

Pixel Readout Limits For LHC

1) Limits in the in-coming links to the FED

The worse case is the layer 1 link which has 8 ROCs.

At full LHC luminosity is has : 21 pixels/link

This needs : 166 clocks to transmit

At 100kHz trigger rate the the link is almost 50% full:

$$166 * 100\text{kHz}/40\text{MHz} = 1.7/4.0 = 0.43$$

Keeping in mind that the traffic is random we would need large data buffers on each side in order not to loose data with an increased data rate.

With such large data buffers maybe we can increase the rate by 50%.

Running at 2 times higher luminosity we would need to change the data protocol.

2) Limits in the FED outgoing link (S-link)

Presently the highest rate is in the FEDs connected to the “edge” sectors (sectors 1&8).

The event size at the LHC full luminosity is: 2160bytes/FED

At 100KHz trigger rate this gives : 216 Mbytes/sec

The present S-link/myrinet limit is 200 Mbytes/sec,
so we are already too high.

We can gain something by changing the readout format and moving from 4bytes/pixel to 3bytes/pixel by grouping hits coming from a single input link.

This will gain only 25%.

Running at 2 times the LHC luminosity will need a DAQ upgrade
Slink/Myrinet -> 400Mbytes/sec.