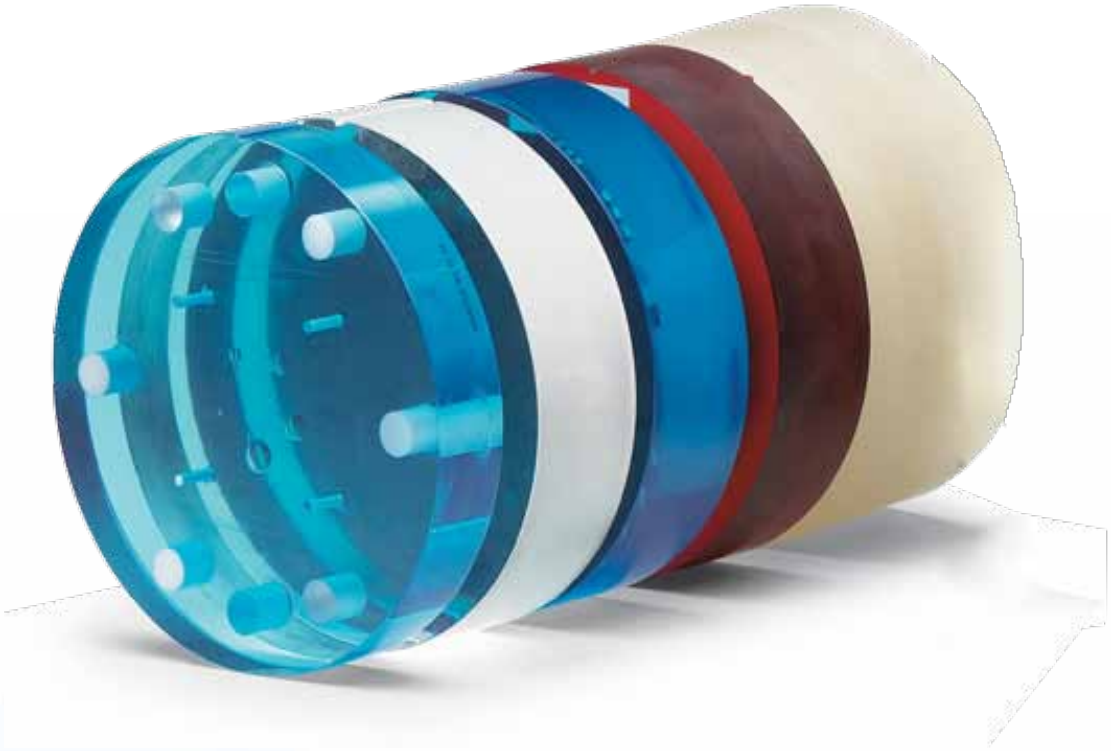
southern scientific

CATPHAN® 500/600
PHANTOM

INTERNATIONALLY RECOGNISED FOR MEASURING THE MAXIMUM OBTAINABLE PERFORMANCE OF AXIAL, SPIRAL AND MULTI-SLICE CT SCANNERS.



EXTENSIVE RESEARCH

The Phantom Laboratory and physicist David Goodenough, Ph.D., have worked together to develop the Catphan® Phantoms. Dr Goodenough has been involved in CT performance testing since the first generation EMI scanner.

The new Catphan® designs are based on over 25 years of scientific research and direct field experience in the evaluation of medical imaging equipment.

CATPHAN® 500/600
DESIGN AND CONSTRUCTION

CONVENIENT SET-UP

The Catphan® Phantom's patented design includes many exclusive features that make it easy to achieve perpendicular alignment. As all of the test sections are arranged at prescribed intervals from the first module, operators can quickly scan all test sections in a single sequence, eliminating the need to reposition the phantom for each section.

In addition the integral case mount allows the phantom to be positioned in the scanner, supported off the end of the table, eliminating table artifacts. The case is also equipped with a level to aid in positioning. Fast, easy positioning and the universal mount of the Catphan® Phantom makes it ideal for daily quality assurance programs on any scanner.

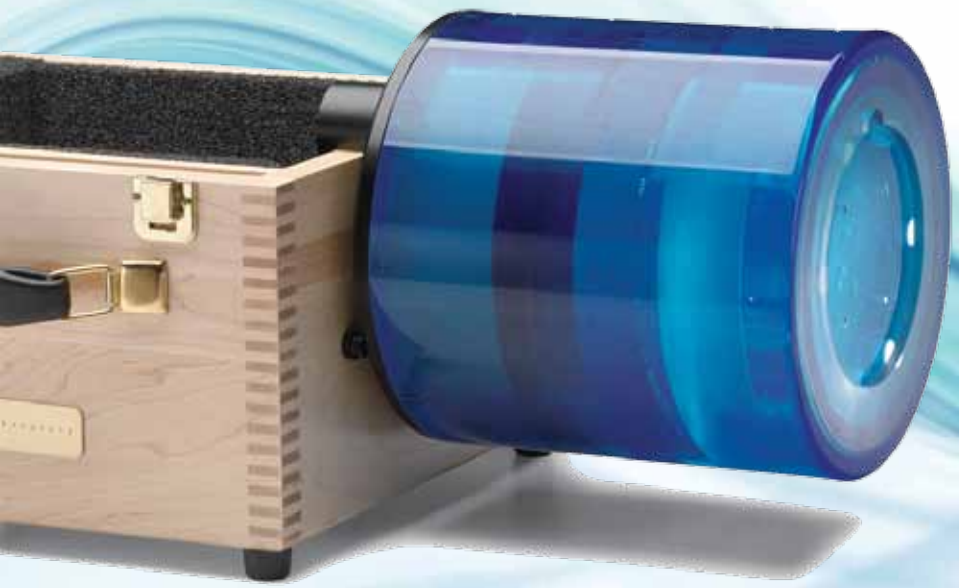
SOLID-CART CONSTRUCTION

Catphan® Phantoms are constructed from modules that fit snugly into a durable 20 cm housing. Both the 500 and 600 Catphan® models are made from solid-cast materials, eliminating material absoption of water and leaks associated with water bath phantoms, as well as problems related to varied water sources.

MODULAR DESIGN

The Catphan® modular design allow test module to be interchanged. As your testing needs change and new modules are developed, you can upgrade test modules that are compatible with your Catphan® system. Additionally, the modular design makes the Catphan® system ideal for traveling physicists and engineers who conduct comprehensive evaluations of CT scanners at multiple locations, as they are easily transportable and no draining is required between uses.

This brochure deals with two primary Catphan® models: The **Catphan® 500** 5th generation model designed to address specific concerns associated with spiral CT scanners and the **Catphan® 600** 6th generation model designed to evaluate the maximum performance potential of multi-slice CT scanners.

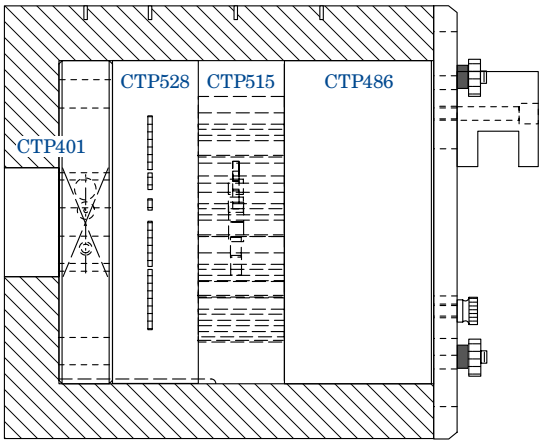


FAST, EASY POSITIONING AND THE UNIVERSAL MOUNT OF THE CATPHAN® PHANTOM MAKES IT IDEAL FOR DAILY QA PROGRAMS ON ANY SCANNER

CATPHAN® 500/600
DESIGN & FEATURES

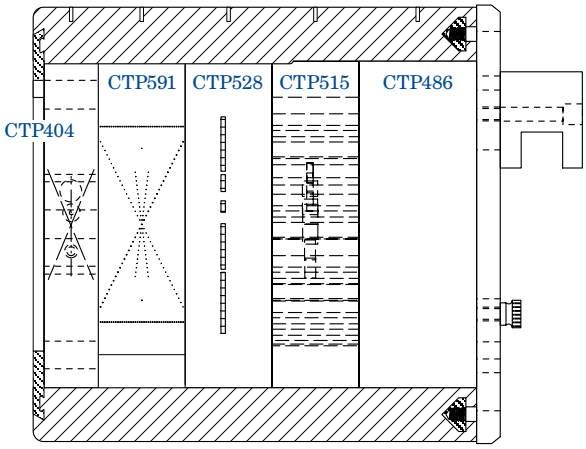
CATPHAN® 500

Designed to evaluate the maximum performance potential of axial and spiral CT scanners.



CATPHAN® 600

Designed to evaluate the maximum performance potential of multi-slice CT scanners with enhanced sinsitometry samples for radiation therapy planning.



Test Module	500	600
CTP401 module with slice width, pixel size and sensitometry (Teflon, Acrylic, LDPE, Air)	•	
CTP404* module with slice width, pixel size and sensitometry (Teflon, Delrin Acrylic, Polystyrene, H_2O, LDPE, PMP, Air)		•
CTP515 low contrast module with supra-slice and subslice contrast targets	•	•
CTP486 image uniformity module	•	•
CTP591** module with slice geometry and point source bead module		•

*The CTP404 module contained in the Catphan® 600 includes three additional sensitometry targets along with a small vial for a water sample. See the description for the CTP404 for more details.

TESTS - SUMMARY

- Scan slice geometry (slice width and slice sensitivity profile)**
- High resolution (1 to 21 line pairs per cm)
- Phantom position verification
- Patient alignment system check
- Low contrast sensivity
- Spatial uniformity
- Scan incrementation
- Noise (precision) of CT systems
- Circular symmetry
- Sensitometry (linearity)*
- Pixel (matrix) size
- Point spread function and modulation transfer function (MTF) for the x, y and z axes**

**The CTP591 module enables these test measurements to be conducted in multiple slices covering a range of detector positions from a singlescan sequence. This eliminates the need to reposition the table and repeat scans to cover the z axis range of the multi-slice detectors.

CTP401/404

SLICE GEOMETRY & SENSITOMETRY MODULE

Diameter: 15 cm Thickness: 25 mm

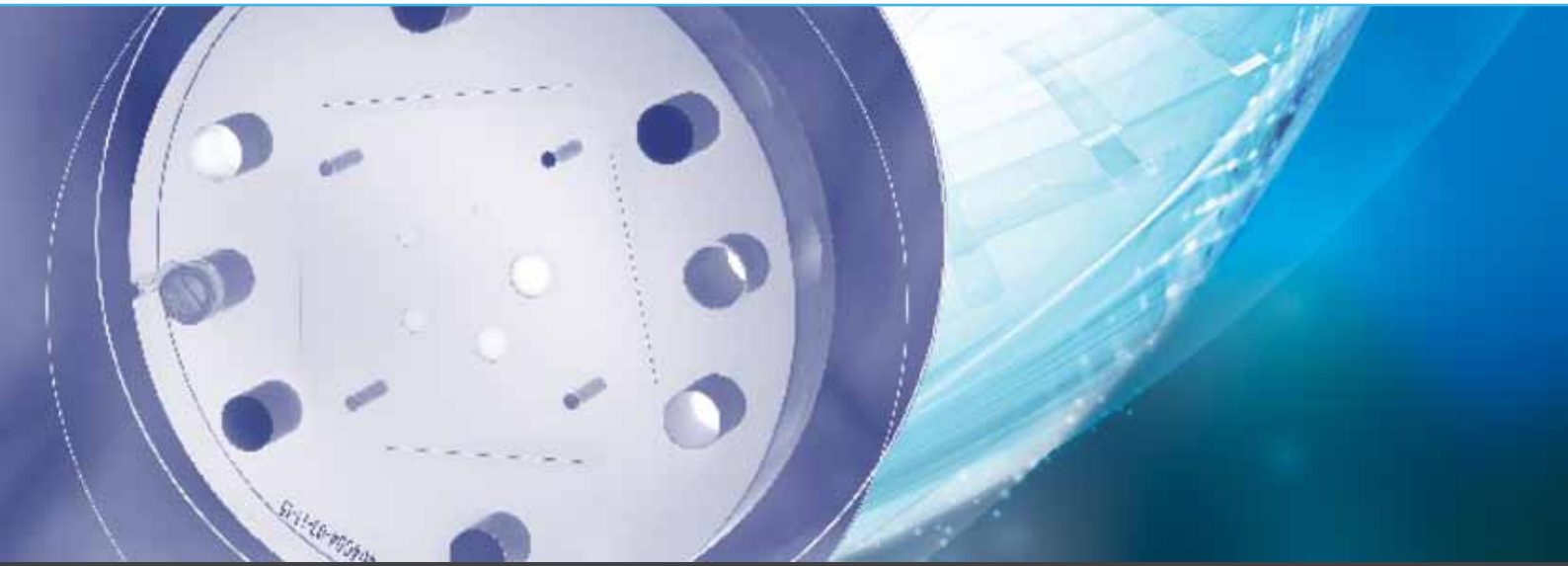
- Scan slice geometry (slice width)
- Circular symmetry
- Phantom position verification
- Sensitometry (CT number linearity)
- Patient alignment system check
- Pixel (matrix) size
- Scan incrementation

UNIQUE ADVANTAGES

A 23° ramp angle instead of the 45° angle commonly used in phantoms to produce a ramp image 2.4 times longer, greatly reduces the effects of imprecise image measurements. Additionally, thin wire ramps are used to reduce the over-range streaking artifacts found in the more commonly used thick ramps, particularly in thin slice geometry (1 mm or 2 mm slice widths). The two opposing pairs of ramps allow operators to easily verify whether the phantom is correctly aligned with the scanner axis. By measuring the ratio between opposed ramps, gantry angles up to 10° can be verified, avoiding erroneous measurements.

The CTP401 test module in the Catphan® 500 includes sensitometry samples for Teflon, Acrylic, LDPE and Air. The CTP404 test module used in the Catphan® 600 includes sensitometry samples for Teflon, Delrin, Acrylic, Polystyrene, LDPE, PMP, Air and a small vial for water. Pixel size can be calculated by counting the number of pixels between the test cylinders in the x and y directions.

The module also contains fixe acrylic spheres to evaluate the scanner's imaging of subslice spherical volumes. The diameters of the acrylic spheres are 2, 4, 6, 8 and 10 mm.



CTP528
HIGH RESOLUTION MODULE

Diameter: 15 cm
Thickness: 40 mm

- Scan slice geometry (slice width and slice sensitivity profile)
- High resolution (1 to 21 line pairs per cm)
- Point spread function and modulation transfer function (MTF) for the x, y and z axes

The unique design of the CTP528 minimises vidual artifacts by reducing the amount of high contrast material. The 2 mm thick aluminium contrast figures are cast into position on the radial guage, which has resolution sections ranging from 1 to 21 lines per cm. This radial design pattern eliminates the possibility of streaking artifacts from other test objects.

This section, combined with spherical beads - rather than wire - for MTF measurements, allows operators to avoid the tedious and time consuming step of positioning and aligning MTF wires with the z axis. The point source beads also eliminate the over-ranging problems and streaking artifacts that occur with MTF wires, because the bead density is volume averaged with the surrounding material.

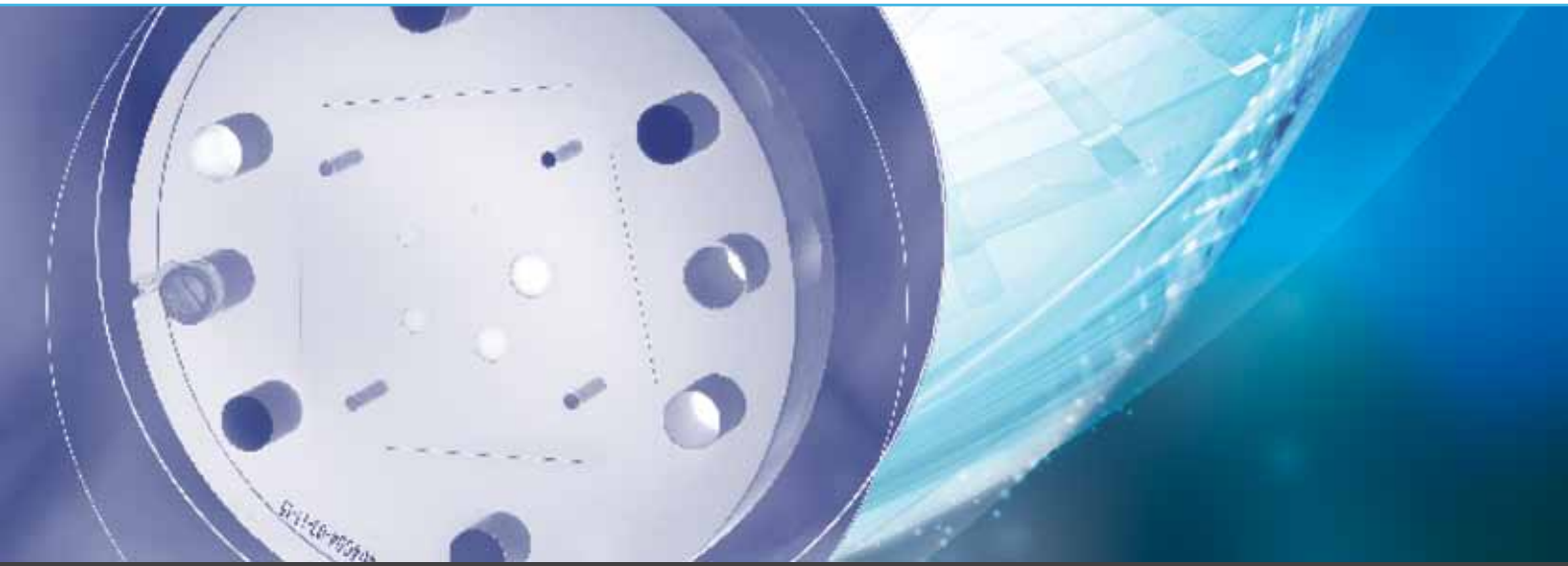
CTP486
UNIFORMITY MODULE

Diameter: 15 cm
Thickness: >40 mm

- Spacial Uniformity (noise)
- Noise (precision) of CT systems

The CTP486 does not leak and is not damaged by exposure to freezing temperatures because it does not use water. While water is generally considered the standard calibration material, many physicists prefer using our CTP486 solid-image uniformity module because it provides consistent results, is much more convenient to use than modules using water-filled tanks, and eliminates variations due to different water sources.

The CTP 486 module is cast from a uniform material that has a CT number within 2% (0-2H0) of water. This solid material's high radial and axial uniformity makes it an ideal substitute for water. It has been thoroughly tested over a wide variety of variables in the x, y and z planes and has proven stable in all applications.



CTP515
LOW CONTRAST MODULE

Diameter: 15 cm Thickness: 40 mm

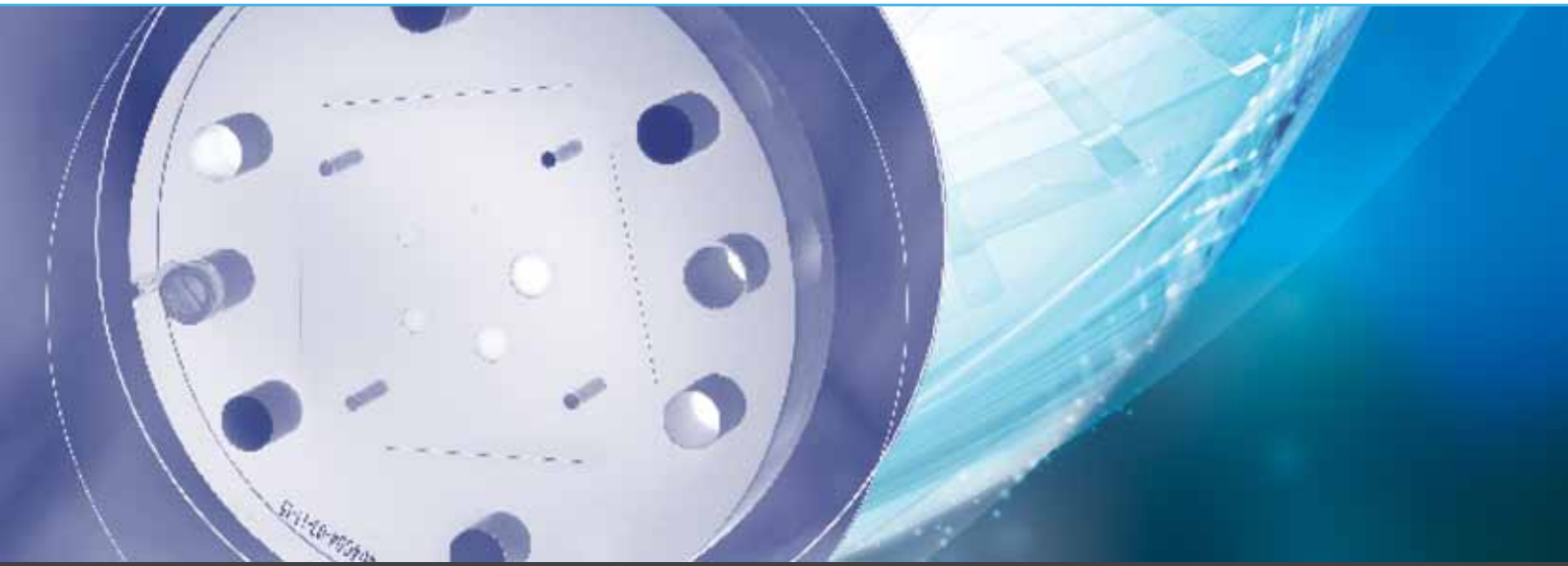
- Low contrast sensitivity
- Comparative subslice and supra-slice low contrast sensitivity

UNIQUE ADVANTAGES

The CTP515 consists of a series of cylindrical rods of various diameters and three contrast levels to measure low contrast performance. The 40 mm-long rods provide consistent contrast values at all z-axis positions, thereby avoiding any volume-averaging errors as you scan through the section. The unique subslice test objects enable evaluation of the effectiveness of different scan protocols (pitch, slice width and reconstruction algorhythms) in resolving subslice low contrast objects.

For selection of helical and multi-slice image protocols, unique subslice low contrast targets (truncated cylinders) have been included in this module. Comparing the images obtained by scanning the subslice targets with different imaging settings (slice width, pitch and reconstruction algorithms) provides valuable information to assist with the selection of optimal protocols for identifying small low contrast objects such as tumors.

Contrast	Length	Diameters
SUPRA-SLICE CONTRAST RODS		
0.3%	40 mm	2,3,4,5,6,7,8,9,15 mm
0.5%	40 mm	2,3,4,5,6,7,8,9,15 mm
1.0%	40 mm	2,3,4,5,6,7,8,9,15 mm
SUB-SLICE CONTRAST RODS		
1.0%	7 mm	3,5,7,9 mm
1.0%	5 mm	3,5,7,9 mm
1.0%	3 mm	3,5,7,9 mm



CTP591
BEAD GEOMETRY MODULE

Diameter: 15 cm Thickness: 40 mm

- Slice width for thin slices
- Slice width for thick slices
- MTF and SSP with two size point sources
- Test on multiple slices in a multi-slice sequence

UNIQUE ADVANTAGES

The CTP591 Bead Geometry Module contains both coarse ramps with 1 mm z axis increments and precision ramps with 0.25 mm z axis increments. To maintain a strong signal with an appropriate diameter, the coarse ramps use 0.28 mm diameter tungsten carbide beads.

The use of beads enables quick assessment and comparison of slice thickness in a multi-slice sequence verifying consistency across the detector area.

The unique ramps are positioned in opposed pairs to eliminate errors caused by non-perpendicular alignment.

There are 2 pairs of coarse ramps and 1 pair of precision ramps. The coarse ramps each contain 39 beads, transversing all but the last millimetre of the 40 mm module. The precision 0.25 mm ramps each contain 25 beads covering a 6 mm range.

For detailed MTF and SSP calculations, two isolated beads 0.28 mm and 0.018 mm in diameter are located in the mid plane of the module.

For thin slice high resolution measurements, a 50µ diameter steel MTF wire runs through the full 40 mm thickness of the module.

NOTE: *This module is ideal for efficient processing by automated software. The IRIS has developed new CT Auto QA software that is specifically designed to measure slice thickness using the bead ramps and calculates the MTF from the offset wire and the two isolated bead impulse sources.*

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