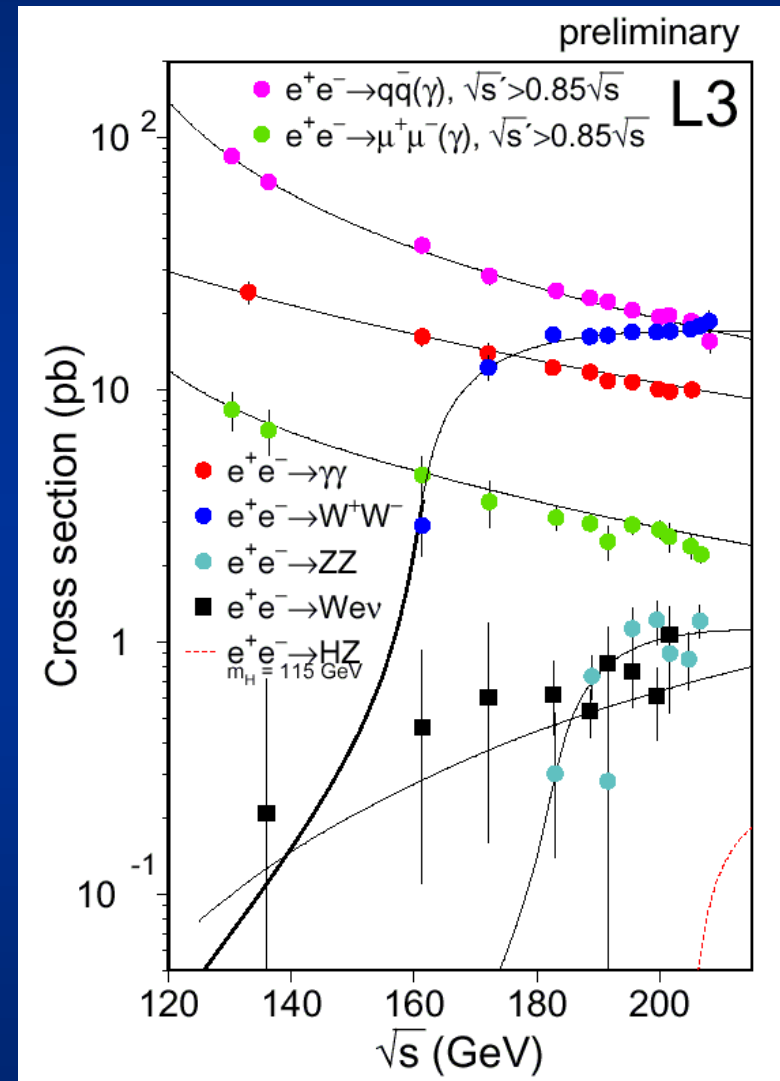


Status of L3 analyses

María Chamizo
Bossey 12 July 2002

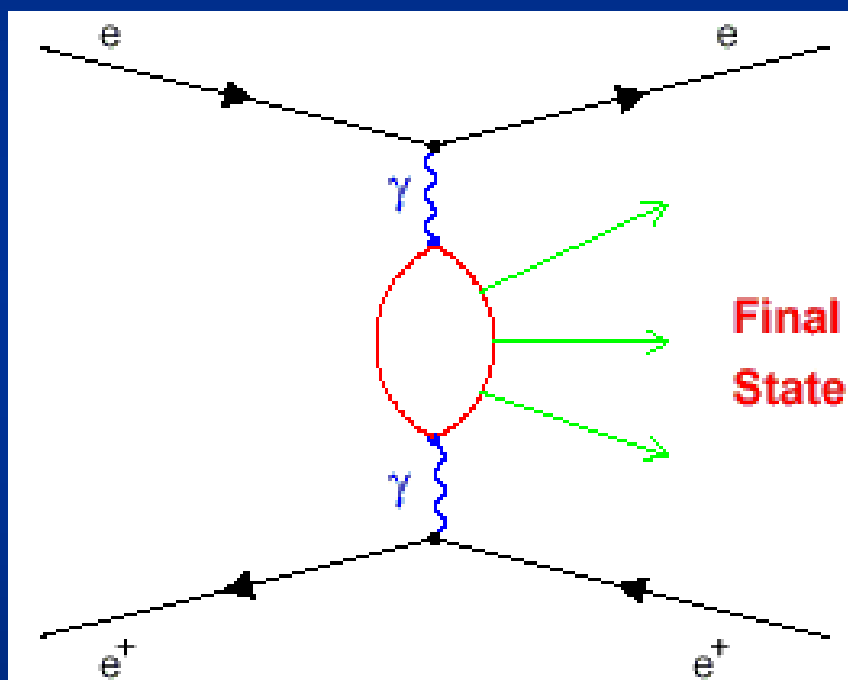
Outlook

- Main Geneva activities in L3
- Two photon physics
 - P. Achard, B. Echenard**,
 - M. Kienzle, P. Mermod*,
 - D. Haas**
- Two fermion
 - P. Deglon, P. Extermann
- QCD
 - J.H. Field
- W-physics
 - M. Chamizo, E. Delmeire,
 - L. Malgeri, S. Natale**
 - * already left
 - ** part time



$ee \rightarrow eeff$

Two photon processes

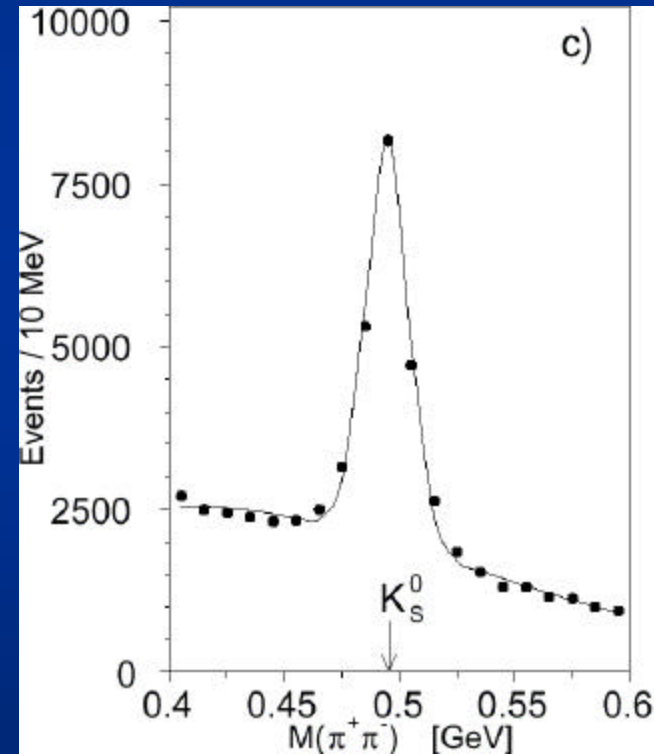
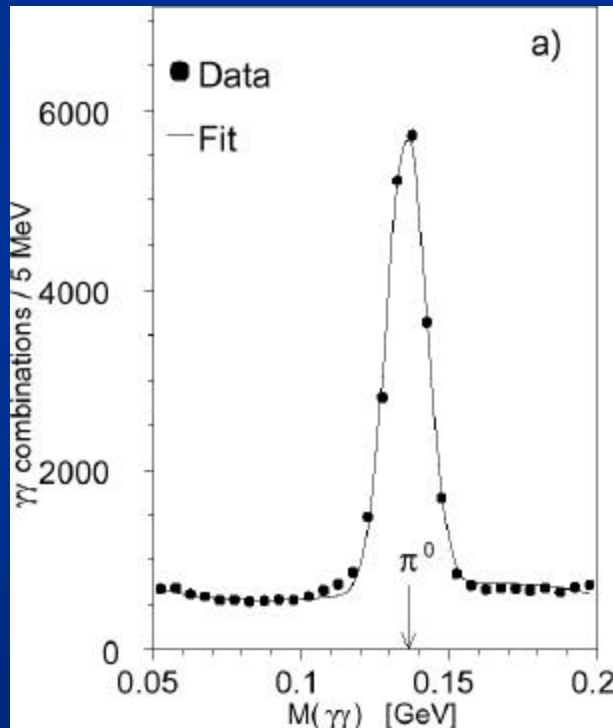


- **Untagged events**
 - The e^+e^- are undetected
 - Quasi-real photons
 - The final state is fully reconstructed
- **Single tag**
 - Either the e^- or e^+ are detected in the low angle forward calorimeters

Inclusive π^0 and K_S^0

P.Achard

- $\pi^0 \rightarrow \gamma\gamma$ Mass resolution ~ 6.6 to 13.5 MeV
- $K_S^0 \rightarrow \pi^- \pi^+$ Mass resolution 8 - 10 MeV



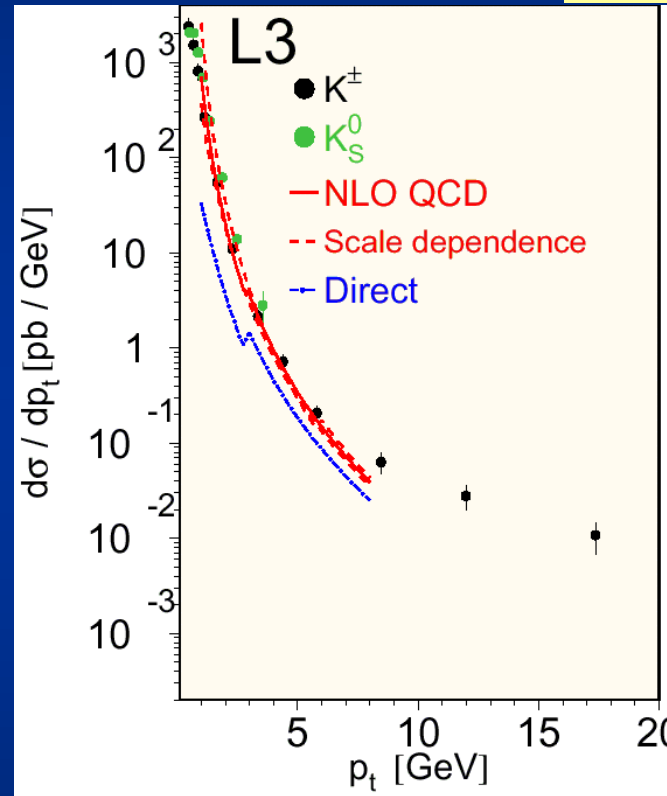
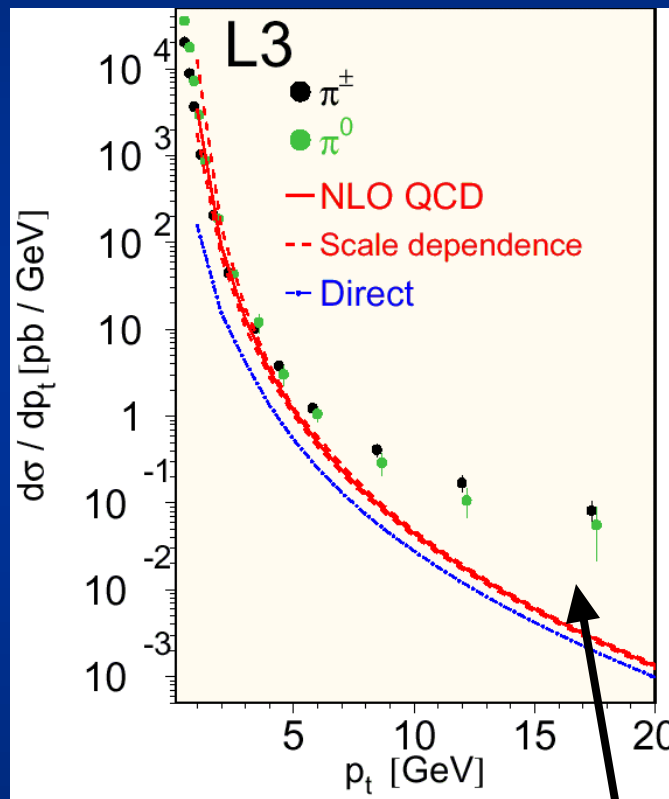
(Phys. Lett. B 524 (2002) 44)

Inclusive charged hadrons

P. Achard

p_t = transverse momentum of the particle

Submitted to summer conf.



Poor agreement with theory in the high p_t region

Bossey July 2002

María

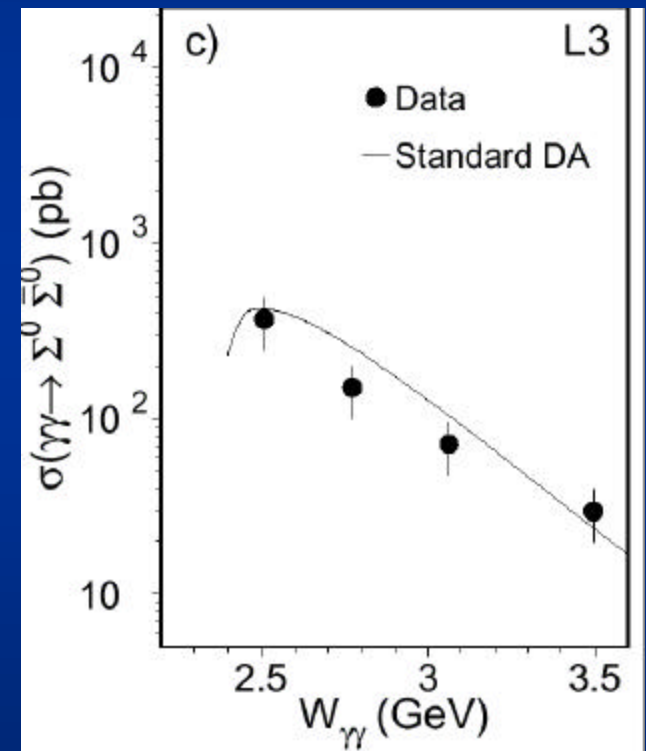
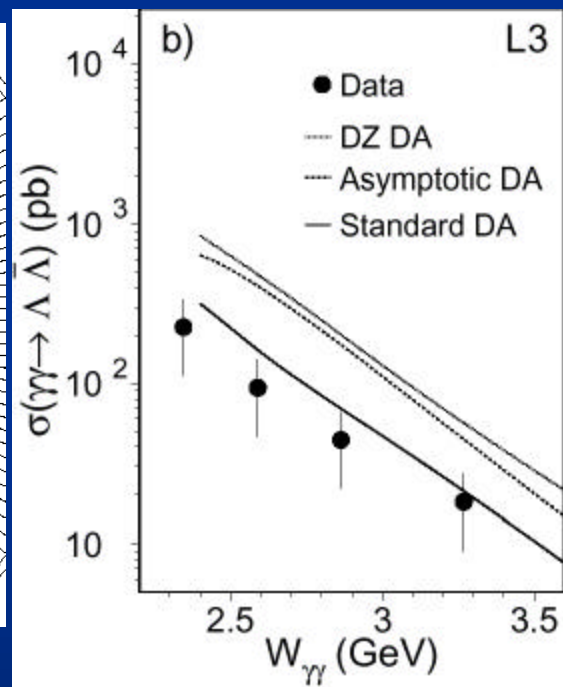
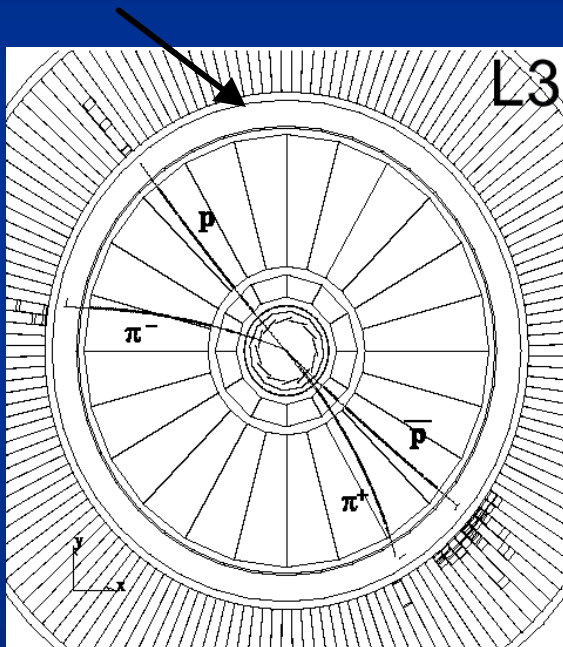
- Charged had. ready for pub.
- New: inclusive jet production

Λ and Σ^0 pair production B.Echenard

$\Lambda \rightarrow p \pi^-$ and $\Sigma^0 \rightarrow \Lambda \gamma$

Candidate $\gamma\gamma \rightarrow \Lambda\Lambda$

$W_{\gamma\gamma}$ = two photon inv. mass



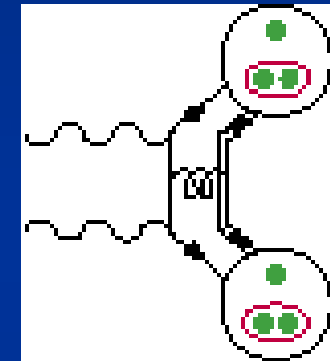
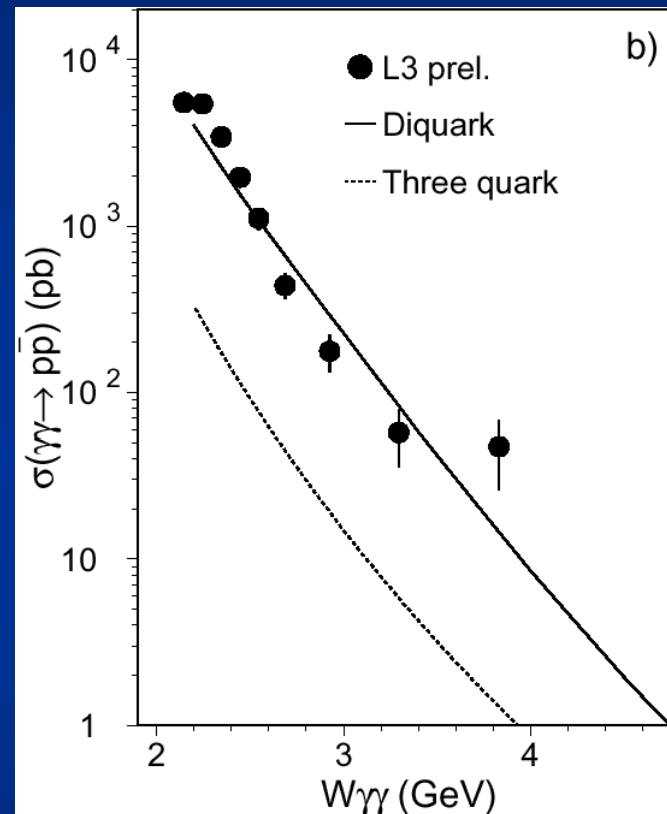
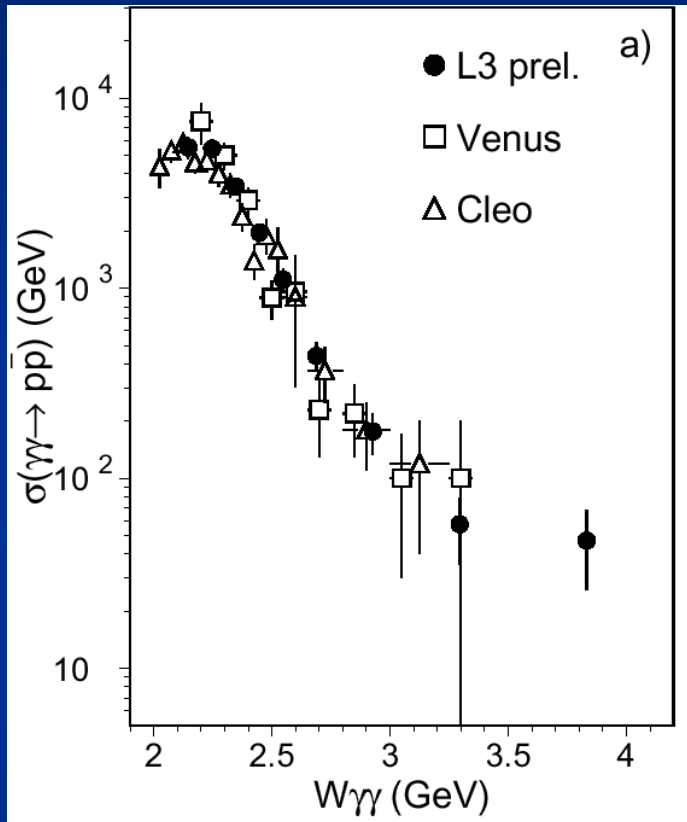
Phys. Lett. B 536/1-2 (2002) 24

$p\bar{p}$ production

B.Echenard

Submitted to
summer conf.

Diquark model



Waiting for

$gg \rightarrow h_c \rightarrow p\bar{p}$ $gg \rightarrow p\bar{p}p^0$ before publishing

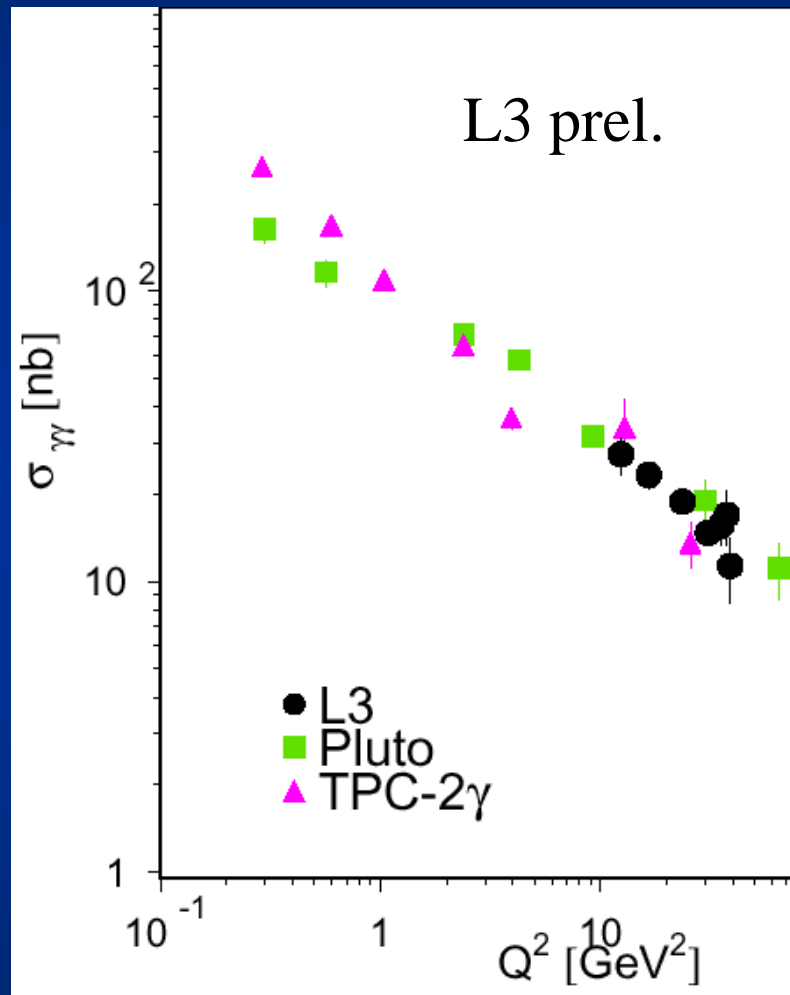
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María Chamizo

7

Single tag analysis

- One e detected at low angle
- The other undetected



detector	q (deg)	Q^2 (GeV ²)
VSAT	0.45-0.61	1.5-2.3
LUMI	1.8-3.6	21-81
ALR	4-6	97-219
ENDCAP	14-35	1188-7234

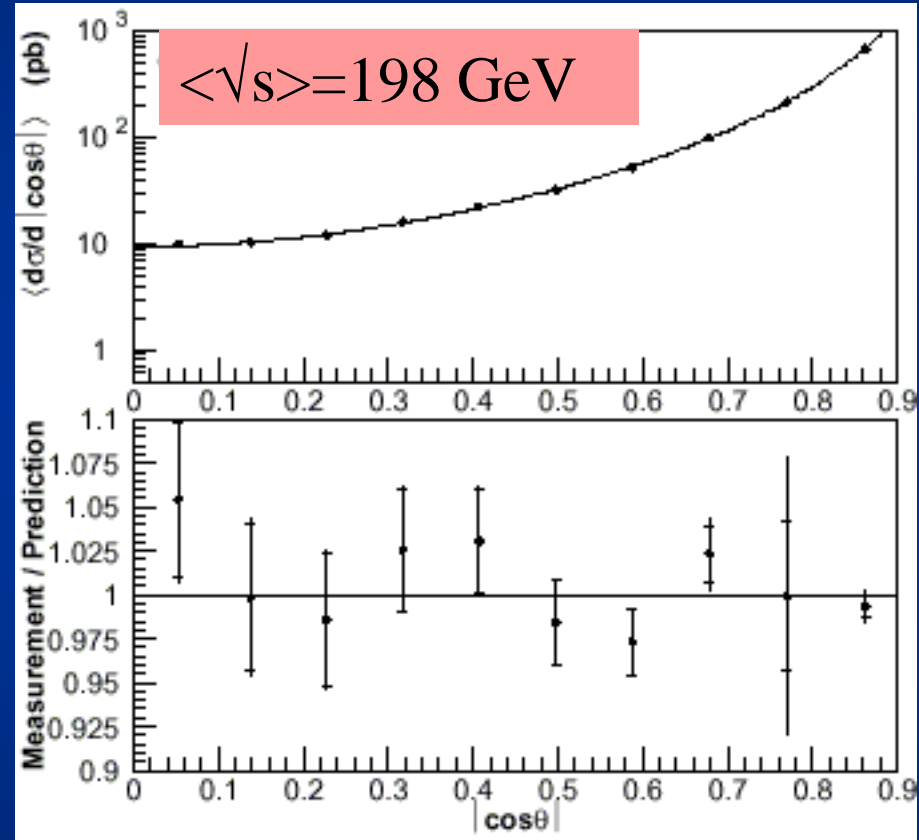
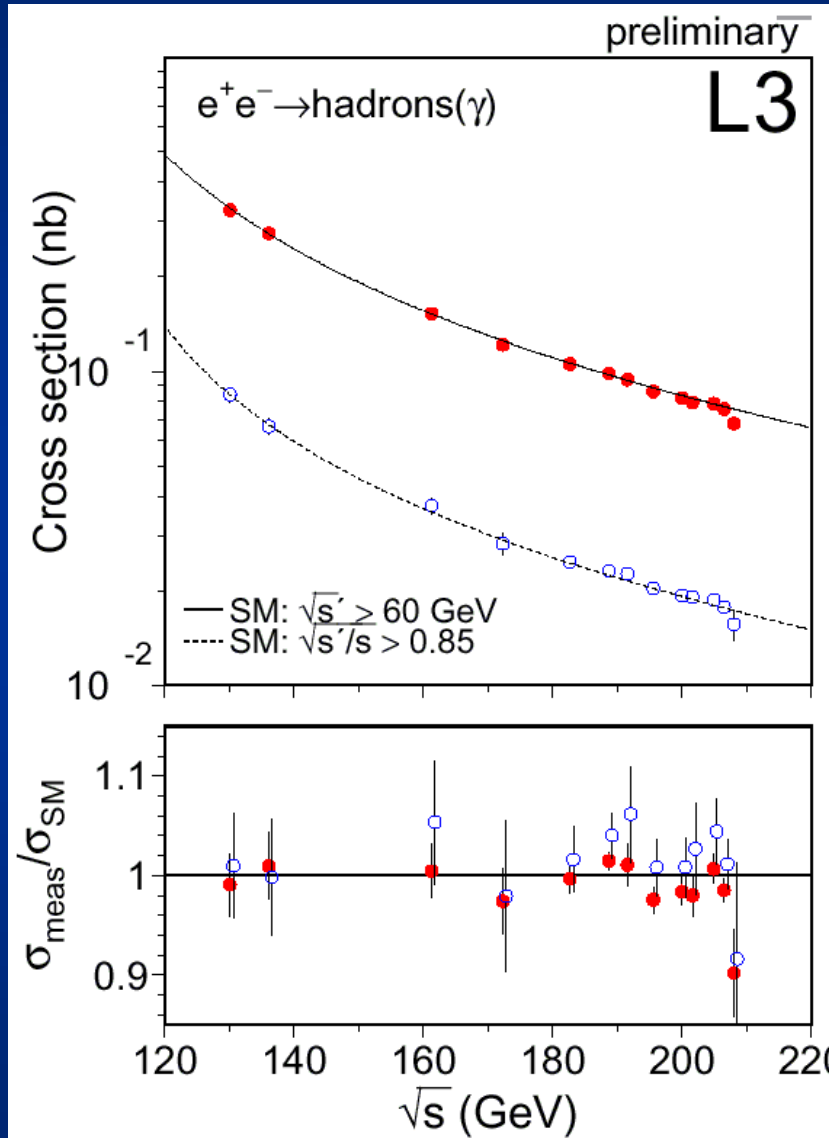
- Systematic errors
- Use other low angle calorimeters to cover a larger Q^2 range

Submitted to
summer conf.

P. Deglon

$ee \rightarrow ff$

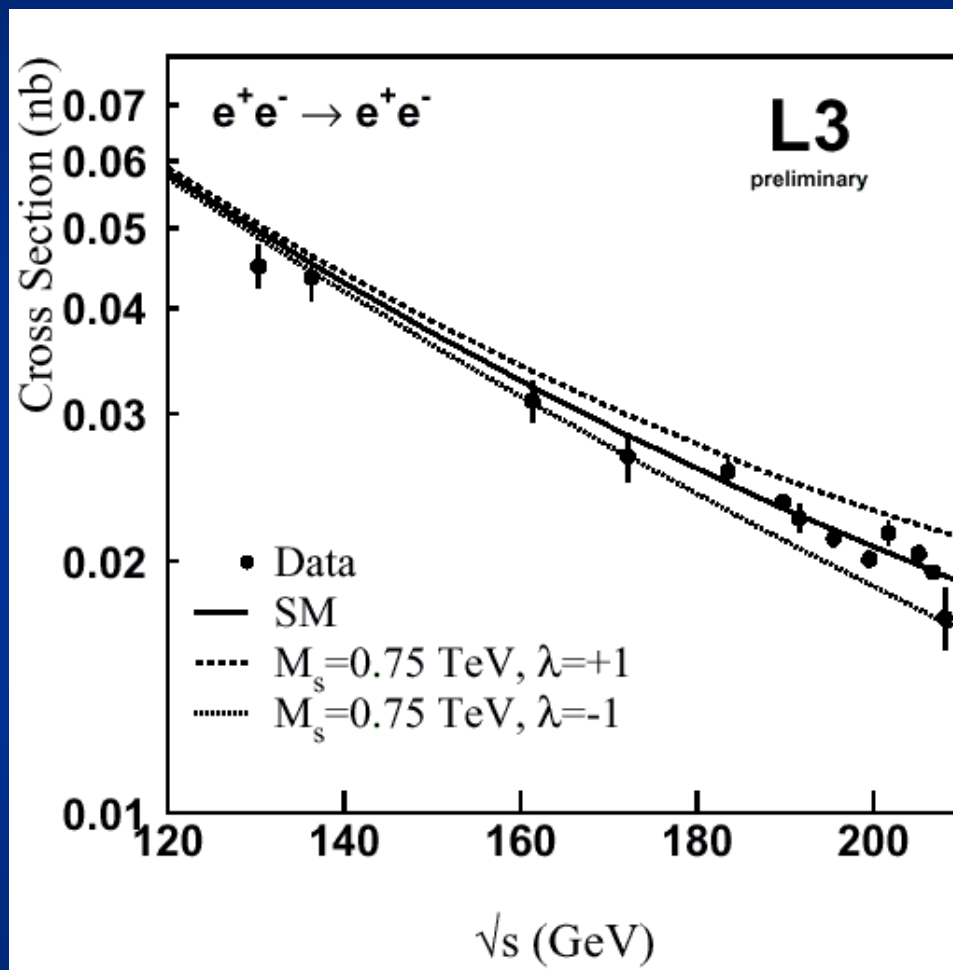
Bhabha differential cross section



➤ Analysis ready for pub.

Search for new physics in $ee \rightarrow ff$

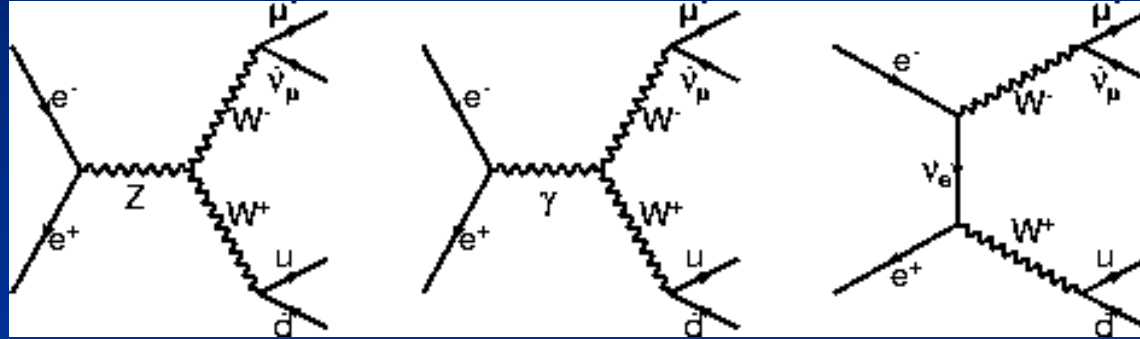
Submitted to
summer conf.



- Many models tested
- No deviation wrt SM found

➤ Analysis nearly ready for pub.

WW

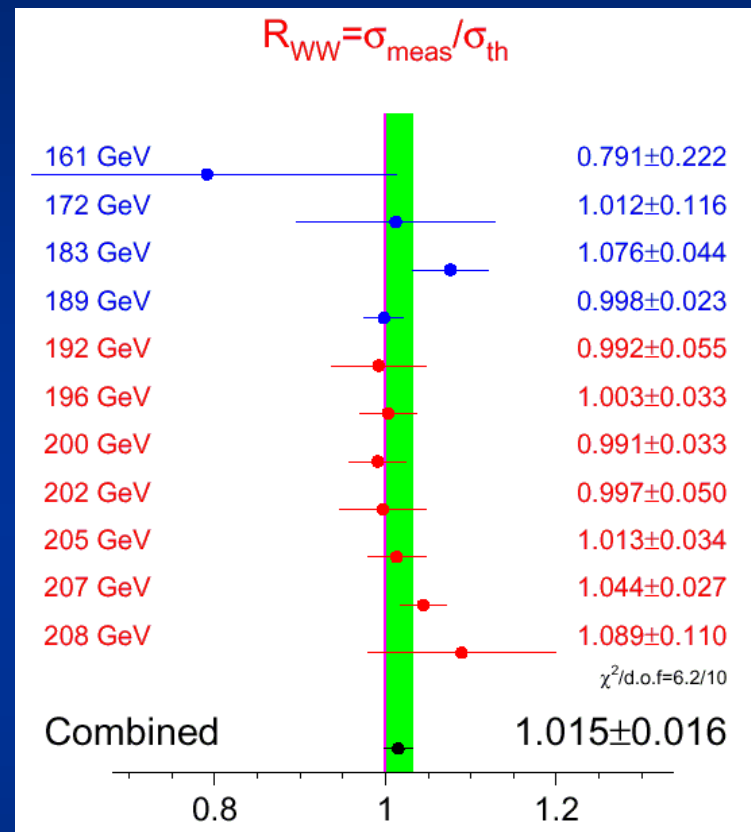
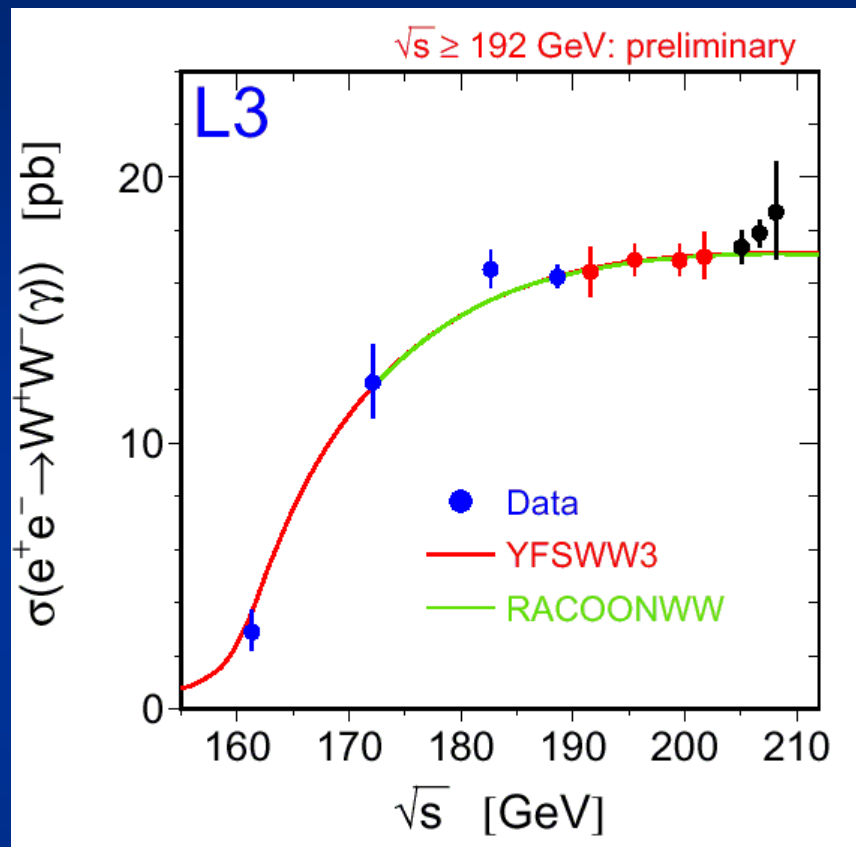


- $WW \rightarrow qq\bar{q}\bar{q}$ hadronic channel
- $WW \rightarrow qq\nu\bar{\nu}$ semileptonic
- $WW \rightarrow \nu\bar{\nu}\nu\bar{\nu}$ leptonic

- Cross section and W decay branching ratio
- W polarization
- W mass
 - Improvements on mass extraction
 - Systematic error due to Color Reconnection

W cross section and BRs

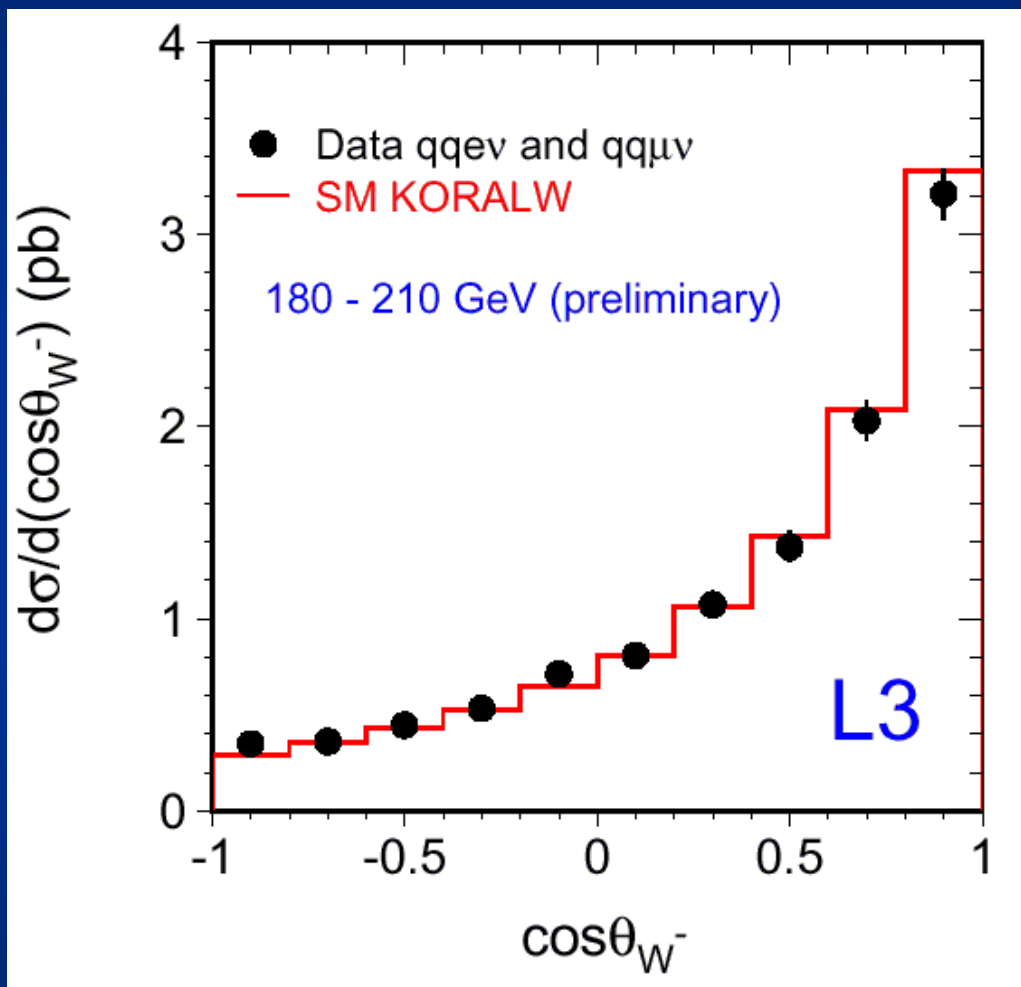
L.Malgeri
S.Natale
E.Delmeire



	Lepton Universality	Standard Model
B(W→ln)	10.55+0.13+0.11	10.83
B(W→qq)	68.10+0.41+0.33	67.51

Reanalyze using latest MC generator

Differential cross section

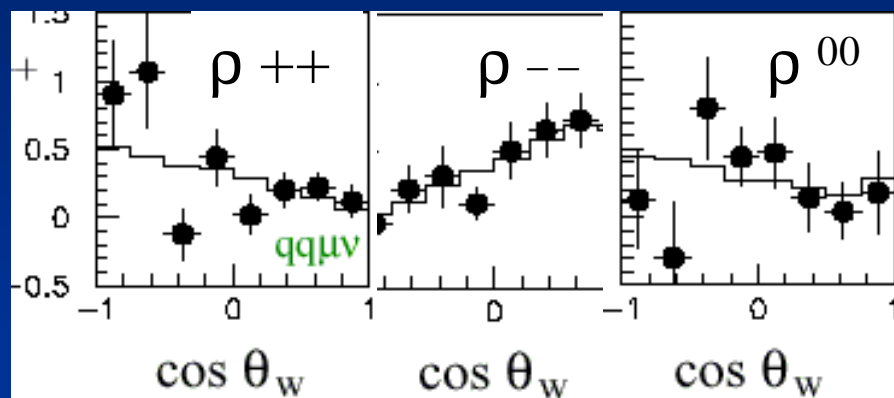


- Submitted to summer conf.
- will be combined with other LEP experiments

➤ Publication together with xsec when new MC ready

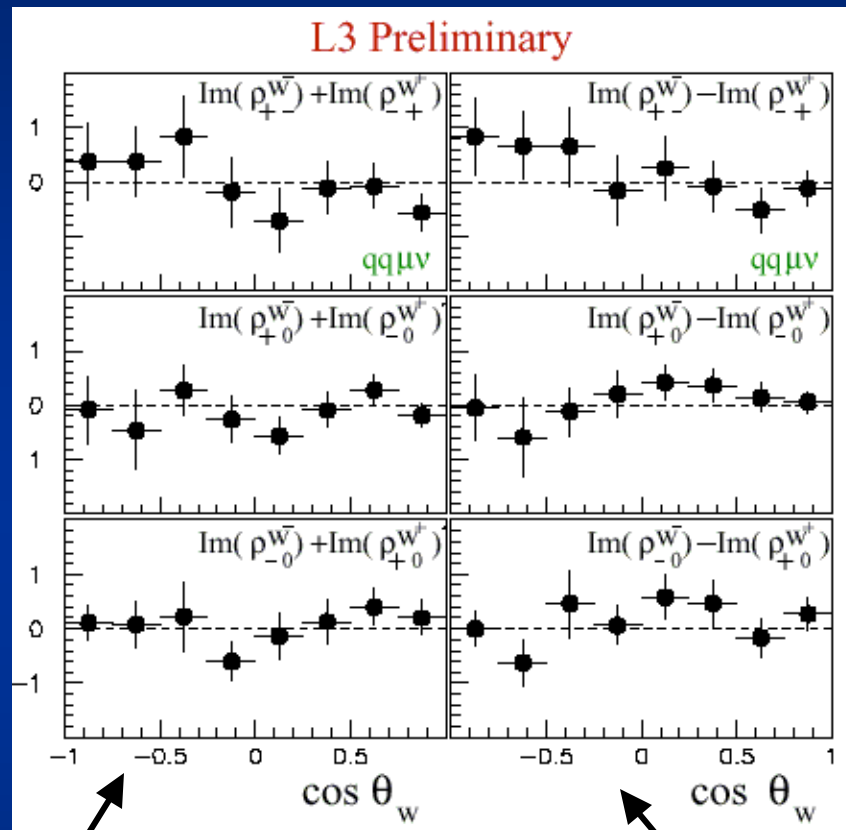
Submitted to
summer conf.

Spin Density Matrix



$\rho^{++}, \rho^{--}, \rho^{00} \sim$ probability of
producing a W^- with helicity $+, -, 0$

- Analyze all energies
- Systematic errors
- Set limits to CP violating couplings

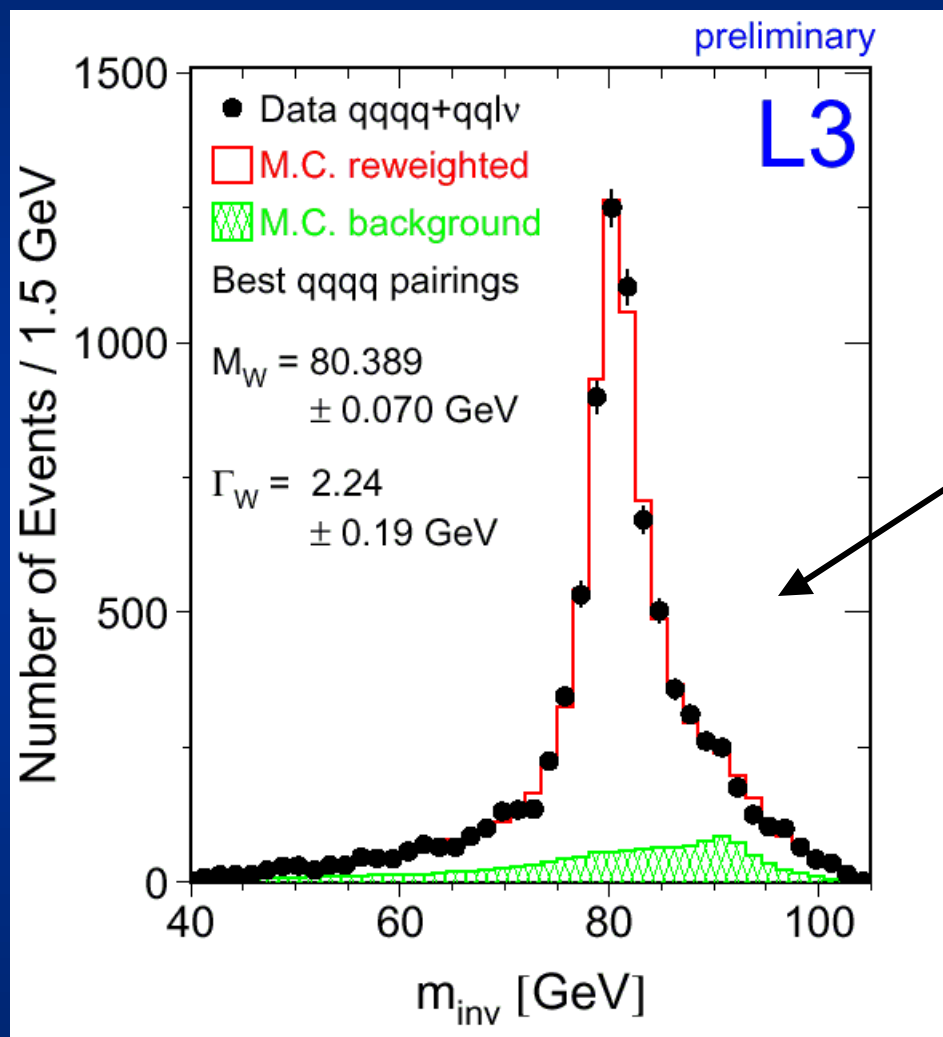


Test CPT invariance

Test CP invariance

W mass determination

Submitted to
summer conf.



L3 average

$$M_W = 80.389 \pm 0.048 \pm 0.051 \text{ GeV}$$

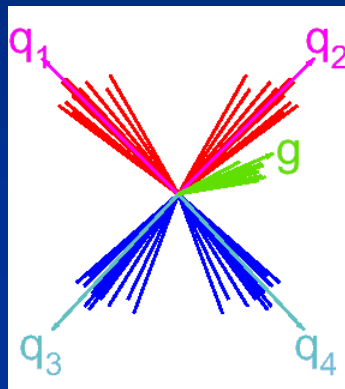
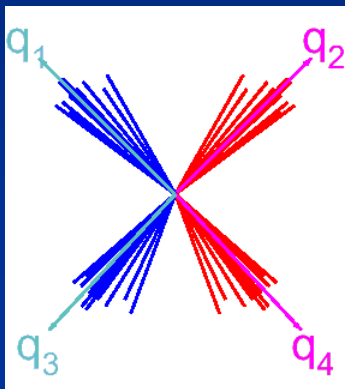
Minv= invariant mass after a fit imposing E,p conservation and equal mass constraint

M_W extracted using one estimator per event (1D method)

➤ Work in progress to improve statistical & systematic uncertainties

Improvements on W mass

- Improvements for qqqq



- Divide the events in two samples

- 4 or 5 jets according to y45 cut

Up to ~ 6% improvement on statistical error wrt to standard L3 analysis

- Use more information per event

- 2 masses, mass error, y45...

- 2D method improvements

- qqqq : up to 8% (M5C, σ 5C)
- lvqq : up to 4% (M2C, M1Chad)

➤ Try 3 Dimensional fits

Systematic uncertainties on Mw

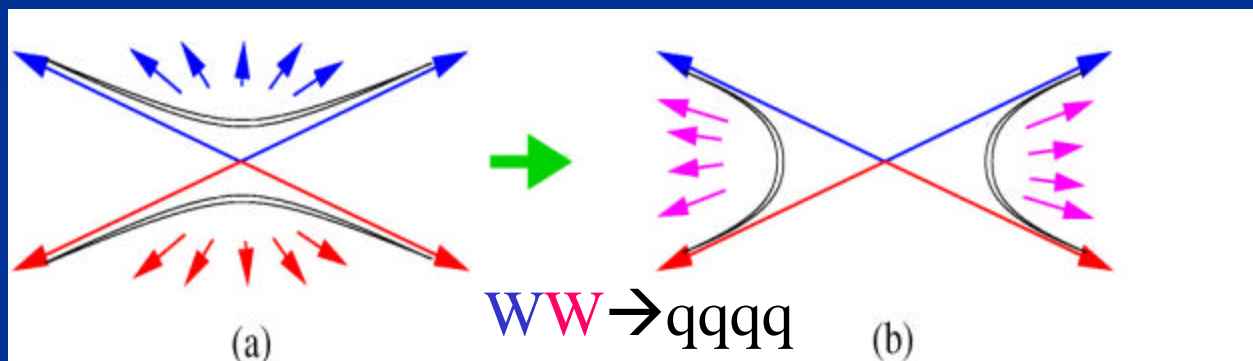
<i>Source</i>	<i>qqln</i>	<i>qqqq</i>	<i>combined</i>
ISR/FSR	18	11	15
Hadronization	30	30	30
Detector syst.	10	11	11
Fit method	15	15	15
Selection	5	7	4
Background	4	7	4
MC stat	9	7	6
LEP beam energy	17	17	17
Colour Reconnection	-	50	26
BE correlations	-	20	9
Total systematics	45	69	51
Statistical	74	63	48
Total	86	93	70

BE, CR, LEP energy, hadronization → correlated for all LEP experiments

- CR dominates the systematic error
- Total qqqq error is larger than qqln (similar behaviour for all LEP exp.)

Colour Reconnection

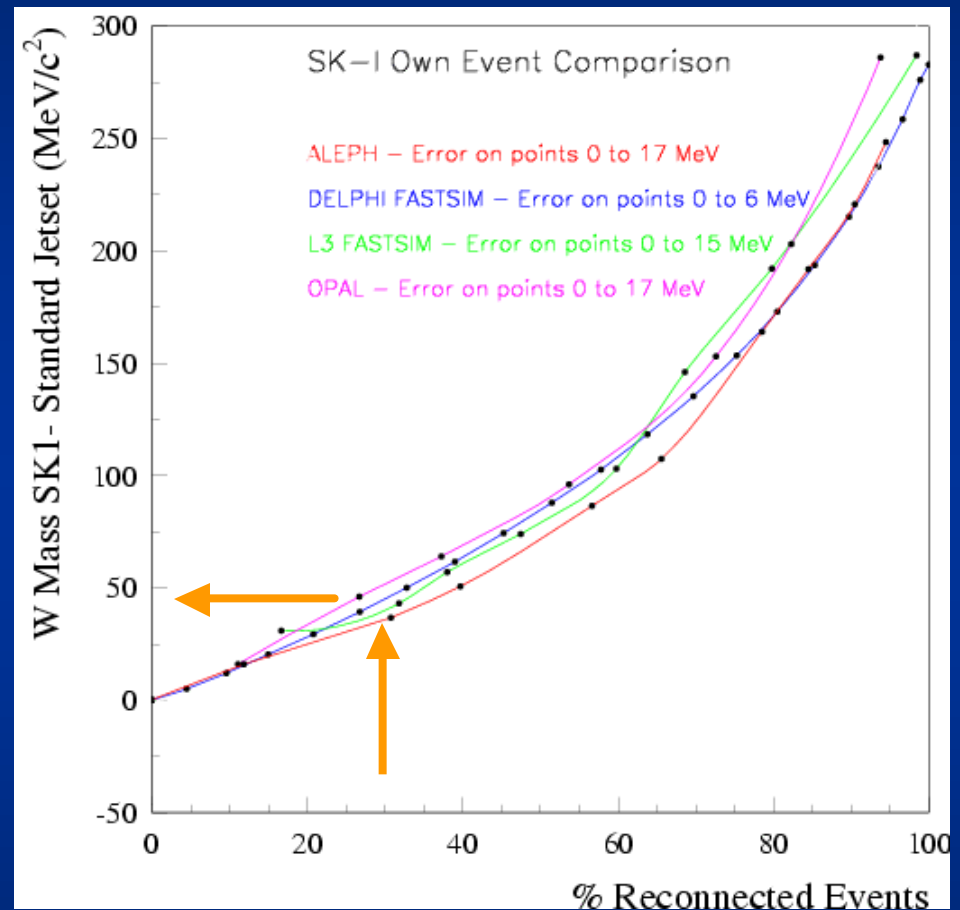
- Hadronization of the two W s may not be independent
 - Bias on reconstructed mass by momentum transfer between the W s



- CR affects low momentum particles between jets
- Two strategies :
 - Reduction of CR sensitivity (dedicated W mass analyses)
 - Direct CR measurement (using WW and Z events)

Colour reconnection

- Many models in the market
 - Up to 200 MeV bias on W mass
- all experiments have same sensitivity
- Current uncertainty of 50 MeV evaluated with assumption 30% of reconnected events



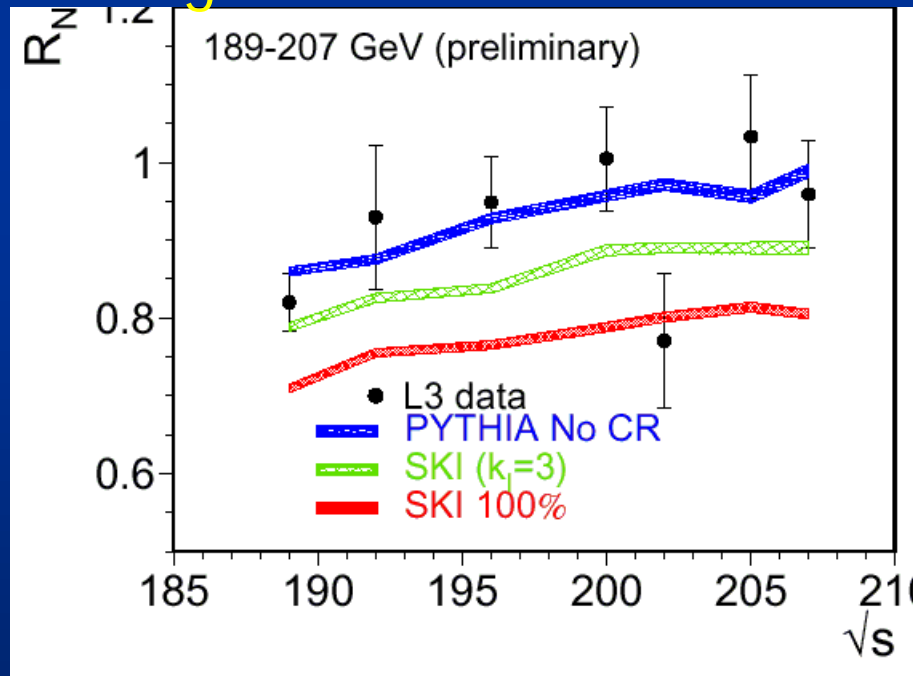
Search for CR

In case of CR :

- depletion of multiplicity in **W region**
- enhancement in **non W region**

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summer conf.

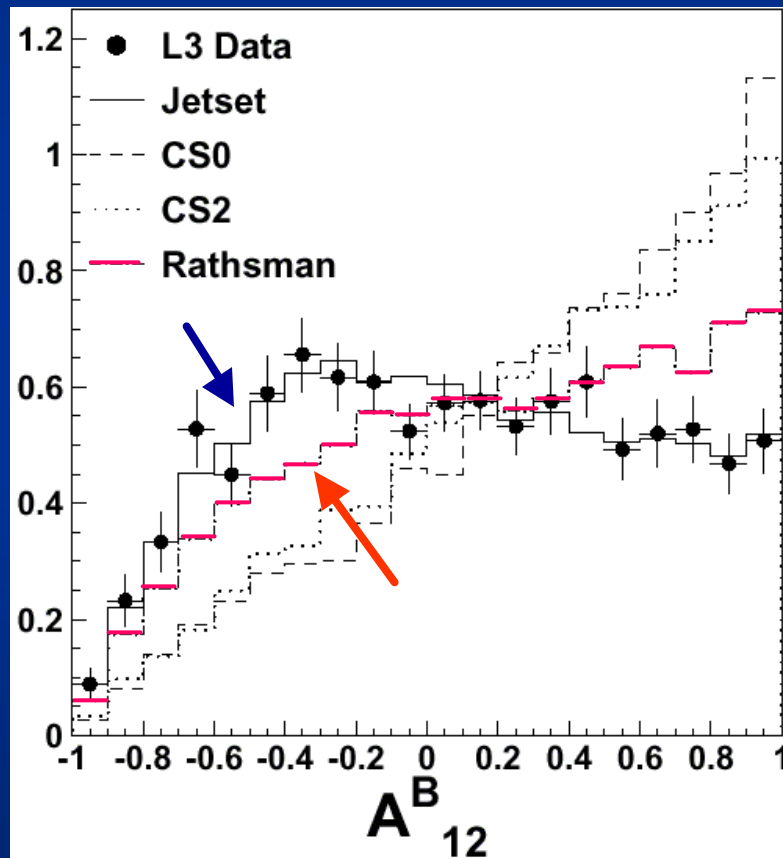
R_N : density of particle inside/outside
W regions



- L3 data compatible with both no CR or CR < 40%
- LEP combination in progress to set better limits

CR measurement in Z events

Asymmetry of particle density between jets in 3-jet evts



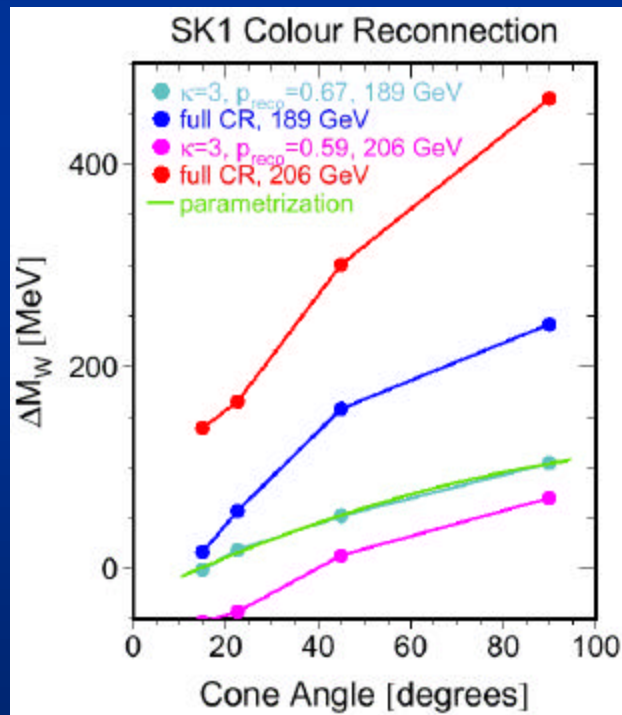
Submitted to
summer conf.

- Use new Rathsmann parameters
- Transport Z results into W s

W mass and CR

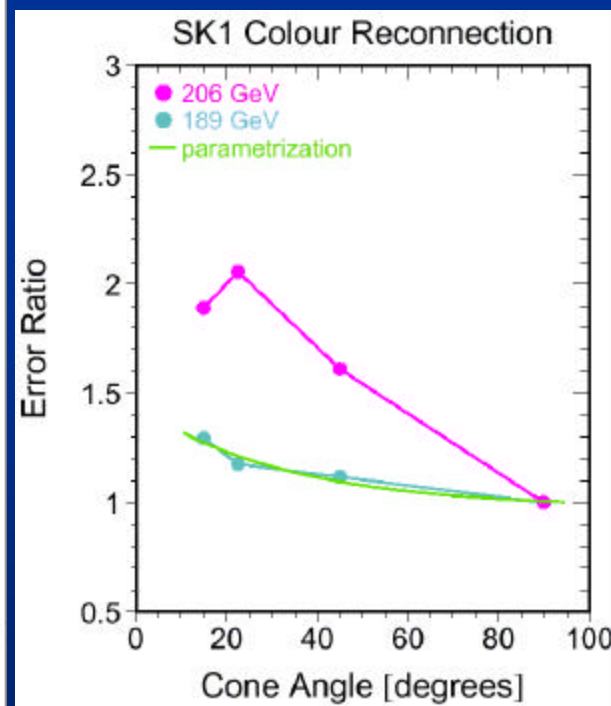
- Use alternative jet algorithms less sensitive to inter-jet activity
 - Restrict jets to narrower cones
 - Exclude particles with low momentum

Mass bias vs cone size

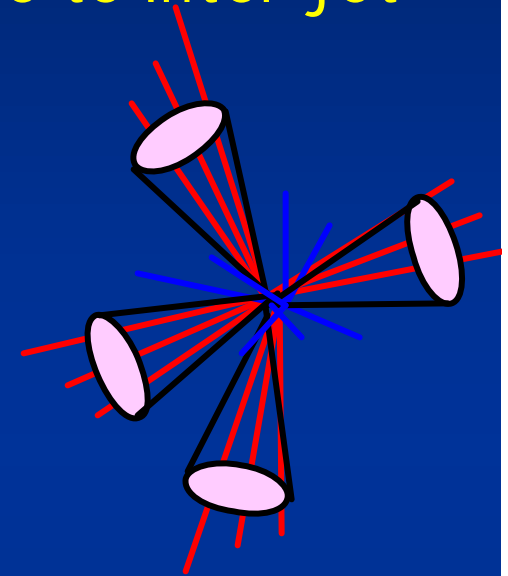


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Error increase vs cone size



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➤ Try to exclude some CR models from Z and WW data

➤ optimize analysis for non-excluded models

Conclusions

- Still a lot of work to do for final papers in
 - 2-photon, W physics
- ~35 publications foreseen with the analysis going on at L3
 - ~ 10 involving Geneva group
 - 3 thesis submitted using L3 data end 2003-2004