COLLABORATION MEETING

Physics Book

Analysis on the Electromagnetic Form Factors

Status report

MARIA CARMEN MORA ESPI

Uni-Mainz - GSI

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How well can we separate Ge and Gm

$\bar{p}p \rightarrow e^+e^-$ Cross Section:

$$\frac{d\sigma}{d(\cos\theta)} = \frac{\pi\alpha^2}{8M_p^2\tau\sqrt{\tau(\tau-1)}}[\tau|G_M|^2(1+\cos^2\theta)+|G_E|^2(1-\cos^2\theta)]$$

Fit functions:

$$y = C[|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

$$\tau = \frac{s}{4M_p^2}$$

$$y = [|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

Next fit functions (E. Tomasi):

$$y = N[\tau(1+\cos^2\theta)+(\frac{|G_E|}{|G_M|})^2(1-\cos^2\theta)]$$

$$R = \frac{|G_E|}{G_M} \qquad A = \frac{\tau-R}{\tau+R}$$

$$y = N'[1+\frac{\tau-R}{\tau+R}\cos^2\theta]$$

How well can we separate pi+pi- and e+e-

0.14.1

3 10^5 pi+pi- generated events in total

-> No event misidentified

0.15.2

10^7 pi+pi- generated events in total

-> Analysis in progress

M. Sudol : dE/dx PID

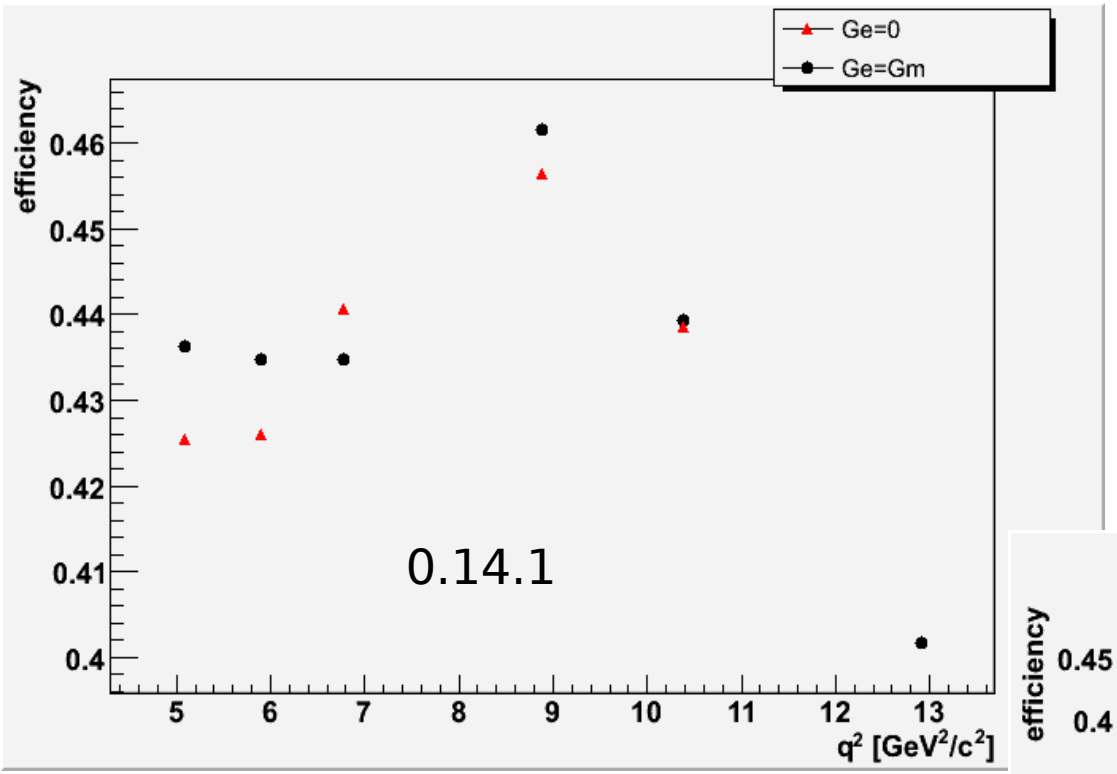
Spmodes release 0.14.1

# events	spmode	decay mode	p (GeV)	s (GeV/c)^2
50000	227	Ge=0	1.5	5.1
50000	228	Ge=Gm	1.5	5.1
50000	229	Isotrop	1.5	5.1
50000	230	Ge=0	2.0	5.9
50000	231	Ge=Gm	2.0	5.9
50000	232	Isotrop	2.0	5.9
50000	233	Ge=0	2.5	6.8
50000	234	Ge=Gm	2.5	6.8
50000	235	Isotrop	2.5	6.8
50000	236	Ge=0	4.5	10.4
50000	237	Ge=Gm	4.5	10.4
50000	238	Isotrop	4.5	10.4
50000	239	Pi+Pi-	1.5	5.1
50000	240	Pi+Pi-	2.0	5.9
50000	241	Pi+Pi-	2.5	6.8
50000	242	Pi+Pi-	4.5	10.4
50000	243	Ge=0	3.7	8.9
50000	244	Ge=Gm	3.7	8.9
50000	100	Isotrop	3.7	8.9
50000	101	Pi+Pi-	3.7	8.9

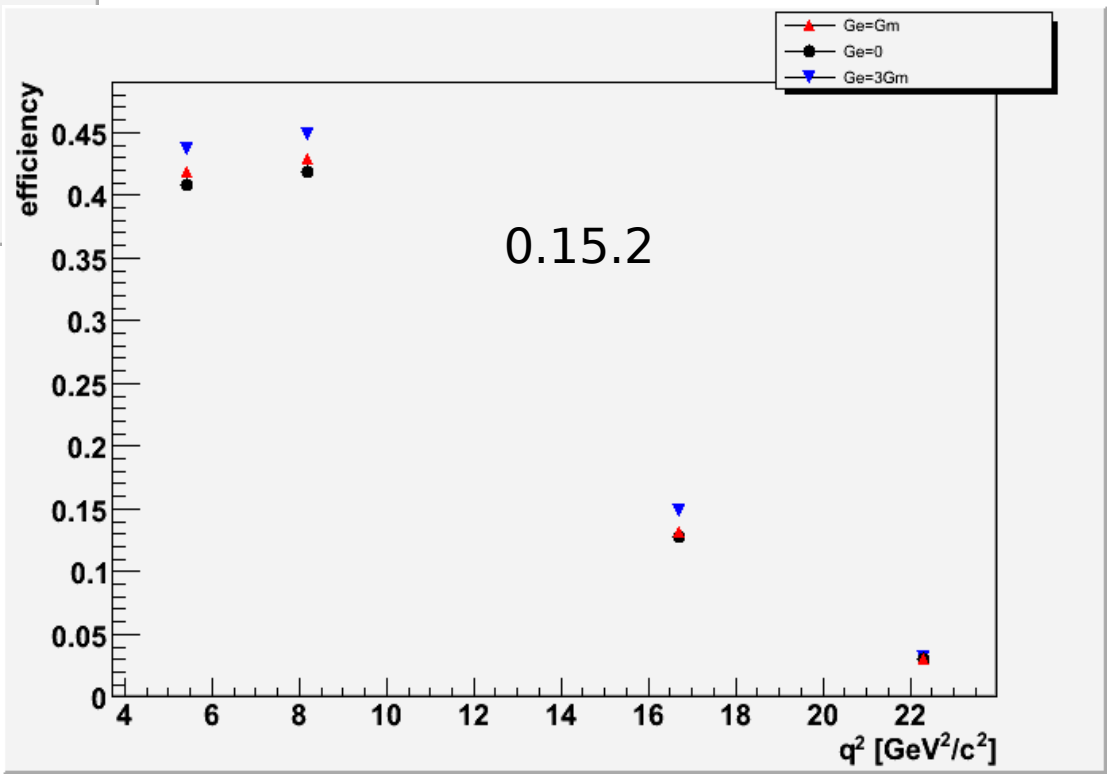
Spmodes release 0.15.2

# events	spmode	decay mode	p (GeV)	s (GeV/c)^2
1000000	356	Ge=Gm	1.7	5.4
996000	357	Ge=0	1.7	5.4
996000	358	Ge=3Gm	1.7	5.4
976000	359	Ge=Gm	3.3	8.2
934000	360	Ge=0	3.3	8.2
932000	361	Ge=3Gm	3.3	8.2
940000	362	Ge=Gm	7.9	16.7
922000	363	Ge=0	7.9	16.7
932000	364	Ge=3Gm	7.9	16.7
996000	365	Ge=Gm	10.9	22.3
998000	366	Ge=0	10.9	22.3
998000	367	Ge=3Gm	10.9	22.3
12000000	368	Pi+Pi-	3.3	8.2
12000000	369	Pi+Pi-	7.9	16.7
100000	384	Isotrop	1.7	5.4
90000	385	Isotrop	3.3	8.2
100000	386	Isotrop	7.9	16.7
100000	387	Isotrop	10.9	22.3

Efficiency



$$Efficiency = \frac{Reconstructed}{True}$$



<u>CUTS</u>

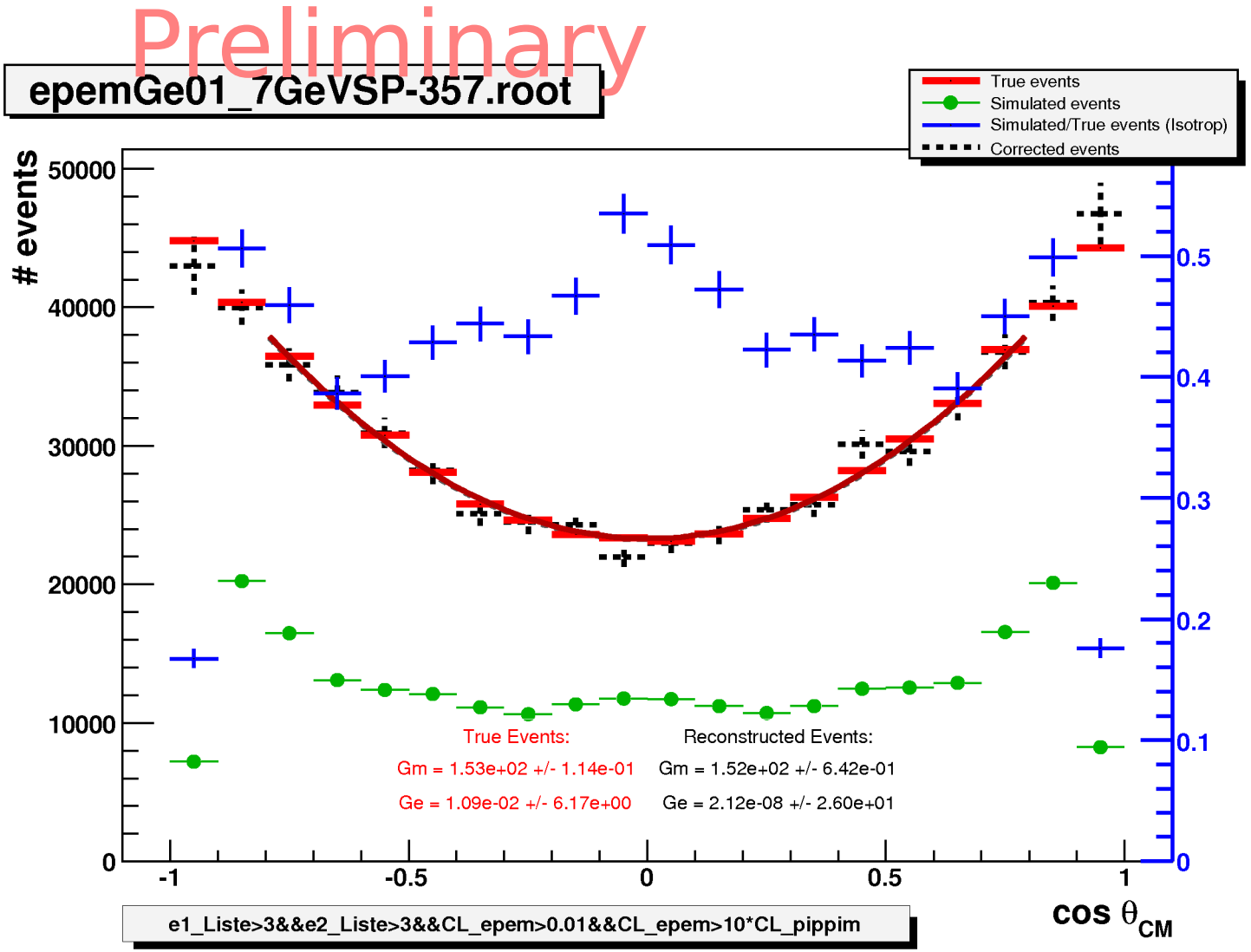
CL_epem>0.01
e1_Liste>3
e2_Liste>3
CL_epem>10*CL_pippim

Two parameter fit Ge=0

0.15.2

Fit ranges:

-0.6 to 0.6
-0.8 to 0.8
-0.9 to 0.9



$$y=[|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

Two parameter fit Ge=Gm

0.15.2

Fit ranges:

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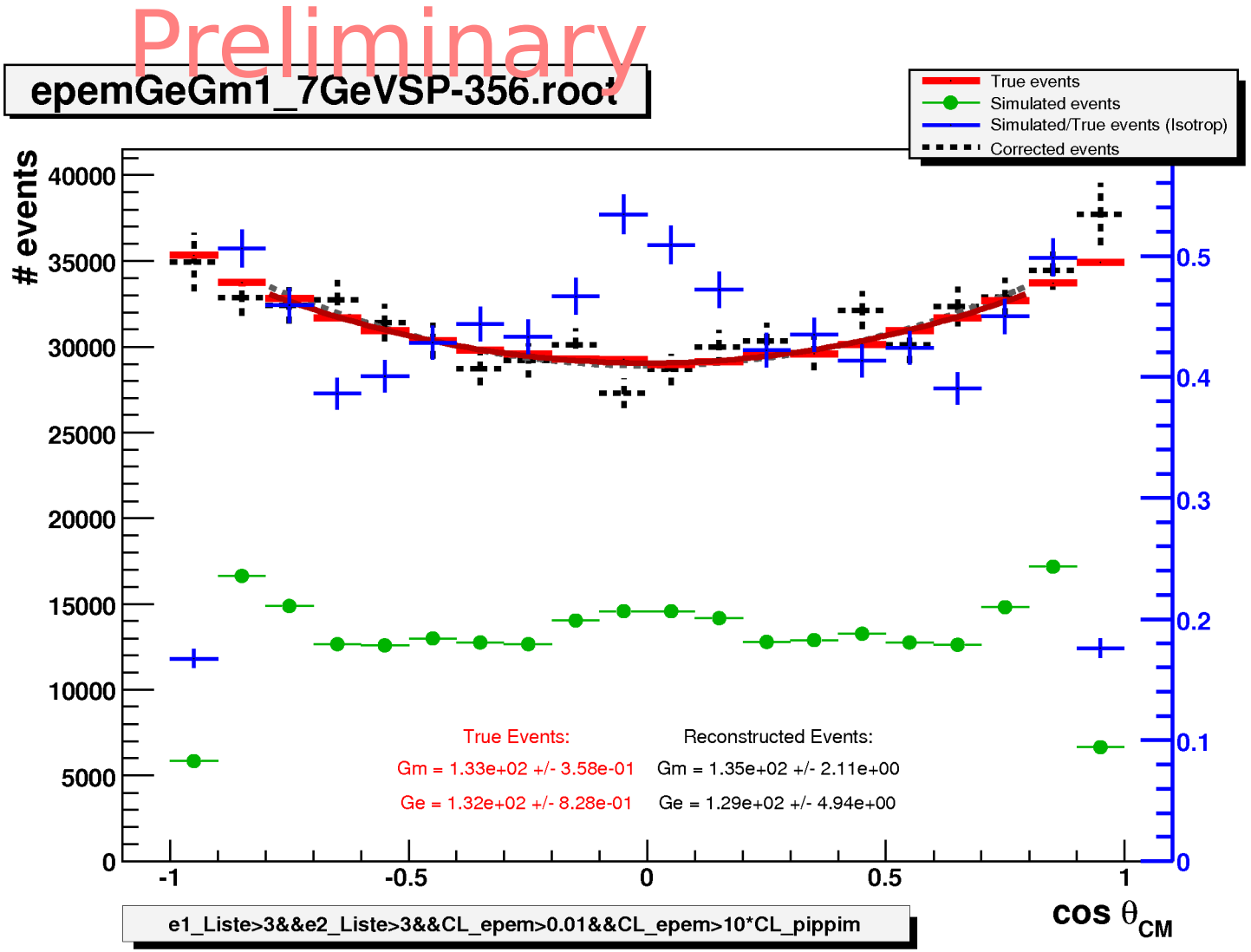

$$y=[|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

Two parameter fit Ge=3Gm

0.15.2

Fit ranges:

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-0.8 to 0.8
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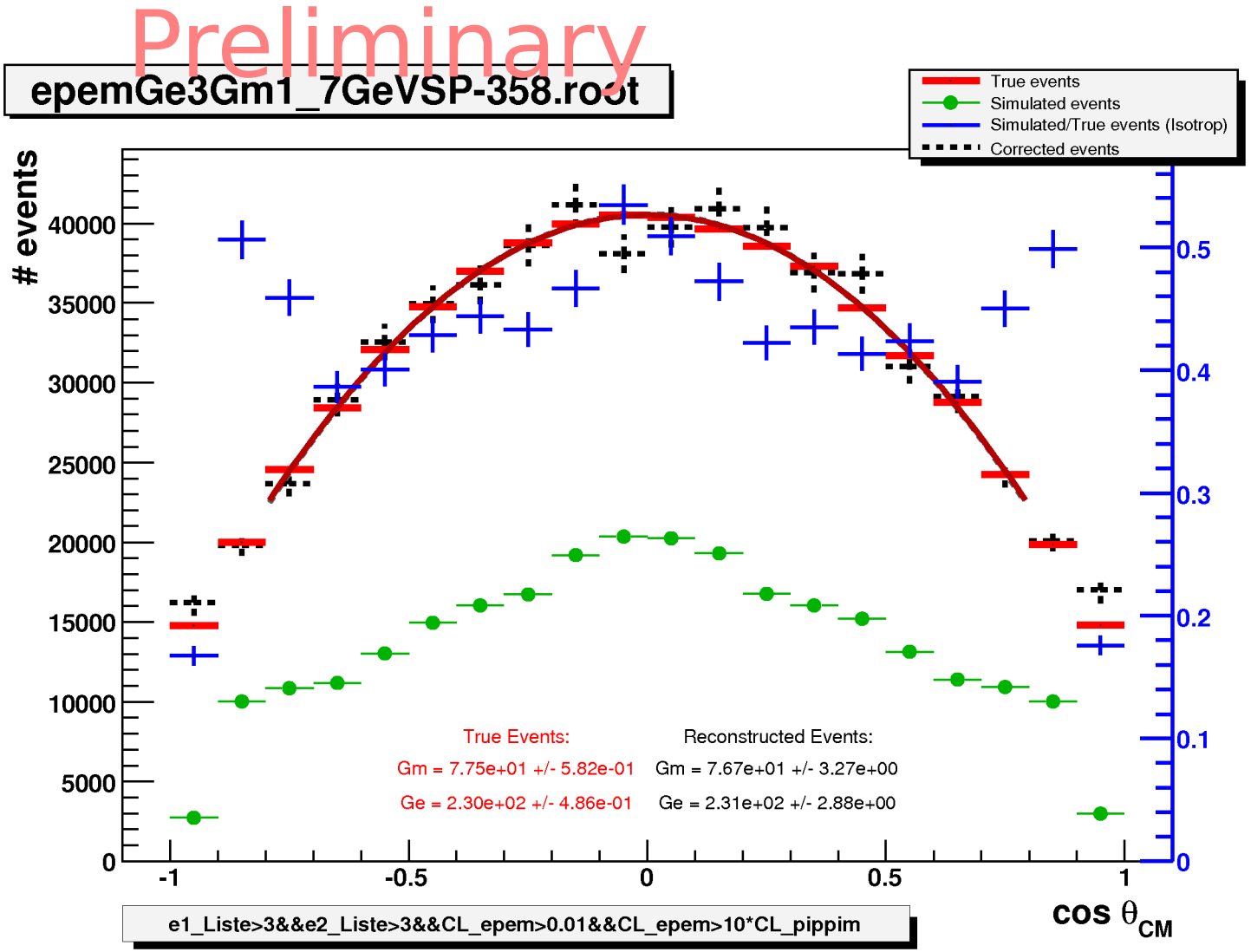
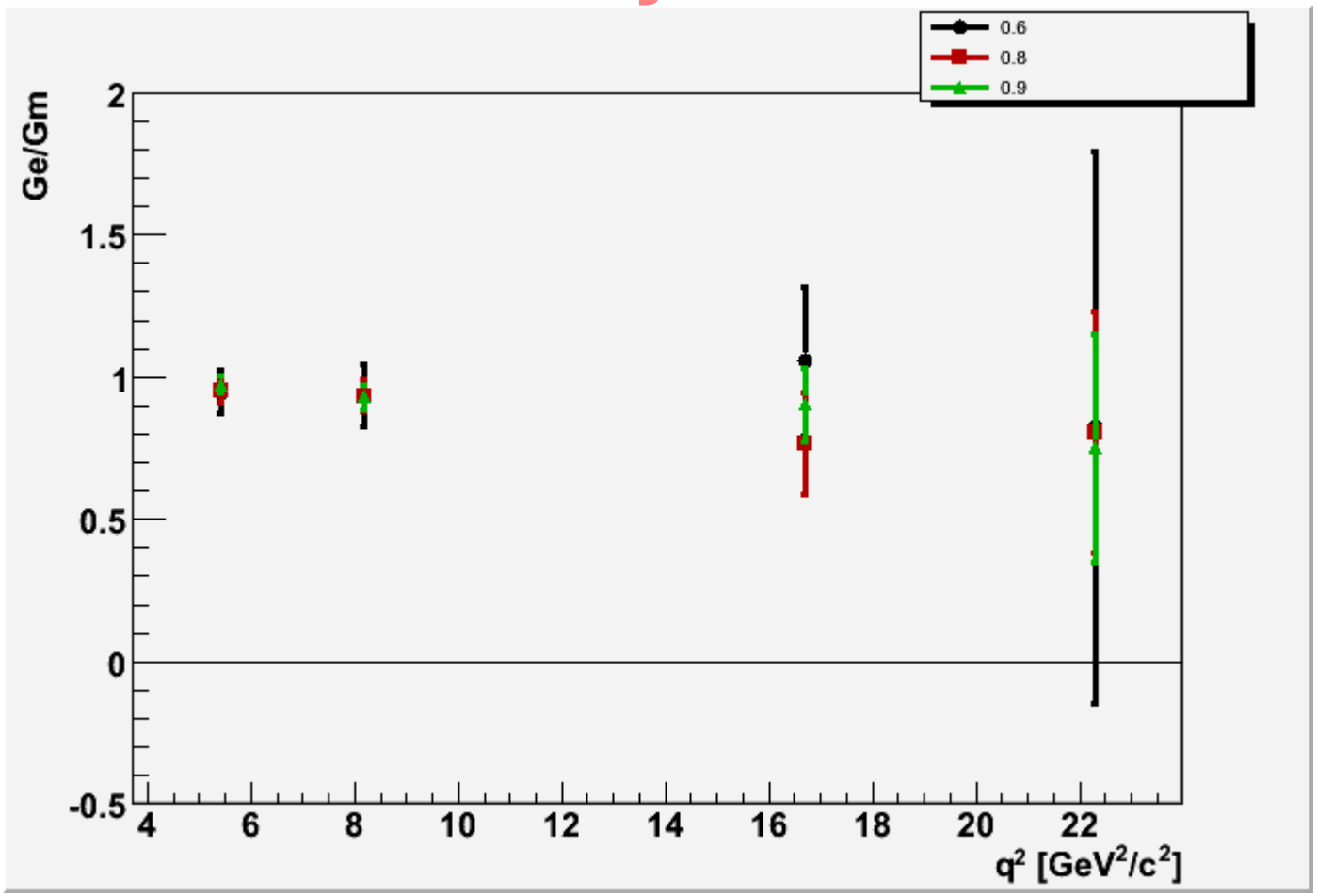


$$y=[|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

Comparison 2 and 3 parameter

Preliminary

0.15.2



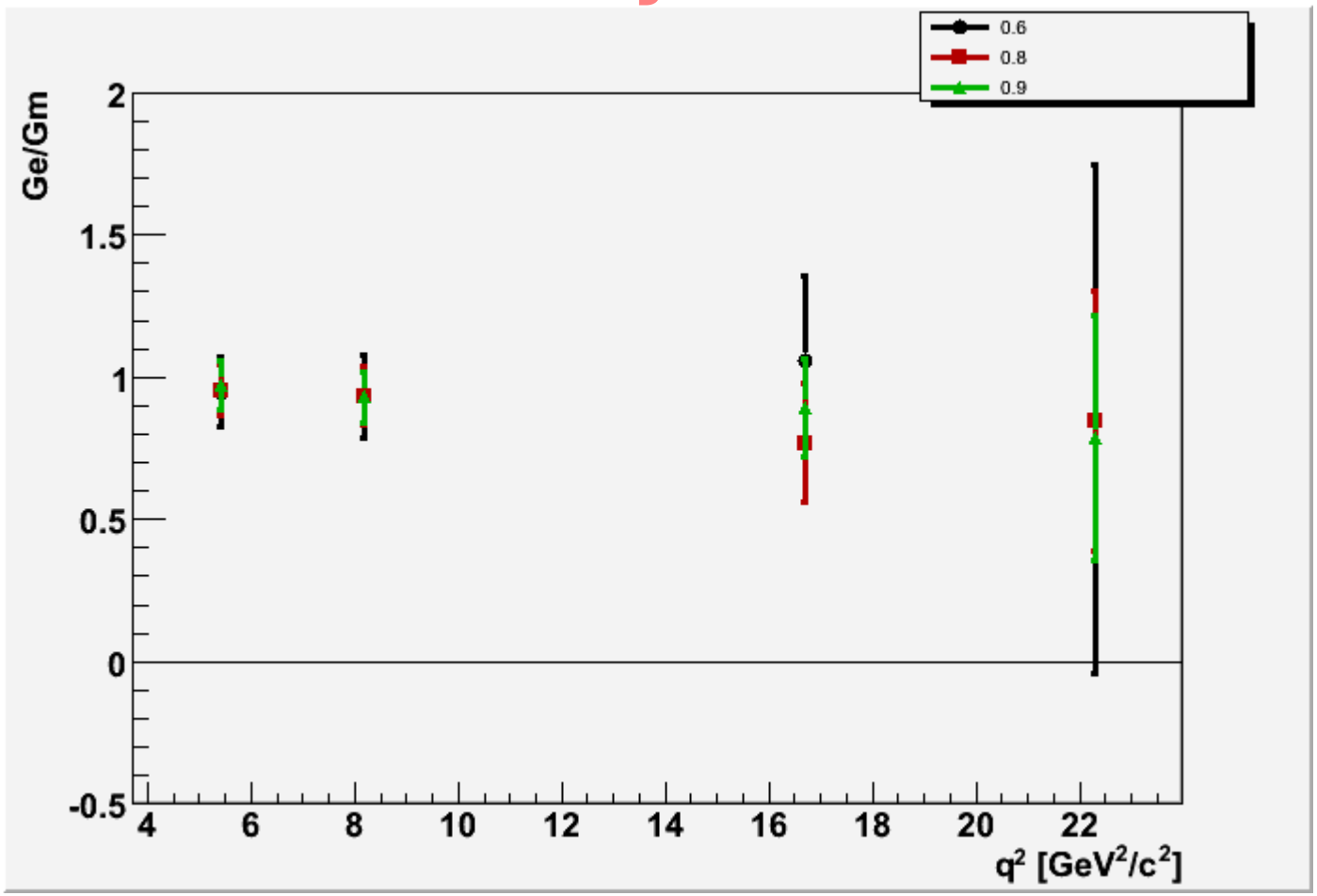
Two parameter fit > Smaller errors

BABAR: 50% error at low energies

Comparison 2 and 3 parameter

Preliminary

0.15.2

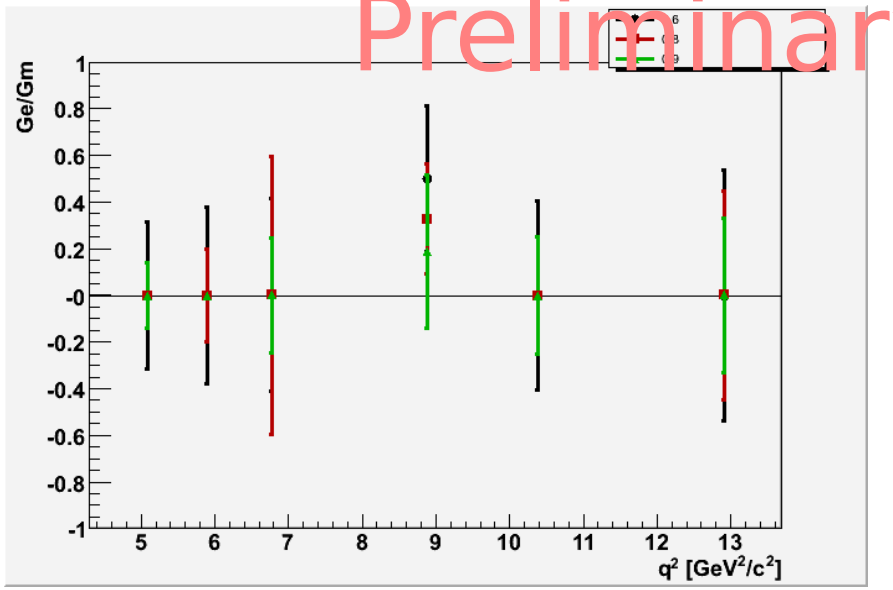


Three parameter fit > Bigger errors

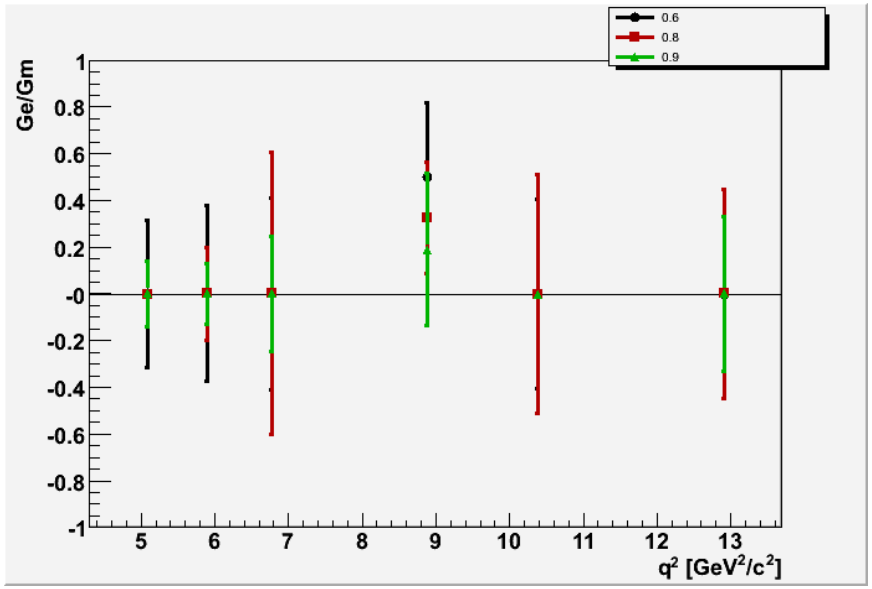
Comparison 2 and 3 parameter

0.14.1

Preliminary



Two parameter fit > Smaller errors



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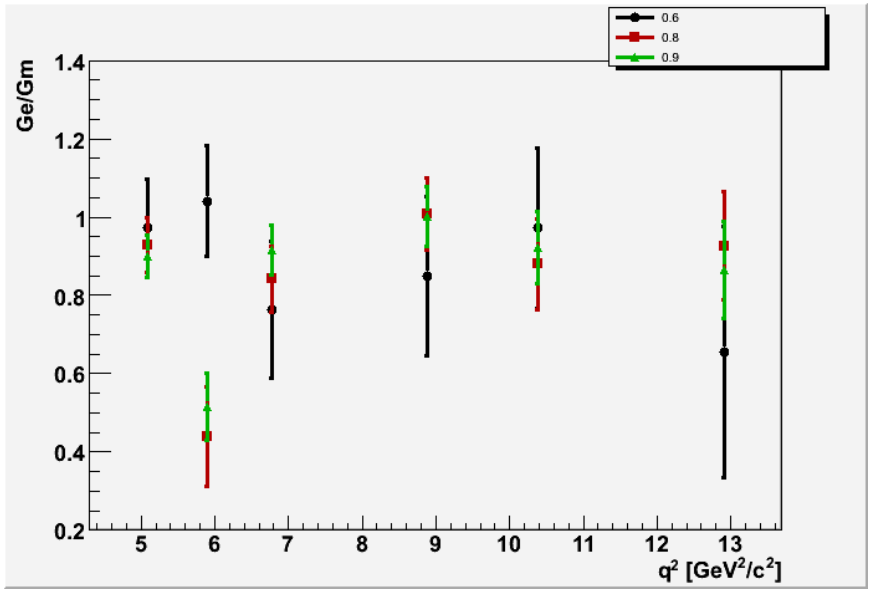

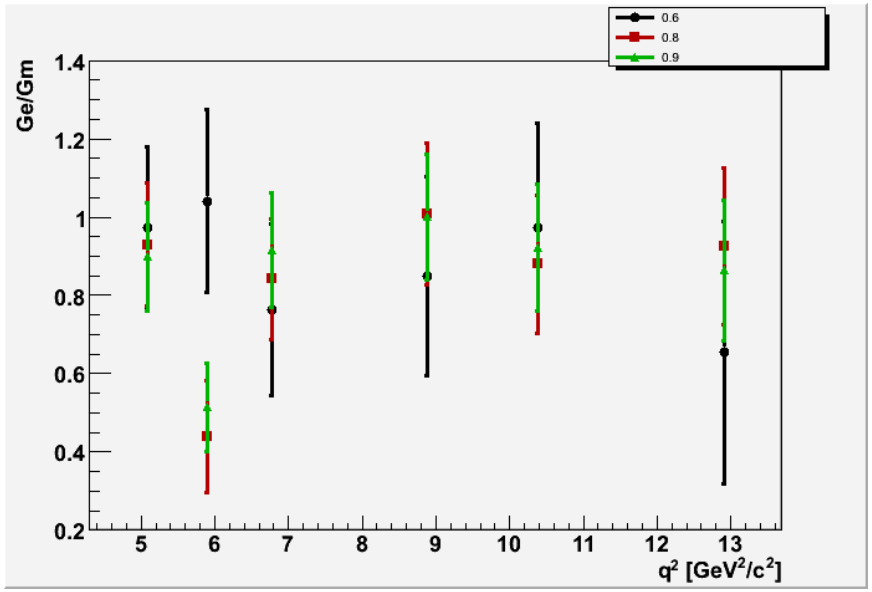

Comparison 2 and 3 parameter

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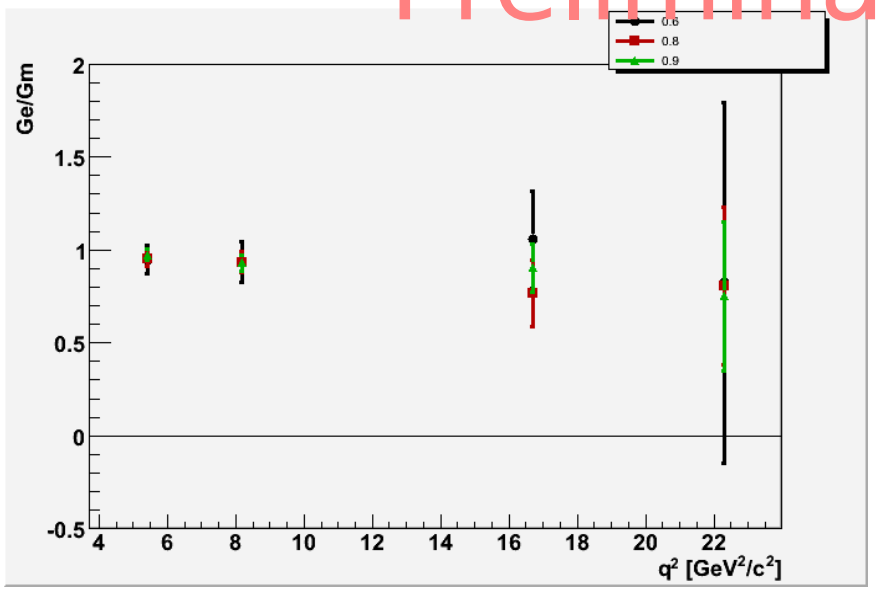
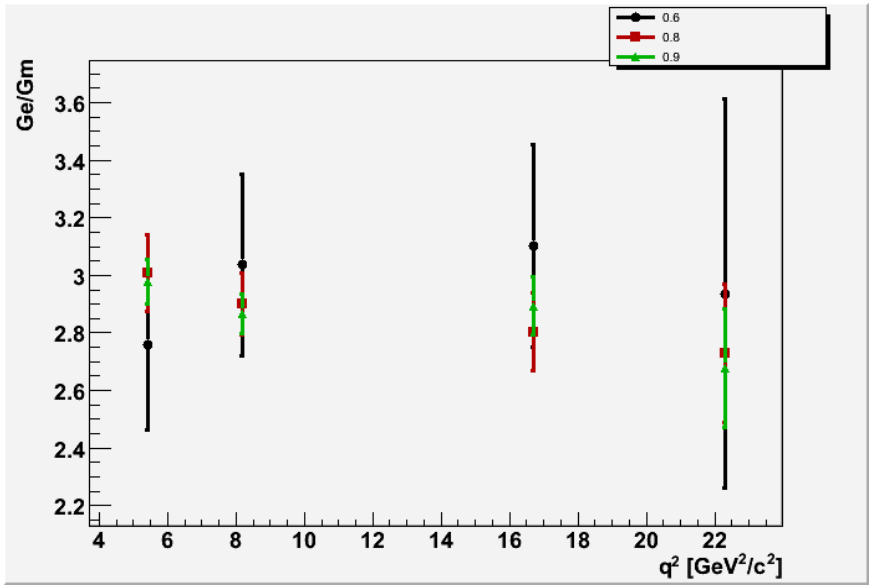
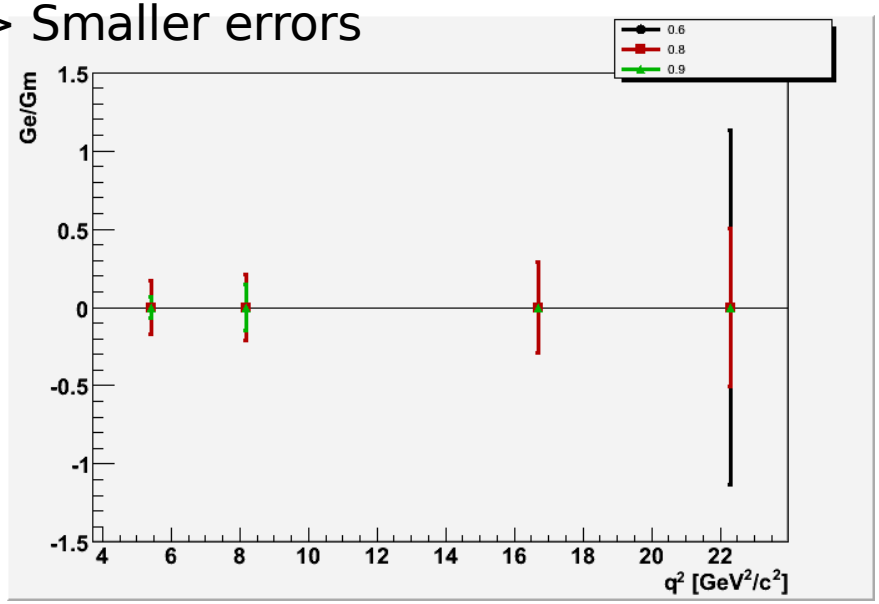
Preliminary





Two parameter fit > Smaller errors



Conclusions

- Very preliminary results, there are many open questions.

- Promising results (2% relative error in Ge/Gm for low E).

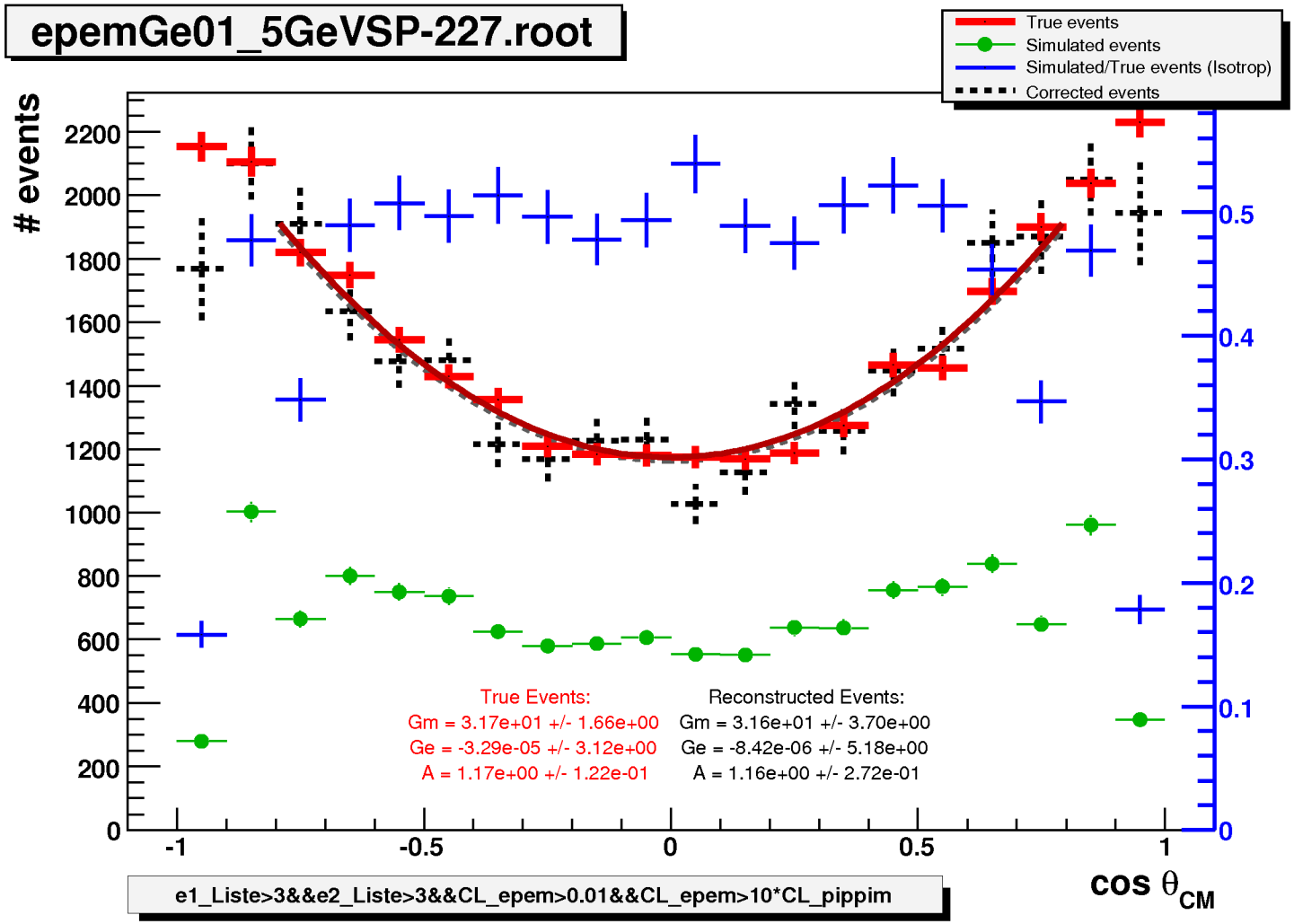
- Next step, using the fit function proposed by E. Tomasi.

- Analysis on background in progress.

Background slides ....

Three parameter fit

0.14.1



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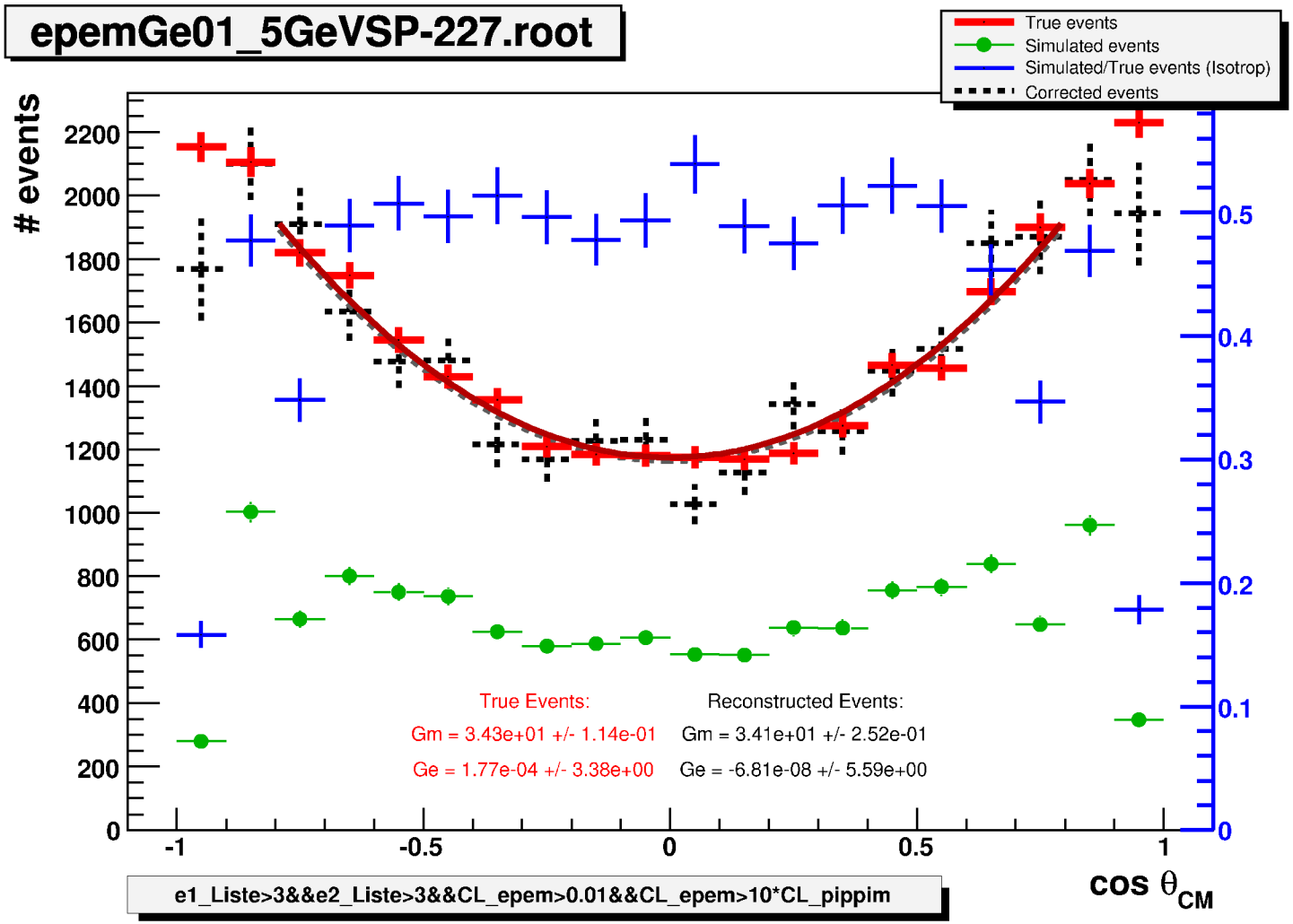
Two parameter fit

0.14.1



$$y=[|G_M|^2(1+\cos^2\theta)+\frac{|G_E|^2}{\tau}(1-\cos^2\theta)]$$

Three parameter fit Ge=0

0.15.2

Fit ranges:

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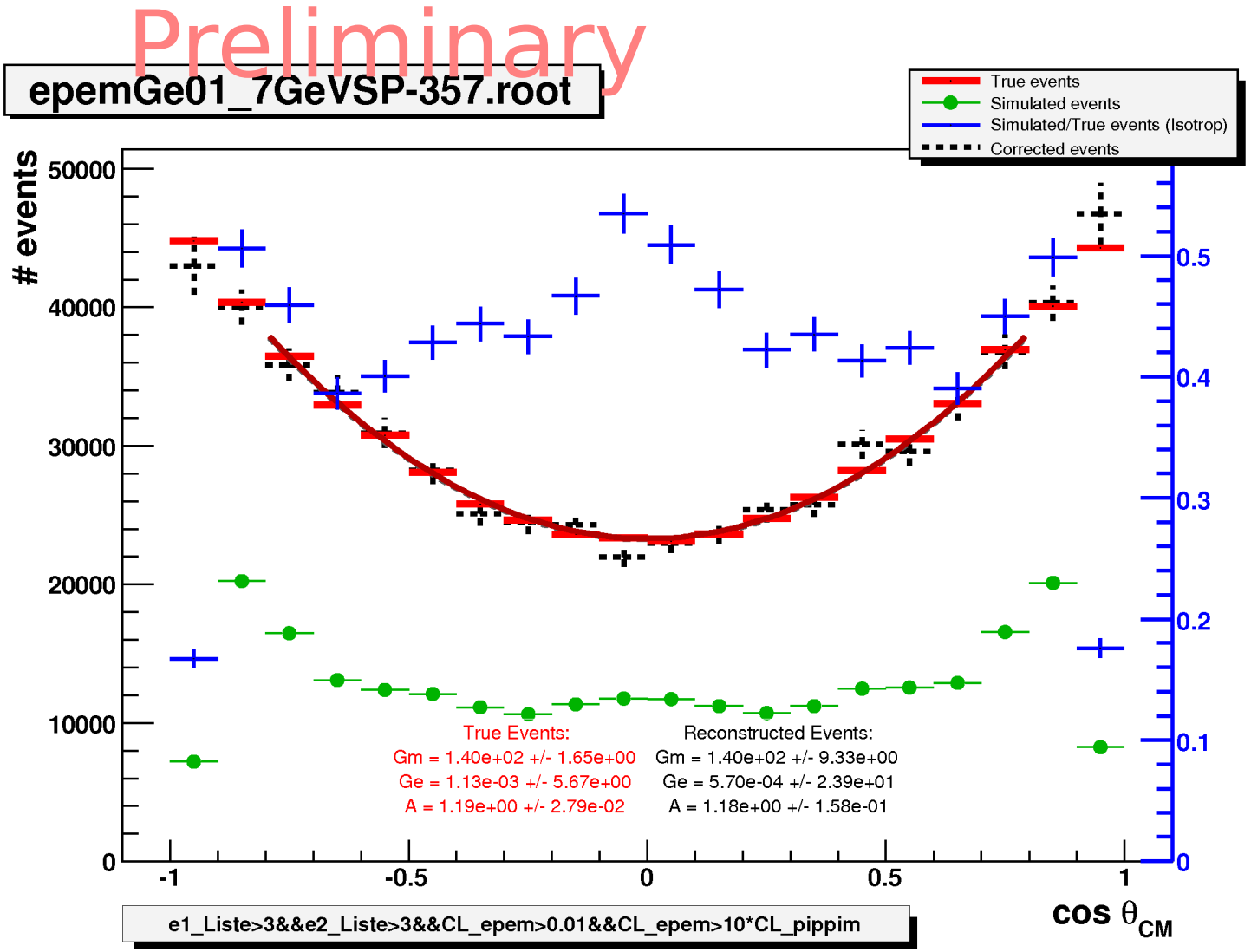

$$y = C\left[|G_M|^2(1+\cos^2\theta) + \frac{|G_E|^2}{\tau}(1-\cos^2\theta)\right]$$

Three parameter fit Ge=Gm

0.15.2

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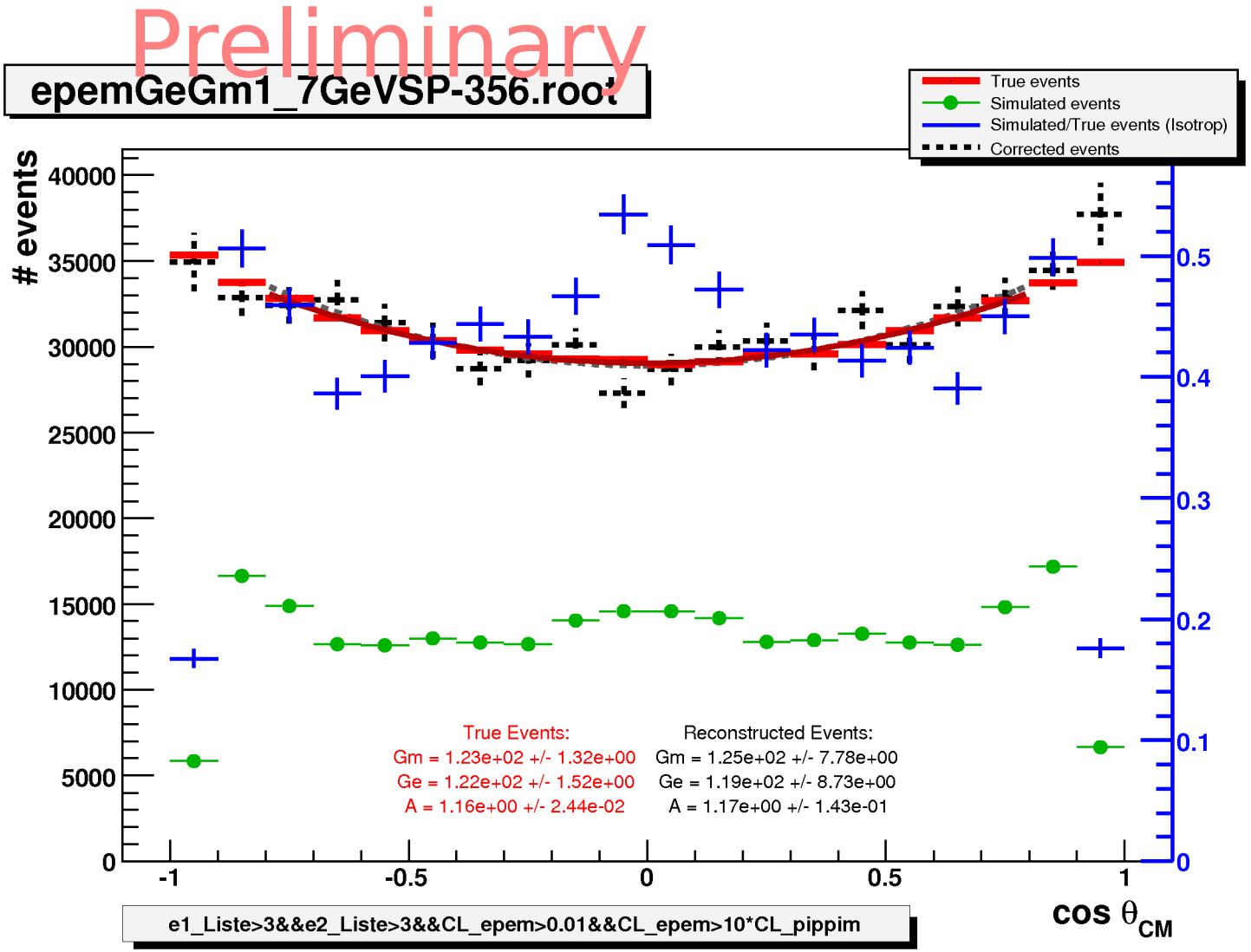

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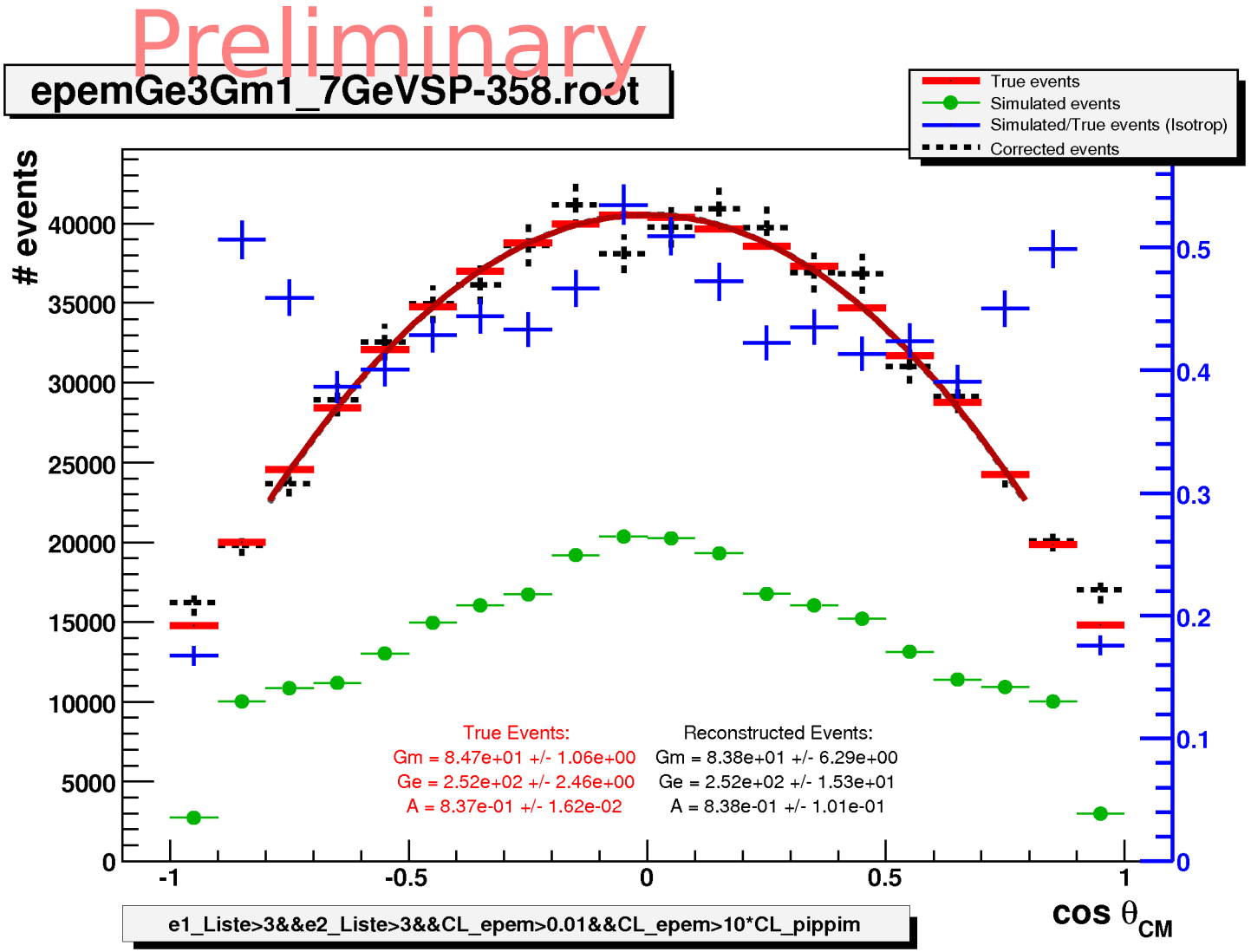

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Comparison 2 and 3 parameter

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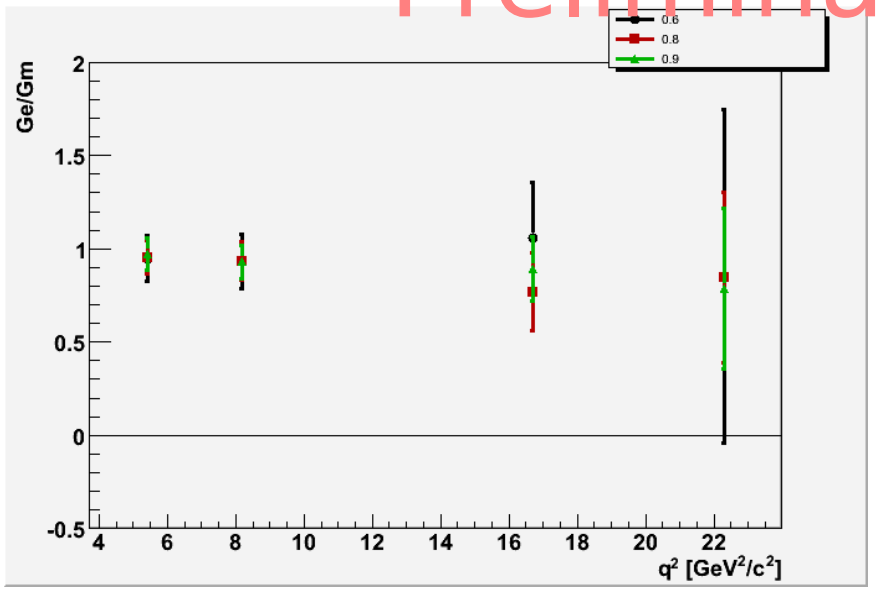

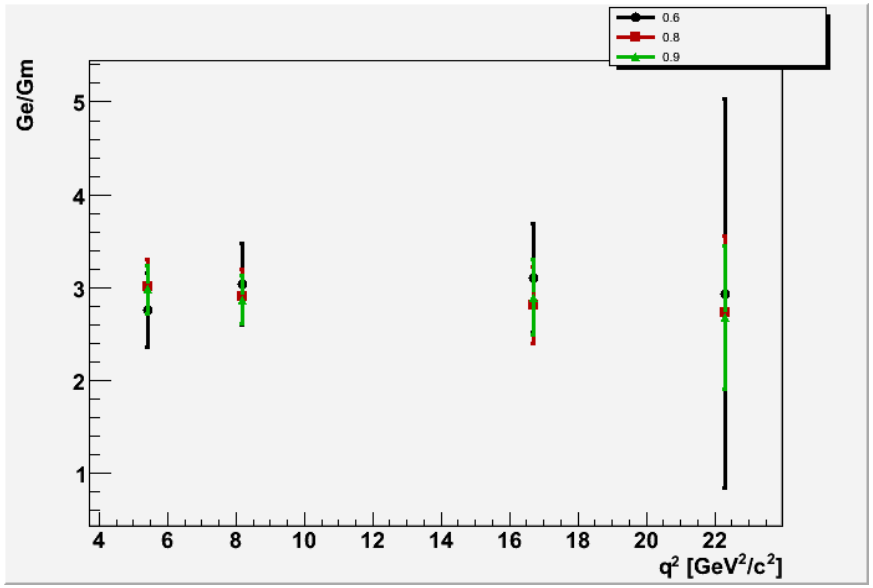

Three parameter fit > Bigger errors