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The Fast Simulation Chain for ATLAS

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In order to generate the huge number of Monte Carlo events that will be required by the ATLAS experiment over the next several runs, a very fast simulation is critical. Fast detector simulation alone, however, is insufficient: with very high numbers of simultaneous proton-proton collisions expected in Run 3 and beyond, the digitization (detector response emulation) and event reconstruction time quickly become comparable to the time required for detector simulation. The ATLAS Fast Chain simulation has been developed to solve this problem. Modules are implemented for fast simulation, fast digitization, and fast track reconstruction. The application is sufficiently fast – several orders of magnitude faster than the standard simulation – that the simultaneous proton-proton collisions can be generated during the simulation job, so Pythia8 also runs concurrently with the rest of the algorithms. The Fast Chain has been built to be extremely modular and flexible, so that each sample can be custom-tailored to match the resource and modeling accuracy needs of an analysis. It is ideally suited for analysis templating, systematic uncertainty evaluation, signal parameter space scans, simulation with alternative detector configurations (e.g. upgrade), among other applications.

Tertiary Keyword (Optional)

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