Optimal Parameters for Energy Spectral Calculations of Mega Voltage Photon Beam Using Monte Carlo Simulations

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Purpose:
For the convolution/superposition and/or Monte Carlo dose distribution algorithm, energy spectrum data is an essential parameter. However, adjustment of property of electrons which impinge on target is time consuming procedure on BEAMnrc code. To cover the difference of many accelerators, it is important how we obtain optimal energy spectrum by a simple method. Especially, the total accuracy of dose calculation depends on the degree of coincidence of OAR (Off Axis Ratio) of measurement and calculation. To address this problem, a simple method for the determination of the simulation parameters was considered.

Method:
Many parameters are required in order to make the dose distributions of measurement and calculation in agreement with high precision. To reduce this procedure, we selected the important three parameters, which were mean energy of the input electron beam, energy distribution of the input electron beam and area in which electrons impinge on the target. Mean energy of the input electron beam was determined by LaRiviere's formula. Other parameters; energy distribution of the input electron beam and the area were determined by Gaussian distribution model. The three parameters were applied to several field sizes. Then they were compared to the OARs of measurement.

Result:
The OARs of simulation by adjusting only the mean energy of the input electron beam could not be matched to the OARs of measurement at small fields, such as the field size of 4 cm×4 cm. On the other hand, by adjusting the three parameters, the OARs of simulation could be matched to the OARs of measurement for a wide range of field size. By these results, the adjustment of the three parameters was more sensitive at small fields.