studies of Δm_H & $\Delta \lambda_{HHH}$

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introduction: study of Δm_H

- motivation: one source of systematic errors (parametric) for precision coupling measurements
- status: a new method has been developed to improve Δm_H at $\sqrt{s}$>=500 GeV (talk on 27/07/2016)
- update: formulae much more simplified (thanks to Graham)
- next step: publish new method based on demonstration in leptonic channels; then go to hadronic channels (need study details of jet-clustering, trying to find student as collaborator); study systematics from jet mass and hadronisation

updated formulae

transverse balance

$$p_1 \sin\theta_1 \cos\phi_1 + p_2 \sin\theta_2 \cos\phi_2 = p_x \tag{1}$$

$$p_1 \sin\theta_1 \sin\phi_1 + p_2 \sin\theta_2 \sin\phi_2 = p_y \tag{2}$$

solution: old formulae

$$\begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \frac{1}{\sin^2\phi_{12}} \begin{pmatrix} \frac{1}{\sin\theta_1}[(\cos\phi_1 - \cos\phi_{12}\cos\phi_2)p_x + (\sin\phi_1 - \cos\phi_{12}\sin\phi_2)p_y] \\ \frac{1}{\sin\theta_2}[(\cos\phi_2 - \cos\phi_{12}\cos\phi_1)p_x + (\sin\phi_2 - \cos\phi_{12}\sin\phi_1)p_y] \end{pmatrix} \tag{7}$$

solution: new formulae A (Thanks to comments by Graham)

$$\begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \frac{1}{\sin\phi_{12}} \begin{pmatrix} \frac{1}{\sin\theta_1}(p_y\cos\phi_2 - p_x\sin\phi_2) \\ \frac{1}{\sin\theta_2}(p_x\sin\phi_1 - p_y\cos\phi_1) \end{pmatrix} \tag{9}$$

solution: new formulae B

b.) if parameterise (p_x, p_y) as $(p_t\cos\phi, p_t\sin\phi)$, results can be formulated as

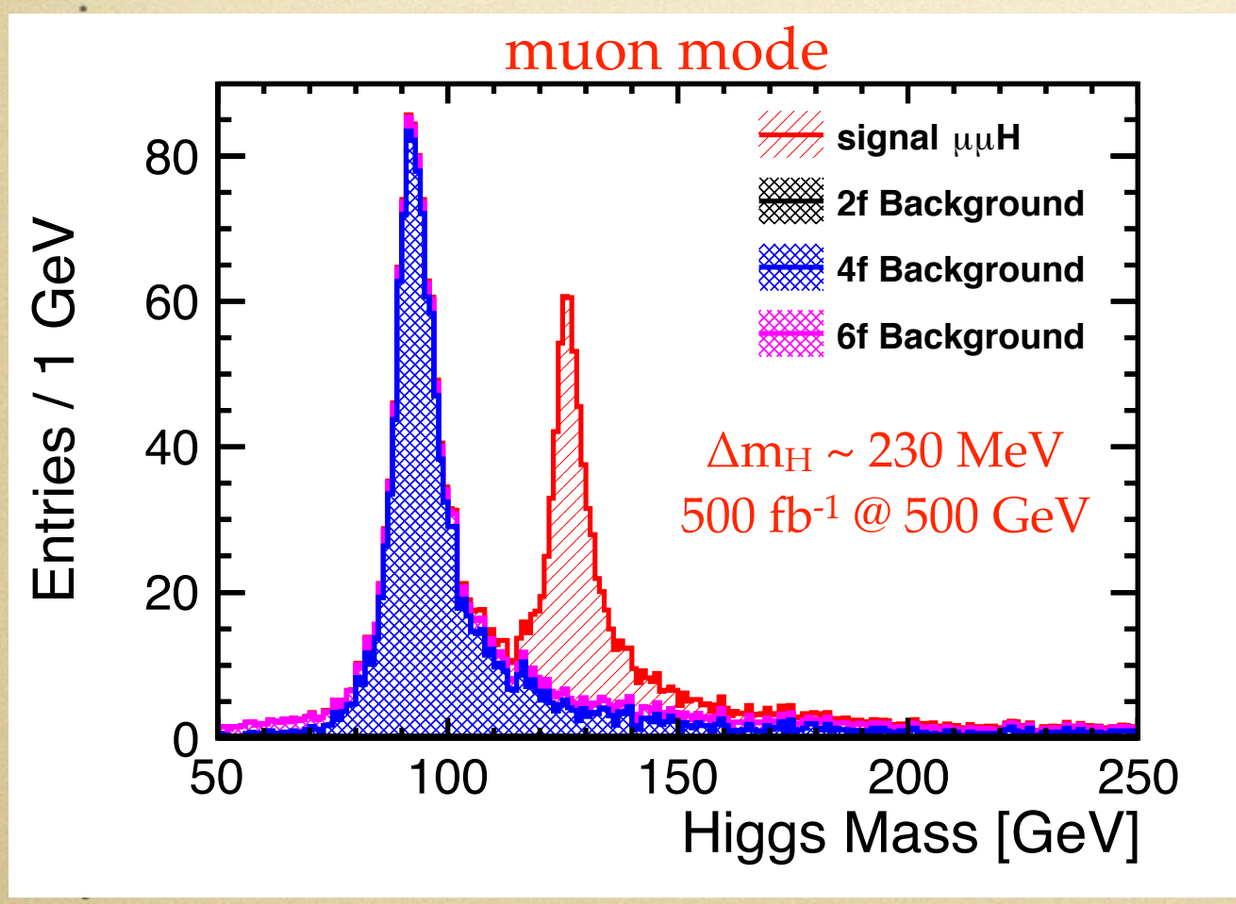
$$\begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \frac{p_t}{\sin\phi_{12}} \begin{pmatrix} \frac{\sin(\phi-\phi_2)}{\sin\theta_1} \\ \frac{\sin(\phi_1-\phi)}{\sin\theta_2} \end{pmatrix} \tag{10}$$

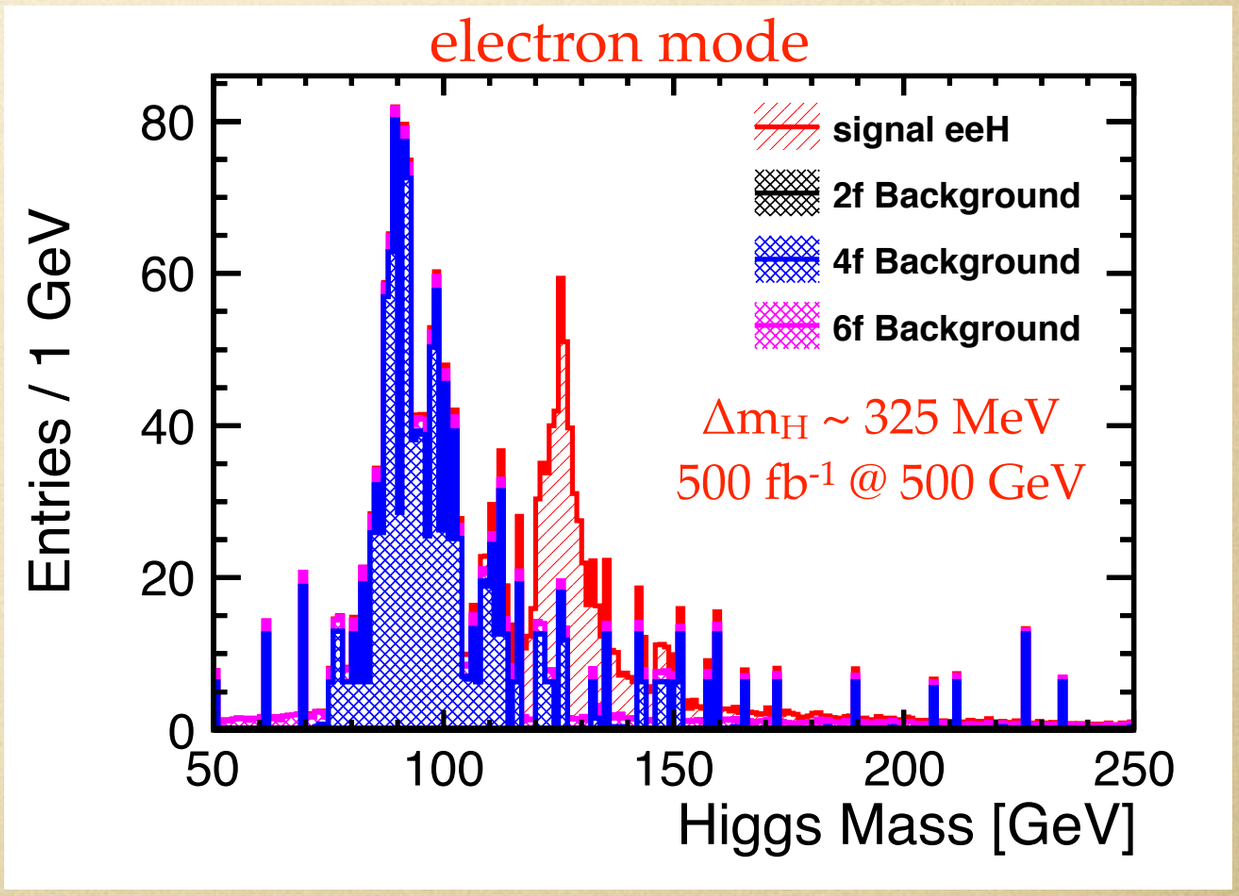
potential problem when ϕ_{12}~0/π

$$\begin{pmatrix} p_1 \\ p_2 \end{pmatrix} = \frac{p_t}{\sin\phi_{12}} \begin{pmatrix} \frac{\sin(\phi-\phi_2)}{\sin\theta_1} \\ \frac{\sin(\phi_1-\phi)}{\sin\theta_2} \end{pmatrix}$$

- when $\phi_1=\phi_2=\phi$, in principle this new method doesn't work, because there's one constraint which always holds
- anyhow, only for a very small fraction of events; and for those events, we can use recoil mass

current results (leptonic): Δm_H~60MeV with 5 ab-1@500 GeV





introduction: study of systematics of $\Delta\lambda_{HHH}$

- motivated to answer a crucial question: whether λ_{HHH} can be measured model independently?
- one of the main issues is to address the impact from quartic HHVV coupling
- in a general EFT framework —> impact from several anomalous couplings
- status: qualitative study done; constraints from EWPO/ TGC/HVV known; parametrisation done; error propagation done for SM-like anomaly (talk on 15/06/2016)
- next step for non-SM-like couplings, and publication

$$L = \kappa_\lambda \lambda_{hhh} HHH + \kappa_Z g_{zzh} Z_\mu Z^\mu H + \kappa_Q g_{zzhh} Z_\mu Z^\mu HH$$
$$+ \frac{d}{\Lambda} H \partial_\mu H \partial^\mu H + \frac{b}{\Lambda} Z_{\mu\nu} Z^{\mu\nu} H + \frac{q}{\Lambda^2} Z_{\mu\nu} Z^{\mu\nu} HH$$
$$+ \frac{\tilde{b}}{\Lambda} Z_{\mu\nu} \tilde{Z}^{\mu\nu} H + \frac{\tilde{q}}{\Lambda^2} Z_{\mu\nu} \tilde{Z}^{\mu\nu} HH$$

status & plan for other projects from my side

- overlay removal by reconstructing pile-up vertices (relatively higher priority)
- develop colour-singlet jet clustering (going slowly, now working together with H.Nakanishi in U' of Tokyo)
- develop MEM method (now mainly with T.Ogawa for relatively simple application)
- publish current Higgs self-coupling analyses together with C.Duerig, M.Kurata, etc.
- collaboration on any of above projects is highly welcome