BUBBLE DETECTORS
Medical LINAC Monitoring

Image courtesy of Varian Medical Systems of Palo Alto, CA

The Background

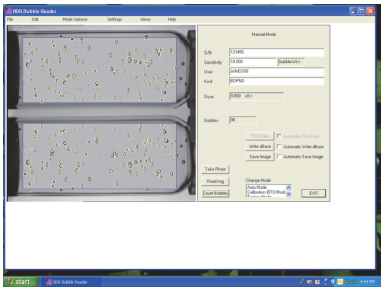
- Medical linear accelerators (LINACs) are used to generate high energy electrons and photons for medical radiation therapy.
- One of the hazards associated with linear accelerators is unwanted neutrons. Accelerators with a photon peak energy greater than about 9 MeV produce neutrons by (photon, n) reactions.
- Most neutrons are produced in the treatment head, flattening filters and collimating devices. However, neutrons can also be produced in other materials in the path of the photon beam (including air and the patient) . The typical energy spectrum of the neutrons has a peak slightly above 1 MeV similar to the neutrons from uranium fission.

The Application

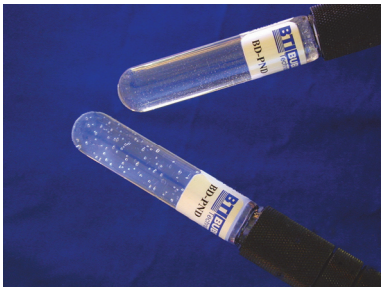
- In order to protect patients from stray radiation generated by medical accelerators, national and international agencies recommend dose limits for leakage during patient treatment.
- LINAC facilities must perform commissioning surveys and submit these results to regulatory authorities in order to receive certification. Radiation fields, including neutron fields, must also be measured as part of the facility's ongoing radiation safety program.
- Common survey locations include: all areas adjacent to the accelerator room (outside primary shielding walls); areas in the hallway in front of the room and the doorway; at the operator's console; above the accelerator room; and areas outside the building. Both thermal and fast neutrons must be measured.
- Most neutron measurement devices are unable to provide accurate data around a LINAC due to interference in the readings caused by the intense primary photon field generated by the LINAC. For example, readings from common rem meters are distorted by the photon field.
- Passive techniques, such as TLDs placed in moderators or activation foils, suffer from photon-induced reactions, large sizes due to moderating material, requirements for sophisticated equipment and skilled trained operators.

The Solution

- The neutron-detecting "bubble detector" has been used by government, military, scientific agencies, and medical facilities for over 15 years and is a proven, patented technology.
- Bubble detectors are ideal for neutron measurements around LINACs, and have been used by many groups, as the detector is insensitive to electrons and photons, enabling accurate measurements of neutron doses. Both fast and thermal neutron bubble detectors are available (BD-PND and BDT).
- The detectors are small, light-weight, and rugged. They require no training and are re-usable. They provide real-time, tissue-equivalent measurement of the neutron dose and can be read with the naked eye.
- Bubble detectors require no power and never require software/hardware upgrades. They are maintenance-free and environmentally friendly.
- Complete measurements of the neutron field around the LINAC can be achieved by placing detectors in multiple locations around the facility.
- The low cost and high accuracy of bubble detectors make this solution the best choice for today's medical physics professional to meet operational and regulatory requirements and to ensure patient and operator safety.



BDR-III™ Automatic Bubble Reader



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