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Search for neutral Higgs bosons in the Standard Model and the MSSM at 189 GeV

DELPHI Collaboration

Preliminary Results
for Winter99 Conferences

This note presents an update of the search for Higgs bosons at LEP energies ranging from 130 to 189 GeV. The analysis at 183 GeV has been described in detail in the paper CERN-EP 99-06 (submitted to E.Phys.J. C). First results from 189 GeV have been presented by Vanina Ruhlmann-Kleider at the LEPC in November 1998.

The analyses themselves are unchanged since the LEPC meeting. However, the derivation of the limits on the Higgs mass has been improved by including two-dimensional information in the likelihood ratio method. In addition to the mass spectrum, which is used for all decay channels, the distribution of a discriminant variable is also taken into account for the four-jet final state, hence increasing the sensitivity of the search.

Searches: Higgs bosons - hZ channel

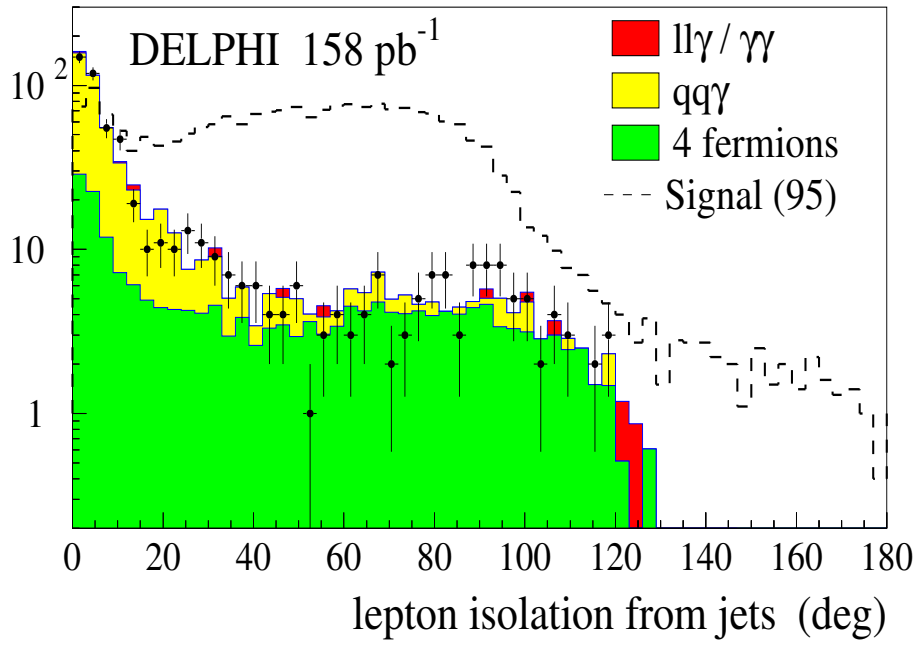
•Event selection:

hZ channel	$\mathcal{L}(\mathrm{pb}^{-1})$	obs.	exp. bkg.	$\epsilon_{95}(\%)$	exp. sig_{95}
h ee	155.4	0	1.91±0.41	44.8	0.39
h $\mu\mu$	158.0	2	1.90±0.20	59.4	0.52
h $\nu\nu$	153.3	2	4.11±0.48	24.7	1.27
h $\tau\tau$	158.0	0	0.55±0.15	12.8	0.10
$\tau\tau hadr$	158.0	1	2.50±0.29	15.6	0.23
$hadr\ q\bar{q}$	158.0	21	20.31±2.09	44.5	7.56
total	-	26	31.3 ±2.2	-	10.1

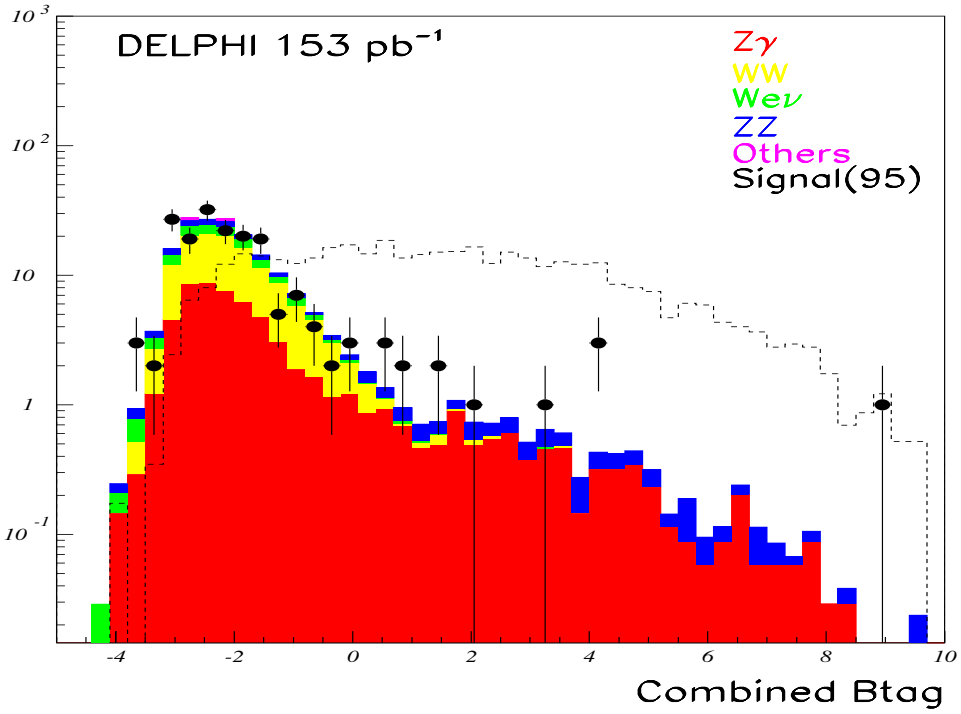
⇒Good agreement with SM predictions

NB: working point determined by the automatic optimization procedure (minimization of the expected CL_s taking the reconstructed Higgs mass into account)

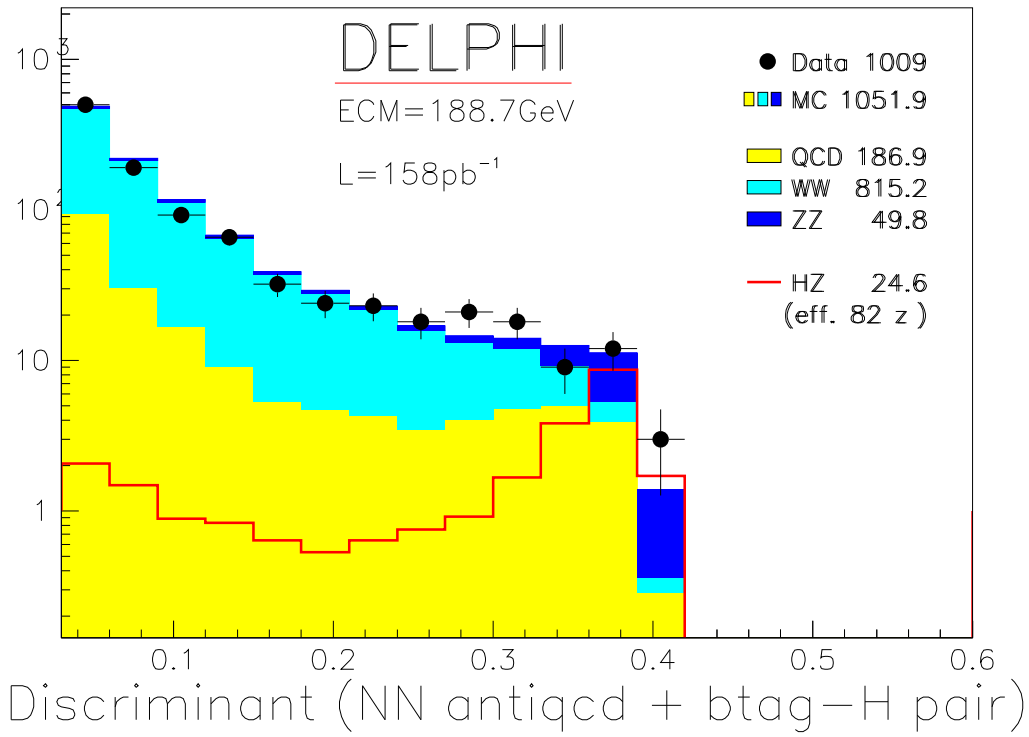
•Data vs simulation: the h$\mu\mu$ channel



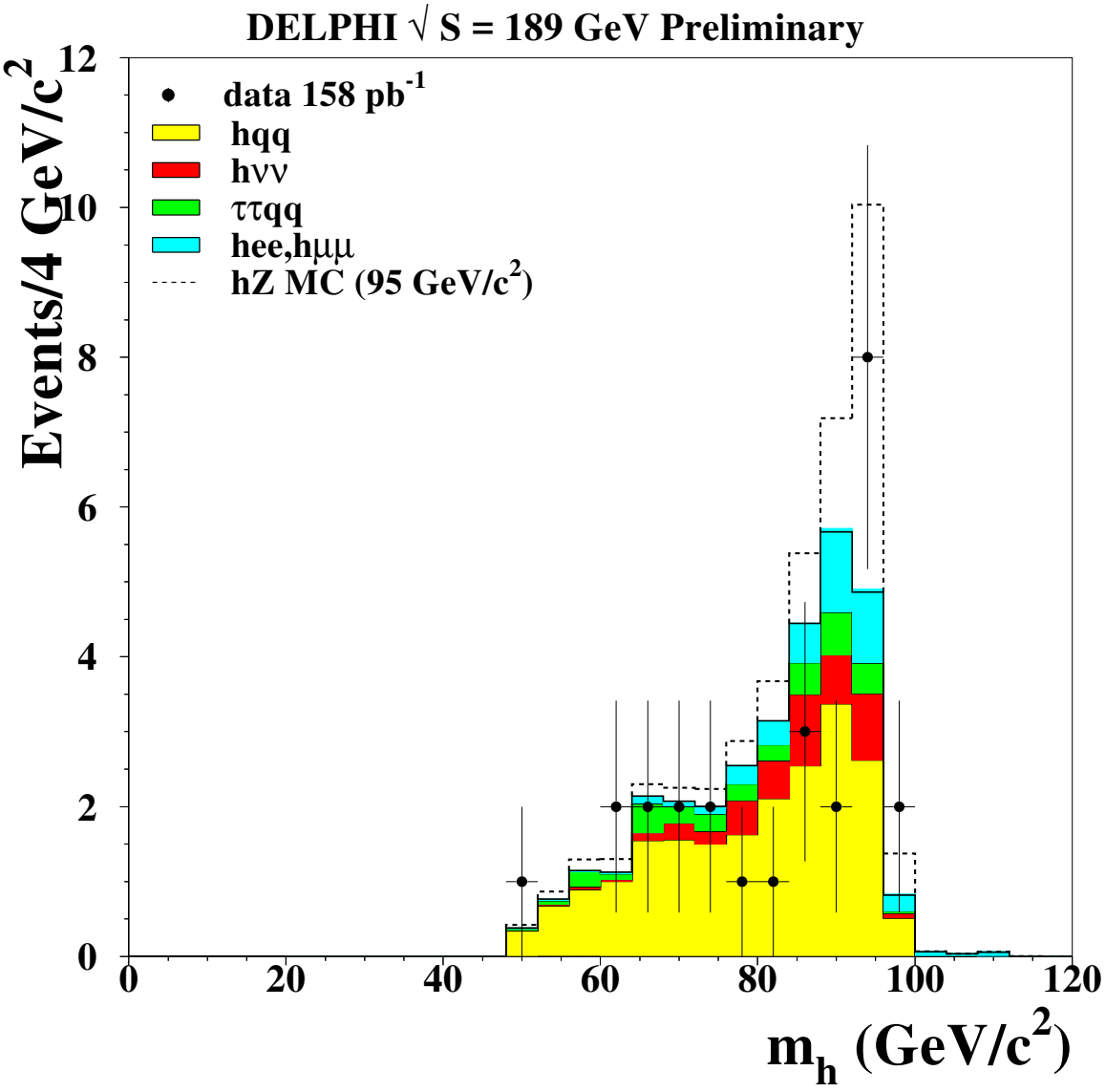
h $\nu\bar{\nu}$ channel



4-jet channel



•Reconstructed M_h spectrum:



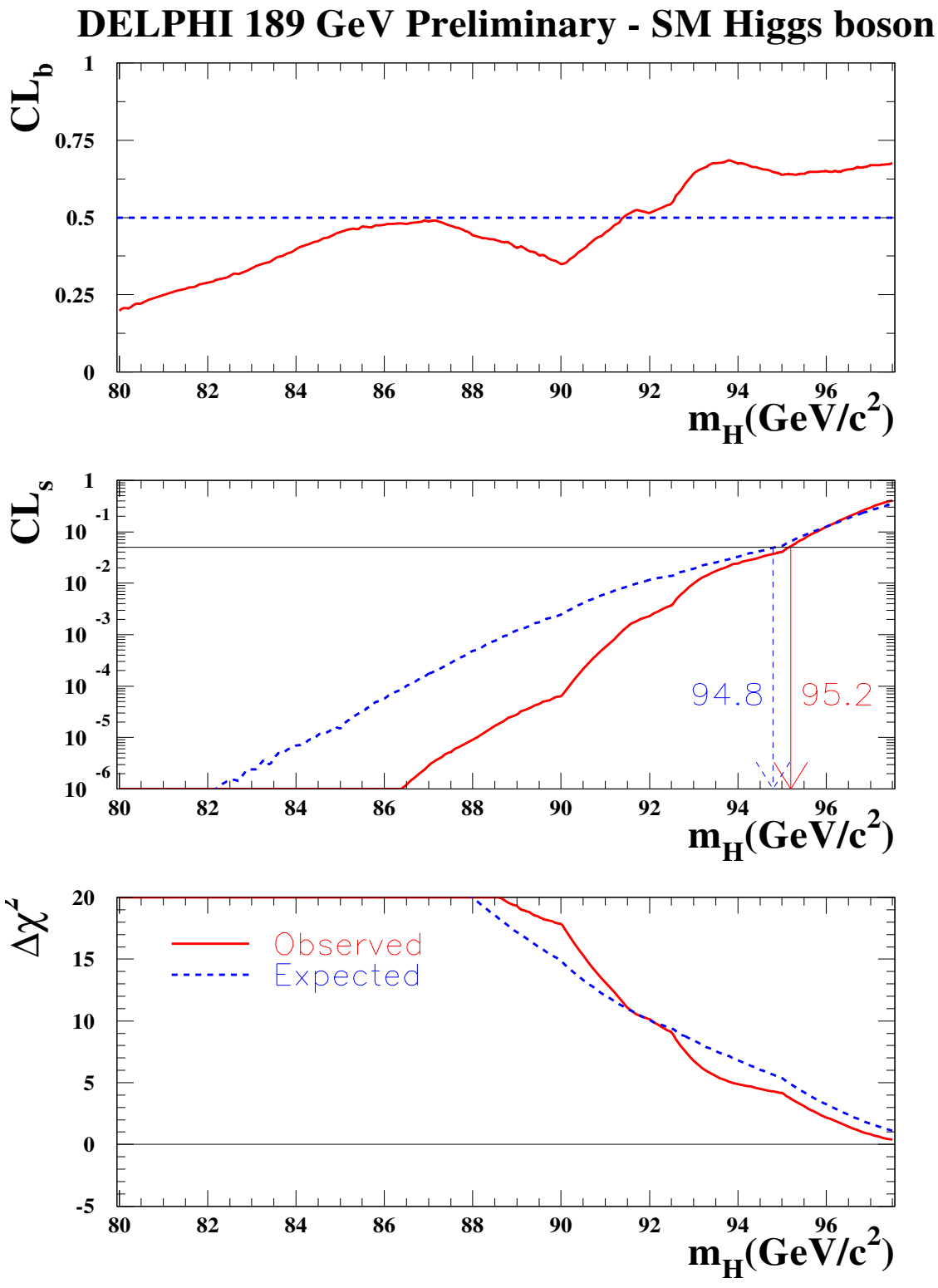
•95% Exclusion limit on the SM Higgs boson:

Statistical method:

•based on likelihood ratio test-statistics

•takes into account rates and distributions from 1 or 2 discriminant variable(s) in each channel

•uncertainties on efficiencies and background rates included



observed: M_h >95.2 GeV expected: 94.8 GeV (mean)

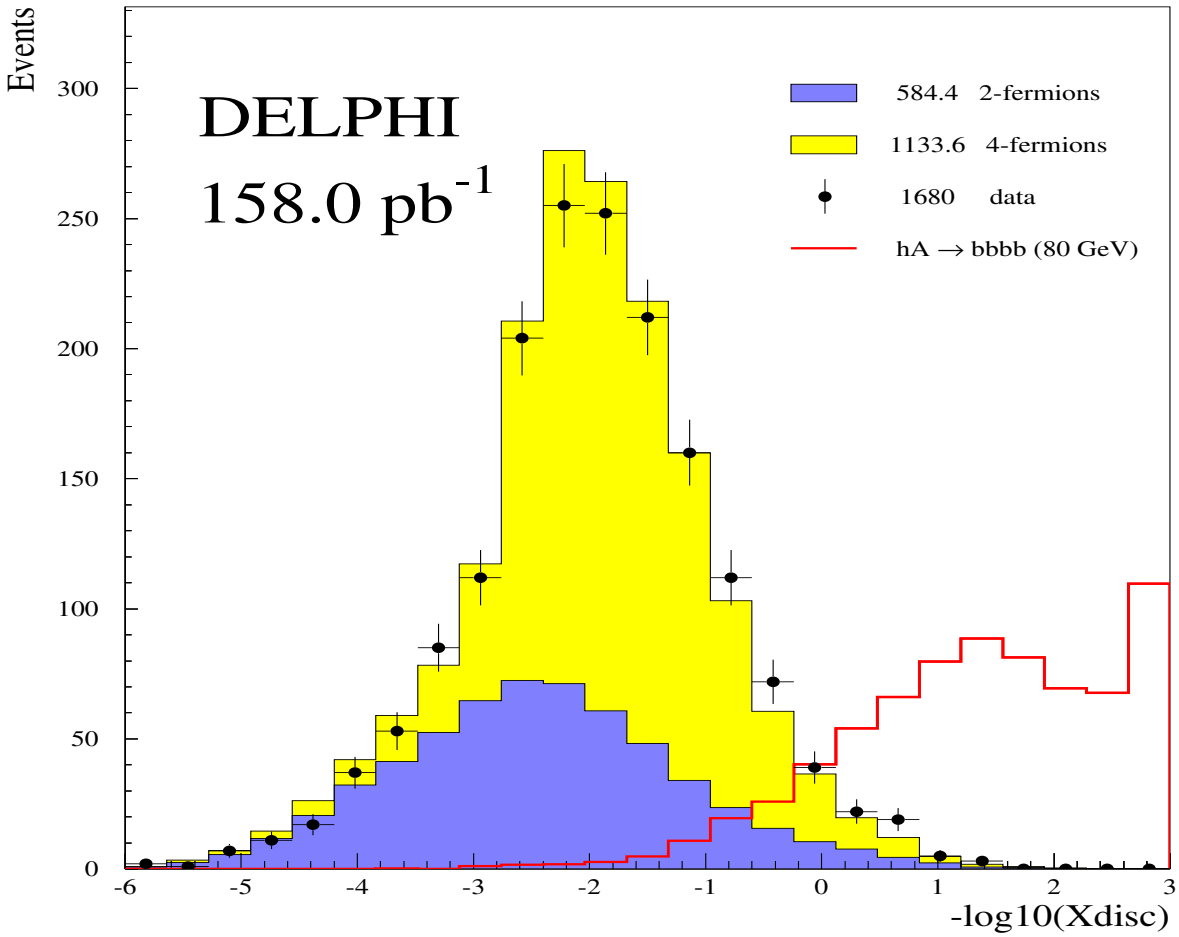
Searches: Higgs bosons - hA channel

•Event selection:

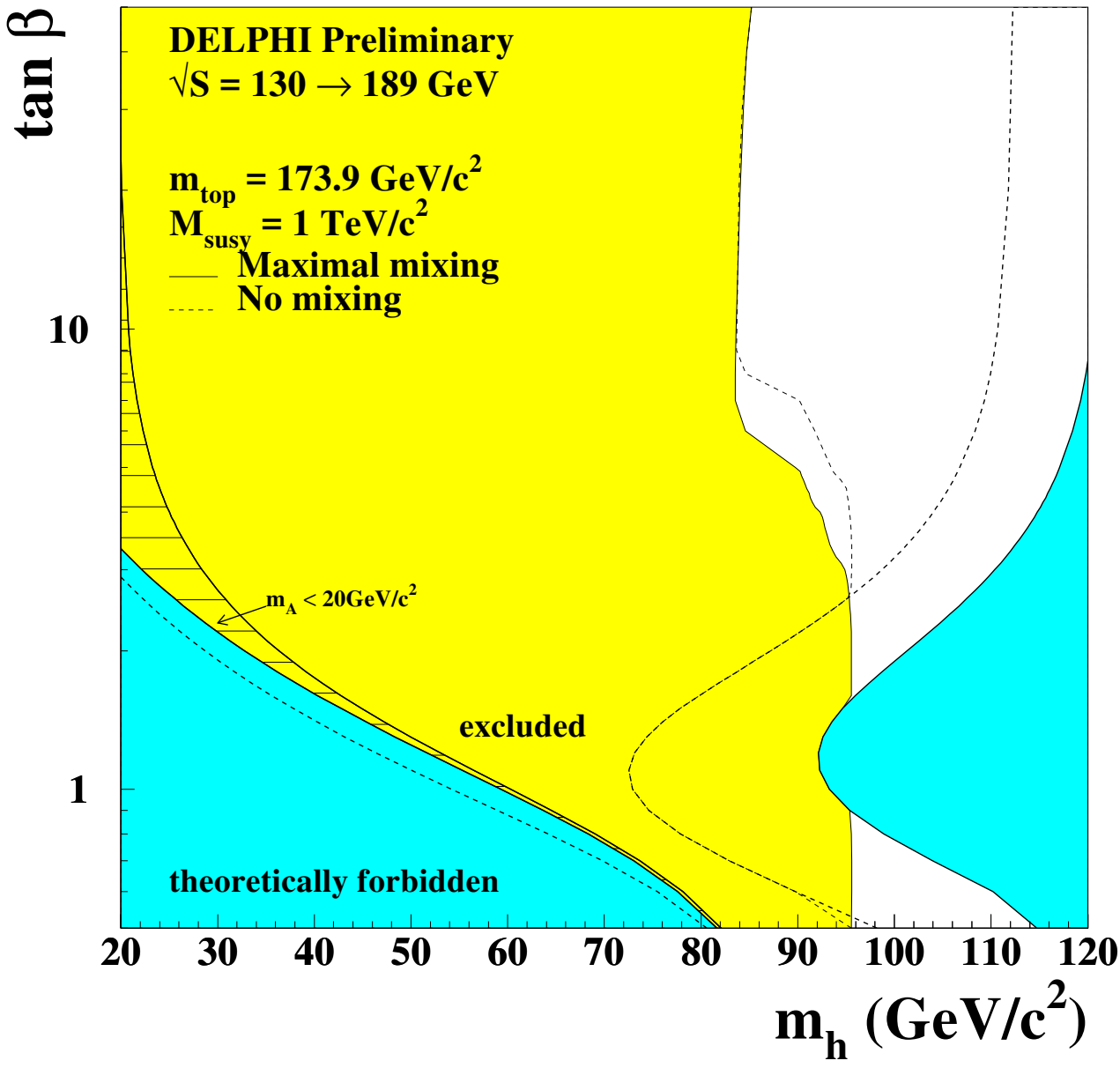
hA channel	$\mathcal{L}(\mathrm{pb}^{-1})$	obs.	exp. bkg.	$\epsilon_{80}(\%)$	exp. sig_{80}
$\tau\tau b\bar{b}$	158.0	0	0.55±0.15	18.3	0.31
$b\bar{b}b\bar{b}$	158.0	11	11.1±0.80	65.3	6.47
total	-	11	11.6±0.81	-	6.8

NB: working point in 4-b channel: chosen by hand to allow for more statistics (statistics with 1d working point was much too low)

NB: 2d information in 4b channel = distribution of reconstructed $M_h + M_A$ vs Likelihood output



•95% MSSM exclusion limits (benchmark scans): tanβ vs M_h plane

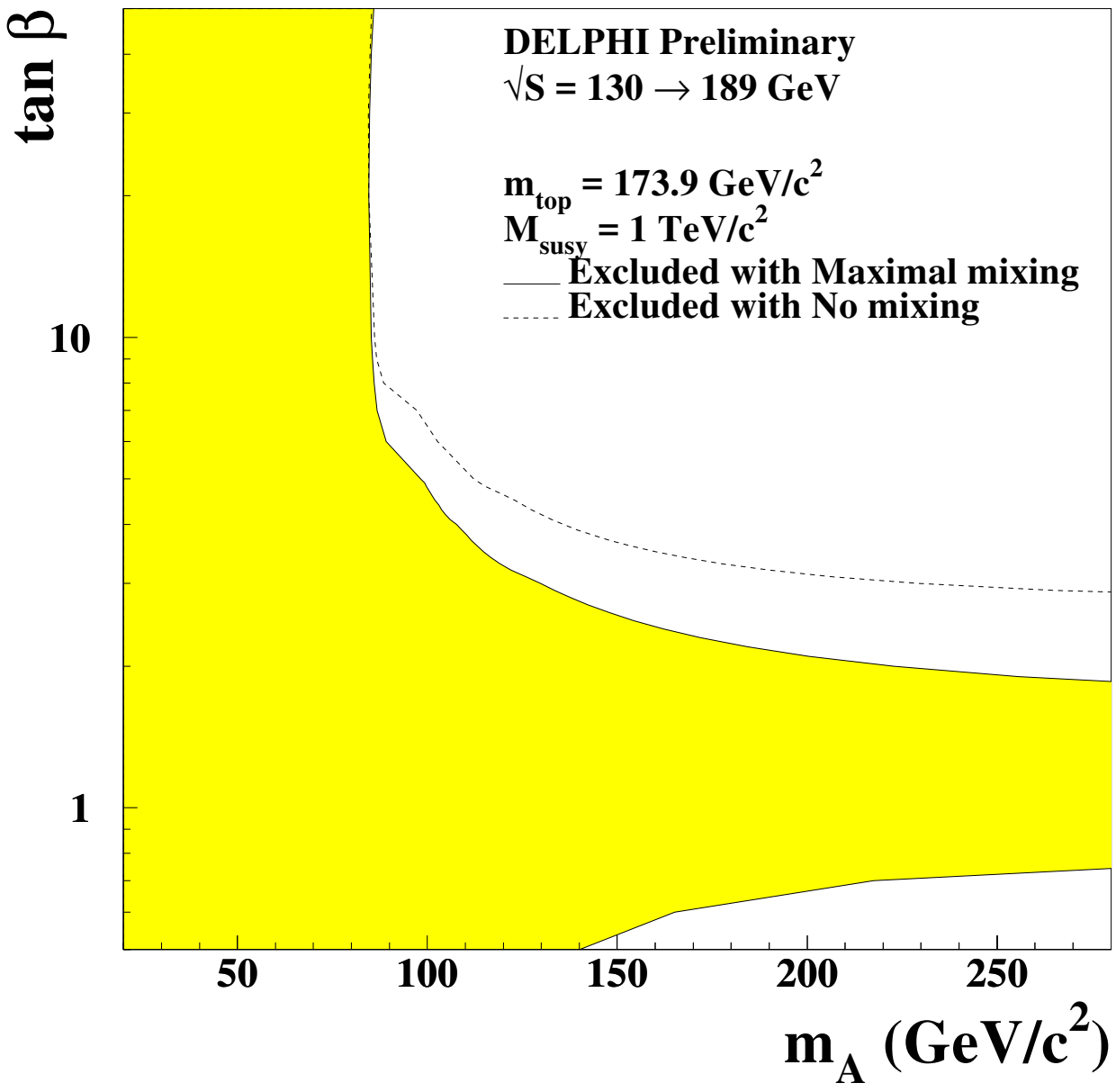


$M_h > 83.5$ GeV (exp. 80.5 GeV) for all $\tan\beta > 0.5$

$0.6 < \tan\beta < 2.6$ excluded for no mixing

$0.9 < \tan\beta < 1.5$ excluded for maximal mixing

•95% MSSM 2d exclusion limits: tanβ vs M_A plane



$M_A > 84.5$ GeV (exp. 81.6 GeV) for all tan$\beta > 0.5$

Gain of $\sim$ 1 GeV (200 MeV) in obs. (exp.) limits going from 1d to 2d limits calculation