DATA JULY 2020

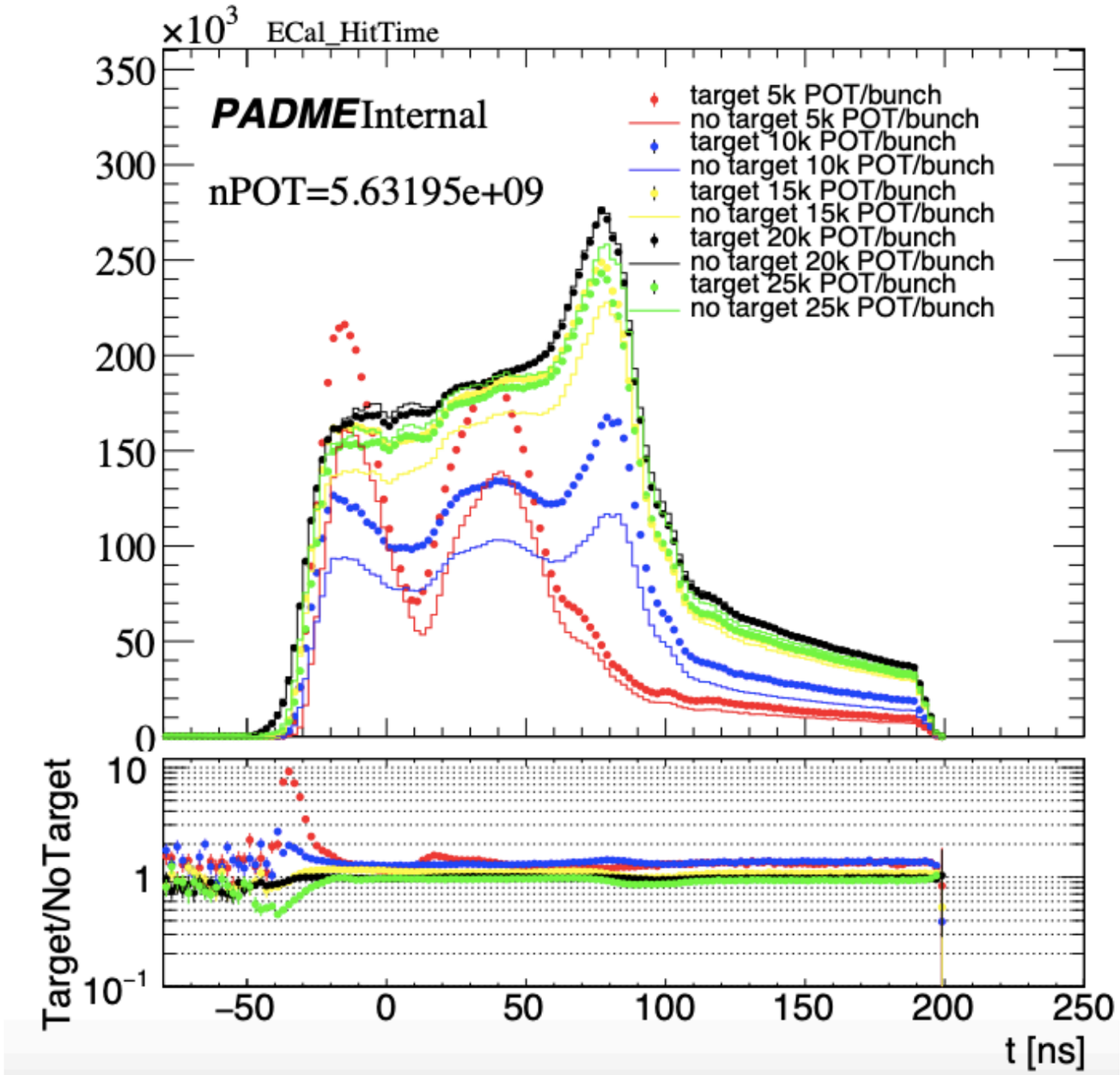
I.Oceano

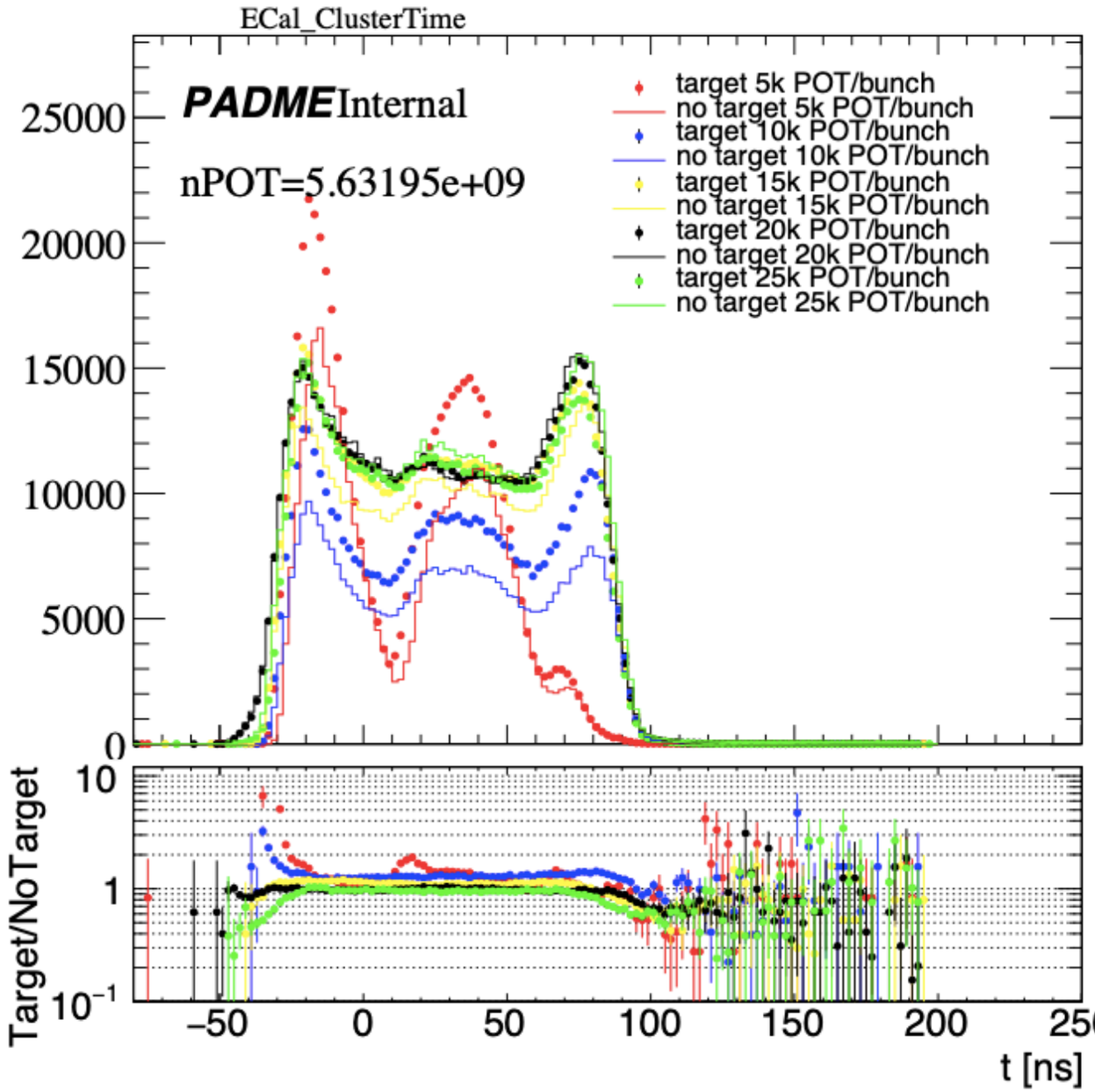
SCAN MULTIPLICITY : RUN NUMBER

	RUN	DATE	NPOT(BTF TRIGGER)	NO TARGET RUN	DATE NO TARGET
5K	30211	2020-07-22 19:18:22	3.56518e+09	30220	2020-07-23 05:49:20
10K	30205	2020-07-22 08:16:40	3.36962e+09	30207	2020-07-22 11:58:00
15K	30201	2020-07-21 22:43:35	5.63313e+09	30202	2020-07-22 01:02:24
20K	30203	2020-07-22 03:17:23	7.74356e+09	30204	2020-07-22 05:40:45
25K	30209	2020-07-22 14:36:34	6.0939e+09	30210	2020-07-22 17:36:55

RUNS FEATURES

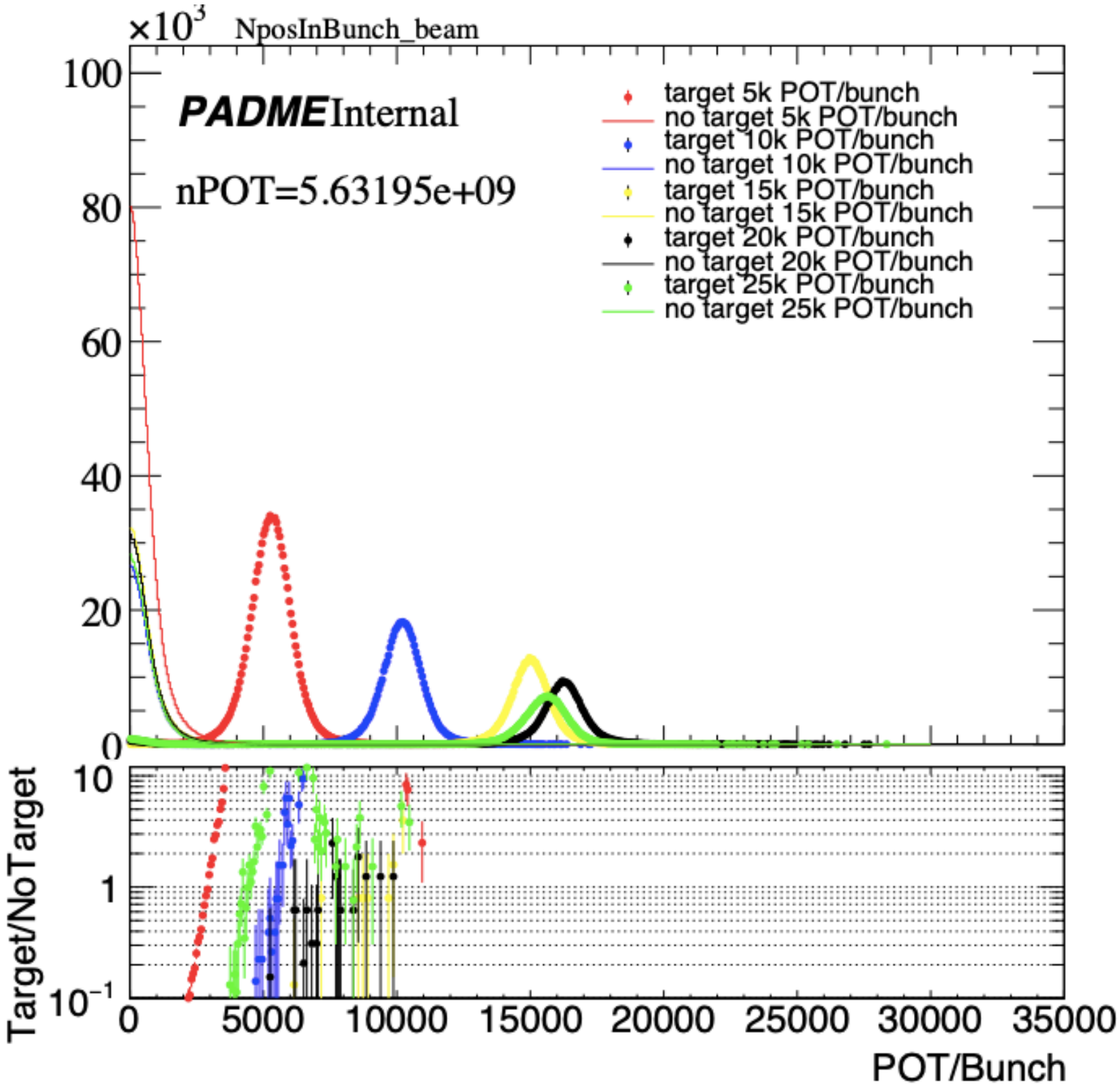
- Bunch length ~150 ns





nPOT/BUNCH

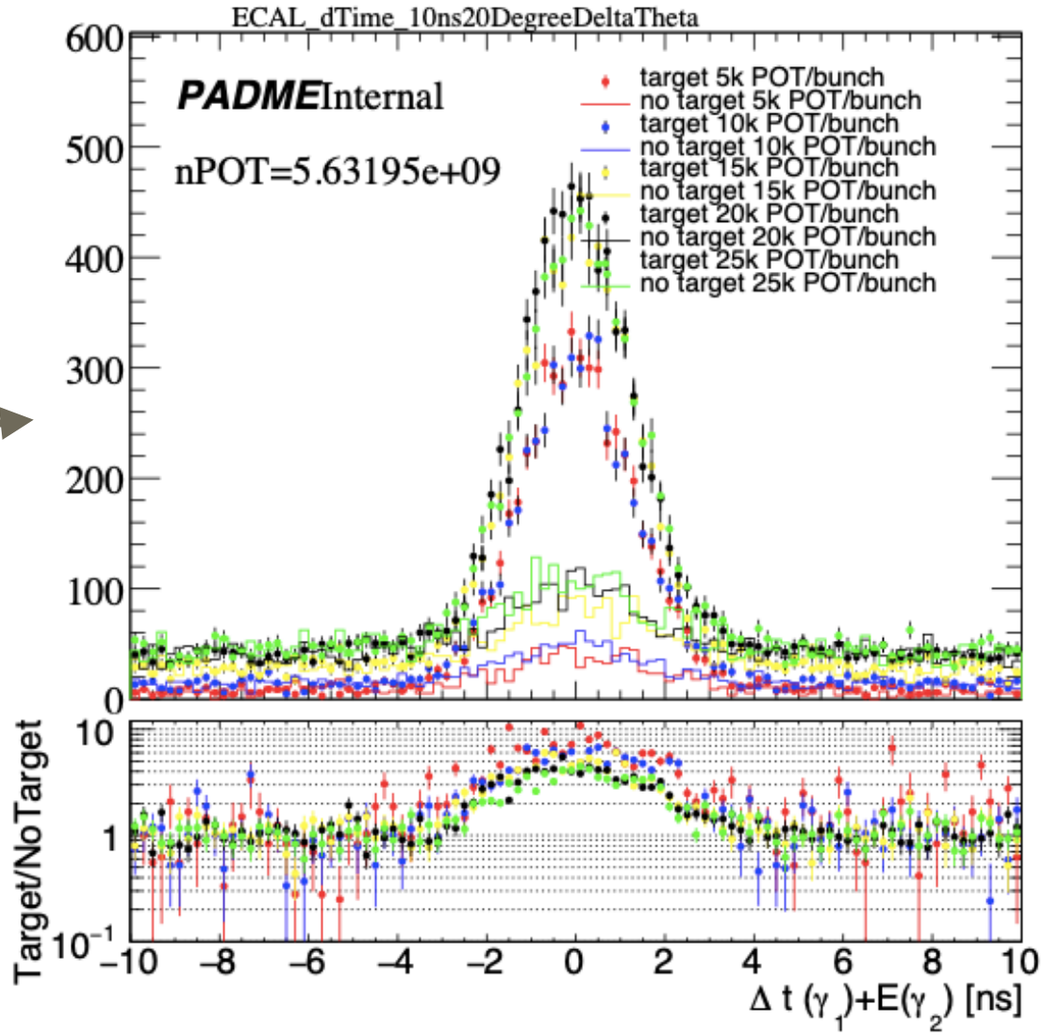
- 30211 (5k POT/bunch)
- 30205 (10k POT/bunch)
- 30201 (15k POT/bunch)
- 30203 (20k POT/bunch)
- 30209 (25k POT/bunch)



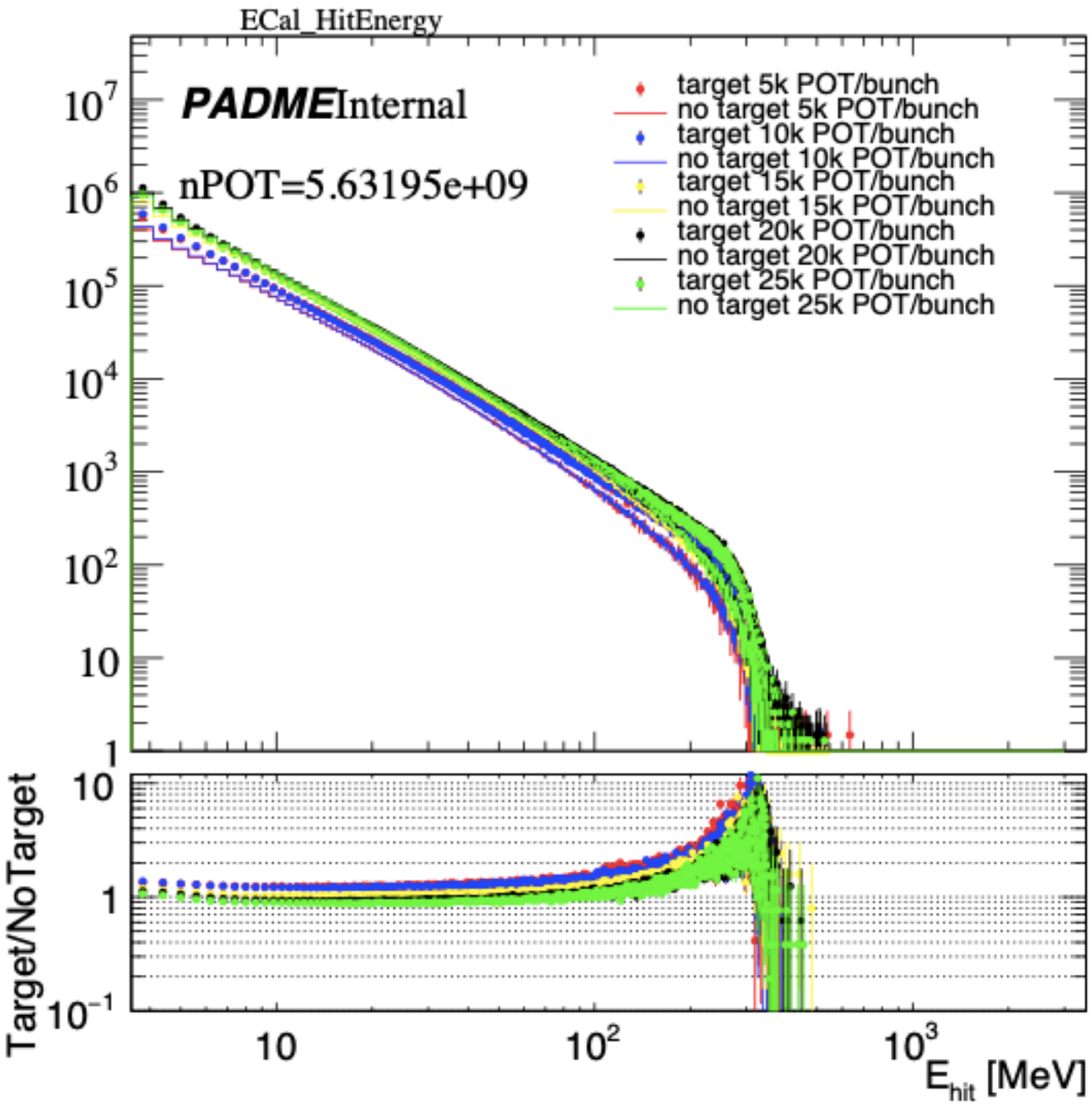
NORMALISATION

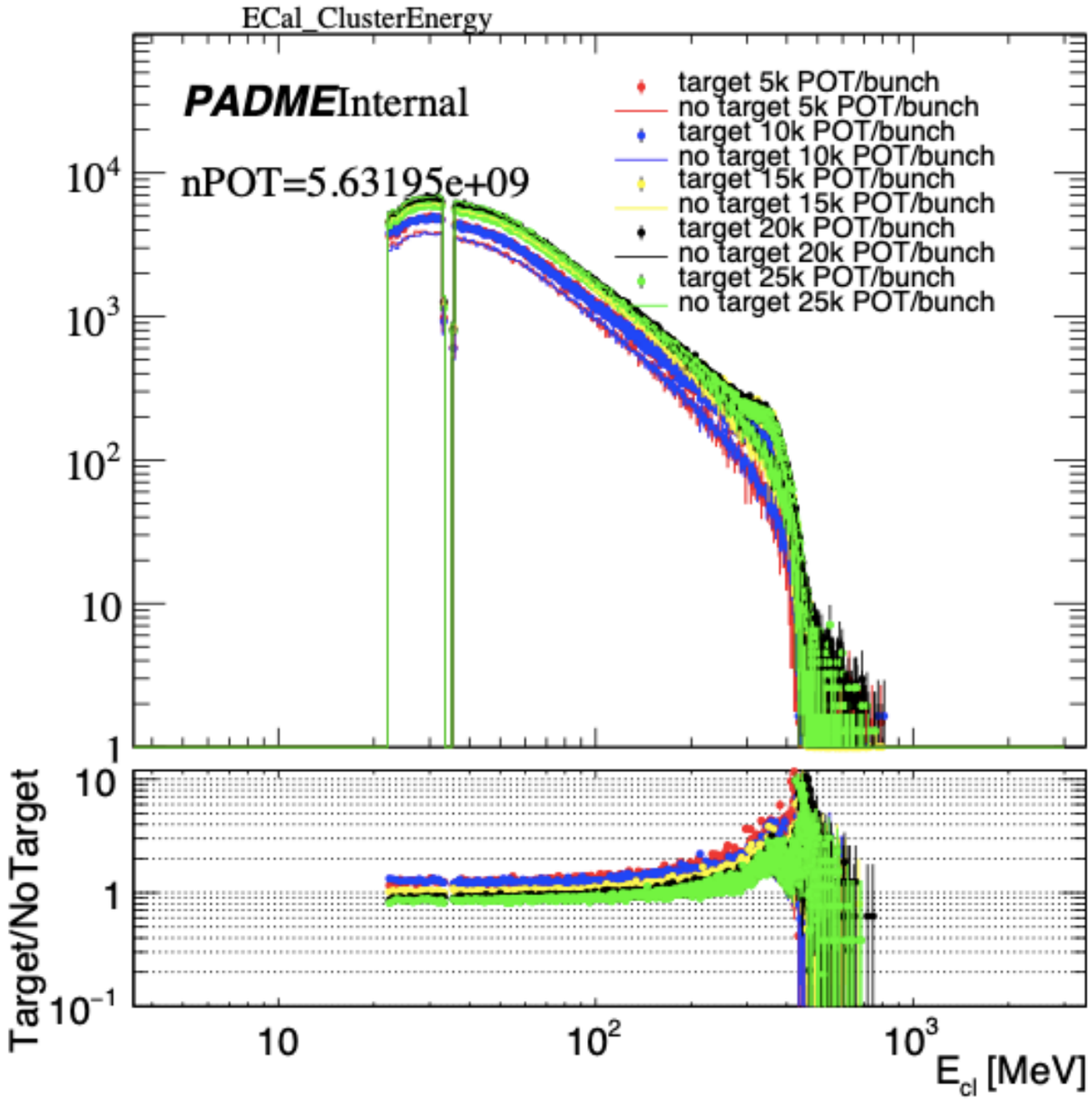
- For TARGET IN runs
  - Normalised at the number of total POT of the 30201 run (chosen because we have a good target response)- 5.6×10^9 POT
  - For the runs with 20k and 25k POT/bunch
    - I extrapolate the scale factor to shift the pick at 20(25)k and multiplicate the total nPOT for this scale factor

- For TARGET OUT runs
  - Take the delta time distribution between the two photon if
    - Delta time < 10 ns
    - Delta phi < 20°
    - Delta theta cut
  - Calculate the integral in range R[-10,-6]
  - The scale factor S is the factor
    - $Int_R^{target_{in}} = S \times Int_R^{target_{out}}$

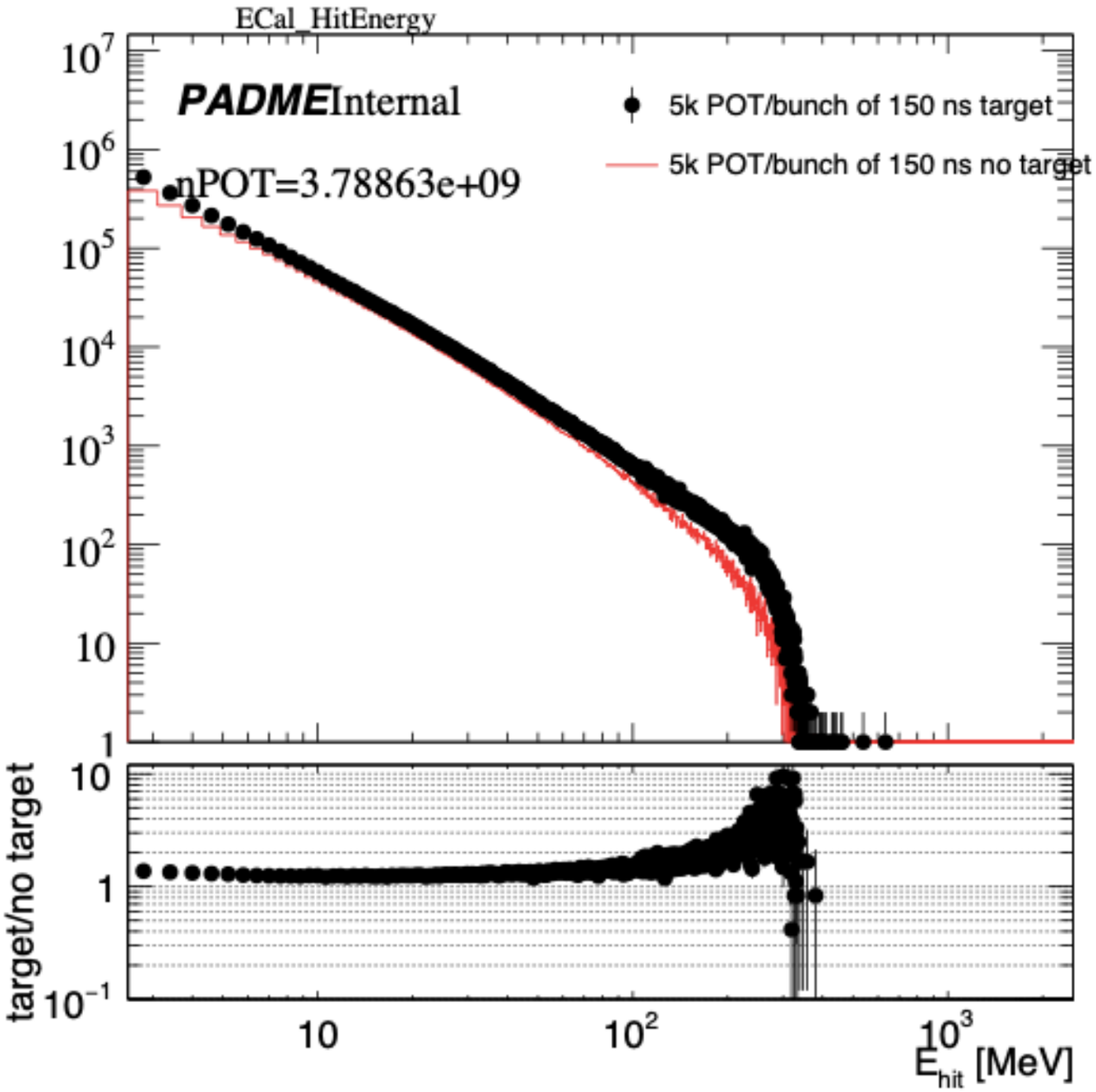


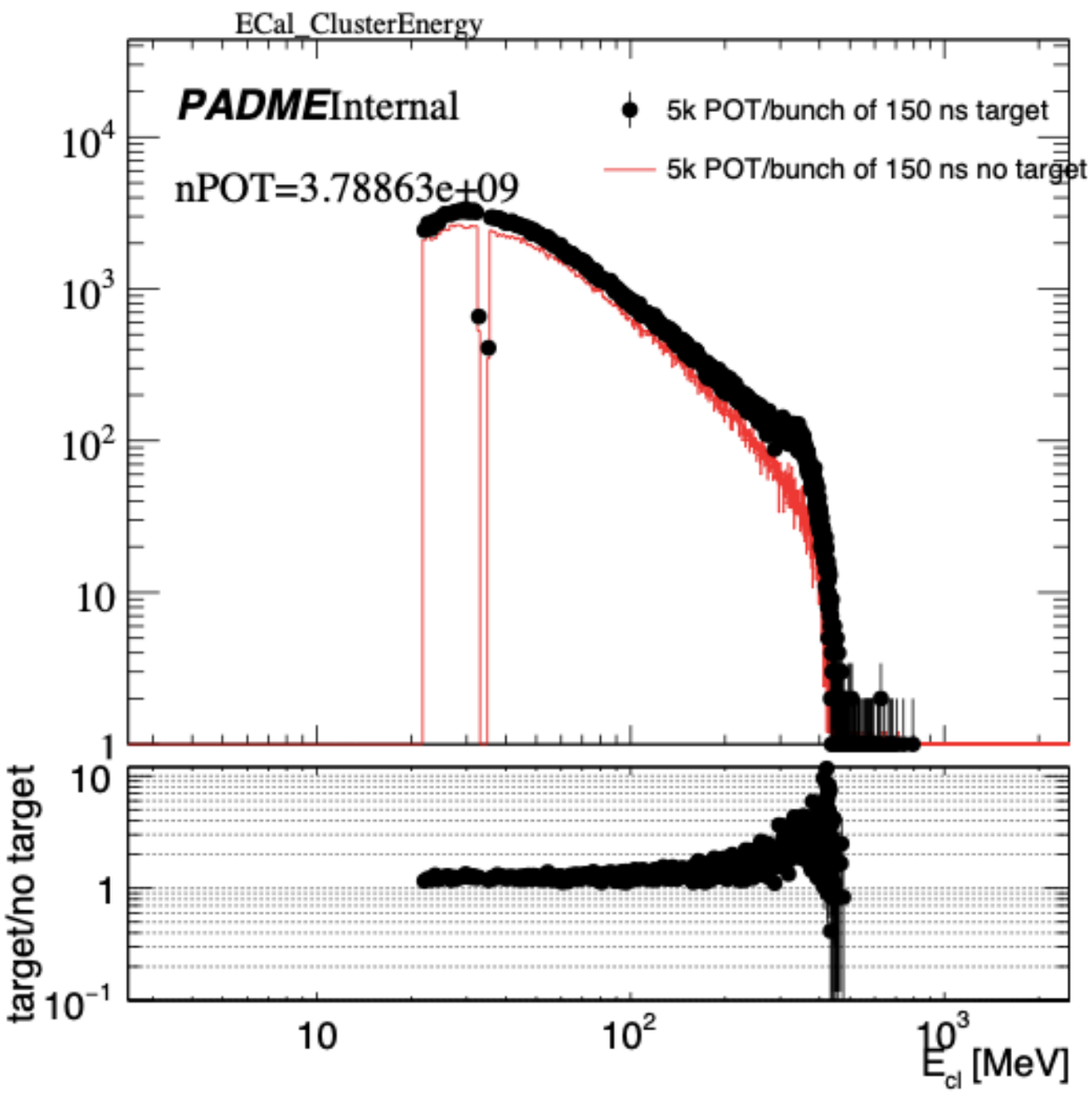
ENERGY DISTRIBUTION



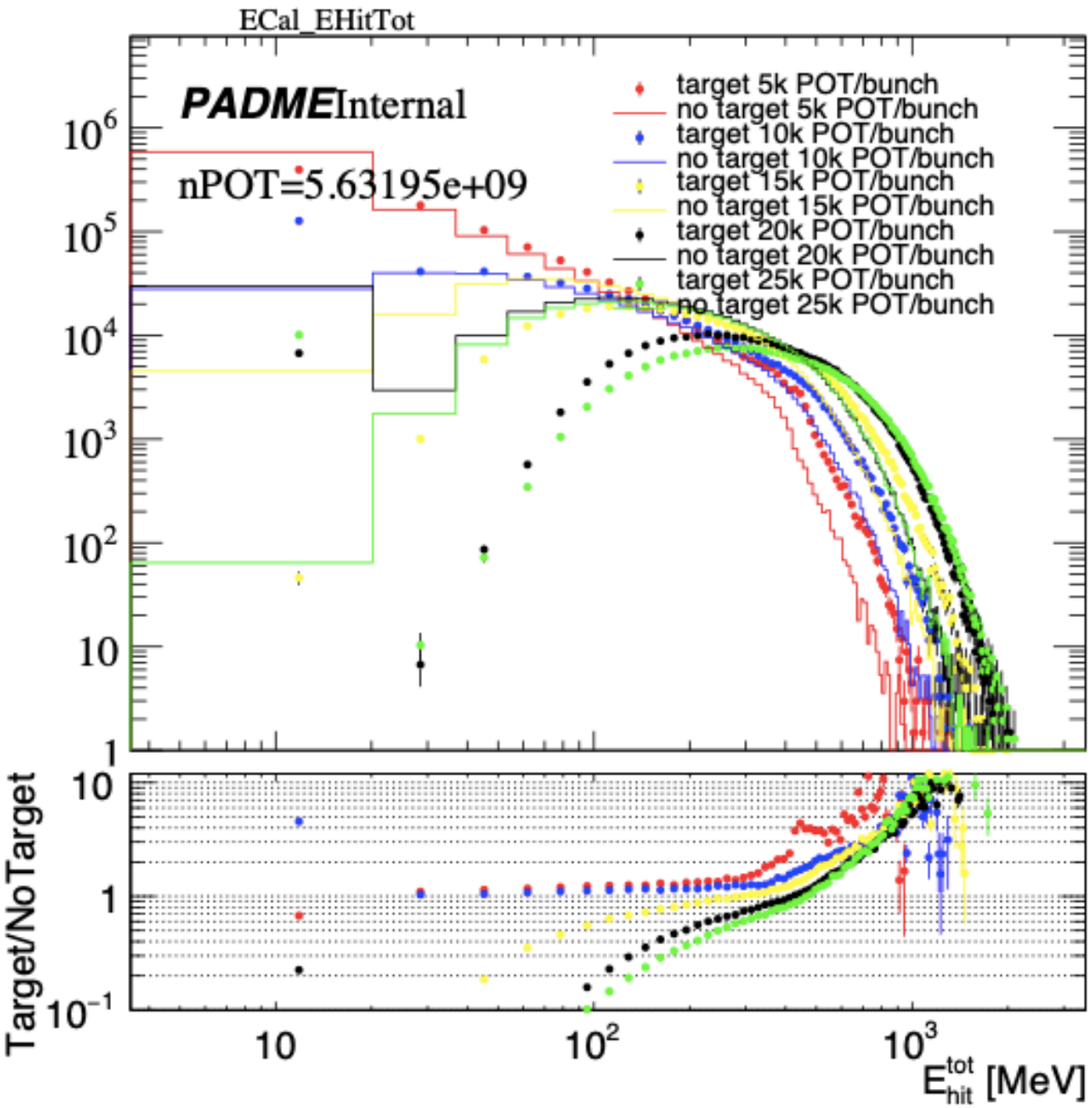


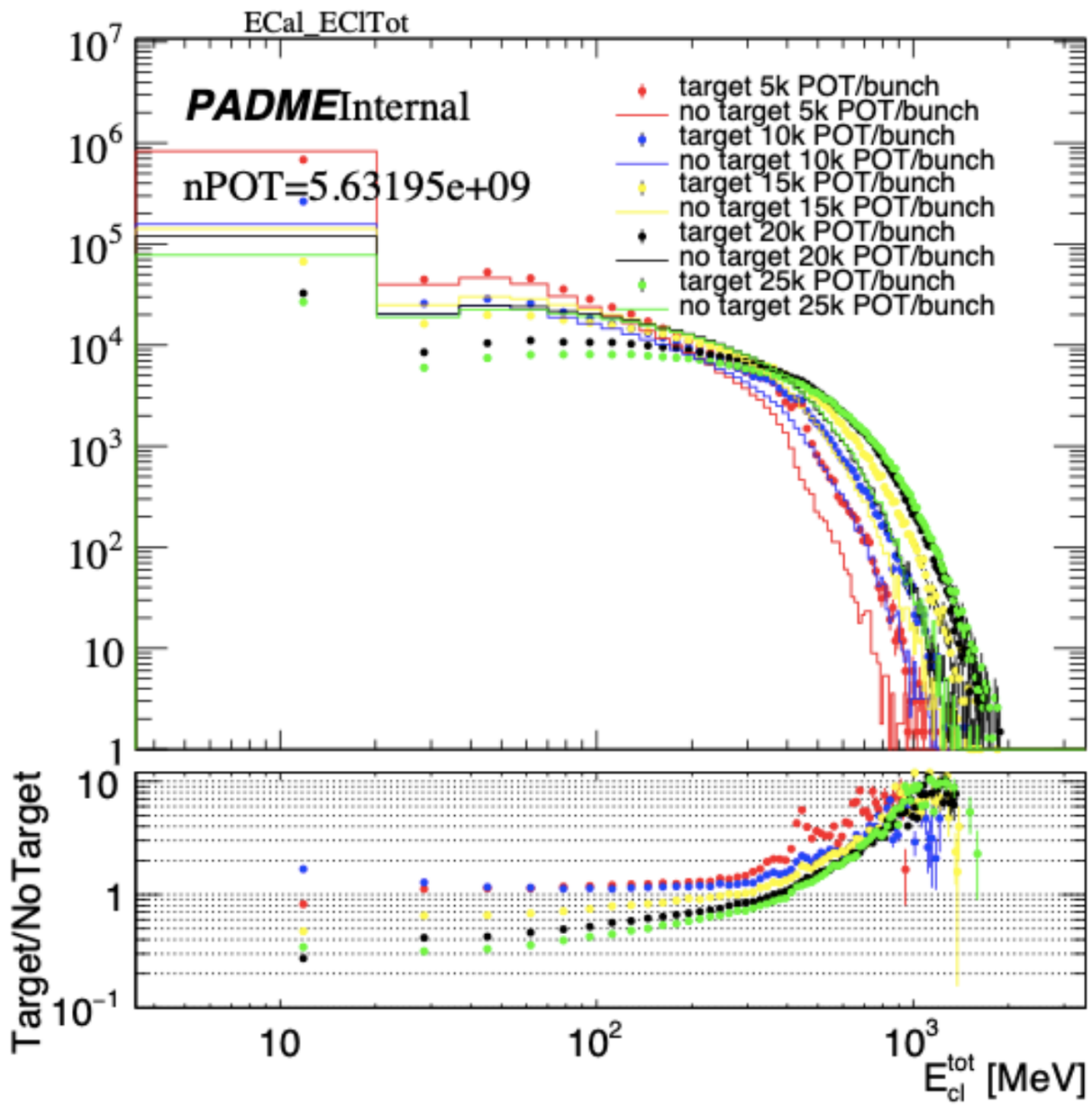
ENERGY DISTRIBUTION (5K POT/BUNCH)



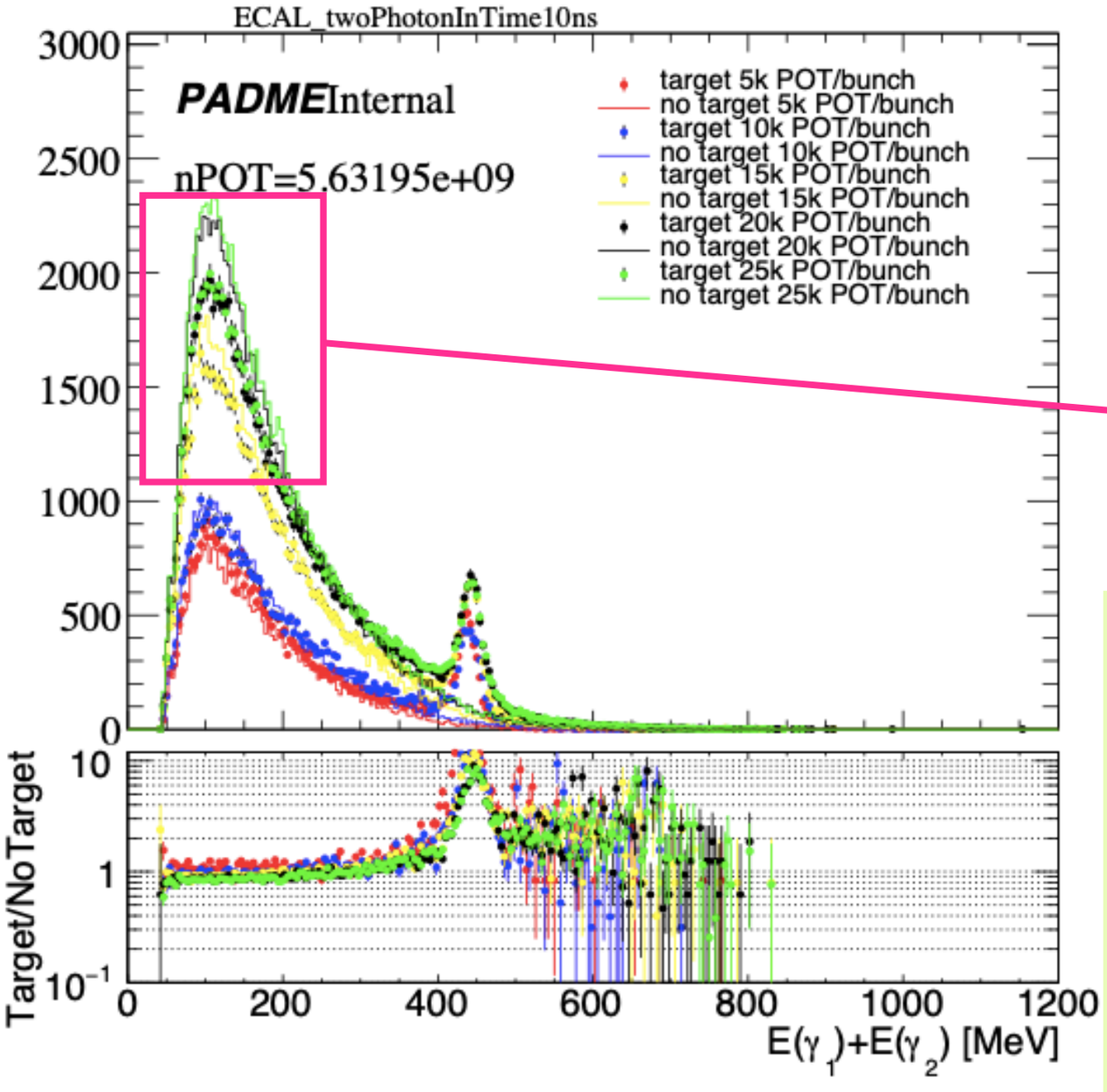


TOTAL ENERGY DISTRIBUTION





GG YIELD



$\Delta t < 10.$ ns $\quad R_\gamma \in FR$

Background higher in no target run

ggYield from subtraction target-noTarget in [300,700]MeV

5k: 5164

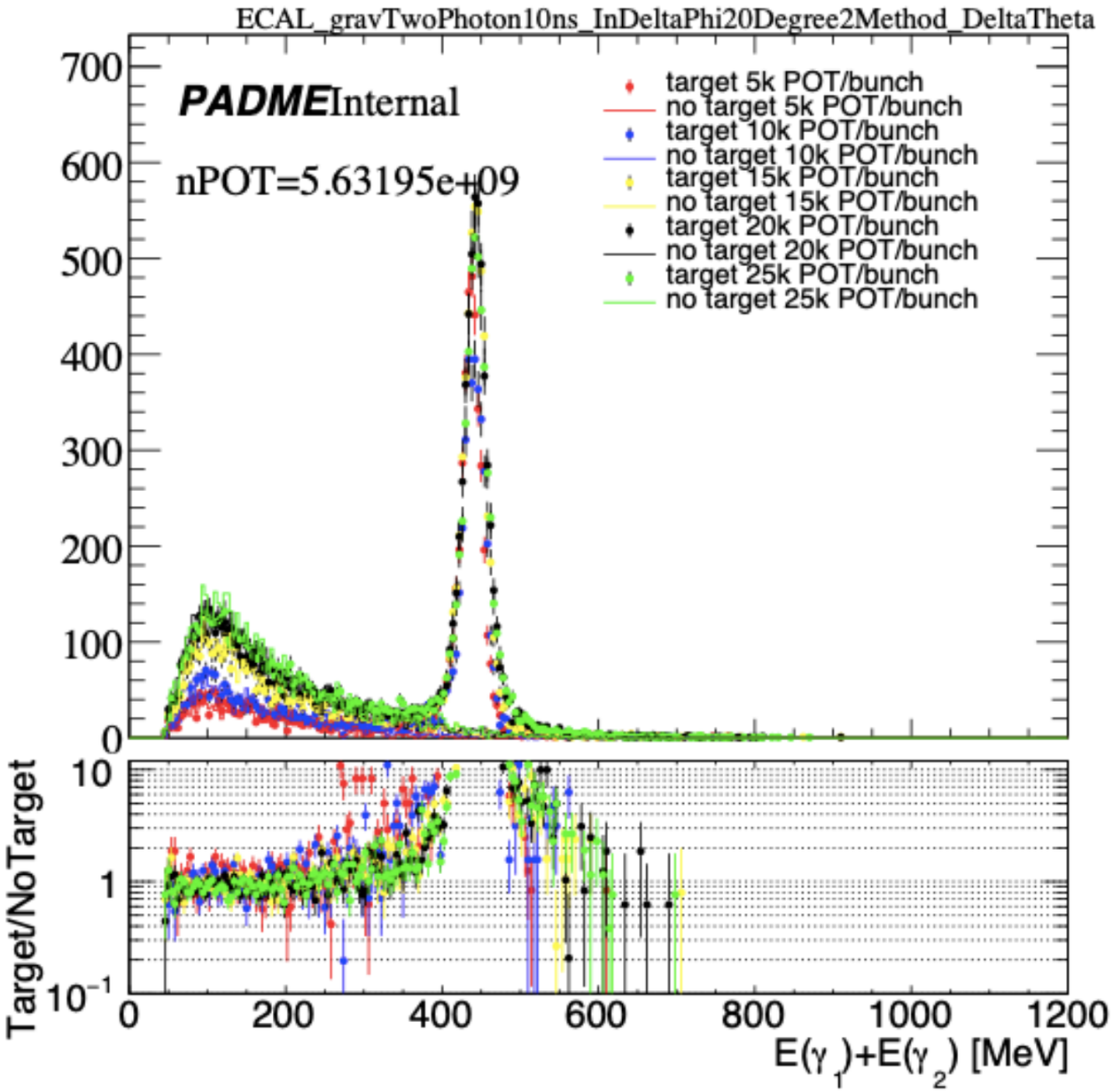
10k: 4851

15k: 7507

20k: 7676

25k: 8013

GG YIELD ANGULAR CUT



$\Delta t < 10.$ ns $\quad R_\gamma \in FR$

$\Delta\phi < 20^o$

$0.08 < \Delta\theta < 0.12$

ggYield from subtraction target-noTarget in [300,700]MeV

5k: 4138

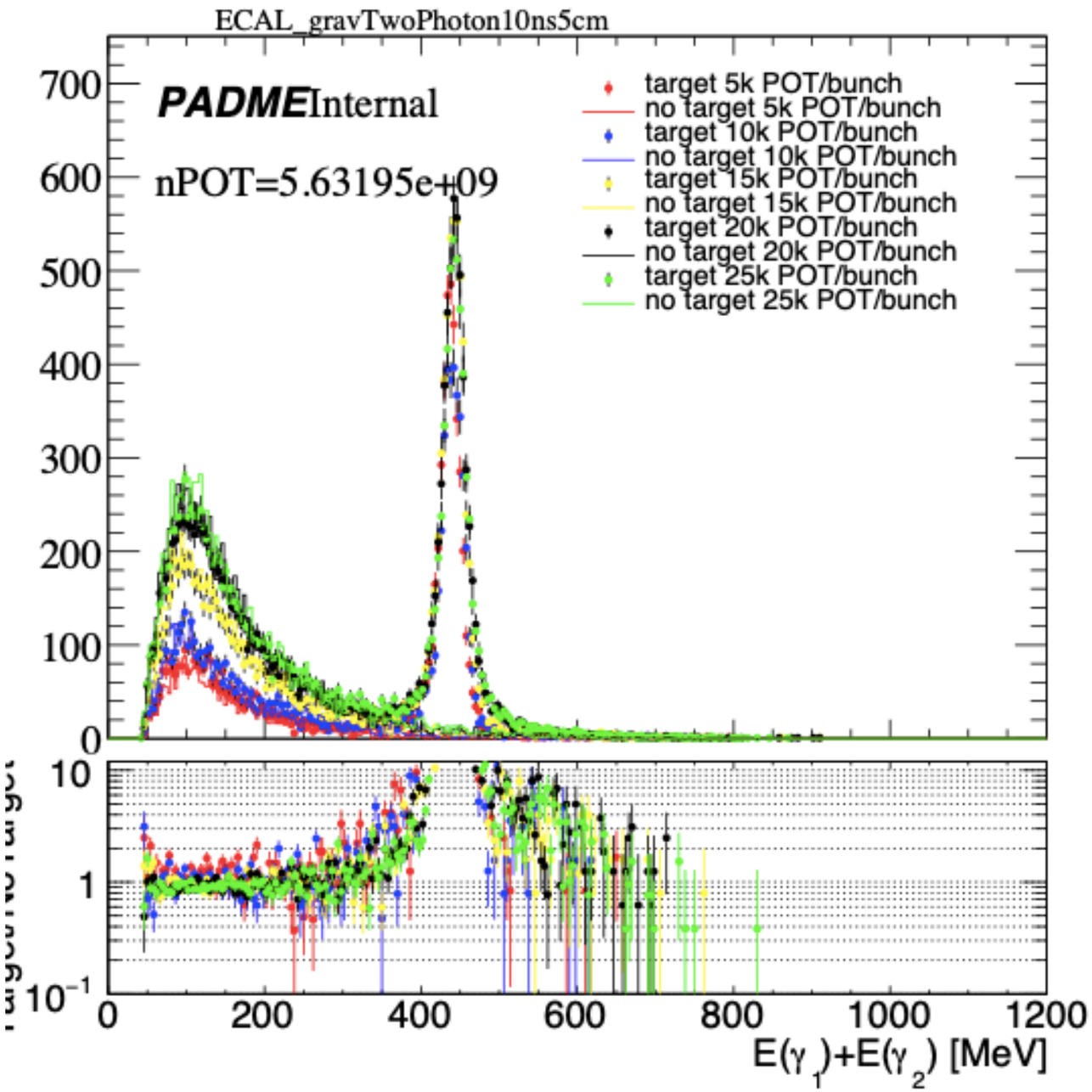
10k: 3903

15k: 5376

20k: 5620

25k: 5313

GG YIELD COG



$\Delta t < 10.$ ns $\quad R_\gamma \in FR$

$CoG < 5$ cm

ggYield from subtraction target-noTarget in [300,700]MeV

5k: 4212

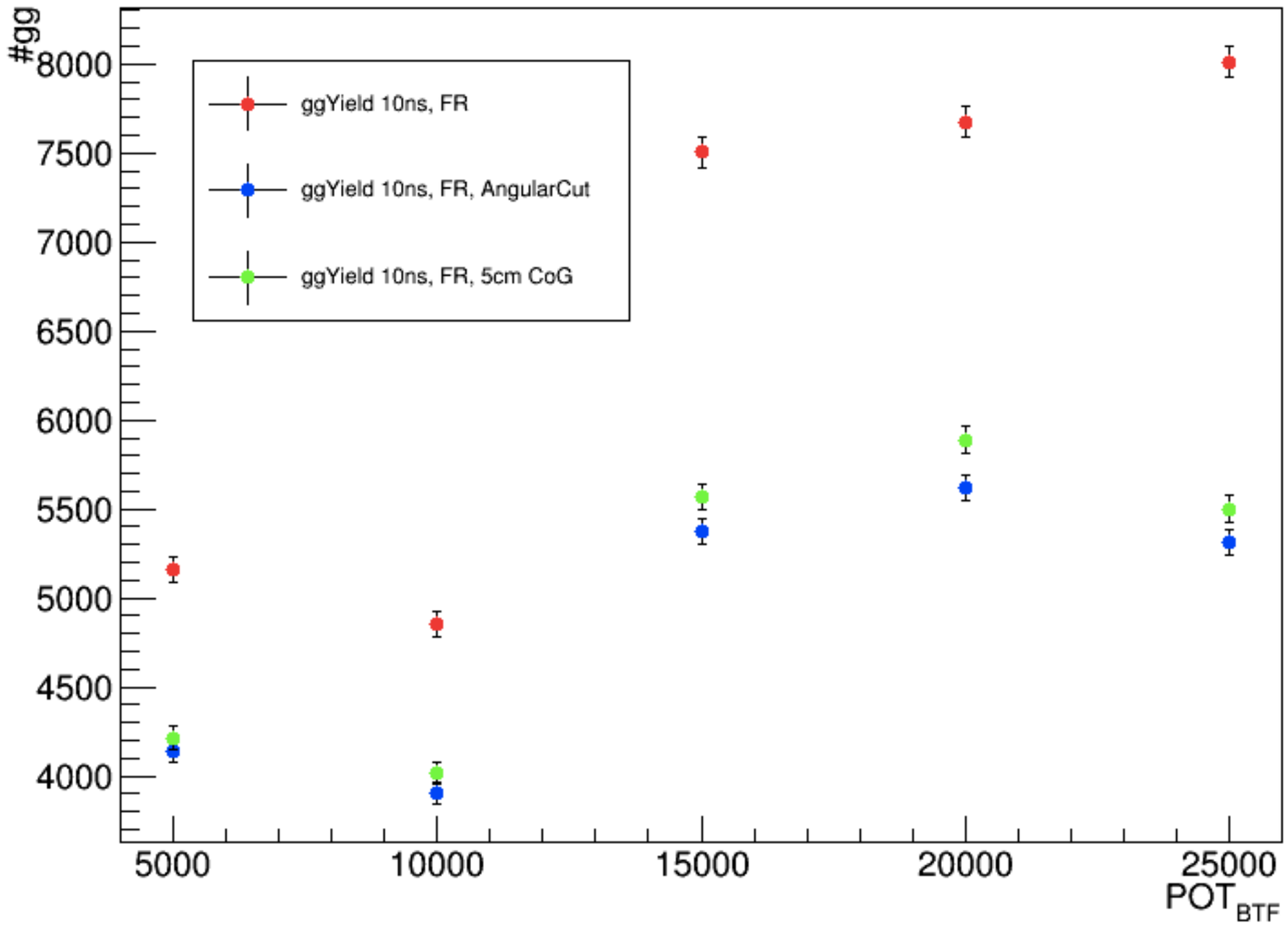
10k: 4015

15k: 5568

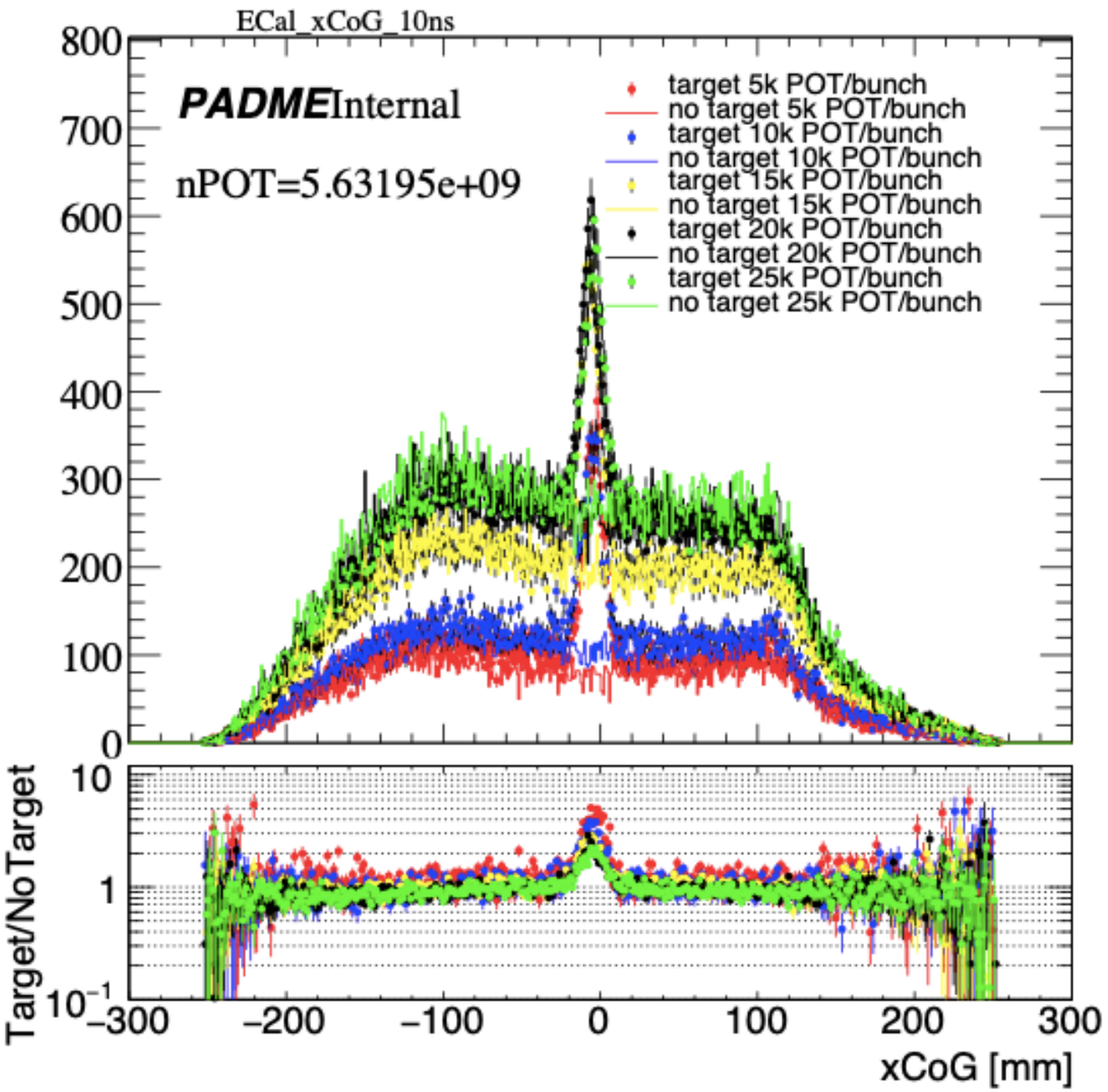
20k: 5886

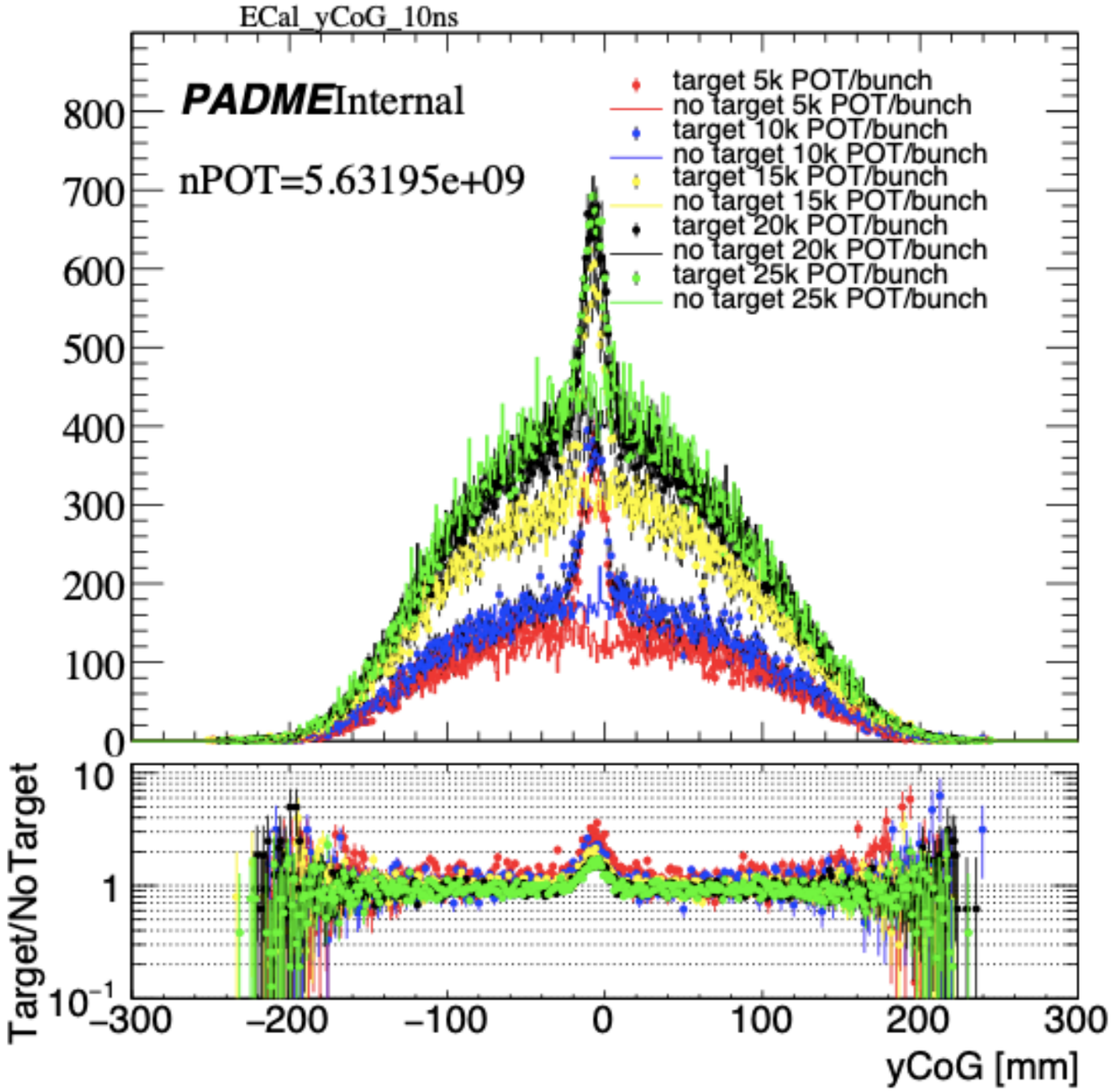
25k: 5500

ANNIHILATION YIELD

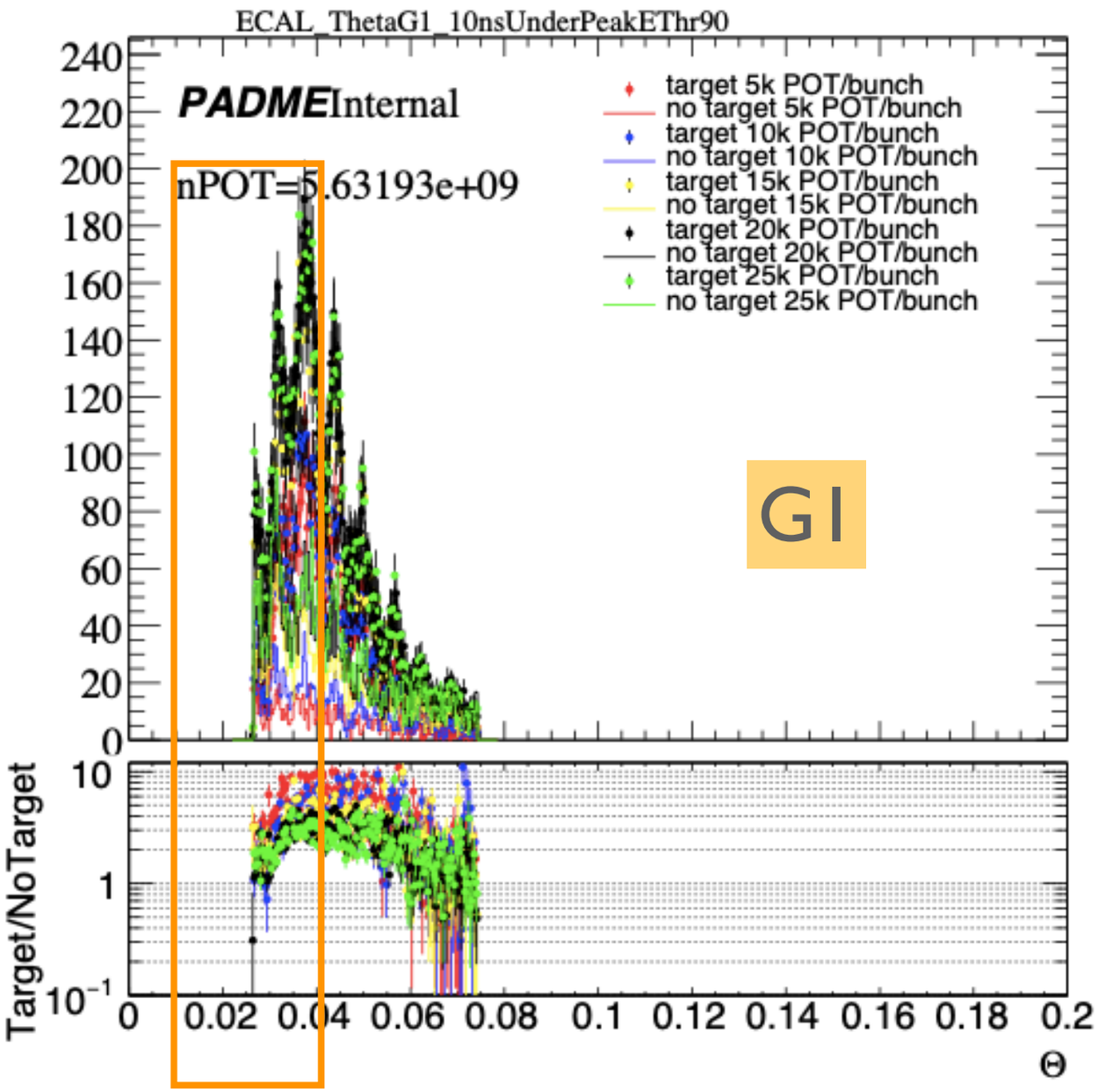


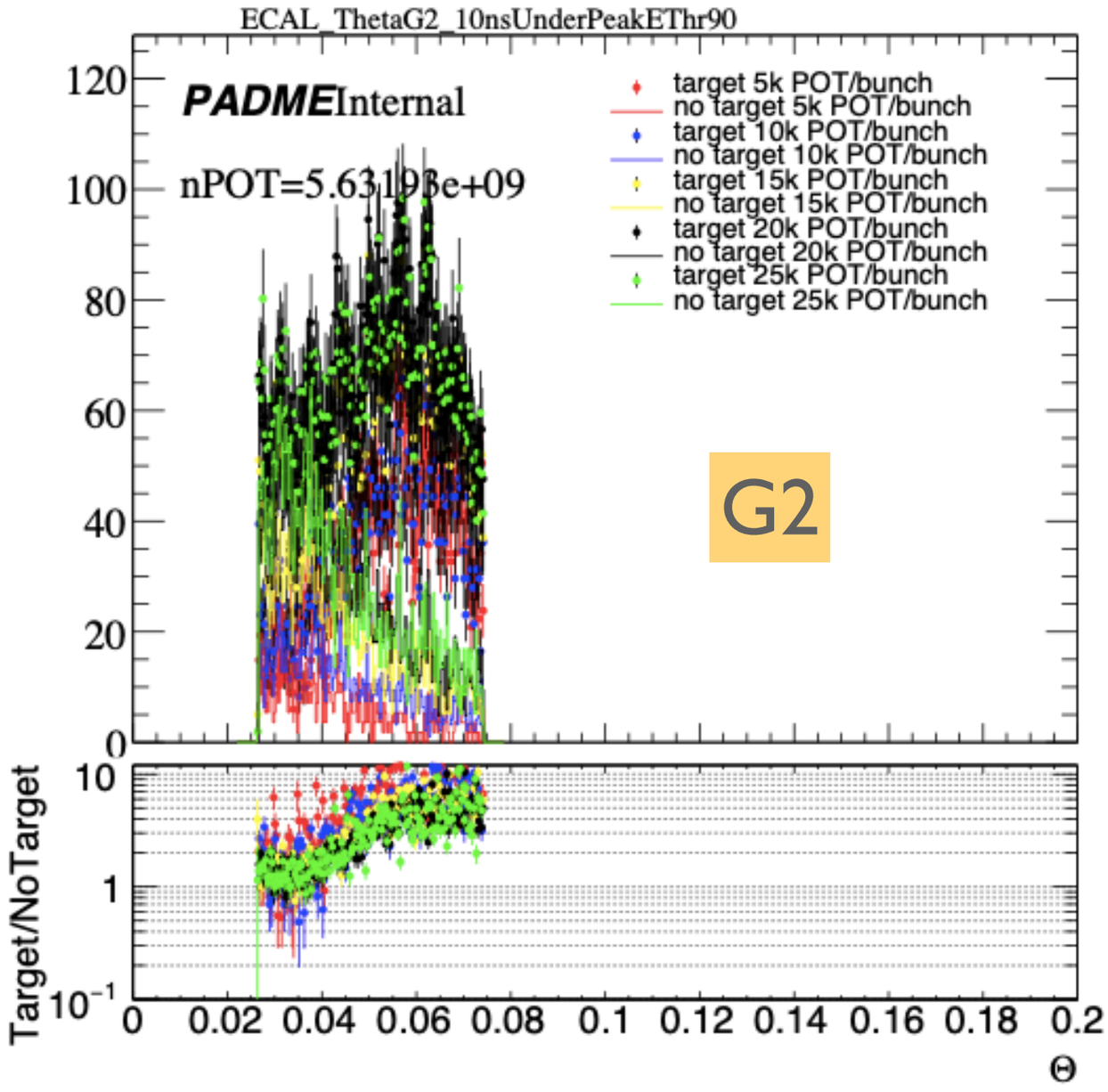
CoG DISTRIBUTIONS





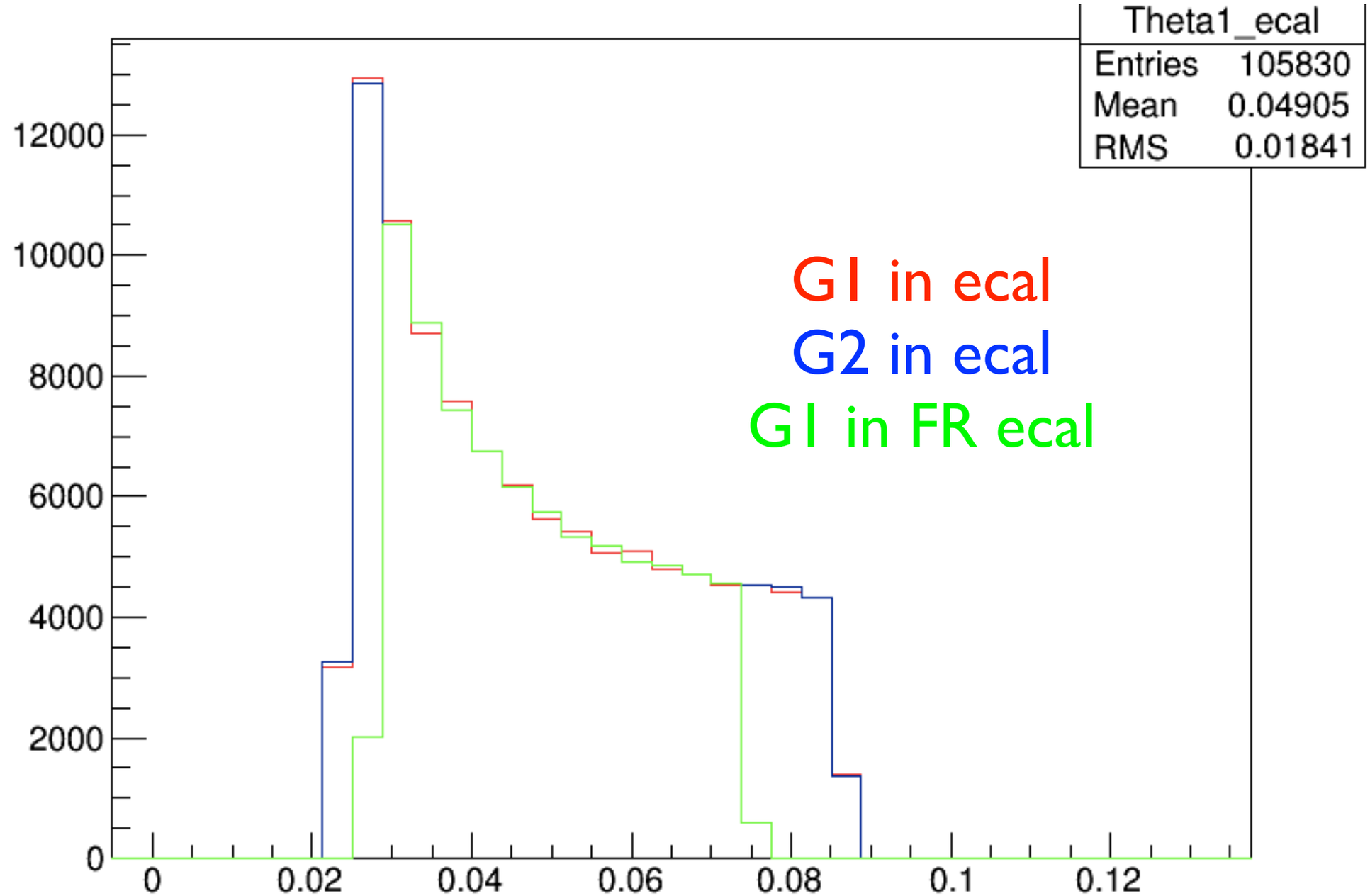
THETA DISTRIBUTION



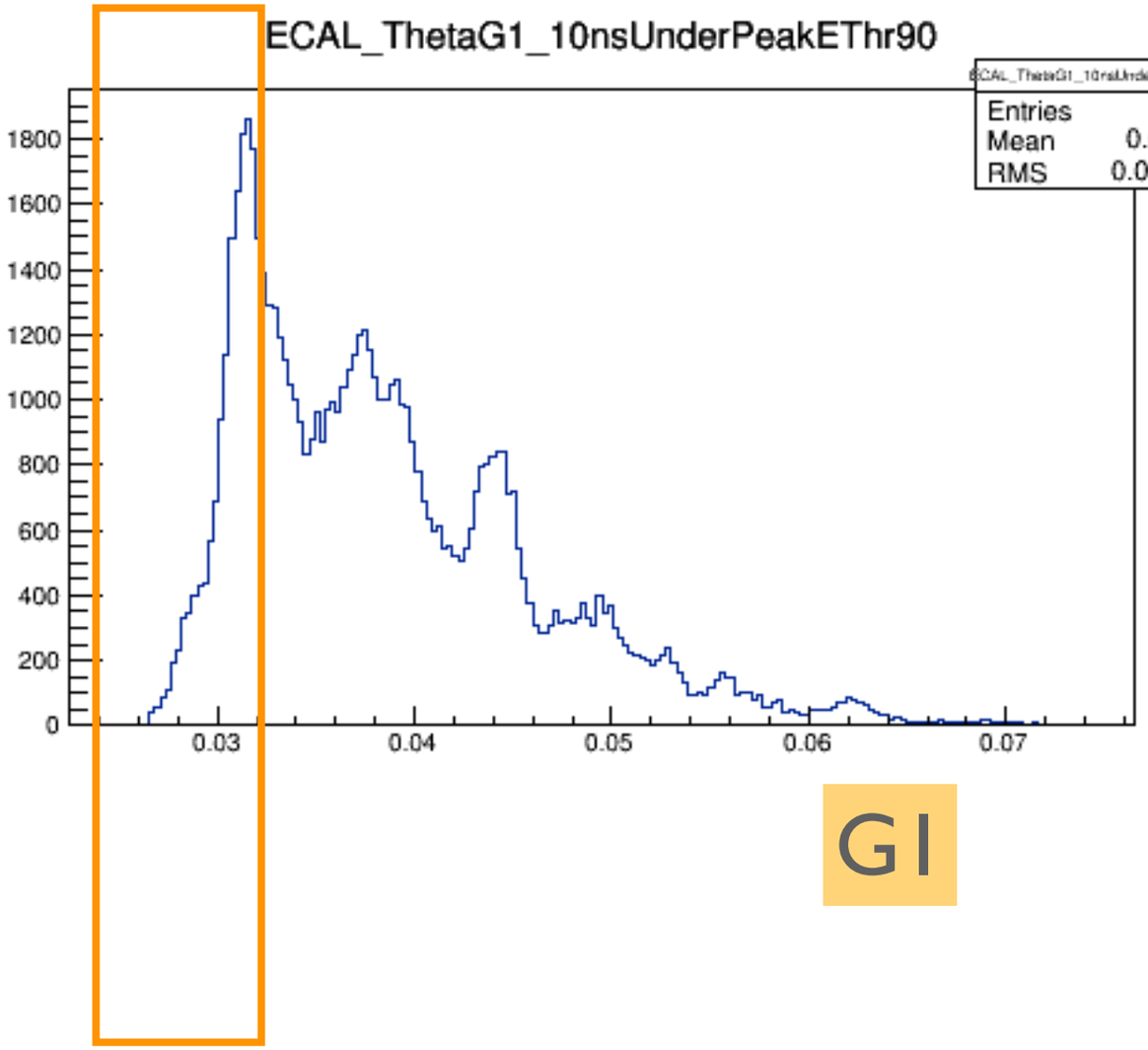


Reco inefficiency

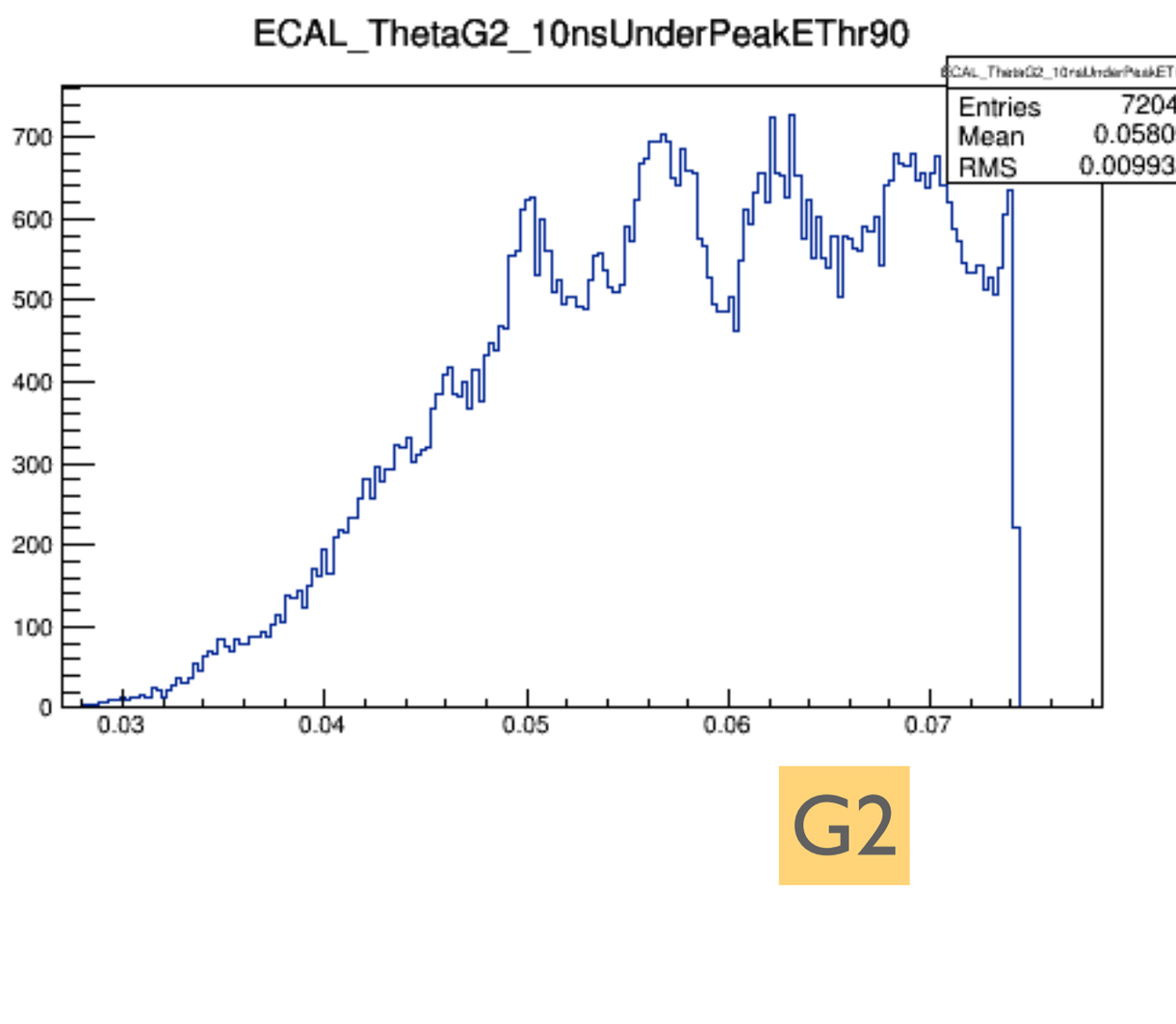
FROM SIMULATION..MC TRUTH



From simulation..MC truth after reconstruction



G1



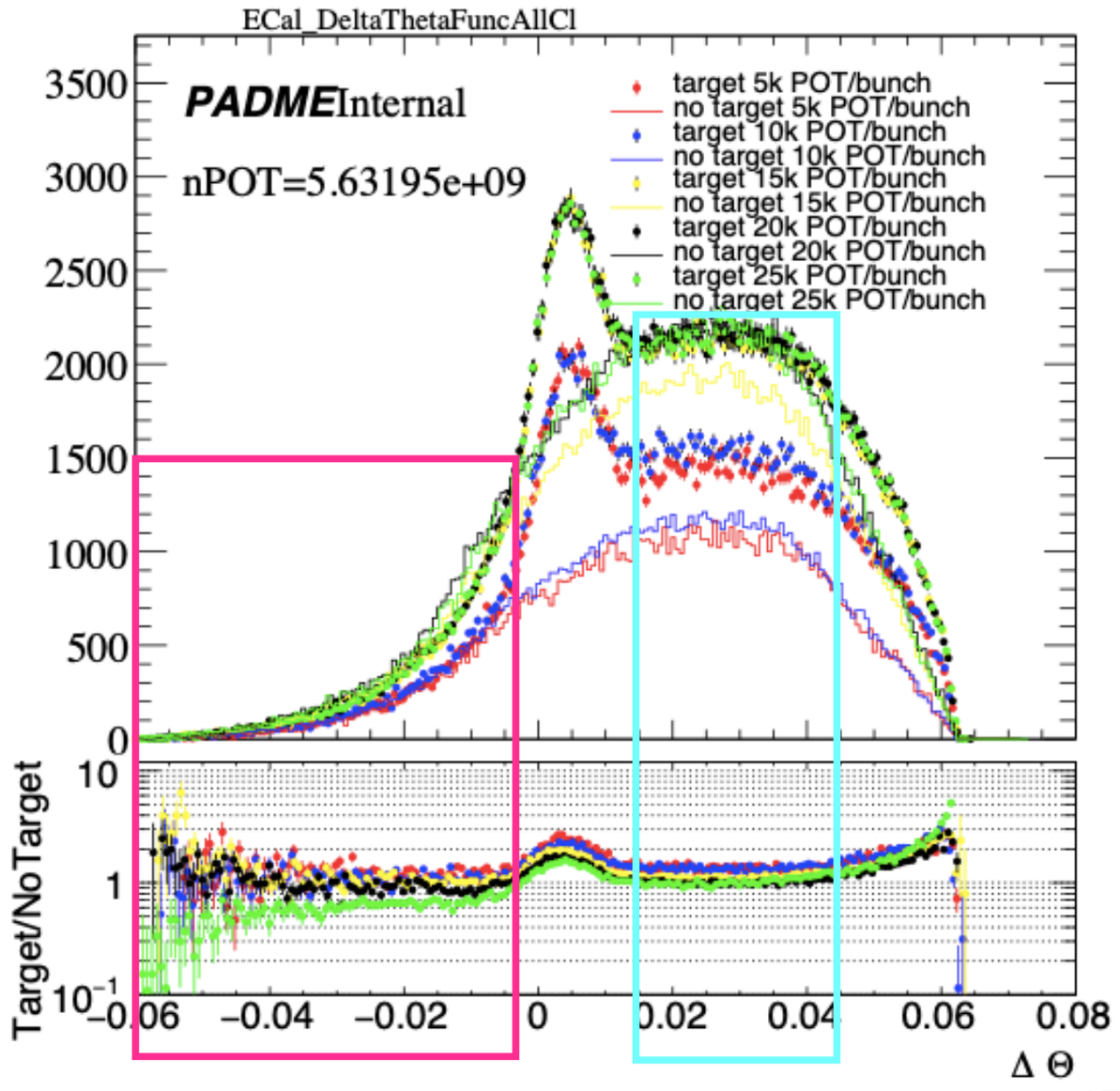
G2

Reco inefficiency

POSSIBLE PROBE FOR EFFICIENCY

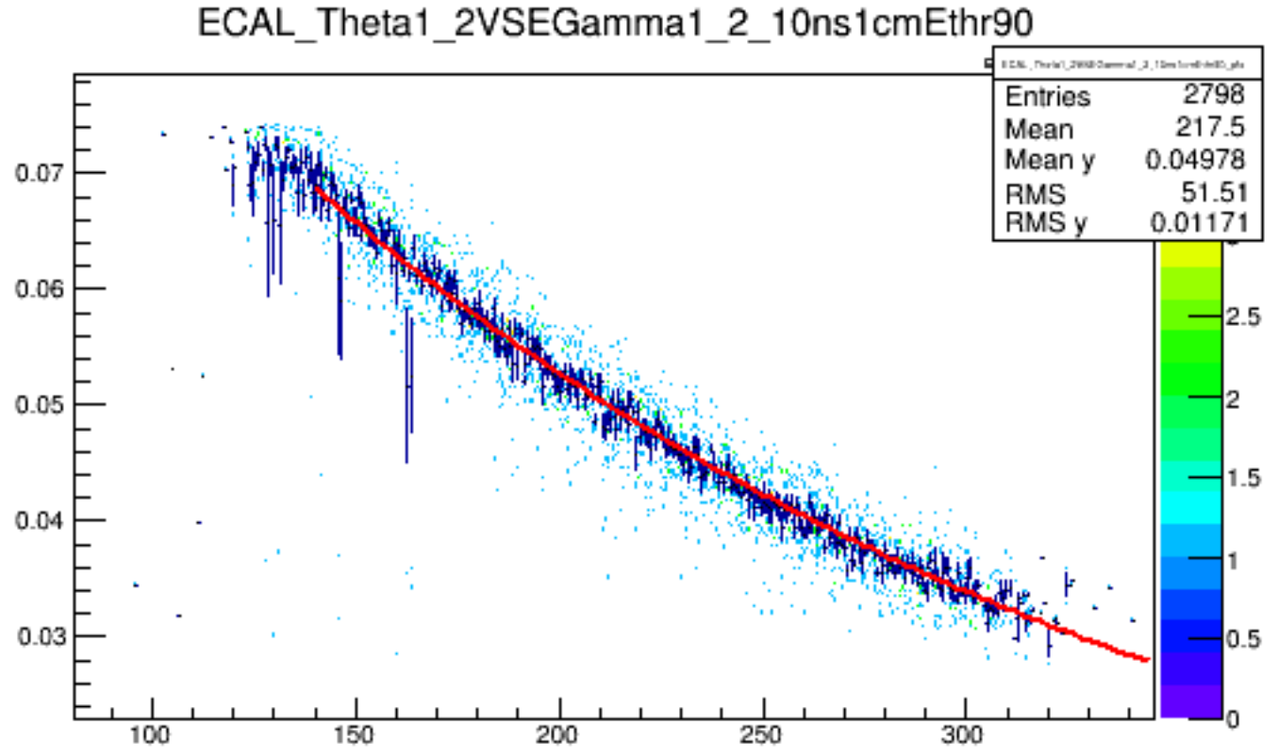
- Using the correlation between the energy of the photon with theta
  - I extract the theta using that correlation θ_{func}
  - I study the distribution of $\theta_{func} - \theta_{real}$
  - cut: 110<Ephoton<390 MeV

Agreement of background in [0.01, 0.04] for 20,25k POT/bunch
but disagreement for the other samples
t of background in [-0.06, -0.01] for 5,10,15k POT/bunch
but disagreement for the other samples

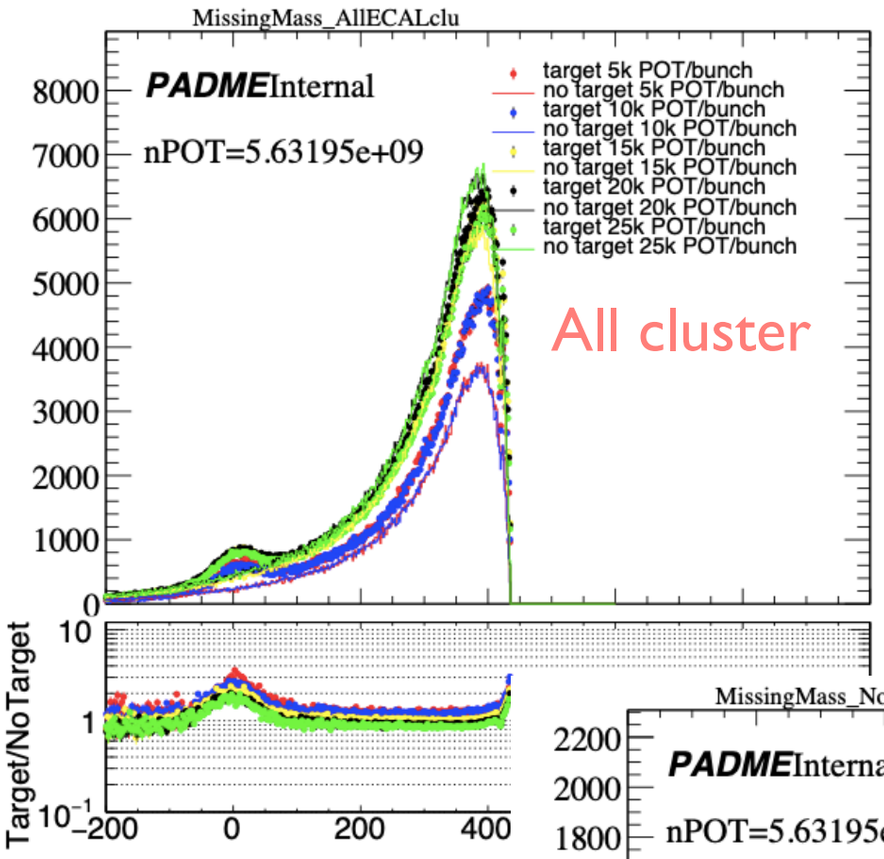


CORRELATION USING A RUN OF JULY ‘20

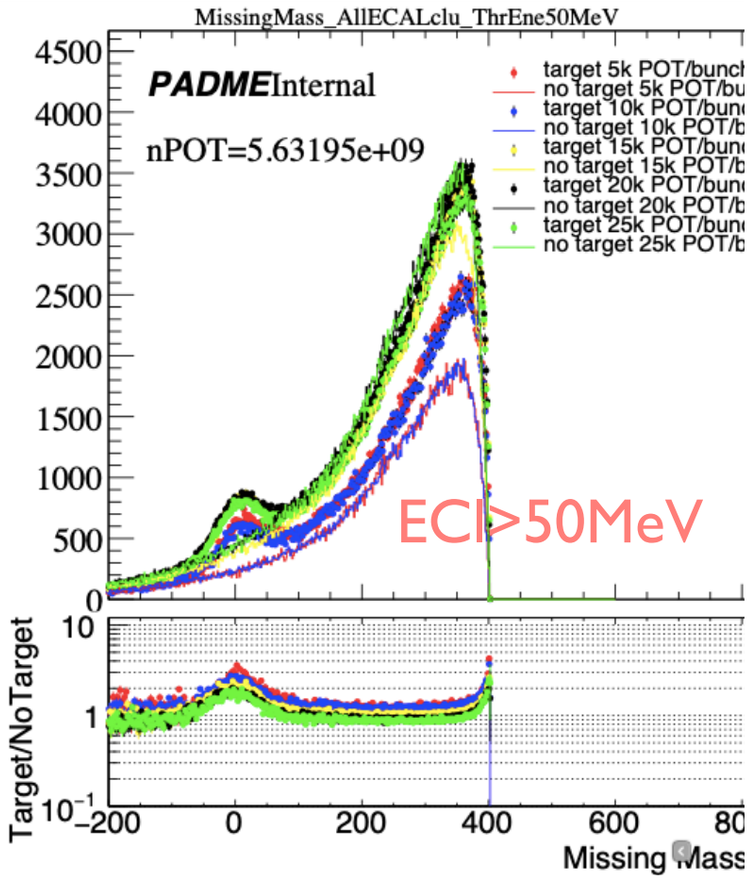
- Old parameters (ebeam 490 MeV):
  - Expo
    - constant:-2.06;
    - slope: -4.13e-03
- New parameters (ebeam 450 MeV):
  - Expo
    - constant:-2.058;
    - slope: -4.42e-03



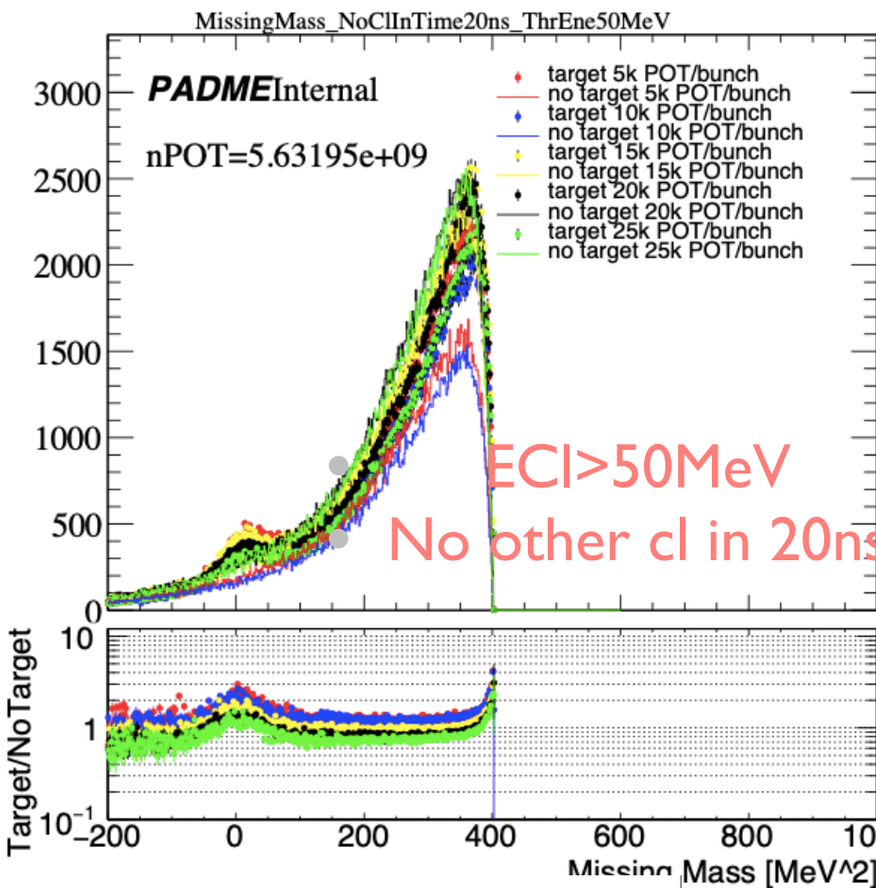
MISSING MASS



All cluster

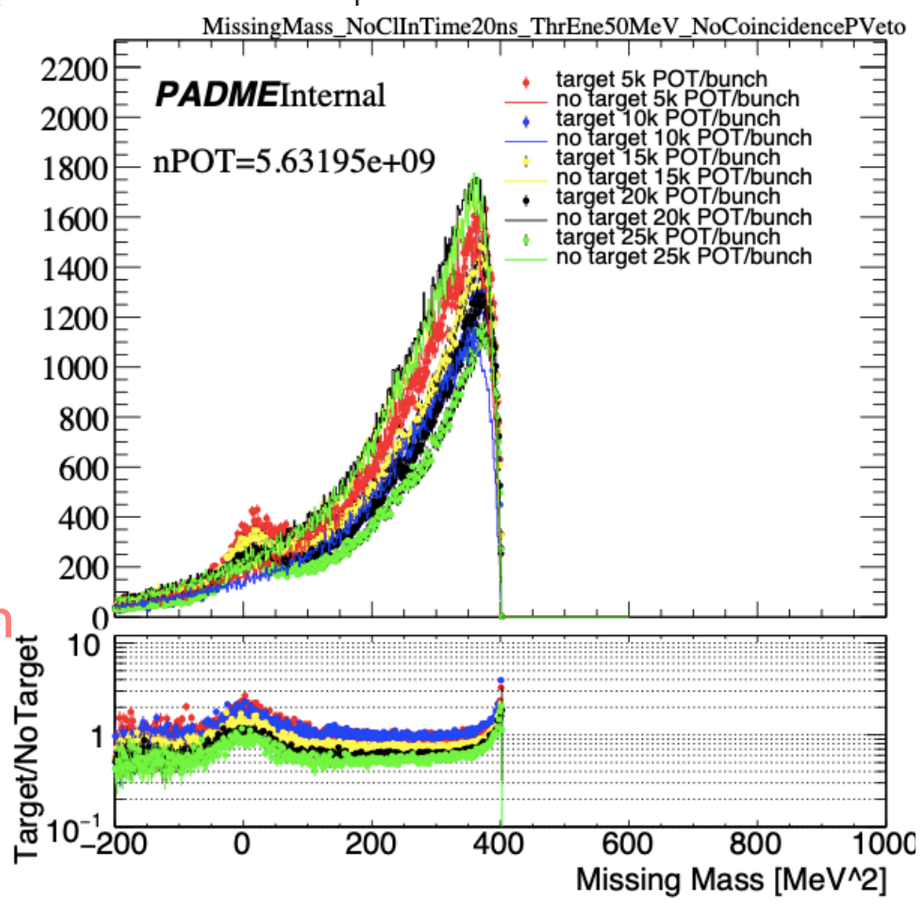


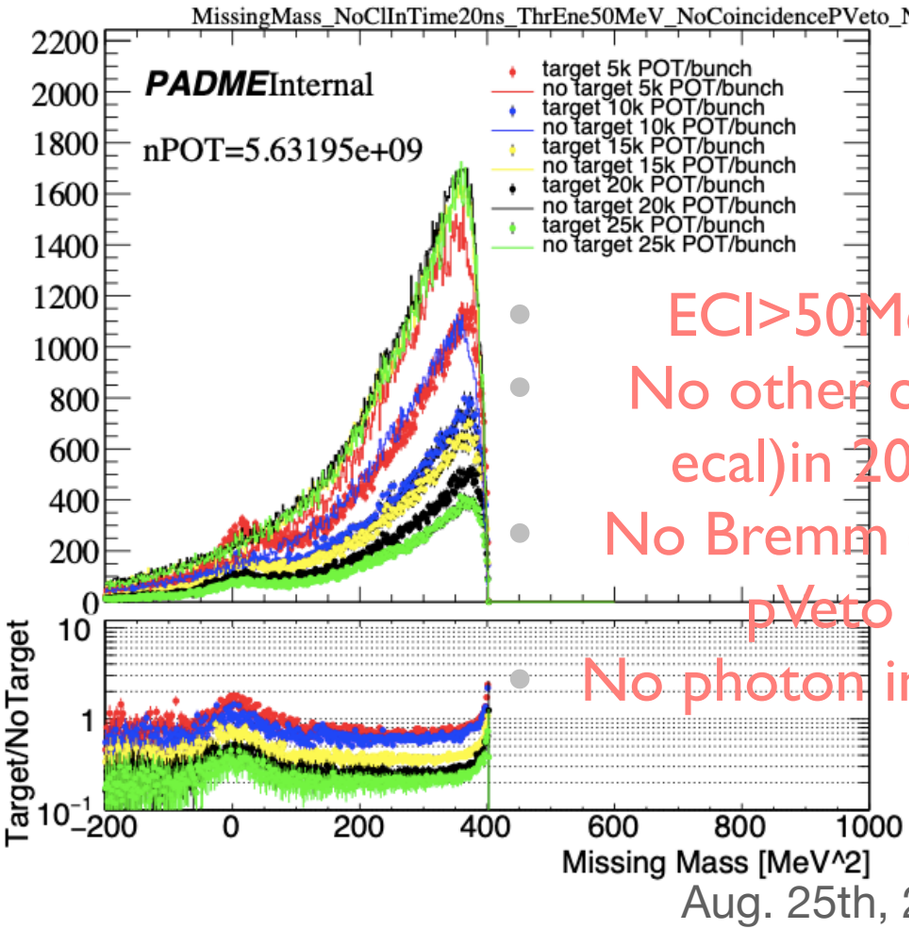
ECl>50MeV



ECl>50MeV
No other cl in 20ns

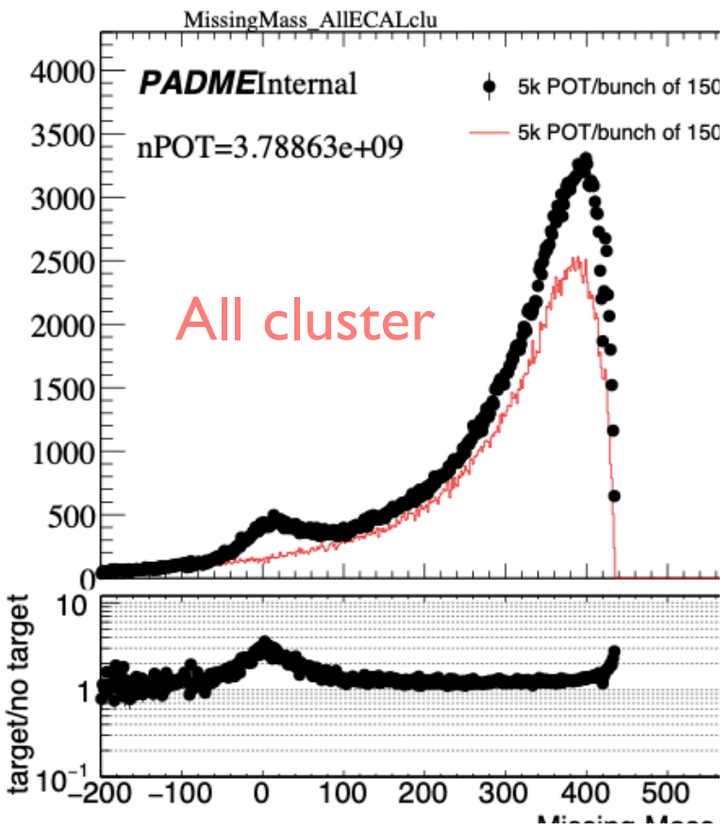
- ECl>50MeV
- No other cl (in ecal)in 20ns
- No Bremm e+ in pVeto

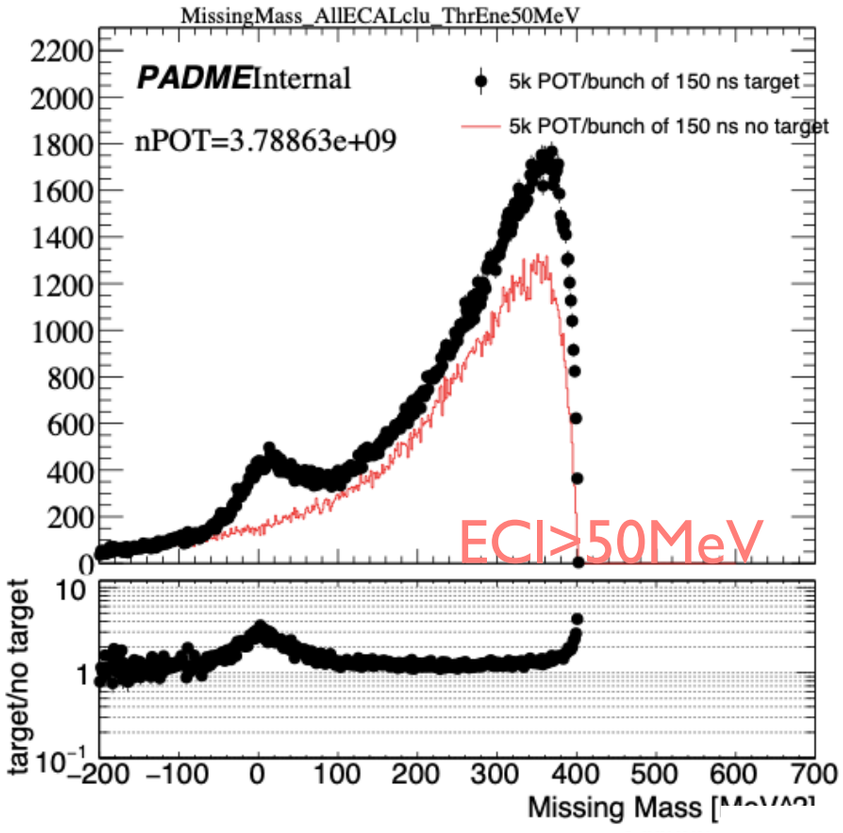


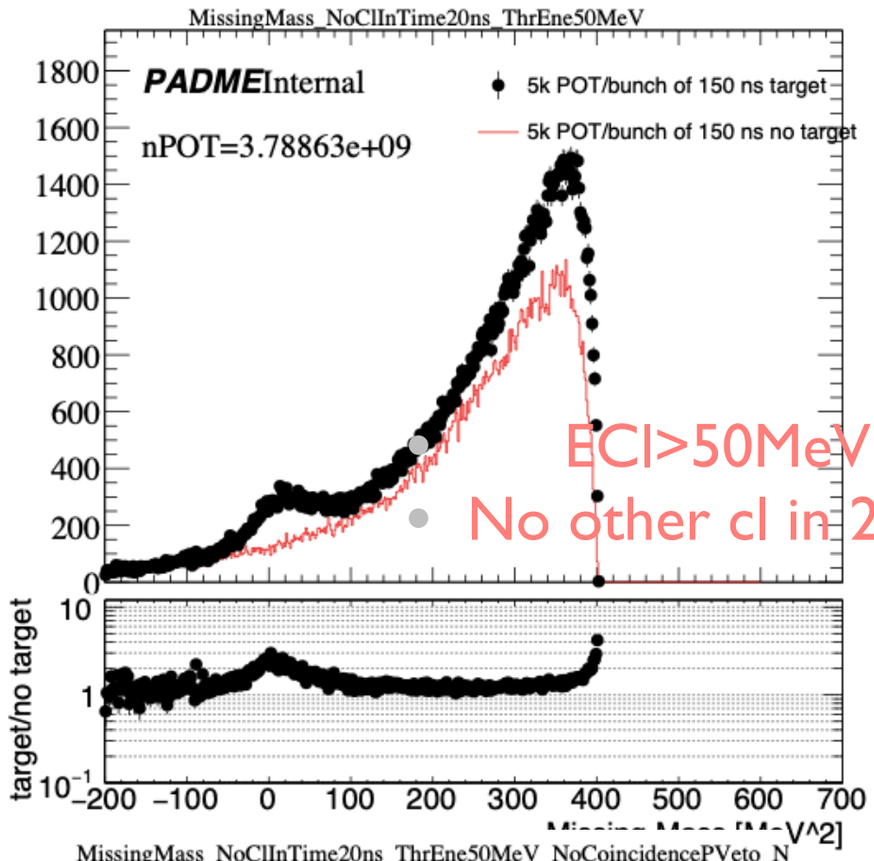


- ECl>50MeV
- No other cl (in ecal)in 20ns
- No Bremm e+ in pVeto
- No photon in SAC

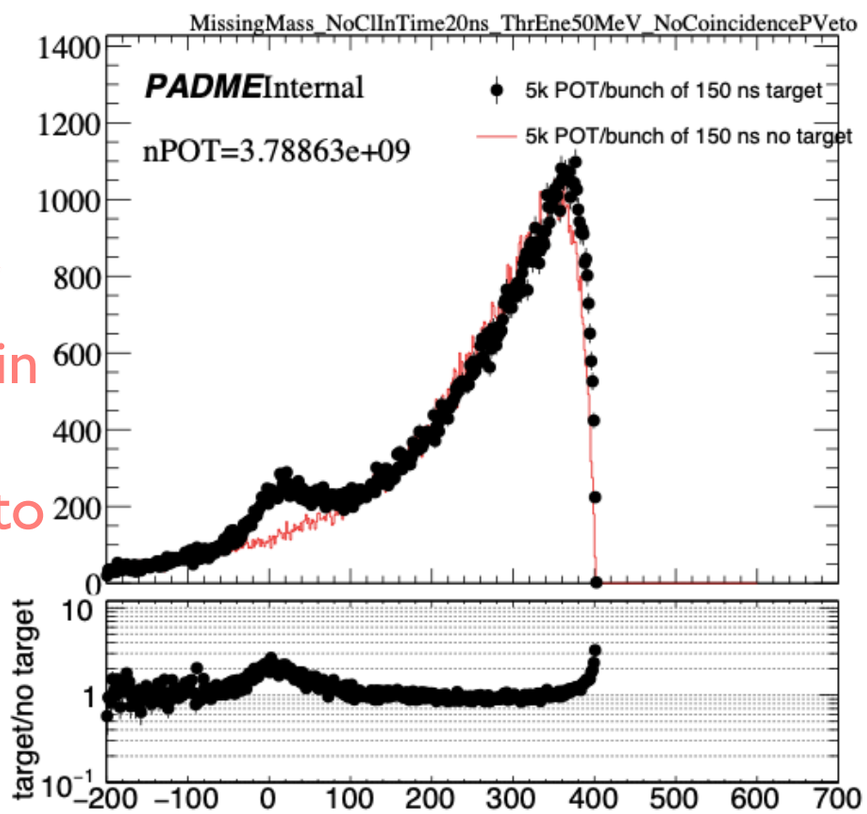
MISSING MASS (5K POT/BUNCH)

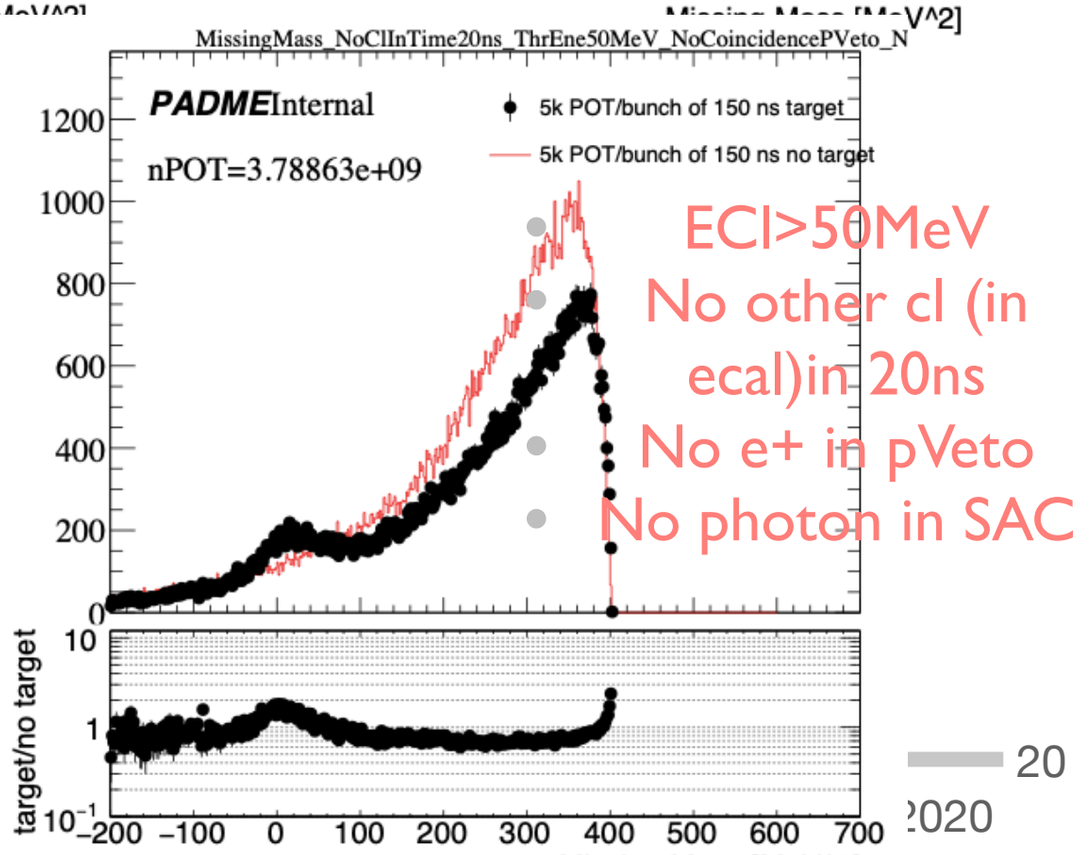






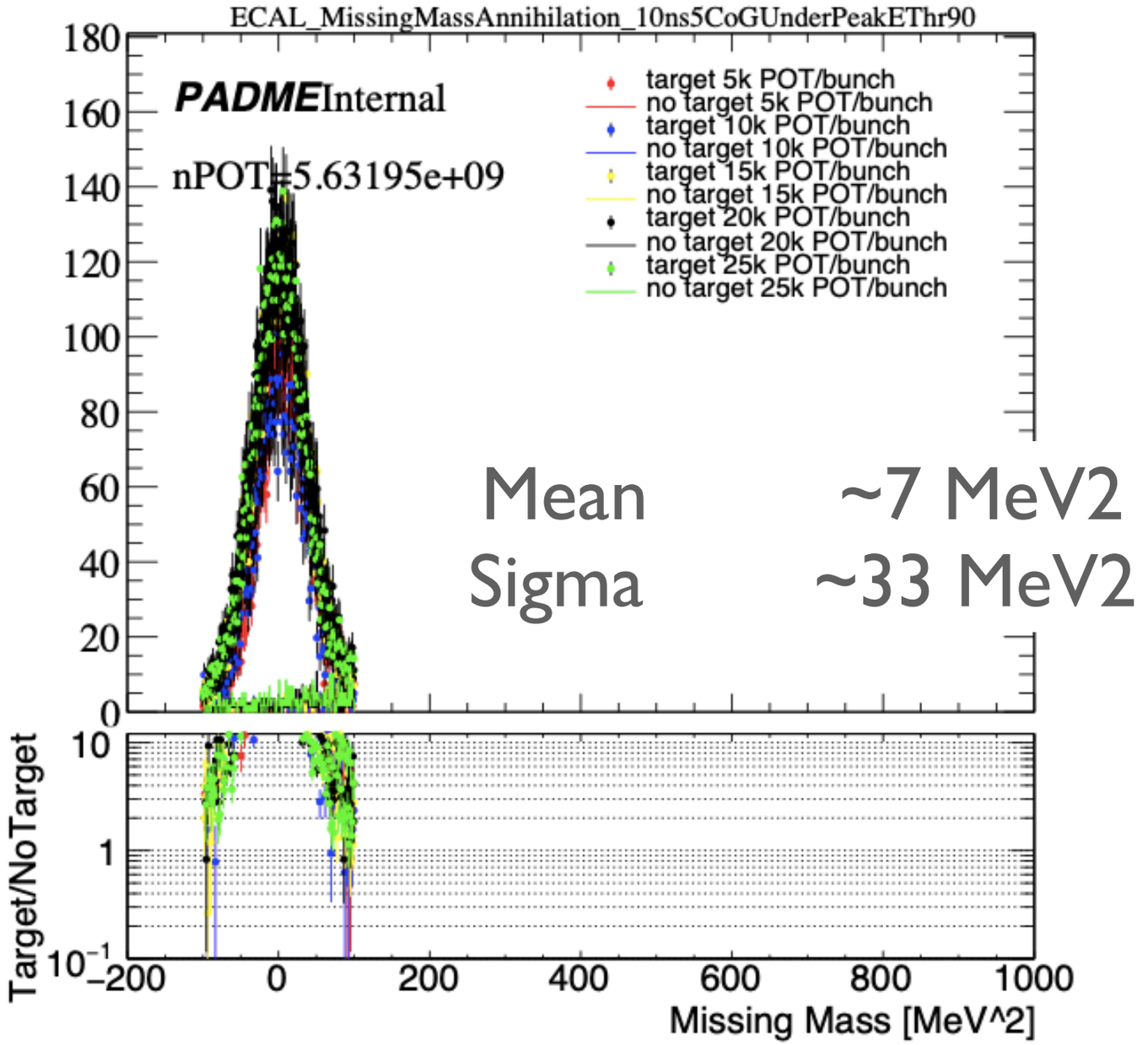
- ECl>50MeV
- No other cl (in ecal)in 20ns
- No e+ in pVeto





MISSING MASS RESOLUTION

- Photon selected
  - $\Delta t < 10$ ns
  - $R_\gamma \in FR$
  - $CoG < 5$ cm
  - E_{thr}



THE SELECTIONS

- $\Delta t < 10.\ \text{ns} \qquad R_\gamma \in FR$
  $CoG < 5\ \text{cm}$

5CoG

- $\Delta t < 10.\ \text{ns} \qquad R_\gamma \in FR$
  $CoG < 5\ \text{cm}$

5CoGEThr

$$350 < E_{\gamma_1} + E_{\gamma_2} < 600\ \text{MeV}$$

$$90 < E_\gamma < 400\ \text{MeV}$$

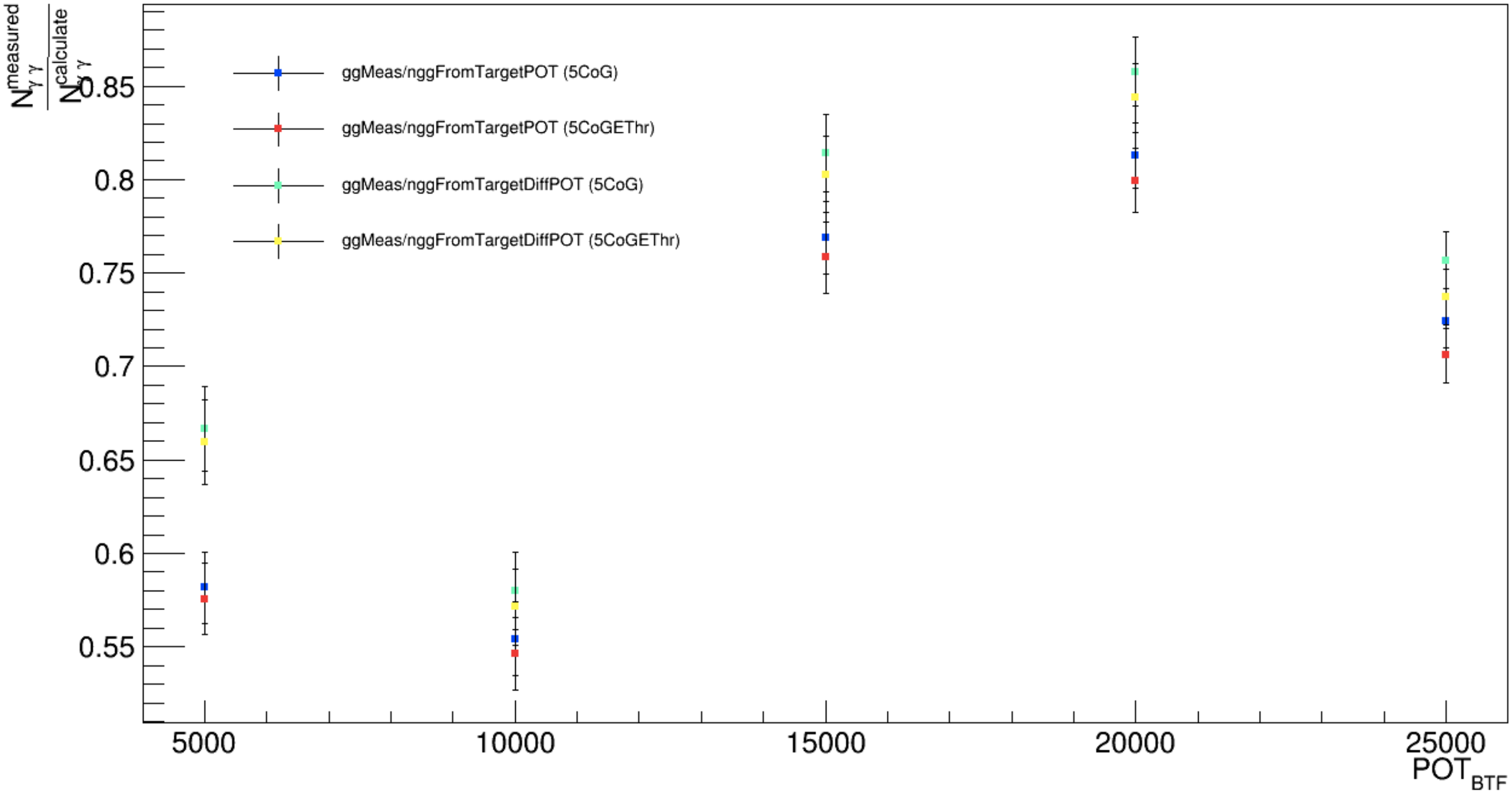
EFFICIENCY OF THE MEASUREMENT

- The yield measured is extracted using the difference of the distribution in target and no target runs

- To estimate the theoretical yield of annihilation is needed the POT number
  - First test:
    - Use the number that is recorded by target
      - Problem: target saturation with 20k and 25k POT/bunch
        - I corrected the POT with a factor given by the fraction of the BTF POT/bunch and the mean of the POT/bunch distribution for each problematic run
  - Second test:
    - The total number of POT that I use for the theoretical calculation is given by:
      - $POT^{TargetRun} - POT^{noTargetRun}$

I'm rejecting empty events

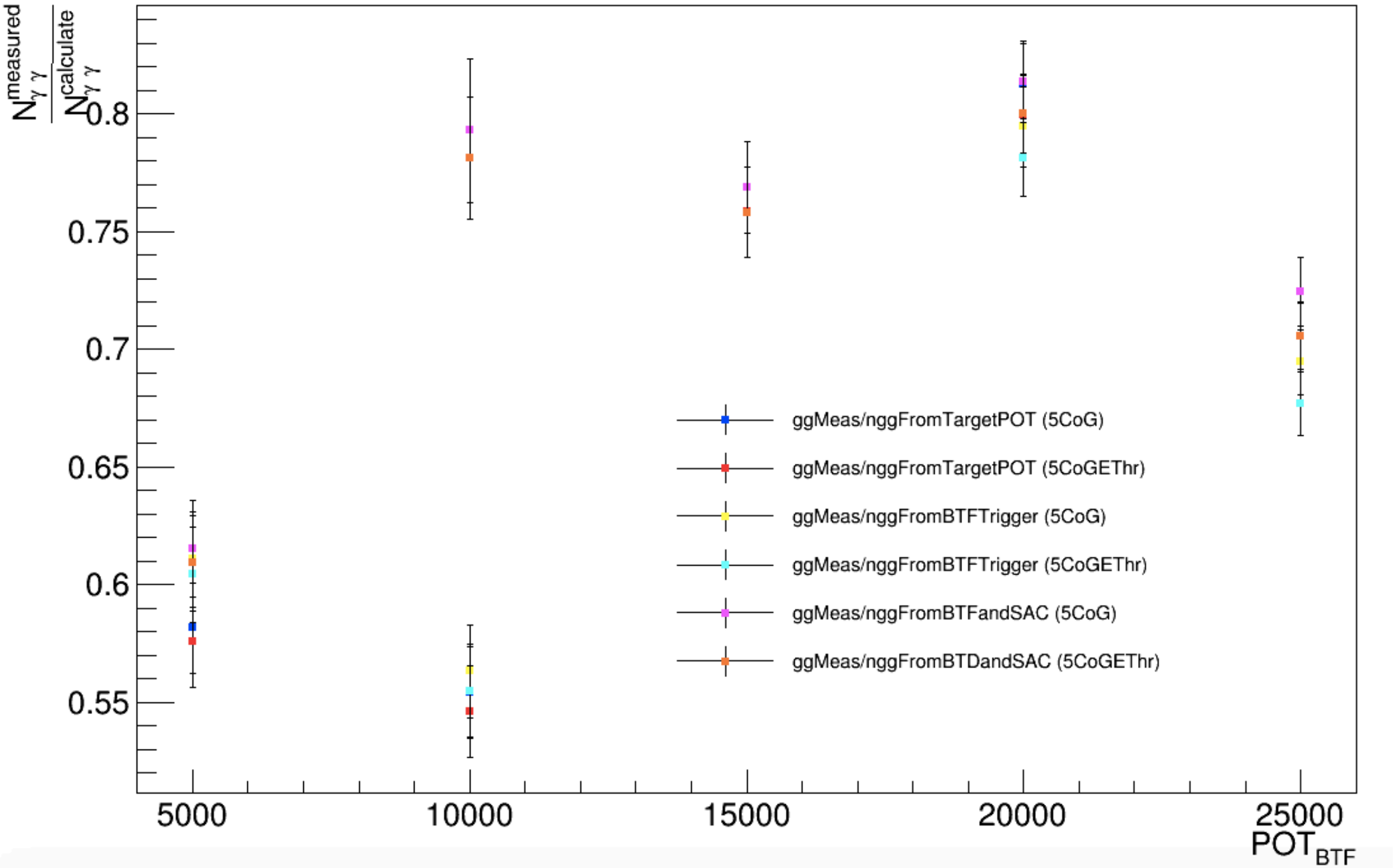
EFFICIENCY OF THE MEASUREMENT



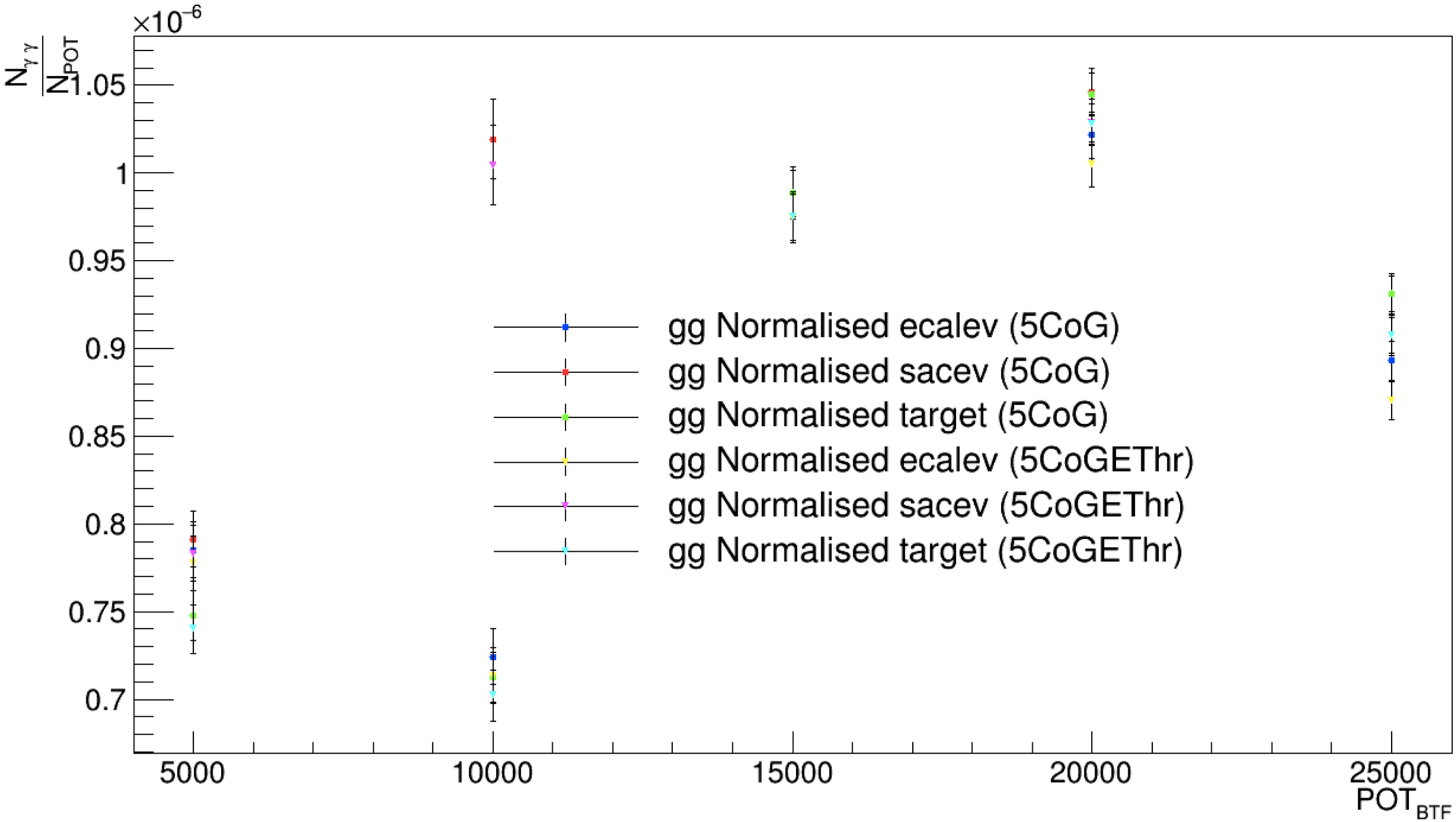
EFFICIENCY OF THE MEASUREMENT

- To estimate the theoretical yield of annihilation is needed the POT number
  - Fourth test:
    - Use the BTF trigger x POT^{BTF}/bunch
  - Fifth test:
    - Use the number of events that has $N_{SAC}^{cl} > N_{thr}$
      - $N_{thr} > 0$ for the run with 5k POT/bunch
      - $N_{thr} > 5$ for the run with 10k POT/bunch
      - $N_{thr} > 10$ for the other runs

EFFICIENCY OF THE MEASUREMENT



Cross section constant



CONSIDERATION

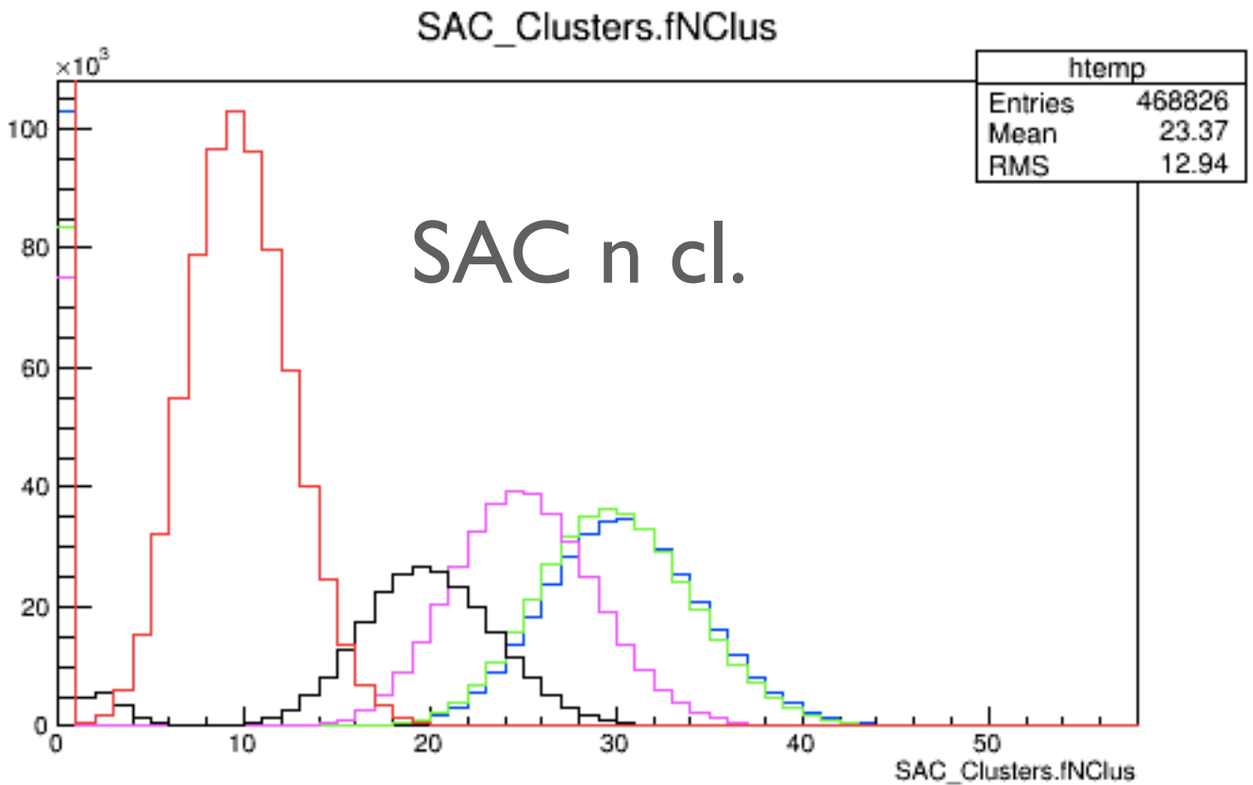
- If we assume that the response of the target is not compromised up to 15k POT/bunch
  - There is a strange efficiency trend, at higher POT/bunch the efficiency seems higher than the same variable at low POT/bunch!
- How to normalise the samples? I assume that have a different POT/bunch imply a different background, so it is not right to normalise using the background

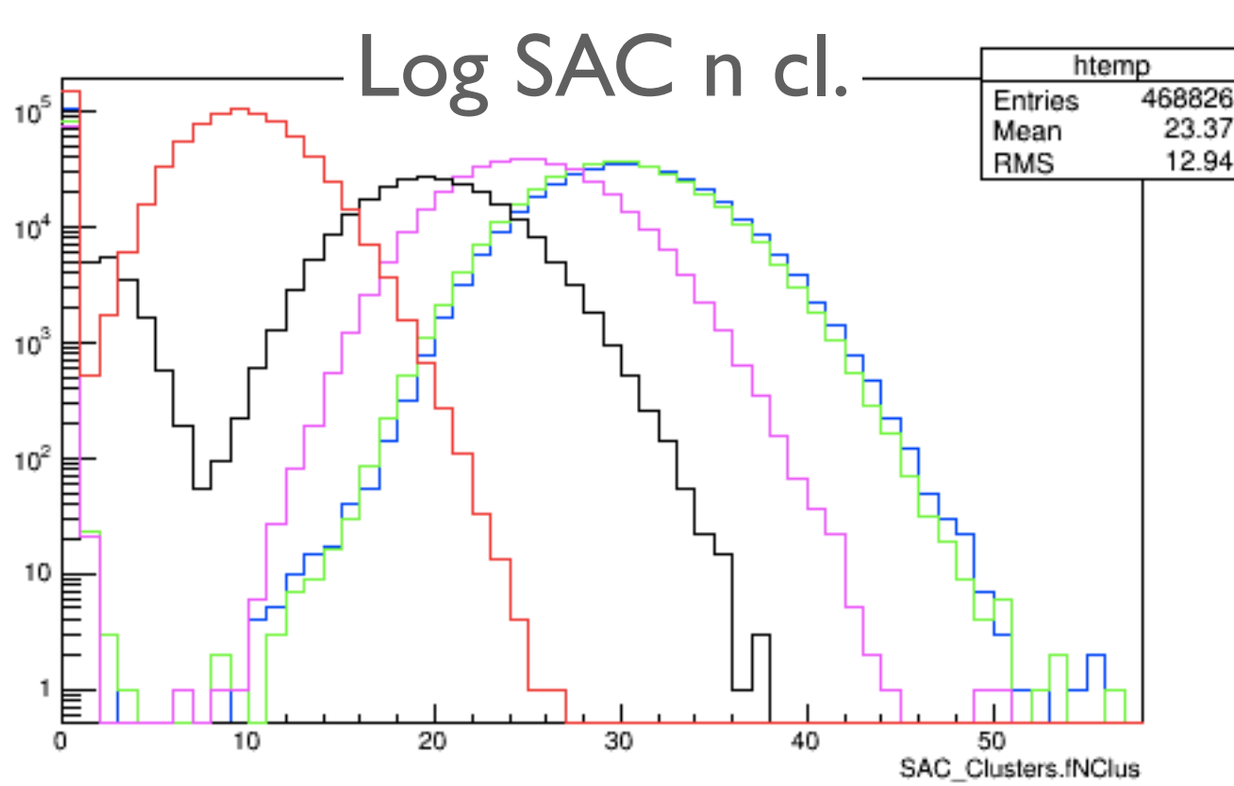
CONSIDERATION ON NPOT

- It is right up to now that I'm integrating also the empty events, but I'm not sure that the pedestal in equal in target and no target run, so I can not reject empty events using
  - $POT^{TargetRun} - POT^{noTargetRun}$
- What I did is to reject the events that has
  - nPOT<1800 for run with 5k POT/bunch
  - nPOT<5000 for run with >5k POT/bunch
- In no target run I didn't apply this cut!

CONSIDERATION ON SAC NCL

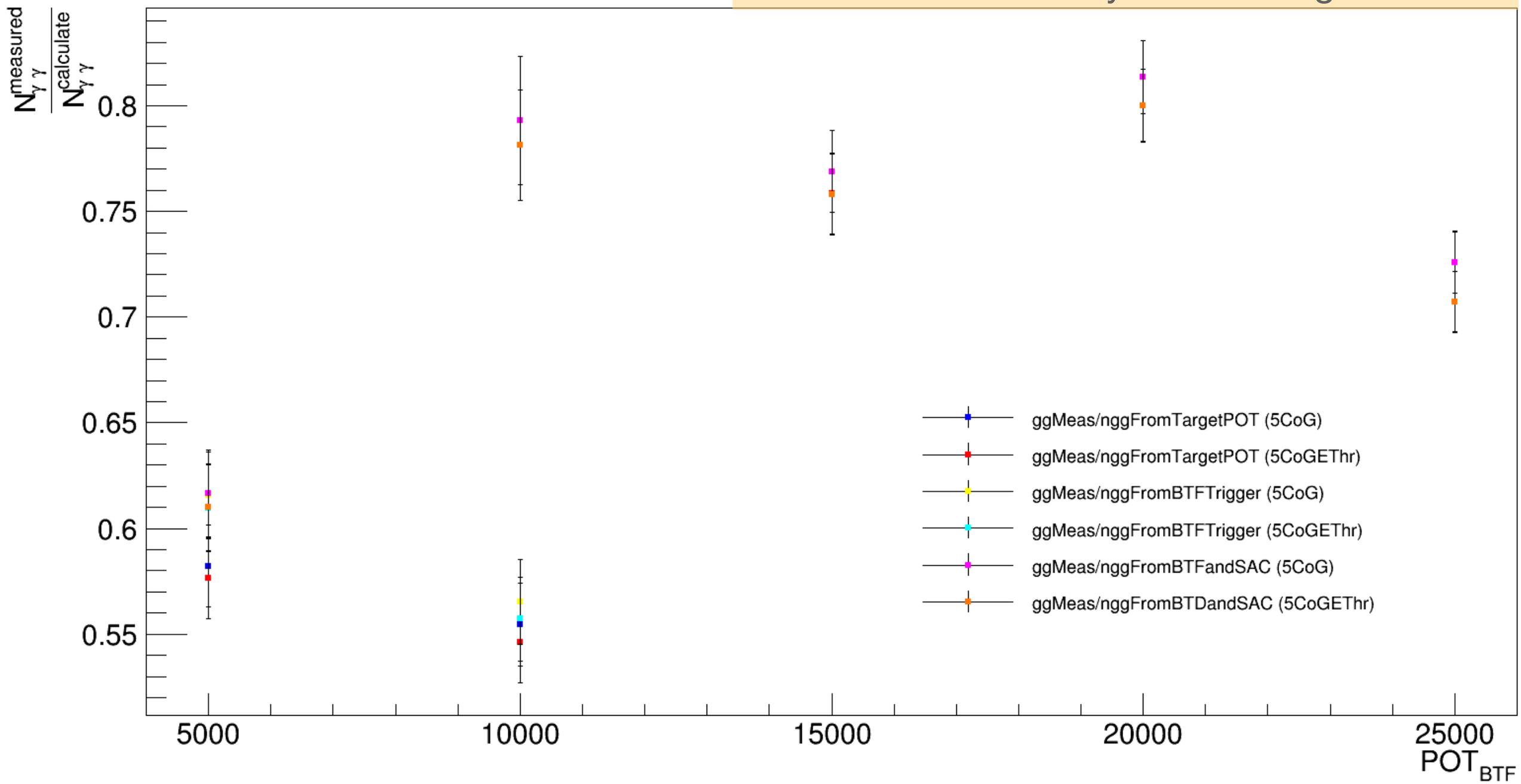
- ...
  - Use the number of events that has $N_{SAC}^{cl} > N_{thr}$
    - $N_{thr} > 1.5$ for the run with 5k POT/bunch
    - $N_{thr} > 6$ for the run with 10k POT/bunch
    - $N_{thr} > 10$ for the other runs
  - 30211 (5k POT/bunch)
  - 30205 (10k POT/bunch)
  - 30201 (15k POT/bunch)
  - 30203 (20k POT/bunch)
  - 30209 (25k POT/bunch)





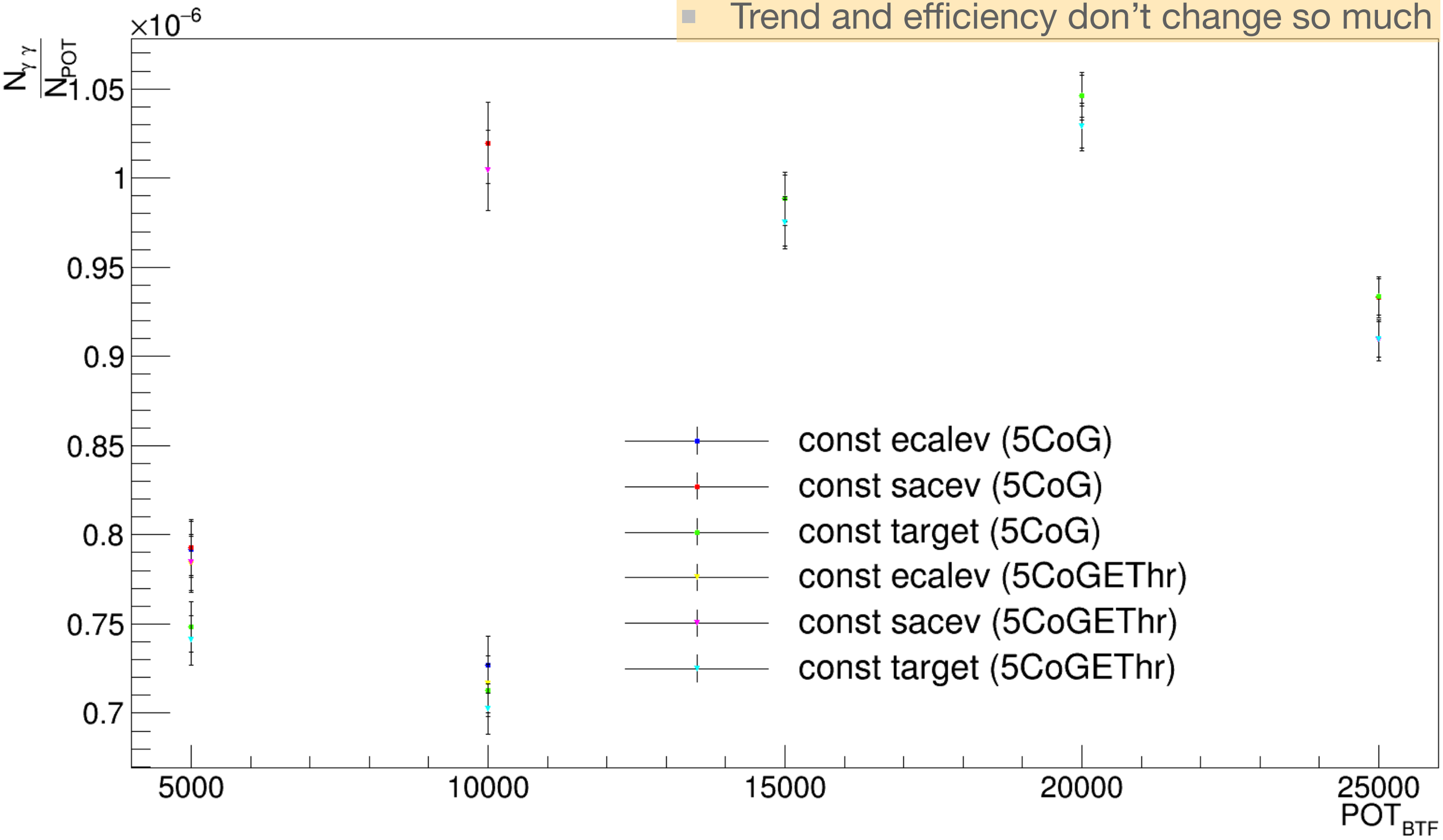
THE RESULTS-EFFICIENCY OF THE MEASUREMENT

- Trend and efficiency don't change so much



THE RESULTS-CROSS SECTION CONSTANT

- Trend and efficiency don't change so much



CONSIDERATION

- The inefficiency of 5k POT/bunch run can be related to the bunch structure, so density?

COMPARISON BETWEEN RUNS WITH SAME MULTIPLICITY BUT DIFFERENT BUNCH LENGTH

- The runs analysed up to now is taken with a bunch length of 150 ns
- In the latest time of data taking the bunch length was ~250 ns
- I compared run with same POT/bunch but different bunch length

- Run samples:
  - 30211->5k POT/bunch - 150ns bunch length
  - 30297->5k POT/bunch - 250ns bunch length

  - 30203->20k POT/bunch - 150ns bunch lenght
  - 30294->20k POT/bunch - 150ns bunch lenght

- Take care:
  - The samples has also a different Ebeam:
  - Samples with 150ns bunch length -> EBeam=450MeV
  - Samples with 250ns bunch length -> EBeam=430MeV

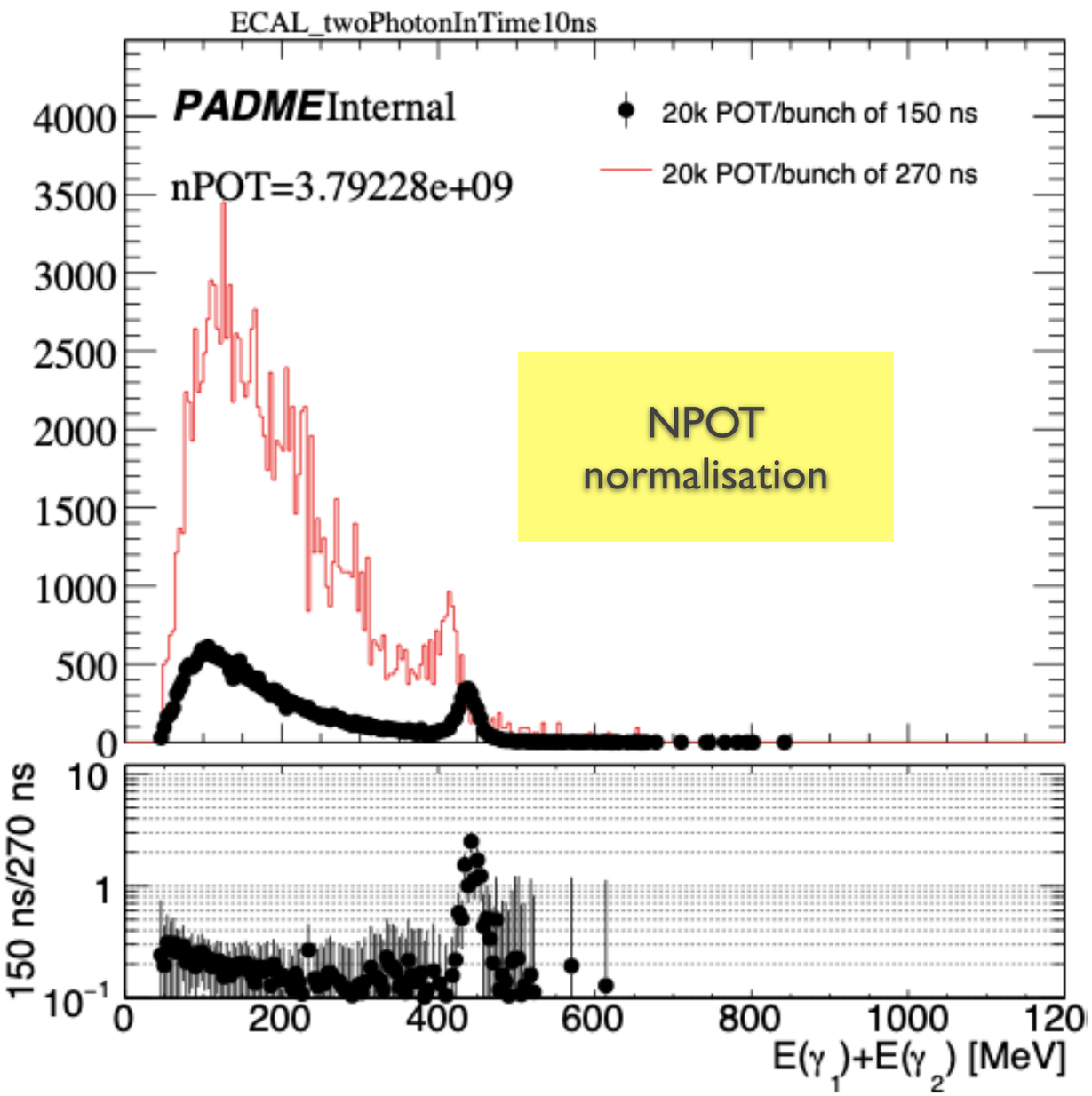
5K POT/BUNCH

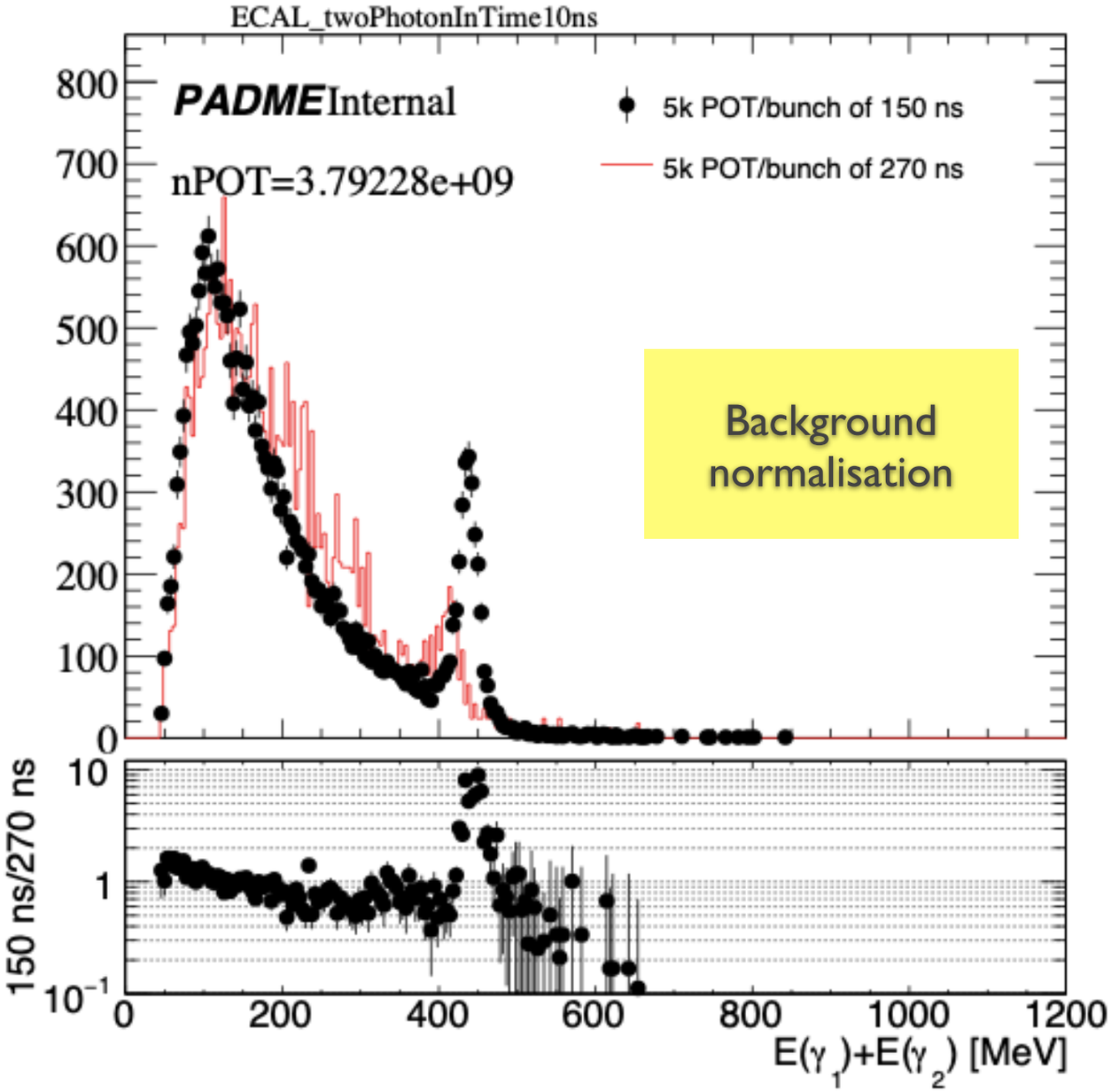
- Normalisation of two samples using
  - NPOT from target
  - Background
    - ! Very different scenarios

- Problem: low statistic of run 30297
  - Run 30211 nPOT: 3.79×10^9
  - Run 30297 nPOT: 1.21×10^9

ANNIHILATION YIELD

$\Delta t < 10.$ ns $R_\gamma \in FR$





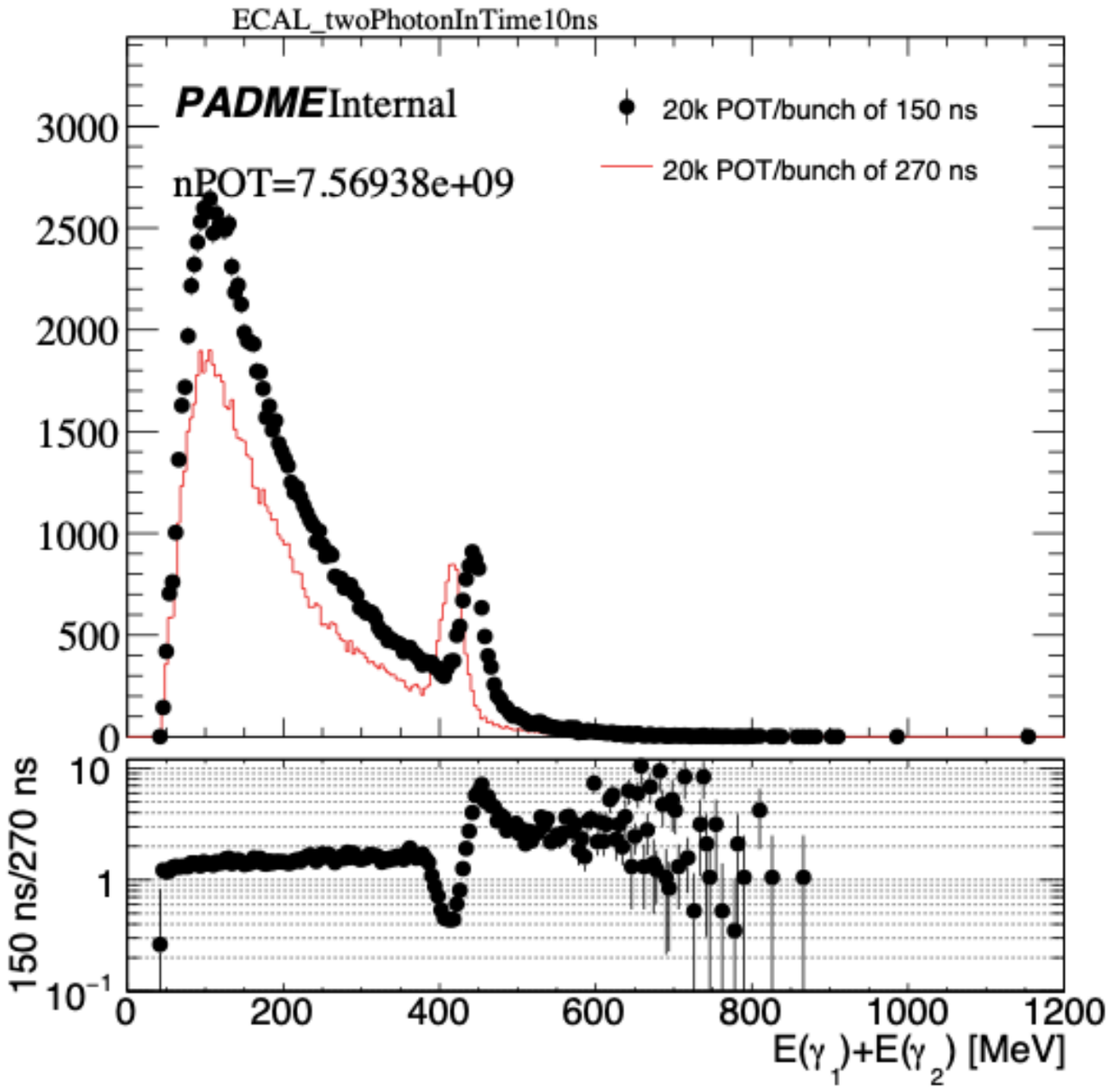
What's the right?

20K POT/BUNCH

- Normalisation of two samples using
  - Corrected NPOT from target (in 30203 run there is target saturation)

  - Run 30203 nPOT: $6.15 \times 10^9 \rightarrow 7.57 \times 10^9$
  - Run 30294 nPOT: 7.97×10^9

ANNIHILATION YIELD

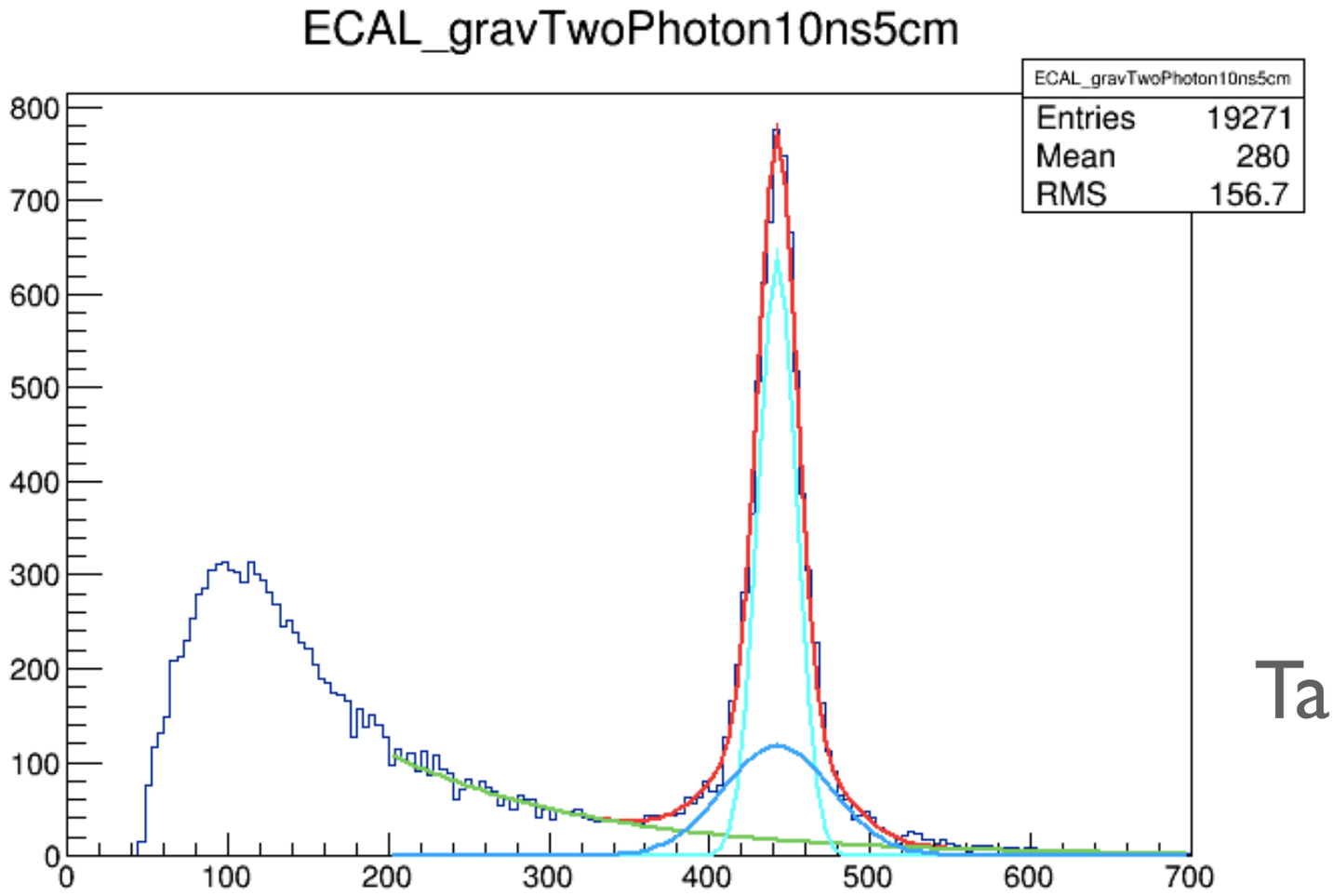


$\Delta t < 10.\ \text{ns} \qquad R_\gamma \in FR$

More background if the bunch length is 150 ns, but the yield is not different

NPOT=6.15 x 1.23 x 10^9

150 NS BUNCH LENGTH



$\Delta t < 10.$ ns $\quad R_\gamma \in FR$

$CoG < 5$ cm

Fit ngg: 7275

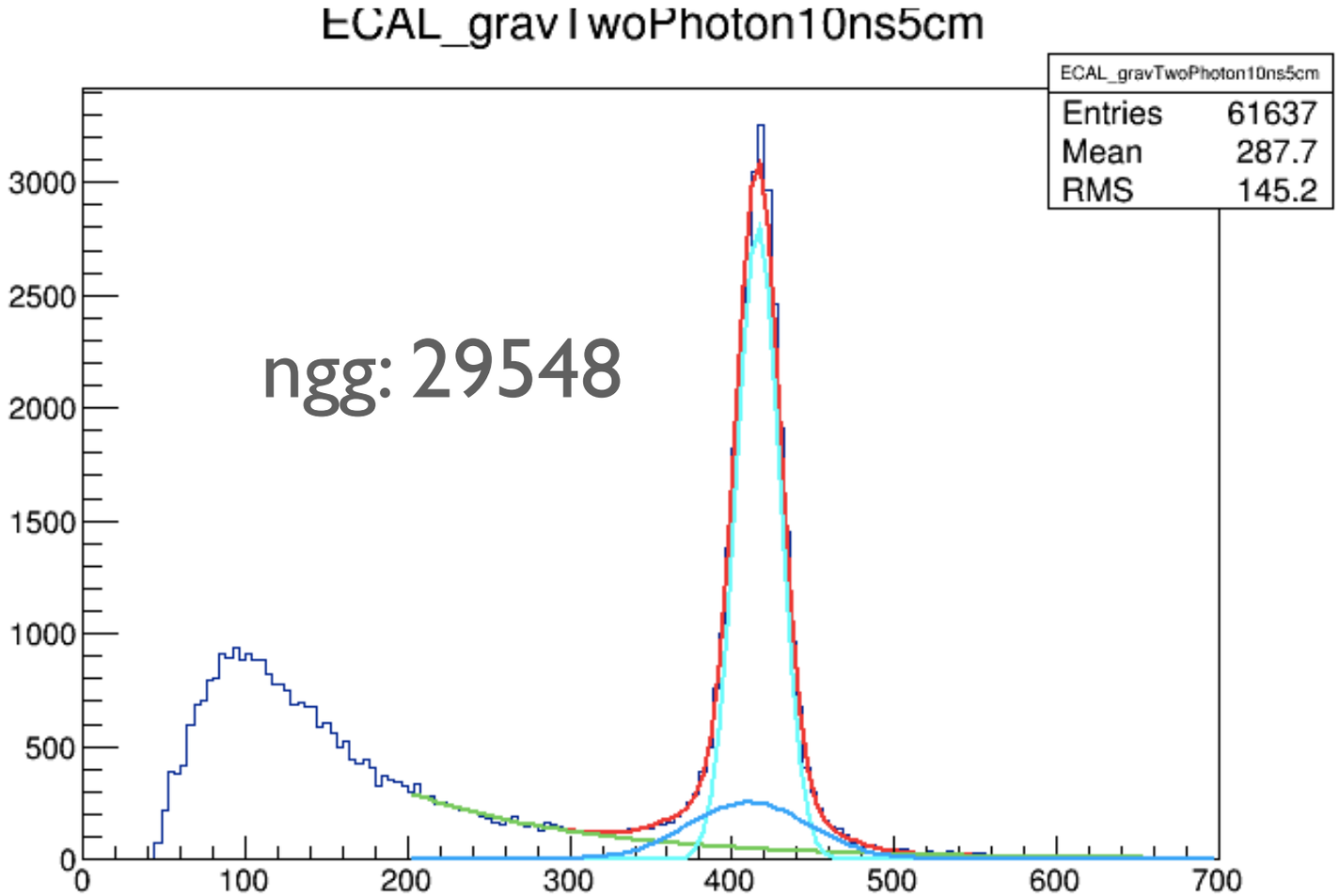
Target- NoTarget ngg: 7779

EXT NO.	PARAMETER NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	p0	6.25013e+00	6.16297e-02	3.91046e-05	9.70911e-04
2	p1	-7.76029e-03	2.09182e-04	-1.76709e-07	-1.01007e-02
3	p2	6.35653e+02	1.74919e+01	7.35377e-03	1.63454e-06
4	p3	4.42615e+02	2.31157e-01	-1.09842e-04	7.93817e-04
5	p4	1.20000e+01	3.99473e-02	-1.86897e-04** at limit **	
6	p5	1.17847e+02	9.46704e+00	-1.30600e-03	-6.08121e-06
7	p6	4.42697e+02	9.96510e-01	6.38220e-05	8.33186e-06
8	p7	3.37807e+01	1.53076e+00	2.75317e-04	-2.51083e-05

gaus1 mean 442.615 gaus2 mean 442.697
Chi^2:135.999, number of DoF: 116 (Probability: 0.0989598).
gg yield 19120.1 divided by bin lenght 4780.04
gg yield 2 9978.79 divided by bin lenght 2494.7

NPOT=3.16 x 10^10

250 NS BUNCH LENGTH



$\Delta t < 10.$ ns $\quad R_\gamma \in FR$

$CoG < 5$ cm

EXT NO.	PARAMETER NAME	VALUE	ERROR	STEP SIZE	FIRST DERIVATIVE
1	p0	7.45382e+00	4.02583e-02	8.94982e-05	-6.40989e-02
2	p1	-8.77236e-03	1.44523e-04	2.96616e-07	-1.70410e+01
3	p2	2.80003e+03	2.97527e+01	1.46494e-01	8.25087e-06
4	p3	4.16437e+02	1.15305e-01	7.75764e-04	-1.19995e-03
5	p4	1.34523e+01	1.56550e-01	5.20921e-04	1.47684e-03
6	p5	2.52811e+02	2.40514e+01	4.24425e-02	3.39736e-06
7	p6	4.10533e+02	8.48450e-01	5.33350e-03	3.69095e-04
8	p7	3.75215e+01	1.63823e+00	3.56489e-03	1.44439e-04

gaus1 mean 416.437 gaus2 mean 410.533
Chi^2:227.84, number of DoF: 116 (Probability: 2.74046e-09).
gg yield 94416.8 divided by bin lenght 23604.2
gg yield 2 23777.5 divided by bin lenght 5944.38

COMPARISON ECAL ANNIHILATION

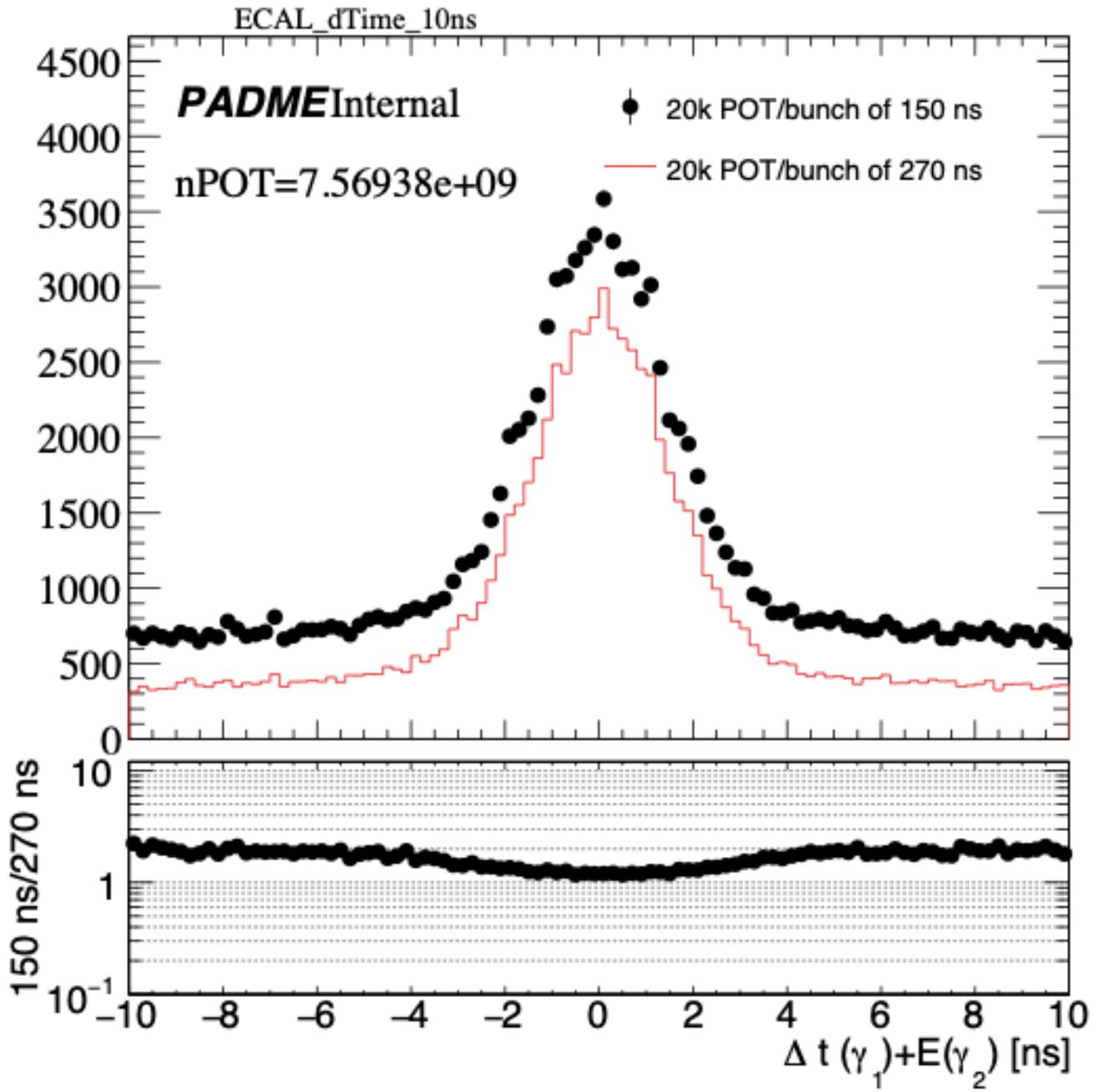
- nPOT (150 ns) = 6.15 x 1.23 x 10^9 = 7.56 x 10^9
- nPOT (250 ns) = 3.16 x 10^10

- Scale factor = nPOT(250)/nPOT(150)= 4.2

- Ngg(150)= 7275 x 4.2 = 30555
- Ngg(250)= 29548
- -> ngg(150)/ngg(250)=1.03

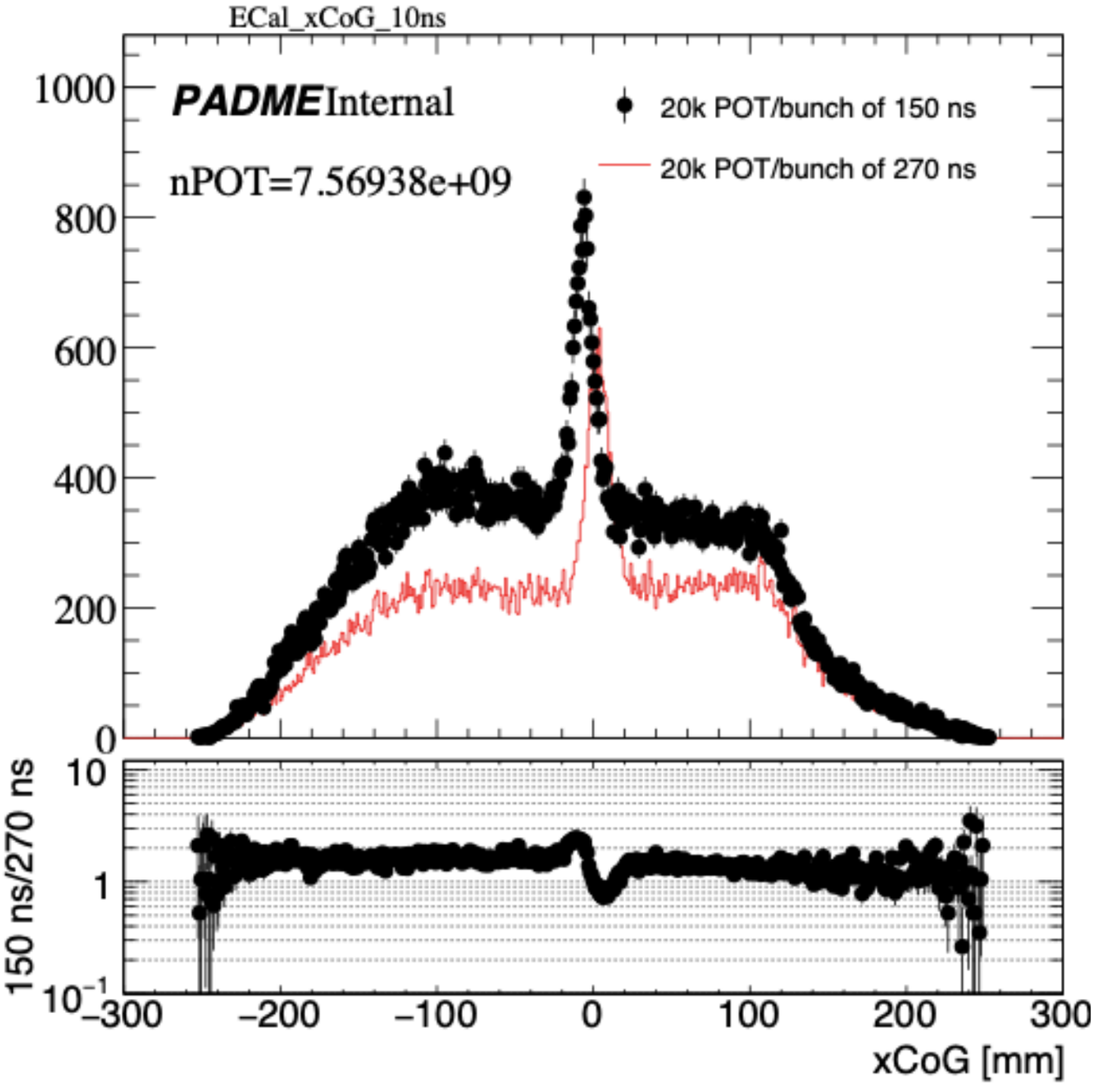
TIME RESOLUTION

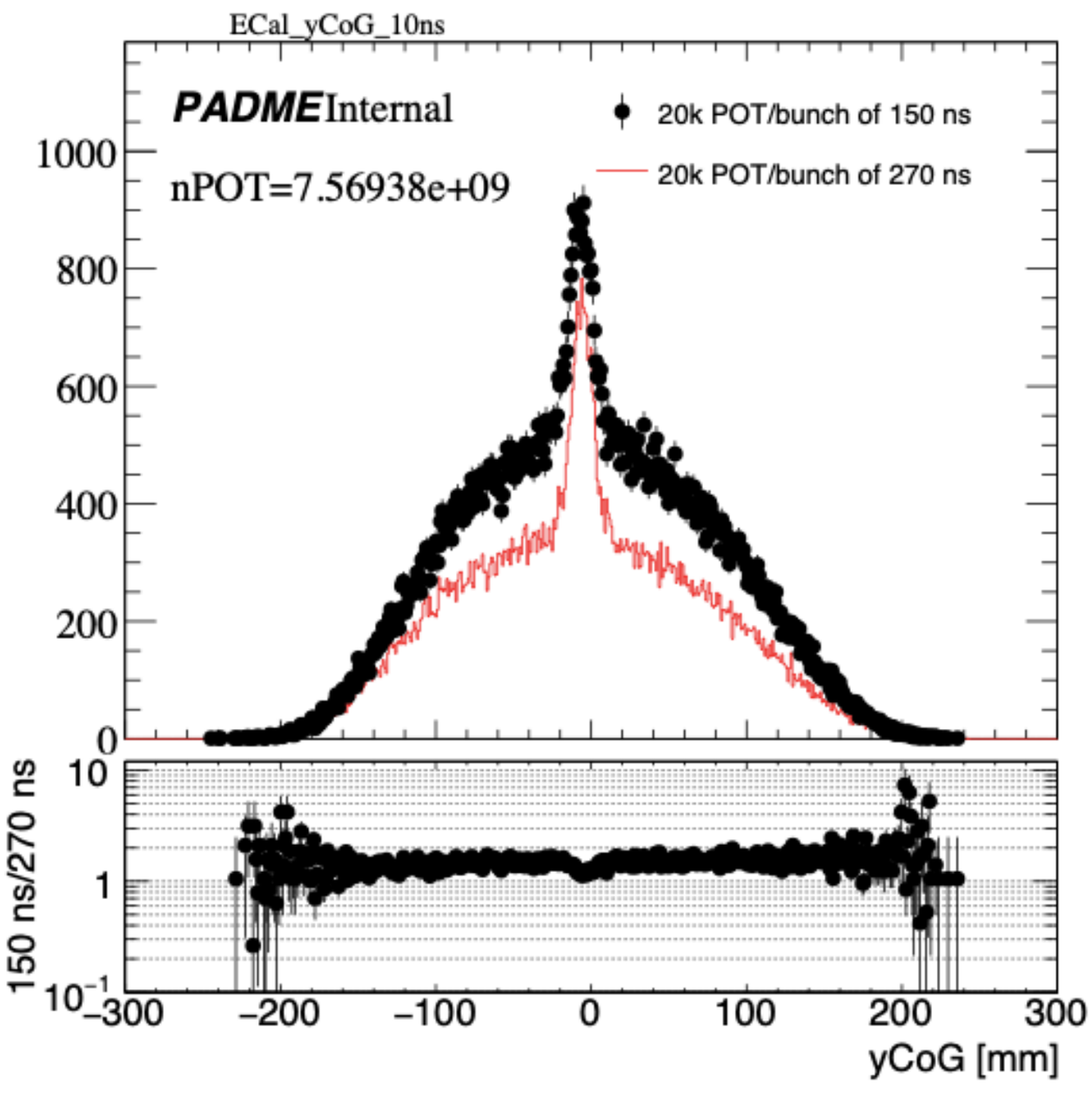
- Same time resolution



CoG RESOLUTION

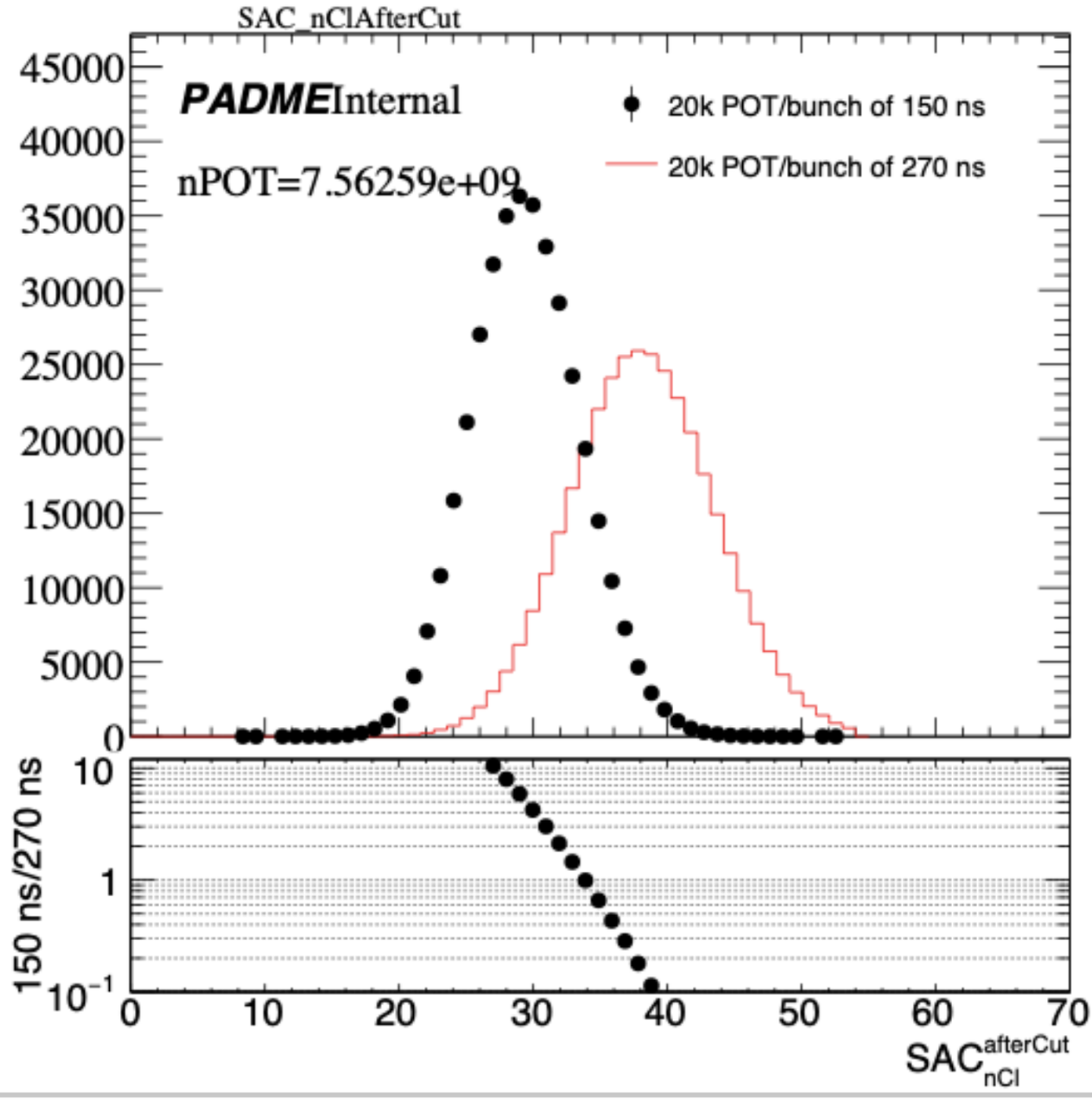
- Same CoG resolution, but there is a shift in x direction



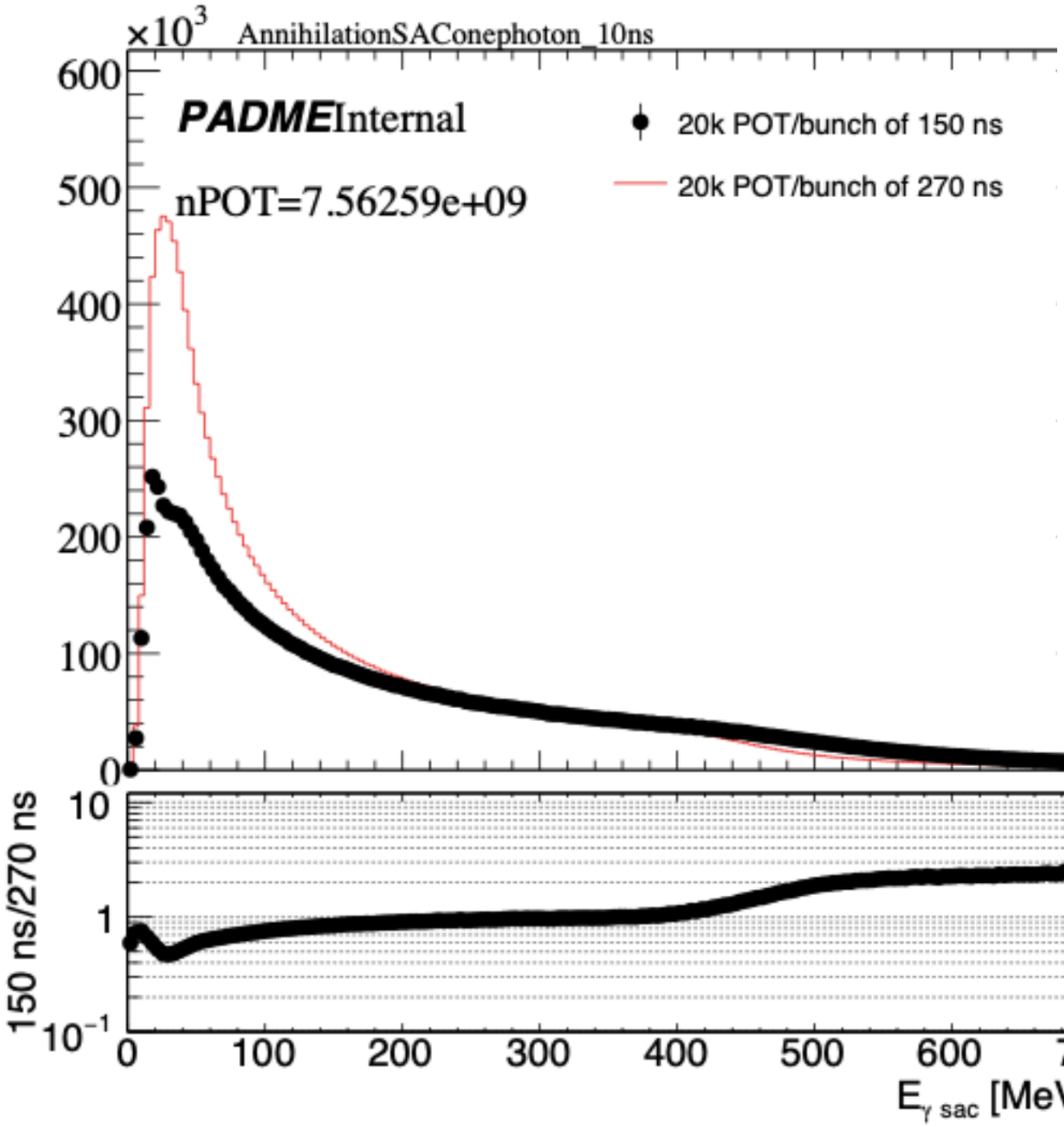


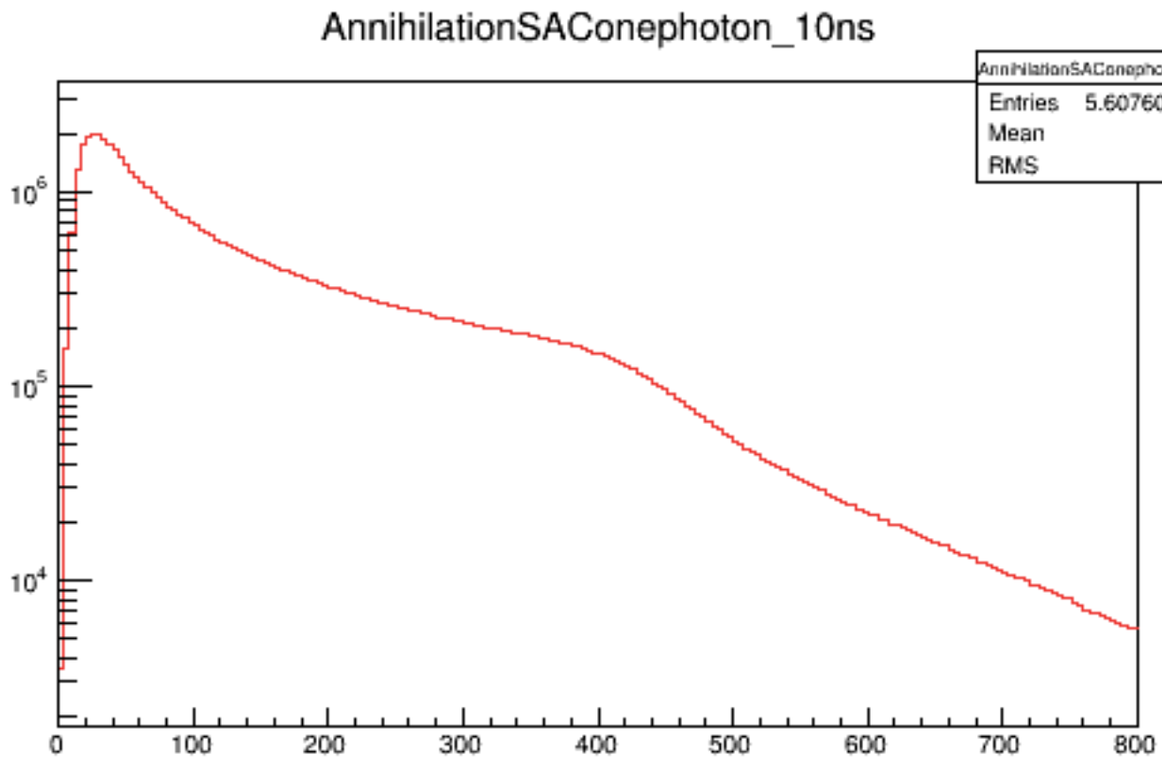
About SAC

- No ncluster saturation in run 30294



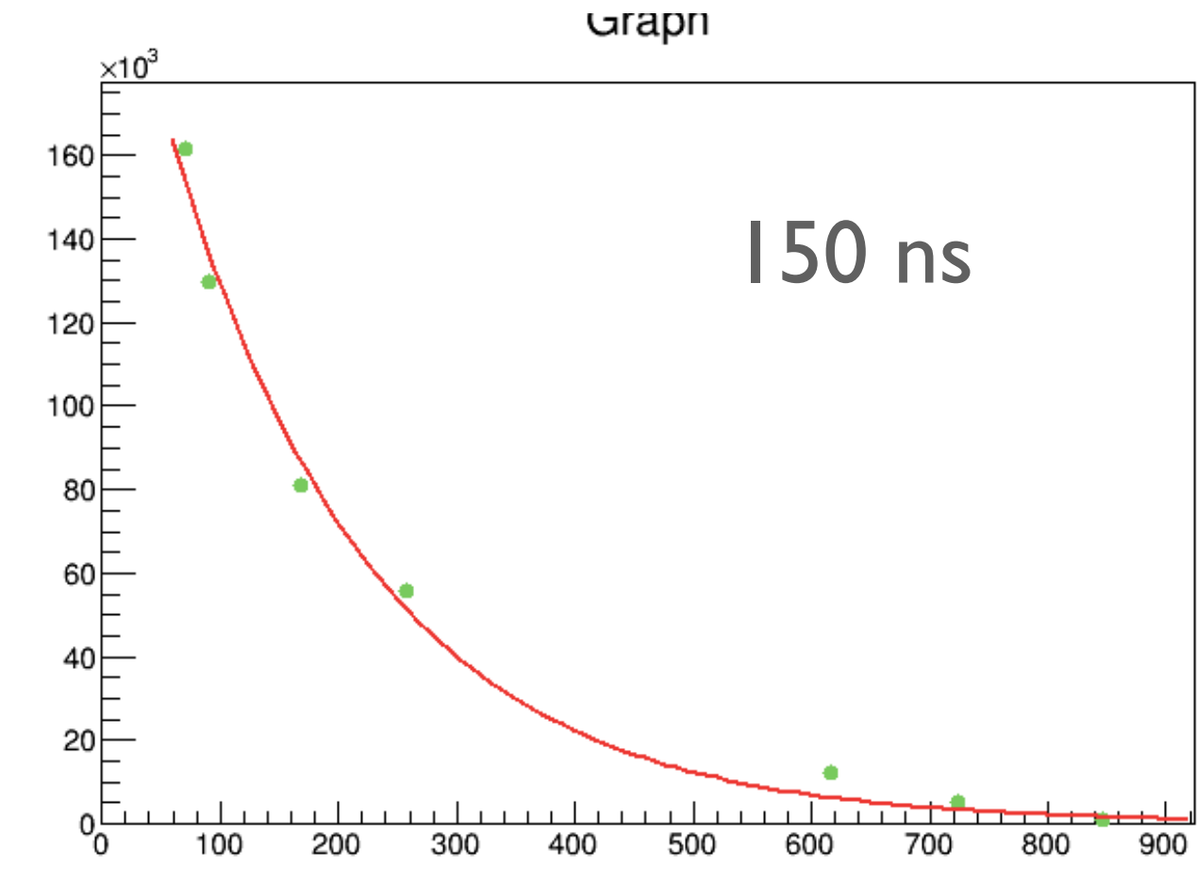
ANNIHILATION IN SAC

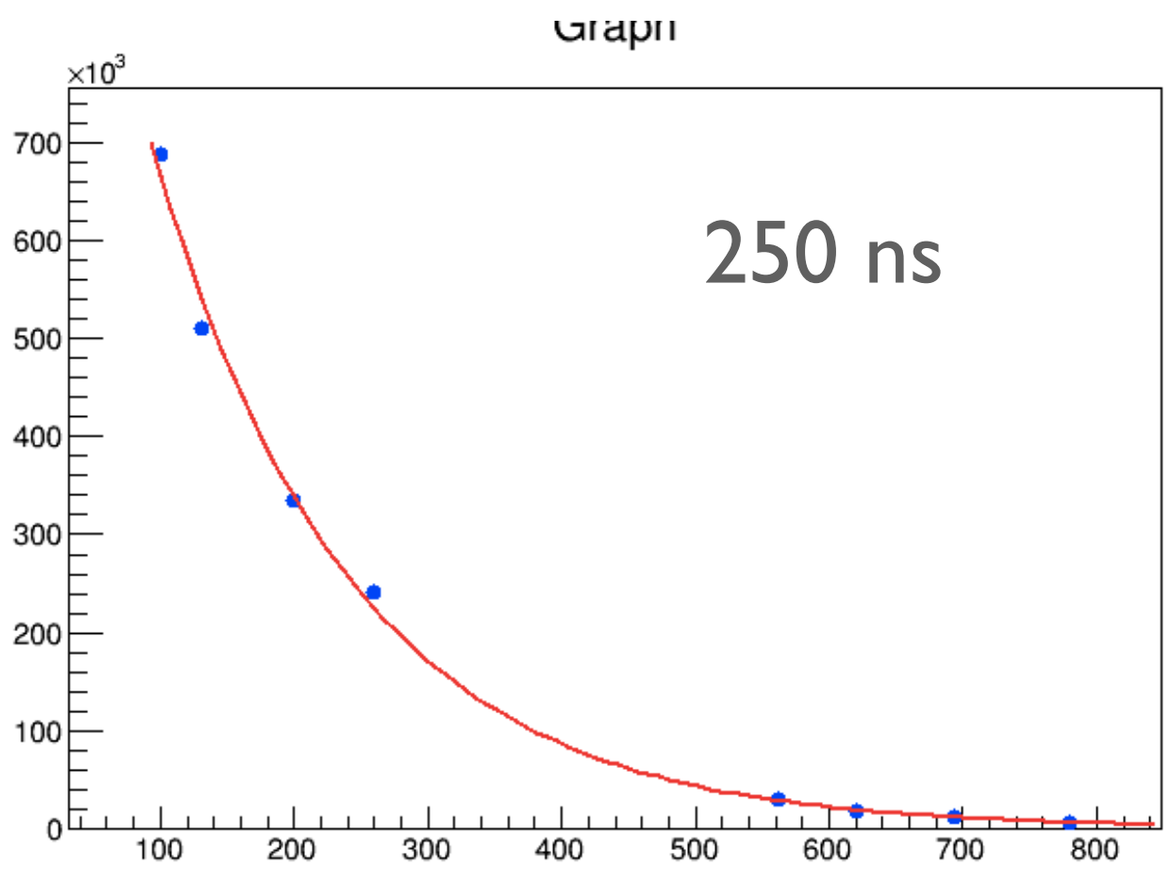




Only one photon in sac
Time window 10ns

BACKGROUND






```
Minimizer is Minuit / Migrad
Chi2                      =  2.08712e+08
NDf                       =           5
Edm                       =   7.0214e-08
NCalls                    =          66
Constant                  =     12.3563   +/-   0.0655953
Slope                     =  -0.00585415   +/-   0.000581934
```

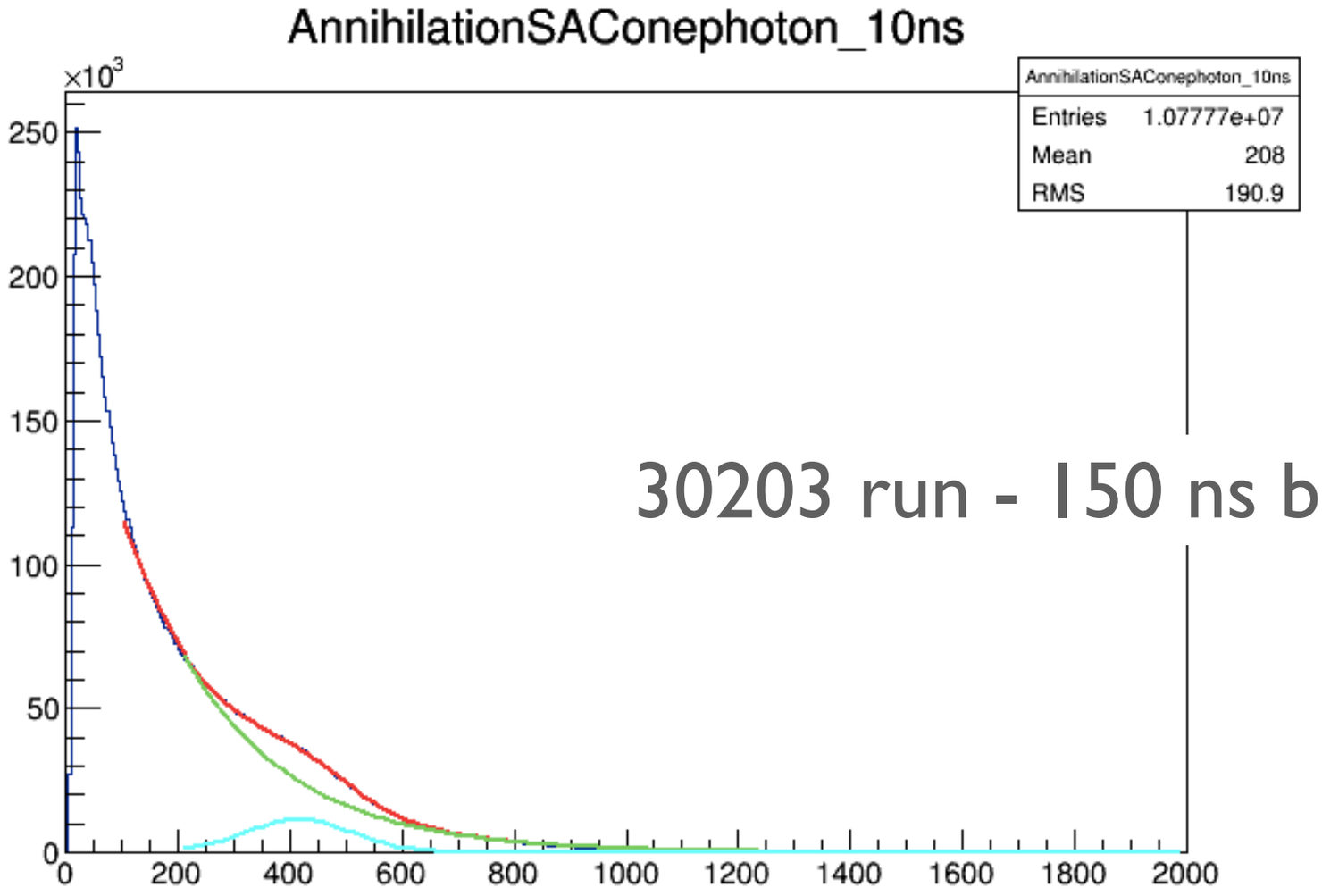
```
Minimizer is Minuit / Migrad
Chi2                      =  1.58686e+09
NDf                       =           6
Edm                       =  1.36763e-07
NCalls                    =          67
Constant                  =     14.0899   +/-   0.0507119
Slope                     =  -0.00679729   +/-   0.000360405
```

NPOT=6.15 x 1.23 x 10^9

ANNIHILATION IN SAC- EXTRACT NGG

- Amplitude 1.13398e+04 +/- 4.37279e+01
- Mean 4.15604e+02 +/- 3.93336e-01
- Sigma 9.86334e+01 +/- 4.85952e-0

ng: 700896



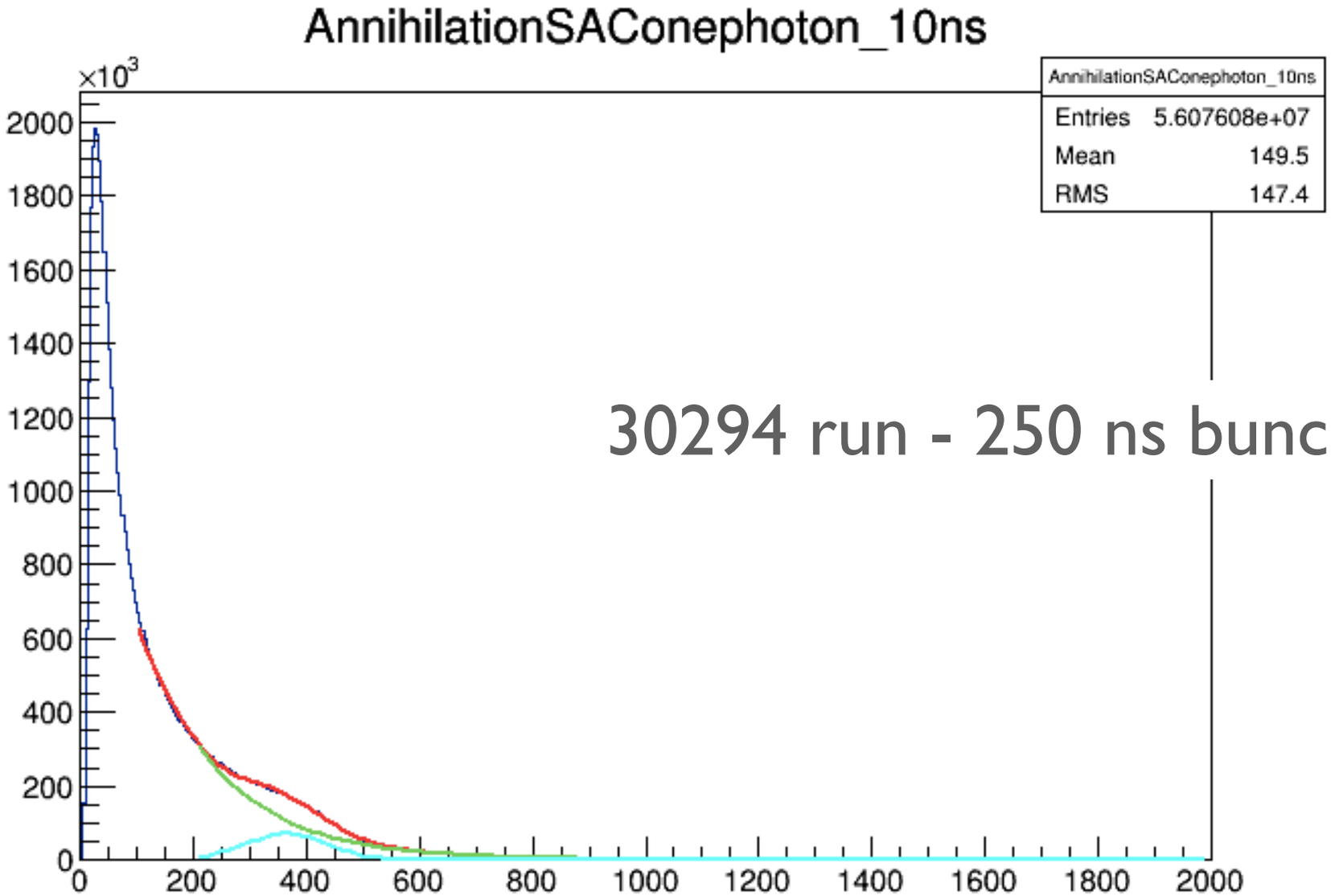
30203 run - 150 ns bunch length

NPOT=3.16 x 10^10

ANNIHILATION IN SAC- EXTRACT NGG

- Amplitude 6.98802e+04 +/- 9.59438e+01
- Mean 3.62677e+02 +/- 1.22274e-01
- Sigma 7.44911e+01 +/- 1.19025e-01

ng: 3.26203e+06



30294 run - 250 ns bunch length

COMPARISON SAC ANNIHILATION

- nPOT (150 ns) = 6.15 x 1.23 x 10^9 = 7.56 x 10^9
- nPOT (250 ns) = 3.16 x 10^10

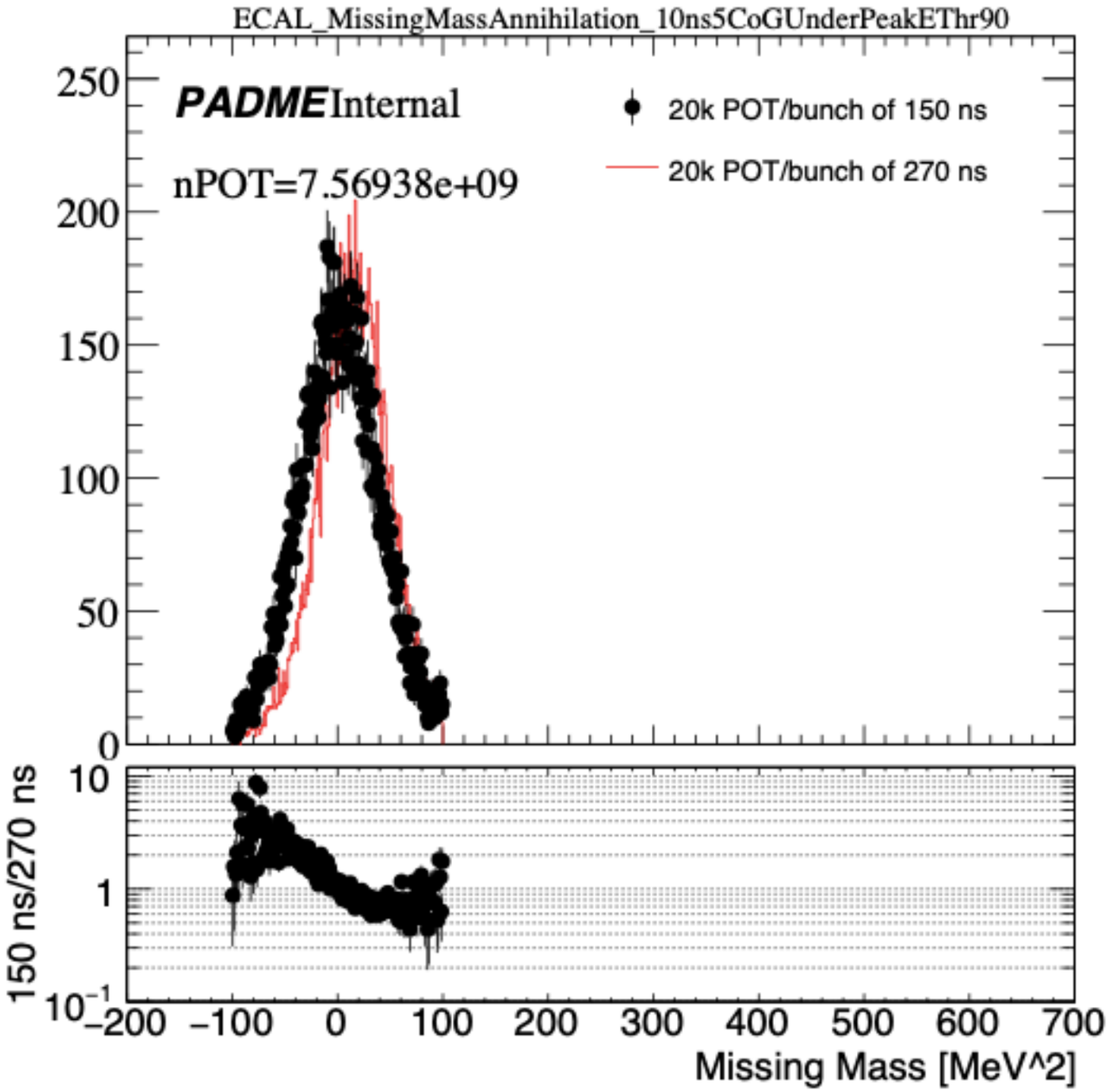
- Scale factor = nPOT(250)/nPOT(150)= 4.2

- Ngg(150)= 700896 x 4.2 = 2.9 x 10^5
- Ngg(250)= 3.3 x 10^6
- -> ngg(150)/ngg(250)=0.087

- First acceptance estimation in SAC:
  - At least one photon : 0.779225
  - Both photon: 0.0694819
  - -> if nPOT=3.16 x 10^10
    - ->ngg in sac = 4.007 x 10^5

MISSING MASS RESOLUTION

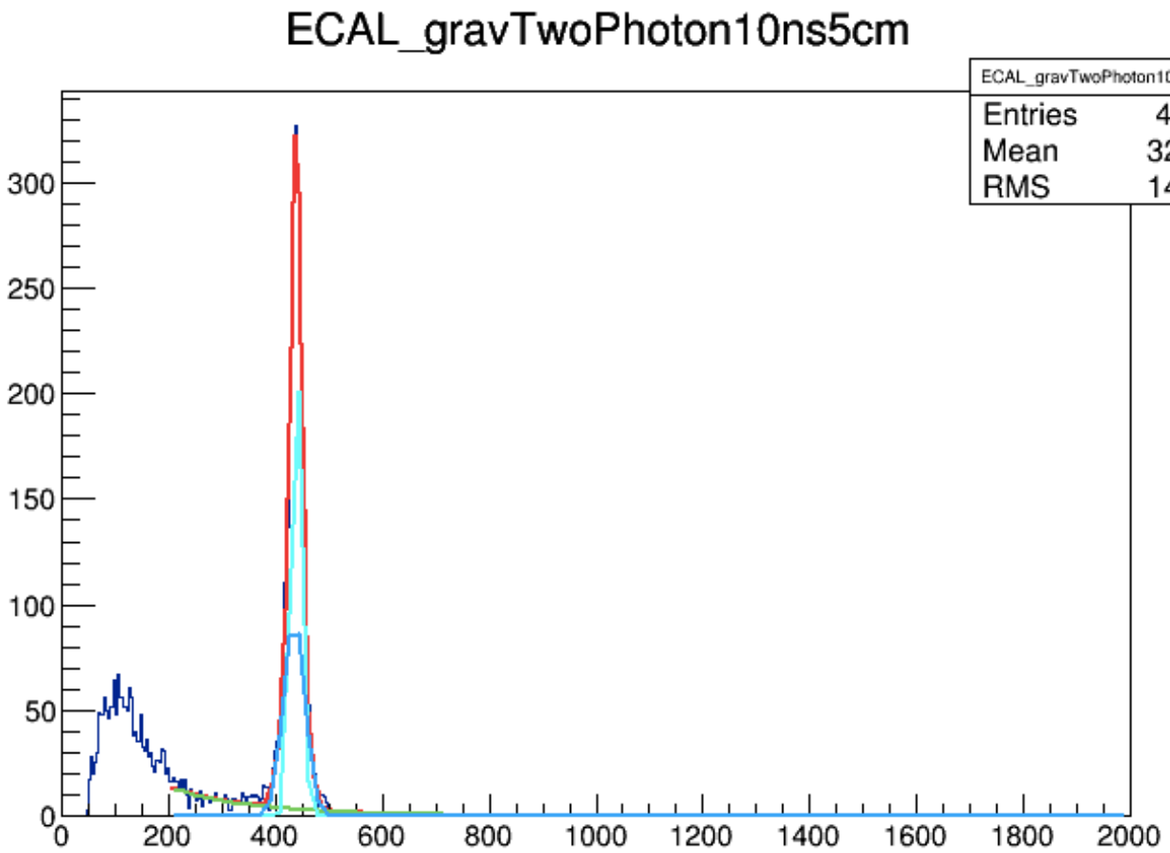
- Same missing mass resolution
  - Missing mass of the annihilation photon
  - Selection:
    - $\Delta t < 10$ ns
    - $R_\gamma \in FR$
    - $CoG < 5$ cm
    - E_{thr}

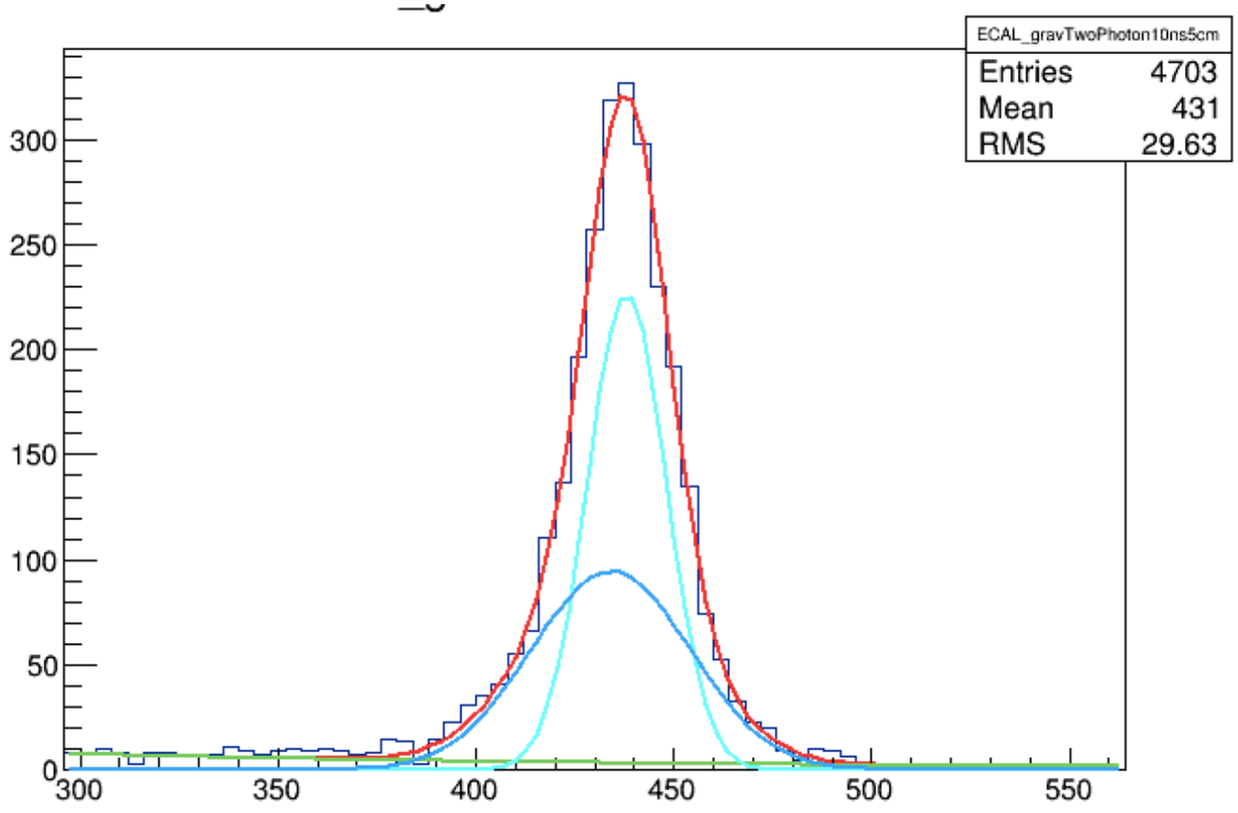


Next steps

- Define a normalisation method
- Compare the number of ggYield for the different samples
  - Perform better the fit to extract the annihilation yield, up to now the target-no target method gives us a different value of gg yield from the fit method!
- Use some variables to define what kind of beam we would like

SIGNAL+BACKGROUND FIT





LET'S STUDY THE ACCEPTANCE AND EFFICIENCY

ANNIHILATION YIELD FOR SEVERAL FIDUCIAL REGIONS (15K POT/BUNCH RUN)

R_{in}	R_{out}	ANGULAR CUT	ANGULAR CUT ETHR
70	280	5376	5272
90	260	5376	5272
110	240	5105	5051
130	220	3234	3210
150	200	1568	1550
160	190	650	645
90	280	5376	5272
110	280	5105	5051
130	280	3534	3517
150	280	1670	1641
160	280	721	698

ECAL ACCEPTANCE FROM **MC TRUTH**

Calchep

- acc ecal 50 300 0.10583
- acc ecal 92 258 (FR) 0.0776289

- acc ecal 70 280 0.0927949
- acc ecal 90 260 0.0790159
- acc ecal 110 240 0.0567079
- acc ecal 130 220 0.029979
- acc ecal 150 200 0.00833899
- acc ecal 160 190 0.0

- acc ecal 90 280 0.0924529
- acc ecal 110 280 0.0567079
- acc ecal 130 280 0.029979
- acc ecal 150 280 0.00833899
- acc ecal 160 280 0.0

From Reco->Analysis

- FR_10ns 0.0757
- FR_AngularCut 0.0757
- FR_5CoG 0.0743

- AngularCut_70_280 0.0757
- AngularCut_90_260 0.0757
- AngularCut_110_240 0.049
- AngularCut_130_220 0.0227
- AngularCut_150_200 0.0036
- AngularCut_160_190 0

- AngularCut_90_280 0.0757
- AngularCut_110_280 0.049
- AngularCut_130_280 0.0227
- AngularCut_150_280 0.0036
- AngularCut_160_280 0

E beam MC truth : 490 MeV

FIRST ESTIMATION OF RECONSTRUCTION EFFICIENCY

From Reco->Analysis/From simulation

- FR_10ns 0.975138

- AngularCut_70_280 0.815777
- AngularCut_90_260 0.958035
- AngularCut_110_240 0.864045
- AngularCut_130_220 0.757197
- AngularCut_150_200 0.431707
- AngularCut_160_190 /

- AngularCut_90_280 0.818795
- AngularCut_110_280 0.864077
- AngularCut_130_280 0.757197
- AngularCut_150_280 0.431707
- AngularCut_160_280 /

EXTRACTION OF #GG

$$N_{\gamma\gamma}^{tot} = \sigma(e^+e^- \to \gamma\gamma) \times \alpha_{geom} \times N_{POT} \times \frac{N_{e^-}}{S_{target}}$$

$\sigma(e^+e^- \to \gamma\gamma) = 1.55$ mb

$\frac{N_{e^-}}{S_{target}} = 0.0105\ \text{b}^{-1}$

$\alpha_{geom} =$ variable

~5.63 X 10^9 POT (15k sample)

ECAL ACCEPTANCE FROM MC TRUTH

Calchep

- acc ecal 50 300 0.10583
- acc ecal 92 258 (FR) 0.0776289

- acc ecal 70 280 0.0927949
- acc ecal 90 260 0.0790159
- acc ecal 110 240 0.0567079
- acc ecal 130 220 0.029979
- acc ecal 150 200 0.00833899
- acc ecal 160 190 0.0

- acc ecal 90 280 0.0924529
- acc ecal 110 280 0.0567079
- acc ecal 130 280 0.029979
- acc ecal 150 280 0.00833899
- acc ecal 160 280 0.0

Calchep-ngg

- 9700
- 7115

- 8506
- 7243
- 5198
- 2748
- 764
- 0

- 8474
- 5198
- 2748
- 764
- 0

ECAL ACCEPTANCE FROM MC TRUTH

From Reco->Analysis

- FR_10ns 0.0757
- FR_AngularCut 0.0757
- FR_5CoG 0.0743

- AngularCut_70_280 0.0757
- AngularCut_90_260 0.0757
- AngularCut_110_240 0.049
- AngularCut_130_220 0.0227
- AngularCut_150_200 0.0036
- AngularCut_160_190 0

- AngularCut_90_280 0.0757
- AngularCut_110_280 0.049
- AngularCut_130_280 0.0227
- AngularCut_150_280 0.0036
- AngularCut_160_280 0

From Reco->Analysis- ngg

- 6939
- 6939
- 6810

- 6938
- 6939
- 4491
- 2081
- 330
- 0

- 6939
- 4491
- 2080
- 330
- 0

ECAL ACCEPTANCE FROM MC TRUTH

From Reco->Analysis- ngg		From Data	Data/expetation
FR_10ns	6939	6401	0.92
FR_AngularCut	6939	5246	0.76
FR_5CoG	6810	5450	0.80

See slide

Using data in slide 46

- Acc in FR = 0.0776289
- Acc in FR x Eff(10ns, FR, 5CoG)=0.0743->
- Eff(10ns, FR, 5CoG)=0.96

- Using this theoretical acc and eff->data/ngg=0.8, this means that the other effects, like pileup, produces +20% inefficiency

~5.63 X 10^9 POT (15k sample)

ANNIHILATION YIELD FOR SEVERAL FIDUCIAL REGIONS (15K POT/BUNCH RUN)

		Data	Theoretical		
R_{in}	R_{out}	ANGULAR CUT	NGG-SIMULATION	NGG-RECONSTRUCTION	DATA/NGGRECO
70	280	5246	8507	6939	0.76
90	260	5246	7243	6939	0.76
110	240	4470	5198	4491	.995
130	220	3188	2748	2081	1.53
150	200	1557	764	330	4.71
160	190	651	0	0	/
90	280	5246	8474	6939	0.76
110	280	4995	5198	4491	1.11
130	280	3460	2748	2081	1.66
150	280	1624	764	330	4.92
160	280	693	0	0	/

E beam MC truth : 490 MeV

…NEW PRODUCTION…ECAL IN CALCHEP FILE

- I created a file txt with calchep events that are in ecal….the efficient is lightly different

From Reco->Analysis

- FR_10ns 0.697419
- FR_AngularCut 0.694457
- FR_5CoG 0.687076

Difference ->high statistic
->maybe MC sw
-same Reconstruction & develop software

- AngularCut_70_280 0.694457
- AngularCut_90_260 0.694457
- AngularCut_110_240 0.542895
- AngularCut_130_220 0.3228
- AngularCut_150_200 0.118781
- AngularCut_160_190 0.0195429

- AngularCut_90_280 0.694457
- AngularCut_110_280 0.568419
- AngularCut_130_280 0.32361
- AngularCut_150_280 0.118886
- AngularCut_160_280 0.0196095

E beam MC truth : 490 MeV

TO BE SURE OF THE ACCEPTANCE RESULTS

- I generated a new sample with all calchep events…
  - Calchep events in 4pi are 10^6
  - Cutting the events that do not hit ecal ([50,300]), I have 105381 events
  - Acc->10.5% !according to result of slide

  - Of this 105381 ev:
  - acc ecal 50 300 1
  - acc ecal 92 258 (FR) 0.733519
  - acc ecal 70 280 0.876822
  - acc ecal 90 260 0.746605
  - acc ecal 110 240 0.535835
  - acc ecal 130 220 0.283272
  - acc ecal 150 200 0.078786
  - acc ecal 160 190 0

  - acc ecal 90 280 0.8736
  - acc ecal 110 280 0.535835
  - acc ecal 130 280 0.283272
  - acc ecal 150 280 0.078786
  - acc ecal 160 280 0

Calchep

If I compute 0.105*0.876822=0.92->same acc of slide

…NEW PRODUCTION…ECALFR IN CALCHEP FILE

- I created a file txt with calchep events that are in FR ecal [92,258]

From Reco->Analysis

- FR_10ns 0.944832
- FR_AngularCut 0.94259
- FR_5CoG 0.932397

- AngularCut_70_280 0.94259
- AngularCut_90_260 0.94259
- AngularCut_110_240 0.739974
- AngularCut_130_220 0.441598
- AngularCut_150_200 0.162809
- AngularCut_160_190 0.0273454

- AngularCut_90_280 0.94259
- AngularCut_110_280 0.775528
- AngularCut_130_280 0.442784
- AngularCut_150_280 0.162899
- AngularCut_160_280 0.0274098

E beam MC truth : 490 MeV

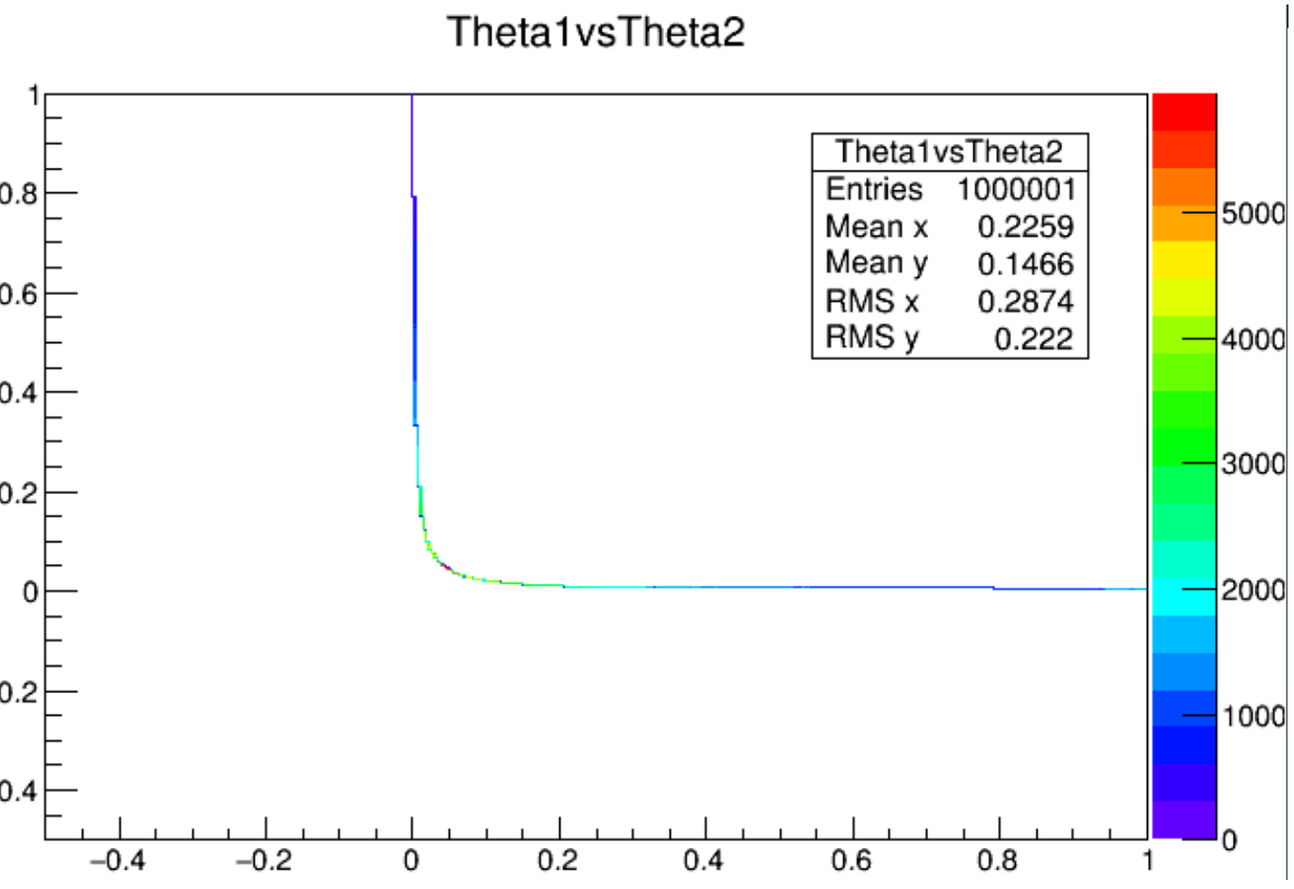
TO BE SURE OF THE ACCEPTANCE RESULTS

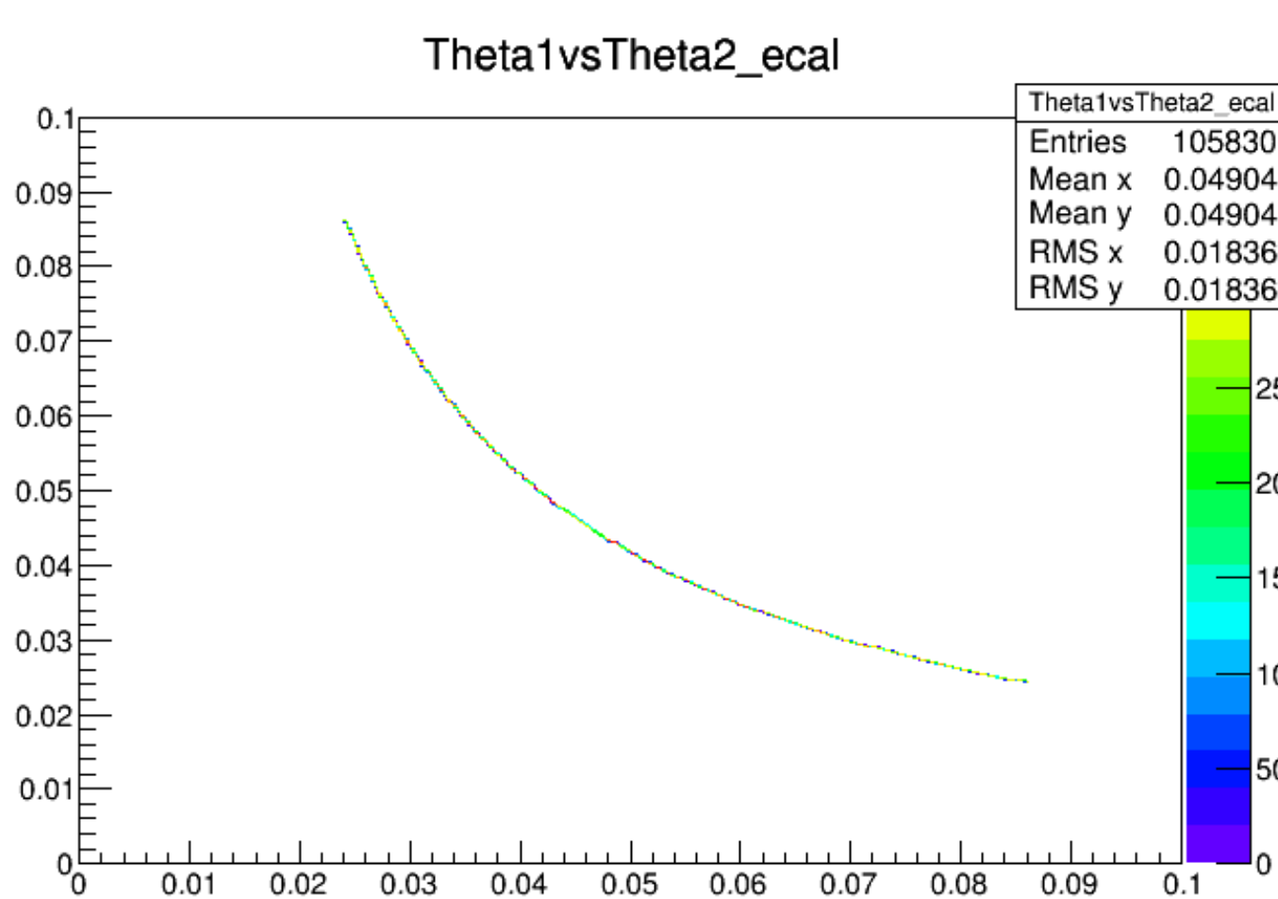
- I generated a new sample with all calchep events…
  - Calchep events in 4pi are 10^6
  - Cutting the events that do not hit ecal ([92,258]), I have 77630 events
  - Acc->7.8% !according to result of slide

Calchep

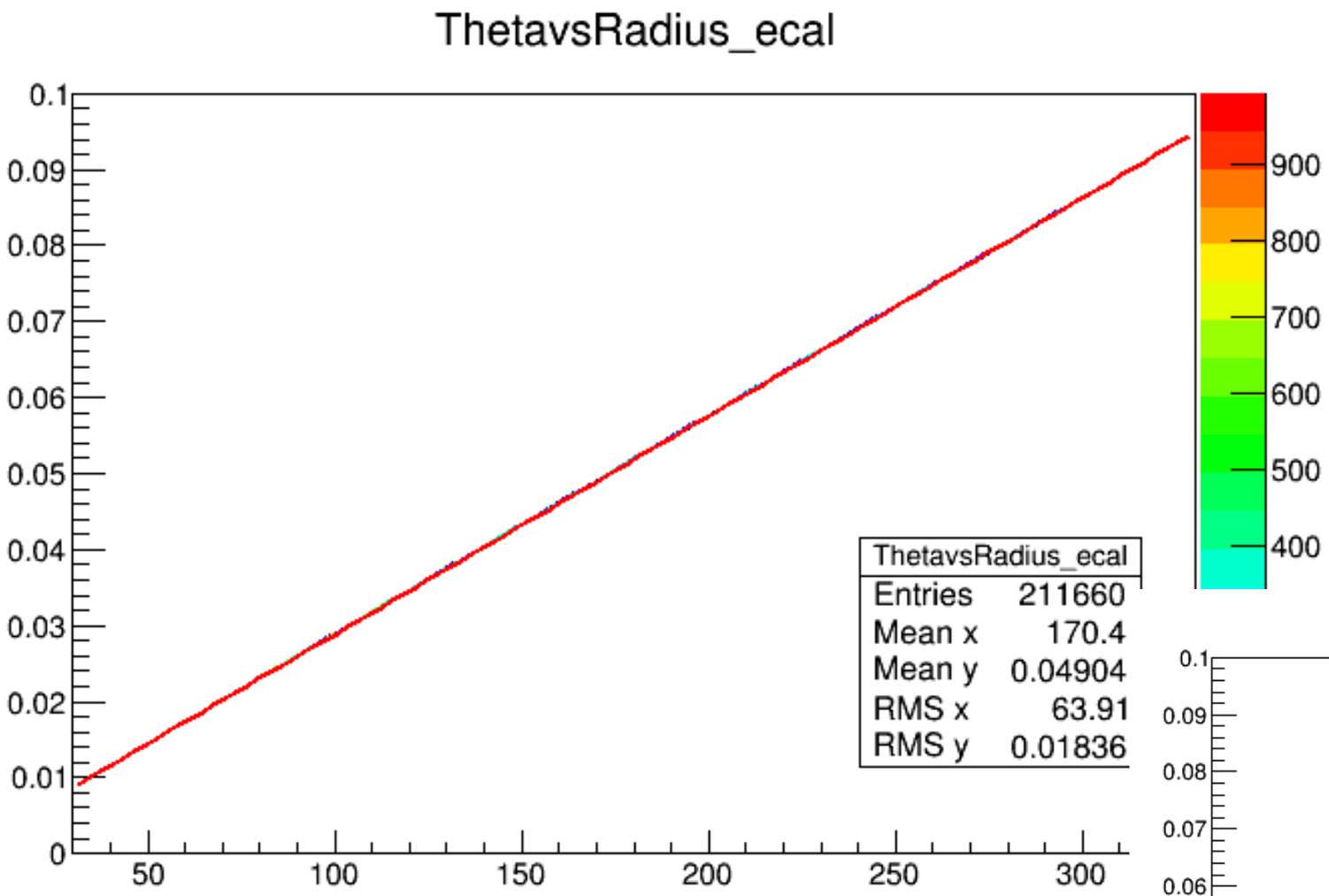
  - Of this 77630 ev:
  - acc ecal 50 300 1
  - acc ecal 92 258 (FR) 1
  - acc ecal 70 280 1
  - acc ecal 90 260 1
  - acc ecal 110 240 0.730504 → If I compute 0.077630*0.730504=0.567->same acc of slide
  - acc ecal 130 220 0.386191
  - acc ecal 150 200 0.107407
  - acc ecal 160 190 0
  - acc ecal 90 280 1
  - acc ecal 110 280 0.730504
  - acc ecal 130 280 0.386191
  - acc ecal 150 280 0.107407
  - acc ecal 160 280 0

THETA DISTRIBUTION FROM CALCHEP

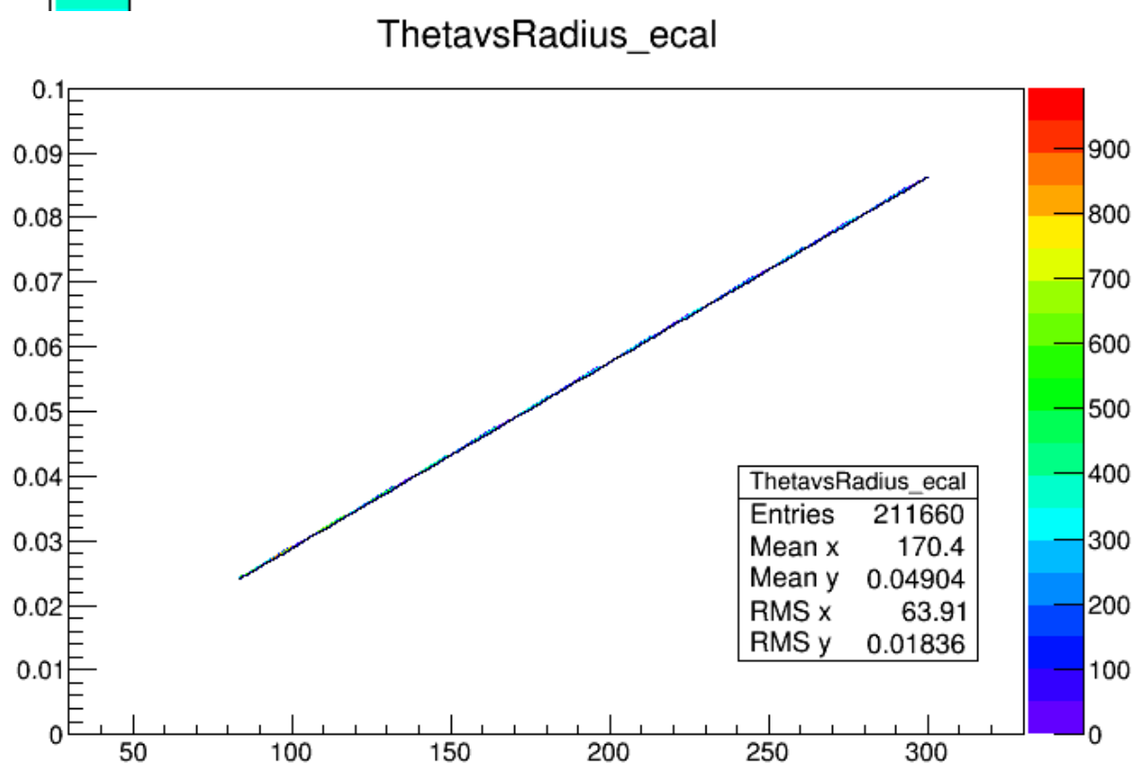




FUNCTION TO CONVERT RADIUS IN THETA




```
Minimizer is Linear
Chi2                      =  2.61087e+14
NDf                       =          362
p0                        =  9.72089e-05   +/-   6.69937e-12
p1                        =  0.000287325   +/-   4.91458e-14
```



THETA-RADIUS CORRISPONDENTE

RADIUS	THETA
50	1.45e-02
92	2.65e-02
110	3.17e-02
130	3.74e-02
150	4.32e-02
160	4.60e-02
190	5.47e-02
200	5.76e-02
220	6.33e-02
240	6.91e-02
260	7.48e-02
280	8.05e-02
300	8.62e-02

Extraction of #gg - If I add the reconstruction efficiency

$$N_{\gamma\gamma}^{tot} = \sigma(e^+e^- \to \gamma\gamma) \times \alpha_{geom} \times \epsilon \times N_{POT} \times \frac{N_{e^-}}{S_{target}}$$

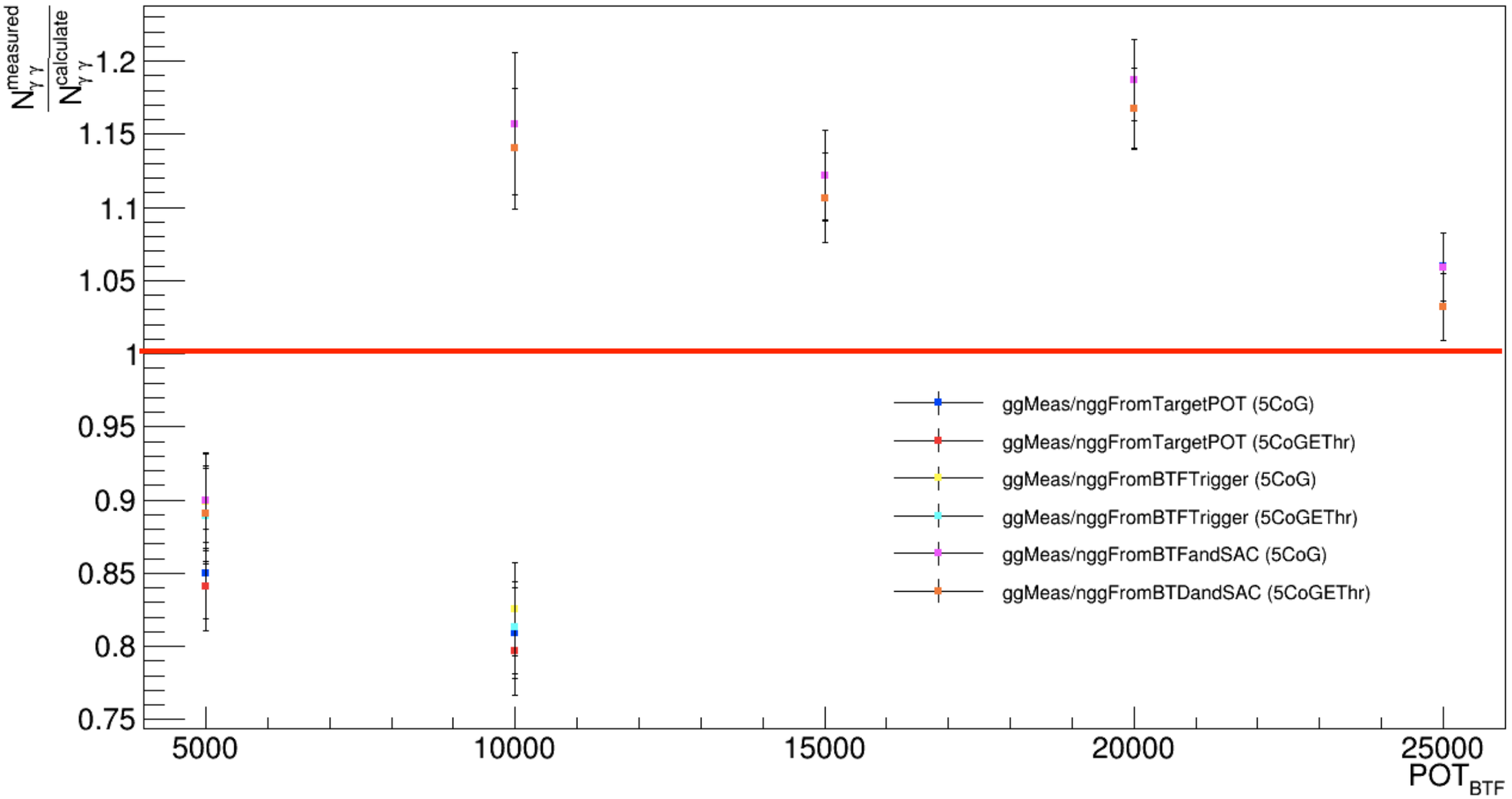
$$\sigma(e^+e^- \to \gamma\gamma) = 1.55 \text{ mb}$$

$$\frac{N_{e^-}}{S_{target}} = 0.0105 \text{ b}^{-1}$$

$$\alpha_{geom}^{FR} = 0.0776289$$

$$\epsilon^{10ns;FR} = 0.697419$$

- An efficiency of ~70% seems be so low



To understand

- Why the acceptance change differently in DATA and MC when I change FR !!!

- Federica Giacchino said me that the file calchep used for this studies is generated with a wrong alpha
  - alpha_em wrong: 1/127.4 ; cross-section -> 2.11*10^9pb
  - alpha_em ok: 1/137.0359895 ; cross-section ->1.841*10^9pb

- I think that this mistake doesn’t change the situation, but to be sure Federica gives me catchup file generated with the right alpha and an energy of the beam of 450 MeV (the old one is 490 MeV)

MC TRUTH ACCEPTANCE - E BEAM 450 MEV

Calchep

- acc ecal 50 300 0.011144
- acc ecal 92 258 (FR) 0.007998

- acc ecal 70 280 0.009667
- acc ecal 90 260 0.008145
- acc ecal 110 240 0.006593
- acc ecal 130 220 0.00419
- acc ecal 150 200 0.001686
- acc ecal 160 190 0.000588

- acc ecal 90 280 0.009667
- acc ecal 110 280 0.007325
- acc ecal 130 280 0.00419
- acc ecal 150 280 0.001686
- acc ecal 160 280 0.000588

From Reco->Analysis

- FR_10ns 0.069336
- FR_AngularCut 0.068853
- FR_5CoG 0.068053

- AngularCut_70_280 0.068853
- AngularCut_90_260 0.068853
- AngularCut_110_240 0.056223
- AngularCut_130_220 0.03935
- AngularCut_150_200 0.019263
- AngularCut_160_190 0.008002

- AngularCut_90_280 0.068853
- AngularCut_110_280 0.066018
- AngularCut_130_280 0.042586
- AngularCut_150_280 0.019724
- AngularCut_160_280 0.008148

…CALCHEP FILES 490 MEV AND 450 MEV HAVE DIFFERENT THETA DISTRIBUTION!