



Iranian Journal of Physics Research, Vol. 23, No. 1, 2023  
DOI: 10.47176/ijpr.23.1.81563

## Calculation of photon absorbed dose kernel in a homogeneous water phantom by Monte Carlo Geant4 toolkit

K Tabaei and M Shamsaei-Zafarghandi

Energy Engineering and Physics Department, Amirkabir University of Technology, P.O.BOX: 4413-15875, Tehran, Iran

Email: Keyvantabaei@aut.ac.ir

(Received 26 August 2022; in final form 7 January 2023)

---

### Abstract

Nowadays, convolution/superposition(C/S) is used to calculate absorbed dose distribution by using the absorbed dose kernel(ADK). ADK describes the absorbed dose distribution per number of interaction at a small volume around the point of photon interaction. The purpose of this study is to calculate ADK and investigate its angular and radial behavior. In this study, ADK is calculated in a homogeneous water phantom in the polar coordinates by using the Monte Carlo Geant4 toolkit for monoenergetic photons with energies in the range 0.3MeV-5MeV. To study accurately, ADK is divided into several groups in order of produced charged particle set in motion at each photon interaction. Our result shows ADK rapidly decreases as the polar angle, with respect to the incident photon direction, is increased. As the radial distance from the interaction point increases, ADK is raised and then strongly decreased. ADK is symmetrically distributed around the point of interaction for low incident photon energy while forward distributed for high incident energy photons.

**Keywords:** absorbed dose kernel, dose distribution calculation, convolution, Geant4 toolkit

---

For full article, refer to the Persian section