# AbstractID: 10091 Title: Electronic Brachytherapy Sources

Electronic brachytherapy (eBx) is a treatment modality in which a miniature x-ray source is used to provide intracavitary or interstitial radiation therapy. The Xoft Axxent® source operating at 50 kVp and 0.3 mA beam current has a depth-dose characteristic which is essentially equivalent to $^{125}$I with a dose rate equivalent to a 7 Ci $^{192}$Ir source. Because the source emits relatively low energy x-rays and contains no radionuclides, shielding requirements are modest and it can be used in a wide variety of treatment facilities. To date eBx has been used for accelerated partial breast irradiation using a balloon applicator placed in a lumpectomy cavity, vaginal cuff irradiation using a rigid vaginal cylinder, and intraoperative radiation therapy following breast conserving surgery.

The Axxent electronic brachytherapy source is a miniature diode x-ray source attached to a flexible high voltage cable and enclosed in a catheter which contains recirculating cooling water. Prior to treatment delivery, the source air kerma strength is measured using a well ionization chamber calibrated with respect to the Attix free air chamber at the University of Wisconsin Medical Radiation Research Laboratory. The spatial distribution of dose from the source is characterized by the TG-43 parameters radial dose function and anisotropy function. These were determined by Monte Carlo simulation, radiochromic film dosimetry and miniature ion chamber measurements in a water phantom. Treatment planning for the eBx source is performed using either the Varian BrachyVision® or the Nucletron Plato® treatment planning system.

The final stages of the source manufacturing process include measurements of a) the spatial characteristics of azimuthal symmetry, polar anisotropy and depth-dose; and b) the x-ray output reproducibility and stability during repeated on-off cycling and an extended operating period. Automated software runs the tests, analyzes and evaluates the results, and produces printed reports that form part of the permanent history for each source. This manufacturing testing of every source ensures that those accepted for human use will be stable, and have spatial output characteristics consistent with the values used for treatment planning within error limits established to ensure accurate dose delivery.

Educational Objectives:

1. Understand key elements of electronic brachytherapy source construction and operation.
2. Understand the rationale and methodology of air kerma strength calibration.
3. Understand methods to characterize and confirm the source spatial dose distribution.