



Short Status Report:
Search for Heavy, Long-Lived Neutralinos
that decay via $\tilde{\chi}_1^0 \rightarrow \gamma \tilde{G}$

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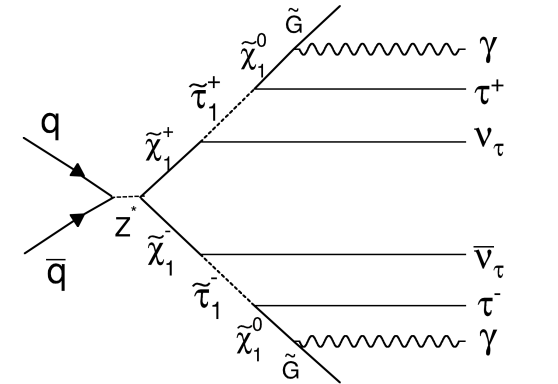
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Search for Heavy, Long-Lived Neutralinos that decay via $\tilde{\chi}_1^0 \rightarrow \gamma \tilde{G}$ in three different final states



Dominant Signal Process (GMSB)



1. $\gamma + \mathbf{E}_T + Jet$
sensitive to **high lifetime** ($> 1 \text{ ns}$)

Mainly covered in this talk

“Reproducing the Delayed Photon Analysis”

2. $\gamma + \mathbf{E}_T + IsoTrk$
complimentary to $\gamma + \mathbf{E}_T + Jet$
3. $\gamma \gamma + \mathbf{E}_T$
sensitive to **low lifetime**



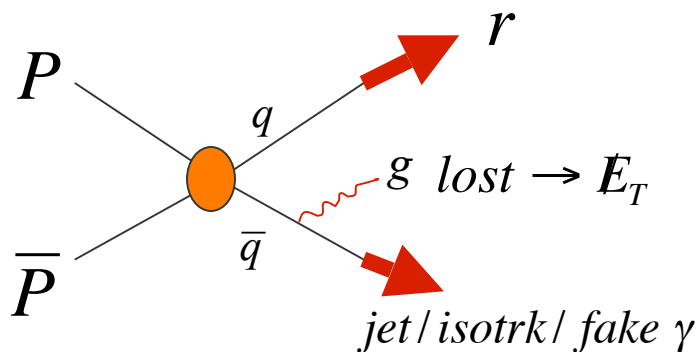
Delayed Photon Analysis

Looking for $\tilde{\chi}_1^0 \rightarrow \gamma + \tilde{G}$ in $\gamma + E_T + Jet$ final state

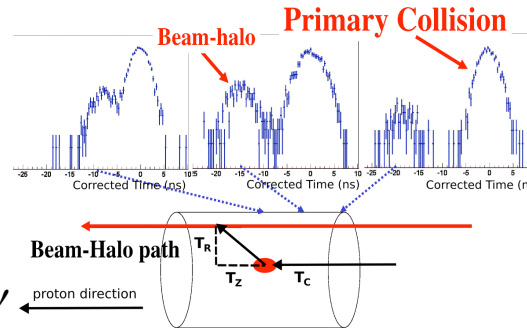
Delayed Photon Analysis
M.Goncharov, V.Krutelyov, E.Lee,
D.Toback and P.Wagner
Phys. Rev. Lett 99, 121801 (2007)
PRD in progress (CDF NOTE 9171)

Background Sources

Collision (SM) Background



Non-Collision Background : Cosmic and Beam Halo



Luminosity = $570 pb^{-1}$

$E_T^{\gamma} > 30 GeV$

$|\eta_{Pho}| < 1.0$

$E_T^{jet} > 30 GeV$

$|\eta_{Jet}| < 2.0$

$E_T > 30 GeV$

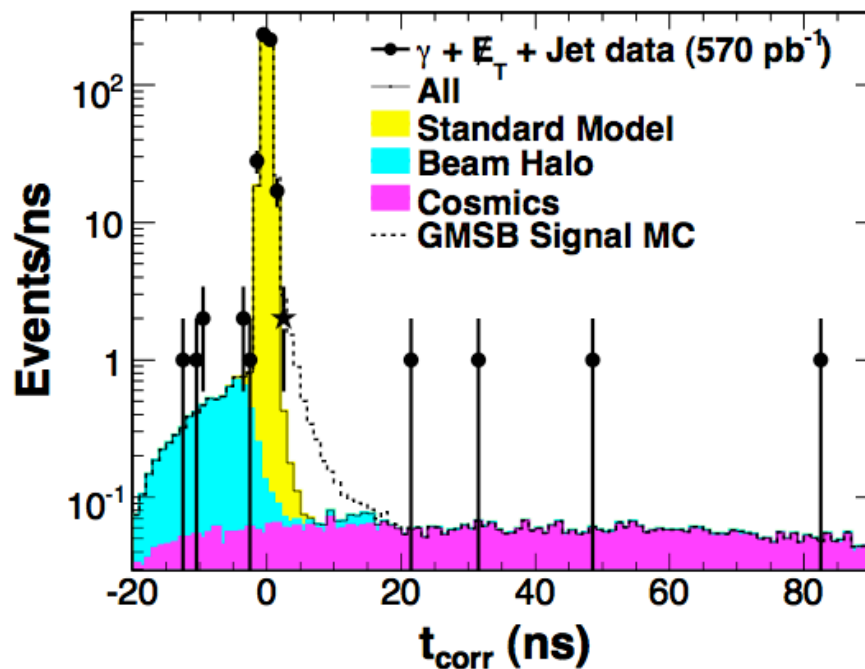
W_NOTRACK trigger



Reproducing Delayed Photon PRL: What we have done and Why we do it



1. Reproduced final 508 events after all optimized kinematic cuts in timing window.
2. Reproduced events in each control region after all optimized kinematic cuts (2 observed events in signal window ($2 < \text{CorrT0} < 10$))
3. Finishing up Background Estimation
4. Finishing up GMSB signal acceptance





Reproducing Numbers in PRL

- Event reduction for the baseline $\gamma + E_T + \geq 1 \text{ jet}$

Selection Requirement	No. of Observed Events
Ph_Et>30, Met>30, and Photon ID cuts	119944 (119944)
Good Vertex, SumPt>15 GeV	19574 (19574)
≥ 1 jet with Et>30 and $ \eta <2.0$	13097 (13097)
Cosmic Rejection (μ co-stub)	12855 (12855)

Control Region	Dominant Background	Observed Events
$-20 < \text{CorrT0} < -6 \text{ ns}$	Beam Halo	4 (4)
$-10 < \text{CorrT0} < 1.2 \text{ ns}$	SM	498 (493)
$25 < \text{CorrT0} < 90 \text{ ns}$	Cosmics	4 (4)

PRL

My Number



Conclusion and Future Plan



- $\gamma + E_T + Jets / IsoTrk$
 - Reproduced delayed photon PRL numbers
 - Finishing Background estimation
 - Looking at $\gamma + E_T + IsoTrk$ with same data set (570 pb-1) to see if it is better
 - Go with 2 fb-1 data and do Full optimization and set limits on GMSB model for high lifetime

- $\gamma \gamma + E_T$
 - Reproduced Sasha's diphoton event selection
 - Finalizing GMSB signal Acceptance with EMTiming
Example point ($m_{\tilde{\chi}_1^0} = 100 GeV, \tau_{\tilde{\chi}_1^0} = 0 ns$)
 - Reproducing Sasha's Met model.
 - Optimize and Set limits on GMSB model for low lifetime neutralino.