

IGRT QA Solutions

1 Introduction

Image guided radiotherapy (IGRT) allows a more accurate positioning of the patients tumor in the beam, which is required for precise treatment techniques like IMRT. The use of MV/kV imagers and cone beam CT in clinical routine requires an extended QA for those devices, since the quality of IGRT devices is the basis for a precise IMRT treatment.

Since IGRT QA guidelines are still work in progress the QA procedures are not fully standardized yet. Nevertheless PTW has already high quality tools for MV and kV QA in IGRT available.

2 QA Solutions

2.1 MV Imager (EPID) QA

The PTW EPID QC Phantom (T42025) is a well known and established phantom since many years. All relevant test objects are included for a complete EPID QA acquired in a single beam. The epidSoft software (S070010) allows an automatic evaluation and stores the data for statistical analysis. For each imager a complete set of limits can be defined. Phantom and software comply with preliminary regulation DIN 6847-6 [1].

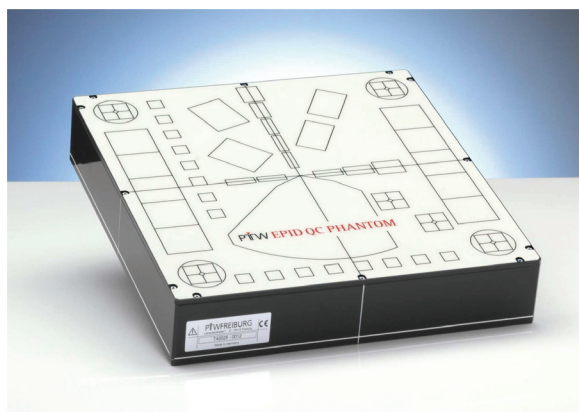


Figure 1: EPID QC Phantom

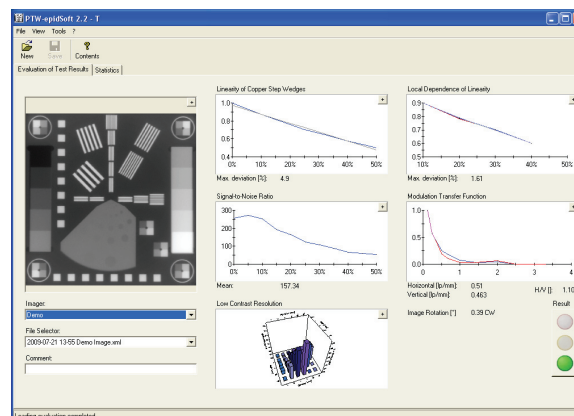


Figure 2: epidSoft Software

2.2 kV Imager QA

QA of the kV imager can be done with the diagnostic fluoroscopic X-ray phantom NORMI 4 FLU (L981301) acc. to DIN 6868-4 [2]. It includes a copper step wedge for testing the dynamic range, a resolution test pattern, low contrast and detail test elements. For more information about the QA measurements with the NORMI 4 FLU, please refer to the Code of Practice [3].

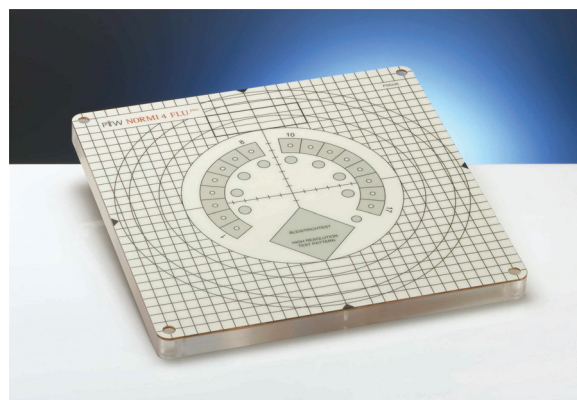


Figure 3: NORMI 4 FLU Test Object

2.3 Dose Measurement

Absolute dose can be measured with the 6 cm³ SFD ionization chamber in combination with a UNIDOS^{webline} (or any other available absolute dosimeter) or with the diagnostic dosimeter DIADOS E (L981239) in combination with the DIADOS semiconductor detector (T60004).

2.4 Voltage Measurement

DIAVOLT RAD/FLU (L981810) is a non-invasive kV meter, dosimeter and timer for diagnostic X-rays. The key features that provide easy handling are the built-in automatic functions like auto start, auto stop and auto range. The DIADOS E and the DIAVOLT are components of the QA X-ray kit DIAsset RAD/FLU (L981242).



Figure 4: DIAVOLT Meter

2.5 Isocenter Check

The classical isocenter QA is the analysis of star shots to check the isocenter circle acquired by a film (for gantry, collimator and couch) acc. to DIN 6847-5 [4] - or by an EPID for collimator and couch. Both can be done with the PTW IsoCheck software (S070019). IsoCheck can also read and analyse starshots acquired with 2D-ARRAY *seven29*. The ISOCHECK phantom (T42004) can be used to irradiate a film with a MV beam and to mark the isocenter with a needle. The Winston-Lutz test [5] as used in stereotactic radiotherapy acc. to DIN 6875-1 [6] is an alternative test. An automatic evaluation is work in progress. Images or films can be evaluated manually in FilmSoft (S080047) or optionally in FilmAnalysis for MEPHYSTO mc² (S080045.004).

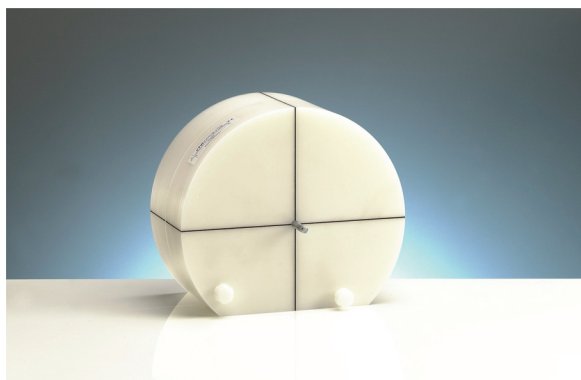


Figure 5: ISOCHECK Phantom

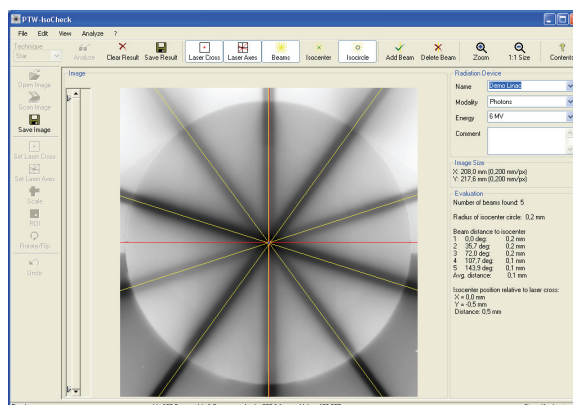


Figure 6: IsoCheck Software

2.6 IGRT QA Sets

The IGRT QC set (L981097) for quality control of IGRT accelerators with kV and MV imaging systems includes a NORMI 4 FLU test object with Cu and PMMA absorber for kV imaging as well as the EPID QC PHANTOM with epidSoft for automatic evaluation for MV imaging.

If an additional X-ray dosimeter is required a complete kit for kV and dose measurement can be used. DIAsset RAD/FLU X-ray QC kit (L981242) includes the diagnostic dosimeter DIADOS E with DIADOS diagnostic detector, DIAVOLT RAD/FLU kV and dosimeter, power supply, extension cable carrying case and DiaControl Expert software.

- [1] DIN 6847-6 Medical electron accelerators - Part 6 Electronic image receptors - Constancy testing (In preparation)
- [2] DIN 6868-4 Image quality assurance in diagnostic X-ray departments - Part 4 Constancy testing of medical X-ray equipment for fluoroscopy
- [3] Code of Practice, Constancy tests of X-ray equipment in diagnostic radiology (download available at www.ptw.de)
- [4] DIN 6847-5 Medical electron accelerators - Part 5 Constancy tests and functional performance characteristics
- [5] Winston K.R., Lutz W.: Linear Accelerator as a Neurosurgical Tool for Stereotactic Radiosurgery, *Neurosurgery* 22, 1988, 454 – 463
- [6] DIN 6875-1 Special radiotherapy equipments - Part 1 Percutaneous stereotactic radiotherapy, Basic performance characteristics and essential test methods

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