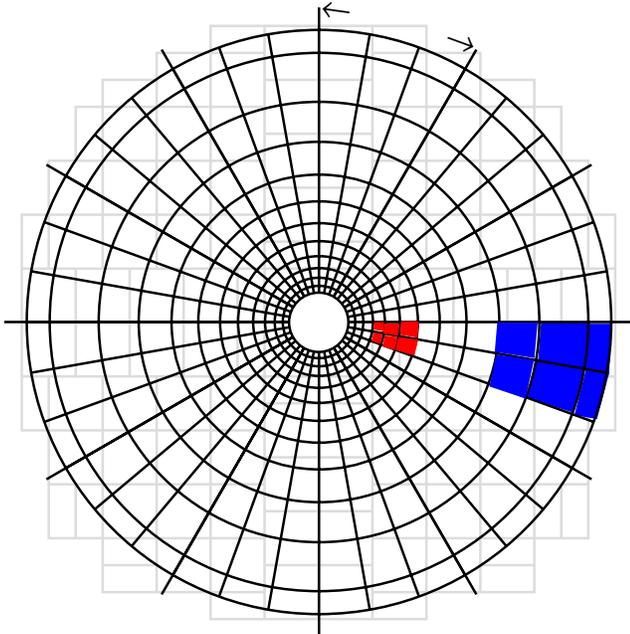




HF Segmentation



2 CMS HF Calorimeters mapping onto
Trigger System HF Crate

Readout segmentation: $36\phi \times 12\eta \times 2z \times 2F/B$

Trigger Tower segmentation: $18\phi \times 4\eta \times 2F/B$

HF Trigger Data

- Reduce η divisions compared to previous proposal
- 2 (+Z/-Z HF) x 4 η x 18 ϕ HF trigger towers, each send 8-bit nonlinear E_T
- Outer most 4x4 region of HE is of size $\sim 0.9\eta \times 0.345\phi$ compared to $\sim 0.5\eta \times 0.345\phi$ proposed for HF
- Each HF trigger tower is treated as if it is a 4x4 trigger tower region in the barrel/endcap
- 3x3 overlapping sums of these regions form a nominal sliding window "12x12 jet"



Jet/ τ algorithm - clustering

Cluster Crate

- Clusters 4x4 tower E_T regional sums from barrel/endcap and HF trigger towers with sliding window to form "12x12 jets"
- Classifies as central or forward jets or τ , ranks, sorts

Cluster Processor Cards (9)

- Receive data from $+\eta$ and $-\eta$ regional + HF crates
 - 2 $20^\circ \phi \times 7\eta$ regions from 18 HB/HE crates
 - 2 $(+/-\eta) \times 14$ regions $\times 12$ bits = 336 bits
 - 2 $20^\circ \phi \times 4\eta$ regions from HF crate
 - 2 $(+/-\eta) \times 8$ regions $\times 8$ bits = 124 bits
 - Total input data on 6 34-pair cables @ 80 MHz = 460 bits
- Share neighbor data for two 20° phi regions
 - Backplane data sharing for overlap = 460 bits
- Sum 3x3 region, i.e., 12x12 tower, energies with the center greater than neighbors (prevent double count) requirement
 - Convert result to 6 bit rank and 5 bit position
 - Result: 28 central candidates, 16 forward candidates
 - Classify as τ if all 3x3 τ veto bits = 0 - otherwise as jet
 - Sort to find top 4 central and forward jet candidates
 - Sort to find top 4 τ central candidates ($|\eta| < 2.6$ only)
- Sum $+\eta$ and $-\eta$ $20^\circ \phi$ sectors to get four E_T values
 - 10 bit energy + 2 bit overflow (OR the overflows)
- Transfer output to Jet Cluster Output Card
 - 4 x 11 (central jets, forward jets, τ s, E_T) = 176 bits

Cluster Output Cards (3)

Backplane Pins @ 160 MHz:
(460+176)*2/4 = 318

- Input from 3 Cluster Processor Cards (3x176 = 528 bits)
- Output all data to Global Calorimeter Trigger
 - 528 bits on 8 cables (2 central jet, 2 forward jet, 2 τ , 2 sums)



Global Calorimeter Trigger

Input data

- **From 18 regional crates**
 - Noniso elec: 18 x 4 cand. x 10 bits (4 bit loc)
 - Iso. electrons: 18 x 4 cand. x 10 bits (4 bit loc)
- **From 1 cluster crate**
 - Central jets: 9 x 4 cand. x 11 bits (5 bit loc)
 - Forward jets: 9 x 4 cand. x 11 bits (5 bit loc)
 - Taus: 9 x 4 cand. x 11 bits (5 bit loc)
 - E_T : 18 ϕ regions x 2 (+Z & -Z) x 11 bits

Process data

- **Sort non-iso & iso electrons, central jets, forward jets and taus**
 - Output: 6 bit E_T and 8 bit location for top 4 objects of each of the five types
- **Convert E_T sums to E_x and E_y and make sums**
 - Sum E_T , Missing E_T value and direction
- **Jet counts**
 - Various thresholds and η sub-regions
- **Make Luminosity histogram**
 - 18 ϕ x 2 η bins
 - Jet histograms