中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

ATLAS EXPERIMENT

2021.09-2021.12研究生考核

贾雪巍
Supervisor:Joao Guimaraes da Costa
2023/01/06

Outline

- Analysis:
  - Low-mu W/Z pT measurement
  - Low-mu W mass measurement
- Detector:
  - ATLAS HGTD testbeam
  - CEPC MOST2 testbeam

Low-μ W Z pT measurement

- Finalized the channel combination, modify iteration in the combination

Bias correction with iteration in the combination:

  - Previous: Scale covariance matrix with factor iter_n/iter_n-1, treat all errors proportional(scale linearly)
  - *Modified:* Scale statistic in sqrt, Linear scale for sys, No scale to bkg

- Integral xsec and xsec ratio calculation

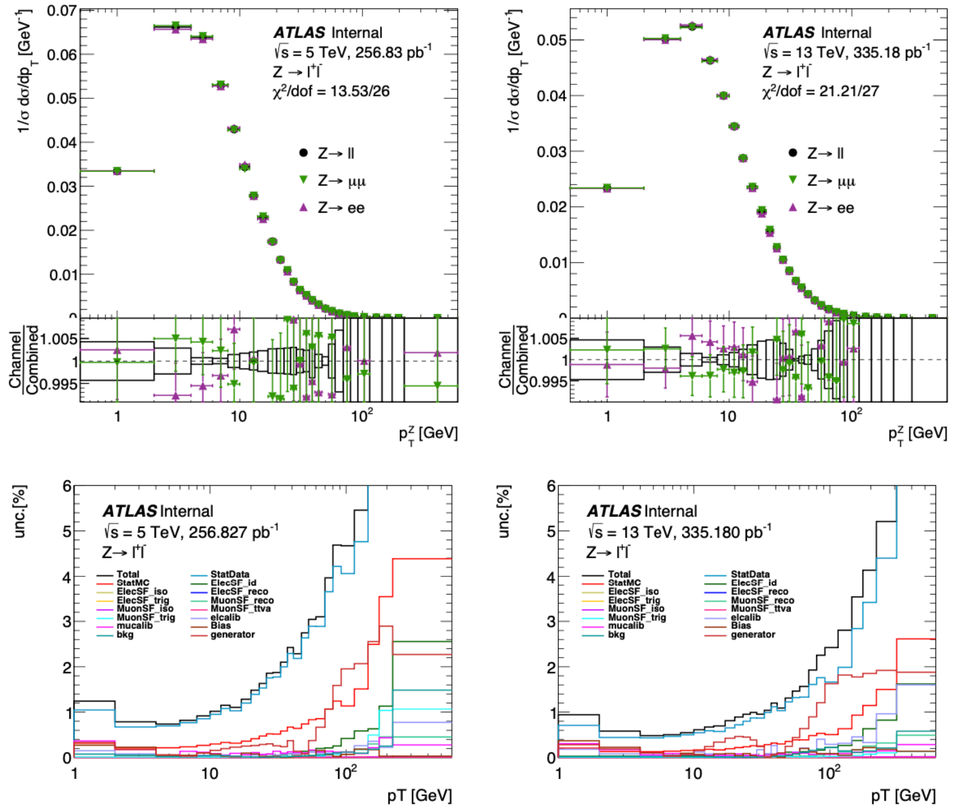


Figure 159: Breakdown of uncertainties for the combined Z measurements at 5 TeV (left) and 13 TeV (right).

Process	Cross section at $\sqrt{s}$ = 5 TeV [pb]	Cross section at $\sqrt{s}$ = 13 TeV [pb]	13/5 TeV Ratio
$W^+ \to \ell\nu$	2211.8 ± 2.5 (stat.) ± 7.5 (sys.) ± 36.6 (lumi.)	4614.5 ± 3.1 (stat.) ± 21.0 (sys.) ± 72.6 (lumi.)	2.08 ± 0.05
$W^- \to \ell\nu$	1373.4 ± 2.0 (stat.) ± 5.3 (sys.) ± 22.9 (lumi.)	3518.2 ± 2.7 (stat.) ± 17.1 (sys.) ± 55.8 (lumi.)	2.56 ± 0.06
$Z \to \ell\ell$	331.1 ± 1.2 (stat.) ± 2.2 (sys.) ± 5.3 (lumi.)	787.8 ± 2.7 (stat.) ± 7.5 (sys.) ± 11.8 (lumi.)	2.38 ± 0.06

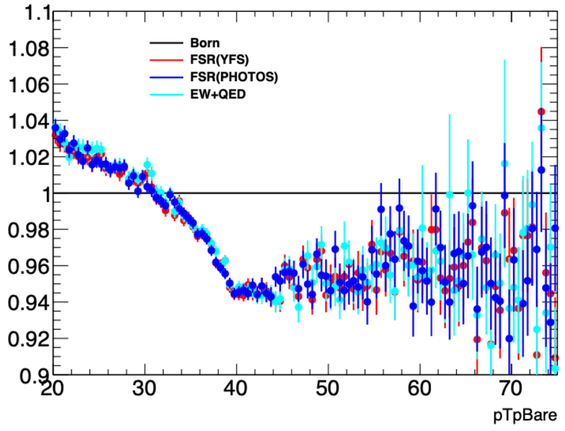
Table 22: Integrated fiducial cross sections for W^+, W^- and Z production in pb as well as the ratio of cross sections a

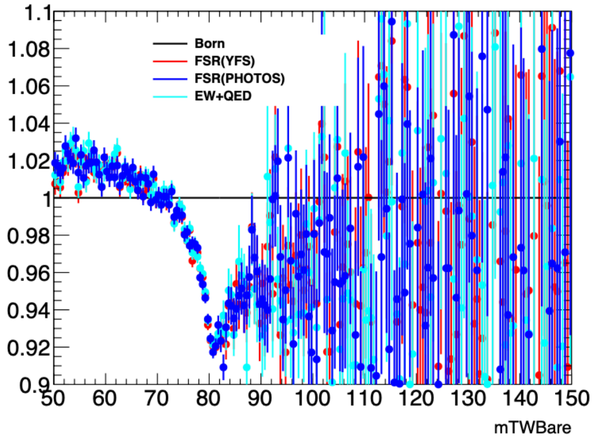
Processes	Cross-section ratio at $\sqrt{s}$ = 5 TeV	Cross-section ratio at $\sqrt{s}$ = 13 TeV
W^+/W^-	1.608 ± 0.005	1.312 ± 0.004
W^+/Z	6.69±0.08	5.86±0.09
W^-/Z	4.16±0.05	4.47±0.07
$W^\pm/Z$	10.86±0.12	10.38±0.15

Table 23: Integrated cross-section ratios.

Low-μ m_W measurement

- Attended ATLAS w mass workshop @DESY in Sep
  - Met analysis team
  - Kick-off talk representing IHEP group
- Working on EW correction systematic in m_W
  - Generate spectrum with full QED+weak correctio
  - Next input into mass fit





14:30 **mw kick-off : expertise/plans and person power** 1h

Speakers: Fabrice Balli (Université Paris-Saclay (FR)) , Hicham Atmani (Shandong University (CN)) , Jan Kretzschmar (University of Liverpool (GB)) , Matthias Schott (CERN / University of Mainz) , Raimund Strohmer (Julius Max. Universitaet Wuerzburg (DE)) , Xiaowen Su (Université Paris-Saclay (FR)) , Xuewei Jia (Chinese Academy of Sciences (CN))

Mainz 5m
Speaker: Matthias Schott (CERN / University of Mainz)
MW_Mainz...

Würzburg 5m
Speaker: Raimund Strohmer (Julius Max. Universitaet Wuerzburg (DE))
Würzburg ...

Liverpool (&DESY) 5m
Speaker: Jan Kretzschmar (University of Liverpool (GB))
Wm_Liverp...

Saclay 5m
Speaker: Fabrice Balli (Université Paris-Saclay (FR))
mWWorks...

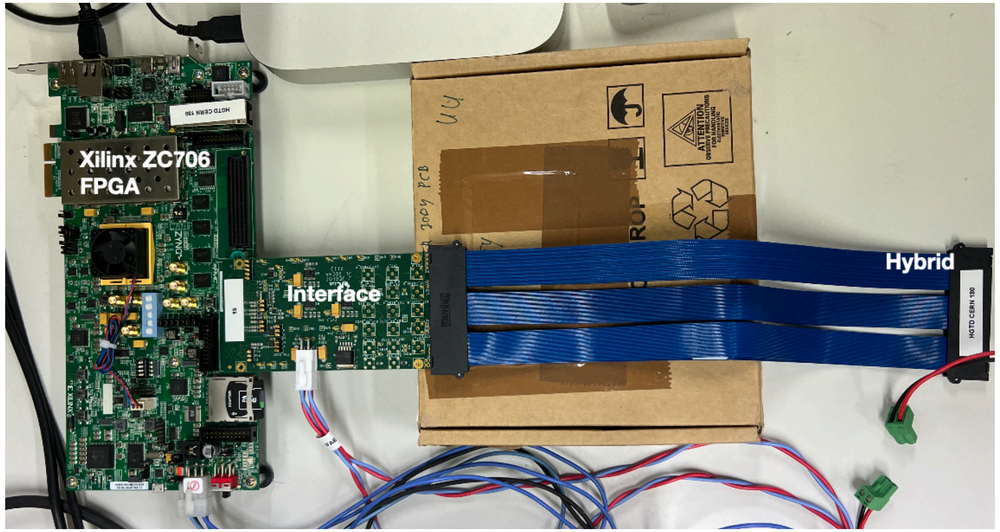
Shandong 5m
Speaker: Hicham Atmani (Shandong University (CN))
Wmass.pdf

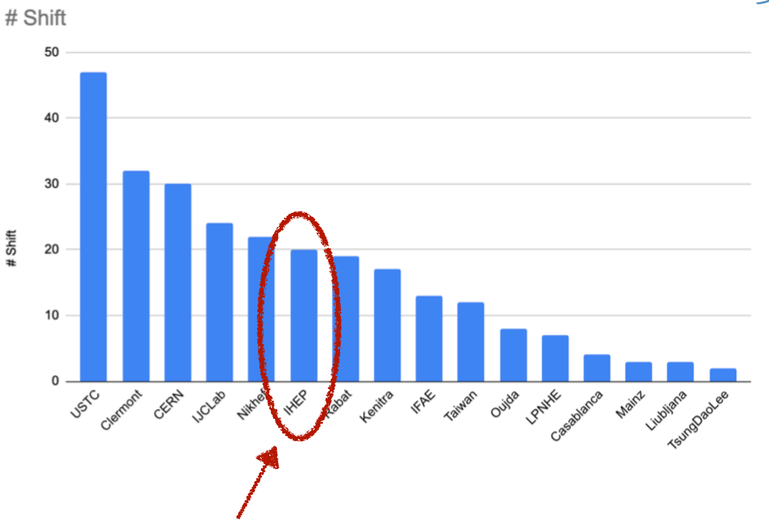
IHEP 5m
Speaker: Xuewei Jia (Chinese Academy of Sciences (CN))
W mass ki...

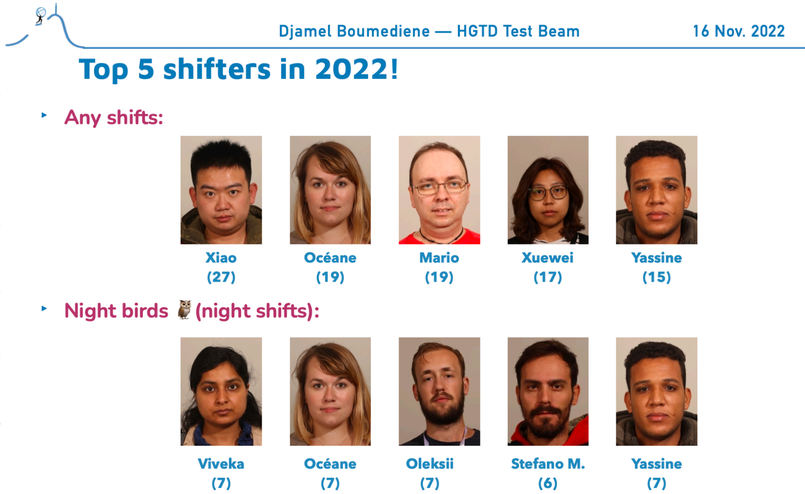
IJCLab 5m
Speaker: Xiaowen Su (Université Paris-Saclay (FR))
kickoff_ijcl...

Hardware work

- ATLAS HGTD testbeam:
- Set up ALTIROC(HGTD module) testbench @CERN, facilitate tests at testbeam
- HGTD testbeam shifts

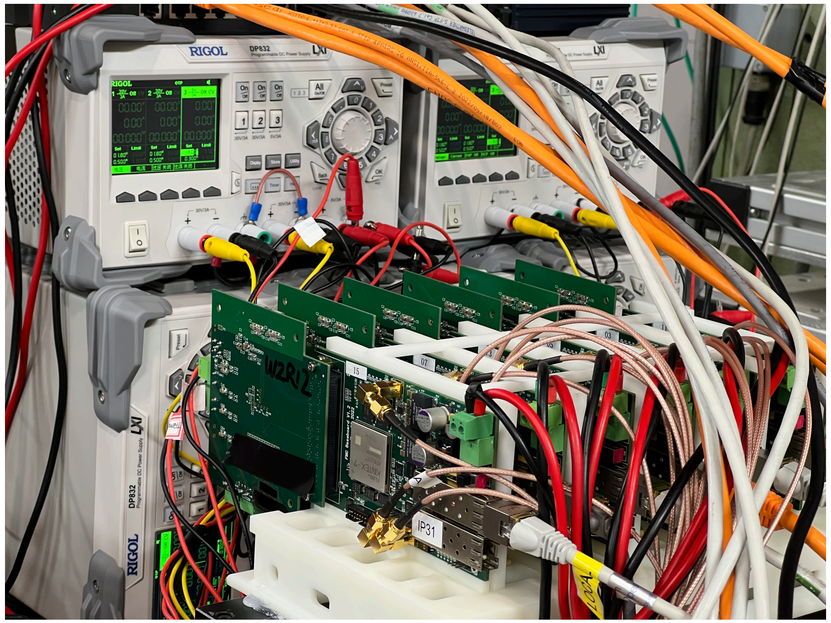


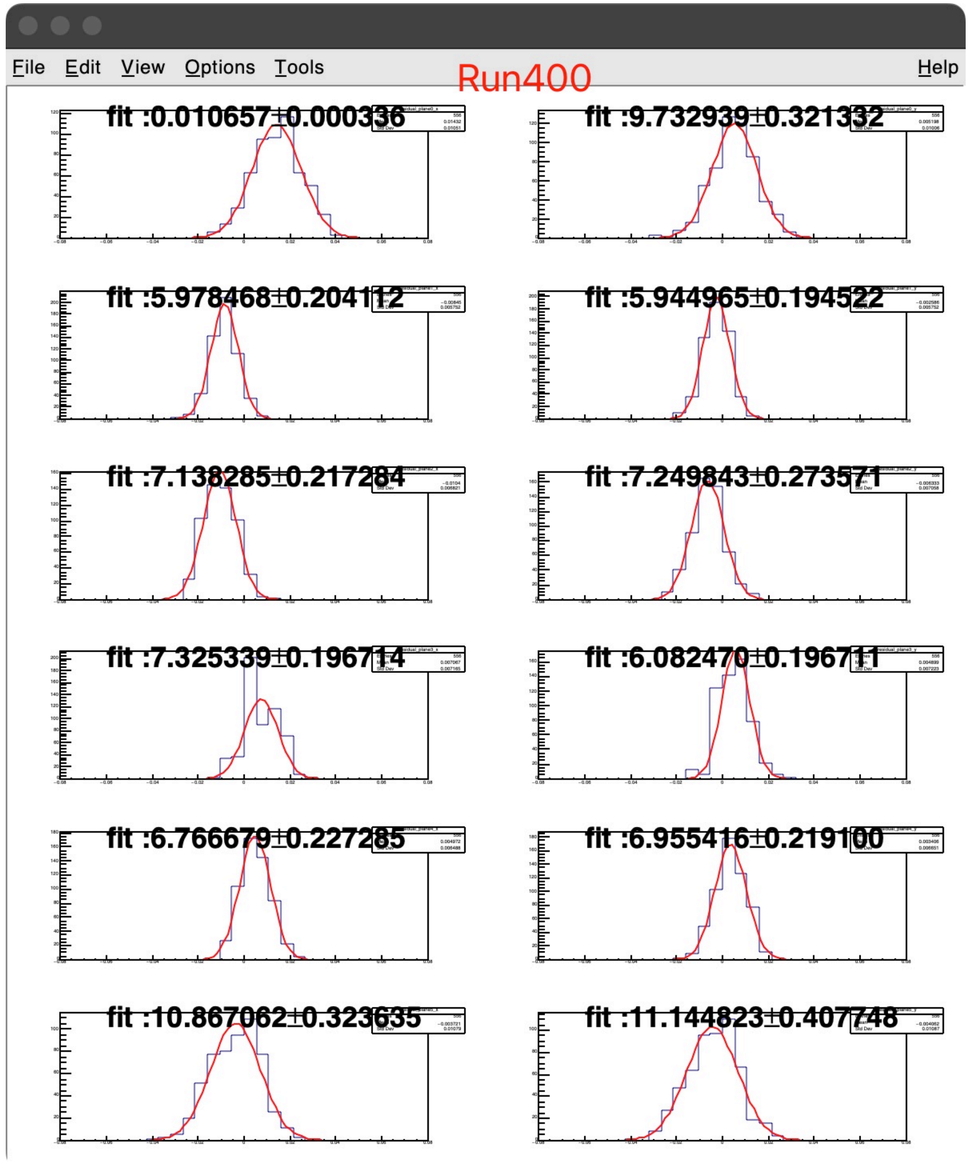




Hardware work

- CEPC MOST2 testbeam @ DESY
- Many people got covid, so I joined in the last week ~~to get covid~~…
- Helped to check the run parameters during the runs





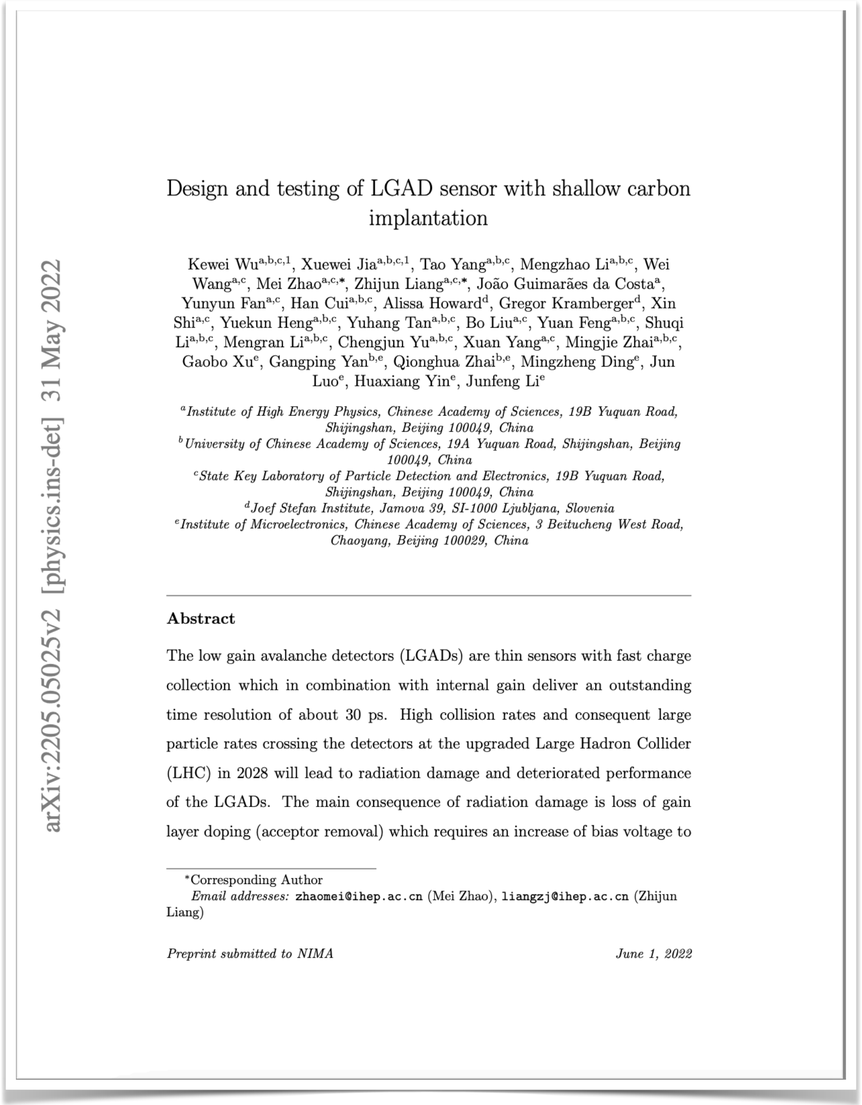
Resolution(microns) in X and Y direction of 6 chips

Hardware work

- IHEP-IMEv2 LGAD radiation hardness paper published

“Design and testing of LGAD sensor with shallow carbon implantation”

- Nucl.Instrum.Meth.A 1046 (2023) 167697



Design and testing of LGAD sensor with shallow carbon implantation

Kewei Wu[a,b,c,1], Xuewei Jia[a,b,c,1], Tao Yang[a,b,c], Mengzhao Li[a,b,c], Wei Wang[a,c], Mei Zhao[a,c,*], Zhijun Liang[a,c,*], João Guimarães da Costa[a], Yunyun Fan[a,c], Han Cui[a,b,c], Alissa Howard[d], Gregor Kramberger[d], Xin Shi[a,c], Yuekun Heng[a,b,c], Yuhang Tan[a,b,c], Bo Liu[a,c], Yuan Feng[a,b,c], Shuqi Li[a,b,c], Mengran Li[a,b,c], Chengjun Yu[a,b,c], Xuan Yang[a,c], Mingjie Zhai[a,b,c], Gaobo Xu[e], Gangping Yan[b,e], Qionghua Zhai[b,e], Mingzheng Ding[e], Jun Luo[e], Huaxiang Yin[e], Junfeng Li[e]

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[e] *Institute of Microelectronics, Chinese Academy of Sciences, 3 Beitucheng West Road, Chaoyang, Beijing 100029, China*

Abstract

The low gain avalanche detectors (LGADs) are thin sensors with fast charge collection which in combination with internal gain deliver an outstanding time resolution of about 30 ps. High collision rates and consequent large particle rates crossing the detectors at the upgraded Large Hadron Collider (LHC) in 2028 will lead to radiation damage and deteriorated performance of the LGADs. The main consequence of radiation damage is loss of gain layer doping (acceptor removal) which requires an increase of bias voltage to

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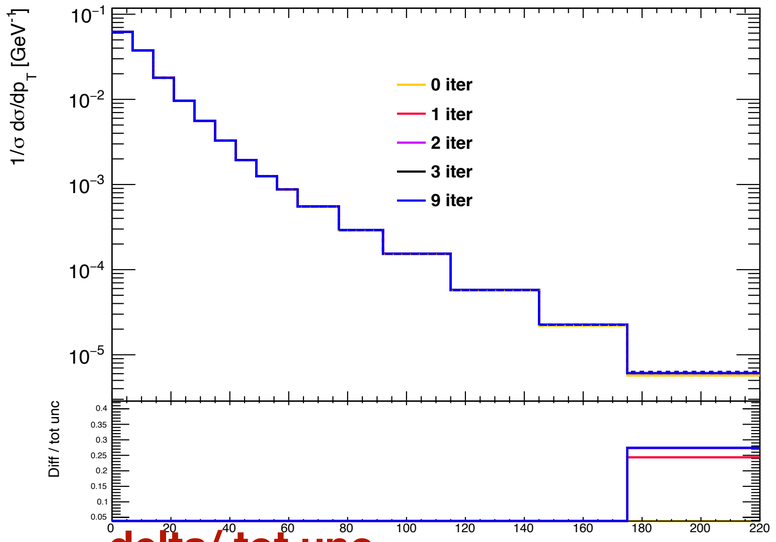
Preprint submitted to NIMA *June 1, 2022*

Thanks!

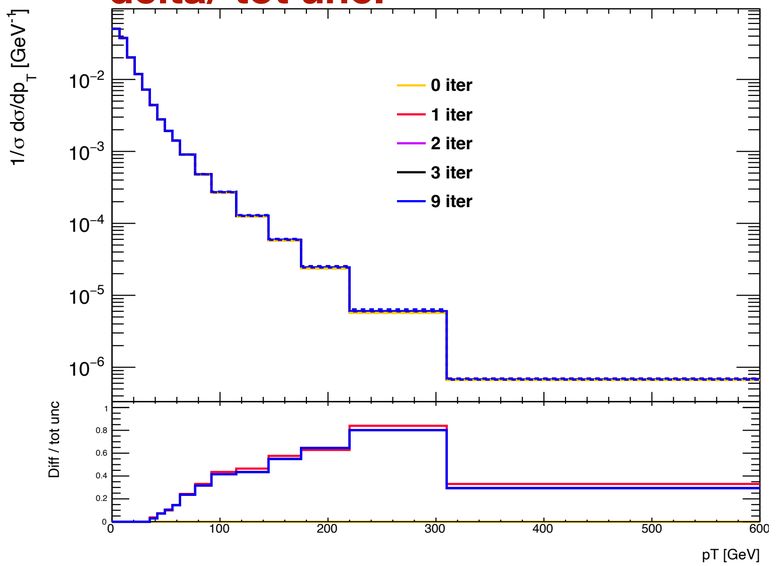
Back-up

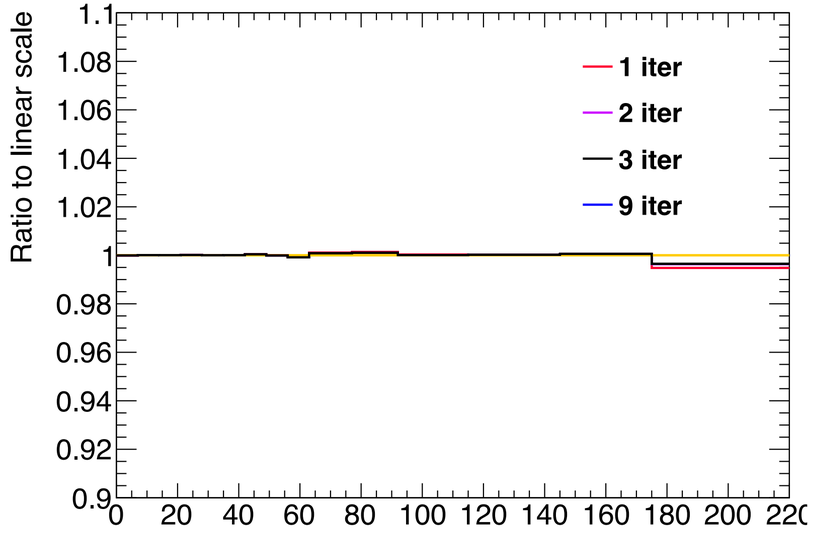
5 and 13 TeV W

- *Stat sqrt scale*
- *Bkg scale 1*
- *Sys Linear scale*

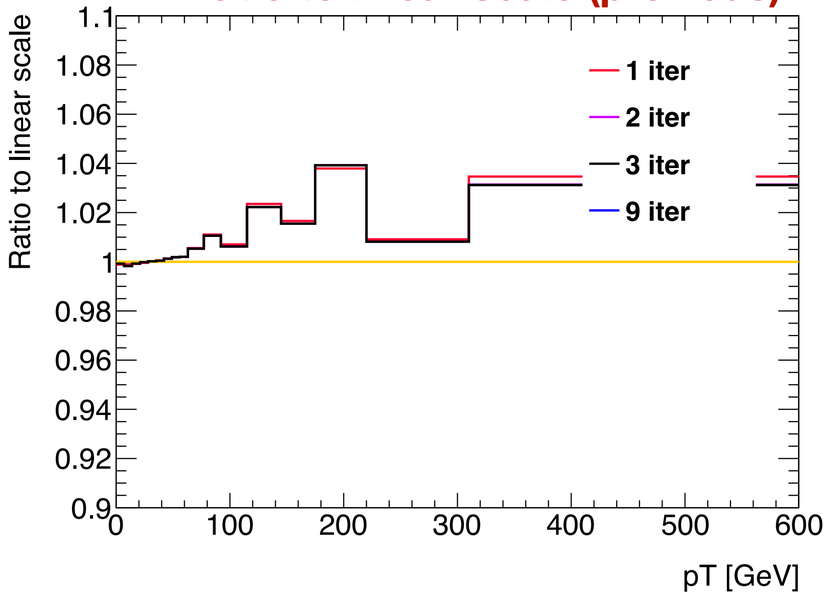


delta/ tot unc.

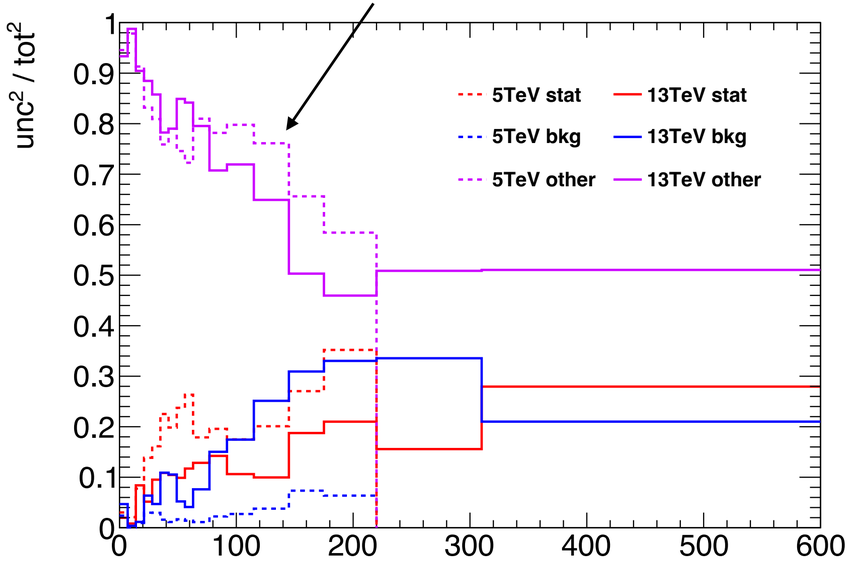




Ratio to linear scale (previous)

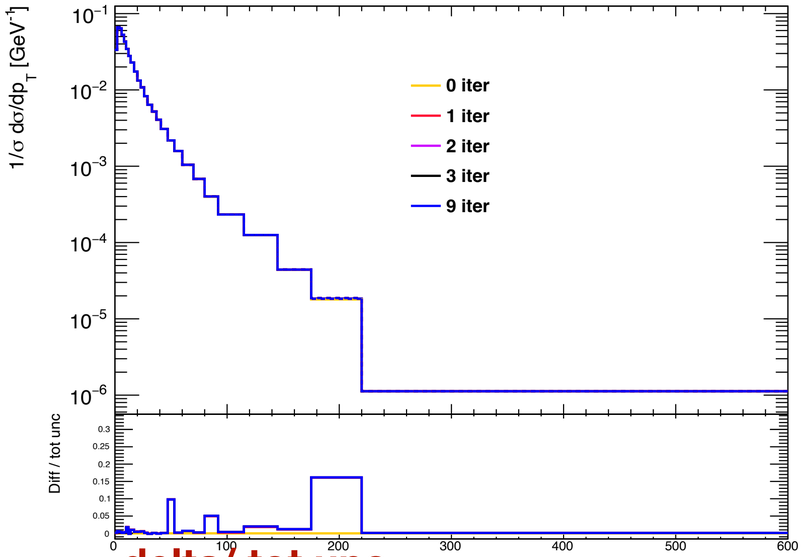


5TeV seems to have a little bit more unchanged components.

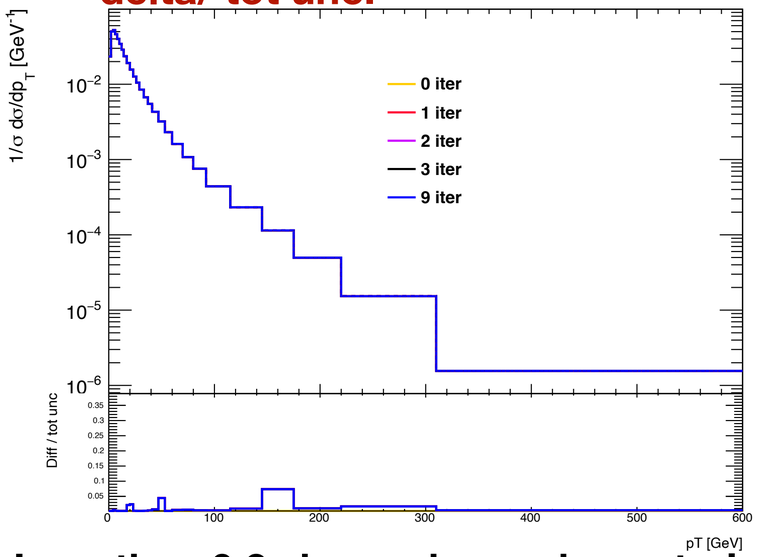


5 and 13 TeV Z

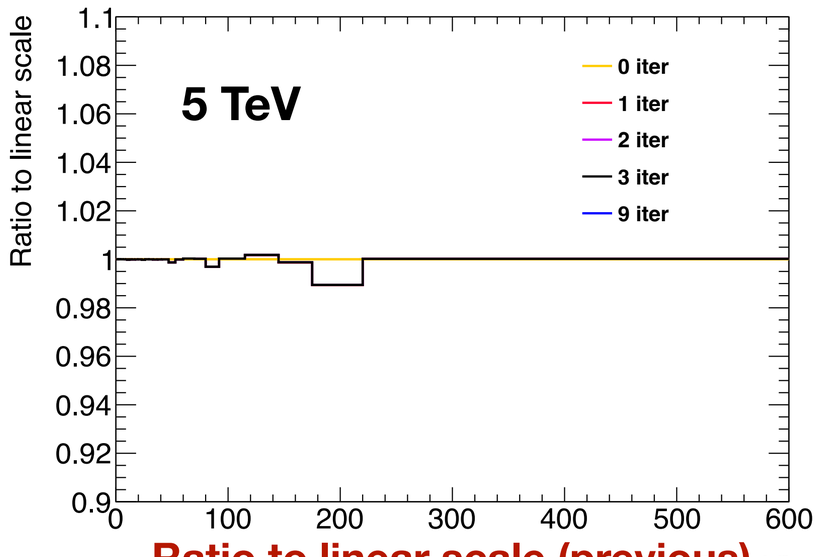
- *Stat sqrt scale*
- *Bkg scale 1*
- *Sys Linear scale*



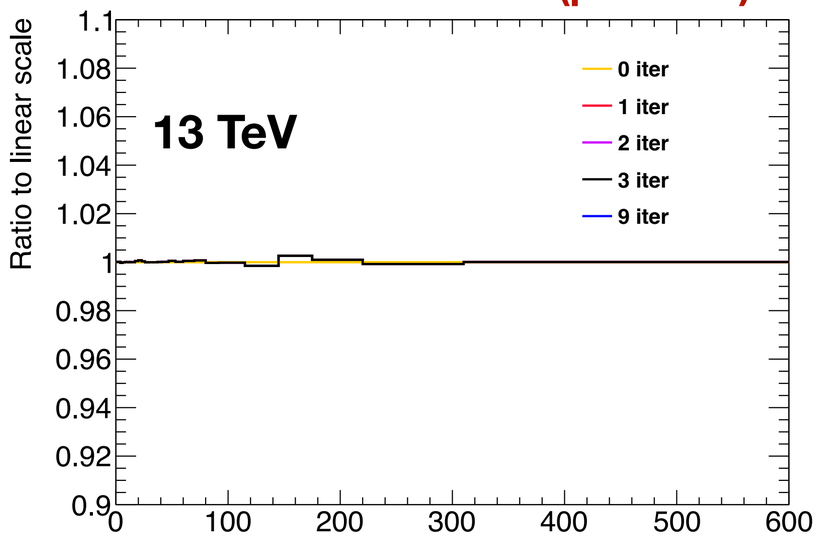
delta/ tot unc.



Less than 0.2 sigma change in central value



Ratio to linear scale (previous)



Expect larger effect @5TeV ✅