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slic: A full-featured Geant4 simulation program

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As the complexity and resolution of particle detectors increases, the need for detailed simulation of the experimental setup also increases. We have developed efficient and flexible tools for detailed physics and detector response simulations which build on the power of the Geant4 toolkit but free the end user from any C++ coding. Geant4 is the de facto high-energy physics standard for simulating the interaction of particles with fields and materials. However, the end user is required to write their own C++ program, and the learning curve for setting up the detector geometry and defining sensitive elements and readout can be quite daunting, especially for those without previous experience or not associated with large collaborations. We have developed the Geant4-based detector simulation program, slic, which employs generic IO formats as well as a textual detector description. Extending the pure geometric capabilities of GDML, LCDD enables fields, regions, sensitive detector readout elements, etc. to be fully described at runtime using an xml file. We also describe how more complex geometries, such as those from CAD programs, can be seamlessly incorporated into the xml files. We have defined generic "hits" which can be used to model sophisticated tracking and calorimetry readouts, but the native Geant4 scoring functionality can also be used for simpler applications. Although developed within the context of HEP collider detectors, the program is completely flexible and can be used to simulate detectors in many different fields.

Summary

We present a software toolkit and computing infrastructure which allows physicists to quickly and easily contribute to detector design by modeling detector elements without requiring either C++ coding expertise or experience with Geant4. This makes it perfect for small groups in new and emerging technologies, or those not associated with large collaborations or universities with in-house expertise.

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