

Simulation of dark photon generation process $e-Z \rightarrow e-ZA'$ for NA64 experiment using Geant4

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According to some theoretical models a new dark matter gauge boson A' (dark photon) might exist, possibly coupled with ordinary photon by different (non-gravitational) type of weak interaction. The NA64 experiment at CERN SPS accelerator is aimed at probing an unexplored parameter space of kinetic $\gamma-A'$ mixing strength and mass values of A' . Experiment utilizes 100 GeV electron beam and the main process is the generation of A' inside an active target via the reaction: $e-Z \rightarrow e-ZA'$ which is possible due to $\gamma-A'$ mixing. The existence of A' can be determined by presence of missing energy signature events inside the target and subsequent A' decay signature events inside downstream calorimeters. The NA64's simulation software package provides Monte-Carlo modelling for such processes. This work is aimed at developing a Geant4-like implementation of a new A' particle and processes corresponding to its production and decay for the NA64's simulation software package. Added modules are based on Bremsstrahlung process implementation for e^- with modified cross section computations. Developed modules can be later included into further versions of Geant4 simulation toolkit

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