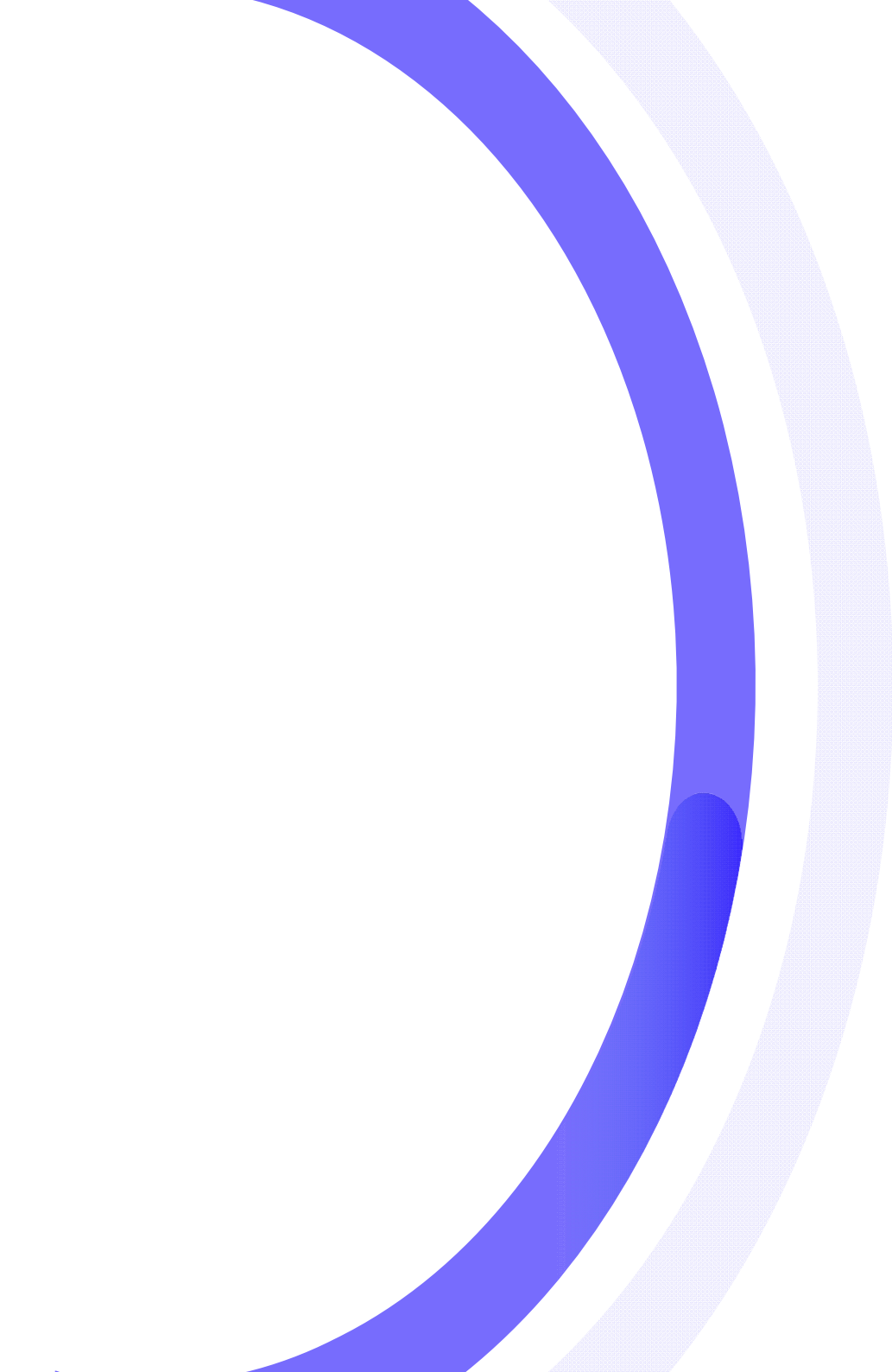


# 2024年 年度考核报告

汇报人：代洪亮

实验物理中心 电子学组

2024年11月

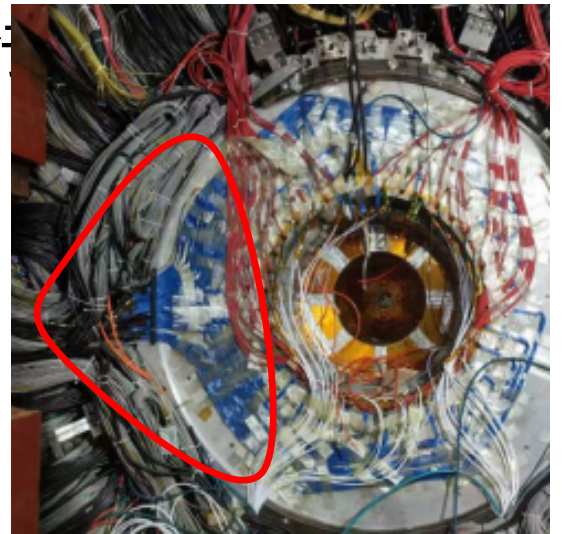
- 
- **岗位职责**
  - **本年度主要工作**
  - **其它工作**
  - **下年度工作计划**

## 岗位职责 主要工作及完成情况

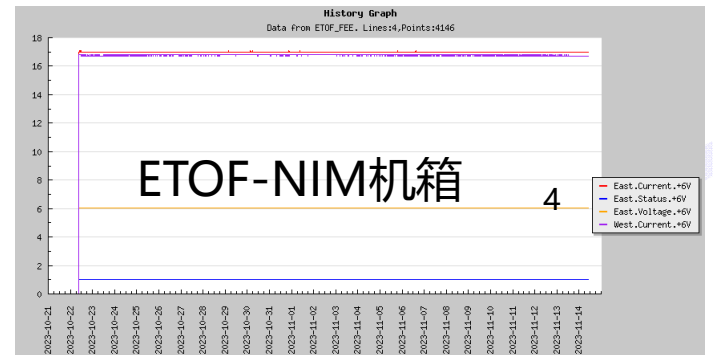
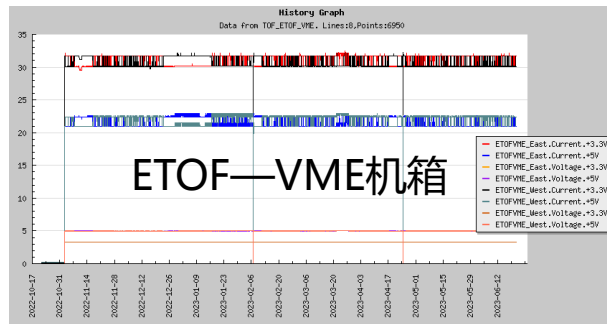
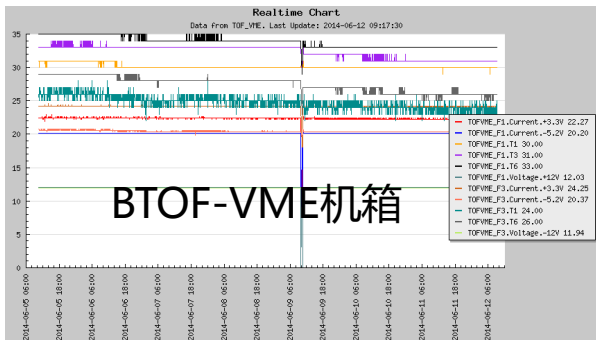
- 负责BESIII-TOF电子学系统的运行维护（岗位职责）
  - 全年稳定运行
- 负责LHAASO项目的缪子探测器读出电子学工作（岗位职责）
  - 运行维护工作
  - 备份电子学板研制
- 参加高能中微子望远镜项目电子学系统，
  - 电子学研制

# — BESIII运行维护工作

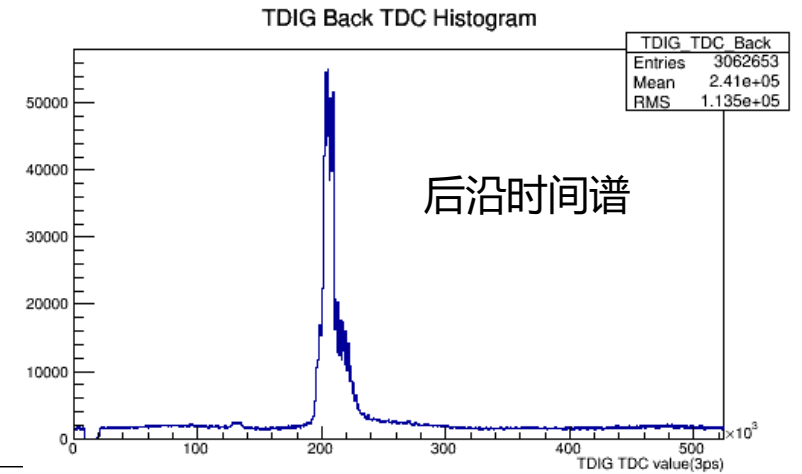
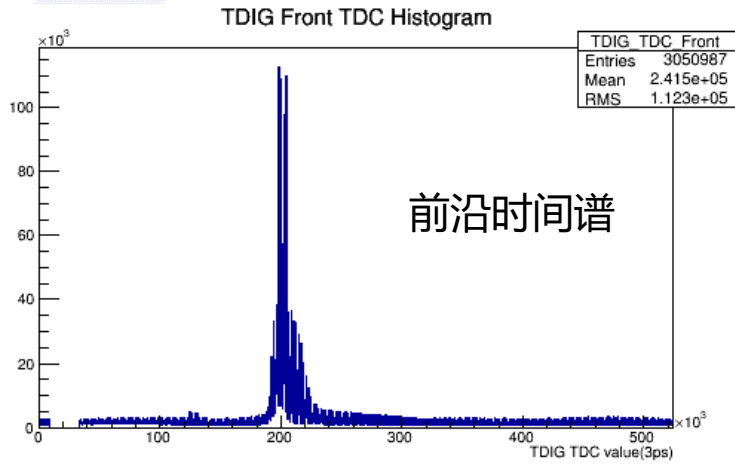
- 担任TOF电子学系统ONCALL，负责TOF电子学系统的维护工作
  - 参加每周运行例会，及时解决运行中出现的问题
    - 更换一次插件
  - 日常检查电子学系统状态
    - 23/24年度运行中，TOF电子学系统稳定运行
  - 维修更换的机箱
    - 维修NIM机箱，验收，报销
- TOF电子学系统运行稳定，保证了物理取数的顺利进行
  - BTOF系统时间分辨稳定，保持在80PS左右
  - ETOF系统时间分辨稳定，55-65PS
- 配合CGEM替换漂移室内室
  - 整理ETOF电子学电缆
  - 配合系统运行测试



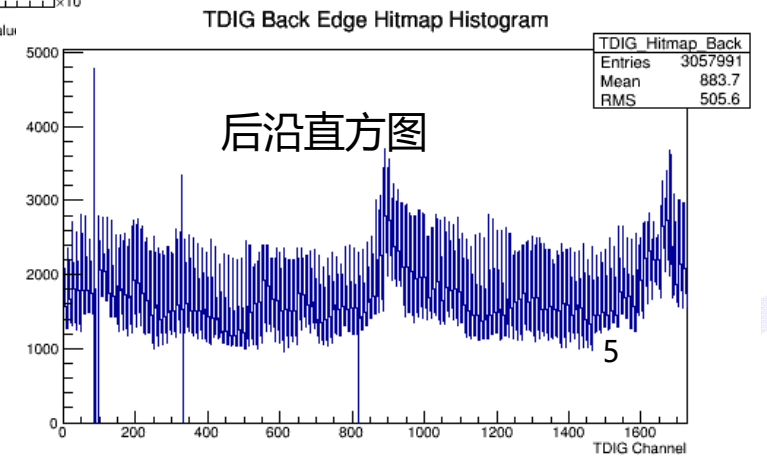
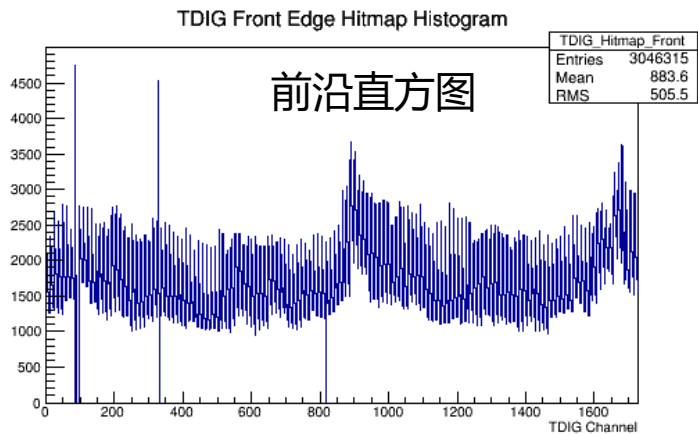
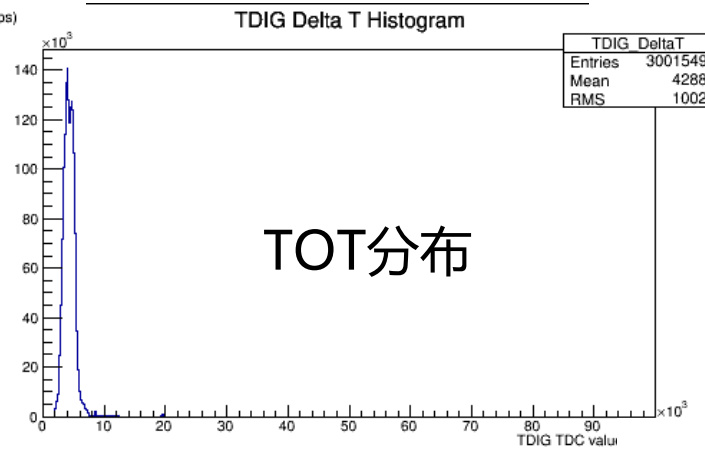
电子学机箱运行监测



# ETOF在线直方图

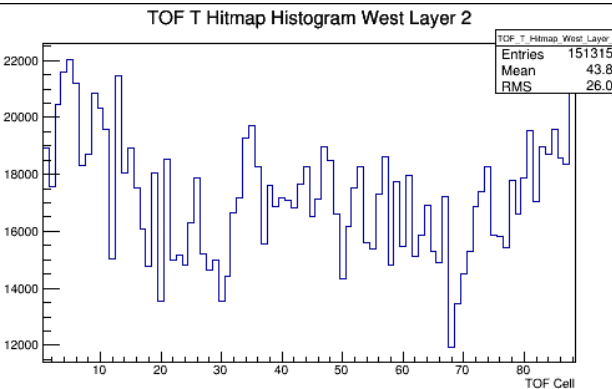
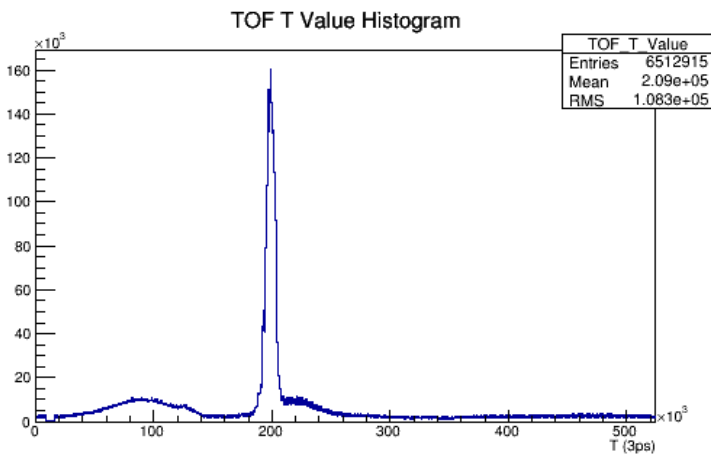
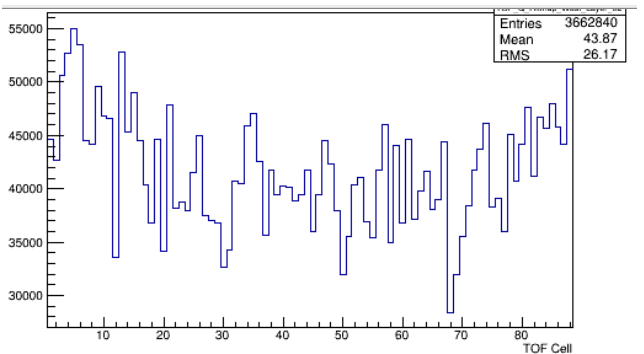
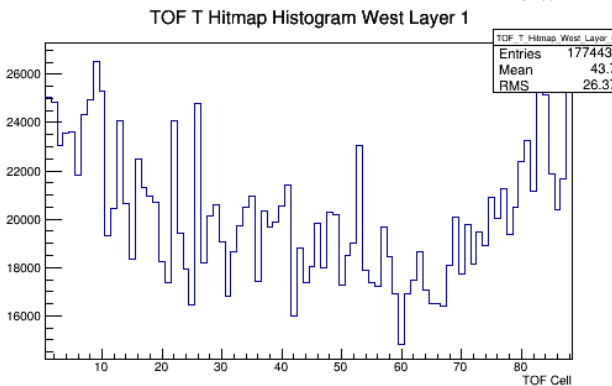
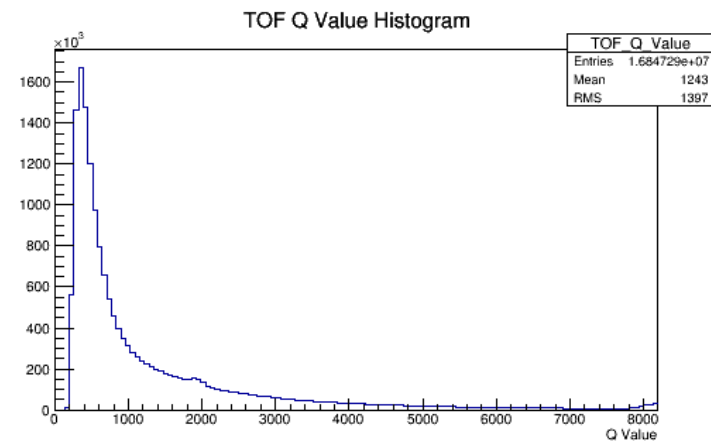
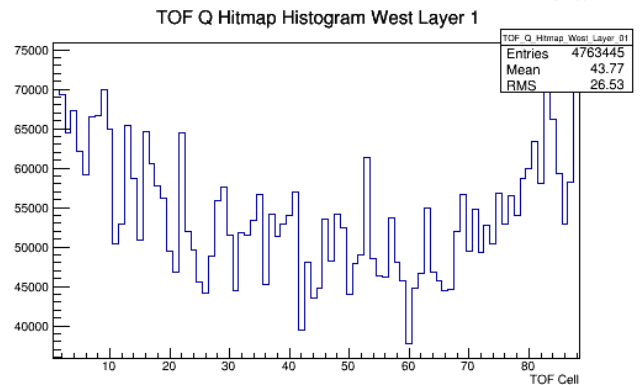
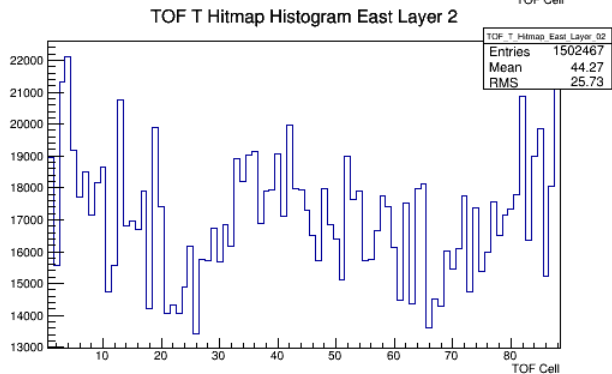
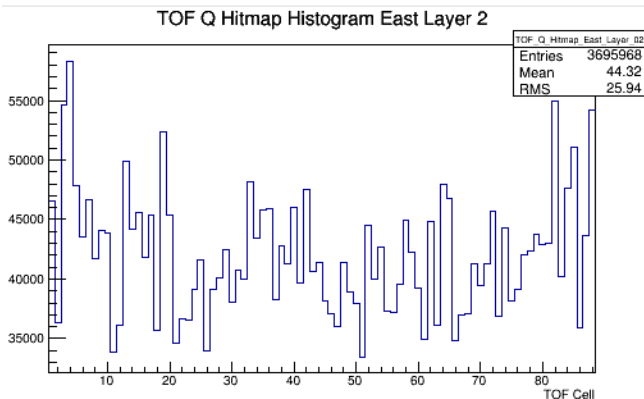
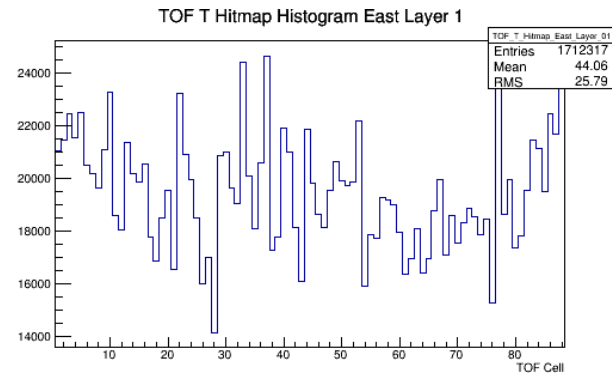
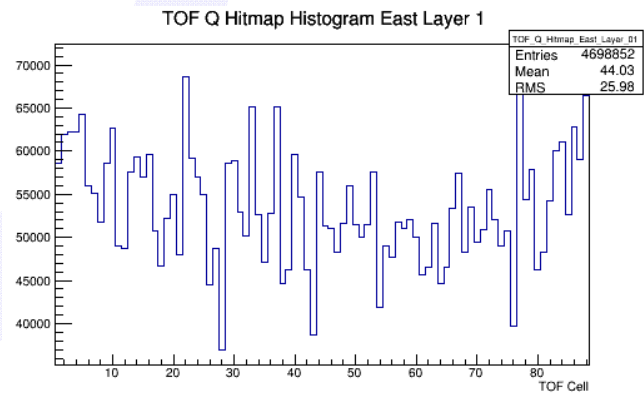


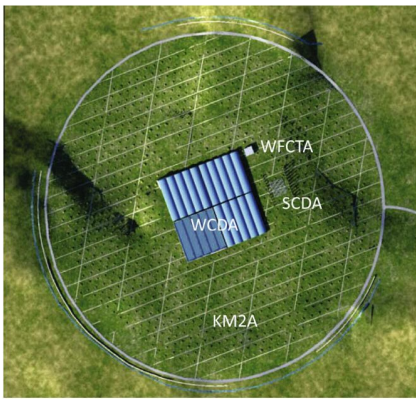
稳定运行



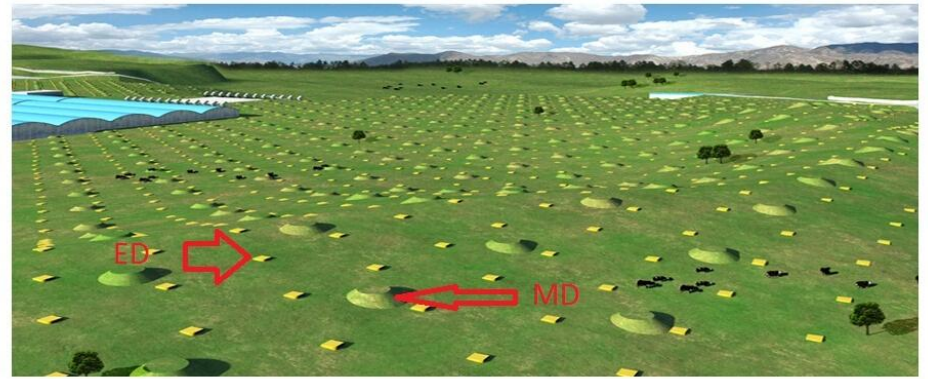
# BTOF在线直方图

## 稳定运行

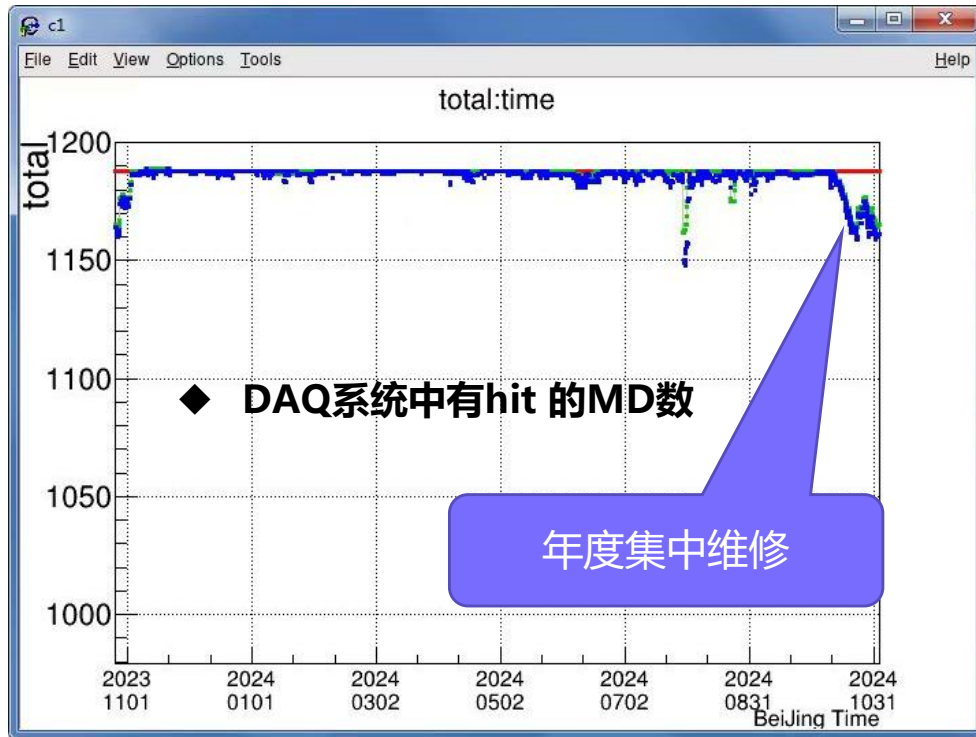




## 二 LHAASO缪子探测器 电子学

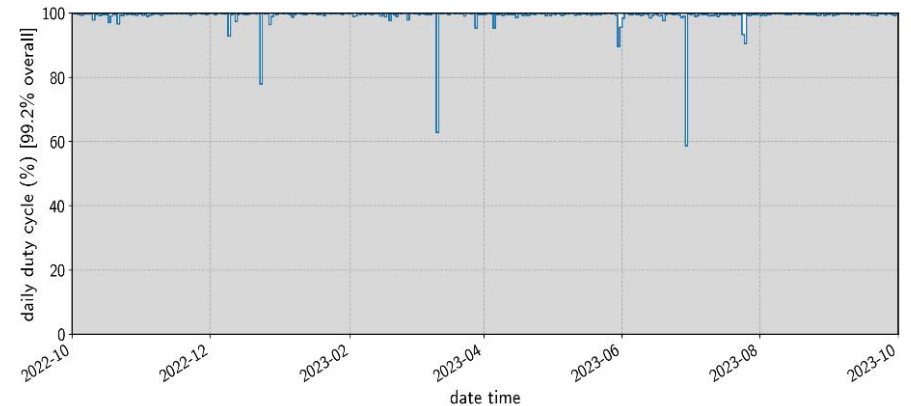


- 高海拔宇宙线观测站--缪子探测器阵列--KM2A阵列探测器之一



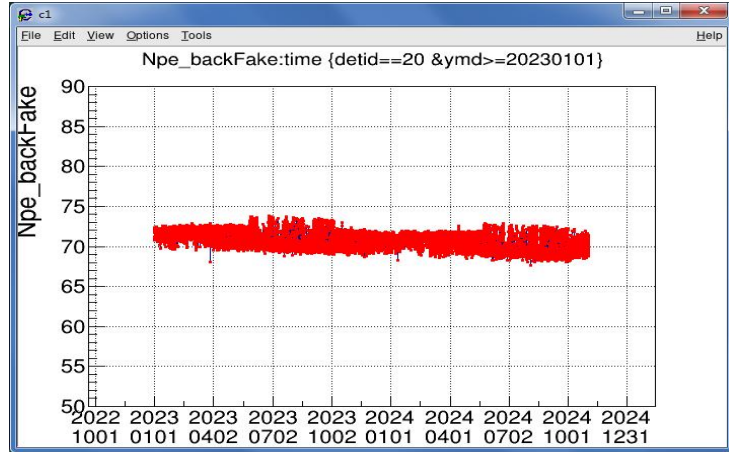
运行探测器数目（在线），10分钟一个点，  
黑点表示新run开启点

运行值班  
电子学维修：20块  
现场更换：9块

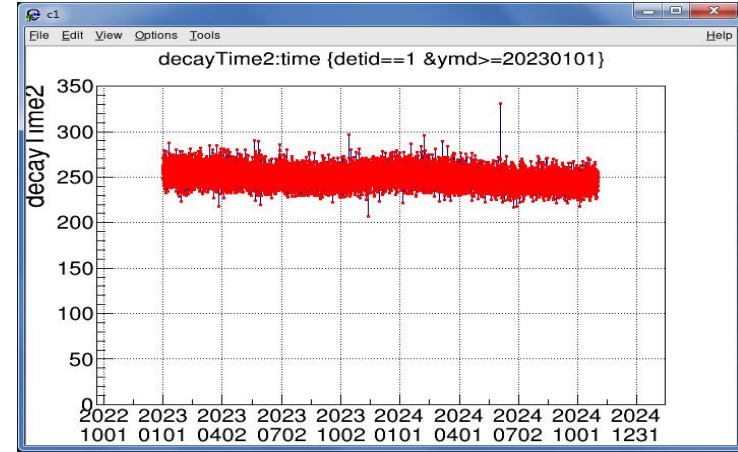


- Duty cycle ~99%;
- Detectors in DAQ ~99%

# LHAASO-缪子探测器电子学运行维护

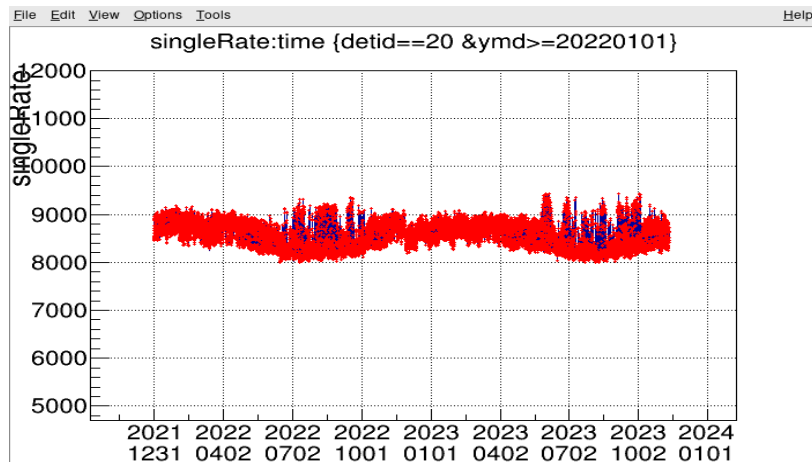


单缪光电子数，监测信号变化

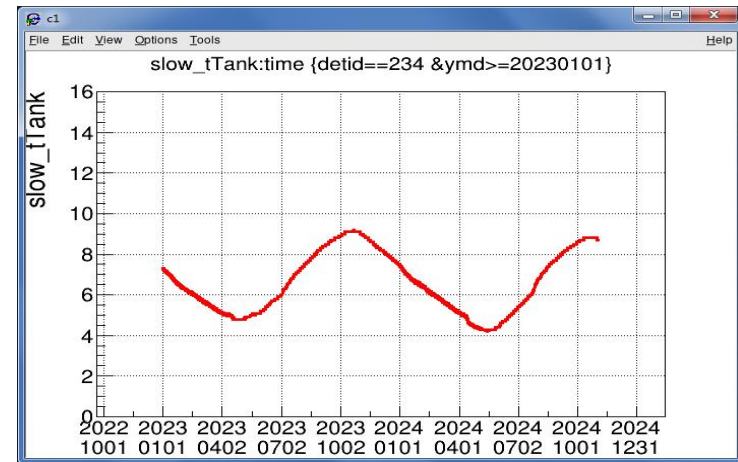


波形衰减时间，监测水质和Tyvek反射率

全阵列  
运行稳定



单道计数率，监测探测器系统工作稳定性

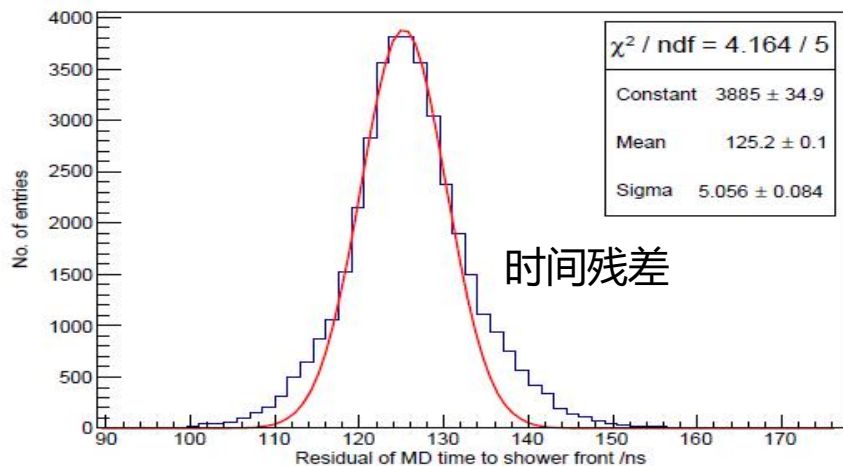
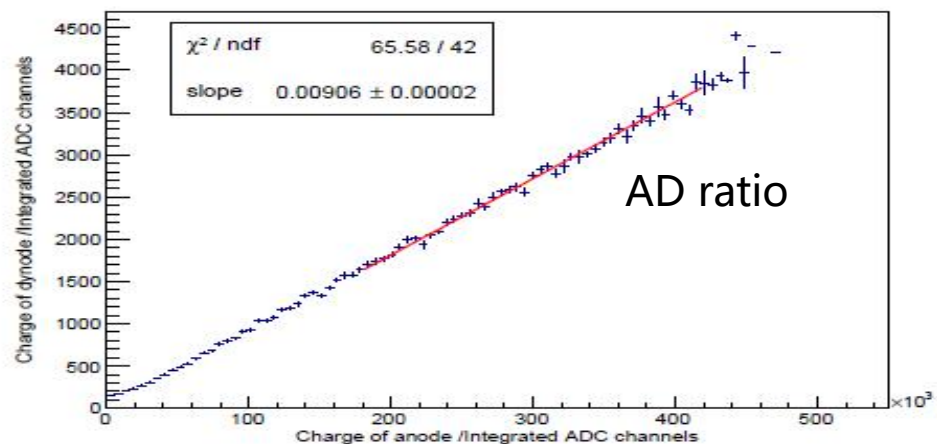
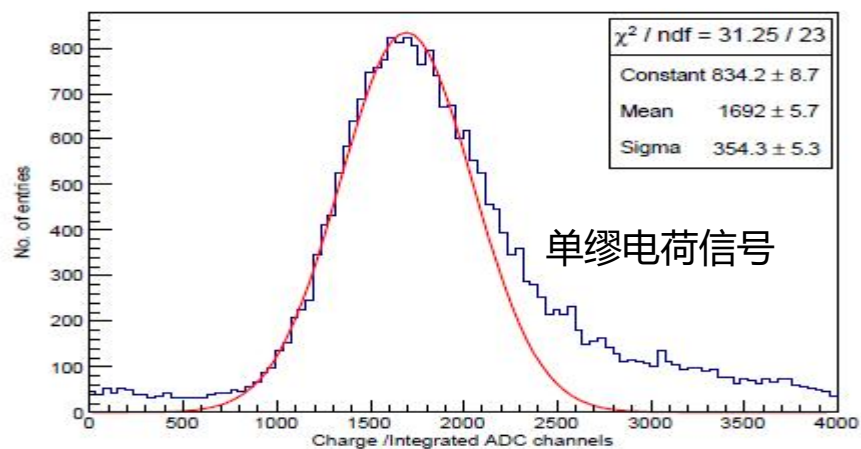


罐体内温度，监测保温层效果



# LHAASO-缪子探测器电子学运行维护

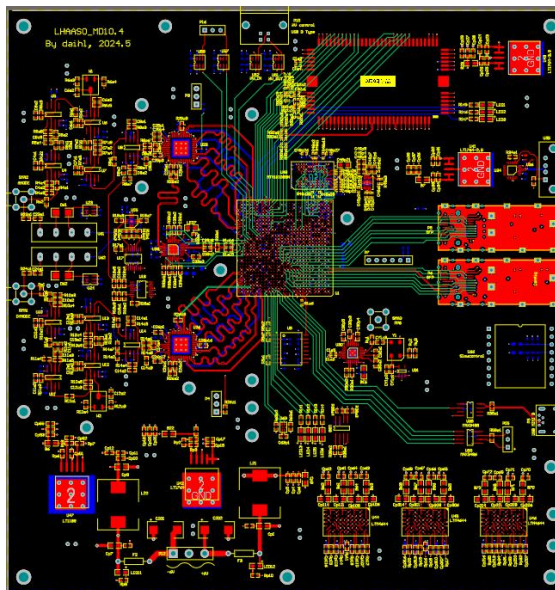
## 电子学系统稳定高质量运行



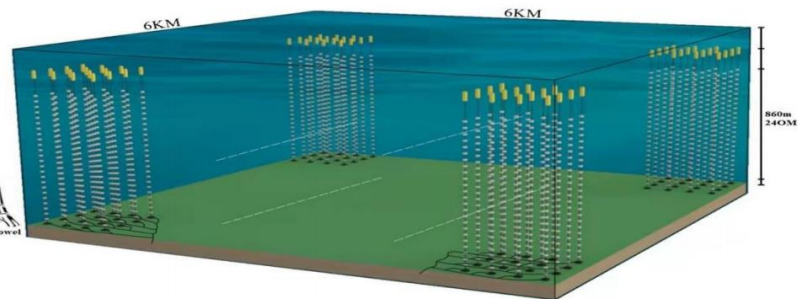
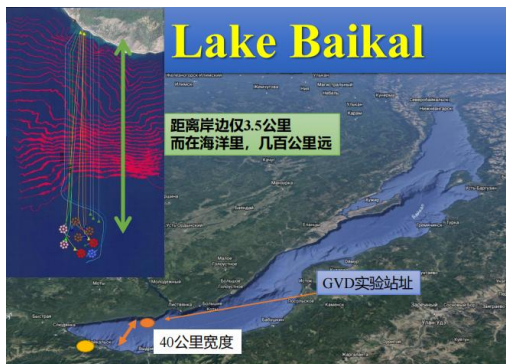
标定参数	标定精度
单缪信号电荷	< 1%
时间残差	< 1ns
AD ratio	< 1%

# 新增备份MD电子学板设计

- 设计方案
  - 全新的芯片
  - AD9434 (500MHZ) +XILINX-K7+DDR3 (8G)
  - 解决缓存时间短的问题
  - 通过初步调试
- 正在进行第二版的设计



# 三 参加高能中微子望远镜 电子学研制工作

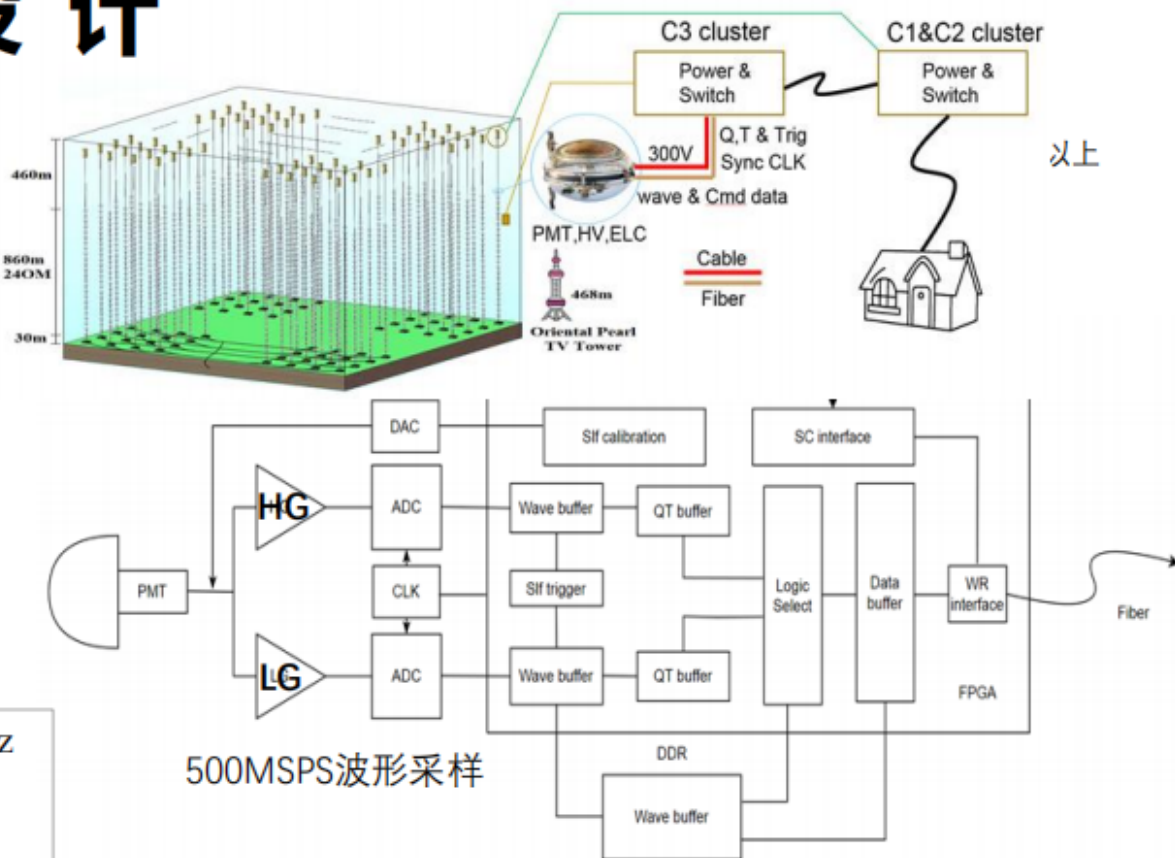


中微子望远镜整体布局示意图。

## 读出电子学设计

电子学系统分布总体示意图

参数	设计指标
测量需求	波形采样
电荷测量范围	1 - 2000pe
波形采样宽度	500ns
时间测量精度	<1 ns
单通道平均事例率	100KHz
平均触发率	10KHz
平均着火率	500Ms

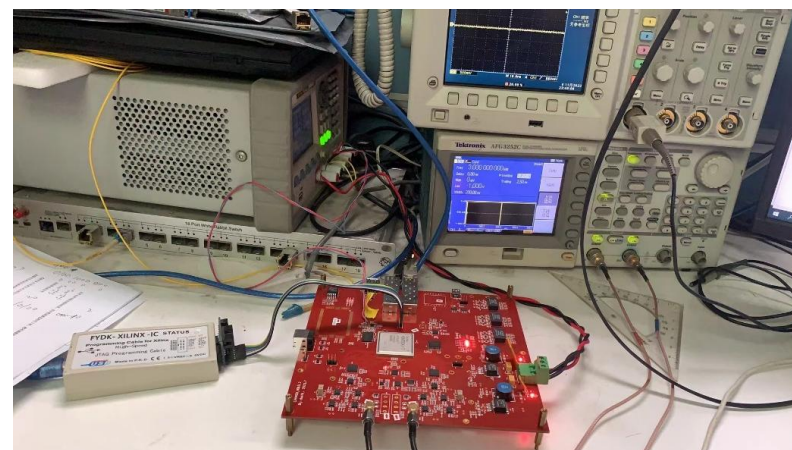
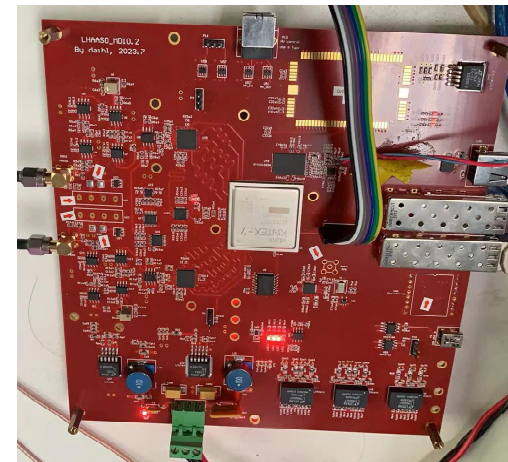
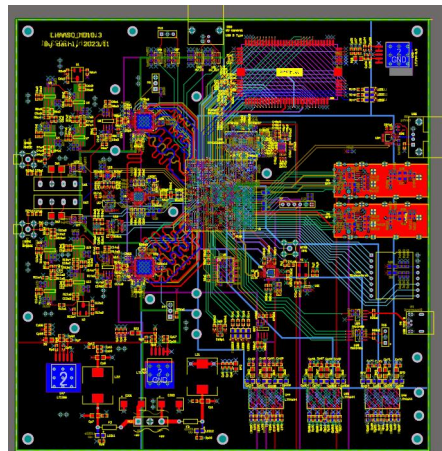


- 单个光学模块的过阈事例率平均为100KHz
- 每一串用于触发的数据量为30.48MB/s
- 每一串的波形事例率为17.76MB/s
- 每一串总的的数据量为48.24MB/s

500MSPS波形采样  
预计数据量：300MB/s

# HUNT Baikal样机实验

- 目前已设计三版电子学系统
  - 分布式,  $Q$ ,  $T$ 软触发
  - 500MSPS ADC, 8G DDR
  - 融合WR千兆光纤数据传输
  - 多种慢控接口
- 完成电子学部分实验室测试
- 完成和探测器的联合调试
- 完成生产20块及调试
- 2024年3月, 完成(12+4)样机贝加尔湖的投放
  - 持续运行
  - 实现了宇宙线MUON信号的搜寻探测
- 完成电子学固件更新
  - 解决BUG
  - 新增功能





# 其它工作

- 作为骨干参与的基金（2024年）
  - 2024年11月，**获得**“国家重点研发计划重点专项”2025-2029年支持（高计数率TPC技术，**260万**）
  - 2024年03月，**获得**“核探测与核电子学国家重点实验室基金”2024年支持（TPC技术，**20万**）
- 年度论文，合作作者，2 篇论文发表
- 参加会议及交流：
  - 第二十二届全国核电子学与核探测技术学术年会暨第十二届全国先进气体探测器研讨会
  - 第十四届全国粒子物理学术会议
  - 参加LHAASO国际合作组两次年度会议
  - 第四届半导体辐射探测器研讨会
  - 参加谱仪运行工作例会，
- 公共服务
  - 2024年研究生入室培训
    - BESIII-MDC电子学系统
  - 获得北京正负电子对撞机运行评比 **一等奖**



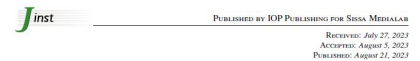
## Feasibility Study of the Pixel Readout TPC Technology at high luminosity Tera Z on CEPC

Yue Chang,<sup>a,b,c</sup> Huirong Qi,<sup>b,c,e</sup> Xin She,<sup>b,c,d</sup> Chunxu Yu,<sup>d</sup> Jinxian Zhang,<sup>b,c</sup> Hongliang Dai,<sup>b,c</sup> Jian Zhang,<sup>b,c</sup> Linghui Wu,<sup>b,c</sup> Guang Zhao,<sup>b,c</sup> Gang Li,<sup>b,c</sup> Manqi Ruan,<sup>b,c</sup> Jianchun Wang<sup>b,c</sup> and Zhi Deng<sup>e</sup>

<sup>a</sup>School of Physics, Nankai University, 94 Weijin Road, Tianjin, China  
<sup>b</sup>Institute of High Energy Physics, 19B Yuquan Road, Beijing, China  
<sup>c</sup>State Key Laboratory of Particle Detection and Electronics, 19B Yuquan Road, Beijing, China  
<sup>d</sup>University of Chinese Academy of Sciences, No.1 Yanqihu East Road, Beijing, China  
<sup>e</sup>Department of Engineering Physics, Tsinghua University, 30 Shuangqing Road, Beijing, China  
E-mail: qibr@ihep.ac.cn

In recent years, the requirements of the high spatial resolution and  $dE/dx$  for the flavor, Z pole, and Higgs physics in the high-energy physics have been raised. To meet this requirements, the design of high-energy  $e^+e^-$  colliders has been improved the very high luminosity to Tera Z. The Circular Electron Positron Collider (CEPC) is a proposed high-luminosity factory for Higgs and Z pole run, with a the maxim luminosity of  $10^{34} \text{cm}^{-2}\text{s}^{-1}$ . Time Projection Chamber (TPC) is an important detector option for tracking in  $e^+e^-$  collider, which included the high spatial resolution and excellent particle identification (PID) resolution. The Pixel readout TPC technology, known for its low material budget, high occupancy, and good PID capabilities, is developed as a promising option at the Tera Z comparing the classical pad readout TPC technology. By the utilizing cluster counting, the pixel readout can significantly enhance PID resolution. The simulation studies are ongoing at Institute of High Energy Physics, CAS to improve detector performance at the different luminosity. This paper presents the structure of the pixel readout TPC simulation framework and the preliminary results. The simulation results demonstrate the optimization of the high-granularity readout ( $300 \mu\text{m} \times 500 \mu\text{m}$ ).

DOI: [10.22323/1.449.0553](https://doi.org/10.22323/1.449.0553)



## Erratum: Development of Time Projection Chamber prototype integrated with UV laser tracks for the future circular $e^+e^-$ collider

X. She,<sup>a,b,c</sup> H.R. Qi,<sup>b,c,d,e</sup> Y. Chang,<sup>b,d</sup> L.W. Yu,<sup>b,c</sup> H.L. Dai,<sup>a,b,c</sup> J.X. Zhang,<sup>a,b</sup> J. Zhang,<sup>d,e</sup> Z. Deng,<sup>f</sup> L.H. Wu,<sup>b,c</sup> G. Li,<sup>a,b</sup> M.Q. Ruan,<sup>a,b</sup> J.C. Wang,<sup>a,b</sup> Y.B. Chen<sup>a,b</sup> and C.X. Yu<sup>d</sup>

<sup>a</sup>Physics Department, University of Chinese Academy of Sciences, Beijing, China  
<sup>b</sup>Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China  
<sup>c</sup>State Key Laboratory of Particle Detection and Electronics, Beijing, China  
<sup>d</sup>School of Physics, Nankai University, Tianjin, China  
<sup>e</sup>Physics Department, Liaoning University, Shenyang, China  
<sup>f</sup>Engineering Physics Department, Tsinghua University, Beijing, China  
E-mail: qibr@ihep.ac.cn

ERRATUM TO: 2023 JINST 18 C07018

In the author list section (affiliation <sup>d</sup>) "Department of Physics, Nankai University, Tianjin, China" has been corrected with "School of Physics, Nankai University, Tianjin, China".

\*Corresponding author.  
DOI: [10.1088/1748-0221/18/08/E08002](https://doi.org/10.1088/1748-0221/18/08/E08002)

<https://doi.org/10.1088/1748-0221/18/08/E08002>

## 下一年度计划

- 继续负责BESIII-TOF电子学系统的运行维护
- 继续负责LHAASO-MD电子学的运行维护及电子学备份工作
- 参加高能中微子望远镜项目电子学系统

谢谢!