


Cambridge ATLAS 2023 Highlights

Bill Balunas

HEP extravaganza/jamboree/festival
6 December 2023

Overview

ATLAS has been busy this year...

Applied filters:
arxiv date:
From 2023-01-01 to 2023-12-29

Papers and publications of ATLAS physics and performance results 1230 documents (Published: 1174 - Accepted: 21 - Submitted: 35)
(Full list of ATLAS papers, List/RSS from CDS)

Hide table

Showing 1 to 10 of 105 entries

Overall search (incl. keywords - click here for full list):

Short Title	Group	Journal Reference	Date	√s (TeV)	L	Links
h→Za, a→γγ NEW	HDBS	Submitted to PLB	2023-12-04	13	139 fb^{-1}	Documents | Internal
Measurement of same-sign W boson pair production in association with two jets NEW	STDM	Submitted to JHEP	2023-12-01	13	139 fb^{-1}	Documents | 2312.00420 Internal
Search for dark photons decaying into collimated jets of leptons or light hadrons in the decays of Higgs bosons produced via VBF production.	EXOT	Submitted to EPJC	2023-11-30	13	139 fb^{-1}	Documents | 2311.18298 Internal
Combination of searches for HH resonances	HDBS	Submitted to PRL	2023-11-27	13	140 fb^{-1}	Documents | 2311.15956 Inspire | Internal
Measurement of ZZ production cross-sections in the four-lepton final state	STDM	Submitted to Phys. Lett. B	2023-11-16	13.6	29 fb^{-1}	Documents | 2311.09715 Inspire | Internal
Simultaneous Large-R jet energy & mass scale calibration	JETM	Submitted to MLST	2023-11-15	13		Documents | 2311.08885 Inspire | Internal
Observation of quantum entanglement in top-quark pairs using the ATLAS detector	TOPQ	Submitted to Nature	2023-11-13	13	140 fb^{-1}	Documents | 2311.07288 Inspire | Internal

Overview

What has the Cambridge ATLAS group been up to?

A few highlights in…

- Supersymmetry searches
- Higgs boson pair production
- Tau g-2
- Trigger developments
- ATLAS software

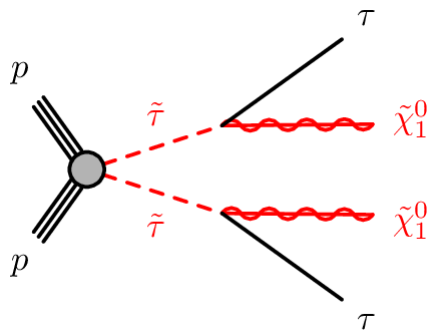
Not exhaustive! Other speakers will show you more.

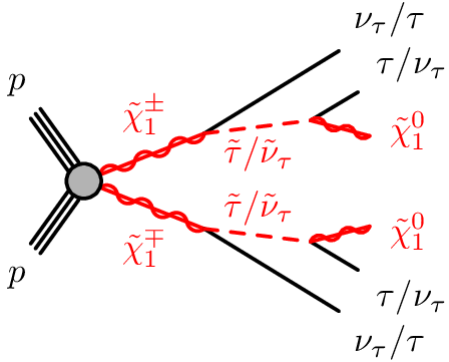
SUSY: Stau search

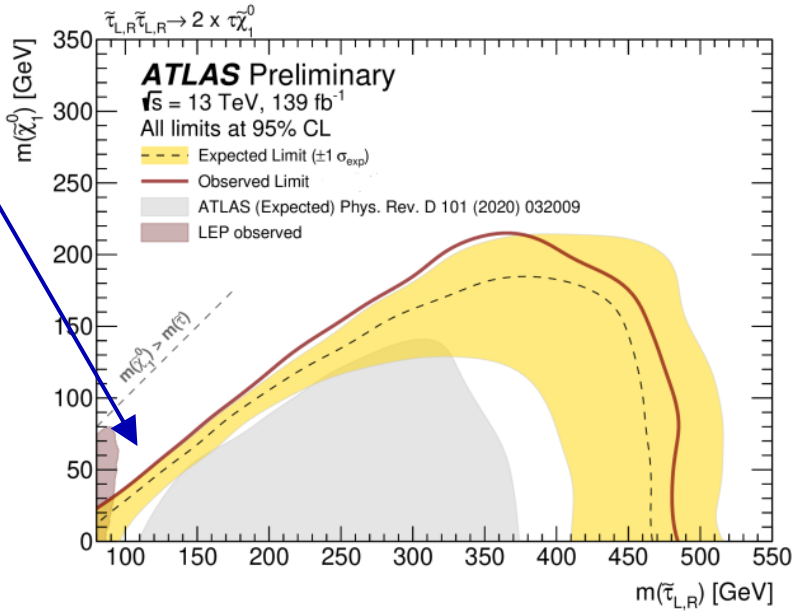
Dominic & Tina

ATLAS-CONF-2023-029

- Look for final states with taus and invisible particles
- ML methods used to substantially improve sensitivity over previous results
- Closed the gap between LEP and LHC sensitivity
- First-time sensitivity to right-handed staus







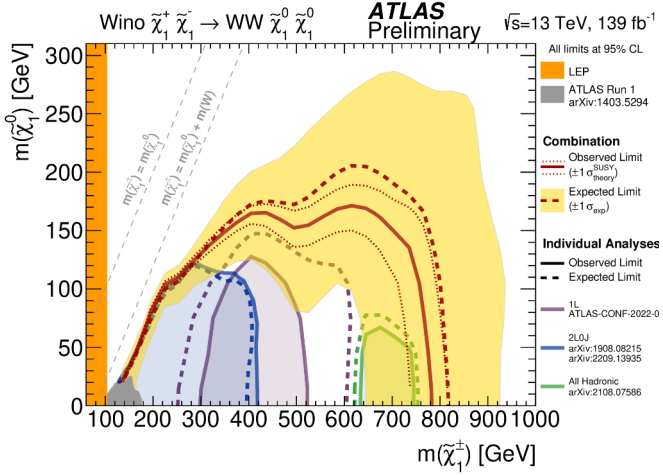
SUSY: EW combination

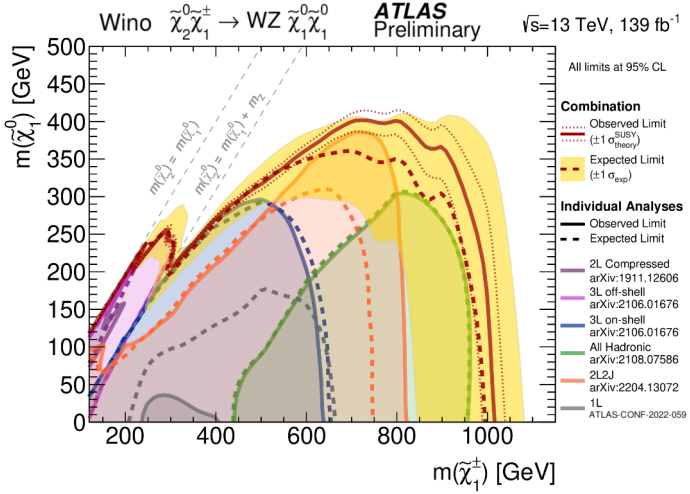
Ben, Dominic, & Tina

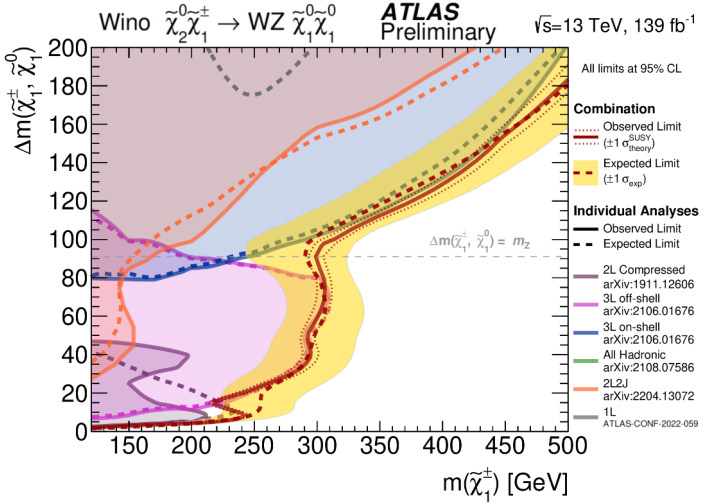
ATLAS-CONF-2023-046

12 different searches for electroweakino production statistically combined

- Extend sensitivity to higher sparticle masses and smaller mass splittings than before





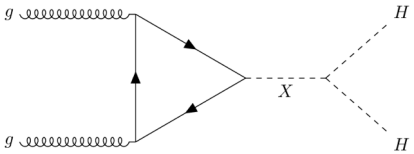


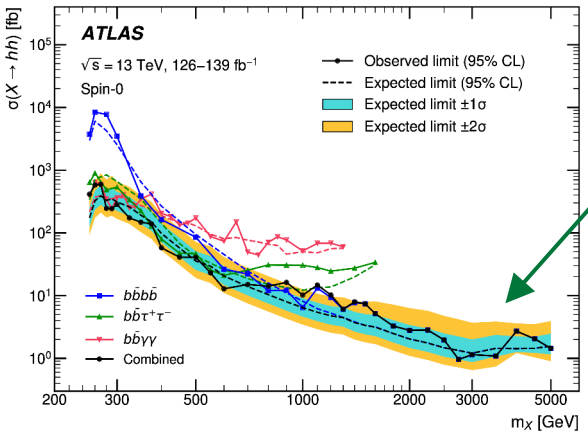
See also the pMSSM scan in Sarah's talk

Di-Higgs: Resonant

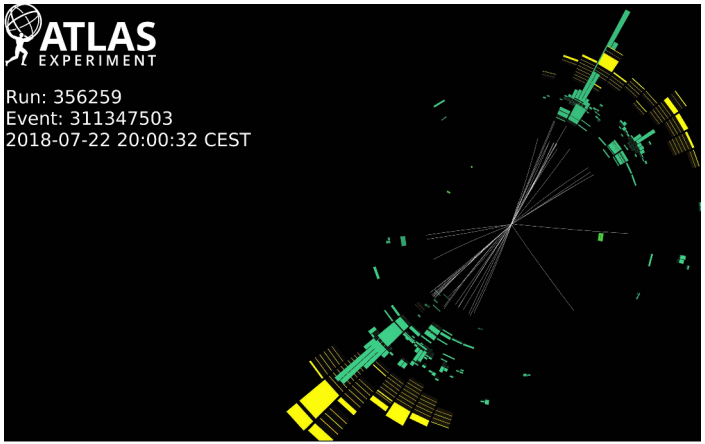
Bill
2311.15956 (submitted to PRL)

Look for new particles decaying into Higgs pairs across several channels





Merged H→bb jet tagging essential at high mass



Non-resonant result (to probe Higgs self-coupling etc.) in bbbb channel out earlier this year

- See Phys. Rev. D 108 (2023) 052003

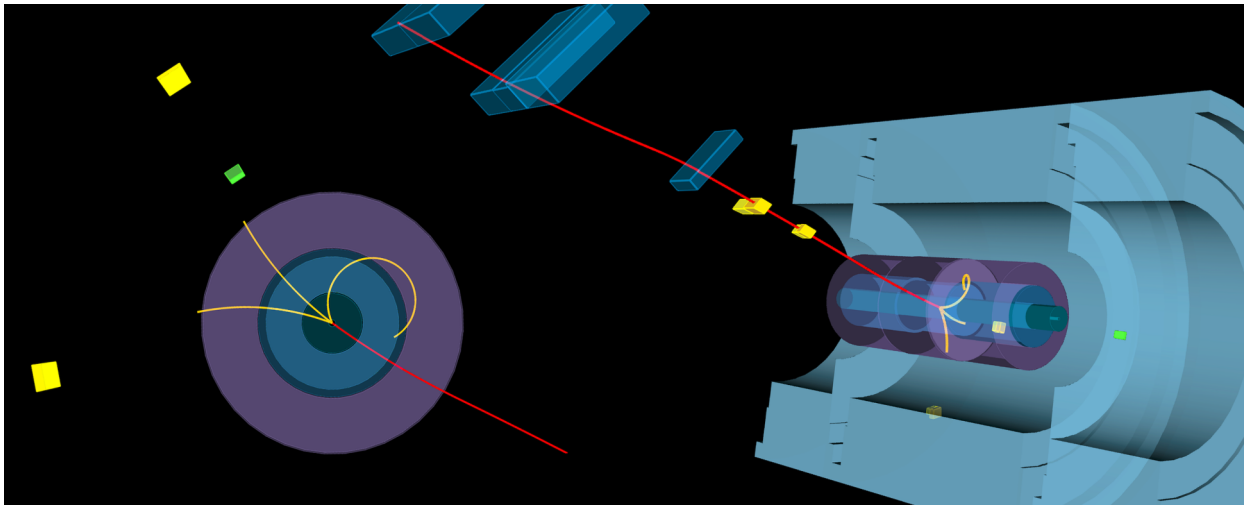
Tau g-2

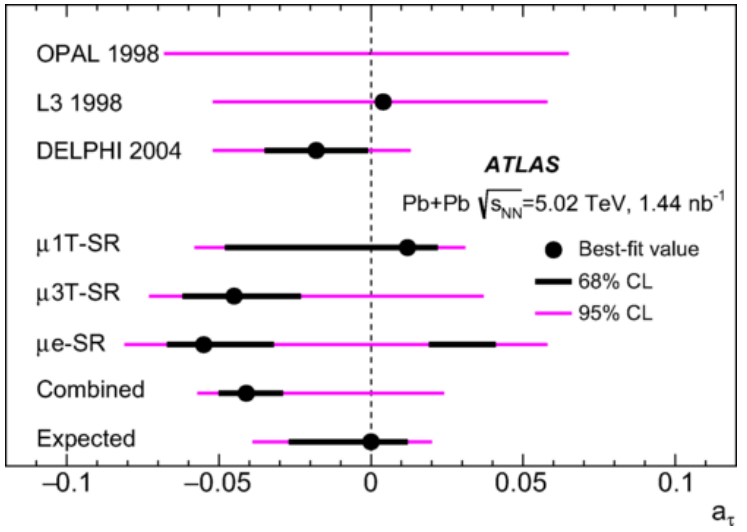
Jesse

Phys. Rev. Lett. 131 (2023) 151802

First LHC measurement of tau g-2 now published in PRL

- Use photon-photon scattering in ultraperipheral Pb-Pb collisions
- Includes first observation of γγ→ττ scattering

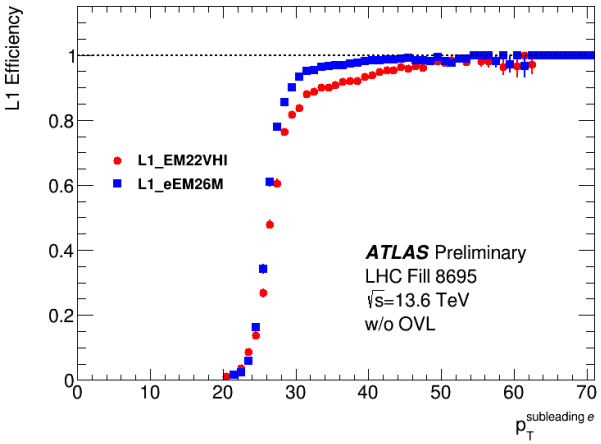


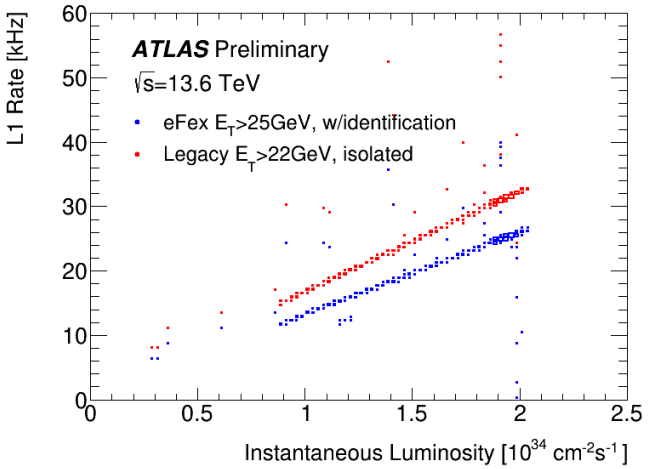


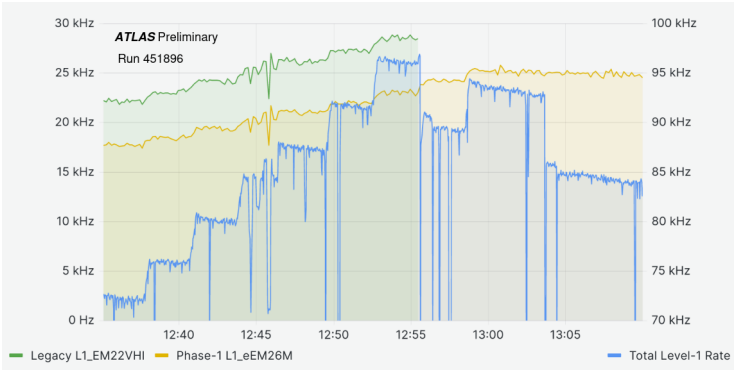
Hardware-level trigger

Gareth & Ed

Major Run 3 upgrade to hardware-level electron/photon triggers now commissioned







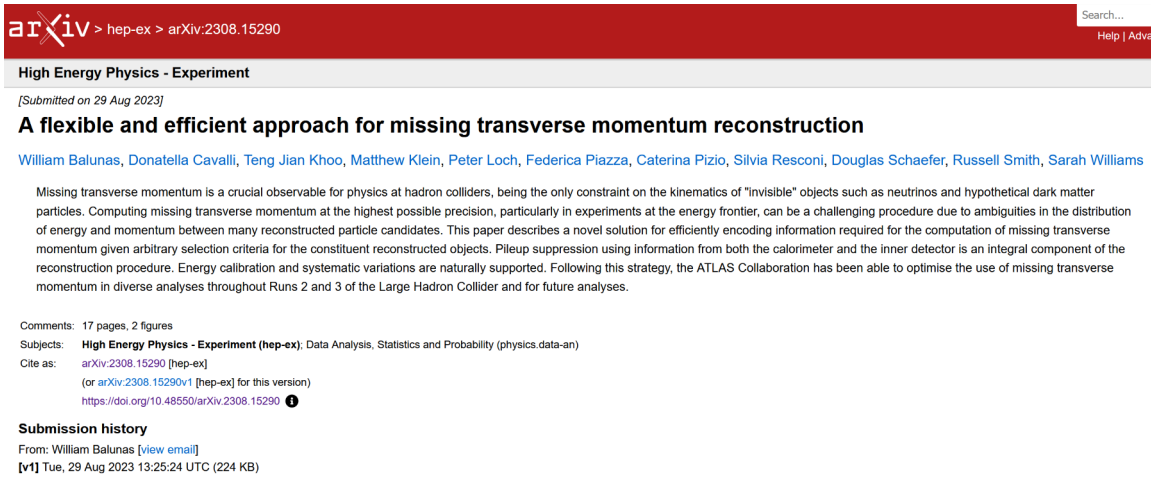
ATLAS Software

Bill & Sarah, John

A method for efficiently encoding all information needed for fully generic MET reconstruction (implemented in central ATLAS reconstruction software)

Factor of ~2 speed-up in ATLAS simulation

2308.15290 (Submitted to CSBS)



arXiv > hep-ex > arXiv:2308.15290

Search... Help | Adva

High Energy Physics - Experiment

[Submitted on 29 Aug 2023]

A flexible and efficient approach for missing transverse momentum reconstruction

William Balunas, Donatella Cavalli, Teng Jian Khoo, Matthew Klein, Peter Loch, Federica Piazza, Caterina Pizio, Silvia Resconi, Douglas Schaefer, Russell Smith, Sarah Williams

Missing transverse momentum is a crucial observable for physics at hadron colliders, being the only constraint on the kinematics of "invisible" objects such as neutrinos and hypothetical dark matter particles. Computing missing transverse momentum at the highest possible precision, particularly in experiments at the energy frontier, can be a challenging procedure due to ambiguities in the distribution of energy and momentum between many reconstructed particle candidates. This paper describes a novel solution for efficiently encoding information required for the computation of missing transverse momentum given arbitrary selection criteria for the constituent reconstructed objects. Pileup suppression using information from both the calorimeter and the inner detector is an integral component of the reconstruction procedure. Energy calibration and systematic variations are naturally supported. Following this strategy, the ATLAS Collaboration has been able to optimise the use of missing transverse momentum in diverse analyses throughout Runs 2 and 3 of the Large Hadron Collider and for future analyses.

Comments: 17 pages, 2 figures

Subjects: **High Energy Physics - Experiment (hep-ex)**; Data Analysis, Statistics and Probability (physics.data-an)

Cite as: arXiv:2308.15290 [hep-ex]

(or arXiv:2308.15290v1 [hep-ex] for this version)

https://doi.org/10.48550/arXiv.2308.15290

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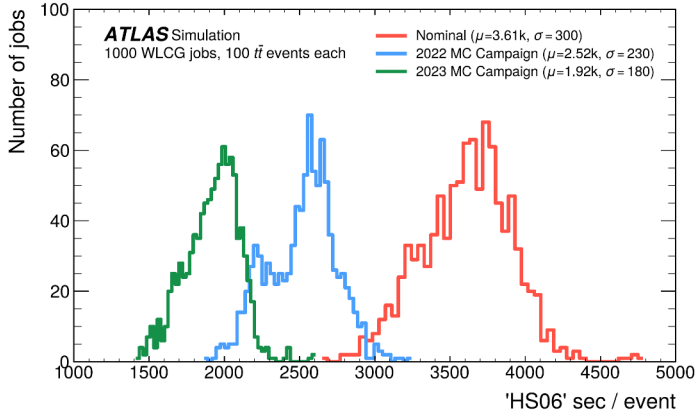

Cambridge leadership in ATLAS

Many group members serving in roles of responsibility…

- **Tina** as SUSY Strong & Summaries subgroup convener
- **Sarah** as Statistics Committee chair and ATLAS UK Physics Coordinator
- **Bill** as Physics Validation Coordinator and ATLAS UK Combined Performance convener
  - Until it was concluded earlier this year, also as Run 3 Di-Higgs Forum coordinator
- **Jesse** as SM Soft QCD subgroup convener and LHC Forward Physics Working Group convener
- **John** as Software Coordinator

Not to mention ANUBIS, hardware, & upgrade work…