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Editorial

Timing of Annual Output Calibration of Radiotherapy Linear Accelerators

Editorial

The output of radiotherapy Linear Accelerators (Linacs) is calibrated following national or international protocols like TG-51 by the American Association of Physicists in Medicine [1] or TRS-398 by the International Atomic Energy Agency [2], annually on or before the anniversary date of the commissioning of each Linac. The anniversary dates fall at random times around the year. Is there a better time for annual output calibration than on random anniversary dates? In view of the recent report of seasonal output variation [3,4], it is time to consider performing annual output calibration in the months not having extreme air humidity.

It is reported that the output may have annual variation of about ±1.5% from the average [Figure 15, Ref. 3]. There are ways to correct the ion chamber readings for humidity in addition to temperature and pressure [Figure 5.14 Ref. 5]. This correction factor can have a maximum value of about ±0.5%. This is consistent with the reported seasonal variation when the daily Linac output is adjusted by the measurements taken during the monthly quality assurance as reported in Figure 16 of Ref. 3. The additional 1% of the variation in Figure 15 Ref. 3 is probably due to seasonal effects on electronics or other factors. It is speculated that humidity may also influence the conducting plates of the accelerator monitor chambers thereby affecting the output [6].

Institutions having multiple Linacs which are equivalent in terms of the geometry and energy are often matched with each other so that an average calibration factor can be used for each energy across all appropriate Linacs for monthly output calibration. But, if the annual calibration is done on or near the anniversary date of each Linac then a difference between the average monthly calibration factor over all Linacs and the one determined from the annual calibration may differ due to seasonal output variation. As a result of this difference the monthly calibration following the annual calibration will require output adjustments for most Linacs.

Depending on the stability of the Linac output and the action level for output adjustment there can be on average 6-7 output adjustments needed per year [3]. However, as suggested in this writing if the annual calibration is performed in the months not having extreme atmospheric humidity then it may require less number of adjustments per year.

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