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An automated tool to facilitate consistent test-driven development of trigger selections for LHCb's Run 3

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Upon its restart in 2022, the LHCb experiment at the LHC will run at higher instantaneous luminosity and utilize an unprecedented full-software trigger, promising greater physics reach and efficiency. On the flip side, conforming to offline data storage constraints becomes far more challenging. Both of these considerations necessitate a set of highly optimised trigger selections. We therefore present HltEfficiencyChecker: an automated extension to the LHCb trigger application, facilitating trigger development before data-taking driven by trigger rates and efficiencies. Since the default in 2022 will be to persist only the event's signal candidate to disk, discarding the rest of the event, we also compute efficiencies where the decision was due to the true MC signal, evaluated by matching it to the trigger candidate hit-by-hit. This matching procedure –which we validate here –demonstrates that the distinction between a "trigger"and a "trigger-on-signal"is crucial in characterising the performance of a trigger selection.

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