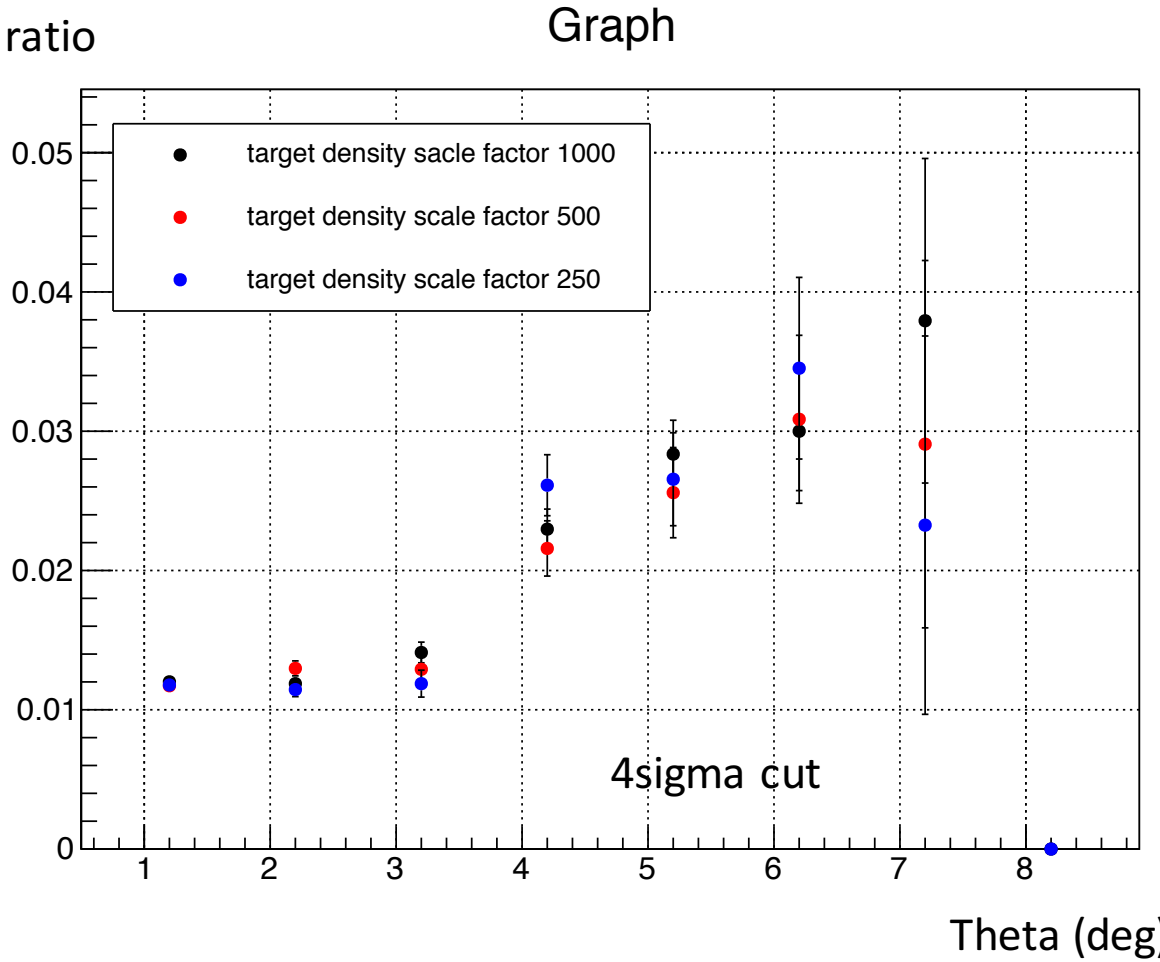
Progress

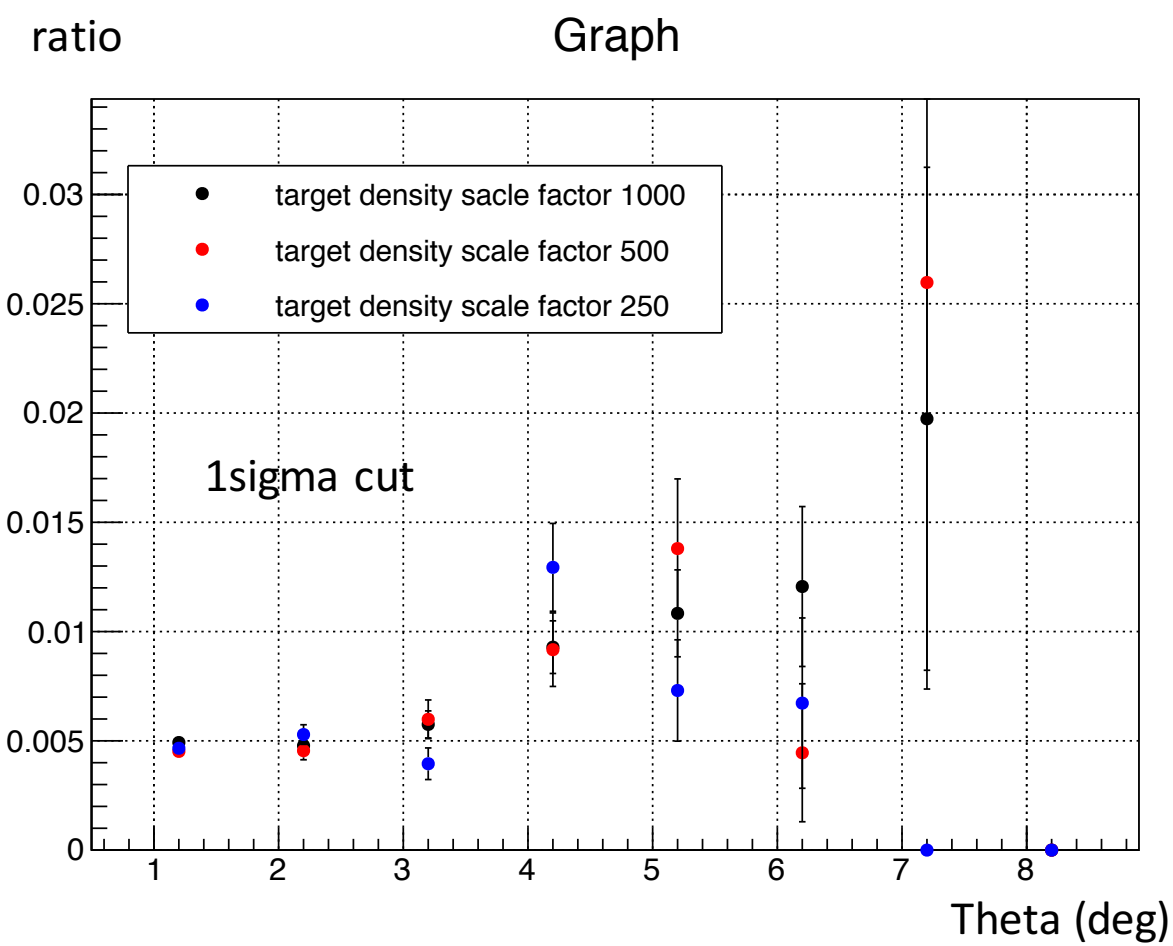
- Finished running beam on target simulation with target density scaling factor 250, 500 and 1000
- Will run empty target simulation and more detailed beam on target simulation with reaction ID and vertex z recorded

- Have set up the decoder of snake runs based on Maxime's code, and have started the analysis for a small part of the data
- So far distributions seem reasonable, have been discussing with Chao about how to move on

Beam on target simulation

High energy photon yield / high energy electron yield

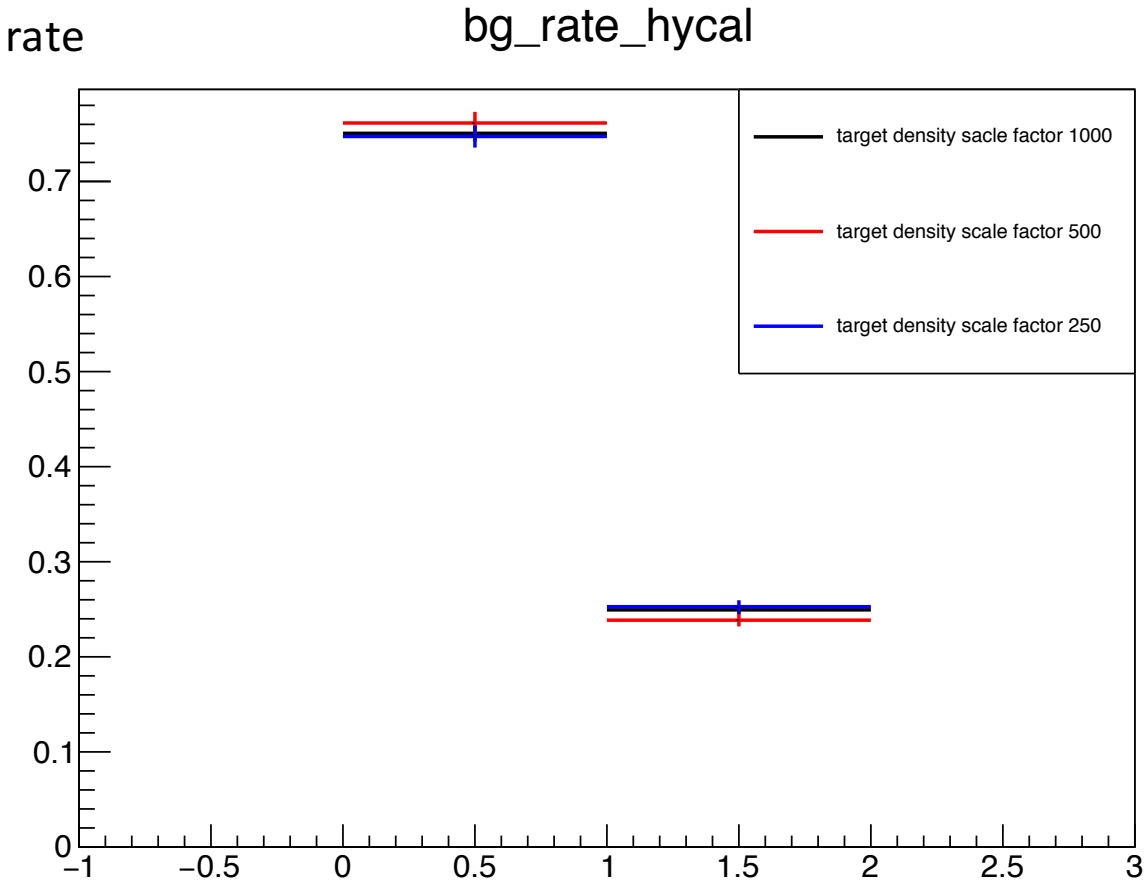




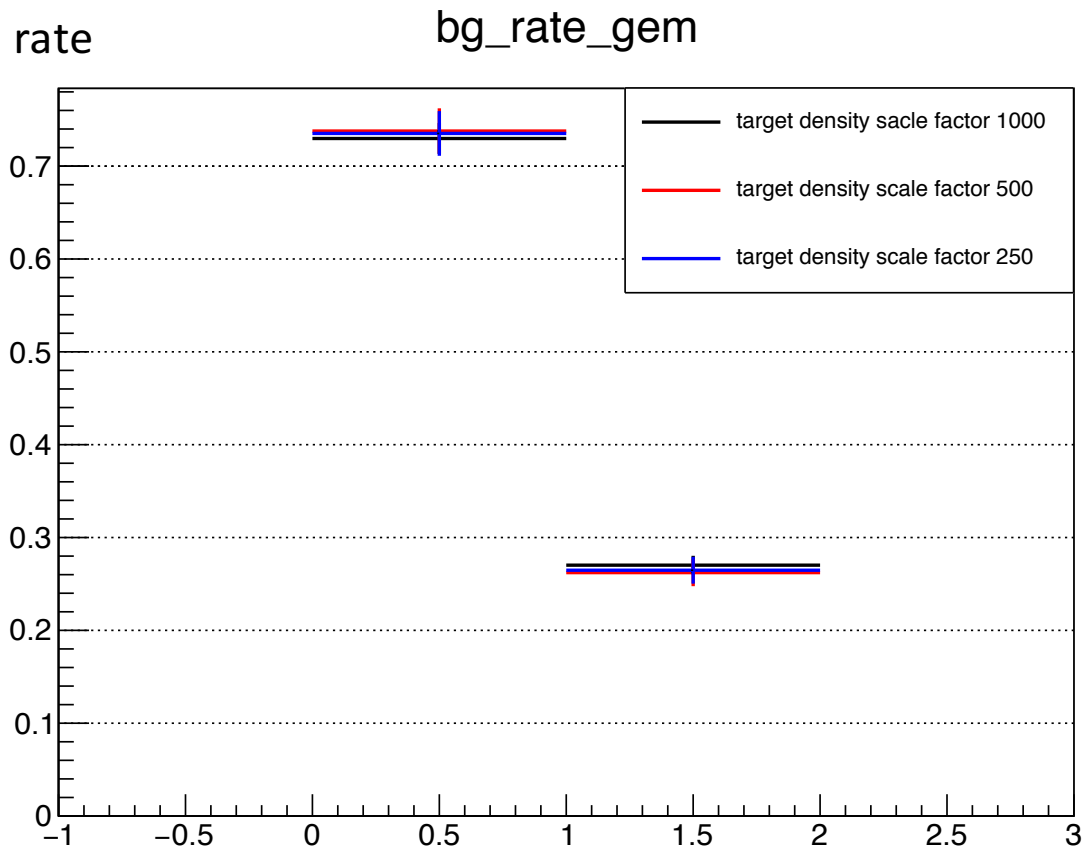
Beam on target simulation

- 0 means there is at least 1 charged particle within 10mm radius around the high energy photon
- 1 means there is no charged particle within 10mm radius around the high energy photon

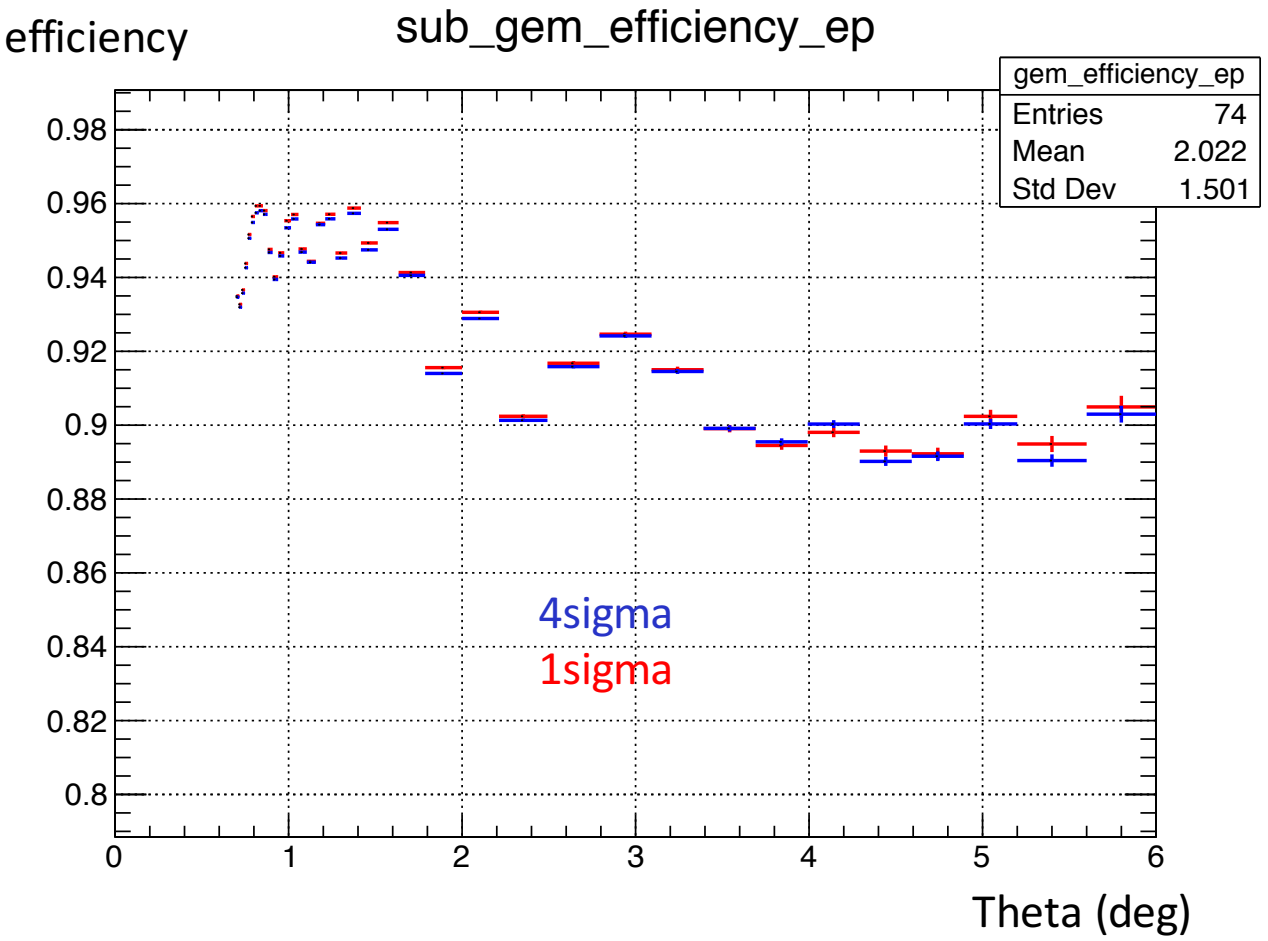
ep elasticity cut for analysis – 4sigma

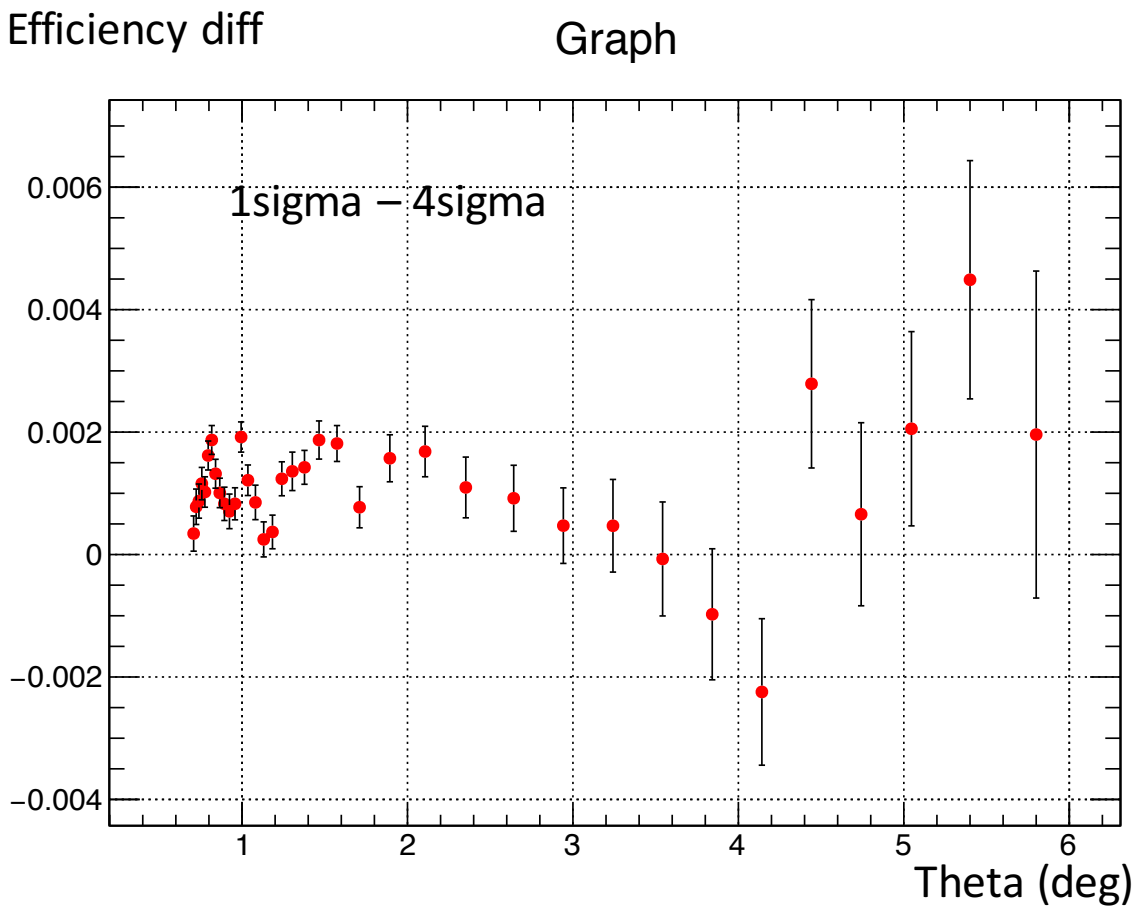


ep elasticity cut for GEM efficiency calculation– 1sigma



ep GEM efficiency from data





Conclusion

- High energy photon to high energy electron ratio has nice linear scaling behavior on the target density so far

- High energy photon may lower the GEM efficiency calculated by ep, by at most ~0.3%
  - Actual number should be somewhat less than that due to single cluster cut applied in the GEM efficiency calculation

- Need to understand better the origin of those high energy photon
  1. If coming from Brem. Radiation due to external source, probably fine
  2. If coming from Brem. Radiation of target, then we have an extra background source

Trigger efficiency

- Have set up the decoder of snake runs based on Maxime's code, and have started the analysis for a small part of the data
- Using run 890 as example for today's presentation (beam hitting second row of LG, counting from the outer boundary)
- Going to show distributions for event selection cuts based on Maxime's tech note and then discuss how to get the trigger efficiency

Single tag photon, single cluster cut

- only 1 hit in tagger and 1 hit in HyCal
  → at low energy, there can be several events reconstructed in the tagger, they are then hard to identify with HyCal hits.

HyCal min cluster E cut

- $E_{HyCal} > 200\ MeV$
  → below this energy, the tagger E channel become to noisy

Transporter position cut

- $|x_{HyCal} - x_{transporter}| < 15\ mm$
  → this cut is performed to avoid photons from the halo, which create some noise. It corresponds to $\sim 1\sigma$ of the distribution Fig. 1. The variable $x_{transporter}$ is extracted using the files transporter_time_position_#run_number.txt that follows time linearly the transporter movement.

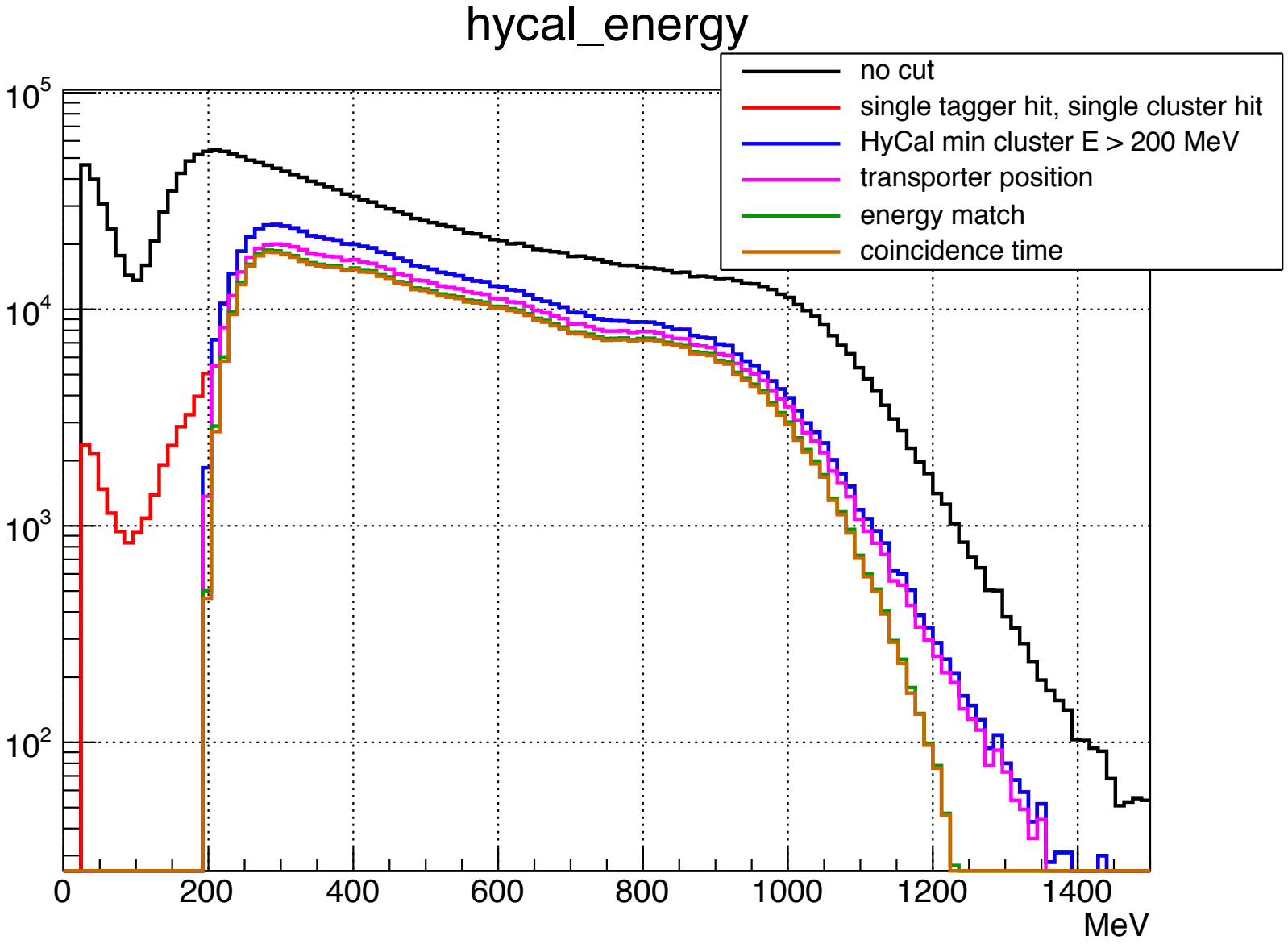
Coincidence time cut

- $|t_{tagger} - t_{HyCal} - t_{offset}| \leq 25ns$
  → This cut is performered to insure the matching of HyCal and the tagger. It also correspond with 1σ of the distribution Fig. 2. The variable t_{offset} is different for each run and each trigger, it is given in the file tagger_timings.txt (columns 1, 4 and 7).

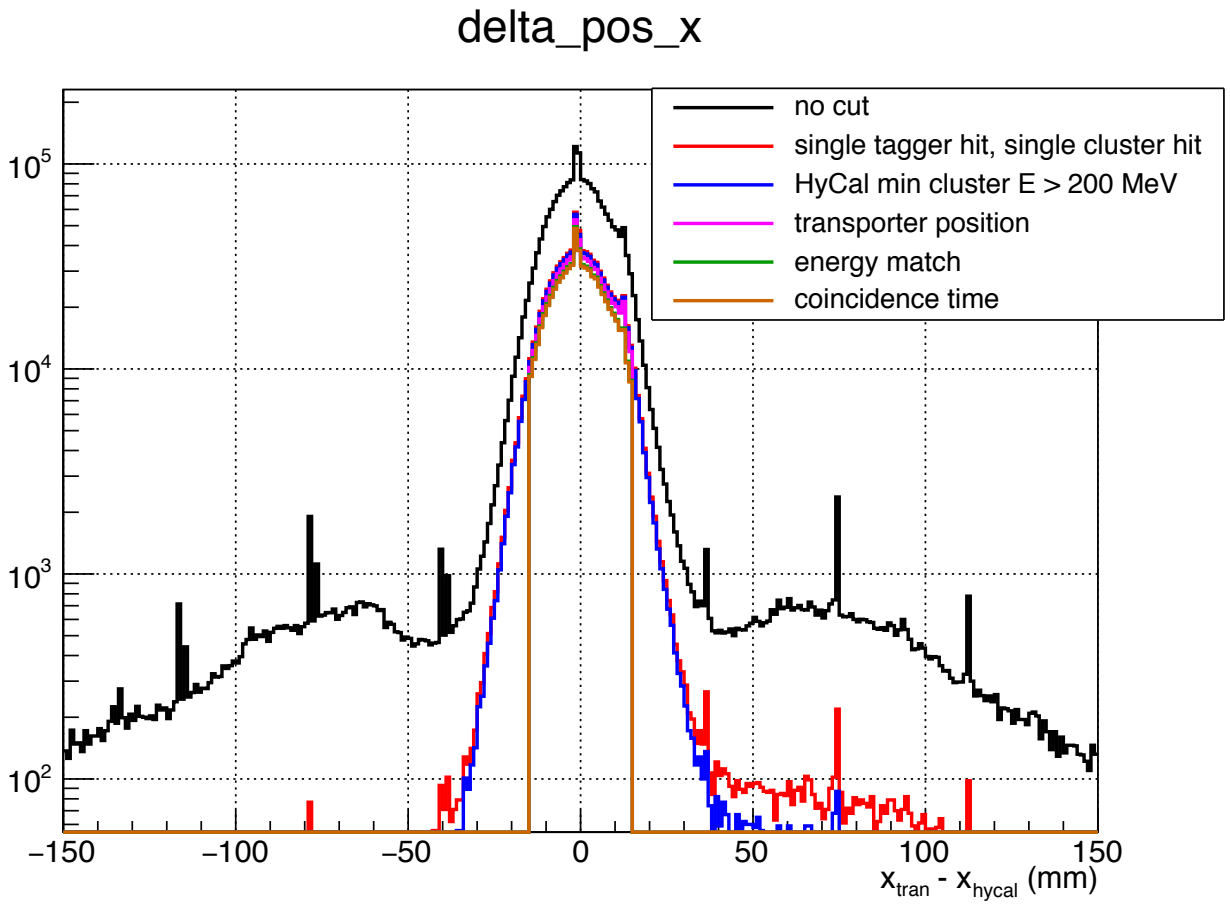
Energy matching cut

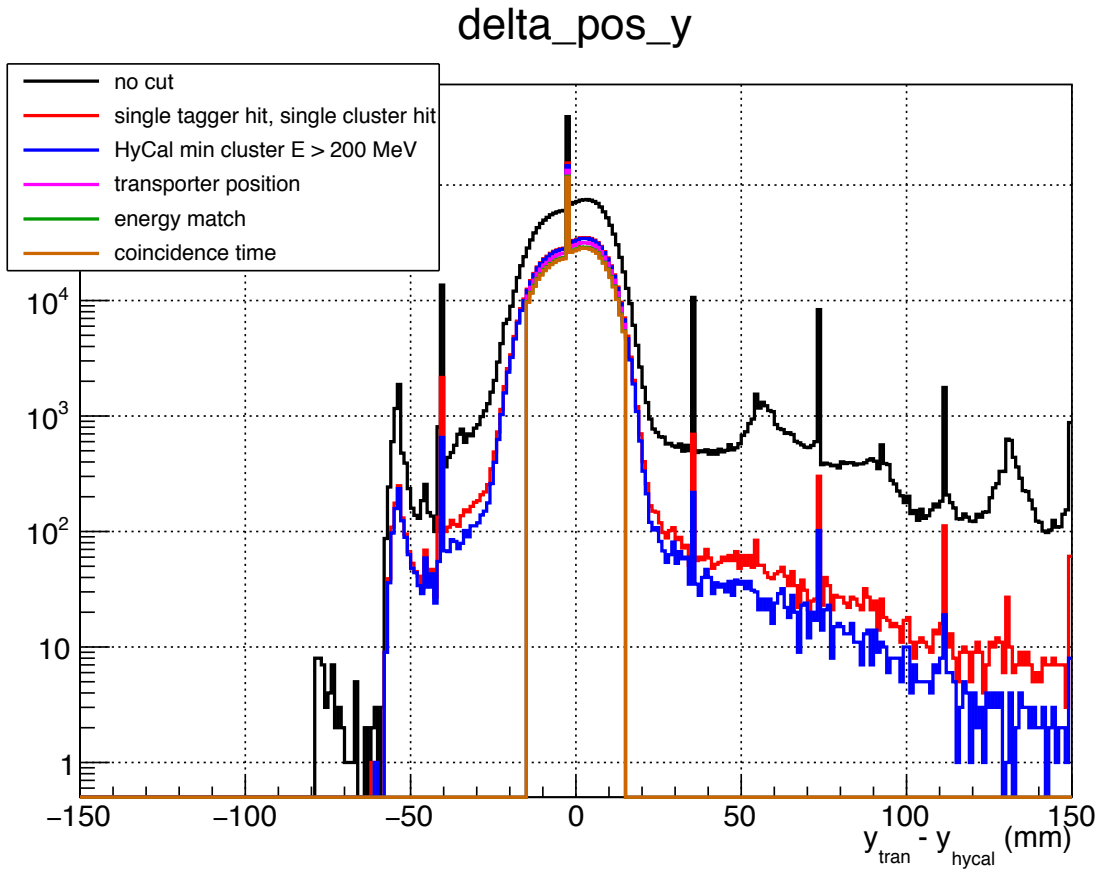
- $|E_{HyCal}/E_{tagger} - 1| < 3\sigma_{E_{HyCal}/E_{tagger}}$
  → This cut removes events badly reconstructed in the tagger Fig. 3

Cluster energy on HyCal

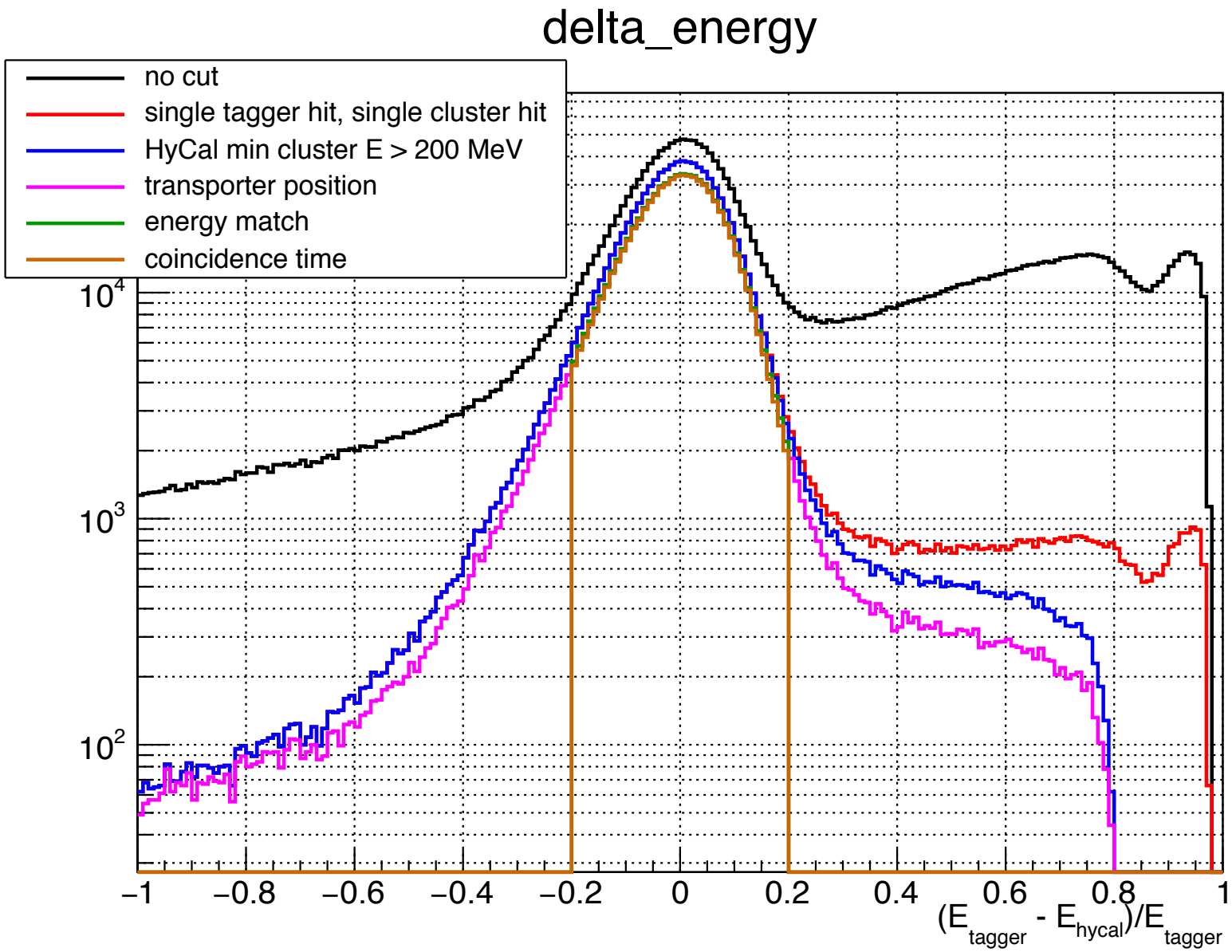


Transporter position – cluster position

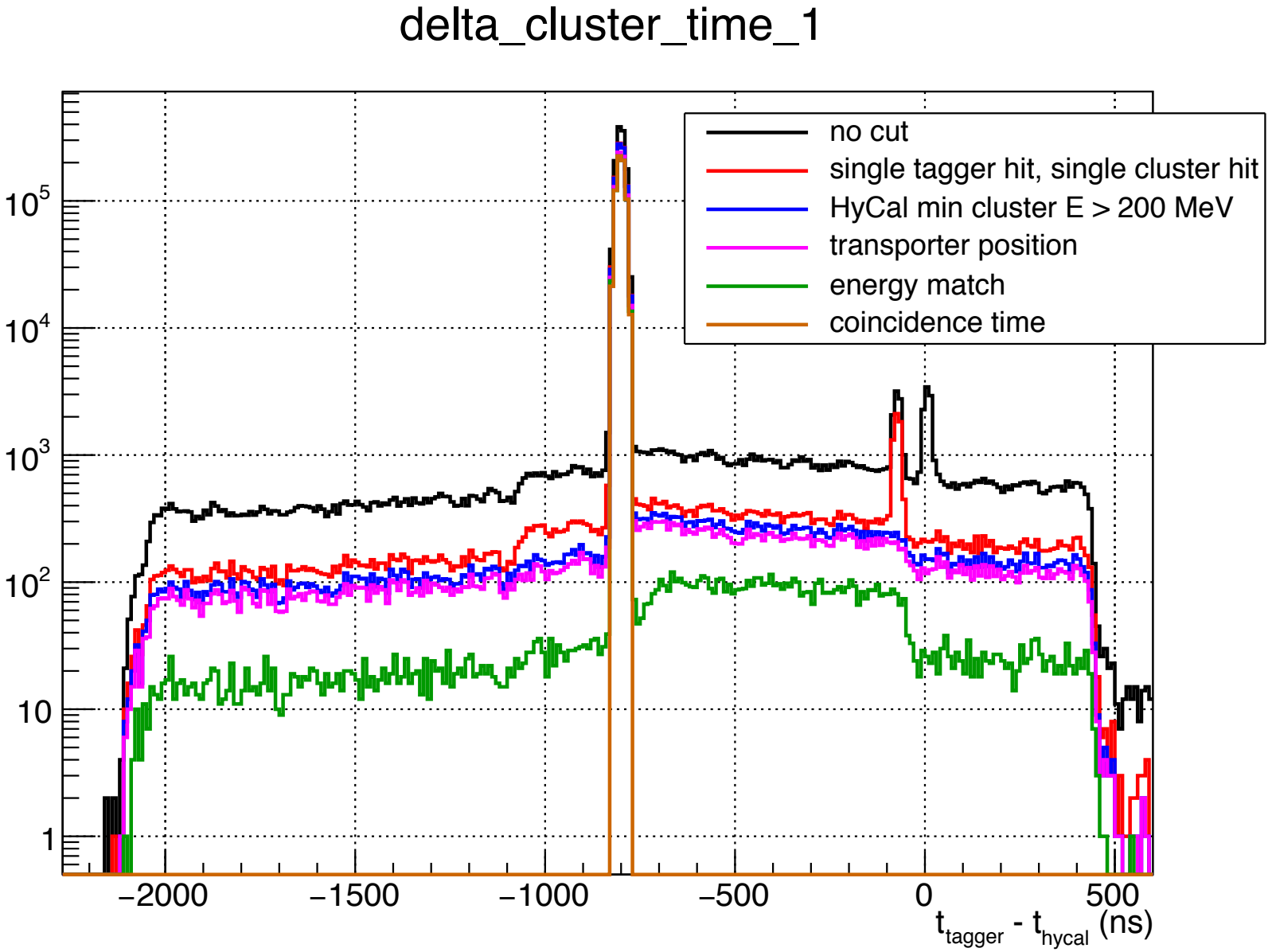




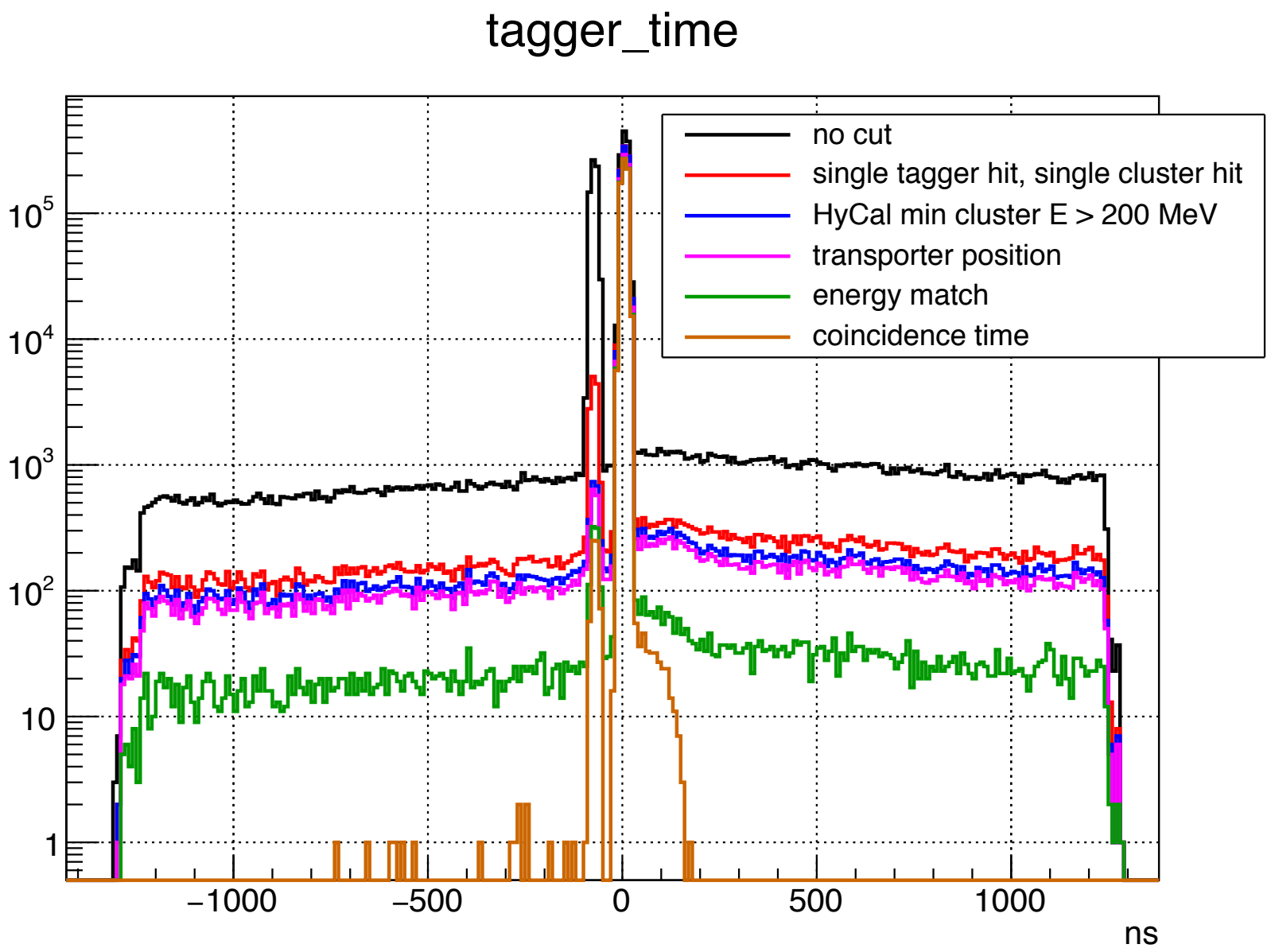
(Tag photon energy – cluster energy)/tag photon energy



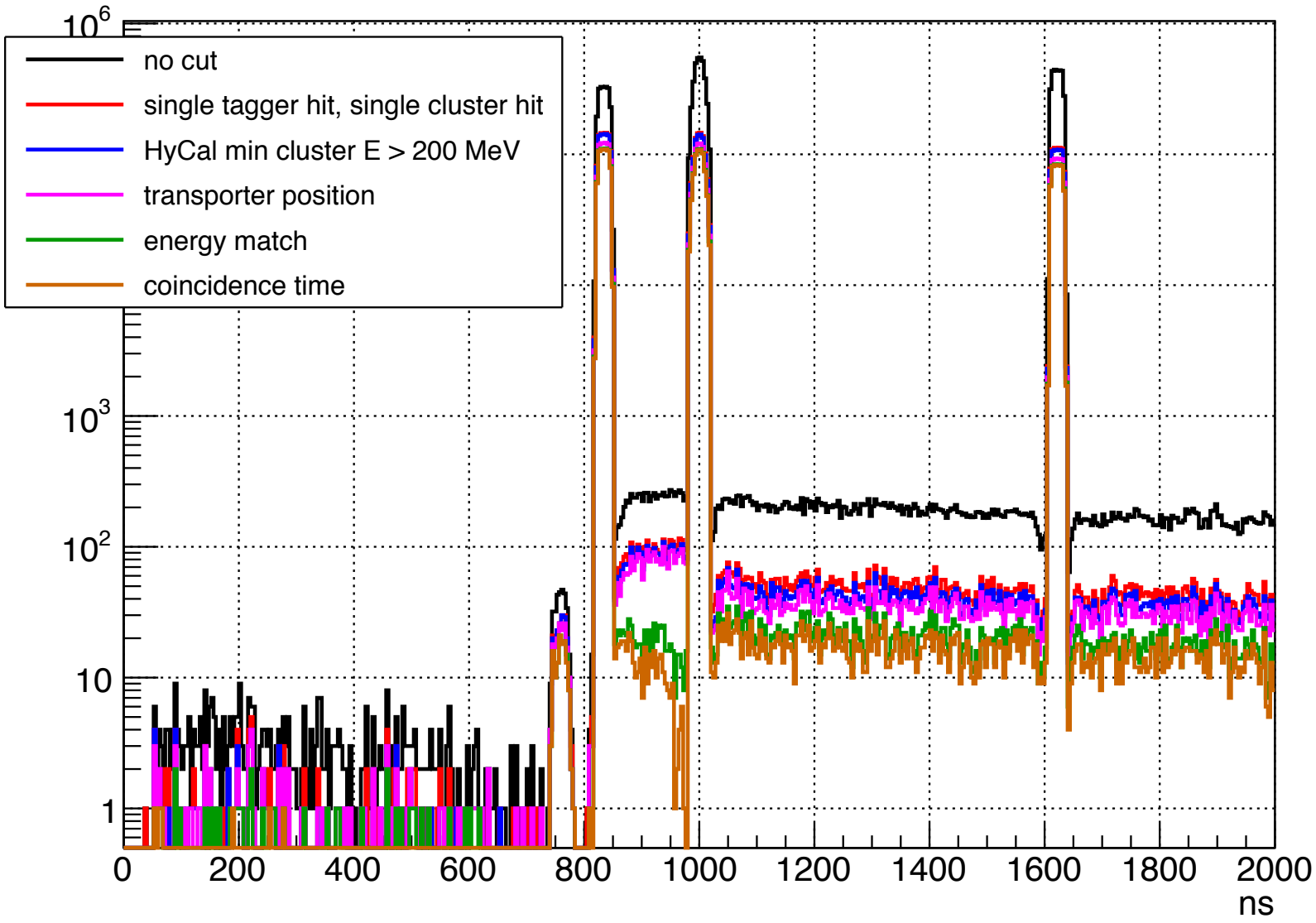
Tag photon time – cluster time



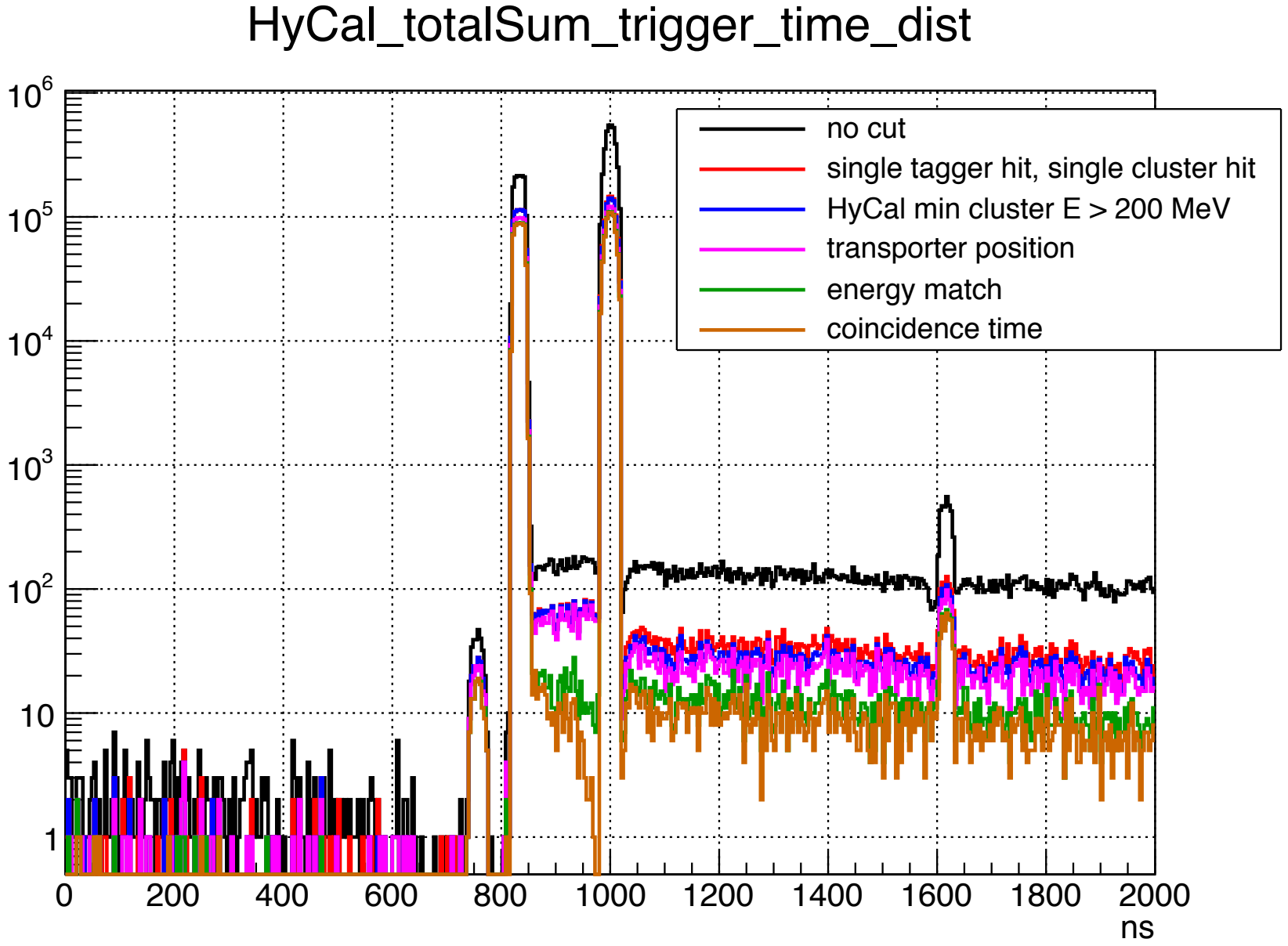
Tagger time distribution



LG sum trigger time distribution

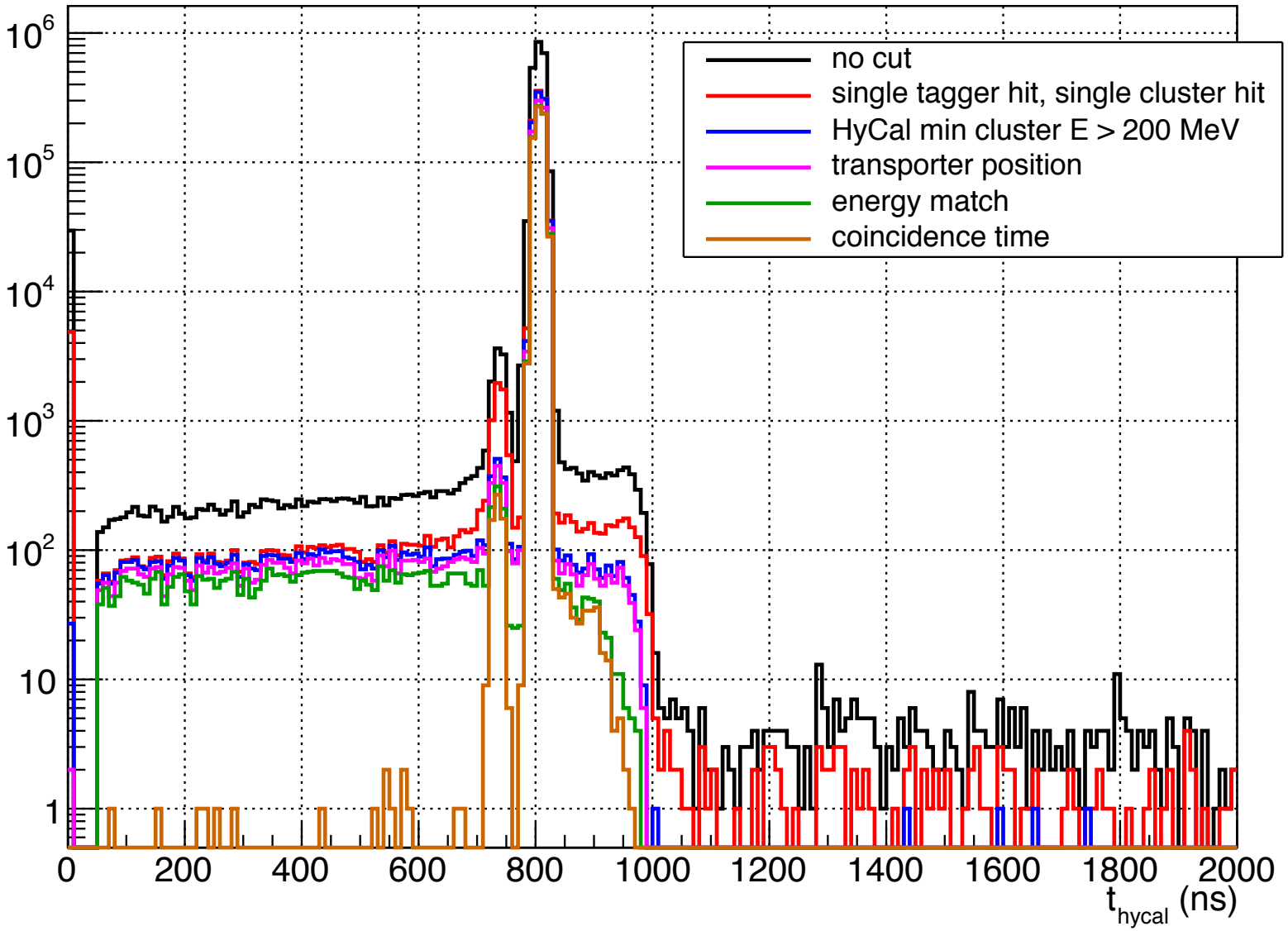


Total sum trigger time distribution

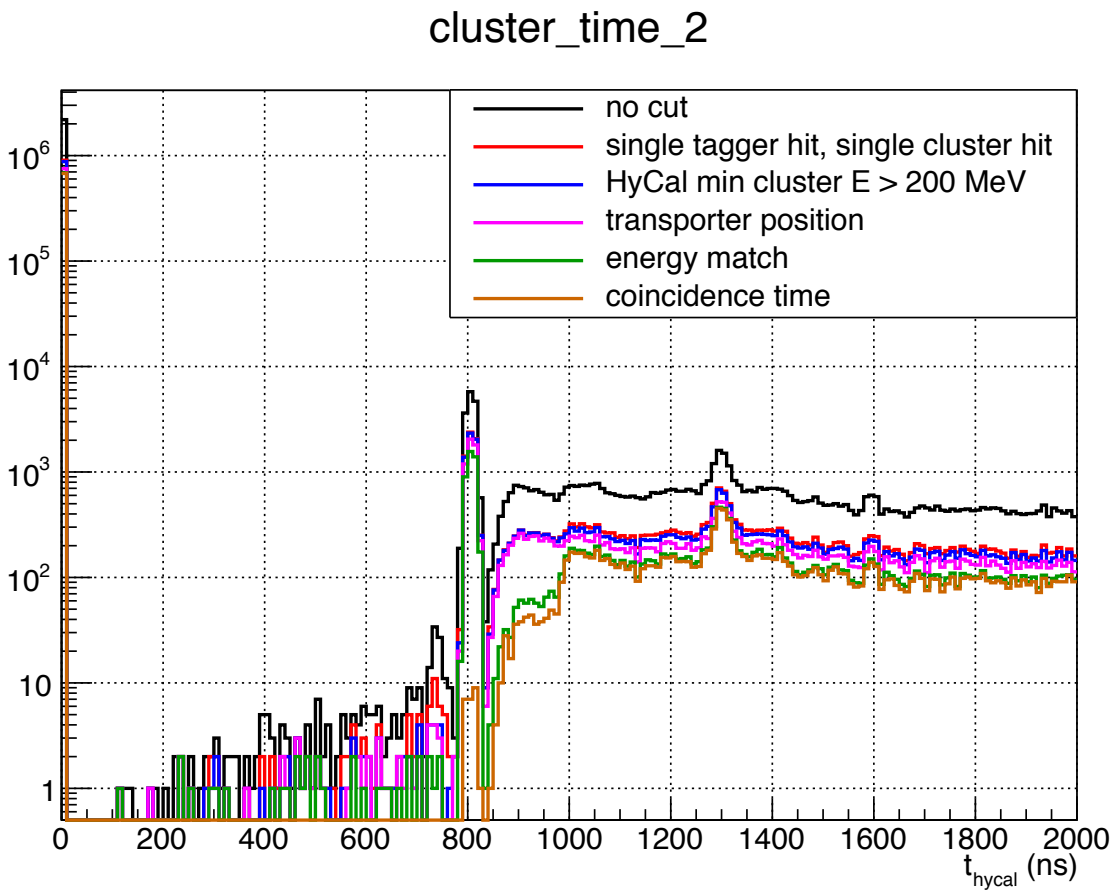


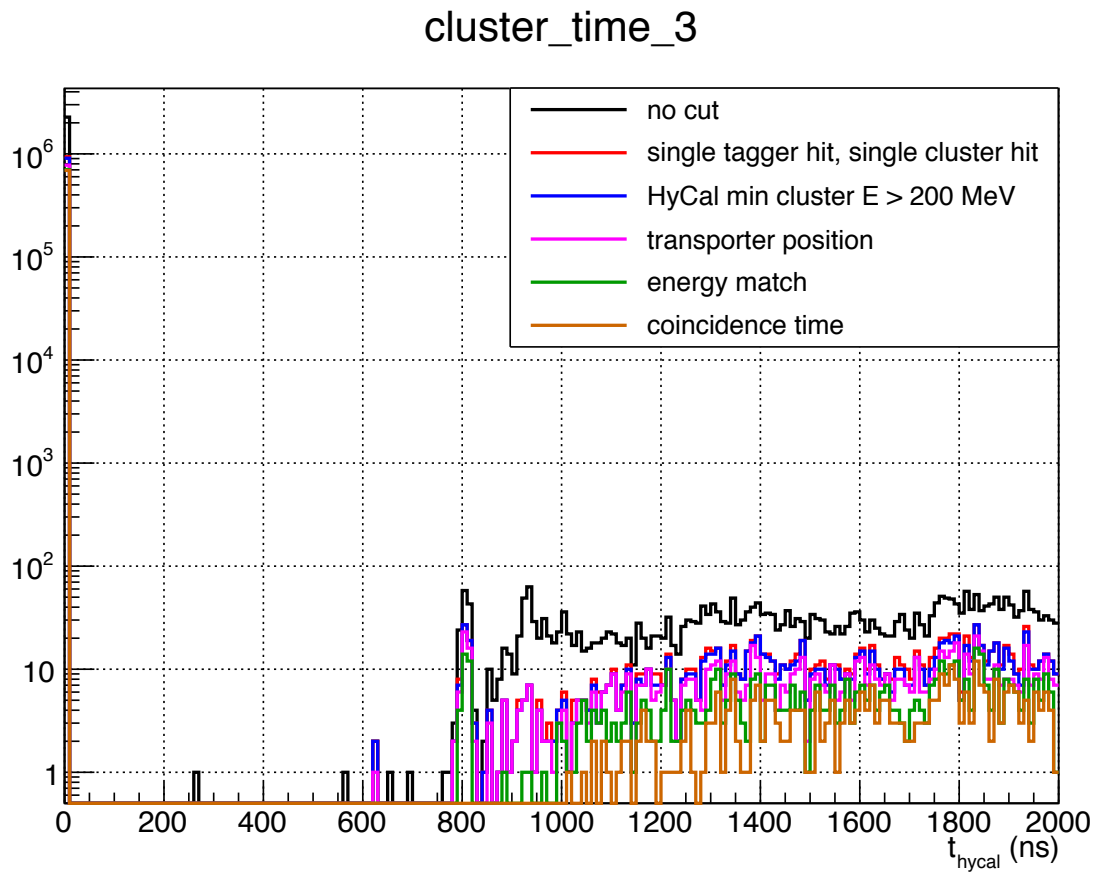
Cluster time distribution

cluster_time_1



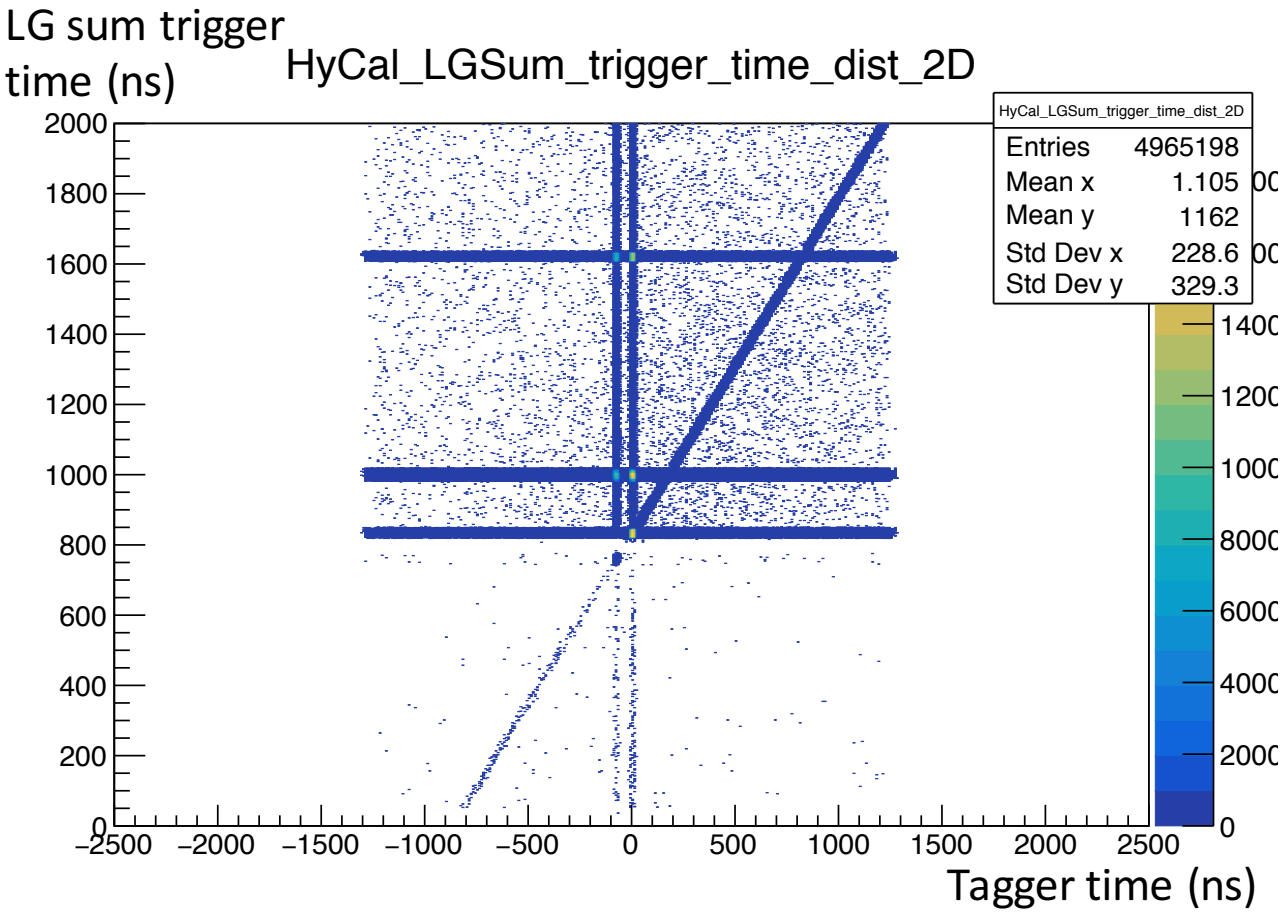
Cluster time distribution



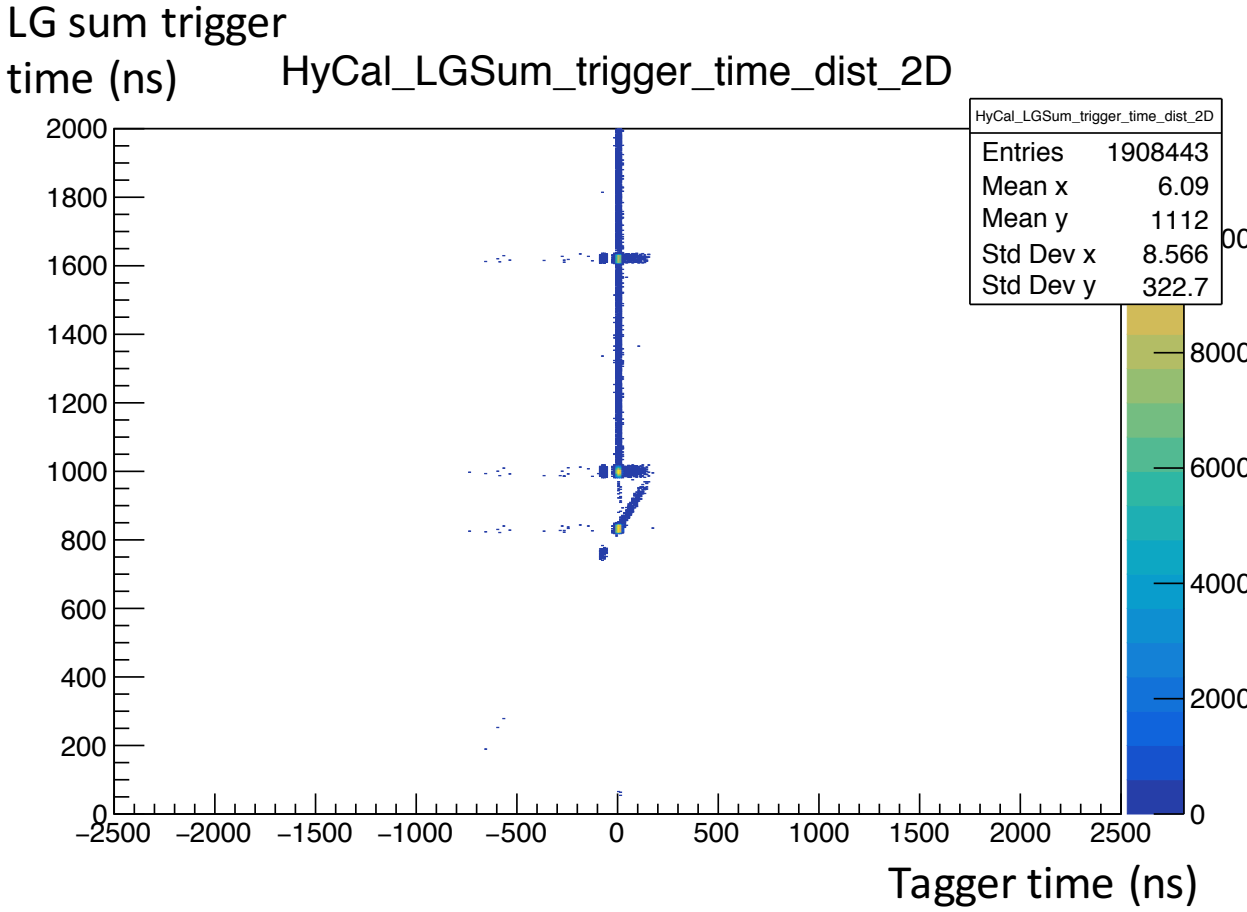


LG sum trigger time vs tagger time

No cut

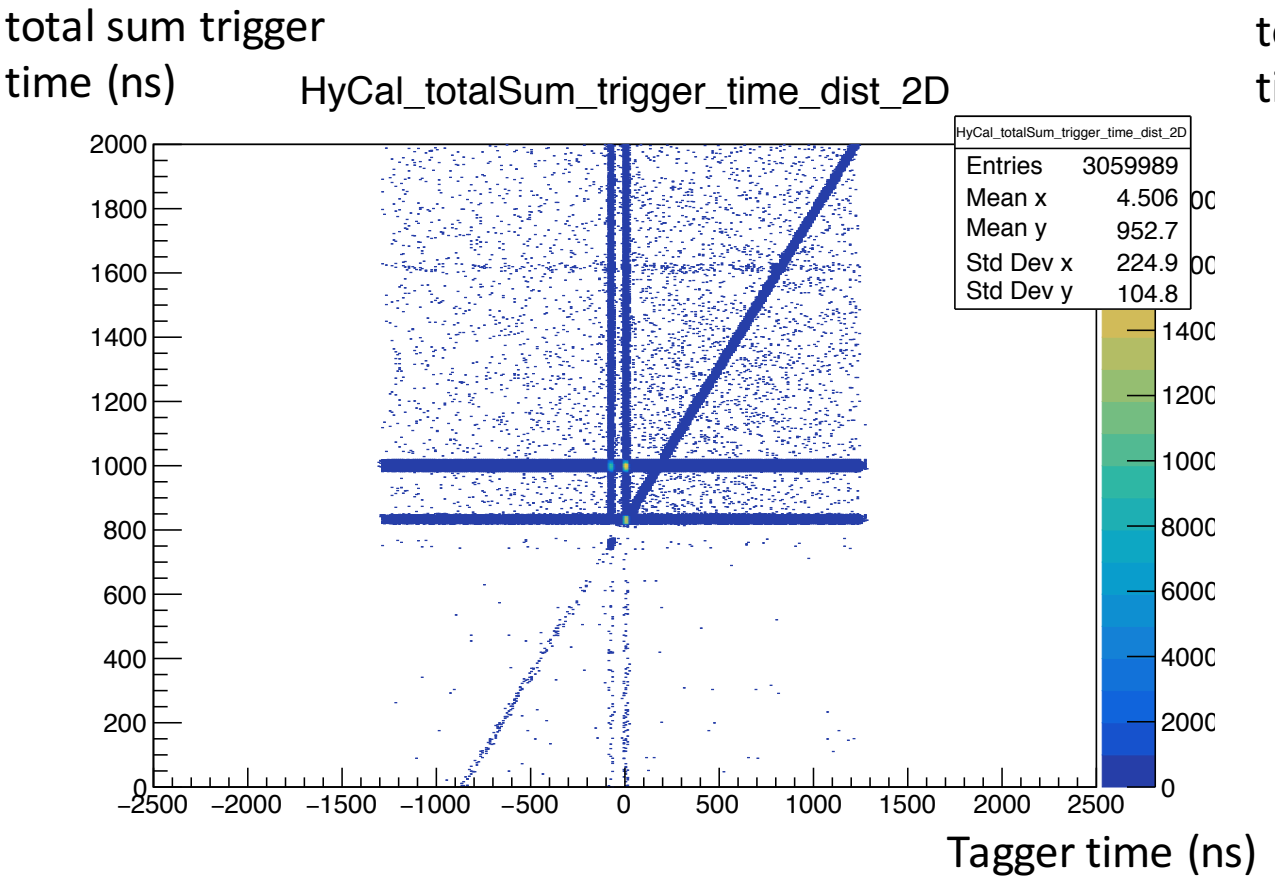


After all selection cuts

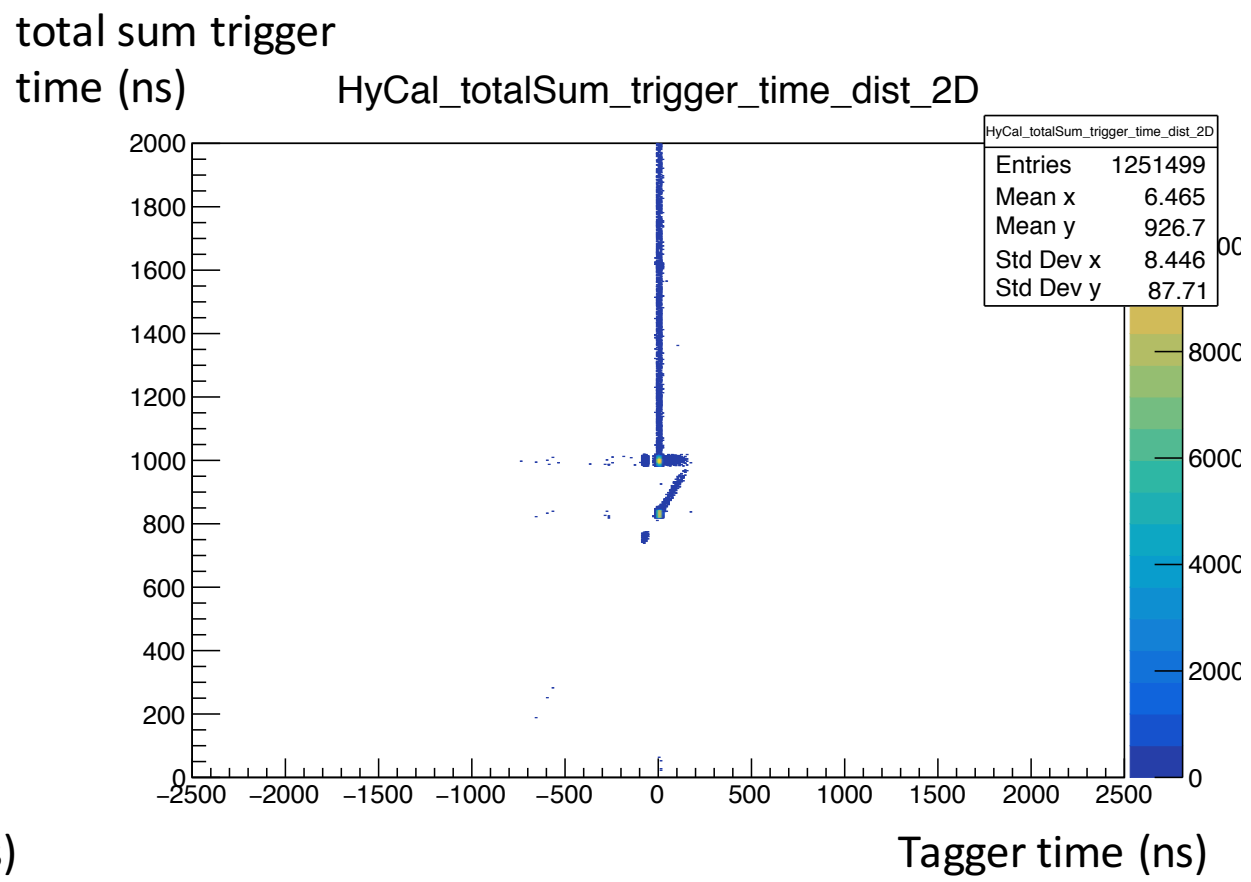


Total sum trigger time vs tagger time

No cut

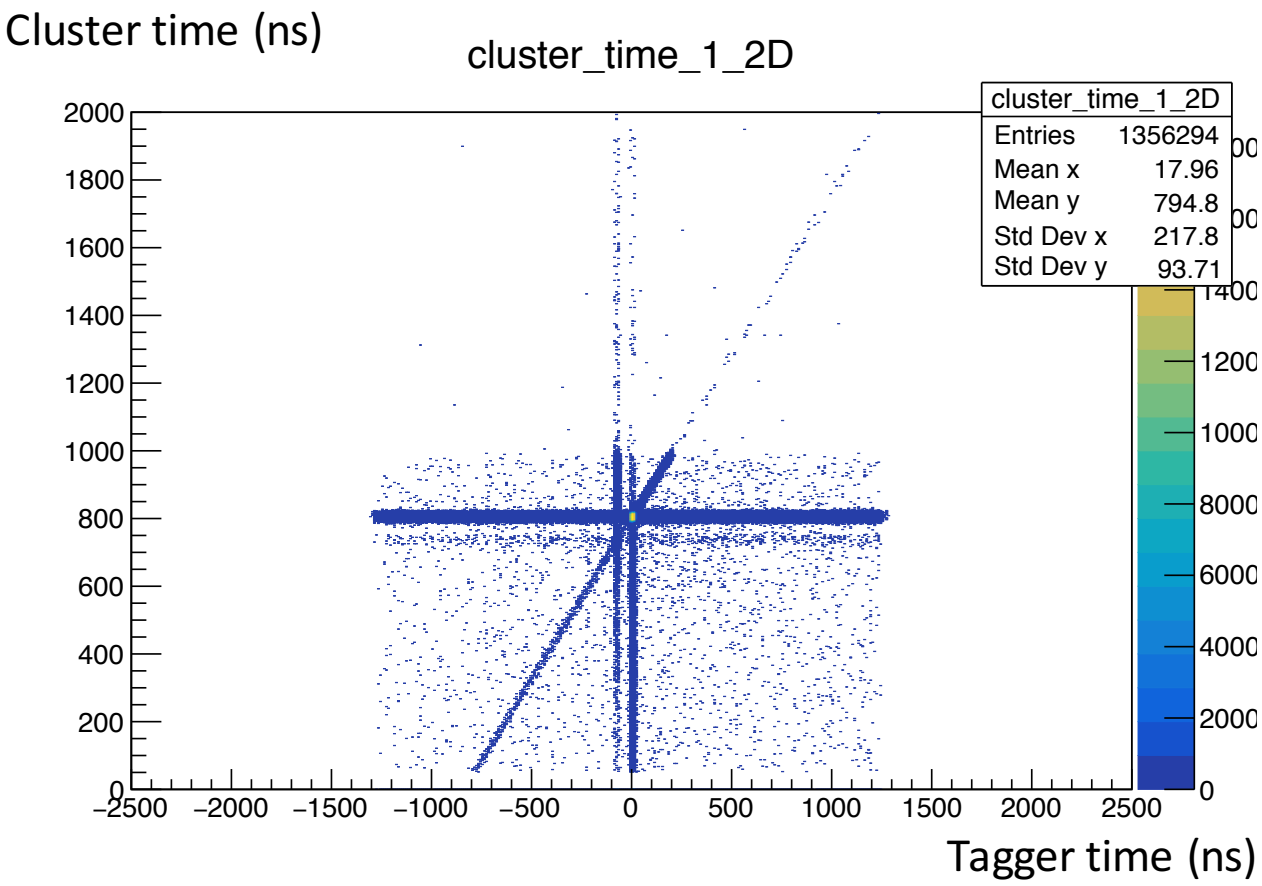


After all selection cuts

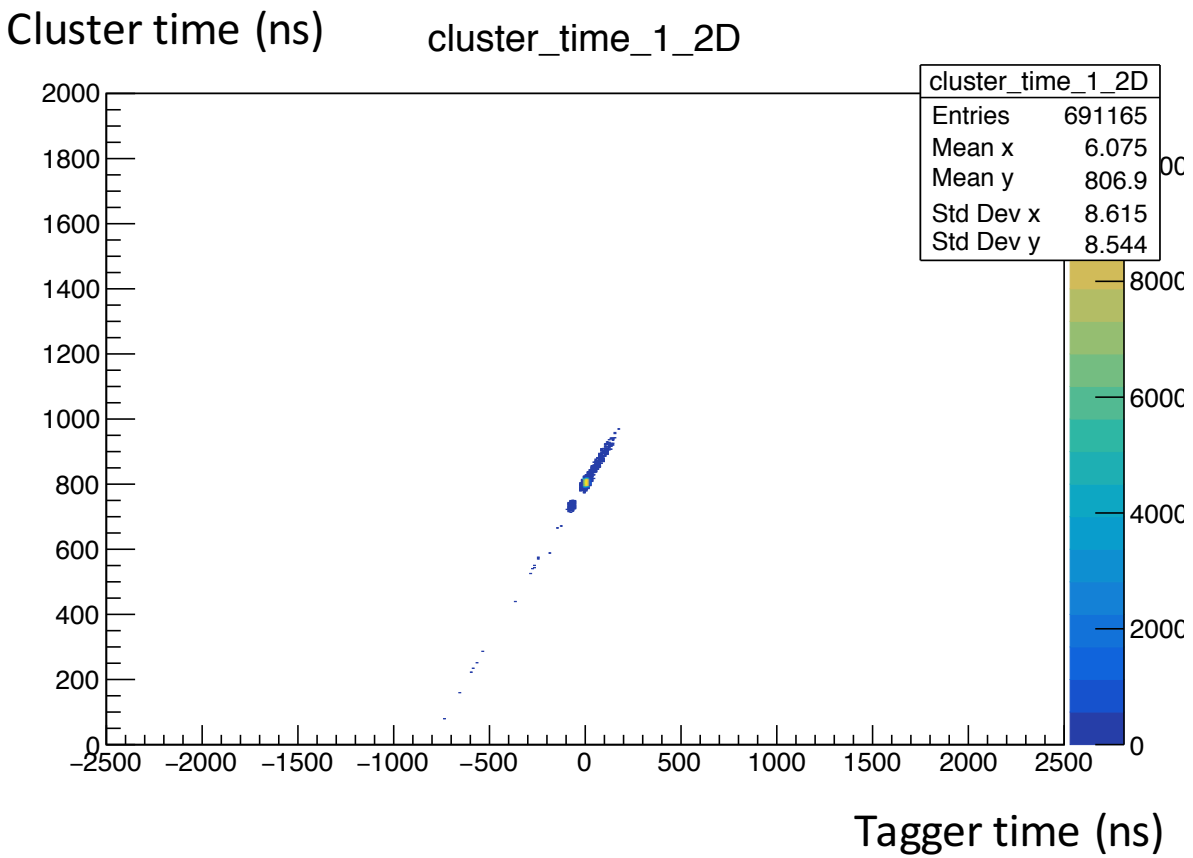


Cluster time vs tagger time

No cut



After all selection cuts



- Q: How do we know if an event has HyCal trigger?
  - Do we use the trigger type of the event?
  - Do we cut on the LG sum and total sum time distribution to determine if the event has a HyCal trigger?

After all cuts and require the event trigger type must be HyCal LG trigger or HyCal total sum trigger