MCNP CLASS SERIES
(HAMBURGER PATTY IRRADIATION)

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Simulation of hamburger patty irradiation

- $E = 10$ MeV electrons (upper beam direction)
- Using cylinder surface card
  - 10 patties stacked one over the other
    - Each patty is 0.4 cm thick
Simple hamburger patty
irradiation simulation (Tuesday, 03/04/08)
probid = 03/04/08 17:18:31
basis: YZ
( 0.000000, 1.000000, 0.000000)
( 0.000000, 0.000000, 1.000000)
origin:
( 0.00, 0.00, 1.00)
extent = ( 5.00, 5.00)
cell labels are
cell names
Simulation geometry

Air

Hamburger patty
(thickness = 0.4 cm, diameter = 2.54 cm)
### Surface card (Surface equations)

<table>
<thead>
<tr>
<th>Mnemonic</th>
<th>Equation</th>
<th>Card Entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>PZ</td>
<td>$z-D = 0$</td>
<td>D</td>
</tr>
<tr>
<td>CY</td>
<td>$x^2 + y^2 - R^2 = 0$</td>
<td>R</td>
</tr>
<tr>
<td>SO</td>
<td>$x^2 + y^2 + z^2 - R^2 = 0$</td>
<td>R</td>
</tr>
</tbody>
</table>
Surface card

- Part of surface card

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>pz</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>pz</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>pz</td>
<td>0.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>cz</td>
<td>1.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cell card

- Part of cell card

```
101 2 -0.90 10 -11 -30 imp:e=1
102 2 -0.90 11 -12 -30 imp:e=1
.. ...
200 3 -0.001124 -40 (30:-10:20) imp:e=1
```
# Data cards

<table>
<thead>
<tr>
<th></th>
<th>MCNP card name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mode</strong></td>
<td>MODE</td>
</tr>
<tr>
<td><strong>Source specification</strong></td>
<td>SDEF</td>
</tr>
<tr>
<td><strong>Tally specification</strong></td>
<td>Fn</td>
</tr>
<tr>
<td><strong>Material specification</strong></td>
<td>Mn</td>
</tr>
<tr>
<td><strong>Problem cutoff</strong></td>
<td>NPS</td>
</tr>
</tbody>
</table>
Data card (1. MODE card)

- Electron transport only
  => MODE E

- Electron photon transport (hw: compare results)
  => MODE P E
Data card
(2.1 Source specification card)

- Uniform parallel source (3 cm x 3 cm)*

SDEF X=D1 Y=D2 Z=36 ERG=10.0 DIR=1 VEC=0 0 -1
SI1 -1.5 1.5 $ X axis
SD1  0  1
SI2 -1.5 1.5 $ Y axis
SD2  0  1

* We will check results depending on source size, such as 1 cm x 1 cm, 2 cm x 2 cm.
Data card

(2.2 Source distribution card)

SDEF X=D1

-> Position x is defined by distribution #1

SI1 -1.5 1.5

SP1 0 1
Data cards

(4. Tally specification cards)

- Using F8 tally
  - Energy distribution of pulses created in a cell that models a physical detector
  - Energy deposition in a cell

\*f18:e 101 81 110
Data cards
(5. Material specification cards)

- Hamburger patty
  - Using USDA Nutrition database (NDB No: 21107)
    - Fast foods, hamburger, regular, single patty, plain

M2 6000 -0.314669 1000 -0.086984 8000 -0.548882
7000 -0.021904 20000 -0.002408 26000 -0.000093
12000 -0.000722 15000 -0.003921 19000 -0.005538
11000 -0.014791 30000 -0.000077 29000 -0.000003
25000 -0.000008
Data cards

(6. Problem cutoffs)

- To terminate execution of MCNP

NPS 1e4