

**Purpose:** Investigate the feasibility of using post proton therapy PET and Monte Carlo simulation as a treatment verification system for pediatric patients with localized brain tumors.

**Method:** Under a prospective IRB approved protocol, twelve patients received proton therapy followed by a PET activation study. All patients were under the age of 3 and were under general anesthesia during treatment and post PET imaging. On the day of the PET evaluation, the patient was treated with a single beam corresponding to the activation beam under study. A separate plan was developed to ensure that using a single beam did not compromise the treatment plan. The duration between end of treatment and start of PET imaging for each of the single field treatments was recorded. The PET activation study was acquired for 30 minutes. The patient was fully immobilized for the PET in the same manner as during treatment. The Monte Carlo simulation utilized a previously verified proton dose distribution system modified to report a weighted count of positrons. Comparisons between the treatment planning dose and acquired PET image and between the acquired PET image and Monte Carlos simulated image were made.

**Results:** On average, there were 3 treatment fields per plan and 2 per plan that met the criteria for the PET activation study. The average time between end of irradiation and start of PET acquisition was 14.51.3 minutes. Based on preliminary data, setup errors are detectable and, utilizing Monte Carlo, distal edge errors may be detectable.

**Conclusion:** The potential exists to detect setup errors and it may be possible to determine if there is a discrepancy between the planned and delivered distal edge of a field. Out of room PET verification has limited clinical usefulness; however, in room PET may be of benefit.

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none