Developing dose reference field using a compact accelerator

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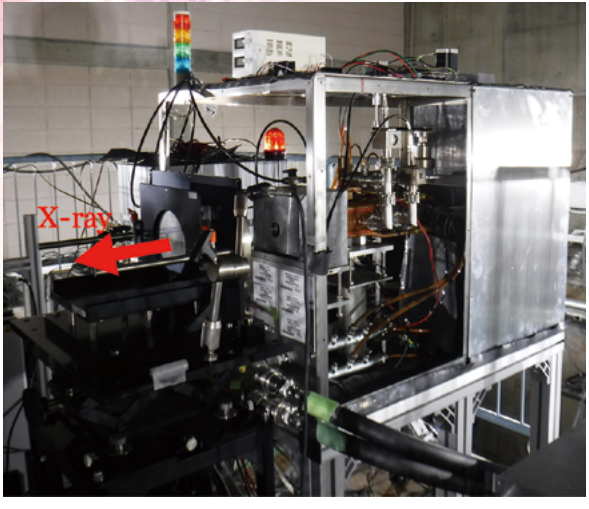
Currently, the maintenance of irradiation equipment using high-intensity radioisotopes (RI) for the calibration of dosimeters poses formidable challenges with respect to nuclear security, safety management, and cost considerations. Hence, we diligently pursued the development of a novel reference field to calibrate the dosimeter response using a compact accelerator that was developed independently as a radiation source, effectively supplanting the need for RIs. The accelerator-driven calibration system does not require an RI with a temporal decay in the radiation intensity. Therefore, the proposed technique enables safer and more continuous operation of a dosimeter calibration facility.



Accelerator-driven replicated Cs-137 γ-ray irradiation system

NMIJ constructed a new radiation field using an accelerator with a maximum energy of less than 1 MeV coupled with energy adjustment filters. The developed radiation field was meticulously designed to mirror the characteristics of the Cs-137 γ-ray field (662 keV), a widely employed standard for calibrating dosimeters. We verified that the dosimeter responses recorded within this field exhibited agreement within acceptable margins of uncertainty when compared to those derived from the conventional Cs-137 γ-ray field. We expect to develop another reference field replicating gamma rays from Co-60 (average 1.25 MeV) by increasing the accelerator energy. Such endeavors will reinforce the reliability and comprehensiveness of our calibration method.

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