a new method for Higgs mass measurement

Junping Tian (U' of Tokyo)

Asian ILC Physics & Software Group Meeting, Aug. 19, 2016

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

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

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

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

updated formulae

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

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

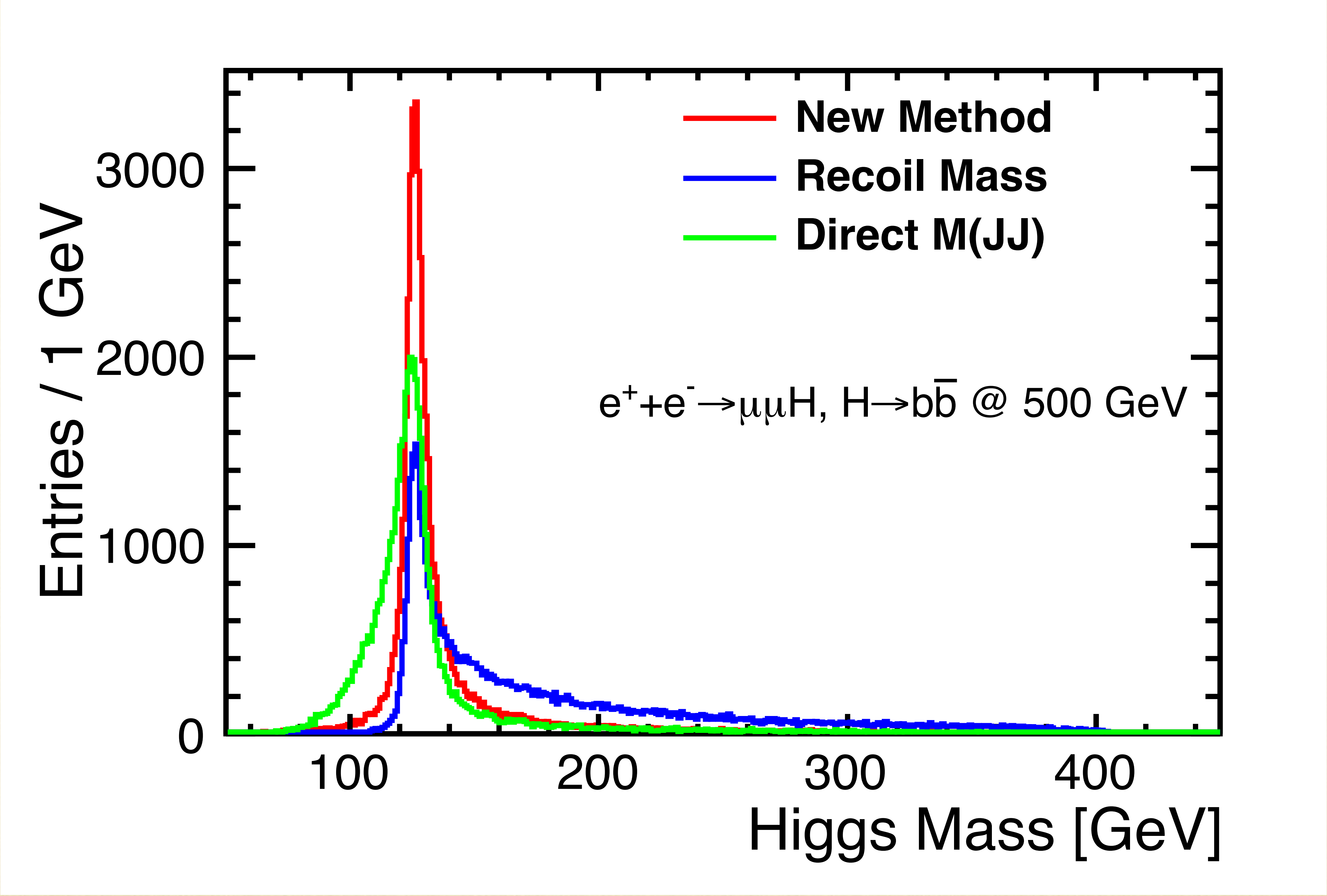
potential problem when ϕ_{12}~0

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

- when $\phi_1=\phi_2$, 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

backup

comparison of different methods for Higgs mass



effect on background: new method doesn't depend on mass