## Total Mission Dose at the Center of Solid Aluminum Spheres
## ENA: I=28 deg, H=1.2$R_e$x12$R_e$
## SAA + Solar Protons, Solar Maximum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 2 Years rads-si | Bremsstrahlung SAA 2 Years rads-si | Trapped Protons SAA 2 Years rads-si | Solar Protons SAA 2 Years rads-si | Total rads-si |
|---|---|---|---|---|---|
| 1 | 5.32E+07 | 2.65E+04 | 3.41E+07 | 1.13E+06 | 8.84E+07 |
| 3 | 3.36E+07 | 2.07E+04 | 8.83E+06 | 2.36E+05 | 4.27E+07 |
| 4 | 2.36E+07 | 1.70E+04 | 4.26E+06 | 1.11E+05 | 2.80E+07 |
| 6 | 1.76E+07 | 1.45E+04 | 2.48E+06 | 6.62E+04 | 2.02E+07 |
| 7 | 1.37E+07 | 1.28E+04 | 1.59E+06 | 4.49E+04 | 1.53E+07 |
| 9 | 1.09E+07 | 1.13E+04 | 1.17E+06 | 3.49E+04 | 1.21E+07 |
| 10 | 8.92E+06 | 1.02E+04 | 8.84E+05 | 2.84E+04 | 9.84E+06 |
| 12 | 7.41E+06 | 9.16E+03 | 7.02E+05 | 2.43E+04 | 8.14E+06 |
| 13 | 6.24E+06 | 8.32E+03 | 5.75E+05 | 2.15E+04 | 6.84E+06 |
| 15 | 5.32E+06 | 7.60E+03 | 4.74E+05 | 1.93E+04 | 5.82E+06 |
| 29 | 1.68E+06 | 4.14E+03 | 1.37E+05 | 1.24E+04 | 1.83E+06 |
| 44 | 8.36E+05 | 2.96E+03 | 6.42E+04 | 9.71E+03 | 9.12E+05 |
| 58 | 5.06E+05 | 2.32E+03 | 3.56E+04 | 8.01E+03 | 5.50E+05 |
| 73 | 3.31E+05 | 1.90E+03 | 2.20E+04 | 6.94E+03 | 3.60E+05 |
| 87 | 2.23E+05 | 1.60E+03 | 1.55E+04 | 6.16E+03 | 2.45E+05 |
| 117 | 1.06E+05 | 1.23E+03 | 9.14E+03 | 5.09E+03 | 1.20E+05 |
| 146 | 5.25E+04 | 1.01E+03 | 6.13E+03 | 4.34E+03 | 6.30E+04 |
| 182 | 2.21E+04 | 8.31E+02 | 4.42E+03 | 3.69E+03 | 3.03E+04 |
| 219 | 9.09E+03 | 7.13E+02 | 3.45E+03 | 3.14E+03 | 1.57E+04 |
| 255 | 3.56E+03 | 6.28E+02 | 2.92E+03 | 2.80E+03 | 9.28E+03 |
| 292 | 1.28E+03 | 5.64E+02 | 2.55E+03 | 2.50E+03 | 6.33E+03 |
| 365 | 1.35E+02 | 4.77E+02 | 1.94E+03 | 1.89E+03 | 4.03E+03 |
| 437 | 9.56E+00 | 4.19E+02 | 1.59E+03 | 1.62E+03 | 3.28E+03 |
| 510 | 6.21E-01 | 3.78E+02 | 1.33E+03 | 1.32E+03 | 2.74E+03 |
| 583 | 3.88E-03 | 3.46E+02 | 1.16E+03 | 1.10E+03 | 2.38E+03 |
| 656 | 0.00E+00 | 3.21E+02 | 1.05E+03 | 9.71E+02 | 2.14E+03 |
| 729 | 0.00E+00 | 2.99E+02 | 9.57E+02 | 8.33E+02 | 1.92E+03 |
| 875 | 0.00E+00 | 2.63E+02 | 8.09E+02 | 6.35E+02 | 1.58E+03 |
| 1167 | 0.00E+00 | 2.14E+02 | 6.02E+02 | 4.02E+02 | 1.14E+03 |
| 1458 | 0.00E+00 | 1.79E+02 | 4.65E+02 | 2.68E+02 | 8.66E+02 |

*For 90% Confidence Level, 2 AL Events are predicted.

## Total Mission Dose at the Center of Solid Aluminum Spheres
## ENA: I=28 deg, H=1.9$R_e$x12$R_e$
## SAA + Solar Protons, Solar Maximum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 2 years rads (Si) | Bremsstrahlung SAA 2 Years rads (Si) | Trapped Protons SAA 2 Years rads (Si) | Solar Protons 2 Years rads (Si) | Total rads (Si) |
|---|---|---|---|---|---|
| 1 | 4.081E+07 | 1.604E+04 | 4.517E+07 | 6.718E+03 | 8.600E+07 |
| 3 | 2.525E+07 | 1.233E+04 | 9.415E+06 | 6.781E+03 | 3.468E+07 |
| 4 | 1.762E+07 | 1.013E+04 | 3.844E+06 | 6.840E+03 | 2.148E+07 |
| 6 | 1.315E+07 | 8.705E+03 | 1.948E+06 | 6.904E+03 | 1.511E+07 |
| 7 | 1.023E+07 | 7.679E+03 | 1.149E+06 | 6.972E+03 | 1.140E+07 |
| 9 | 8.215E+06 | 6.866E+03 | 7.590E+05 | 7.047E+03 | 8.988E+06 |
| 10 | 6.750E+06 | 6.198E+03 | 5.476E+05 | 7.125E+03 | 7.311E+06 |
| 12 | 5.650E+06 | 5.635E+03 | 4.141E+05 | 7.217E+03 | 6.077E+06 |
| 13 | 4.797E+06 | 5.158E+03 | 3.260E+05 | 7.298E+03 | 5.135E+06 |
| 15 | 4.123E+06 | 4.744E+03 | 2.628E+05 | 7.461E+03 | 4.398E+06 |
| 29 | 1.368E+06 | 2.705E+03 | 6.134E+04 | 8.550E+03 | 1.441E+06 |
| 44 | 6.968E+05 | 1.966E+03 | 2.521E+04 | 7.703E+03 | 7.317E+05 |
| 58 | 4.279E+05 | 1.555E+03 | 1.255E+04 | 6.800E+03 | 4.488E+05 |
| 73 | 2.832E+05 | 1.282E+03 | 6.979E+03 | 6.147E+03 | 2.976E+05 |
| 87 | 1.928E+05 | 1.087E+03 | 4.488E+03 | 5.578E+03 | 2.039E+05 |
| 117 | 9.334E+04 | 8.349E+02 | 2.242E+03 | 4.724E+03 | 1.011E+05 |
| 146 | 4.695E+04 | 6.837E+02 | 1.293E+03 | 4.065E+03 | 5.299E+04 |
| 182 | 2.021E+04 | 5.637E+02 | 7.989E+02 | 3.463E+03 | 2.503E+04 |
| 219 | 8.476E+03 | 4.838E+02 | 5.480E+02 | 2.985E+03 | 1.249E+04 |
| 255 | 3.393E+03 | 4.268E+02 | 4.136E+02 | 2.598E+03 | 6.831E+03 |
| 292 | 1.252E+03 | 3.842E+02 | 3.265E+02 | 2.291E+03 | 4.254E+03 |
| 365 | 1.458E+02 | 3.256E+02 | 2.063E+02 | 1.774E+03 | 2.451E+03 |
| 437 | 1.185E+01 | 2.873E+02 | 1.411E+02 | 1.471E+03 | 1.911E+03 |
| 510 | 8.531E-01 | 2.601E+02 | 1.054E+02 | 1.201E+03 | 1.567E+03 |
| 583 | 5.514E-03 | 2.392E+02 | 8.669E+01 | 9.863E+02 | 1.312E+03 |
| 656 | 0.000E+00 | 2.220E+02 | 7.481E+01 | 8.460E+02 | 1.143E+03 |
| 729 | 0.000E+00 | 2.075E+02 | 6.551E+01 | 7.179E+02 | 9.909E+02 |
| 875 | 0.000E+00 | 1.837E+02 | 5.180E+01 | 5.291E+02 | 7.646E+02 |
| 1167 | 0.000E+00 | 1.524E+02 | 3.367E+01 | 3.072E+02 | 4.932E+02 |
| 1458 | 0.000E+00 | 1.280E+02 | 2.330E+01 | 1.860E+02 | 3.373E+02 |

*For 90% Confidence Level, 2 AL Events are predicted.

## Total Mission Dose at the Center of Solid Aluminum Spheres
## MMS Probe: I=10 deg, H=1.2$R_e$x12$R_e$
## SAA, Solar Minimum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 1 year rads-si | Bremsstrahlung SAA 1 year rads-si | Trapped Protons SAA 1 year rads-si | Total rads-si |
|---|---|---|---|---|
| 1 | 2.21E+07 | 1.11E+04 | 2.99E+07 | 5.19E+07 |
| 3 | 1.35E+07 | 8.49E+03 | 7.27E+06 | 2.08E+07 |
| 4 | 9.45E+06 | 6.98E+03 | 3.45E+06 | 1.29E+07 |
| 6 | 7.13E+06 | 6.01E+03 | 2.00E+06 | 9.13E+06 |
| 7 | 5.62E+06 | 5.31E+03 | 1.28E+06 | 6.90E+06 |
| 9 | 4.57E+06 | 4.76E+03 | 9.41E+05 | 5.51E+06 |
| 10 | 3.80E+06 | 4.31E+03 | 7.15E+05 | 4.52E+06 |
| 12 | 3.22E+06 | 3.93E+03 | 5.70E+05 | 3.80E+06 |
| 13 | 2.77E+06 | 3.60E+03 | 4.69E+05 | 3.24E+06 |
| 15 | 2.40E+06 | 3.32E+03 | 3.89E+05 | 2.79E+06 |
| 29 | 8.51E+05 | 1.90E+03 | 1.17E+05 | 9.70E+05 |
| 44 | 4.37E+05 | 1.37E+03 | 5.62E+04 | 4.95E+05 |
| 58 | 2.63E+05 | 1.08E+03 | 3.18E+04 | 2.95E+05 |
| 73 | 1.68E+05 | 8.80E+02 | 1.98E+04 | 1.89E+05 |
| 87 | 1.11E+05 | 7.42E+02 | 1.40E+04 | 1.26E+05 |
| 117 | 5.20E+04 | 5.67E+02 | 8.29E+03 | 6.08E+04 |
| 146 | 2.56E+04 | 4.64E+02 | 5.53E+03 | 3.16E+04 |
| 182 | 1.09E+04 | 3.83E+02 | 3.98E+03 | 1.53E+04 |
| 219 | 4.66E+03 | 3.29E+02 | 3.13E+03 | 8.12E+03 |
| 255 | 1.95E+03 | 2.91E+02 | 2.67E+03 | 4.92E+03 |
| 292 | 7.59E+02 | 2.62E+02 | 2.37E+03 | 3.39E+03 |
| 365 | 9.40E+01 | 2.22E+02 | 1.88E+03 | 2.19E+03 |
| 437 | 7.47E+00 | 1.96E+02 | 1.56E+03 | 1.76E+03 |
| 510 | 5.18E-01 | 1.77E+02 | 1.34E+03 | 1.52E+03 |
| 583 | 3.41E-03 | 1.62E+02 | 1.22E+03 | 1.38E+03 |
| 656 | 0.00E+00 | 1.51E+02 | 1.13E+03 | 1.28E+03 |
| 729 | 0.00E+00 | 1.41E+02 | 1.05E+03 | 1.19E+03 |
| 875 | 0.00E+00 | 1.24E+02 | 9.29E+02 | 1.05E+03 |
| 1167 | 0.00E+00 | 1.01E+02 | 7.41E+02 | 8.43E+02 |
| 1458 | 0.00E+00 | 8.51E+01 | 6.06E+02 | 6.91E+02 |

## Total Mission Dose at the Center of Solid Aluminum Spheres
## MMS Probe: I=10 deg, H=1.2$R_e$x30$R_e$
## SAA, Solar Minimum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 6 months rads-si | Bremsstrahlung SAA 6 months rads-si | Trapped Protons SAA 6 months rads-si | Total rads-si |
|---|---|---|---|---|
| 1 | 3.41E+06 | 1.71E+03 | 6.63E+06 | 1.00E+07 |
| 3 | 2.12E+06 | 1.32E+03 | 1.67E+06 | 3.79E+06 |
| 4 | 1.50E+06 | 1.09E+03 | 7.95E+05 | 2.29E+06 |
| 6 | 1.13E+06 | 9.44E+02 | 4.61E+05 | 1.59E+06 |
| 7 | 8.91E+05 | 8.36E+02 | 2.96E+05 | 1.19E+06 |
| 9 | 7.25E+05 | 7.50E+02 | 2.17E+05 | 9.43E+05 |
| 10 | 6.03E+05 | 6.78E+02 | 1.65E+05 | 7.69E+05 |
| 12 | 5.11E+05 | 6.18E+02 | 1.31E+05 | 6.43E+05 |
| 13 | 4.38E+05 | 5.67E+02 | 1.08E+05 | 5.47E+05 |
| 15 | 3.80E+05 | 5.22E+02 | 8.93E+04 | 4.70E+05 |
| 29 | 1.35E+05 | 3.00E+02 | 2.64E+04 | 1.62E+05 |
| 44 | 6.97E+04 | 2.17E+02 | 1.25E+04 | 8.24E+04 |
| 58 | 4.21E+04 | 1.71E+02 | 6.96E+03 | 4.92E+04 |
| 73 | 2.71E+04 | 1.40E+02 | 4.28E+03 | 3.15E+04 |
| 87 | 1.80E+04 | 1.18E+02 | 3.00E+03 | 2.11E+04 |
| 117 | 8.43E+03 | 9.00E+01 | 1.74E+03 | 1.03E+04 |
| 146 | 4.17E+03 | 7.36E+01 | 1.15E+03 | 5.39E+03 |
| 182 | 1.78E+03 | 6.08E+01 | 8.15E+02 | 2.66E+03 |
| 219 | 7.59E+02 | 5.23E+01 | 6.36E+02 | 1.45E+03 |
| 255 | 3.17E+02 | 4.62E+01 | 5.40E+02 | 9.03E+02 |
| 292 | 1.23E+02 | 4.16E+01 | 4.75E+02 | 6.40E+02 |
| 365 | 1.52E+01 | 3.53E+01 | 3.75E+02 | 4.25E+02 |
| 437 | 1.20E+00 | 3.11E+01 | 3.09E+02 | 3.42E+02 |
| 510 | 8.24E-02 | 2.82E+01 | 2.66E+02 | 2.94E+02 |
| 583 | 5.48E-04 | 2.59E+01 | 2.40E+02 | 2.66E+02 |
| 656 | 0.00E+00 | 2.40E+01 | 2.23E+02 | 2.47E+02 |
| 729 | 0.00E+00 | 2.24E+01 | 2.08E+02 | 2.30E+02 |
| 875 | 0.00E+00 | 1.98E+01 | 1.84E+02 | 2.04E+02 |
| 1167 | 0.00E+00 | 1.62E+01 | 1.47E+02 | 1.63E+02 |
| 1458 | 0.00E+00 | 1.36E+01 | 1.21E+02 | 1.34E+02 |

## Total Mission Dose at the Center of Solid Aluminum Spheres
## MMS Probe: I=10 deg, H=8$R_e$x80$R_e$
## SAA, Solar Minimum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 1 month rads-si | Bremsstrahlung SAA 1 month rads-si | Trapped Protons SAA 1 month rads-si | Total rads-si |
|---|---|---|---|---|
| 1 | 4.24E+04 | 2.27E+01 | 0.00E+00 | 4.24E+04 |
| 3 | 2.08E+04 | 1.44E+01 | 0.00E+00 | 2.09E+04 |
| 4 | 1.29E+04 | 1.07E+01 | 0.00E+00 | 1.29E+04 |
| 6 | 8.89E+03 | 8.67E+00 | 0.00E+00 | 8.89E+03 |
| 7 | 6.47E+03 | 7.28E+00 | 0.00E+00 | 6.47E+03 |
| 9 | 4.91E+03 | 6.25E+00 | 0.00E+00 | 4.92E+03 |
| 10 | 3.84E+03 | 5.44E+00 | 0.00E+00 | 3.85E+03 |
| 12 | 3.07E+03 | 4.79E+00 | 0.00E+00 | 3.08E+03 |
| 13 | 2.49E+03 | 4.26E+00 | 0.00E+00 | 2.50E+03 |
| 15 | 2.05E+03 | 3.82E+00 | 0.00E+00 | 2.06E+03 |
| 29 | 4.59E+02 | 1.87E+00 | 0.00E+00 | 4.61E+02 |
| 44 | 1.68E+02 | 1.24E+00 | 0.00E+00 | 1.69E+02 |
| 58 | 7.87E+01 | 9.30E-01 | 0.00E+00 | 7.96E+01 |
| 73 | 4.09E+01 | 7.39E-01 | 0.00E+00 | 4.16E+01 |
| 87 | 2.23E+01 | 6.16E-01 | 0.00E+00 | 2.29E+01 |
| 117 | 7.40E+00 | 4.67E-01 | 0.00E+00 | 7.87E+00 |
| 146 | 2.63E+00 | 3.81E-01 | 0.00E+00 | 3.01E+00 |
| 182 | 8.55E-01 | 3.12E-01 | 0.00E+00 | 1.17E+00 |
| 219 | 3.40E-01 | 2.64E-01 | 0.00E+00 | 6.05E-01 |
| 255 | 1.61E-01 | 2.30E-01 | 0.00E+00 | 3.91E-01 |
| 292 | 5.39E-02 | 2.04E-01 | 0.00E+00 | 2.58E-01 |
| 365 | 3.85E-03 | 1.67E-01 | 0.00E+00 | 1.71E-01 |
| 437 | 1.06E-06 | 1.43E-01 | 0.00E+00 | 1.43E-01 |
| 510 | 0.00E+00 | 1.26E-01 | 0.00E+00 | 1.26E-01 |
| 583 | 0.00E+00 | 1.13E-01 | 0.00E+00 | 1.13E-01 |
| 656 | 0.00E+00 | 1.02E-01 | 0.00E+00 | 1.02E-01 |
| 729 | 0.00E+00 | 9.36E-02 | 0.00E+00 | 9.36E-02 |
| 875 | 0.00E+00 | 7.98E-02 | 0.00E+00 | 7.98E-02 |
| 1167 | 0.00E+00 | 6.16E-02 | 0.00E+00 | 6.16E-02 |
| 1458 | 0.00E+00 | 4.95E-02 | 0.00E+00 | 4.95E-02 |

## Total Mission Dose at the Center of Solid Aluminum Spheres
## MMS Probe: I=90, H=10$R_e$x100$R_e$
## SAA, Solar Minimum
## Values Do Not Include Design Margins

| Aluminum Shield Thickness mils | Electrons SAA 6 months rads-si | Bremsstrahlung SAA 6 months rads-si | Trapped Protons SAA 6 months rads-si | Total rads-si |
|---|---|---|---|---|
| 1 | 5.16E+03 | 4.19E+00 | 0.00E+00 | 5.17E+03 |
| 3 | 1.45E+03 | 1.87E+00 | 0.00E+00 | 1.45E+03 |
| 4 | 6.32E+02 | 1.19E+00 | 0.00E+00 | 6.33E+02 |
| 6 | 3.25E+02 | 8.75E-01 | 0.00E+00 | 3.26E+02 |
| 7 | 1.82E+02 | 6.86E-01 | 0.00E+00 | 1.83E+02 |
| 9 | 1.08E+02 | 5.60E-01 | 0.00E+00 | 1.09E+02 |
| 10 | 6.81E+01 | 4.71E-01 | 0.00E+00 | 6.86E+01 |
| 12 | 4.44E+01 | 4.07E-01 | 0.00E+00 | 4.48E+01 |
| 13 | 2.98E+01 | 3.57E-01 | 0.00E+00 | 3.02E+01 |
| 15 | 2.03E+01 | 3.19E-01 | 0.00E+00 | 2.06E+01 |
| 29 | 1.40E+00 | 1.57E-01 | 0.00E+00 | 1.55E+00 |
| 44 | 3.11E-01 | 1.04E-01 | 0.00E+00 | 4.14E-01 |
| 58 | 1.01E-01 | 7.63E-02 | 0.00E+00 | 1.78E-01 |
| 73 | 4.08E-02 | 6.01E-02 | 0.00E+00 | 1.01E-01 |
| 87 | 1.92E-02 | 4.95E-02 | 0.00E+00 | 6.87E-02 |
| 117 | 6.20E-03 | 3.67E-02 | 0.00E+00 | 4.28E-02 |
| 146 | 2.90E-03 | 2.89E-02 | 0.00E+00 | 3.18E-02 |
| 182 | 1.45E-03 | 2.25E-02 | 0.00E+00 | 2.39E-02 |
| 219 | 7.40E-04 | 1.81E-02 | 0.00E+00 | 1.88E-02 |
| 255 | 3.25E-04 | 1.49E-02 | 0.00E+00 | 1.52E-02 |
| 292 | 7.20E-05 | 1.26E-02 | 0.00E+00 | 1.26E-02 |
| 365 | 0.00E+00 | 9.43E-03 | 0.00E+00 | 9.43E-03 |
| 437 | 0.00E+00 | 7.51E-03 | 0.00E+00 | 7.51E-03 |
| 510 | 0.00E+00 | 6.23E-03 | 0.00E+00 | 6.23E-03 |
| 583 | 0.00E+00 | 5.30E-03 | 0.00E+00 | 5.30E-03 |
| 656 | 0.00E+00 | 4.57E-03 | 0.00E+00 | 4.57E-03 |
| 729 | 0.00E+00 | 3.98E-03 | 0.00E+00 | 3.98E-03 |
| 875 | 0.00E+00 | 3.06E-03 | 0.00E+00 | 3.06E-03 |
| 1167 | 0.00E+00 | 1.94E-03 | 0.00E+00 | 1.94E-03 |
| 1458 | 0.00E+00 | 1.34E-03 | 0.00E+00 | 1.34E-03 |

Total Dose of All 4 Phases

| | |
|---|---|
| 6.20E+07 | 1 |
| 2.46E+07 | 3 |
| 1.52E+07 | 4 |
| 1.07E+07 | 6 |
| 8.10E+06 | 7 |
| 6.46E+06 | 9 |
| 5.29E+06 | 10 |
| 4.44E+06 | 12 |
| 3.79E+06 | 13 |
| 3.26E+06 | 15 |
| 1.13E+06 | 29 |
| 5.77E+05 | 44 |
| 3.45E+05 | 58 |
| 2.20E+05 | 73 |
| 1.47E+05 | 87 |
| 7.11E+04 | 117 |
| 3.70E+04 | 146 |
| 1.79E+04 | 182 |
| 9.57E+03 | 219 |
| 5.82E+03 | 255 |
| 4.03E+03 | 292 |
| 2.62E+03 | 365 |
| 2.11E+03 | 437 |
| 1.81E+03 | 510 |
| 1.65E+03 | 583 |
| 1.53E+03 | 656 |
| 1.42E+03 | 729 |
| 1.26E+03 | 875 |
| 1.01E+03 | 1167 |
| 8.25E+02 | 1458 |