

Purpose: To report progress made by AAPM Task Group 192 which was charged to review the state-of-the-art systems for robotic interstitial brachytherapy and to recommend commissioning and quality assurance procedures for the safe and consistent clinical use of these systems.

Methods: In the last decade, there have been significant developments in medical robots and automation tools, which have been integrated into brachytherapy systems. These developments have led to higher precision and reproducibility in source placement, optimization of source locations, improvement in consistency, elimination of clinician's fatigue as well as further reduction of radiation exposure to medical staff. Most of the applications of these technologies have been in the implantation of seeds in patients with early stage prostate cancer. Nevertheless, the techniques apply to any clinical sites where interstitial brachytherapy is appropriate. The TG-192 has reviewed all the available pertinent robotic systems, and is testing a procedure for commissioning and quality assurance for the safe and reliable clinical use of these systems. The committee addressed both the characteristics of robotic behaviors, and the interactions between the robots and the clinicians in an operational radiotherapy environment.

Results: Existing robotic brachytherapy systems are capable of achieving a spatial accuracy of about 1 mm for source placement in a phantom. Considering that manual source placement with a rigid template has an estimated accuracy of 2-3 mm and source placement may vary from ideal within a patient due to multiple factors such as tissue deformation, source displacement, and edema. This task group recommends that robotic systems should have a spatial accuracy of source placement in phantom of <1 mm.

Conclusions: Preliminary recommendations are that during clinical commissioning, specified tests should be conducted to ensure that this level of accuracy is maintained. The recommended tests mimic the real operating procedure as closely as possible.