Fast Simulation for SuperB detector and physics reach studies

Content:
We have developed a parameterized (fast) simulation for detector optimization and physics reach studies of the proposed SuperB Flavor Factory at Frascati. A fast simulation allows studying rare signals and their backgrounds in the large data sample of \(-10^{11}\) B meson pair events anticipated over the lifetime of SuperB. Our simulation is fully compatible with the event generators and analysis framework of BaBar, allowing physics signal significance to be used as a metric when evaluating detector options. Detector components are modeled as thin sections of planes, cylinders, or cones. Thick objects are built by layering thin sections. Overall cylindrical symmetry is enforced by design, allowing closed-form stepping of linear and helical particle paths in most cases. Particle-material interactions are modeled using simplified cross-sections and formulas. Unstable particles are allowed to decay within the detector volume. Active detectors are modeled using parameterized response functions. Geometry and response parameters are configured using xml files with a custom-designed schema. Reconstruction algorithms adapted from BaBar are used to build tracks and clusters. Multiple sources of background signals can be merged with primary signals statistically using estimated spatial and temporal multi-hit resolutions. Pattern recognition errors are modeled statistically by randomly misassigning nearby tracking hits. Standard BaBar analysis tuples are used as an event output. Hadronic B meson pair events can be simulated at roughly 10Hz. In this talk we will describe the design and implementation of the SuperB fast simulation, and show examples of its use in SuperB detector and physics studies.

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