

Simulations for TDAQ

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Pitt, CMU, The Ohio State U, MIT, UC Irvine, SMU, Duke, BNL,
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TDAQ Architecture decision tree

No. There is enough bandwidth to readout all the sub-detectors for every bunch crossing.

Do we need a fixed-latency trigger?

Yes. A sub-detector needs a trigger

Develop off-detector data post-processing with commodity compute.

- Filtering of trivial bunch crossings.
- Removal of beam backgrounds.
- Formatting data.
- Storing data.

The triggerless readout is easier to develop and support than a fixed-latency trigger but it requires more off-detector compute.

What are the parameters of the TDAQ system?

- Which sub-detectors can be used for triggering?
- What experimental signatures can we trigger on?
- What would be the trigger latency?
- Can the sub-detector accommodate the buffer?

Simulation status

- We need GEANT-based detector simulations with realistic parameters (pixel size, calorimeter sampling range, granularity, data formats etc.) to estimate the data rates.
- Simulations of the vertex detector are central to decide for TDAQ architecture.
- Work is happening internationally. E.g. see Armin's talk https://indico.cern.ch/event/1298458/contributions/5987291/attachments/2875496/5035607/Silicon%20tracker%20optimisation_Armin%20llg.pdf
- These GEANT datasets can be also used to train AI/ML algorithms for on- and off-detector data processing

