CONCLUSIONS

This presentation reports the results of recent proton and heavy ion Single Event Effect (SEE) testing on a variety of COTS and non-COTS electronic devices for NASA-JSC Space Projects.

ANALYSIS METHODS

To analyze the proton data, the SEEs are grouped by type, frequency and severity. The errors are counted and inputted into a program called PROTEST [3]. PROTEST derives the equivalent 10 year MTBF for the hardware. This software integrates the test data with the LEO radiation environment defined above. It typically assumes worst-case environmental conditions, with 0.1 inch shielding around the device to give a conservative result. The output of PROTEST is the calculated Mean-Time-Between-Failure (MTBF), rate expected for operating the hardware in LEO orbit (expressed in terms of days between failures). An MTBF is calculated for each beam position, as well as a final box-level composite rate. These estimates assume the hardware is operating continuously on-orbit and does not take into account the actual mission timeline in which it will be used. For these devices that show no SEE failures in a typical 1E-10 exposure, we estimate the LEON on-orbit MTBF to be greater than 10 years. This is the same methodology that has been used at JSC for more than 15 years to evaluate the radiation hardness of most COTS hardware.

REFERENCES


TABLE I: Summary of Laptop Hardware using Proton Radiation Testing

<table>
<thead>
<tr>
<th>Hardware Type</th>
<th>Radiation Mode</th>
<th>Beam Energy (MeV)</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laptop</td>
<td>Proton Tests</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

TABLE II: Summary of COTS & GFE Hardware Tested with Proton Radiation Testing

<table>
<thead>
<tr>
<th>Hardware Type</th>
<th>Radiation Mode</th>
<th>Beam Energy (MeV)</th>
<th>Results</th>
</tr>
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<td>Laptop</td>
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