



Search For
Displaced
Photons
Using
Timing.

Tambe E.
Norbert

Motivation

Production
and Decay

Dataset
and
Trigger

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Remaining
Completion

Search For Displaced Photons Using Timing.

Long-Lived Meeting

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How are we measuring the neutralino Lifetime?

- 1 Calculate time from distance travelled by Neutralino before it decays

Definition (Distance Travelled)

$$L = c\tau \cdot \gamma\beta \quad \rightarrow \quad c\tau = \frac{|\Delta \vec{r}|}{\gamma\beta}$$

- 2 Extract time directly from MC

Definition (MC Time)

$$c\tau = \frac{ct}{\gamma}$$



Production and Decay



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Production and Decay Diagrams



Dataset and Trigger



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Datasets and HLT Triggers used.

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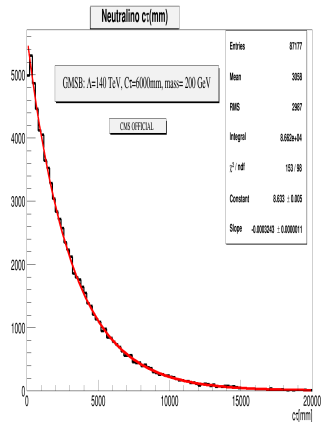
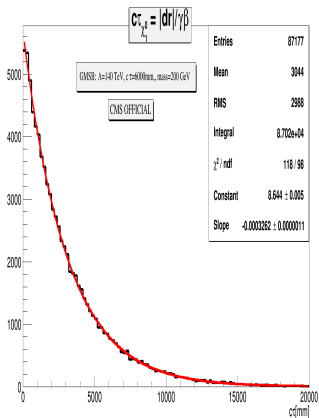


Figure : $1/\text{Slope} = 3065.60$ mm Figure : $1/\text{Slope} = 3083.56$ mm

Sample is $c\tau = 6000$ mm but we measure $c\tau \approx 3000$ mm



Background Estimation



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Have fun lets see!



Systematics



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Limits



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Are we measuring the original $c\tau$ of the neutralino?

CMS Official GMSB Samples

| Λ [TeV] | mass[GeV] | C_{grav} | $c\tau$ [mm] | Fit Value[mm] |
|-----------------|-----------|------------|--------------|---------------|
| 120 | 169 | 93.5 | 1000 | 657.89 |
| 120 | 169 | 162 | 3000 | 1942.12 |
| 140 | 198 | 162 | 3000 | 1550.38 |
| 140 | 198 | 187 | 4000 | 2064.83 |
| 140 | 198 | 229 | 6000 | 3083.56 |
| 180 | 256 | 93.5 | 1000 | 378.64 |
| 180 | 256 | 132 | 2000 | 749.45 |
| 180 | 256 | 162 | 3000 | 1104.85 |
| 180 | 256 | 229 | 6000 | 2203.61 |

We seem to be measuring neutralino $c\tau$ by some factor off.

By how much are we off in neutralino $c\tau$ measurements?

| CMS Official GMSB Samples | | | |
|---------------------------|--------------|---------------|------------|
| Λ [TeV] | $c\tau$ [mm] | Fit Value[mm] | Factor Off |
| 120 | 3000 | 1942.12 | 1.54 |
| 140 | 3000 | 1550.38 | 1.93 |
| 180 | 3000 | 1104.85 | 2.71 |
| 140 | 6000 | 3083.56 | 1.9 |
| 180 | 6000 | 2203..61 | 2.7 |

Factor is **The SAME** for different neutralino $c\tau$ with same Λ value. However, factor is **NOT THE SAME** for the same $c\tau$ with different Λ values.

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Is this due to how sample is generated?

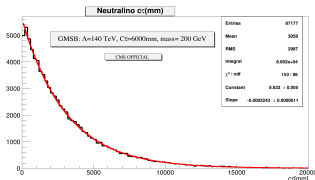


Figure : $1/\text{Slope} = 3083.56 \text{ mm}$

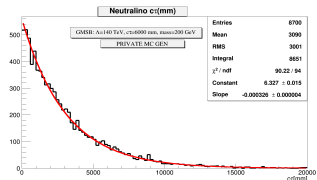


Figure : $1/\text{Slope} = 3067.48 \text{ mm}$

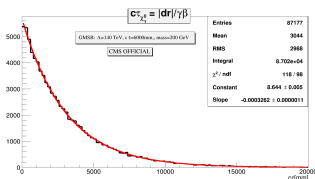


Figure : $1/\text{Slope} = 3065.60 \text{ mm}$

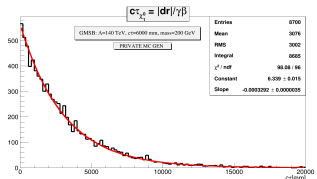


Figure : $1/\text{Slope} = 3037.66 \text{ mm}$

Private GMSB sample seems to show same offset measurements



To Be Completed



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- Offset in neutralino $c\tau$ seems to have a more subtle origin than expected. Probably how mass enters into the lifetime definition and implementation at MC generation level.
- GMSB samples with the same sample $c\tau$, hence C_{grav} , but with different Λ values have different offset factor.
- The observation that the $c\tau$ value for a given sample with Λ is different from the measured value is very unclear, even without looking at samples with different Λ values.
- Our next step involves understanding cause of this offset.