

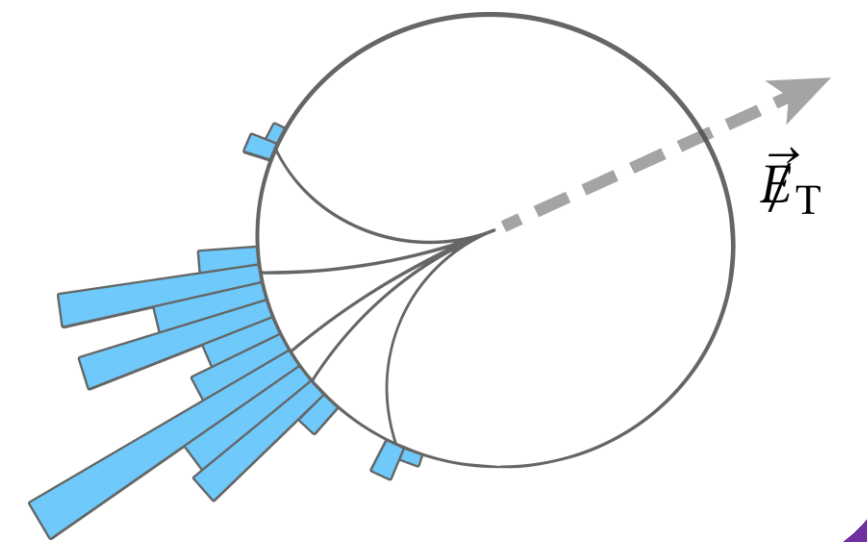
SModelS : An LHC new physics tool - Development towards general signatures beyond missing energy

What is SModelS?

An open source software tool to compare Z2-conserving new physics models to LHC simplified model results

- It evaluates current SUSY searches (Is your theory already excluded?)
- It identifies blind spots in parameter space

Originally limited to MET signatures



Theory

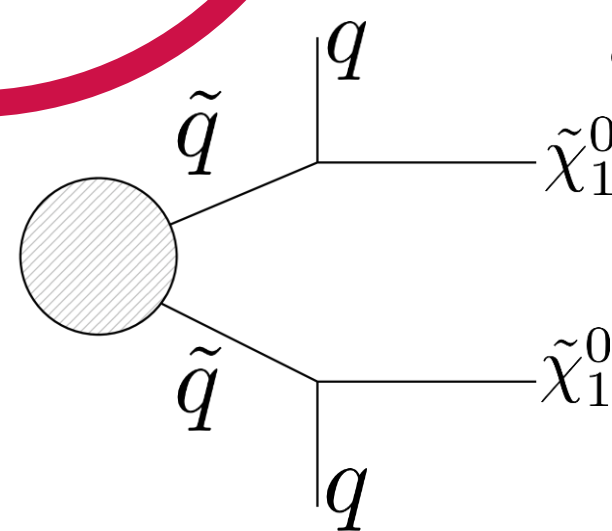
Input theory file provides:

- Production cross sections $\sigma(pp \rightarrow \tilde{q}\tilde{q})$ at 13 TeV
- Masses of new particles $m_{\tilde{q}}, m_{\tilde{\chi}_1^0}$
- Decays of new particles $\tilde{q} \rightarrow q\tilde{\chi}_1^0$ $BR(\tilde{q} \rightarrow q\tilde{\chi}_1^0)$

→ Produce the decay with cross section:

$$\sigma_{th} = \sigma(pp \rightarrow \tilde{q}\tilde{q}) \times BR(\tilde{q} \rightarrow q\tilde{\chi}_1^0)^2$$

How does it work?



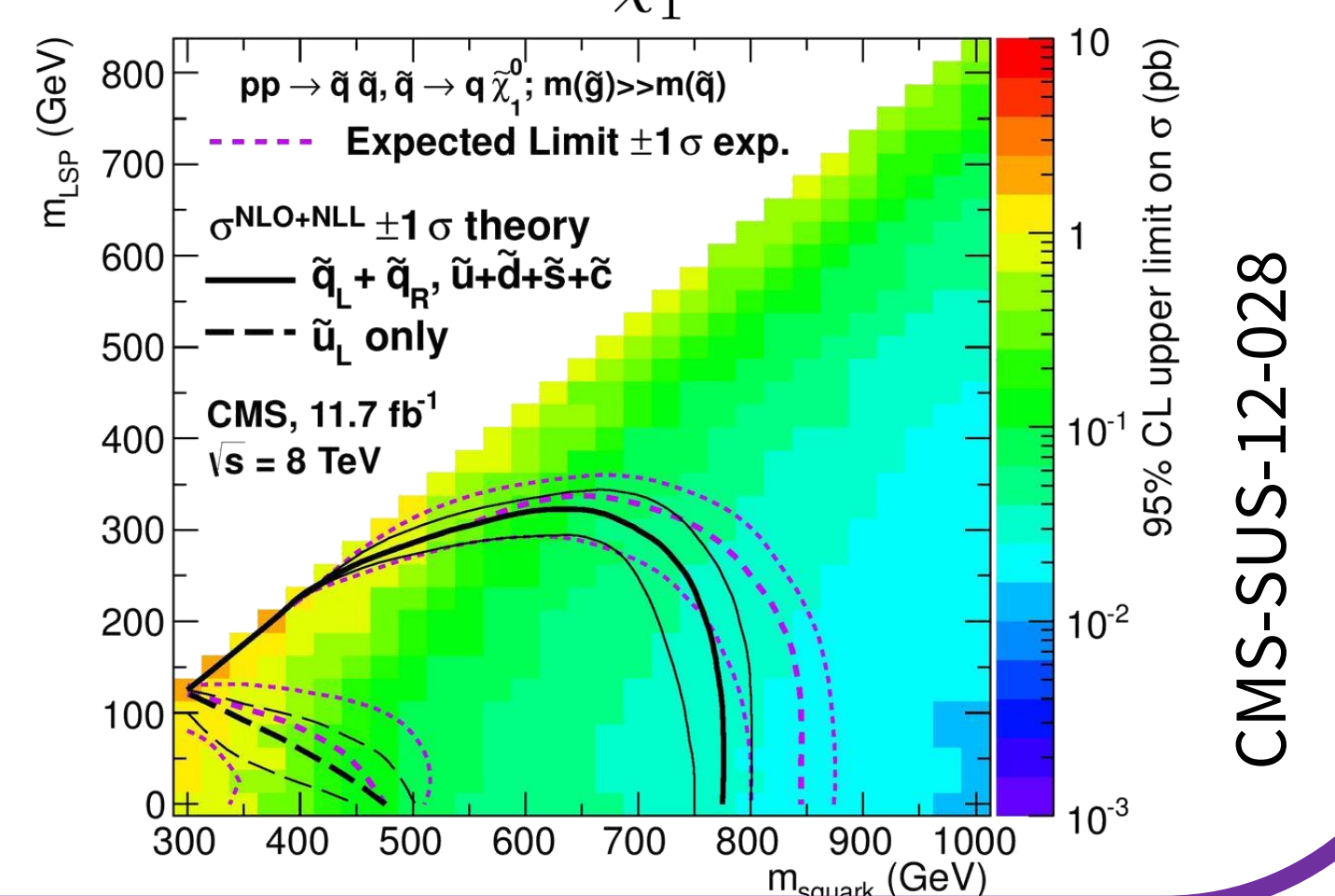
Conclusion:

$\sigma_{th} > \sigma_{UL}$: excluded
 $\sigma_{th} < \sigma_{UL}$: allowed

Experiment

Simplified Model results:

- Reduced number of BSM particles and decays, assuming 100% BR
- 95% C.L. Upper Limit maps on $\sigma \times BR$ as function of masses of BSM particles
- Read of $\sigma_{UL}(m_{\tilde{q}}, m_{\tilde{\chi}_1^0})$



Signatures beyond missing energy

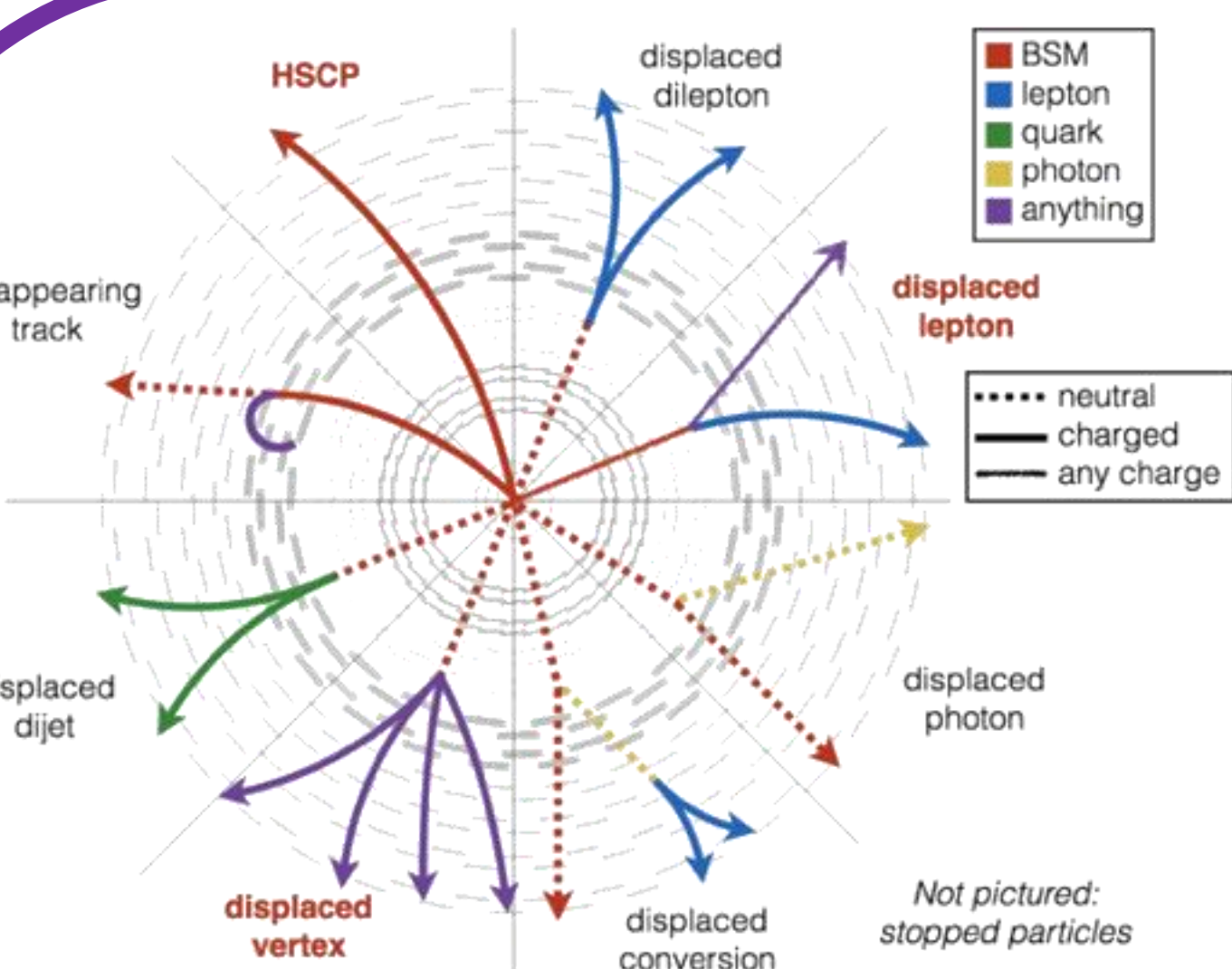
- No excess in MET final states, many BSM models featuring other signatures
- Necessary to keep track of quantum numbers, life times and masses of BSM particles → particle class
- Latest SModelS release already introduced heavy stable charged particle (HSCP) results

What is coming up?

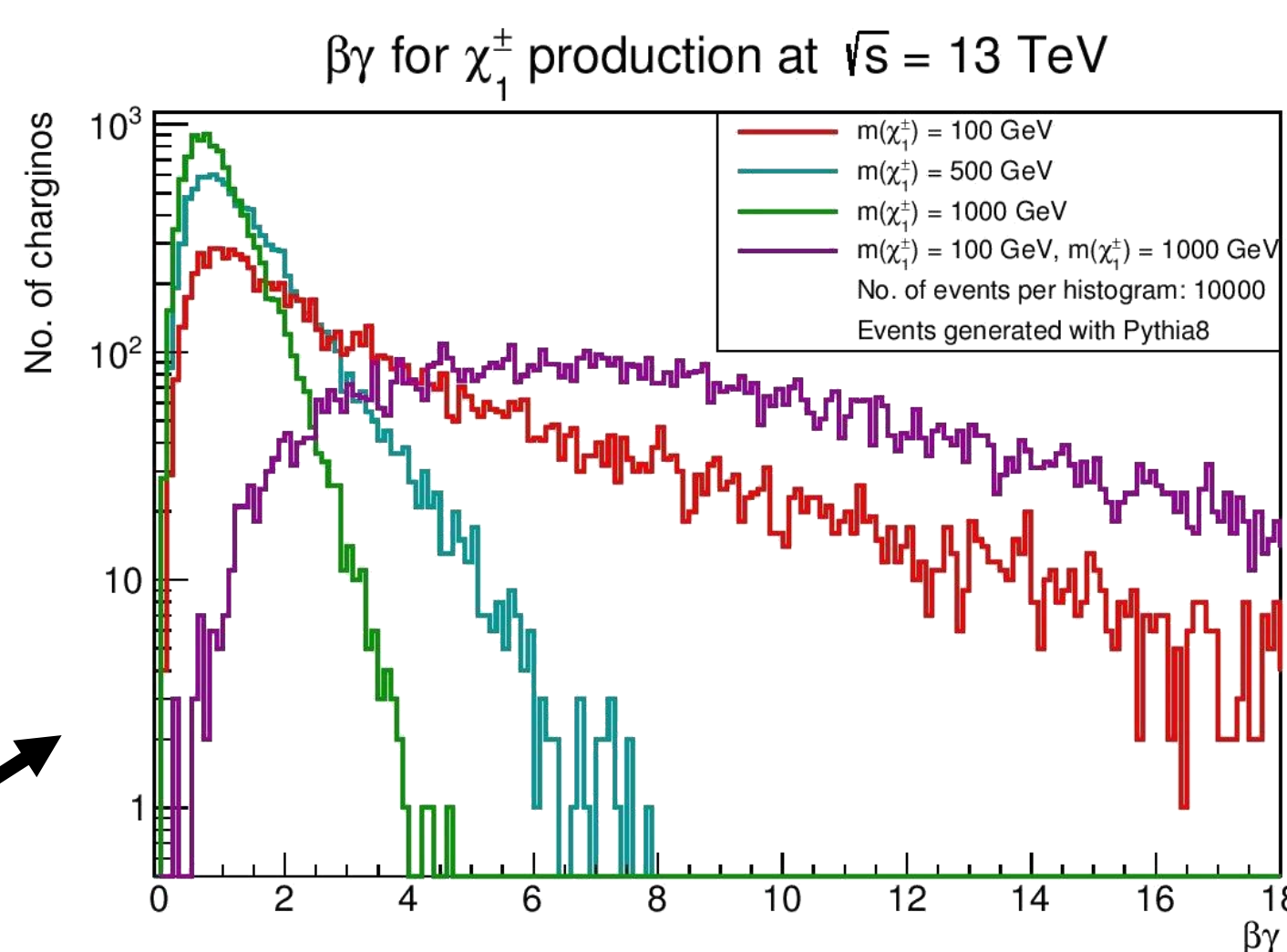
Particle class:

```
neutralino1 = Particle(
    Z2parity='odd',
    label='N1',
    pdg=1000022,
    eCharge=0,
    colordim=1,
    spin=1./2)
```

Mass, decay width and decays added from input file; for SM particles hard coded



- Every particle (with non-zero width) has probability to survive a certain distance $F = \exp(-\Gamma \frac{l}{\beta\gamma\hbar c})$
- Theory cross sections have to be rescaled with this F
- $\beta\gamma$ dependent on mass and production mechanism



→ Introduce an additional map for each result holding information on F as function of masses and life times