Usage of Abort Gap Events And Overall AlCa Bandwidth Usage

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on behalf of AlCa group
AlCa trigger Review
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Which subdetector wants to do what during the abort gap?
- Ecal
- DT
- Tracker
- HCAL
Overall AlCa-Bandwidth consumption so far

Ecal Abort Gap Events

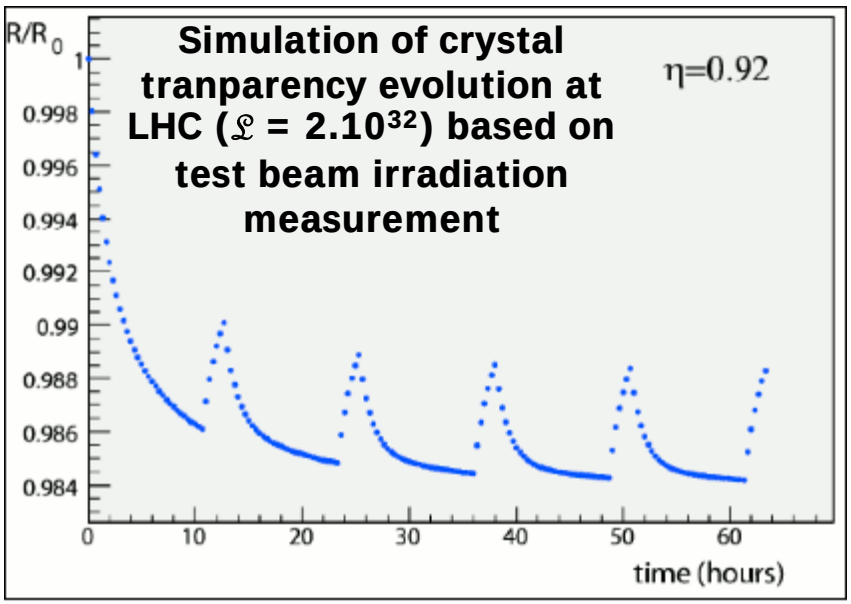
Ecal: Laser Monitoring 2MB/s during abort Gap

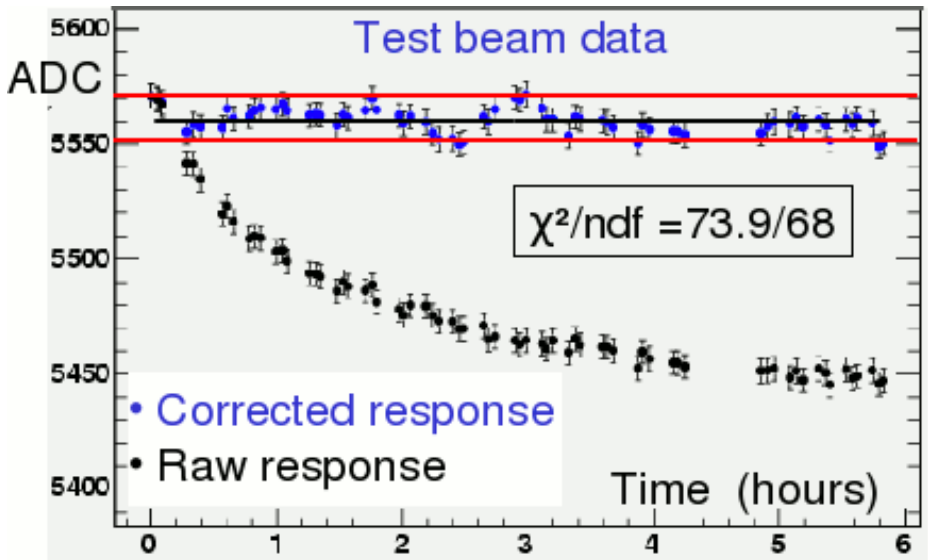
Justification: Ecal need to monitor the transparency of the crystal in order to correct the response

Use full rate 100Hz with an event size of around ~40kB/ev [uncompressed]
➔ Bandwidth ~2MB/s (upper bound 4MB/s) [full cycle in 20 minutes]

Data are processed at P5 on Ecal Farm.
Data transfer to T0.

Responsible: Caltech/Saclay(IRFU) institution (A. Bornheim, P. Jarry)





DT Abort Gap Events

DT: Pulsing 7MB/s during abort Gap

Justification: DT needs to monitor the t0 calibration over data taking

Rate maximum 10Hz

2 levels of acquisition:

level 0 : Test Pulse not enabled size = 6 kB/event (average value corresponding to ~3 muons in CMS DT)

level 1 : Test Pulse enabled size = 600 kB/event

The rate of Test Pulse will be prescaled at 1 or maximum 10Hz.

➔ Bandwidth will be if we assume 100 Hz total rate:

minimum bandwidth = 99 Hz * 6kB/ev + 1 Hz * 600 kB/ev = 1.2 MB/sec

maximum bandwidth = 90 Hz * 6kB/ev + 10 Hz * 600 KB/ev = 7 MB/sec

Tracker Abort Gap Events

Tracker: Laser during 3000 abort Gap events

Justification: Tracker wants to monitor alignment during collisions

Rate: Need to look at laser data which are sent over only 3000 events within Abort Gap events (with test enable on). Working of finding a pattern that can indicate that Laser was ON (to avoid sending at a rate of 100Hz).

Event size is reduced to modules needed: ~20kB/ev (upper bound, implementation is on going)

Data transfer to T0, analysis expected to be done on CAF.

Hcal Abort Gap Events

- The HCAL orbit gap events will consist of
  - RadDam (Laser) events
    - a batch of 1 k events at 10 Hz every 6 hr
  - Gain monitoring (Laser) events
    - HB+HE HPD: a batch of 50 events at 10 Hz every 1 hr
    - HO HPD: as above
    - HF PMT: as above
  - Pedestal events
    - whole HCAL: batched as needed and at a frequency of 1-2 Hz
- Laser event will (most likely) be zero suppressed, while pedestal events will be unsuppressed

Paolo Rumerio, Maryland, Hcal DPG 26th Jan09

Hcal is not so large, so can expect small event size (except if non zero-suppressed). Discussion is on going to finalize all this.

Main analysis done at P5, data transfer to T0 in order to perform analysis on CAF.

Responsible: University of Minnesota

Bandwidth Calculation

(for AlCa concerns)

How do we count?

The bandwidth is a mean value between collision time and non collision period. So all pedestal runs should enter in the calculation.
And only the data which are shipped from P5 to T0 should be counted.

Let's consider 2 situations:
- Runs taken out of collisions time (that do not contain cosmics, as cosmics are considered as physics events for background studies)
- Data taken during collisions that will not be used for physics.

Then we sum considering 10 hours of running and 4 hours of fill for the standard phase (no more commissioning phase).

Runs before collisions

Pixel: Data transferred to castor
Tracker: Data transferred to castor

Ecal: 2x150 MB Pedestal Runs and Test pulse run (before each collision)
Laser Monitoring 2MB/s

Hcal: No need (will use abort gap)

DT: Pulsing + pedestal runs: 7MB/s

CSC: No need

RPC: No need

Total for 4 hours of refill: 0.3+2+ 7 = 9.3 MB/s

Data during collisions

Untouchable:
Ecal: Laser Monitoring 2MB/s during abort Gap
DT: Pulsing 7MB/s during abort Gap
Tracker: laser alignment ~ 20kB/s

AlCaRaw (L = 8.0 x 10^{29} / L =1 x 10^{31} from 24th November prescale):
EcalPhiSym: 2.5 kB x 1255 Hz = 3.1 MB/s / 2.5 kB x 655 Hz = 1.5 MB/s
EcalPi0: 1.2 kB x xx Hz = xx kB/s * / 1.2 kB x 1160 Hz = 1.4 MB/s
Sum of AlCaRaw so far: ~3.1 MB/s / 2.9 MB/s

AlCaRaw (L = 8.0 x 10^{29} / L =1 x 10^{31} from 4th December prescale):
EcalPhiSym: 2.5 kB x 4100 Hz = 10.0 MB/s / 2.5 kB x 3900 Hz = 9.5 MB/s
EcalPi0: 1.2 kB x xx Hz = xx kB/s * / 1.2 kB x 1070 Hz = 1.3 MB/s
Sum of AlCaRaw so far: ~10 MB/s / 10.8 MB/s

EcalPhiSym asked for 1kHz at L1
→ Sum of AlCaRaw so far: ~2.5 MB/s / 3.7 MB/s

*** For Pi0 rate estimation over 8E29 with new code cannot be performed (need to rerun L1)**

Data during collisions

Technical triggers:

Cosmics during collisions: 150kB x 1-2 Hz ~ 300 kB/s

Beam Halo: 200kB x less than 1 Hz < 200 kB/s

BSC: 200kB x a few Hz (2-5Hz) < 1MB/s

HLT_SingleJet15NoBeam: 200kB x ~1Hz = 200 kB/s for Hcal HPD noise studies

So during collision time, we have (24th November prescale):

2 + 7 + 0.02 + 3.1 + xx = 12.1 MB/s (L = 8.0 x 10^{29})

2 + 7 + 0.02 + 1.5 + 1.4 = 11.9 MB/s (L = 1.0 x 10^{31})

So during collision time, we have (4th December prescale):

2 + 7 + 0.02 + 10.0 + xx = 19.2 MB/s (L = 8.0 x 10^{29})

2 + 7 + 0.02 + 9.5 + 1.3 = 19.8 MB/s (L = 1.0 x 10^{31})

With what we would like to have:

2 + 7 + 0.02 + 2.5 + xx = 11.7 MB/s (L = 8.0 x 10^{29})

2 + 7 + 0.02 + 3.7 + 1.3 = 14.0 MB/s (L = 1.0 x 10^{31})

NB: HcalPhiSym is not counted here as it should be run on dedicated runs (not usual running)

Express Stream

List of AlCaReco paths in express stream (HLT bits not tune to lean menu yet):

–TkAlMinBias = HLT_MinBiasEcal, HLT_MinBiasHcal, HLT_MinBiasPixel

–TkAlMuonIsolated = HLT_Mu3, HLT_Mu5, etc

–RpcCalHLT = HLT_L1MuOpen, HLT_L1Mu, HLT_Mu3, HLT_Mu5, HLT_L2Mu9, HLT_DoubleMu3, etc

–HcalCalDijets = HLT_DiJetAve30, HLT_Jet30, HLT_Jet50, (HLT_Jet80, HLT_DiJetAve15, HLT_DiJetAve50)

–SiStripCalMinBias = HLT_MinBiasEcal, HLT_MinBiasHcal, HLT_MinBiasPixel

–MuAlCalIsolatedMu = HLT_L1MuOpen, HLT_L1Mu, HLT_Mu3, HLT_Mu5, HLT_L2Mu9, HLT_DoubleMu3

➔ 100% overlap : - TkAlMinBias/SiStripCalMinBias
- TkAlMuonIsolated/RpcCalHLT/MuAlCalIsolatedMu

(No defined HLT bits picked up as Expressed yet, so for the moment take all of them).

Express Stream

24th November Prescale

Counting only:

1) HLT_MinBiasEcal, HLT_MinBiasHcal, HLT_MinBiasPixel
2) HLT_L1MuOpen, HLT_L1Mu, HLT_Mu3, HLT_Mu5, HLT_L2Mu9, HLT_DoubleMu3 (~All muons)
3) HLT_DiJetAve30, HLT_Jet30 , HLT_Jet50, (HLT_Jet80 , HLT_DiJetAve15, HLT_DiJetAve50) (~All Jets)

Event size taken from Ecomm report
($L = 8.0 \times 10^{29}$ / $L = 1.0 \times 10^{31}$) (24th November prescale) :
1) → 200 kB x 6.4 Hz = 1.3 MB/s /200 kB x 8.2 Hz = 1.6 MB/s
2) → 200 kB x 21.0 Hz = 4.1 MB/s / 200 kB x 10.6 Hz = 2.1 MB/s
3) → 200 kB x 21.0 Hz = 4.1 MB/s / 200 kB x 8 Hz = 1.6 MB/s (overlap not fully taking into account)

If we consider that express Stream are fully AlCa, then:
$L = 8.0 \times 10^{29}$ → 9.5 MB/s
$L = 1.0 \times 10^{31}$ → 5.3 MB/s

Express Stream

4th December Prescale

Counting only:

1) HLT_MinBiasEcal, HLT_MinBiasHcal, HLT_MinBiasPixel
2) HLT_L1MuOpen, HLT_L1Mu, HLT_Mu3, HLT_Mu5, HLT_L2Mu9, HLT_DoubleMu3 (~All muons)
3) HLT_DiJetAve30, HLT_Jet30 , HLT_Jet50, (HLT_Jet80 , HLT_DiJetAve15, HLT_DiJetAve50) (~All jets)

Event size taken from Ecomm report

($L = 8.0 \times 10^{29}$ / $L = 1.0 \times 10^{31}$) (4th December prescale) :

1) → 200 kB x 10.6 Hz = 2.1 MB/s /200 kB x 13.6 Hz = 2.7 MB/s
2) → 200 kB x 23.8 Hz = 4.6 MB/s / 200 kB x 10.6 Hz = 2.1 MB/s
3) → 200 kB x 27.0 Hz = 5.3 MB/s / 200 kB x 21.3 Hz = 4.2 MB/s (overlap not fully taking into account)

If we consider that express Stream are fully AlCa, then:

$L = 8.0 \times 10^{29}$ → 12.0 MB/s

$L = 1.0 \times 10^{31}$ → 9.0 MB/s

Conclusion

Summary of Abort Gap usage has been performed.

Bandwidth calculation:

- **Between collisions: Bandwidth usage: 9.3 MB/s**
- **During collisions (with 24th November prescale): 12.1 / 11.9 MB/s**
- **During collisions (with 4th December prescale): 19.2 / 19.8 MB/s**
- **During collisions (with 1kHz for EcalPhiSym prescale): 11.7 / 14.0 MB/s**
- **Technical triggers during collisions: ~ 2.0 MB/s**
- **Express Stream: (should be share with Physics)**

  L = 8.0 x 10^{29} ➔ 9.5 MB/s (4th December prescale:12.0)

  L = 1.0 x 10^{31} ➔ 5.3 MB/s (4th December prescale: 9.0)

➔ AlCa people understand that what ever AlCa events is selected, it is decreasing physics events by same amount.