PTW-Freiburg
Physikalisch-Technische Werkstätten
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MEASUREMENT CONTROL FOR THERAPY DOSIMETERS (VA)

Procedure Instruction

Measurement control for therapy dosimeters in the energy range above 1.33 MeV and with electron radiation from linear accelerators

PROCEDURAL RULES BETWEEN THE CUSTOMER AND THE PTW TLD LABORATORY

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Revision 001/04.2017	
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Nummer PTW-014122	Seitenzahl: 6

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1 Contract with the TLD laboratory

PTW guarantees to keep all data obtained during the comparative measurements for at least five years and to make it available to the customer on request.

1.1 Comparison measurement with TLD probes

The customer, who is the operator of one or several therapy dosimeters, is commissioning PTW with a comparison measurement by means of thermoluminescence dosimeters (TLD). The "*FB0604E Request form for TLD comparison with PTW*" (FB0604E) contains all necessary information on the devices and radiation qualities to be compared.

PTW guarantees to send the TLD probes to the customer as soon as possible and to evaluate them as soon as possible after the return to the TLD laboratory. The customer will be informed about the results on short term.

The customer guarantees to return the TLD probes immediately after irradiation and to complete and return the irradiation protocols (FB0605E) in full to PTW and, in addition, to provide all necessary information for the complete documentation of the irradiations carried out. In case of excessive measurement deviations, the customer guarantees to provide all information for the purpose of clarification without delay to the TLD laboratory. (This last point applies only if it is legally required).

Furthermore, in case of loss or damage of TLD probes due to the customers fault, the customer will be charged the complete cost for a replacement set of 8 TLD probes (including TLD, PMMA probes and all related work necessary to bring the TLD set back to full usability).

2 Sequence of a comparison measurement with TLD probes

2.1 Request a comparison measurement with TLD probes

The customer requests from PTW the required TLD probes for the MTK and specifies the preferred irradiation date. For this purpose, the form FB0604E is used which contains all the necessary information (for example the contact person phone number for inquiries by the TLD laboratory). For procedural reasons, only complete sets of 8 TLD probes (plus control probe) can be requested. Unused probes of such sets can be used for further (informative) irradiations (with a maximum of 2 Gy per probe). The costs always result from the number of complete TLD sets needed.

2.2 Shipment of TLD probes

PTW includes the customer's request into the schedule of the TLD laboratory and fixes the irradiation date with the customer. The TLD probes are dispatched in a way that they usually arrive at the customer's site in the morning of the irradiation date until 10:30 am.

2.3 Irradiation of the TLD at the customer site

The TLD probes are irradiated in comparison with dosimetry performed with an ionization chamber according to DIN 6800-2: 2008-03. The use of other dosimetry protocols can lead to deviating results.
The customer irradiates the TLD probes in comparison with the dosimetry unit (detector and electrometer) to be checked with the previously selected energy. Irradiation is to be performed exclusively in a water phantom. The expected irradiation dose is set to 1.0 Gy

with a maximum allowed deviation of +/- 0.1 Gy. The exact dose value must be specified for each TLD probe in the protocol FB0605E.

One probe must be used for each measuring point. One TLD probe contains 6 TLD chips and is sealed watertight. The TLD probes must not be opened by the customer! The TLD probes must be protected against oils, greases and solvents and must be kept cool and dry. Labeling of the TLD probes, e.g. with a marker, is strictly forbidden! The safety instructions must be observed (→ see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**)! The control probe is marked with a yellow label 'Don't irradiate control probe !'. The control probe is to be kept with the other TLD probes, but this probe is never to be irradiated!

The standard DIN6800-2:2008-03 describes the reference conditions for the irradiation.

Excerpt: reference conditions, DIN 6800-2:2008-03:

***^{60}Co**:* *SSD = 95 cm, meas. depth: 5 cm, field size: 10 cm x 10 cm in meas. depth*

***Photons**:* *SSD = 100 cm, meas. depth: 10 cm, field size: 10 cm x 10 cm at the phantom surface*

***Electrons**:* *SSD = 100 cm, meas. depth: $z_{ref} = 0.6 \cdot R_{50} - 0.1$cm, z_{ref} and R_{50} in [cm], field size: 20 cm x 20 cm at the phantom surface*

Attention: Care must be taken that the rear of the TLD probe is free of air bubbles after positioning it in the water phantom!

It is recommended to use a PTW water phantom of type T41023 equipped with an adapter of type T41023.1.110 to position the TLD probes in the phantom. For comparison with thimble chambers, spacer rings for displacing the TLD probe into the depth of the effective measuring location of the compact chamber are available. The phantom T41023 and the required adapters can be provided on loan. For more detailed information, please contact the PTW TLD laboratory at +49-761-49055-817 or at tld@ptw.de.

Alternatively, the comparison measurements can be carried out with an MP3, MP3-M or MP3-S water phantom with the adapter T4316 / U321 (only for waterproof chambers). Please note that the reference point of the TLD probe is 1.45 mm behind the focal side (front) of the TLD probe container. This reference point applies, of course, also to all other water phantoms or holders which are used in the MTK by means of comparison measurements. The form FB-E-10047 offers help with the positioning of the TLD probe in relation to the appropriate chamber holder.

In any case, you should refer to the manual of the phantom!

2.4 Irradiation Protocol

The customer is requested to record all the details, irradiation date and time, probe number, radiation quality, nominal energy, the dosimetry unit used (→ electrometer and detector) and, in particular, irradiation dose by means of the protocol form FB0605E. It must be completed by the customer, dated and signed on the first page of the form. The last page of the form FB0605E contains important information to be considered. The form shall be sent to the TLD laboratory together with the TLD probes.

2.5 Returning the TLD set

The customer is requested to return the TLD set immediately after the irradiation using the original black container and the original packaging. This shipment has to be done in a traceable manner by means of a reliable parcel service (not with a simple mail service!). Alternatively, a pick-up service via PTW can be arranged, but this should be agreed upon beforehand with the TLD laboratory.

The rental phantom and the rented accessories must also be returned immediately after the measurement. However, on request it is possible to borrow the loan phantom and accessories for a longer period of time. This usage extension is only intended for the time window before and / or after the TLD irradiation. This option must be discussed beforehand with the TLD laboratory. The schedule agreed upon must be observed. In the potential case of separate shipment of TLD probes, phantom and accessories, additional costs that might arise are then charged to the customer.

When packing the Phantom T41023, it must be assured that the feet are unscrewed for the return shipment!

2.6 Measurement evaluation at PTW

PTW evaluates the TLD immediately after receiving the TLD probes and determines the results.
The measurement data are combined according to irradiation modality for cobalt, high energy electron and photon radiation.
The determined dose values are evaluated according to the model shown in table 1 and divided into categories A, B and C.

Table 1: Evaluation categories for relative measurement deviations (Δ) to TLD dose

	category A	category B	category C
^{60}Co gamma radiation	$\Delta \leq 2$ %	$2\ \% < \Delta \leq 3\ \%$	$\Delta > 3$ %
high energy photon radiation	$\Delta \leq 3$ %	$3\ \% < \Delta \leq 4\ \%$	$\Delta > 4$ %
high energy electron radiation	$\Delta \leq 3$ %	$3\ \% < \Delta \leq 5\ \%$	$\Delta > 5$ %

2.7 Safety instructions

The TLD material is toxic if swallowed and irritates the eyes, respiratory system and the skin.

→ see instructions on the packaging of the TLD probes

For this reason, the hermetically sealed TLD capsules must not be opened!

As a precaution, TLD capsules must not be stored together with food!

3 Reporting

3.1 Reporting of comparison results

The results and their categorization shall be immediately communicated to the customer. When all results are grouped in category A, the MTK is concluded as successful immediately.

3.2 Procedure in case of deviations

If one or more results are grouped in category B, the cause should be determined and documented in a comprehensible manner. If this is not possible, the comparison measurement should be repeated as soon as possible. The affected therapy dosimeters may continue to be used during the clarification period until the cause has been rectified.

If one or more results are grouped in category C, the cause should be determined and documented in a comprehensible manner. If this cannot be done, the measurement should be repeated as soon as possible. The affected therapy dosimeters shouldn't be used until the defect or deviational behavior has been revealed.

4 References

Reference 1	FB0604E "FB0604E Request form for TLD comparison with PTW"
Reference 2	FB0605E "FB0605E Irradiation Protocol MTK"
Reference 3	FB-E-10047 "Einbaubeschreibung TLD-Sonde in Wasserphantom" / *"Installation description for TLD probes in water phantoms"*

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