Computational approaches for developing active radiation dosimeters for space applications based on new paradigms for risk assessment.

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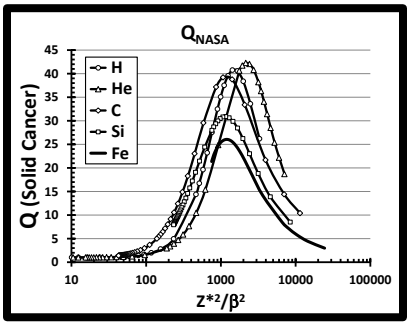
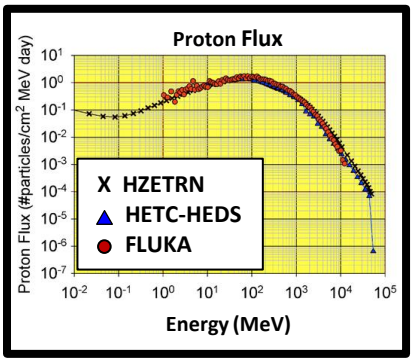
NASA has proposed new models for radiological risk assessment with significant revisions that are based on new epidemiological data and radiation biology results. Extensive computational approaches were used to develop new risk cross sections and the extension of these into recommendations for risk assessment during space missions[1,2]. This has been translated into revised specifications of quality factors in terms of track structure concepts that extend beyond LET alone and will require identification of charge, Z, and velocity, β, of the incident radiations. New paradigms for assessing REID for space radiation place demands on radiation monitoring procedures that are not satisfied by existing dosimetry systems or particle spectrometers.

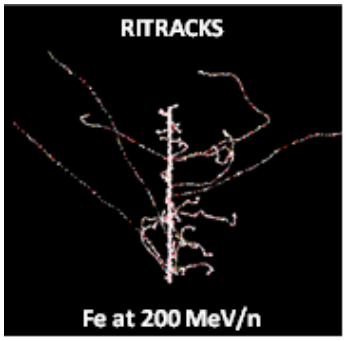
$$Q_{NASA} = \left(1 - P(E,Z)\right) + \frac{6.24(\Sigma_0/\alpha_\gamma)}{LET} \cdot P(E,Z)$$

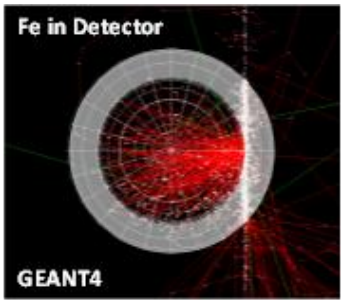
$$P(Z,E) = \left(1 - e^{\frac{-(Z^*/\beta)^2}{\kappa}}\right)^m \cdot P_{TD}$$



The objectives of this research are to exploit state-of-the-art computational capabilities to investigate how radiation dosimeters would respond to the incident radiations and what information needs to be extracted from the data to properly estimate dose and quality factors. It is essential to understand specific limitations of detector systems and what compromises need to be implemented before making and testing new devices.







The research team has unprecedented capabilities in computational methodologies, particle accelerator experiments, detector development and flight instrument operations. The aims of this research are to provide cost effective screening methods for developing ideas at the TRL-1 level before making recommendations for design, fabrication and testing of dosimeter prototypes at the TRL-2 level.

1. Cucinotta, F.A., Kim, M-H. Y.,Chappell, L.A., *Space Radiation Cancer Risk Projections and Uncertainties – 2010*, NASA/TP-2011- 216155,2011
2. National Research Council, *Technical Evaluation of the NASA Model for Cancer Risk to Astronauts due to Space Radiation*, Nat. Acad. Press, 2012