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Modernizing the ATLAS Simulation Infrastructure

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The ATLAS Simulation infrastructure has been used to produce upwards of 50 billion proton-proton collision events for analyses
ranging from detailed Standard Model measurements to searches for exotic new phenomena. In the last several years, the
infrastructure has been heavily revised to allow intuitive multithreading and significantly improved maintainability. Such a
massive update of a legacy code base requires careful choices about what pieces of code to completely rewrite and what to wrap or
revise. The initialization of the complex geometry was generalized to allow new tools and geometry description languages, popular
in some detector groups. The addition of multithreading requires Geant4 MT and GaudiHive, two frameworks with fundamentally
different approaches to multithreading, to work together. It also required enforcing thread safety throughout a large code base,
which required the redesign of several aspects of the simulation, including "truth," the record of particle interactions with the
detector during the simulation. These advances were possible thanks to close interactions with the Geant4 developers.

Primary Keyword (Mandatory)

Simulation

Secondary Keyword (Optional)

Software development process and tools

Tertiary Keyword (Optional)

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