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# The ambient dose in TrueBeam LINAC: Measurement and PHITS simulation with JENDL-5.0/TrueBeam リニアックにおける周辺線量：JENDL- 5.0 による測定と PHITS シミュレーション

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Purpose: At energies above the ($\gamma$,n) threshold, photons can interact with the nuclei of high-Z materials, liberating fast neutrons. The aim of this study was to validate the Monte Carlo simulation with the PHITS code for the TrueBeam LINAC using mono-energy. Additionally, we examined the photon neutron dose surrounding the TrueBeam LINAC's head and investigated the influence of field size on the distribution of photon neutron ambient dose.
Method and Materials: Research group used PHITS codes version 3.29, Japanese Evaluated Nuclear Data Library (JENDL-5.0), and the training data of Varian to simulate the head of TrueBeam LINAC 10 MV. The simulated Percentage Depth Dose (PDD) (Field size 10 x 10 $cm^2$, Source Surface Distance (SSD) 100 cm), and simulated crossline at 5, 10, 20 cm depths were compared with the measured data. And then research group used these PHITS codes to calculate photon and neutron dose at twenty-five points around the head of TrueBeam LINAC 10 MV with both two field size 20 x 20, and 0.5 x 0.5 $cm^2$.
In measurement: PDD and crossline were measured with Blue Phantom, CC13S ion chamber, TrueBeam LINAC 10 MV photon; Photon and neutron dose at each point of twenty-five points around the head's TrueBeam LINAC were measured with three Radio-photoluminescence for photon dose and three CR-39 detectors for neutron dose, when TrueBeam LINAC radiated 50 Gy in both field size 20 x 20, and 0.5 x 0.5 $cm^2$.
Results: The measured neutron doses were in the range 0.4 –12.53 mSv (0.5 x 0.5 $cm^2$), the range 0.43 –12 mSv (20 x 20 $cm^2$); The measured photon doses were in the range 0.63 –177.00 mSv (0.5 x 0.5 $cm^2$), and 2.23 –183.33 mSv (20 x 20 $cm^2$). The simulated neutron doses were in the range 0.11 - 26.65 mSv (0.5 x 0.5 $cm^2$), the range 0.06 –14.36 mSv (20 x 20 $cm^2$); The simulated photon doses were in the range 0.16 –182.63 mSv (0.5 x 0.5 $cm^2$), and 1.58 –178.84 mSv (20 x 20 $cm^2$).
Conclusion: Measured and simulated photon neutron dose showed larger field size increased photon ambient dose distribution, and decreased neutron ambient dose distribution. In vice, smaller field size decreased photon ambient dose distribution and increased neutron ambient dose distribution.

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