



TRD Raw Data Simulation with Zero Suppression and MCM simulation

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Offline Week @ CERN

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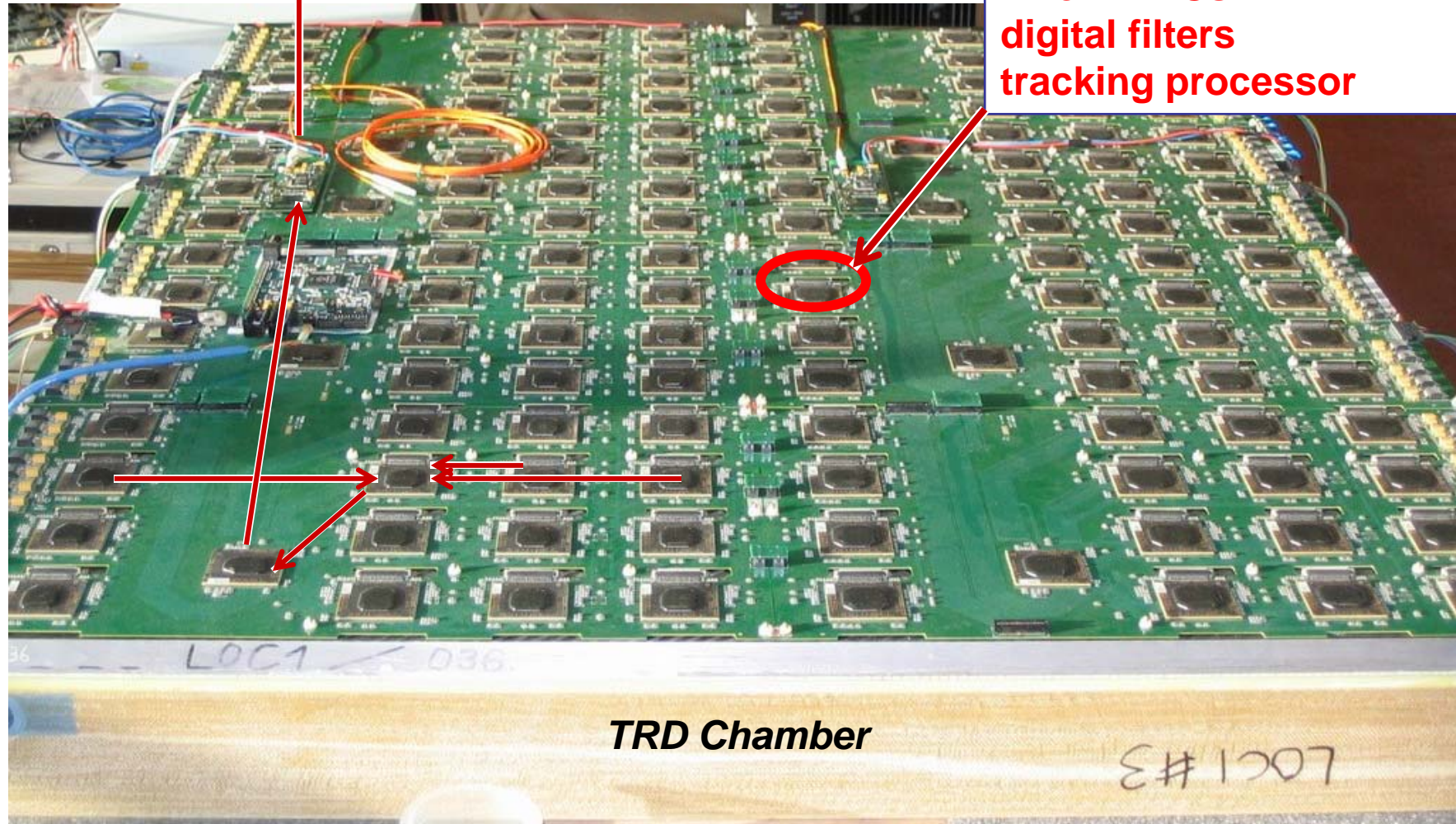
TRD FEE+DAQ Overview

GTU (Global Tracking Unit)

200 MB/s/SM

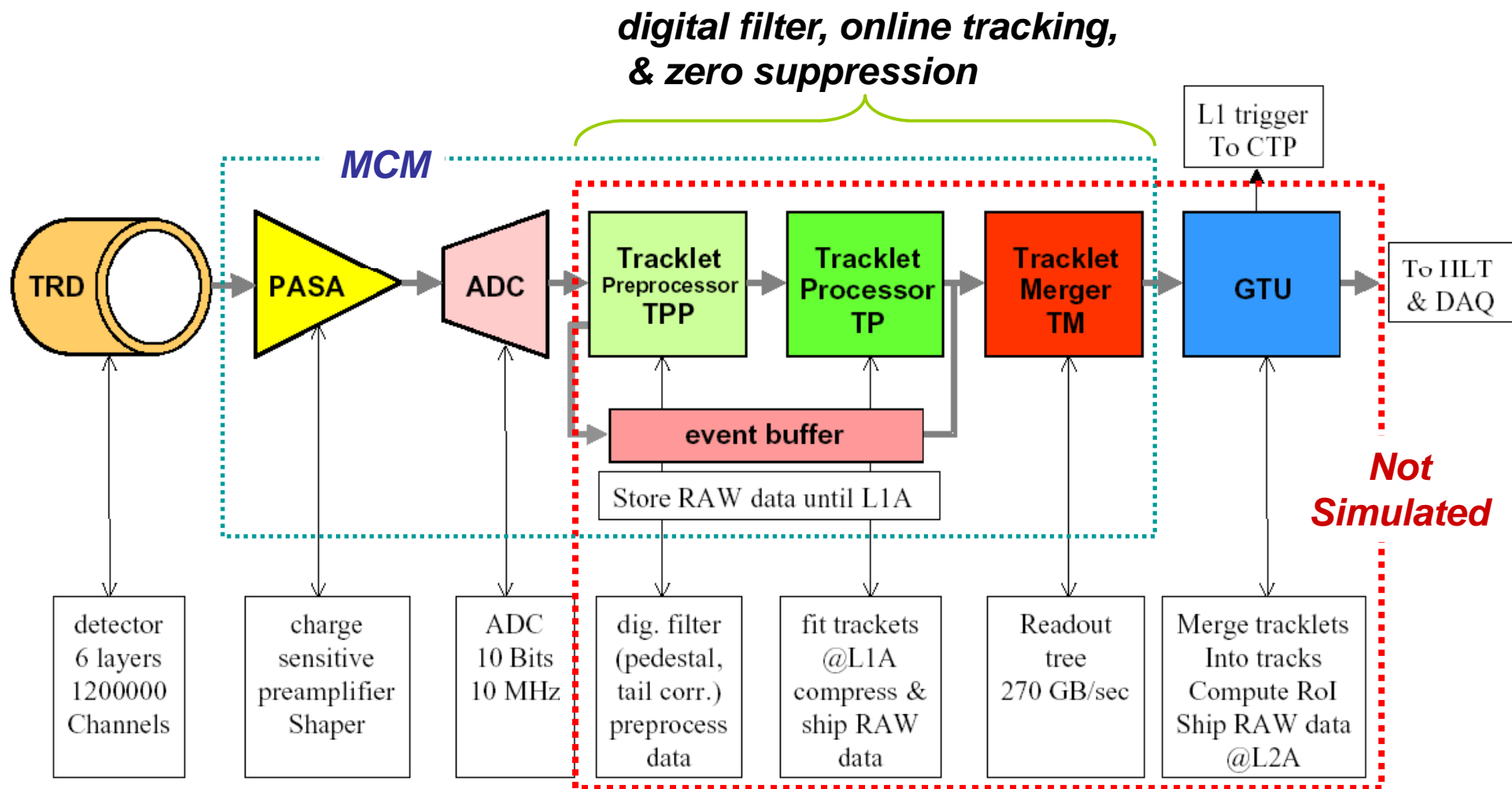
DAQ

Multi Chip Module(MCM) with
18 ch. preamplifiers
21 ch. ADCs
digital filters
tracking processor



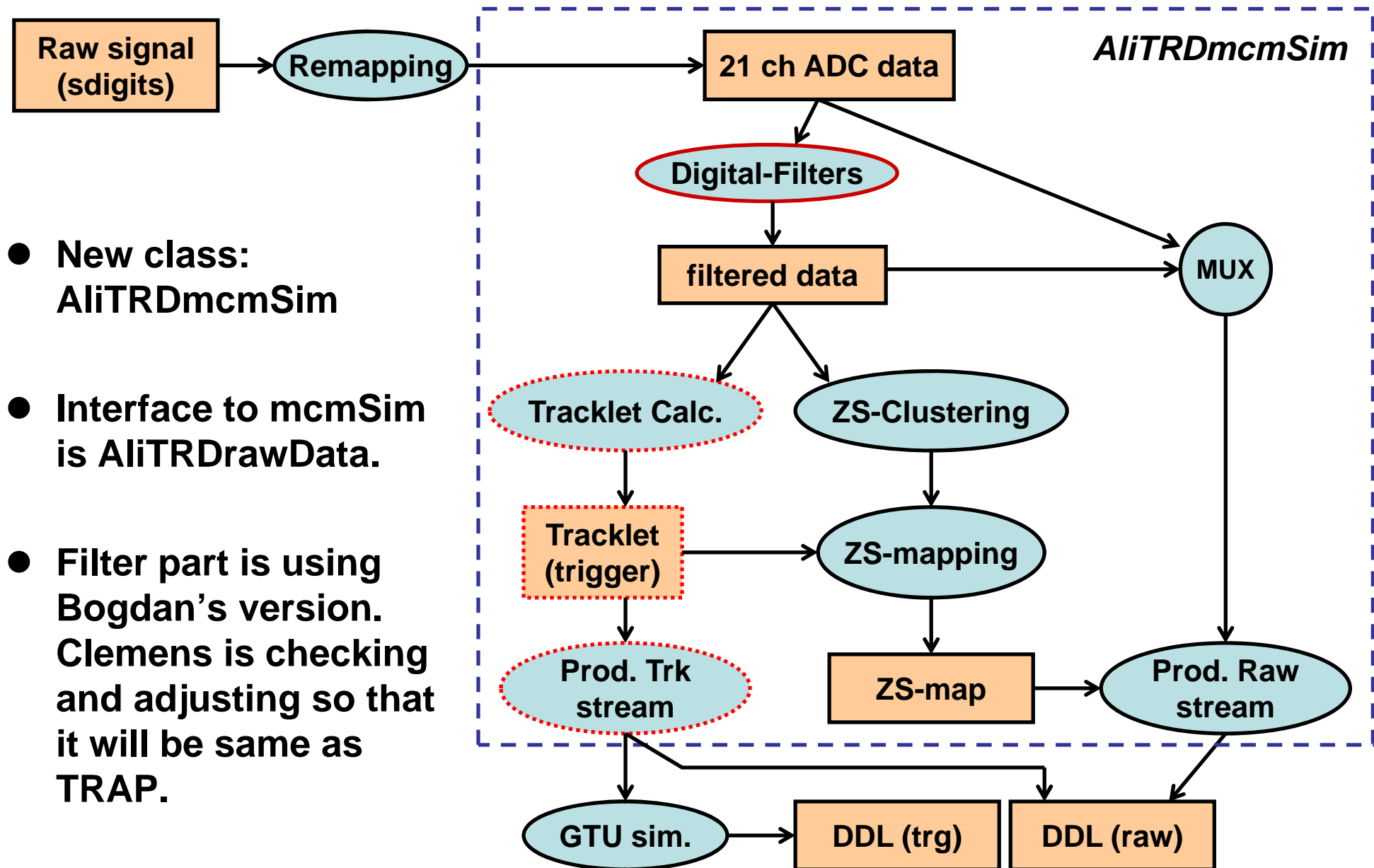
TRD Chamber

Data Flow on the Real System



- So far: only PASA+ADC were simulated in the AliRoot → kept as digits.
- We need simulation of tracking, digital filter, and zero suppression.

New AliTRDmcm Class Structure (updated)



ZSMapping in AliTRDmcmSim for RawVer=V3

Algorithm similar to the one implemented in FEE.

- A lookup table defines hits with three conditions:

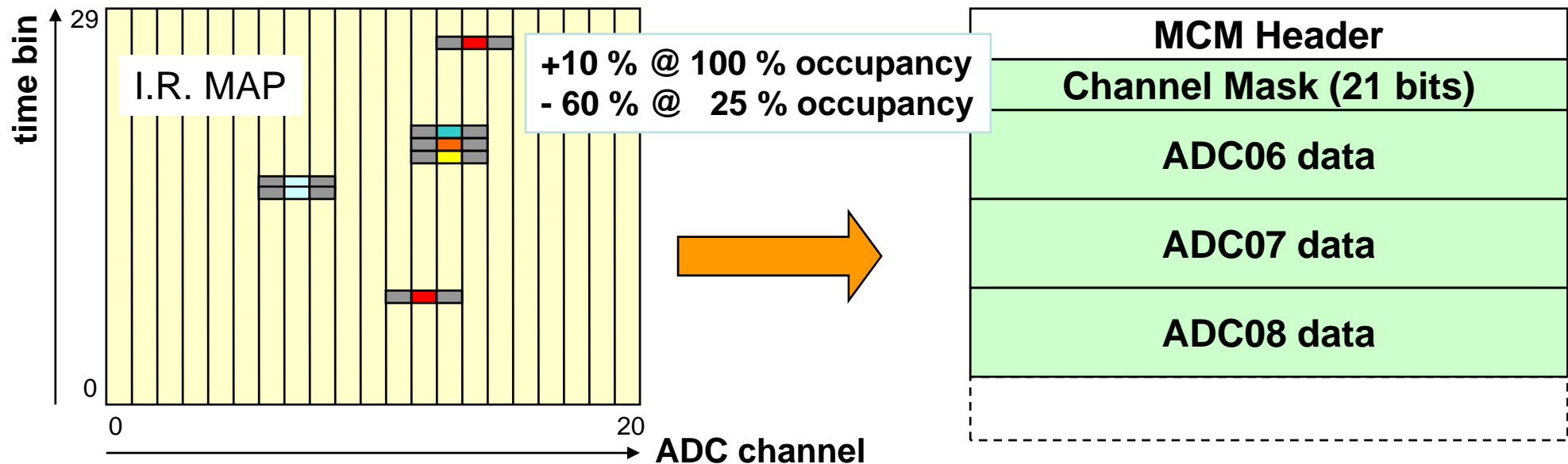
cond1: peak $Q_i > Q_{i-1}$ AND $Q_i > Q_{i+1}$

cond2: cluster size $Q_{i-1} + Q_i + Q_{i+1} > \text{Threshold}$

cond3: absolute size $Q_i > \text{Threshold}$

+ a flag to add neighboring ADC channel (neighbor sensitivity).

- Combination of conditions are programmable by LUT (default: only cond3).
- Full time-bin of ADC with at least one hit will be read out.

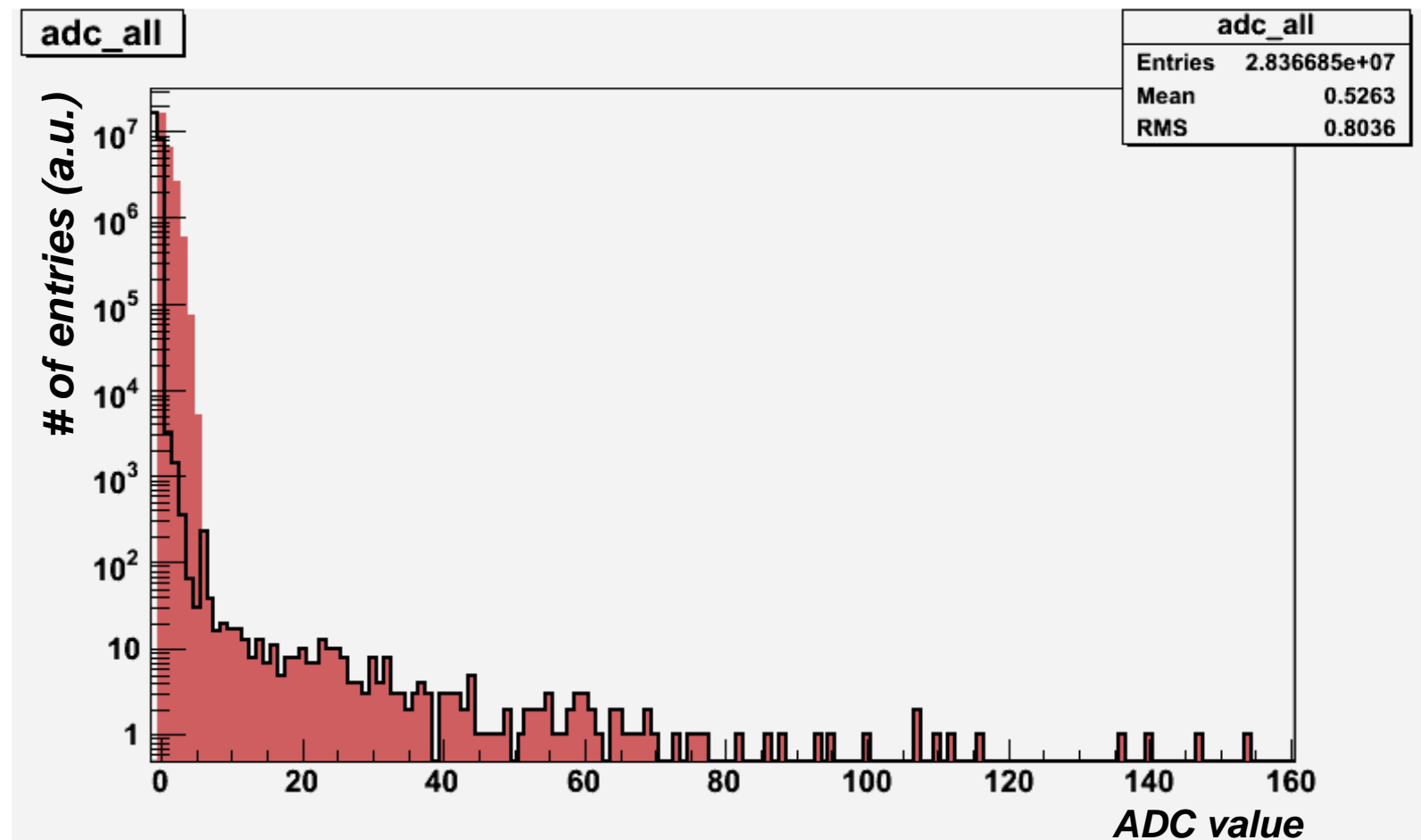


Development Status

- **Version 3 (test version) raw data read/write with zero suppression completed.**
- **A new class “AliTRDmcmSim” completed with:**
 - **Filter() ... apply digital filters: FilterTail(), FilterGain(), FilterPedestal().**
 - **ZSmapping() ... apply zero suppression mapping with same way as in TRAP.**
 - **ProduceRawStream() ... Produce MCM raw data.**
- **Reading part was done by Mateusz ... AliTRDrawStreamV2.**

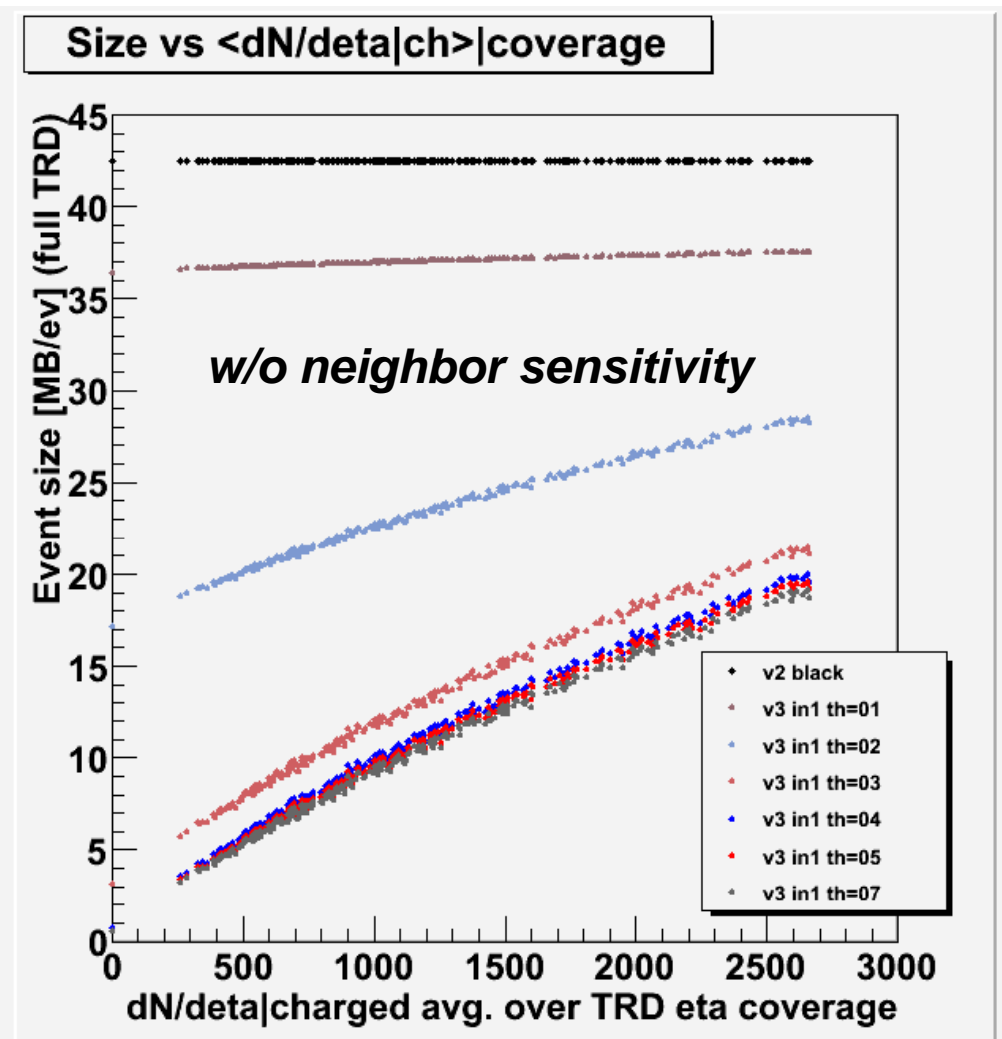
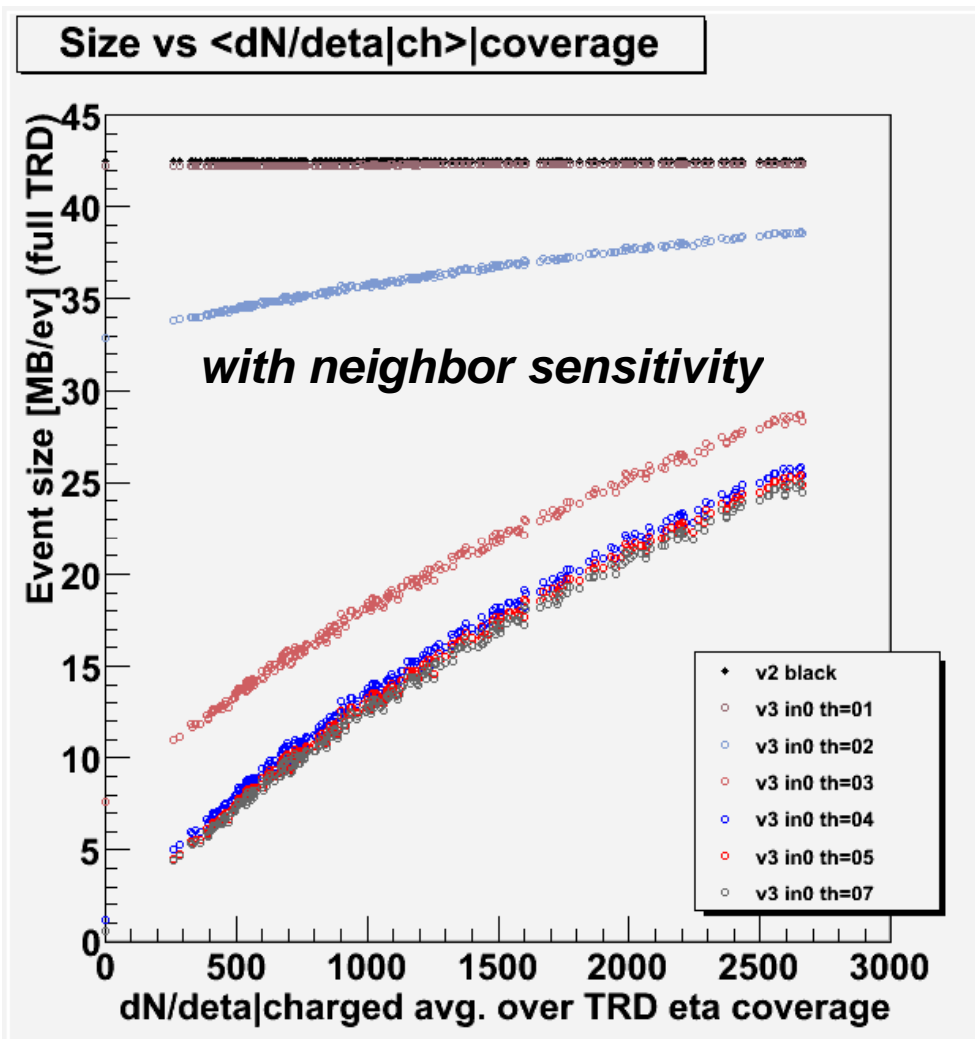
Data Integrity

- Digits integrity and mapping have been fully tested by comparing before and after zero suppression algorithm and full simulation chain including date.root integrity with help of Mateusz.



Z.S. Performance

- Tested with standard p+p (PYTHIA) & Pb+Pb (HIJING std. $b=0\sim 10$ fm) bench.
- Single indicator threshold scanned from $ADC>1$ to $ADC>7$.



Compression Efficiency (cont.)

- **Black event size: 42.5 MB for full super-module.**
- **p+p event size example [kB] (%):**

threshold	neighbor sensitive		neighbor not sensitive	
>1	43,264	(99.5)	37,304	(85.8)
>2	33,688	(77.5)	17,580	(40.4)
>3	7,792	(17.9)	3,180	(7.31)
>4	1,168	(2.69)	732	(1.68)
>5	580	(1.33)	580	(1.33)
>6	580	(1.33)	580	(1.33)
>7	580	(1.33)	580	(1.33)

- **580 kB (32 kB/SM) is the theoretical limit due to header words in data.**
- **DDL: 200 MB/s with assuming 100 kB/Sm/ev → 2 kHz event rate @ p+p achievable GTU to DAQ.**

Future Work

- **Large differences from real so far are:**
 1. **tracklet is not simulated yet. Code exists for trigger study (Bogdan).**
 2. **tail cancellation simulation should be reviewed and closer to real TRAP (will be done by Clemens). New class AliTRDtrapAlu (programmable precision arithmetic logic unit) proposed by Clemens for the first step of filter simulation study.**
- **Careful parameter adjustment is necessary with realistic noise and cluster finding efficiency study.**
- **GTU and trigger simulation are being studied (AliTRDgtuSim by Minjung).**