

Long-lived Stau

Dec. 10. 2010

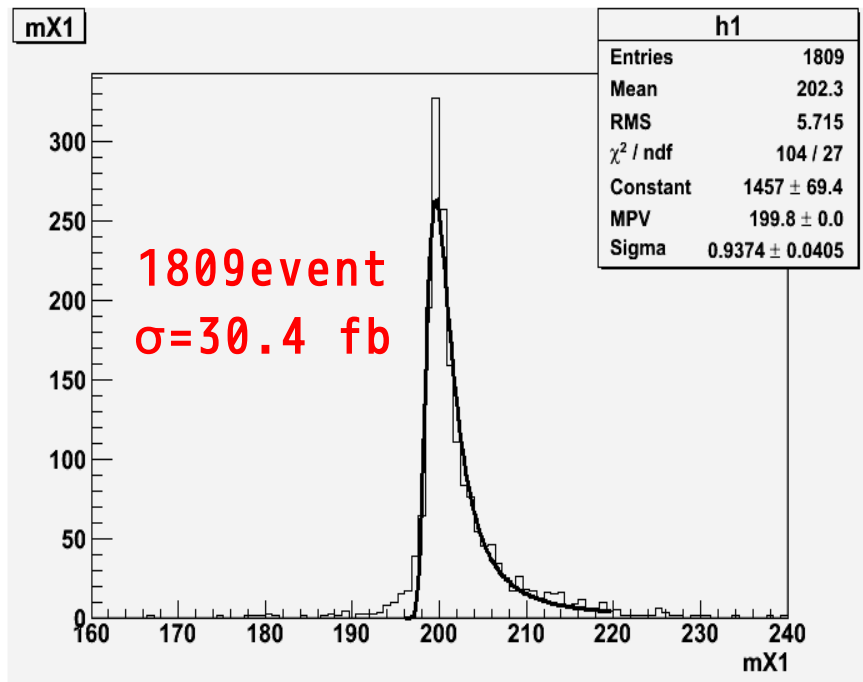
Wataru Yamaura

Outline

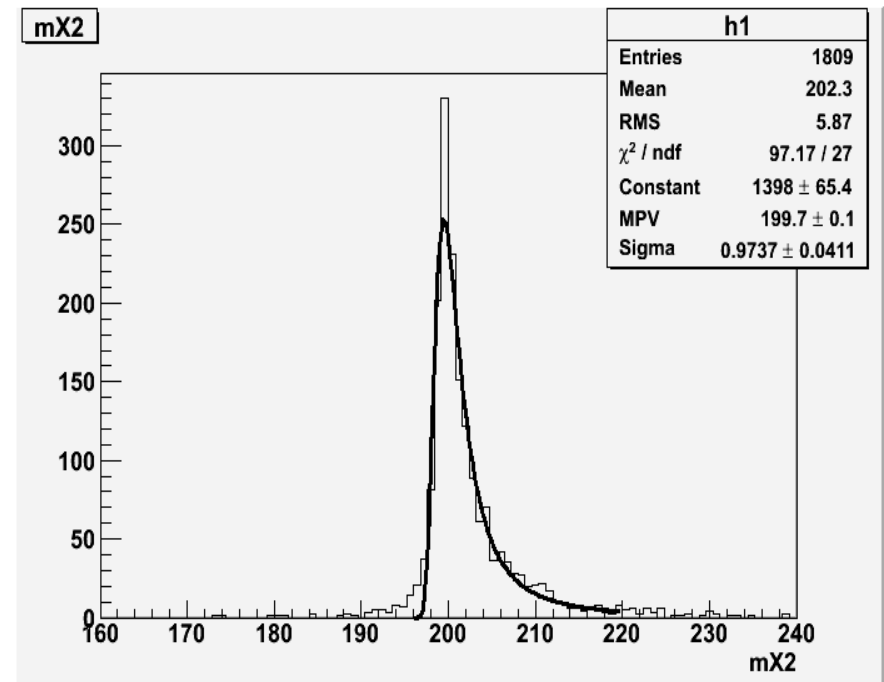
- Carry out a MC simulation in neutralino mode
- Generated number of neutralino mode
- Stau mass is measured at ECAL by TOF

Via neutralino mode

Input value of $m_{\chi_1^0}$ is 200.0 GeV



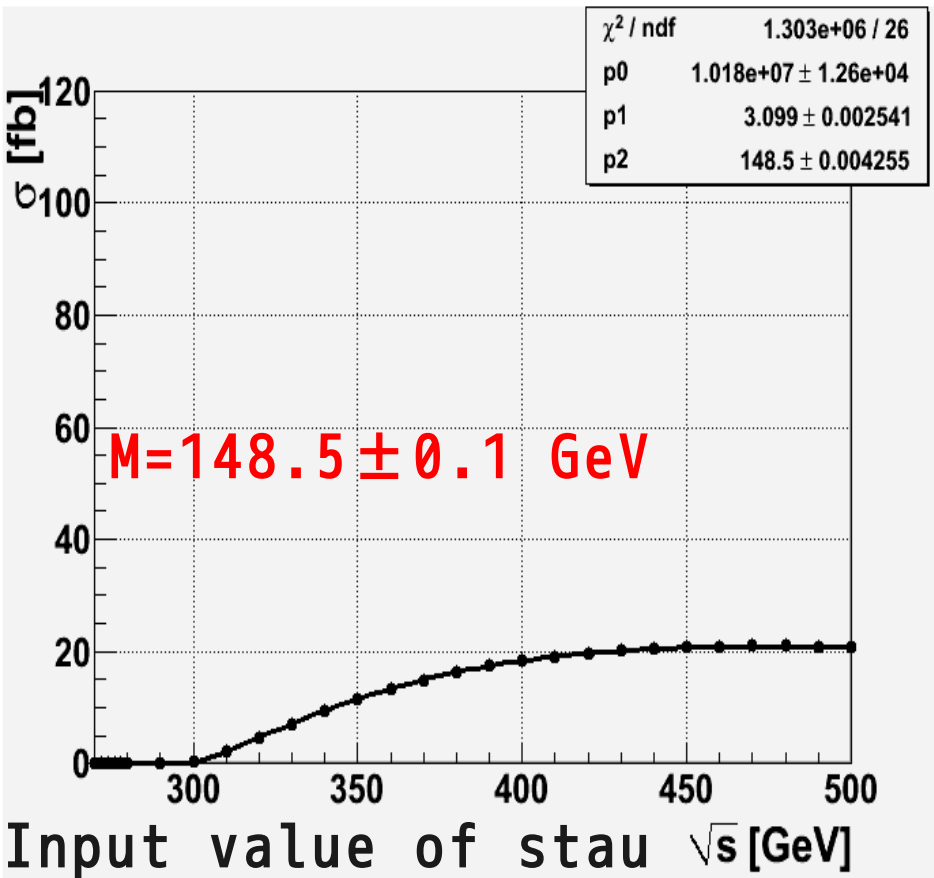
$$m_{\chi_1^0} = 199.81 \pm 0.05 \text{ GeV}$$



$$m_{\chi_1^0} = 199.72 \pm 0.05 \text{ GeV}$$

Generated number is 5000 in this simulation.
From neutralino's cross section (30.4 fb), luminosity is calculated about 164.47 fb^{-1} .

Stau pair mode cross section



mass is 148.8 GeV

Data points are 29. Fitting is considered to error.

\sqrt{s} GeV	Cross section fb	Error fb
:	:	:
:	:	:
:	:	:
350	11.5051	0.0270776
360	13.3376	0.0316874
370	14.9262	0.0356724
380	16.2735	0.0390427
390	17.4023	0.0418938
400	18.3390	0.0442709
410	19.0959	0.0461739
420	19.7001	0.0477751
430	20.1728	0.0490424
440	20.5183	0.0499831
:	:	:
:	:	:

Fitting: $P_0 \times \left(\sqrt{\frac{(\sqrt{s}/2)^2 - P_2^2}{(\sqrt{s}/2)^2}} \right)^{P_1} \times \frac{1}{s}$

$P_0 = |T|^2$: Amplitude

$P_2 = m_{\tilde{\tau}}$: Stau mass

Precision of measurement of stau mass by TOF

ECAL is superior to TPC or SET in the point of the time resolution, so we measure stau mass by time of flight at ECAL.

Scintillator (time resolution is smaller than 1ns.)

absorber

ECAL

1.8474 m

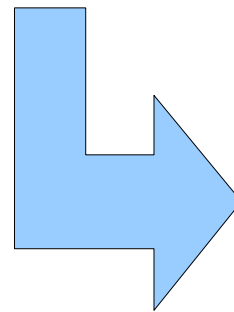
IP

Precision of measurement of stau mass by TOF

Measure precision of mass by time of flight at ECAL.
It is measured at drift region.

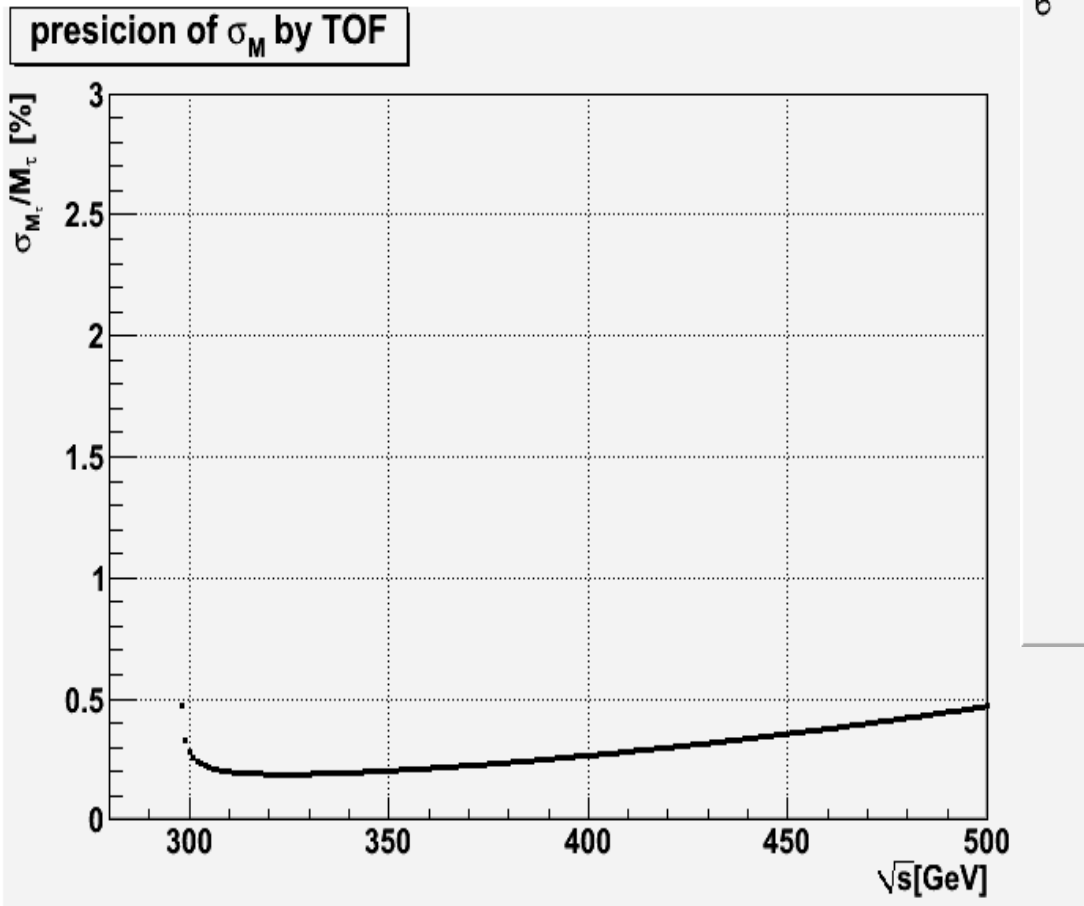
Mass of stau
 $M=148.83\text{GeV}$

$$\left(\frac{\sigma_M}{M}\right)^2 = \frac{P^2 + M^2}{M^4 R^2} \sigma_T^2 P^2 \sin^2 \theta$$

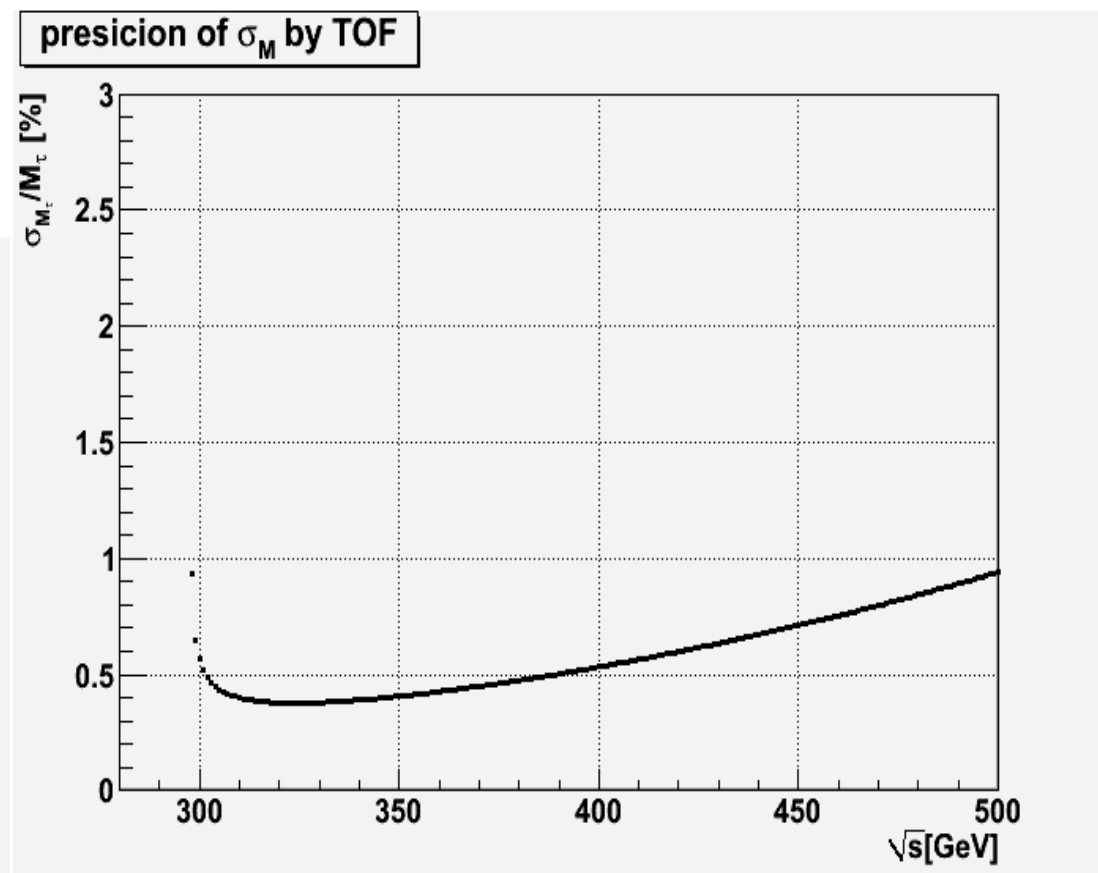


Consider cross section and angular distribution

$$\sigma_{M_{\tilde{\tau}}}^2 = \frac{1}{N \int \frac{1}{\sigma_M^2} \cdot \frac{d\sigma}{\sigma d\cos\theta} d\cos\theta}$$



Time resolution:1ns



Time resolution:2ns

About 320-330 GeV, sigma M value is minimum.

Summary & Plan

- Mass is measured by TOF in ECAL.
- Continue doing MC simulation.

SET

SIT characteristics (current baseline = false double-sided Si microstrips)					
Geometry			Characteristics		Material
R[mm]	Z[mm]	$\cos\theta$	Resolution $R\text{-}\phi[\mu\text{m}]$	Time [ns]	RL[%]
165	371	0.910	R: $\sigma=7.0$,	307.7 (153.8)	0.65
309	645	0.902	z: $\sigma=50.0$	$\sigma=80.0$	0.65
SET characteristics (current baseline = false double-sided Si microstrips)					
Geometry			Characteristics		Material
R[mm]	Z[mm]	$\cos\theta$	Resolution $R\text{-}\phi[\mu\text{m}]$	Time [ns]	RL[%]
1833	2350	0.789	R: $\sigma=7.0$,	307.7 (153.8)	0.65
1835	2350	0.789	z: $\sigma=50.0$	$\sigma=80.0$	0.65
FTD characteristics (current baseline = pixels for first 3 disks, microstrips for the other 4))					
Geometry			Characteristics		Material