

Leipzig Applicator Dose Study Progress and Mesh Computational Phantoms

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Introduction

- Leipzig Applicators are handheld medical devices that encase an isotropic radiation source (IR-192) in a tungsten body, and are used to administer topical brachytherapy. (Fig.1)
- Typically, patients receiving this treatment are given lead shielding to cover their eyes, since eye lenses are sensitive to radiation.
- It is possible that the radiation scatters from the skull of the patient to the eyes, and then scattered back through the eyes due to the lead shielding.
- This could increase the dose received to the vulnerable lense

Methodology

- Used a Monte Carlo simulation software, EGS (Electron Gamma Shower)[1] to simulate what a patient would experience
- Modeled the Leipzig Applicator based on measurements of a real device
- Used the International Commission of Radiological Protection Publication 145 Mesh Computational Human Phantom Adult Female [2] to model the patient
- Before the Mesh Phantom was imported, simplified models were used (Fig.2 a and Fig.2 b)

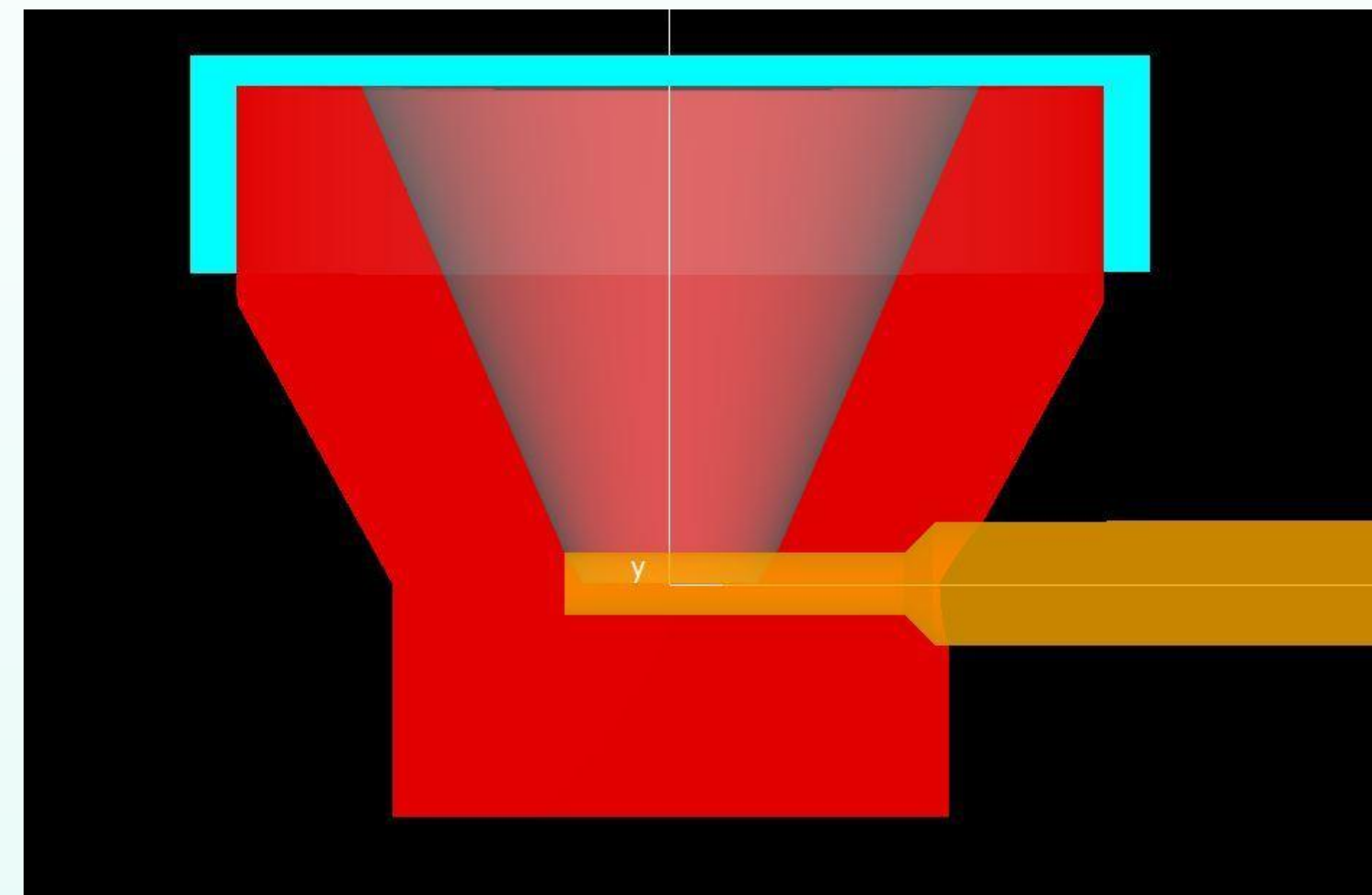


Fig. 1. Cross section of the Leipzig Applicator in the simulation.

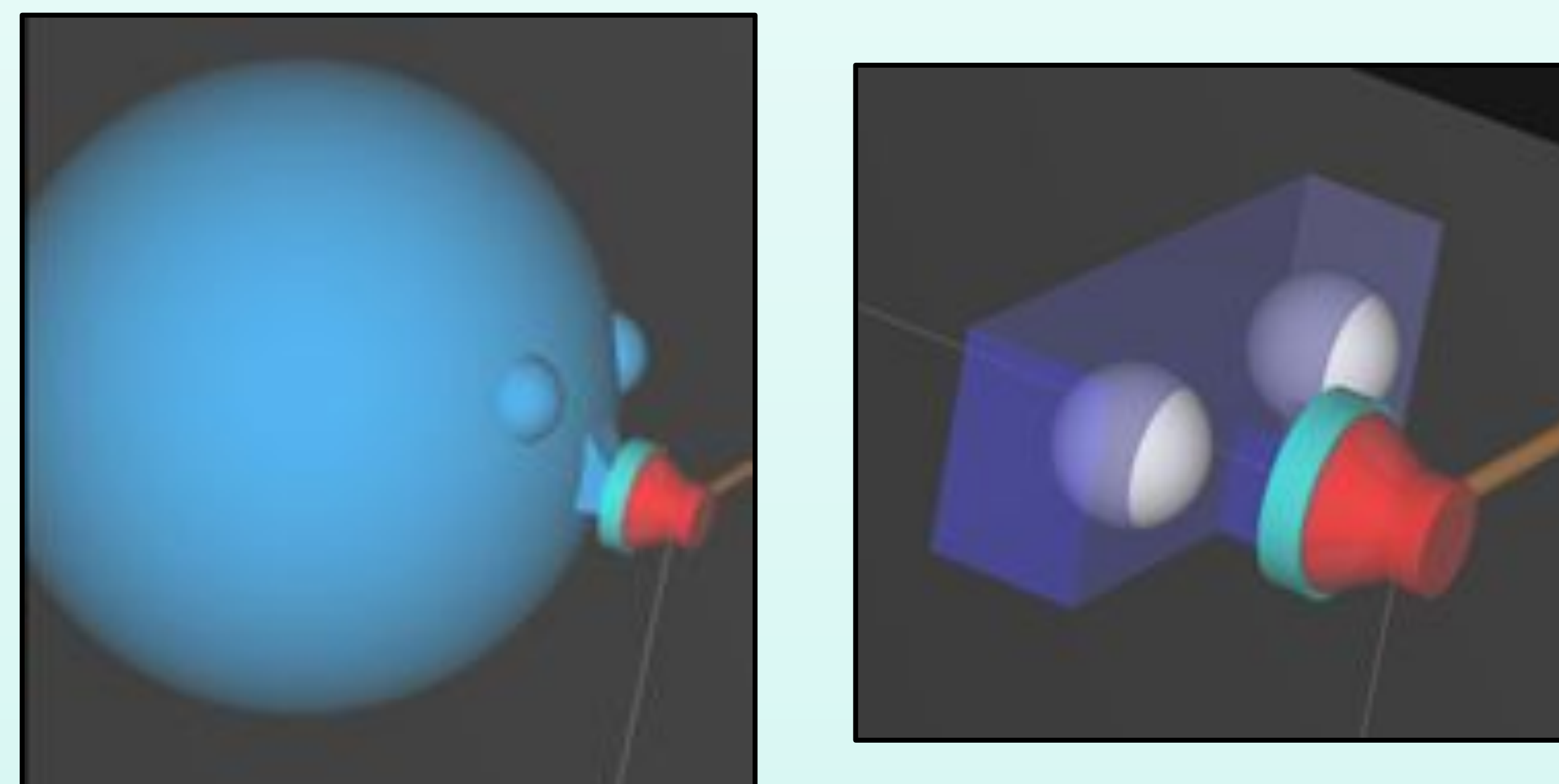


Figure 2. Models used to simulate the human head with applicator. Screenshots taken in EGS (a) Large water sphere (b) Rectangular prism of bone and spheres defined as eyes.

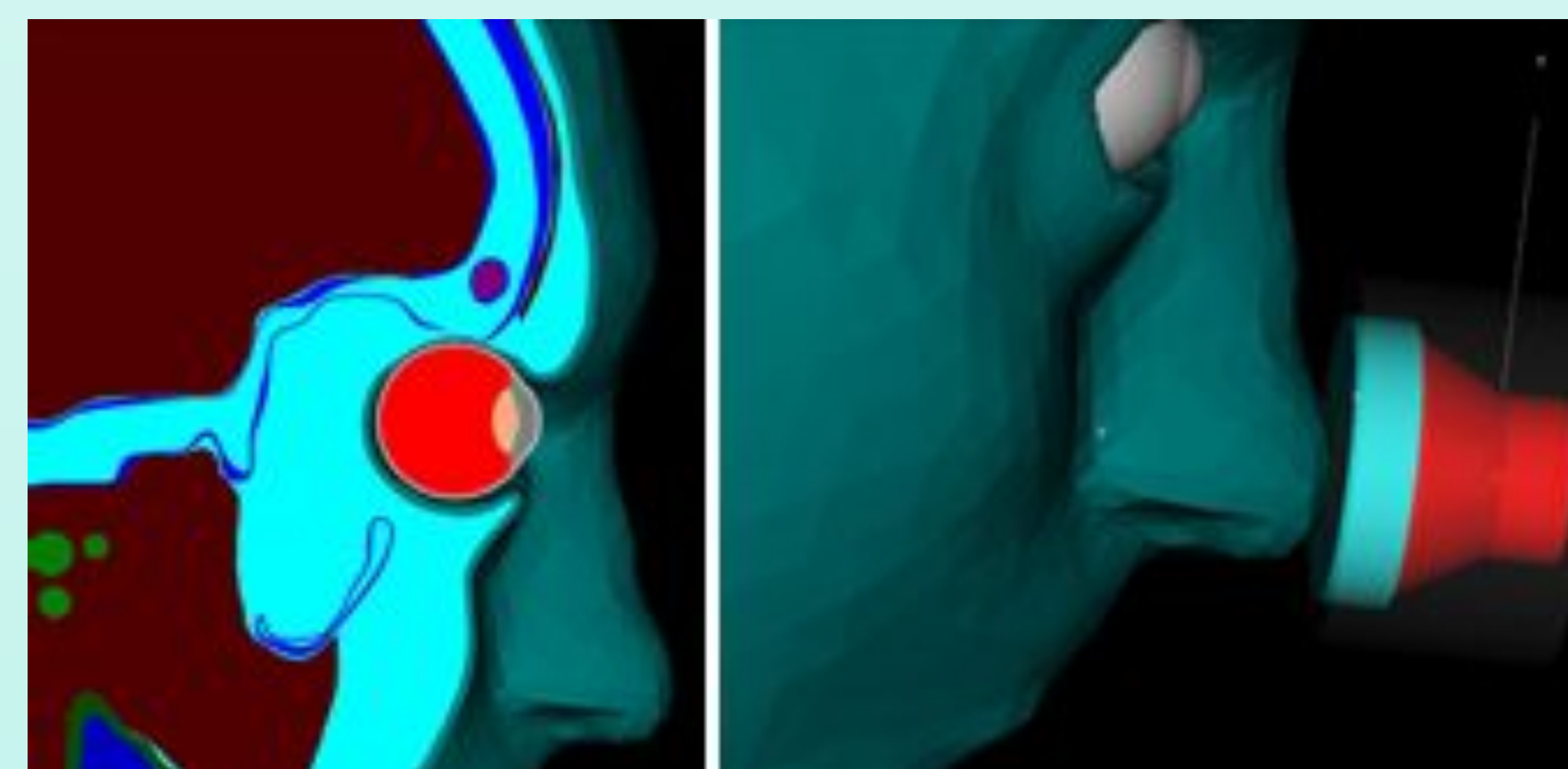


Fig. 3. AF model in EGS. (a) cross section of head through the eye. (b) outside of face with applicator.

Future Work

- Further steps need to be taken to simplify the geometry of the human phantom
- The media and source definitions must be checked to ensure realistic results
- Lead shielding must be considered and added to the model patient
- Adult Male (AM) computational phantom must also be considered
- Simulations and recording data will lead to interpretable results
 - AF and AM, with and without shielding

References

- [1] Kawrakow I, Rogers DWO, Mainegra-Hing E, Tessier F, Townson RW, Walters BRB. EGSnrc toolkit for Monte Carlo simulation of ionizing radiation transport, doi:10.4224/40001303 (2000).
- [2] ICRP, 2020. Adult mesh-type reference computational phantoms. ICRP Publication 145. Ann. ICRP 49(3).

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