DPA and Gas Production in Tungsten

• Ran the Mu2e target in MARS15 using the following parameters:

  – 8 GeV protons on Tungsten target
  – Gaussian distribution with 1mm X and Y sigma
  – 6mm diameter, 160mm length target
  – 3 bins/sigma radially, 1cm bins axially
Results

• Peak DPA:
  – 1.4e-18 DPA/p

• Gas production:
  – H: 60 appm/DPA
  – He: 20 appm/DPA
Converted to yearly..

- $1.9 \times 10^{20}$ p/yr estimated
- Peak DPA:
  - 260 DPA/yr
- Gas production:
  - H: 16000 appm/yr
  - He: 5300 appm/yr
DPA and Gas Production in Beryllium

• Ran an arbitrary case in MARS15:

  – Varying energy protons on Beryllium target
    • 2 MeV, 250 MeV, 120 GeV
  – Gaussian distribution with 0.3mm X and Y sigma
  – 2.1mm diameter (7 sigma), 10mm length target
  – 1 bin/sigma radially, 1cm bins axially
Results

<table>
<thead>
<tr>
<th></th>
<th>DPA (/p)</th>
<th>H (appm/DPA)</th>
<th>He (appm/DPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 GeV</td>
<td>3.66E-21</td>
<td>1030</td>
<td>2885</td>
</tr>
<tr>
<td>250 MeV</td>
<td>6.29E-21</td>
<td>720</td>
<td>3400</td>
</tr>
<tr>
<td>2 MeV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First 20um Bragg Peak</td>
<td>4E-19</td>
<td>10-30</td>
<td>0</td>
</tr>
<tr>
<td>Bragg Peak</td>
<td>7.5E-18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Values are shown averaged over a volume of:
  - 1 sigma diameter
  - 1cm depth for 120 GeV and 250 MeV, depth shown for 2 MeV
Results scaled to LBNE style beam

• 700kW case:
  – 1.3mm beam sigmas
  – 3.7E13 protons/sec
  – 100% uptime

<table>
<thead>
<tr>
<th></th>
<th>DPA (#/yr)</th>
<th>H (appm/yr)</th>
<th>He (appm/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 GeV</td>
<td>0.23</td>
<td>235</td>
<td>659</td>
</tr>
<tr>
<td>250 MeV</td>
<td>0.39</td>
<td>283</td>
<td>1330</td>
</tr>
</tbody>
</table>
Acknowledgements

Many thanks to Nikolai Mokhov for his input and support for the MARS runs.