Purpose:
Currently, no commercial proton treatment planning systems have been FDA-approved for Monitor Unit (MU) prediction. Patient and field specific MU numbers are therefore determined by either measurements or in-house modeling. The purpose of this project is to develop a straightforward and accurate analytical model to predict output factors and MU numbers for the first ProCure Proton Therapy center at Oklahoma City.

Method and Materials:
Our proton therapy center consists of four treatment rooms: one fixed beam room, one gantry room and two inclined beam rooms. All treatment rooms employ a uniform scanning technique, with proton beams coming out of an IBA Cyclotron. An analytical model was developed to predict the output factor based on beam commissioning data, taking into account the effect of proton range, modulation width, field size as well as inverse square correction for each field on the dose output. Field sizes were estimated based on the aperture printout from CMS treatment planning system. The analytical model was retrospectively applied to 101 fields for patients treated at our center and compared to the measured data.

Results:
A straightforward analytical model was developed to predict the output factor and determine the MU for patients treated at out proton therapy center. The model predicted output factors within 2% for most fields, with only 4 fields between 2% and 3%, and 2 fields out of 3%.

Conclusion:
The study demonstrated that the analytical model was adequate for output factor predication. The model has been used to determine MU numbers for prostate patients and will be extended to other patients in the near future. More studies are planned to further validate the model and improve the modeling accuracy. Criteria will be developed to determine cases where the analytical model may be unreliable and measurements are deemed necessary.