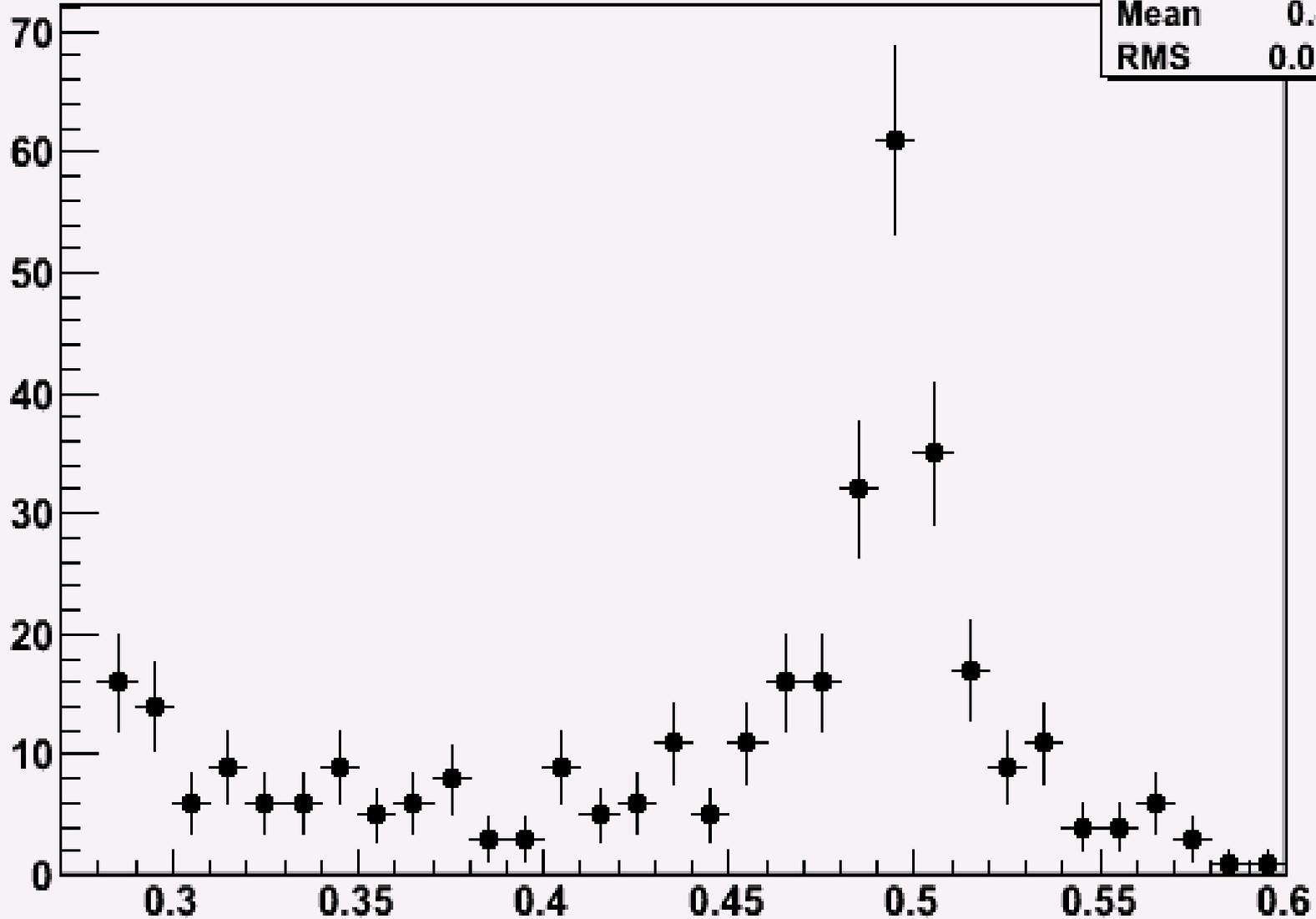


Beryllium 120
old mass plot

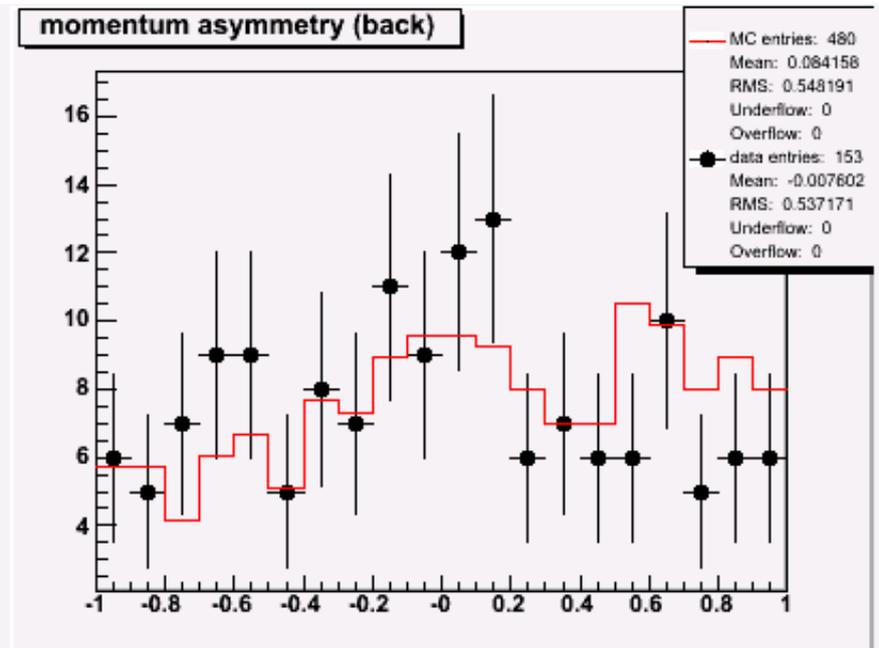
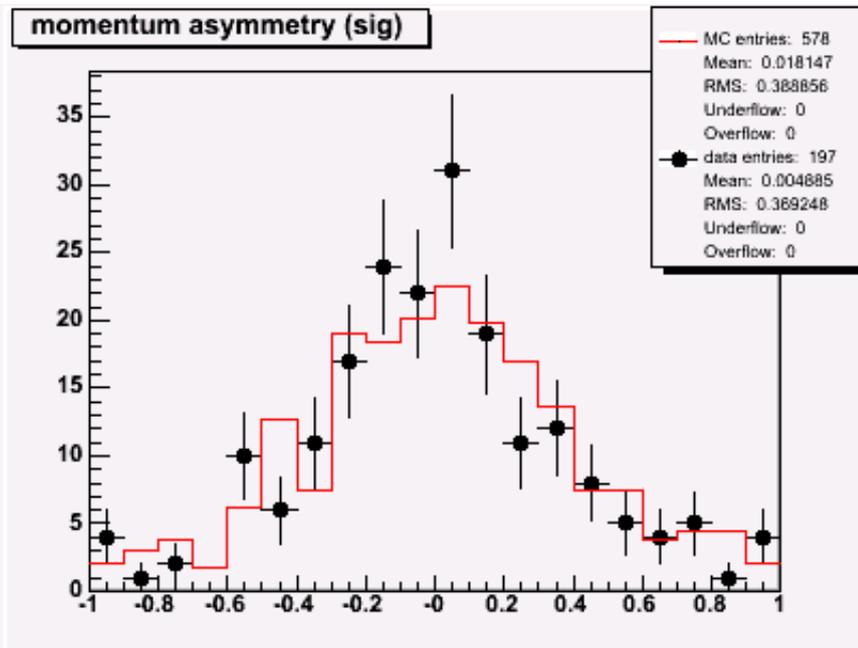
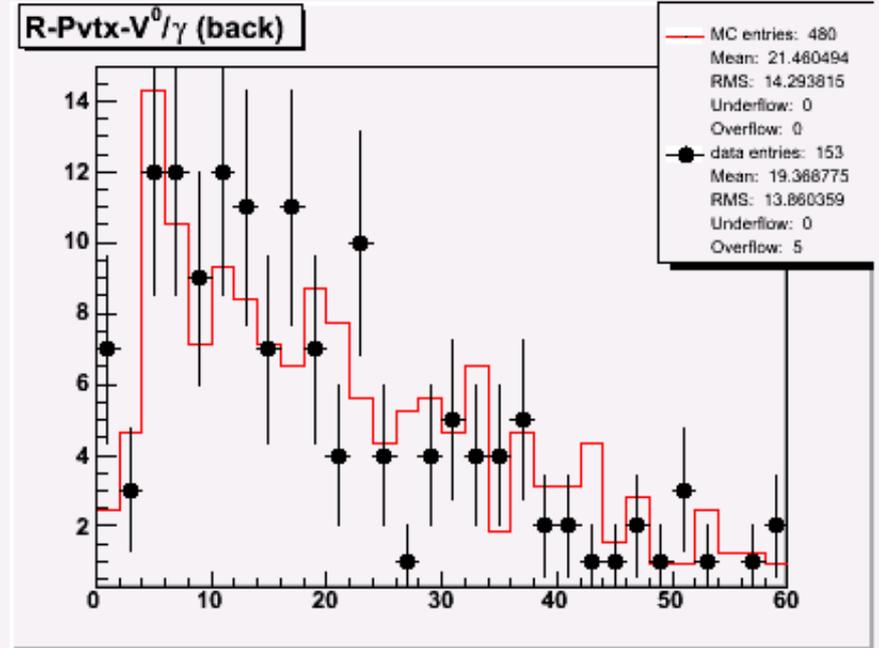
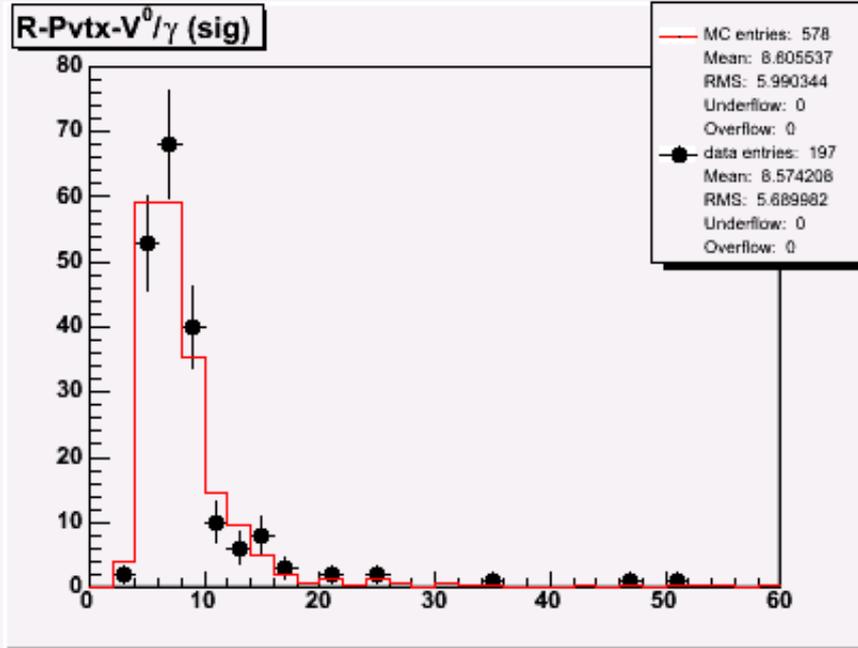
Beryllium 120 GeV K_short invmass w/ 10 MeV bins

invmass_pipi_tenMeV

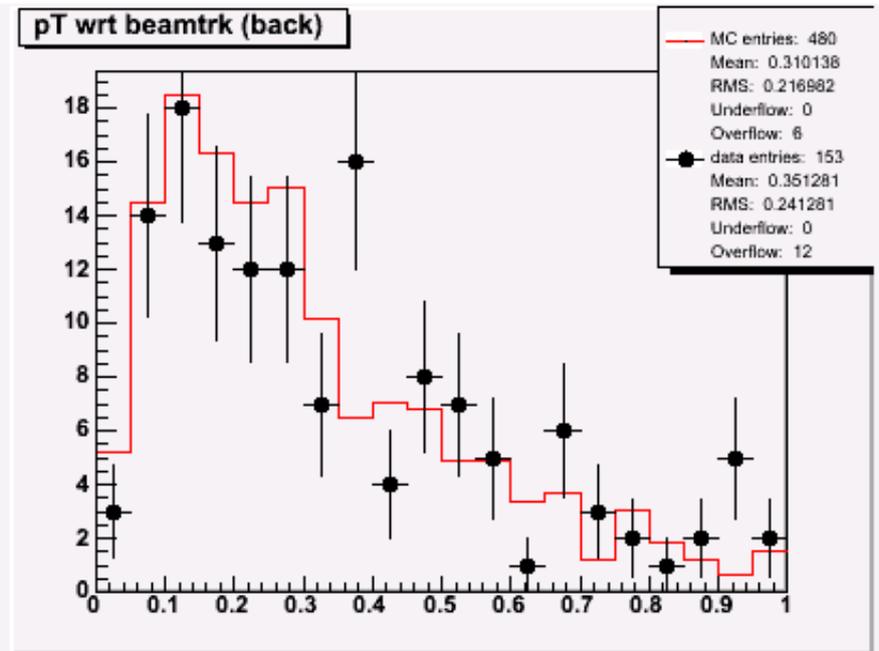
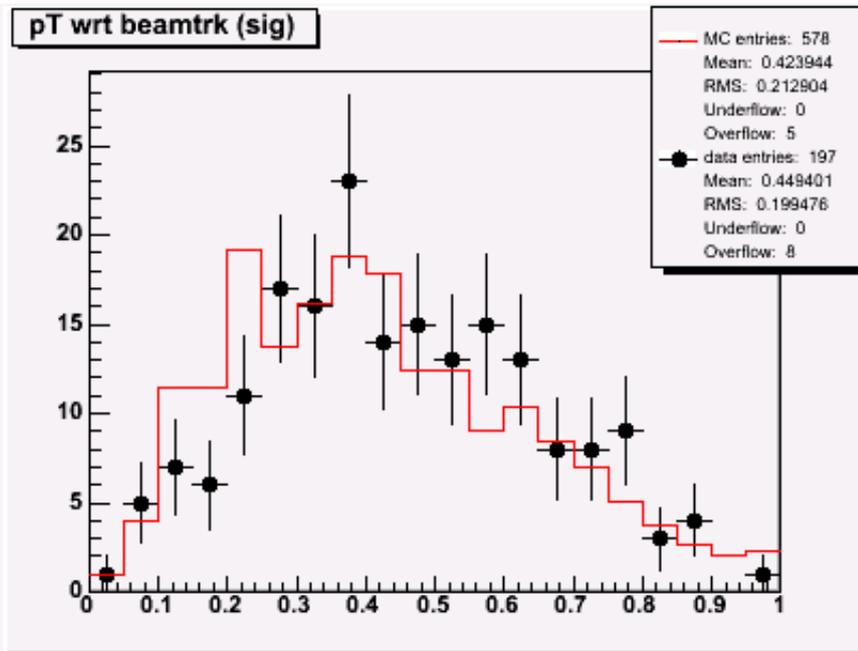
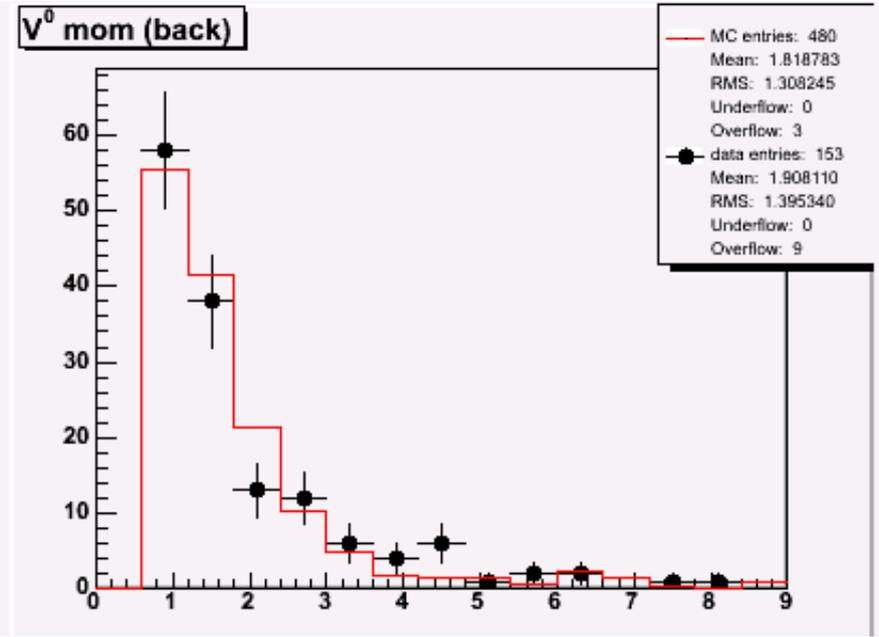
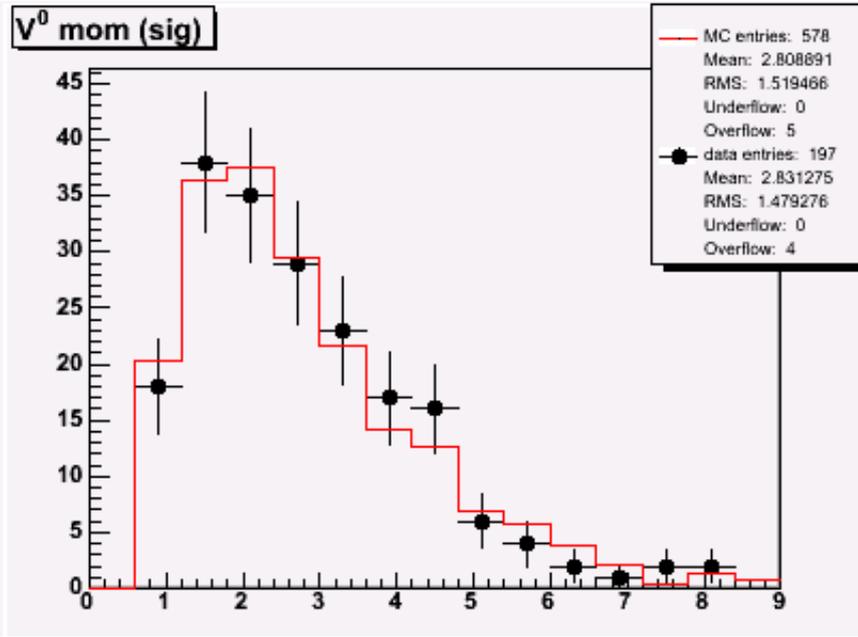
Entries	377
Mean	0.4474
RMS	0.07973



Beryllium 120

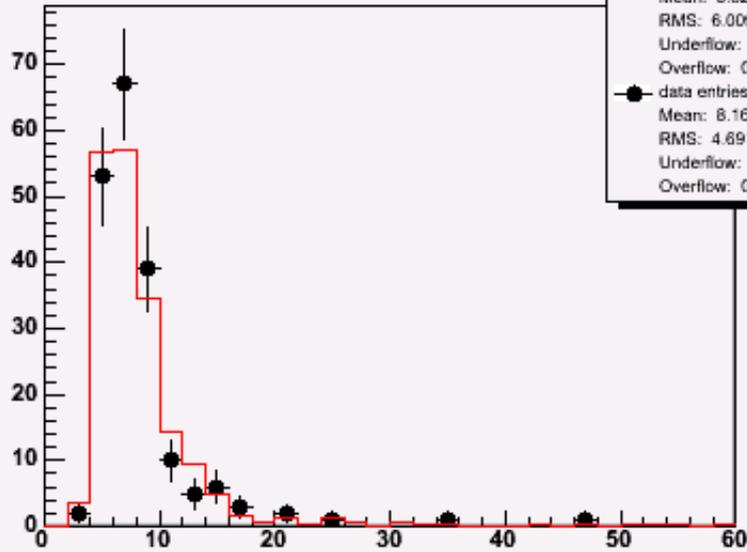


Beryllium 120

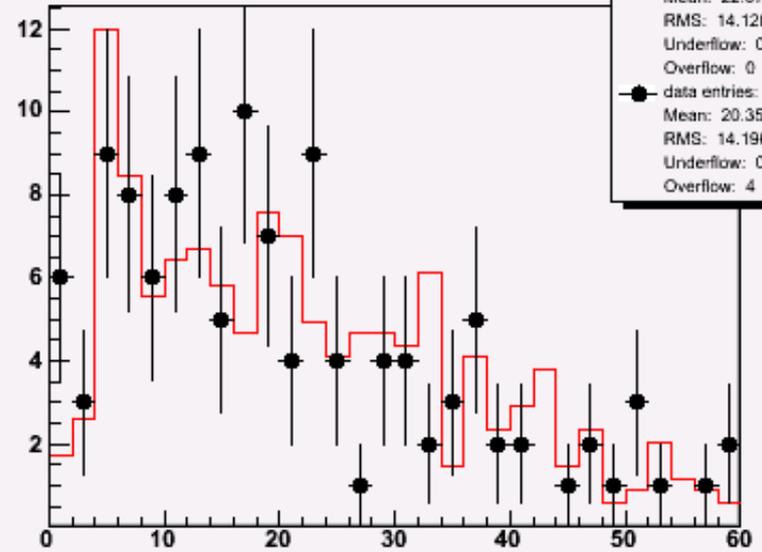


Beryllium 120

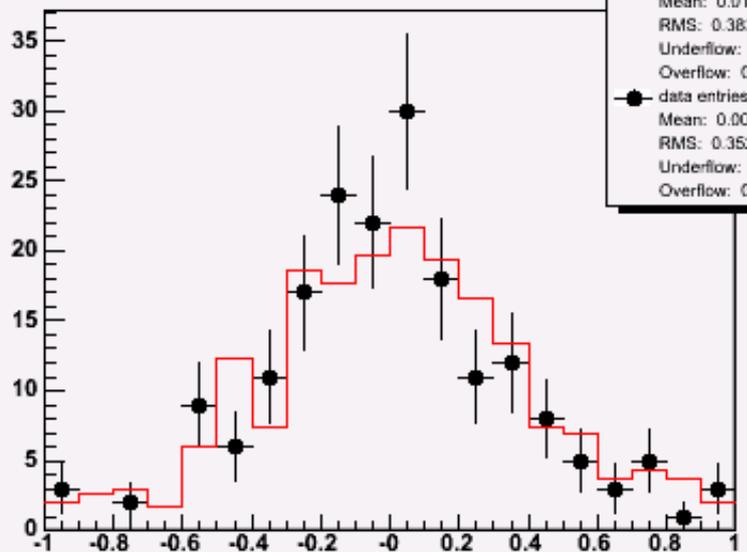
(pT < 0.10) R-Pvtx-V⁰/γ (sig)



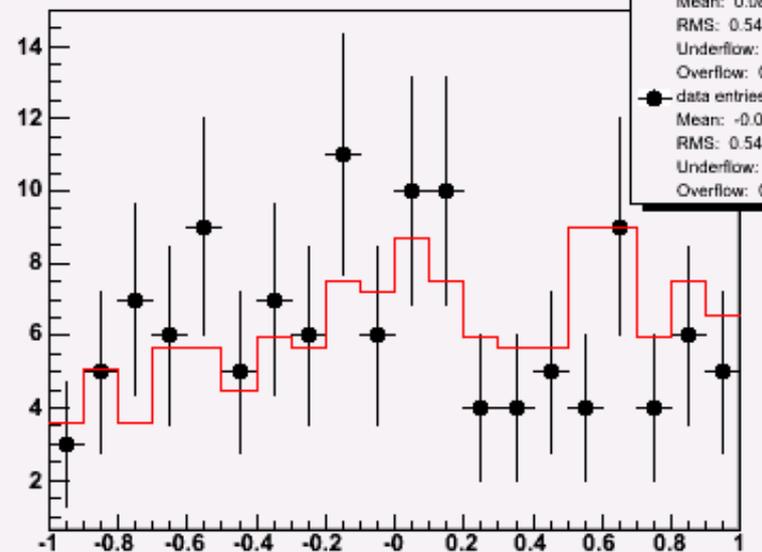
(pT < 0.10) R-Pvtx-V⁰/γ (back)



(pT < 0.10) momentum asymmetry (sig)

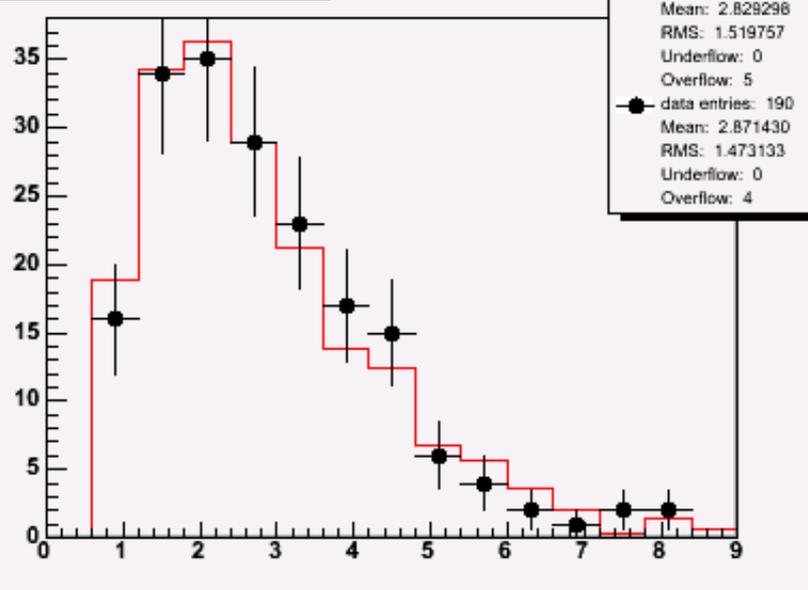


(pT < 0.10) momentum asymmetry (back)

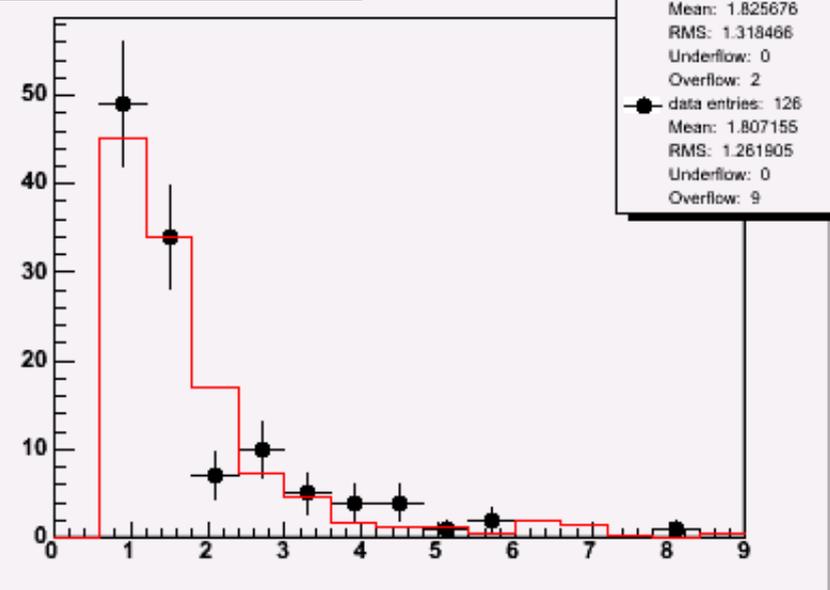


Beryllium 120

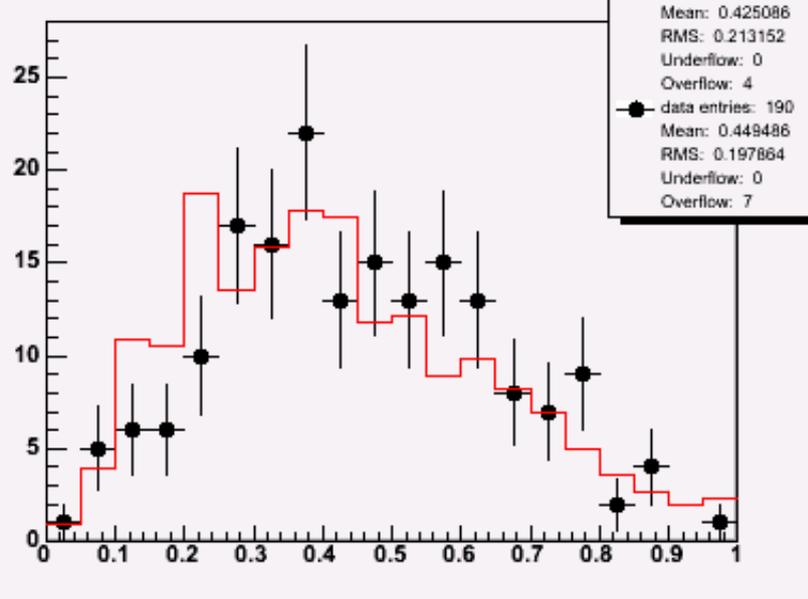
(pT < 0.10) V⁰ mom (sig)



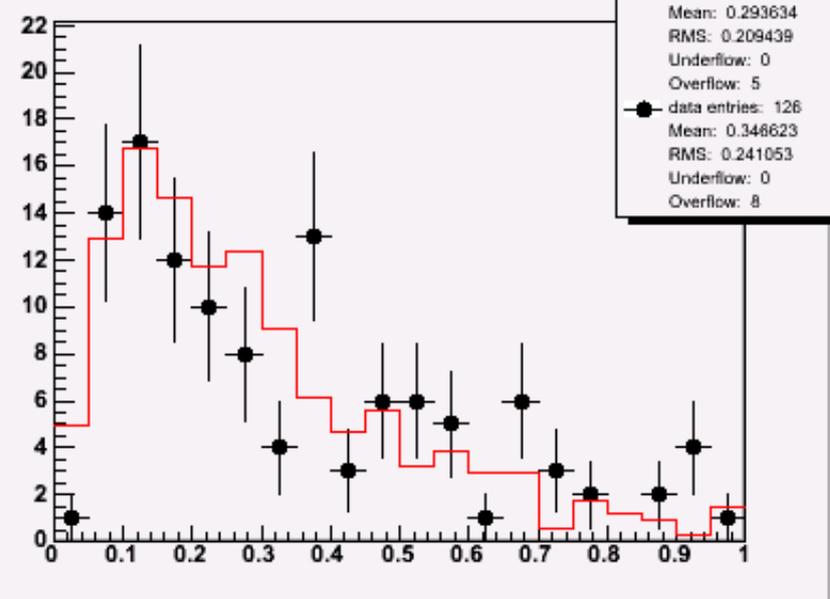
(pT < 0.10) V⁰ mom (back)



(pT < 0.10) pT wrt beamtrk (sig)



(pT < 0.10) pT wrt beamtrk (back)



NuMI 120 (pass4b)

	Data	MC
2 events with 1 bmrk:	618725	89520
3 Pvtx # trks ≥ 3	782583	97206
4 Pvtx at least 3 trks gof ≥ 0.05	484604	76199
5 $[(x\text{-pos})^2 + (y\text{-pos})^2] \leq 1.0$	430971	72011
6 Pvtx z-pos within -940 to -830	423861	70910

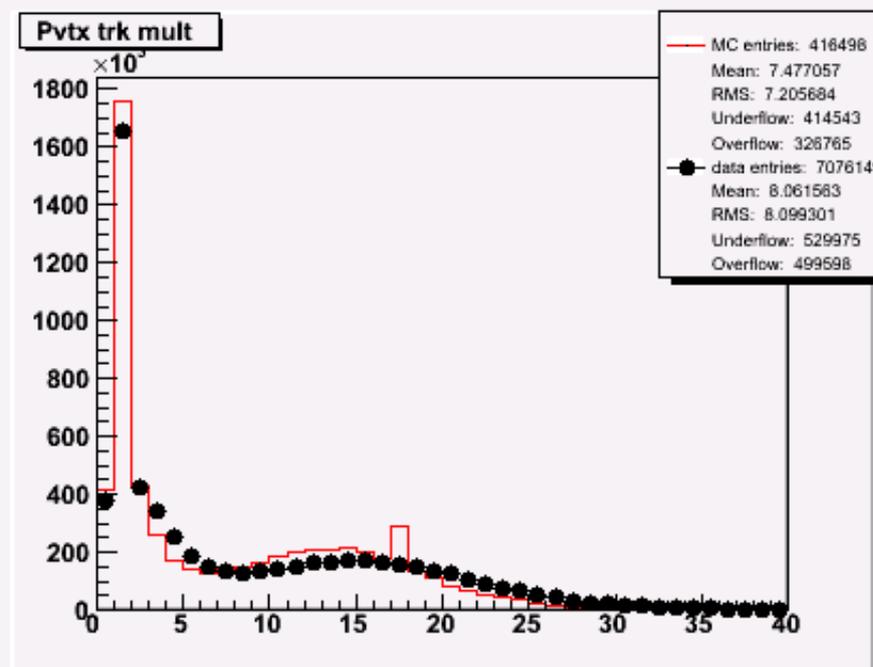
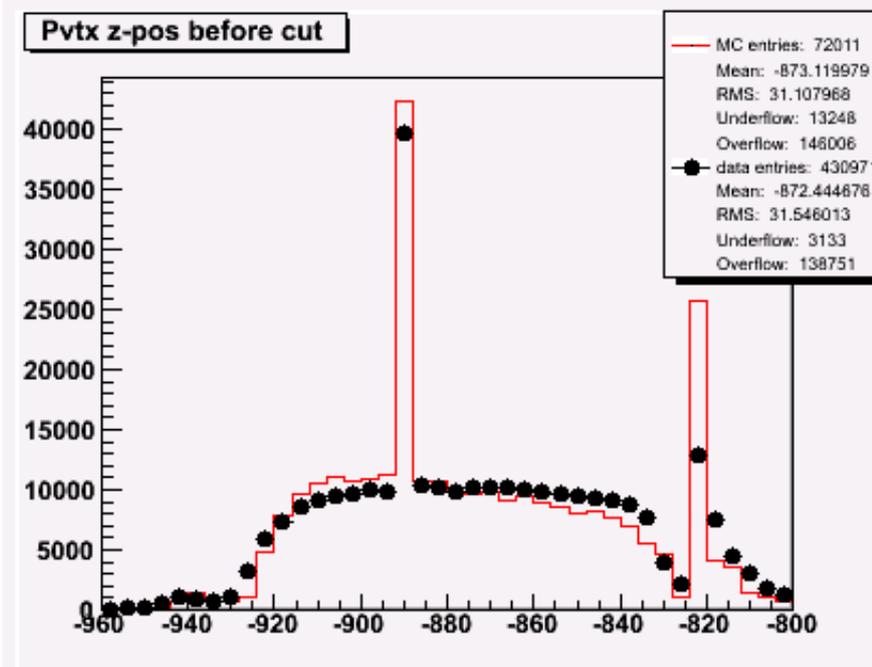
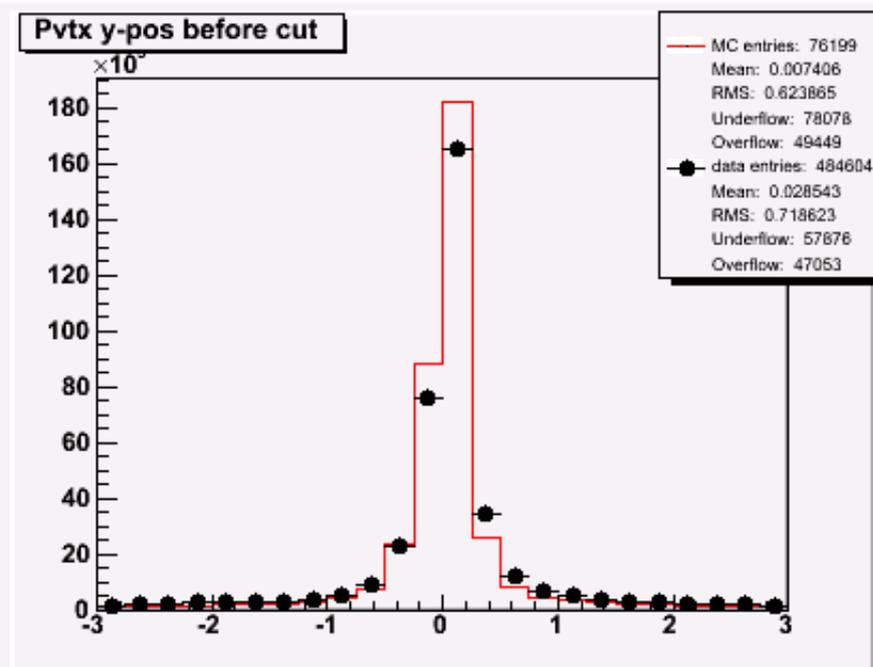
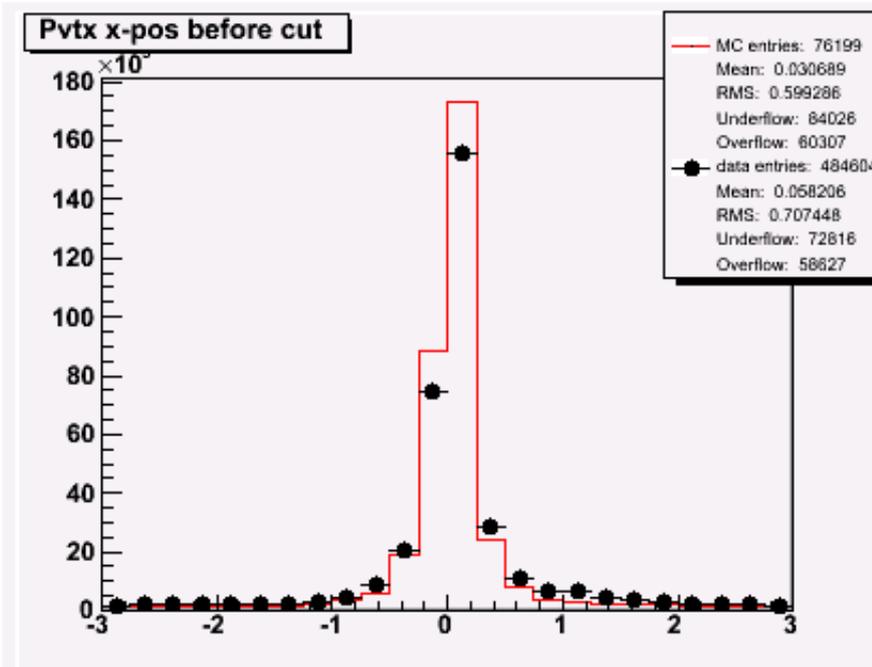
Secondary vertex loop:

7 Svtx 2 trks	201850	23848
8 Svtx downstream of Pvtx	165151	18393
9 Svtx within TPC volume	56308	4199
10 Svtx neutral	25754	2306
11 Svtx trks gof > 0.01	2886	332
12a pT prim < 0.15	1447	243
13a $ \text{Svtx mom} > 0.8 \text{ GeV}$	667	125
12b pT prim < 0.10	1132	215
13b $ \text{Svtx mom} > 0.8 \text{ GeV}$	475	109

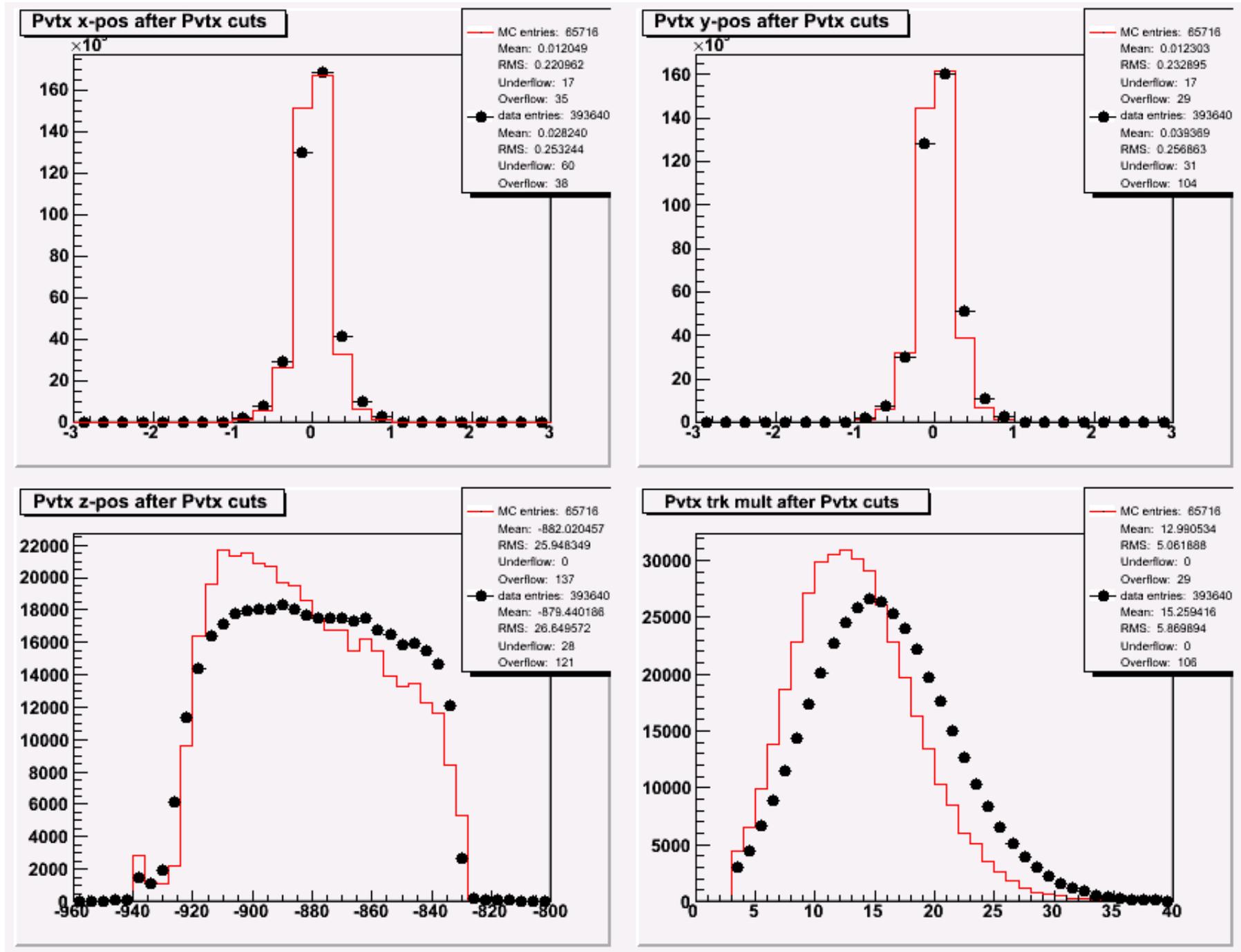
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of generated K_shorts: 31299

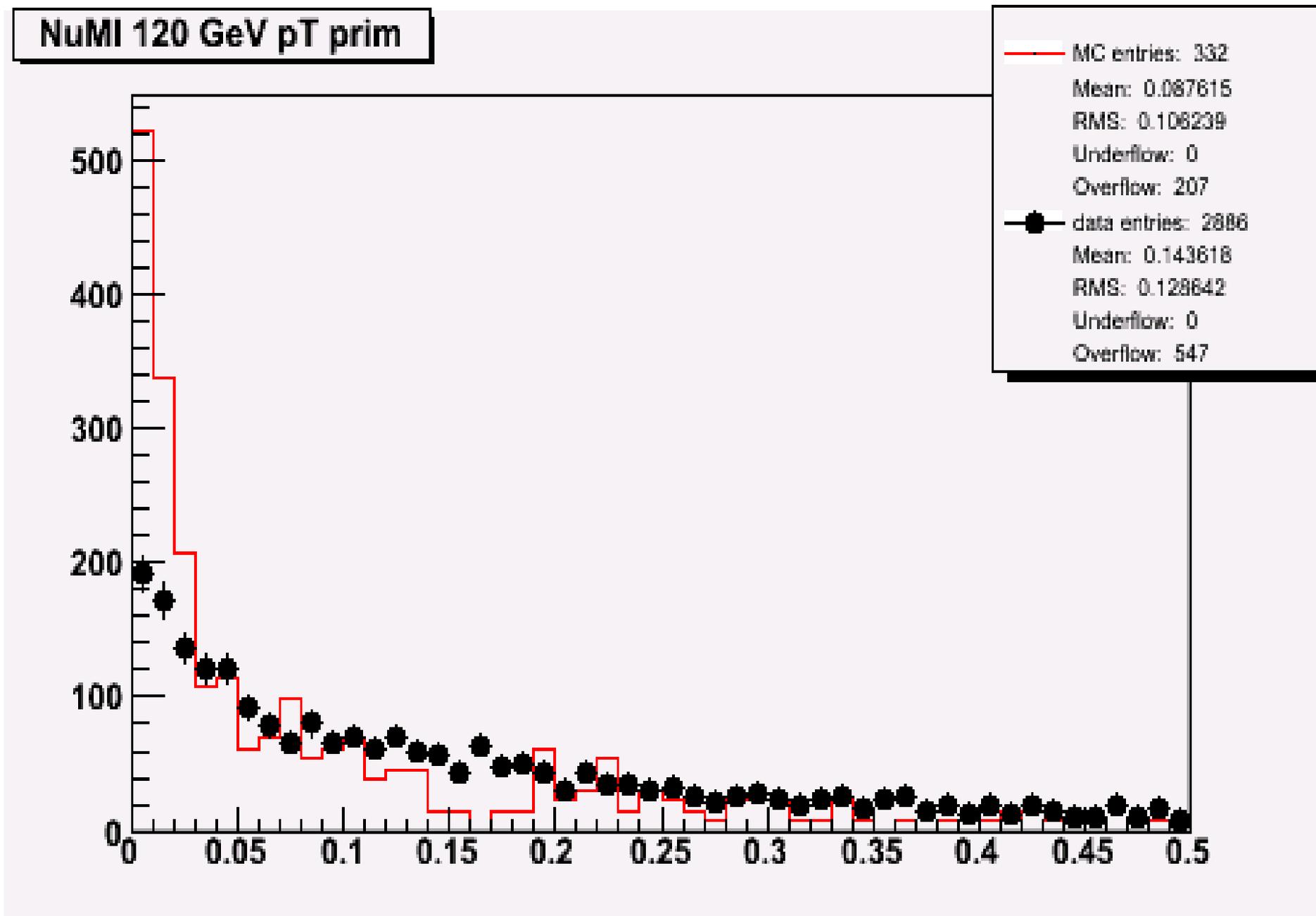
Cut Variable Plots NuMI 120



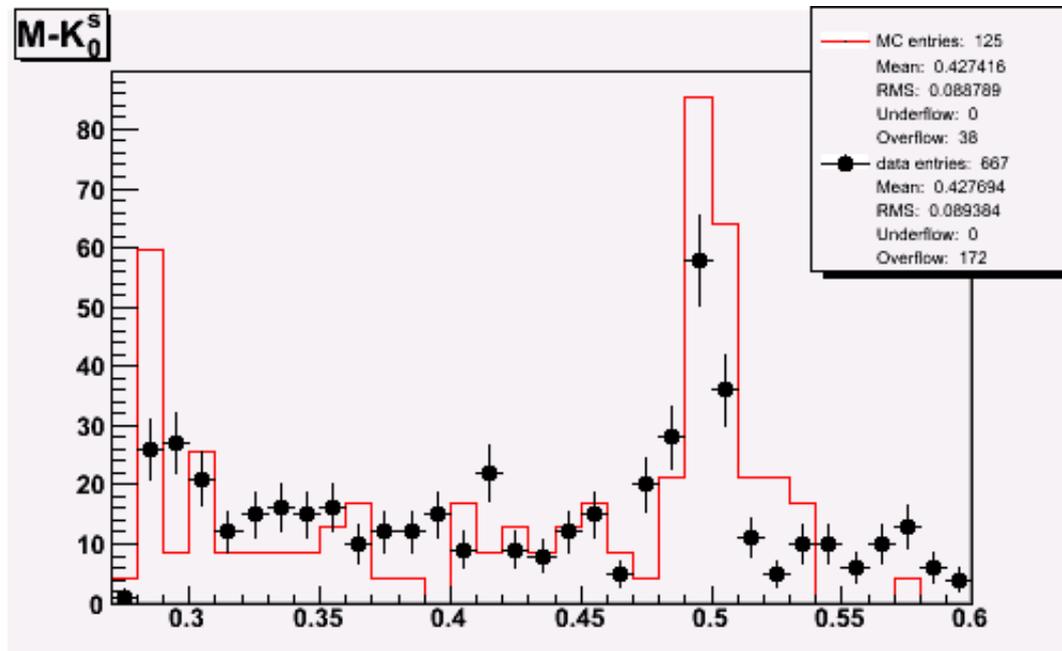
NuMI 120



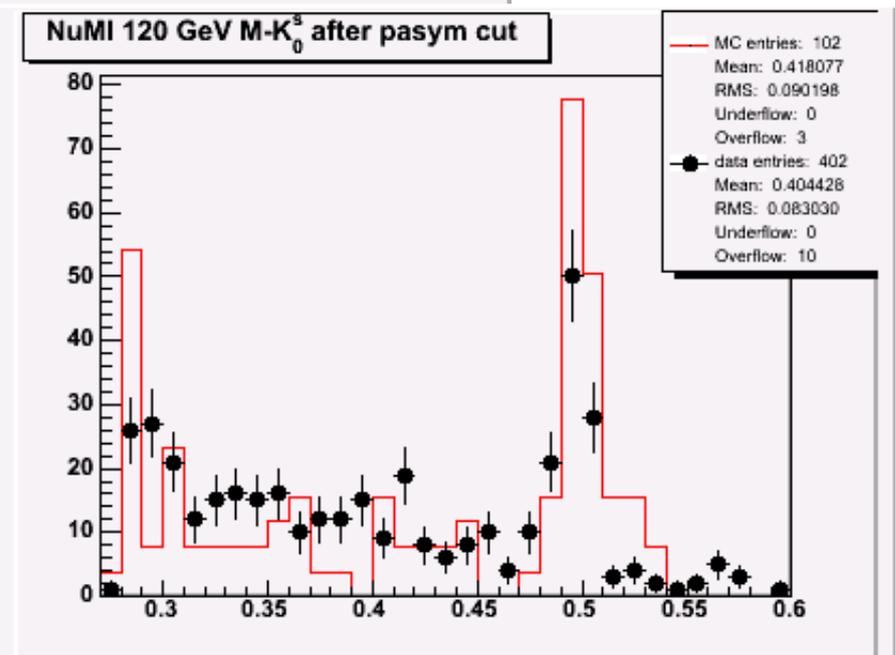
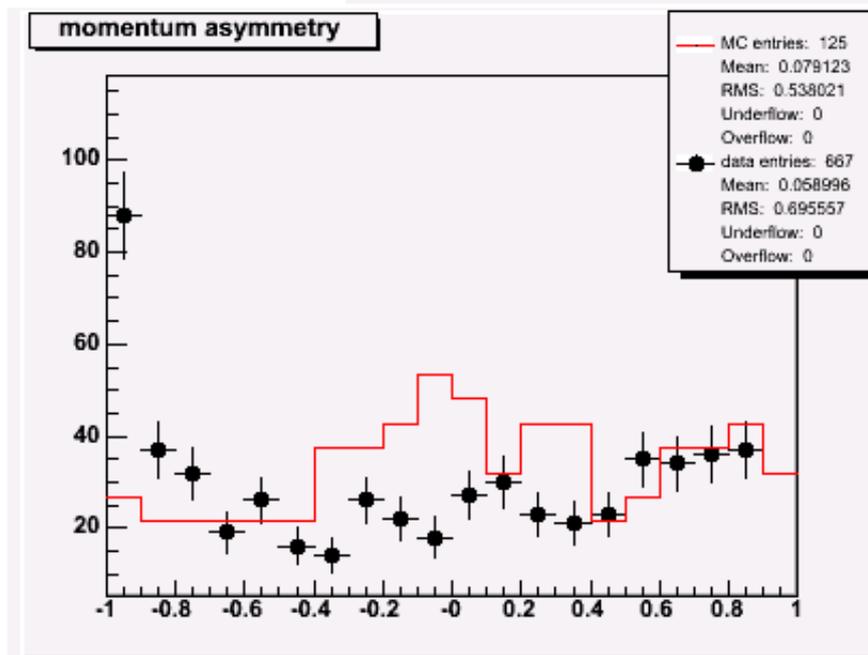
NuMI 120



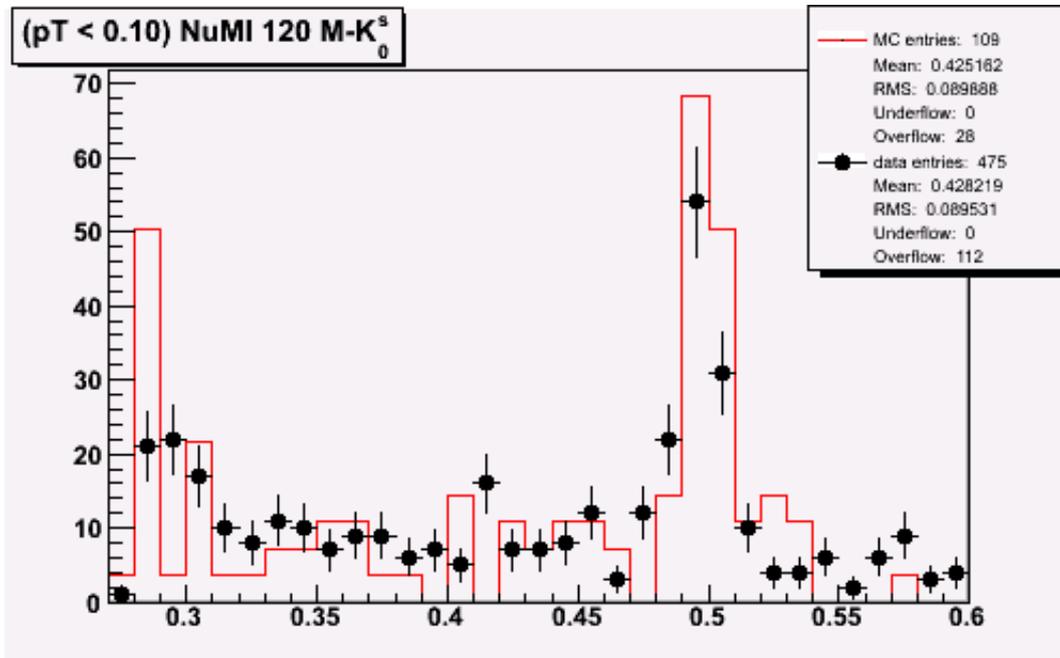
(after all cuts)
NuMI 120



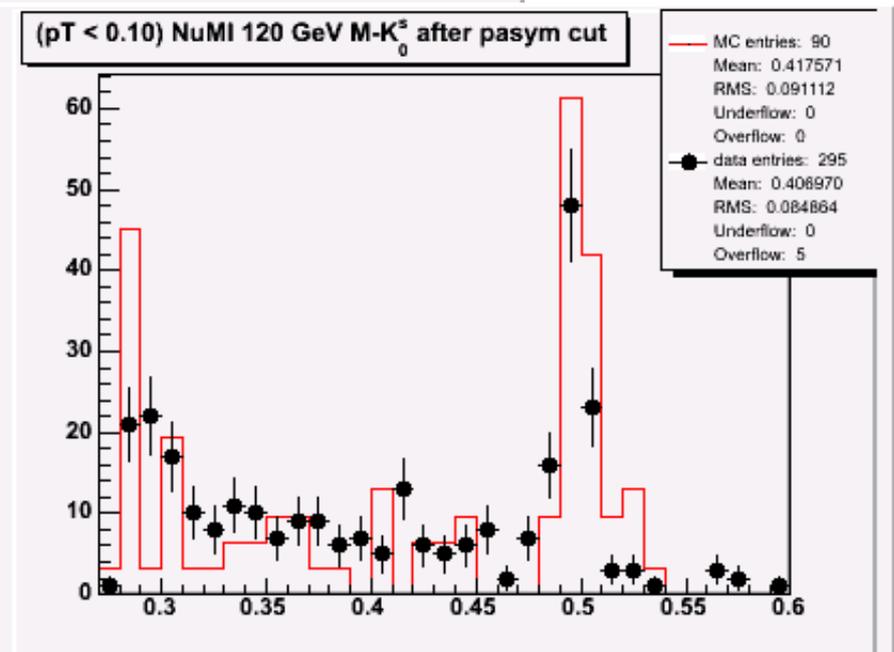
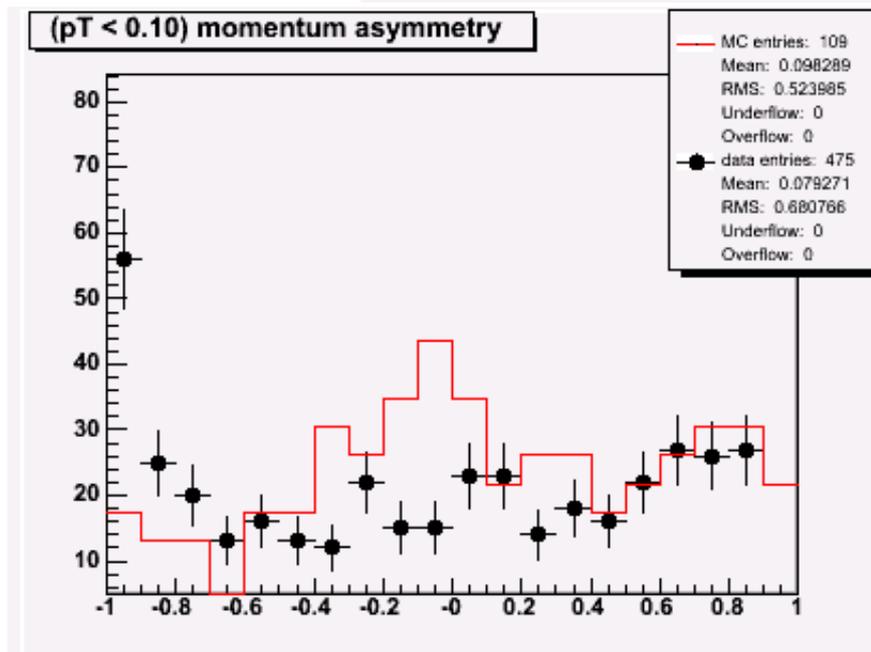
$|\text{pasym}| < 0.8$



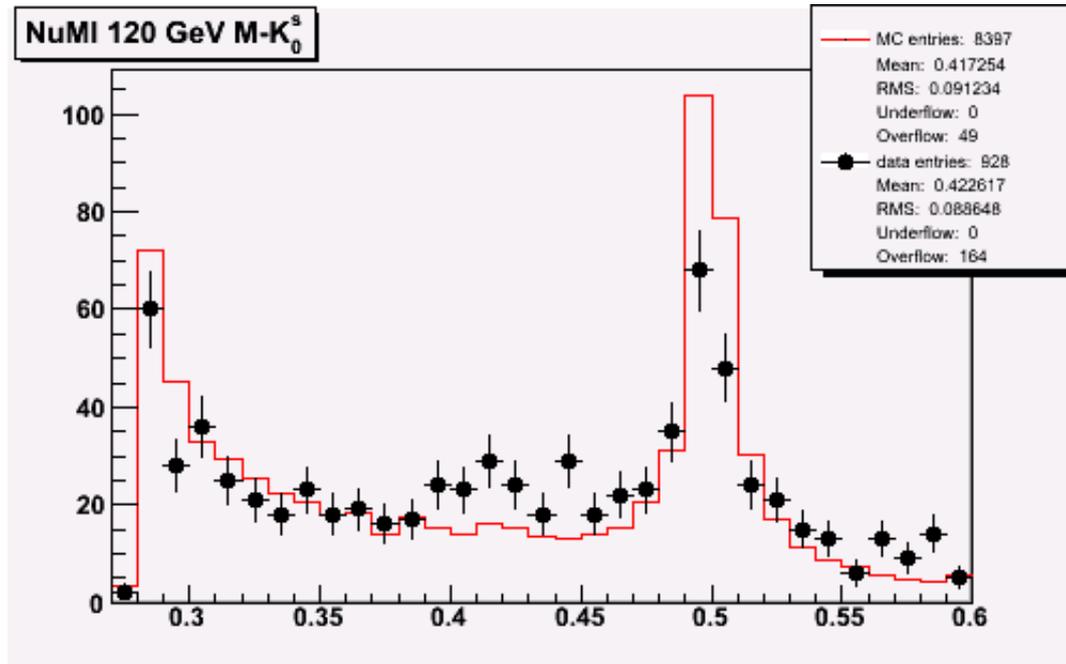
NuMI 120



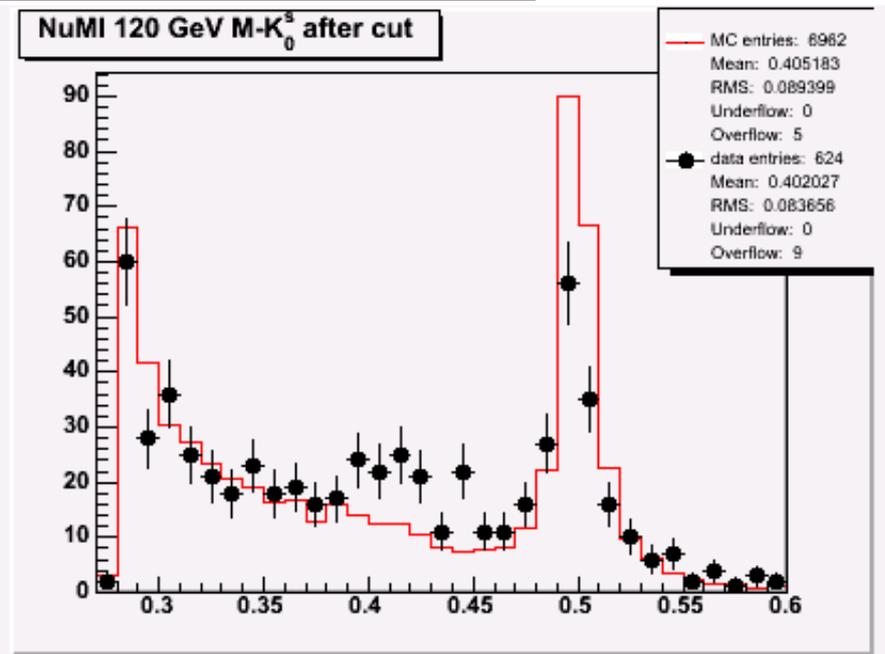
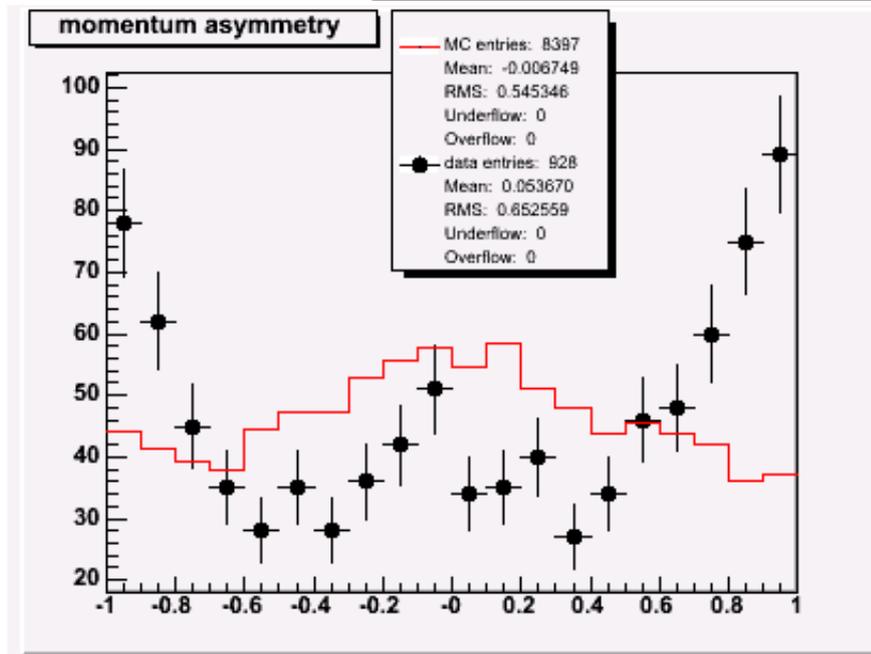
$|\text{pasym}| < 0.8$



NuMI 120 old mass plot

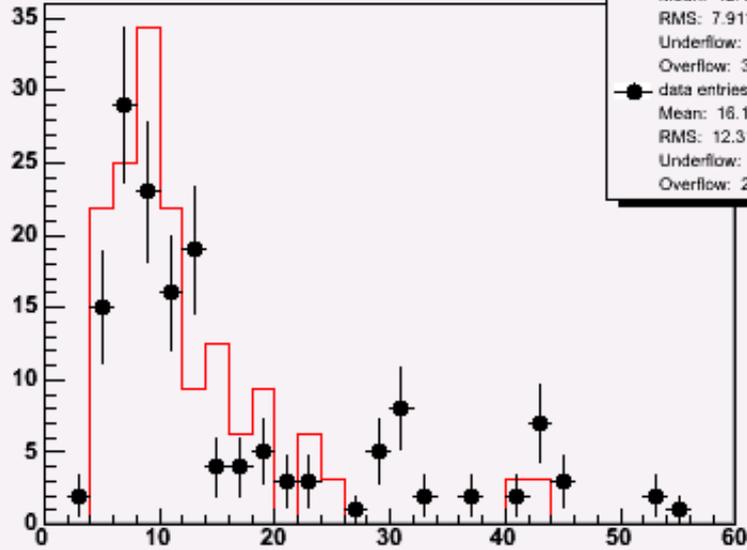


$|\text{pasym}| < 0.8$

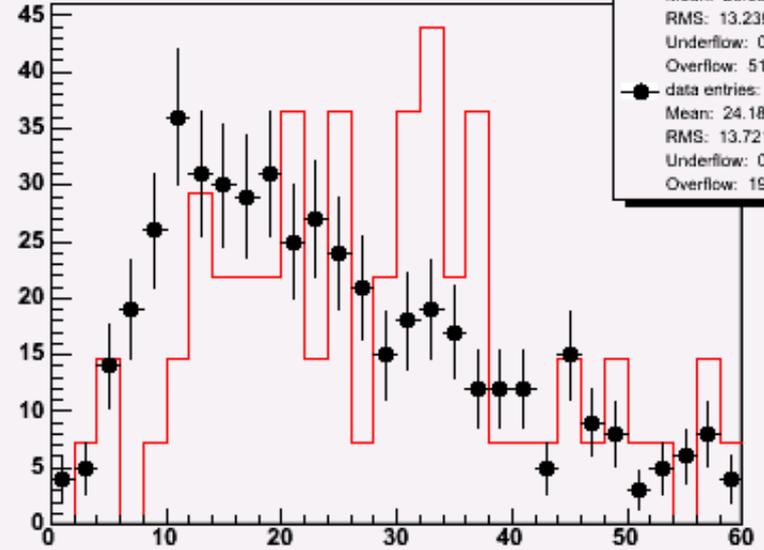


NuMI 120

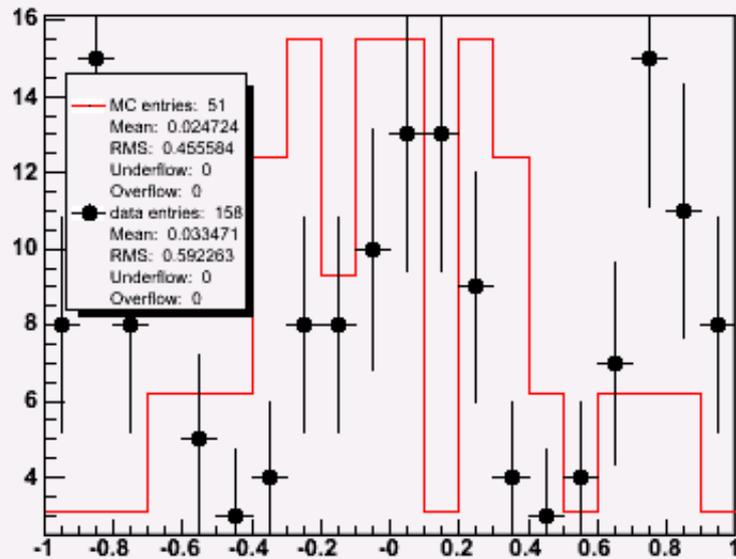
R-Pvtx- V^0/γ (sig)



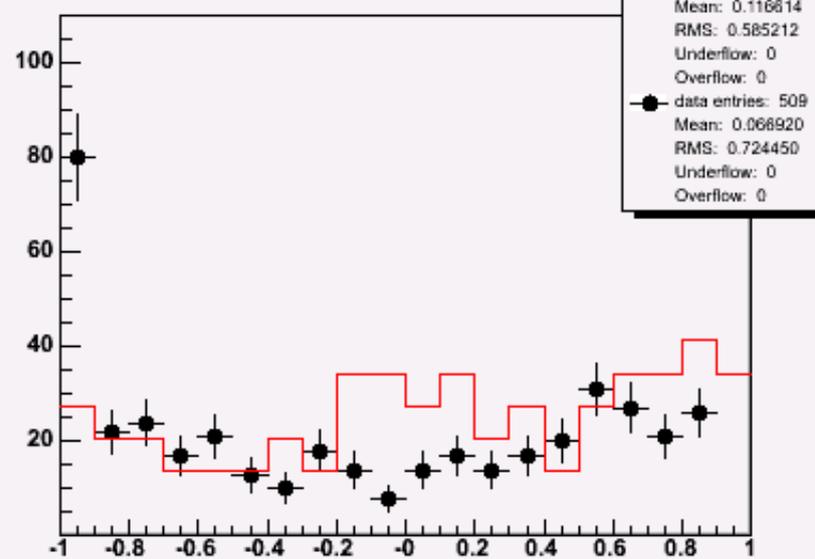
R-Pvtx- V^0/γ (back)



momentum asymmetry (sig)

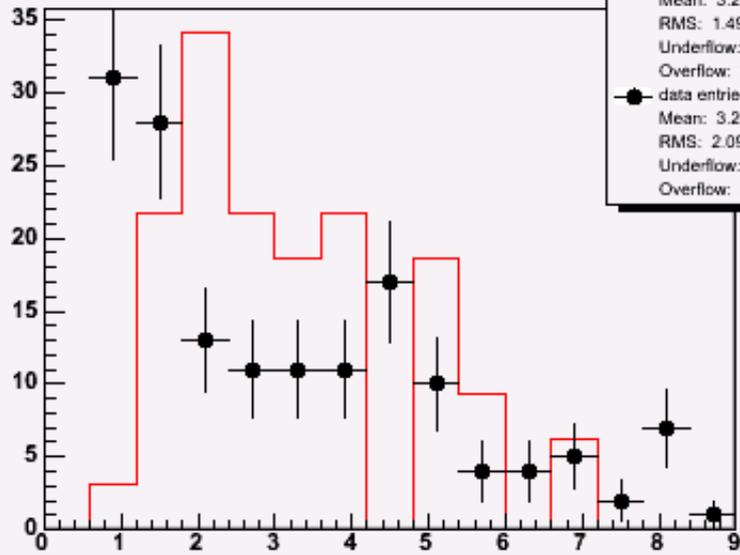


momentum asymmetry (back)

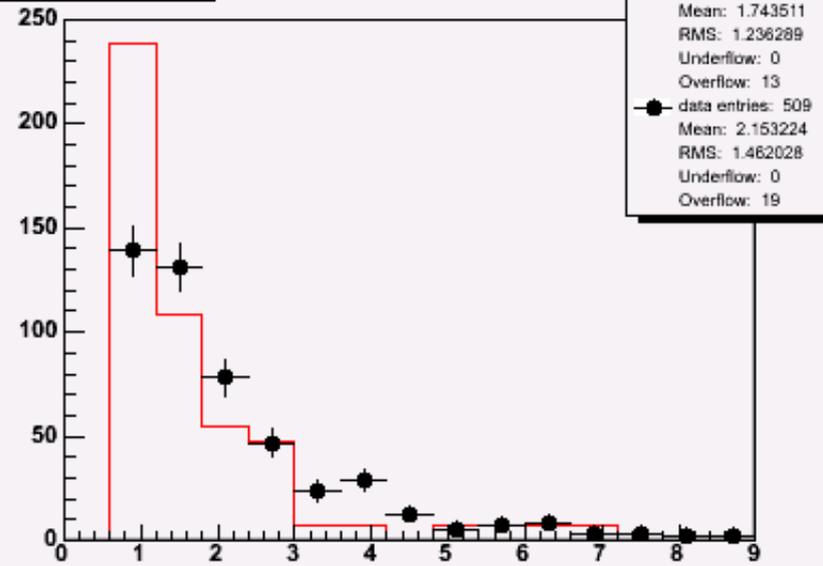


NuMI 120

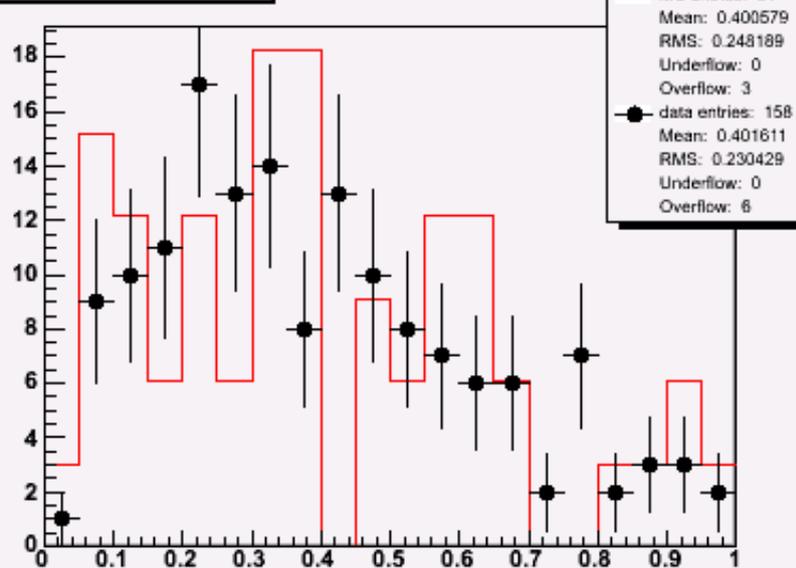
V^0 mom (sig)



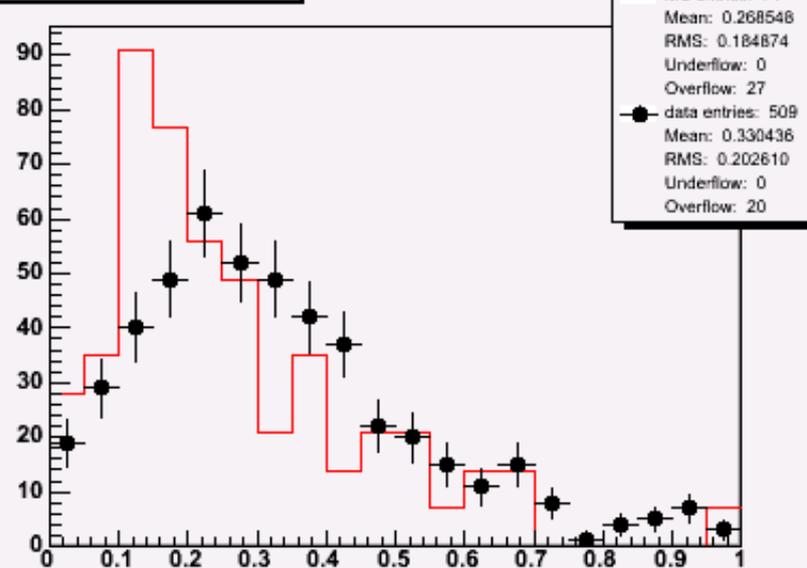
V^0 mom (back)



pT wrt beamtrk (sig)

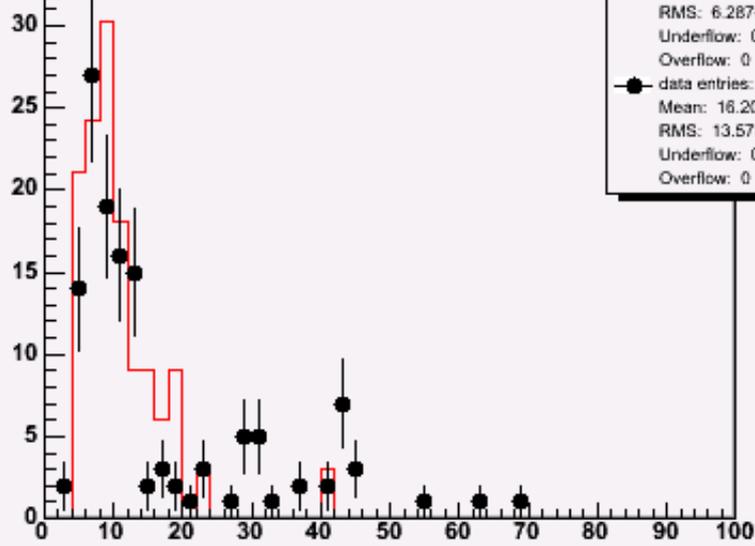


pT wrt beamtrk (back)

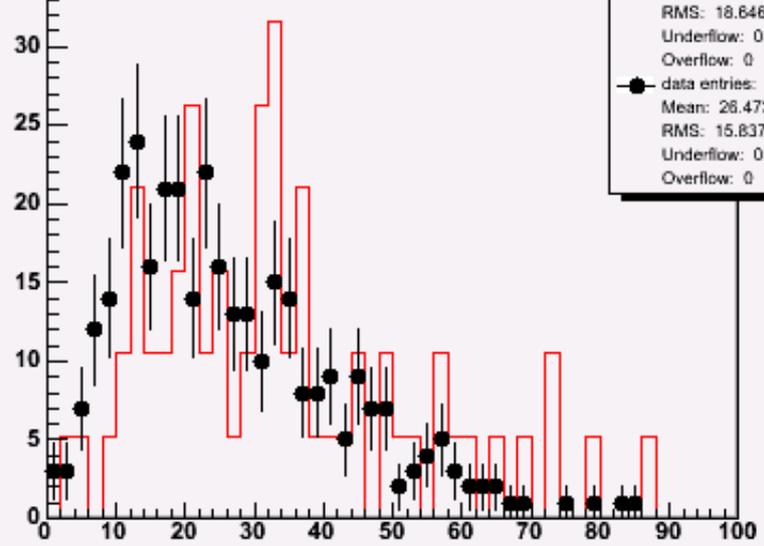


NuMI 120

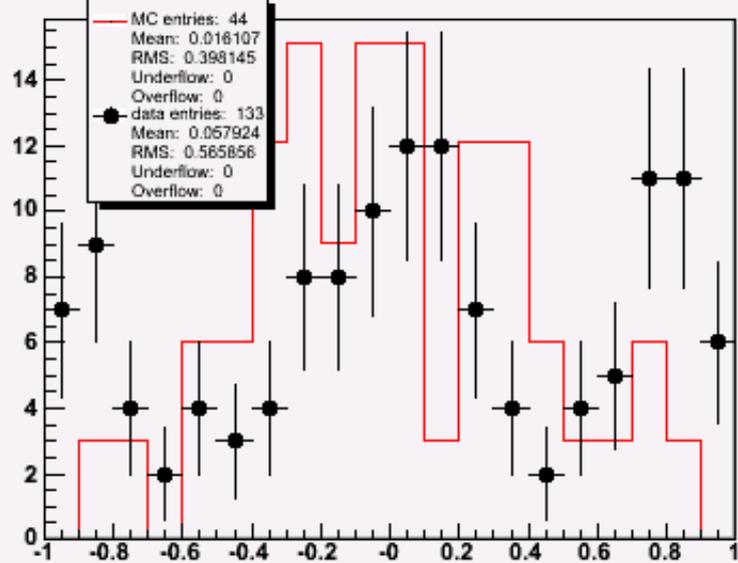
(pT < 0.10) R-Pvtx-V⁰/γ (sig)



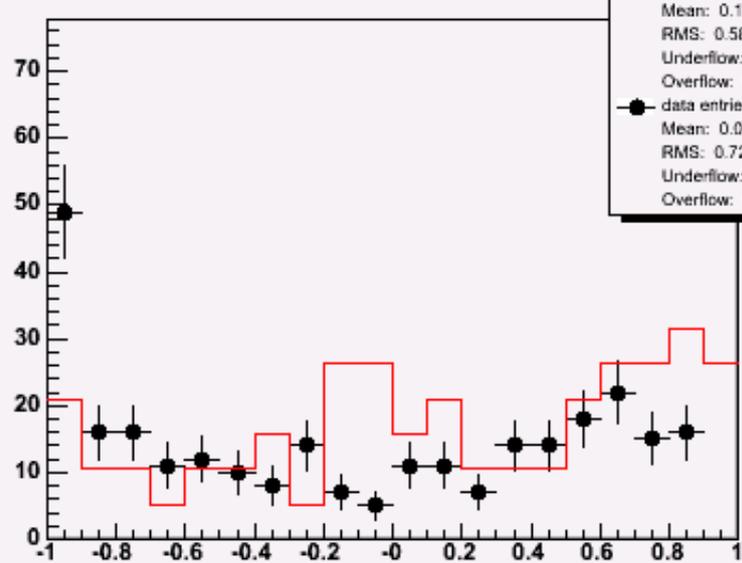
(pT < 0.10) R-Pvtx-V⁰/γ (back)



(pT < 0.10) momentum asymmetry (sig)

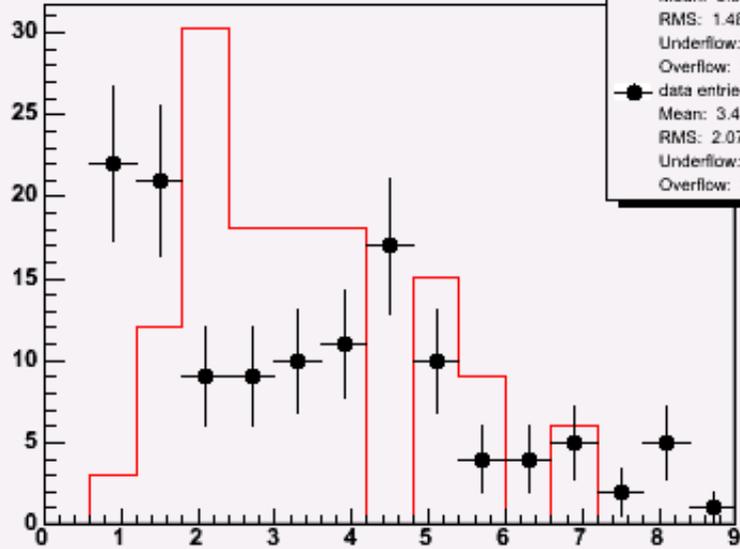


(pT < 0.10) momentum asymmetry (back)

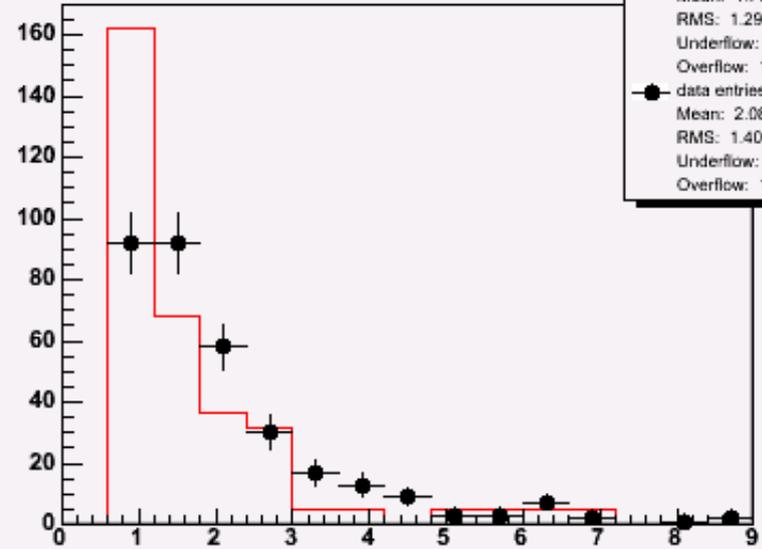


NuMI 120

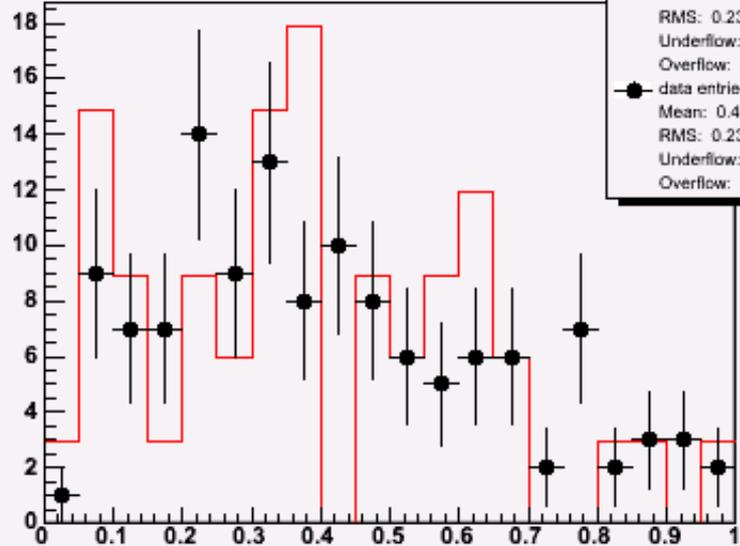
(pT < 0.10) V⁰ mom (sig)



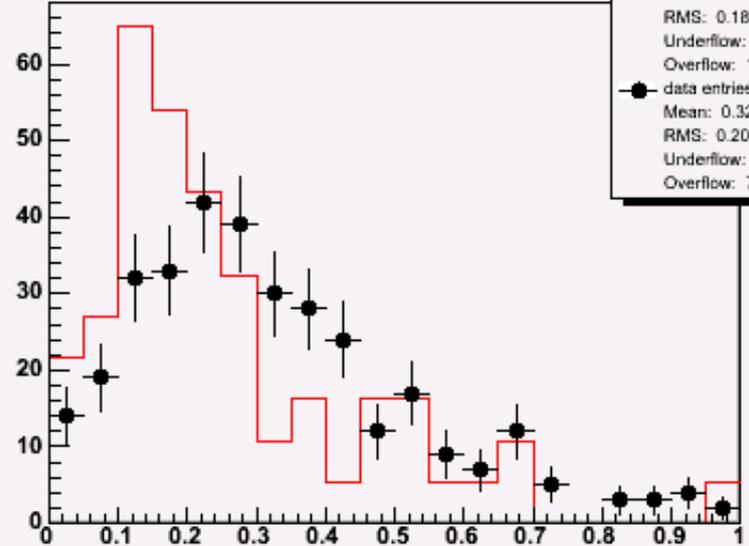
(pT < 0.10) V⁰ mom (back)



(pT < 0.10) pT wrt beamtrk (sig)



(pT < 0.10) pT wrt beamtrk (back)



LH2 58 (pass4b)

	Data
2 events with 1 bmrk:	417465
3 Pvtx # trks ≥ 3	192017
4 Pvtx at least 3 trks gof ≥ 0.05	127149
5 $ dxTgt - 0.32 \leq 1, dyTgt \leq 1$	41138
6 $-8 \leq dzTgt \leq 8$	31377

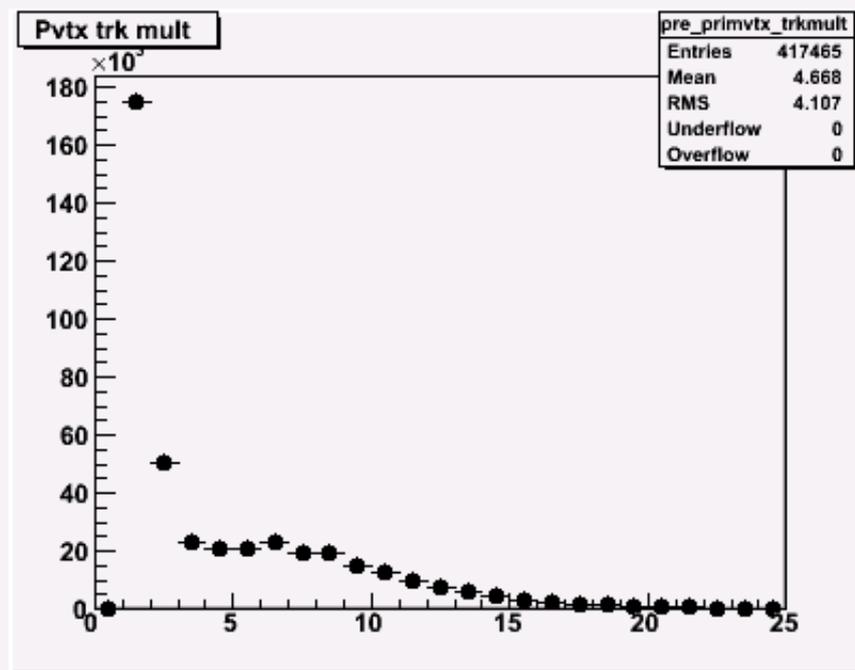
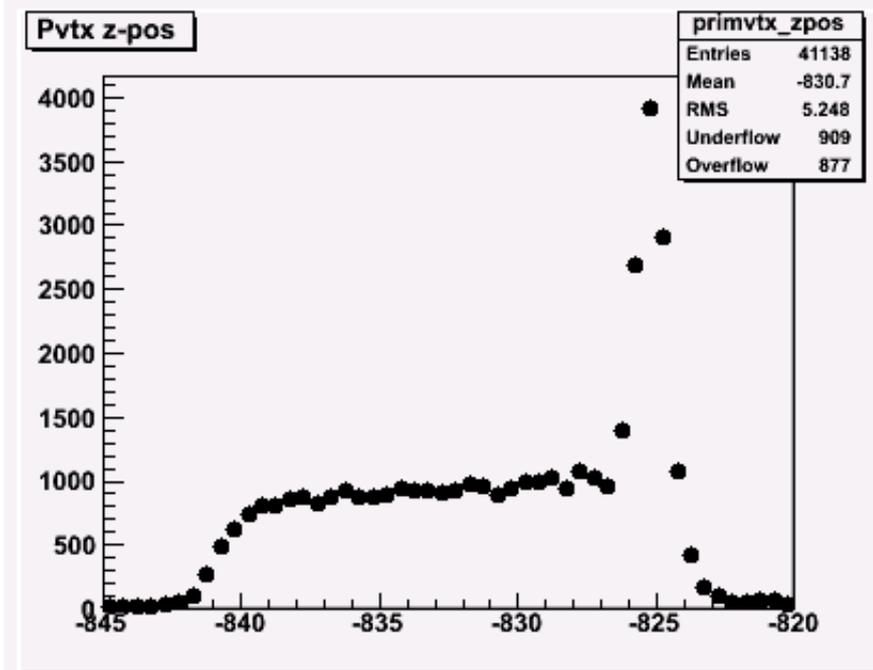
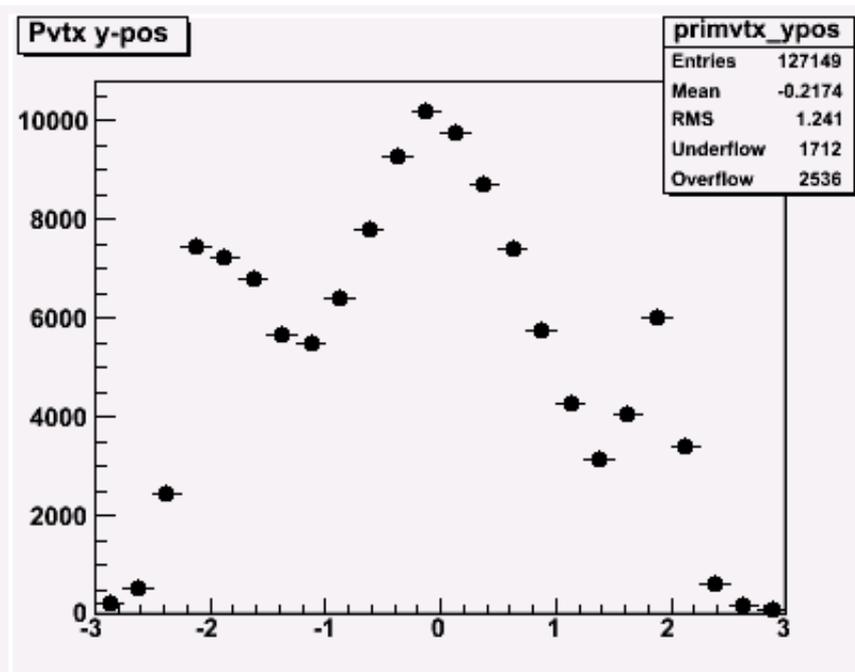
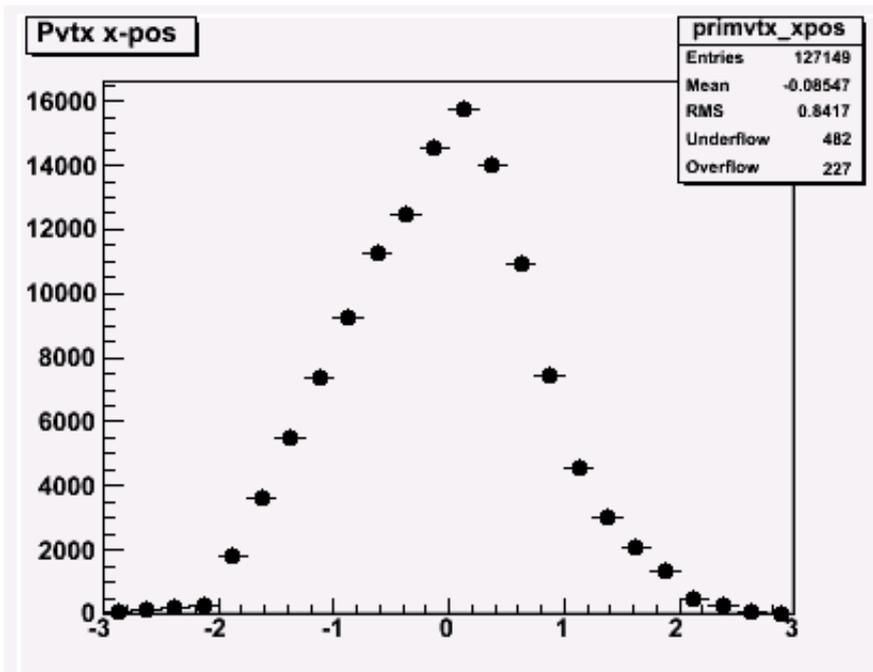
Secondary vertex loop:

7 Svtx 2 trks	4959
8 Svtx downstream of Pvtx	3960
9 Svtx neutral	1954
10 Svtx trks gof > 0.01	130
11a pT prim < 0.15	44
12a $ Svtx\ mom > 0.8\ GeV$	25
11b pT prim < 0.10	38
12b $ Svtx\ mom > 0.8\ GeV$	24

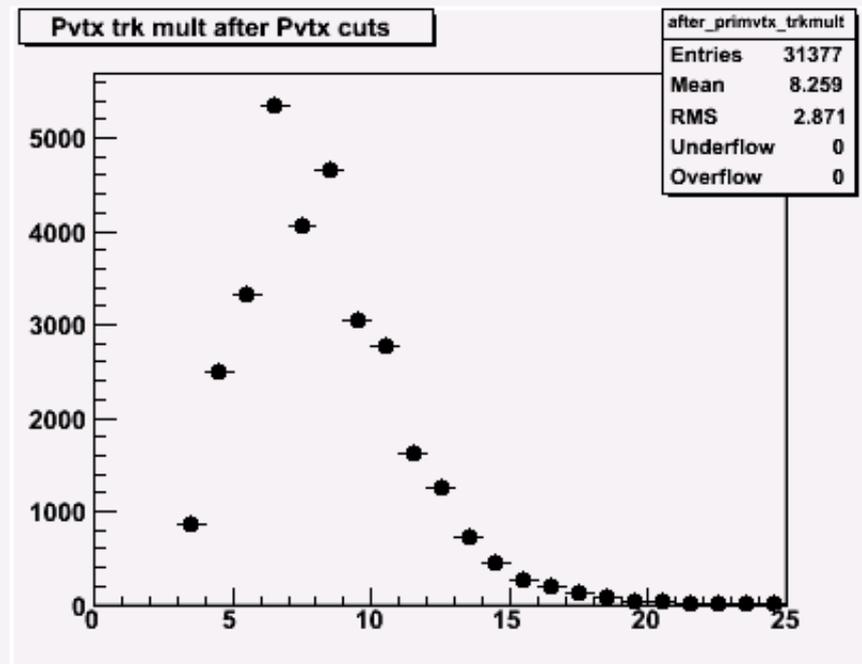
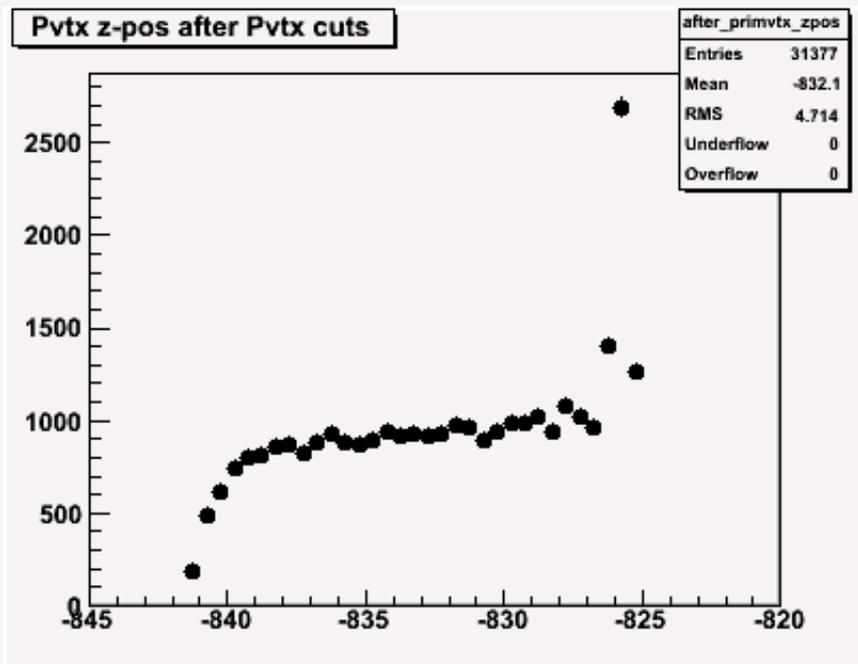
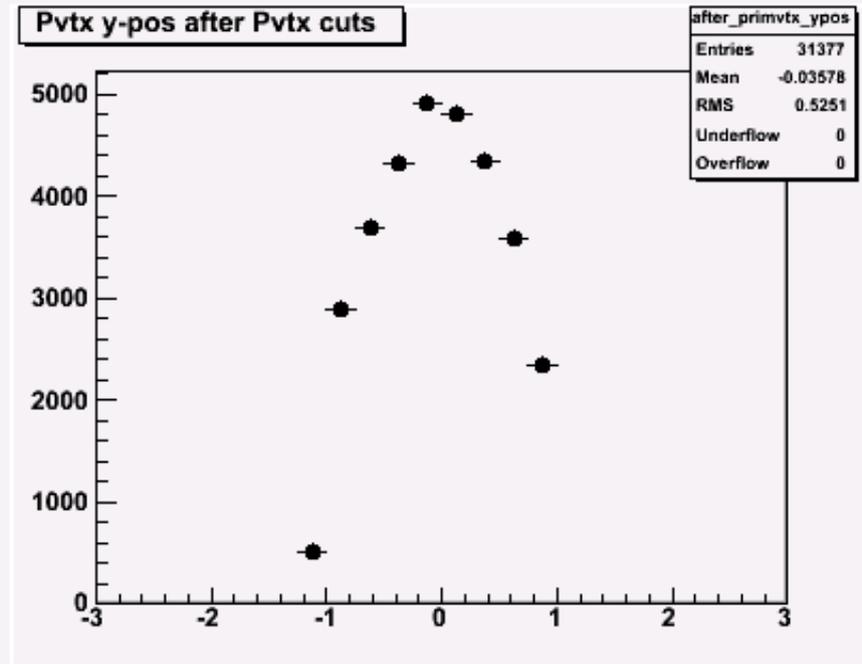
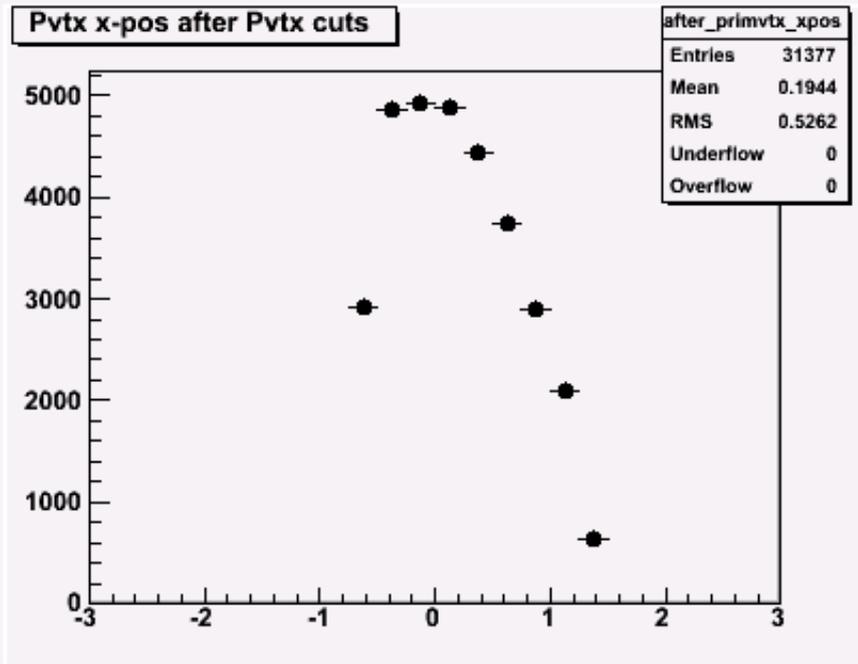
of incident particles on target:

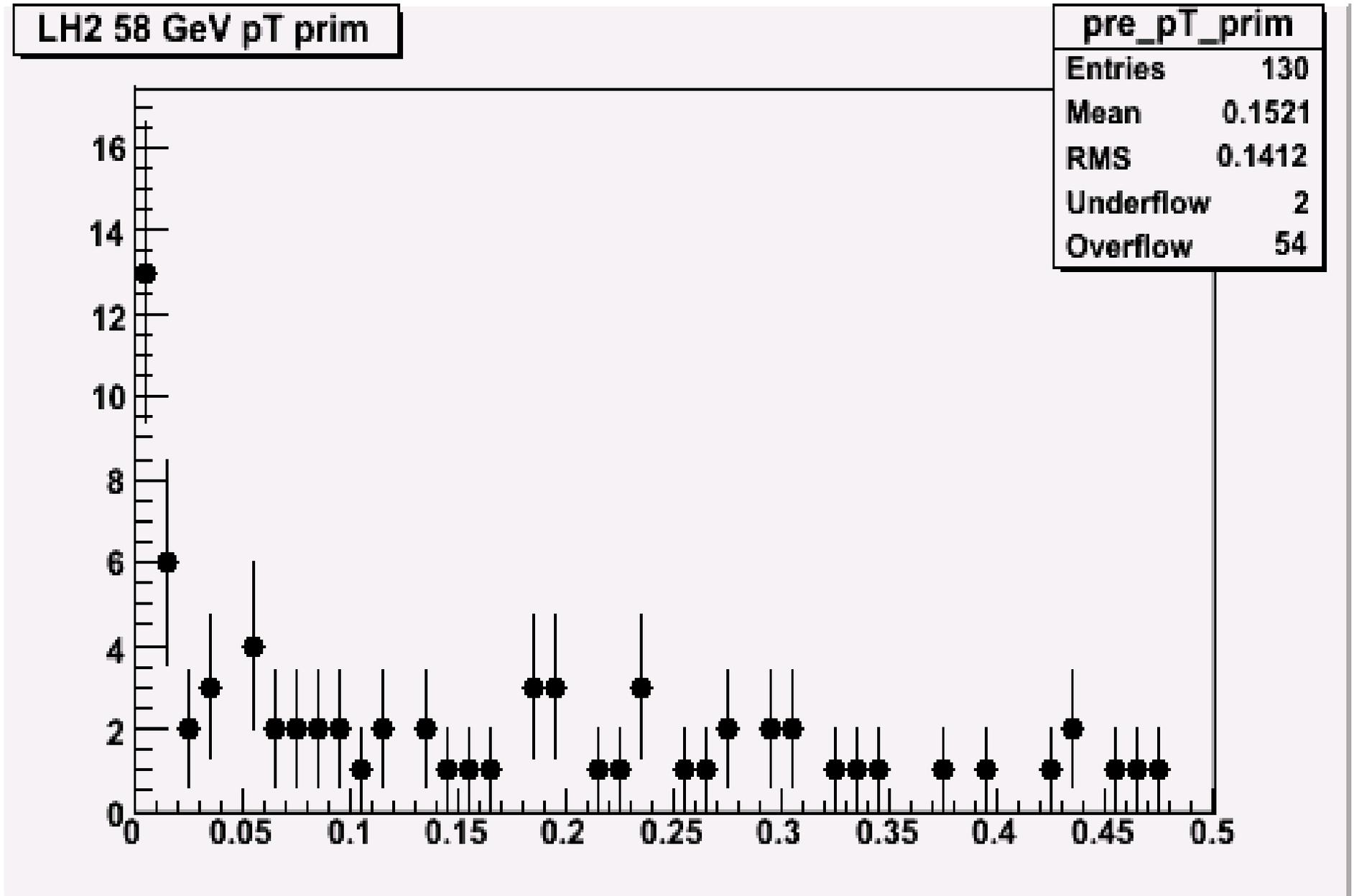
787899

Cut Variable Plots LH2 58

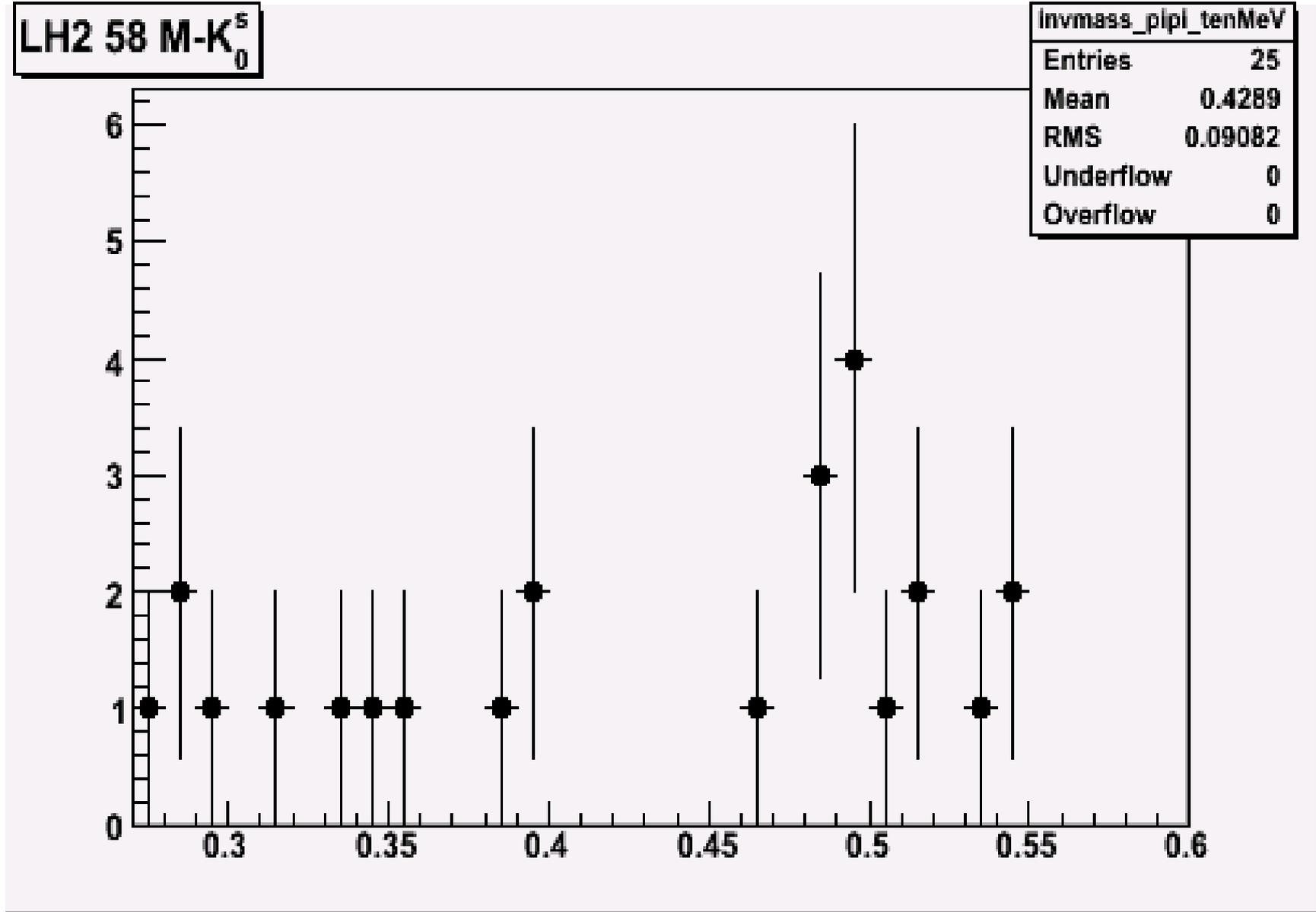


LH2 58

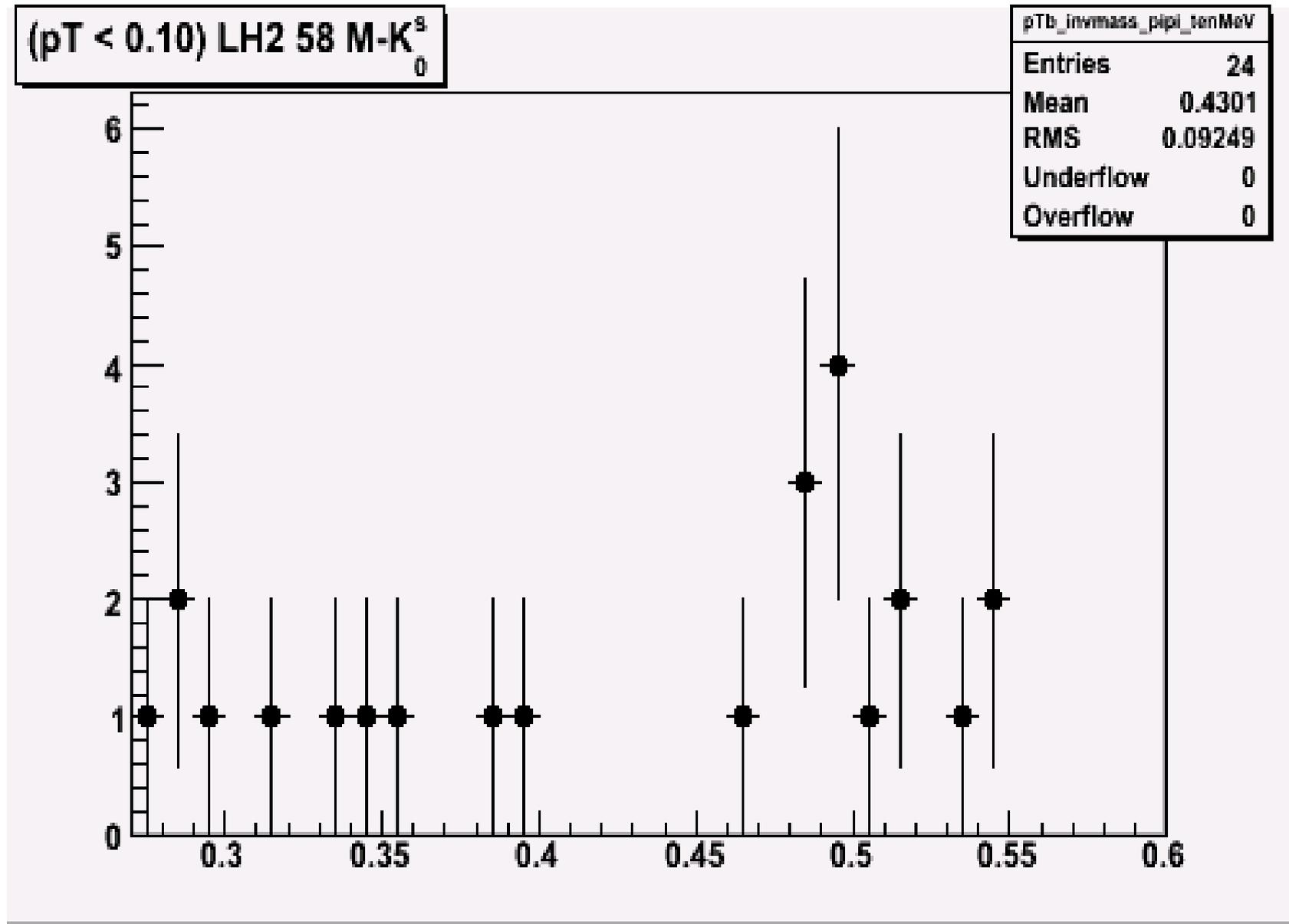




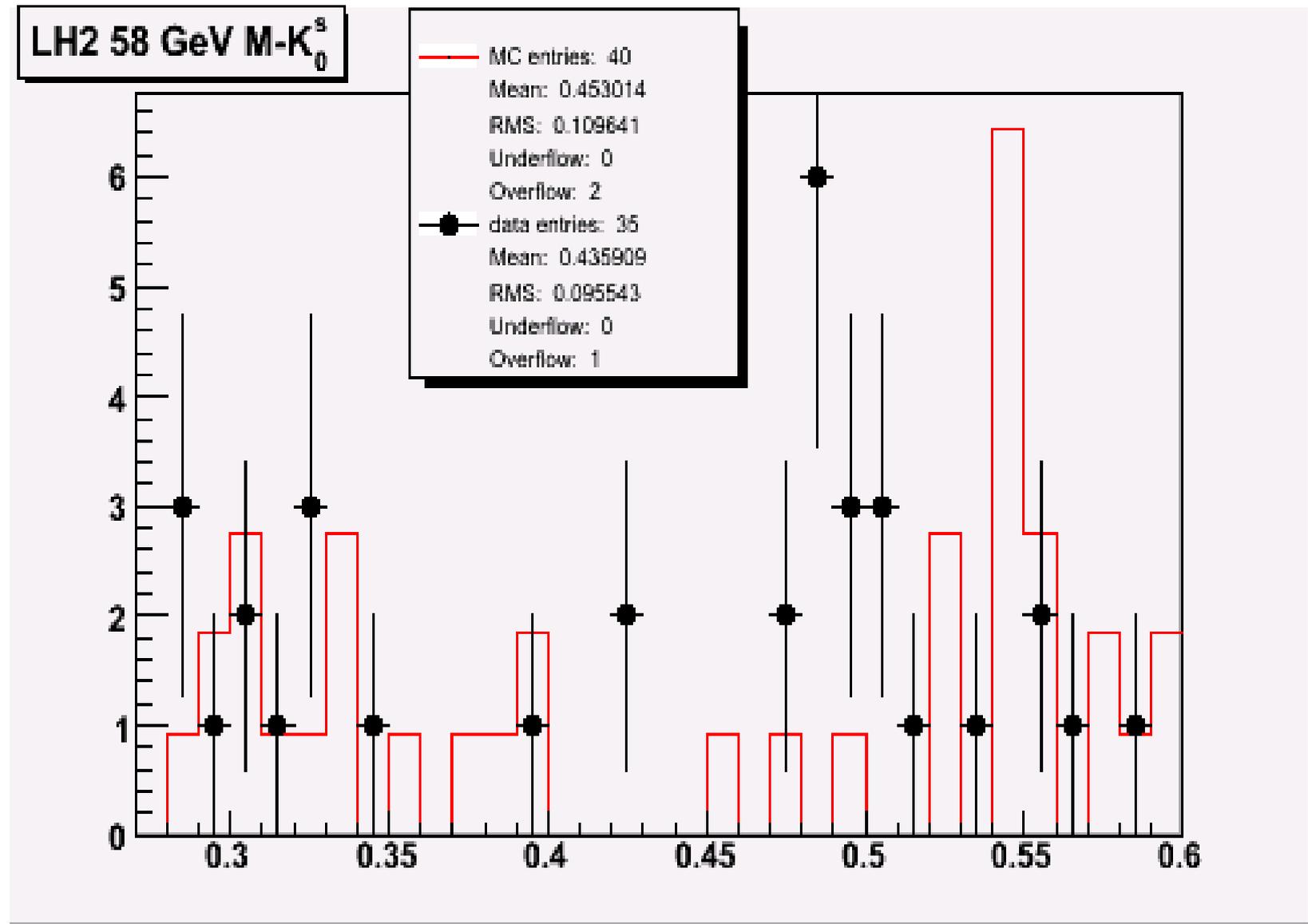
(after all cuts)
LH2 58



LH2 58

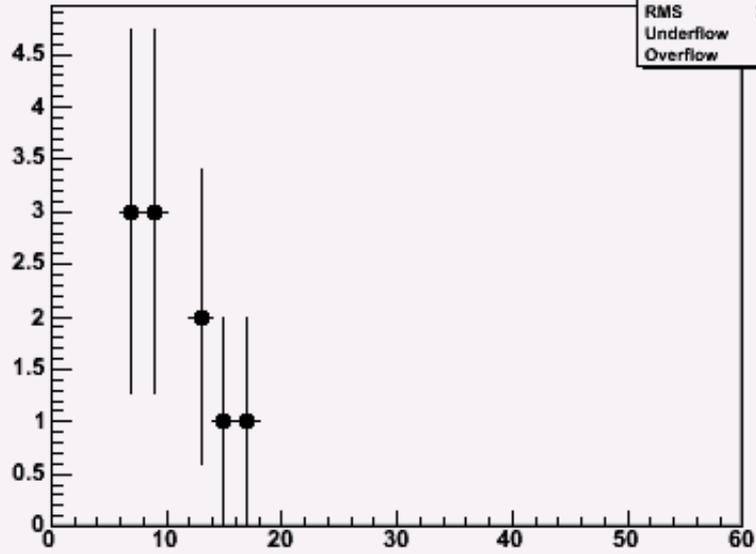


LH2 58 old mass plot



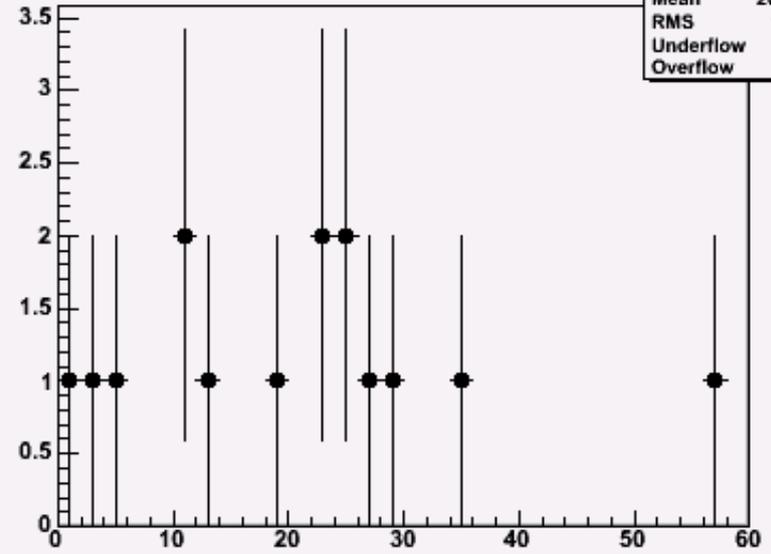
LH2 58

R-Pvtx- V^0/γ (sig)



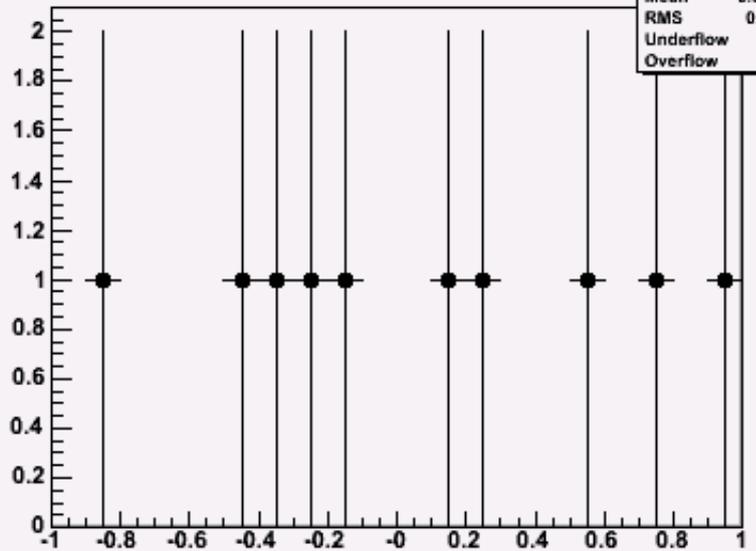
stat	Value
Entries	10
Mean	10.78
RMS	3.373
Underflow	0
Overflow	0

R-Pvtx- V^0/γ (back)



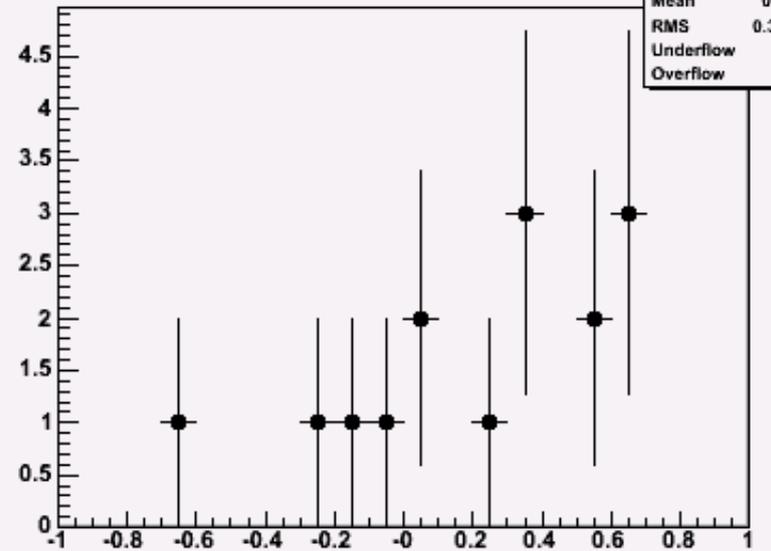
stat	Value
Entries	15
Mean	20.56
RMS	14.1
Underflow	0
Overflow	0

momentum asymmetry (sig)



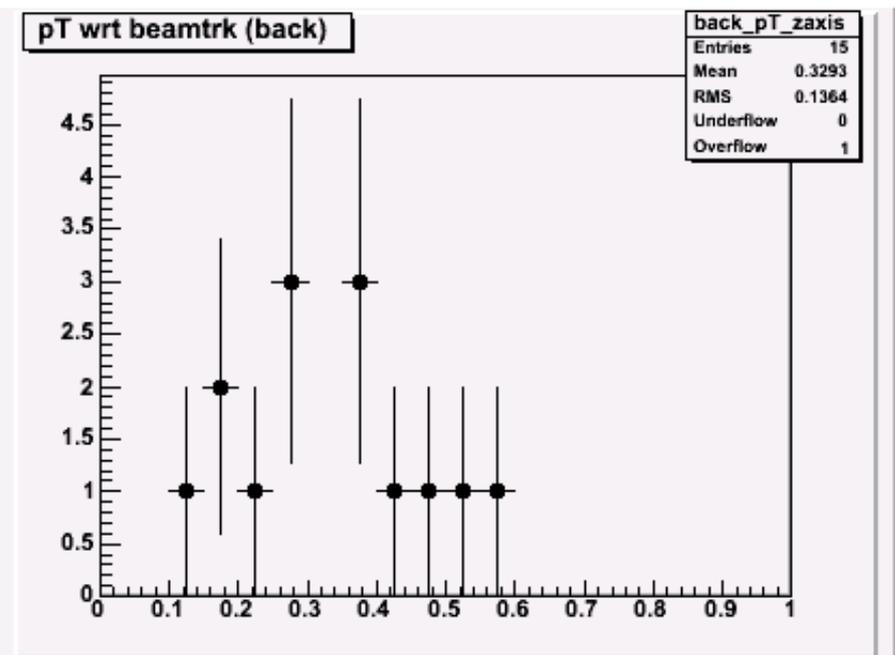
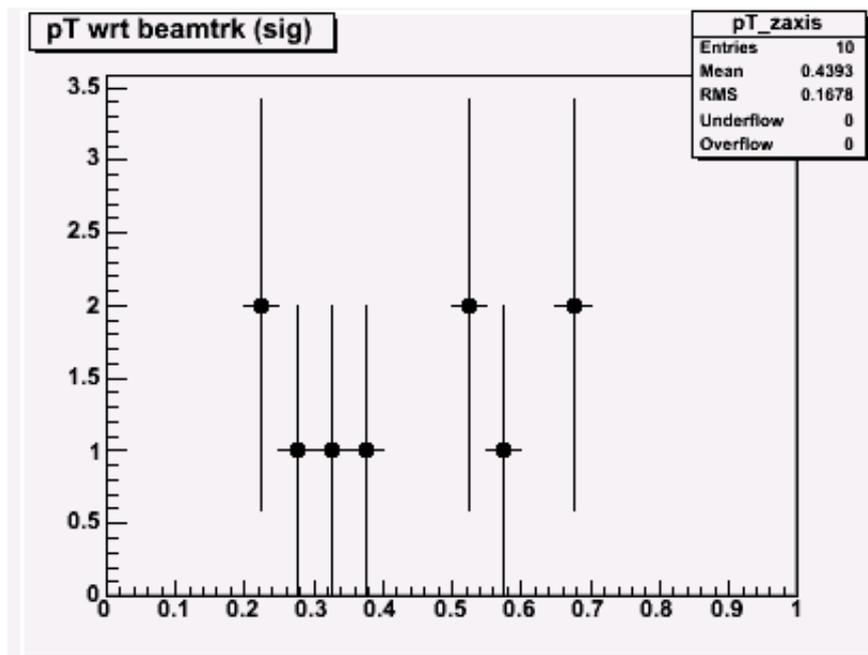
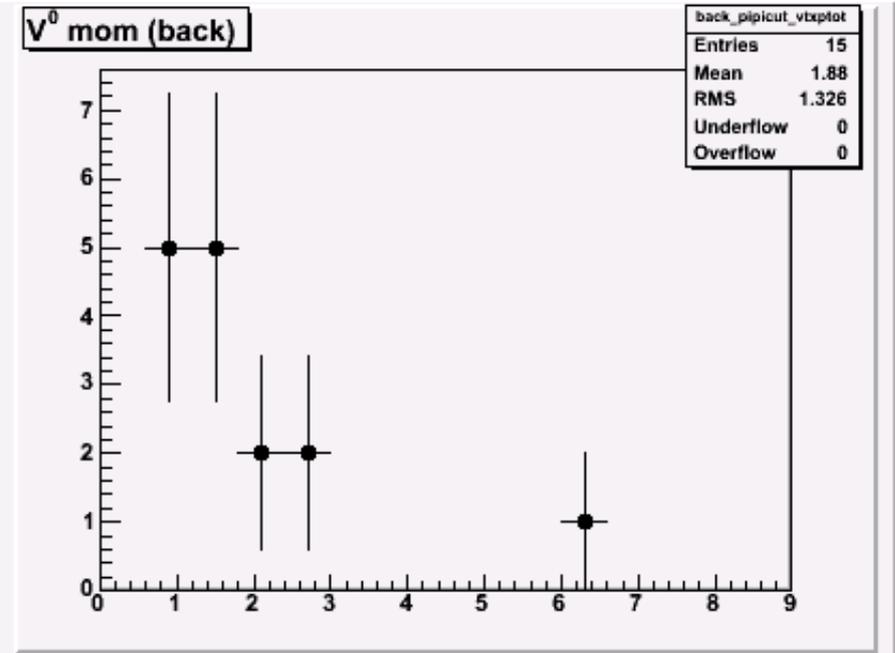
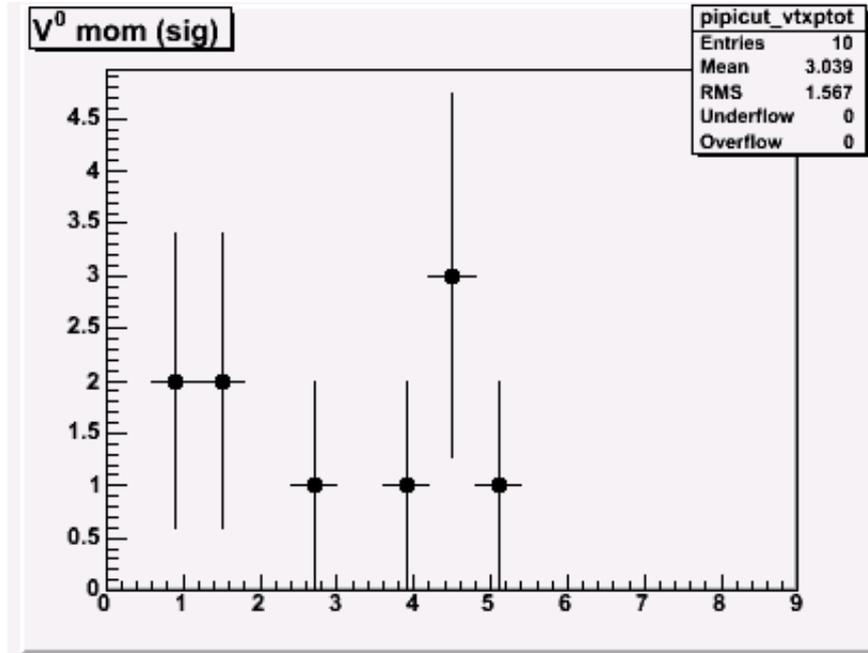
stat	Value
Entries	10
Mean	0.06376
RMS	0.5368
Underflow	0
Overflow	0

momentum asymmetry (back)



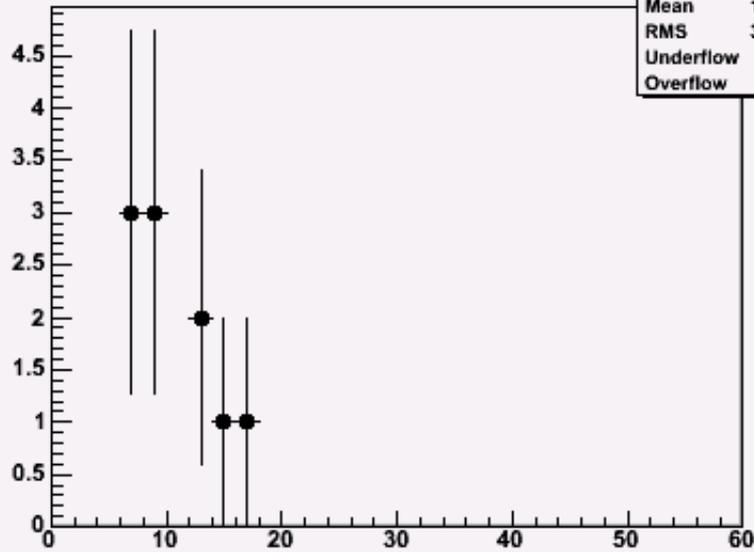
stat	Value
Entries	15
Mean	0.219
RMS	0.3692
Underflow	0
Overflow	0

LH2 58

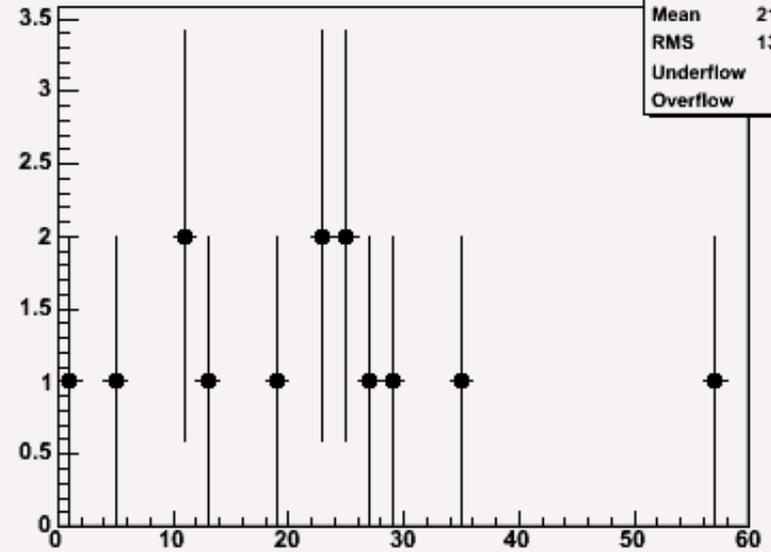


LH2 58

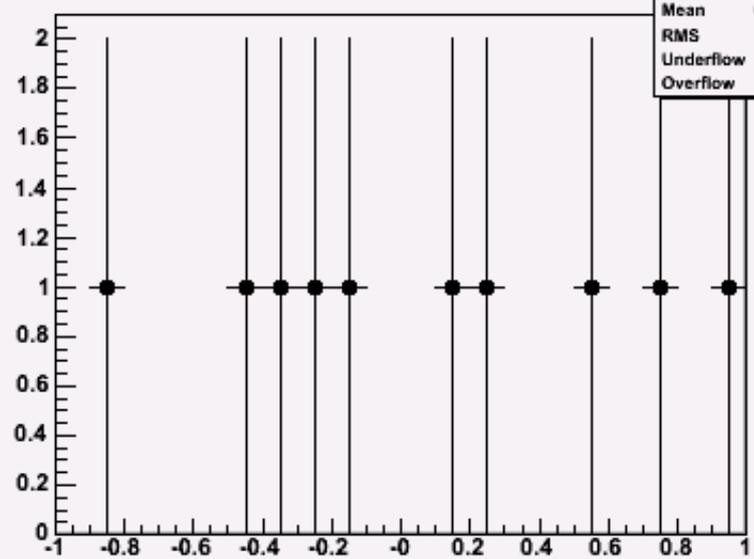
(pT < 0.10) R-Pvtx-V⁰/γ (sig)



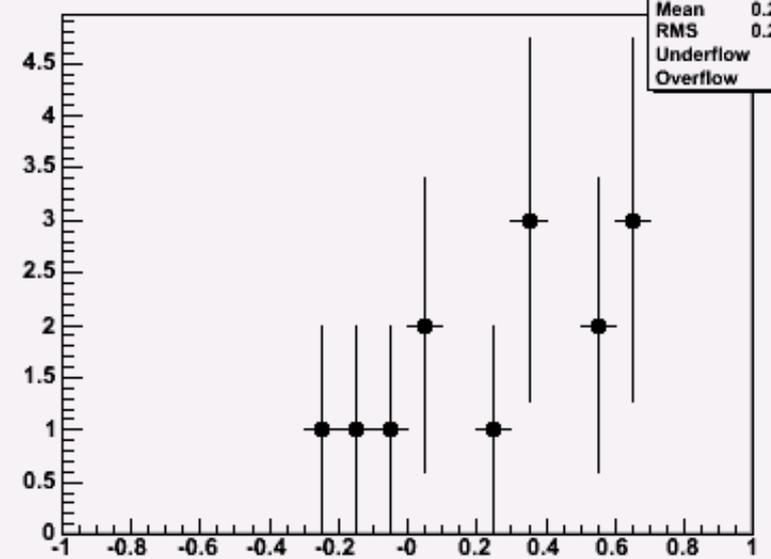
(pT < 0.10) R-Pvtx-V⁰/γ (back)



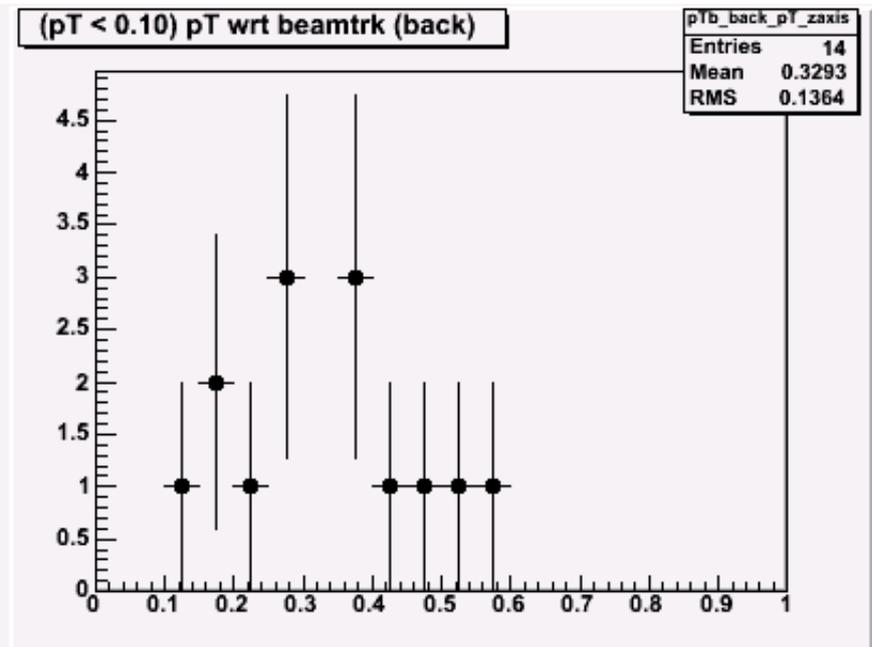
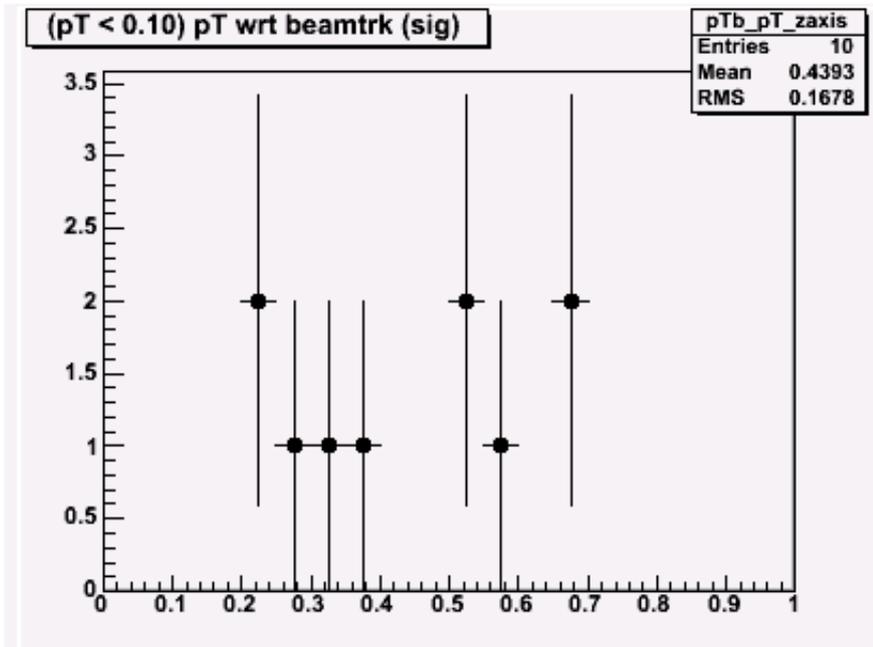
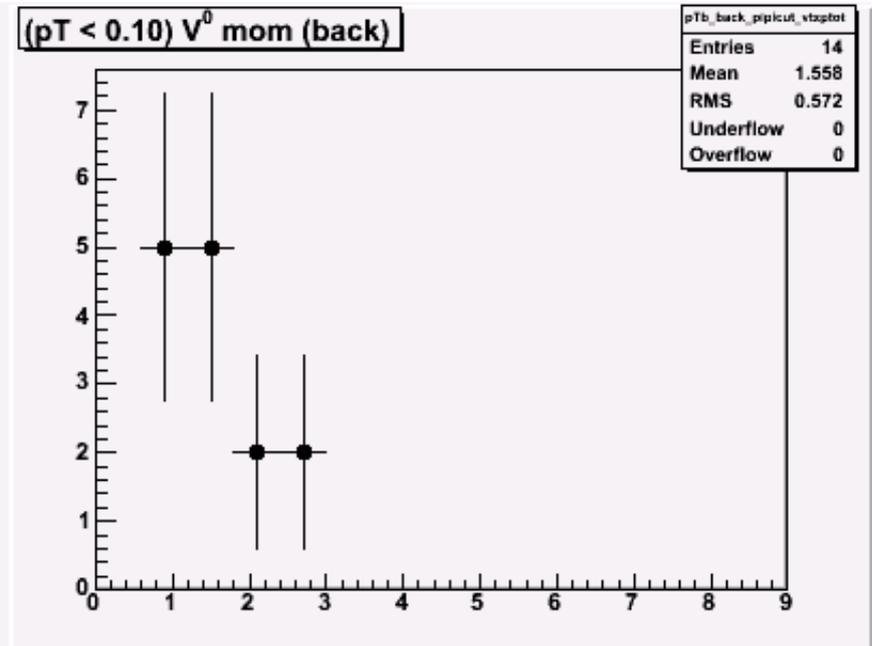
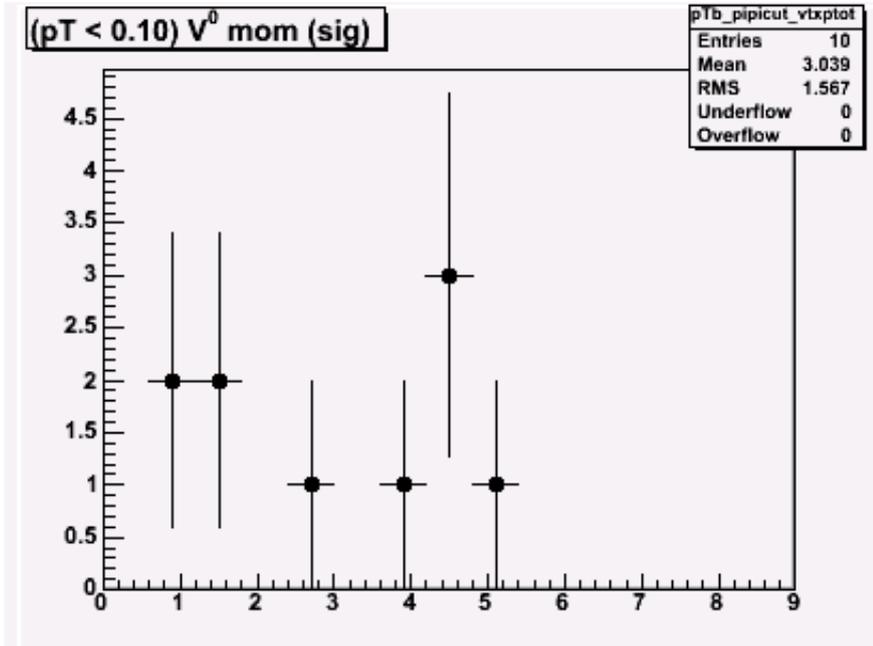
(pT < 0.10) momentum asymmetry (sig)



(pT < 0.10) momentum asymmetry (back)



LH2 58



Back-up Slides

The method that involves MC generated K_s^0 :

First, we get the variables I need:

```
MIPPMCSummary* mcevt = new MIPPMCSummary;  
MIPPMCTrackSummary* mctrk = new MIPPMCTrackSummary;
```

Which allows us to get the events from MCTruth:

```
evtTree->SetBranchAddresses("fMCTruth.", &mcevt);
```

Then we loop over all mctrks from `mcevt->GetTrk()`. If the `pid_pdg` is 310 (the number for K_s^0), we plot the energy.