Purpose: In VMAT, the dose rate, MLC position, and gantry angle change simultaneously, it is important they follow their predefined trajectories to ensure correct dose delivery. Our purpose is to develop an efficient VMAT QA strategy using EPID that is capable of quantifying delivery errors per gantry angle.

Methods: For the QA procedure, portal images are acquired continuously during VMAT delivery. The plan is modified automatically so that the two most inferior MLC leaf pairs are open at all control points. A custom built phantom is positioned via image guidance to be visible in all projections of the opened leaf pairs, and is used to measure the angular fraction through which each portal image is acquired. Expected values of delivered MU and beginning and ending MLC positions are calculated from the plan using the measured start and stop gantry angles per image. They are used to compute a predicted detector response using the treatment planning software (Portal Dosimetry, Varian). The calculated portal response is further analyzed against the EPID images in 3D. We performed the QA procedure for a clinical VMAT 170° arc.

Results: The mean gantry angle and angular width of each portal image measured using the phantom was shown to be accurate to within 0.06°±0.14° and 0.59°±0.36°, respectively. Conversely, the angle recorded with each portal image had a larger error of 1.04°±0.84°. QA analysis consisted of projecting the measured and predicted data into 3 planes: leaf motion axis vs. cross leaf axis, leaf motion vs. gantry angle, and cross leaf vs. gantry. In each plane intensities are defined by dose, dose rate, MLC positioning, and gantry angle, thereby allowing verification of all essential machine parameters.

Conclusions: Accurate and efficient VMAT QA can be performed using EPID and customized phantom and software that provides verification of all plan parameters.