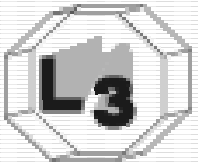
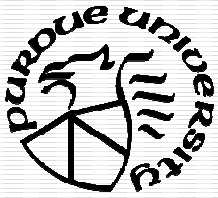
Study of the $e^+e^- \rightarrow Z\ e^+e^-$ process with L3 Detector

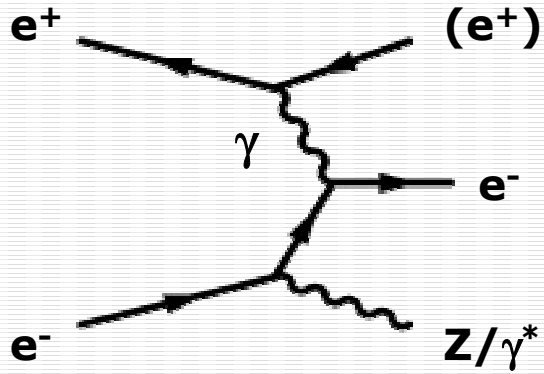
Ricardo Vásquez Sierra

APS April Meeting 2002
Albuquerque, N.M.

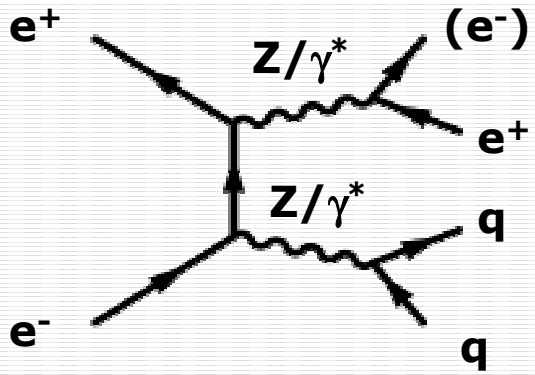


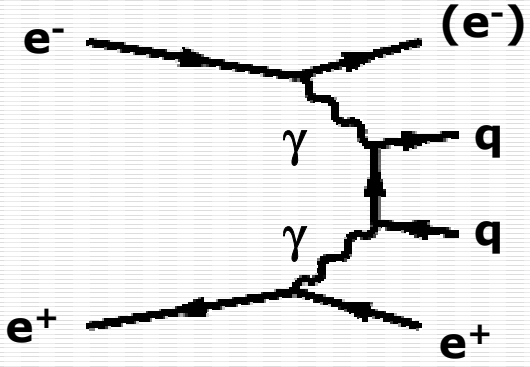


Process studied



Diagrams leading to the same final state

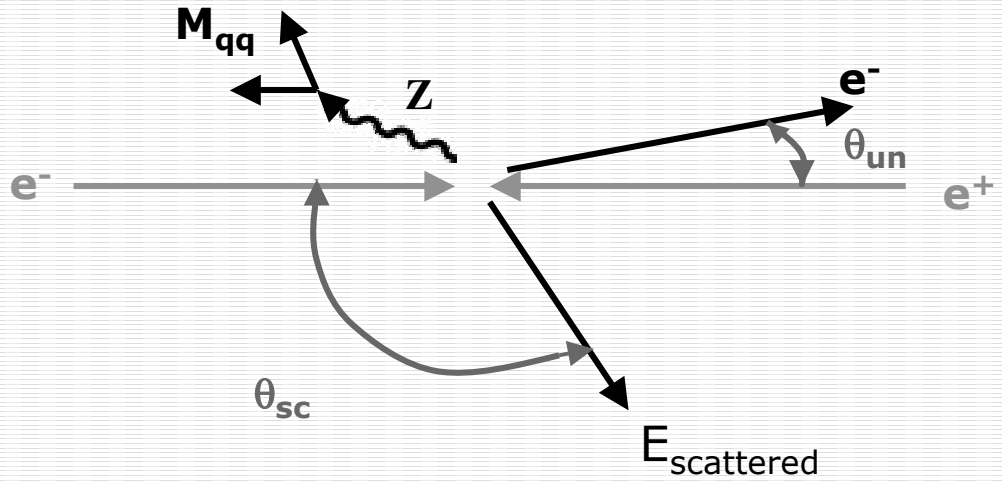




Charge conjugation is implied through out the talk

Signal Definition

Cuts on Monte Carlo Generator Phase Space:



$\theta_{unscattered} < 12.0^o$

$60.0^o < \theta_{scattered} < 168.0^o$

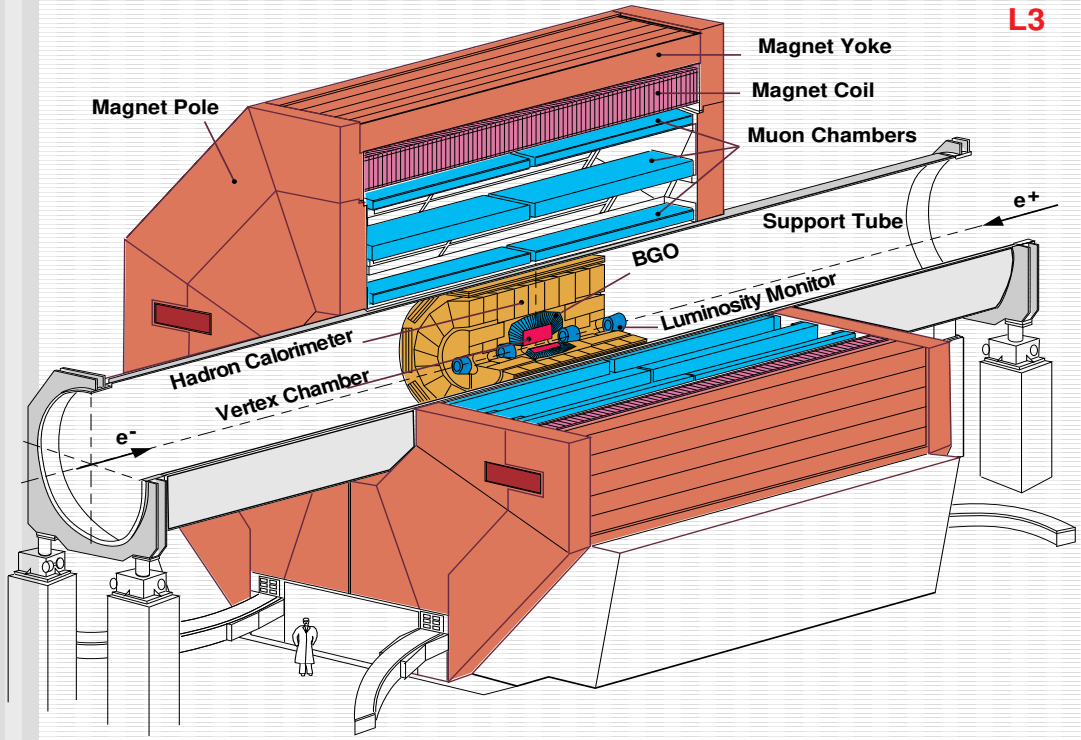
and

$E_{scattered} > 3.0$ GeV

$M_{qq} > 60.0$ GeV

Expected Cross Section at 200.0 GeV is 0.57 pb

L3 Detector



Main detector components:

- Tracking chambers (electron's track)
- EM calorimeter (electron's energy)
- Hadron Calorimeter (2 jets from Z decay)

Analysis performed on 1997-2000 data

$\sqrt{s}$ =183-207 GeV

Luminosity ≈ 0.7 fb^{-1}

Preselection Cuts

- At least one identified electron (shower shape, crystal energies and track)
- # of clusters around the most energetic elec. < 5
- Energy of the most energetic electron > 3.0 GeV
- 50 GeV < hadronic mass < 130 GeV
- Visible energy > 0.4 $\sqrt{s}$
- Missing momentum > 0.28 $\sqrt{s}$

With an efficiency of 53%

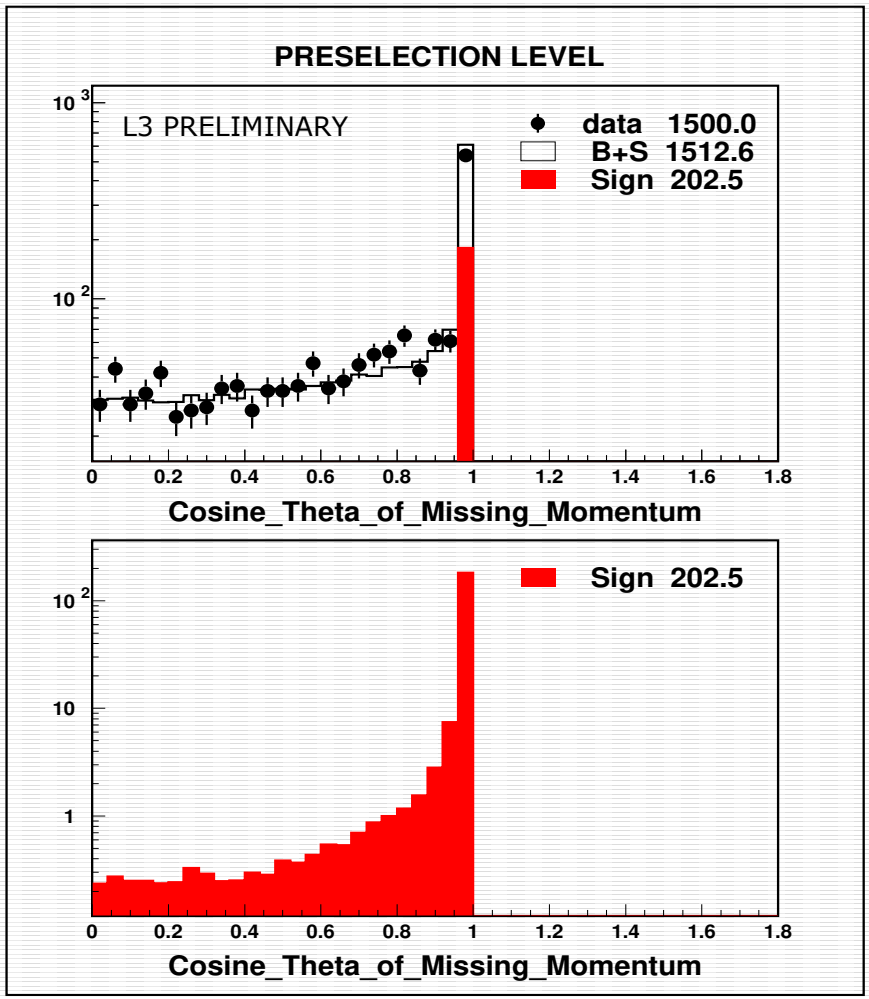
and a purity of 13%

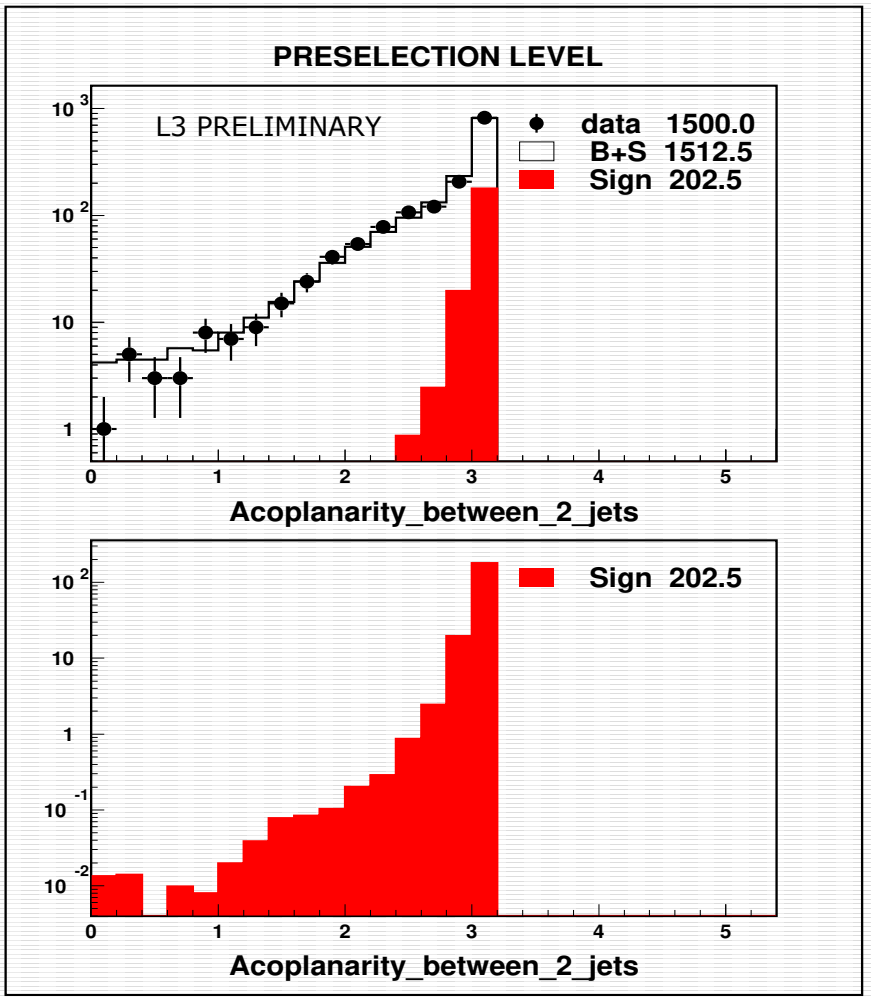
Luminosity (pb^{-1})	Expected Background	Expected Signal	Expected B+S	Data
675.5	**1310**	**202.6**	**1512.6**	**1500**

Results after preselection

Energy (GeV)	Lumi (pb-1)	Expected Background	Expected Signal	Expected B+S	DATA
183	55.1	72.5	14.6	87.1	102
189	176	283.3	48.5	331.8	326
192	29.4	51.6	8.5	60.1	58
196	83	161.1	24.9	186	172
200	80.8	168.9	25	193.9	190
202	36.7	79.5	11.5	91	88
205	76.6	174.5	24.2	198.7	195
207	137.9	318.6	45.4	364	369
SUM	675.5	1310	202.6	1512.6	1500

Results after preselection





Selection Cuts

The main selection cuts are:

- Acoplanarity between the two jets > 2.95
- Energy of the most energetic electron < 60.0 GeV
- Cosine of θ of the missing momentum vector > 0.7
- Few more

With an efficiency of 42%

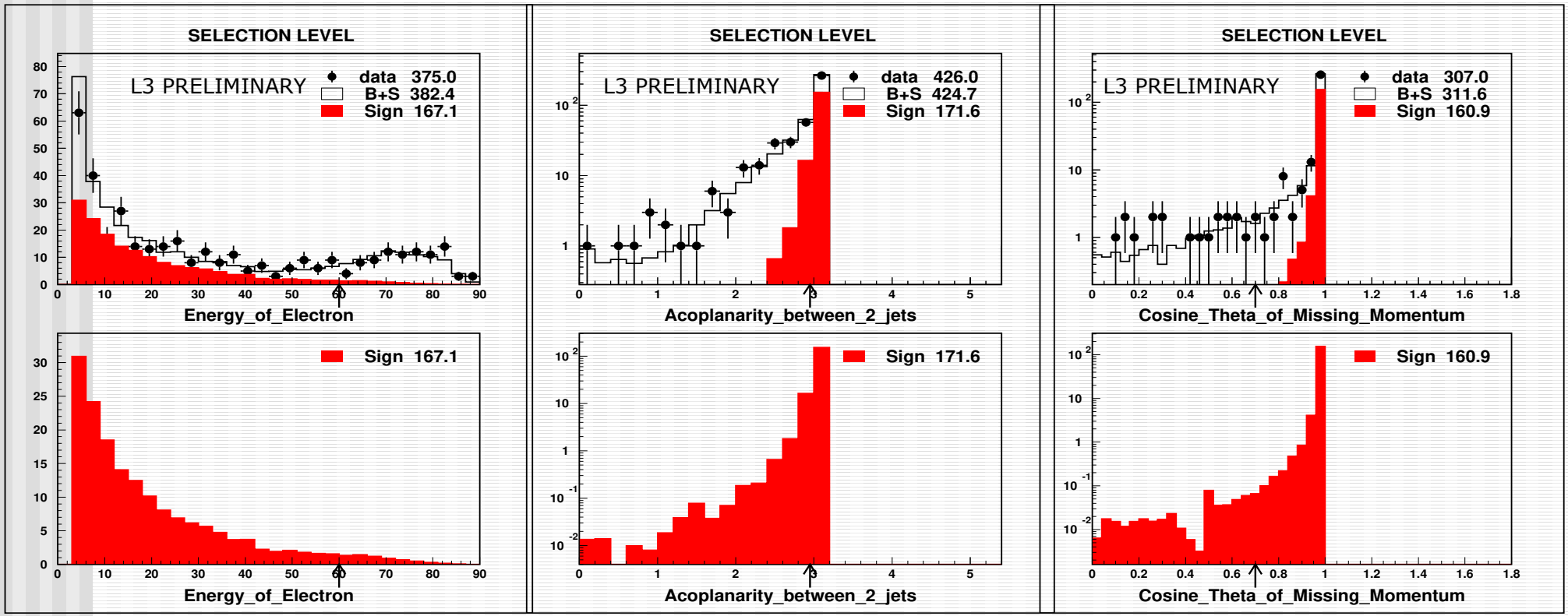
and a purity of 53%

Luminosity (pb^{-1})	Expected Background	Expected Signal	Expected B+S	Data
675.5	**134.8**	**160.4**	**295.2**	**288**

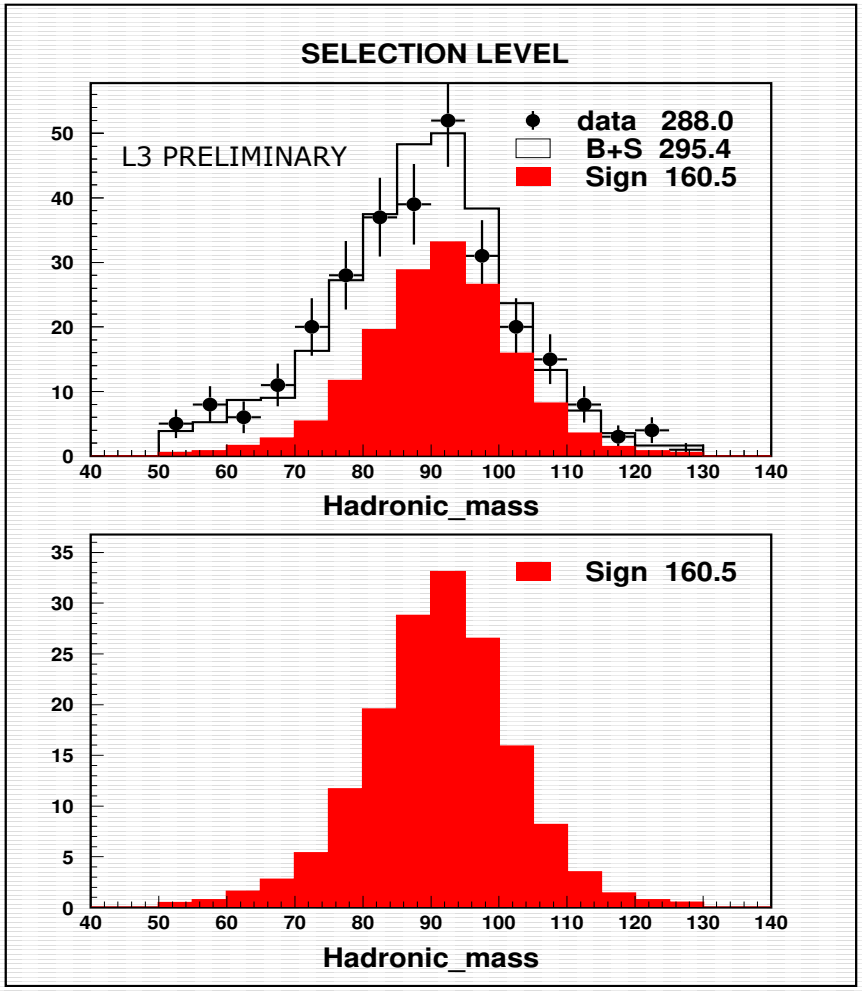
Results after selection

Energy (GeV)	Lumi (pb-1)	Expected Background	Expected Signal	Expected B+S	DATA
183	55.1	10	11.6	21.6	27
189	176	36.9	38.8	75.7	73
192	29.4	5	6.7	11.7	9
196	83	14.9	19.8	34.7	30
200	80.8	15.6	19.9	35.5	32
202	36.7	7.8	9	16.8	20
205	76.6	15.7	19	34.7	31
207	137.9	28.9	35.6	64.5	66
SUM	675.5	134.8	160.4	295.2	288

Cutting all but one variable (N-1 plots)

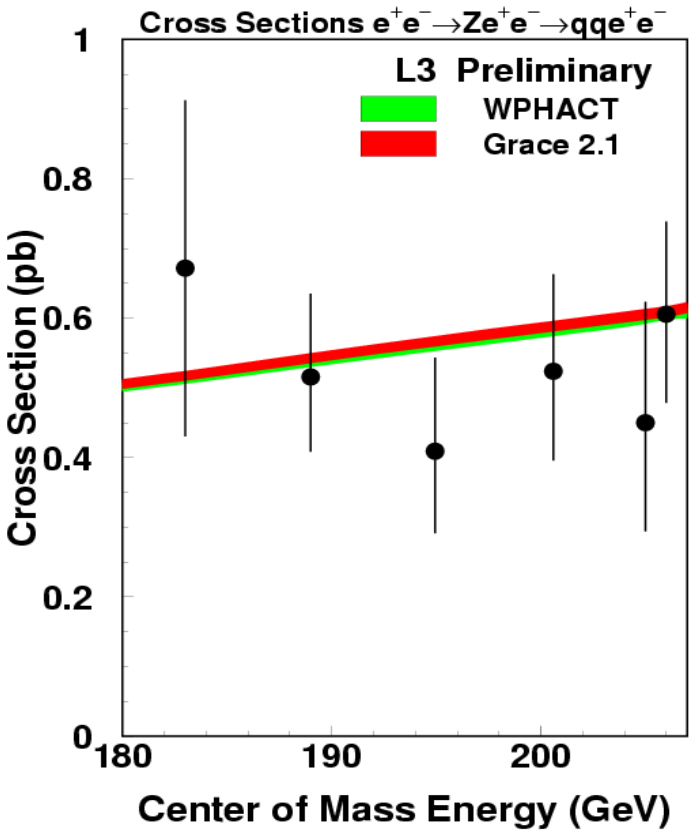


Final variable



By fitting this Variable …

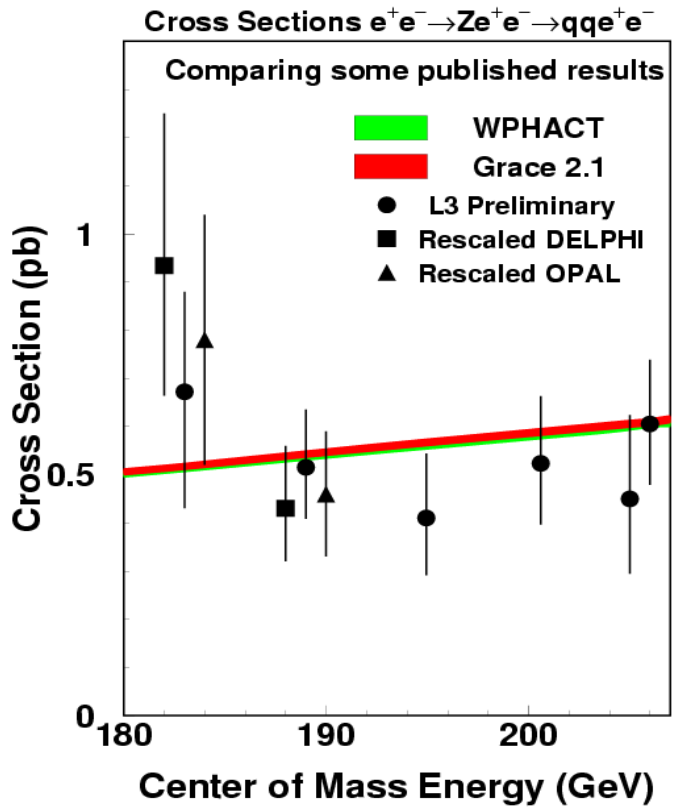
We measure Cross Section



Conclusion:

- Process was seen
- The cross section was measured with a 10% statistical error over all energies

Comparing results



Finally, here we have a comparison with other LEP experiments' measurements