

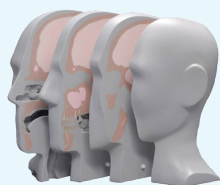


Phantoms for Proton Therapy Applications

Featured Sun Nuclear Anthropomorphic and Calibration Phantoms

Anthropomorphic Realism for Range Verification

Proton Therapy Dosimetry Head



Real-time range verification in IMPT. Researchers used the Proton Therapy Dosimetry Head (Model 731-HN), including its titanium insert, to **demonstrate in-vivo, PET-based verification of where the proton beam stops in a head and neck case.** [1]

1. Zapien-Campos B, Ahmadi Ganjeh Z, Perotti-Bernardini G, Free J, Both S, Dendooven P. Instantaneous in vivo distal edge verification in intensity-modulated proton therapy by means of PET imaging. *Med Phys.* 2025; 52:e17850. <https://doi.org/10.1002/mp.17850>

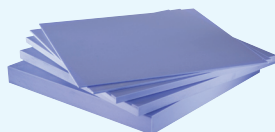
STEEV™ Phantom



A reference patient for adaptive proton. The anthropomorphic STEEV (Model 038) head phantom validated online PET range checks in an intra-fractional, range-guided adaptive proton therapy workflow. [2]

2. Yang, Dongxu & Zhu, Xiaorong & Chen, Mingli & Ma, Lin & Cheng, Xinyi & Grosshans, David & Lu, Weiguo & Shao, Yiping. (2024). Investigation of intra-fractionated range guided adaptive proton therapy: I. On-line PET imaging and range measurement. *Physics in Medicine & Biology*. 69. 10.1088/1361-6560/ad56f4.

Solid Water® HE

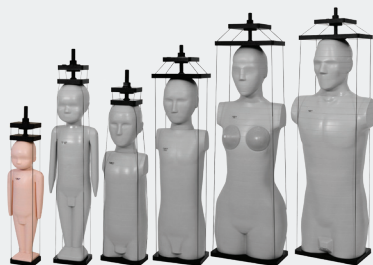


A shared benchmark across proton centers. Calibrated Sun Nuclear tissue-equivalent slabs set the known range-shift standard in a multi-institution comparison of proton range-verification systems, measured across clinical beam energies of 130, 180 and 215 MeV. [3]

3. Hueso-González, F., Berthold, J., Wohlfahrt, P., Bortfeld, T., Khamfongkhrua, C., Tattenberg, S., Zarifi, M., Verbarg, J., & Richter, C. (2024). Inter-center comparison of proton range verification prototypes with an anthropomorphic head phantom. *Physics in Medicine & Biology*, 69(22), 225010.

AI-driven Planning

ATOM® Anthropomorphic Phantoms

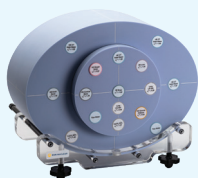


Training the next generation of planning tools. **Deep-learning models for proton stopping-power estimation were trained on the Model 062M Electron Density Phantom and tested on ATOM anthropomorphic phantoms** spanning pediatric to adult anatomy, showing the portfolio supports both calibration and anthropomorphic validation in one workflow. [4]

4. Chang CW, Gao Y, Wang T, Lei Y, Wang Q, Pan S, Sudhyadhom A, Bradley JD, Liu T, Lin L, Zhou J, Yang X. Dual-energy CT based mass density and relative stopping power estimation for proton therapy using physics-informed deep learning. *Phys Med Biol.* 2022 May 26;67(11):10.1088/1361-6560/ac6ebc. doi: 10.1088/1361-6560/ac6ebc. PMID: 35545078; PMCID: PMC10410526.

Stopping-power Calibration to Cut Range Uncertainty

Advanced Electron Density Phantom



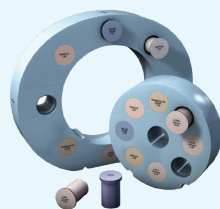
A dual-energy CT stopping-power prediction method was built and validated on Sun Nuclear electron density products: 062M and Advanced Electron Density phantoms. [5]

ESTRO and EPTN consensus guide for CT-based stopping-power calibration in proton therapy demonstrated its step-by-step method on AED phantom. **The AED had the best TMMs for quantifying the needed metrics for proton therapy.** [6]

5. Pettersson E, Thilander-Klang A, Bäck A. Prediction of proton stopping power ratios using dual-energy CT basis material decomposition. *Med Phys.* 2024; 51: 881–897. <https://doi.org/10.1002/mp.16929>

6. Peters N, Trier Taasti V, Ackermann B, Bolsi A, Vallhagen Dahlgren C, Ellerbrock M, Fracchiolla F, Gomà C, Góra J, Cambráia Lopes P, Rinaldi I, Salvo K, Sojat Tarp I, Vai A, Bortfeld T, Lomax A, Richter C, Wohlfahrt P. Consensus guide on CT-based prediction of stopping-power ratio using a Hounsfield look-up table for proton therapy. *Radiother Oncol.* 2023 Jul;184:109675. doi: 10.1016/j.radonc.2023.109675. Epub 2023 Apr 19. PMID: 37084884; PMCID: PMC10351362.

Electron Density Phantom



Validated to the Bragg peak. The Model 062M Electron Density Phantom anchored an end-to-end validation of dual-energy proton stopping-power prediction, confirmed against measured proton Bragg peaks. [7]

7. Duan, J., Zhu, J., Tao, C., Liu, Q., & Zhang, S. (2024). Pre-clinical evaluation of stopping-power ratio prediction for proton therapy planning based on dual-energy CT: An end-to-end validation. *International Journal of Radiation Oncology, Biology, Physics*, 120(2 Suppl.), e120. <https://doi.org/10.1016/j.jrobp.2024.07.2048>

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Findings paraphrased from cited peer-reviewed publications.