

Pitfalls and modelling inconsistencies in computational radiation dosimetry: Lessons learnt from the QUADOS intercomparison

G. Gualdrini⁽¹⁾, R.A. Price⁽²⁾, B.R.L. Siebert⁽³⁾, R.J. Tanner⁽⁴⁾, S. Agosteo⁽⁵⁾, S. Ménard⁽⁶⁾, J-L. Chartier⁽⁷⁾,
B. Großwendt⁽³⁾, I. Kodeli⁽⁸⁾, G.P. Leuthold⁽⁹⁾, H. Tagziria⁽¹⁰⁾, M. Terrissol⁽¹¹⁾, M. Zankl⁽⁹⁾

¹ ENEA ION-IRP, Via dei Colli 16, I-40136 Bologna, Italy

² Department of Radiography, City University, Rutland Place, Charterhouse Square, London, EC1M 6PA, U.K.

³ PTB, Postfach 3345, D-38023 Braunschweig, Germany

⁴ NRPB, Chilton, Didcot, Oxon OX11 0RG, U.K.

⁵ Dipartimento Ingegneria Nucleare, Politecnico di Milano, v. Ponzio 34/3 I-20133 Milano, Italy

⁶ IRSN, BP 17 F-92262 Fontenay-aux-Roses, Cedex, France

⁷ 18 rue d'Yvette (78690) les Essarts-le-Roi France

⁸ IAEA representative, CD/NEA Data Bank, 12 bd. des Iles, F-92130 Issy-les-Moulineaux, France

⁹ GSF, Ingolstadter Landstrasse 1, D85764 Neuherberg, Germany

¹⁰ Joint Research Centre, Ispra site, Via E. Fermi 1, I-21020 Ispra (VA), Italy

¹¹ CPAT, University Paul Sabatier, 118 route de Narbonne, F-31062 Toulouse Cedex 4, France

“QUADOS” (Quality Assurance of Computational Tools for Dosimetry), supported by European Commission, under contract FIGD-CT-2000-20062, proposed an intercomparison aimed at evaluating the use of computational codes for dosimetry in radiation protection and medical physics. The first proposal, circulated in spring 2002, was addressed to all users of Monte Carlo, analytic and semi-analytic codes or deterministic methods, from both inside and outside the European Union, regardless of their field of work.

Eight problems were selected for their relevance to the radiation dosimetry community. Most of them are relatively undemanding in terms of set-up time and CPU required. However, they are deemed to be reasonably indicative of the problems encountered in computational practice.

The eight proposed problems can be schematically subdivided in two main subsets:

- a) Five Photon and Charged Particle Problems: 1) Brachytherapy: ¹⁹²Ir γ -ray source, 2) Endovascular Treatment: ³²P β^- source, 3) Proton therapy on the eye: 50 MeV proton beam, 4) Calibration phantom backscatter: X ray ISO reference beams, 5) Germanium detector response function: photon sources with energies in the range from 15 keV to 1 MeV.
- b) Three Neutron Problems: 1) TLD-albedo dosimeter response calculation: neutron and photon sources, 2) Environmental scatter: bare ²⁵²Cf neutron source located at the centre of a concrete walled calibration room, 3) Consistency check device: ²⁴¹Am-Be neutron source.

About 30 scientists took part in the intercomparison and more than 100 scientists attended the final Workshop held in Bologna (I) from 14 to 16 July 2003.

The paper summarizes the main sources of pitfalls and modelling inconsistencies encountered in the problem solutions, pointing out the crucial role of a suitable overall uncertainty assessment of the results and the need of a non extemporary usage of complex computer codes.

A detailed summary of the Intercomparison has been recently published in the Workshop Proceedings.