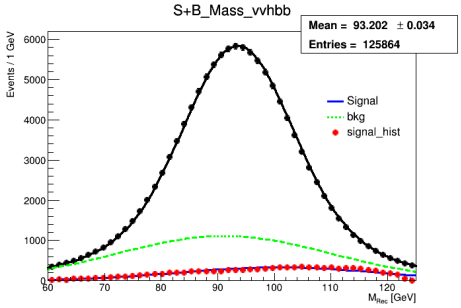
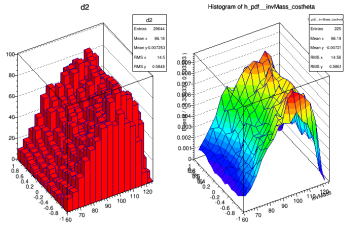
CEPC Higgs Combination towards CDR

ZhangKaili* WangJin LiuZhen

2017-09-25

Correlations : vvh->bb channel

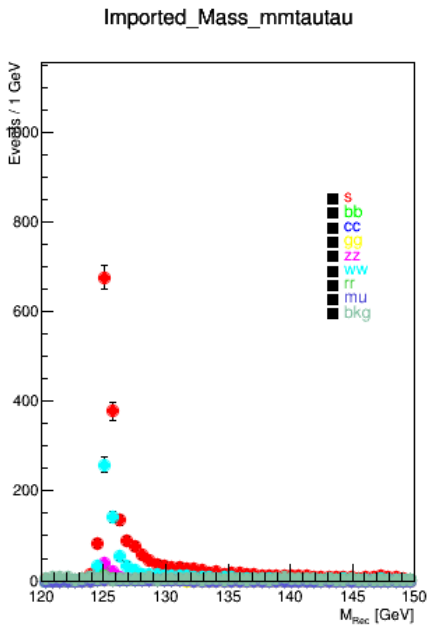


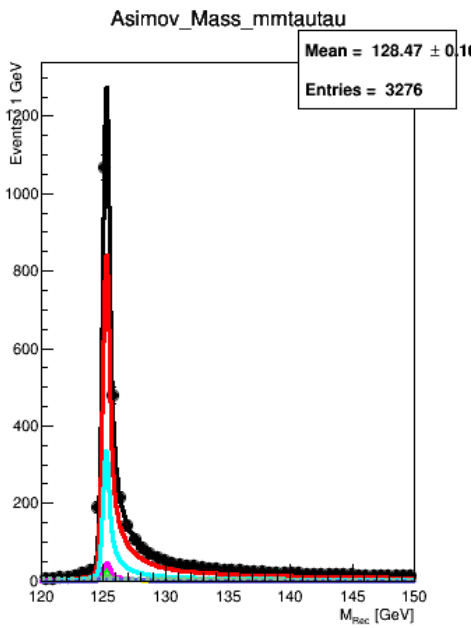


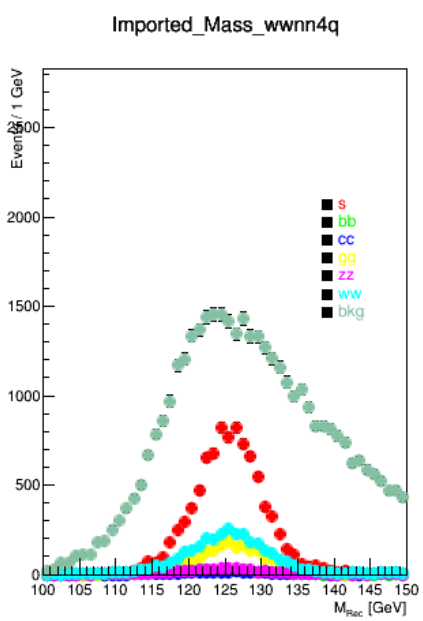
- Mass & Cosθ 2d fit;
- WW fusion channel contains many ZH bkg;
- Initial error is 2.89%, but must consider the uncertainty of ZH process(~0.4%)
- LiangHao assumes the error is Gaussian distribution;
  - $-\mathrm{Log}L = 0.5\left(\frac{\mu_{ZH}-1}{0.375\%}\right)^2 - P\left(data\middle|\mu_{\mathrm{ZH}}N_{ZH}Pdf_{ZH} + \mu_{\mathrm{wwf}}N_{wwf}Pdf_{wwf} + N_{SM}Pdf_{SM}\right)$
- In combination, we can directly use the likelihood in Z->ee/mm/qq, H->bb channel;
- Combine Fit $\{^{+3.12\%}_{-3.11\%}$; consistent with Hao's 3.1%

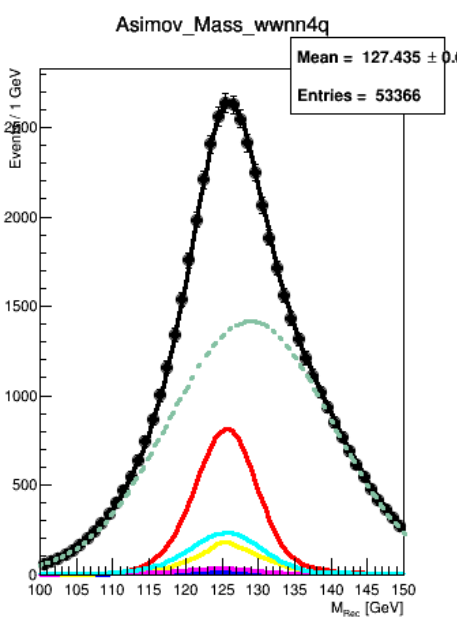
Asimov & Observed data comparison

Jianming Commented, since we use unbinned fit and use function to describe shape, we must guarantee the shape is correct.
Most channels fit well.





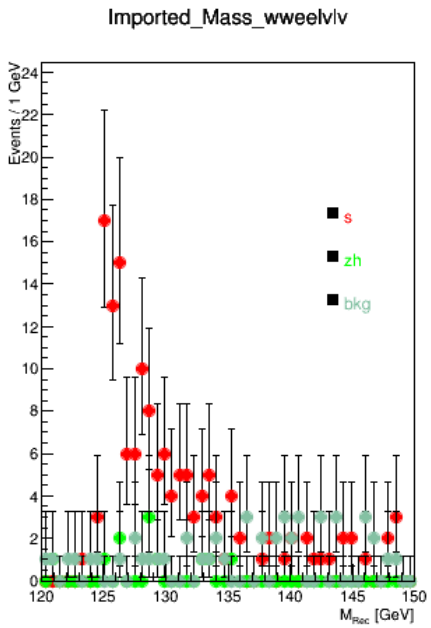


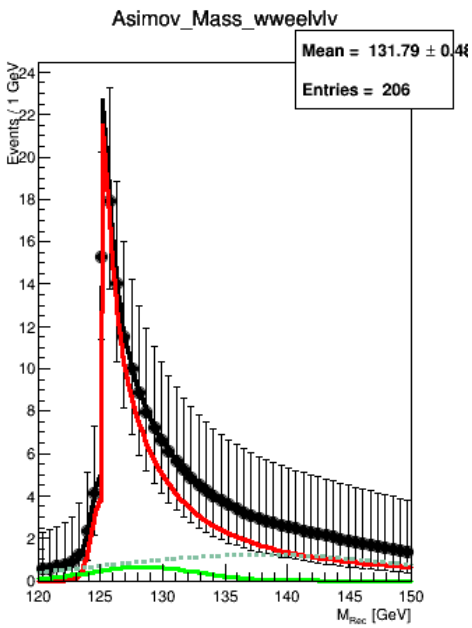


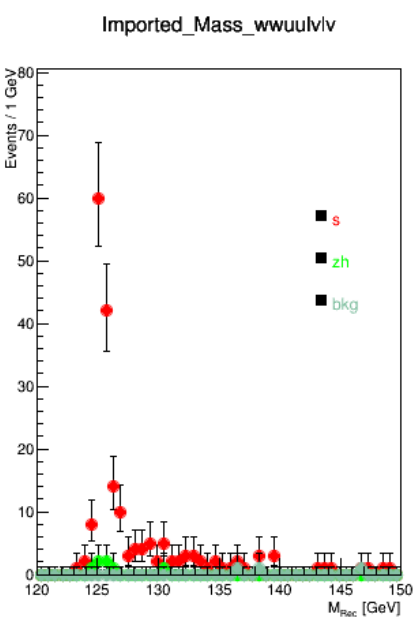
signal & ZH: Cystal Ball+Gaussian
bkg: 2nd Exponential.

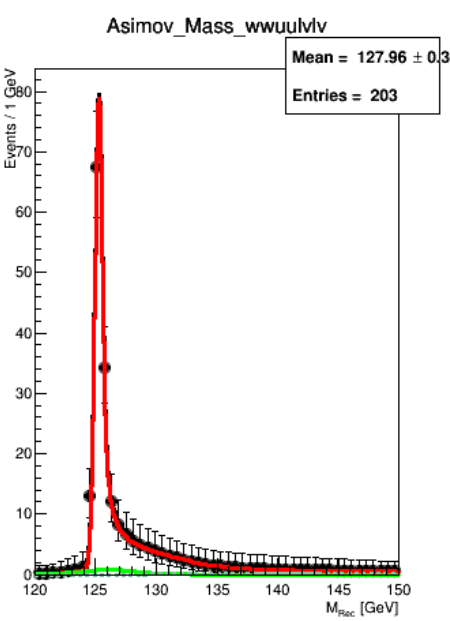
we don't sum the obs data together so there is no total events in the left side.

Asimov & Observed data comparison

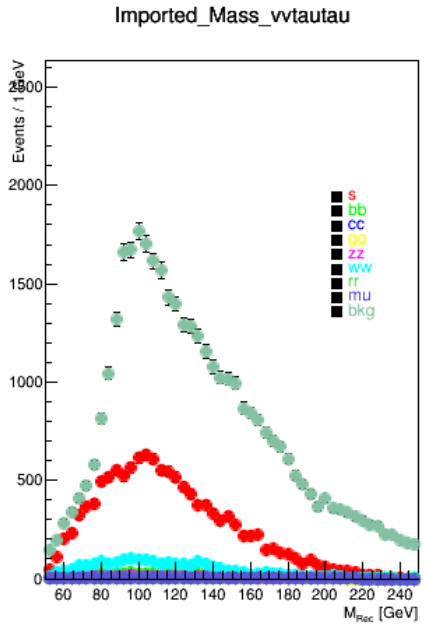


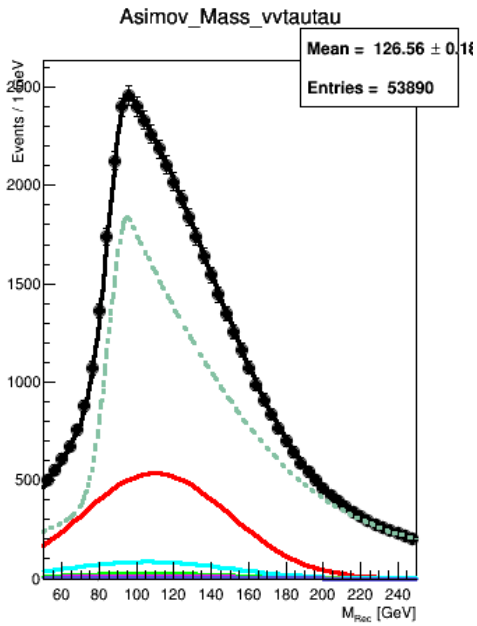


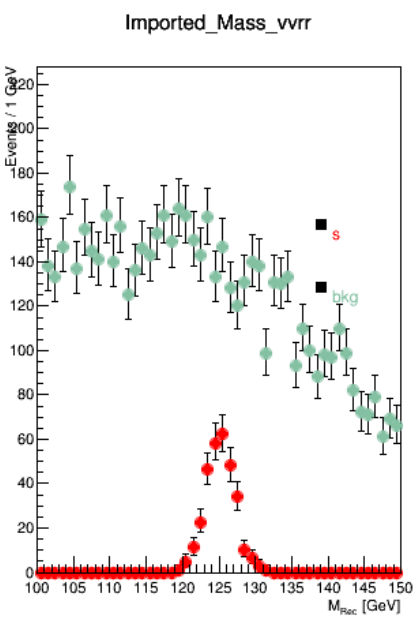


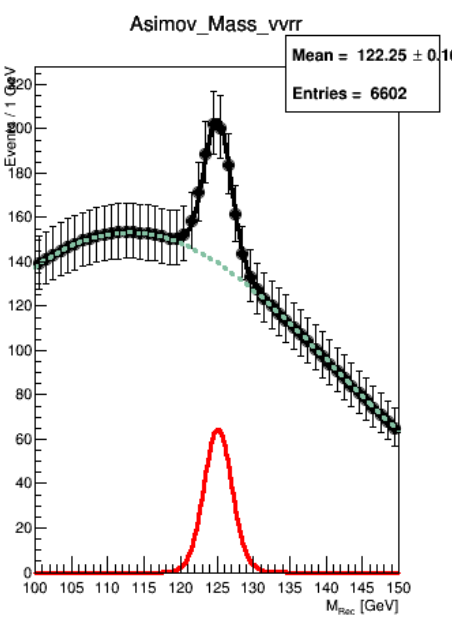


Asimov & Observed data comparison



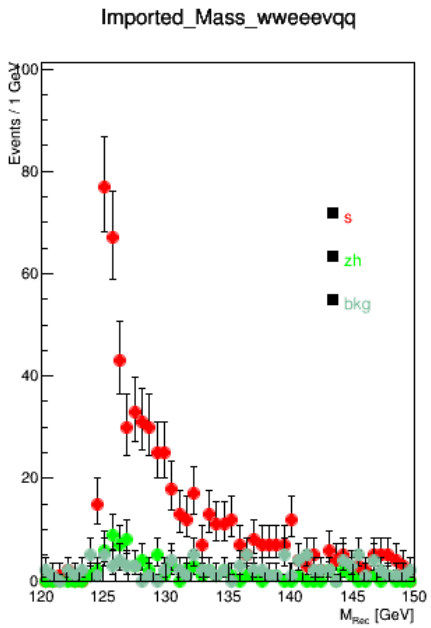


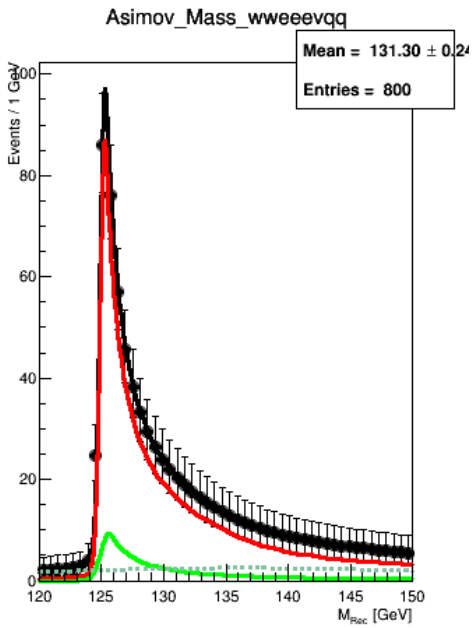


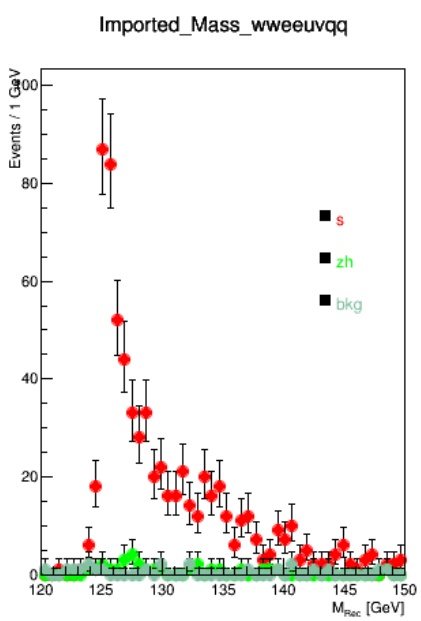


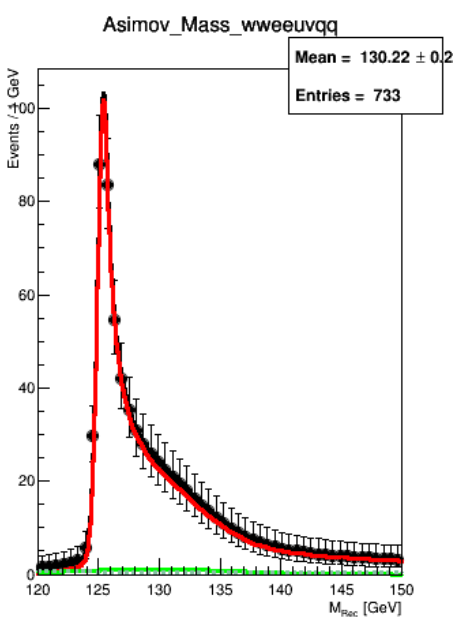
visible mass in vvtt

Asimov & Observed data comparison

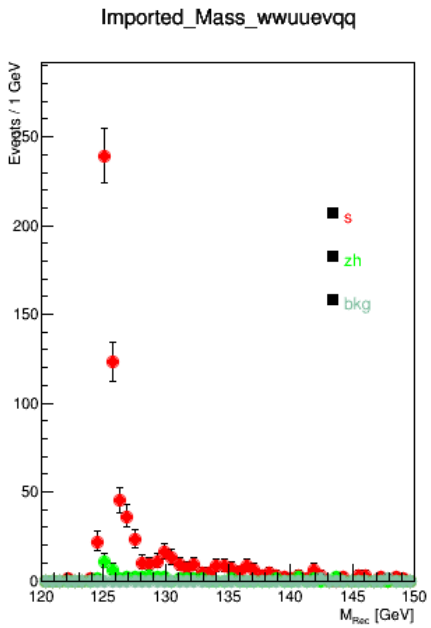


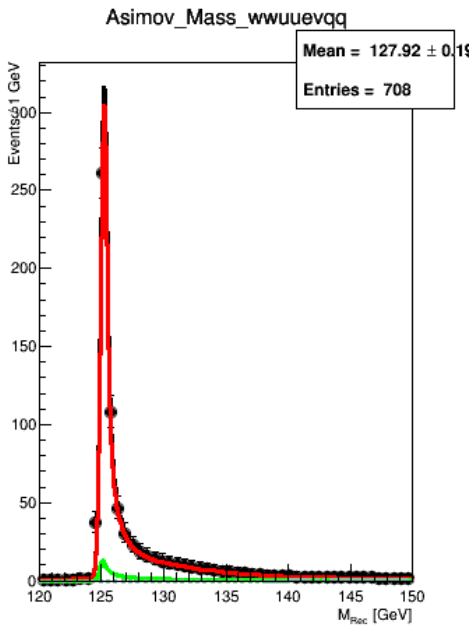


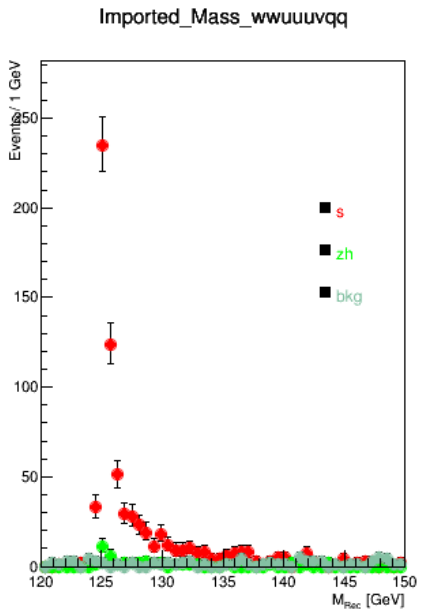


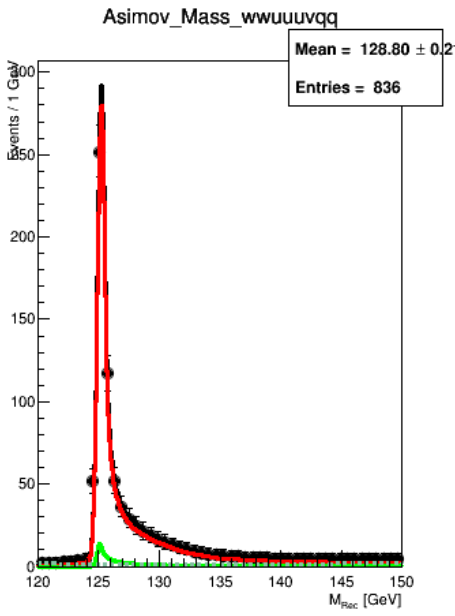


Asimov & Observed data comparison

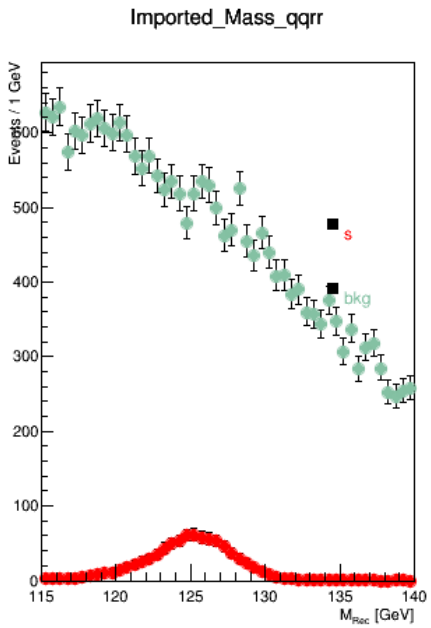


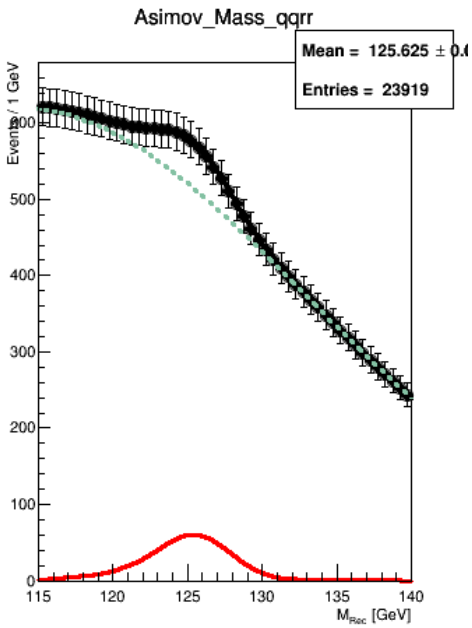


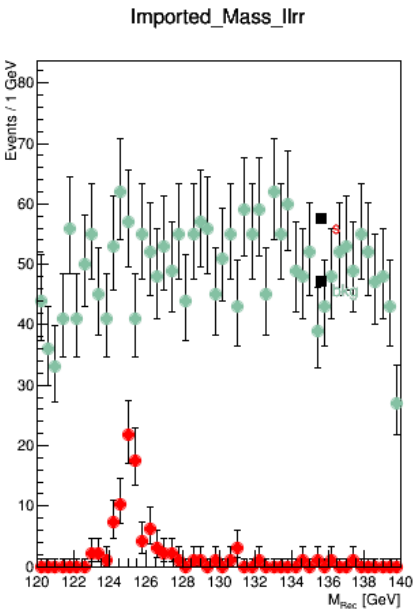


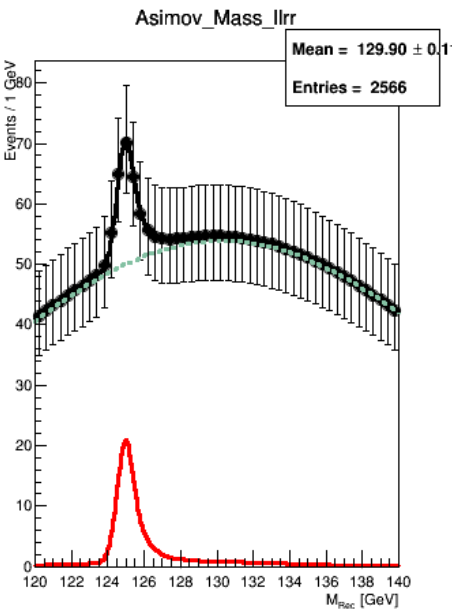


Asimov & Observed data comparison

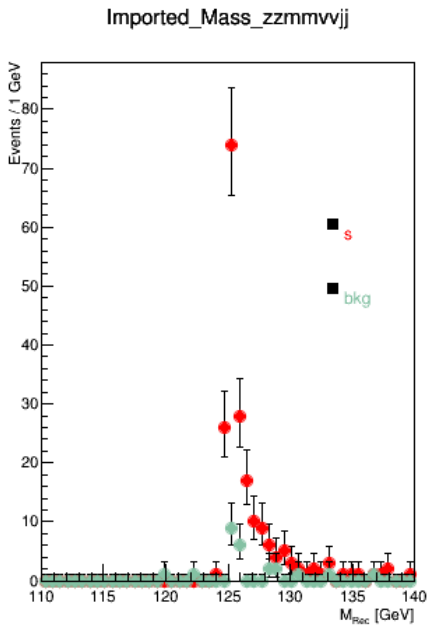


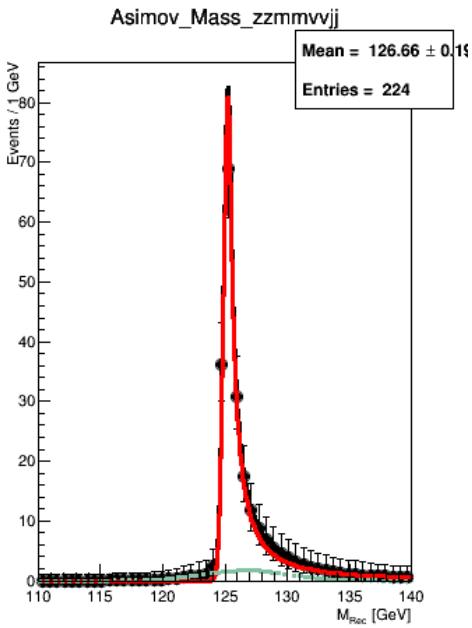


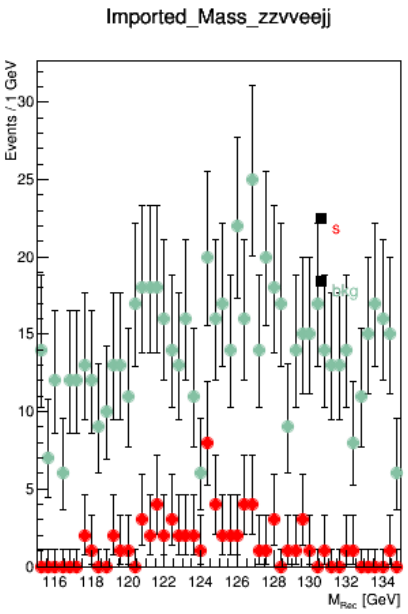


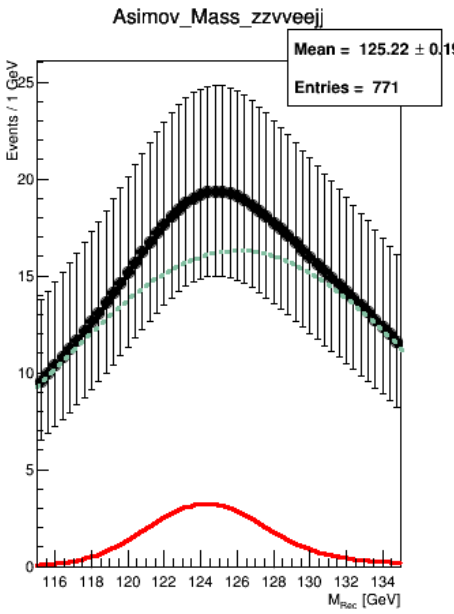


Asimov & Observed data comparison

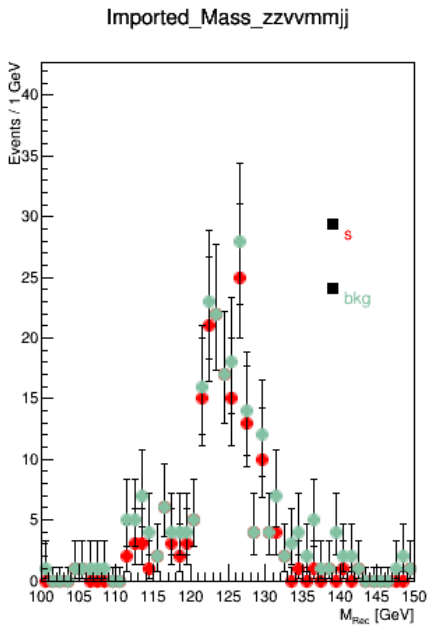


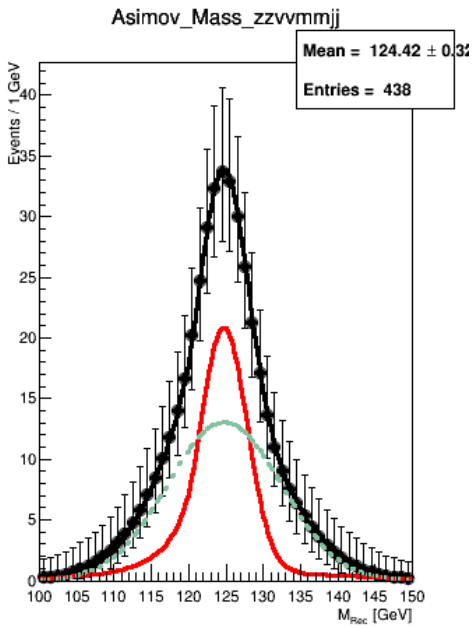


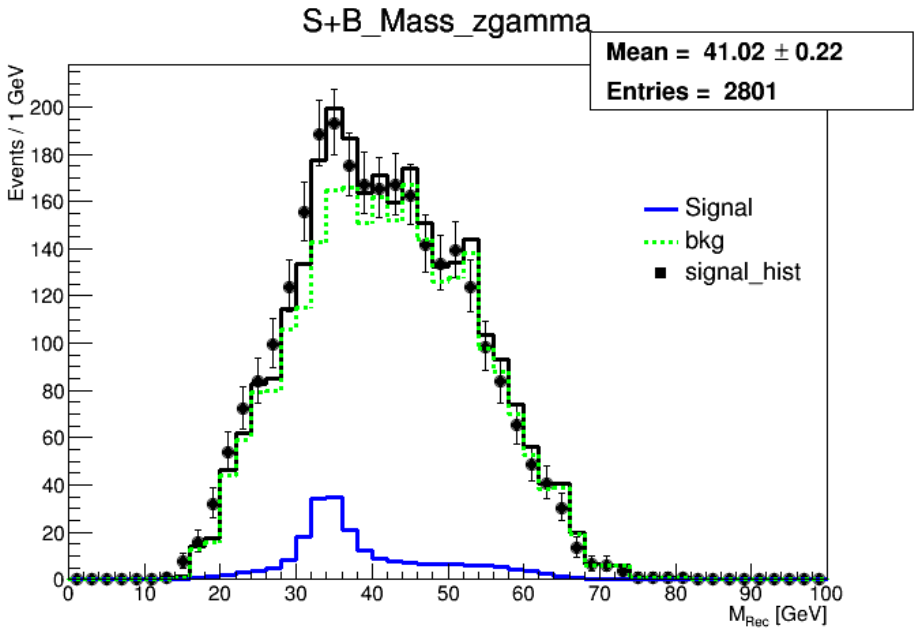




Asimov & Observed data comparison

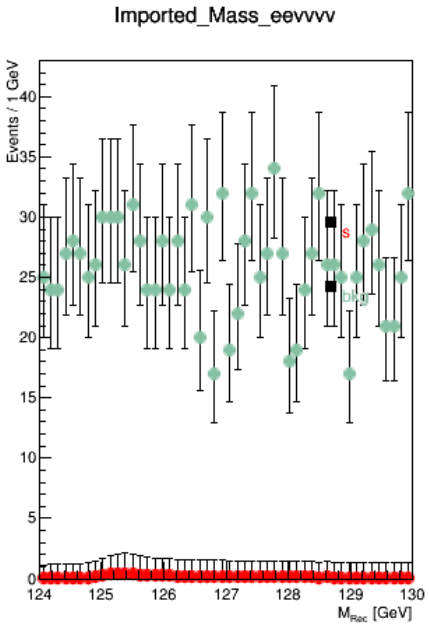


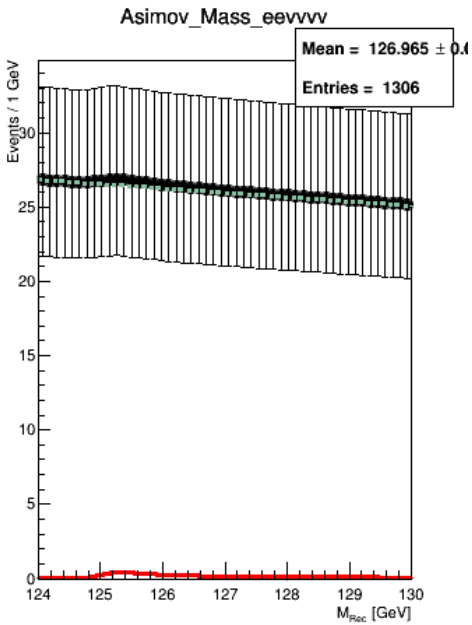


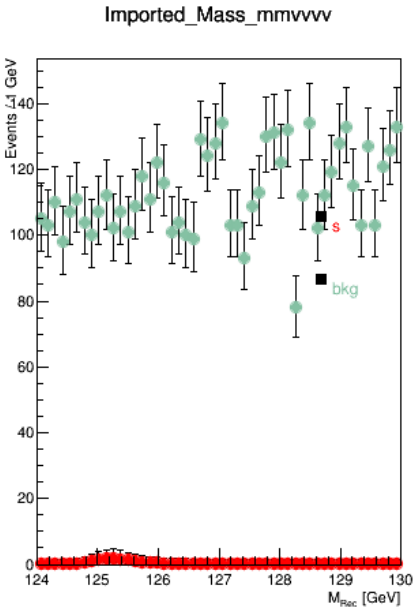


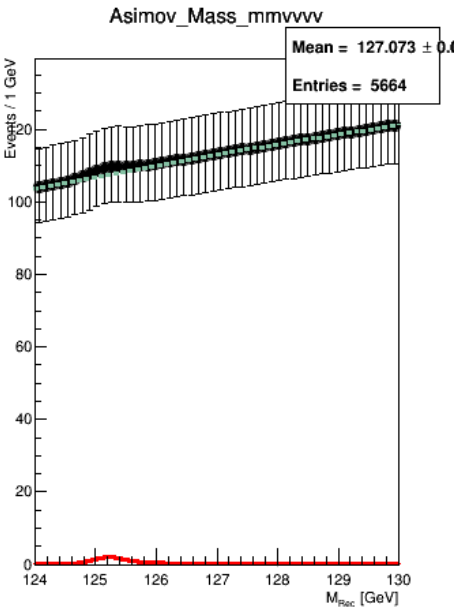
Zgamma from WeiMin, binned fit;

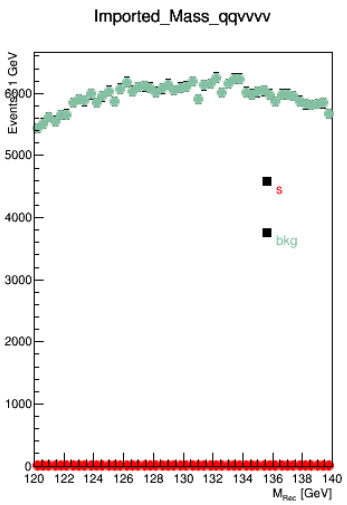
Asimov & Observed data comparison

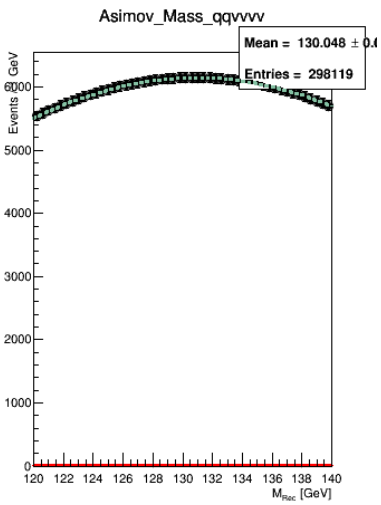




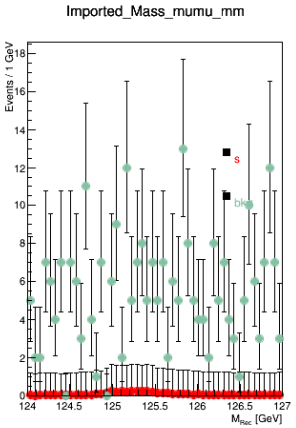


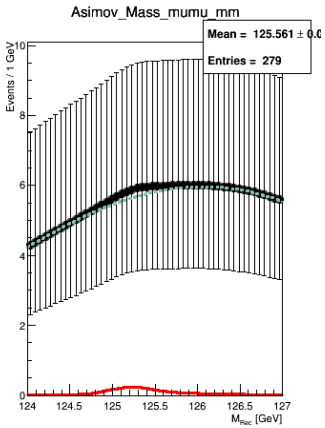


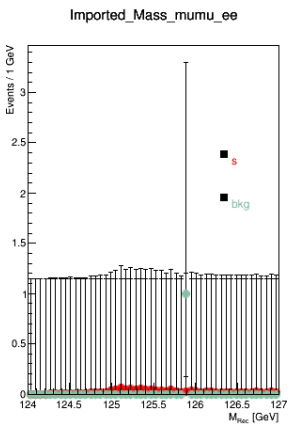


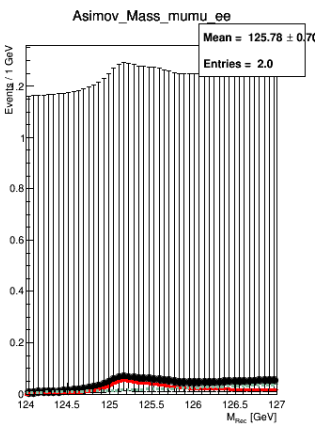


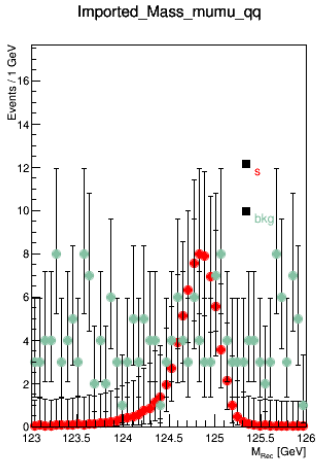
Asimov & Observed data comparison

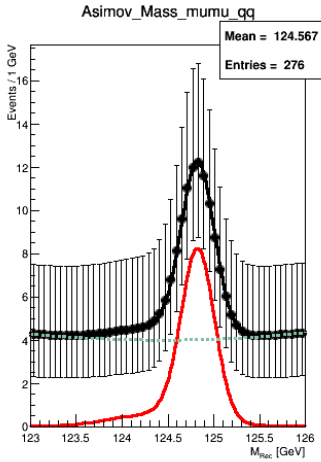


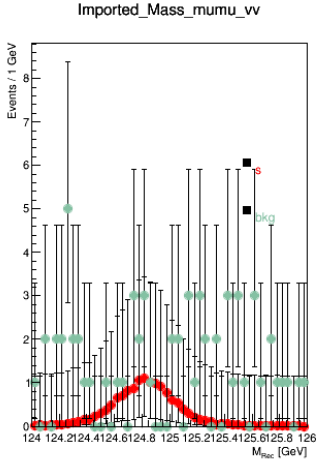


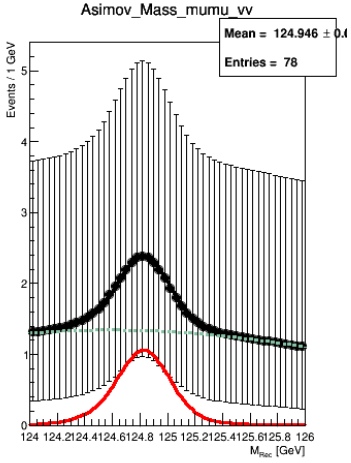












$\Delta(Br * \sigma)$ fit Result

	PreCDR	Current
$\sigma(ZH)$	0.51%	0.50%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{bb})$	0.28%	$^{+0.27\%}_{-0.27\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{cc})$	2.2%	$^{+3.45\%}_{-3.43\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{gg})$	1.6%	$^{+1.43\%}_{-1.42\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{WW})$	1.5%	$^{+1.20\%}_{-1.20\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mathrm{ZZ})$	4.3%	$^{+5.91\%}_{-5.74\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \tau\tau)$	1.2%	$^{+0.68\%}_{-0.67\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \gamma\gamma)$	9.0%	$^{+8.26\%}_{-8.17\%}$
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to \mu\mu)$	17%	$^{+15.8\%}_{-14.9\%}$
$\sigma(\mathrm{vv}H) * \mathrm{Br}(\mathrm{H} \to \mathrm{bb})$	2.8%	$^{+3.12\%}_{-3.11\%}$
$\mathrm{Br}(\mathrm{H} \to \mathrm{inv.})$	0.28%	0.18%
$\sigma(ZH) * \mathrm{Br}(\mathrm{H} \to Z\gamma)$	\	$4\sigma(^{+15.4\%}_{-14.9\%})$

In general, fit result is consistent with results of Pre_CDR and Individual studies.

Results to compare

7 κ	Minos Result	Liu_Zhen Current	Pre_CDR
κ_b	$\begin{cases}+1.34\% \\ -1.33\%\end{cases}$	$\begin{cases}+1.33\% \\ -1.37\%\end{cases}$	1.2%
κ_c	$\begin{cases}+2.23\% \\ -2.21\%\end{cases}$	$\begin{cases}+2.22\% \\ -2.24\%\end{cases}$	1.6%
κ_g	$\begin{cases}+1.57\% \\ -1.55\%\end{cases}$	$\begin{cases}+1.55\% \\ -1.58\%\end{cases}$	1.5%
κ_γ	$\begin{cases}+4.31\% \\ -4.39\%\end{cases}$	$\begin{cases}+4.25\% \\ -4.41\%\end{cases}$	4.7%
κ_μ=κ_τ	$\begin{cases}+1.40\% \\ -1.38\%\end{cases}$	$\begin{cases}+1.37\% \\ -1.41\%\end{cases}$	1.3%
κ_Z	$\begin{cases}+0.14\% \\ -0.14\%\end{cases}$	$\begin{cases}+0.14\% \\ -0.16\%\end{cases}$	0.16%
κ_W	$\begin{cases}+1.38\% \\ -1.36\%\end{cases}$	$\begin{cases}+1.34\% \\ -1.37\%\end{cases}$	1.2%

Difference in 0.01%.

If no big changes, these results will be used in our CDR chapter.

backup

Channels Table (now 43)

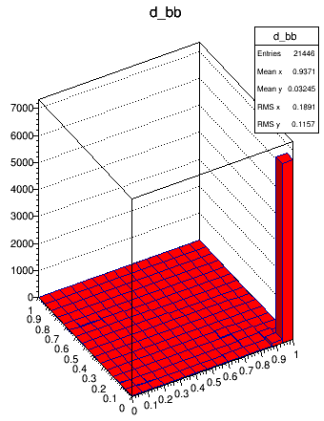
Observed=tagged signal after cutflow and in fit range.
All events are weighted and normalized to 5ab^{-1}.

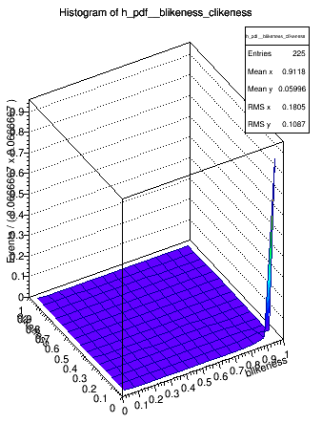
Signal Z	Signal H	Observed Events	Who takes charge	Last update
H->Inclusive				
νν	Inclusive	164170	Libo	2017.8
μμ	Inclusive	29552		
ee	Inclusive	22200		
H->qq				
ee	bb	7655	Baiyu	2017.7
	cc	351		
	gg	1058		
μμ	bb	11108		2017.9
	cc	567		
	gg	1762		
qq	bb	176542		2017.7
	cc	8272		
	gg	25293		
νν	bb	70608		
	cc	3061		
	gg	9633		
H→γγ,Zγ				
ll	γγ	93	Feng	2015
νν		309		
qq		822	Yitian	2017.4
qq	Zγ	219	Weimin	2017.9
H->Invisible				
qq	νννν	202	MoXin	2017.7
ee		8		
μμ		18		

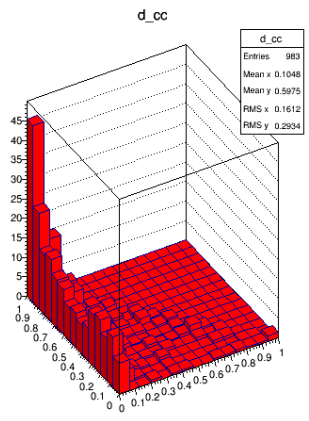
Signal Z	Signal H	Observed Events	Who takes charge	Last update
vvH(WW fusion)				
νν	bb	10256	LiangHao	2017.9
H->WW				
μμ	μνμν	52	Libo	2017.4
	evev	36		
	evμν	105		
	evqq	663		
	μνqq	717		
ee	μνμν	44		
	evev	22		
	evμν	81		
	evqq	612		
	μνqq	684		
νν	qqqq	9022		
H->ZZ				
νν	μμjj	190	Yuqian	2016.9
μμ	νjj	200		
ee	νjj	69		
H→ll				
μμ	ττ	2068	Dan	2017.9
qq		36023		
νν		12456		
qq	μμ	71	Zhenwei	2017.8
ee		1		
μμ		4		
νν		14		

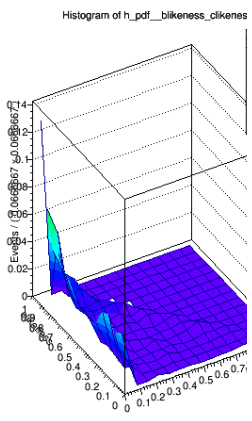
template fit: eeqq

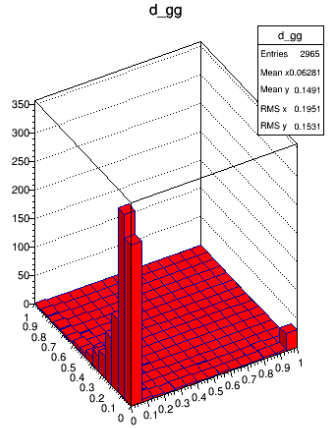
20*20 bins;

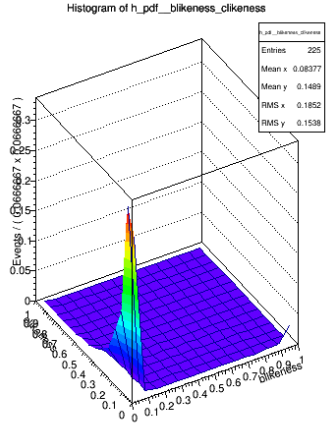


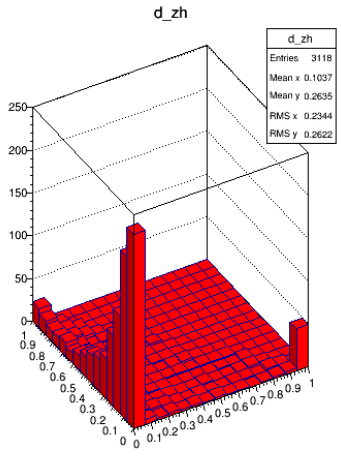


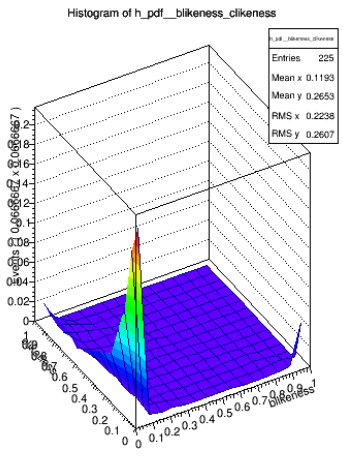


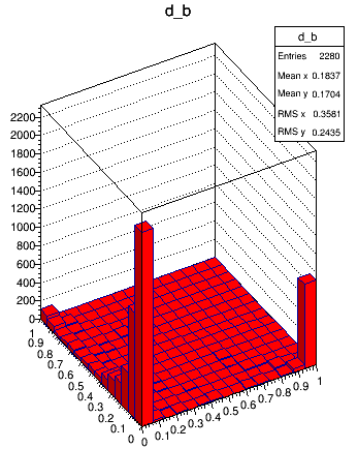


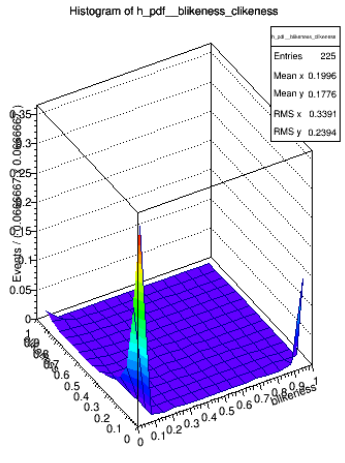






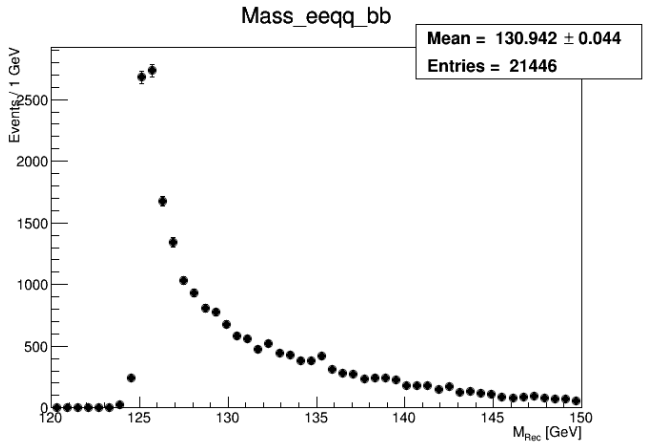


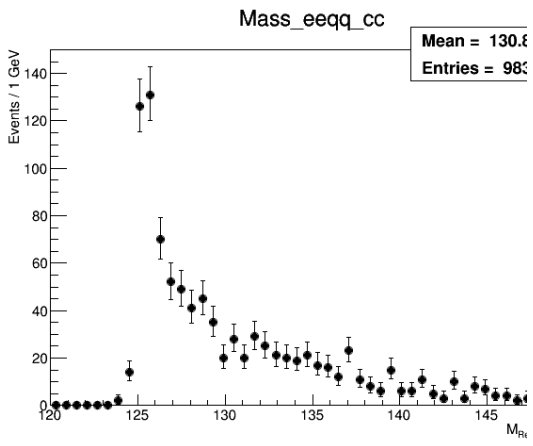


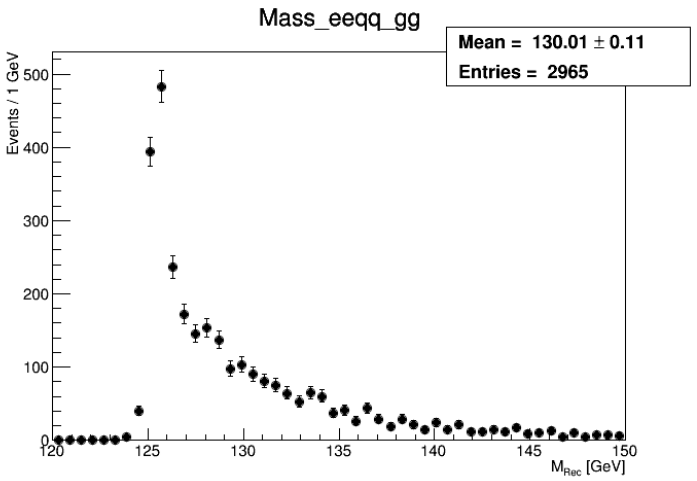


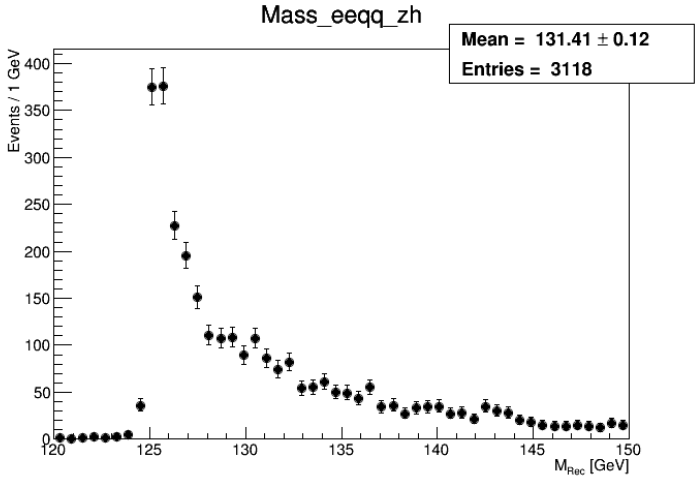
Mass distribution: eeqq

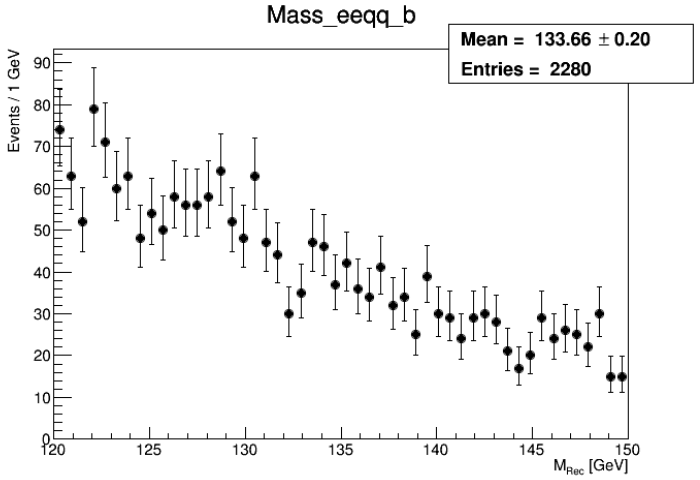
we don't use this mass shape in fit, just for demonstration.







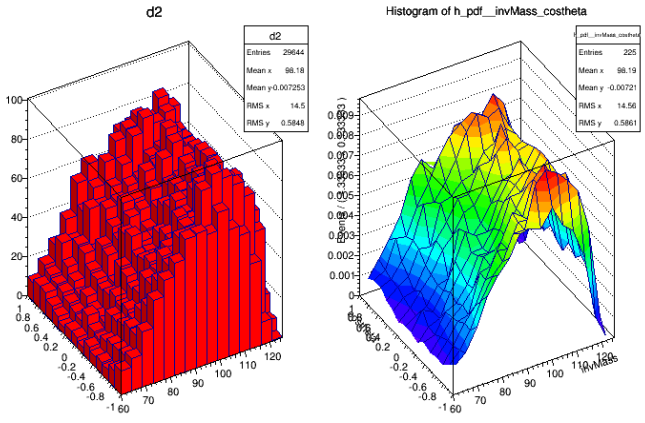




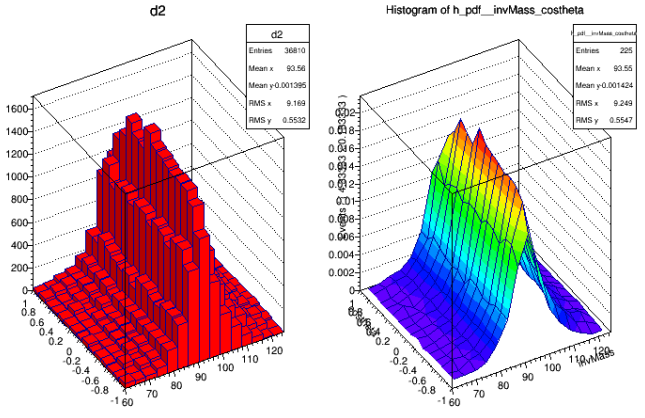
vvhbb

behaviors are different.

signal



zh



bkg