Purpose:
The purpose of this work was to evaluate dosimetry QA criteria for volumetric modulated arc therapy. A 3-dimensional beam dosimetry QA system (ArcCHECK, SUN Nuclear, FL) is under evaluation for SmartArc delivery (Phillip, CA).

Method and Materials:

Arc therapy differs from existing techniques like intensity-modulated radiation therapy (IMRT) because it uses dynamic MLC with rotating gantry and changing dose rate. It also brings challenge for dosimetry QA from conventional planar dose 2D QA to volumetric 3D QA. ArcCHECK QA device utilizes a cylindrical water equivalent phantom with a 3D array of over one thousand diode detectors in a spiral pattern. A DICOM RT Dose file was imported to ArcCHECK and a cylindrical surface dose was generated, and compared with measured dose. To interpret the 3D dose results, a planar dose for the same patient plan was generated and a MapCHECK (SUN Nuclear) was used for the 2D dose measurement and comparison. Parameters in this dosimetry3D and 2D QA study include Gamma analysis, percent acceptance criterion, and distance-to-agreement.

Results:
The Gamma result, percentage of evaluated measurement points passing criteria, for the 3D QA was 91.6% pass with 3% difference and 2 mm DTA. The Gamma result for the 2D QA was 98.3% the same criterions. After changing the criterions to 4% difference and 3 mm DTA, the Gamma result was 98.3%. Six more patients were studied using both 3D and 2D dosimetry QA. Generally, to achieve comparable pass rate (~95%) for 3D dosimetry QA, a 1% difference and 1 mm DTA need to add comparing to 2D dosimetry.

Conclusion:
The 3D dosimetry QA provided the advantage of planned and measured dosimetry info for the whole gantry angle range. It includes QA analysis on composite dose maps for total delivery, and verification for dose map from each segment.