AbstractID: 1845 Title: Verification of proton dose distribution using positron emission tomography

The Department of Radiation Oncology at the University of Pennsylvania is planning to build a proton therapy facility as part of a new radiation therapy center. A key element of the project is the application of the latest imaging techniques. Conventional radiation therapy uses imaging to target or adapt daily radiation delivery. These techniques include: CT-on-rails, cone-beam CT, ultrasound, and portal imaging of markers. In proton therapy, the potential gains in beam placement precision are greater than for conventional photon therapy due to the sharp dose fall-off in the distal edge of the proton beam. One other imaging opportunity offered by proton therapy is the verification of dose delivery by imaging the positron-emitting isotopes produced in the path of the proton beam. Litzenberg *et al* discussed the possibility of imaging the ^{11}C and ^{15}O produced by nuclear interactions in the body tissue and, more recently, Hishikawa *et al* have examined PET images of patients taken after proton therapy. These latter images were obtained by removing the patients from the proton treatment room to a nearby PET scanner. As the strongest PET signal produced from proton interactions comes from ^{15}O, with a half-life of only two minutes, image quality is lost due to the patient transfer. We have undertaken a study of the production and decay of positron-emitting isotopes to determine whether the improvement in signal warrants the expense of mounting a PET detector on the treatment gantry.