Analysis of data from high background fill 2208

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Event Filter Acceptances

MinimumBias dataset, no trigger selection
Layer Efficiency vs Time

Applying Event Filters used in analyses (right plot) doesn’t improve efficiency

Event Selection used (prerequisite for efficiency calculations)
After excluding FED errors, certain ROCs still have low efficiency
(This may be due to Single Event Upsets (SEUs))

-> Exclude SEU candidate ROCs with efficiency over 10σ from mean (<0.982)
SEU Candidates

Layer 1

Layer 2

Layer 3

FPix
Excluded SEU Candidates (Left plot) and recovered 0.1-0.4% Efficiency (most of it late in the fill)

Additionally excluded FED Errors (Right plot) and we recovered ~1.2%

The rest of the Efficiency loss is dynamic efficiency loss
Comparison to fills with the same filling scheme and inst.lumi
Excluded events with FED errors and SEU Candidates
The effects of the vacuum spike is clearly visible when comparing to a normal fill.

If an event with beam background is signaled by FED errors in fill 2208 then the efficiency is 97% on layer 1.

If no FED errors are present efficiency is 99.2% in Fill 2208 and it is in agreement with expectations at such instantaneous luminosity (dynamic efficiency loss).
Efficiency of Modules with FED errors

- FED Error Multiplicity: $N_{\text{FED error}} / N_{\text{event with same error}}$
FED Error Rate

FED Error Rate: $N_{\text{FED error}}/N_{\text{event}}$
FED Error Multiplicity

FED Error Multiplicity: $N_{\text{FED error}}/N_{\text{event with same error}}$
Conclusions

- It seems that when beam background is present it is signaled by FED errors
- Most of the errors are timeouts and overflows
  - Timeouts give consistently ~70% efficiency
  - Overflows ~80%
  The same error code as the one with overflow in offline analysis can yield no efficiency loss (TBM trailer errors)
- In fill 2208 at the time of the vacuum spike on average 1.8 FED errors/event were present
  Although the FED error rates were high they were distributed such that few events had many errors
- In those events where there is FED error (near the spike) the overall efficiency loss is 3%
  - From which ~0.1% is due to Single Event Upsets
  - ~0.5% due to dynamic efficiency loss
  - The rest is due to effects signaled by FED errors
- The rate of SEUs is not larger than usual.
- There is no large difference in the acceptance of offline analysis filters throughout the fill
  - The acceptances only drop significantly around the spike period