



Tracker timing cuts update for slow and long-lived particles

data rate implications

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Timing cuts: the logics behind

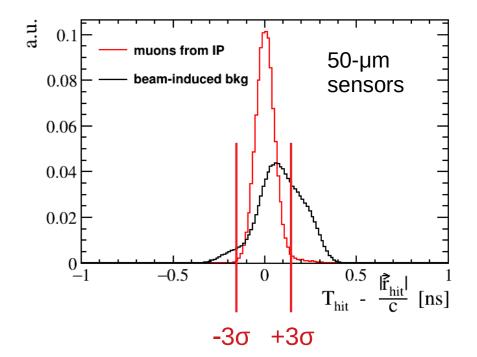
Tracker timing information is an important ingredient for BIB suppression

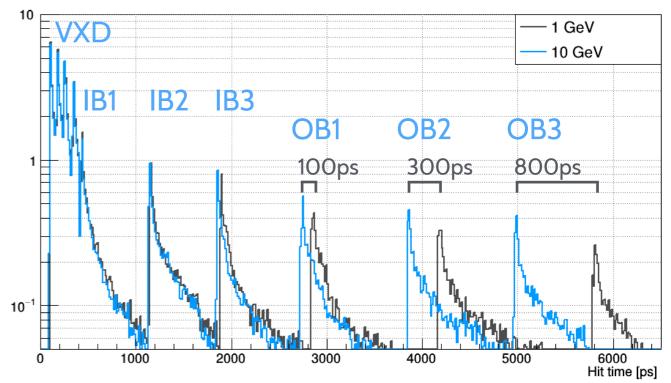
Readout time window driven by two limitations:

- 1. time resolution of Si sensors
 - symmetric $[-3\sigma, +3\sigma]$ window to keep the signal assuming particles with β =1
- 2. time delay of low- β particles
 - Endcap hits extended upper time limit to keep very massive (slow) tracks
 - up to +10µs for triggerless readout at the 100 kHz beam-crossing rate

Triggerless readout might be feasible with timing-aware track reconstruction

Can we afford transferring all that data?



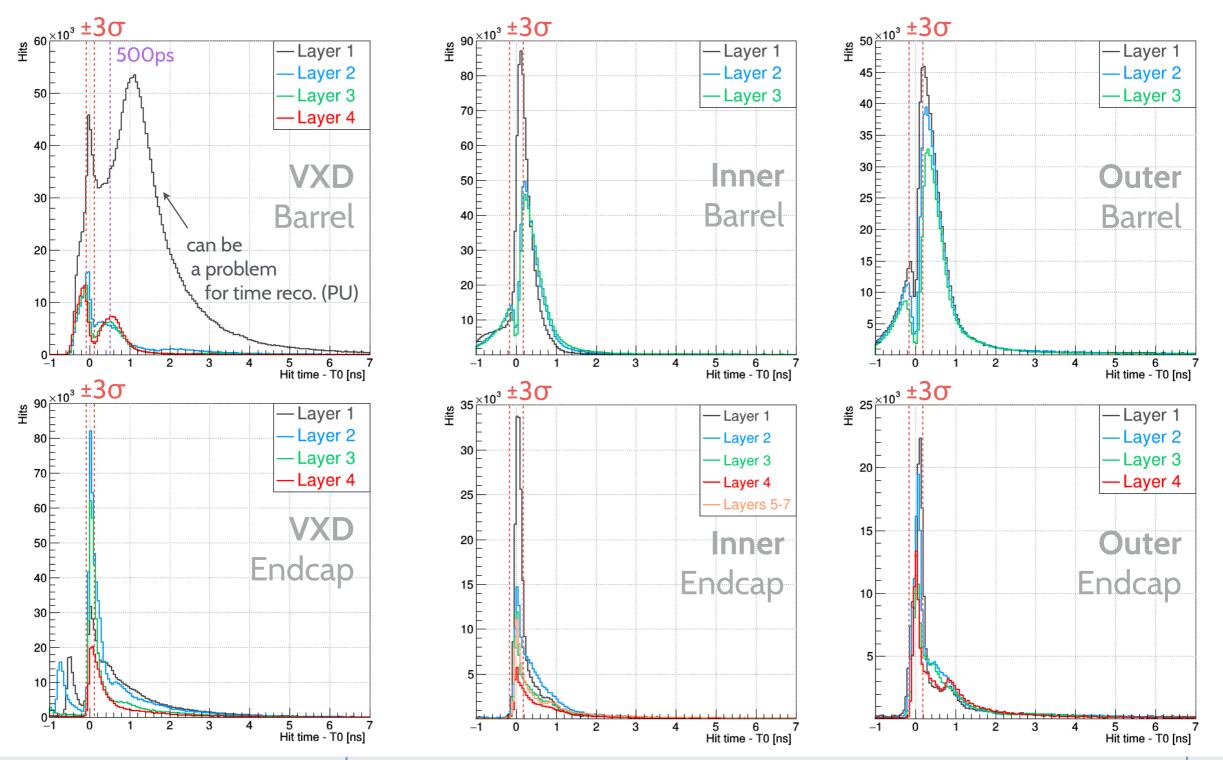


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BIB time distributions: up to 10µs

Repeated GEANT4 simulation with BIB particles at $t \le 10 \mu s$ (default: $t \le 25 ns$)

Evaluating SimHit time distributions in different Tracker regions: (no σ_t smearing)



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Hit multiplicities: up to 10µs

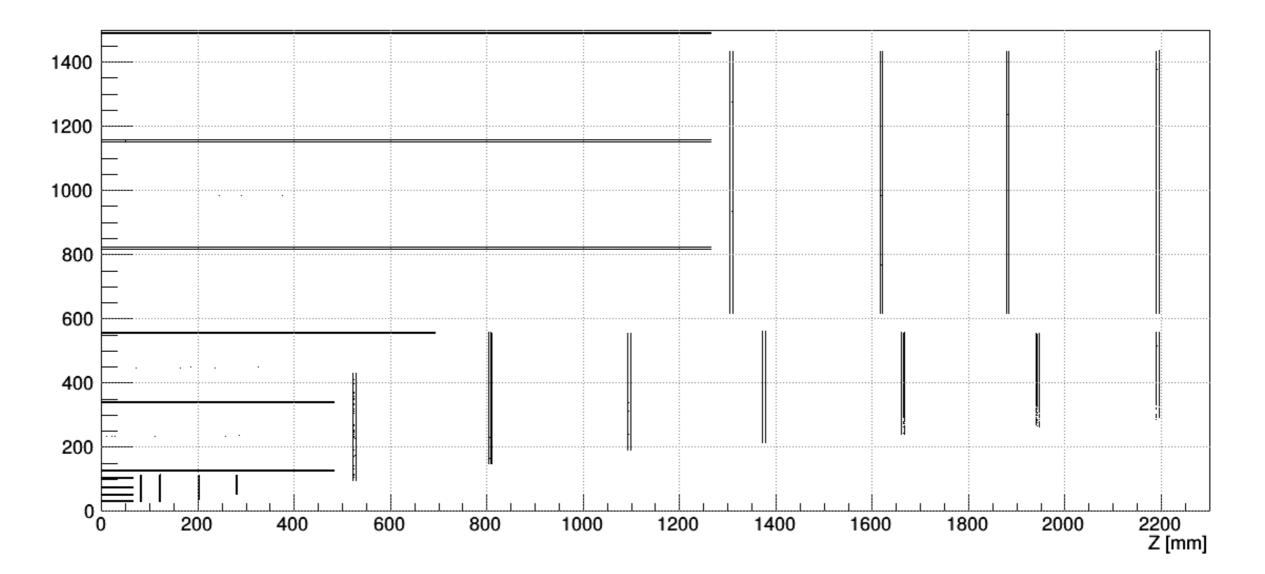
SM particles are relatively light: ~1ns is enough. Massive BSM particles are slower 54Tb/s 30Tb/s Counting all accepted SimHits at several upper time limits: $+3\sigma$, 1ns, 10ns, 10µs Total: 33M 70M 96M needed? ച്ച 10⁷ ച്ച ള 10⁷ ± Hits # hits: 242K # hits: 604K # hits: 272K VXC Inner Outer # hits: 1207K # hits: 1803K # hits: 1426K 10⁶ = # hits: 2498K Barre Barrel # hits: 1965K Barre # hits: 1740K]×1.6 |=# hits: 2508K # hits: 2702K # hits: 2112K 10⁶ 10⁵ 10⁵ 10⁵ 10⁴ 0 2.5 2.5 2 6 0 0.5 1.5 0 0.5 1.5 2 3 5 1 3 3 Layer Layer Layer ള 10⁷ ∺ si ≣ ⊞ Hits # hits: 458K # hits: 293K # hits: 275K VXD Outer Inner # hits: 1342K # hits: 541K # hits: 503K 10^{6} Endcap Endcap # hits: 1833K # hits: 702K Endcap # hits: 706K 1×2]×2.4 | =# hits: 1846K # hits: 1713K # hits: 1517K 10⁶ 10^{6} 10⁵ 10⁵ 10⁵ 10 0 2 3 5 6 3.5 4 1 0.5 1.5 Layer Laver Layer

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Conclusions

We need to define which regions of the tracker are most relevant for slow particles

- VXD is close to IP: \leq 30cm \rightarrow TOF \leq 1ns do we need it up to 10 μ s?
- VXD Layer 1 is even closer: ≤ 7 cm \rightarrow TOF ≤ 210 ps needed for slow particles?
- more on-detector filtering \rightarrow more heat \rightarrow more cooling \rightarrow more material



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