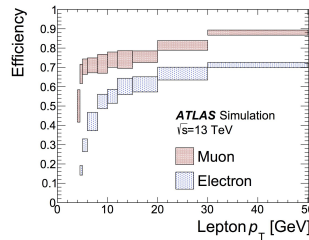
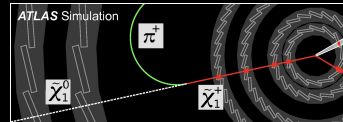


JARGON BUSTER

MET: transverse momentum imbalance
Higgsino: spin 1/2 partner of Higgs boson
Slepton: spin 0 partner of charged lepton
Bino: spin 1/2 partner of U(1) hypercharge boson
IBL: pixel layer closest to vertex installed for Run 2
Shape fit: simultaneous fit of orthogonal signal regions
Supersymmetry (SUSY): new boson-fermion symmetry
Dark matter (DM) χ : stable massive state invisible to ATLAS
mT2: transverse mass of lepton & MET for 2 semi-invisible decays
Coannihilation: DM abundance set by annihilating with state near in mass



SOFT 2L STRATEGY EXPERIMENTAL CHALLENGES

Phys. Rev. D **97** (2018) 052010
 arXiv:1712.08119

PERFORMANCE WORK CRUCIAL FOR SENSITIVITY
 $p_T(e/\mu) > 4.5/4$ GeV among lowest in ATLAS (was 7/6 GeV in 2016)
 Fun fact: muons lose 3 GeV of energy before spectrometer

BACKGROUND ESTIMATION STRATEGY
 Data-driven estimate of fake/non-prompt leptons
 Dominant background & systematic at soft lepton frontier

Prediction	Signal region	Validation
Mix of data & MC methods	Same flavour leptons	Check background modelling
Fake Factor Data-driven method	≥ 1 lepton fake/non-prompt > 50% at low lepton pT E.g. W+jets	VR-SS MET/HT(lep) > 5. Same sign leptons. Fakes purity > 90%.
CR-top N(b-jets) ≥ 1 ttbar, tW MC normalisation	Top quark 2L ttbar & tW missed b-jet	VR-DF Different flavour leptons. Exactly the same kinematic regimes as SRs.
CR-tau $60 < m(\tau\tau) < 120$ GeV MC normalisation	Z $\rightarrow \tau\tau$ 2L decays	VR-VV MET/HT(lep) < 3. Diboson purity ~40%.
Monte Carlo only	Diboson WW 2L WZ missed 3rd lepton	
Monte Carlo only	Others E.g. Z $\rightarrow ee/\mu\mu$, Higgs	

DISAPPEARING TRACK STRATEGY for ultra-compressed Δm

New in Run 2: probe shorter lifetimes with pixels+IBL tracklets (pixels+strips in Run 1)
 JHEP **06** (2018) 022, arXiv:1712.02118, PHYS-PUB-2017-019

INNOVATIVE STRATEGIES AT THE COMPRESSED FRONTIER OF ELECTROWEAK SUSY SEARCHES WITH THE ATLAS EXPERIMENT

Jesse Liu

University of Oxford
 On behalf of the ATLAS Collaboration



'Monojet' + MET with 2 soft leptons (e^+e^- or $\mu^+\mu^-$) or disappearing track
 Target Higgsino dark matter & slepton-bino coannihilation
 Surpass LEP sensitivity for first time in nearly 2 decades

COMPRESSED SPECTRA SIGNALS

Hadronic recoil raises MET to pass trigger

DILEPTON MASS DISCRIMINANTS

Shape fit improves larger Δm sensitivity

SURPASS LEPTON COLLIDER LIMITS

But sub-100 GeV Higgsinos & sleptons still viable

HIGGSINO
DOMINATED DARK MATTER

SLEPTON
BINO COANNIHILATION

