GEM Tracking Simulation with VMM3 Readout

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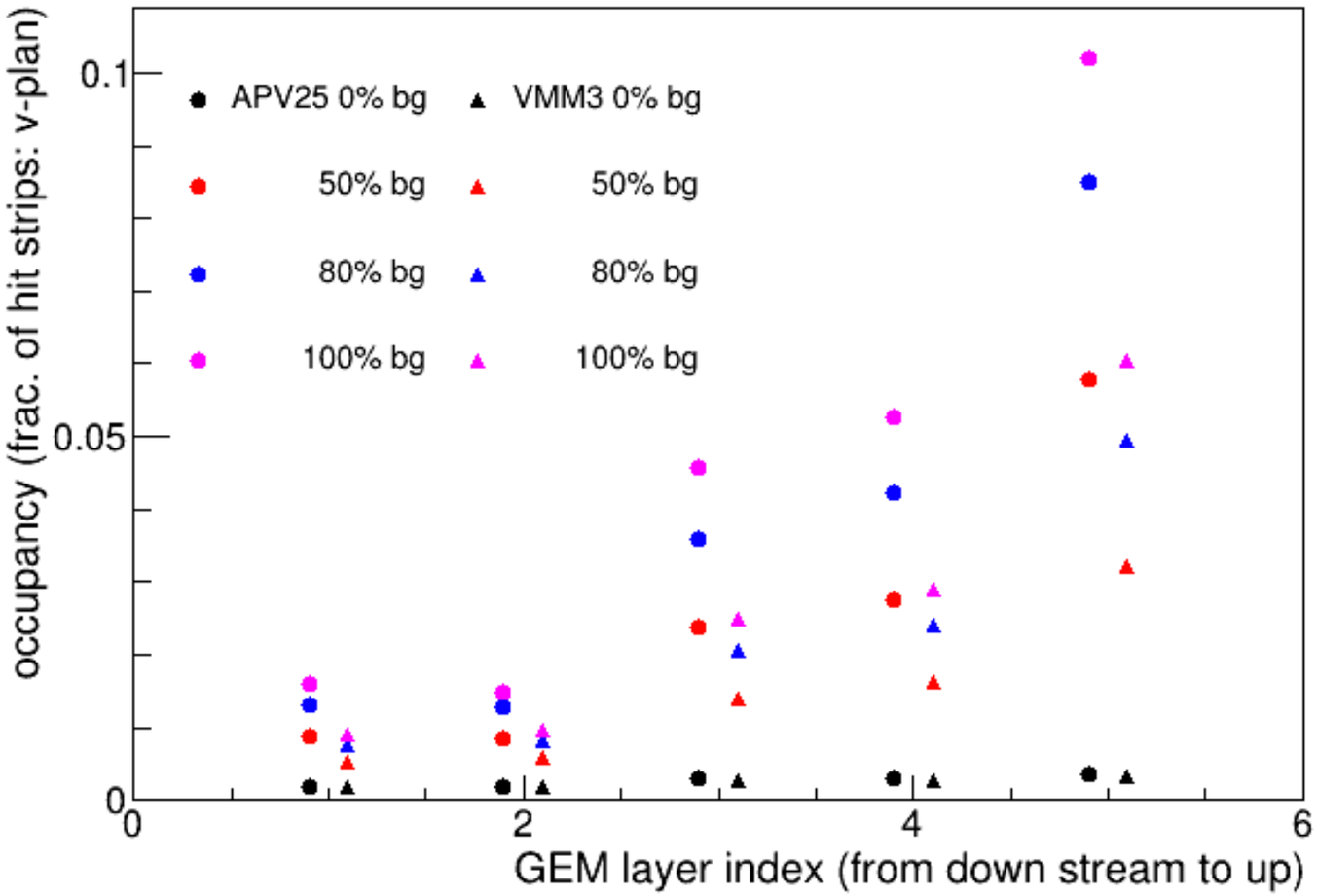
VMM3

- “Digital” output, instead of sampling on the sharped pulse, VMM3 seeks for pulse peak on the fly
- Before trigger arrives, VMM3 keep self-resetting, non-triggered hits (bkgd) and pile-up pulse contribution suppressed significantly
- Low resolution ADC (6-bit)

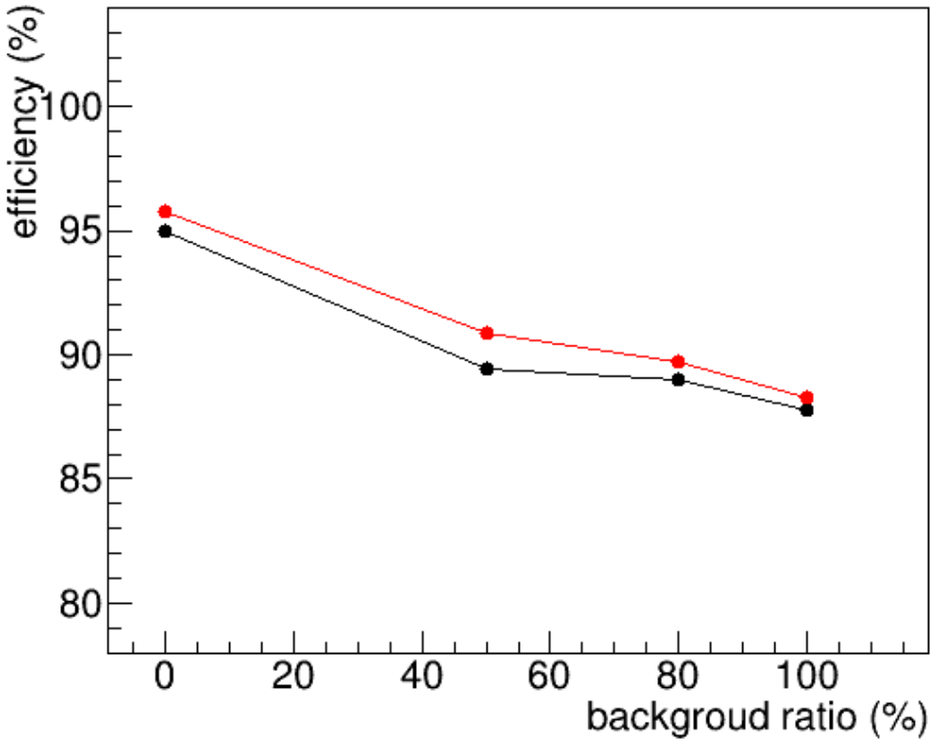
Occupancy

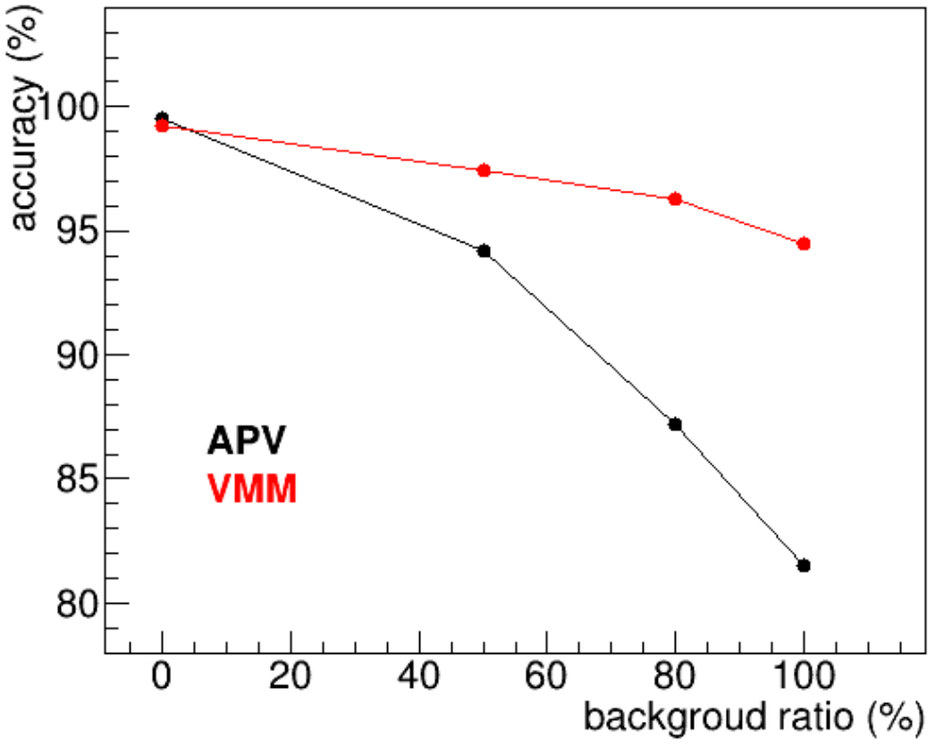


Noise rejected

- High occupancy is one of main issues impact the tracking efficiency and accuracy
- Without background, two readout modes have similar occupancy as expected
- VMM3 have ~40% lower occupancy than APV25 (3 sample, check pulse shape) with 100% background

Background sensitivity





- Efficiency at 0% background should be 95-96% for 5-layer GEM (at least 4 hits for tracking)
- APV: ADC ~ 200, ped noise sigma~15, ADC min cuts > 95 (didn't tune from Weizhi's setup).
- VMM: ADC ~40, ped noise sigma ~5, ADC min cuts > 16 (tuned to APV to have similar 0% background efficiency)
- Efficiency sensitivity to background ratio seminar for APV and VMM
- Accuracy decreases less for VMM (low occupancy) than APV

Simulation details for VMM mode

1. Simulate energy to charge using Cauchy-Lorentz mode
2. Simulate charge to ADC using SAMPA shaping function with 50 ns peaking time
3. Accumulate ADC contribute by signal events and background events in time window 0~50 ns (relative to trigger; resetting before trigger, processing peak to ADC output after 50 ns)
4. Find peak from the accumulated ADC spectrum, and only save peak ADC for tracking
5. Smear ADC with pedestal noise (Gaussian)
6. Do clustering and tracking from the one “sample” hits

The VMM study are based on PVDIS configuration.