

**Purpose:** To describe the commissioning of a database of depth-dose distributions for the dose calculation in Astroid.

**Methods:** A database of Bragg peaks with zero energy width is generated by GEANT4 Monte Carlo. The Bragg peak distributions are smeared with a Gaussian in energy and tuned to match relative dose distributions measured with a Bragg peak chamber (BPC). BPC values are corrected for dose deposited outside of the chamber from scattered and secondary radiation in the pencil beam halo. Individual relative Bragg peaks are calibrated to match the absolute dose measured with a Markus ionization chamber. The uncertainty introduced by this halo correction is minimized by selecting a depth for calibration with the Markus chamber that minimizes the size of the correction. A Faraday cup gives the delivered dose per gigaproton. An SOBP is constructed from the database and the absolute dose in the plateau region is verified with an Exradin T1 ionization chamber.

**Results:** The energy RMS spread decreases with energy from 0.9 to 0.2%. The correction for dose deposited outside the Bragg peak chamber is less than 4%. The uniformity of SOBPs generated between 10 to 30 g/cm<sup>2</sup> is 2% with a global scaling factor of 1.01 to give the best agreement with the measured dose.

**Conclusions:** It is important to have the correct Range, dose, and relative shape of Bragg peaks, otherwise the delivered SOBPs can be tilted or do not match the expected dose. Dose distributions in Astroid agree well with measurements in water. The simulated database with zero energy spread is renormalized per gigaproton following the same procedure and could simplify commissioning at different facilities. In the future one needs only the energy spread, a list of available proton Ranges, and a calibrated ionization chamber measurement to commission treatment planning depth-dose distributions at other facilities.