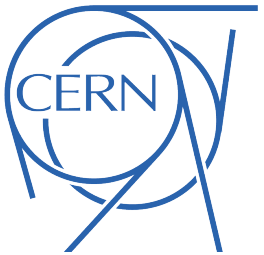
Interplay of flavour and collider physics in the hunt for new physics

Monika Blanke



Les Houches Theory Group Retreat

November 6, 2013

One more member of the BSM group

Andreas Crivellin

Marie Curie fellow at CERN from 01/2014

My research focus

Interplay between flavour and collider physics

high energy frontier
direct searches for new physics in high-p_T collisions
ATLAS, CMS

high precision frontier
flavour and CP violating decays of quarks and leptons
LHCb, Belle-II, NA62, MEG...

Connections? Correlations?

Flavour violation and top squark phenomenology

- electroweak naturalness requires top partners (SUSY: stops) below the TeV scale
- no excess in the data found so far
- constraint on stop mass depends on decay channel of stop
- bounds generically in the range $m_{\tilde{t}} \gtrsim 600 - 700\,\text{GeV}$

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Flavour violation and top squark phenomenology

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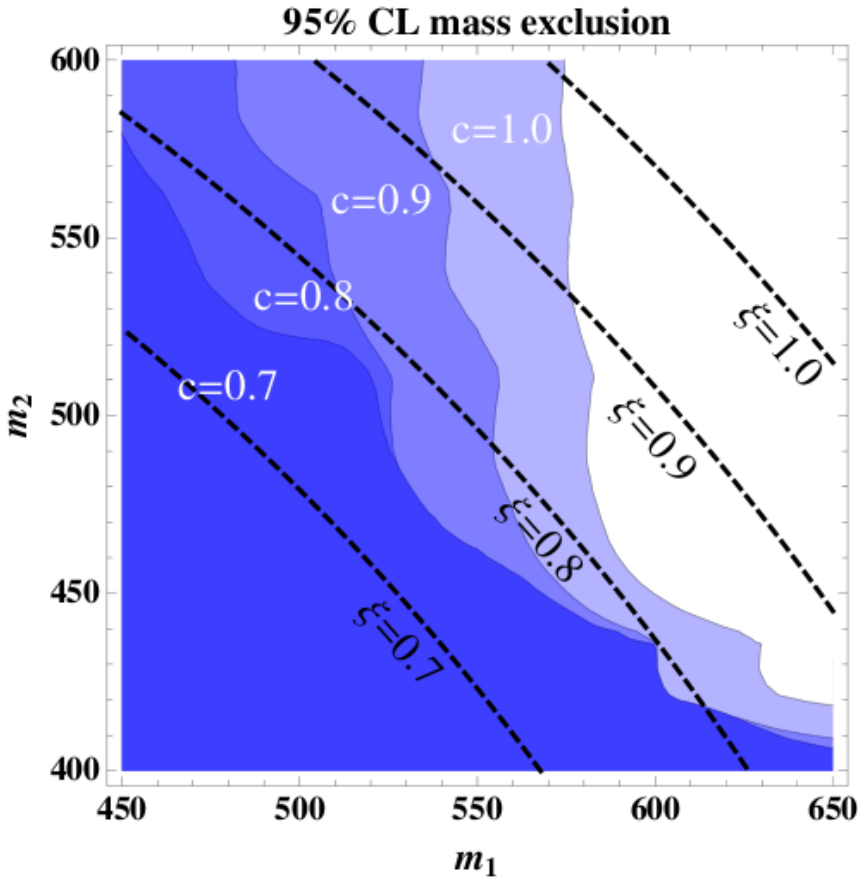
Goal: "hide" stops in the less constrained jets $+ \not{E}_T$ channel

Large flavour mixing between stop and scharm

- induces decay $\tilde{t} \to c + \tilde{\chi}_1^0$
- suppresses $t\bar{t} + \not{E}_T$ signal

MB, Giudice, Paradisi, Perez, Zupan (2013)

Estimated bounds on the mixed stop-scharm masses



m_1 : stop-like mass
m_2 : scharm-like mass

naturalness parameter

$$\xi = \frac{c^2 m_1^2 + s^2 m_2^2}{m^2_{\tilde{t},\text{exp}}}$$

measures contribution to Δm^2_{Hu}

effects of stop-scharm mixing

- mass of stop-like state can be lowered significantly
- $\xi < 1$ – mild improvement of naturalness

MB, Giudice, Paradisi, Perez, Zupan (2013)

Work in progress...

1. **How does squark flavour mixing affect gluino decays and the corresponding bounds?**

   with B.Fuks, I.Galon, G.Perez

2. **Can we measure CP violation in stop decays?**

   with A.Kagan, J.Zupan

3. **What is the impact of flavour violating interactions on the LHC phenomenology of composite models?**

   with C.Delaunay, A.Martin, G.Perez

4. ...?

Recent publications

1. **Flavoured Naturalness**, M. Blanke, G. F. Giudice, P. Paradisi, G. Perez and J. Zupan, JHEP 1306 (2013) 022 [arXiv:1302.7232 [hep-ph]].

2. **Momentum asymmetries as CP violating observables**, J. Berger, M. Blanke, Y. Grossman and S. Ray, JHEP 1210 (2012) 181 [arXiv:1206.1651 [hep-ph]].

3. **The Birds and the Bs in RS: The $b \to s\gamma$ penguin in a warped extra dimension**, M. Blanke, B. Shakya, P. Tanedo and Y. Tsai, JHEP 1208 (2012) 038 [arXiv:1203.6650 [hep-ph]].

4. **$\Delta F = 2$ observables and $B \to X_q\gamma$ decays in the Left-Right model: Higgs particles striking back**, M. Blanke, A. J. Buras, K. Gemmler and T. Heidsieck, JHEP 1203 (2012) 024 [arXiv:1111.5014 [hep-ph]].