gFEX: Physics and Mappings

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21 November 2013

- Responses to Physics questions
- Mappings for phi ring jFEX

Physics Questions: Intro

- Discussions last week raised some physics questions
- List of these sent to Alan and David Strom
  - Quick response from David
    - NB David warns he is not really an expert - but gives opinions anyway
  - Questions also forwarded to Jim Linneman yesterday…
    - He replied yesterday evening - responses not yet fully digested
    - Alan commented on Jims mail late last night

Physics Questions (1)

- Q1: Is 11 bits/tower enough?
  - I proposed LSB 128 MeV, saturating at 255 GeV
    - David thinks this is probably OK. Worried about saturation at 255 but expects we would want to trigger anyway. (NB Tile noise > 128 MeV)
    - Alans prejudice would be for higher LSB and higher saturation
- Q2a: Is 10 bits/tower in HEC overlap acceptable?
  - Eg 0.4*0.4 fibre extended to 0.5*0.4 with 20*10 bits (instead of 16*11 bits elsewhere)
    - David and Jim both thought it was OK
- Q2b: Could the 4 HEC overlap towers be dropped?!
  - NB they would only be missing at the periphery of some jets
    - Again David thought this was probably OK (noting that when a Tile module tripped losing 9 towers the trigger didnt really notice!)
    - Jim preferred 2a to losing them completely

Physics Questions (2)

- Q3: It is useful if jets are fatter only in eta or phi?
  - (ie either 2.2*1.8 or 1.8*2.2 but not 2.2*2.2)
    - David: its ugly (only if desperate). Composite jets in L1Topo are better
    - Jim: existing MC should indicate fat jet shape (no need for new sim)
- Q4: How many bits/jet element?
  - I suggested 10 bits per 0.2*0.2 jet element sum (LSB 128 MeV, saturate at 128 GeV)
    - David didnt answer this one
      - NB I would assume saturated peripheral 0.2*0.2 sums in very fat jets probably mean you should really consider this as two jets
- Q5: Does L1Topo need pileup info from phi ring jFEX?
  - How many fibres per jFEX does L1Topo need (basic assumption is 3 jet fibres plus one energy fibre)
    - David: no need for pileup info. Clearly need missing Et (and sum Et) with about 12 bit precision each

Physics Questions (3)

- Q6: Does the DPS need to send Ex/Ey/E sums?
  - An old idea - I was not sure if needed with pileup subtraction
    - David: "this is all talk and no studies". Might be required for original gFEX proposal (0.2*0.2) but not clear if its useful for 0.1*0.1 towers in jFEX
    - Jim: (see talk at L1Calo meeting) it looks like there is a trade off between noise cuts (high) to benefit missing Et and (low) to benefit jets & pileup (but not clear if these can be applied in jFEX algorithm chains or if they must be done already in the DPS)

- General comments from Jim
  - (My paraphrasing!) Why 0.1*0.1 towers in jFEX anyway?
    - Look at balance of usefulness of 0.1 vs 0.2
      - [ML: but this is perhaps a more basic question for the physics panel]
    - Alan: quick study suggested Gaussian filter algorithm degraded at 0.2

Physics Questions (4)

- My conclusions so far
  - No killer argument against last weeks phi ring jFEX ideas
  - Some questions will remain a bit hazy for a while yet...

Phi Ring Mappings: Tile

- Updated diagrams for Tile inputs
- Phi ring jFEX assumes 0.4*0.4 fibre geometry
  - Or near offer from JEMs at phase 1
  - Will need Tile "RODs" at phase 2 to have 0.4 phi granularity
  - Should we make official request for this?
- Tile at phase 1 via JEMs (at 10 Gbit/s)
  - With 0.4*0.4 (or 0.4*0.6) only need 1 minipod/daughtercard?
    - At 6.4 Gbit/s or with 0.8*0.2 shape fibres need 2 minipods or splitting

Phi Ring Mappings: HEC+FwdEM

- HEC and forward EMEC: seems OK
  - In fact we need fewer copies of fibres
    - Outer phi ring jFEX modules have no fanin from one side
  - Easier fanout from combined HEC+ForwardEMEC DPS

Phi Ring Mappings: eFEX

- Impact of 0.4*0.4 shape fibres on eFEX?
  - Of course we could still have 0.8*0.2 fibres for eFEX
    - Though simpler to keep mapping the same for both FEXes
  - Need more fanout for 0.4*0.4 than 0.8*0.2
    - (Unless eFEX shifted down by 0.2 in phi: more complex for DPS?)
    - But still fewer fibres than for 6.4 Gbit/s

Phi Ring Mappings: Summary

- Still plenty of scope for errors/oversights
- But so far it all looks good
  - In fact in places there are advantages
  - Could chose phi ring jFEX even if gFEX goes ahead?

- PS mappings spreadsheet available via upgrade twiki
  - https://twiki.cern.ch/twiki/bin/viewauth/Atlas/L1CaloUpgrade