Validation and testing of the collection chambers for the CERN-MEDICIS project

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Outline

- MEDICIS facility and the ISOLDE experiment
- Purpose of this work
- Fluka transportation code
- Results
- Future work
ISOLDE is a facility dedicated to the production of a large variety of radioactive ion beams for many different experiments in the fields of nuclear and atomic physics, solid-state physics, materials science and life sciences.
MEDICIS facility

- produce radioisotopes for medical research
- design a collection chamber and transfer system for the radioactive isotopes
To simulate the radiation from collected isotopes and calculate the dose a person may receive by using transport code simulation (Fluka) when the isotope has been collected.

<table>
<thead>
<tr>
<th>System affected/Syndrome</th>
<th>Symptoms</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous system</td>
<td>Shock, severe nausea, disorientation, seizures, coma</td>
<td>100 Gy</td>
</tr>
<tr>
<td>G.I. system</td>
<td>Nausea, vomiting, diarrhea, dehydration</td>
<td>10 Gy</td>
</tr>
<tr>
<td>Blood cells / bone marrow</td>
<td>Chills, fatigue, hemorrhage, ulceration, infections, anemia</td>
<td>3-8 Gy</td>
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<tr>
<td>Hematopoietic Syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>Burning/ infection, sloughing of skin, hair loss</td>
<td>10 Gy</td>
</tr>
<tr>
<td>Ovaries/ Testes</td>
<td>Sterility</td>
<td>0.6-0.8 Gy</td>
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<tr>
<td></td>
<td></td>
<td>2-6 Gy</td>
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</tbody>
</table>

- Absorption Dose (Gy) = 1 J/kg
- Equivalent Dose (Sv) = D*Q  [Q is depend on radiation type]
Dose computation
- Simulate particle histories until all particles have left the grid
- Store the amount of absorbed energy of each particle in each region

- Total cross section → step length
- Differential & partial cross sections → final state
- Energy deposited (Magnetic and electric fields) → Dose
Results

Equivalent Dose of Lu 177

Equivalent Dose of Bi 213
Future work

- make the geometry of the room and the beamline more realistic.
- Instead of using a radioactive point source, I will put the radioactive beam and metal foil from collect the isotope.
Acknowledgement

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