DM Searches with Disappearing Tracks

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SPRACE
The Long-Lived World

- neutral
- charged
- any charge

- displaced dilepton
- displaced lepton
- displaced photon
- displaced dijet
- displaced vertex
- displaced conversion
- HSCP

Not pictured:
- out of time decays
Recasting Searches (FIMP model)

From 1811.05478
Modus Operandi

Models

- Feebly Interacting Dark Matter
  - DM mass as low as 12 keV
  - Charged partner mass ~ 500 GeV
- Inert Doublet Model
  - DM and charged partner mass ~ 500 GeV
  - $\Delta M = 200$ MeV

Machinery

- CalcHEP 3.7.6
- Pythia 8.235
FIMP model

MET [GeV]

p_T [GeV]
FIMP model

TOF*{c [mm]}

Nominal TOF*{c [mm]}
IDM model

MET [GeV]

$p_T$ [GeV]
IDM model

TOF*c [mm]

Nominal TOF*c [mm]
Real Signal Generation (in CMS)

Pythia6, decay in Geant4 (used in the CMS 13 TeV 38.4/fb result)
- But Pythia6 is EOL

Pythia8, decay in Pythia8
- Do not use “isResonance=false” method
- Add 100 MeV to chargino masses instead

Pythia8, decay in Pythia8
- Use “isResonance=false” method as recommended

Pythia8, decay in Geant4
- Needed bugfix in our Geant4 version