

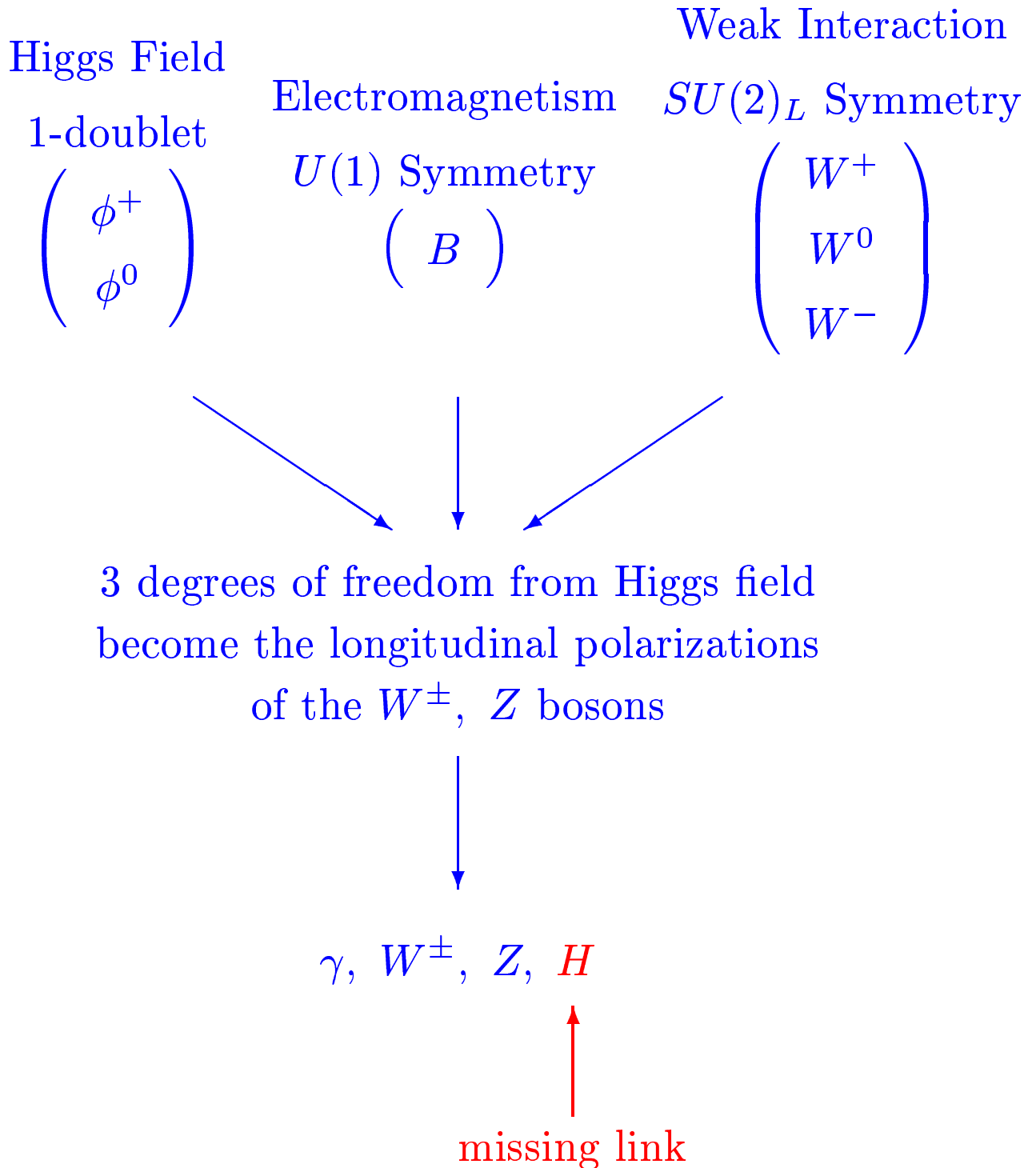
L3 Higgs Candidates

Chris Tully

Princeton

L3 Higgs search

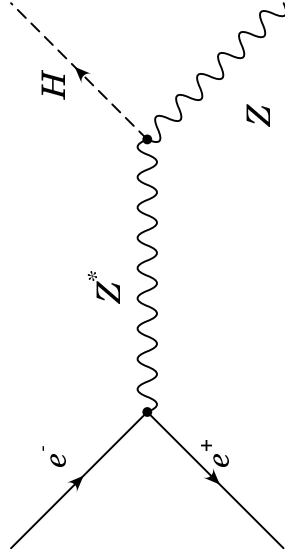
Standard Model Higgs Mechanism



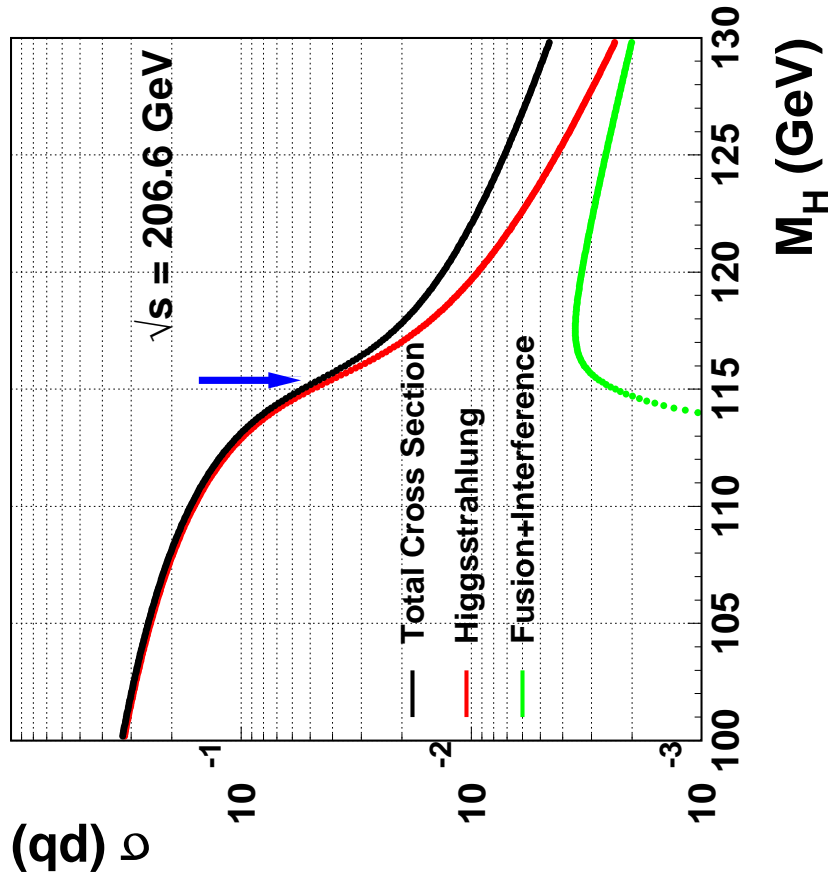
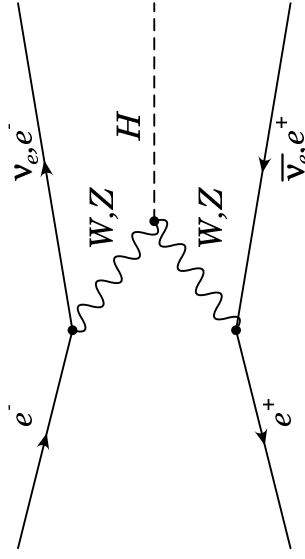
L3 Higgs search

Standard Model Higgs Production at LEP

Higgsstrahlung Diagram

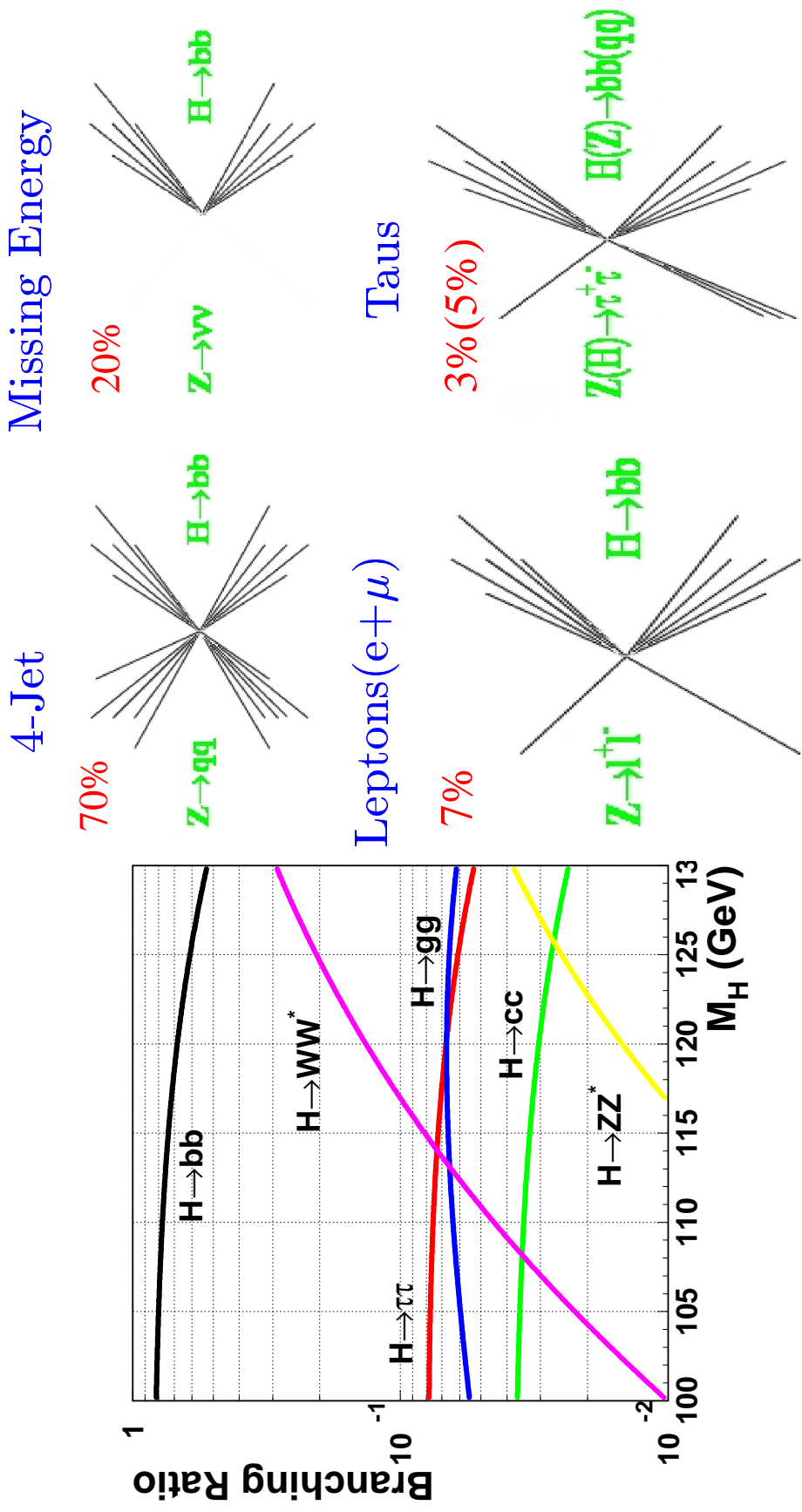


Fusion Diagram



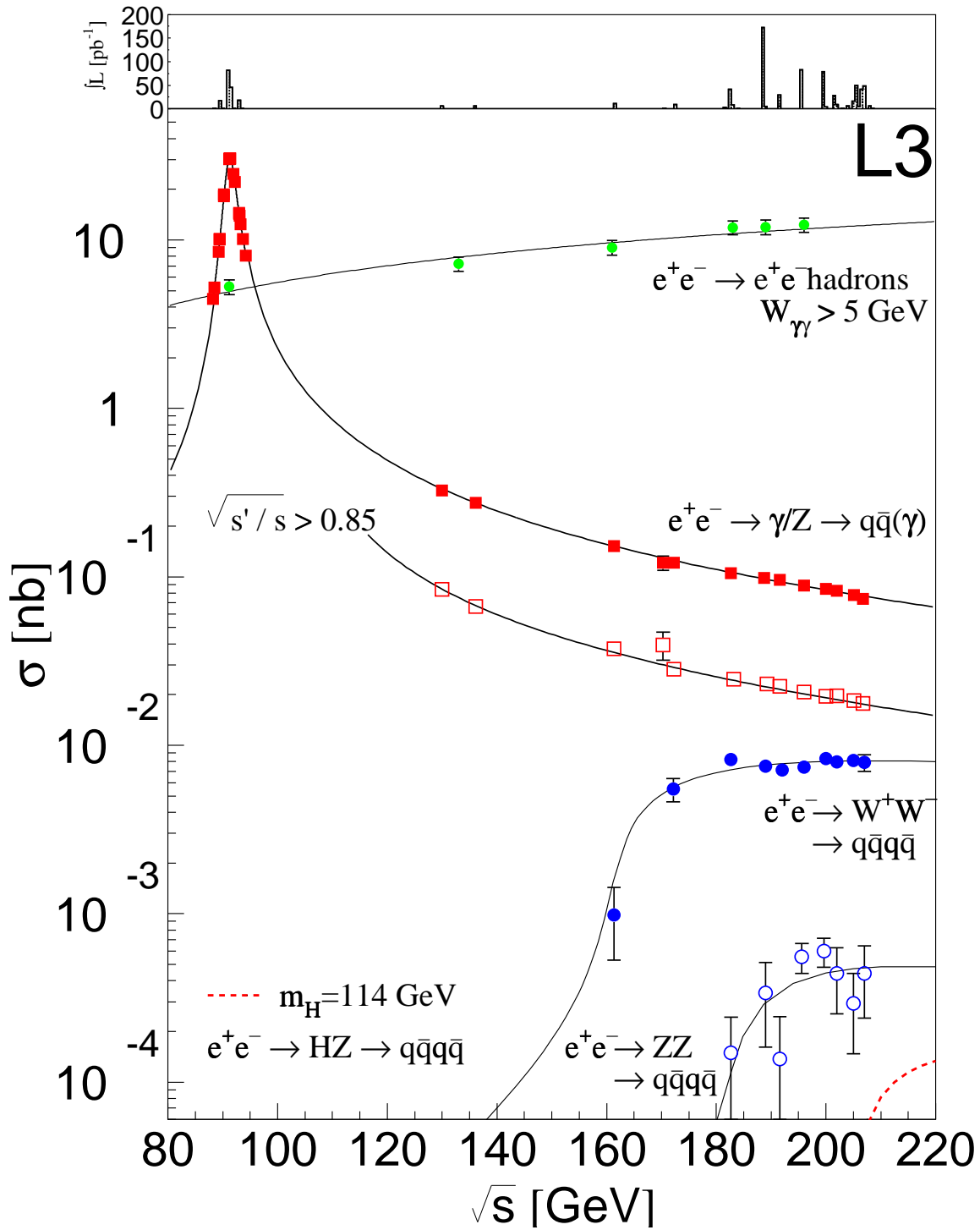
L3 Higgs search

Standard Model Higgs Search Channels



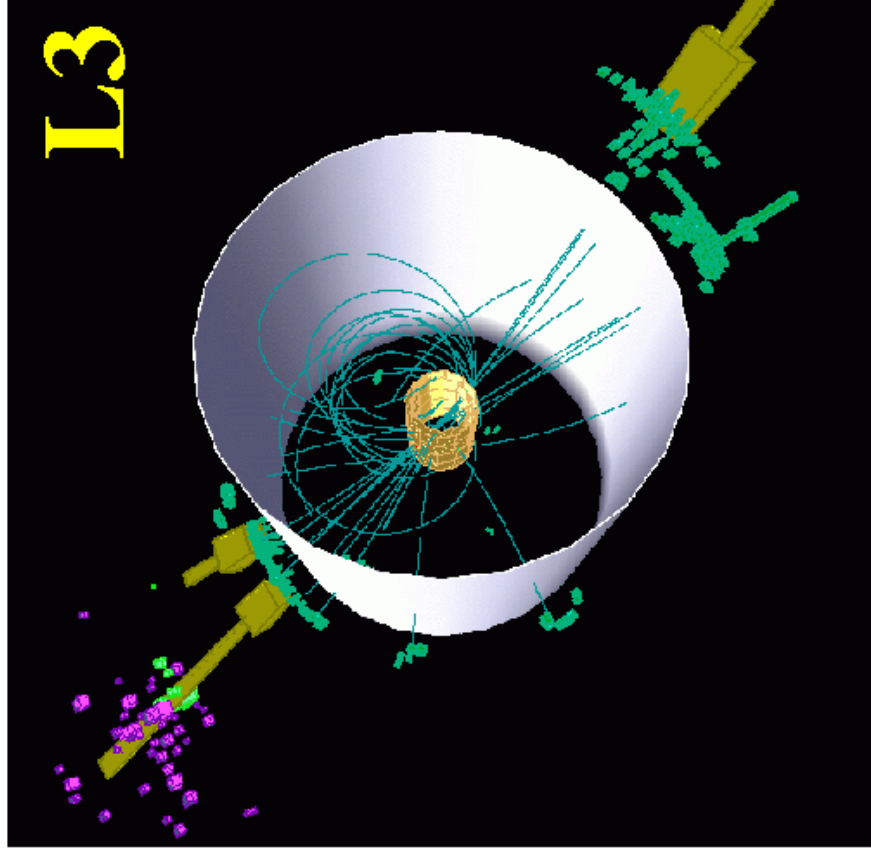
L3 Higgs search

Standard Model Processes at LEP



L3 Higgs search

most significant H $\nu\nu$ candidate

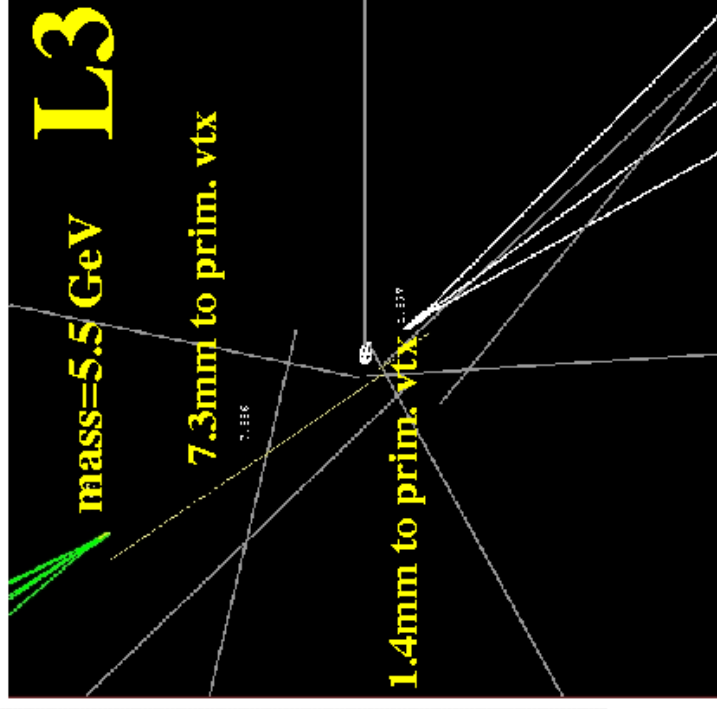


measured H mass=114.4 GeV

H mass resolution ~3 GeV

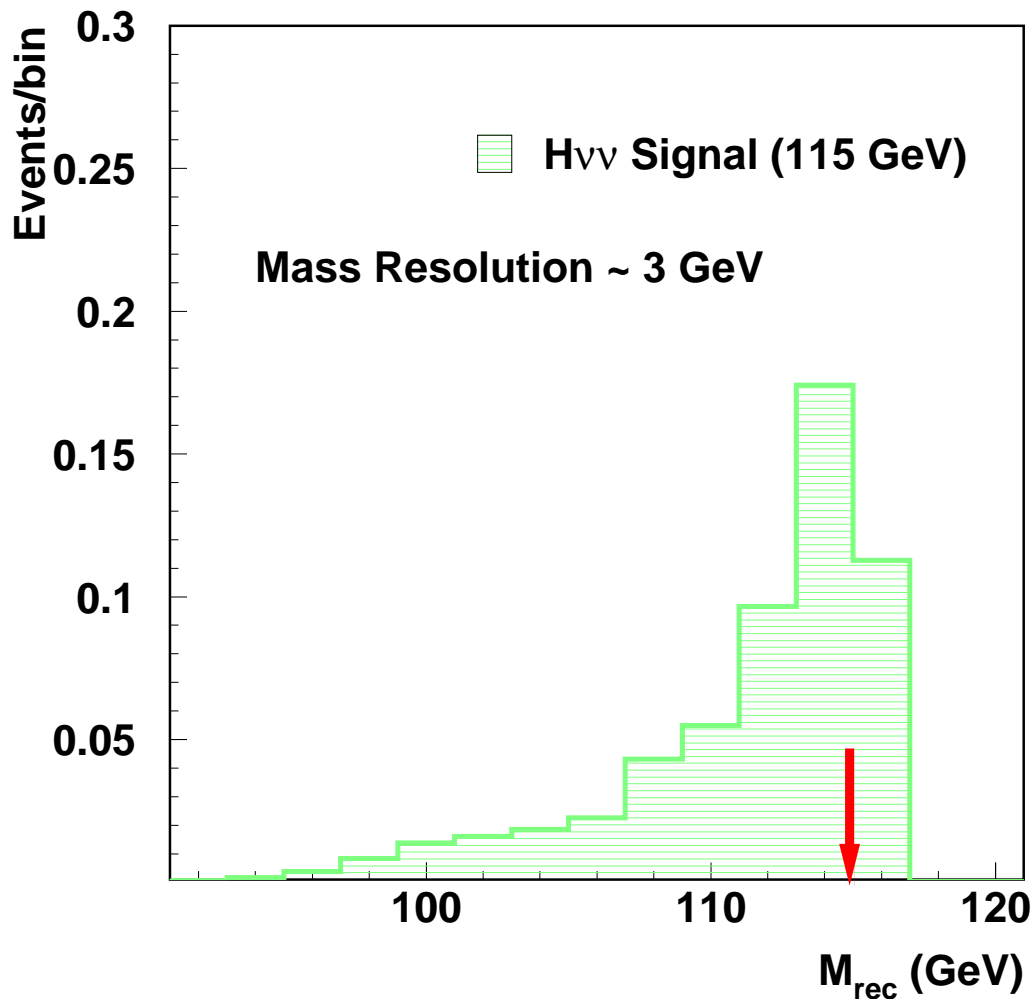
L3 Higgs search

Secondary vtx's view



Mass Resolution

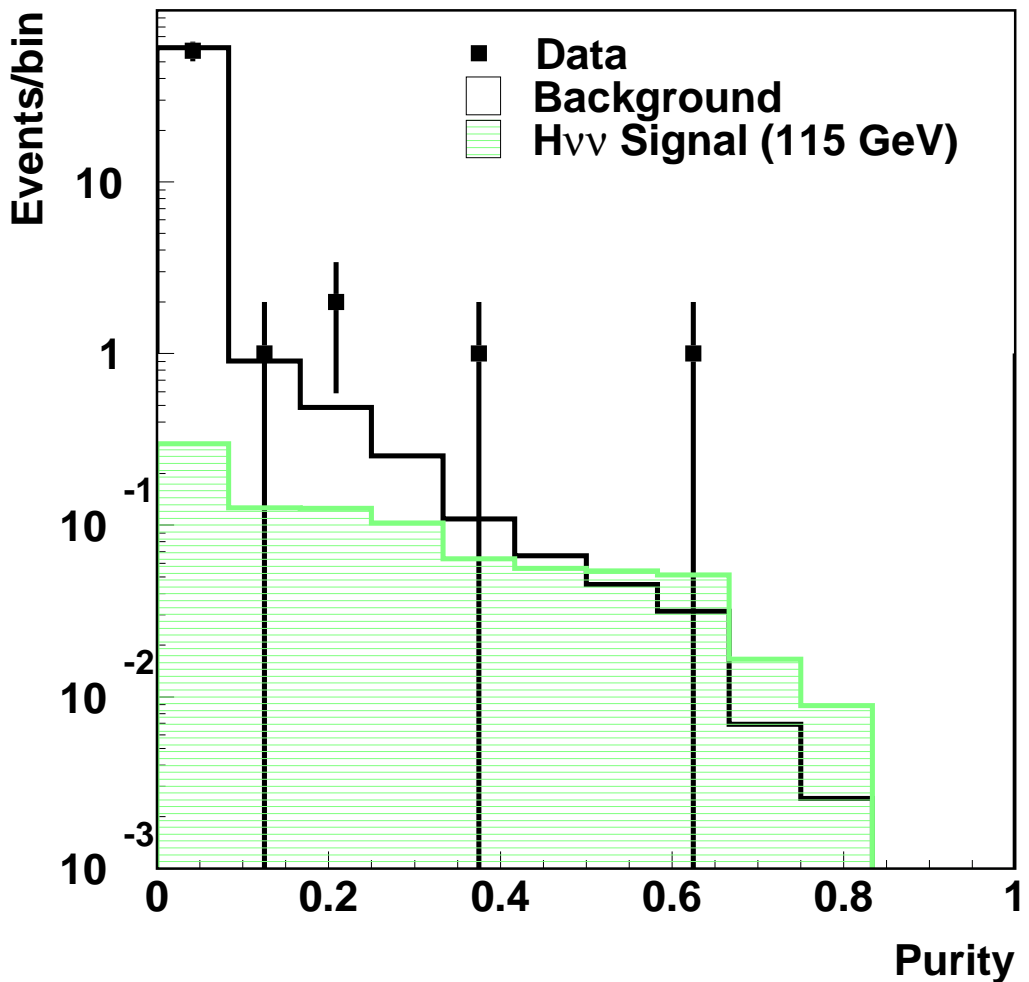
Simulated Missing Energy Events



The upper-edge of the mass distribution falls rapidly due to the kinematic limit.

L3 Higgs search

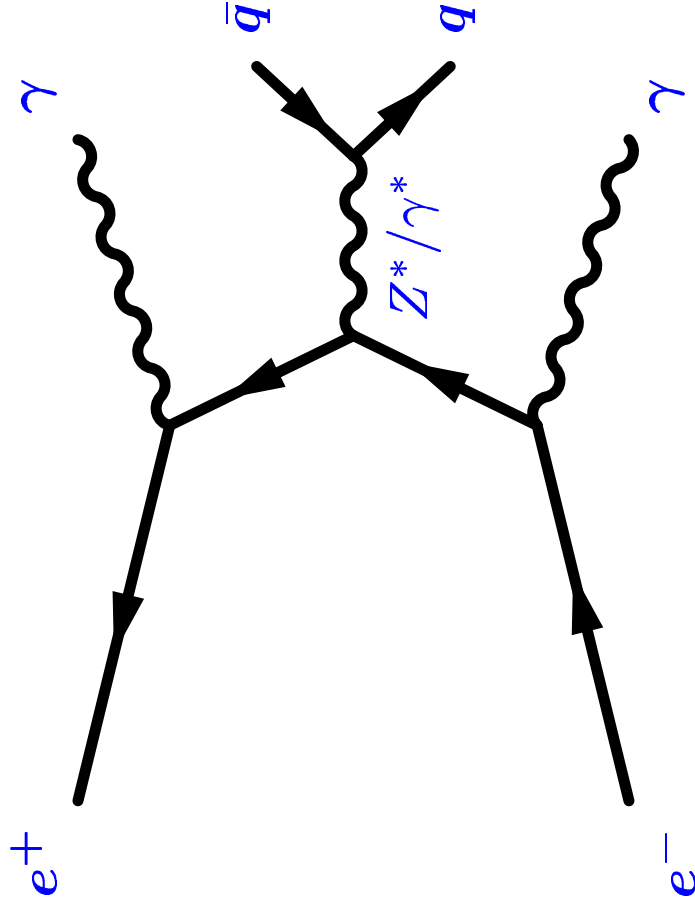
L3 Missing Energy Analysis



Dominant background at high purity is double radiative return to an off-shell Z

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Background from Double Radiative Return

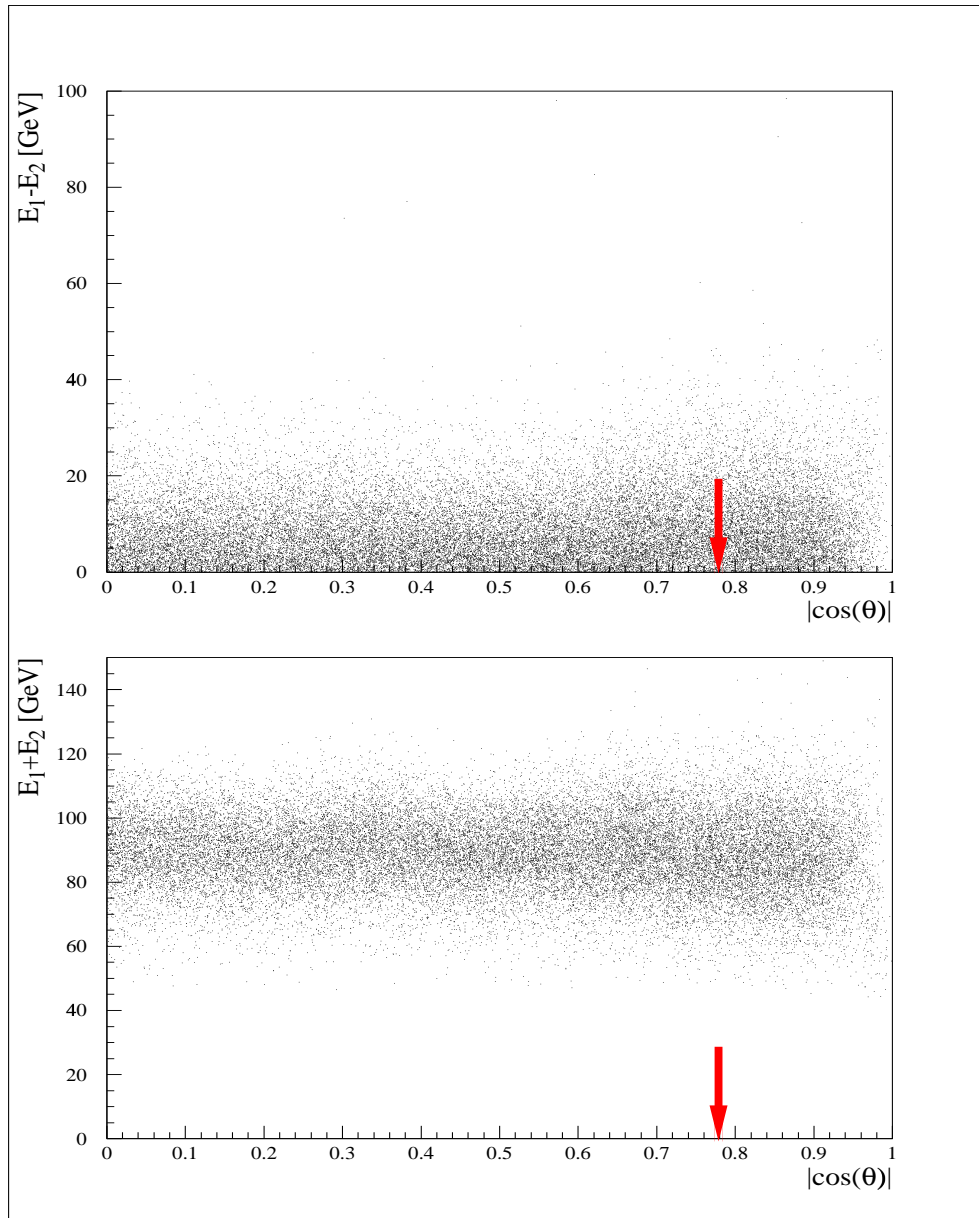


The two emitted photons must both go into the beampipe in opposite directions and have almost exactly the same energy!

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Jet Measurements

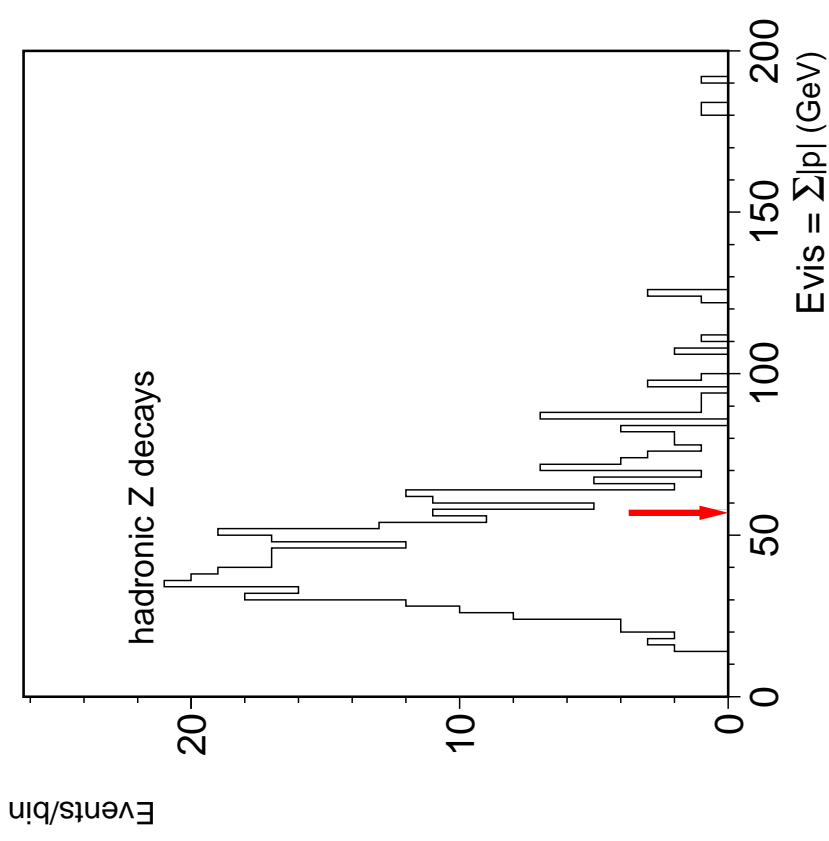
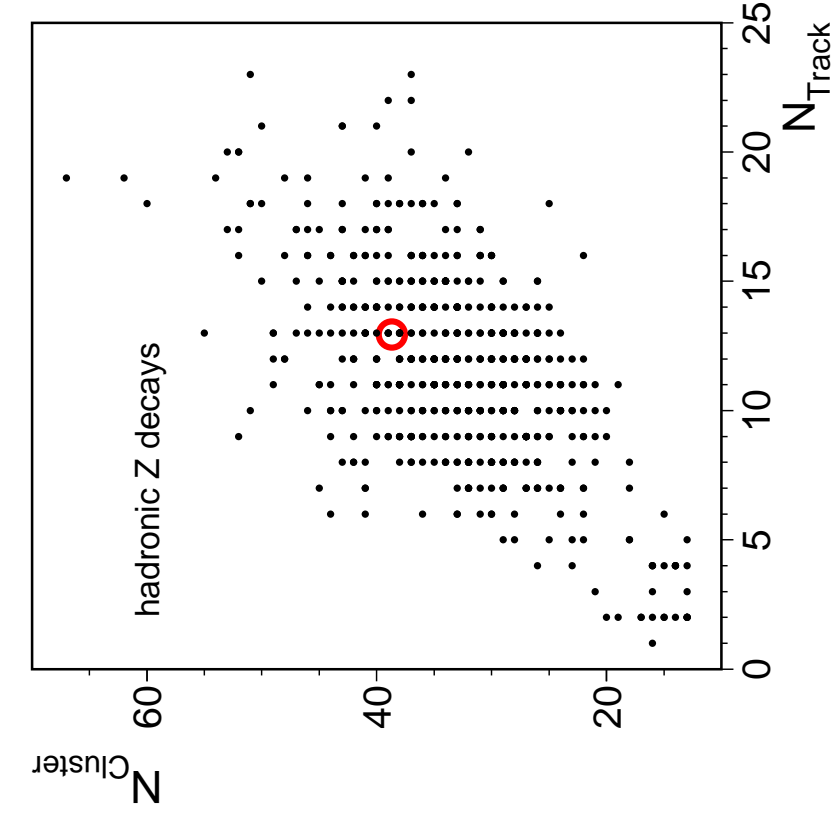
Z Calibration Data in 2000



Missing energy event has $\cos \theta_{thrust} = 0.77$
where the jet energy resolution is 13%.

L3 Higgs search

Track/Cluster Multiplicity and Track Visible Energy

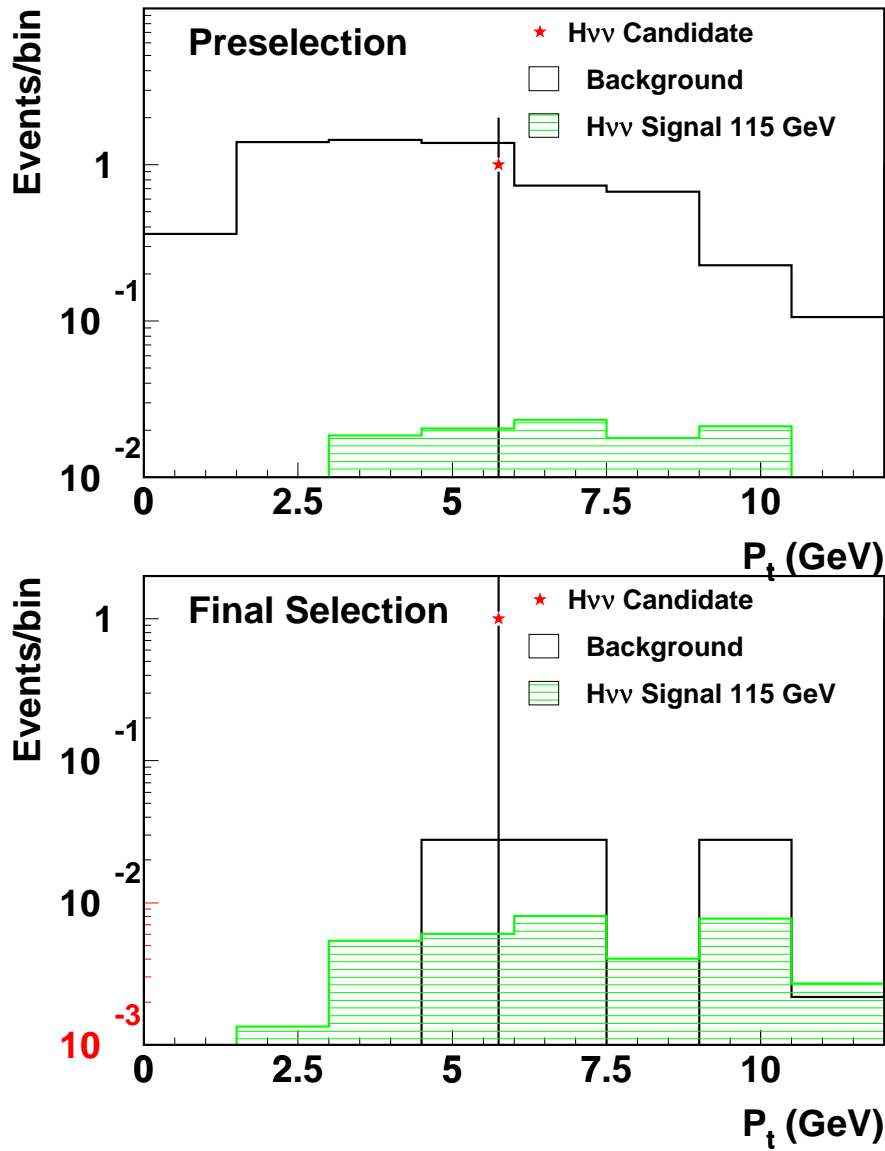


Missing energy event is indicated in red.

L3 Higgs search

Missing Energy Event p_T

Events with $M_{rec} > 114$ GeV (near threshold)

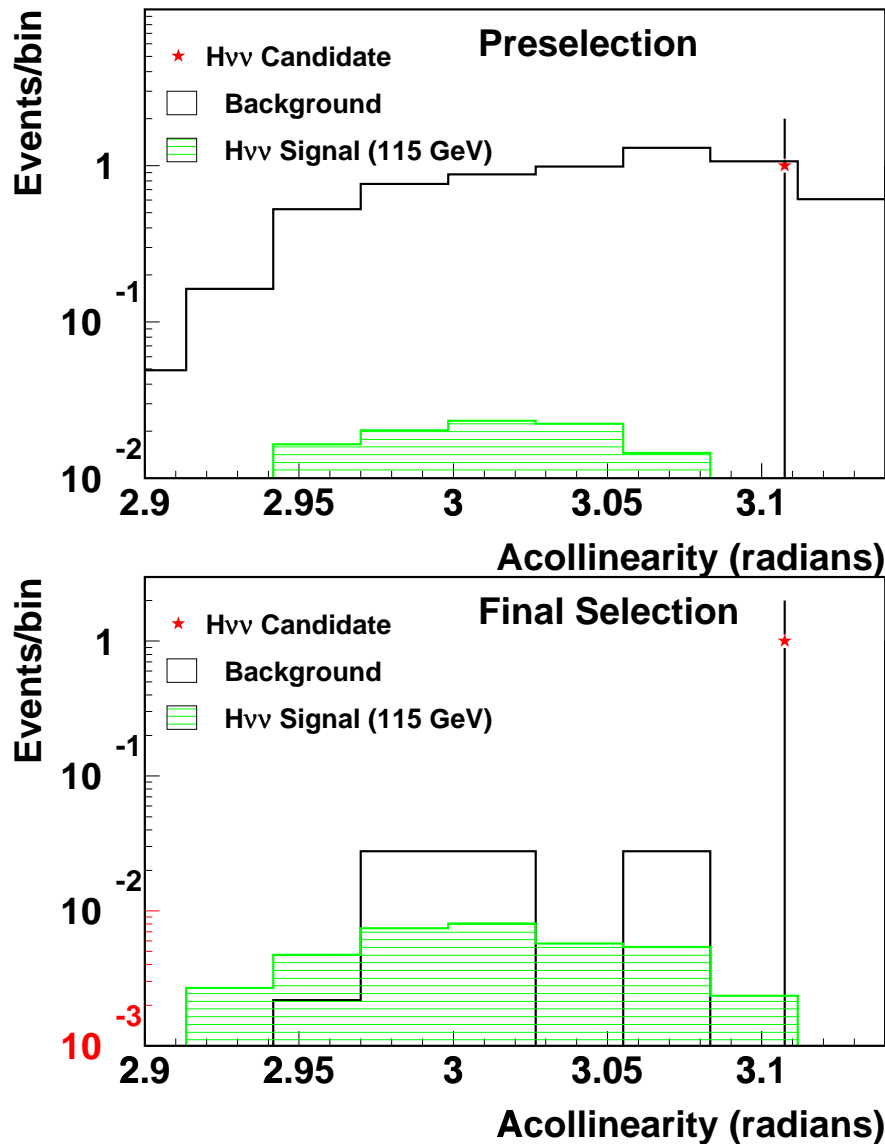


Low p_T values are compatible with Higgs production at threshold.

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Missing Energy Event Acollinearity

Events with $M_{rec} > 114$ GeV (near threshold)



Collinear events are rare

for both the background processes and signal.

L3 Higgs search

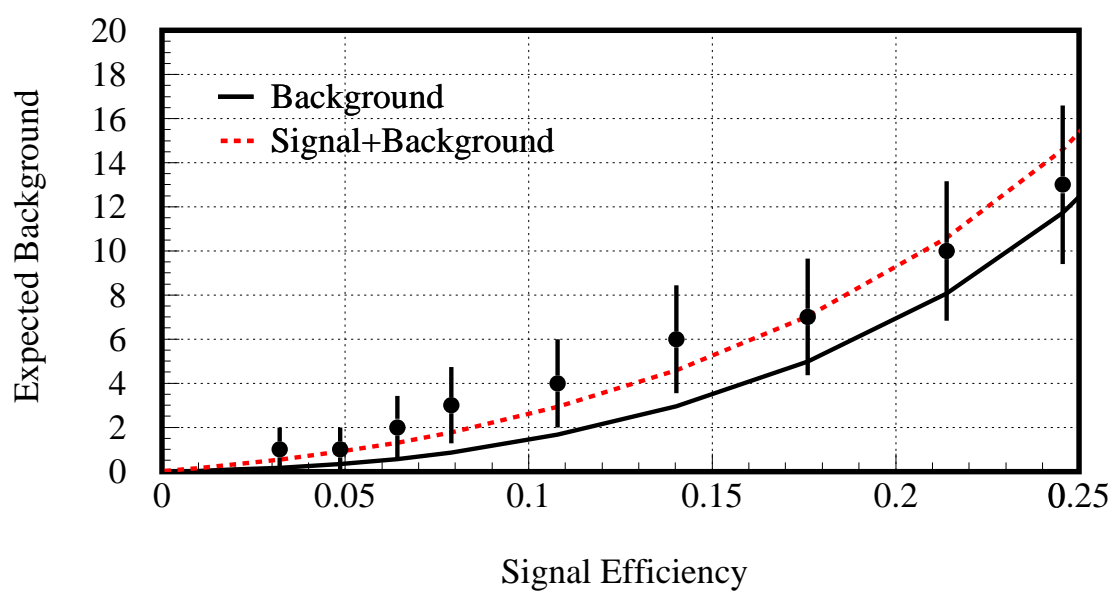
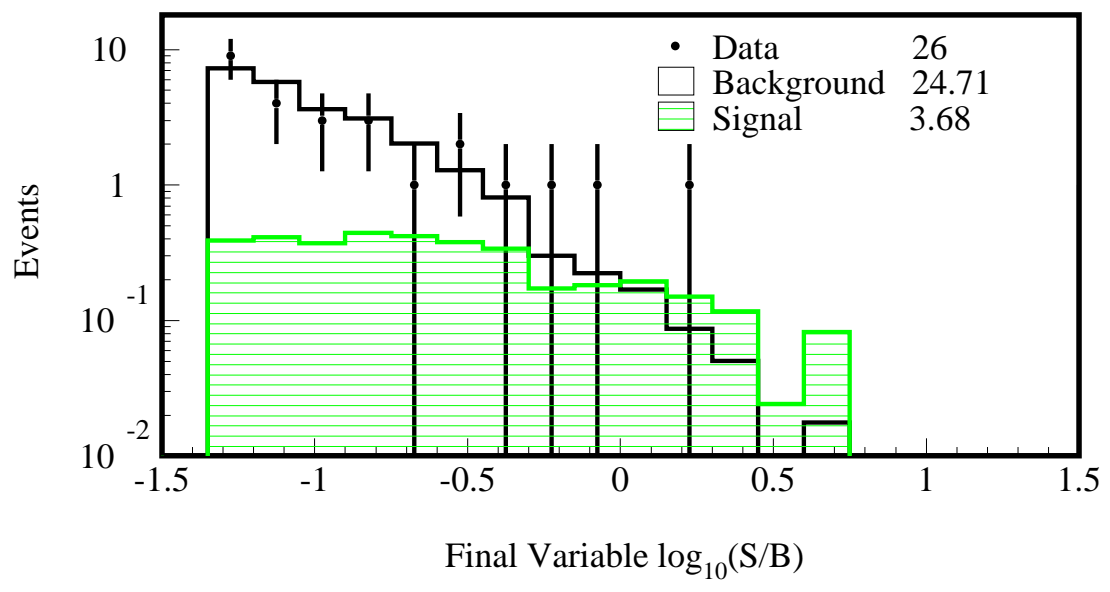
Data Reprocessing

After reprocessing the missing energy event with the final calibrations, the event weight is unchanged.

This event continues to be our most significant Higgs candidate for a 115 GeV mass hypothesis.

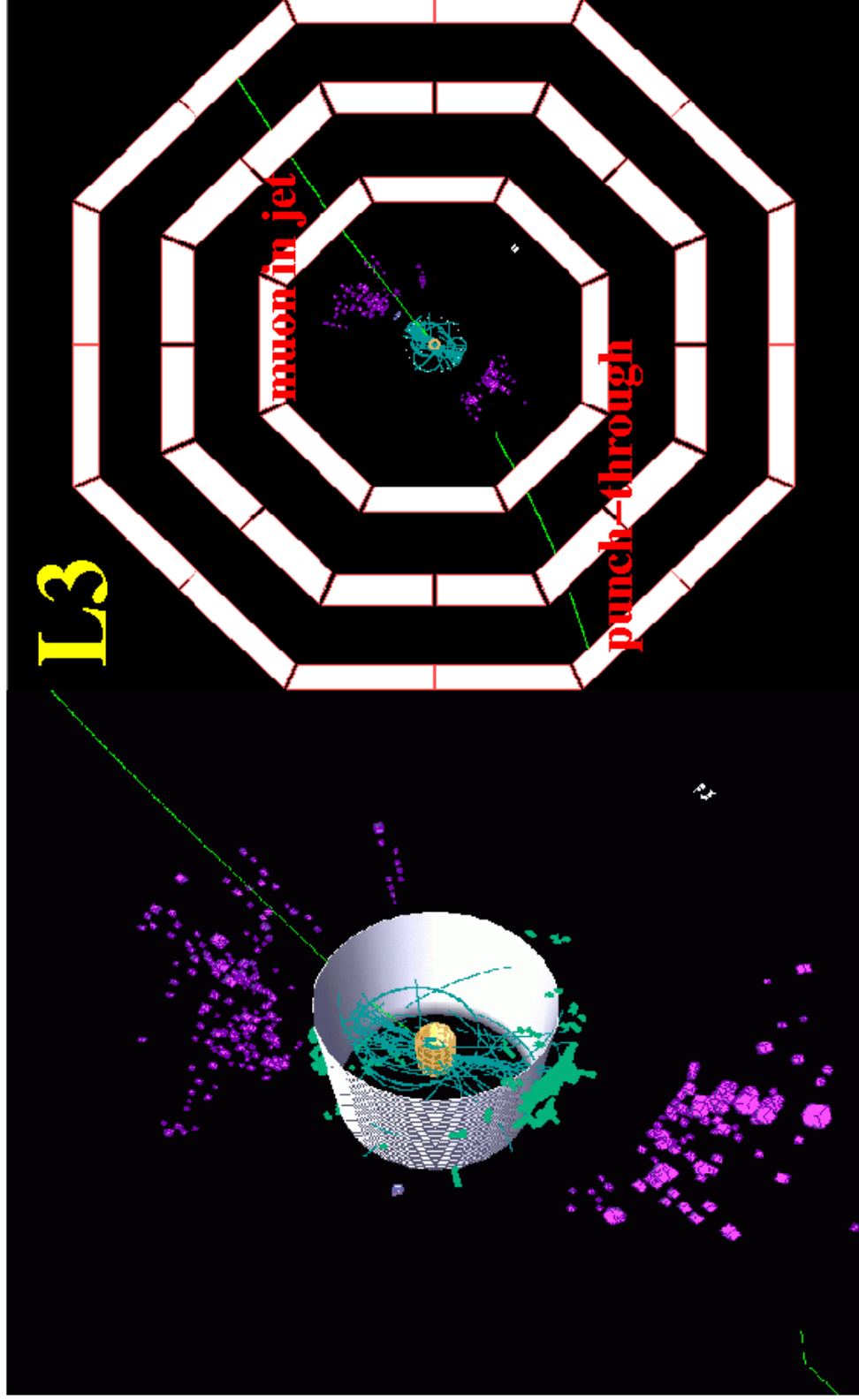
L3 Background-Efficiency Curve

Signal/Background Separation for $m_H = 114.5$ GeV



L3 Higgs search

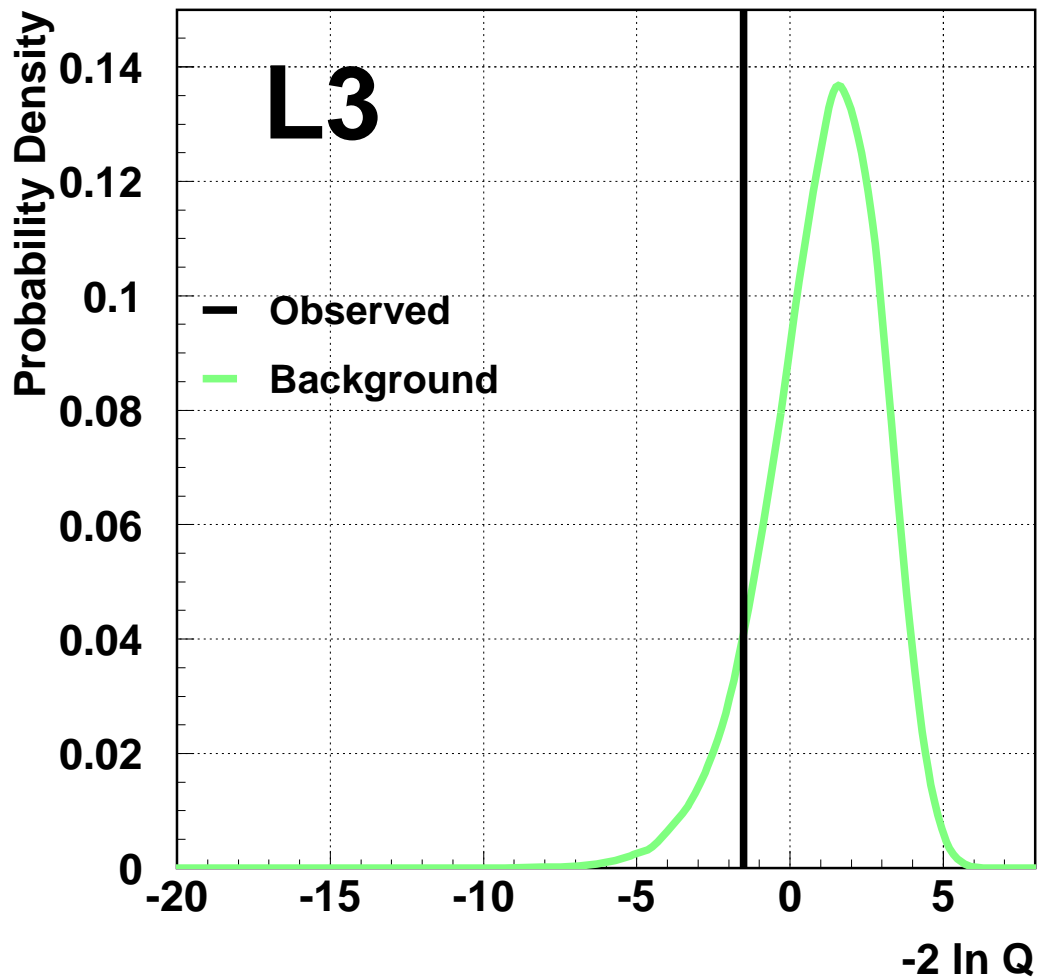
most significant Hqq candidate



measured Higgs mass=114.6 GeV mass resolution~4 GeV

L3 Higgs search

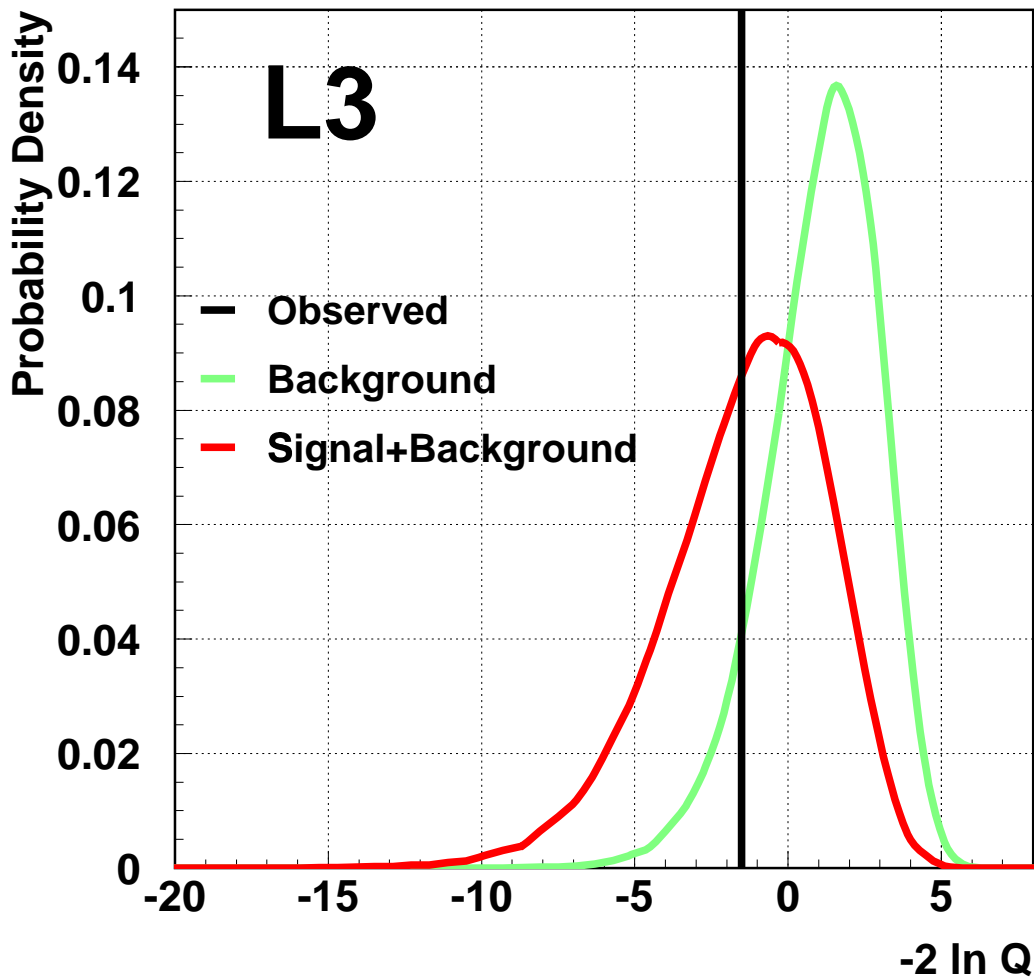
L3 Search Result for $m_H = 114.5$ GeV



$1 - CL_b = 0.09$ indicating a 1.7σ excess for $m_H = 114.5$ GeV.

L3 Higgs search

L3 Search Result for $m_H = 114.5$ GeV



$CL_{s+b} = 0.62$ in good agreement with signal+background.
 $1 - CL_b = 0.09$ indicating a 1.7σ excess for $m_H = 114.5$ GeV.

L3 Higgs search

L3 observes in two different channels
significant Higgs candidates
for a mass of 115 GeV.

We look with enthusiasm to the day
when the missing link in the Standard Model
is finally put in place.

L3 Higgs search