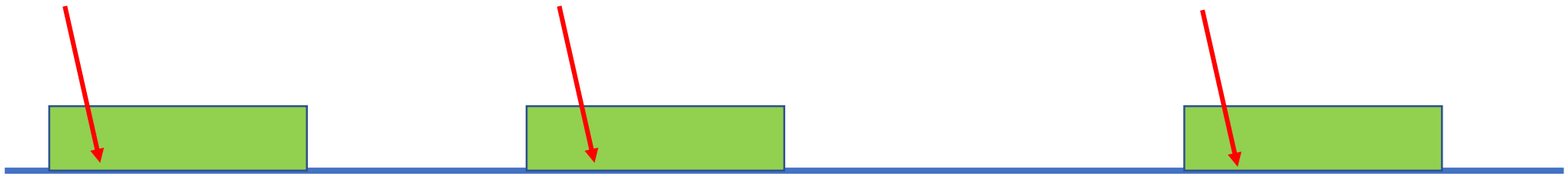
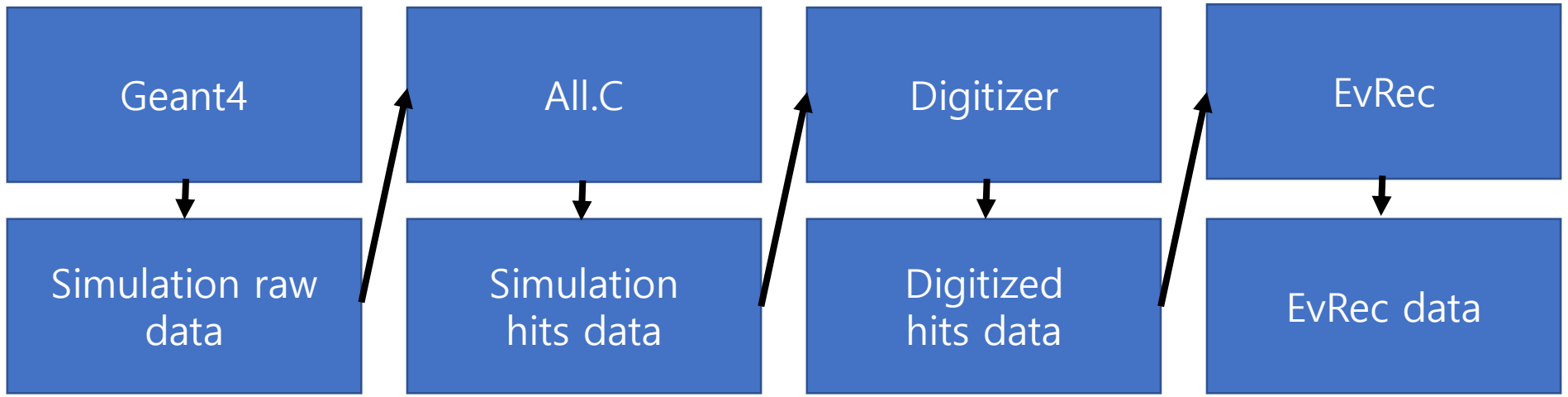
Digitization of simulation

- Waveform is given to all hits in 500ms window
- Trigger from above waveforms
- Make data structure very similar to our real data.
- We can use a little different(only library) evrec code
- we can freely change record length, trigger multiplicity and etc..



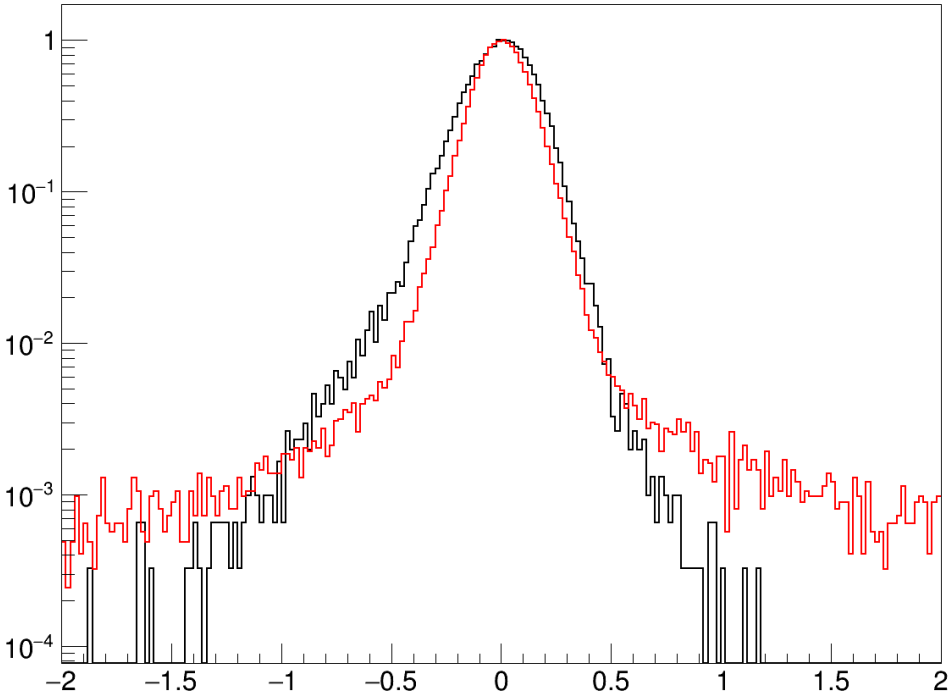
Simulation flow

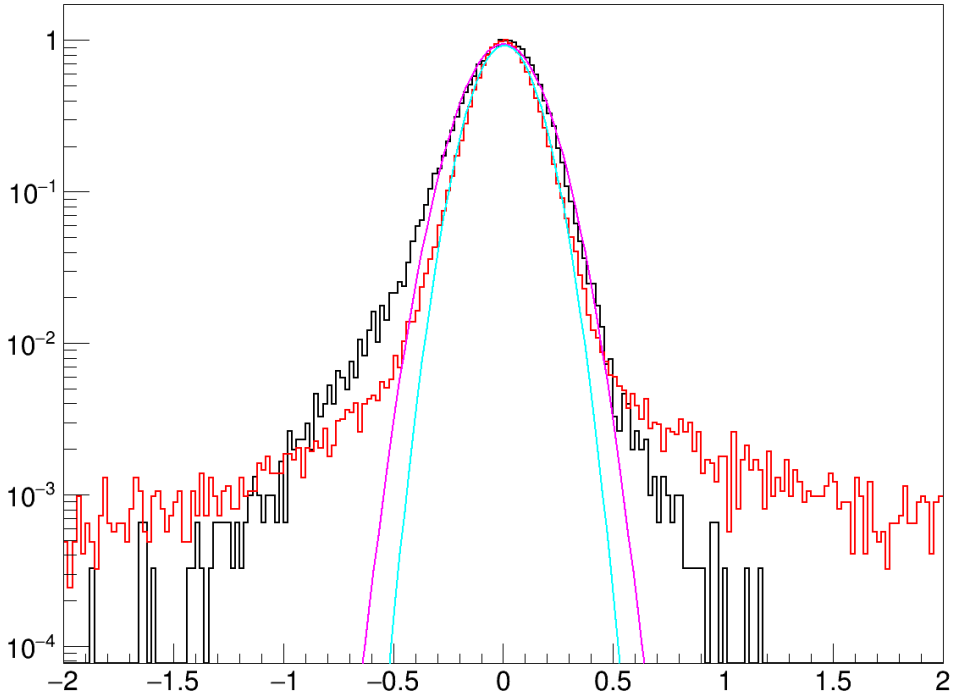


Digitized simulation

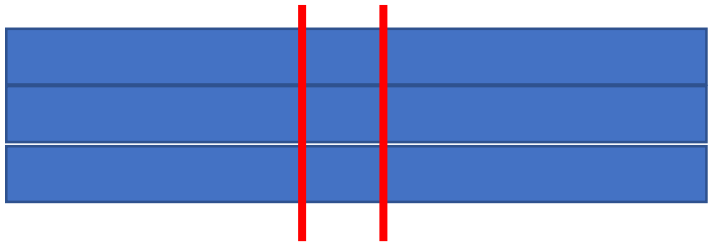
- Time resolution
- No cut is given.
- Black : MC , red : data

No cut	MC	data
Resolution	0.1472±0.0005	0.1209±0.0003



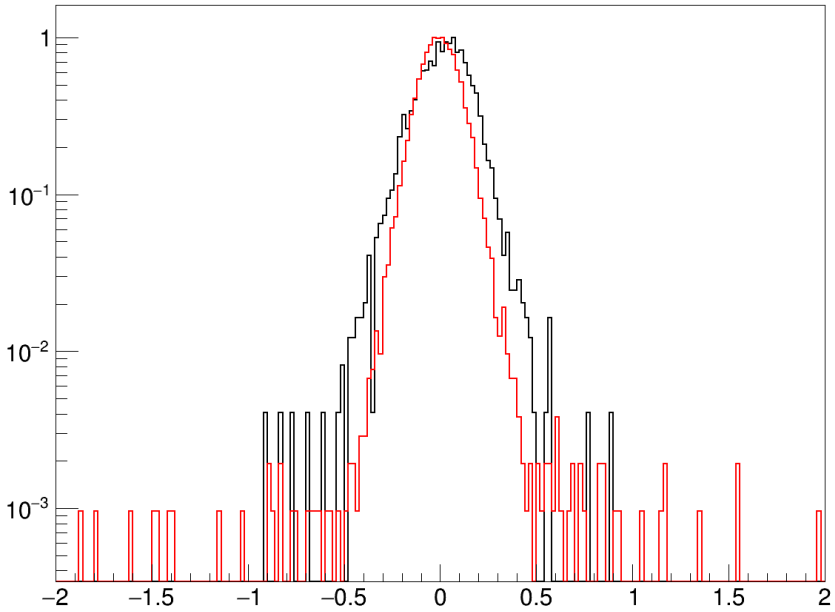


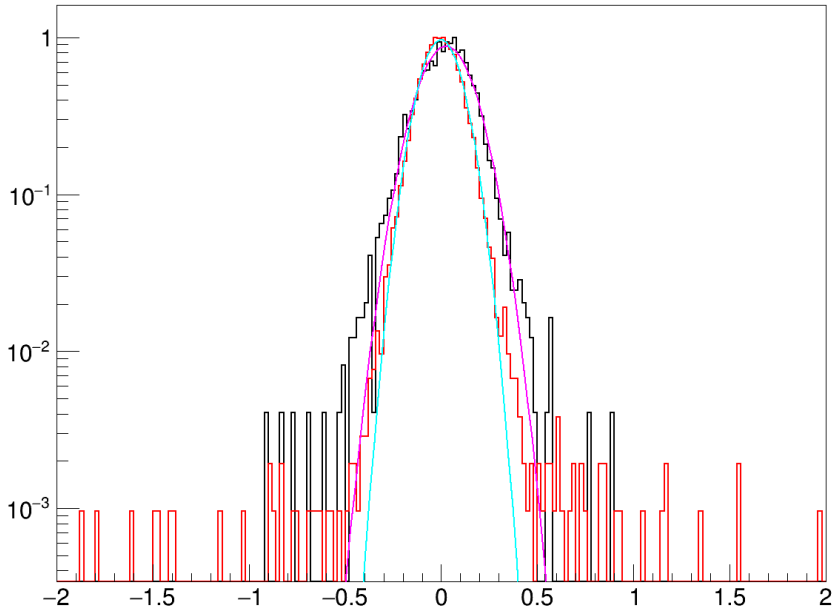
Digitized simulation



- Even the center cut is given, MC still has large resolution.
- Black : MC , red : data

Cut	MC	data
Resolution	0.1316±0.0017	0.1007±0.0007

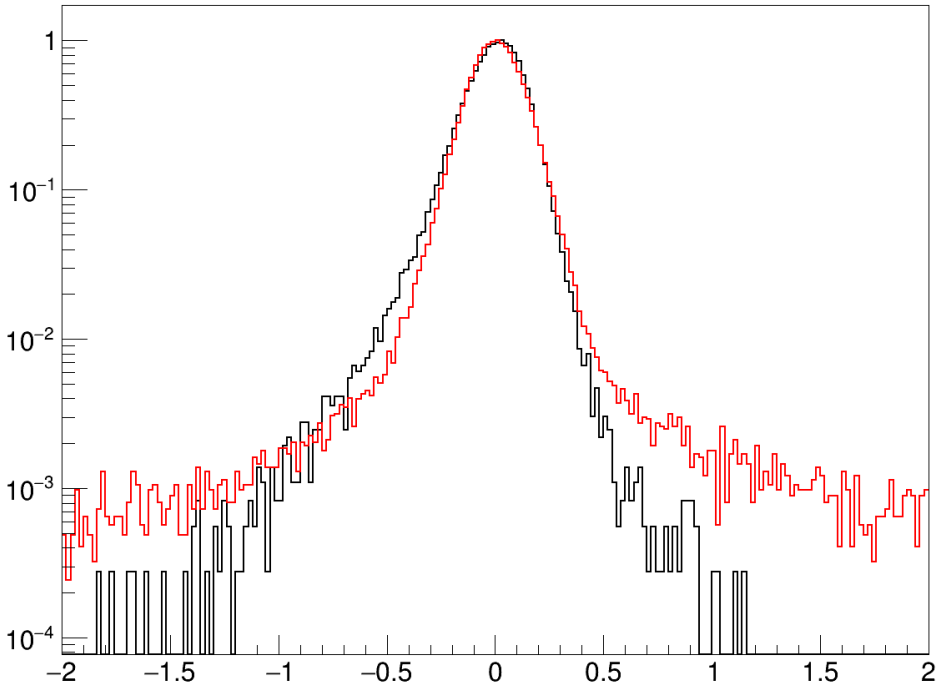


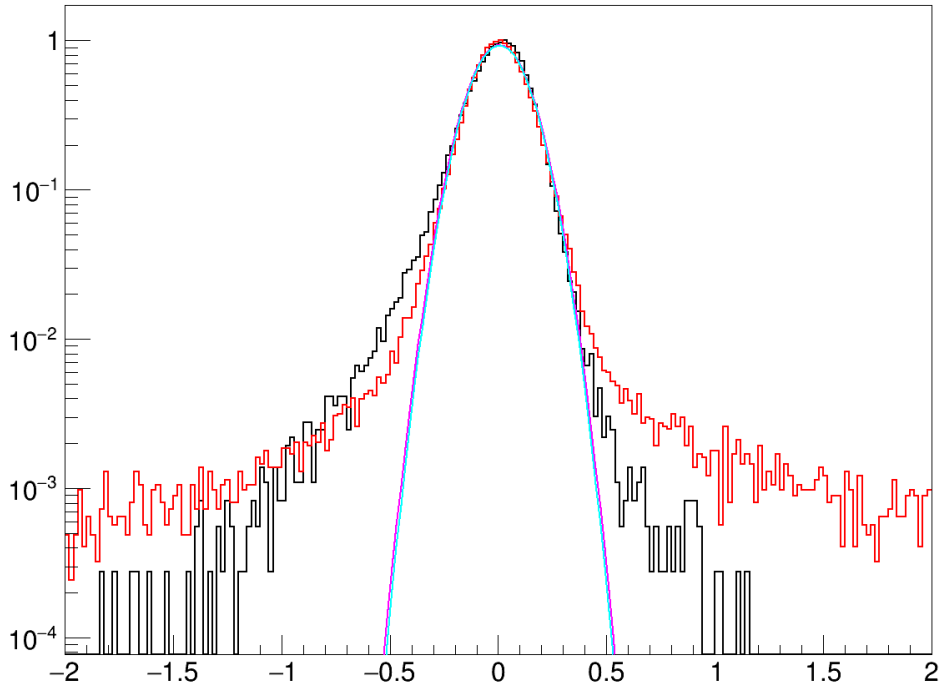


Reduced resolution

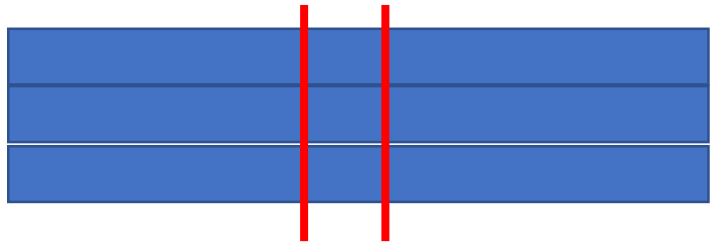
- No cut is given
- Black : MC, red : data

No cut	MC	data
Resolution	0.1232±0.0005	0.1209±0.0003



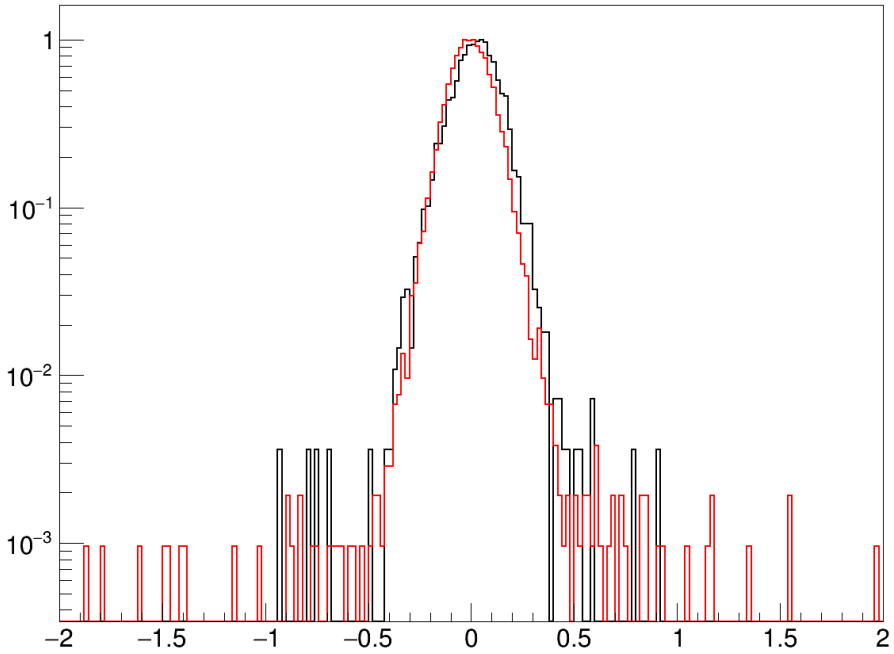


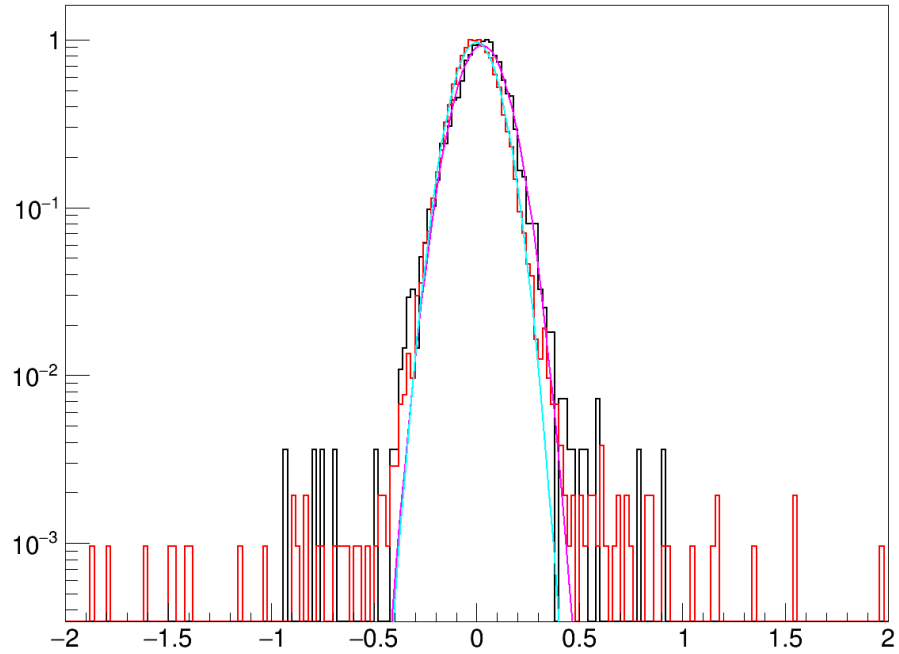
Reduced resolution



- the center cut is given.
- Black : MC , red : data

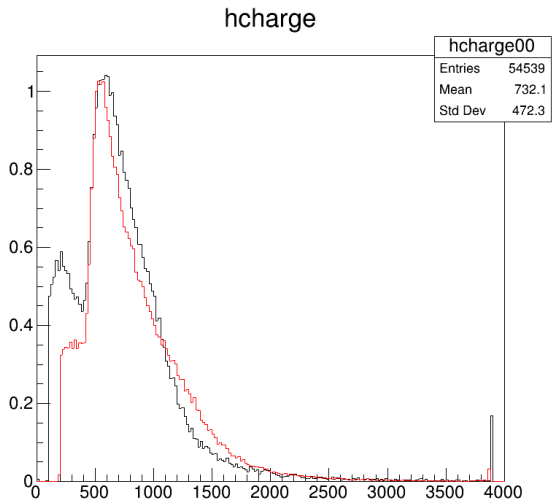
Cut	MC	data
Resolution	0.1105±0.0015	0.1007±0.0007

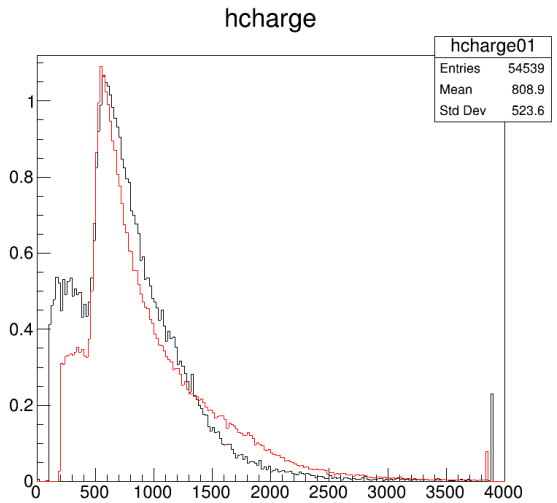


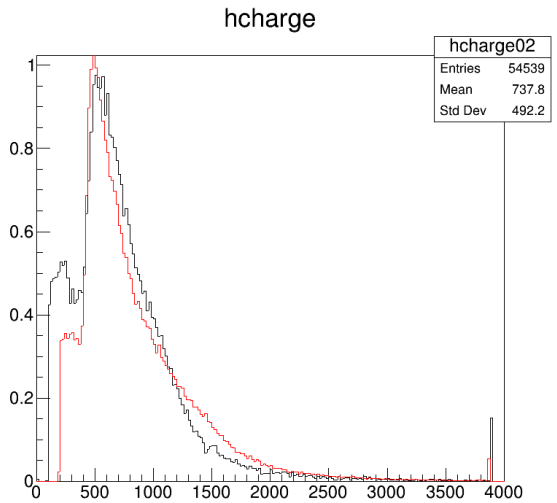


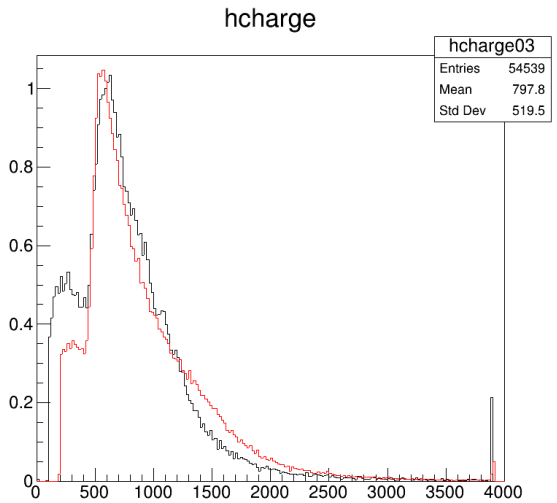
Digitized simulation

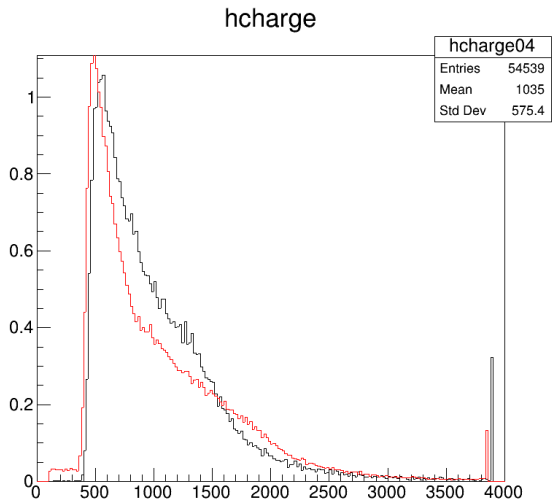
- Height’
- Black:MC
- Red:Data

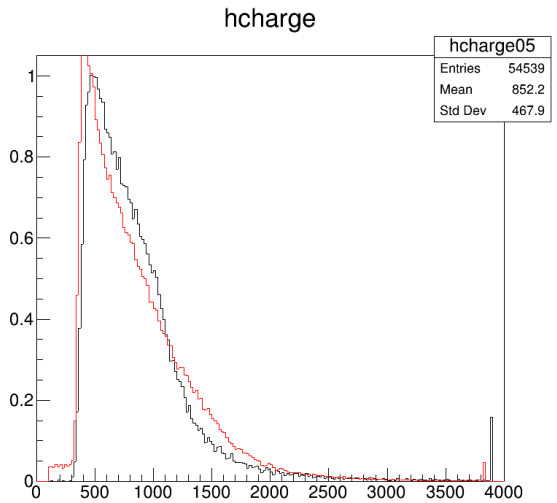






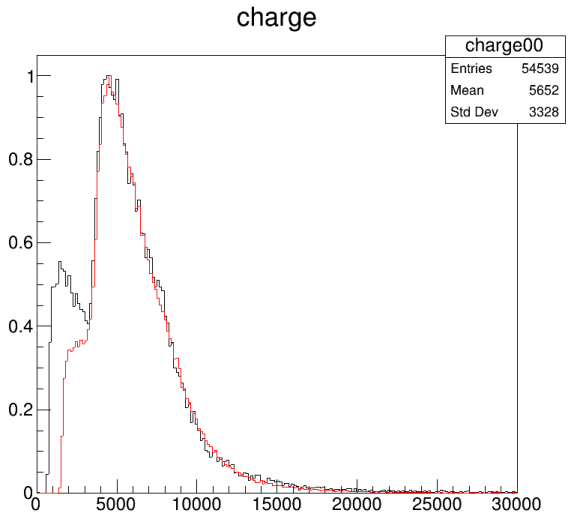


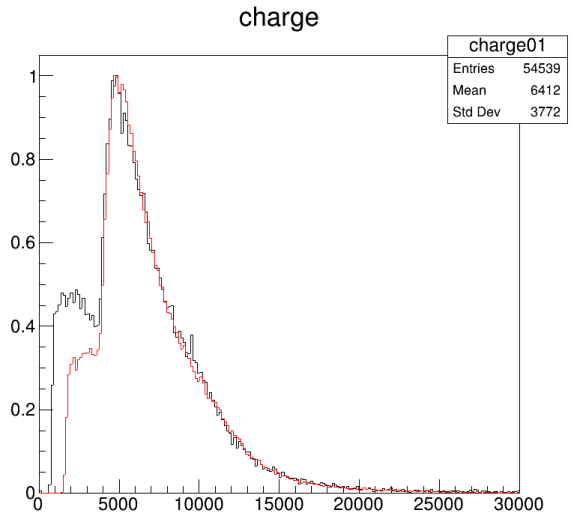


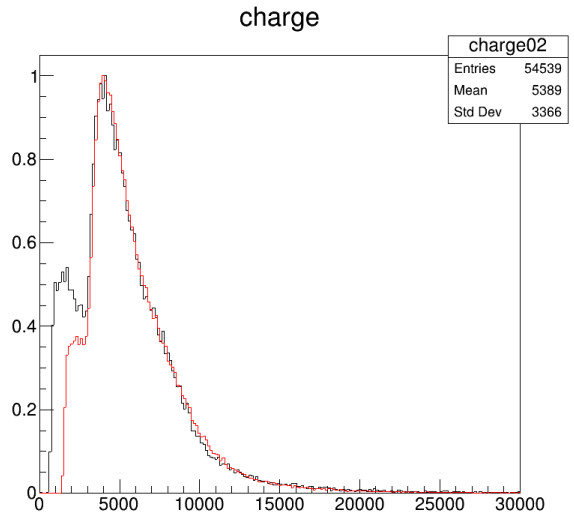


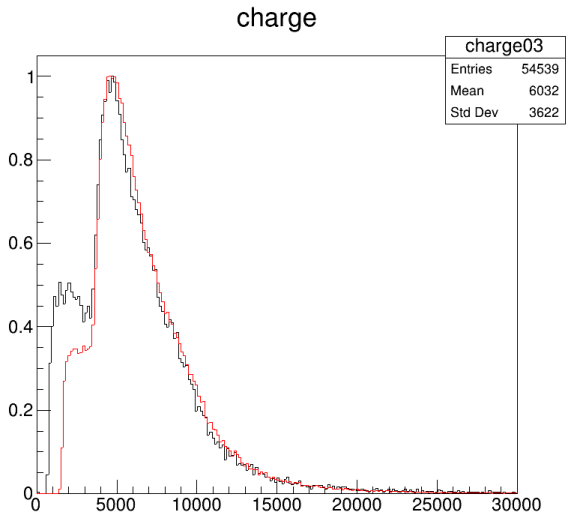
Digitized simulation

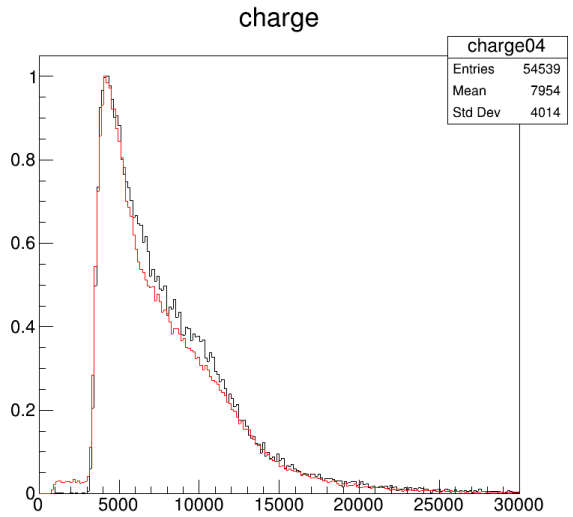
- Integral
- Black:MC
- Red:Data

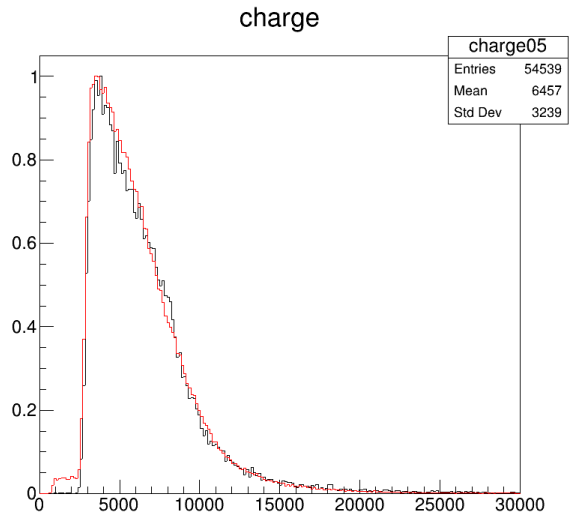






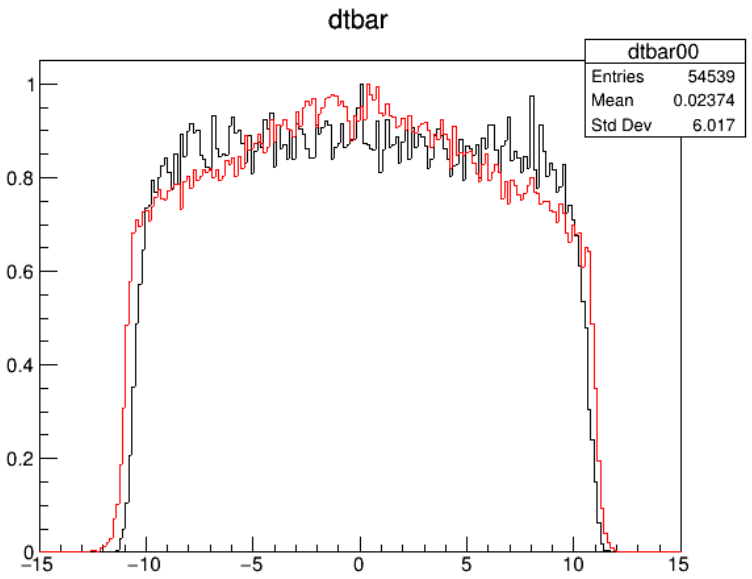


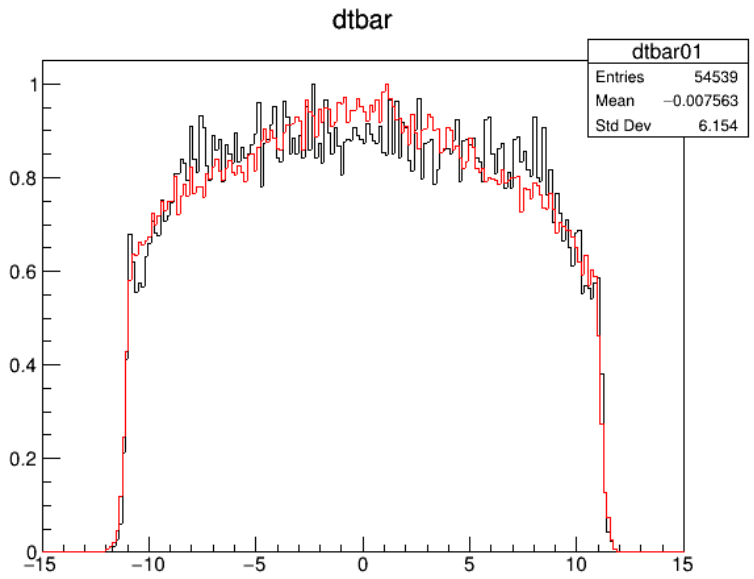


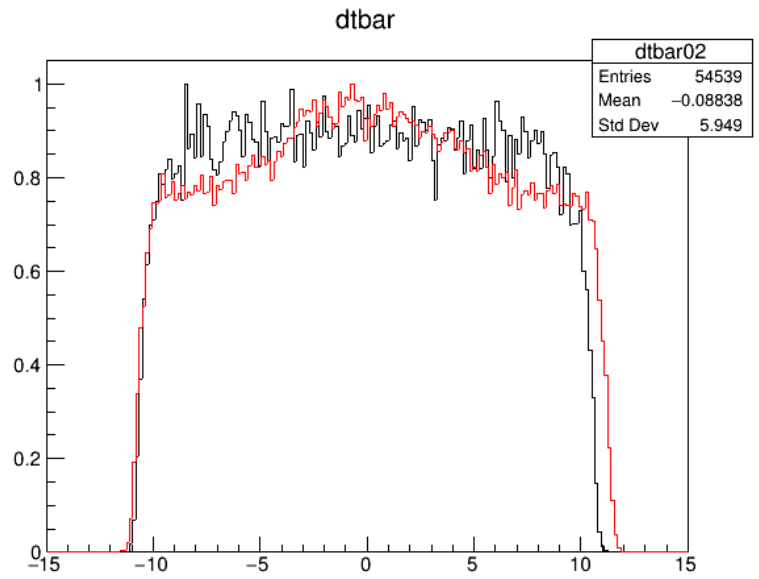


Digitized simulation

- Left right PMT time difference
- There is difference of height attenuation behavior between MC and data.
- So the trigger rate for a given position is different.



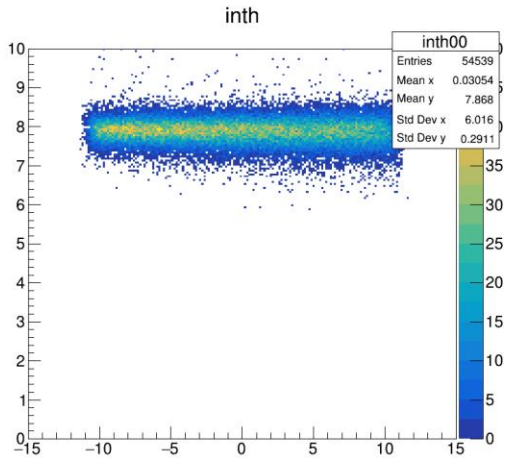


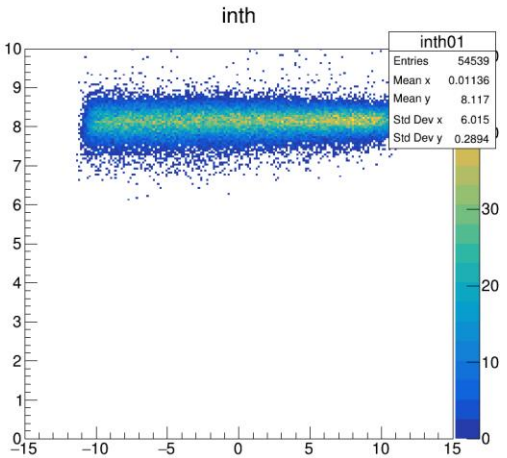


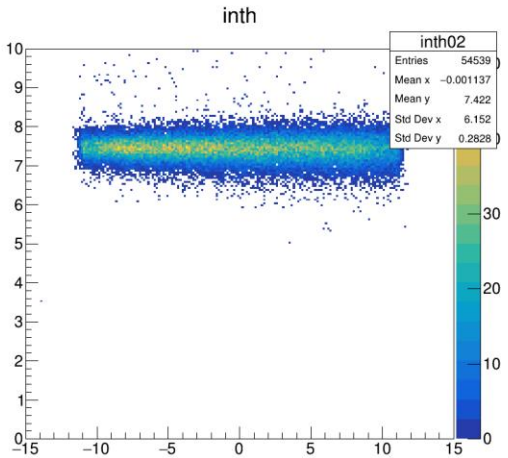
Digitized simulation

- MC integral/height behavior

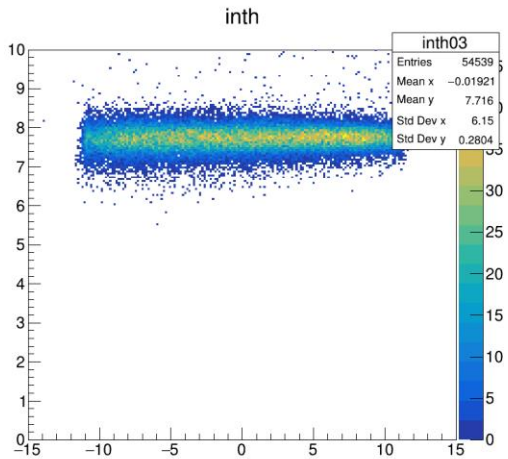
Left PMT

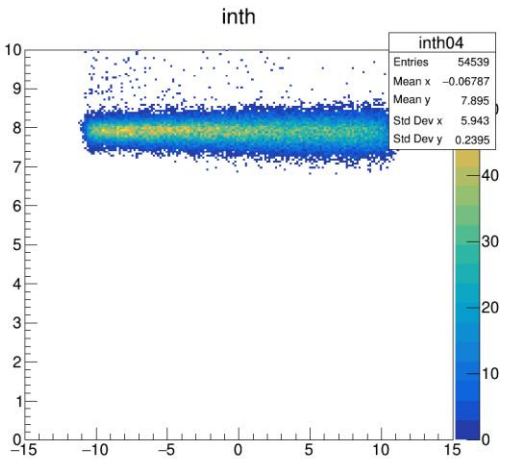


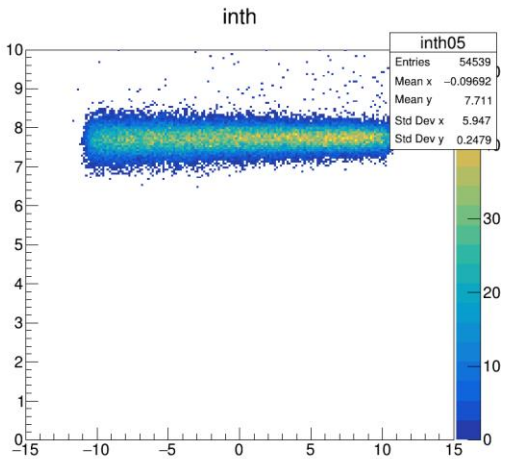




right PMT

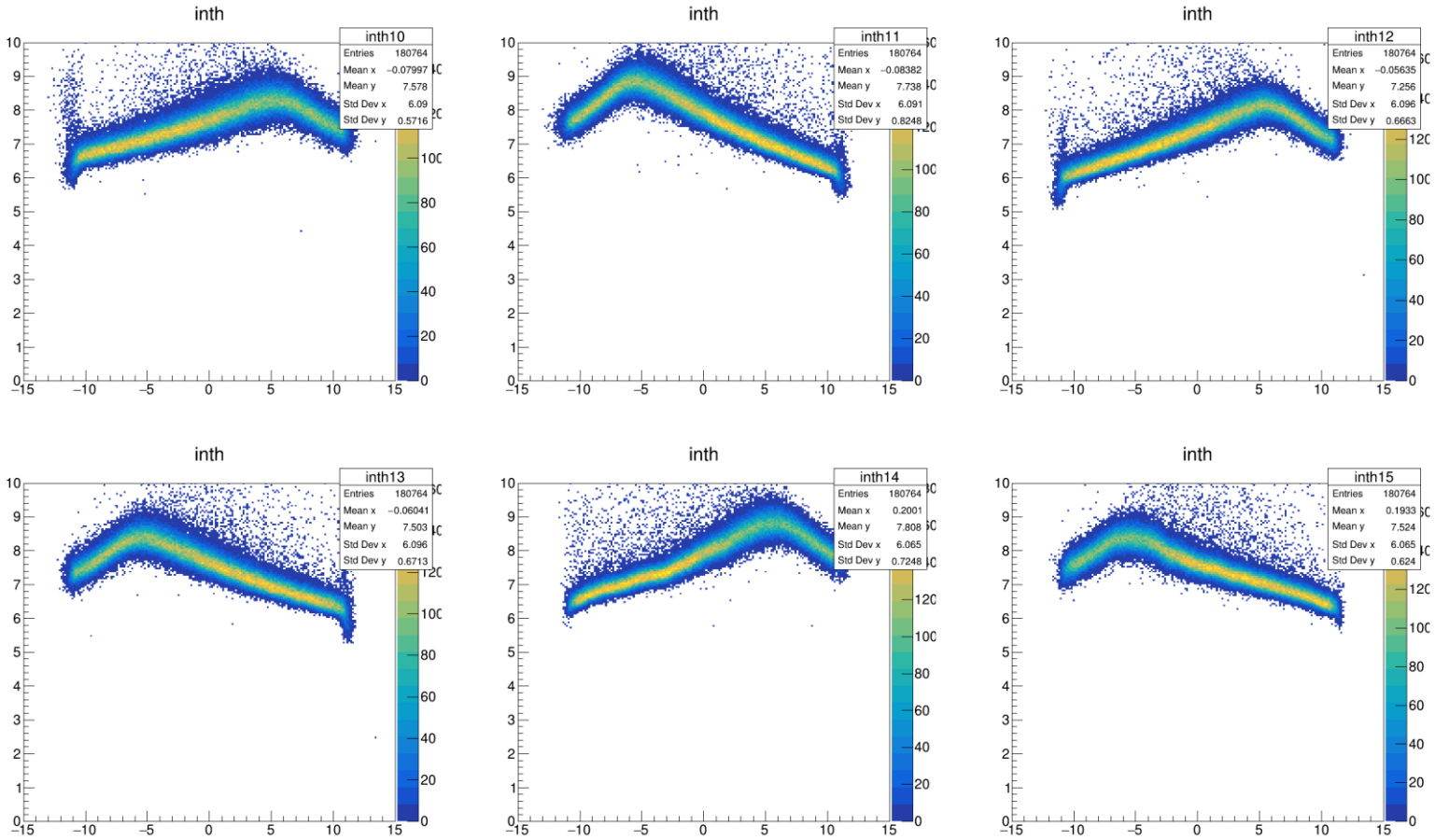






Digitized simulation

- Data integral/height behavior
- Pulse is stretched when the hit position is far from PMT and after some position the pulse is squeezed again.



Full GBAR digitized simulation

- Trigger condition :

  THR = 105 (~ 3 MeV)

  Record length = 224 ns

  Multiplicity = 2 (single track trigger)

  FADC , TCB CW = 40 ns

- Give all bar the same reference charge-position behavior and reference waveform.

Digitization result

- The digitization have performed.
- Independent upward signal, downward signal, cosmic ray background
- # of each : 100k **ann.** , 100k **ann. ,** 50k **second**
- Trigger condition :
  - THR = 105 (~ 3 MeV)
  - Record length = 224 ns
  - Multiplicity = 2 (single track trigger)
  - FADC , TCB CW = 40 ns
- No trouble in triggering
- It seems that all work properly.

Digitization result

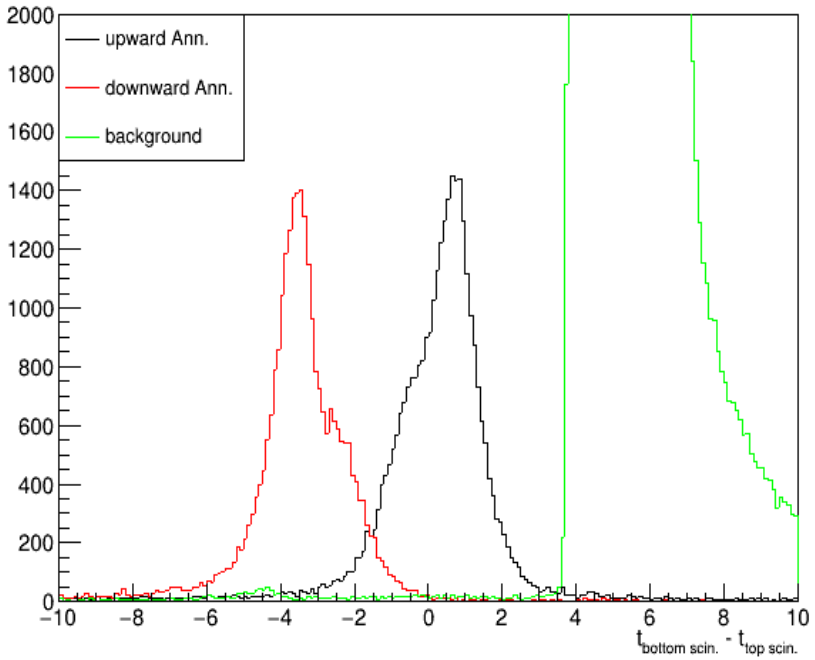
- Signal data are good. (almost one trigger per experiment)
- Cosmic ray-> High trigger rate ~ 300/ 500ms
- 100k experiment
- Assuming 2 min for an experiment
  100k experiment-> 138 days data taking -> 28million trigger
- About 130 gigabytes of digitized raw data

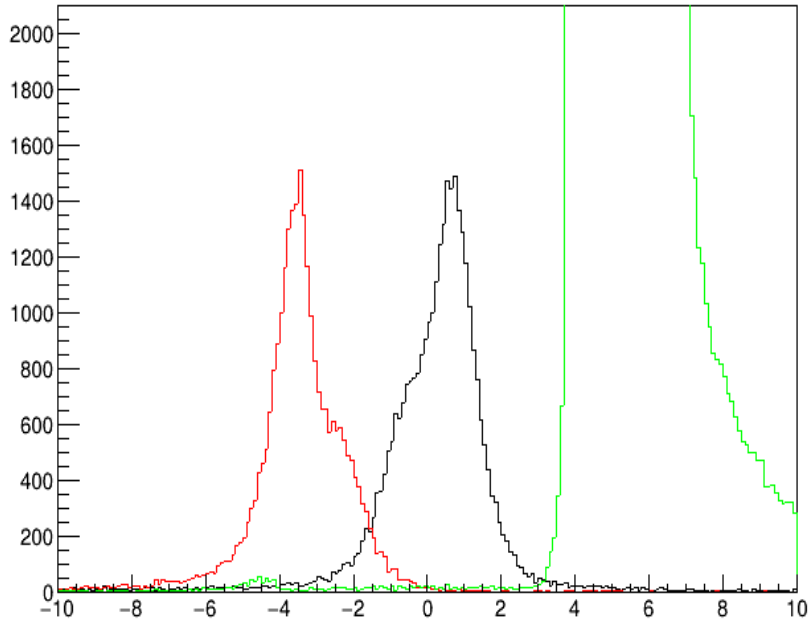
- Cosmic ray - signal mixing in an event is neglectable because of short record length (about O(0.01%))

dt distribution

- Although the response of PMT is given all the same. But some systematic effect shifts the dt between bars ~100ps
- T_bottom, (T_top) = fastest hit time at bot. (top) within a trigger
- Threshold = 105 (~3MeV)
- Left : non digitized MC

Right: digitized MC





dt distribution

- The rejection algorithm will be tested.
- The quantification quantities such as signal efficiency and background rate will be re-defined.
- Temperature likelihood will be tested.
- Machine running based rejection study is ongoing.