Purpose: To implement an independent check on the 3D dose calculation for high-dose rate (HDR) brachytherapy treatment planning using a custom plug-in written for dicompyler.

Methods: A plug-in was developed for the open-source program dicompyler that produces an independent 3D dose calculation based on DICOM-RT files produced by BrachyVision (Varian Medical Systems, Palo Alto, CA). Using the DICOM-RT files as input, dose is calculated to a 3D grid using a point source approximation. Dose volume histograms (DVHs) are then calculated and compared with those produced by the planning system. In order to evaluate the program, patient data was tested using four different parameter configurations for the independent dose calculation: Group 1 with average anisotropy set to 1 and no polynomial term, Group 2 with average anisotropy set to 1 and the Meisberger polynomial applied, Group 3 with average anisotropy set to 0.98 and the Meisberger polynomial applied, and Group 4 with average anisotropy set to 0.98 and no polynomial term. The tumor sites of the patients used in this study were: Prostate (n=10), Breast (n=10), Gynecological (n=10), Base of Tongue (n=4), and Sarcoma (n=3). DVHs computed using dicompyler and the original planning system were compared using differences in the area under the curve (AUC).

Results: Comparison of original and independently calculated volumes showed good agreement with an average difference of 3.5%. Average differences in the AUC varied by group: +1.05%, +0.70%, -1.36% and -0.95%, for Groups 1-4, respectively. The average time for a 3D independent dose calculation was ~5 sec.

Conclusions: With this custom plug-in, dicompyler can be used to provide an independent, 3D dose calculation verification for HDR planning. Since it uses DICOM files directly, the approach is efficient, and it provides not only an independent dose check, but also validates the 3D positions of sources and surrounding organs.