Higgs combination toward CDR

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IHEP

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Channels Table (now 36)

*H->ee/eμ not listed due to no certain ratio.
*nn/qq+ττ without bkg.
*H->zz->vvvv is tagged H->invisible.

Signal Z	Signal H	Observed	Who takes charge	Last update
H->qq				
ee	bb	7466	Baiyu	2017.7
	cc	343		
	gg	1039		
μμ	bb	10575		
	cc	538		
	gg	1556		
qq	bb	176734		
	cc	8268		
	gg	25279		
νν	bb	70443		
	cc	3054		
	gg	9585		
H→γγ				
ll	γγ	93	Feng	2015
νν		309		
qq		822	Yitian	2017.4
H→ll				
μμ	ττ	2067	Dan	2017.7
qq		36024		
nn		12478		
Inc.	μμ	47	Zhenwei	2017.8

Signal Z	Signal H	Observed	Who takes charge	Last update
H->WW				
μμ	μνμν	52	Libo	2017.4
	evev	36		
	evμν	105		
	evqq	663		
	μνqq	717		
ee	μνμν	44		
	evev	22		
	evμν	81		
	evqq	612		
	μνqq	684		
νν	qqqq	9022		
H->ZZ				
νν	μμjj	190	Yuqian	2016.9
μμ	νjj	209		
ee	νjj	72		
H->Invisible				
qq	νννν	202	MoXin	2017.7
ee		12		
μμ		22		

Observed=tagged signal after cutflow and in asimov fit range.
All events are normalized to 5ab^{-1}.

My attempt, $bb/cc/gg$

	CDR	Old sample	Current	Baiyu's
bb	0.28%	0.25%	0.33%	0.3%
cc	2.2%	2.70%	3.01%	3.2%
gg	1.6%	1.17%	1.81%	1.6%

- Adapt a standalone version of workspace to fit bb/cc/gg (refer to liboyang's code)
  - Not together with other channels; (2d and 1d Asimov Data)
  - WW channels has bb/cc/gg ZH bkg, now not included.
  - ToyMC method;
- Currently fit unstable. Can have fluctuations in ~10% for cc/gg.
  - Try to improve……

$\mu\mu$ and other rare decays

	CDR	Mine
$\mu\mu$	17%	14.50%

- $\mu\mu$ process, the Z decay is inclusive
  - performance benchmark for the tracking system design
  - Some details under check with Zhenwei;

- $Z\gamma, e\mu, ee$ process are studied.
  - Since low stats and no clear ratio, not taken into fit model.

$\Delta(Br * \sigma)$ fit Result

	PreCDR	$\sigma(ZH) * \mathrm{Br}$	PreCDR for ΔBr	Fit result for ΔBr
$\sigma(ZH)$	0.51%	set to 0.50%		
$\Delta(Br * \sigma)$	0.28%	0.17%		0.54%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{bb})$	0.28%	0.33%	0.57%	\
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{cc})$	2.2%	3.01%	2.3%	\
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{gg})$	1.6%	1.81%	1.7%	\
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{WW})$	1.5%	**1.24%**	1.6%	1.35%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{ZZ})$	4.3%	**5.41%**	4.3%	5.42%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \tau\tau)$	1.2%	**0.74%**	1.3%	1.00%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \gamma\gamma)$	9.0%	**7.38%**	9.0%	7.38%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mu\mu)$	17%	**14.65%**	17%	14.65%
$\mathrm{Br}(\mathrm{H} \to \mathrm{inv.})$	\	\	0.28%	0.18%

κ: current precision result

κ	9	8	7
κ_b	1.30%	1.30%	1.30%
κ_c	1.77%	1.77%	1.77%
κ_g	1.69%	1.69%	1.69%
κ_γ	4.01%	4.02%	4.00%
κ_τ	1.28%	1.28%	1.16%
κ_μ	8.11%	8.11%	
$\kappa_{inv(H\to vvvv)}$	12.99%		
κ_Z	0.93%	0.93%	0.90%
κ_W	1.13%	1.14%	1.10%

for bb/cc/gg, in fact

9: Assume Γ_H constant.

8: Assume no invisible decay. set $\kappa_{inv} = 1$

7: Assume lepton universality $\kappa_l = \kappa_\tau = \kappa_\mu$

These simplification little affect the precision.

κ: comparison to pre_CDR

7 κ	My fit	Pre_CDR
κ_b	1.30%	1.2%
κ_c	1.77%	1.6%
κ_g	1.69%	1.5%
κ_γ	4.00%	4.7%
κ_μ=κ_τ	1.16%	1.3%
κ_Z	0.12%	0.16%
κ_W	1.10%	1.2%

Pre_CDR's result from Michael Peskin's codes, totally theoretic calculation. (most stats. dependent)

Mine from MC sample.

Since data incomplete, the fit didn't consider $\Delta\sigma(ZH) = 0.5\%$, which contributes a lot to κ_Z.
(and only κ_Z, so others are consistent.)

So there are a big gap.

Add pseudo data

- Since now data incomplete, bad result for κ_z
- If we reuse some MC sample
  - Ensure out total $\sigma(ZH) = 0.5\%$
  - So now κ_z all from pseudo data.
  - Contribute to κ_z and μ_{global}
  - Then κ_z could be 0.12%
  - $\mu_{global} = 0.11\%$, other unchanged;

To dos

- Fix template issues.
- Profile likelihood ratio? 2-D Contour? ……