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Absolute Dosimetry using a Graphite Calorimeter on the Imaging and Medical Beamline at the Australian Synchrotron

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In 2012-13, the Australian Synchrotron installed a superconducting multi-pole wiggler (SCMPW) on the imaging and medical beamline (IMBL) with the intention of future preclinical radiotherapy trials. Before moving to such trials, accurate knowledge of the dose delivered is required to calibrate the secondary dosimeters in regular use. When this is resolved, clinical use of the Australian Synchrotron will be closer to reality.
The dose rate achievable on the IMBL is in the range 10 Gy/s to 10 kGy/s, depending on the SCMPW magnetic field, the filtration set and the distance of the measurement rooms (or hutches) from the photon source. High-dose-rate dosimetry is challenging with detectors such as free-air ionization chambers (FAC), due to the high ion-recombination corrections required. An absolute method of dose determination is required and one such method is graphite calorimetry, which is based on the temperature rise in graphite when irradiated. In this meth-od, the temperature is measured by a calibrated thermistor embedded in the calorimeter graphite core. The ab-sorbed dose from the irradiation is determined from the product of the temperature rise and the specific heat capacity of graphite, corrected for the ratio of graphite core area to beam area.
Results will be presented for measurements in hutches 1B, 2B and 3B, where the dose rates presently vary from 20 Gy/s to 3000 Gy/s. Comparisons with a free-air chamber and calculated dose rates will be presented.

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Summary

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