

(様式4)

学 位 論 文 の 内 容 の 要 旨

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(学位論文のタイトル)

Development of stereotactic radiosurgery using carbon beams (carbon-knife)

(カーボンビームを用いた定位放射線手術の開発 (カーボンナイフ))

(学位論文の要旨)

The aim of this research is to develop a stereotactic-radiosurgery (SRS) technique using carbon beams to treat small intracranial lesions; we call this device the carbon knife. A 2D-scanning method is adapted to broaden a pencil beam to an appropriate size for an irradiation field. A Mitsubishi slow extraction using third order resonance through a rf acceleration system stabilized by a feedforward scanning beam using steering magnets with a 290 MeV/u initial beam energy was used for this purpose. Ridge filters for spread-out Bragg peaks (SOBPs) with widths of 5 mm, 7.5 mm, and 10 mm were designed to include fluence attenuation effects. The collimator, which defines field shape, was used to reduce the lateral penumbra. The lateral-penumbra width at the SOBP region was less than 2 mm for the carbon knife. The penumbras behaved almost the same when changing the air gap, but on the other hand, increasing the range-shifter thickness mostly broadened the lateral penumbra. The physical-dose rates were approximate 6 Gy s⁻¹ and 4.5 Gy s⁻¹ for the 10 x 10 mm² and 5 x 5 mm² collimators, respectively.