

# CERN Summer Student Programme 2011

## Light Neutralino SUSY Scenarios

From Direct Dark Matters Searches to the LHC

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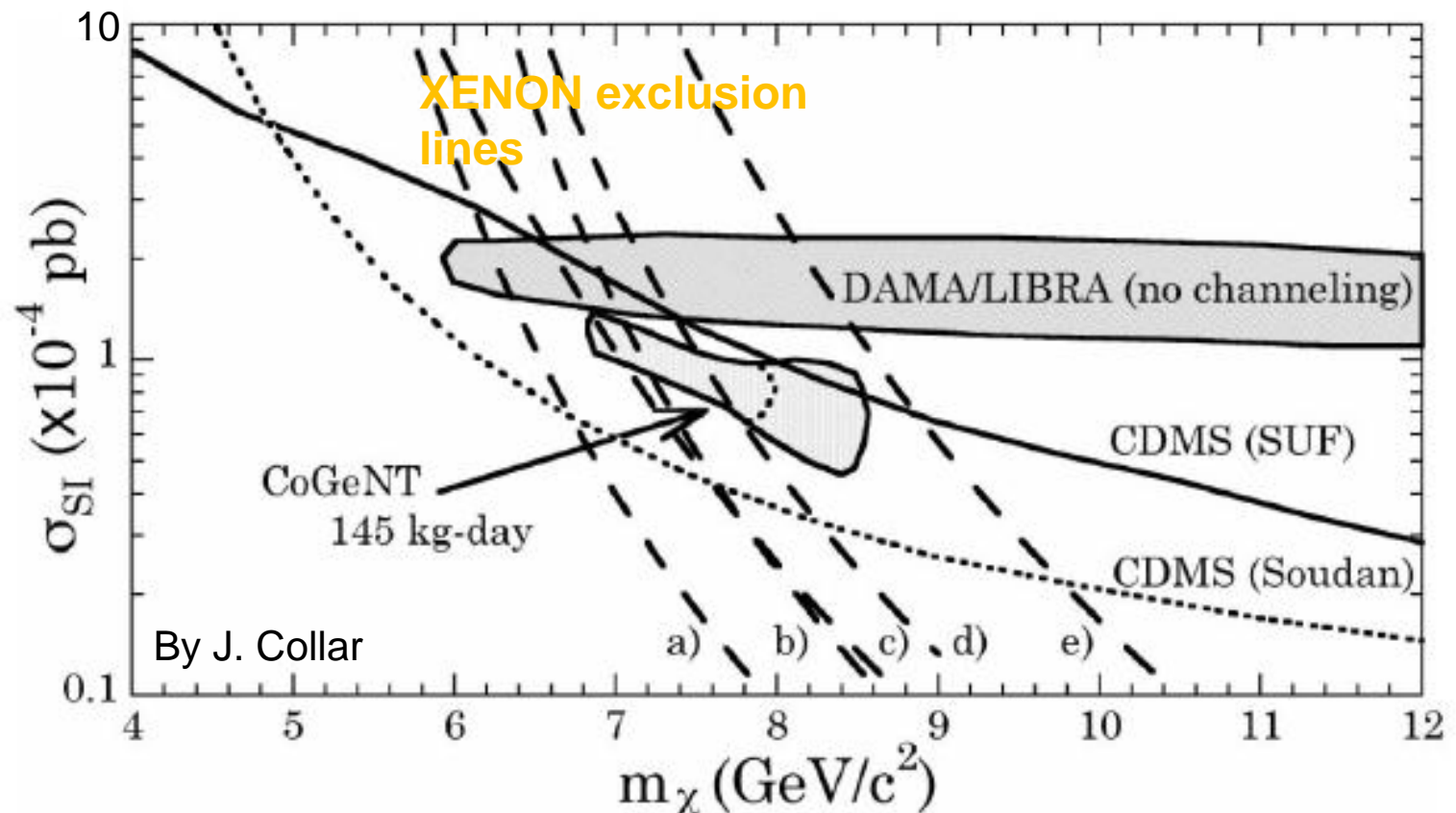
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# SUSY Dark Matter

- > Dark matter particles are stable
- > New conserved quantum number
- > MSSM has a  $\mathbb{Z}_2$  symmetry called R-parity  $P_R$
- >  $P_R$  is multiplicative. For sparticles  $P_R = -1$ ; for particles  $P_R = 1$
- > If R-parity is conserved the lightest SUSY particle (LSP) is stable
- > LSP are produced in pairs in colliders
- > Heavier SUSY particles decay to the LSP
- > We study scenarios with lightest neutralino  $\tilde{\chi}_1^0$  LSP
- > Is the LHC (CMS) sensitive to these scenarios?

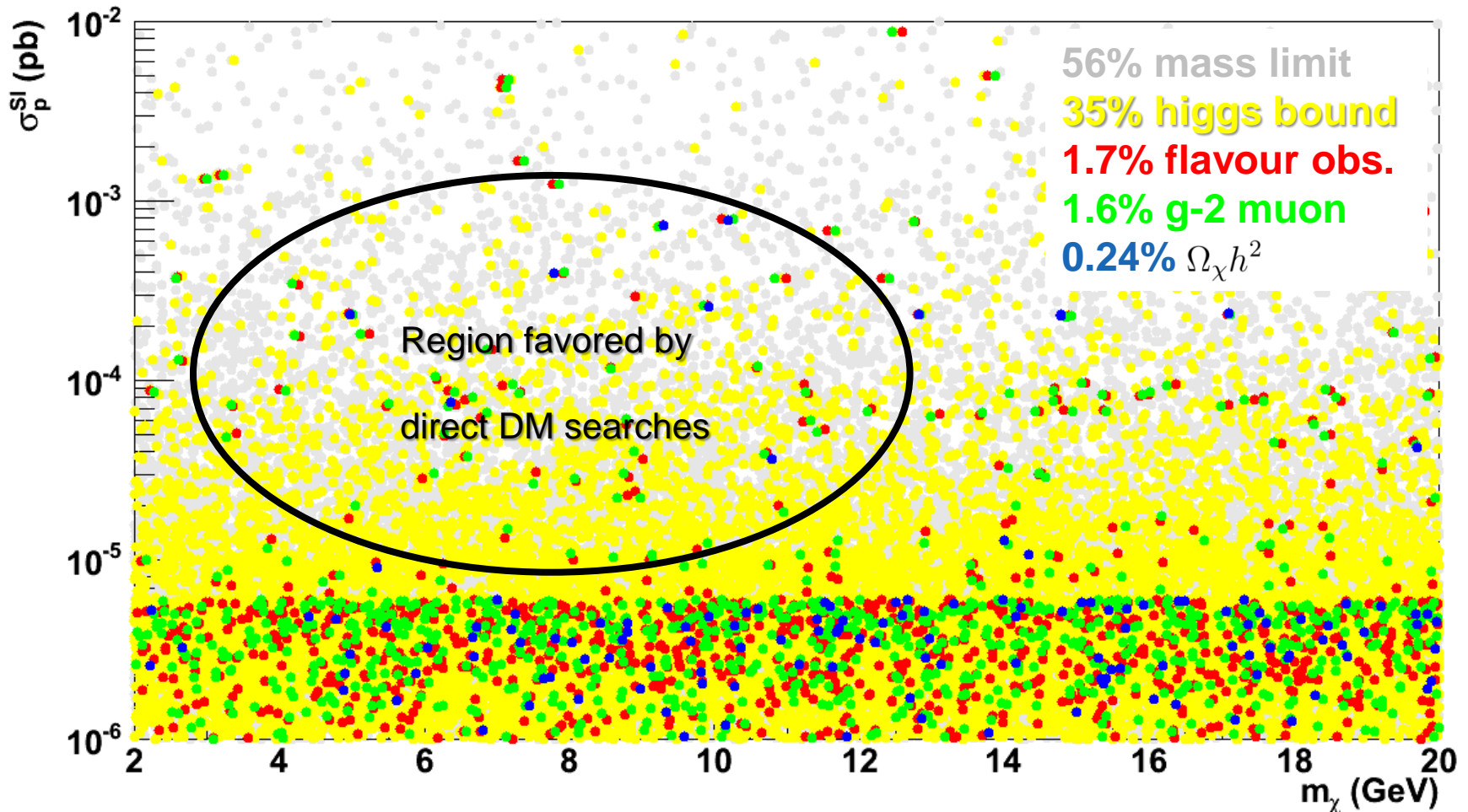
# Direct Dark Matter Searches

- > A WIMP with mass = 6 – 10 GeV and  $\sigma_p^{\text{SI}} \sim 10^{-4}$  pb is consistent with data from DAMA/LIBRA and CoGeNT
- > We study scenarios with  $m_{\tilde{\chi}_1^0} < 20\text{GeV}$



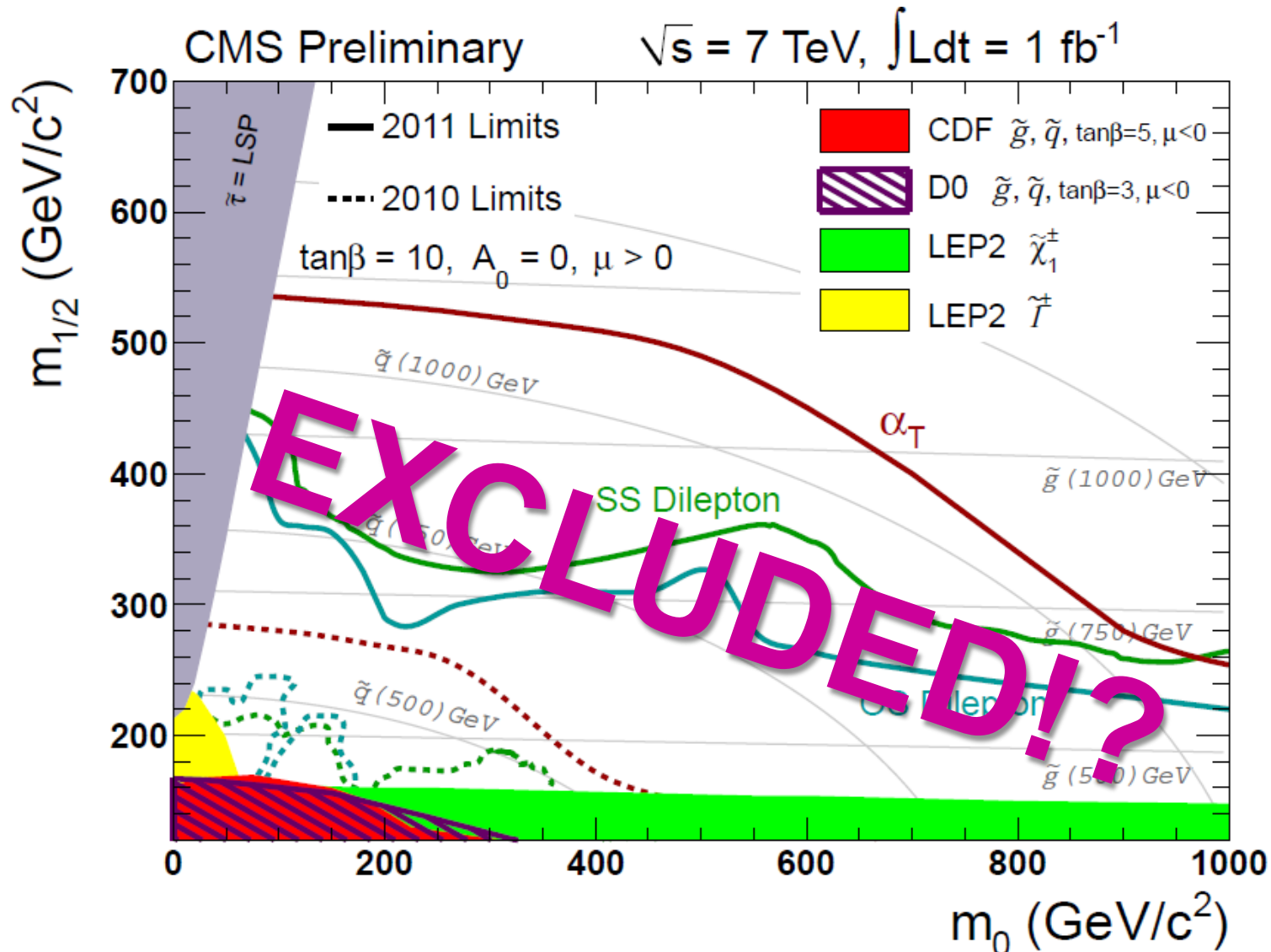
# Methodology

- The 19 free parameters in MSSM are varied randomly
- 58k with points  $m_{\tilde{\chi}_1^0} < 20\text{GeV}$  and  $\sigma_p^{\text{SI}} > 10^{-6}$  pb have been considered in our analysis

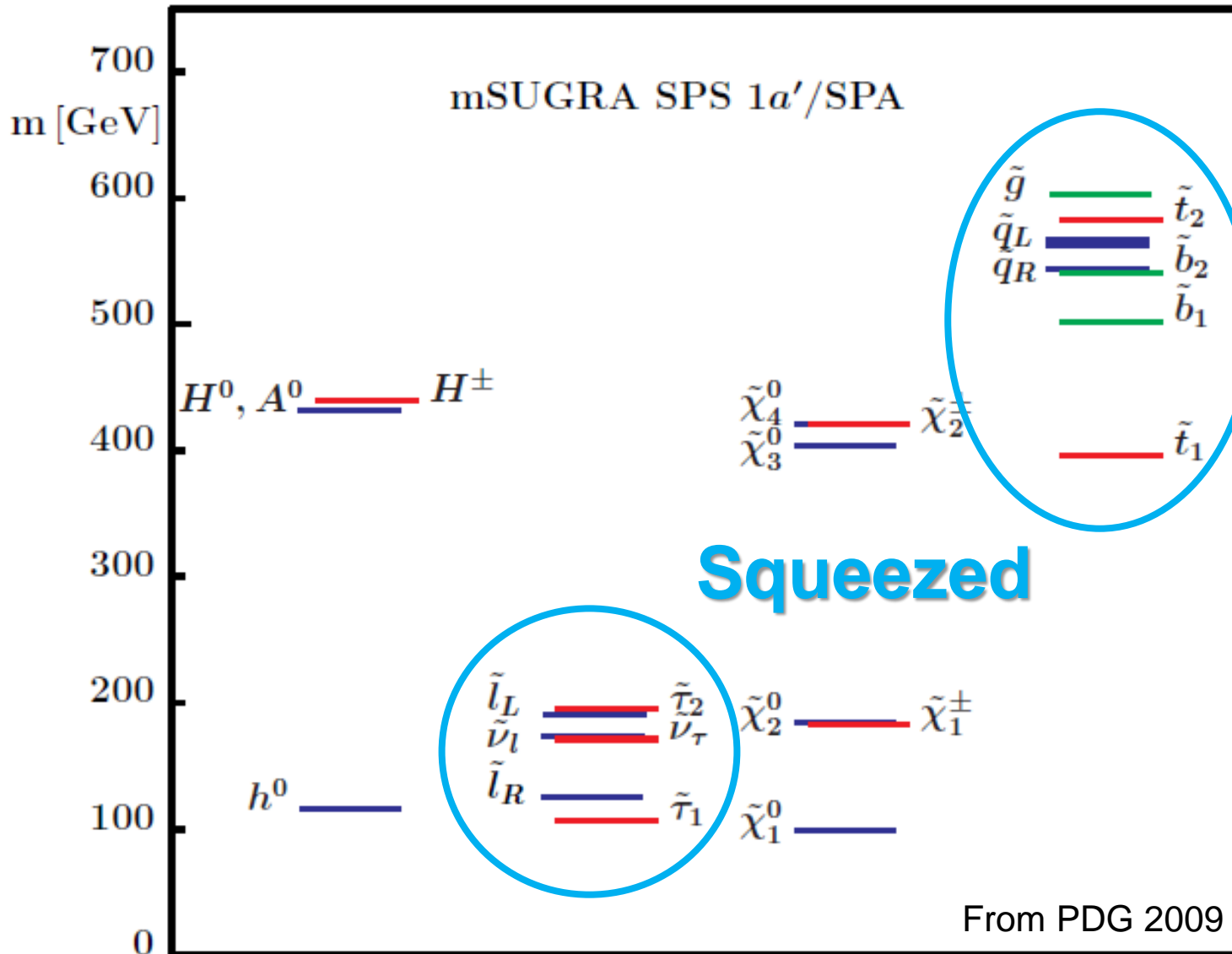


# By the way this does not apply to us...

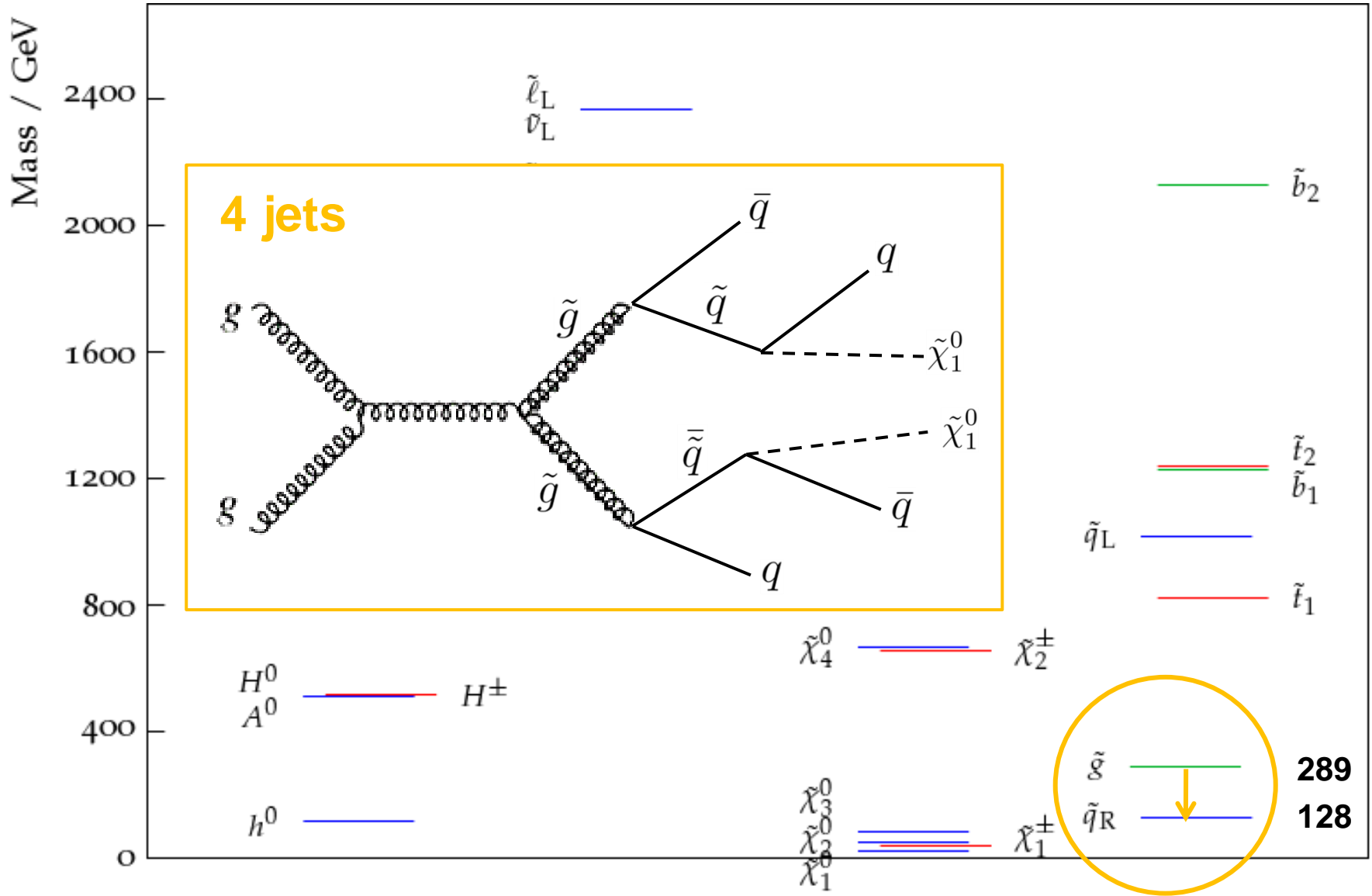
“Observed limits from several 2011 CMS SUSY searches plotted in the **CMSSM** ( $m_0, m_{1/2}$ ) plane”



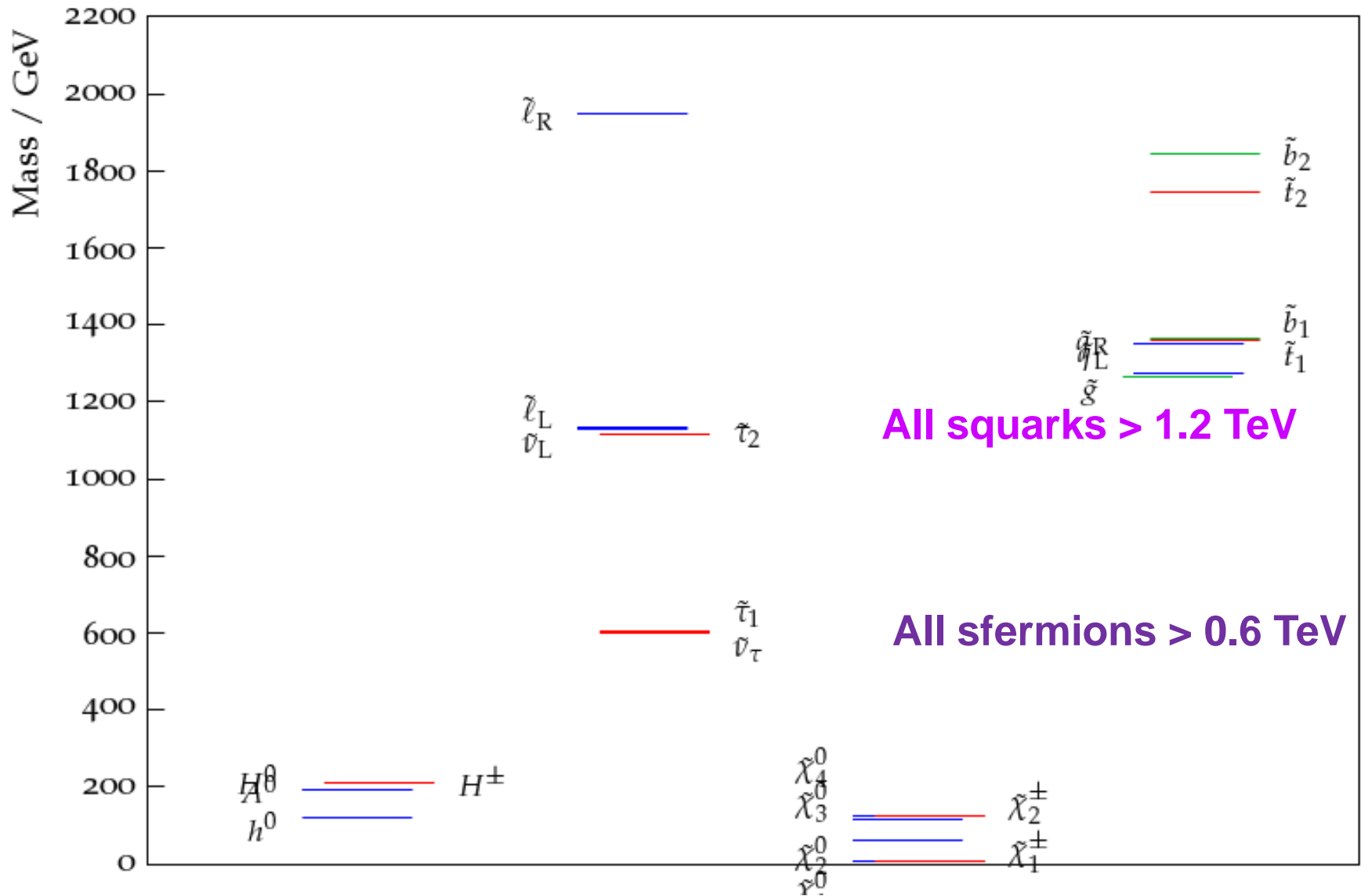
# A typical CMSSM Spectrum



# Case 1: Easily probed by the LHC

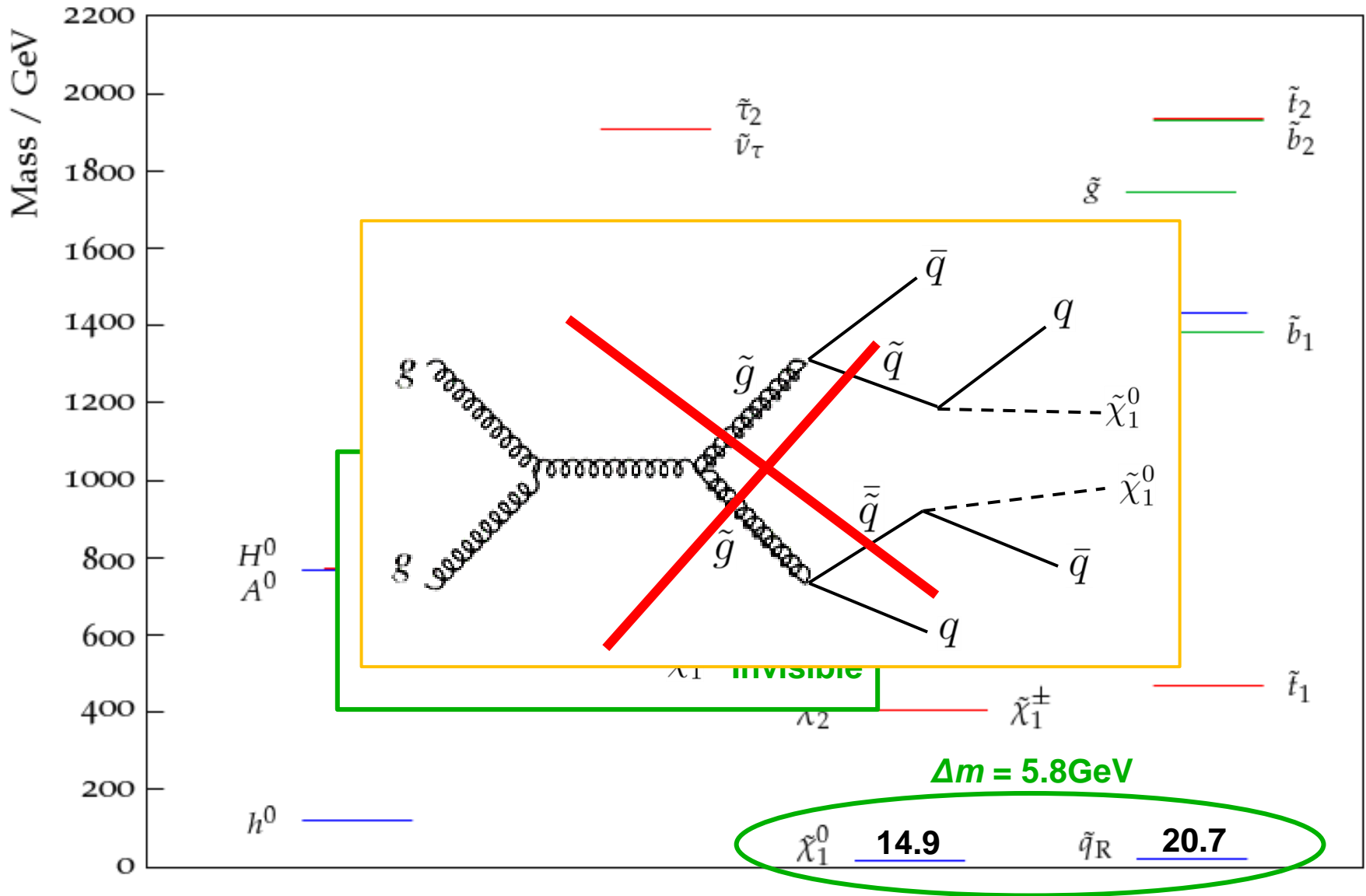


# Case 2: Need some more time...



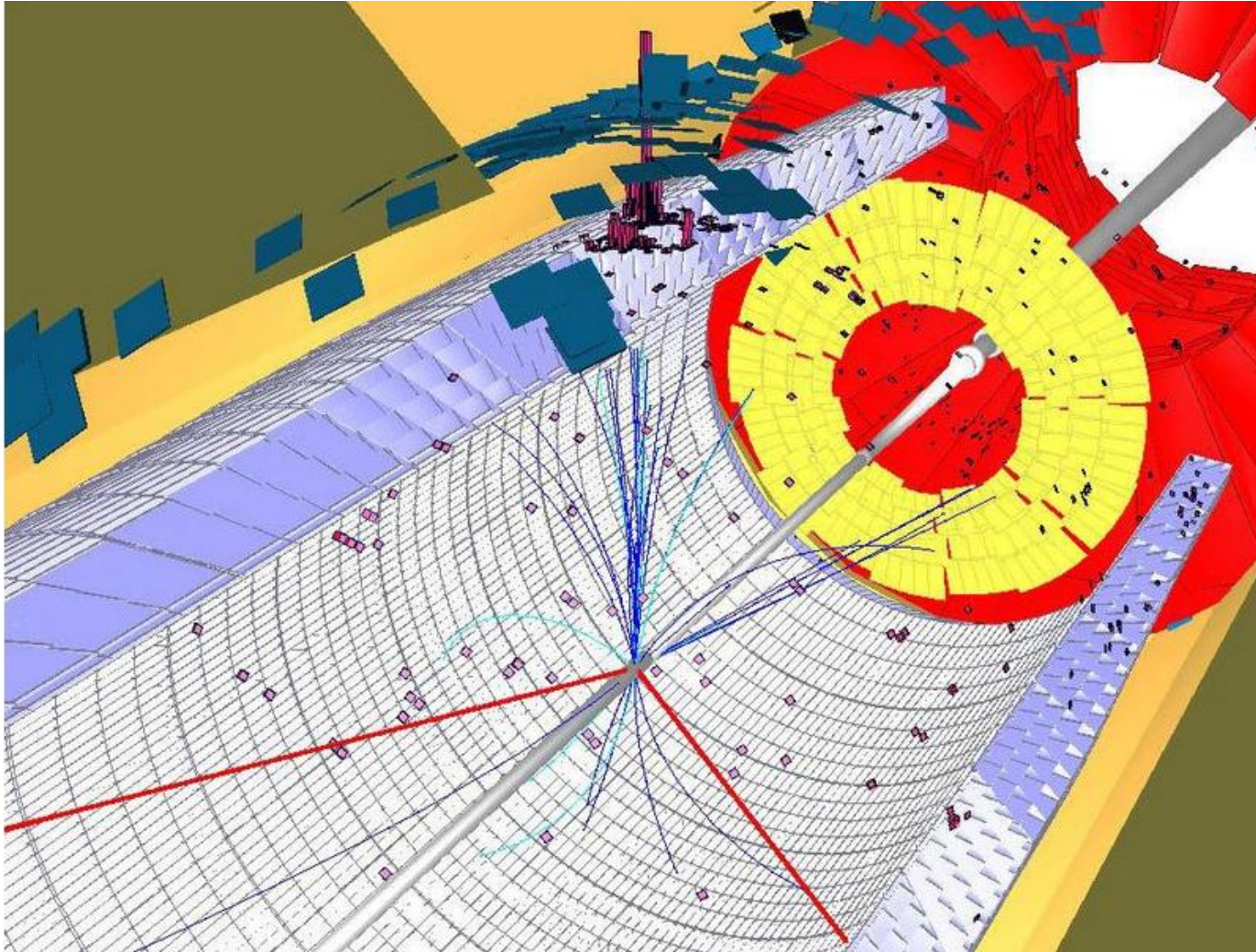


# Case 3: LHC insensitive??



# What's next?

- Currently running a full simulation on CMS



# Thank you!

