

# The most common errors during dosimetry audits in radiotherapy

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\* an actual scope of accreditation No. AB 1499 is available on the PCA website: [www.pca.gov.pl](http://www.pca.gov.pl)

## Introduction

Taking part in an external dosimetry audit enables the independent verification of the correct configuration and operation of the therapy line used in the hospital. Regular participation in such audits can significantly boost confidence in the accuracy of radiotherapy provided.

In Poland, participation in an external dosimetry audit is made possible by the Secondary Standards Dosimetry Laboratory which is integral part of the Maria Skłodowska-Curie National Research Institute of Oncology in Warsaw.

## Introduction

The external dosimetry audit is proposed and carried out by the Polish SSDL.

The Polish SSDL prepares capsules containing TL powder and sends them to the participant.

The participant irradiates the capsules under selected conditions with a dose of 2.0 Gy, before sending them back to the laboratory. There, the dose to which the capsules were exposed is measured.

While the vast majority of cases proceed without any problems, unexpected issues can sometimes arise.

## Introduction

According to their accelerator configuration and the selected audited beam type, the participant determines the number of monitor units required to irradiate the capsule to receive a dose of 2.0 Gy. They then perform the irradiation with the specified number of monitor units under the specified conditions and calculate the dose received by the capsule under these conditions. Several errors can occur at this stage. **The most common ones are shown on the following slides.**

## Incorrect SSD

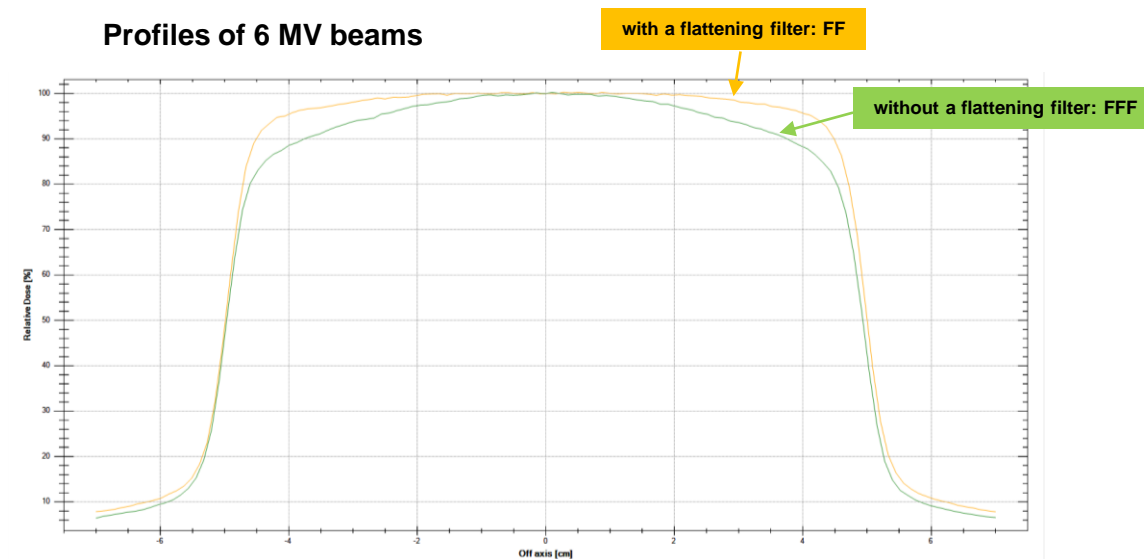
Correctly determining the SSD distance is crucial for all accelerator dosimetric parameter measurements. In the case of SSD capsule irradiation, **an inaccuracy of 2.0 cm in the set beam parameters can result in a 4% error** in the dose recorded by the capsule.

## Incorrect field size

It is important to set the size of the radiation field correctly, as it is easy to make a mistake, especially with asymmetrical fields. For example, **changing the size of the radiation field from 10 cm x 5 cm to 5 cm x 10 cm could result in a 1% error** in the dose irradiated to the capsule.

## Incorrect placement of capsule

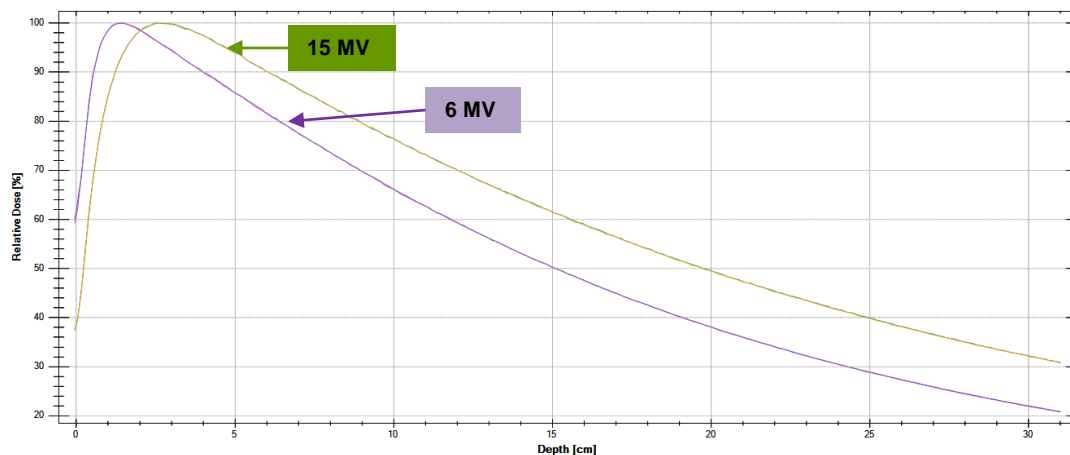
When setting up the capsule on the tripod, it is easy to end up in the incorrect position by accident. While this has little to none effect when auditing photon beams with a flattening filter applied (FF), it has a significant impact when auditing beams without one (FFF). On the right is a comparison of the profiles of 6 MV beams: one with an FF applied and one without. Both profiles have been normalised to the central beam axis. As can be seen, **even a shift of a few centimetres can cause a significant change in the dose registered by the detector.**



## Incorrect declaration of radiation energy

As the radiation energy changes, so does the depth dose distribution (PDD) generated by the beam. **If the capsule is positioned at a depth of 10 cm, but the radiation energy is chosen incorrectly, the dose recorded by the detector can differ significantly from the planned.** Superimposed plots of the percent depth dose for 6 MV and 15 MV beams are shown on the right. Both graphs have been normalised to 100% at the characteristic  $d(\max)$  depth for each energy.

Percent depth dose (PDD) curves



## Conclusions

In conclusion, during an external dosimetry audit, it is crucial to perform capsule irradiation calmly, focused, and accurately. Additionally, it is crucial to assign this task to physicists who have extensive experience in conducting dosimetry measurements. Mistakes can be made in many places, but it has been shown by the Laboratory's experience that the highest standards are maintained by most centers when measurements are performed.

**Thank you for your attention.**