Citation Award 2005

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It is once again time for my annual recognition of the medical physics paper published ten years ago (1995) that has been cited most often in the following ten years. Readers interested in the origins of this quixotic pursuit are referred to my article in *InterACTIONS* (Vol. 50, pp. 29-32) and the announcement for 2004 (Vol. 51, p. 103). I am still hopeful that COMP will initiate a formal award based on similar criteria, but in the meantime, this will have to do. The rules (invented by the author) are simple: the work must have been performed mainly at a Canadian institution, only papers in peer-reviewed journals are considered, review or "popular" articles are not eligible, and the paper must be "medical physics" – for example, articles dealing with clinical application of a mature imaging technology are not included, even if medical physicists are co-authors. The winner is determined by data in the Science Citation Index. I believe that my search strategies are thorough, but no claim of infallibility is made by the author.

This year we have a runaway winner. From its appearance in 1995 until the end of 2005, it was cited 310 times and it is one of the most cited Canadian medical physics papers ever published:

BEAM: A Monte Carlo code to simulate radiotherapy treatment units

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This paper describes BEAM, a general purpose Monte Carlo code to simulate the radiation beams from radiotherapy units including high-energy electron and photon beams, ^{60}Co beams and ortho-voltage units. The code handles a variety of elementary geometric entities which the user puts together as needed (jaws, applicators, stacked cones, mirrors, etc.), thus allowing simulation of a wide variety of accelerators. The code is not restricted to cylindrical symmetry. It incorporates a variety of powerful variance reduction techniques such as range rejection, bremsstrahlung splitting and forcing photon interactions. The code allows direct calculation of charge in the monitor ion chamber. It has the capability of keeping track of each particle's history and using this information to score separate dose components (e.g., to determine the dose from electrons scattering off the applicator). The paper presents a variety of calculated results to demonstrate the code's capabilities. The calculated dose distributions in a water phantom irradiated by electron beams from the NRC 35 MeV research accelerator, a Varian Clinac 2100C, a Philips SL75-20, an AECL Therac 20 and a Scanditronix MM50 are all shown to be in good agreement with measurements at the 2 to 3% level. Eighteen electron spectra from four different commercial accelerators are presented and various aspects of the electron beams from a Clinac 2100C are discussed. Timing requirements and selection of parameters for the Monte Carlo calculations are discussed.

Dedication: This paper is dedicated to the memory of our friend and colleague, Jiansu Wei, who made a significant contribution to this project before he passed away on March 15, 1993.