RSD
Radiology Support Devices, Inc.

Head Phantom for Stereotactic Surgery

Applications

Total system quality assurance

Checks the dose calculation algorithm with and without correction

Measures the dose delivered to intracranial lesions

Modalities

Intensity-Modulated Radiation Therapy (IMRT)

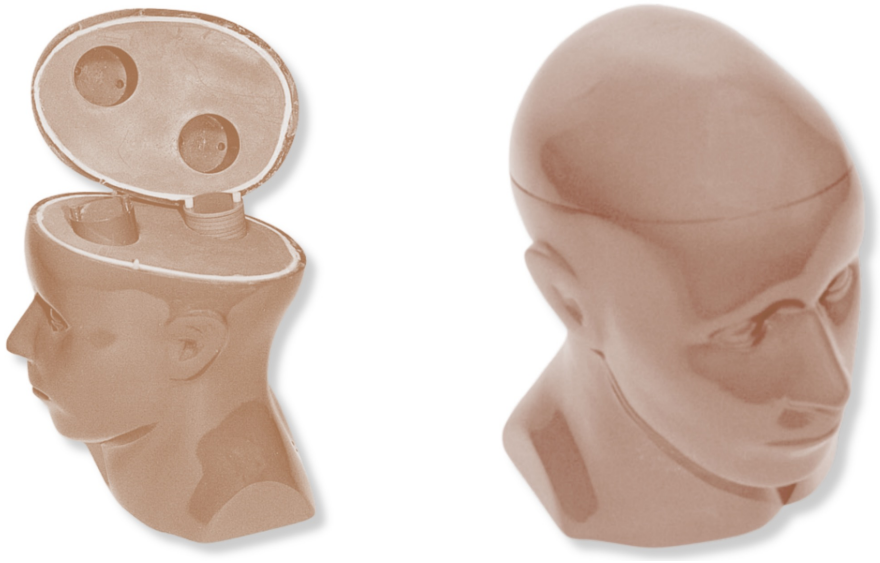
Stereotactic Body Radiation Therapy (SBRT)

Gamma Knife

CyberKnife

CT

Cone Beam CT



TOTAL SYSTEM QUALITY ASSURANCE WITH VERIFICATION OF TREATMENT ACCURACY

RSD's Head Phantom for Stereotactic Surgery serves to check accuracy of treatment for quality assurance. Comes with TLD Dosimetric Cylinder and one solid piece plus the Dry Water Cylinder to fill the other cavity. Also includes two spare nylon assembly rods and two spare blind nylon nuts. Optional: Truncated Cone for Ion Chamber (including molding or machining to install Ion Chamber to User's specification at the center of the sphere) and Film Dosimetric Cylinder.

Provisions are made for installation of the dosimetric cylinder at two locations in the cranium. One is on the CC axis of the head close to the apex. The other is near one side of the head at about ear level. Both cylinders are perpendicular to the transverse planes of the head. Since the dose at only one location is to be measured at a time, the other location is filled with a dry-water cylinder with no dosimetric provisions. The target can be located uniquely by an initial CT scan.

Specifications

Packing Size	Packing Weight
41W x 41D x 41H cm	6 kg
16W x 16D x 16H in	14 lb.

Publication References: 1) Park, Mi-Ae et al. "Performance of a high-sensitivity dedicated cardiac SPECT scanner for striatal uptake quantification in the brain based on analysis of projection data." Medical physics vol. 40,4 (2013): 042504. DOI: https://doi.org/10.1118/1.4794488. 2) Kao, Pan-Fu & Wey, Shiaw-Pyng & Yang, An-Shoei. (2009). Simultaneous ^{99m}TC and ^{123}I Dual-Isotope Brain Striatal Phantom Single Photon Emission Computed Tomography: Validation of ^{99m}TC-Trodat-1 and ^{123}I-IBZM Simultaneous Dopamine System Brain Imaging. The Kaohsiung journal of medical sciences. 25. 601-7. DOI: https://doi.org/10.1016/S1607-551X(09)70563-7.

Model Numbers

Model No.	Product Description
ST-1150A	Head Phantom for Stereotactic Surgery

Materials *See page 30 for more information.*

RSD Soft Tissue	RSD Cortical Bone	RSD Trabecular Bone
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RSD Materials

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	**1.83**
RSD Trabecular Bone	**1.17**

RSD SOFT TISSUE					
Energy (MeV)	Mean (HU)	Calculated (M)	μ (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)	μ (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)	μ (ICRU 44)	% Difference	Ratio
00.08	551	0.2849	--	--	--
00.10	515	0.2586	--	--	--
00.12	439	0.2337	--	--	--
00.14	318	0.1541	--	--	--