Progress on BMR

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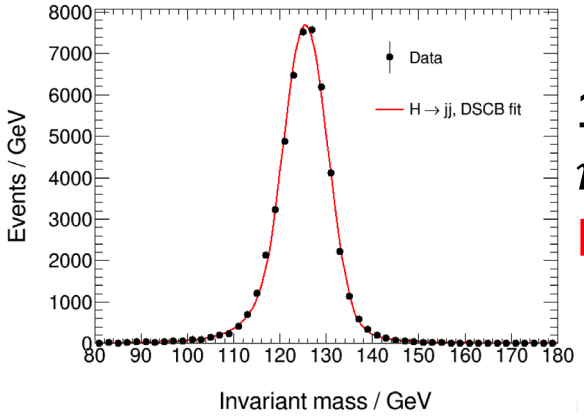
Progress on BMR

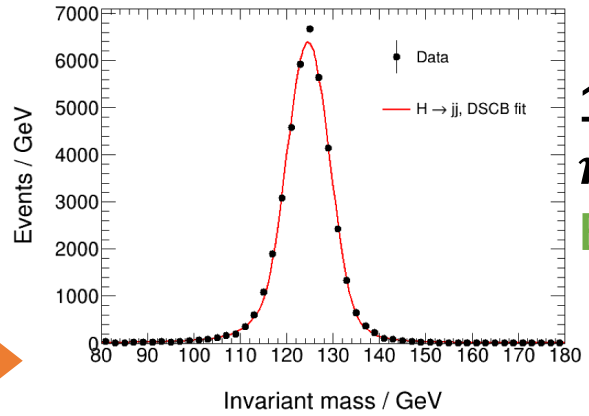
- **全重建: track + ECAL (10 mm / 15 mm) + GS-HCAL**
  - 径迹挑选: 基于 BDTG.
  - 10mm 与 15mm 几何采用相同的数字化
  - 产生~20万事例,



10 mm crystal bar ECAL

$m_H = 125.5 \pm 4.94$ GeV

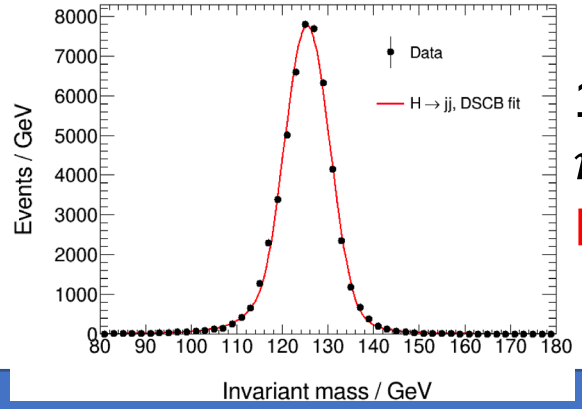
BMR = $3.94 \pm 0.03\%$



10 mm crystal bar ECAL

$m_H = 124.6 \pm 4.76$ GeV

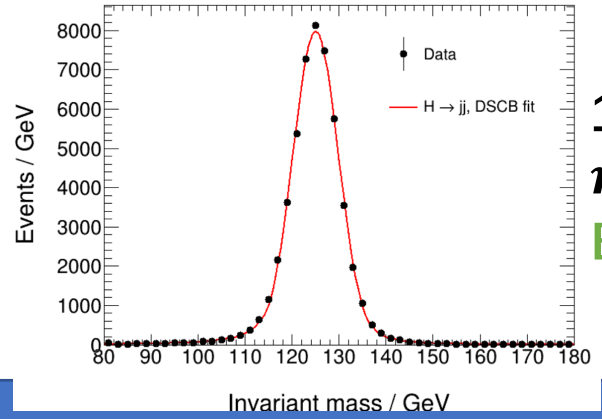
BMR = $3.82 \pm 0.03\%$



15 mm crystal bar ECAL

$m_H = 125.4 \pm 5.09$ GeV

BMR = $4.06 \pm 0.04\%$



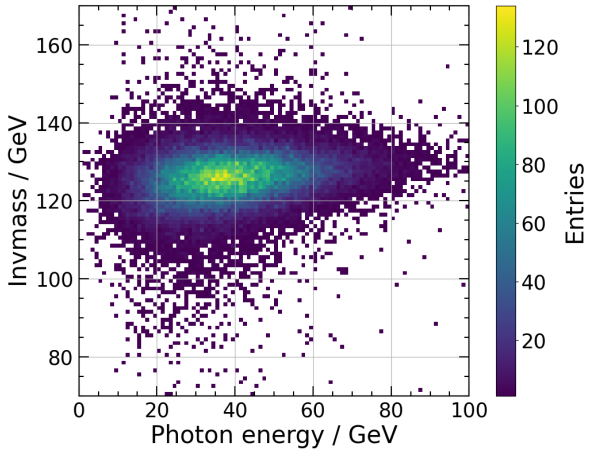
15 mm crystal bar ECAL

$m_H = 125.0 \pm 4.87$ GeV

BMR = $3.89 \pm 0.02\%$

Progress on BMR

- **刻度的优化**
  - ECAL对电磁簇射与强子簇射的响应不同，需要不同的刻度系数



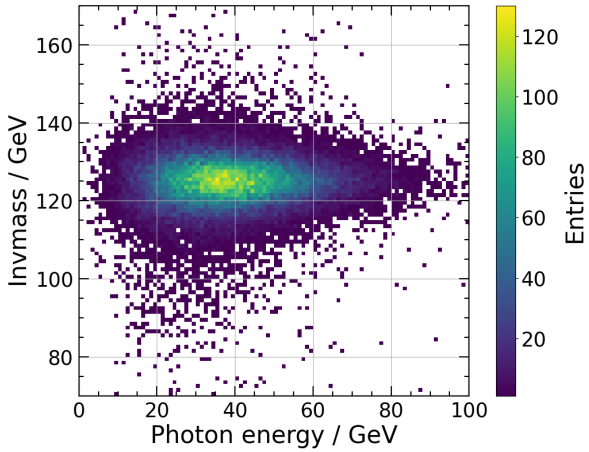
BMR = $4.06 \pm 0.04\%$

旧刻度：作用于所有 cluster

$k_{ECAL} = 1.06, k_{HCAL} = 4.00;$

导致光子的重建能量偏大。

m_H 的质量也会对事例中的光子能量有依赖



BMR = $3.89 \pm 0.02\%$

新刻度: 分别处理 charged cluster 与 neutral cluster

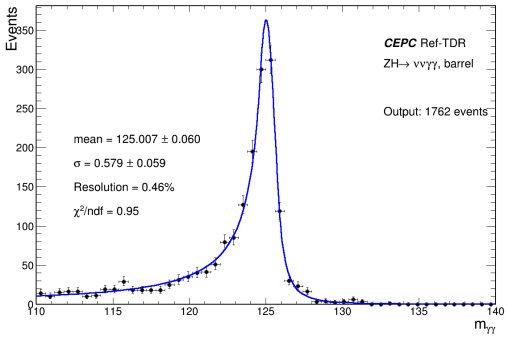
$k_{ECAL}^{charged} = \mathbf{1.26}, k_{HCAL} = 4.00;$

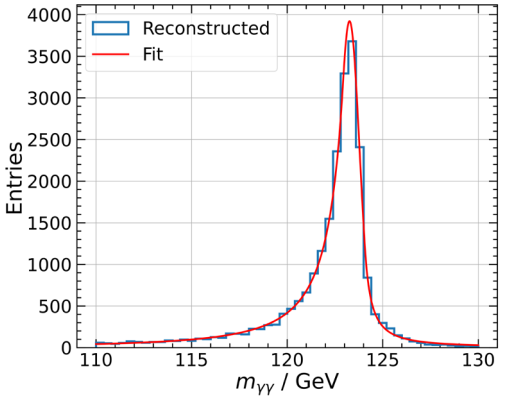
$k_{ECAL}^{neutral} = \mathbf{1.00}, k_{HCAL} = 4.00$

(中性强子能量占比小，假设所有 neutral cluster 都来自光子)

新的刻度方式解决了m_H对光子能量的依赖，降低了BMR；

原则上也可以解决单光子重建能量偏大，以及 $H \to \gamma\gamma$ 重建不变质量偏大的问题



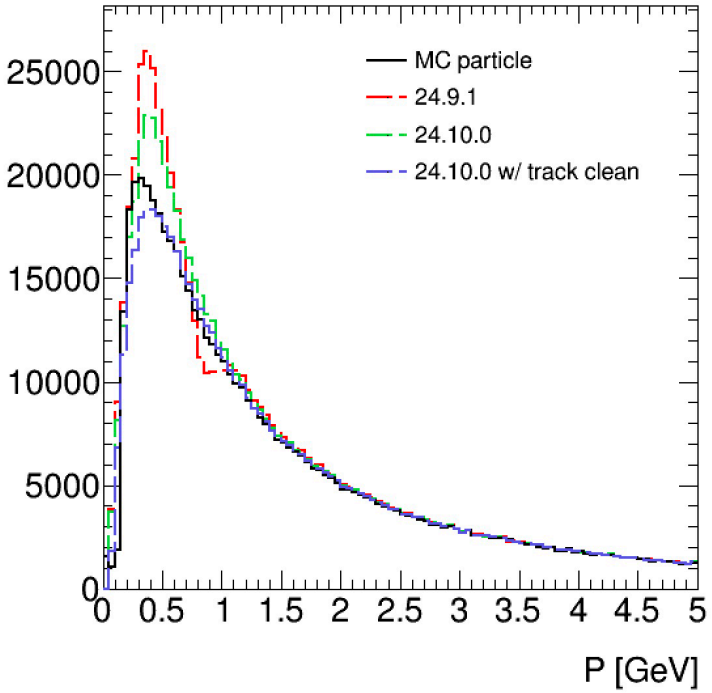


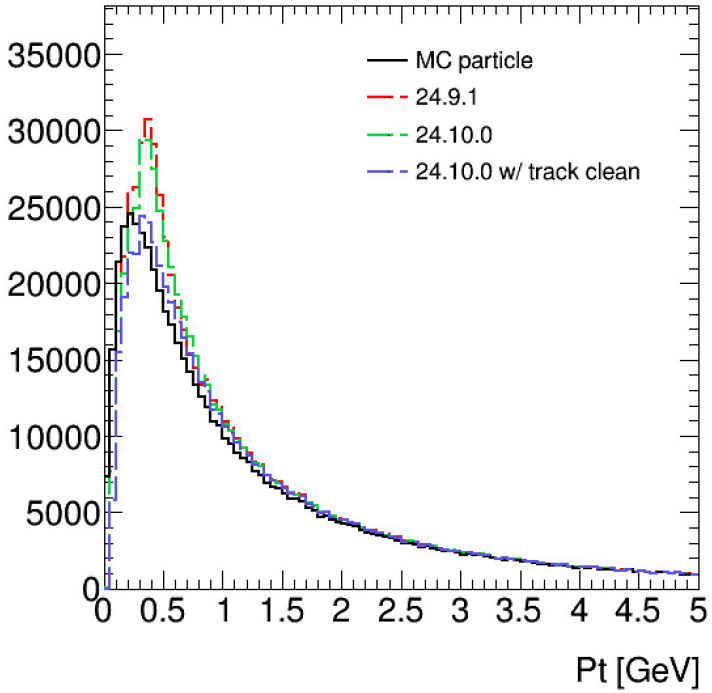
[Raw mass: 130.3 GeV](), scaled to 125 GeV(By Kaili Zhang)

$m_{\gamma\gamma} = 123.3\text{GeV}$

Progress on BMR

- 受益于径迹重建的优化(By Chengdong Fu)





计划

- **将算法的更新同步到官方代码库 CEPCSW**
  - 新的刻度方法，
  - 两套晶体尺寸的几何(10mm & 15mm)
  - 加入ECAL端盖
- **性能测试**
  - $\gamma,\ \pi^{\pm},\ \gamma\gamma,\ \pi^{0},\ \gamma\pi^{\pm},$
  - $H \to \gamma\gamma$
  - $H \to jj,\ Z \to jj$
  - JER
- **端盖重建算法，HCAL中性碎片的处理, PID**
- **机器学习**

Backup

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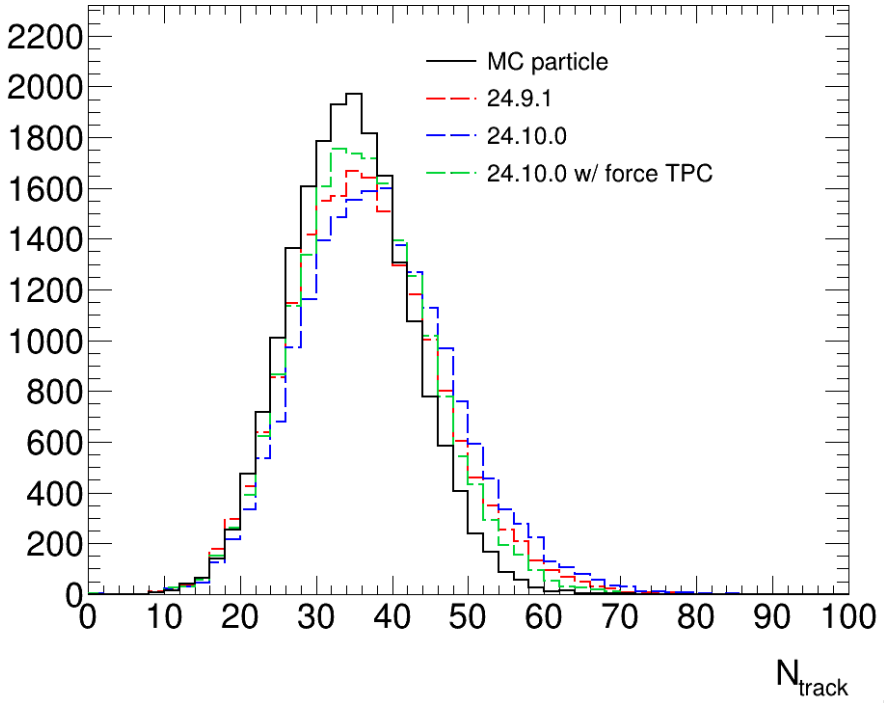
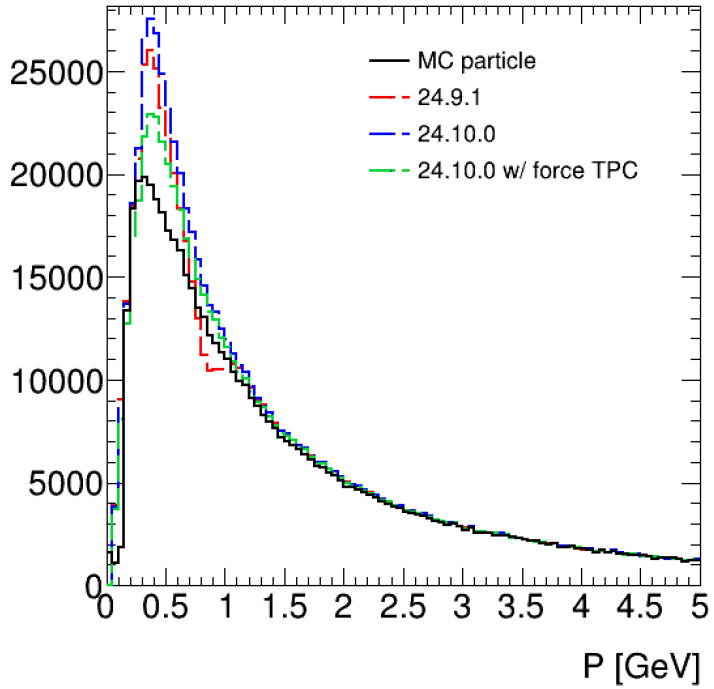
Plan of CyberPFA

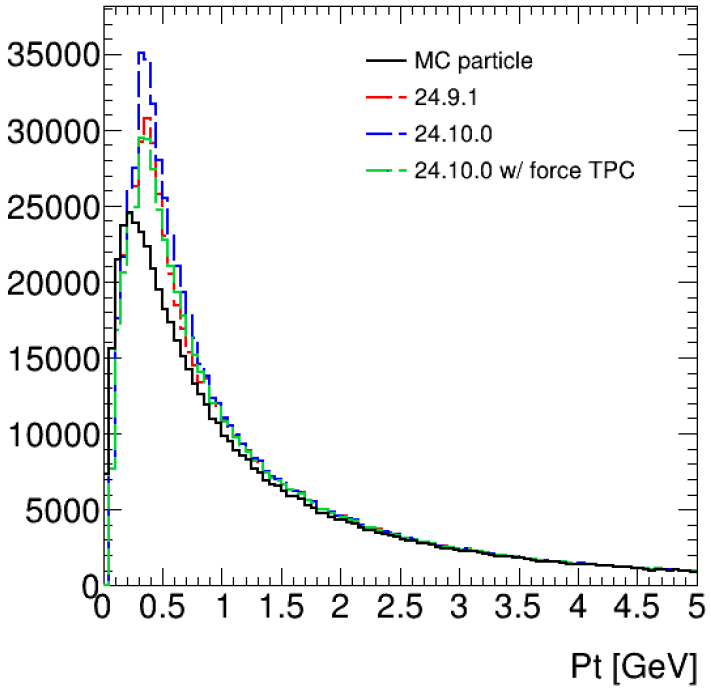
- **Short term goals (1 months)**
  - Granularity 15mm*15mm*400mm crystal ECAL Comments 4 / ECAL Issues 5 / Calo Recommendations 2
  - Endcap of ECAL → Preliminary result → Further tuning Software Recommendation 3
  - Performance studies ECAL Comments 1 / Calo Recommendations 3/ Software Recommendation 2
    - Single particles (γ, π^0, $\pi^{\pm}$, K_L/n) for detector performance Performance Recommendation 2
    - Complex physical processes ($H/Z \rightarrow udscb\ g$, w/ ISR etc.)
  - PID information
- **Medium term goals (5 months)**
  - Sequential improvements of tracking ECAL Comments 1
  - Beam-induced backgrounds analysis
  - Calibration and correction of energy deposition Performance Recommendation 7
  - Optimization of HCAL algorithm ECAL Comments 1
- **Long term goals (2 years)**
  - Optimization of ambiguity removal algorithm
  - ECAL energy splitting ECAL Comments 1

Track update

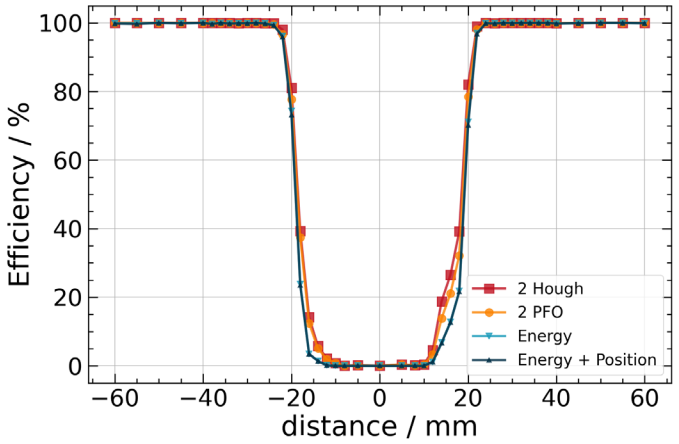
- **Track performance update in CEPCSW tdr24.10.0 by Chengdong Fu:**
  - Fix the low efficiency issue for P<1 GeV
  - Reduced the fake tracks in TPC.



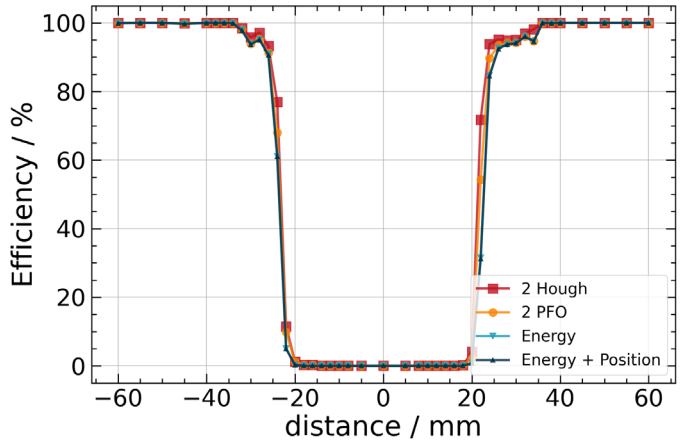




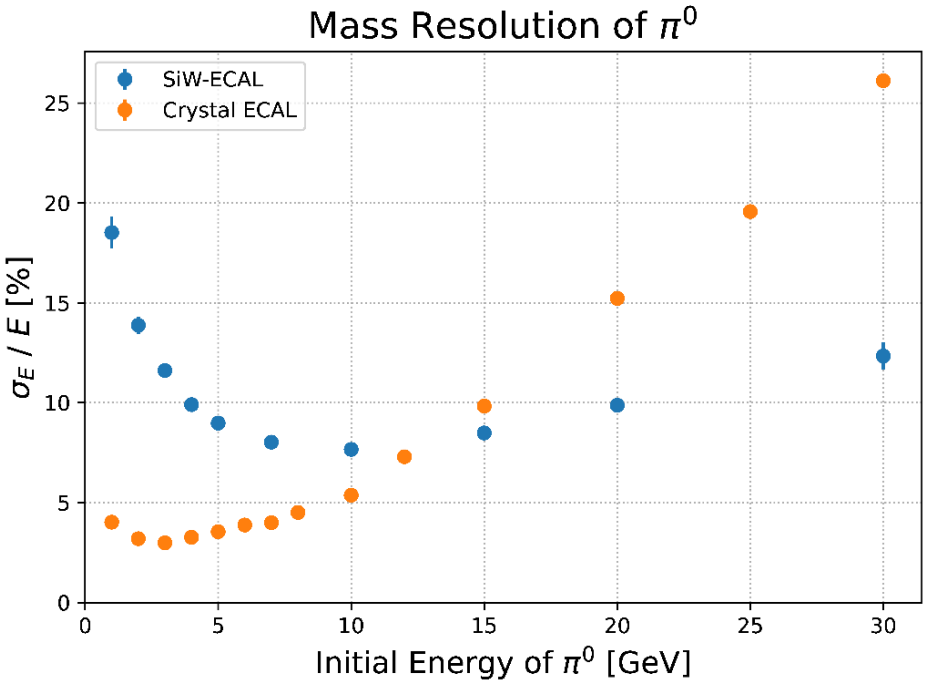
Backup



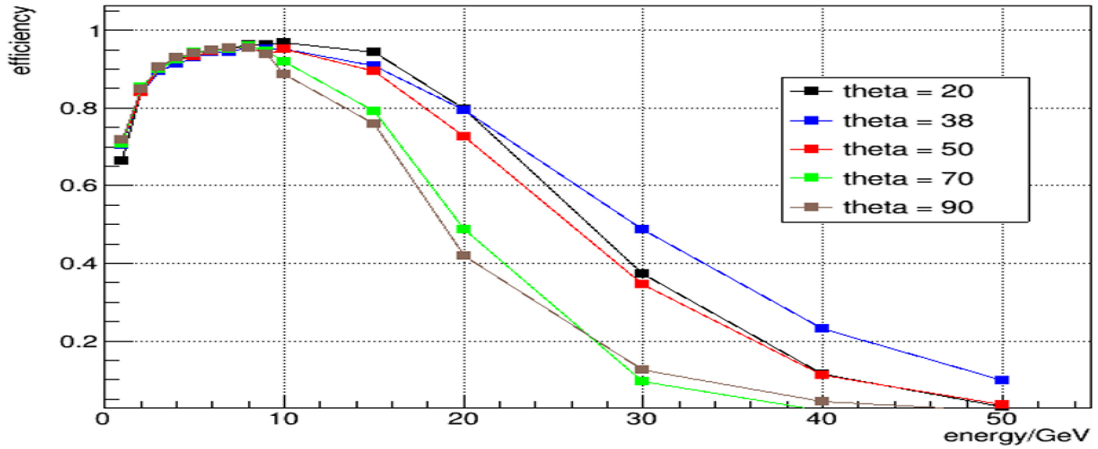
$\gamma\gamma$， 10mm ECAL



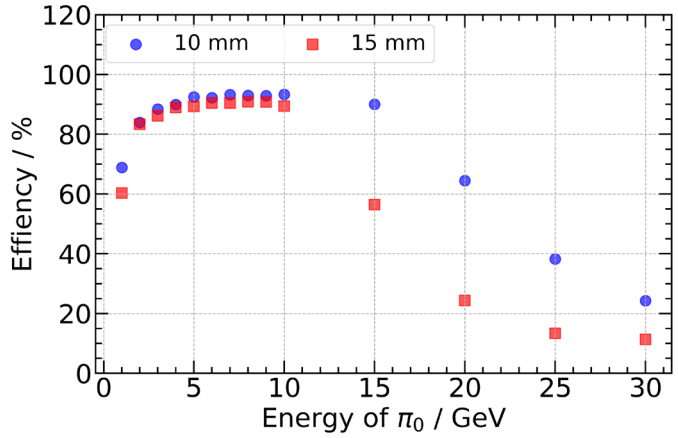
$\gamma\gamma$ ， 15mm ECAL



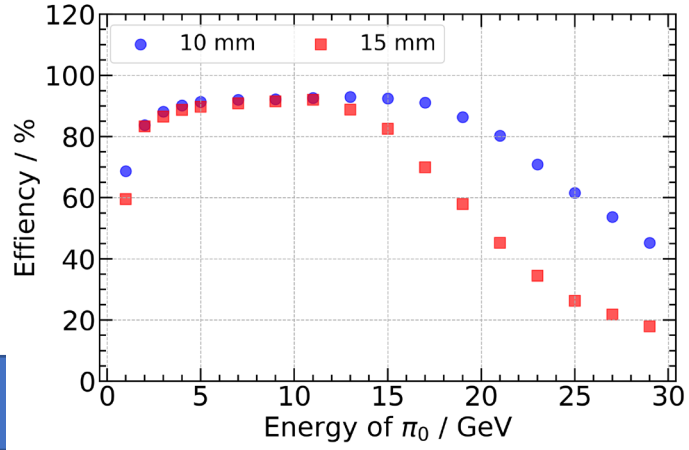
Si-W



晶体ECAL更新前



晶体ECAL更新后

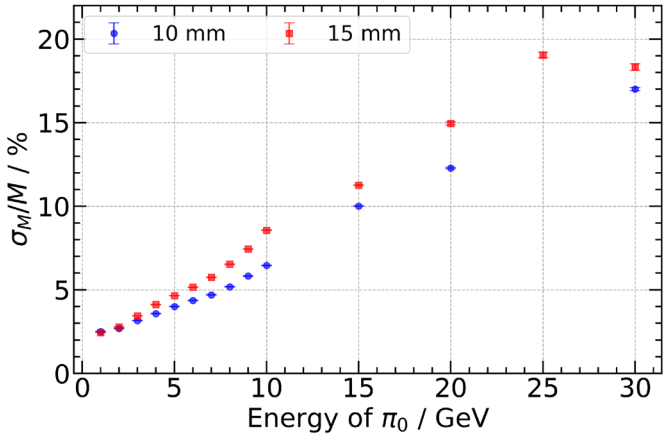


π^0

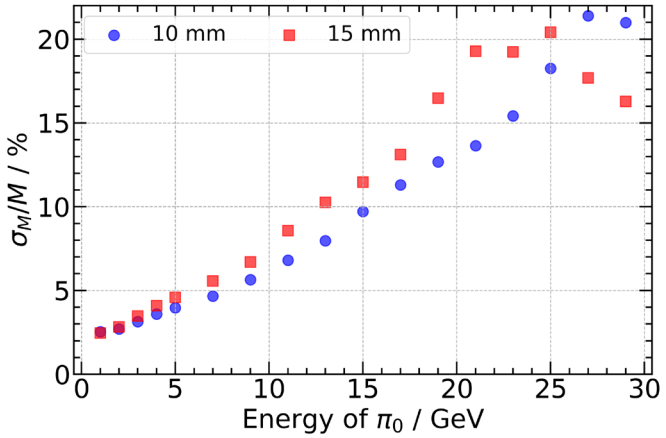
theta 50 - 130

phi 0 - 360

晶体ECAL更新前



晶体ECAL更新后



BMR performance

- **Major difference: ECAL cluster number and energy.**
  - Less clusters in 15 mm ECAL, but larger energy for each cluster -> more confusion.