How to Center a Detector in Small Fields with the TBA System

MEPHYSTO mc² 1.0 or higher

1   General

For measurements with small fields it is important to center the detector precisely with respect to the central axis (CAX) of the beam. Otherwise the volume effect can average the accumulated ionization in the detector which will end up in a lower measured dose. For scanning PDDs in small fields it is also important to align the water tank precisely to get a minimum beam inclination.

The modul CenterCheck (Check of beam Center in MEPHYSTO 3.0 or higher) can be used to adjust the detector at the center of the beam and to measure the beam inclination in both directions.

2   Basic operation and setup

CenterCheck measures main axis profiles at two different depths to detect the shift of the detector from the CAX and the beam inclination. For most applications depths of 50 mm and 200 mm is a good setup for measuring beam inclination and center detection with the high speed scanning used by CenterCheck. The upper profiles should not be too close to the surface to avoid waves in the tank.

2.1 Center the detector for point dose measurements and profiles

The upper profiles at lower depth are used to calculate the CAX by symmetrizing the 50% values from both sides of the profiles. The Set NP button must be pressed after the measurement to download the new calculated zero position to the TBA CONTROL UNIT into a nonvolatile memory.

If the measurement to be performed is not in the same depth as the upper profiles in CenterCheck, the beam inclination and the alignment of the tank must also be checked. (See chapter 2.2)

NOTE
Press the Set NP button only once to correct for the NP shift, otherwise the NP position will get overcorrected.

Check the CAX position with a verification measurement after the correction with Set NP and tank alignment.

2.2 Align the tank and check gantry angle for scanning PDDs

A beam inclination measured by CenterCheck can be caused by a non-zero gantry angle or by a misaligned tank. A centered beam at the surface with a beam inclination of 1° will have a CAX deviation of 1.7 mm at a depth of 10 cm, which is too much for a field size of 1 cm.

Make sure that the gantry angle and the tank are properly aligned according to the minimum field size and maximum measurement depth.

3 Create optimized scanning resolution for small fields

By default CenterCheck uses a scanning resolution for a typical reference field size of 10 cm. The resolution can be optimized to make sure that the peak at very small field sizes will be detected properly. Therefore the ASCII file PROFIL.DAT can be easily modified. The file is located in the installation path and can be found typically in C:\Program Files\PTW\MEPHYSTO mcc\CenterCheck

Procedure to change the resolution:

1.) Close CenterCheck

2.) Backup the file PROFIL.DAT at the location above and modify it

3.) Start CenterCheck

4.) Don't forget to make the original file active at the end of the measuring session

The installed PROFIL.DAT looks like this:

```
PTW-FREIBURG COORDINATE_FILE V1.0
BEGIN
PROFILE_COORDINATES
COMPLETE_SYMMETRIC_PROFILE[YES/NO] = YES
SSD_REF[cm] = 100
FS_REF[cm] = 10
COORDINATES[mm] = 0 ,10,20,30,40,42,44,46,48,50,52,54,56,58,60,65,70,75,80
END PROFILE_COORDINATES
END
```

Following sample modification shows a high resolution scanning for very small fields:

```
FS_REF[cm] = 1
COORDINATES[mm] = 0, 0.3, 0.6, 0.9, 1.2, 1.5, 1.8, 2.1, 2.4, 2.7, 3, 3.3, 3.6, 3.9, 4.2, 4.5, 4.8, 5.1, 5.4, 5.7, 6, 6.3, 6.6, 6.9, 7.2, 7.5, 8, 10, 12
```

The sample above defines a symmetric scanning resolution of 0.3 mm with a scan length of ± 12.0 mm for a reference field size of 1cm, at a reference SSD of 100 cm and a measurement depth of 0 mm. For any other setup, the lateral positions of the measuring points are given by:

MeasurementPosition(x) = COORDINATES(x) * (Square Field / FS_REF) * ((SSD + Depth) / SSD_REF)

With:
COORDINATES(x), FS_REF, SSD_REF   defined in PROFIL.DAT
Square Field, SSD, Depth   defined in CenterCheck

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