Always One Step Ahead

OCTAVIUS®

Turnkey Solutions for 2D Patient Plan Verification
As new complex treatment and delivery techniques evolve, which tend to increase potential error sources, the need to verify dose delivery quickly during the entire treatment period becomes crucial. Continuing where other QA devices leave off, OCTAVIUS® solutions perfectly answer these needs. With their modular design and trendsetting technologies, OCTAVIUS® systems cover the complete patient QA chain from patient plan verification to in vivo verification, providing you with the optimal solution for each treatment technique. Just as you expect from PTW.

**Modular 2D QA Solutions**

- **OCTAVIUS® I**
  - Pre-Treatment Verification
  - Field-by-Field, Gantry 0°
  - OCTAVIUS® Detector 1500, 1000 SRS or 729 and VeriSoft® Software

- **OCTAVIUS® II**
  - Pre-Treatment Verification
  - Composite Plan, Rotating Gantry
  - OCTAVIUS® Phantom with Detector 1500 or 729, VeriSoft® Software

- **OCTAVIUS® III**
  - Pre-Treatment Verification ...
  - ... and In Vivo Verification
  - OCTAVIUS® Phantom with Detector 1500 or 729, DAVID® Detector and VeriSoft® Software
  - DAVID® Detector for in vivo IMRT dosimetry
Pre-Treatment Plan Verification

Field-by-Field, Gantry 0°

Built on two strong components, an OCTAVIUS® detector and VeriSoft® software, OCTAVIUS® perfectly answers the needs of field-by-field IMRT verification measurements with fixed gantry positions. Select the detector that is best for your application or budget, and get started.

Quick Overview
- Very quick set up – ready for measurement within a few minutes
- Outstanding flexibility – three detectors to choose from
- High detector density, best available field coverage – better error detection
- Optional 4D dosimetry and machine QA with FFF analysis
- Reliable Gold Standard ionization chambers as detectors
- Modular – upgradeable to any OCTAVIUS® system

OCTAVIUS® 729

Highlights
- Large field coverage – cubic detector design, uniform detector spacing (5 mm edge-to-edge)
- 729 vented ionization chambers (size 5 x 5 x 5 mm³) on 27 cm x 27 cm
- Full field coverage, increased sensitivity with four measurements using VeriSoft® Merge
- Gold Standard ionization chambers as detectors – no ageing, no degradation
- Extended dose rate range for FFF beams (up to 48 Gy/min)

OCTAVIUS® Detectors – which one is best for you?

OCTAVIUS® 1500

Highlights
- Highest detector density and largest field coverage of available arrays
- Resolution nearly doubled – 1405 vented ionization chambers (size 4.4 x 4.4 x 3 mm³) on 27 cm x 27 cm
- Unique checkerboard detector layout – no leaf undetected
- 100% field coverage with two measurements via simple couch shift
- Gold Standard ionization chambers as detectors – no ageing, no degradation
- Extended dose rate range for FFF beams (up to 48 Gy/min)

OCTAVIUS® 1000 SRS

Highlights
- Smallest detector size (2.3 x 2.3 x 0.5 mm³) with highest spatial resolution (2.5 mm) – ideal for SRS/SBRT QA
- 977 liquid-filled ionization chambers on 10 cm x 10 cm
- Full field coverage on 5 cm x 5 cm
- Excellent sensitivity – measures single MUs
- 2.5 mm detector spacing in center area – suitable for high-definition MLC QA
- Optional accessory package for CyberKnife® patient QA
- Extended dose rate range for FFF beams (up to 36 Gy/min)

OCTAVIUS® Detectors: Largest field coverage – better detection of hot spots

With their high detector density and unique detector layout, OCTAVIUS® detectors offer the best field coverage of commercially available arrays, increasing the chance of detecting a hot spot or measuring dose at steep gradients.
OCTAVIUS® II
Pre-Treatment Plan Verification

Rotational dosimetry made simple
Including the complete functionality of the OCTAVIUS® I, OCTAVIUS® II adds a specially designed phantom along with a wide range of dedicated measurement tools to enable fast and precise verification of composite IMRT plans performed with a rotating gantry.

Quick setup on patient couch, ready for measurement within a few minutes
Plan verification truly independent of LINAC or treatment planning system (TPS)
Flexible phantom positioning for measurements in the clinically most relevant directions
Superior directional detector response compared to cubic phantoms due to built-in semicircular air cavity and unique detector design

Outstanding detector technology with best field coverage of available arrays – better error detection
Measurements of isocenter dose (CAX) without additional measurement tools
Wide range of optional tools for advanced QA measurements, including inserts for inhomogeneities, film and single ionization chambers or machine QA with FFF analysis

True 3D Gamma Index Analysis
Fewer false-positive errors, better protection of OAR

A 3D Gamma Index analysis may reduce the number of failed points in regions of high dose gradient perpendicular to the measurement plane (Fig. 3 and 4) as it uses all three spatial dimensions for data comparison. If this method is used in combination with the local dose chosen as reference value, the 3D Gamma Index analysis method will increase the chance of detecting relevant overdose in organs at risk (OAR).

The OCTAVIUS® Phantom
Perfectly adapted to rotational dosimetry
Superior directional response
OCTAVIUS® phantom with slot for OCTAVIUS® Detectors 1500 or 729 and optional measurement inserts (inhomogeneities, ion chambers, film). A built-in semicircular air cavity provides for an angle-independent detector response.

Measurements inside the clinically relevant volume
The OCTAVIUS® II phantom can be rotated in eight different positions, allowing precise measurements in the clinically relevant direction and inside the planned target volume (PTV).

Which turnkey solution is best for you?
OCTAVIUS® II 1500 or 729
OCTAVIUS® II is available in two ready-to-use solutions which include everything you need for patient plan QA. Select the package with the detector that is best for your application or budget, and get started. Enhance or upgrade your OCTAVIUS® system as and when needed. With modular OCTAVIUS®, you stay flexible – now and in the future.

OCTAVIUS® II 1500 with OCTAVIUS® Detector 1500
OCTAVIUS® II 729 with OCTAVIUS® Detector 729

Quick Overview
Quick, easy set up within a few minutes
Ready for measurement – no commissioning required
Unique phantom geometry, perfectly adapted to rotational QA
Suitable for all IMRT and IMAT treatment techniques
Flexible – two detectors to choose from
Versatile – multiple options for advanced QA measurements
Modular – enhance or upgrade as and when needed

Highlights
Quick setup on patient couch, ready for measurement within a few minutes
Plan verification truly independent of LINAC or treatment planning system (TPS)
Flexible phantom positioning for measurements in the clinically most relevant directions
Superior directional detector response compared to cubic phantoms due to built-in semicircular air cavity and unique detector design

Does it agree or not?
Quick and easy dose comparison and evaluation with powerful VeriSoft®

OCTAVIUS® II 1500
OCTAVIUS® II 729
OCTAVIUS® III cleverly combines pre-treatment verification using OCTAVIUS® I or II with the DAVID® detector, a truly innovative real-time in vivo dosimetry system for IMRT. By integrating DAVID®, OCTAVIUS® III gives you a powerful, yet highly practical QA solution at hand to verify whether the planned dose is actually being delivered over the entire treatment period.

Highlights
- Clinically established QA solution for patient plan verification and in vivo verification of dose delivery and MLC accuracy during each patient treatment
- Pre-treatment QA based on independent measurements with OCTAVIUS® I, II or optional DIAMOND® secondary check software
- Immediate detection of errors or malfunctions (e.g. lost MLC positions) during each session
- Truly independent measurements, acquired and transmitted in real-time
- Entirely wireless operation and data transfer during treatment verification
- Quickly installed, ready for operation in a few minutes (no cables, no detector placement on patient)
- Available for all standard MLCs

DAVID® is a multi-wire transmission detector specially developed for patient delivery QA. It is inserted into the LINAC accessory tray to monitor dose delivery and MLC accuracy while the patient is treated. Since it is transparent, the DAVID® detector does not interfere with the LINAC’s light field. DAVID® consists of measurement wires which run parallel to the direction of the MLC. Each measurement wire monitors the opening of a leaf pair. The measured dose length product consequently correlates with the opening of the leaf pair and supplied dose.

To maximize both efficiency and patient safety, DAVID® operates and communicates completely wireless via Bluetooth. As an ultra-lightweight, cable-free device, it can be quickly inserted for measurement and swiftly removed as needed (e.g. for electron treatment), requiring no complicated setup or commissioning procedures.

Prior to daily measurements, a reference measurement is to be taken that can be simultaneously recorded during patient plan verification with an OCTAVIUS® QA system. The dose subsequently measured during each session is then compared real-time to the reference dose. Deviations are displayed immediately according to predefined warning and alarm levels.

Step 1: Pre-treatment plan verification with OCTAVIUS® I or II and DAVID® reference measurement

Step 2: In vivo verification of dose and MLC position with DAVID® during each session

Closing the Gap in IMRT QA

OCTAVIUS® III cleverly combines pre-treatment verification using OCTAVIUS® I or II with the DAVID® detector, a truly innovative real-time in vivo dosimetry system for IMRT.

Why In Vivo IMRT Dosimetry?
- More potential for treatment-related incidents due to increased complexity of planning and new technologies
- Certain types of tumors require accuracy better (up to 3.5%) than 5% as recommended by ICRU Report 24 (1976).
- Of the more than 4,000 near misses without adverse outcome to patients reported in the years 1992 to 2007, more than 50% were related to the planning or treatment delivery stage.
- More system or equipment-related errors were reported as compared to other errors, e.g. dose prescription.

Statistics from: Radiotherapy Risk Profile, World Health Organization 2008
The easiest way to 4D dosimetry

**Key Features**
- Budget-friendly solution for users of PTW two-dimensional detector arrays who wish to upgrade to 4D dosimetry
- Upgrade package includes: Motorized OCTAVIUS® 4D phantom, wireless inclinometer, electronics, VeriSoft® upgrade with Navigator single user interface
- Supported detector arrays: OCTAVIUS® Detector 1500, OCTAVIUS® Detector 1000 SRS, OCTAVIUS® Detector 729, 2D-Array seven29®

**DIAMOND® CyberKnife® Accessory Package**
- Unique, ready-to-use accessory package for CyberKnife® patient-specific QA in combination with OCTAVIUS® Detector 1000 SRS and VeriSoft® software
- Quick, comfortable setup – ready for measurement within a few minutes
- Suitable for CyberKnife® VSI and M6 systems
- Optional MultiCheck® software for quick and easy CyberKnife® machine-specific QA
- Package includes: Positioning device for VSI or M6 birdcage, fiducial marker plate for beam release, foam rubber padding

**LINAC QA for OCTAVIUS®**
- Complete package for machine-specific QA in combination with an OCTAVIUS® detector and MultiCheck® LINAC QA software
- Fast, efficient check of all relevant beam profile parameters, including beam quality and absolute dose, in one single shot
- QA checks at all gantry angles without gantry mounts using optional OCTAVIUS® 4D phantom
- EFF analysis
- Record and playback function for a quick assessment of the LINAC startup behavior
- Profile and trend display

**LINAC QA Upgrade Package**
- Fast, simple. With millimetric accuracy. Patented specific QA for CyberKnife® VSI and M6 systems with OCTAVIUS® Detector 1000 SRS in combination with CyberKnife® accessory package

**OCTAVIUS® 4D Upgrade Package**
- The easiest way to 4D dosimetry
- Key Features
  - Budget-friendly solution for users of PTW two-dimensional detector arrays who wish to upgrade to 4D dosimetry
  - Upgrade package includes: Motorized OCTAVIUS® 4D phantom, wireless inclinometer, electronics, VeriSoft® upgrade with Navigator single user interface
  - Supported detector arrays: OCTAVIUS® Detector 1500, OCTAVIUS® Detector 1000 SRS, OCTAVIUS® Detector 729, 2D-Array seven29®

**Supporting QA Procedures**
- X-ray and electron output constancy
- Electron and photon beam profile constancy
- Electron beam energy constancy
- Electron and x-ray output constancy vs. gantry angle
- Electron and x-ray off-axis factor constancy vs. gantry angle
- Check of wedge angle for 60°
- Dose rate and symmetry over time
- Segmental IMRT (step and shoot) test
- Moving Window IMRT (four cardinal gantry angles)

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*In combination with OCTAVIUS® 4D Rotating Phantom*
**Options & Accessories**

**Film Measurement**
Polyethylene holding device for OCTAVIUS® phantom to insert a GafChromic® EBT / EBT 2 film (max. size 20.32 cm x 25.4 cm, 8” x 10”) for film measurements.

**Chamber Measurement**
Insert plates for OCTAVIUS® phantom with cavities to allow point measurements with up to nine 0.125 cm³ Semiflex ionization chambers. Unneeded cavities can be closed with blind plugs.

**0.125 cm³ Semiflex Ionization Chamber**
Vented cylindrical ionization chamber with a sensitive volume of 0.125 cm³ which is inserted into the chamber insert plate of the OCTAVIUS® phantom to allow point measurements.

**Inhomogeneity**
30 cm x 30 cm x 2.5 cm acrylic phantom to test TPS with consideration of inhomogeneities. Includes five exchangeable inserts, two of different density (lung, bone and soft tissue), one of acrylic glass (PMMA) and a specific adapter plate for OCTAVIUS® phantom. The inhomogeneity phantom is not a CT test phantom. The Hounsfield units of the phantom must be determined by a CT scan.

**Universal Gantry Mount**
Vendor-specific gantry holding device designed to keep PTW ionization chamber arrays secure at isocenter at any gantry position.

**Inclinometer**
Device to measure the gantry angle. Allows dose measurements as a function of time or gantry angle to verify partial plans.

**OCTAVIUS® Trolley**
Robust, functionally designed trolley to conveniently store and move OCTAVIUS® phantom and detector. Dimensions (WDH): 60 cm x 64 cm x 94 cm, weight: 33 kg

**Workflow: Pre-Treatment Verification “Field-by-Field”**
Verification plan is calculated in TPS system. TPS dose planes is loaded into VeriSoft®. OCTAVIUS® detector is set up and aligned on patient couch. OCTAVIUS® detector is installed (gantry 90°). Measured dose map is displayed in VeriSoft®. Measured and calculated dose maps are compared in VeriSoft®. Green: Verification passed. Red: Deviations outside tolerance.

**Workflow: Pre-Treatment Verification “Composite Plan”**
Verification plan is calculated in TPS system. TPS dose planes is loaded into VeriSoft®. OCTAVIUS® phantom with detector is set up and aligned on patient couch. OCTAVUS® phantom with detector is installed according to plan. Measured dose map is displayed in VeriSoft®. Measured and calculated dose maps are compared in VeriSoft®. Green: Verification passed. Red: Deviations outside tolerance.

**Workflow: Pre-Treatment Verification**
Verification plan is calculated in TPS system. TPS dose planes is loaded into VeriSoft®. OCTAVUS® phantom with detector is set up and aligned on patient couch. OCTAVUS® phantom with detector is installed according to plan. Measured dose map is displayed in VeriSoft®. Measured and calculated dose maps are compared in VeriSoft®. Green: Verification passed. Red: Deviations outside tolerance.

**Workflow: In Vivo Treatment Verification during each fraction**
DAVID® detector is inserted into accessory tray of LINAC. Reference measurement is taken and shown as transparent bar graph. Patient is set up on patient couch. Patient is being irradiated. DAVID® measures dose length product of each leaf pair and transfers data wirelessly to a remote PC. Measured dose is overlaid with reference dose. Deviations are displayed color-coded: Green bars: Irradiation delivered as planned. Red bars: Deviations outside tolerance.

**Workflow: In Vivo Treatment Verification**
Verification plan is calculated in TPS system. TPS dose planes is loaded into VeriSoft®. OCTAVUS® phantom with detector is set up and aligned on patient couch. OCTAVUS® phantom with detector is installed according to plan. Measured dose map is displayed in VeriSoft®. Measured and calculated dose maps are compared in VeriSoft®. Green: Verification passed. Red: Deviations outside tolerance.
### OCTAVIUS® 2D QA Systems Overview

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<td>&quot;Standard&quot;</td>
<td>&quot;Horizontal&quot;</td>
<td>&quot;In vivo&quot;</td>
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#### Applications
- Pre-Treatment "field-by-field" Pre-Treatment "composite plan" In vivo Verification
- LINAC QA

#### Supported Techniques
- 2DID
- Step & Shift
- Sliding Window
- Arc BERT (IMRT/RapidArc®, VMAT)
- OctaviusTomotherapy®
- SRC/IBERT
- CyberKnife

#### Components
- VeriSoft® Patient Plan Verification Software
- OCTAVIUS® Detector
- OCTAVIUS® Phantom
- DAVID® System

#### Options
- LINAC QA for OCTAVIUS®
- DIAMOND® Secondary Check Software
- DAVID® for In vivo Verification
- Film Measurement
- Chamber Measurement
- Imageology
- Dimension
- CyberKnife® Accessory Package
- OCTAVIUS® 1500 Upgrade Package
- OCTAVIUS® II 1500 Upgrade Package
- OCTAVIUS® II 1000 Upgrade Package

#### OCTAVIUS® Detector
- Type: Liquid-filled ionization chambers
- Number of detectors: 977
- Detector size: 2.3 mm x 2.3 mm x 0.5 mm (0.020 cm³)
- Detector spacing: 10 mm center-to-center
- Max. field size: 10 cm x 10 cm
- Reproducibility: ± 0.5%
- Dead time: Zero
- Repetition rate: 100 ms
- Measured quantities: Absorbed dose to water (Gy), absorbed dose rate to water (Gy/min)
- Resolution: 0.1 mGy, 0.1 mGy/min
- Measurement range: 0.01 to 1000 Gy
- Dimensions: 30 cm x 46.7 cm x 2.2 cm (W x D x H)
- Weight: 8 kg
- Power supply: 100 ... 265 VAC, 50 ... 60 Hz
- PC connection: Ethernet, RIS22
- Extent of supply: OCTAVIUS® Detector 1500, Detector Interface 4000

#### OCTAVIUS® Radar Detector 1000
- Type: Detector: 2D parallel-wire ionization chambers
- Number of detectors: 225
- Detector size: 4.4 mm x 4.4 mm x 3 mm (0.06 cm³)
- Detector spacing: 7.1 mm center-to-center
- Max. field size: 27 cm x 27 cm
- Reproducibility: ± 0.5%
- Dead time: Zero
- Repetition rate: 100 ms
- Measured quantities: Absorbed dose to water (Gy), absorbed dose rate to water (Gy/min)
- Resolution: 0.1 mGy, 0.1 mGy/min
- Measurement range: (0.5 ... 48) Gy/min
- Reference point: 7.5 mm below the surface of the array
- Housing material: PC, GRP (frame)
- Dimensions: 30 cm x 46.7 cm x 2.2 cm (W x D x H)
- Weight: 6 kg
- Power supply: 100 ... 265 VAC, 50 ... 60 Hz
- PC connection: Ethernet, RIS22
- Extent of supply: OCTAVIUS® Detector 1000, Detector Interface 4000

#### OCTAVIUS® Detector 729
- Type: Detector: 2D parallel-wire ionization chambers
- Number of detectors: 729
- Detector size: 5 mm x 5 mm x 5 mm (0.125 cm³)
- Detector spacing: 10 mm center-to-center
- Max. field size: 27 cm x 27 cm
- Reproducibility: ± 0.5%
- Dead time: Zero
- Repetition rate: 200 ms
- Measured quantities: Absorbed dose to water (Gy), absorbed dose rate to water (Gy/min)
- Resolution: 0.1 mGy, 0.1 mGy/min
- Measurement range: (0.5 ... 48) Gy/min
- Reference point: 7.5 mm below the surface of the array
- Housing material: GRP
- Dimensions: 30 cm x 46.7 cm x 2.2 cm (W x D x H)
- Weight: 5.4 kg
- Power supply: 100 ... 265 VAC, 50 ... 60 Hz
- PC connection: Ethernet, RIS22
- Extent of supply: OCTAVIUS® Detector 729, Detector Interface 4000

#### Technical Specifications

- **OCTAVIUS® 2D Phantom**
  - Design: Octagon-shaped solid body phantom with two exchangeable bottom parts (LINAC phantom with air cavity, CT phantom)
  - Dimensions: Diameter 32 cm, length 32 cm
  - Weight: 24 kg
  - Material: Polyethylene (water equivalent within ~ 2%)
  - Density: 1.04 g/cm³
  - Extent of supply: Detector-specific OCTAVIUS® LINAC phantom, CT phantom

- **DAVID® Detector**
  - Type: Transparent multi-wire ionization chamber (MIC technology)
  - Number of measurement wires: Dependent on MLC
  - Beam attenuation: Approx. 5% for 6 MV photons; compensation via tray factors
  - Dimensions: Dependent on MLC
  - Weight: 3 kg, incl. battery
  - Power supply: 180 W rechargeable batteries, incl. charger; approx. 16 hours operation
  - Data transmission: Bluetooth, 1 mW power – Bluetooth class 2
  - Transmission distance: Up to 10 m distance between measurement electronics and transceiver
  - PC connection: RS232 (transceiver)
  - Extent of supply: Vendor-specific DAVID® detector, transceiver, DAVID® software

**VeriSoft® 6.1 or higher**
- Operating system: Microsoft® Windows® XP Professional, Vista® Business x32/x64, Windows 7 Professional x32/x64, Windows 8 Professional x32/x64
- Processor: Multi-core processor
- Memory (RAM): 4 GB, 8 GB recommended
- Hard disk: Min. 500 MB of free space for application software and min. 1.5 GB of free space for HET Framework 2.0, 3.5 and 4.0
- Screen resolution: 1280 x 1024 or higher
- Interfaces: Network interface, Other: Windows® Internet Explorer® 8.0 or higher, Adobe® Reader® 7.0 or higher
- Extent of supply: VeriSoft® software

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**DAVID®**
- Detector type: Transparent multi-wire ionization chamber (MIC technology)
- Number of measurement wires: Dependent on MLC
- Beam attenuation: Approx. 5% for 6 MV photons; compensation via tray factors
- Dimensions: Dependent on MLC
- Weight: 3 kg, incl. battery
- Power supply: 180 W rechargeable batteries, incl. charger; approx. 16 hours operation
- Data transmission: Bluetooth, 1 mW power – Bluetooth class 2
- Transmission distance: Up to 10 m distance between measurement electronics and transceiver
- PC connection: RS232 (transceiver)
- Extent of supply: Vendor-specific DAVID® detector, transceiver, DAVID® software

**VeriSoft® 6.1 or higher**
- Operating system: Microsoft® Windows® XP Professional, Vista® Business x32/x64, Windows 7 Professional x32/x64, Windows 8 Professional x32/x64
- Processor: Multi-core processor
- Memory (RAM): 4 GB, 8 GB recommended
- Hard disk: Min. 500 MB of free space for application software and min. 1.5 GB of free space for HET Framework 2.0, 3.5 and 4.0
- Screen resolution: 1280 x 1024 or higher
- Interfaces: Network interface, Other: Windows® Internet Explorer® 8.0 or higher, Adobe® Reader® 7.0 or higher
- Extent of supply: VeriSoft® software
Dosimetry Pioneers since 1922.

It all started with a brilliant invention - the revolutionary Hammer dosemeter in 1922. Ingenuity coupled with German engineering know-how shaped the company's history, leading to innovative dosimetry products that later became an industry standard. Over the years, PTW has maintained its pioneering spirit, growing into a global market leader of dosimetry and QA solutions well known for its product excellence and innovative strength. Today, PTW dosimetry is one of the first choices for healthcare professionals in radiation therapy, diagnostic radiology, nuclear medicine and health physics.

For more information on OCTAVIUS® QA systems and other PTW products, visit www.ptw.de or contact your local PTW representative:

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