IN SILICO DOSIMETRY

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I-SEE COMPUTING
INDEX

• INTRODUCING I-SEE
• APPLICATIONS WITH I-SEE
• I-SEE INTERFACE
• EXAMPLES
• I-SEE CUSTOMIZED PRODUCTS
Collaboration

• In the framework of a collaboration between I-SEE and Nucleonica

• Objective: better products and better services

• Radiation therapy field
APPLICATIONS

Radiation therapy
APPLICATIONS

Protontherapy
To allow exploration and colonization with acceptable risk from radiation exposure, space radiation and biophysics research is crucial.
“Special” chromosomal damage induced by low doses of heavy ions

3 Gy γ-rays

0.3 Gy Fe-ions

Durante et al., Radiation Research 2002
APPLICATIONS
RADIOBIOLOGICAL SIMULATION
APPLICATIONS
BEAM DELIVERY LINE

Protontherapy
Carbon ion therapy

Beam

-> Exit window
-> Monitoring System

-> Ripple Filters
-> Passive Elements

HUMAN TISSUE Modelling
I-SEE Solution
I-SEE@Nucleonica Interface

Source

Source Pos_Z

Number of events: 1000000
Sigma X: 0.3 cm
Sigma Y: 0.2 cm
Sigma E: 7.2 MeV

World

Slice thickness: 10.0 cm
Phantom dimZ depth

Phantom Height: 10.0 cm
Phantom Width: 10.0 cm
Phantom Material: Water
Input:
- Simulation Name
- Run ID
- Particle type: P or C ions
- Beam Energy
- Source Pos_Z
- Source Pos_X
- Source Pos_Y
- Number of events (initial particles)
- Beam dimensions: Sigma in X and Y
- Sigma in Energy
- Phantom dimZ (depth)
- Phantom dimX
- Phantom dimY
- Slice thickness
- Phantom material
- Short description

I-SEE: Beam Simulations Submission page

<table>
<thead>
<tr>
<th>Simulation Name:</th>
<th>Pencil_Beam_01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author:</td>
<td></td>
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<tr>
<td>Main Parameters</td>
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<tr>
<td>Particle Type:</td>
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<tr>
<td>Energy:</td>
<td>240 MeV/μm</td>
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<tr>
<td>Number of events:</td>
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<tr>
<td>Simulation Tool:</td>
<td>Geant4</td>
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<tr>
<td>Secondary Parameters</td>
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<tr>
<td>Sigma X:</td>
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<tr>
<td>Sigma Y:</td>
<td>0.2 cm</td>
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<tr>
<td>Sigma E:</td>
<td>7.2 MeV</td>
</tr>
<tr>
<td>Phantom Thickness:</td>
<td>10.0 cm</td>
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<tr>
<td>Phantom Height:</td>
<td>10.0 cm</td>
</tr>
<tr>
<td>Phantom Width:</td>
<td>10.0 cm</td>
</tr>
<tr>
<td>Slice Thickness:</td>
<td>10.0 cm</td>
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<tr>
<td>Phantom Material:</td>
<td>Water</td>
</tr>
<tr>
<td>Description:</td>
<td>Test for Pencil Beam.</td>
</tr>
</tbody>
</table>

Submit Scene
Output:
- Total Energy loss in depth
- Fragments Energy loss in depth
- 2d graphs
- 3d graphs

Note:
- It is possible to generate directly the graph in different graphic formats, otherwise we can export in Ascii format.
- 3d distribution can be as well automatically generated and represented in graphs.
Analysis Examples
I-SEE CUSTOMIZED PRODUCTS

Simulation info
- Name: GwaterC212_6MeV
- Description: Events vs Depth
- Primary particles: C
- Energy: 212.8 MeV
- Tool: Geant4 (v9.2)

Analysis settings
- Rows limit: 10000
- Perform Analysis

Simulated depths

Note: Click on a depth to generate a plot of the particle energy distribution for the selected depth.
I-SEE CUSTOMIZED PRODUCTS
I-SEE CUSTOMIZED PRODUCTS

Monitoring system in the Beam Delivery line
Beam Filters Study.
Beam Diagnostics
Scattering Effects

Sigma of the beam in X direction in the Water Phantom

- $d = \sigma$
- $d = 2\sigma$
- No Watch Dog
Planning Verification

Carbon ion beam

Dose Response Curves for Cell Survival

$S_{\text{Ion}} = \langle S \rangle$
Open I-SEE

• Open for possible new solutions focused on online ‘heavy computing’.
• Open to new ideas
• Open to create and customize a new solutions
• Open to any questions 😊

=>contact: faiza@i-seecomputing.com
After all our online chats, it's great to finally meet you in person.

Same here.

Tanks for your attention