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## Nuclear Orientation Thermometry using the UCT Dilution Refrigerator

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The development of a Nuclear Orientation (NO) thermometer system for use at the University of Cape Town is essential to address the significant challenge in the accurate measurements at ultra-low temperatures (down to 8mK). A  $^{60}\text{Co}$  (*hcp*) gamma-ray thermometry source was irradiated using the NECSA SAFARI-1 research reactor for 6 minutes and a preliminary activity value of 1.3 MBq was achieved. The activity of this source has been validated using an absolute gamma-ray coincidence technique and verified using a well-type ionizing chamber. Preliminary temperature measurements were taken by placing the  $^{60}\text{Co}$  source within the University of Cape Town Department of Physics dilution refrigerator using a vertical sample holder and measuring the anisotropy of the radiation at a  $90^\circ$  angle using a Sodium Iodide (NaI) scintillation detector. These results were promising, but inconclusive, prompting a second set of measurements. Modifications were made to the experimental set up by re-designing the sample holder to hold the source horizontally and take measurements at  $0^\circ$  angle along the *c*-axis. A Lanthanum Bromide ( $\text{LaBr}_3$ ) scintillation detector was also used to measure the radiation at temperatures ranging from 10 mK to 100 mK. These experimental improvements provided more accurate and conclusive results.

### Apply to be considered for a student ; award (Yes / No)?

Yes

### Level for award;(Hons, MSc, PhD, N/A)?

MSc

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