Purpose: To perform the annual QA of proton gantry with a robotic table.

Methods: A new proton gantry with robotic table has been commissioned and is being used in clinic for patient treatment. The gantry is equipped with a robotic table with 6-degrees of freedom and dual cardinal angle KV imagers for patient registration. The system allows direct movement from one beam location to another without additional image registration, which effectively reduces portal setup time and increases treatment efficiency. The annual QA has four main components: Beam parameter checks included proton depth dose, output, linearity, modulation factor, field size factor, effective source distance, compensator gap factor, and monitor unit comparison between model calibration and physical measurements for every energy. Mechanical checks included gantry and robotic table isocenter, gantry and robotic couch isocentricity, and mechanical movement of fully loaded couch and corresponding digital readout. Imaging system checks included proton, X-ray beam, laser and image receptor alignment, image quality of KV imagers, and image registration accuracy. The last were the system safety checks. Methods used to perform these checks, especially those pertaining to robotic positioner will be discussed.

Results: The new proton gantry and robotic table had the isocentric accuracy of about 1mm. The accuracy of mechanical movements of the robotic table was within 1mm/0.5 degree in the clinical motion range. The accuracy of proton outputs determined by IAEA TRS 398 protocol was within +/-2% and the consistency of beam range for all clinical energies at cardinal gantry angles was within 1mm.

Conclusions: The results of the gantry annual QA demonstrate that the machine satisfies the highest standards of quality assurance for proton radiation treatment. The annual QA verifies the proton output, robotic table movement accuracy, image registration and safety of the machine and thus increases our confidence level in the uncertainties of daily proton treatments.