

AbstractID: 3716 Title: Monte Carlo modelling of the response of NRC's <sup>90</sup>Sr/<sup>90</sup>Y primary beta standard

**Purpose:** To benchmark an EGSnrc Monte Carlo calculated response against the high quality measured response of an extrapolation chamber used as NRC's primary standard of absorbed dose to tissue in a <sup>90</sup>Sr/<sup>90</sup>Y beta field.

**Method and Materials:** The BEAMnrc code was used to model the NRC's beta source and indigenously developed extrapolation chamber. The calculated response was compared to the measured response in 3 different series of measurements. An overall scale factor was determined by a global fit. It was used to scale the calculated values to the measured values and was compared to the known activity of the source. A single measurement configuration (30 cm distance, 0.2015 cm chamber depth) was common to all 3 sets of experimental data.

**Results:** The scale factor led to an estimated source activity of  $1.237 \pm 0.08\%$  GBq which is consistent with the nominal value of  $1.2 \pm 0.1$  GBq. As the source-detector distance was varied from 11 cm to 60 cm, values of calculated and measured responses agreed within 0.37% for a variation in response by a factor of 29. As chamber depth was varied from 0.05 cm to 0.25 cm the values agreed within 0.4%. As Mylar thicknesses up to  $11 \text{ mg/cm}^2$  were added to the face of the chamber, the values agreed within 0.2%, and agreed within 1.2% up to  $150 \text{ mg/cm}^2$ .

**Conclusion:** This project demonstrates EGSnrc's ability to calculate the response of extrapolation chamber with a remarkable degree of accuracy. Such high precision comparisons with experimental data are rare. This benchmarking of the Monte Carlo model will allow it to be used to calculate correction factors needed for the NRC's primary standard.