Research for Deciding the Number and Each Width of Bins of the Energy Spectrum of the X-rays Used for Radiotherapy

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Abstract

With development of radiotherapy, the dose calculating method used for radiotherapy planning equipment has also been improved variously, and recently the convolution method and the super position method came to be used. These algorithms are operated by the already known energy spectrum outputted from a liner accelerator.

Actually, it is very difficult to measure the energy spectrum of the X-rays used for radiotherapy. So, we began to study for calculating the energy spectrum outputted from a linear accelerator using EGS4 Monte Carlo code.

The energy spectrum of the X ray beam outputted from a linear accelerator is an unknown probability density function. Hence, we need to know the probability density function of an energy spectrum. Consequently, each dose distribution of monochromatic beams is individually calculated by EGS4, and the energy spectrum is determined by calculating backward from each dose distribution of monochromatic beams.

However, calculating each distribution of monochromatic beams finely requires time very much. For this reason, it is better that we divide the energy spectrum into some rectangles, and that we calculate backward the energy spectrum from these rectangles. The number of rectangles that are created by dividing the energy spectrum expresses the number of bins.

Generally, it will be easy to calculate backward the energy spectrum if this number of rectangles is a few. Note that, dividing the energy spectrum into a few rectangles with a constant width can cause largely changing a quality of radiation beam. But, if the quality of radiation beam is not almost changed by modifying each width of bins, it needs not to be a constant width. Then, the number and each width of bins should be selected under the condition that the quality of radiation beam has not changed.

And so, in this study, we discussed how select the number and each width of bins.