Study Of Dose Distribution In ISS Compartments With Passive Detectors

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Dose characteristics depend on:

- phase of solar cycle;
- orbit parameters;
- shielding of spacecraft.

It's necessary to study dose distribution at various compartments of ISS.
SPD: Set of Passive Detectors
(6 boxes)

dimensions: 118 x 63 x 43 mm
no electricity supply
List of participants

- IBMP, Russia
- NPI, Czech republic
- NIRS, Japan
- CER MTA, Hungary
- DLR, Germany
- TU Vien , Austria
Instruments

- TLD (LiF:Mg,Ti; CaSO4:Dy; Al2O3:C)
- PNTD

Measured characteristics:

- absorbed dose;
- equivalent dose;
- quality factor

In current presentation only TLD data* by IBMP is presented

*For sessions 1,2,4,5,6 measurements were done by Yu. A. Akatov
Set of passive detectors...
Homogeneity of dose distribution inside SPD box

Variations in dose were verified
- Glass ~ 2%
- CR-39 ~ 6%

in dose.

These will be a kind of variations (errors) that can be targeted.
## Flight data

<table>
<thead>
<tr>
<th># session</th>
<th>Launching</th>
<th>Landing</th>
<th>Duration, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.01.2004</td>
<td>30.04.2004</td>
<td>92</td>
</tr>
<tr>
<td>2</td>
<td>11.08.2004</td>
<td>09.04.2006</td>
<td>606</td>
</tr>
<tr>
<td>4</td>
<td>12.05.2007</td>
<td>22.10.2007</td>
<td>163</td>
</tr>
<tr>
<td>5</td>
<td>14.05.2008</td>
<td>24.10.2008</td>
<td>163</td>
</tr>
<tr>
<td>6</td>
<td>22.04.2009</td>
<td>11.10.2009</td>
<td>172</td>
</tr>
<tr>
<td>7</td>
<td>28.04.2010</td>
<td>26.11.2010</td>
<td>212</td>
</tr>
<tr>
<td>8</td>
<td>05.04.2011</td>
<td>22.11.2011</td>
<td>231</td>
</tr>
<tr>
<td>9</td>
<td>15.05.2012</td>
<td>14.05.2013</td>
<td>364</td>
</tr>
<tr>
<td>10</td>
<td>11.09.2013</td>
<td>30.04.2014</td>
<td>231</td>
</tr>
</tbody>
</table>
## Locations (for sessions 1, 2, 4, 5, 6)

<table>
<thead>
<tr>
<th>SPD box #</th>
<th>Coordinates [cm]</th>
<th>Panel, position</th>
<th>Average shielding [g/cm²]</th>
<th>Standart deviation [g/cm²]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(327, -54.48)</td>
<td>#102, Piers Module 1, floor</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>2</td>
<td>(301, 37, -43)</td>
<td>#401, Piers Module 1, the star board</td>
<td>34</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>(786, 135, -108)</td>
<td>#325, SM, cone, ceiling, close to R-16</td>
<td>47</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>(1216, 22, -81)</td>
<td>#461, SM, the star board</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>5</td>
<td>(786, 129, 97)</td>
<td>#323, SM, cone, ceiling, close to R-16</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>(317, 54, 27)</td>
<td>#305, SM, ceiling, small diameter</td>
<td>33</td>
<td>31</td>
</tr>
</tbody>
</table>
Сборка “СПД” (A01) на пан 102

Сборка “СПД” (A02) на пан 401
A02 location
Сборка “СПД” (A06) на пан 305
Сборка “СПД” (A05) на пан 323
Сборка “СПД” (A03) на пан 325
A03 location
Сборка "СПД" (A05) на пан 323
A05 location
Сборка "СПД" (A06) на пан 305
Сборка "СПД" (A05) на пан 323
Сборка "СПД" (A03) на пан 325
A06 location
Max/Min average = 1.9 ± 0.6
Conclusions

- The duration of experiment cover almost 10 years of exposure. Total duration of detector exposure onboard ISS is 2234 days.
- The ratio of maximum dose observed to minimum is
  \[ \text{Max/Min}_{\text{average}} = 1.9 \pm 0.6 \]
- Biological objects that do not require special care and nutrition can be used more intensively in future (seeds, insect larvae).
- Intercompatrison in real space conditions.
- In this report IBMP TLD data was presented. Though, the presented above data is not complete yet and can be corrected when the detector processing and analysis by all space intercomparison participants is completed. Track detector processing that requires more time and efforts can give us additional important information on the LET spectra and thus on radiation quality factors and dose equivalents.
THANK YOU.
Protective curtain do protect!