Avances DiHiggs $b\bar{b}\tau^+\tau^-$ Boosted

Luciano Arellano Bert

Universidad Técnica Federico Santa María

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Outline

Objetivos (Julio)

- Predecir el numero de eventos de background en region de senal usando el metodo de *sidebands* 2D
- Optimizar definicion de las regiones basado en la significancia $s/\sqrt{b}$

Introducción

Metodo de sidebands

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  - Paper $b\bar{b}b\bar{b}$ usa MC solo para modelar $t\bar{t}$

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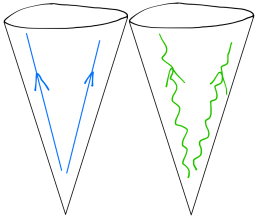
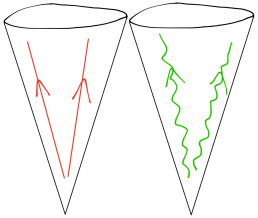
- En nuestro caso podriamos usar algo como

$$N^{n\text{-tag}}_{\text{background}} = \mu^{n\text{-tag}}_{b\text{-multijet}} N^{\text{lower-tag}}_{b\text{-multijet}} + \nu^{n\text{-tag}}_{\tau\text{-multijet}} N^{\text{lower-tag}}_{\tau\text{-multijet}} + \alpha^{n\text{-tag}}_{t\bar{t}} N^{n\text{-tag}}_{t\bar{t}}$$

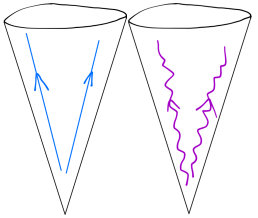
Lower tag background ($b\bar{b}\tau^+\tau^-$) (propuesta)



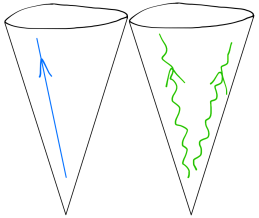
(a) Senal 2-tag



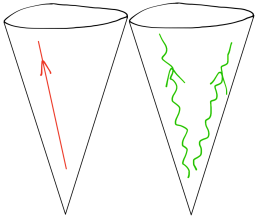
(b) anti 2b-tag



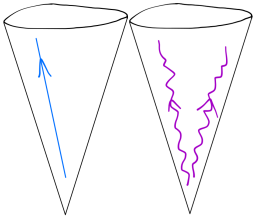
(c) anti di-τ



(d) Senal 1-tag



(e) anti 1b-tag



(f) anti di-τ

Backup

Alternative selection regions: Sidebands

- `m_Xhh3 > 1`, `m_Xhh4 < 1` (entre elipses exteriores)
  - Fuera de elipse 3 y dentro de 4

Set Description (?):

- BDT < 0.6
  - SBAnti2Tau
- BDT ≥ 0.6
  - SBMedium2Tau

Alternative selection regions: Sidebands

- Elipses definidas en *alternative selection*

$$m_{Xhh2} = \sqrt{\left(\frac{m_{\mathrm{FJ}}^{\mathrm{lead}} - 120}{20}\right)^2 + \left(\frac{m_{\mathrm{FJ}}^{\mathrm{subl}} - 100}{25}\right)^2}$$

$$m_{Xhh3} = \sqrt{\left(\frac{m_{\mathrm{FJ}}^{\mathrm{lead}} - 120}{30}\right)^2 + \left(\frac{m_{\mathrm{FJ}}^{\mathrm{subl}} - 100}{35}\right)^2}$$

$$m_{Xhh4} = \sqrt{\left(\frac{m_{\mathrm{FJ}}^{\mathrm{lead}} - 120}{40}\right)^2 + \left(\frac{m_{\mathrm{FJ}}^{\mathrm{subl}} - 100}{45}\right)^2}$$

Sidebands en paper $b\bar{b}b\bar{b}$ (arXiv:1804.06174)

$$X_{HH} = \sqrt{\left(\frac{m_{2j}^{\text{lead}} - 120\,\text{GeV}}{0.1 m_{2j}^{\text{lead}}}\right)^2 + \left(\frac{m_{2j}^{\text{subl}} - 110\,\text{GeV}}{0.1 m_{2j}^{\text{subl}}}\right)^2}$$

$$\sqrt{(m_{2j}^{\text{lead}} - 124\,\text{GeV})^2 + (m_{2j}^{\text{subl}} - 113\,\text{GeV})^2} < 30\,\text{GeV}$$

$$\sqrt{(m_{2j}^{\text{lead}} - 126\,\text{GeV})^2 + (m_{2j}^{\text{subl}} - 116\,\text{GeV})^2} < 45\,\text{GeV}$$

Alternative selection regions: QCD (Control region)

- DT BDTScore < 0.6 (?)
- `m_Xhh2 > 1` or `m_Xhh3 < 1` (elipse del medio)

Alternative selection regions: TTbar

- DT BDT < 0.6
- Btag != 0
- Masa FJ entre 140 y 200 (?)
  `f(m_SelFJ->p4().M()*1e-3 < 140.0 || m_SelFJ->p4().M()*1e-3 > 200.0) return false;`
- Masa DT entre 120 y 220

Alternative selection regions: SR

- `|m_dPhi < pi/2|`
- BDT > 0.6
- BTag n != 0
- DT subjets < 4
- `m_Xhh2 < 1` (dentro de la elipse interior)