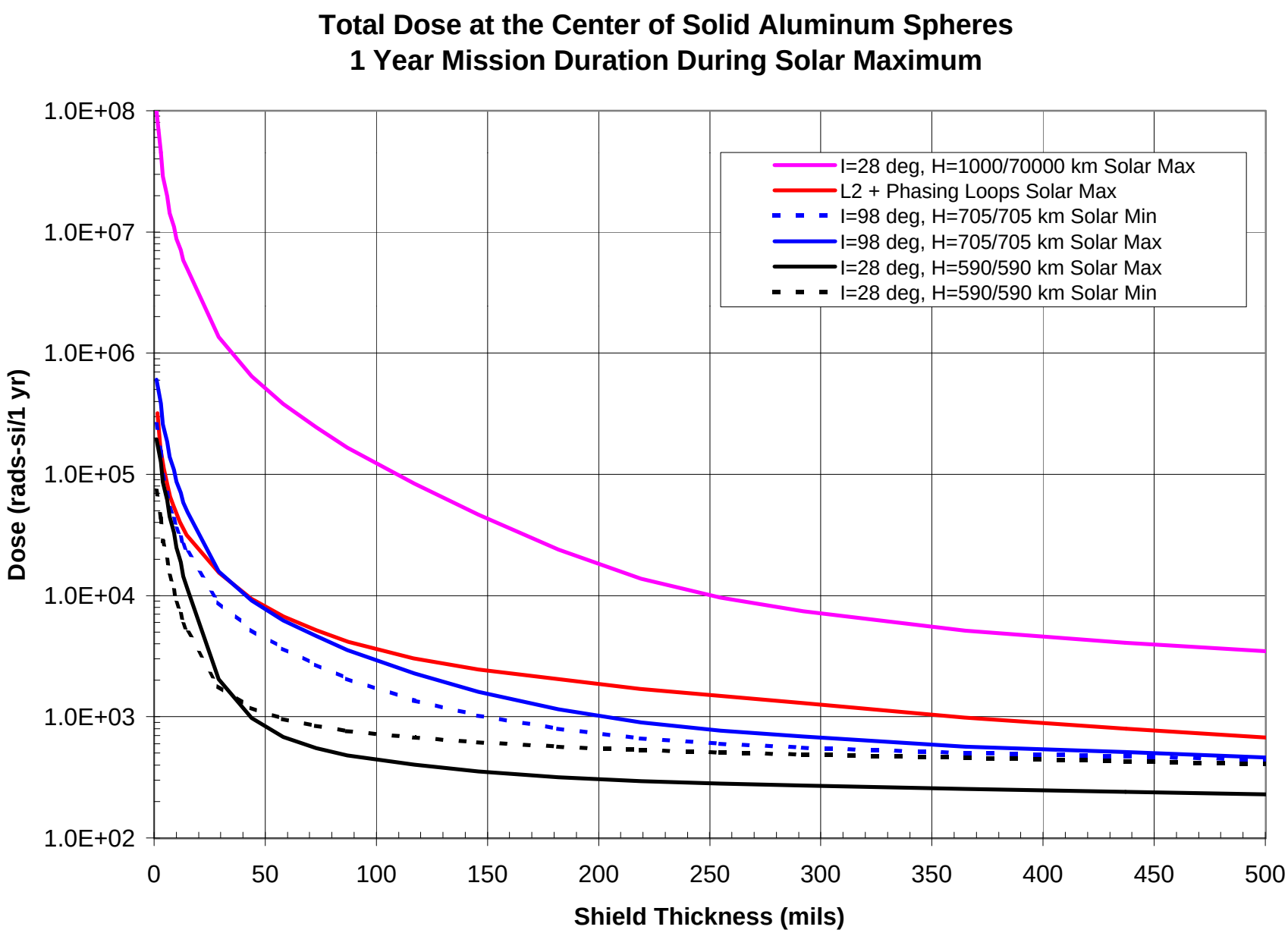
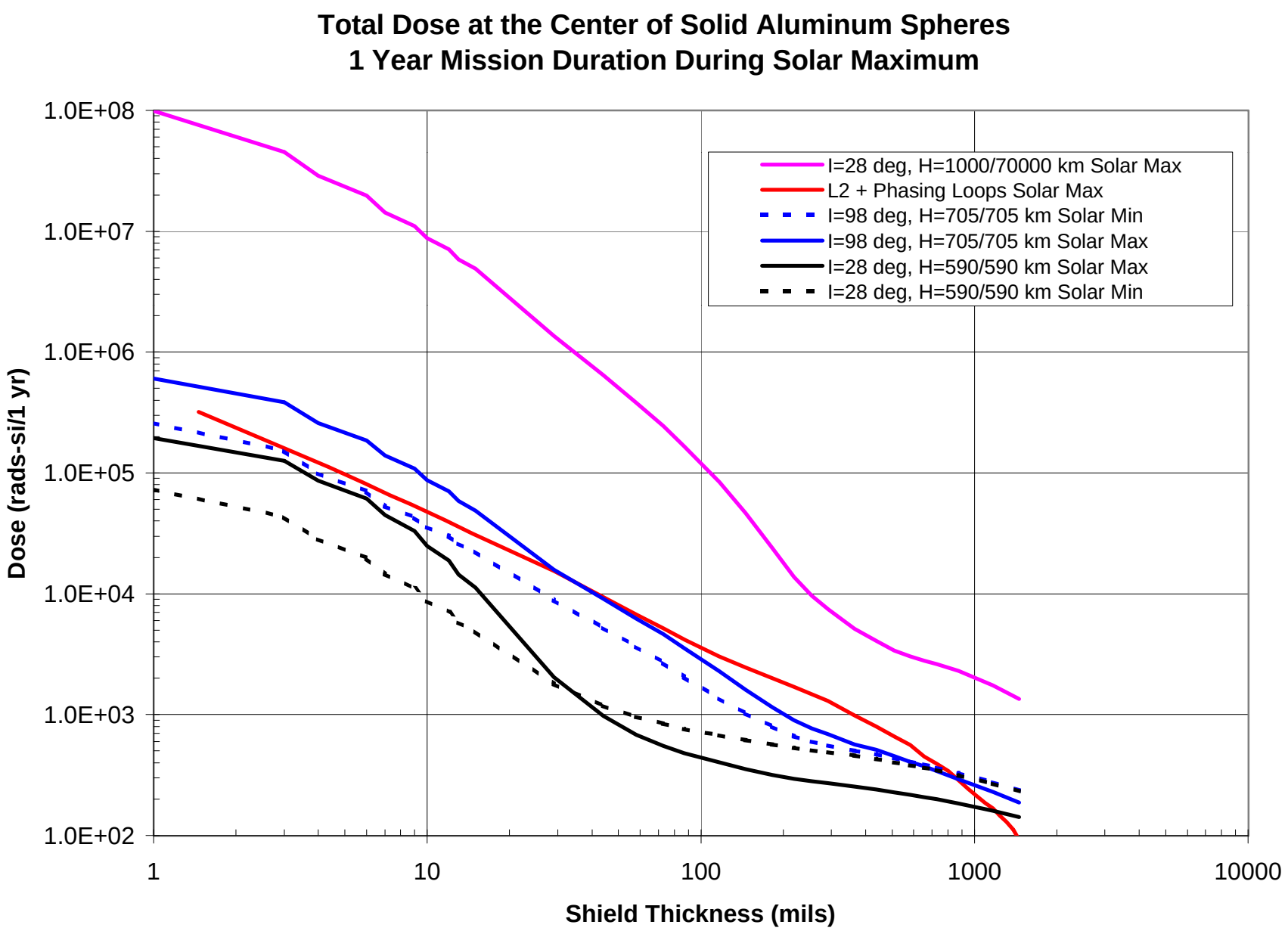

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Maximum
Dose (rads-si/1 yr)
1.0E+08
1.0E+07
1.0E+06
1.0E+05
1.0E+04
1.0E+03
1.0E+02
0
50
100
150
200
250
300
350
400
450
500
Shield Thickness (mils)
I=28 deg, H=1000/70000 km Solar Max
L2 + Phasing Loops Solar Max
I=98 deg, H=705/705 km Solar Min
I=98 deg, H=705/705 km Solar Max
I=28 deg, H=590/590 km Solar Max
I=28 deg, H=590/590 km Solar Min


Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Maximum
1.0E+08
1.0E+07
1.0E+06
1.0E+05
1.0E+04
1.0E+03
1.0E+02
Dose (rads-si/1 yr)
1
10
100
1000
10000
Shield Thickness (mils)
I=28 deg, H=1000/70000 km Solar Max
L2 + Phasing Loops Solar Max
I=98 deg, H=705/705 km Solar Min
I=98 deg, H=705/705 km Solar Max
I=28 deg, H=590/590 km Solar Max
I=28 deg, H=590/590 km Solar Min

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Maximum*
I=29 deg, H=590/590 km

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	1.93E+05	9.28E+01	8.01E+02	0.00E+00	1.94E+05
0.02	0.07	3	1.26E+05	7.33E+01	7.22E+02	0.00E+00	1.26E+05
0.03	0.11	4	8.56E+04	5.86E+01	6.86E+02	0.00E+00	8.64E+04
0.04	0.15	6	6.09E+04	4.85E+01	6.58E+02	0.00E+00	6.16E+04
0.05	0.19	7	4.42E+04	4.09E+01	6.34E+02	0.00E+00	4.49E+04
0.06	0.22	9	3.25E+04	3.48E+01	6.19E+02	0.00E+00	3.32E+04
0.07	0.26	10	2.42E+04	2.99E+01	6.03E+02	0.00E+00	2.49E+04
0.08	0.30	12	1.82E+04	2.58E+01	5.89E+02	0.00E+00	1.89E+04
0.09	0.33	13	1.39E+04	2.25E+01	5.75E+02	0.00E+00	1.45E+04
0.10	0.37	15	1.06E+04	1.97E+01	5.61E+02	0.00E+00	1.12E+04
0.20	0.74	29	1.55E+03	8.80E+00	4.72E+02	0.00E+00	2.03E+03
0.30	1.11	44	5.44E+02	5.90E+00	4.27E+02	0.00E+00	9.76E+02
0.40	1.48	58	2.79E+02	4.50E+00	3.99E+02	0.00E+00	6.83E+02
0.50	1.85	73	1.73E+02	3.65E+00	3.76E+02	0.00E+00	5.53E+02
0.60	2.22	87	1.16E+02	3.10E+00	3.62E+02	0.00E+00	4.81E+02
0.80	2.96	117	5.96E+01	2.40E+00	3.40E+02	0.00E+00	4.01E+02
1.00	3.70	146	3.14E+01	1.97E+00	3.20E+02	0.00E+00	3.54E+02
1.25	4.63	182	1.16E+01	1.61E+00	3.04E+02	0.00E+00	3.18E+02
1.50	5.56	219	2.65E+00	1.36E+00	2.89E+02	0.00E+00	2.93E+02
1.75	6.48	255	4.35E-01	1.18E+00	2.78E+02	0.00E+00	2.80E+02
2.00	7.41	292	4.21E-02	1.05E+00	2.69E+02	0.00E+00	2.70E+02
2.50	9.26	365	0.00E+00	8.66E-01	2.53E+02	0.00E+00	2.54E+02
3.00	11.11	437	0.00E+00	7.44E-01	2.40E+02	0.00E+00	2.41E+02
3.50	12.96	510	0.00E+00	6.56E-01	2.27E+02	0.00E+00	2.27E+02
4.00	14.81	583	0.00E+00	5.88E-01	2.16E+02	0.00E+00	2.17E+02
4.50	16.67	656	0.00E+00	5.34E-01	2.08E+02	0.00E+00	2.08E+02
5.00	18.52	729	0.00E+00	4.90E-01	1.99E+02	0.00E+00	1.99E+02
6.00	22.22	875	0.00E+00	4.20E-01	1.84E+02	0.00E+00	1.84E+02
8.00	29.63	1167	0.00E+00	3.26E-01	1.60E+02	0.00E+00	1.60E+02
10.00	37.04	1458	0.00E+00	2.63E-01	1.41E+02	0.00E+00	1.41E+02

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Minimum*
I=29 deg, H=590/590 km

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	7.18E+04	3.41E+01	1.42E+03	0.00E+00	7.32E+04
0.02	0.07	3	4.20E+04	2.50E+01	1.29E+03	0.00E+00	4.33E+04
0.03	0.11	4	2.70E+04	1.94E+01	1.23E+03	0.00E+00	2.82E+04
0.04	0.15	6	1.85E+04	1.58E+01	1.18E+03	0.00E+00	1.97E+04
0.05	0.19	7	1.33E+04	1.33E+01	1.14E+03	0.00E+00	1.45E+04
0.06	0.22	9	9.93E+03	1.14E+01	1.12E+03	0.00E+00	1.11E+04
0.07	0.26	10	7.61E+03	9.90E+00	1.09E+03	0.00E+00	8.70E+03
0.08	0.30	12	5.96E+03	8.67E+00	1.07E+03	0.00E+00	7.03E+03
0.09	0.33	13	4.76E+03	7.68E+00	1.04E+03	0.00E+00	5.81E+03
0.10	0.37	15	3.86E+03	6.86E+00	1.02E+03	0.00E+00	4.89E+03
0.20	0.74	29	9.00E+02	3.37E+00	8.82E+02	0.00E+00	1.79E+03
0.30	1.11	44	3.84E+02	2.32E+00	8.00E+02	0.00E+00	1.19E+03
0.40	1.48	58	2.15E+02	1.78E+00	7.45E+02	0.00E+00	9.62E+02
0.50	1.85	73	1.38E+02	1.45E+00	6.99E+02	0.00E+00	8.38E+02
0.60	2.22	87	9.36E+01	1.22E+00	6.68E+02	0.00E+00	7.63E+02
0.80	2.96	117	4.80E+01	9.43E-01	6.24E+02	0.00E+00	6.73E+02
1.00	3.70	146	2.54E+01	7.72E-01	5.88E+02	0.00E+00	6.14E+02
1.25	4.63	182	9.37E+00	6.31E-01	5.58E+02	0.00E+00	5.68E+02
1.50	5.56	219	2.17E+00	5.36E-01	5.28E+02	0.00E+00	5.31E+02
1.75	6.48	255	3.59E-01	4.68E-01	5.07E+02	0.00E+00	5.08E+02
2.00	7.41	292	3.50E-02	4.17E-01	4.89E+02	0.00E+00	4.90E+02
2.50	9.26	365	0.00E+00	3.46E-01	4.56E+02	0.00E+00	4.57E+02
3.00	11.11	437	0.00E+00	3.00E-01	4.30E+02	0.00E+00	4.30E+02
3.50	12.96	510	0.00E+00	2.67E-01	4.03E+02	0.00E+00	4.03E+02
4.00	14.81	583	0.00E+00	2.41E-01	3.82E+02	0.00E+00	3.82E+02
4.50	16.67	656	0.00E+00	2.21E-01	3.64E+02	0.00E+00	3.64E+02
5.00	18.52	729	0.00E+00	2.04E-01	3.46E+02	0.00E+00	3.46E+02
6.00	22.22	875	0.00E+00	1.76E-01	3.15E+02	0.00E+00	3.15E+02
8.00	29.63	1167	0.00E+00	1.39E-01	2.67E+02	0.00E+00	2.67E+02
10.00	37.04	1458	0.00E+00	1.14E-01	2.30E+02	0.00E+00	2.31E+02

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Maximum*
I=98 deg, H=705/705 km

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	5.98E+05	2.93E+02	6.73E+03	8.58E+02	6.06E+05
0.02	0.07	3	3.78E+05	2.26E+02	4.09E+03	8.66E+02	3.83E+05
0.03	0.11	4	2.55E+05	1.81E+02	3.08E+03	8.73E+02	2.59E+05
0.04	0.15	6	1.82E+05	1.52E+02	2.48E+03	8.81E+02	1.85E+05
0.05	0.19	7	1.36E+05	1.31E+02	2.07E+03	8.89E+02	1.39E+05
0.06	0.22	9	1.06E+05	1.14E+02	1.82E+03	8.98E+02	1.08E+05
0.07	0.26	10	8.41E+04	1.01E+02	1.63E+03	9.08E+02	8.67E+04
0.08	0.30	12	6.82E+04	8.95E+01	1.49E+03	9.19E+02	7.07E+04
0.09	0.33	13	5.61E+04	8.03E+01	1.39E+03	9.29E+02	5.85E+04
0.10	0.37	15	4.62E+04	7.25E+01	1.30E+03	9.48E+02	4.86E+04
0.20	0.74	29	1.38E+04	3.87E+01	8.76E+02	1.09E+03	1.58E+04
0.30	1.11	44	7.36E+03	2.80E+01	7.10E+02	9.89E+02	9.09E+03
0.40	1.48	58	4.70E+03	2.23E+01	6.32E+02	8.73E+02	6.23E+03
0.50	1.85	73	3.24E+03	1.85E+01	5.73E+02	7.93E+02	4.62E+03
0.60	2.22	87	2.30E+03	1.58E+01	5.28E+02	7.21E+02	3.56E+03
0.80	2.96	117	1.18E+03	1.22E+01	4.71E+02	6.14E+02	2.27E+03
1.00	3.70	146	6.21E+02	1.00E+01	4.36E+02	5.33E+02	1.60E+03
1.25	4.63	182	2.78E+02	8.23E+00	4.05E+02	4.59E+02	1.15E+03
1.50	5.56	219	1.17E+02	7.03E+00	3.77E+02	3.94E+02	8.95E+02
1.75	6.48	255	4.59E+01	6.18E+00	3.61E+02	3.55E+02	7.68E+02
2.00	7.41	292	1.78E+01	5.54E+00	3.46E+02	3.17E+02	6.87E+02
2.50	9.26	365	1.78E+00	4.66E+00	3.19E+02	2.42E+02	5.67E+02
3.00	11.11	437	1.65E-01	4.10E+00	2.99E+02	2.08E+02	5.12E+02
3.50	12.96	510	5.84E-04	3.69E+00	2.79E+02	1.69E+02	4.52E+02
4.00	14.81	583	0.00E+00	3.38E+00	2.63E+02	1.39E+02	4.06E+02
4.50	16.67	656	0.00E+00	3.13E+00	2.49E+02	1.22E+02	3.74E+02
5.00	18.52	729	0.00E+00	2.92E+00	2.36E+02	1.03E+02	3.42E+02
6.00	22.22	875	0.00E+00	2.58E+00	2.13E+02	7.68E+01	2.93E+02
8.00	29.63	1167	0.00E+00	2.09E+00	1.82E+02	4.58E+01	2.30E+02
10.00	37.04	1458	0.00E+00	1.75E+00	1.58E+02	2.82E+01	1.88E+02

* Solar proton dose is for 1 extremely large solar proton event. For longer mission durations or higher confidence levels, refer to the solar proton event worksheet for the # of events predicted.

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Minimum
I=98 deg, H=705/705 km

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	2.37E+05	1.17E+02	2.21E+04	0.00E+00	2.59E+05
0.02	0.07	3	1.42E+05	8.60E+01	9.71E+03	0.00E+00	1.52E+05
0.03	0.11	4	9.20E+04	6.81E+01	7.47E+03	0.00E+00	9.95E+04
0.04	0.15	6	6.45E+04	5.70E+01	5.70E+03	0.00E+00	7.03E+04
0.05	0.19	7	4.87E+04	4.95E+01	4.33E+03	0.00E+00	5.31E+04
0.06	0.22	9	3.89E+04	4.38E+01	3.67E+03	0.00E+00	4.26E+04
0.07	0.26	10	3.23E+04	3.92E+01	3.16E+03	0.00E+00	3.54E+04
0.08	0.30	12	2.73E+04	3.55E+01	2.78E+03	0.00E+00	3.01E+04
0.09	0.33	13	2.34E+04	3.24E+01	2.51E+03	0.00E+00	2.60E+04
0.10	0.37	15	2.02E+04	2.97E+01	2.31E+03	0.00E+00	2.25E+04
0.20	0.74	29	7.37E+03	1.73E+01	1.44E+03	0.00E+00	8.83E+03
0.30	1.11	44	4.11E+03	1.28E+01	1.13E+03	0.00E+00	5.25E+03
0.40	1.48	58	2.64E+03	1.03E+01	9.93E+02	0.00E+00	3.64E+03
0.50	1.85	73	1.78E+03	8.52E+00	8.92E+02	0.00E+00	2.68E+03
0.60	2.22	87	1.23E+03	7.26E+00	8.15E+02	0.00E+00	2.05E+03
0.80	2.96	117	6.26E+02	5.61E+00	7.26E+02	0.00E+00	1.36E+03
1.00	3.70	146	3.34E+02	4.60E+00	6.79E+02	0.00E+00	1.02E+03
1.25	4.63	182	1.54E+02	3.79E+00	6.37E+02	0.00E+00	7.94E+02
1.50	5.56	219	6.86E+01	3.25E+00	5.93E+02	0.00E+00	6.65E+02
1.75	6.48	255	3.00E+01	2.87E+00	5.65E+02	0.00E+00	5.98E+02
2.00	7.41	292	1.31E+01	2.58E+00	5.41E+02	0.00E+00	5.57E+02
2.50	9.26	365	1.58E+00	2.19E+00	4.98E+02	0.00E+00	5.02E+02
3.00	11.11	437	1.62E-01	1.93E+00	4.67E+02	0.00E+00	4.69E+02
3.50	12.96	510	5.81E-04	1.75E+00	4.35E+02	0.00E+00	4.36E+02
4.00	14.81	583	0.00E+00	1.61E+00	4.08E+02	0.00E+00	4.10E+02
4.50	16.67	656	0.00E+00	1.50E+00	3.85E+02	0.00E+00	3.87E+02
5.00	18.52	729	0.00E+00	1.40E+00	3.63E+02	0.00E+00	3.64E+02
6.00	22.22	875	0.00E+00	1.24E+00	3.26E+02	0.00E+00	3.27E+02
8.00	29.63	1167	0.00E+00	1.02E+00	2.74E+02	0.00E+00	2.75E+02
10.00	37.04	1458	0.00E+00	8.57E-01	2.35E+02	0.00E+00	2.36E+02

* Solar proton dose is for 1 extremely large solar proton event. For longer mission durations or higher confidence levels, refer to the solar proton event worksheet for the # of events predicted.

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration During Solar Maximum*
I=28 deg, H=1000/70000 km

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	3.86E+07	1.54E+04	6.03E+07	3.14E+03	9.90E+07
0.02	0.07	3	2.56E+07	1.22E+04	1.97E+07	3.17E+03	4.53E+07
0.03	0.11	4	1.80E+07	1.00E+04	1.08E+07	3.20E+03	2.88E+07
0.04	0.15	6	1.33E+07	8.54E+03	6.49E+06	3.23E+03	1.98E+07
0.05	0.19	7	1.02E+07	7.45E+03	4.13E+06	3.26E+03	1.43E+07
0.06	0.22	9	8.04E+06	6.57E+03	2.99E+06	3.30E+03	1.10E+07
0.07	0.26	10	6.48E+06	5.84E+03	2.25E+06	3.33E+03	8.74E+06
0.08	0.30	12	5.31E+06	5.22E+03	1.78E+06	3.38E+03	7.10E+06
0.09	0.33	13	4.40E+06	4.70E+03	1.45E+06	3.41E+03	5.87E+06
0.10	0.37	15	3.69E+06	4.26E+03	1.20E+06	3.49E+03	4.90E+06
0.20	0.74	29	1.02E+06	2.22E+03	3.35E+05	4.05E+03	1.36E+06
0.30	1.11	44	4.92E+05	1.57E+03	1.49E+05	3.63E+03	6.46E+05
0.40	1.48	58	2.97E+05	1.23E+03	7.83E+04	3.18E+03	3.80E+05
0.50	1.85	73	1.96E+05	1.01E+03	4.50E+04	2.87E+03	2.45E+05
0.60	2.22	87	1.33E+05	8.62E+02	2.96E+04	2.60E+03	1.66E+05
0.80	2.96	117	6.42E+04	6.68E+02	1.72E+04	2.19E+03	8.42E+04
1.00	3.70	146	3.22E+04	5.52E+02	1.18E+04	1.89E+03	4.65E+04
1.25	4.63	182	1.38E+04	4.58E+02	8.13E+03	1.61E+03	2.40E+04
1.50	5.56	219	5.66E+03	3.95E+02	6.34E+03	1.37E+03	1.38E+04
1.75	6.48	255	2.23E+03	3.49E+02	5.76E+03	1.22E+03	9.56E+03
2.00	7.41	292	8.15E+02	3.15E+02	5.20E+03	1.08E+03	7.42E+03
2.50	9.26	365	9.19E+01	2.67E+02	3.97E+03	8.08E+02	5.13E+03
3.00	11.11	437	6.71E+00	2.35E+02	3.13E+03	6.88E+02	4.06E+03
3.50	12.96	510	4.85E-01	2.13E+02	2.62E+03	5.54E+02	3.39E+03
4.00	14.81	583	3.14E-03	1.95E+02	2.37E+03	4.54E+02	3.02E+03
4.50	16.67	656	0.00E+00	1.81E+02	2.23E+03	3.95E+02	2.80E+03
5.00	18.52	729	0.00E+00	1.69E+02	2.11E+03	3.33E+02	2.61E+03
6.00	22.22	875	0.00E+00	1.49E+02	1.90E+03	2.45E+02	2.29E+03
8.00	29.63	1167	0.00E+00	1.22E+02	1.47E+03	1.44E+02	1.74E+03
10.00	37.04	1458	0.00E+00	1.02E+02	1.16E+03	8.75E+01	1.35E+03

* Solar proton dose is for 1 extremely large solar proton event. For longer mission durations or higher confidence levels, refer to the solar proton event worksheet for the # of events predicted.

Total Dose at the Center of Solid Aluminum Spheres
1 Year Mission Duration + Phasing Loops During Solar Maximum*
L2 + MAP Phasing Loops

Shield Thickness			Electron	Bremsstrahlung	Proton	Solar Proton	Total
g/cm^2	mm	mils	rads(si)	rads(si)	rads(si)	rads(si)	rads(si)
0.01	0.04	1	1.39E+05	6.13E+00	3.70E+04	1.42E+05	3.18E+05
0.02	0.07	3	8.46E+04	9.81E+00	1.16E+04	6.90E+04	1.65E+05
0.03	0.11	4	6.21E+04	1.15E+01	6.02E+03	4.33E+04	1.11E+05
0.04	0.15	6	4.84E+04	1.21E+01	3.87E+03	3.13E+04	8.35E+04
0.05	0.19	7	3.79E+04	1.23E+01	2.54E+03	2.53E+04	6.57E+04
0.06	0.22	9	3.06E+04	1.23E+01	1.98E+03	2.24E+04	5.50E+04
0.08	0.30	12	2.15E+04	1.18E+01	1.26E+03	1.79E+04	4.06E+04
0.10	0.37	15	1.58E+04	1.11E+01	9.08E+02	1.50E+04	3.17E+04
0.20	0.74	29	5.45E+03	7.53E+00	3.05E+02	9.55E+03	1.53E+04
0.30	1.11	44	2.81E+03	5.69E+00	1.68E+02	6.45E+03	9.43E+03
0.40	1.48	58	1.73E+03	4.42E+00	1.05E+02	4.88E+03	6.71E+03
0.50	1.85	73	1.14E+03	3.65E+00	6.53E+01	3.98E+03	5.18E+03
0.60	2.22	87	7.67E+02	3.08E+00	4.02E+01	3.33E+03	4.14E+03
0.80	2.96	117	3.64E+02	2.38E+00	2.90E+01	2.65E+03	3.05E+03
1.00	3.70	146	1.81E+02	1.95E+00	2.15E+01	2.26E+03	2.46E+03
1.50	5.56	219	2.99E+01	1.35E+00	1.35E+01	1.65E+03	1.69E+03
2.00	7.41	292	4.10E+00	1.11E+00	1.07E+01	1.28E+03	1.30E+03
2.50	9.26	365	4.40E-01	9.50E-01	8.89E+00	9.78E+02	9.88E+02
3.00	11.11	437	3.14E-02	8.43E-01	7.12E+00	7.88E+02	7.95E+02
3.50	12.96	510	1.88E-03	7.11E-01	6.57E+00	6.48E+02	6.55E+02
4.00	14.81	583	4.03E-05	7.14E-01	6.18E+00	5.55E+02	5.62E+02
4.50	16.67	656	0.00E+00	7.36E-01	5.54E+00	4.43E+02	4.49E+02
5.00	18.52	729	0.00E+00	6.16E-01	5.15E+00	3.85E+02	3.91E+02
5.50	20.37	802	0.00E+00	5.90E-01	4.86E+00	3.35E+02	3.40E+02
6.00	22.22	875	0.00E+00	5.27E-01	4.57E+00	2.80E+02	2.85E+02
6.50	24.07	948	0.00E+00	4.63E-01	4.35E+00	2.38E+02	2.43E+02
7.00	25.93	1021	0.00E+00	4.66E-01	4.13E+00	2.07E+02	2.11E+02
7.50	27.78	1094	0.00E+00	4.20E-01	3.91E+00	1.82E+02	1.86E+02
8.00	29.63	1167	0.00E+00	4.61E-01	3.71E+00	1.64E+02	1.68E+02
8.50	31.48	1239	0.00E+00	5.73E-01	3.52E+00	1.43E+02	1.47E+02
9.00	33.33	1312	0.00E+00	3.79E-01	3.35E+00	1.25E+02	1.29E+02
9.50	35.19	1385	0.00E+00	3.43E-01	3.18E+00	1.09E+02	1.12E+02
10.00	37.04	1458	0.00E+00	3.94E-01	2.93E+00	8.85E+01	9.18E+01

* Solar proton dose is for 1 extremely large solar proton event. For longer mission durations or higher confidence levels, refer to the solar proton event worksheet for the # of events predicted.

Solar Activity Levels for Environment Modeling

Year	Solar Activity Level
1998	Minimum
1999	Maximum
2000	Maximum
2001	Maximum
2002	Maximum
2003	Maximum
2004	Maximum
2005	Maximum
2006	Minimum
2007	Minimum
2008	Minimum
2009	Minimum
2010	Maximum

Number of Extremely Large Solar Particle Events Predicted for Solar Maximum Years

Confidence	Mission Duration				
Level	1 year	2 years	3 years	4 years	5 years
80%	1	1	2	2	3
85%	1	1	2	3	3
90%	1	2	2	3	4
95%	1	2	3	4	5
99%	2	3	5	6	7