



# The use of Monte Carlo technique to optimize the dose distribution in total skin irradiation

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## Abstract

Cutaneous T-cell lymphoma (mycosis fungoides) is an indolent disease with a low percentage of cure. Total skin irradiation using an electron beam has become an efficient treatment of mycosis fungoides with curative intention, with success in almost 40% of the patients. In this work, we propose the use of a Monte Carlo technique to simulate the dose distribution in the patients during total skin irradiation treatments. Use was made of MCNP-4B, a well known and established code used to simulate transport of electrons, photons and neutrons through matter, especially in the area of reactor physics, and also finding increasing utility in medical physics. The goal of our work is to simulate different angles between each beam with a fixed treatment distance in order to obtain a uniform dose distribution in the patient. © 2001 Elsevier Science Ltd. All rights reserved.

*Keywords:* Total skin irradiation; Monte Carlo simulation; Mycosis fungoides

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## 1. Introduction

In this work, the modified Stanford technique (AAPM, 1988) was used for total skin irradiation by a 4 MeV electron beam. The patients are irradiated in longitudinal extension with two angled fields of 19.5° above and below the horizontal line passing through from the waistline of the patient standing up, at a distance of 3 m from the focus. During the treatment, six pairs of these beams irradiate the patient, which are being rotated 60° about the longitudinal axis.

The delivered doses in the treatment plane were compared to the simulated data obtained from the Monte Carlo Code MCNP-4B, showing good agreement with those measured with dosimetric films (Fig. 1). These results show us that the program can be used to optimize the dose distribution in the treatment plane

instead of dosimetric films, which are very expensive. Moreover, the program allows many simulations of different geometry so that we can choose the best configuration for the treatment plan.

## 2. Results

The beam homogeneity with two angled fields  $\pm 19.5^\circ$  in relation to the patient's waistline was verified placing dosimetric films on the vertical and horizontal axis of the treatment plane. The dose variation, in terms of optical density, is about 4% along the horizontal direction. This variation was obtained relative to the average dose value, which was estimated as a single average value between the minimum and the maximum value of the dose curve found along the range distance of 60 cm (–30 to +30 cm). Along the vertical direction of the treatment plane the variation is about 6.5%. The experimental results show that independent of the stage

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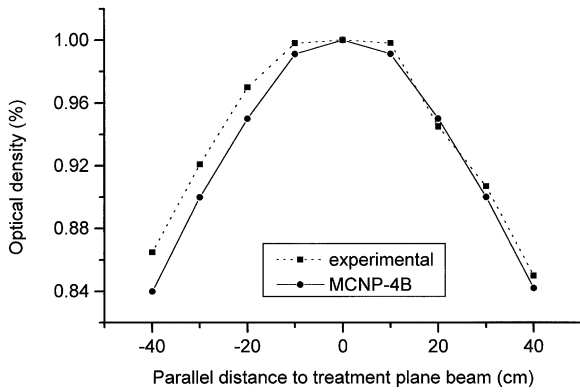


Fig. 1. Field flatness in the treatment horizontal plane.

of the disease, the total skin irradiation technique can always be used. Its main advantages are reduced time of

treatment (less than 20 min); homogeneity of the skin dose at an interesting depth (from about 4 to 8 mm); and low treatment cost.

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#### References

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