Shingo Kazama (The University of Tokyo) for the ATLAS Collaboration

Anomaly Mediated SUSY Breaking (AMSB) scenario

- No SUSY-FCNC/CP problem
- No gravitation production problem
- Wino can be a good candidate for dark matter
- \( m_{\tilde{\chi}^0} \approx 126 \text{ GeV} \) can be realized due to large squark mass
  \( \approx O(10-100) \text{ TeV} \)
- \( m_{\tilde{q}} : m_{\tilde{q}} = 3 : 1 \text{ to } 8 \), LSP = pure neutralino
- \( \Delta m_{\tilde{\chi}} \) (chargino/neutralino) = 160 MeV
  - Measurable lifetime \( \tau_{\chi} > 0.2 \text{ ns} \Rightarrow c \tau > O(1-10) \text{ cm} \).
- Decay inside the tracking detectors.
- Chargino decays into a neutralino + soft pion.
- \( (E_{miss}) \) (undetectable)
  \( \Rightarrow \) Chargino is observed as a “disappearing track”

Disappearing track selection

- Isolation from hadronic activity
  - \( p_T \text{cone} 40 / p_T < 0.04 \)
  - \( \Delta R(\text{jets, track}) > 0.4 \)
- Quality requirements
  - Probability(\( \chi^2 \), ndf) > 0.1
  - \( |d_y| < 0.1 \text{ mm}, |z, \sin \theta| < 0.5 \text{ mm} \)
- No holes in Pixel and SCT detector.
- Disappearing track selection
  - Number of TRT Hits: N(TRT) < 5
  - Short-length track reconstruction
  - Number of SCT Hits: N(SCT) ≥ 2

Monojet selection

- Topological Trigger
  - Jet + \( E_{miss} + \Delta \Omega (\text{jets, } E_{miss}) \)
- Dedicated trigger for the analysis
- No lepton \( (p_T > 10 \text{ GeV}) \)
- \( \geq 1 \) jets
- Leading jet \( p_T > 90 \text{ GeV} \)
- \( E_{miss} > 90 \text{ GeV} \)
- \( \Delta \Omega (\text{jets, } E_{miss}) > 1.5 \)

Background estimation

- Chargino decaying into \( \chi^{+} \rightarrow \ell \nu \rightarrow \ell + X \)
  - 1.5 mm reconstruction track
  - First stereo error in \( p_T \)
  - High pt, charged hadron, and \( E_{miss} \) in 3D detector
  - Lepons failing to satisfy id/recollisions due to large energy loss of scattering

How to estimate: data-driven method

- Derive background track \( p_T \) shapes from their data control samples.
- Perform a “Signal + Background template fit” to candidate track \( p_T \).
- Track \( p_T \) shapes in control samples must be the same as those in SR.

Results

1. Counting experiment

   \( \text{Signal Region} \) \( p_T > 200 \text{ GeV} \)
   - Expected events: 18.0 ± 4.6
   - Observed events: 13

2. Shape analysis

   \( ATLAS \text{ Preliminary} \)

   - \( T = 62 \% \) / \( f = 30.3 \% \)

   - \( m_0 \text{ GeV} \)

   - \( m_{\tilde{\chi}} \text{ GeV} \)

   - \( m_{\tilde{\chi}^0} \text{ GeV} \)

   - \( m_{\tilde{\chi}^+} \text{ GeV} \)

   - \( m_{\tilde{\chi}^-} \text{ GeV} \)

   - \( m_{\tilde{\tau}} \text{ GeV} \)

   - \( m_{\tilde{\nu}} \text{ GeV} \)

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   - \( m_{\tilde{\nu}} \text{ GeV} \)

   - \( m_{\tilde{\nu}} \text{ GeV} \)

Interpretation

- No significant excess beyond the Standard Model.
- In AMSB scenarios \( \tau_{\chi} = 0.2 \text{ ns}, \Delta m_{\tilde{\chi}} = 160 \text{ MeV} \),
  \( \text{chargino mass} < 270 \text{ GeV} \) is excluded at 95% C.L.
  \( \Rightarrow \) These constraints are generally valid in Wino LSP scenarios.

Direct chargino production

- \( E_{miss} \) (undetectable)
  \( \Rightarrow \) Undetectable


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