Purpose: To systematically test an algorithm to correct for the directional response of a 2D ion chamber array (PTW Seven29TM) and implement techniques to use it in quality assurance (QA) of volumetric modulated arc therapy (VMAT).

Methods: The 27×27 ion chamber array was placed in sagittal orientation between two slabs of 10-cm thick Plastic WaterTM to measure the directional response. Photon beams from anterior hemisphere of 10×10cm2 field size and energies of 6, 10 and 15MV with flattening filter, and 6 and 10MV without flattening filter from Varian TrueBeamTM were used with gantry angles ranging from 90° to 270° (IEC). An artificial cylindrical half-shell of 1-cm thickness was inserted into the backside 10-cm slab in the treatment planning system and assigned the CT number of 2000 Hounsfield units to compensate for the Seven29TM directional response. The method was tested using half-arc plans with 5×5cm2 and 10×10cm2 field size in sagittal orientation and full-arc VMAT patient treatment plans in both sagittal and coronal orientations.

Results: In the absence of the attenuation shell, measurements of the Seven29TM in sagittal orientation indicate a relatively flat response for gantry angles 90° to 15°, decreasing to 97.2% at 0°, and an approximately uniform under response of ~89% for the beams from the backside quadrant. Using the correction method resulted in agreement within 2.8% for each beam angle and 1.9% for half-arc deliveries. Results of a typical VMAT QA plan gave gamma test (3mm, 3%) passing rates of 95.3% and 99.7% in sagittal and coronal orientations, respectively.

Conclusions: The combination of Seven29TM and software-modified Plastic WaterTM phantom proved to be a fast and reliable tool for QA of VMAT. Through this characterization of its directional response, accurate orthogonal 2D dose maps can be generated for independent verification of the treatment delivery from complex VMAT plans.