

BR($h \rightarrow \tau^+ \tau^-$) Study Status

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Summary (ALCW2015)

preliminary

We evaluated the measurement accuracy of $\text{BR}(h \rightarrow \tau^+ \tau^-)$ with using ILD full detector simulation at 250 GeV and 500 GeV.

$\frac{\Delta(\sigma \times \text{BR})}{(\sigma \times \text{BR})}$	$q\bar{q}h$	e^+e^-h	$\mu^+\mu^-h$	$\nu\bar{\nu}h$	Combined
250 GeV, 250 fb ⁻¹	3.4%	14.4%	11.3%	32.4%	3.2%
500 GeV, 500 fb ⁻¹	4.6%	25.2%	17.8%	6.9%	3.7%

(250 GeV, 250 fb⁻¹)
+ (500 GeV, 500 fb⁻¹): **2.4%** (Combined)

now summarizing into a paper and PhD thesis...

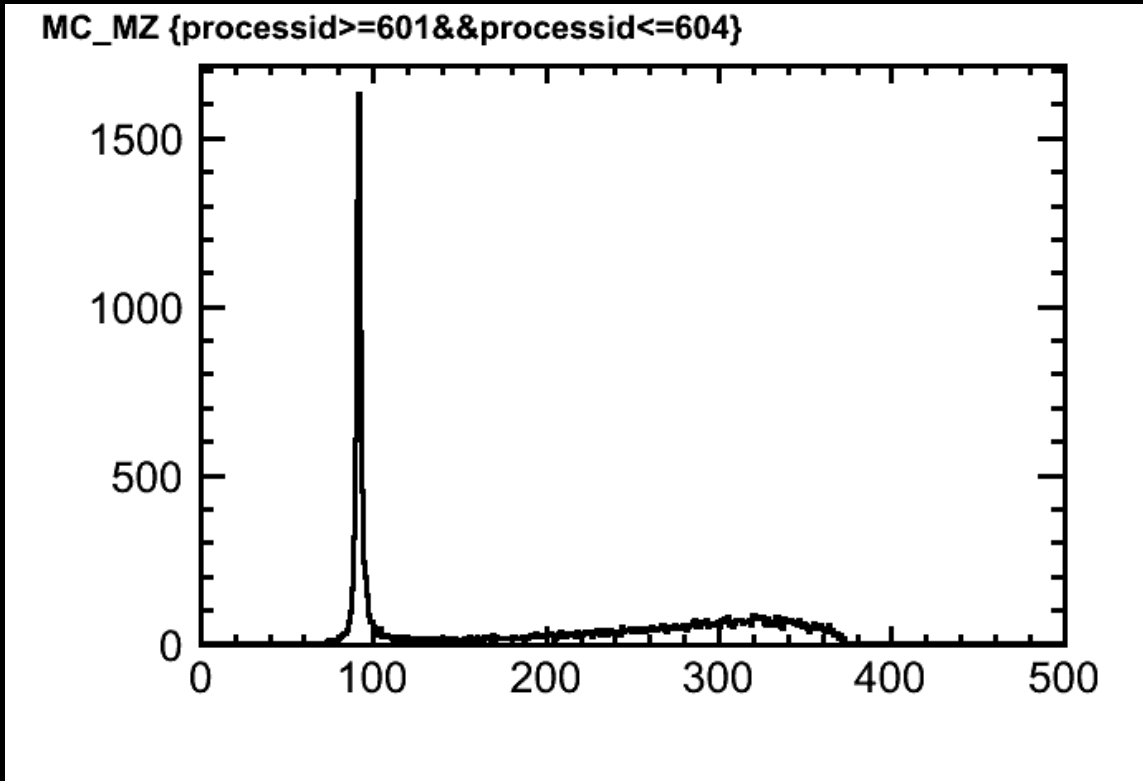
What I Did & Still Missing...

- I think 250 GeV analysis has been completed. ---> summarizing...
- Separation study of...
 - Zh and WWF in 500 GeV $\nu\bar{\nu}h$
 - Zh and ZZF in 500 GeV e^+e^-h

Recent Work (Progress?)

- Mainly worked on separation and more optimization in 500 GeV e^+e^-h
 - easy to separate rather than $\nu\bar{\nu}h$
 - previous analysis were not so optimized

Separation for Analysis



using $M_{e^+e^-}$
(generator level)

2 categories

Zh: $M_{e^+e^-}(\text{MC}) = 85 - 100 \text{ GeV}$

ZZF: $!(85 - 100 \text{ GeV})$

Zh: Cut-based Analysis

Cut 1: visible energy < 500

Cut 2: thrust < 0.93

Cut 3: $|\cos \theta_{\text{thrustaxis}}| < 0.89$

Cut 4: $|\cos \theta_{\text{miss}}| < 0.98$

Cut 5: $235 < E_{e^+e^-} < 245$

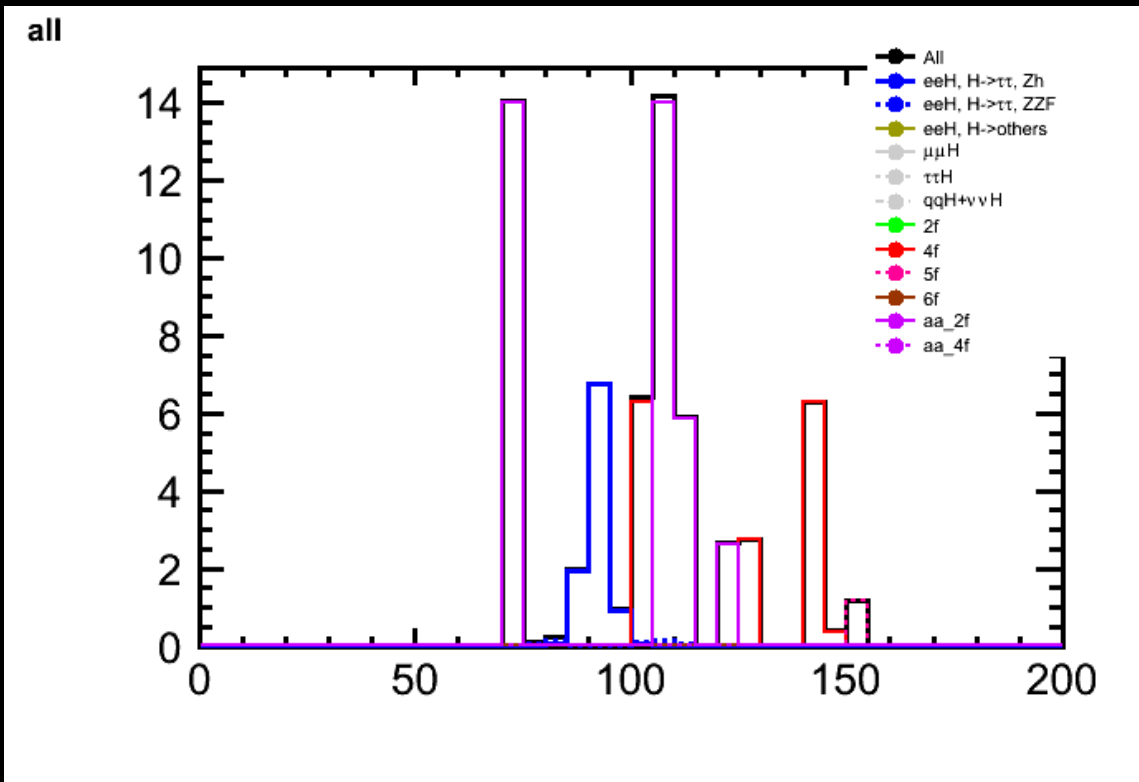
Cut 6: $\cos \theta_{e^+e^-} > -0.05$

Cut 7: $\cos \theta_{\tau^+\tau^-} < 0.58$

Cut 8: $\log_{10}|d_0 \text{sig}(\tau^+)| + \log_{10}|d_0 \text{sig}(\tau^-)| > 0.4$

Cut 9: $85 < M_{e^+e^-} < 100$

$M_{e^+e^-}$ Before Cut 9



remained

$$N(\text{Zh}) = 9.636$$

$$N(\text{ZZF}) = 0.069$$

$$N(\text{bkg}) = 0$$

$$\text{signi.} = 3.09$$

Backgrounds are almost suppressed, but
event weight of aa_2f ~ 14 !

ZZF: Cut-based Analysis

Cut 1: visible energy < 480

Cut 2: $P_t > 120$

Cut 3: thrust < 0.93

Cut 4: $|\cos \theta_{\text{thrustaxis}}| < 0.99$

Cut 5: $|\cos \theta_{\text{miss}}| < 0.99$

Cut 6: $E_{e^-} > 50, E_{e^+} > 50$

Cut 7: $E_{\tau^+\tau^-} > 120$

Cut 8: $\cos \theta_{\tau^+\tau^-} < 0.5$

Cut 9: $\cos \theta_{\text{acop}} < 0.99$

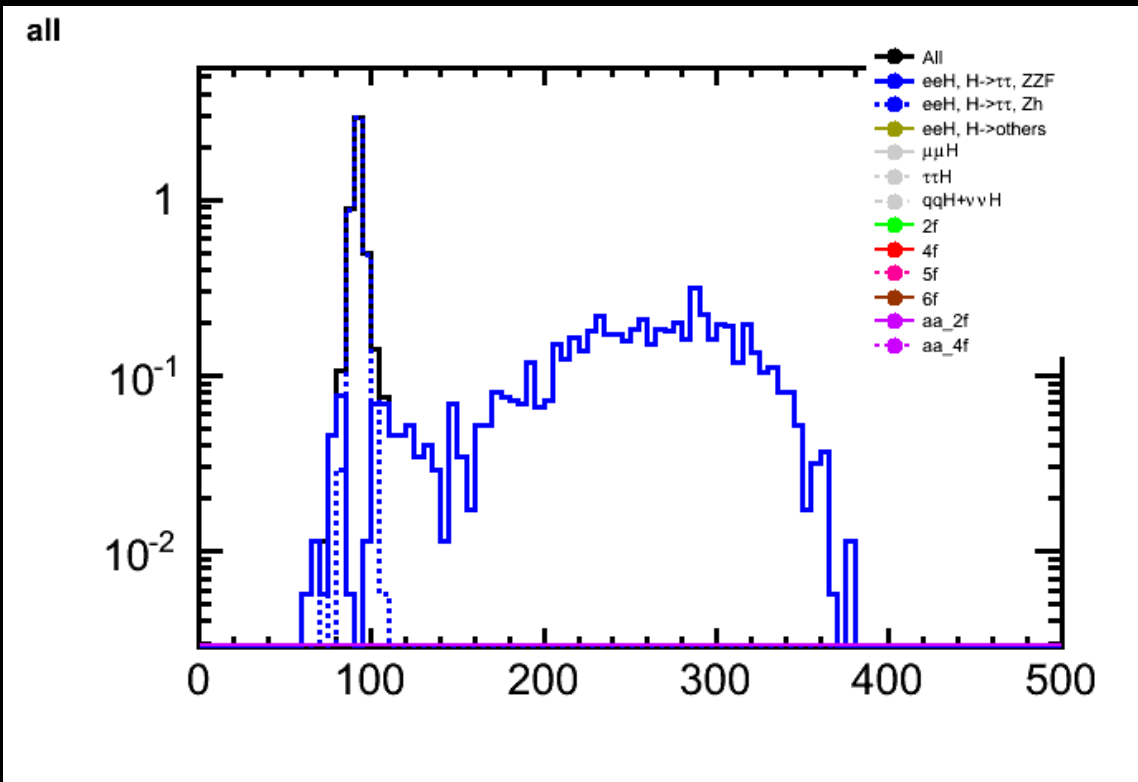
Cut 10: $\log_{10}|d_0 \text{sig}(\tau^+)| + \log_{10}|d_0 \text{sig}(\tau^-)| > 0.2$

Cut 11: $\log_{10}|z_0 \text{sig}(\tau^+)| + \log_{10}|z_0 \text{sig}(\tau^-)| > 1.2$

Cut 12: $100 < M_{\text{recoil}} < 170$

Cut 13: $M_{e^+e^-} > 100$

$M_{e^+e^-}$ Before Cut 13



remained

$$N(\text{ZZF}) = 5.962$$

$$N(\text{Zh}) = 0.078$$

$$N(\text{bkg}) = 0$$

$$\text{signi.} = 2.43$$

Backgrounds are almost suppressed,,

Summary

- Always writing something into a paper and PhD thesis...
- Works for separation and more optimization in 500 GeV e^+e^-h were performed to some extent.
 - Zh: 3.09sigma, ZZF: 2.43sigma, if combine: 3.93sigma
 - previous: 3.32sigma
- But some bkg are too low stat. ---> I requested to generate more aa_2f bkg samples... waiting answers...