Dark matter search in higgs portal scenario

‘10 11/12

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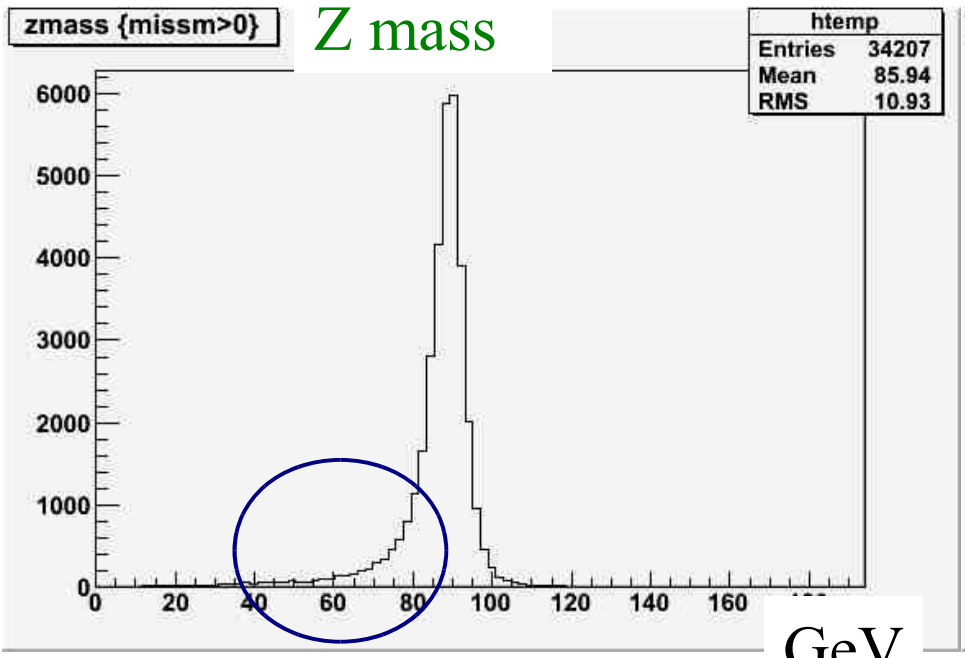
status

- Next, setup the dark-matter mass under 60GeV (On Shell Higgs) and check the ILC sensitivity of higgs-dark matter coupling.
  - First, Check the detector information of missing mass & Z boson mass.
  - Compare two analysis procedures
    - Case 1 (previous method)
      : do not fit the higgs mass (both zmass & zenergy are used)
    - Case 2 : want to fit the higgs mass (only zmass)

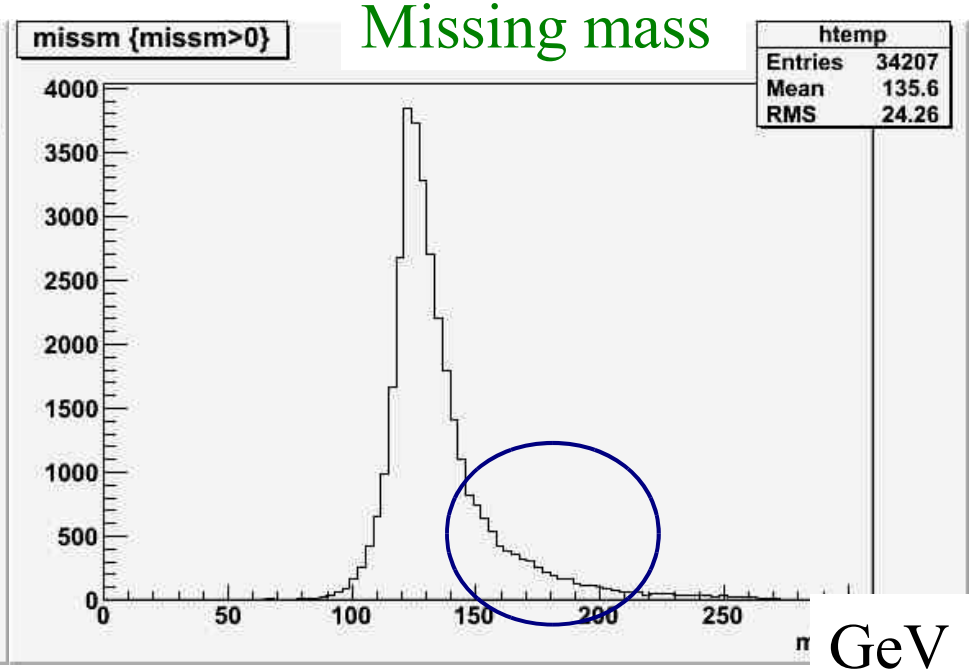
Setup

- Checked dark-matter mass : 50GeV
- Ecm : 300 GeV
- Beam polarization : electron +0.8, positron -0.3

Check the detector information



Z mass



Missing mass

GeV

GeV

Z mass distribution has low energy tail

Because of bremsstrahlung in detector

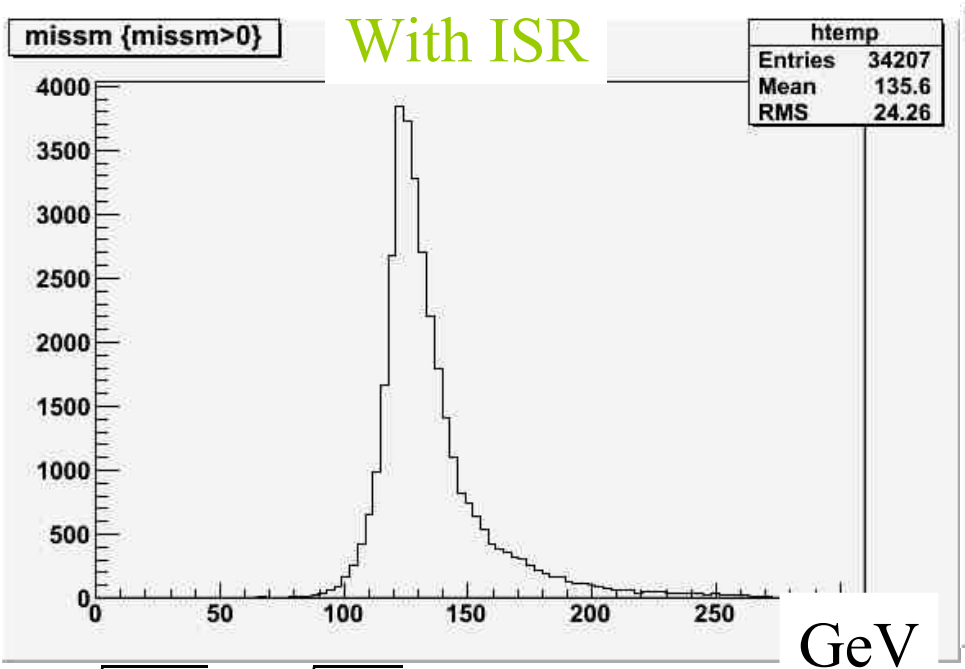
Missm distribution has also tail

This reason would be Beamstrahlung & ISR

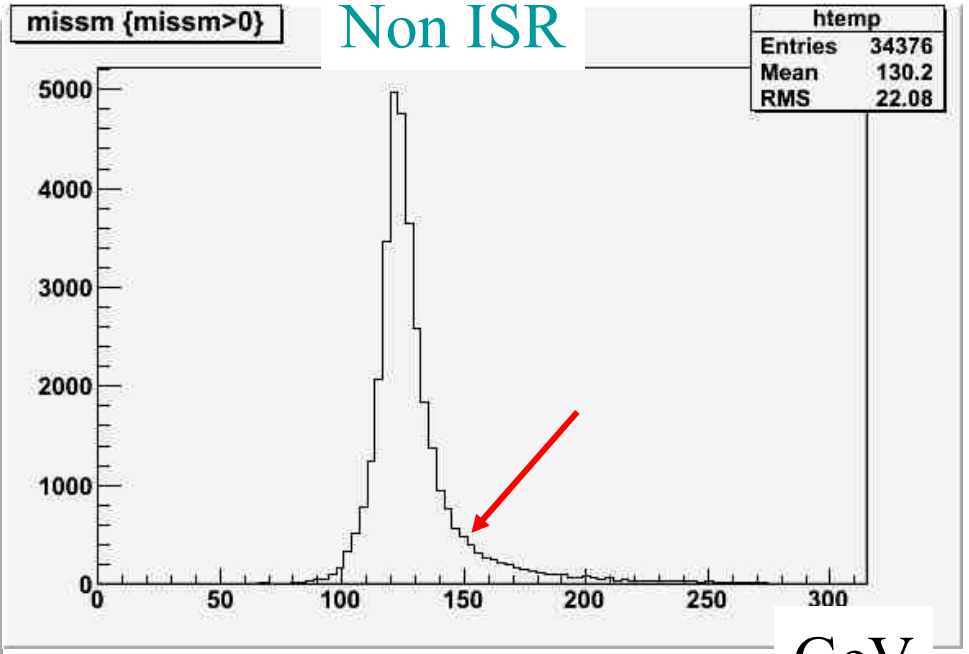
Effect of ISR & Beamstrahlung

Check the information of missing mass in two types

With ISR



Non ISR



$$\sqrt{s_{real}} = \sqrt{s_{fix}} - ISR = 300 - ISR$$

$$Missm_{fix}^{\ 2} = \left(\sqrt{s_{fix}} - Ez\right)^2 - Pz^2$$

$$Missm_{fix} \geq Missm_{real}$$

So shift toward high energy

The left figure was shaped up

analysis procedure

Case 1 : do not fit the missm

- Reconstruction of all events as 2 jets
- Event selection
  - Z-mass cut , Z-angular cut
- likelihood analysis
- Parameter : Z-angular ,
  Z-mass ,
  Z-momentum

Case 2 : want to fit

- Reconstruction of all events as 2 jets
- Event selection
- likelihood analysis
  - Parameter : Z-angular ,
    Z-mass

Reduction table

Signal region is 115 to 150 GeV

Case 1 : do not fit the missm

	Non cut	zmass	Cosθ	Likelihood
Signal	3943	2642	2182	1611
ννZ	20175	1874	956	303
ZZ	1661878	78208	40134	17645
WW	4773700	12459	5155	1797
eνW	2177000	16915	7445	1696
eeZ	9607180	202183	0	0

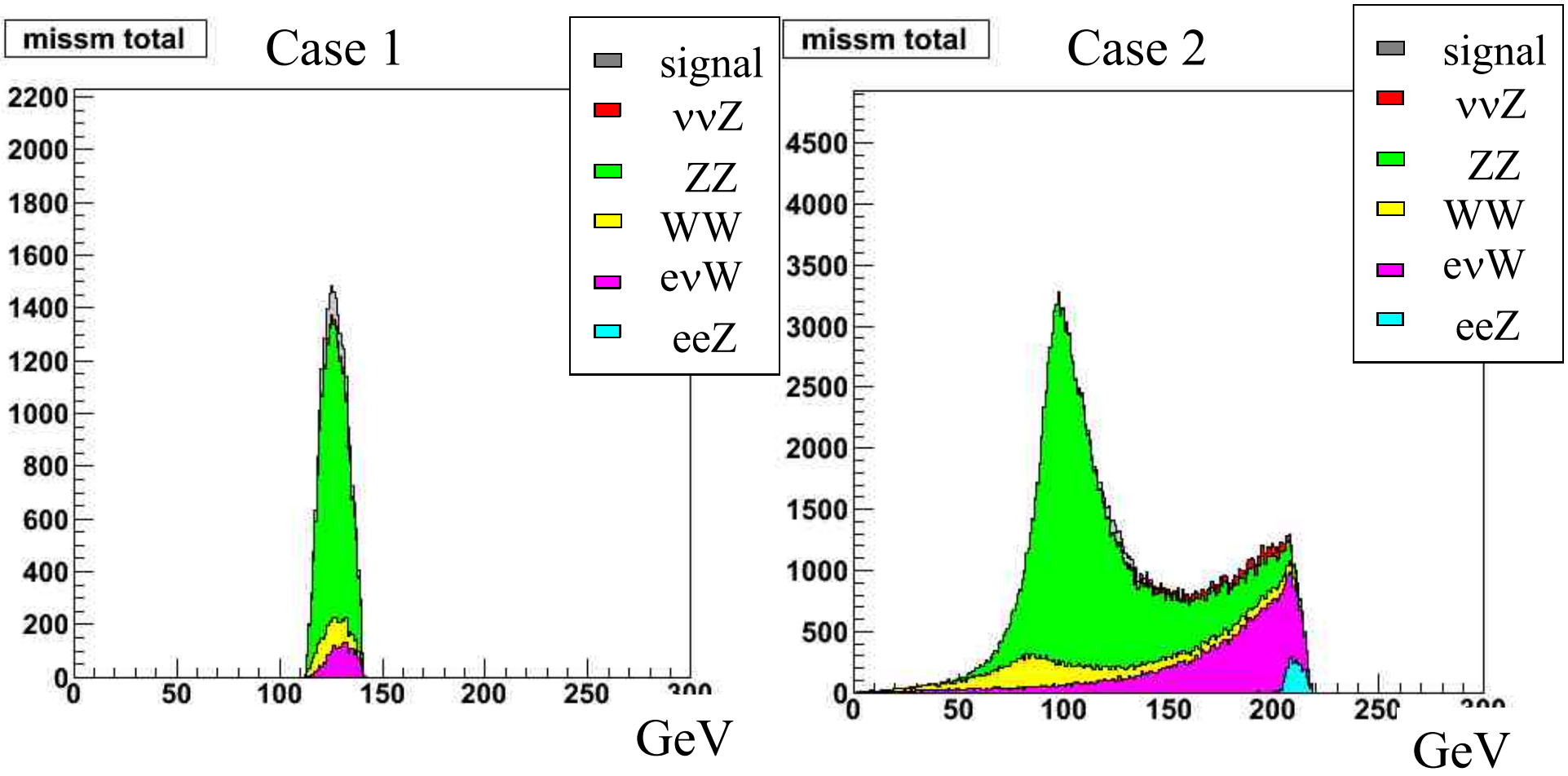
Significance is 10.4

Case 2 : want to fit

	Non cut	Likelihood
Signal	3943	1966
ννZ	20175	741
ZZ	1661878	32431
WW	4773700	3387
eνW	2177000	5538
eeZ	9607180	0

Significance is9.2

Missing mass distribution after all cut



Case 2 : I wanted to fit the higgs mass
But in this case, the fitting is not available
Need more significance or larger cross-section

Summary & plan

Summary

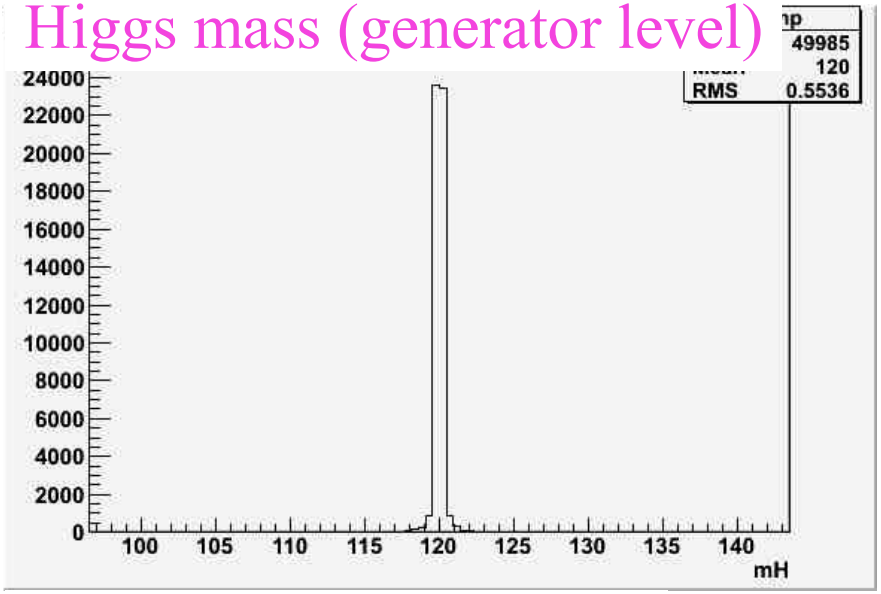
- Analysis is performing.

Plan

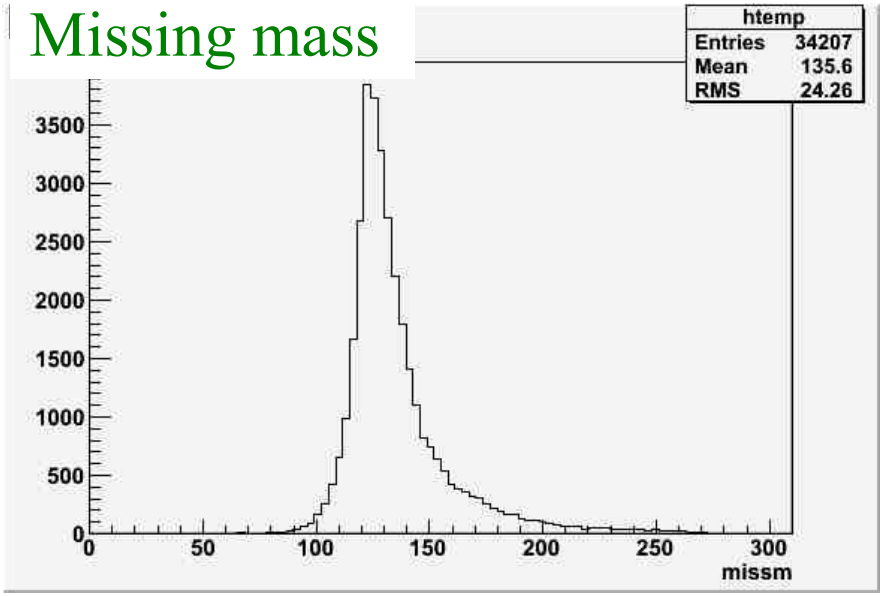
- To get more significance, the number of tracks and total charge information will be cut value. I think this cut reduce the enW event.
  - Question : how to get the charge information

Check the generator information and the detector one

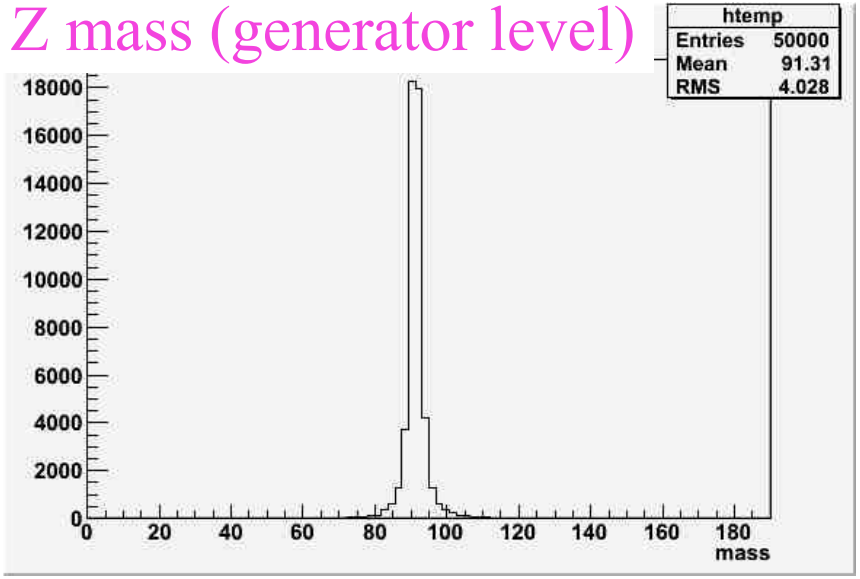
Higgs mass (generator level)



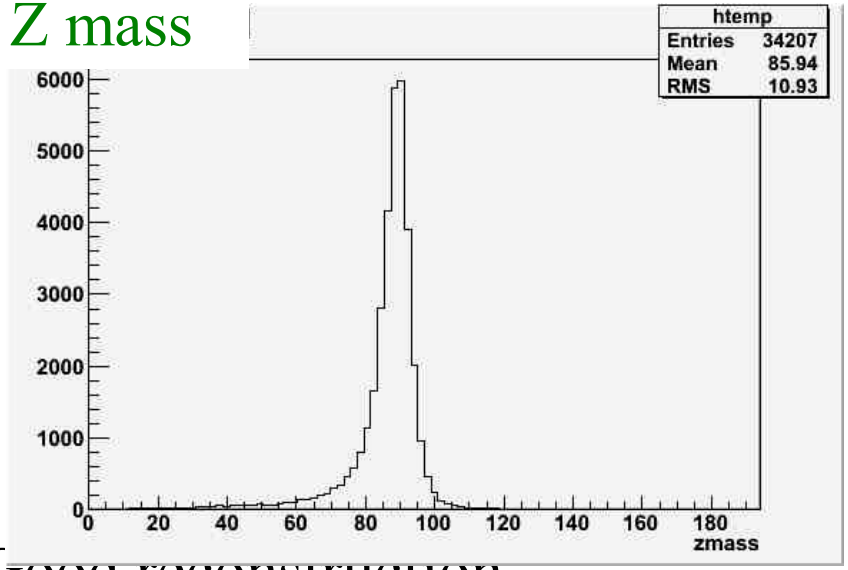
Missing mass



Z mass (generator level)



Z mass



Good reconstruction