Sensitivity to Anomalous Couplings Between the Higgs and Vector Bosons at the ILC

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Outline

>. Motivation.

>. Angular parameters.

>. Procedure of analysis.

>. Sensitivity.

>. Quotation

>. Summary.

Motivation

>. The KEY to probe the new physics is to clarify the origin of the EWSB.

>. High precision measurement of the Higgs boson properties is the most important.

>. The measurement of the Higgs CP-mixture, particularly, might have a possibility that it shows us new physics beyond the SM.

>. The CP-odd state higgs boson (A) appears in many extensions of SM (the Higgs sector(h)).

- 2HDM; h(CP-even), A(CP-odd)
- MSSM; h and H(CP-even), A(CP-odd)

>. New physics can be represented by higher dimension operators as the extension of the SM.

>. The lowest operator is dim-5, if the couplings between weak bosons are considered.

Relevant term is (arXiv:1011.5805)

$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu}+\frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu}+\frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

SM (CP-even) Correction [a] | Tensor Couplings CP-even [b] | Tensor Couplings CP-odd [bt]

>. The purpose is to estimate how the ILC is sensitive to these parameters, if there is any.

Idea

>. Kinematic distributions which are predicted with SM will change for either the decay particles and the associated particles to the Higgs boson.

>. Using the information of final state momentum spectra, angular distributions, We can judge the existence of the anomalous couplings.

$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu}+\frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu}+\frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

"**a**" is a simple rescaling parameter.
It affects the normalization of the process.

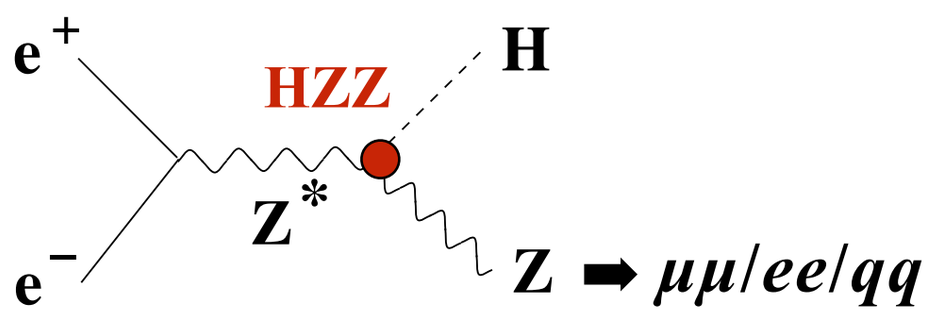
"**b**" has a different Lorentz structure
It affects the momentum and
change the ratio of couplings to
the transverse or longitudinal components.

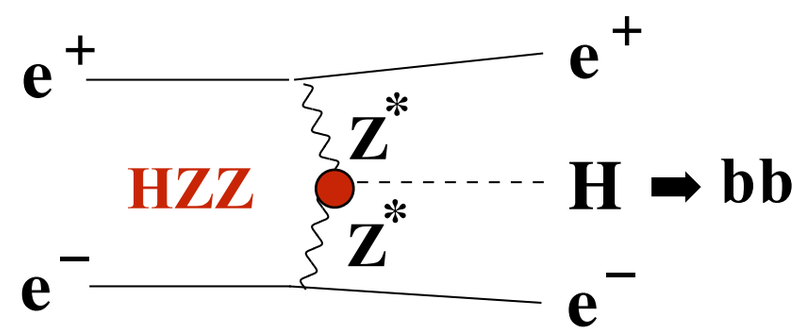
"**bt**" is a CP-violating parameter
It affects the angular correlations.

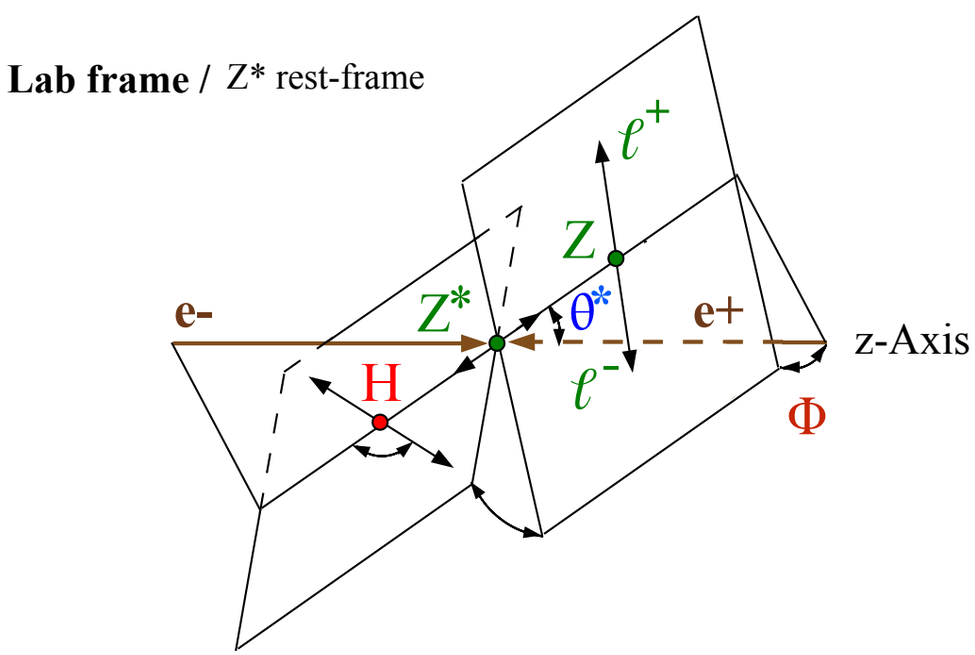
Processes (Focus on ZZH)

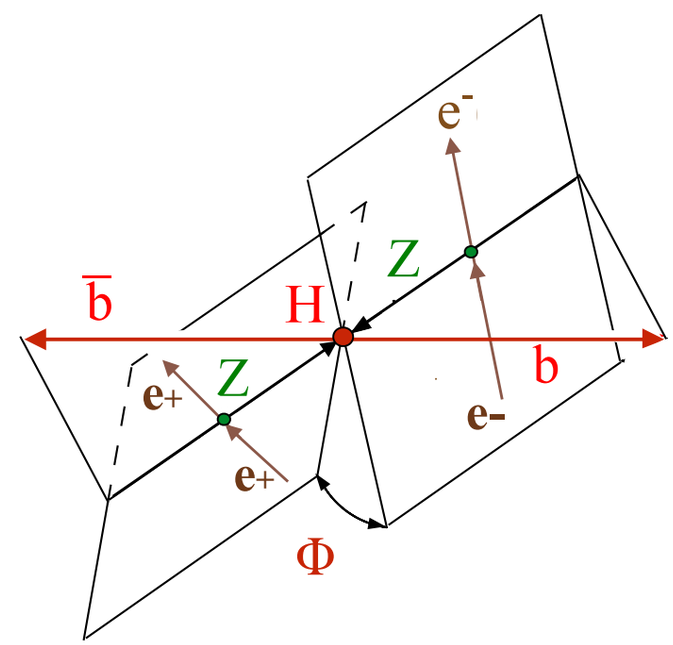
>. In the lepton collider environment.

>. Several processes are available for the testing of anomalous couplings on ZZH.
e.g.) **Zh-strahlung @ 250GeV & 500GeV** + **VBF @ 500GeV.**









※ Original picture © arXiv:1309.4819

Definition of Parameters

>. Definition of the angles (in the Lab-frame).

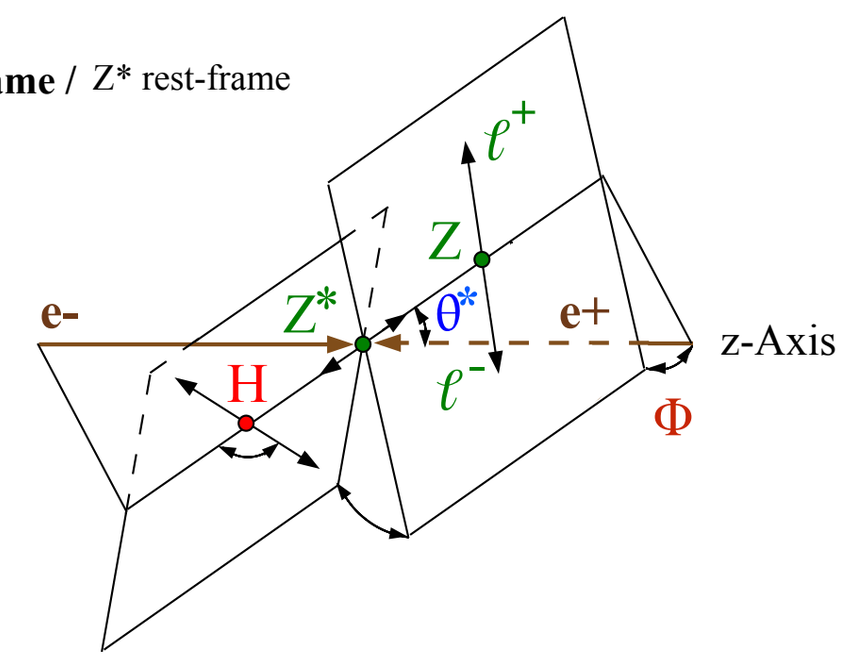
>. θ^* : The production angle of the Z boson in the Lab frame.

>. Φ : The angle between two planes defined in the Lab frame.

>. θ_h : The production angle of the H boson in the Lab frame.

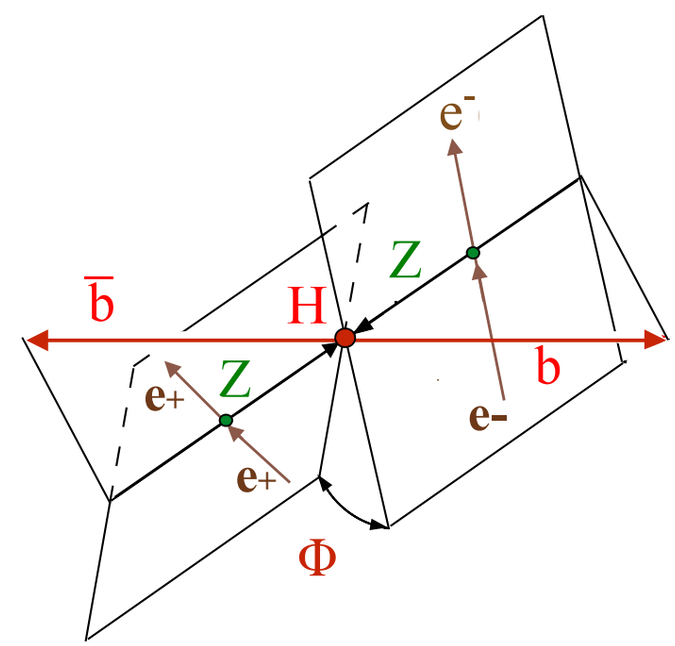
(>. P_h : A momentum of the H boson in Lab frame.)

Lab frame / Z* rest-frame



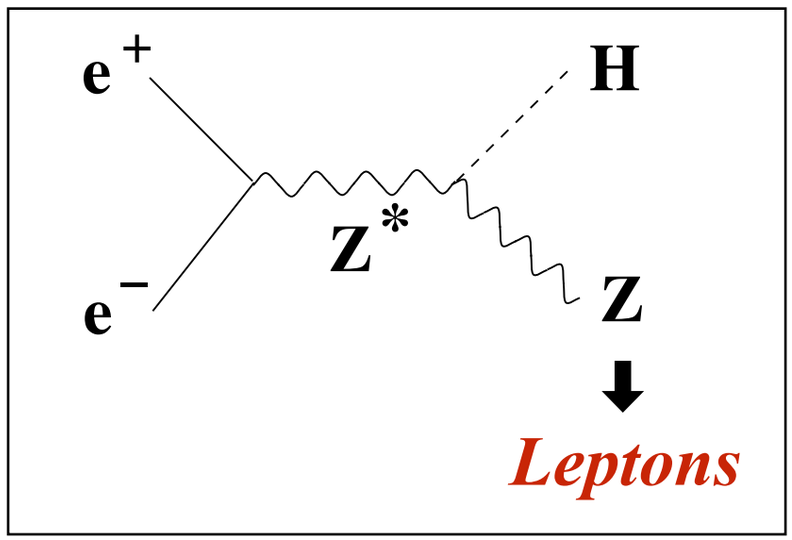
※ Original picture © arXiv:1309.4819

The picture is the H rest-frame.
Angle calculation is actually based on Lab frame



Difference of Angular Distribution

>. 250GeV Zh-strahlung.



$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu}+\frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu}+\frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

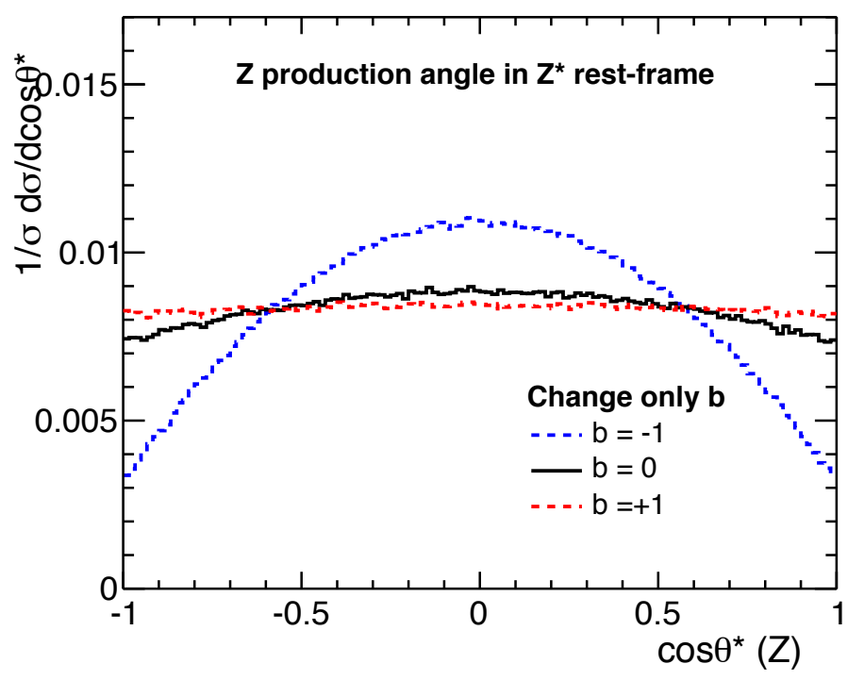
Change "b" to ± 1

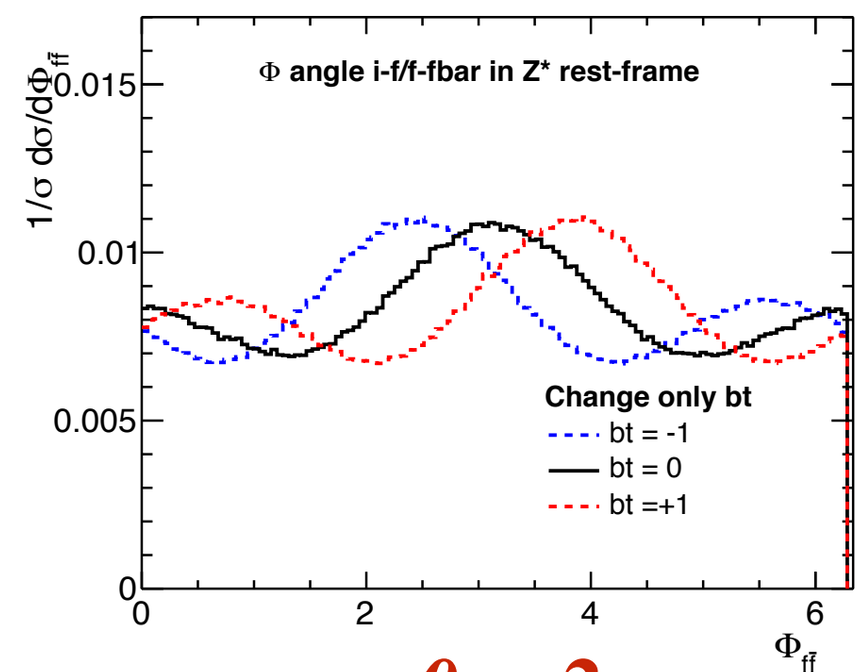
Change "bt" to ± 1

— **SM**

— **- 1**

— **+ 1**



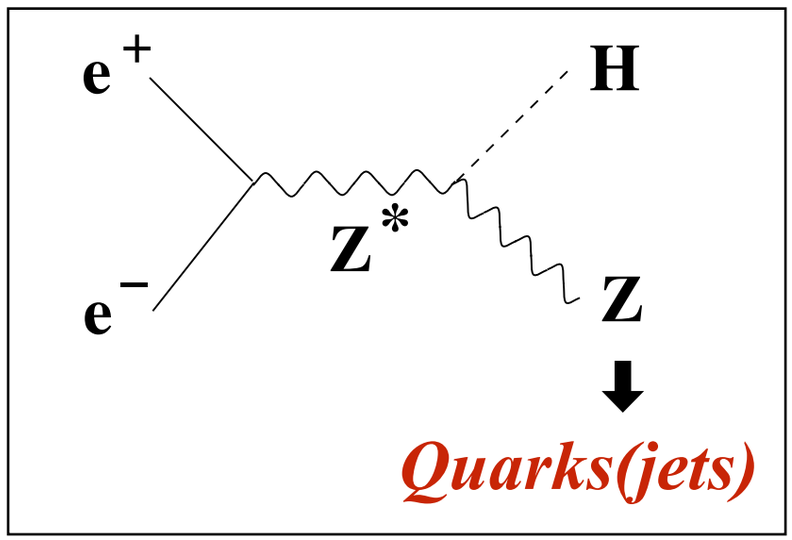


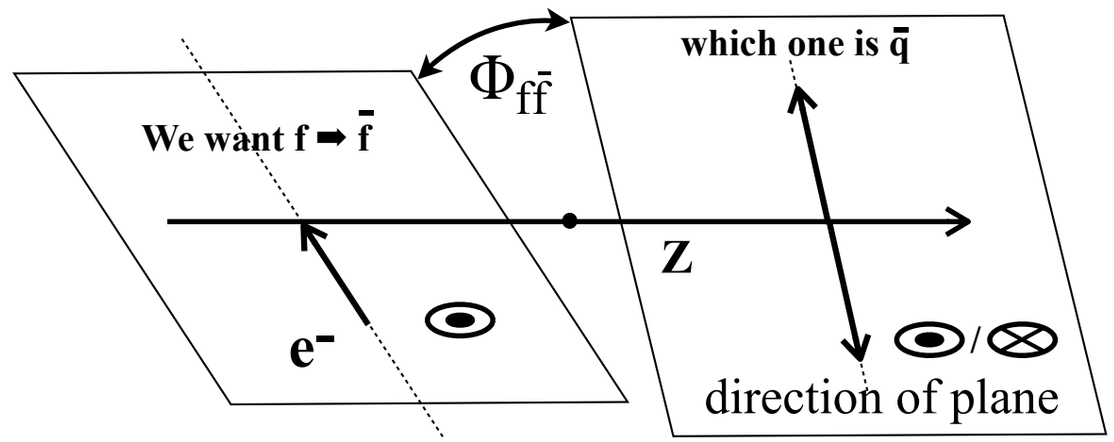
0 ~ 2π

※ The other distributions are shown at back up slides

Difference of Angular Distribution

>. 250GeV Zh-strahlung.





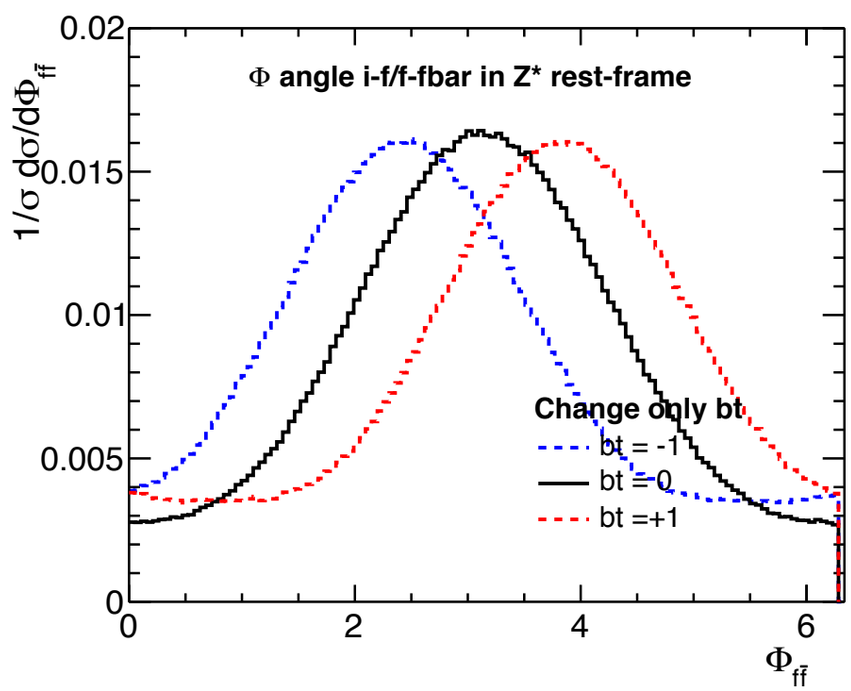
We can't distinguish the direction of plane.

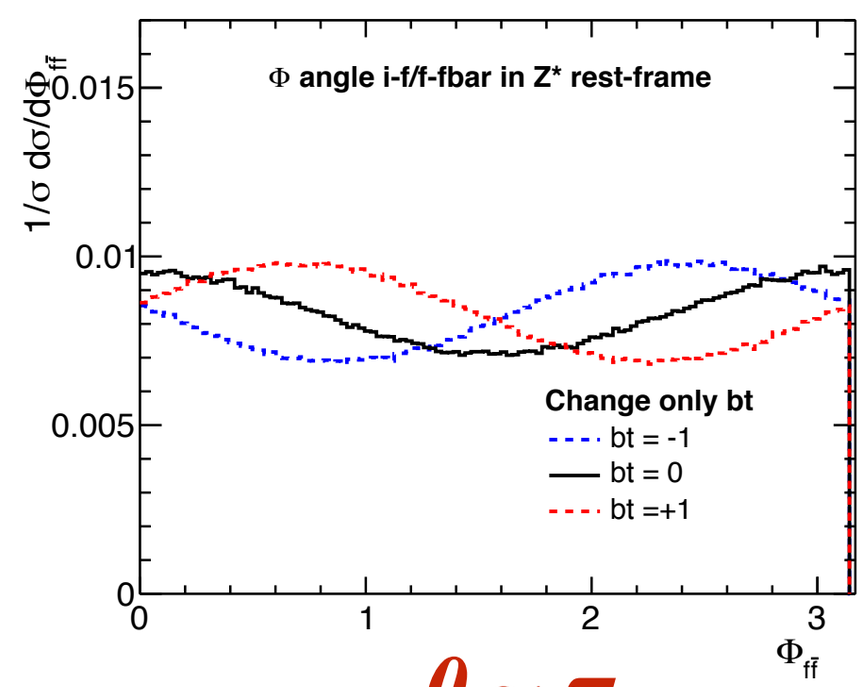
➡ ***Sensitivity is Limited.***

— **SM**

— **- 1**

— **+ 1**





0 ~ π

※ Jet charge identification is other theme.

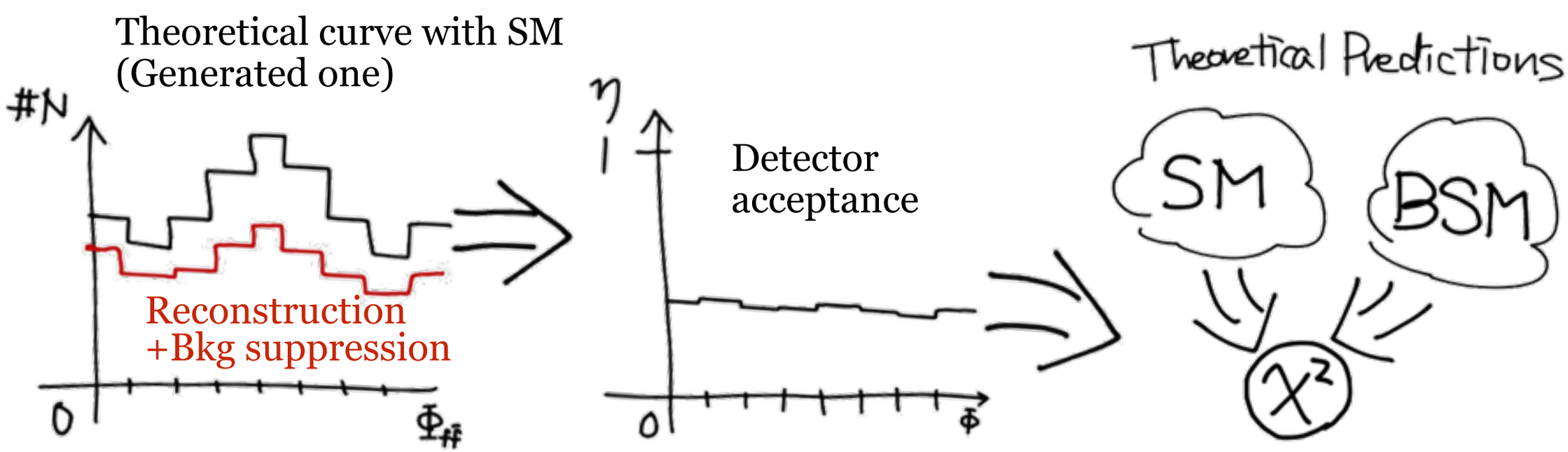
Procedure of Analysis

>. Overall procedure

>. **Using full simulation and assuming the SM,**
we reconstruct parameters θ* and Φ.

>. Comparing these observables with the SM predictions,
we get detector acceptance (**η**) for each parameter.

>. Using the estimated detector acceptance
and theoretical curves with BSM models (ToyMC),
we conduct χ2 test to evaluate sensitivity to anomalous couplings.



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>. Calculation of χ2 (which is divided into 2 parts).

Theoretical angular distribution

N is the number of expected events
after Bkg suppression (**ε**: efficiency).

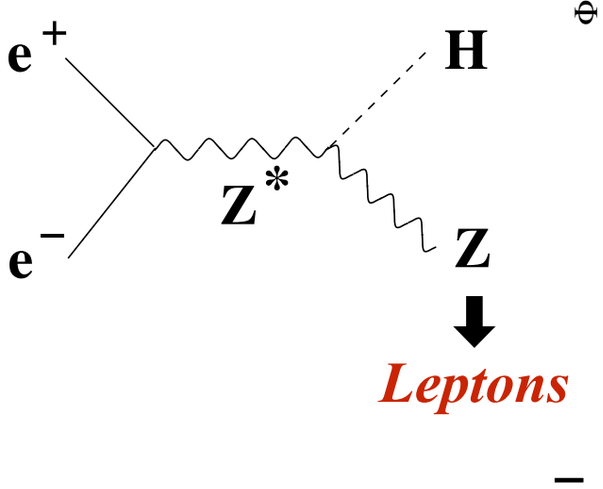
$$\chi^2 = \sum_{bin=1}^{n} \left(\frac{f_{SM}(x_{bin}) \cdot \eta_{bin} - f_{BSM}(x_{bin}; a, b, \tilde{b}) \cdot \eta_{bin}}{\delta f_{SM}(x_{bin})} \right)^2 + \left(\frac{N_{SM} \cdot \epsilon - N_{BSM} \cdot \epsilon}{\delta\sigma \cdot N_{SM} \cdot \epsilon} \right)^2$$

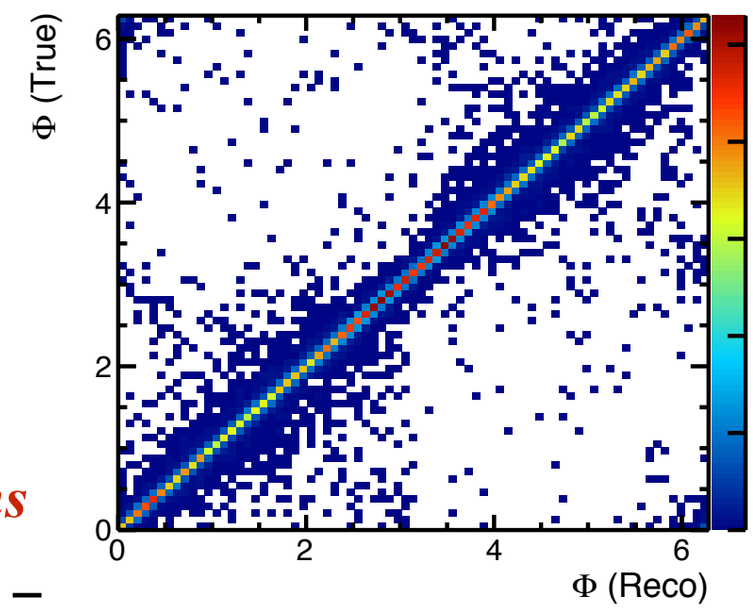
Statistical error estimated by full-simu

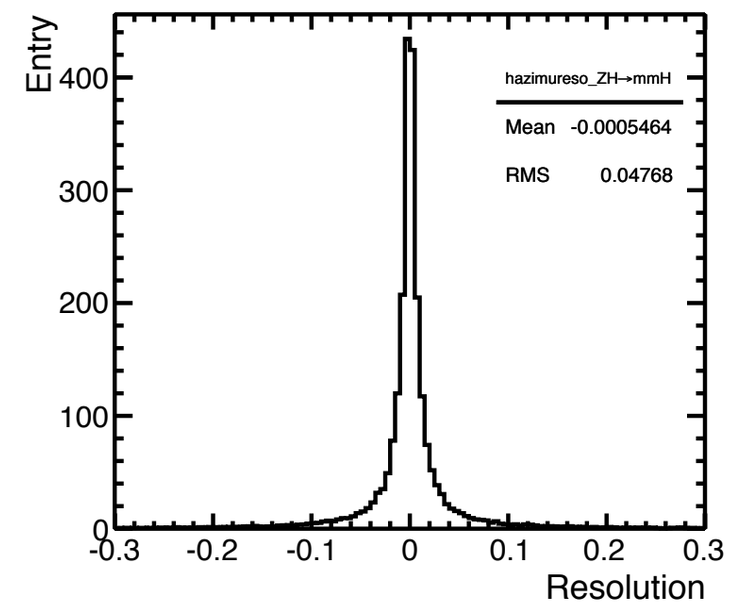
δσ is evaluated by full-simu.
It's set 2.5% (250GeV) and 3.0% (500GeV).

Reconstructed Parameters

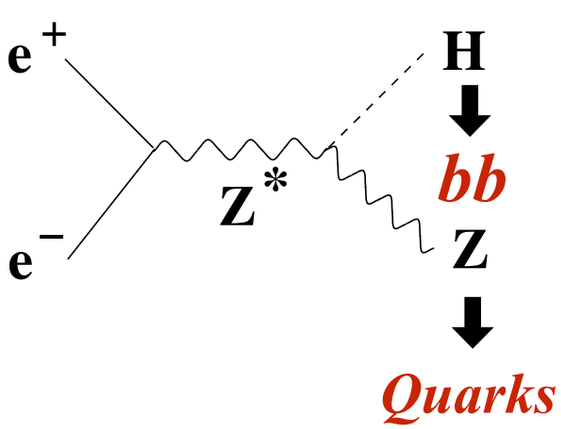
>. The reconstructed angle, for instance, Φ. Comparison with MC truth.

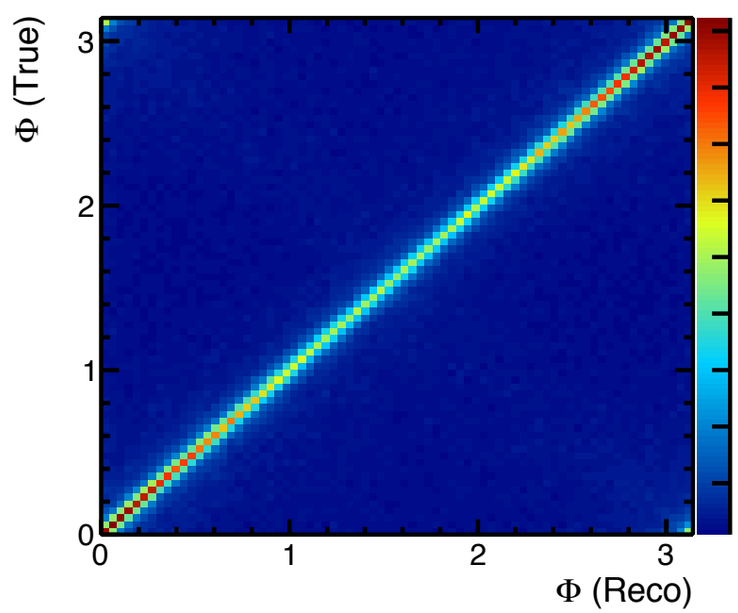


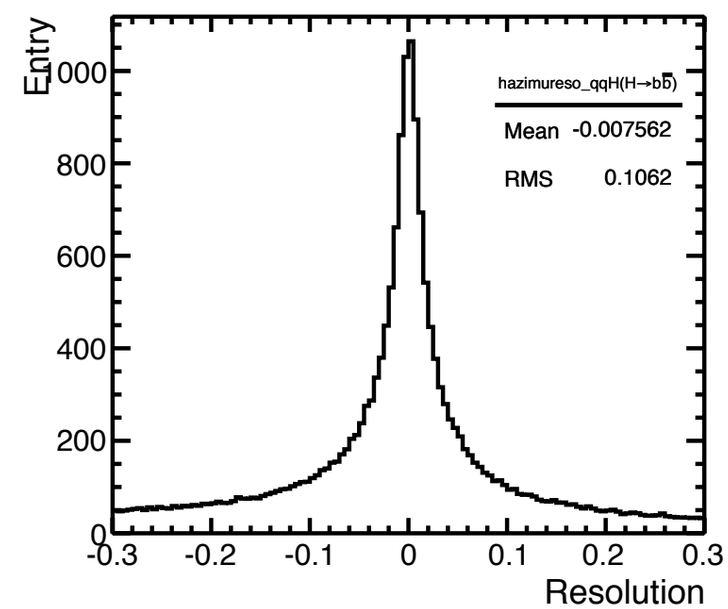




Resolution is so clear.



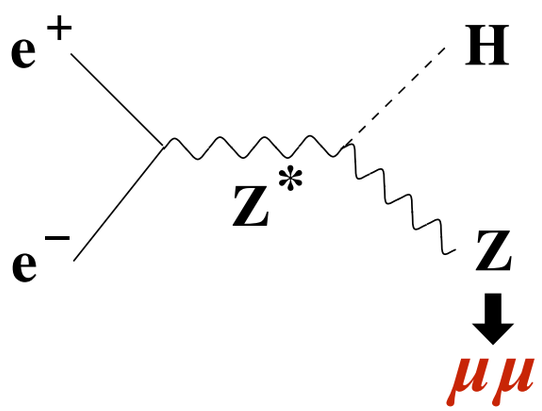


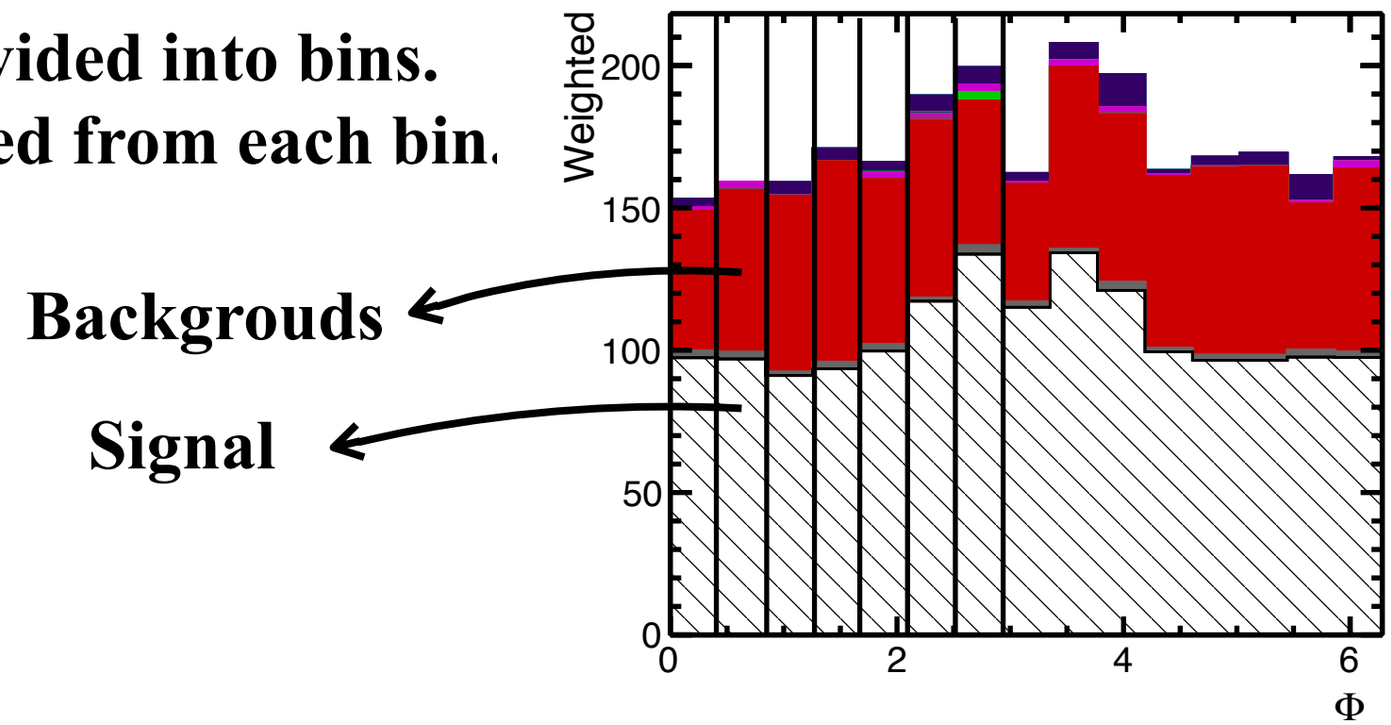


Resolution is still clear.

Estimation of Detector Acceptance

>. Parameters θ* and Φ are divided into bins.
#Sigs and its error is extracted from each bin.





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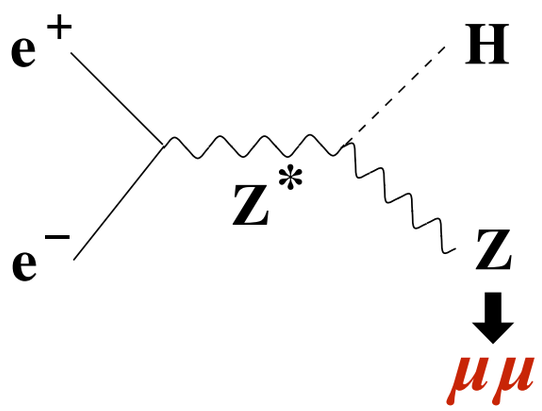
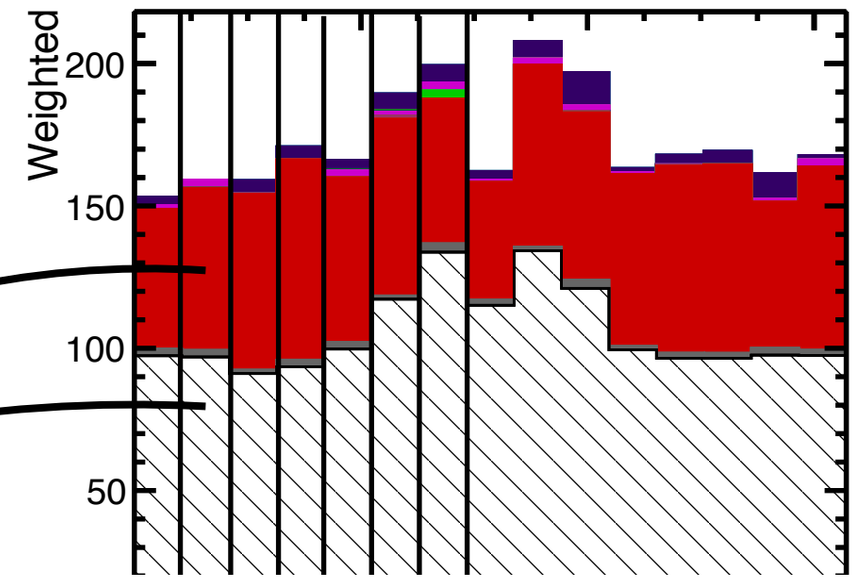
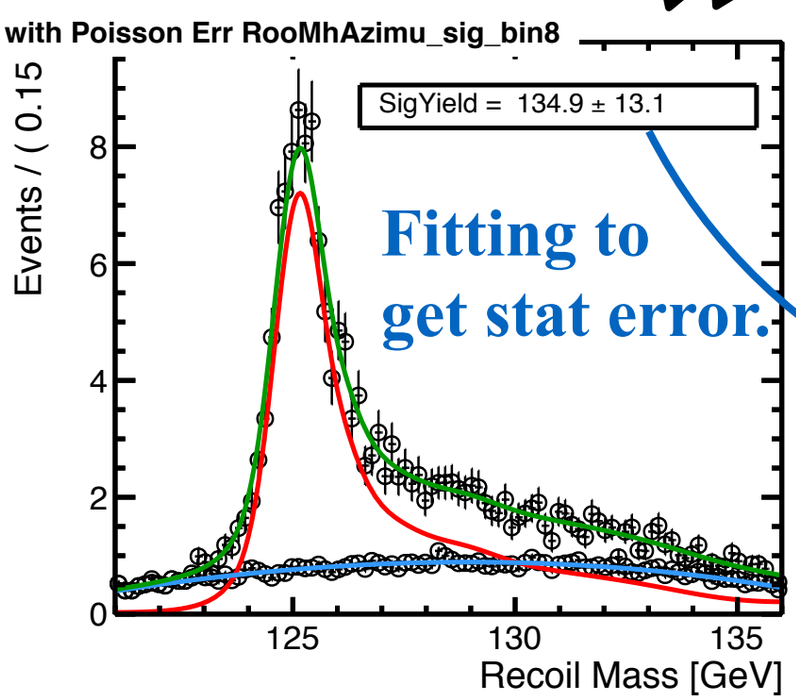




Backgrouds

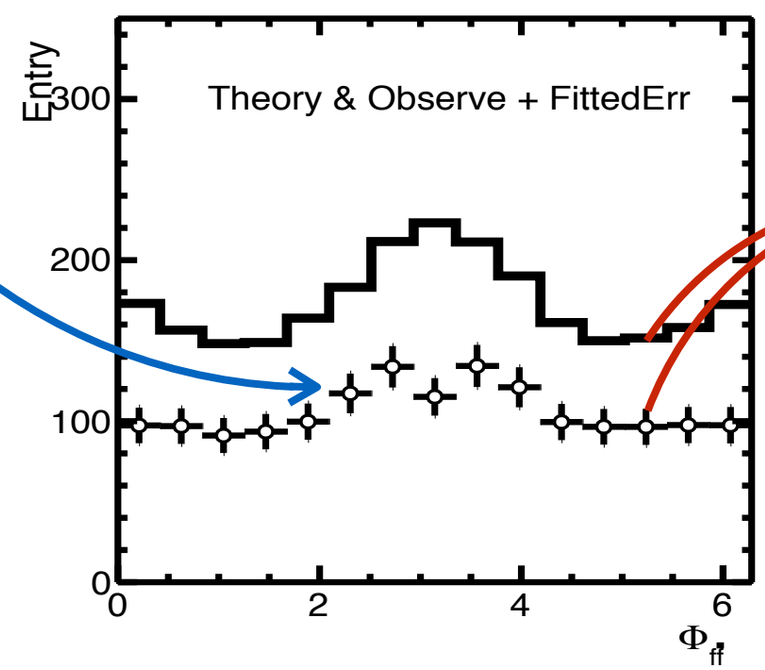
Signal

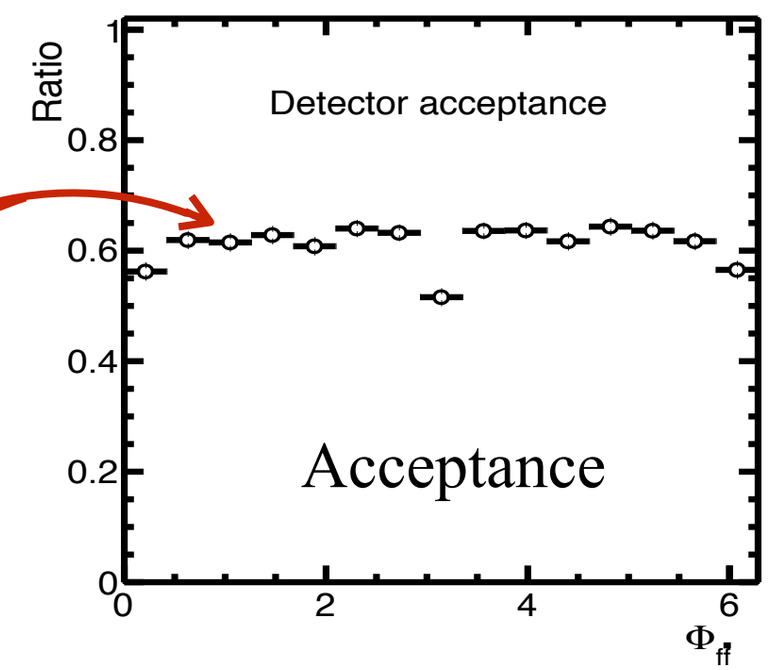


Fitting to get stat error.

Typical mass dist.

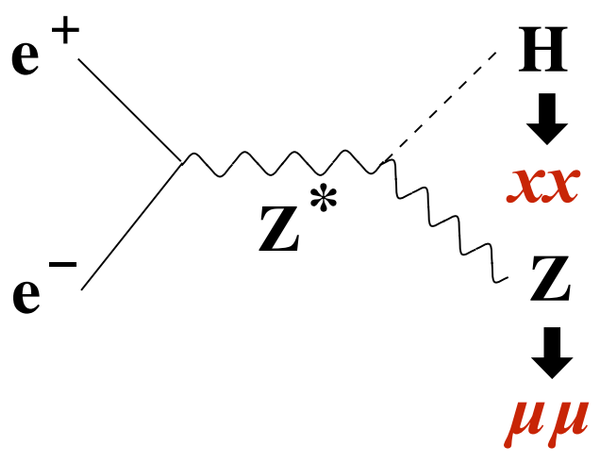
Comparison with theoretical distribution.





—: Theoretical ○: Observes

Sensitivity to Anomalous ZZH @ 250GeV



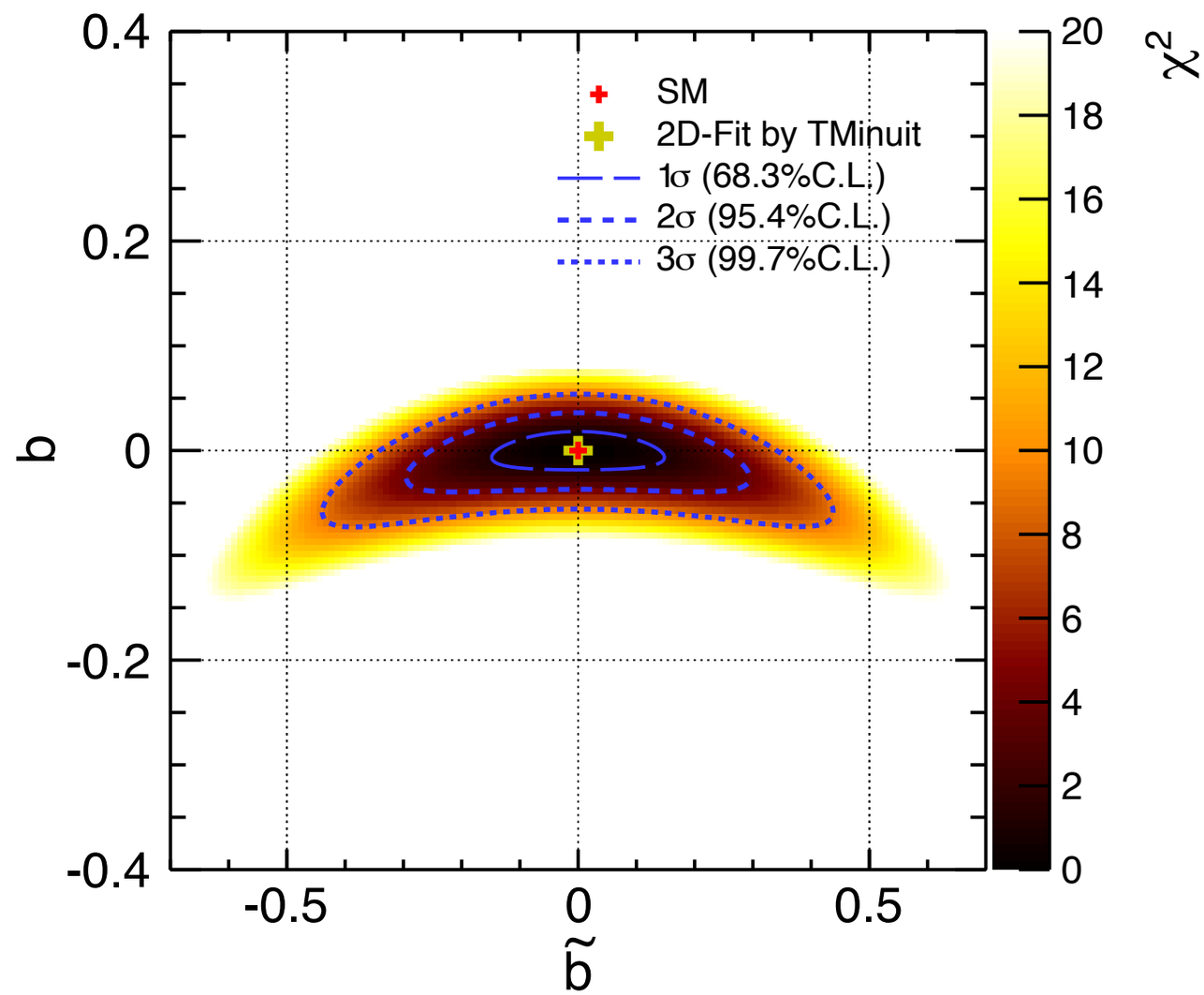
$$\chi^2 = \sum_{bin=1}^{n} \left(\frac{f_{SM}(x_{bin}) \cdot \eta_{bin} - f_{BSM}(x_{bin}; a, b, \tilde{b}) \cdot \eta_{bin}}{\delta f_{SM}(x_{bin})} \right)^2 + \left(\frac{N_{SM} \cdot \epsilon - N_{BSM} \cdot \epsilon}{\delta\sigma \cdot N_{SM} \cdot \epsilon} \right)^2$$

>. Only Zh → *μμX* channel.
250fb^{-1} is assumed.

σ is small. Φ is full range.

Sensitivity for b & bt

b ~ 0.05 (1σ)
bt ~ 0.15 (1σ)



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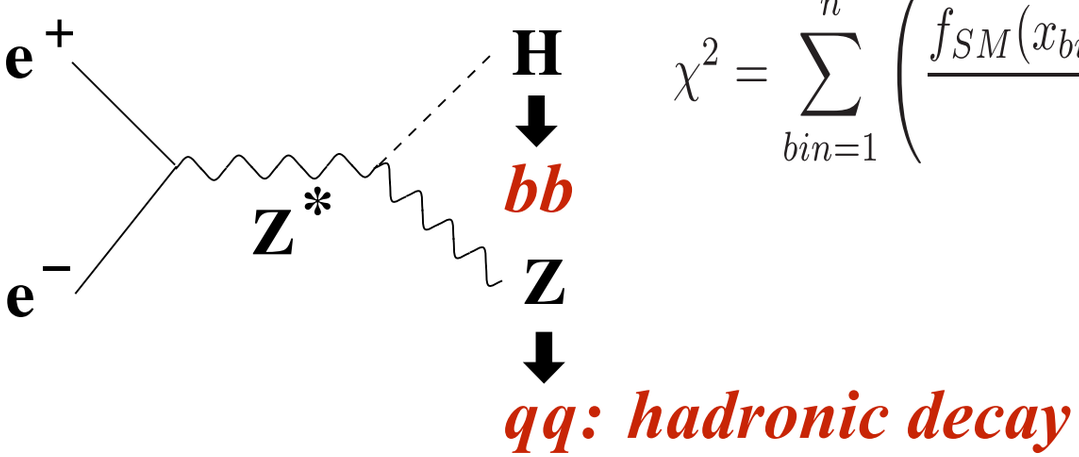

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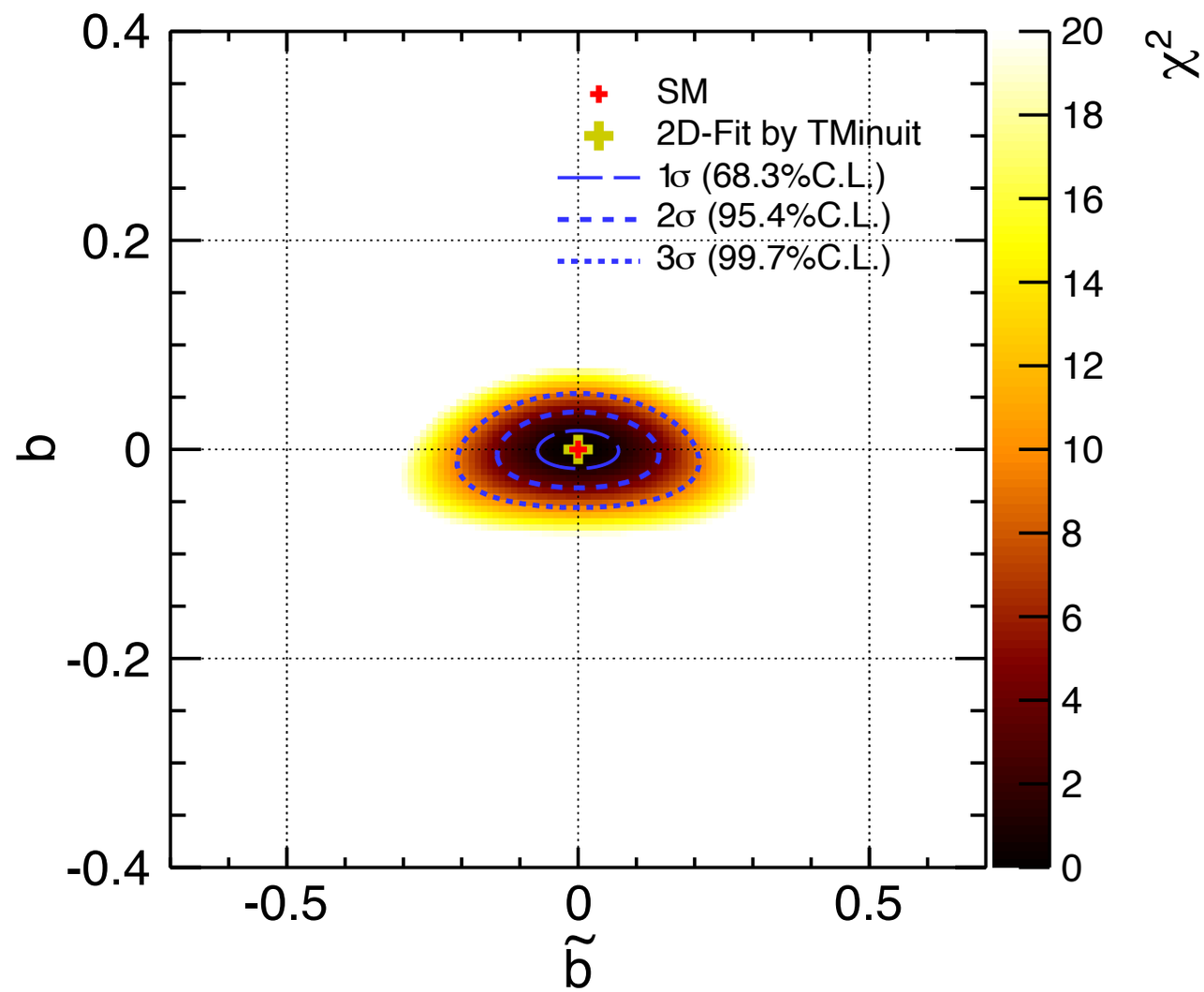
>. Only Zh → *qqbb* channel.
250fb^{-1} is assumed.

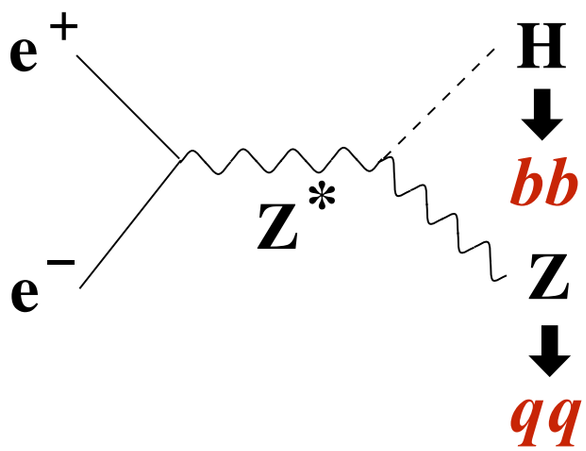
σ is large. Φ is half range.

Sensitivity for b & bt

b ~ 0.05 (1σ)
bt ~ 0.08 (1σ)



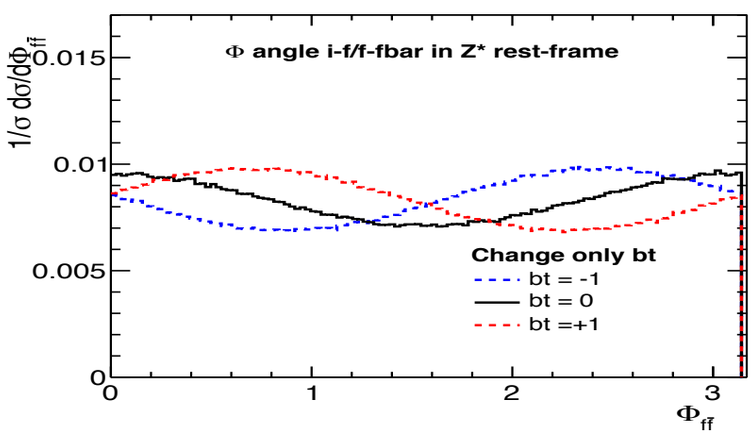
Sensitivity to Anomalous ZZH @ 500GeV



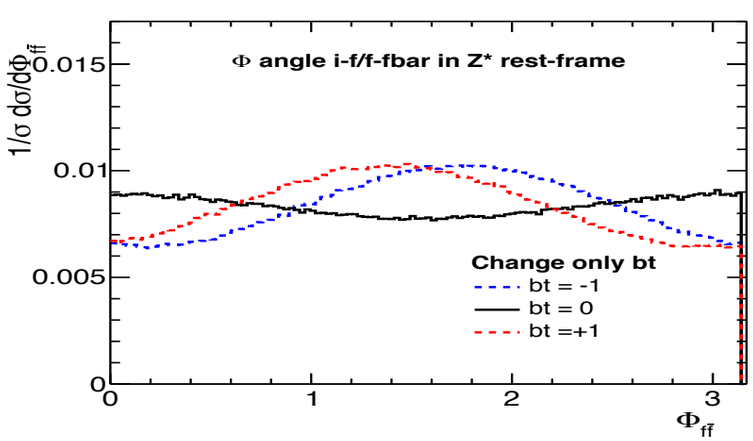
$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu} + \frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu} + \frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

※ Φ with same parameter settings.

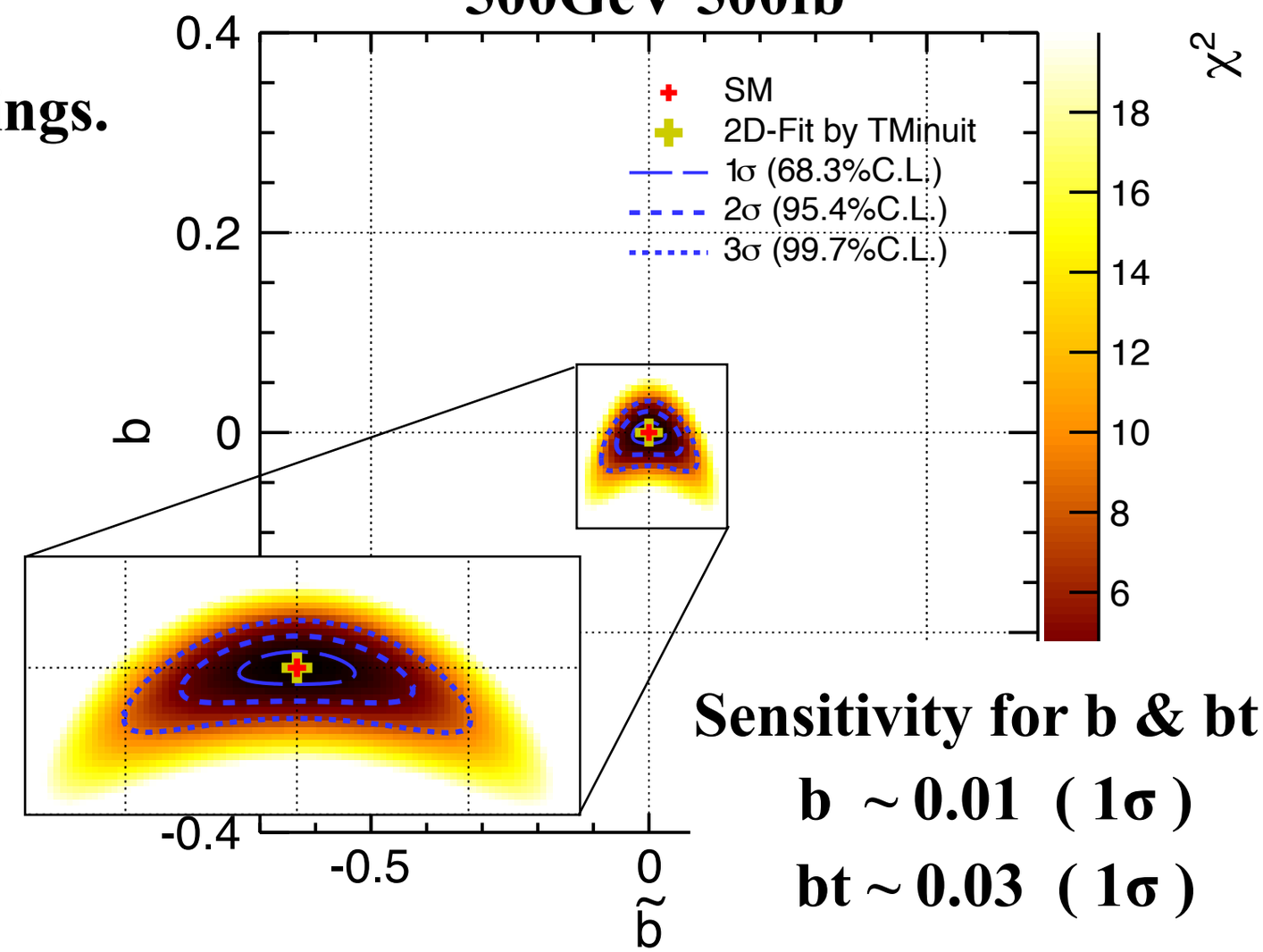
250GeV



500GeV



500GeV 500fb^{-1}



Sensitivity for b & bt

b ~ 0.01 (1σ)

bt ~ 0.03 (1σ)

Combined Sensitivity to Anomalous ZZH

>. Combine all angular information on 7-processes and cross section information of 250GeV & 500GeV.

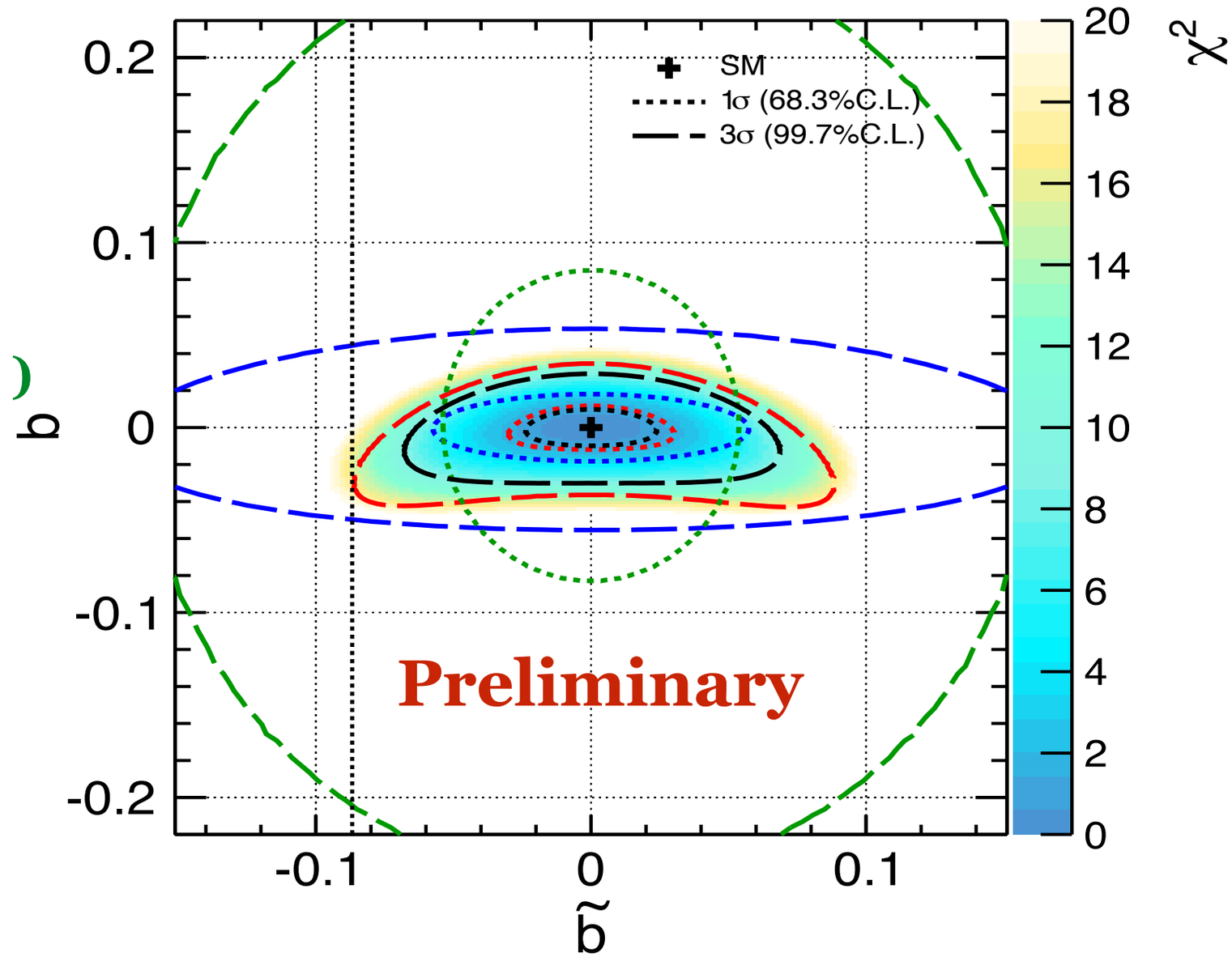
— Zh 250GeV (250fb-1)
(μμH, eeH, qqbb)

— Zh 500GeV (500fb-1)
(μμH, eeH, qqbb)

— ZZ-f 500GeV (500fb-1)
(eeH → eebb)

1 sigma sensitivity ~ O(0.01)

b ~ 0.010 (1σ)
bt ~ 0.020 (1σ)



Combined Sensitivity to Anomalous ZZH (H20)

>. **Combine all angular information on 7-processes and cross section information of 250GeV & 500GeV.**

Assuming H20 "LR" scenario,

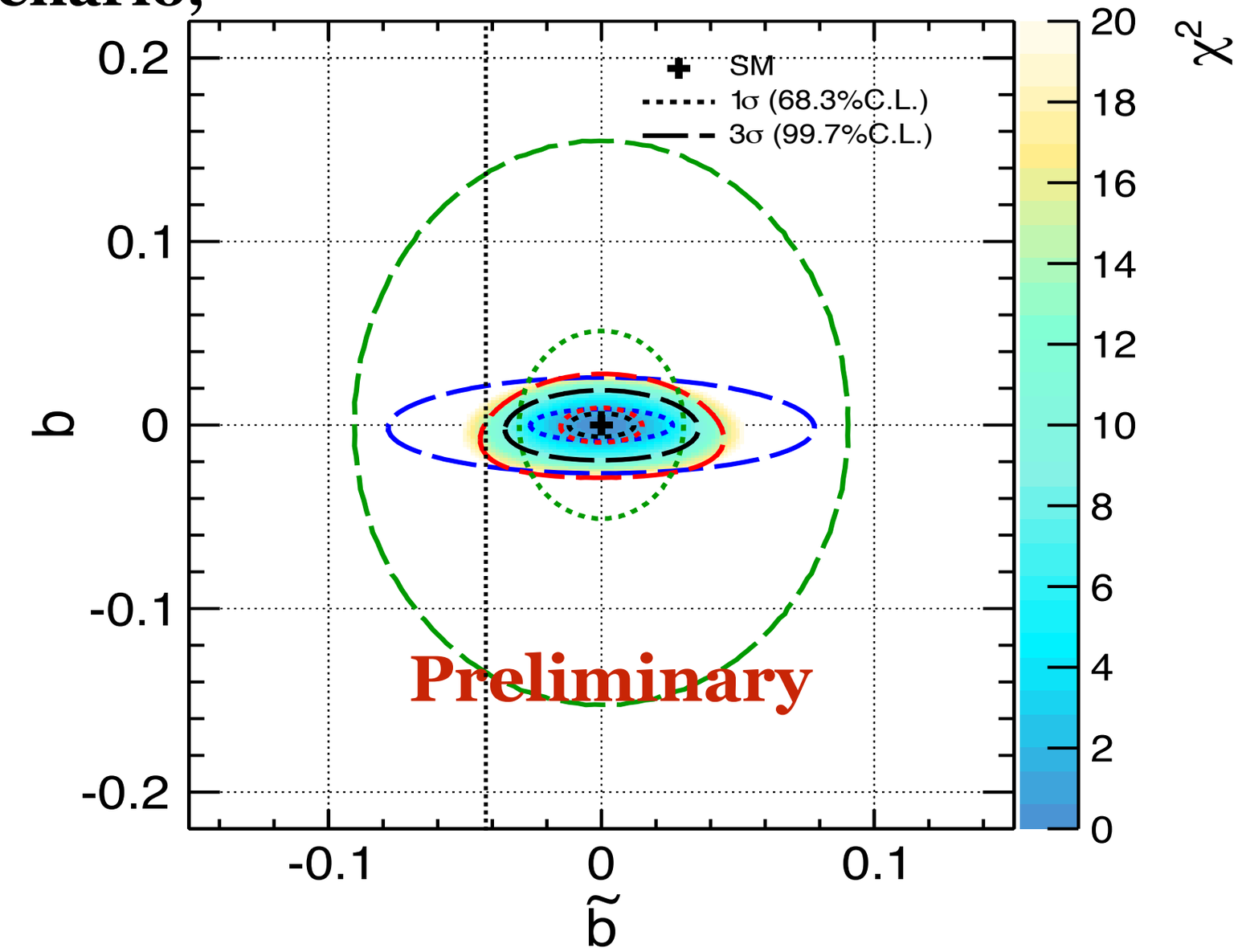
arXiv:1510.05739

>. **250GeV → 1350 fb-1**
(2 [ab-1] * 67.5 [%(LR)])
~ δσ 1.2%

>. **500GeV → 1600 fb-1**
(4 [ab-1] * 40.0 [%(LR)])
~ δσ 2.6%

1 sigma sensitivity

b ~ 0.007 (1σ)
bt ~ 0.012 (1σ)



Quotation (Snowmass study)

>. Snowmass study on anomalous VVH.

(arXiv: 1310.8361, arXiv: 1309.4819)

Precision of CP-violating coupling (f_{CP})

Collider	pp	pp	e^+e^-	e^+e^-	e^+e^-	e^+e^-	target
E (GeV)	14,000	14,000	250	350	500	1,000	(theory)
$\mathcal{L}$ (fb^{-1})	300	3,000	250	350	500	1,000	
spin-2^+_m	$\sim 10\sigma$	$\gg 10\sigma$	$>10\sigma$	$>10\sigma$	$>10\sigma$	$>10\sigma$	$>5\sigma$
$VVH^\dagger$	0.07	0.02					$< 10^{-5}$
$VVH^\ddagger$	$4\cdot 10^{-4}$	$1.2\cdot 10^{-4}$	$7\cdot 10^{-4}$	$1.1\cdot 10^{-4}$	$4\cdot 10^{-5}$	$8\cdot 10^{-6}$	$< 10^{-5}$
$VVH^\diamond$	$7\cdot 10^{-4}$	$1.3\cdot 10^{-4}$					$< 10^{-5}$

† estimated in $H \to ZZ^*$ decay mode

‡ estimated in $V^* \to HV$ production mode

$^\diamond$ estimated in $V^*V^* \to H$ (VBF) production mode

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† estimated in $H \to ZZ^*$ decay mode
‡ estimated in $V^* \to HV$ production mode
$^\diamond$ estimated in $V^*V^* \to H$ (VBF) production mode

Preliminary translation

@ **250 GeV and 250 fb^{-1}.** Translate our result on **bt ~ 0.06 (1σ)** sensitivity to $f_{cp.}$

➡ **f_{CP} ~ 3.0 x 10^{-4},** which is improved by a factor of more than **2**.

@ **500 GeV and 500 fb^{-1}.** Translate our result on **bt ~ 0.03 (1σ)** sensitivity to $f_{cp.}$

➡ **f_{CP} ~ 2.5 x 10^{-5},** which is improved by almost a factor of **2**.

@ **500 GeV and H20 scenario "LR".** Translate our result on **bt ~ 0.02 (1σ)** .

➡ **f_{CP} ~ 1.5 x 10^{-5}.**

Summary & Prospects

>. The couplings between the Higgs and vector bosons is an important point for the new physics (e.g. It is completely SM? or not?).

>. Using full simulation, we tested sensitivity to anomalous couplings at the ILC to know how further the ILC can reach if there is any.

>. Concerning ZZH couplings, the ILC can achieve sensitivity less than **O(0.01)** by using main 7-processes.

>. Comparing Snowmass study on anomalous HVV, particularly for the ILC results, the sensitivity at the ILC will be improved by a factor of **2**.

>. We have already started to analyze HWW anomalous couplings. If it is combined, the sensitivity can be more strong.

>. It will be also necessary to consider which region corresponds to what kinds of extended model.

Back Up

Procedure of Analysis

>. What we want to do : Estimate the sensitivity of anomalous couplings using χ2 test (MC simulation)

>. What we have to do : Estimate the detector acceptance for sensitive parameters "θ* and Φ" without bias as less as possible (Full simulation)

>. For less bias : Any angular cut (also related to angles) for Bkgs suppression should not be used.

>. For less error : Values of each cut variables for Bkgs suppression are set to take the maximum significance (overall significance).

$$Signif = \frac{N_{sig}}{\sqrt{N_{sig} + N_{bkg}}}$$

>. Calculation of χ2 (it is divided into 2 parts).

Use distributions generated by PHYSSIM (generator).
Include detector acceptance(η) for both.
Unify its normalization with SM.

#N is the number of expected events after Bkg suppression (ε: efficiency).

$$\chi^2 = \sum_{bin=1}^{n} \left(\frac{f_{SM}(x_{bin}) \cdot \eta_{bin} - f_{BSM}(x_{bin}; a, b, \tilde{b}) \cdot \eta_{bin}}{\delta f_{SM}(x_{bin})} \right)^2 + \left(\frac{N_{SM} \cdot \epsilon - N_{BSM} \cdot \epsilon}{\delta\sigma \cdot N_{SM} \cdot \epsilon} \right)^2$$

δσ is evaluated from another test.
it is set 2.5% (250GeV) and 3.0% (500GeV).

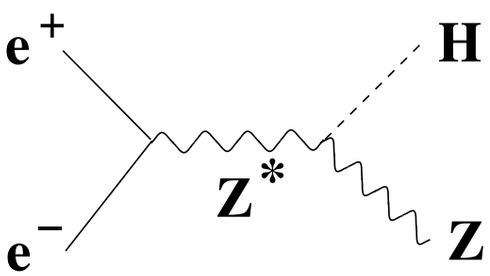
Use errors estimated by fitting on each bin.

Effect of angular distribution **Effect of cross section**

Difference of Angular Distribution

$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu}+\frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu}+\frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

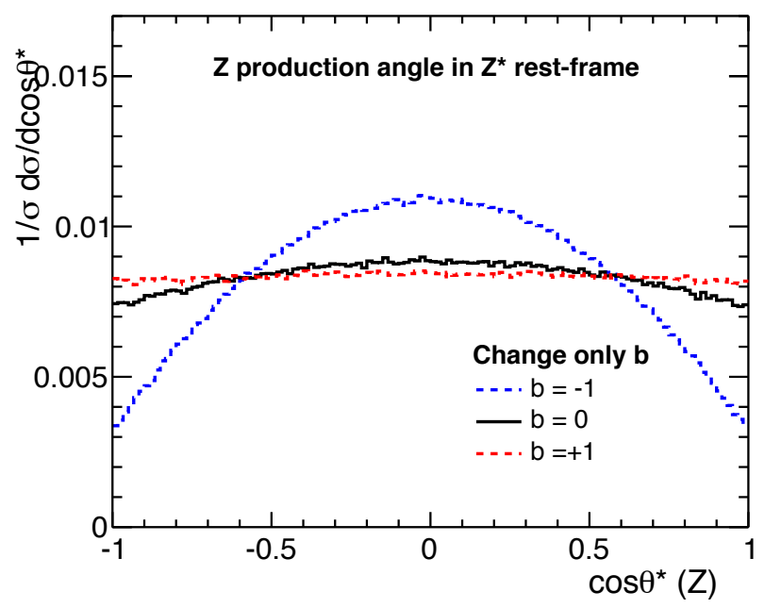
Zh-strahlung

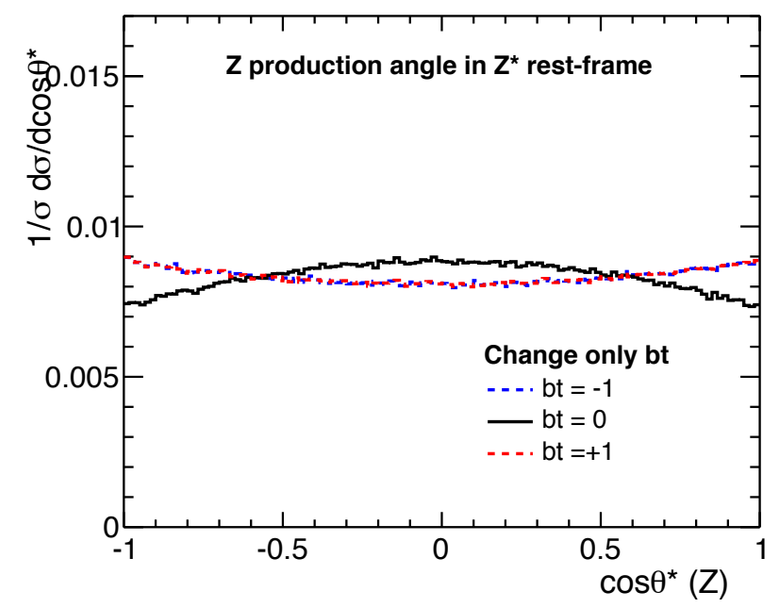


leptons

Change "b" to ± 1

Change "bt" to ± 1

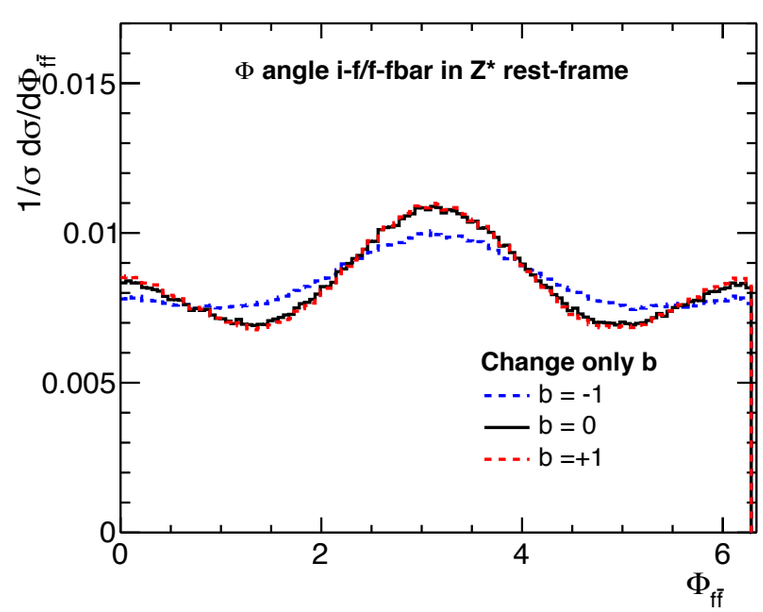


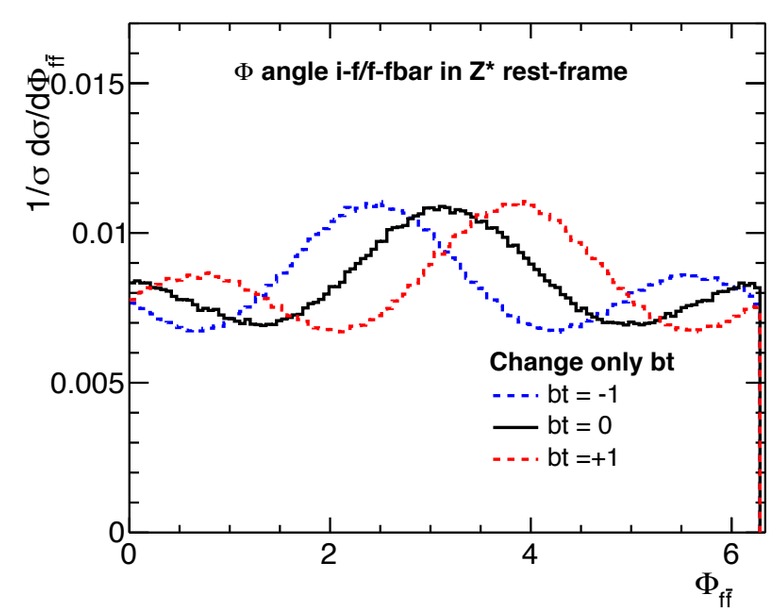


— SM

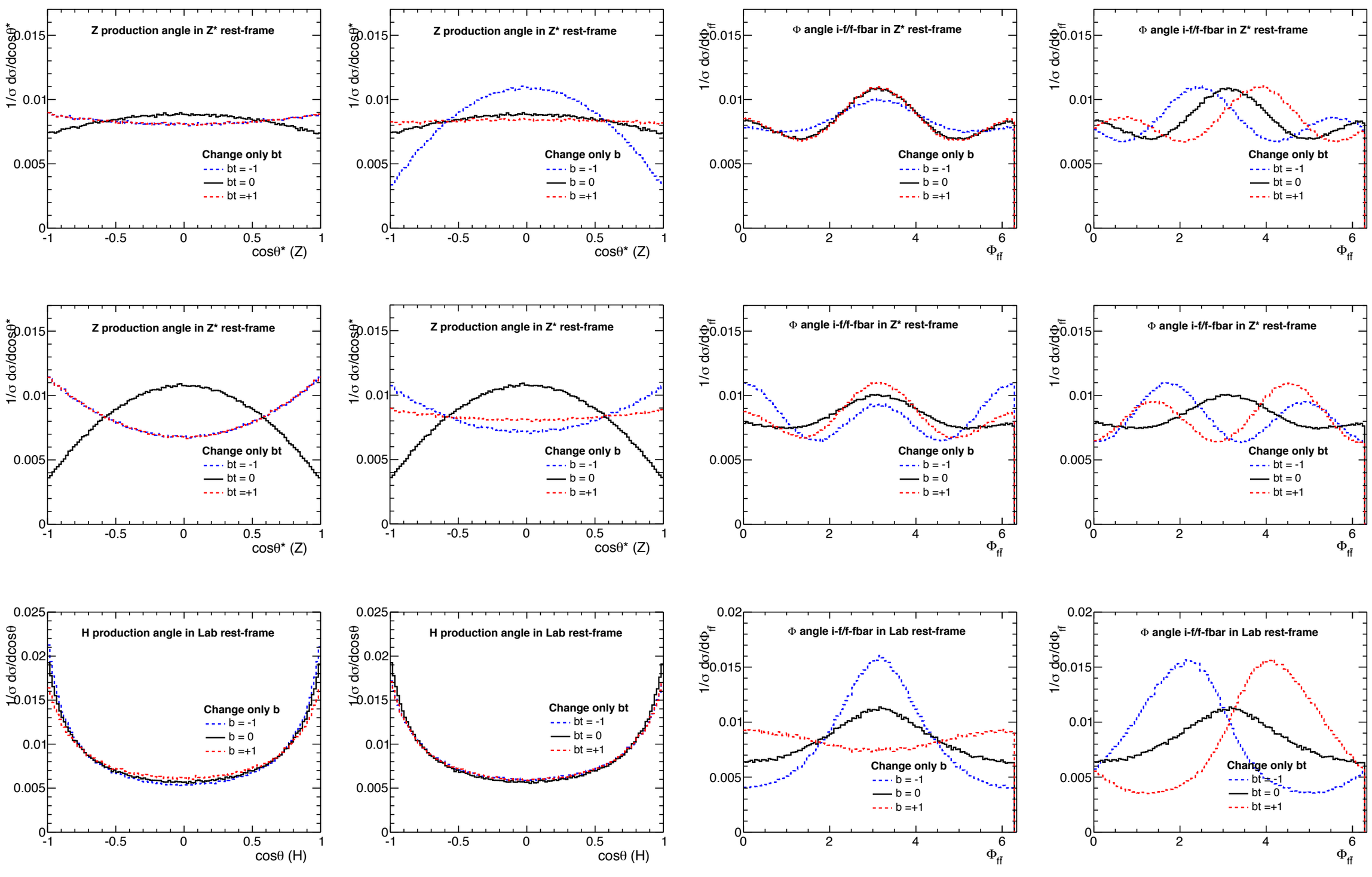
— -1

— +1



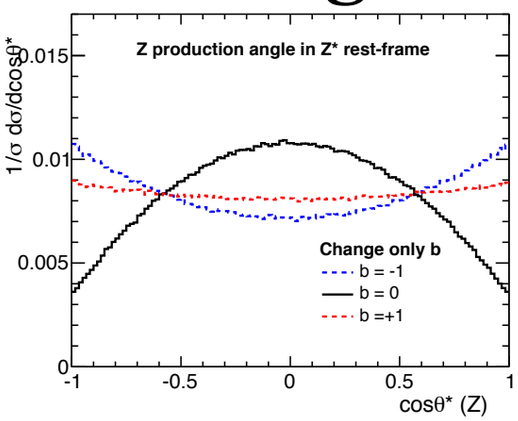


Angular Distribution



Angular Distribution + 2d-information
500GeV *ee→Zh→llh*

Change b



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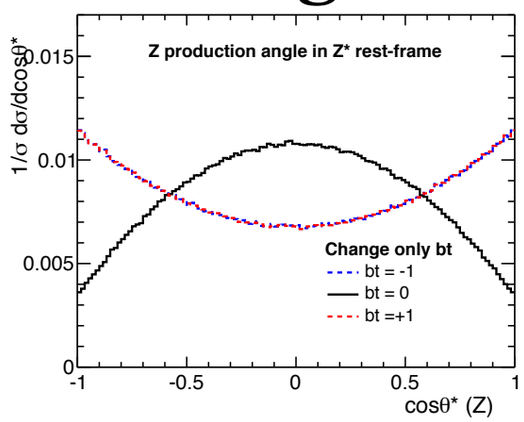

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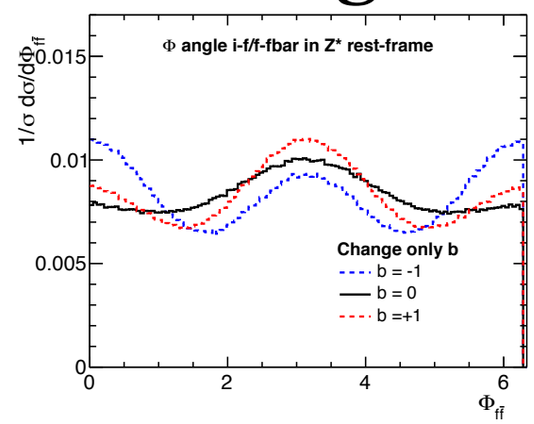

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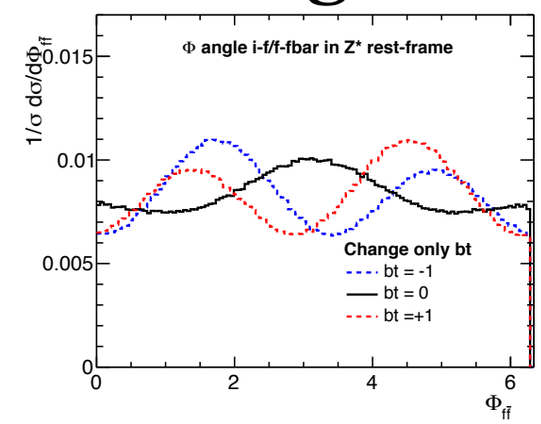

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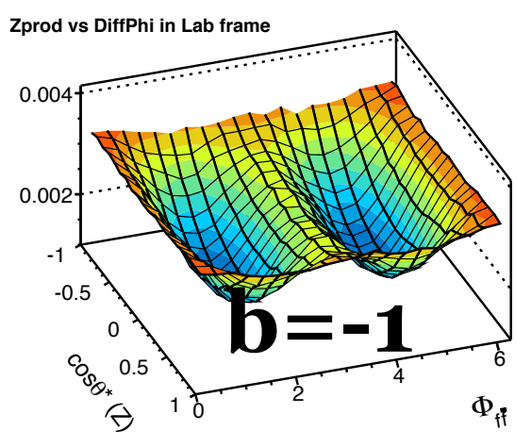

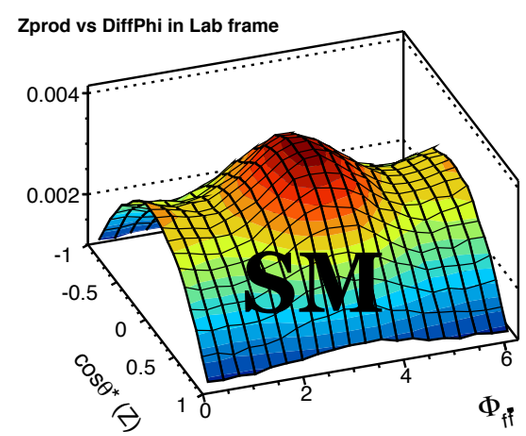

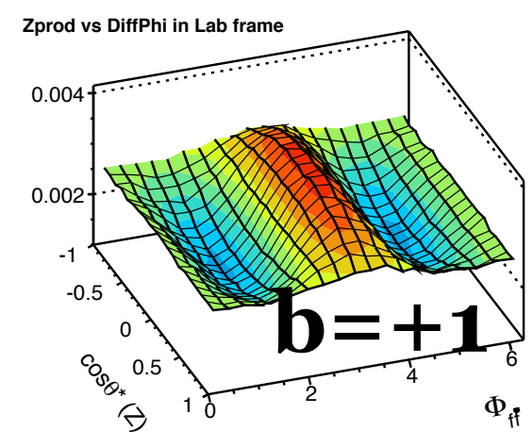

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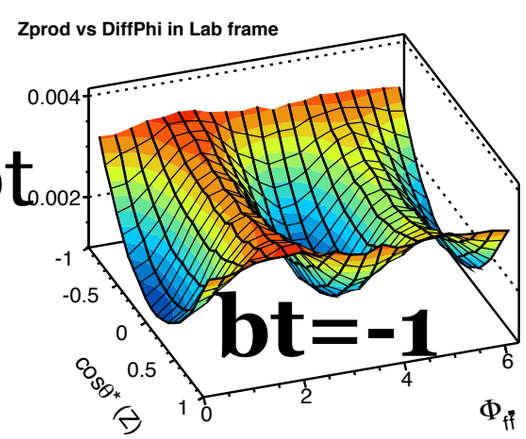
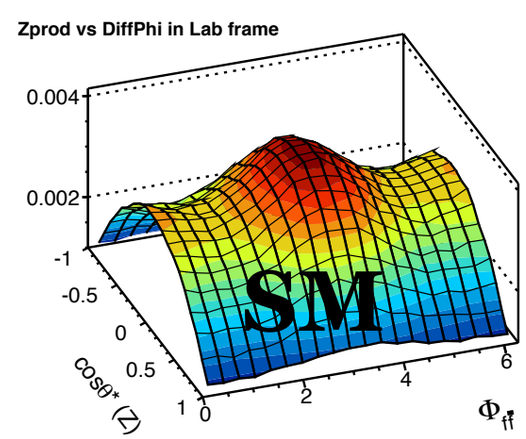
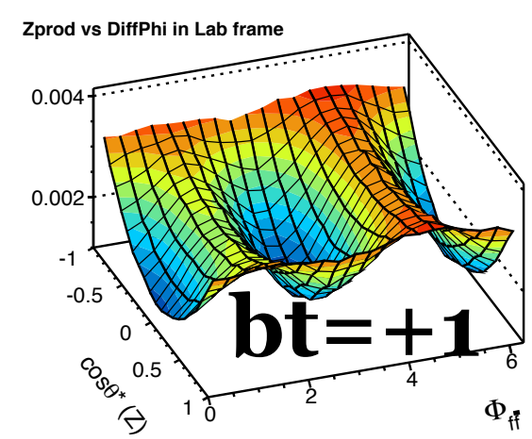
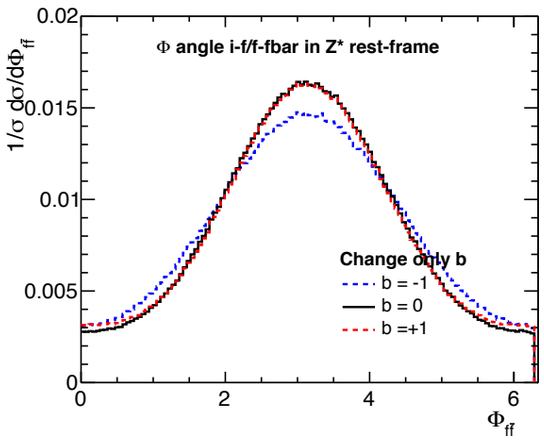


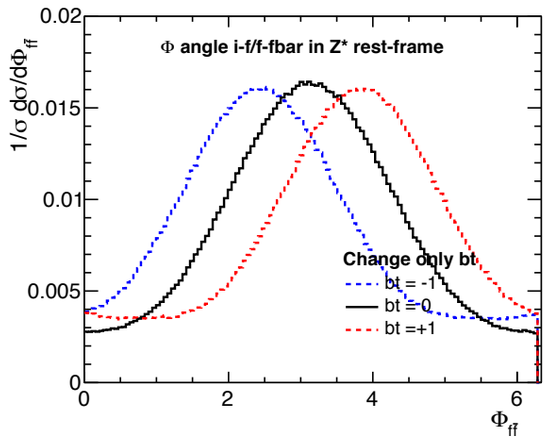


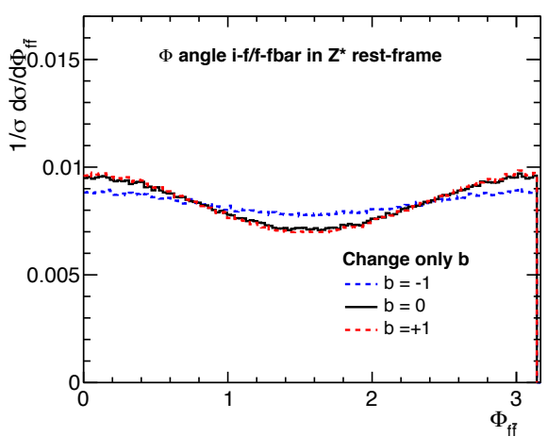


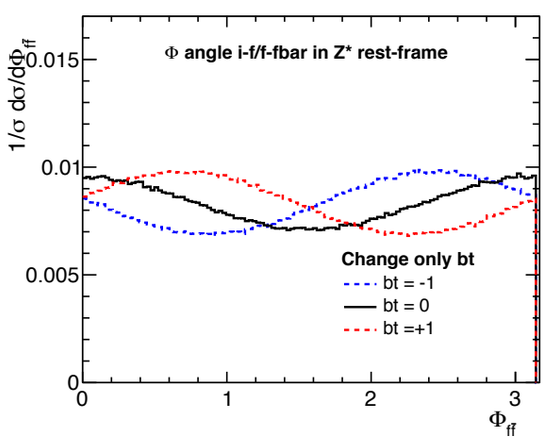
Angular Distribution + 2d-information 250GeV *ee→Zh→qqh*

Change b Change bt ➡ ***Sensitivity is Limited***









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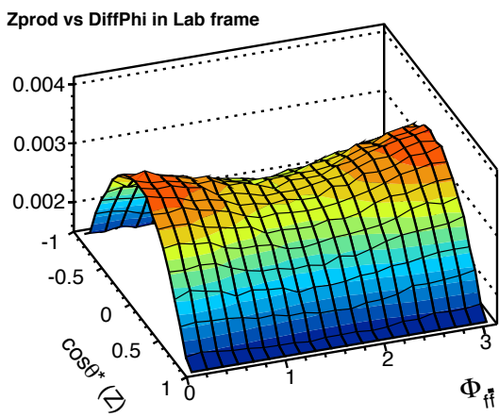

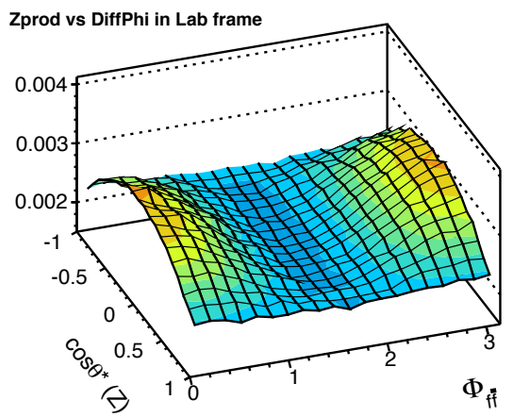

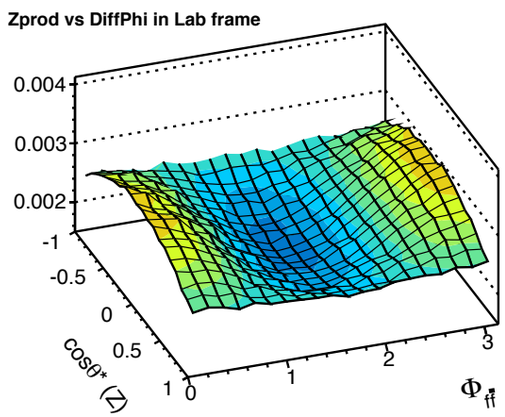

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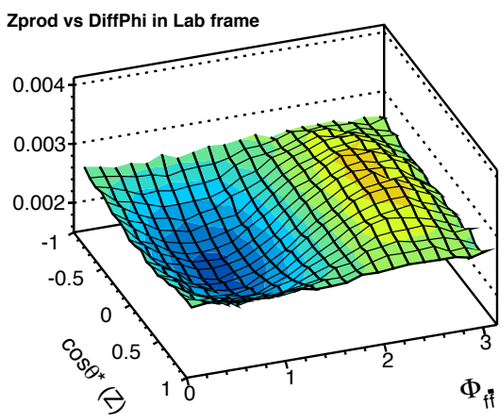
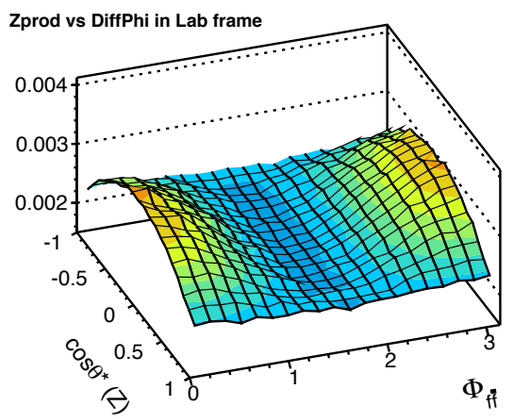
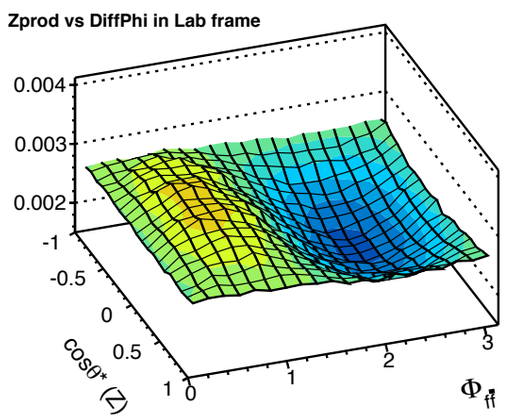
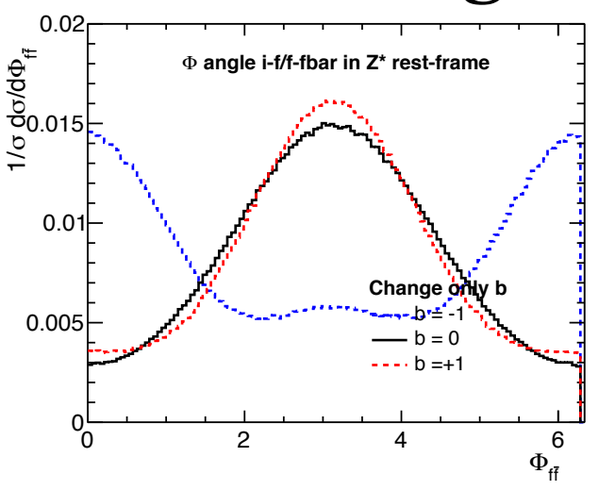
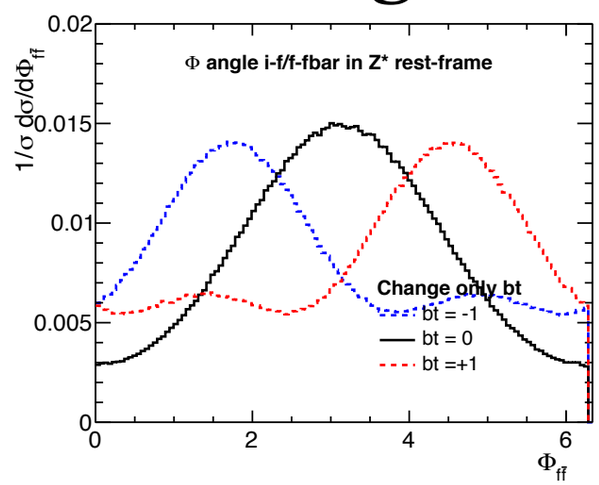
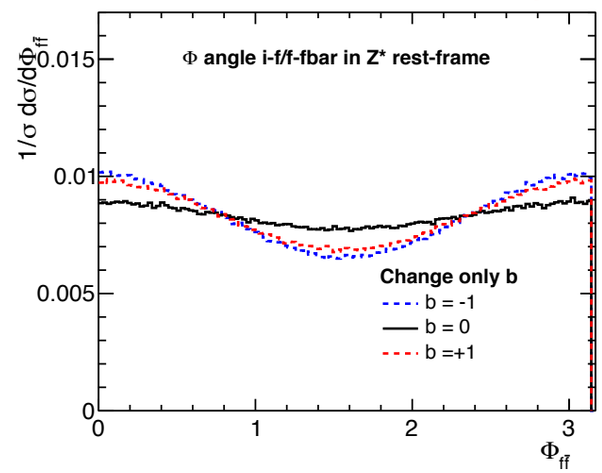


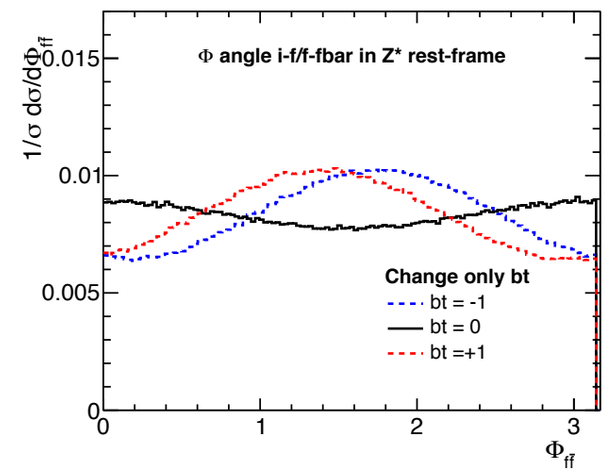


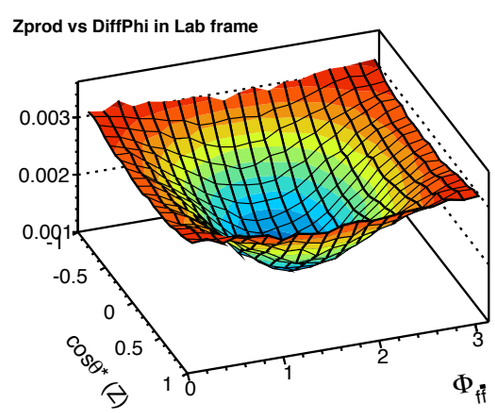


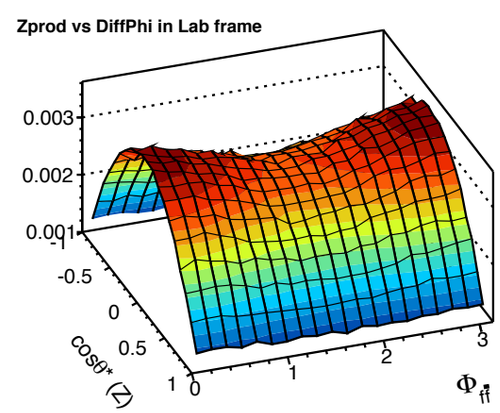


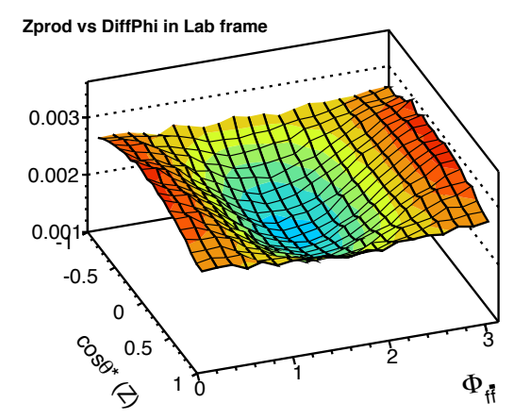


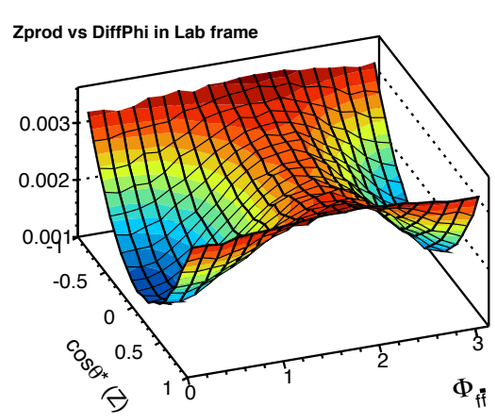


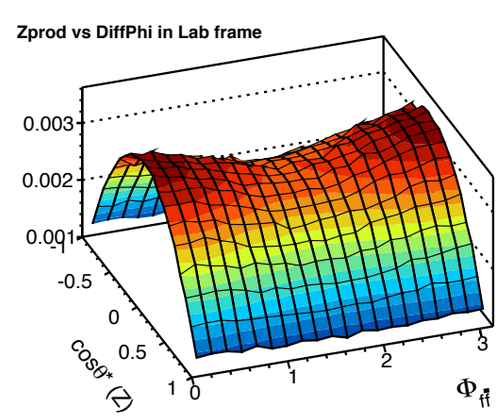


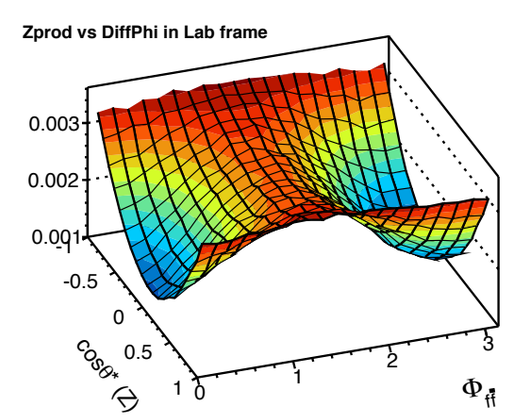










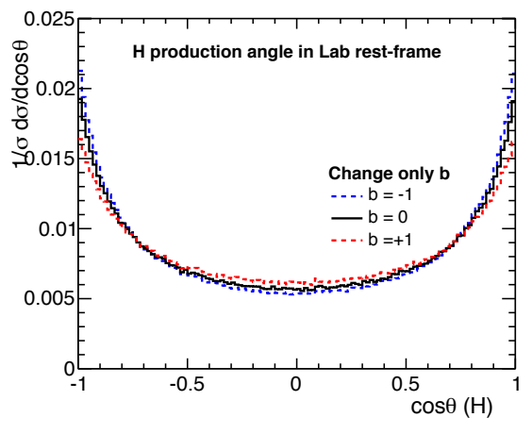


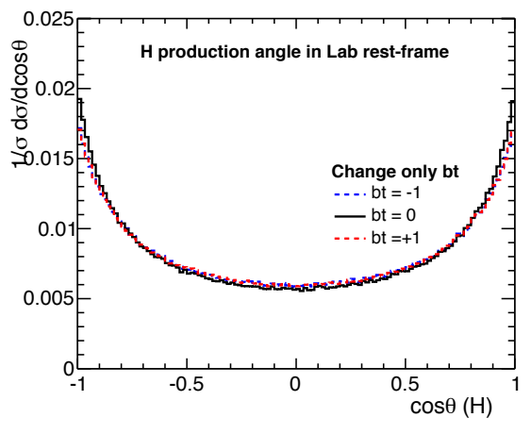
Angular Distribution + 2d-information
500GeV *ee→Zh→qqh*

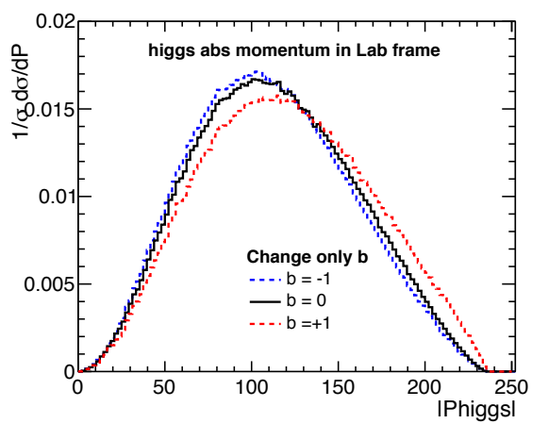
Change b

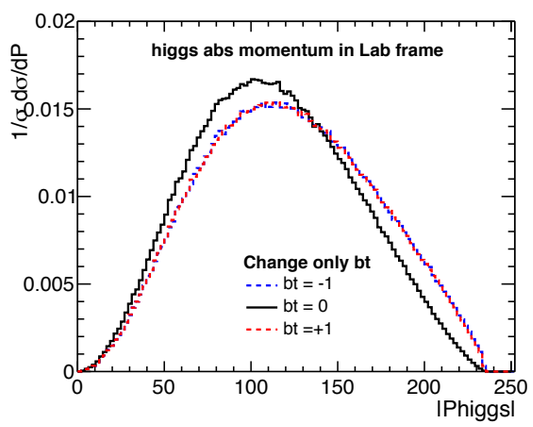
Change bt

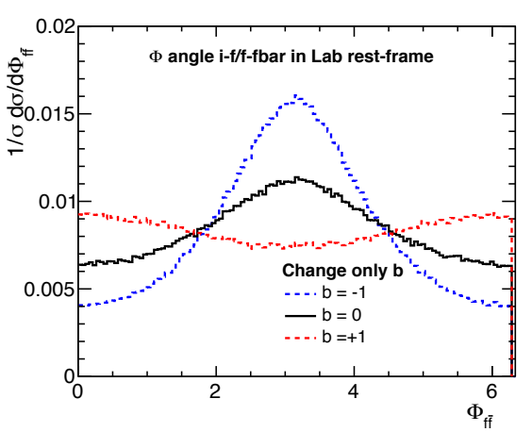
➡ *Sensitivity is Limited*

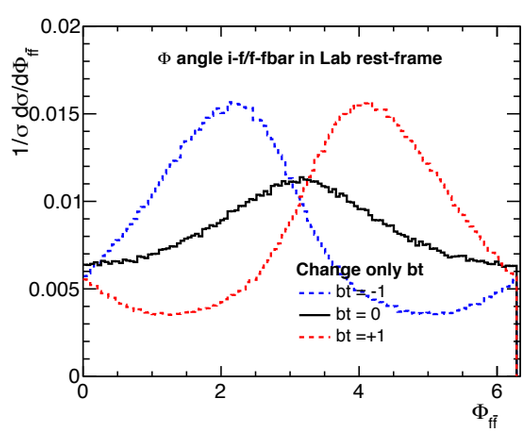


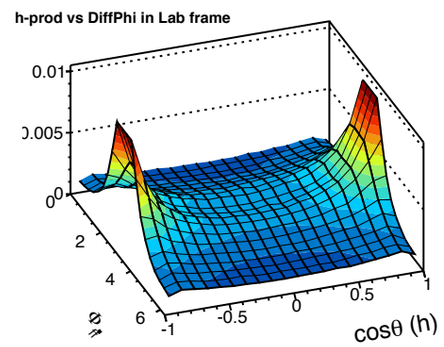


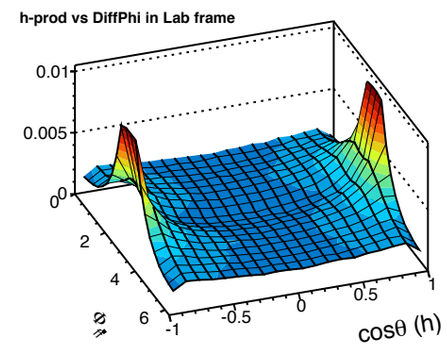


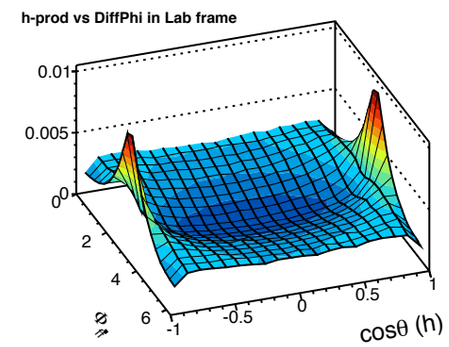


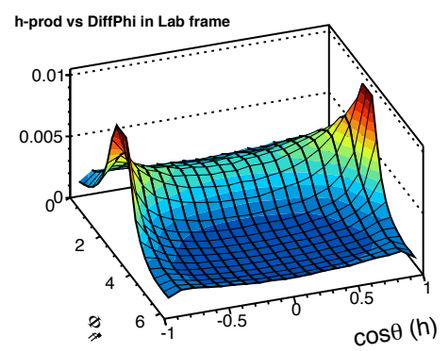


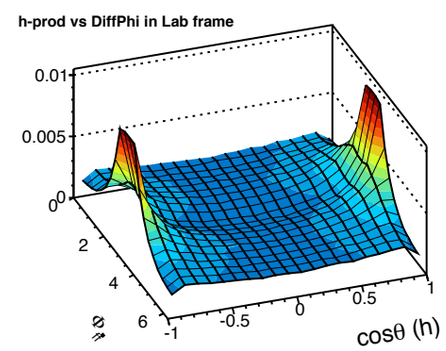


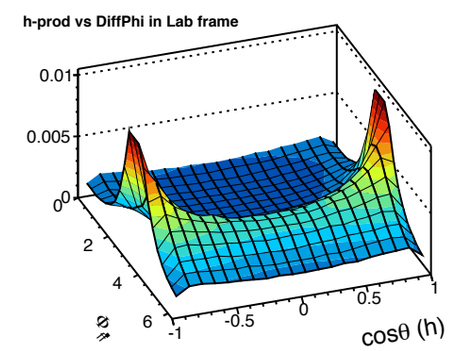


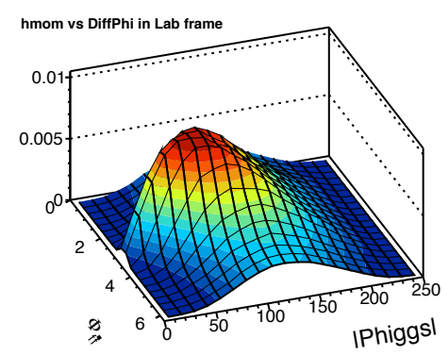


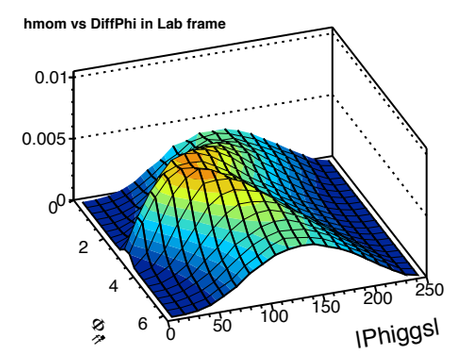


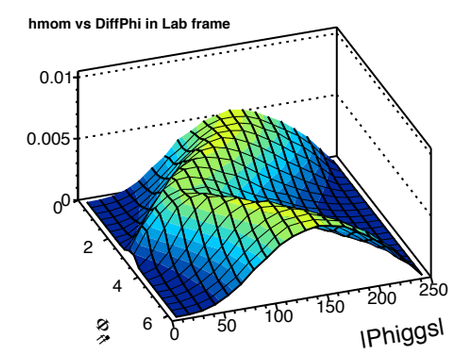


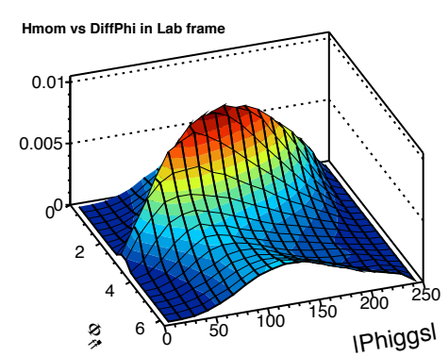


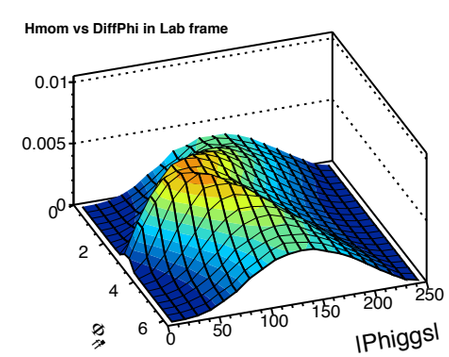


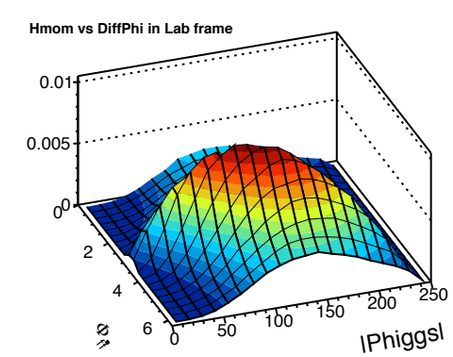








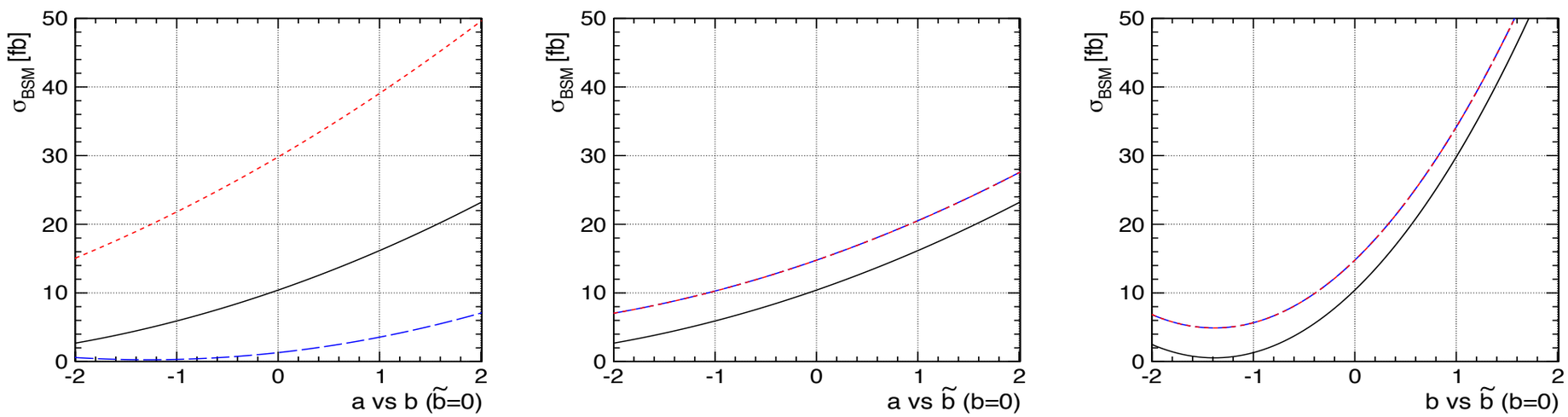




Angular Distribution + 2d-information
500GeV *ee→eeh(ZZ-f)*

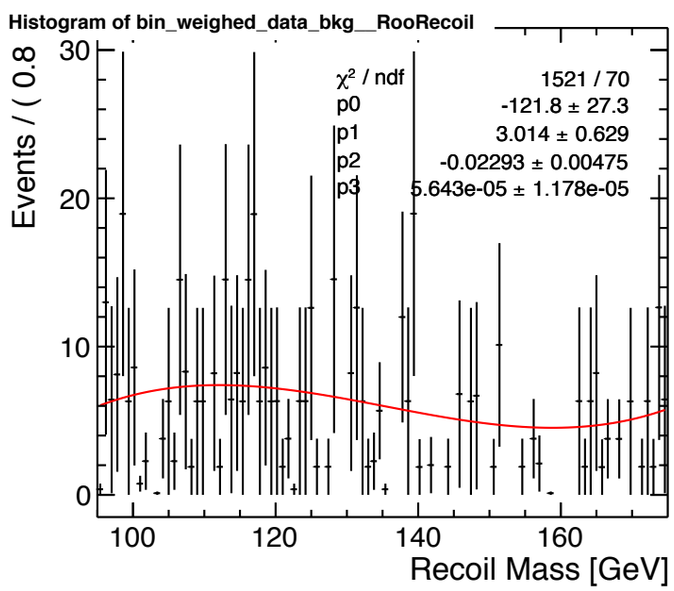
Difference of Xsection

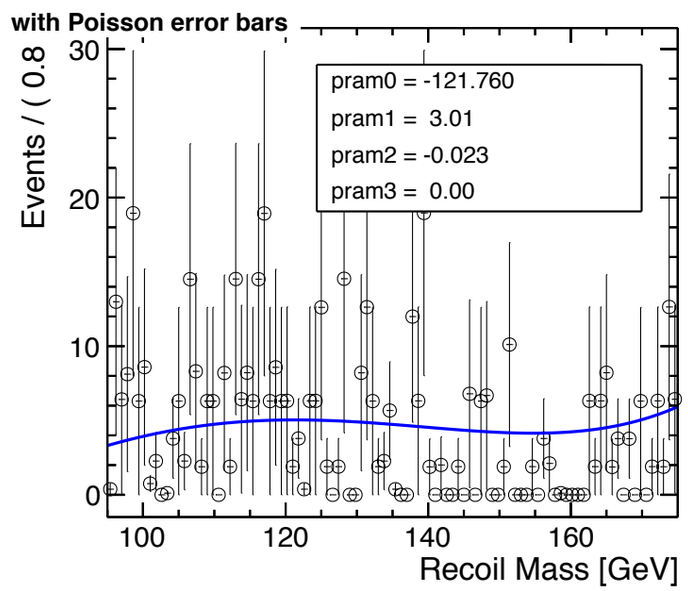
250GeV LR $ee \to Zh \to \mu\mu h$

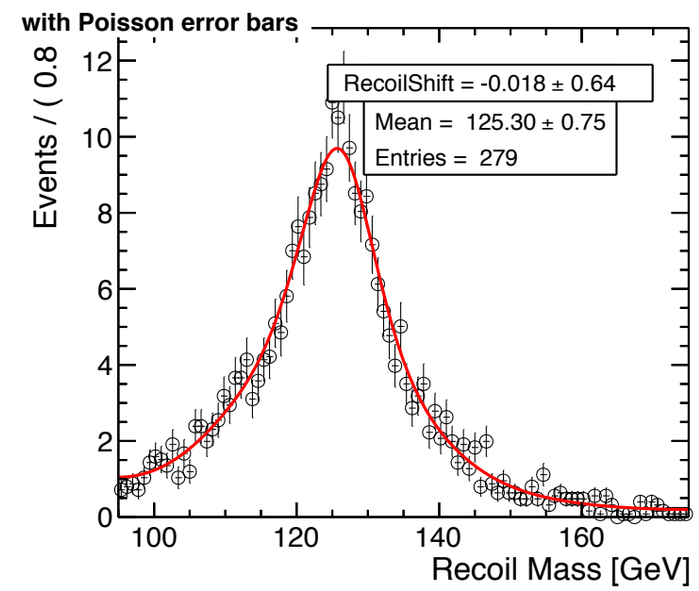


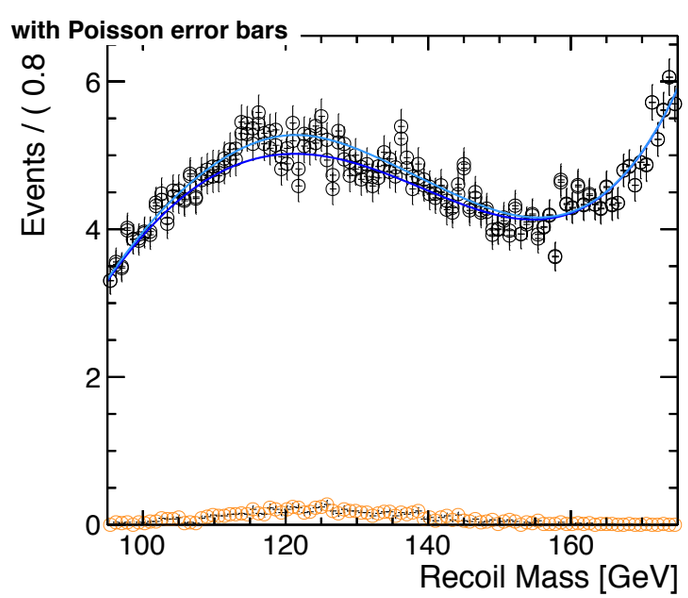
Fitting

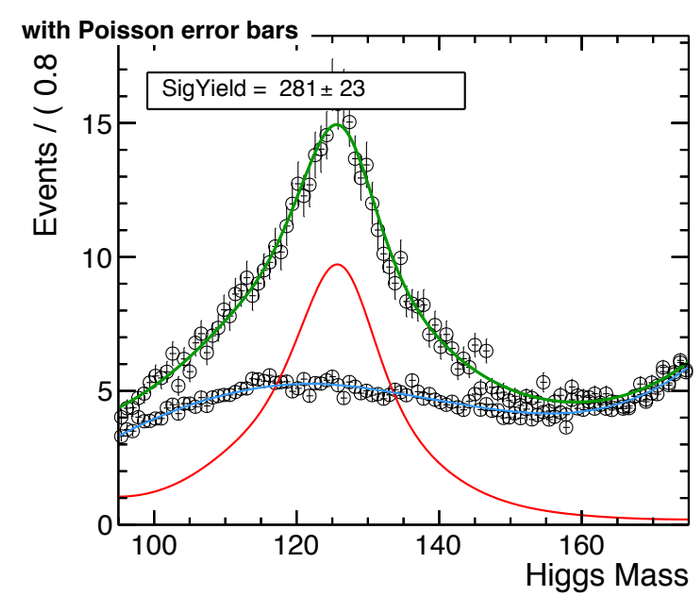
500GeV *ee→Zh→qqbb (sig)*





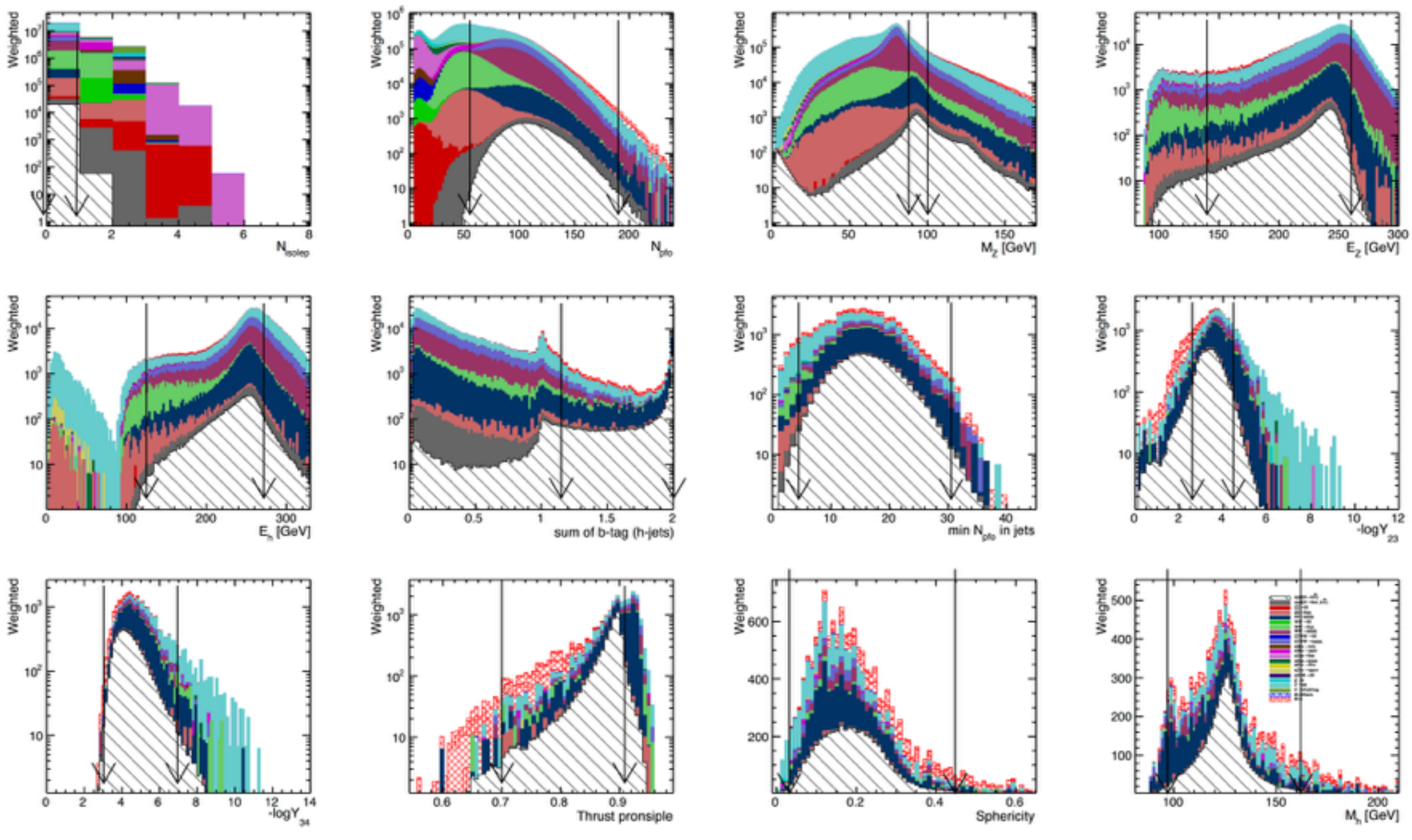






Bkg suppression

500GeV *ee→Zh→qqbb (sig)*



Cut table

500GeV *ee→Zh→qqbb (sig)*

Cut Table Summary

# cut&process	qqbb	qqNbb	ZZ_l	ZZ_sl	ZZ_h	WW_l	WW_sl	WW_h	ZZWW_l	ZZWW_h	sW_l	sW_sl	sZee_l	sZee_sl	sZvv_l	Zvv_sl	sZsW_l	Z_l	Z_h	bhbhag
# raw data	343605	79131	4600	41648	44189	36850	340504	357033	38949	299910	135400	382103	1041561	271547	13700	46898	57350	452103	2335116	493204
# used data	343605	79131	4600	41648	44189	36850	340504	357033	38949	299910	135400	382103	1041561	271547	13700	46898	57350	452103	2335116	493204
# passed data	56631	691	0	16	496	0	21	92	0	64	0	15	1	2	0	4	0	3	353	0
# passed/used	16.481	0.873	0.000	0.038	1.122	0.000	0.006	0.026	0.000	0.021	0.000	0.004	0.000	0.001	0.000	0.009	0.000	0.001	0.015	0.000
# xsection	40.3	29.4	36.4	366.1	407.4	462.7	5571.6	4494.4	480.3	3746.8	1620.5	4853.0	7150.7	1882.5	163.6	558.8	652.0	3397.4	19625.0	3375.7
# xsection*L	20134	14700	18201	183053	203724	231357	2785822	2247189	240130	1873411	810241	2426502	3575364	941270	81808	279409	325978	1698702	9812516	1687833
success	99.39	100.00	87.61	99.98	100.00	86.51	100.00	100.00	83.87	100.00	87.11	100.00	90.42	99.99	80.23	99.99	88.32	85.12	99.99	97.48
+nisoleps	99.10	79.45	41.17	77.82	99.68	11.18	51.61	99.68	40.53	99.70	13.49	29.66	46.92	66.12	55.64	99.83	4.89	44.52	99.16	2.35
+nallpfos	98.84	73.19	0.89	39.38	97.99	0.17	23.94	98.29	0.85	98.27	0.21	11.27	0.71	8.03	0.80	41.82	0.07	0.81	54.86	0.05
+zmass	30.79	27.01	0.04	3.04	36.44	0.00	1.37	11.36	0.05	12.16	0.01	0.51	0.02	0.55	0.02	1.46	0.00	0.07	4.50	0.00
+zenergy	29.51	25.40	0.02	2.35	33.34	0.00	0.91	8.11	0.02	8.87	0.00	0.28	0.01	0.34	0.00	0.78	0.00	0.03	3.58	0.00
+henergy	26.59	21.94	0.00	1.53	27.56	0.00	0.74	5.62	0.02	6.28	0.00	0.20	0.00	0.17	0.00	0.19	0.00	0.02	1.91	0.00
+btagsumHjet	21.59	1.48	0.00	0.16	4.97	0.00	0.04	0.12	0.01	0.13	0.00	0.01	0.00	0.01	0.00	0.02	0.00	0.01	0.11	0.00
+minpfoinjet	21.33	1.31	0.00	0.13	4.87	0.00	0.04	0.12	0.00	0.12	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.09	0.00
+logy23	18.51	1.09	0.00	0.10	3.70	0.00	0.02	0.09	0.00	0.09	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.00
+logy34	18.25	1.08	0.00	0.10	3.61	0.00	0.02	0.09	0.00	0.09	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.00
+printhrust	17.30	0.98	0.00	0.07	1.46	0.00	0.01	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
+sphericity	16.97	0.96	0.00	0.06	1.41	0.00	0.01	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
+hmass	16.48	0.87	0.00	0.04	1.12	0.00	0.01	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00
# Evts(Remain)	4506.1	128.1	0.0	65.4	2469.7	0.0	172.9	569.6	0.0	368.8	0.0	84.0	6.2	7.5	0.0	25.3	0.0	7.2	1791.7	0.0

6f-ttbar

# cut&process	tt_yyveevtt_yyvelvtt_yyveyxtt_yyvlevtt_yyvllvtt_yyvlyxtt_yyxyevtt_yyxylvtt_yyuyyctt_yycyyu										
# raw data	4785	8762	25280	8762	16917	49552	25179	49552	35498	35529	
# used data	4785	8762	25280	8562	16917	49552	24979	49552	35498	35529	
# passed data	0	4	35	1	14	379	50	423	56	50	
# passed/used	0.000	0.046	0.138	0.012	0.083	0.765	0.200	0.854	0.158	0.141	
# xsection	12.1	23.8	70.2	23.6	47.1	138.9	70.0	138.8	98.3	98.8	
# xsection*L	6054	11878	35092	11823	23553	69461	34996	69421	49155	49409	
success	100.00	99.99	100.00	99.99	99.99	100.00	100.00	100.00	100.00	100.00	0.00
+nisoleps	1.50	5.54	11.89	6.94	23.46	49.90	12.47	50.00	99.77	99.81	0.00
+nallpfos	0.96	4.26	11.84	6.13	18.74	49.74	12.42	49.80	95.22	95.26	0.00
+zmass	0.13	0.78	2.43	3.09	3.40	11.48	3.32	11.70	7.49	7.72	0.00
+zenergy	0.06	0.39	1.97	2.67	1.47	8.34	2.82	8.63	7.41	7.63	0.00
+henergy	0.04	0.37	1.83	2.61	1.31	7.91	2.67	8.26	3.16	3.33	0.00
+btagsumHjet	0.00	0.10	0.60	2.41	0.50	3.27	1.54	3.50	1.19	1.18	0.00
+minpfoinjet	0.00	0.07	0.57	2.39	0.31	3.04	1.52	3.23	1.16	1.12	0.00
+logy23	0.00	0.07	0.27	2.36	0.12	1.38	1.20	1.52	0.53	0.48	0.00
+logy34	0.00	0.07	0.27	2.36	0.12	1.34	1.20	1.49	0.53	0.48	0.00
+printhrust	0.00	0.06	0.25	2.35	0.09	1.20	1.14	1.32	0.51	0.46	0.00
+sphericity	0.00	0.05	0.19	2.35	0.08	0.96	1.10	1.09	0.46	0.42	0.00
+hmass	0.00	0.05	0.14	2.29	0.08	0.76	0.99	0.85	0.16	0.14	0.00
# Evts(Remain)	0.0	5.7	55.5	1.9	24.6	518.8	69.6	562.7	71.7	64.2	

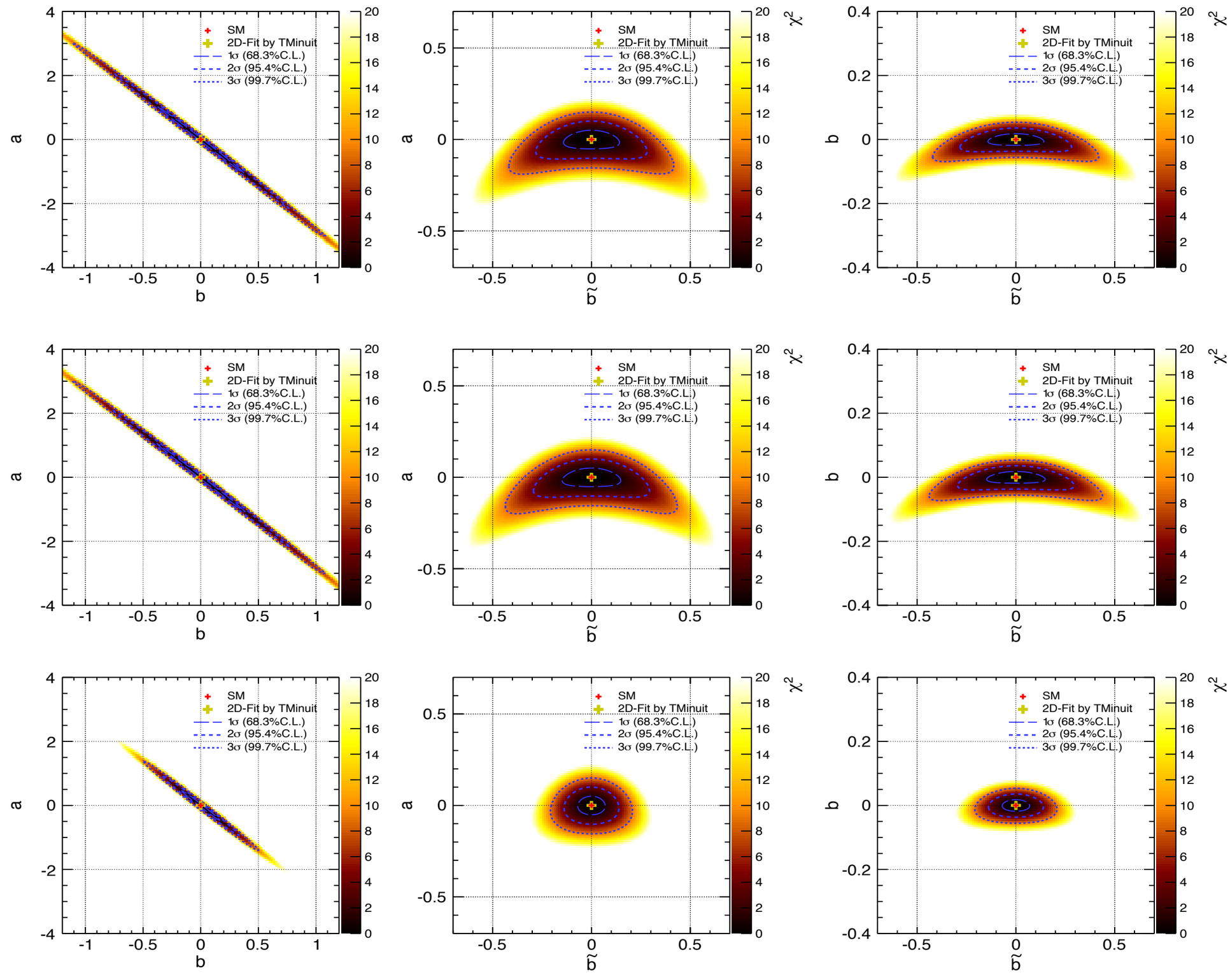
Sensitivity on anomalous ZZH @ 250GeV

a vs b | **a vs bt** | **b vs bt**

μμh

eeh

qqbb



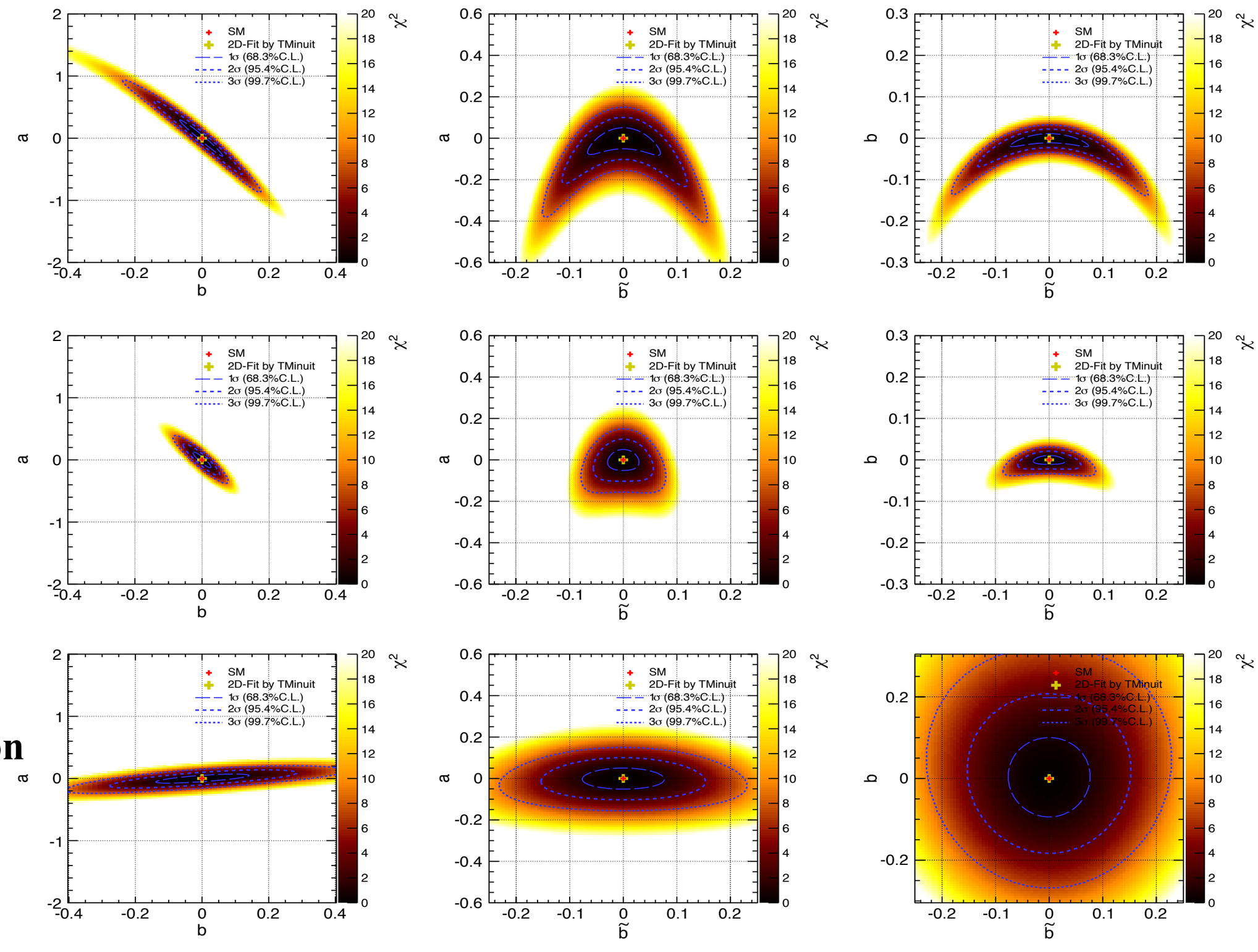
Sensitivity on anomalous ZZH @ 500GeV

a vs b | **a vs bt** | **b vs bt**

μμh

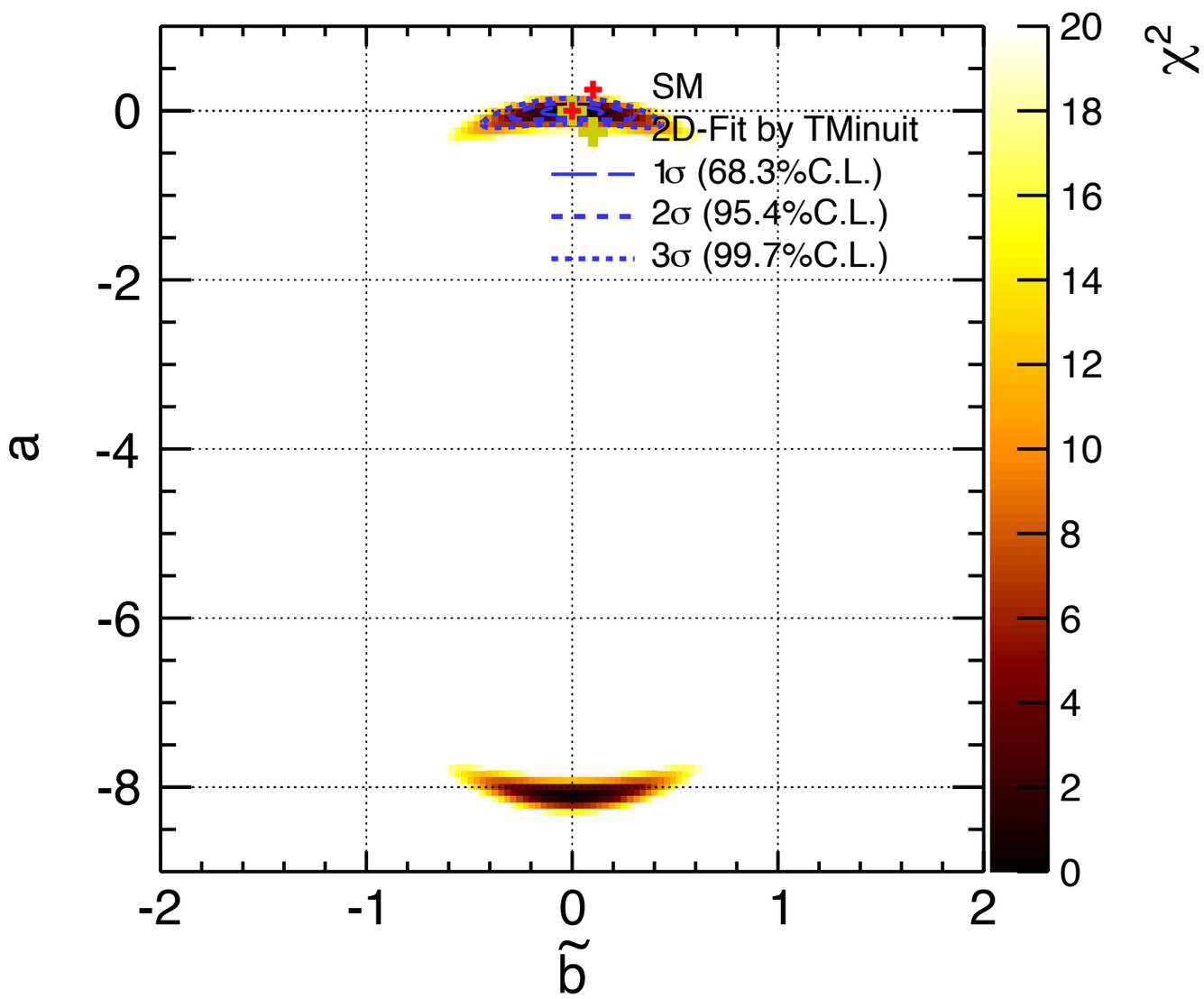
qqbb

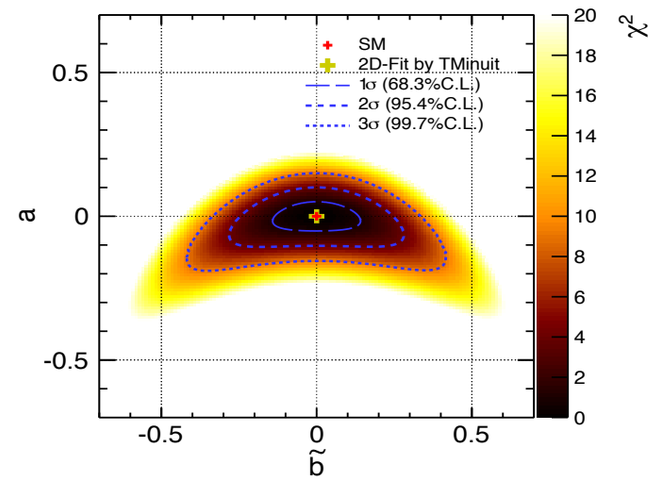
ZZ-fusion eebb



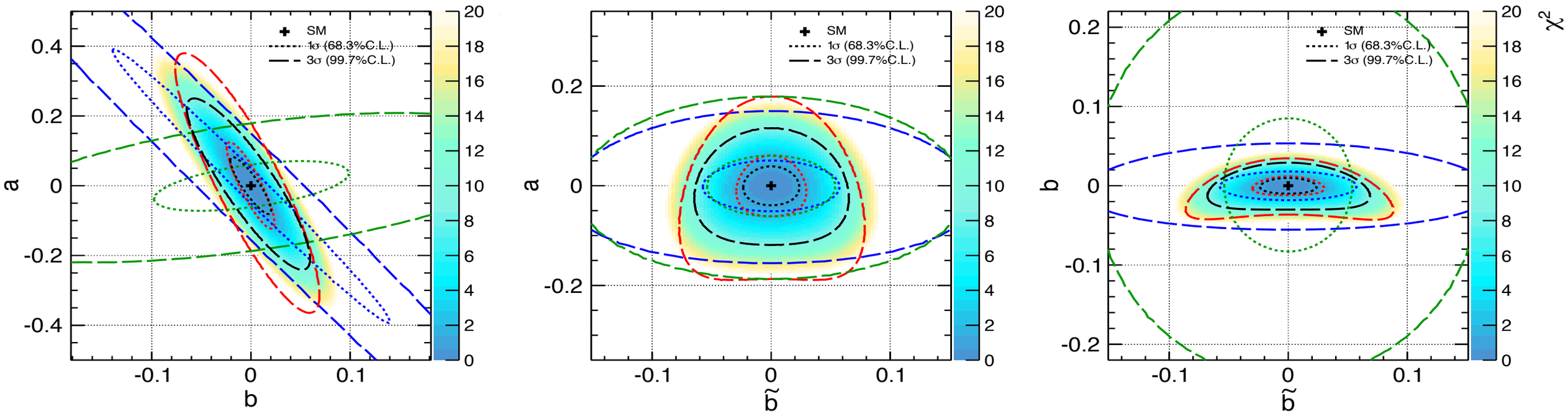
$$\mathcal{L}_{HVV} = 2M_V^2\left(\frac{1}{v}+\frac{a}{\Lambda}\right)HV_\mu^+V^{-\mu}+\frac{b}{\Lambda}HV_{\mu\nu}^+V^{-\mu\nu}+\frac{\tilde{b}}{\Lambda}H\epsilon^{\mu\nu\rho\sigma}V_{\mu\nu}^+V_{\rho\sigma}^-$$

At a ~ -4.1, the couplings is canceled with SM.
So, another island appears in the opposite direction.

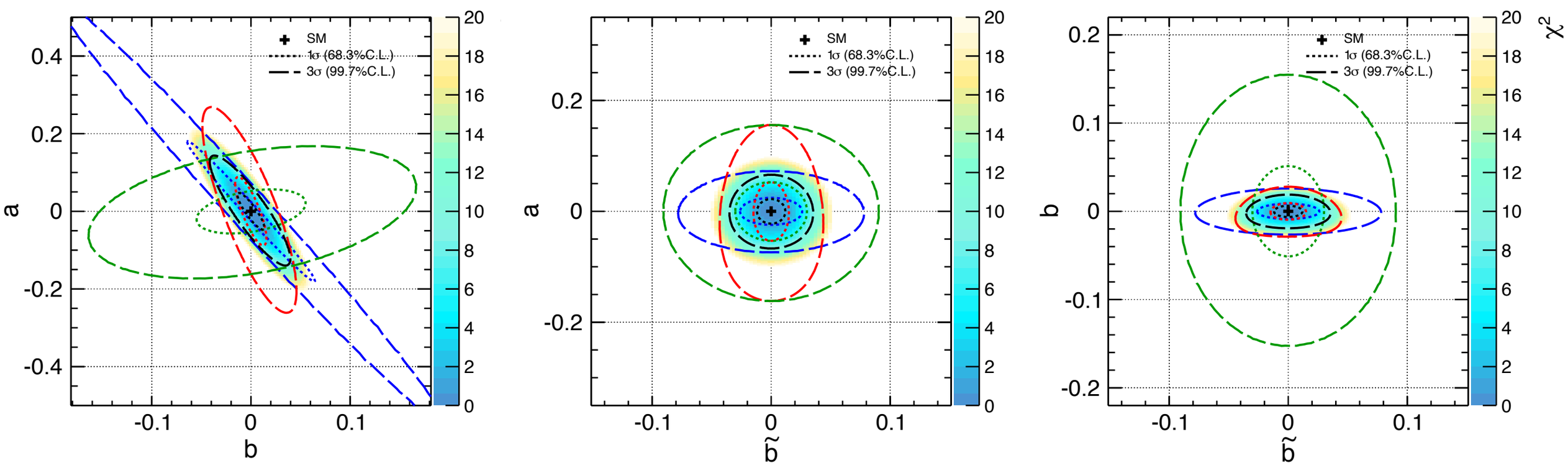




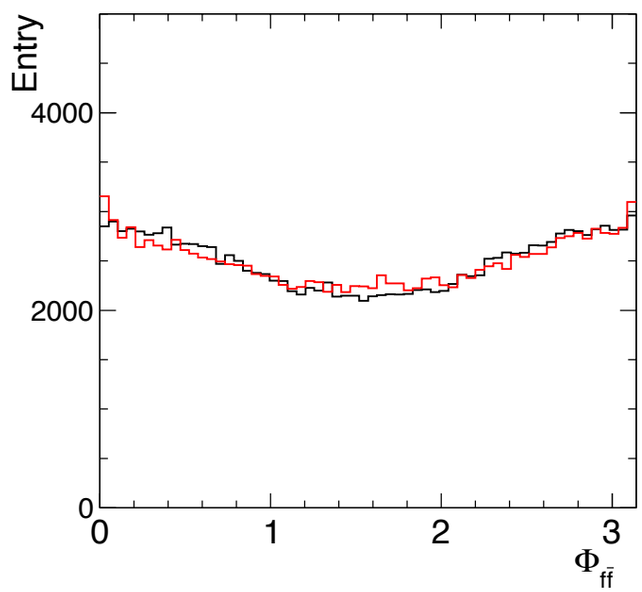
Combined Sensitivity on anomalous ZZH

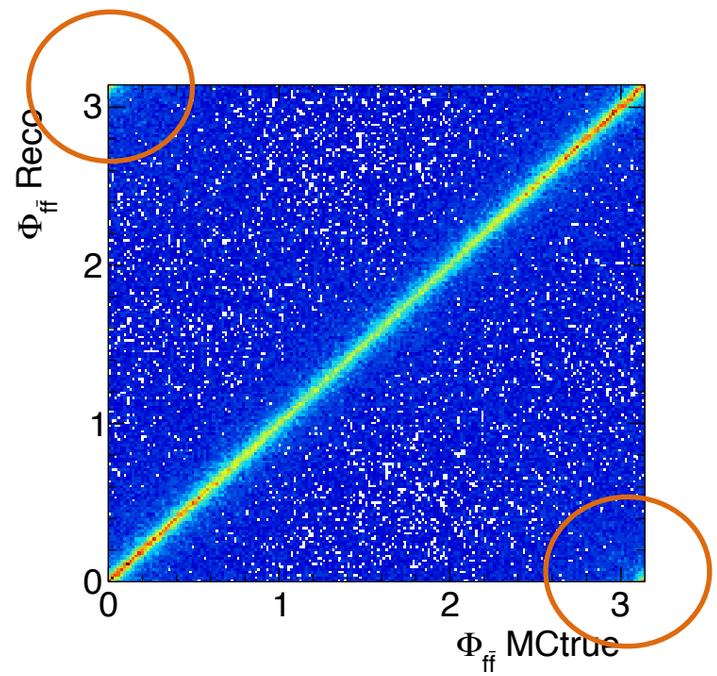


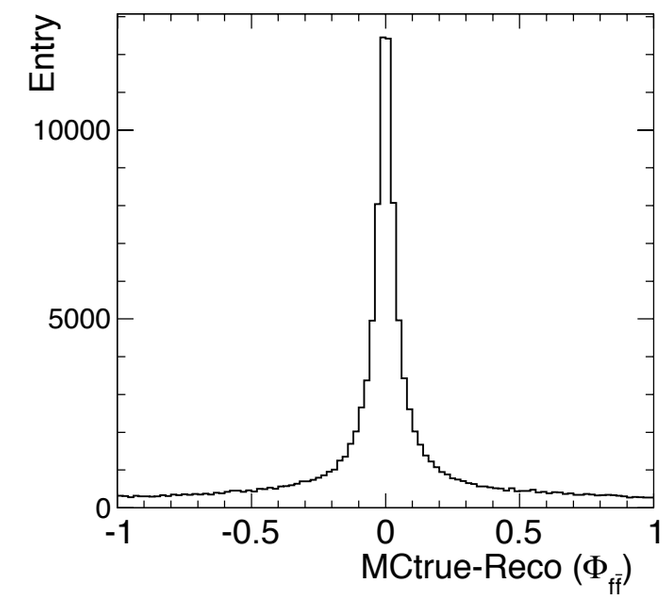
Combined Sensitivity on anomalous ZZH (H20) "LR"



>. Check only signal events of MC and Reco

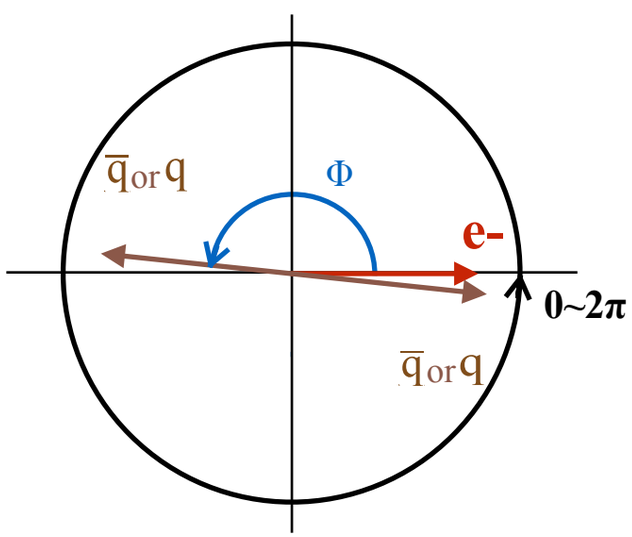


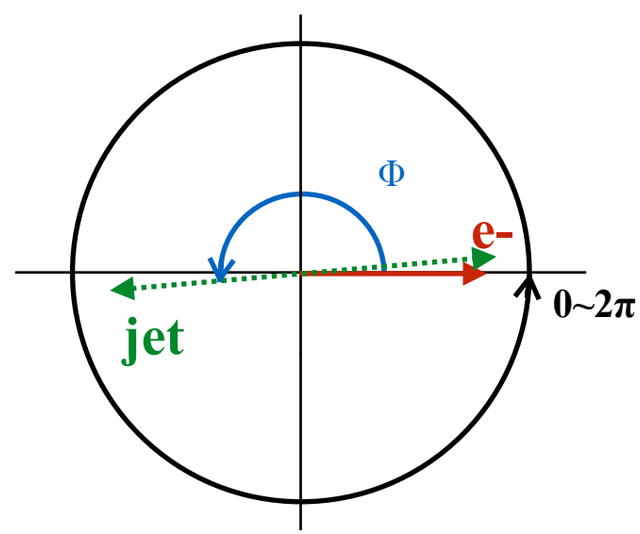




>. parton info **(MC true)**: Φ is, for instance, 3.06

>. Reconstructed jet: Φ > π, then,
Φ = Φ - π = (for instance) 0.10





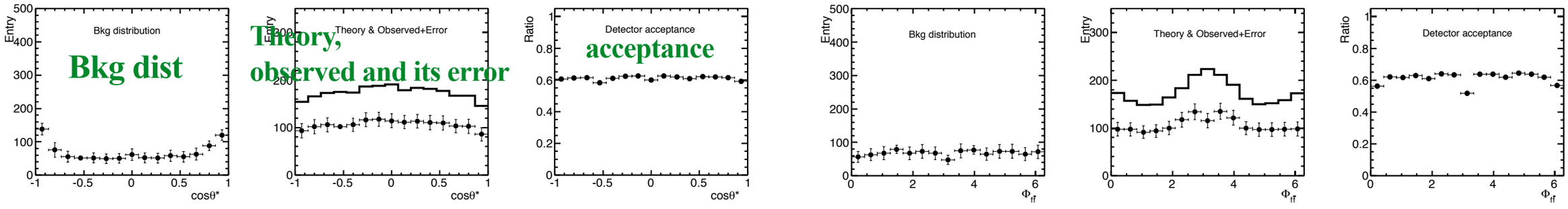
jet clustering is not complete.

Simulation Test

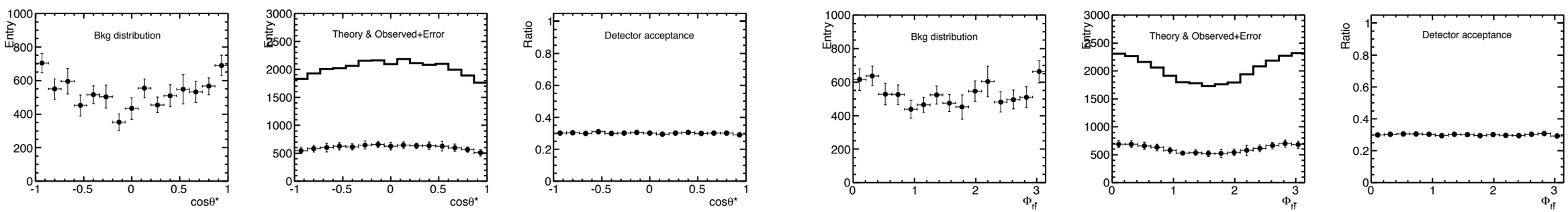
>. Detector acceptance (divided into 15 bins)

>. 250GeV, Zh ➡ μμh

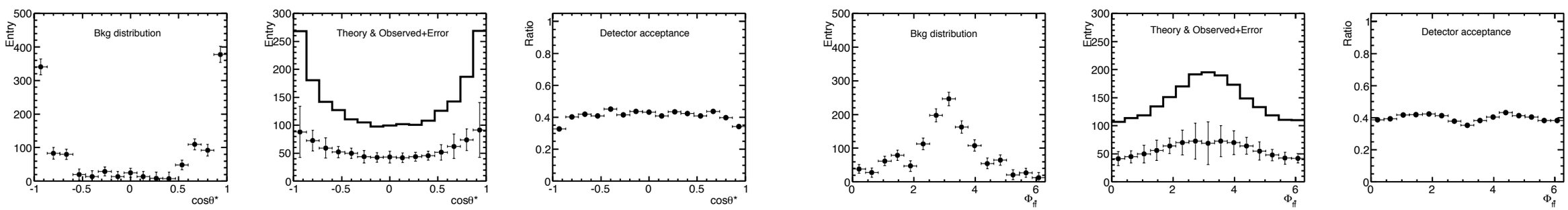
cosθ* Φ



>. 250GeV, Zh ➡ qqbb

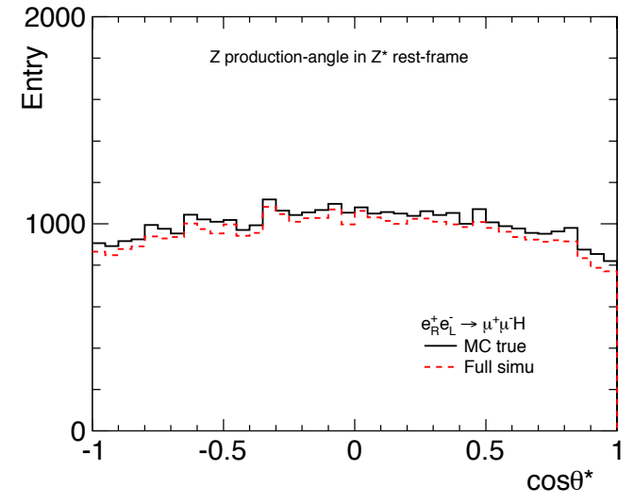


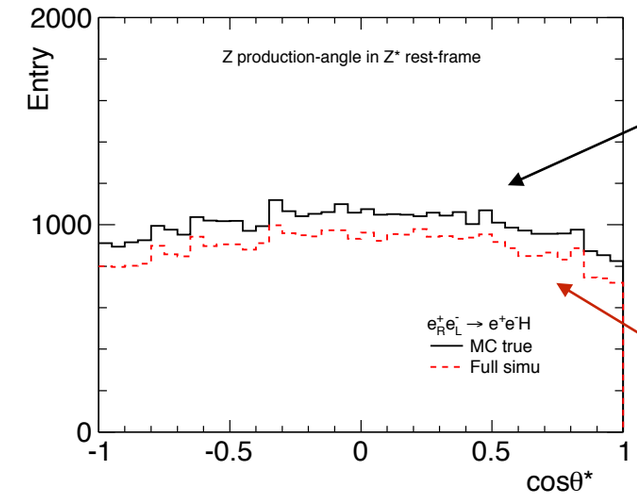
>. 500GeV, eeh ➡ eebb



mmh **eeh**

>. Z production angle θ*

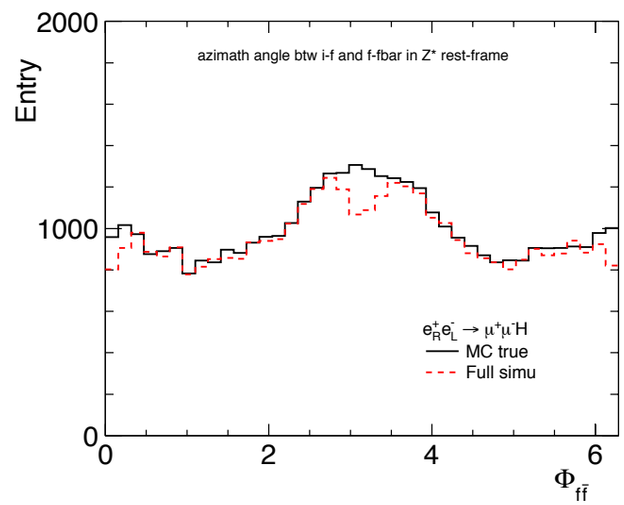


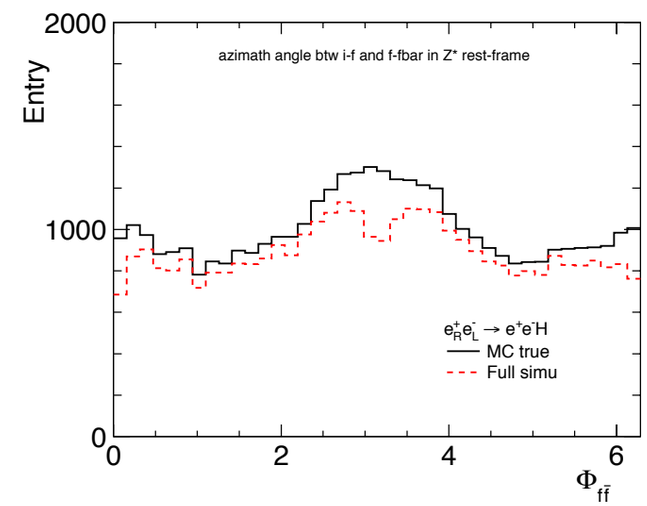


MC Truth

Reconstructed

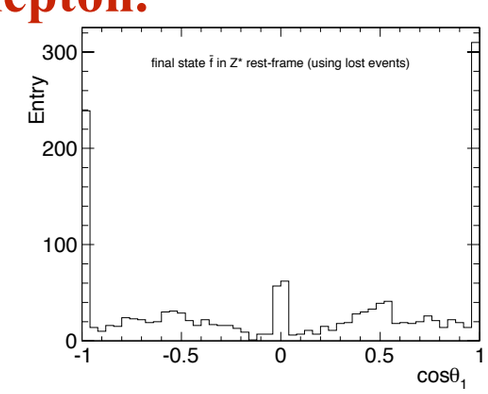
>. Angle Φ btw H production planes

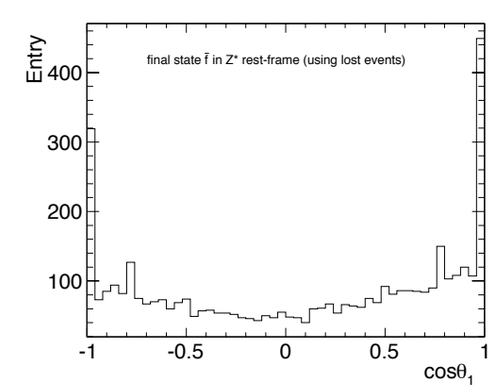




➡ We lose sensitivity to some extent up to reconstruction .

Using only lost event,
check a plar angle of lepton.





comparison of aHVV in Snowmass

(arxiv: 1310.8361; 1309.4819)

convention: transalte f_{ai} at different collider, Ecm to f_{ai} in decay

$$A(X_{J=0} \to VV) = v^{-1}\left(a_1 m_V^2 \epsilon_1^* \epsilon_2^* + a_2 f_{\mu\nu}^{*(1)} f^{*(2),\mu\nu} + a_3 f_{\mu\nu}^{*(1)} \tilde{f}^{*(2),\mu\nu}\right)$$

$$f_{CP} = \frac{|a_3|^2 \sigma_3}{\sum |a_i|^2 \sigma_i}$$

Collider	pp	pp	e^+e^-	e^+e^-	e^+e^-	e^+e^-	$\gamma\gamma$	$\mu^+\mu^-$	target
E (GeV)	14,000	14,000	250	350	500	1,000	126	126	(theory)
$\mathcal{L}$ (fb^{-1})	300	3,000	250	350	500	1,000	250		
spin-2^+_m	$\sim 10\sigma$	$\gg 10\sigma$	$>10\sigma$	$>10\sigma$	$>10\sigma$	$>10\sigma$			$>5\sigma$
$VVH^\dagger$	0.07	0.02	✓	✓	✓	✓	✓	✓	$< 10^{-5}$
$VVH^\ddagger$	$4\cdot10^{-4}$	$1.2\cdot10^{-4}$	$7\cdot10^{-4}$	$1.1\cdot10^{-4}$	$4\cdot10^{-5}$	$8\cdot10^{-6}$	–	–	$< 10^{-5}$
$VVH^\diamond$	$7\cdot10^{-4}$	$1.3\cdot10^{-4}$	✓	✓	✓	✓	–	–	$< 10^{-5}$

† estimated in $H \to ZZ^*$ decay mode

‡ estimated in $V^* \to HV$ production mode

$^\diamond$ estimated in $V^*V^* \to H$ (VBF) production mode

translate our new result O(0.1) sensitivity on b-tilde at 250 GeV using 250 fb-1

—> $f_{CP} \sim 1.0\times10^{-4}$, which is already improved by a factor of 7

—> $f_{CP} \sim 1.2\times10^{-5}$, b-tilde ~ O(0.03), assuming 2 ab-1 in H20 scenario

—> $f_{CP} \sim 1.0\times10^{-6}$, b-tilde ~ O(0.01), + 4 ab-1 @ 500 GeV in H20 scenario

Abstract

Title:
Sensitivity of anomalous couplings between the Higgs and vector boson at the ILC

Abstract:
Precise measurement of the Lorentz structure of the HVV couplings
plays an important role at the International Linear Collider (ILC) to
understand the Higgs CP property and the electroweak symmetry breaking mechanism.

Higgs CP odd contribution to HVV coupling comes in via radiative
correction, which is expected
to be small. But at the ILC we can take advantage of the leading Higgs
production channels which are
via HZZ/HWW couplings to detect the small anomalous effect if there is any.

In this report, we use a full detector simulation to evaluate the
sensitivity of the anomalous HVV couplings at the ILC,
based on an dimension-5 effective Lagrangian approach. All the major
channels at both 250 and 500 GeV are employed.