李政道研究所
TSUNG-DAO LEE INSTITUTE

上海交通大学
物理与天文学院
School of Physics and Astronomy,SJTU

ATLAS Activities and Highlights @ SJTU/TDLI

Kun Liu

On behalf of the SJTU/TDLI ATLAS Team

ATLAS-China Faculty Meeting @Zhengzhou
2026.04.25

Outline

交大/李所ATLAS团队介绍

杨海军

李亮

郭军

周宁

李数

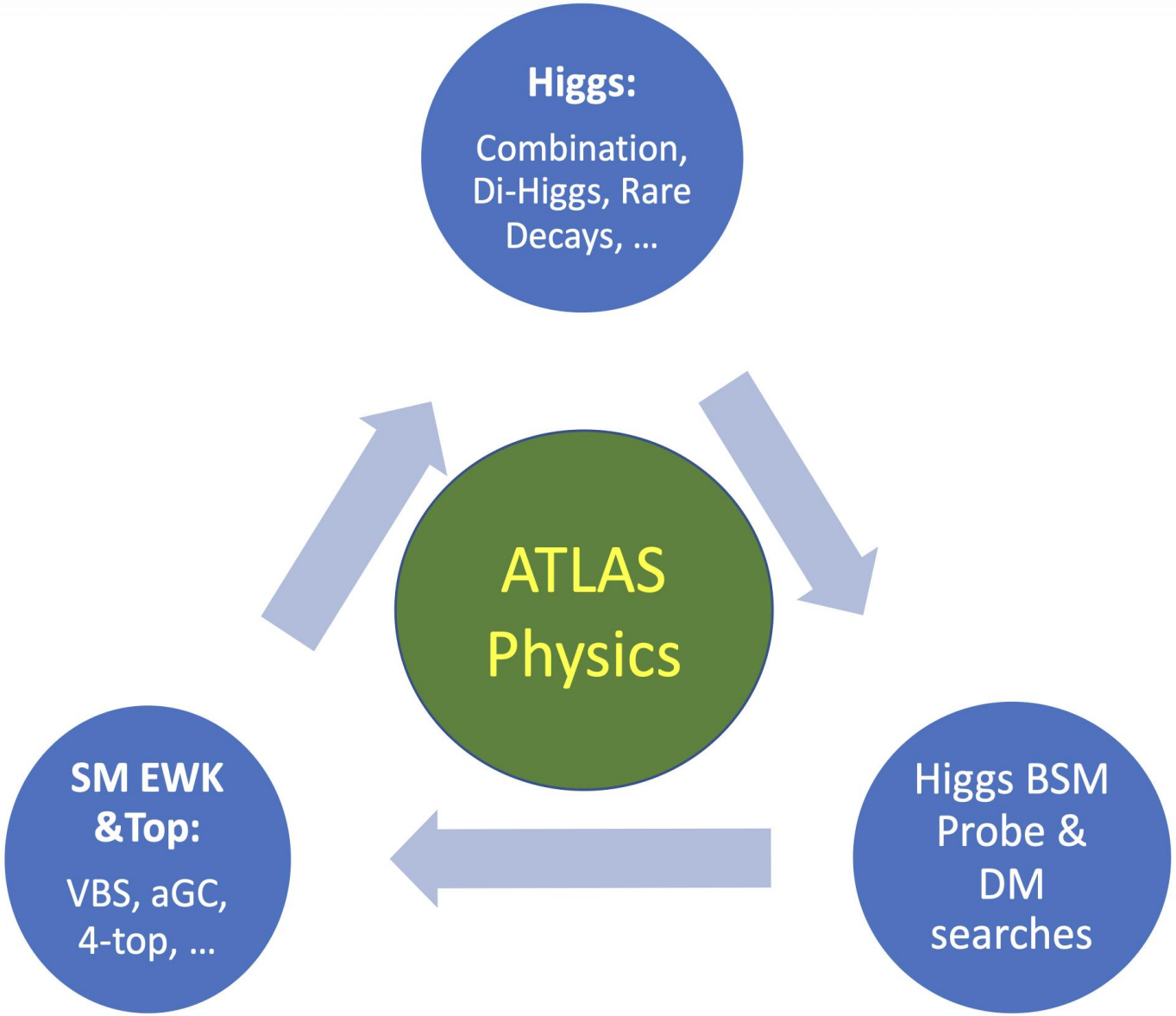
刘坤

Kim Siang Khaw（许金祥）
【No M&O】

邬维浩
【No M&O】

团队成员：~3名博士后，~20名研究生

Resarch Topics



Outline

H→Zγ Search Run 2 + Partial Run 3

w/ IHEP&NJU

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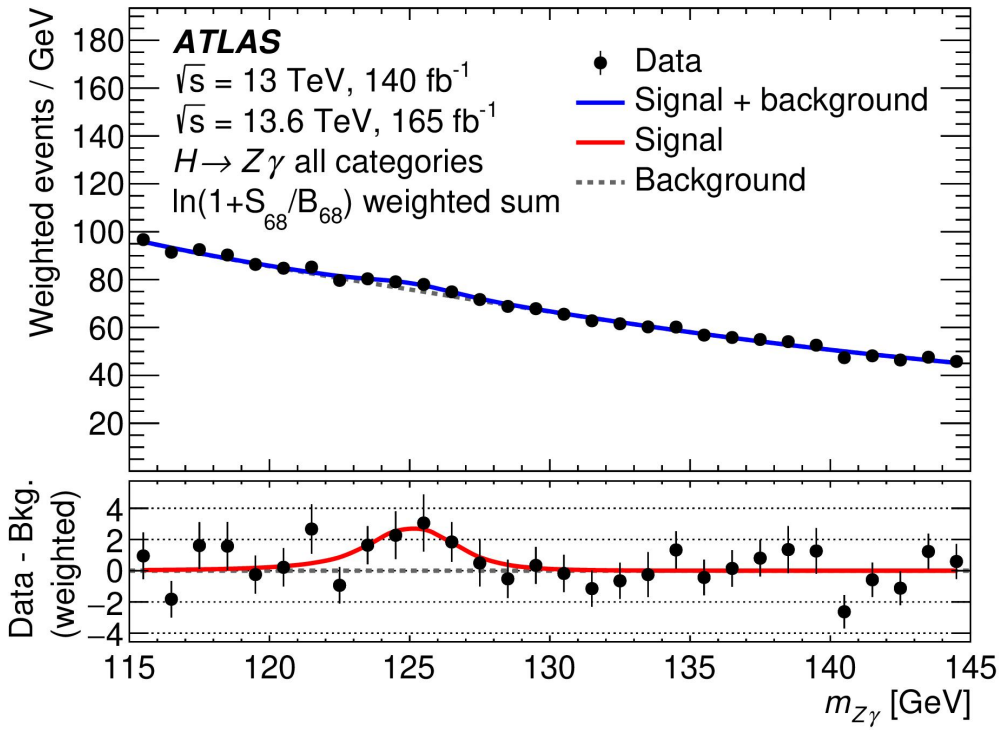
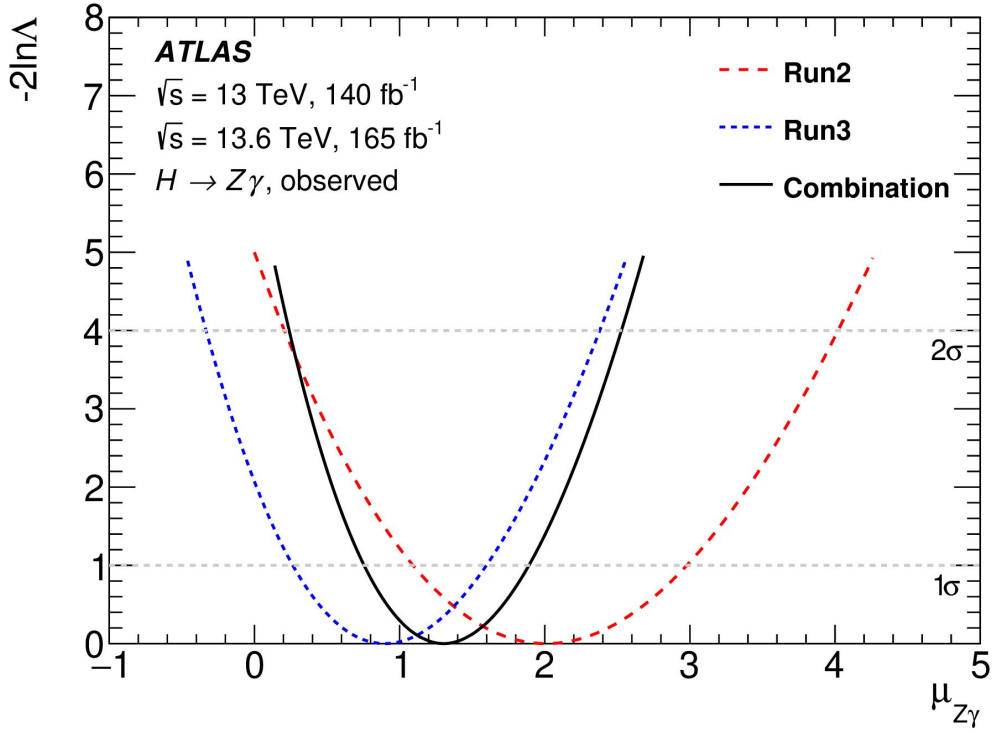
[arXiv.2507.12598 [Phy. Lett. B accepted]]

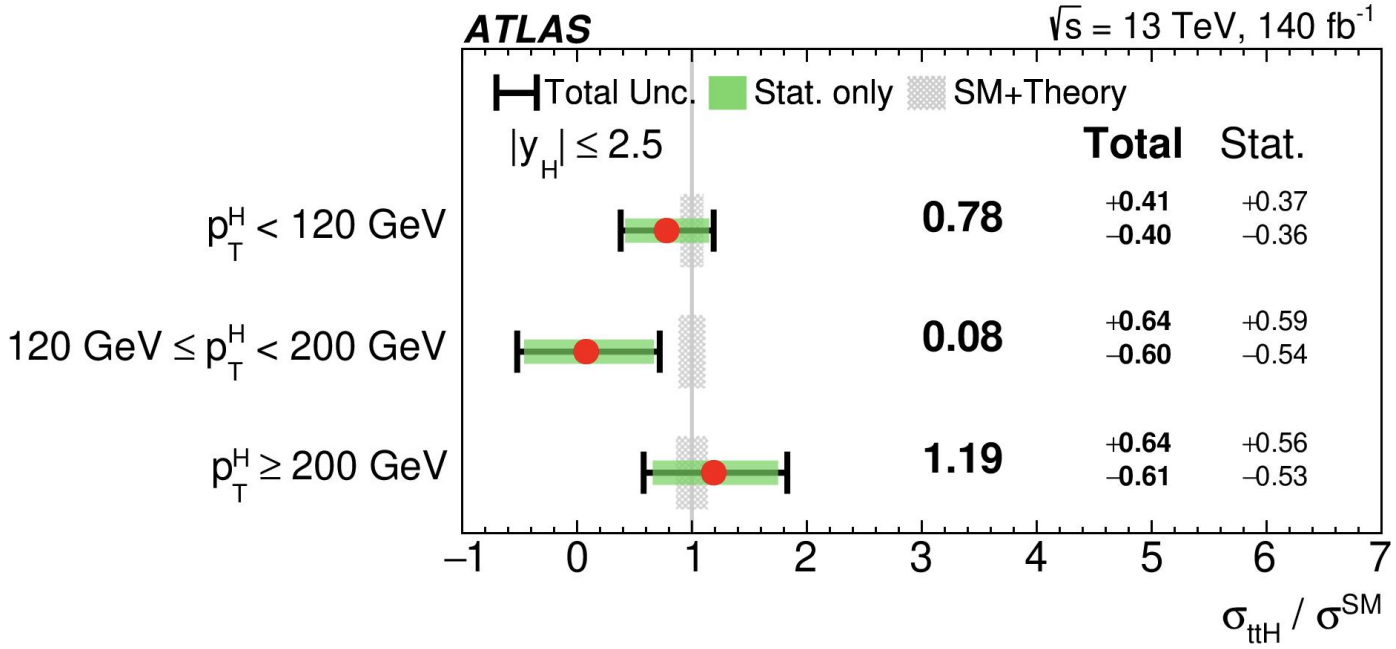


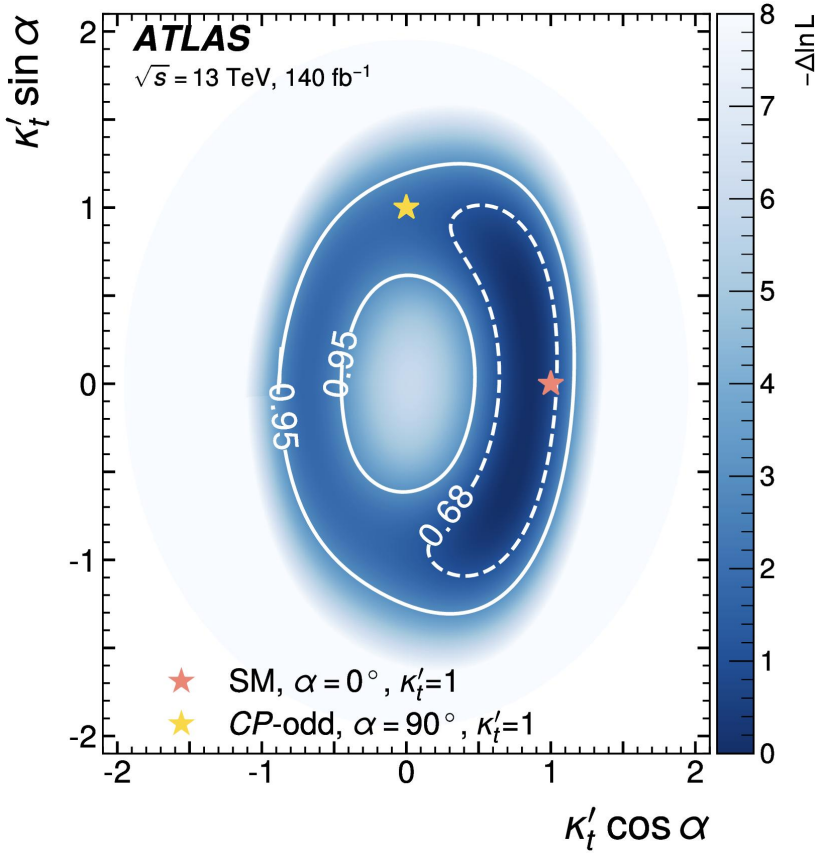


- Updated analysis with Full Run2 + Partial Run3(165fb^{-1}), obs. (exp.) significance 2.5σ (1.9σ)
  - ~61% improvement to ATLAS Run 2
  - ~19% improvement to ATLAS+CMS Run 2 combination
- Contribution: analysis contact, INT editor, approval talk, bkg. modelling and syst. etc.

ttH→multi-lepton Full Run 2 w/ SDU

arXiv.2510.23755 [JHEP accepted]





- ATLAS full Run 2 measurement $\mu_{ttH} = 0.63\ ^{+0.20}_{-0.19}$, 7.2% compatibility with SM.
- CP interpretations in Higgs-top Yukawa coupling
  - obs. (exp.) exclusion at 68% CL. |α|<62°(43°)
- Contribution: analysis contact (until Aug. 2023, former postdoc), 2lSS channel etc.

HH Full Run 2 Combination ATLAS + CMS

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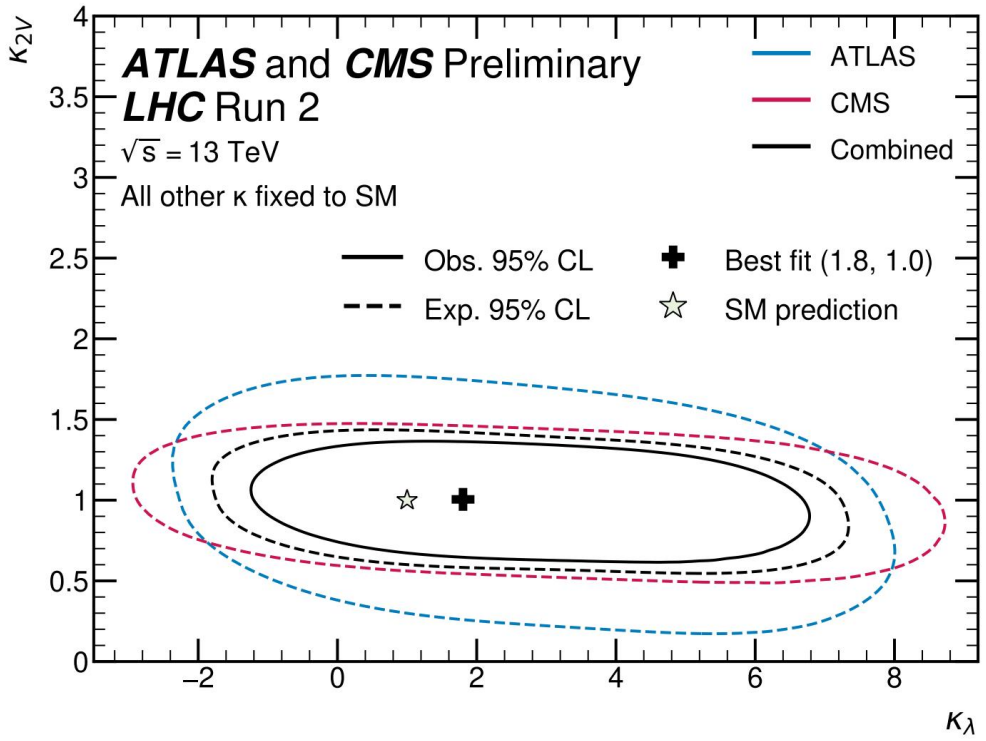
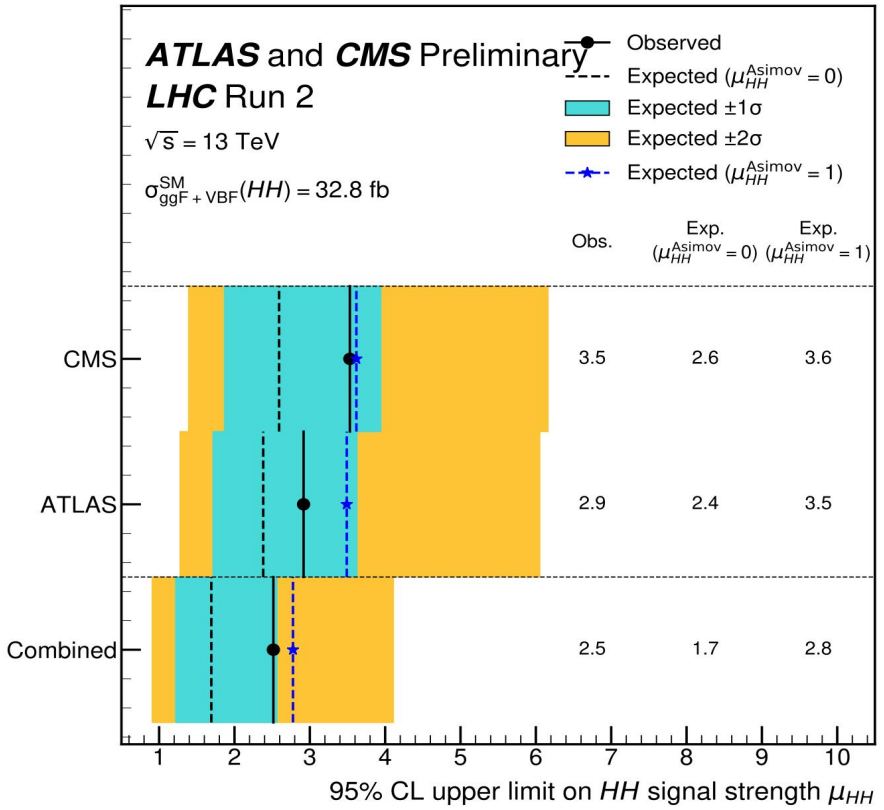
w/ IHEP&NJU&USTC&SDU

arXiv:2602.23991 (submited to P.R.L)





- ATLAS+CMS Full Run 2 combination (140 + 126 fb^{-1}): $\mu_{HH} = 0.8\ ^{+0.9}\ _{-0.7}$
  - HH significance ~1.1σ
  - Limits: $-0.71 < \kappa_\lambda < 6.1$, $0.73 < \kappa_{2V} < 1.3$
- Contribution: INT Editor， statistical framework optimization、statistical results etc.

Triple Higgs Search HHH→6b

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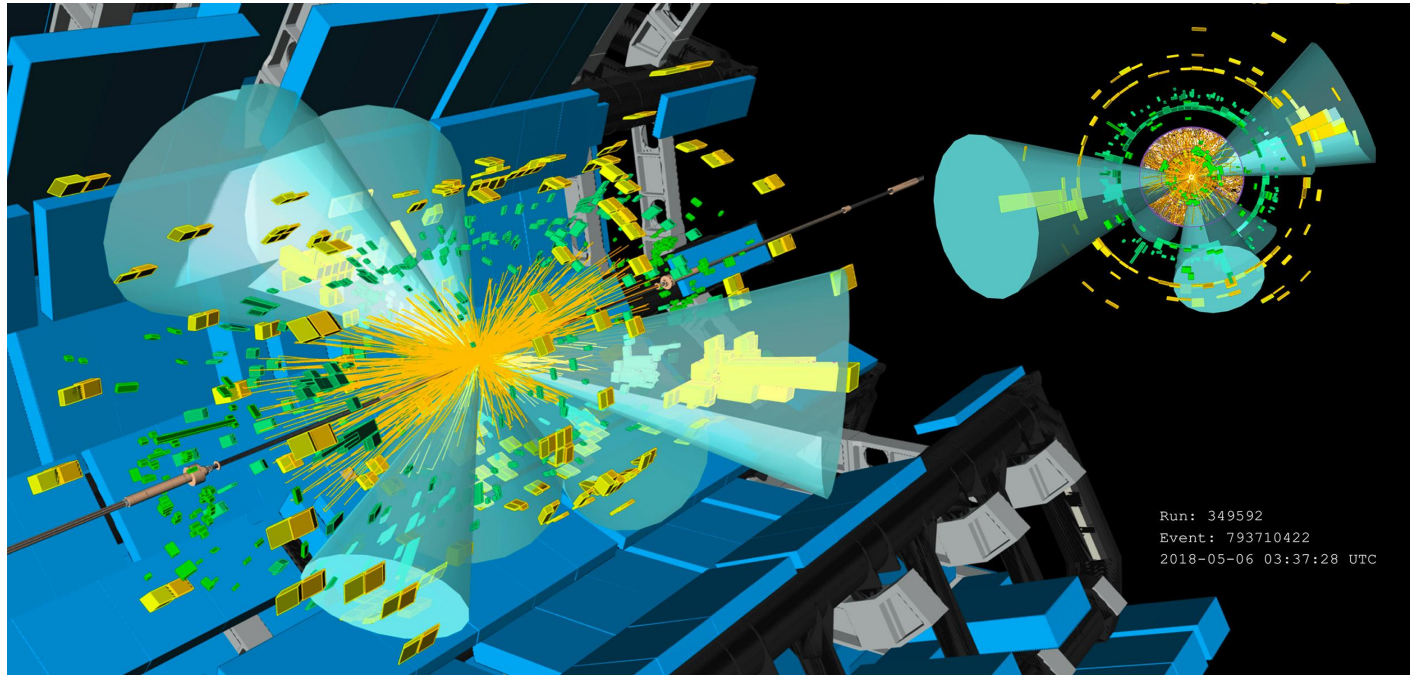
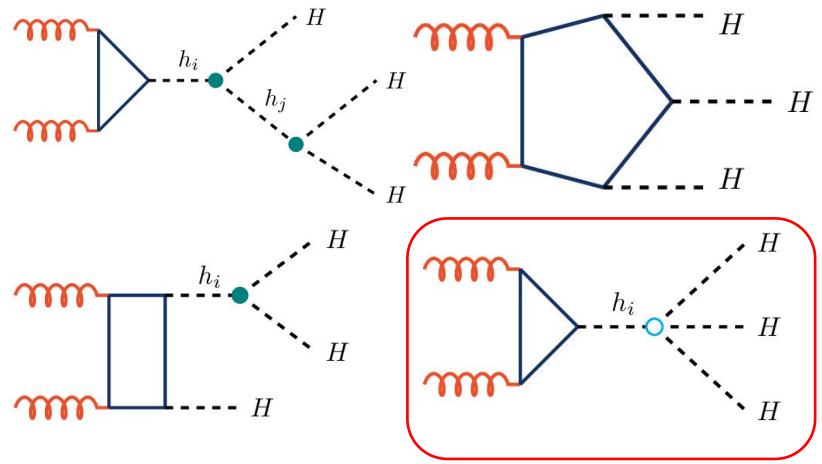
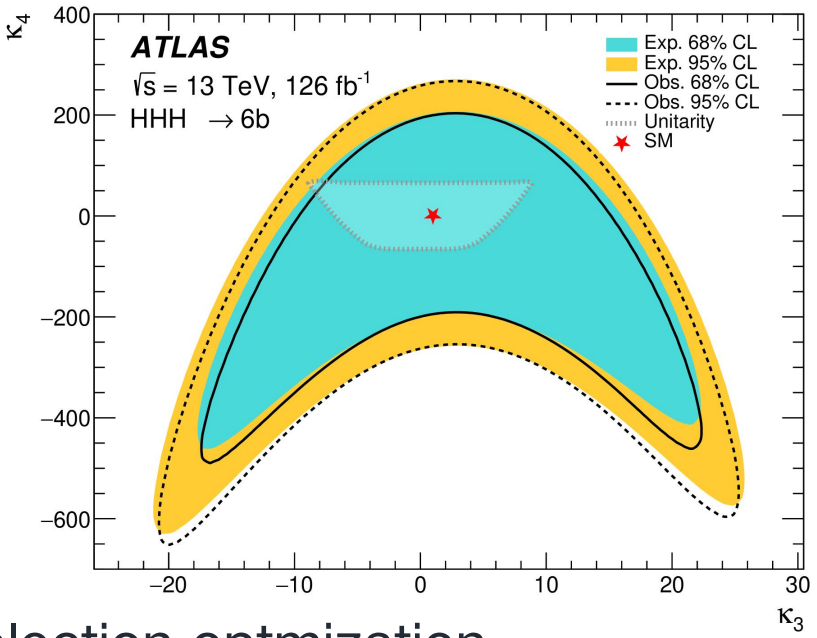
Phys. Rev. D 111 (2025) 032006

https://atlas.cern/Updates/Briefing/First-Tri-Higgs-Search



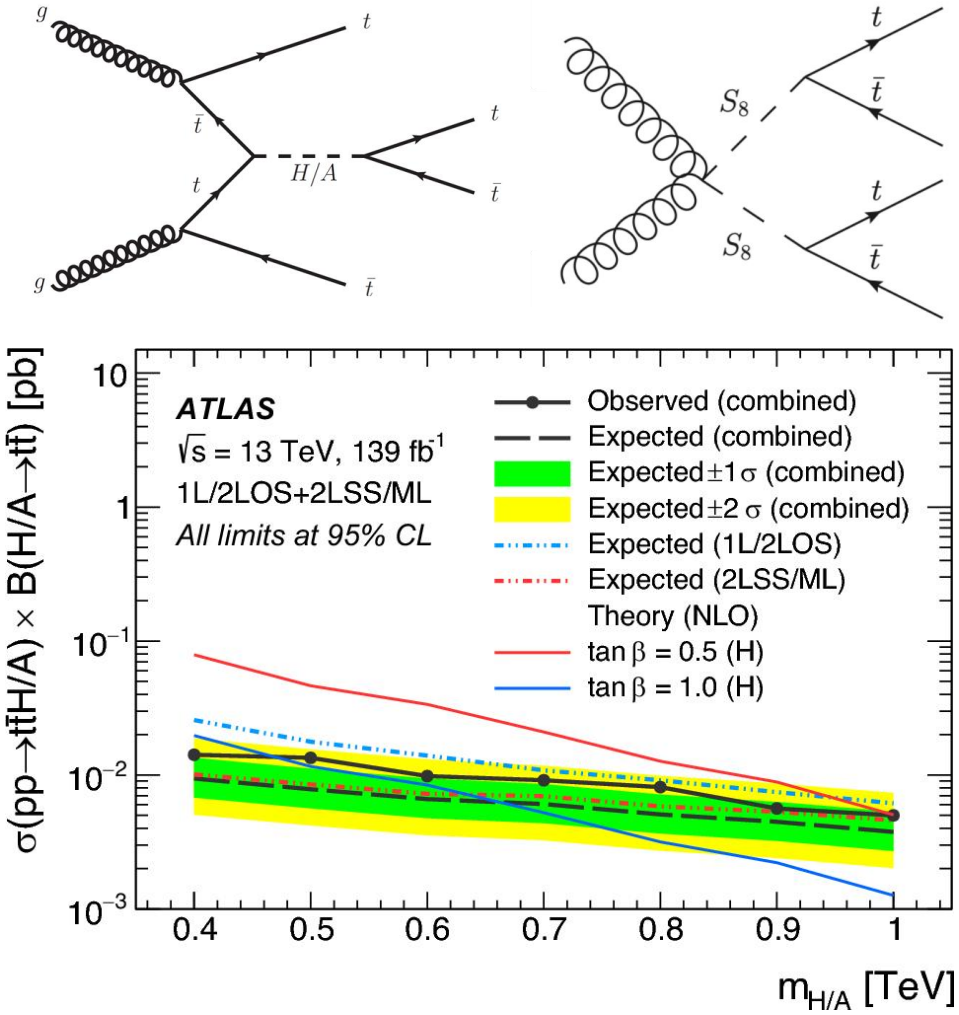




- 1st triple Higgs search and resonance search at LHC
  - 59fb upper limit at 95% CL on SM HHH
- Higgs quartic self-coupling limit [-230, 240]
- Contribution: Analysis Contact，analysis strategy, event selection optmization

BSM in 4-tops & nTGC in Z(→ll)γ

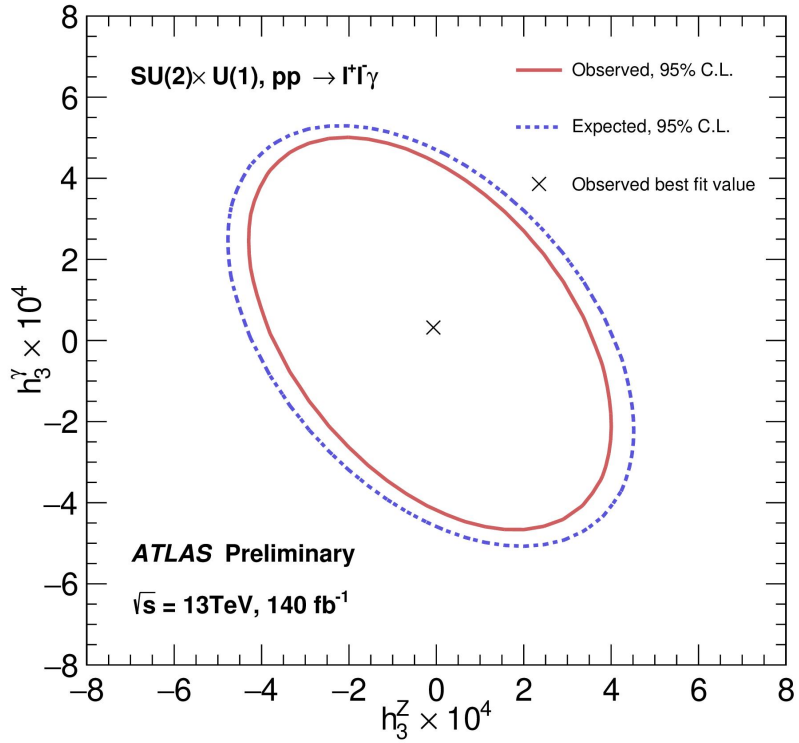
Eur. Phys. J. C 85 (2025) 573



- Conribution: Approval Talk, 1LOS analysis

- The 1st SU(2)⊗U(1) nTGC constraints at the LHC (SMEFT理论最新进展)

ATLAS-CONF-2025-001



- Contribution: Analysis Contact, Contact Editor, Approval Talks, full analysis

Wγ updates & VBS ZZ(→llνν)

w/ USTC

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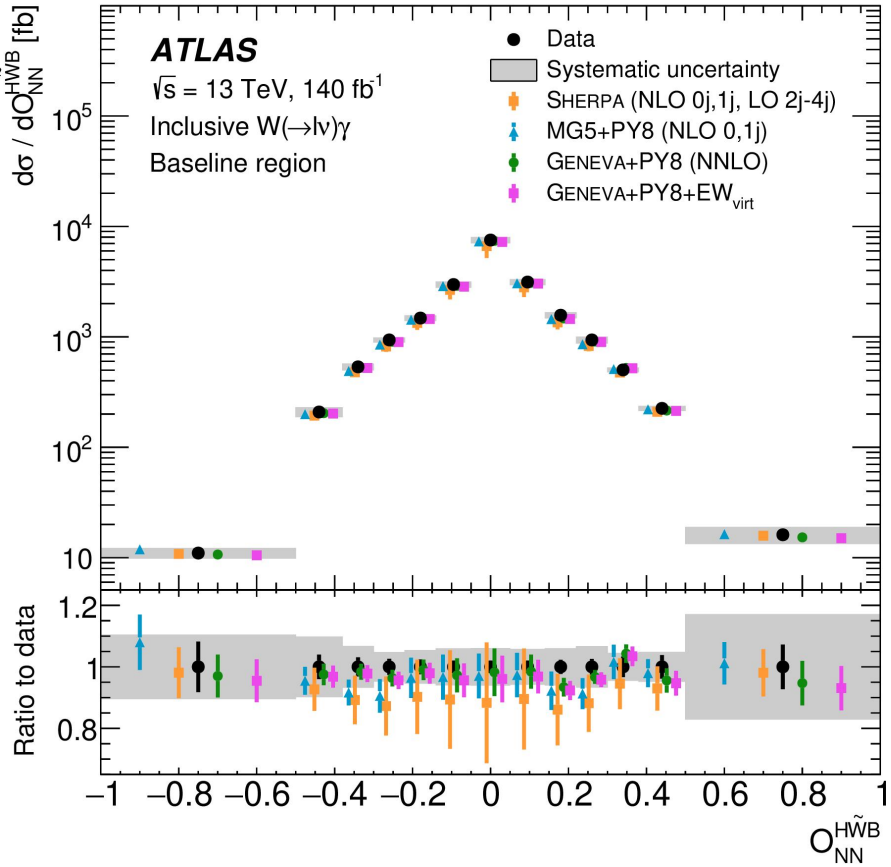
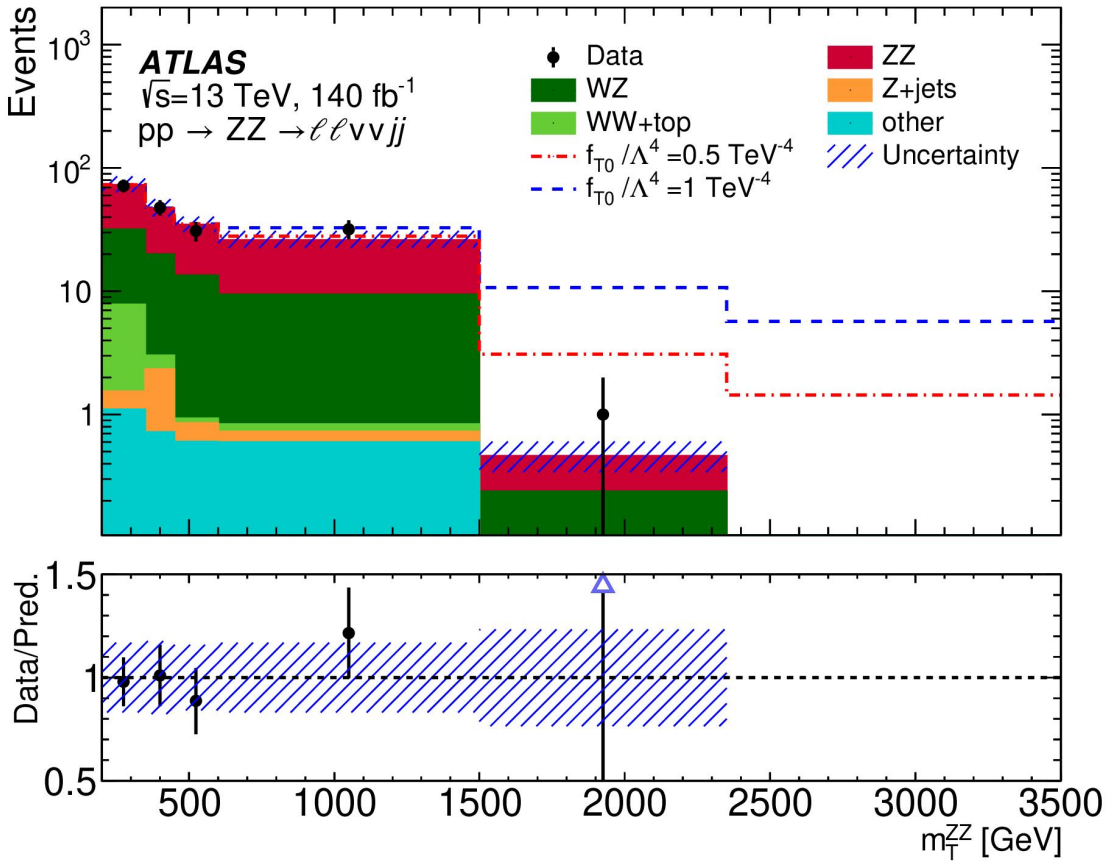
arXiv:2603.22478 (submitted to EPJC)



arXiv:2511.15569 (submitted to EPJC)

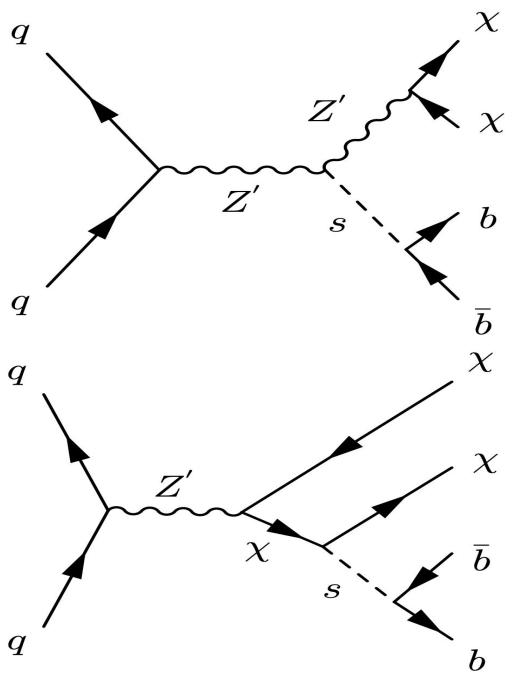


- Improved sensitivity on $\mathcal{O}_{H\tilde{W}B}$ by a factor of 2.5
- Contribution: bgd estimation, lepton fake factor study

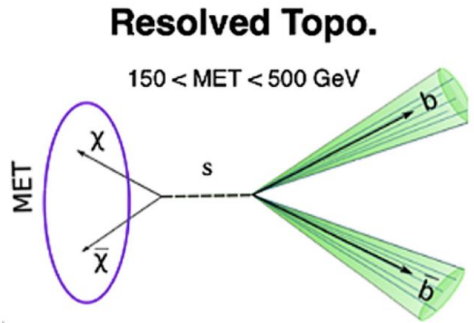
$$\sigma(pp \to ZZ) = 15.38 \pm 0.81 \text{ pb}.$$

- Contribution: Analysis Contact, Approval Talk, bgd estimation, unfolding.

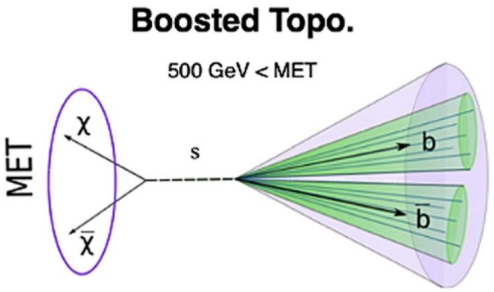
Mono-S to bb Updates



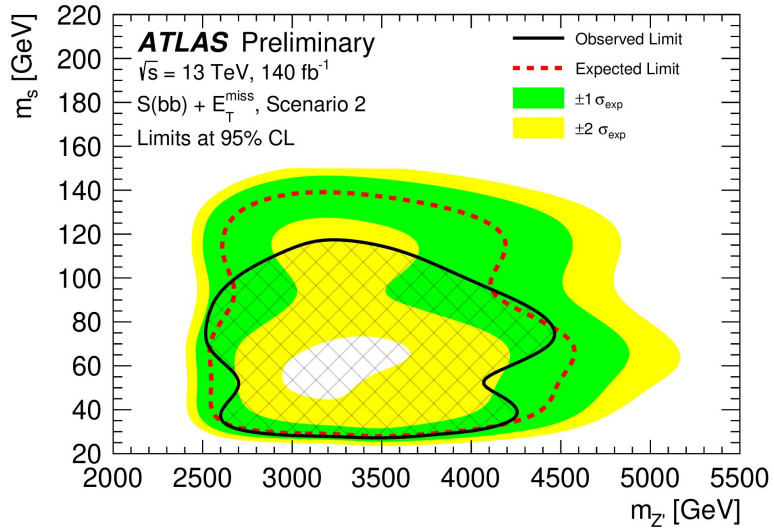
Phys. Rev. Lett. 134 (2025) 121801

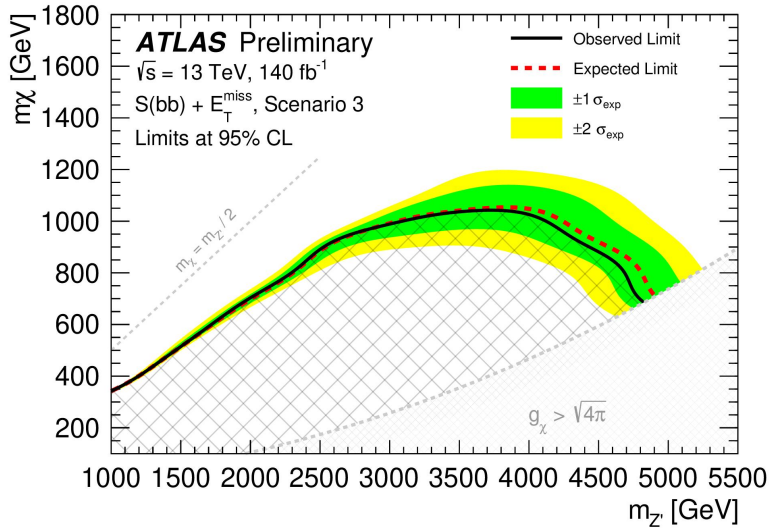


Good statistics



Sensitive to high mZ'
dominates for mZ'>2 TeV





Reclustering(RC) Jet 探索低质量区
Dxbb 标定方法提高重味夸克喷注标定效率

目前最好的低质量区暗希格斯寻找物理结果
LHC首个基于“宇宙学一致性”的暗希格斯粒子寻找物理结果： Cosmological constraint: freeze-out relic density $\Omega h^2 = 0.1200 \pm 0.0012$ [PLANCK2018]

Contribution: Analysis Contact, Approval Talk，Full analysis

Jet Flavour Tagging Performance

[ATLAS Physics Briefing]

w/ SYSU&USTC&NJU

Nature Commun. 17 (2026) 541


ATLAS EXPERIMENT

Collaboration Site | Physics Results

Updates > Briefing > ATLAS enters a new era of jet flavour tagging – powered by AI

Physics Briefing

Tags: jets, EPS 2025, machine learning

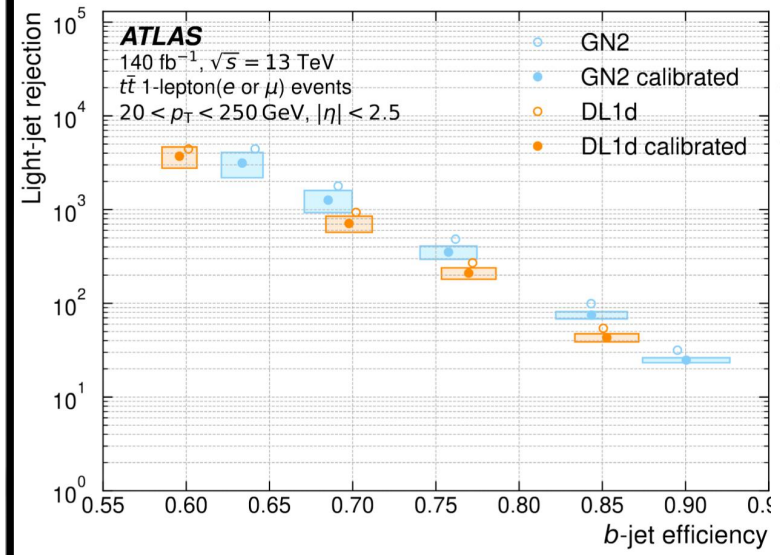
ATLAS enters a new era of jet flavour tagging – powered by AI

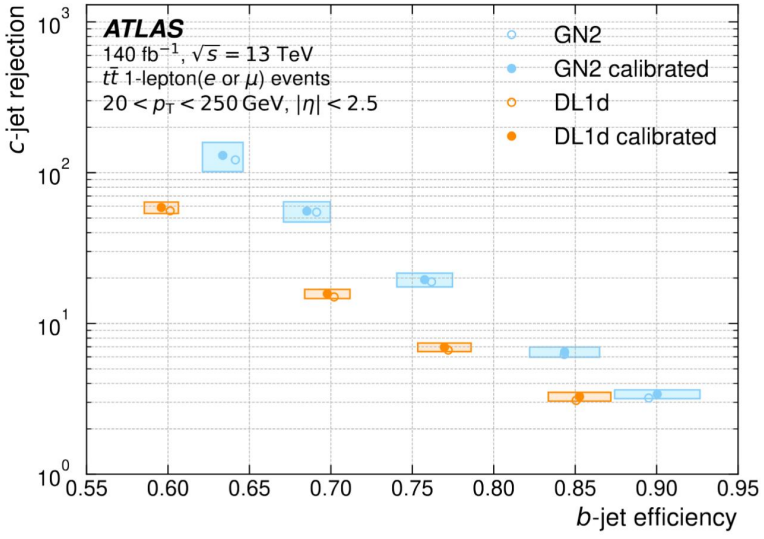
7 July 2025 | By ATLAS Collaboration

Modern AI techniques are unlocking new ways to analyse particle collisions, and ATLAS is embracing the possibilities.

The most common signals produced in proton-proton collisions come from particle *jets* – collimated sprays of particles created when quarks or gluons transition into hadrons. Jets dominate the data collected by the ATLAS experiment, yet identifying what type, or flavour, of quark initiated a jet (*jet flavour tagging*) is highly challenging. This information is crucial for precise Standard Model measurements and searches for new physics phenomena.

Jets arising from a bottom or charm quark (*b*-jets and *c*-jets) have unique signatures compared to jets initiated by up, down or strange quarks or gluons ("light-jets"). They contain a high number of tracks, a fraction of which are measurably displaced from the proton-proton collision point. Jet flavour tagging takes advantage of these subtle but distinctive features. Traditionally, ATLAS physicists used algorithms aimed to reconstruct various features associated with displaced decays to then feed them into a machine-learning model that would determine the jet flavour. Now, physicists are using major advancements in artificial intelligence to upend this paradigm.





- GN2 tagger：ATLAS introduced new flavour tagging calibration technique
  - Significantly improved flavour tagging performance
- Contribution: MC samples production/validation for GN2 training/calibration

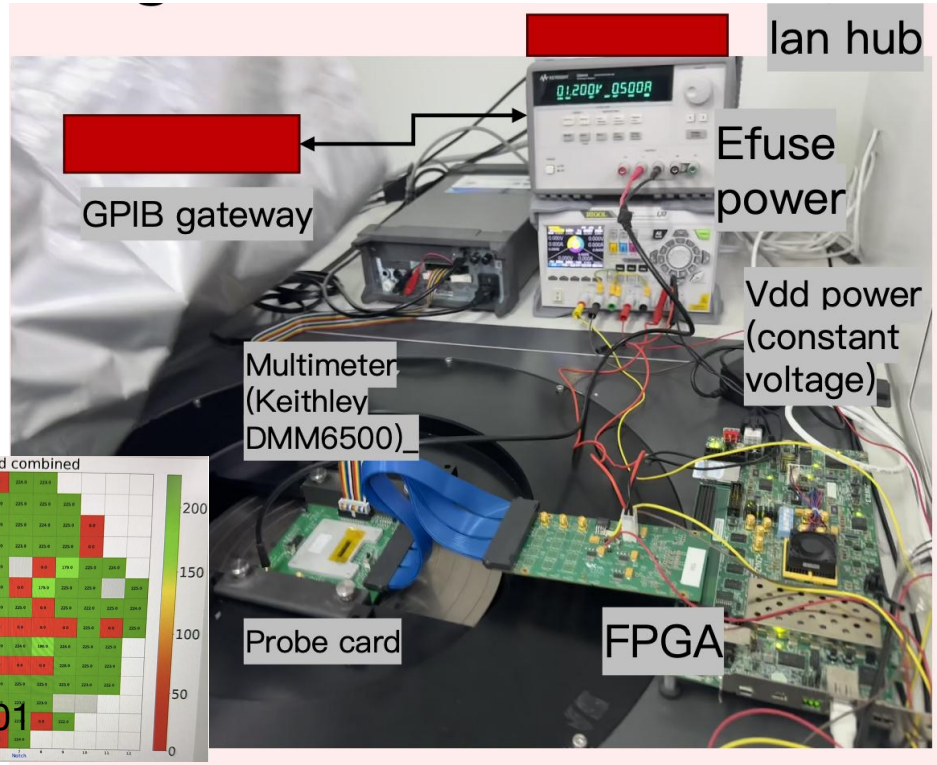
Outline

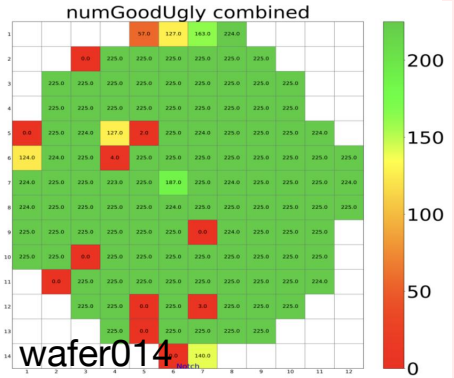
RPC Activities

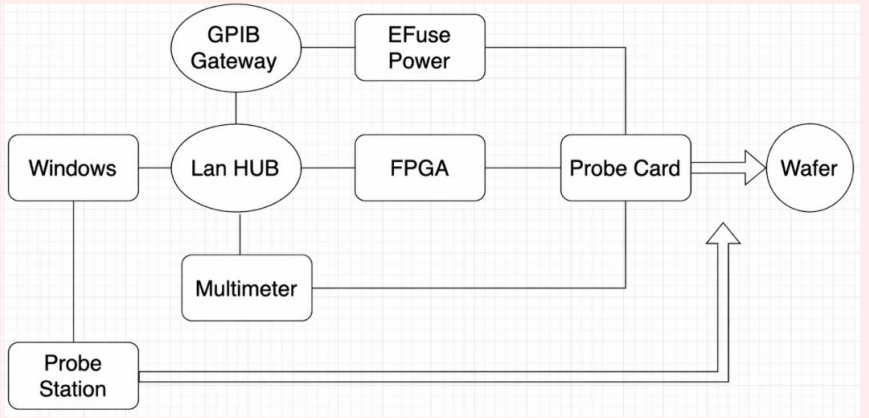
- **Joint massive production and testing at CERN:**
  - Lining Mao, Xi wang, Yifan Zhu.
  - Will send more manpower
- **Bakelite procurement from Italy (finished) for BLS chamber building: 50 pieces,**
- **FE boards:**
  - Received items from CERN: LDO regulator, connectors
  - Will order with some companies in China for manufacture when the design is settled
- **MDT Gas System Monitoring** (Ngoc Khanh Vu -> Yifan Zhu)

HGTD Wafter Testing Activities

- **Set up wafer testing stand using UF3000-Exe probe station**
- **Develop automation scripts and remote testing workflow with IHEP team**
  - ~6min per ASIC -> 13hrs per wafer, excluding retest
  - Efuse: 20s per ASIC -> ~1hr per wafer
  - Auto summarizing test results and retesting for bad ASICs
- **HGTD DCS FELIX Monitoring Development**
- **Shift period: one week per month**
  - 2025 May – June; 2025 August; 2025 Oct – 2026 Jan
  - Tested and documented 11 wafers
- **Next step**
  - Main production test from April ‘26
  - Wafer switching / FPGA automation



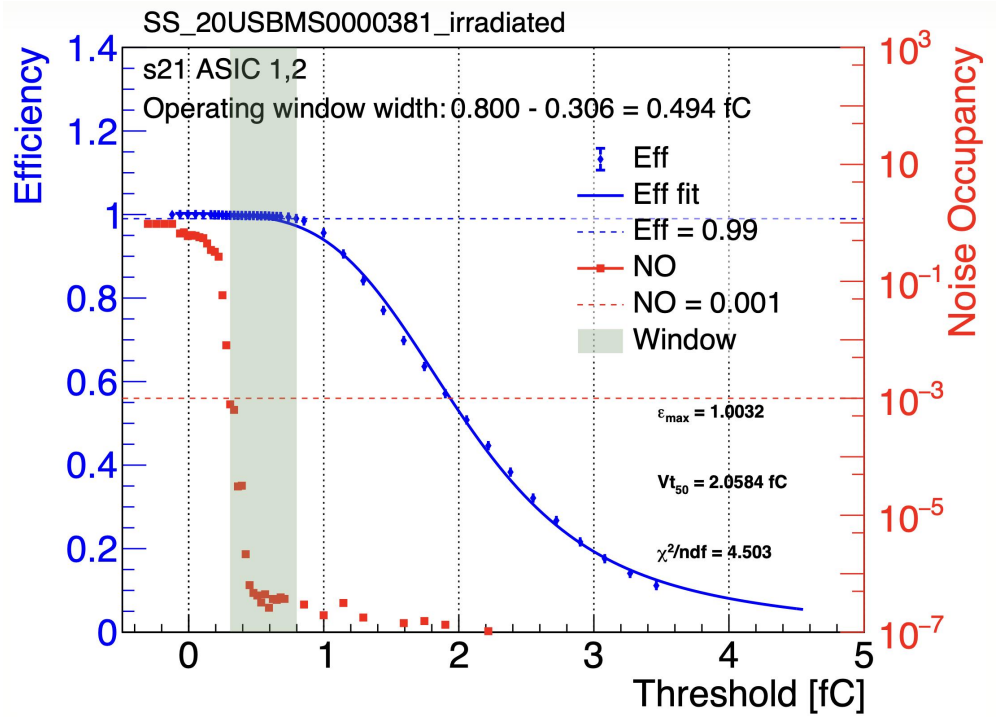




Team: Xiang Chen, Jiahui Wu, Chonghao Wu, Zelin Yan, Haydar Mas‘ud Alfanda, Shu Li, Liang Li

ITk Beam Test Activities

- SJTU/TDLI team participated in Beam test activitives (Lin Yang at DESY, April 2025)
- Dian Yu completed QT at March 2026: “Develop Python scripts and database reporting to supporting the production of ATLAS Inner Tracker Strips ASICs”



➜ **Lin Yang’s talk at CLHCP, Oct. 2025:** *“Beam Testing of ATLAS ITk Strip Module”;*

Poster at the “第六届半导体辐射探测器研讨会”（上海）， April 16 -19, 2026

总结

- **ATLAS实验物理研究**（Run1/2/3→HL-LHC）
  - 希格斯粒子性质研究: Higgs rare decays; Higgs-top Yukawa coupling; Higgs self-coupling
  - 标准模型精确检验: Wγ, ZZ(→llvv) differential cross sections
  - 寻找新物理信号: 4-tops; nTGC in Z(→ll)γ; mono-S to bb search
  - 探测器性能研究：Jet Flavour tagging; E/gamma and muon performance etc.
- **参与ATLAS探测器升级项目有序进行**
  - RPC: joint massive production at CERN
  - HGTD: developed automation scripts for wafter test
  - ITk: joint beam test at DESY and completed data analysis for module-s381

SJTU-TDLI Cluster OTP 总结

1	Class	Task	2025	2026
2	Class 2	ADCoS Senior shifts	0.2	0.2
3	Class 2	ADCoS Trainee shifts	0.18	0.01
4	Class 2	Analysis Release Shift	0.16	0.04
5	Class 3	Generator Physics	0.01	
6	Class 3	MC Sample Request for Physics and CP Groups	0.2	
7	Class 3	Performance Studies - Flavour Tagging	0.81	
8	Class 3	Simulation	0.3	
9	Class 3	MDT operation and Maintenance	0.17	
10	Class 3	RPC operation and maintenance	0.02	
11	Upgrade Construction	Phase-II HGTD	0.66	
12	Upgrade Construction	Phase-II ITk Strips	0.55	0.24
13	Upgrade Construction	Phase-II Muons	0.91	
14				
15	Total		4.17	0.49