Higgs BR study

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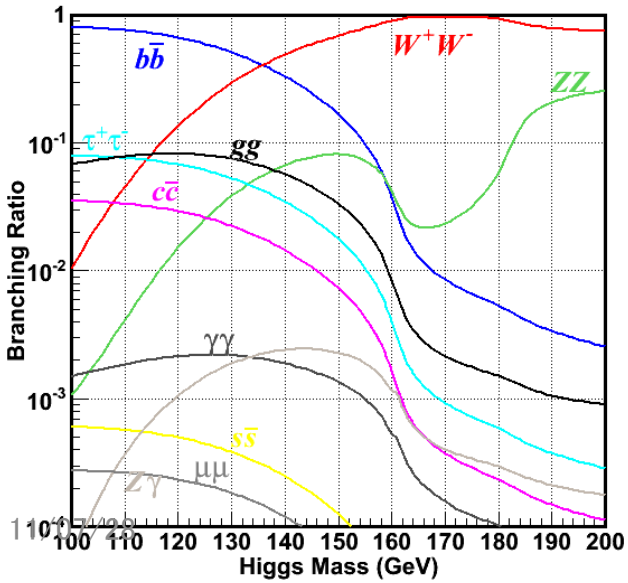
Current status

- Discuss about the 0^{th} draft with Miyamoto-san and additional check are needed for final results
  - "Data sample" and "template sample" are same and just scaled for current study
    → Prepare individual data and template samples to check the bias from same samples analysis
- Try to evaluate the absolute BR measurement accuracy with fitted parameter (r_{xx})
  - $r_{xx} = \varepsilon_{xx}/\varepsilon_{all} * BR(H \rightarrow xx)$ (ε_{xx}: cut efficiency)

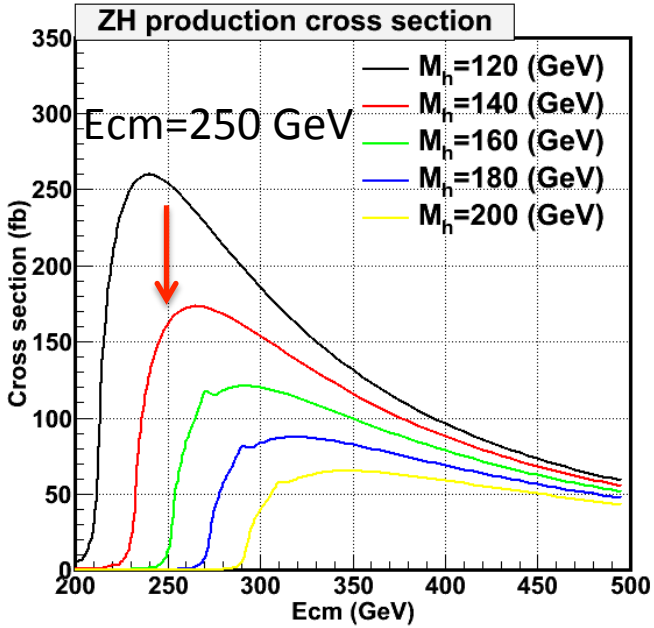
Consideration of different Higgs mass

Higher Higgs mass around the MH=140 GeV is also considered from LHC results

Higgs BR	MH=120 GeV	MH=140 GeV
H→bb	66.5%	33.0 %
H→ττ	6.8%	3.5 %
H→cc	2.9%	1.5%
H→WW*	13.6%	49.2%
H→ZZ*	1.5%	6.7%
H→gg	8.2%	5.6%



from HDECAY



Ecm=250 GeV is also suitable for the MH=140 GeV study (Ecm~Mz+MH+20 GeV)

Consider to generate the signal samples with MH=140 GeV at Ecm=250 GeV
LOI samples are available for BG (Ecm=250 GeV)

Fitted parameter r_{xx} definition

Current definition of fitted template sample rxx includes BR

$$N_{ijk}^{template} = \sum_{s=bb,cc,oth} r_s \left(\frac{N^{Hall}}{N^s} \right) \cdot N_{ijk}^s + r_{bkg} \cdot N_{ijk}^{bkg}$$

$$r_{oth} = 1\text{-}r_{bb}\text{-}r_{cc} \qquad r_{bkg} = 1 \text{ or free}$$

Possibility to reduce the fitting fluctuation fixed to $r_{bkg} = 1$,
which assume the SM backgrounds are well understand in the template samples

Definition of fitted r_{xx}

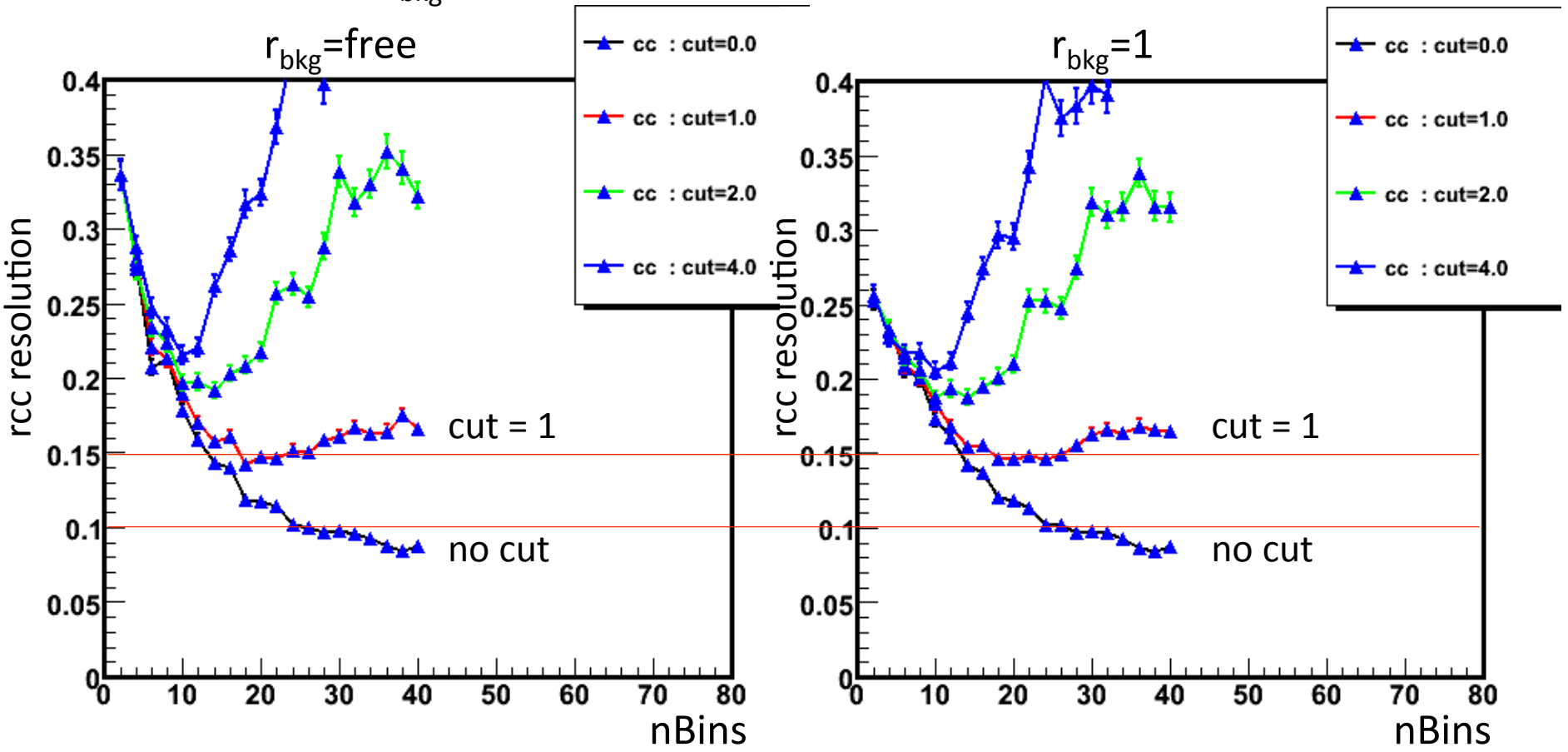
$$r_{xx} = \varepsilon_{xx}/\varepsilon_{all} * BR(xx)$$

Extract absolute BR from the fitted parameter r_{xx} and ε_{xx} (cut efficiency)

r_{bkg} parameter free or fixed

vvH Ecm=250 GeV, L=1000fb^{-1} template sample, L=250fb^{-1} data

Set r_{bkg}=1 if all the SM backgrounds are well understood



Significant difference is not observed from fix or free r_{bkg}

Measurement accuracy of BR

$$r_{xx} = \varepsilon_{all} / \varepsilon_{xx} \cdot BR(xx)$$

BR is extracted from the fitted parameter r_{xx}

ε_{xx}s are cut efficiency of each samples

	vvH		qqH	
Ecm (GeV)	250	350	250	350
ε_{all}	24.5%	35.4%	29.2%	24.1%
ε_{bb}	31.6%	44.6%	34.2%	28.6%
ε_{cc}	26.0%	45.2%	36.2%	32.1%
r_{bb}	0.86±0.01	0.84±0.01	0.78±0.02	0.79±0.02
r_{cc}	0.039±0.005	0.051±0.004	0.045±0.005	0.048±0.005
BR(bb)	66.3±0.9%	66.7±0.8%	66.6±1.3%	66.6±1.4%
BR(cc)	3.65±0.52%	3.99±0.33%	3.66±0.40%	3.60±0.38%
ΔBR(bb)	1.3%	1.2%	1.9%	2.1%
ΔBR(cc)	14.2%	8.2%	11.1%	10.6%

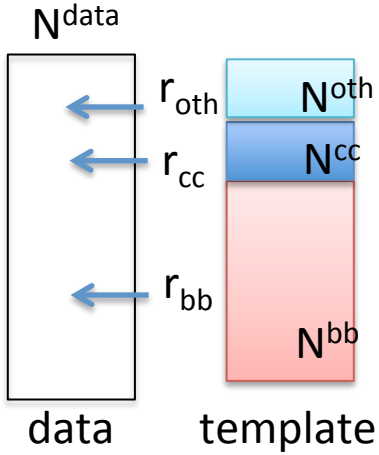
BR(bb)=65.7%, BR(cc)=3.6% in Pythia

Different definition of r_{xx}

Different definition of template sample in other study

$$N_{ijk}^{template} = \sum_{s=bb,cc,oth,bkg} r_s \cdot N_{ijk}^{s}$$

$$r_{bkg} = 1$$

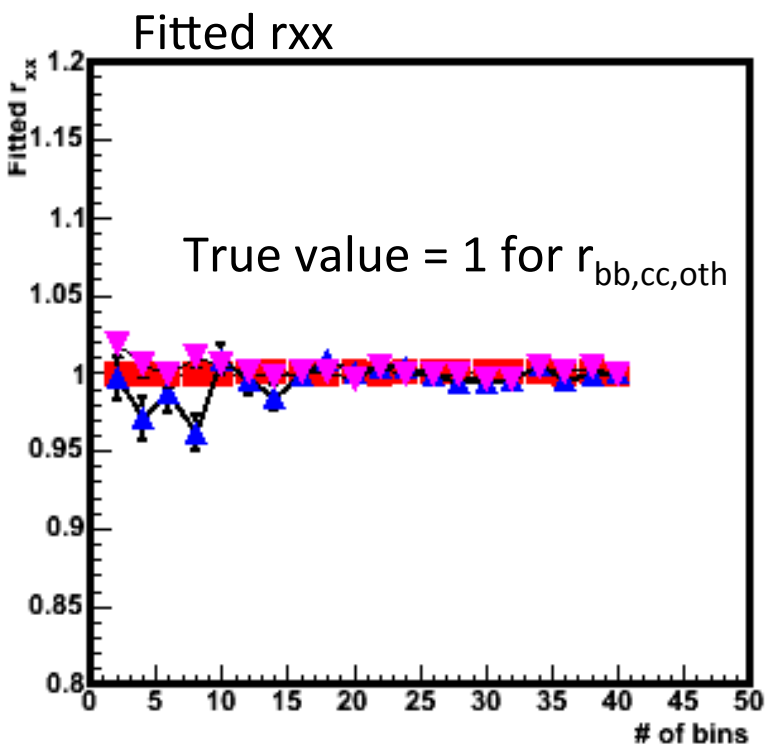


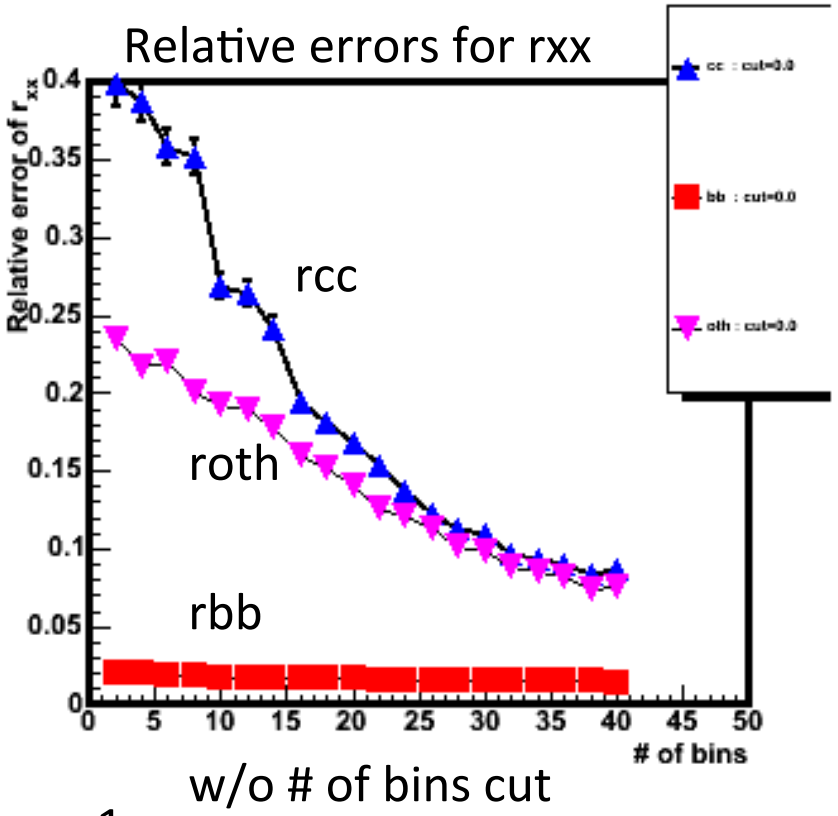
rxx does not include BR fraction, fitt to be 1

$$BR(xx) = r_{xx} \cdot BR(xx)^{SM} \cdot \frac{\sigma(ffH)^{SM}}{\sigma(ffH)}$$

$\Delta\sigma$~2.5% from recoil mass study

Fitted results for r_{xx} with different definition





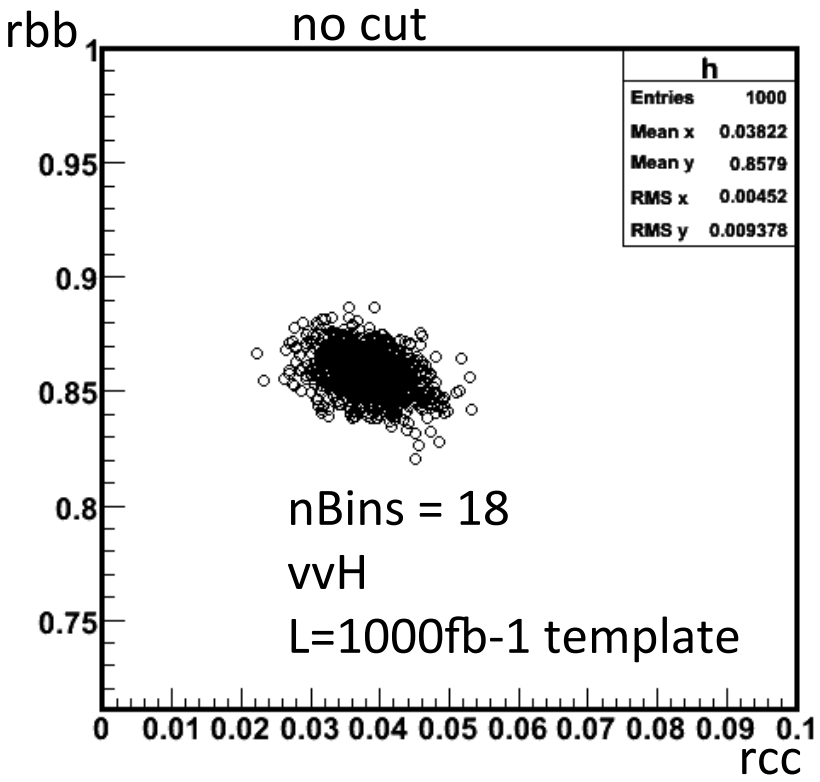
w/o # of bins cut

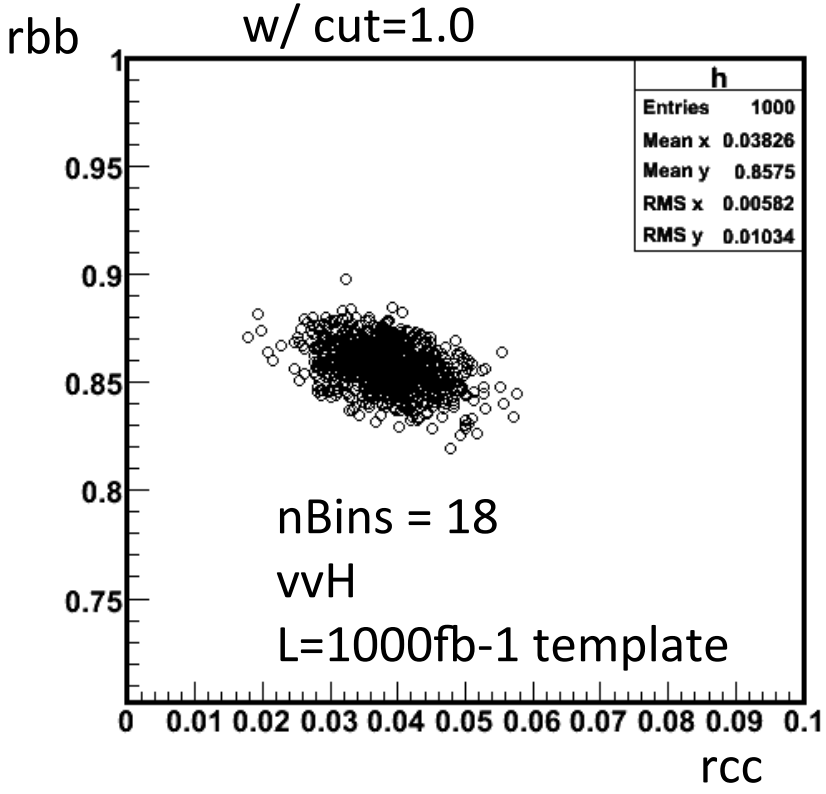
Fitted value reproduce the true value of $r_{xx} = 1$

BACKUP

rbb, rcc correlation plot

vvH Ecm=250 GeV, L=1000fb-1 template sample, L=250fb-1 data



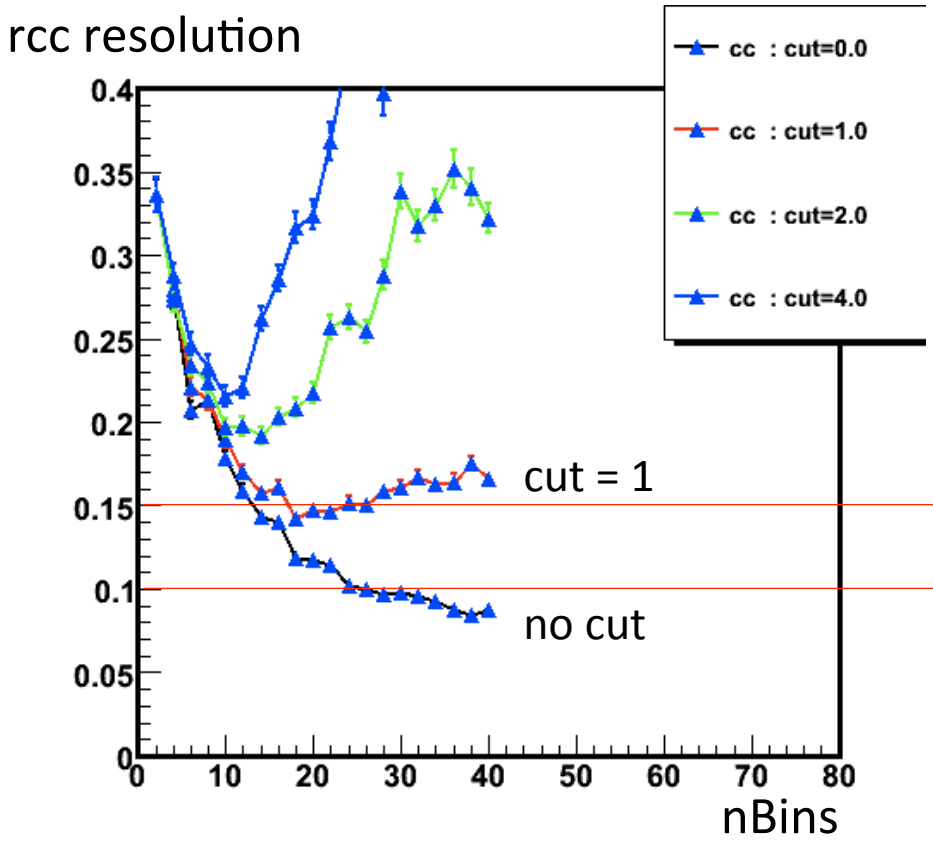


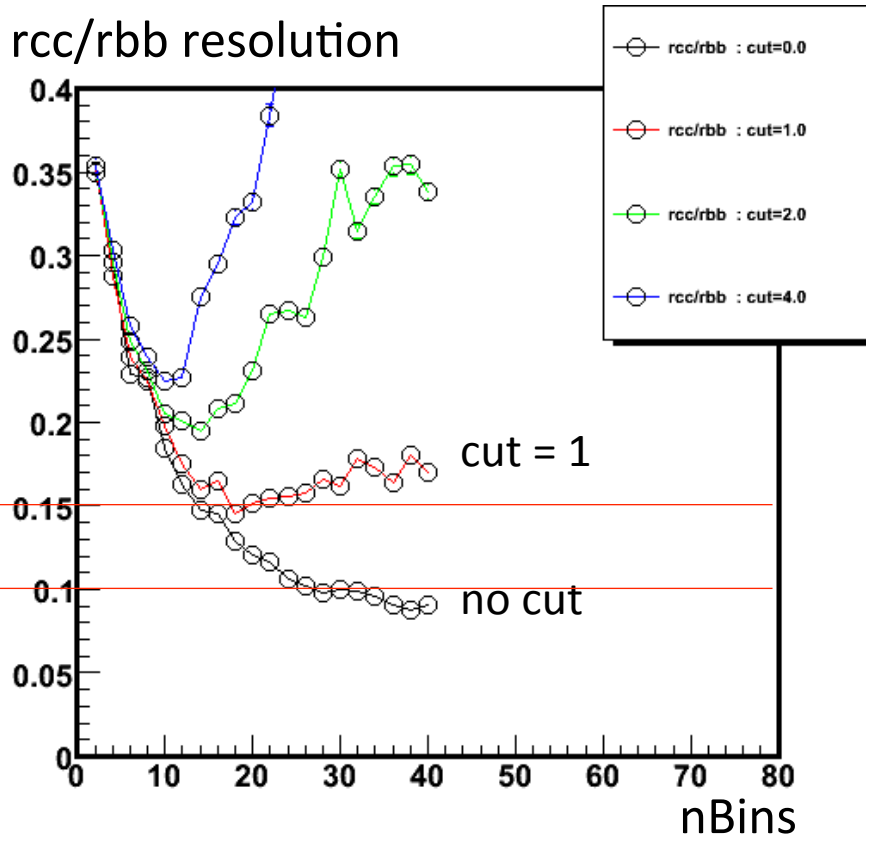
Correlation between rbb and rcc is observed

→Ratio of rcc/rbb is better to evaluate the measurement accuracy?

Comparison of rcc and rcc/rbb ratio

vvH Ecm=250 GeV, L=1000fb-1 template sample, L=250fb-1 data





Almost same as rcc resolution and rcc/rbb resolution .

→Relative error is dominated by rcc (H→cc) accuracy.