

Exotica Research Line

Contributions to the 2003 summer conferences

Abstracts:

Paper 0260: Search for single top production via FCNC with the DELPHI detector at LEP at $\sqrt{s}=189-208\text{GeV}$

Draft 2 submitted for circulation. Results are not expected to change → submit to conferences.

Paper 0261: Search for fermiophobic Higgs at LEP2

Moriond conference note will be reused.

Paper 0262: Flavour Independent Neutral Higgs Boson Searches with DELPHI at LEP-2

Moriond conference note will be reused.

Paper 0384: Search for a fourth generation b' -quark at LEP-II at $\sqrt{s}=200-209\text{ GeV}$

Note is almost ready – final checks / review being done.

Paper 0259: Search for excited leptons with the DELPHI detector in e^+e^- collisions at $\sqrt{s}=189-208\text{ GeV}$

Draft 0 in review, but results might still change – will be withdrawn.

Search for single top production via FCNC with the DELPHI detector at LEP at $\sqrt{s}=189\text{-}208\text{GeV}$

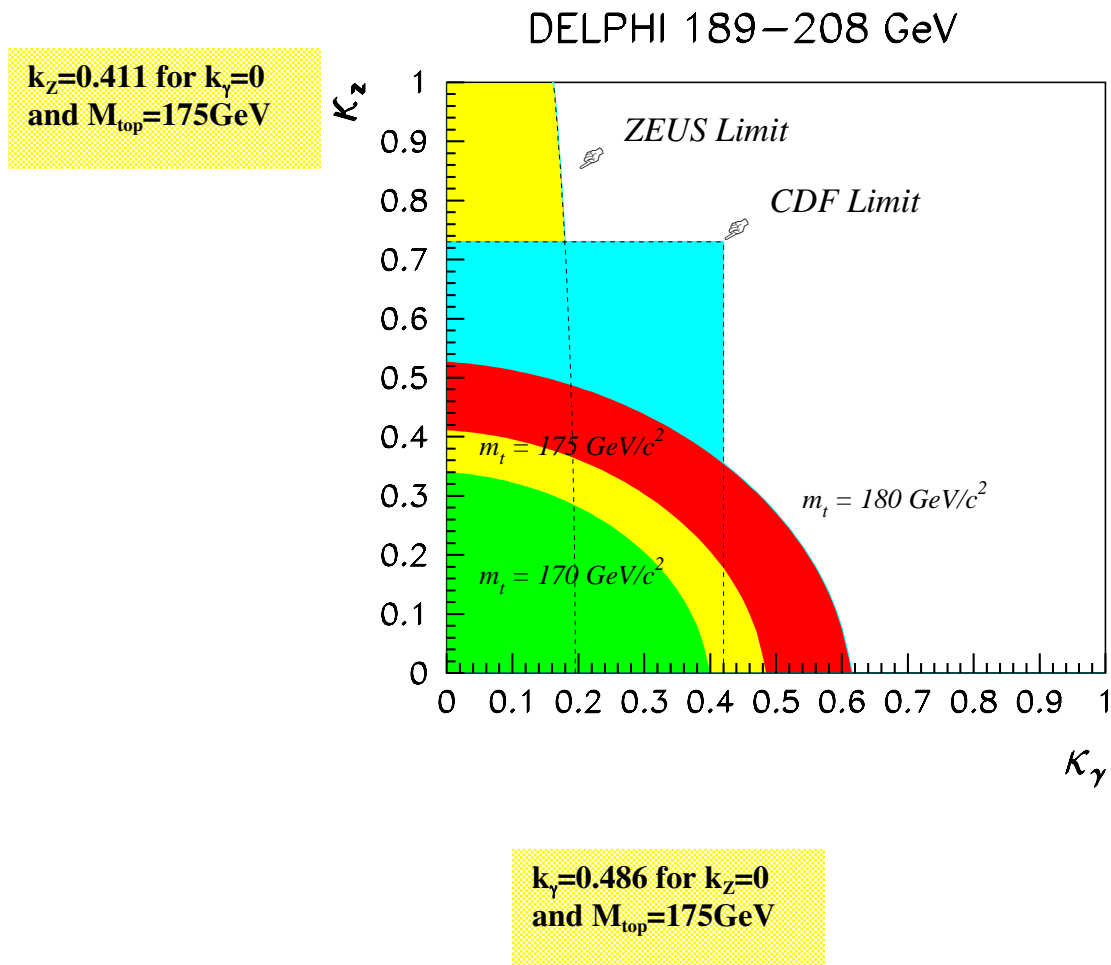
Process: $e^+e^- \rightarrow Z/\gamma \rightarrow tc \rightarrow Wbc$

Forbidden in SM, possible in extensions: use general Lagrangian involving two anomalous couplings k_Z and k_γ .

Topologies analysed:

- Hadronic ($W \rightarrow qq'$)
- Semileptonic ($W \rightarrow l\nu$)

Both using a likelihood for the final selection.

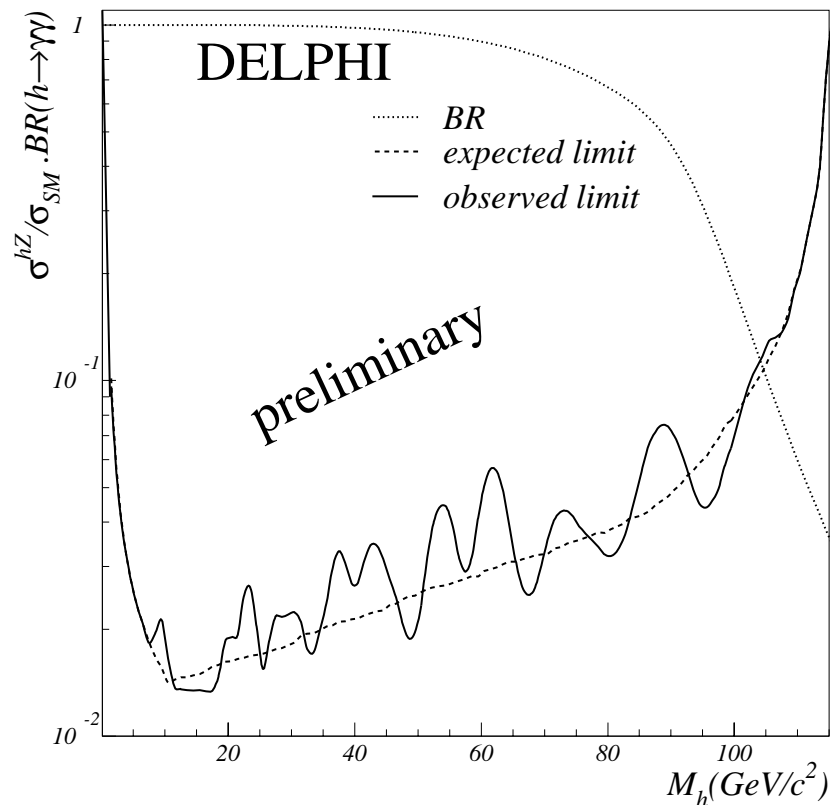


Search for fermiophobic Higgs at LEP2

Search for Higgs boson decays to photons in 2HDM models with suppressed couplings of h to fermions. Channels searched for:

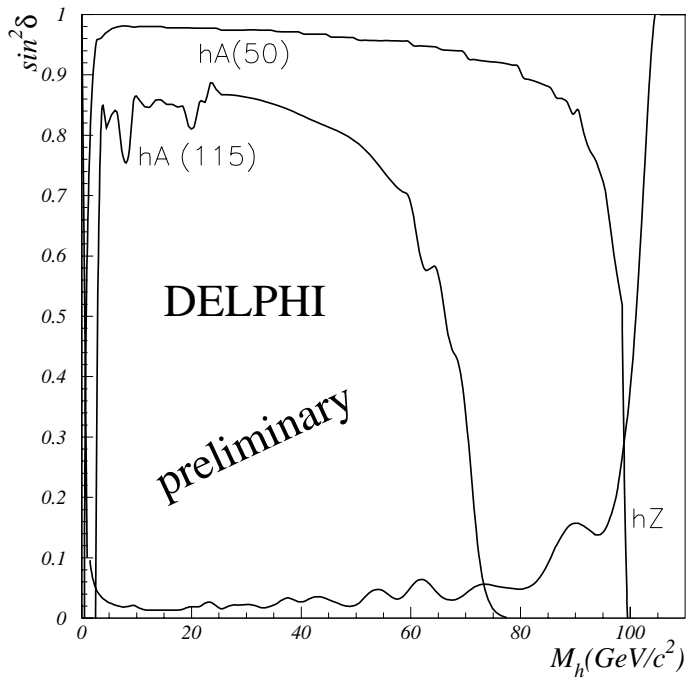
- hZ with $h \rightarrow \gamma\gamma$, $Z \rightarrow qq, ll$ or $\nu\nu$
- hA with $h \rightarrow \gamma\gamma$, $A \rightarrow bb$
- hA with $h \rightarrow \gamma\gamma$, $A \rightarrow hZ$, $Z \rightarrow qq$

Limit on production cross section from hZ production (relative to SM and including $BR(h \rightarrow \gamma\gamma)$):



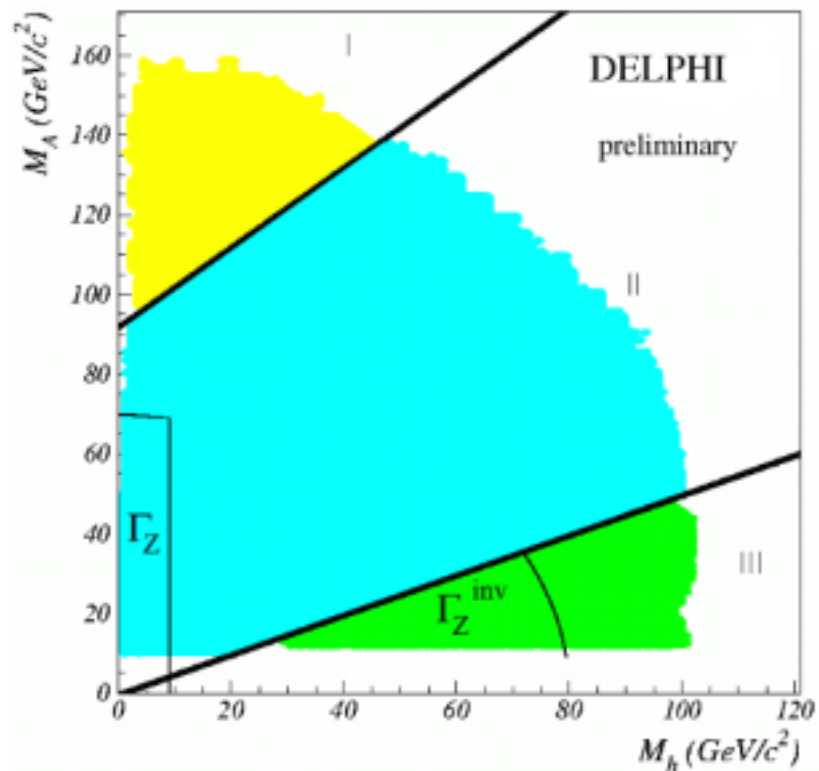
Comparison with SM prediction (setting $hff \rightarrow 0$):
 $M_h < 104.1 GeV$ ($104.6 GeV$ expected)

Limits from hZ and hA production: in 2HDM complementary ($\propto \sin^2(\alpha-\beta)$ and $\cos^2(\alpha-\beta)$) \rightarrow interpret as limits on $\sin^2(\alpha-\beta)$ (depends on both Higgs masses!)



M_h excluded for all $\sin^2(\alpha-\beta)$ up to the intersection of the hZ and hA lines.

Scan $M_A \rightarrow$ limits in $M_h - m_A$ space



Flavour Independent Neutral Higgs Boson Searches with DELPHI at LEP-2

Search for hZ and hA production with hadronic Higgs decays.
Based on MC samples of Higgs \rightarrow light quark and gluon pairs,
with conservative estimates for efficiency and resolution.

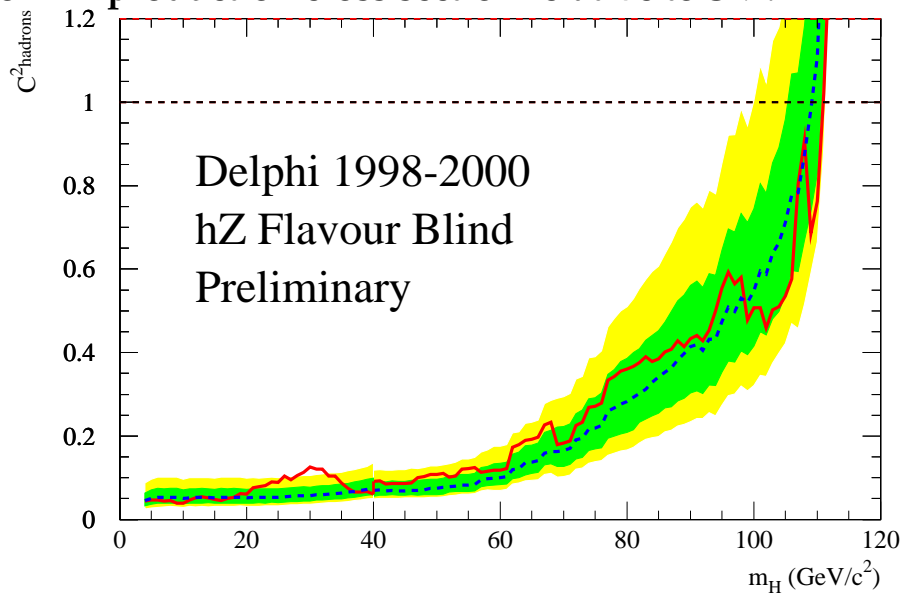
Channels & mass range covered:

<i>hZ channels</i>	
<i>qqqq</i>	$M_h < 40\text{GeV}, M_h > 40\text{GeV}$
<i>qqnn</i>	$M_h < 45\text{GeV}; 40\text{GeV} < M_h < 67.5\text{GeV},$ $70\text{GeV} < M_h < 87.5, 90\text{GeV} < M_h < 115\text{GeV}$
<i>qqll</i>	$40\text{GeV} < M_h < 115\text{GeV}$
<i>hA channels</i>	
<i>"four jets"</i>	~ equal masses
<i>"three jets"</i>	high mass difference
<i>"3jet, high T"</i>	both light

Mostly based on existing analyses:

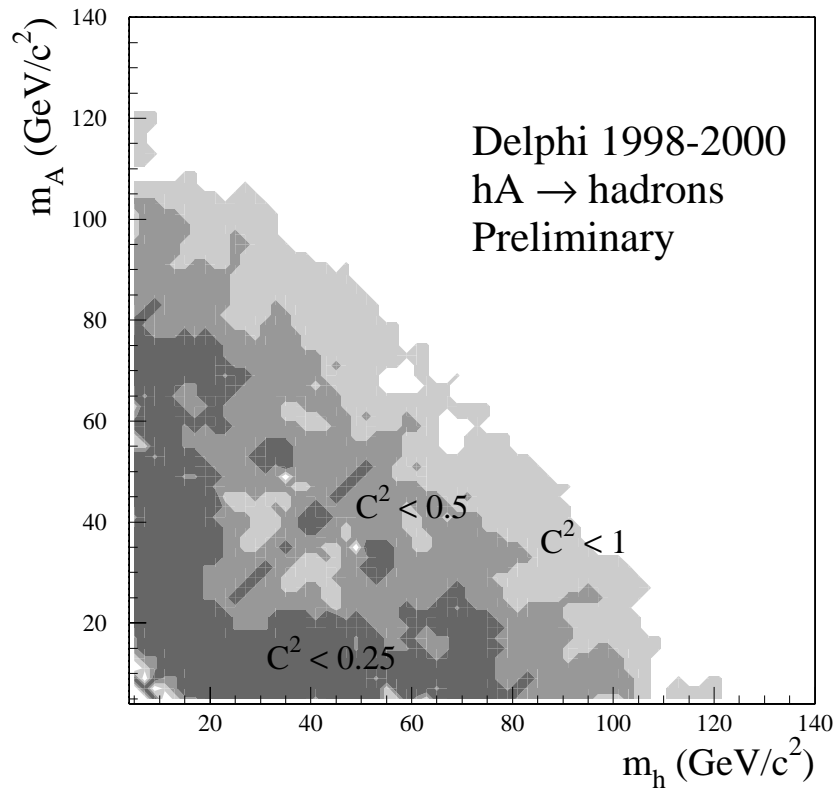
- probabilistic 4-jet analysis
- invisible Higgs analysis
- $Z\gamma^*$ analysis
- ...

Limits on hZ production cross section relative to SM:



Mass limits for SM cross section are 110.6 GeV for decays to ss and 110.0 GeV for decays to gg (SM decays: 114.1 GeV).

Limits on hA production cross section relative to SM:



Search for a fourth generation b' -quark at LEP-II at $\sqrt{s}=200\text{-}209\text{ GeV}$

4th generation of **heavy** fermions can be compatible with precision data. Assume sequential model with 4th generation quarks t' and b' .

Search for pair production of b' with CC decays (to cW) or FCNC decays (to bZ), expected to be dominant for $M_Z < M_{b'} < M_{H'} M_{t'}$.

Channels investigated (CC):

- 6 jet (ccqqqq)
- 4 jet + lepton (ccqqlv)

Channels investigated (FCNC):

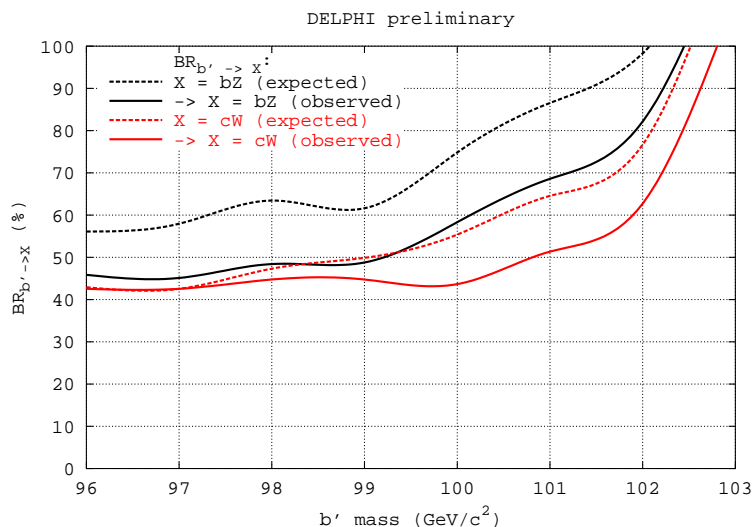
- 6 jet (bbqqqq)
- 4 jet + missing E (bbqqvv)
- 2 jet + 2 leptons (bbqqll)

Lepton channels divided into e , μ and no-id (mainly τ). All analyses except 2j+2l based on discrimination with likelihood ratio. No overlap within CC or FCNC channels.

Data: 196–209 GeV. Analysis now done for $M_{b'}$ range of 96-103 GeV.

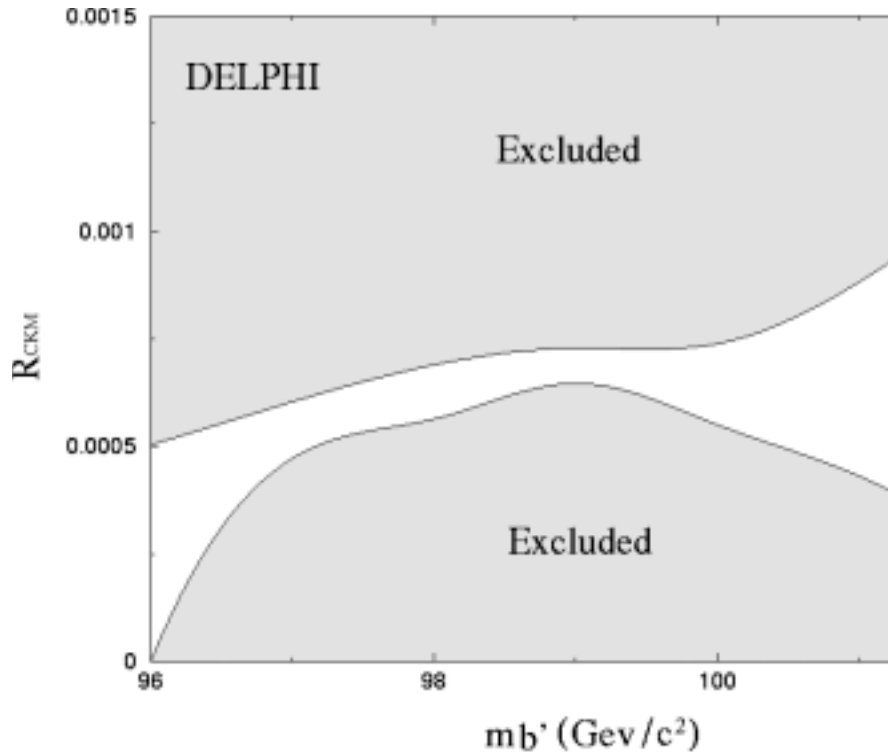
Results (preliminary!):

Assuming SM-like pair production cross-section limits on $BR(b' \rightarrow bZ)$ and $BR(b' \rightarrow cW)$ can be derived.



Assuming a sequential model with assumptions on the CKM-matrix (real, partially symmetric, nearly diagonal) the BRs can be expressed in terms of 3 parameters: $M_{b'}$, $M_{t'}$, $R_{\text{CKM}} = |V_{cb'}/(V_{tb'}V_{tb})|$.

→ Limits on R_{CKM} as $f(M_{b'})$ for two extreme values of $M_{t'}-M_{b'}$ (1GeV and 50GeV):



Note is in final review – should be ready in O(days).