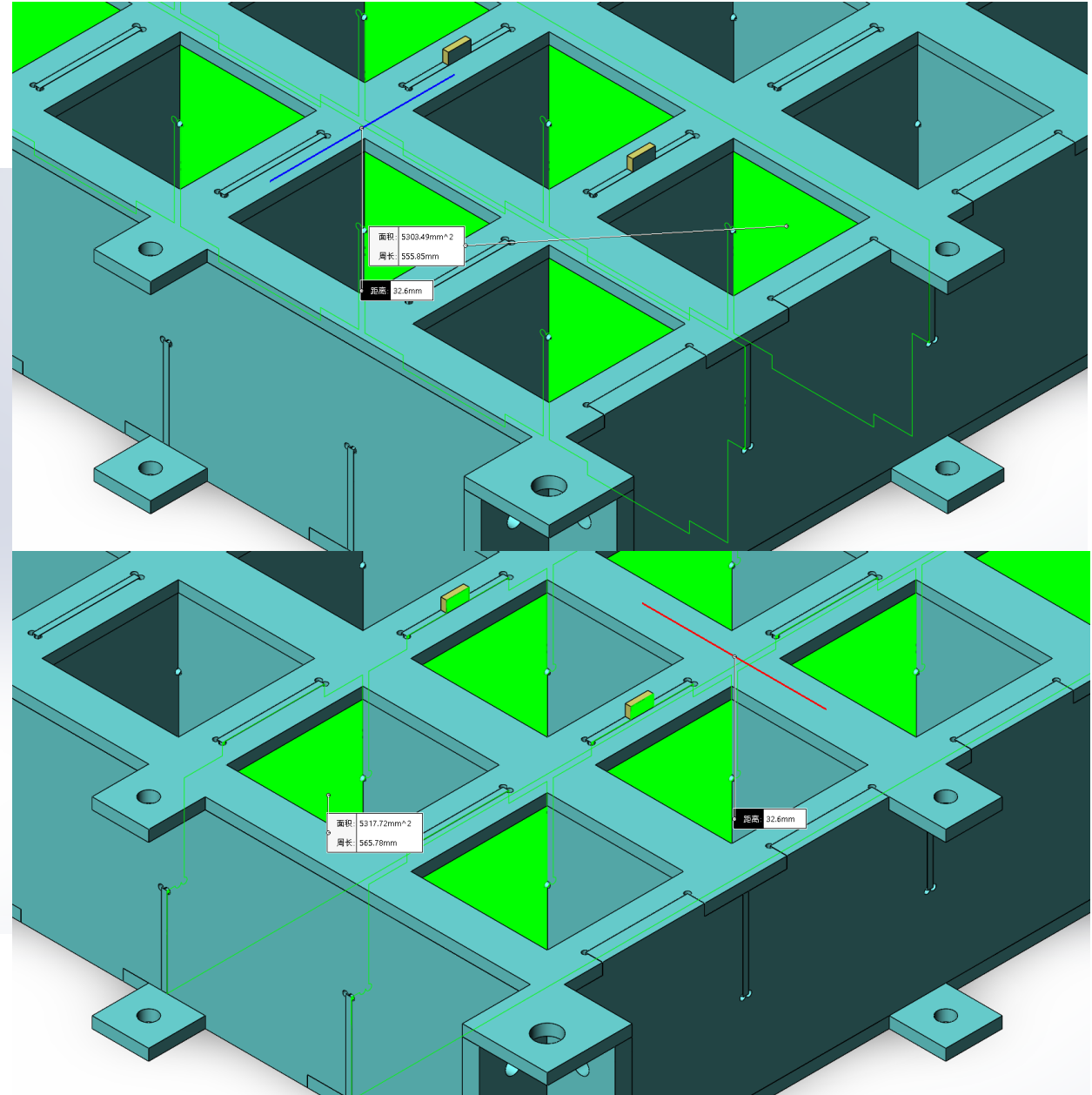
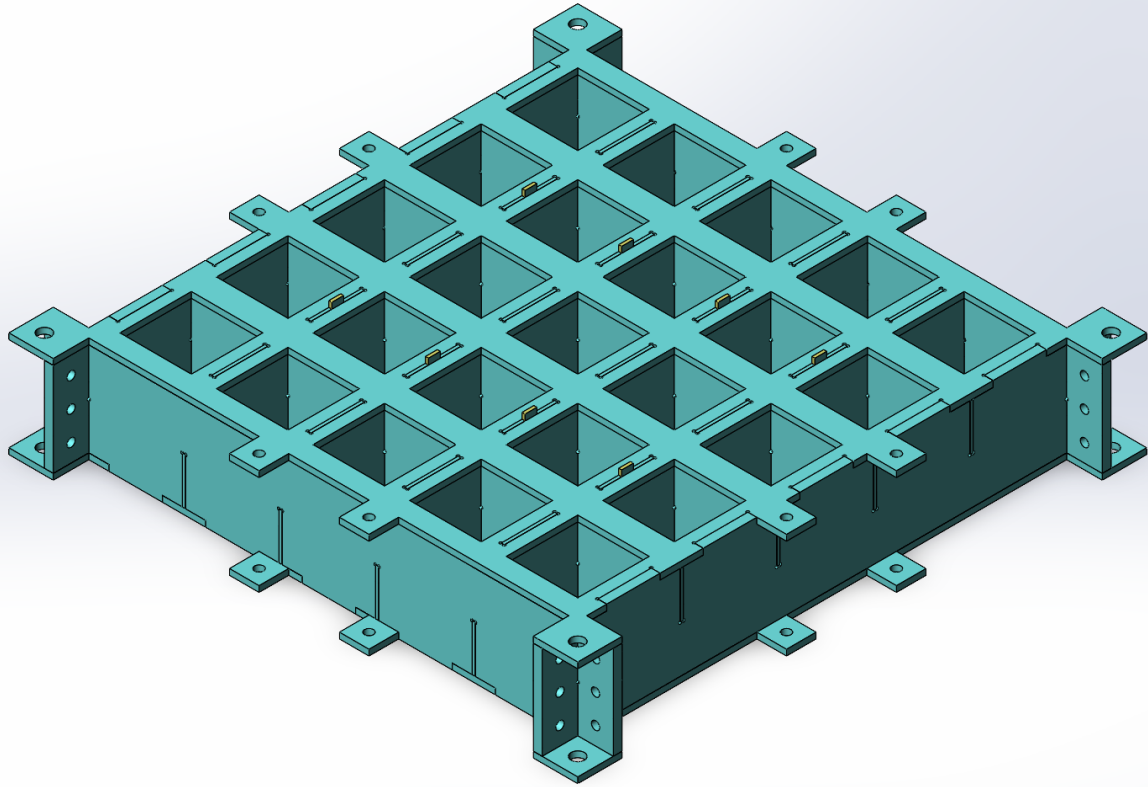


# HEIC-Cube structure

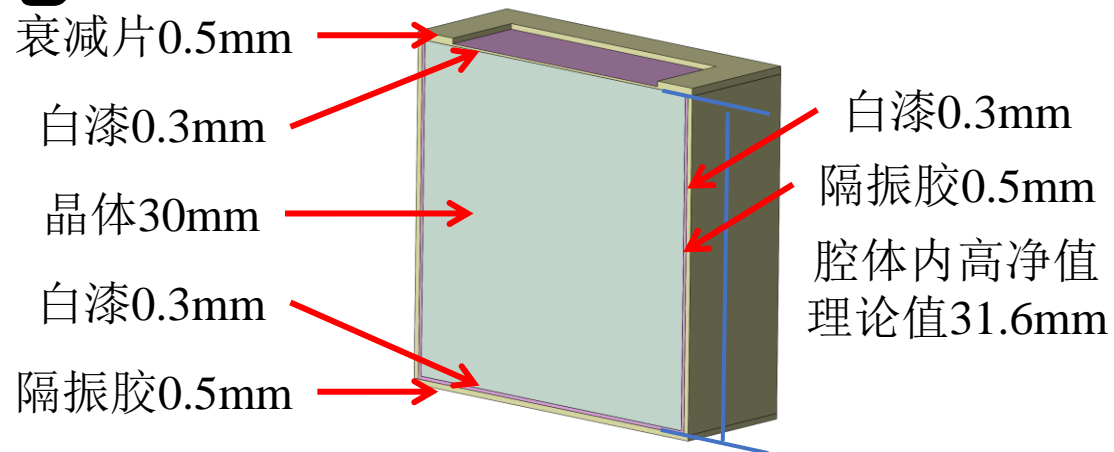
张研硕

2024.09.02

# 碳纤维框架

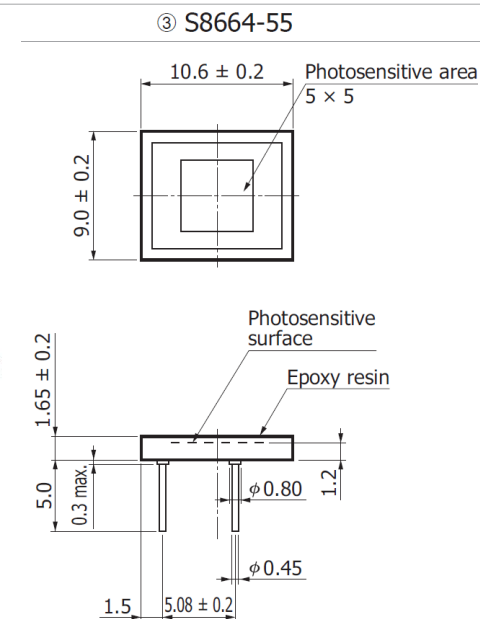
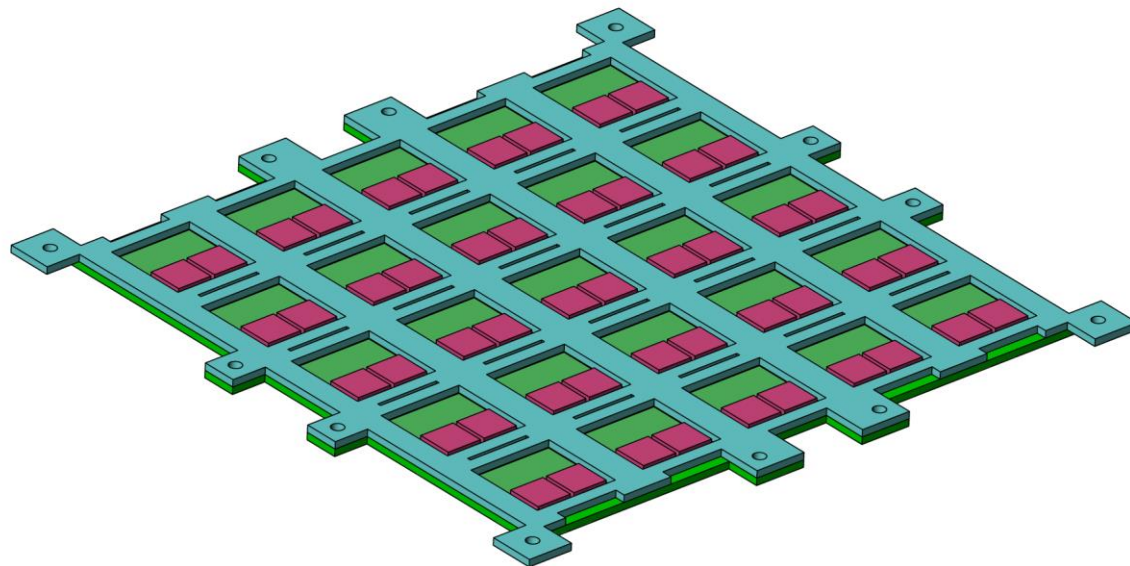
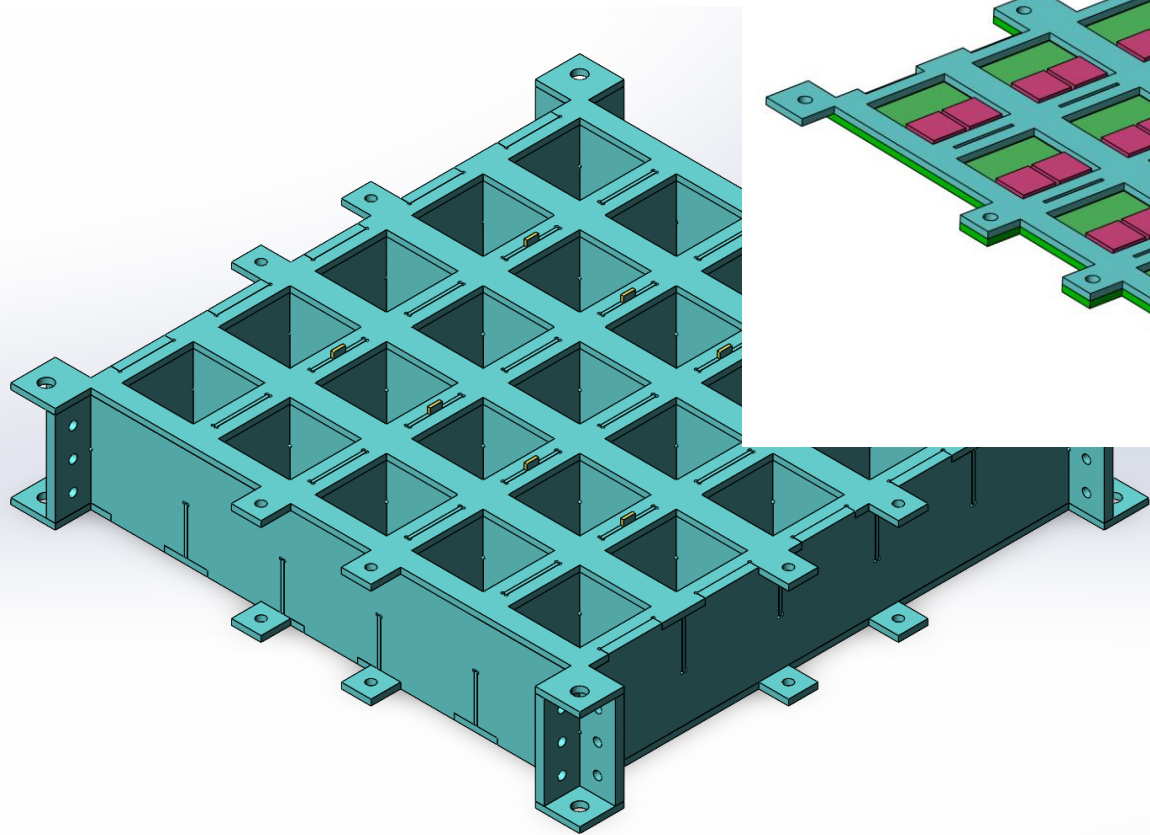


# 每个小单元



物质	尺寸	材料	说明
晶体中心至边线	15mm	BGO	上下左右四面都有
白色漆	0.3mm	BaSO <sub>4</sub>	左右下三面完整，上面开窗18.5mm*18.5mm
黑色减震胶	0.5mm	1.02g/cm <sup>3</sup> , C <sub>2</sub> H <sub>6</sub> O <sub>Si</sub>	左右下三面完整，上面完全去除，换成衰减片
衰减片	0.5mm	1.125g/cm <sup>3</sup> , C <sub>11</sub> H <sub>12</sub> O <sub>3</sub>	仅上面有
半个隔板	0.5mm	1.62g/cm <sup>3</sup> , 89C+2.5H+2.4N+6.1O	左右面有，上下面另计

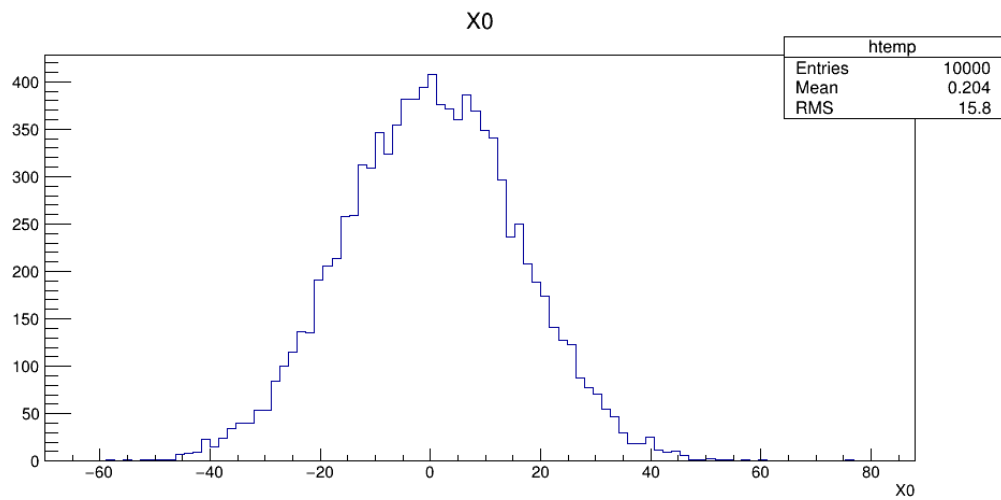
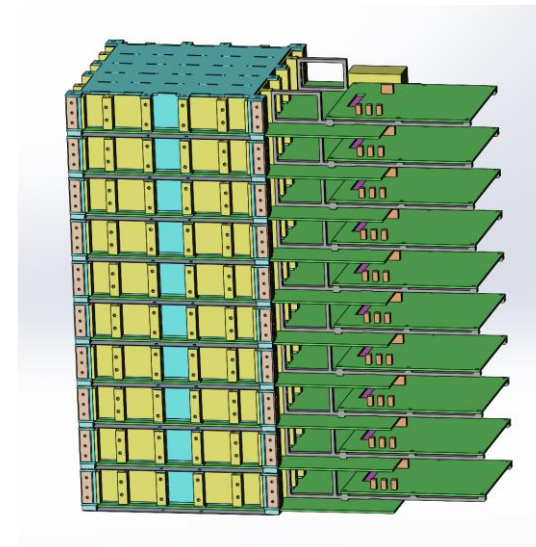
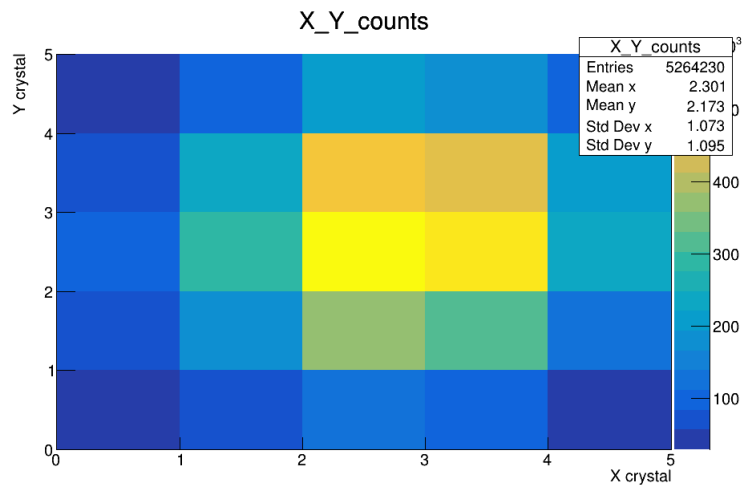
# 碳纤维框架



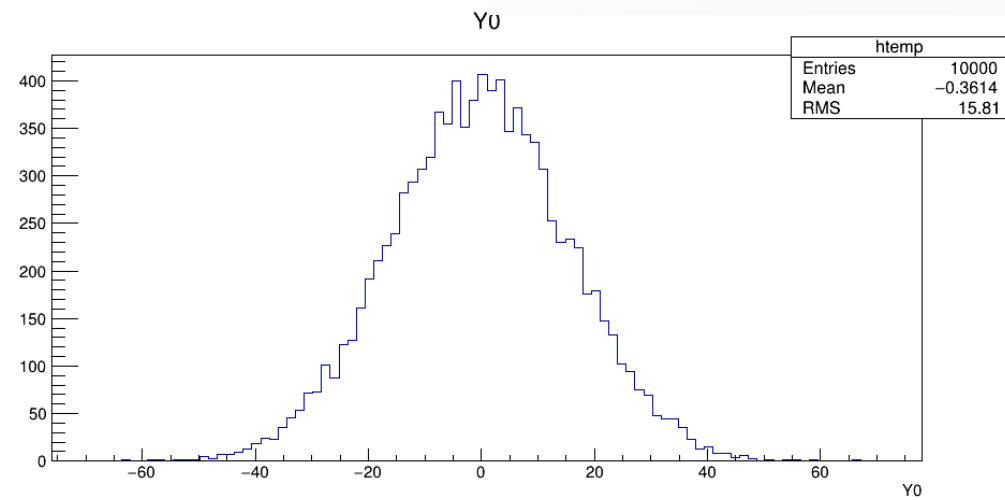
材料：碳纤维； $1.62\text{g/cm}^3$ ；89C+2.5H+2.4N+6.1O；  
底板：2mm厚，完整无开孔；  
主体：每个小单元 $32.6\text{mm} \times 32.6\text{mm} \times 31.6\text{mm}$ ，前后左右4个外框2mm厚，单元之间的隔板1mm厚；  
上盖：2mm厚，对应每个晶体的中心位置开窗 $24\text{mm} \times 24\text{mm}$ ；

电路板：2mm厚； $1.125\text{g/cm}^3$ ；C38H40O6Br4；  
APD外壳： $10.6\text{mm} \times 9\text{mm} \times 1.65\text{mm}$ ； $1.125\text{g/cm}^3$ ；C11H12O3；  
灵敏区域： $5\text{mm} \times 5\text{mm} \times 10\mu\text{m}$ ，距离底面1.2mm；  
层间距：2.4mm

# 平面源

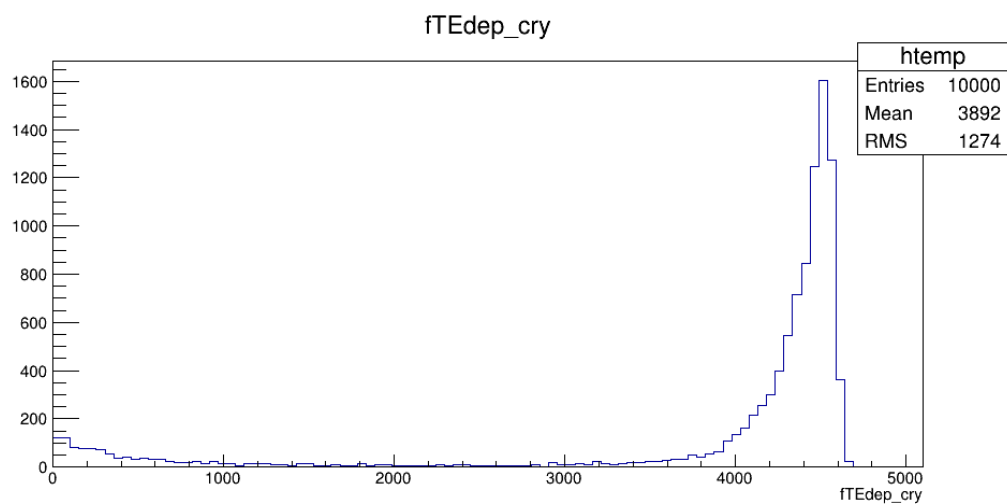
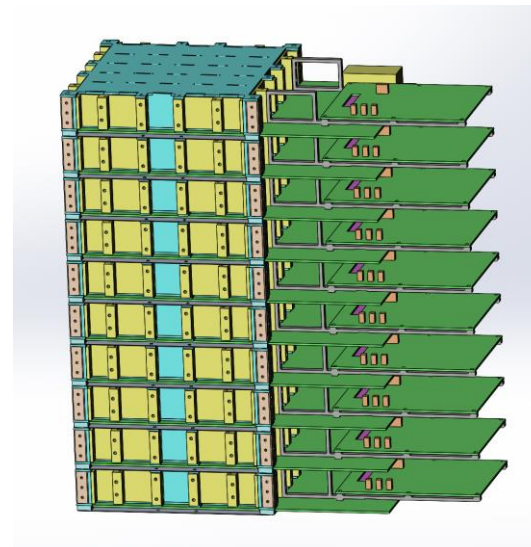


X\_direction

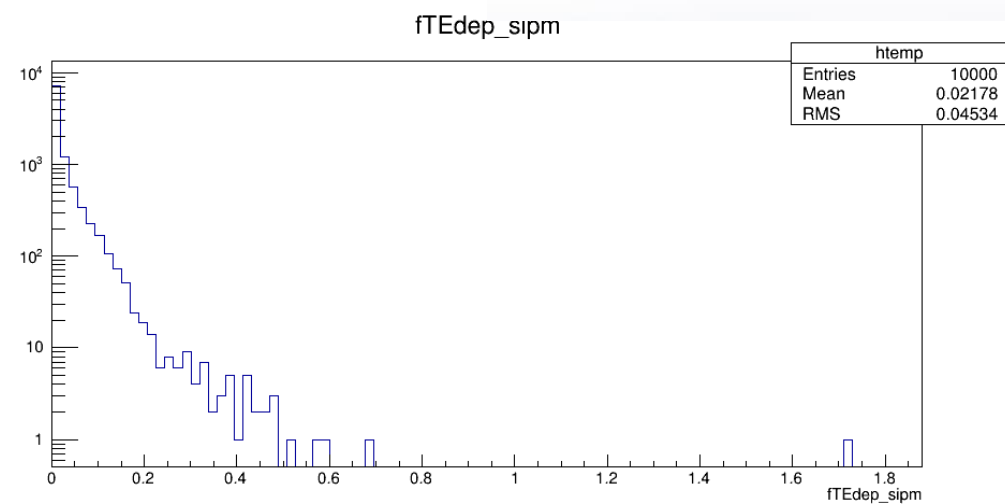


Y\_direction

# 模拟结果



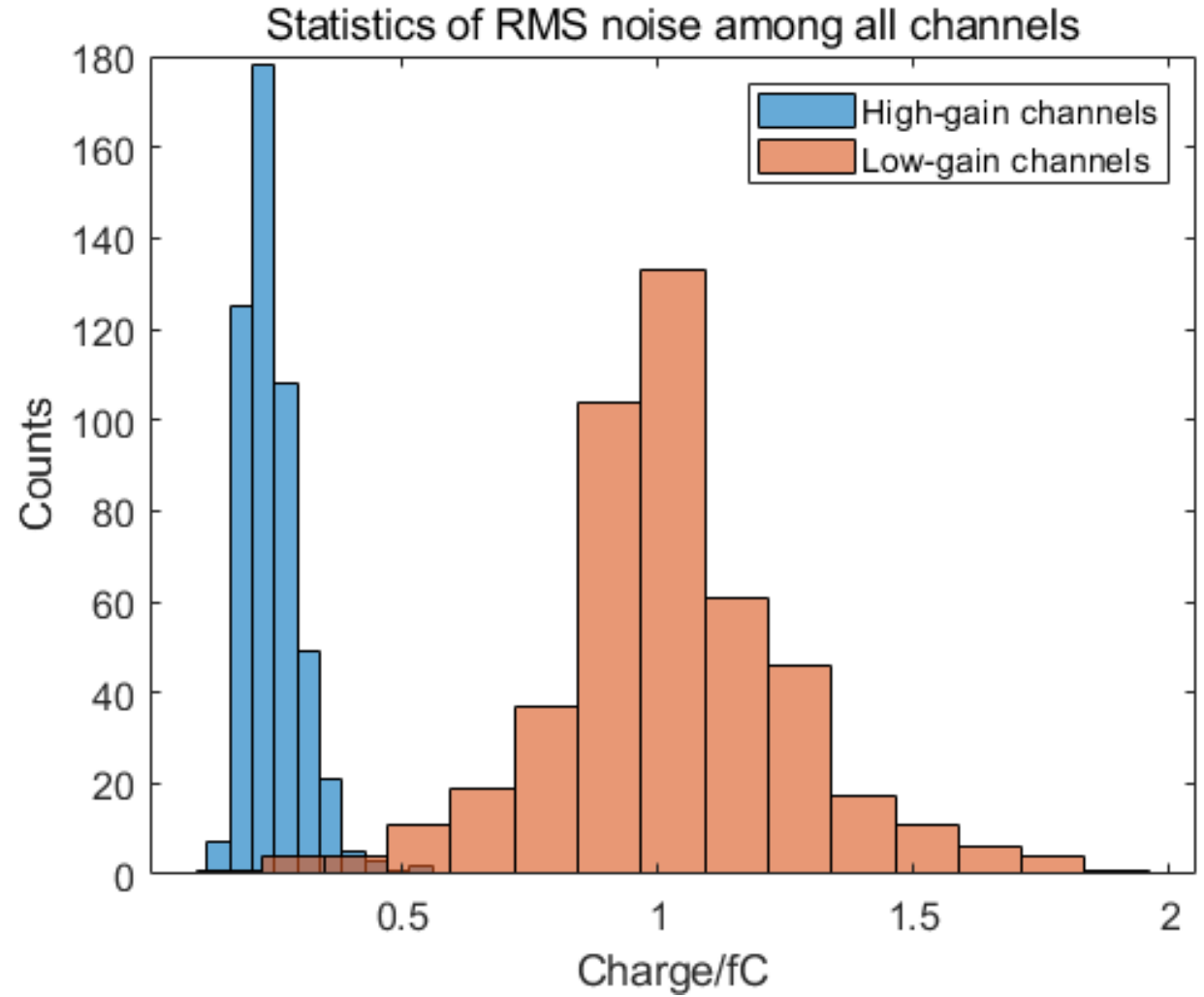
Crystal energy



APD energy

# 前端电子学噪声

- 电子学低增益通道 (HL和LL)  
噪声均**小于 $2fC$**
- 电子学高增益通道 (HH和LH)  
噪声均**小于 $0.5fC$**

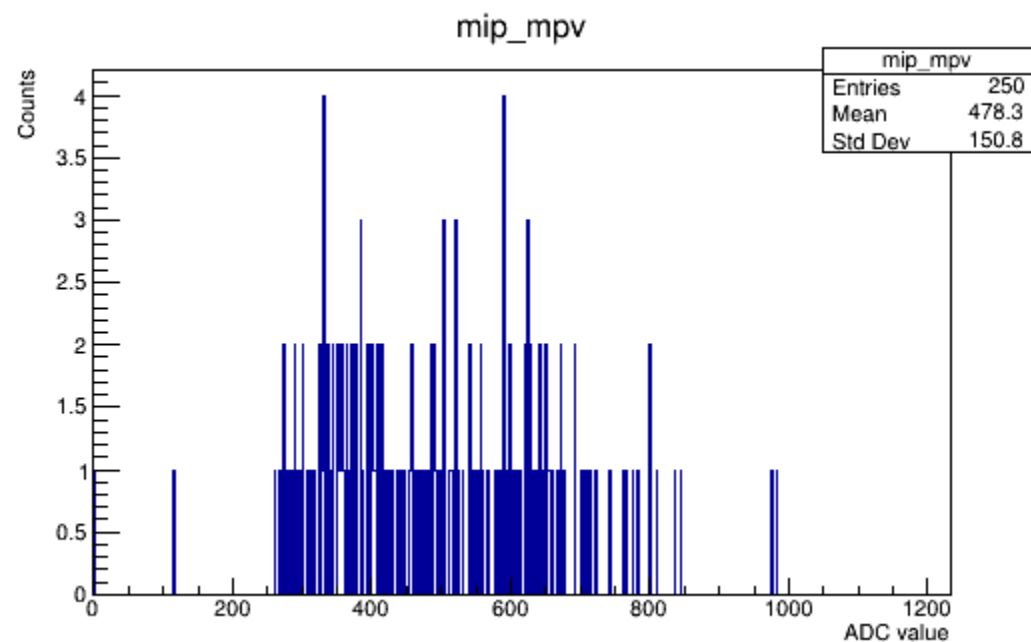


# 数字化

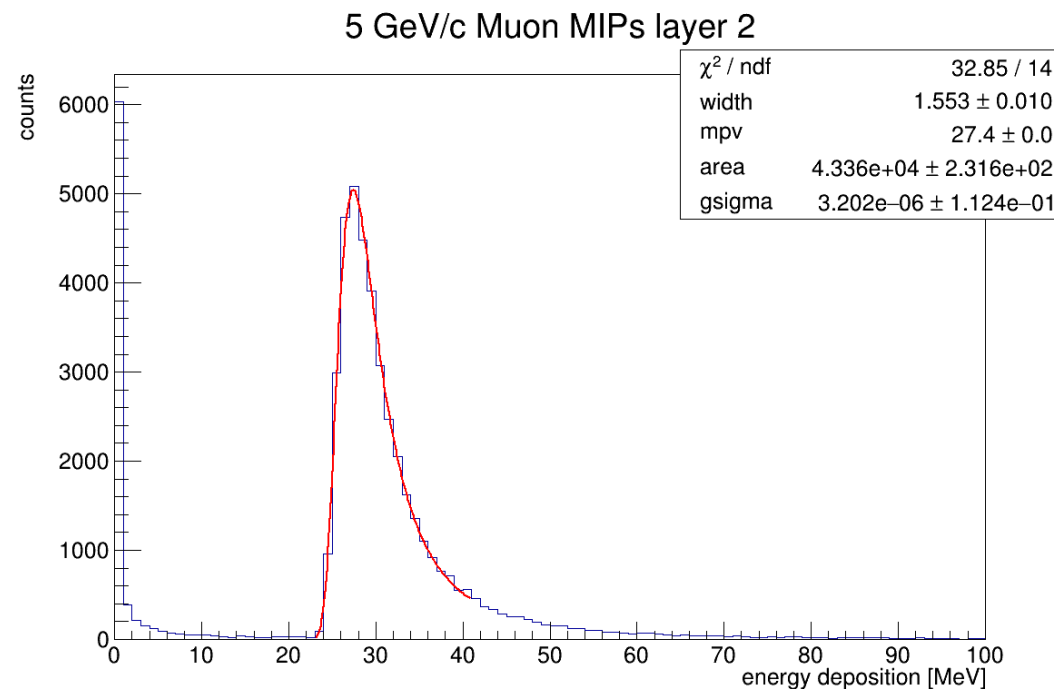
$\frac{3 \times 0.5E-15 C}{1.6E-19 C} \times \frac{27.4}{480} = 535.2$ , 取BGO 1MeV对应500个光电子;

APD灵敏区域是硅, 平均电离能为 3.6eV;

台基大小取0.25MIPs位置, 电子学噪声固定为125个光电子;



MIPs mpv



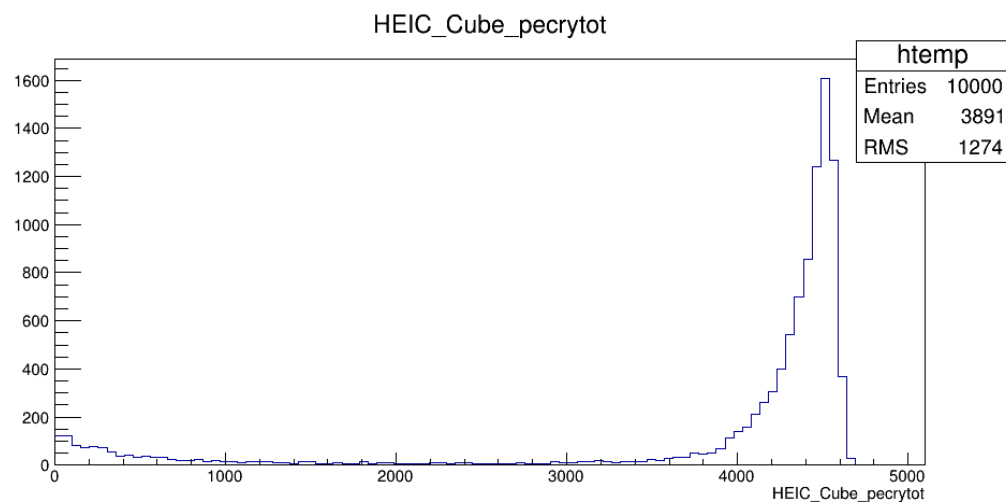
MIPs energy



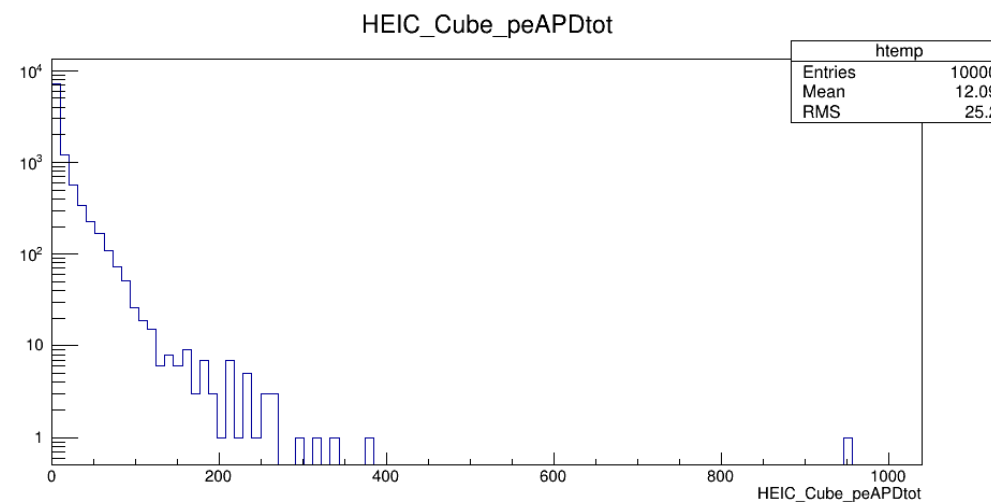
# 数字化

```
Pe_cry=eng_cry*500;  
Pe_APD=(eng_APD/eV)/3.6;  
Pe_ped=0;
```

```
CLHEP::RandGauss* gauss->shoot(pe_cry,sqrt(pe_cry))/500;  
CLHEP::RandGauss* gauss->shoot(pe_APD,sqrt(pe_APD))/500;  
CLHEP::RandGauss* gauss->shoot(0,sqrt(125));
```



Crystal energy

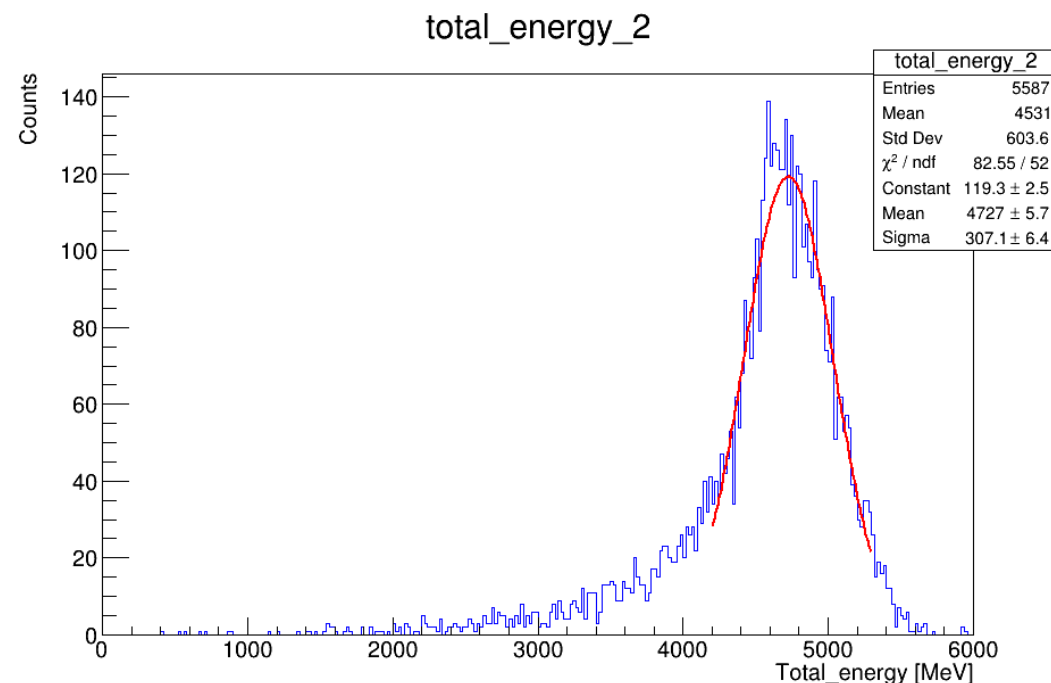


APD energy

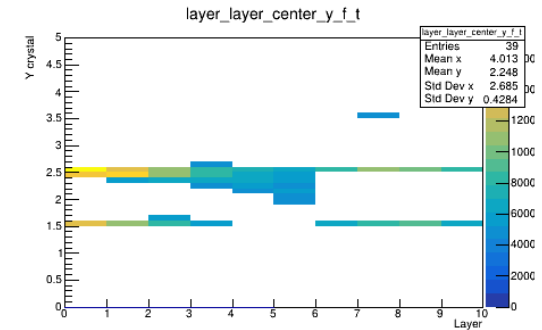
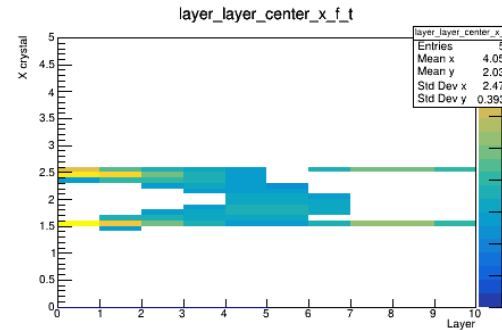
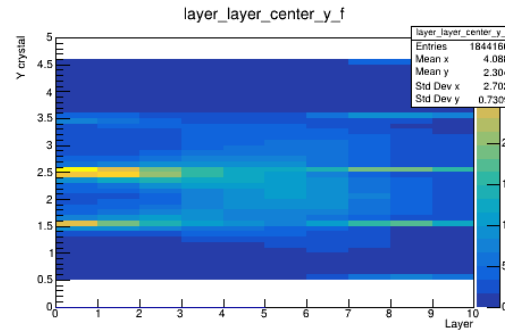
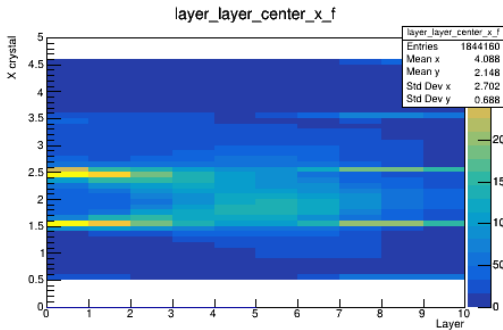
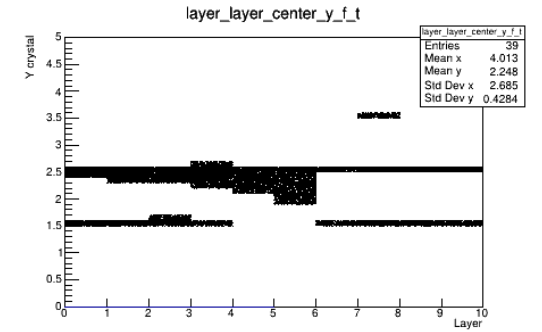
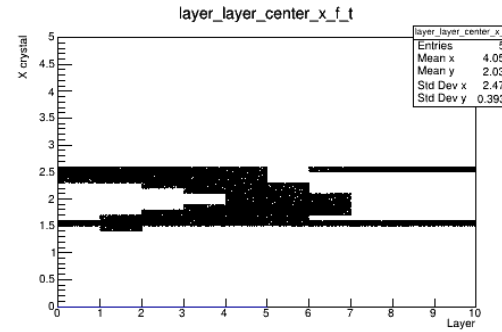
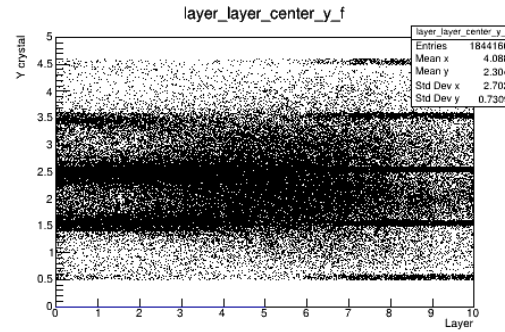
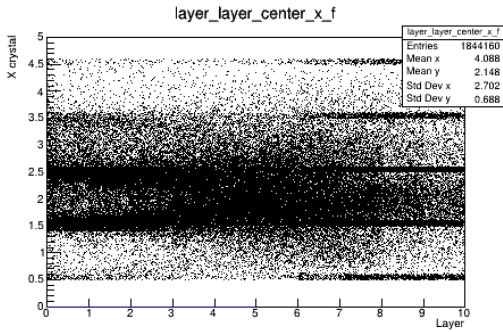
# 5GeV electron – beam test



- 筛选条件：
  - 前6层中至少3层的总能量大于2个MIPs;
  - $2.3 \leq x\_center[2] \leq 2.7$ ;
  - $2.3 \leq y\_center[2] \leq 2.7$ ;
  - $2.3 \leq x\_center[3] \leq 2.7$ ;
  - $2.3 \leq y\_center[3] \leq 2.7$ ;



# X\_center; Y\_center – beam test



# 5GeV electron – simulation

