

Notes: FEB / ASIC interfaces Session

1. Need document control system for Interface control documents
2. Need document system for firmware / electronics design documents. Best might be simple: dropbox + defined directory structure
3. PolarFire FPGA keep coming up!
4. Radiation
  - a. Need table of electronics location -> to total ionization doze / neutron doze
  - b. Many radiation effects { spurious signal, degradation of sensors, SEU, permanent Latchups, Burn out, Gate Rupture }
  - c. SEE transients can mess up timing synchronization. Test developments under radiation doses.
  - d. Pietro finds inconsistency in radiation maps, need to resolve or understand. (use higher – ecce calibrated to phenix measured dose, but don't know which is better) Background study group forming in EPIC to study these issues.
  - e. Agree for running scenario (“10 years at max lumi”)
  - f. Database for components
  - g. Libraries for mitigation strategies (TMR) common repository
  - h. Collect data of radiation tests for qualification
  - i. Engineering design review, production review include radiation tolerance
  - j. DAQ timing, control, data should benchmark with radiation tests.
  - k. Total doze vs specific events – recommendation as to mitigation
  - l. Will have SIU... need detection “heartbeats”, build in reconfiguration on the fly!
5. What is aggregation on RDO. Assuming FEB -> RDO is serial. RDO is both connector and serial bandwidth limited. 16-32 initial estimate
  - a. Connector limit
  - b. Serial limit
  - c. Artix+ maximum 12 transceivers (so 10 FEB/RDO at most) (can also use pins w/wo serdes)
  - d. MAPS (x\*9 reticles) -> RDO [see Jo's talk on Monday]
  - e. Buffering not clear if limitation
6. RDO location... depends on data rate
  - a. CAL - 30meters
  - b. Firefly electrical – 7m difficult (1Gb/s)
  - c. Want to be close for grounding // far for radiation // repeaters
  - d. Common mode noise is an issue
  - e. Form Factors (on detector multiple, off constant)
  - f. On detector, 1 fiber, off detector multiple cables (i2c, clocks, data, LV)
  - g. Need detector by detector analysis
7. \*\*\*Might\*\*\* need support for ZS in RDO, but not for known detectors. If needed not an issue.
8. Rack space available but not allocated in detail to detectors
9. Repositories of information (where are the engineering diagrams) – push for standardization of diagrams

## Functional Protocols Session

1. Encoding to balance bits...Helps timing due to many transitions & provides DC balance to avoid swings.
2. FEC5 , FEC12 allows data correction
3. Can learn from gbt
  - a. Jitter <10ps rms
  - b. Cms implement gbt in fpga
  - c. Error correction + interleaving + clock and data recovery + encoding
  - d. How does phase scale with clock rate if we use gpt on FPGA at different frequency?
4. "GTU" distribution
  - a. Point to point multipoint network: bidirectional on one fiber by multiple wavelengths
5. How often will ALICE need to use throttle? Not yet
6. Rates if use GBT try to go to 20/25 Gb/s.
7. Need ability to trigger OTHER THINGS: eg led, pulsers
8. Need abort gap info in FEB... Need to consider what bits must be forwarded to FEB
9. Regarding low level fiber protocols between FELIX and RDO start with simple protocol, but gbt exists/works
10. No need for gbt on asic side for salsa/eicroc or others
11. Time frame configurable, but not less than revolution. Must be the same for all detectors. Fixed but programmable. Must be > revolution (Need somebody to write up a plan a present a concrete concept)
12. Long discussion regarding the formats of data on the fiber between RDO and DAM. This includes the nature of time windows, packetization as well as the requirements of time ordering as it interacts with multiplexing separate channels and FEB contributions, and data compression. There is no consensus yet, but two points are clear
  - a. There is no general agreement
  - b. It is a complicated question. There is competition between the general streaming concept and packetization. Packetization is likely needed, but implies trade-offs on time ordering vs using direct ASIC formats vs data volume efficiency.
  - c. Different detectors may have quite different needs for time windows and data formats
  - d. The way forward is to have individuals &/or small groups develop and present concrete plans in the coming months.

## Timing / Clock and Data Session

1. Common features of RDO. Fine tuning of the phase output of common clock, 20-30ps steps?
2. GTU – DAM fiber
3. Timing Common Platform –
  - a. jitter "better than 8ps"