

ArcCHECK[®]

The Benchmark for
3D Pre-Treatment QA



SUN NUCLEAR
A MIRION MEDICAL COMPANY

The World's Most Selected 4D Array

ArcCHECK® is the only detector array specifically designed to identify errors in rotational delivery. It's the ideal solution for: 4D Patient Pre-Treatment QA for IMRT, VMAT, SBRT and MRgRT; including specialty systems such as Varian Medical Systems® Halcyon™ System and Ethos™ Therapy; and Accuray TomoTherapy® and Radixact™ Systems.

Powerful, Patient-Specific QA

ArcCHECK is recommended by AAPM Task Group 218 for 3D measurement requirements. It measures and correlates gantry angle, leaf-end position, absolute dose and time to identify any potential source of error throughout the patient volume. Independent absolute dose measurements enable the gold standard for stringent and efficient patient plan and Machine QA testing.

Patient Plan QA

Stringent, fully independent measurement QA of patient plan and delivery with SNC Patient™ software

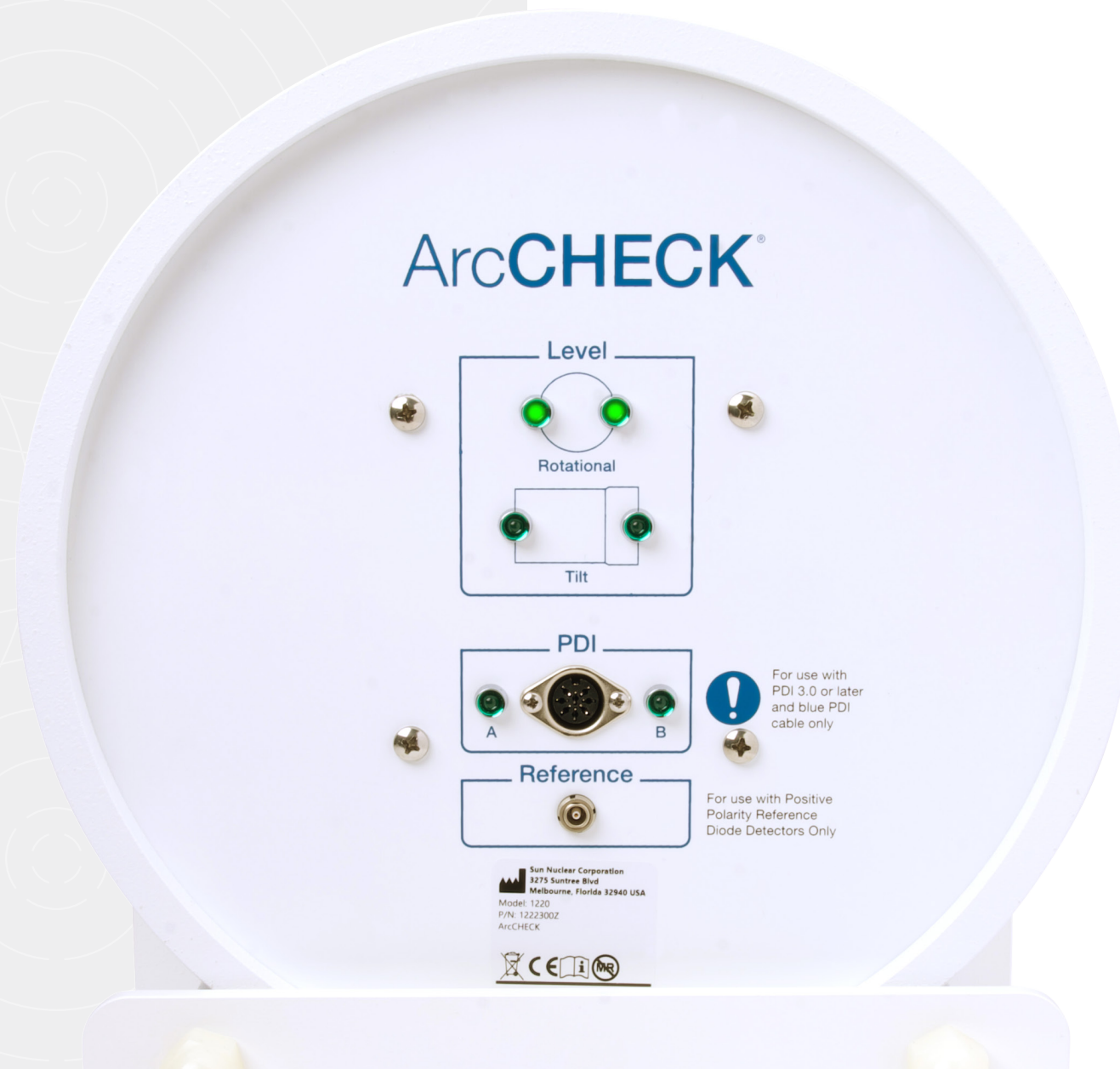
Machine QA

Dynamic Machine QA testing routines are provided for a wide variety of tests with SNC Patient software

Hardware

ArcCHECK embodies the spirit of independent Medical Physics measurement.

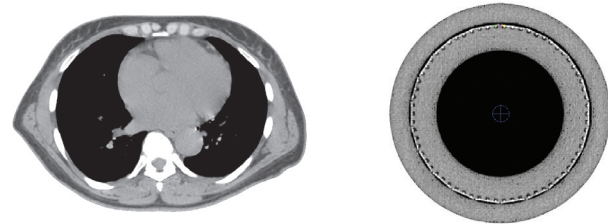
- 1,386 SunPoint® Diode Detectors (0.019 mm³)
- Consistent Beams Eye View (BEV) for all gantry angles measuring entrance and exit dose
- Real-time electrometer measures every pulse, as well as composite and sub-arcs
- Interior cavity allows for a wide range of detector and tissue equivalent inserts



See the Entire Picture

An Ideal Geometry

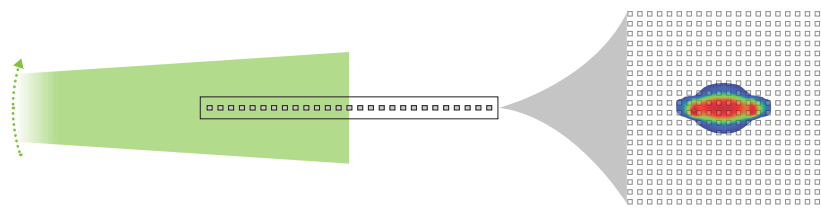
Phantoms are ideally shaped like a patient. The cylindrical design of ArcCHECK intentionally simulates patient geometry to better match reality.



Because ArcCHECK detectors always face the delivery beam regardless of gantry angle, detection of very small gantry angle errors are possible. In contrast, when a 2D array is irradiated obliquely, the geometry collapses to 1D. Even when there is no detector shadowing effect, significant information is lost on a 2D array, and errors up to 10° are missed 75% of the time.¹

With ArcCHECK, gantry angle, leaf-end position, absolute dose, and time (4D) are measured and correlated to identify sources of error. Dose accuracy is improved and errors can be traced to the treatment planning system, the delivery system, or the imaging system.

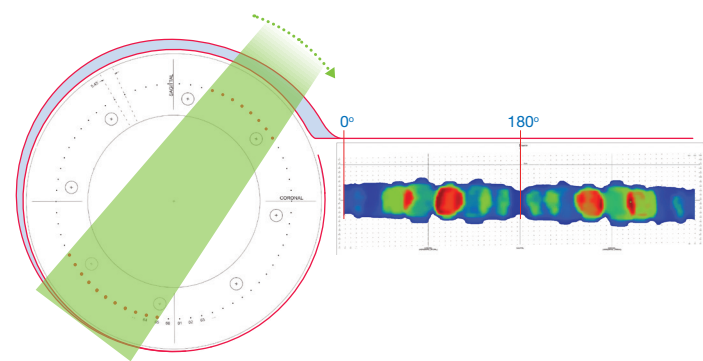
What You See with a 2D Array



2D Array Measurement

An inherent limitation of 2D arrays is an inability to capture all of the dose information for rotational deliveries.

What You See with ArcCHECK



ArcCHECK Measurement

ArcCHECK displays BEV dose distribution throughout the entire arc delivery. More data is available to perform a more thorough QA analysis.



"Significant information is lost on a 2D array, and errors up to 10° are missed 75% of the time."¹

1. Hauri, P et al., "Clinical evaluation of an anatomy-based patient specific quality assurance system," JACMP, 15, 2 (2014)

Interior Measurements

Measuring completely around the isocenter in a uniform manner for each angle is a more stringent measurement than a simple composite dose at the isocenter. Errors visible in the isocenter are also visible in the surrounding dose measurements, but in more detail.

ArcCHECK measures entry and exit dose for every angle. For each beam angle, ArcCHECK measures high dose regions at the entrance and low dose regions at the exit, detecting potential delivery and TPS modeling errors for both high and low dose levels. For those who would like to measure the dose at isocenter or elsewhere within the cavity, Sun Nuclear offers the versatile MultiPlug™ and CavityPlug™ with detector insert capabilities.

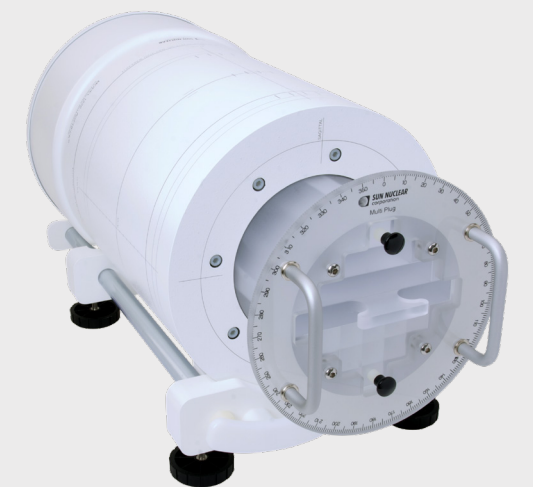
CavityPlug™

- Precision fitted to ArcCHECK cavity
- Measure dose in cavity center
- Precision milled holders available for a wide range of detectors.
 - Custom holders can be created for any detector not currently available
- Solid insert included to achieve solid cavity



MultiPlug™

- Hounsfield Unit (HU) conversion testing
- Tissue equivalent inserts, available as options:
 - Brain
 - Bone
 - Breast
 - Liver
 - Lung
 - Muscle
 - Apidose
 - Titanium
 - Water/Air
- Dose in up to 25 locations
- Film cassette insert
- Bezel angle indicator for rotation within cavity
- Precision milled detector holder included
 - Solid insert included to achieve solid cavity

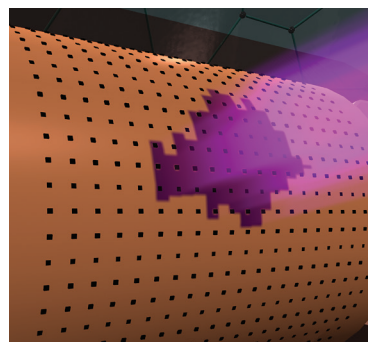


Helical Detector Grid

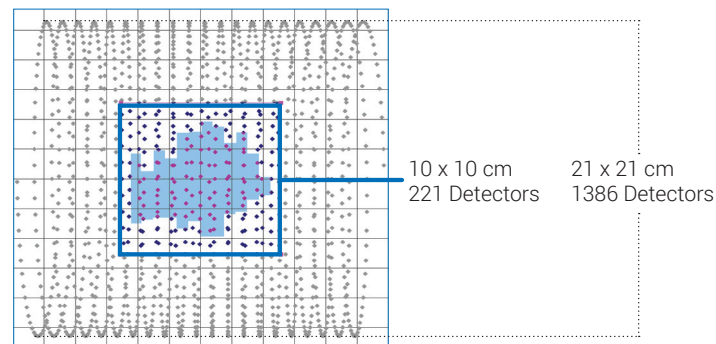
Detectors are arranged on a HeliGrid™ which increases the sampling rate and reduces BEV detector overlap and shadowing.

- An ArcCHECK 10 x 10 cm² area contains 221 detectors
- Entrance and exit dose are measured, effectively doubling the detector density in the measurement field

Beam Delivery



ArcCHECK Detector BEV



Virtual Inclinator™

ArcCHECK calculates gantry angle independently using entrance and exit dose.

- Virtual Inclinator is accurate to $\pm 1^{\circ 2}$
- System design eliminates the need for additional inclinometer cables and mounting to the delivery system.

Larger Fields

Two ArcCHECK measurements can be combined in SNC Patient software for larger field sizes.

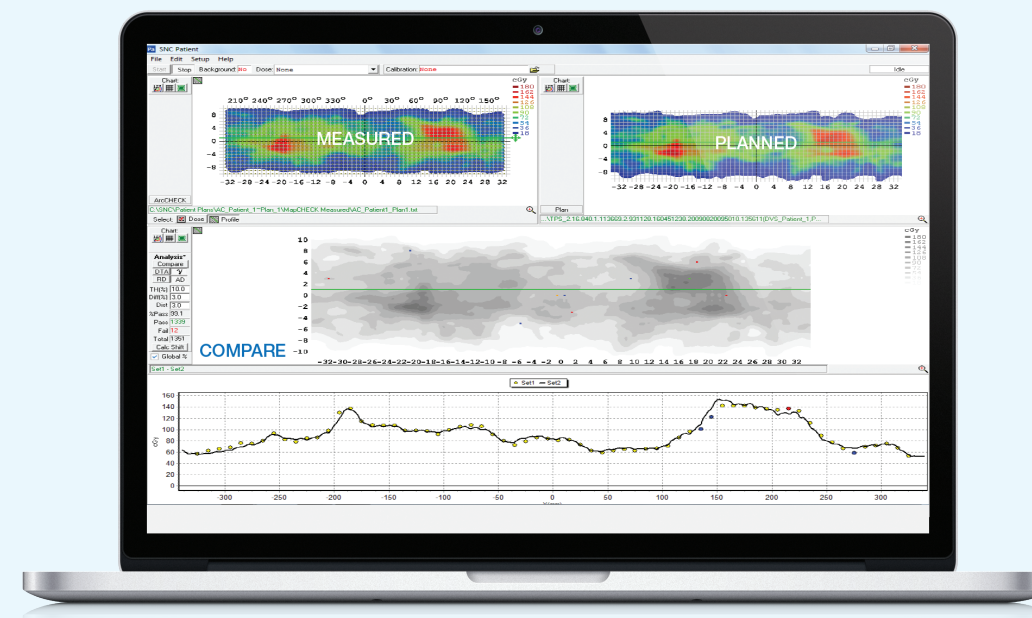
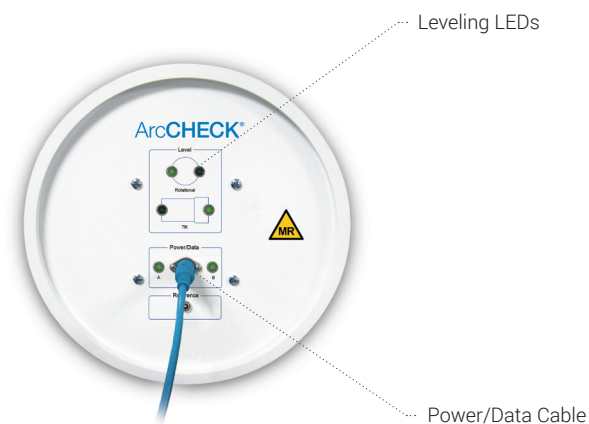
Smaller Fields

Merge feature provides 442 detectors within a 10x10 cm² field.

Easy Setup

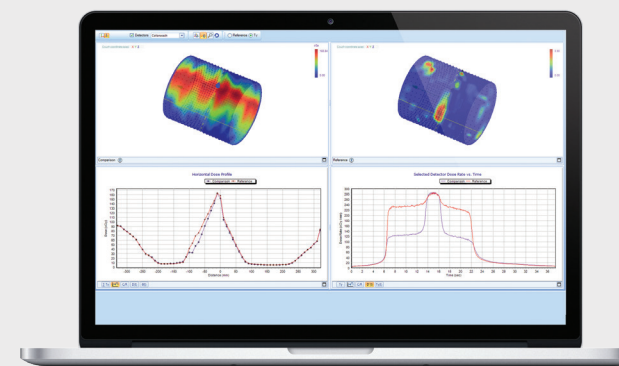
ArcCHECK contains a sophisticated yet easy to use leveling system that ensures quick and accurate setup.

- With integrated rotation and tilt inclinometers, the leveling LEDs relay setup status in real-time.



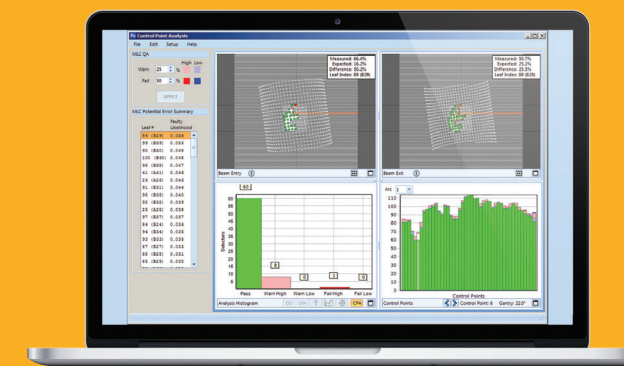
3D Dose Analysis

With a single mouse click, SNC Patient software compares measured ArcCHECK dose points to planned dose points. Compare normalized data or absolute dose data using Distance to Agreement (DTA), Gamma (γ), and Gradient Compensation.



4D Beam Reproducibility Analysis

Speed up TG-53 checks and monthly VMAT tests with 4D QA of your month-to-month machine performance. Users can analyze when, where, and in what magnitude discrepancies are occurring.



Dynamic MLC Analysis

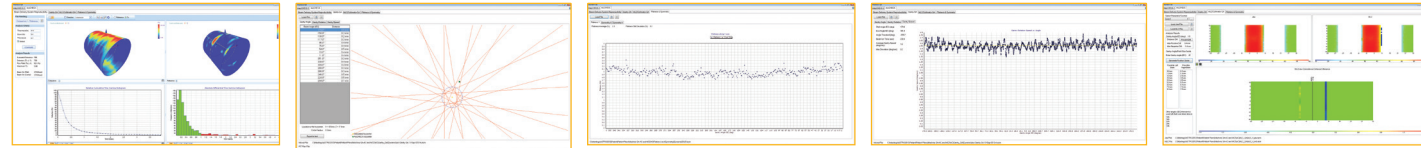
Evaluate the difference between the planned and delivered MLC pattern, and identify leaves that may indicate required service. Additional machine QA tests are also included.

2. Kozelka, J. et al., "Optimizing the accuracy of a helical diode array dosimeter," Med. Phys., 38, 9 (2011)

Machine QA Analysis

Use ArcCHECK for a wide variety of machine QA tests in dynamic and rotational mode.

- Dynamic Gantry Rotation QA*
- Dynamic Gantry Angle QA*
- Dynamic Gantry Speed QA
- Dynamic Symmetry and Flatness*
- MLC QA
- Treatment Reproducibility QA



*Also available with static angles

INTEGRATION

Integration with the SunCHECK® Platform

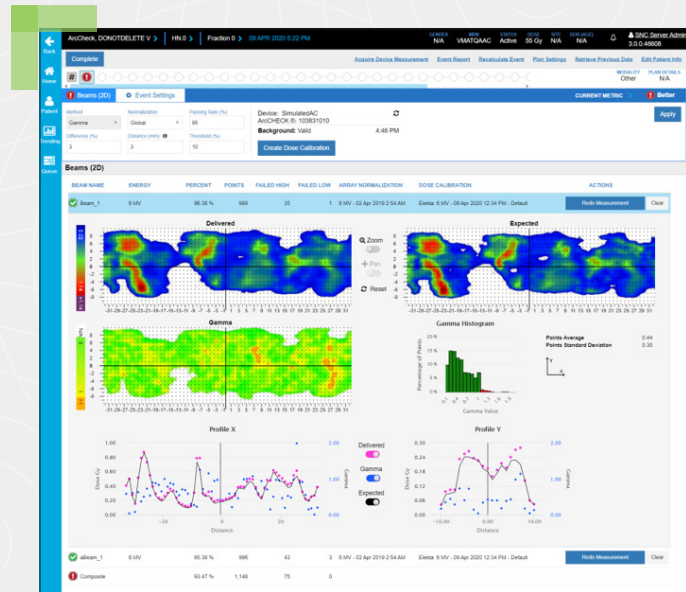
Together, ArcCHECK and SunCHECK® Patient provide unmatched flexibility for pre-treatment QA, improved root cause analysis, and efficient audit QA

Simplified Workflow

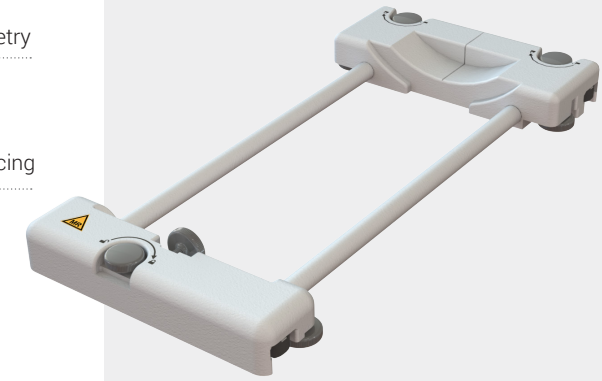
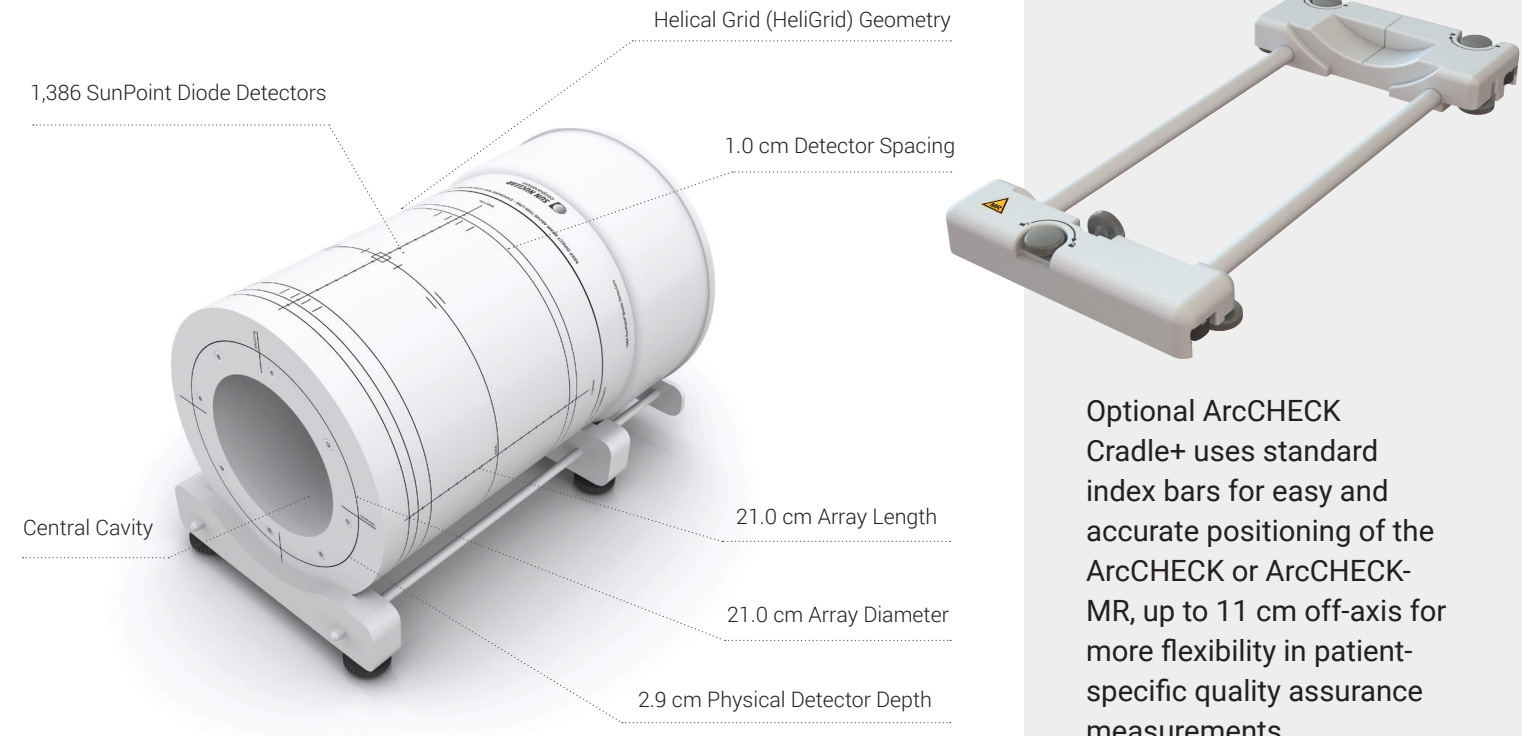
Easily transition between ArcCHECK Patient QA records and SunCHECK Patient QA records, all in one Platform, saving ~30 minutes per patient otherwise spent searching for data.

Separate Error Sources

More easily identify sources of error. DoseCHECK™ software identifies algorithm errors. ArcCHECK identifies delivery errors.



Specifications



Optional ArcCHECK Cradle+ uses standard index bars for easy and accurate positioning of the ArcCHECK or ArcCHECK-MR, up to 11 cm off-axis for more flexibility in patient-specific quality assurance measurements.

Detector Type:	SunPoint® Diode Detectors
Detector Quantity:	1,386
Detector Spacing (cm):	1.0
Array Diameter (cm):	21.0
Array Length (cm):	21.0
Cavity Diameter (cm):	15.0
Inherent Buildup (g/cm²):	3.3
Inherent Backscatter (g/cm²):	3.3
Detector Physical Depth (cm):	2.9
Array Geometry:	Helical Grid (HeliGrid) 1 cm offset
Phantom Material:	PMMA (Acrylic)
Active Detector Area (mm²):	0.64
Detector Sensitivity (nC/Gy):	32.0
Max Dose/Pulse (Gy):	0.002
Detector Volume (mm³):	0.019

Detector Stability:	0.5% / kGy at 6 MV
Dose Rate Dependence:	±1% over the range 150 MU/min to 1400 MU/min
Update Frequency (ms):	50
Number of Connection Cables:	Single power/data cable
Dimensions (Total Length)(cm):	44.29
Weight (kg):	15.4

Compatibility

FFF:	Yes
MR:	Yes (ArcCHECK-MR®)
Varian and Elekta C-arm linacs, Varian Medical Systems® Halcyon™ System, Ethos™ Therapy and Accuray's TomoTherapy® and Radixact™ Systems:	Yes
SunCHECK:	Direct device connectivity within SunCHECK Patient

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**Sun Nuclear
Headquarters (US)**

Phone

+1 (321) 259-6862

Address

3275 Suntree Blvd,
Melbourne, FL 32940

**Sun Nuclear
Wisconsin (US)**

Phone

+1 (800) 426-6391

Address

7600 Discovery Drive,
Middleton, WI 53562

**Sun Nuclear
CIRS, Virginia (US)**

Phone

+1 (757) 855-2765

Address

900 Asbury Ave
Norfolk, VA 23513

**Sun Nuclear
GmbH**

Phone

+49 6102-50495-00

Address

Gutenbergring 67 A 22848
Norderstedt, Germany

**SunServices™
Center - EMEA**

Phone

+31 20 399 90 41

Address

Verlengde Poolseweg 36
4818 CL Breda, The
Netherlands



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