Implications of the Higgs Discovery

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1207.0990, 1110.0085
\[ \tau_{QCD} \sim 10^{-25} \text{ s} (\Lambda_{QCD} 100 \text{ MeV}) \]
\[ c\tau_{B^\pm} \sim 500 \mu\text{m} (\tau \sim 10^{-12} \text{ s}) \]
\[ c\tau_{\tau^\pm} \sim 80 \mu\text{m} (\tau \sim 10^{-13} \text{ s}): \tau^+ \rightarrow \pi^+ \bar{\nu}_\tau \text{ isolated pion.} \]
\[ c\tau_{\mu^\pm} \sim 600 \text{ m} (\tau \sim 10^{-6} \text{ s}) \]
LHC is a QCD machine!

Digging signal out of QCD: 1 out of $10^8$

- high $p_T$ object of $p_T > 120$ GeV: large mass difference
- large missing transverse energy: $E_T > 100$ GeV: DM and right kinematics
- isolated hard leptons (electron or muon) or photon: $e^\pm, \mu^\pm, \gamma$: isolation is the key
- jet with displaced vertex: $b$-tagging: $b$ is from gluon splitting third generation new physics
However, what we see may not be what we think we have seen.

- jet/lepton energy measurement
- $\pi^0 \to \gamma\gamma$: boosted pion may look like photon
- $D_s^\pm$ being faked as $B^\pm$ 10%.
- $\pi^+$ being faked as $\mu^+$.
- $\mu^+$ from $B$ semi-leptonic decay.
- $\tau$ identification
- ..... A lot of more faking

We should appreciate the tremendous effort put in by our experimental colleagues!
Experimental Fundation of Higgs Mechanism

Heaviest known particle $t$: $m_t$ breaks electroweak gauge symmetry.

Large $m_t$ couples to symmetry breaking sector ("Goldstone", longitudinal polarized $W$) strongly.

$m_b/m_t \to 0$: "massless" $b$ is left-handed polarized.

Longitudinal $W$ polarization: $\epsilon_0 \sim k_\mu/m_W$

$$\epsilon_0^* \bar{u}bL \gamma_\mu u_t \simeq \frac{m_t}{m_W} \bar{u}bL u_t$$

$$f_0 = \frac{\Gamma(t \to bW_0^+)}{\Gamma(t \to bW_0^+) + \Gamma(t \to bW_+^+) + \Gamma(t \to bW_-^+)} \simeq 70\%$$

$$f_- \simeq 30\%, \ f_+ \simeq 0$$
Confirmed by D0 and CDF and also CMS...

**W polarization (2.2 fb⁻¹)**

Anomalous contributions to the tWb vertex change the probabilities of the W helicity states

- In SM: 3 possible W helicity states:
  - $F_0$ (longitudinal) ~ 0.70, $F_L$ (left) ~ 0.30, $F_R$ (right) ~ 0

- Measure sensitive variable, $\cos(\theta^*)$, in **muon+jets** channel:
  - 1 isolated high-$p_T$ $\mu$, 
    $\geq$ 4 jets, $\geq$ 1 b-tag
  - Kinematic fit to reconstruct ttbar system

- Helicity fractions extracted from maximum likelihood fit:
  - $F_0 = 0.567 \pm 0.074$ (stat.) $\pm 0.047$ (syst.)
  - $F_L = 0.393 \pm 0.045$ (stat.) $\pm 0.029$ (syst.)
  - $F_R = 0.040 \pm 0.035$ (stat.) $\pm 0.044$ (syst.)

*Good agreement with SM*

*Similar precision as previous measurements (Tevatron, ATLAS)*

Great! but what does it tell us? Only EWSB occurs but not how EWSB take place......
Higgs的发现
LHC实验在双光子，四轻子以及双轻子道都发现了一个重建质量为125〜GeV左右的新粒子。

- \( h \to \gamma \gamma \): h自旋为0或2 (Landau-Yang)
- \( h \to ZZ^* \to 4\ell, WW^* \to \ell^+\ell^-\nu\bar{\nu} \): h和W,Z耦合
- 如果h为自旋为零，h必然来源于\( gg \) fusion (light quark质量MeV量级)
Higgs的发现
LHC实验在双光子，四轻子以及双轻子道都发现了一个重建质量为$125\sim GeV$左右的新粒子。

- $h \rightarrow \gamma\gamma$: h自旋为0或2 (Landau-Yang)
- $h \rightarrow ZZ^* \rightarrow 4\ell$, $WW^* \rightarrow \ell^+\ell^-\nu\bar{\nu}$: h和W,Z耦合
- 如果h为自旋为零，h必然来源于$gg$ fusion (light quark质量MeV量级)
是否是标准模型Higgs?

Signal strength of individual channels (SM: $\mu=1$)

<table>
<thead>
<tr>
<th>ATLAS 2011 - 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>$W,Z H \rightarrow bb$</td>
</tr>
<tr>
<td>$H \rightarrow \tau\tau$</td>
</tr>
<tr>
<td>$H \rightarrow WW^{(*)} \rightarrow 4l$</td>
</tr>
<tr>
<td>$H \rightarrow ZZ^{(*)} \rightarrow 4l$</td>
</tr>
<tr>
<td>Combined $\mu = 1.4 \pm 0.3$</td>
</tr>
<tr>
<td>$m_H = 126.0$ GeV</td>
</tr>
</tbody>
</table>

$\sigma(gg \rightarrow h \rightarrow \gamma\gamma)/\sigma_{SM} \simeq 1.9 \pm 0.5$  
$\sigma(gg \rightarrow h \rightarrow ZZ^* \rightarrow 4\ell)/\sigma_{SM} \gtrsim 1$  
$\sigma(gg \rightarrow h \rightarrow WW^* \rightarrow 2\ell2\nu)/\sigma_{SM} \gtrsim 1$
The probability for a single Higgs boson-like particle to produce resonant mass peaks in the di-µ channel is estimated to be 1.6 ± 0.7 (stat) ± 0.6 (sys). Similarly, the expected cross-section for the WW channel is 1.0 ± 0.7 (stat) ± 0.6 (sys). The ratio of the observed cross-sections to the SM expectation for these modes is shown in Fig. 11, where the asymptotic approximations have been validated with ensembles of pseudo-experiments. Simulated mass distributions for all values of m_H are shown in Fig. 10, while more inclusive observables are shown in Fig. 9. The signal strength for a SM Higgs boson mass hypothesis is a function of the mass resolution. The mass of the observed new particle is estimated to be m_H = 125.5 GeV. The resulting 68% and 95% CL contours for the mass of a signal hypothesis are simultaneously consistent with the SM expectation. The horizontal bars indicate the systematic uncertainties due to the smaller number of candidates in the signal categories. The results are self-consistent with the expected yield for each production mode, defined by H → ZZ, H → WW, H → ττ, and H → bb. The observed signal yield is shown in Fig. 11, although they are only approximate for the combined analysis. The SM expectation and the observed signal yield are shown in Fig. 9. The results are self-consistent with the expected yield for each production mode, defined by H → ZZ, H → WW, H → ττ, and H → bb. The observed signal yield is shown in Fig. 11, although they are only approximate for the combined analysis. The SM expectation and the observed signal yield are shown in Fig. 9.
If you take the excess in di-photon seriously, a naive look is

\[
\frac{\Gamma(h \to gg) \Gamma(h \to \gamma\gamma)}{\Gamma_{\text{Total}}(h \to X)}
\]

- **Scenario I:** \(\Gamma(h \to \gamma\gamma) \uparrow\)
- **Scenario II:** \(\Gamma(h \to gg) \uparrow, \Gamma(h \to \gamma\gamma) \downarrow\)

- \(\Gamma(h \to \gamma\gamma)\) dominated by \(W\) in SM
- Enhancement in \(\Gamma(h \to gg)\) inevitable reduce the \(\Gamma(h \to \gamma\gamma)\)

- **Scenario III:** \(\Gamma(h \to b\bar{b}) \downarrow\) (Tevatron excess mostly \(Wb\bar{b}\) so inconsistent with Tevatron)

However, after taking a serious look.....
Conclusions

- Data incompatible with B-only hypothesis
- Full Search
  - 3.0σ local significance at 120GeV
  - 2.5σ global significance
  - Signal strength: μ = 1.4 ± 0.6
- H → bb only
  - 3.3σ local significance
  - 3.1σ global significance

\[(\sigma_{WH} + \sigma_{ZH}) \times \mathcal{B}(H \rightarrow b\bar{b}) = 0.23^{+0.09}_{-0.08} \text{ (stat + syst) pb}\]

SM Higgs @ 125 GeV: 0.12 ± 0.01pb

- Direct evidence that new particle observed by ATLAS and CMS couples to fermions
Example of Enhanced $h \to gg$: Enhanced Yukawas


- Fermiophobic sector that only gives rise to the $m_W$, $m_Z$.
- Flavor-safe SM fermion mass generation require a doublet scalar $h$.
- Yukawa couplings of $h$ are enhanced but the couplings to $W/Z$ are reduced.

Realizations:
Type-I 2HDM, Georgi-Machacek, Bosonic TechniColor

At $m_h \sim 125$ GeV, the Higgs total width is completely dominated by the fermionic decay partial widths. $\Gamma_{\text{total}}$ grows in similar rate as $h \to gg$. It then requires $h \to \gamma\gamma$ to increase but this only happens when the top quark loop dominates the $h \to \gamma\gamma$. 
Enhancement of production by a factor of 9.

Again, cancelation leads to $\Gamma(h \to \gamma\gamma) \downarrow$

To achieve $\text{Br}(h \to ZZ^*) \downarrow$, new decay mode is needed.

4th generation neutrino ($M_N > M_Z/2$)

$\text{Br}(h \to b\bar{b}) \downarrow$ at the same time: Reduced signal at Tevatron (Again inconsistent with Tevatron).
Possible contribution to $h \rightarrow \gamma \gamma$ loop from $W'$ or exotic lepton (with negative coupling)
Higgs后时代的超对称
First of All!
125 GeV Higgs is non-trivial: Large $A$-term or Heavy $\tilde{t}$

$$m_h^2 \simeq M_Z^2 \cos^2 2\beta + \frac{3}{4\pi^2} \frac{m_t^4}{v^2} \left[ \frac{1}{2} \tilde{X}_t + t + \frac{1}{16\pi^2} \left( \frac{3}{2} \frac{m_t^2}{v^2} - 32\pi\alpha_3 \right) \left( \tilde{X}_t t + t^2 \right) \right]$$

$$t = \log \frac{M_{SUSY}^2}{m_t^2}; \quad \tilde{X}_t = \frac{2\tilde{A}_t^2}{M_{SUSY}^2} \left( 1 - \frac{\tilde{A}_t^2}{12M_{SUSY}^2} \right); \quad \tilde{A}_t = A_t - \mu \cot \beta$$

To cancel quadratic divergence

For heavy $\tilde{t}$ required by the $m_h = 125$ GeV, mostly suppressed $gg \rightarrow h$. (Might increase $gg \rightarrow h$ for very light stop with large $\tilde{A}_t$)
Enhanced Diphoton from light staus

\[
M_\tilde{f}^2 = \begin{pmatrix}
    m_{fL}^2 + m_f^2 + D_L^f & m_f \tilde{A}_f \\
    m_f \tilde{A}_f & m_{fR}^2 + m_f^2 + D_R^f
\end{pmatrix}
\]

\[
g_{h\tilde{f}_1\tilde{f}_1} = -\cos 2\beta \left[ I_f^3 \cos^2 \theta_f - e_f \sin^2 \theta_W \cos 2\theta_f \right] - \frac{m_f^2}{M_Z^2} + \frac{1}{2} \sin 2\theta_f \frac{m_f \tilde{A}_f}{M_Z^2}
\]

\[
g_{h\tilde{f}_2\tilde{f}_2} = -\cos 2\beta \left[ I_f^3 \sin^2 \theta_f - e_f \sin^2 \theta_W \cos 2\theta_f \right] - \frac{m_f^2}{M_Z^2} - \frac{1}{2} \sin 2\theta_f \frac{m_f \tilde{A}_f}{M_Z^2}
\]

Diphoton form-factor

\[
A_{\gamma\gamma}^{SM} + \Delta A_{\gamma\gamma} \propto -13 - \frac{(\mu \tan \beta)^2 m_T^2}{3 [M_{L3}^2 m_{e3}^2 - m_T^2 (\mu \tan \beta)^2]}
\]

- \tilde{\tau}_1, \tilde{\tau}_2 loop contribution should be separated.
- large \(\mu \tan \beta\) to enhance the couplings and split the \(\tilde{\tau}_1, \tilde{\tau}_2\)
Benchmark Point

Combining constraints from flavor physics ($B \to \mu^+\mu^-$, $b \to s\gamma$, ......) relic abundance of neutralino darkmatter...

\[ M_1 = 85 \text{ GeV}, M_3 = 1.2 \text{ TeV}, \]
\[ \tan \beta = 30, \mu = 2.15 \text{ TeV} \]
\[ M_{\tilde{Q}_{L}}^{1,2,3} = M_{\tilde{u}_{R}}^{1,2,3} = 1.5 \text{ TeV}, M_{\tilde{d}_{R}}^{1,2,3} = 2 \text{ TeV} \]
\[ M_{\tilde{\ell}_{L}}^{1,2} = 1.5 \text{ TeV}, M_{\tilde{e}_{R}}^{1,2} = 2 \text{ TeV} \]
\[ A_t = A_b = A_\tau = 2.5 \text{ TeV}, M_{\tilde{\tau}_{L,R}} = 350 \text{ GeV} \]
\[ M_2 : 125 - 500 \text{ GeV}, M_A : 600 - 1000 \text{ GeV} \]

MSSM spectrum:

\[ m_h = 124.05 \text{ GeV}, m_{\tilde{\tau}_1} = 120.0 \text{ GeV}, m_{\tilde{\chi}^0_1} = 84.91 \text{ GeV} \]

The predictions of di-photon, four-lepton and $b\bar{b}$ channels are

\[ \frac{\sigma(gg \to h \to \gamma\gamma)}{\sigma_{SM}} = 1.52, \frac{\sigma(gg \to h \to ZZ^*)}{\sigma_{SM}} = 1.04, \frac{\sigma(Wh \to b\bar{b})}{\sigma_{SM}} = 0.92 \]
\[ B_s \rightarrow \mu^+ \mu^- \]


Br(\( B_s \rightarrow \mu^+ \mu^- \)) < 4.5 \times 10^{-9} (LHCb-TALK-2012-028)

(SM: Br(\( B_s \rightarrow \mu^+ \mu^- \)) = 3.2 \pm 0.2 \times 10^{-9})

\[
\frac{\tan^6 \beta}{M_A^4}
\]

\( M_A = 600 \, \text{GeV} \) for \( \tan \beta \approx 30 \)
Implications of the benchmark point

$M_A$ is constrained by the $B \to \mu^+ \mu^-$ for given $\tan \beta$,

$$M_A \gg m_Z \to \tan \alpha \tan \beta \simeq -1 \to \frac{\sin \alpha}{\cos \beta} \to 1$$

$h$ is at the decoupling limit as SM-like (before correction).
SUSY loop would induce correction to SM fermion mass as $10 \cdot 5^c \cdot H_u^*: W = Y_u 10 \cdot 10 H_u + Y_d 10 \cdot \bar{5} H_d + \mu H_u H_d$

<table>
<thead>
<tr>
<th>Field</th>
<th>10</th>
<th>5</th>
<th>$H_u$</th>
<th>$H_d$</th>
<th>$\theta$</th>
<th>$10 \cdot 5^c \cdot H_u^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-charge</td>
<td>$\frac{1}{5}$</td>
<td>$\frac{3}{5}$</td>
<td>$\frac{4}{5}$</td>
<td>$\frac{6}{5}$</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>PQ</td>
<td>0</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-1</td>
</tr>
</tbody>
</table>

$$F_{H_d} = \frac{\partial W}{\partial H_d} = y_d Q d^c + y_\tau L e^c + \mu H_u, V = |F_{H_d}|^2$$
$m_b = y_b v_d + \Delta y_b v_u, \quad m_\tau = y_\tau v_d + \Delta y_\tau v_u$

For Yukawa couplings, we get

$$y_b = \frac{\sqrt{2}m_b}{v \cos \beta (1 + \Delta_b)}, \quad y_\tau = \frac{\sqrt{2}m_\tau}{v \cos \beta (1 + \Delta_\tau)}$$

$$\Delta_b = \mu \tan \beta \left[ \frac{g_3^2 M_3}{6\pi^2} I \left( M_3^2, m_{\tilde{b}_1}^2, m_{\tilde{b}_2}^2 \right) + \frac{y_t^2 A_t}{16\pi^2} I \left( \mu^2, m_{\tilde{t}_1}^2, m_{\tilde{t}_2}^2 \right) \right],$$

$$\Delta_\tau = \mu \tan \beta \left[ \frac{g_1^2 M_1}{16\pi^2} I \left( M_1^2, m_{\tilde{\tau}_1}^2, m_{\tilde{\tau}_2}^2 \right) + \frac{g_2^2 M_2}{16\pi^2} I \left( M_2^2, \mu^2, m_{\tilde{\nu}_\tau}^2 \right) \right],$$

$I(x, y, z) = -\frac{xy \ln(x/y) + yz \ln(y/z) + zx \ln(z/x)}{(x - y)(y - z)(z - x)}$.

After the SUSY correction with large $\mu \tan \beta$

$$y_b, y_\tau \downarrow: h \rightarrow \tau^+ \tau^-, b\bar{b} \downarrow$$
Light Stau Production

$\tilde{\tau}^\pm_1$ and $\tilde{\chi}^0_1$ are at $\mathcal{O}(100 \text{ GeV})$

$$\tilde{\tau}^\pm_1 \to \tilde{\chi}^0_1 \tau^\pm$$

- Drell-Yan $\tilde{\tau}^+_1 \tilde{\tau}_1^-$: $\mathcal{O}(10)$ fb ($\tilde{\tau}^\pm \tilde{\nu}$ production is at similar order in 1205.5842, will then require 300 fb$^{-1}$ at 14 TeV LHC)

- Signature as $\tau^+ \tau^- + E_T$

Hadronic $\tau^\pm$ (65% of the $\tau^\pm$) suffer server faking from light jets.

$$\eta_{\tau} = 60\%, \quad R_j = 5\%$$

$$\eta_{\tau} = 24\%, \quad R_j = 1\%$$
Enhanced Production of Staus

- $bb \rightarrow H \rightarrow \tilde{\tau}_1^+ \tilde{\tau}_1^-$: By fixing $\mu \tan \beta$ and choose a lower $\tan \beta=30$, one can lower the $M_A$ to 600 GeV or so. (consistent with the charged Higgs search)
- $\tilde{\tau}_1^+ \tilde{\tau}_1^-$ from winos productions (100% and on-shell $\tilde{\tau}_1^\pm$)

**Graphs:**
- Direct Stau Pair
- DY+bb fusion
- DY stau pair

**Graphs:**
- $\mu=2.15$ TeV, $\tan \beta=30$
  - $\sqrt{s}=7$ TeV
  - $\chi^+ \chi^- \rightarrow 3\tau + E_T$
  - $\chi^0 \chi^0 \rightarrow 2\tau + E_T$
  - $\chi^0 \chi^0 \rightarrow 4\tau + E_T$
Direct Stau Pair (DY+bb Fusion)

\[ \mu = 2.15 \text{ TeV}, \tan \beta = 30 \]

\[ \sqrt{s} = 14 \text{ TeV} \]

\[ \sigma \text{ (fb)} \]

\[ M_A \text{ (GeV)} \]

\[ \sigma \text{ (fb)} \]

\[ M_2 \text{ (GeV)} \]
- $p_T > 20$ GeV, $\max\{p_T\} > 25$ GeV for electron and 20 GeV for muon.

- $|\eta_e| < 2.47$ with exclusion from $1.37 < |\eta_e| < 1.52$, $|\eta_\mu| < 2.5$

- Electrons and muons are required to be separated $\Delta R > 0.4$ from any jet with $p_T > 25$ GeV + 0.05 × $p_T(l)$.

- $M_{\ell^+\ell^-} > 15$ GeV. Exclusion of the electron invariant mass $M_{e^+e^-}$ from 70 to 110 GeV to veto the $Z \rightarrow e^+e^-$ events due to larger electron mis-charge ID rate.
the hardest jet with $p_T > 80$ GeV

$E_T > 100$ GeV

identification of at least two $\tau_h$ (reconstructed $p_T^\tau > 25$ GeV)

$M_T > 80$ GeV ($M_T$ defined by minimum $\Delta \phi$ between $\vec{p}_T^\tau$ and $\vec{p}_T$)
$$j + \tau^+\tau^- + E_T \quad 2j + \tau^\pm + E_T \quad 3j + \nu \bar{\nu} \quad 3j$$

<table>
<thead>
<tr>
<th></th>
<th>(j + \tau^+\tau^- + E_T)</th>
<th>(2j + \tau^\pm + E_T)</th>
<th>(3j + \nu \bar{\nu})</th>
<th>(3j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sigma(\text{pb}) )</td>
<td>0.34</td>
<td>1280</td>
<td>670</td>
<td>(7.8 \times 10^7)</td>
</tr>
<tr>
<td>(p_T^j \geq 80 \text{ GeV})</td>
<td>29.67%</td>
<td>20.53%</td>
<td>42.02%</td>
<td>7.75%</td>
</tr>
<tr>
<td>(E_T \geq 100 \text{ GeV})</td>
<td>24%</td>
<td>6.5%</td>
<td>22%</td>
<td>(&lt; 10^{-5})</td>
</tr>
<tr>
<td>(N_\tau \geq 2 , (\eta_\tau = 60%))</td>
<td>10.14%</td>
<td>1.3%</td>
<td>0.22%</td>
<td>0.12%</td>
</tr>
<tr>
<td>(M_T \geq 80 \text{ GeV})</td>
<td>16.27%</td>
<td>4.84%</td>
<td>42.70%</td>
<td>(&lt; 10^{-5})</td>
</tr>
<tr>
<td>(\sigma_{\text{cut}}(\text{fb}))</td>
<td>0.4</td>
<td>10.6</td>
<td>59.0</td>
<td>(&lt; 10^{-3})</td>
</tr>
</tbody>
</table>

Table: Cut efficiency for SM irreducible and reducible background for one hard-jet plus two tagged hadronic \(\tau^\pm\)s.
<table>
<thead>
<tr>
<th>$M_2$(GeV)</th>
<th>125</th>
<th>200</th>
<th>300</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_T^j \geq 80$GeV</td>
<td>30.24%</td>
<td>37.48%</td>
<td>48.22%</td>
<td>54.65%</td>
</tr>
<tr>
<td>$E_T \geq 100$GeV</td>
<td>22.47%</td>
<td>31.66%</td>
<td>45.80%</td>
<td>56.56%</td>
</tr>
<tr>
<td>$N_\tau \geq 2, (\eta_\tau = 60%)$</td>
<td>8.24%</td>
<td>17.20%</td>
<td>19.85%</td>
<td>21.28%</td>
</tr>
<tr>
<td>$M_T \geq 80$GeV</td>
<td>14.20%</td>
<td>26.80%</td>
<td>39.24%</td>
<td>48.07%</td>
</tr>
</tbody>
</table>

Table: Cut efficiency for signal benchmarks by varying $M_2$(GeV)
<table>
<thead>
<tr>
<th>( M_2(\text{GeV}) )</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_T^j \geq 80 \text{GeV} )</td>
<td>34.73%</td>
<td>37.96%</td>
<td>39.85%</td>
<td>39.89%</td>
</tr>
<tr>
<td>( E_T \geq 100 \text{GeV} )</td>
<td>24.60%</td>
<td>28.29%</td>
<td>30.82%</td>
<td>31.24%</td>
</tr>
<tr>
<td>( N_T \geq 2, (\eta_T = 60%) )</td>
<td>12.21%</td>
<td>12.42%</td>
<td>12.89%</td>
<td>12.70%</td>
</tr>
<tr>
<td>( M_T \geq 80 \text{GeV} )</td>
<td>19.16%</td>
<td>22.22%</td>
<td>23.74%</td>
<td>26.22%</td>
</tr>
</tbody>
</table>

Table: Cut efficiency for signal benchmarks by varying \( M_A(\text{GeV}) \)
bb Fusion+DY ($\sqrt{s} = 14$ TeV)

Stau Pair from gauginos
($\sqrt{s} = 14$ TeV)
$3.5 \sigma$
谢谢!
Thank you!