

# Update on $X^0 \rightarrow L^0 g$ analysis

January, 18 2003

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- $X^0 \rightarrow L^0 p^0$  selection cuts
- $X^0 \rightarrow L^0 g$  selection cuts
- **Trigger 10 results.**
- **Trigger 11 results.**
- **Branching ratio systematic error due to background uncertainty.**
- **Branching ratio systematic error due to asymmetry uncertainty.**
- **Asymmetry.**
- **Hadron Anti (HA) study.**
- **Conclusion**

## $X^0 \rightarrow L^0 p^0$ selection

- $N_{\text{nclus}} > 1$   $N_{\text{track}} = 2$
- Fiducial cuts for  $L^0$  and  $X^0$  vertices and  $L^0$  mass cut:  
The  $X^0$  vertex is calculated by the center of gravity method.  
 $|M_{L^0} - 1.115684| < 0.010$  (GeV),  $Z_{\text{vtx}L^0} > Z_{\text{vtx}X^0}$   
 $95.\text{m} < Z_{\text{vtx}} < 158.\text{m}$ ,  $0.00043 < Y_{\text{vtx}}/Z_{\text{vtx}}$   
 $0.000376 < X_{\text{vtx}}/Z_{\text{vtx}} < 0.00124$
- Proton and pion momentum and containment cuts  
 $0.065\text{m} < |X_p| < 0.235\text{m}$  and  $|Y_p| < 0.085\text{m}$   
 $0.215\text{m} < |X_{p^-}|$  or  $|X_{p^-}| < 0.085\text{m}$  and  $|Y_{p^-}| > 0.065\text{m}$   
 $85.\text{GeV} < P_p < 600.\text{GeV}$  and  $5.\text{GeV} < P_{p^-} < 150.\text{GeV}$   
 $E_{p^-}(\text{CSI})/P_{p^-} < 0.9$
- Equivalent Kaon mass  $M_K > 0.55\text{GeV}$
- $K_1 > 5.0$  GeV,  $K_1 + K_2 > 18.0$  GeV.
- Good separation of clusters on CSI:  
 $d(p^-, g_1) > 0.2\text{m}$ ,  $d(p^-, g_2) > 0.2\text{m}$ ,  $d(g_1, g_2) > 0.2\text{m}$

# $X^0 \rightarrow L^0 g$ selection

- $N_{\text{nclus}} = 1$  or  $2$     $N_{\text{track}} = 2$     $k > 5 \text{ GeV}$    and  $d(\text{gp}^-) > 20 \text{ cm}$
- Fiducial cuts for  $L^0$  and  $X^0$  (center of gravity method) vertices and  $L^0$  mass cut  
 $|M_{L^0} - 1.115684| < 0.005 \text{ GeV}$     $Z_{\text{vtx}L^0} > Z_{\text{vtx}X^0}$   
 $95 \text{ m} < Z_{\text{vtx}} < 158 \text{ m}$ ,  $0.00043 < Y_{\text{vtx}}/Z_{\text{vtx}}$ ,  $0.000376 < X_{\text{vtx}}/Z_{\text{vtx}} < 0.00124$
- Proton and pion momentum and containment cuts (same as  $L^0 p^0$ ).
- $|M_{X^0} - 1.315| < 0.04 \text{ GeV}$ ,  $P_{T X^0} < 0.07 \text{ GeV}$ ,  $P_{T L^0}(\text{primary}) > 0.03 \text{ GeV}$ ,  $|DZ_{X^0}| < 15 \text{ m}$
- If  $N_{\text{clus}} = 2$     $M_{p^0} < 0.1 \text{ GeV}$ ,  $|Z_{p^0} - Z_{X^0}| > 10.0 \text{ m}$ ,  $M_K > 0.55 \text{ GeV}$
- $F_{k1} < 0.000025 \text{ m}$ ,  $F_{k2} > 0.00005 \text{ m}$

$$F = \frac{(y_k - y_\Lambda) P_x^\Lambda - (x_k - x_\Lambda) P_y^\Lambda}{P_z^\Lambda} + \frac{x_k y_\Lambda - x_\Lambda y_k}{Z_{CSI}} \quad \vec{P}_x^T = \vec{P}_y^T \quad F = 0$$

- Equivalent Kaon mass  $M_K > 0.5 \text{ GeV}$  for Kaon background suppression
- $\chi^2 < 2.65$

$$\chi^2 = \left( \frac{k_{\text{miss}} + 0.4528}{3.089} \right)^2 + \left( \frac{\Delta z_{\Xi} + 0.00314}{2.902} \right)^2 + \left( \frac{E_\gamma - 41.699}{18.62} \right)^2$$

$$k_{\text{miss}} = \frac{(1.3149 \text{ GeV})^2 - M_{\Xi}^2}{2(E_{\Xi} - P_{\Xi})}$$

# Trigger 10 results. UPA043-UPA333

	<u>Total Trigger 10</u>	<u>Trigger 10.!11 +Trigger 10.11</u>	<u>Flux</u>
$L^0p^0 + \underline{L}^0p^0$	5,990,978	5,124,646+866,332	113,792,082 $\pm$ 242245
$L^0p^0$	5,495,416	4,701,207+794,209	104,379,424 $\pm$ 222576
$L^0g + \underline{L}^0g$	1,600-(141+21)	1,327+273-(141-21)	140,061 $\pm$ 4312
$L^0g$	1,446-(129+19)	1,201+245-(129+19)	128,373 $\pm$ 4092

## With Hadron-Anti correction:

	<u>Total Trigger 10</u>	<u>Trigger 10.!11 +Trigger 10.11</u>	<u>Flux</u>
$L^0p^0 + \underline{L}^0p^0$	11,826,520	10,116,324+1,710,533	224,638,229 $\pm$ 473853
$L^0p^0$	10,892,931	9,318,711+1,574,624	206,906,998 $\pm$ 436806
$L^0g + \underline{L}^0g$	3,136-(278+41)	2,589+547-(278+41)	274,375 $\pm$ 6338
$L^0g$	2,849-(256+37)	2,353+482-(256+37)	248,954 $\pm$ 5969

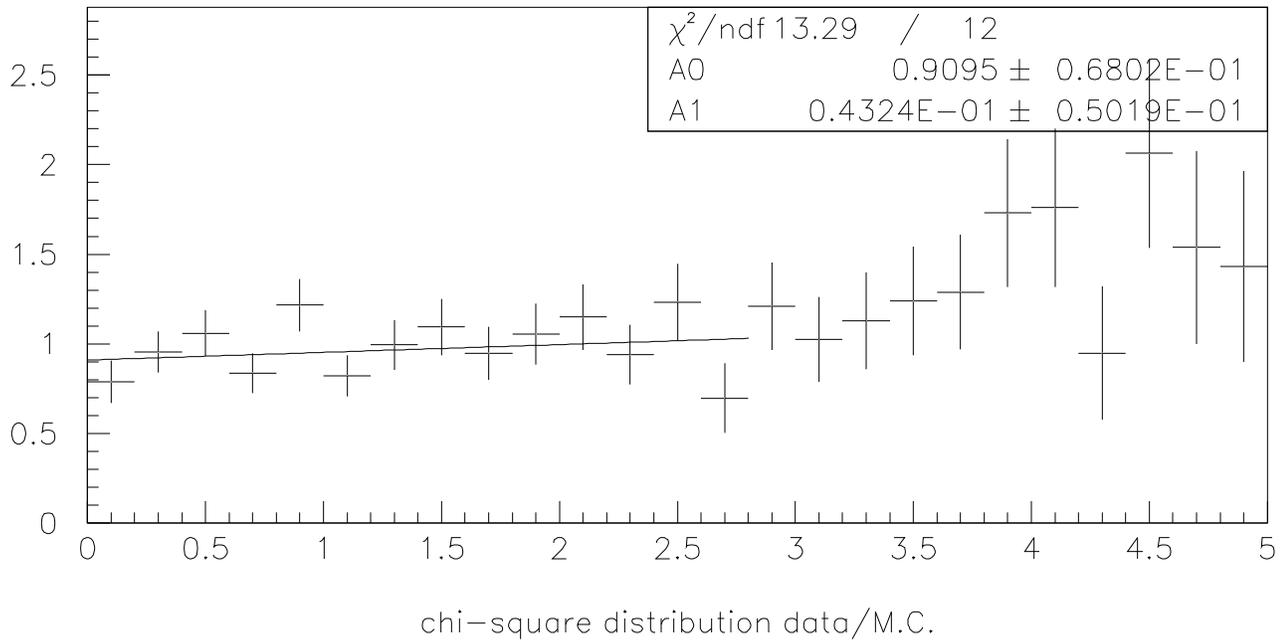
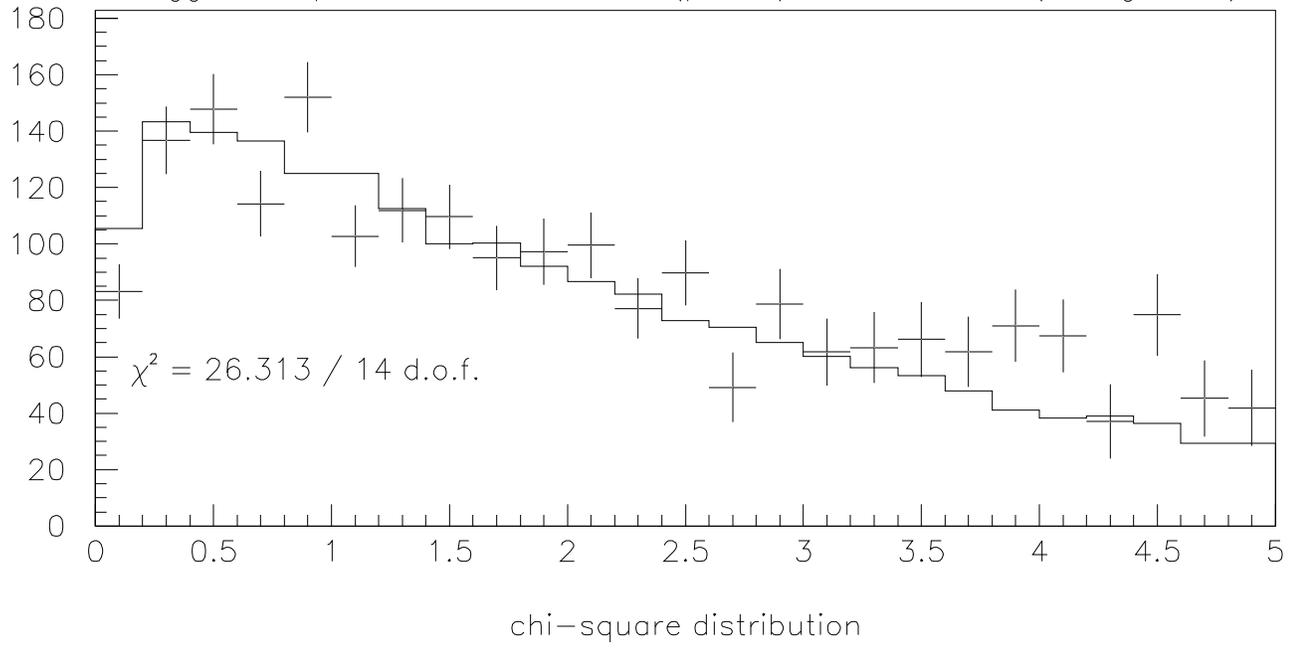
## Trigger 10 Monte Carlo acceptance studies: ( $a_{Lg} = -0.70$ )

	<u>Generated</u>	<u>Accepted</u>	<u>acceptance</u>
$L^0p^0$	3,999,908	210,589	0.052650 $\pm$ 0.00011
$L^0g$	999,907	10,266	0.010267 $\pm$ 0.00010

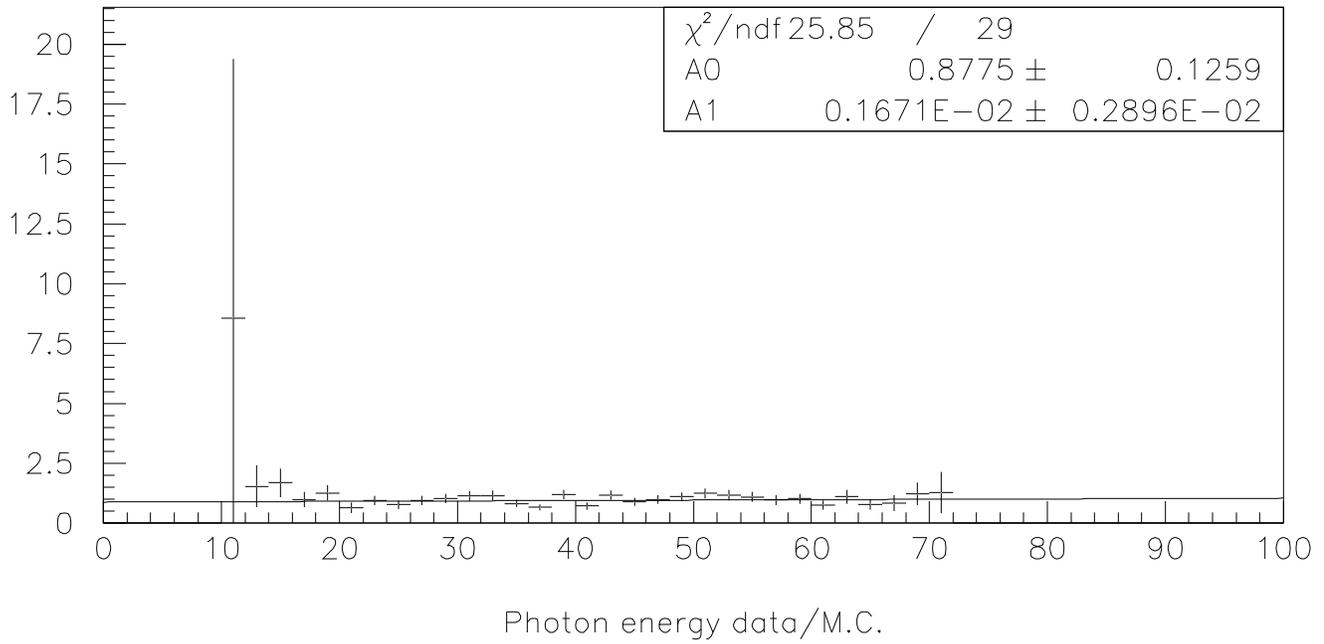
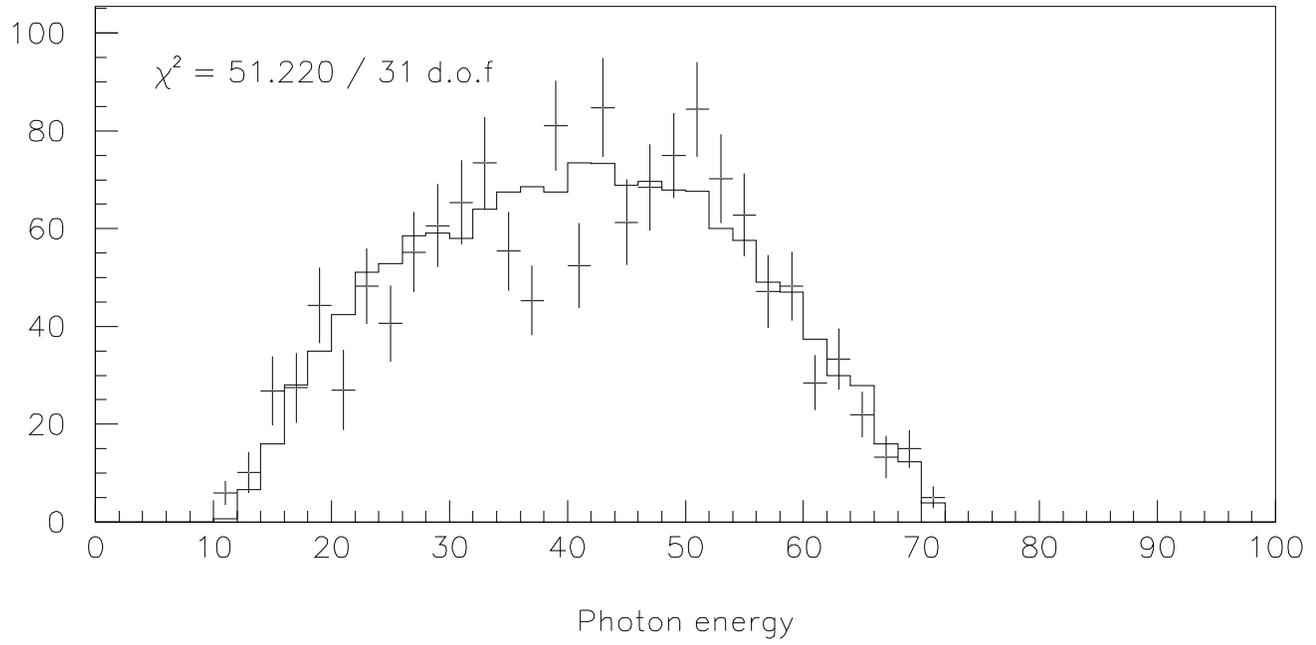
## Monte Carlo background study:

	<u>Generated</u>	<u>Background left</u>
$L^0p^0$	59,080,201	73
$S^0g$	499,903	27

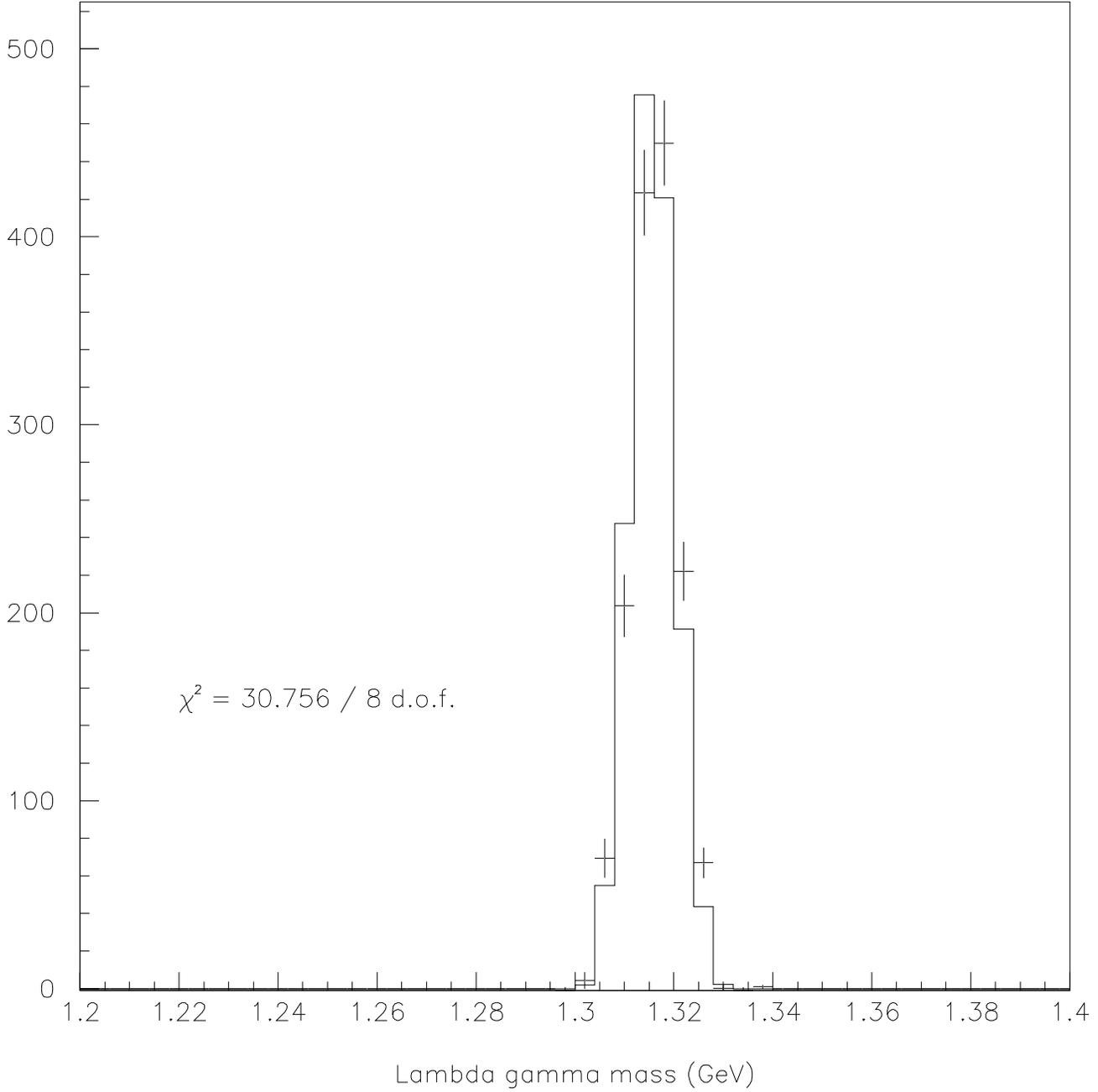
Trigger 10  $\Lambda\gamma$  HA uncorrected Data (points) vs Monte Carlo (histogramm)



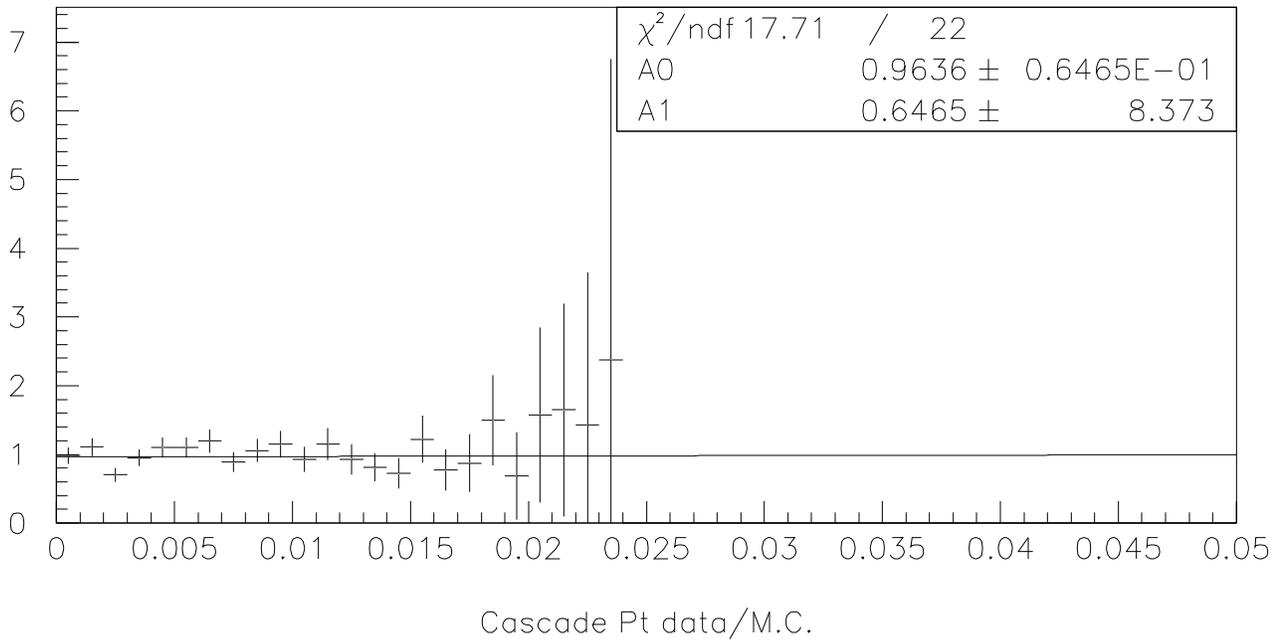
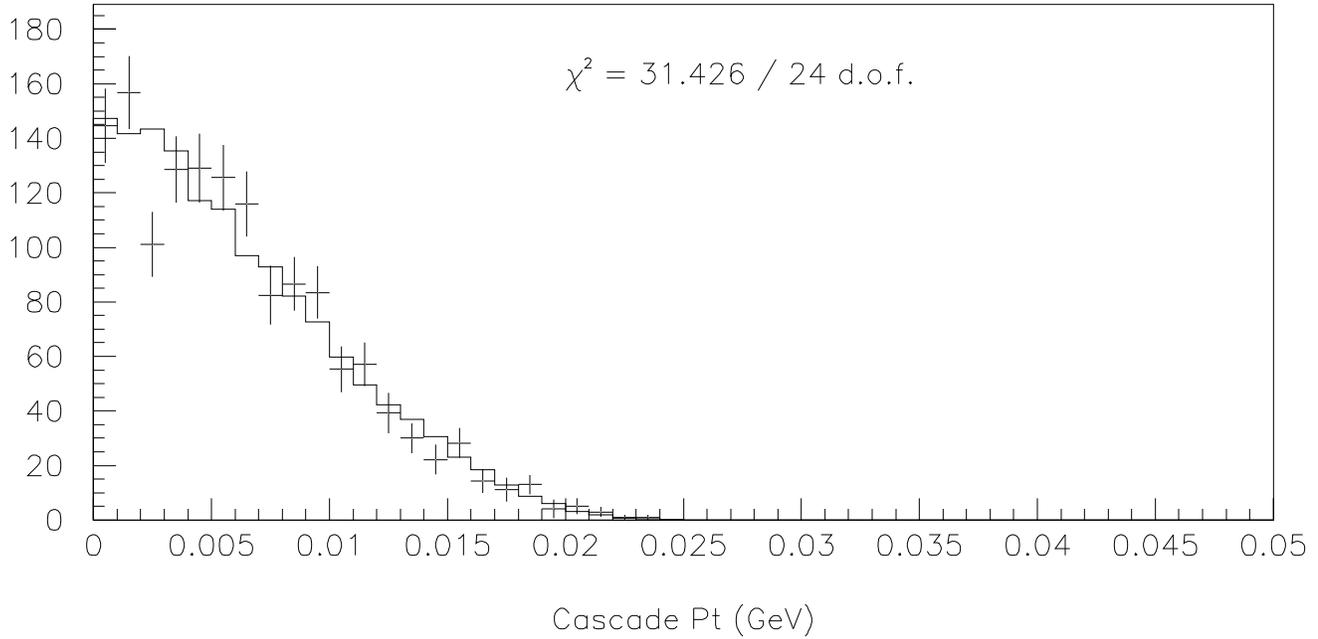
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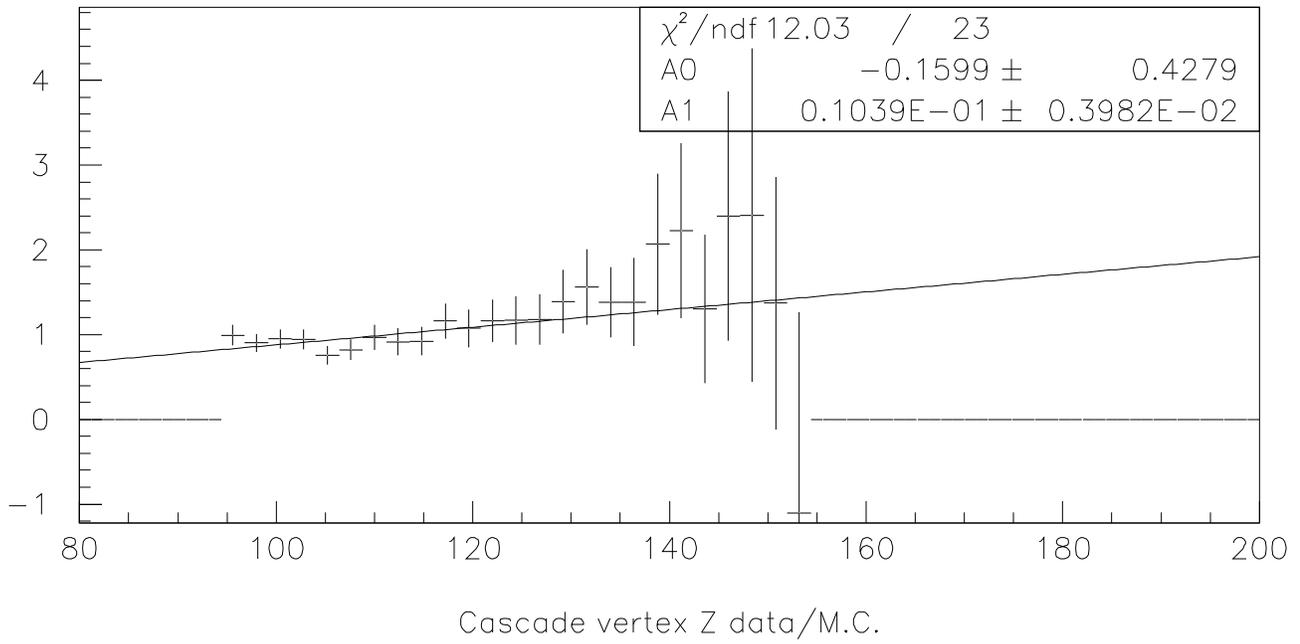
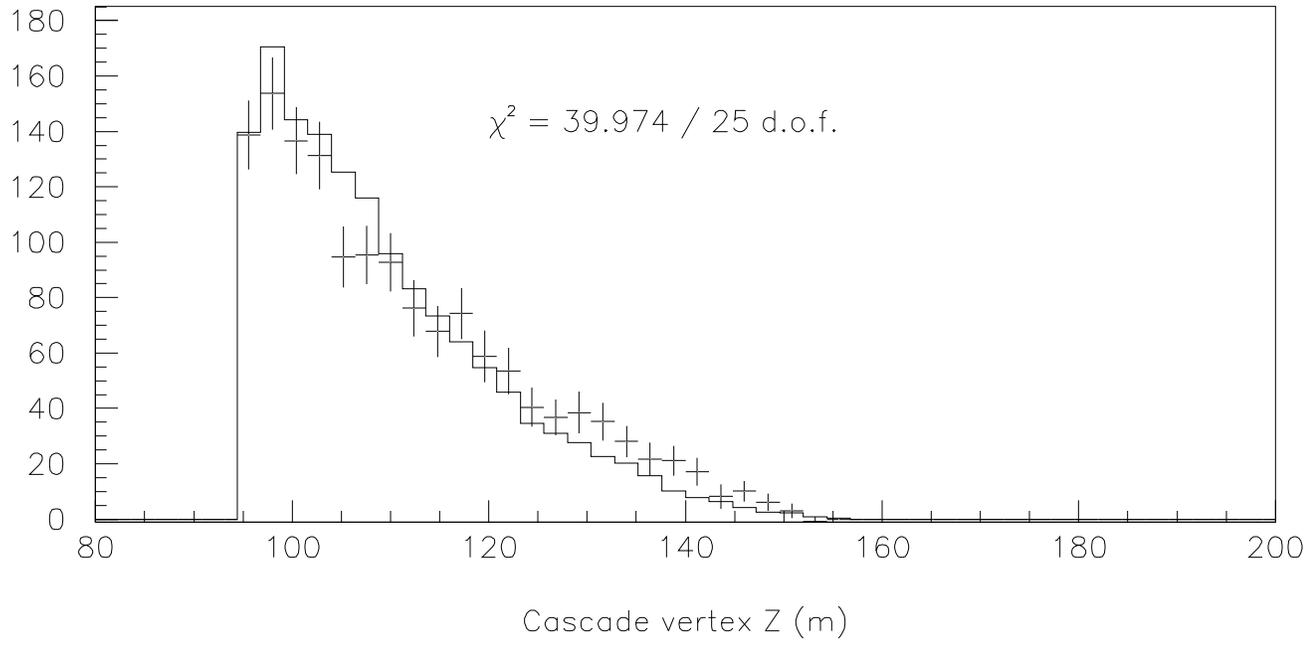
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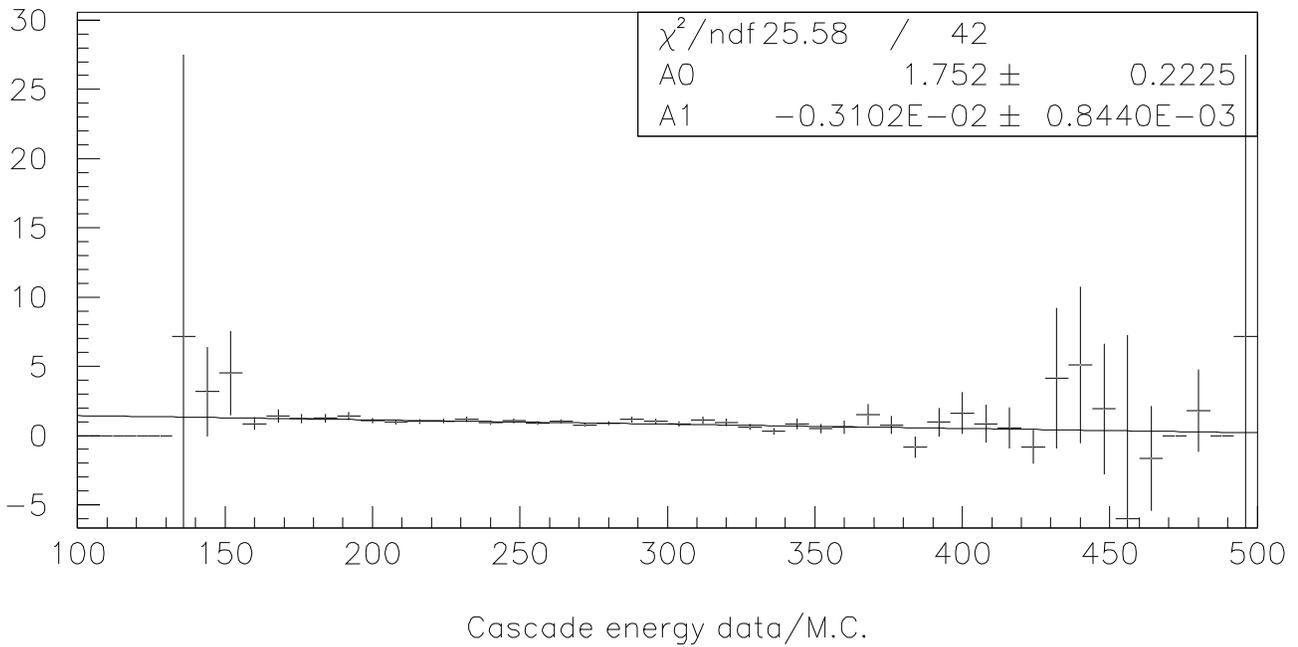
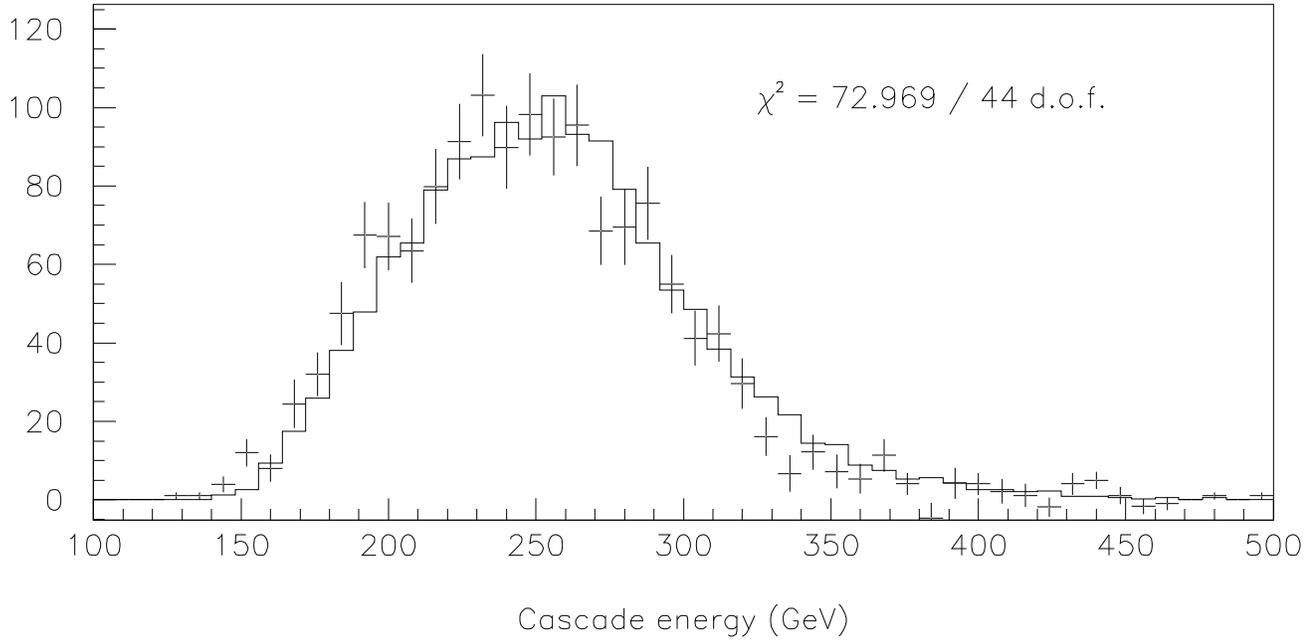
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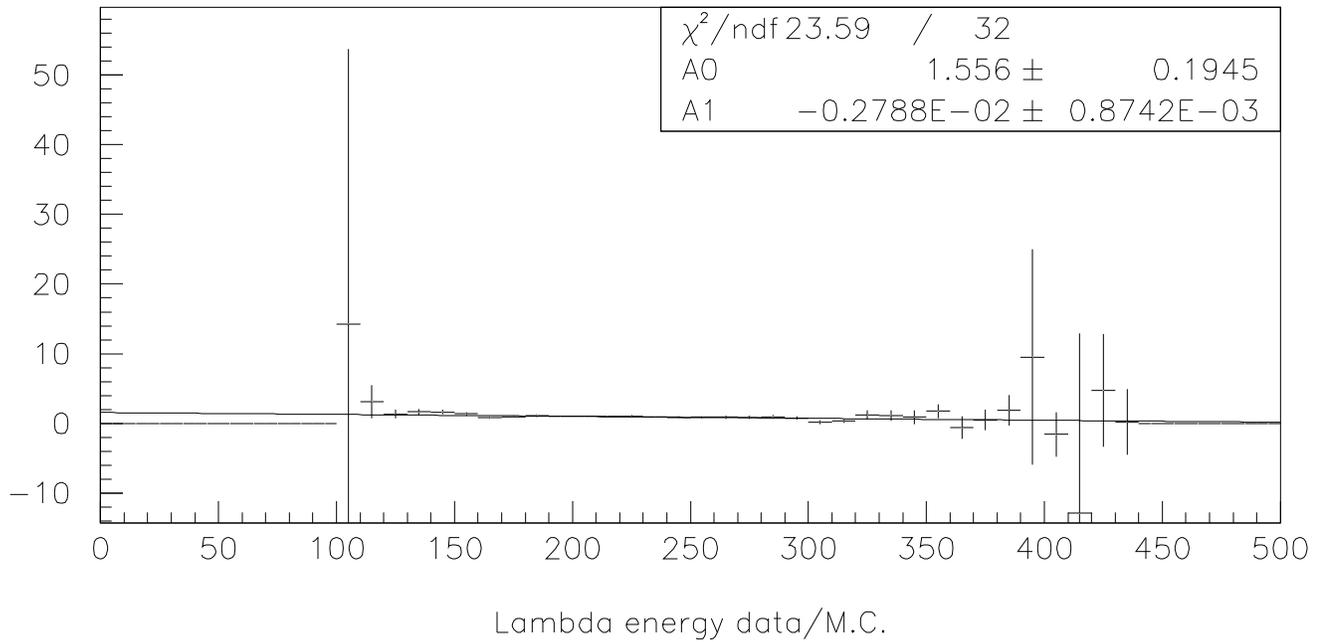
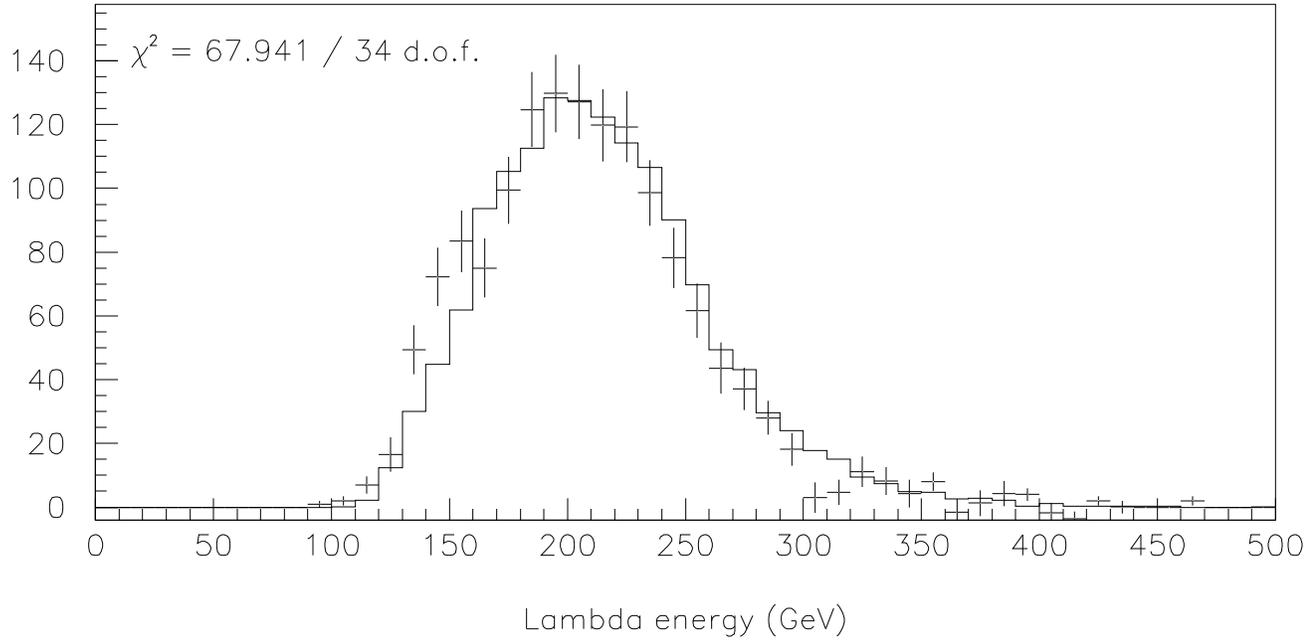
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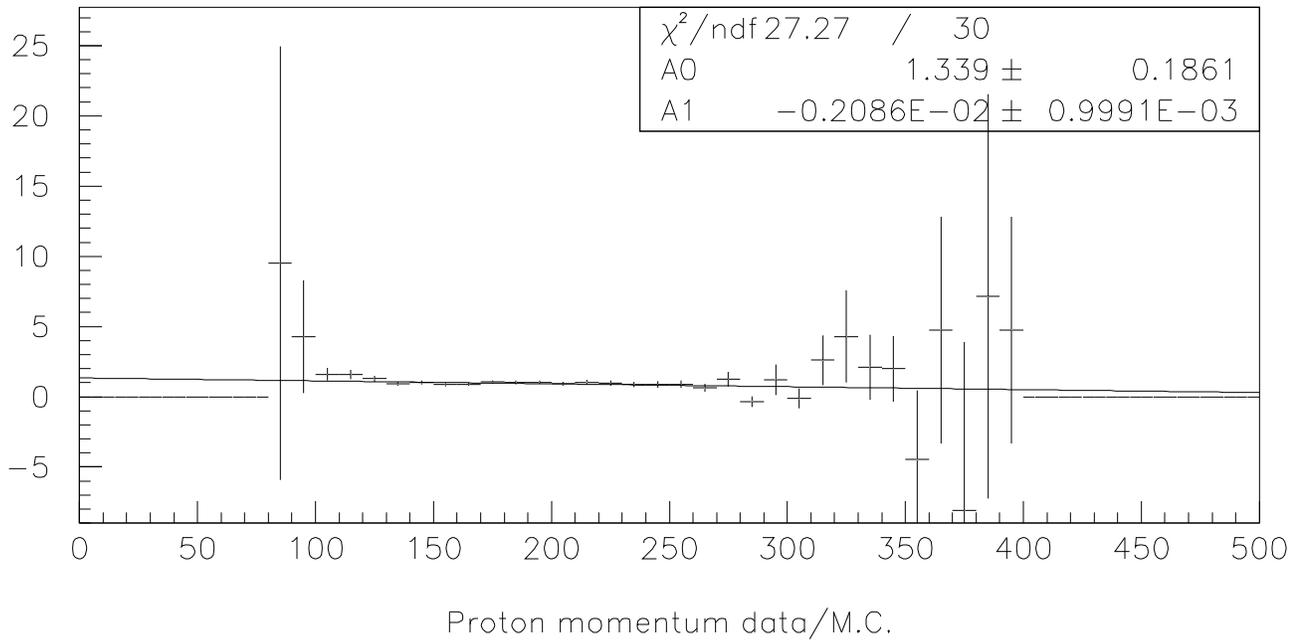
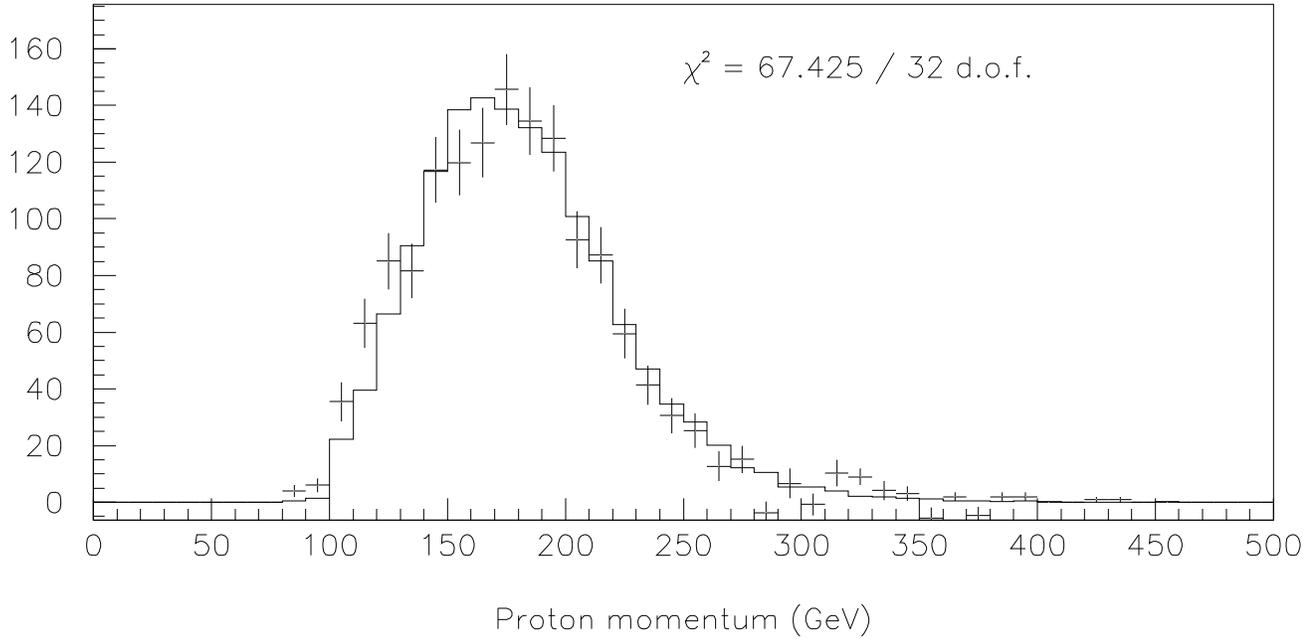
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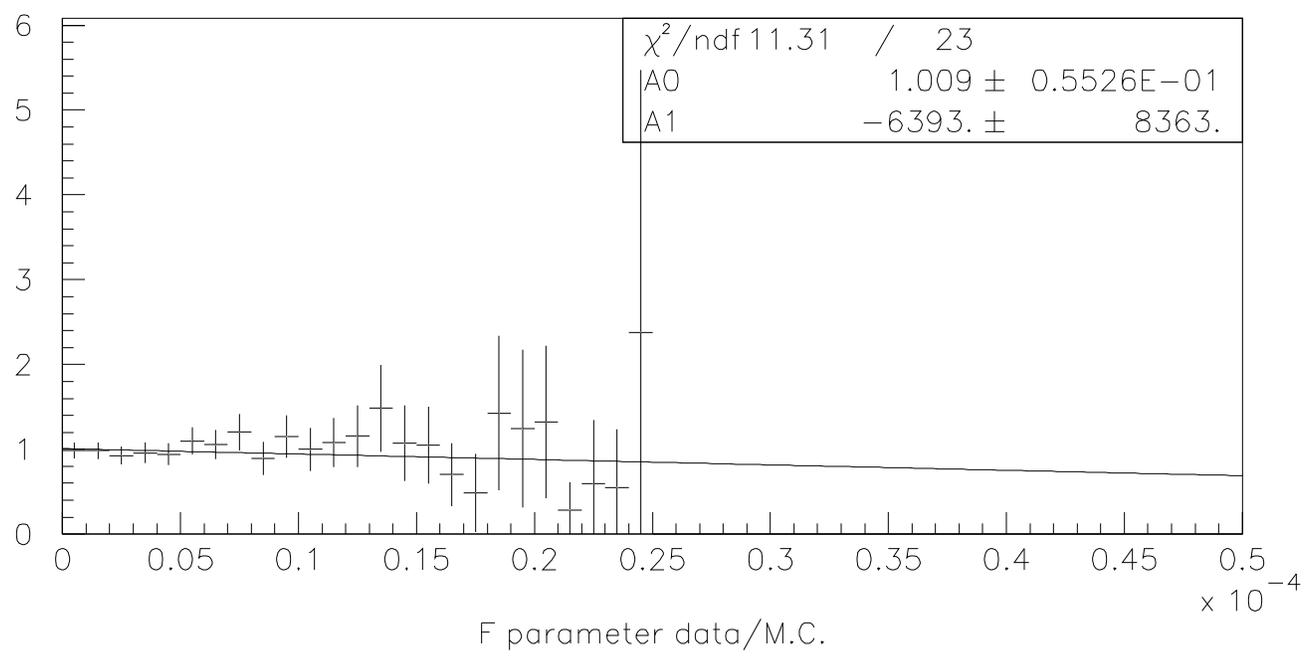
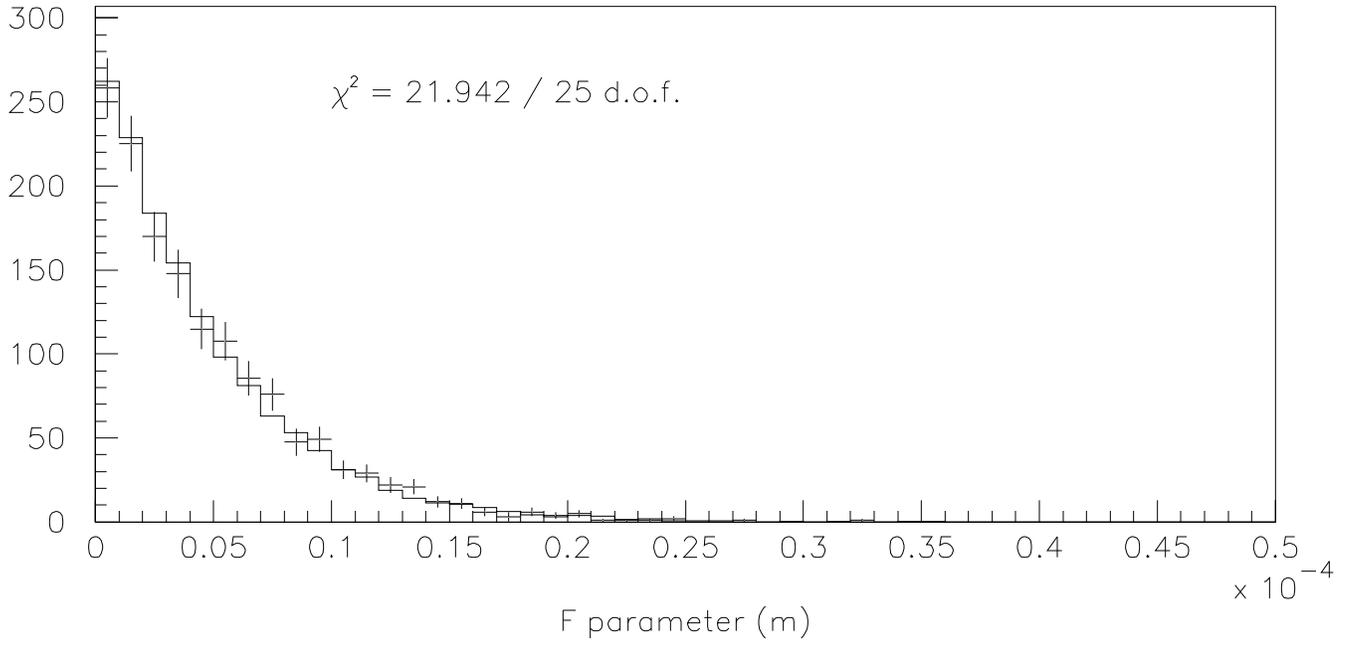
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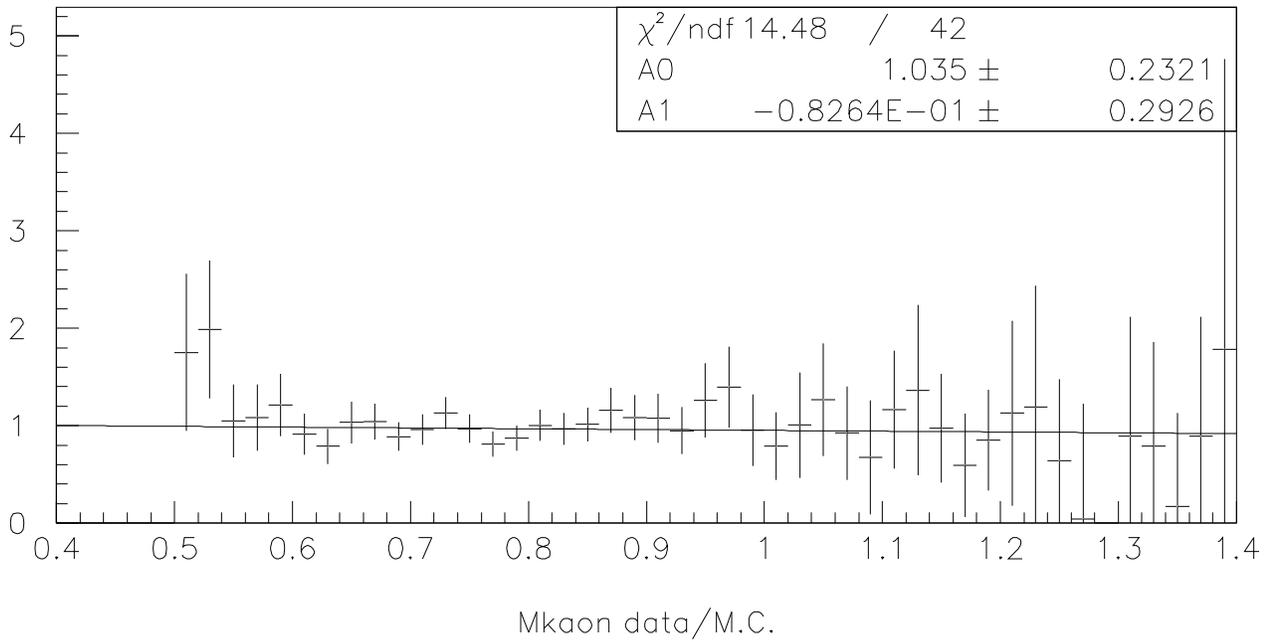
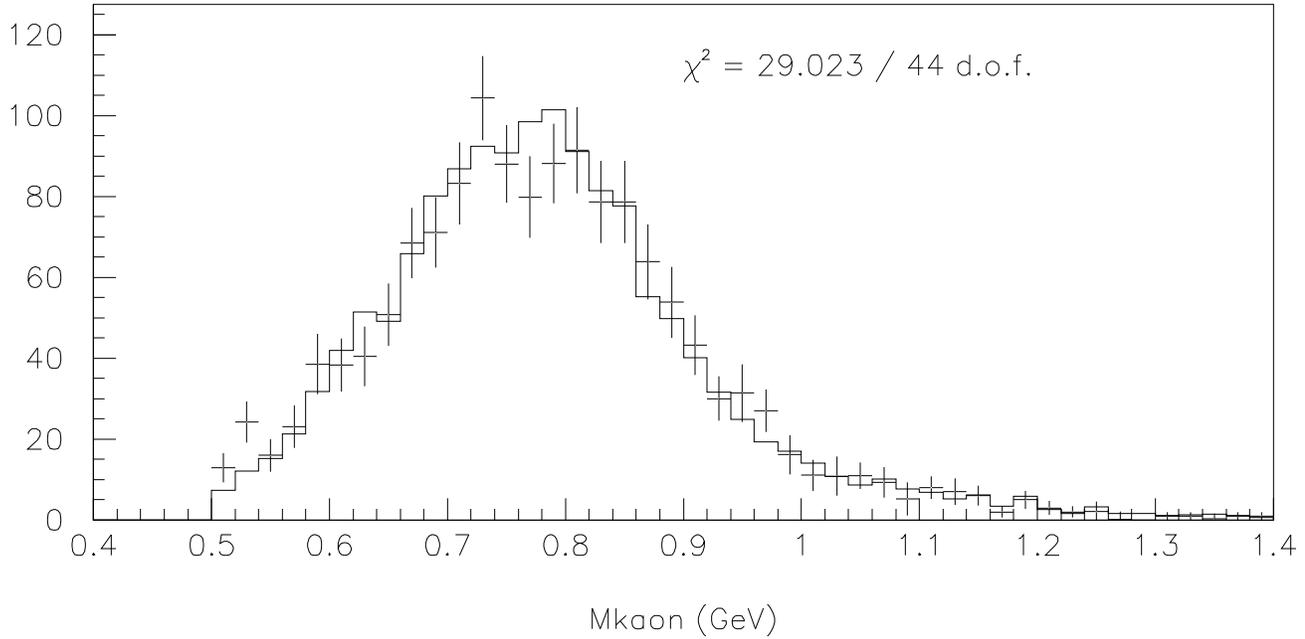
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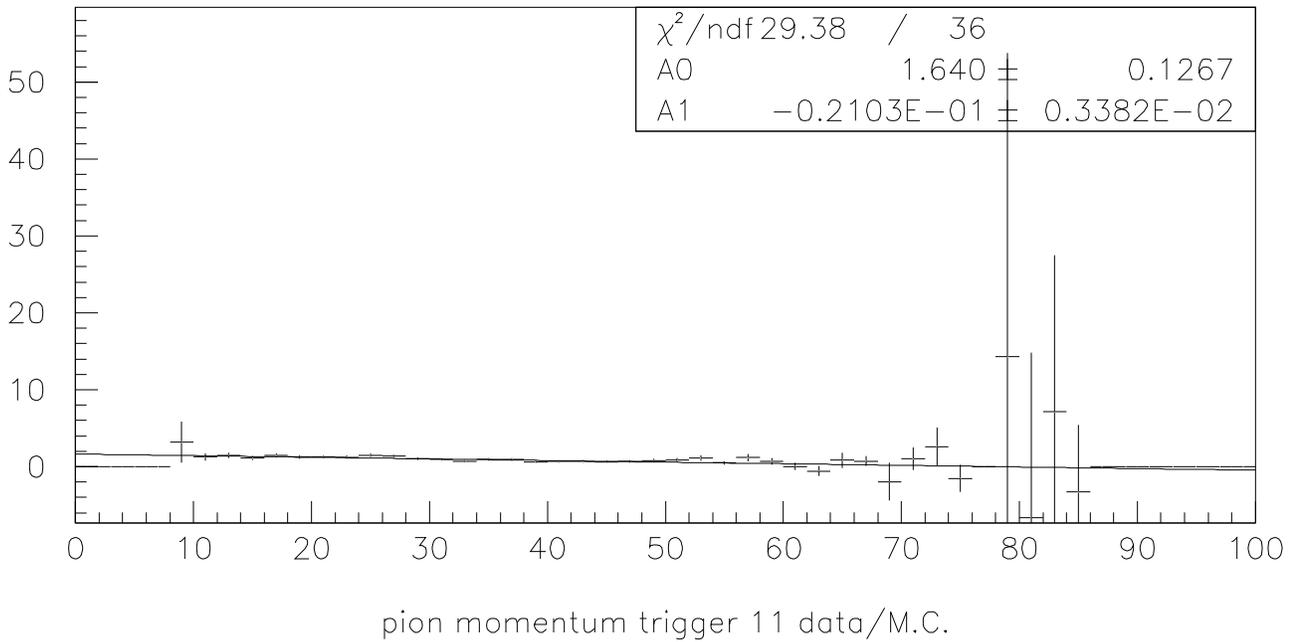
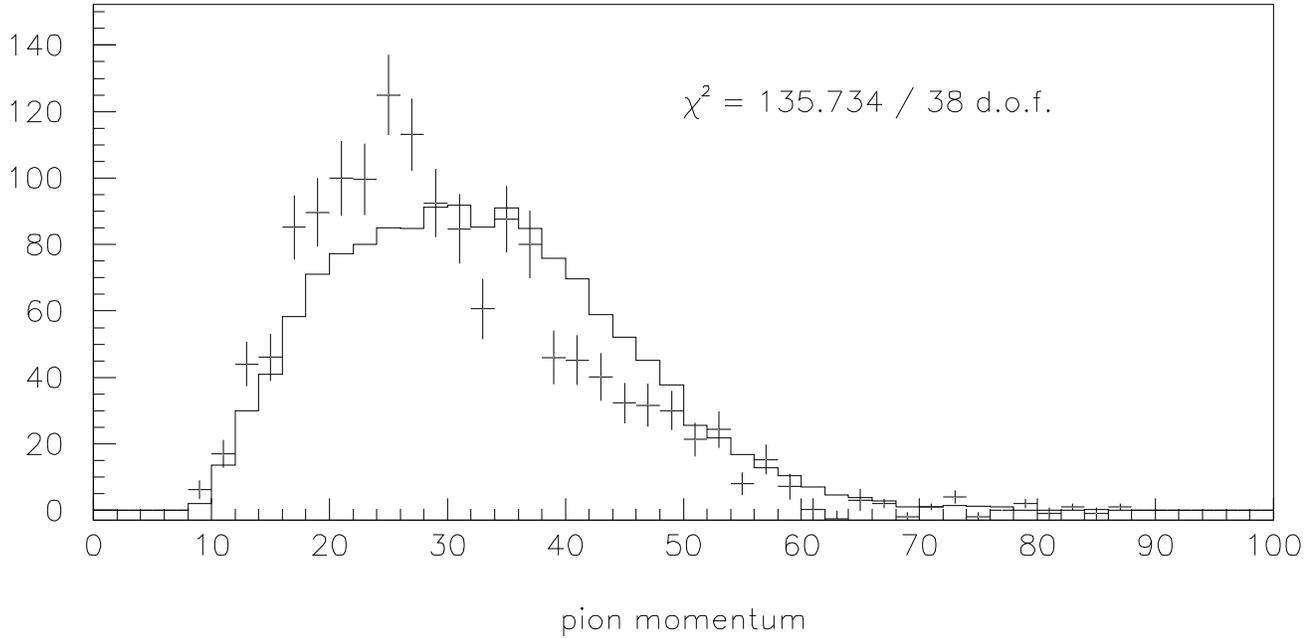
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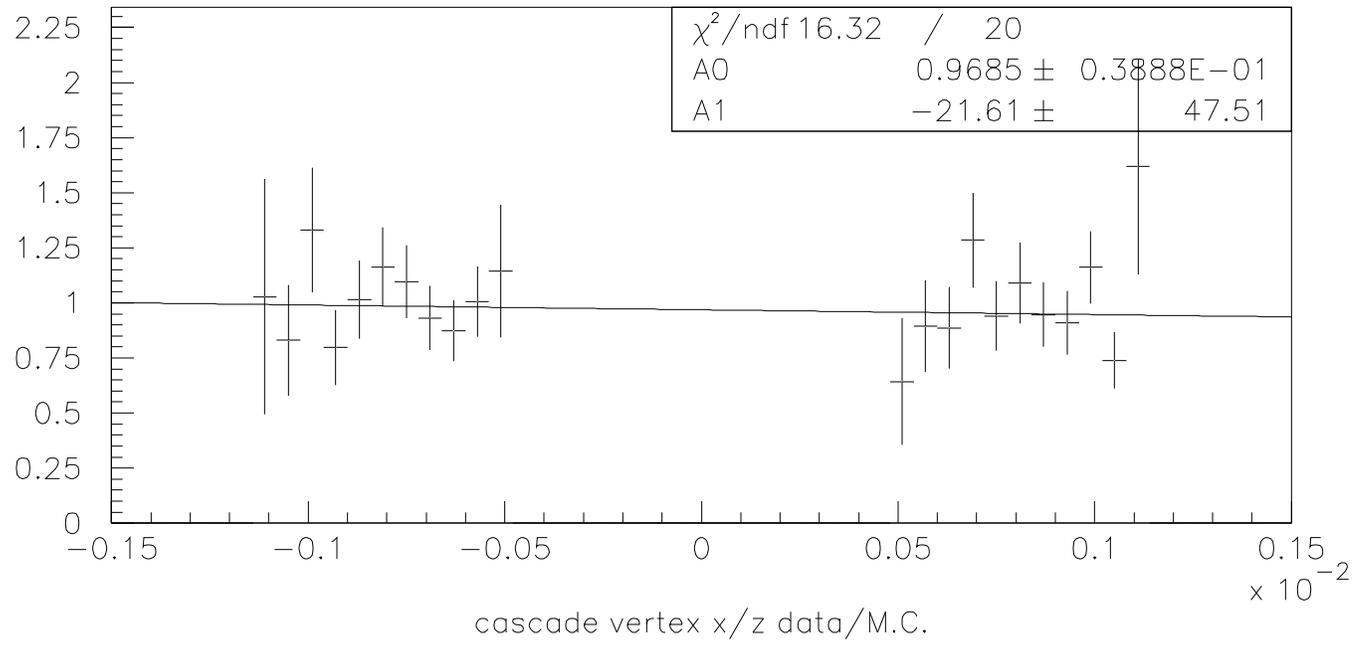
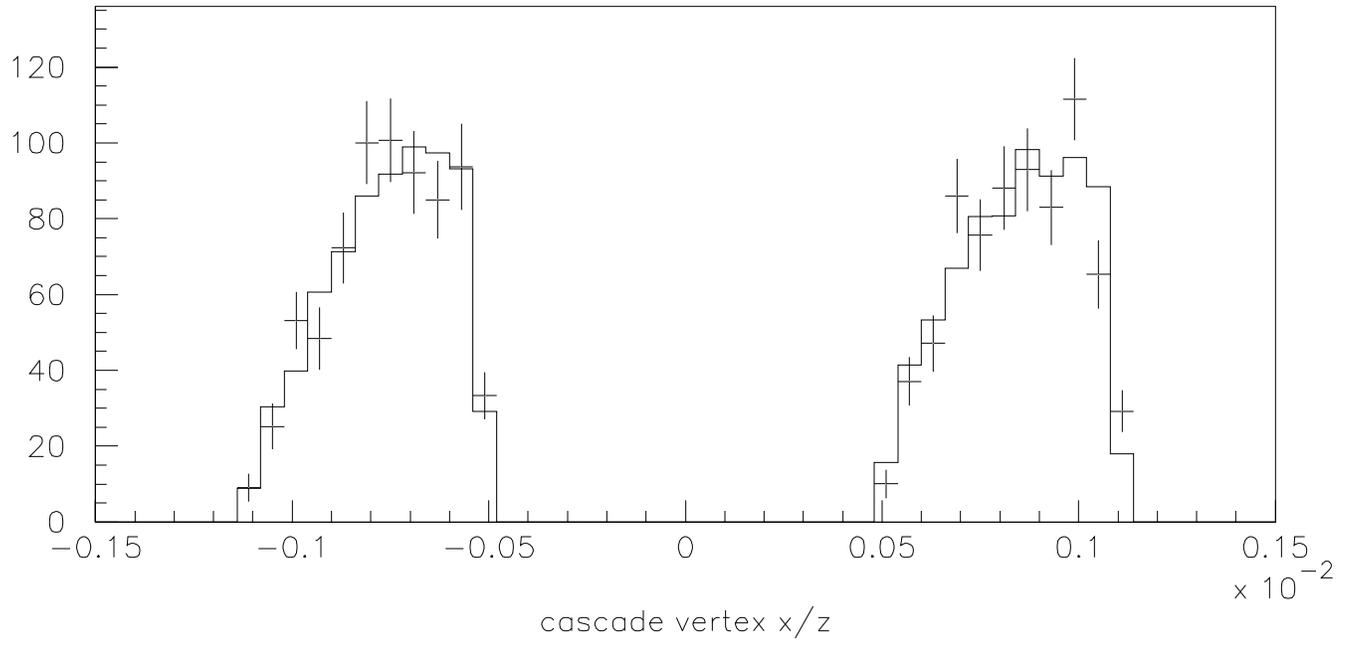
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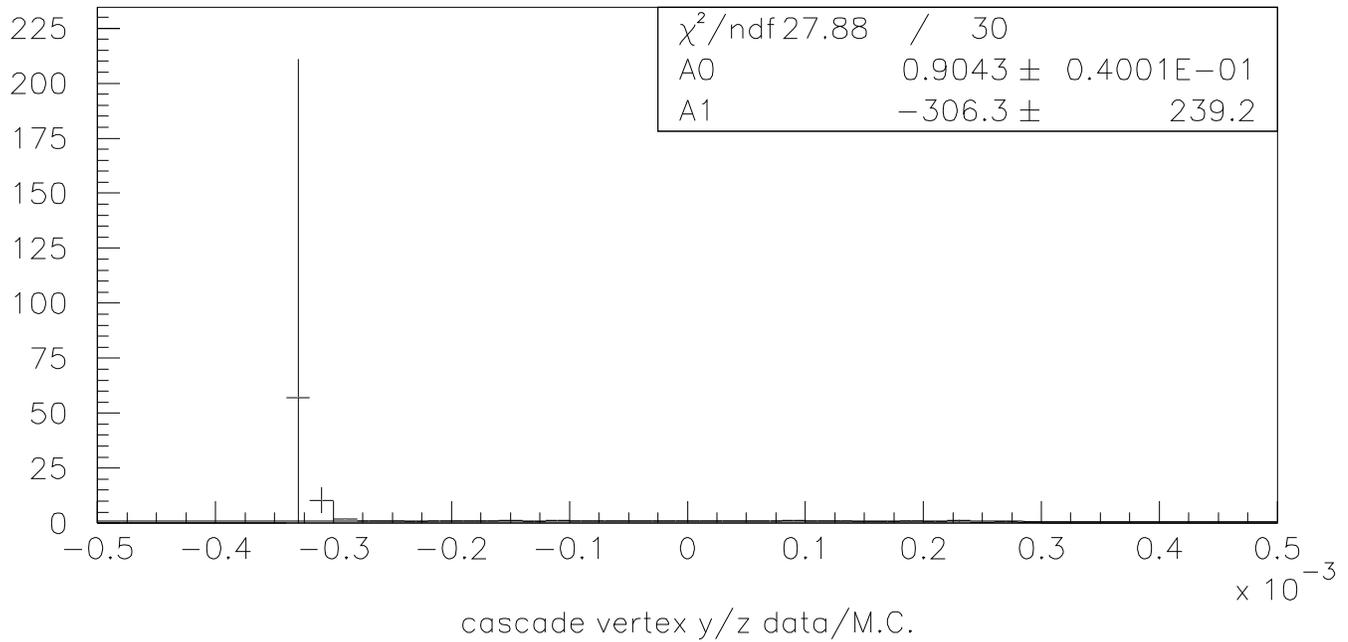
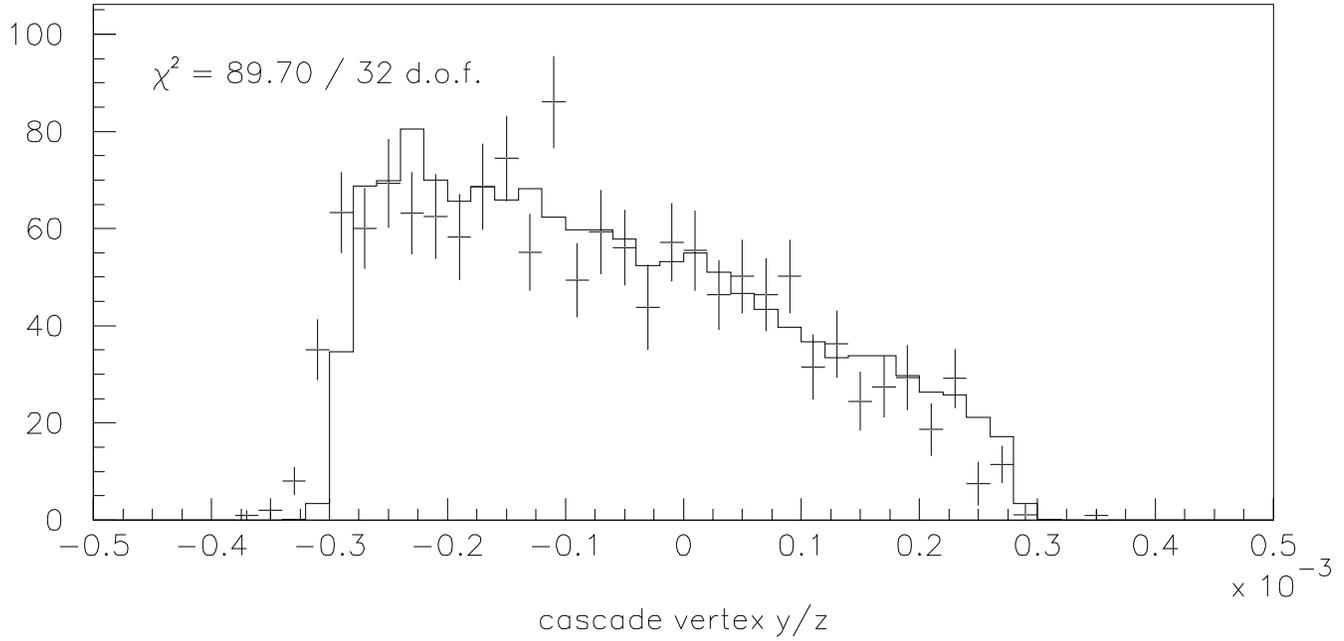
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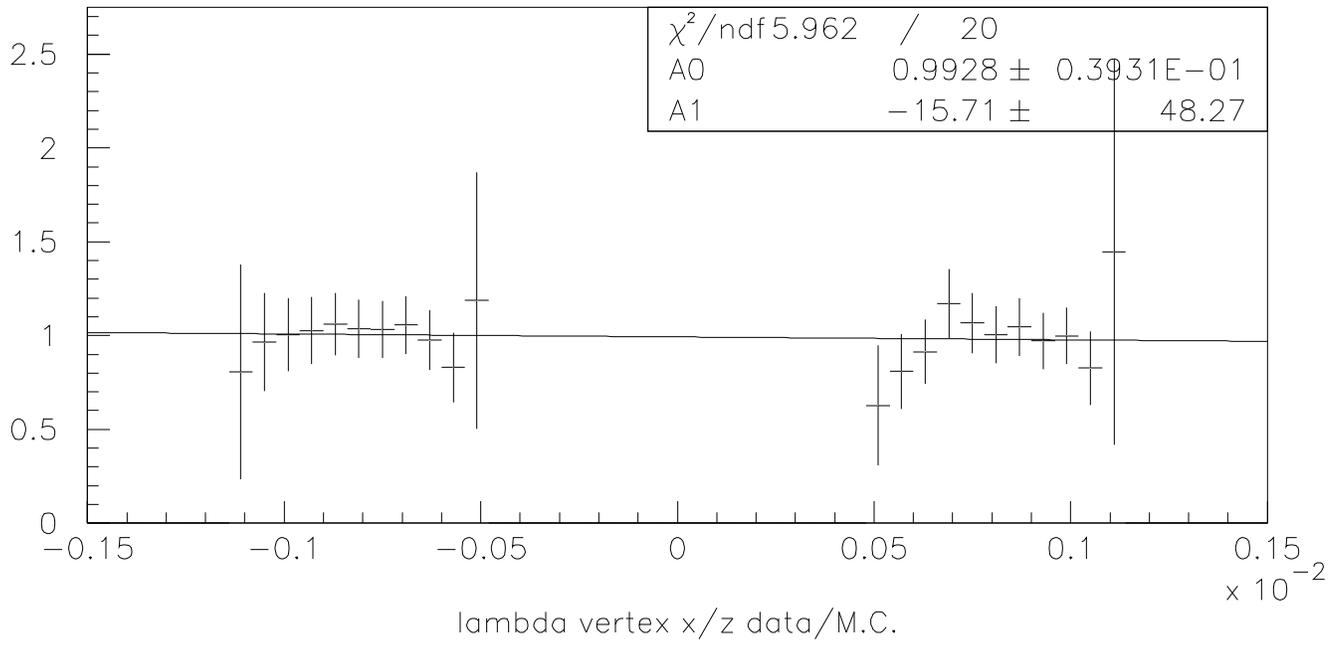
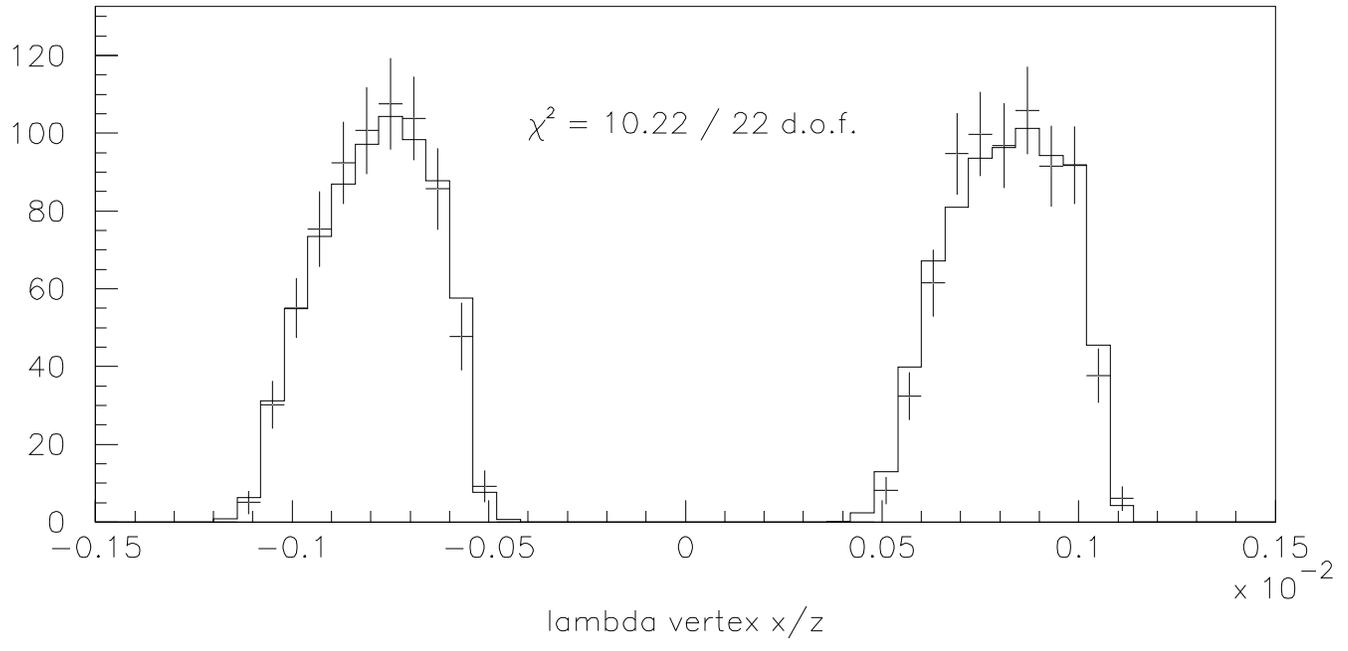
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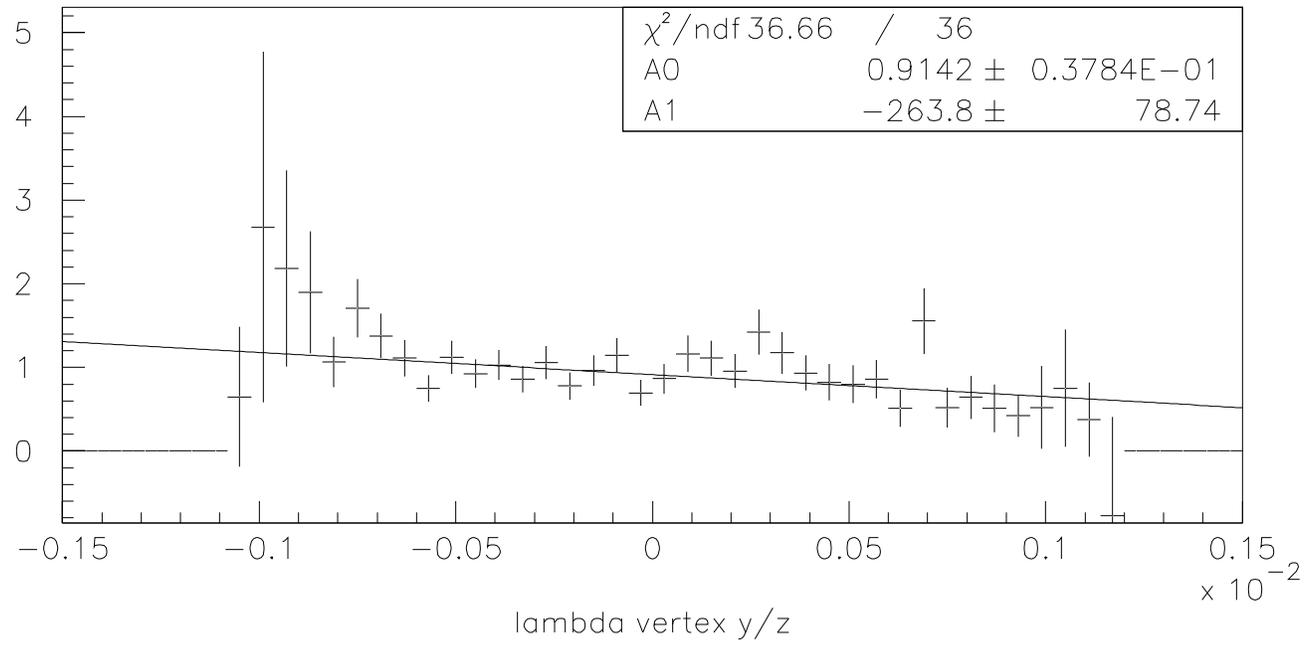
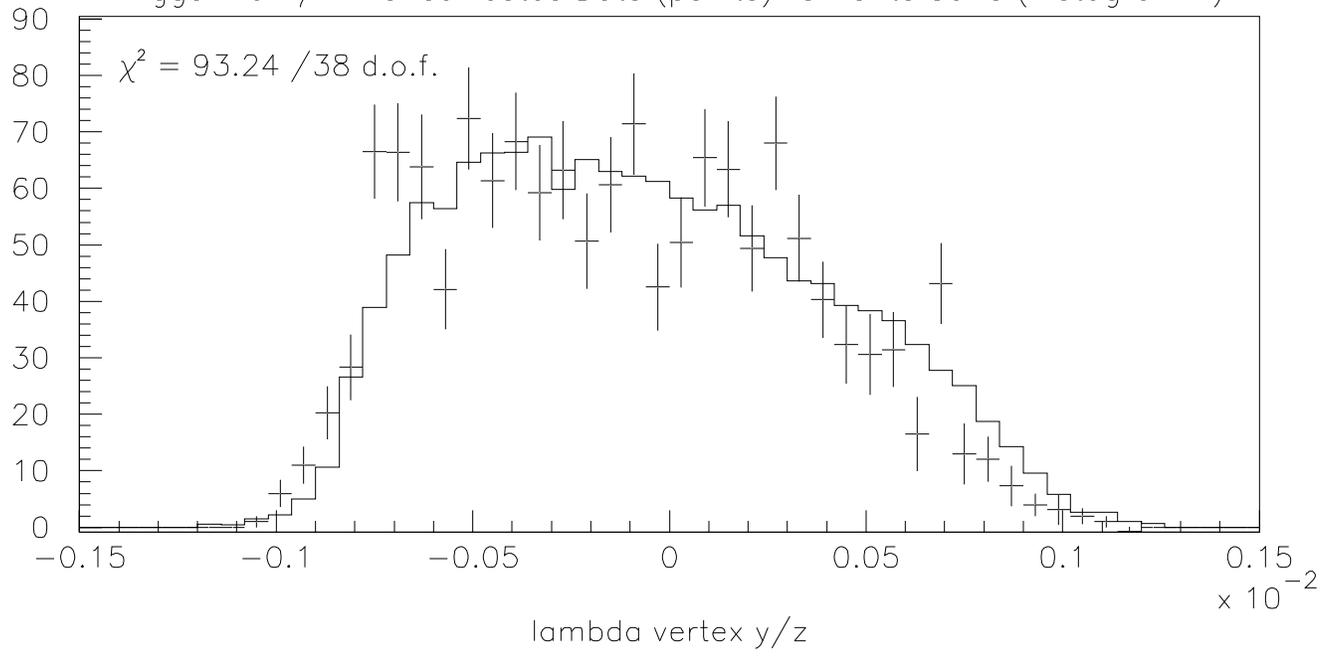
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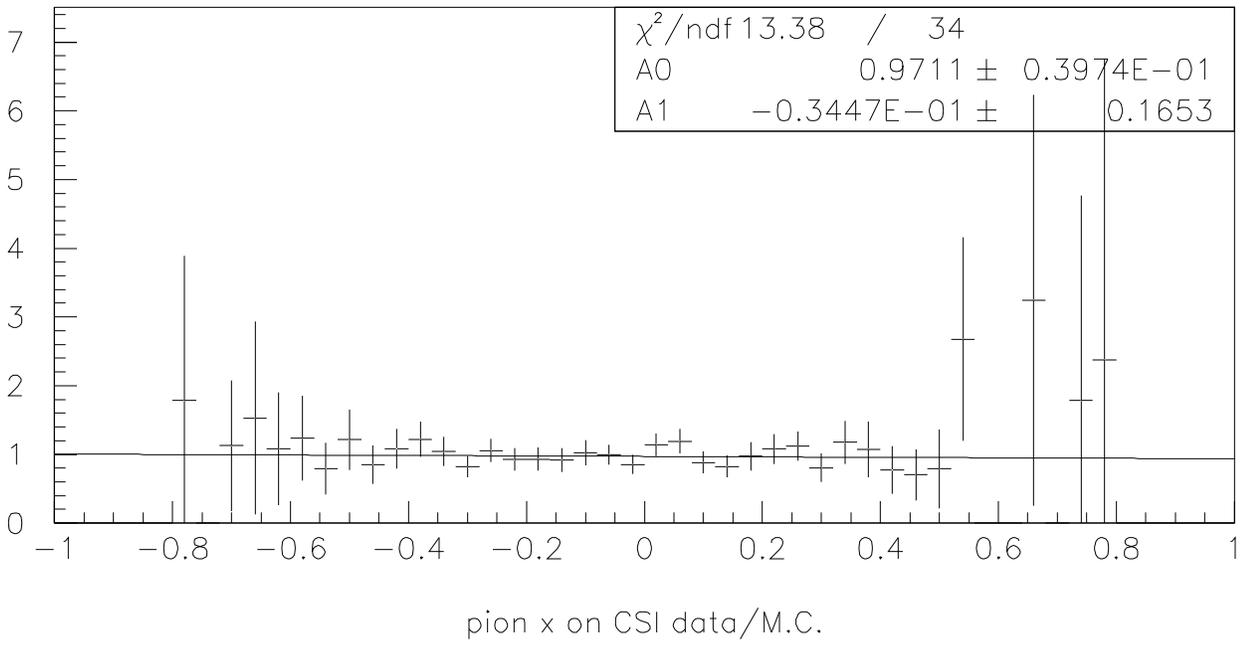
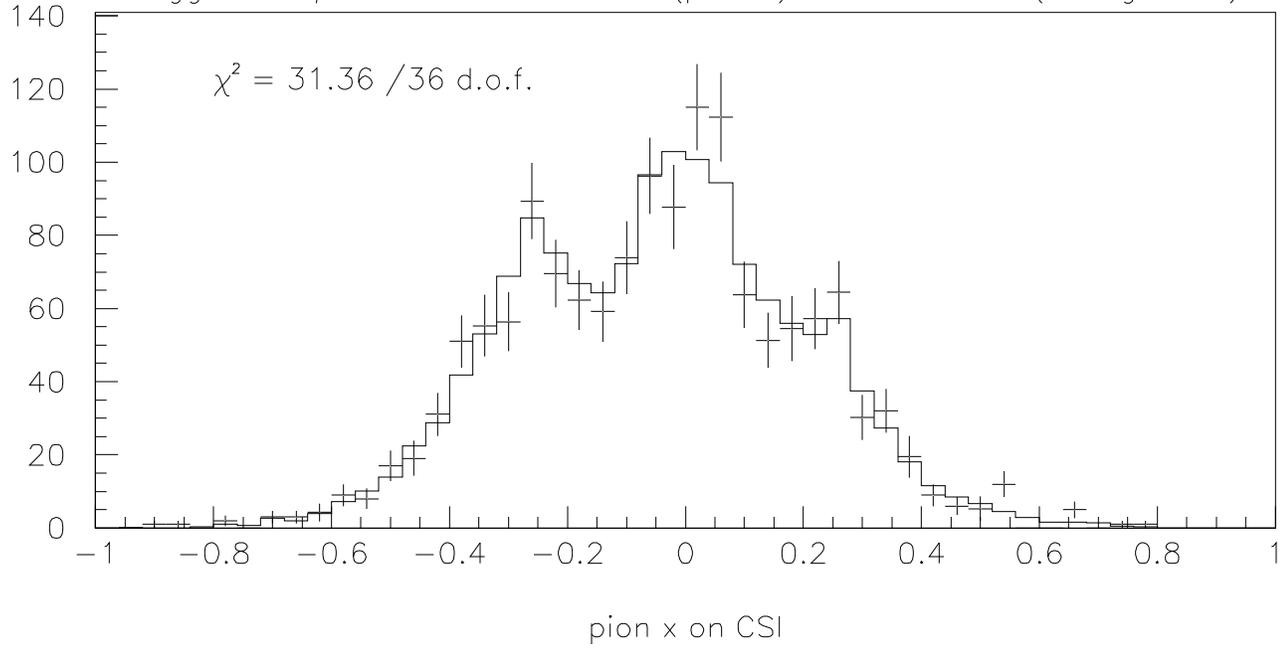
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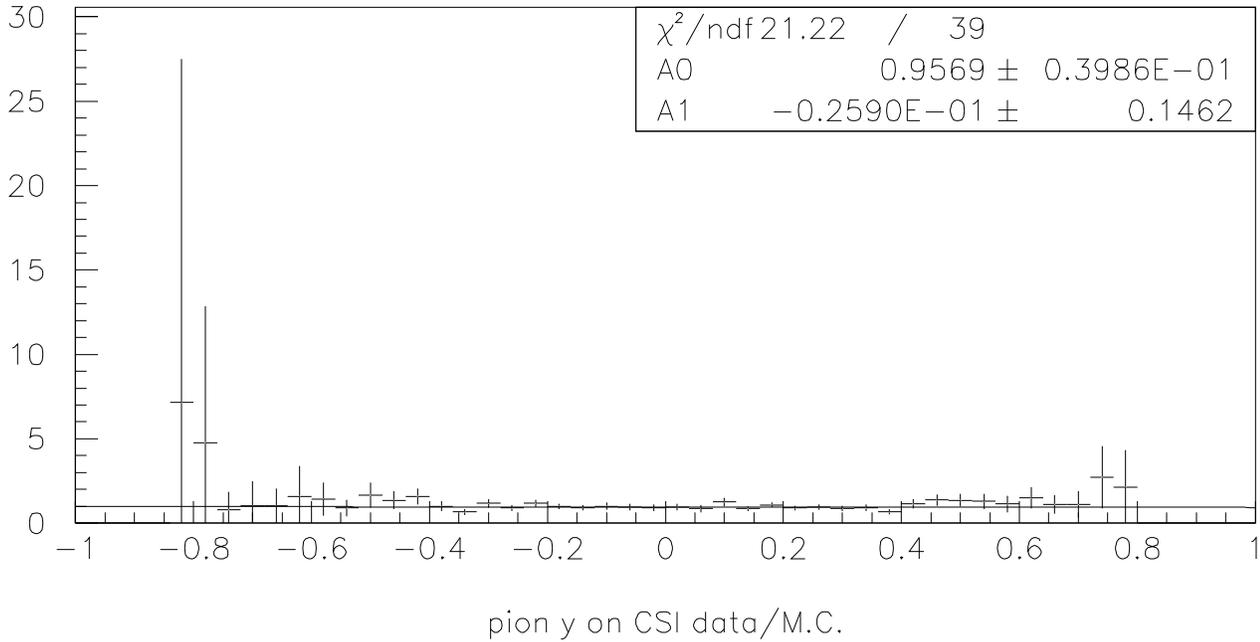
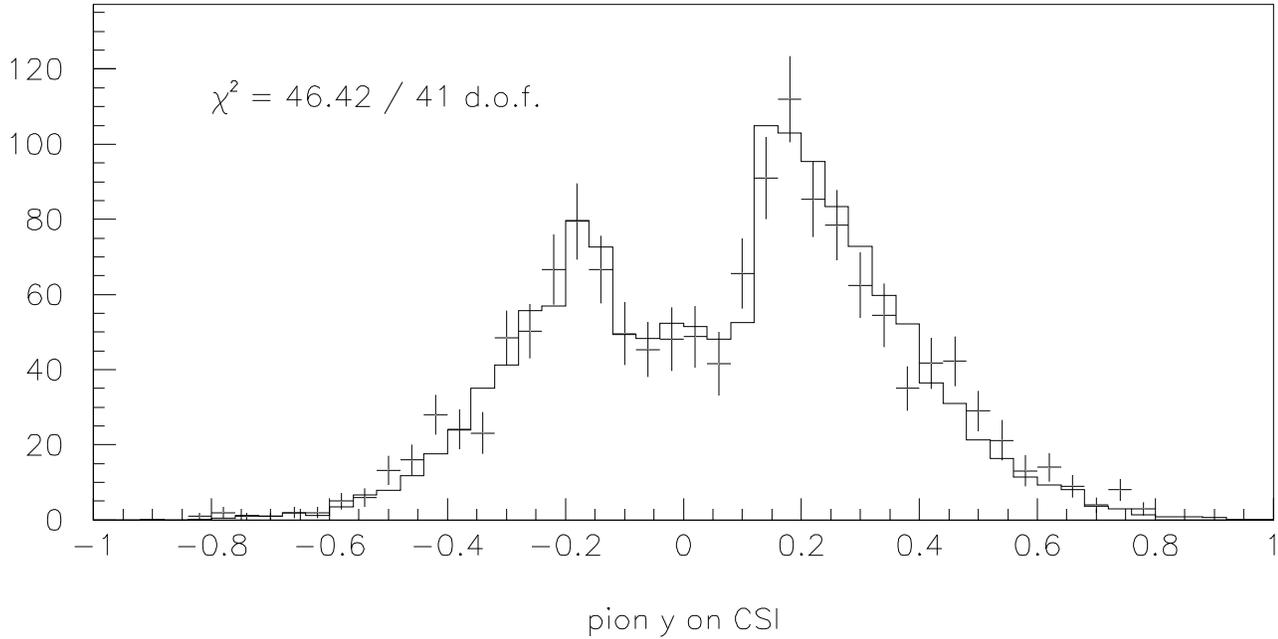
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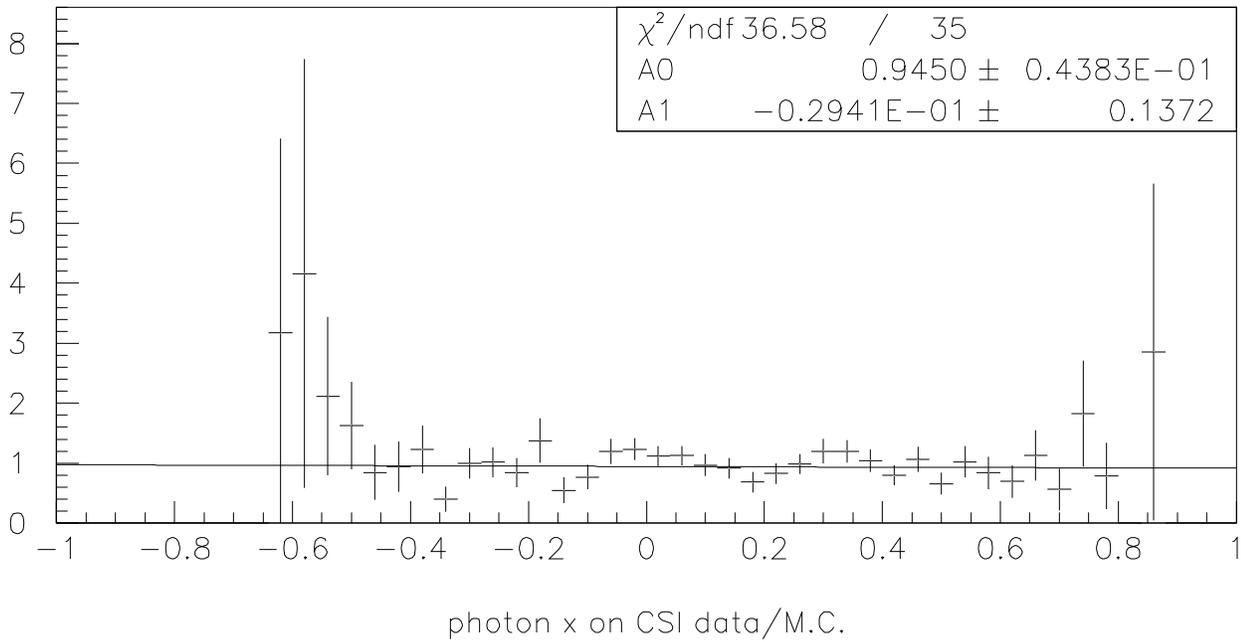
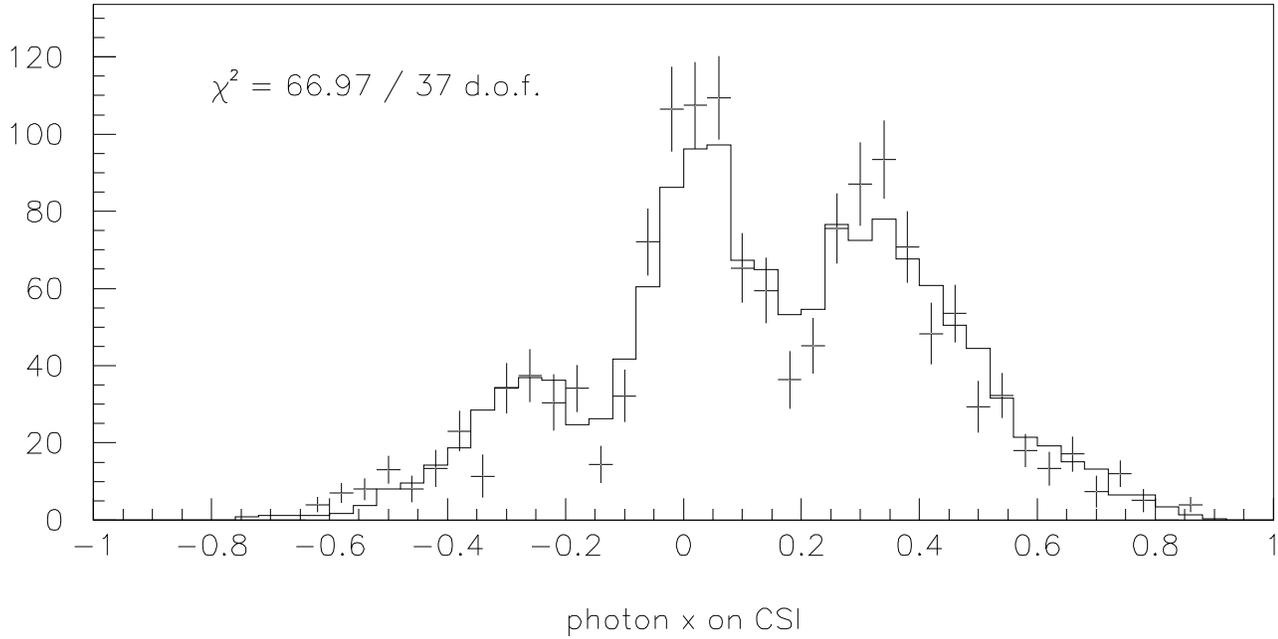
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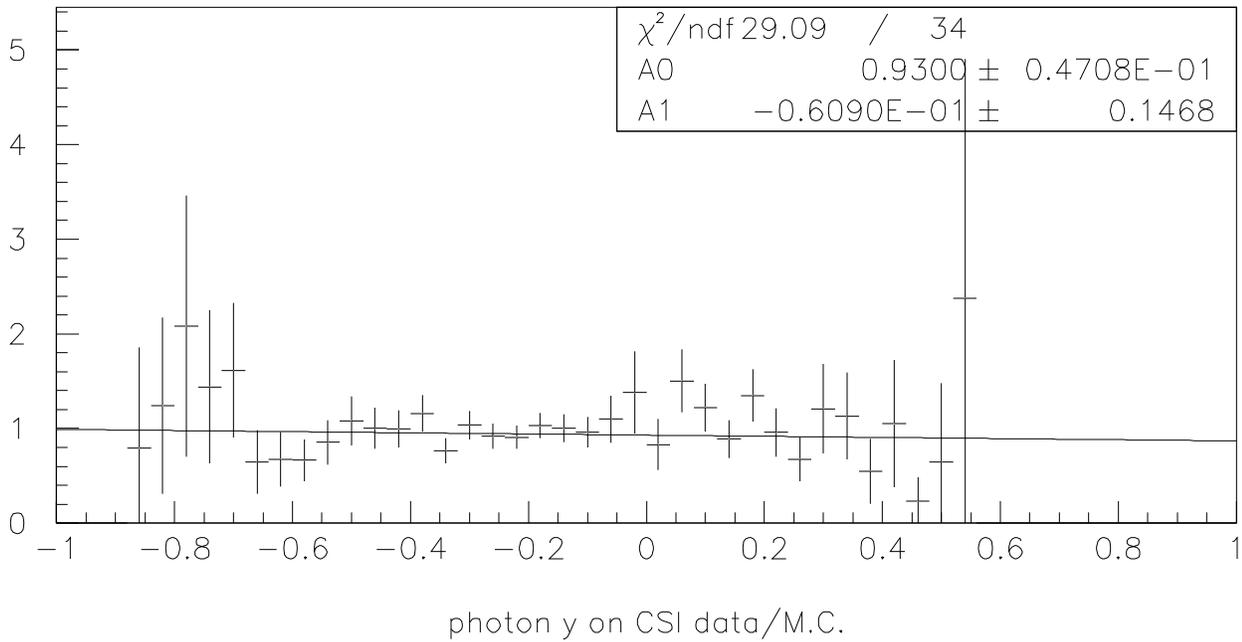
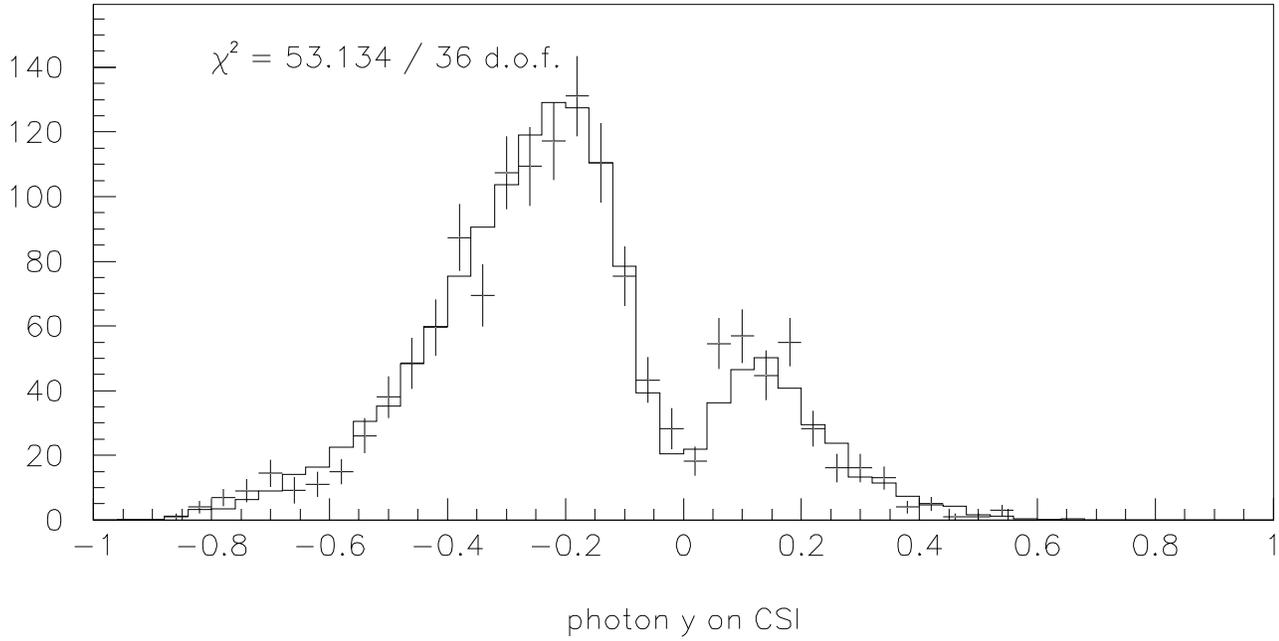
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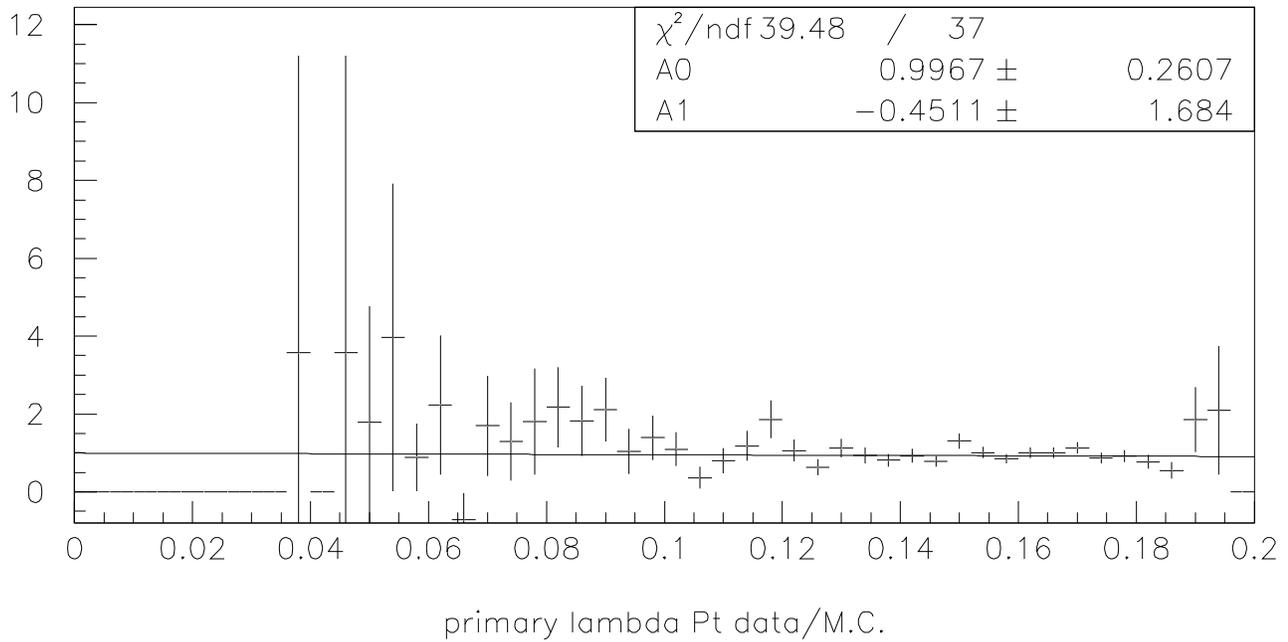
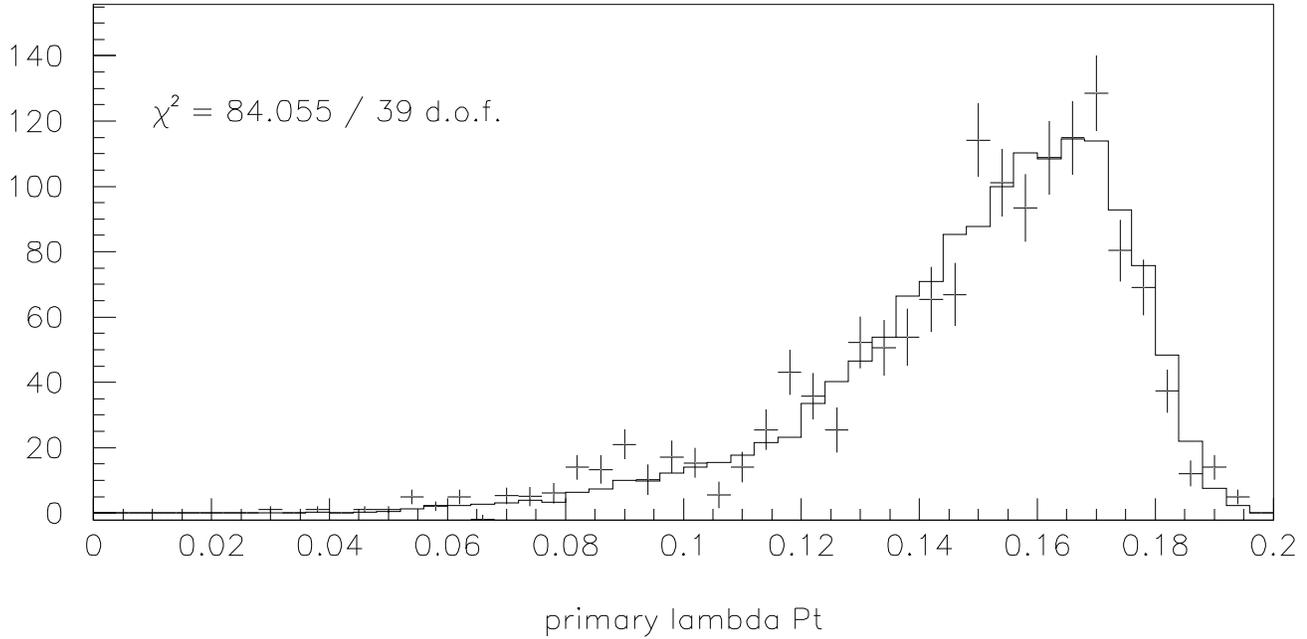
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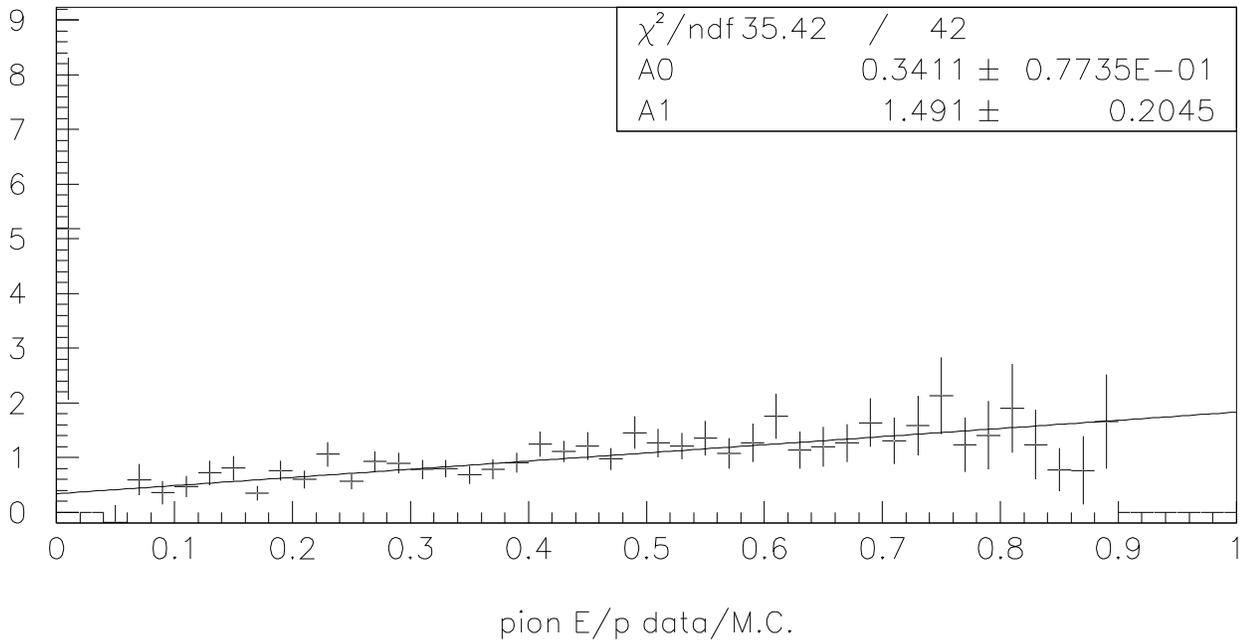
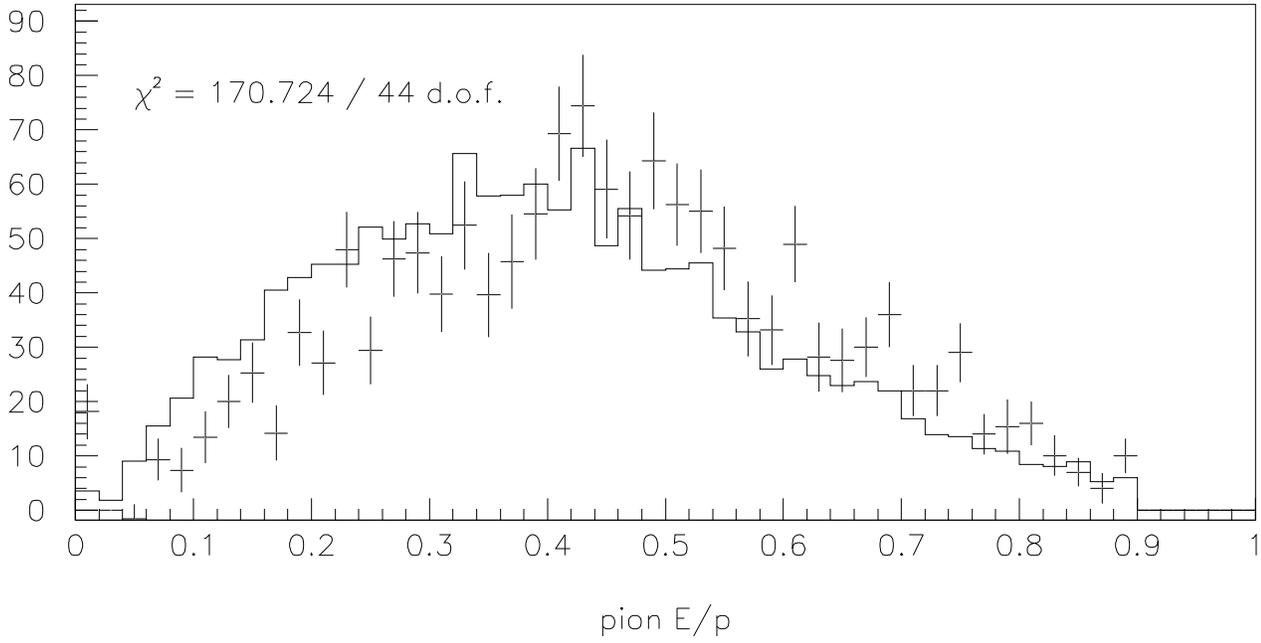
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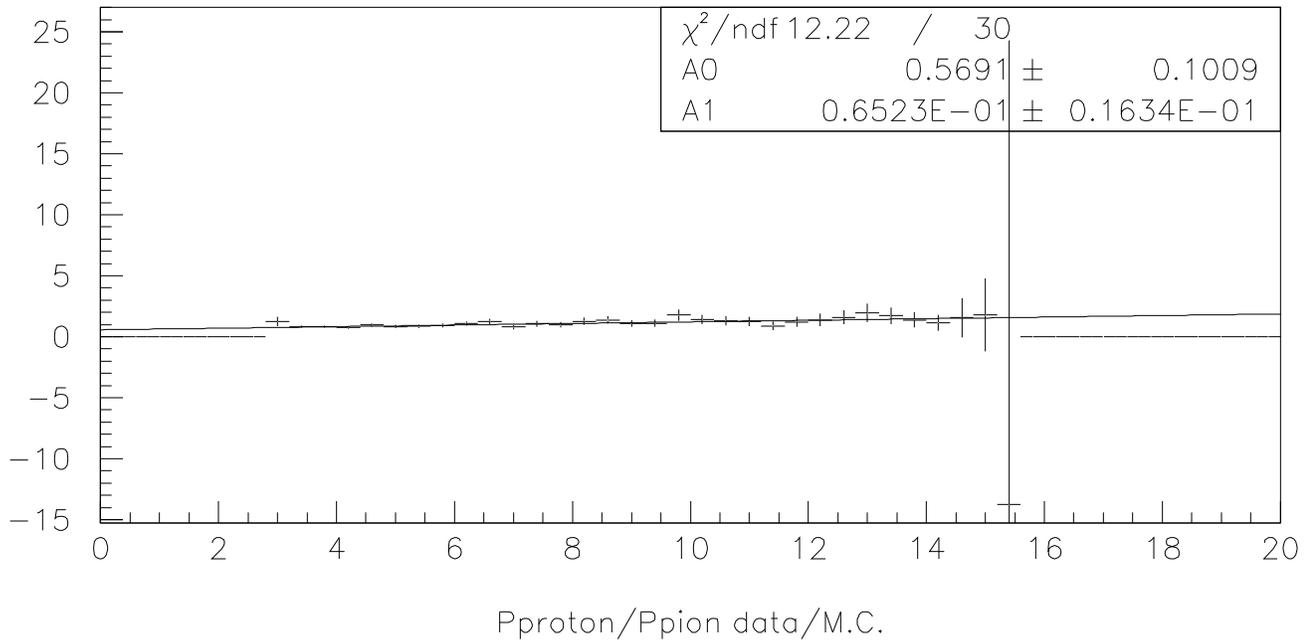
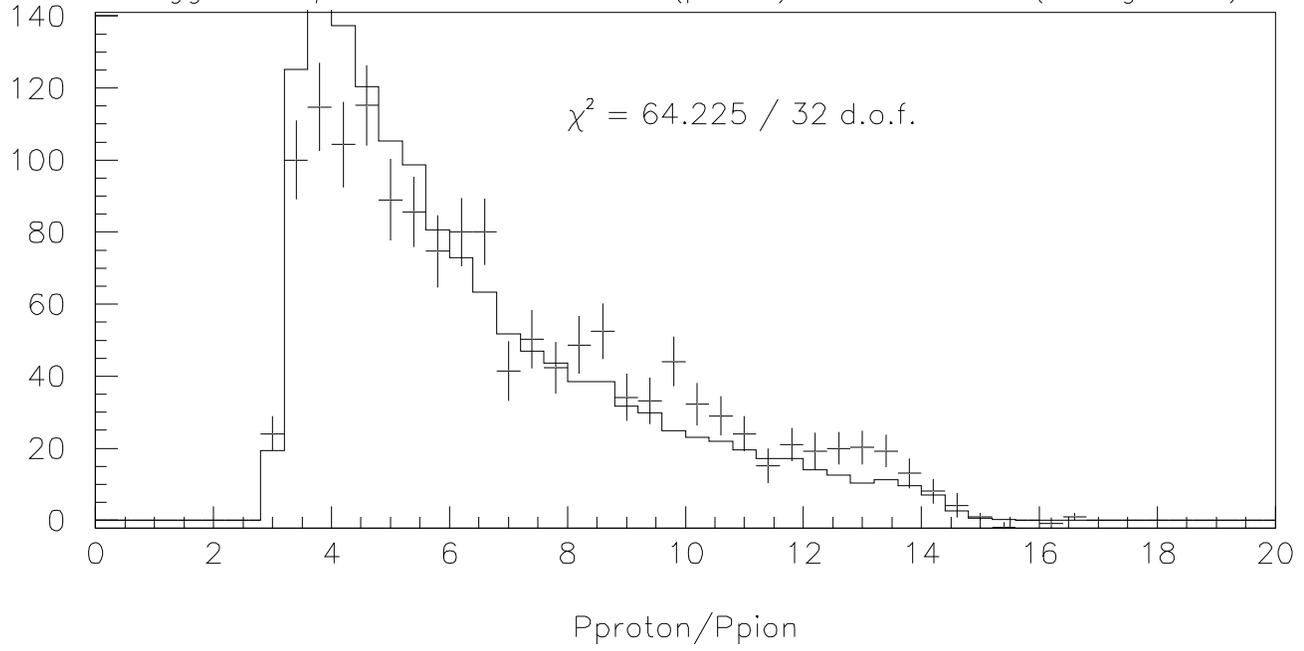
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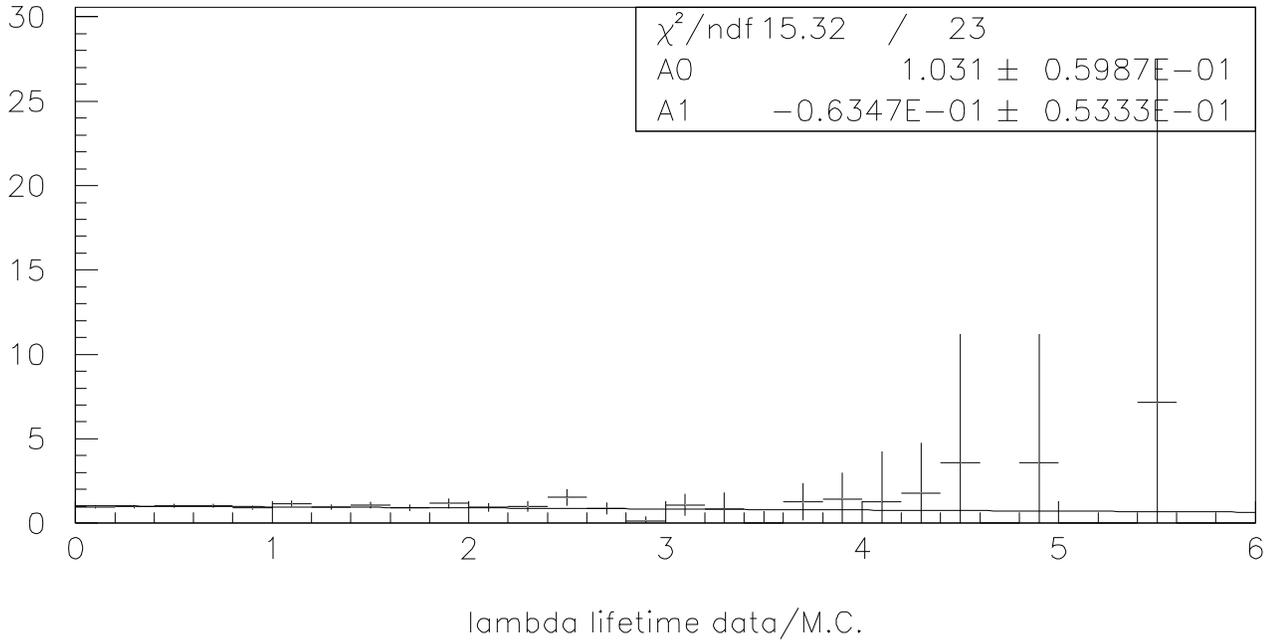
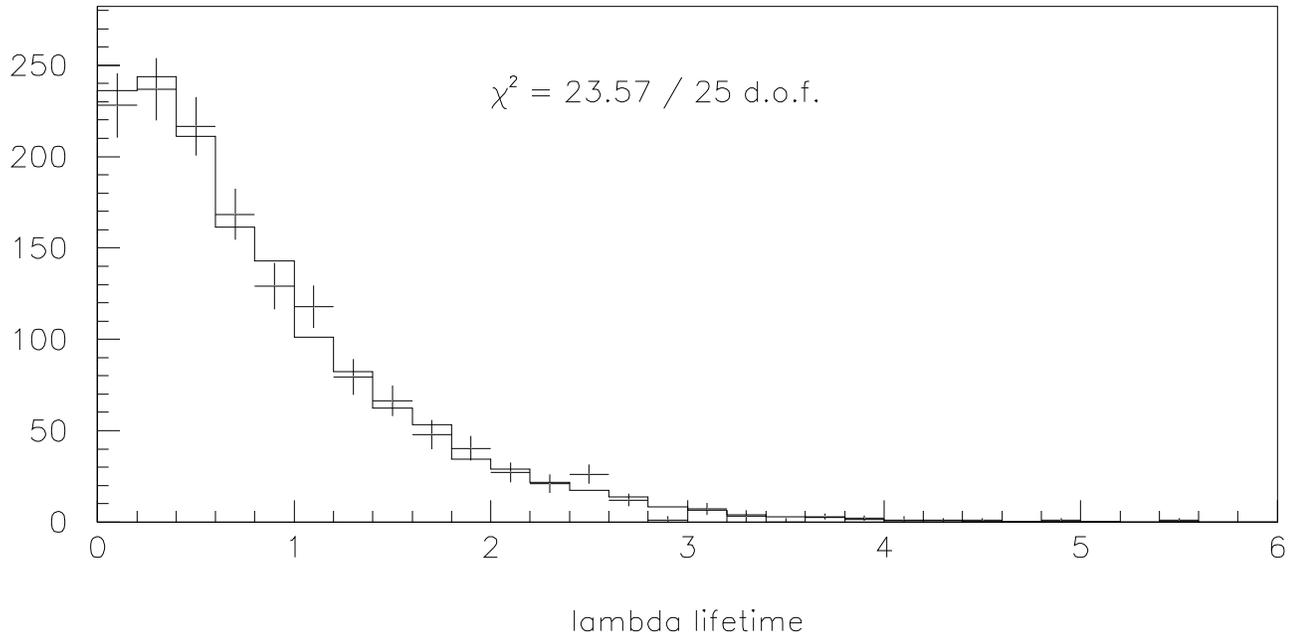
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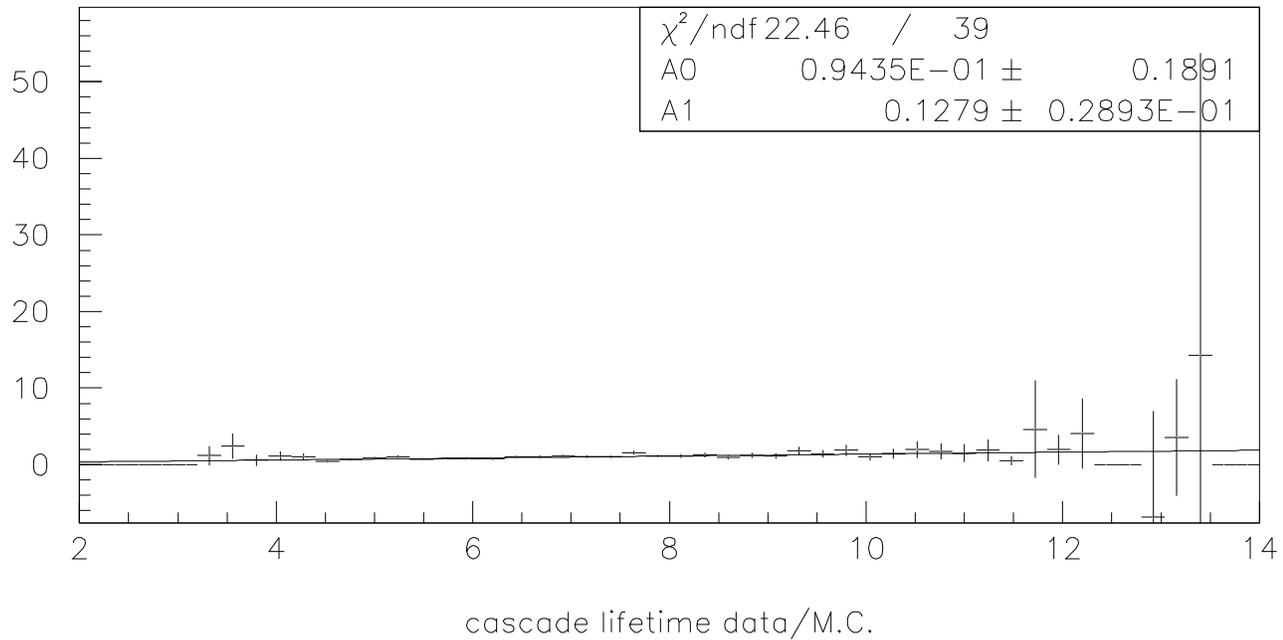
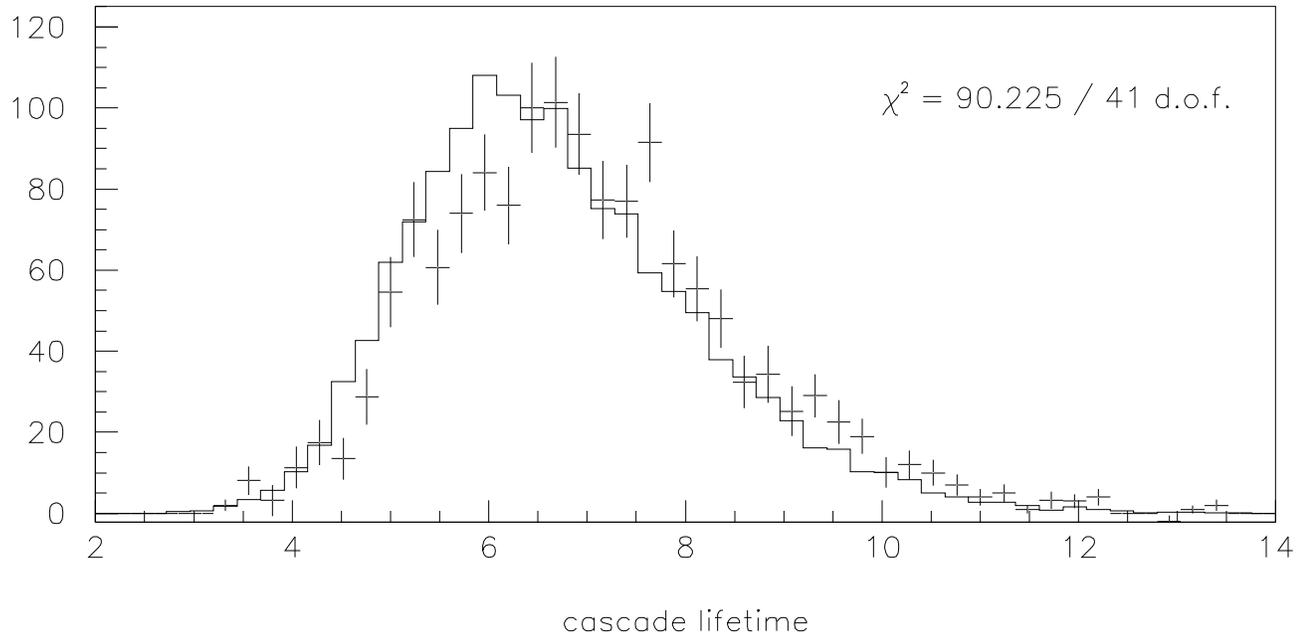
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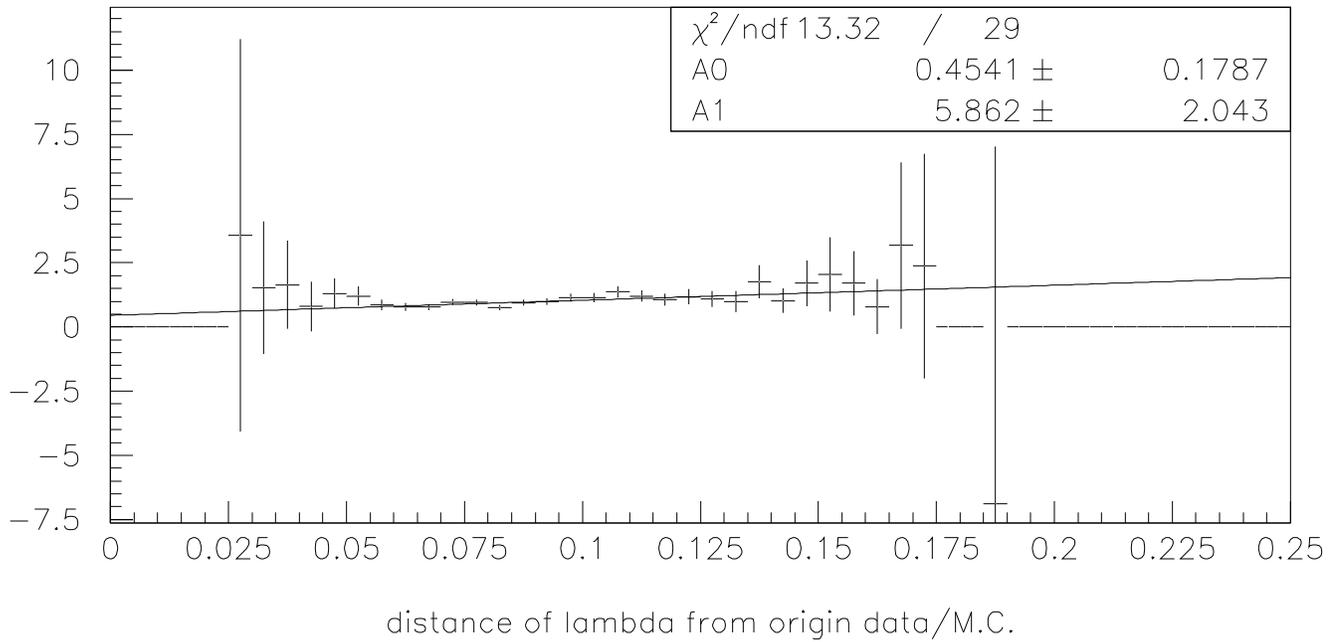
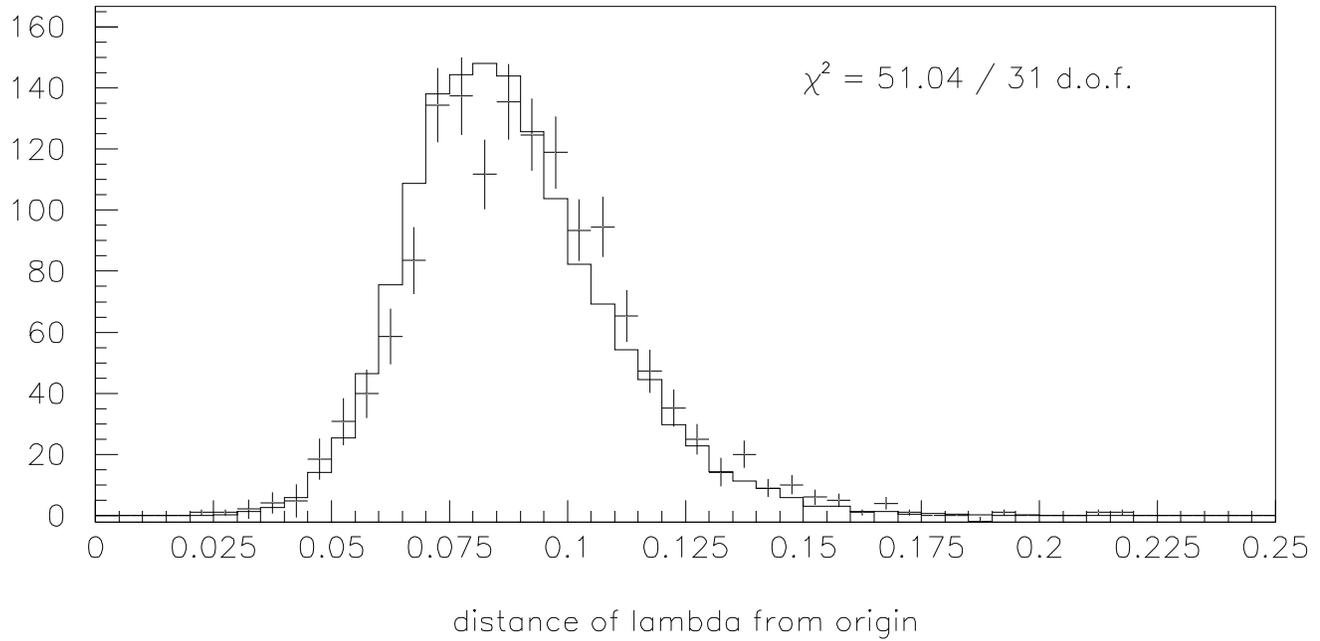
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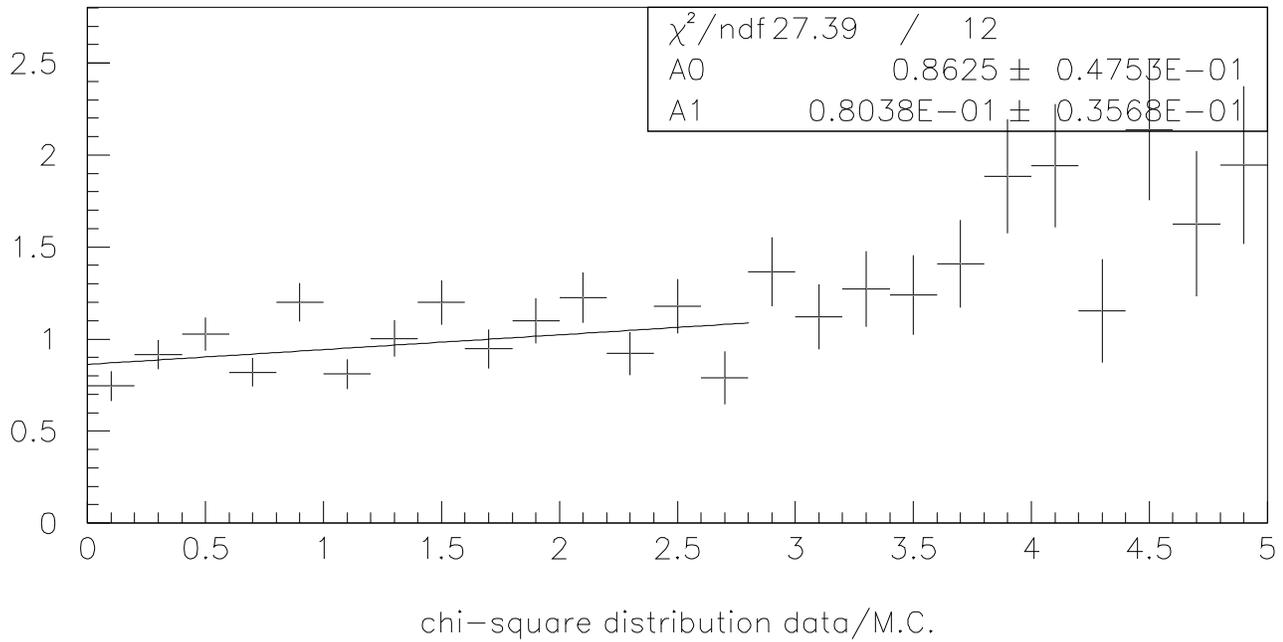
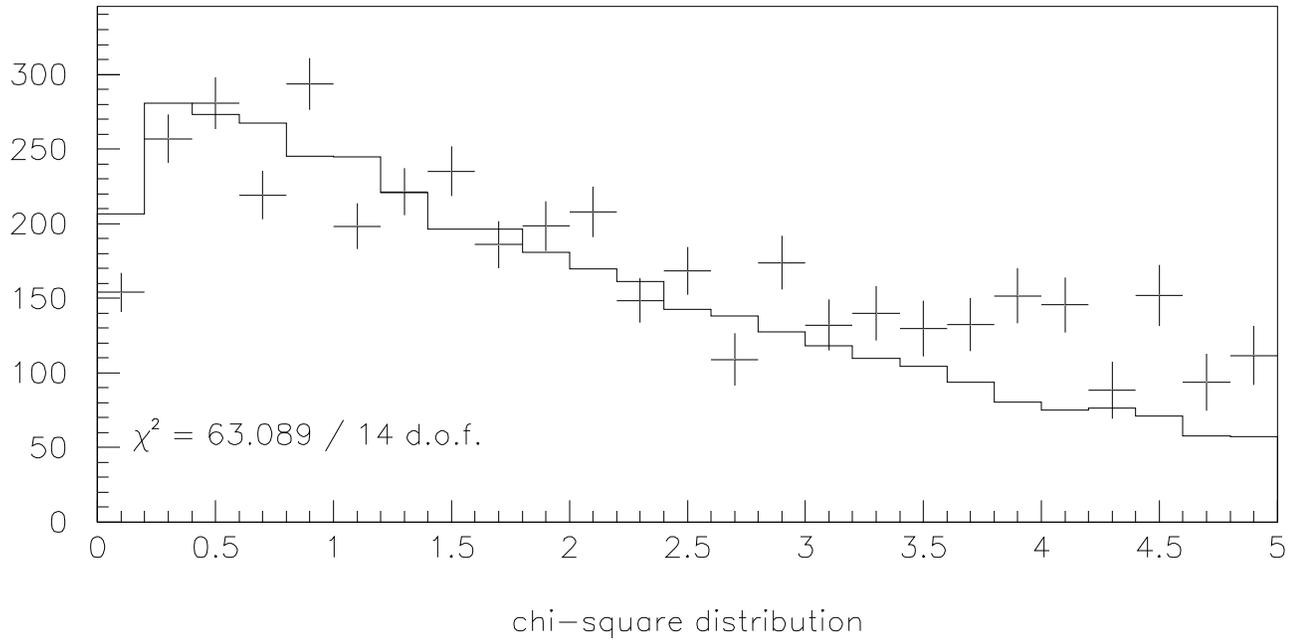
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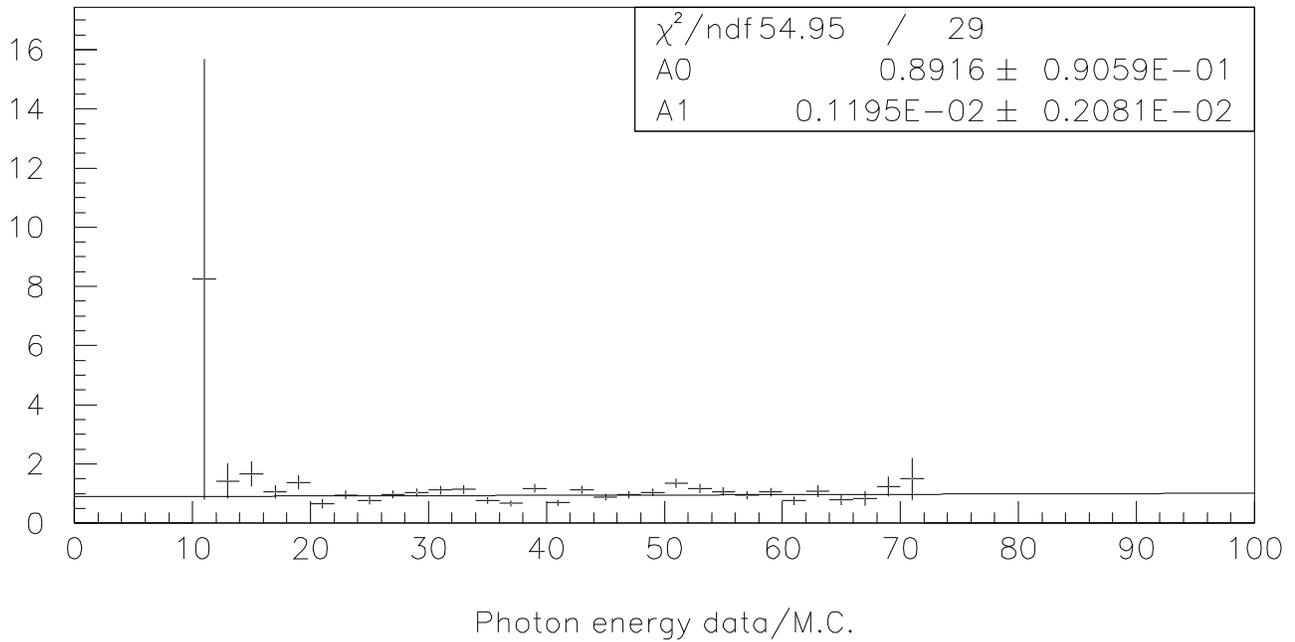
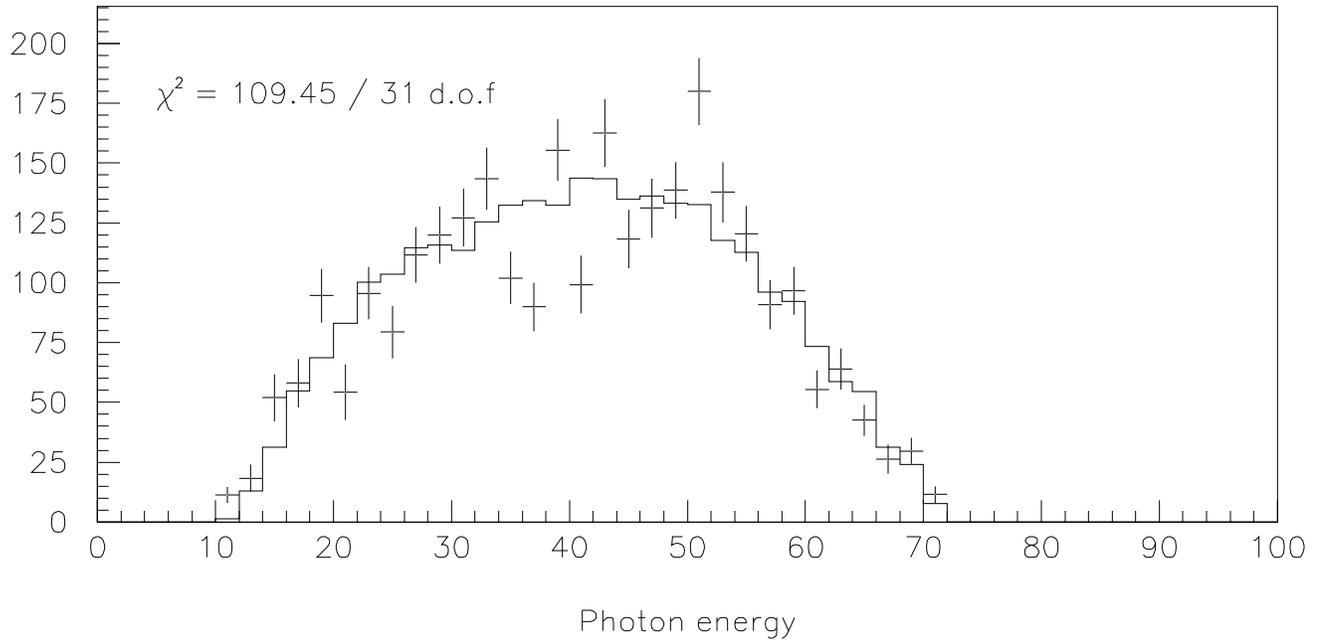
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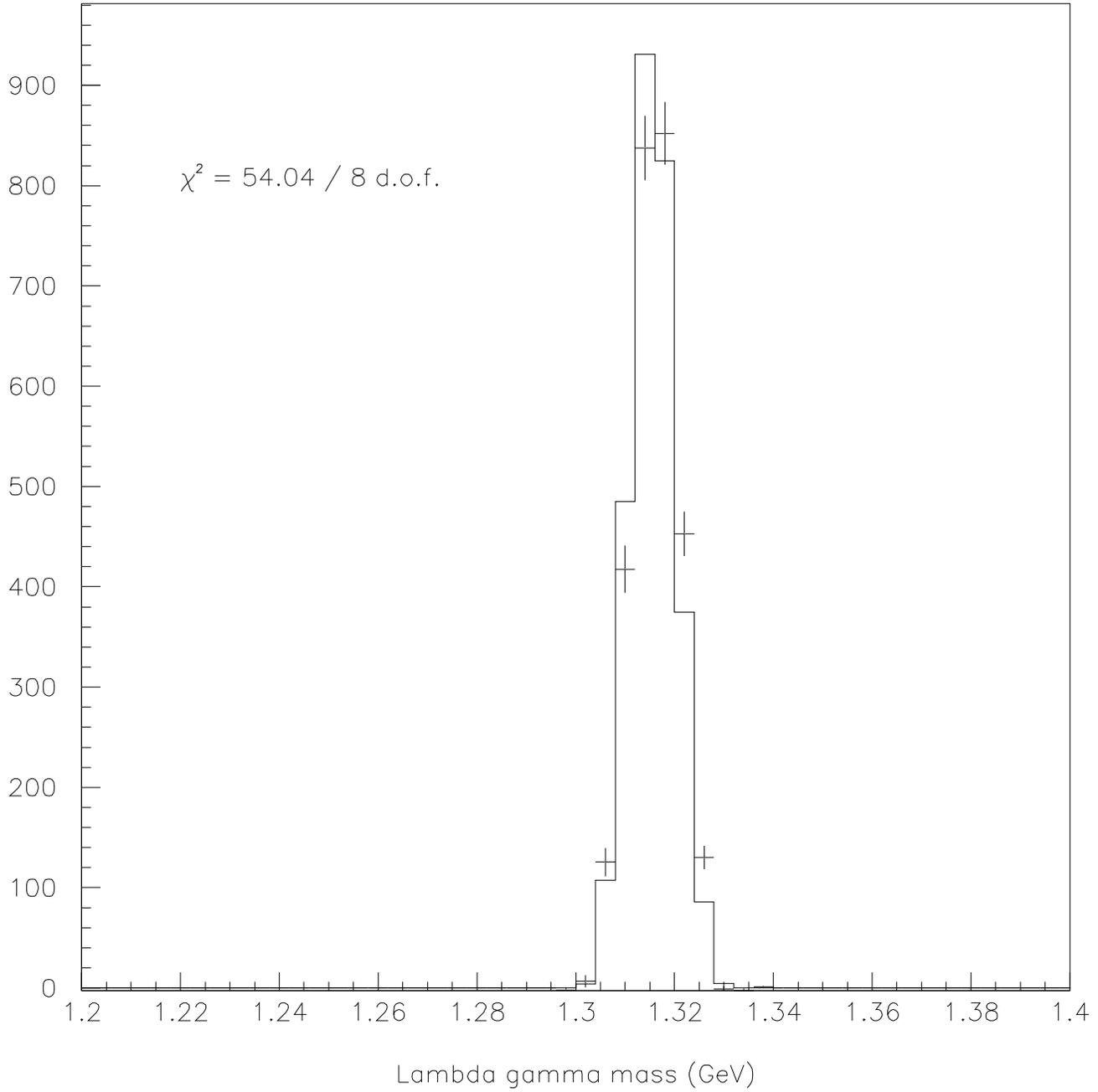
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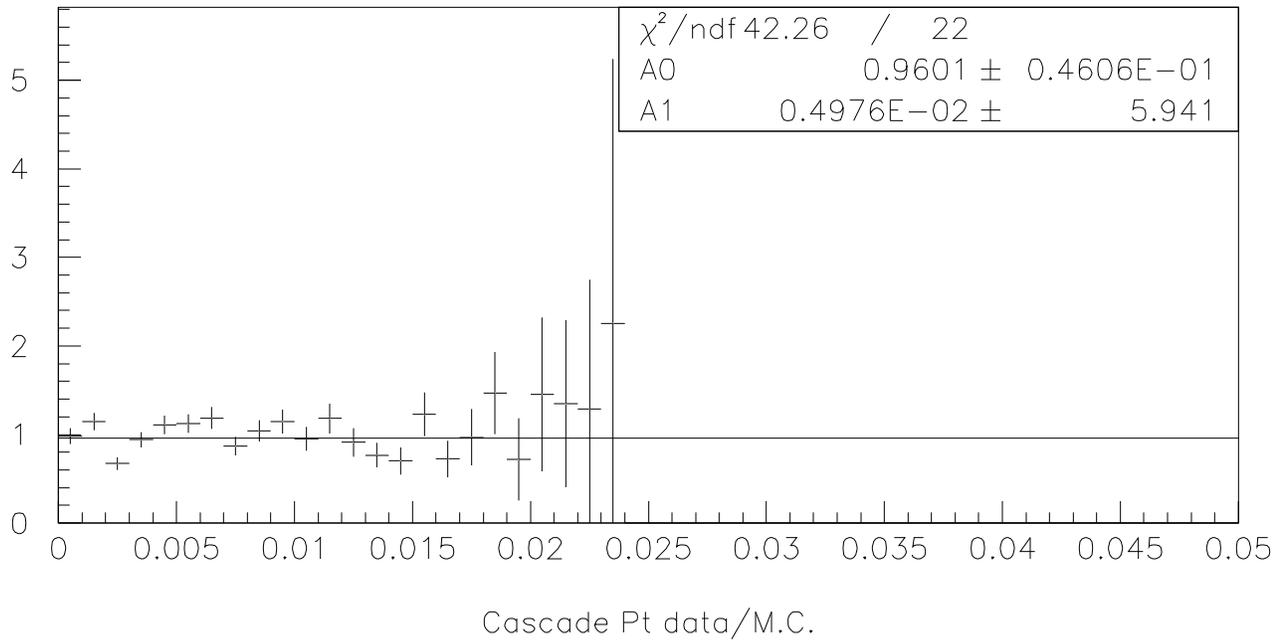
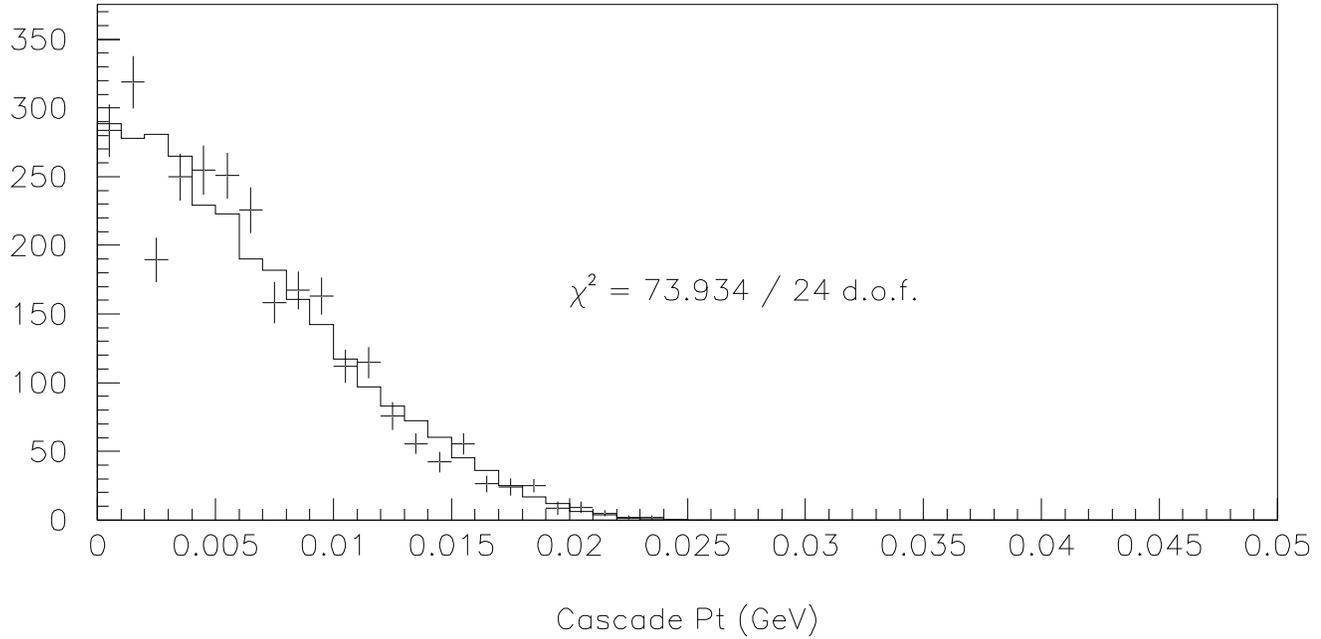
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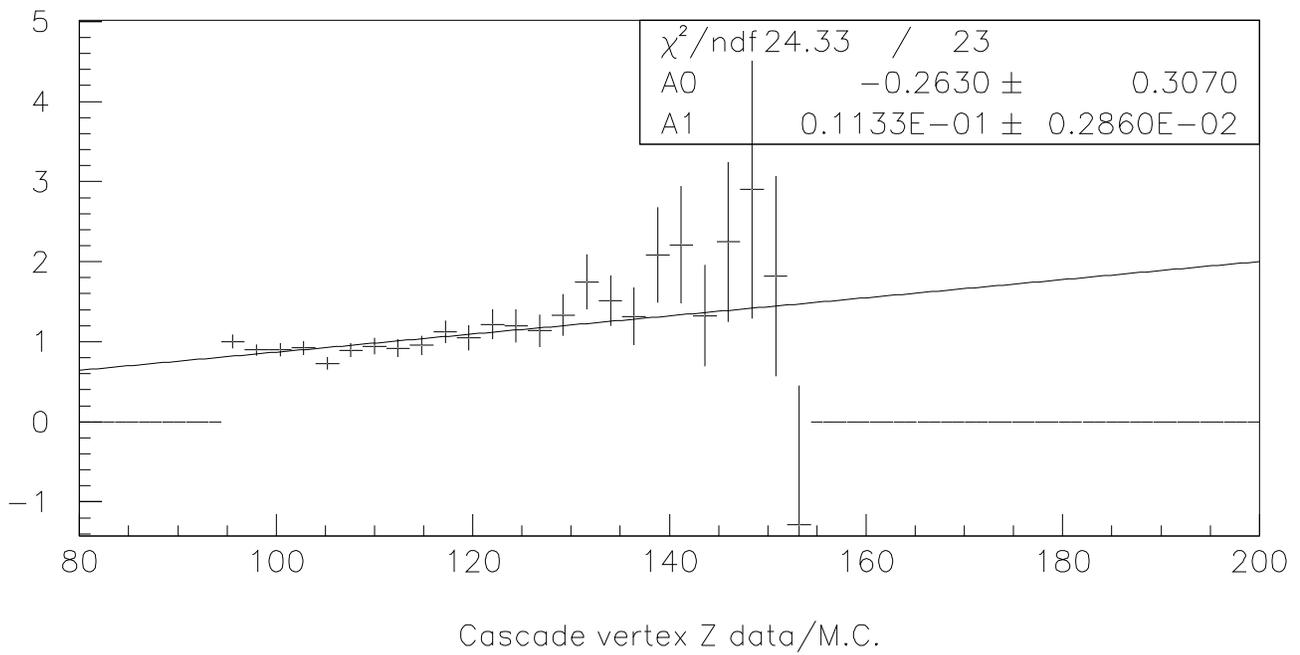
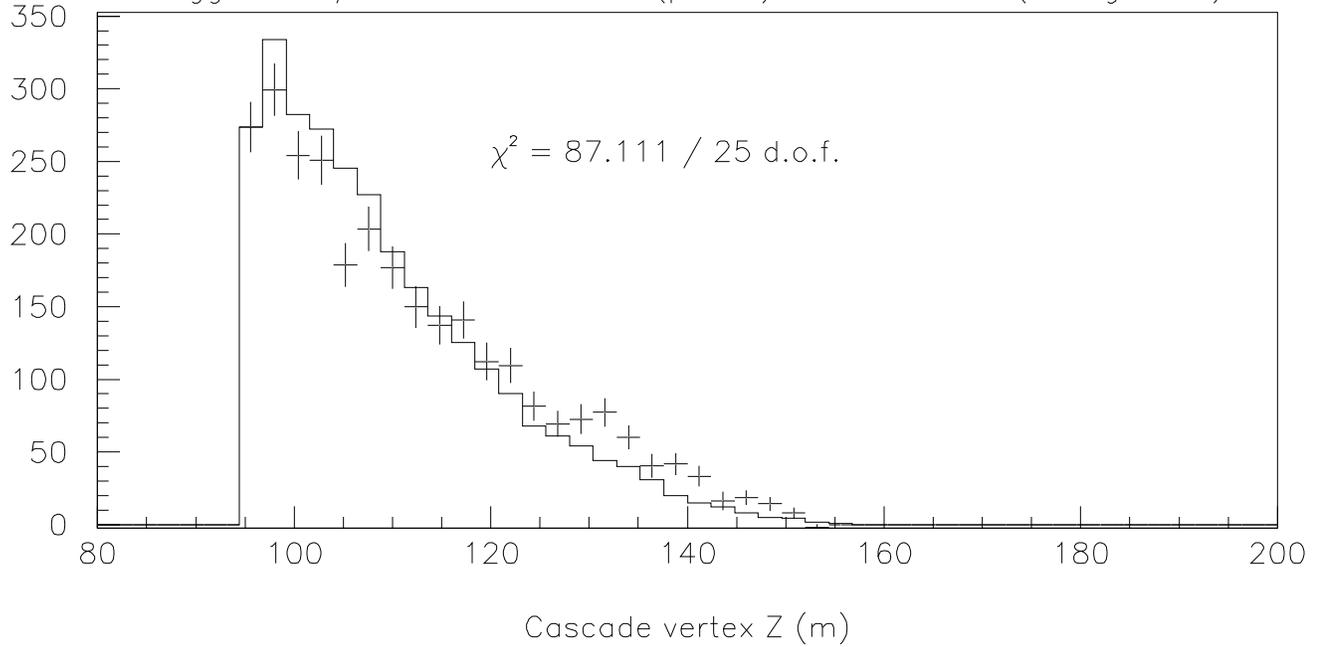
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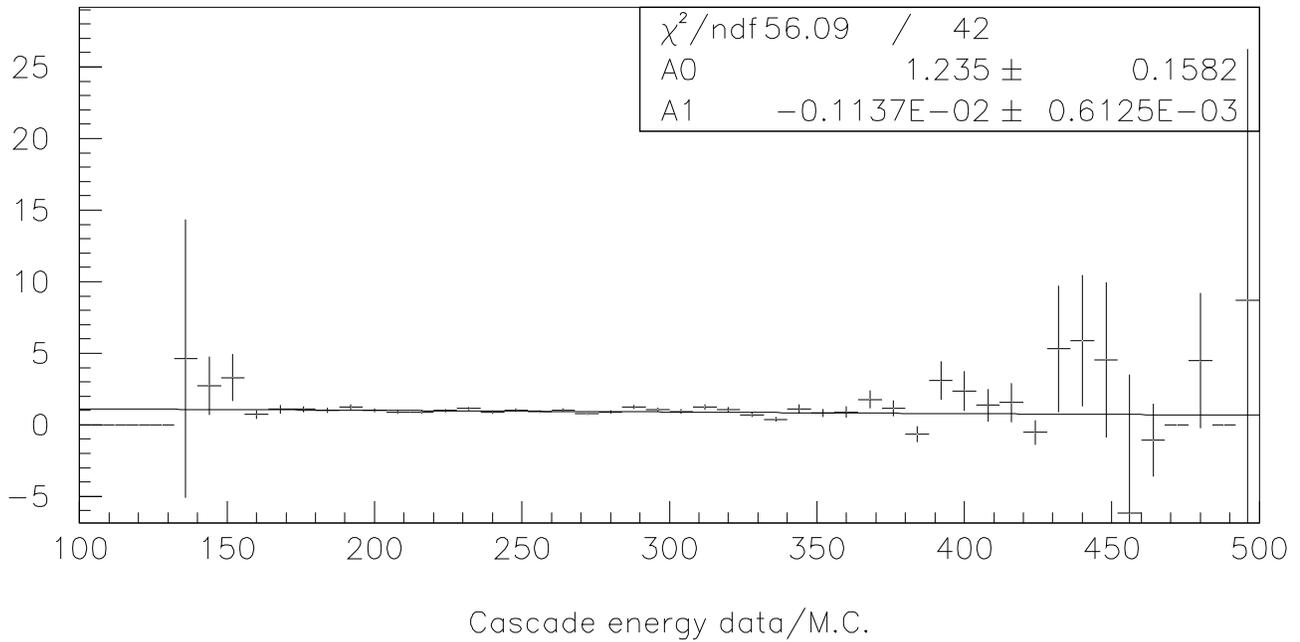
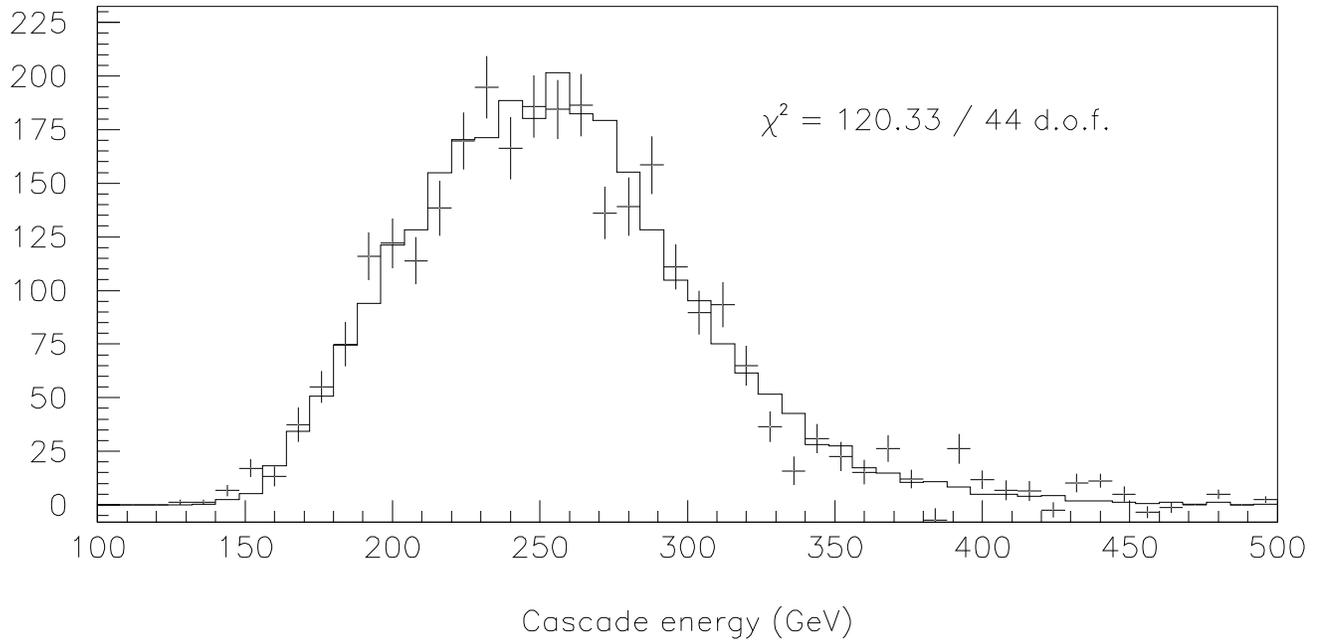
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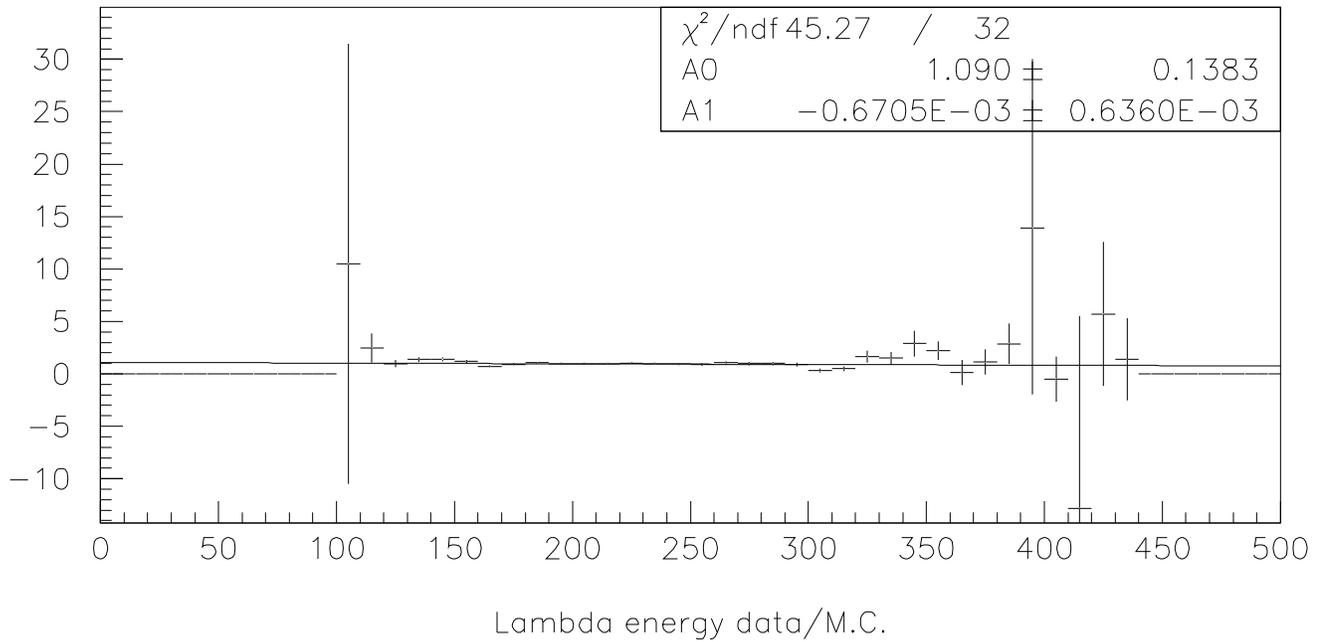
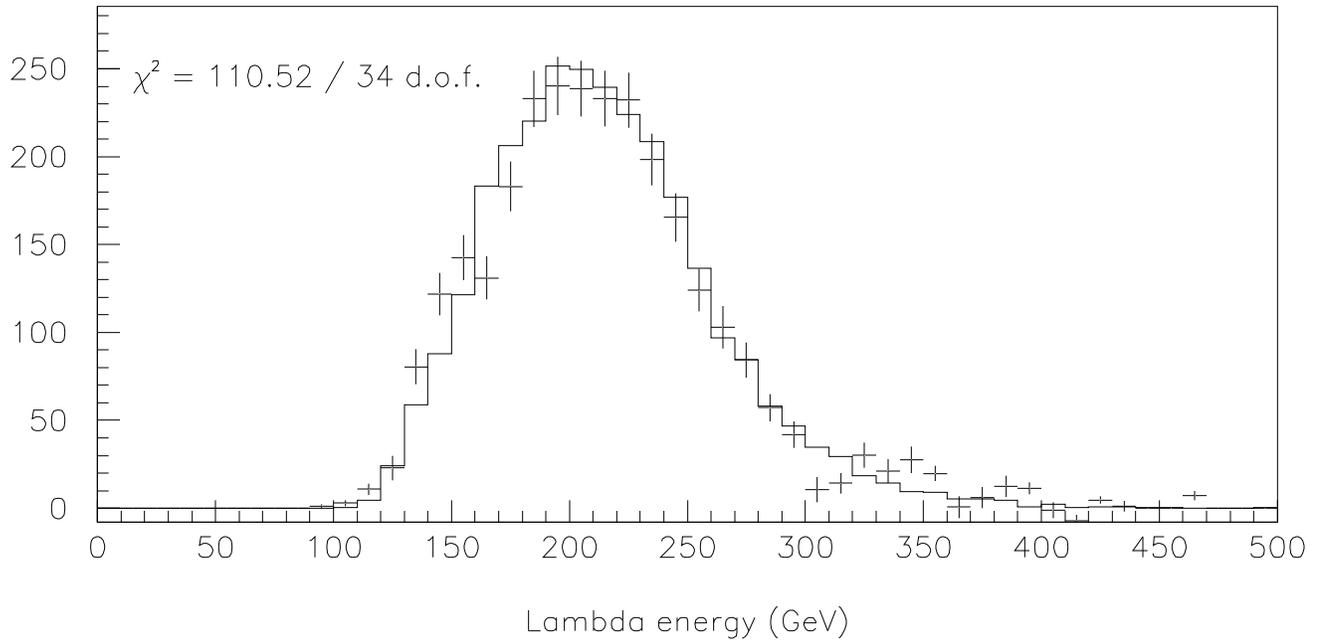
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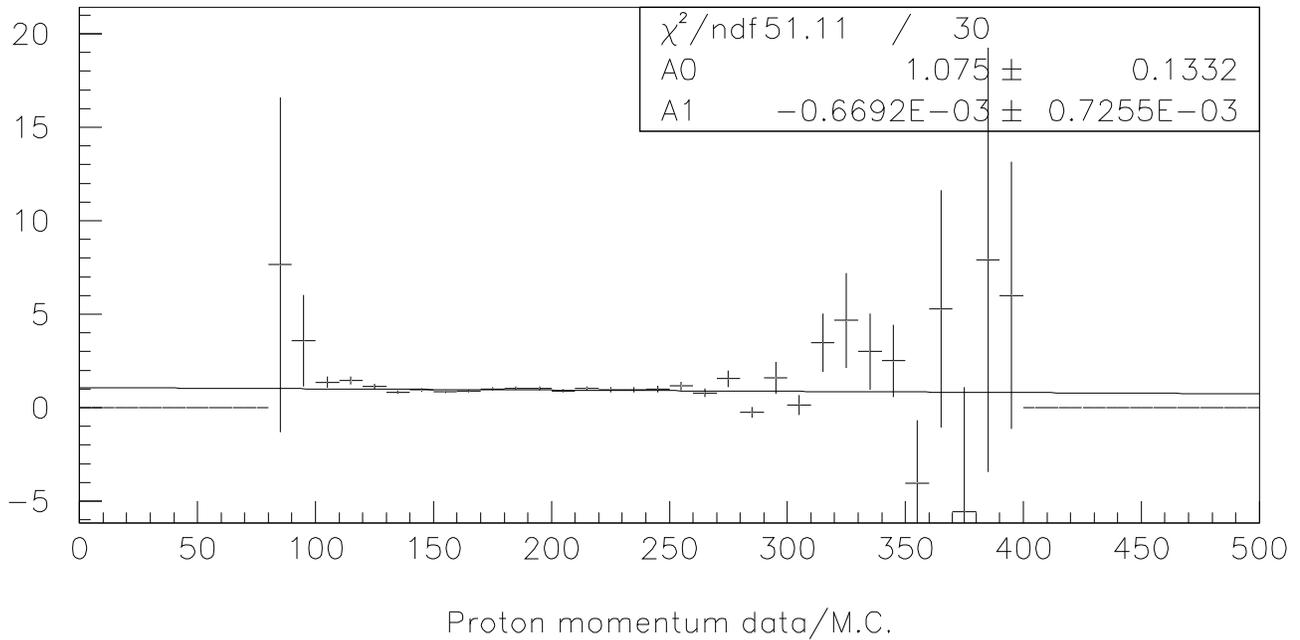
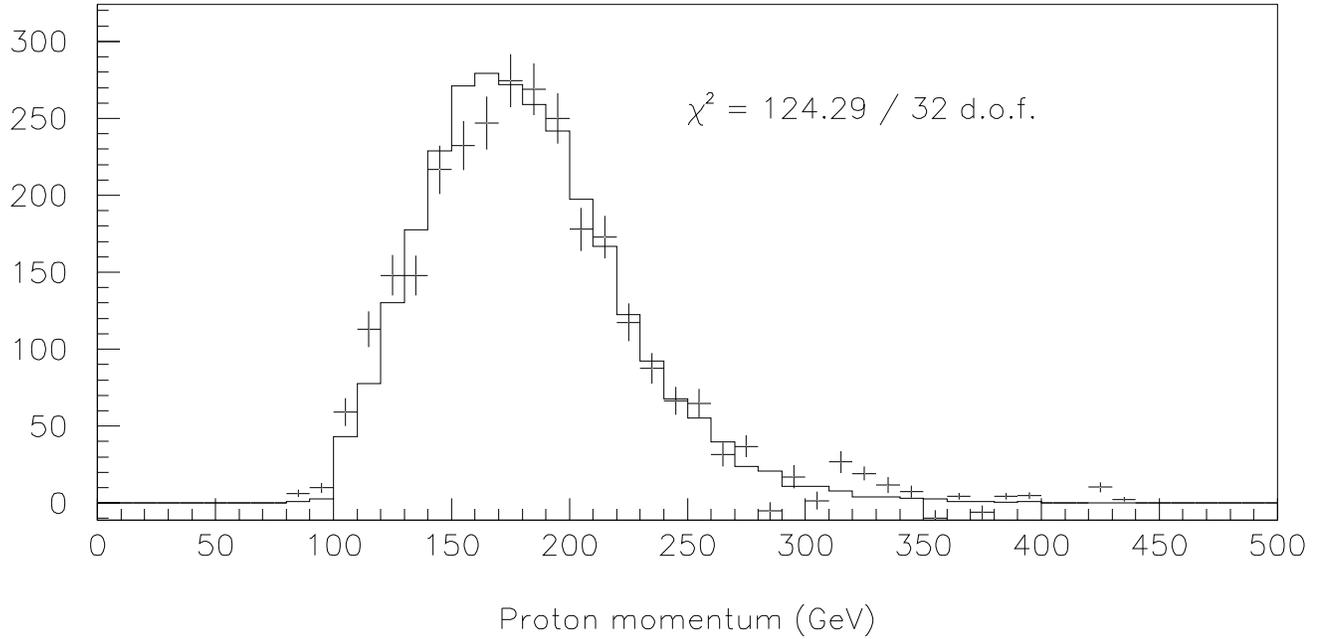
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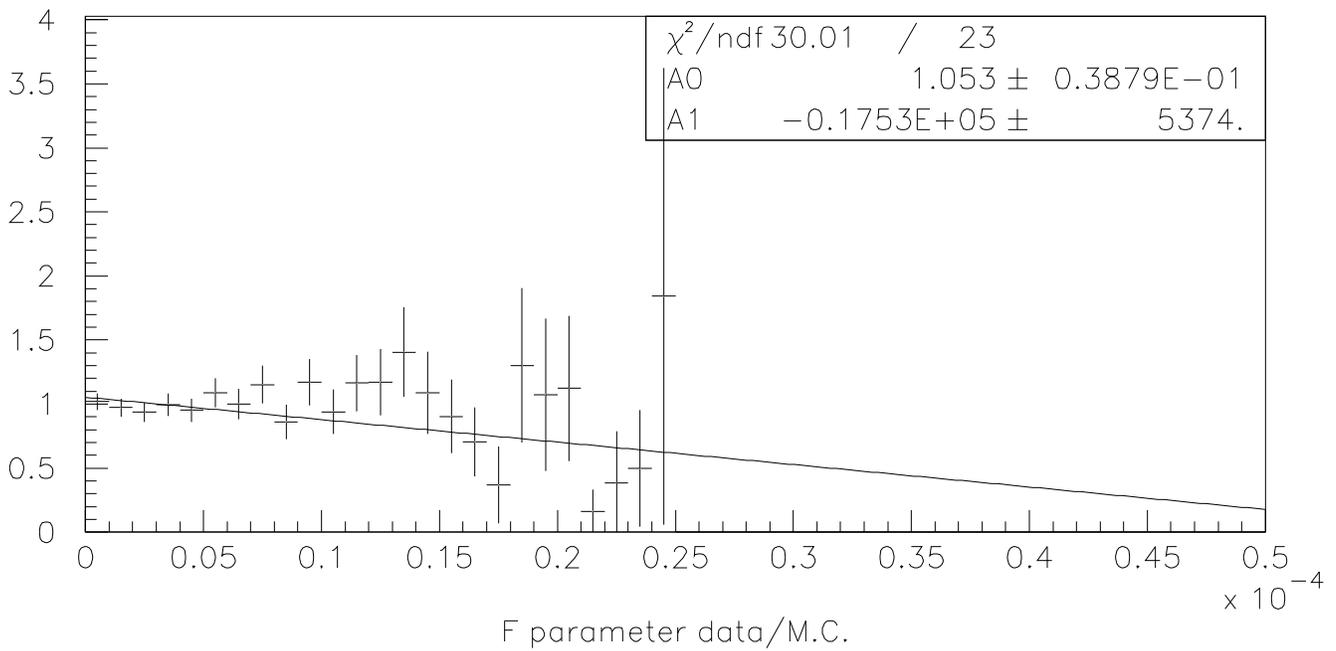
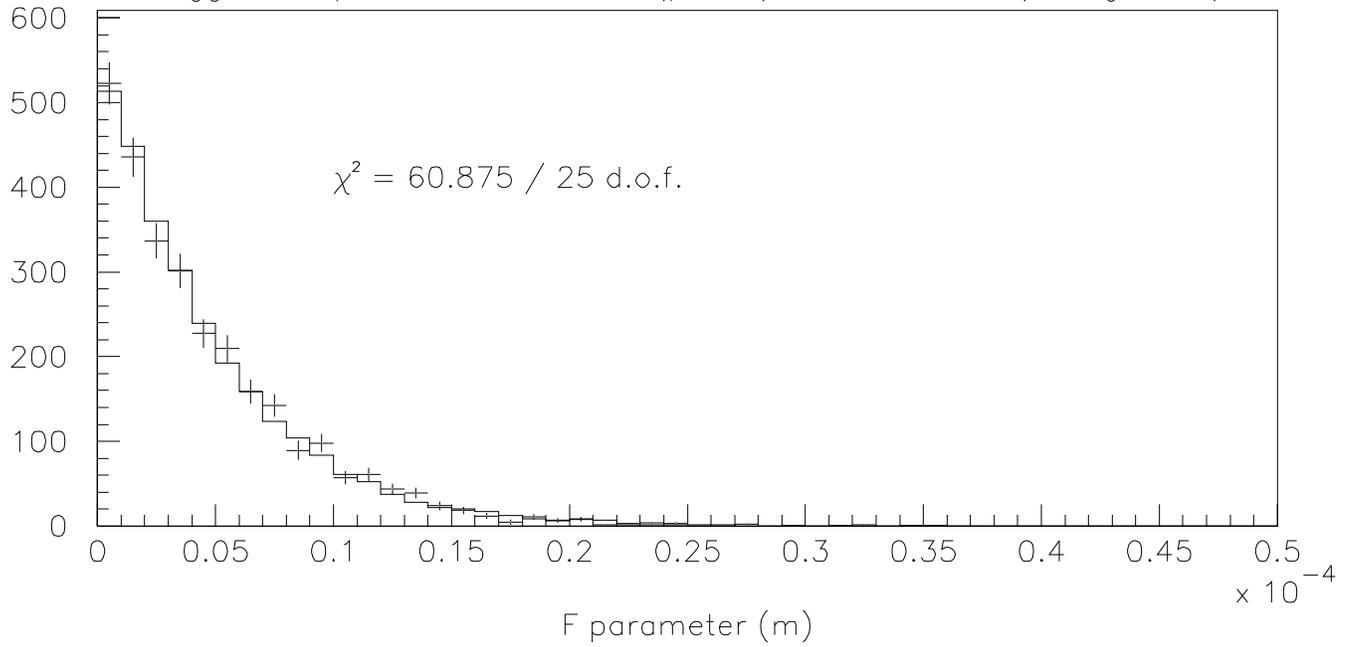
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



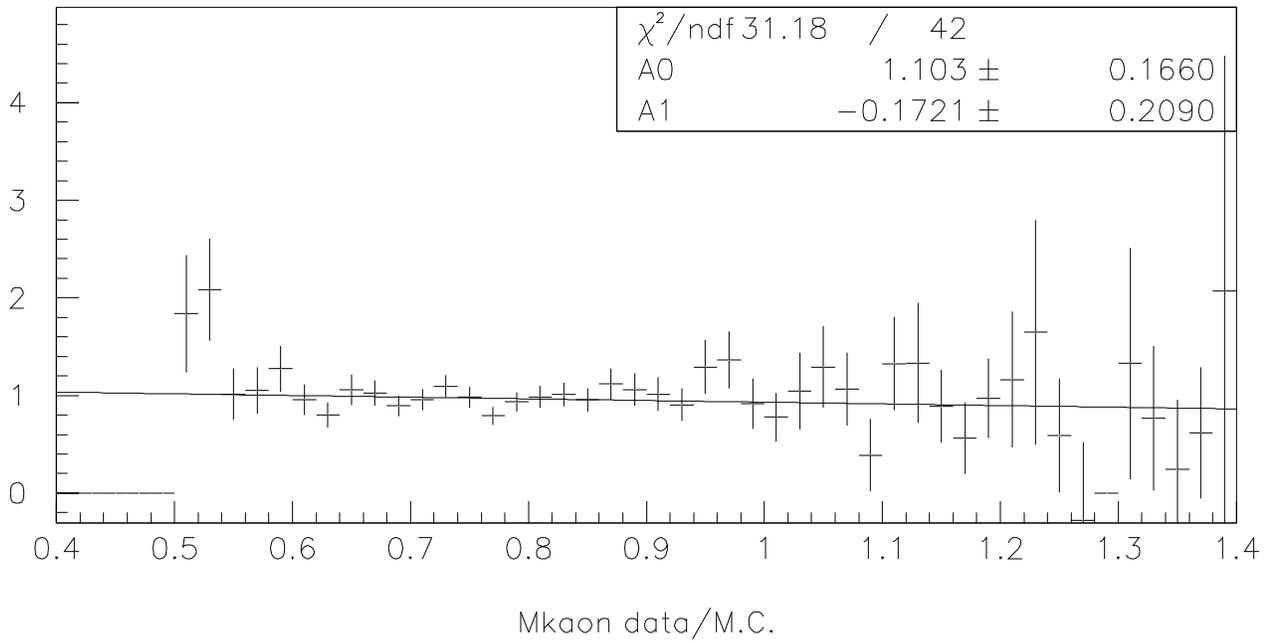
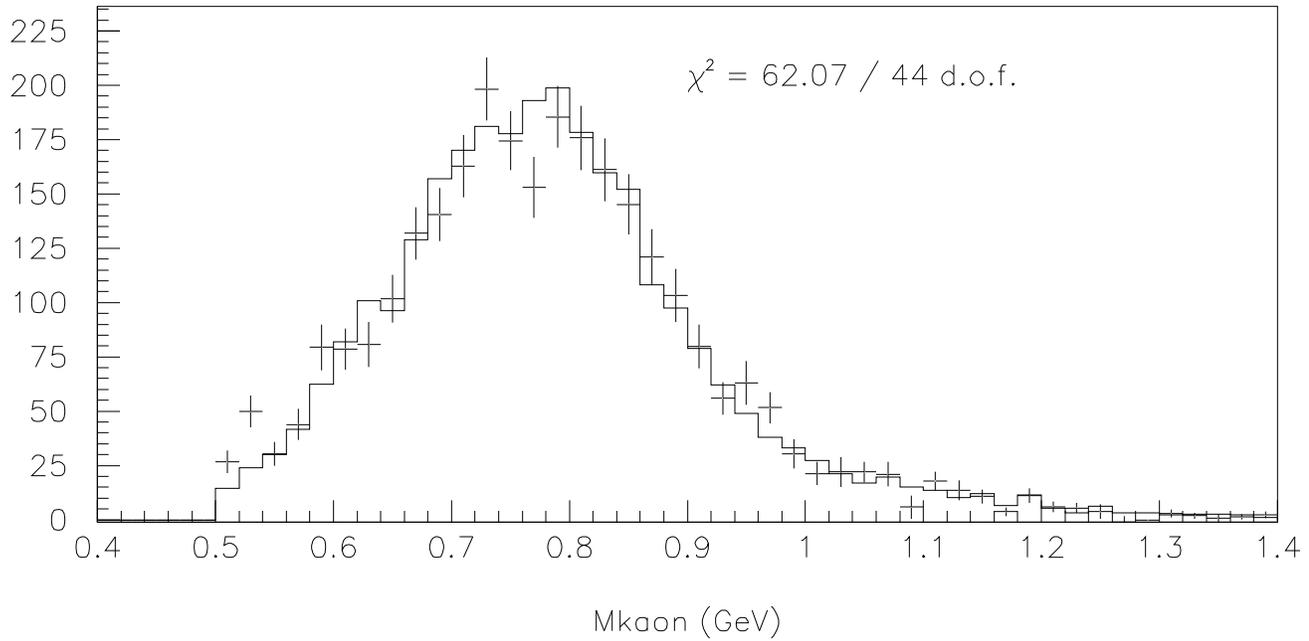
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



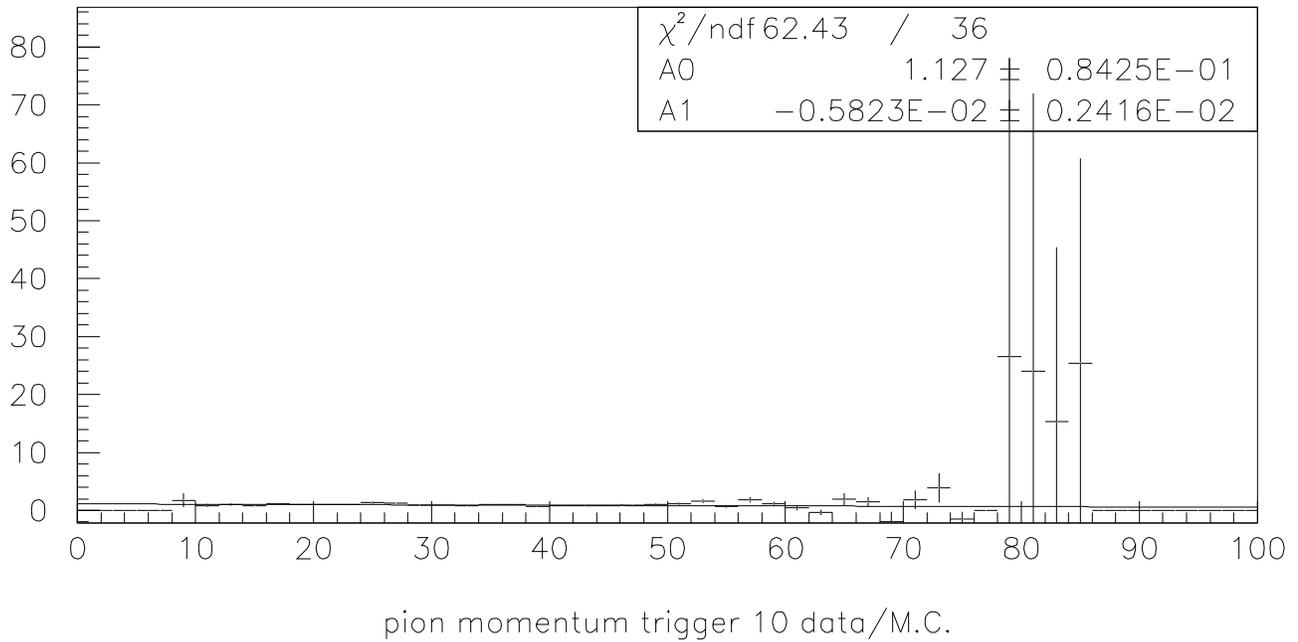
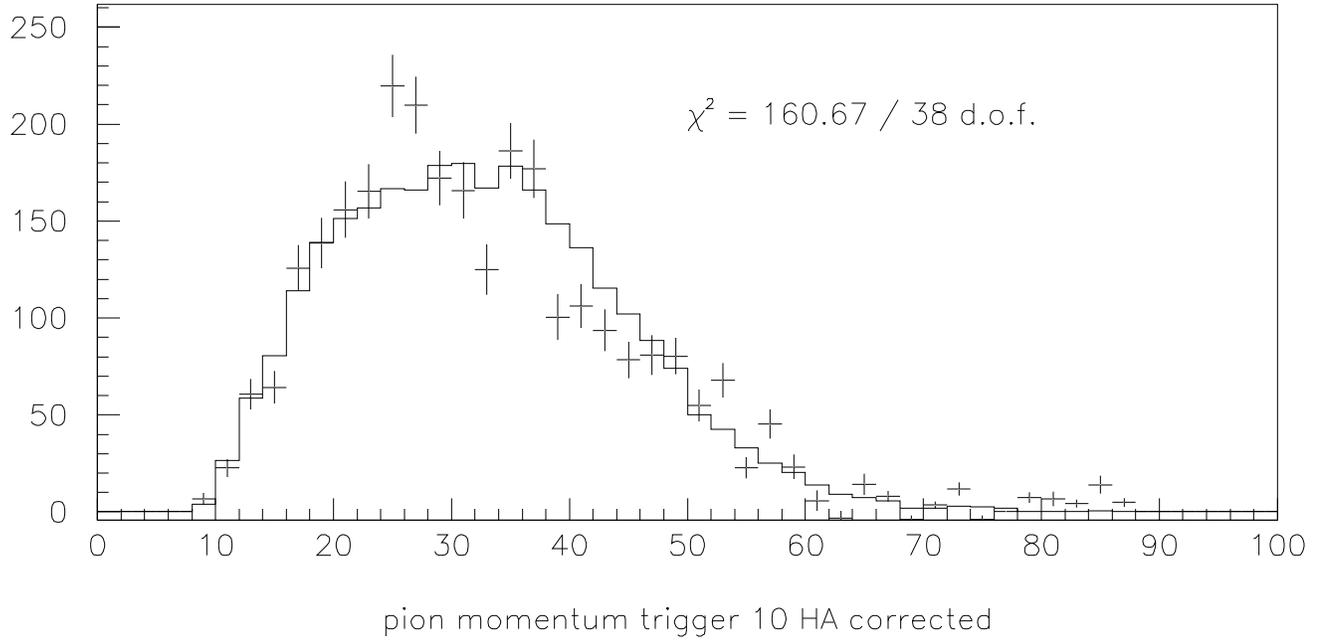
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



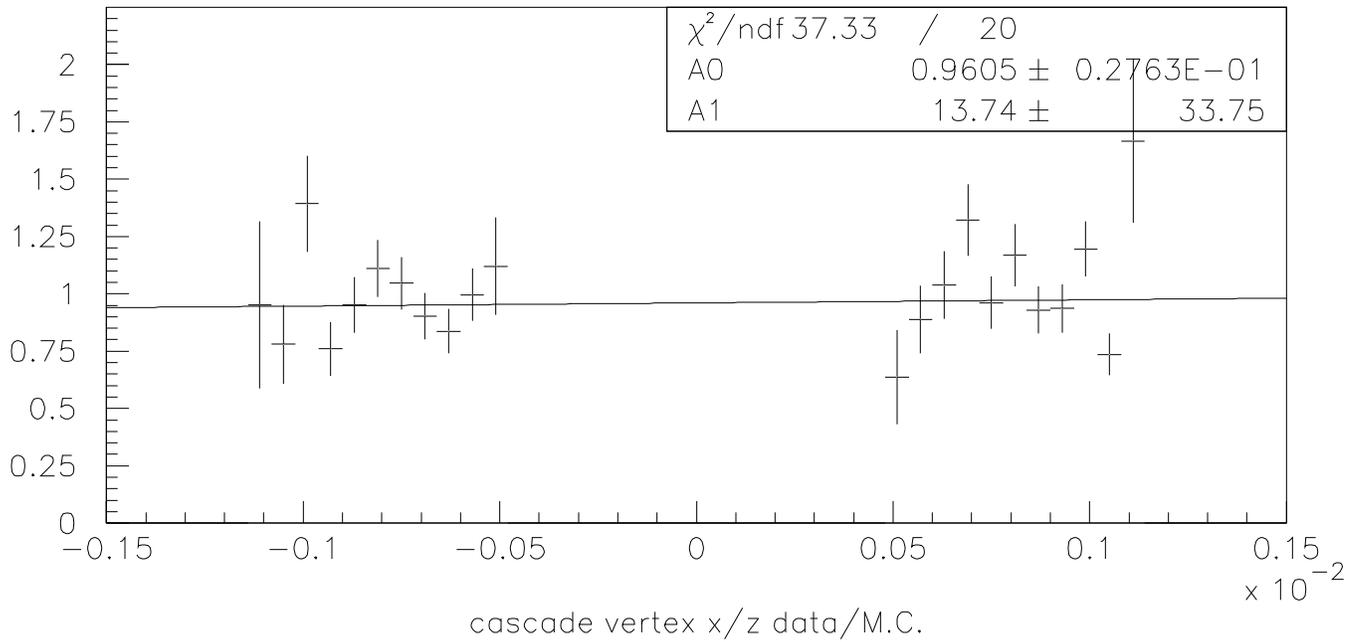
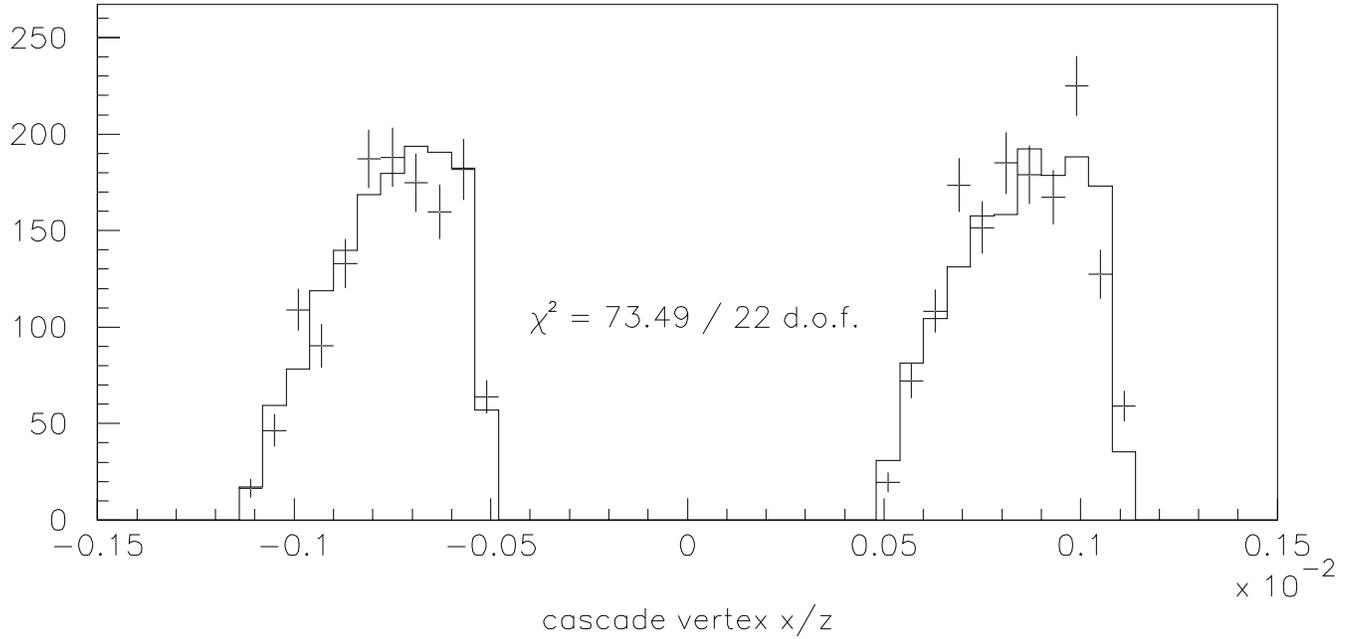
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



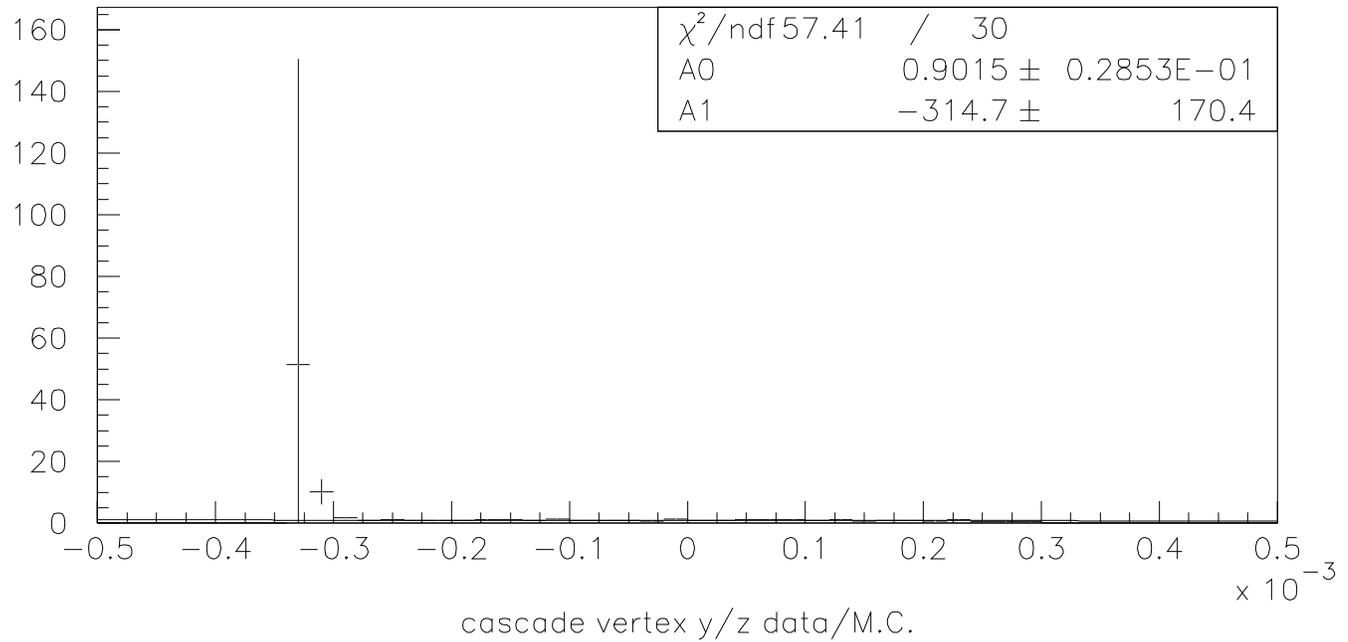
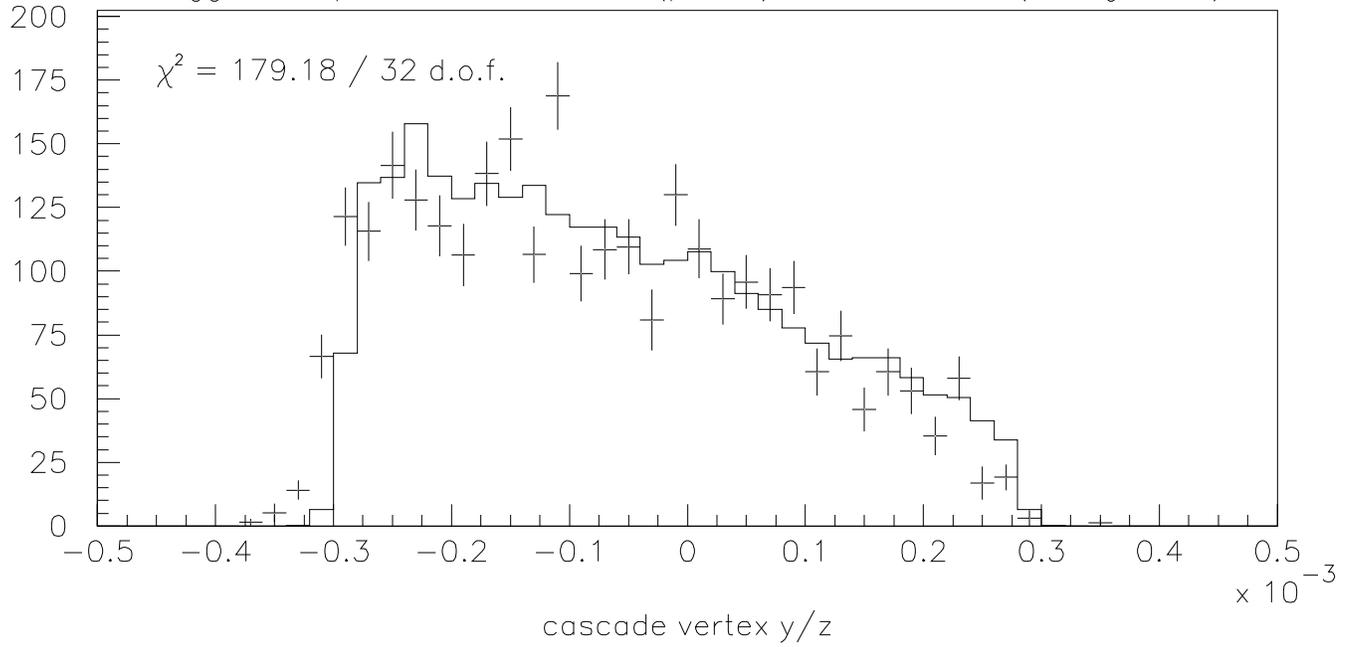
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



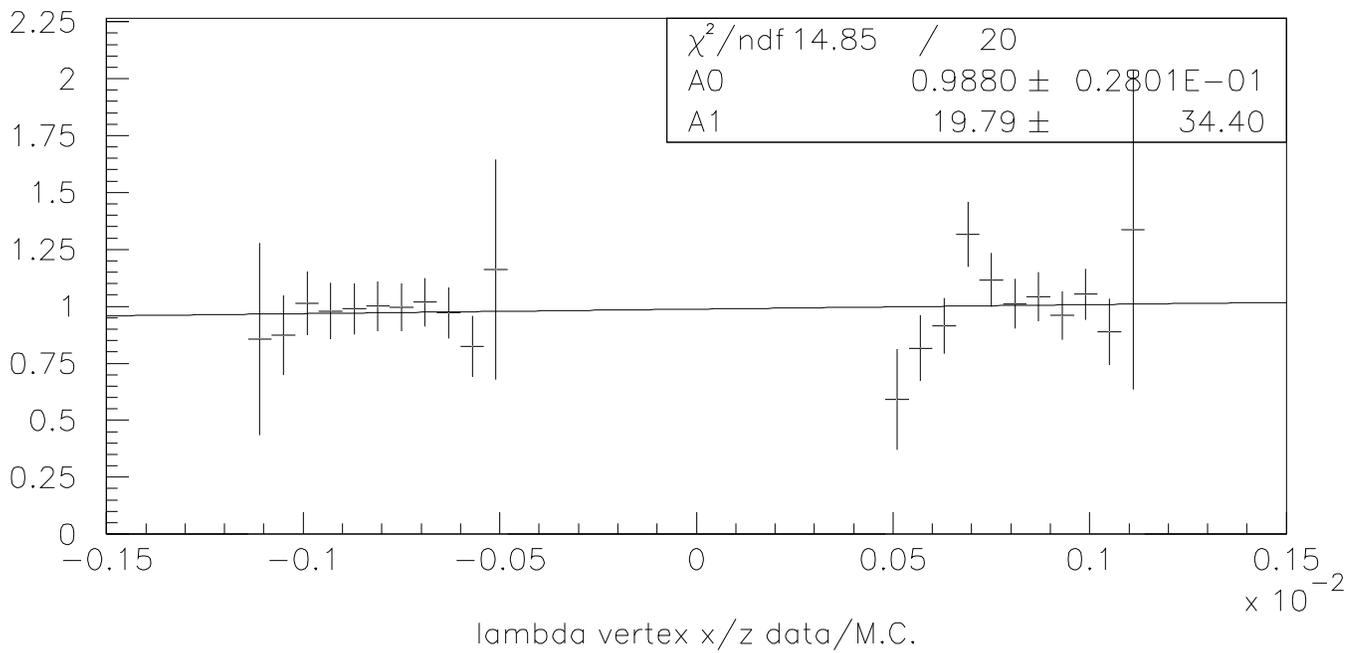
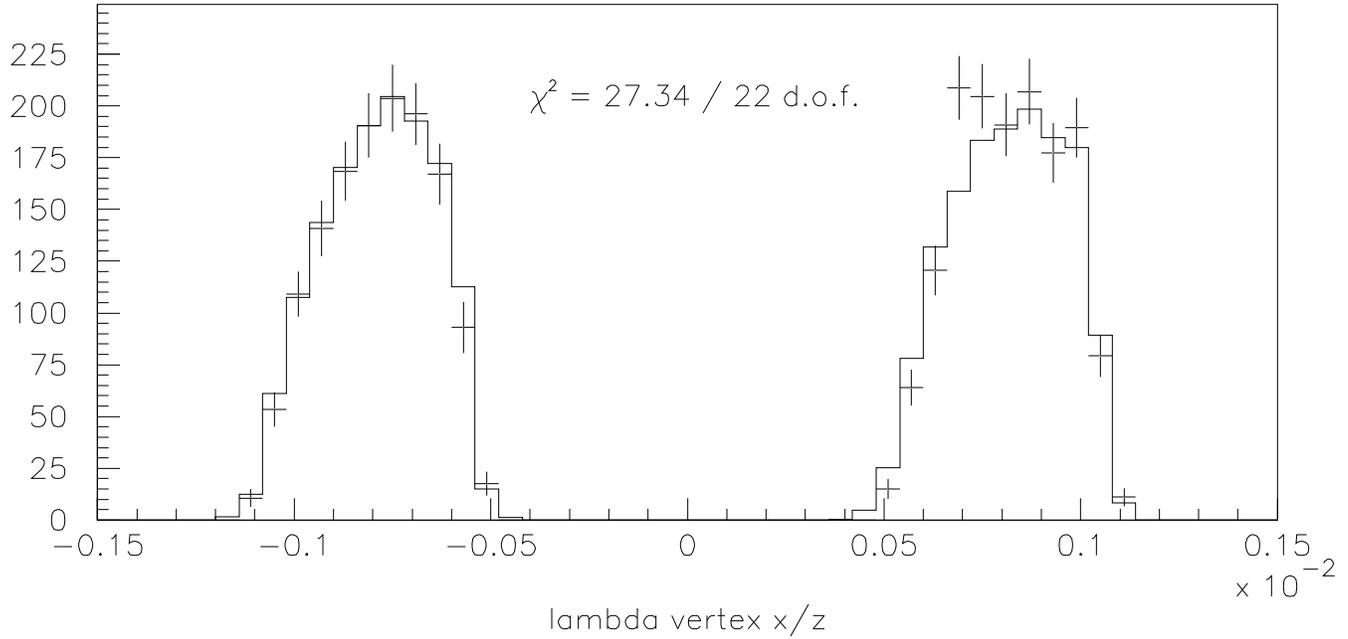
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



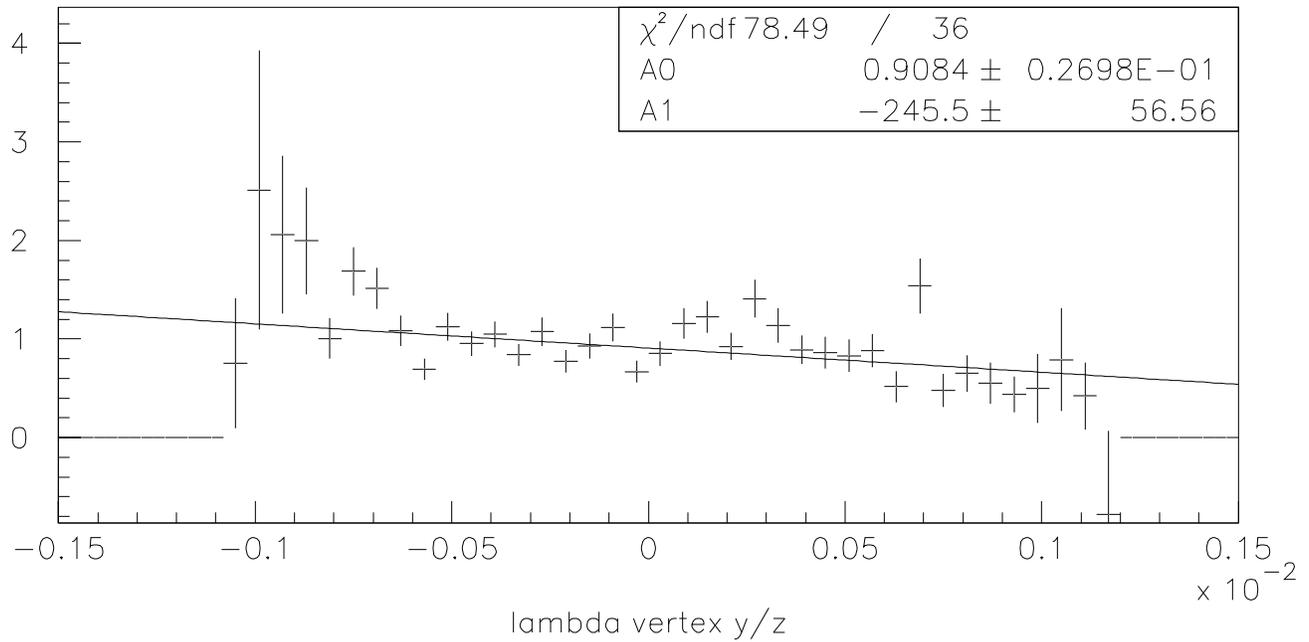
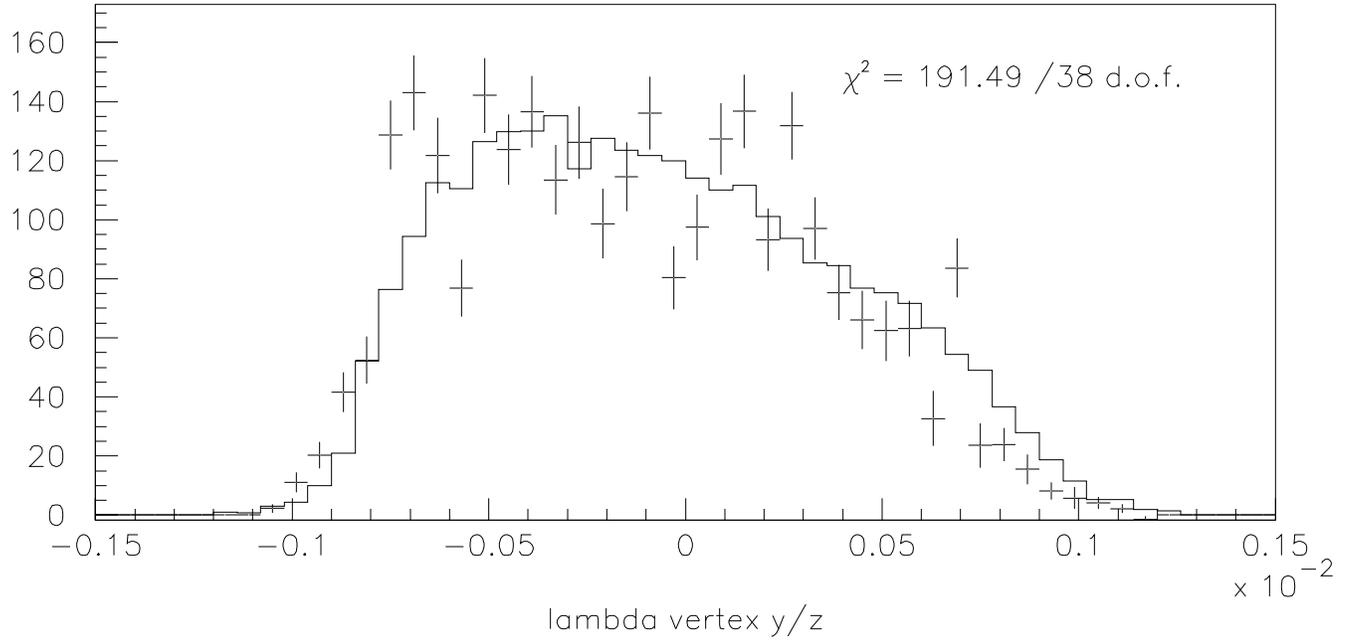
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



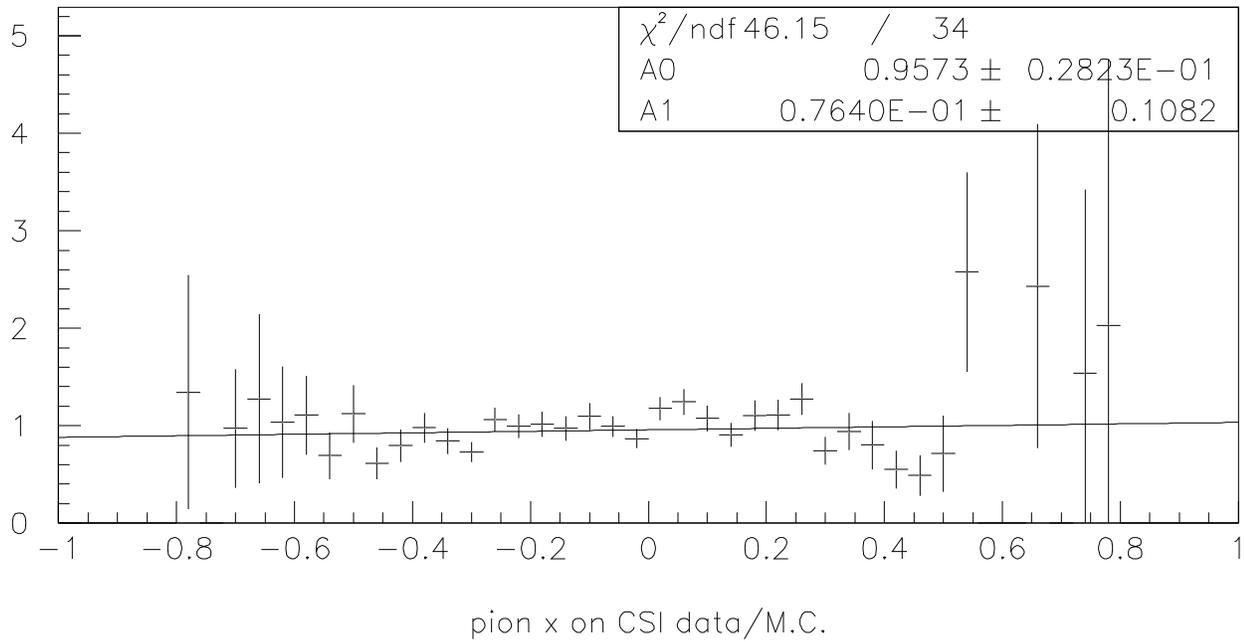
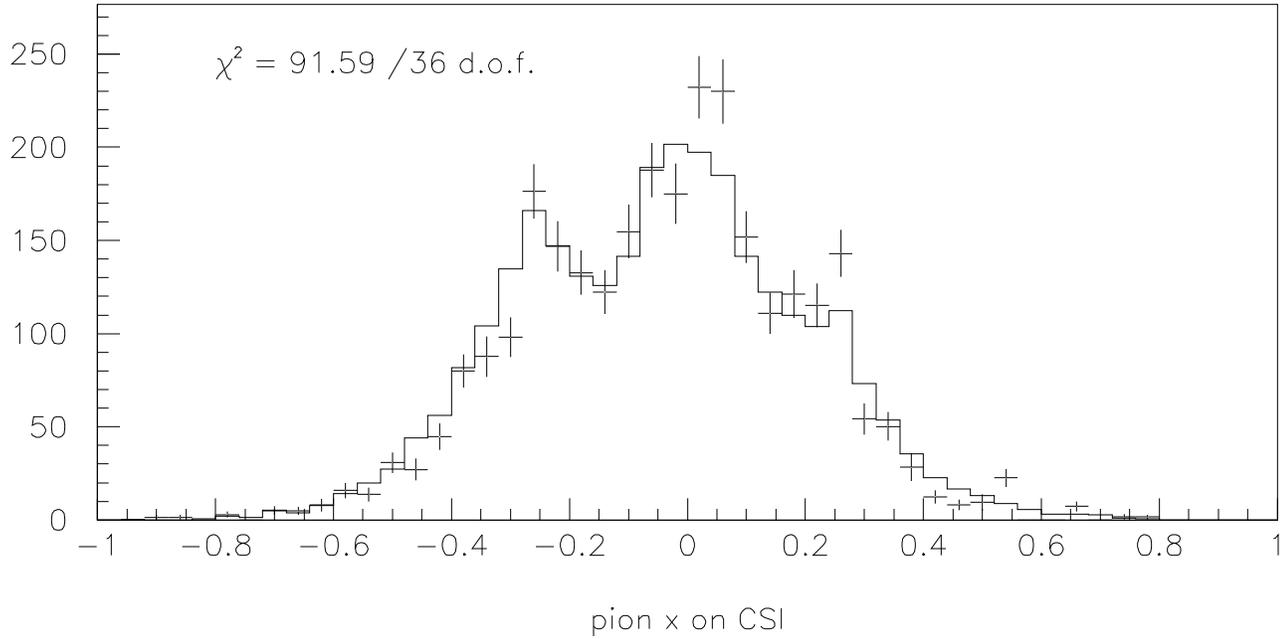
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



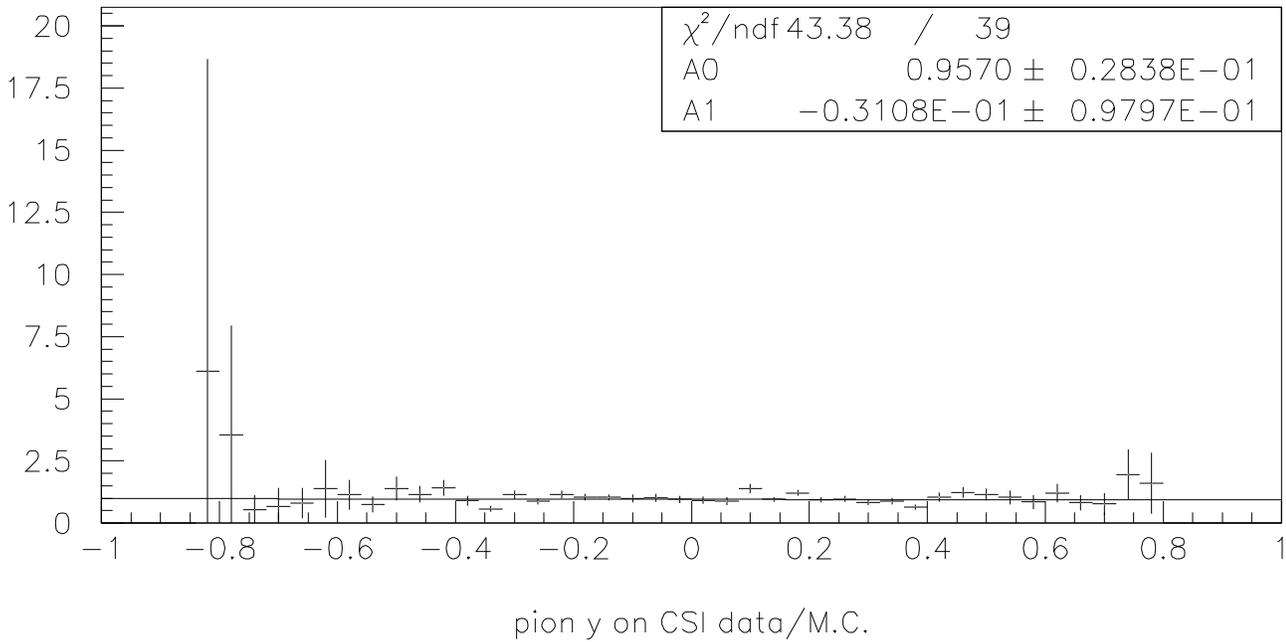
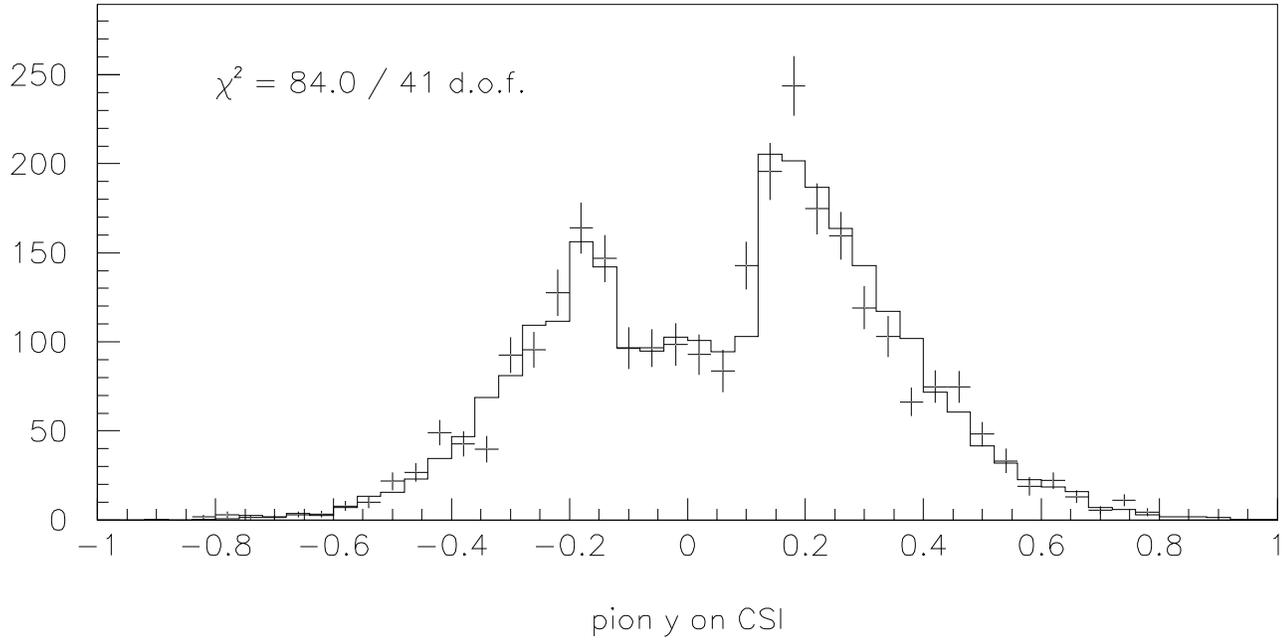
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



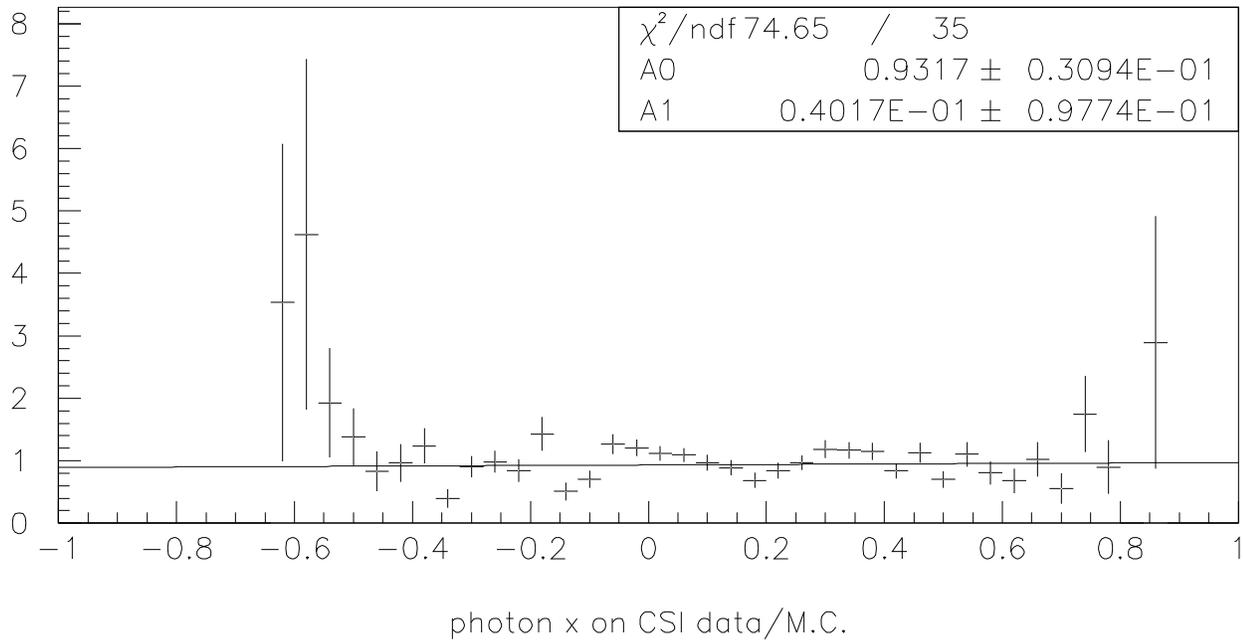
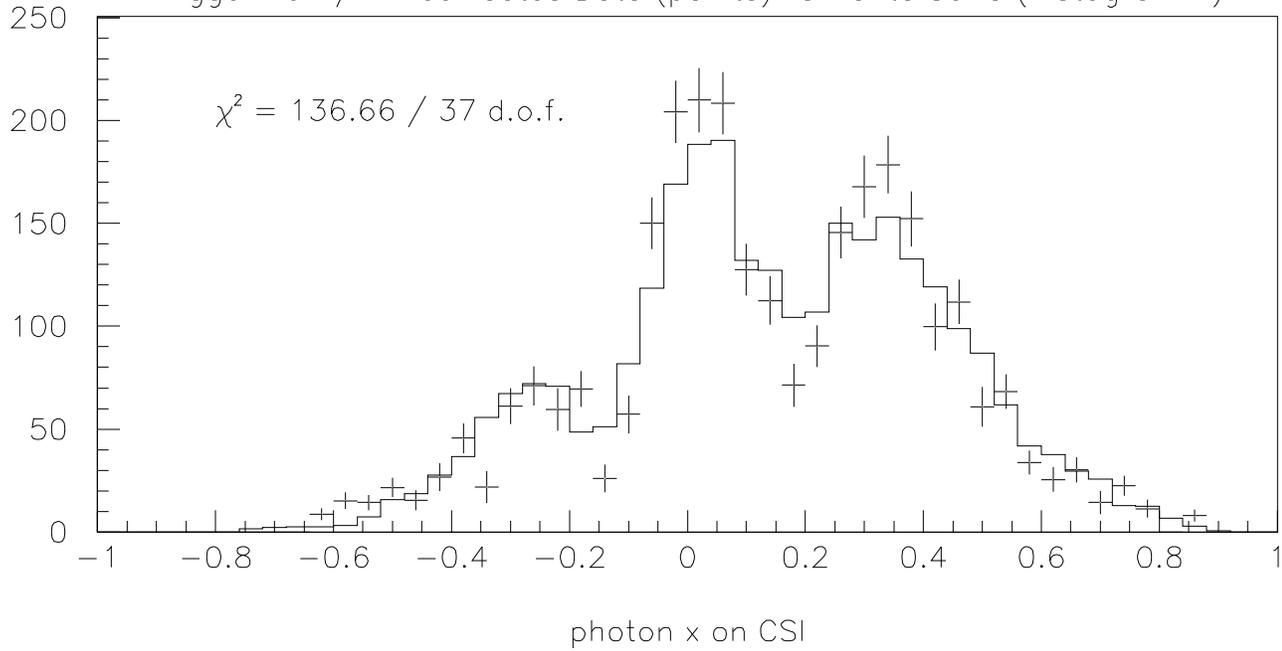
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



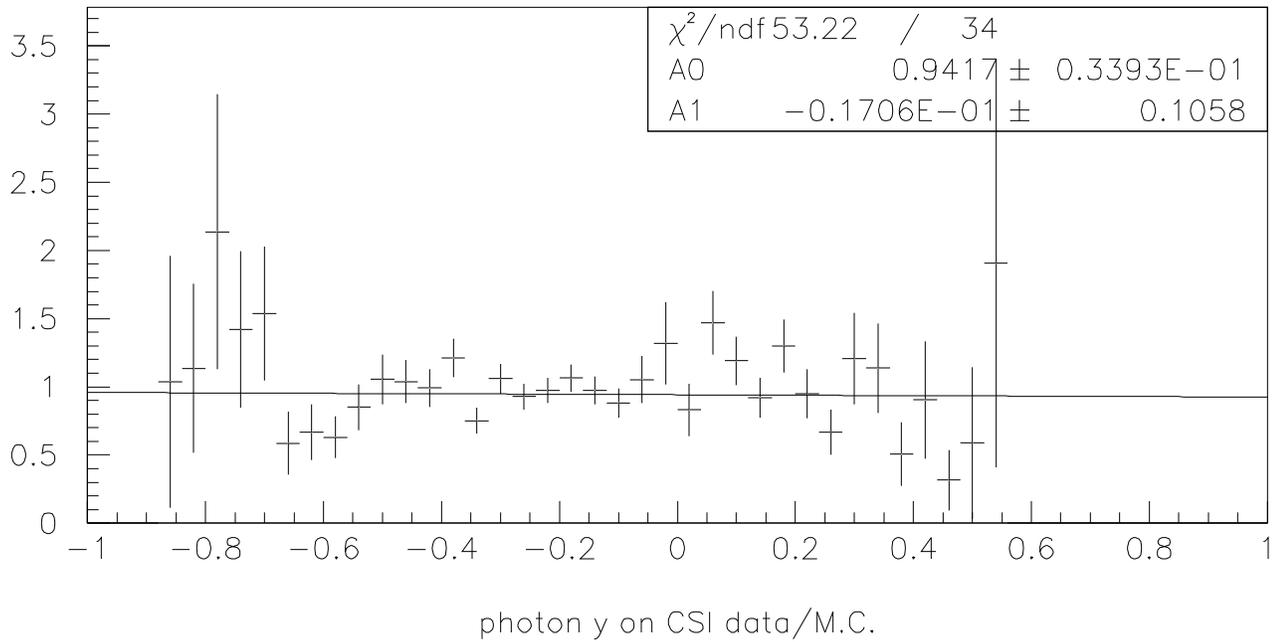
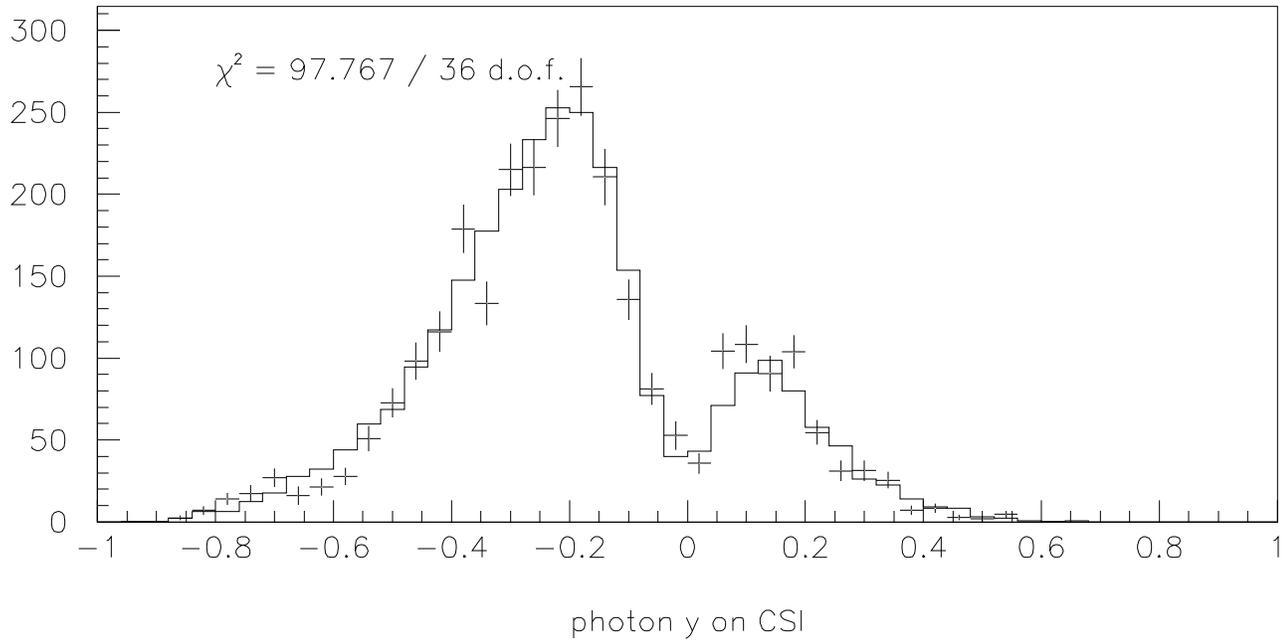
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



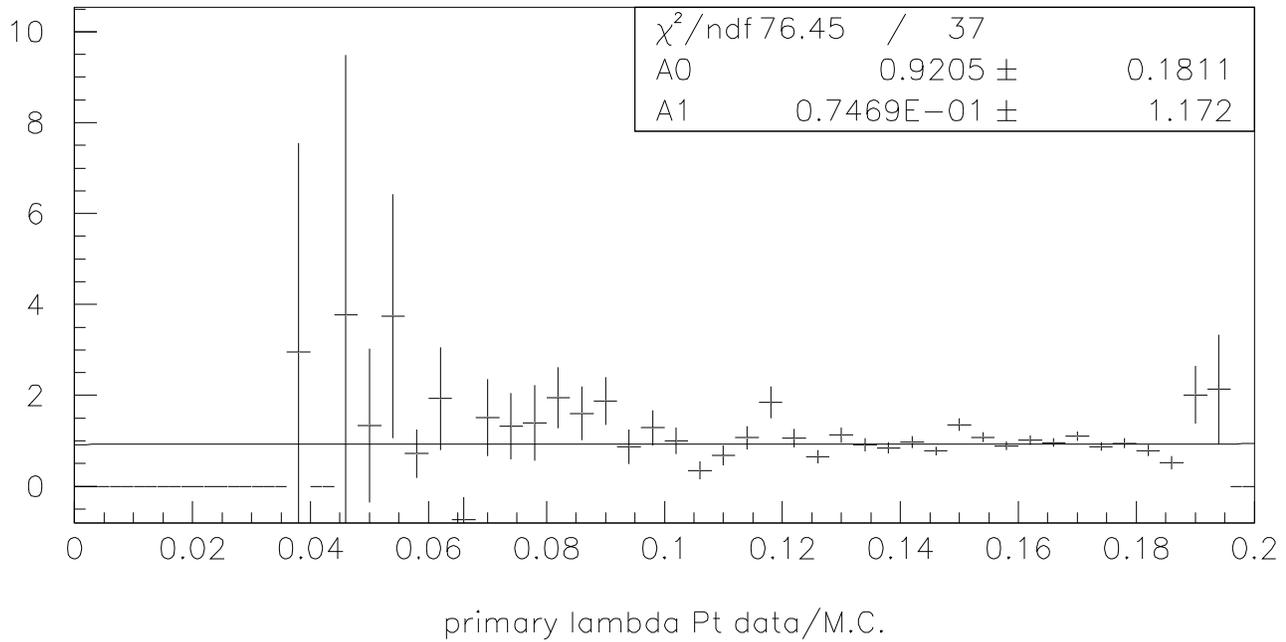
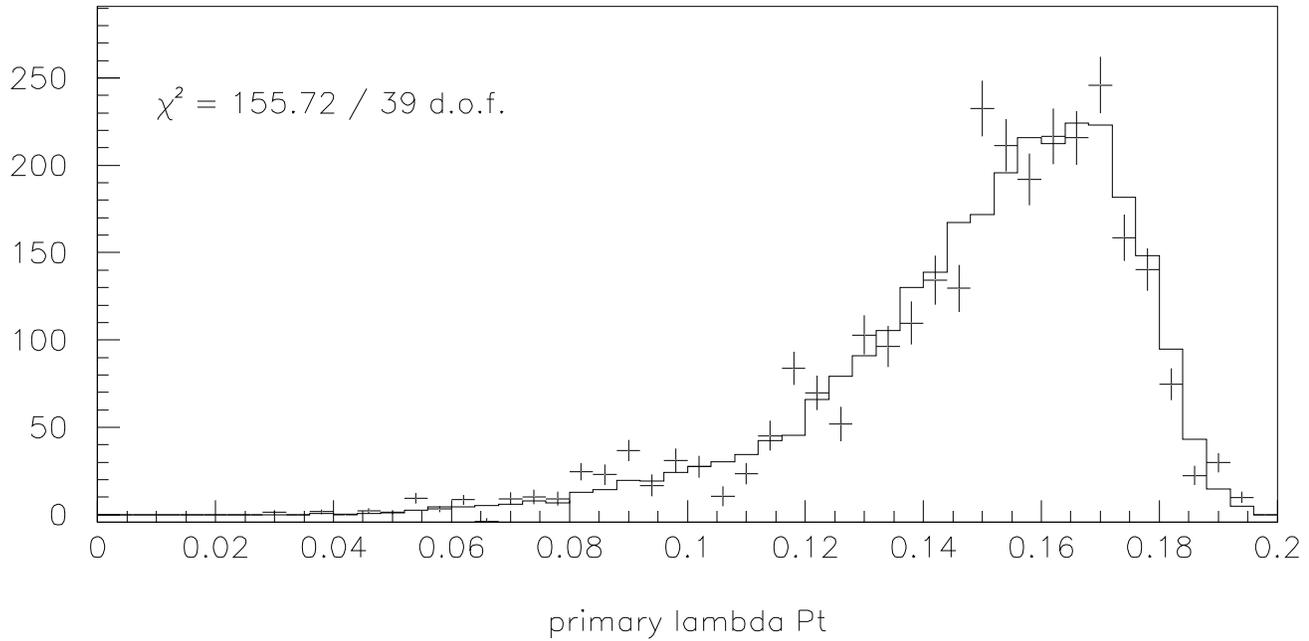
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



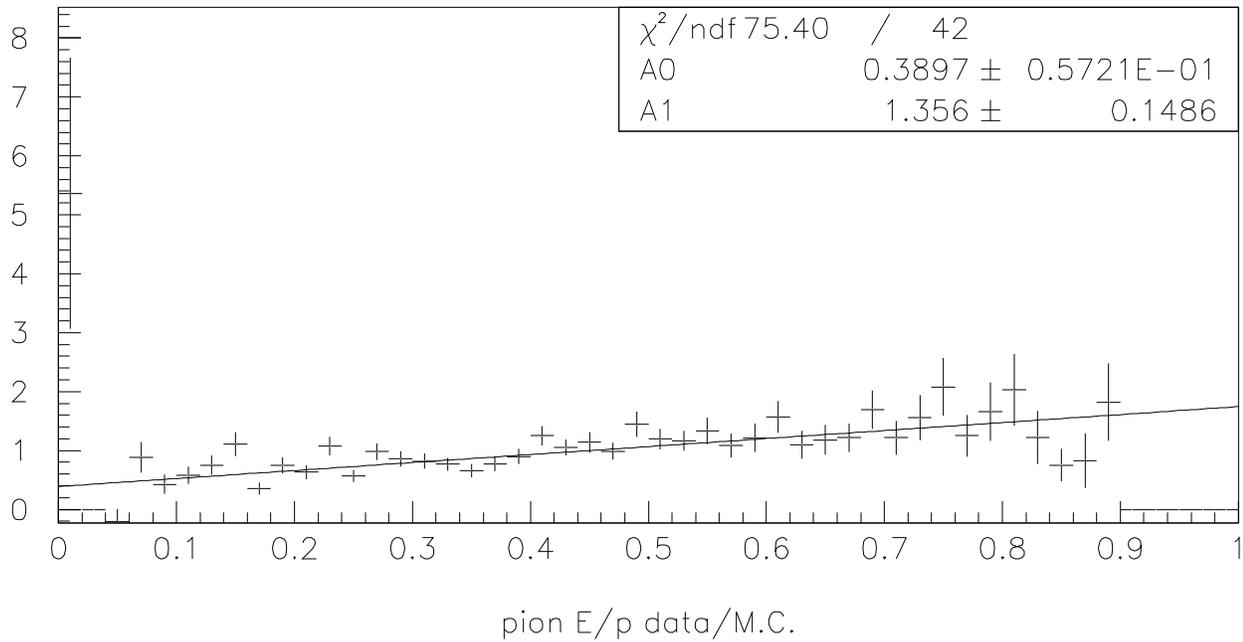
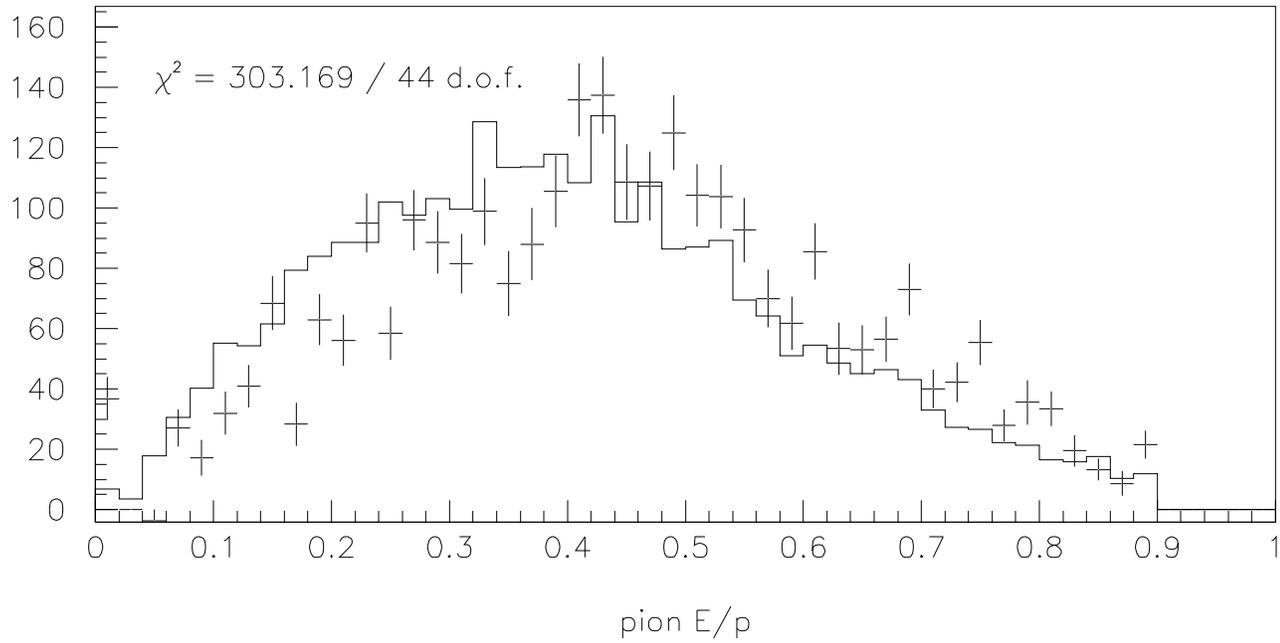
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



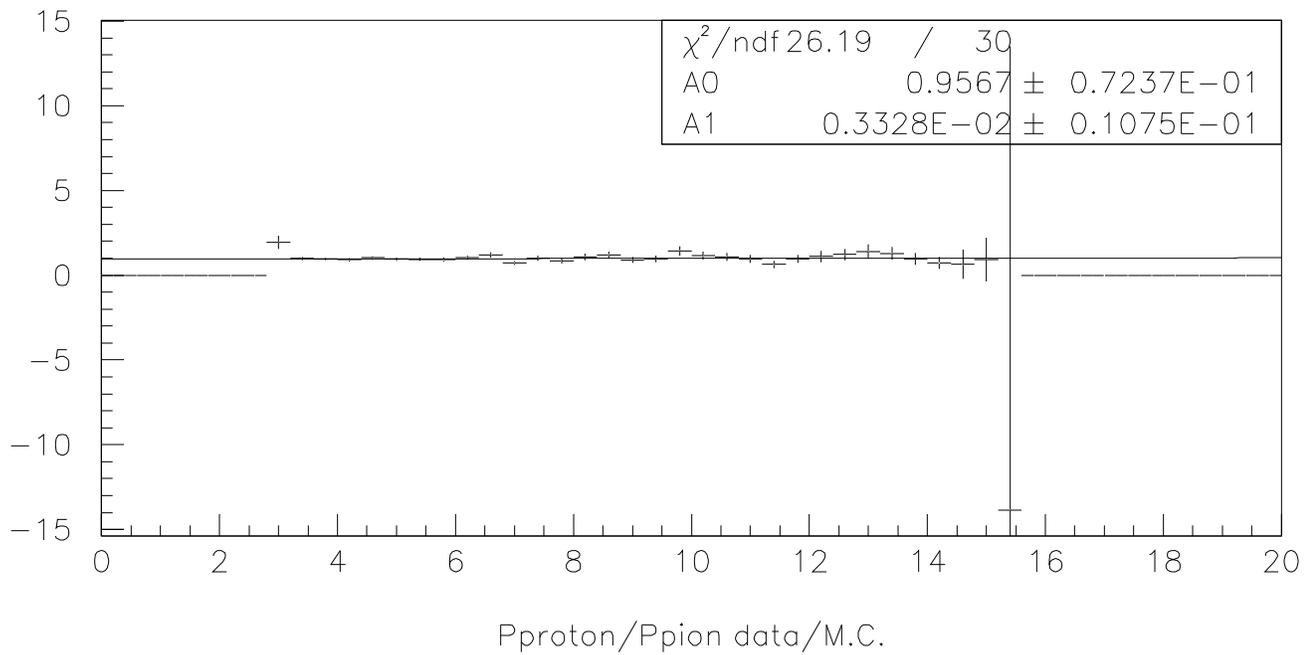
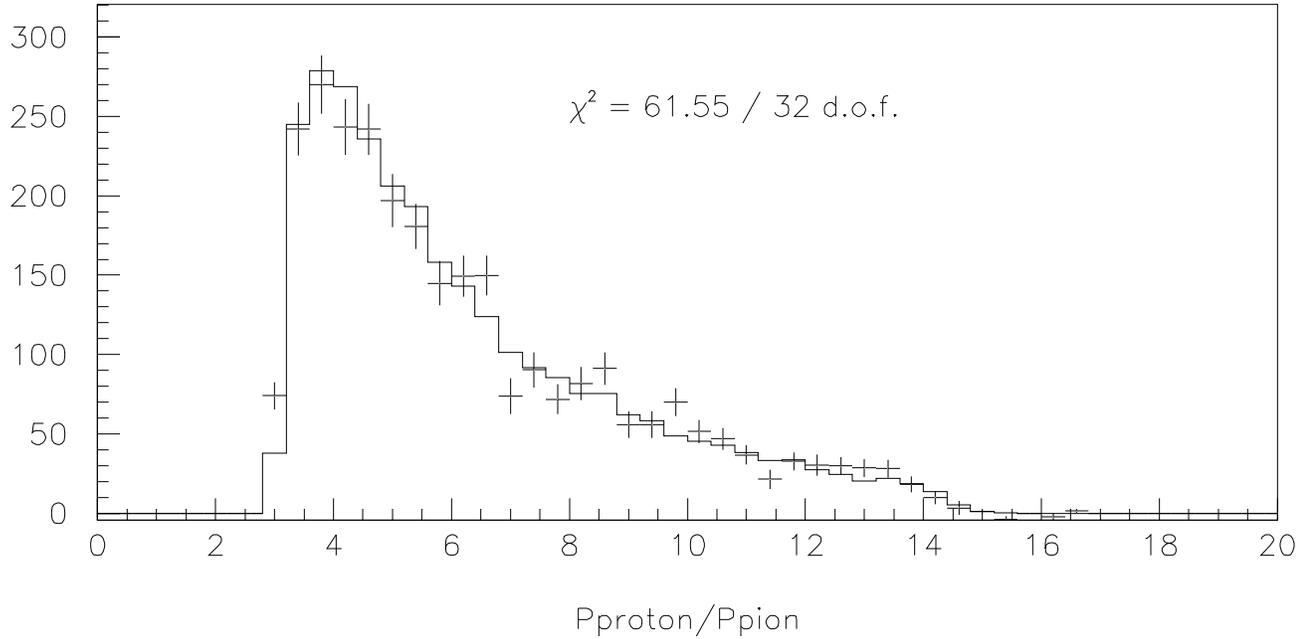
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



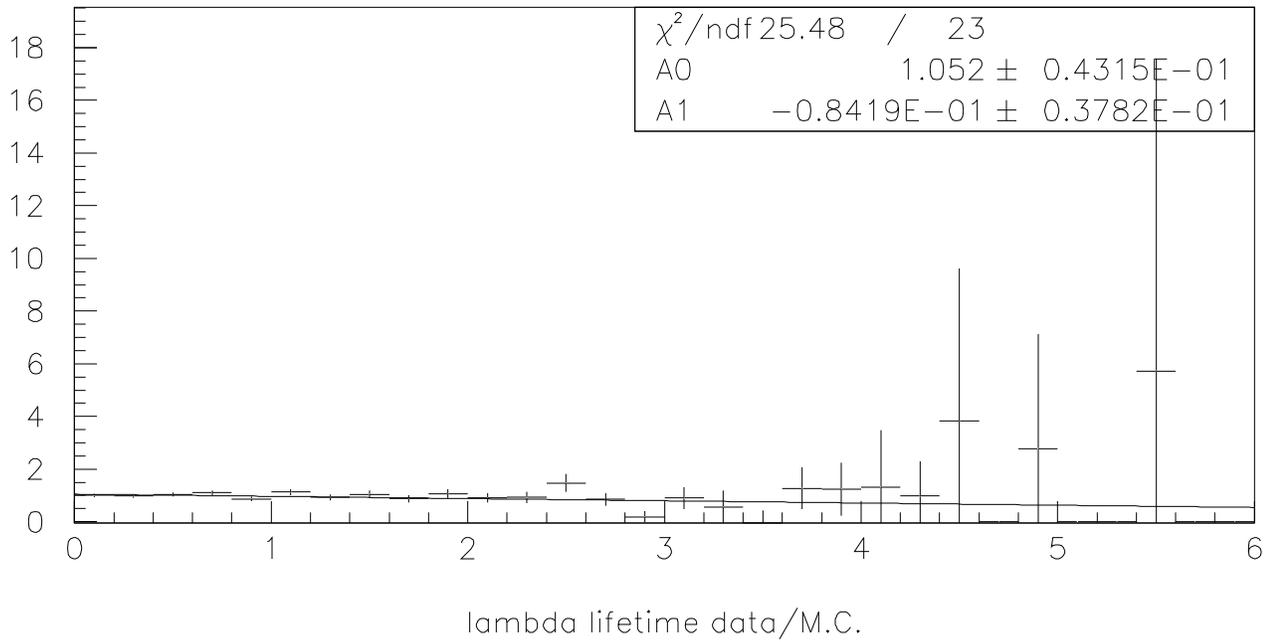
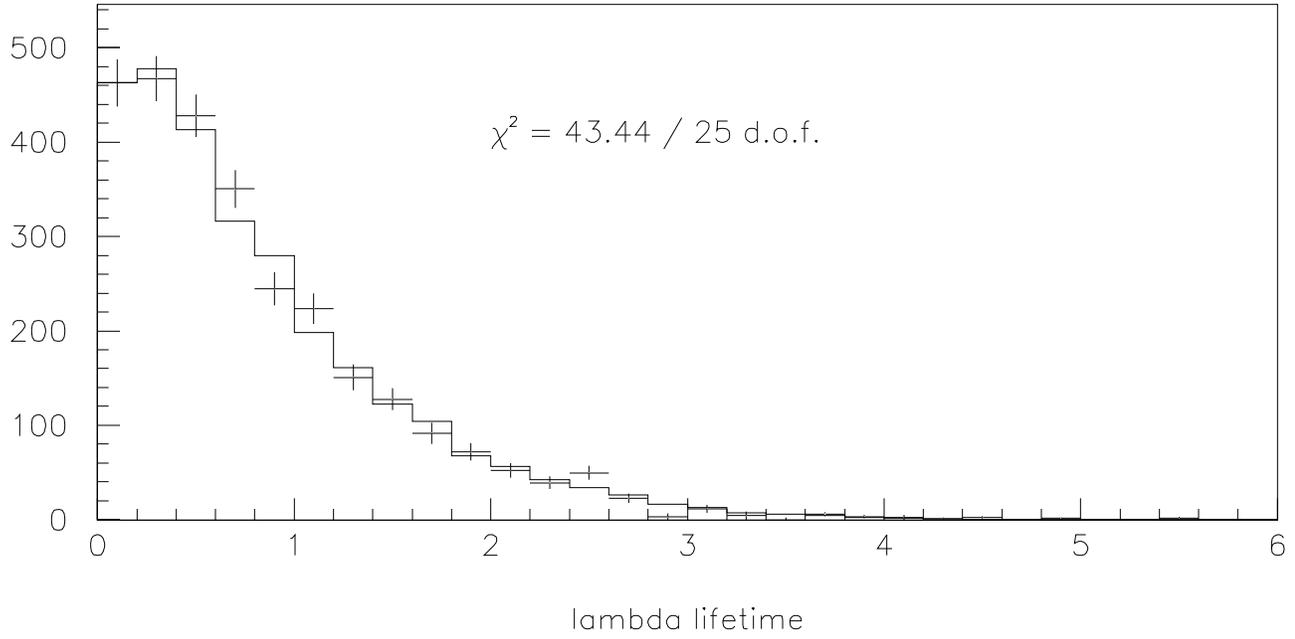
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



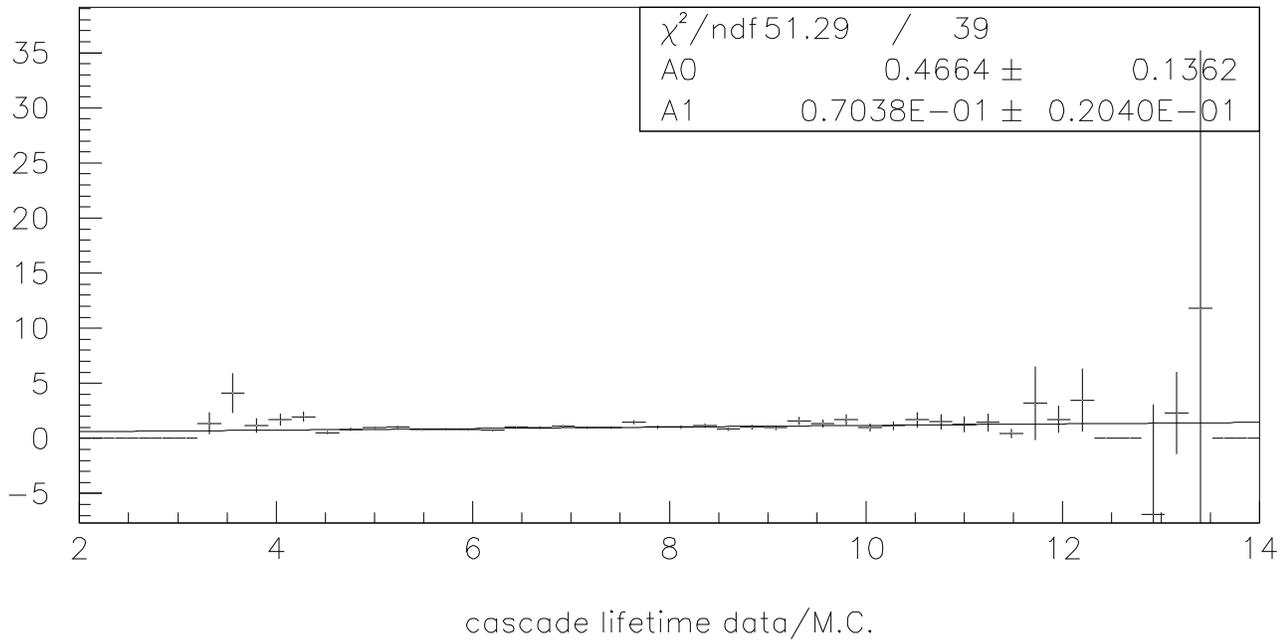
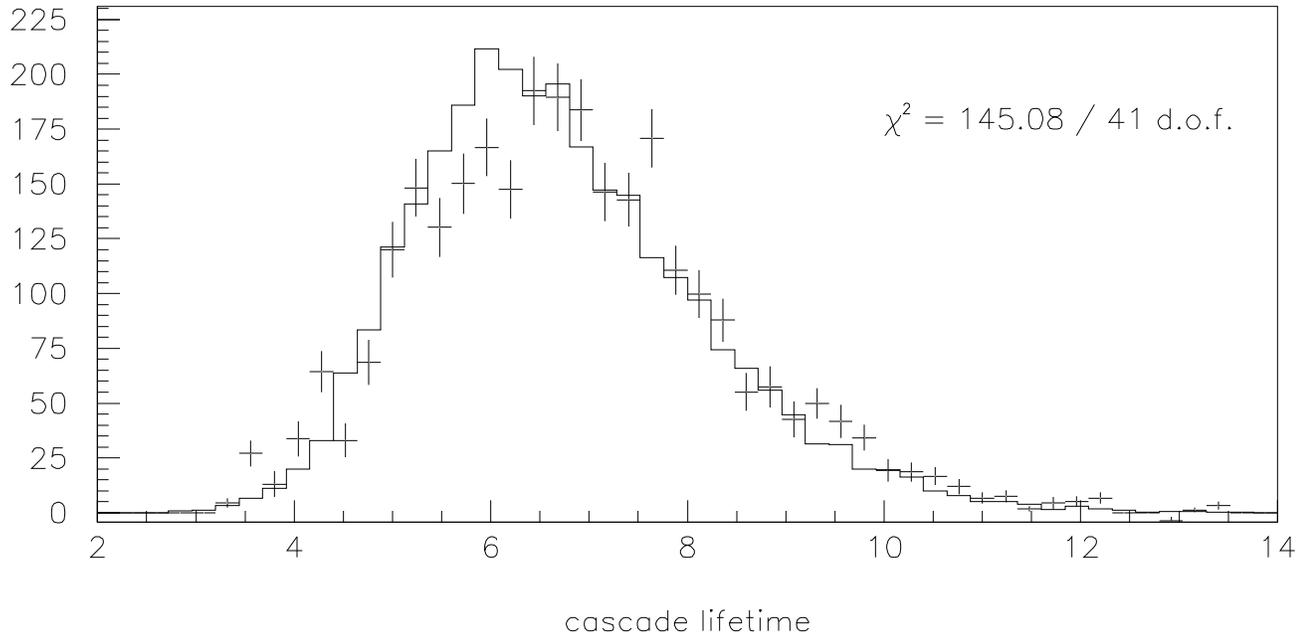
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)



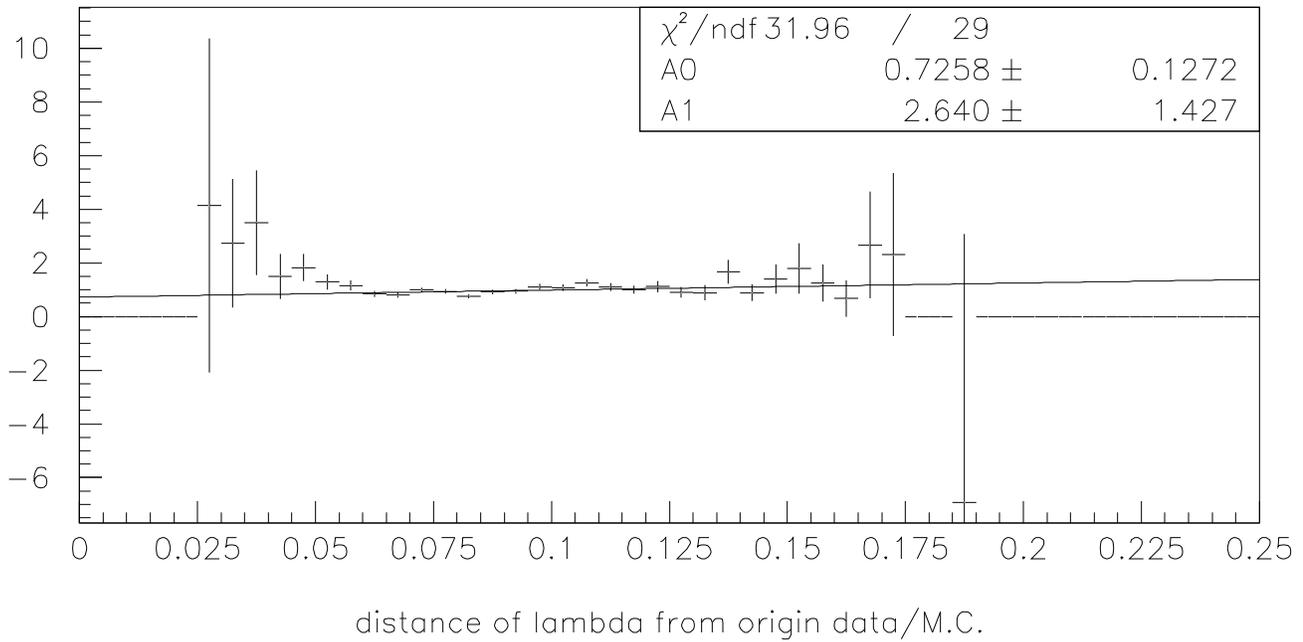
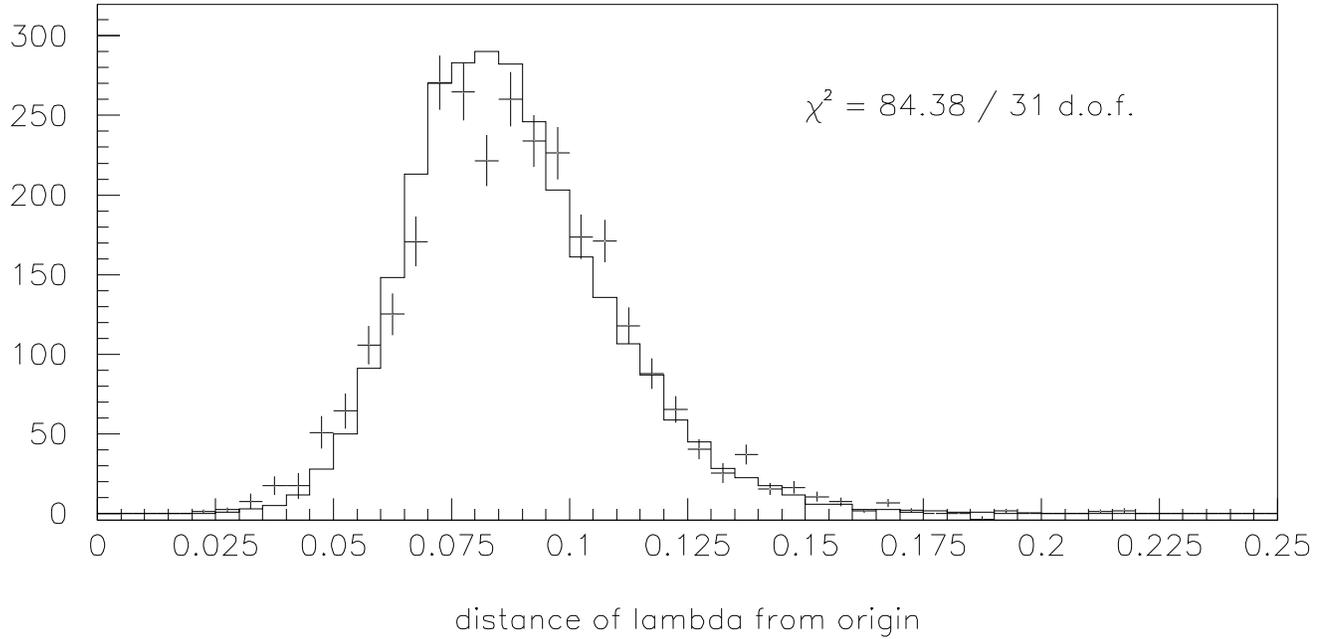
Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)

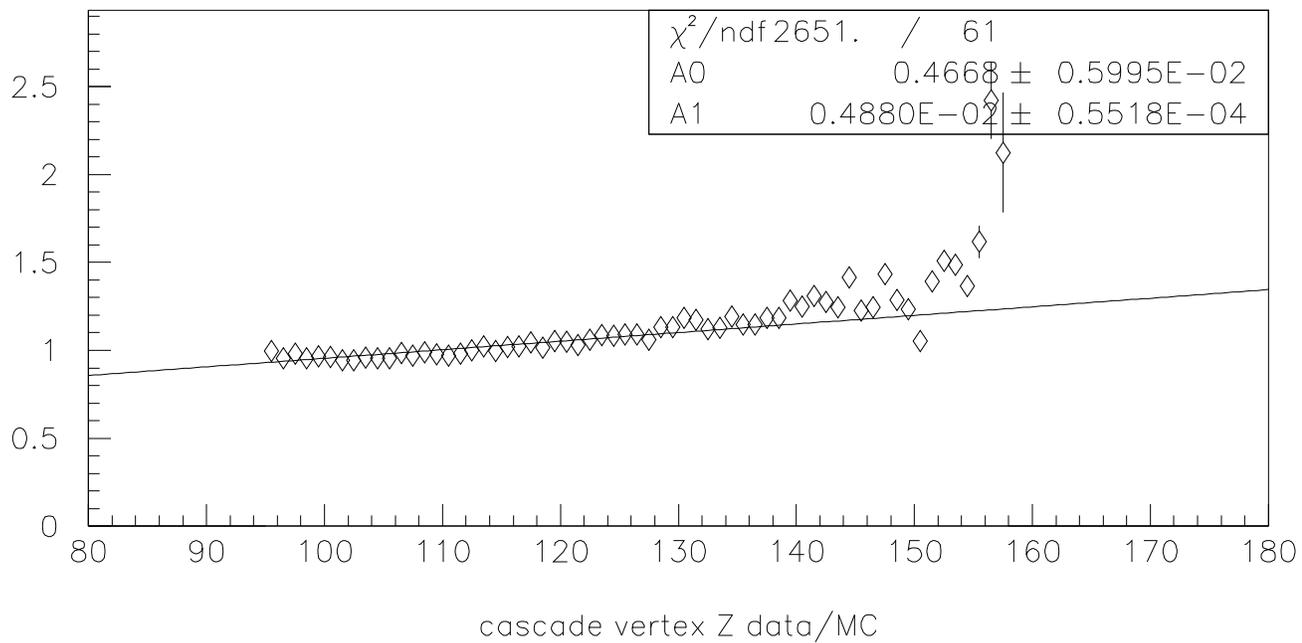
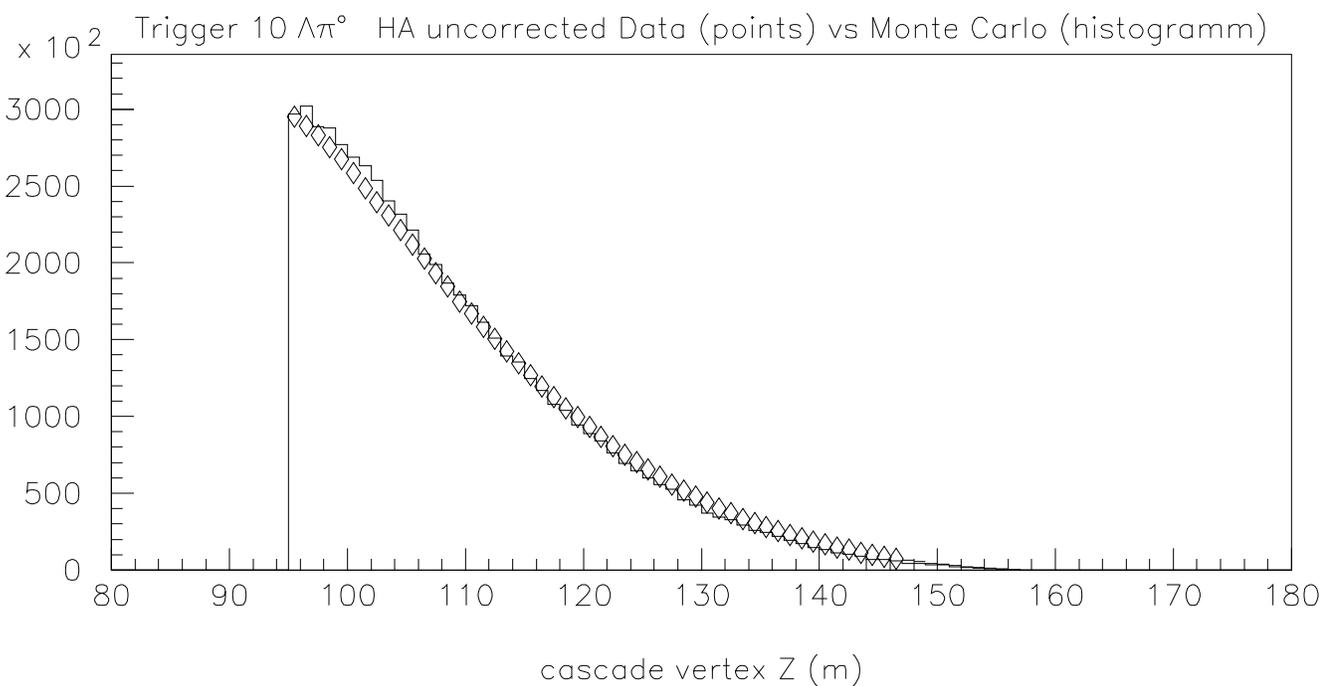


Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)

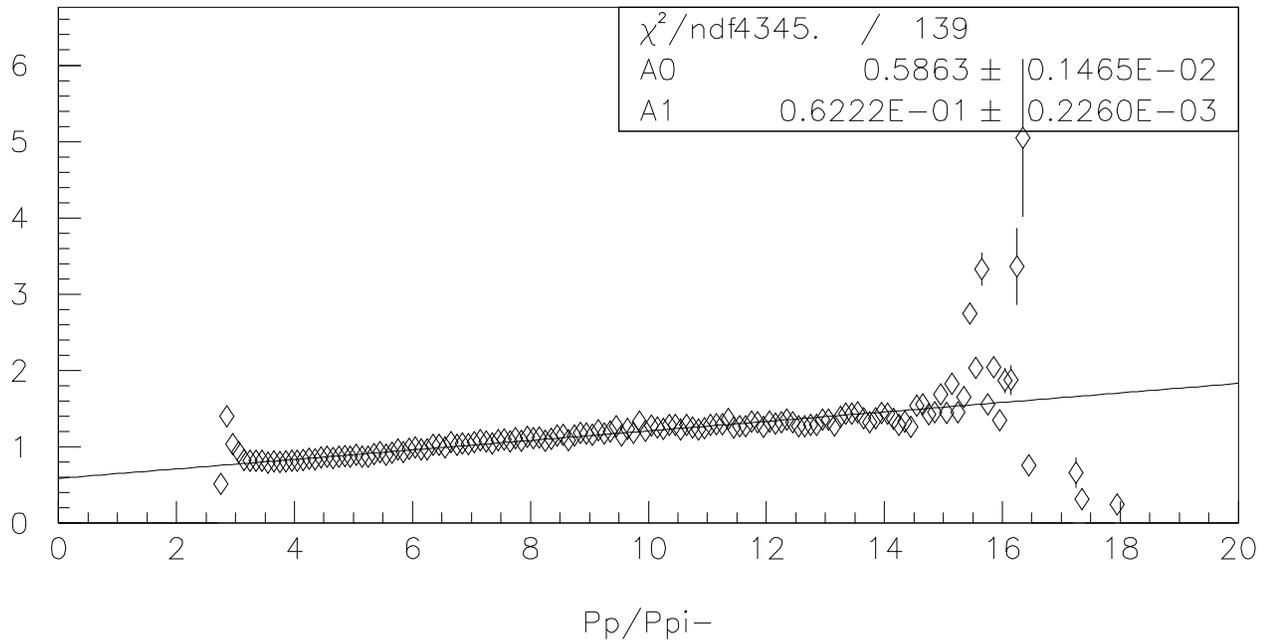
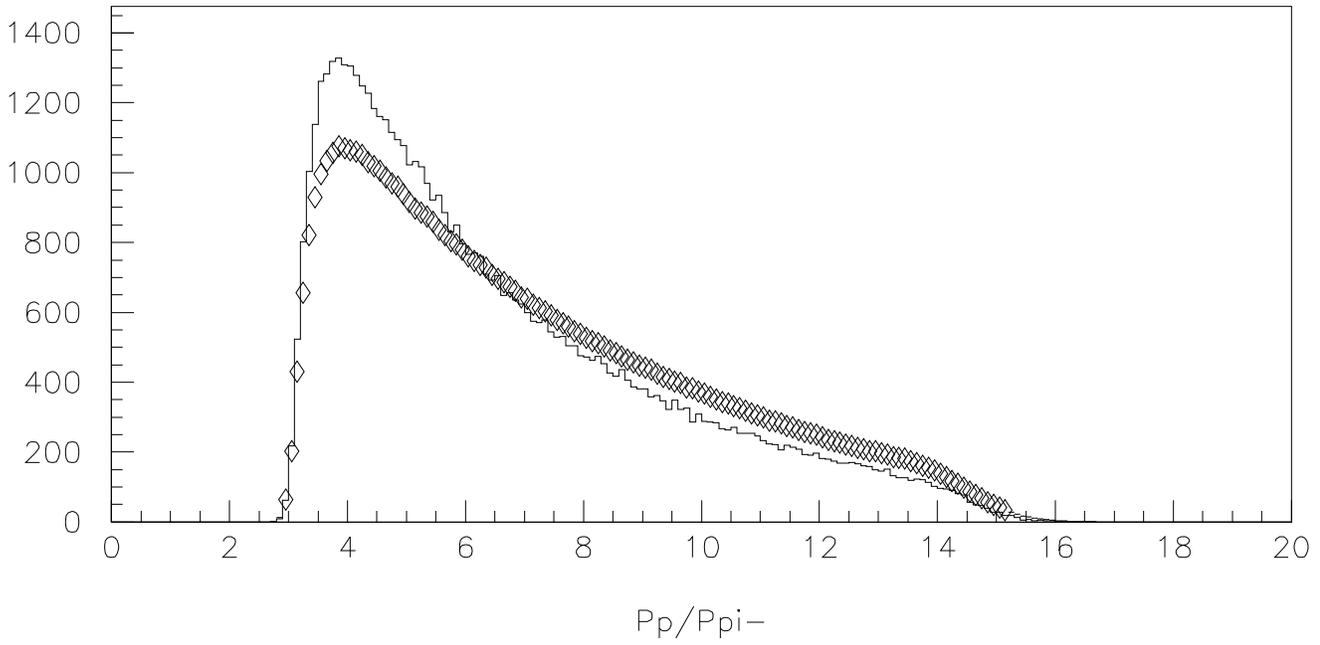


Trigger 10  $\Lambda\gamma$  HA corrected Data (points) vs Monte Carlo (histogramm)

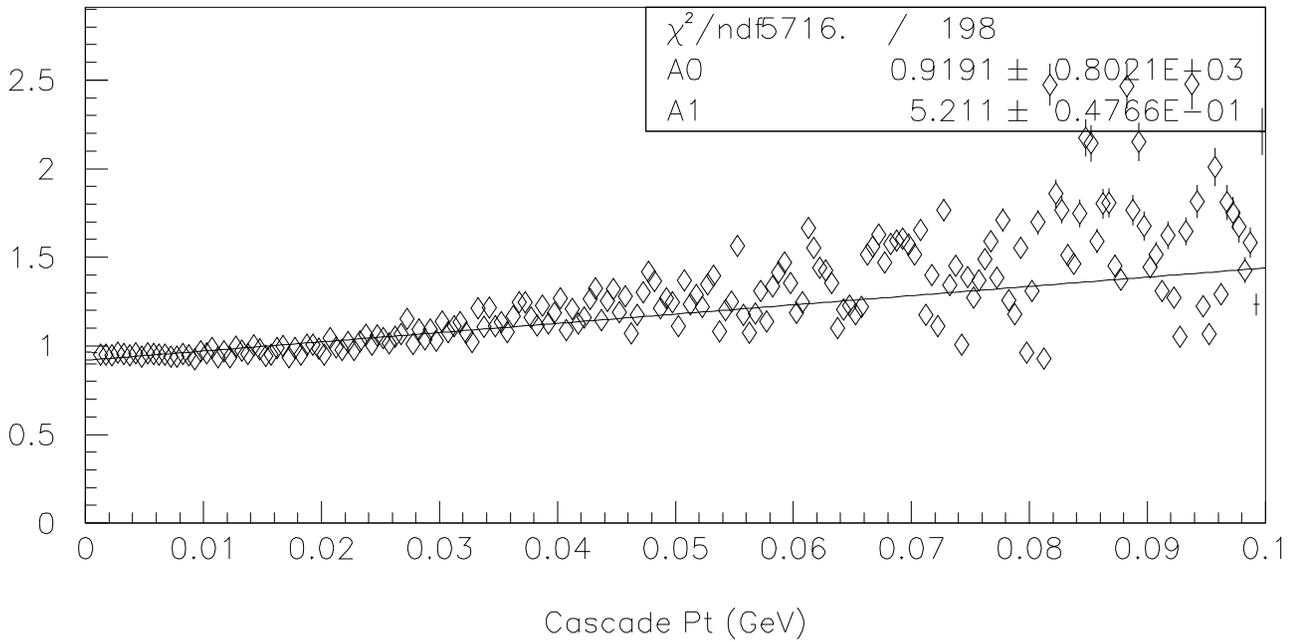
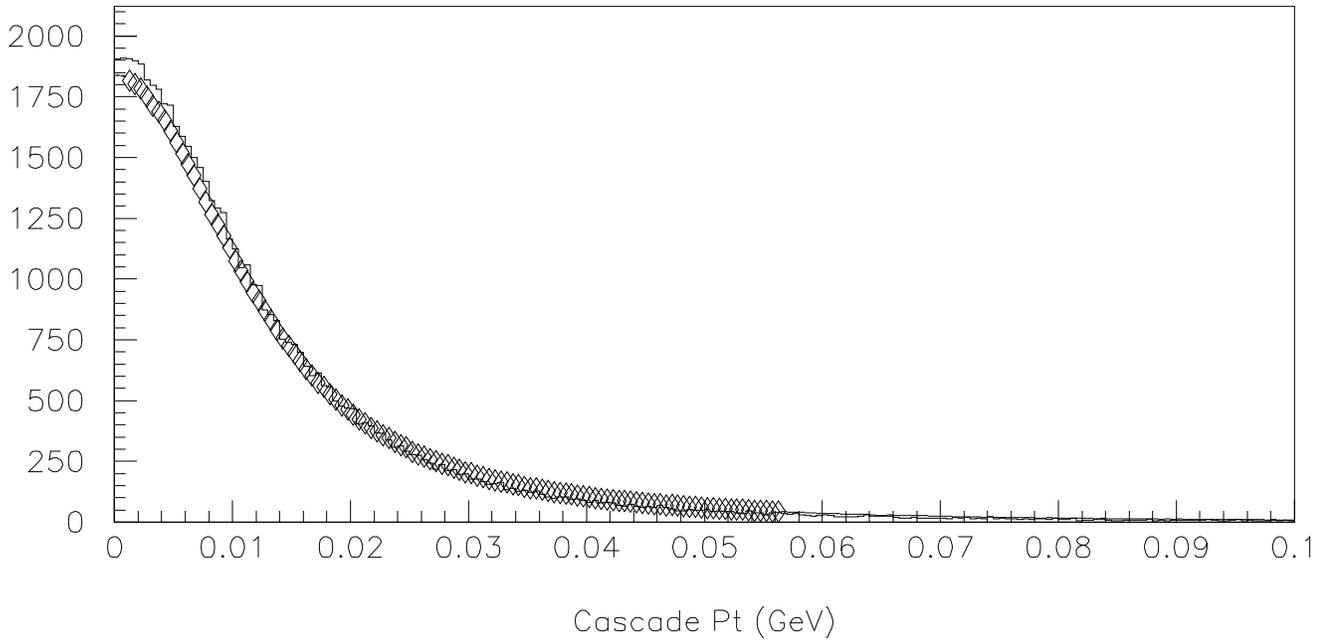


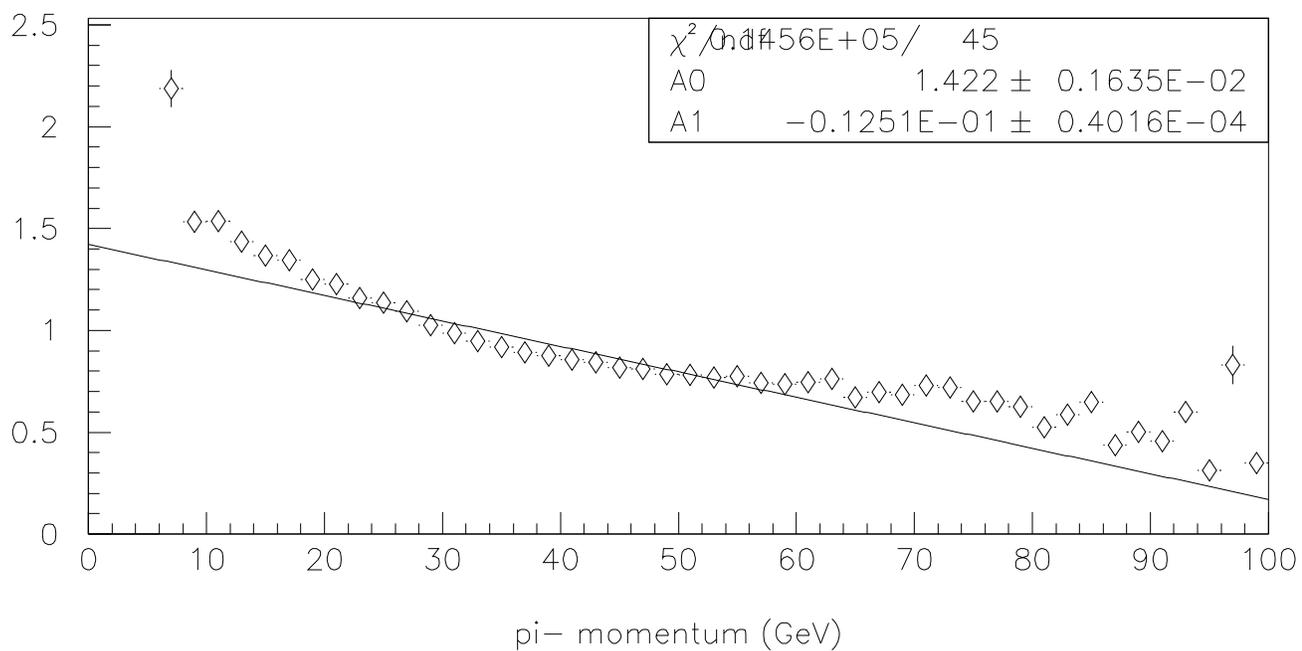
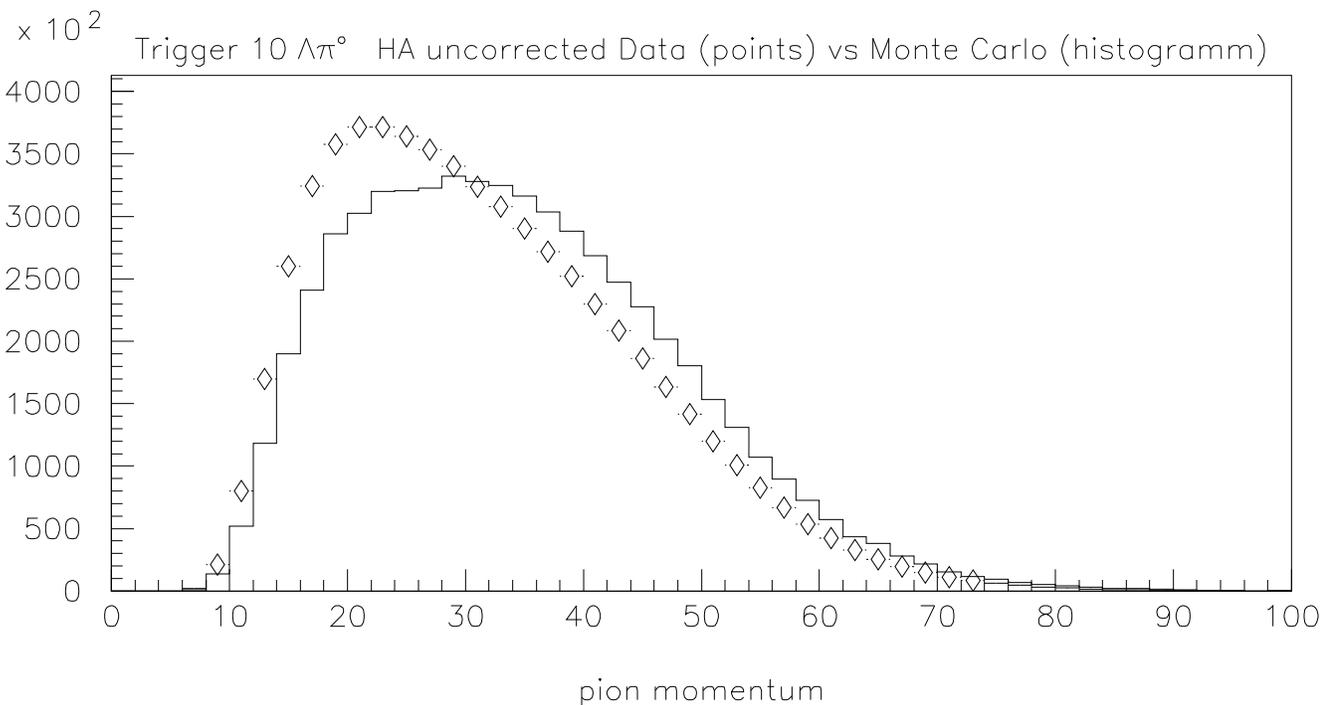


$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA uncorrected Data (points) vs Monte Carlo (histogramm)

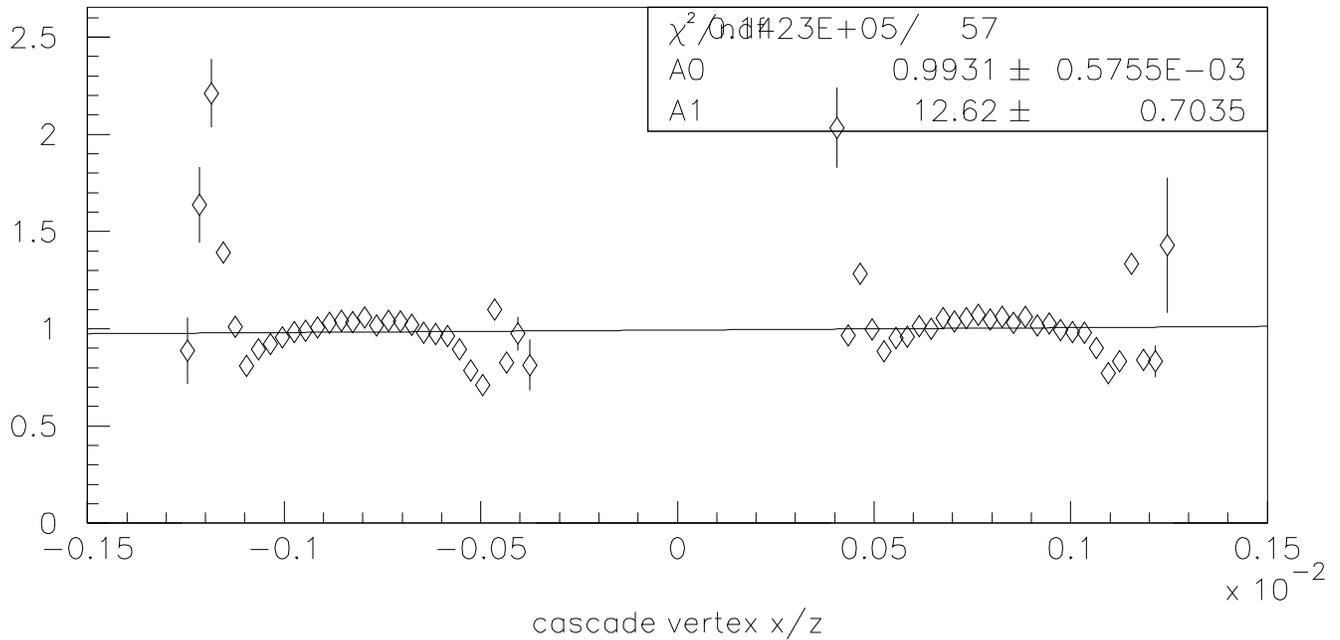
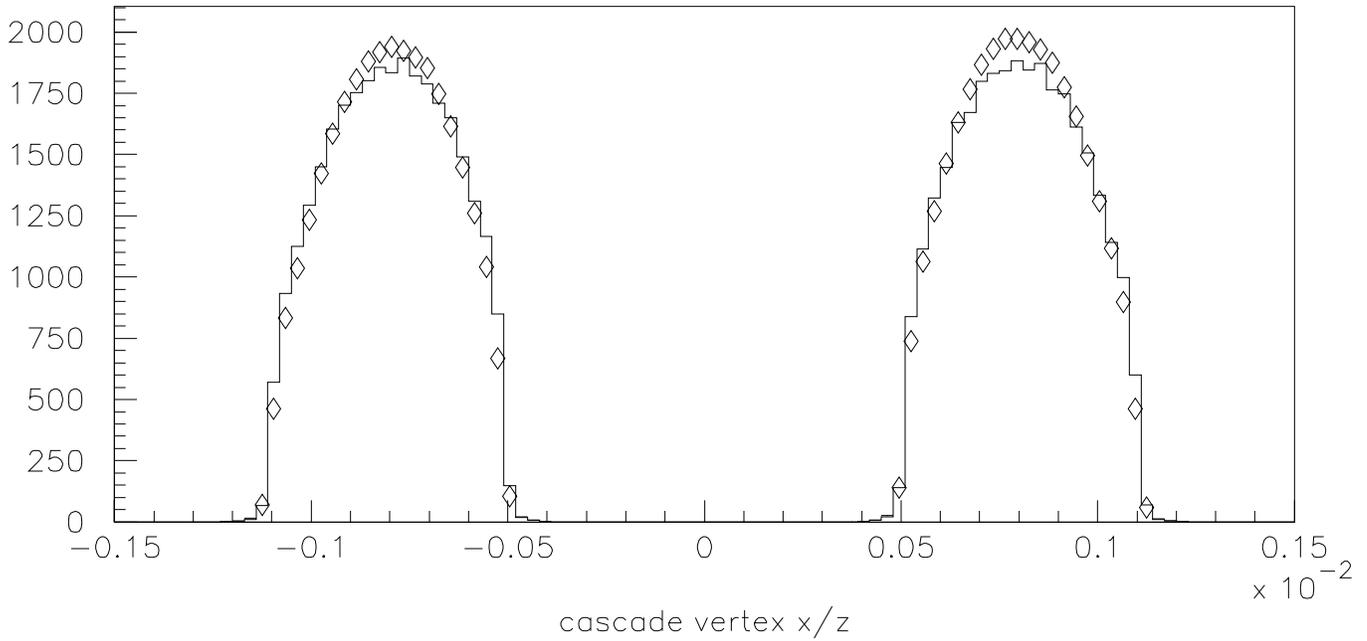


$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA uncorrected Data (points) vs Monte Carlo (histogramm)

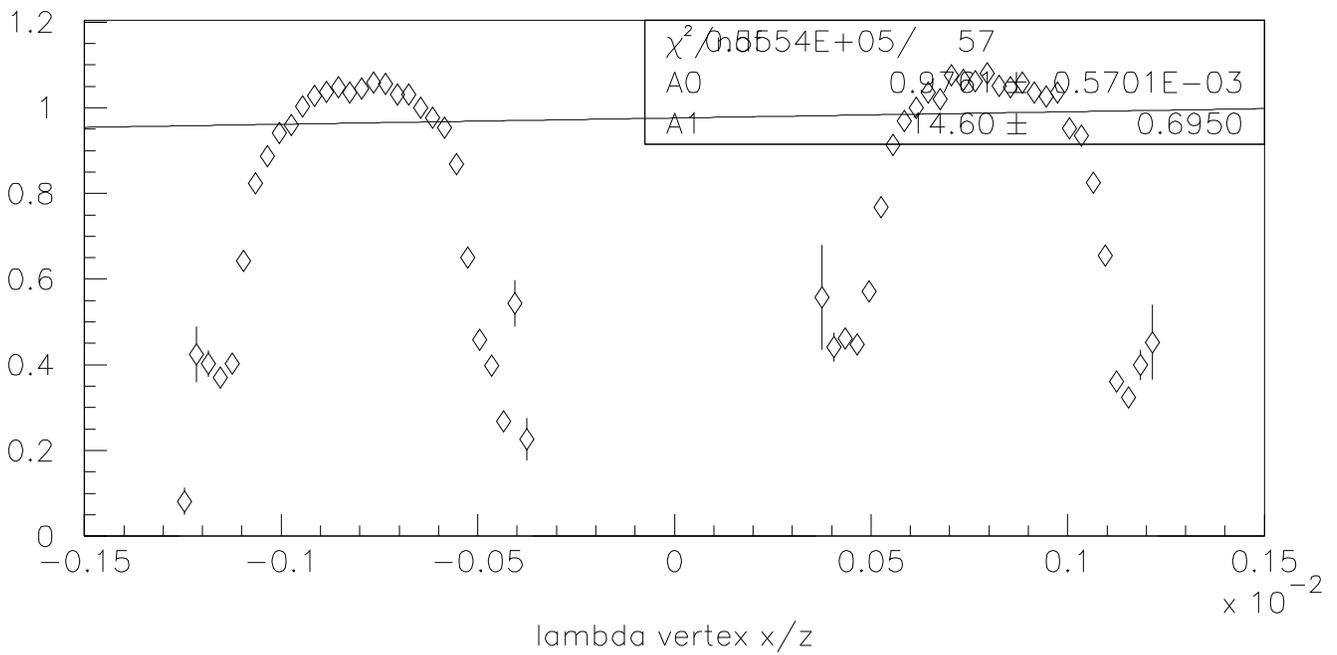
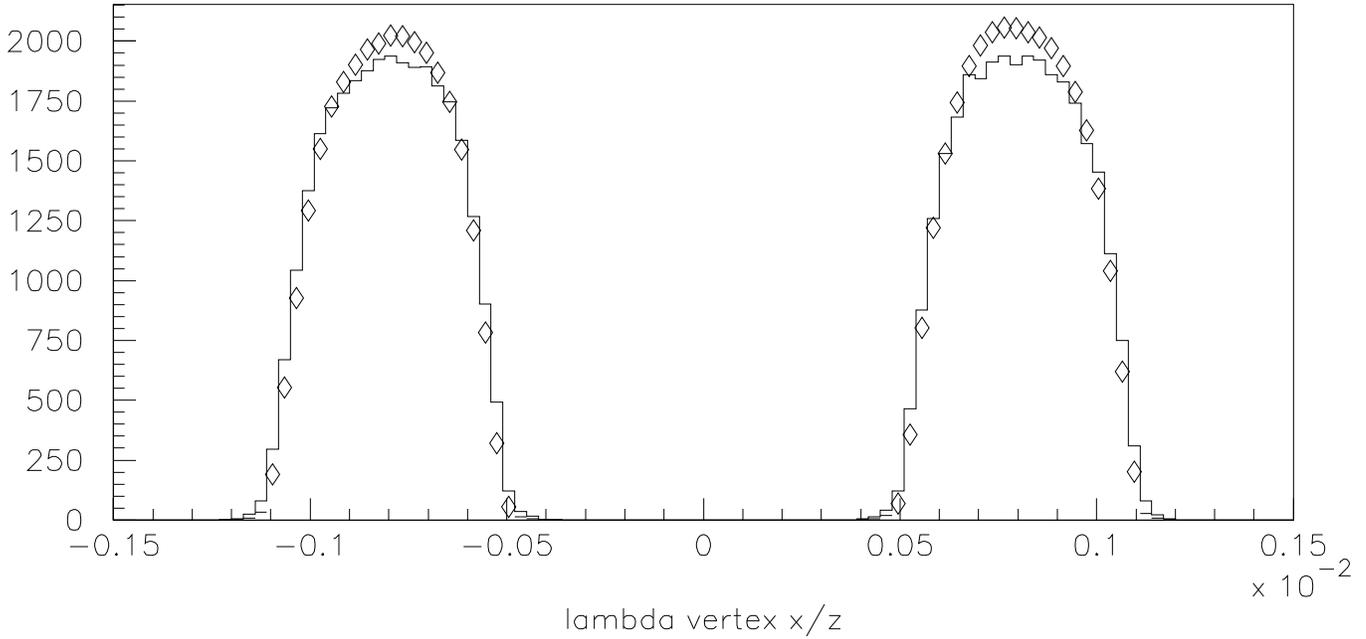


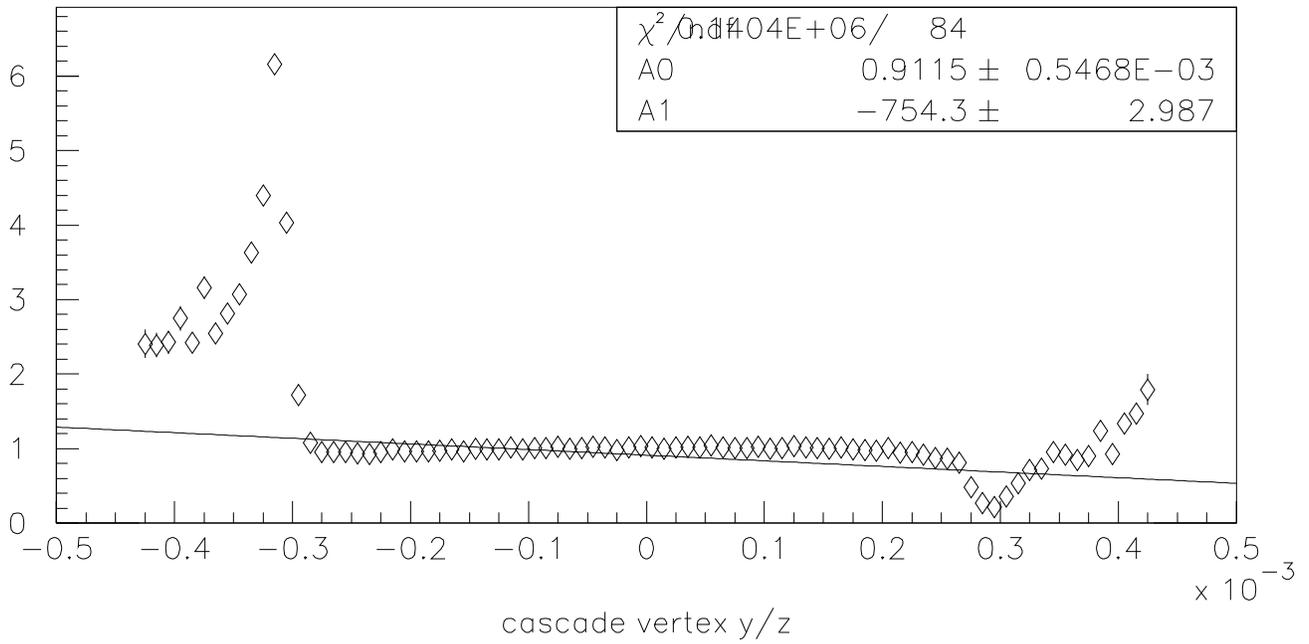
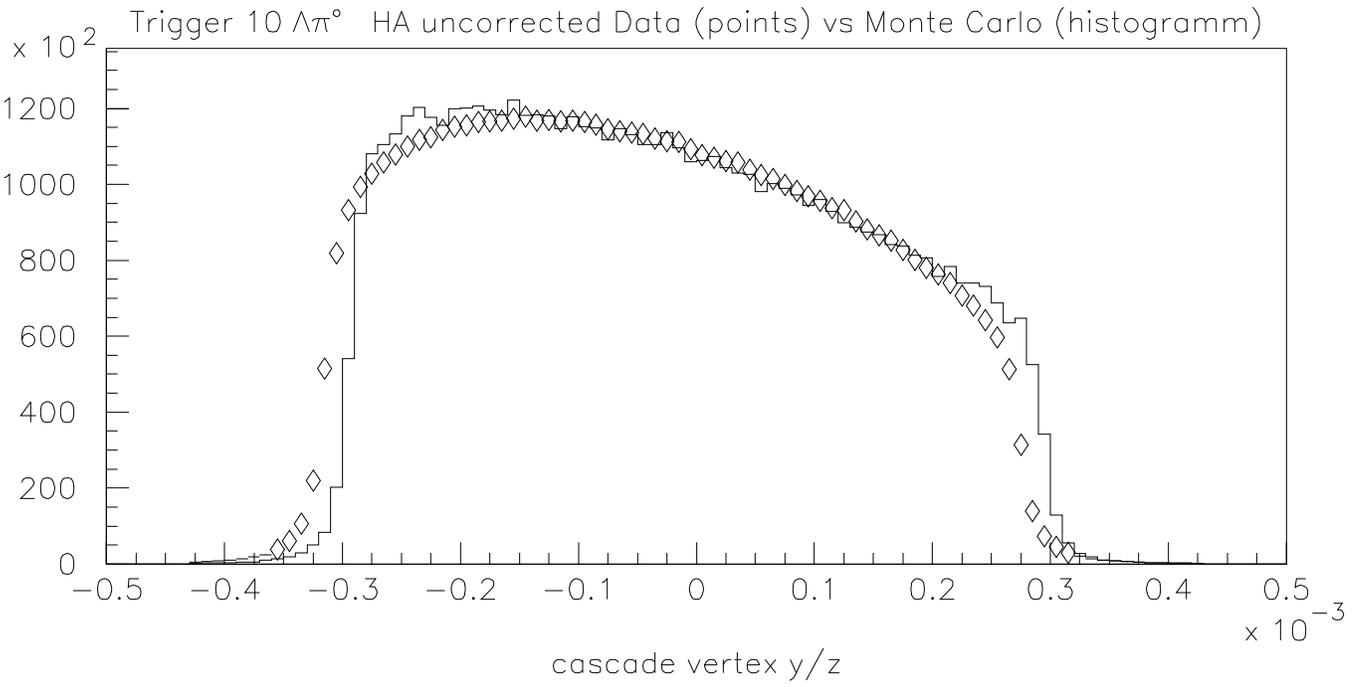


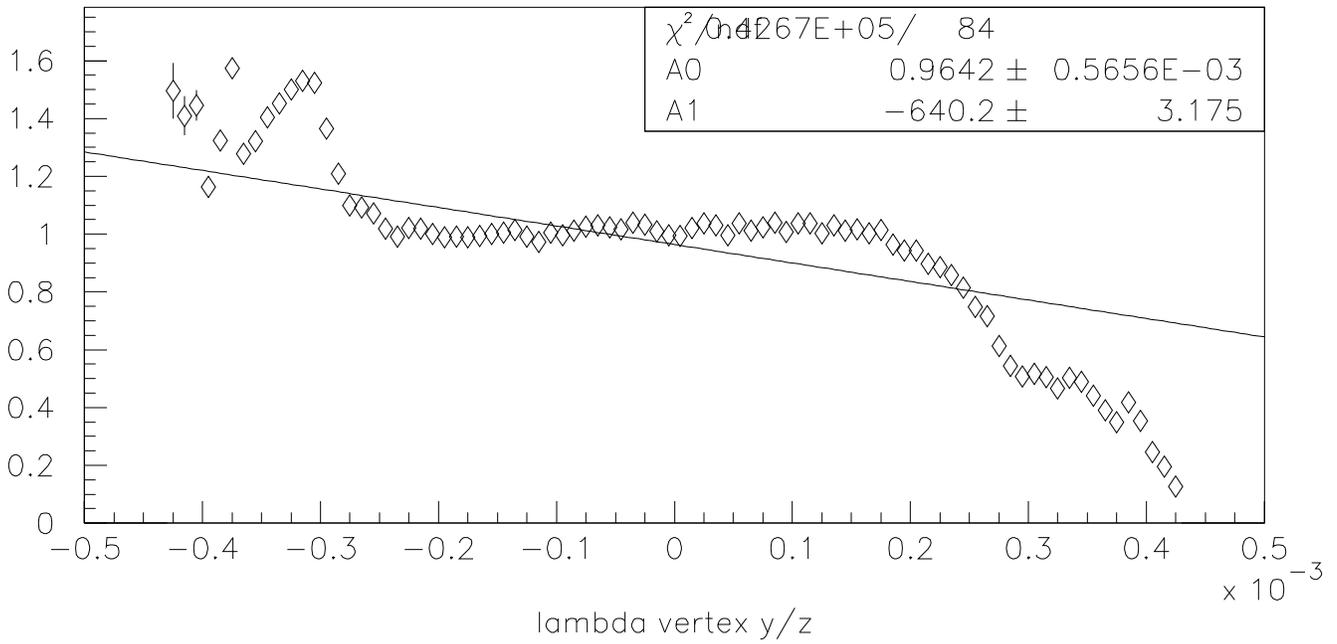
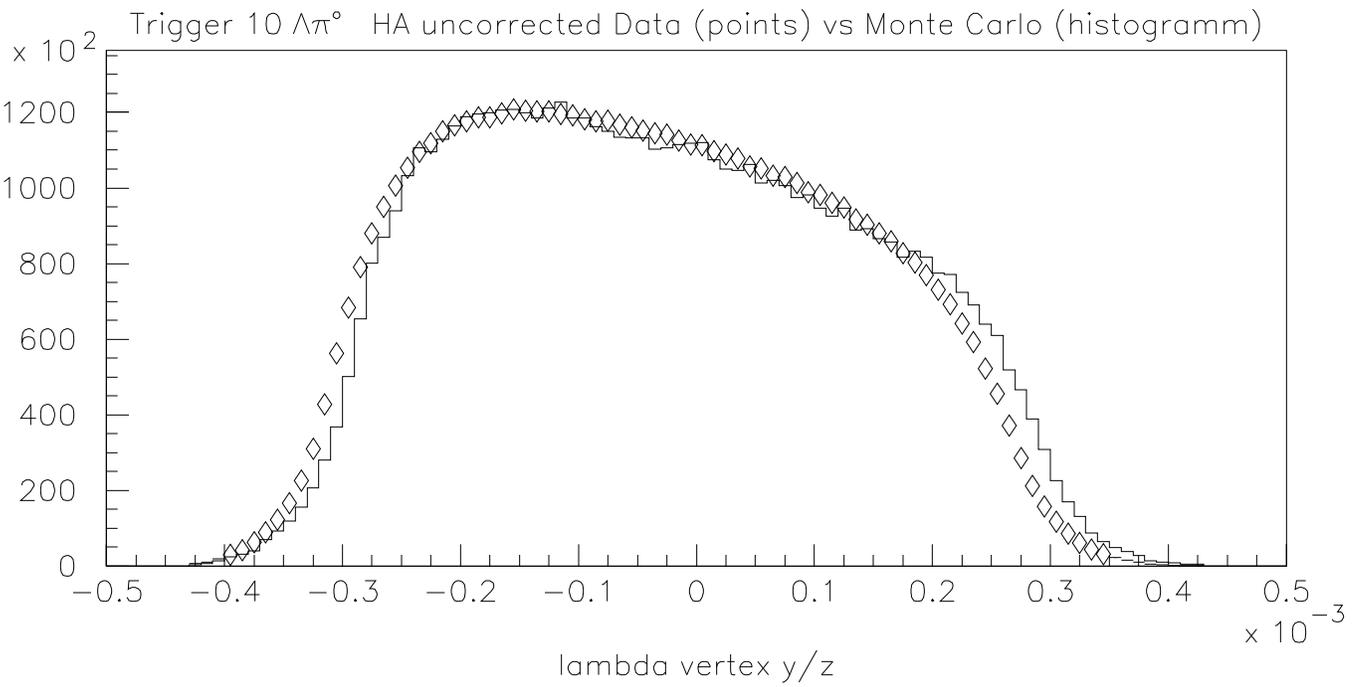
$\times 10^2$  Trigger 10  $\Lambda\pi^\circ$  HA uncorrected Data (points) vs Monte Carlo (histogramm)

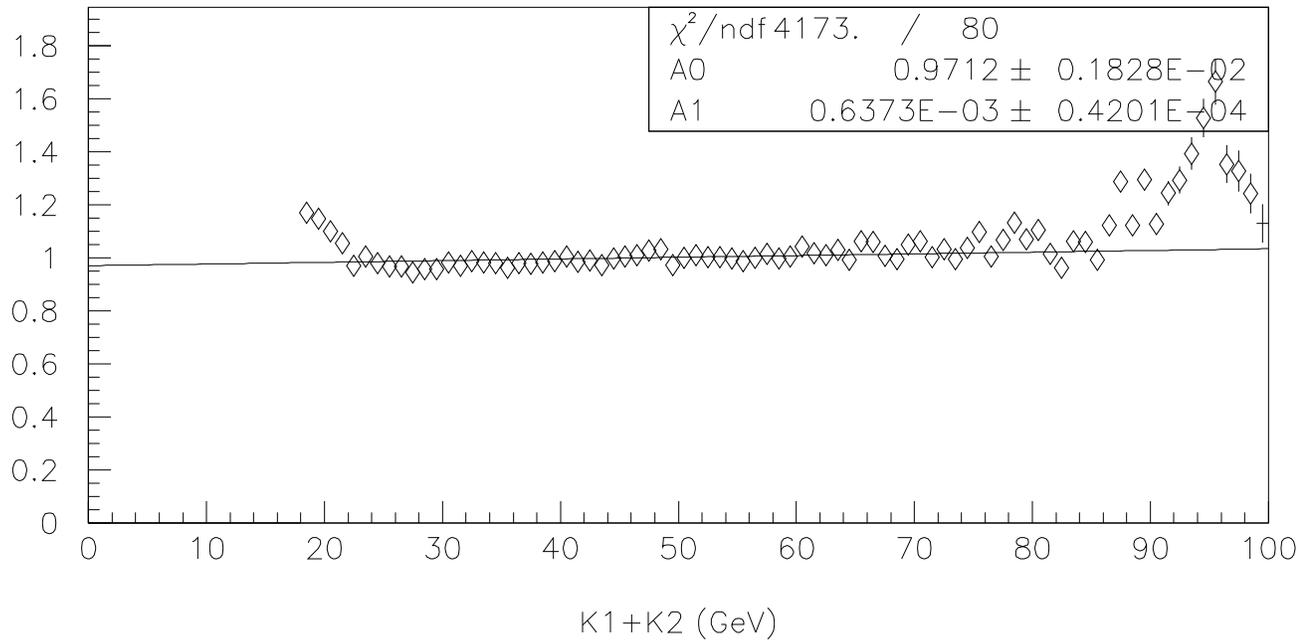
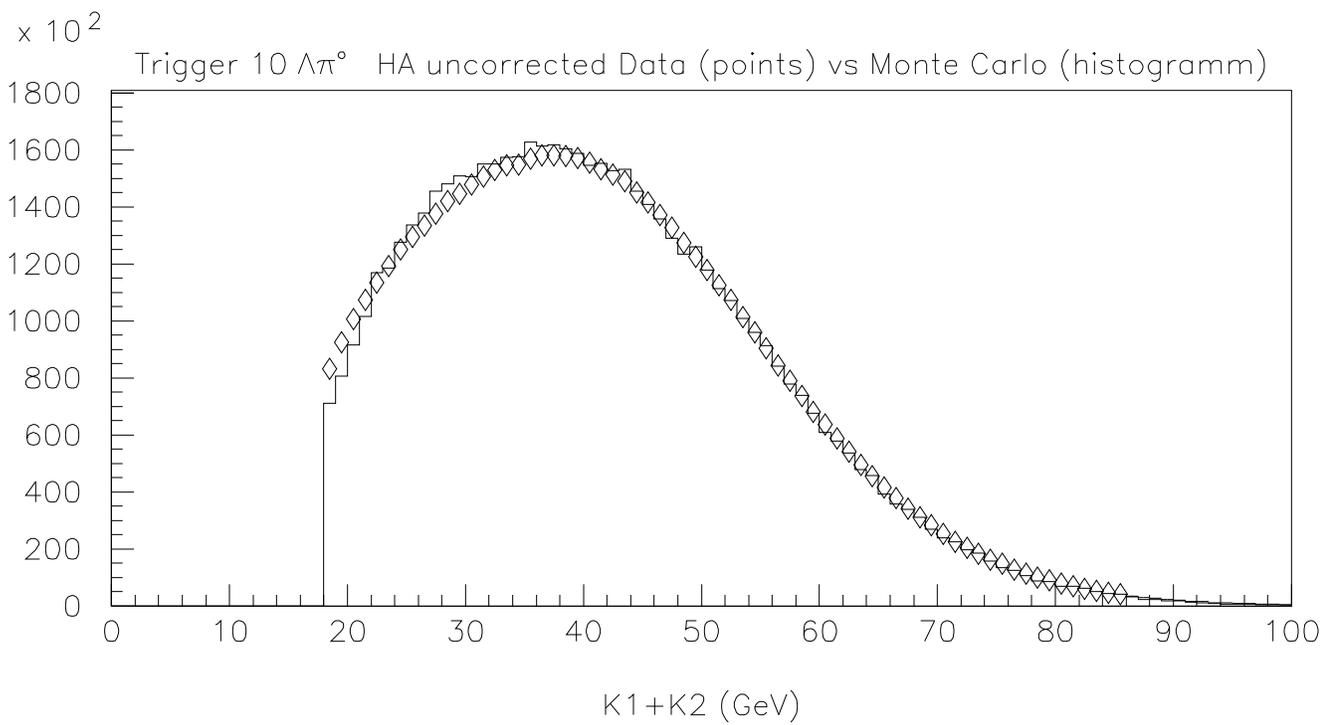


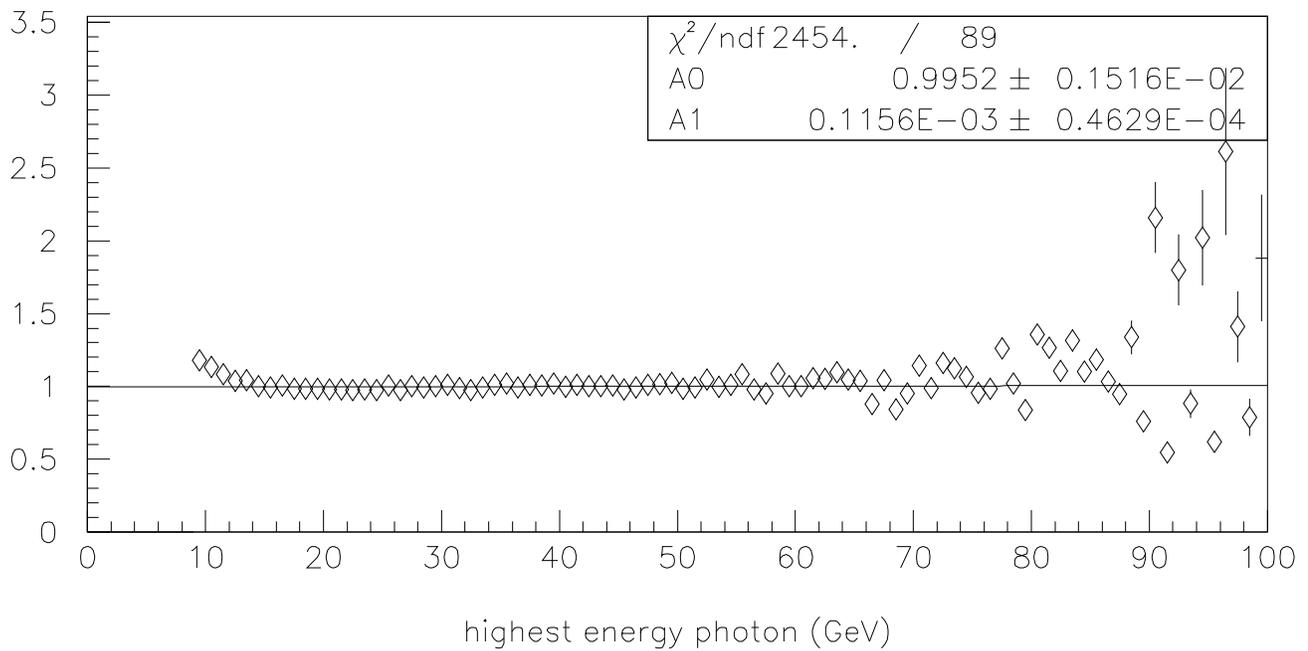
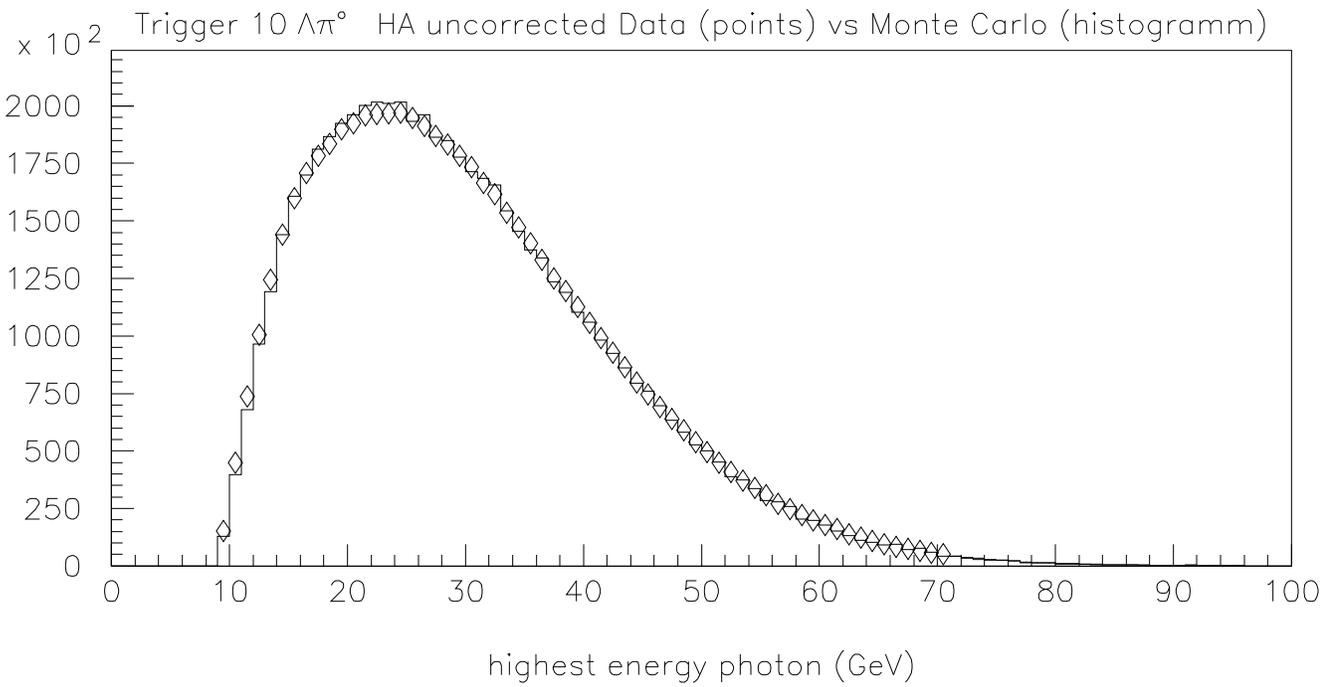
$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA uncorrected Data (points) vs Monte Carlo (histogramm)



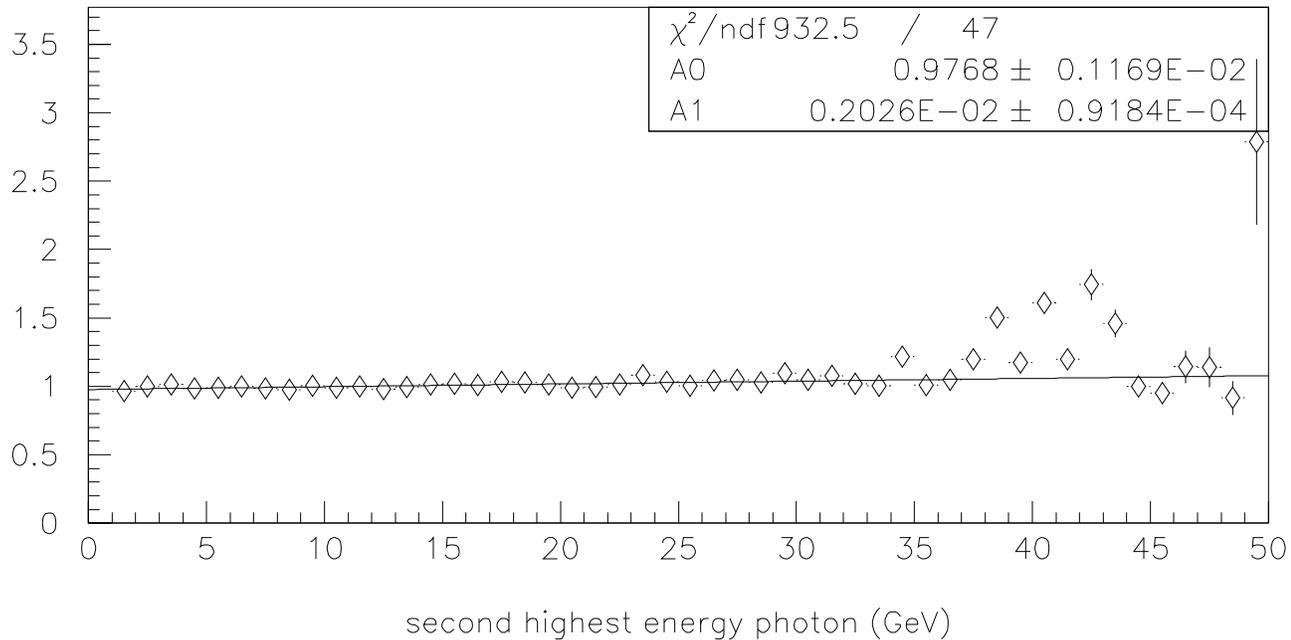
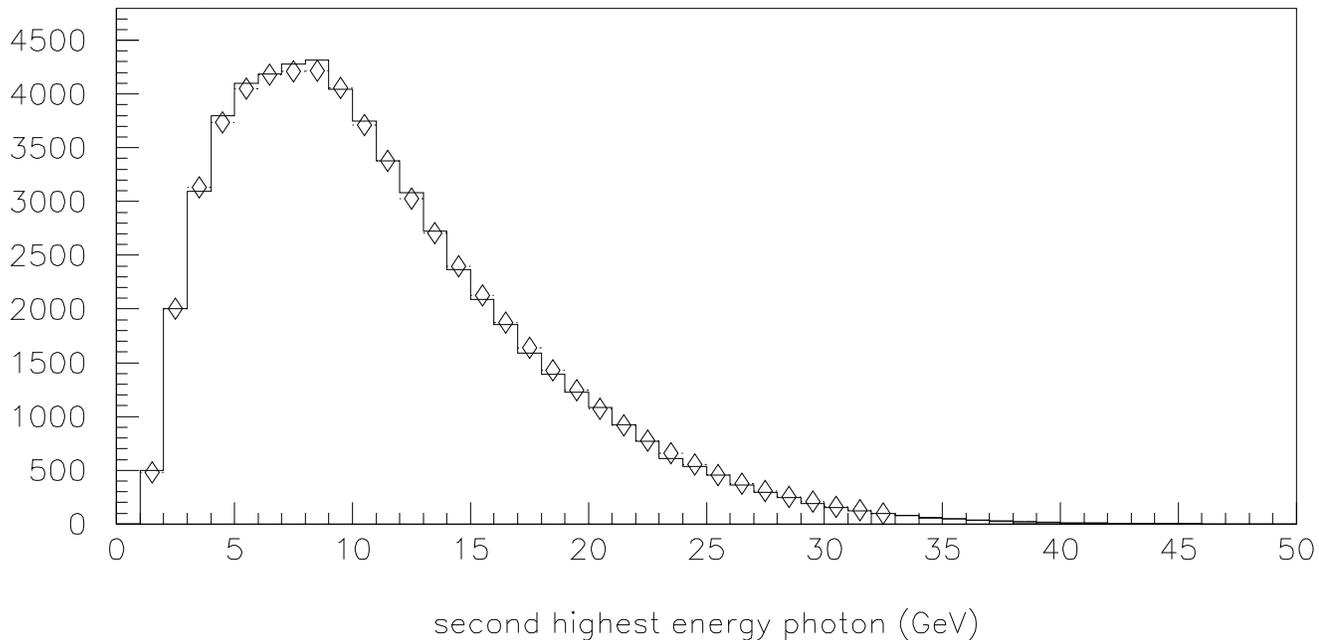


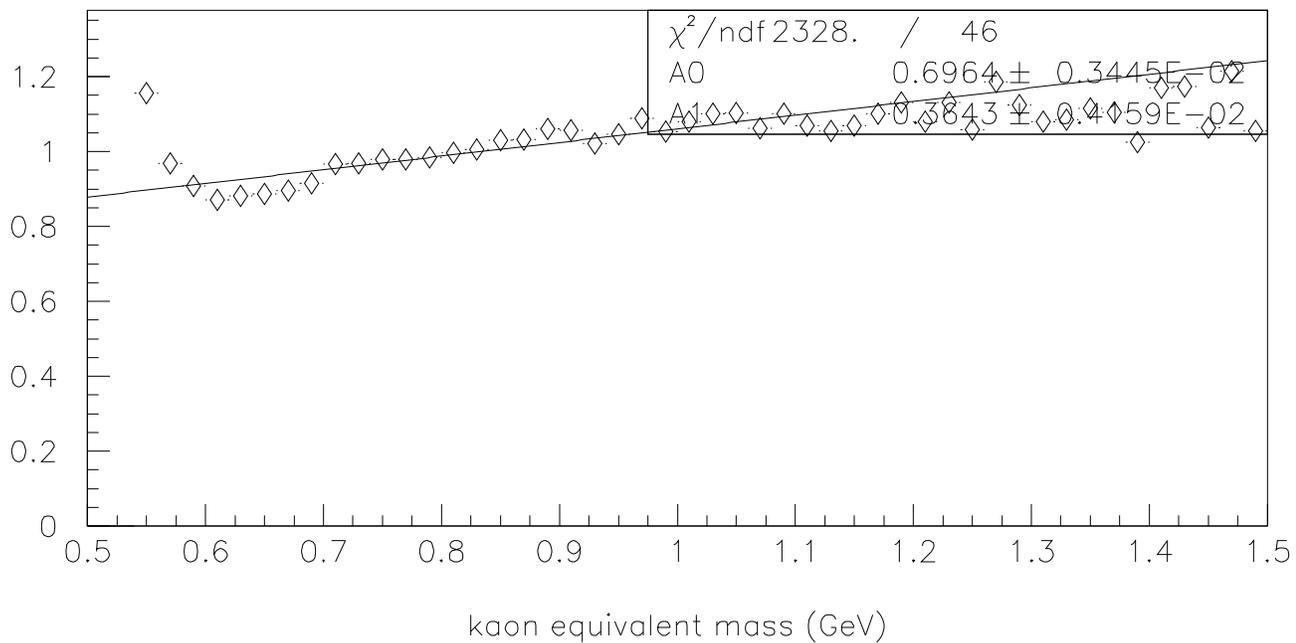
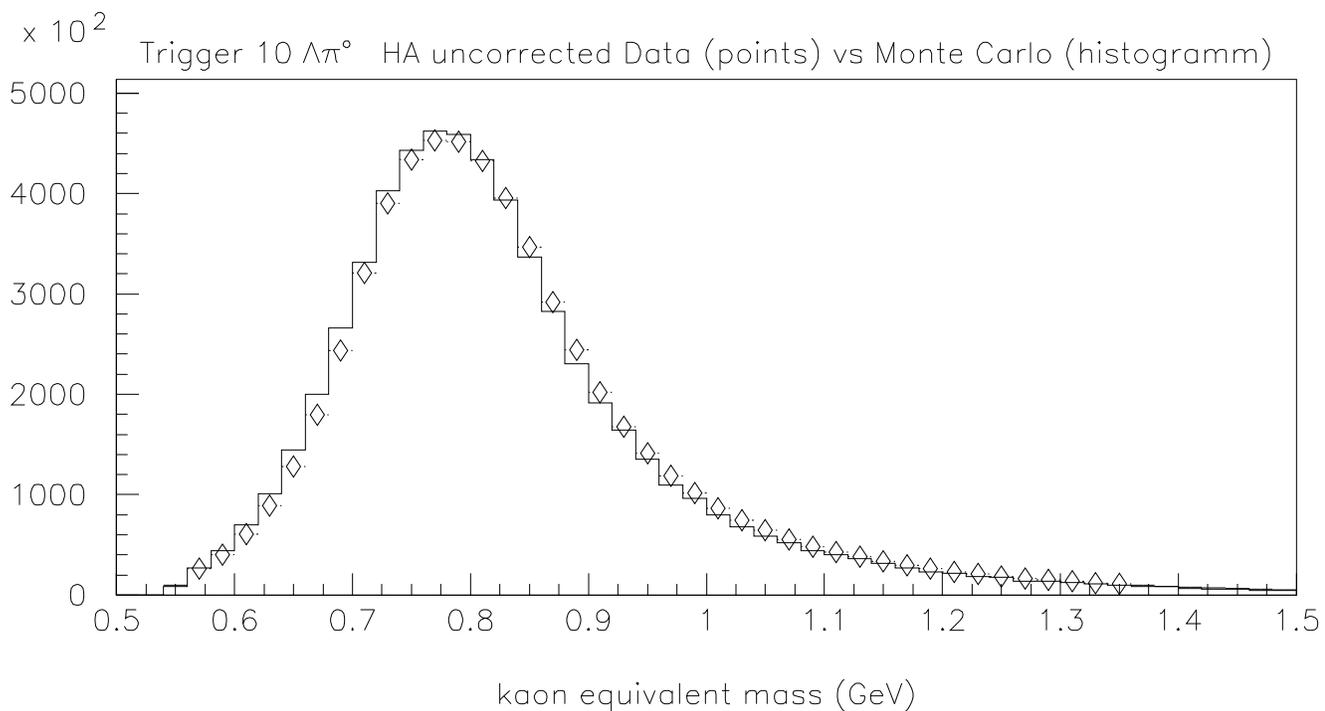


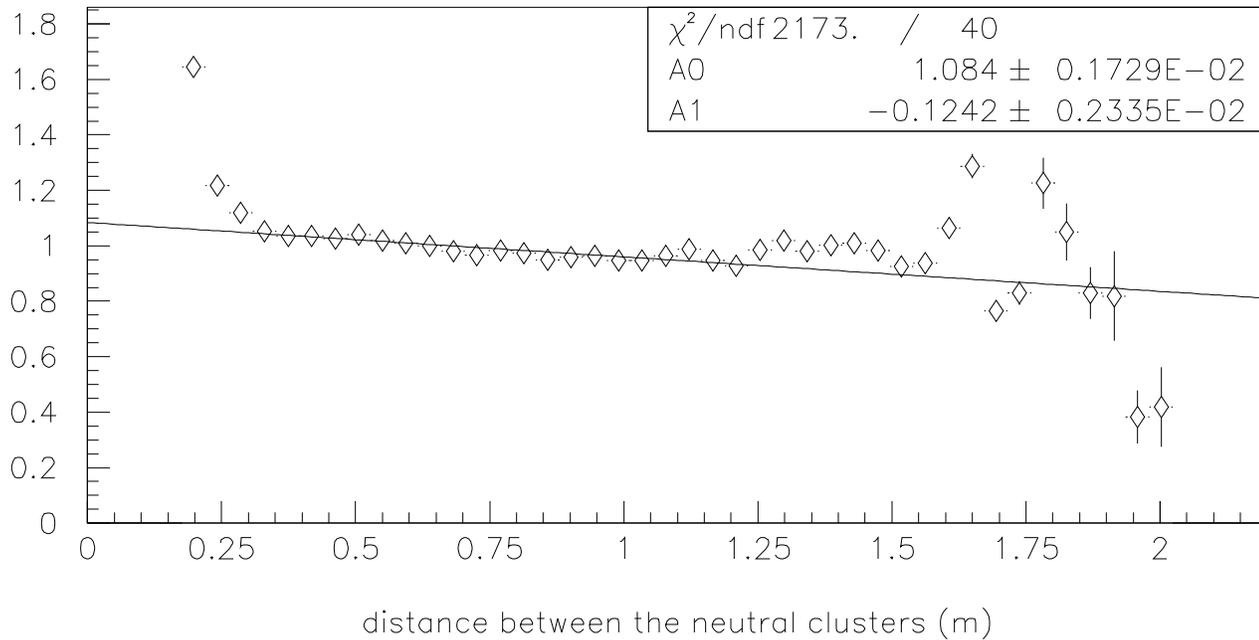
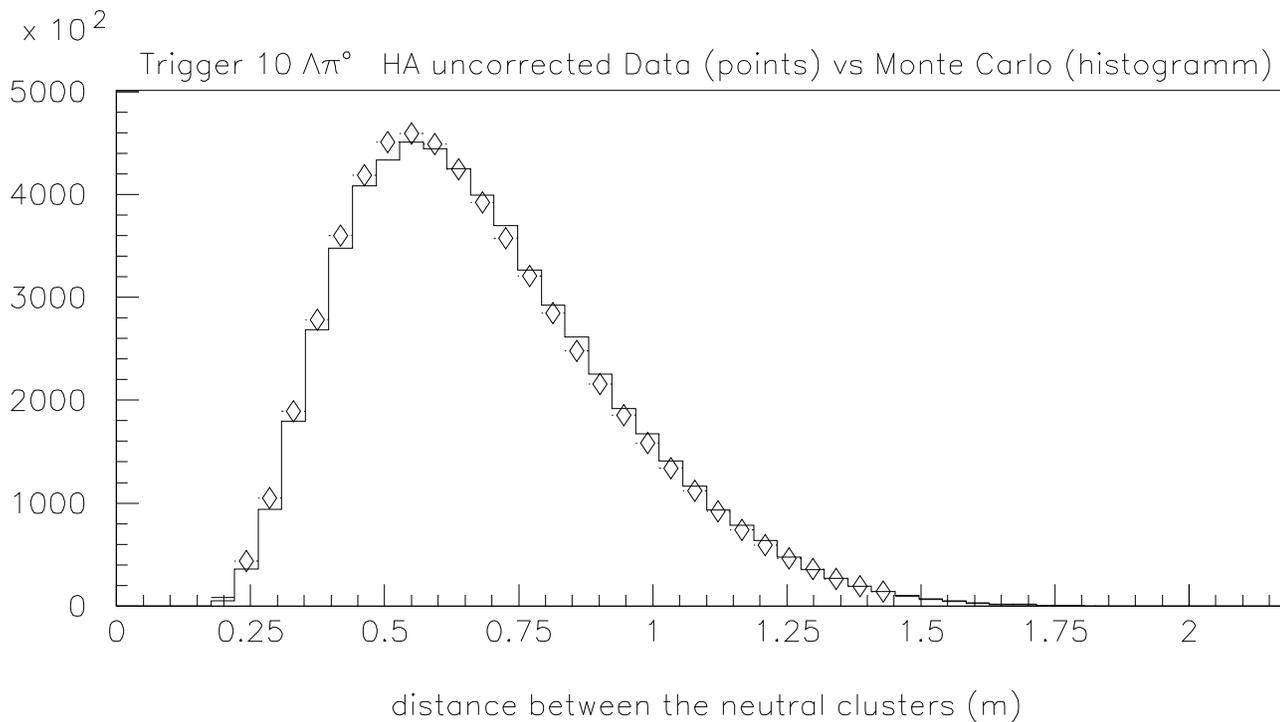


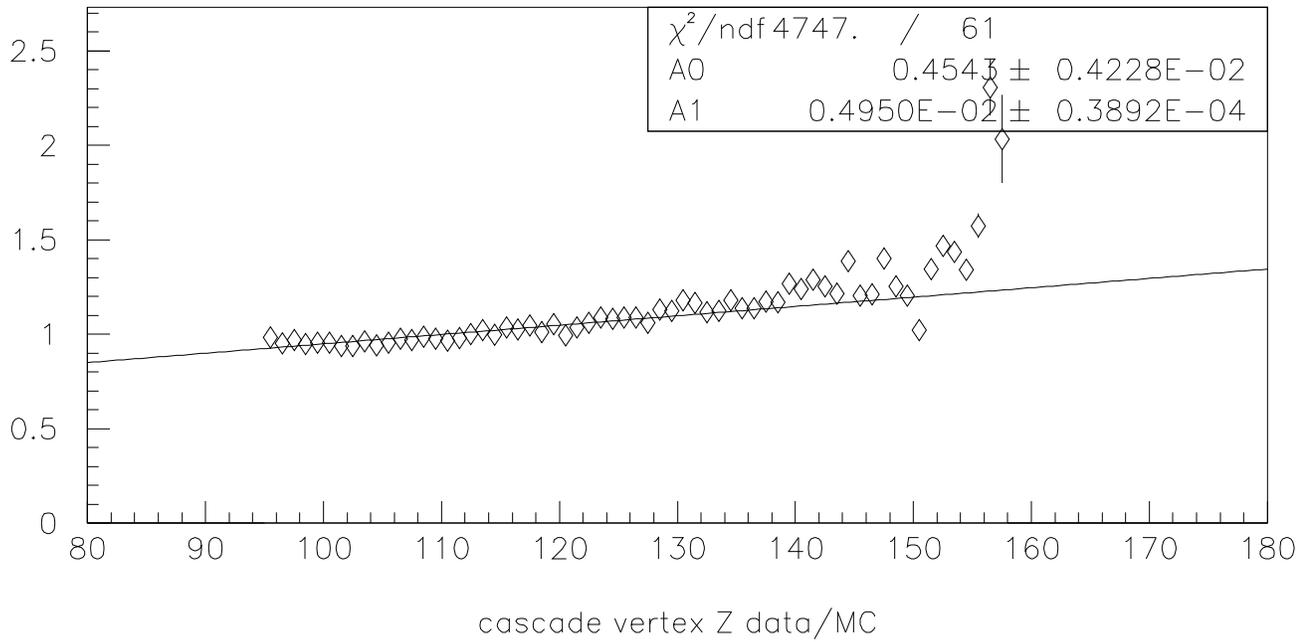
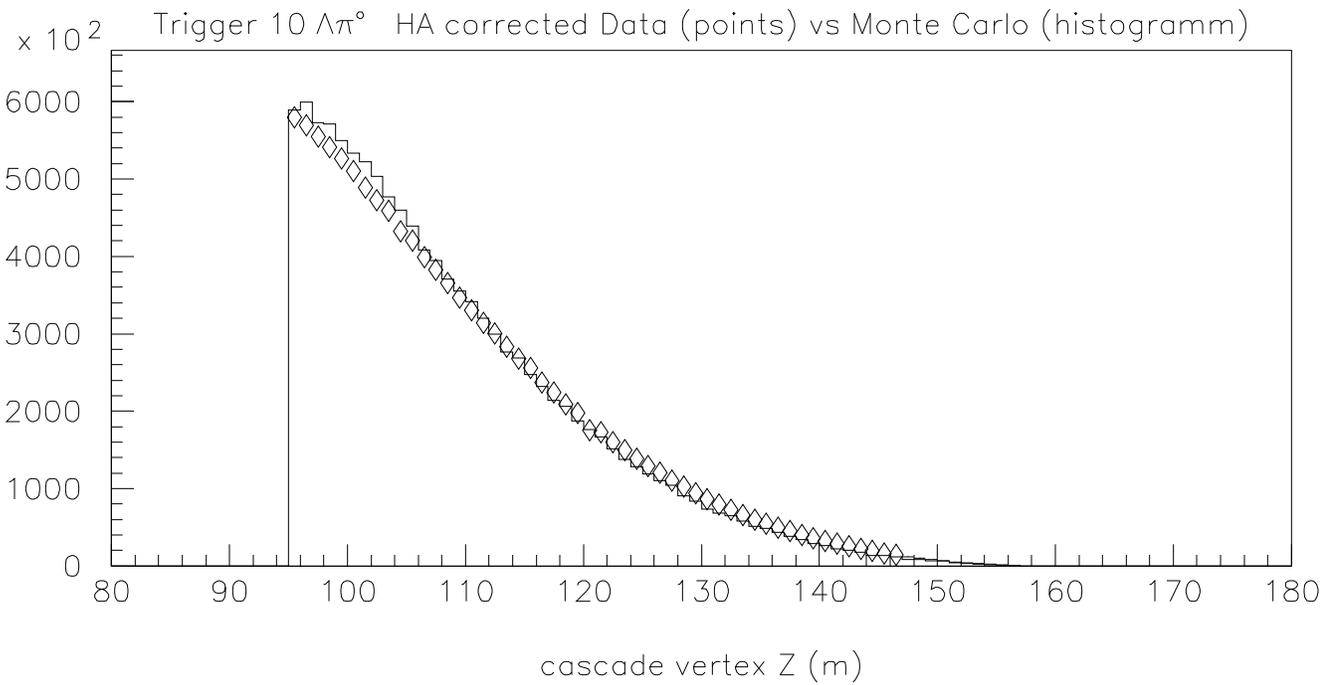


$\times 10^2$  Trigger  $10 \Lambda\pi^0$  HA uncorrected Data (points) vs Monte Carlo (histogramm)

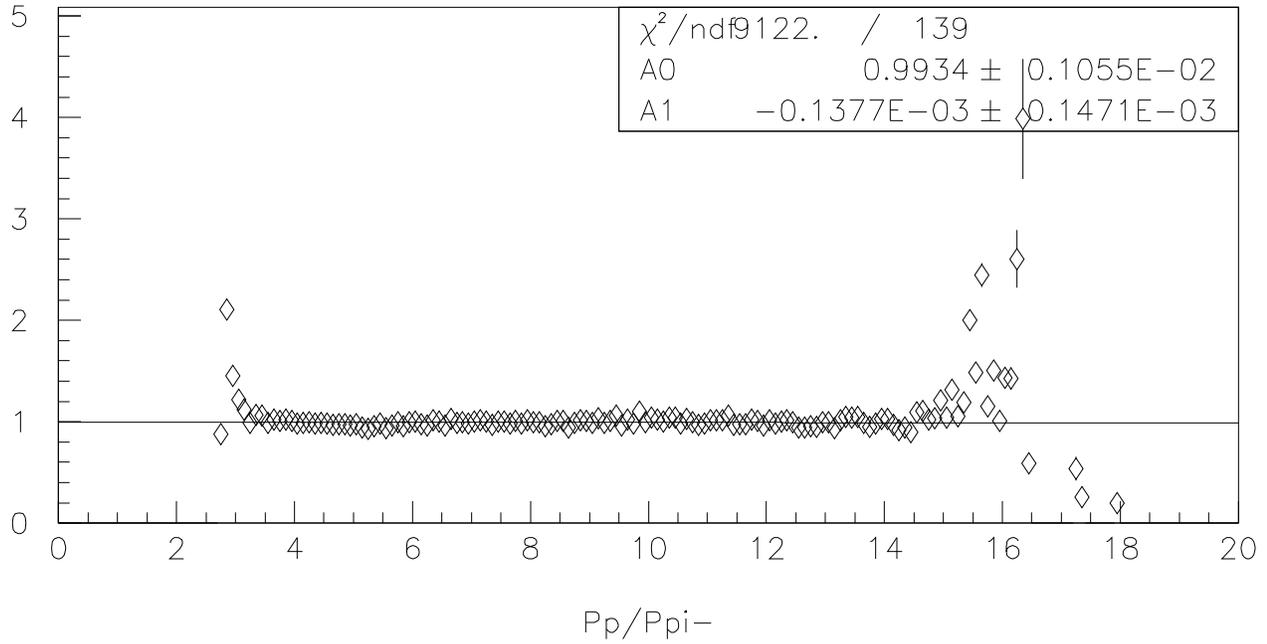
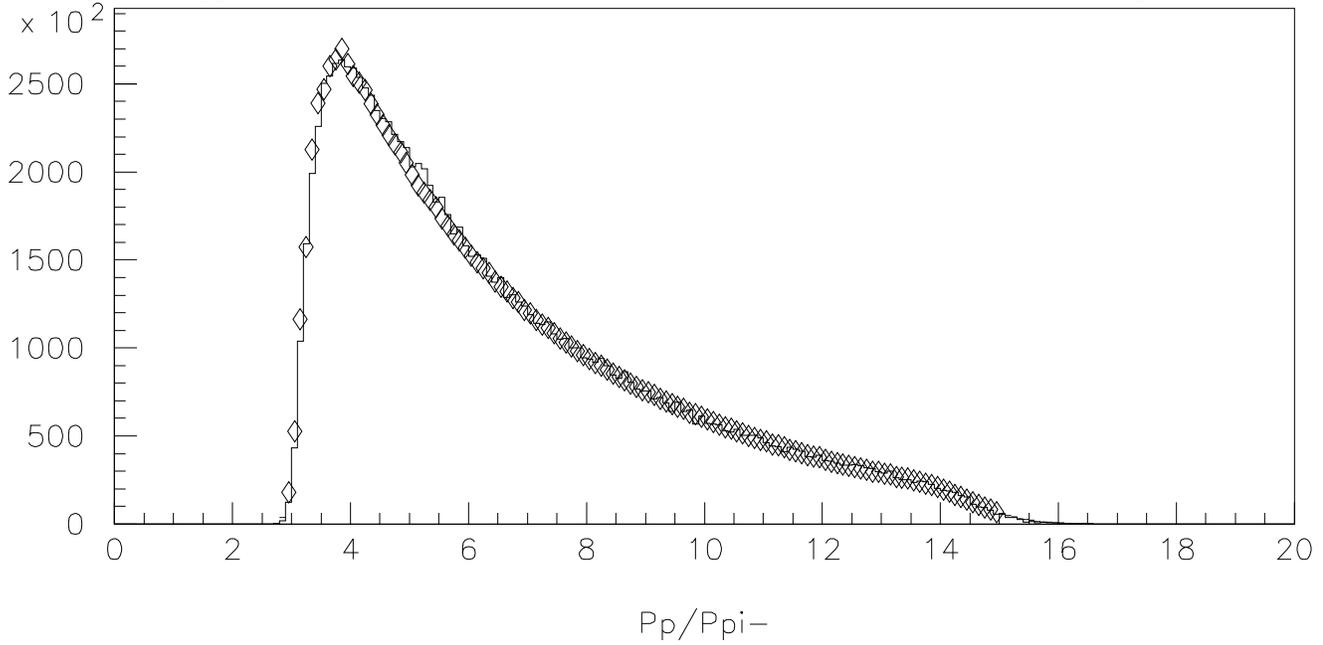


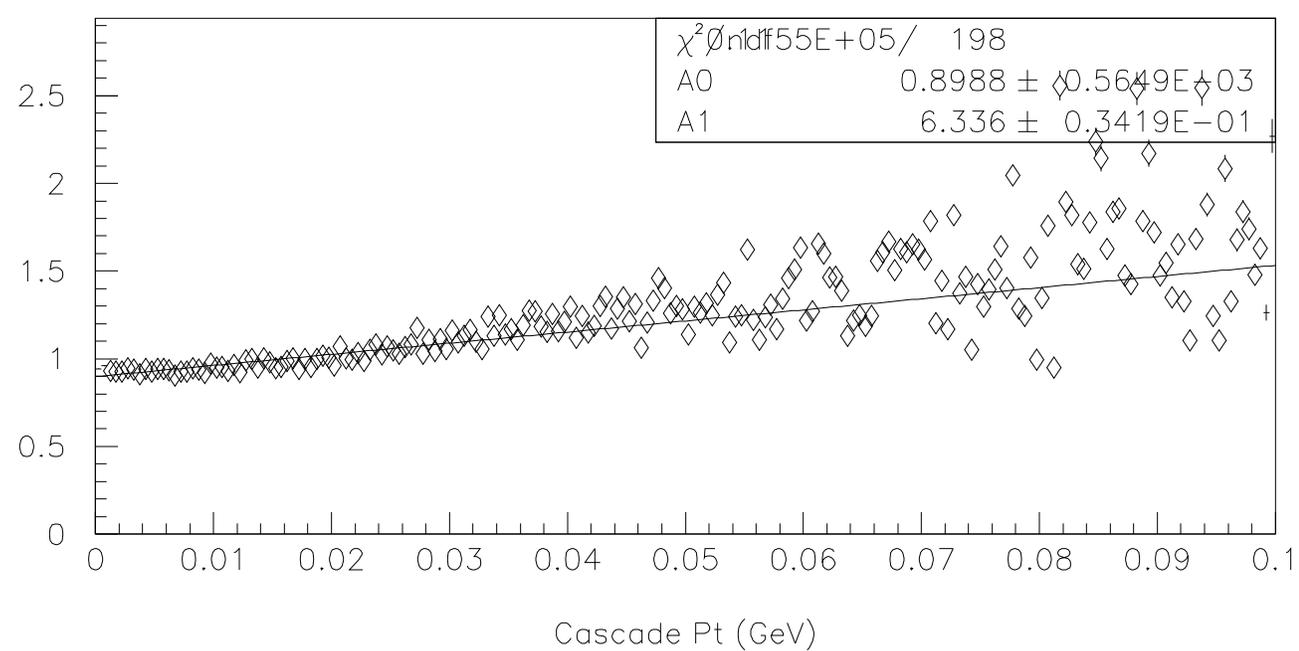
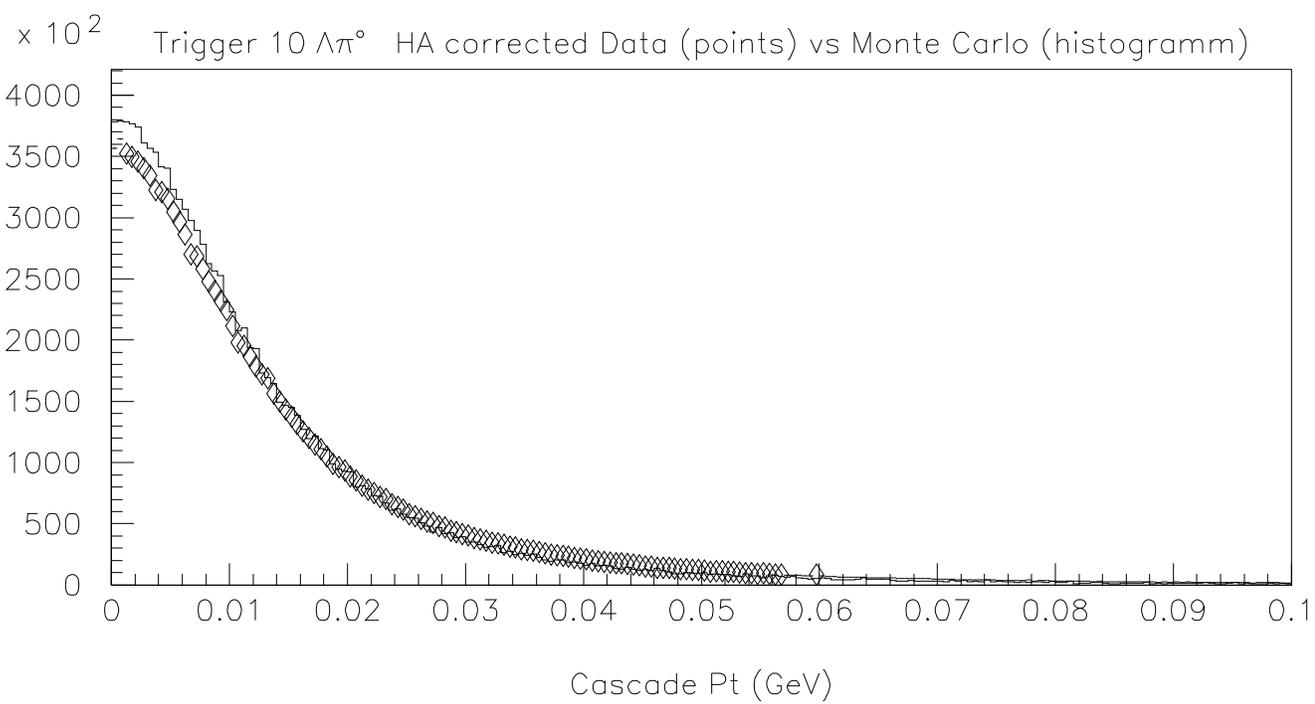


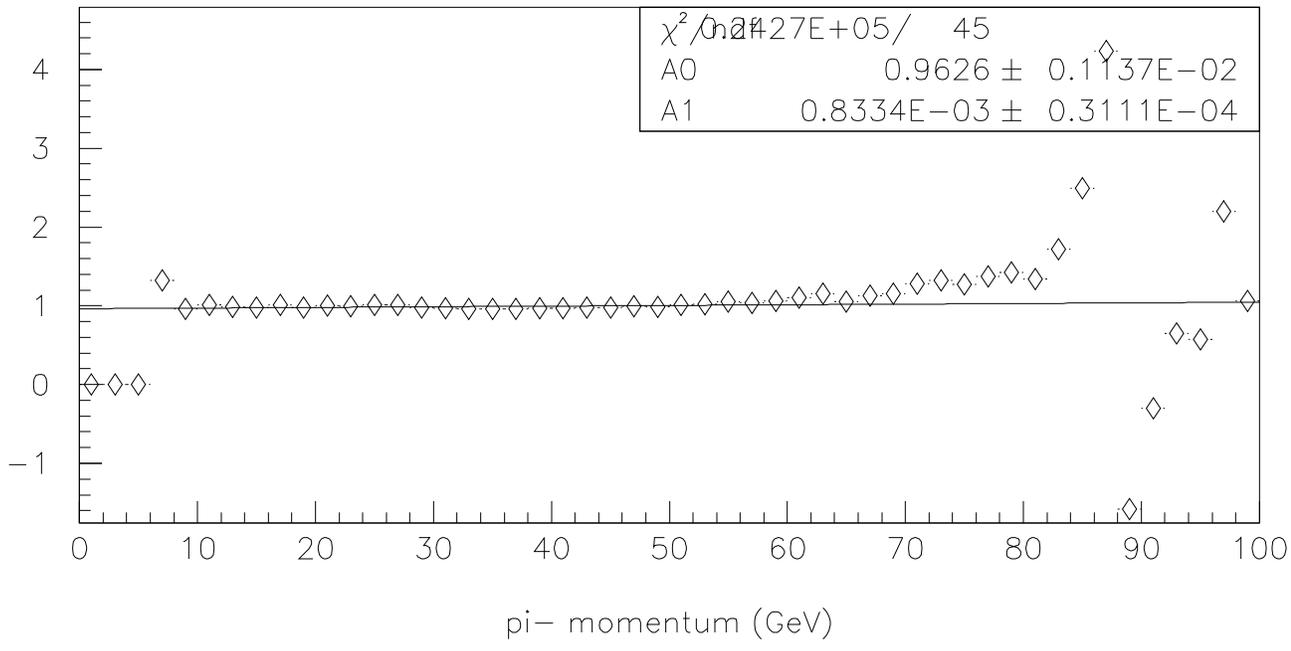
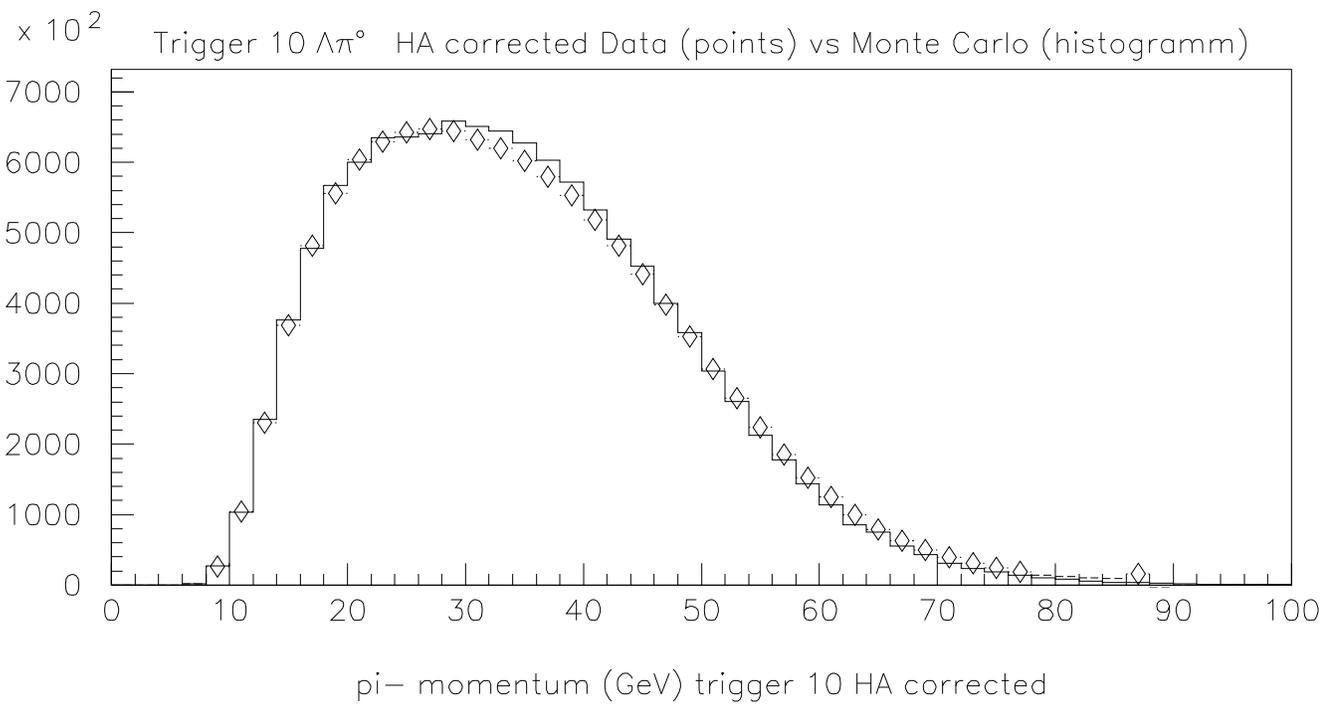


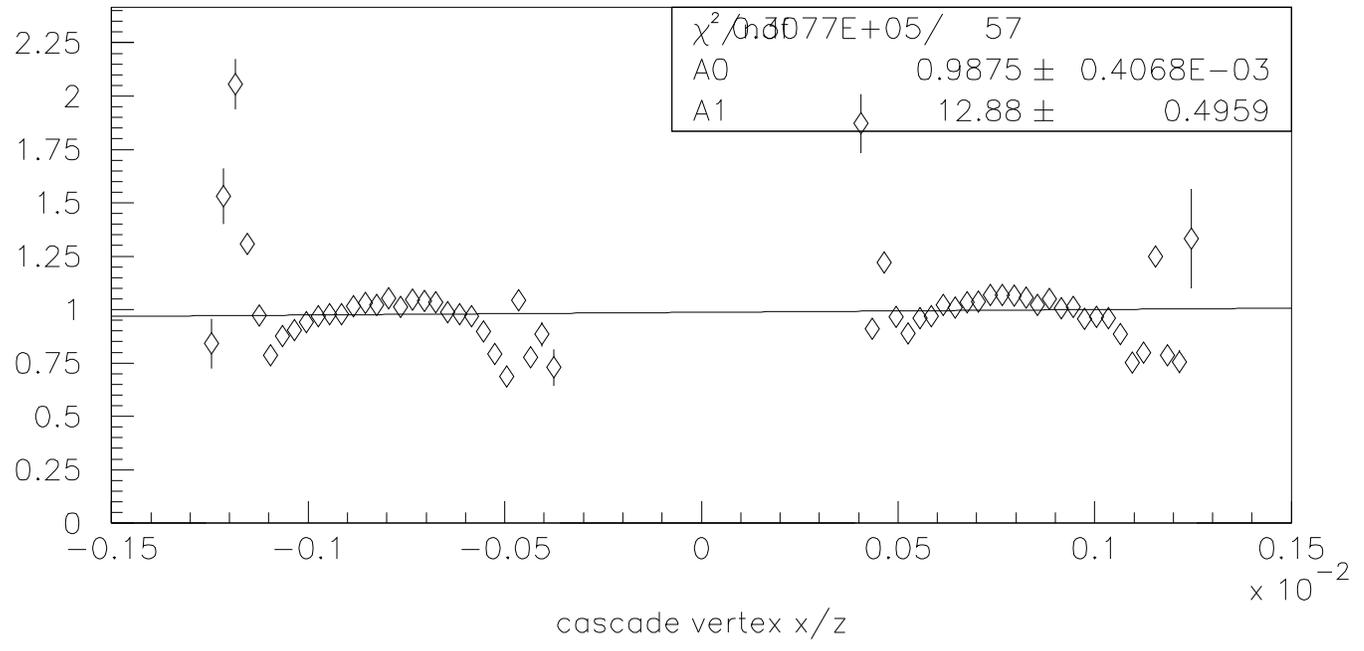
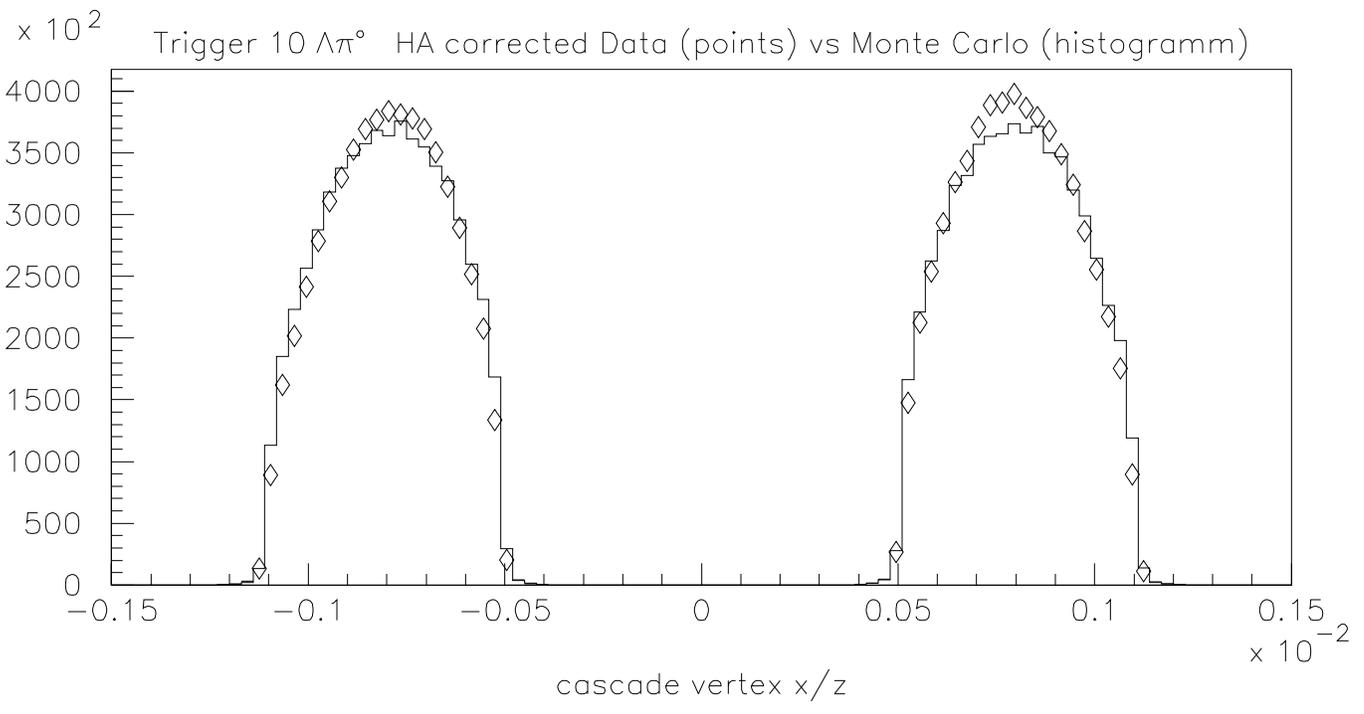


Trigger 10  $\Lambda\pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)

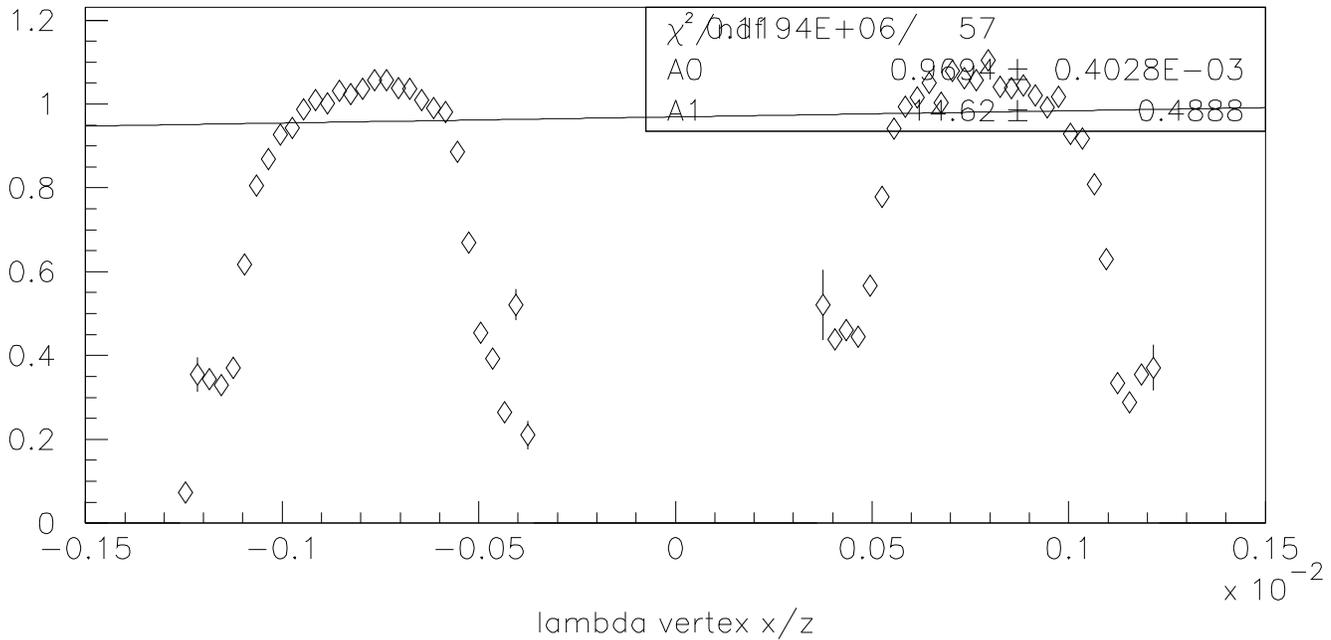
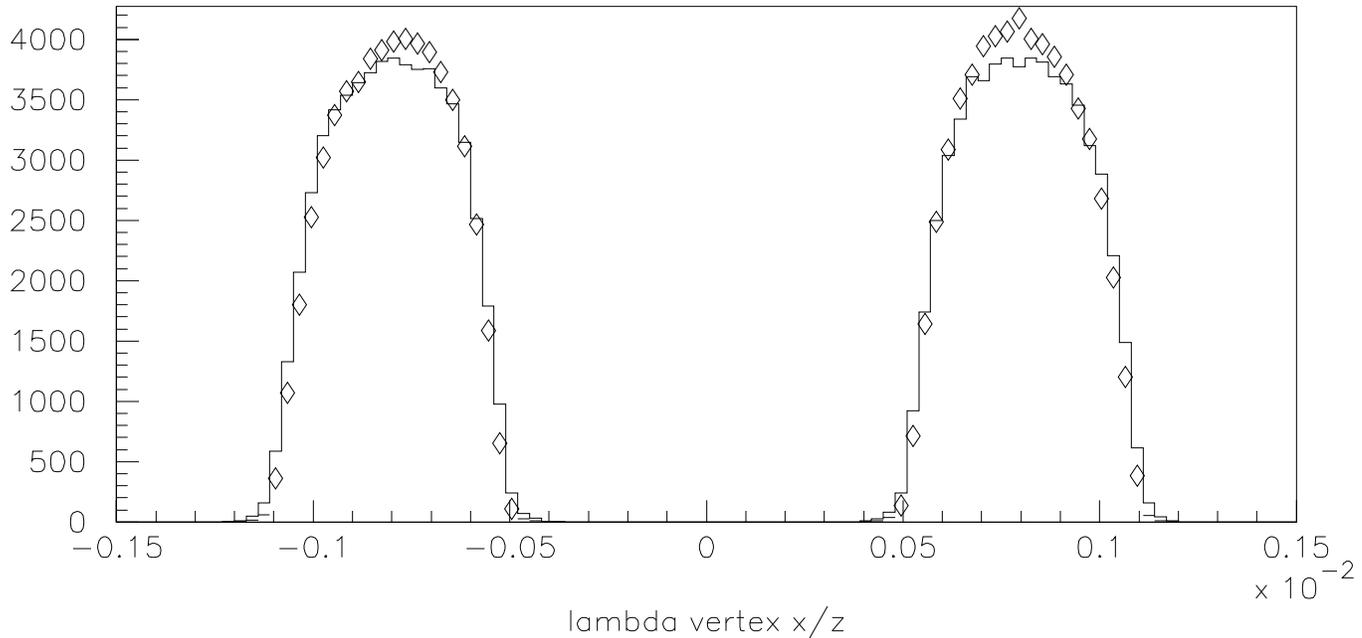




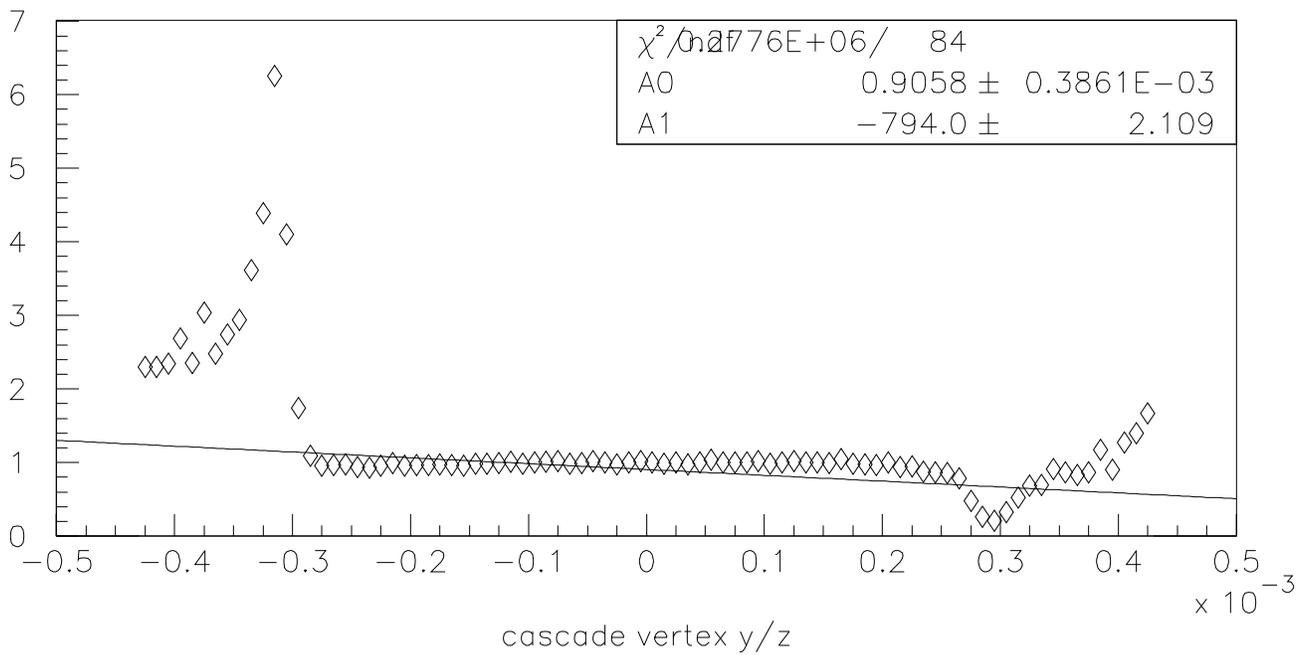
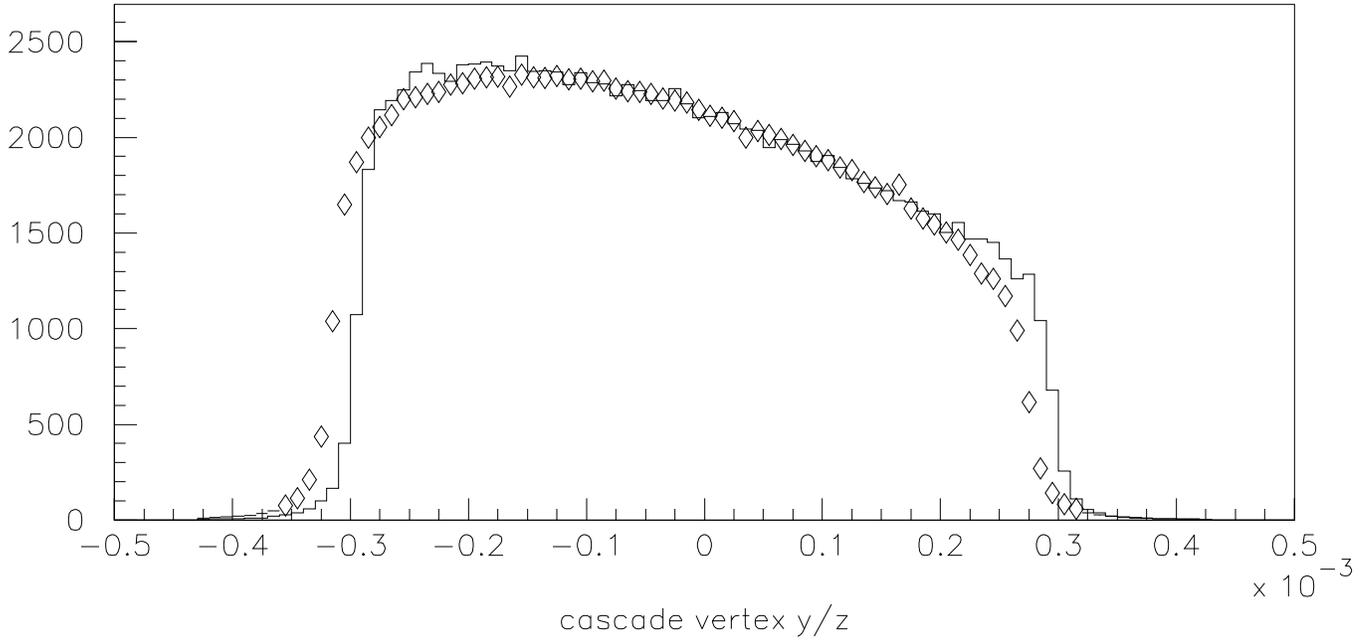




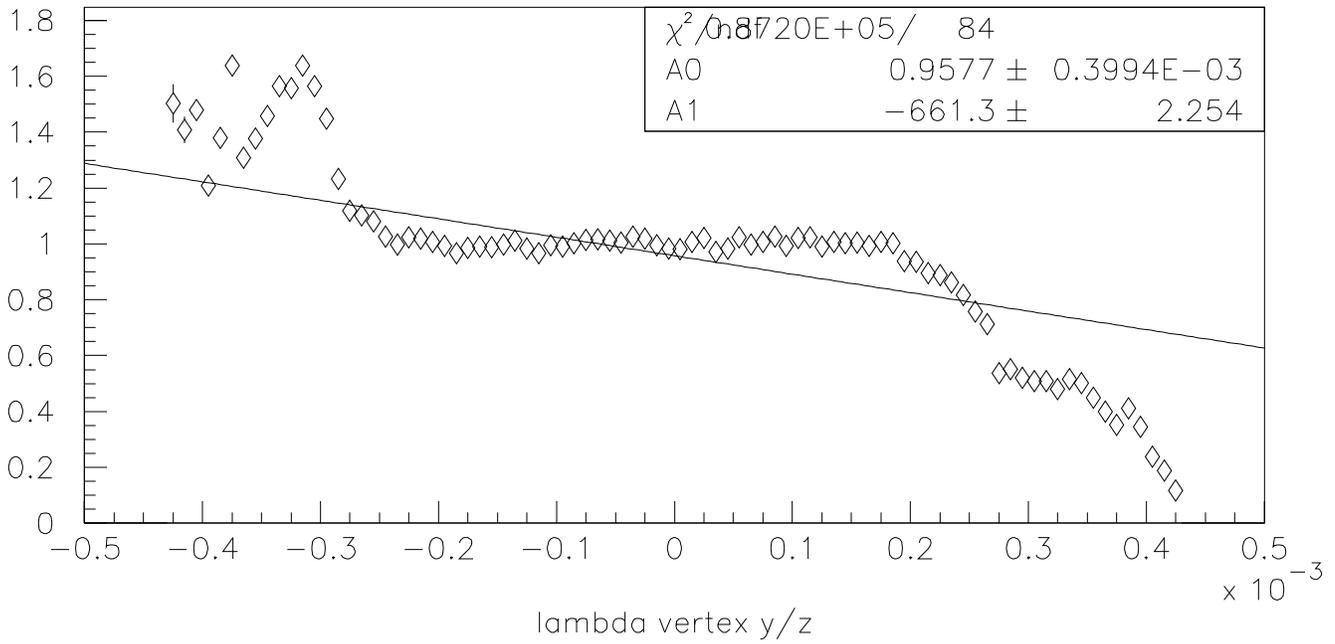
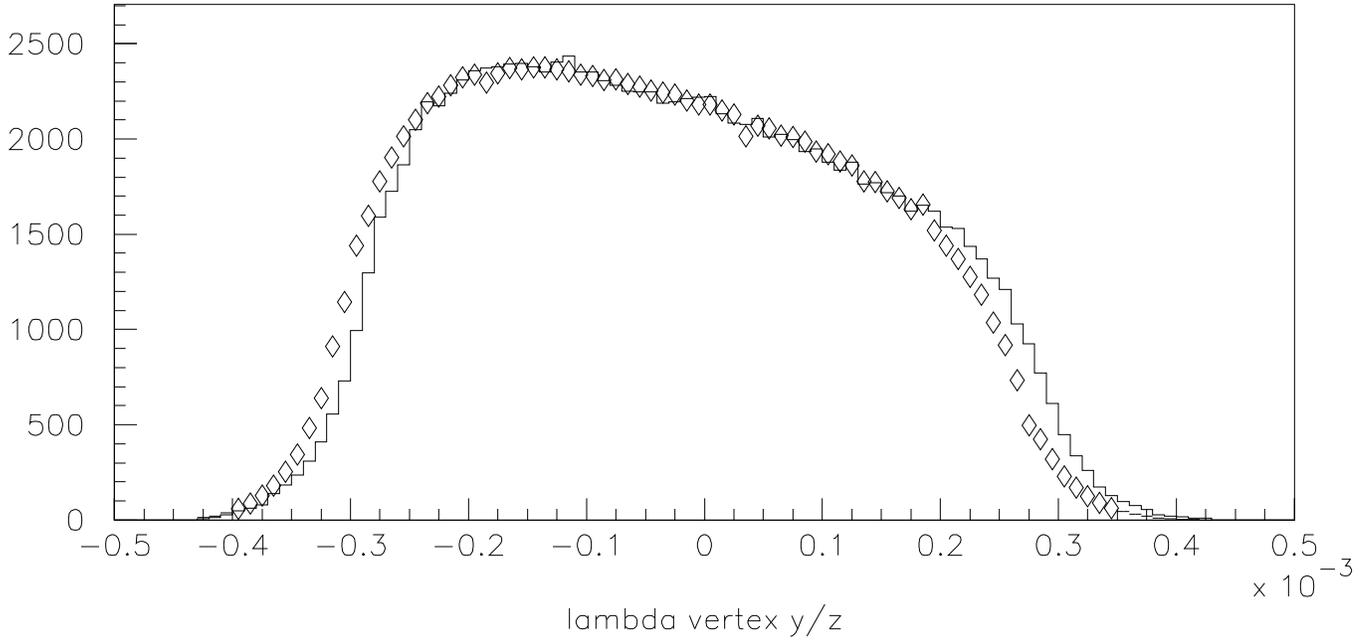
$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)

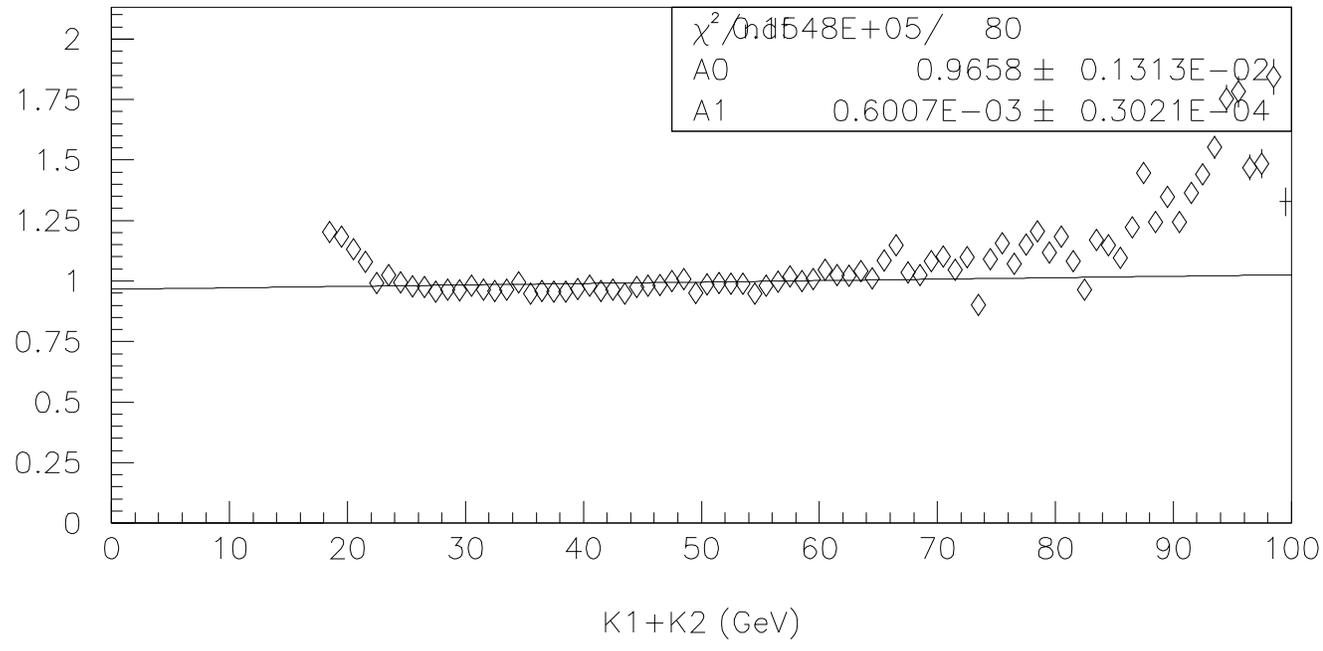
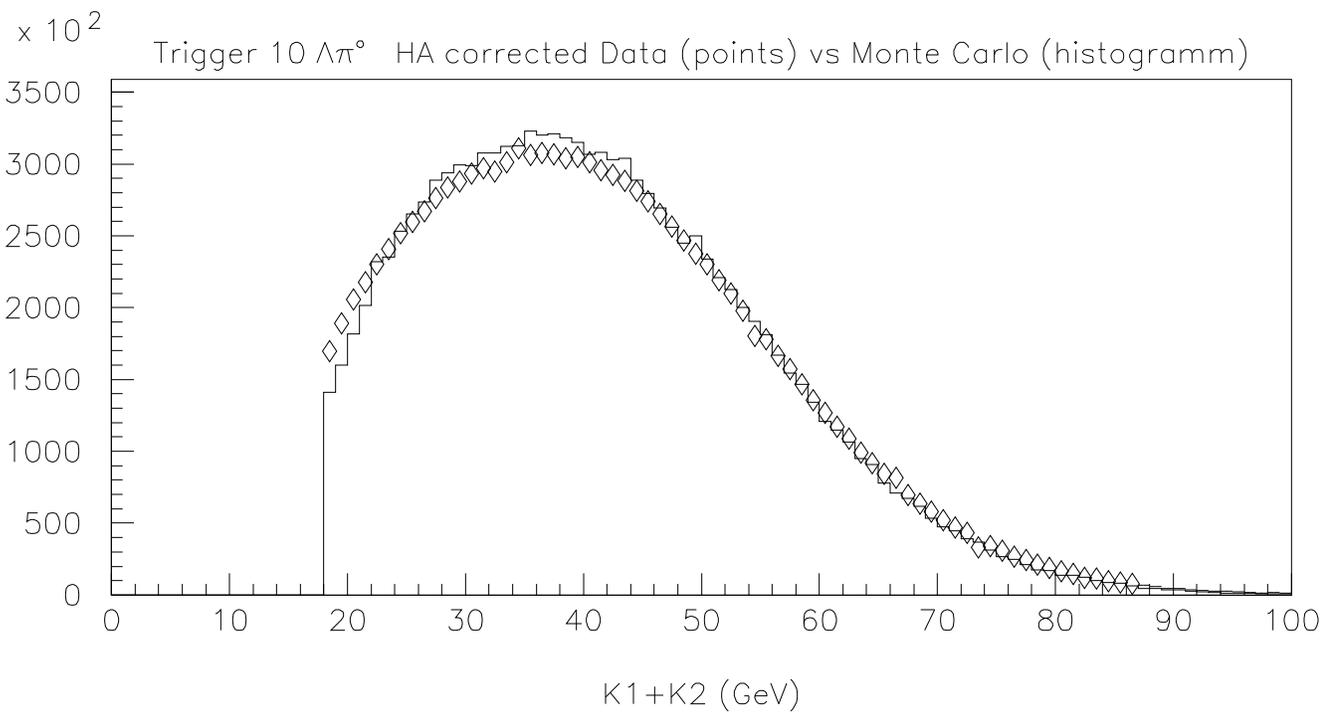


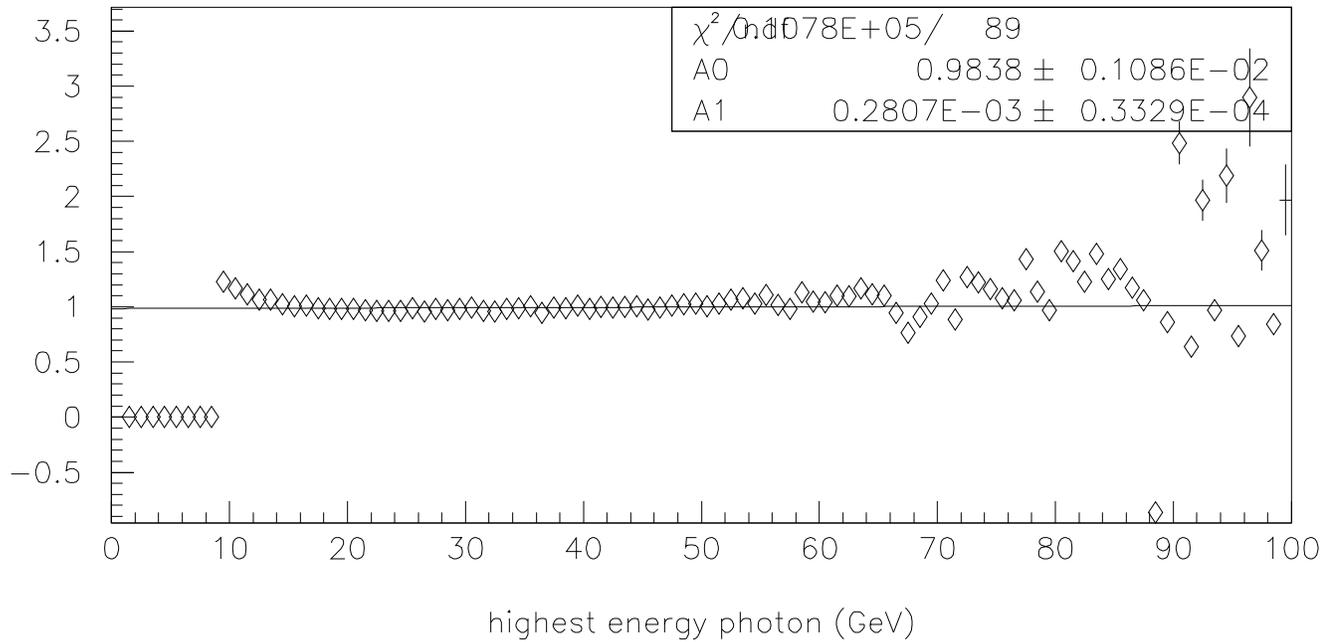
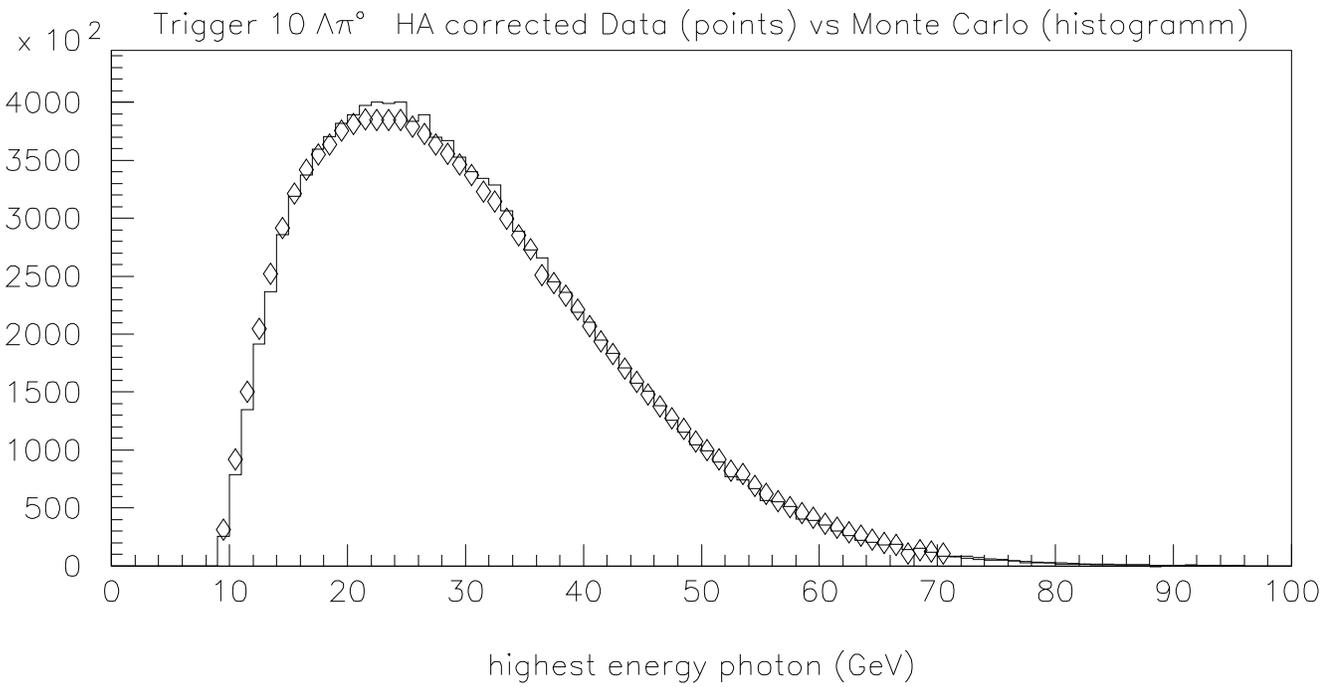
$\times 10^2$  Trigger  $10 \Lambda \pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)



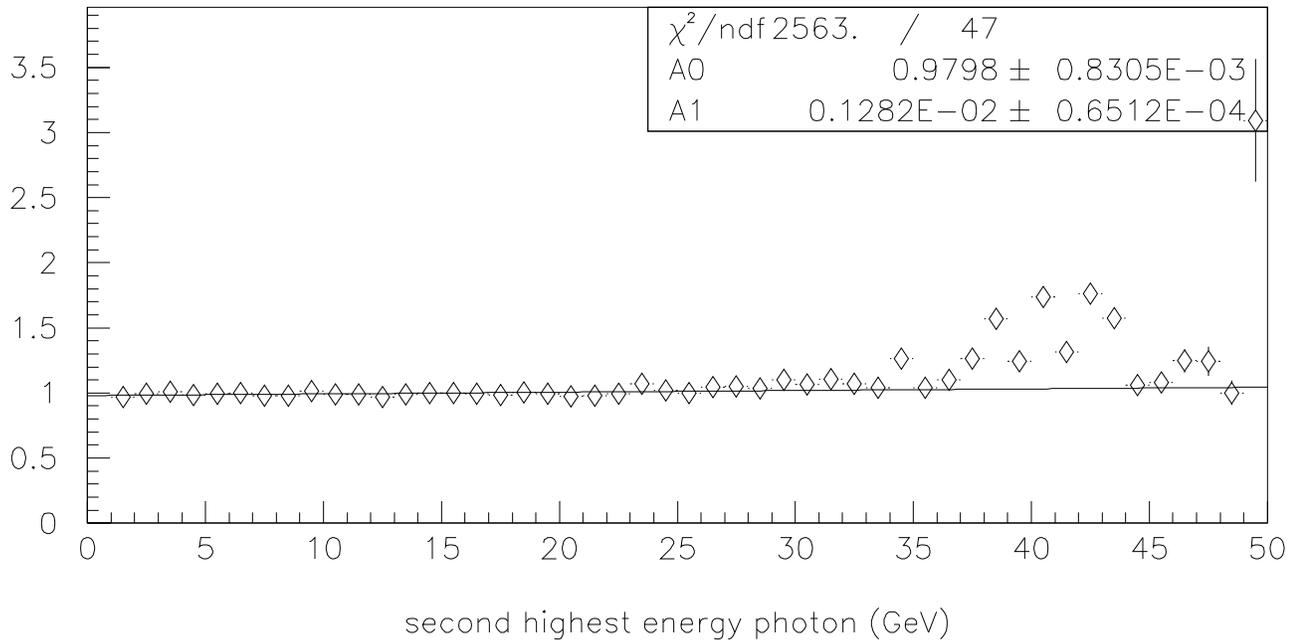
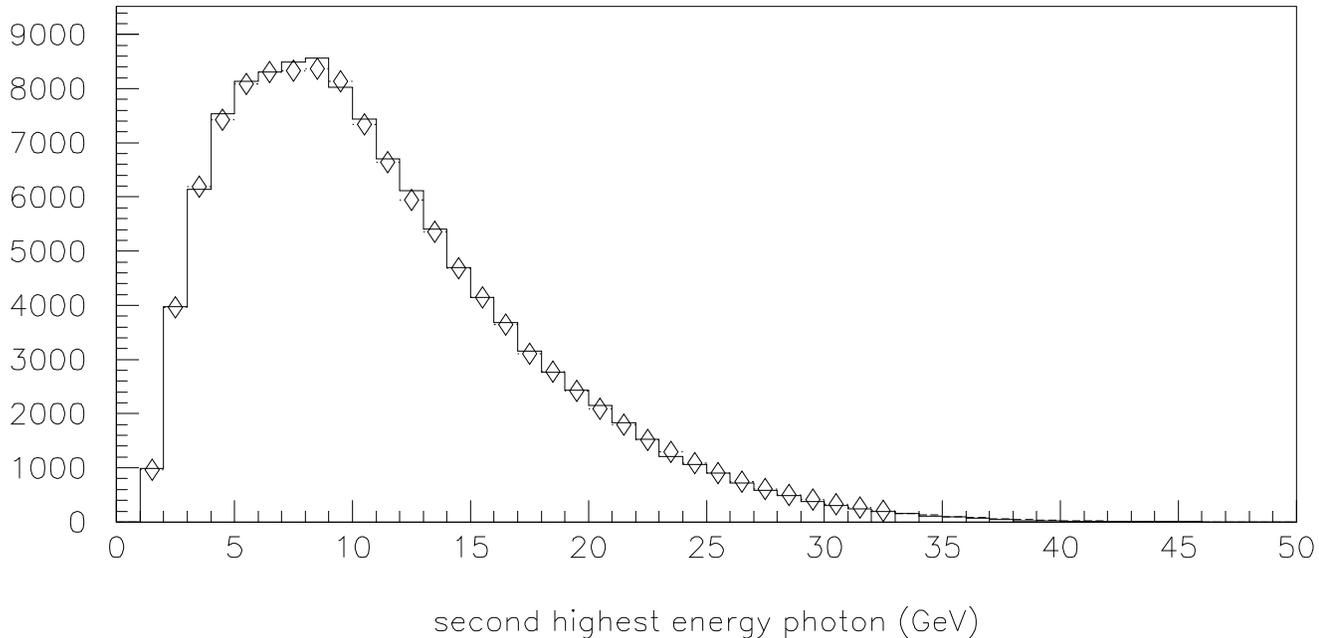
$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)

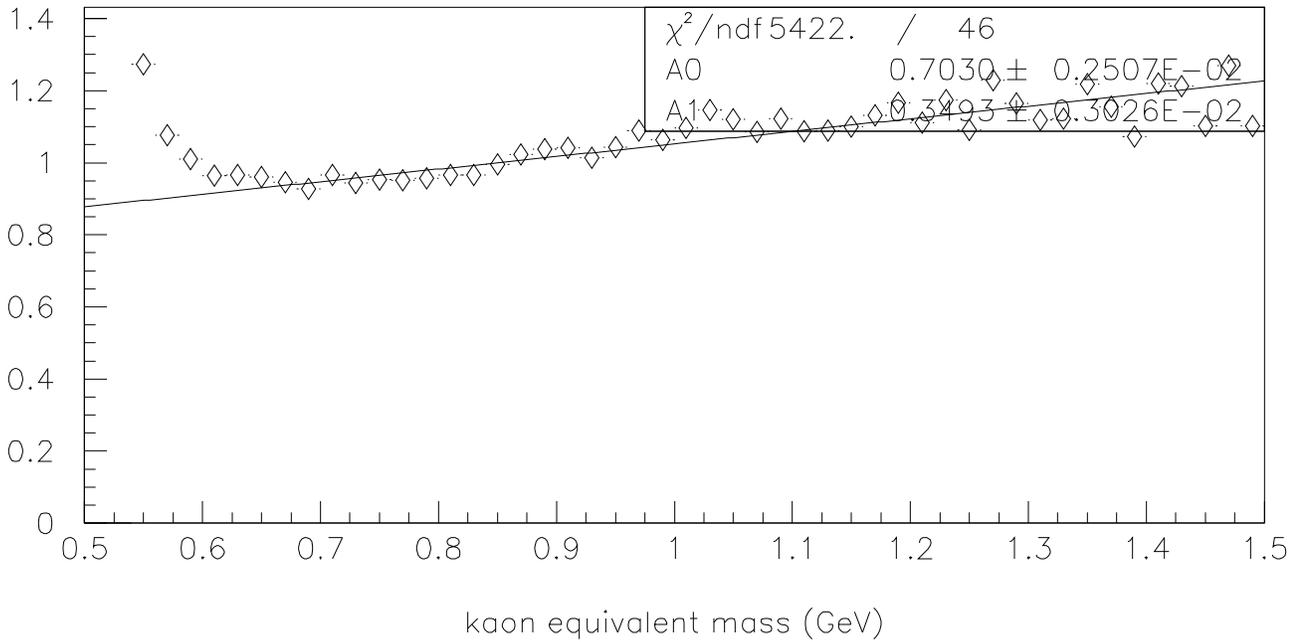
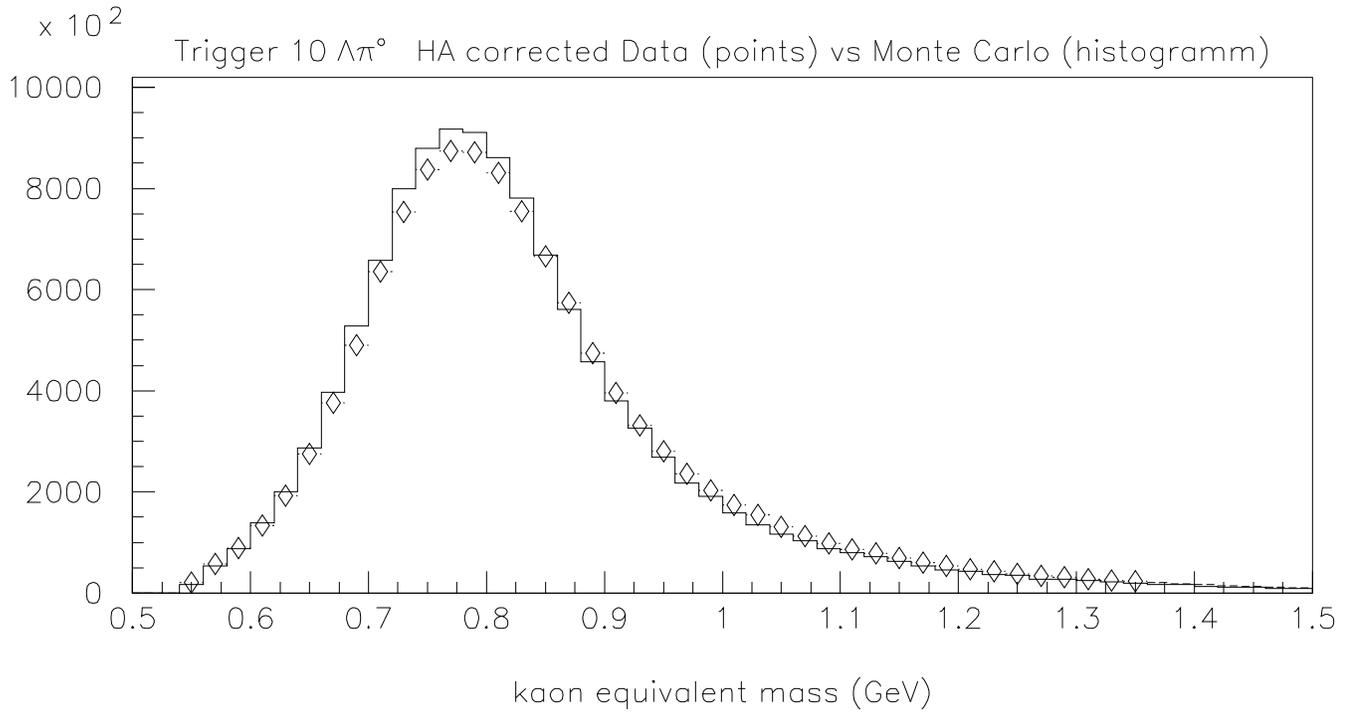




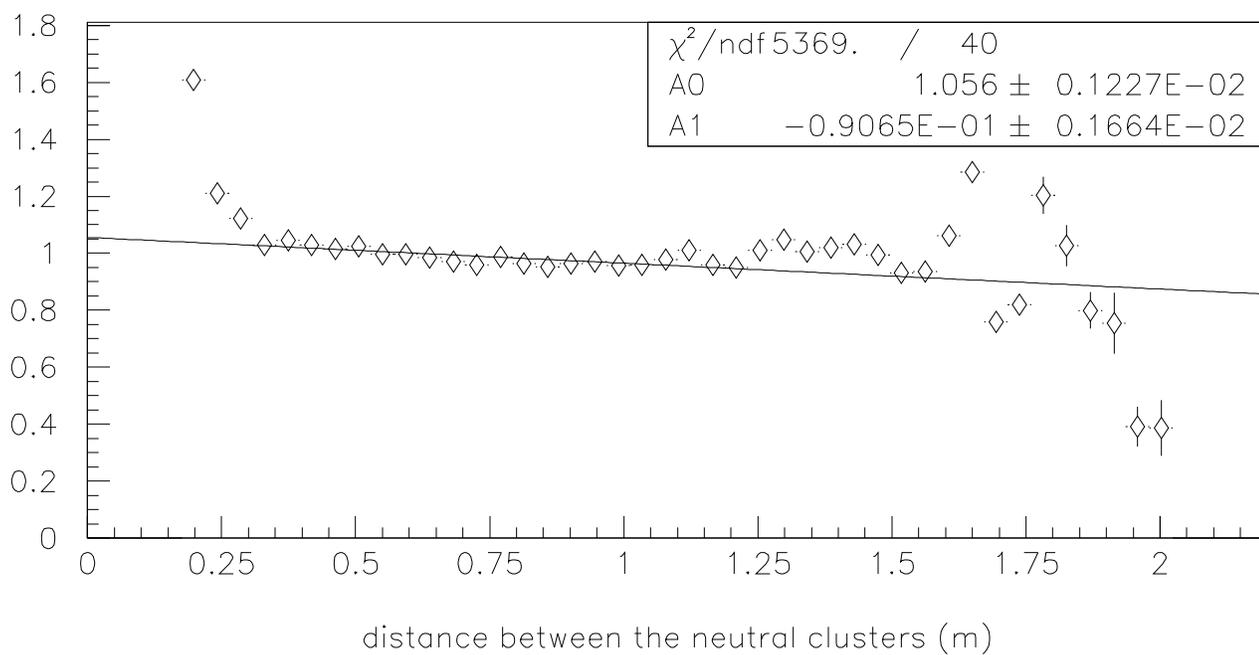
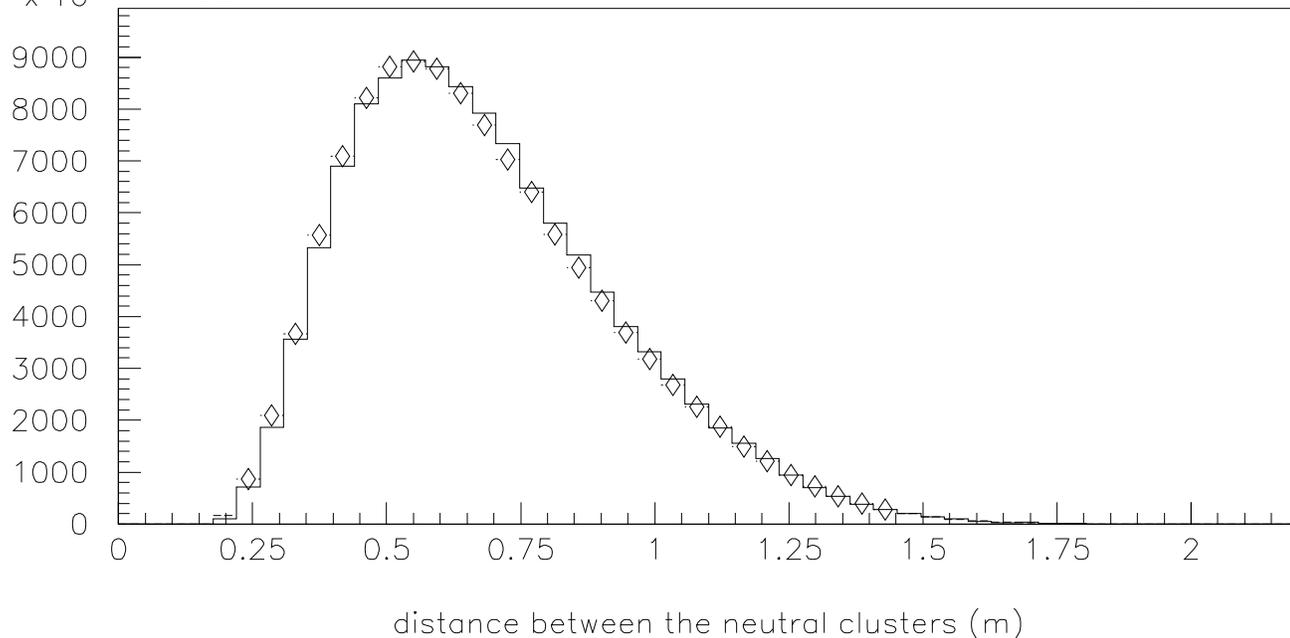


$\times 10^2$  Trigger  $10 \Lambda\pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)





$\times 10^2$  Trigger 10  $\Lambda\pi^0$  HA corrected Data (points) vs Monte Carlo (histogramm)



# Trigger 11 study. UPA043-UPA333

	<u>Total Trigger 11</u>	<u>Trigger 11.!10 +Trigger 10.11</u>	<u>Flux</u>
$L^0 p^0 + \underline{L}^0 p^0$	1,706,899	840,567+866,332	$32,002,170 \pm 70,395$
$L^0 p^0$	1,569,929	775,720+794,209	$29,434,158 \pm 65,088$
$L^0 g + \underline{L}^0 g$	508-(40+8)	235+273-(40+8)	$43,730 \pm 2,320$
$L^0 g$	453-(36+5)	208+245-(36+5)	$39,167 \pm 2,124$

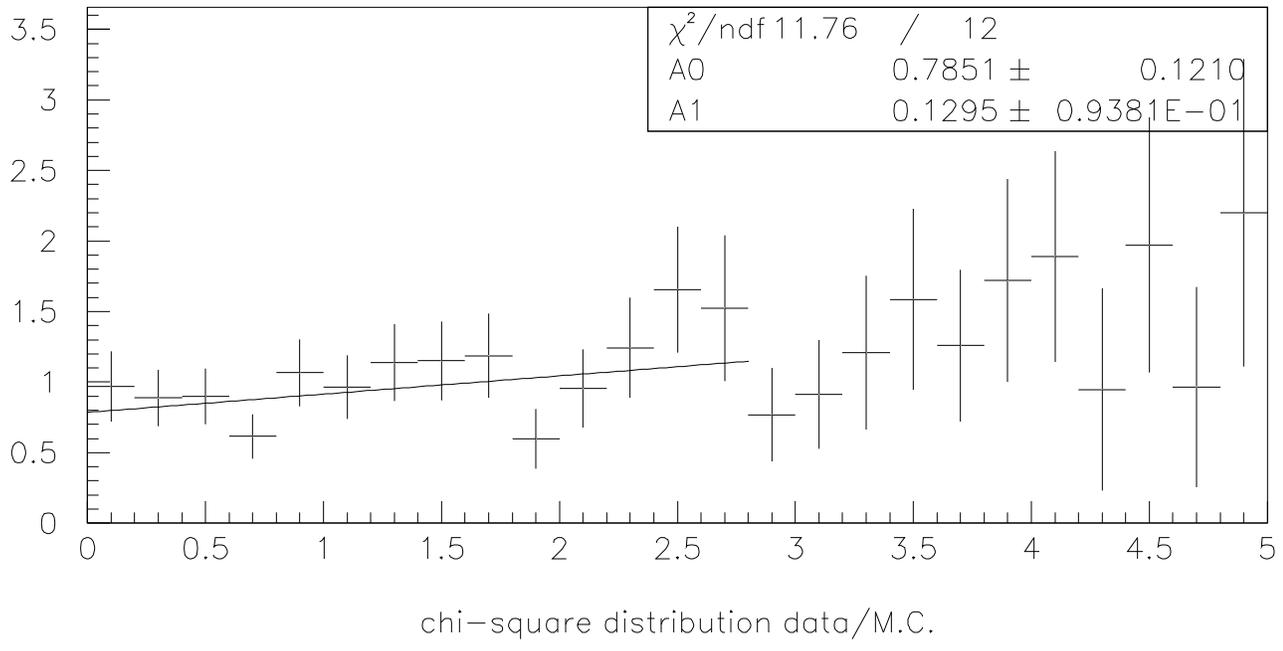
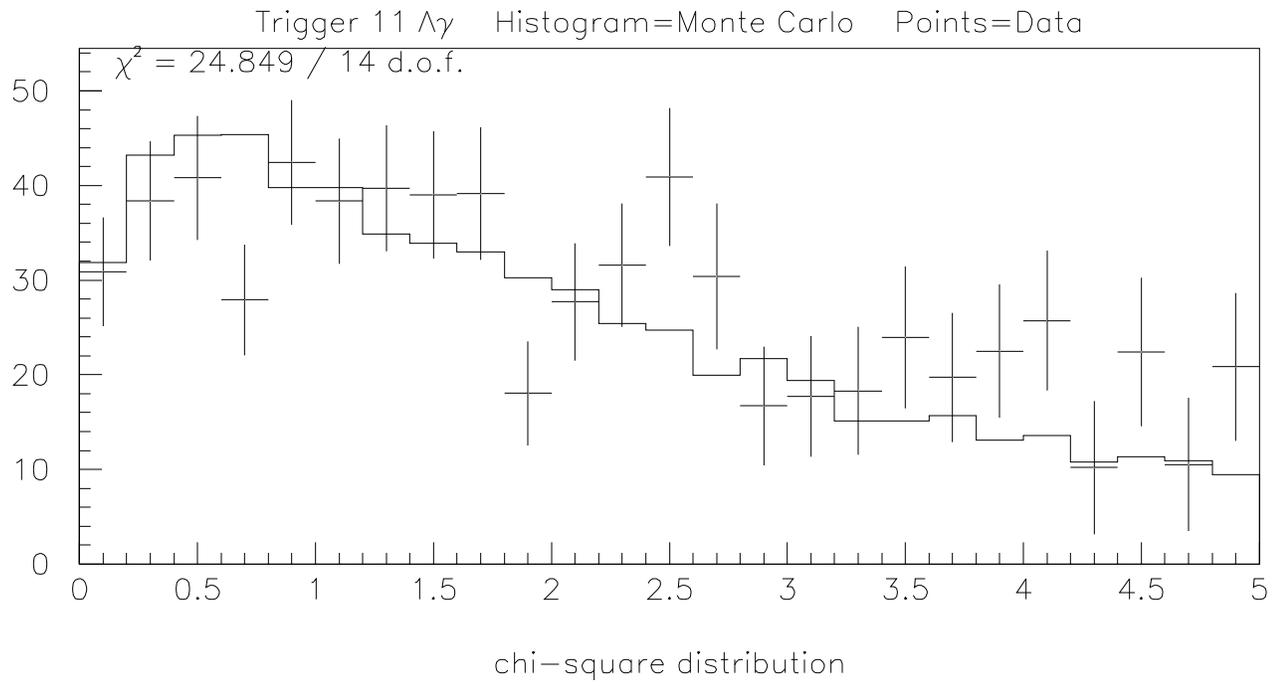
## Trigger 11 Monte Carlo acceptance studies: ( $a_{Lg} = -0.70$ )

	<u>Generated</u>	<u>Accepted</u>	<u>acceptance</u>
$L^0 p^0$	3,999,908	213,343	$0.053340 \pm 0.00011$
$L^0 g$	999,907	10,518	$0.010519 \pm 0.00010$

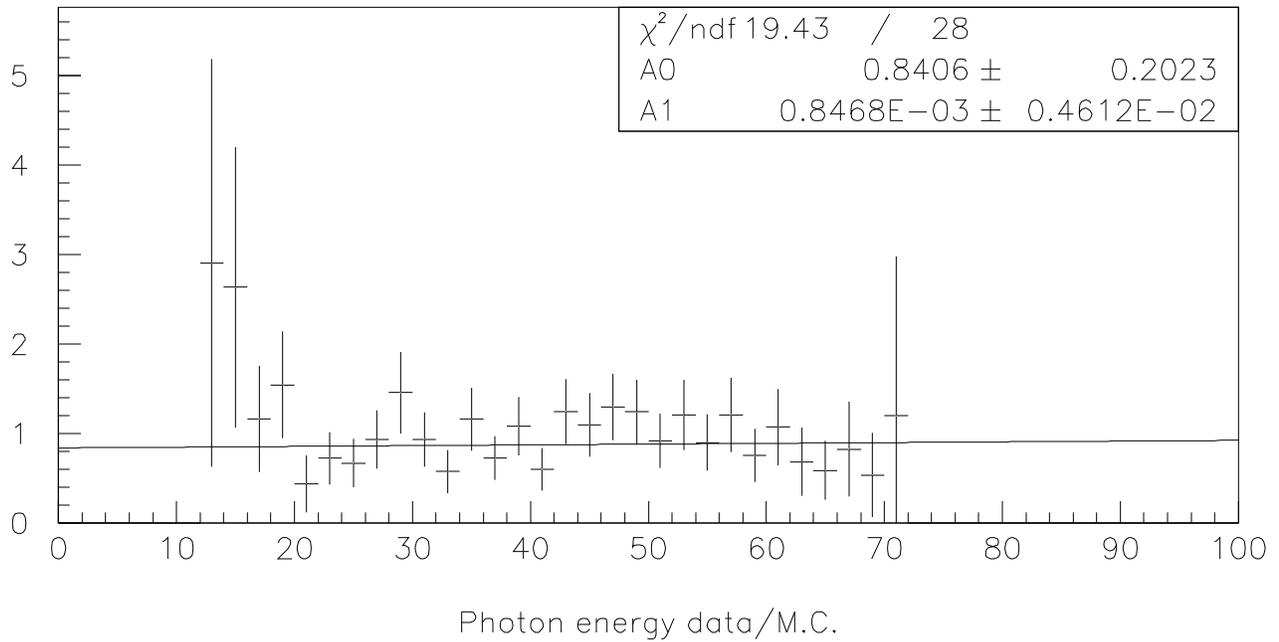
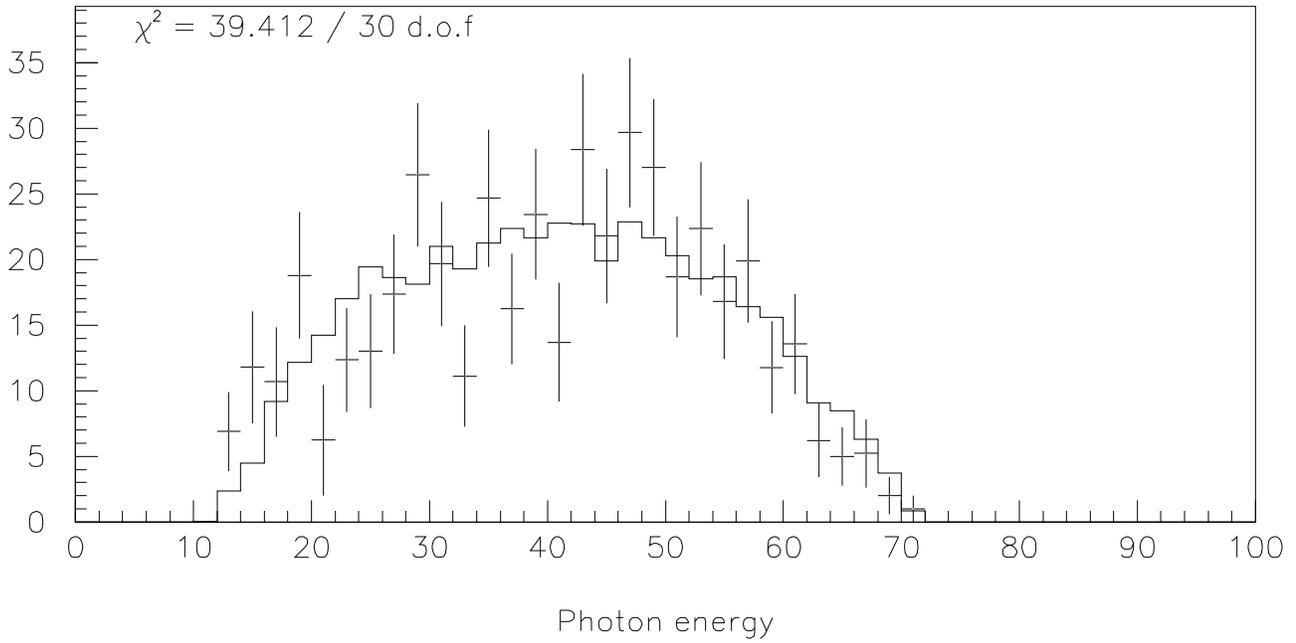
## Branching Ratios

- From Trigger 11  $L^0 g + \underline{L}^0 g$ :  $(1.366 \pm 0.072 \pm 0.003) \times 10^{-3}$
- From Trigger 11  $L^0 g$ :  $(1.331 \pm 0.072 \pm 0.003) \times 10^{-3}$
- From Trigger 10  $L^0 g + \underline{L}^0 g$ :  $(1.231 \pm 0.038 \pm 0.003) \times 10^{-3}$
- From Trigger 10  $L^0 g$ :  $(1.230 \pm 0.039 \pm 0.003) \times 10^{-3}$

**Average Branching Ratio:**  $(1.30 \pm 0.04 \pm 0.07) \times 10^{-3}$

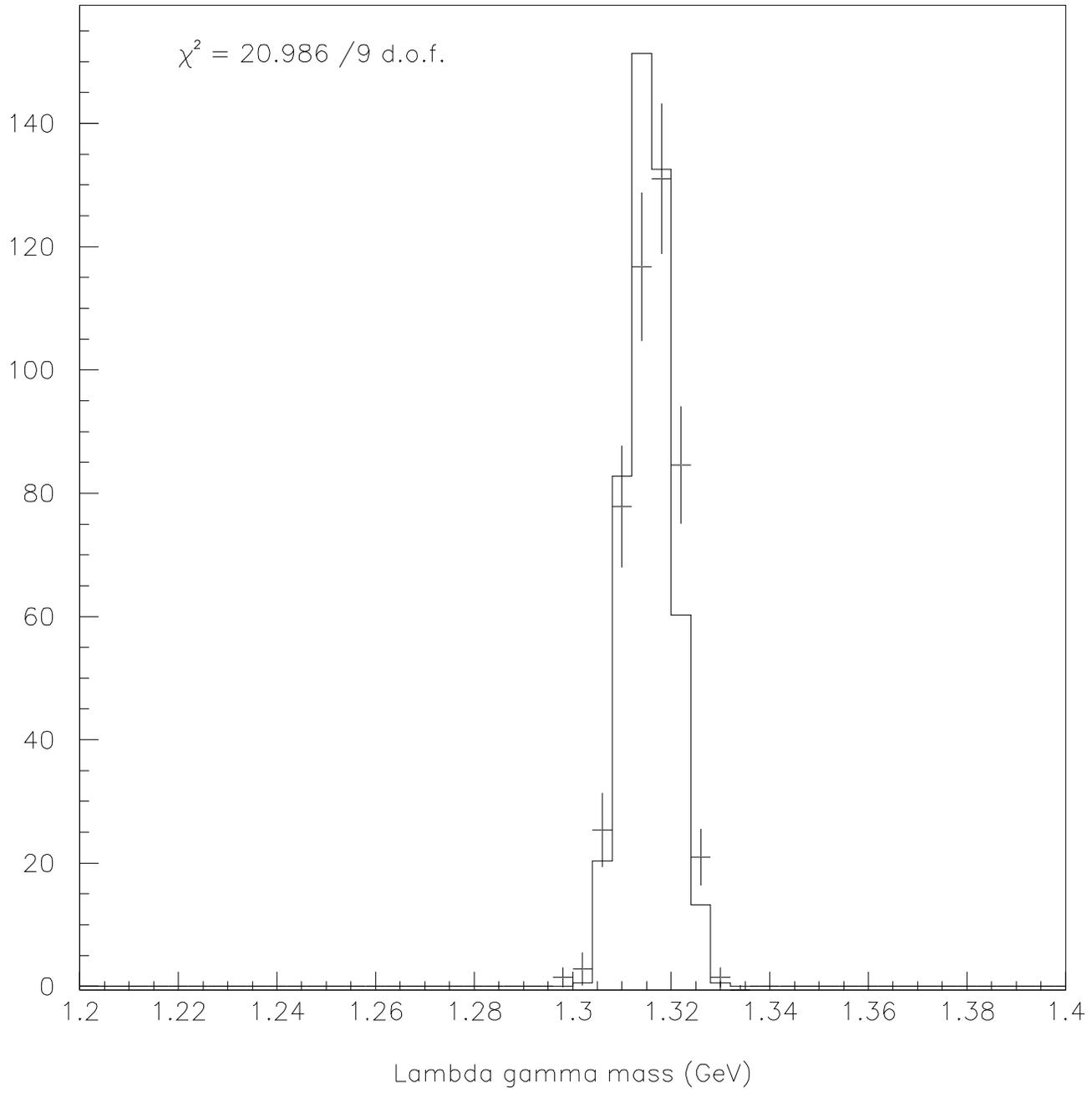


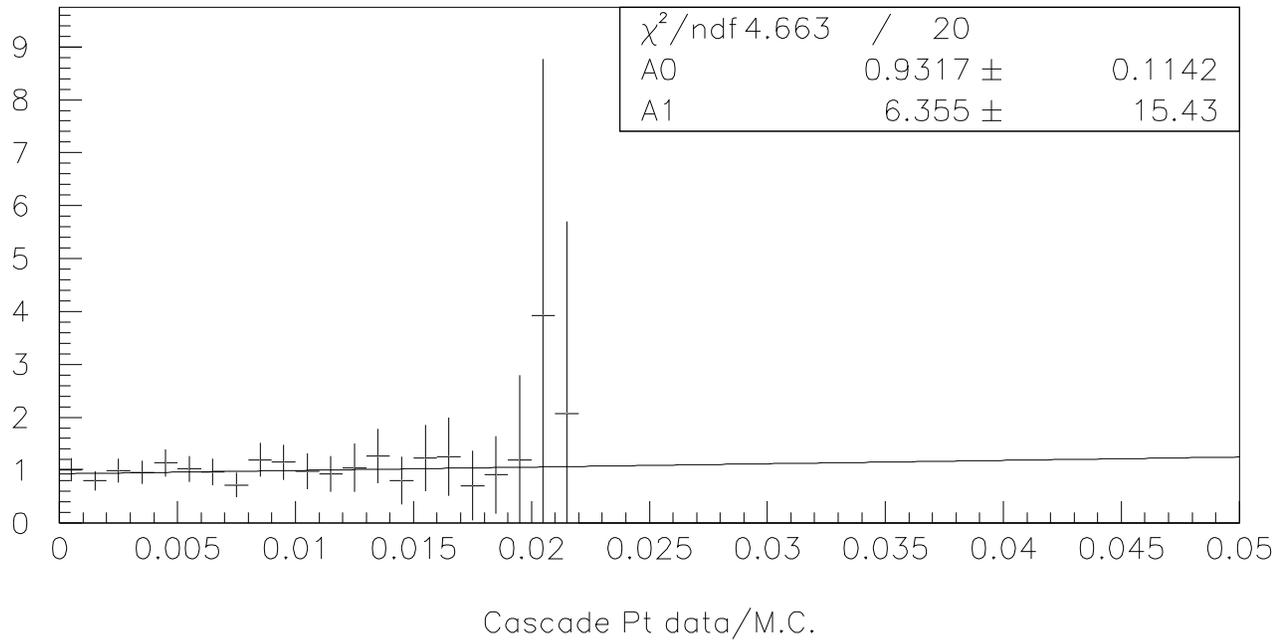
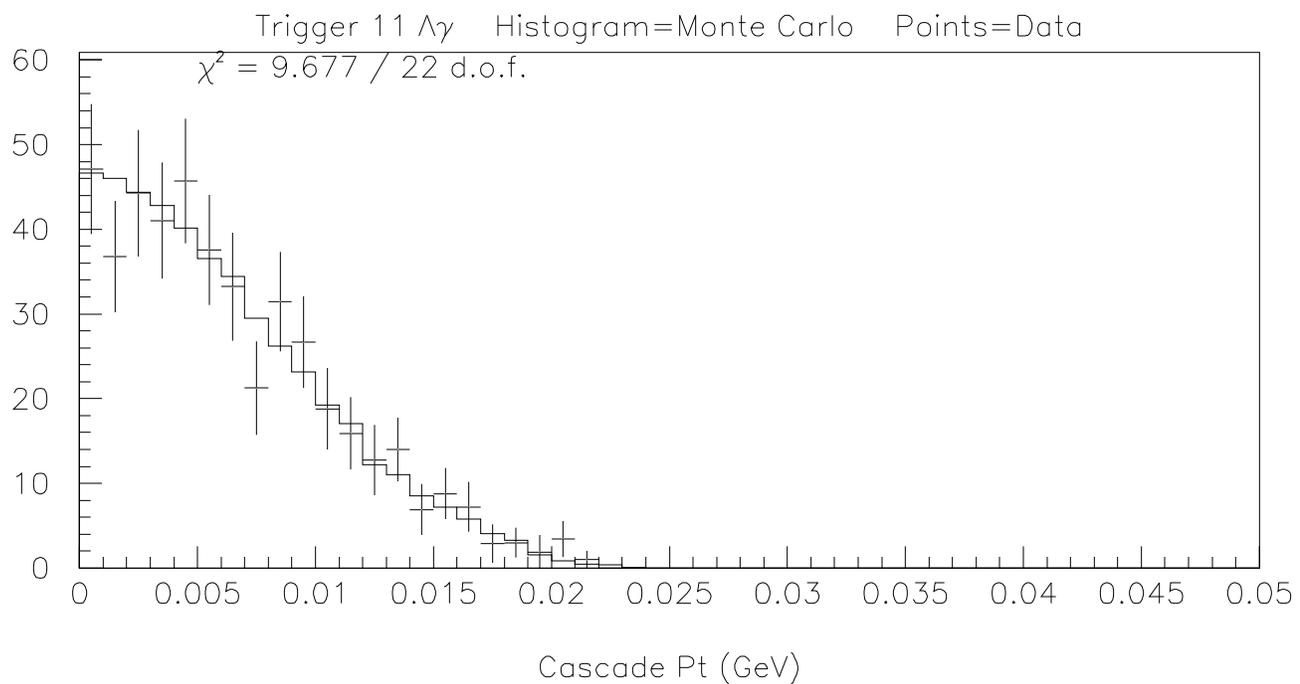
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



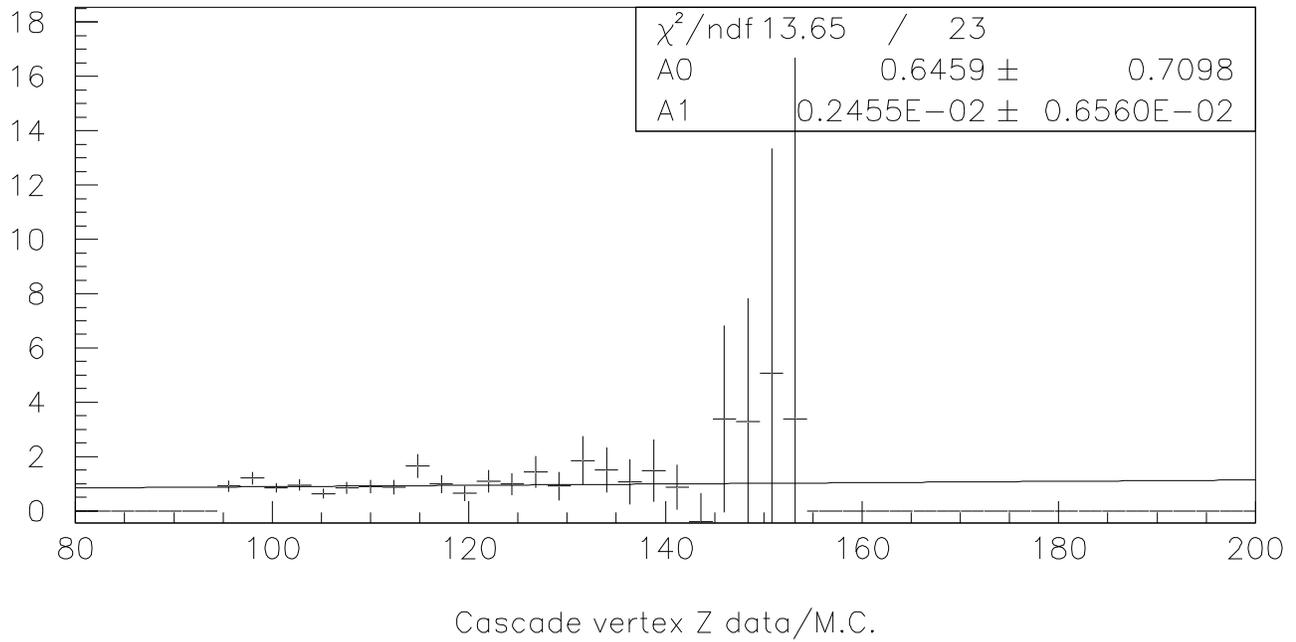
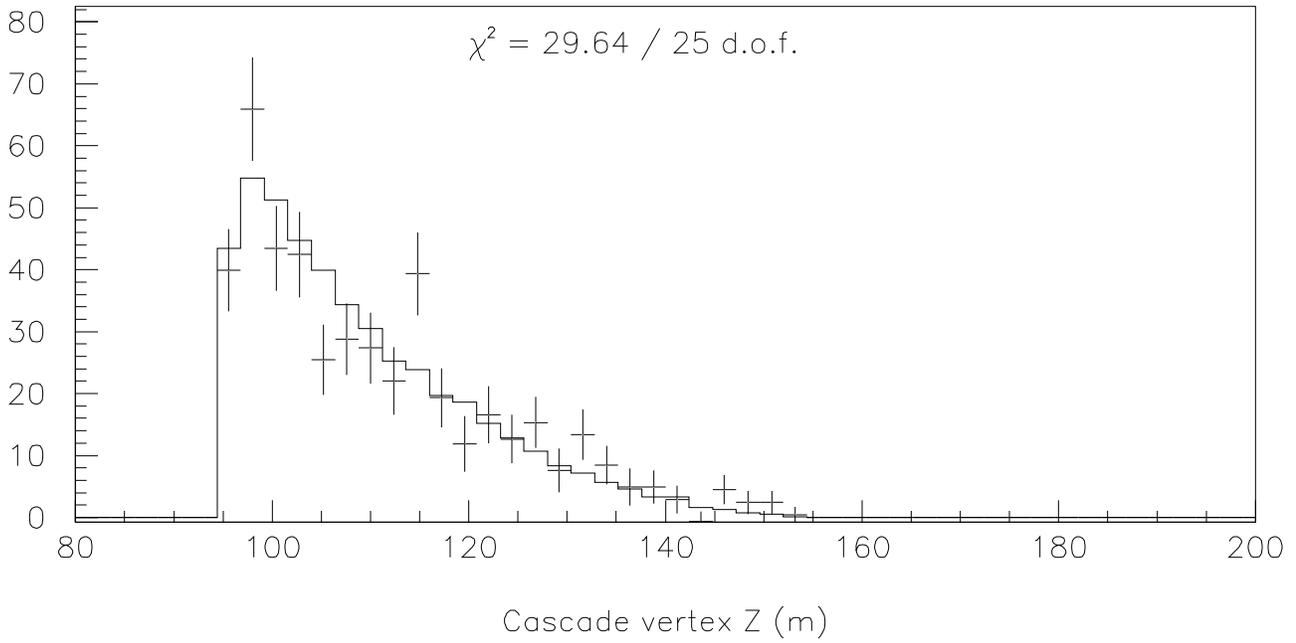
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 20.986 / 9 \text{ d.o.f.}$



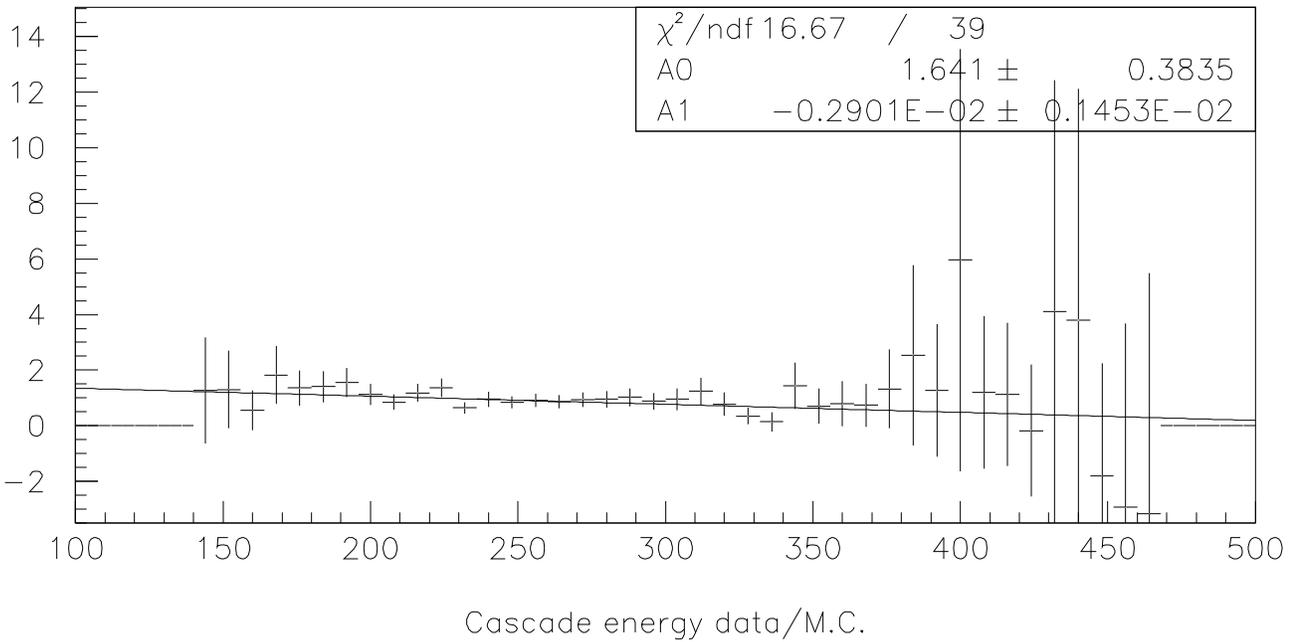
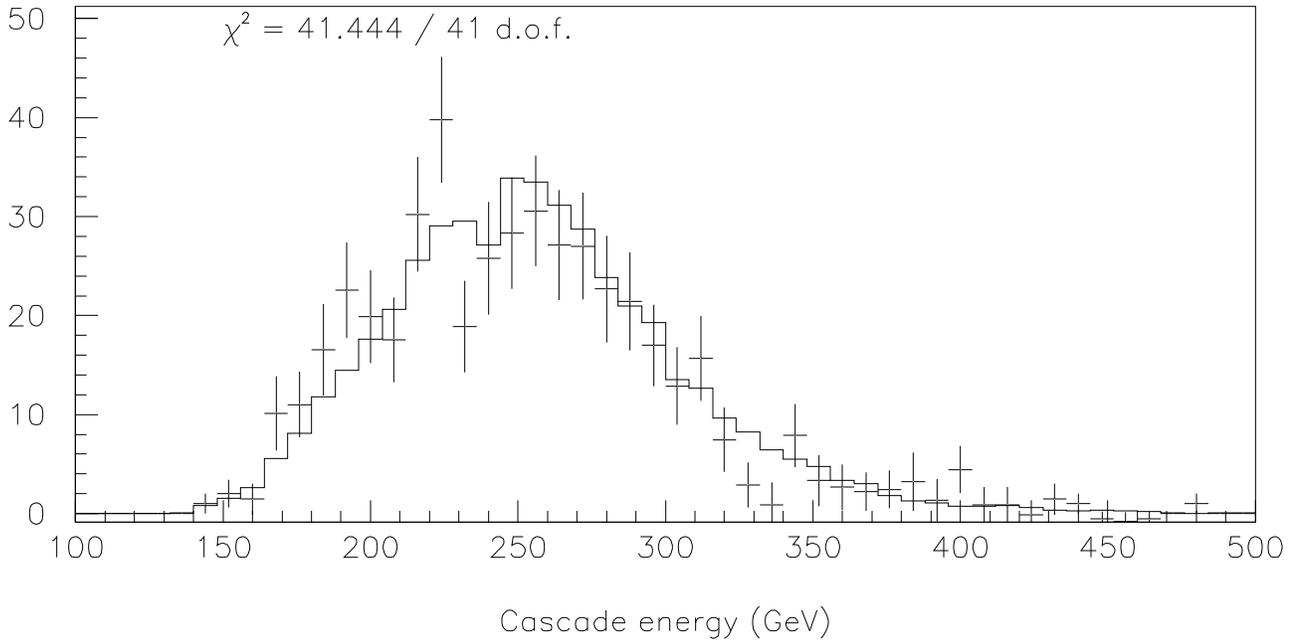


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



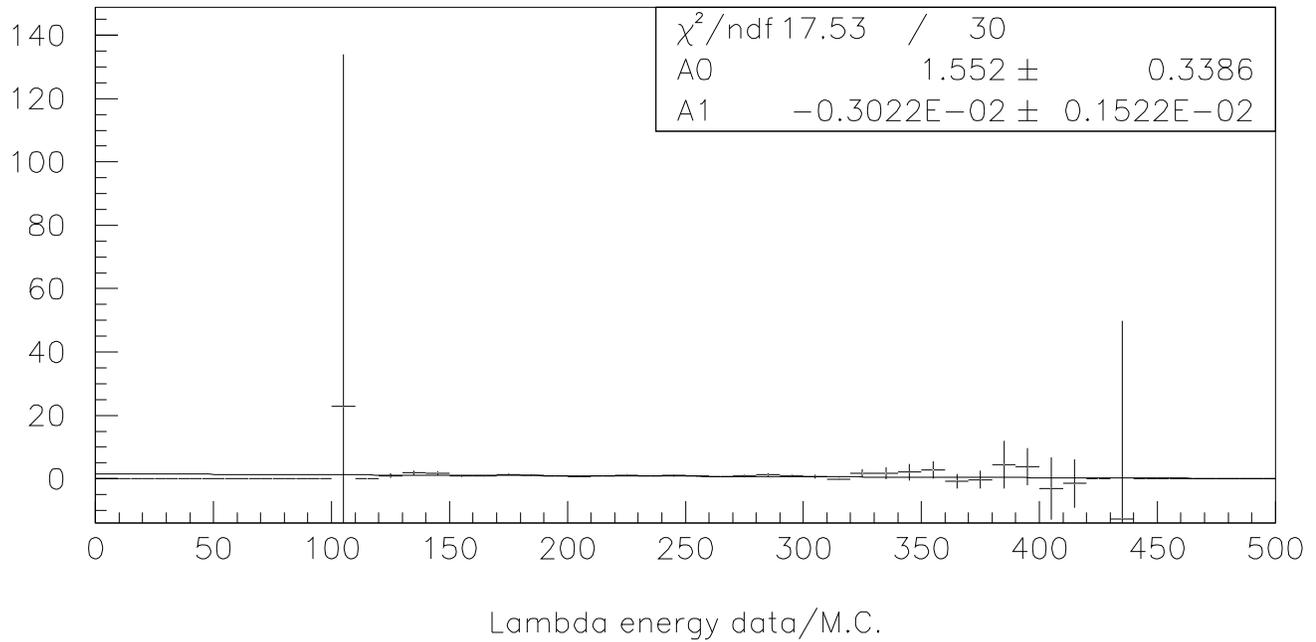
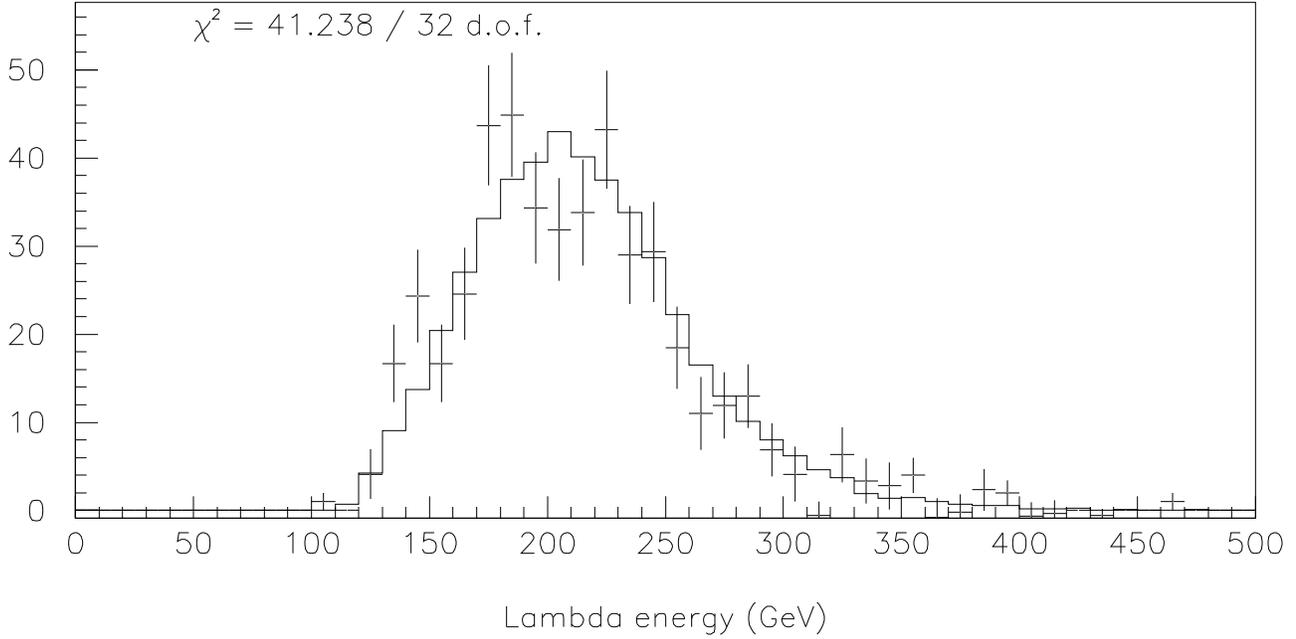
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 41.444 / 41$  d.o.f.



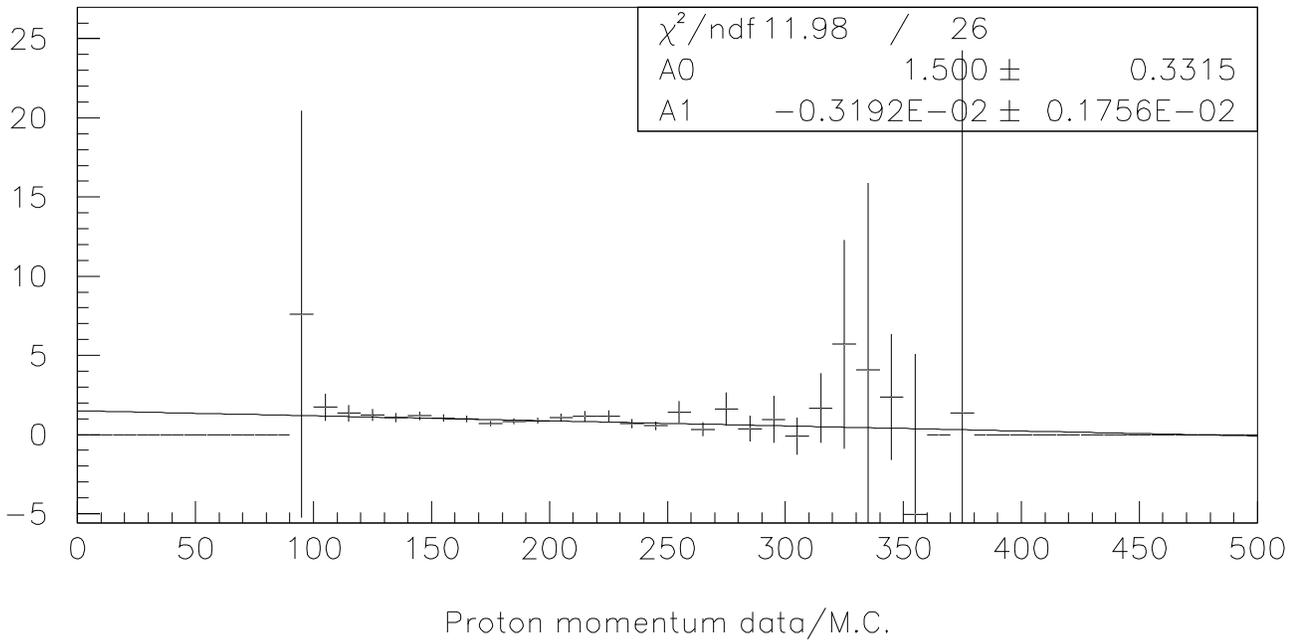
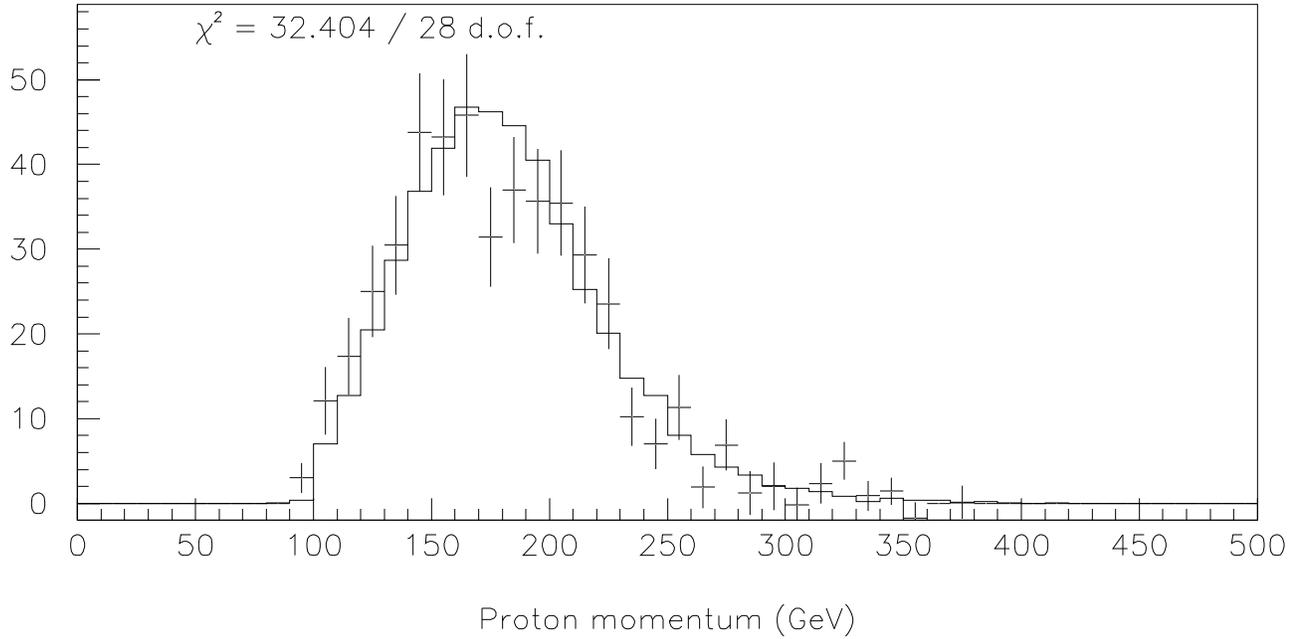
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 41.238 / 32$  d.o.f.

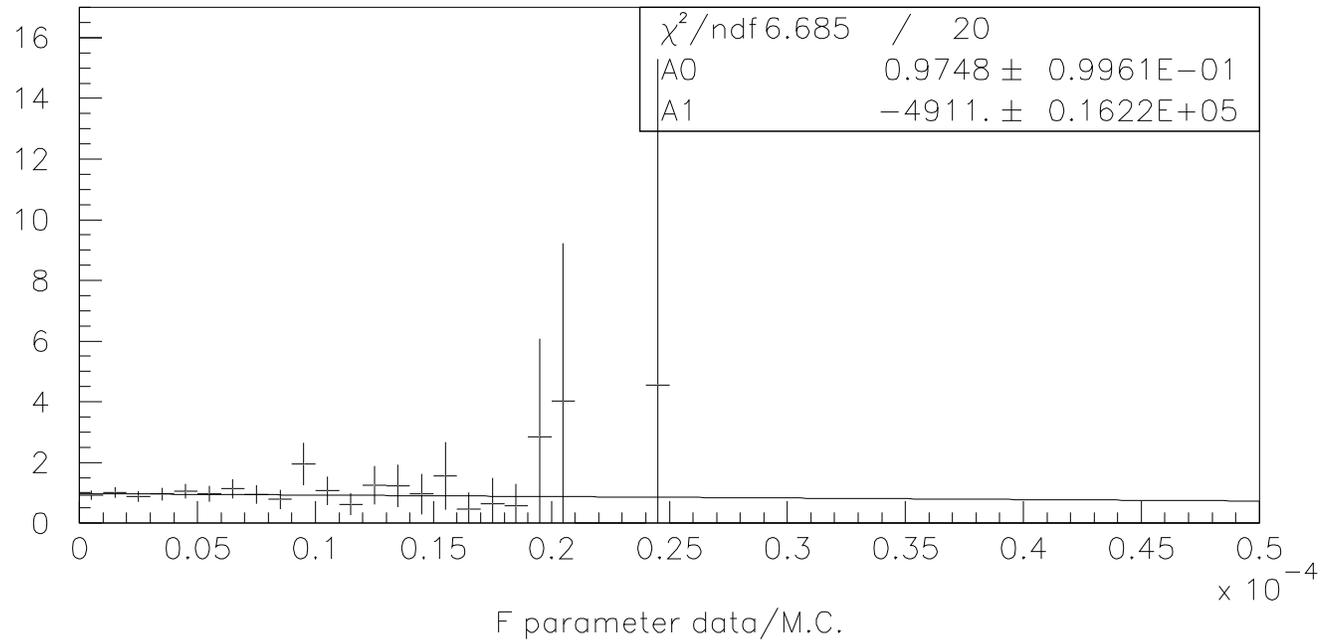
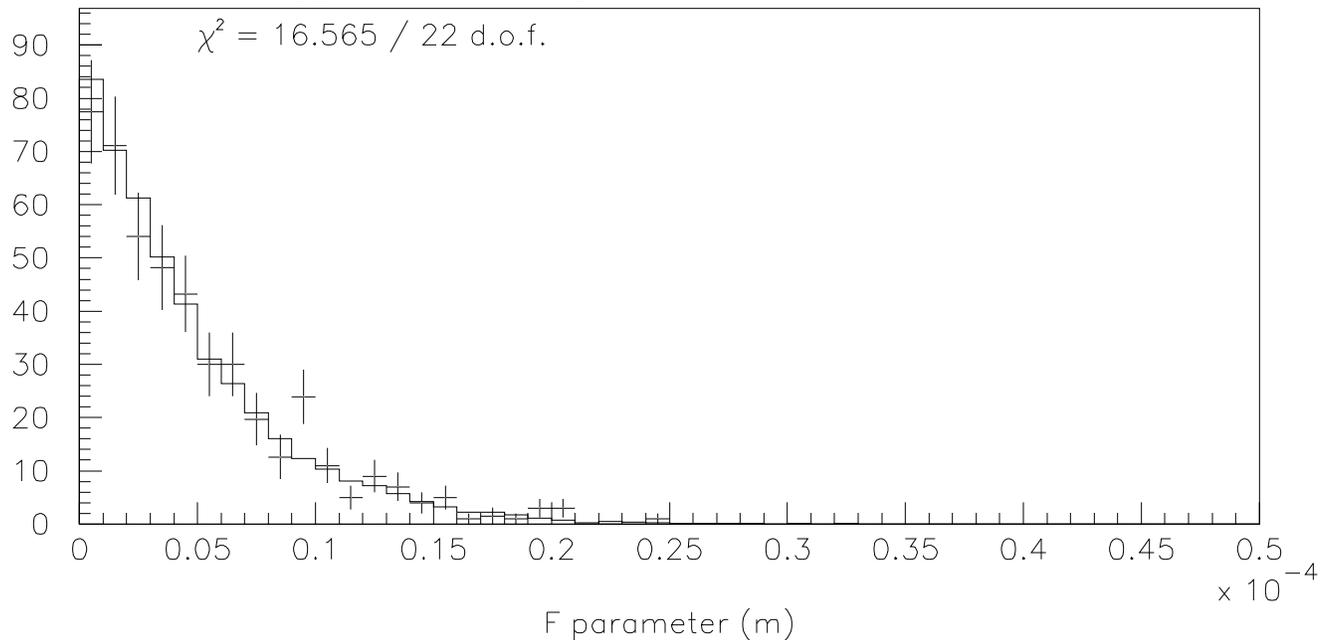


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

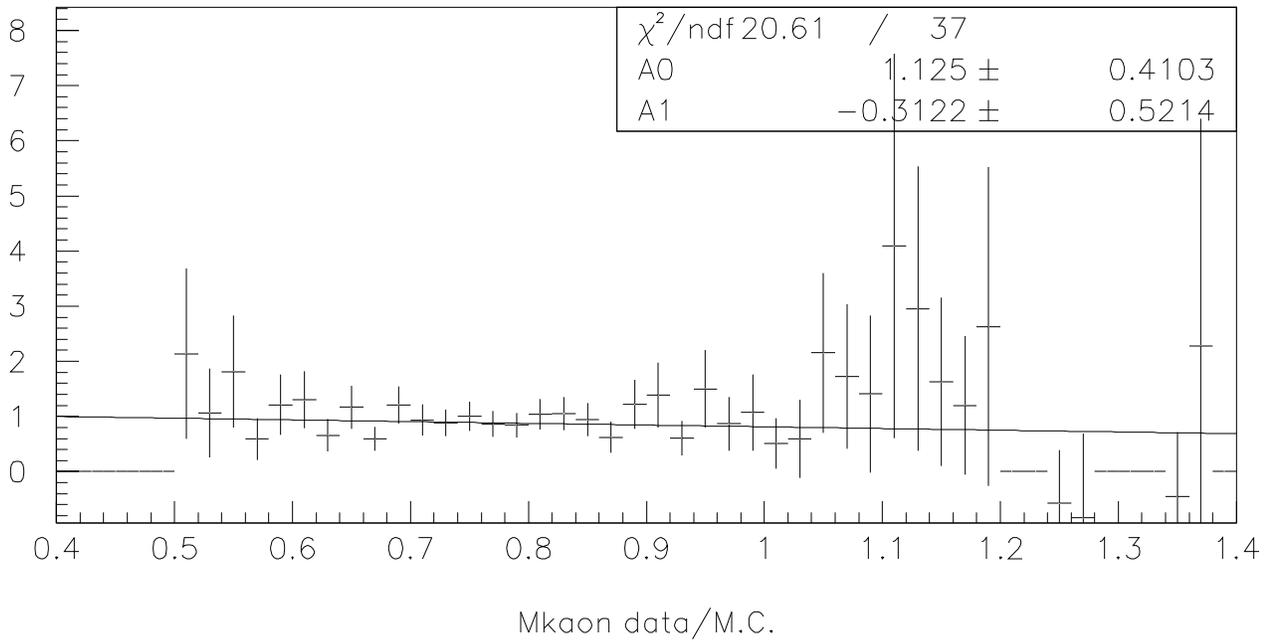
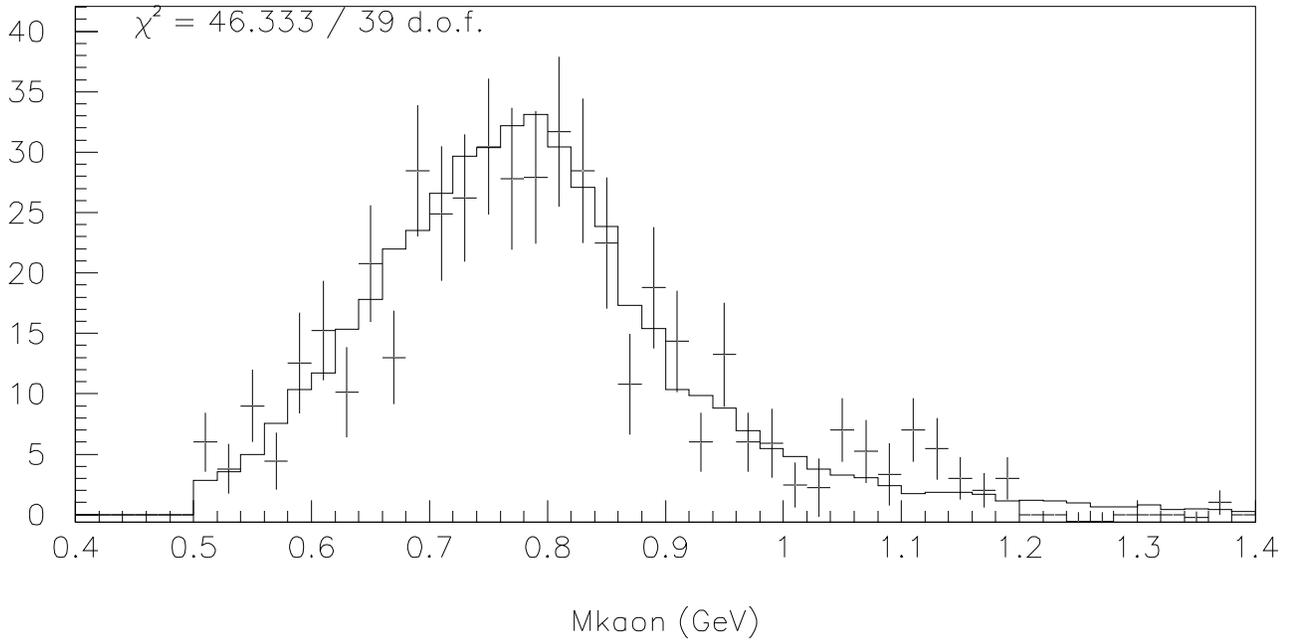
$\chi^2 = 32.404 / 28$  d.o.f.



Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

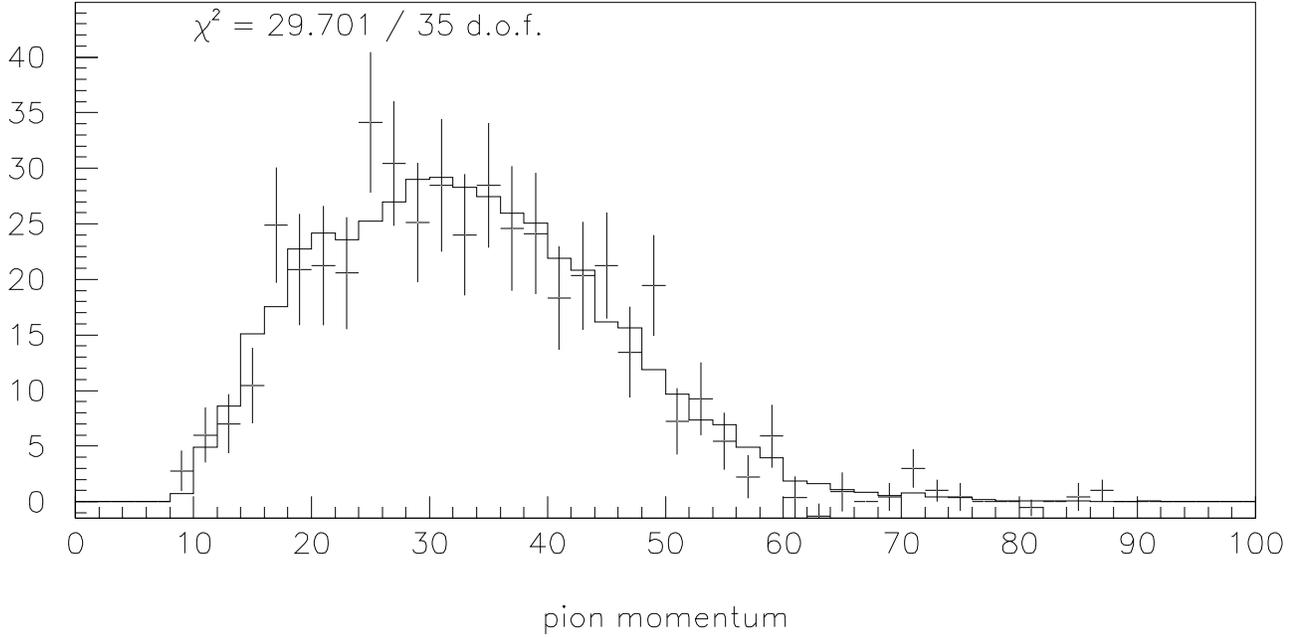


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

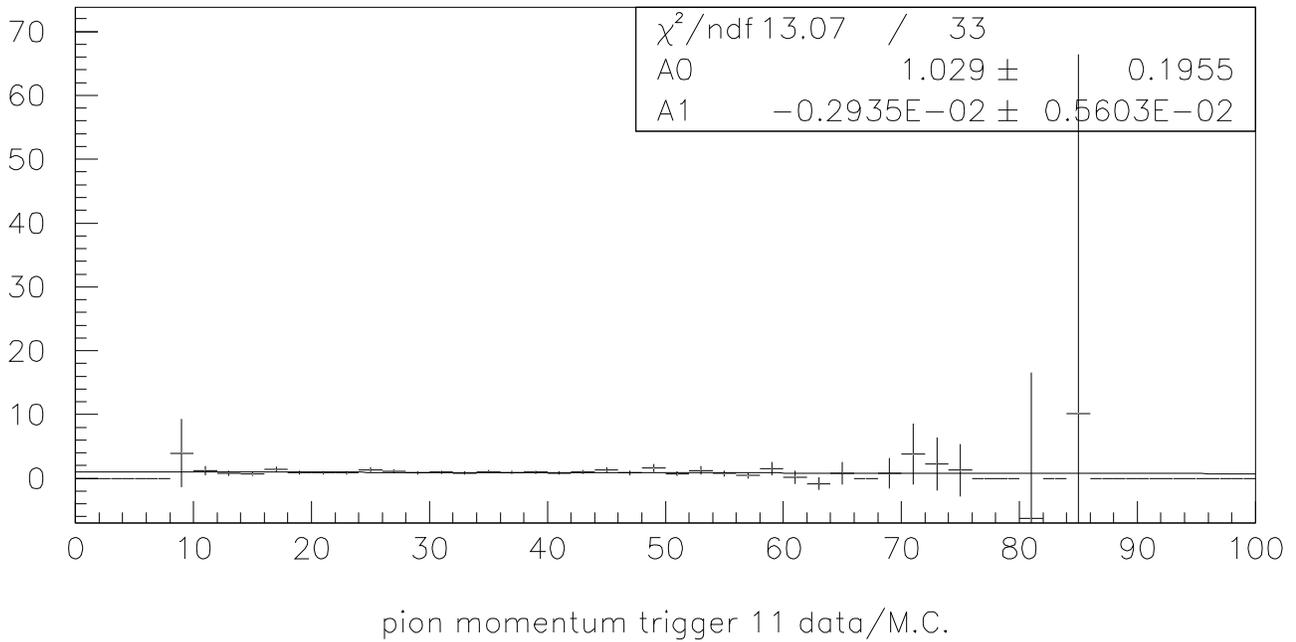


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 29.701 / 35$  d.o.f.

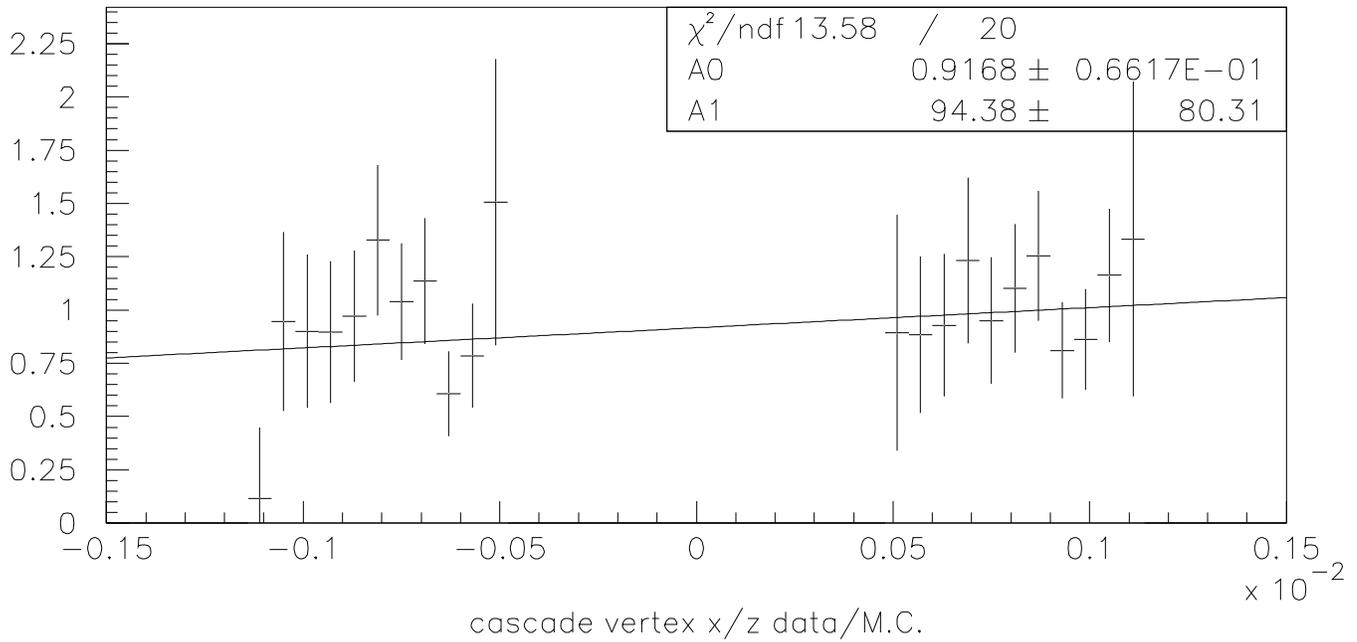
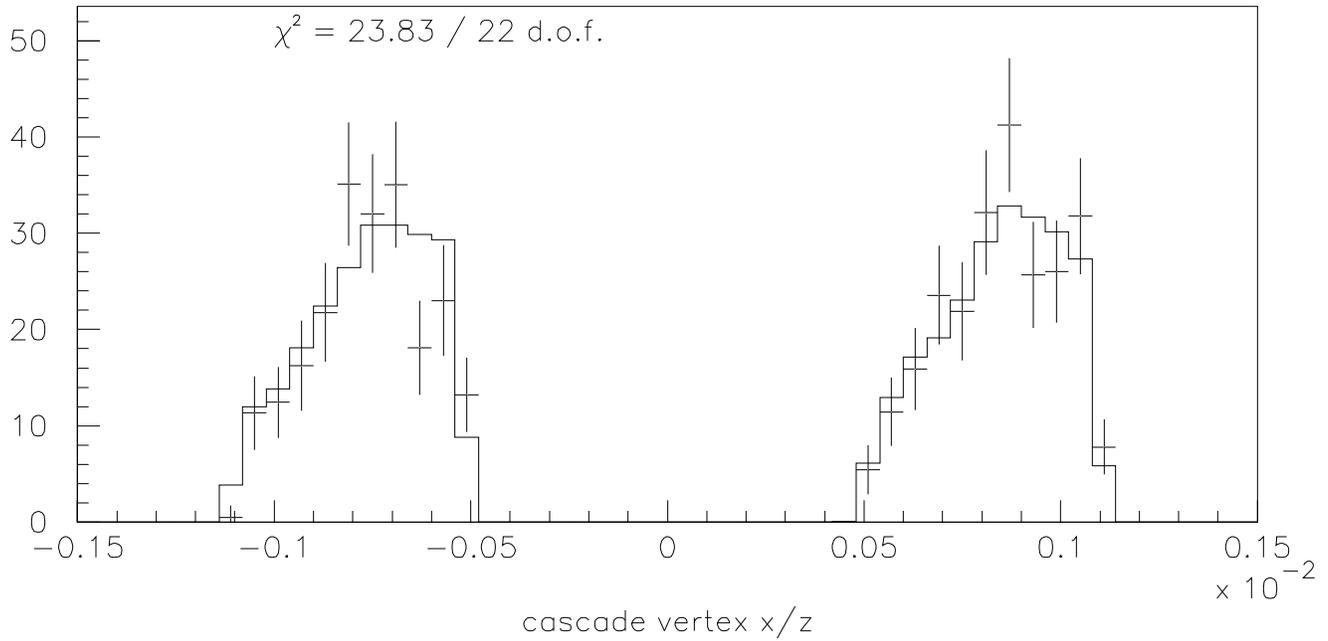


$\chi^2/\text{ndf}$	13.07	/	33
A0			$1.029 \pm 0.1955$
A1			$-0.2935\text{E}-02 \pm 0.5603\text{E}-02$

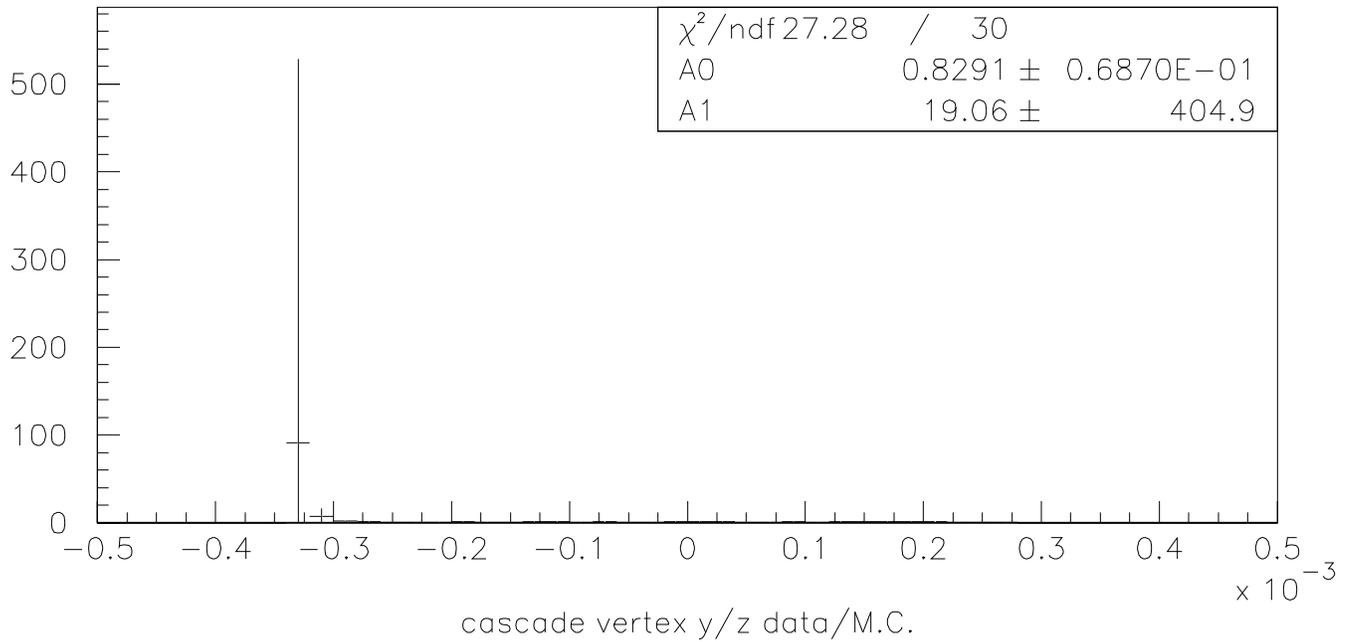
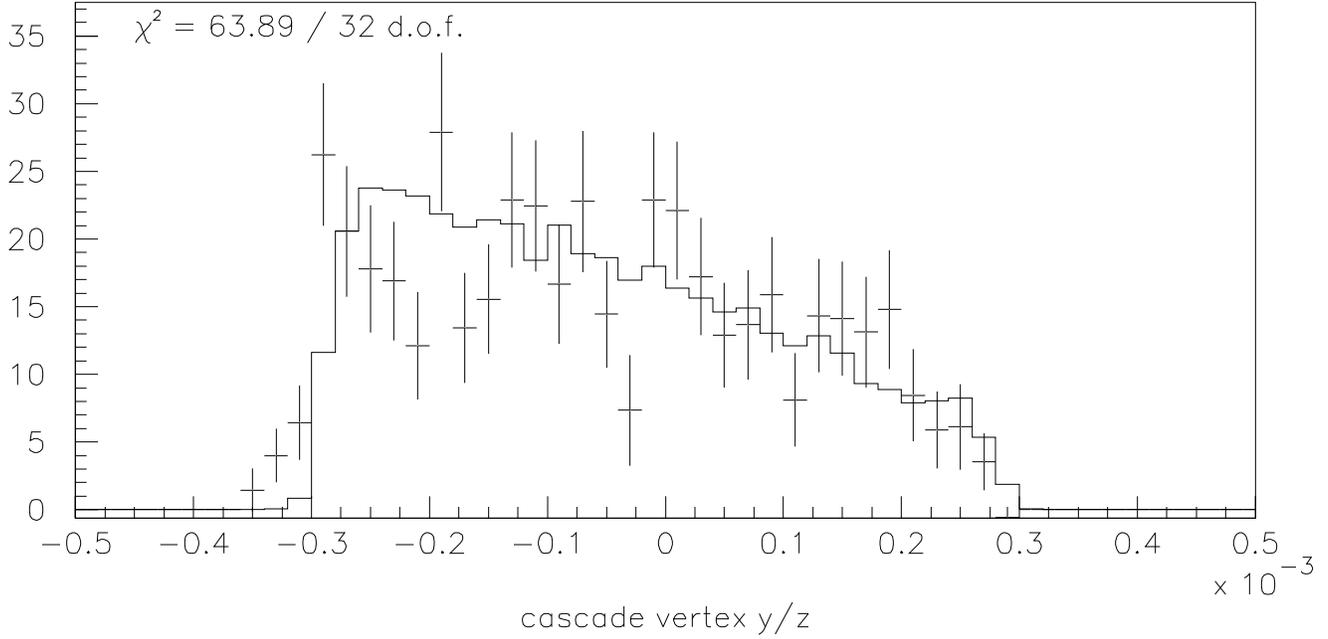


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

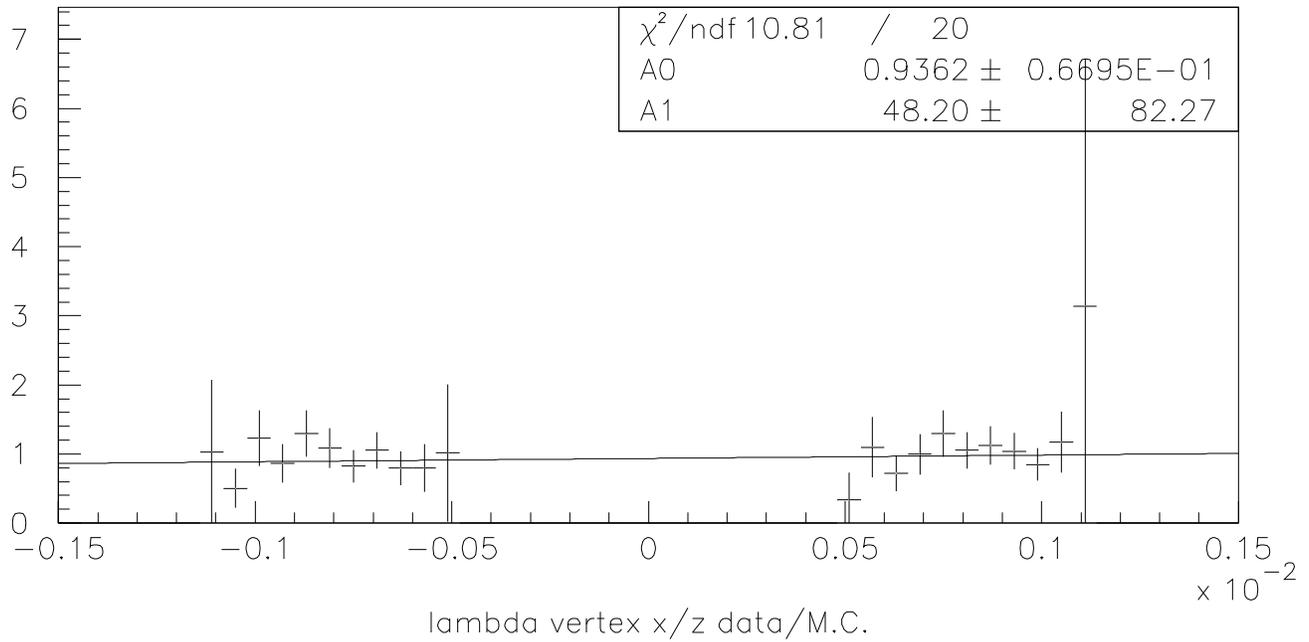
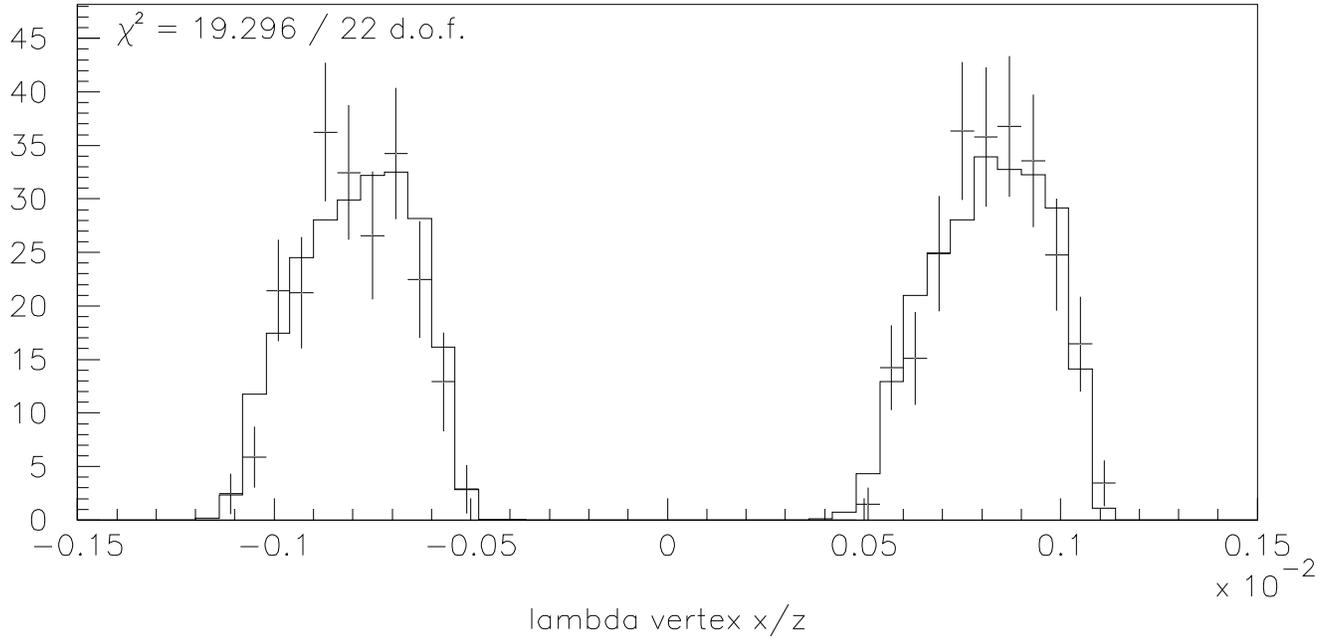
$\chi^2 = 23.83 / 22$  d.o.f.



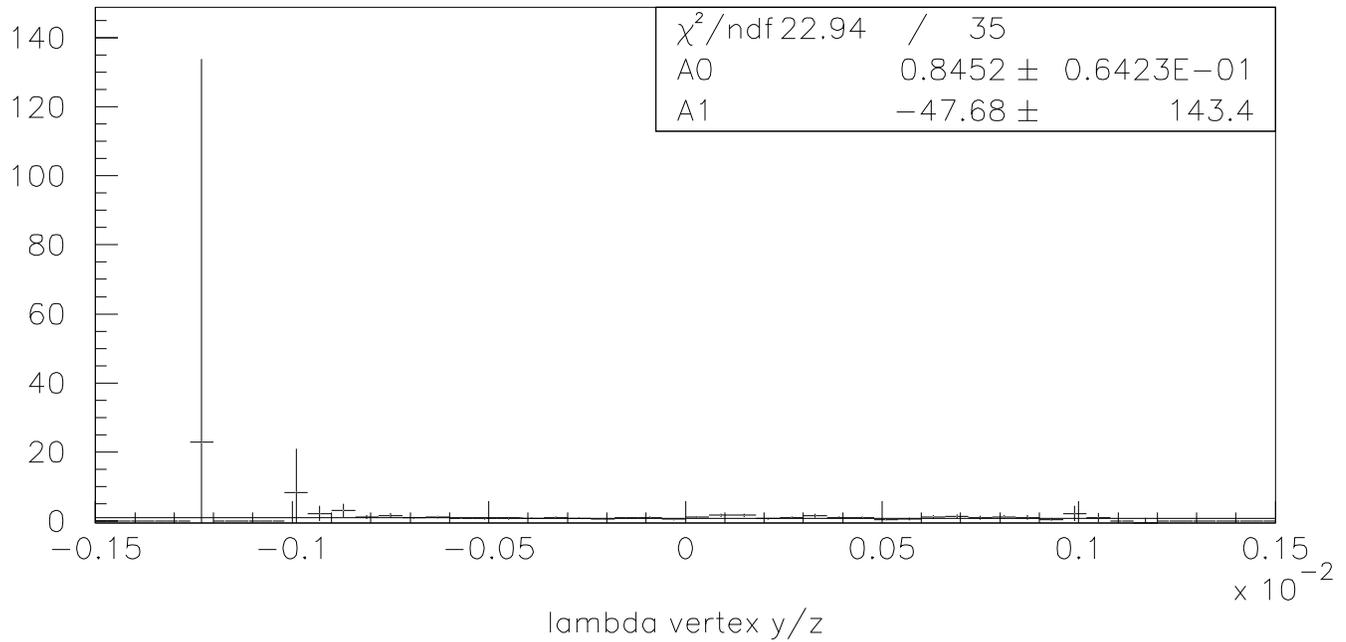
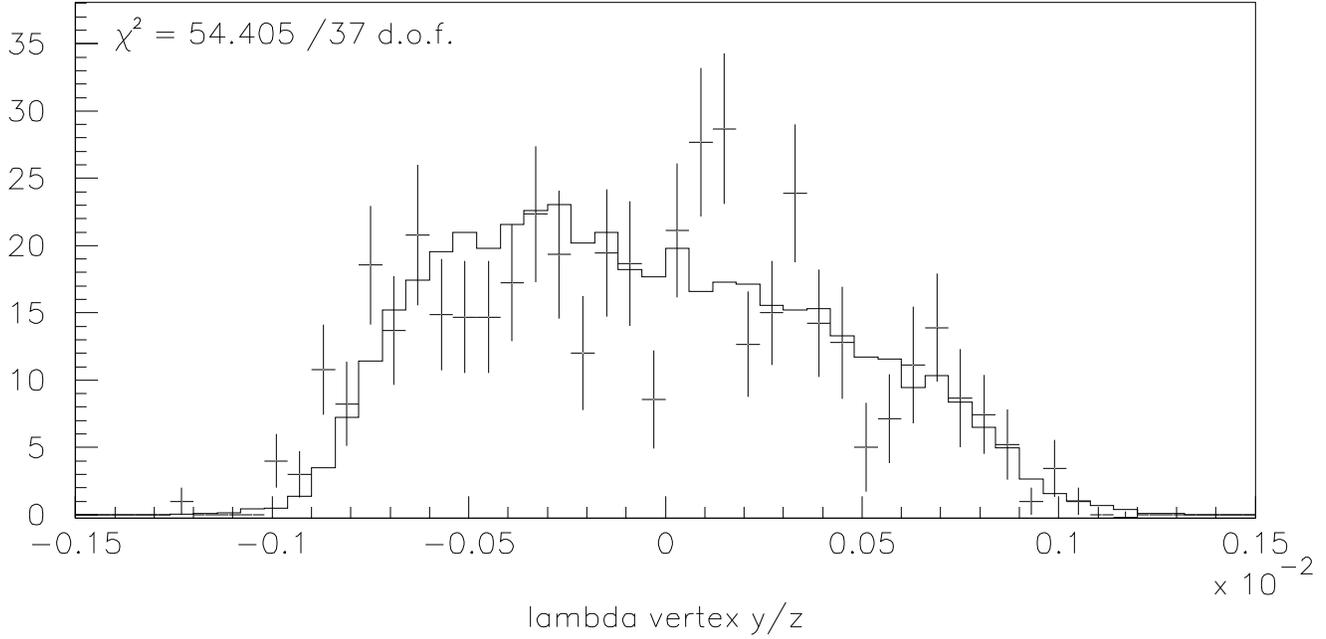
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



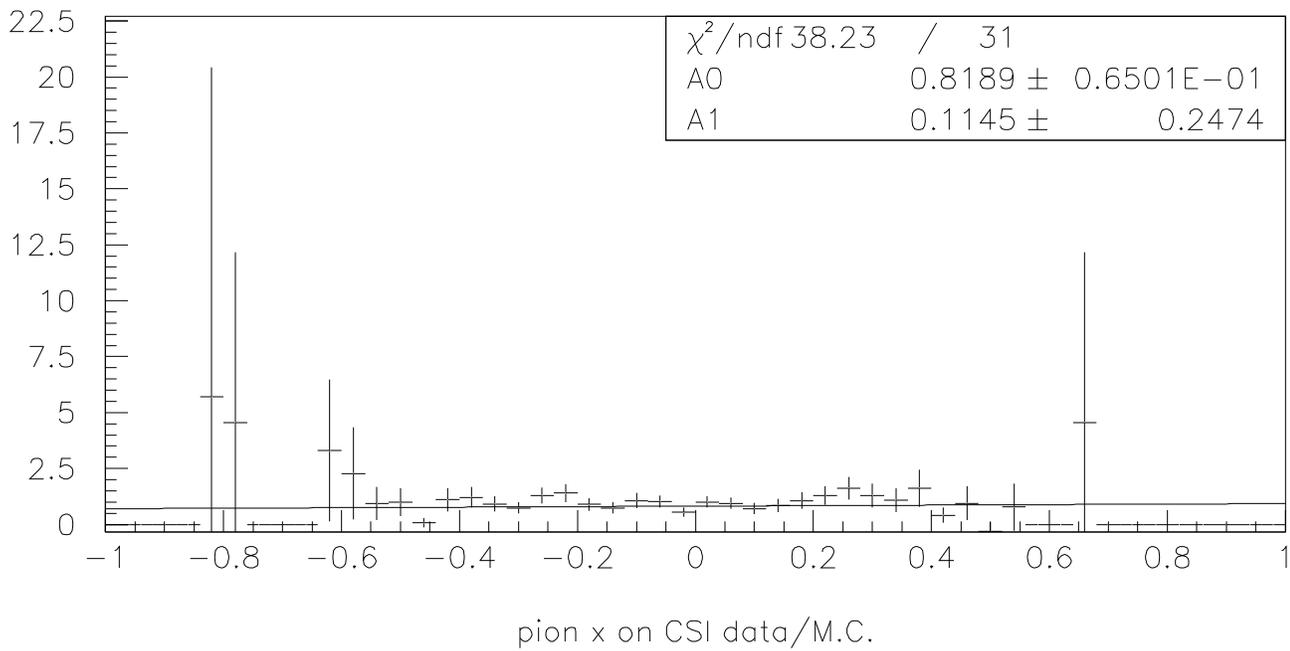
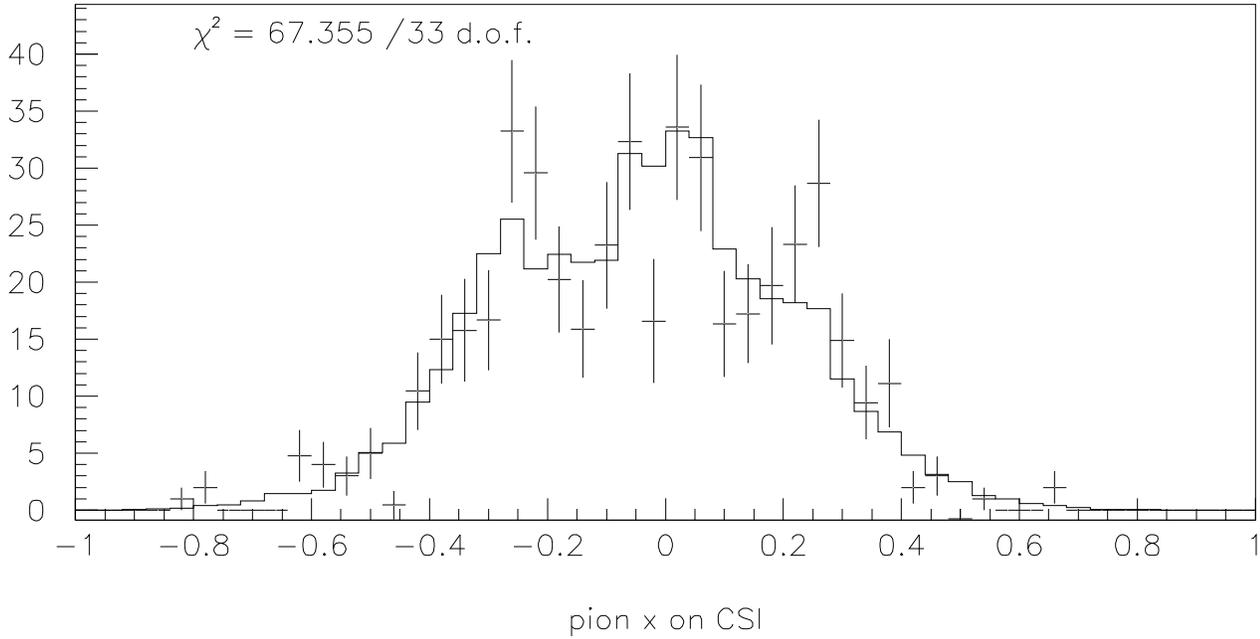
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



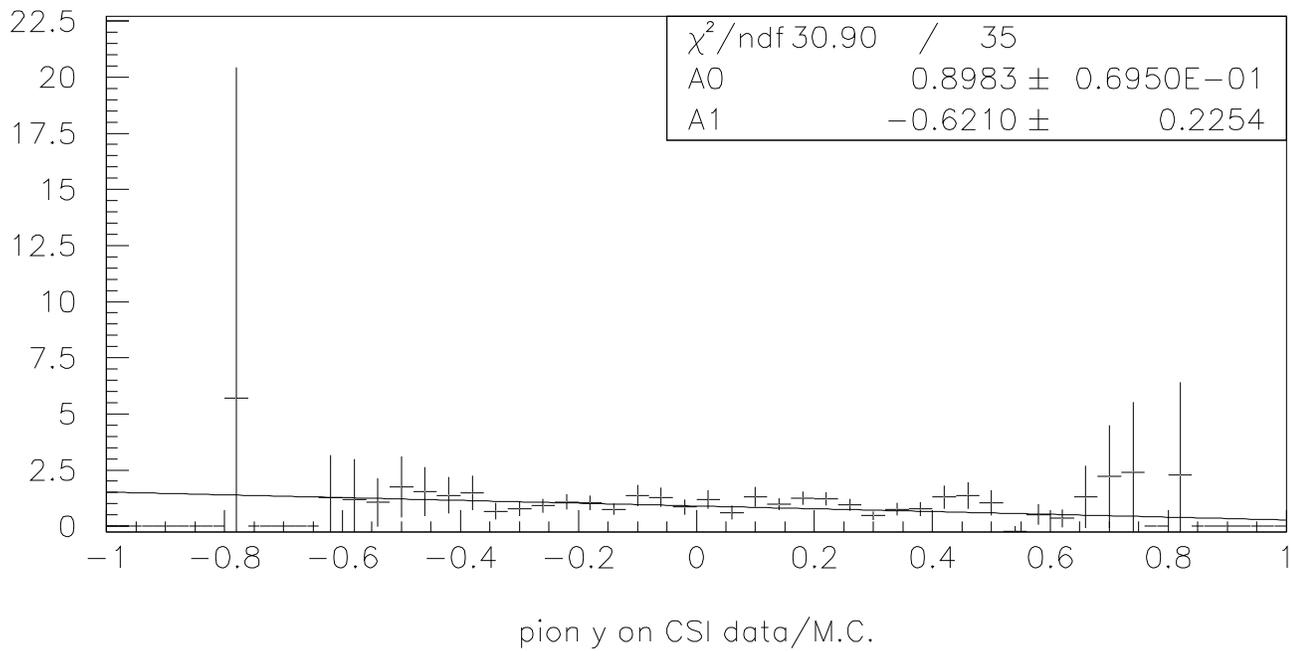
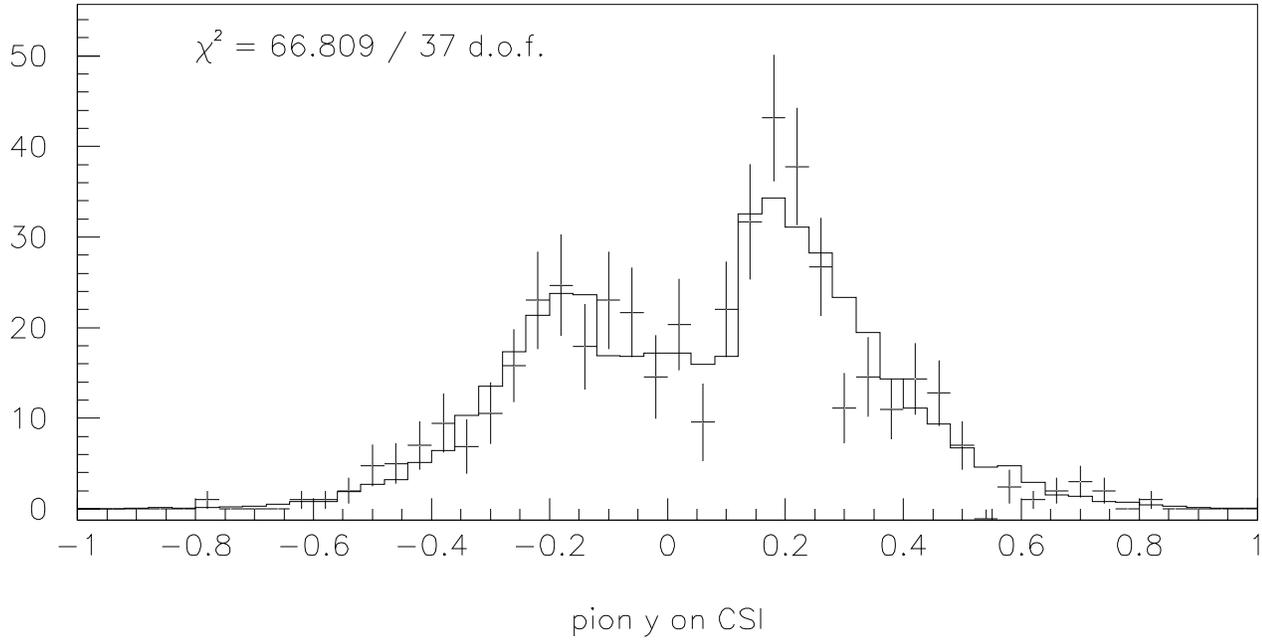
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

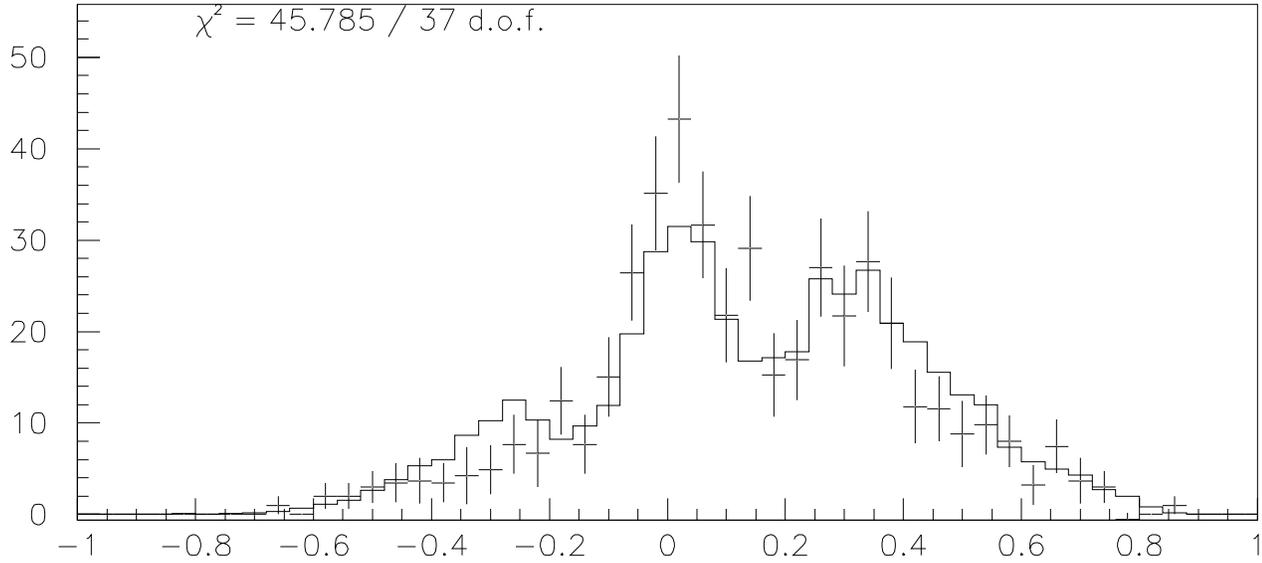


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

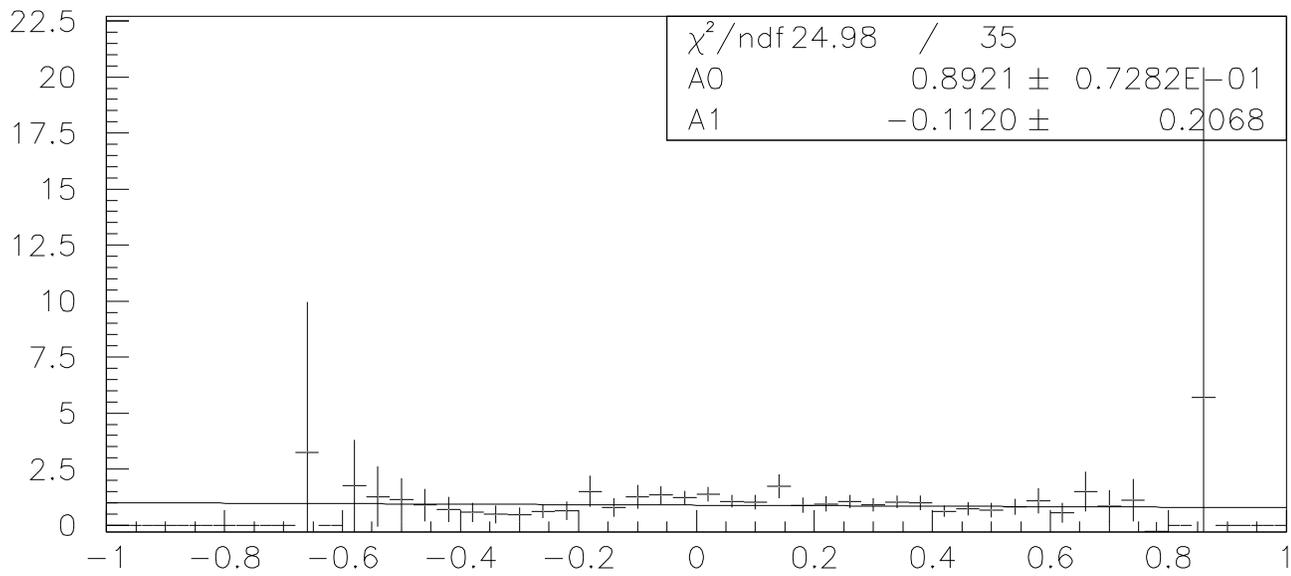


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 45.785 / 37$  d.o.f.

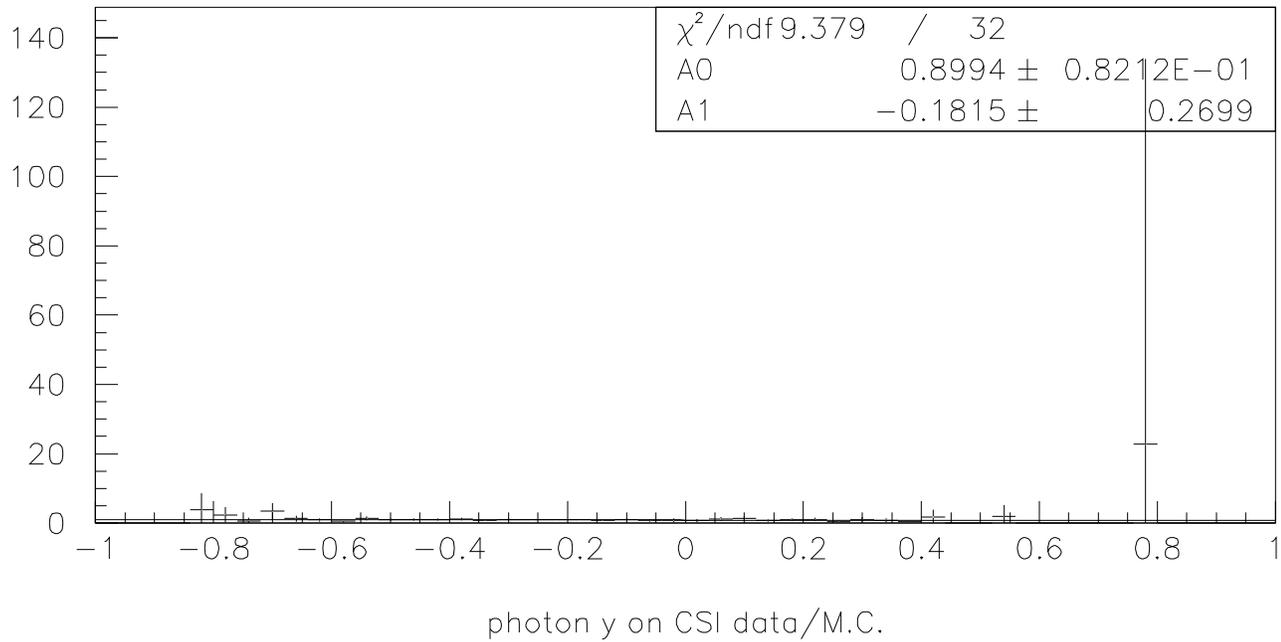
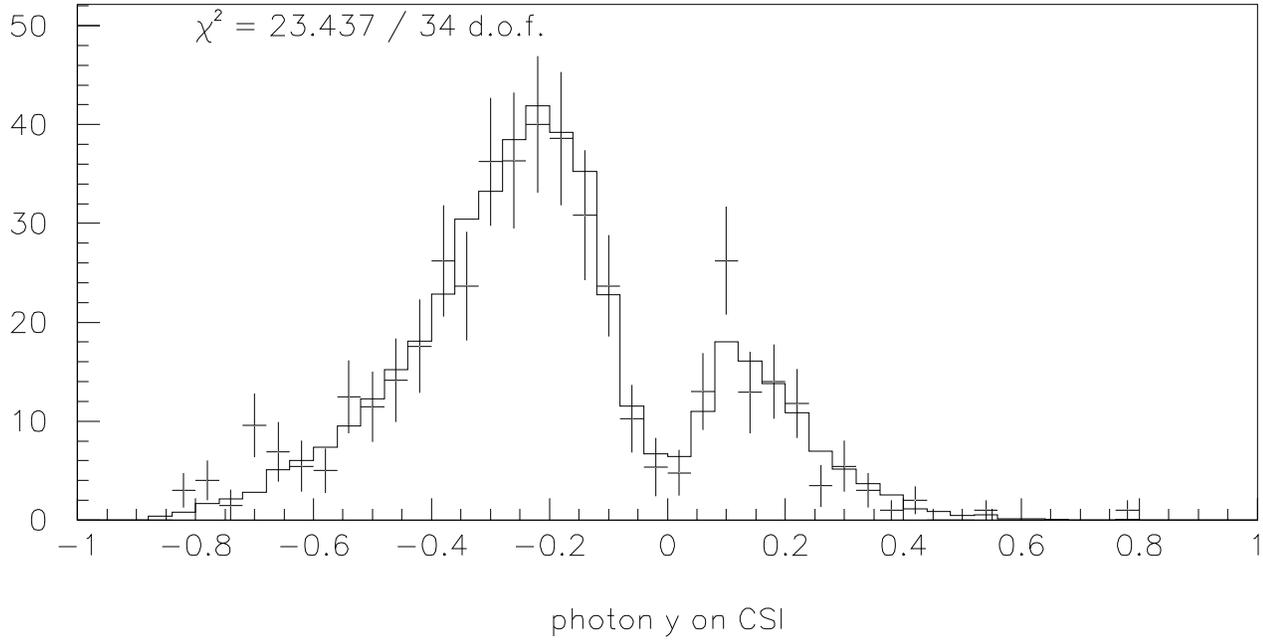


photon x on CSI

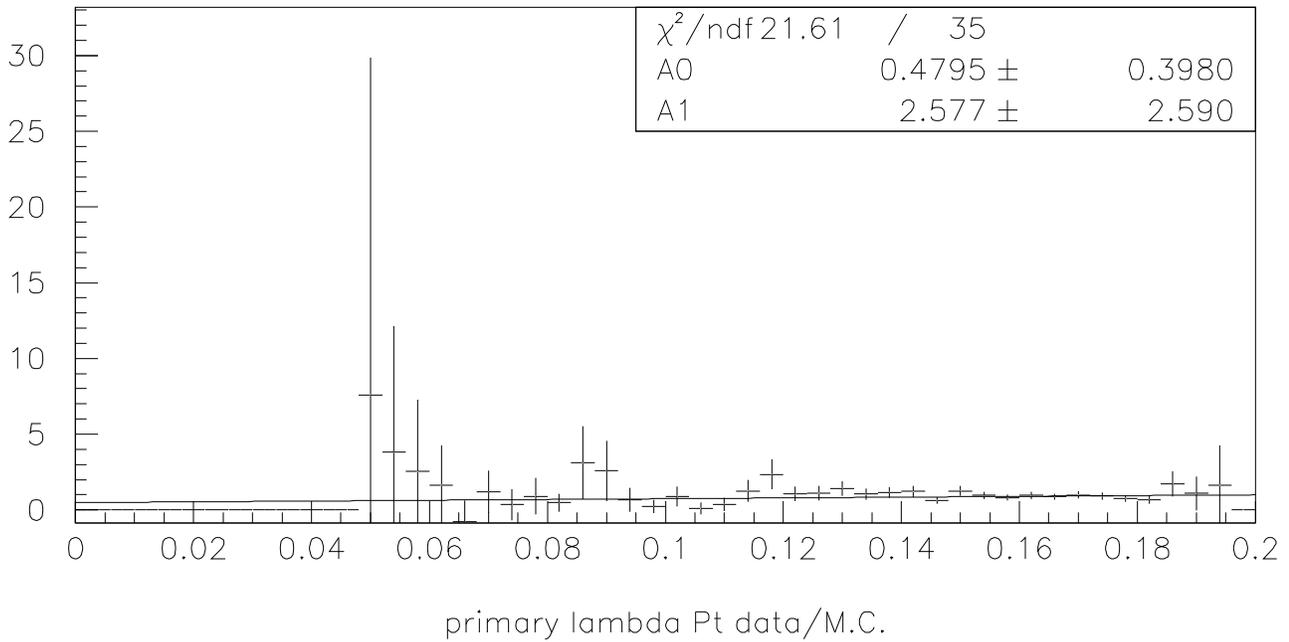
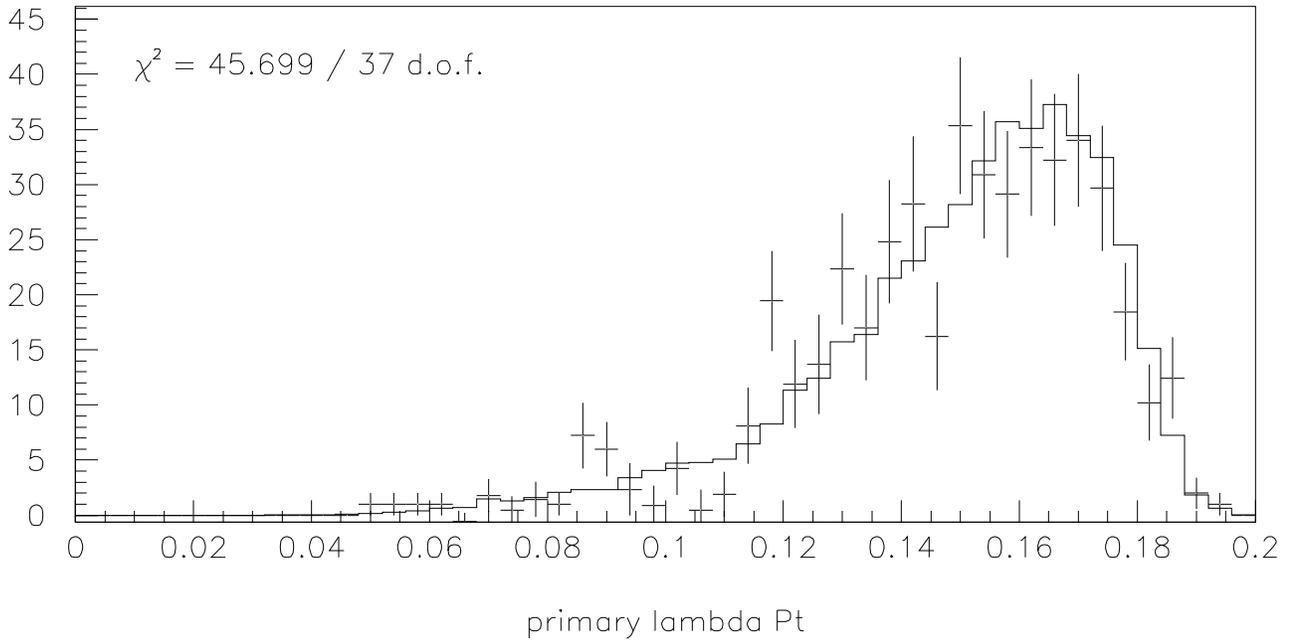


photon x on CSI data/M.C.

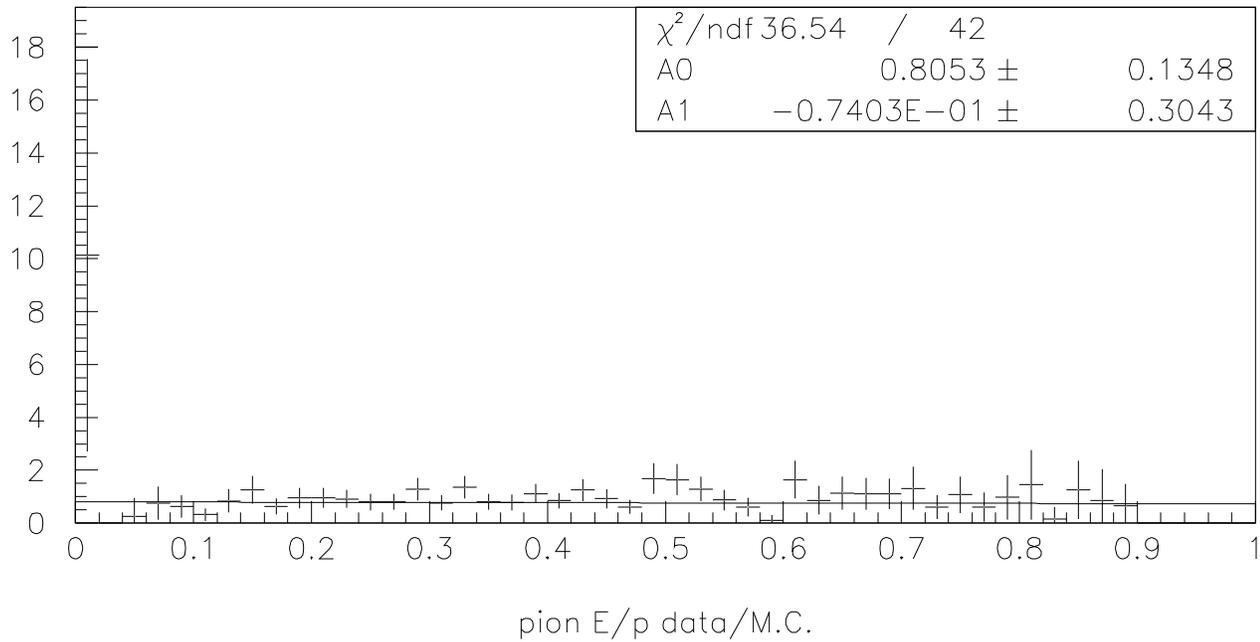
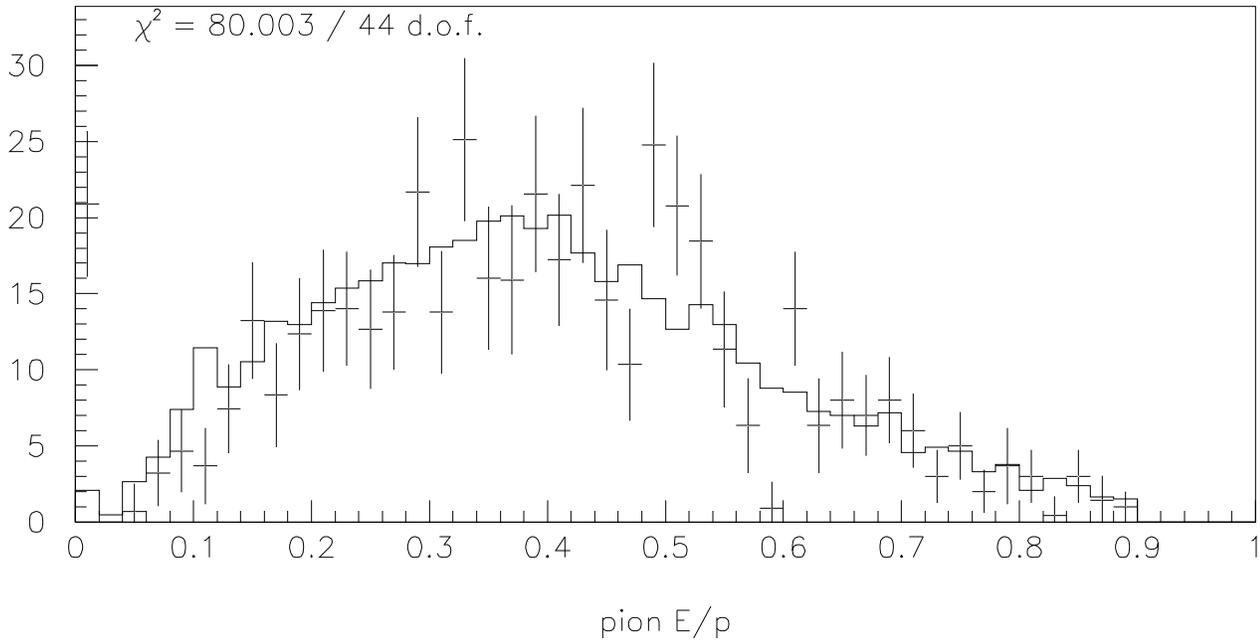
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



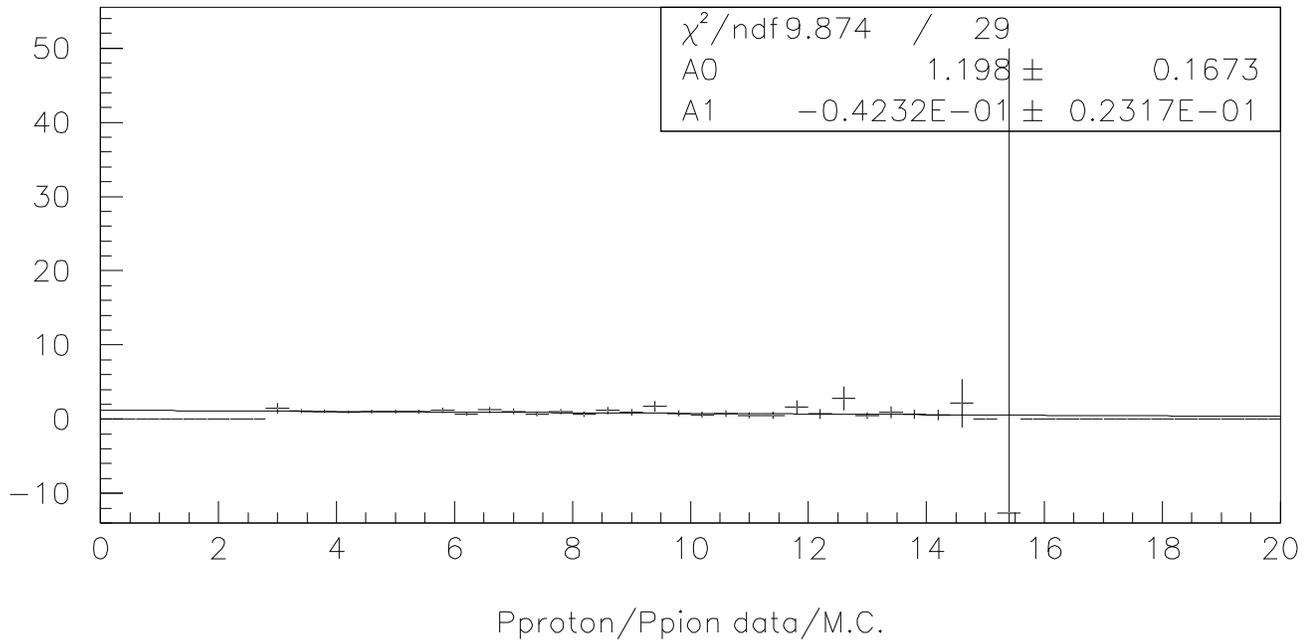
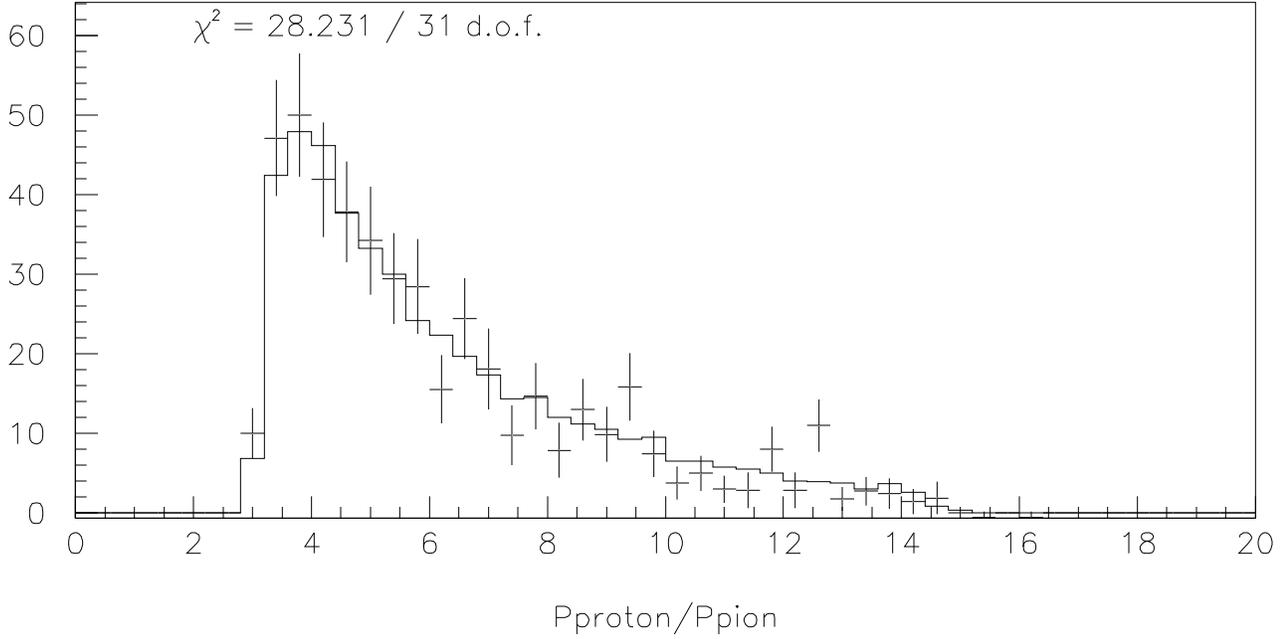
Trigger 11  $\Lambda$  Histogram=Monte Carlo Points=Data

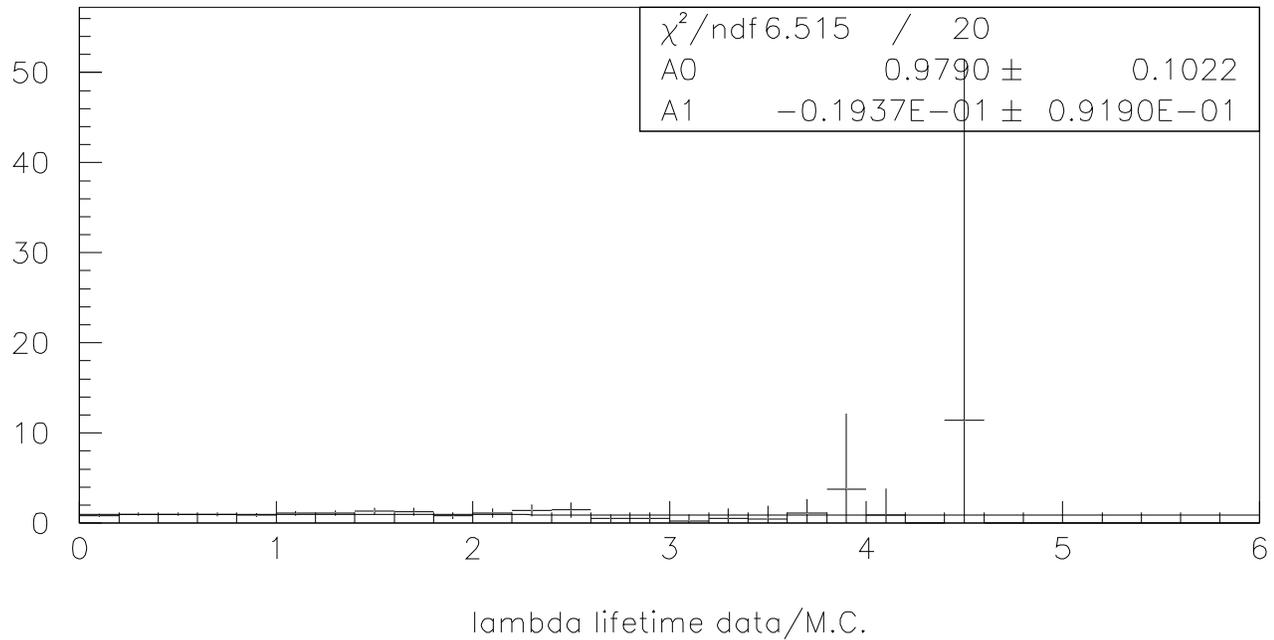
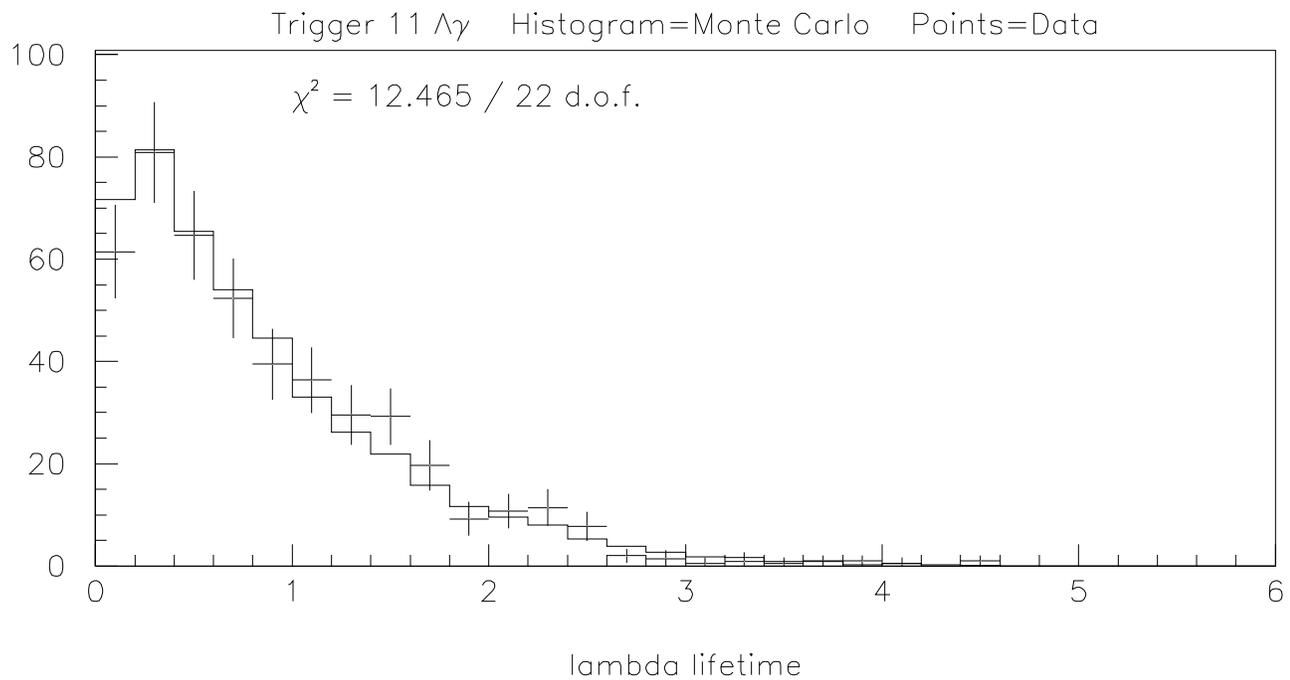


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



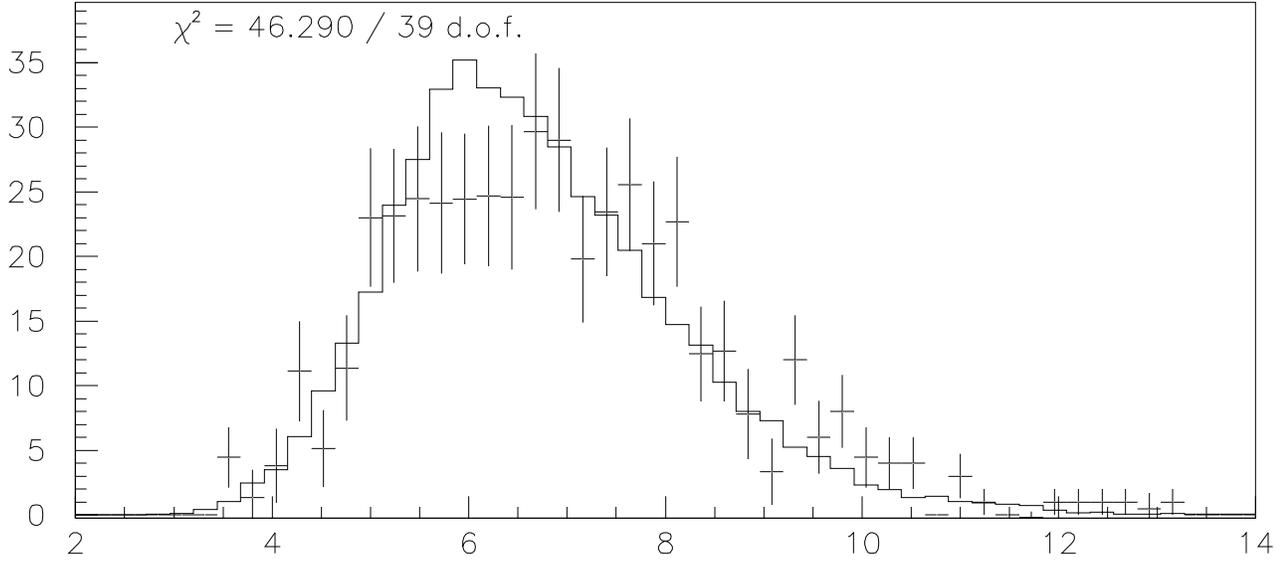
Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data



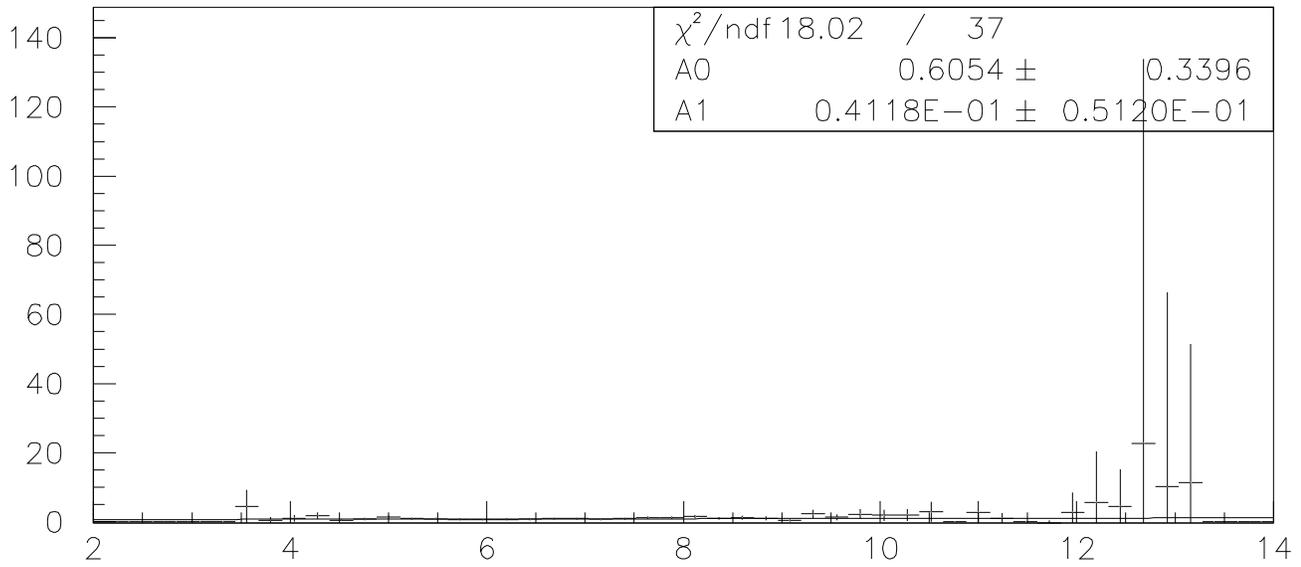


Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

$\chi^2 = 46.290 / 39$  d.o.f.



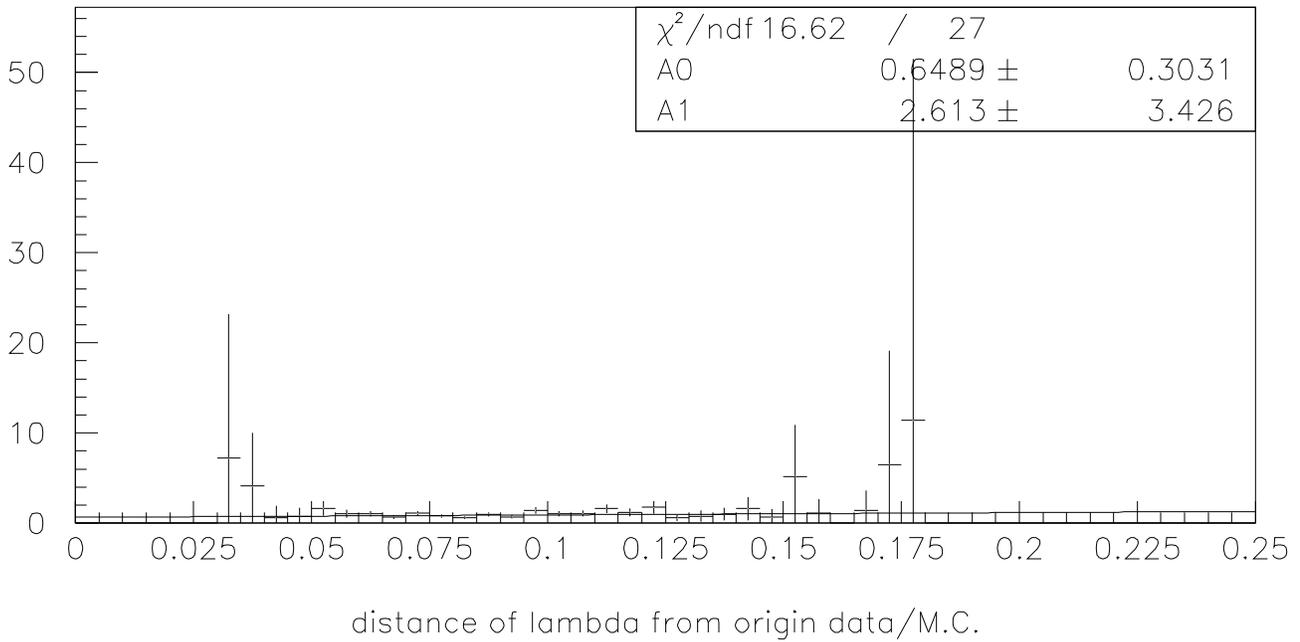
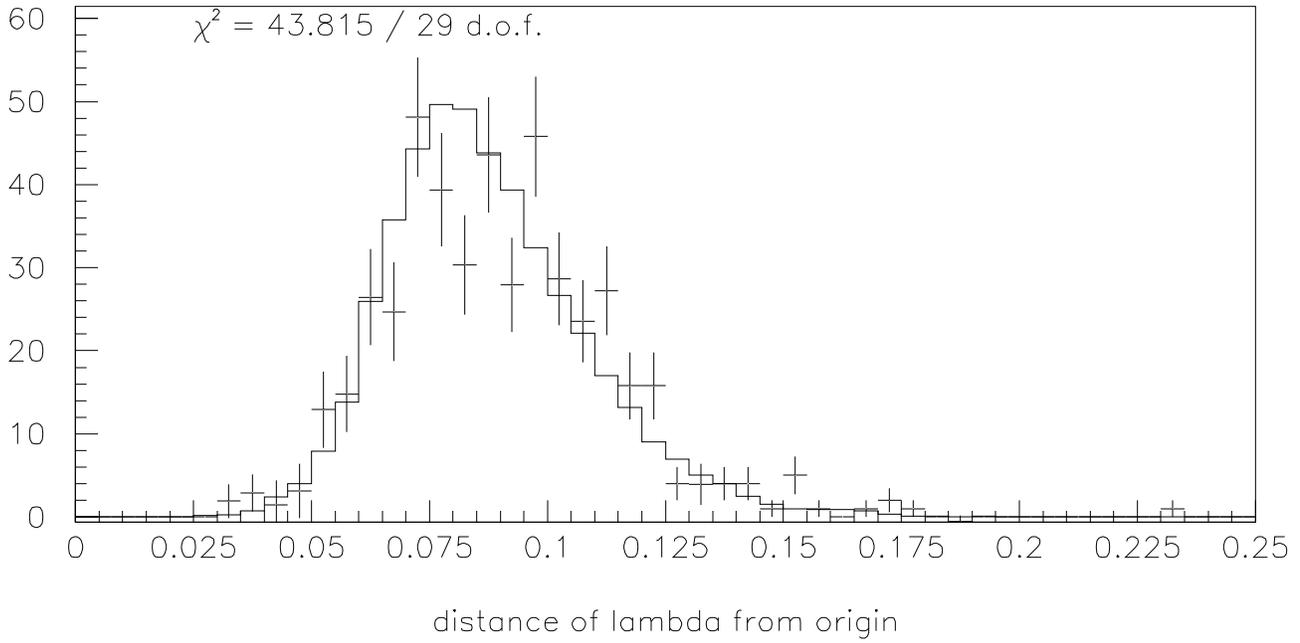
cascade lifetime



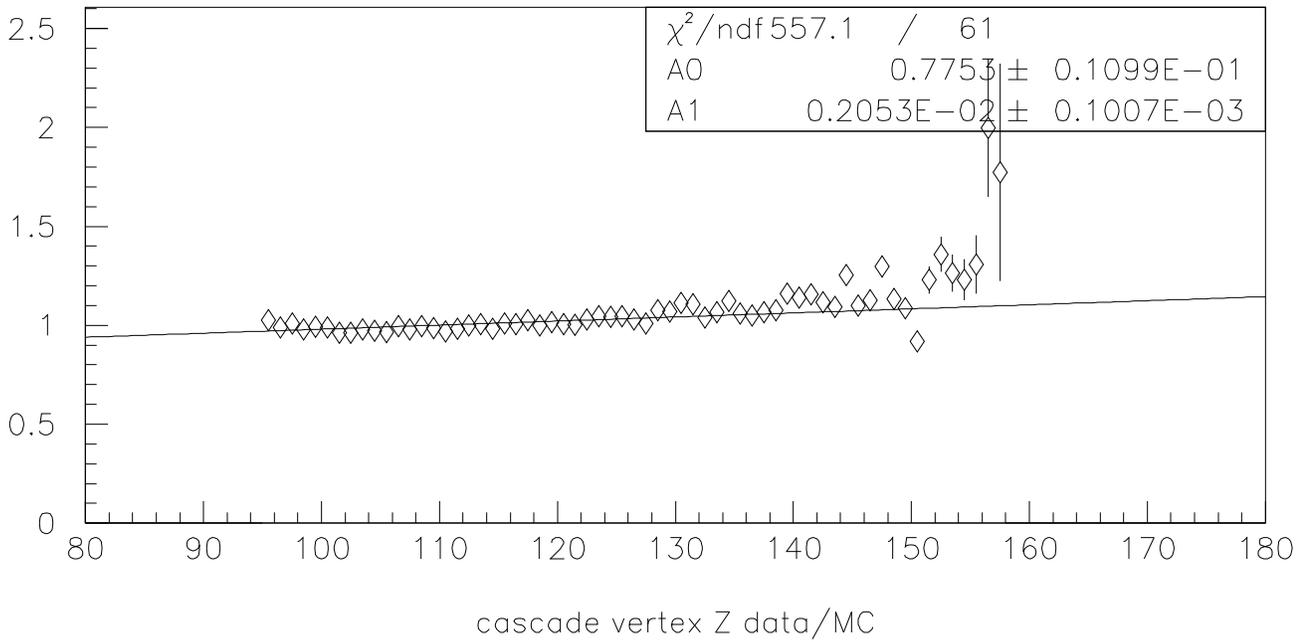
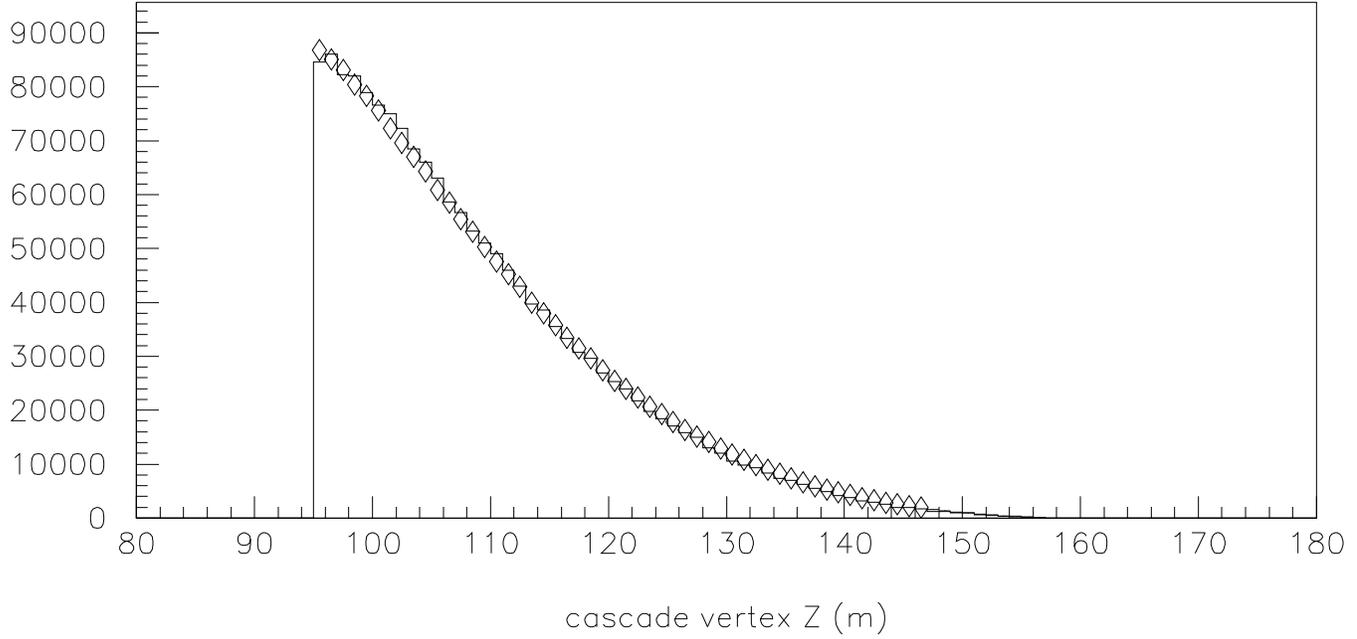
cascade lifetime data/M.C.

Trigger 11  $\Lambda\gamma$  Histogram=Monte Carlo Points=Data

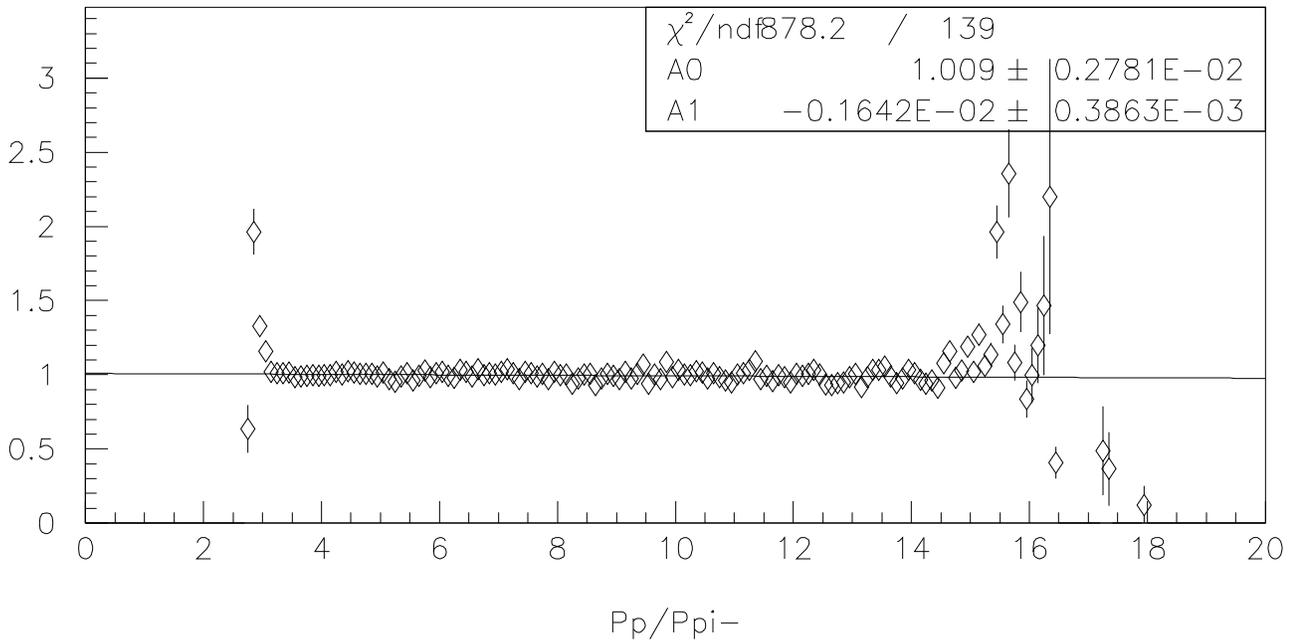
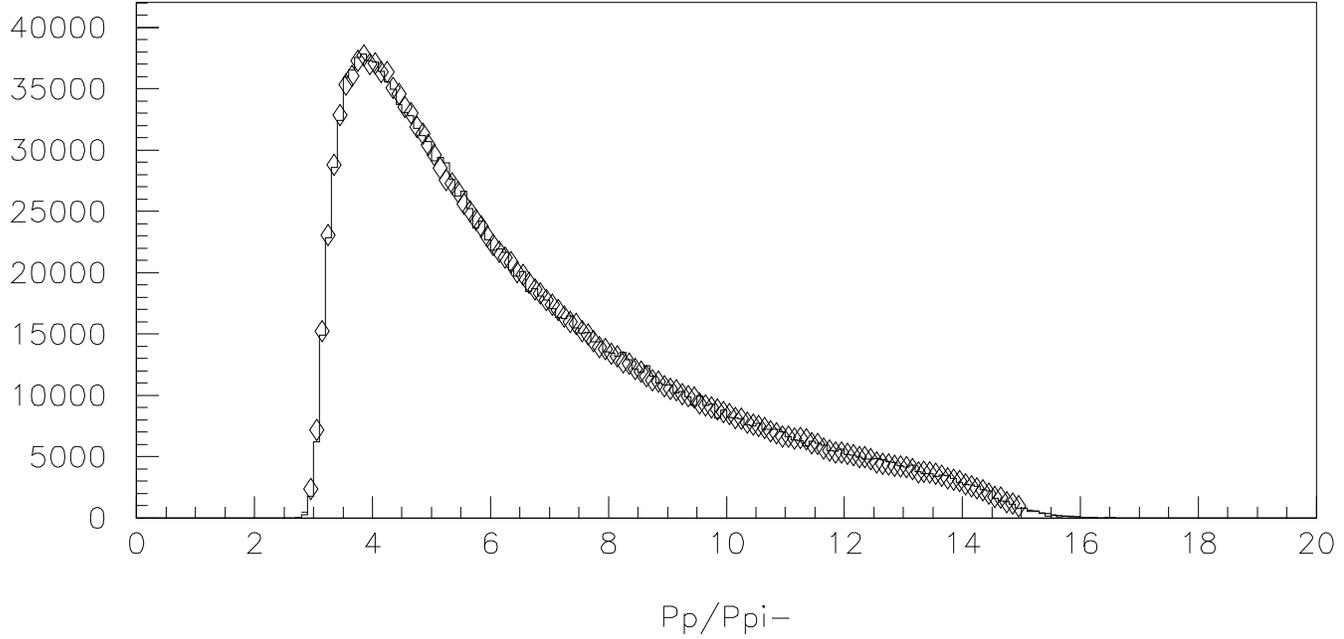
$\chi^2 = 43.815 / 29$  d.o.f.



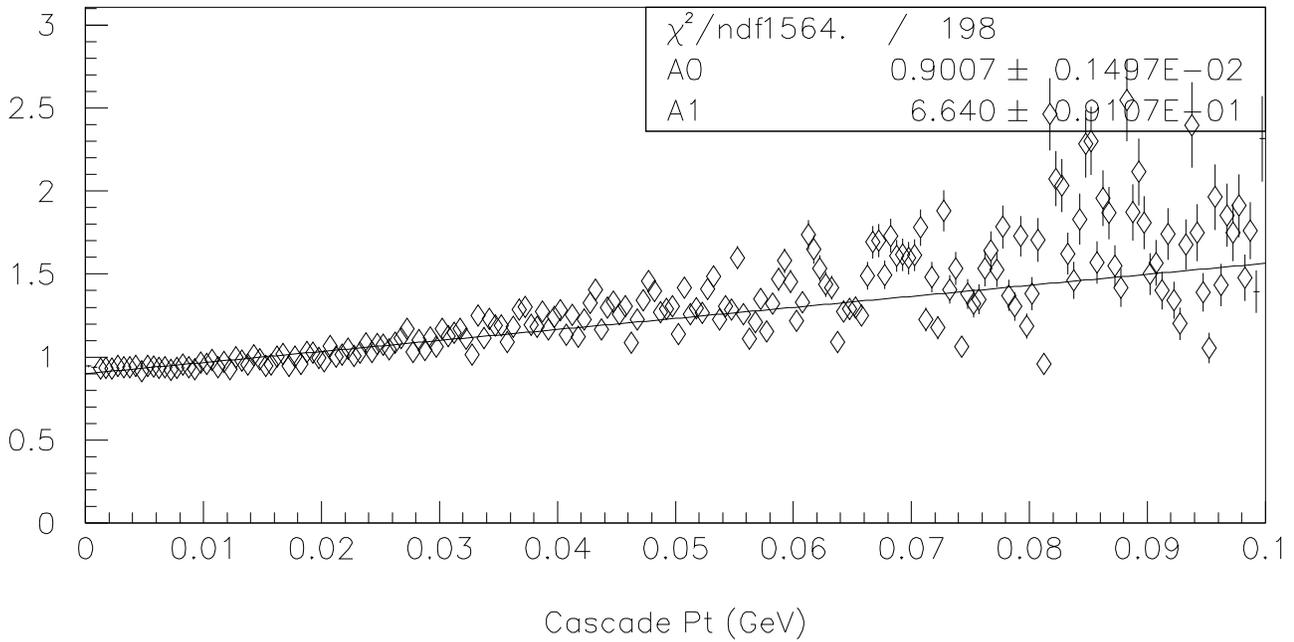
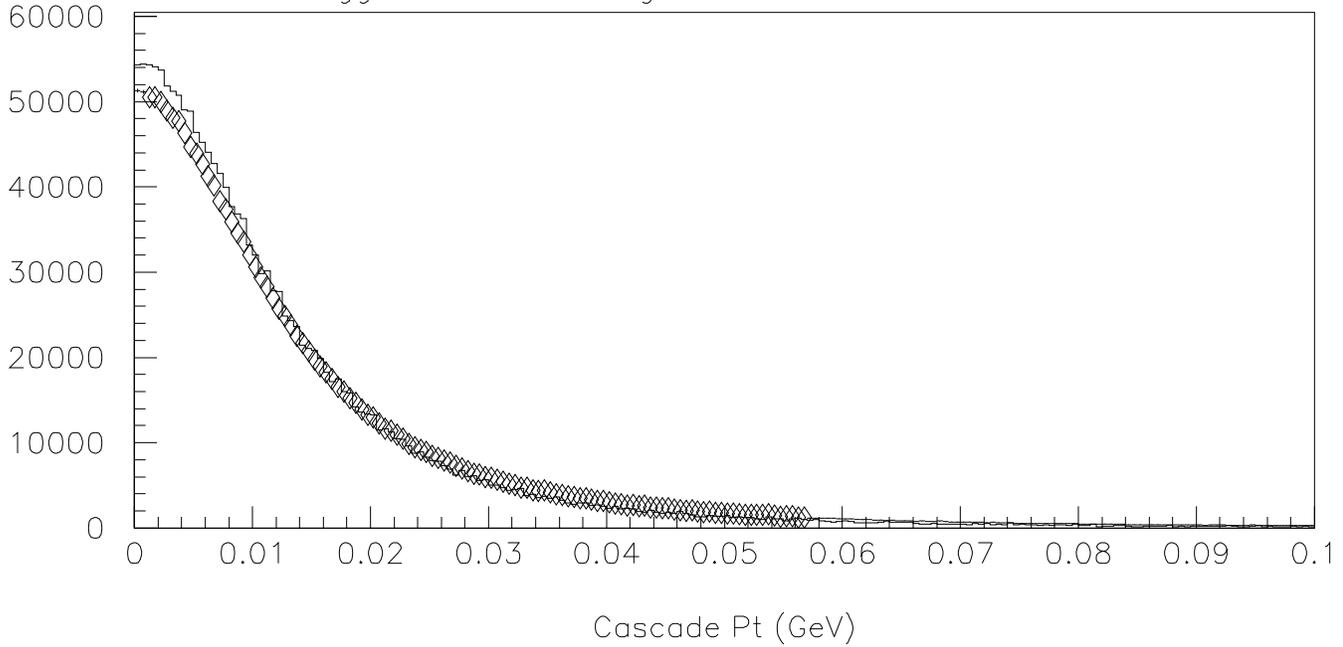
Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data

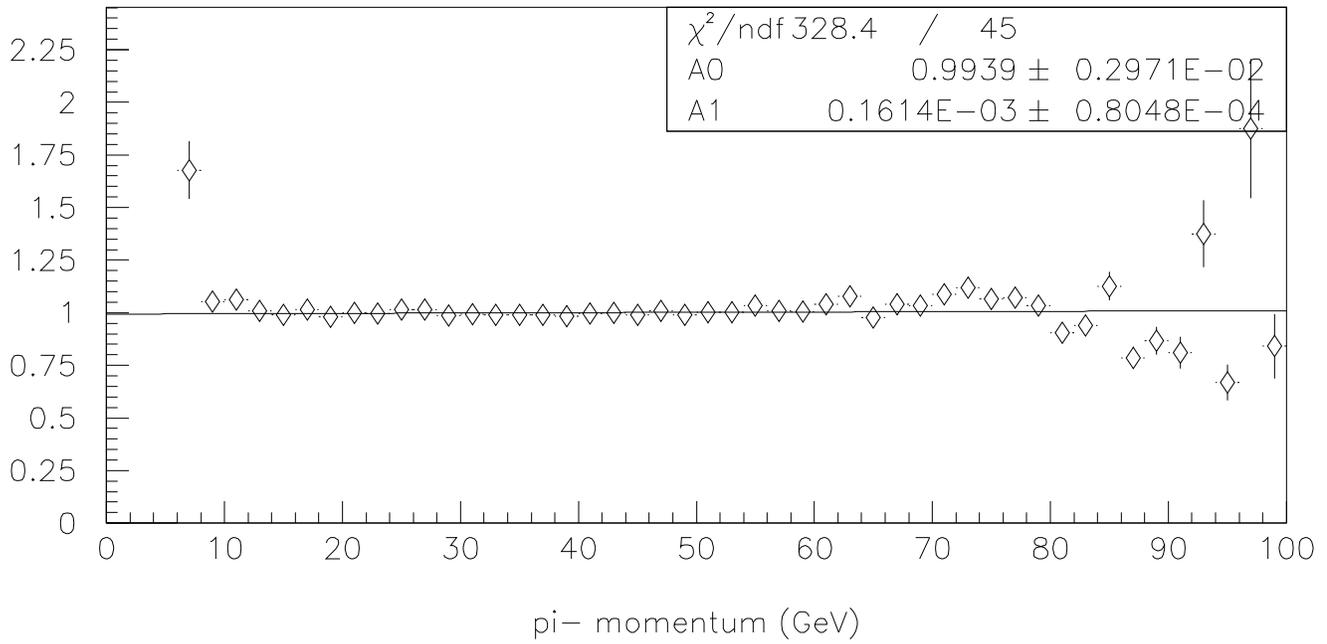
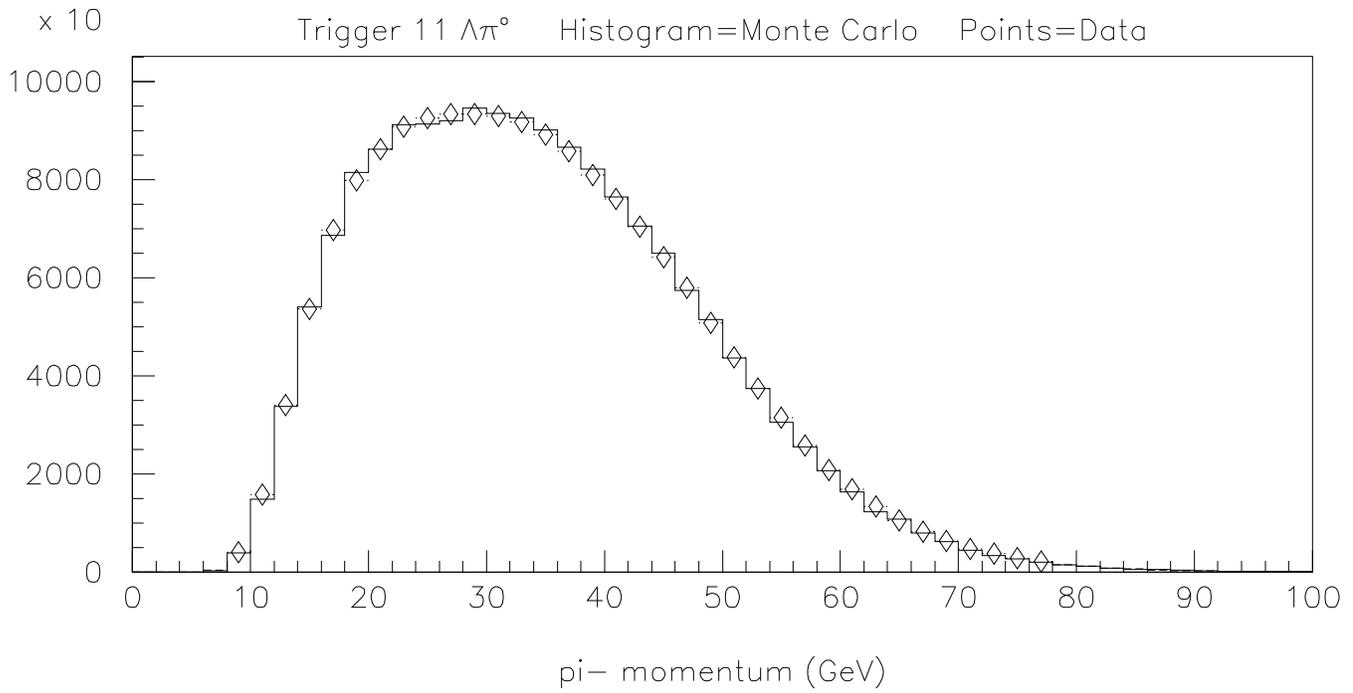


Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data

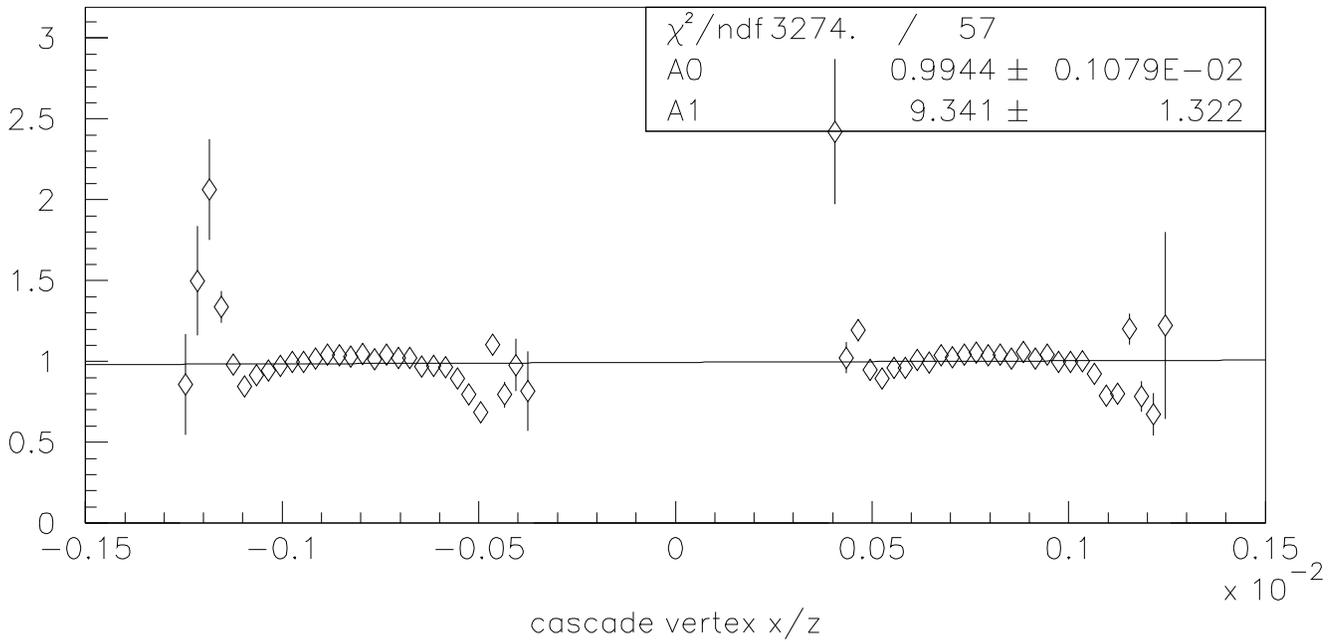
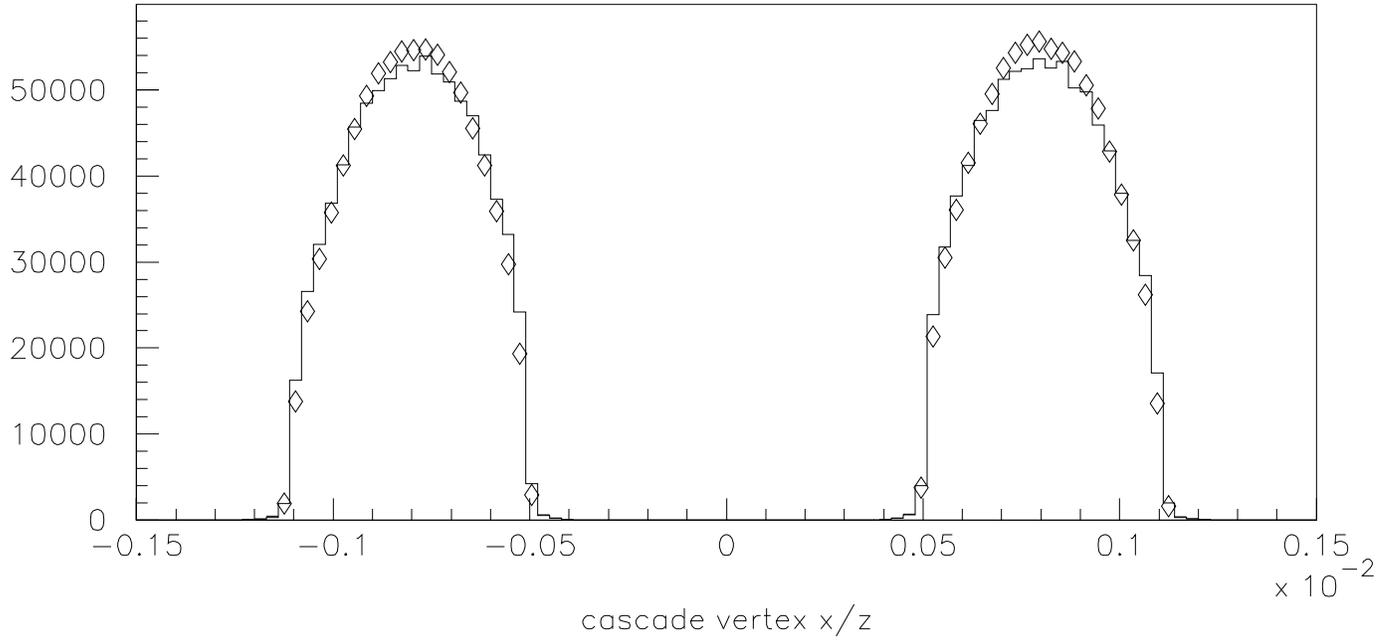


Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data

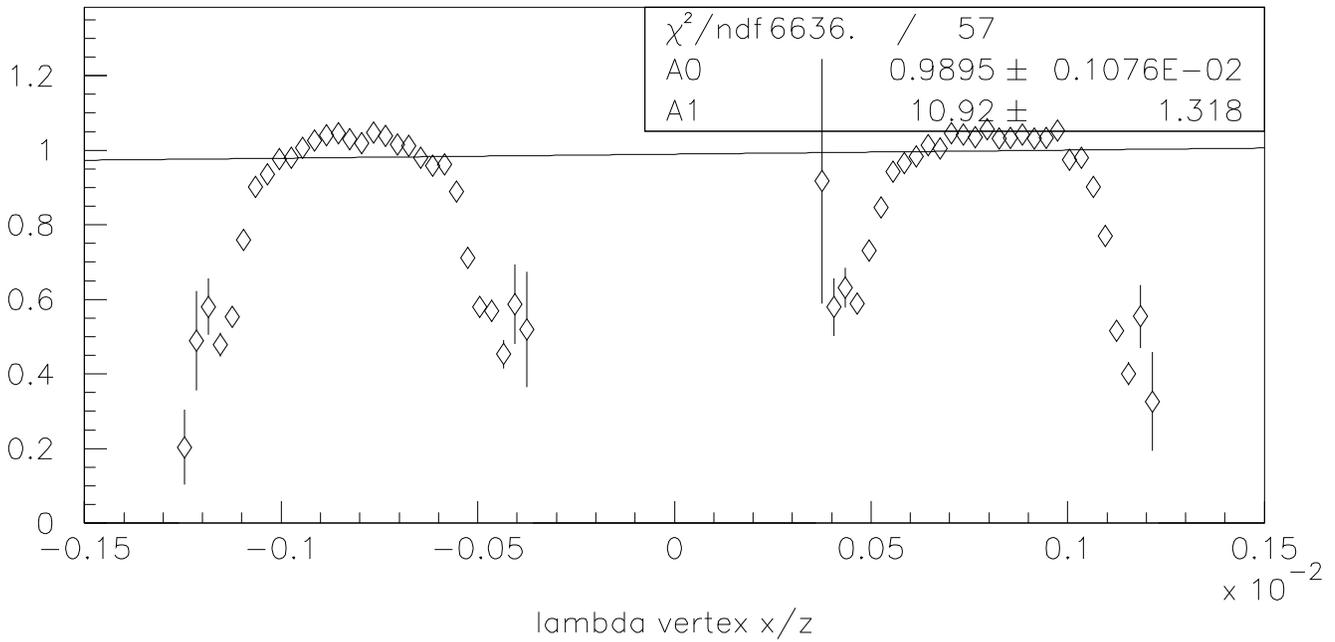
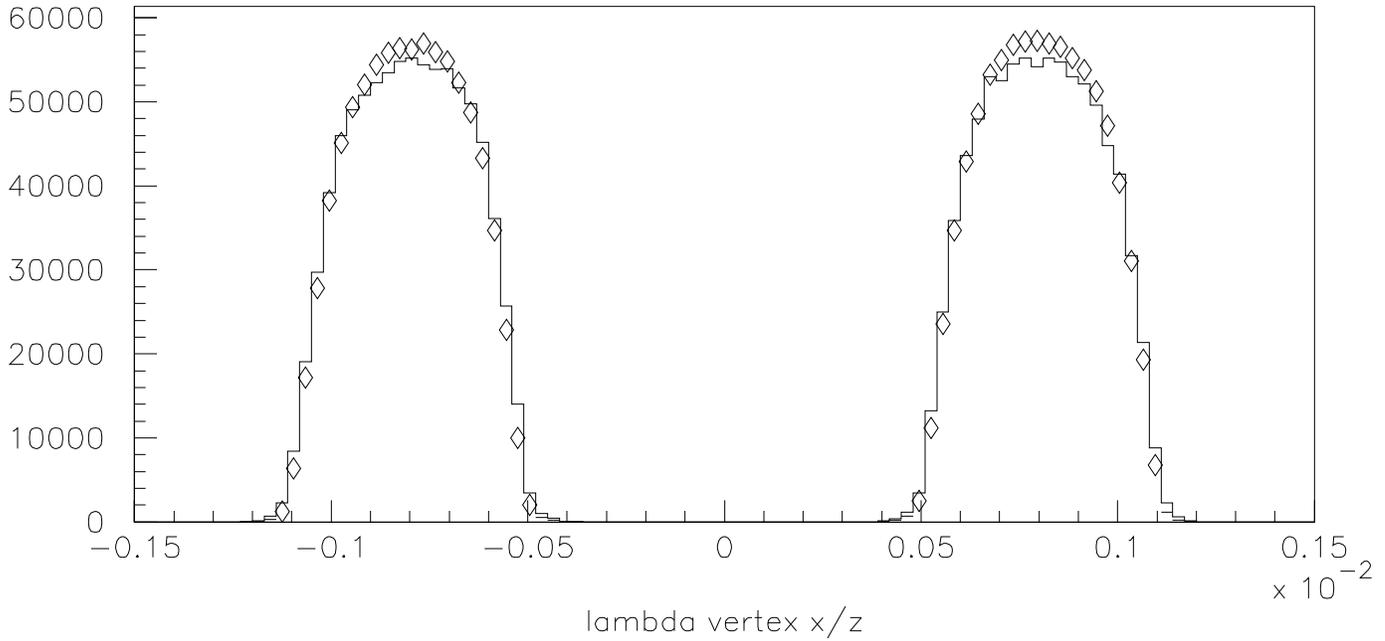




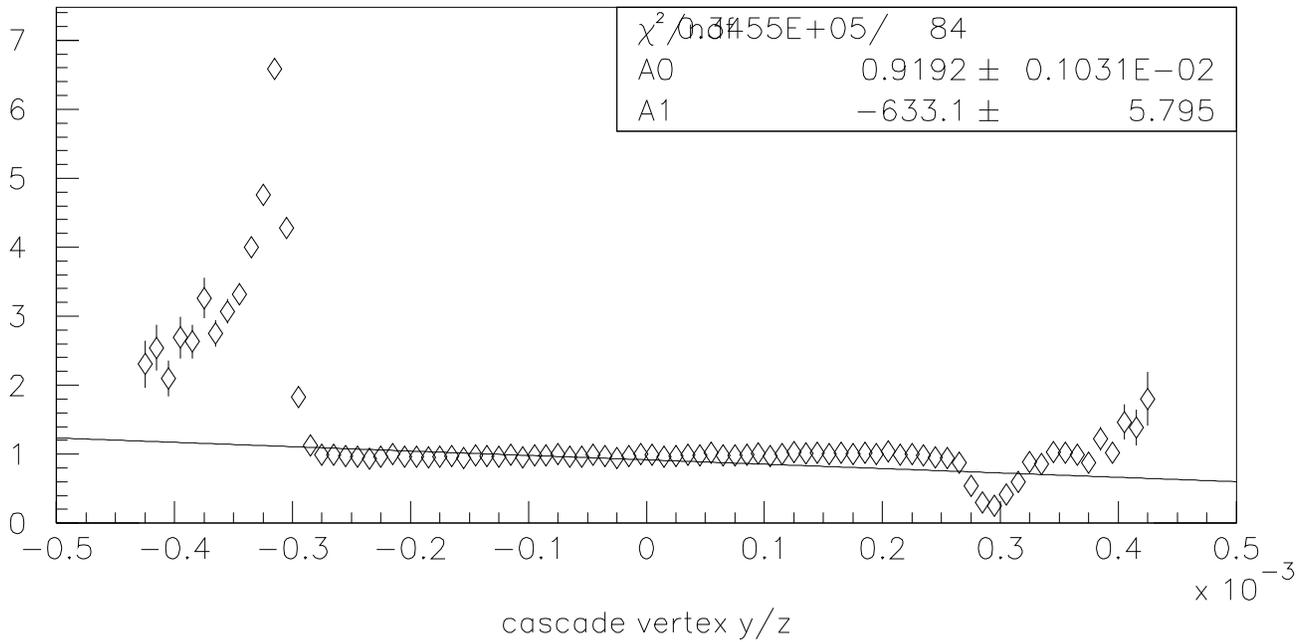
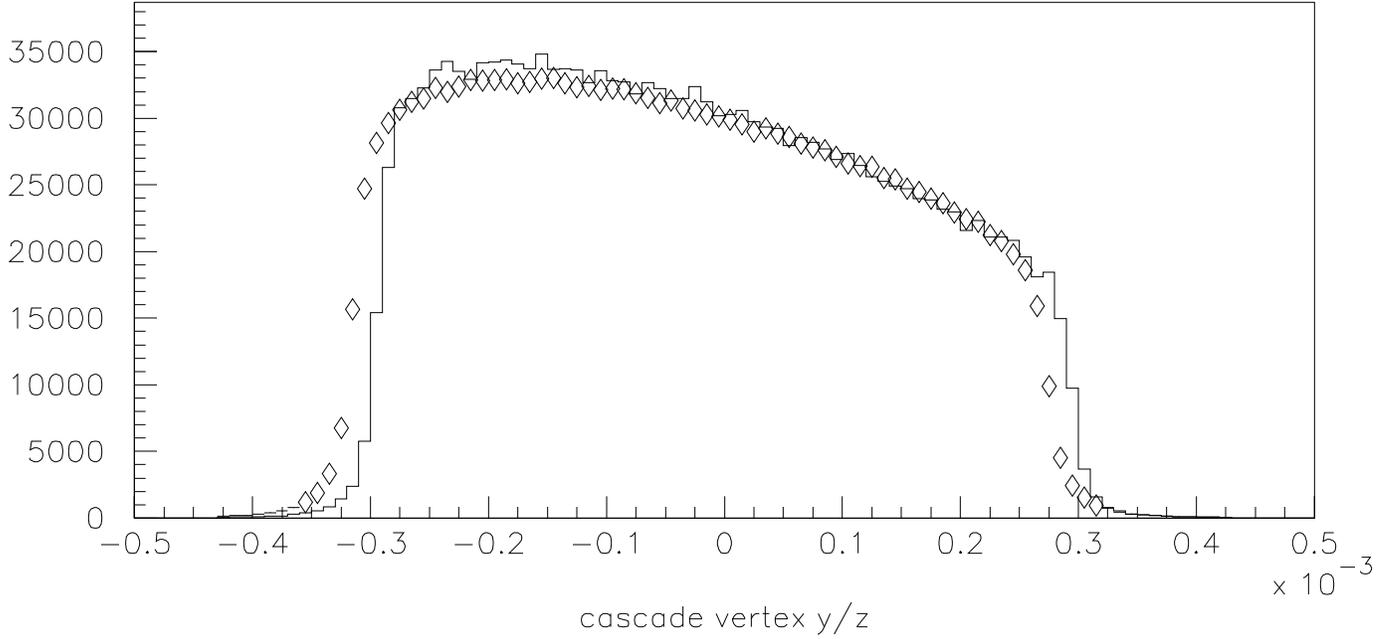
Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data



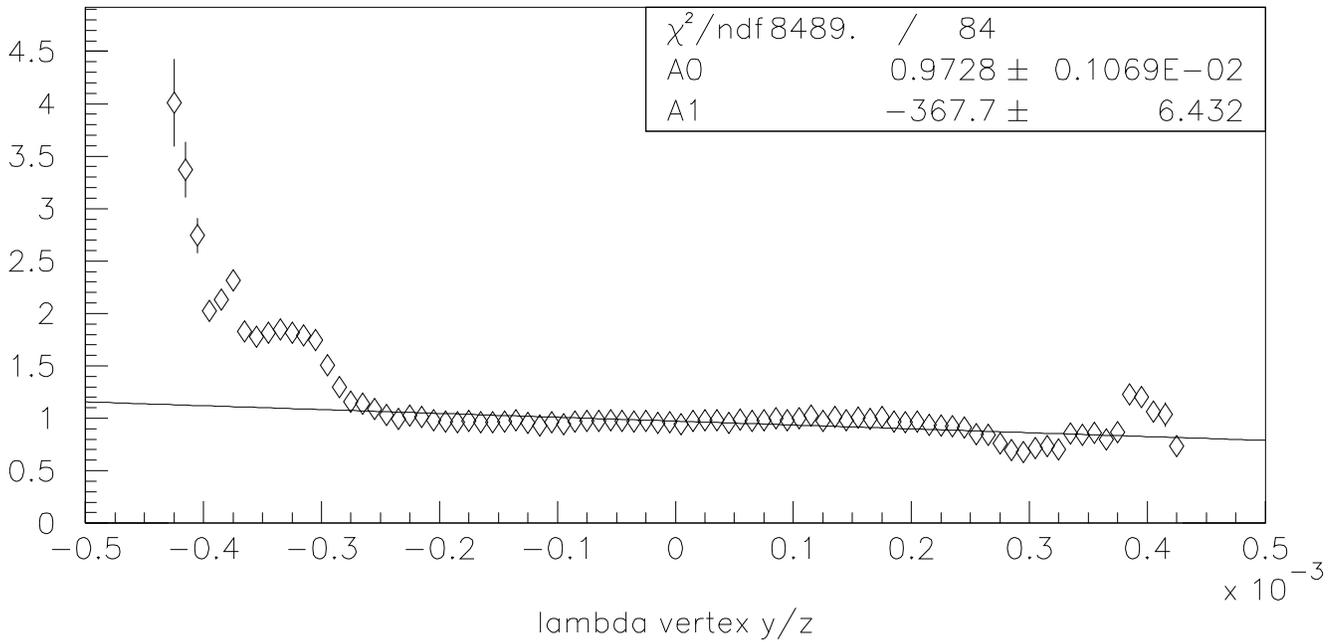
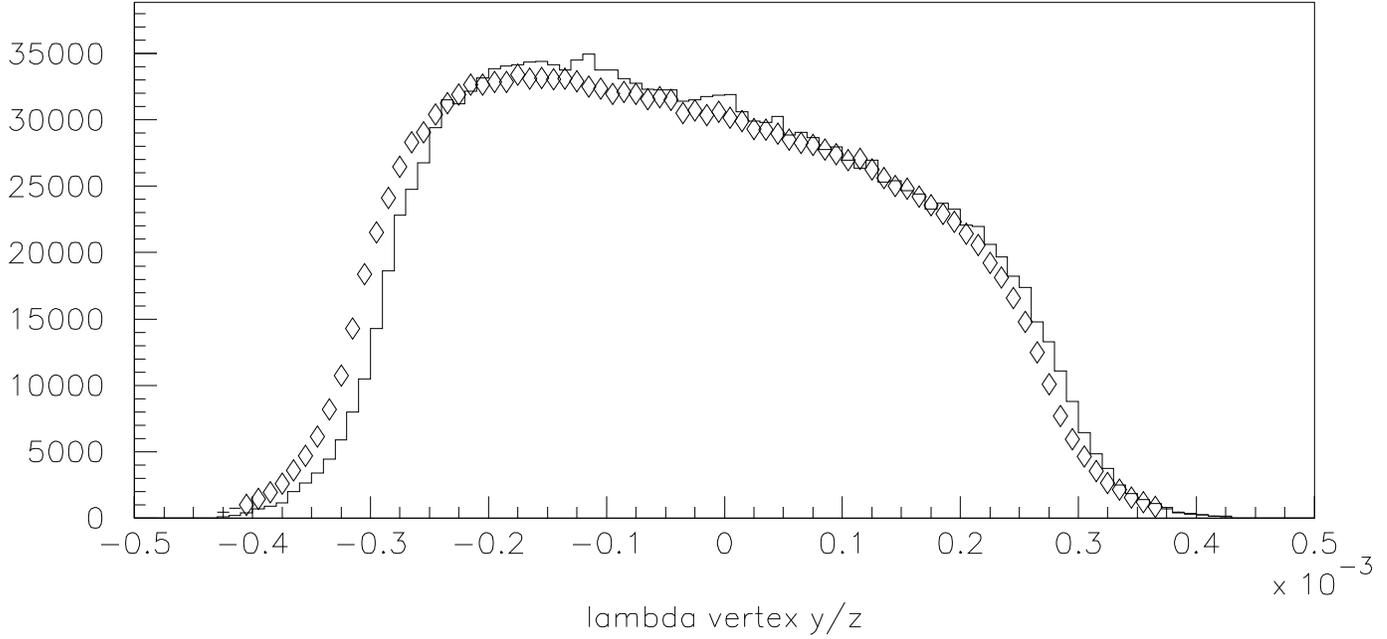
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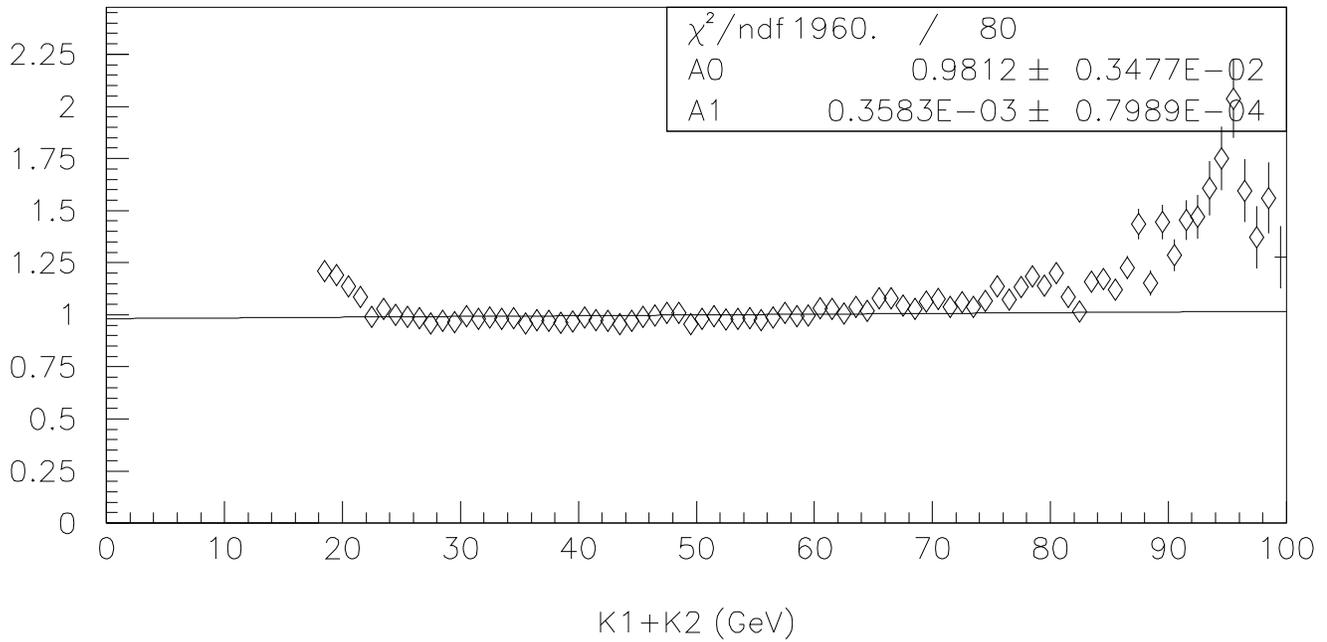
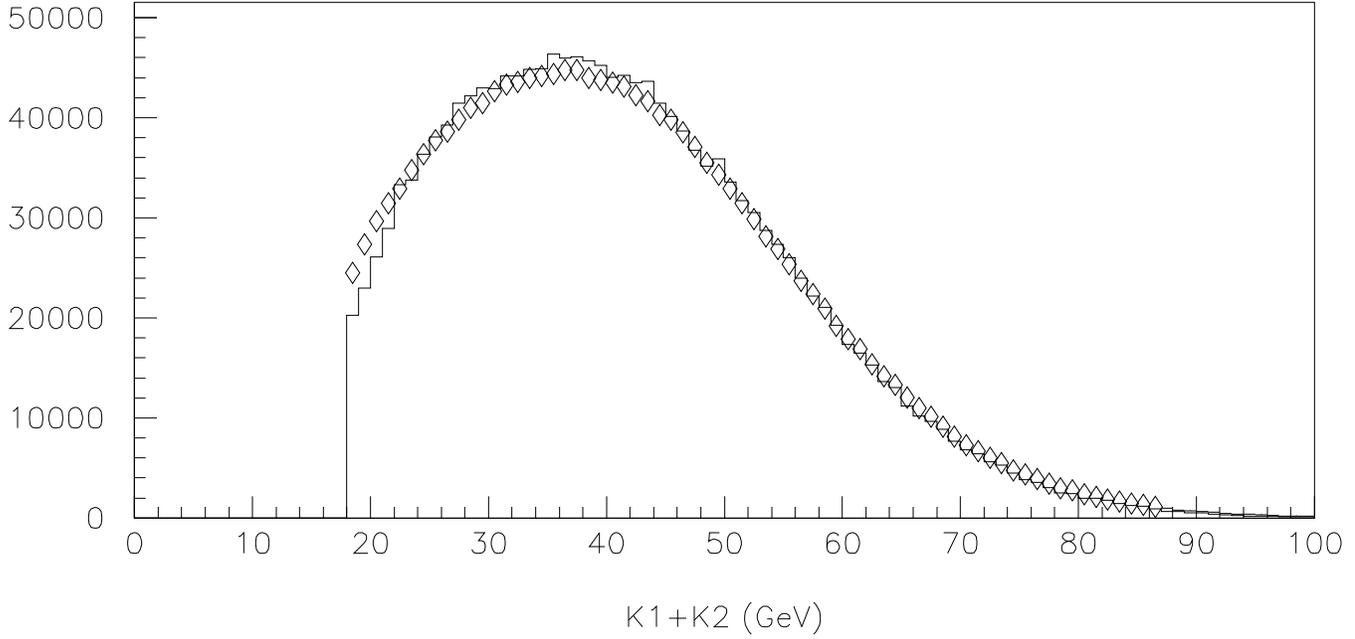
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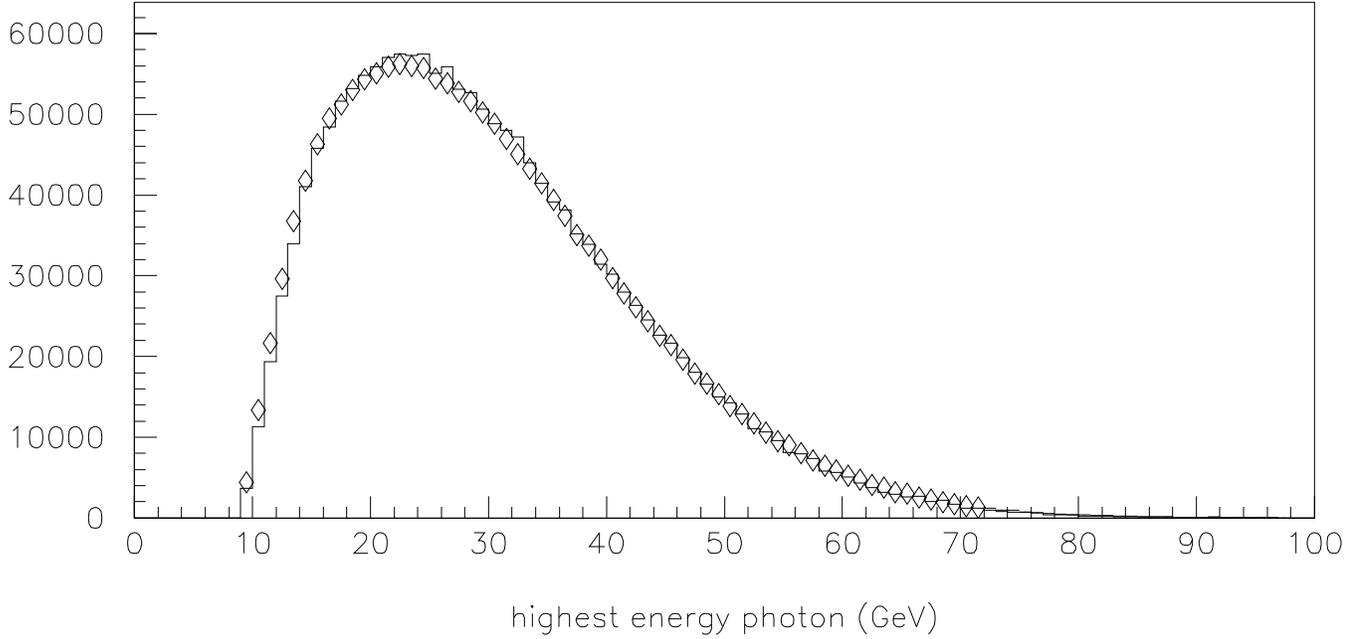
Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data



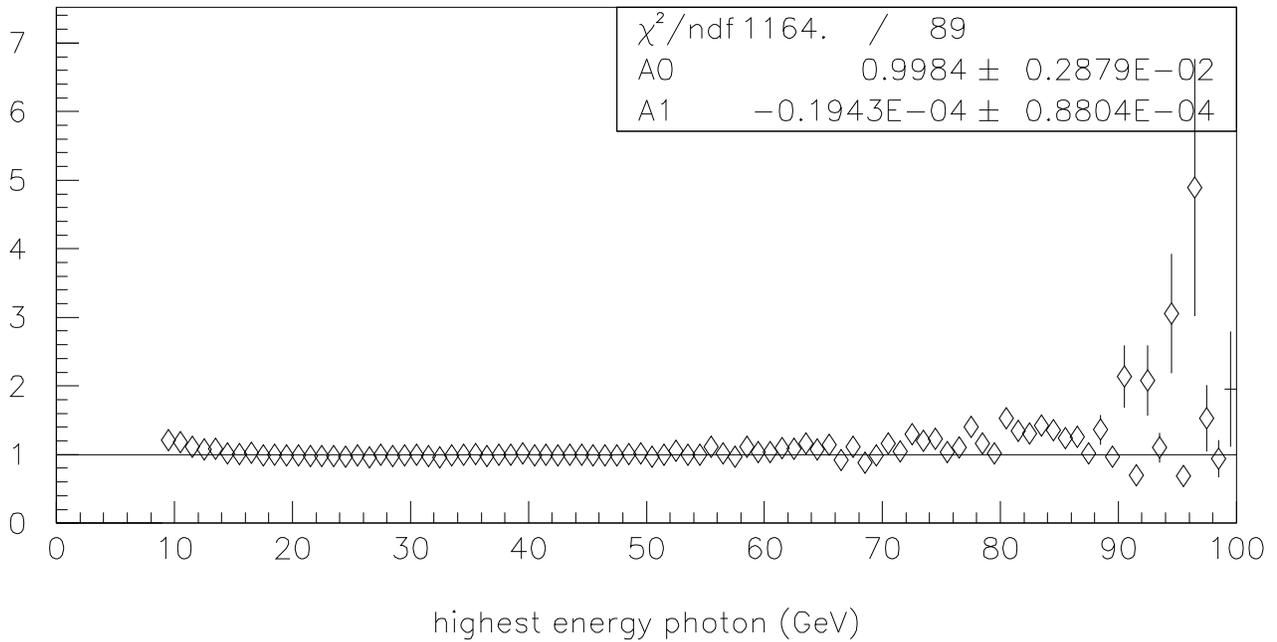
Trigger 11  $\Lambda\pi^0$  Histogram=Monte Carlo Points=Data

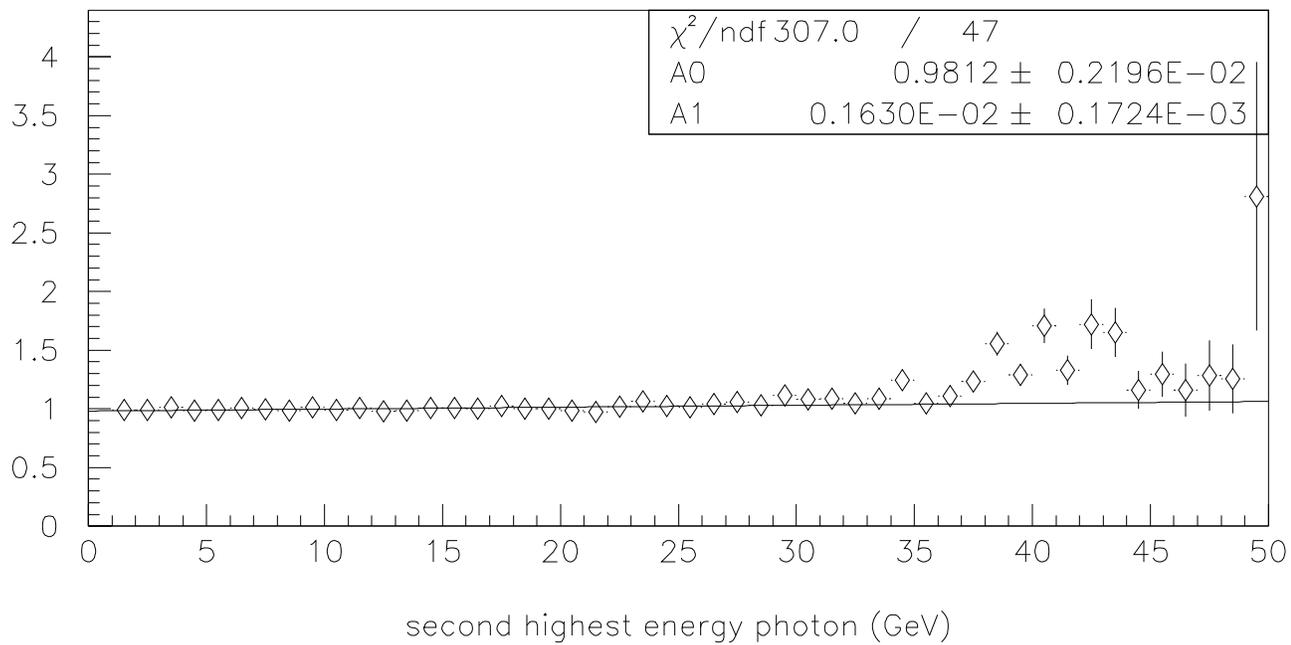
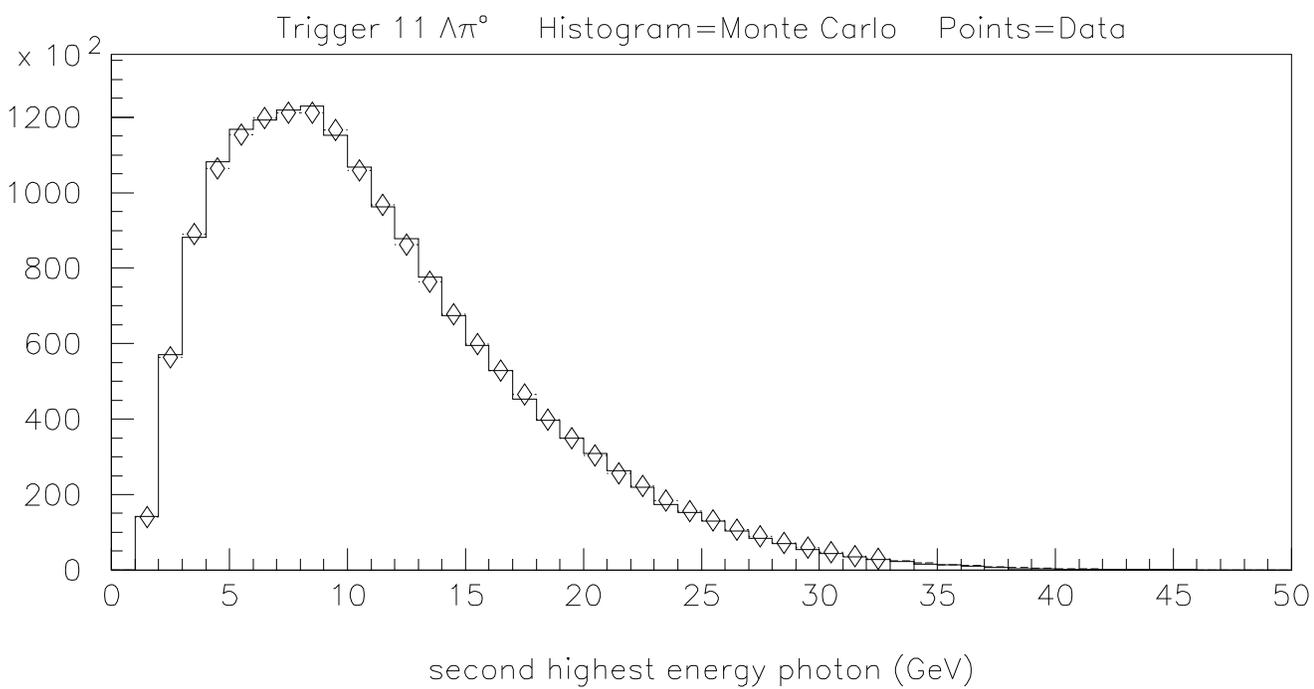


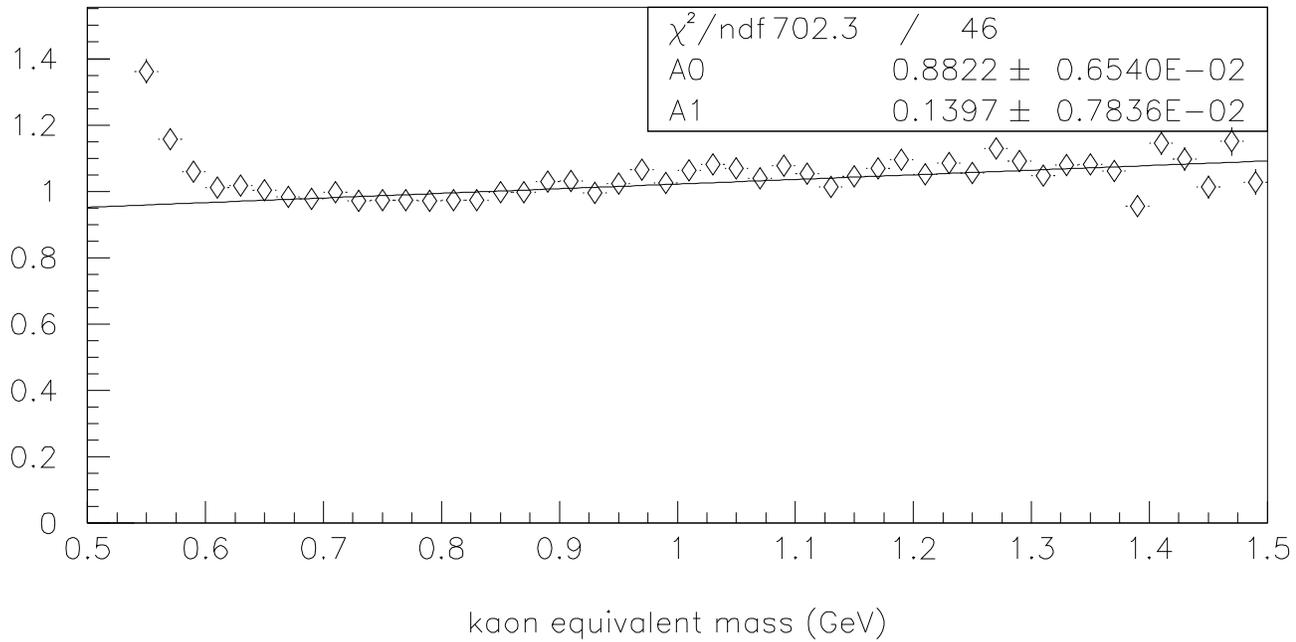
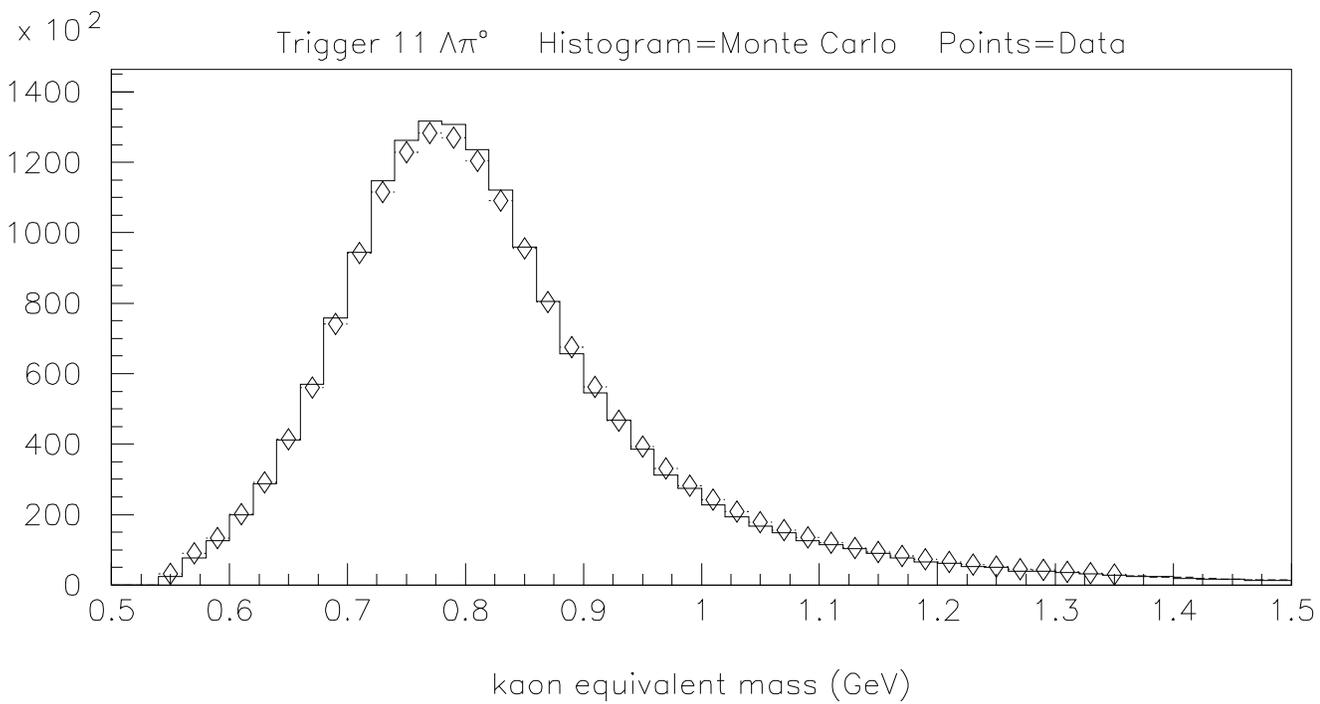
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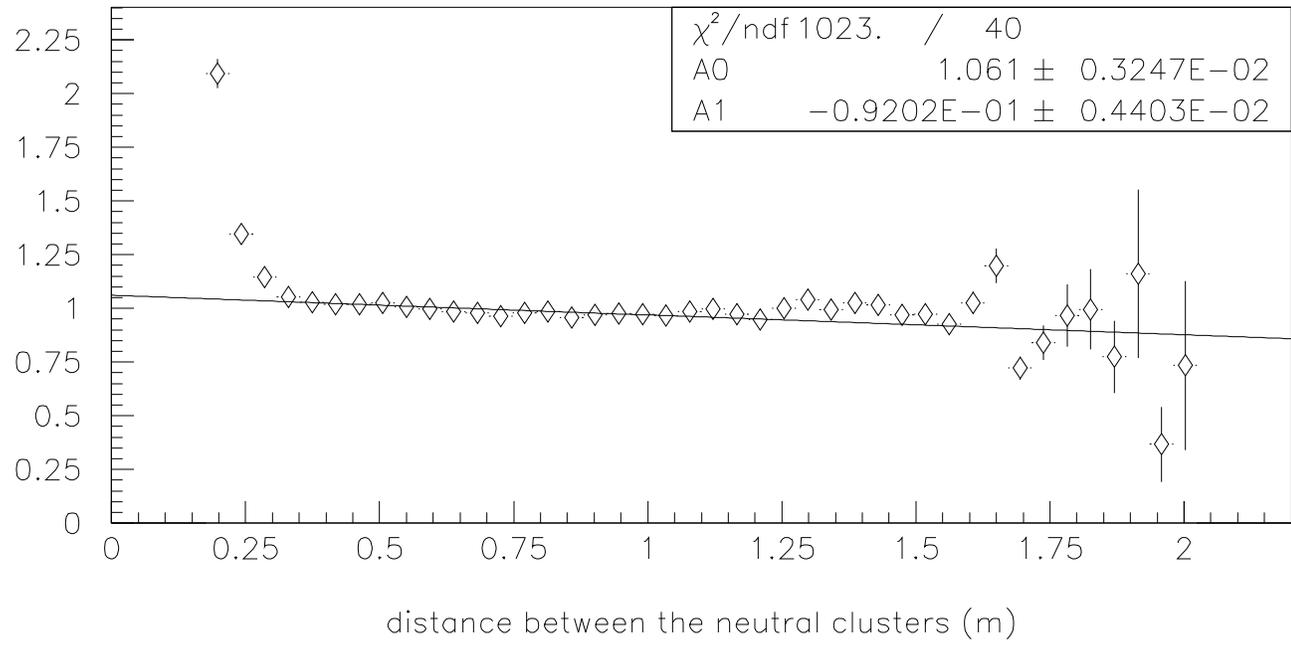
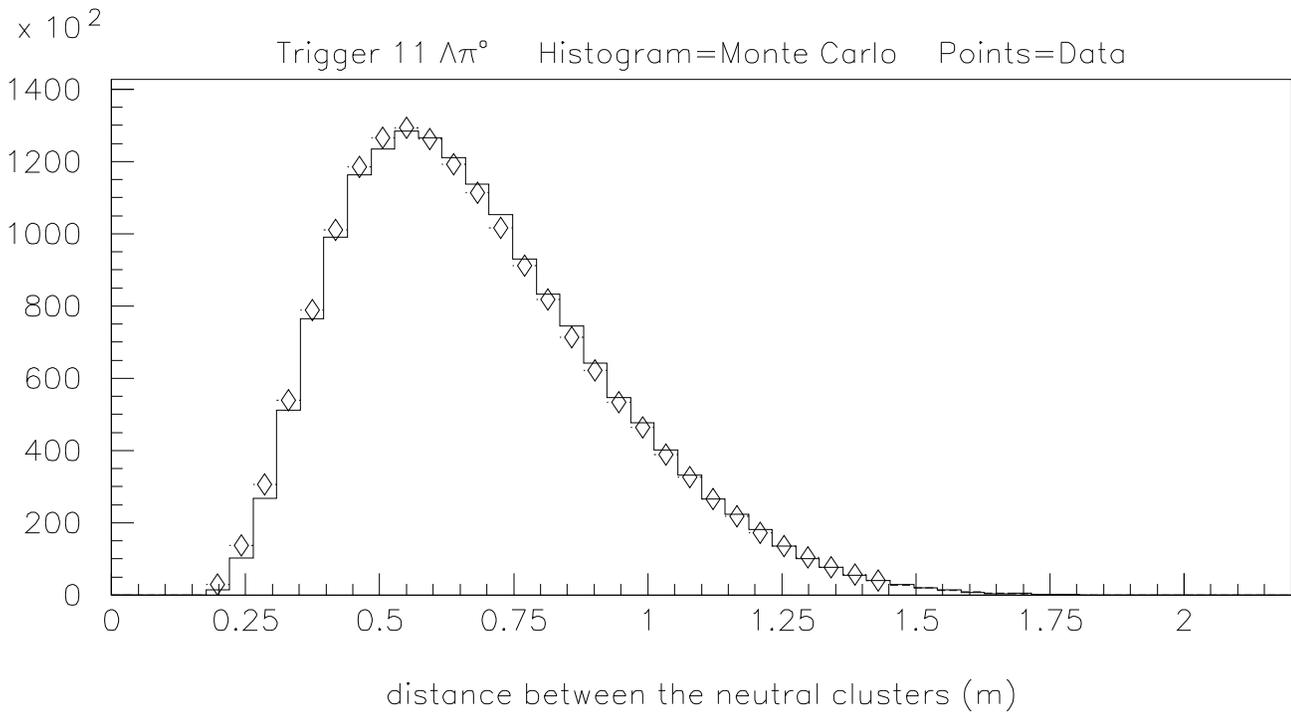


$\chi^2/\text{ndf}$	1164.	/	89
A0	$0.9984 \pm 0.2879\text{E-}02$		
A1	$-0.1943\text{E-}04 \pm 0.8804\text{E-}04$		









# Branching ratio systematic error due to background uncertainty study:

chi square cut	Trigger 11 Branching ratio ( $\times 10^{-3}$ )	Trigger 10 Branching ratio ( $\times 10^{-3}$ )
2.0	1.26 $\pm 0.07$	1.20 $\pm 0.04$
2.1	1.26 $\pm 0.07$	1.21 $\pm 0.04$
2.2	1.26 $\pm 0.07$	1.22 $\pm 0.04$
2.3	1.29 $\pm 0.07$	1.22 $\pm 0.04$
2.4	1.29 $\pm 0.07$	1.21 $\pm 0.04$
2.5	1.32 $\pm 0.07$	1.22 $\pm 0.04$
2.6	1.34 $\pm 0.07$	1.23 $\pm 0.04$
2.7	1.33 $\pm 0.07$	1.21 $\pm 0.04$
2.8	1.37 $\pm 0.07$	1.21 $\pm 0.04$
2.9	1.38 $\pm 0.07$	1.22 $\pm 0.04$
3.0	1.35 $\pm 0.07$	1.22 $\pm 0.04$
4.0	1.40 $\pm 0.07$	1.27 $\pm 0.04$
5.0	1.47 $\pm 0.07$	1.32 $\pm 0.04$
1.5	1.26 $\pm 0.08$	1.18 $\pm 0.05$
1.0	1.18 $\pm 0.10$	1.20 $\pm 0.06$

# Branching ratio systematic error due to asymmetry uncertainty study:

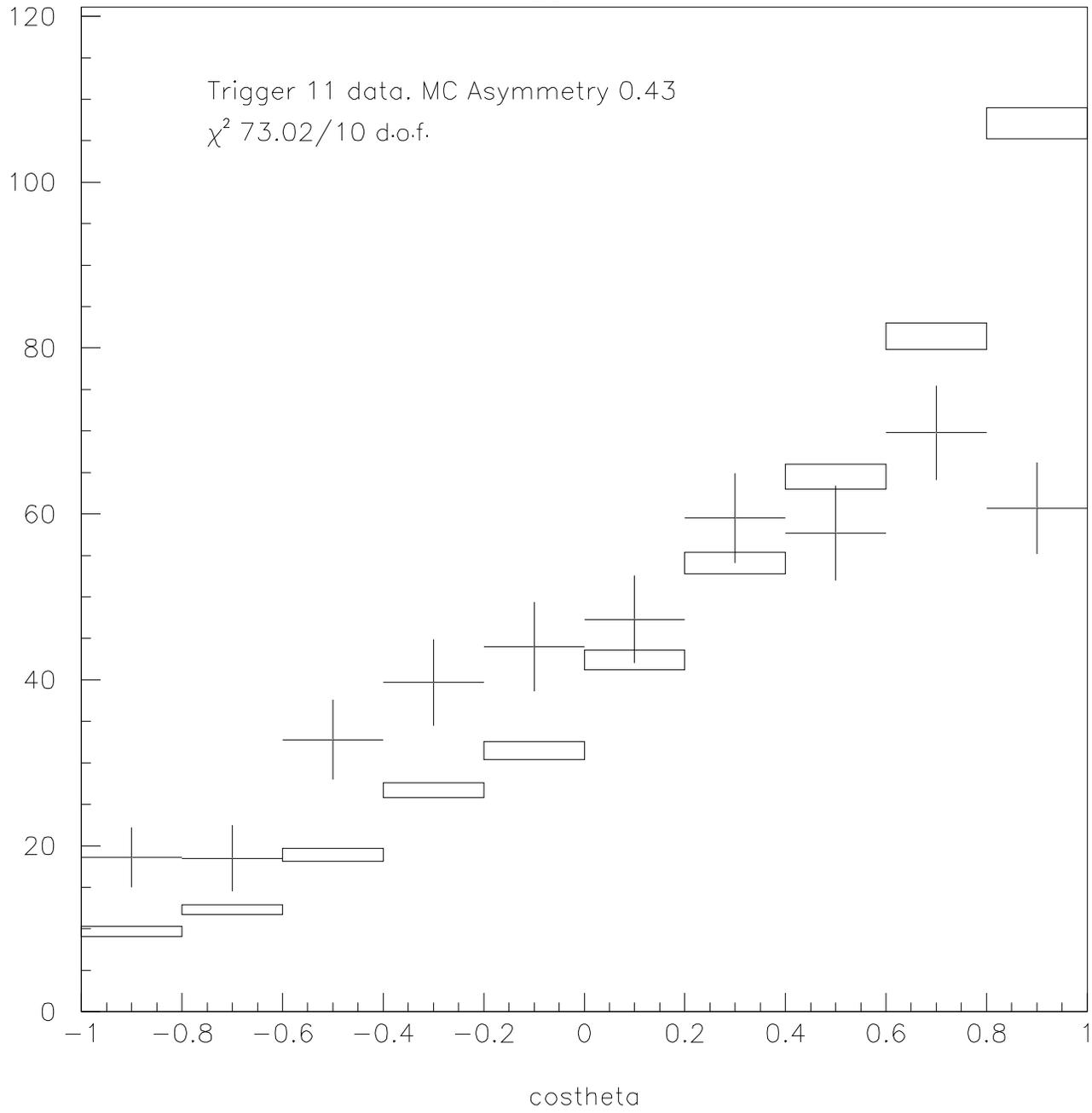
- Asymmetry

Asymmetry	Monte Carlo accepted $L^0g$	Generated $L^0g$
-1.00	9,765	999,907
-0.90	10,026	
-0.80	10,209	
-0.75	10,413	
-0.70	10,518	
-0.65	10,571	
-0.60	10,800	
-0.55	10,829	
-0.50	11,051	
-0.45	11,193	
-0.25	11,611	
0.0	12,318	

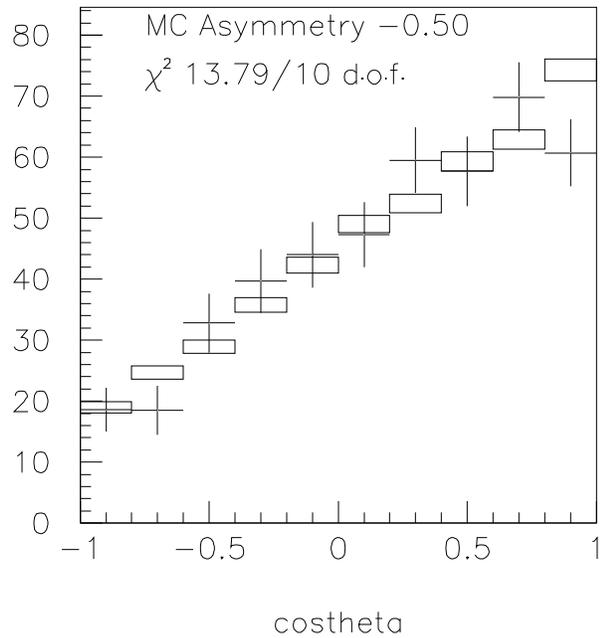
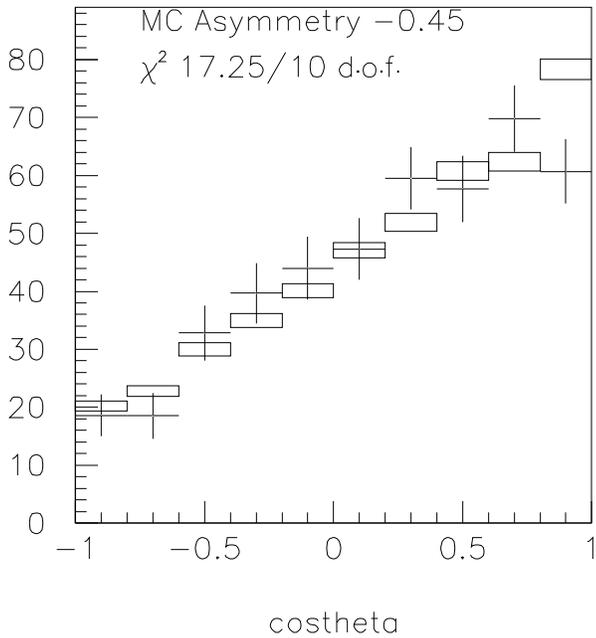
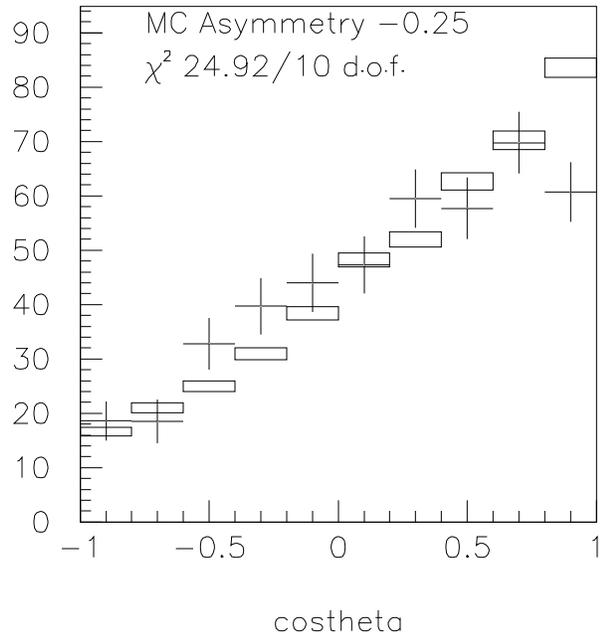
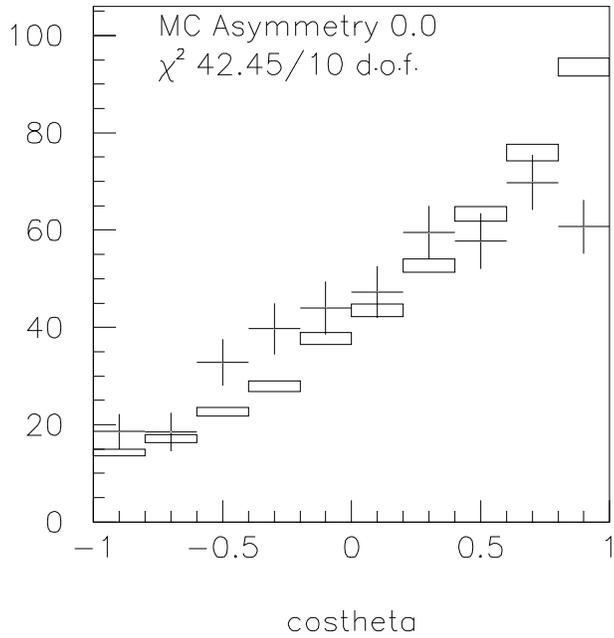
# $a(X^0 \rightarrow L^0 g)$ studies

- Construct an unpolarized data sample by mixing equal number of spin-up and spin-down cascade decays
- Construct similarly an unpolarized Monte Carlo sample of cascade decays.
- Compare the Monte Carlo and data, mutually normalized,  $\cos^2 \phi$  distributions and get the  $\chi^2$  for various Monte Carlo asymmetries.  $\phi$  is the angle between the proton and the cascade in the Lambda rest frame of reference.
- The  $a(X^0 \rightarrow L^0 g)$  is the one corresponding to the minimum  $\chi^2$
- After fitting a parabola at the vicinity of minimum we find from both trigger 10 and 11 data:  $a(X^0 \rightarrow L^0 g) = -0.72 \pm 0.03 \pm 0.06$ . The 0.06 is a systematic error associated with background uncertainties. It is derived after repeating the analysis without correcting the data sample for background.

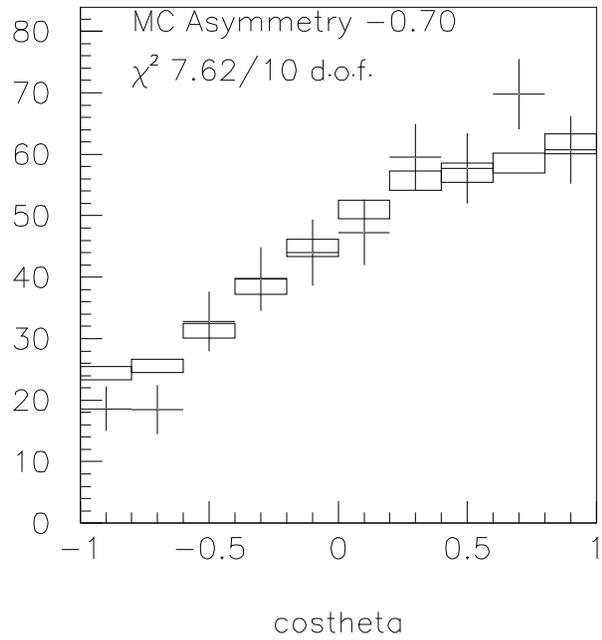
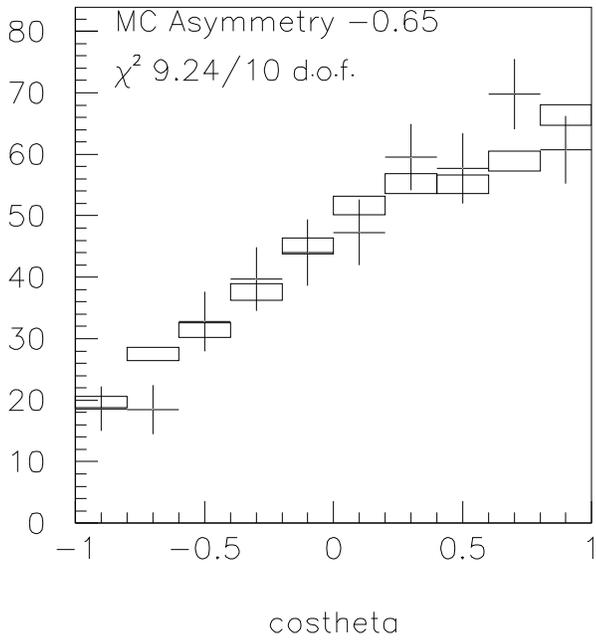
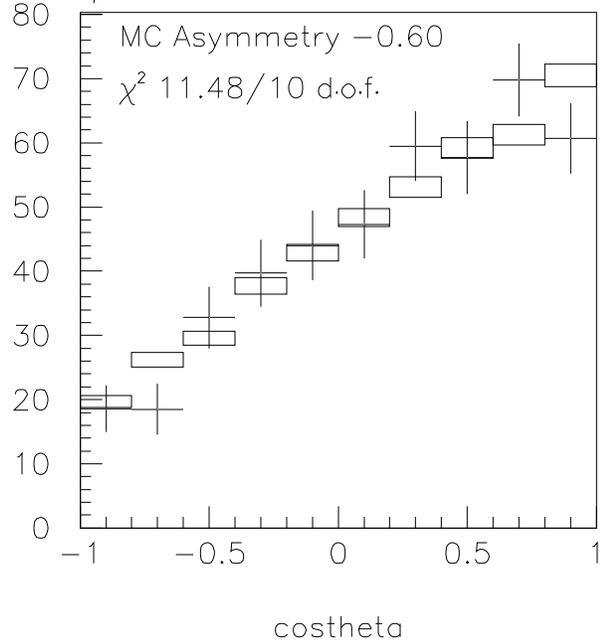
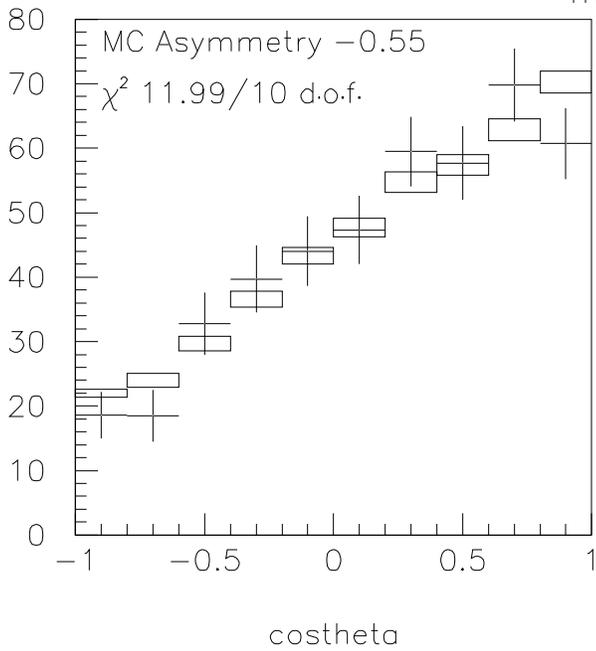
Trigger 11  $\Lambda\gamma$



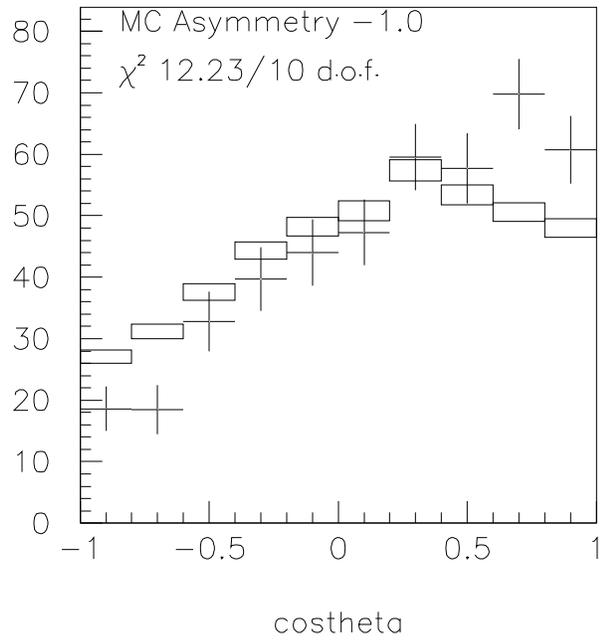
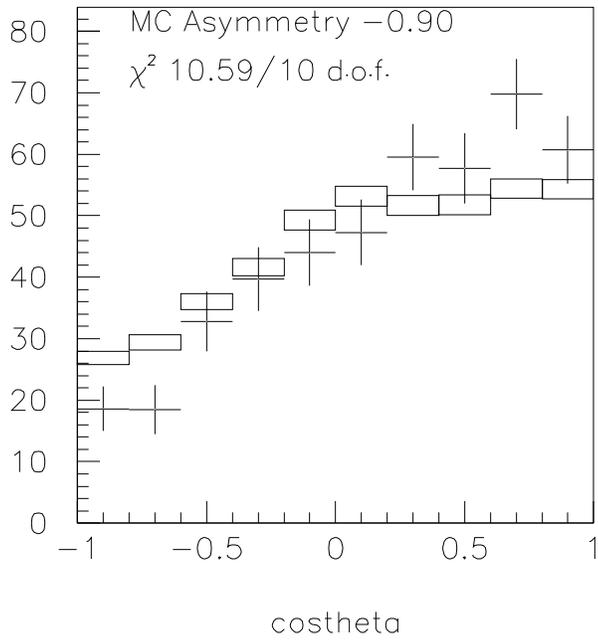
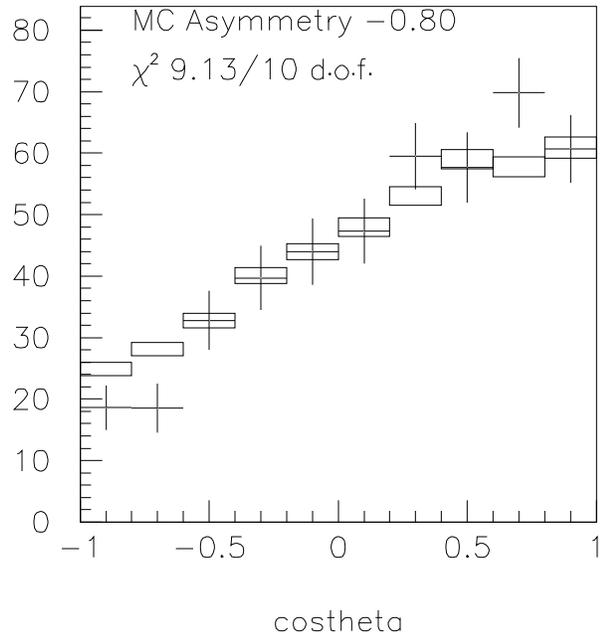
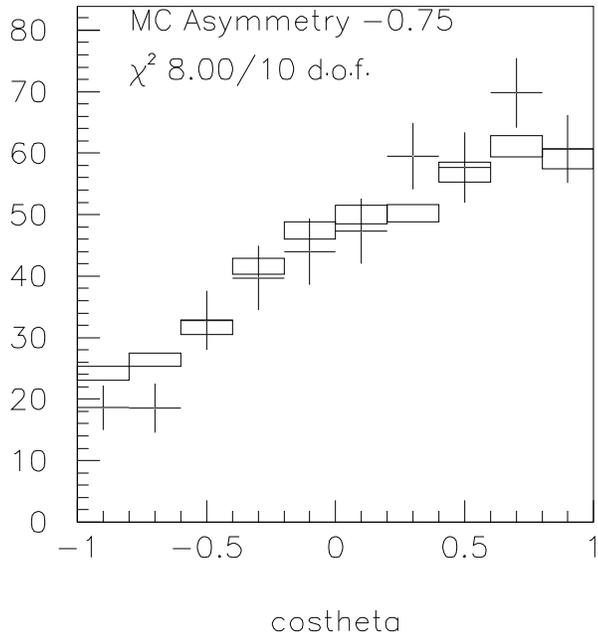
Trigger 11  $\Lambda\gamma$



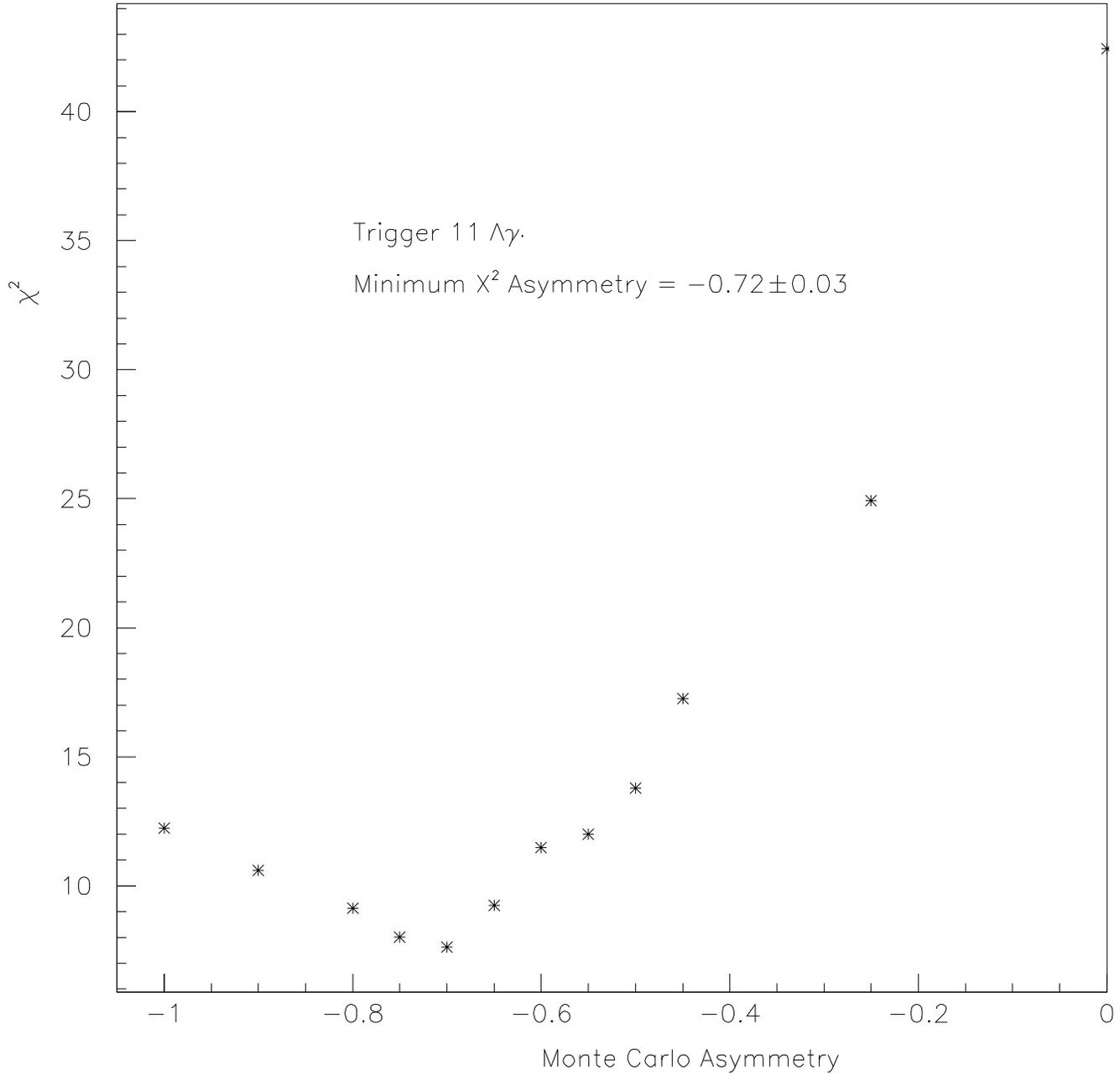
Trigger 11  $\Lambda\gamma$



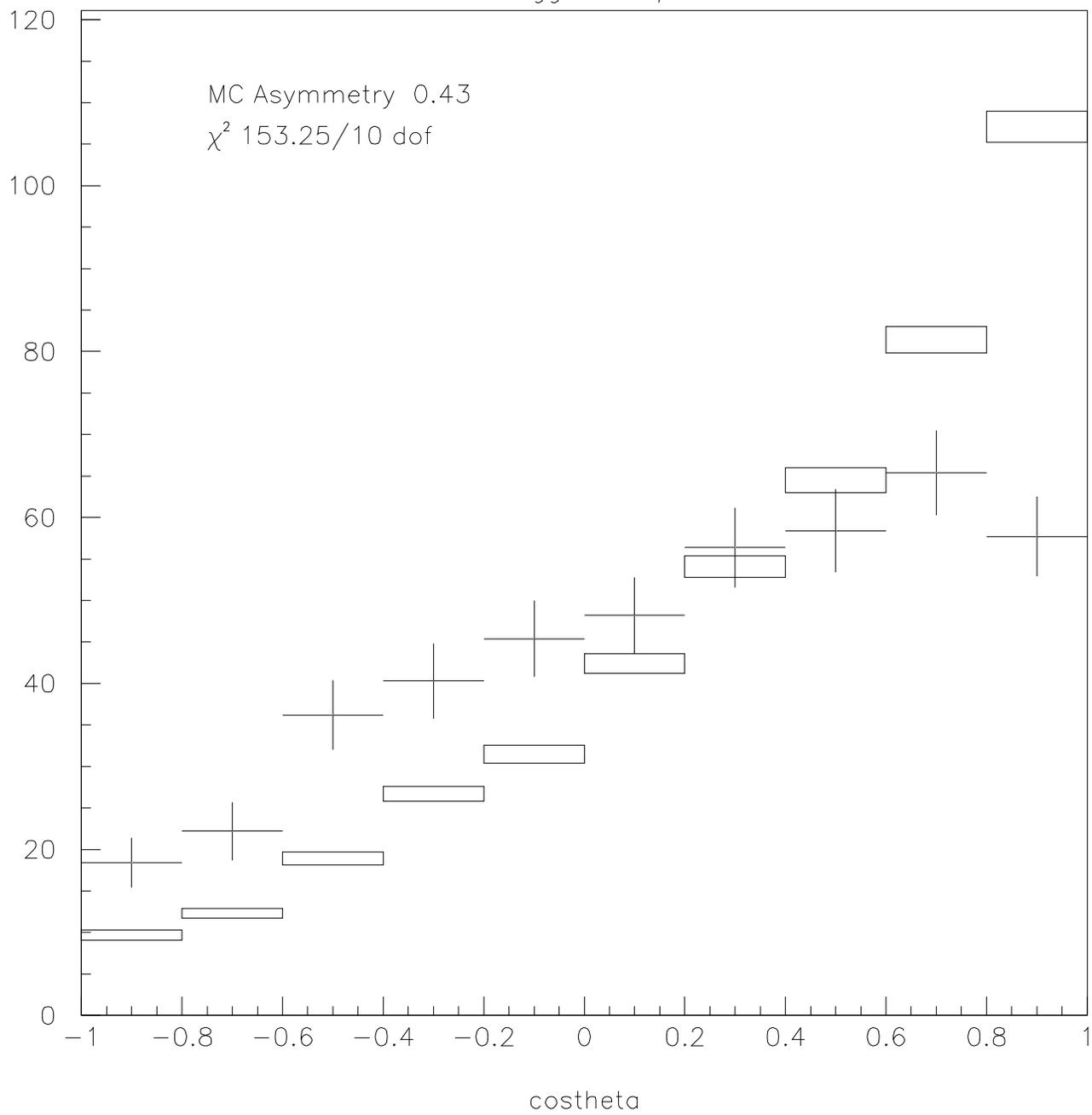
Trigger 11  $\Lambda\gamma$



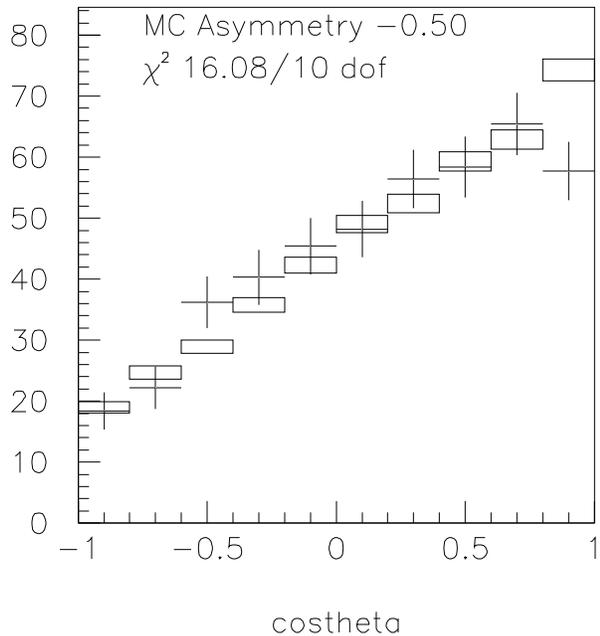
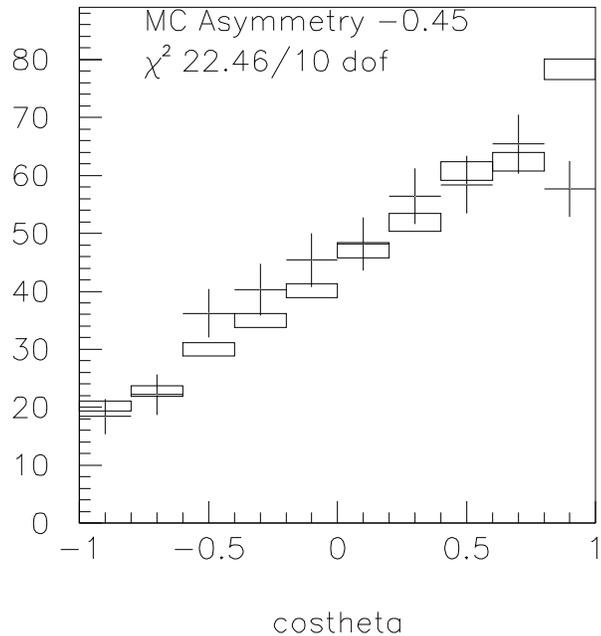
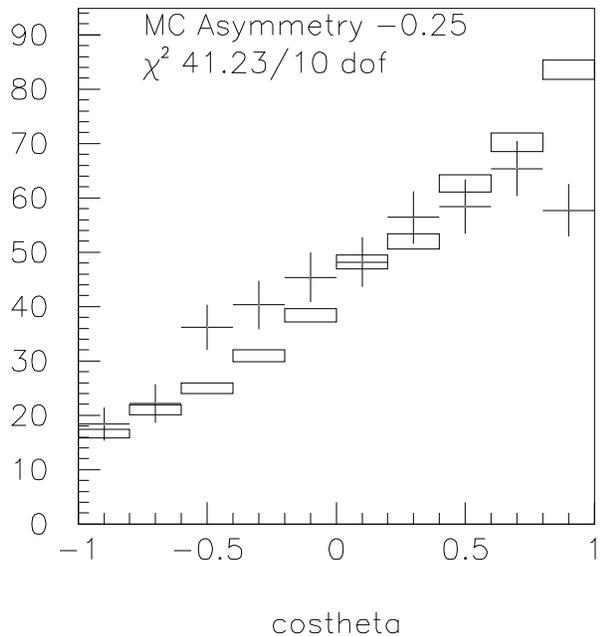
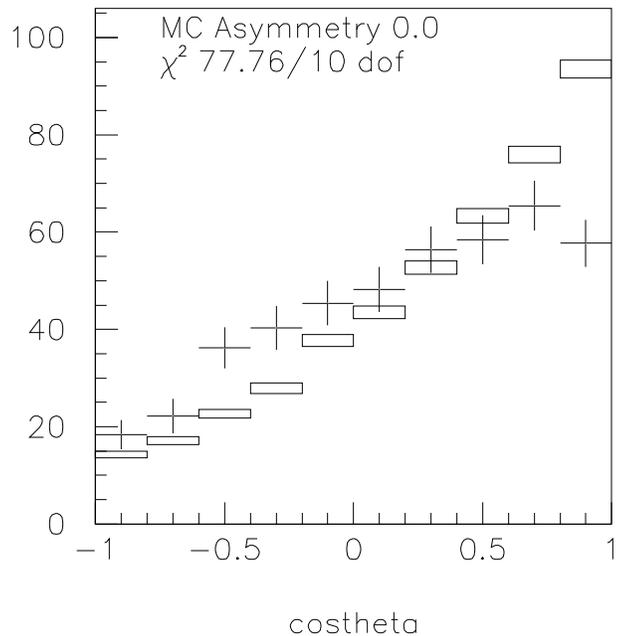
Trigger 11  $\Lambda\gamma$



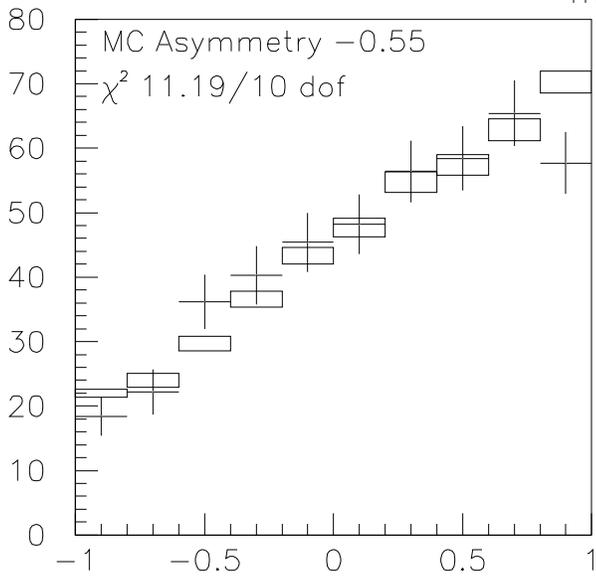
Trigger 10  $\Lambda\gamma$



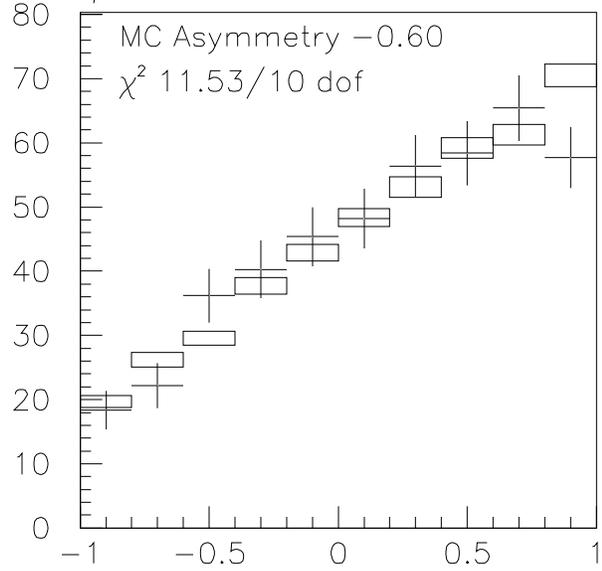
Trigger 10  $\Lambda\gamma$



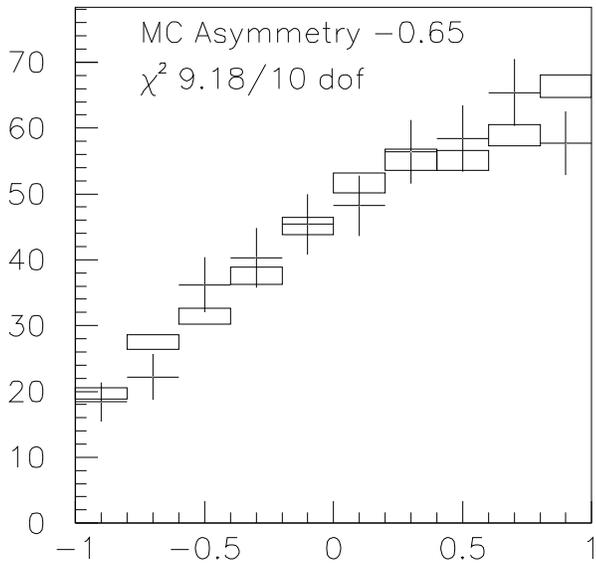
Trigger 10  $\Lambda\gamma$



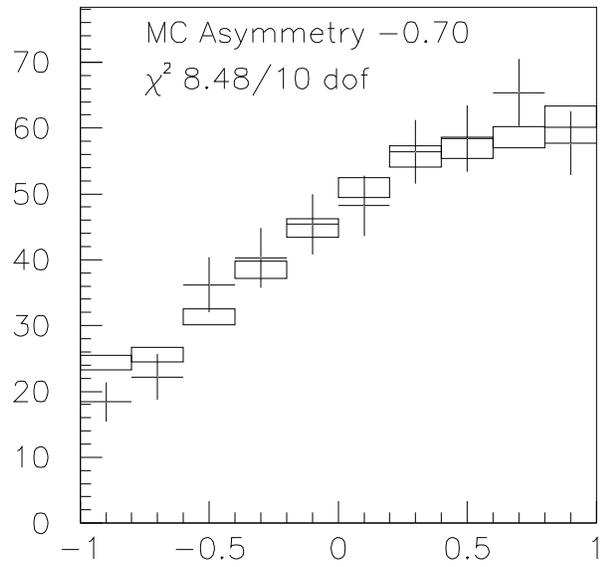
costheta



costheta

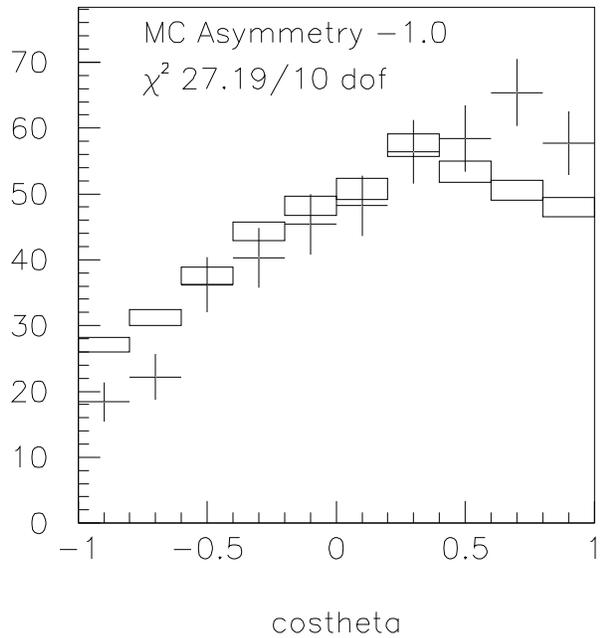
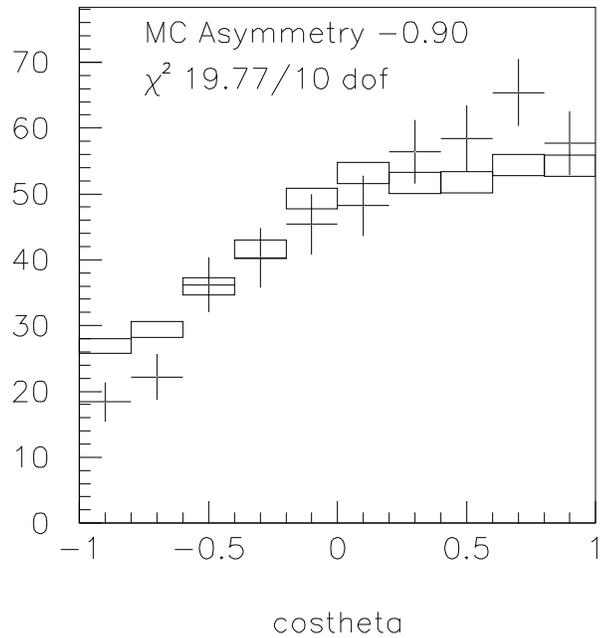
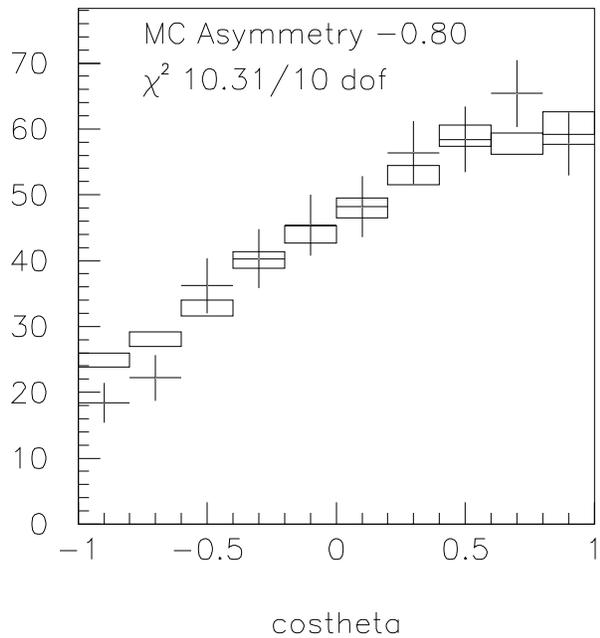
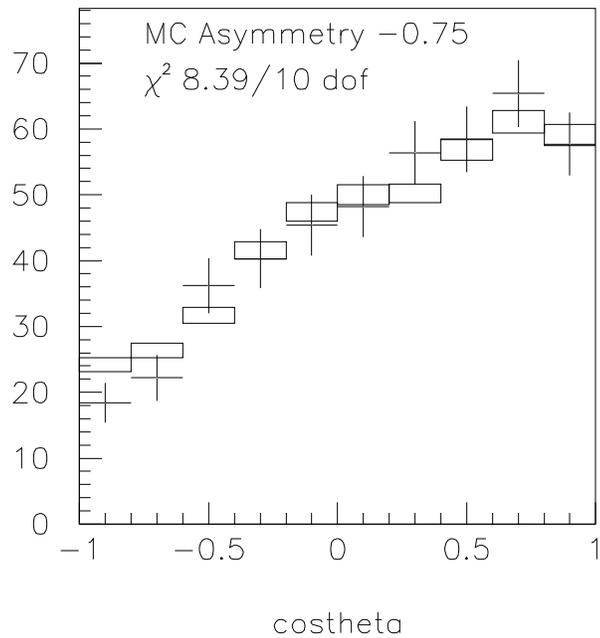


costheta

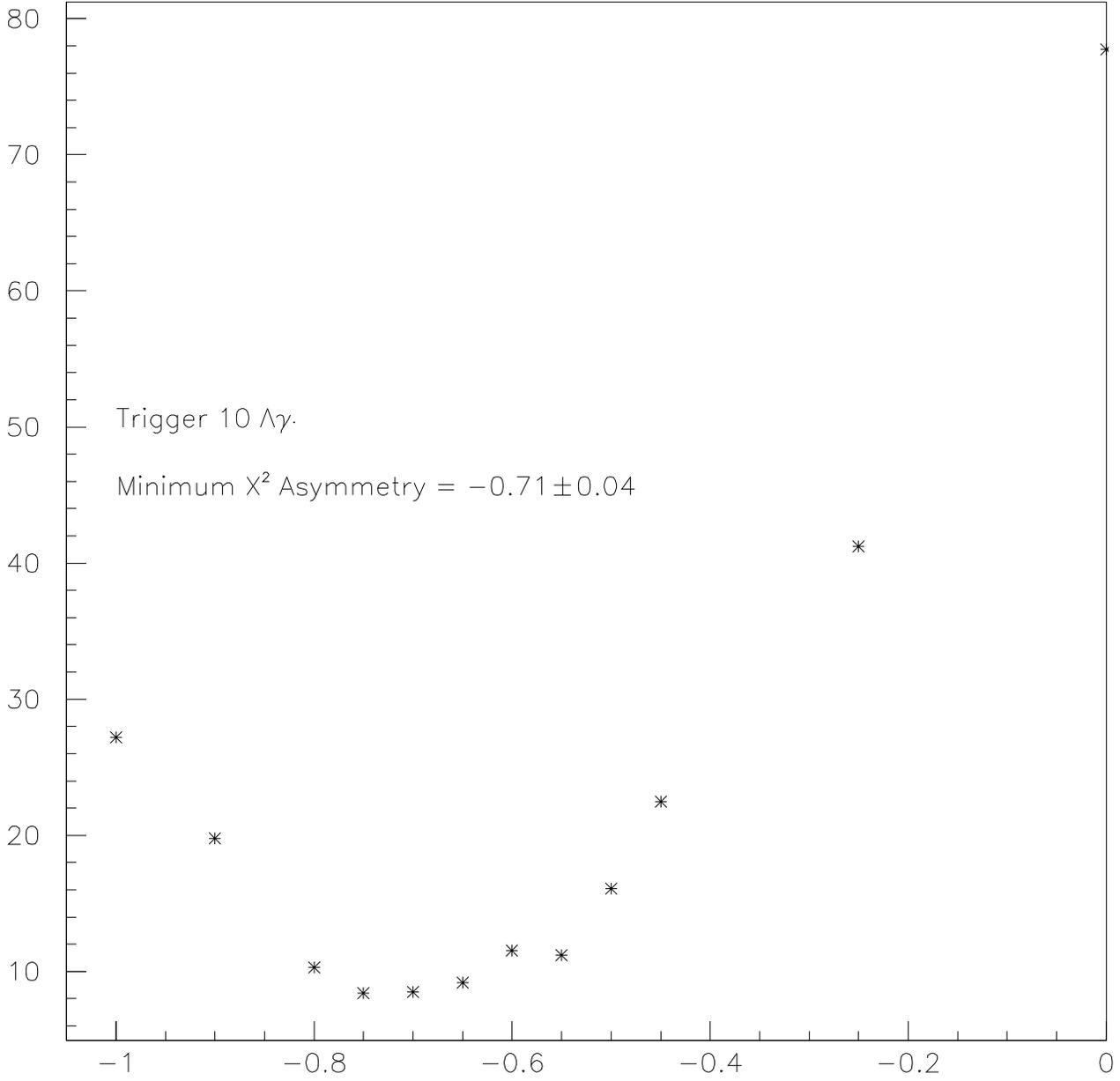


costheta

Trigger 10  $\Lambda\gamma$



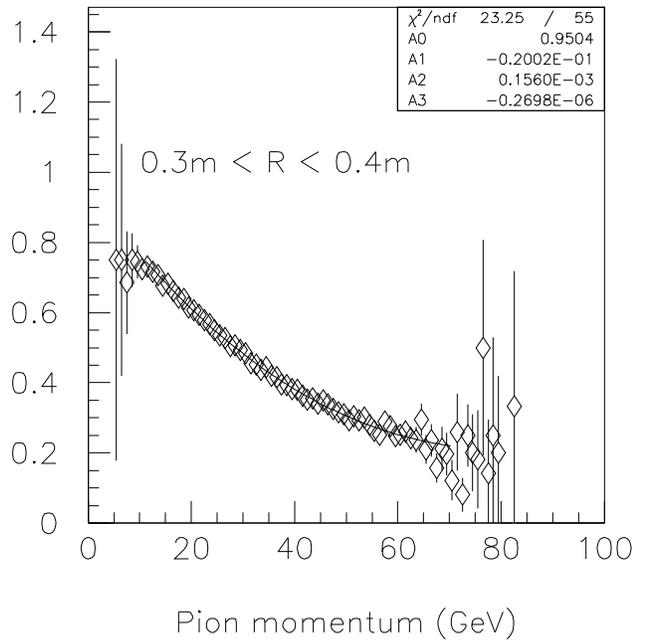
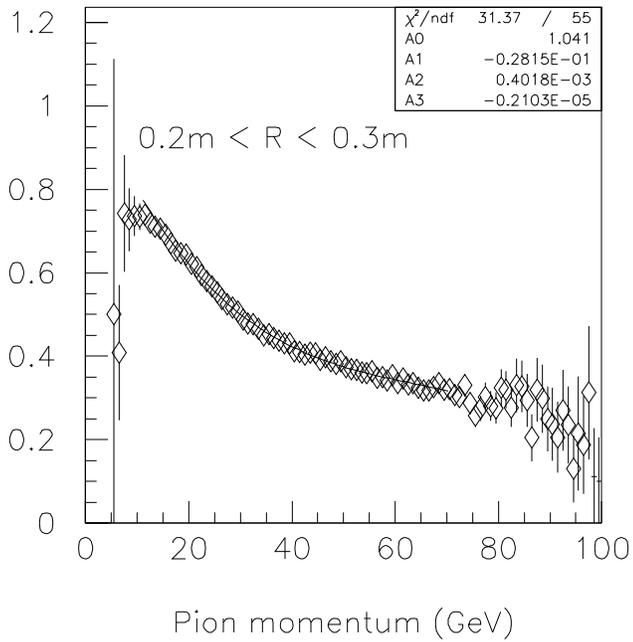
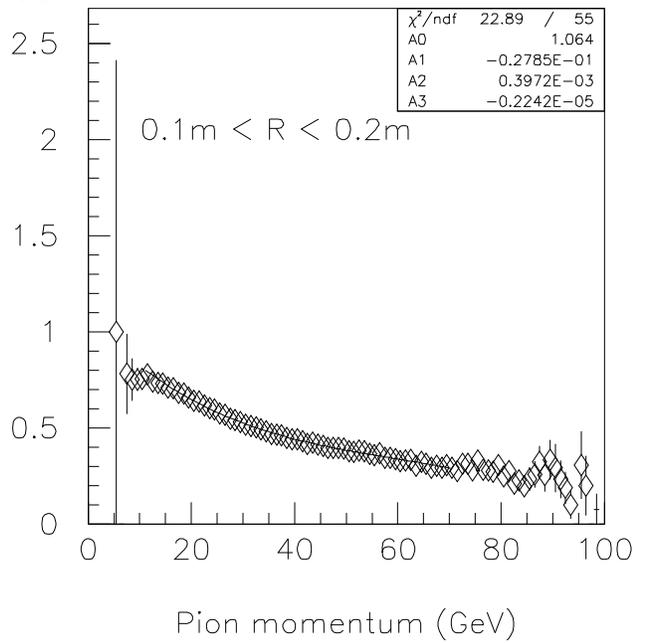
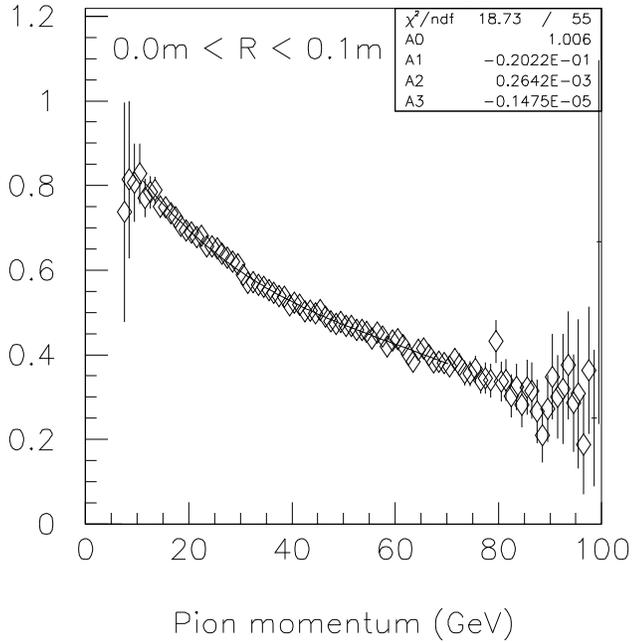
Trigger 10  $\Lambda\gamma$



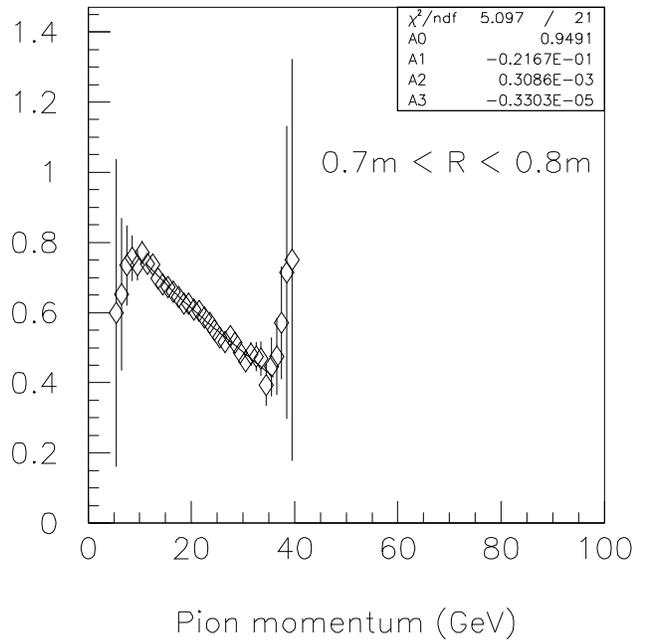
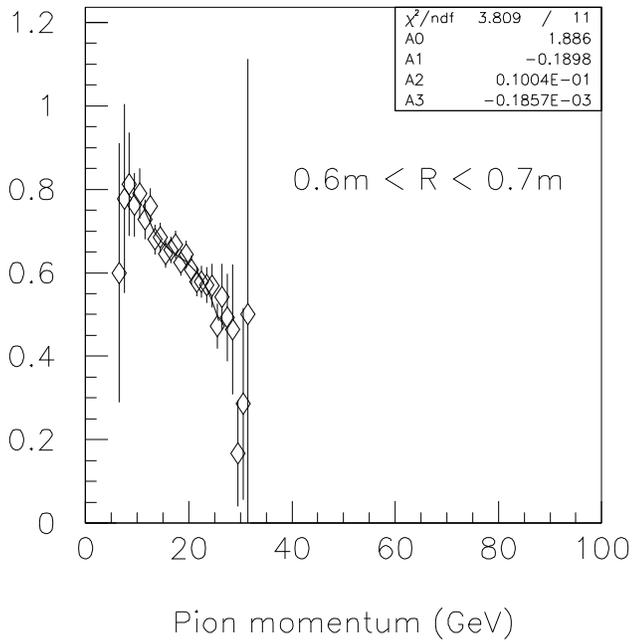
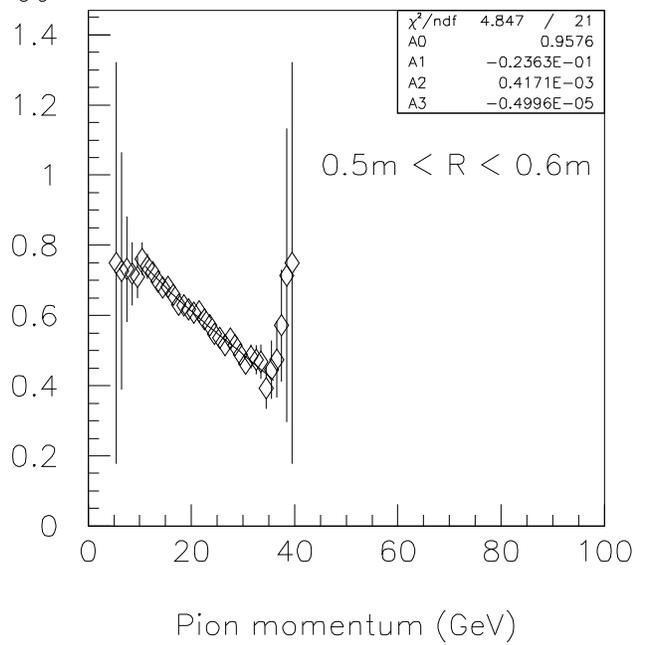
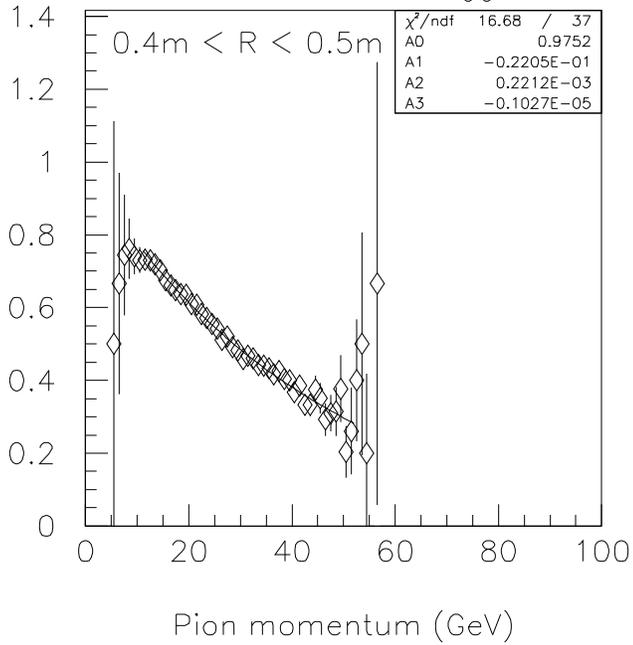
# Hadron Anti study methodology

- If trigger 10 had not contained the Hadron Anti, trigger 11 data should have had trigger 10 always on. Also the ratio of trigger 10 data with trigger 11 on over the total number of trigger 10 data would equal the pre-scale factor  $1/7$ .
- Using trigger 11 data, we study the HA efficiency as a function of  $p^-$  momentum for various bins (0.1m each) of  $p^-$  position on the calorimeter (to get any position dependence). We define the HA efficiency as  $N(11*10)/N(11)$  and consider it as a function of  $p^-$  momentum. For each  $p^-$  position bin we fit a third degree polynomial to the efficiency as a function of the  $p^-$  momentum.
- Use  $w=1./\text{efficiency}$  as a weight to get the HA corrected  $Lp^0$  and  $Lg$  trigger 10 data. After the trigger 10 correction, the number of data with trigger 10 and 11 on should be equal to the trigger 10 data.
- The HA correction, did NOT improve the branching ratio from trigger 10 data.

Trigger 11.10/Trigger 11  $\Lambda\pi^0$  data



Trigger 11.10/Trigger 11  $\Lambda\pi^0$  data



# Conclusion

- The UPA043-UPA333 raw data tapes used for both data sample and normalization. The number of  $Lp^0$  found in the raw data tapes is significantly higher than what I previously found in the split tapes (UPH).
- The asymmetry of the decay is found -0.72 in both trigger 10 and 11 data.
- The  $Lg$  acceptance depends on the asymmetry in the Monte Carlo. A systematic error  $\pm 0.02$  has been assigned to the branching ratio due to the asymmetry uncertainty.
- The trigger 10 branching ratio is (significantly ?) smaller ( $1.7\sigma$ ) than the trigger 11 one. A systematic error  $\pm 0.07$  (5.4%) has been assigned.
- The HA efficiency was studied but did not improve the trigger 10 branching ratio.
- The background sources examined were from cascade decays into  $Lp^0$  and  $Sg$ . 30M simulated primary  $Ls$  yielded no background. Any other background uncertainty (kaons?).