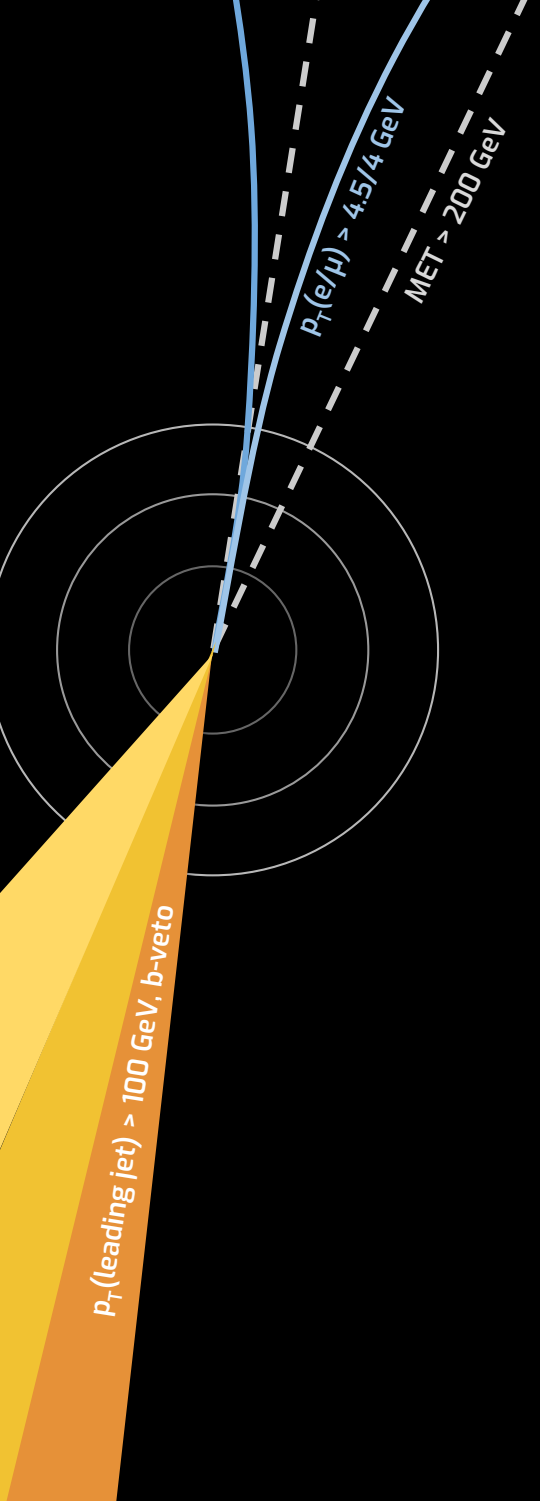


INNOVATIVE STRATEGIES AT THE

COMPRESSED FRONTIER OF ELECTROWEAK SUSY

SEARCHES WITH THE **ATLAS EXPERIMENT**

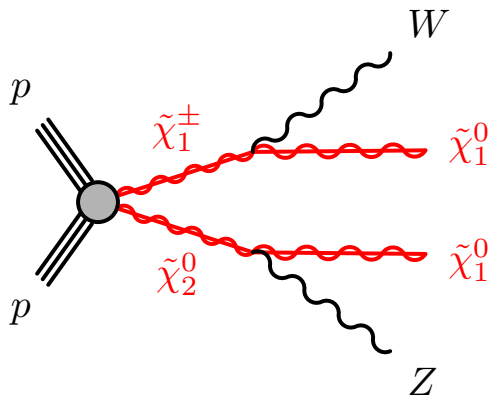
ICHEP 2018 @ SEOUL | 11 JULY 2018

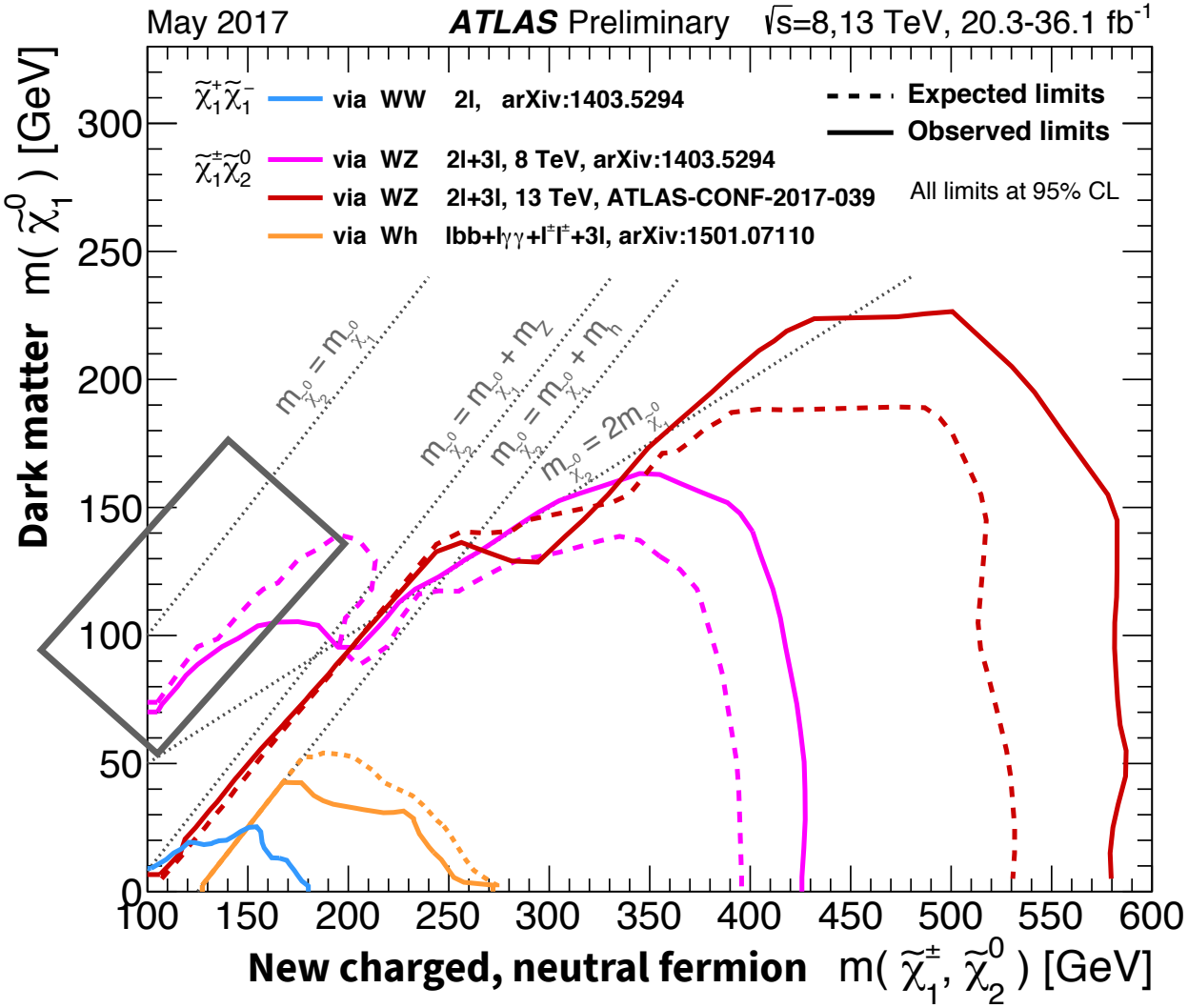
Jesse Liu
University of Oxford
On behalf of the ATLAS Collaboration

ATLAS EXPERIMENT

UNIVERSITY OF OXFORD

Backdrop: striking blind spot in ATLAS Electroweak SUSY searches last year



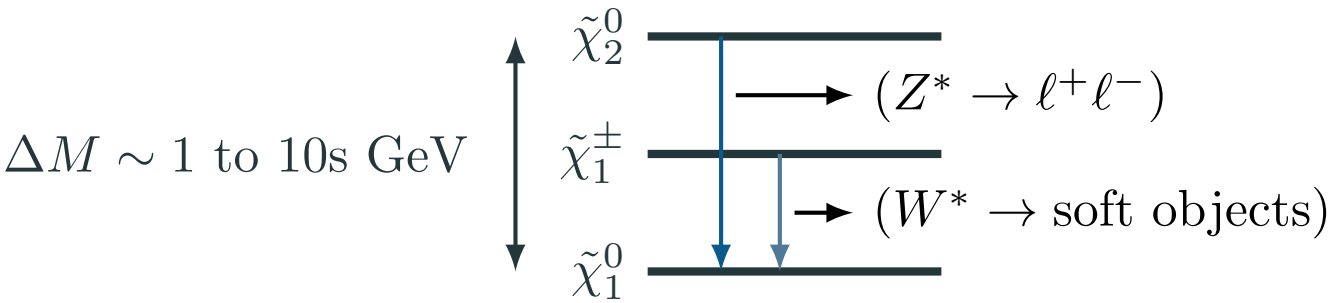


For $m_{\tilde{\chi}} \sim 100$ GeV, $\sigma(pp \to \tilde{\chi}_2^0 \tilde{\chi}_1^{\pm}) \times \mathscr{L} \sim 10^4$ fb $\times$ 30 fb^{-1} $\sim$ 300 000 events

[LHC SUSY Cross-section Working Group; ATLAS SUSY Summary Plots]

Higgsinos $\tilde{H}$ near weak scale by naturalness arguments

Higgsinos $\tilde{H}$ realised as multiplet of charged & neutral states

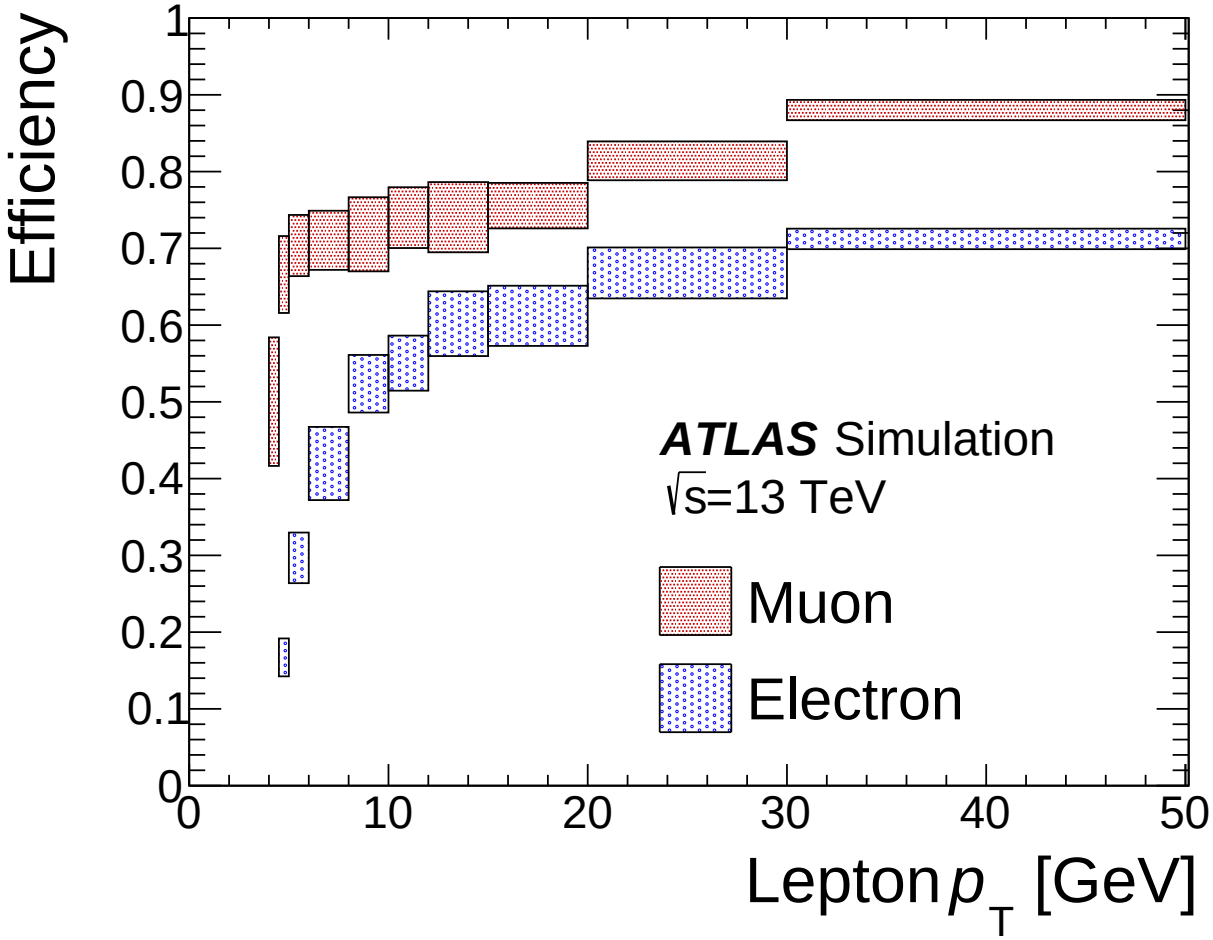


Challenge to reconstruct & trigger soft intra-Higgsino decays

Higgsinos = spin 1/2 partners of two Higgs doublets

[Sara Strandberg plenary, Anyes Taffard parallel]

Performance highlight: confronting soft lepton reconstruction limitations

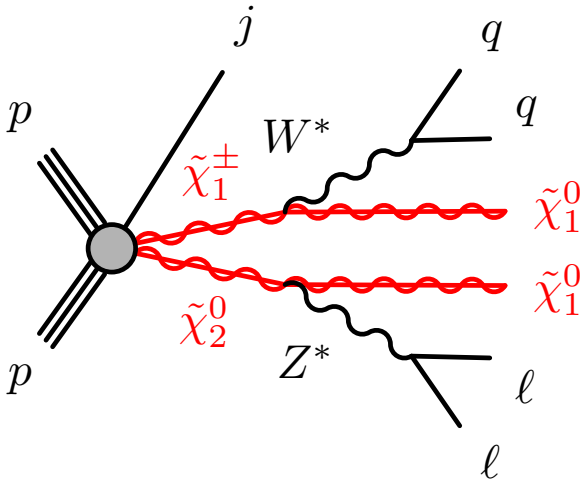


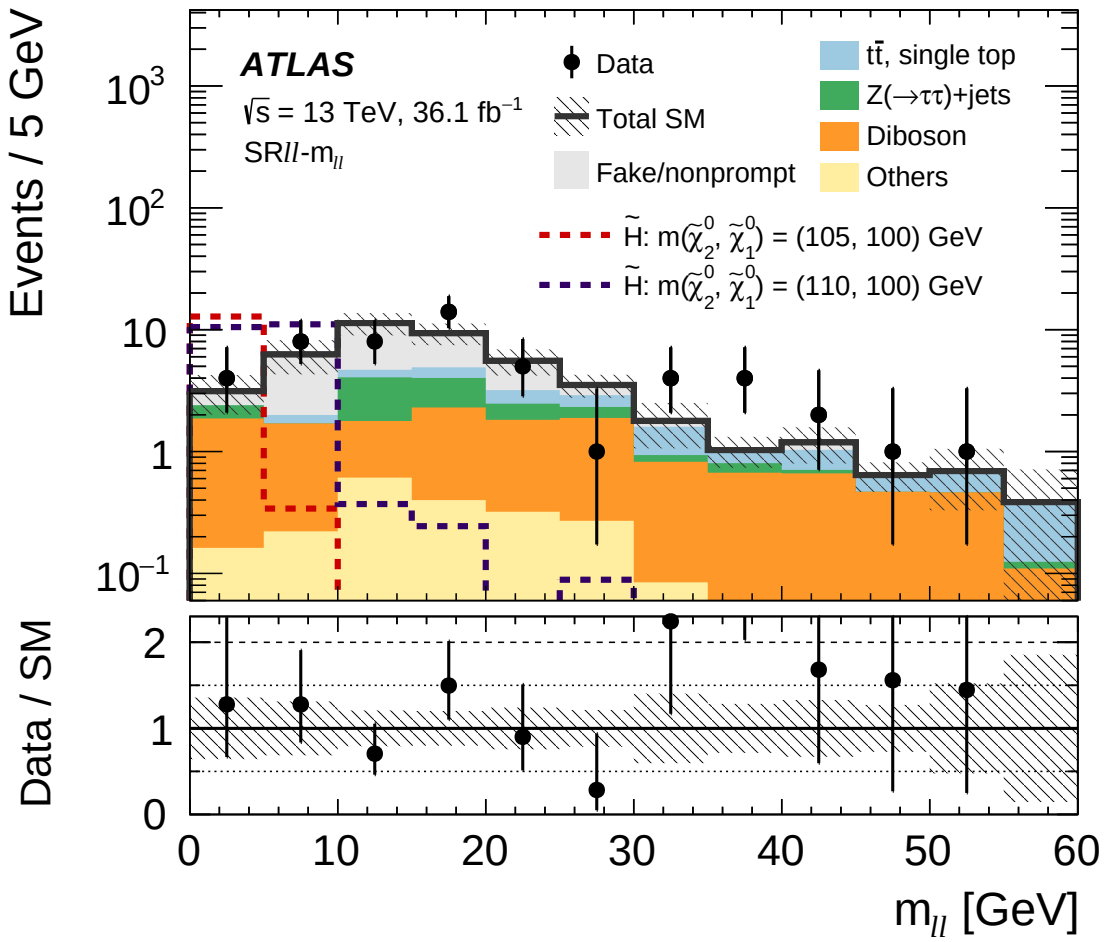
$p_T(e/\mu) > 4.5/4$ GeV for 2017 **among lowest in ATLAS** ($> 7/6$ GeV in 2016)

Fun fact: **a muon loses 3 GeV of energy** before reaching the muon spectrometer

[Mark Hodgkinson parallel]

Dilepton discriminant: signals localised at low $m_{\ell\ell}$ ('bump-hunt' SUSY style)

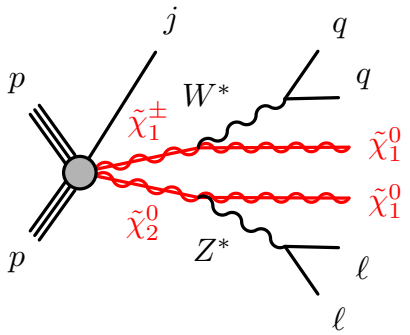




Signal endpoint $m_{\ell\ell} < \Delta m(\tilde{\chi}_2^0, \tilde{\chi}_1^0)$ for decisive **background rejection**

[PRD 97 (2018) 052010]

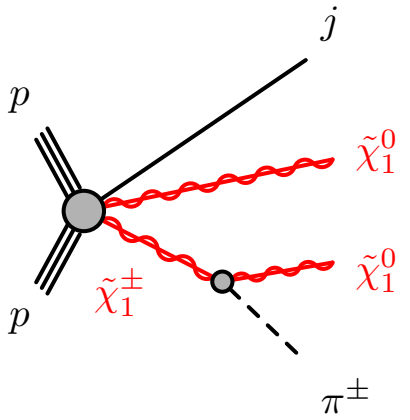
First hadron collider sensitivity to Higgsino dark matter beyond LEP



2ℓ compressed

$p_T(e,\mu) > 4.5, 4$ GeV

PRD 97 (2018) 052010

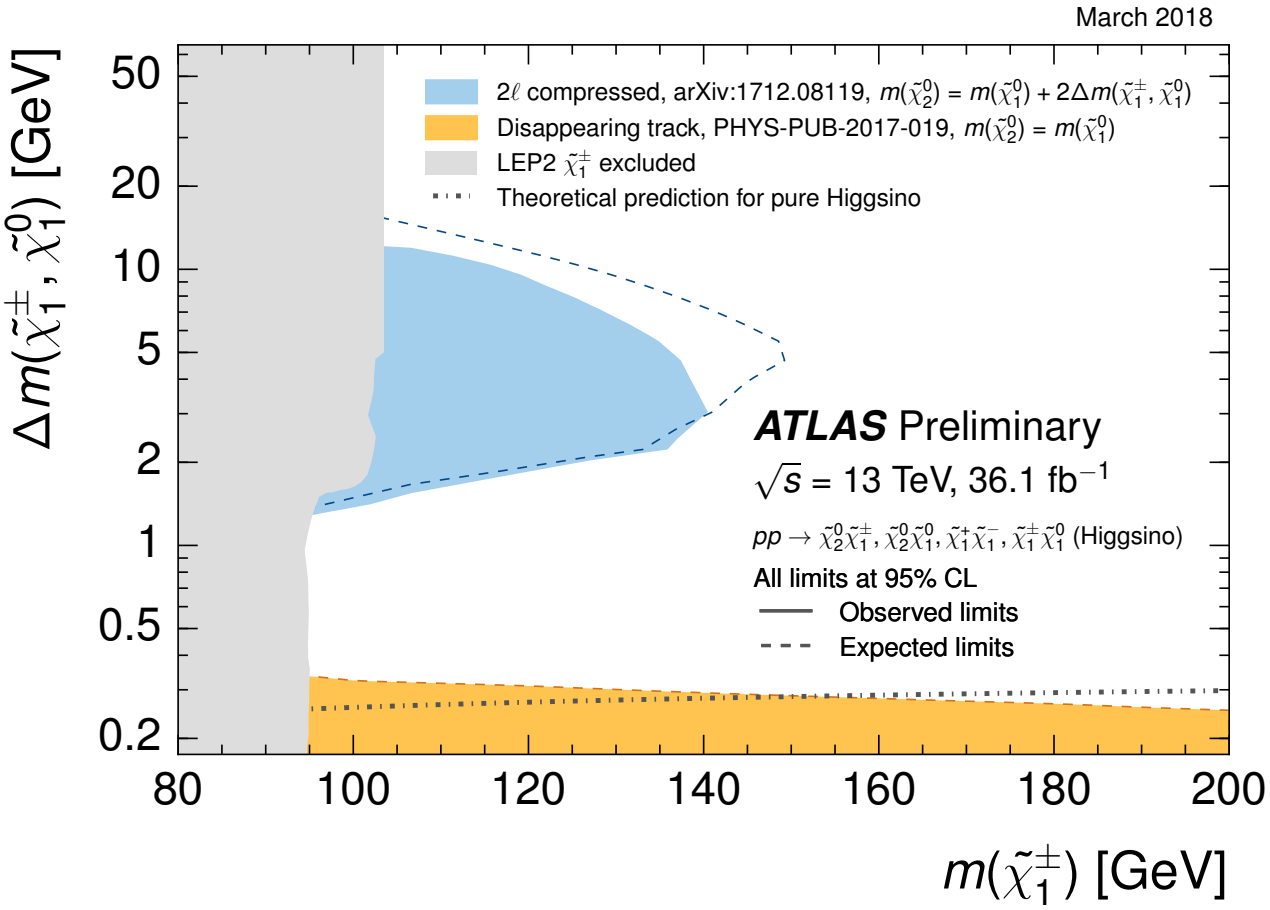


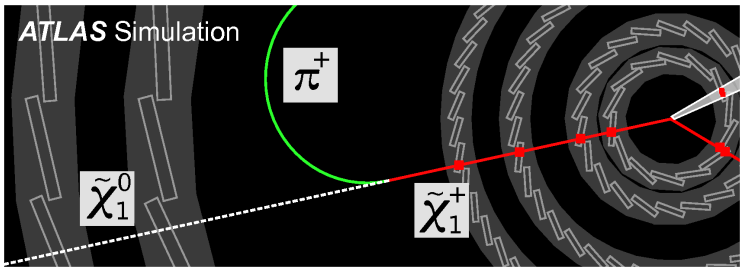
Disappearing track

IBL+Pixel tracklets

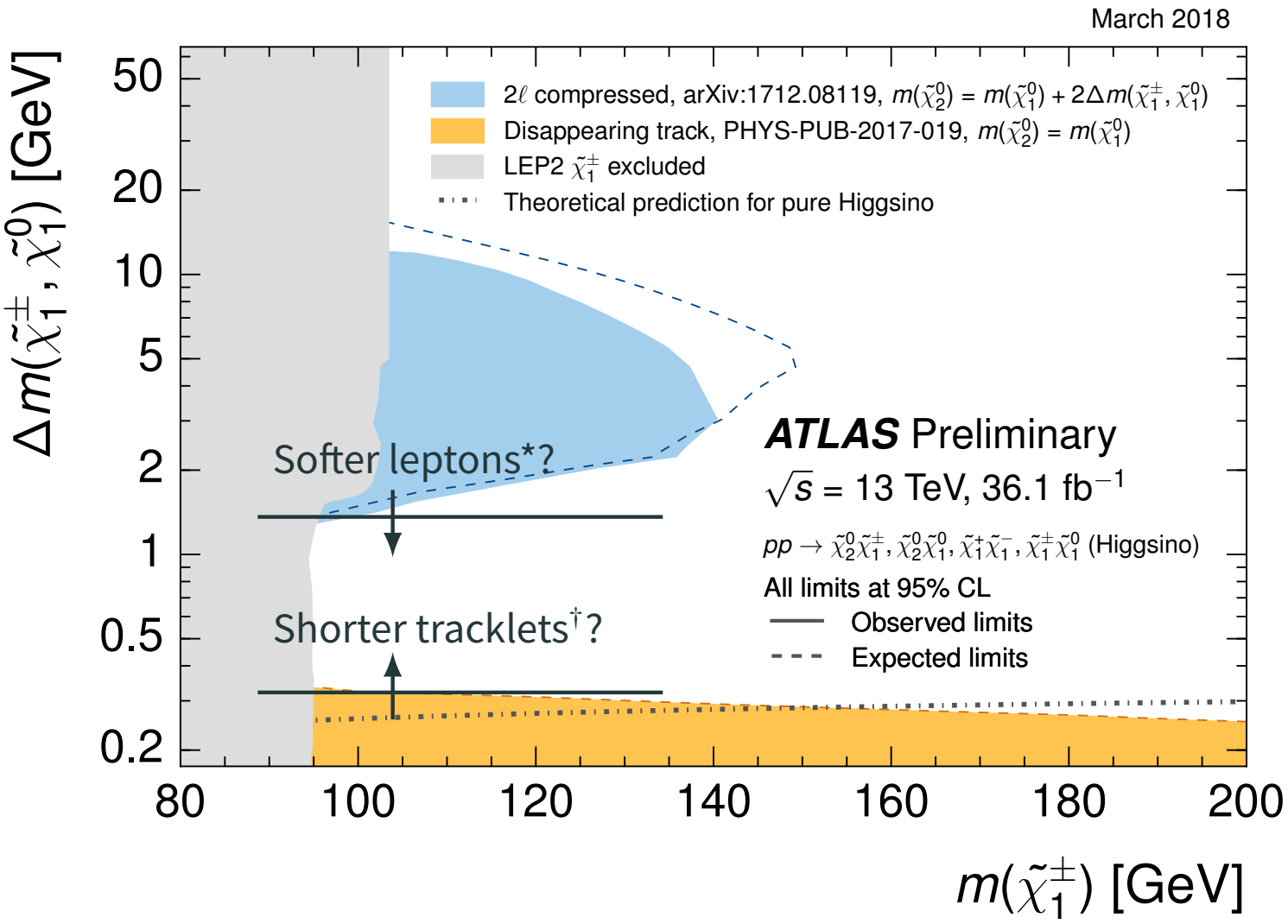
(Run 1: SCT+Pixel)

JHEP 06 (2018) 022, PUB-2017-019





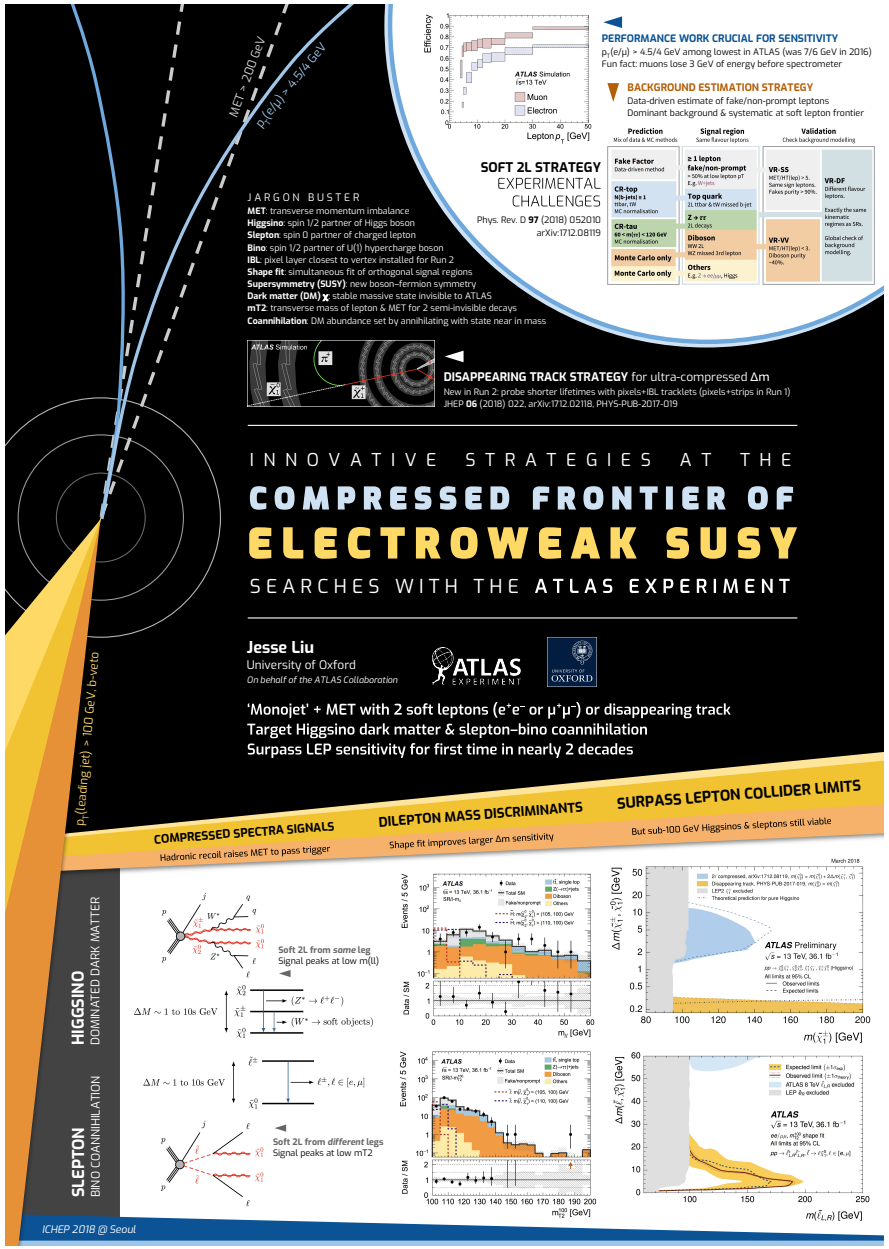
How do we close the Higgsino prompt–long-lived gap?



Striking blind spot: need new ideas to discover Higgsinos below 100 GeV

*Zhi Zheng poster, †1703.09675

Gratitude & acknowledgements

Thank you ICHEP for hospitality, for this opportunity, for supporting this poster and for dropping by last Friday.

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