Overview of TKR readout limitation

Each side of the MCM (GTRC) can only read 64 hits. So max per plane is 128!

But each of the 8 cables can only read max of 128 hits as well! This is the limitation that we are worried about. We can "only" readout a max of 8 x 128 hits = 1024 hits.

Readout starts from the bottom.
Discrepancy in TKR RC 8 between Data and MC

- 2 Weeks ago Xin was studying the TEM errors and reported that Data and MC did not agree.
• As we know the depth of the cable controllers in the TKR is 128
  – However it DOES NOT guarantee that there is room for 128
    hits for each event!
  – This feature could explain MC discrepancy between DATA
    and MC (seen by Xin)

• How does it work?

  – A FIFO TEM error is generated whenever the
  – The sum of strip hits for any of the current AND previous
    event exceeds 128
  – Occurs dynamically on a tick-by-tick basis (1 tick = 50 ns)
    » It is possible to simultaneously add data from new
      event while removing data from previous event (multi
      buffering capability)
The 128 strip hit limit/CC can be enforced

- Any of the Cable Controller (CC) buffers in the TEM
  - Can have a “almost full” condition asserted
- If that happens for the CC Data FIFO then
  - Data doesn’t flow from Readout Controllers (RC) to CC
- A register in the CC controls how many words have to be in the FIFO before the “almost full” condition is asserted
  - If asserted, whenever there is at least a word in the FIFO it will be considered non-empty.
    - As a result, the multi-buffering capabilities of the FIFO is lost because
      » The next event can not leave the GTRC to enter the FIFO, until data from previous events have been read out and transferred, at least as far as, the event builder
TEM FIFO Errors can be eliminated

- To eliminate TEM FIFO errors (theoretically) one could
  - Tweak the number of maximum number of hits per plane to guarantee that
    - The number of hits in the TKR CC FIFO is greater or equal than the number of hits in each GTRC associated with that cable controller

- Note:
  » Each plane has 2 GTRC’s, so max = 2 x 64 hits = 128 hits (not to be confused with the TKR cable controller FIFO’s limit which is also 128)
E2E runs and Special Test Request

• For all runs taken we did NOT enforce the 128 limit
  – To preserve multi-buffering capability
    – A buffer can be filled with events from current and previous event

• We want to request a special test to verify that one can eliminate all TEM FIFO errors by appropriately setting the registers
  – Of course, with a loss of multi-buffering capability

• Divide 128 hits/ 9 RC ~ max 14 hits per RC
  – Should we restrict more on the top?
  – Working on designing a test to check that
    – Preliminary discussions with Leon, Hiro and Eric Siskind