中国科学技术大学
University of Science and Technology of China

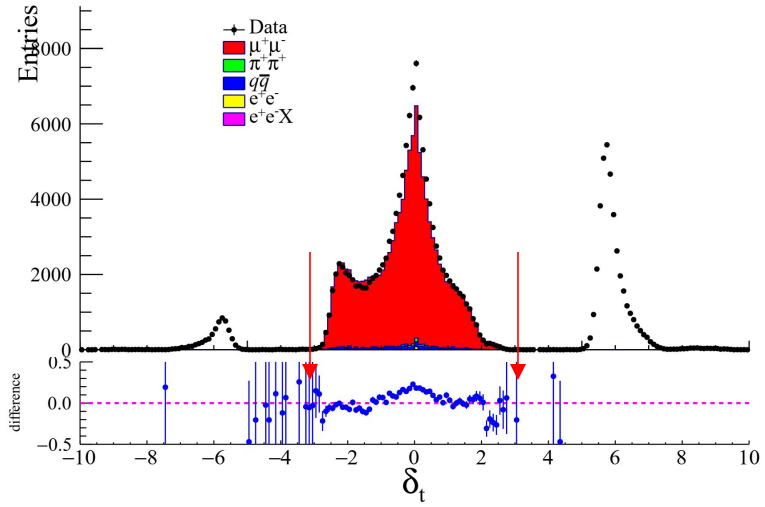
ISR dimu

By Yijing Wang

Selection criteria

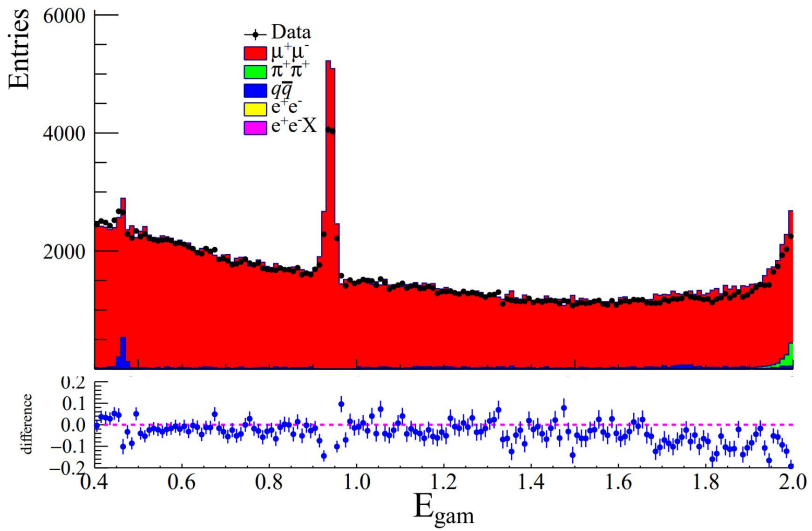
The control sample is $e^+e^- \to \mu^+\mu^-\gamma_{ISR}$

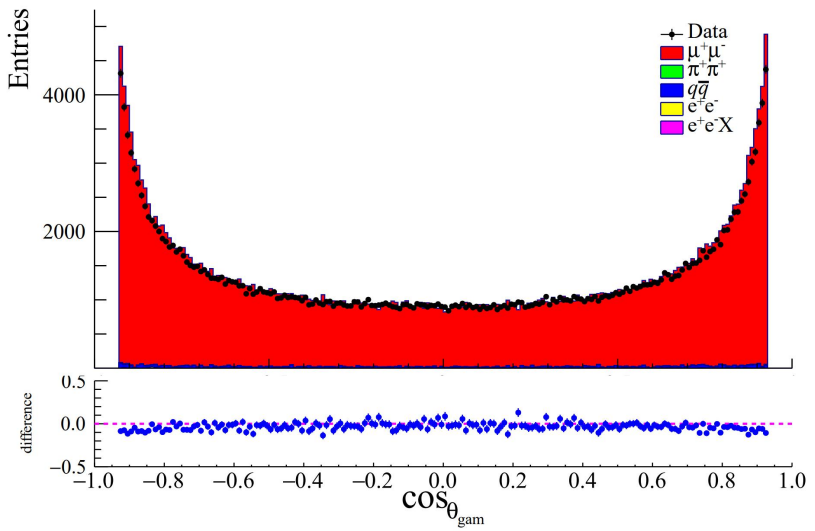
- Good charge tracks:
  - $|\cos\theta| < 0.93$, $V_r \leq 1$cm, $V_z \leq 10$ cm
  - $E/p \leq 0.5$ (E is the deposited energy in EMC) , $p/E_{beam} \leq 0.95$
  - The depth of at least one charge track in MUC should be larger than 35 cm.
  - $N_{good} = 2$, $|Q_{total}| = 0$
- Vertex Fit:
  - Successful vertex fit for $\mu^+\mu^-$
- Kinematic Fit:
  - Successful kinematic fit 1c.
  - $\chi^2 \leq 10$
  - $0.4\ \text{GeV} < E_{gam} < 2\ \text{GeV}$
  - $|cos\theta_{gam\_fit}| < 0.93$
- Further Selection:
  - The absolute difference of flight time between positive and negative should be smaller than 3ns to veto cosmic-ray background

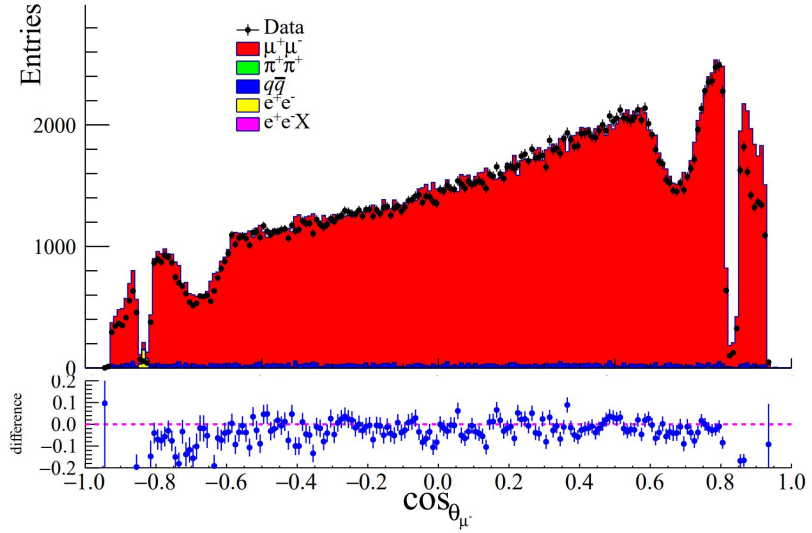


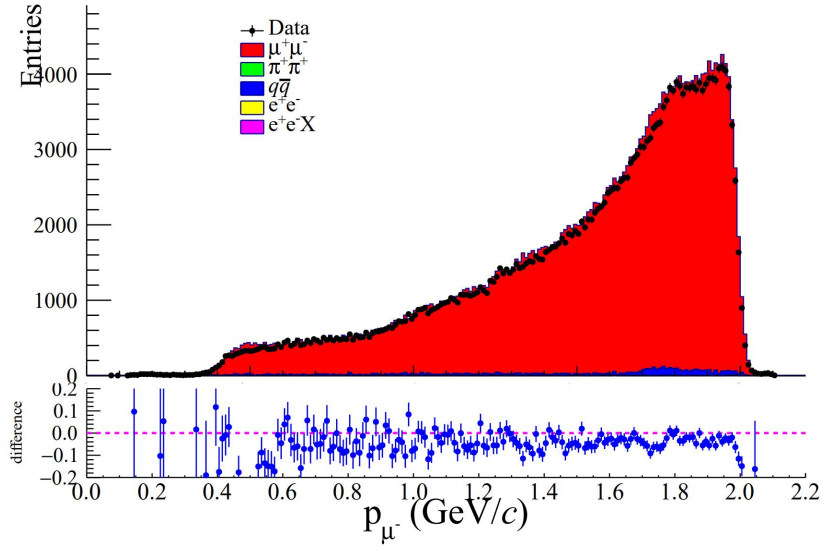
Tag an ISR photon by the same way as ISR KK. Then do another kmfit and require $\chi^2 \leq 50$. Then use the ratio of the events before and after tagging the ISR photon to get the photon efficiency.

Some distributions before tagging ISR photon

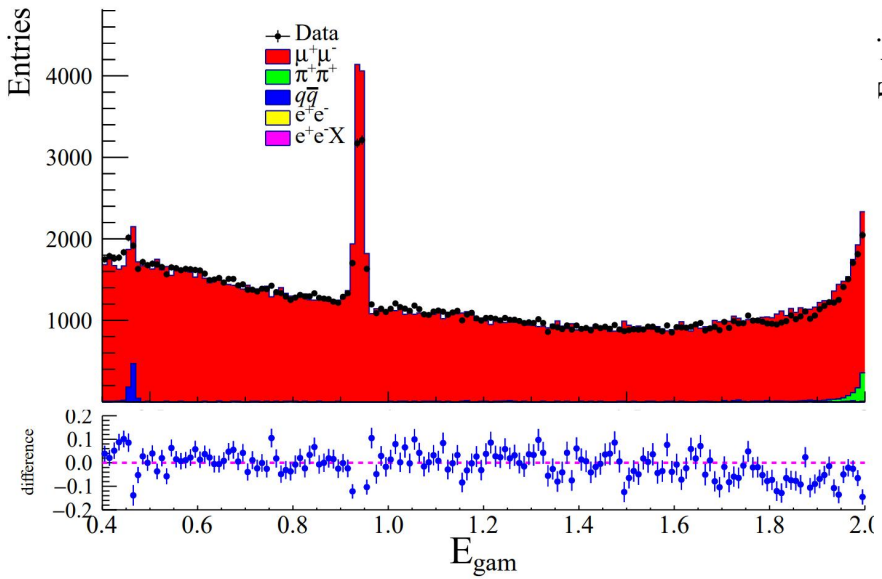


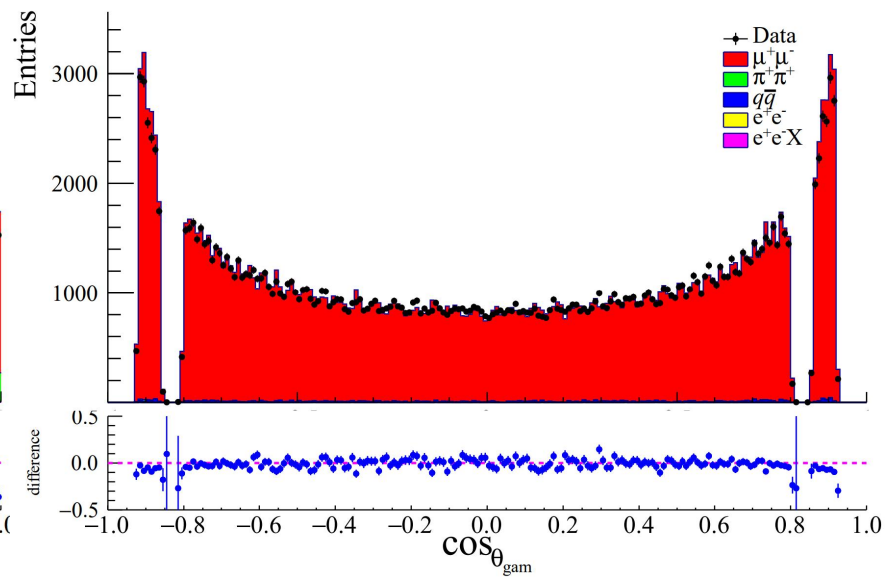


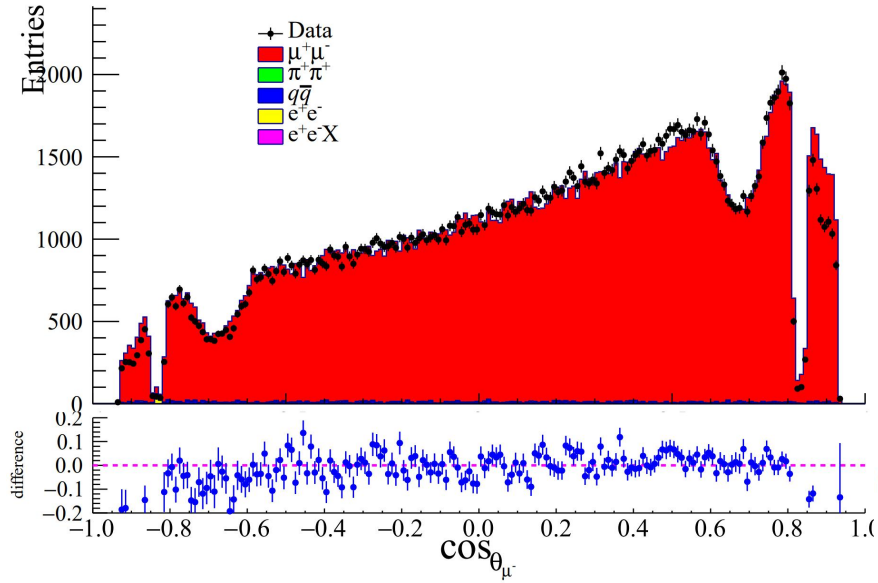


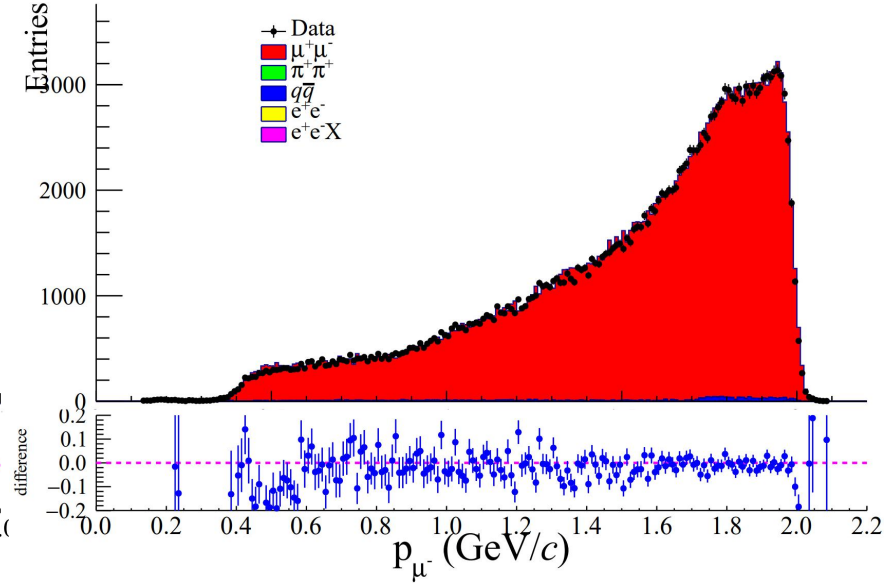


Some distributions after tagging ISR photon

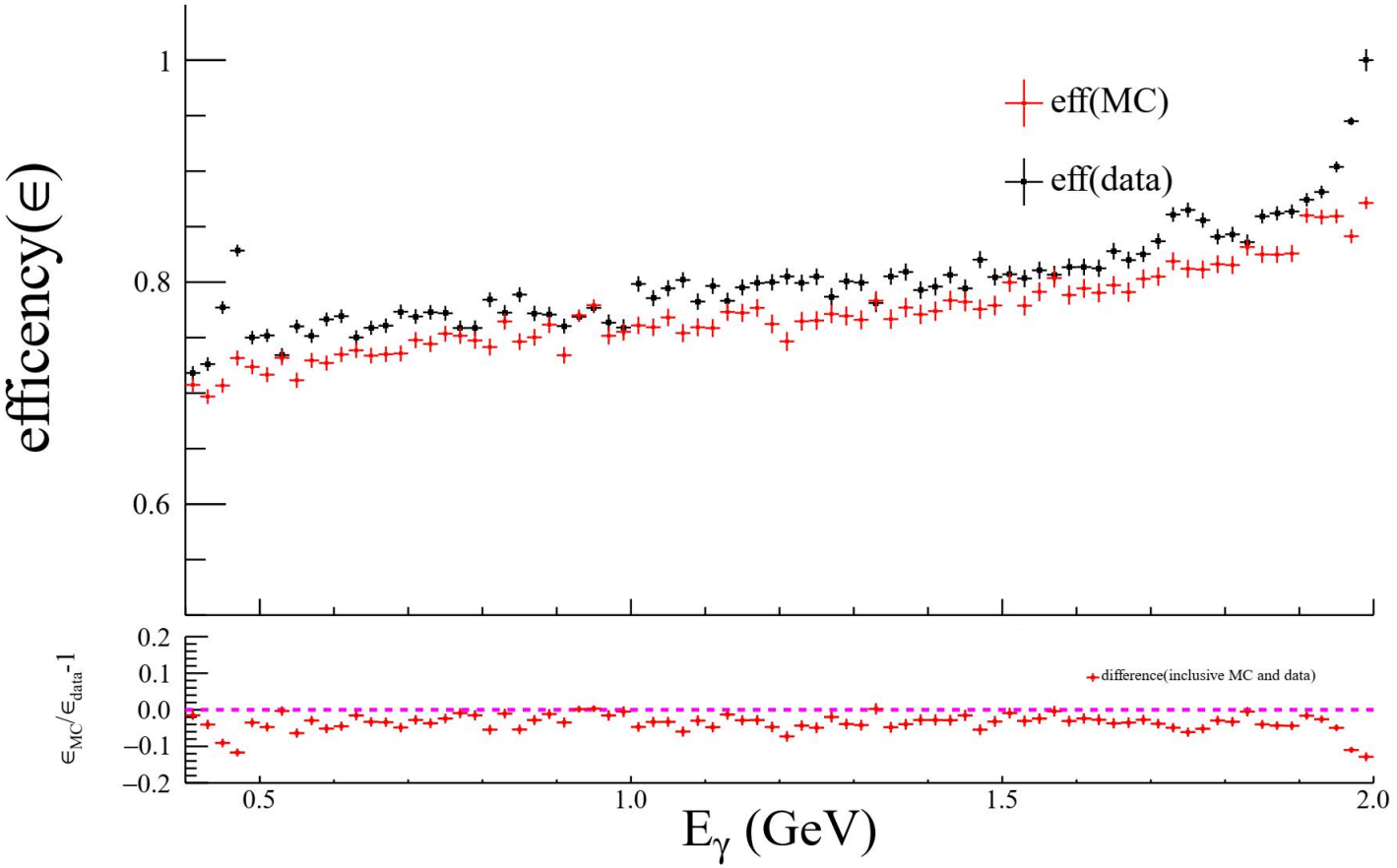




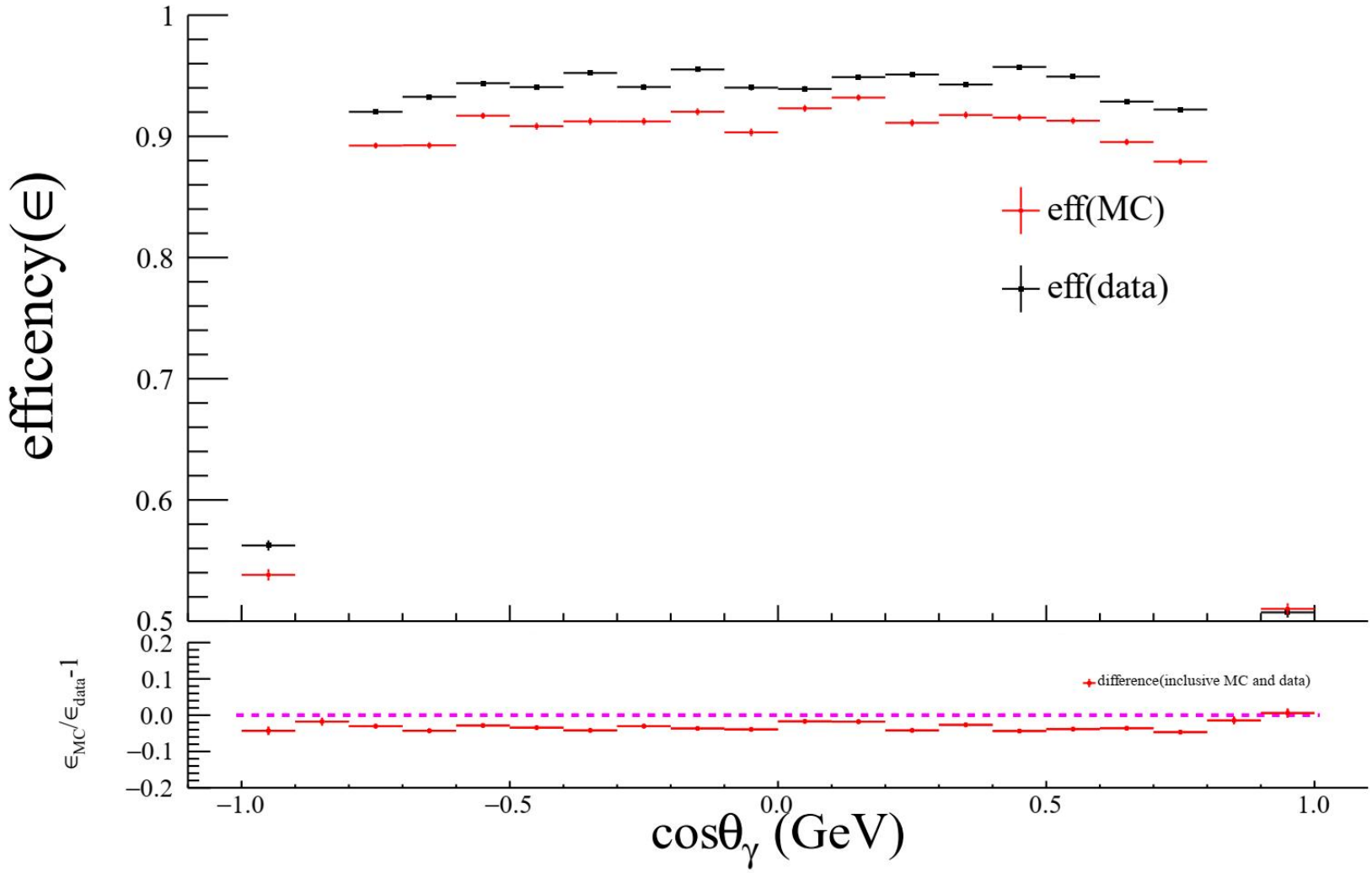




eff_{E_γ}


efficency(∈)
1
0.8
0.6
eff(MC)
eff(data)
0.2
0.1
0.0
−0.1
−0.2
$\epsilon_{MC}/\epsilon_{data}$-1
difference(inclusive MC and data)
0.5
1.0
1.5
2.0
E_γ (GeV)

$eff_{cos\theta_\gamma}$



Selection Result (untagged)

	$\mu^+\mu^-$	$\pi^+\pi^-$	hardrons	e^+e^-	$\tau^+\tau^-$	eeX	data
N_{gen}	9800000	10000000	20000000	257383500	11022800	5431500	
N_{surv}	281014	3551	1012	65	0	6	250700
L_{int}	3194500	3194500	3194500	3194500	3194500	3194500	
sigma	2.7974	1.00	24.08	424.00	3.45	1.70	
scale factor	0.9119	0.32	4.04	4.99	1.00	1.00	1
N_{surv_scale}	**256003**	**1136**	**4089**	**325**	**0**	**6**	**250700**

Selection criteria

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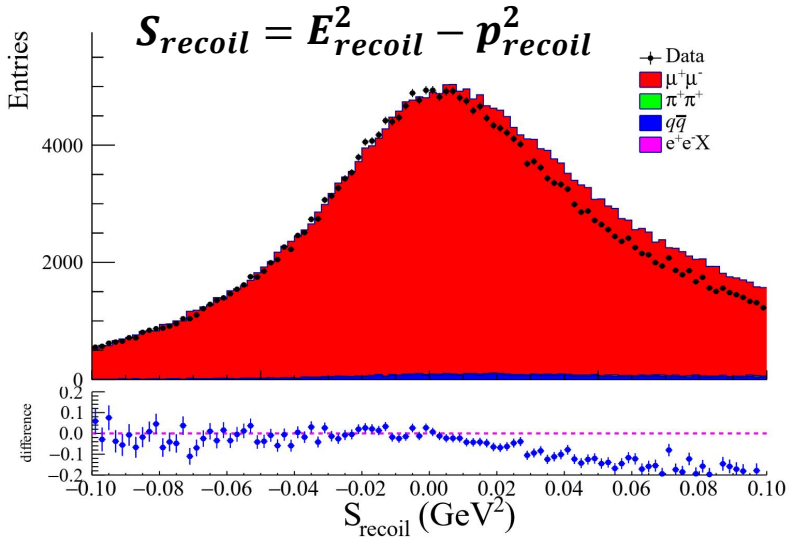
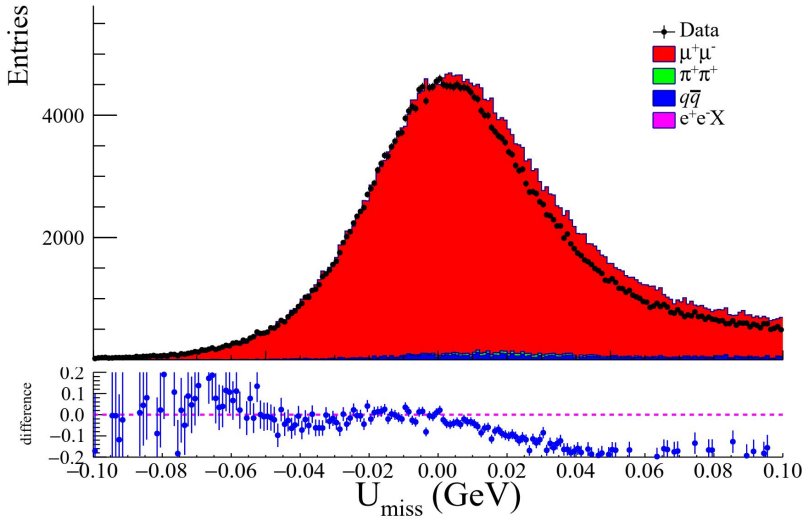
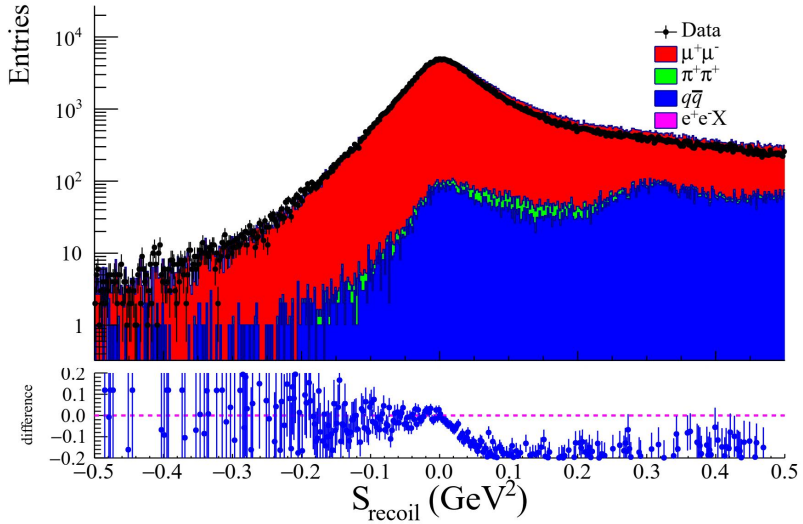
  - The depth of at least one charge track in MUC should be larger than 35 cm.
  - $N_{good} = 2$, $|Q_{total}| = 0$
- Vertex Fit:
  - Successful vertex fit for $\mu^+\mu^-$
- Further Selection:
  - $0.4\text{GeV} < E_{recoil} < 2$ GeV
  - -0.1 GeV $< U_{miss} < 0.1$ GeV, $U_{miss} = E_{recoil} - p_{recoil}$
  - $|cos\theta_{recoil}| < 0.93$

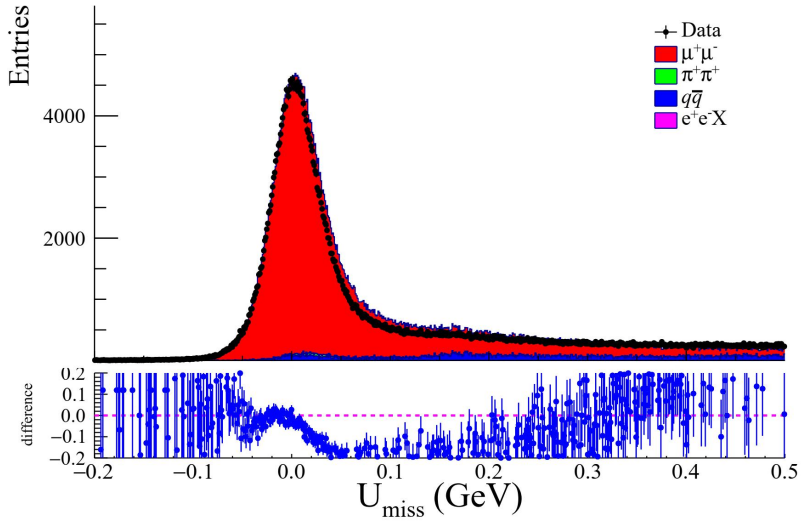
Tag an ISR photon by the same way as ISR KK. Then do another kmfit and require $\chi^2 \leq 50$. Then use the ratio of the events before and after tagging the ISR photon to get the photon efficiency.

S_{recoil} and U_{miss}

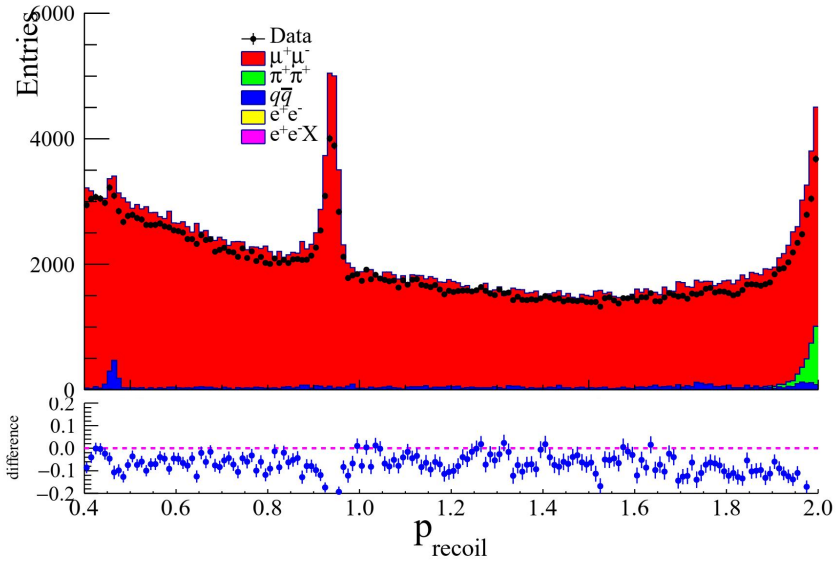


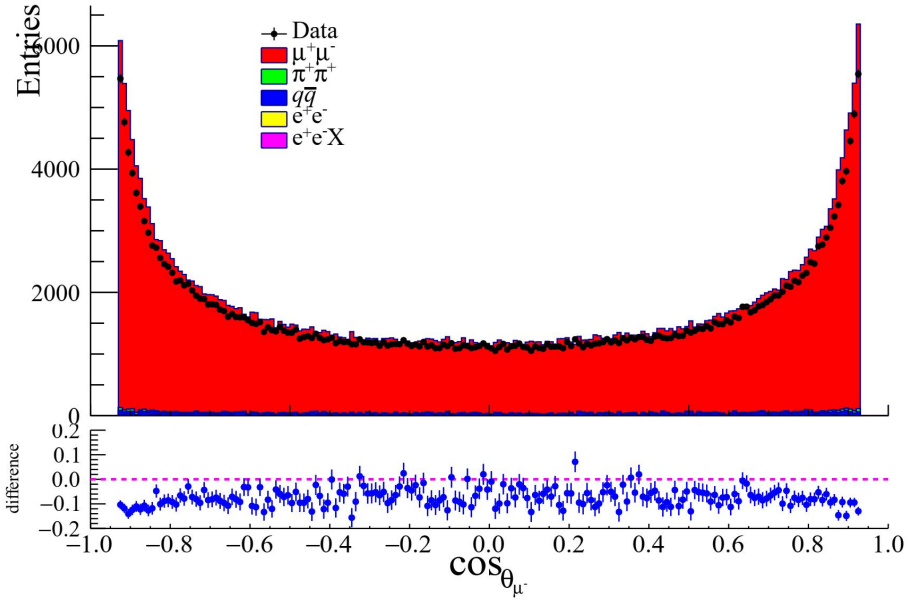


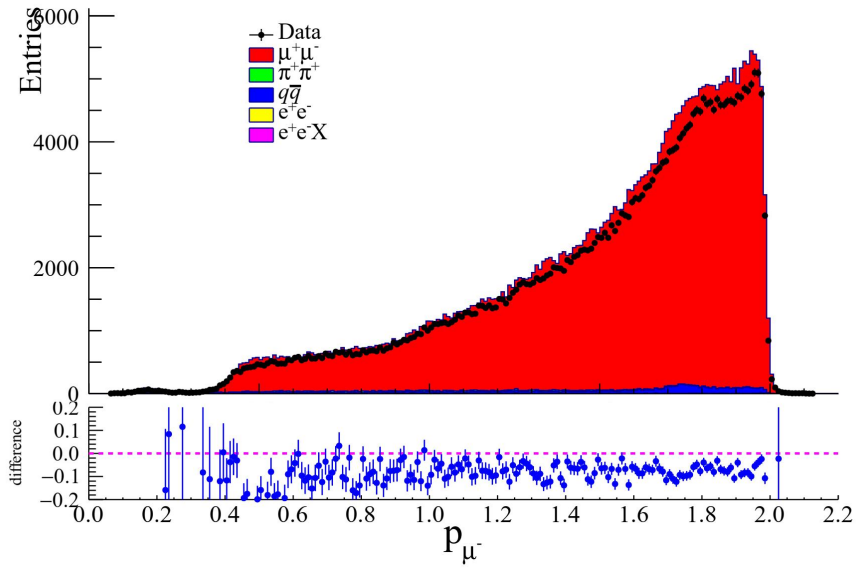


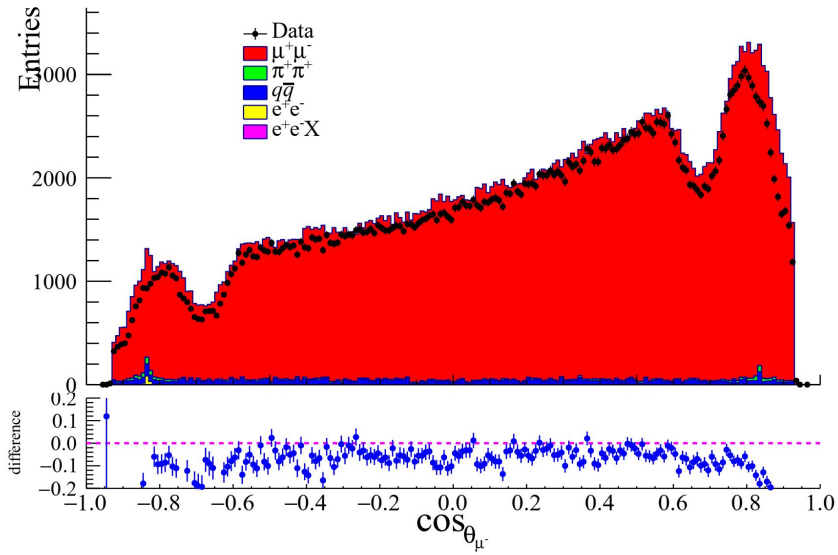


Other distributions

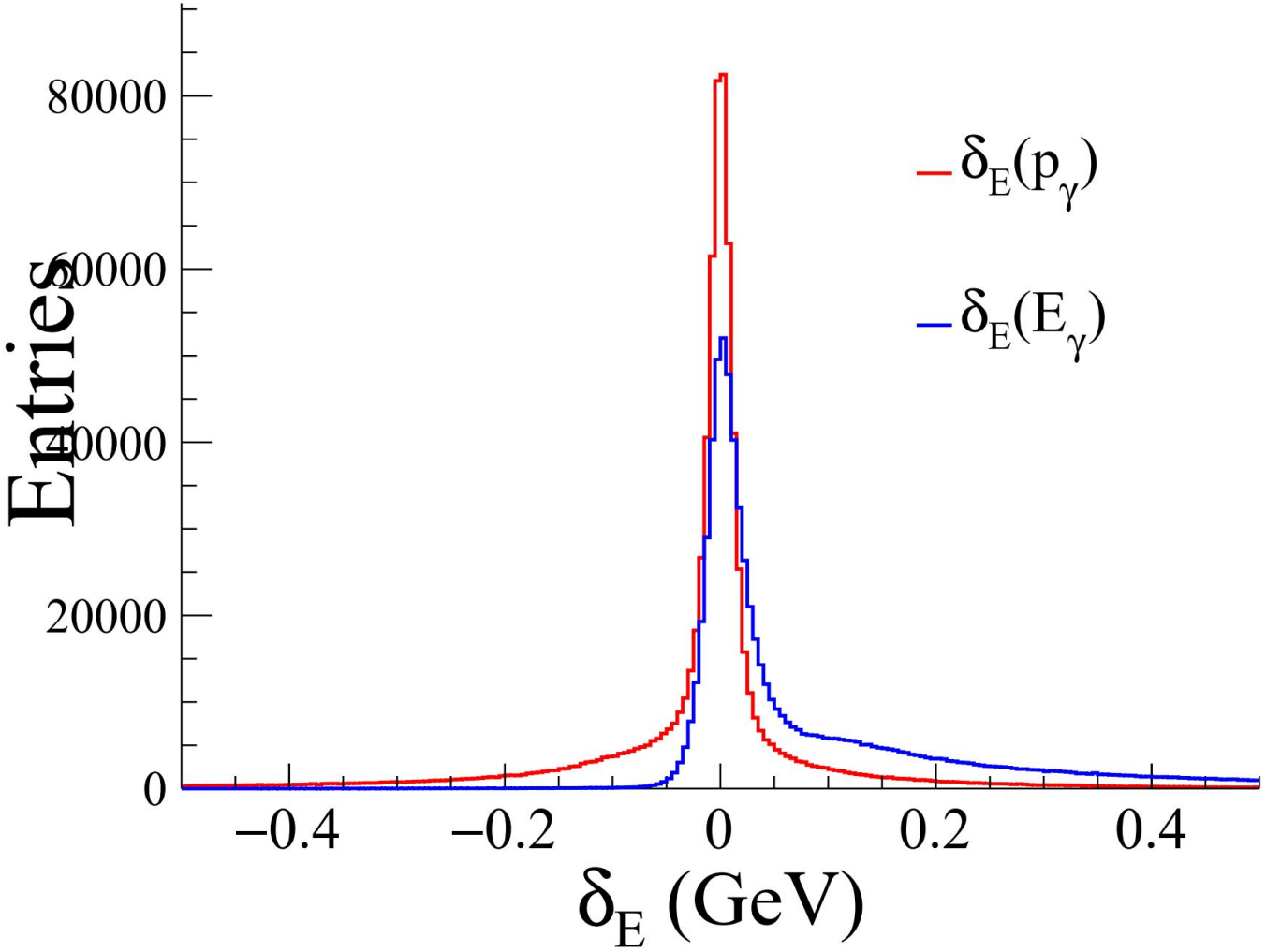






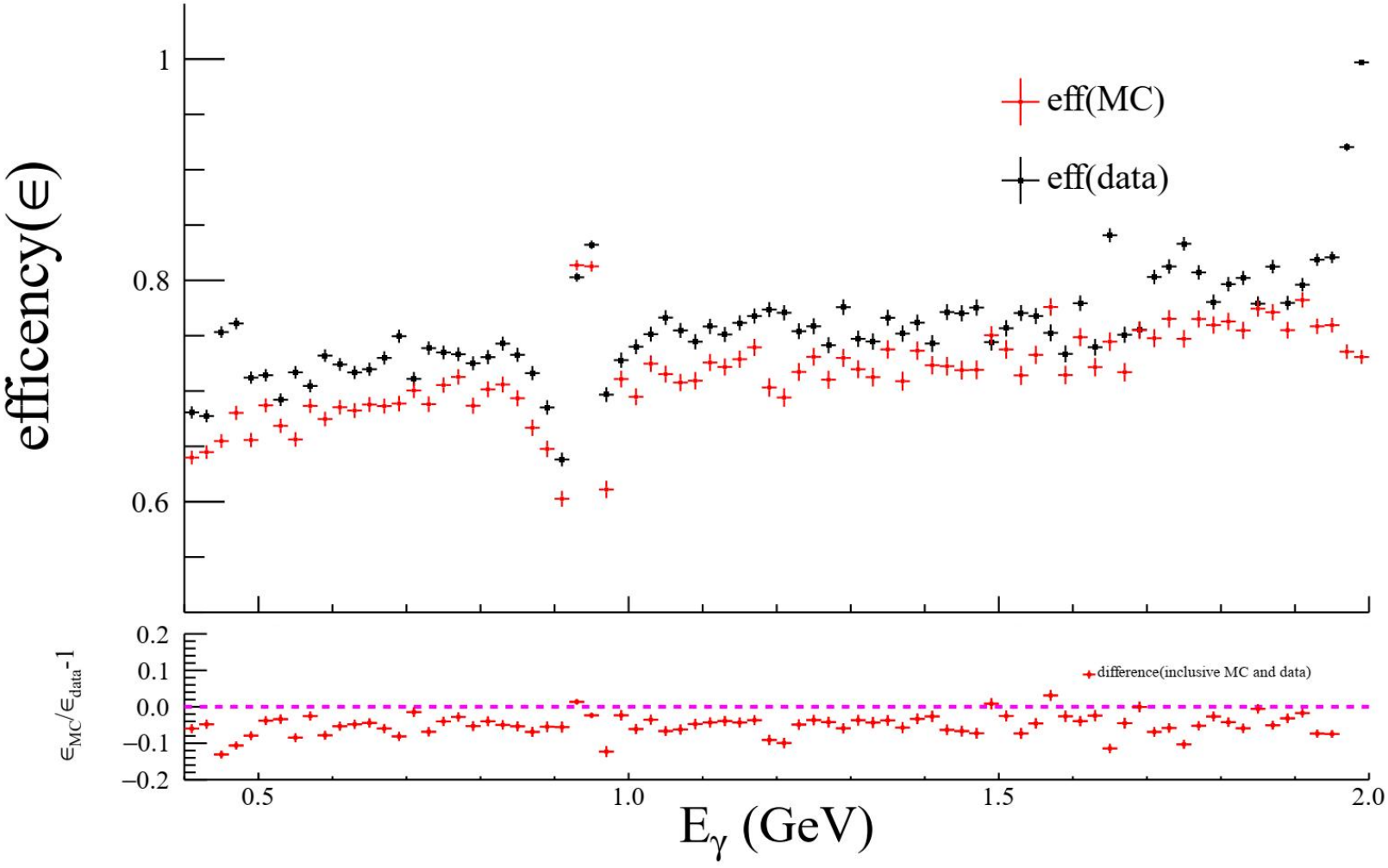


Choos the "true" E_γ

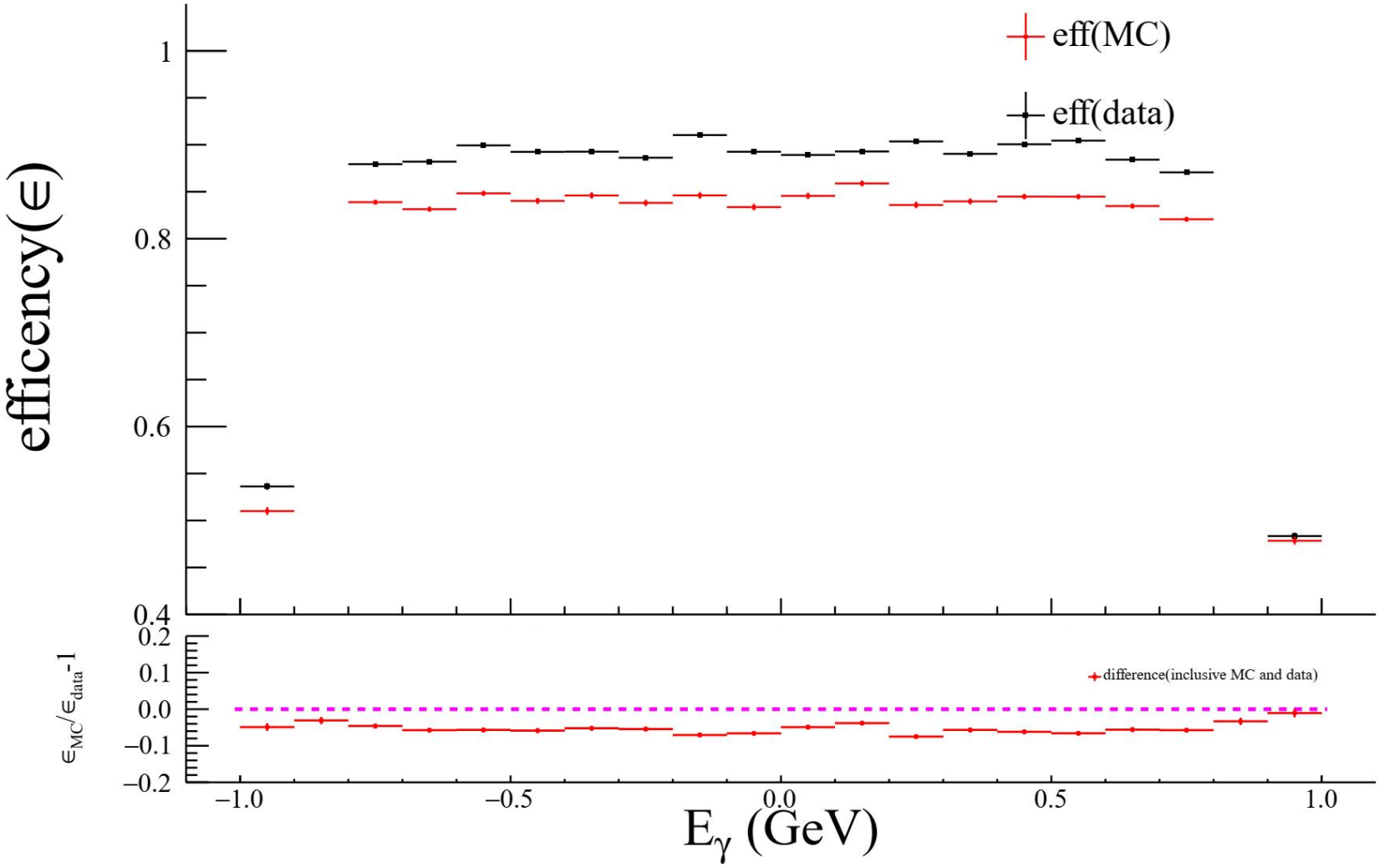


Use the recoiled momentum as the real energy of ISR photon

eff_{E_γ}


efficency(∈)
1
0.8
0.6
eff(MC)
eff(data)
$\epsilon_{MC}/\epsilon_{data}$-1
0.2
0.1
0.0
−0.1
−0.2
difference(inclusive MC and data)
0.5
1.0
1.5
2.0
E_γ (GeV)

$eff_{cos\theta_\gamma}$



```
2575230
Original events          :  2575230
After EP ratio cut       :  2432330
After PE ratio cut       :  971643
After muon distance      :  780201
After umiss              :  520872
1062171
After taggam
Original events          :  1062171
After EP ratio cut       :  1004153
After PE ratio cut       :  525995
After muon distance      :  435253
After umiss              :  414168
After kmfit              :  368358
```

```
815308575
Original events          :  815308575
After EP ratio cut       :  35401073
After PE ratio cut       :  12502849
After muon distance      :  1747885
After umiss              :  433511
20333844
After taggam
Original events          :  20333844
After EP ratio cut       :  1110942
After PE ratio cut       :  601804
After muon distance      :  366870
After umiss              :  351137
After kmfit              :  317776
```

Selection Result (untagged)

	$\mu^+\mu^-$	$\pi^+\pi^-$	hardrons	e^+e^-	$\tau^+\tau^-$	eeX	data
N_{gen}	10000000	10000000	20000000	257383500	11022800	5431500	
N_{surv}	368211	8989	1699	37	0	0	312317
L_{int}	3194500	3194500	3194500	3194500	3194500	3194500	
sigma	2.7974	1.00	24.08	424.00	3.45	1.70	
scale factor	0.8936	0.32	4.04	4.99	1.00	1.00	1
N_{surv_scale}	**329033**	**2876**	**6863**	**185**	**0**	**0**	**312317**