Boosters and Simulation update

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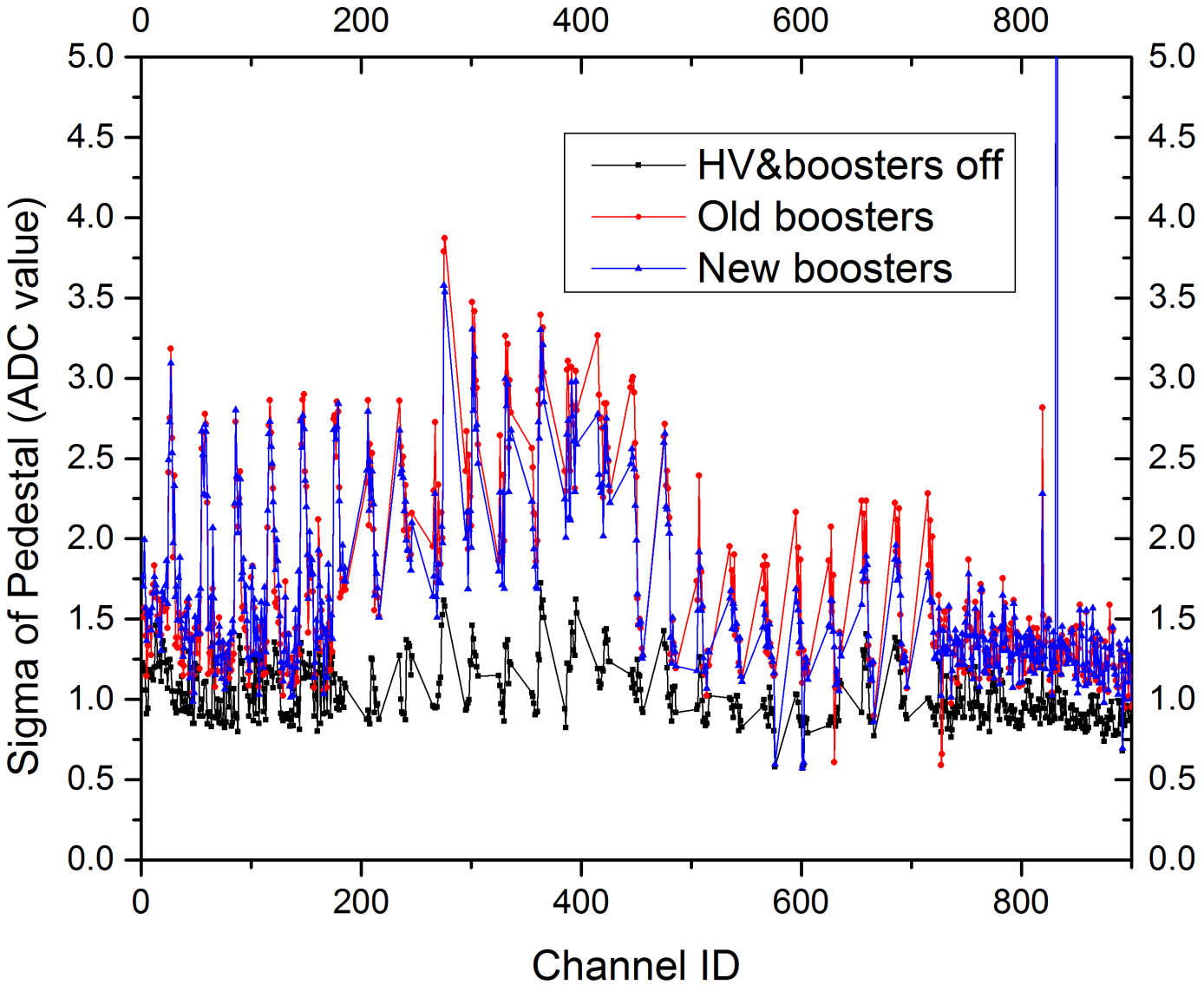
Boosters

- The sigma of pedestal data with the new boosters and the old boosters are shown in the following figures
  - There is no significant difference between the old and new boosters
  - There are a few of high sigma channels (5~6) for each case, and they are not the same channels

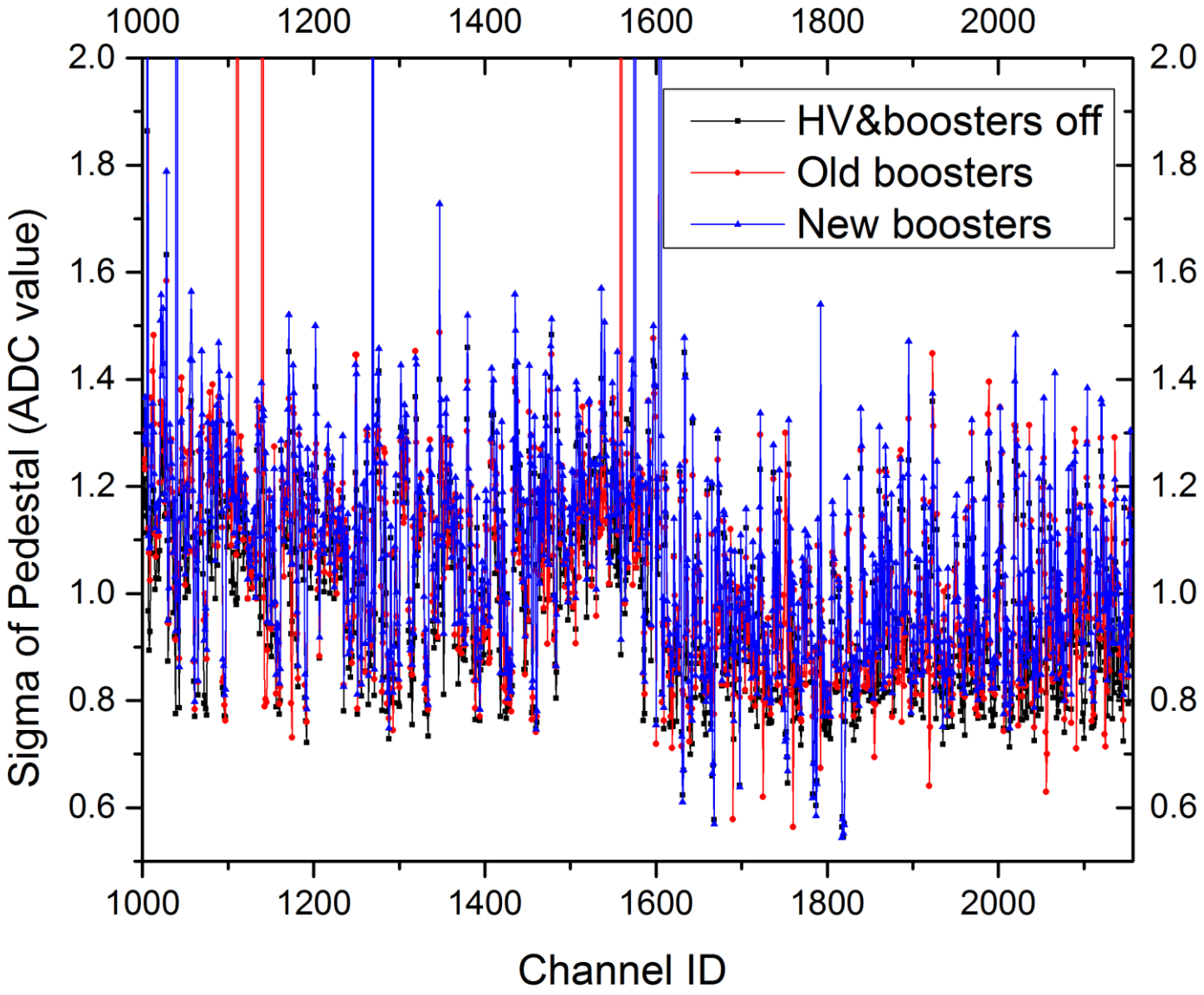
- Average sigma is

	HV&boosters off	Old boosters	New boosters
Crystal	1.06	1.67	1.67
Pb-glass	1.04	1.10	1.14

Pb-glass Modules



Crystal Modules

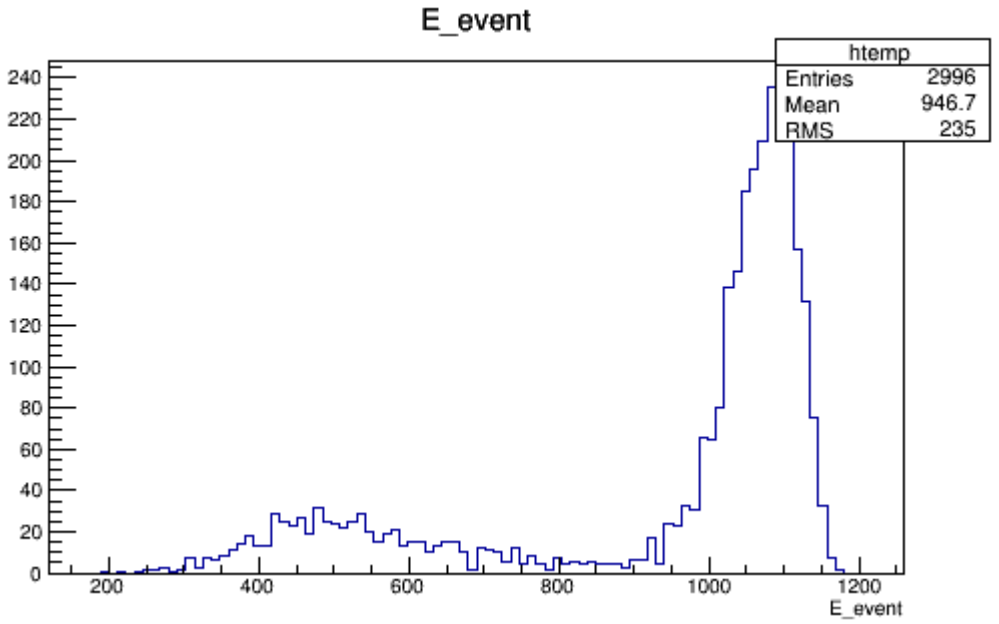


Solid target simulation

- Default physics list for hadronic process in Geant4 is added
- Target is a diamond piece with the thickness of 1 mm
  - Geant4 has problem to deal with a very thin material, thus I made a 1 mm thick target here
  - 1 mm diamond = 1.755×10^{22} C/cm^2, 10 um diamond = 1.755×10^{20} C/cm^2
- Trigger rates for DAQ and raw event rates on HyCal are studied in the simulation

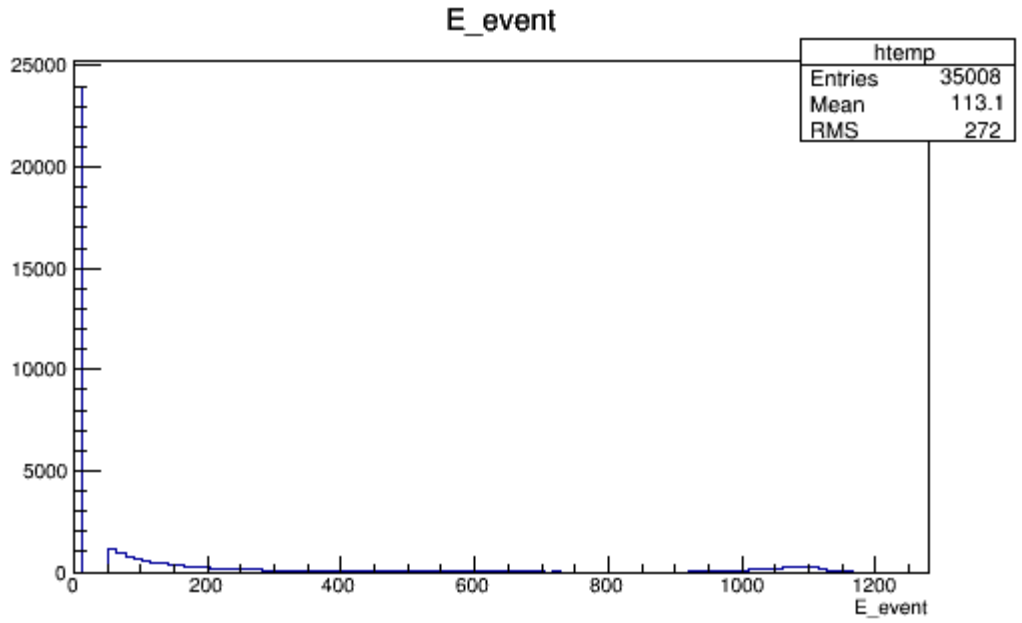
Solid target simulation

- Trigger: total sum of energy deposit in HyCal > 500 MeV
- Incident electrons 10^6, Trigger rates = 6250×2996 = 18.73 MHz (1 nA)
- If we limit DAQ rates at 5 kHz, the target thickness limit will be 4.7×10^{18} C/cm^2



Solid target simulation

- Raw event rates without any trigger 6250×35008 = 218.8 MHz
  - 0 energy means no valid hits reconstructed (reconstruction criterion: cluster energy > 50 MeV)



Solid target simulation

- If we scale the target thickness to 10 um, the rates are shown in the table

	10 um Diamond target	Limits
DAQ Rates	187.3 kHz	5 kHz
Raw Rates	2188 kHz	28 kHz

- DAQ rates limit < 5 kHz
- Simple estimation of pile-up events
  - Events obey Poisson distribution, dead time of HyCal is estimated as 500 ns
  - Probability that 0 events occur in the upcoming 500 ns is $e^{-R*500ns}$, R is the total rates
  - If we require the pile-up events < 0.5%, R ≈ 10 kHz (local limit for the highest occupied module)
  - In the simulation, about 35.6% events fired the modules closest to the beam center. Total rates limit is thus estimated as 10 kHz/0.356 = 28 kHz