PandaX-III TPC原型进展

PandaX-III 实验组

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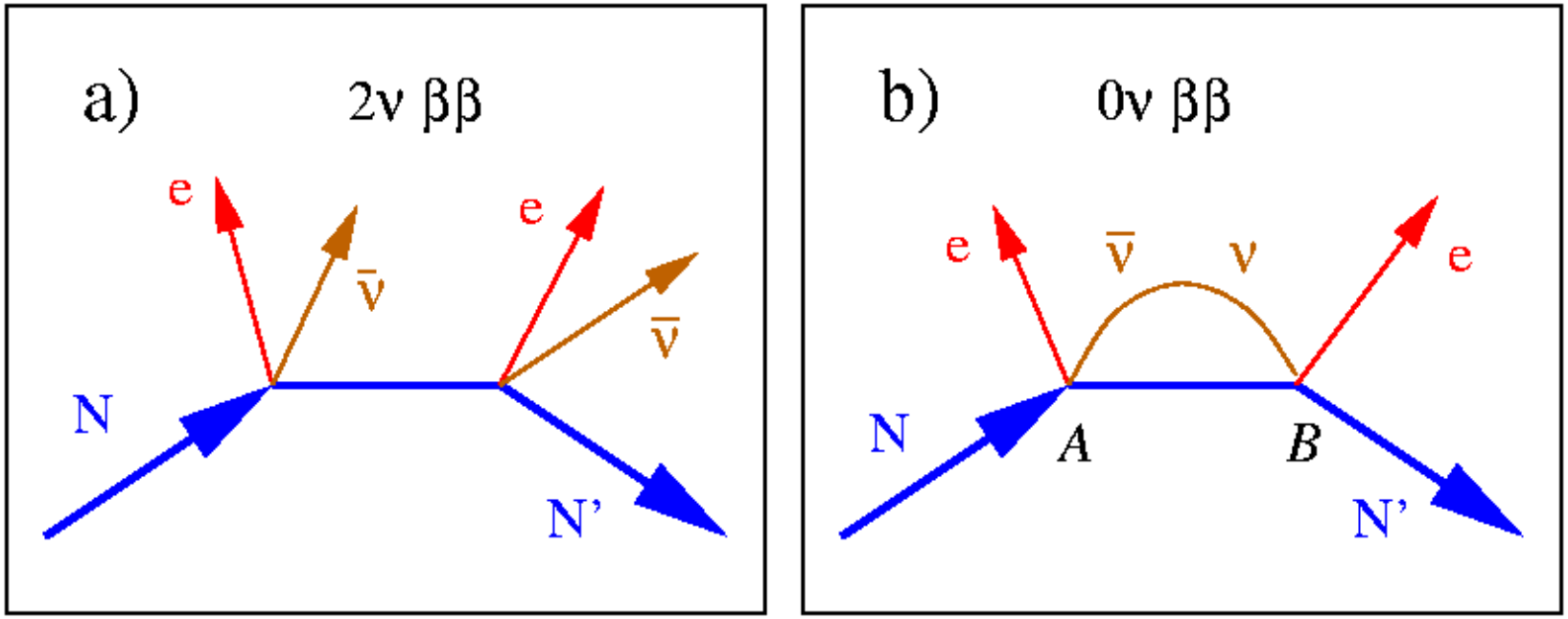
概要

- TPC原型介绍
- TPC原型各方面进展
- 接下来的工作

PandaX-III的实验目的

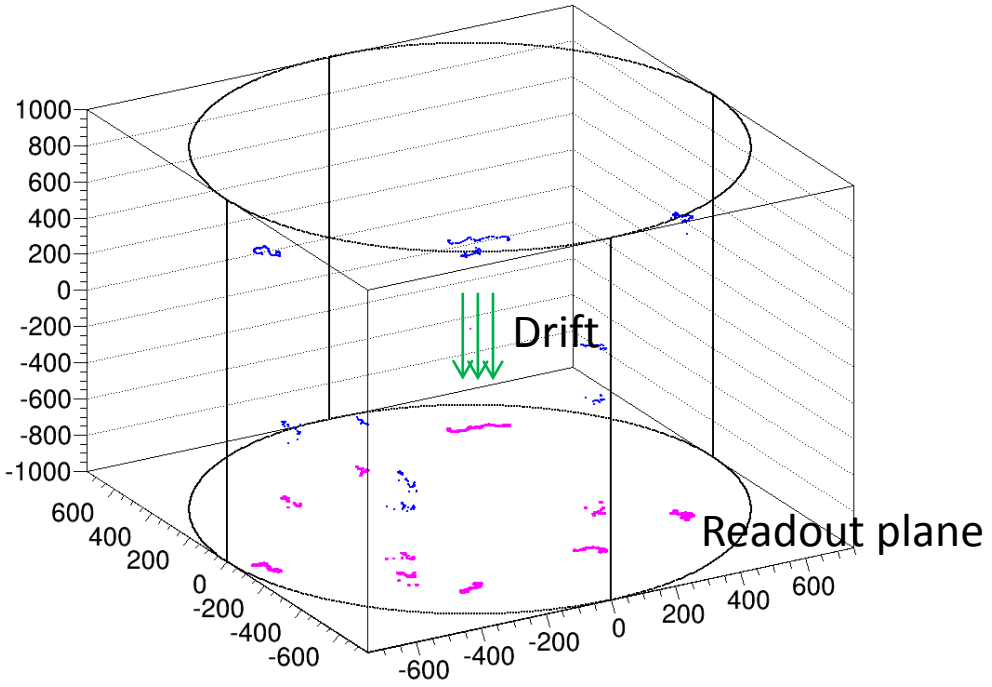


两种类型的双β衰变

寻找无中微子双β衰变以研究中微子是否majorana费米子。

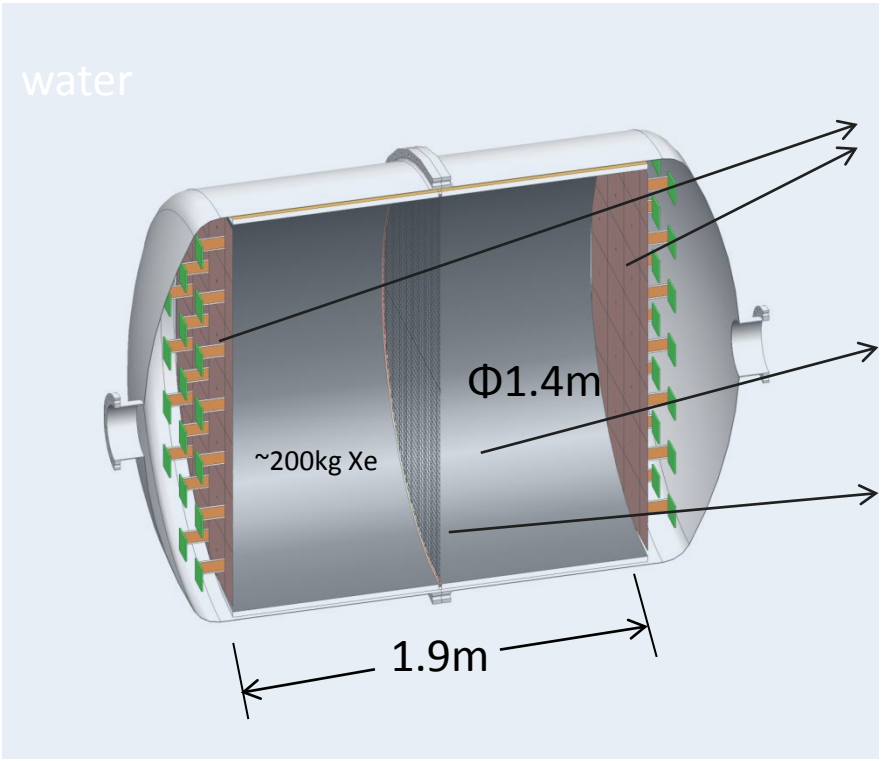
TPC(时间投影室)简介

- 主要过程:
  - 电离产生电子离子对
  - 电子离子的漂移
  - 读出探测器输出信号
  - 能量径迹分析
- 主要考虑因素:
  - 漂移电场
  - 气体
  - 读出探测器

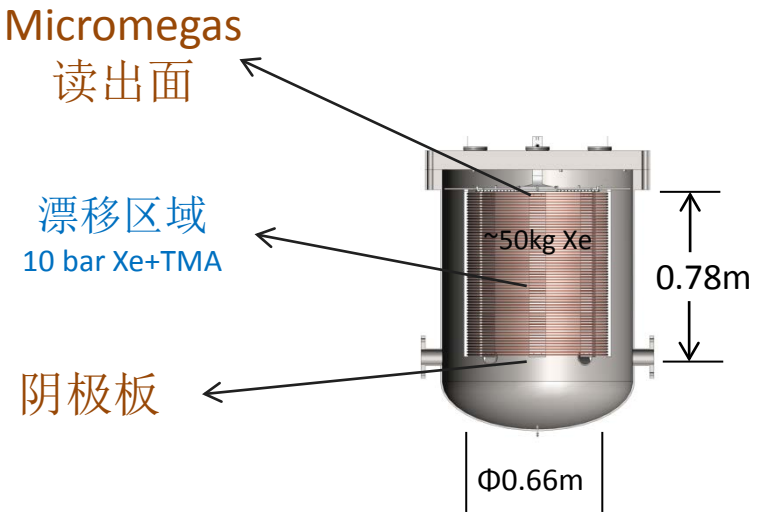


pandaX-III TPC 与 TPC原型

pandaX-III TPC @CJPL

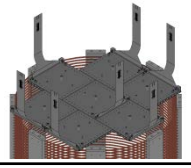


TPC原型 @SJTU



通过TPC原型实验，来测试高压气体系统，漂移电场高压和读出探测器系统。

TPC系统框图



Mesh HV

Preamplifier

Micromegas

Oscilloscope

AGET #0

AGET #1

AGET #2

AGET #3

AsAd

Xe + TMA

chamber

CoBo

Getter

Circulation pump

DAQ server

Drift HV

Vacuum pump

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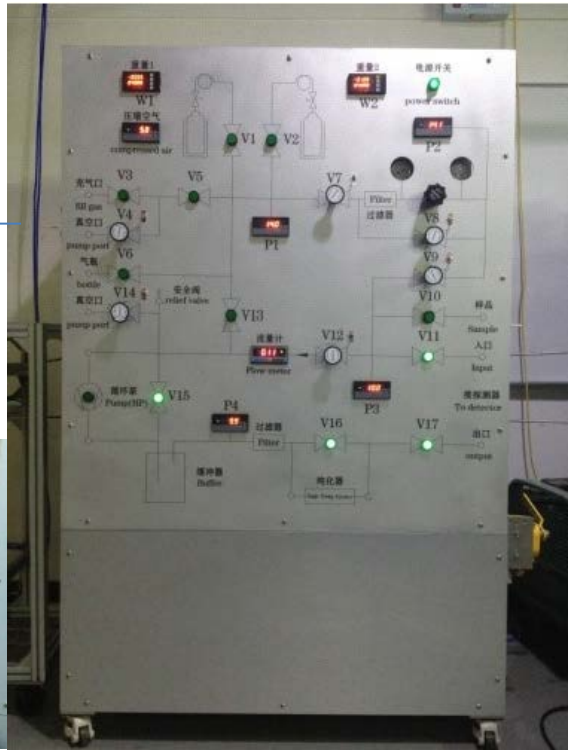
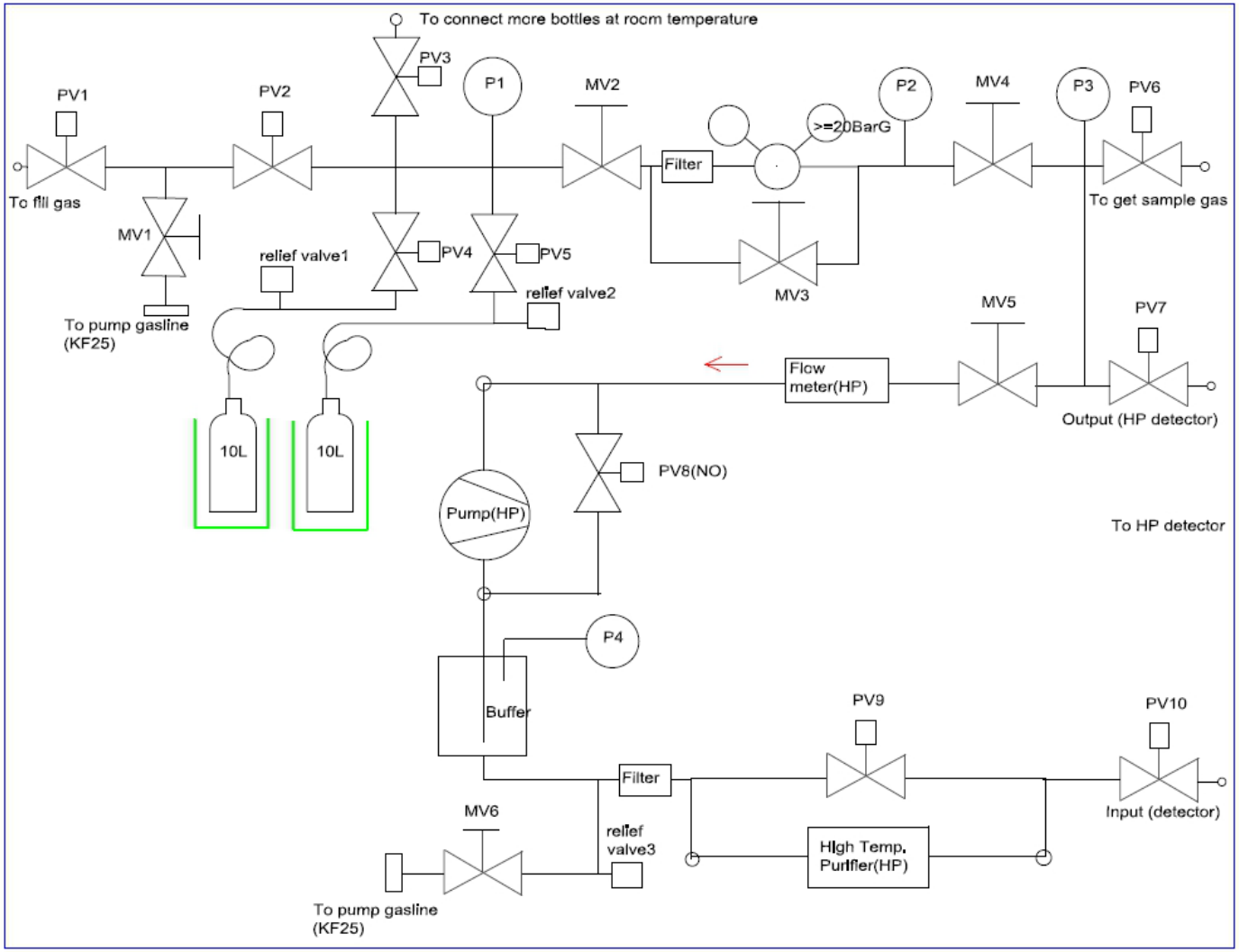
高压气体系统

- 气室充入10bar N_2
  - 无漏气
  - 流速10L/min时，循环系统运行稳定
- 处理Ar, CO_2, Xe, TMA等气体时运行正常

在线监控系统



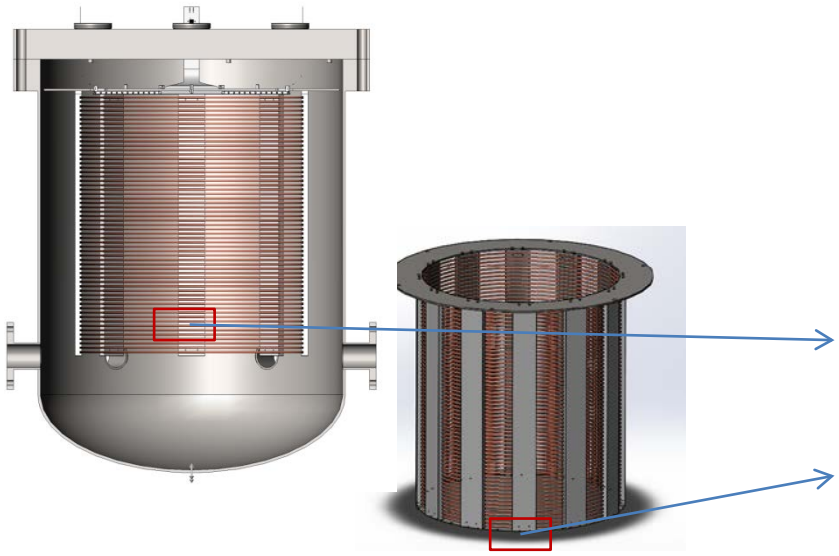
高压气体系统

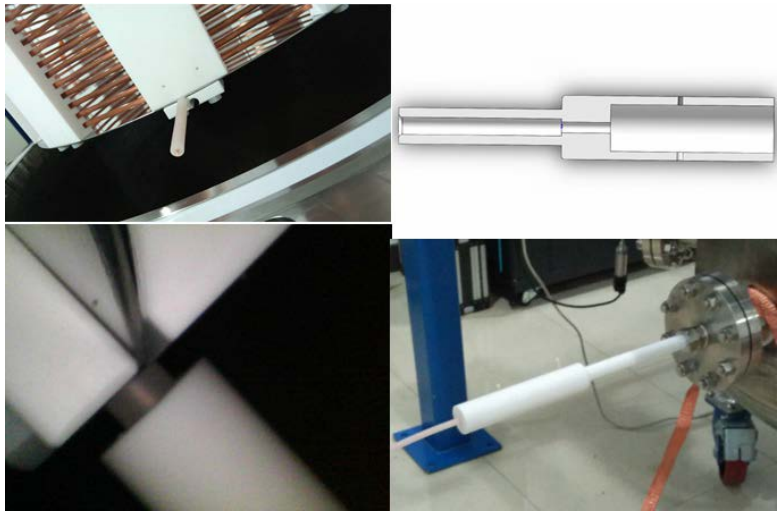


高压气体系统原理图

漂移电场高压

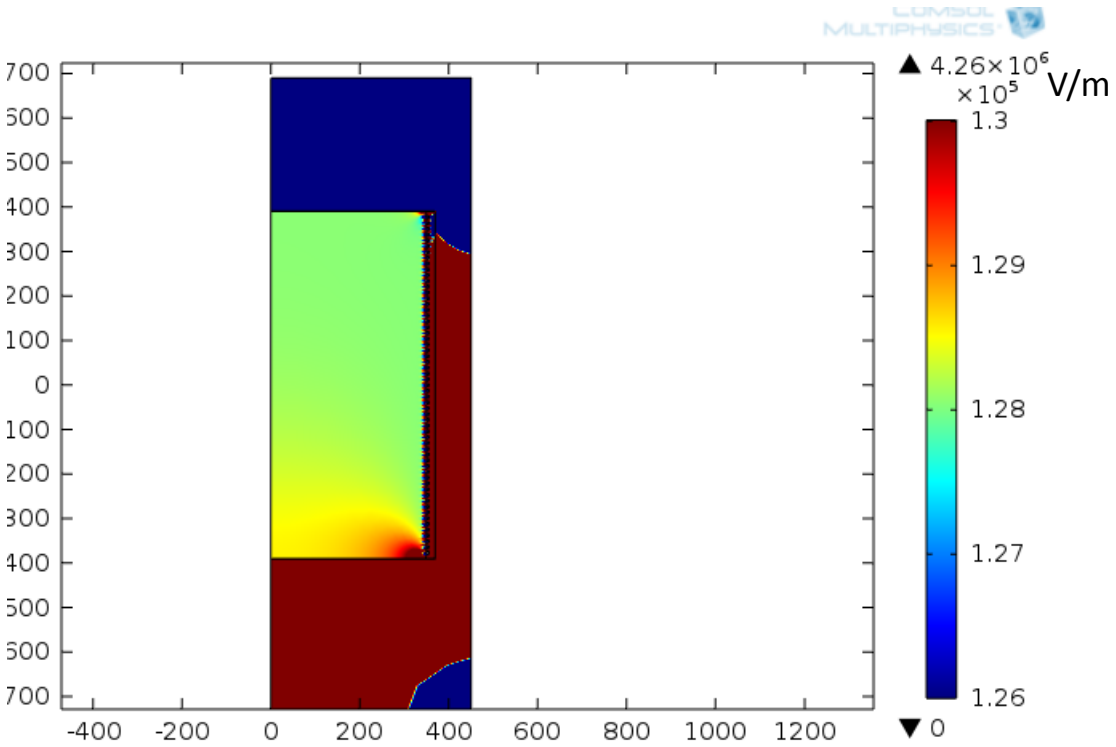
- 充入10bar N_2时，漂移电场高压可达96kV
- 高压接线法兰无漏气

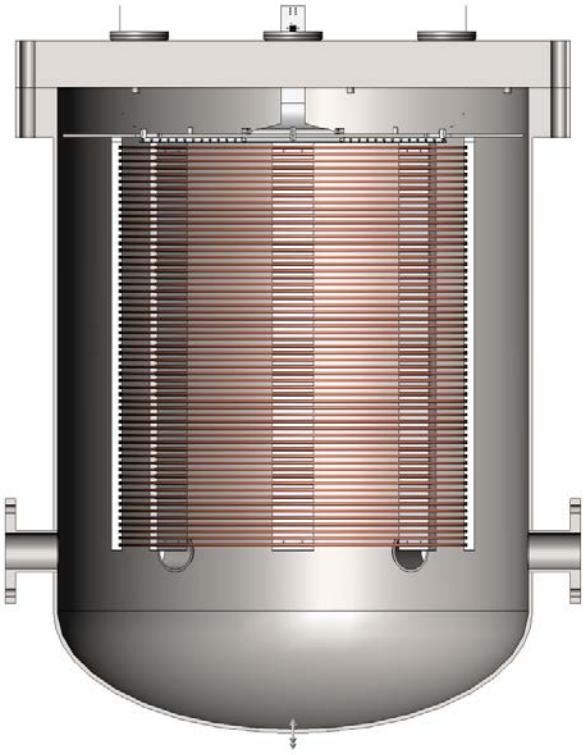




漂移电场模拟

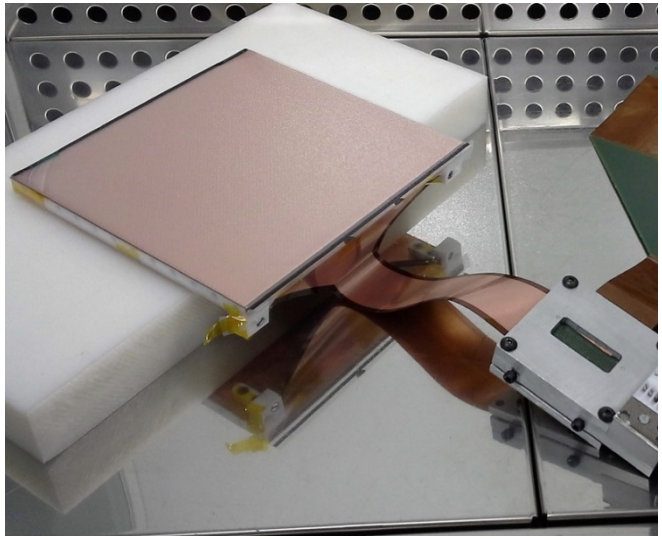
- Comsol电场模拟结果显示，漂移电场的不均匀性小于2%

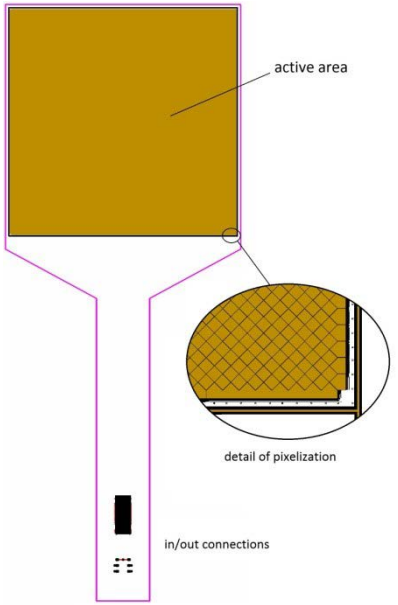




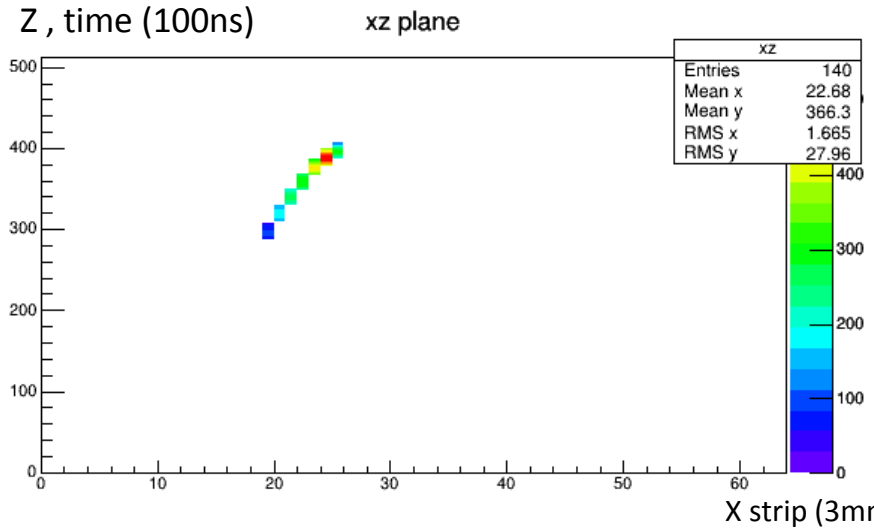
读出探测器系统

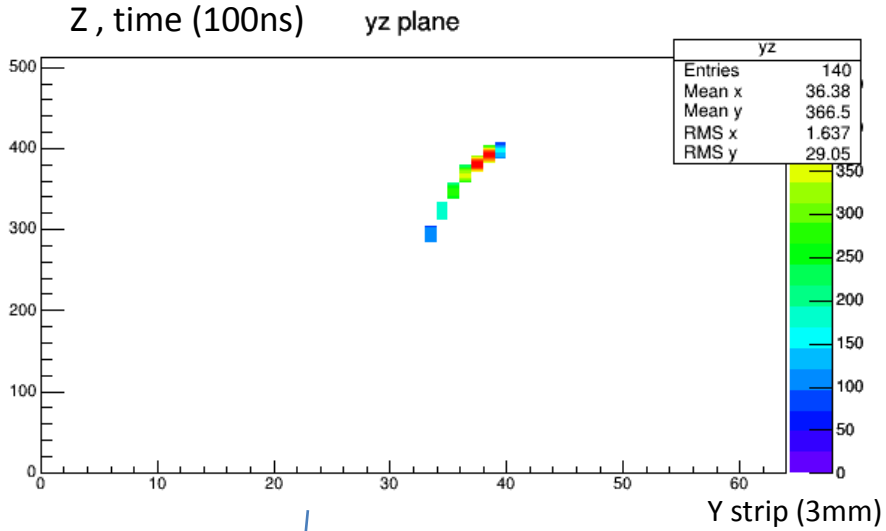
- 读出平面计划由7块Micromegas组成，现仅在中心处安装了一块Micromegas
- 20cm*20cm, 128道条读出, 3mm 条间距

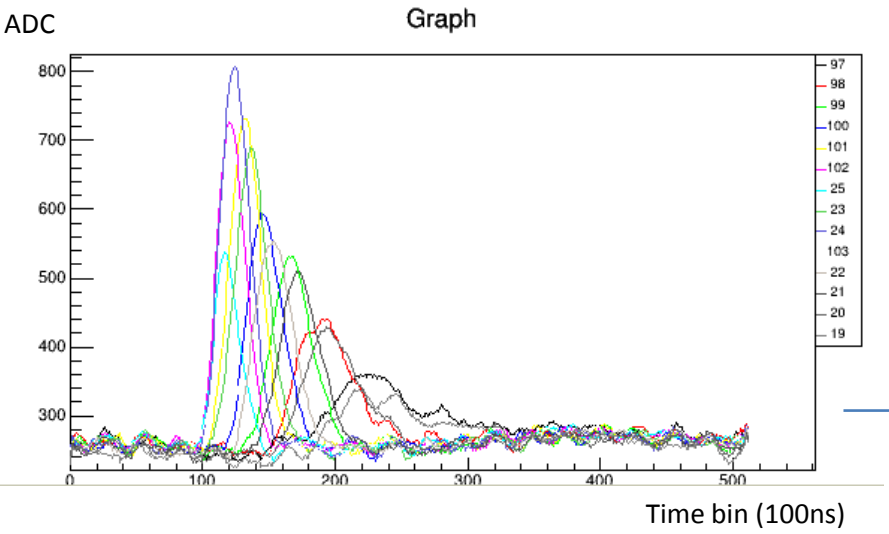




Am241 α信号







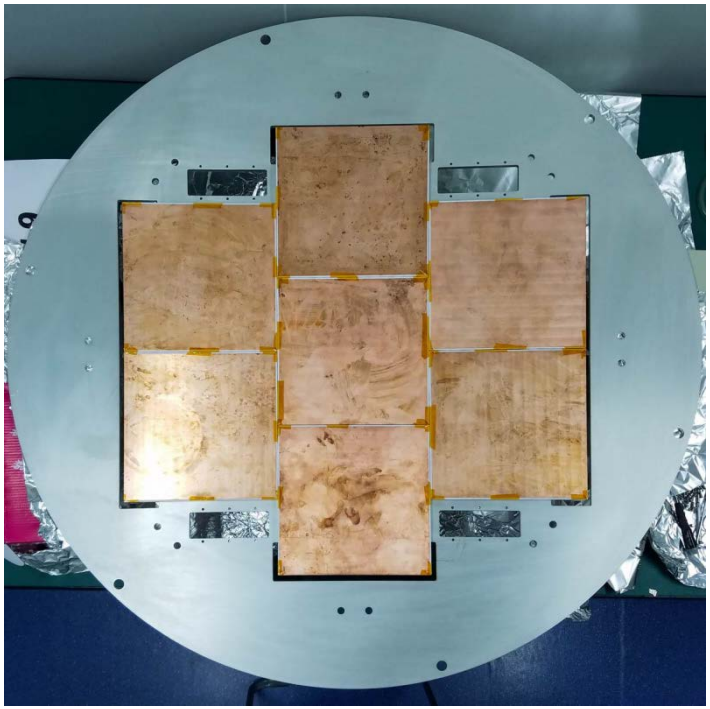
α径迹的二维投影(初步)

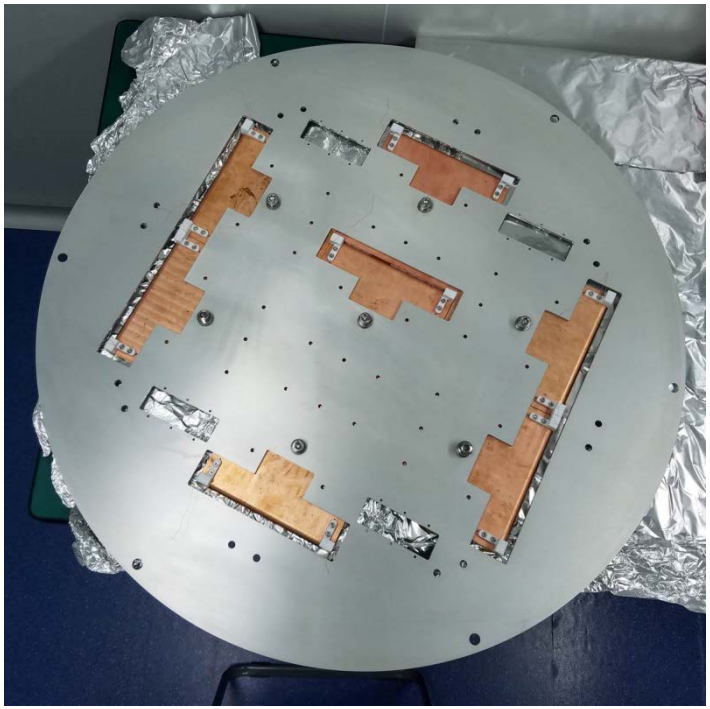
α粒子产生的micromegas信号
工作气体 Ar+30%CO_2

Z轴同漂移方向

安装7个Micromegas的准备工作

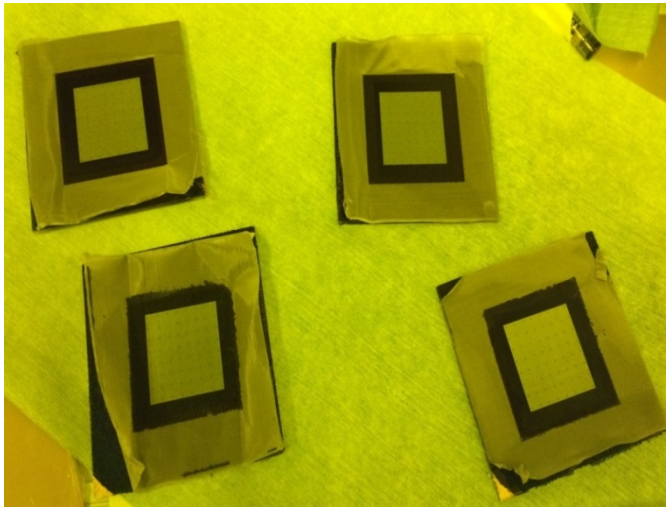
- 由CERN制作的新的一批Micromegas(9个)接近完成
- 由铝板和铜板拼装的机械支撑已加工好

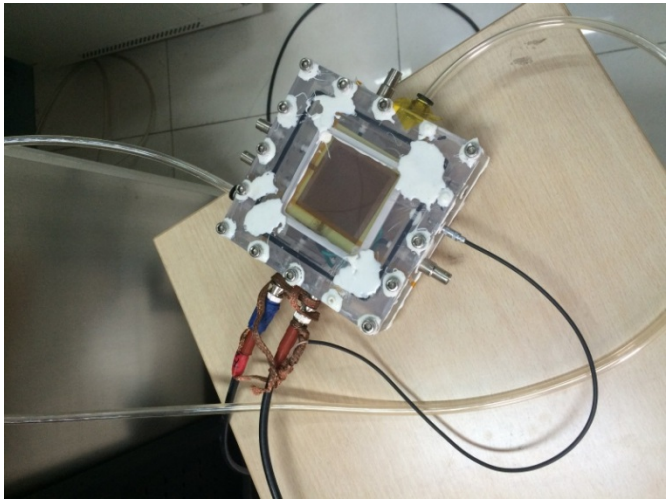




R&D of MicroMegas at CIAE

- Detector
  - Active Area: 3cm*3cm
  - Photolithography technology used
  - Resistance： 15-100GΩ
- Test
  - Ar: CO_2=70% : 30%
  - Start to see spark signal at HV: 380V





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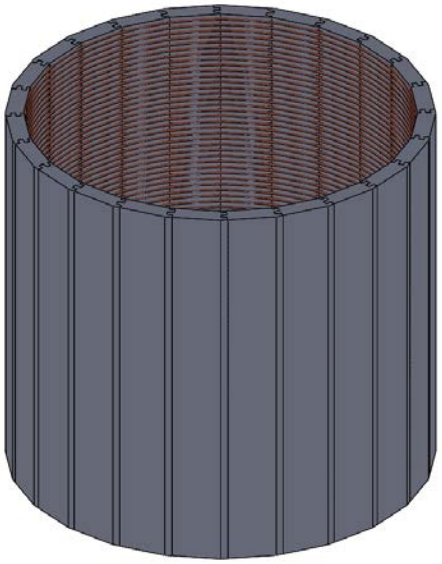
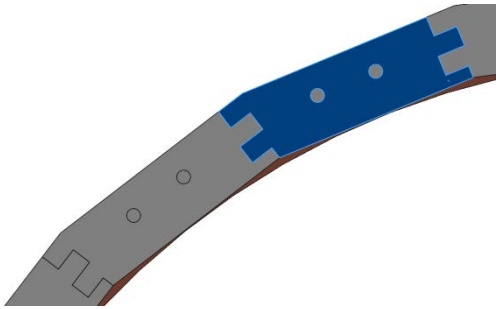
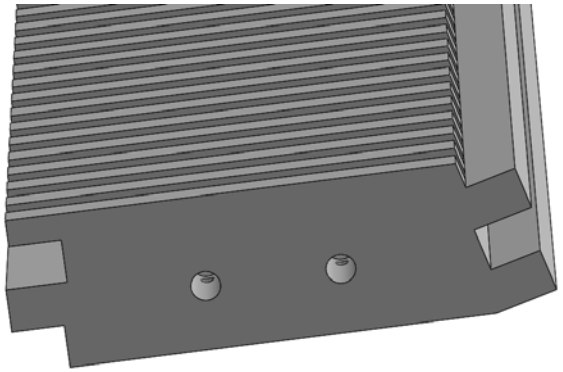
接下来的工作

- 在1bar, 10bar Xe+TMA的条件下做更多测试
- 继续能量分辨率的研究
- 安装7个Micromegas
- 研究有机玻璃电场结构的应用



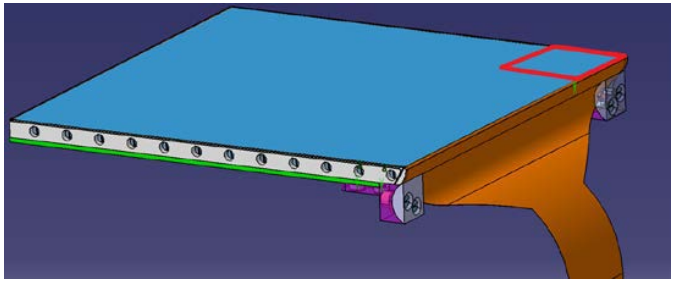


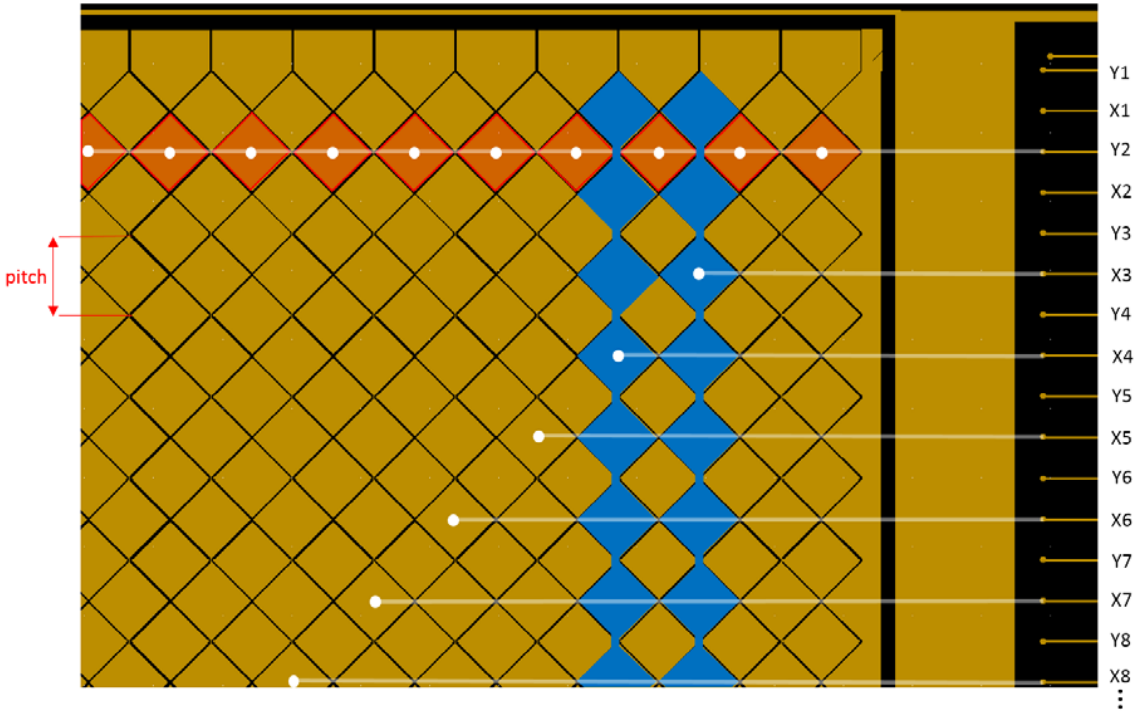


谢谢大家！

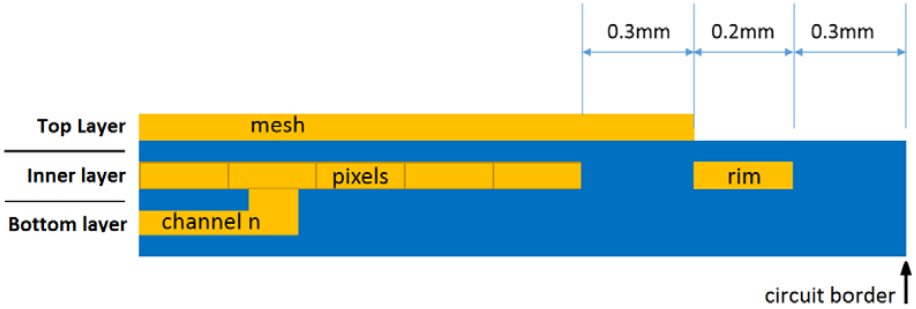
Backup

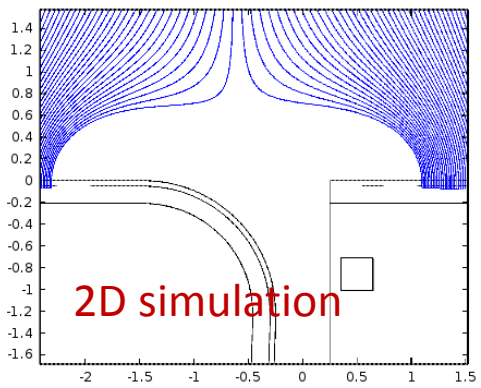
Micromegas

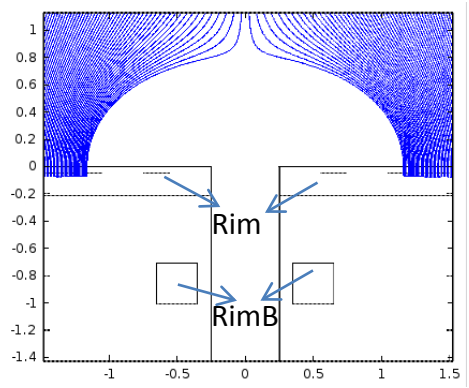




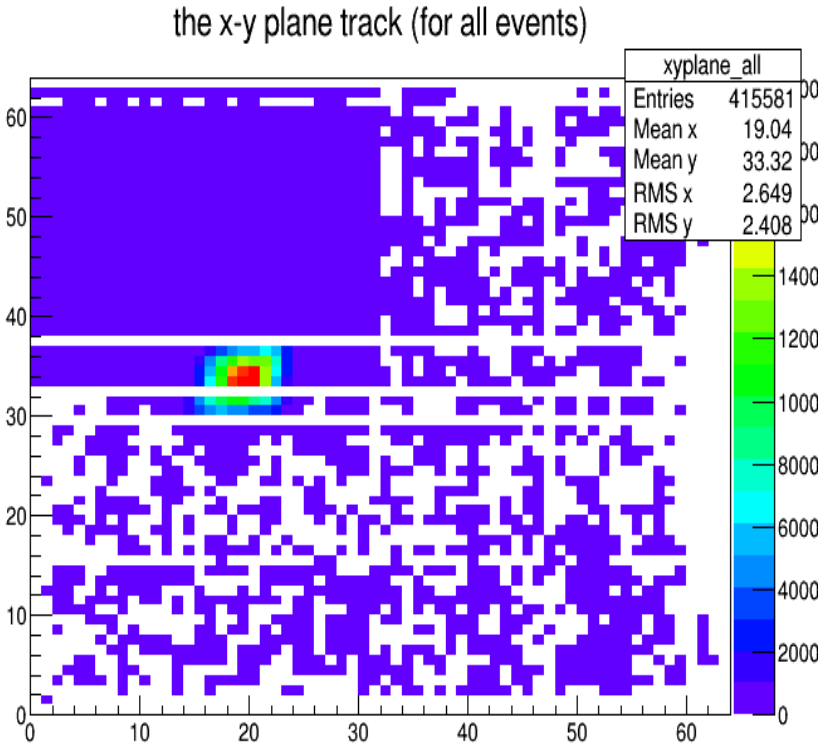
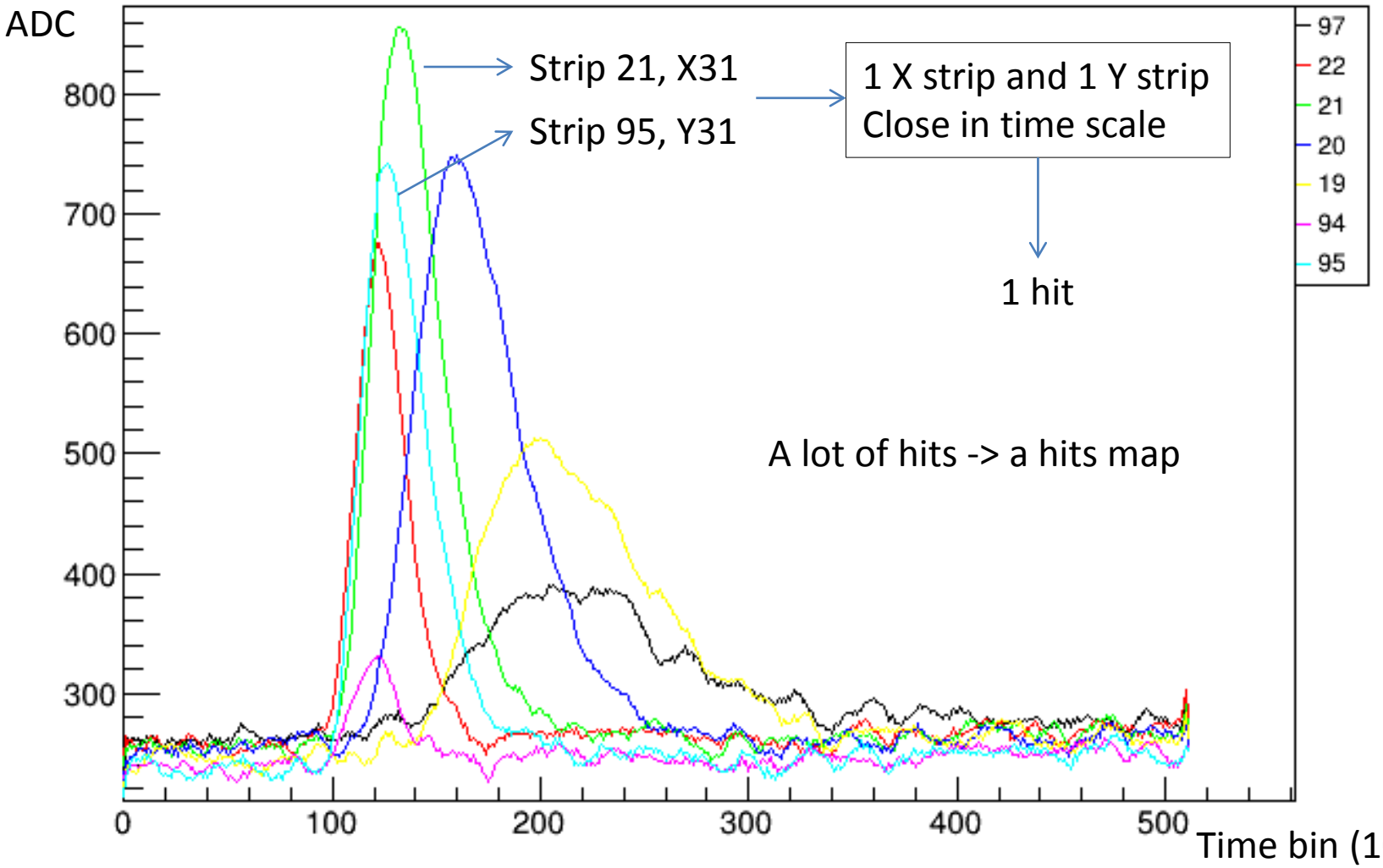
rim


0.3mm
0.2mm
0.3mm
Top Layer
mesh
Inner layer
pixels
rim
Bottom layer
channel n
circuit border


2D simulation


Rim
RimB

Accumulation of events



How to make a hits map