Previously we evaluated [1] a plastic phantom for medical accelerator Quality Assurance (QA). We now describe several significant modifications to this phantom that enables it to check beam uniformity as well as output and energy constancy to a high degree of precision using a single ionization chamber. The phantom also enables these QA parameters to be easily measured at three orthogonal gantry angles. It is constructed of white acrylic with a density of 1.194 gm/cm^3 and a physical size of 25x25x25 cm^3. Interchanging the positions of eight "domino" shaped inserts (thickness ranging from 0.5 cm to 5 cm) allows fast placement of a Farmer chamber to a precisely indicated depth without the need for readjusting the TSD or realigning the plastic slabs with the beam central axis. We report on extensive testing of this phantom using both CL-6 and CL-20 accelerators (photon and electron modalities) over a period of twelve weeks. The output, depth dose and uniformity constancy measurements were highly reproducible (within ± 0.5%) for repeated setups during a single measurement session. The variation of beam output with different gantry angles on our CL-6 is less than 0.15 %. The position of the ion chamber and the phantom was unchanged during the measurement that eliminates any placement error. We also report on its use for beam calibration using the AAPM TG21 protocol in comparison to our customary water phantom technique.

[1] J. C. Huang, L. E. Reinstein, Med. Phys. 22, 1010 (1995)