Status Report of Trigger and Latching(Hit) Efficiencies Study(4)

-- Comparison with MC Prediction for 6 tower data--

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Idea of the study

- Measure and monitor local/overall “trigger/latching(Hit)” efficiencies including Si gap, dead strip, insensitive area, alignment, timing, etc.
- Use muons of known position and direction -> detailed study
- Minimum event selection criteria -> least (or no) bias
- Compare data with MC prediction -> validate Gleam as well as LAT
- Use muon telescope (independent trigger) -> measure absolute efficiency
Test Configuration

**Objective:**
Measure and monitor local/overall “trigger/latching(Hit)” efficiencies (including Si gap, dead strip, insensitive area, alignment, timing, etc.)

“Method 1”: without muon telescope
- Select muon-like events with TKR (keep bias as small as possible; use only 3 top layers and the bottommost one)
- Test intermediate layers
- Comparison with Gleam simulation (direction/position measured by TKR)

“Method 2”: with muon telescope
- Select muon-like events with muon telescope (plastic scintillators)
- Unbiased overall efficiency study
- Comparison with Gleam simulation (require muons to cross plastic scintillators)

Here we show “Method 1” for 6 towers data with events passing through 1 tower or 2 towers. Analysis of muon telescope data (“Methods 2”) is underway.
Event crossing only one tower (1)

• Run id: 135003739-3753 (SVAC B2 run). Use EM-v5r0608p1 for MC.
• Select $\mu$-like events that pass from top of Tower A to the bottom of Tower A
• Study local efficiency of intermediate planes.
• Michael Kuss’s intra-tower alignment was taken into account.
• Know issue of trigger primitive – concentrate on Hit efficiency

![Graph showing fraction of event with a hit and Gleam prediction normalized to 1.]

Fraction of event with a hit
gleam prediction

due to Si gap, well reproduced by MC
Event crossing only one tower (2)

Data and Sim agree within 1%
Event crossing only one tower (3)

- Good agreement within 1% for all 6 towers (except planes with partial dead strips).
- Data is slightly (~0.5%) over-efficient (or vice versa). We will examine this.
Event crossing two towers (1)

• Run id: 135003739-3753 (SVAC B2 run). Use EM-v5r0608p1 for MC.
• Select $\mu$-like events that pass from top of Tower in #0 to the bottom of Tower in #1
• Study efficiency of intermediate planes. (Any interference between towers?)

Fraction of event with a hit

Gleam prediction

Tower in Pos#0 to Tower Pos#1

Normalized to 1
Event crossing two towers (2)

Data and Sim agree in 2-3%

Tower in Pos#0 to Tower in Pos#1
Event crossing two towers (3)

- Reasonable agreement in 2-3% for all 7 combination of 2 towers (except planes with partial dead strips).
- Data is somewhat (1-2%) over-efficient (or vice versa). We will examine this.
Acknowledgement

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• Gary Godfrey (muon telescope preparation/data taking)
• Jamas Chiang (FileSource class implementation)
• Toby Burnett (surface muon generator)
• Leon Rochester and Anderson Borgland (valuable instructions in Gleam simulation)
• Michael Kuss (intra-tower alignment)
• And all others! (extensive work of hardware/software)

Residual from the straight line, before (black) and after (red) Kuss’s alignment parameters were taken into account.
Summary and Future Plan

• We have checked latching (Hit) efficiency of each plane for 6 towers, by using muon events and comparison with MC simulation. (Distribution of directions/positions of MC muons are adjusted to the measured ones.)

  • Good agreement between Gleam and real data for the events passing through one tower/two towers in “Method 1”. -> LAT and Gleam were validated each other in 2-3% level.

  • Data is somewhat over efficient (or vice versa). Need further study.

  • Will work on inter-tower alignment and take it into account.

• Muon telescope data analysis (“Method 2”) is underway in order to measure absolute trigger efficiency.
Backup Slide (1): 6 tower configuration

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6 Towers
Backup Slide (2): example of plane with partial dead strips

Data/Sim ratio for y-layers, #0

Some strips are over efficient