# Long-lived Stau

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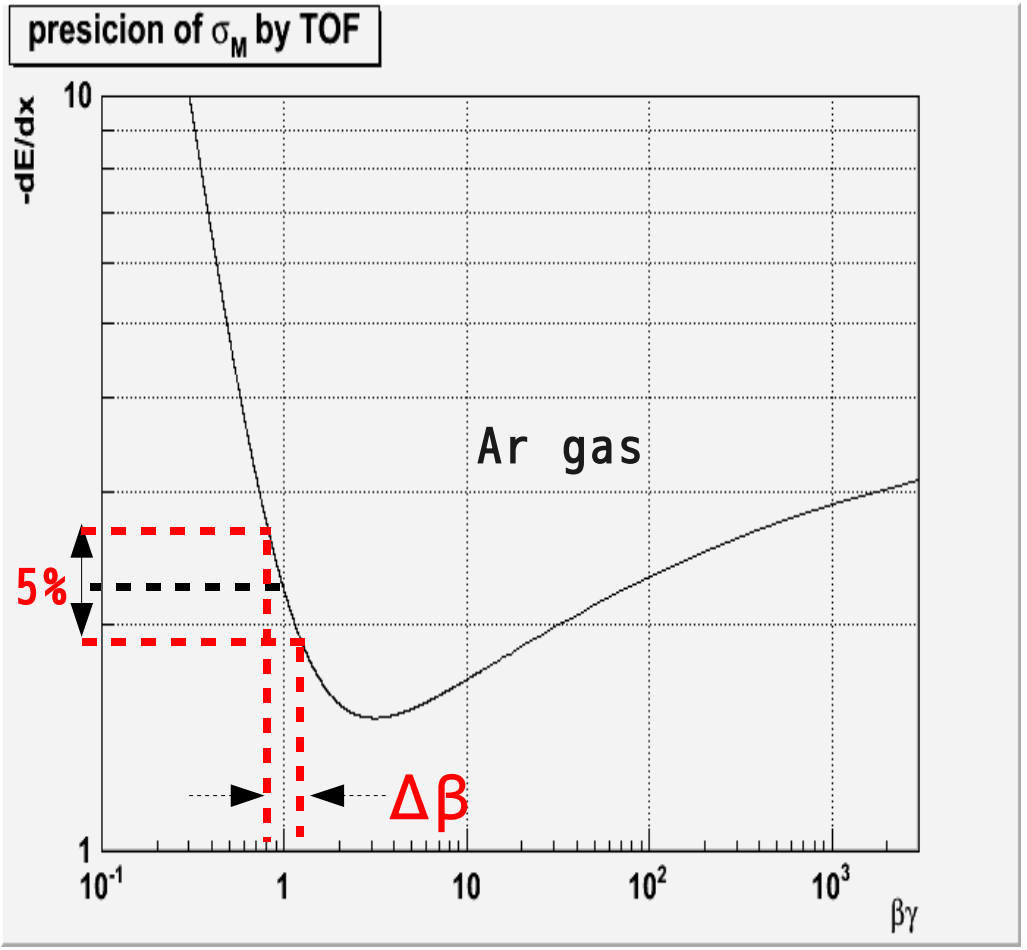
# Outline

- About measurement of stau mass from dE/dx at TPC
- About precision of life time measurement at HCAL

# dE/dx




$$\beta\gamma = \frac{p}{M}$$

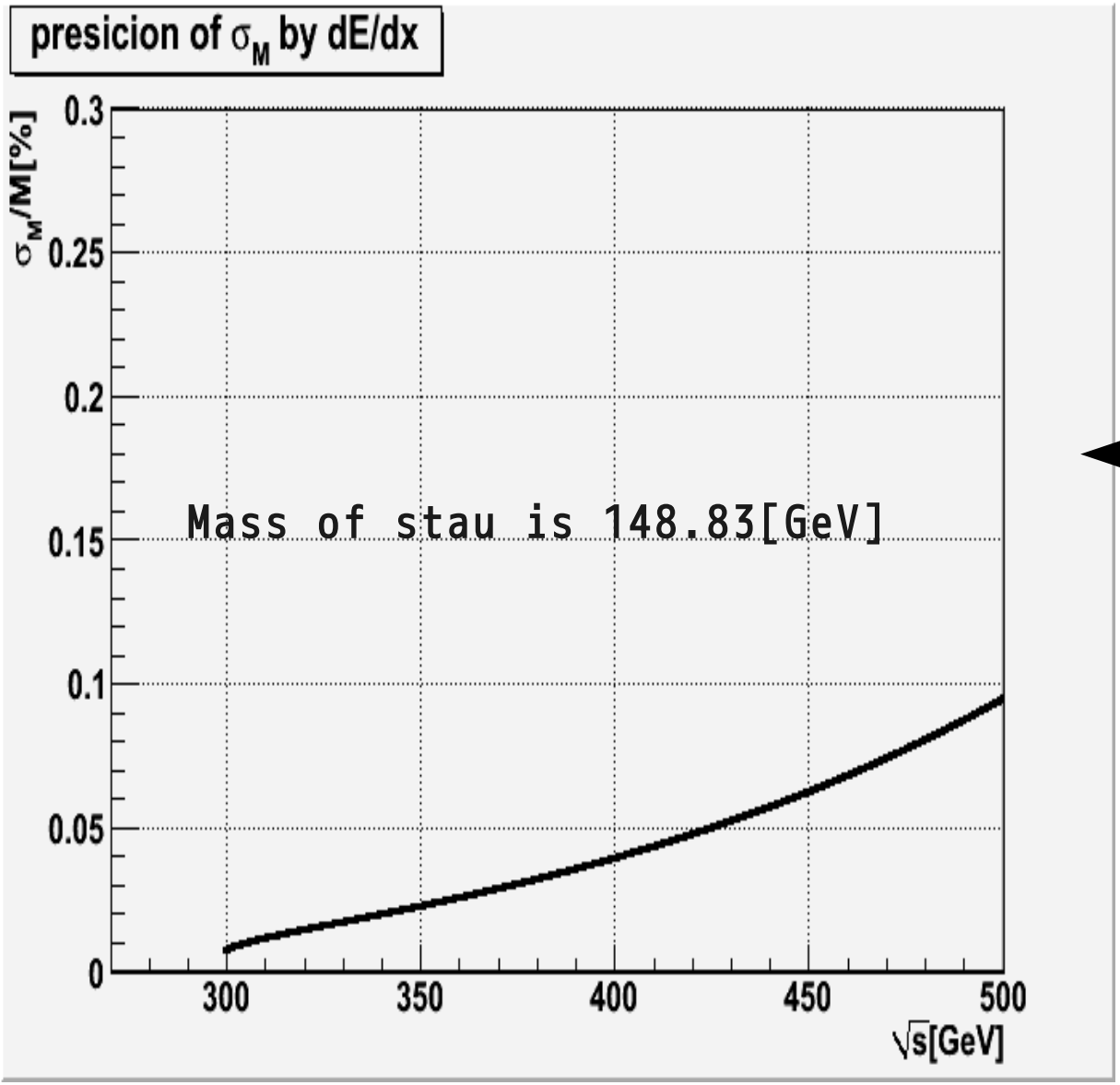
$$p = \sqrt{E^2 - M^2} \qquad E = \frac{\sqrt{s}}{2}$$

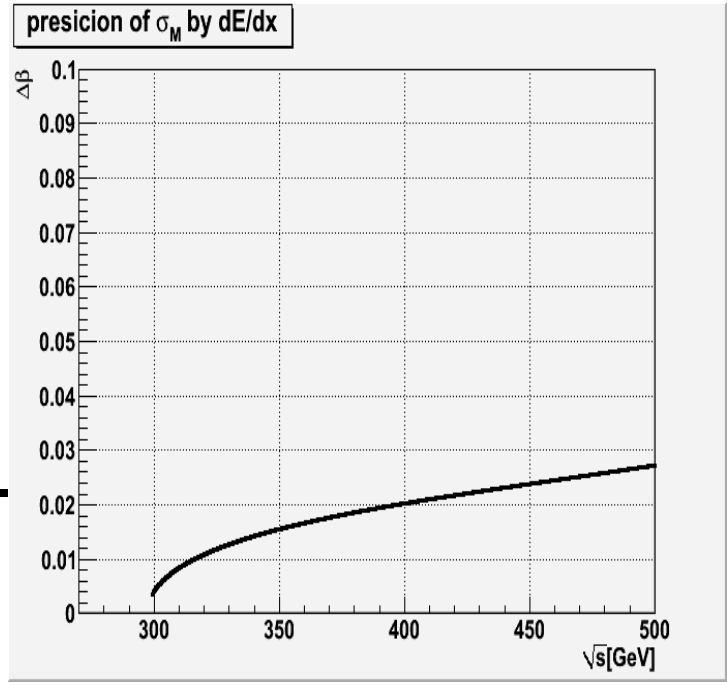
$$M = \frac{\sqrt{s}}{2} \cdot \sqrt{1-\beta^2}$$

$$\sigma_M = \frac{\sqrt{s}}{2} \cdot \sqrt{\frac{\beta^2}{1-\beta^2}} \cdot (\Delta\beta)$$

√sを横軸に、$\sigma_{dE/dx}$ を縦軸にとる → $\sigma_{dE/dx} = \dfrac{\sigma_M}{\sqrt{L \cdot \sigma}}$ ← Cross section

# dE/dx



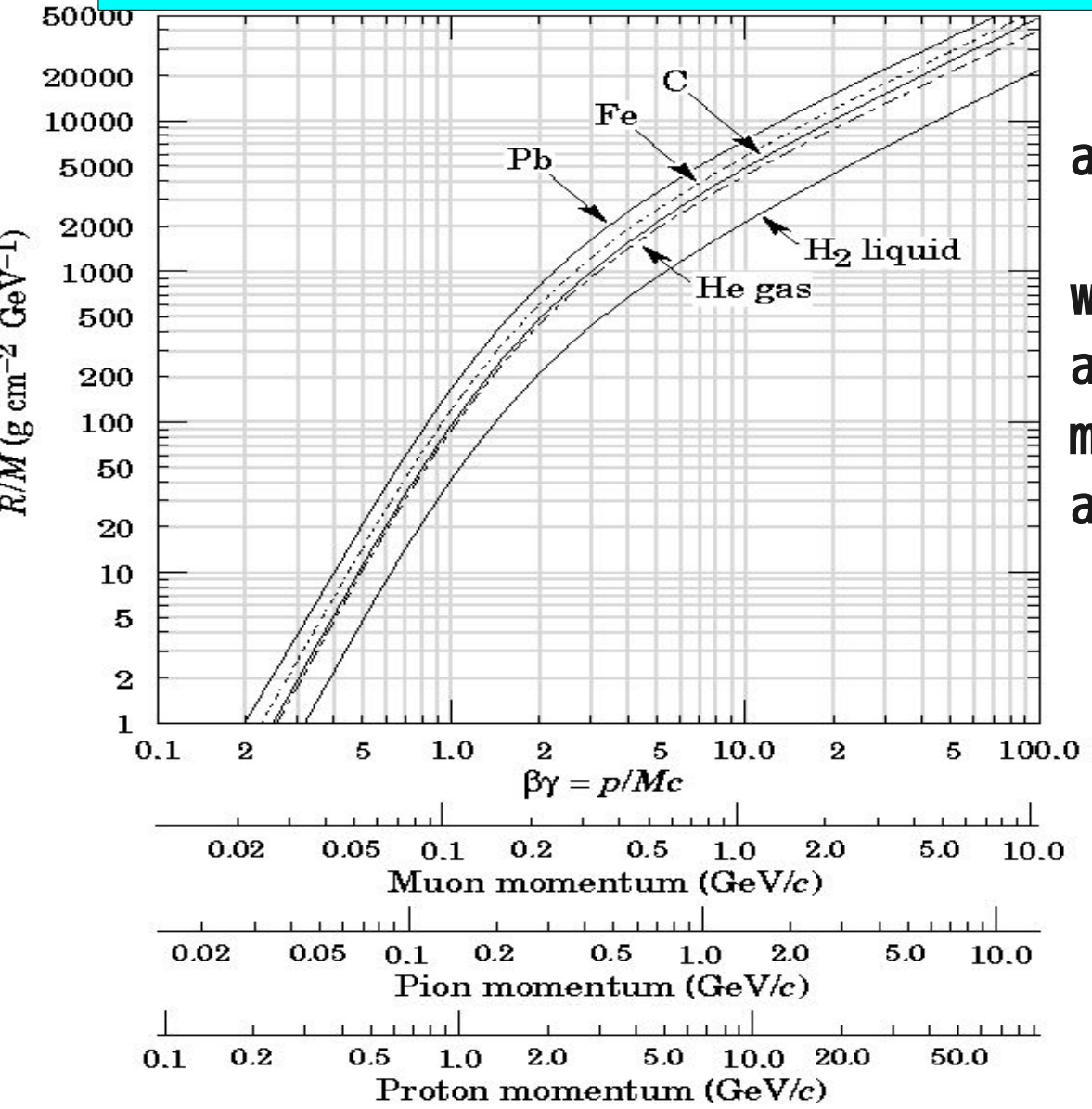

$$\sigma_{dE/dx} = \frac{\sqrt{s}}{2} \cdot \sqrt{\frac{\beta^2}{1-\beta^2}} \cdot (\Delta\beta)$$

$$\sigma_{dE/dx} = \frac{\sigma_M}{\sqrt{L \cdot \sigma}}$$

200/fb

Cross section

# Life time



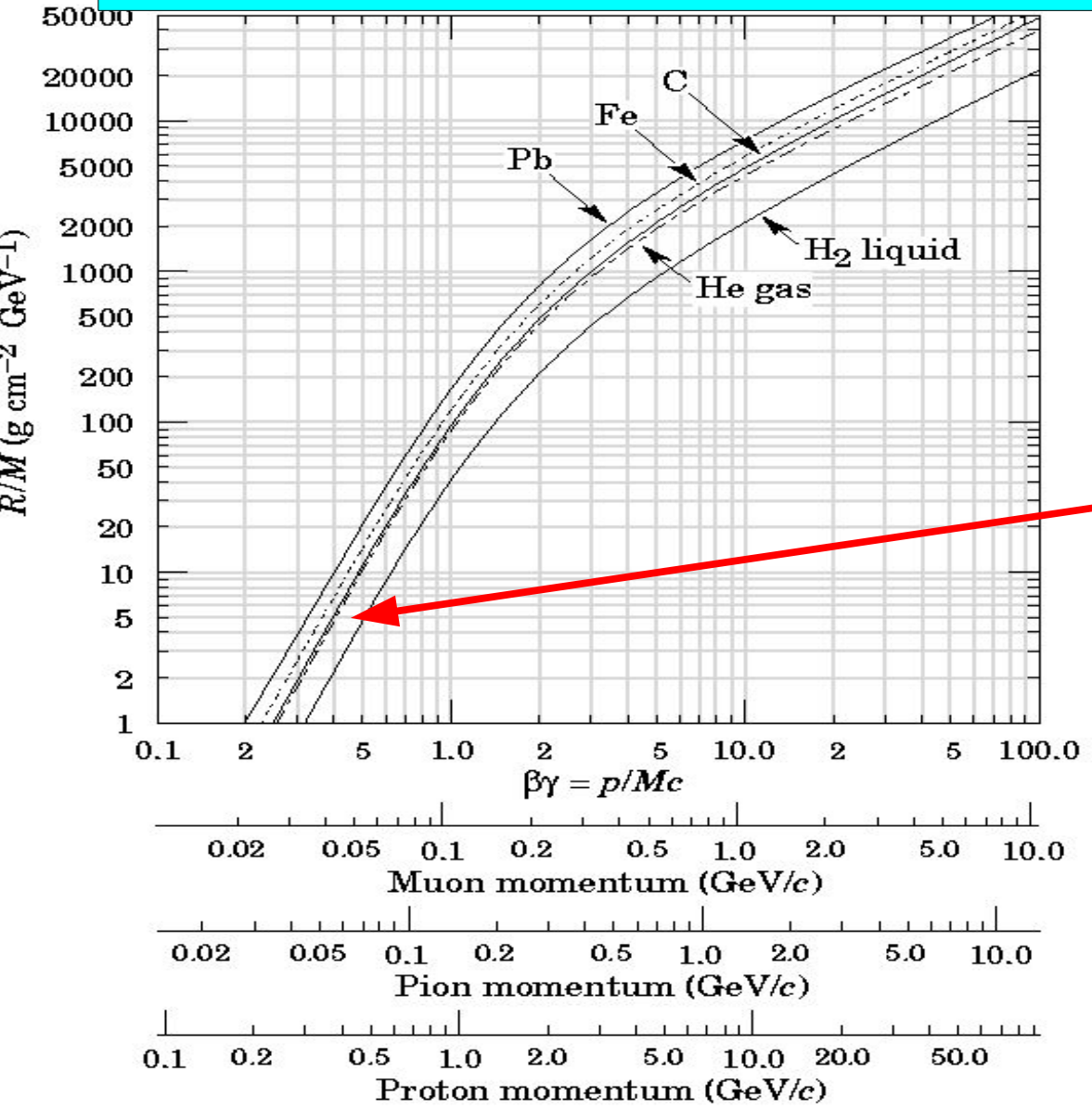

Life time is measured at HCAL.

Calculate beam energy when particle stops in HCAL and precision of life time measurement by luminosity and cross section.

$$\frac{\sigma_\tau}{\bar{\tau}} = \frac{1}{\sqrt{L \cdot \sigma}}$$

HCAL :48 steel plates
thickness 20mm

# Life time




$$\frac{\sigma_\tau}{\bar{\tau}} = \frac{1}{\sqrt{L \cdot \sigma}}$$

200/fb

HCAL :48 steel plates
thickness 20mm

**R/M=5.079**

βγ=0.35±0.01

√s=315.4±1.0[GeV]

σ=3.7±0.3[fb]

$$\frac{\sigma_\tau}{\bar{\tau}} = \frac{1}{\sqrt{L \cdot \sigma}} = 3.7 \pm 0.1 \ [\%]$$

# Plan

- MC simulation