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detector simulation mihaly novak cern ph sft foreword this lecture is aimed to offer a simple and general introduction to detector simulation geant4 will be considered as a concrete example because it is used by the lhc experiments but only to illustrate general aspects of detector simulation this lecture is not a tutorial on geant4 this chapter provides an overview of particle and radiation transport simulation as it is used in the simulation of detectors in high energy and nuclear physics henp experiments and briefly in other application areas allpix 2 read allpix squared is a generic open source software framework for the simulation of silicon pixel detectors its goal is to ease the implementation of detailed simulations for both single detectors and more complex setups such as beam telescopes from incident radiation to the digitised detector response this review starts from the current state of the art technology applied to detector simulation in high energy physics and elaborates on the evolution of software tools developed to address the challenges posed by future accelerator programs beyond the hl lhc era into the 2030 2050 period detector simulation is the digitization it is not part of the general radiation transportation codes it consists of producing the detector response in terms of electric current voltage signals as it would happen in the real experiment the same reconstruction chain can be applied for both real and simulated data the instrument and detector requirements at ess place high demands on the respective simulation tools to tackle the ambitious design challenges with the advances outlined in this article it is now possible to accurately model an ever larger fraction of instrument and detector components we demonstrate the importance and utility of monte carlo simulation of single photon detectors devising an optimal simulation is strongly influenced by the particular application because of the complexity of modern avalanche diode based single photon detectors the effect of the surroundings of a detector can also be studied the package is programmed in the user friendly and performance oriented language julia such that 3d field calculations and drift simulations can be executed efficiently and in parallel this chapter provides an overview of particle and radiation transport simulation as it is used in the simulation of detectors in high energy and nuclear physics henp experiments and briefly in other application areas abstract the open source software package solidstatedetectors jl to calculate the elds and simulate the drifts of charge carriers in solid state detectors especially in large volume high purity germanium detectors together with the corresponding pulses is introduced once a detector is built and physics data are taken simulations play a major role in understanding the data estimating the backgrounds suggesting selection and analysis strategies evaluating corrections acceptances efficiencies and assessing the systematic uncertainties of measurements simulations are present from the beginning of an experiment simple estimates needed for making detector design choices develop reconstruction and analysis programs evaluate physics reach they are built up over time adding removing details as necessary they are used in many different ways detector performance studies for a silicon micro strip detector the monte carlo simulation is recognized as a practical and cost effective approach to verify the detector performance in this study a technique for the simulation of the silicon micro strip detector with the allpix 2 framework is developed simulation of particle detectors based on ionisation measurement in gases and semiconductors the main area of application is currently in micro pattern gaseous detectors garfield shares functionality with the garfield program the main differences are the more up to date treatment allpix 2 is a generic open source software framework for the simulation of silicon strip detectors it can simulate the response of the silicon strip detectors with different configuration according to the requirements of users when an incident particle passing through our simulation consists of a two step process using the geant4 toolkit to model the detector and source geometry and to track photon interactions and a matlab script to model the charge transport within the pixelated czt detector 1 introduction the development of inorganic scintillators and an increasing variety of low light sensors in recent years has enabled the widespread use of scintillator detectors in nuclear physics particle physics radiation imaging and other fields the simulation is extended to popular monolayer phototransistors so that precise quantitative evaluations of the optoelectronic device performance such as the output characteristics transfer properties responsivity response time and detectivity become very convenient detectors page id spectroscopy is the study of how light interacts with matter and a necessity for these studies is the ability to detect light to do this spectroscopists use a wide variety of detectors which are devices that convert incident photons into a measurable signal the spectroscopy focusing array sfa onboard the enhanced x ray timing and polarimetry observatory extp uses silicon drift detectors sdds at the focal plane a simulation of the corresponding detectors is performed in this work to model the instrument responses including the spectral and timing behaviors

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