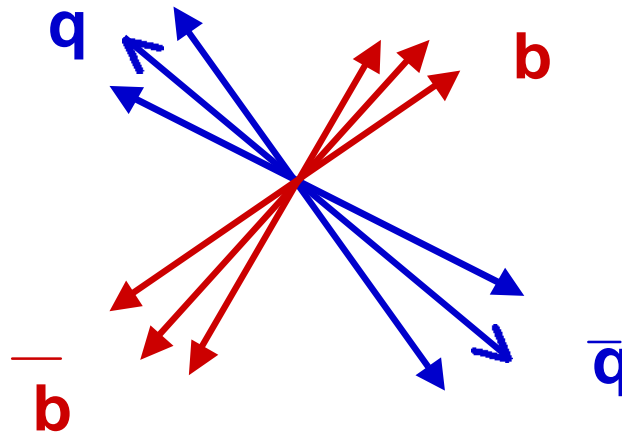


Mass Reconstruction in Fully Hadronic Boson-Boson decays



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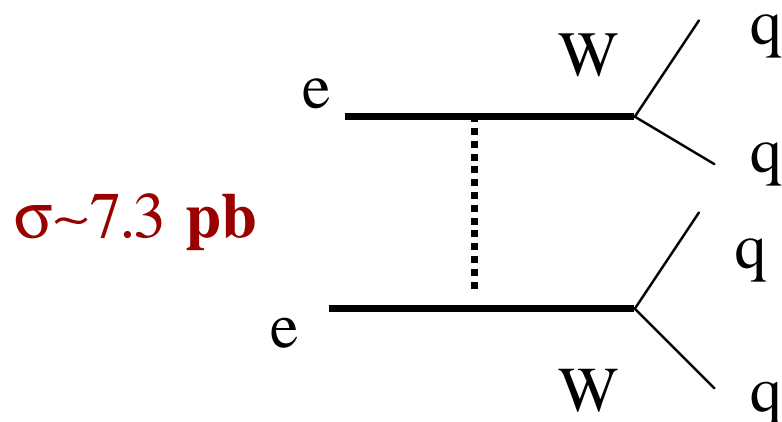
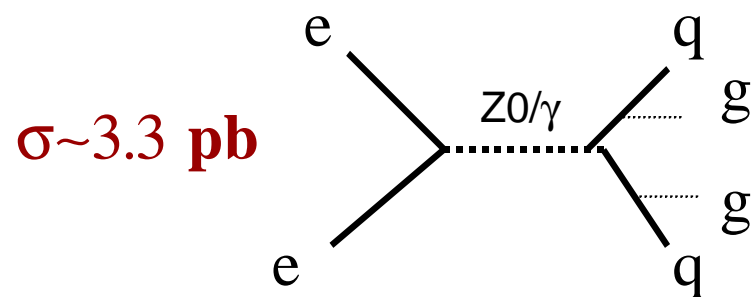
Introduction:



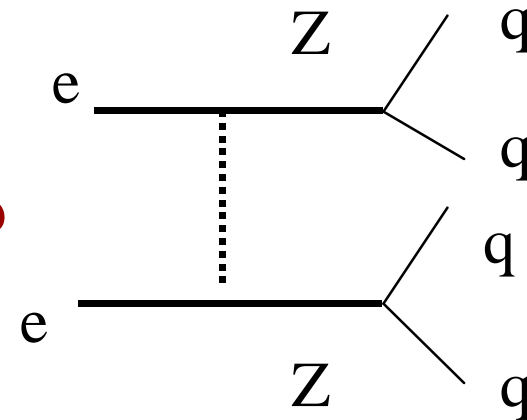
- ⌘ 4 jet events at LEP.
- ⌘ Jet Algorithm
- ⌘ Different Mass Estimators
- ⌘ '00 High energy events at LEP.
- ⌘ Summary

4 jet Bck. Events at LEP.

- ⌘ Since 1997 LEP is running above the ZZ threshold (182 GeV).
- ⌘ We are producing WW, ZZ and Z0/γ events into 4 jets:



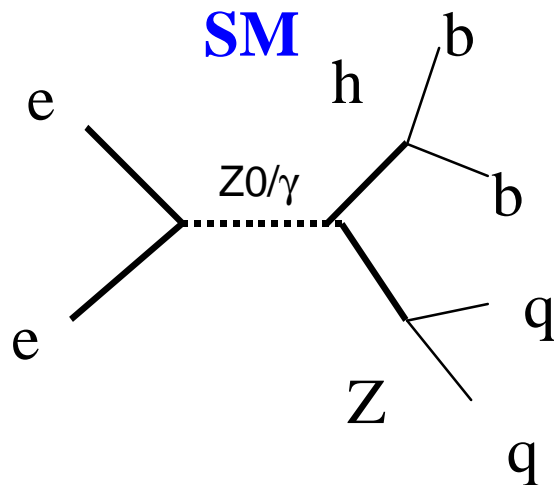
$\sigma \sim 0.5 \text{ pb}$



4 jet signal Events

⌘ Main decay channel for higgs boson(s) is into b quarks

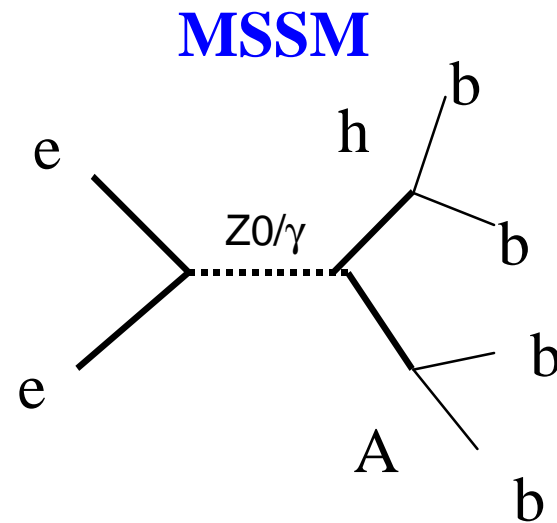
☒ 85% for SM and 92% for MSSM



$\sigma \sim 0.1 \text{ pb (} m_h = 114 \text{)}$



$S/B \sim 1/100 !$



$\sigma \sim 0.04 \text{ pb (} m_h = m_A = 90 \text{)}$



$S/B \sim 1/275 !$

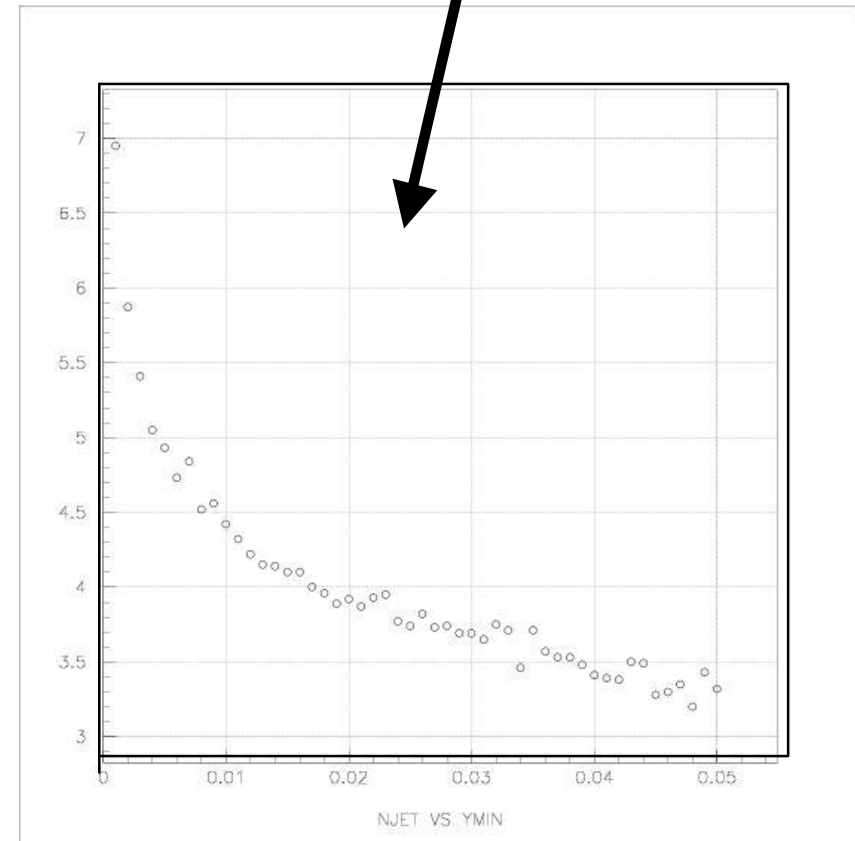
Jet Reconstruction:

- ⌘ Use of Durham algorithm:

$$y_{ij} = [2\min(E_i^2, E_j^2)(1-\cos\phi_{ij})]/E_{cm}^2$$

- ⌘ If y_{ij} for 2 'particles' is smaller than a certain value y_{min} they are joined up into a 'jet'.
- ⌘ Initial preselection of 4-jet events.

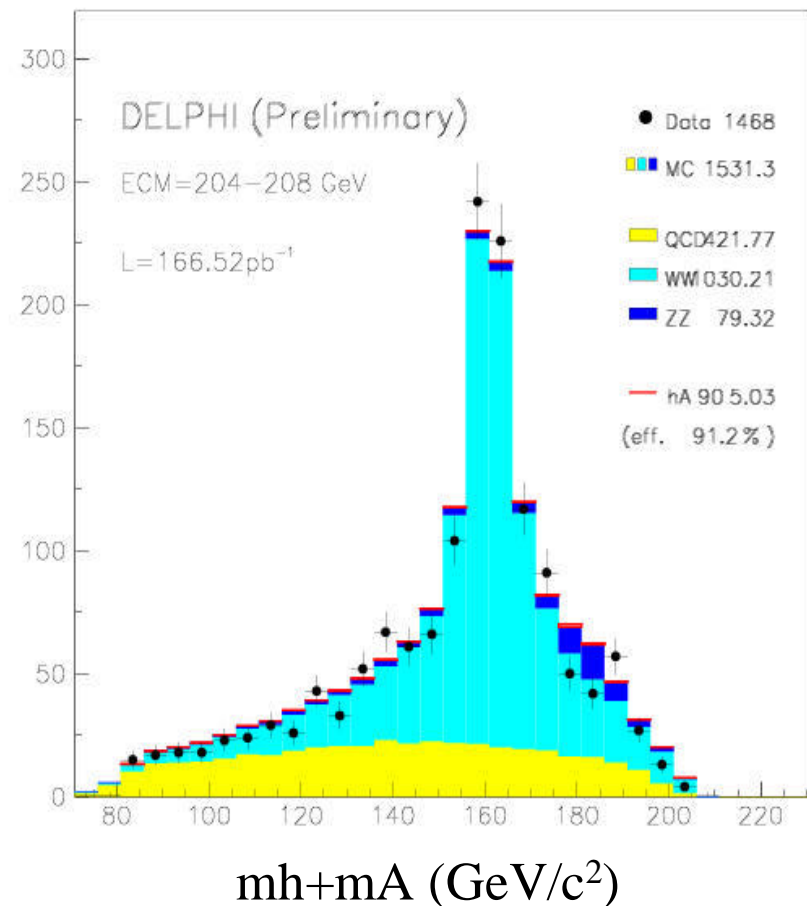
Njet vs y_{min}



Celso M. Rivero. CERN

Different Mass Stimators:

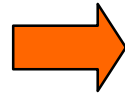
- ⌘ **Rescaling** (Momentum and energy Conservation, using angles)
 - ☒ $\sum \vec{\beta}_i E_i = 0$
 - ☒ $\sum E_i = E_{CM}$
- ⌘ **4C fit**: As rescaling but accepting 'small' jet angle movements. Use of angles as well as jet energies.
- ⌘ Three possible dijet combinations (12-34, 13-24, 14-23)
- ⌘ Usually smallest mass difference combination chosen.



Different Mass Stimators:

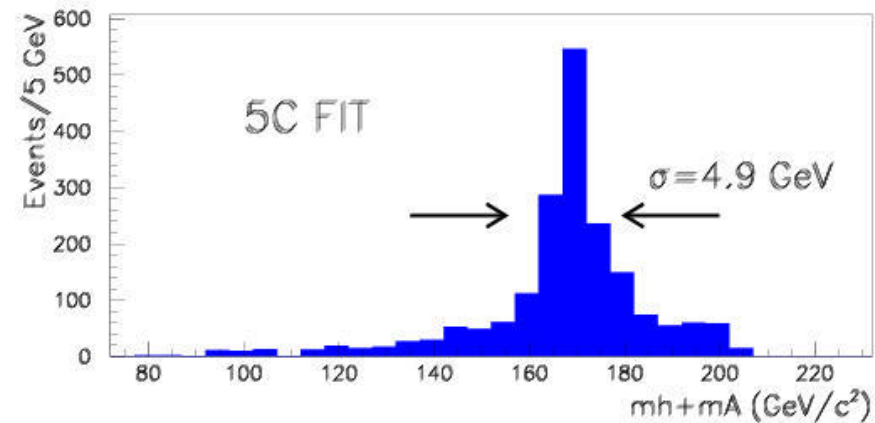
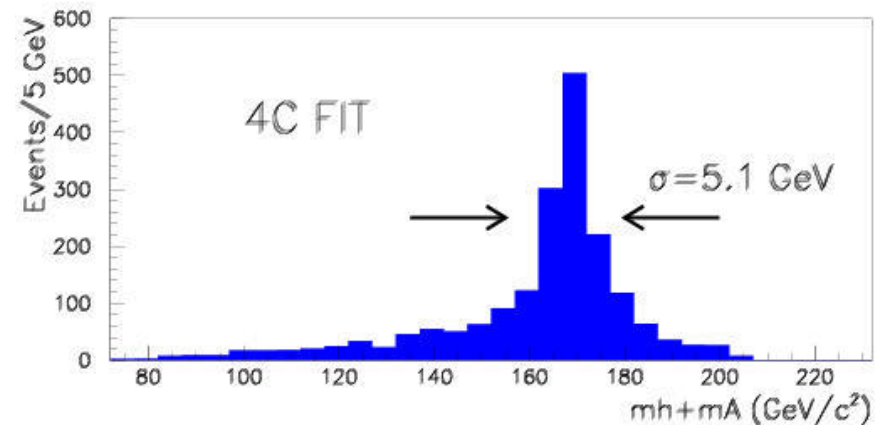
⌘ **5C fit**: as 4C fit but imposing an extra condition

☒ Equal Mass bosons



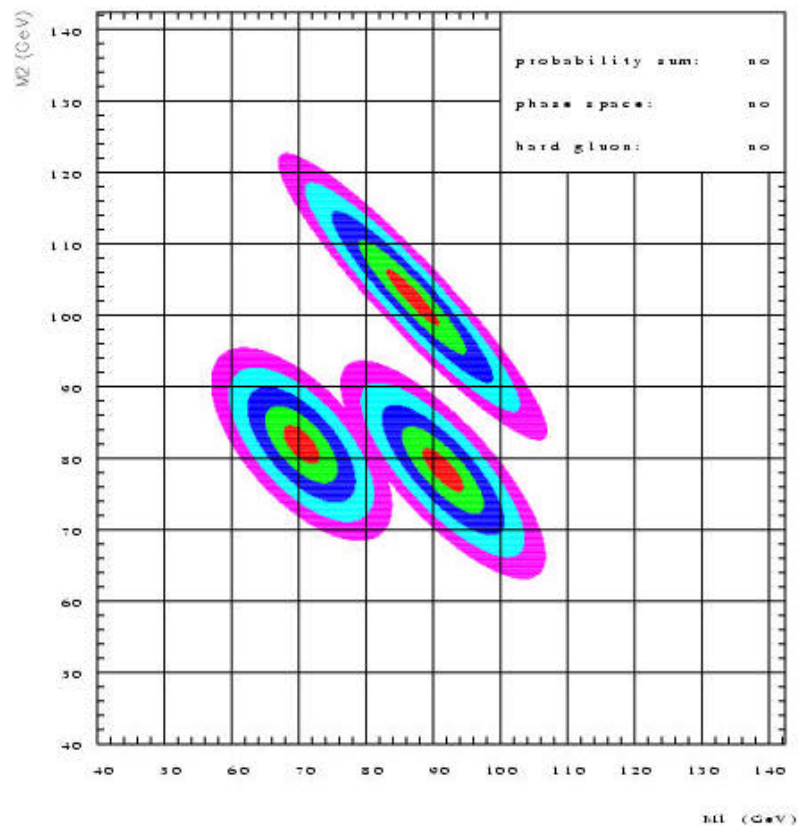
☒ Z boson present (m_h will then be the recoiling mass to the Z boson)

$m_h = m_A = 85 \text{ GeV}$

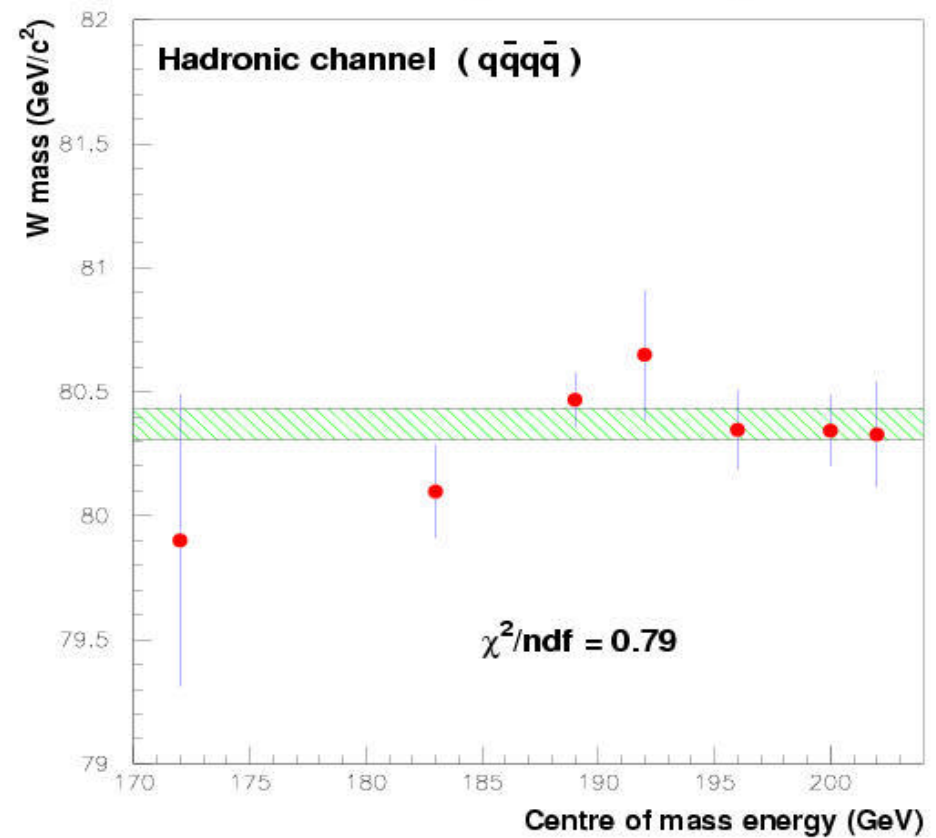


Ideogram and Precision Measurements :

1: TK Ideogram 2D, run 115548, event 2777, type Tan+DST



DELPHI preliminary

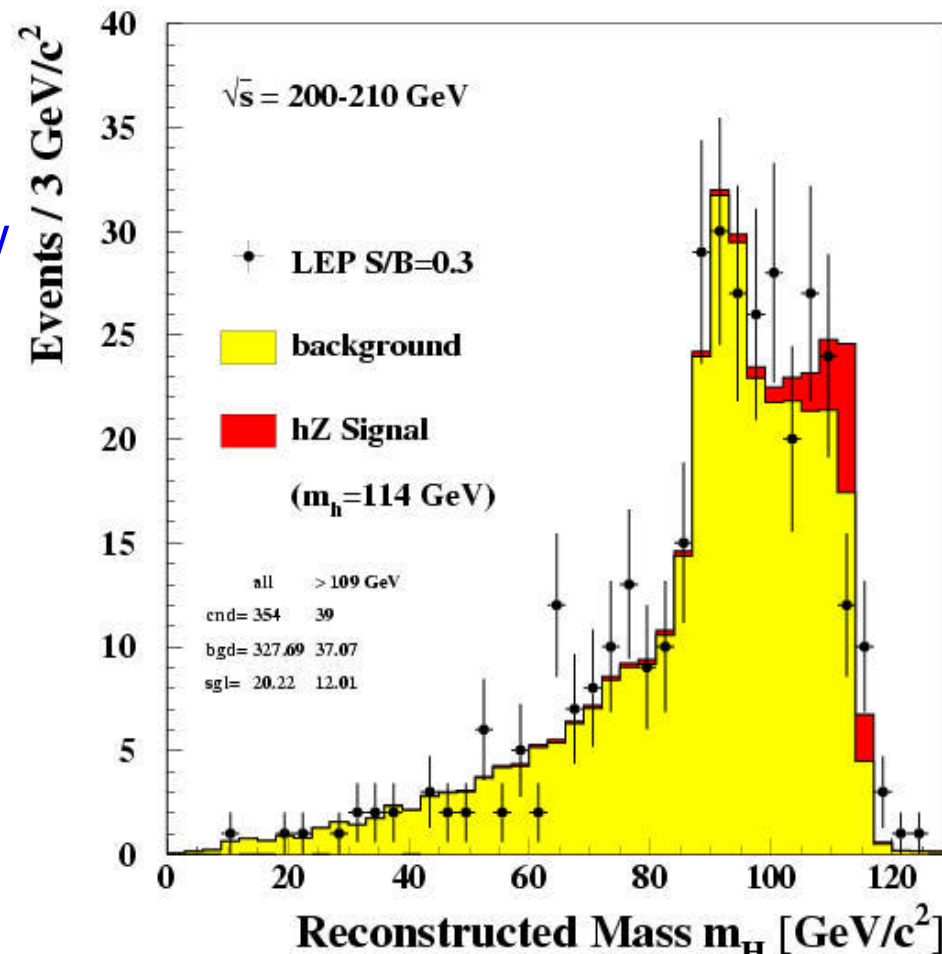


Standard Model Higgs Mass plots

⌘ S/B definition for mass plots:
number of expected events for a
114 GeV Higgs signal with
reconstructed mass $m_h > 109$ GeV
divided by the corresponding
number of selected background

⌘ 594 pb⁻¹ recolected from the 4
LEP experiments at energies
between 204-208 GeV

S/B > 0.3 →

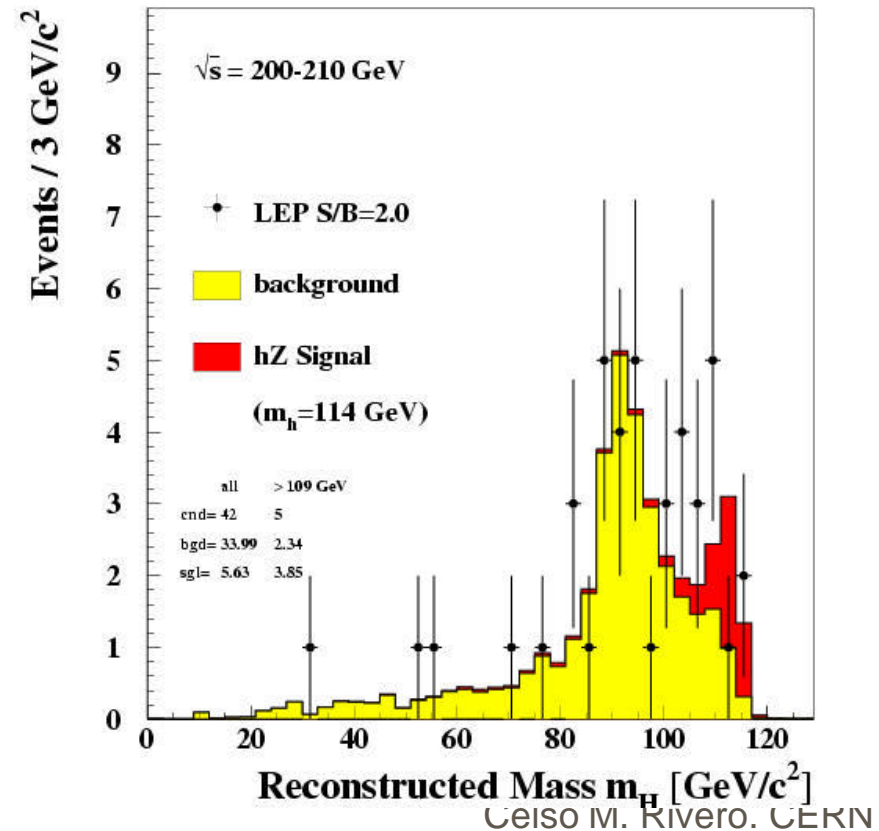
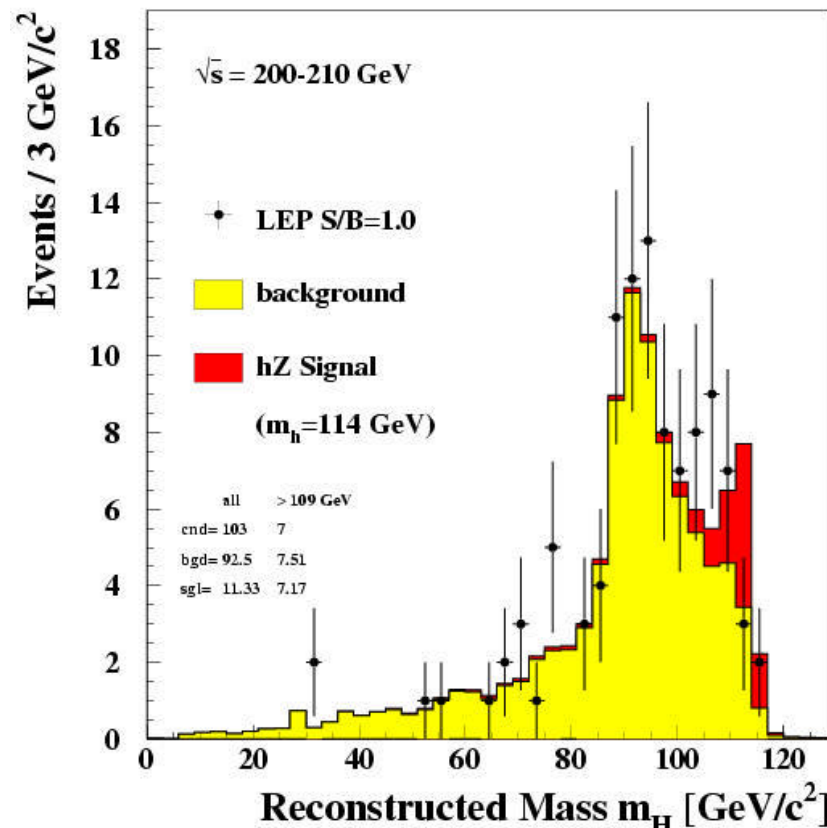


Standard Model Higgs Mass plots

$S/B > 1$



$S/B > 2$



LEPC (5/9) Results:

⌘ $-2\ln(Q)$ with minimum at
114.9 GeV

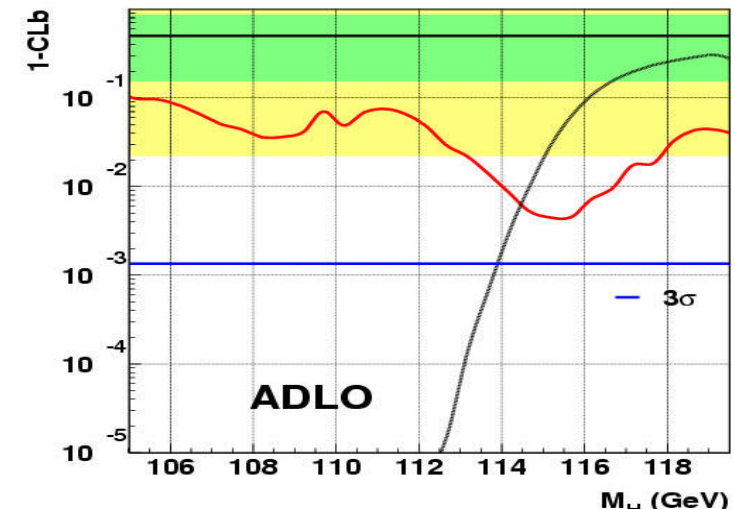
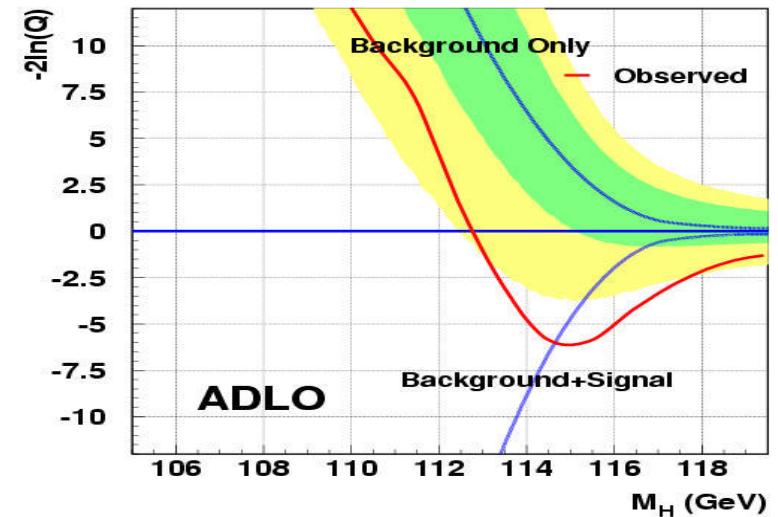
⌘ $1 - CL_b$ with minimum at
 2.6σ significance.

⌘ Observed limit:

⌘ $m_h > 112.3 \text{ GeV}/c^2$

⌘ Expected limit:

⌘ $m_h > 114.5 \text{ GeV}/c^2$



Summary:



- ⌘ ~2000 4 jet events per experiment so far this year.
- ⌘ Mass reconstruction used for:
 - ⌘ Precision measurements
 - ⌘ Higgs search
- ⌘ 2 main mass fits used: 4C and 5C (either equal mass or recoiling mass to the Z boson)
- ⌘ Comparison Data/MC shows some excess in the 4-jet channel:
 - ⌘ investigation will follow with extended run until November.