

## SPECIALLY DESIGNED TEACHING & TRAINING AID FOR RADIOLOGICAL TECHNOLOGISTS



Available in opaque or transparent, with or without cervical spine, RSD's Head Phantom allows for tremendous flexibility with teaching and training. Our Head Phantom represents an average male 5 ft. 9 in. tall (175 cm), with a weight of 162 lb. (74 kg). It is rugged, easily transported, and shatter-proof.

### Model Numbers

Model No.	Product Description
RS-108	Opaque, Head Phantom with Cervical Spine
RS-108T	Transparent, Head Phantom with Cervical Spine
RS-109	Opaque, Head Phantom ONLY
RS-109T	Transparent, Head Phantom ONLY

Contact RSD or an authorized RSD Dealer for custom pathologies and traumas.

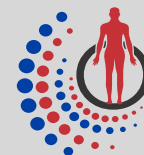
### Materials *See page 30 for more information.*

RSD Soft Tissue	RSD Cortical Bone	RSD Trabecular Bone
•	•	•

### Specifications

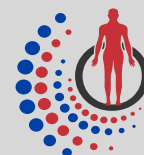
Packing Size	Packing Weight
36W x 36D x 36H cm	6 kg
14W x 14D x 14H in	14 lb.

**Publication References:** 1) Compagnone G, Pagan L, Bergamini C. Comparison of Six Phantoms for Entrance Skin Dose Evaluation in 11 Standard X-Ray Examinations. *J Appl Clin Med Phys.* 2005;6(1):101-113. DOI: <https://doi.org/10.1120/jacmp.v6i1.2020>. 2) Akyalcin S, English JD, Abramovitch KM, Rong XJ. Measurement of Skin Dose From <sup>90</sup>Yttrium Cone-Beam Computed Tomography Imaging. *Head Face Med.* 2013;9:28. Published 2013 Oct 9. DOI: <https://doi.org/10.1186/1746-160X-9-28>.



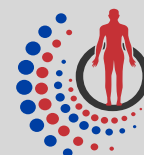
### Applications

- Teaching & training
- Image quality
- Panographic Imaging
- Dosimetry verification
- Protocol verification



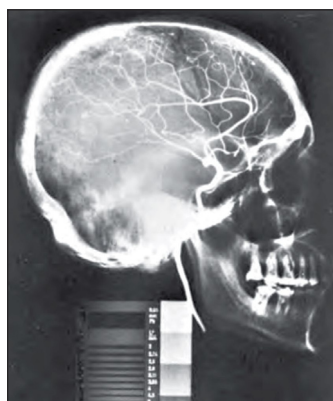
### Modalities

- CT
- X-Ray
- Fluoroscopy
- Dental X-Ray
- CBCT

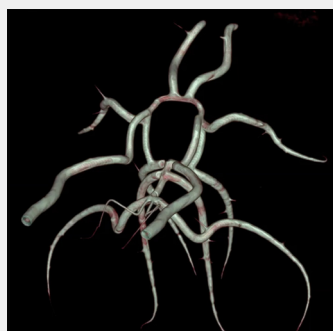


### Anatomy

- Skull and spine composed of Cortical (TS-1003) and trabecular bone (TS-1002) equivalent materials
- Brain material composed of RSD ART soft tissue material (TS-1001-T)
- Spinal cord material made of ART soft tissue material with density of 1.1 g/cc
- Oral, trachea, and sinus cavities filled with Styrofoam



# Circle of Willis



## HIGH ANATOMICAL DETAIL IN THE SUB-MILLIMETER RANGE

The 3-D printed Circle of Willis provides a much cleaner and robust solution for end users. Using a novel resin, RSD is able to simulate contrast-infused vasculature thereby eliminating the need to inject messy contrast through tubing that has to be constantly replaced. May be added to any new order with head phantom for an additional fee.



## Applications

- Teaching & training
- Image quality
- Dosimetry verification
- Protocol verification



## Modalities

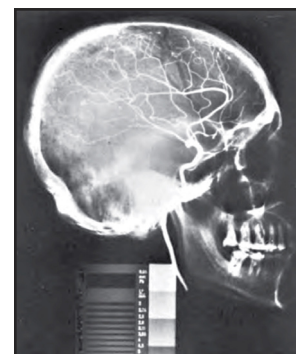
- CT
- X-Ray
- Fluoroscopy

## EVALUATION CORRELATION OF IMAGE QUALITY WITH ACTUAL MEASUREMENTS OF RESOLUTION & CONTRAST

- 3-dimensional high-contrast vascular pattern
- Tissue equivalent materials
- Step wedge and resolution test patterns

Available in opaque and transparent, full or half-head, RSD's Angiographic Head Phantom bridges the gap between physical and anatomical information requirements. Molded in tissue equivalent material, an accurate male skull contains a 3-dimensional, 89+6 high-contrast vascular simulation to facilitate correlation of the radiologist's subjective evaluation of angiographic image quality with actual measurements of resolution and contrast under the same exposure conditions.

The Angiographic Head Phantom provides a "dry run" to thoroughly assess angiographic equipment and ensure that is operating satisfactorily in all significant details before subjecting patients to radiological procedures. If the imaging system malfunctions, the phantom also plays a critically important role in isolating and verifying correction of problems. The Angiographic Head Phantom confines the variables to components and technique and has proven to be an invaluable service and teaching tool.



## Materials *See page 30 for more information.*

RSD Soft Tissue	RSD Cortical Bone	RSD Trabecular Bone
•	•	•

## Specifications

Packing Size	Packing Weight
36W x 36D x 36H cm	6 kg
14W x 14D x 14H in	14 lb.

**Publication Reference:** Borota L, Patz A. Spot Region of Interest Imaging: A Novel Functionality Aimed at X-Ray Dose Reduction in Neurointerventional Procedures. *Radiat Prot Dosimetry.* 2020;188(3):322-331. DOI: <https://doi.org/10.1093/rpd/ncz290>.

## Model Numbers

Model No.	Product Description
RS-230	Full, Opaque, with step wedge
RS-230T	Full, Transparent, with step wedge
RS-235	Full, Opaque, with resolution test pattern (2-10 lp/mm) and step wedge
RS-235T	Full, Transparent, with resolution test pattern (2-10 lp/mm) and step wedge
RS-240	Half, Opaque, with step wedge
RS-240T	Half, Transparent, with step wedge
RS-245	Half, Opaque, with resolution test pattern (2-10 lp/mm) and step wedge
RS-245T	Half, Transparent, with resolution test pattern (2-10 lp/mm) and step wedge

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**Soft Tissues:** There are unlimited, small variations in density and absorption throughout the human body. Phantom soft tissue is closely controlled to have the average density of these tissues.

**Skeletons:** RSD skeletons are highly detailed polymer moldings which reproduce the shape, mass density and attenuation coefficients of cortical bone and spongiosa. RSD's proprietary moldings allow for continuous production, eliminate the restrictions of human skeleton bones (including limited availability, unethical collection of human bone specimen, variable size, and uncertain chemical composition), and avoid the loss of marrows in dried natural skeletons thereby making RSD skeletons superior to "real bone."

**Molds:** Molds for the RSD cortical bone and spongiosa were made from human skeletons consistent with the sizes of the soft tissue molds.

**ICRU 44:** RSD skeletons conform closely to the standards established by the International Commission on Radiation Units and Measurements ([ICRU Report No. 44](#)); mass density is reduced slightly to take into account a small decrease in calcium content for older patients.

## LINEAR ATTENUATION DATA

1. Monte Carlo simulation was used to calculate linear attenuation coefficients as a function of beam.
2. Monte Carlo results were validated with linear attenuation coefficients derived from Hounsfield Unit measurements at discreet energy levels.
3. RSD Phantom material linear attenuation data was compared to NIST data using ICRU Report 44 compositions of human tissues.
4. NIST data was interpolated when necessary.

MATERIALS	DENSITY (g/cc)
RSD Soft Tissue (Opaque)	1.08
RSD Soft Tissue (Transparent)	1.10
RSD Cortical Bone	<b>1.83</b>
RSD Trabecular Bone	<b>1.17</b>

RSD SOFT TISSUE					
Energy (MeV)	Mean (HU)	Calculated (M)	$\mu$ (ICRU 44)	% Difference	Ratio
00.08	60.30	0.1948	0.1932	0.0080	0.9921
00.10	52.88	0.1797	0.1795	0.0015	0.9985
00.12	57.10	0.1717	0.1709	0.0044	0.9956
00.14	52.95	0.1623	0.1624	0.0007	1.0007
00.20	--	0.1477	0.1439	0.0261	0.9746
00.30	--	0.1245	0.1246	0.0004	1.0004
00.60	--	0.0950	0.0941	0.0101	0.9900
00.80	--	0.0825	0.0826	0.0013	1.0013
01.00	--	0.0744	0.0743	0.0018	0.9982
02.00	--	0.0520	0.0519	0.0018	0.9982
03.00	--	0.0351	0.0357	0.0171	1.0174
06.00	--	0.0288	0.0291	0.0088	1.0088
08.00	--	0.0252	0.0255	0.0098	1.0099
10.00	--	0.0229	0.0232	0.0149	1.0151
15.00	--	0.0203	0.0203	0.0015	0.9985
20.00	--	0.0189	0.0189	0.0017	1.0017

RSD CORTICAL BONE					
Energy (MeV)	Mean (HU)	Calculated (M)	$\mu$ (ICRU 44)	% Difference	Ratio
00.08	1365	0.4345	0.4280	0.0151	0.9851
00.10	1048	0.3496	0.3562	0.0184	1.0188
00.12	0977	0.3211	0.3274	0.0191	1.0195
00.14	0902	0.2932	0.2986	0.0180	1.0184
00.20	--	0.2511	0.2513	0.0009	1.0009
00.30	--	0.2155	0.2137	0.0084	0.9916
00.60	--	0.1596	0.1598	0.0011	1.0011
00.80	--	0.1403	0.1402	0.0010	0.9990
01.00	--	0.1274	0.1261	0.0106	0.9895
02.00	--	0.0883	0.0885	0.0017	1.0017
03.00	--	0.0611	0.0625	0.0229	1.0235
06.00	--	0.0512	0.0525	0.0246	1.0253
08.00	--	0.0468	0.0474	0.0120	1.0121
10.00	--	0.0446	0.0444	0.0039	0.9962
15.00	--	0.0410	0.0409	0.0016	0.9984
20.00	--	0.0393	0.0397	0.0102	1.0103

RSD TRABECULAR BONE (SPONGIOSA)					
Energy (MeV)	Mean (HU)	Calculated (M)	$\mu$ (ICRU 44)	% Difference	Ratio
00.08	551	0.2849	--	--	--
00.10	515	0.2586	--	--	--
00.12	439	0.2337	--	--	--
00.14	318	0.1541	--	--	--