LEP SUSY Working Group Status Report

LEPC - Sept 5 2000

S. Rosier-Lees, LAPP Annecy

The Working Group strategy

Single and two photon searches

Scalar lepton searches

Scalar heavy quark searches

Chargino searches

Conclusions

The Working Group strategy

Goal: Fast combination performed quasi online of the searches to spot possible signal in a very short time

LEP results are based on a total luminosity of ~585 pb^{-1} collected at Ecm between 203 and 208 GeV (Y2K)

275 pb^{-1} @ $\sqrt{s}$ > 206.5 GeV

27 pb^{-1} @ $\sqrt{s}$ > 207.5 GeV

New strategy compared to the previous years: care about 'standard' searches but also any new analyses with 2.5 SD. Many exciting and fruitful exchanges in a very short time -> less good quality of checks

Results from Y2K are VERY PRELIMINARY

The Working Group

The LEP SUSY WG members:

Aleph: F.Cerutti, G.Ganis

Delphi: A. de Min, L. Pape (convener)

L3 : A.Favara, S.R.L.

Opal : P. Giacomelli, R. McPherson

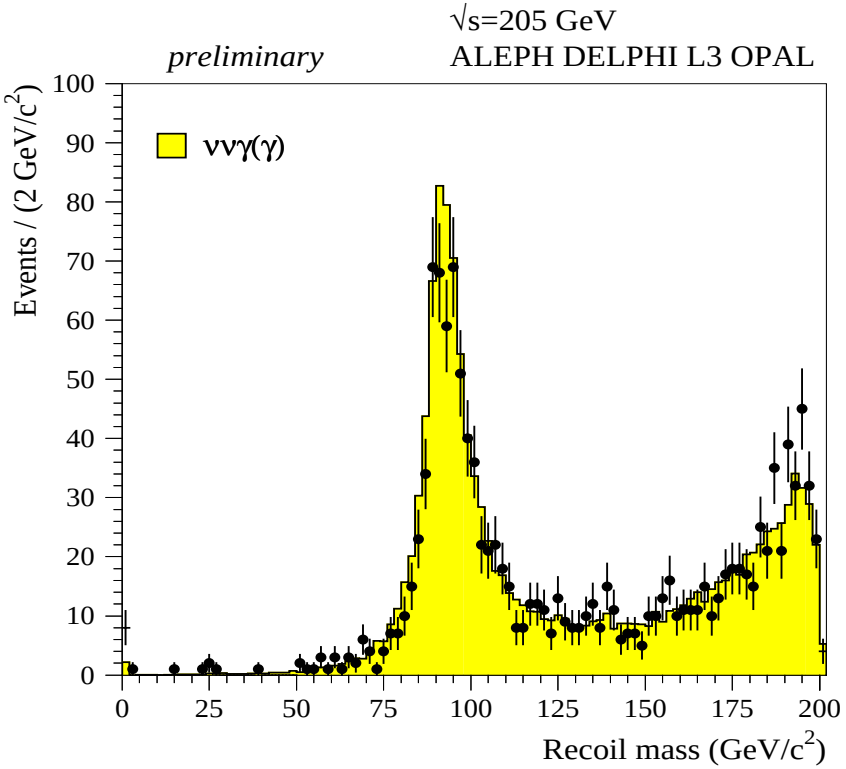
Additional people actively involved in discussions and data combination:

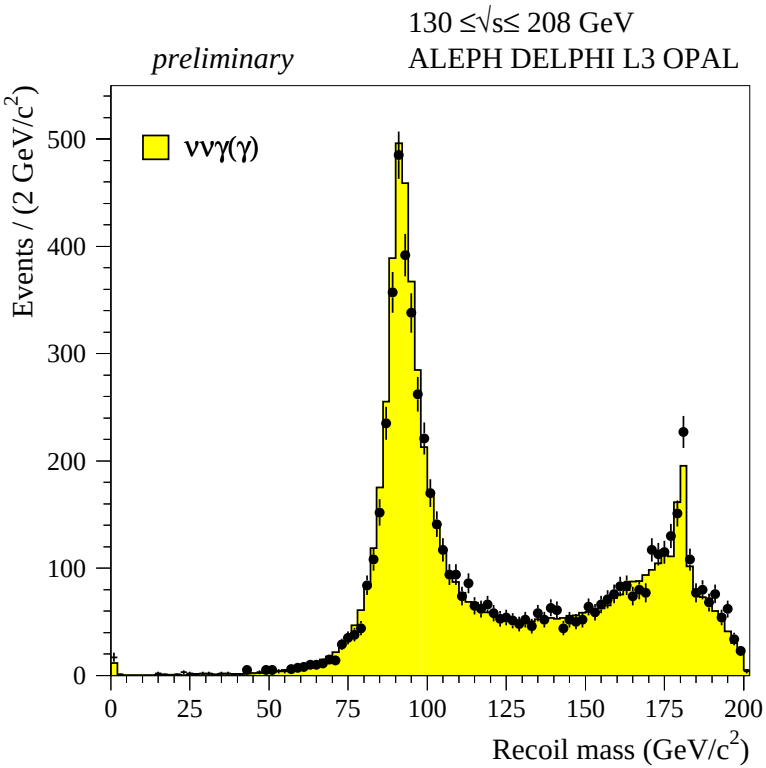
M. Maggi, G.Wilson, B. Clerbaux

People providing the data: Too many to be listed. Many thanks to them.

Single photons $\gamma + \not{E}$

$e^+e^- \to \tilde{\chi}_2^0\tilde{\chi}_1^0 \to (\tilde{\chi}_1^0\gamma)\tilde{\chi}_1^0$ or $e^+e^- \to \tilde{G}\tilde{\chi}_1^0 \to (\tilde{G}\gamma)\tilde{G}$...





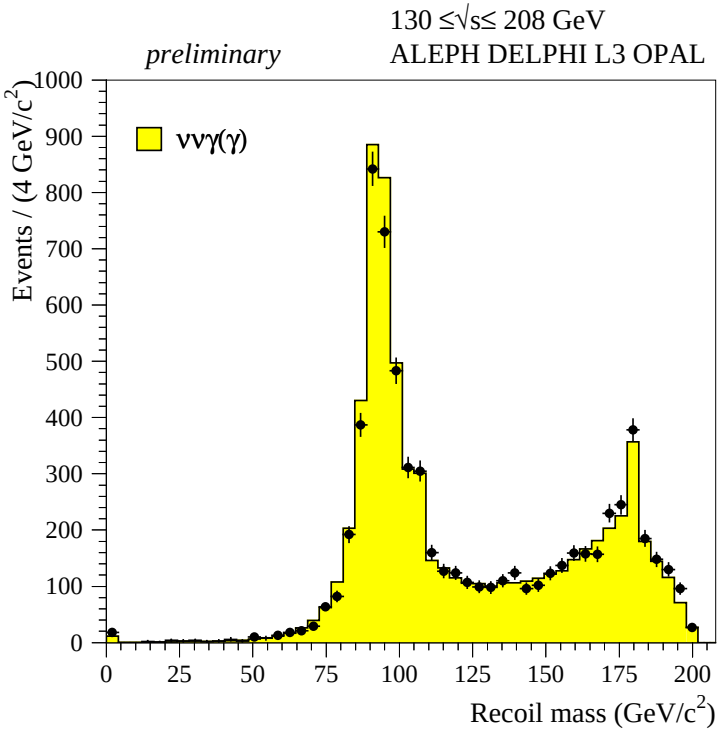
Y2K data

130 GeV<Ecm<208 GeV

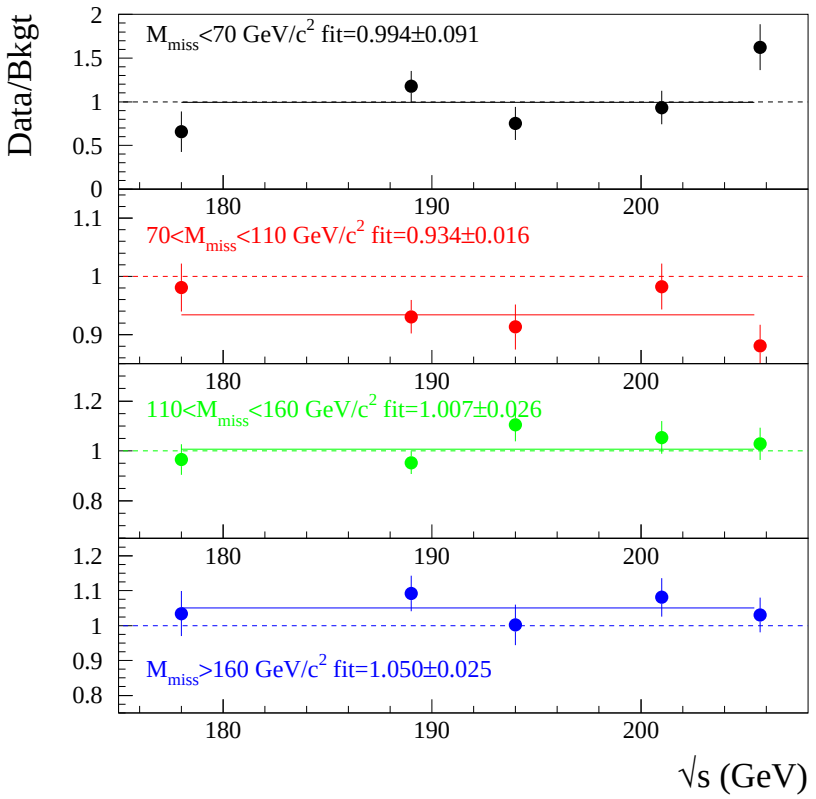
The deficit under the Z peak is still present ->

The recoil mass is divided into 4 micro bins (A. De Min, LEPC July 2(

Single photons $\gamma + \not{E}$



130 GeV<Ecm<208 GeV

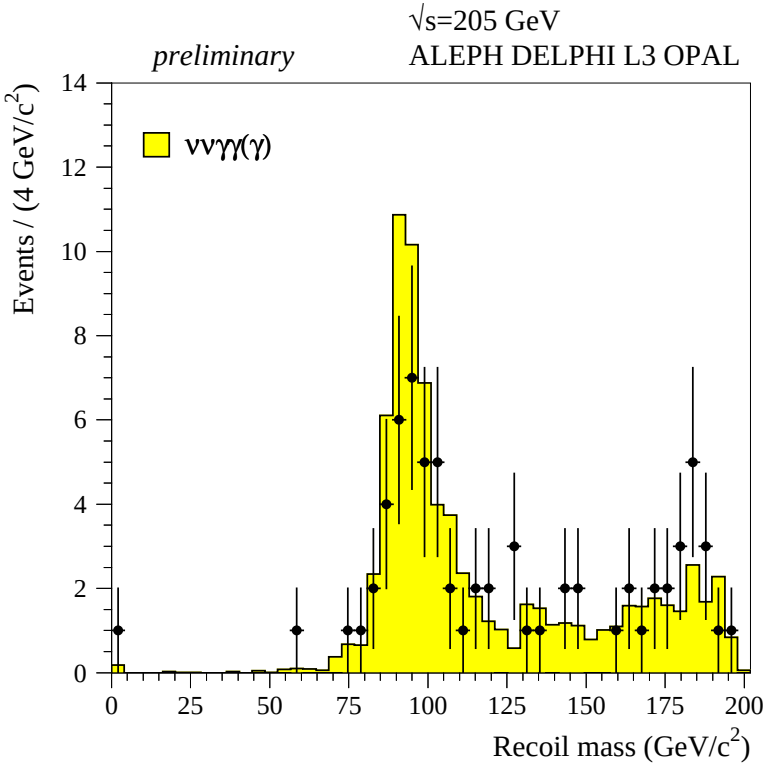


Including Y2K: DATA/MC=0.984 ± 0.012(stat)

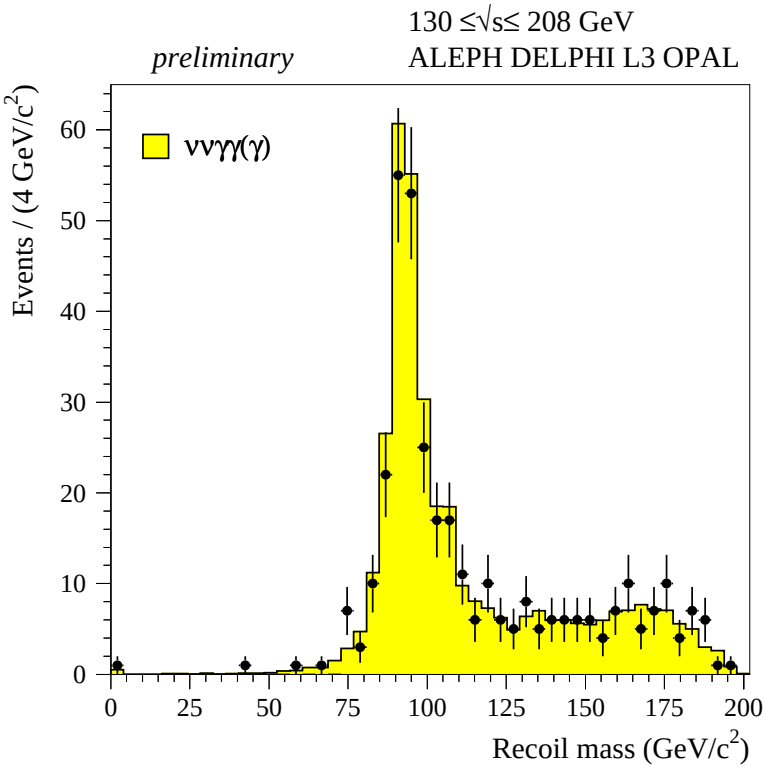
Deficit of 6.6± 1.6% under the Z peak

Acoplanar photon pair $\gamma\gamma + \not{E}$

$$e^+e^- \to \tilde{\chi}_1^0\tilde{\chi}_1^0 \to (\tilde{G}\gamma)(\tilde{G}\gamma)$$



Y2K data



130 GeV<Ecm<208 GeV

Relative good agreement within the statistical uncertainties

Scalar lepton searches $\tilde{e}, \tilde{\mu}, \tilde{\tau}$

Look for $e^+e^- \to \tilde{l}^+\tilde{l}^- \to (l^+\chi_1^0)(l^-\chi_1^0)$ **processes leading to acoplanar lepton pair final states**

Cross section: β^3/s **dependence -> no sensitivity at the kinematic limit -> Luminosity matters**

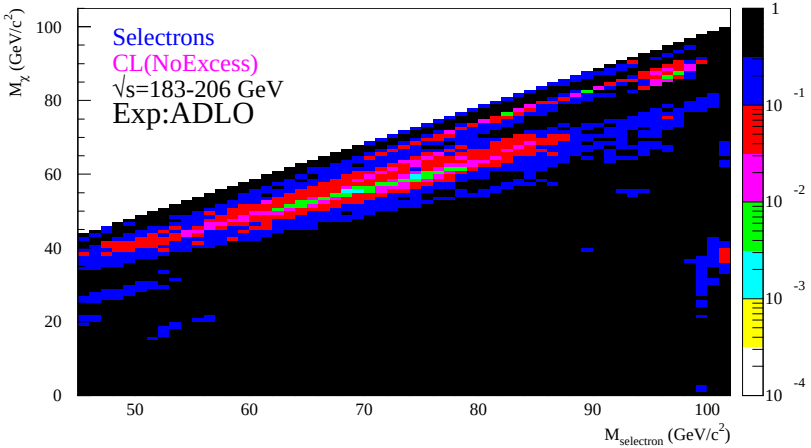
	# obs	# exp	Eff(%)
selectron	48	57.9	53
smuon	47	46.6	55
stau	80	82.1	39

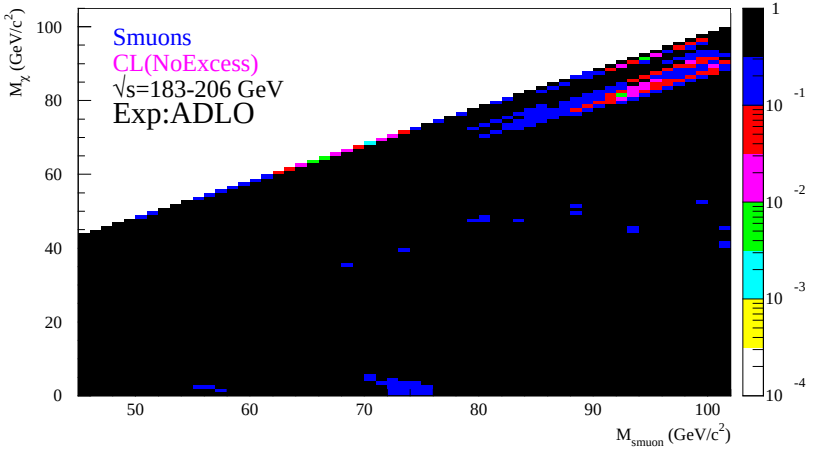
$(M_{\tilde{l}}, M_{\tilde{\chi}_1^0}) = (85, 22)\ GeV$

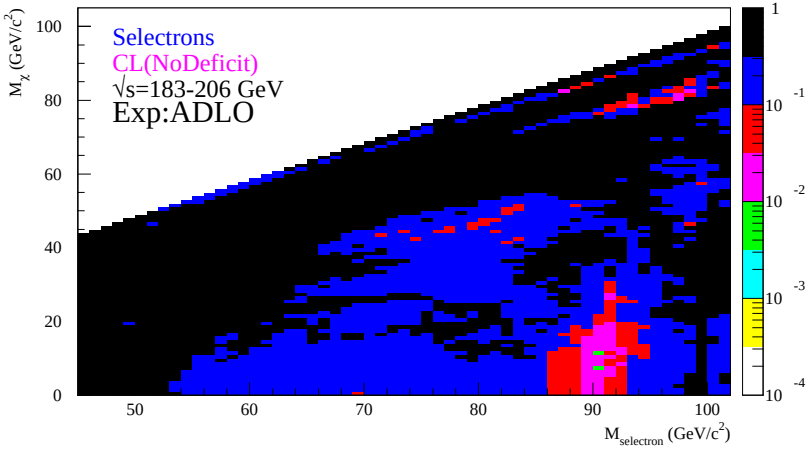
Y2K $L = 585\ pb^{-1}$

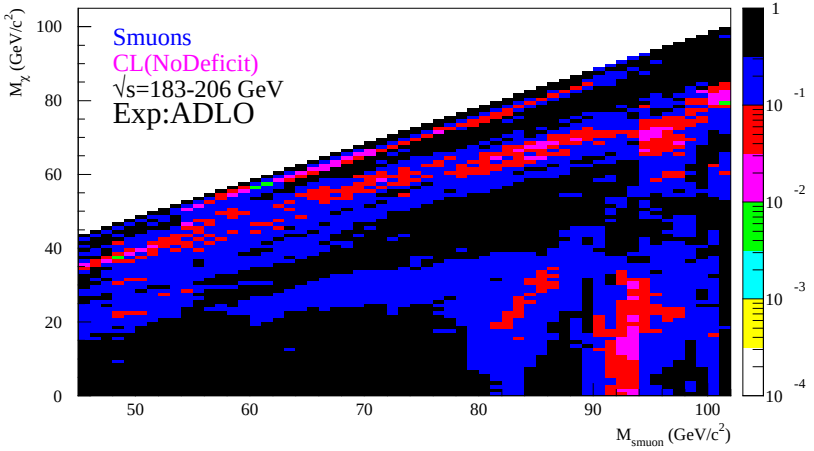
Selector and Smuon searches $\tilde{e}$ $\tilde{\mu}$

Compatibility with SM background







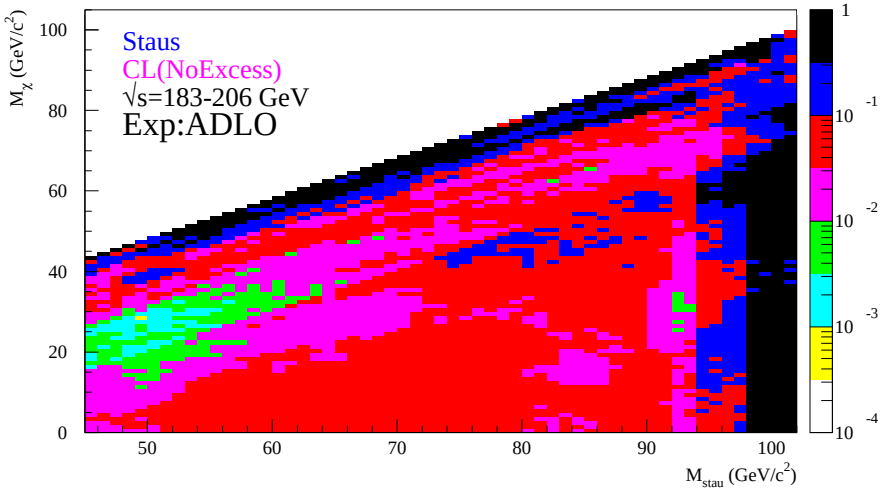


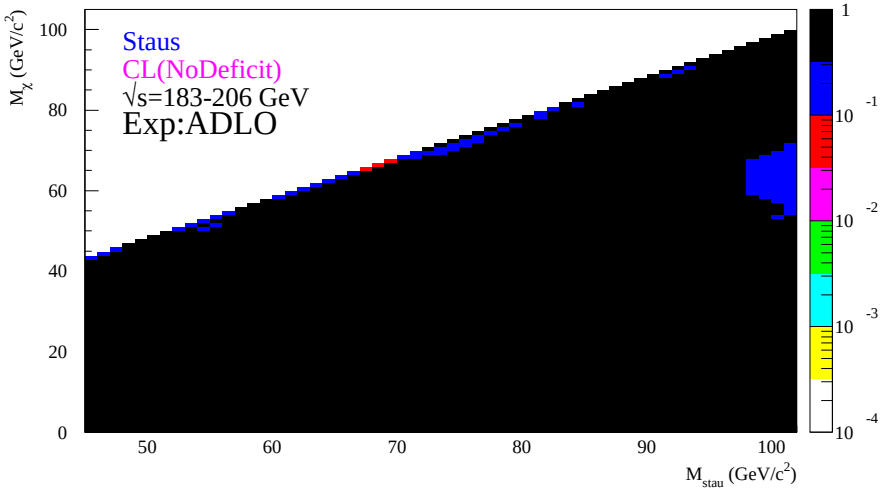
$M_{\tilde{e}} > 98\ GeV\ (\Delta M > 15\ GeV)$ $M_{\tilde{\mu}} > 94\ GeV\ (\Delta M > 15\ GeV)$

Just slight improvement since last LEPC, July 20

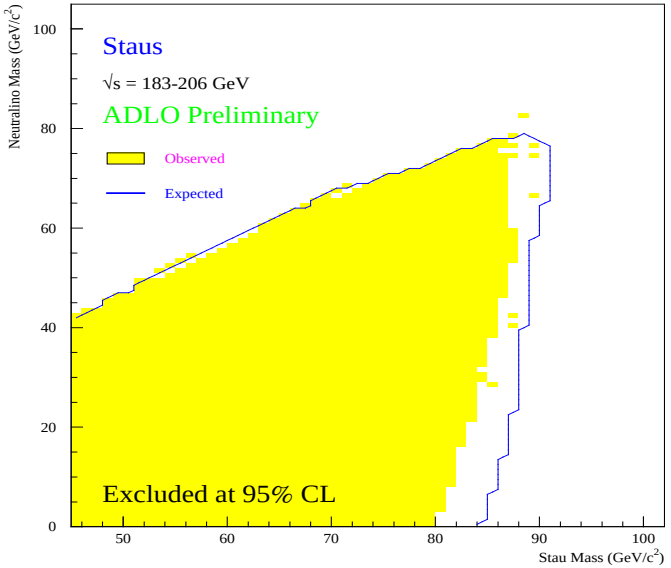
Stau searches $\tilde{\tau}$

Compatibility with SM background





Mass Limit



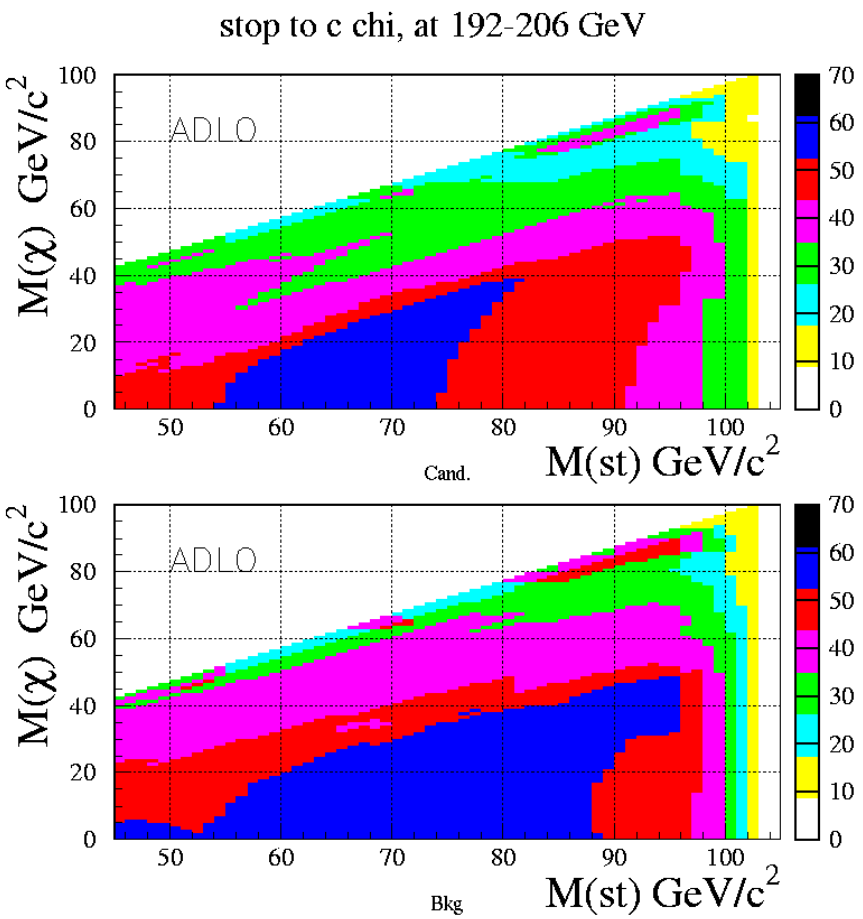
$(M_{\tilde{\tau}}, M_{\tilde{\chi}^0_1}) = (85, 22)$ GeV

Now excluded at 95 % C.L. with the Y2K data only

Stop and Sbottom searches $\tilde{t}, \tilde{b}$

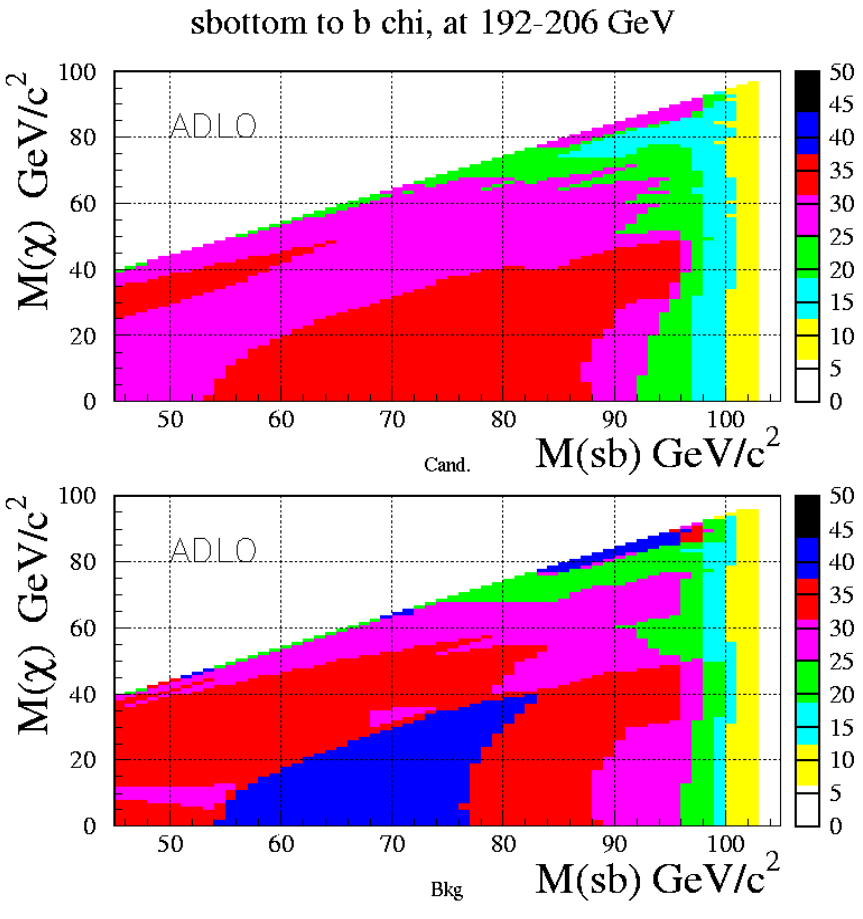
L=1314 pb-1 192<Ecm<208 GeV

$e^+e^- \to \tilde{t}\bar{\tilde{t}} \to (c\tilde{\chi}_1^0)(\bar{c}\tilde{\chi}_1^0)$



$M_{\tilde{t}} > 97.5$ GeV $M_{\chi_1^0} = 50$ GeV

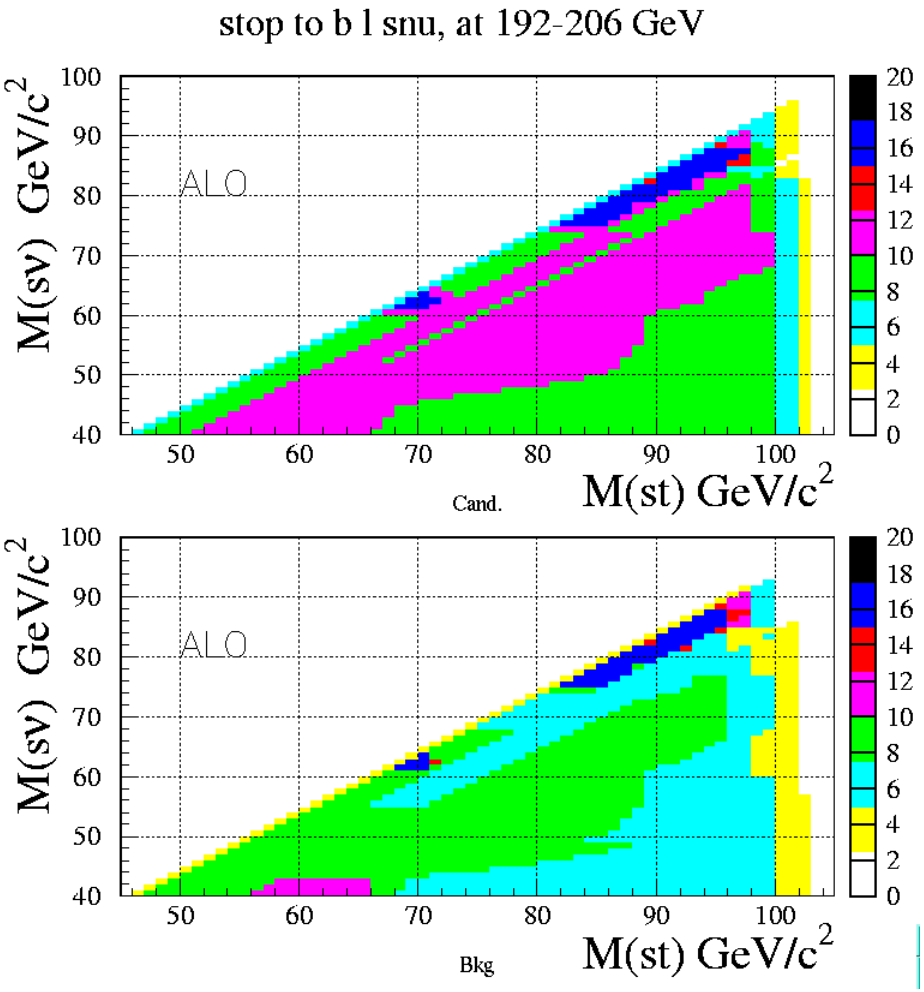
$e^+e^- \to \tilde{b}\bar{\tilde{b}} \to (b\tilde{\chi}_1^0)(b\tilde{\chi}_1^0)$

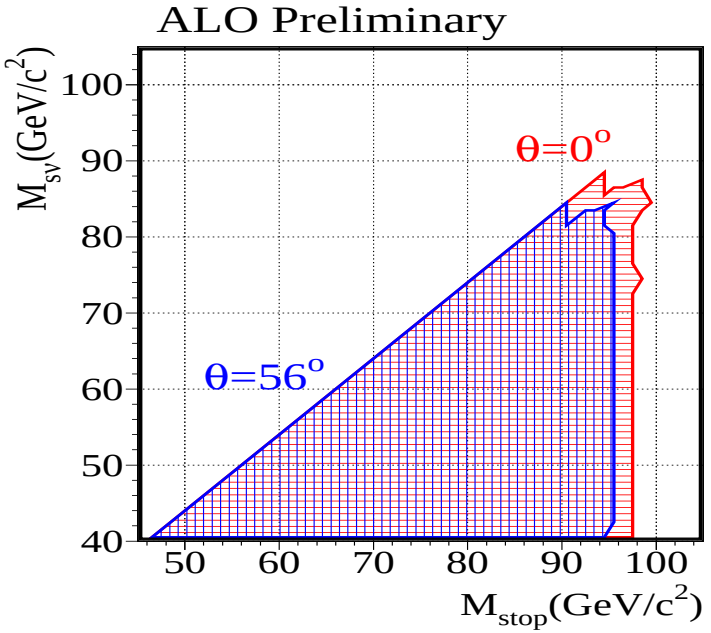


$M_{\tilde{b}} > 97.0$ GeV $M_{\chi_1^0} = 50$ GeV

Stop search $\tilde{t} \rightarrow bl\tilde{\nu}$

Look for acoplanar b jets plus leptons





$M_{\tilde{t}} > 98.5$ GeV $M_{\tilde{\nu}} = 50$ GeV

Data versus background @192-208 GeV

L = 932 pb^{-1}

(Light) Sbottom search $\tilde{b} \to l\tilde{\nu}c$

Light sbottom search was triggered by Aleph

(G.Taylor, LEPC July 20)

Within the following assumptions:

- The sbottom mass is 3.6 GeV (-> mixing)
- The sbottom decouples from the Z (no Z width constraints)
- The sbottom lifetime is ~ 1 ps
- With $B(\tilde{b} \to e\tilde{\nu}c) = B(\tilde{b} \to \mu\tilde{\nu}c) = 0.5$ -> the sneutrino mass is low
- Light sneutrino only if sneutrino mixing is assumed and if the sneutrino decouples also from the Z (no LEP1 constraints)

(Light) Sbottom search $\tilde{b} \to l\tilde{\nu}c$

Experimental signature at LEP2:

- Two b-like jets (b-tag)
- Two opposite sign charged leptons back to back
- Main background bbar (semileptonic b decay)

Since July, each experiment have developed at least two analyses (the Aleph-like analysis is the reference) and estimated the efficiency on the signal MC file provided by Aleph

	L(pb-1)	#obs	#exp	F=S/√B
A	580	56	33.4	5.8
D	460	17	26.3	3.4
L	528	17	25.1	3.3
O	540	15	20.5	4.8
ADLO		105	105.3	

Signal with this topology confirmed neither by Aleph (Ind. Analysis) nor by the 3 other experiments

Chargino search $\tilde{\chi}_1^+$

Large production cross section for Gaugino-like chargino assuming large sneutrino mass

- Sensitivity depends more on $\sqrt{s}$ than luminosity

- Sensitivity close to the kinematic limit with few 10 pb^{-1} per experiment (A. De Min - LEPC July 20)

A 100% W-like branching ratio is assumed $B(\tilde{\chi}_1^+ \to W^* \chi_1^0) = 1$

The samples of data at the two highest energies have been considered

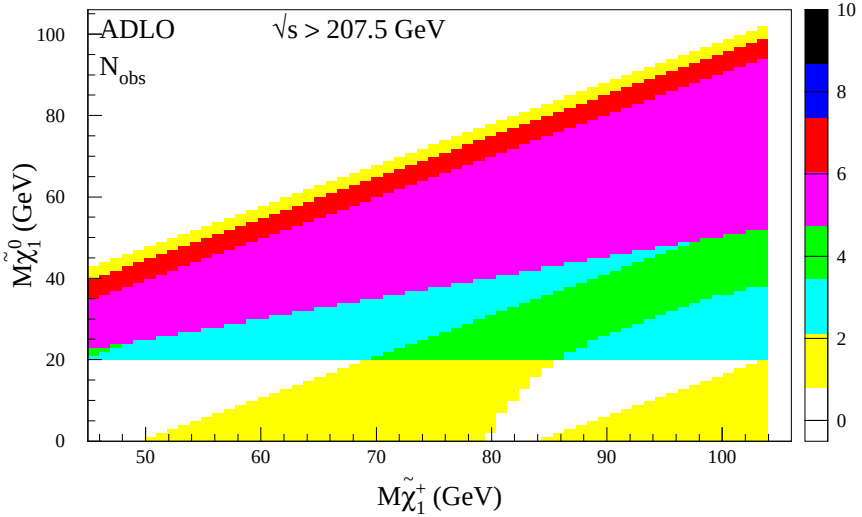
275 pb^{-1} @ $\sqrt{s}$ > 206.5 GeV

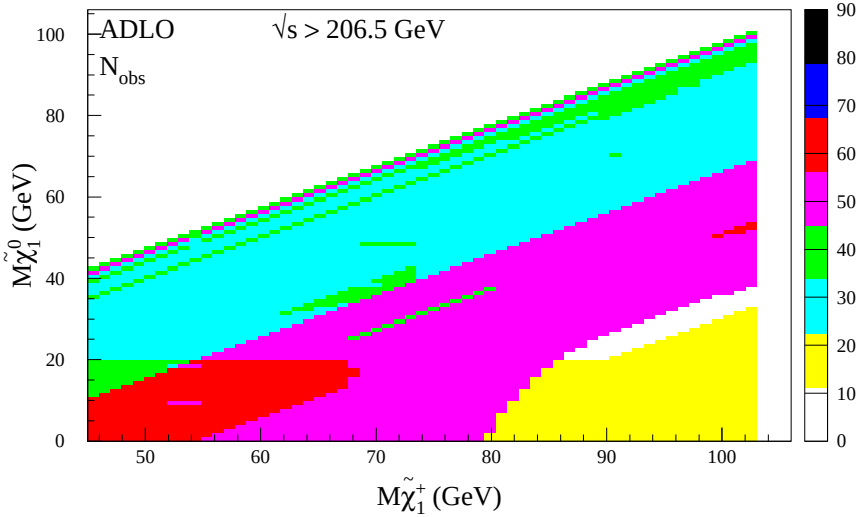
27 pb^{-1} @ $\sqrt{s}$ > 207.5 GeV

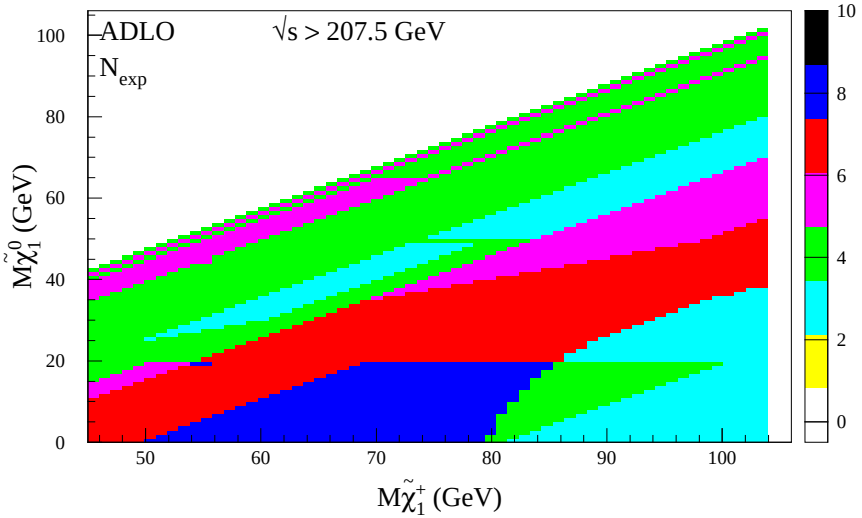
Chargino search

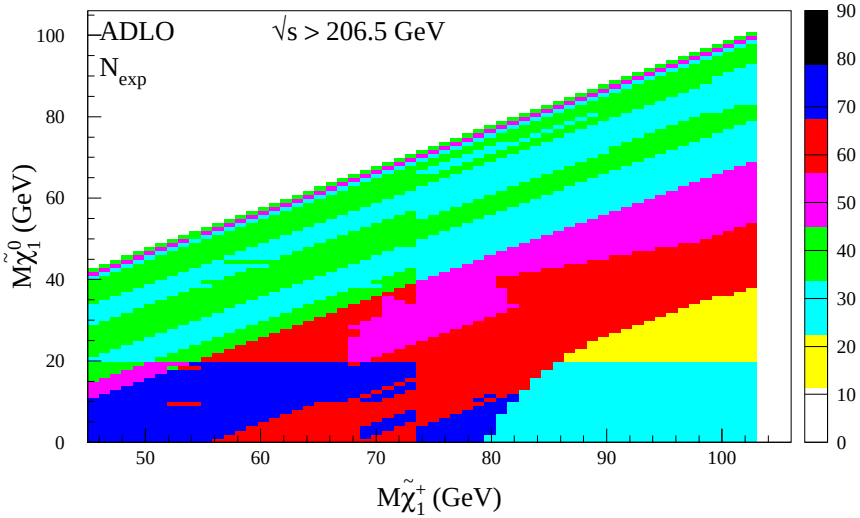
$\tilde{\chi}_1^+$

Background Data Comparison









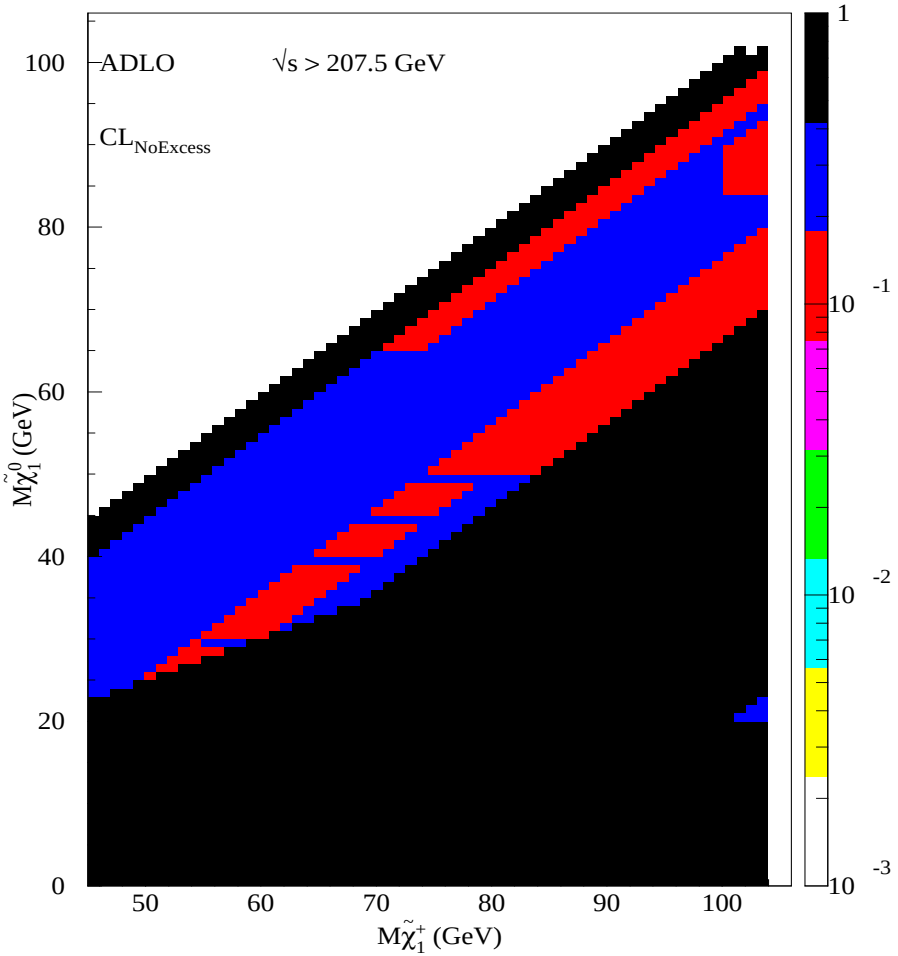
27 pb^{-1} √s>207.5 GeV

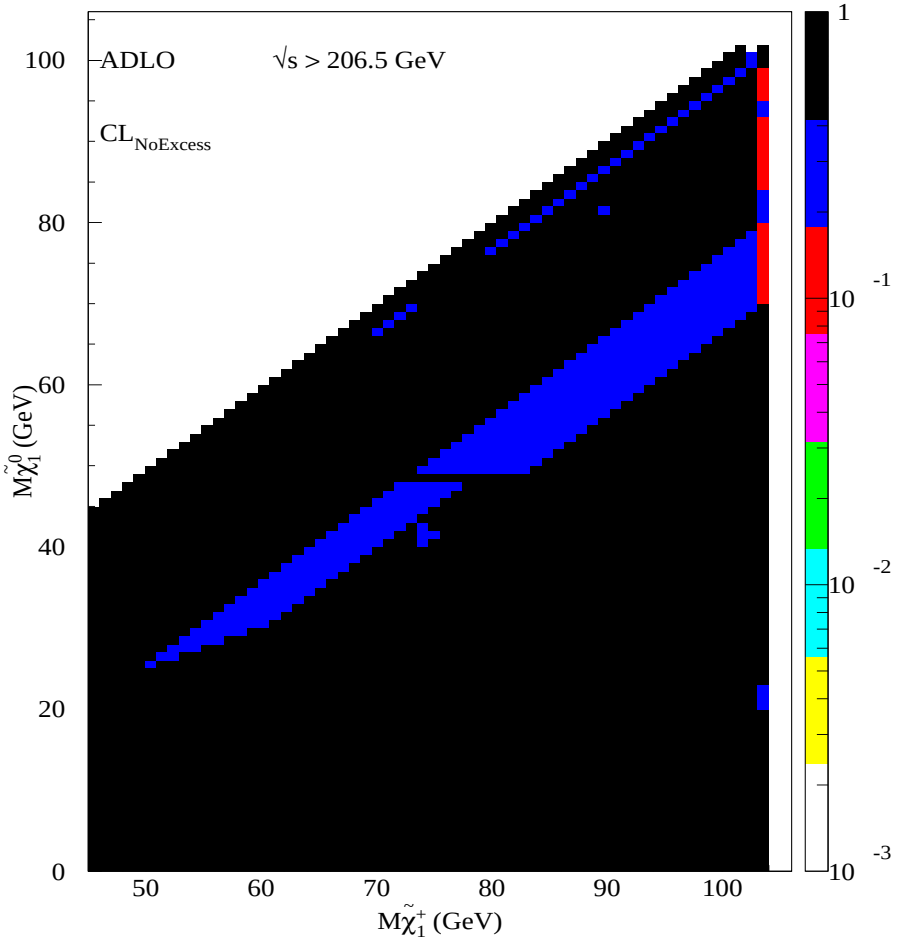
275 pb^{-1} √s>206.5 GeV

Chargino search

$\tilde{\chi}_1^+$

Any deviation ? Poiss. Prob. $\{N \geq N_{obs}\,;\, N_{exp}\}$



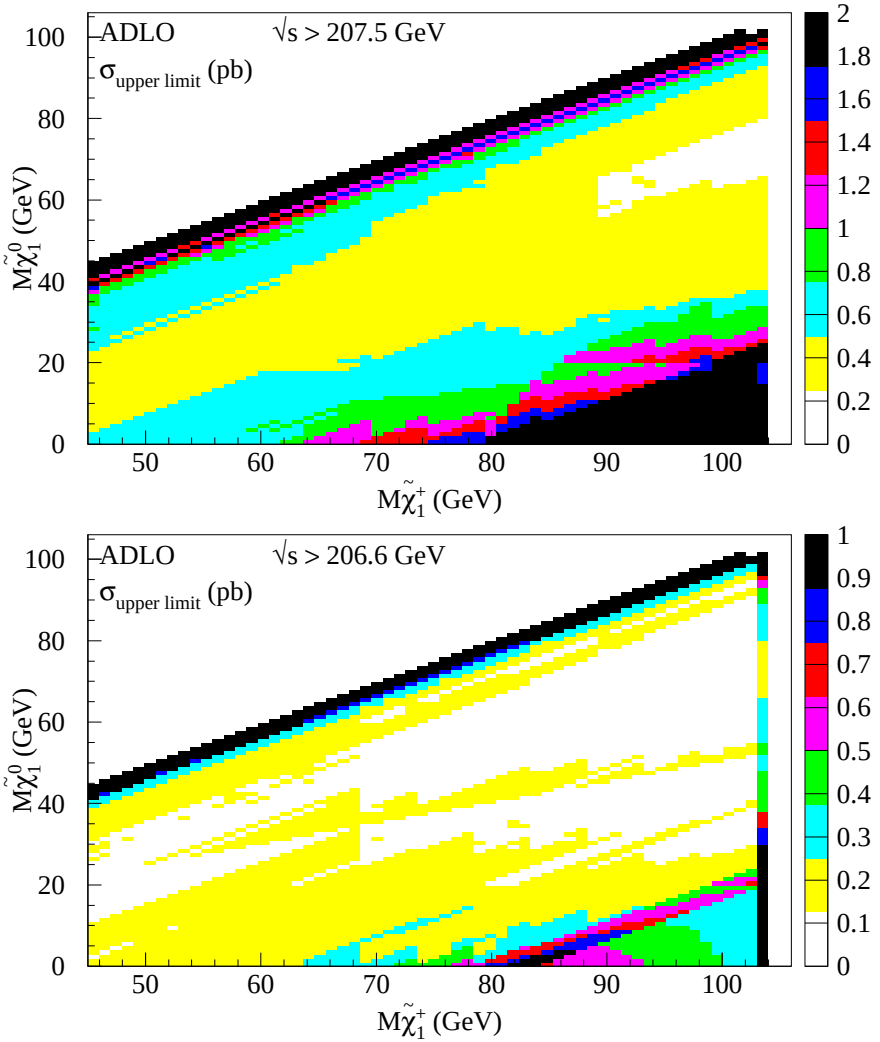


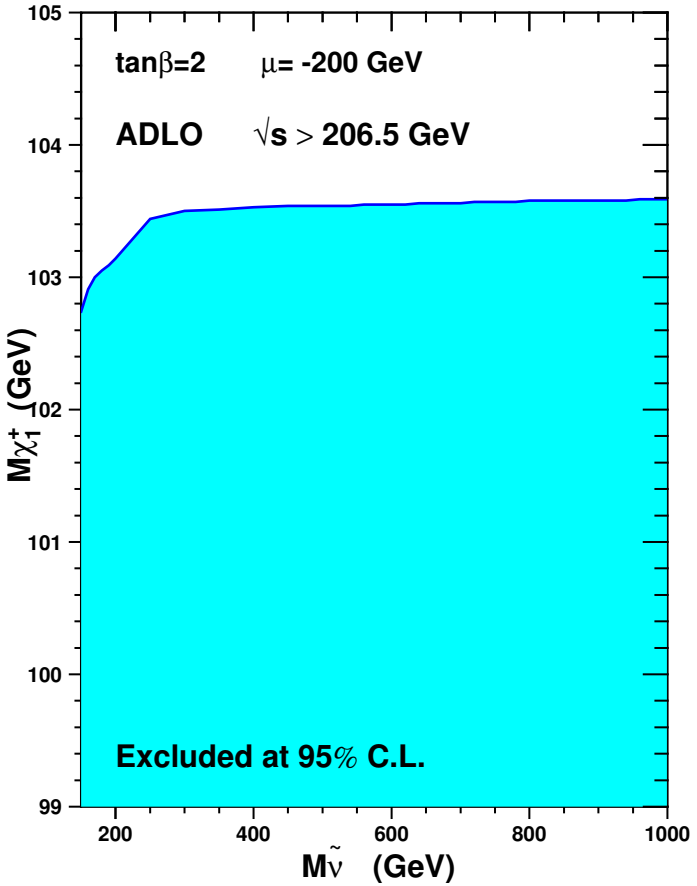
$\boldsymbol{Pb\{N \geq N_{obs}\,;\, N_{exp}\} \geq 8\%}$

Chargino search

$\tilde{\chi}_1^+$

No evidence for excess -> derive limits



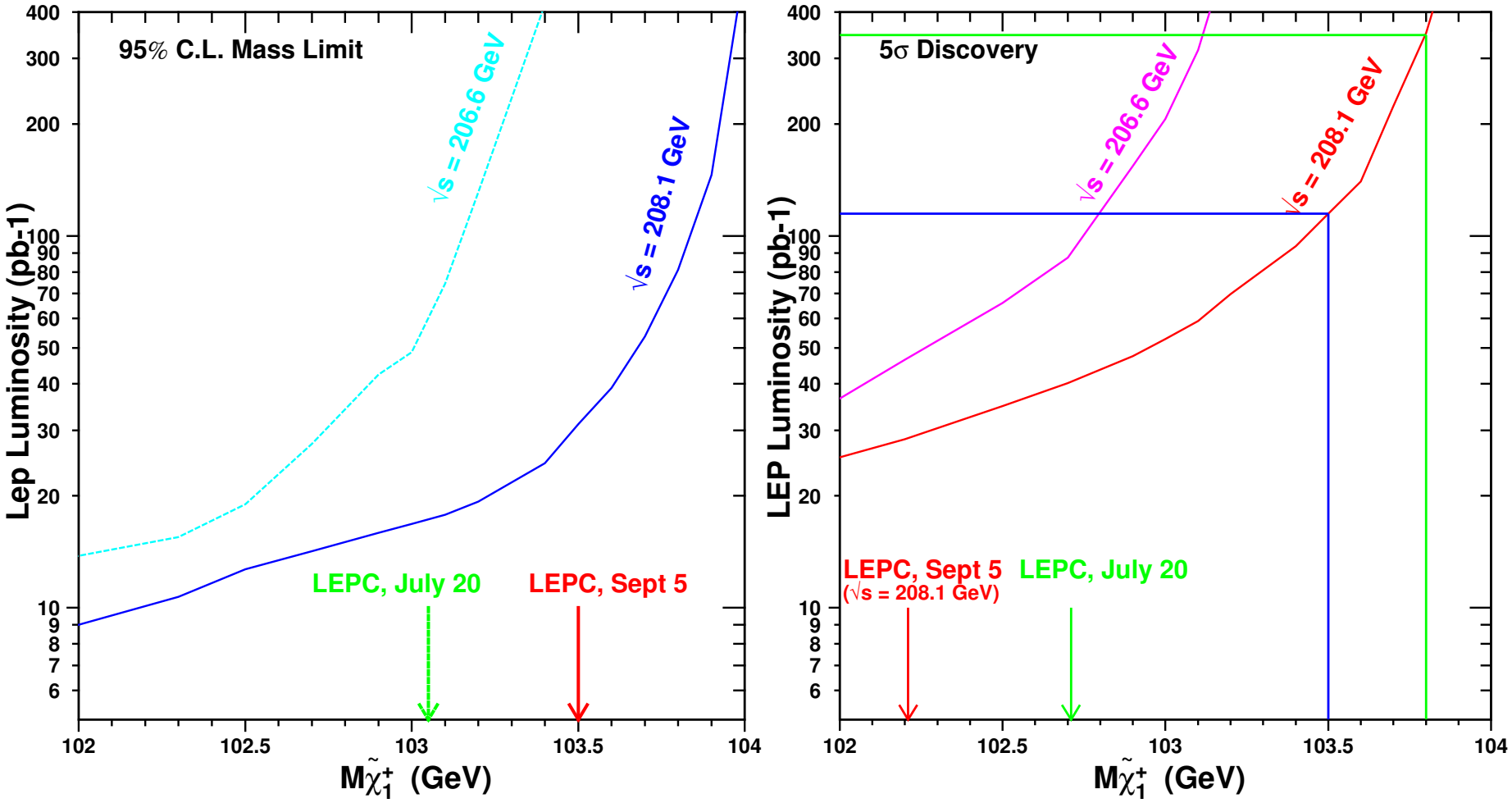


$M\,\tilde{\chi}_1^+ > 103.5\ GeV\ (M\tilde{\nu} > 300\ GeV)$

Chargino search

$\tilde{\chi}_1^+$

Improvement since last LEPC (July,20 2000)



5σ discovery sensitivity: a total luminosity of 120 pb^{-1} @ 208 GeV is required to reach the present mass limit and a total luminosity of 350 pb^{-1} is needed to reach 103.8 GeV

Conclusion

All SUSY was searched for with a total luminosity of 27 pb^{-1} collected at Ecm>207.5 and a total luminosity of 585 pb^{-1} luminosity at Ecm > 203 GeV (Y2K data) without (unfortunately) any new physics evidence.

It was a very active and enthusiastic year, all fluctuations were considered and shared !

The only possible improvement (in term of discovery) concerns the Chargino searches...But 350 pb^{-1} at Ecm>207.5 GeV are needed to extend the 5σ discovery potential to 103.8 GeV (just 300 MeV beyond the present mass limit)

Therefore no particular optimisation are requested from our group for the running of the rest of the year.