

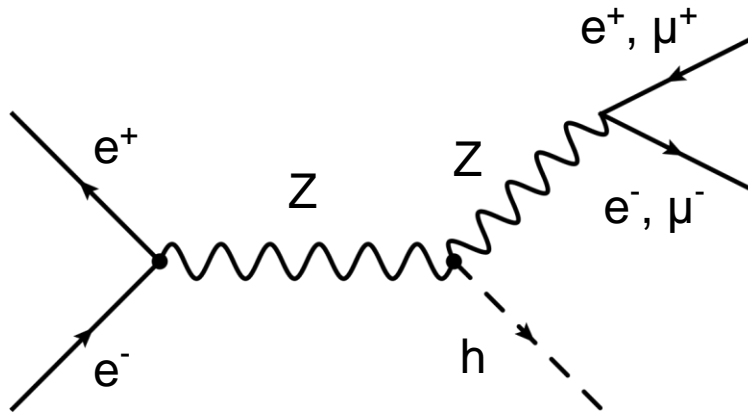
Higgs Branching Ratios using Leptonic Z-Decays

ILD Analysis Meeting, 09 March 2011

Nina Herder, University of Bonn

- Higgs Strahlung Process
- Lepton Identification
- Cuts & Cutflow
- Fitting Method & Branching Ratios
- Summary & Outlook

Higgs Strahlung Process



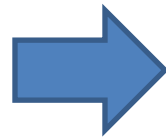
- Z decays to 3% into e^+e^- ($\mu^+\mu^-$)
- light SM-Higgs ($m_h=120\text{GeV}$)
- $E_{\text{cms}}=350\text{ GeV}$
- Identify the two leptons and force the other particles into two jets
- Analysis done for $L=250\text{ fb}^{-1}$, Polarization (-80%,+30%)
- SM-Background: $llqq$, qq , $qqqq$, $qqlv$ (not all files included yet)

Higgs Decay	Pythia BR
bb	65.7%
cc	3.6%
gg	5.5%

Lepton Identification

- Electron Identification

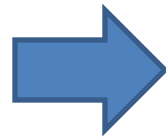
- $p_{\text{track}} > 15 \text{ GeV}$
- $E_{\text{em}}/E_{\text{tot}} > 0.6$
- $E_{\text{tot}}/p_{\text{track}} > 0.9$



ID-Efficiency (pairs): 86.4%

- Muon Identification

- $p_{\text{track}} > 15 \text{ GeV}$
- $E_{\text{em}}/E_{\text{tot}} < 0.5$
- $E_{\text{tot}}/p_{\text{track}} < 0.3$

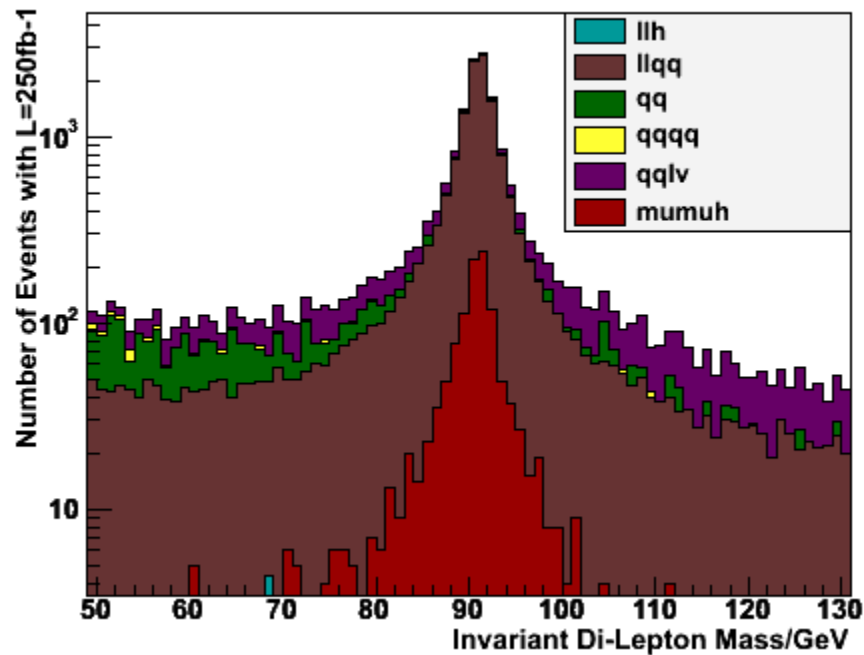


ID-Efficiency (pairs): 91.7%
for the signal (see next slides)

- Loop to get the two hardest leptons

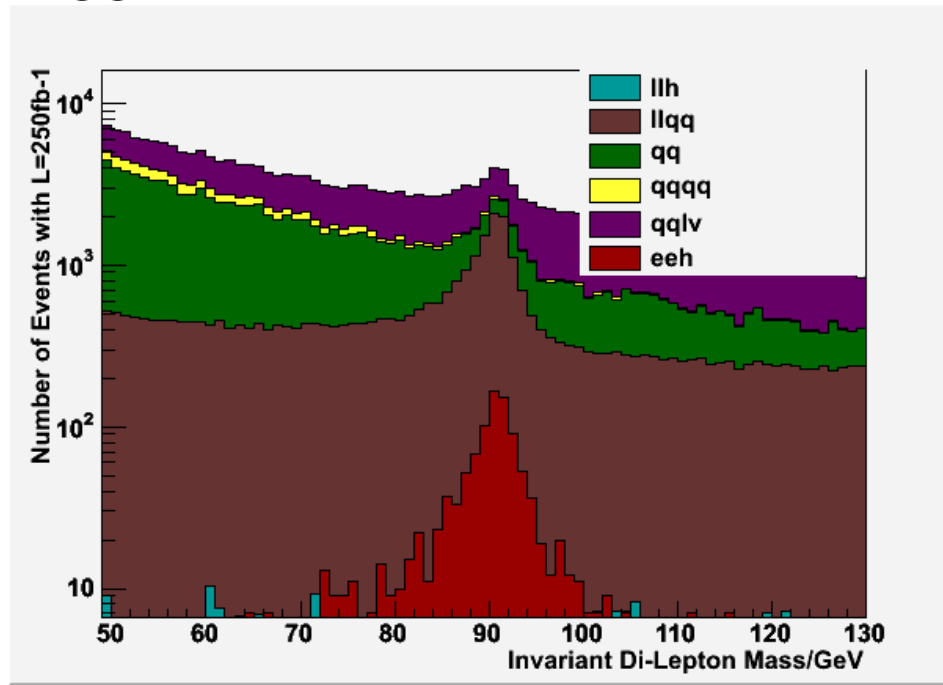
Muon Channel

- Signal Definition: Higgs decays into bb, cc, gg



Electron Channel

- Signal Definition: Invariant Di-Lepton Mass (truth information) between 70 and 130 GeV, Higgs decays into bb, cc, gg



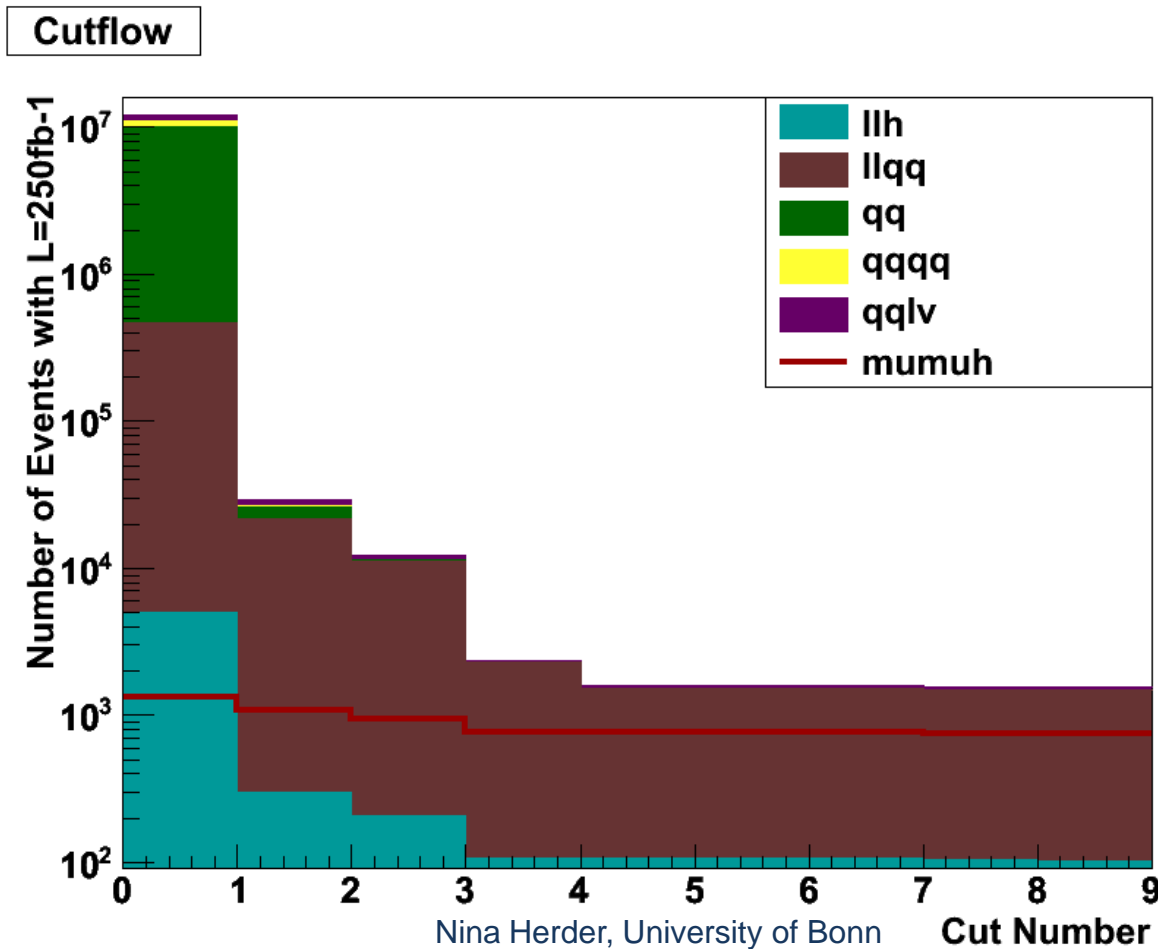
Cuts & Cutflow

1. #particles > 10 & Entries in E_{had} , E_{em}
2. $80 \text{ GeV} < \text{di-lepton mass} < 100 \text{ GeV}$ (105 GeV electron channel)
3. $100 \text{ GeV} < \text{di-jet mass} < 150 \text{ GeV}$
4. $115 \text{ GeV} > \text{di-lepton recoil mass} < 250 \text{ GeV}$
5. $\theta_{jj} < 2.8 \text{ rad}$
6. $\theta_{ll} < 2.6 \text{ rad}$
7. $E_{\text{vis}} > 250 \text{ GeV}$
8. $y_{\text{minus}} < 0.7$, $y_{\text{plus}} < 0.2$

Cuts & Cutflow

- Muon Channel - Signal Efficiency: 56.2%,

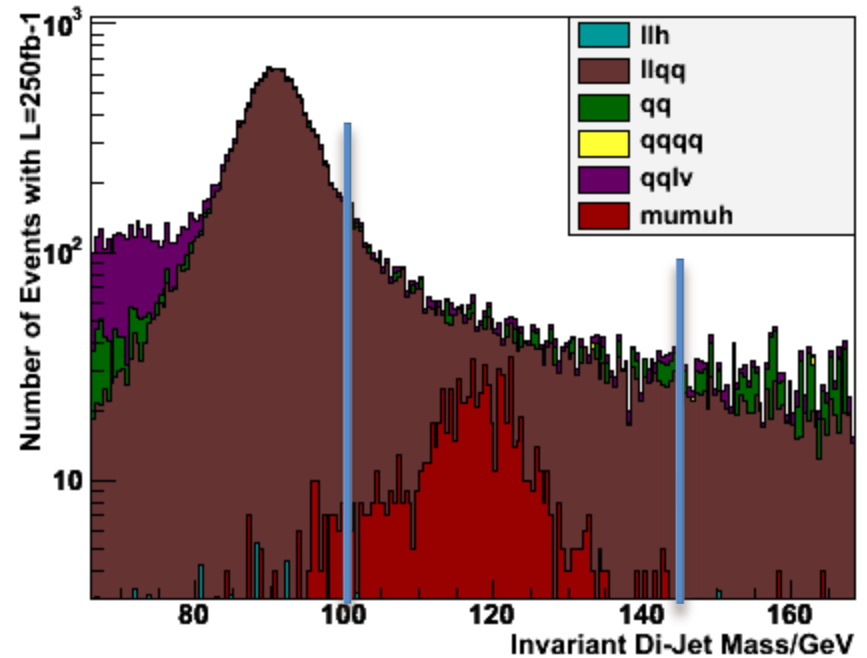
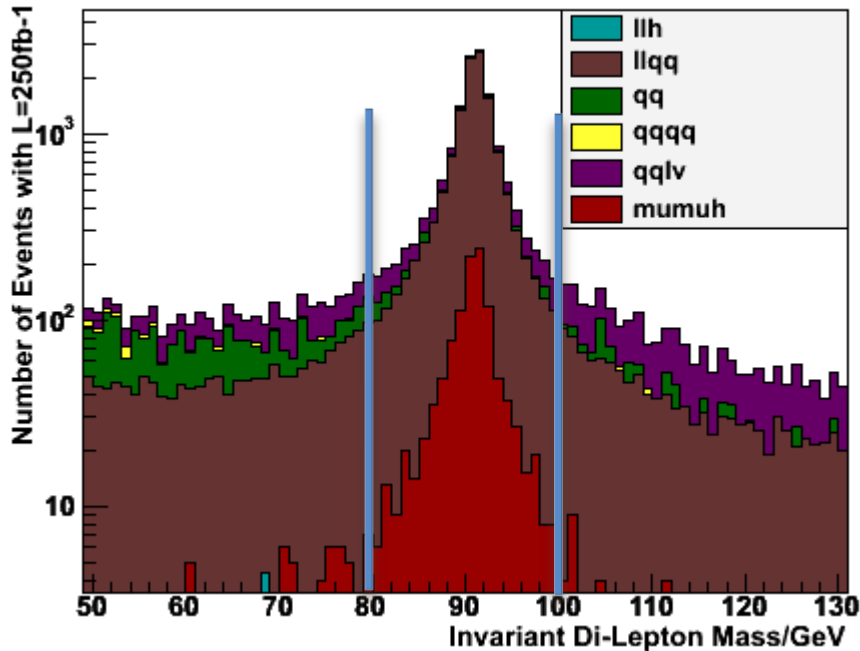
$$\frac{S}{\sqrt{B}} = 19.4$$



Cuts & Cutflow

- Muon Channel - Signal Efficiency: 56.2%,

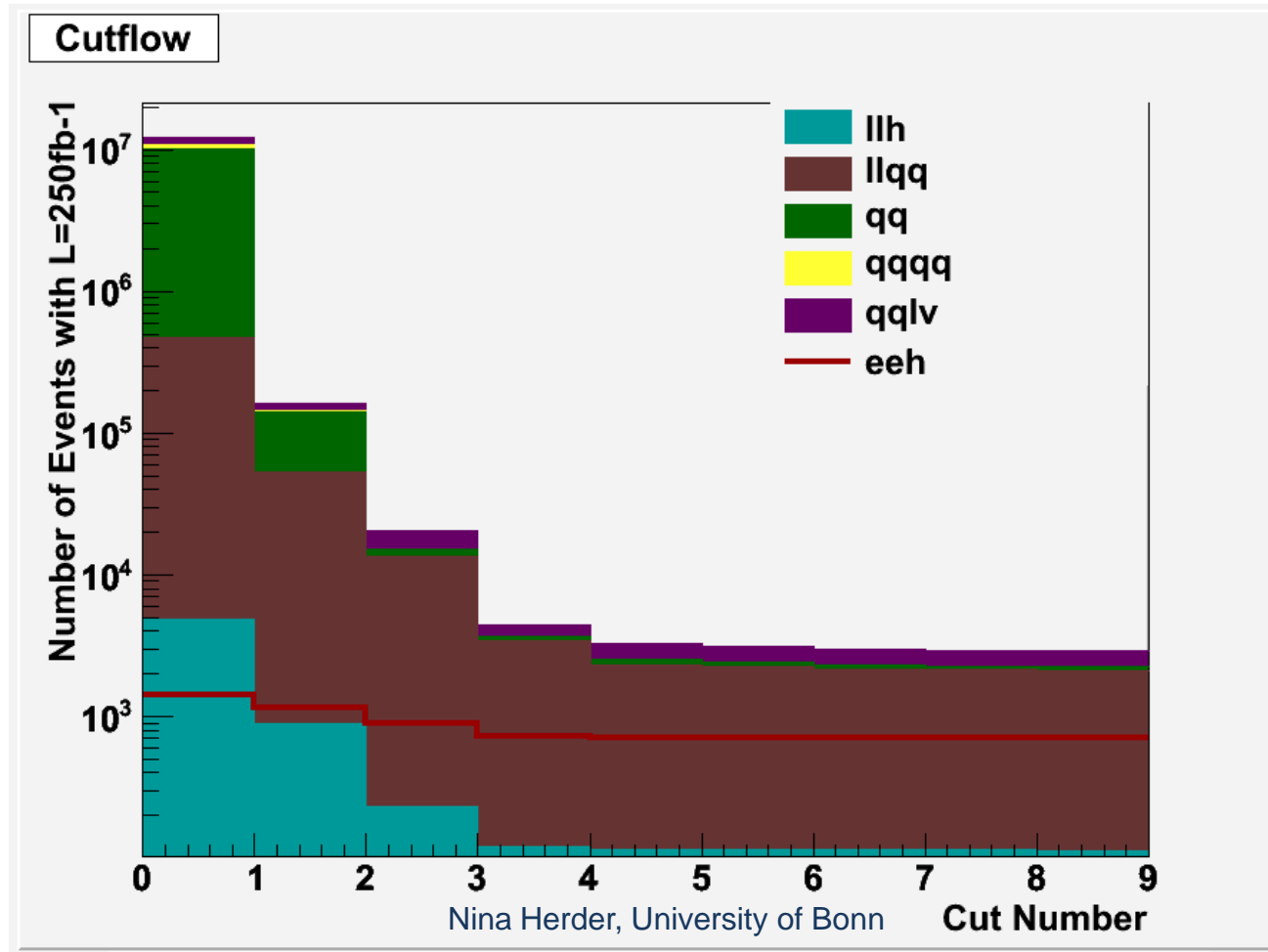
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Cuts & Cutflow

- Electron Channel – Signal Efficiency: 49.6%

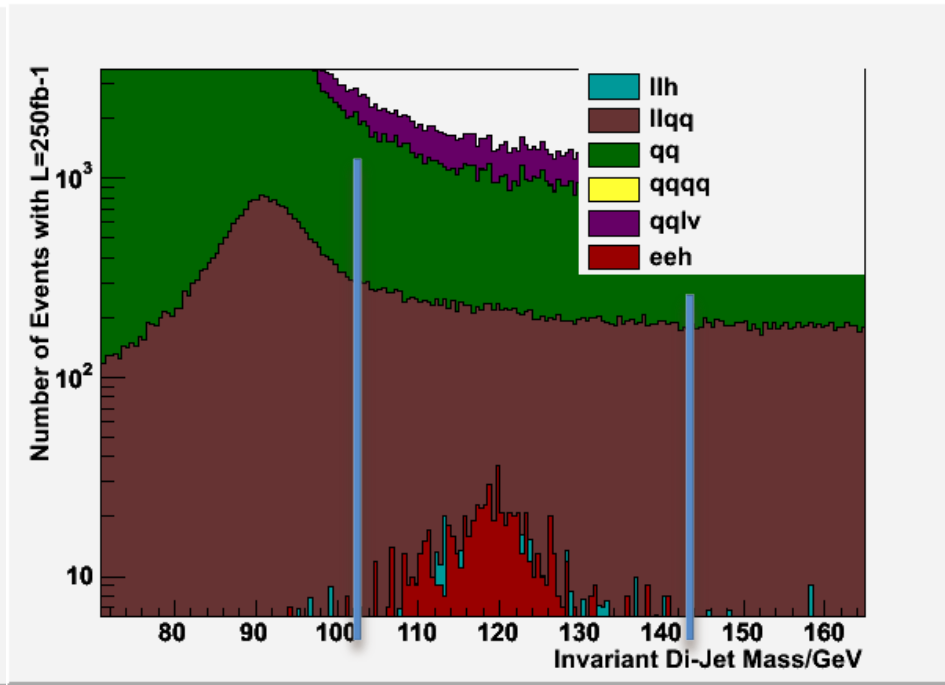
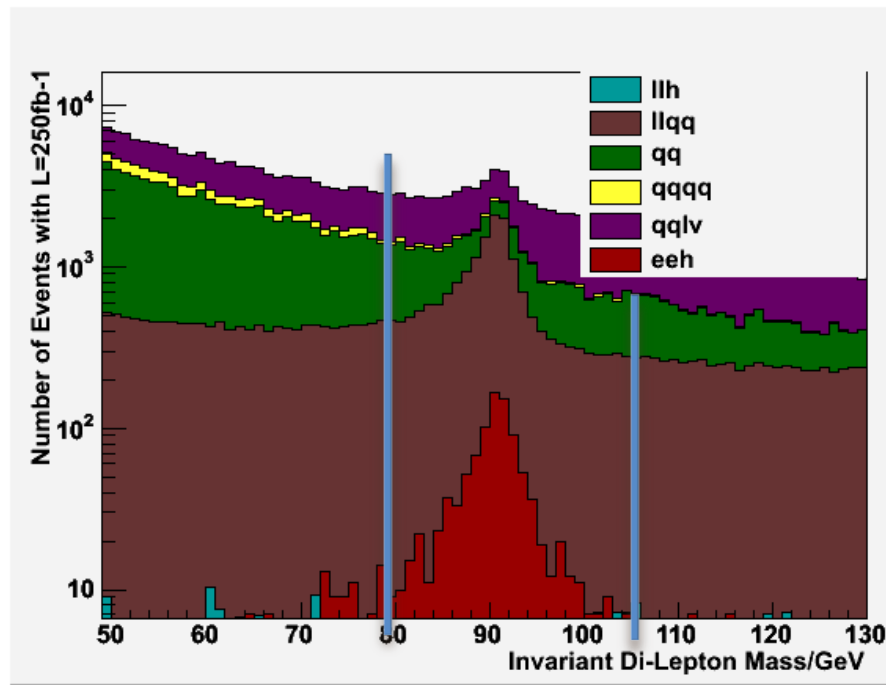
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Cuts & Cutflow

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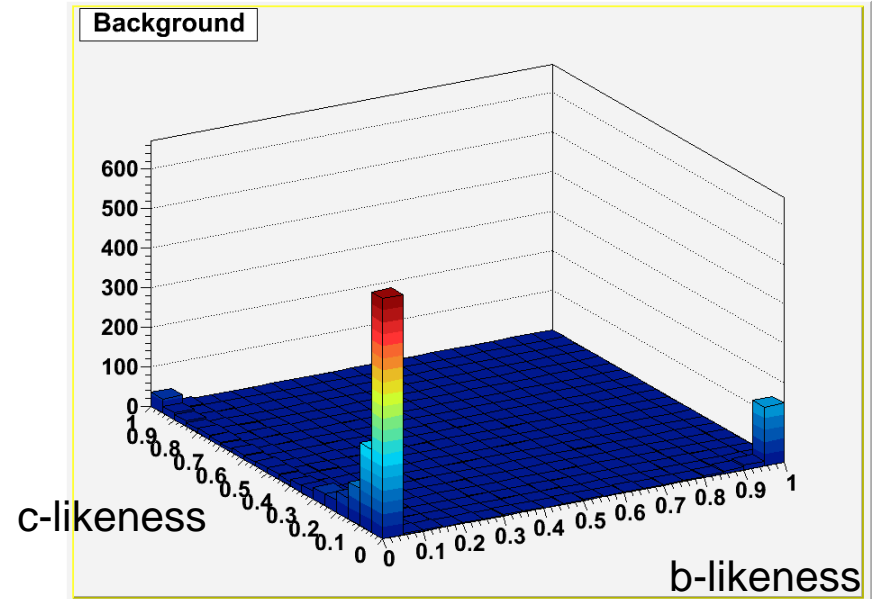
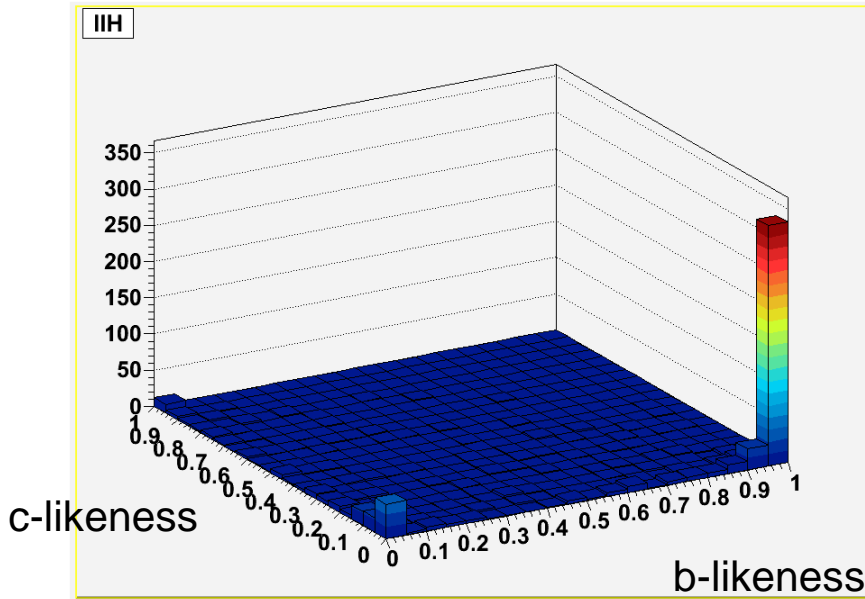
Fitting Method & Branching Ratios

- Use 3-D b-likeness/c-likeness templates and perform a χ^2 -Fit

$$x\text{-likeness} = \frac{x_1 x_2}{x_1 x_2 + (1 - x_1)(1 - x_2)},$$

Muon Channel only

$x = b, c$ and $x_{1,2}$ b/c – tag value for Jet 1, 2



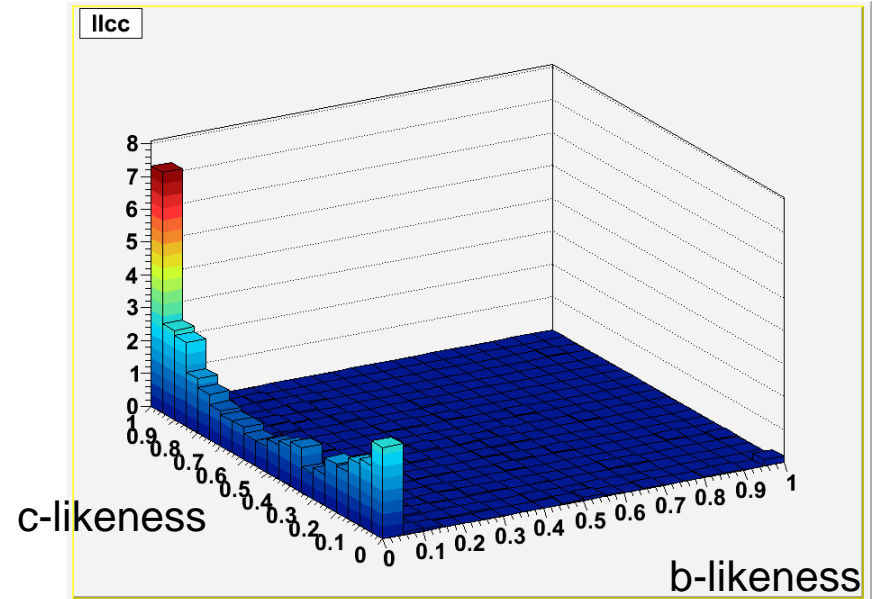
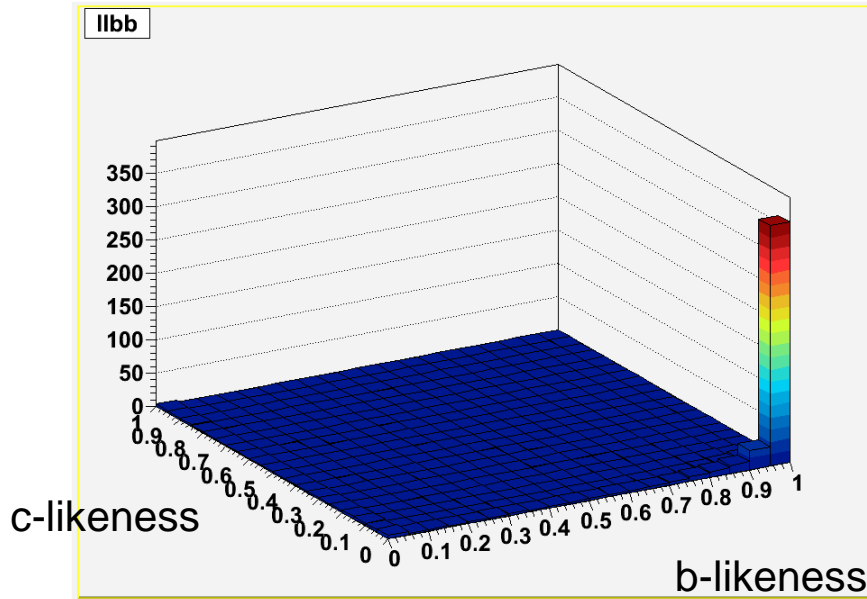
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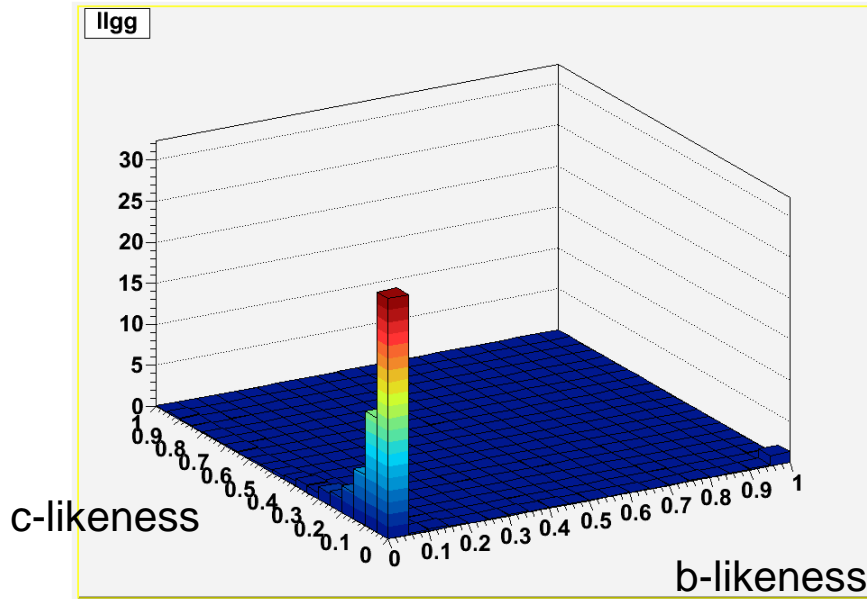
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Fitting Method & Branching Ratios

- Fit-function with r_{bkg} fixed to 1:

$$\chi^2 = \sum_{i,j} \frac{\left(N_{data}^{i,j} - \sum_{s=bb,cc,gg,bkg} r_s N_s^{i,j} \right)^2}{N_{data}^{i,j}}, \quad r_s : \textit{fit parameter}$$

- Fit results:

r_{bb}	XX ± XX
r_{cc}	XX ± XX
r_{gg}	XX ± XX

electron channel

r_{bb}	XX ± XX
r_{cc}	XX ± XX
r_{gg}	XX ± XX

muon channel

Branching Ratios

- Calculation of the Branching Ratios from r_s according to:

$$\sigma(e^+e^- \rightarrow Zh) \times BR(H \rightarrow s) = r_s \times BR(H \rightarrow s)_{SM} \times \sigma(e^+e^- \rightarrow Zh)_{SM}$$

- Results:

s	$r_s \cdot BR(H \rightarrow s)$
bb	XX ± XX
cc	XX ± XX
gg	XX ± XX

Summary & Outlook

- Cuts seem to lead to a good Signal to Background Ratio, need to include missing background files to get final results
- Get the template-fit running correctly & improve
- Include a kinematic fit (maybe)

Thank you for your attention.

BACKUP