Applications of Health Physics R&D at Accelerators

LRPC Presentation

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Introduction

- The field of accelerator health physics is one in which a great deal of research remains to be done.
- The radiation fields which are present at accelerator facilities differ greatly in their nature and their energies from those of nuclear facilities, where most of the health physics work is done.

- Research in a variety of areas, from dosimetry to development of instrumentation, is typically performed using radiation from encapsulated radioactive materials or from nuclear reactors. The results found in such radiation fields do not necessarily reflect those that would be found in the high-energy accelerator radiation fields.
- Advent of high energy, high intensity beams require much better understanding of radiation physics issues in order to come up with both radiologically and economically efficient designs.

Radiation Physics R&D

1. Radiation Effects and Damage Studies;
   - Material; oils, greases, paints, cables, construction material and insulators…
   - Active and Passive electronic components
   - Need a new database for radiation effects at Giga- and Tera- rads of irradiation.
2. Shielding Studies;
   - Field Characterization,
   - **Software Benchmarking (MARS, FLUKA,…),**
   - Source terms.

Radiation Physics R&D

3. Radiation Transport in Labyrinths for
   - Different radiation fields,
   - Absorbers (wall material),
   - Geometries. (Non-rectangular bends, long penetrations and neutron rooms)
4. Instrumentation R&D;
   - Better neutron detectors,
   - Portable detectors,
   - New detector material,
   - Radiation hard detectors.

Radiation Physics R&D

5. Material Activation;
   - Controlled Irradiation and cooling,
   - Waste Characterization. (Systematic Activation Cross Sections Measurements for all isotopes of interest)
     - Required by regulation
     - Determines requirements for the decontamination and decommissioning of a facility

Radiation Physics R&D

6. Dosimetry Application;
   - Intercomparison; response of different detectors to the same field.
   - High-energy neutrons, protons, and gamma calibrations and some low energy muon dosimetry.
7. Environmental Studies
   - Controlled air, water, and soil activation studies.

Radiation Physics R&D

8. Radio-biological studies
    1. Beam-on exposures (BODA).
9. Microdosimetry; LET measurements
10. Controlled sky (ground) shine studies

Conclusion

- A Radiation/Health Physics research program is needed for the future high energy, high intensity machines.
- Need knowledge base for new areas
- Need to fill gaps in old areas
- Less demanding experiments can be done at the existing test beams or parasitically at the existing experiments.

Conclusion

- **Can't AFFORD** to be "conservative" by factors of 2-10 for the new machines!

- A good Radiation Physics Program Saves Money!