

LAr Cabling Problems and Solutions

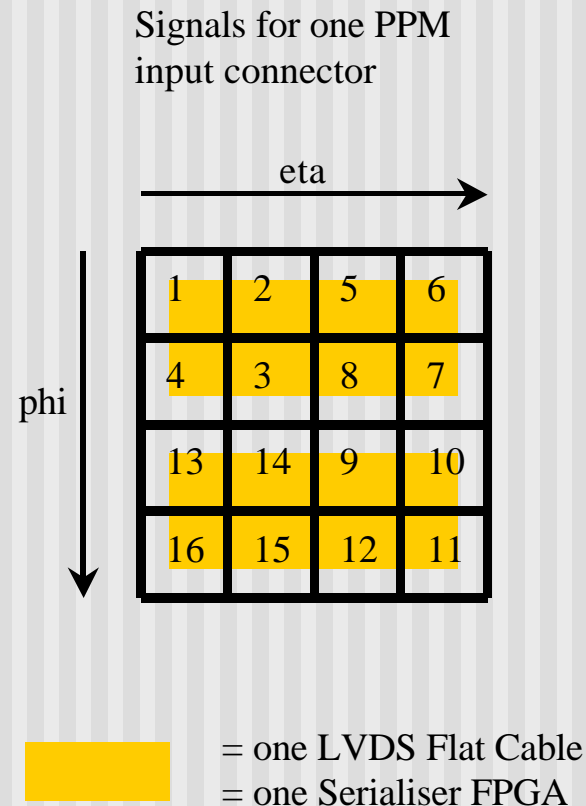
- Brief History of the situation
- Description of the three problems
 - Round the Clock
 - Extreme Eta
 - Eta Reflection
- Introduction to the LAr Receiver System
 - Documents
 - Solution
- Hindsight
- Where to go from here

A brief history of the problems

- Major panic was started in August
 - Gilles discovered problem in PPM post-PDR document
 - Original 'Round the Clock' problem at PPM/CPM interface
 - On closer study I discovered two more problems
 - Extreme Eta problem at edge of CPM acceptance
 - Eta reflection problem at $\eta < 0$
- PPM docs revised to solve two problems
 - Re-ordering of some signals on board
 - Correct input signal specification
- Bill Cleland discussion for remaining problem
 - October 17th in ATLAS week
 - Turns out problem already foreseen and planned for!

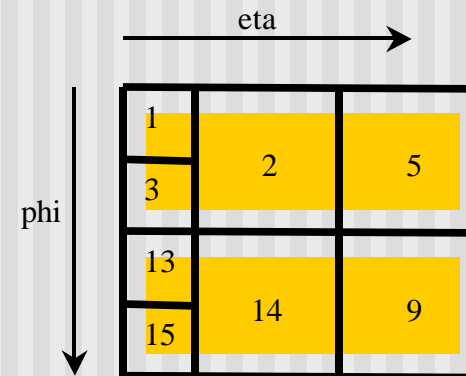
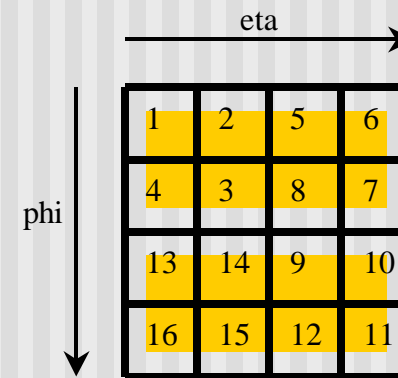
Round the Clock Problem

- Round the clock at 2x2 cell level sorted at MCM level
- However, each CPM input serializer expects same (increasing) pattern in eta
 - Note, not a problem for JEM as one LVDS cable covers all 16 signals
- Could be fixed by alternating serializer code in CPM FPGAs
- Better done in PPM by re-ordering before output



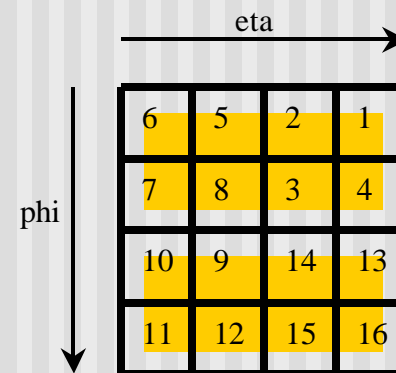
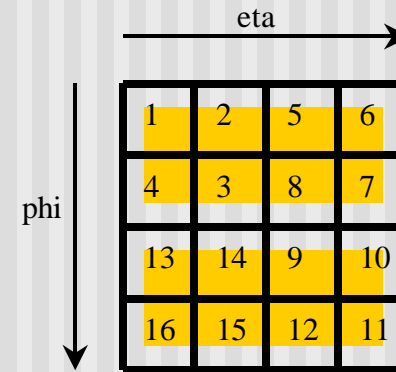
Extreme Eta Problem

- CPM only cares about signals to $\eta=2.5$
 - However odd things start happening at $\eta=2.4$
- On final LVDS cable, most signals are ignored
 - However, relevant one MUST have same configuration as others
 - Or different FPGA code is required again
- Corrected in PPM spec
 - It's just a question of asking receiver to do a different re-ordering (CLUE)



Eta Reflection Problem

- I made naïve assumptions about eta symmetry of inputs to PPM
- Basic Idea:
 - Our hardware has translational symmetry across ?
 - Detector Signals have reflectional symmetry between +/- ?
- Implications: LVDS cables to CPM at negative eta have different configuration
 - More Serializer FPGA code
 - Problem also for JEM
 - Solution – two different PPMs?



The LAr Receiver System

- Don't want to go into details
 - It's all there in Bill Cleland's documents
 - Receiver/Monitor System for the ATLAS Liquid Argon Calorimeters
 - Cabling of the ATLAS Liquid Argon Receiver System
 - Comment on the documents
 - Very impressed by level of detail
 - We should be similarly rigorous
 - Cabling complications made 'easy'
 - Easy = 'as easy as one could imagine' = still very tough
- As Paul Hanke has always claimed – Bill does all the work for us
 - (Well, almost all)

What is the solution?

- Don't have read far to see:
 - Cabling document page 1 –
 - Level 1 trigger requires ... the pin-out for each connector (ie the pin number vs geometrical position of the trigger tower in the global ATLAS coordinate system) should be invariant as one moves across the detector. ...It is clear a re-mapping of signals in the receiver is desirable.
 - Receiver document page 2 –
 - The required re-ordering...is done through the use of an 'interconnect board'...
 - There are about 12 different types of interconnect boards...
- Some debate over the number 12
- However, all the flexibility we need is built in

Hindsight...

- Already knew that receiver re-ordering solves extreme eta problem
 - Only a small problem in one area for CPM
 - Actually far harder for JEM, and this had already been thought out
- Could have been used to solve round-the-clock
 - Avoided PPM change (but done now)
 - Maybe even avoided MCM re-ordering (eta/phi switch)
- It is the solution to the negative eta problem
 - My assumption about PPM input cables having reflectional symmetry in eta was false
 - However, true for receiver station **inputs**
 - So there was never any need to panic!

So whats next?

- Having started to understand cabling, it's a good time to nail things down tightly
 - Also ASSO told we should do this!
- There are still several holes in the specifications
 - Receiver interconnect boards
 - Is 12 correct – more maybe (18?)
 - Should be better specified
 - Octopus cables between Receiver and PPM – 4 types
 - Tile receiver system!
- Document in 'preparation'
 - Complete overview of LAr/Tile sums to PPM cabling
 - Still gathering information!
 - (Insert URL Here)