



Injection Veto and Code Management

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Updates on Injection Veto



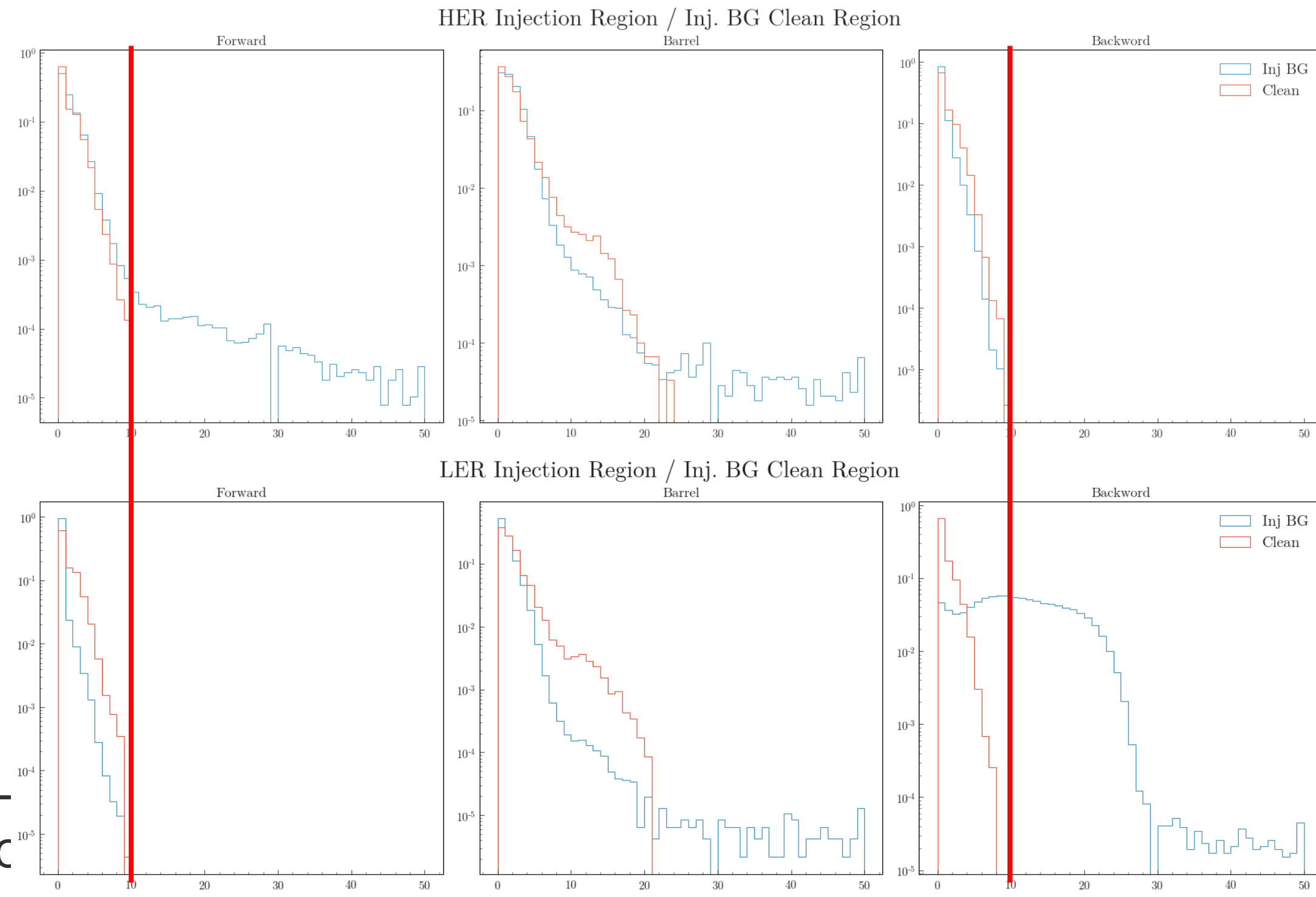
- In the last run period (2024a/b), we observed many leakages from the injection by adopting the active injection veto scheme.
- To deal with the problem, we updated the injection veto system during this run-stop period.
 - ECL partwise cut
 - DQM Update
 - TRGSummary Update
- We will introduce those topics briefly.

ECL Partwise Cut



- We confirmed that the distribution of N(TC) from endcap and barrel is significantly different between the normal and injection region.

- The injection background from
 - HER is mainly distributed at FWD
 - LER is mainly distributed at BWD
- We updated the ECL and GDL to apply the N(TC) cuts for the active IV scheme in a partwise fashion.



Modification on ETM and GDL



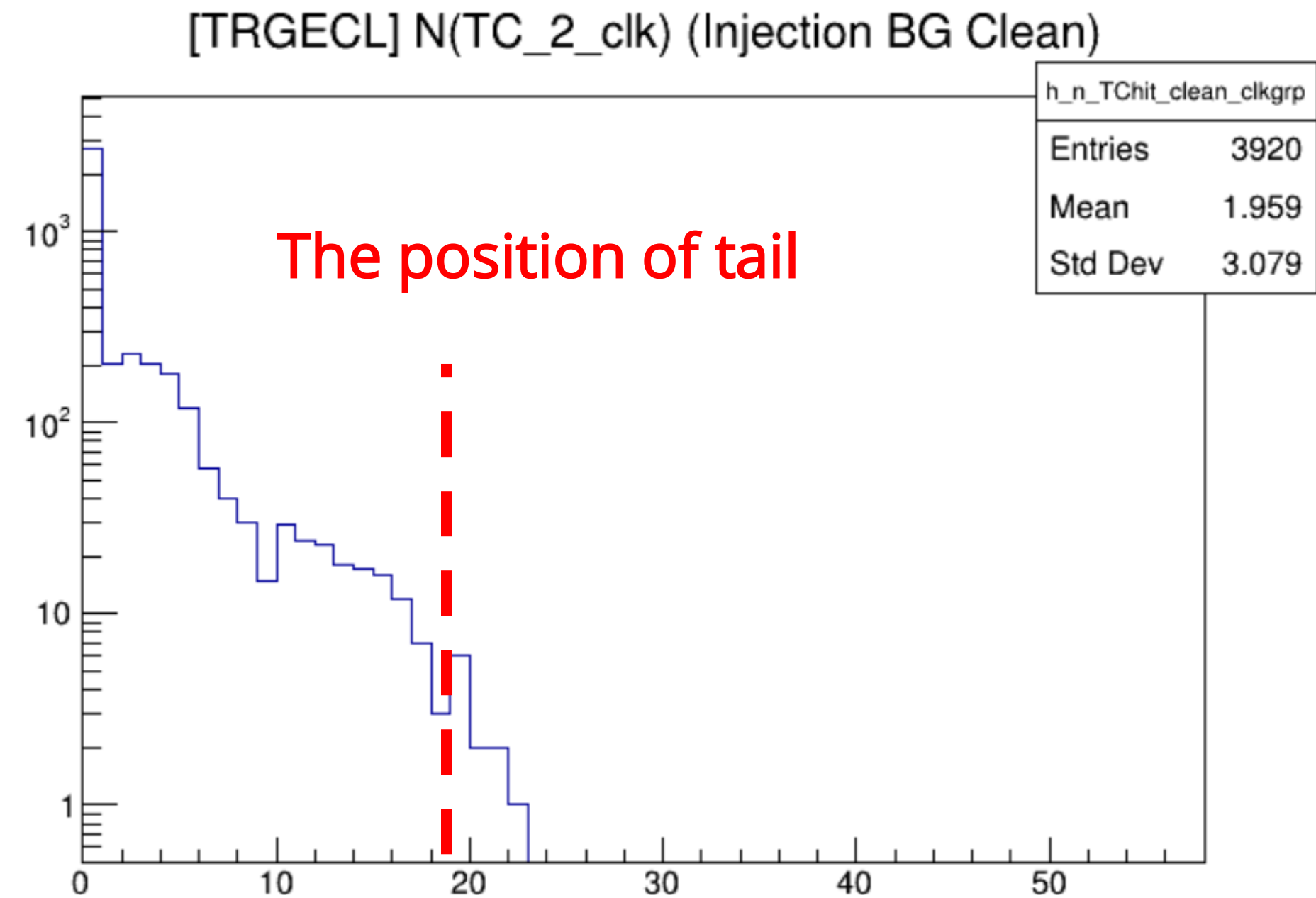
- Unno-san kindly updated ETM to provide the partwise N(TC) information to GDL
 - Currently, GDL receives three information of FWD, BRL and BWD.
- GDL firmware also modified to apply cuts on those variables separately
 - The number of injection parameters increased 6 (3 x HER and LER)
- I confirmed the new GDL firmware is working on properly, but not strictly tested with the detectors. I will check it in the cosmic runs.

Type	Bitmap	Bit width
All	105 downto 96	10
Forward EC	112 downto 106	7
Barrel	121 downto 113	9
Backcap EC	128 downto 122	7

DQM Updates and the Position of Tail



- We added some DQM plots for the ECL partwise cuts: N(TC) distribution from forward, barrel, and backward.
- A basf2 module of DQMHistAnalysisTRG also changed to broadcast the position of tails of the injection background clean regions
- All the related settings for the DQM page and PV values are updated also.





TRGSummary and B2L Data from GDL

- TRGSummary provides L1 trigger information of an event
 - e.g., what L1 trigger bits are issued, how L1 timing has been determined, and so on...
 - A basf2 module "trggdlSummary" makes TRGSummary from unpacked GDL B2L data
- The B2L data from GDL contains a digital waveform of trigger bits
 - GDL stores 128 clocks of the trigger system clock (127 MHz), but due to the limitation of B2L bandwidth, it merges signals of four clocks into one clock and send the merged signal.
 - If the signal is '0' during the four clocks, the merged signal is '0'. Otherwise, the signal is '1'.
 - Example:

# of GDL clk	0	1	2	3	4	5	6	7	...	120	121	122	123	124	125	126	127
Signal	0	1	0	0	0	0	0	0	...	1	1	0	0	0	0	1	1

This is what we can see in GDL B2L data

# of merged clk	0	1	...	30	31
Merged signal	1	0	...	1	1



How trggdSummary Module Decides Trigger Bits?

- The waveform is used for deciding the L1 trigger bits of TRGSummary objects.
 - E.g., basf2 variables such as 'L1PSNM(hie)', 'L1Input(ffy)', and so on
- Currently, trggdSummary sets the given trigger bit if there are '1' signals during 32 merged clocks

(Example) L1 trigger window

# of Merged clocks	0	1	2	3	4	5	...	26	27	28	29	30	31	Result
'hie' waveform	1	1	0	0	0	0	...	0	0	0	0	0	0	1
'ffv' waveform	0	0	0	0	0	0	...	0	0	0	0	0	0	0
'c4' waveform	0	0	0	0	0	1	...	1	0	0	0	0	0	1

- Typically, the span of the L1 trigger window is shorter than the 32 clocks: this algorithm cannot consider the window for the trigger bit decisions
 - In the above example, the L1 trigger has been issued by 'c4' and we should get '1' as the result only for the bit, but 'hie' also counted as '1' bits even though it is triggered outside of the window



Modifying the "trggdSummary" Module

- We are trying to modify "trggdSummary" module as follows:
 - Change the bit decision algorithm only for the injection-veto-related (IV-related) bits
 - Other bits will not be affected. We expect there will be no effects on any other analysis

(Example) L1 trigger window

# of Merged clocks	0	1	2	3	4	5	...	26	27	28	29	30	31	Result	
IV-related bits ('passive_veto')	1	1	0	0	0	0	...	0	0	0	0	0	0	Original	1
														New	0
Non-IV-related bits	1	1	0	0	0	0	...	0	0	0	0	0	0	Original	1
														New	1
IV-related bits ('passive_veto')	0	0	0	0	0	1	...	1	0	0	0	0	0	Original	1
														New	1
Non-IV-related bits	0	0	0	0	0	1	...	1	0	0	0	0	0	Original	1
														New	1

Code Management: Buildsystem



- Currently, all the systems are written, but not tested by the users (FW developers)
- We are writing a quick guide to get started and detailed manual for the system. The quick guide will be prepared within one week.
- Based on the feedback from users, we will try to make more reliable and easier to use buildsystem.

Summary



- We are preparing the improved injection veto and related system
 - ECL partwise cut for the active injection veto scheme
 - Updates for the DQM modules
 - TRGSummary update: Hanwook Bae delivered a presentation for this update and learned how to implement this update from Nakazawa-san
- The buildsystem for UT4 is ready and documentation is being prepared.

New Injection Veto and the Current Algorithm



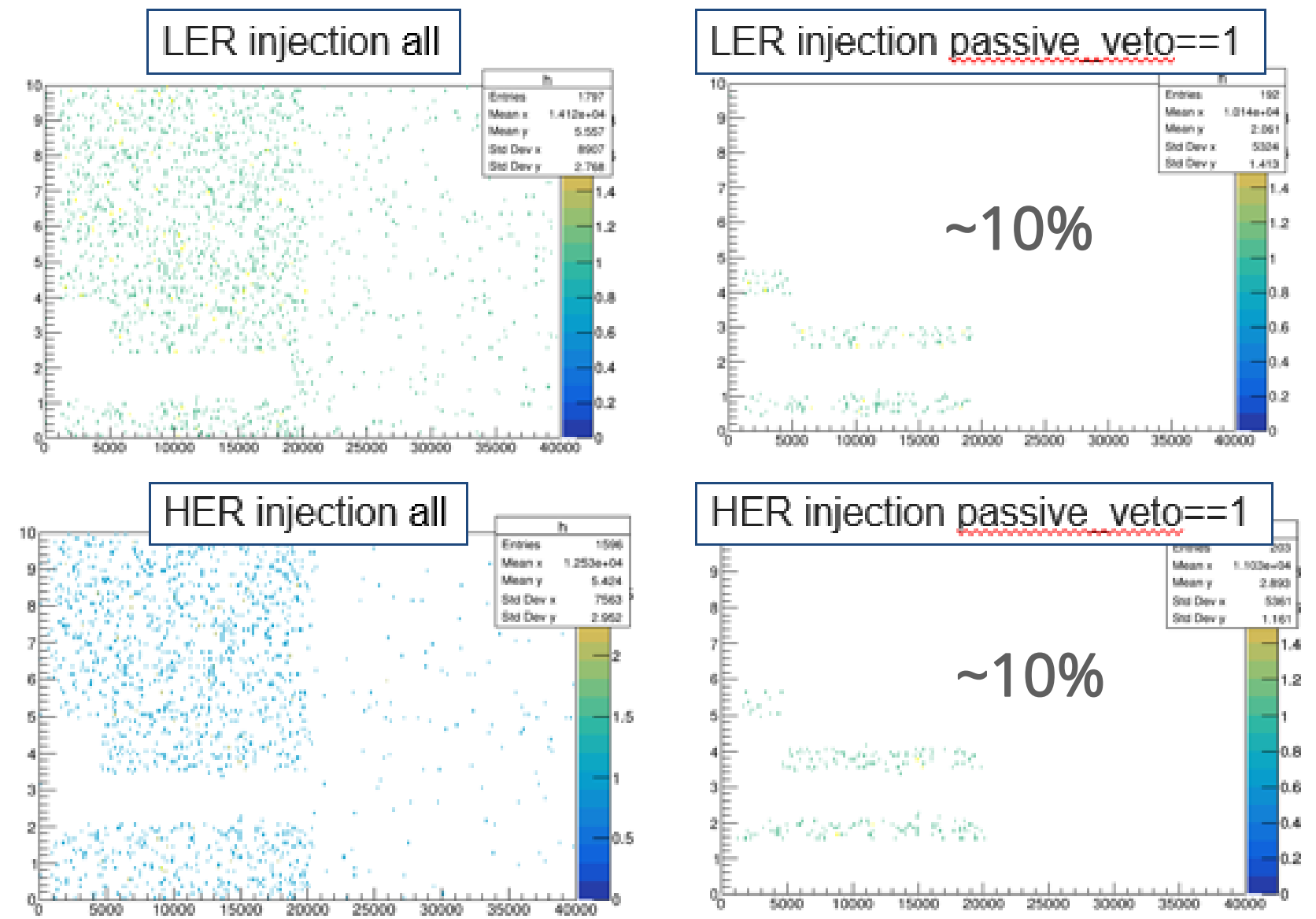
- Among the input trigger bits from GDL, there is a bit for the injection veto
 - This bit can be used for some studies such as the estimation of the DAQ deadtime reduction

passive veto on ITD

- The current algorithm makes the bits working improperly:
 - The problem on passive_veto without the new (active) injection veto
 - Without the new injection veto, the fraction of events that 'passive_veto==1' should be very low ($< 1\%$)
 - However, we observe the significant fraction of such an event over than 10%.

-exp33run, active veto=OFF
 -Bhabha_all skim event after HLT filtering

Koga-san's slide



Detector Develop 'passive_veto': The old (passive) injection veto vetoed the event