Analysis of four Flight Software Runs

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(with the help of Eduardo)

SLAC April 21 2006
Summary

- FSW Runs 077002163 – 077002164 – 077002165 – 077002166
  - Total time: 3126 s
  - Total counts: 1283691 events

- Engine Rate
  - No solicited and periodic trigger

- Study of the Tracker trigger rate

- Study of ROI trigger rate
  - understanding GemRoiVector, GemTkrVector and GemConditionsWord
  - as the structure of the ACD and the ROI definition affect the data

- Study of the trigger rate with different cuts
  - TkrNumTracks>0
  - TkrNumTracks==1
  - TkrNumTracks==2
No cuts

- In Engine rate:
  - No solicited and periodic trigger
  - The highest is Engine 10 with ~300Hz
  - The distribution is similar to that of Non FSW
    - except for Engine 2 & 3
      » see Andrea’s presentation of April 7 2006

- In ROI conditions rate:
  - rate of ~60Hz per ROI condition
    - expected 43Hz per TWR...
  - rate of ROI conditions 5, 6, 9, 10 is significant lower
    - ROI shadows of central tower (see Jane Day IA6)

- In ROI conditions per event Distribution
  - 2 & 4 conditions per event have a rate of ~100Hz
  - we see decreasing rate until 16 conditions per event
    - in practice all the ACD detector

• Need to explain the peak at 2, 4 and 6
Towers trigger rate (No cuts)

- The Tower trigger rate is ~35Hz
  - central towers do not have a significant lower rate
- The histogram of the Towers triggered per event is quite different from the ROIs triggered per event
  - the distribution is smooth
  - there aren't the peaks at 2, 4, 6 towers triggered per event
  - there is an increasing in rate after 14 towers triggered
- Why we have all these differences if the topological trigger condition of the ROI is:
  - ROI = 1 just if the particle hits the ACD tiles configured to shadow the triggered TKR
- Following this condition the Tower trigger rate should be greater or equal of the ROI trigger rate
  - but we have the opposite case
  - the answer on the next slide....
GemTkrVector & GemRoiVector

- To obtain these distribution I have used the GemTkrVector and the GemRoiVector
- GemTkrVector:
  - is a vector of 16 elements corresponding to each tracker
  - a bit is set if 3(XY layer) on a row of the corresponding tracker are hits
- GemRoiVector
  - is a vector of 16 elements corresponding to each ROI
  - a bit is set if a tiles of the corresponding ROI is hit
- This means that to set a bit in GemRoiVector it is not needed the coincident with the tracker trigger
  - as requested by the topological condition
- the coincident ROI-Tracker is instead requested by GemConditionsWord
With this conditions the distribution should be less different

But it is not the case

- ROI rate is already greater than Tkr
- in ROI conditions per event Distribution are present the peaks at 2, 4 and 6

This features can be explain taking into account the ACD structure and the ROI definitions

- A single ACD tiles could belong to different ROI
  - see next and slide 3

In the Towers distributions

- we can see the lower rate of central towers
- in Towers triggered per event distribution the rate is zero after 14 towers
Shadow ROI trigger conditions

### ACD map

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Rev 2.4

### Shared Tiles

**Shared 1 times:**
- 000, 100, 110, 200, 210 (roi 0)
- 004, 204, 214, 300, 310 (roi 3)
- 040, 104, 114, 400, 410 (roi C)
- 044, 304, 314, 404, 414 (roi F)

**Shared 2 times:**
- 001, 201, 211 (roi 0, roi 1)
- 002, 202, 212 (roi 1, roi 2)
- 003, 203, 213 (roi 2, roi 3)
- 014, 301, 311 (roi 3, roi 7)
- 024, 302, 312 (roi 7, roi B)
- 034, 303, 313 (roi B, roi F)
- 041, 401, 411 (roi C, roi D)
- 042, 402, 412 (roi D, roi E)
- 043, 403, 413 (roi E, roi F)
- 010, 101, 111 (roi 0, roi 4)
- 020, 102, 112 (roi 4, roi 8)
- 030, 103, 113 (roi 8, roi B)

**Shared 4 times:**
- 011 (roi 0, roi 1, roi 4, roi 5)
- 012 (roi 1, roi 2, roi 5, roi 6)
- 013 (roi 2, roi 3, roi 6, roi 7)
- 021 (roi 4, roi 5, roi 8, roi 9)
- 022 (roi 5, roi 6, roi 9, roi A)
- 023 (roi 6, roi 7, roi A, roi B)
- 031 (roi 8, roi 9, roi C, roi D)
- 032 (roi 9, roi A, roi D, roi E)
- 033 (roi A, roi B, roi E, roi F)
• It happens that when a particle hits a tile, it can be triggered just one ROI but also 2 or 4 ROIs
  – the tiles not shared are just the corner ones
    – 20 tiles
    – 4 on the top
  – tiles shared 2 times
    – 36 tiles
    – 8 on the top
  – tiles shared 4 times
    – 9 tiles
    – all on the top
• This structure explains the peaks at 2, 4 and 6 ROI per event
• and also the ROI trigger rate greater than the Tracker
At least 1 Track per event

- In Engine rate:
  - the ratio between the Engines is much different
  - except for Engine 10 & 7

- the rate and the shape of the ROI and Tkr trigger distributions do not have significant changes respect to No cuts case
  - see slides 4 & 5

- In Tkr triggered per event Distribution
  - 0 Tkr rate is 2 order of magnitude lower than in No cuts case
    - 0.1Hz vs 10Hz

- In ROI conditions per event distribution
  - we always see the peaks
Single Track per event

- In Engine rate:
  - The relative height of Engine 4, 6 & 9 is just a little bit lower than in the precedent case

- In ROI and Tkr trigger rate
  - no changes but for the lower rate
- Tkr triggered per event
  - is cut at 5 Tkr
- In ROI conditions per event distrib
  - with this cut the rate of 0 ROI conditions per event is lower than rate of 1 ROI conditions
    - this could be explained taking into account that with this cut should be a more fraction of muons
    - the tail of the distribution is not smooth
      - seems that there is a stair structure with the bin grouped in this way:
        » (7, 8) (9, 10) (11, 12, 13) (14, 15, 16)
      - maybe due to the overlapped tails
2 Tracks per event

- In Engine rate:
  - the ratio between the Engines is not so different from the case of at least 1 Track per event (TkrNumTracks>0)

- In Tkr trigger rate
  - the distribution is not so flat
  - the central tower has the highest rate now

- In ROI conditions
  - the rate here is very low (~10Hz)

- In Tkr triggered per event
  - the distribution fall until 10 Tkr

- In ROI conditions per event Distribution
  - the rate of 0 ROI conditions per event is very high compared to the other
  - this means that we have a large fraction of photons with this cut
**Rate of each Engine vs cuts effectuated**

– in this plot we can see a not regular behavior of Engine 5 and Engine 8

– to check
Conclusion

• We have studied the ROI and Tracker trigger rate
• We have explained the differences between the distributions
  – we have understand how work GemTkrVector and GemRoiVector
    – GemRoiVector do not require the coincidence with the Tkr trigger
  – the request of the coincidence between ROI and Tkr is requested just by GemConditionsWord
• We have understand the presence of the peaks in the Distribution of ROI conditions per event
  – it is due to the structure of the ACD and the ROI definition
• To do:
  – understand the behavior of the rate of Engine 5 and Engine 8
    » see the plot in the precedent slide