

# A Beam Applicator for Radiosurgery of the Eye using a Scanning Ion Beam Delivery System

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## Abstract

**Objectives:** Develop a method for radiosurgery of the eye using a modulated scanning ion beam delivery system (BDS).

**Methods:** A configurable beam applicator, beam applicator gantry, collimators, range modulator, extension cone, light field, eye fixation light, bite block, and head holder were developed to be used in concert with a horizontal proton and carbon ion beamline designed to deliver a modulated scanned beam. Since the BDS manufacturer does not allow anything to touch the BDS, the beam applicator had to be mounted onto an independent translatable gantry that moves the beam applicator into place along the beam axis during treatment. The gantry has 3 translational and 3 rotational fine adjustments to bring the devices into proper alignment with the beam and patient. The first designated use of the beam applicator was for treatment of polypoidal choroidal vasculopathy (PCV) with a proton beam. For PCV, a field of 10 mm diameter was indicated with a water equivalent range of 27 mm.<sup>1</sup>

**Results:** Coincidence between the light and radiation fields was within 1 mm at the isocenter. At the center of the mesa, which coincided with the isocenter, lateral profile measurements indicated a 95% to 95% field diameter of 7.5 mm, a 50 to 50% field width of 10.6 mm, and a 80% to 20% penumbra of 1.3 mm. Propagation of uncertainties indicates the lateral alignment uncertainty to be  $\pm 2.1$  mm at the 2 s. d. level. Depth dose measurements indicated a surface dose of 53% with the 90% to 90% mesa extending from a water equivalent depth of 17 mm to 27 mm. A prescribed dose of 14 Gy(RBE), specified at the center of the mesa, can be delivered in approximately 70 seconds.

**Conclusions:** A method has been developed to treat a common eye disease with ion beams. To the authors' knowledge, this is the first scanning ion beam delivery system to be used for radiosurgery of the eye.

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### Abstract

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