Purpose: Discontinuation by the manufacturer of construction materials and several known design imperfections of the existing patient dose monitor (PDM) in our gantry nozzle prompted a redesign of the PDM. We fabricated and tested a replacement prototype detector with an improved design that uses widely available materials and new fabrication techniques. For continuity of clinical operations, the prototype detector’s output factor and beam range attenuation are kept virtually unchanged.

Methods: After fabrication, the prototype’s performance was tested for stability as a function of humidity. Contribution to signal from electrode leads (stem effect) was studied. Total detector thickness was measured by the beam range attenuation and detector response as a function of gantry angle was studied. The prototype PDM linearity in dose rate, charge collection efficiency, reproducibility of response, and output stability over the week were also measured.

Results: After temperature correction, the response of the redesigned PDM is constant within +/- 2 % in the 20 %–80 % relative humidity range. The stem effect is less than 1 %. The total water-equivalent thickness of the new detector is 0.5 mm, reducing beam range by only 0.15 mm compared with the original PDM. The new detector’s output as a function of gantry angle is constant within +/- 0.5 % and the response is linear with dose rate in the 0.25 – 25 Gy/s range while charge collection efficiency is 0.999 +/- 0.002. Stability of the detector output throughout the week is 0.7 % and reproducibility for ten consecutive measurements is 0.16 %.

Conclusions: The redesigned patient dose monitor has been tested to meet design goals, has improved performance characteristics, and can be used in a proton gantry uniform scanning nozzle.