ESR6: Optimization of RTA resources for LHCb Lepton Flavor Violation search and manufacturing

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About me: Daniel Magdalinski

- Born and raised in Stockholm, Sweden
- Both bachelor and master at Lund University
- Bachelor
  - Energy regression with neural networks at LDMX(Light Dark Matter eXperiment)
- Master
  - Lepton to doubly charged higgs initial analysis study at ATLAS

About me: Daniel Magdalinski

- CERN summer student 2022
  - HGCAL reconstruction at CMS
- Mainly physics background with deep interest in programming and machine learning
- ESR6 in Amsterdam from 1st of October

About me: Daniel Magdalinski

- Other interests:
  - Gaming
  - Classical guitar
  - Cooking
- Sports
  - Skiing(cross-country and alpine)
  - Squash
  - Bouldering recently

Lepton Flavor Universality(LFU)

- Lepton couplings to vector bosons are independent of generation/flavor
- Violation of this principle would be an indication of new physics
- LFU measurements have so far shown tension to the SM but no discoveries so far
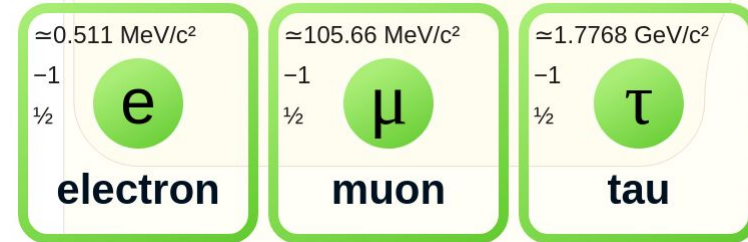
LFV process: $\tau \rightarrow \mu + \gamma$

- Flavor violating process
  - Current best: $B(\tau \rightarrow \mu + \gamma) < 4.2 \times 10^{-8}$
- Initial investigation into if LHCb could be competitive with Belle II
  - LHCb: very messy but higher luminosity and cross section for τ
  - Belle II very clean
- Simple decay products
  - Background very large

LHCb software trigger update

- Hardware trigger limited physics gain of increased luminosity
- Solution: Throw it out and replace with software trigger
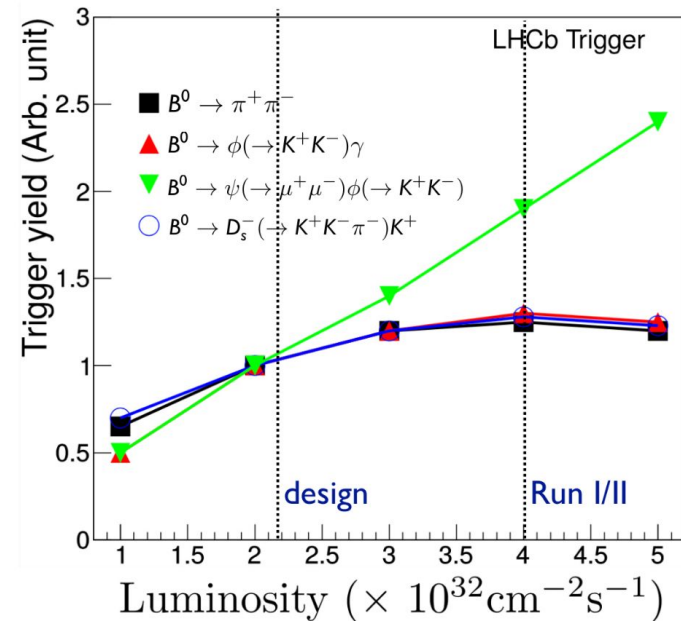
LHCb software trigger update

- **30 MHz using GPUs in HLT1**
  - 1 MHz output
- **HLT1 focus on displaced charged tracks**
  - Muon and calorimeter info also available for PID
- **HLT2 does full reconstruction with CPUs**
  - Alignment and calibration needed for offline-quality reconstruction
  - Trigger chains
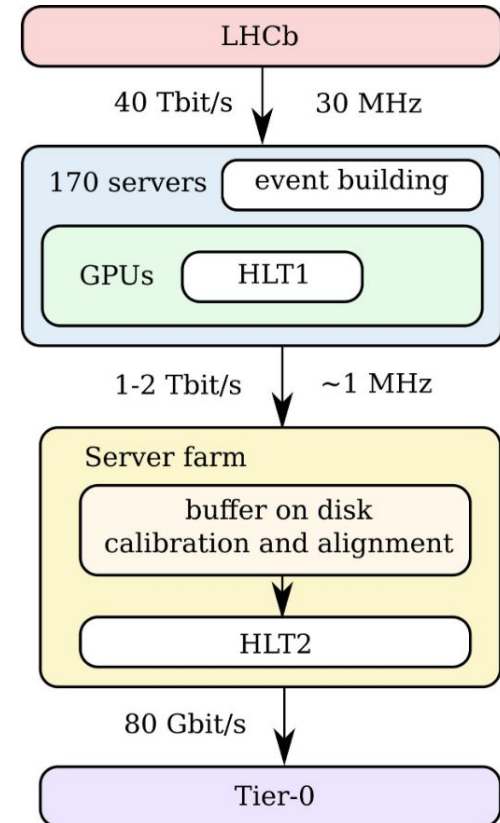
Optimization of trigger

- HLT2 trigger consists of ~1000 trigger chains
  - Similar analysis: similar computations
  - Possibly saving the same object twice in the event
- Optimization task
  - Computational resources
  - Storage resources
  - Cost-benefit

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- Global optimization task ideal candidate for machine learning
- Optimization should be generalized so it can be applicable to ATLAS during secondment to CERN

Thank you for listening!