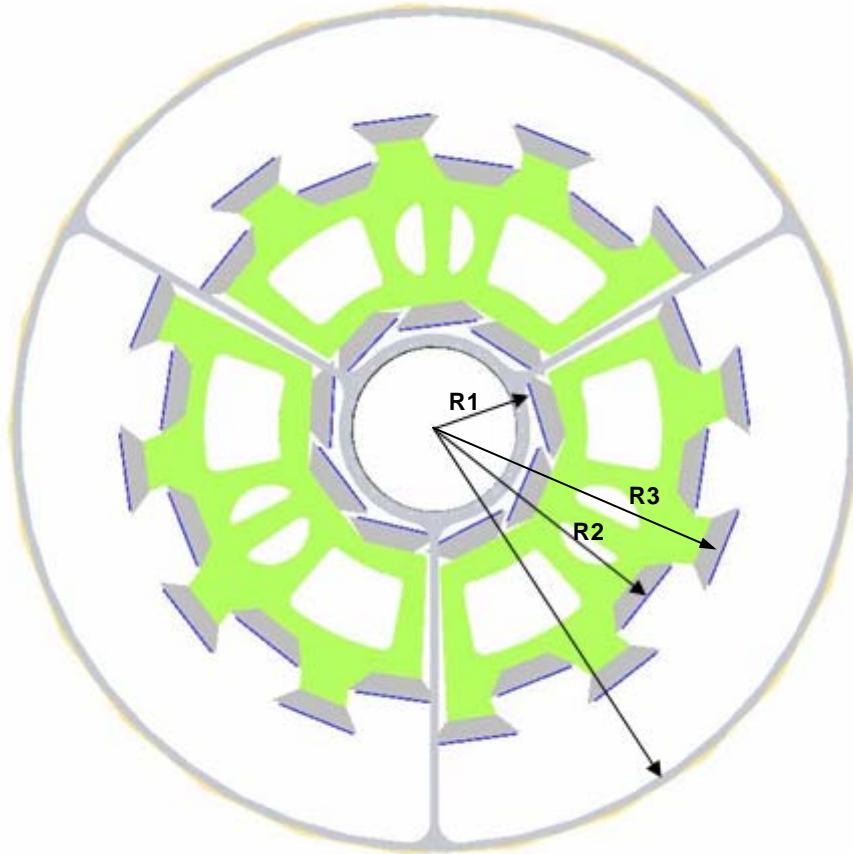


LG 1/29/2007  
Updated 02/02/2007

Calculation of rates on the HFT for the 33 ladder 2007 version

HFT consists of



R1 = 9 ladders @ 2.5cm  
R2 = 12 ladders @ 6.5cm  
R3 = 12 ladders @ 7.5cm

With 10 sensors @ 2cm x 2cm per ladder

#### Data

(from Howard Matis, Howard Wieman, Andrew Rose e-mail)

At RHIC I luminosity

The rate with a 4 ms integration time

1.5 cm	72 /cm <sup>2</sup>
2.5 cm	37
4.5 cm	17
5.5 cm	13

The UPC electrons result in

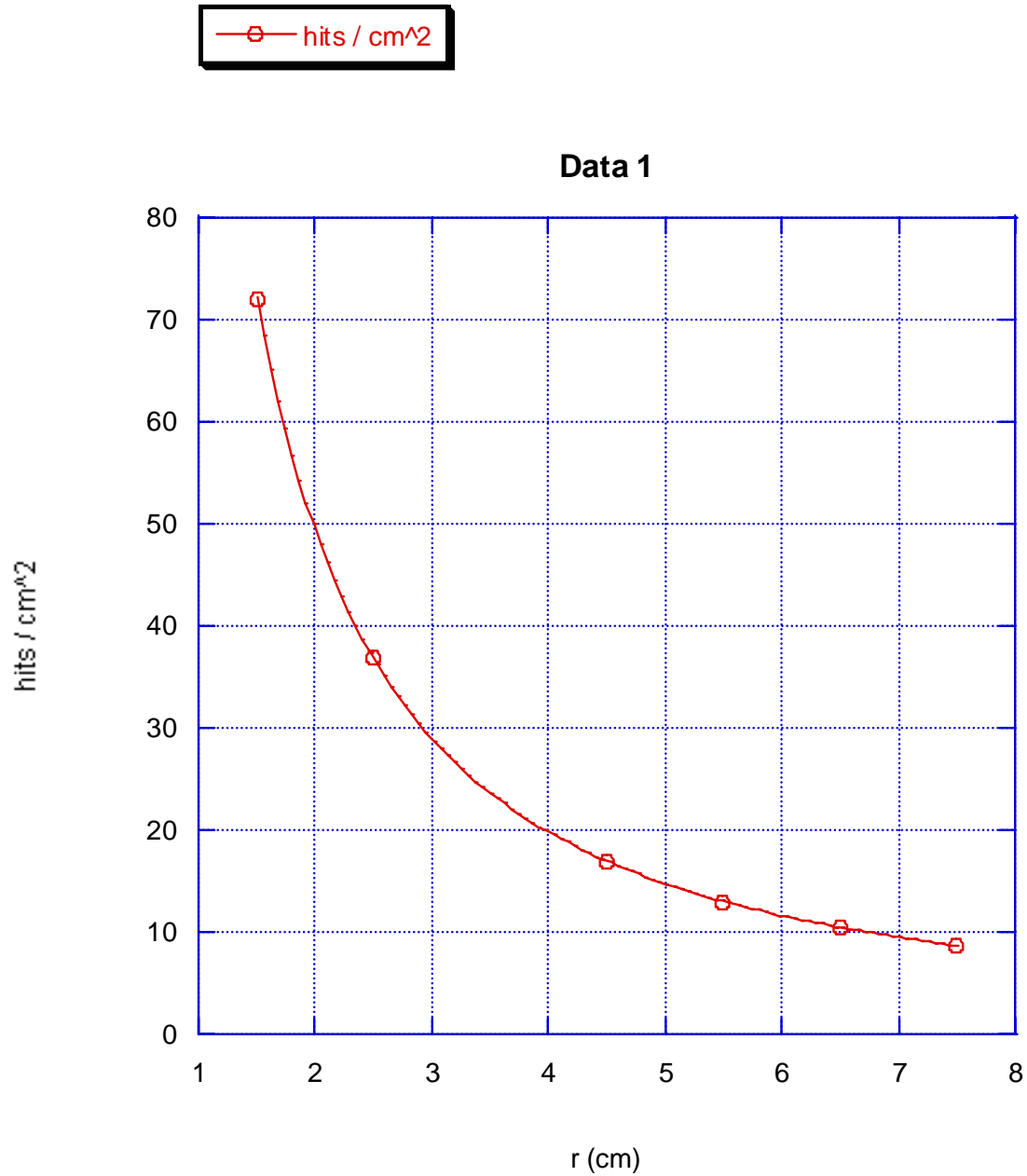
2.5cm - 15.9 hits/cm<sup>2</sup>

6.5cm - .291 hits/cm<sup>2</sup>

7.5cm - .1 hits/cm<sup>2</sup>

Analysis

Fitting the data from the 4ms integration time interactions given above



At R = 6.5cm, the rate is 10.46 hits / cm<sup>2</sup>

At R = 7.5cm, the rate is 8.66 hits / cm<sup>2</sup>

Assuming: *Total rate = TPC charged particle rate + UPC electron rate*

We get:

$$\text{Rate @ R1 (2.5cm)} = 37 + 15.9 = 52.9$$

$$\text{Rate @ R2 (6.5cm)} = 10.46 + .291 = 10.75$$

$$\text{Rate @ R1 (7.5cm)} = 8.66 + 0.1 = 8.76$$

So:

$$\text{Raw data from ADC} = 12 \text{ bits} * 640^2 \text{ pixel array} * 10 \text{ sensors} * 33 \text{ ladders} * 250 \text{ frames/s} = \mathbf{50.7 \text{ GB / s}}$$

$$\text{Post CDS} = 9 \text{ bits} * 640^2 \text{ pixel array} * 10 \text{ sensors} * 33 \text{ ladders} * 250 \text{ frames/s} = \mathbf{38 \text{ GB / s}}$$

After cluster finding with 18 bit addresses we are duplicating data since we are taking data at a rate of 1 KHz but every frame we read out contains a full set of hits, so:

$$\text{HFT (hits) / second} = \text{SUM R1, R2, R3} [(\text{rate}) * (\text{area}) * 10 \text{ detectors} * (\# \text{ of ladders})] * 1000 \text{ frames/s}$$

$$= (19044 + 5160 + 4205) * 1000 = 28,409,000 \text{ hits / sec}$$

According to our data format ([http://www.lbnl.leog.org/rdo/Data\\_format\\_HFT.pdf](http://www.lbnl.leog.org/rdo/Data_format_HFT.pdf)), we pad the 18 bit addresses to get to 32 bit byte boundaries so

$$* 32 \text{ bits} = \mathbf{113.6 \text{ MB/s}}$$