Search For Displaced Photons Using Timing.

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Outline

Motivation

How are we measuring the neutralino Lifetime?

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

Definition (Distance Travelled)

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

2. 2 Extract time directly from MC

Definition (MC Time)

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

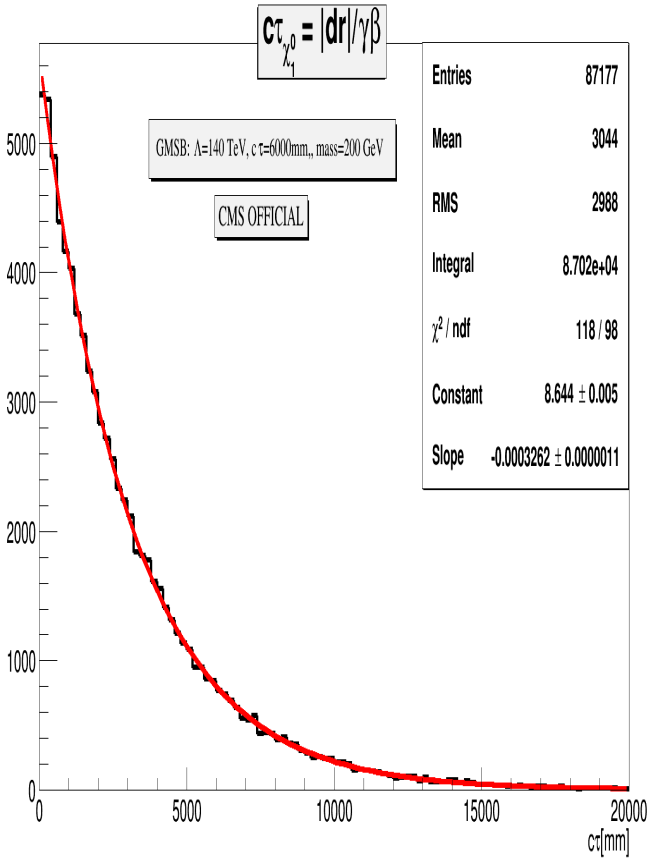
Production and Decay

Production and Decay Diagrams

Dataset and Trigger

Datasets and HLT Triggers used.

Event Selection



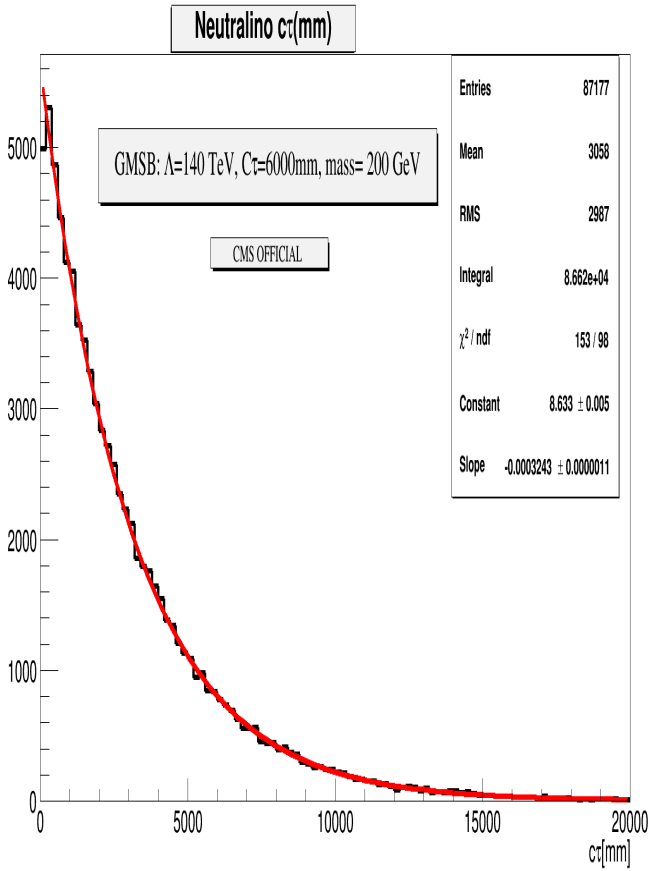


Figure : 1/Slope = 3065.60 mm Figure : 1/Slope = 3083.56 mm

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

Background Estimation

Have fun lets see!

Systematics

Limits

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

CMS Official GMSB Samples				
Λ[TeV]	mass[GeV]	C_{grav}	cτ[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]	cτ[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.

Cause of this difference in $c\tau$ values?

Is this due to how sample is generated?

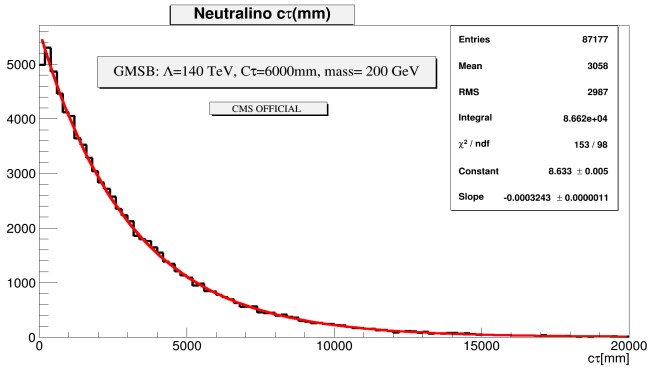


Figure : 1/Slope = 3083.56 mm

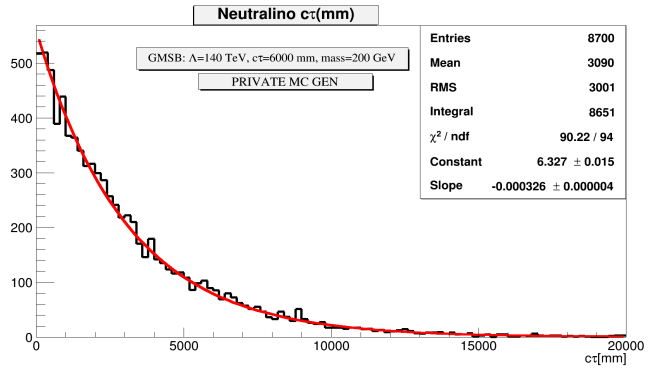


Figure : 1/Slope = 3067.48 mm

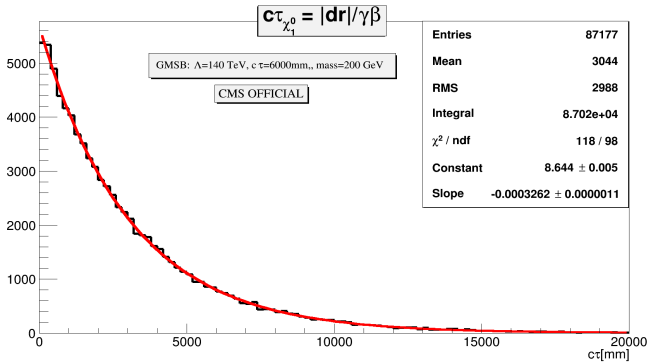


Figure : 1/Slope = 3065.60 mm

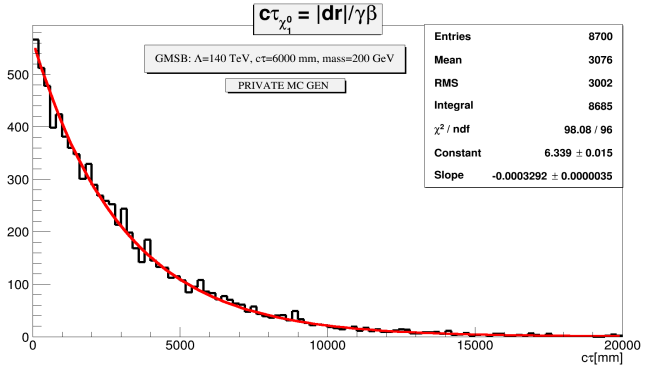


Figure : 1/Slope = 3037.66 mm

Private GMSB sample seems to show same offset measurements

To Be Completed

- 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.