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The comparison of multiple-scattering effects in GEANT-DIRAC 2.63 and in the corresponding version of Santiago group.

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1 Preface

There is a need to clarify the differences in multiple scattering(MS) effects which take place between GEANT-DIRAC 2.63 and that one which is used by the Santiago group.

These both versions are based on earlier version of GEANT-DIRAC where there is some standard description of all the DIRAC setup materials. As there were some doubts that these descriptions are not enough correct then two methods were suggested to solve this problem. The first one was to use the Δx and Δy distributions of two tracks at the level of the target to tune the values of radiation thickness of forward detectors materials(Santiago method - [1]). The second one was to measure the multiple scattering effects of these materials directly, by locating the pieces of these materials between planes of DIRAC drift chambers([2]).

Both methods were realized and converted into some additional codes for GEANT-DIRAC program. Santiago group changed the codes of GMOLIE routine of GEANT: for all the materials which are down of the fiber detector the multiple scattering angle is increased on 13%, for the upper part, except the target material, the increasing is equal to 15%. The second method was realized in the additional codes which change the multiple scattering angle for measured materials according to the obtained results. This method has indeed another realization where the densities of these materials are changed in the way to get the same value of MS angle.

2 Results

In this work we used both of the GEANT-DIRAC versions, [1] and [2]. We made the simple simulation using them: we determined the values of $T = \Theta_x \times p(\Theta_y \times p)$, where Θ is the angle due to the multiple scattering and p - momentum of pion, for:

1. pions which passed all the materials: they started before the target and stopped after ionization godoscope.

2. pions which passed through the aluminum membrane.

For the first trajectory we obtained the following results:

1. Base, not improved, version of GEANT-DIRAC gave the value of $\sigma(T)$ of $3.068 \cdot 10^{-3}$
   (the statistical errors are very small; the fit was done by gaussian function).

2. Santiago version - $3.423 \cdot 10^{-3}$(increase on 11.2%).

3. "Measured" version - $3.213 \cdot 10^{-3}$(increase on 4.7%).

For the aluminum membrane we obtained the following results:

1. Base version of GEANT-DIRAC gave the value of $\sigma(T)$ of $0.960 \cdot 10^{-3}$

2. Santiago version - $1.081 \cdot 10^{-3}$(increase on 12.6%).

3. "Measured" version - $0.987 \cdot 10^{-3}$(increase on 2.8%).

We see that for both sets of materials the Santiago version gives bigger value of multiple scattering angle.

References

[1] B. Adeva, A. Romero, O. Vazquez Doce [Santiago] , DIRAC Note 2005-16.

[2] A. Dudarev, V. Kruglov, L. Kruglova, M. Nikitin [JINR], DIRAC Note 2008-06.