LANDAUER®

microSTAR®ii and nanoDots™

microSTAR® ii
medical dosimetry system

Frequently Asked Questions

about the implementation and use of microSTARii and nanoDots for accurately measuring dose in medical applications

General Information & Operation

What is the microSTARii Medical Dosimetry System?

The LANDAUER microSTARii Medical Dosimetry System provides an accurate, reliable and easy-to-use dosimeter and reader intended for use in measuring dose on-phantom or on-patient in medical dosimetry applications such as the secondary verification of treatment planning in external beam radiotherapy and brachytherapy, and the measurement of dose uniformity and radiation exposure to the patient in diagnostic radiology. The output of the microSTARii is not used to adjust the dose to the patient.

What is a nanoDot and how does it work?

The nanoDot is an optically-stimulated luminescence dosimeter (OSLD).

Optically-stimulated luminescence is a characteristic of certain crystalline materials. When OSL crystals are exposed to ionizing radiation, electron-hole pairs are created within the crystalline structure in proportion to the absorbed dose. Some of these electrons become trapped at defects in the crystal. The magnitude of the dose is determined during readout by exposing the crystals to light of sufficient energy to free the trapped electrons, which subsequently recombine and release photons of light in the form of luminescence that is proportional to the originally absorbed dose.

The active element within the nanoDot is a small cylindrical disk comprised of aluminum oxide powder and trace amounts of carbon (dopant), embedded in an plastic matrix.

What are the key differences between the original microSTAR and the microSTARii?

Unlike the original microSTAR Reader, which was used in occupational, environmental and medical dosimetry, the new microSTARii Reader has been designed from the outset specifically for medical dosimetry applications.

The microSTARii utilizes a state-of-the-art electro-optical engine housed in a lightweight, compact design to read nanoDot optically stimulated luminescence (OSL) dosimeters. Together, the nanoDot dosimeters and microSTARii reader deliver excellent performance in patient dosimetry.

The microSTARii incorporates three primary improvements over the original microSTAR Reader:

- A new state-of-the-art optical system that utilizes Pulsed Optically Stimulated Luminescence (POSL) technology to achieve a significant improvement in signal to noise performance.
- An “integrated” nanoDot drawer mechanism to improve mechanical reliability and achieve more accurate, repeatable nanoDot readings.
- A significantly improved reader software application featuring: fully-integrated and automated reader and dosimeter quality assurance functions, better support for medical dosimetry including enhanced workflow, patient demographics, dose reports, and improved administrative functions, including automated backup and manual backup on demand, the ability to easily manage user accounts and access privileges, and enhanced security via restricted access to advanced features such as reader hardware configuration and user account and database management.

What components are included in the purchase of a microSTARii Medical Dosimetry System?

The microSTARii measurement system includes the following components:

- The LANDAUER microSTARii Reader (Reader Box, Drawer, Power Supply and USB cable).
- A laptop with Windows Pro 64 bit OS with microSTARii software and Microsoft Excel installed
- A 2D barcode scanner.
- A Calibration and QC set to be used for installation verification only; Cs-137 or 80 kVp may be chosen by the user.

Operation and Clinical Applications

What are the functions of the microSTARii Reader?

There are two basic reader functions provided by the microSTARii: (a) Intrinsic Measurements, which are used to assess reader stability and (b) Dosimetric Measurements, which are performed when reading a nanoDot dosimeter.

What are the major features of the microSTARii software?

The major features of the microSTARii software include:

- Optimized dosimetry workflow: Screens to capture patient demographics, dosimeter characteristics and exposure conditions, perform dose calculations and generate dose reports, and manage user accounts and administrative privileges.
- Integrated QA: Fully-integrated and automated reader and dosimeter quality assurance tools.
- Database Backup: Automated database backup and administrative access to database management features.

What energy range can be used for the nanoDot/microSTARii systems?

The useful energy range of the nanoDot/microSTARii system is from 5 keV to 20 MeV (diagnostic and therapeutic energies).

The clinical use conditions and energy response of aluminum oxide in the nanoDot dosimeter (Al2O3 :C) varies substantially across this range, requiring calibration of the reader to the specific application of interest. For more guidance on the requirements for reader calibration contact LANDAUER Customer Service.

What are some typical clinical applications of the nanoDot/microSTARii system?

As a "discrete" dosimeter, the nanoDot provides an estimate of absorbed dose at the point where it was placed during an irradiation.

LANDAUER markets the nanoDot and microSTARii Medical Dosimetry System for measurements of dose at a point on the skin surface of a patient, or on or within a phantom, and as a quality assurance instrument. The data provided by this system is informational and for quality assurance control purpose.

Should the bolus or build up material cover only the dosimeter, or the entire field, when using the nanoDot dosimeter?

There are different types of bolus (or build-up) material used in radiation therapy, and the choice of bolus material depends upon the application.

There are two physical categories of bolus material used in radiation therapy applications: slabs of bolus material that often cover the field, or build-up caps that are smaller in extent. The choice of type of bolus is a clinical decision that should be made on a case-by-case basis by the Qualified Medical Physicist (QMP) in Radiation Oncology at the facility.

How can the nanoDot dosimeter be used for different energies with the same buildup?

The primary objective in using build-up material is to achieve "electronic equilibrium." Provided that the bolus material is included in the radiation therapy treatment plan, a QMP will be able to reliably compare the dose on the nanoDot to that shown in the treatment plan.

Are there limitations in beam angular incidence with the nanoDot dosimeter due to the buildup cap?

Bolus material is only used in radiation therapy and, for the vast majority of applications in the therapy Megavoltage energy range (6-20 MV), the angular dependence of the nanoDot is minimal. However, for other applications, such as diagnostic imaging, the angular dependence of the nanoDot may be a factor, so it should be assessed on a case-by-case basis.

Are there any bolus correction factors for different bolus buildup thicknesses with the nanoDot?

There are no nanoDot-specific Bolus Correction Factors.

The bolus correction factor is determined by the bolus material type and thickness used, and is not dependent on the nanoDot. The choice of bolus and the appropriate correction factor should be determined by the QMP in Radiation Oncology at the facility.

If bolus material is used on a patient, is the nanoDot dosimeter placed on top or under the bolus material?

Typically, the nanoDot is placed UNDER the bolus material in order to achieve electronic equilibrium and in order to determine the dose "at depth" to the patient.

Ideally the bolus location is reflected in the treatment plan such that the dose measured by the nanoDot can be directly correlated with the dose shown in the treatment plan.

What is the form factor of a nanoDot dosimeter?

The active element of the nanoDot dosimeter is a circular disc of OSL material (Al2O3 :C) supported by a holder, both of which are embedded within a plastic case as shown in the diagram below. The case is labeled with the nanoDot serial number; one side displays the barcode label and the other side an alphanumeric version of the serial number. When retracted, the nanoDot active element is asymmetrically positioned within the dosimeter as shown by the location of the cross-hair below.

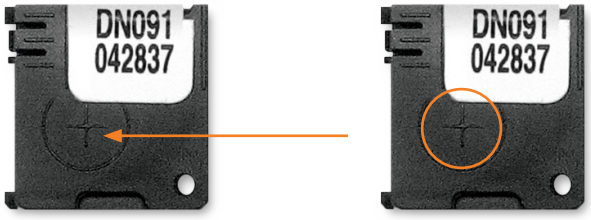
The OSL element physical dimensions are: 5 mm diameter and 0.3 mm thick. The dimensions of the ABS plastic case (density=1g/cm3) are 10 mm x 10 mm x 2 mm and, as a result, the nanoDot dosimeter has essentially no inherent buildup.

When positioning the dosimeter, how do I know the exact location of the OSL detector within the dosimeter?

The OSL active element is not symmetrically located within the case (see 2.10) but, as shown in the picture below, the outside of the nanoDot case has a visible raised cross-hair on both surfaces, which indicates the center of the active element. The cross-hair can be used to guide positioning of the dosimeter in applications where accuracy of location is crucial.

What is the maximum dose the nanoDot dosimeter can detect?

The maximum measurable dose is limited by the settings in the microSTARii Reader. For typical therapy applications in the Megavoltage range, the system can accurately measure up to 1500 cGy (Cs-137) provided the reader has been calibrated appropriately.



What is the minimum dose that the nanoDot dosimeter can detect?

The nanoDot / microSTARii system can detect a minimum dose of 50 µGy.

The microSTARii has a lower limit of detection of 50 µGy for measurements obtained using the strong (low dose range) and 500 µGy for measurements obtained using the weak beam (high dose range) when using freshly annealed nanoDot dosimeters.

What is the temperature range for operation of the microSTARii?

The recommended operating temperature range for the microSTARii is 65°F – 75°F.

Both the LED and the PMT are affected by temperature. At low temperatures the LED output intensity is higher and the PMT is more sensitive. At high temperature the LED output is decreased and the PMT is less sensitive.

The microSTARii will accurately reproduce dose at any constant temperature over the range of 46°F to 80°F provided the unit is operated at a relatively stable temperature, i.e. within a +/- 5° F range. Above 85°F the dark counts will exceed the manufacturer-recommended threshold and both the Daily Quality Control and Calibration operations will fail.

What are the proper conditions for storage of nanoDot dosimeters?

We recommend that the nanoDot dosimeters be stored away from light sources including sunlight, e.g. in a light-tight container at normal room temperatures (65°F – 75°F) and at normal humidity levels (< 80%). For best results, the nanoDot dosimeters should be stored in a location that is not in close proximity to radiation- emitting devices or other sources of radiation.

What is the definition and use of the term “sensitivity value”?

During the process of “screening” each nanoDot dosimeter is assigned a relative sensitivity value (relative to the response of standard reference nanoDots) and this sensitivity value is reflected in the dosimeter serial number.

What is the definition and use of the term “calibration”?

The term “calibration” is reserved to describe how the reader is calibrated for a specific irradiation beam in order to yield accurate dose readings.

How is the reader calibrated?

The term Calibration used in the context of the microSTARii Medical Dosimetry System, describes the action of establishing reader parameters that permit the conversion of reader raw counts to absorbed dose.

There are two potential types of parameters, depending upon the type of calibration curve utilized:

(a) a simple LINEAR calibration or (b) a NON-LINEAR calibration. Either calibration type can be performed by reading dosimeters at a variety of known "exposed dose levels" across the dose range of interest. The linear calibration, which is recommended for measurement of doses < 300 cGy, is obtained by taking the sensitivity-and background-corrected average reader counts divided by the known exposed dose, averaged across all dose levels in the dose range of interest (low or high dose) to yield a single calibration factor. The non-linear calibration, which is recommended for measuring doses above 300 cGy, employs factors that are derived from fitting a second order polynomial to the plot of average sensitivity-corrected reader counts at a given dose level versus the known exposed dose.

A minimum of three dosimeters is required at each dose level. For more details on the reader calibration process, please contact LANDAUER Customer Service.

Individual nanoDot dosimeters are not "calibrated". However, the relative sensitivity of individual dosimeters differs and the process whereby LANDAUER establishes the sensitivity of a dosimeter to reference standards is called "Sensitivity Assignment".

The dose calculation formula incorporates both the dosimeter sensitivity and the reader calibration factors.

What is a Calibration Certificate?

The A2LA-accredited LANDAUER Calibration Facility provides a certificate with each calibration set manufactured by LANDAUER. The certificate records the dose or exposure levels for each dosimeter in the Calibration or QC Set. Please refer to this set to acquire the "known exposed dose" for your calibration dosimeters.

What does the term "lot" refer to?

The term "lot" is a manufacturing term that refers to a group of nanoDot dosimeters that were produced in the same timeframe.

How do I use the calibration certificate?

The User should enter the SDE value on the Calibration Certificate in the "known exposed dose" field when performing reader calibrations using a LANDAUER-manufactured calibration set.

How do I enter descriptive information into the microSTARii system?

The process whereby a dosimeter is "assigned" or associated with a patient is referred to as Dosimeter Assignment. The reader software has a Dosimeter Assignment Screen where descriptive data can be added to the system. Once added, a dosimeter can then be assigned to that patient. The patient demographics or exposure-related fields can be modified at any time before the dosimeter is read out. Corrections or additions can be made on the Dosimeter Assignment Screen or on the Reading Screen.

What if I cannot enter descriptive parameters into the microSTARii system prior to exposure?

The User can enter as few or as many of the descriptive parameters as preferred into the microSTAR Reader software prior to use of a nanoDot dosimeter.

At the time of dosimeter readout the User must add or correct previously entered information displayed on the reading screen, before the dosimeter is read. To add or edit information, the User can select the "More" button beside the data fields to be modified or click directly on the specific field of interest.

What is the handheld barcode reader used for?

The handheld barcode reader is used to read the unique serial number that identifies each nanoDot dosimeter.

How do I know how many readings are stored in the database?

The total number of readings stored in the database is displayed on the DATA SCREEN.

Is there a battery in the Reader?

No. The microSTARii Reader is powered by a 6 V DC external power supply plugged into a standard 120V wall outlet.

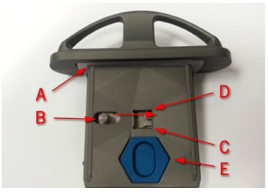
What is the "Drawer" and how does it function?

The microSTARii Reader Drawer, depicted in the following figure, refers to the removable tray that holds the nanoDot in the microSTARii Reader. The function of the drawer is conceptually similar to the function of the nanoDot "Adapter" used in the original microSTAR Reader – it holds the nanoDot in position and advances the OSL active element into position to be read.

Within the microSTARii drawer is a component that holds the nanoDot in the tray, while the Slide Actuator and Pin open the nanoDot and position it for reading.

Compared to the Adapter in the original microSTAR, the Drawer is much easier to use.

- Design Simplicity
  - 2 Moving parts contained in drawer
    - nanoDot Opening slide
    - nanoDot Ejector



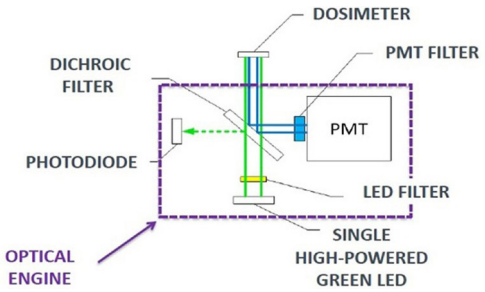
A. Light Seal
B. Roller bearing slide actuator
C. nanoDot Opening pin
D. nanoDot Keeper
E. nanoDot Ejector

What is the Optical Engine?

The microSTARii Optical Engine reads the nanoDot by using pulsed LED light to stimulate luminescence of the OSL material, where the luminescence is proportional to the total dose absorbed by the dosimeter.

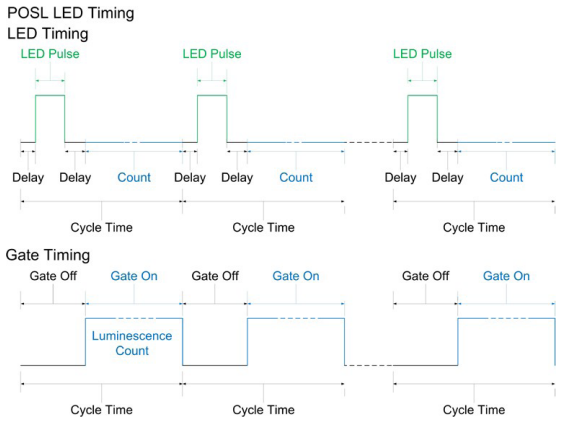
The Optical Engine is a highly compact, custom-designed LED illumination (optical stimulation) and light collection (stimulated luminescence) module that was originally developed for the US Army. The optical engine uses a reflection geometry that places the LED and the PMT on the same side of the OSL element. It relies on custom optics and separate stimulation and luminescence cycles (a characteristic of the POSL technique) to separate the LED illumination and OSL luminescence.

The optical engine also includes a photodiode for independent monitoring of the LED light output stability.



What measurement technique does the microSTARii use?

The Optical Engine is designed to be operated in a Pulsed Optically Stimulated Luminescence (POSL) mode. The original microSTAR used Continuous Wave – Optically Stimulated Luminescence (CW-OSL). The POSL method employs separate illumination and luminescence collection cycles whereas the CW-OSL method primarily relies on optical filtration to separate the illumination and luminescence emission spectra.



What are Intrinsic Measurements on the microSTARii?

Intrinsic Measurements are performance metrics that permit the reader performance and stability to be assessed independently, i.e. without using a dosimeter. There are three types of Intrinsic Measurement on the microSTARii Reader:

- Dark Counts (DRK) are a reflection of the reader photomultiplier tube counts acquired in the absence of stimulation. This metric is an indicator of baseline electronic noise and alternatively, can be a direct indicator of light leakage within the reader.
- Photomultiplier Tube (PMT) Counts reflect the PMT signal when the PMT is irradiated with the internal LED light source. The stability of this metric is influenced by the stability of both the PMT and LED. This is the metric that most closely correlates with routine use of the reader in medical dosimetry applications using the nanoDot.
- Photodiode (P-Diode) Counts reflect the LED light assessed with a photodiode. This metric is useful to assess the LED stability independently and can also help to differentiate PMT and LED stability issues when interpreting the PMT Counts.

The expected values of these metrics are as follows: Dark Counts: < 20 PMT Counts (of the LED): +/- 5% of the baseline established at installation (Daily QC) and a CV of < 0.05 across 5-20 sequential readings (Daily QC and Control Limit Tests)

Photodiode Signal (due to LED): +/- 5% of the baseline established at installation (Daily QC) and a CV of < 0.05 across 5-20 sequential readings (Daily QC and Control Limit Tests)

Does the microSTARii require a C-14 reference source?

No, the Intrinsic Measurements in the new microSTARii reader do not rely on an internal C-14 source to assess PMT stability. The PMT and LED stability both are reflected in the new PMT metric and the LED stability is assessed independently using the new P-Diode.

What is the LLD?

The reader's Lower Limit of Detection or LLD is strongly influenced by the background dose on the unexposed dosimeter. This background dose can be influenced by: 1. the conditions under which they are stored (they should be stored away from any sources of radiation), 2. the length of time in storage prior to use as dosimeters will accumulate dose over time due to natural background and 3. the effectiveness of initial annealing or subsequent re-annealing. Each nanoDot is annealed during manufacturing, and Quality Control protocols are in place to ensure that all dosimeters are properly annealed prior to release. For freshly annealed dosimeters the LLD is 5 mrad (50 µGy).

LLD Strong Beam: 5 mrad (50 µGy); LLD Weak Beam: 20 mrad (0.02 cGy)

What do the terms "repeatability" and "reproducibility" refer to?

In the context of the microSTARii Reader, these two terms are equivalent and refer to the ability to reproduce a dose reading when sequential readings of the same nanoDot in the same microSTARii Reader are performed.

NOTE: In the field of metrology, these terms have precise definitions and refer to two different measures of variability. However, in the context of the microSTARii Reader, the distinction between these terms is negligible.

In the microSTARii Reader there are two metrics of variability: Stationary Repeatability (inherent variability) and Moving Repeatability (operator variability or Reproducibility). Stationary Repeatability captures the consistency of sequential readings obtained when the nanoDot is not removed from the reader between measurements. Stationary Repeatability is the coefficient of variation of 10 repeat readings obtained with the weak beam. Moving Repeatability captures the additional variability that arises when the nanoDot is removed and reinserted into the reader between readings. The moving repeatability is the coefficient of variation of 10 repeat readings obtained with the weak beam.

Stationary Repeatability: <1%

Moving Repeatability: <1%

Why is it necessary to perform daily QC tests?

Consistent with best practice recommendations, all medical devices should be verified on the day of use when those devices are used in applications associated with patient care. The microSTARii Daily QC Test is a Manufacturer-recommended test that is designed to assess the reader stability and establish that the device is operating consistently with the demanding requirements of the medical dosimetry application. The consistency of the PMT and P-Diode metrics provides objective evidence that the reader is stable between calibrations.

NOTE: 1. The validity of established calibrations should always be assessed directly by exposing one or more test dosimeters to a "calibrated" and known exposure and verifying that when read, the dose obtained is within the expected accuracy limits for the class of dosimeter being used, i.e. general purpose (+/- 10%) or screened (+/- 5.5%*). 2. Electronic or hardcopy QA reports are automatically generated and it is recommended that these be stored indefinitely for the lifetime of the device. These QA documents may need to be provided during regulatory inspections or audits, i.e. to Joint Commission or state inspectors.*

nanoDot Readout & Correction Factors

What is the accuracy of the dose reading?

The accuracy of the dose reading is limited by the accuracy of the reader calibration and the type of nanoDot dosimeter used. When the reader calibration exposure condition and clinical use exposure condition are matched in terms of exposure geometry, scattering conditions and radiation quality (energy), a General Purpose (unscreened) nanoDot will have an accuracy of +/- 10% whereas a Screened nanoDot will have an accuracy of +/- 5.5% (at the 95% confidence level). Both types of nanoDot dosimeters will have a precision of +/- 5%.

What parameters can be entered into the reader in order to correct the dosimeter readout?

The microSTARii software supports the use of correction factors that can be employed to adjust the reader calibration condition to specific use conditions. However, these correction factors should only be used when there is a firm scientific foundation for their application. It is incumbent upon the User to understand the impact of these factors on reader calibration for a specific application.

IMPORTANT: The User assumes all responsibility when applying site-specific correction factors to calibration data and LANDAUER cannot be held responsible for any consequences resulting from the use of this feature of the software.

If the conditions of irradiation are not entered, is the correct dose determined?

The information entered in the "radiation quality" field does not impact the reader operation or choice of calibration to be applied when reading a dosimeter.

The intent of the "radiation quality" field is to record the conditions of irradiation and to assist the User in verifying that the calibration and clinical use conditions match prior to dosimeter readout. Therefore this information can be omitted without impacting the accuracy of the dose calculation, but this is not generally recommended because this information is a key characteristic of the dosimeter exposure condition and should be recorded in the database and any dosimetry reports that are generated.

Can a nanoDot be read multiple times, and what does "Depletion" refer to?

Yes, a nanoDot dosimeter can be read multiple times.

The POSL readout method employed in the microSTARii Optical Engine liberates only a small fraction of trapped electrons, such that the majority of the signal (dose) remains within the dosimeter in the form of trapped electrons. The loss of signal due to stimulation during the process of reading the dosimeter is referred to as "depletion." The depletion rate is dependent upon the optical engine readout method, configuration parameters, and the illumination beam mode. When the "Automatic" readout mode is used depletion rates are approximately 0.5% in the low dose range (where the strong beam is employed) and 0.05% in the high dose range (where the weak beam is employed).

What does "Fade" refer to, and how quickly does the signal fade?

The term "fade" refers to the loss of signal slowly over time due to the spontaneous depopulation of electron traps. When the nanoDot dosimeters are stored under appropriate conditions, the residual signal in the nanoDot will fade by approximately 1% per calendar quarter.

How are the dosimeters differentiated from each other?

Individual nanoDot dosimeters can be differentiated using the unique serial number printed on the white labels which are affixed to the outer plastic case of the nanoDot.

NOTE: For dosimeters manufactured prior to April 1st, 2014, it may not be possible from the serial number alone to determine whether a nanoDot is General Purpose (Unscreened) or Screened. All Screened nanoDots manufactured after April 1st, 2014 have a printed yellow line through the serial number (on the opposite side of the barcode label). If it is unclear whether a particular nanoDot is Screened or Unscreened, consult the documentation that arrived with your dosimeter shipment. If necessary, LANDAUER Customer Service can verify the type of dosimeter by serial number over the phone or via email.

Where are the unique serial number and other dosimeter information located on the nanoDot?

The dosimeter information, i.e. serial number and sensitivity are printed on the white nanoDot label that is affixed to the plastic case. One side of the label displays the serial number in a bar code format to facilitate entry of this information in the microSTARii application software. The other side contains a human-readable version of the serial number for ease of use, handling and documentation.

Note: nanoDot serial numbers start with two letters. The relative sensitivity of the nanoDot can be determined by taking the three numbers following these two letters and dividing by 100. For example, the dosimeter serial number of DN097018204 would indicate that the nanoDot sensitivity was 0.97.

How long are the archived data available for retrieving?

All of the information collected during the readout of a nanoDot is stored in the microSTARii software indefinitely. This information is available for the life of the system (unless it is intentionally deleted by the User).

When should I read the dosimeter?

After exposure of the nanoDot dosimeter you must wait at least 10 minutes before reading the dosimeter, and best practices require that you wait no more than 4 hours.

Can the dosimeter be irradiated and left overnight for reading the next day?

Ideally the dosimeter would be read promptly after exposure (see previous FAQ in this section), however dosimeters can be left overnight and read out the following day provided they are stored in a location where they will not be exposed to bright light or sunlight, or radiation.

Dose Determination

How is the dose on a nanoDot determined?

The dose on a nanoDot is determined during the readout process as displayed on the Reading Screen.

During readout the reader drawer mechanism positions the nanoDot OSL element over the aperture of the optical engine where the OSL element is exposed to a pulsed stimulation light source. In the intervals between stimulations, luminescence light emitted by the OSL element when liberated electrons interact at luminescence centers is collected by the PMT. The original dose stored in the dosimeter can be inferred from the number of luminescence photons or raw counts collected by the PMT when the dose calculation factor(s) and other corrections (i.e. for background dose and dosimeter sensitivity) are applied.

The dose reading from a nanoDot represents the total accumulated dose at the point where the nanoDot was positioned and exposed.

What is the Crossover Point?

The “Cross-Over Point” is a threshold that is used by the microSTARii Reader to determine whether the reader will use the “Strong Beam” or the “Weak Beam” to read a dosimeter with an unknown dose. The Cross-Over Point (COP) value is unique to each reader, is establish during manufacturing testing and is shown on the Configuration Screen under the beam mode section.

For nanoDot dosimeter reading performed using the “Automatic” beam use mode selection on the Configuration Screen, the microSTARii Reader first performs a very short pre-read of the dosimeter using the “Weak Beam” illumination mode. The resultant test counts are compared to the reader COP to determine whether the “Weak Beam” or the “Strong Beam” should be used to read the nanoDot dosimeter.

When verifying the calibration, what should be done if the QC dosimeter reading is different from the expected value by more than 5% ?

If the dosimeter is a QC dosimeter that is part of a LANDAUER Calibration and QC Set, the result obtained should be within 5% of the expected result because the dosimeters in these sets are always screened nanoDots. If there is a difference the User should contact LANDAUER Customer Service for help in identifying the reason for the difference.

How can I verify that the nanoDot dosimeters are working properly?

A simple test is to expose the dosimeter to a known dose (using reference conditions after machine calibration) and compare the measured to expected dose; verify that you obtain a dose within +/-5.5% (for SCREENED nanoDots). To achieve a +/-5.5% agreement the calibration should be recent and match the clinical exposure condition in terms of geometry, scatter conditions and radiation quality.

The best practice is to establish a reader Quality Control program that includes testing performed at installation, periodic calibration and post calibration verification, Daily Quality Control testing any day the reader is used clinically, and monitoring of reader daily QC trends over time (especially between calibrations).

Initializing the Dosimeter

How can I be sure that a nanoDot dosimeter was not exposed prior to clinical use?

The dose that the nanoDot will be exposed to clinically is not necessarily known in advance nor is the readout mode (strong beam or weak beam) that will be used to read the nanoDot after exposure. Therefore, the nanoDot pre-use "exposure level" is measured by comparing the raw reading counts on the dosimeter obtained in both illumination modes (strong beam and weak beam), prior to use. However, only the average counts obtained using the strong beam are compared with the user- selectable exposure threshold limit (default: 500) to determine if the dosimeter is "exposed" or "unexposed". If the average count is < 500 the dosimeter verification QA test result is PASSED, if >500 it is FAILED. The User can increase or decrease this threshold value (500) as required.

It is a "Best Practice" to "Verify" that a dosimeter is unexposed prior to clinical use. Within the microSTARii software "Verification" can be performed using either of the following dosimeter QA tests available on the QA Screen:

- Verify each nanoDot dosimeter by performing a physical reading of the dosimeter background counts.
- Verify the dosimeter by using a "proxy" for its background, such as the reference nanoDot background reading (both dosimeters should be from the same lot and they should have been stored under similar conditions).

Once the nanoDot dosimeter has been verified and the baseline counts have been measured, the background count value will be incorporated into the dose calculation formula if the "Background Correction" option is checked (enabled) on the Configuration Screen.

Note: Background/Baseline Count correction is optional and is not required to verify that the dosimeter is unexposed, but if background correction has been selected the dosimeter must have been verified to provide a background count reading for use in the dose calculation formula shown on the Reading Screen.

Note: For radiation oncology applications where dosimeters are used in a "single use mode" the baseline counts are typically negligible, however dosimeters are still verified prior to clinical use for medical legal reasons.

What happens if the nanoDot is not read prior to irradiation?

For medical dosimetry applications, the baseline counts on the nanoDot must either be read or estimated prior to clinical use as described in the earlier FAQ section.

Failure to "Verify" a dosimeter as unexposed prior to clinical use undermines the intent of using a nanoDot dosimeter as a dose verification solution because the measured reading may not be accurate (depending on how much background signal has accumulated on the nanoDot dosimeter).

Access to Dose Information

What information is stored in the microSTARii Medical Dosimetry System when a dosimeter is read?

The following information is stored in the microSTARii database and can be accessed on the DATA SCREEN of the microSTARii software:

- Information identifying the dosimeter and it's characteristics, including serial number, sensitivity and screened status.
- Readout data: Raw counts (from exposed dosimeter readout), background counts (from unexposed dosimeter readout or the alternative <population background reference> when background correction is enabled), computed dose and computed average dose (when the average mode is employed), the form of dose calculation formula employed: linear vs. non-linear, and the calibration factor(s) utilized during the dose calculation
- When the Dosimetry Category is Patient additional demographic data identifying the patient and the exposure conditions is also stored.

Is dose information stored on the network or in other places?

Dose information is stored locally in the reader database. The microSTARii software can be configured to export dose information to other locations on the network. The User can also export dosimetry data in the form of PDF dose reports or, alternatively, in the Excel file format.

Can dose data be exported to another computer?

Yes, the microSTARii software can export dose-related information into an Excel file or into a PDF dose report, either of which can be transferred to another computer.

Can dose data be shared between microSTARii Readers?

Yes, multiple microSTARii Readers can be configured to operate with a central database such that a User at one reader location can view the results from all other reader locations.

Reimbursement

Is there a CPT code for the use of nanoDot dosimeters in Radiation Therapy?

CPT code 77331 – "Special dosimetry" may be used, when ordered by the treating physician, to check the dosimetry treatment plan at a point in a treatment port that is "outside of" the normal parameters of the treatment planning system or calibration of the treatment device.

The use of special dosimetry must be prescribed by the treating physician, and the use of an OSL dosimeter must be specified. This code is not intended for routine QA.

NOTE: Only the qualified medical physicist and the treating physician can determine if the use of CPT code 77331 is appropriate for an individual patient undergoing a specific procedure.

Learn More

Call 800-561-2708 or email inlightcustserv@landauer.com
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Stakeholder Approval

This document meets LANDAUER standards for quality and use.

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