



# Reference Class for Reference Dosimetry

Trusted by Medical  
Physicists since 1922

# UNIDOS® Tango and PTW Farmer®

Your Perfect Match for Reference Dosimetry



## UNIDOS® Tango

### The Smart Reference Class Electrometer

As a secondary standard reference class electrometer, UNIDOS Tango delivers fast, reliable, and highly accurate results across all applications. Equipped with industry-leading amplifier technology, it is exceptionally stable and ready for use immediately upon start. With its extensive measurement range and proven resolution of 0.1 fA, UNIDOS Tango is your electrometer of choice for dose measurements where accuracy and reliability are of critical importance.

#### The UNIDOS® Advantage

- ▶ Reference class confidence – meets and exceeds IEC 60731, JSMP and IPEM device requirements
- ▶ Intelligent Detector Recognition (IDR) for automated detector management and identification
- ▶ User profiles for frequent measurement tasks
- ▶ Statistical calculations of your measurements immediately available
- ▶ Comprehensive detector database with ready-to-use templates
- ▶ Auto start/stop with auto reset
- ▶ Touch screen and remote operation via LAN or WiFi

#### UNIDOS® Tango Specifications

|                     |  |
|---------------------|--|
| Measurement Ranges  | Current 400 fA ... 2.6 $\mu$ A<br>Charge 4 pC ... 9.3 C        |
| Resolution          | Current 1 fA (0.1 fA VERY LOW)<br>Charge 10 fC (1 fC VERY LOW) |
| Repeatability       | < $\pm$ 0.25 %   |
| Long-Term Stability | < $\pm$ 0.1 % per year   |
| Response Time       | < 1.5 s  |



IDR



Touchscreen



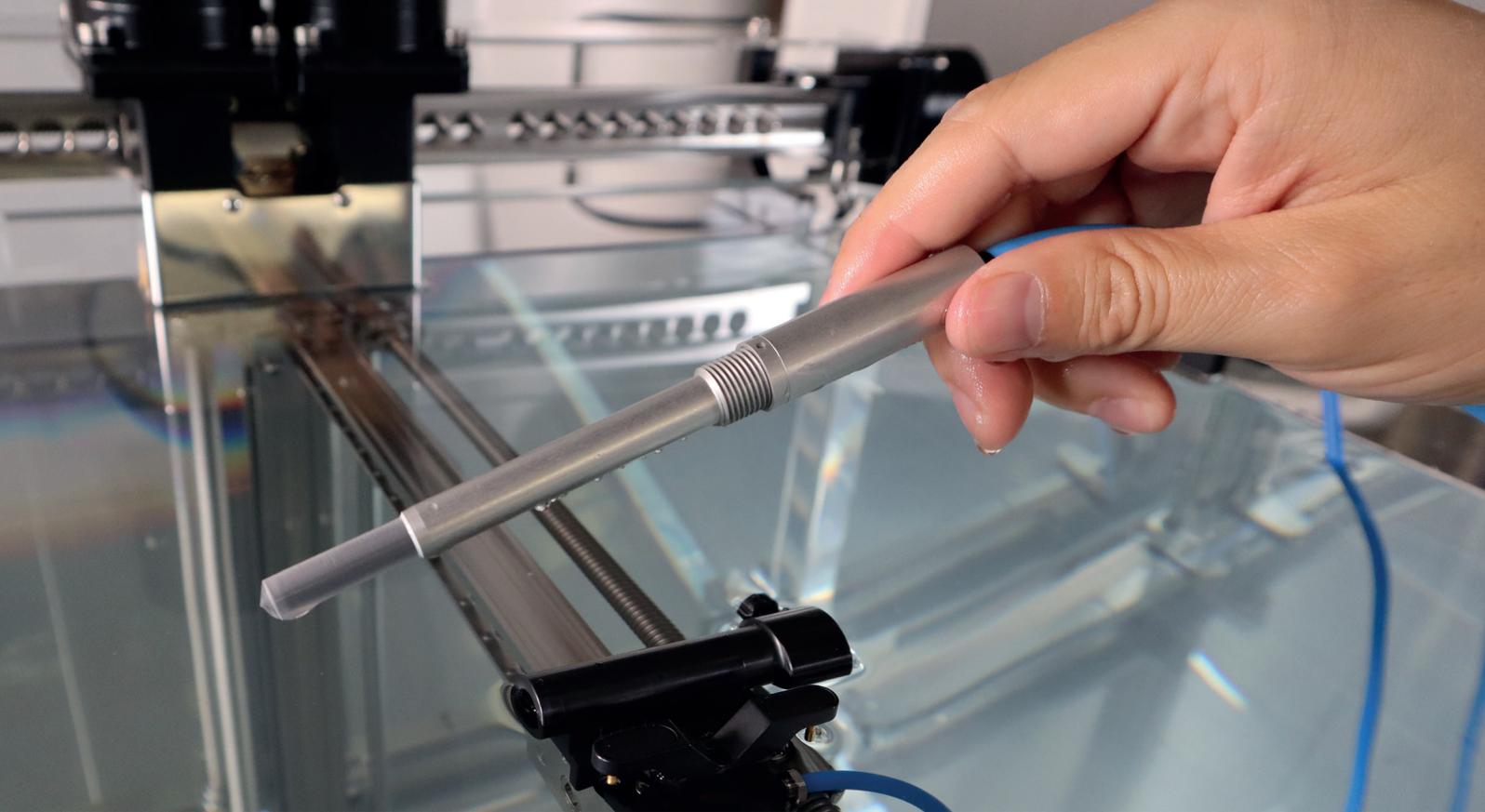
Ethernet/LAN



WiFi

Smart. Intelligent. Connected.  
Learn more about UNIDOS Tango





# PTW Farmer<sup>®</sup> Chamber (30013)

## The Gold Standard Chamber for Clinical Reference Dosimetry since 2001

With its fully guarded, waterproof design, the reference class PTW Farmer chamber (30013) is the perfect detector for reference dose measurements in water or solid-state phantoms, which require the highest level of accuracy to ensure safe patient treatments.

The PTW Farmer chamber (30013) is clinically proven, well-characterized in all major dosimetry protocol procedures, and suitable for use in high-energy photon, electron, and proton beams. It has well-established dosimetric characteristics and is supplied pre-calibrated with traceability to a primary standard for maximum accuracy.

Combined with a reference class UNIDOS electrometer, the PTW Farmer chamber provides you with a highly accurate, long-term reliable reference dosimetry system from a single source, delivering results you can trust.

### **Why you should use the PTW Farmer<sup>®</sup> chamber (30013) for reference dosimetry**

- ▶ Proven reference class with validated accuracy – exceeds device requirements of IEC 60731 and AAPM TG-51 addendum
- ▶ Reference dose calibration and measurement according to all major dosimetry protocols – IAEA TRS-398, AAPM TG-51, DIN 6800-2
- ▶ Well-studied, well-characterized – correction factors for absorbed dose and air kerma determination available and specified in all dosimetry protocols
- ▶ Exceptional long-term stability – minimal chamber-to-chamber variation over years demonstrated in internal (Fig. 2) and external studies<sup>[1, 2]</sup>
- ▶ Rotationally symmetric design with durable components for long-term stability and a uniform response – graphite and PMMA walls (no plastic), aluminum electrode
- ▶ Reliable air-density correction – no need to correct for additional temperature and humidity effects, e.g., chamber deformation<sup>[3]</sup>
- ▶ Exceptional reliability even at very high humidity levels – no increase in leakage current ( $< \pm 4$  fA), no change in response ( $< 0.1\%$ )
- ▶ Quality reference dosimetry systems from a single manufacturing source – from electrometer, detectors and phantoms to cables and detector holders, from instrument design to production, from testing to traceable calibration (PTW SSDL)

# PTW Farmer<sup>®</sup> Chamber (30013)

## Most trusted, most chosen chamber worldwide

### The most popular choice worldwide

The PTW Farmer chamber (30013) is the most commonly used detector for reference dosimetry of photon beams according to a survey among clinical institutions<sup>[4]</sup>. Nearly 40% of the survey participants use it regularly for their measurements. And more than 55% of the participants chose a PTW ionization chamber.

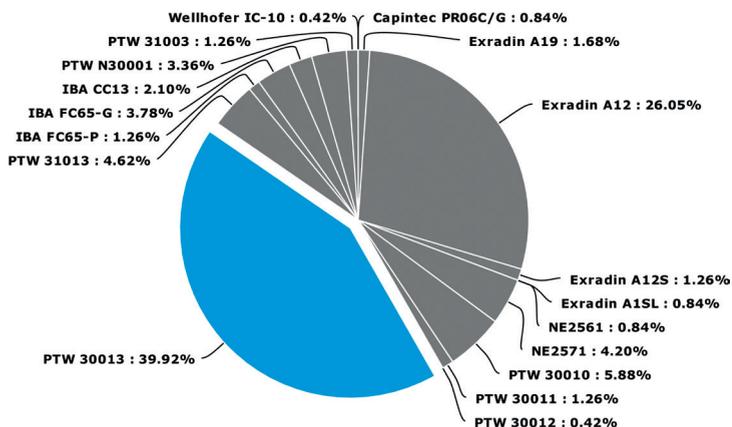


Fig. 1: Survey results on reference dosimetry practices published by Muir et al<sup>[4]</sup>

### Unmatched stability since 2001

The stable design of PTW Farmer chambers (which contains no plastic materials) ensures that every single chamber resembles the ideal chamber model as closely as possible. This model is used to calculate type-specific correction factors, such as  $k_Q$ , which need to be applied for accurate reference dosimetry. The more your individual chamber resembles this ideal chamber model, the more the type-specific  $k_Q$  factor is suitable for your individual chamber. Accurate reference dosimetry is directly linked to a reliable and stable production process with minimal chamber-to-chamber variations.

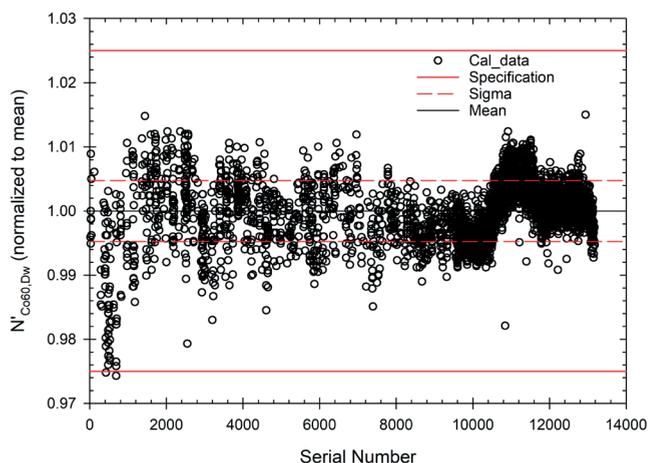


Fig. 2: Absorbed dose to water calibration coefficients  $N_{D,w}$  of all PTW Farmer chambers 30013 produced since 2001, based on internal long-term study of PTW SSDL calibration lab

## The Established Reference Class

### Exceptional long-term stability – outstanding accuracy

PTW Farmer chambers meet and exceed all specification requirements of a reference class ionization chamber as defined in IEC 60731 and the addendum of the AAPM TG-51 protocol.

They are manufactured entirely in-house to the strictest tolerances and specifications using carefully chosen, extensively tested components. Their well-established dosimetric characteristics along with an exceptional stability and reliability make PTW Farmer chambers an ideal detector for protocol-compliant, accurate reference dose measurements.

- ▶ Exceptional long-term stability – far below AAPM TG-51 addendum requirements
- ▶ Minimal polarity effect (< 0.4% correction, < 0.5% maximum variation)
- ▶ Excellent settling time (< 0.3%)
- ▶ Very low post-irradiation leakage – far below IEC 60731 requirements
- ▶ Minimal chamber-to-chamber variation – reliable correction factors

More information: PTW Detector Catalog with Code of Practice



# Optional Reference Dosimetry Equipment

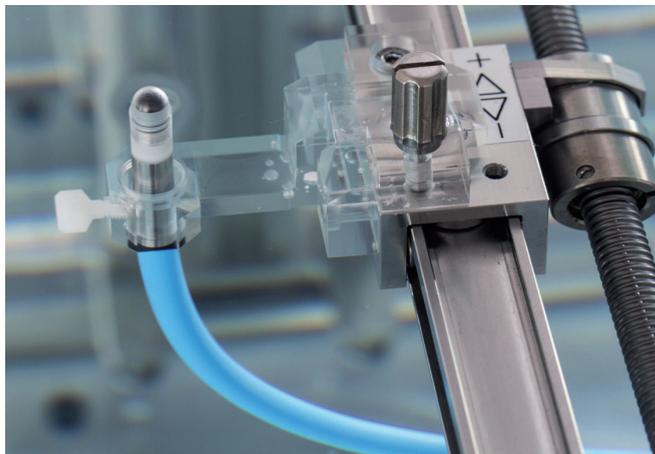


## UNIDOS® Romeo

Stand-alone high-precision reference class electrometer with exceptional stability

### Key Features

- ▶ Exceeds IEC 60731 device requirements
- ▶ Intuitive, multi-lingual touch screen display
- ▶ Auto start/stop with auto reset
- ▶ User profiles for frequent measurement tasks
- ▶ Statistical calculations of your measurements immediately available
- ▶ Comprehensive detector database with ready-to-use templates



## Semiflex 3D Chamber (31021)

Waterproof cylindrical ionization chamber for reference and relative dosimetry measurements, especially in FFF beam qualities

### Key Features

- ▶ Reference class – exceeds IEC 60731 and AAPM TG-51 addendum device requirements
- ▶ Small size (0.07 cm<sup>3</sup>), minimal volume averaging, high spatial resolution
- ▶ Ideal for reference dose measurement in small and FFF fields
- ▶ Full 3D geometry – uniform response in any direction
- ▶ Reference dose measurements according to major dosimetry protocols
- ▶ Suitable for use in water, air or solid-state phantoms, appropriate holders available



## BEAMSCAN®

All-in-one 3D water phantom with advanced automated features for accurate relative and reference dosimetry measurements

### Why use it for reference dosimetry

- ▶ 15-minute setup – faster and easier to use than a small 1D water phantom
- ▶ Fully automated setup procedures – water filling, detector positioning, leveling, CAX and rotational correction
- ▶ Built-in water sensor for automatic water filling and complete draining
- ▶ Patented TRUFIX® detector clip-in for fast, easy mounting
- ▶ Auto EPOM positioning for relative dose measurements
- ▶ One-click positioning on-axis for reference dose measurements
- ▶ Auto air-density correction
- ▶ Remote control and measurement using optional BeamDose software



Infographic: Fast and easy reference dosimetry with BEAMSCAN using BeamDose or a UNIDOS electrometer

### References

- [1] Andreo P et al. Determination of consensus k Q values for megavoltage photon beams for the update of IAEA TRS-398, Phys. Med. Biol. 65 (2020) 095011, doi: 10.1088/1361-6560/ab807b. PMID: 32182598.
- [2] Muir, B.R. Ion Chamber Absorbed Dose Calibration Coefficients, ND,w, Measured at ADCLs: Distribution Analysis and Stability. Medical Physics 2015, 42, 1546-1554. <https://doi.org/10.1118/1.4914381>
- [3] McEwen MR, Taank J. Examining the influence of humidity on reference ionization chamber performance. Med Phys. 2017 Feb;44(2):694-702. doi: 10.1002/mp.12057. Epub 2017 Jan 30. PMID: 28133754.
- [4] Muir, B.R. et al Insight gained from responses to surveys on reference dosimetry practices. J Appl Clin Med Phys 2017, 18: 182-190. <https://doi.org/10.1002/acm2.12081>



# Making Radiation Safer.

PTW is a global market leader for dosimetry and quality control solutions in radiation medicine, serving the needs of medical radiation experts in more than 160 countries worldwide. Starting with the famous Hammer dosimeter in 1922, the German manufacturer is the pioneer in medical radiation measurement, known for its unparalleled quality and precision.

For PTW, making medical radiation safer is both a passion and lifetime commitment. The family-run, high-tech company operates the oldest and largest accredited calibration laboratory in the field of ionizing radiation and established THE DOSIMETRY SCHOOL to globally promote the exchange of knowledge in clinical dosimetry.

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