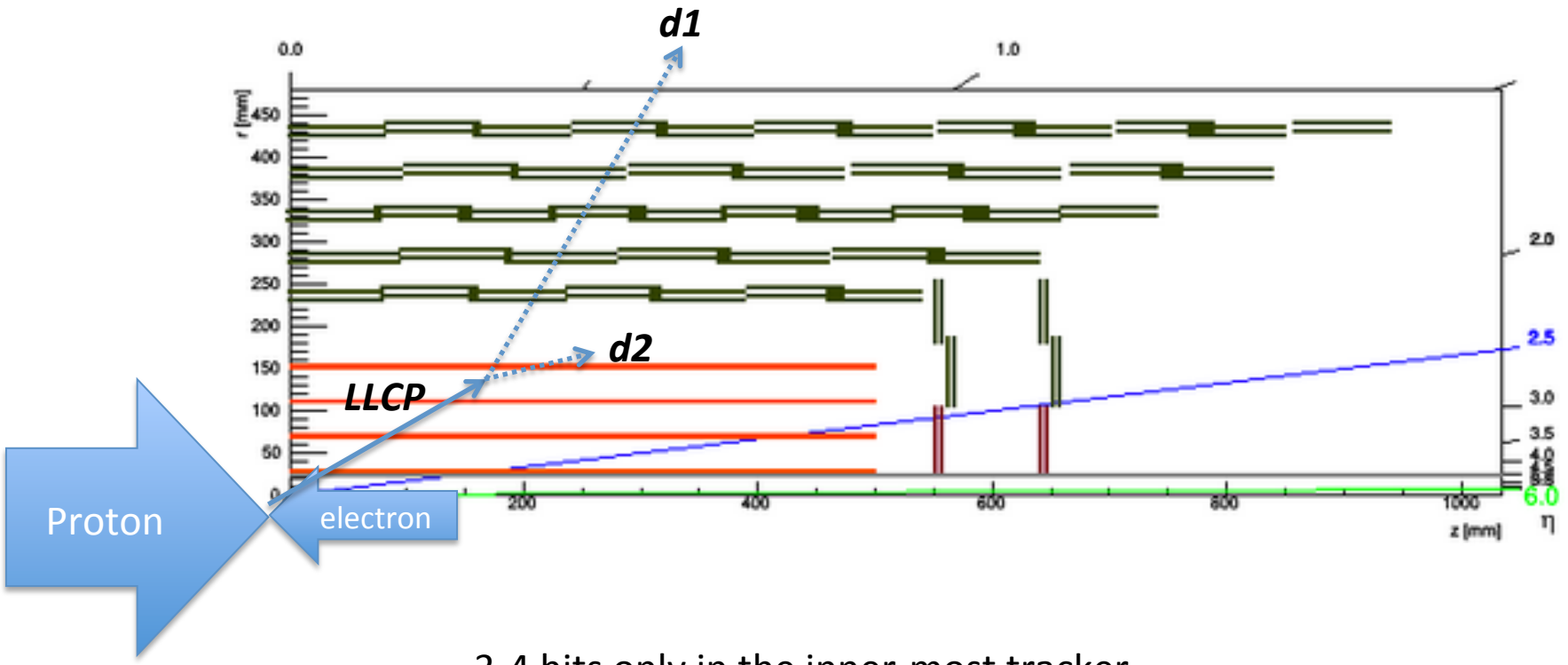
SUSY

Searches for disappearing tracks: LLCP with $c\tau$ >~ 10mm [long-lived charged particles]



3-4 hits only in the inner-most tracker

→ missing (disappearing track)

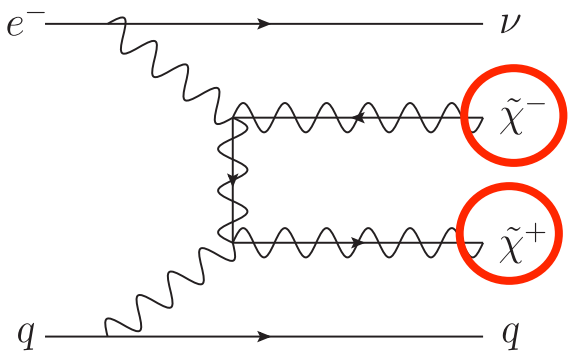
(or a “kink” if the harder daughter ***d1*** is charged)

SUSY

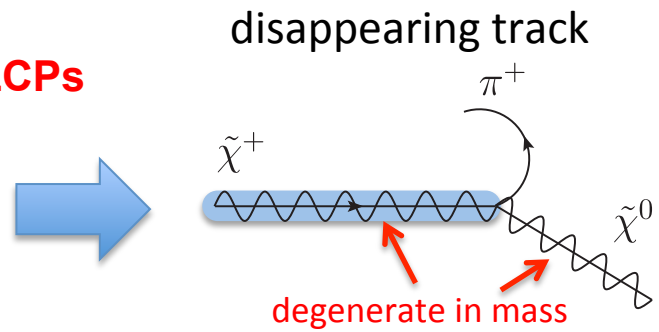
Searches for disappearing tracks: LLCP with *cτ* >~ 10mm [long-lived charged particles]

Simplest models at FCC-he: four-body process and tiny cross section

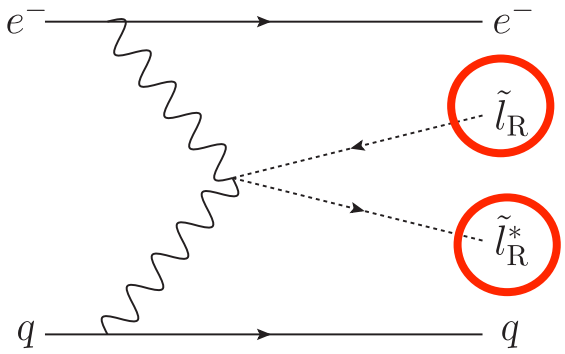
- Charginos (Wino or Higgsino)

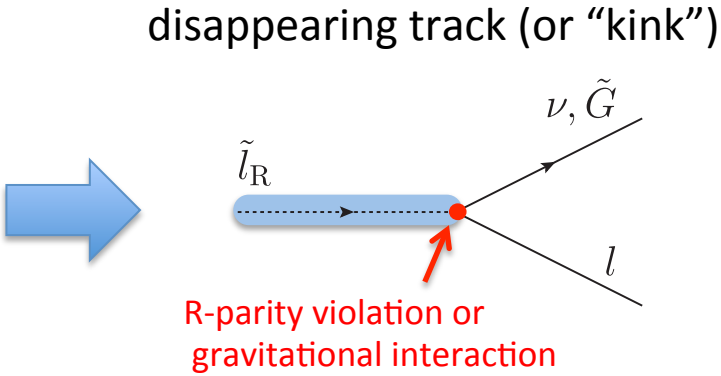


LLCPs



- Sleptons decaying via
  - gravitational interaction
  - R-parity violation



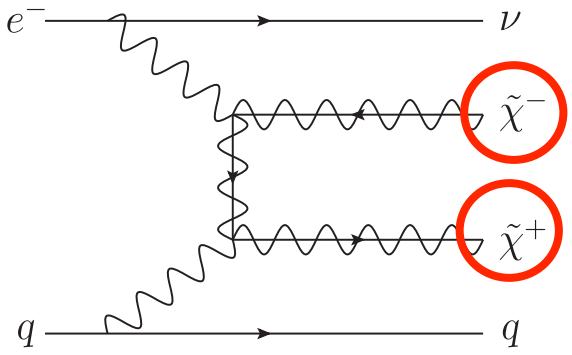


SUSY

Searches for disappearing tracks: LLCP with *cτ* >~ 10mm [long-lived charged particles]

Simplest models at FCC-he

- Charginos (Wino or Higgsino)



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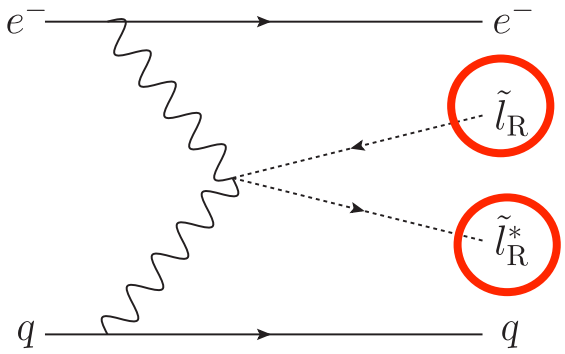
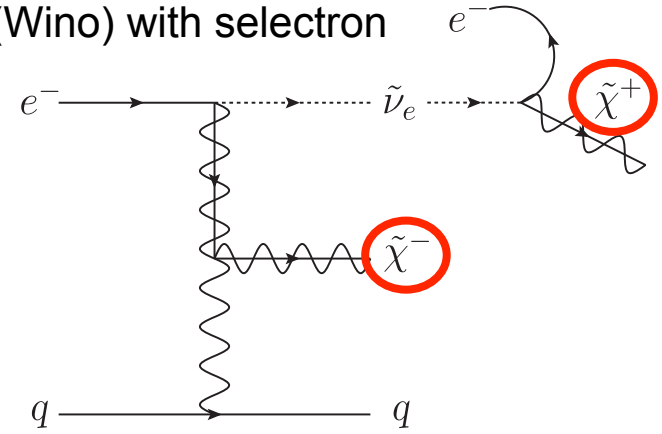
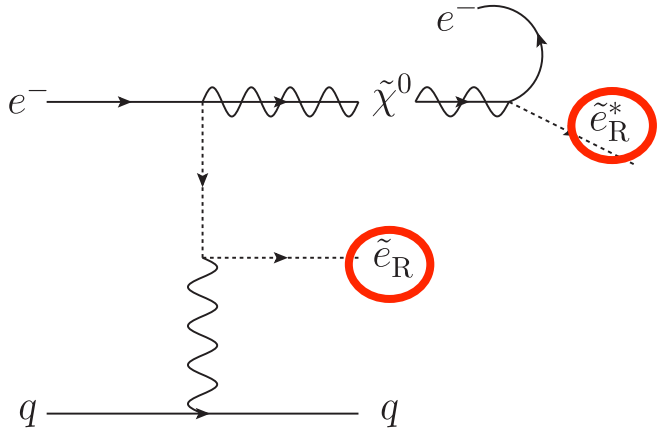


Cross section enhanced with "co-production"

- Chargino (Wino) with selectron



- Selectrons with neutralino



SUSY

Searches for disappearing tracks: LLCP with $c\tau$ >~ 10mm [long-lived charged particles]

Simplest models at FCC-he

- Wino-LSP scenario
  - ✓ main target @ LHC (and well studied)
- Higgsino-LSP scenario
  - ✓ challenging because $c\tau$ < 10mm
- Slepton-LSP scenario
  - ✓ R-parity violation, or keV gravitino

Cross section enhanced with "co-production"

- Chargino (Wino) with selectron

(e.g. 300 GeV Wino + 309 GeV selectron)

$(\chi_1^{\pm}, \chi_1^0)$ $(\tilde{e}_L, \tilde{\nu}_e)$

- Selectrons with neutralino

(e.g. 300 GeV selectron + 301 GeV Bino)

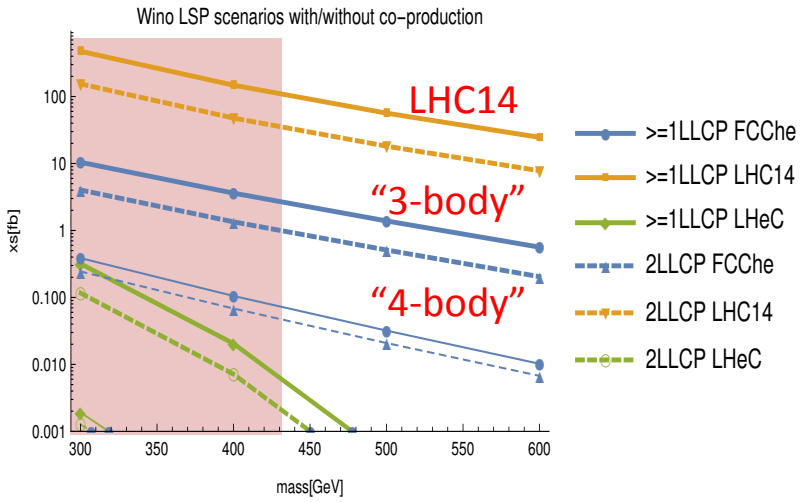
$(\tilde{e}_R)$ (χ_1^0)

SUSY

Searches for disappearing tracks: LLCP with *cτ* >~ 10mm [long-lived charged particles]

Nominal cross section without acceptance / efficiency

Charginos (Wino LSP)



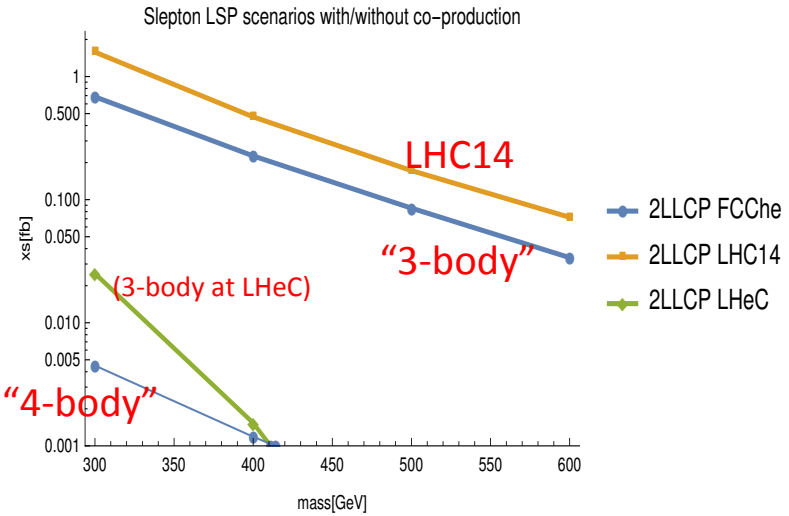
With no polarization.

Shaded region is excluded by ATLAS (13TeV, 36/fb)

FCC-he "3-body" process assumes

$$m_{\tilde{e}_{\mathrm{L}}} = m_{\tilde{\chi}_1^0} + 9 \text{ GeV}$$

Sleptons



With no polarization.

FCC-he "3-body" process assumes

$$m_{\tilde{\chi}_1^0} = m_{\tilde{e}} + 1 \text{ GeV}$$

SUSY

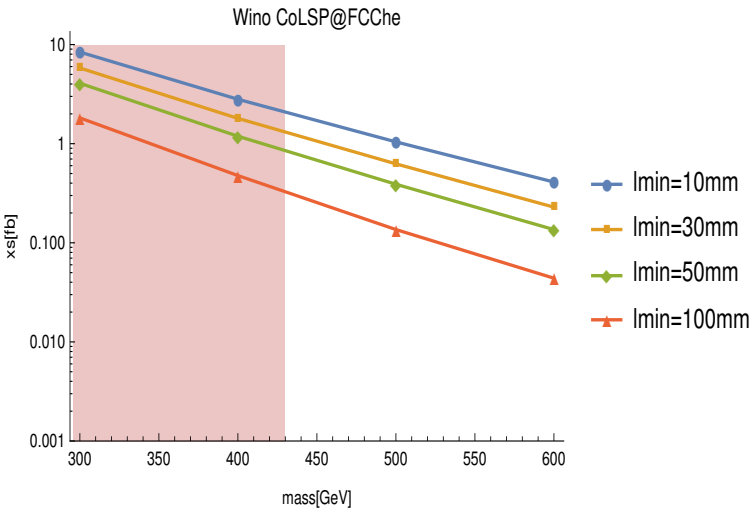
Searches for disappearing tracks: LLCP with *cτ* >~ 10mm [long-lived charged particles]

Simple efficiency analysis

$$\epsilon_{\mathrm{LLCP}} = \begin{cases} 1 & \text{if } l_{\mathrm{T}} > \{10,\ 30,\ 50,\ 100\}\mathrm{mm} \\ 0 & \text{otherwise} \end{cases}$$

:= minimal detection length lmin

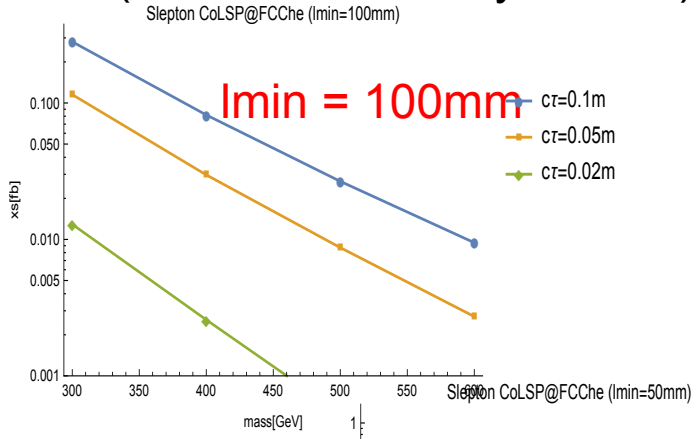
Charginos (Wino LSP) w/ selectron (enhanced “3-body” model)

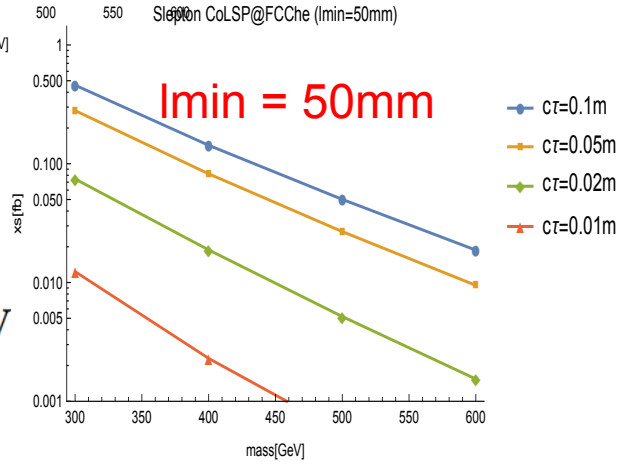


With no polarization;

$m_{\tilde{e}_{\mathrm{L}}} = m_{\tilde{\chi}_1^0} + 9$ GeV

Sleptons w/ bino (enhanced “3-body” model)



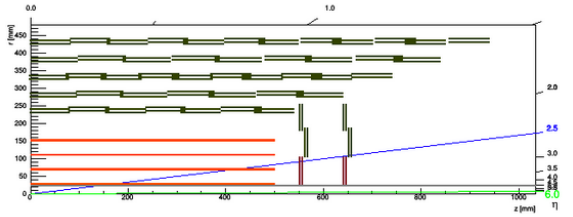


With no polarization;

$m_{\tilde{\chi}_1^0} = m_{\tilde{e}} + 1\,\mathrm{GeV}$

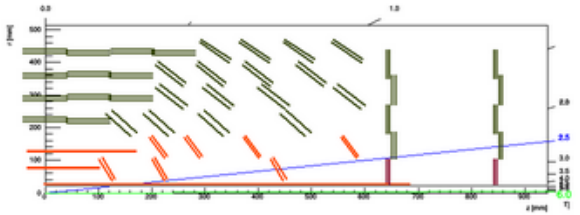
SUSY

Searches for disappearing tracks: LLCP with *cτ* >~ 10mm [long-lived charged particles]



TODO / improvements?

- More realistic tracker design (using the design provided by Peter Kostka)
  - the results won't be very different.
  - anyway **Sho will do this.**



- SM/detector background?
  - … not easy because
    - the BKGD will mainly from detector effect.
    - no running EP-collider to rescale.
  - → **not to do**

- **Any other improvements?**
  - maybe with Ee=100GeV as well?
  - **POLARIZATION!!! what values should I use?**