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Minimising wasted CPU time with interruptible LHCb Monte Carlo

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During 2017 LHCb developed the ability to interrupt Monte Carlo
simulation jobs and cause them to finish cleanly with the events
simulated so far correctly uploaded to grid storage. We explain
how this functionality is supported in the Gaudi framework and handled
by the LHCb simulation framework Gauss. By extending DIRAC, we have been
able to trigger these interruptions when running simulation on
unoccupied capacity of the LHCb High Level Trigger farm, and are able to
reclaim this capacity when needed for online data taking tasks. This has
increased the opportunities for running Monte Carlo simulation during
data taking runs as well as interfill periods and technical stops. We
have also applied this mechanism to grid and cloud resources at external
sites, providing the ability to reclaim capacity for operational reasons
without long draining periods. In addition, the mechanism is used to
increase the efficiency of the "job masonry" of packing
single and multiprocessor jobs into the time slots on a single worker node,
without the need for draining periods when multiple free processors must be
assembled for a multiprocessor job. We explain how the Machine/Job
Features mechanism is instrumental in communicating the desired finish
time to LHCb jobs and virtual machines.

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