MC Study of the SM Higgs at TESLA LC
- BRAHMS (G3) analysis -

Valeri Saveliev
University of Obninsk, Russia

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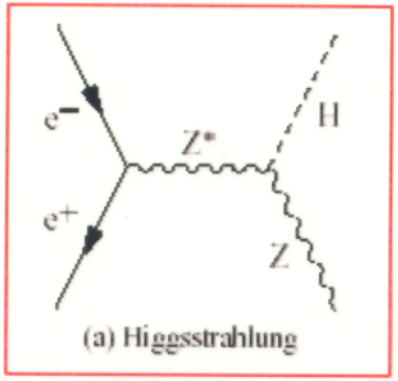
SM Higgs Discovery Potentials

The main goal this Study is define the Significance of Detecting of SM Higgs at TESLA

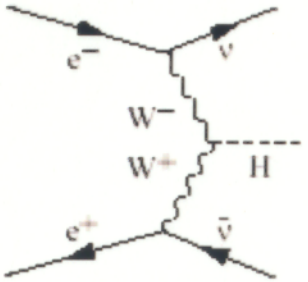
On base full MC simulation including realistic TESLA spectrometer and full reconstruction chain

SM Higgs Production at TESLA

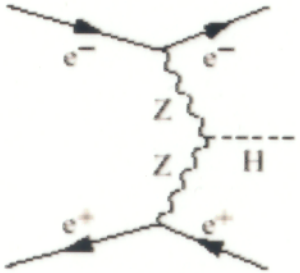
Dominant processes for the SM Higgs Boson at 500 GeV Center Mass Energy and Higgs mass 120-160 GeV is Higgsstrahlung process, others are by fusion of WW and ZZ bozons.



(a) Higgsstrahlung



(b) W fusion



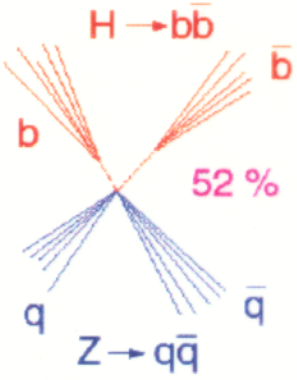
(c) Z fusion

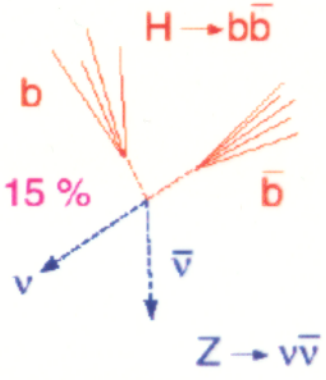
Development stage

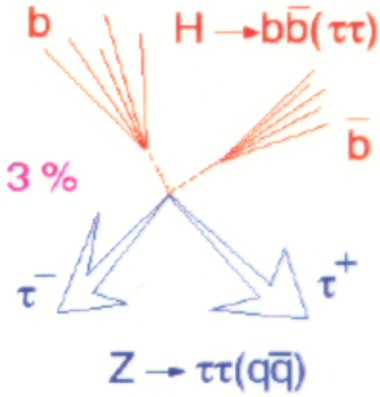
SM Higgs Decay Final States

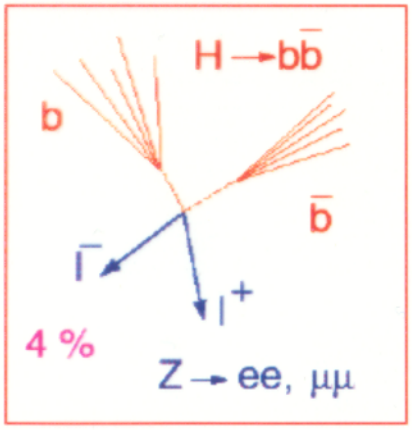
Final States with Good Sensitivity to Higgs Boson: at CMS 500 GeV and Higgs mass 120-160 GeV

$h^0 \rightarrow$	$b\bar{b}$	WW	$\tau\bar{\tau}$	$c\bar{c}$	gg
	77%	6.8%	6.4%	4.9%	4.1%
$Z^0 \rightarrow$	$q\bar{q}$	$\nu\bar{\nu}$	ee	$\mu\mu$	$\tau\bar{\tau}$
	70%	13.4%	3.4%	3.4%	3.4%



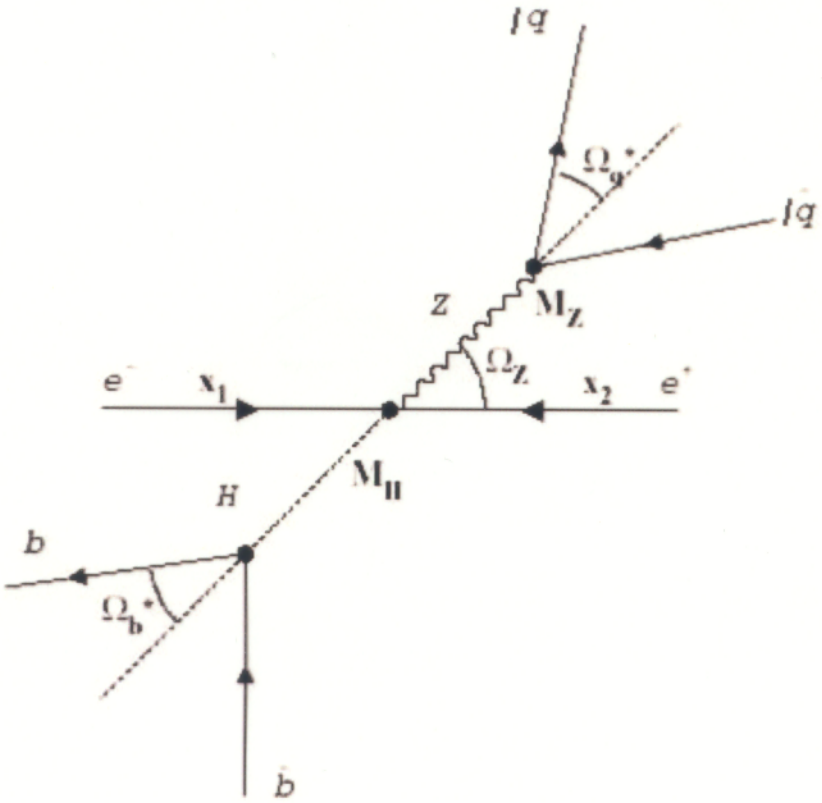






SM Higgs Decay Final States

Set of kinematics variables in Zh0 final states



Searches SM Higgs at the TESLA Linear Collider

In the Higgsstrahlung process, the decay ll in the associated Z0 bozon plays a special role

- The cannels are the most clean ones in all final states of h0Z0.
- Event topology for the signal is high energy ee or μμ with invariant mass of lepton pair similar to Z0.
- The branching ration in the Z0 decay to ee and μμ is limited ~6% .
- The background similar to signal is only those of ee ->Z0Z0-eeX or mu muX
- Recoil mass of two leptons corresponds to the Higgs mass without dilution by Z0 natural width.

SM Higgs Generator for TESLA LC

Pythia 6.152 – stable version

a) CM Energy is 500 GeV, Higgs mass is 140 GeV;

b) L = 250 fb-1

d) Z0 is forced decay to e+, e- (l+,l-);

e) h0 is forced decay to b, bbar;

Interface Pythia\Brahms HEPEVT format based

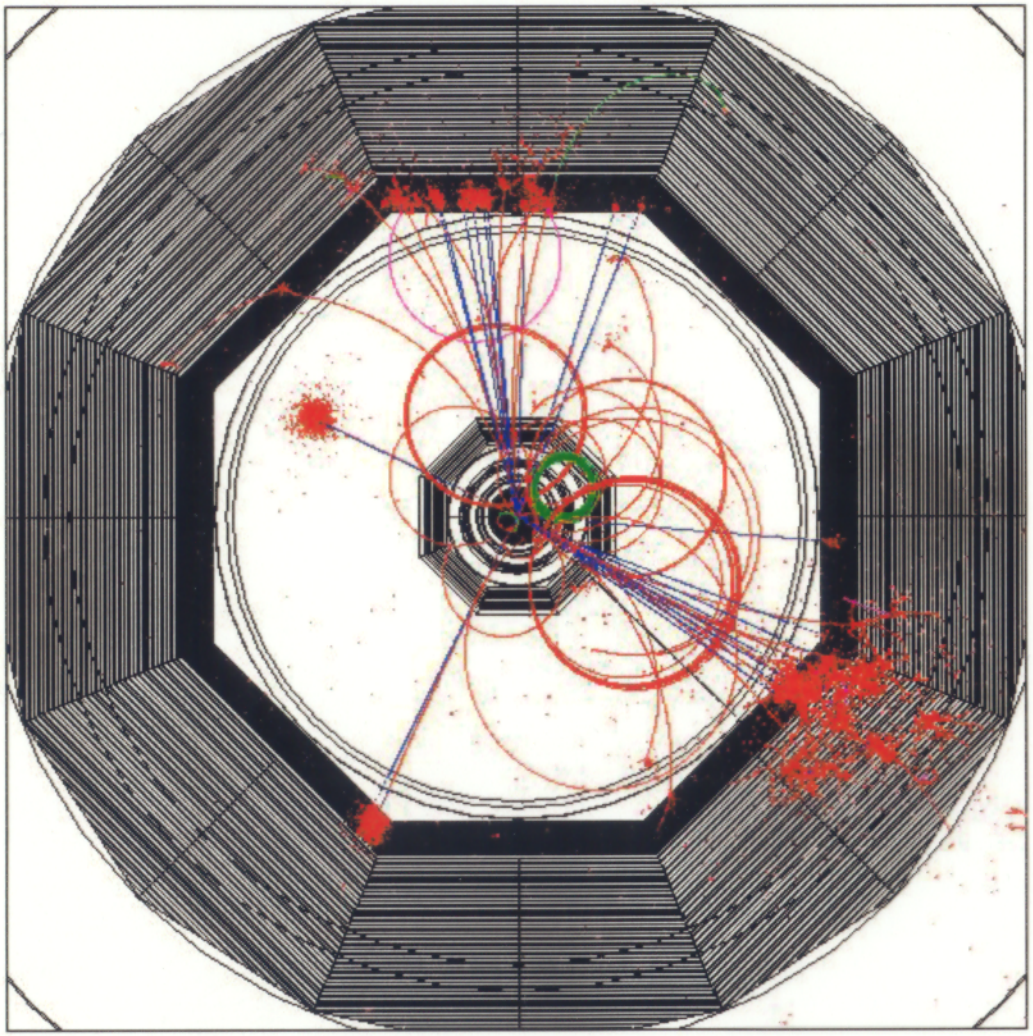
TESLA Spectrometer Simulation and Analysis

G3 based TESLA MC simulation frame

Brahms v306 (the last version is v308)

Reconstruction Chain Rereco (Energy Flow method)

Searches SM Higgs at the TESLA Linear Collider



Event Display

$$e^+e^- \to h^0 Z^0 \to b\bar{b}e^+e^-$$

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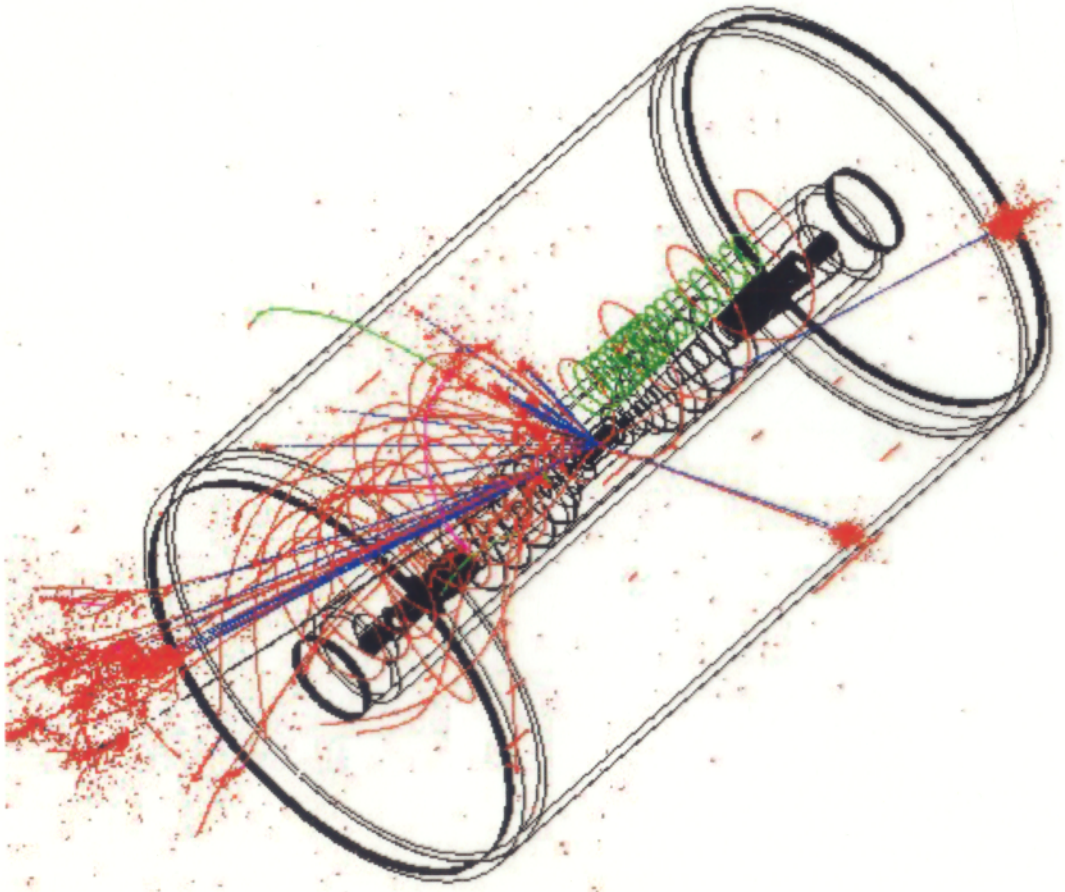

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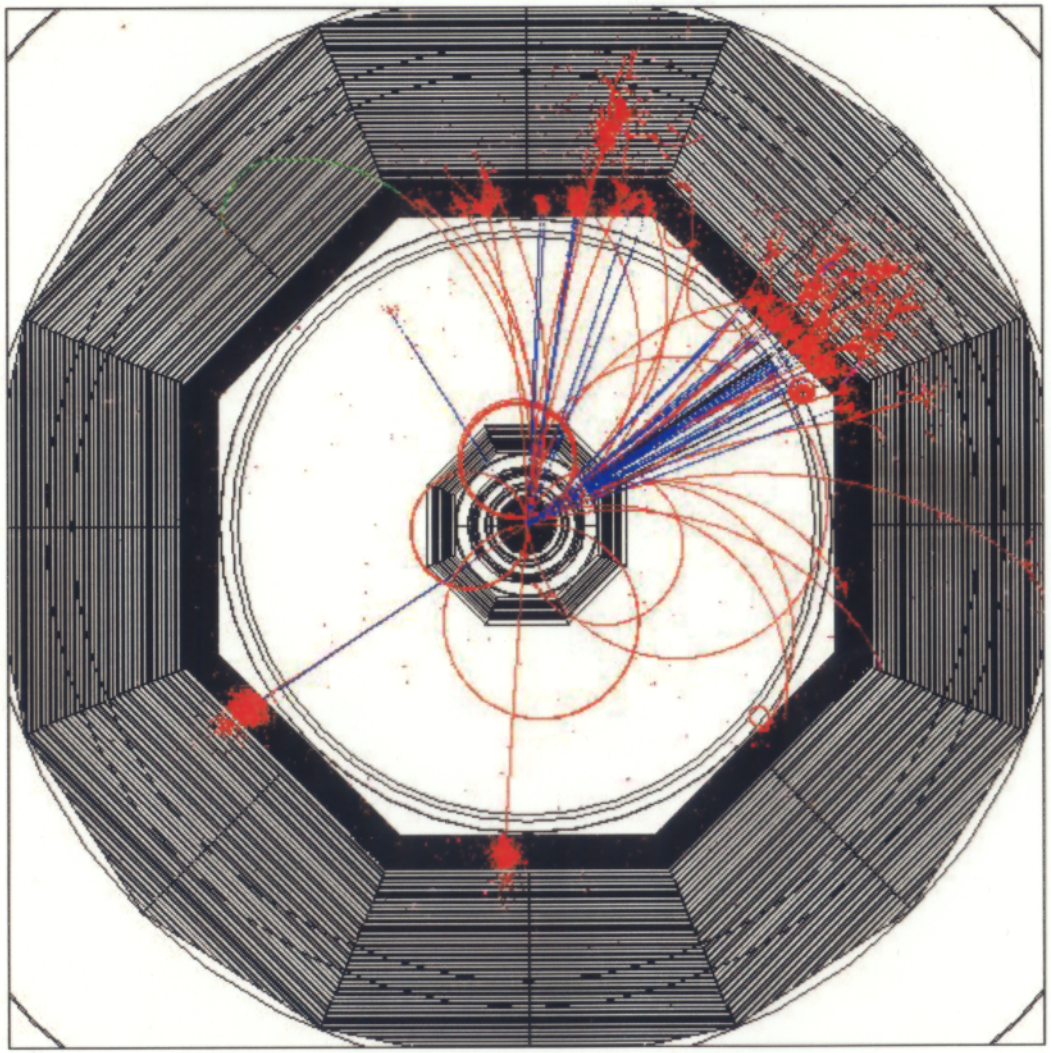


Event Display

$$e^+e^- \to h^0 Z^0 \to b\bar{b}e^+e^-$$

Method of Analysis

The Invariant Mass of Invisible System (the recoil Mass):

The recoil mass is determined by requiring energy and momentum conservation and by constraining the invariant mass of the visible system to the Z mass.

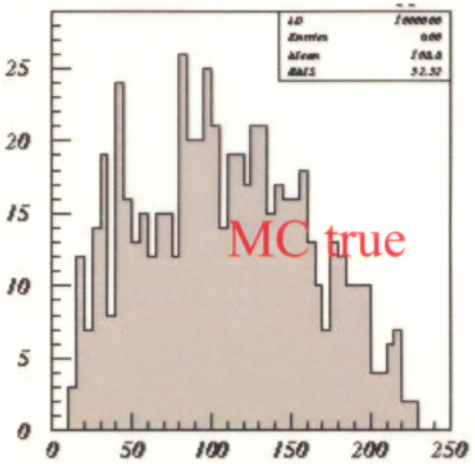
$$m^2_{rec} = s - 2\sqrt{s}(E_{l^+} + E_{l^-}) + m_z^2$$

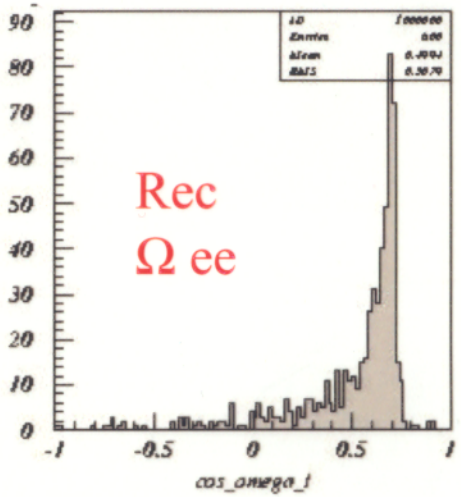
which is independent of assumption about SM Higgs decay, and the direct reconstruction of the invariant mass of the Higgs decay final states

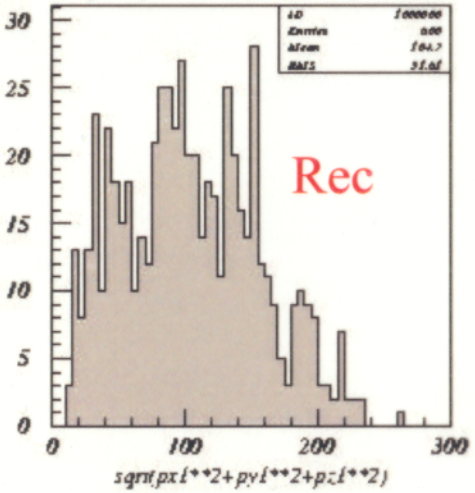
Kinematic Selection Two isolated Eflow objects with E > 10 GeV.

Analysis

The Invariant Masses of Invisible System (the Recoil Mass Method)





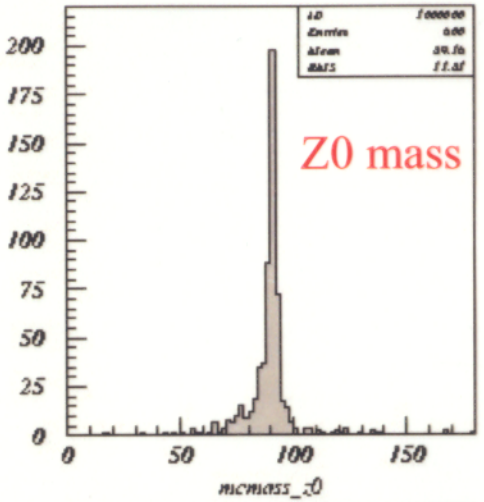


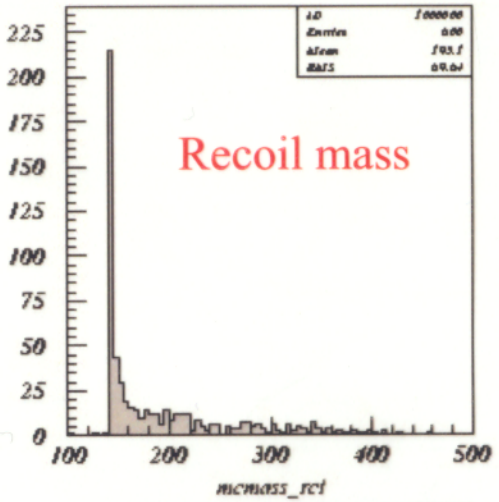
Brahms: Reconstruction

Energy Flow Objects

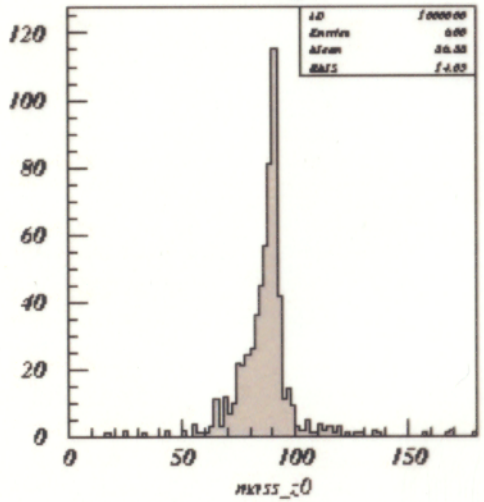
Analysis

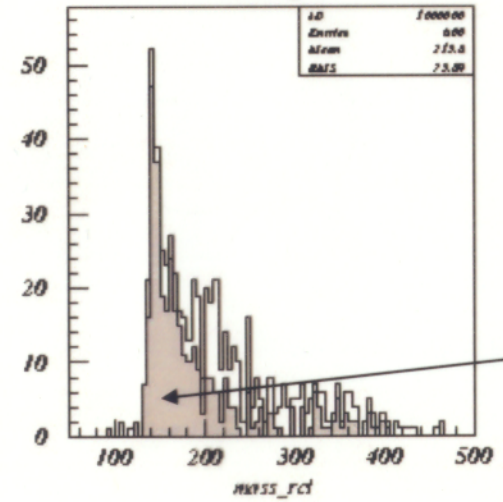
The Invariant Masses of Invisible System (the Recoil Mass Method)





MC true





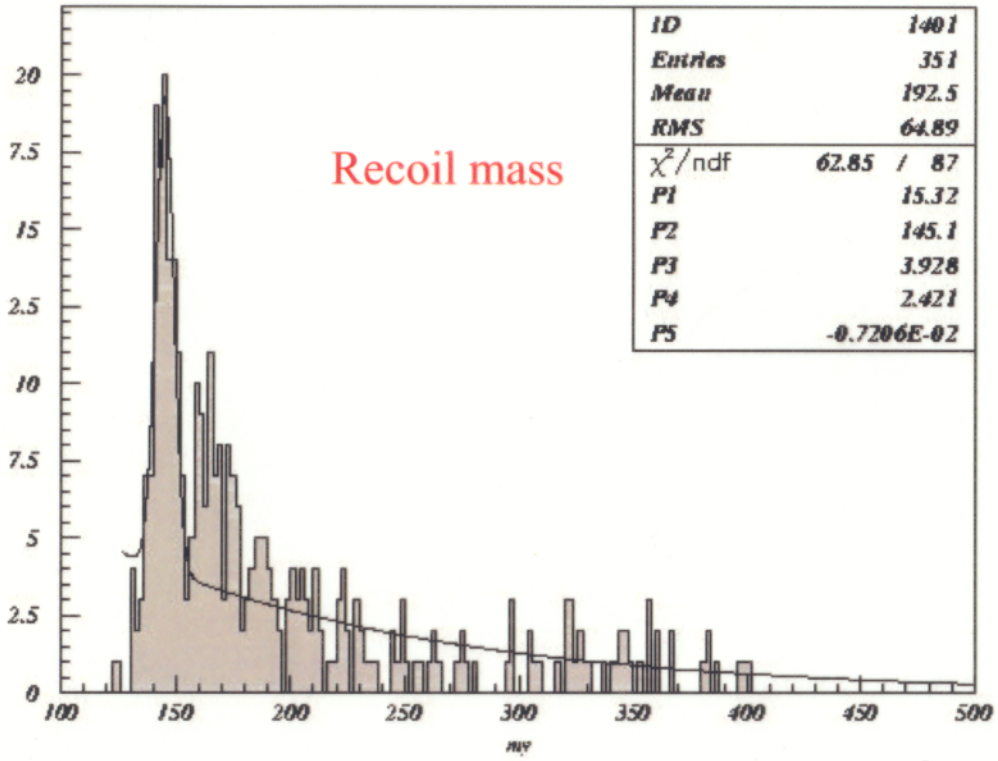
Brahms: Reconstruction

Energy Flow Objects

Mass cut M_z+-5 GeV

Analysis

The Invariant Masses of Invisible System (the Recoil Mass Method)



Recoil mass

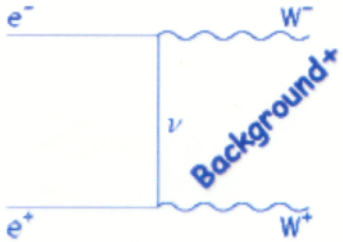
Brahms: Reconstruction

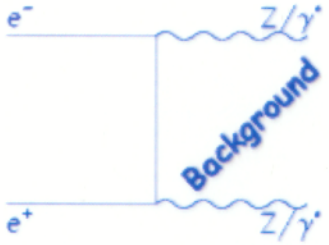
Energy Flow Objects

Mass cut M_z+-5 GeV

SM Higgs Decay Final States

Background Processes





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Next Steps

- Background processes generation.
- Definitions of Significancy
- Other methods of reconstruction of SM Higgs.