Trigger rates

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Trigger cuts

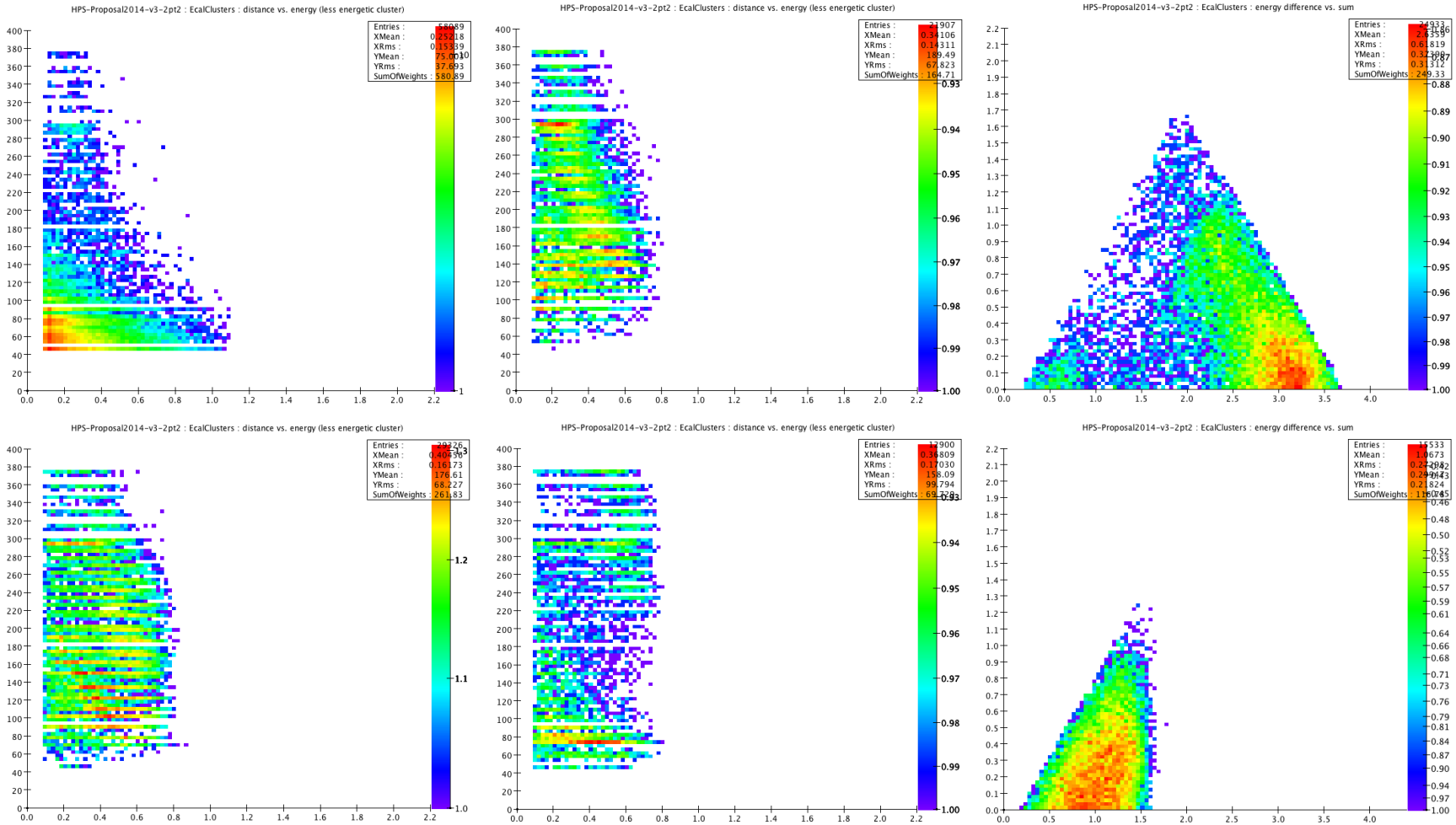
- Cuts are as specified in test run proposal (energy cuts use energy read out from crystals):
  - Cluster energy: 0.1 to 1.85 GeV
  - Pair energy sum less than 2.2 GeV
  - Pair energy difference less than 1.5 GeV
  - Energy-distance: for less energetic cluster, $E + d \times (0.0032\mathrm{GeV}/\mathrm{mm}) > 0.8$ GeV
  - Cluster seed crystals coplanar to 35°
- For different beam energies, just scale all the cut energies proportionally
- Dropped opposite-quadrant cut—redundant with coplanarity and doesn't reflect actual trigger setup

Simulation

- Stdhep files at 1.1, 2.2 and 6.6 GeV:
  - EGS5 beam background
  - MadGraph tridents
  - A' tridents (spaced by 1000 ns)
  - For 6.6 GeV, pion singles from Geant4 and FLUKA (to compare)
- 5×10^7 bunches, or 100 ms of beam; at least 10^5 A' tridents for all but the lowest masses
- Run SLIC using HPS-Proposal2014-v3 geometry
- Readout sim uses "constant window" integration in FADC
- All files available online: see `https://confluence.slac.stanford.edu/display/hpsg/Finding+Data`

Looking at cuts

- Check each cut by looking at events where all other cuts passed
- Here: energy-distance cut on 2.2 GeV background and 50, 100 and 200 MeV A'; pair energy for background and 50 MeV A'



Background trigger rates

Sample	Rate (kHz)
2.2 GeV EGS5	22.3
2.2 GeV EGS5+tridents	28.3
6.6 GeV EGS5	5.3
6.6 GeV EGS5+tridents	7.4

- These are just the runs completed so far
- 2.2 EGS5+tridents rate is increased from 12.6 kHz in previous set of studies (`http://www.slac.stanford.edu/~meeg/presentation/2012-02-07/2012-02-07.pdf`) because of the different FADC algorithm
  - Old time-over-threshold integration algorithm gives 11.1 kHz (reduction consistent with new geometry)

A' acceptance

Sample	Acceptance (%)
2.2 GeV beam, 25 MeV A'	2.4
2.2 GeV beam, 50 MeV A'	10.6
2.2 GeV beam, 75 MeV A'	18.2
2.2 GeV beam, 100 MeV A'	16.6
2.2 GeV beam, 150 MeV A'	5.9
2.2 GeV beam, 200 MeV A'	2.5
2.2 GeV beam, 250 MeV A'	1.4

- Not significantly changed
- Again, just the runs completed so far
- With-background (pileup) runs not done
- Trigger+tracker "combined acceptance" still to come