LAr Trigger Plot

ATLAS Liquid Argon Calorimeter Group

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Context

- Special physics runs were taken in early 2011 to verify the L1 calorimeter trigger timing of the EM overlap region and strip-layer.

- The plot for approval (p.4) is the main result of the strip-layer timing, using the physics run 177904.

- Within the same special run, the pulses (ADCs) from EM trigger tower were collected with both standard and special configurations of the Tower Builder Boards:

  - EM triggers with full sum from LAr cells in trigger tower.

  - EM triggers with only the strip-layer (layer 1) cells from LAr in trigger tower.

- The **analysis** consists in, for each trigger tower (j), measuring the difference (delay, Δt) in mean trigger tower pulse peaking time t_j :

$$\Delta t_j^{(1)} = t_j^{(\mathrm{All})} - t_j^{(1)}$$

- The **update** (or **alignment**) consists in entering the opposite-sign value for each trigger tower in the 'physics delays' database. This update only affects the LAr layer 1 within the trigger tower.

- Note to be released soon. For more information:

  - https://indico.cern.ch/getFile.py/access?contribId=5&resId=0&materialId=slides&confId=135229

Context

- Illustration of the standard and special configurations of the Tower Builder Boards for the strip-layer (layer 1 is referred to as 'Front') delay measurement:
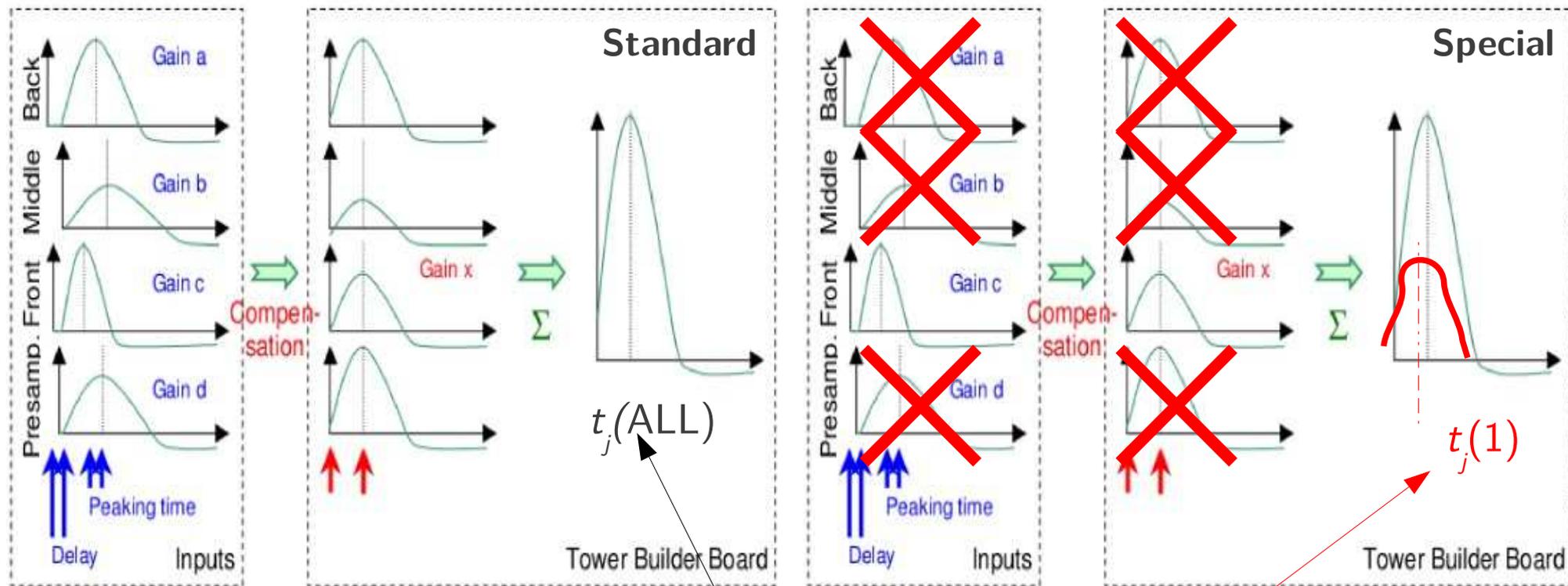
$$\Delta t_j^{(1)} = t_j^{(\mathrm{All})} - t_j^{(1)}$$

Timing of Strip-Layer

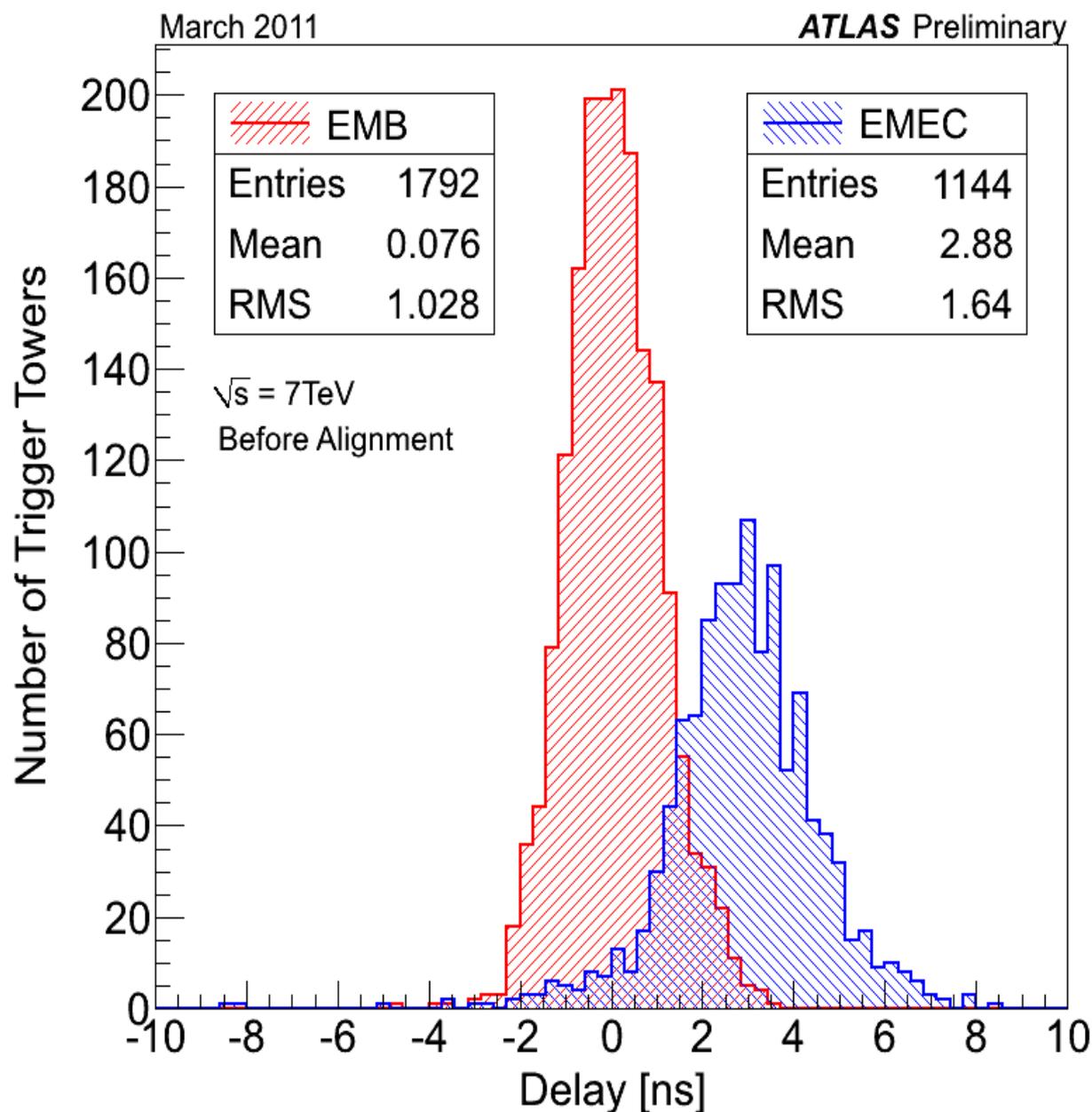## Trigger Pulse Time Delay (Sum of all Layers - Layer 1)

Figure 1: Delays between trigger tower analog pulses measured from a special run in 2011. The average peaking times of each trigger tower are extracted individually from physics events with two analog summing modes: 'Sum' corresponds to the normal operating mode where the sum of all LAr calorimeter layers are summed to build the pulse. 'Layer 1' corresponds to the special configuration where only the first layer (strips) is used to trigger and build the pulse. By subtracting the two, one obtains the delay of layer 1 with respect to the summed trigger tower pulse (shown). The alignment, which was performed in May 2011 after correcting for the latter delays with a hardware granularity of 3ns, improves the timing of the L1Calo trigger system.

Details and Comments

- The physics delays found in the database are loaded in the Tower Builder Boards in the LAr front-end crates when the electronics of the LAr calorimeters are configured. Hence the new physics delays were in use since the update date [May 6, 2011: elog-146331] in physics-running mode.

- Given the granularity of 3ns in the delay settings allowed by the Tower Builder Boards, and the bunch spacing of 25ns in the LHC:

  - EMB: The layer 1 is well-aligned. The update of the delays only affected a few outliers.

  - EMEC: The layer 1 is shifted on average. The update of the delays affected a greater number of trigger towers compared to EMB. The majority of the shifted towers were corrected by one count (3ns).

  - After the update of the delays, the strip-layer is assumed to be aligned within the trigger tower to better than 3ns.

- Another, short, special run may be requested to confirm the delays measured on p.4 have been efficiently minimized with this update. This may be done within any new special run in parallel with other sub-systems.