Status on ecl trigger

2023/02/08
B2GM meeting
Y.Unno

Plan of tsim bugfix and update

- (1) definition of cluster position variable "getPostionX(),Y(),Z()" in TRGECLCluster dataobject is wrong.
  - (Correct) most energetic TC position in cluster on firmware
  - (Wrong) TC energy weighted position in cluster in current tsim
  - "getPostionX(),Y(),Z()" is not used anywhere in ecltrg, but used in track-cluster matching on GRL
  - Simple simulation showed no large discrepancy in efficiency of cluster-matching on GRL

- (2) strange energy cut on TRGECLDigitization
  - TC is rejected if TC energy < 30 MeV in T=0-1us
  - This would affect ecltrg outputs when signal MC starts from negative timing (from release7 ?)

Plan of tsim bugfix and update

- (3) wrong dead time after fitter detects TC E > 100MeV
  - (Correct) 12 clock on firmware
  - (Wrong) 2 clock in current tsim
  - Probably effect is negligible, but better to check

- (4) update TRGECLMapping
  - Conversion of TCID, TCThetaID, TCPhiID, cellID, etc.
  - Currently this class cannot be used from python script, etc
  - Plan to add more useful conversion functions

- (5) update/modification of TRGECLBGTCHit module for background study
  - 1st version of samples were passed to nkzw-san
  - Discuss detail todo lists and strategy, and provide script, etc

Status of UT4 ETM

- (Fixed) Timing error on clustering logic
  - Improved logic which caused routing congestion

- (Fixed) Timing error in b2tt(idelayctrl)
  - Deactivated idelayctrl

- "ecl-inj" on GDL fluctuates w/ 5Gbps protocol UT4ETM-UT4GDL link
  - Likely to be due to long latency of 5Gbps protocol (~600ns)
  - 12Gbps protocol(~300ns) is being tested
    - Usage of gty_64b66b_top_GDLxxx_12g provided by YunTsung
    - Data transmission confirmed to be OK at test bench

- Strange b2link data with clustering logic
  - b2link data is OK w/o clustering logic
  - Clustering logic is same as UT3ETM

ECL bkg monitor

- bkg group is planning to add ECL as one of beam bkg monitor([pdf](pdf))
  - Machine parameter tuning, understanding of bkg components, future bkg prospect
  - Utilize TC hit rate as bkg parameter
- FAM node provides hit rate PV of all 576 TC (w/o injection veto)
- Requested to prepare the PV w/ and w/o injection veto
  - more looser injection veto
    - Prepare on GDL and pass it to ETM or just on ETM
    - Study of the "loose" injection veto condition, and timing adjustment on ETM is necessary

Summary

- Some bugs found in tsim-ecl and bugfix and minor update will be done

- Preparation of UT4 ETM is in progress
  - Server setup on btrgsrv3 and SLC update will be done after UT4ETM is ready

- Preparation of ECL bkg monitor is requested and will be started

Backup

Plan for LS1

- ETM to UT4 from UT3
  - Optical link
    - TMM, GDL, GRL, and b2link -> Stability check
  - I/O for trigger server
    - FW logic, Software update on trigger server
- Background study
  - BGOverlay logic for both MC and random data
  - Performance study for MC and data
  - Consistency study between MC and data
  - Based on the results, make a strategy for high luminosity and bkg conditions (for both after LS1 and LS2)
- ETM logic study for hie, Bhabha, and other bits
  - Detail studies with MC and data rejected by HLT filter ?
- Update/modify local run scripts ?
  - Update of script of single channel test run for PCIe40 => prepared by Mikahil
  - (Hope to) fix default large timing resolution
  - Prepare linearity local run script

Plan for LS1

- Calibration
  - TC Energy (in progress by Eunji)
  - TC timing
  - Automation system for TC E and T calibration (CAF can be utilized ?)
    - Or consider or prepare system(DQM) to monitor them with beam data
- TC and event timing study
  - TC energy weighted event timing
  - Xtal by xtal timing bias into tsim
- Software update
  - conditionDB
  - Integer tsim version
  - MC truth information
- Trigger server related work for ecl trigger
- Online luminosity by ecl trigger as redundancy requested by Alex

Plan after LS1 and in LS2

- Try to separate two energy deposition in one TC (if necessary) ?
  - If two signal peak positions are >500ns, it would be possible

- New ShaperDSP ?
  - Currently 576 ShaperDSPs in 52 9-VMEs around Belle2 detector
  - Alex is planning to upgrade ShaperDSP
    - Some studies are in progress in BINP (the status not shown anywhere)
  - For ecl trigger, any requests and the meaningful improvement ?
    - "TC" timing can be improved if cell-by-cell timing adjustment in each TC is possible, but bad resolution is mainly from low energy TC
  - Any merit if logic of FAM can be implemented in new ShaperDSP ?
    - TC with from 4x4=16xtail to 2x2 if it improves some performance ?

- PureCsl ?
  - Would be not realistic⋯

Bug in cluster postion in tsim

- Communication with Isabel Haide triggered to find wrong definition of cluster position("getPostionX(),Y(),Z()") in TRGECLCluster dataobject.
 - Cluster consists of energy in 3x3 TCs
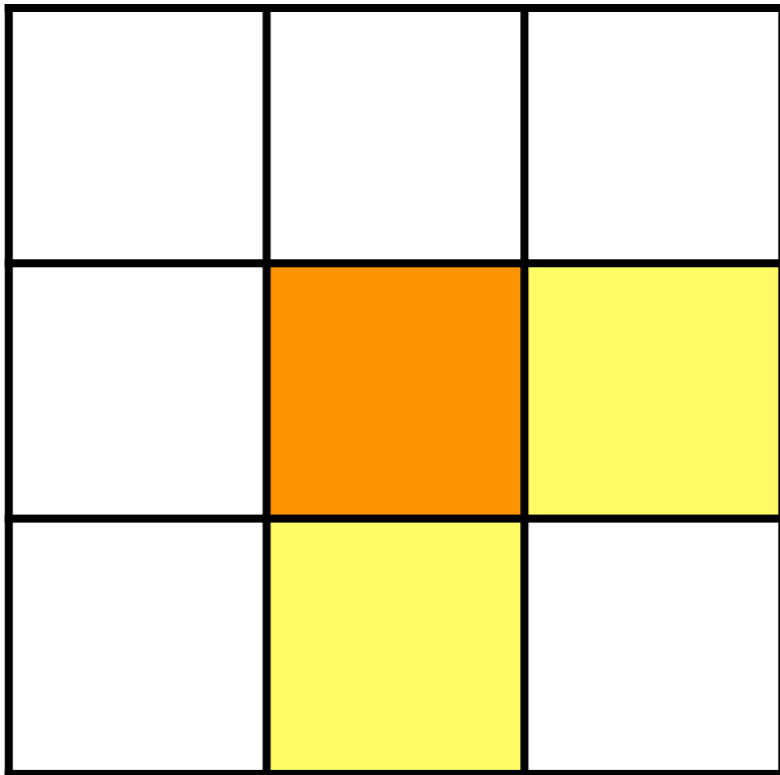
- (A) Cluster position in FW is center of most energetic TC in the cluster

- (B) "getPostion" returns TC energy weighted position in the cluster

- In ecl trigger logic, "getPosition" is not used anywhere
  - Logic is based on TCID of most energetic TC in a cluster
- In grl tsim, "getPosition" is used for track-cluster matching
- This bug will be fixed.

Trk-cluster matching check w/ particlegun

- Check track-cluster matching for (A) and (B) with simple simulation
  - "cdcecl_X" where X=0,1,2,3
  - "cdcecl_0" is "N of matched CDC track and ECL cluster is 1"
- Particle gun
  - 10K events
  - e+ or e- randomly
  - N(track) = 1 or 2 or 3 or 4 (4 cases)
  - Momentum = 0.7 to 7.0 GeV uniformly
  - Theta = 33 to 128 degree (ECL barrel region) uniformly
  - Phi = 0 to 360 degree uniformly
  - From IP
- No background
- Without any payload(?) for tsim-cdc(Is this OK!?)
- No event display check done
- No truth information in tsim-ecl
- No requirement on opening angle between any tracks
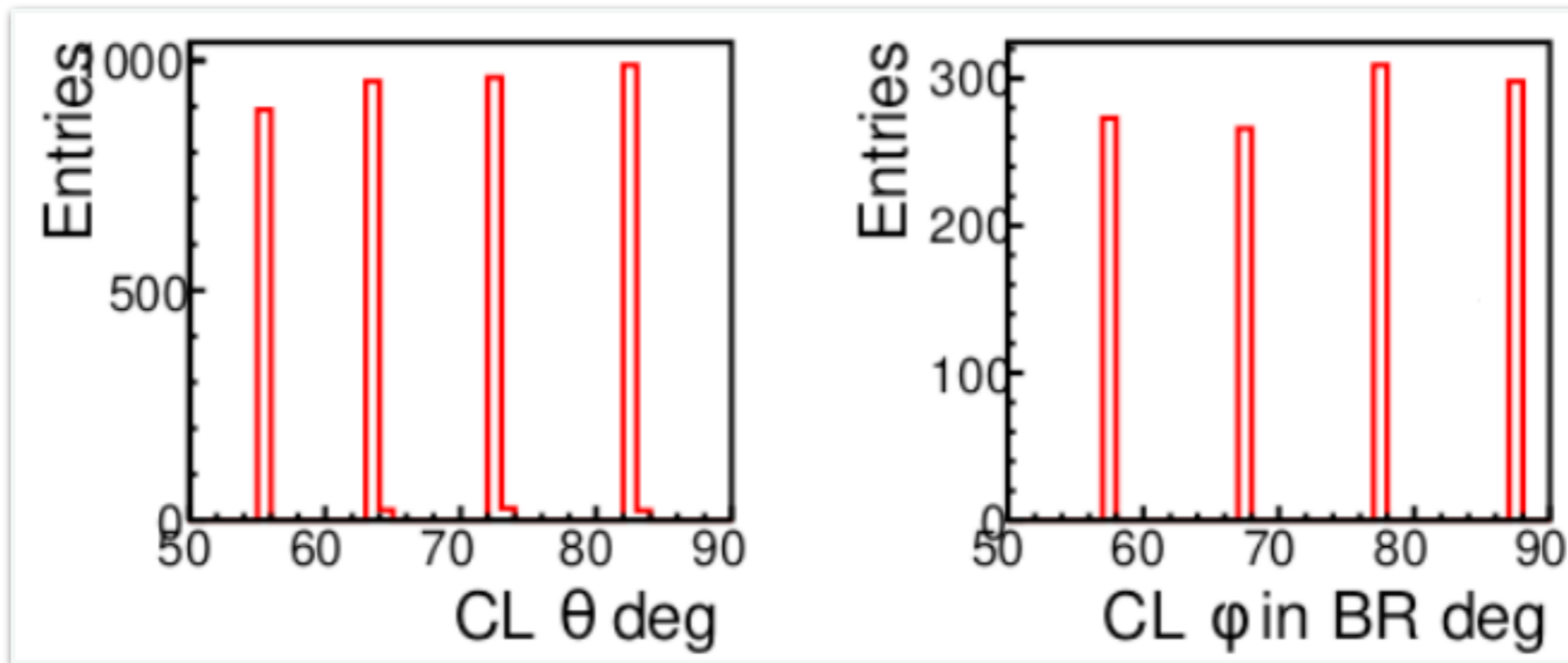- No check on L1
- W/ release06-01-04
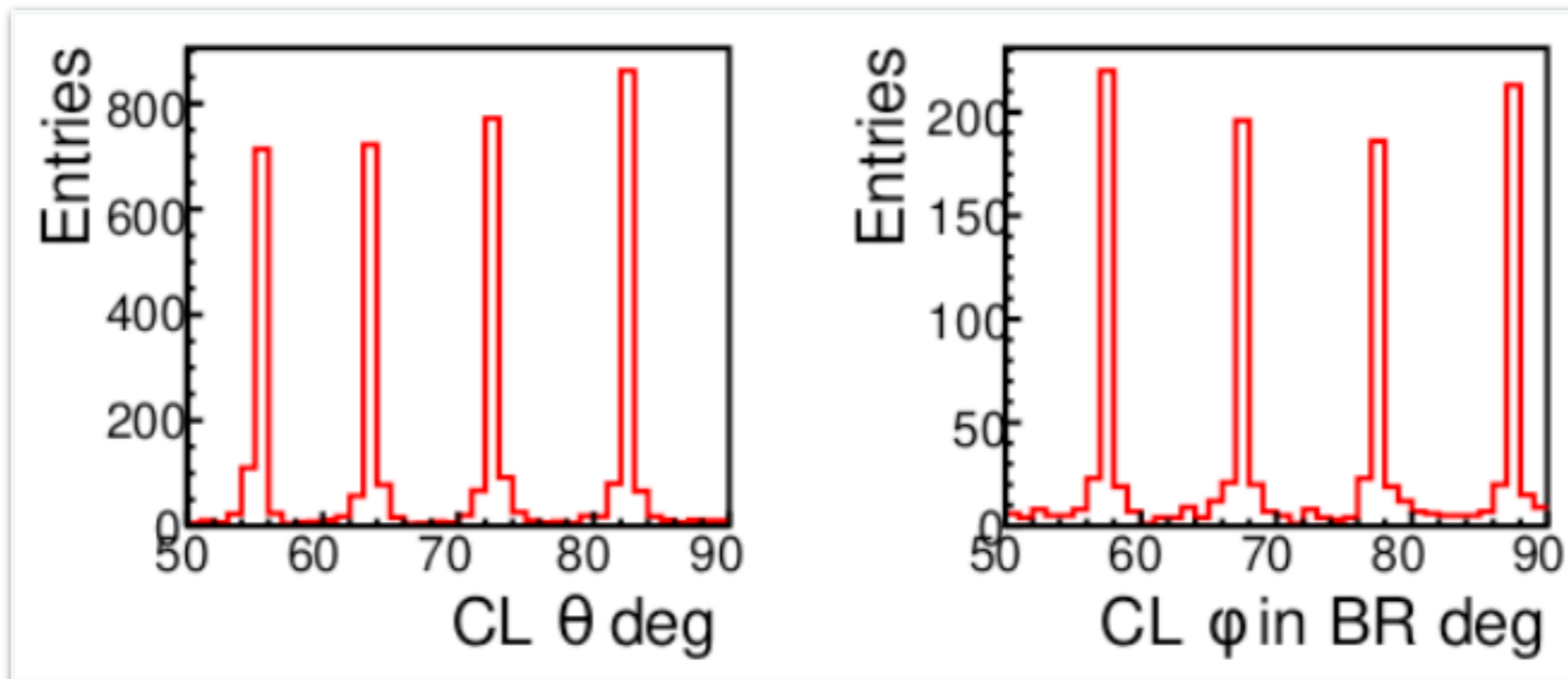
CL variable plots
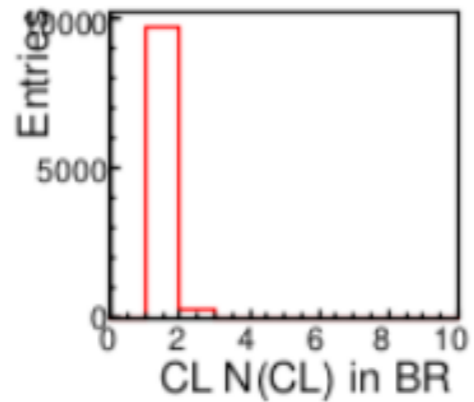
- N(trk)=1 and (A) case as an example
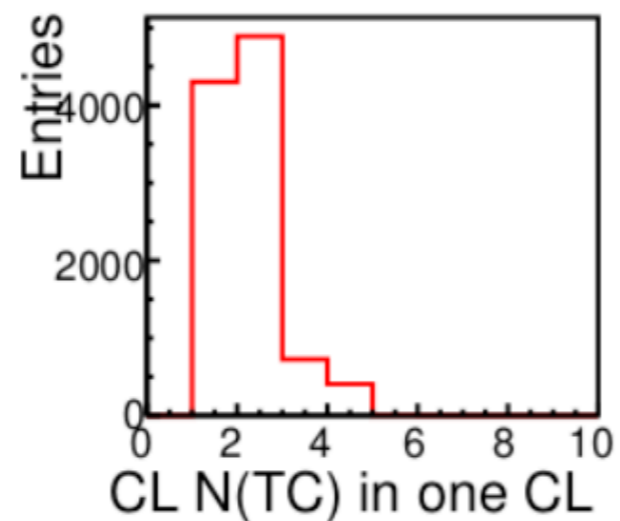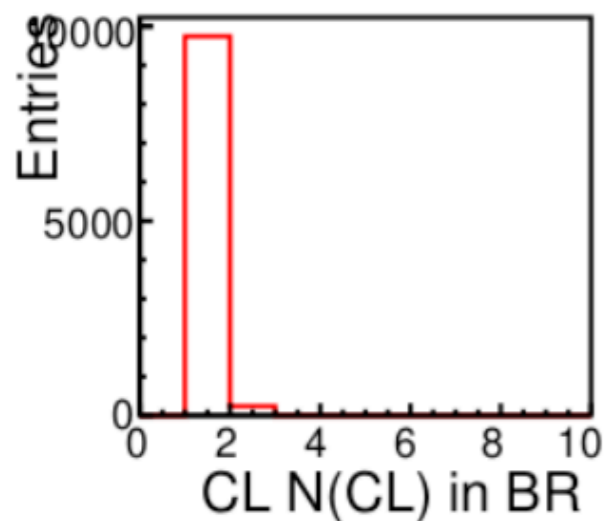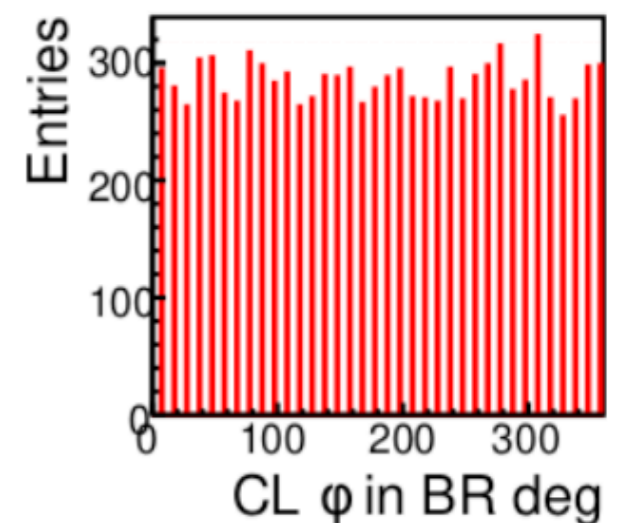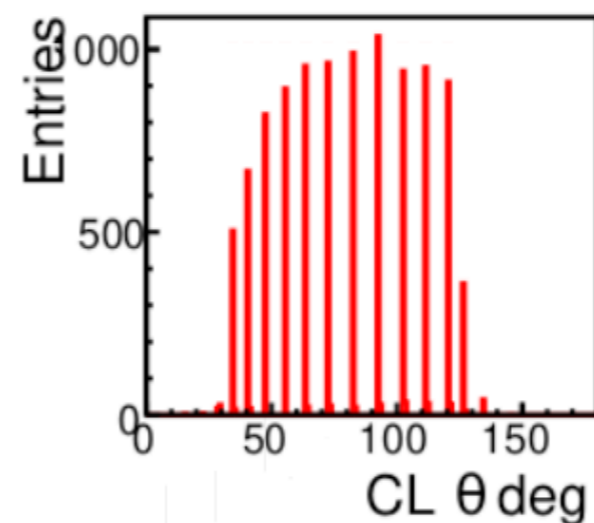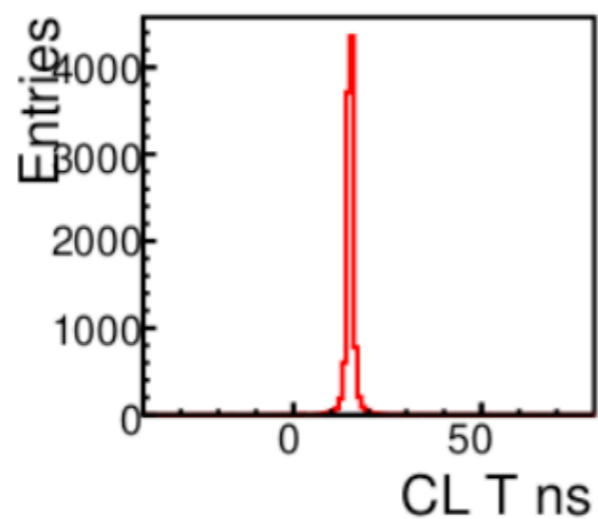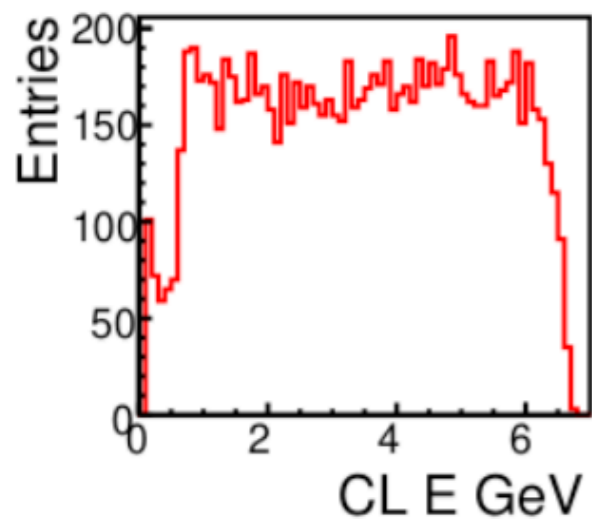
(A)

(B)

"cdcecl_X" for (A) and (B)

N(trk)=1

	[A]		[B]		[A/B]
cdcecl_0	8953	/	9001	=	0.99
cdcecl_1	15	/	16	=	0.94
cdcecl_2	3	/	3	=	1.00
cdcecl_3	0	/	0	=	0.00

N(trk)=2
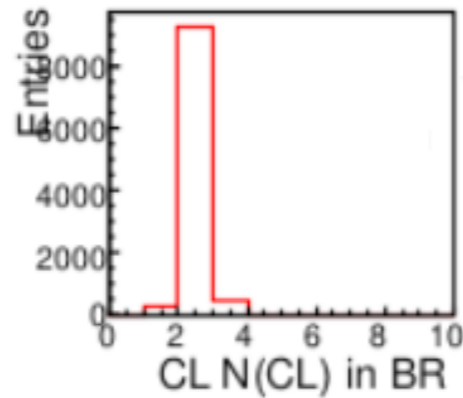
	[A]		[B]		[A/B]
cdcecl_0	1958	/	1896	=	1.03
cdcecl_1	7880	/	7962	=	0.99
cdcecl_2	42	/	56	=	0.75
cdcecl_3	5	/	9	=	0.56

N(trk)=3
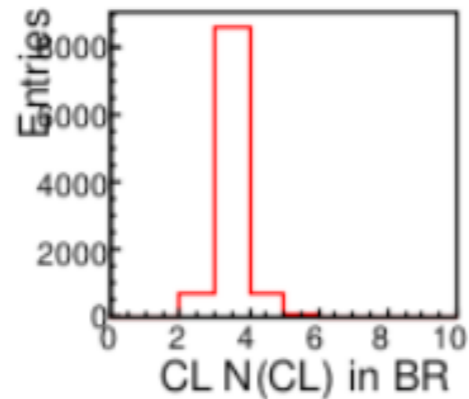
	[A]		[B]		[A/B]
cdcecl_0	361	/	261	=	1.38
cdcecl_1	2670	/	2579	=	1.04
cdcecl_2	6858	/	7024	=	0.98
cdcecl_3	101	/	122	=	0.83

N(trk)=4
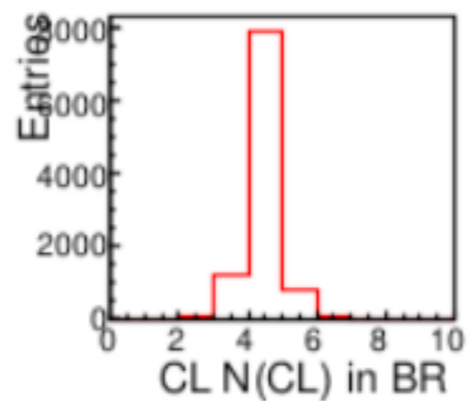
	[A]		[B]		[A/B]
cdcecl_0	46	/	44	=	1.05
cdcecl_1	657	/	572	=	1.15
cdcecl_2	3215	/	3161	=	1.02
cdcecl_3	6080	/	6221	=	0.98