National Aeronautics and Space Administration

Modelling and holographic visualization of space radiation-induced DNA damage

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HAT: 6.5.a-e **TA:** 6.5.2 radiation mitigation and countermeasures **TRL:** start 2 / current 4

OVERVIEW

Space radiation is composed by a mixture of ions of different energies. Among these, heavy ions are of particular importance because their health effects are poorly understood. In the recent years, a software named RITRACKS (Relativistic Ion Tracks) was developed to simulate the detailed radiation track structure, several DNA models and DNA damage. As the DNA structure is complex due to packing, it is difficult to visualize the DNA structure and the distribution of the damage using a regular computer screen.

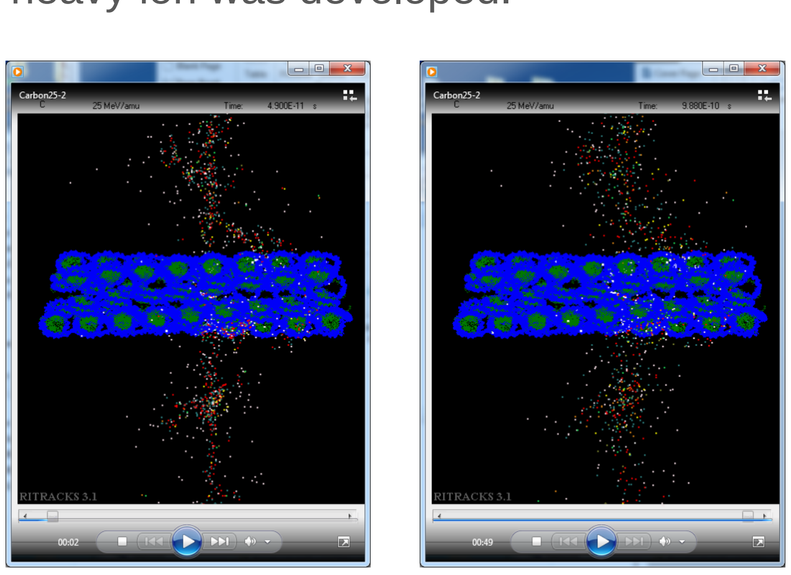
INNOVATION

The goal of this project is to demonstrate that using virtual reality technologies to enhance visualization can help improve our comprehension of radiation-induced DNA damage and other radiation related events.

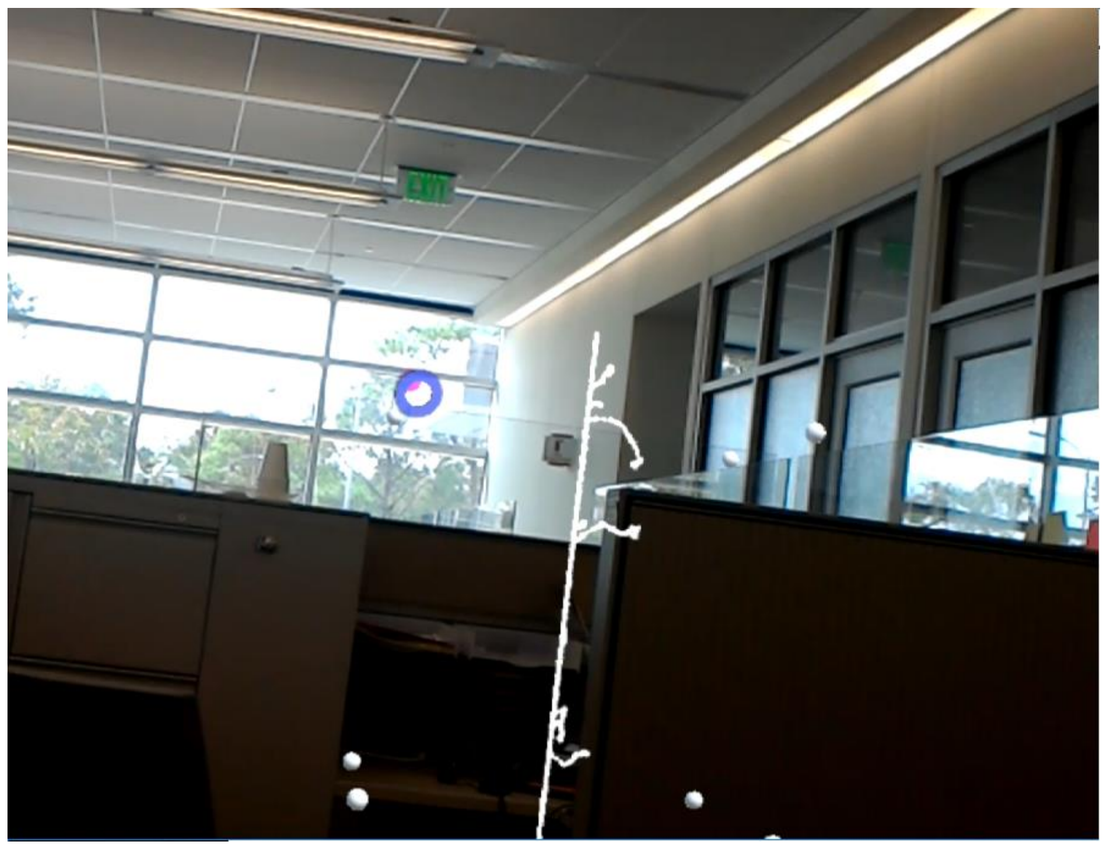
OUTCOME

The Hololens device from Microsoft was purchased, and various software and development kits were installed.

An application to visualize the radiation track of an heavy ion was developed.



Simulation of DNA damage by a 25-MeV/n carbon ion track, performed with the code RITRACKS, at two different times after irradiation. The static structure is a chromatin fiber comprising DNA (blue) with histones proteins (green). The pictures show extensive damage to the chromatin fiber.



Holographic visualization of a 25-MeV/n carbon ion track, calculated with the code RITRACKS, and displayed with the Hololens application. In the picture, one corner is selected by the user (purple donut)

PARTNERSHIPS / COLLABORATIONS

This technology may be interesting for radiation-induced DNA damage applications, notably in the field of medical physics.

FUTURE WORK

Due to limited time available for this project, it was only possible to implement basic features to display the radiation track structure. However it has demonstrated that this technology can be used to create holograms of objects that are modeled. Future work would concentrate on displaying more complex structures and implementing interactivity of the user with the objects.