

ALEPH Status Report

LEPC Sept 5, 2000

D. Schlatter

CERN

TPC

SUSY Searches

Higgs Searches



Results are very PRELIMINARY

Y2K Data until 1. Sept.

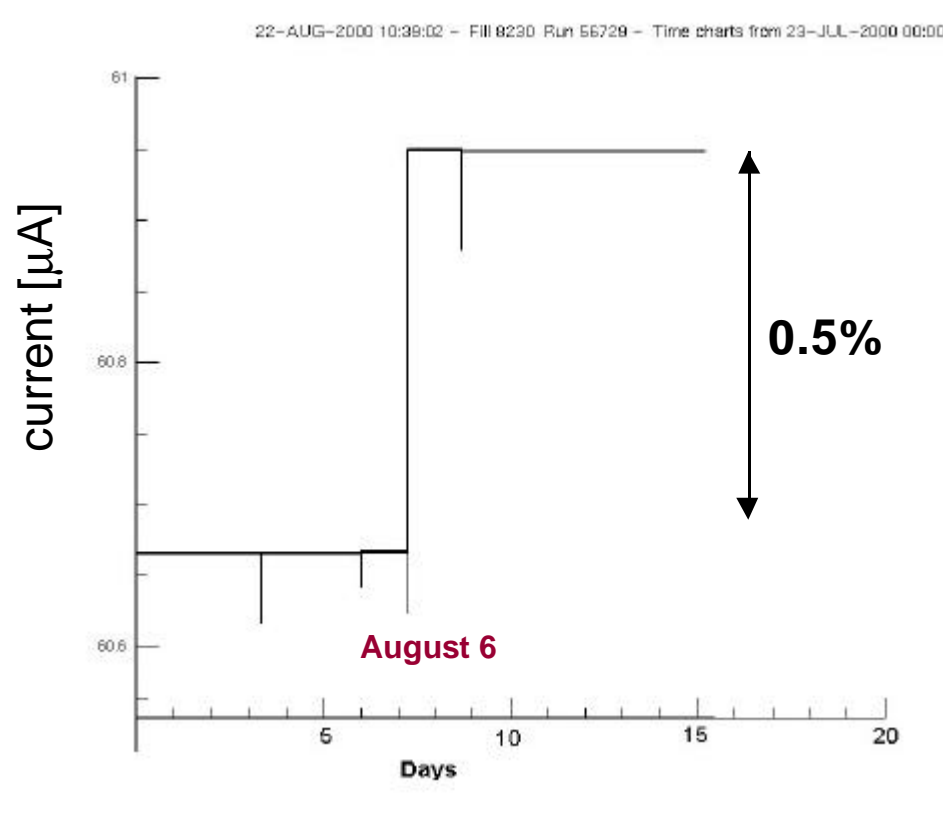
collected luminosity (in pb⁻¹)

	now	until July 20
all energies	154	93
<205 GeV	4	
~205.5 GeV	68	62
~206.5 GeV	75	31
>207 GeV	7	

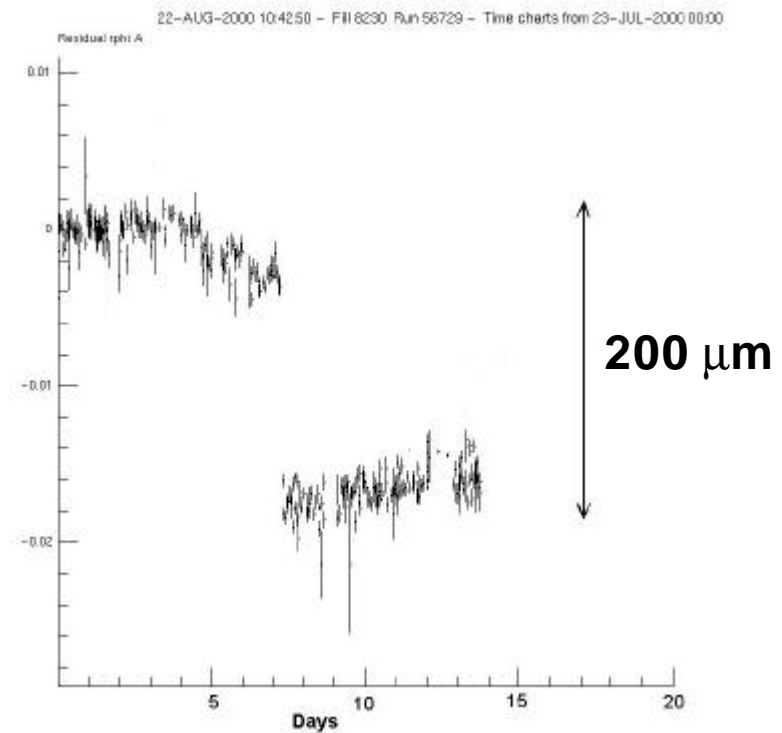


Short in TPC Field Cage

TPC field cage current



track residuals in VDET



Similar to August 1999 incident (carbon fibre)

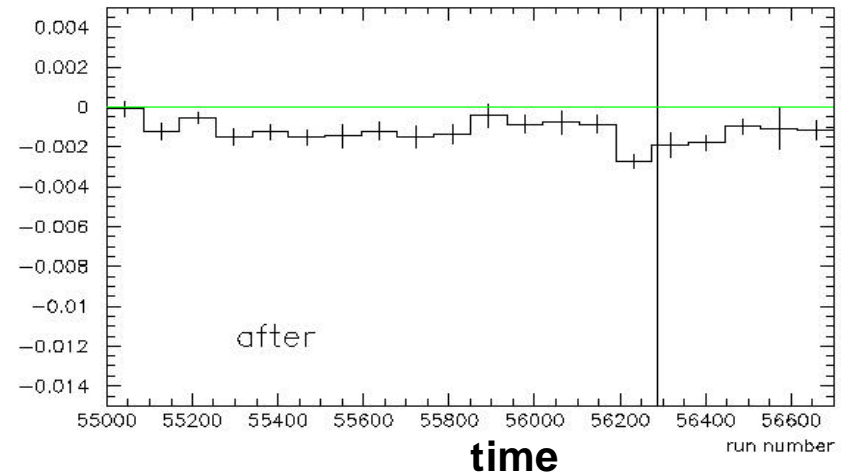
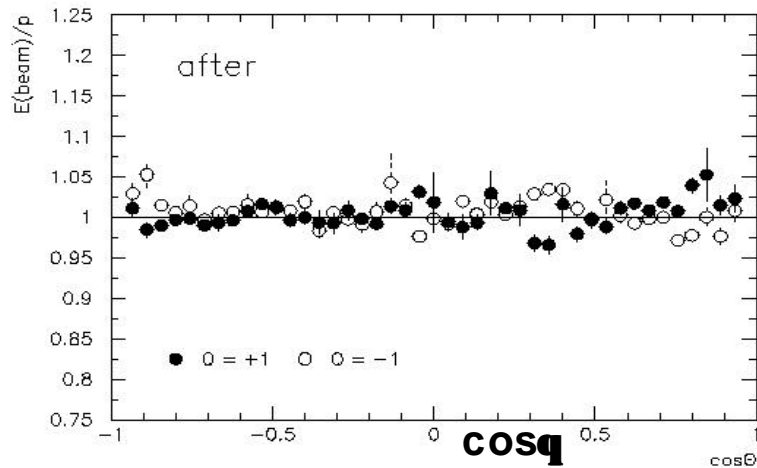
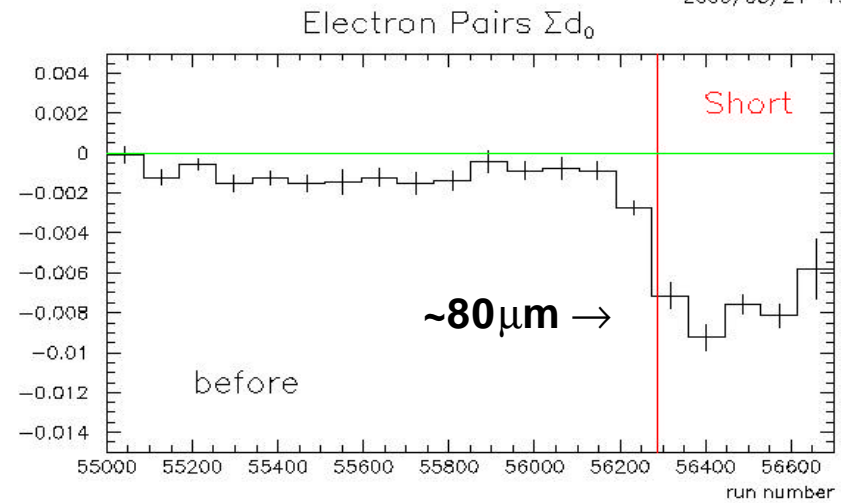
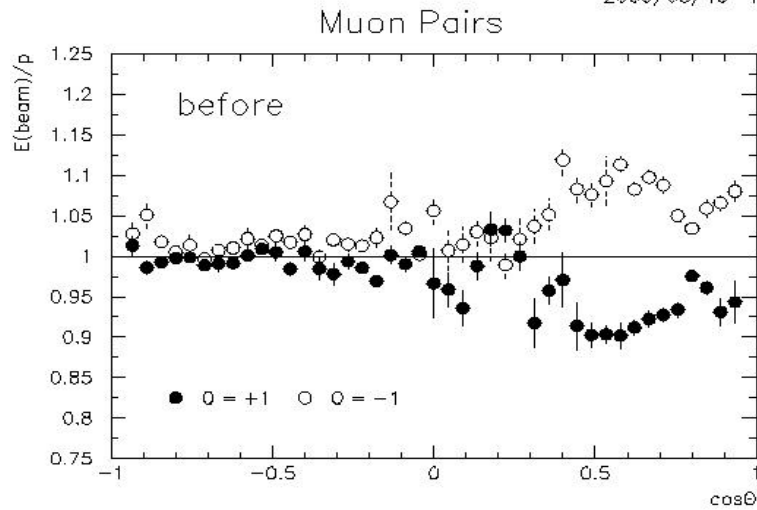


TPC Short continued

2000/08/19 14:27

2000/08/21 13:30

E_{beam}/P



affected data have been reprocessed



Hot News

8h30, Sept 2

LEP, heavy beam loss

⇒ TPC short is gone!



Light s-bottom Search

At LEPC on July 20, ALEPH presented a fresh analysis with a possible excess for:

b-jets with leptons: **56 obs. / 33.6 exp. for 580 pb⁻¹**
(39 obs. / 23.0 exp. 411 pb⁻¹)

- n-tuple of preliminary analysis contained lepton-id for isolated leptons.
- **new study** using e.g. heavy flavour lepton identification, more adequate for leptons in jets yields no excess

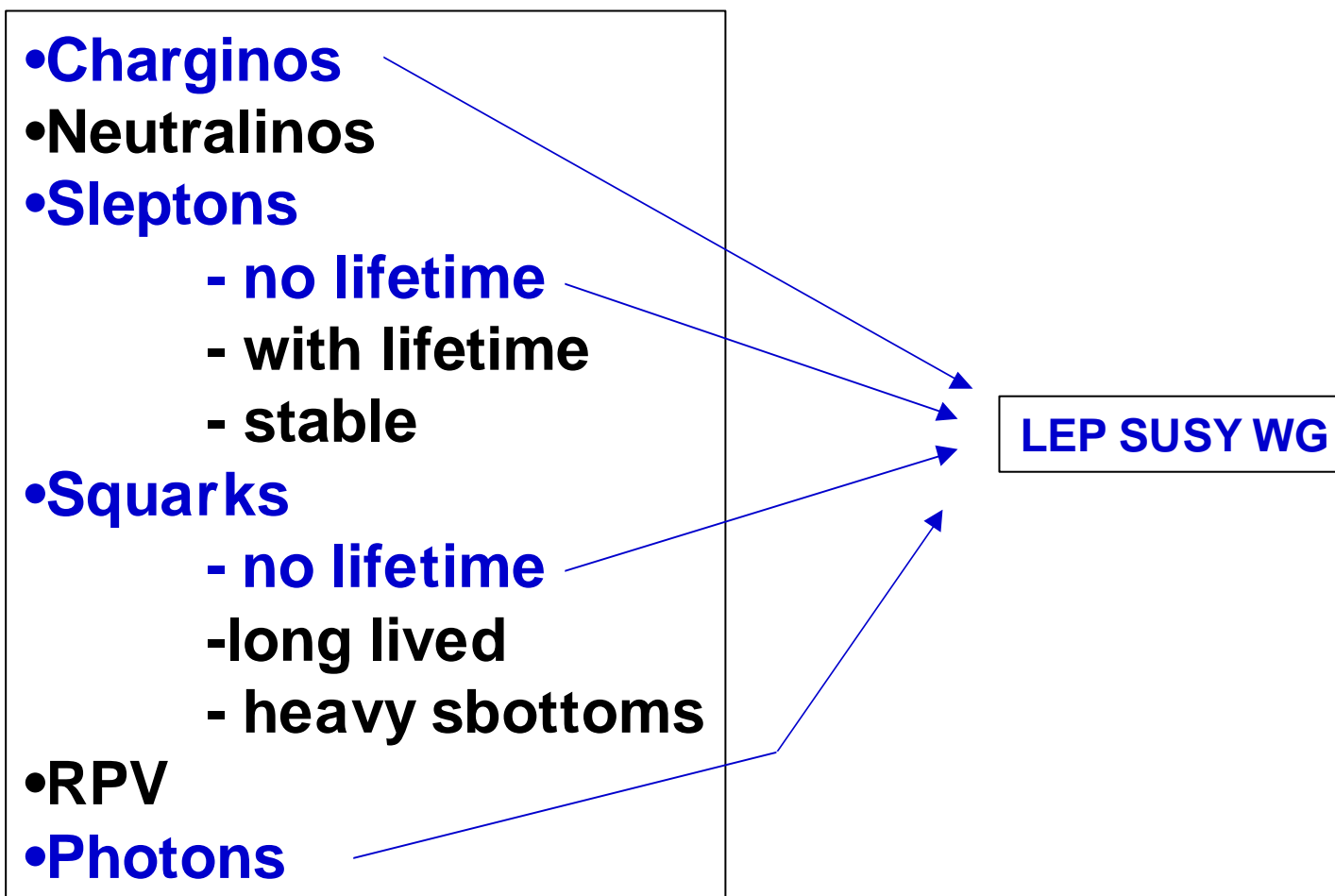
P **24 obs. / 20. exp. for 411 pb⁻¹**

excess is NOT confirmed



SUSY Particle Searches

No significant excess in any channel!





SM Higgs Searches

“Online” Analyses

frozen before start of data taking,
4jet analysis same as last year

Number of observed and expected events

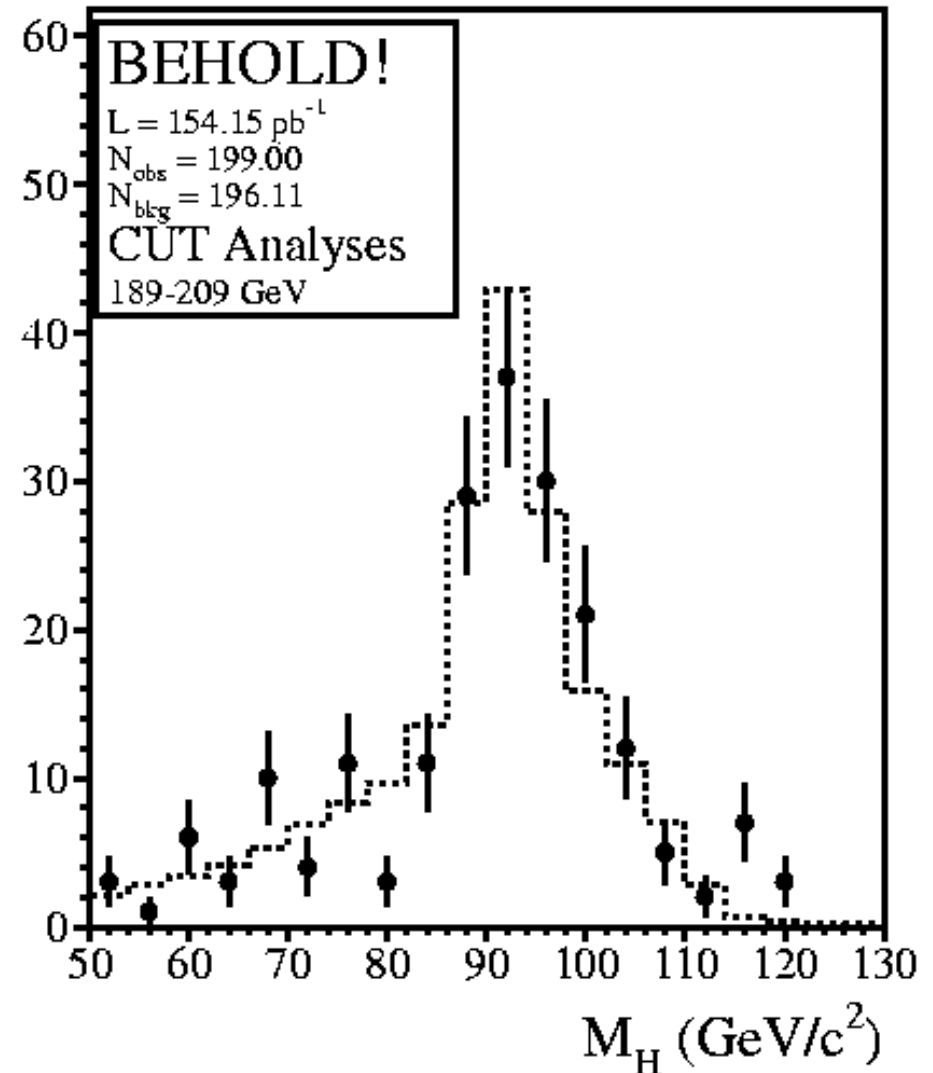
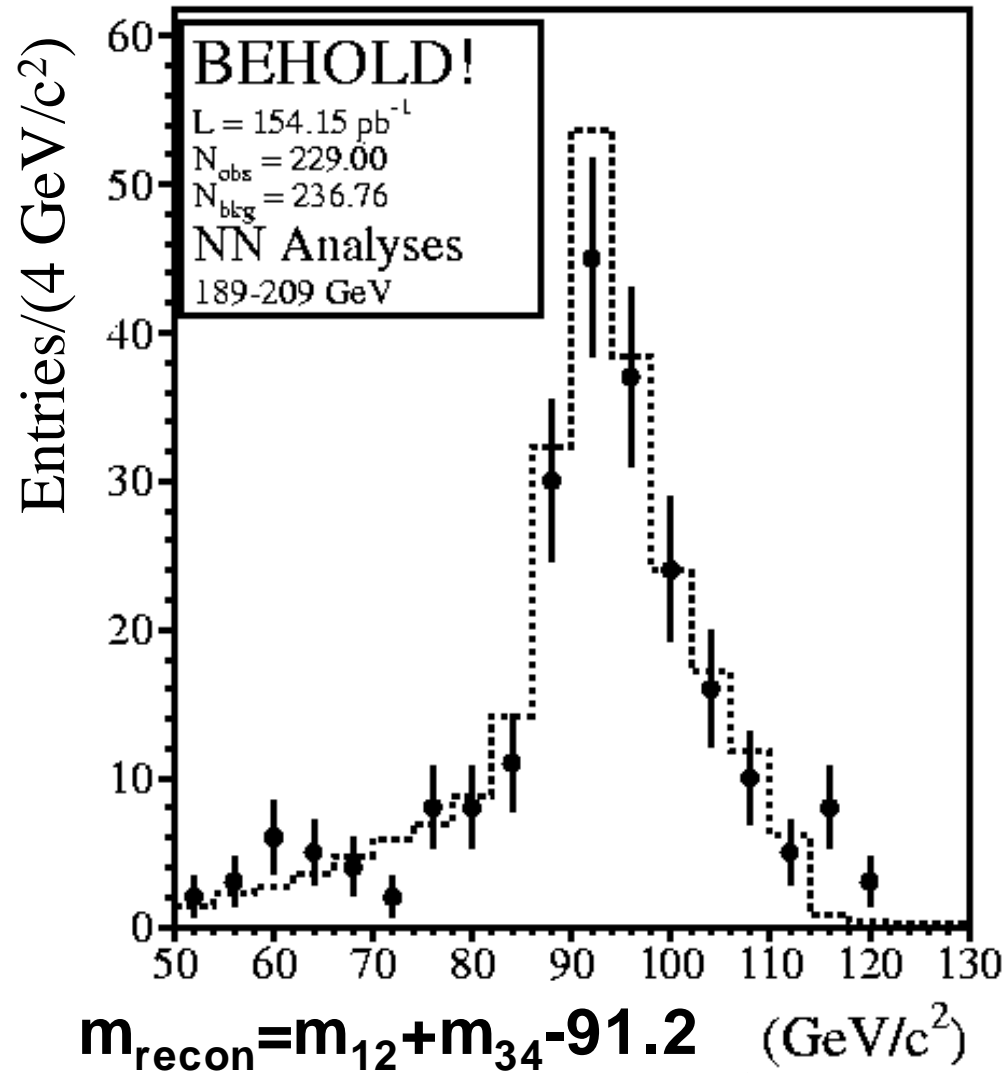
Analysis	Data	SM Bkg expected	Signal ($m_H = 114$ GeV)
$q\bar{q}q\bar{q}$	34	33.3	3.0
$q\bar{q}m\bar{m}$	29	27.0	1.0
$q\bar{q}ll$	21	21.1	0.4
$q\bar{q}tt$	11	9.7	0.2
All NN	95	91.1	4.6

overall good agreement, but...



Online Higgs Analyses

Two independent streams: NN(19 variables) and Cuts





High Mass Events ($>109\text{GeV}$)

	Data	Bkg	Signal $M_H=114\text{GeV}$
Four Jet	10	5.1	0.9
qqmm	2	2.2	0.2
qqll	4	1.7	0.2
qqtt	2	0.6	0.07

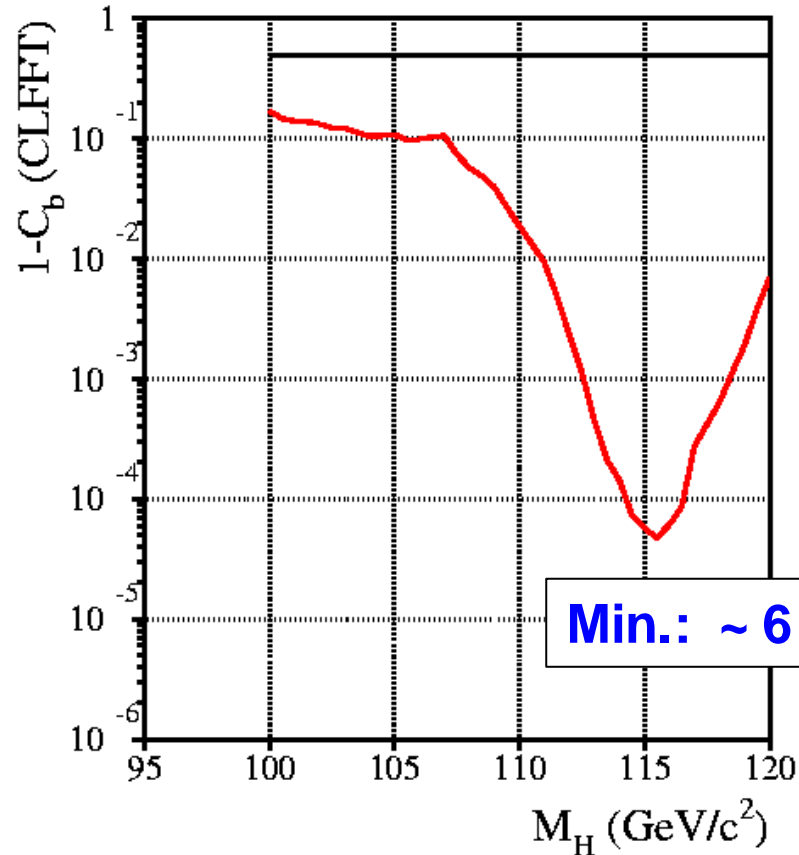
Bkg ($>109\text{ GeV}$):
WW ~40%
ZZ ~23%
 $q\bar{q}$ ~37%

mass cut:
 $M_H - 5\text{ GeV}$

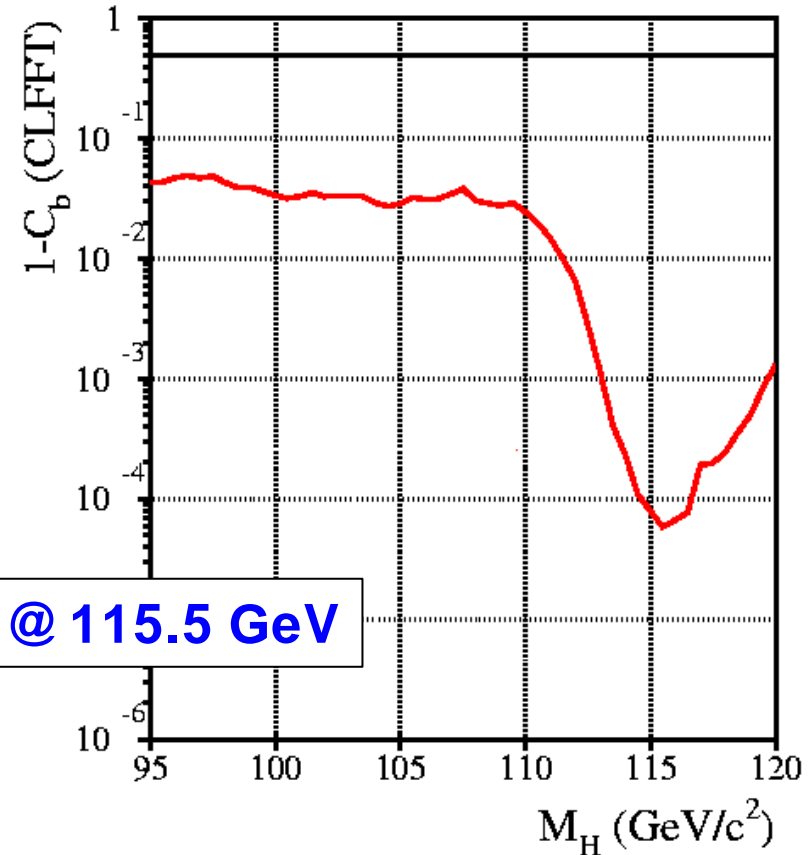


CL for Background Hypothesis, C_b

NN analyses



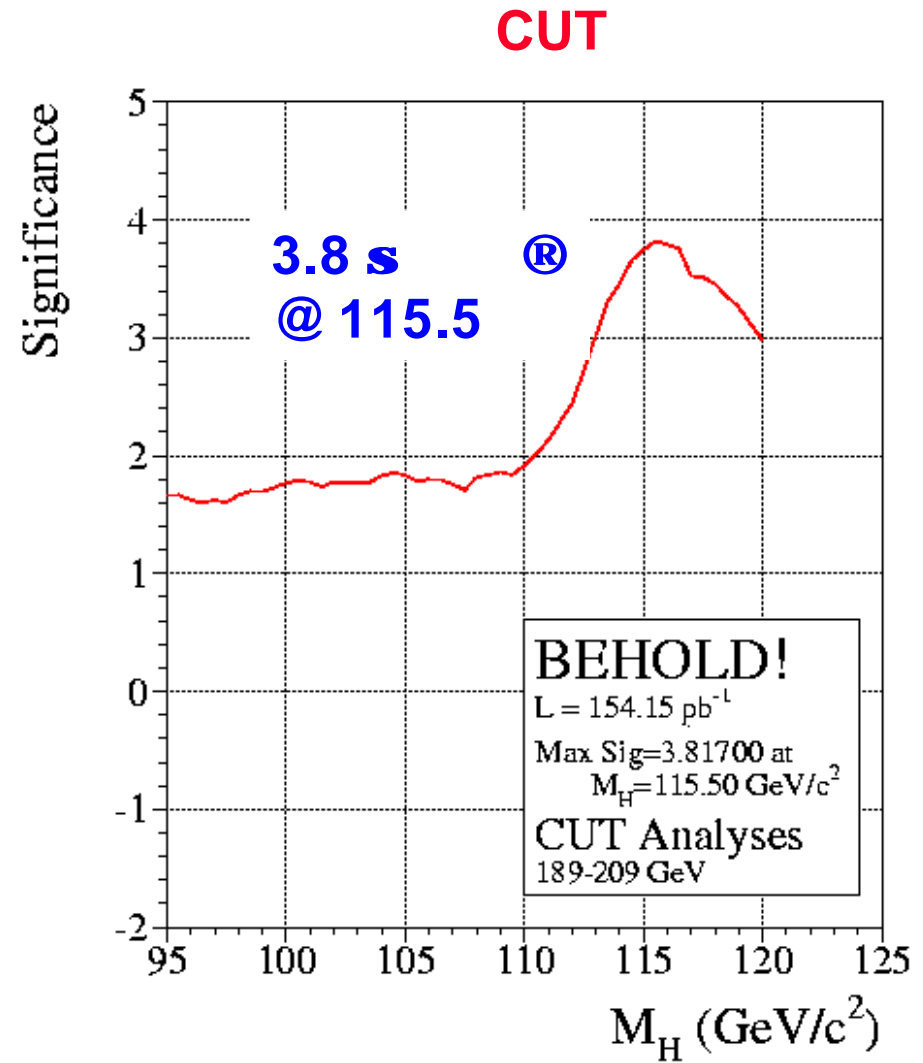
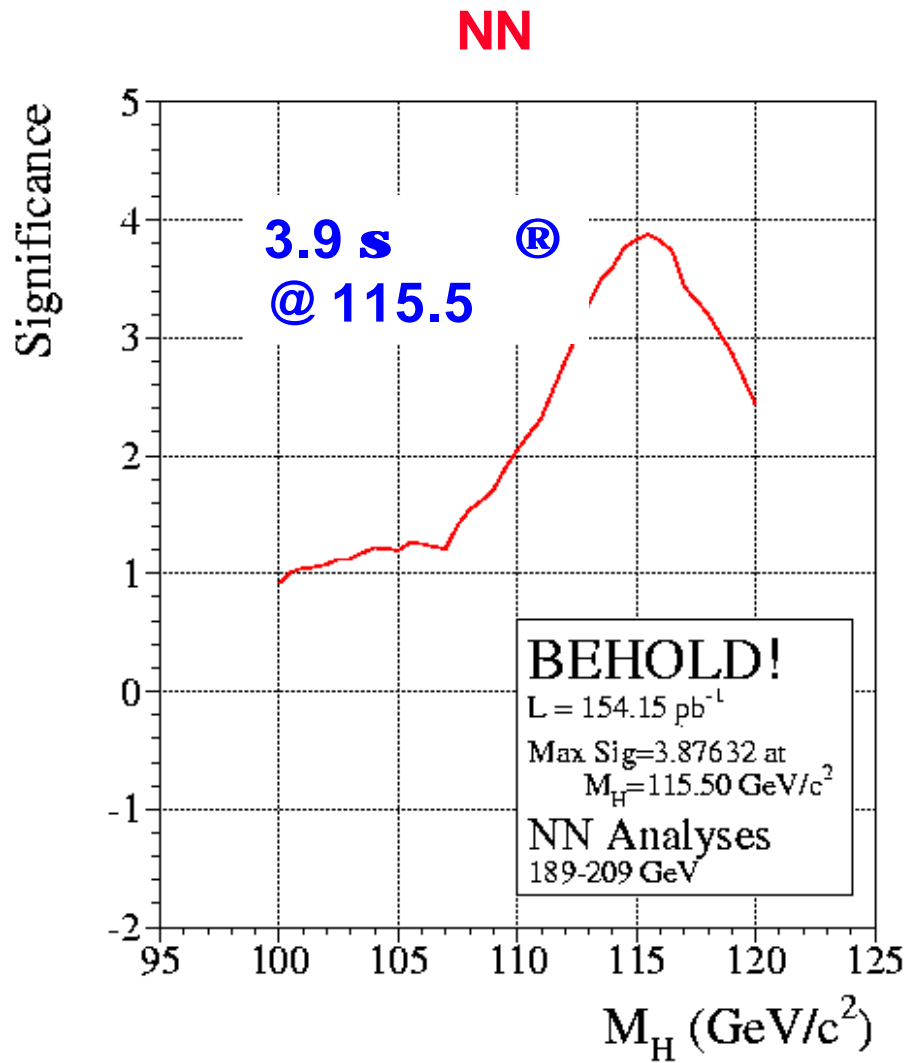
CUT analyses



Four Jets alone: $\min(1-C_b) = 3 \cdot 10^{-5}$ @ 114.5 GeV
all others: $\min(1-C_b) = 0.03$



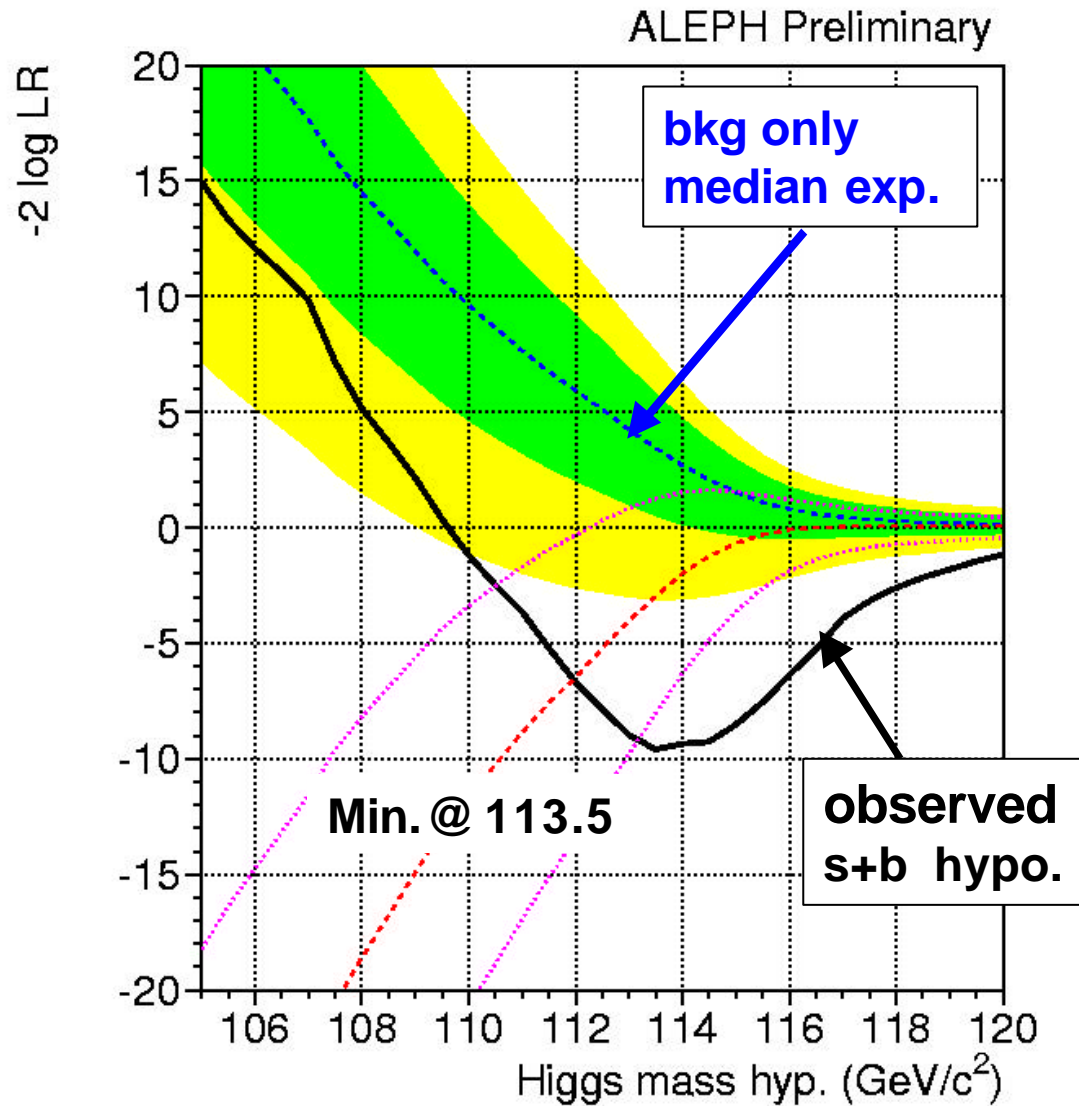
Significance of Excess



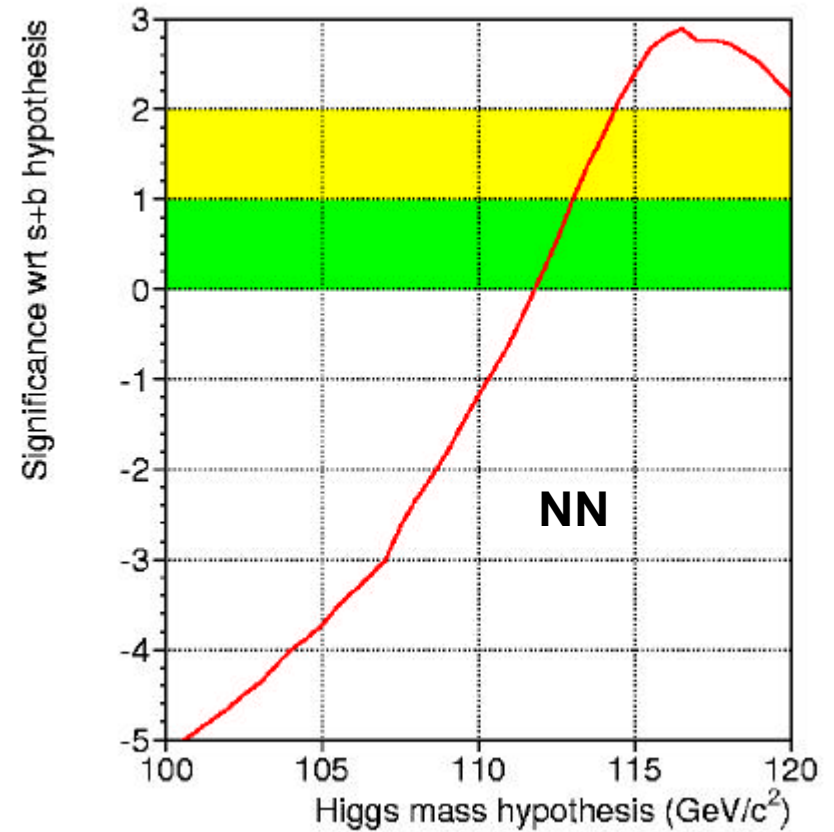
The peak is dominated by 4 jet candidates!



SM Higgs: Likelihood Ratio

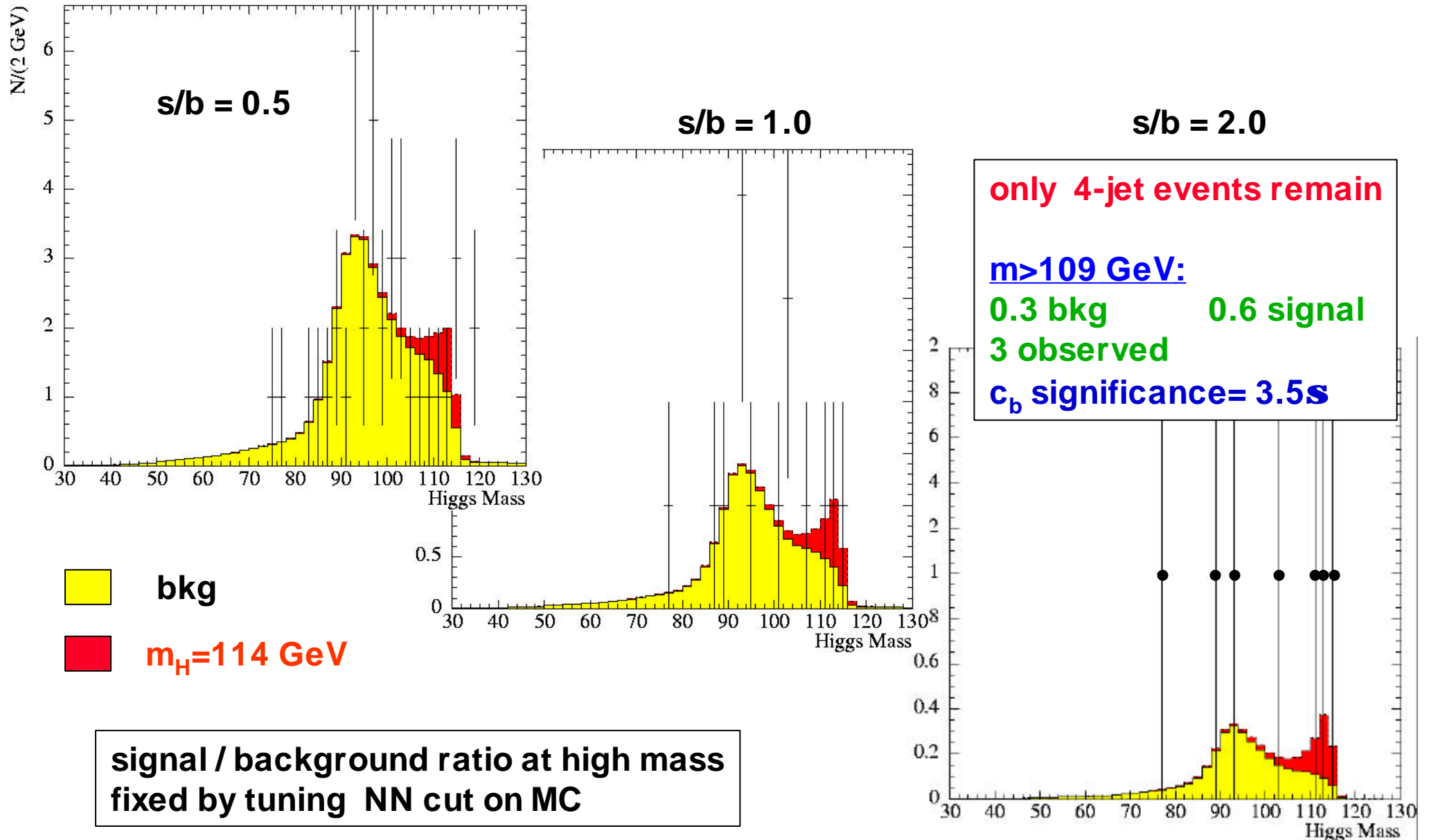


Significance s+b hypo.





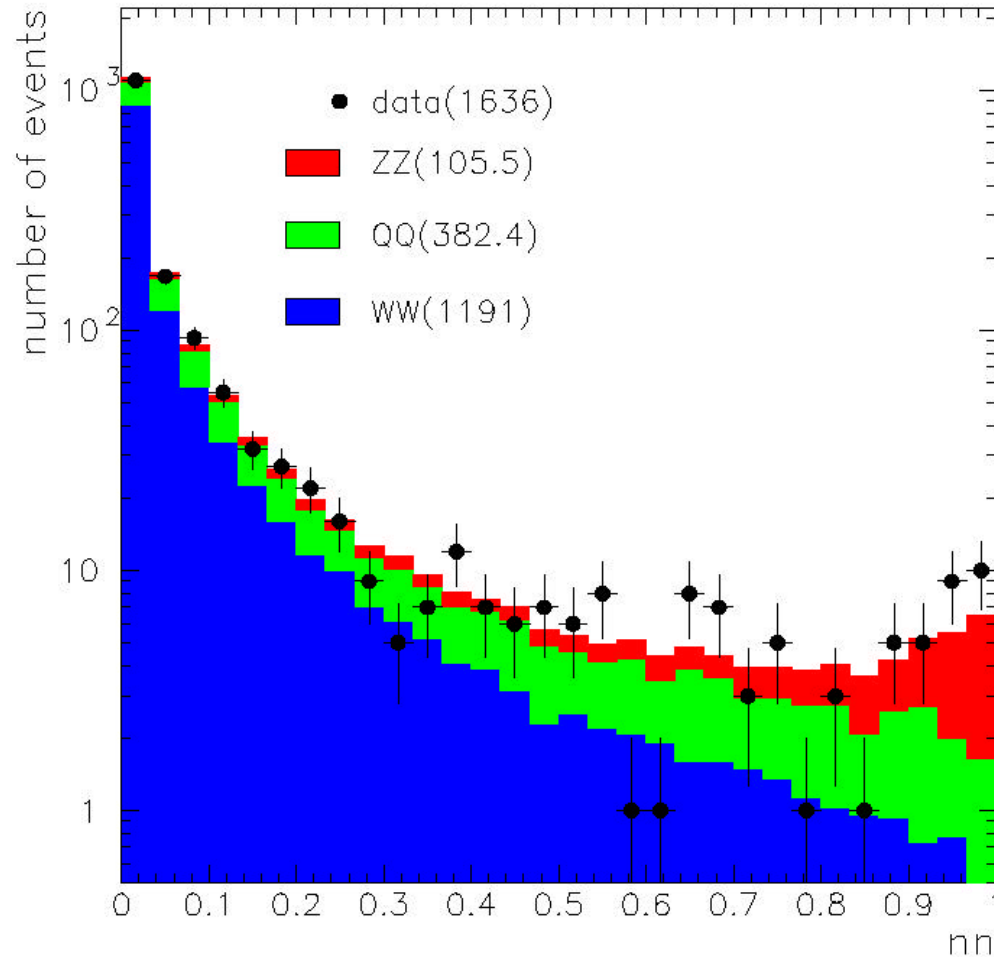
High Purity Selection





NN Output Distribution

Four Jets



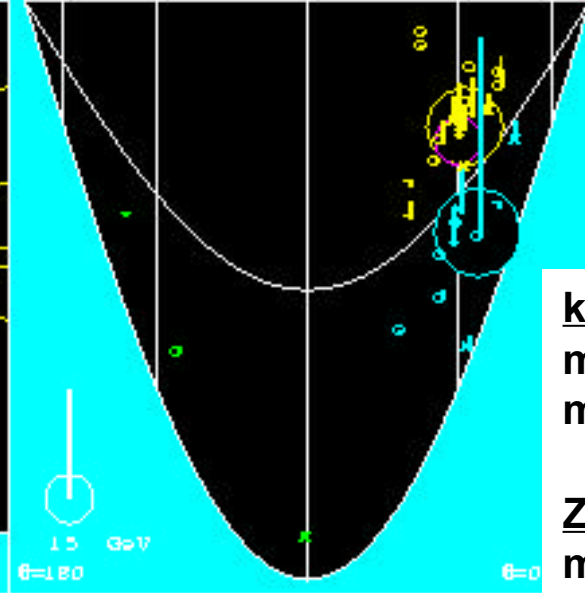
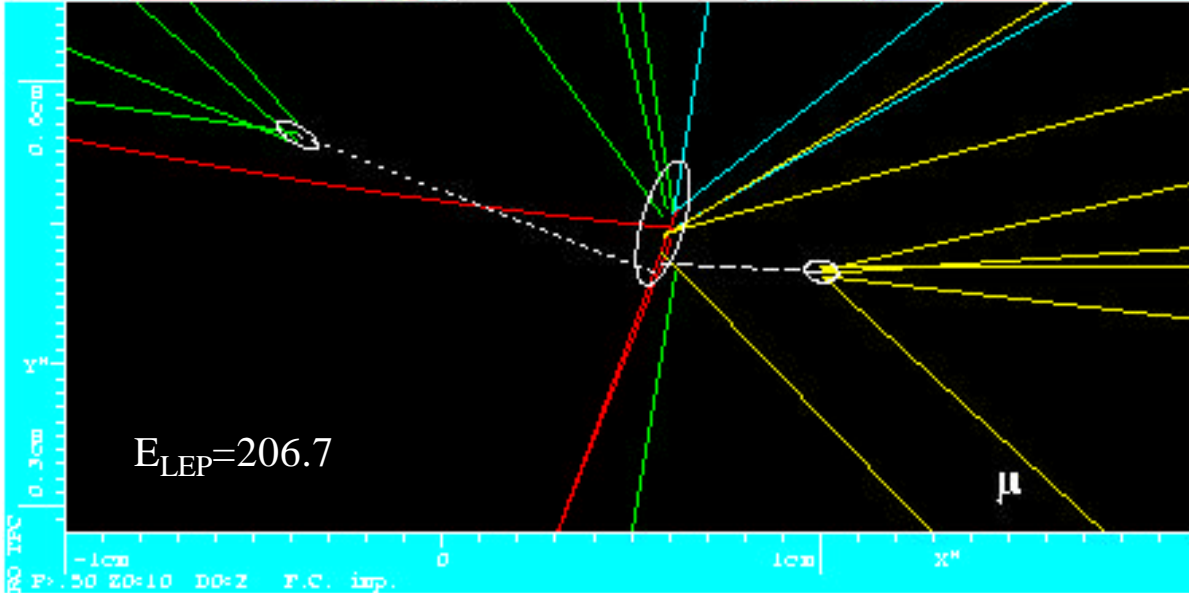
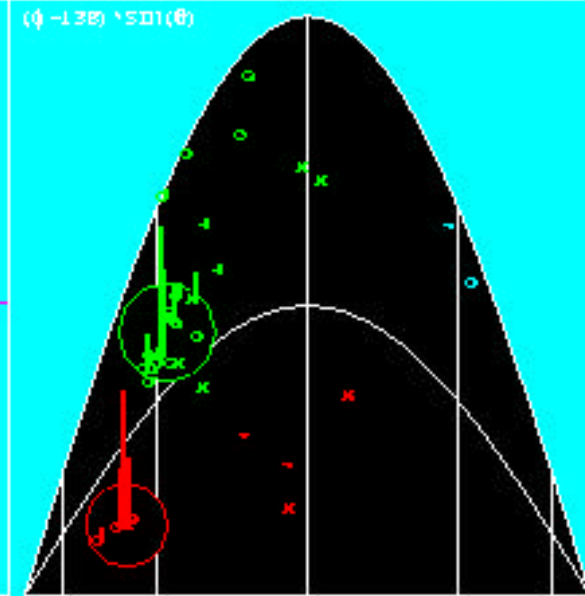
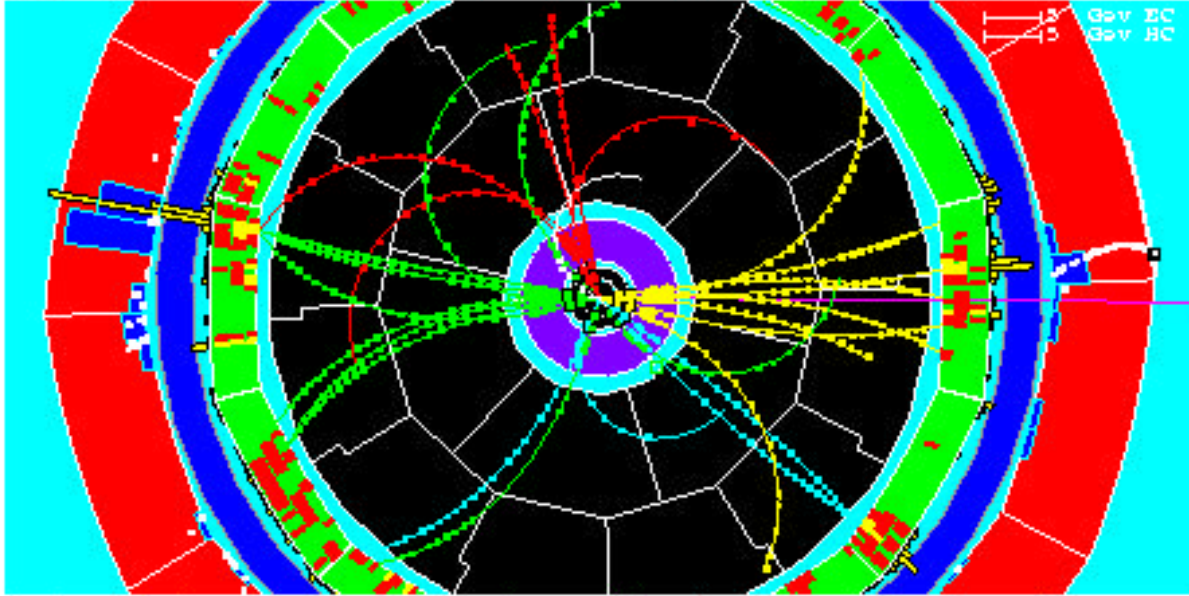
At very high NN values
ZZ bkg dominates.

e.g.

NN>0.96:

75% ZZ

25% $q\bar{q}$



2 b cand.

HZ hyp.
 $m_H=114 \text{ GeV}$
 $\pm 3 \text{ GeV}$

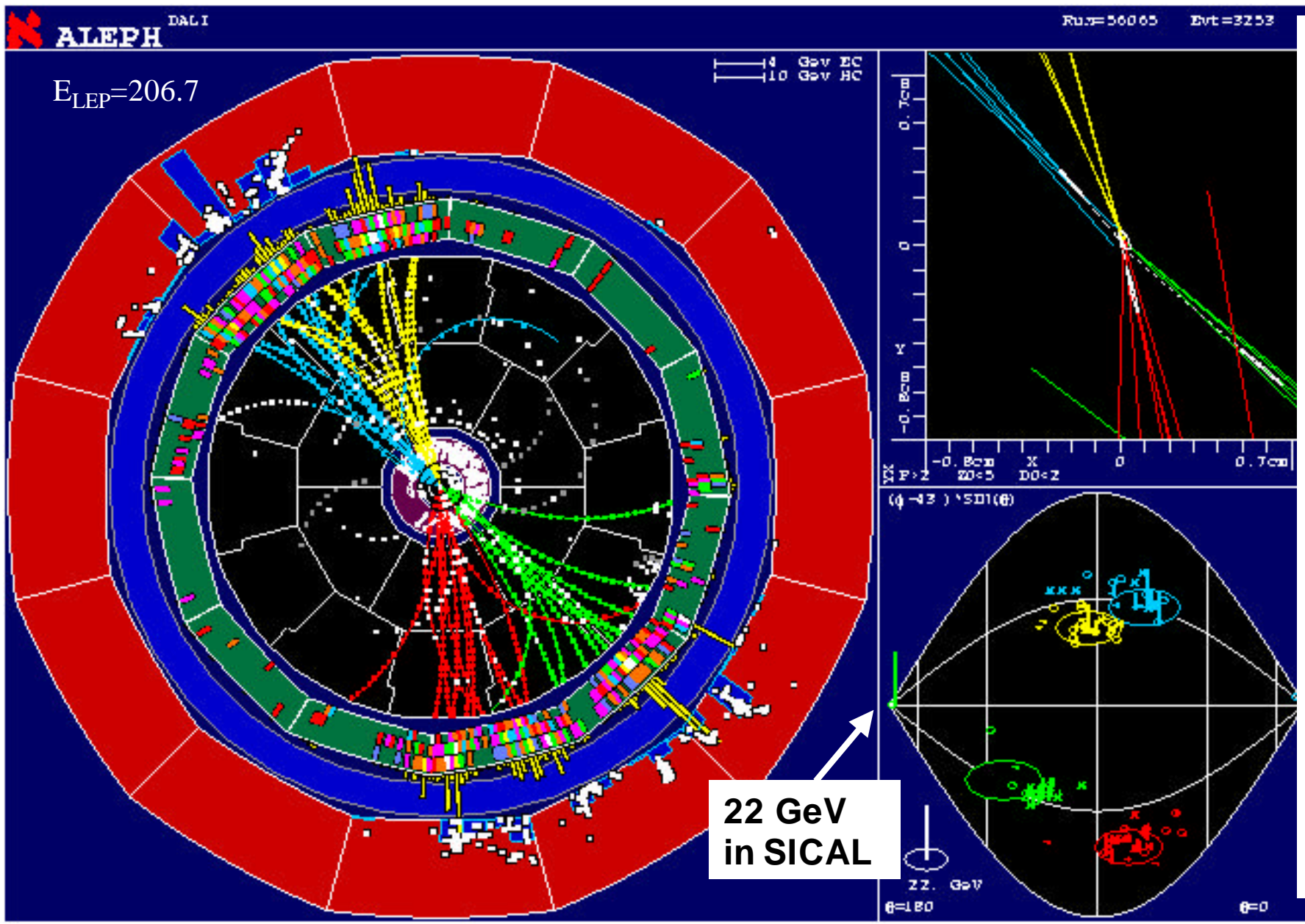
NN = 0.996

jet b-tag:

	Z
1	0.14
2	0.01
	H
3	0.99
4	0.99

kin. mass fit
 $m_H=112.4 \text{ GeV}$
 $m_Z=93.3 \text{ GeV}$

ZZ hyp.
 $m_Z=102 \text{ GeV}$
 $m_Z=91.7 \text{ GeV}$



4 b cand.

HZ hyp.
 $m_H = 112.8 \text{ GeV}$

NN = 0.997

jet b-tag:

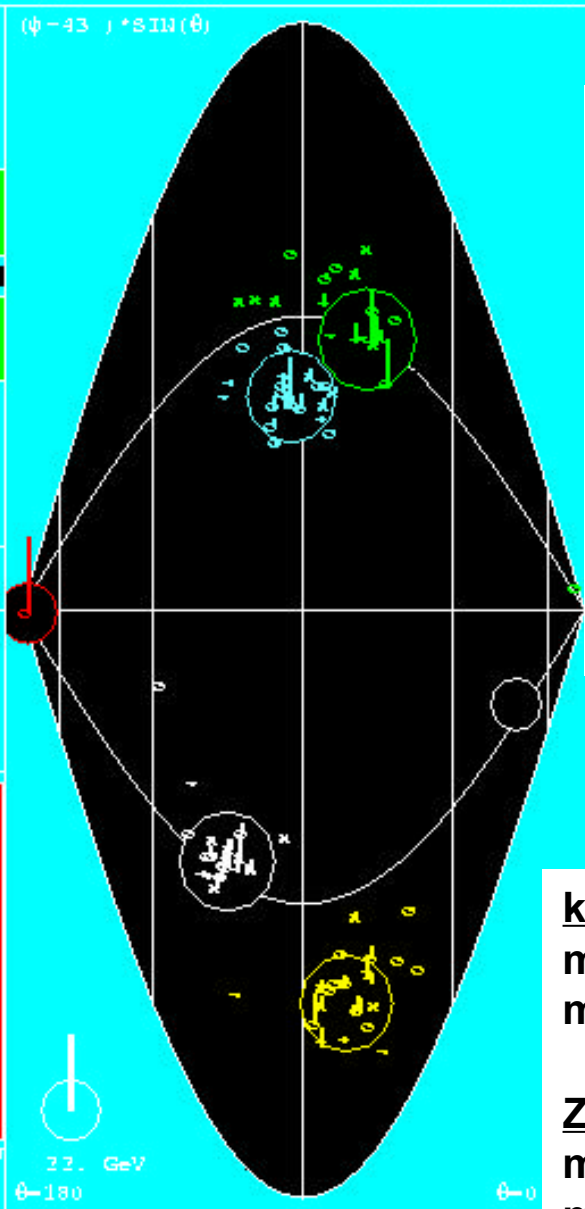
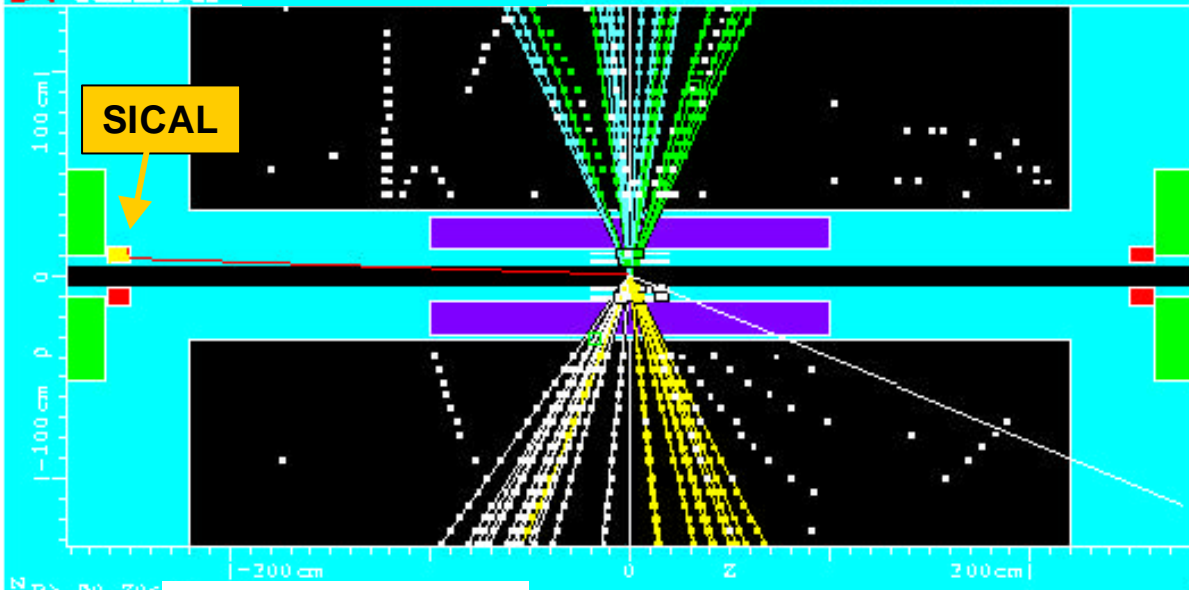
Z	H
1 0.994	3 0.993
2 0.78	4 0.999

Evis= 252 GeV !

very bad kin. fit!

⇒

assumption: 22 GeV in SICAL is beam related



remove
extra energy
in SICAL

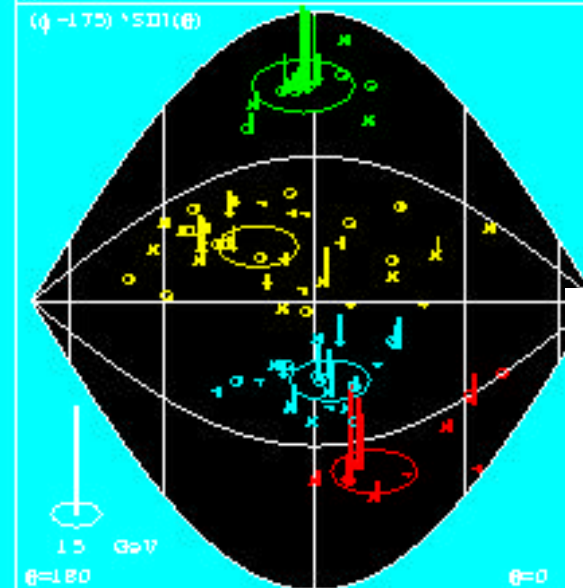
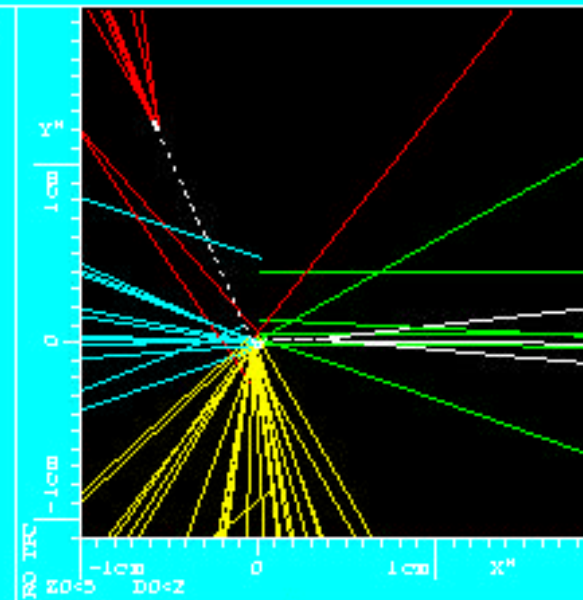
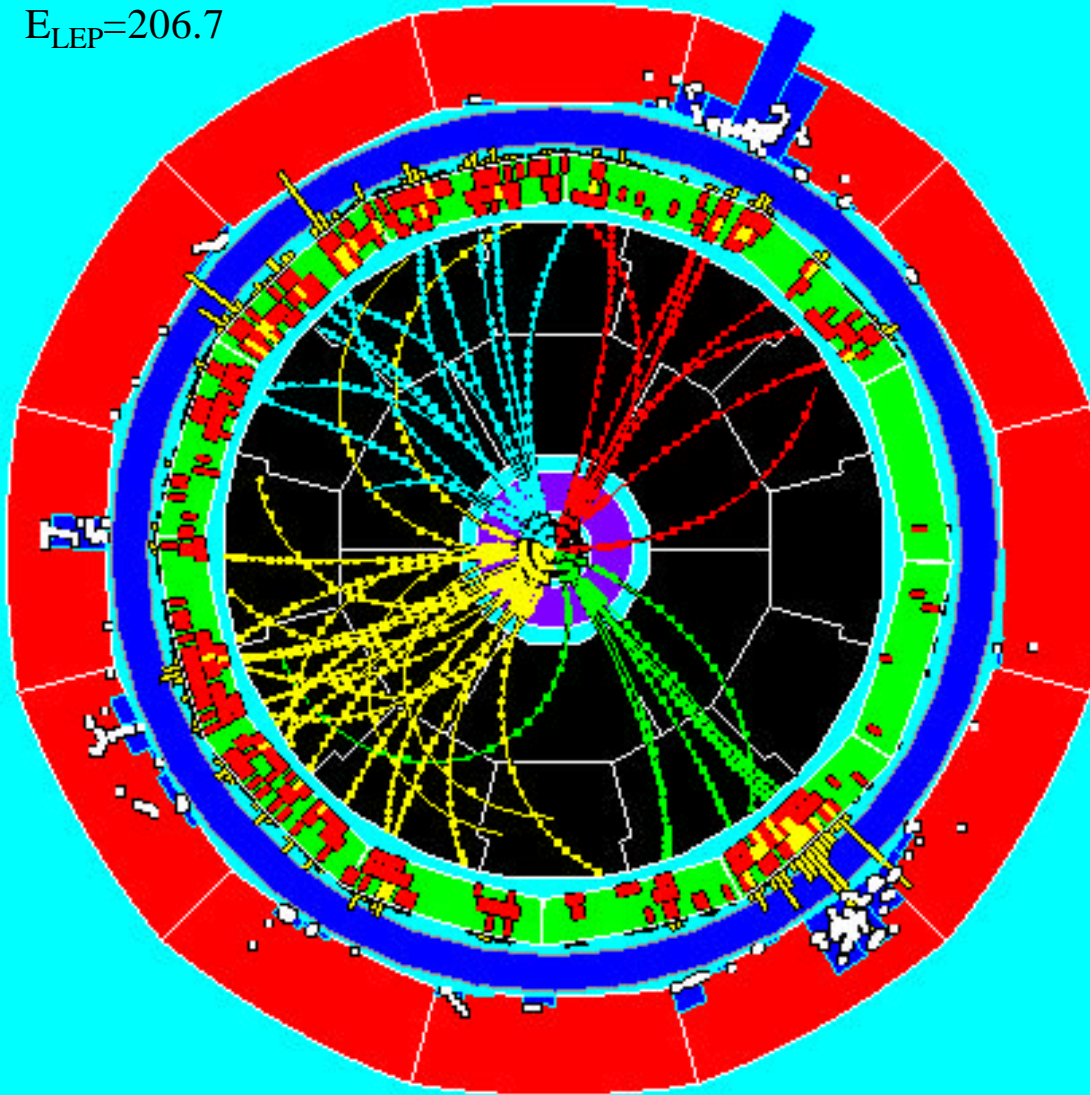
⇒ **good fit:**
 $m_H = 114 \text{ GeV}$
 $\pm 3 \text{ GeV}$

kin. mass fit
 $m_H = 113.8 \text{ GeV}$
 $m_Z = 91.9 \text{ GeV}$

ZZ hyp.
 $m_Z = 97 \text{ GeV}$
 $m_Z = 94 \text{ GeV}$

$E_{LEP}=206.7$

13 GeV EC
0.3 GeV HC



4 b cand.

$m_H=110 \text{ GeV} \pm 3 \text{ GeV}$

NN = 0.999

jet b-tag:

Z	
1	0.99
2	0.84
H	
3	0.99
4	0.21

kin. mass fit
 $m_H=109.1 \text{ GeV}$
 $m_Z=92.3 \text{ GeV}$

ZZ hyp.
 $m_{Z^*}=100 \text{ GeV}$
 $m_Z=99 \text{ GeV}$



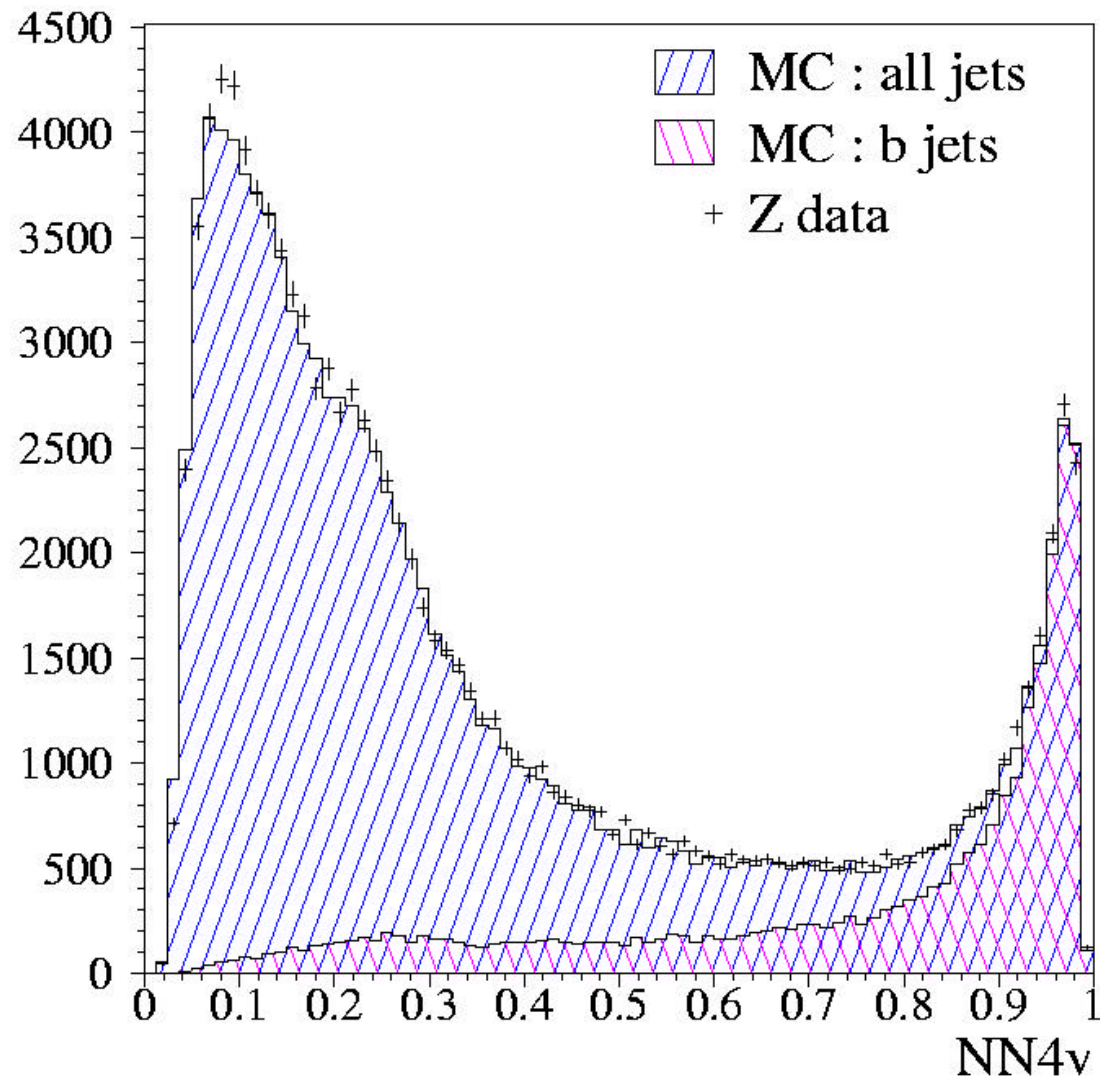
The Three 4J Candidates

- | | evt.: 1 | 2 | 3 |
|--|---------|--------|-------|
| • very signal like, NN output very high: | 0.996, | 0.997, | 0.999 |
| • very good b-tagging for H cand. jets: | 0.990, | 0.993, | 0.990 |
| (except one jet) | 0.990, | 0.999, | 0.21 |
- the two evts with $m=114\text{GeV}$ have only one jet combination passing all cuts (CUT analysis)
 - in second 4b cand., second best jet pairing in NN flips $H\hat{U}Z$ assignment.
 $m_{\text{reconst}}=m_{12}+m_{34}-91.2$ remains the same!

However, all three candidates also have an acceptable kin. fit (prob = $O(1\%)$) for the ZZ hypothesis.



b-tag Checks

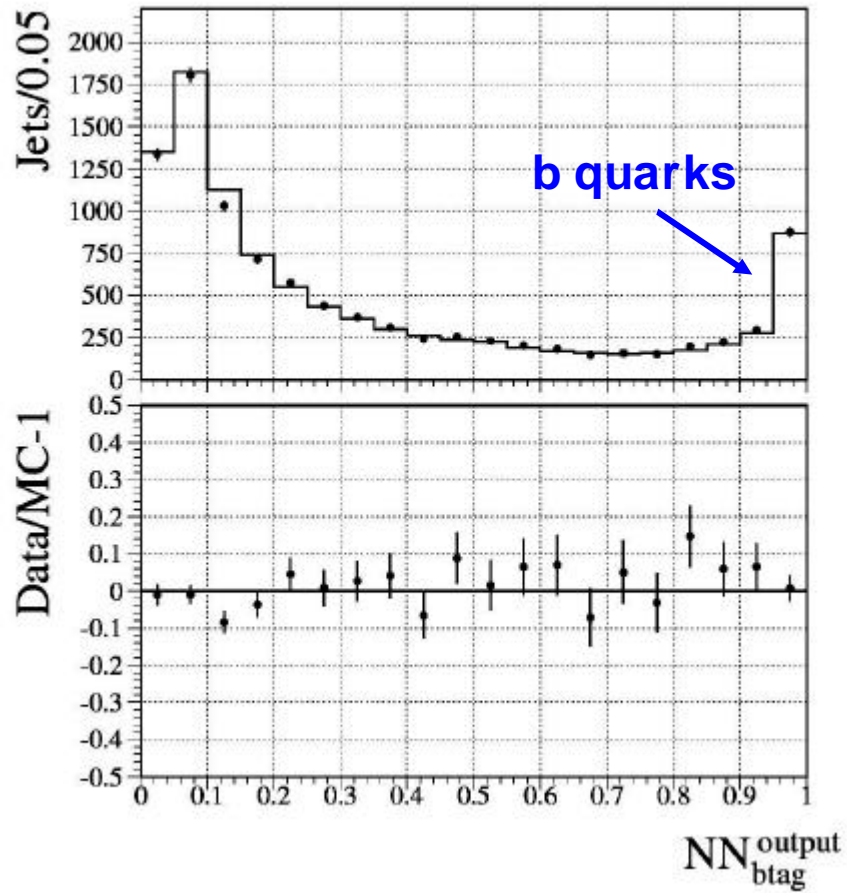


**Z data
from Y2K**

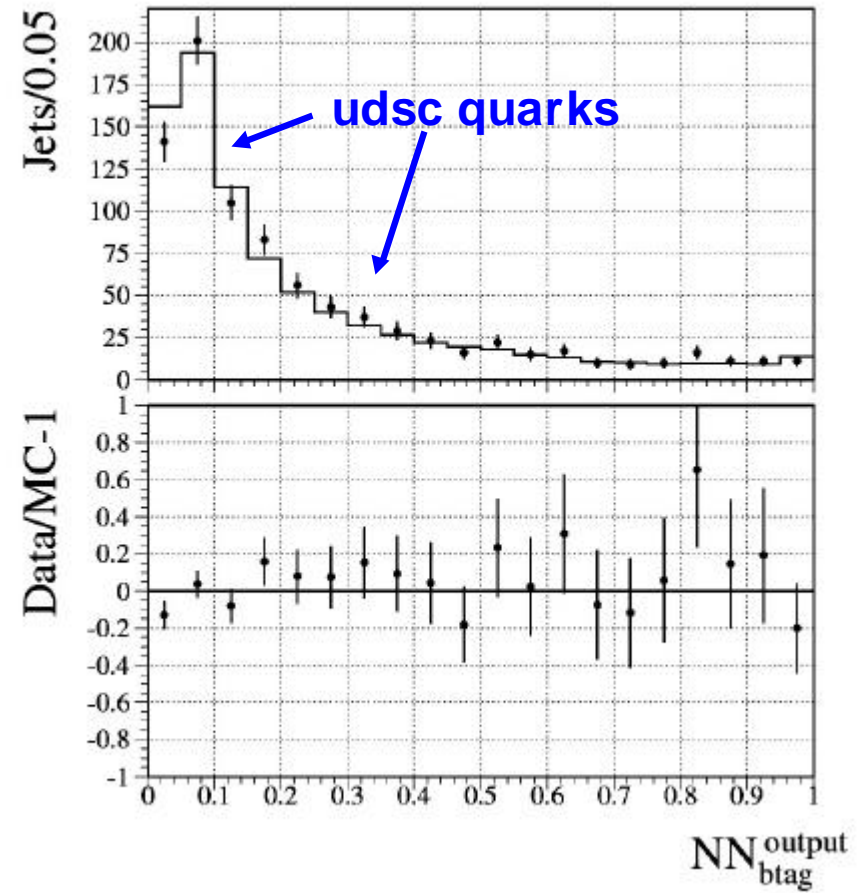


b-tag Checks

Z $\gamma\gamma$ events

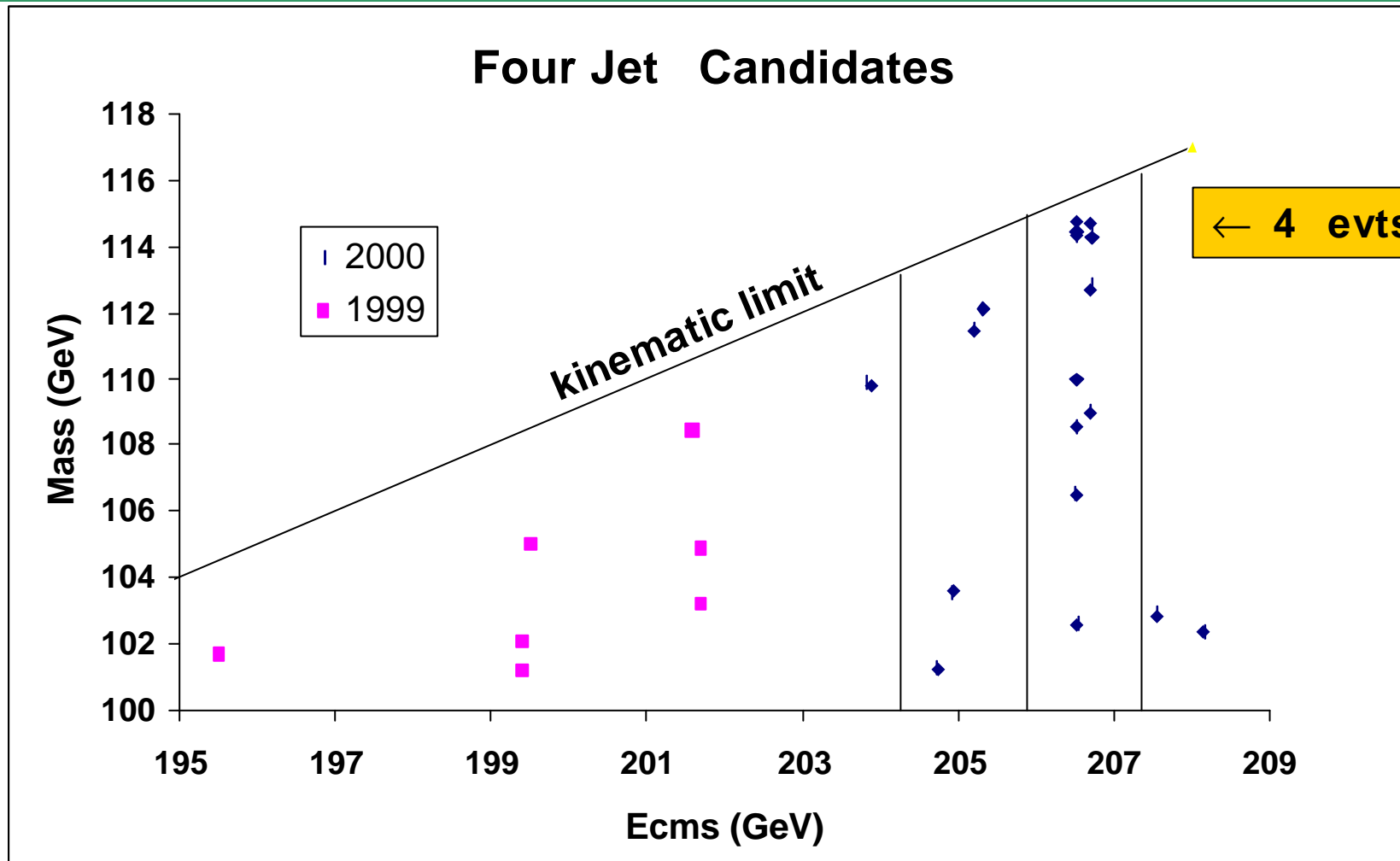


semi-leptonic WW events





Mass Distribution close to Kin. Limit



reconstructed Higgs mass is result of 4C fit (E and \vec{P} conservation)

⇒ no bias close to limit looking at last years data



Summary

Preliminary search results based on 154 pb⁻¹ collected:

SUSY: no excess

- no chargino candidates @ 208 GeV

Exotic Higgs no excess

- Charged Higgs, Invisible Higgs, Fermiophobic Higgs

MSSM Higgs no excess

BUT...



Summary: SM Higgs Search

Using two online analyses:

- ◆ **from c_b : 3.9(NN) or 3.8(cuts) std deviation from Standard Model background**
- ◆ **compatible with SM Higgs around 114 GeV**
- ◆ **but cross section $1s - 2.5s$ too high wrt SM Higgs**
- ◆ **at $s/b \approx 2$ and $m_{rec} > 109$ GeV, observe 3 candidates, 0.3 bkg evts expected (signal \gg 0.6 evts, $m = 114$ GeV)**

Exciting, but small number of events and not background free!



Request for Running

- ◆ Can **neither claim nor rule out** that the excess observed in the Higgs search is first sign for production of SM Higgs.
- ◆ therefore, we request an extension of running to allow us to
double the statistics at > 206.5 GeV
(³ 75 pb⁻¹)

This would not be enough for a **5 σ** discovery, but will give a definite answer if excess was due to background fluctuation