Department of Physics & Astronomy

Novel Computational Phantoms for Assessing Dose Topology Following Exposure to the Space Radiation Environment

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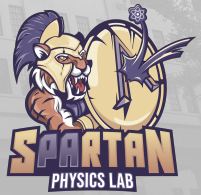


Space Radiation Environment

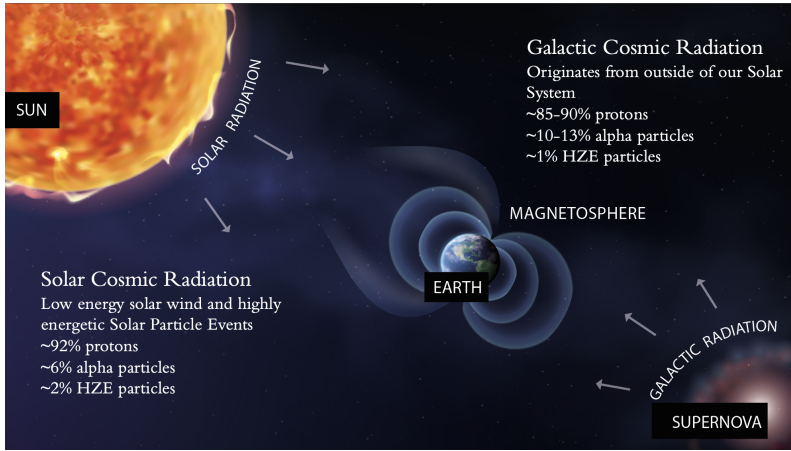


Figure: The Space Radiation Environment. The two primary sources of radiation, the sun and surrounding universe, are a biological hazard for astronauts. Graphic courtesy of IAEA.

Computational Phantoms

Phantoms have been used extensively in the medical field and in space science in order to calculate various dosimetric quantities.

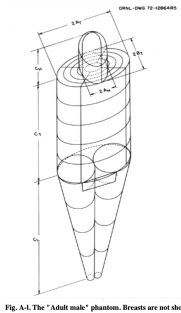


Figure: Wireframe of Stylized Phantom

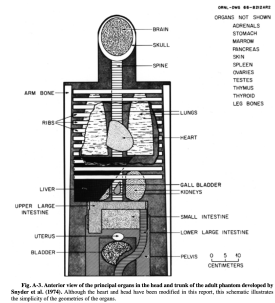


Figure: Internal Anatomy of Stylized Phantom

Voxel-Type Computational Phantoms

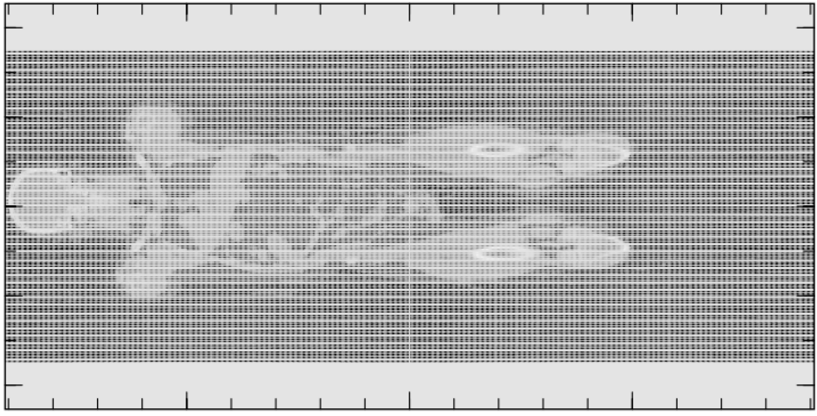


Figure: A voxel-type phantom constructed from medical images. Unpublished results, M. Chesal

Voxel-Type Computational Phantoms

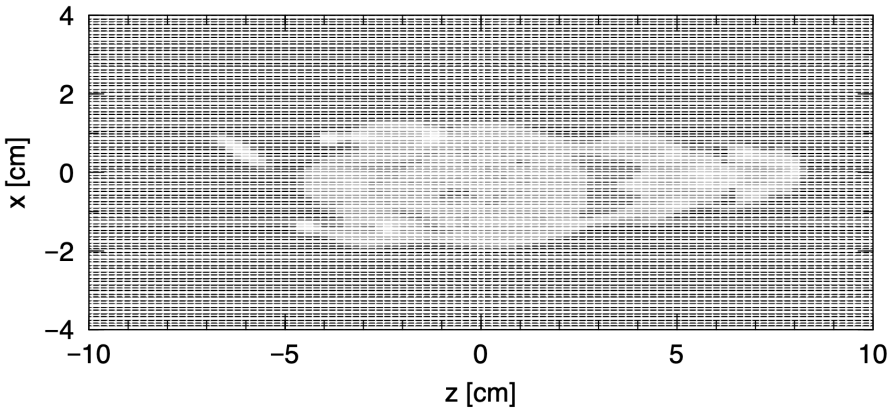


Figure: A voxel-type phantom constructed from a mouse medical image. Unpublished results, M. Chesal

Voxel-Type Computational Phantoms

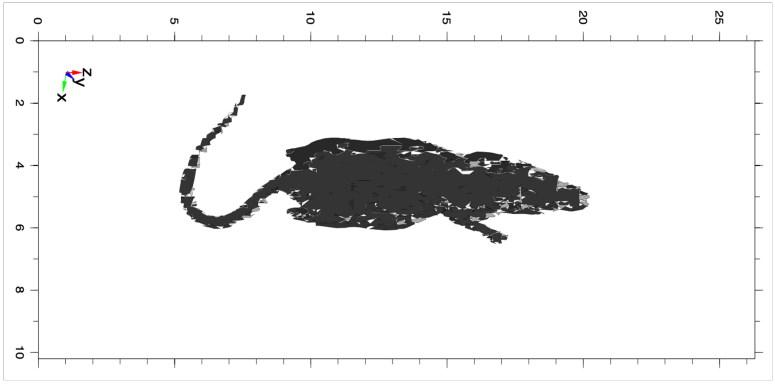


Figure: A 3D visualization of a voxel-type mouse phantom. Unpublished results, M. Chesal

Surface-Type Computational Phantoms

To overcome the shortcomings of voxel-type phantoms, surface-mesh phantoms were developed.
Surface-mesh phantoms have the capability to

- model very fine structures
- represent smooth, complex surfaces
- be deformable

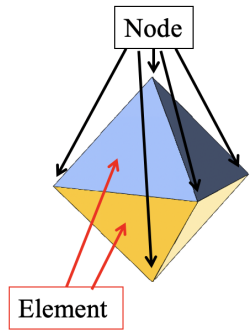
Have their own issues. Either

- cannot be used in Monte Carlo Simulations or
- dramatically increase computational times.

Figure: The FASH phantom

Tetrahedral-Type Computational Phantoms

Tetrahedral phantoms are an extension of surface-mesh phantoms. They retain the same fine detail and deformation capabilities, but are geometrically structured in a manner that is more suitable to Monte Carlo calculations.



Tetrahedral-Type Computational Phantoms

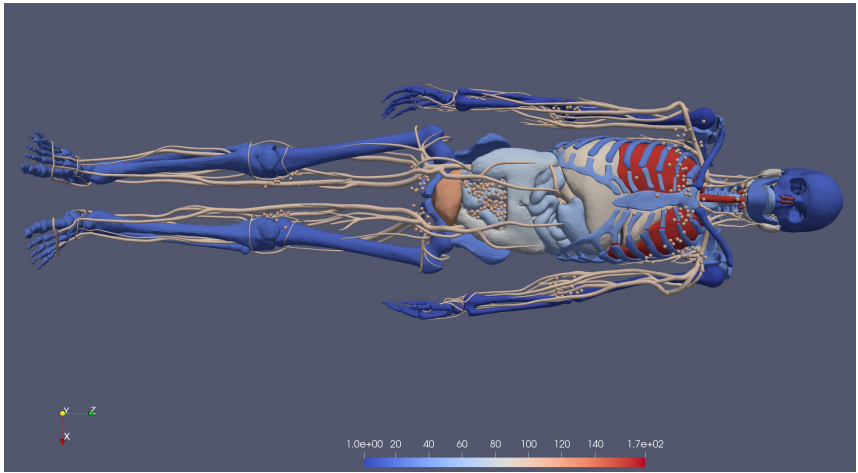
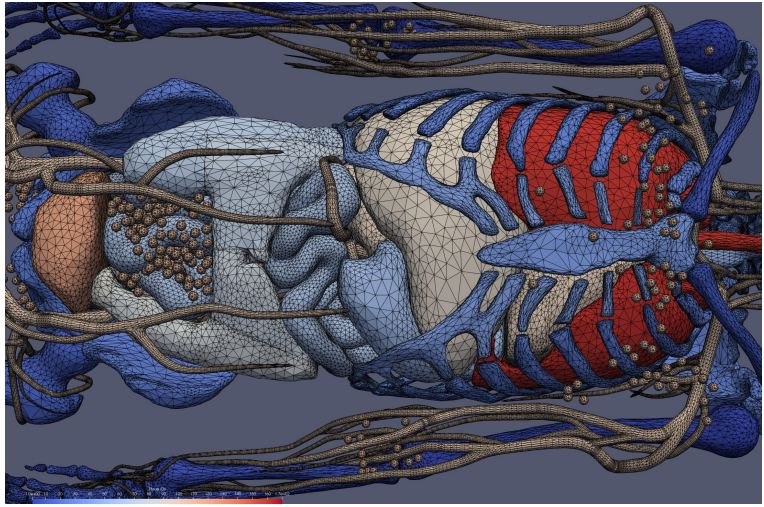
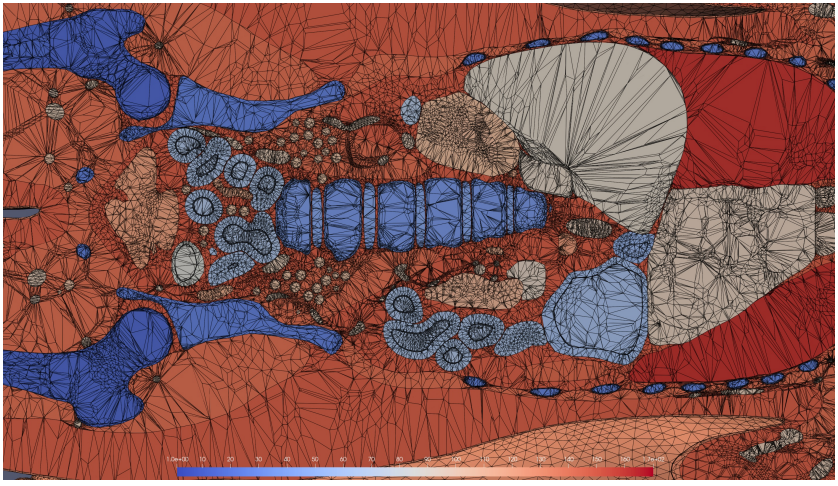


Figure: Unpublished Results, M. Chesal

Tetrahedral-Type Computational Phantoms



Tetrahedral-Type Computational Phantoms



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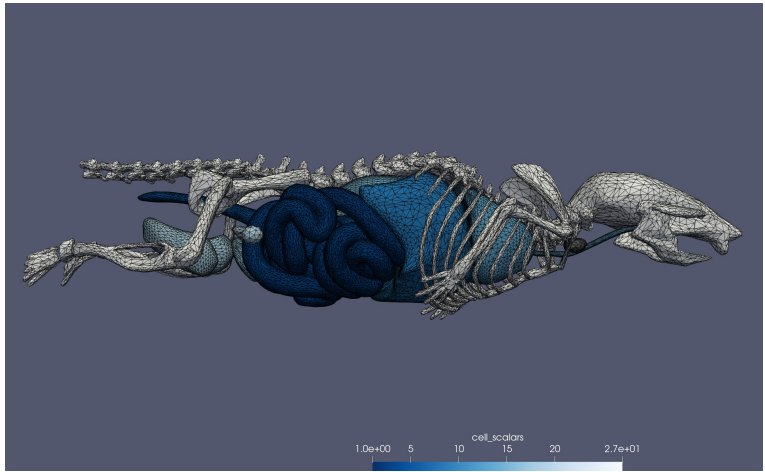

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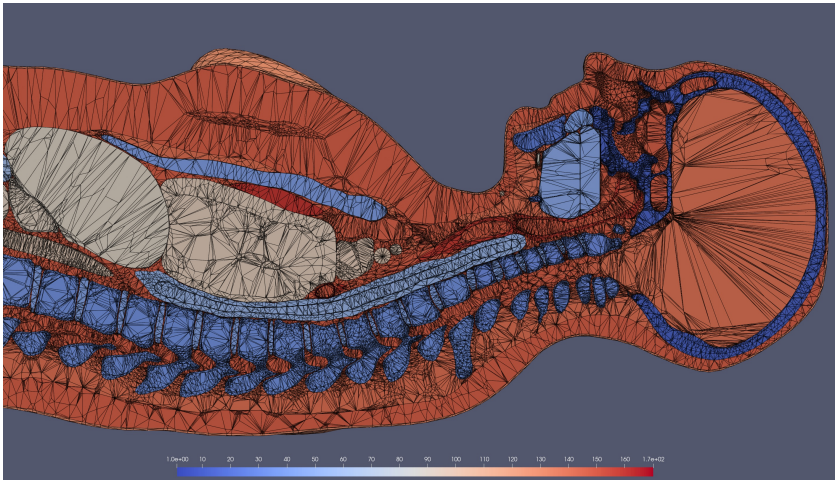

Figure: Unpublished Results, M. Chesal

Questions?

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