

Analysis of data from high background fill 2208

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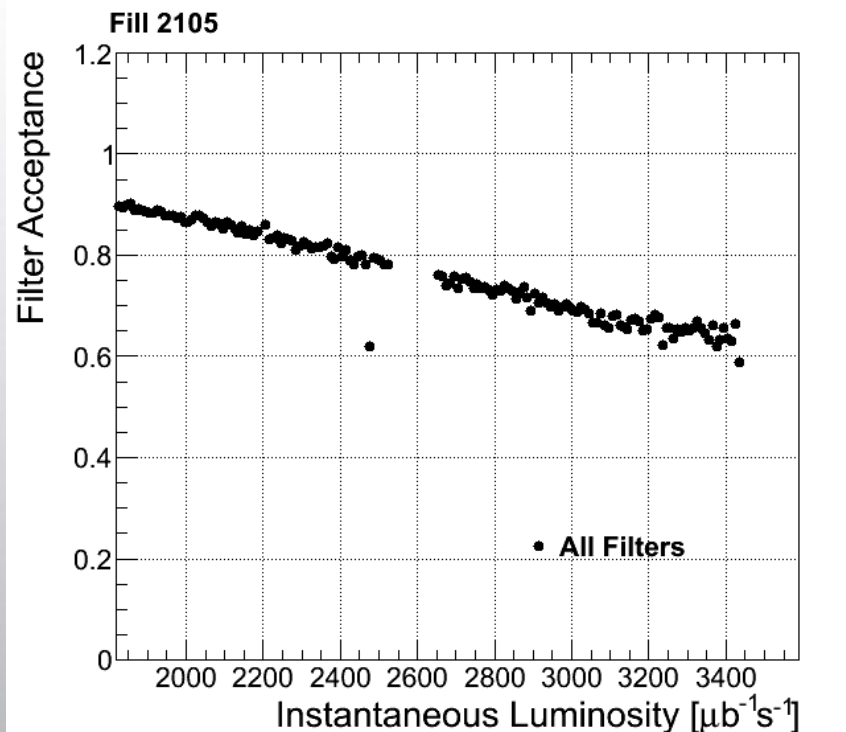
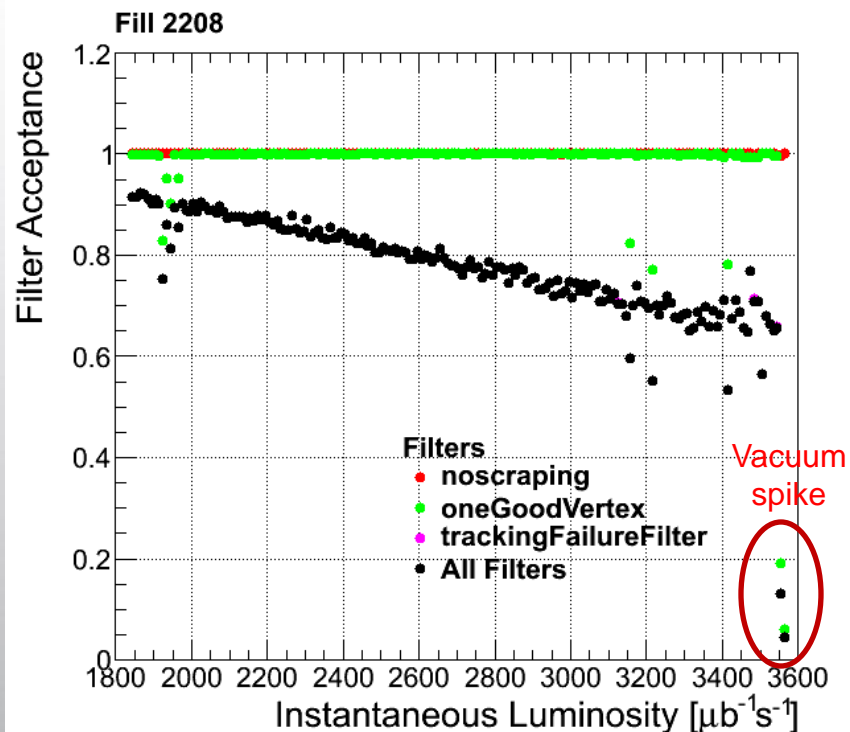
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Event Filter Acceptances

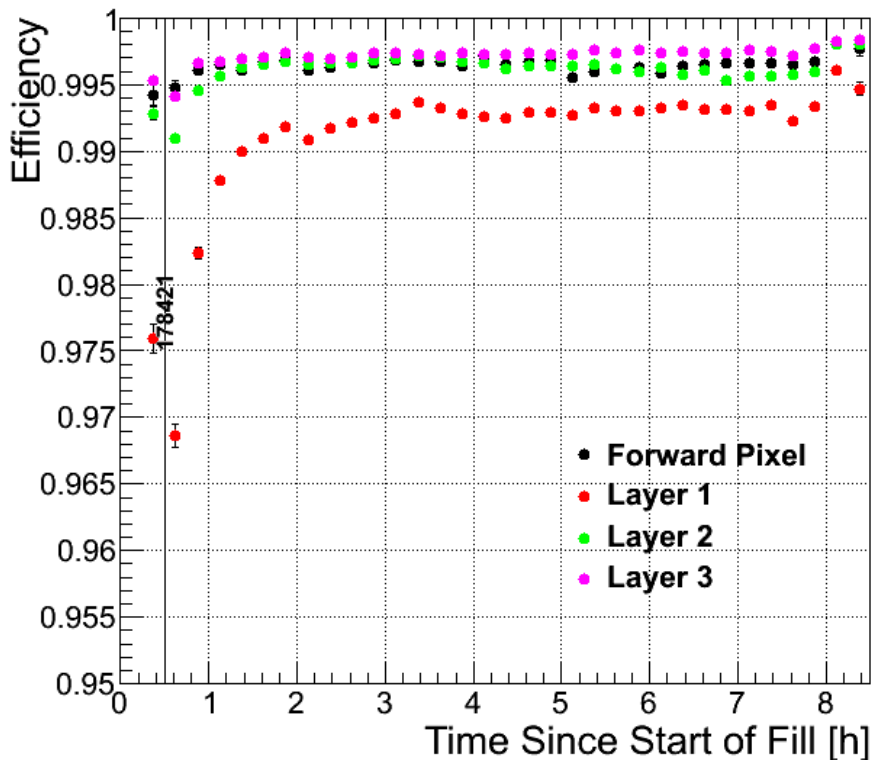
Reference Fill



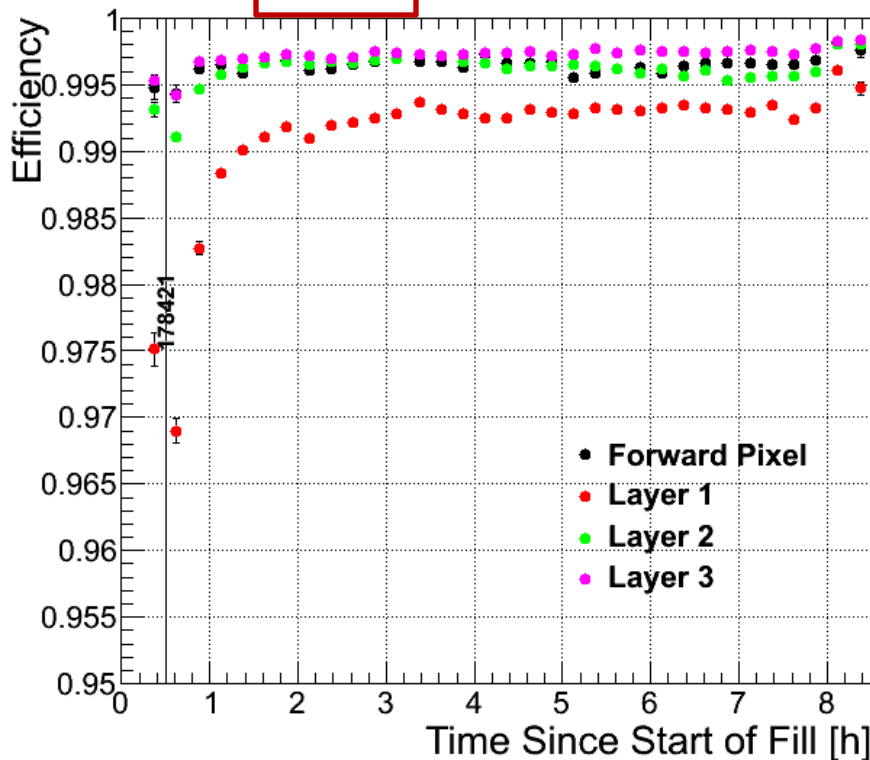
■ MinimumBias dataset, no trigger selection

Layer Efficiency vs Time

Fill 2208 - No Filters

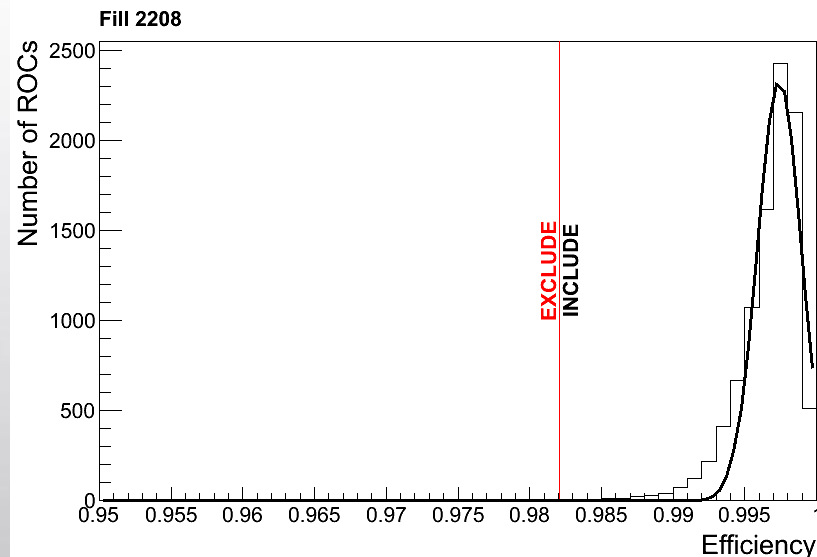
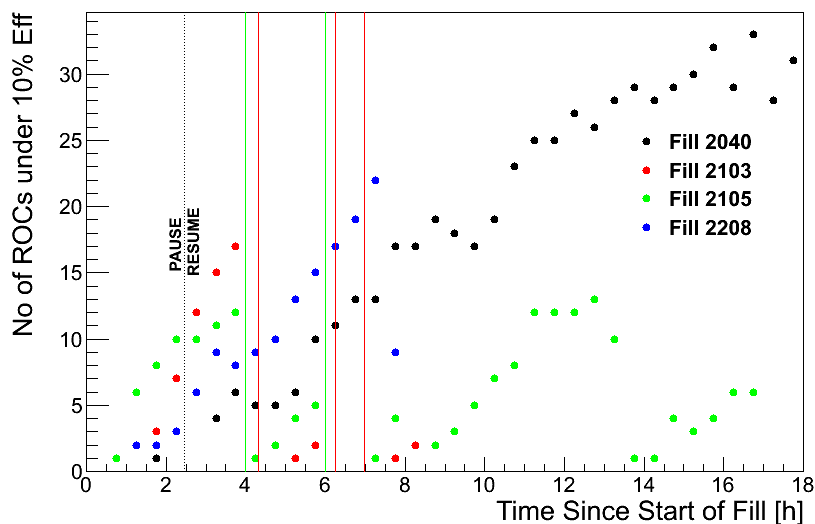


Fill 2208 **All Filters**



- Applying Event Filters used in analyses (right plot) doesn't improve efficiency
- Event Selection used (prerequisite for efficiency calculations)

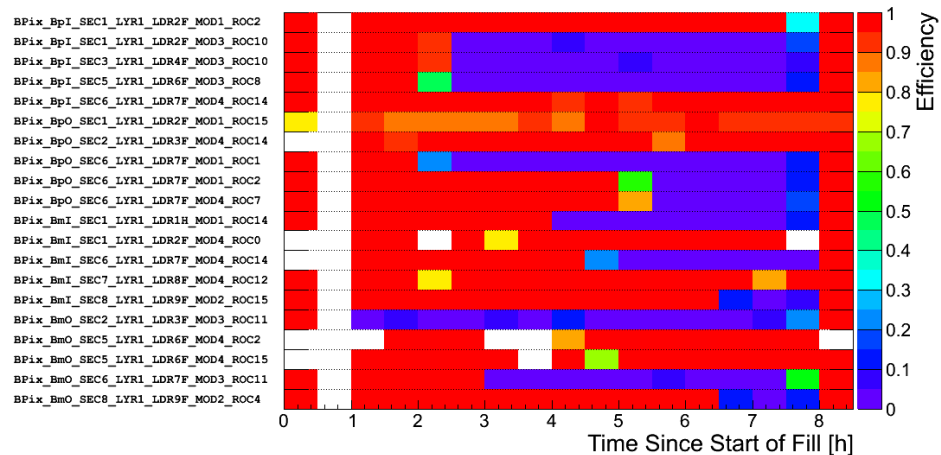
Bad ROC Exclusion



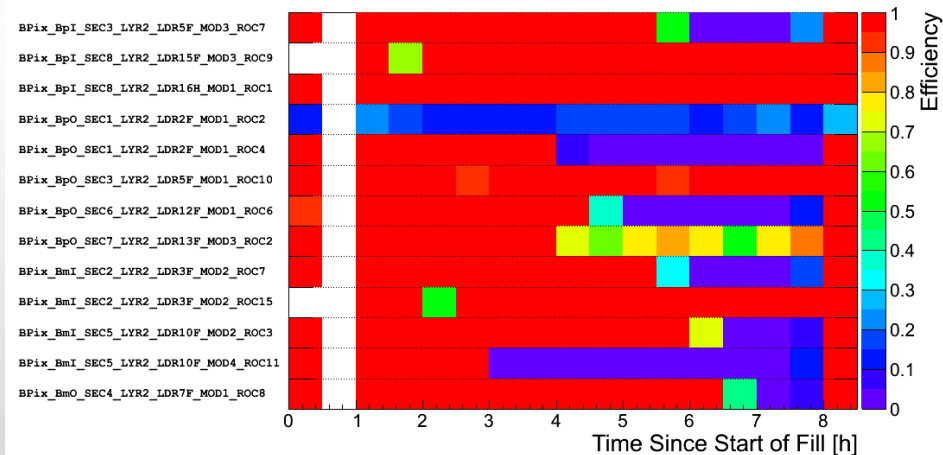
- After excluding FED errors, certain ROCs still have low efficiency (This may be due to Single Event Upsets (SEUs))
- > Exclude SEU candidate ROCs with efficiency over 10σ from mean (<0.982)

SEU Candidates

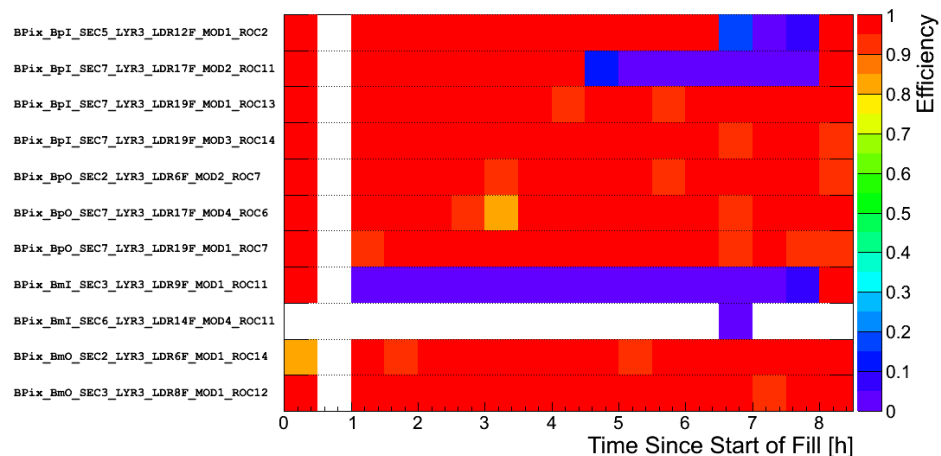
Layer 1



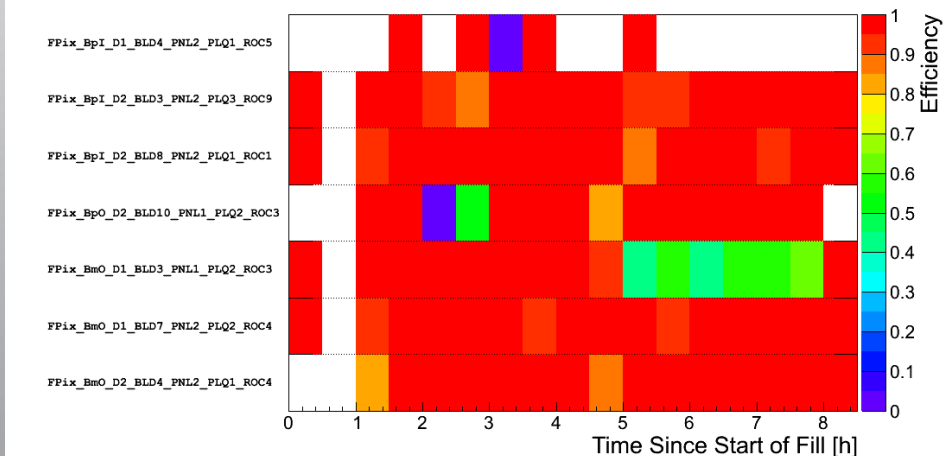
Layer 2



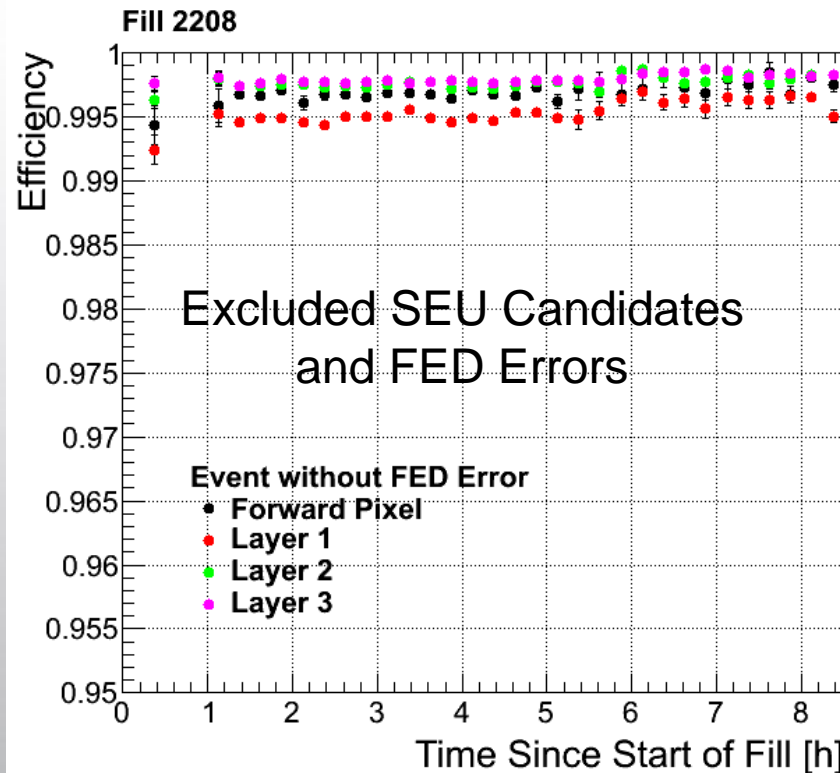
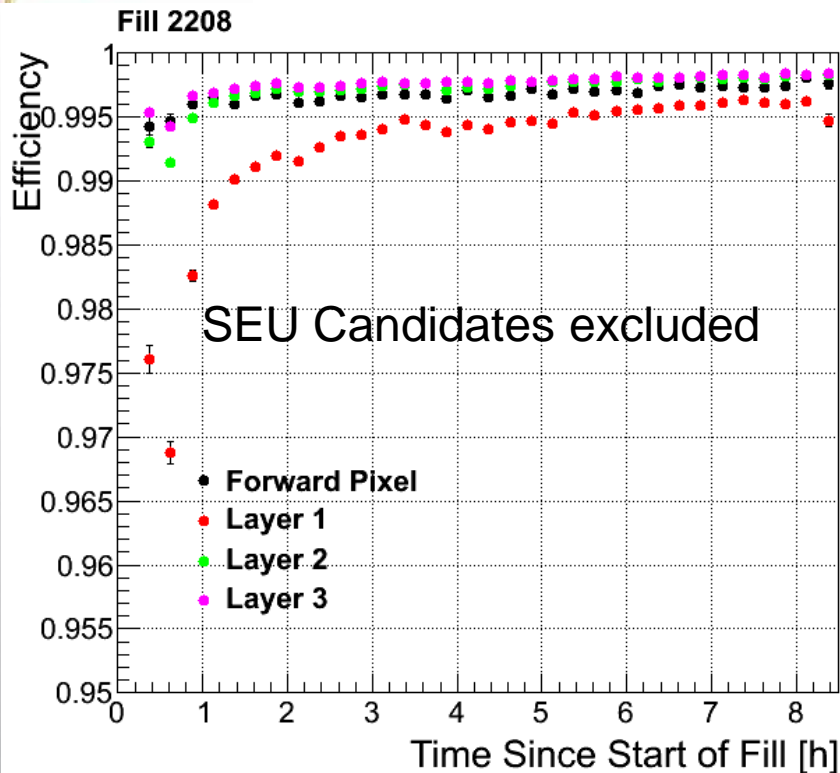
Layer 3



FPIX

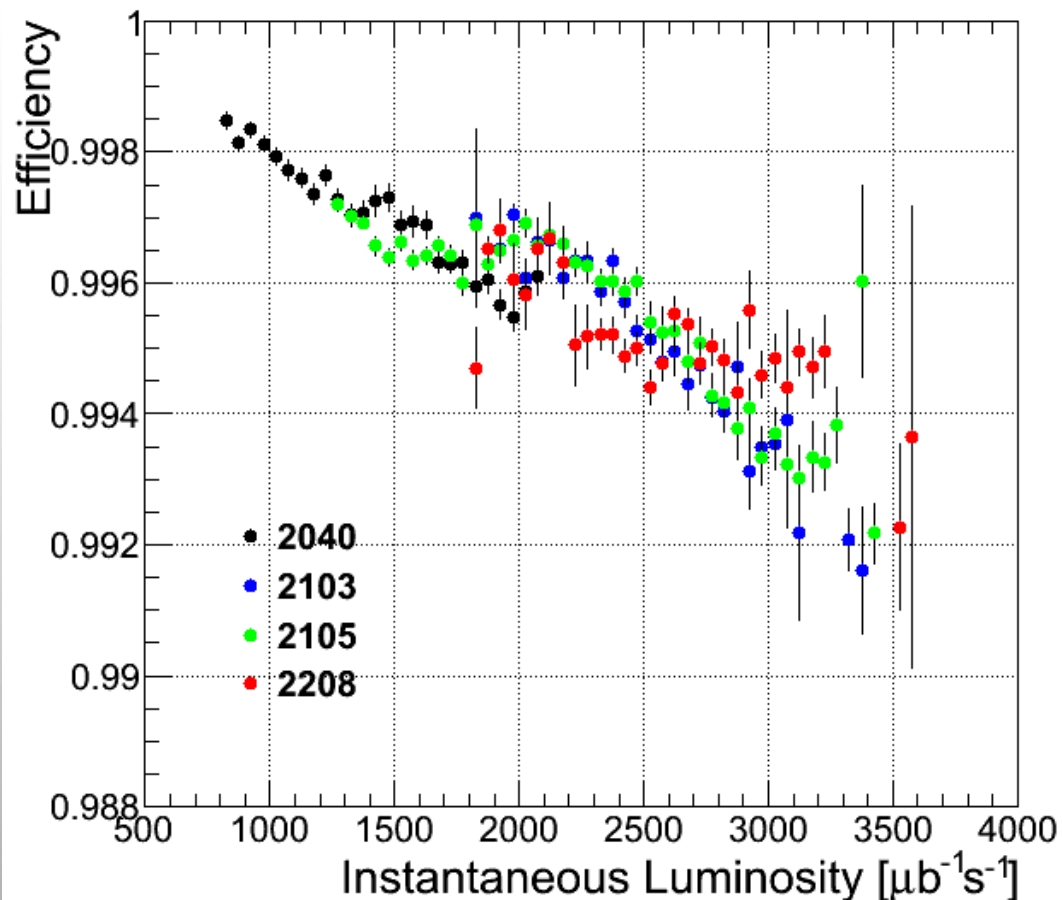


Layer Efficiency vs time



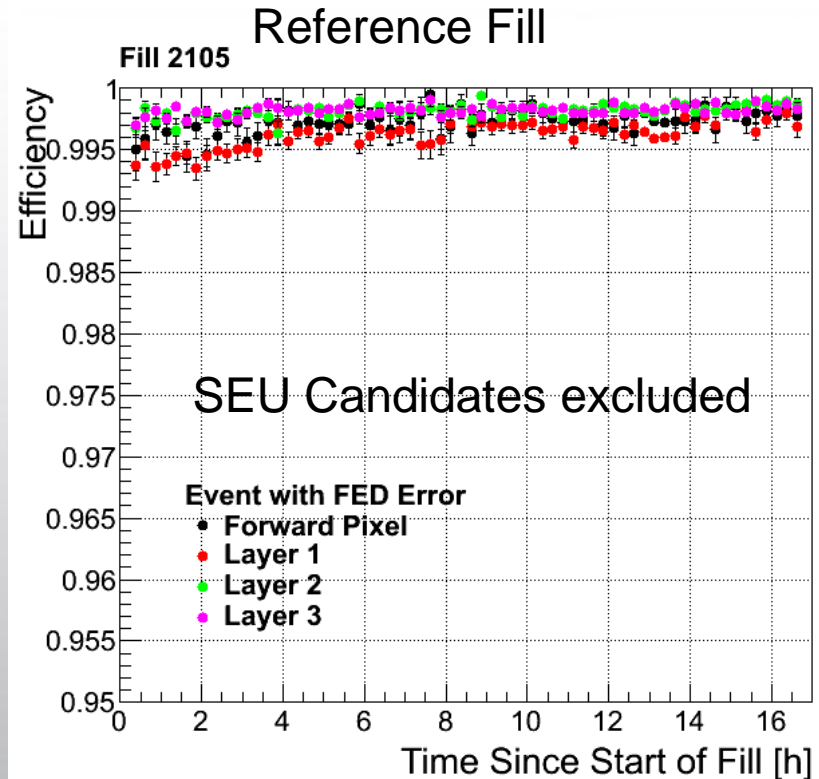
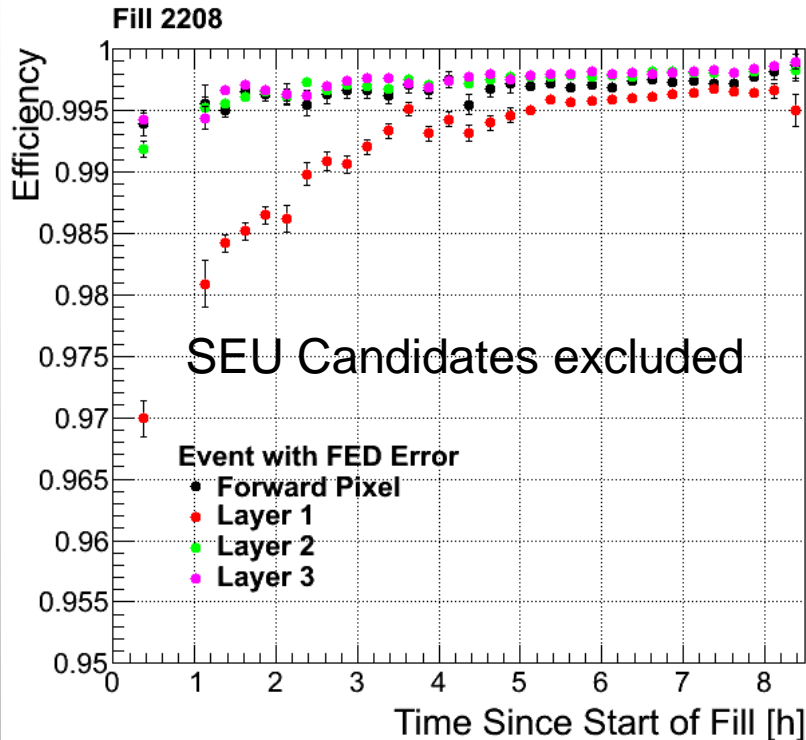
- Excluded SEU Candidates (Left plot) and recovered 0.1-0.4% Efficiency (most of it late in the fill)
- Additionally excluded FED Errors (Right plot) and we recovered $\sim 1.2\%$
- The rest of the Efficiency loss is dynamic efficiency loss

Dynamic Efficiency Loss – Layer 1



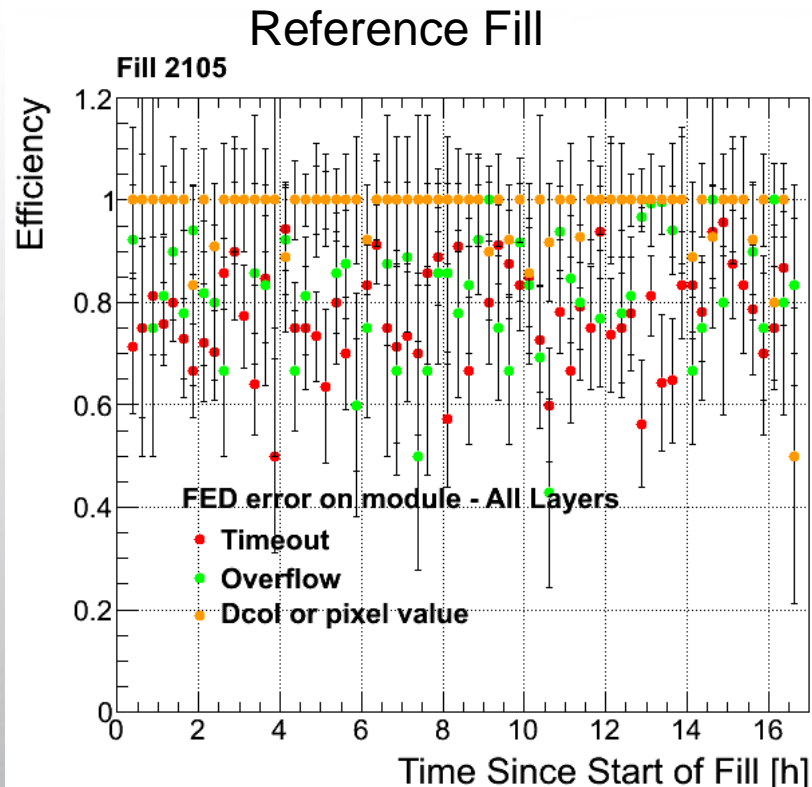
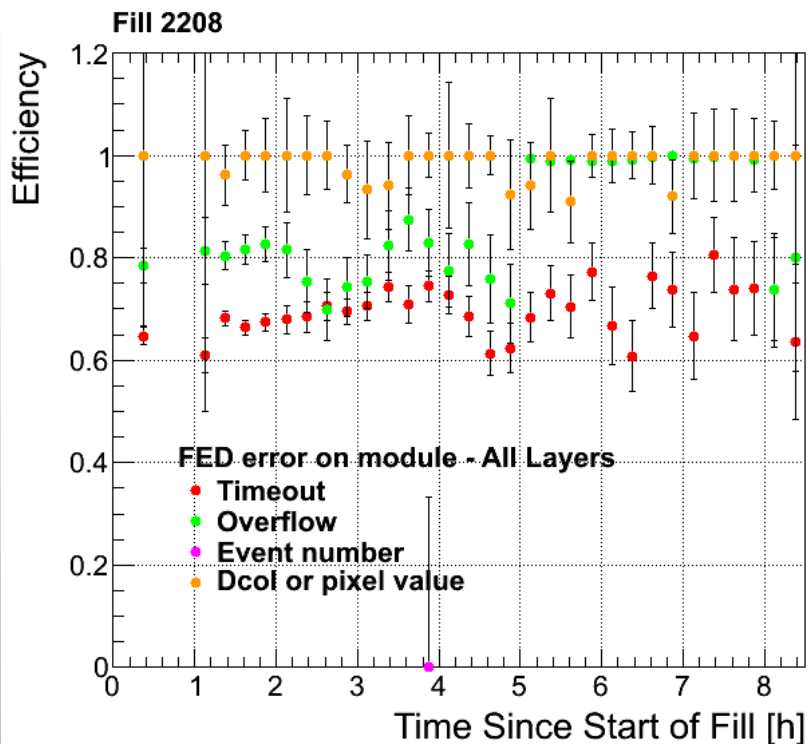
- Comparison to fills with the same filling scheme and inst.lumi
- Excluded events with FED errors and SEU Candidates

Efficiency of Events with FED errors



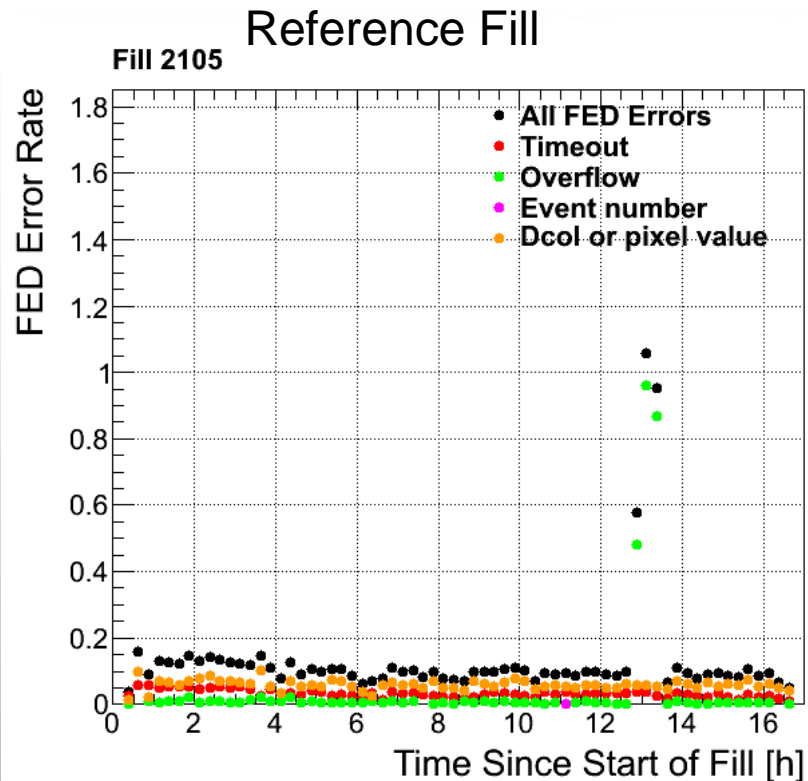
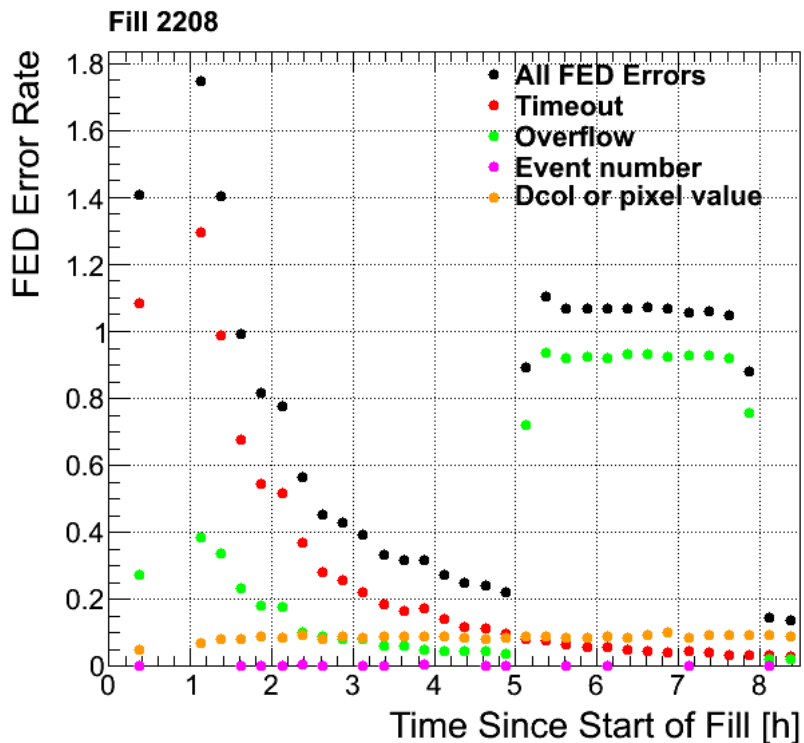
- The effects of the vacuum spike is clearly visible when comparing to a normal fill
- If an event with beam background is signaled by FED errors in fill 2208 then the efficiency is 97% on - layer 1
- If no FED errors are present efficiency is 99.2% in Fill 2208 and it is in agreement with expectations at such instantaneous luminosity (dynamic efficiency loss)

Efficiency of Modules with FED errors



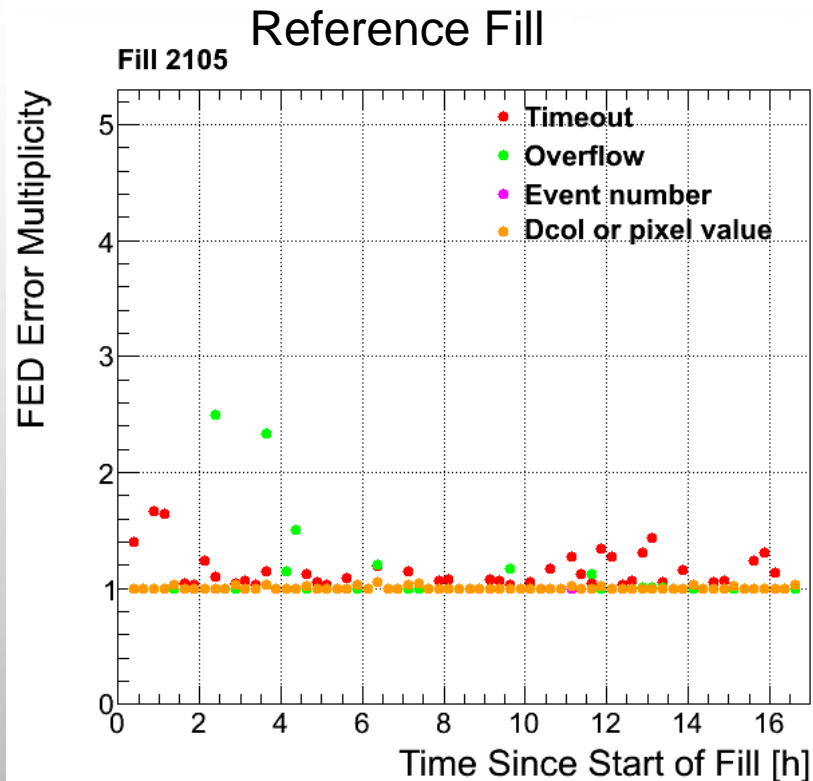
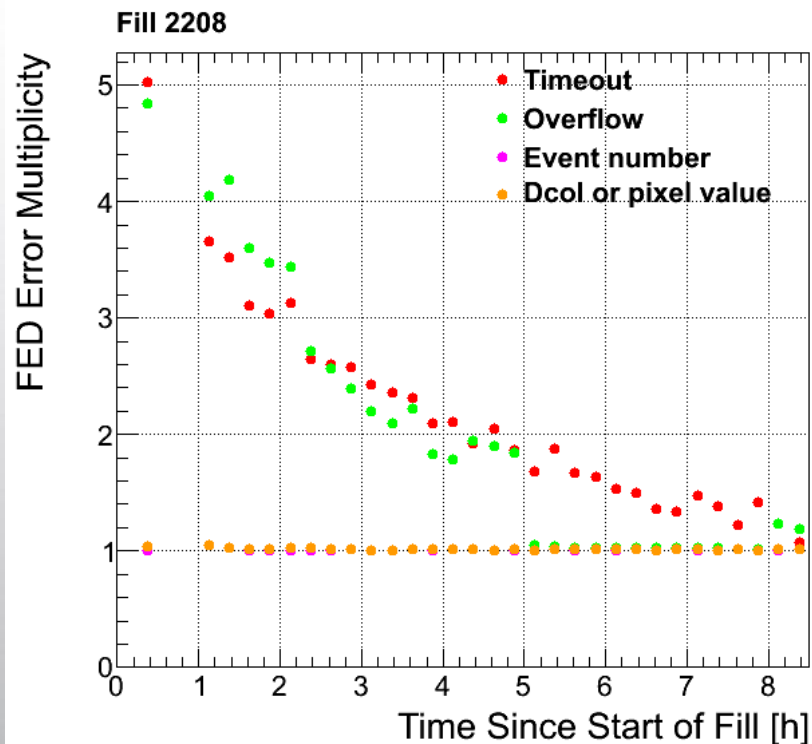
■ FED Error Multiplicity: $N_{\text{FED error}}/N_{\text{event with same error}}$

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