COLLABORATION MEETING
Physics Book

Analysis on the Electromagnetic Form Factors

Status report

MARIA CARMEN MORA ESPI
Uni-Mainz - GSI

Ferrara – 11th September, 2008

Generated events

Background:

	8.2 $(GeV/c)^2$ **3.7 GeV/c**	12.9$(GeV/c)^2$ **5.9 GeV/c**	16.7$(GeV/c)^2$ **7.9 GeV/c**
$\pi^+\pi^-$	10^8 events	10^8	$2 \cdot 10^8$
$\pi^0\pi^0$			
$\gamma\gamma + \gamma\, e^+e^-$	10^6	10^6	10^6
$\gamma\gamma\ \gamma\gamma$	10^6	10^6	10^6
$\gamma e^+ e^- + \gamma e^+ e^-$	10^6	10^6	10^6

Talk by Gosia Sudol

$\mu^+\mu^-$		
Ge=0	10^6	10^6
Ge=Gm	10^6	10^6
Ge=3·Gm	10^6	10^6

Generated events

Signal:

	8.2 $(GeV/c)^2$	12.9$(GeV/c)^2$	16.7$(GeV/c)^2$
	3.7 GeV/c	**5.9 GeV/c**	**7.9 GeV/c**
e^+e^-			
Ge=0	10^6	10^6	10^6
Ge=Gm	10^6	10^6	10^6
Ge=3·Gm	10^6	10^6	10^6
$\mu^+\mu^-$			
Ge=0	10^6	10^6	
Ge=Gm	10^6	10^6	
Ge=3·Gm	10^6	10^6	

To be analysed

e^+e^- have been generated and analysed also at:

1.7 GeV/c; 2.87 GeV/c; 2.99 GeV/c; 4.85 GeV/c; 6.38 GeV/c and 10.9 GeV/c

Explanation of the cuts/suppresion factor

PID:

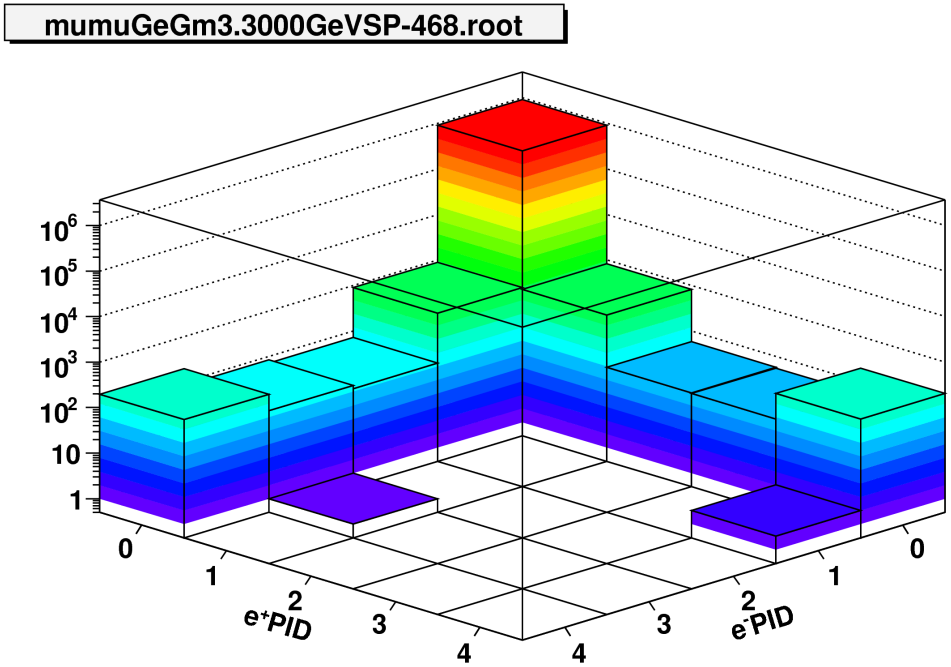
Very Loose	19.9%
Loose	85%
Tight	99%
Very Tight	99.8%

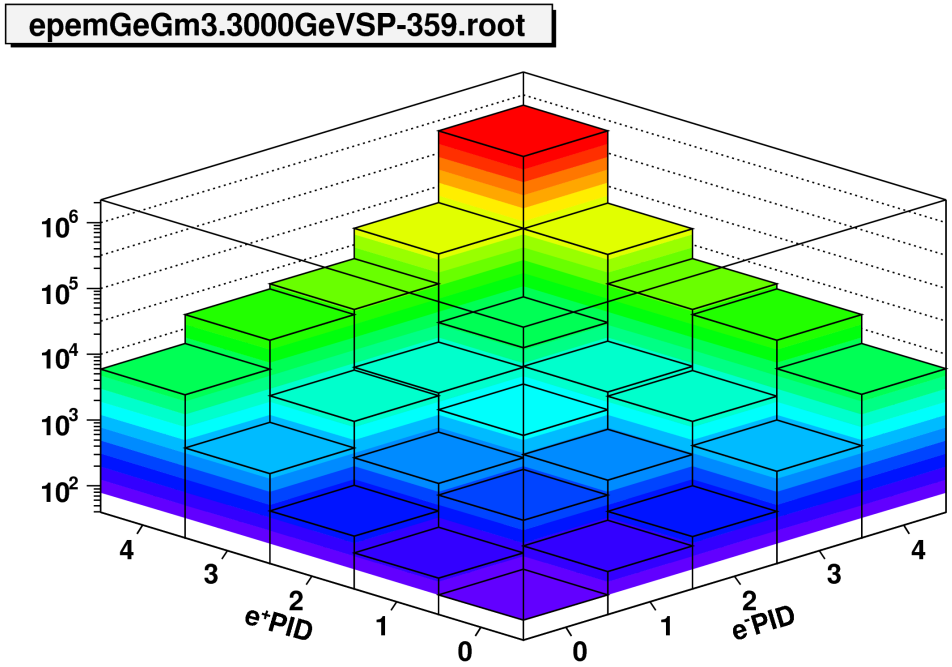
Kinematical fit:

CL>10^{-9}

CL>10^{-3} → To suppress completely the pion background

Muon and electron lists:

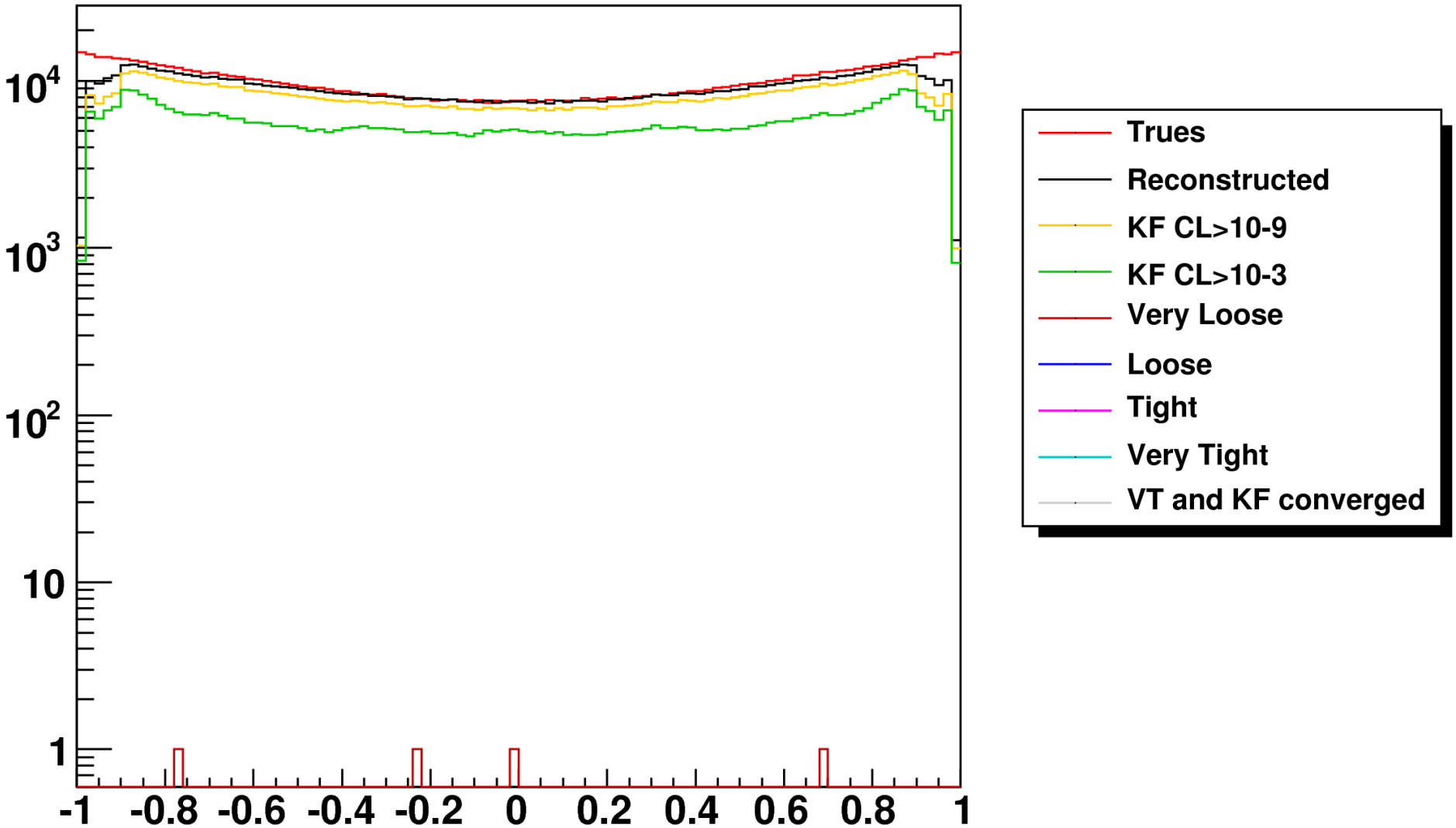




$\mu^+\mu^-$ as background

Analysed with e^+e^- hypothesis

pbar p →$\mu^+\mu^-$, Ge=0 and 8.20 $(GeV/c)^2$



The muons are completely suppressed by applying PID cuts

Signal Analysis

e+e-

Analysed with e^+e^- hypothesis

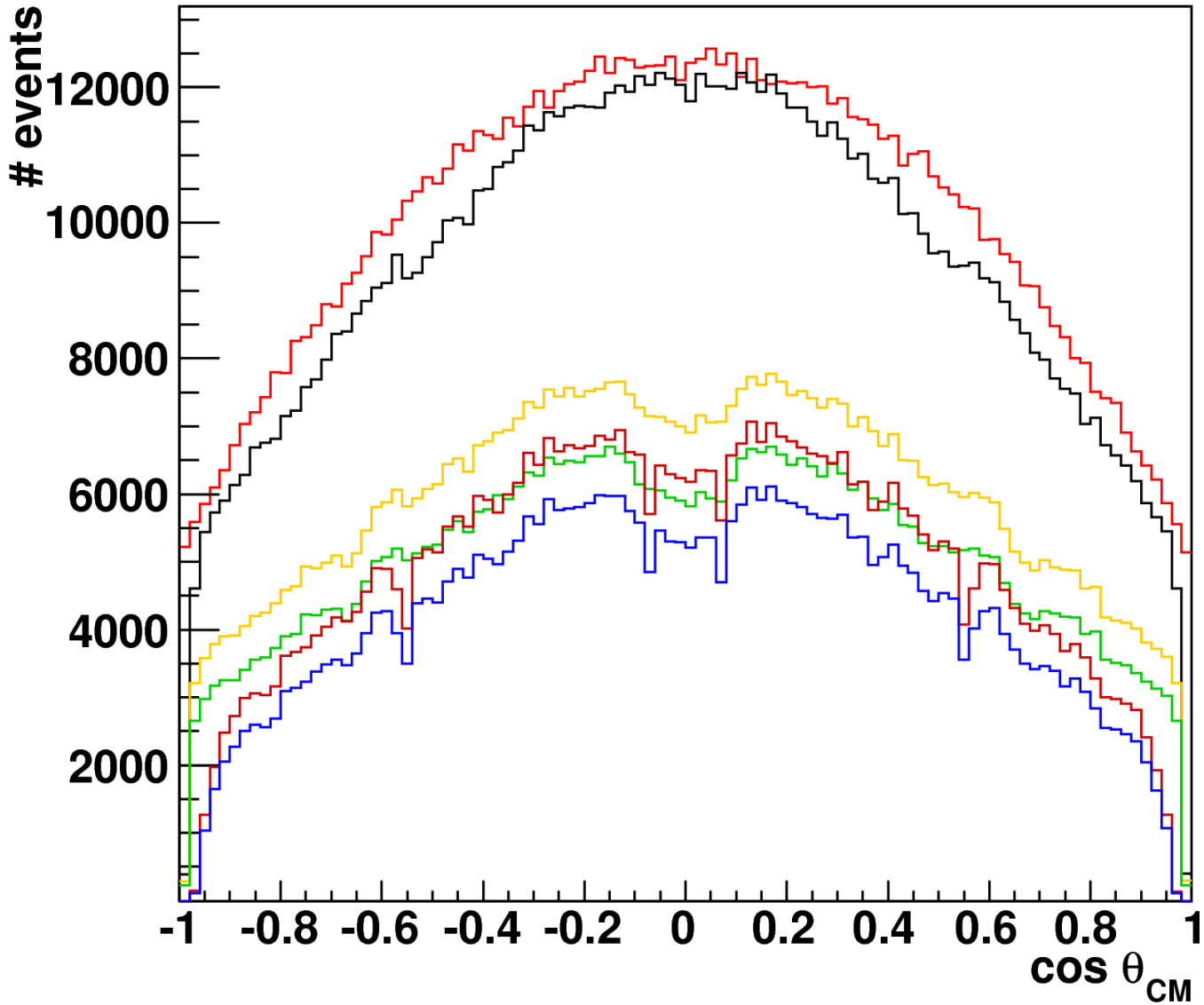
Analysis with realistic statistics

Signal (e^+e^-):

At full luminosity ($\mathcal{L}$= $2\cdot10^{32}$ cm^2s^{-1}) and 10^7 s of measurement time, corresponding to approximately 116 days, the expected number of events is the following.

s(GeV/c)^2	Ge=0	Ge=Gm	Ge=3·Gm
5.40	$9.01\cdot10^5$	$1.23\cdot10^6$	$3.83\cdot10^6$
7.43	$1.06\cdot10^5$	$1.34\cdot10^5$	$3.56\cdot10^5$
7.64	$8.82\cdot10^4$	$1.11\cdot10^5$	$2.91\cdot10^5$
8.20	$5.56\cdot10^4$	$6.88\cdot10^4$	$1.74\cdot10^5$
11.03	8030	9450	$2.08\cdot10^4$
12.90	2880	3310	6790
13.86	1790	2050	4060
16.69	525	587	1080
22.29	76	83	136

pbar p $\rightarrow e^+e^-$, Efficiency measurement Ge=3·Gm and 8.20 $(GeV/c)^2$



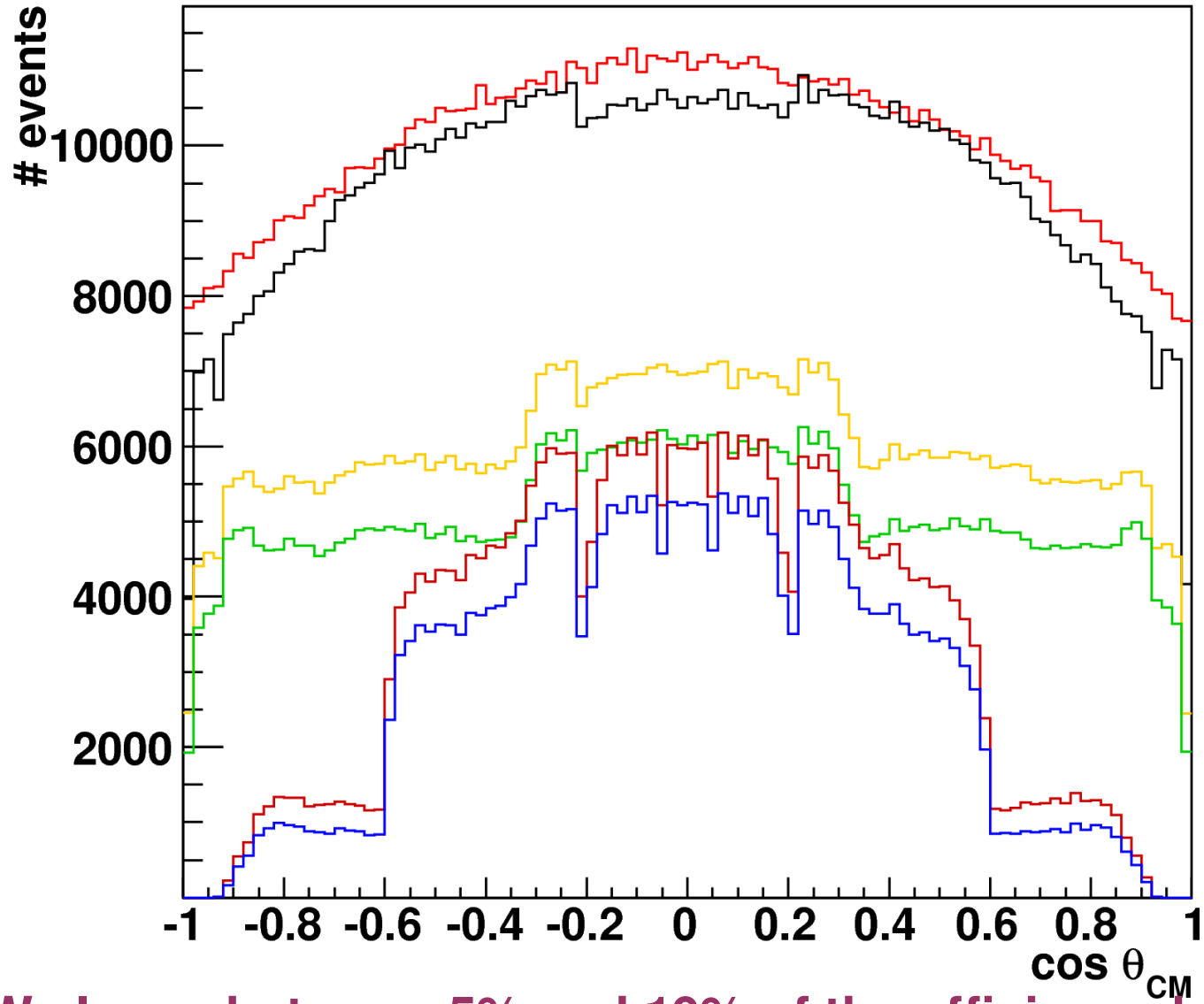
MC True events
Reconstructed
KF CL>10-9
KF CL>10-3
VT and CL>10-9
VT and CL>10-3

EFFICIENCY

No cuts: 0.93
CL>10-9: 0.60
CL>10-3: 0.50
CL>10-9 & VT: 0.49
CL>10-3 & VT: 0.42

We loose about a 10% of the efficiency by restricting the CL

pbar p $\rightarrow e^+e^-$, Efficiency measurement Ge=3·Gm and 16.69 $(GeV/c)^2$



EFFICIENCY

No cuts: 0.95

CL>10-9: 0.60

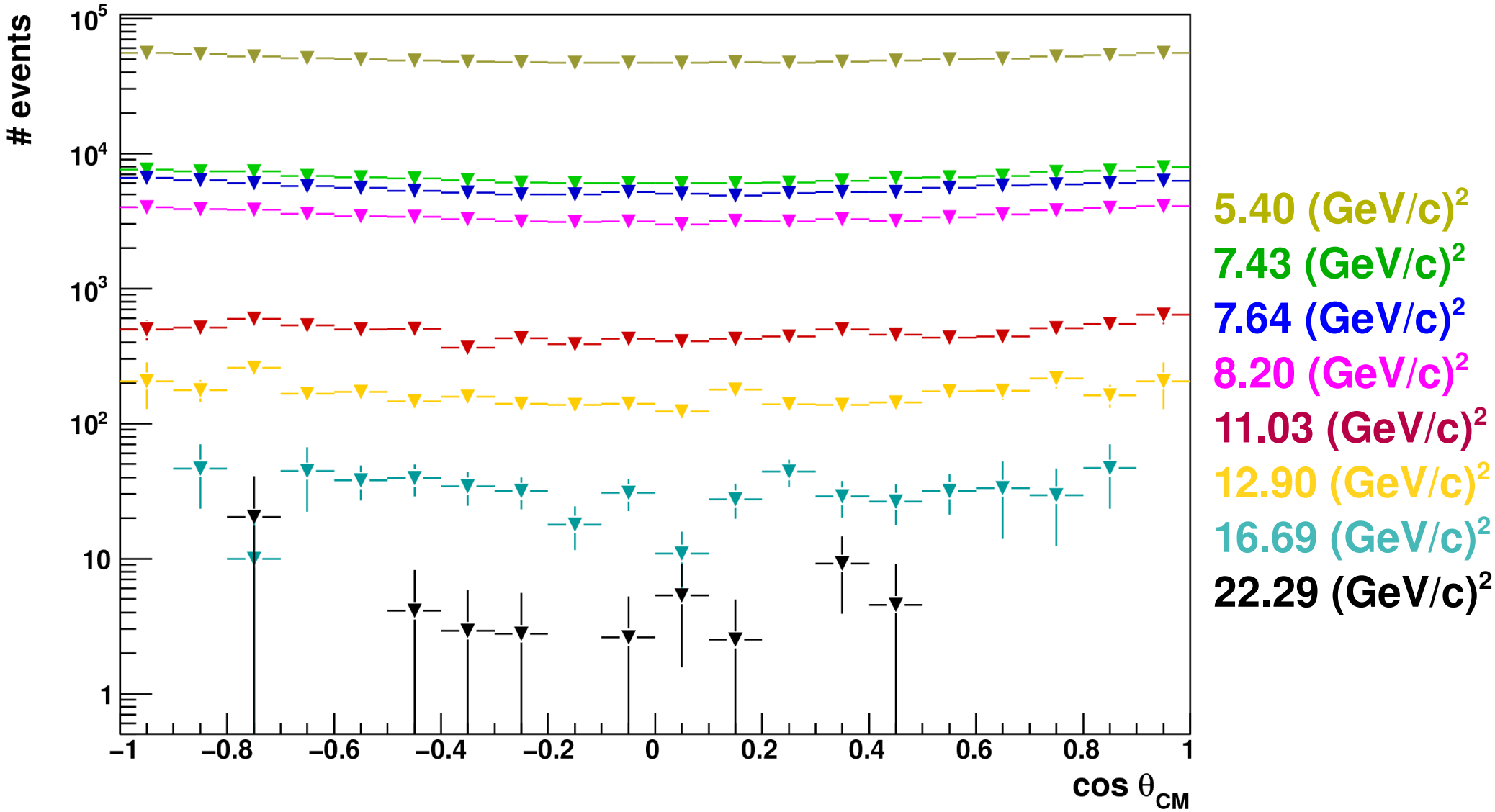
CL>10-3: 0.51

CL>10-9 & VT: 0.33

CL>10-9 & VT: 0.28

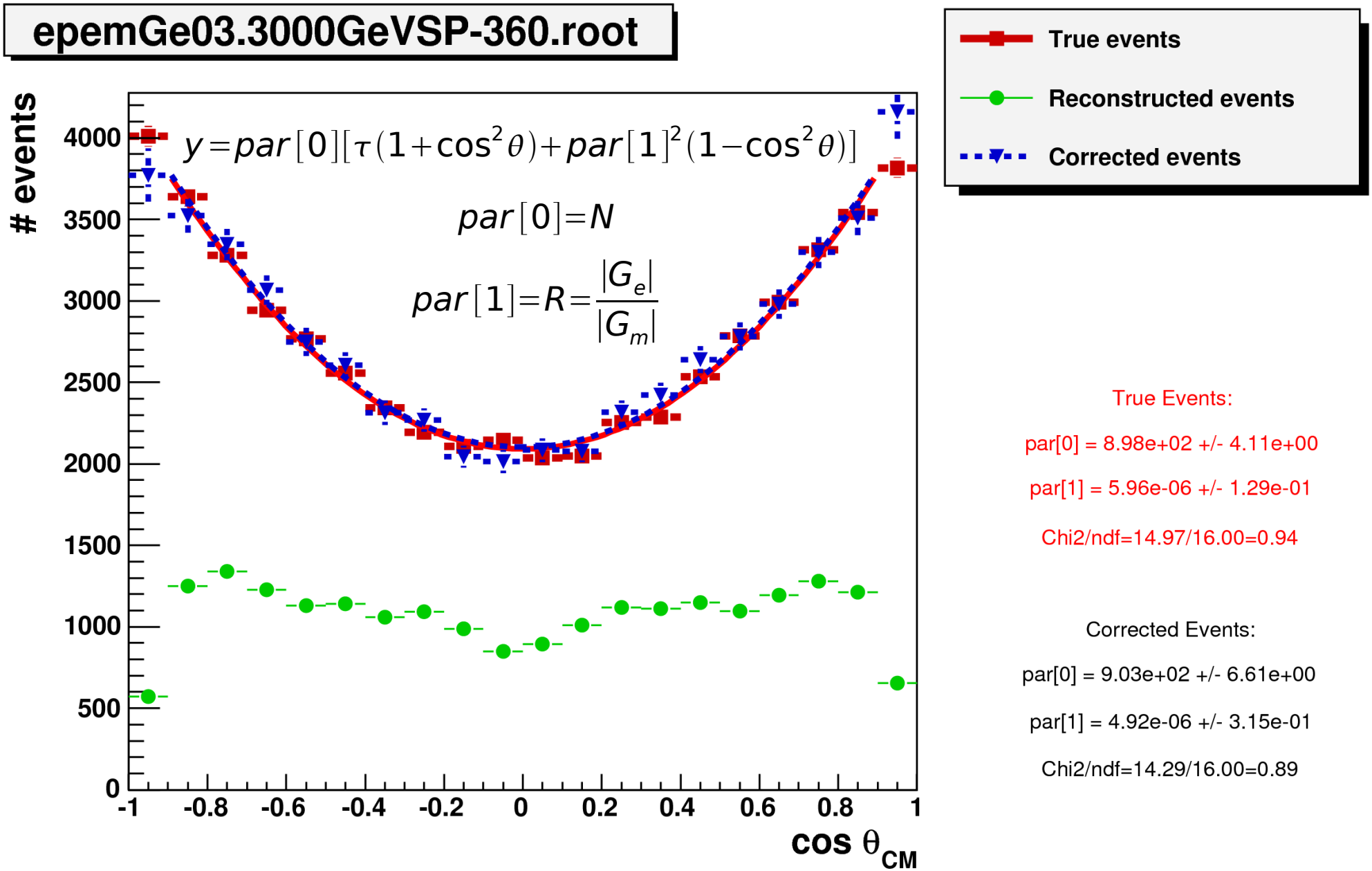
We loose between 5% and 10% of the efficiency by restricting the CL and applying PID cuts

pbar p → e^+e^-, Acceptance corrected angular distribution for Ge=Gm



For values of s larger than s=13.86 (GeV/c)^2 the acceptance correction introduces errors larger than 50%

pbar p → e^+e^-, Angular distribution fit results: Ge=0 and 8.20 $(GeV/c)^2$



True Events:

par[0] = 8.98e+02 +/- 4.11e+00

par[1] = 5.96e-06 +/- 1.29e-01

Chi2/ndf=14.97/16.00=0.94

Corrected Events:

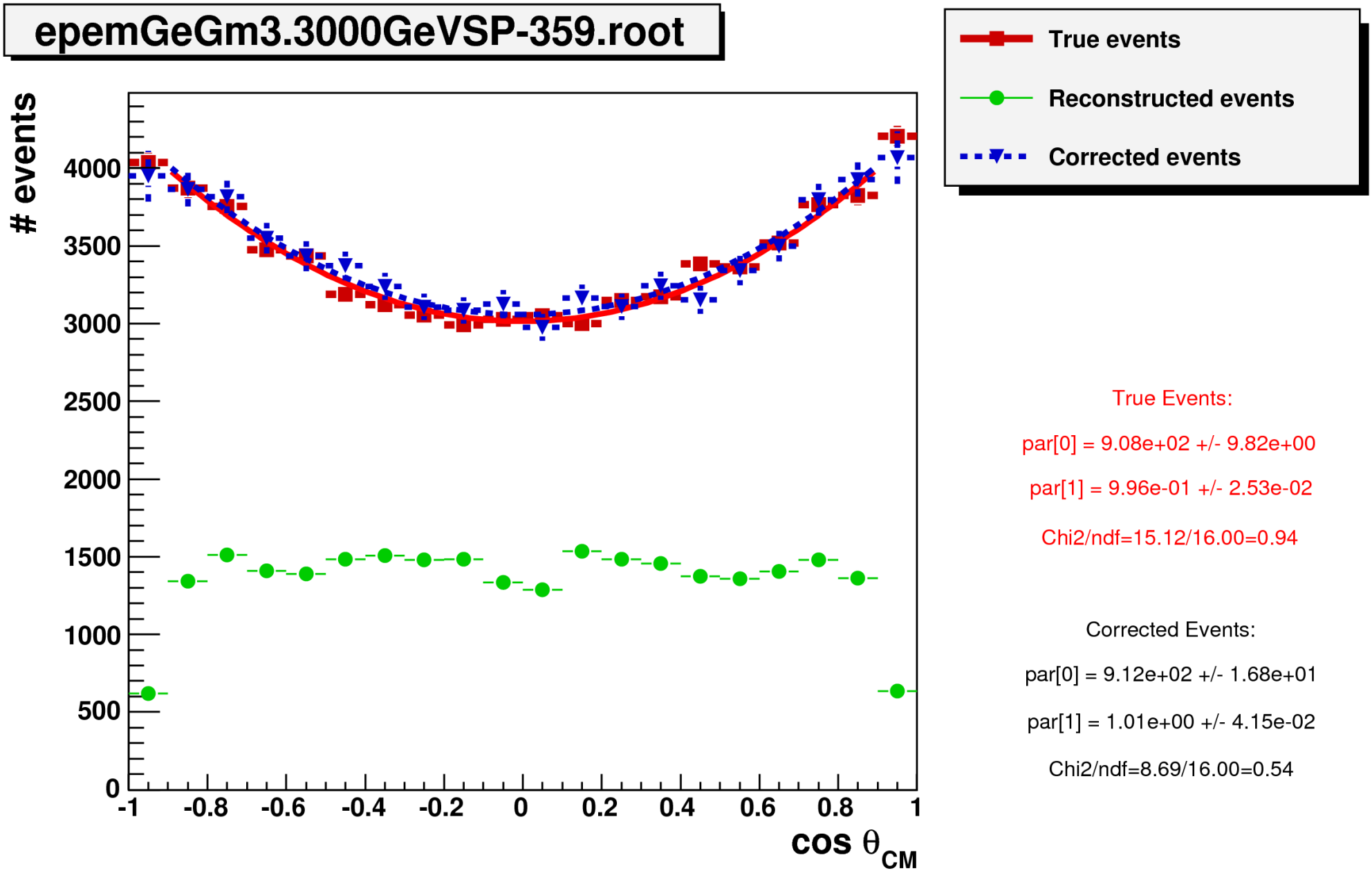
par[0] = 9.03e+02 +/- 6.61e+00

par[1] = 4.92e-06 +/- 3.15e-01

Chi2/ndf=14.29/16.00=0.89

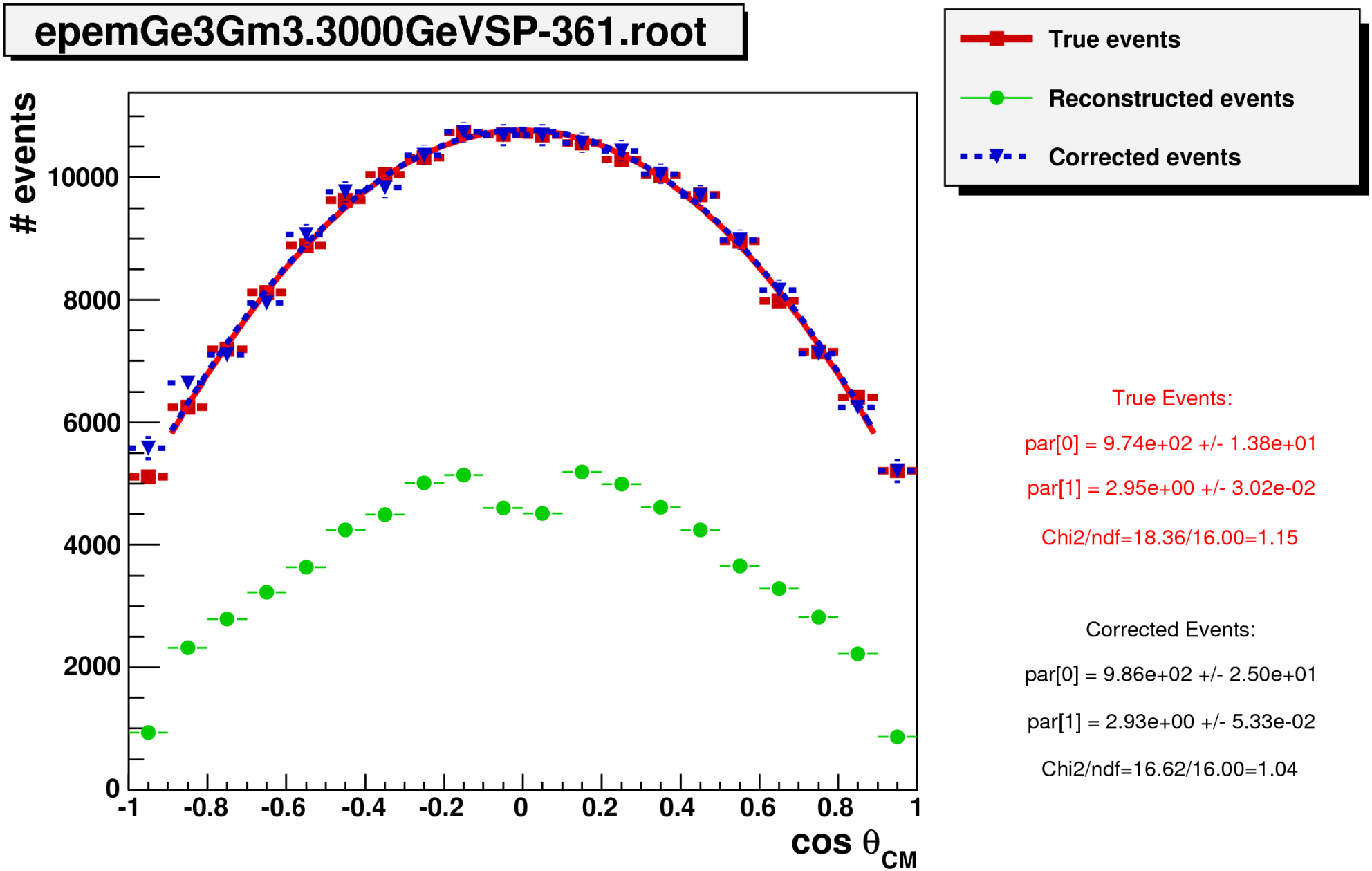
Expected and analysed: 55600 events

pbar p $\rightarrow e^+e^-$, Angular distribution fit results: Ge=Gm and 8.20 $(GeV/c)^2$



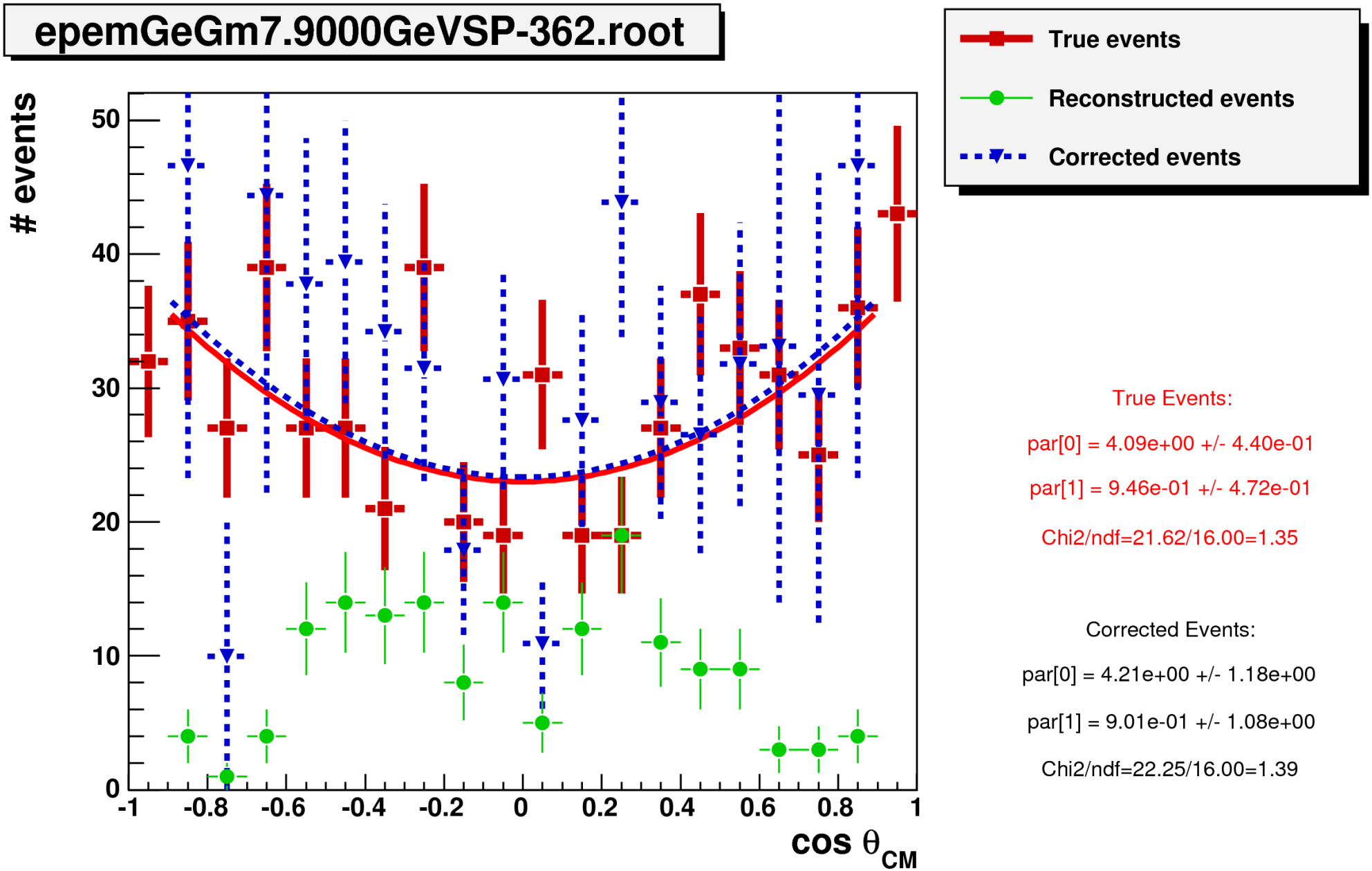
Expected and analysed: 68700 events

pbar p → e^+e^-, Angular distribution fit results: Ge=3·Gm and 8.20 $(GeV/c)^2$



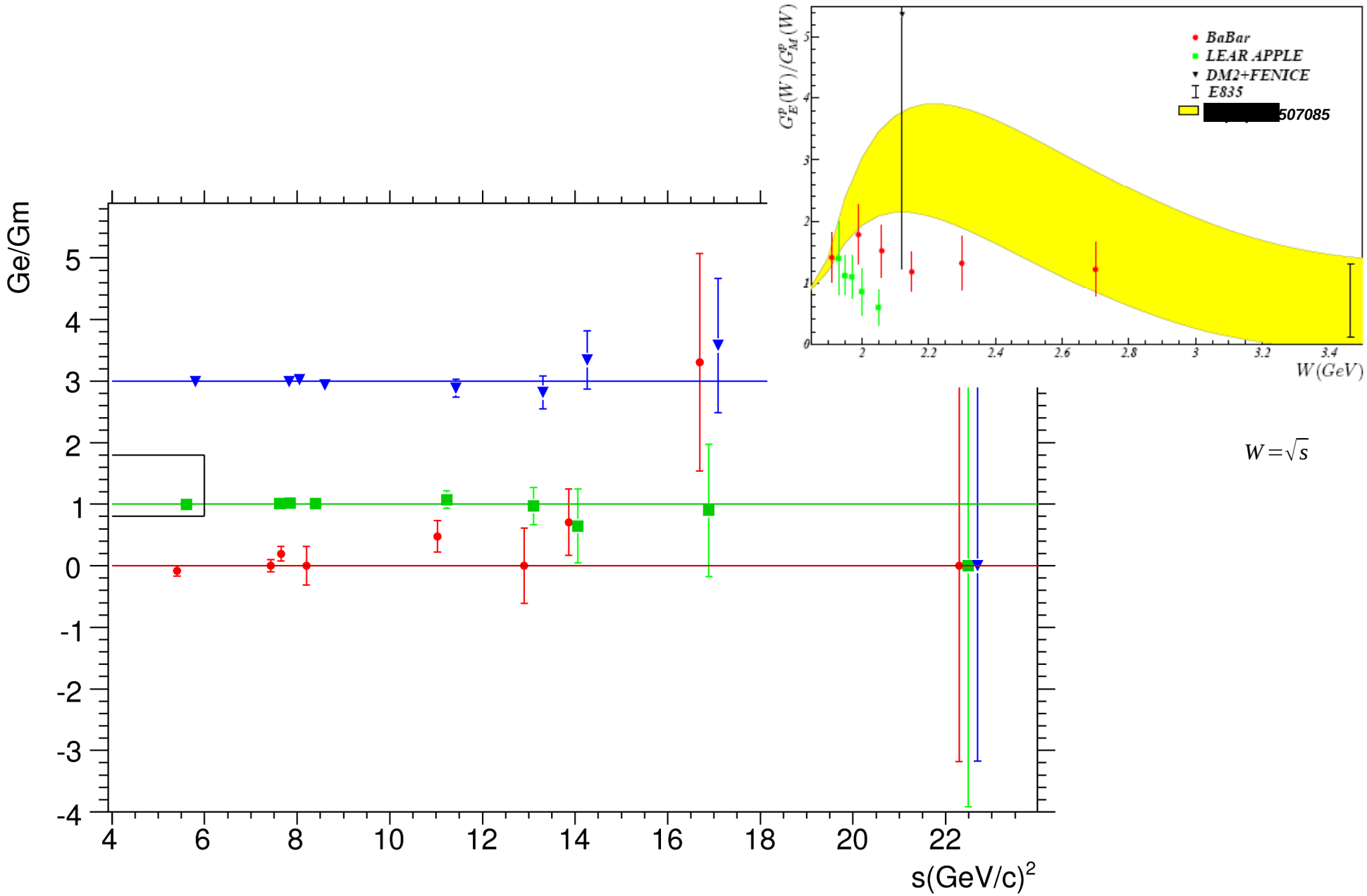
Expected and analysed: 174000 events

pbar p $\rightarrow e^+e^-$, Angular distribution fit results Ge=Gm and 16.69 $(GeV/c)^2$



Expected and analysed: 586 events

Results resume:



Conclusions

Absolut errors for Ge/Gm from the signal fit e^+e^-:

	Ge=0	Ge=Gm	Ge=3·Gm
5.40 $(GeV/c)^2$	$8.47 \cdot 10^{-2}$	$1.26 \cdot 10^{-2}$	$3.61 \cdot 10^{-2}$
7.43 $(GeV/c)^2$	$1.01 \cdot 10^{-1}$	$2.87 \cdot 10^{-2}$	$4.26 \cdot 10^{-2}$
7.64 $(GeV/c)^2$	$1.18 \cdot 10^{-1}$	$3.18 \cdot 10^{-2}$	$4.61 \cdot 10^{-2}$
8.20 $(GeV/c)^2$	$3.15 \cdot 10^{-1}$	$4.15 \cdot 10^{-2}$	$5.33 \cdot 10^{-2}$
11.03 $(GeV/c)^2$	$2.55 \cdot 10^{-1}$	$1.41 \cdot 10^{-1}$	$1.45 \cdot 10^{-1}$
12.90 $(GeV/c)^2$	$6.12 \cdot 10^{-1}$	$3.01 \cdot 10^{-1}$	$2.67 \cdot 10^{-1}$
13.58 $(GeV/c)^2$	$5.38 \cdot 10^{-1}$	$5.99 \cdot 10^{-1}$	$4.74 \cdot 10^{-1}$
16.69 $(GeV/c)^2$	1.77	1.08	1.09
22.29 $(GeV/c)^2$	3.18	3.91	3.17

Background $\mu^+\mu^-$:

PID: supression $\geq 10^6$ = 100%

CL: supression ~ 40 %