Study of Higgs recoil mass various tracker resolution

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Motivation & Condition

- How does the tracker resolution affect the results of the measurement of Higgs recoil mass and cross section?
- I reconstructed ee -> Zh -> μμh events and estimated statistical errors of mass and cross section using toy-MC.

geometry [cm]	magnetic field [T]
185	3.5
160	3.5
160	4.5
140	3.5
140	5.0

* nominal sample

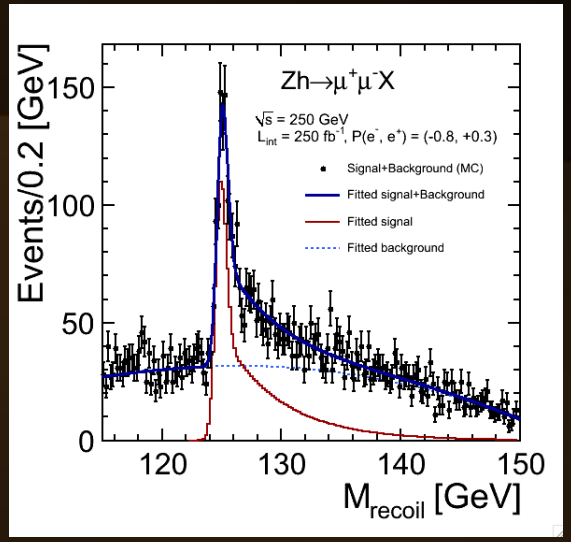
- I used DBD samples for BG.

Outline of analysis

BG rejection	
selection of di-lepton	
PT_{dl}	
M_{dl}	
acoplanarity	
dPT_{bal}	
$\cos\theta_{missing}$	
M_{recoil}	
Likelihood	PT_{dl}
	acol
	$\cos\theta_{dl}$
	M_{dl}

lepton selection	muon	electron
Ptrack	> 15	> 15
Eecal / Etotal	< 0.5	> 0.6
Etotal / Ptrack	< 0.3	> 0.9

- Fitting function
  - Gaussian Peak with Exponential Tail (GPET) for signal.
  - 3rd order polynomial for BG.
  - Fit recoil mass distribution (toy-MC) keeping signal shape fixed.
  - Then, estimate stat. error of mass and cross section from mean and height value of GPET.



Result for μμX channel

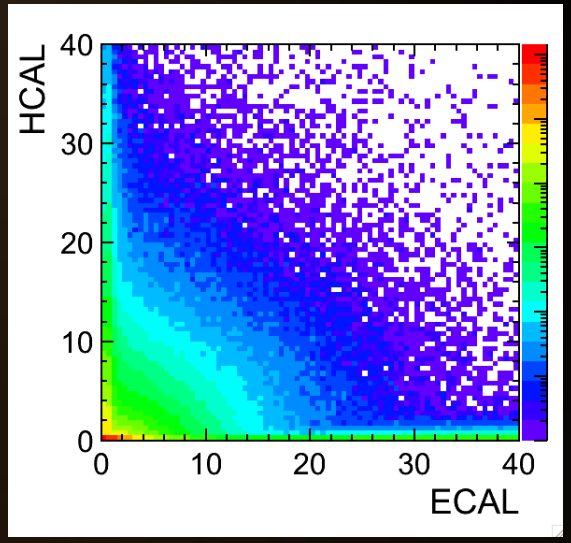
	N_{sig}	N_{BG}	δ_σ	δ_m
nominal	1596	4584	3.55%	32.5 MeV
DBD			~3.7%	~37 MeV
160, 3.5	1590	4583	3.60%	35.6 MeV
160, 4.5	1592	4662	3.66%	33.7 MeV
140, 3.5	1595	4654	3.64%	39.3 MeV
140, 5.0	1586	4640	3.66%	34.0 MeV

- The deviation from nominal case may be not large. (0.5 ~ 1.0% for cross section error)
- If we use stronger magnetic field, mass error analysis will be better.
- However, this study may depend on likelihood selection, so more investigation is needed. Likelihood cut was fixed from DBD case.

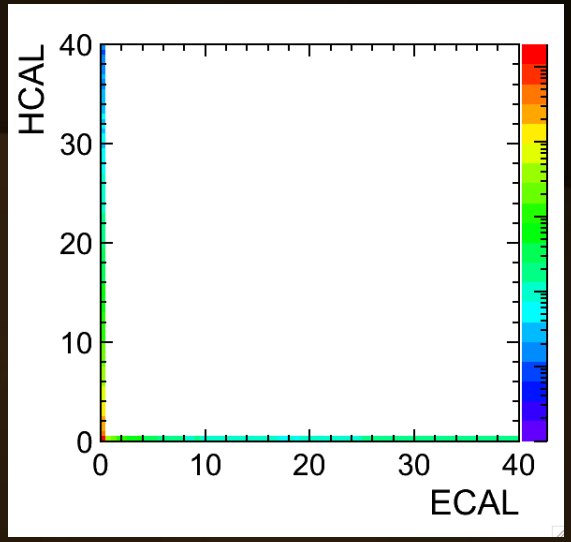
About eeX channel samples

- I also tried to reconstruct eeX channel, but I found there are two problems.
- One is that PFO's deposited energy of calorimeter is strange.
  - In SGV samples, there are only events in which PFO's deposited energy has value only in one calorimeter, and another is zero.
  - Then, I can't reconstruct correctly because a lot of events are rejected in process of $e^{\pm}$ selection.

    efficiency of $e^{\pm}$ selection
    ~70% -> ~20%
  - Same thing can be said in $\mu\mu$X channel study, but in the channel, selection eff. is similar to DBD case (a few better, ~87% -> ~90%).



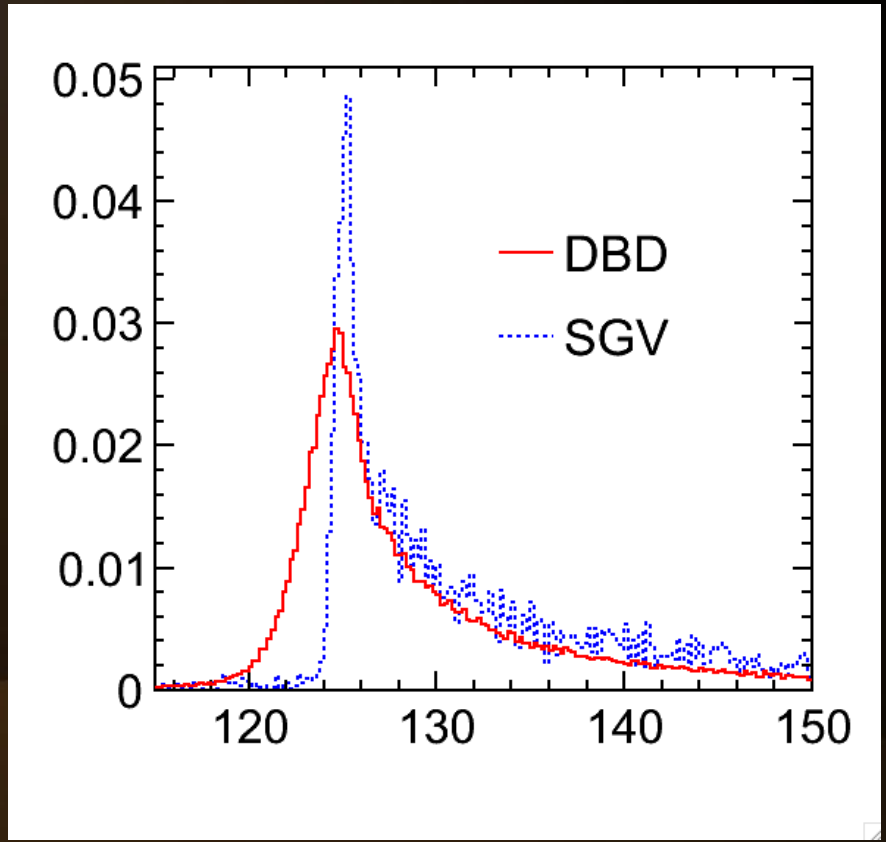
eeX DBD



eeX SGV

Bremsstrahlung recovery

- Another problem is about bremsstrahlung.
- Since energy resolution of photon is bad, if I perform bremsstrahlung recovery to eeX recoil mass, the distribution should have wide width.
- But right figure shows that the distribution was not widened after recovery, which mean that photon resolution is not smeared in SGV samples.



Summary

- I reconstructed various tracker resolution μμX SGV samples to estimate the effect of tracker in measurement of higgs mass and cross section.
- As a result, cross section error didn't vary significantly, but mass error was better if stronger magnetic field was used.
- In eeX channel samples, there were some problems in the reconstruction.
  - PFO's deposited energy in calorimeter is strange.
  - Photon energy resolution may not be smeared.