LONG LIVED PARTICLES CONTRIBUTION OVERVIEW

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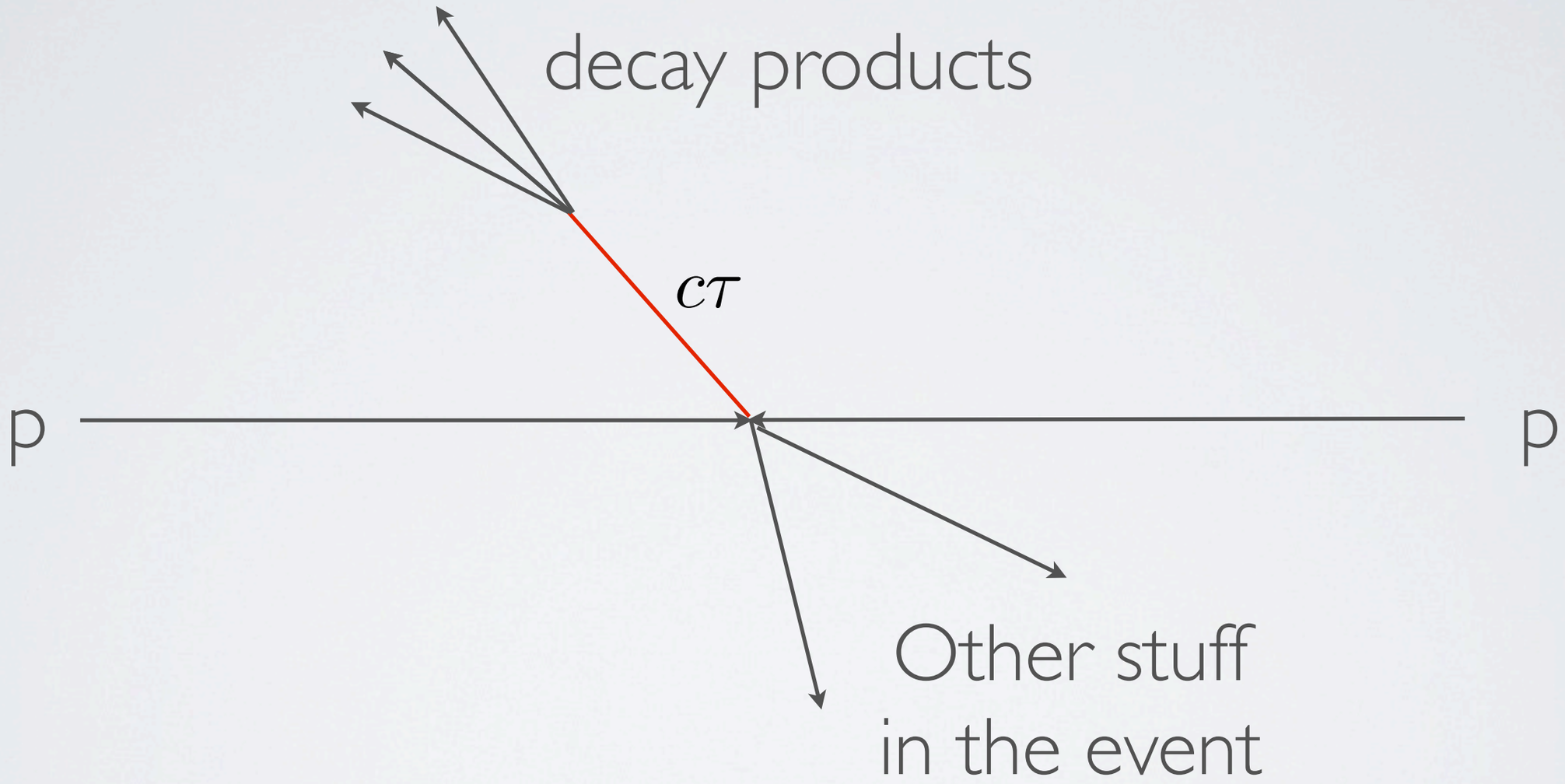
CLASSIFICATION INDEPENDENT OF MODELS



WHAT DO WE NEED TO CLASSIFY?

- Quantum numbers of long lived particle dictate how they show up BEFORE they decay
  - Neutral - have to wait for decay products
  - Charged
  - Colored
- Decay length - Does it happen in the detector? If it stops when will it decay later?
- What does it decay into?

EXPERIMENTALLY

- Search for odd tracks
  - highly ionizing
  - LIGHTLY ionizing
  - kinked tracks
- Decay products, displaced vertices, weird energy deposits
- Significantly out of time decays
- Can look for all these things in association with some normal object to either trigger on, or cut down on backgrounds (stop being model dependent)

WHERE DO MODELS FIT IN?

- SUSY
  - GMSB - all kinds of long lived objects
  - AMSB - long lived charginos
  - Split
    - RPV
- Hidden Valleys
- DM/light mediators (MET not STABLE)
- *Your suggestions for inclusion*

THE HIGGS CONNECTION...

- SUSY and 125 GeV Higgs options:
  - model extensions associated with Higgs
  - low scale mediation (not so low anymore) leads to long lived particles
  - high scale - model with maximal mixing naturally (I don't know of any) or somewhat split (which implies longer lifetimes)
- Depending on how you count 2/3 or 2/4 options for SUSY **IMPLY** long lived particles...

WHAT NEEDS TO BE IMPROVED?

- Many ideas require more than just BSM monte carlo, really enter into GEANT issues and describing new particles

- Long lived backgrounds...

- Is there a way to prioritize long lived + X in the event, or is X just the low hanging fruit?

- most generally to do MORE searches!

FUTURE COLLIDER RESULTS

- Long lived particles should be thought of as just as important and in 1-1 correspondence with almost **ANY** search

- Higher luminosity/energy vs pileup, worrisome for neutral long lived particles

- Higher energy or precision machines are in principle very useful since we don't know the portal that gets us INTO the long lived sector