

Yellow Report ATLAS studies - SUSY and exotics

Brief summary of current status

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WG3: Beyond the Standard Model

Large amount of foreseen results.

Ongoing discussion of systematic uncertainties treatment:

- ▶ Statistical component will often remain sizeable
- ▶ ATLAS combined performance groups working on providing *as realistic as possible* predictions
 - ▶ Could be conservative
 - ▶ We would like to discuss with CMS and theorists to ensure we have a coherent approach

1. **Introduction and overview**
2. **Supersymmetry**
 - ▶ SUSY strong production
 - ▶ SUSY EWK production
3. **Dark Matter searches**
 - ▶ DM + jets
 - ▶ DM + single top, ttbar / bbbar
 - ▶ More models expected to be targeted
4. **Long Lived particles**
 - ▶ Disappearing tracks
 - ▶ Displaced vertices
 - ▶ dE/dx and ToF/timing
5. **Dark sector: dark photons**
 - ▶ Dark photons
 - ▶ Axion-like particles at the LHC
 - ▶ Prospects for long-lived dark-photon decays
6. **Heavy resonances**
 - ▶ Precision searches in di-jets
 - ▶ Prospects for di-boson resonances
 - ▶ Exotic composite quarks
7. **VLQ**
 - ▶ Radiative Decays of Top-partners
 - ▶ Vectorlike quarks and leptons
8. **Flavor-related studies [to be discussed]**
9. **Conclusions and outlook**



Overview of on-going SUSY activities

Analysis	Started (MC etc..)	Aim for June workshop	End of Summer
DV+MET	✓	~	On track
Disappearing tracks	✓	✓	On track
CICI (WW)	✓		On track
Direct stau	✓	~	On track
Higgsino (soft-leptons)	✓	✓	On track
DM+HF (bb, tt 2L)	✓	~	On track
Stops/sbottoms (0L)	✓	✓	On track
CIN2 - WZ/W _h (multilep)	~		On track
CIN2- W _h (bb)	✓		On track
Inclusive 0L	~		On track
Higgs to invisible	✓	~	On track



Overview of on-going Exotics activities

Analysis	Started (MC etc..)	Aim for June workshop	End of Summer
Ttbar resonance	✓		On track
$W' \rightarrow l\nu, Z' \rightarrow ll$	✓		On track
Mono-jet DM	✓		On track
Pure WIMP mono- γ and VBF	✓	~	On track
VV resonances	✓		On track
$W' \rightarrow tb$	~		On track
Tt/tt DM	✓		On track
DM with 2HDM in 4 top	✓		On track
Dark photons with Displaced l-jet	✓		On track



Possible new-comers

A few additional analyses are being discussed and might be added to the ATLAS programme:

▶ SUSY:

▶ Gtt/Gbb models with multi-b signature

- ▶ Would be important/interesting to assess gluino “discoverability” at HL-LHC

▶ Mono-jet Higgsinos with FSR photon radiation

▶ VBF ewk-inos

- ▶ Improve coverage for low Δm

▶ Exotics:

▶ Lepto-quark

▶ Others long-lived (e.g. depending on feedback from LL workshop)



Detailed informal discussions

Especially for the “early results” it would be nice to organise dedicated informal discussions with the CMS counterparts (and interested theorists).

- ▶ Identify complementarities and reduce duplication of work
- ▶ Harmonize detailed uncertainty treatment

Candidates:

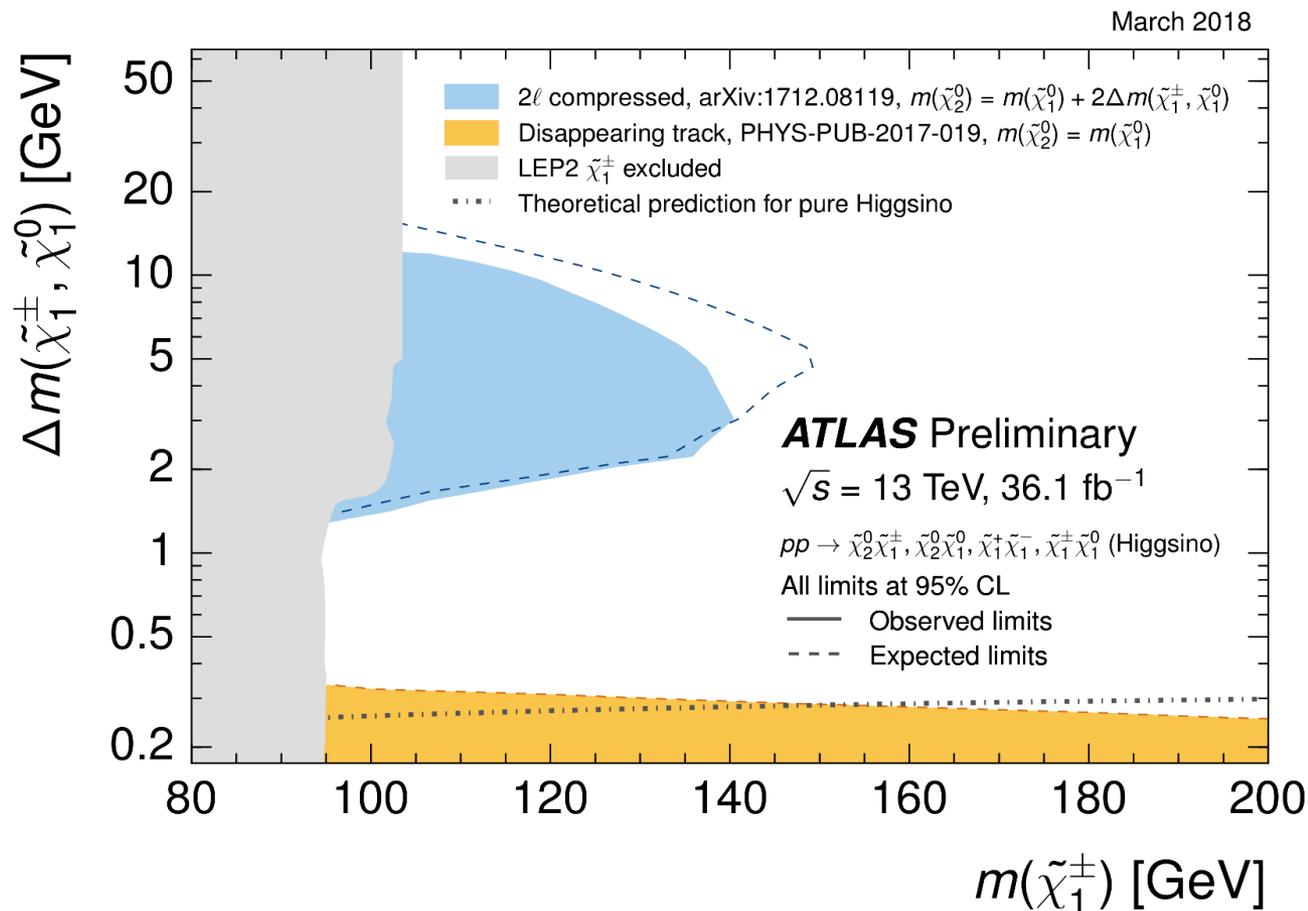
- ▶ DM+HF
- ▶ Higgsinos

If people are at CERN, could be done even this week!



Result grouping: e.g. higgsino summary plot

A summary plot including both ISR+soft leptons and disappearing tracks



In scenarios with complementary results from the various experiments, we can think of producing “LHC summary plots”

Other items to be discussed (not a full list)

- ▶ MC samples
 - ▶ 13 TeV → 14 TeV rescaling or 14 TeV samples?
 - ▶ Need high statistics samples sliced in HT but we have technical issues at the moment
 - ▶ Which samples are used by CMS for mono-jet analyses? Is there a gain to have common LHE files ?
 - ▶ Furthermore, we would like to rescale at NNLO level as suggested in <https://arxiv.org/abs/1705.04664v2>
 - ▶ Any experience on this?
- ▶ Treatment of fake background
 - ▶ Data-driven in Run 2 analysis

Summary

We are going to present a **comprehensive update of the prospects for the SUSY search programme and several benchmark Exotics analyses.**

- ▶ Good coverage
- ▶ HE-LHC prospects might be investigated in ATLAS when “core” results are done
- ▶ Overall progress in the early stages but on track for end of summer release