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## Speeding up CMS simulations, reconstruction and HLT code using advanced compiler options

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The CMS simulation, reconstruction, and HLT code have been used to deliver an enormous number of events for analysis during Runs 1 and 2 of the LHC at CERN. In fact, these techniques have been regarded as of fundamental importance for the CMS experiment. In the following arguments presented, several ways to improve efficiency of these procedures will be described and it will be displayed how no particular conceptual or technical blocker has been identified in their implementation.

In this framework, particular attention will be devoted to highlight how CMS simulation, Reco and HLT will gain a considerable increase in speed recompiling several CMS sub-libraries using advanced compiler options. In fact, using this logic, the compiler will be leveraged to obtain a up to 10% speedup. As will be shown, the focus of the reasonings reported will be on the LTO (Link Time Optimization) and PGO (Profile Guided Optimization) approaches: using these advanced tools, several results will be seen about improving the event loop time and event throughput and the differences between the profiles of the processes will be shown. Moreover, an important feature of PGO approach will be considered: profiles obtained running events based on one process will be enough to speedup many other ones (and a profile obtained with the Phase 1 detector configuration will manage to give an improvement for Phase 2 processes too).

### Significance

### References

### Experiment context, if any

CMS Collaboration

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