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Modern Applications of Monte Carlo Simulations in External Beam Radiation Therapy

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Monte Carlo simulations of radiation transport have played an important role in medical applications over the past three decades. More recently, Monte Carlo methods have been used for such modern radiotherapy applications as 4D patient doses calculations that take into account anatomy variations during treatment, in-vivo patient-specific verification of the treatment delivery, or image-guided radiation therapy and the associated dose delivered to patients. Moreover, treatment machines with dynamic beam delivery and tumour tracking capabilities have been characterized by Monte Carlo generated phase space data. Several ultra-fast, GPU-based, Monte Carlo codes have been introduced in the past few years, opening the exciting prospect of using them for real-time adaptive radiation therapy. We will give an overview of these recent developments.

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