2022年9-12月研究生考核报告

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2023. 1. 6

$Z\gamma$+jets analysis

- Introduction
  - Measurement of pp → Z(ll) γ + jets fiducial differential cross section
  - Motivation: test of parton shower prediction, pdf, and fixed order QCD calculation; Z-boson polarization interpretation
  - Method: Unfolding
  - Measured observables: **QCD variables (1D Unfolding)**: m_{jj}, $nJets$, $m_{ll\gamma}$, p_T^{γ}, p_T^{ll} ...
    Polarisation variables (2D Unfolding): $cos\theta_{CS}$ /ϕ_{CS} in 5 bins of p_T^{ll}
- Status
  - Finished second circulation
  - Paper submitted to JHEP at December 2022
  - arxiv: https://arxiv.org/abs/2212.07184
- Finished task
  - 2D unfolding and all relative task related to unfolding, systematic uncertainties study, final results
  - support note editor, ATLAS approval meeting reporter

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH (CERN)

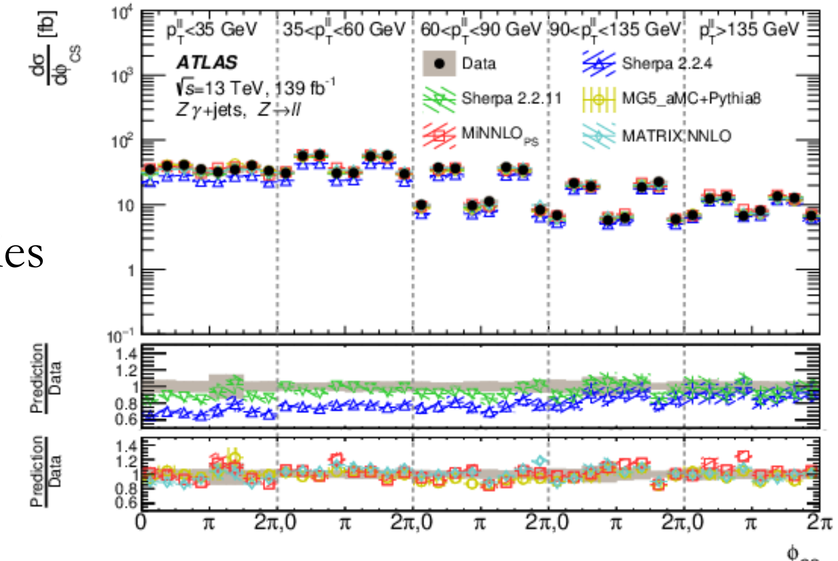
Submitted to: JHEP

CERN-EP-2022-240
15th December 2022

Measurements of $Z\gamma$+jets differential cross sections in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector

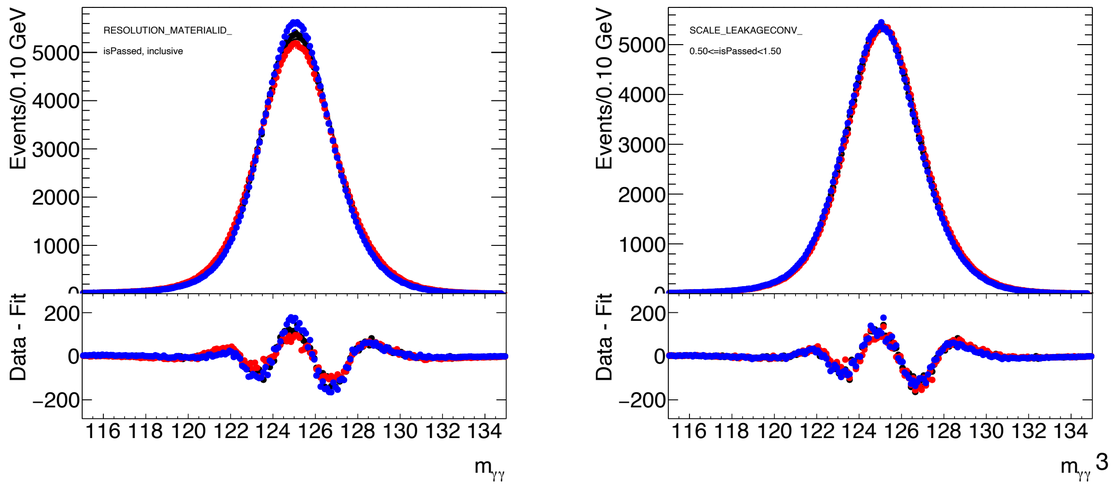
The ATLAS Collaboration

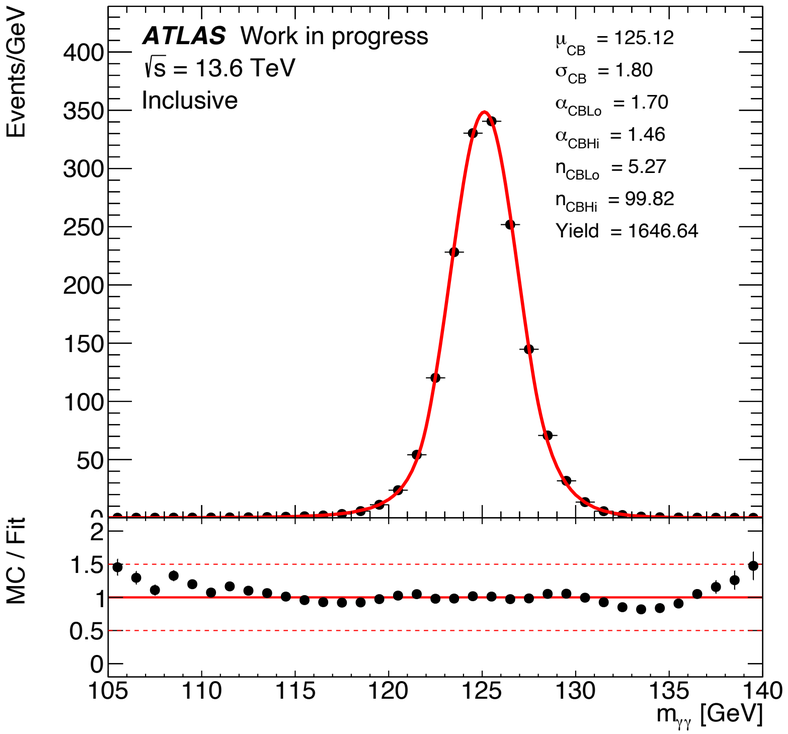
Differential cross-section measurements of $Z\gamma$ production in association with hadronic jets are presented, using the full 139 fb^{-1} dataset of $\sqrt{s}$ = 13 TeV proton–proton collisions collected by the ATLAS detector during Run 2 of the LHC. Distributions are measured using events in which the Z boson decays leptonically and the photon is usually radiated from an initial-state quark. Measurements are made in both one and two observables, including those sensitive to the hard scattering in the event and others which probe additional soft and collinear radiation. Different Standard Model predictions, from both parton-shower Monte Carlo simulation and fixed-order QCD calculations, are compared with the measurements. In general, good agreement is observed between data and predictions from MATRIX and MiNNLO$_{PS}$, as well as next-to-leading-order predictions from MadGraph5_aMC@NLO and Sherpa.



Early run3 H$\gamma\gamma$ analysis

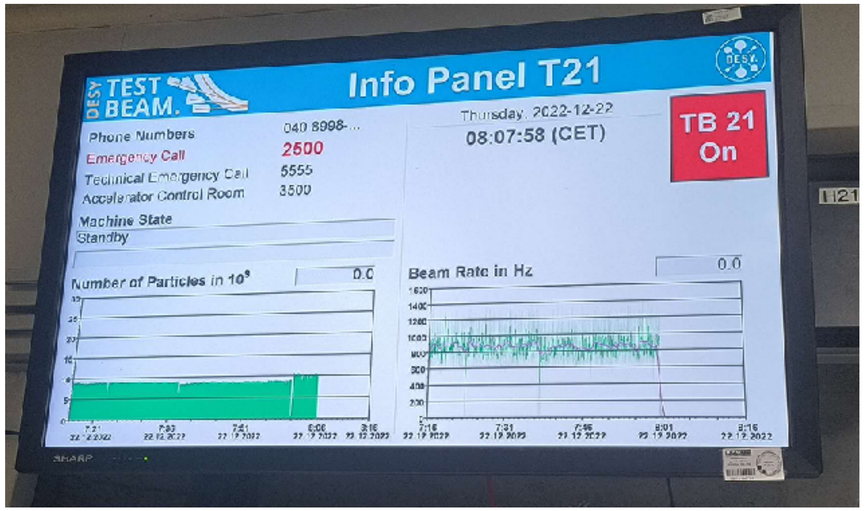
- Introduction
  - Goal: measure the first Higgs fiducial cross section at 13.6TeV in H->$\gamma\gamma$ channel
- Status
  - Requested EB at December 2022
- Task
  - finished Rel22 signal MC validation
  - working on signal modelling and uncertainties (photon energy scale and resolution uncertainties)

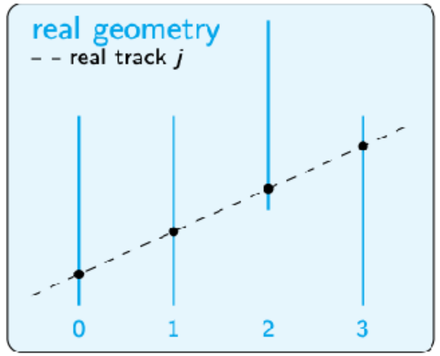


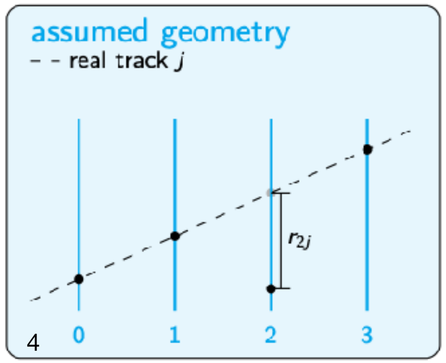


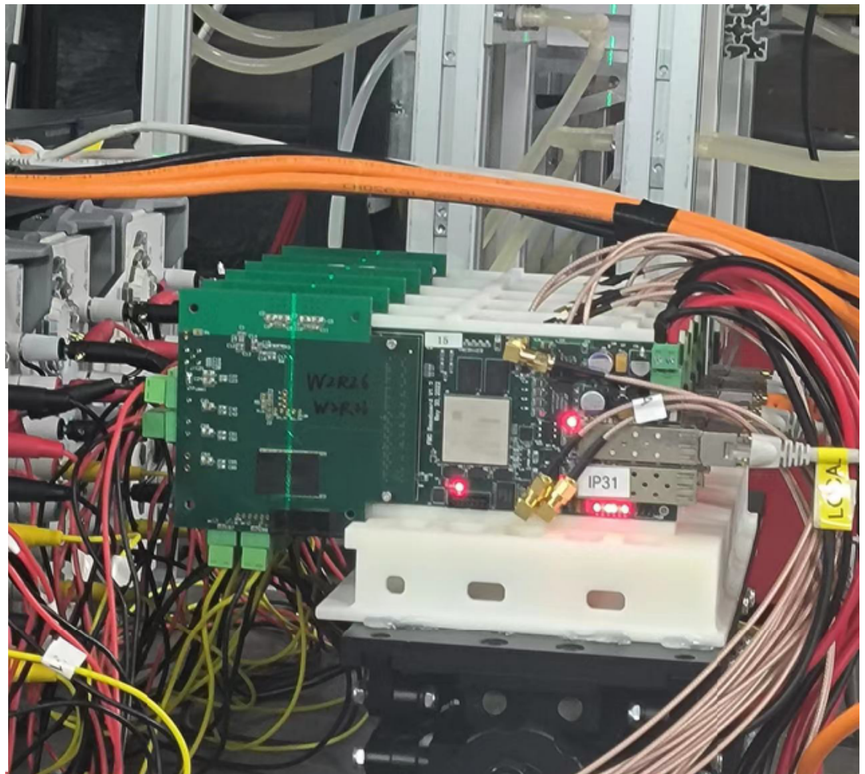
CEPC TaiChu Silicon chip testbeam at DESY

- Introduction
  - TaiChu chip is designed for CEPC vertex detector
  - Beam test at DESY from 2022.12.12 - 2022.12.22
  - Motivation is to get the spatial resolution < 5 um
- Setup
  - 6 layers of planes, each layer is 4cm apart
  - beam energy 3 - 6 GeV
- Offline analysis
  - Built the standalone offline analysis framework for track reconstruction and alignment
  - Track reconstruction method: linear fit
  - Track alignment method: Millepede matrix method



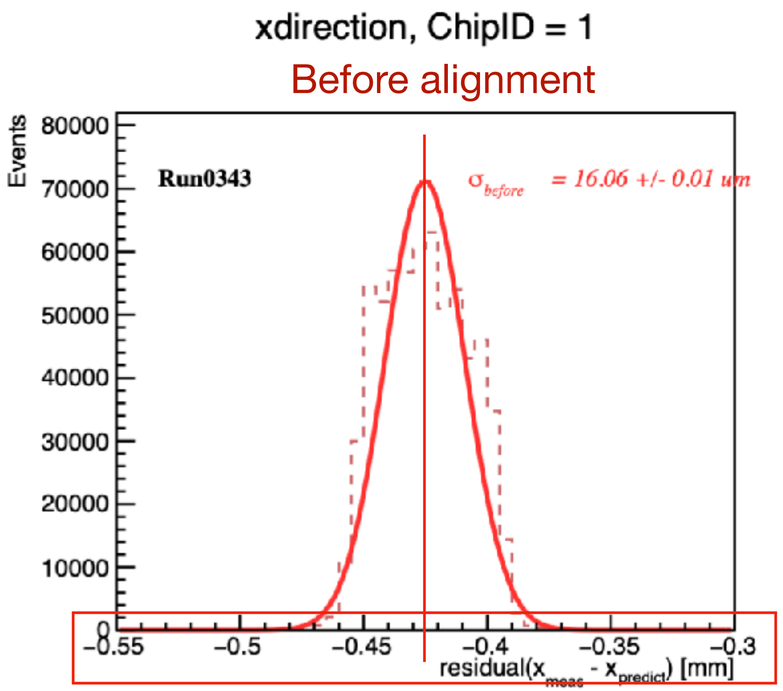


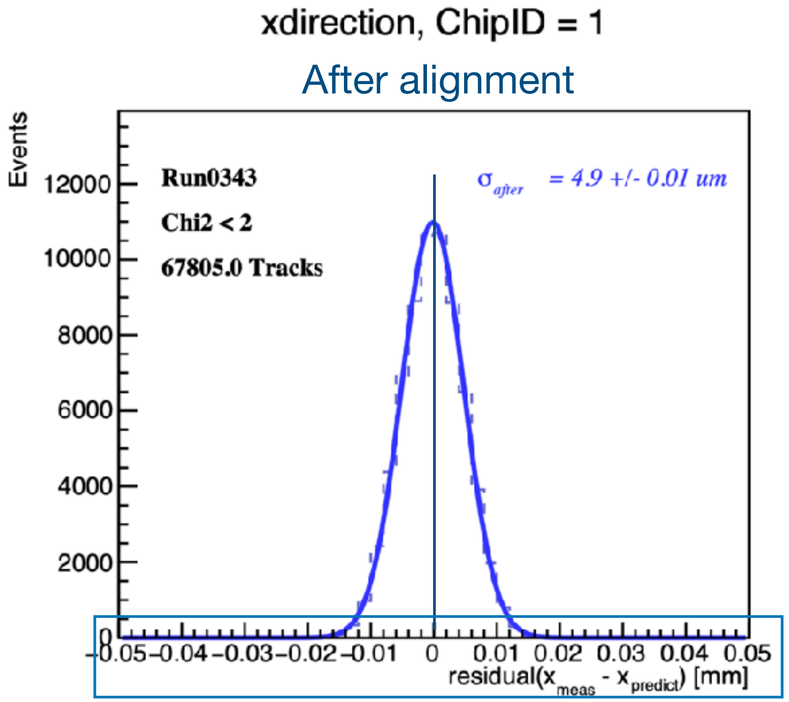




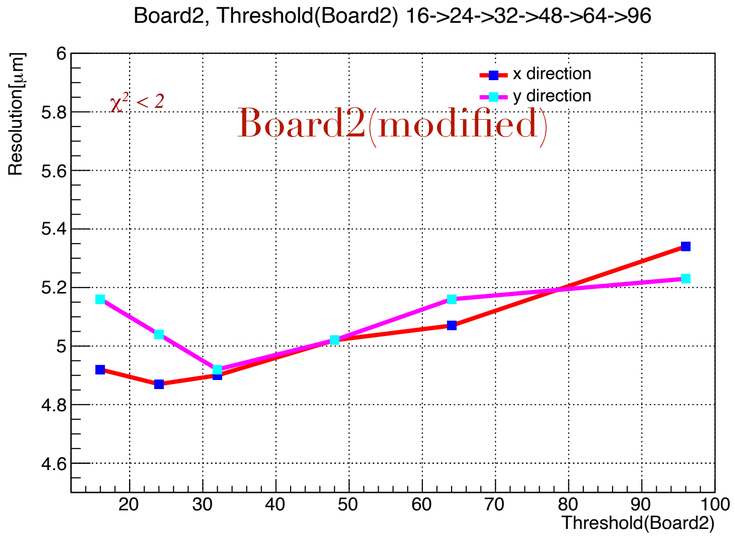
• Offline analysis results

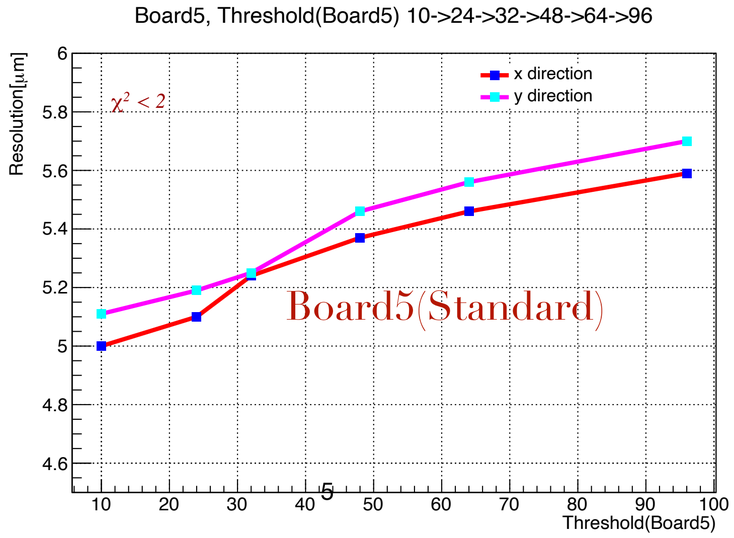
- Residual plots before and after alignment





- Spatial resolution vs. chip threshold





- Alignment framework can work well for test beam data
- The spatial resolution can < 5 um

Summary

- ATLAS Zgamma + jets physics analysis
  - 在 2022 CLHCP 给了该分析报告
  - 文章已经投稿到JHEP
  - arxiv: https://arxiv.org/abs/2212.07184
- ATLAS H$\gamma\gamma$ Early Run3 fiducial cross section analysis
  - 完成了信号蒙卡的验证工作
  - 正在做信号分布拟合模拟以及光子能量不确定度的影响等工作
- Offline analysis framework for TaiChu test beam
  - 为太初硅像素芯片束流测试搭建了径迹重建和校准的离线分析软件
  - 通过离线分析得到空间分辨率小于5 um, 满足科技部二期项目CEPC Vertex detector MOST2的验收指标
  - 预计今年上半年会把该束流测试的结果发表一篇文章
  - 下一步：把 Kalman filter加到径迹重建中，考虑多次散射的影响

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