Radcal® Worldwide Leader in Diagnostic X-ray Measurement

AN1007 – Scatter and Leakage Testing

Assessing the Environment and Conditions

In order to prepare for measurement we must determine the area where the leakage/scatter measurements will be conducted.

- XRAY Tube w/ shield
- XRAY Tube w/out shield
- Gamma ray source inside a shielded container.
- Inside controlled environment
- Outside controlled environment

Depending on the technique and radiation levels to be detected will determine the sensor best suited for your evaluation. A 180cc, 500cc, or 1800cc chamber may be used. While the 180 Ionization Chamber is excellent for detecting direct leakage with its 100cm volume it is not practical for scatter measurements. The 1800 Ionization Chamber allows for 360° detection. Note: build-up material may be required for the 180cc or 500cc chamber for energies above 600 keV.

Validating Results

A good way to validate your measurement technique is to turn up the machine settings to the highest limit and conduct several short exposures and compare them to each other, the results should be similar. Once satisfied with your results you can lower the mA by a factor of two or something appropriate to the measurements you are making and the results should be proportional to the initial MAX setting results.

Making Low Level Measurements

When making low dose measurements using an ion chamber (in the range of 10 times the minimum rated range), it is important to eliminate all sources of noise including noise induced by changing temperatures of the surroundings and the electronics. Position the ion chamber. Set the threshold to low and wait 3 minutes. Do not touch the cable or digitizer. For changing environments, allow 10 minutes for every 10 C difference for the sensor/electronics to equilibrate. Grounding the system to eliminate interference may be warranted.

To minimize noise or pickup, connect the chamber directly to the digitizer and avoid using extension cables. Place the ion chamber/digitizer so it will not move by using a test stand or tripod. Holding the Ion Chamber by hand will add noise to the measurement.

When making scatter or leakage measurements, the readings may be too low to trigger a measurement. In that case a second sensor placed in the beam can be used to trigger the measurement which will guarantee that the ion chamber's signal is captured during the triggering period of that sensor.

Triggering with a Multi-Sensor/Dose Diode *(for use with Accu-Gold measurement system – see AN1002 - Ion Chamber measurements using multi-sensor trigger)*

In order to detect leakage or scatter during an exposure it is recommended that a external trigger source such as a Accu-Gold Multi-Sensor or Dose Diode is used. This can be done by placing the trigger sensor in the primary beam using an extension cable as necessary to connect it to the digitizer, and the Ionization Chamber in a fixed position (tripod, clamp, etc.) in the areas of choice. (See figure) If additional distance is necessary, the USB connection can be extended using active USB extensions or even USB-over-Ethernet.

NOTE: To achieve the maximum sensitivity for the measuring sensor, the dose rate measured at the trigger sensor should not exceed 1% of its max dose rate (e.g. < 0.06 mGy/s for the DDX6-WL). To achieve the <1% max dose rate at the trigger sensor, it may be necessary to position it off axis from the radiation beam or add shielding to the trigger sensor.

Grounding (grounding cables are available for the Accu-Gold measurement system)

Grounding is essential for low-level measurements to reduce the interference in the waveform.

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