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Tracker timing cuts update
for slow and long-lived particles

data rate implications

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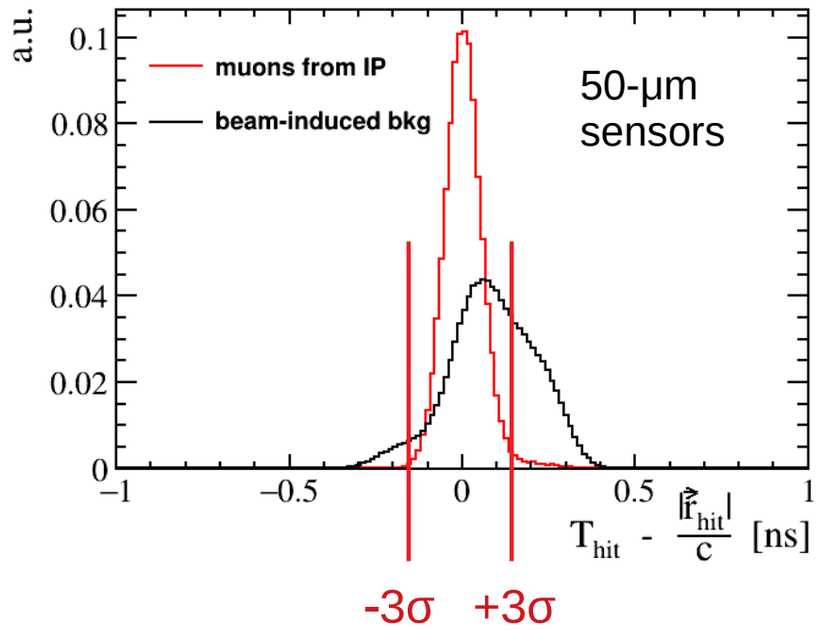
Timing cuts: the logics behind

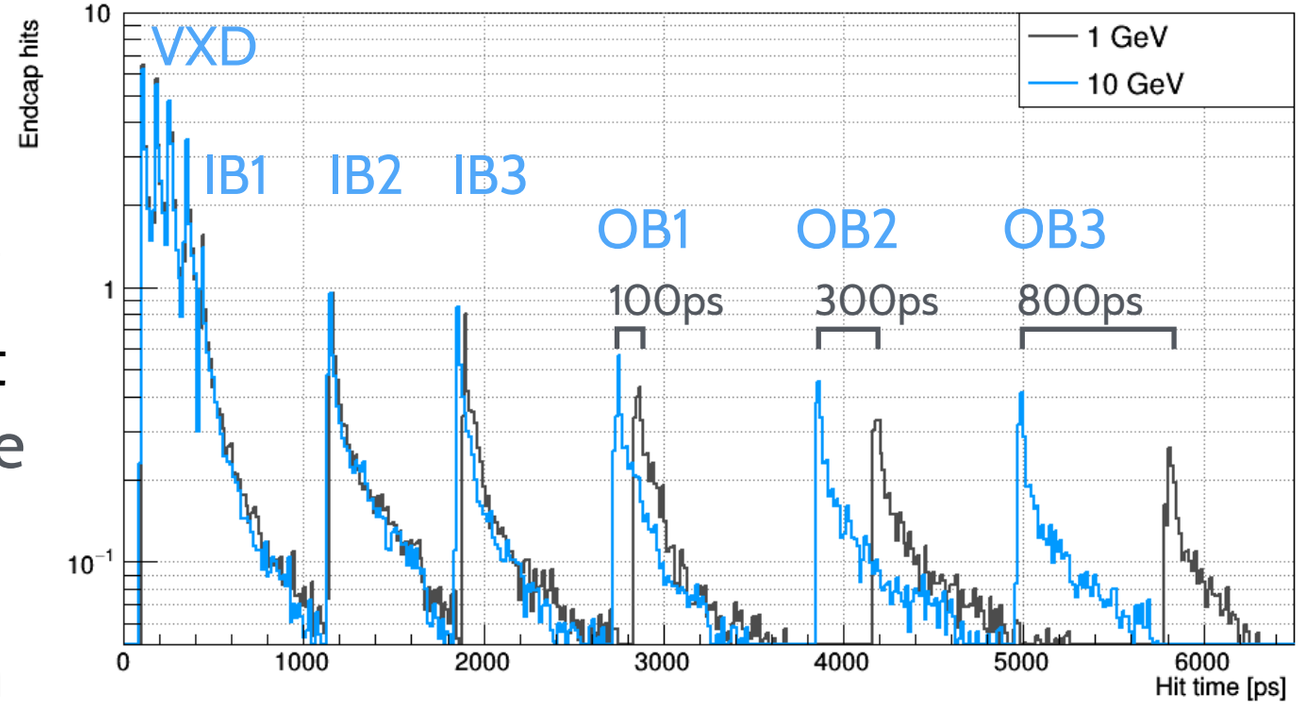
Tracker timing information is an important ingredient for BIB suppression

Readout time window driven by two limitations:

1. **time resolution of Si sensors**
   - symmetric [-3σ, +3σ] window to keep the signal assuming particles with β=1



2. **time delay of low-β particles**
   - extended upper time limit to keep very massive (slow) tracks
   - up to +10μs for triggerless readout at the 100 kHz beam-crossing rate



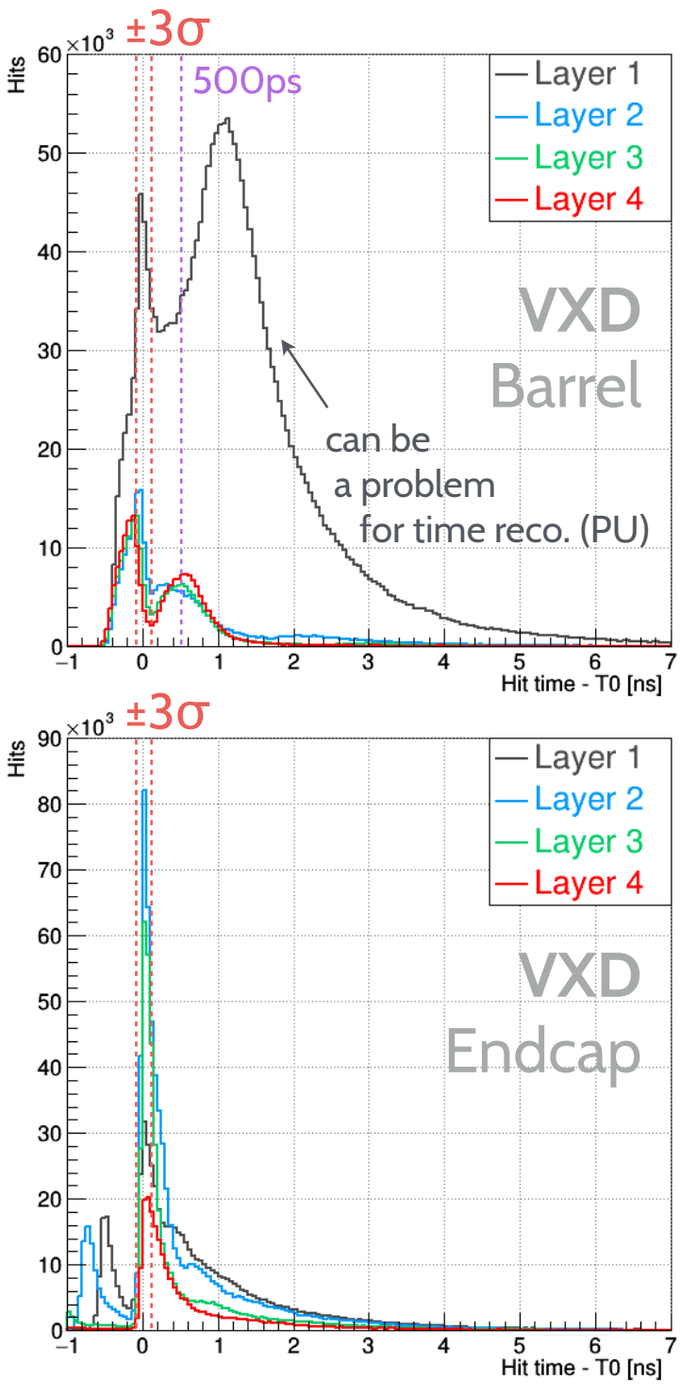
Triggerless readout might be feasible with timing-aware track reconstruction

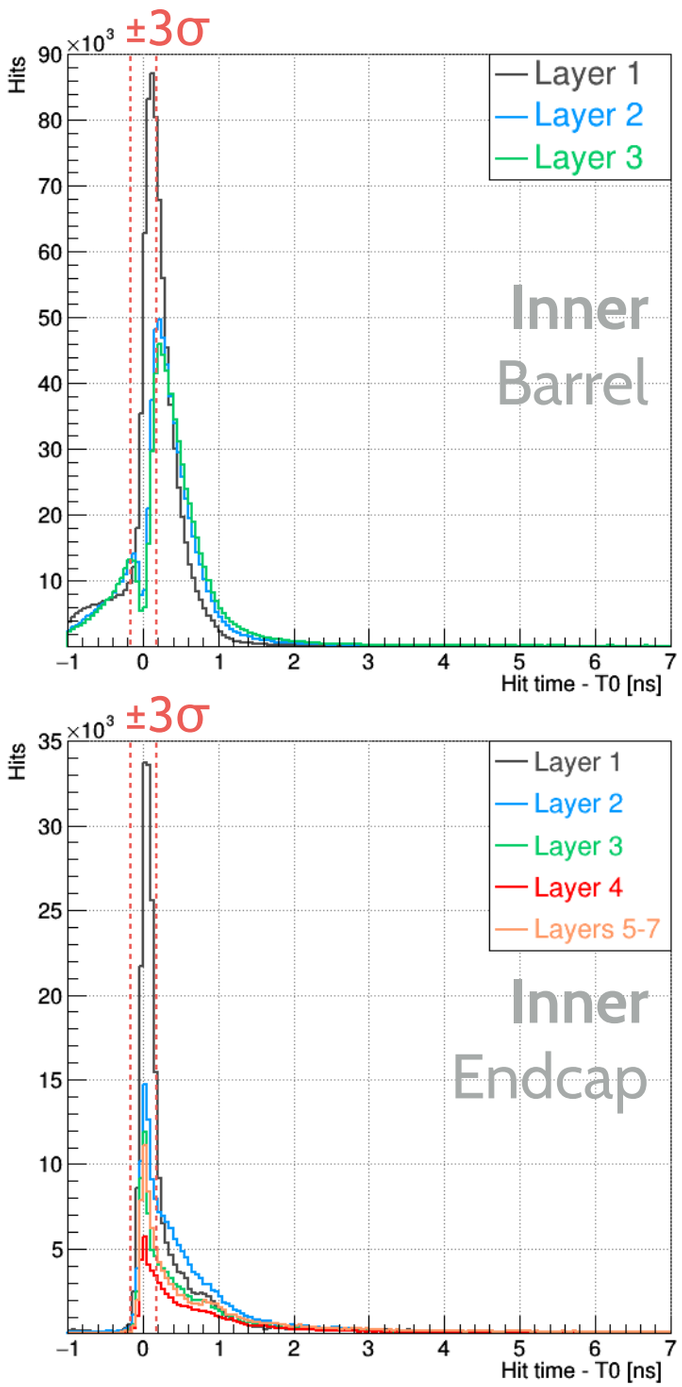
Can we afford transferring all that data?

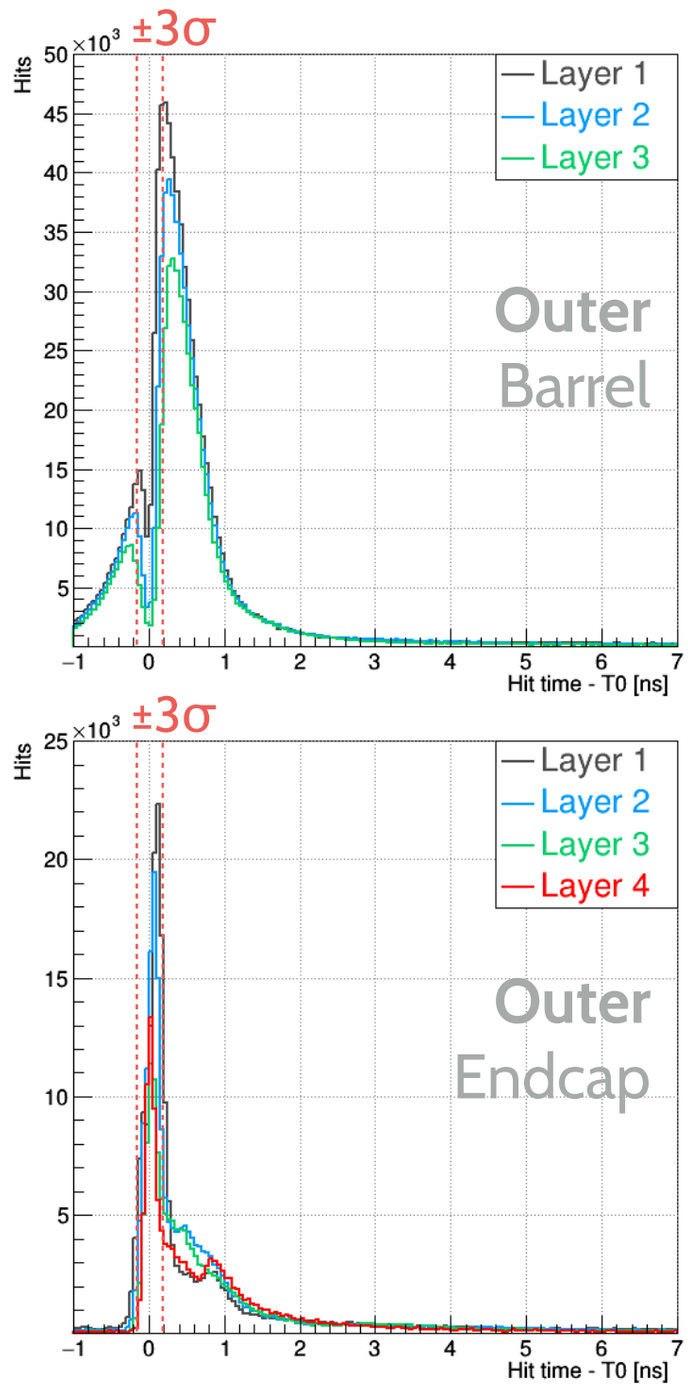
BIB time distributions: up to 10μs

Repeated GEANT4 simulation with BIB particles at t ≤ 10 μs (default: t ≤25 ns)

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







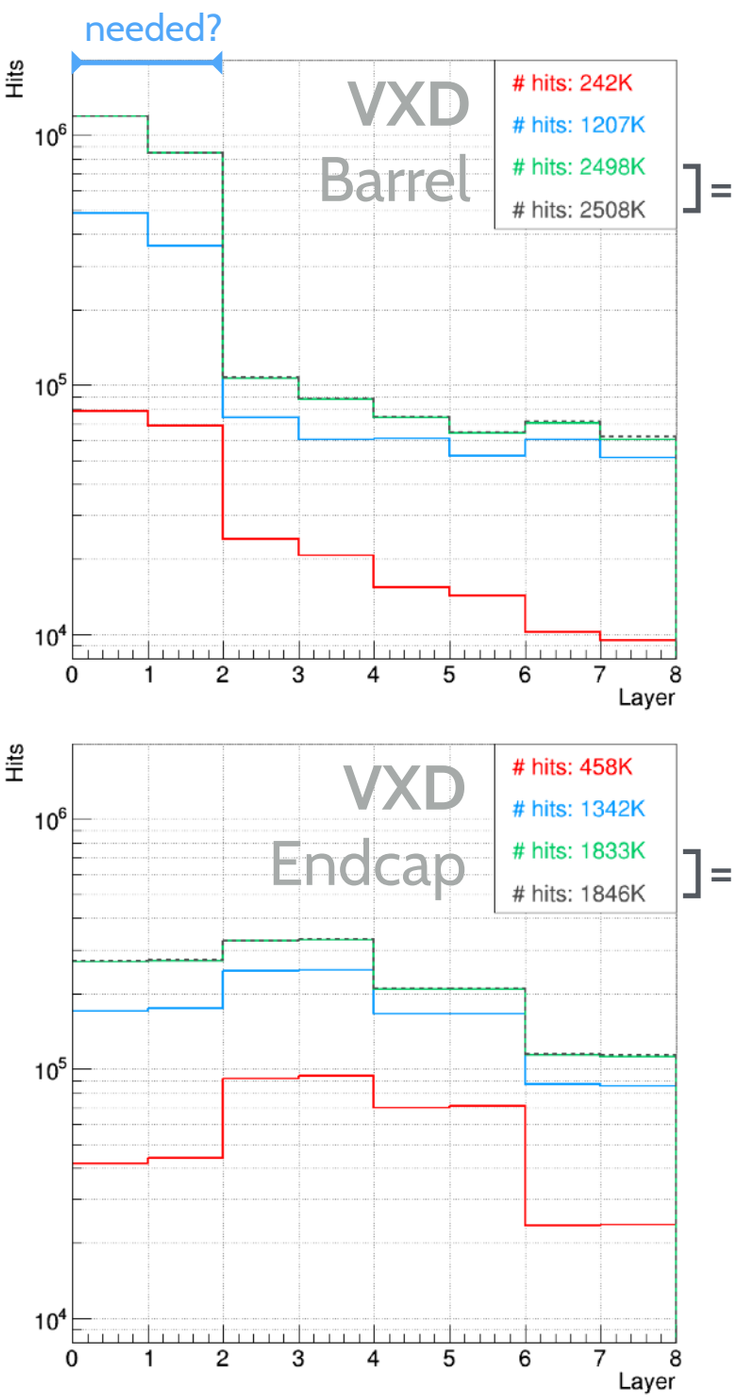
Hit multiplicities: up to 10μs

SM particles are relatively light: ~1ns is enough. Massive BSM particles are slower

Counting all accepted SimHits at several upper time limits: +3σ, 1ns, 10ns, 10μs

30Tb/s 54Tb/s

Total: 33M 70M 96M 125M



Conclusions

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

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