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Abstract
A curative radiation therapy treatment requires high absorbed dose in a malignant area and minimizing the damages to the neighbouring normal tissues. Increased normal tissue sparing effect to highly spatially fractionated radiation therapy (SFRT) has been extensively explored for the past 25 years. Microbeam radiation therapy (MRT) is an approach based on dose-volume effect which uses spatially fractionated high flux synchrotron X-ray beams as arrays of micrometric beamlets. The zone of interest is irradiated with high doses through beams path (>100 Gy) and doses below tolerance level between the beamlets. The precilinical experiences performed at the European Synchrotron Radiation Facility (ESRF) confirmed the MRT's higher therapeutic index compared to non-fractionated beams with the same characteristics. The biological response and in consequence the effectiveness of MRT treatments depend on beamlet dose (peak) and central dose between beamlets (valley) as well as peak to valley dose ratio (PVDR). In order to have an optimal therapeutic gain, the PVDR should be maximised and accurately calculated. The commercially available treatment planning systems (TPS) are not suitable for MRT dose planning, due to its distinct features of irradiation geometry, beam source, low energy spectrum and beam polarization compared to conventional
radiotherapy. Therefore, in pursuing the realisation of this treatment modality, it is important to have a modern treatment planning paradigm. There are three categories of dose calculation methods for MRT: pure Monte Carlo, convolution based methods and hybrid methods. The aims of this study was to investigate the reliability, the pros and cons of hybrid dose calculation algorithm and to validate this algorithm using experimental film dosimetry.