LG – 11/22/2005

Expected data rates out of the HFT after data reduction.

We calculate the expected data rates from the HFT for two possible cluster finding scenarios.

The first calculation assumes that we will use a simple cluster finding method. A pixel would trigger a high threshold and the trigger pixel ADC as well as the 8 surrounding pixels ADCs would then be read out along with their addresses. This method is the simplest to implement but does contain a lot of unnecessary address information. This assumes hot pixels are removed.

Inner Layer
1 frame = 4 ms
Occupancy = 72 hits / cm^2 frame (inner layer)
Detector area = 4 cm^2

Bits/frame per detector = [(10 row address) + (10 column address) + (4 detector address) + (5 ladder address bits) + (8 data)] • 9 pixels/hit • (72 hits / cm^2 • 4 cm^2)

Bits/frame per detector = 95,904

- ⇨ 959,040 bits/frame per ladder

Data rate / ladder = (959,040 bits/frame per ladder • 250 frames/sec)

Data rate / ladder = 239.76 Mb/s

Outer Layer
1 frame = 4 ms
Occupancy = 17 hits / cm^2 frame (inner layer)
Detector area = 4 cm^2

Bits/frame per detector = [(10 row address) + (10 column address) + (4 detector address) + (5 ladder address bits) + (8 data)] • 9 pixels/hit • (17 hits / cm^2 • 4 cm^2)

Bits/frame per detector = 22,644

- ⇨ 226,440 bits/frame per ladder

Data rate / ladder = (195,840 bits/frame per ladder • 250 frames/sec)

Data rate / ladder = 56.61 Mb/s

Total Rate
6 inner ladders
18 outer ladders

(6 • 239.76 Mb/s) + (18 • 56.61 Mb/s) = 2.457 Gb/s

Data rate / HFT = 2.46 Gb/s for simple cluster finding with all addresses saved

The second calculation assumes that we will use the same simple cluster finding method. A pixel would trigger a high threshold and the trigger pixel ADC and it's address would be read out. The 8 surrounding pixels ADCs would then be read out in a fixed order and the data stored with the seed pixel as a cluster. This method is harder to implement but does significantly reduce the data rate since a lot of unnecessary address information is removed from the cluster. This assumes hot pixels are removed.

Inner Layer
1 frame = 4 ms
Occupancy = 72 hits / cm^2 frame (inner layer)
Detector area = 4 cm^2

Bits/frame per detector = [[(10 row address) + (10 column address) + (4 detector address) + (5 ladder address bits) + (8 data)] + 8• (8 data)] • (72 hits / cm^2 • 4 cm^2)

Bits/frame per detector = 7,272

⇨ 72,720 bits/frame per ladder

Data rate / ladder = (72,720 bits/frame per ladder • 250 frames/sec)

Data rate / ladder =18.18 Mb/s

Outer Layer
1 frame = 4 ms
Occupancy = 17 hits / cm^2 frame (inner layer)
Detector area = 4 cm^2

Bits/frame per detector = [[(10 row address) + (10 column address) + (4 detector address) + (5 ladder address bits) + (8 data)] + 8• (8 data)] • (17 hits / cm^2 • 4 cm^2)

Bits/frame per detector = 1,717

⇨ 17,170 bits/frame per ladder

Data rate / ladder = (17,170 bits/frame per ladder • 250 frames/sec)

Data rate / ladder = 4.29 Mb/s

Total Rate
6 inner ladders
18 outer ladders

(6 • 18.18 Mb/s) + (18 • 4.29 Mb/s) = 186.3 Mb/s

Data rate / HFT = 186.3 Mb/s for cluster finding with only seed pixel addresses saved