AbstractID: 8939 Title: Measuring the spot size of a proton therapy scanning nozzle

Purpose:
Spot size, i.e. the lateral extent of the proton pencil beams used to compose a patient treatment field, is an important characteristic of a proton therapy scanning nozzle. Among other things, the spot size determines the lateral penumbra that may be achieved through pencil beam weight optimization. In this paper we describe measurements of spot size made on a synchrotron based proton therapy scanning system located at the University of Texas MD Anderson Cancer Center, in Houston.

Method and Materials:
Spots size is measured using three different techniques: pinpoint chamber, EBT film, and Lanex screen with CCD camera. Spot size is measured by fitting a Gaussian distribution to the measured data. The Lanex CCD system consists of a Lanex screen, enclosed in a light tight box, which is being observed with a CCD camera by way of a Mylar mirror. (See Figure 1.) Software was written in order to allow for an efficient acquisition of data under the condition of a pulsed proton beam.

Results:
In all three techniques spot size was measured at isocenter, in air. All three systems were found to give the same result within the margins of uncertainty for each measurement technique. Spot size was found to strongly depend on energy. Furthermore the spot proved not to be circularly symmetric but rather to have a larger extent in the cross plane direction. See Figure 2. We also found a non-Gaussian component to the beam spot, consistent with Molier's theory of multiple Coulomb scattering. (See Figure 3.)

Conclusion:
We are able to characterize the spot size of a proton therapy scanning nozzle using three different techniques. The three different techniques differ in signal to noise ratio and in the time it takes to take the measurement.