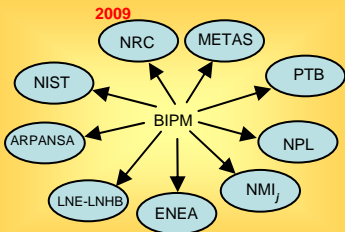


Recent progress on the BIPM absorbed dose graphite calorimeter

In radiotherapy it is necessary to know the absorbed dose of radiation received by the patient. Ideally, the instrument used at a hospital is traceable to a primary dose measurement.

The BIPM has developed a primary calorimetric standard to measure the absolute absorbed dose of ionizing radiation in ^{60}Co and megavoltage accelerator beams used for medical applications.

One of the objectives of the Ionizing Radiation Section is to organize a dosimetry comparison of high-energy accelerator beams involving at least 8 NMIs. A protocol is currently being refined.



The absorbed dose D can be determined using the relation

$$D = E / m = c_p \Delta T.$$

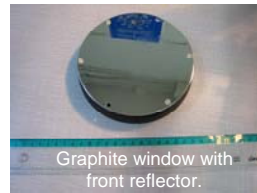
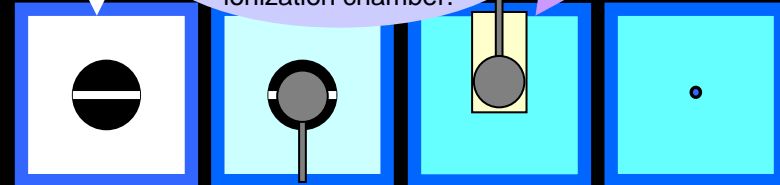
The specific heat capacity c_p of a particular graphite sample has been determined with a standard uncertainty of 9 parts in 10^4 .

The water absorbed dose rate of the ^{60}Co source at the BIPM, D_w , is determined through three different measurements in the beam combined with Monte Carlo calculations modelling these different experimental configurations:

Calorimetric measurement of D_c in vacuum with the graphite core in the graphite jacket.

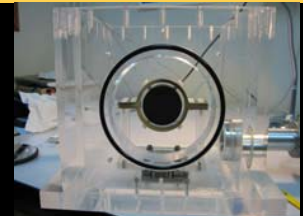
Ionometric measurement of I_w with the parallel plate ionization chamber placed in a water phantom.

Ionometric measurement of I_c where the core is replaced by a parallel plate ionization chamber.



The calorimeter is mounted in a vacuum chamber, shown here in the cobalt-60 beam of the BIPM. This arrangement is surrounded by a thermally insulating enclosure before being irradiated.

The novel jacket design favours a homogenous temperature distribution.



$$D_w \approx D_c \frac{I_w}{I_c} \left(\frac{D_w}{D_c} \right)^{MC} \left(\frac{I_c}{I_w} \right)^{MC}$$

Calculated Monte Carlo factors to realize the absorbed dose to water at a point.