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FLASH radiotherapy using high energy X-rays: Metrological challenge and solution in dose measurement

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Recent studies showed that ultra-high dose rate radiotherapy (FLASH radiotherapy) can selectively kill tumor tissues and protect normal tissues in vivo more significantly, which make possible to mitigate dramatically adverse reactions to aggressive radiation therapies even with limited geometrical conformity, and/or to extend the prescribed dose to unprecedented tumor control. However, FLASH-RT present significant metrological challenges because the established active detectors for real-time dosimetry as ionization chambers or diodes start to fail when the dose rate/dose-per-pulse is increased beyond what is used in conventional radiotherapy. Therefore, the improvement of gas ionization chamber and the development of FLASH dosimeters such as micro diamond, calorimeter and scintillator are being studied. Some metrological solutions for FLASH radiotherapy and critical physical and technical issues in dosimetry of high-energy X-ray FLASH will be introduced. Some of our experimental results on high-energy X-rays will also be presented in this paper.

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