Cluster Finder and Cluster List Status Report

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- L2CAL Overview
- Cluster Finder performance
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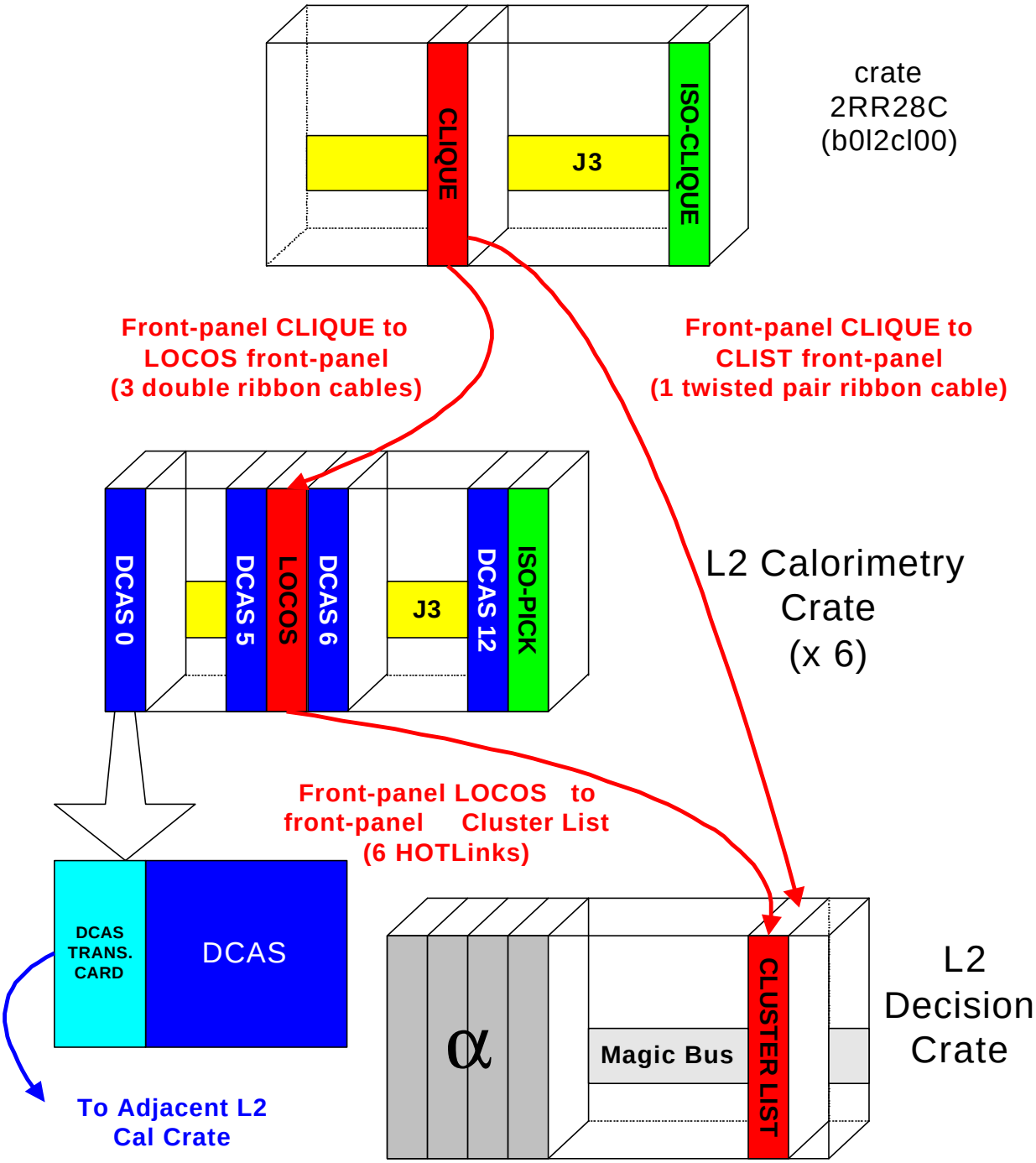
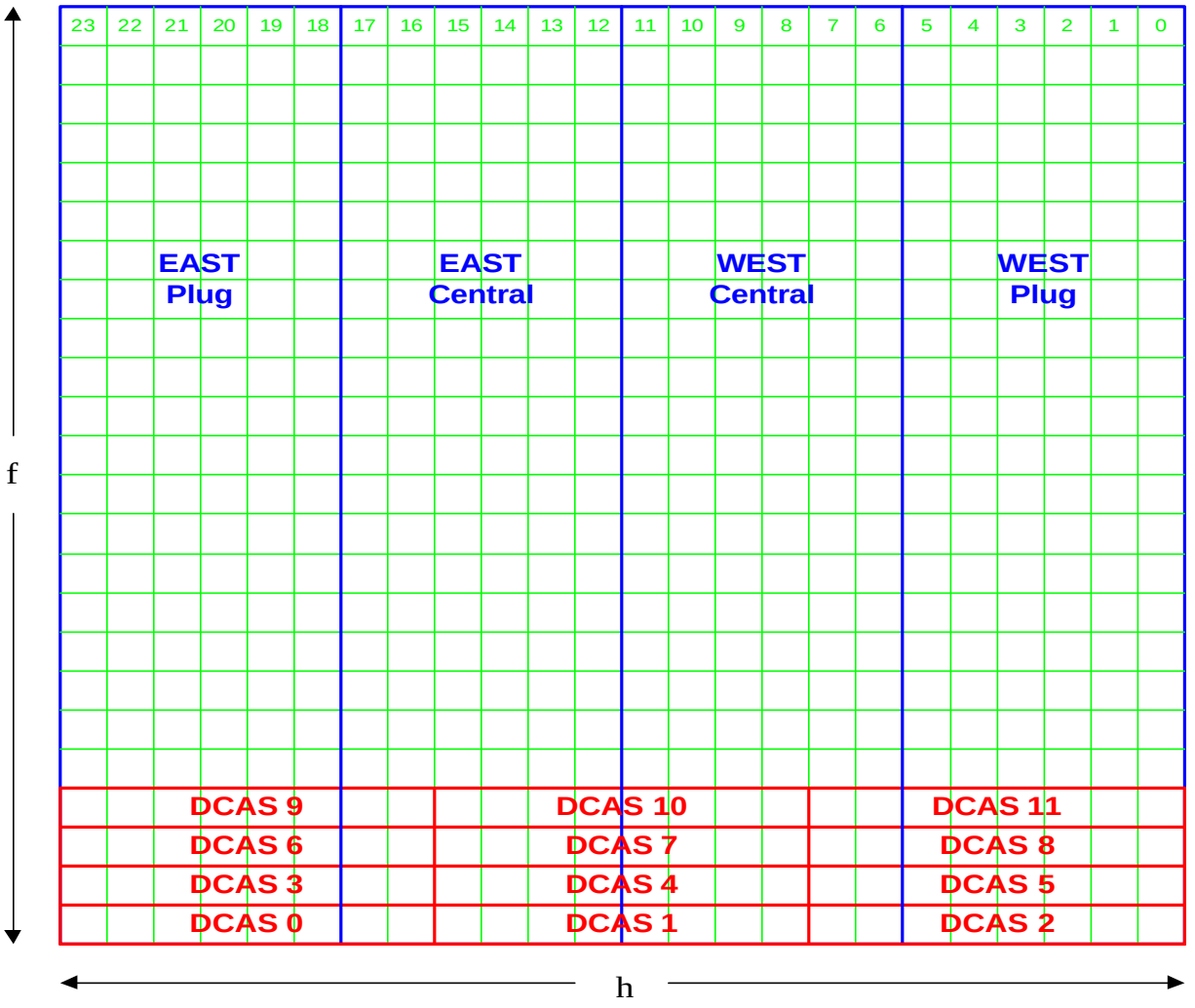
- Interaction with other boards

L2CAL Overview



L2CAL Trigger Map



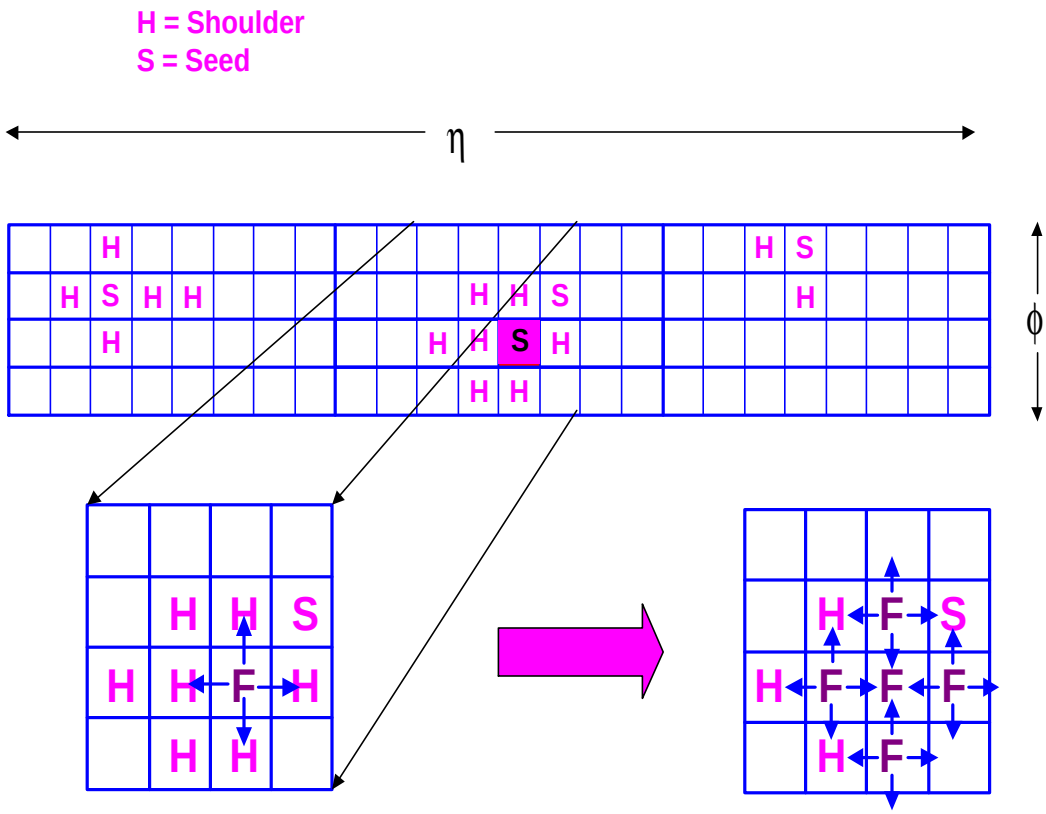
East (h > 0)

***LEFT* side of trigger room**

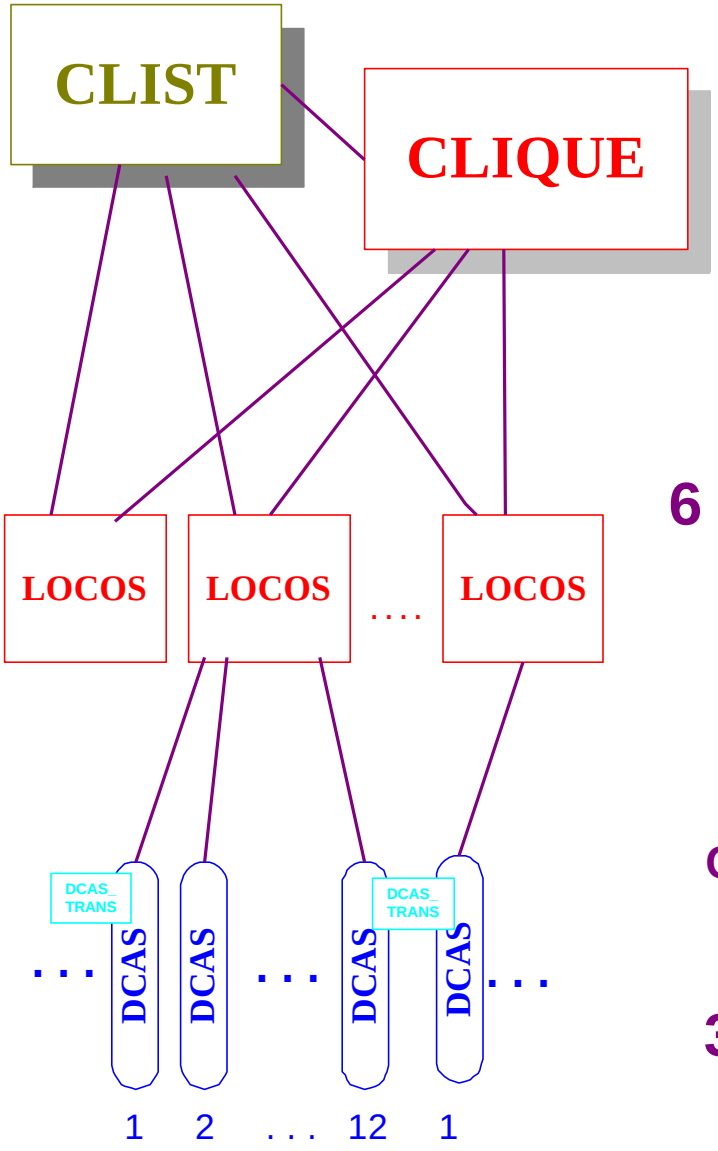
West (h < 0)

***RIGHT* side of trigger room**

L2CAL
Clustering Algorithm



L2CAL Board Counts



1 Cluster LIST
(2 spares)
+
1 CLuster QUEer
(2 spares)

6 LOcal COntrol and Sum
(6 spares)

72 Digital Cluster And Sum
(8 spares)
+
36 DCAS Trans
(8 spares)

Cluster Finder Performance

DCAS + LOCOS + CLIQUE

Seed selection and expansion seem to be working reliably up to the maximum L1A rate tested so far (17 KHz using L2_RATE_TEST).

Known problems:

1) Tower usage bit error, i.e. some towers are mislabelled as seeds when they are only shoulders.
   It happens mostly for the highest η tower covered by one DCAS. DOES NOT AFFECT NO. OF CLUSTERS.
2) Cluster Merging, i.e. the energy of two separate clusters are merged into a single cluster, typically with the (η,ϕ) seed of the first.
   It happens only if two clusters are in the same crate.
   DOES NOT AFFECT LOSS OF SYNC ERROR.
3) Cluster η error, i.e. the rapidity of the seed if wrong by $\Delta\eta = 8$ or 16.
4) Cluster ϕ error, i.e. the local phi of the seed if wrong.

Cluster Finder Performance

On a last run taken with PHYSICS_0_01 (L1A ~ 100Hz), the rates (per no. of clusters) of the different errors are:

Tower usage error ~ 10^{-5}

Cluster merging error ~ 10^{-4}

Eta seed error ~ 10^{-4}

Phi seed error ~ 10^{-5} - 10^{-6}

Cluster merging error has been studies the most.
It looks like it is happening in LOCOS, after the clusters are created but before being sent to CLIST.

Eta seed error has been observed also in Michigan when a large number of clusters is simulated…will be studied there soon.

CLIST Performance

CLIST performances has been plagued by out of sync errors.

Designed to put the clusters (zero clusters included) for up to 4 L1A into its internal FIFO.

Observed errors:

1) One event does not send anything, remaining events are by one buffer.
2) One event does not send complete list of clusters, left over clusters are sent on the next event.
3) Internal FIFO get out of sync one wrt to the other so cluster list is scrambled up and end-of-event is not well determined.

Also some recurrent single bit energy errors usually due to bad solder joints on the MB data drivers.

CLIST Performance

CLIST design has been modified to:

- avoid getting hold of BOSS signal until all clusters for one event are received.
- avoid buffer number comparison between end-of-event buffer and Magic Bus buffer (occasional mismatches have been observed).
- making reading of FIFO synchronous with an internal 50 ns. clock.
- avoid writing up to 2 clusters in a single MB word. Now each clusters fills one MB word.

After this last mod, CLIST can run at high rates with cosmics for ~10^7 events w.o. losing sync when only L1 Interface is in the crate. Still some remaining loss-of-sync observed at 10^6 level with collisions.

CLIST Performance

When other boards apart from L1 Interface are in the run, events consistent with Magic Bus collisions are observed, i.e. CLIST does not lose sync but its words are seen in other boards addresses and viceversa.

One design problem is that the MB data and address drivers are enabled by a local copy of the BOSS signal.

When BOSS from CLIST is cleared, it is passed to the next board at "PECL speed" while the drivers are disabled at "TTL speed" (typically data/address lines are released 20 ns after the falling edge of BOSS).

Trying new firmware for which BOSS is delayed by ~500 nsec after STARTLOAD* is asserted.

Conclusion

To implement jet triggers we still need to study remaining loss of sync errors present at 10^6 level with collisions.

Cluster merging will show up as a low level jet trigger overefficiency and should not delay implementation of jet triggers.

Remaninig seed (η,π) single bit errors will affect only electron triggers, i.e. require working Track List board.