Detection of SUSY Signals in Stau-Neutralino Coannihilation at the LHC
- Finger Print of CDM -

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$E_T^{\text{miss}} + 2j + 2\tau$ Analysis (II)

$p_T^{\text{vis}} > 40, 20 \text{ GeV}$

$M_{\text{max}} = 78.7 \text{ GeV}$

$p_T^{\text{vis}} > 40, 40 \text{ GeV}$


OS–LS counts (10 fb$^{-1}$) for $M_{\tau\tau} < 100$ GeV:
- Top : 6 counts
- $W$+jets : 1 count
- SUSY : 125 counts

How to Establish the Discovery

[1] $N_{\text{OS–LS}}$ (Number of OS–LS counts)

[2] Clear peak ($M_{\text{peak}}$) and end-point ($M_{\text{max}}$) in di-tau mass distribution for OS–LS pairs

[3] $M_{\text{peak}}$ is used to determine $\Delta M$

$p_T^{\tau} > 20 \text{ GeV}$ is essential!
A small $\Delta M$ can be detected in first few years of LHC.

[Assumption] The gluino mass is measured with $\delta M / M_{\text{gluino}} = \pm 5\%$ in a separate analysis.
We extract $\Delta M$ from $M_{\text{peak}}$.

I. $\delta M_{\text{peak}} = \text{r.m.s}(M_{\text{peak}}) / \sqrt{N_{\text{OS-LS}}}$

II. $\delta M/M_{\text{gluino}} = \pm 5\%$

$\Delta M = 10 \pm 1.2^{+1.4}_{-1.2}$ GeV (10 fb$^{-1}$)
Reach in $m_{1/2}$?

With $100 \text{ fb}^{-1}$, the LHC could probe $m_{1/2}$ up to $\sim 700 \text{ GeV}$.
## Appendix 1: Reference Points

\[ m_{1/2} = 360 \text{ GeV} \]

\[ M_{\text{gluino}} = 830 \text{ GeV} \]

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<td>154.8</td>
<td>156.7</td>
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\[ \Delta M \equiv M_{\tilde{\tau}_1} - M_{\tilde{\chi}_1^0} \]

| \( \Delta M \) | 5.7 | 7.6 | 10.6 | 12.5 | 15.4 |

| \( M_{\tilde{t}^0}^{\text{max}} \) | 60.0 | 68.3 | 78.7 | 84.1 | 91.2 |