Trigger Primitives

Benn Tannenbaum
UCLA
September 2000
Studies

• All studies done using Norbert Neumeister’s SimHit database.
• $3 \text{ GeV}/c < p_T < 100 \text{ GeV}/c$ (flat distribution)
• $-2.5 < \eta < 2.5$ (flat distribution)
• $0 < \phi < 2\pi$
• Used both $\mu^+$ and $\mu^-$
• Used 40 000 events
Cathode LCT Processor

- Follows logic of J.K.’s CLCT99 design but also does low $p_T$ LCTs and assigns bend
- Finds highest quality pattern in each 16-strip group (one card)
- Eliminates overlaps at card boundaries
- Returns two best from a given chamber sorted by quality (higher is better) and then strip number (lower is better)
- Stores LCT(s) in instance(s) of CathodeLCT

Pattern used for finding cathode LCTs. If the code finds at least 4 layers hit in this pattern, an LCT is returned with key 1/2 or di strip $n$. 

```
 1/2- or di-strip number
 n-1   n   n+1
 ||||  ||||  ||||
```

abcdef

layer
Old phi resolution

$\Delta \phi_{\text{Hit, trigger}}$ versus 1/2 strip number

Spread is roughly 1 strip wide
Old phi resolution

$\Delta \phi (\text{Hit, trigger})$ versus wire group number

Slope of unknown origin
Improved phi resolution

Spread is roughly 1/2 strip
Improved phi resolution
Improved phi resolution

Ideal resolution = 10° / 160 strips * π / 180° / √12 = 0.31 mRad
20° / 160 strips * π / 180° / √12 = 0.62 mRad
CLCT Efficiency

CLCT Efficiency station by station

η+, μ-
η+, μ+
η-, μ-
η-, μ+

Station 1

Station 2

Station 3

Station 4
CLCT Efficiency

CLCT Efficiency station by station

η+, μ−
η+, μ+
η−, μ−
η−, μ+

Station 1

Station 2

Station 3

Station 4
Anode LCT Processor

- Follows logic of J.K.’s ALCT99 design
- Finds highest quality pattern in each 16-w.g. group (one card)
- Eliminates overlaps at card boundaries
- Returns two best from a given chamber sorted by quality (higher is better) and then w.g. number (lower is better)

Pattern used for finding anode LCTs. If the code finds at least 4 layers hit in this pattern, an LCT is returned with key wire group $n$. 

Wire group number

```
     n+2
     n+1
     n
     n-1
     n-2
```

Pattern:

```
abcdef
layer
```
Eta resolution

$\Delta \eta(\text{Hit, trigger})$ versus wire group number

- ME1/A
- ME1/1
- ME1/2
- ME1/3
- ME2/1
- ME2/2
- ME3/1
- ME3/2
- ME4/1
- ME4/2
Eta Resolution
Eta Resolution

- Station 1:
  - $\eta^+\mu^- 5777$ events
  - $\eta^+\mu^+ 5539$ events
  - $\eta^-\mu^- 5730$ events
  - $\eta^-\mu^+ 5746$ events

- Station 2:
  - $\eta^+\mu^- 5410$ events
  - $\eta^+\mu^+ 5261$ events
  - $\eta^-\mu^- 5409$ events
  - $\eta^-\mu^+ 5412$ events

- Station 3:
  - $\eta^+\mu^- 4905$ events
  - $\eta^+\mu^+ 4826$ events
  - $\eta^-\mu^- 4885$ events
  - $\eta^-\mu^+ 4968$ events

- Station 4:
  - $\eta^+\mu^- 4589$ events
  - $\eta^+\mu^+ 4534$ events
  - $\eta^-\mu^- 4527$ events
  - $\eta^-\mu^+ 4545$ events
Applying only marginal cuts greatly improves the efficiency. The inefficiency is caused by badly mismeasured events.
ALCT Efficiency station by station

Station 1

Station 2

Station 3

Station 4
Summary

• Tim’s geometry fixes remove strange features in phi resolution
• Phi and eta resolution look good
• Efficiency is pretty good, need to understand what’s happening in stations 3 and 4.
• Finishing up CMS Note
• Next up
  – Persistent trigger primitives
  – Visualization
  – Accelerator bit for ALCT