WG2: missing energy signatures

Introduction to parallel sessions
and countdown for the report

Motivation

The LHC has been built

- to discover the Higgs

  → mechanism of electroweak symmetry breaking

- to discover new physics BSM

  → stabilization of the electroweak scale

  [connection with dark matter make MET signatures specially interesting]

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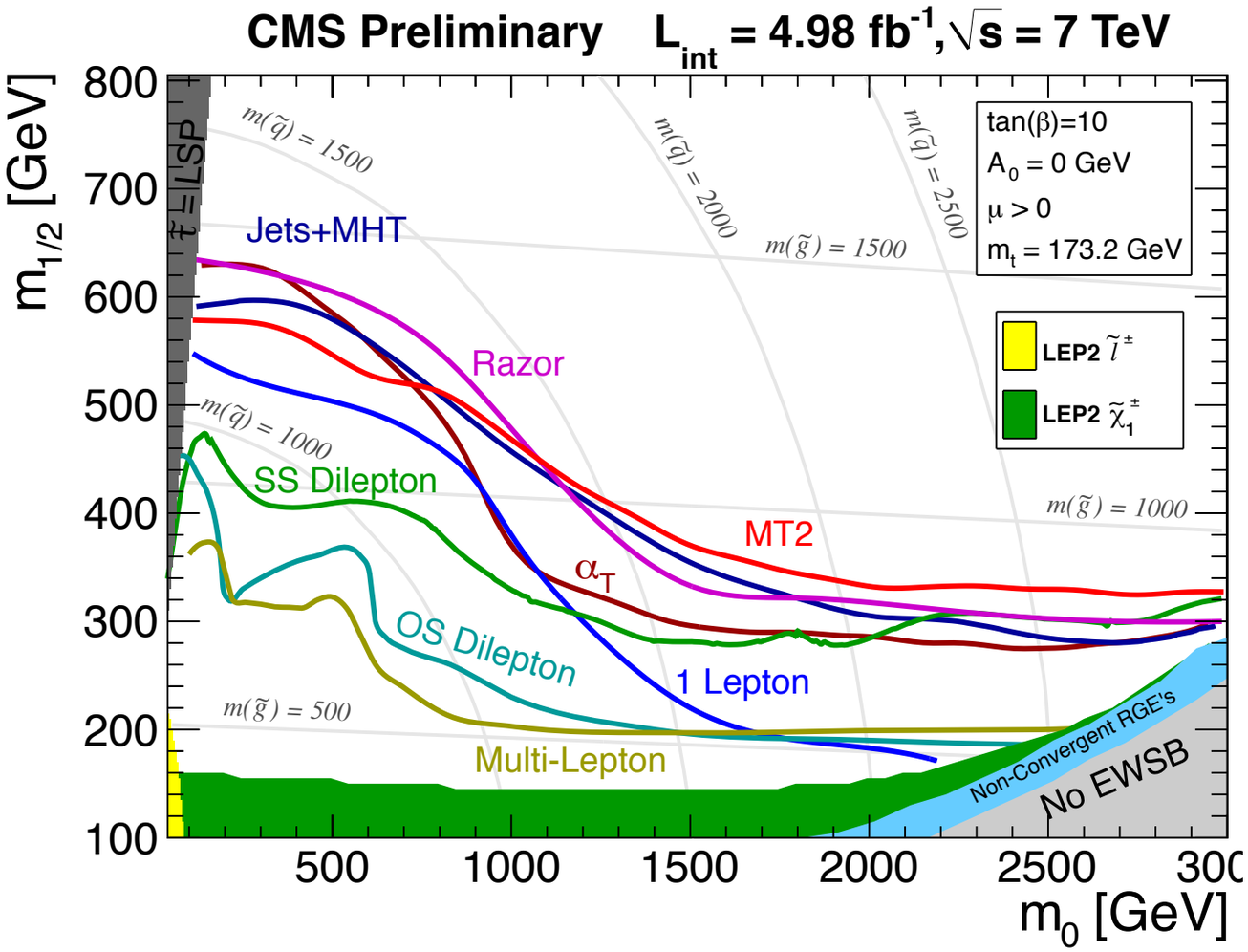
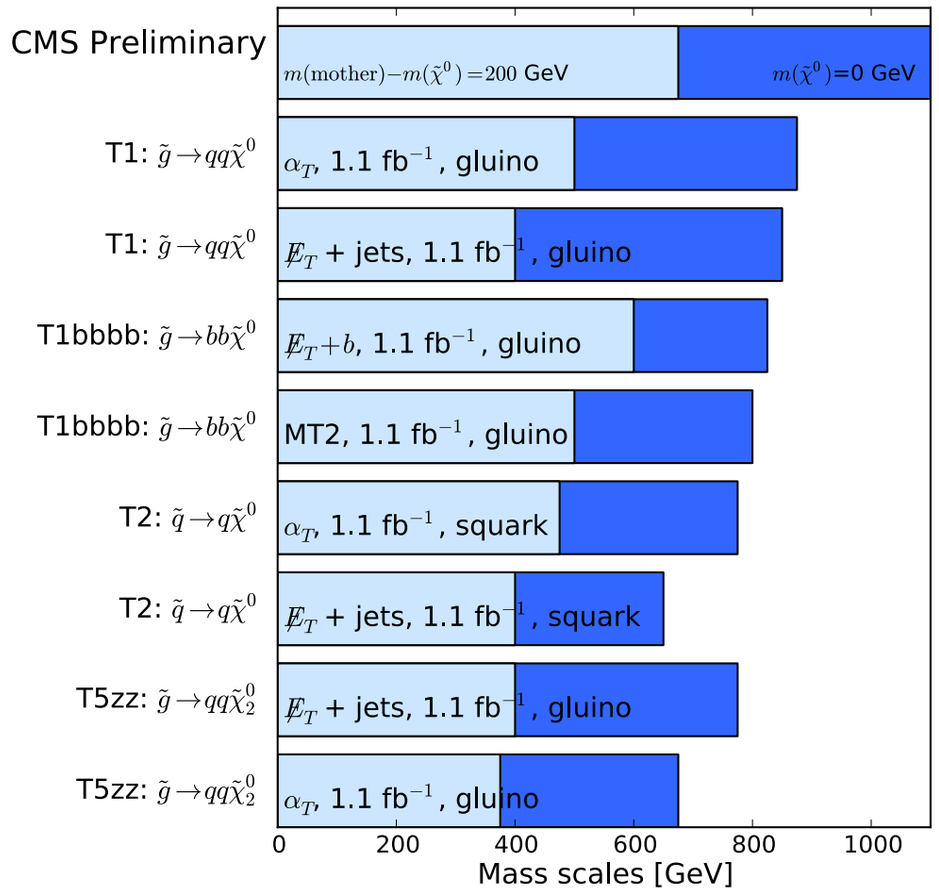
Limits being pushed higher and deeper

into SUSY parameter space





Simplest (constrained) models hard under pressure

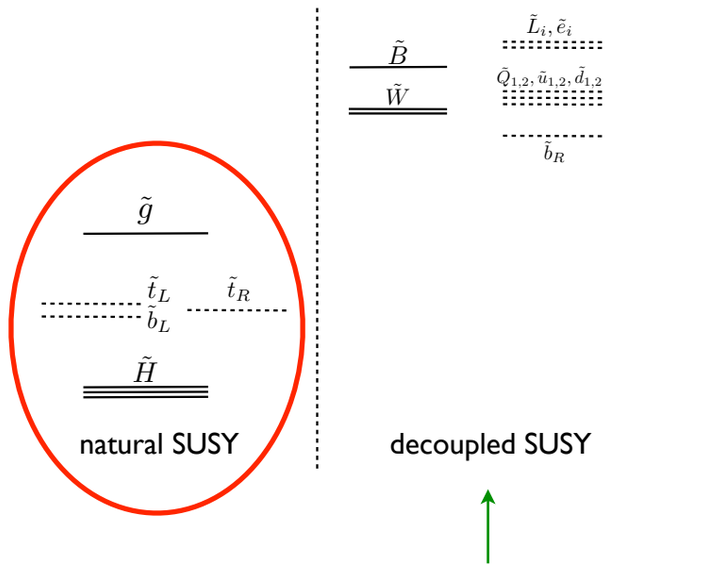
The fact that SUSY has not been discovered so far leaves us with **two options** [G.F. Giudice]

- ➡ SUSY is natural but not plain vanilla
- ➡ SUSY solves only the big hierarchy but not the "little" one

Light stops
(and somewhat light gluino)

$$-\frac{m_Z^2}{2} = |\mu|^2 + m_{H_u}^2$$

Light higgsinos



heavy 1st/2nd generation
preferred by flavour physics

Focus of the parallel sessions

- "Not plain vanilla": phenomenological/general MSSM

  this afternoon

- Dark matter connection, monojets and related issues

  Monday 11:00-13:00

- Natural SUSY and 3rd generation (stops, sbottoms)

  Monday 14:00-16:00

- Mainly EW production, EWK-inos, higgsinos, sleptons

  Monday 16:30-18:00

Questions from ATLAS/CMS

1. Are there regions of the parameter space at low mass that the current analyses are not sensitivity to? Role of taus? Coverage?
2. What is the impact of the latest Higgs results on the various SUSY models? Are there models that have become very unlikely? Can we learn lesson to guide future searches?
3. Prospects for split SUSY?
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6. Can we agree on a minimal list of SMSs/signatures to look at?
   Can we do the same for RPV?
7. Is it recommended to expand on the searches for 'non standard' SUSY?
   (long lived etc)
8. Thinking at the 14TeV data and heavy SUSY particles, can we agree on where and how boosted topologies can help? Which boosted-object topologies should we consider?

Not plain vanilla: go pMSSM

- The pMSSM is a 19-dimensional parametrization of the MSSM that captures most of its phenomenological features. It encompasses and goes beyond a broad range of more constrained SUSY models.

> "The pMSSM leads to a much broader set of predictions for the properties of the SUSY partners as well as for a number of experimental observables than those found in any of the conventional SUSY breaking scenarios such as mSUGRA [CMSSM]. This set of models can easily lead to atypical expectations for SUSY signals at the LHC."

from the conclusions of arXiv:0812.0980
"SUSY without prejudice"

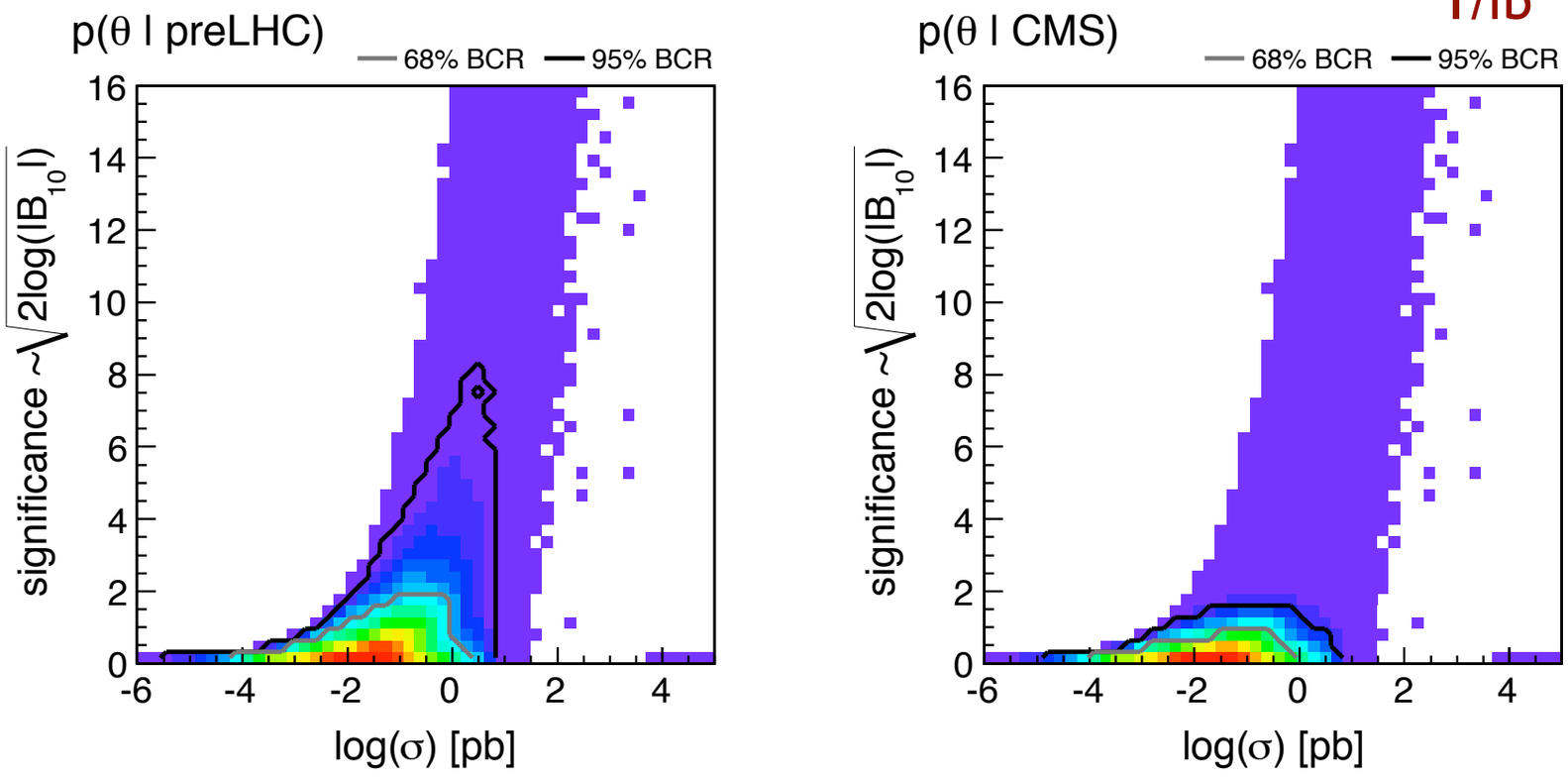
- Parameters defined at the weak scale; minimal assumptions: no new CP phases, flavor-diagonal sfermion mass matrices and trilinear couplings, 1st/2nd generation degenerate and A-terms negligible, lightest neutralino is the LSP.

→ focus of this session

S. Sekmen et al., arXiv:1109.5119

pMSSM

Large cross section ⇔ high signal significance?



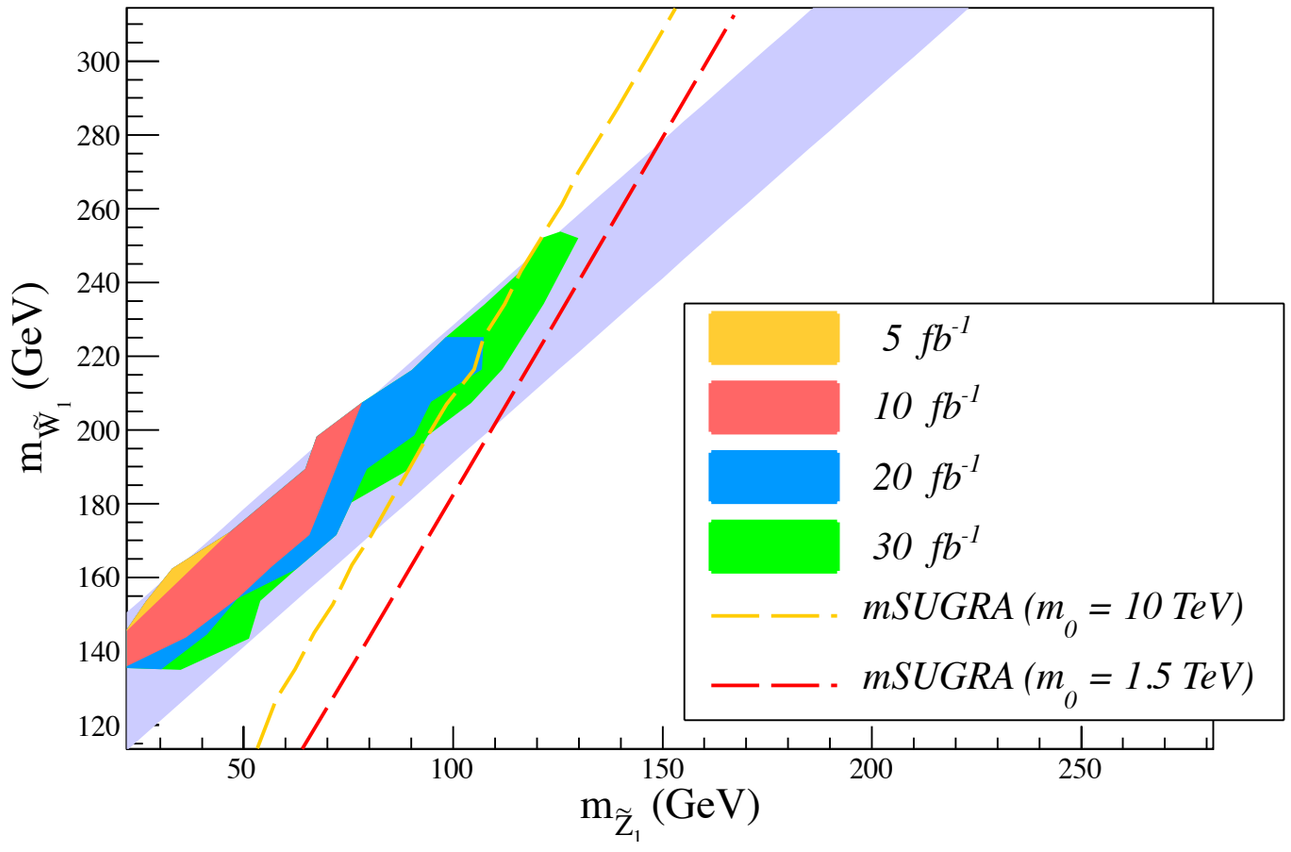
Signal of order 1 pb cross section can have escaped detection!

characteristics of such scenarii: small mass splittings, soft jets, low MET

Need higher energy? Higher luminosity? Can LHC analyses be improved?

Reach for EW-inos in WZ+MET channel

H. Baer et al, arXiv:1201.5382

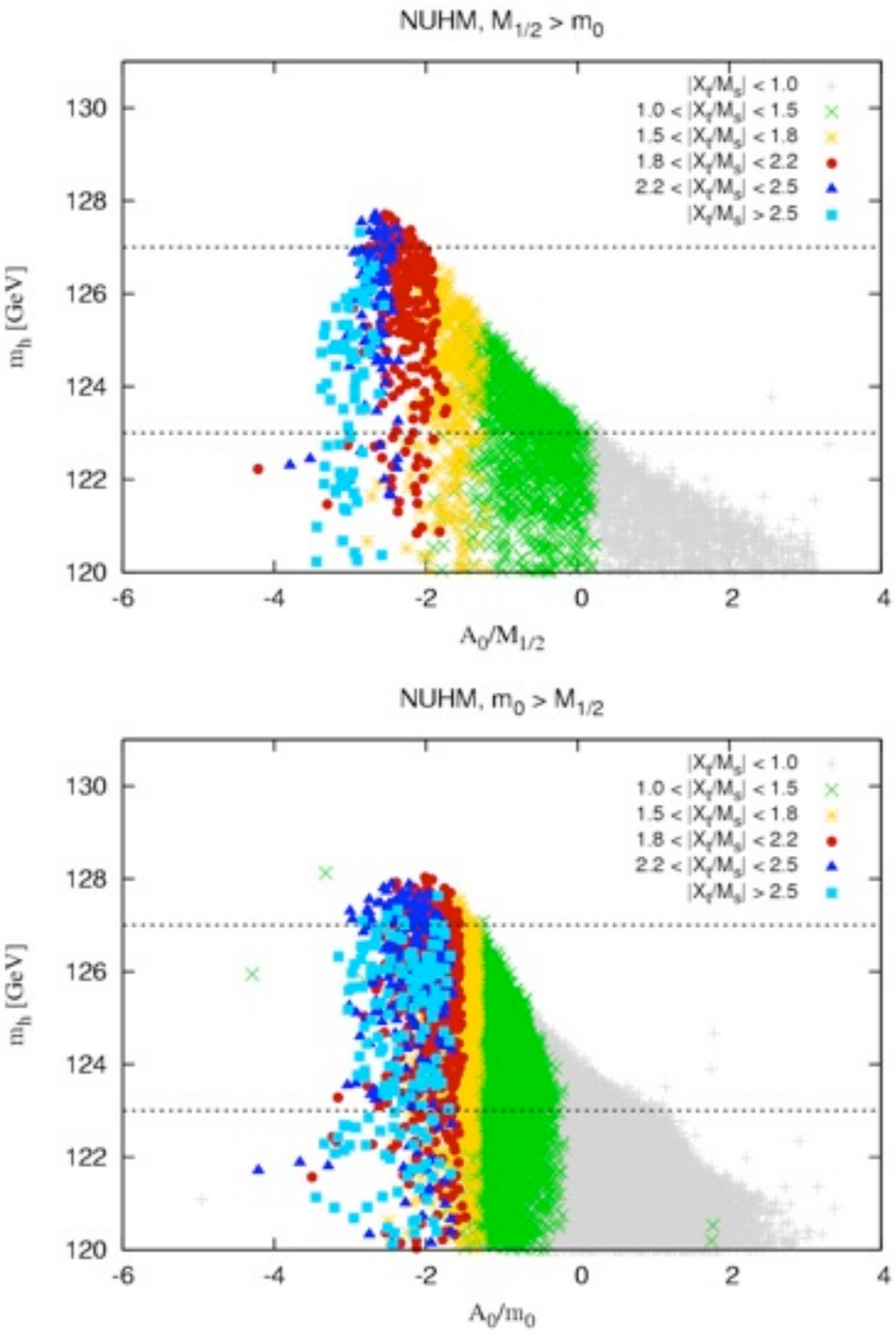


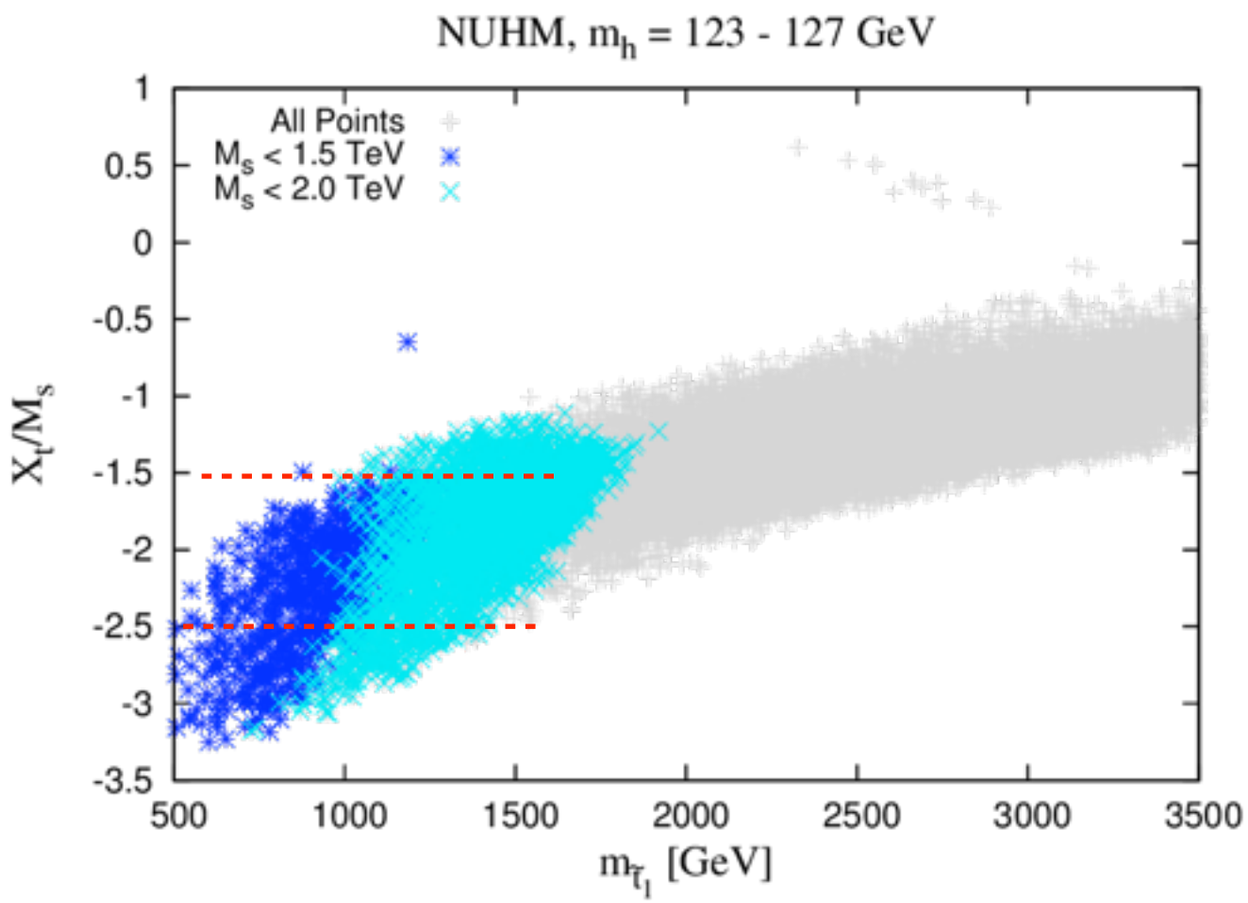
Expect very interesting new ATLAS and CMS results;
should have chargino/neutralino simplified model.

Compressed case and in particular higgsino LSP is however intrinsically difficult.

125 GeV Higgs and natural SUSY

- To reconcile a 125 GeV Higgs in the MSSM with light stops, one typically needs very large A-terms and maximal stop mixing

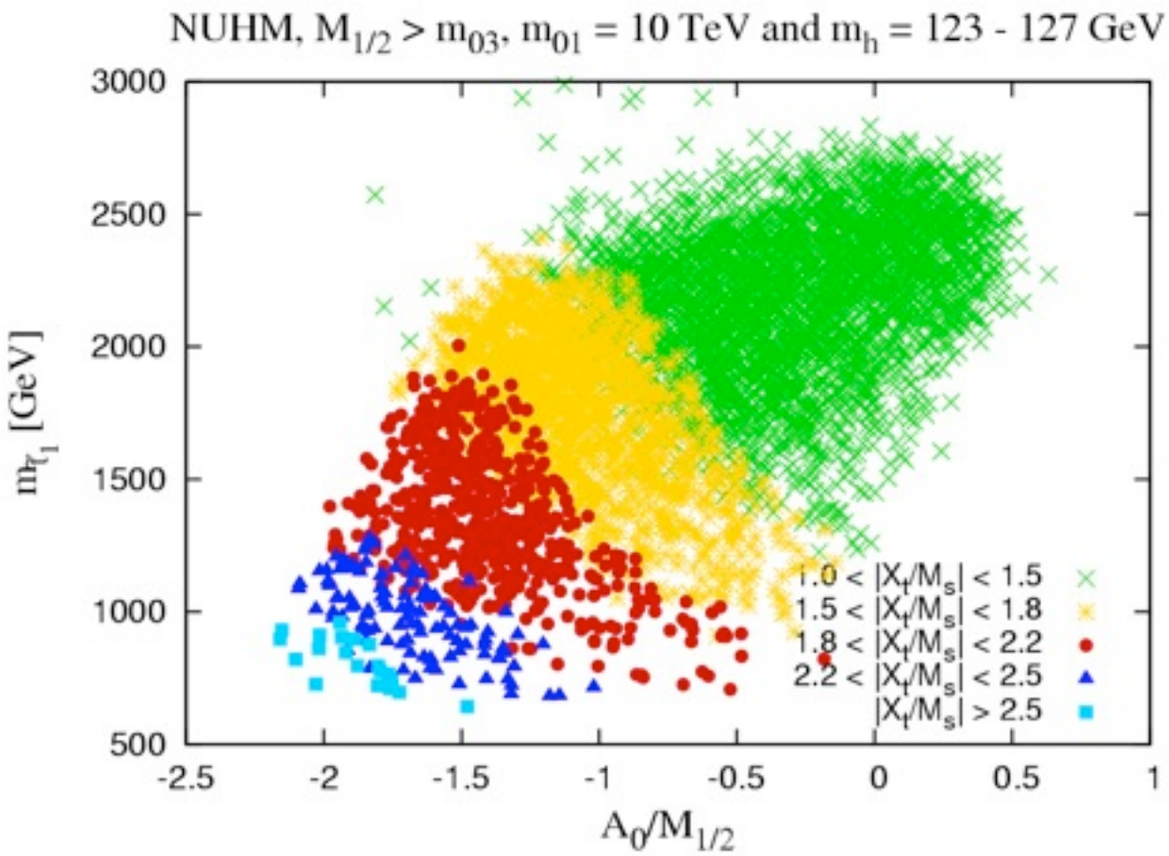


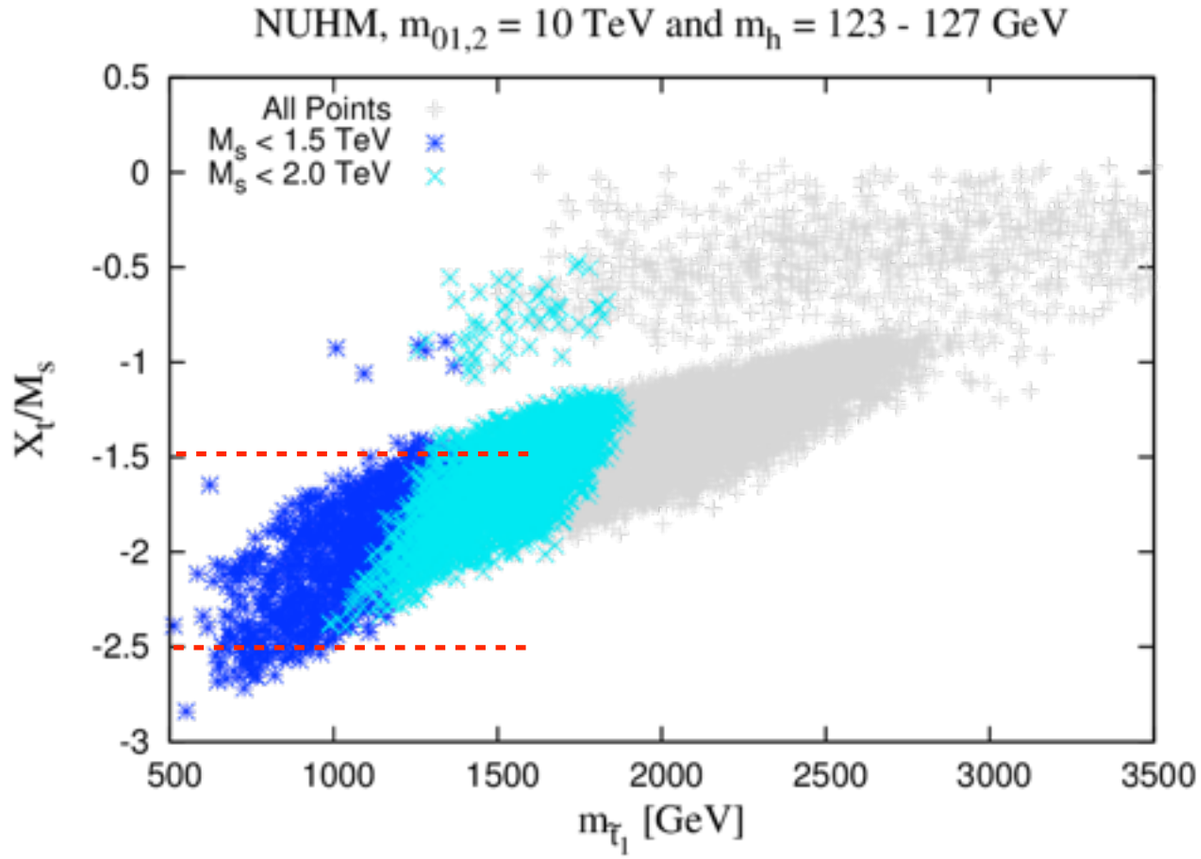


Brummer, SK, Kulkarni, arXiv:1204.5977

125 GeV Higgs and natural SUSY

- Less dramatic in case of O(10) TeV first/second generation squarks because of 2-loop effects driving $M_S = \sqrt{(m_{stop1} \times m_{stop2})}$ down

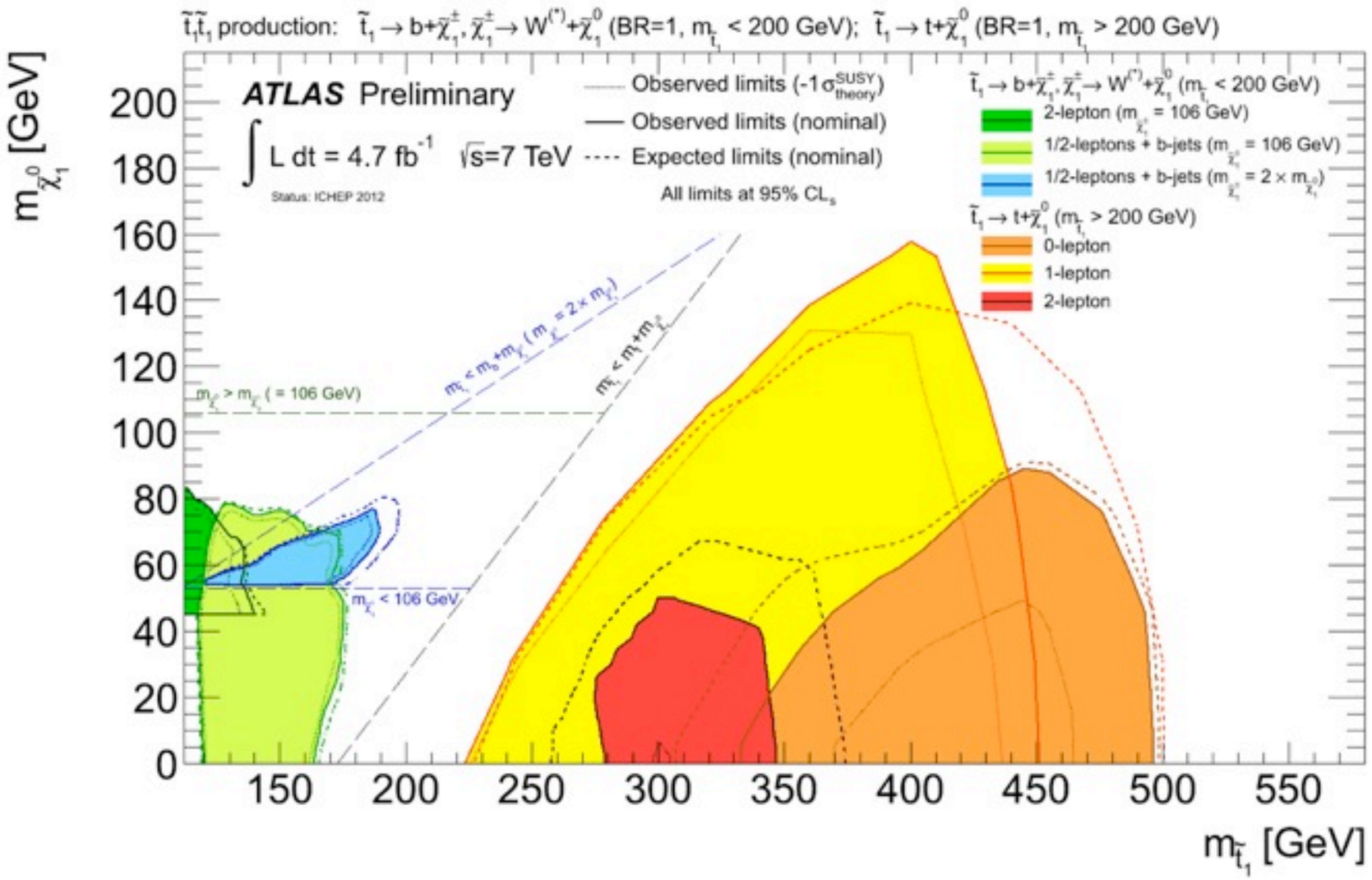




Brummer, SK, Kulkarni, arXiv:1204.5977

see also Badziak et al, arXiv:1204.5977, and talk by Marek Olechowski this afternoon in WG1

Search for direct stop production



Great progress in stop searches!
Good coverage of stops is a key issue for scrutinizing SUSY.

Towards the report

15 pages!

- Strategy and results of ATLAS and CMS searches
- Status of constrained models (mostly CMSSM)
- pMSSM
- Natural SUSY, light stops
- Electroweak gauginos
- Compressed spectra
- Higgsino LSP
- NMSSM
- SUSY with extra gauge groups
- Mono-jet / mono-photon + MET and dark matter

implications of 125 GeV Higgs

tions for future machines
es, linear collider)

Current draft still needs a lot of editing;
→ available for comments tomorrow (Indico)
→ discussion session Tuesday morning
!! missing: section on stops / 3rd generation !!

deadline July 31
only 2 weeks left

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