Cassini Ultraviolet Imaging Spectrograph

Ring Solar Occultation Atlas
Volume 1: Revs 009 - 090

Version: 1.0
June 18, 2018

Table of Contents

The table lists all solar occultations observed by UVIS over the course of the Cassini mission. The table includes the rev number, whether the occultation was ingress or egress, the radial range sampled in the ring plane, the instrument integration period, solar elevation angle of the occultation, and duration of the occultation.

For each occultation there are four graphical products: (1) a plot of the total signal collected as a function of ring plane radius (the data have been binned spectrally); (2) the nominal radial resolution as a function of ring plane radius; (3) the azimuthal look angle as a function of ring plane radius; (4) a geometric rendering of Saturn from the point of view of Cassini at the temporal midpoint of the occultation. The nominal radial resolution does not include effects due to the nonzero angular dimensions of the Sun, diffraction, or smearing. The geometric rendering includes the UVIS EUV Solar occultation window field of view.

Occultations are presented chronologically in the order they were observed. In order to keep the file sizes small, the atlas is divided into volumes.

Introduction

The Cassini UVIS Extreme Ultraviolet Channel (EUV) had a solar port offset 20 degrees from the main UVIS optical axis to allow safe solar viewing. This was co-aligned with the Visual and Infrared Mapping Spectrometer (VIMS) solar port so that both instruments could observe the Sun simultaneously. Solar occultations by Saturn's atmosphere, Titan's atmosphere, the plumes of Enceladus, and Saturn's rings were observed. Because of the finite angular size of the solar disk projected onto the rings as seen from Cassini and longer integration times, the nominal spatial resolution of the ring solar occultations is much worse than that of the stellar occultations.

On the first ring solar occultation on "rev 9" it was discovered that an offset between the VIMS and UVIS solar fields of view resulted in the Sun falling just at the edge of the UVIS field of view when the VIMS solar boresight was pointed at the Sun. This resulted in an unusual occultation profile for rev 9 that also, coincidentally, passed near a particularly dust region of the F ring, resulting in a prominent diffraction signal (Becker et al. 2018). Most future occultations used UVIS pointing because that enabled both VIMS and UVIS to see the full solar disk due to the differences in instrument field of view shapes and sizes. The misalignment of rev 9 was approximately re-produced on the solar occultations on revs 90, 172 and 181.

Description of Data Products in the Atlas

The data are shown summed in the spectral dimension and plotted as a function of nominal ring plane intercept of the line of sight to the Sun. The data plots are at the full temporal resolution recorded. The summary table identifies the integration period for each occultation.

Two additional geometry plots are included for each occultation: (1) the radial ring plane resolution of the occultation (in the frame of Saturn, not accounting for ring particle motion, size of the solar disk, or diffraction); and (2) the value of ϕ, an angle measured in the ring plane in the counterclockwise sense from the outward radial vector at the measurement point to the direction to the Sun projected into the ring plane. Thus, an observation where the look vector to the Sun is tangent to the rings has ϕ=90 degrees.

On the page following the data plots, a geometry visualization is shown at a time near the middle of the occultation. The position of the UVIS EUV solar port field of view is labeled on each of these plots. Occultations that cut a chord across the rings, are presented here as separate "Ingress" and "Egress" occultations, referring to the portion of the occultation where the observation point is approaching or receding from Saturn, respectively.

Document assembled by Joshua Colwell, UVIS Co-Investigator, University of Central Florida, with the assistance of Tina Notrika, UCF.

References

1. Becker, T. M., J. E. Colwell, L. W. Esposito, N. O. Attree, C. D. Murray 2018. Cassini UVIS Solar Occultations by Saturn's F Ring and the Detection of Collision-Produced Micron-Sized Dust. *Icarus* **306**, 171-199, doi:10.1016/j.icarus.2018.02.006.
2. Esposito, L. W., J. E. Colwell, and W. E. McClintock 1998. Cassini UVIS Observations of Saturn's Rings. *Planet. Space Sci.* **46**, 1221-1235.
3. Esposito, L. W., C. A. Barth, J. E. Colwell, G. M. Lawrence, W. E. McClintock, A. I. F. Stewart, H. U. Keller, , A. Korth, H. Lauche, M. Festou, A. L. Lane, C. J. Hansen, J. N. Maki, R. A. West, H. Jahn, R. Reulke, K. Warlich, D. E. Shemansky, and Y. L. Yung 2004. The Cassini Ultraviolet Imaging Spectrograph Investigation. *Space Sci. Rev.* **115**, 299-361.

Rev	Ing/Eg	Year/Day	B0	ϕ (degrees)	Radius (km)	Int. Period (s)	Duration (minutes)	I0 (counts/int.)	Background (counts/int.)
9	I	2005-159	-21.45	281.96-281.67	168,669-66,033	4	144.5	8.0E+03	6.0E+02
11	I	2005-196	-21.07	284.83-286.18	116,000-53,978	4	81.7	4.0E+05	1.0E+03
28	I	2006-257	-15.86	281.20-230.96	128,084-87,624	37	633.9	2.5E+06	4.0E+03
28	E	2006-258	-15.86	234.16-230.96	87,490-87,624	37	31.4	2.5E+06	4.0E+03
43	I	2007-114	-12.76	41.24-78.81	126,232-100,226	5.5	38.8	4.7E+05	4.0E+02
43	E	2007-114	-12.76	78.81-139.77	100,226-205,453	5.5	129.4	4.7E+05	6.0E+02
55	I	2008-003	-9	314.11-258.18	172,488-96,962	4	40.1	3.2E+05	8.0E+02
55	E	2008-003	-9	258.18-207.70	96.962-151,727	4	73	3.2E+05	1.0E+03
59	I	2008-051	-8.27	331.78-262.26	194,733-68,372	4	34.3	3.2E+05	1.2E+04
59	E	2008-051	-8.27	262.26-257.22	68,372-68,628	4	1.1	3.2E+05	1.2E+04
62	I	2008-083	-7.79	337.93-264.72	257,380-74,524	4	41.7	3.2E+05	2.1E+03
62	E	2008-083	-7.79	264.72-192.75	74,524-238,015	4	38.3	3.2E+05	2.1E+03
65	I	2008-111	-7.36	332.21-266.13	206,054-83,837	1	30.2	8.1E+04	1.0E+02
65	E	2008-111	-7.36	266.13-194.65	83,837-262,873	1	40	8.1E+04	1.5E+02
66	I	2008-121	-7.21	337.36-266.20	261,953-85,115	1	38.9	7.8E+04	5.5E+02
66	E	2008-121	-7.21	266.20-194.49	85,115-270,107	1	40.2	7.8E+04	7.0E+02
90	I	2008-298	-4.49	346.51-268.82	445,890-95,719	2	36.3	4.0E+03	Unknown
90	E	2008-298	-4.49	268.82-206.69	95,719-204,613	2	15	4.3E+03	Unknown
172	I	2012-267	15.9	320.48-308.40	150,286-78,637	1	70.1	4.0E+03	6.0E+01
181	E	2013-044	17.5	147.36-153.60	100,304-148,010	1	35.3	1.8E+03	6.0E+01
239	I	2016-221	26.4	348.95-254.61	157,454-119,150	2	59.1	1.5E+05	1.0E+02
239	E	2016-221	26.4	103.36-134.95	59,983-150,709	2	151.6	1.5E+05	4.0E+02
241	I	2016-245	26.5	4.58-64.53	161,762-81,459	2	212.4	1.5E+05	1.0E+02
241	E	2016-245	26.5	64.53-116.75	81,459-132,557	2	158.7	Unknown	4.0E+02
243	I	2016-269	26.5	53.17-65.08	71,084-69,558	2	22.1	1.4E+05	Unknown
243	E	2016-269	26.5	65.08-119.41	69,558-118,986	2	146	1.4E+05	4.0E+02
245	I	2016-288	26.5	16.56-66.62	147,966-95,457	2	181.5	1.4E+05	4.0E+02
245	E	2016-288	26.5	66.62-82.74	95,457-99,340	2	44.1	Unknown	Unknown
249	I	2016-325	26.6	17.64-67.75	148,772-96,097	1	194.8	5.1E+04	1.0E+02
249	E	2016-325	26.6	67.75-117.77	96,097-148,630	1	194.3	5.1E+04	1.0E+02
254	I	2016-361	26.6	11.24-69.07	146,194-78,903	1	221.3	6.5E+04	1.5E+02

254	E	2016-361	26.6	69.07-126.58	78,903-145,372	1	218.9	6.5E+04	2.0E+02
257	I	2017-017	26.7	6.64-16.07	145,205-111,292	1	71.6	6.5E+04	Unknown
261	E	2017-046	26.7	118.88-143.42	68,714-147,371	1	159.6	6.5E+04	2.0E+02
263	E	2017-060	26.7	133.09-143.50	75,268-113,102	1	73.6	Unknown	2.0E+02
265	E	2017-074	26.7	146.20-152.35	95,650-147,462	1	95.1	6.4E+04	2.0E+02
267	E	2017-089	26.7	152.28-156.80	95,293-153,775	1	105.6	6.6E+04	2.0E+02
269	I	2017-103	26.7	348.26-349.55	157,777-117,823	1	72.1	6.4E+04	Unknown
271	E	2017-116	26.7	171.30-169.90	126,863-174,743	1	87.1	6.7E+04	Unknown
279	I	2017-168	26.7	321.49-267.36	127,778-77,483	1	180.1	Unknown	1.0E+02
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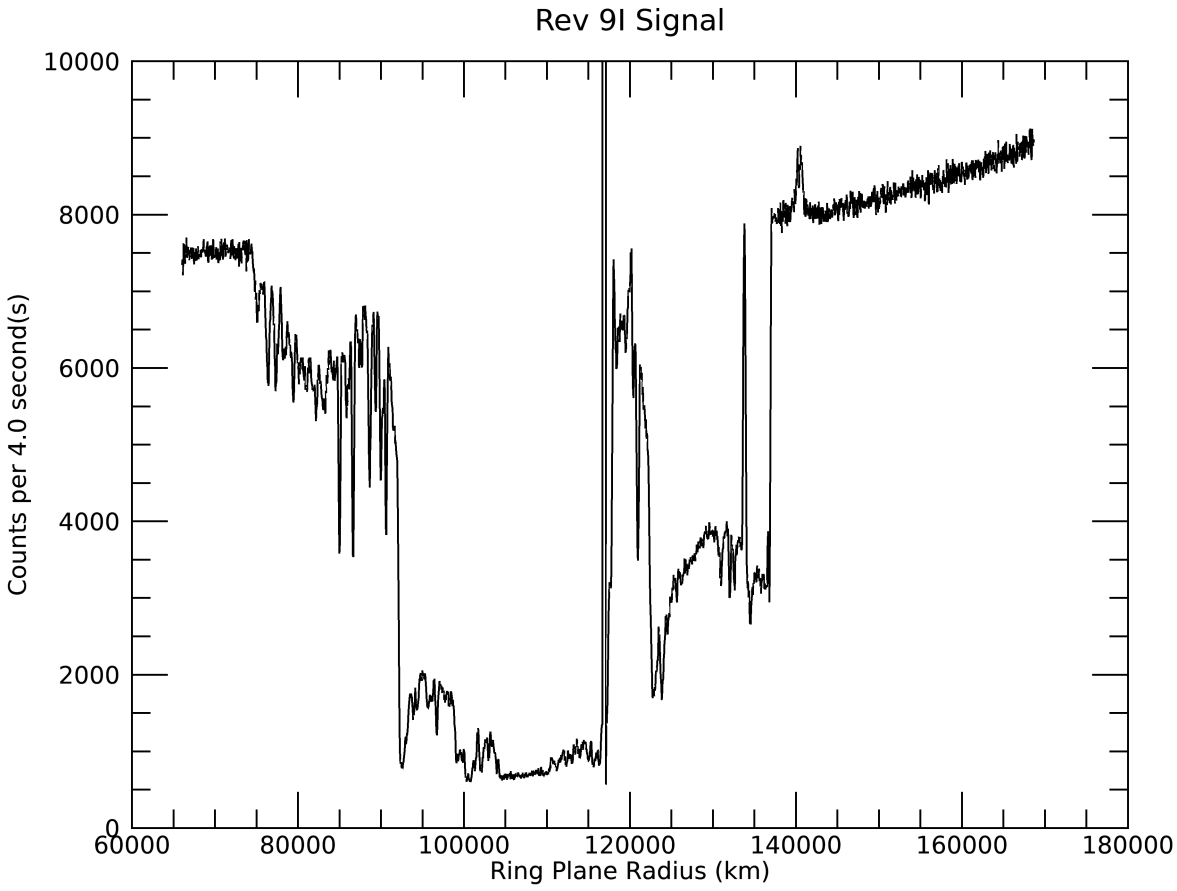
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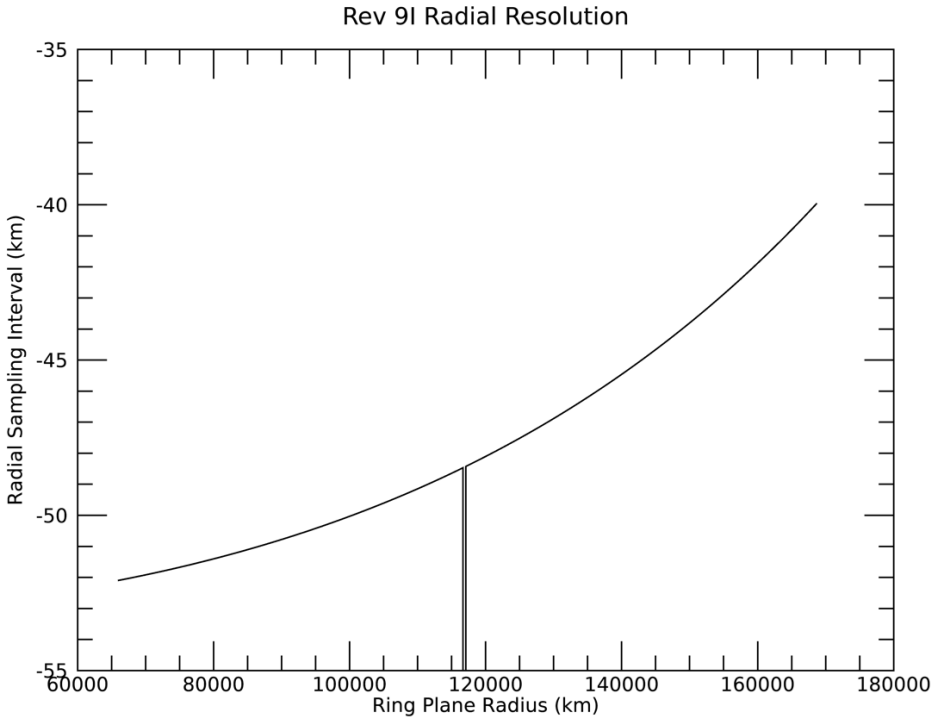
140000
160000
180000
Ring Plane Radius (km)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-40
-45
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-55
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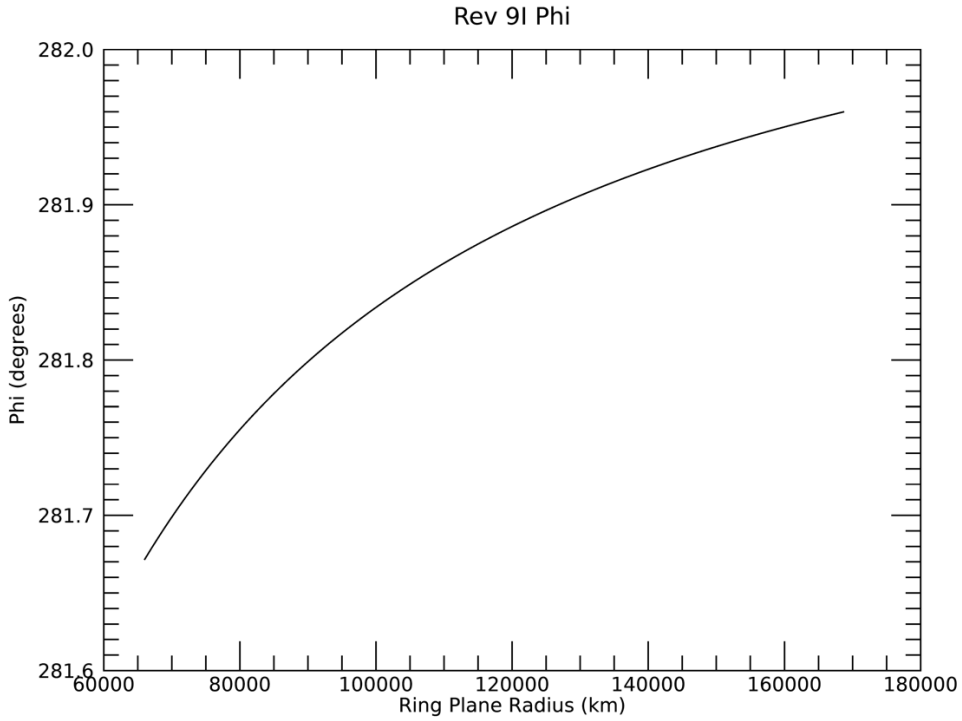
120000
140000
160000
180000
Ring Plane Radius (km)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281.8
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281.6
Phi (degrees)
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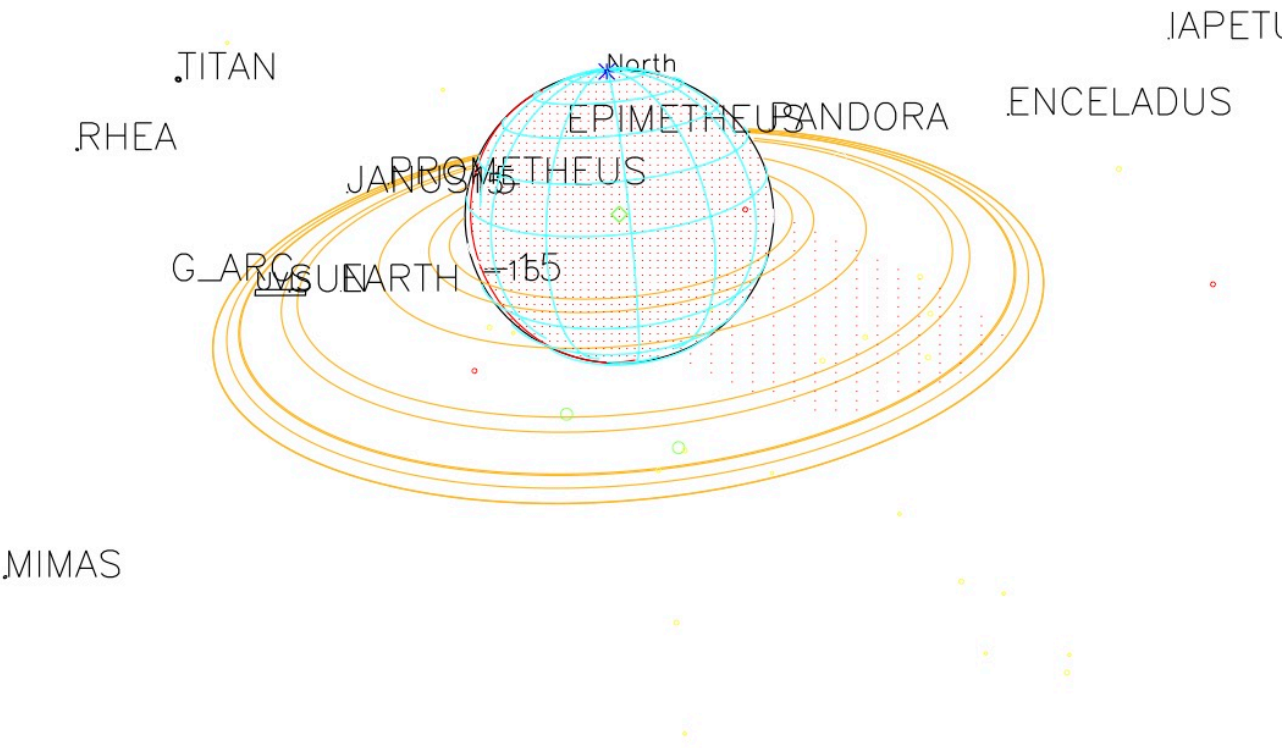
80000
100000
120000
140000
160000
180000
Ring Plane Radius (km)



2005-159T12:52:00.000 237634.48 km

Target RA/dec: 270.14, -16.54

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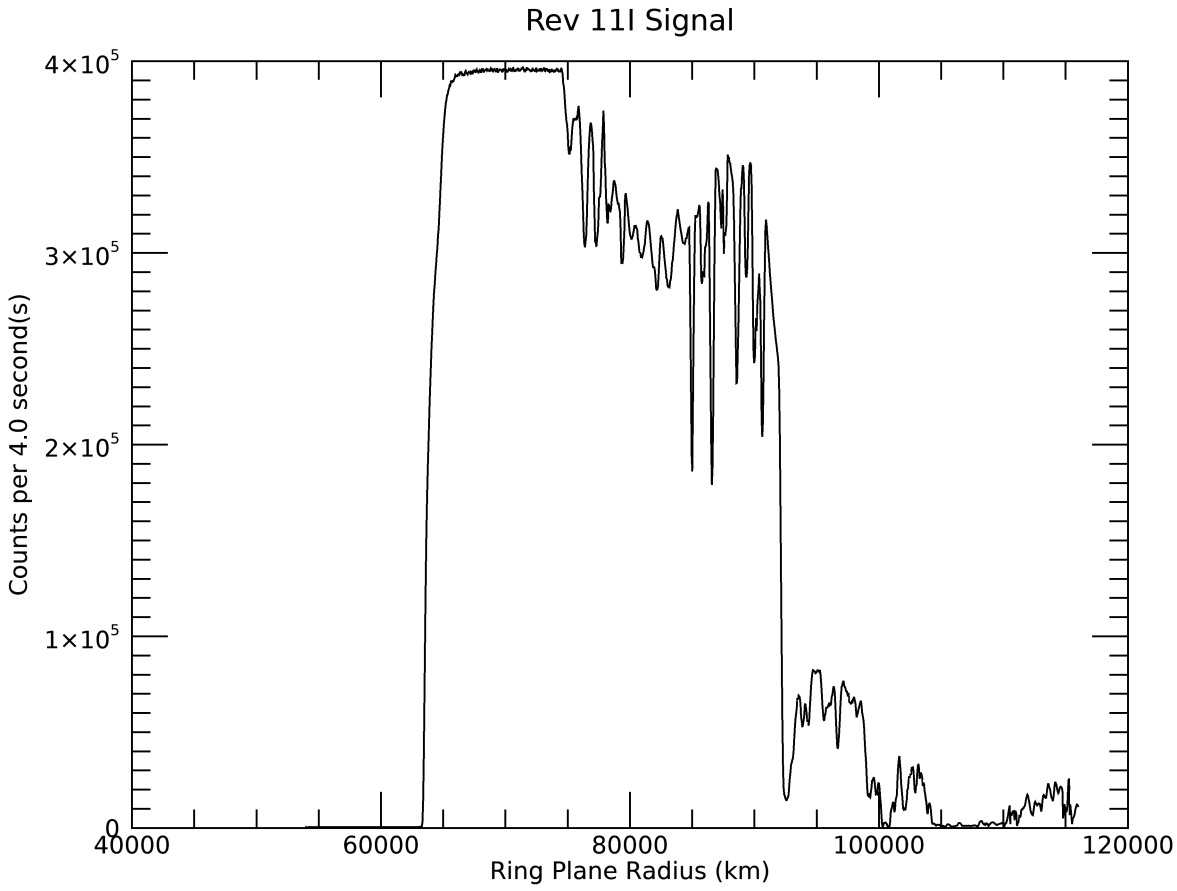
Sub-s/c lat/lon: 17.85, 26.57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3×10^5
2×10^5
1×10^5
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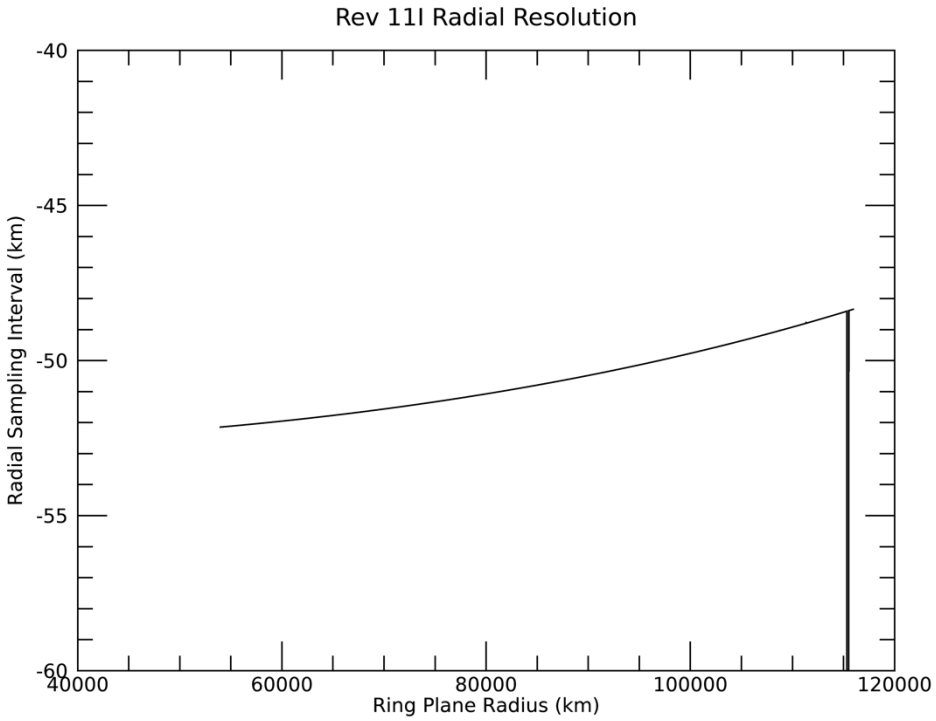
60000
80000
100000
120000
Ring Plane Radius (km)


Rev 11I Radial Resolution
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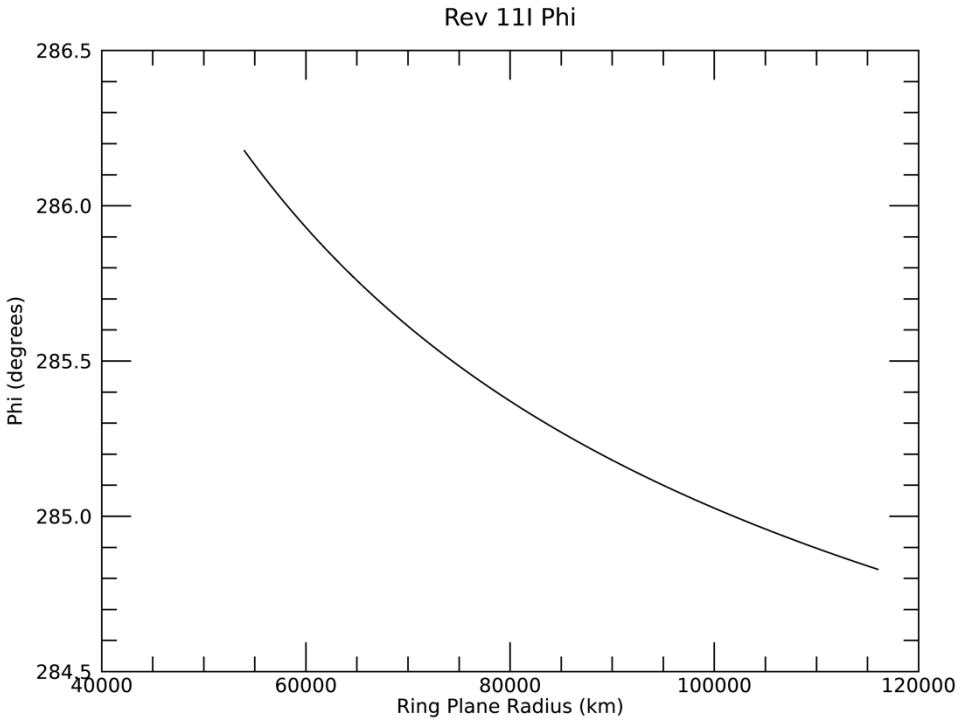
-45
-50
-55
-60
Radial Sampling Interval (km)
40000
60000
80000
100000
120000
Ring Plane Radius (km)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285.5
285.0
284.5
Phi (degrees)
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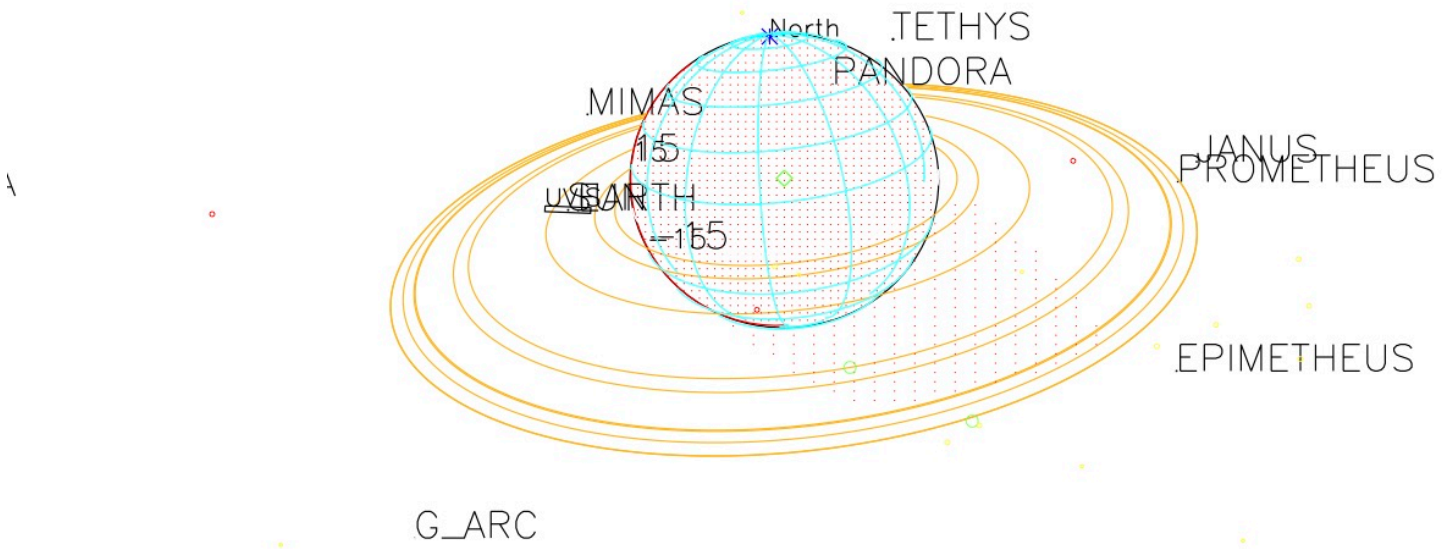
60000
80000
100000
120000
Ring Plane Radius (km)



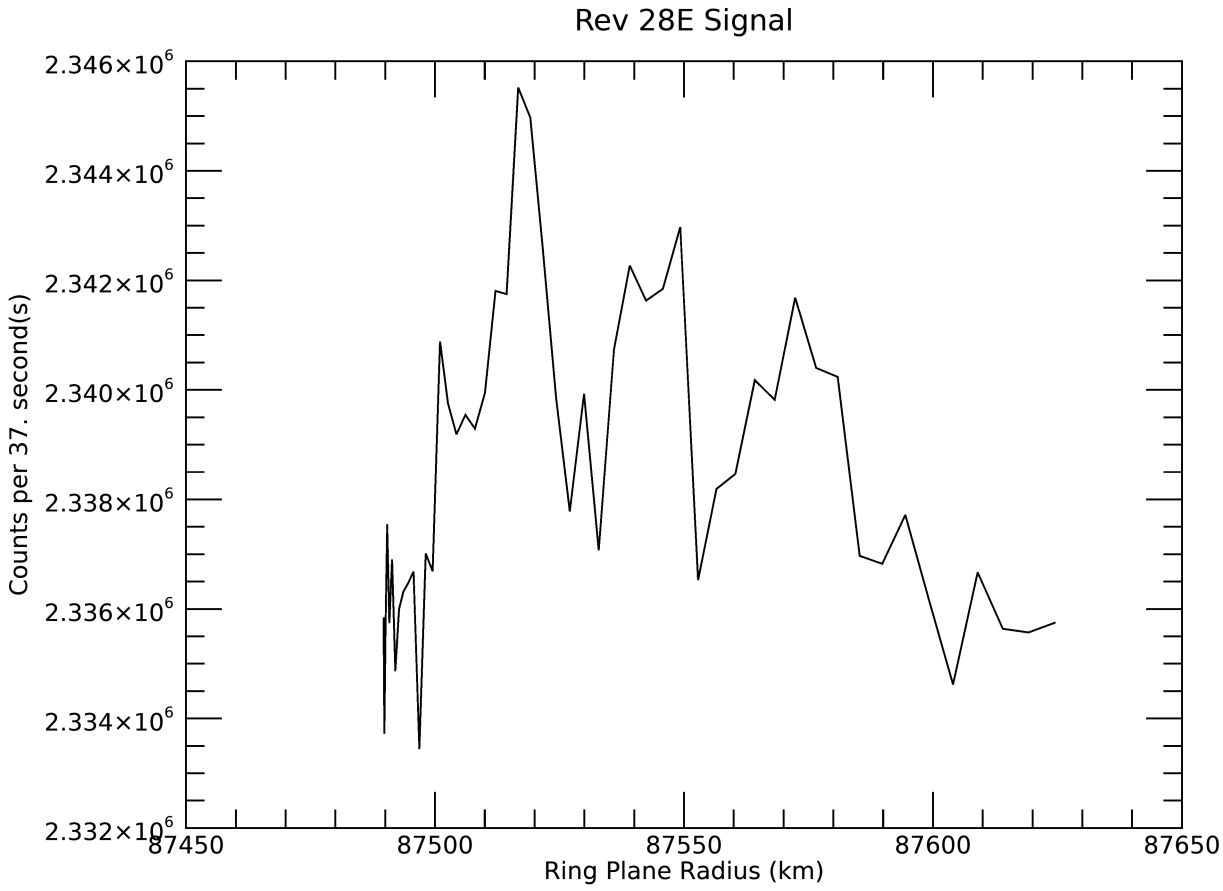
G_ARC

2005-196T01:22:00.000 257021.82 km

Target RA/dec: 282.88, -18.79

Subsolar lat/lon: -17.40, 149.12

Sub-s/c lat/lon: 18.70, -51.11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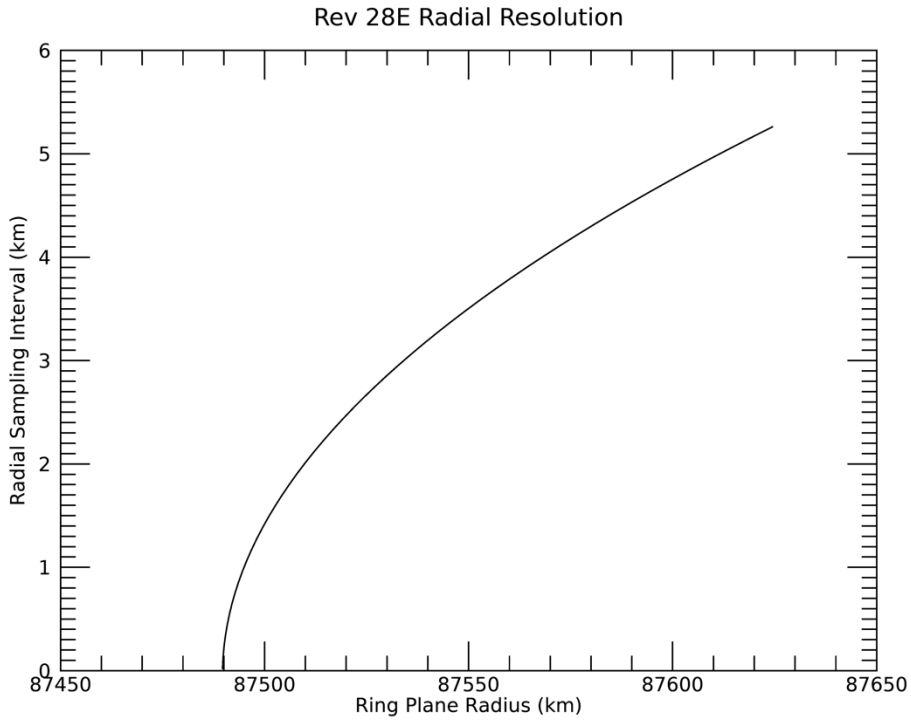
2.344×10^6
2.342×10^6
2.340×10^6
2.338×10^6
2.336×10^6
2.334×10^6
2.332×10^6
Counts per 37. second(s)
87450
87500
87550
87600
87650
Ring Plane Radius (km)


Rev 28E Radial Resolution
Radial Sampling Interval (km)
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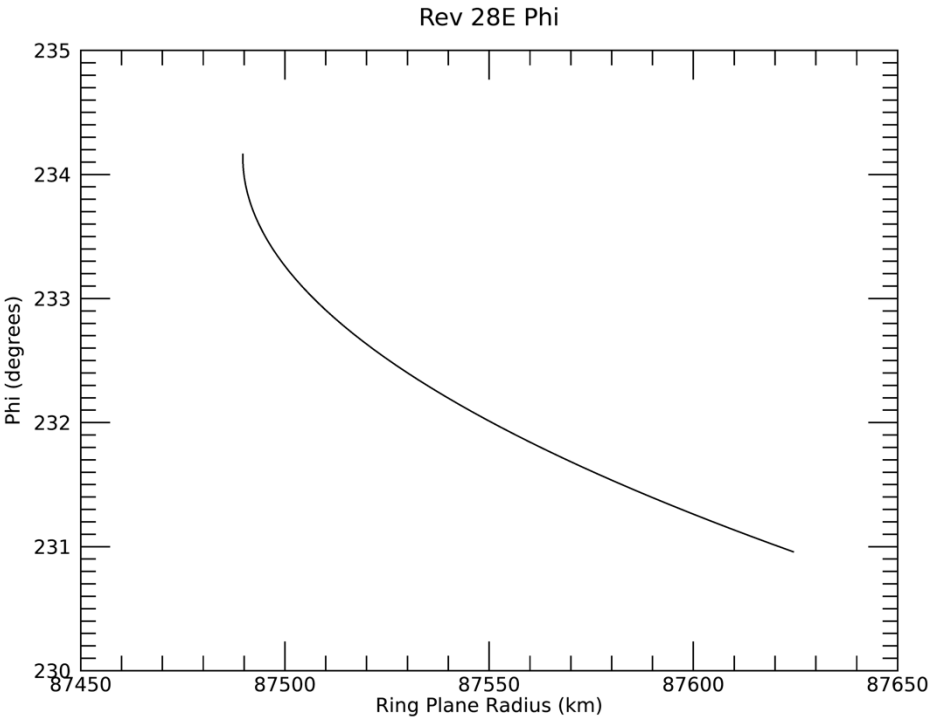
1
2
3
4
5
6
87450
87500
87550
87600
87650
Ring Plane Radius (km)


Rev 28E Phi
Phi (degrees)
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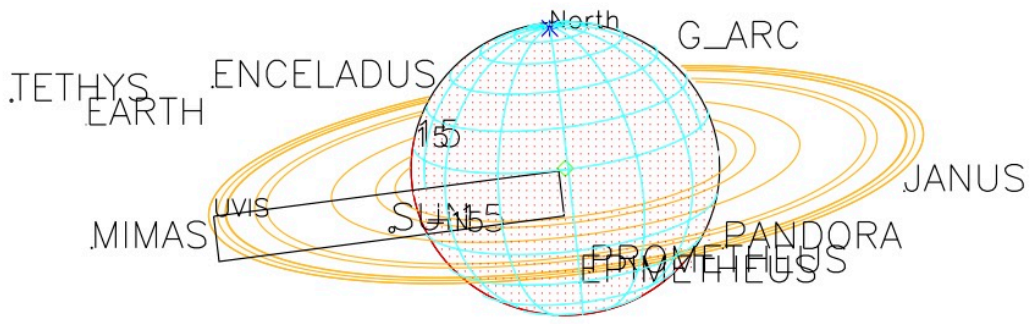
231
232
233
234
235
87450
87500
87550
87600
87650
Ring Plane Radius (km)



2006-258T05:57:00.000 2120453.5 km

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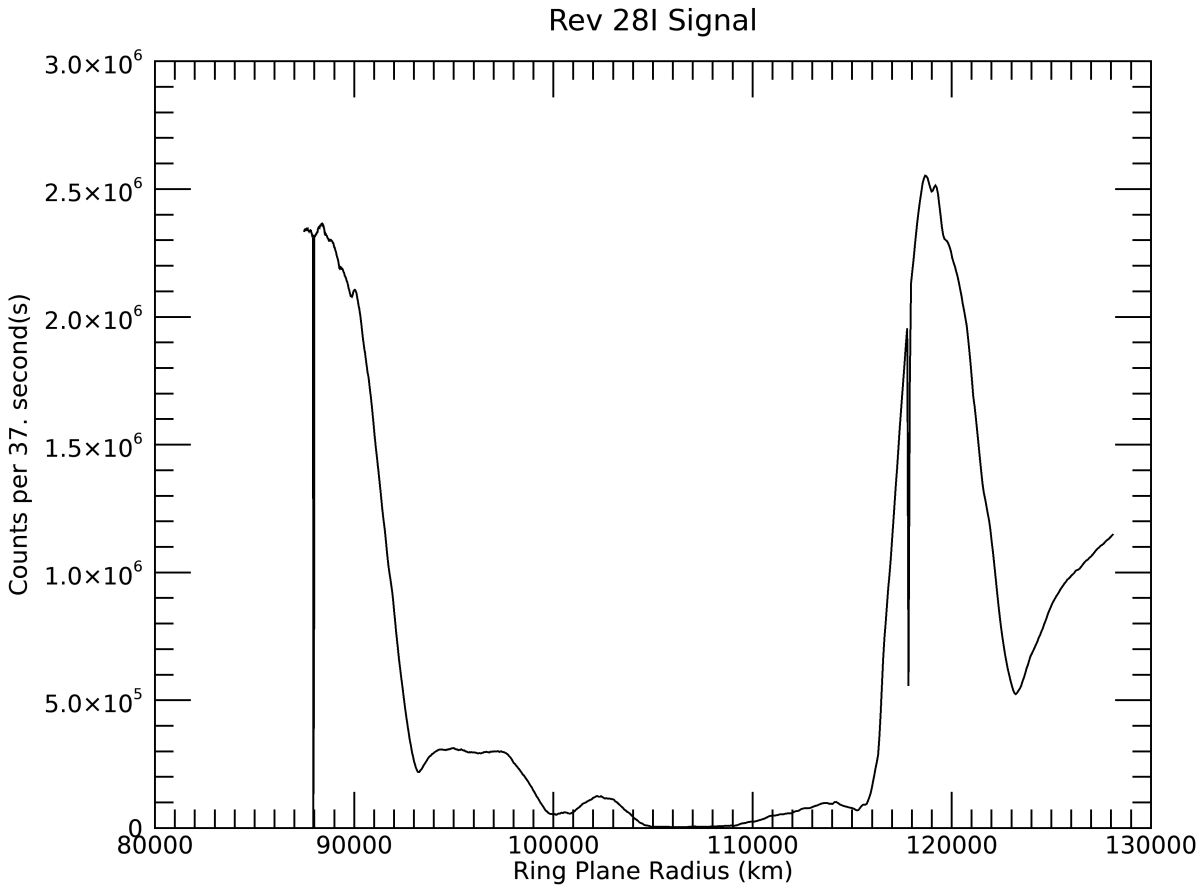
Subsolar lat/lon: -13.01, 120.90

Sub-s/c lat/lon: 12.75, -61.07


Rev 28I Signal
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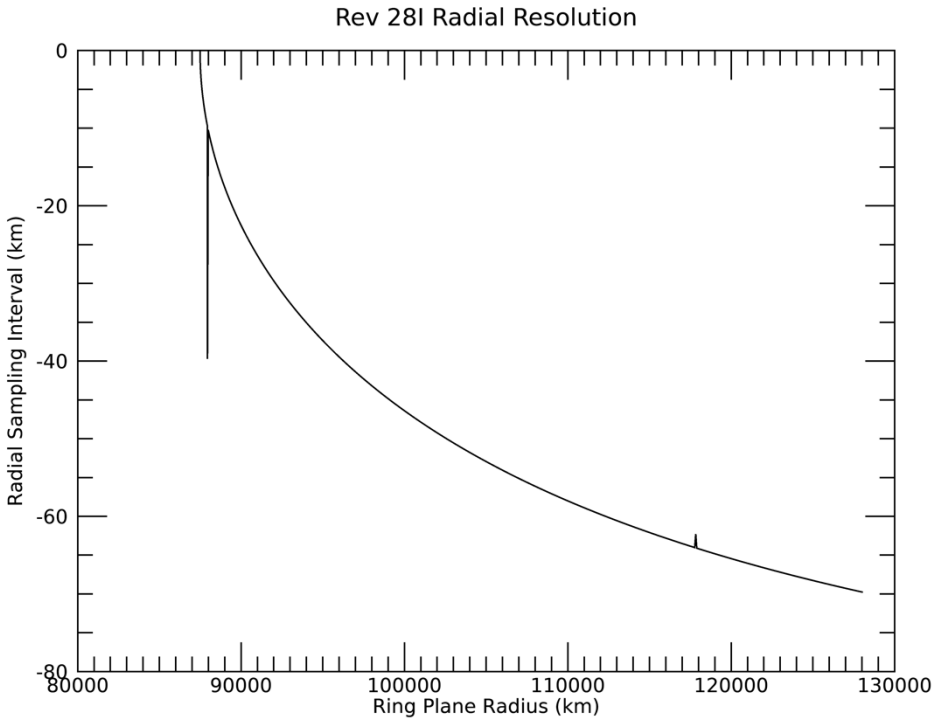
2.5×10^6
2.0×10^6
1.5×10^6
1.0×10^6
5.0×10^5
0
Counts per 37. second(s)
80000
90000
100000
110000
120000
130000
Ring Plane Radius (km)


Rev 28I Radial Resolution
Radial Sampling Interval (km)
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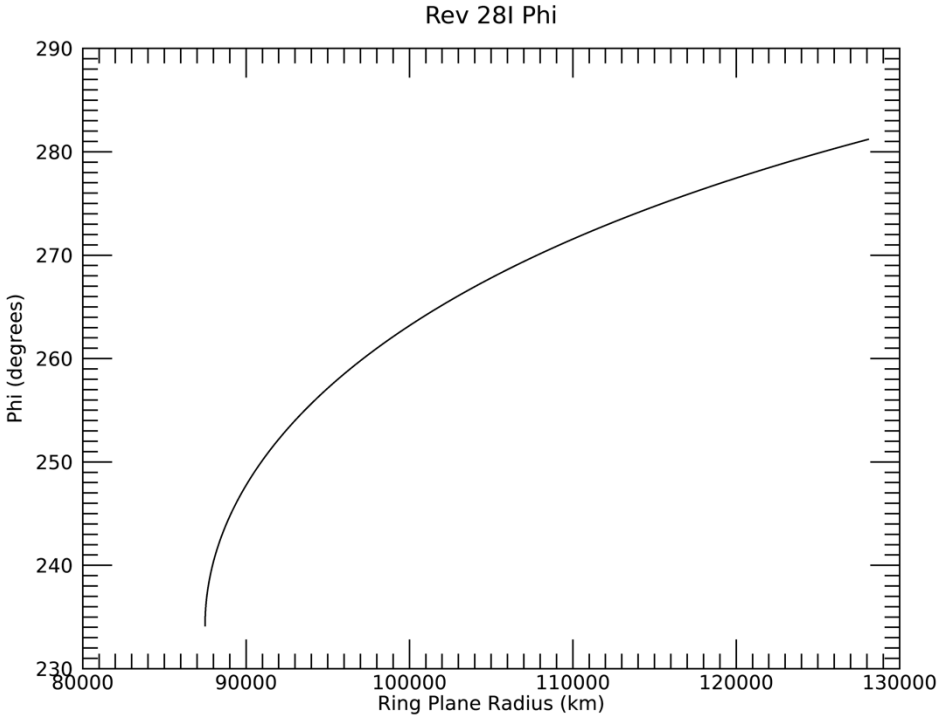
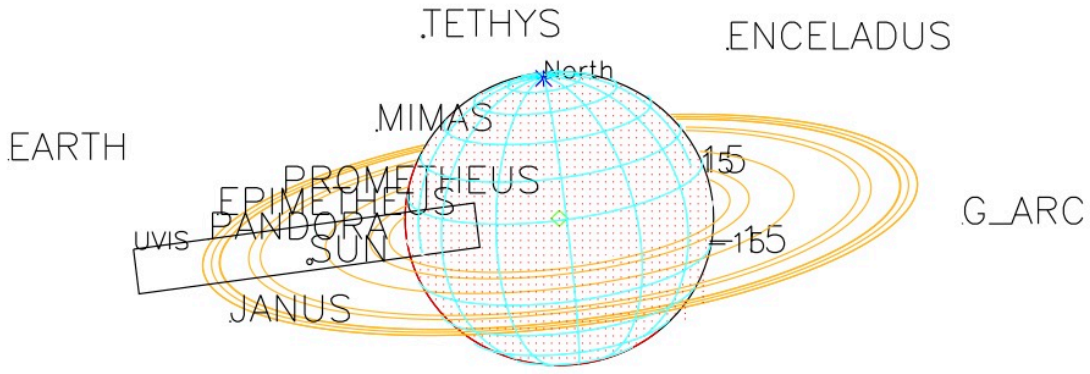
-20
-40
-60
-80
80000
90000
100000
110000
120000
130000
Ring Plane Radius (km)


Rev 28I Phi
Phi (degrees)
290
280
270
260
250
240
230
80000
90000
100000
110000
120000
130000
Ring Plane Radius (km)

TITAN



2006-258T00:39:00.000 2092433.2 km

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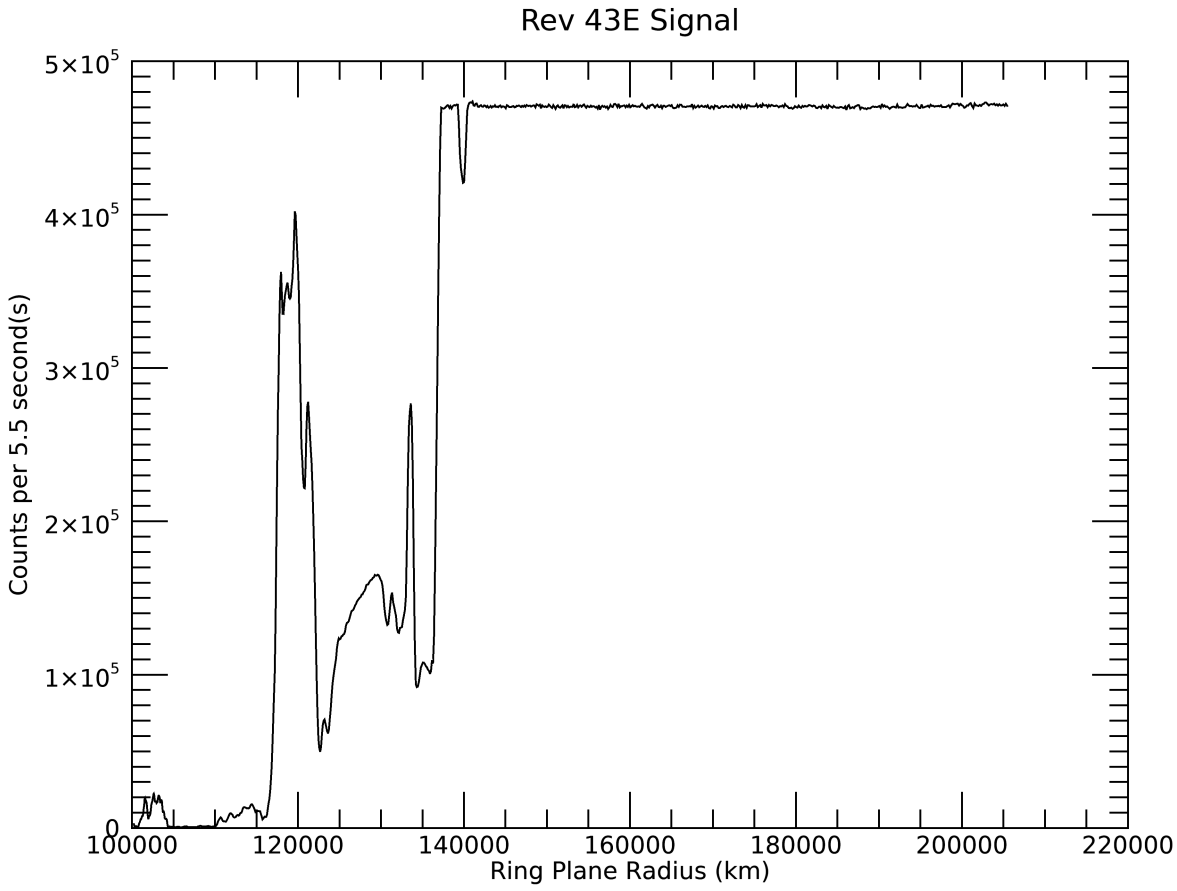
Sub-s/c lat/lon: 12.99, 117.13


Rev 43E Signal
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4×10^5
3×10^5
2×10^5
1×10^5
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Counts per 5.5 second(s)
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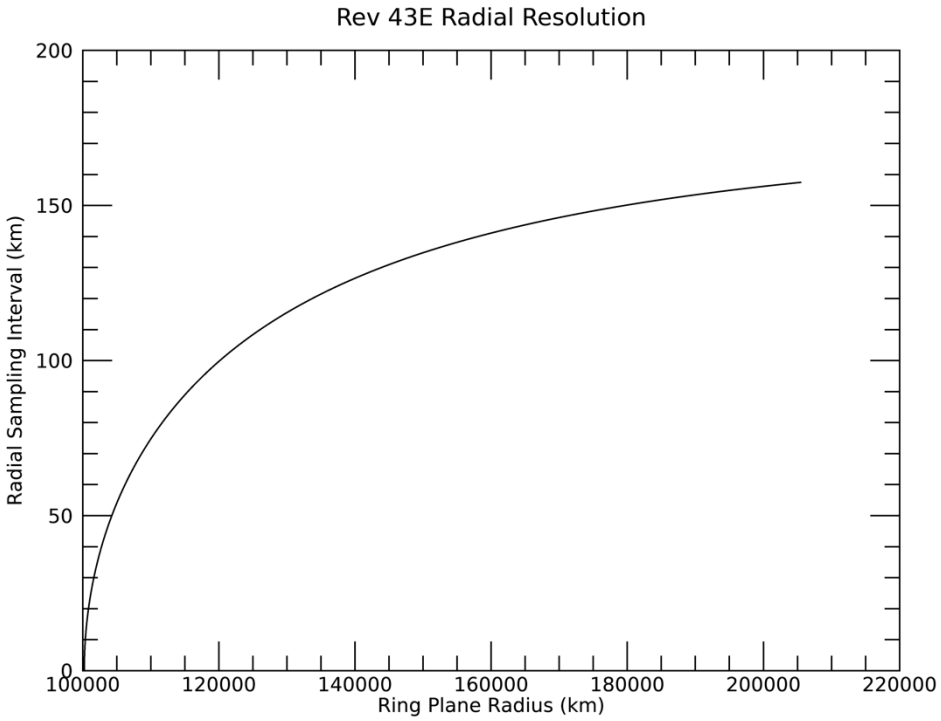
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 43E Radial Resolution
Radial Sampling Interval (km)
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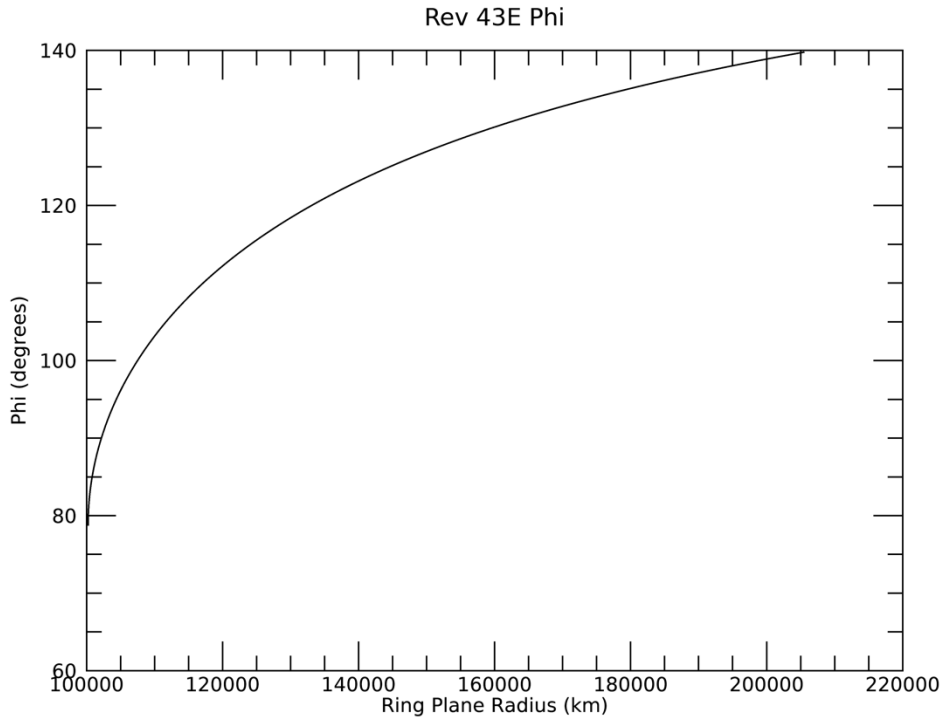
150
100
50
0
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 43E Phi
Phi (degrees)
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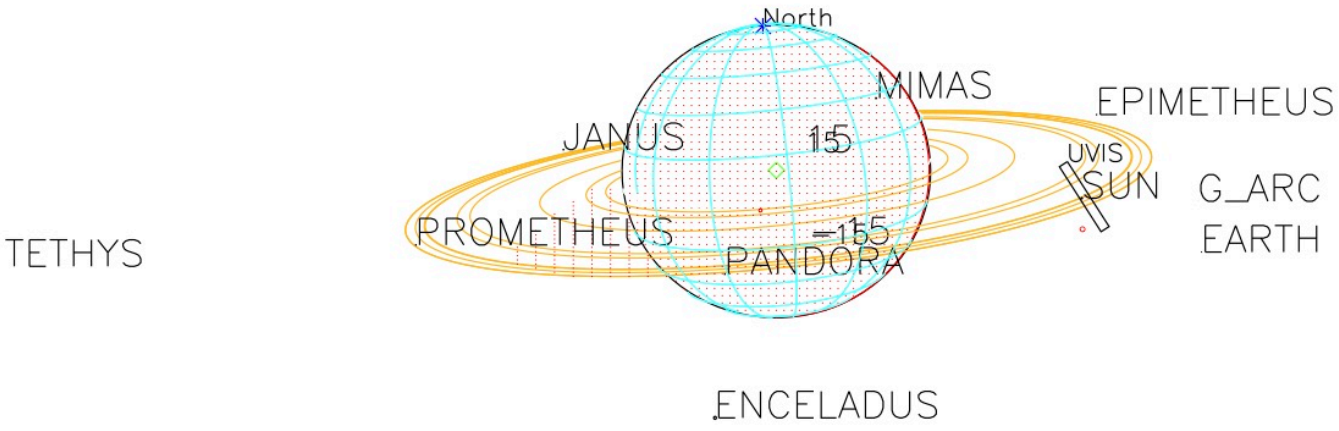
120
100
80
60
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)



2007-114T11:22:00.000 437730.47 km

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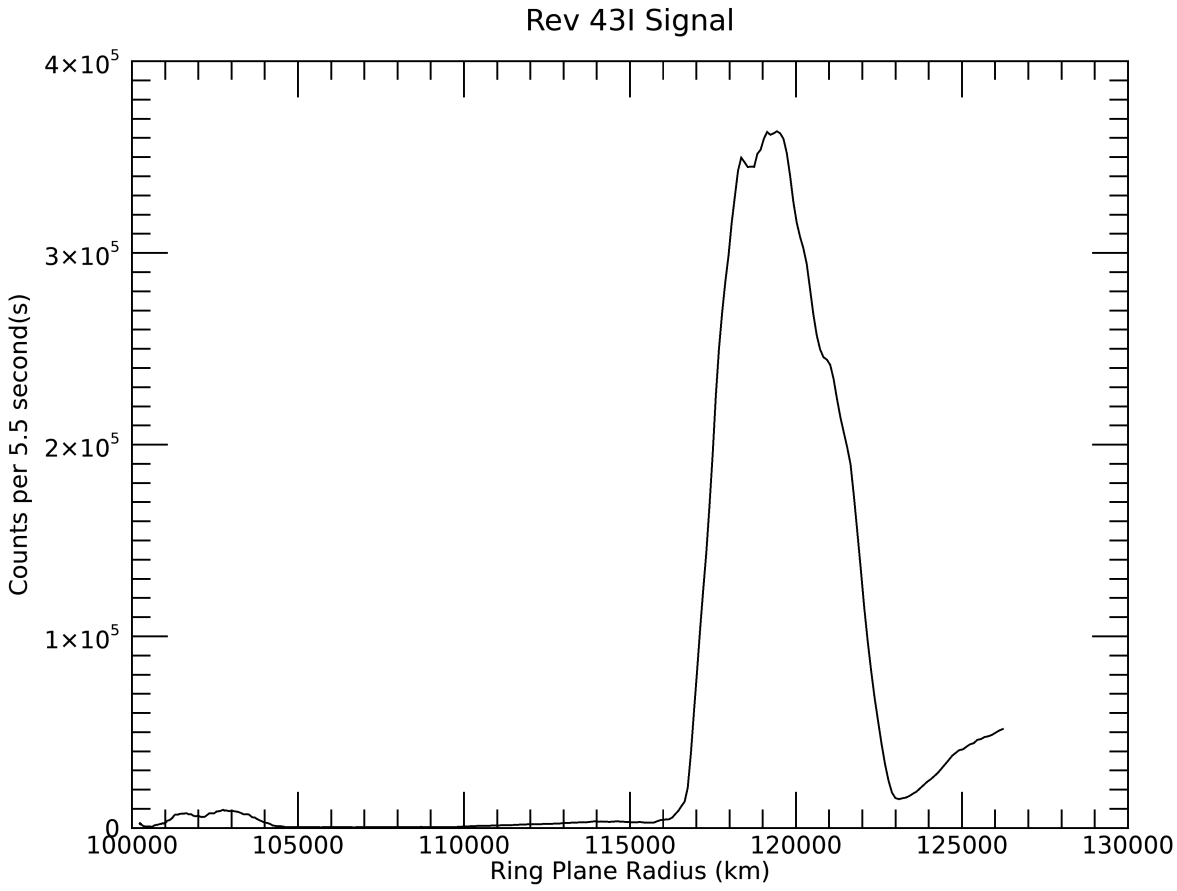
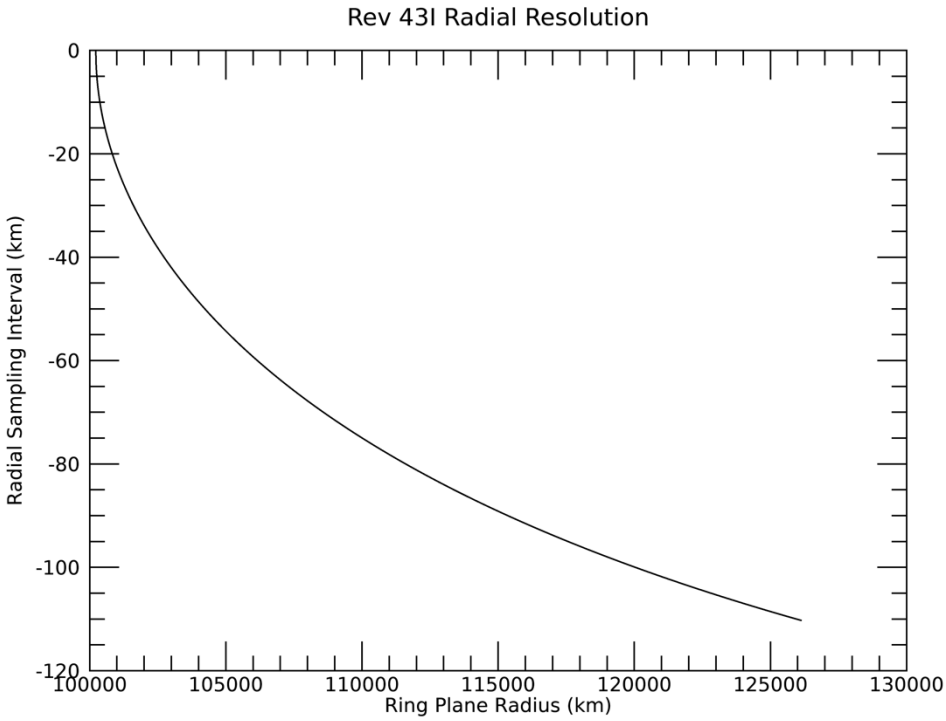
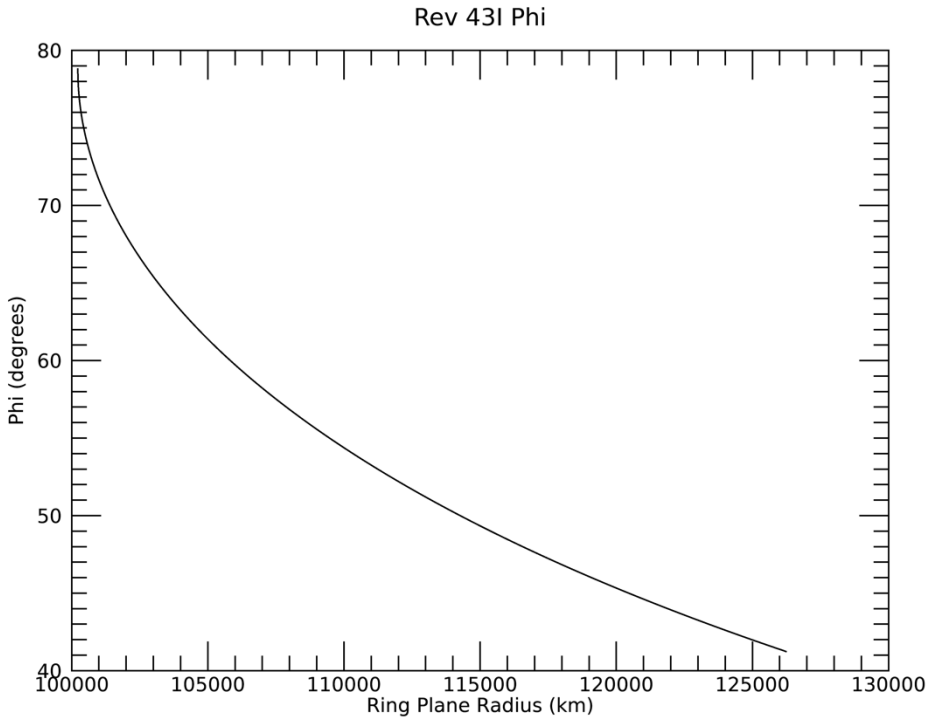
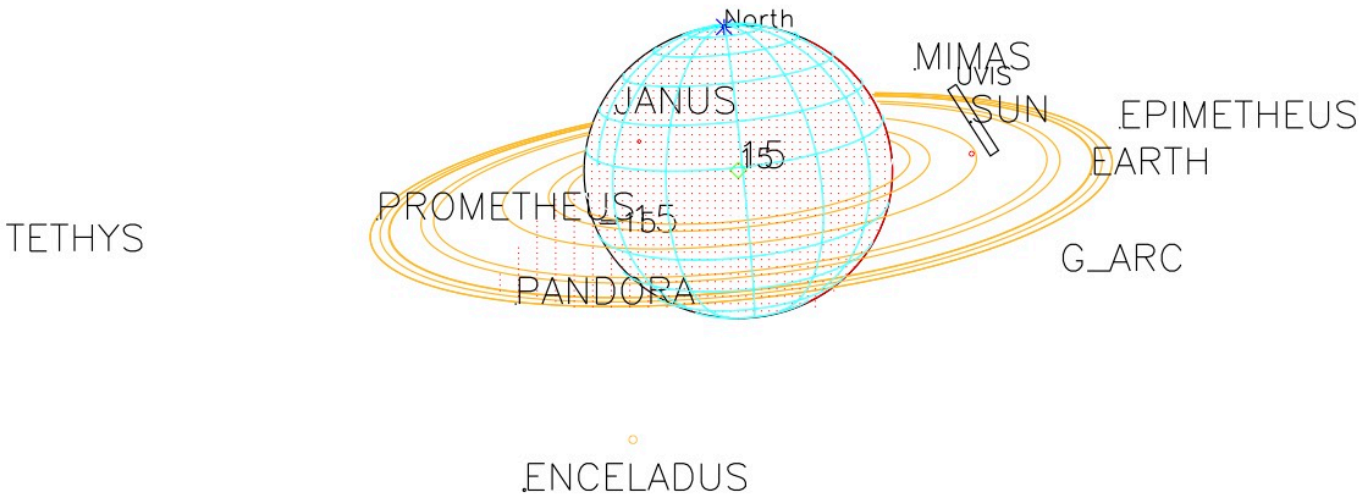
Sub-s/c lat/lon: 8.66, -124.43


Rev 43I Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 5.5 second(s)
100000
105000
110000
115000
120000
125000
130000
Ring Plane Radius (km)


Rev 43I Radial Resolution
Radial Sampling Interval (km)
0
-20
-40
-60
-80
-100
-120
100000
105000
110000
115000
120000
125000
130000
Ring Plane Radius (km)


Rev 43I Phi
Phi (degrees)
80
70
60
50
40
100000
105000
110000
115000
120000
125000
130000
Ring Plane Radius (km)

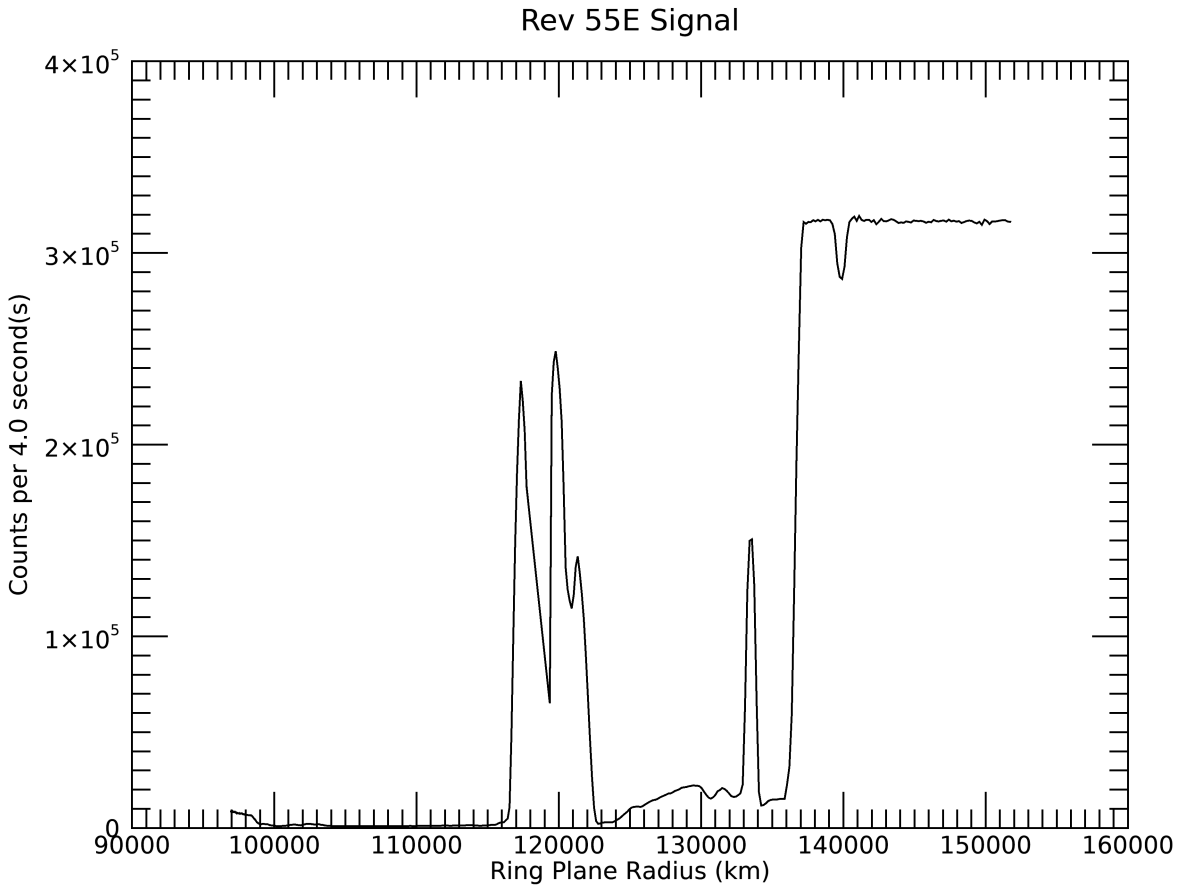


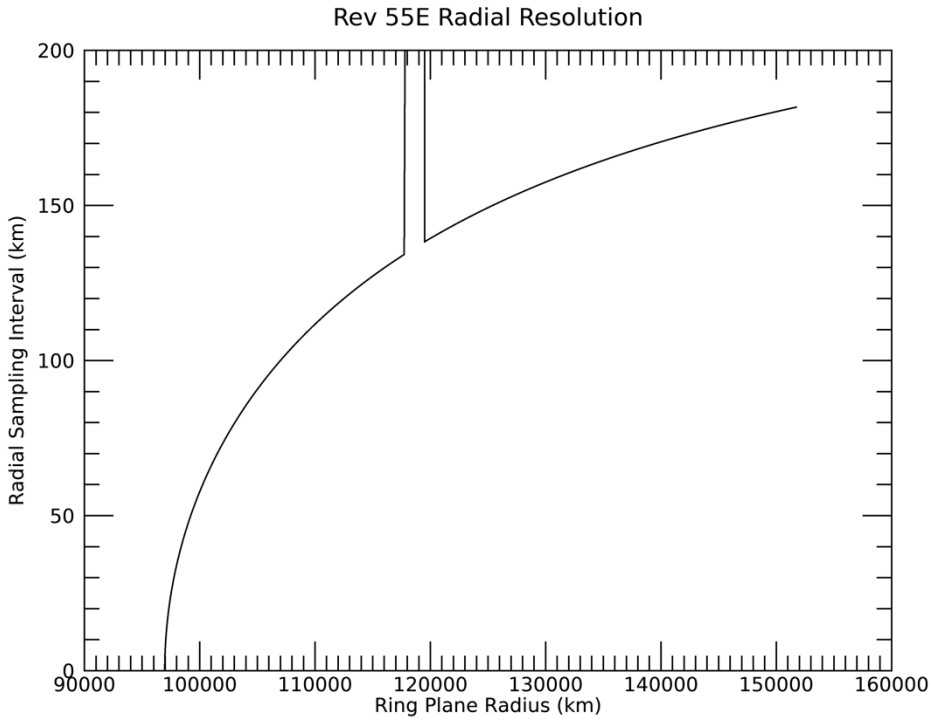
2007-114T10:17:00.000 457569.08 km

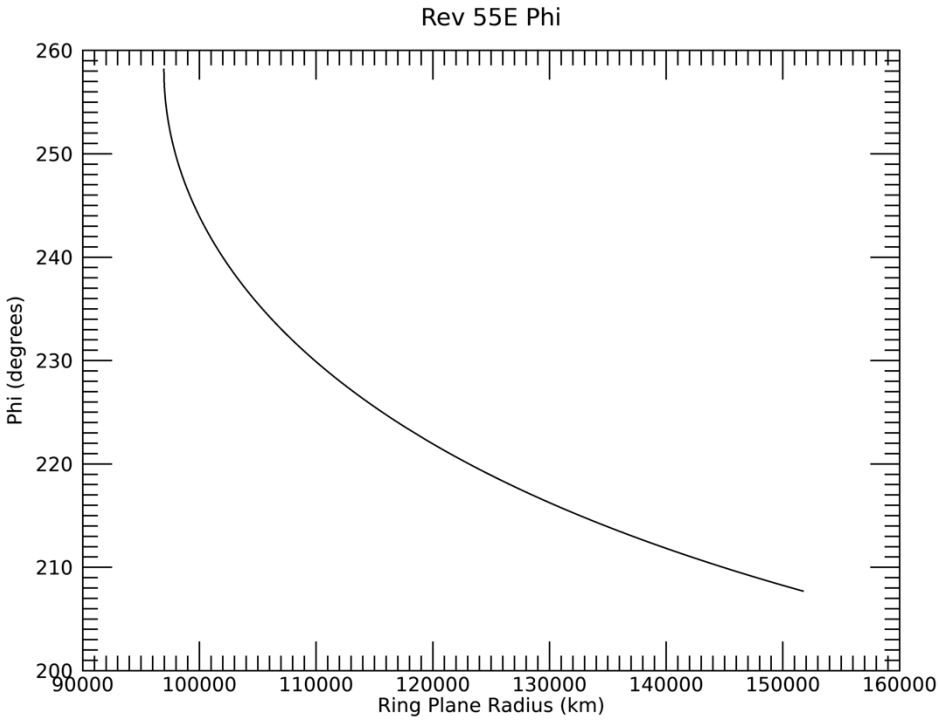
Target RA/dec: 338.59, -17.24

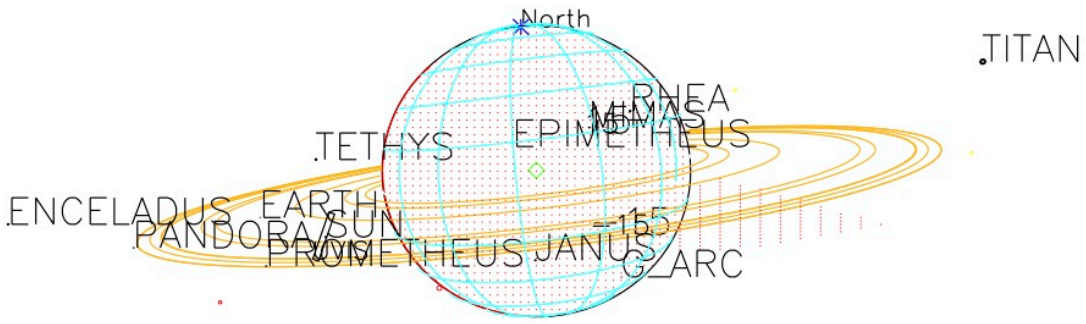
Subsolar lat/lon: -10.44, 76.60

Sub-s/c lat/lon: 11.85, -91.62


Rev 55E Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 4.0 second(s)
90000
100000
110000
120000
130000
140000
150000
160000
Ring Plane Radius (km)


Rev 55E Radial Resolution
Radial Sampling Interval (km)
200
150
100
50
0
90000
100000
110000
120000
130000
140000
150000
160000
Ring Plane Radius (km)


Rev 55E Phi
Phi (degrees)
260
250
240
230
220
210
200
90000
100000
110000
120000
130000
140000
150000
160000
Ring Plane Radius (km)

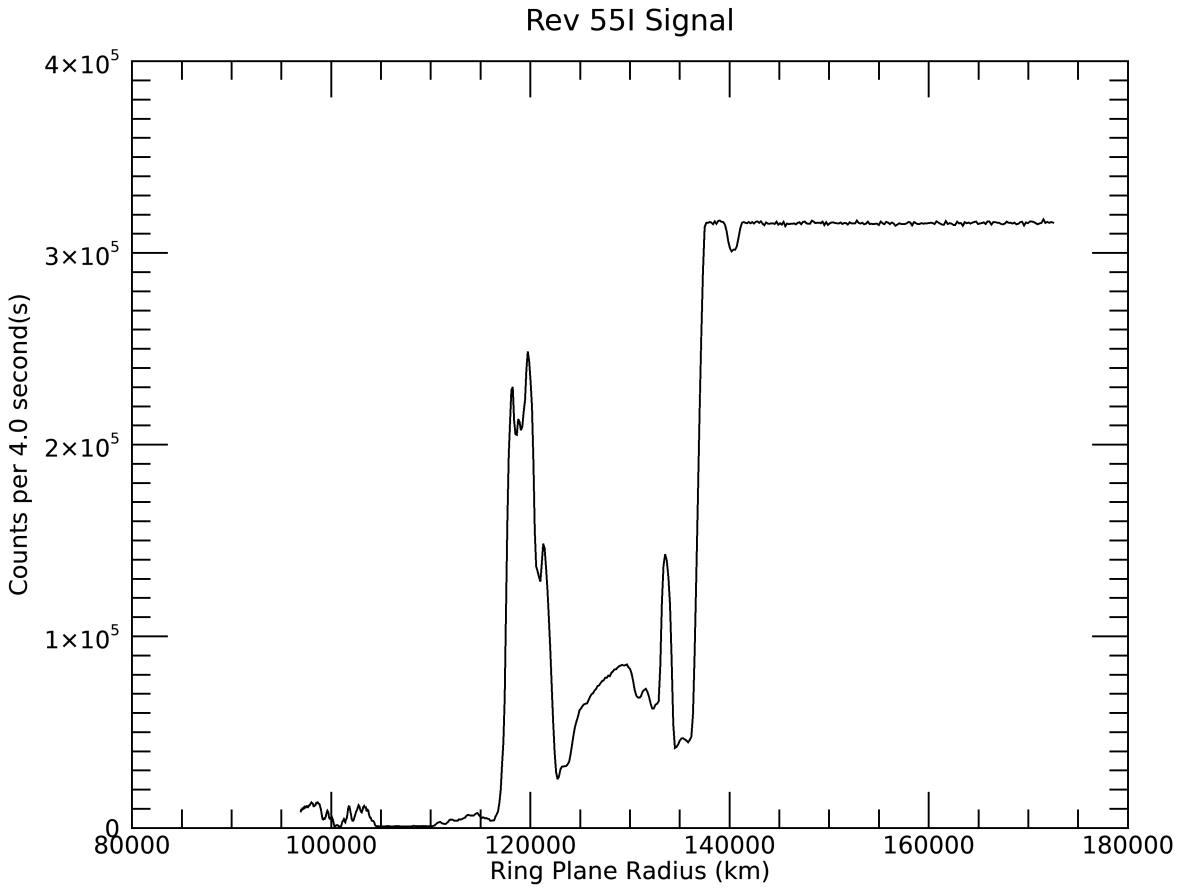


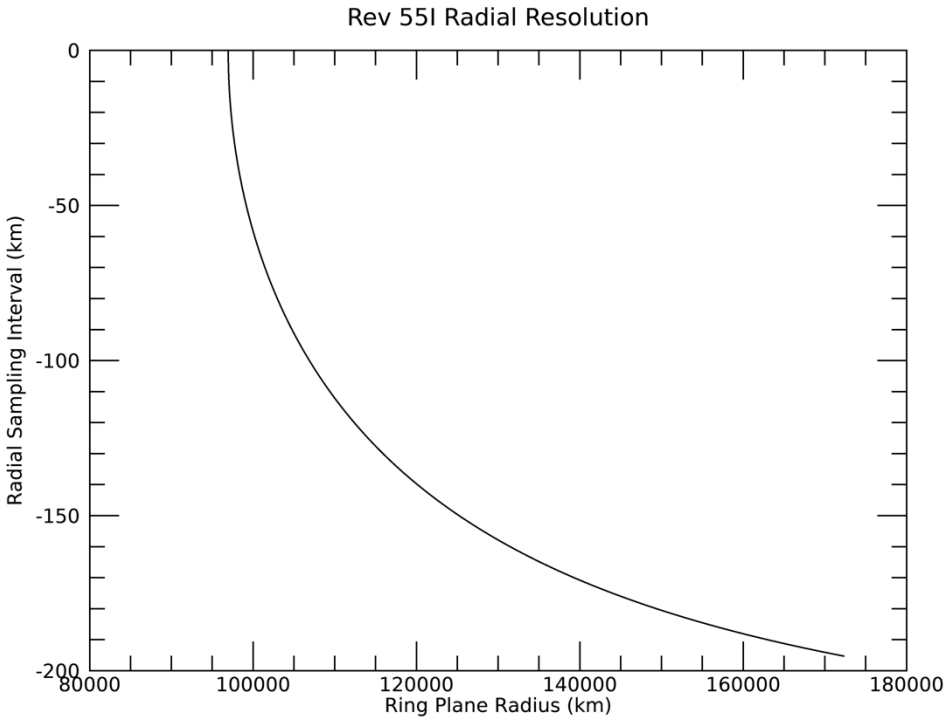
2008-003T21:12:00.000 279163.93 km

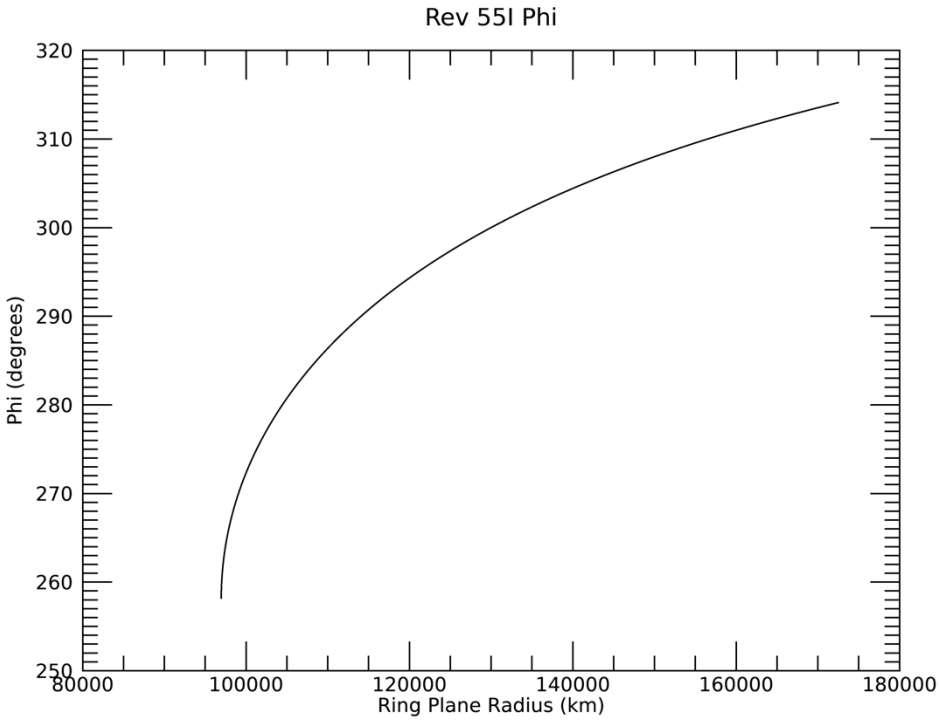
Target RA/dec: 318.62, -7.11

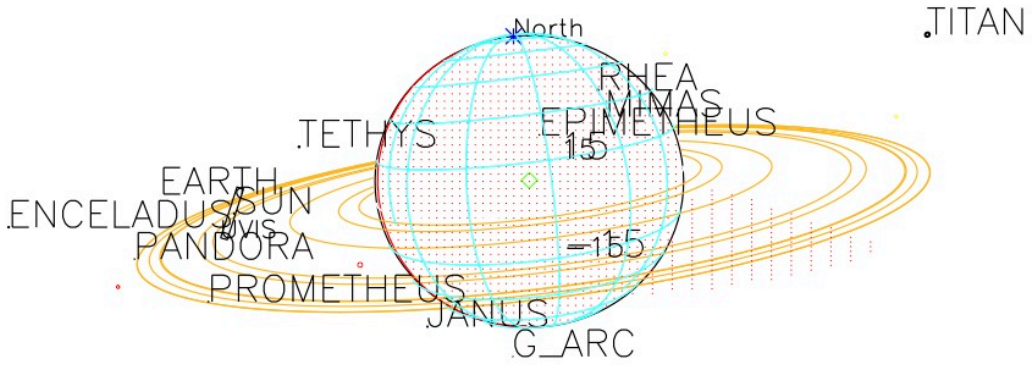
Subsolar lat/lon: -7.34, 54.55

Sub-s/c lat/lon: 5.23, -142.89


Rev 55I Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 4.0 second(s)
80000
100000
120000
140000
160000
180000
Ring Plane Radius (km)


Rev 55I Radial Resolution
Radial Sampling Interval (km)
0
-50
-100
-150
-200
80000
100000
120000
140000
160000
180000
Ring Plane Radius (km)


Rev 55I Phi
Phi (degrees)
320
310
300
290
280
270
260
250
80000
100000
120000
140000
160000
180000
Ring Plane Radius (km)

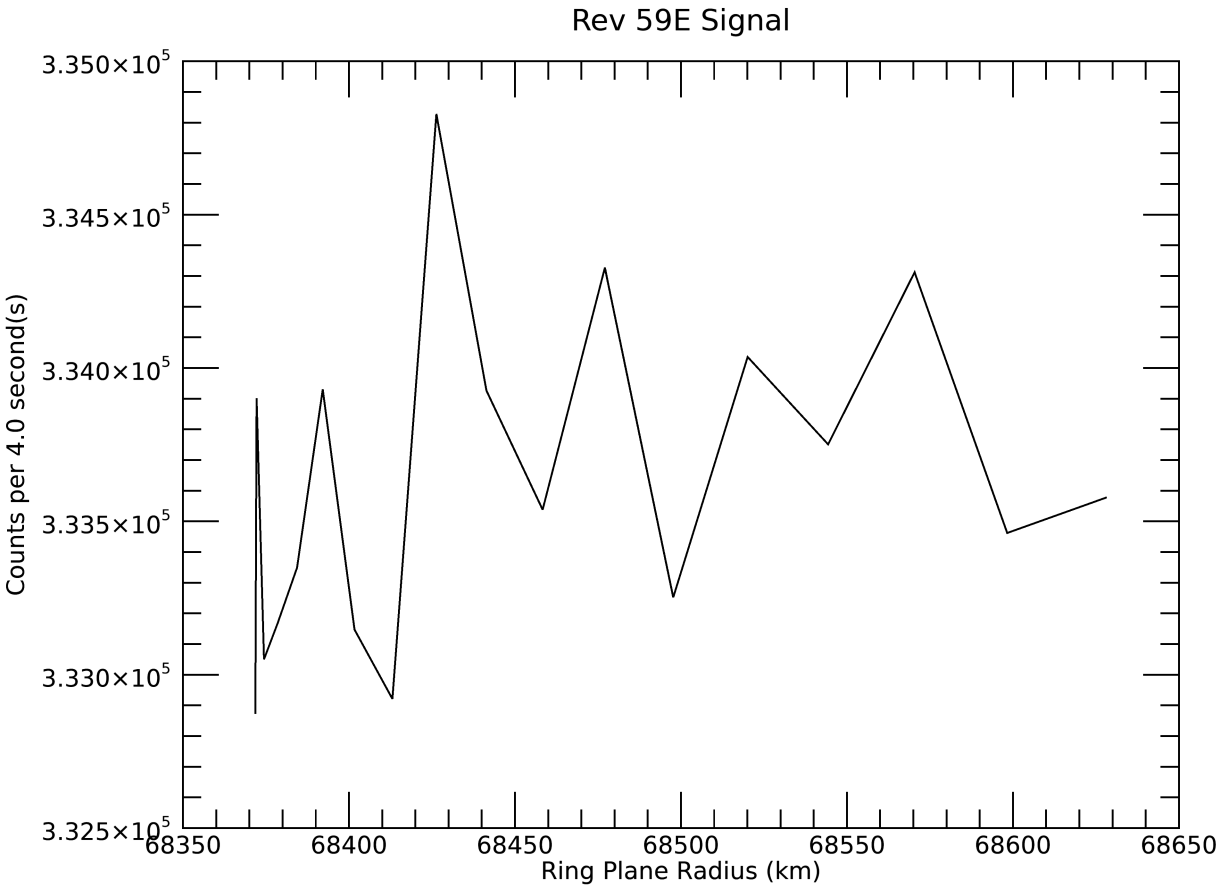


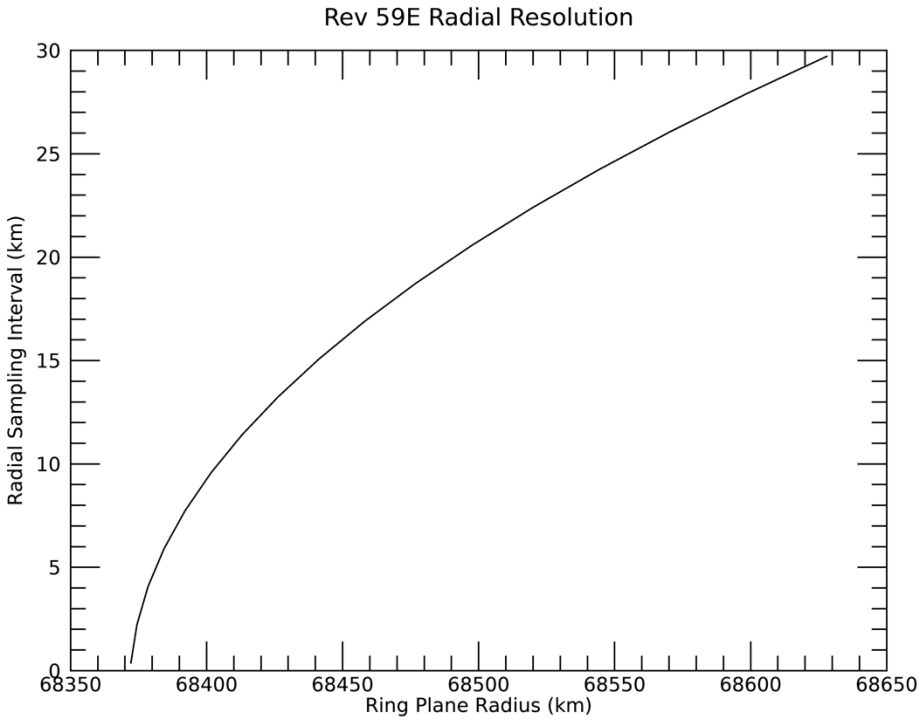
2008-003T20:36:00.000 291645.89 km

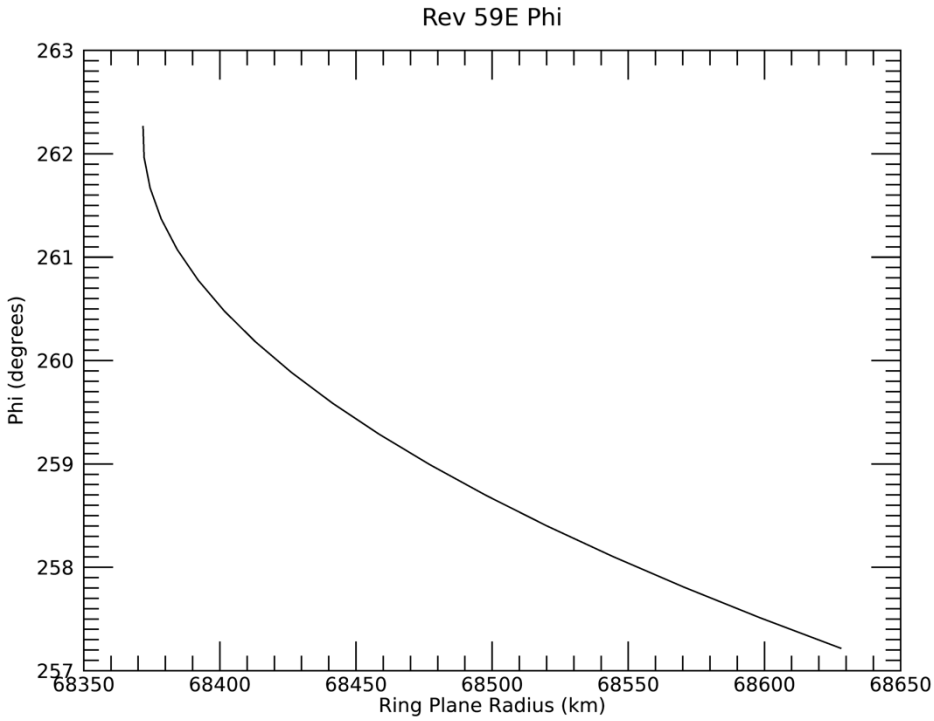
Target RA/dec: 313.26, -10.24

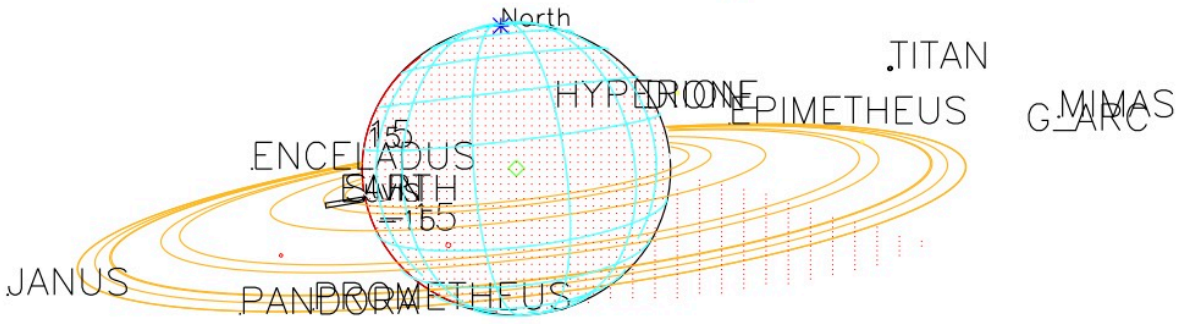
Subsolar lat/lon: -7.34, 74.82

Sub-s/c lat/lon: 8.38, -127.59


Rev 59E Signal
3.350×10^5
3.345×10^5
3.340×10^5
3.335×10^5
3.330×10^5
3.325×10^5
Counts per 4.0 second(s)
68350
68400
68450
68500
68550
68600
68650
Ring Plane Radius (km)


Rev 59E Radial Resolution
Radial Sampling Interval (km)
0
5
10
15
20
25
30
68350
68400
68450
68500
68550
68600
68650
Ring Plane Radius (km)


Rev 59E Phi
Phi (degrees)
257
258
259
260
261
262
263
68350
68400
68450
68500
68550
68600
68650
Ring Plane Radius (km)

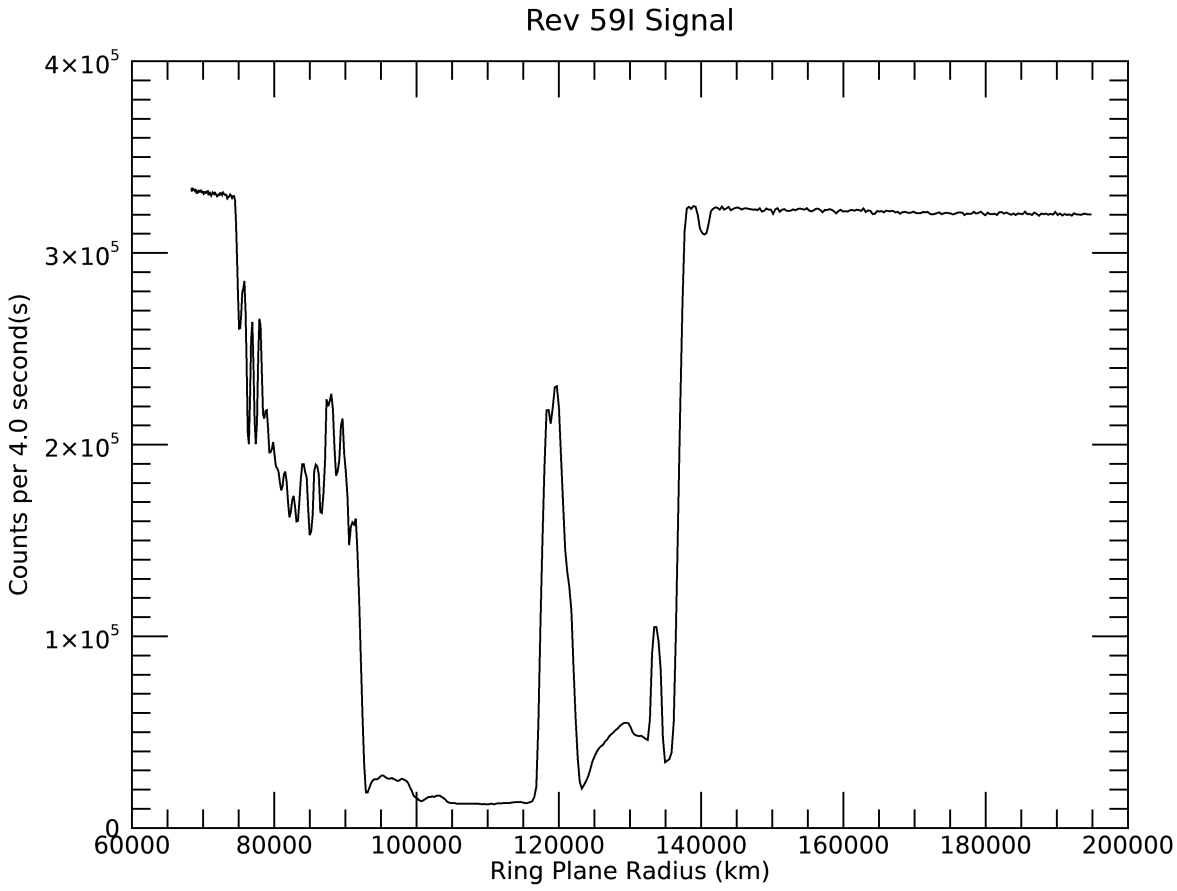


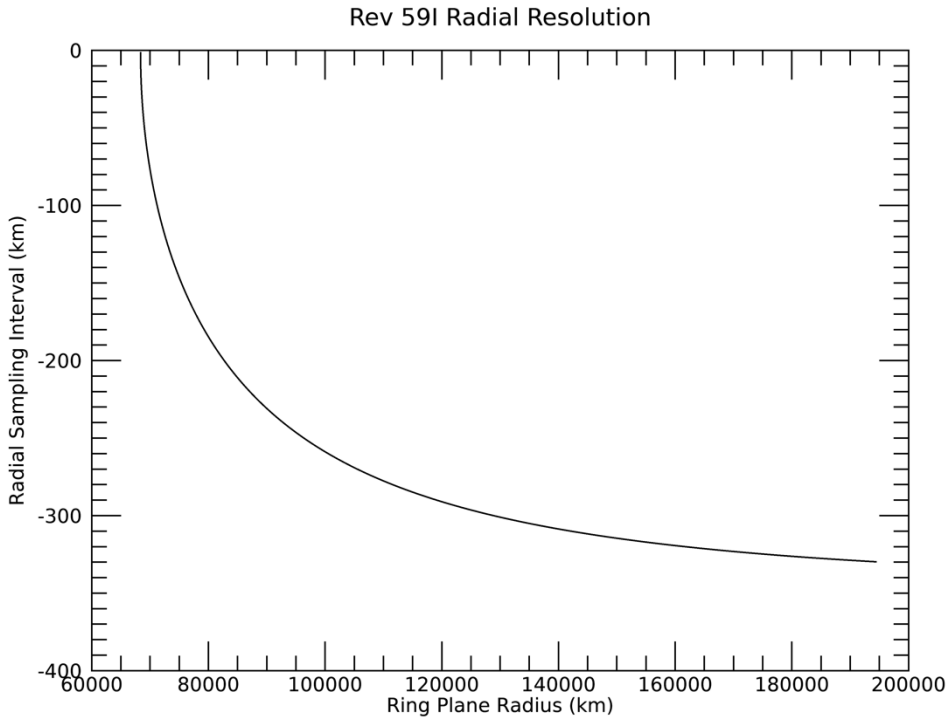
2008-051T17:14:00.000 218947.98 km

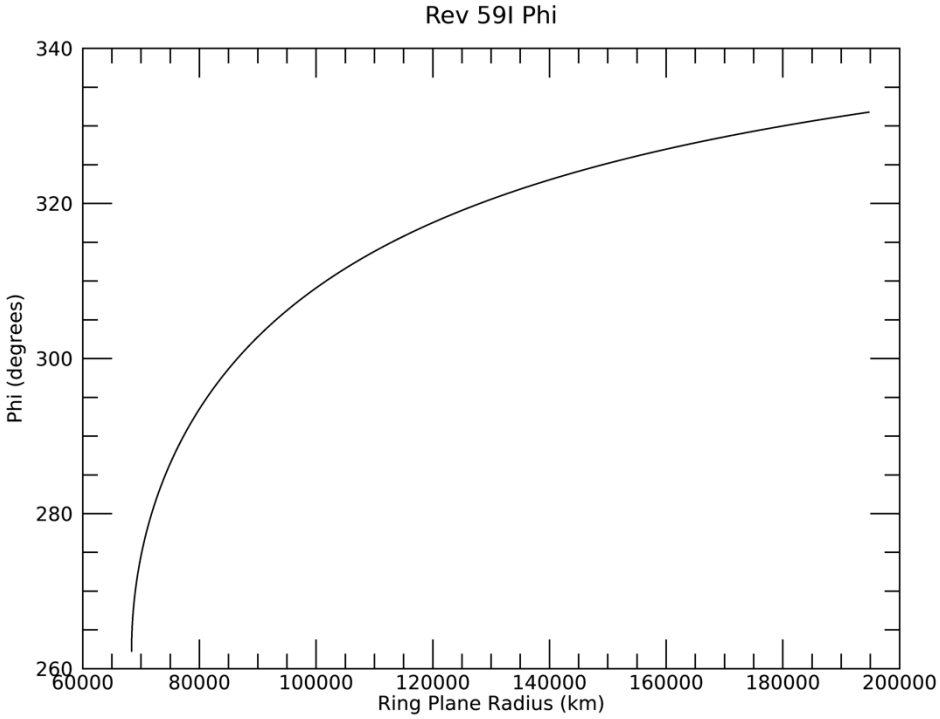
Target RA/dec: 319.34, -8.49

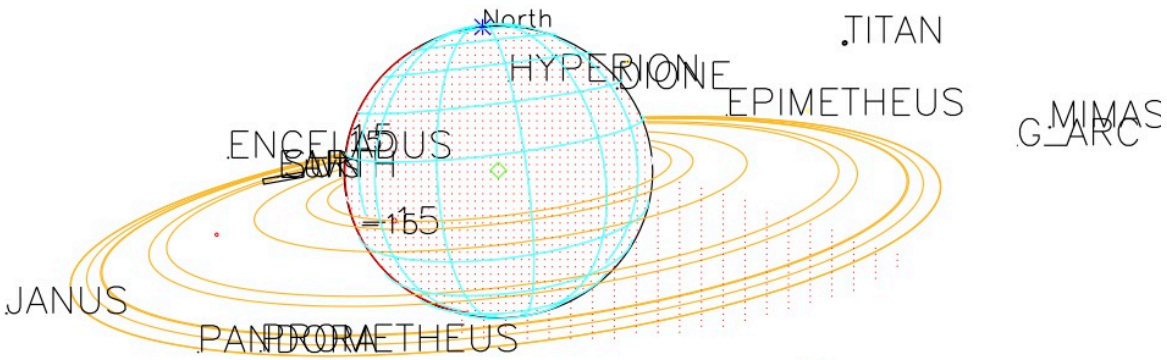
Subsolar lat/lon: -6.75, 151.99

Sub-s/c lat/lon: 6.40, -46.12


Rev 59I Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 4.0 second(s)
60000
80000
100000
120000
140000
160000
180000
200000
Ring Plane Radius (km)


Rev 59I Radial Resolution
0
-100
-200
-300
-400
Radial Sampling Interval (km)
60000
80000
100000
120000
140000
160000
180000
200000
Ring Plane Radius (km)


Rev 59I Phi
340
320
300
280
260
Phi (degrees)
60000
80000
100000
120000
140000
160000
180000
200000
Ring Plane Radius (km)

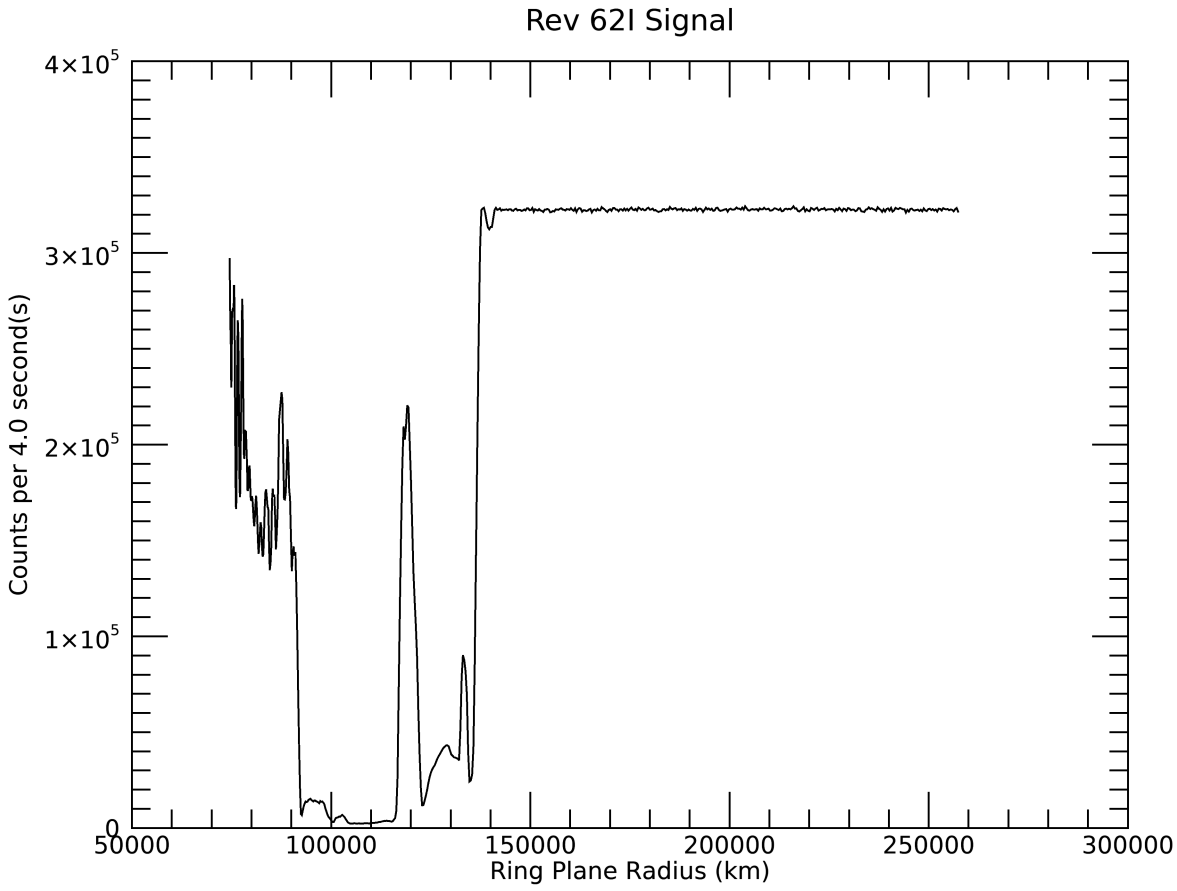


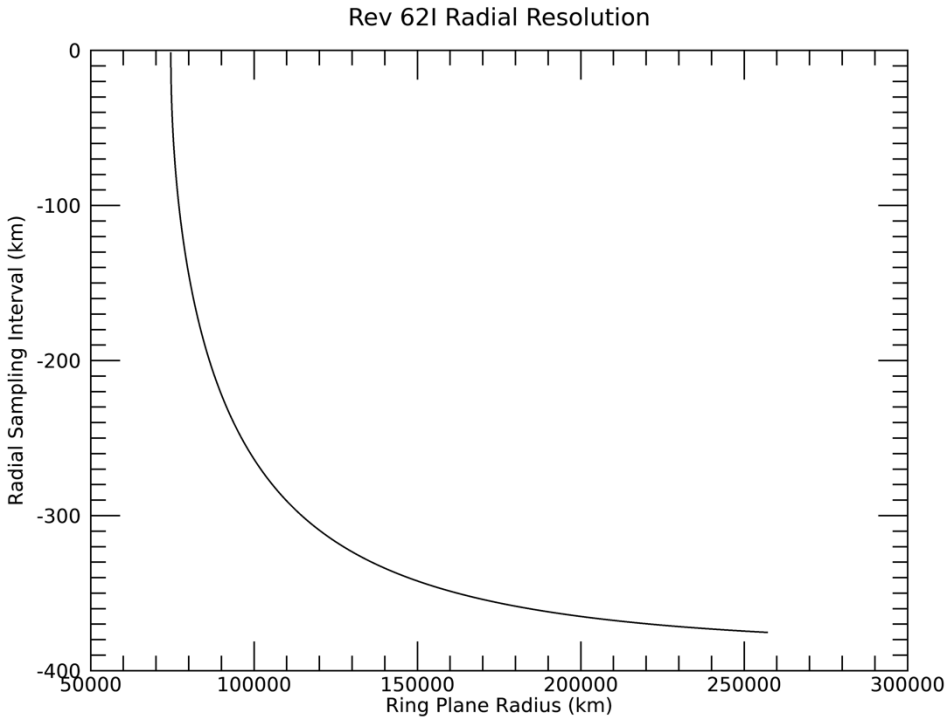
2008-051T16:56:00.000 224869.15 km

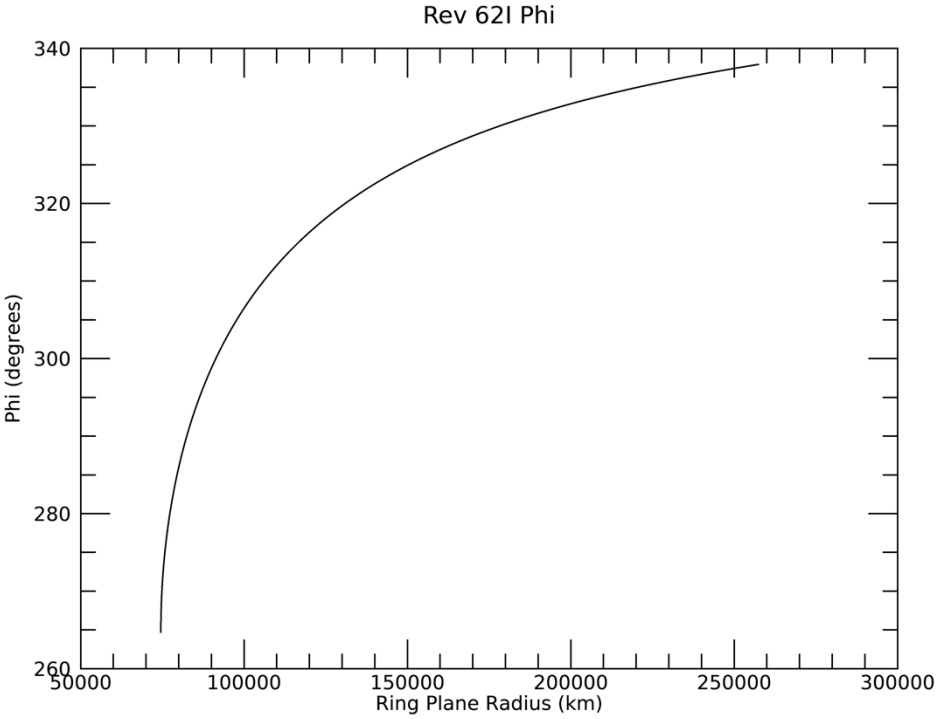
Target RA/dec: 315.74, -11.45

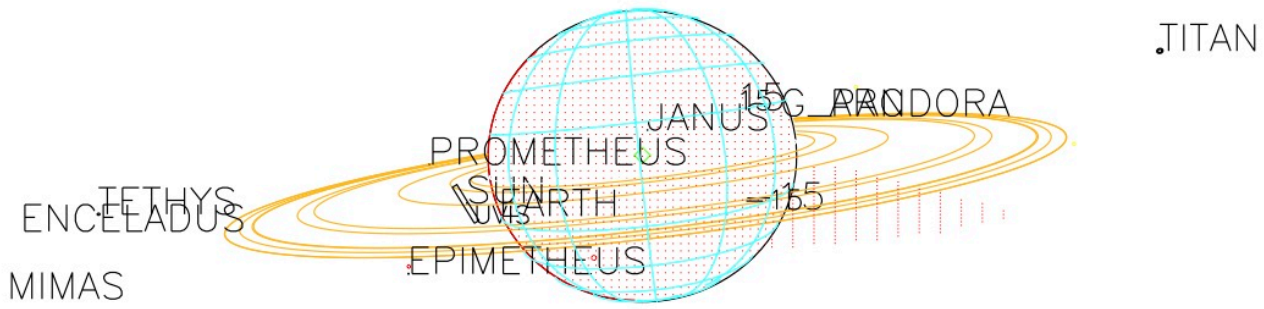
Subsolar lat/lon: -6.75, 162.13

Sub-s/c lat/lon: 9.27, -39.22


Rev 62I Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 4.0 second(s)
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 62I Radial Resolution
0
-100
-200
-300
-400
Radial Sampling Interval (km)
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 62I Phi
340
320
300
280
260
Phi (degrees)
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)

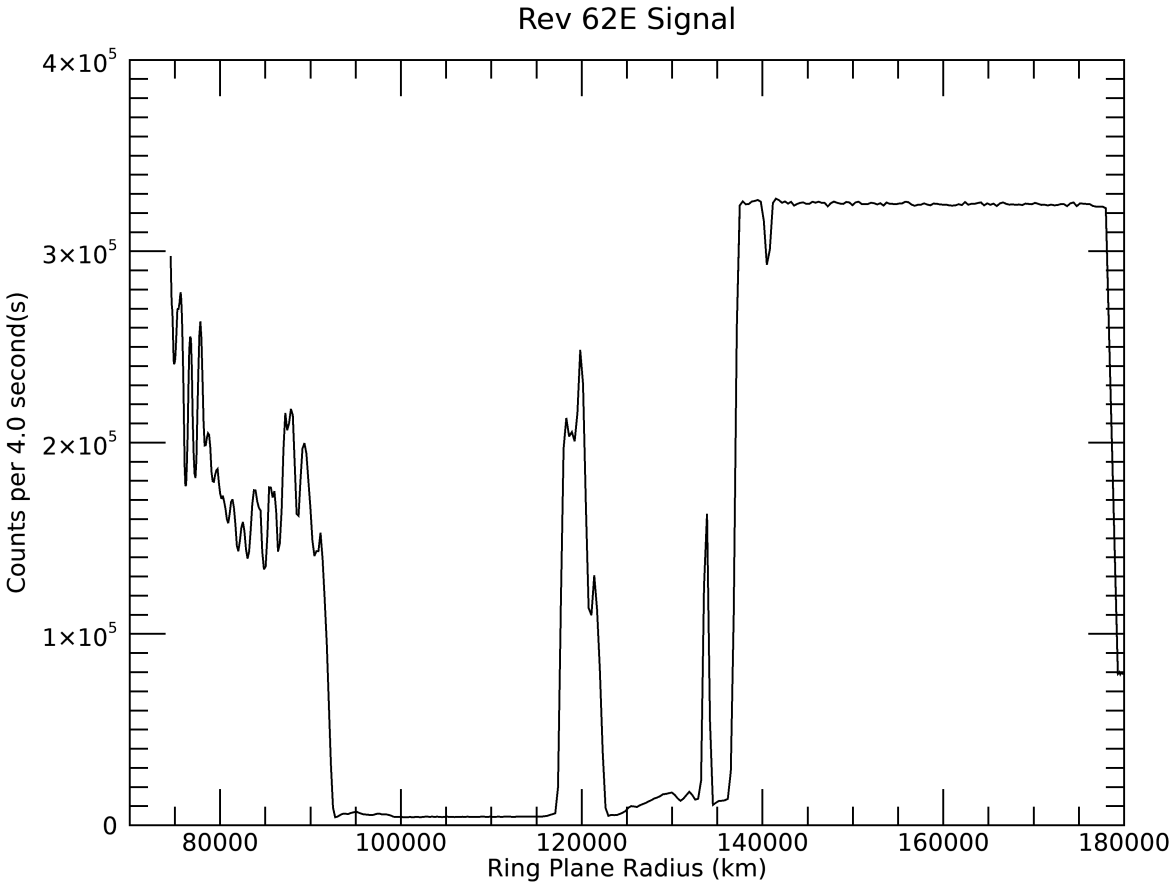


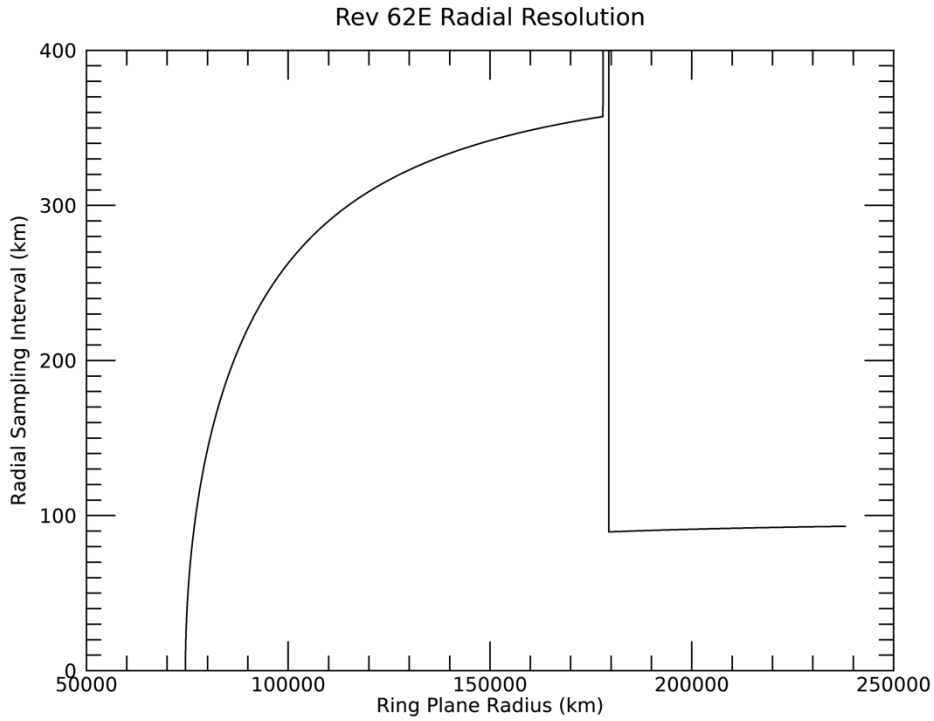
2008-083T09:50:00.000 244924.94 km

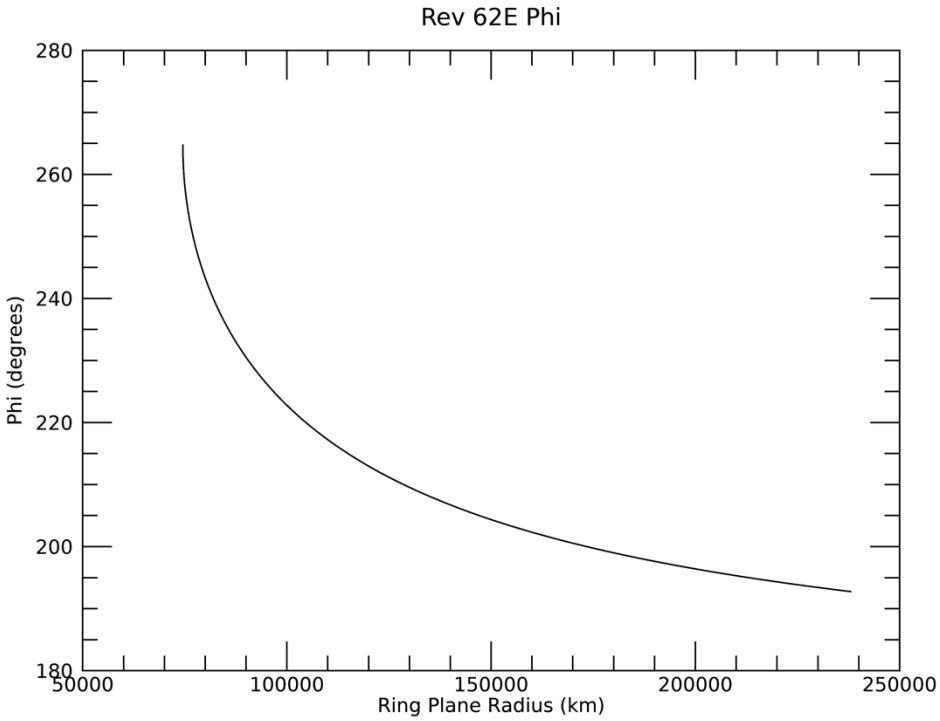
Target RA/dec: 322.08, -7.01

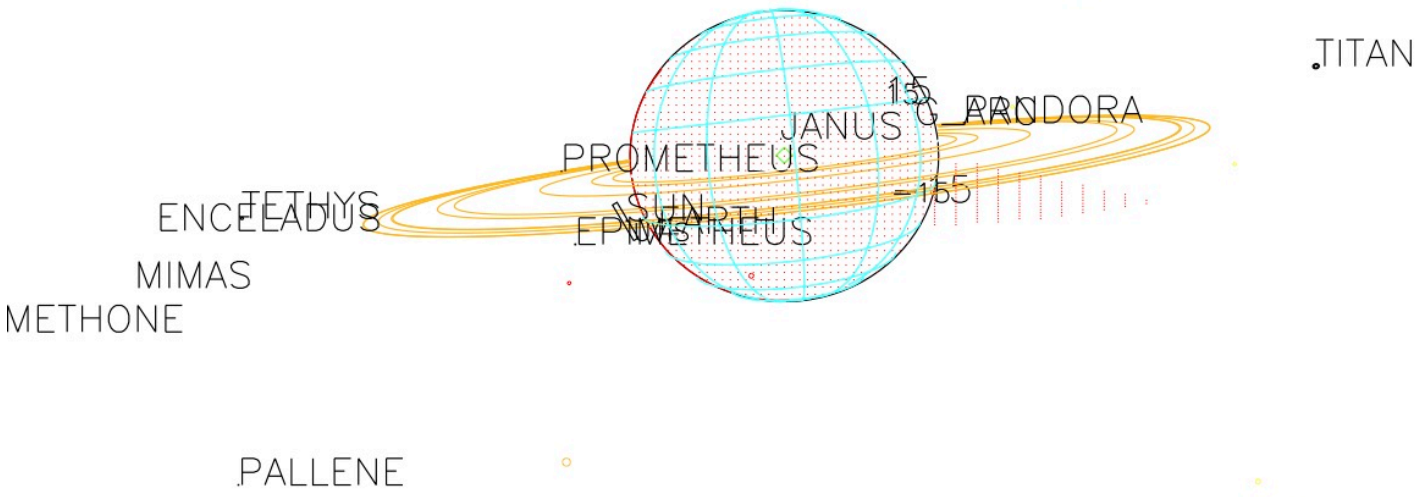
Subsolar lat/lon: -6.35, 17.60

Sub-s/c lat/lon: 4.85, -178.98


Rev 62E Signal
4×10^5
3×10^5
2×10^5
1×10^5
0
Counts per 4.0 second(s)
80000
100000
120000
140000
160000
180000
Ring Plane Radius (km)


Rev 62E Radial Resolution
Radial Sampling Interval (km)
400
300
200
100
0
50000
100000
150000
200000
250000
Ring Plane Radius (km)


Rev 62E Phi
Phi (degrees)
280
260
240
220
200
180
50000
100000
150000
200000
250000
Ring Plane Radius (km)

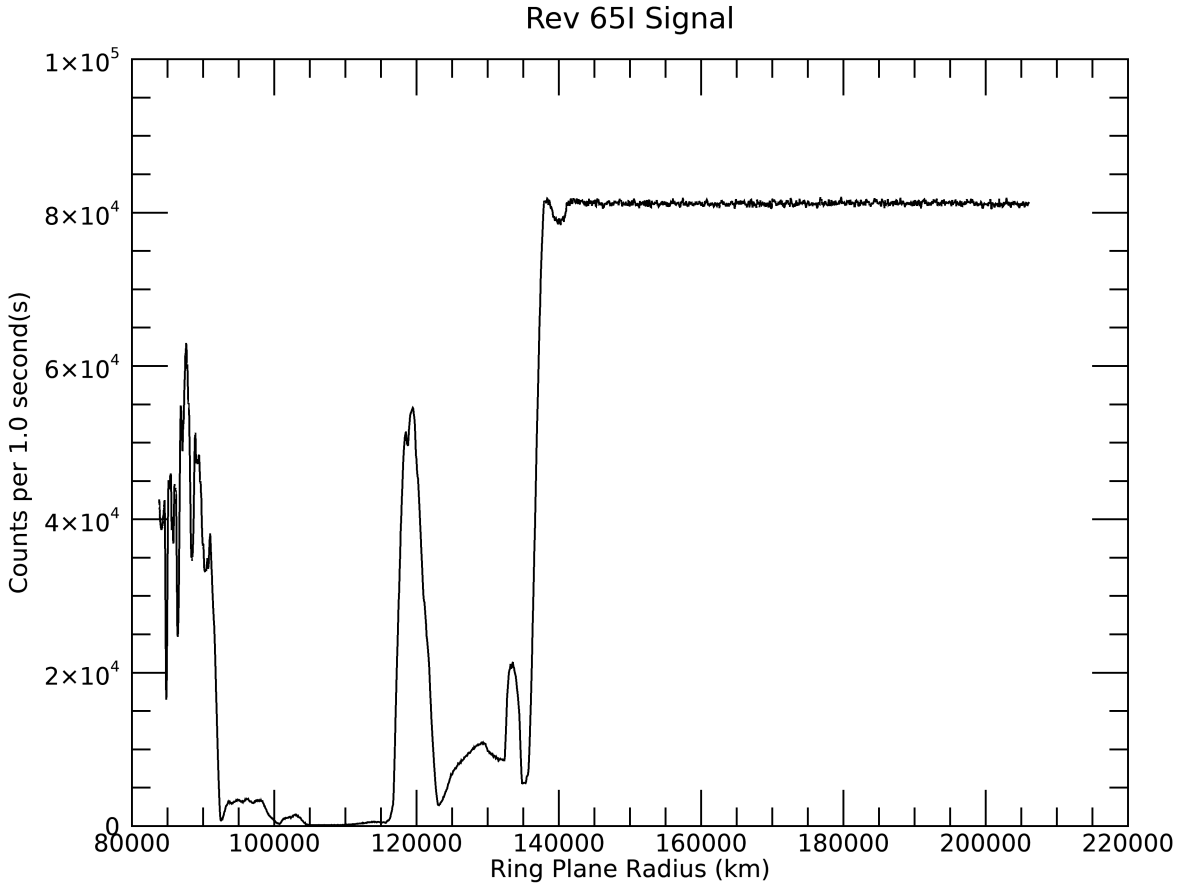


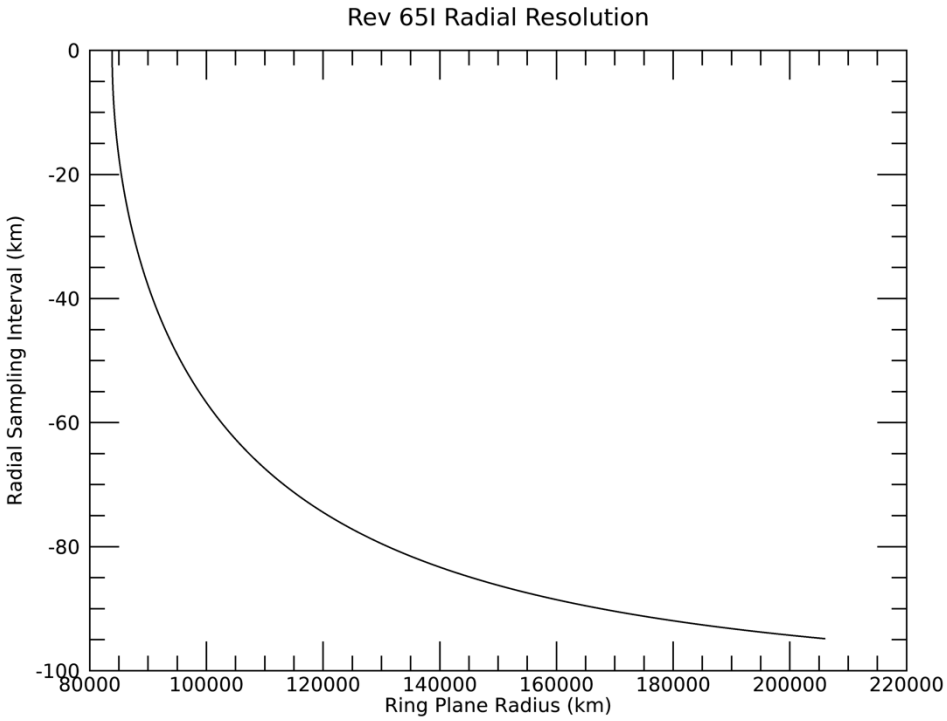
2008-083T10:00:00.000 242464.43 km

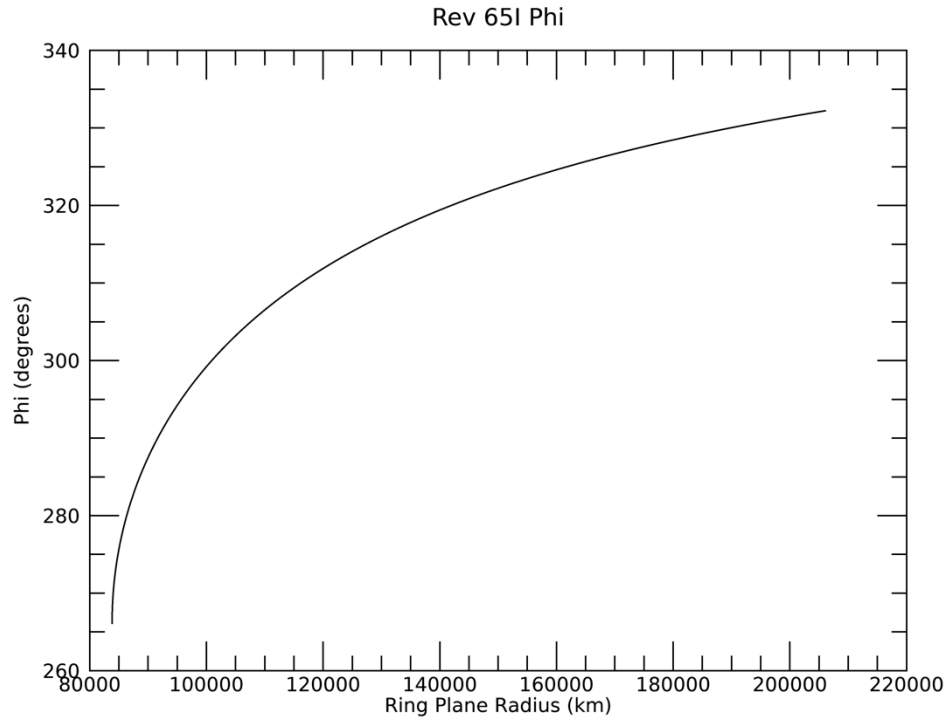
Target RA/dec: 323.55, -5.30

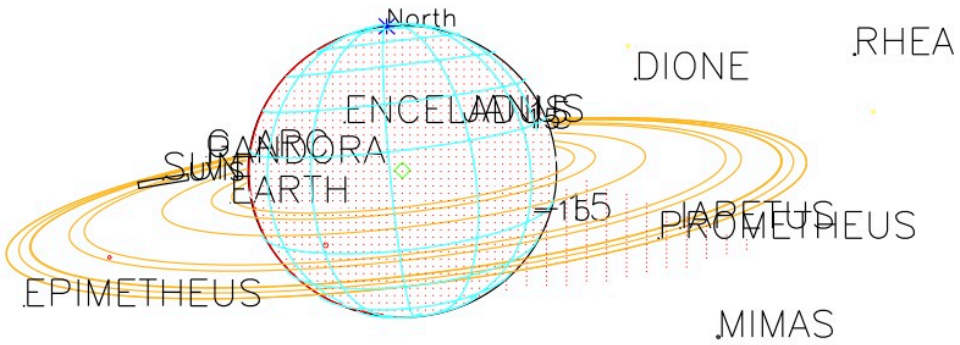
Subsolar lat/lon: -6.35, 11.97

Sub-s/c lat/lon: 3.26, 176.65


Rev 65I Signal
1×10^5
8×10^4
6×10^4
4×10^4
2×10^4
0
Counts per 1.0 second(s)
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 65I Radial Resolution
Radial Sampling Interval (km)
0
-20
-40
-60
-80
-100
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 65I Phi
Phi (degrees)
340
320
300
280
260
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)

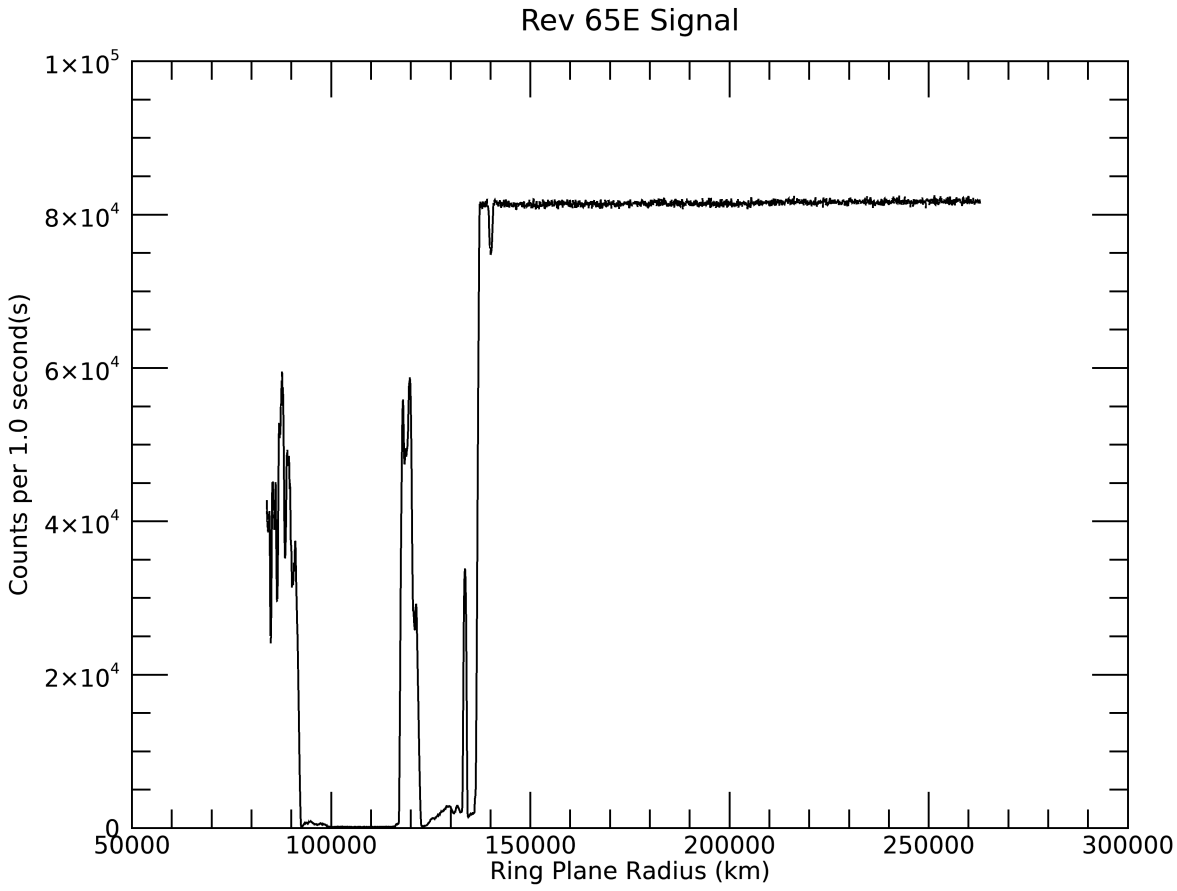


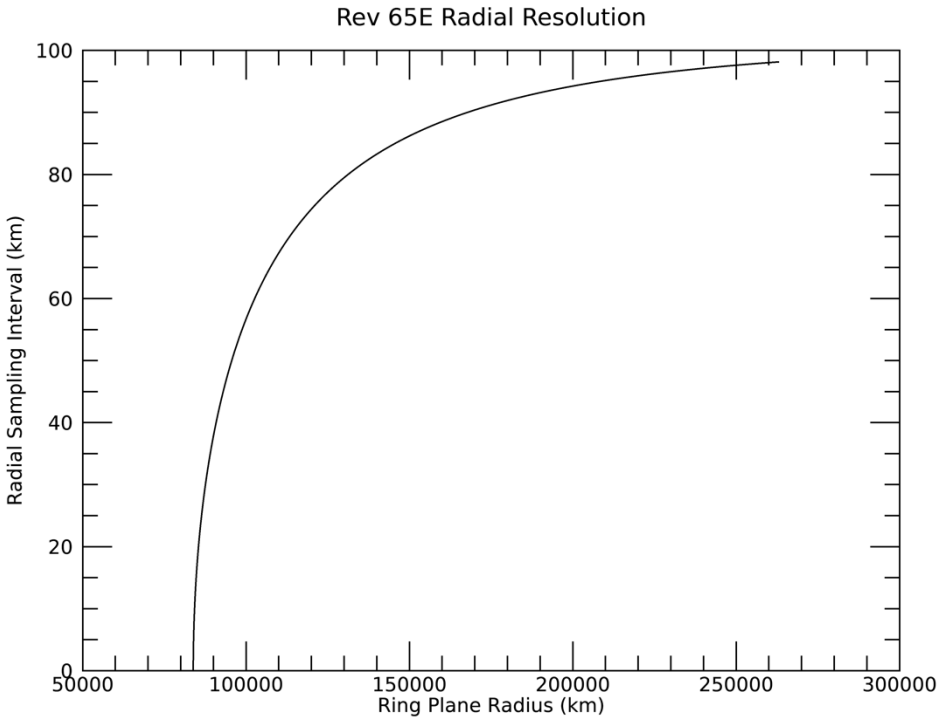
2008-111T20:35:00.000 282077.20 km

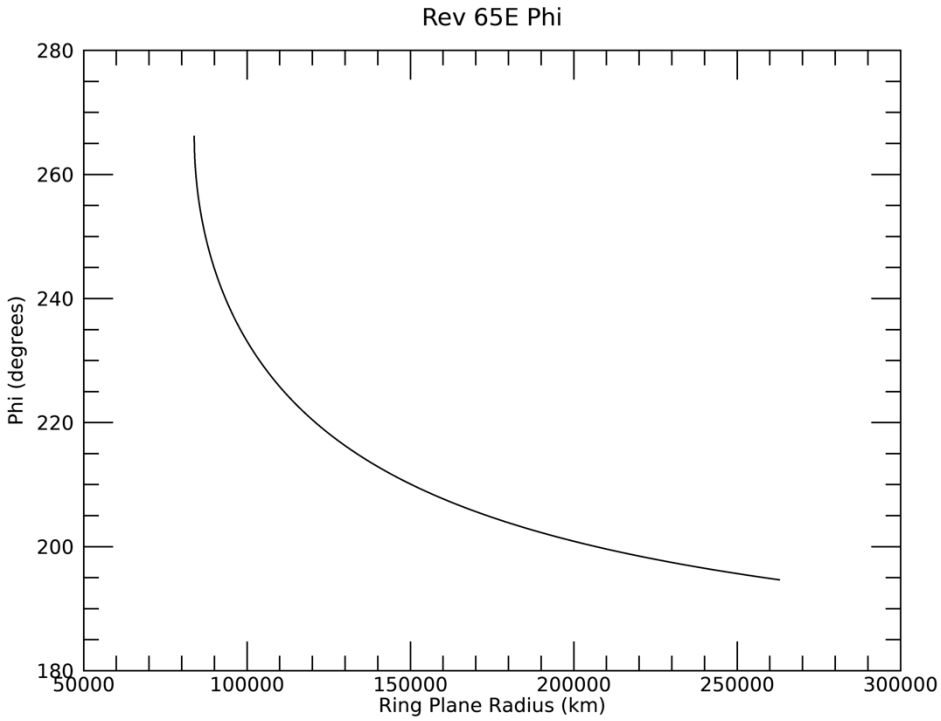
Target RA/dec: 320.34, -10.42

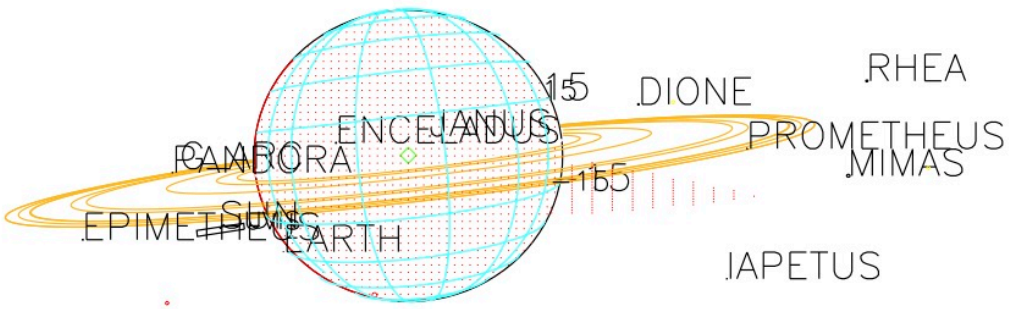
Subsolar lat/lon: -6.00, -6.88

Sub-s/c lat/lon: 7.87, 154.27


Rev 65E Signal
1×10^5
8×10^4
6×10^4
4×10^4
2×10^4
0
Counts per 1.0 second(s)
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 65E Radial Resolution
Radial Sampling Interval (km)
0
20
40
60
80
100
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 65E Phi
Phi (degrees)
180
200
220
240
260
280
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)

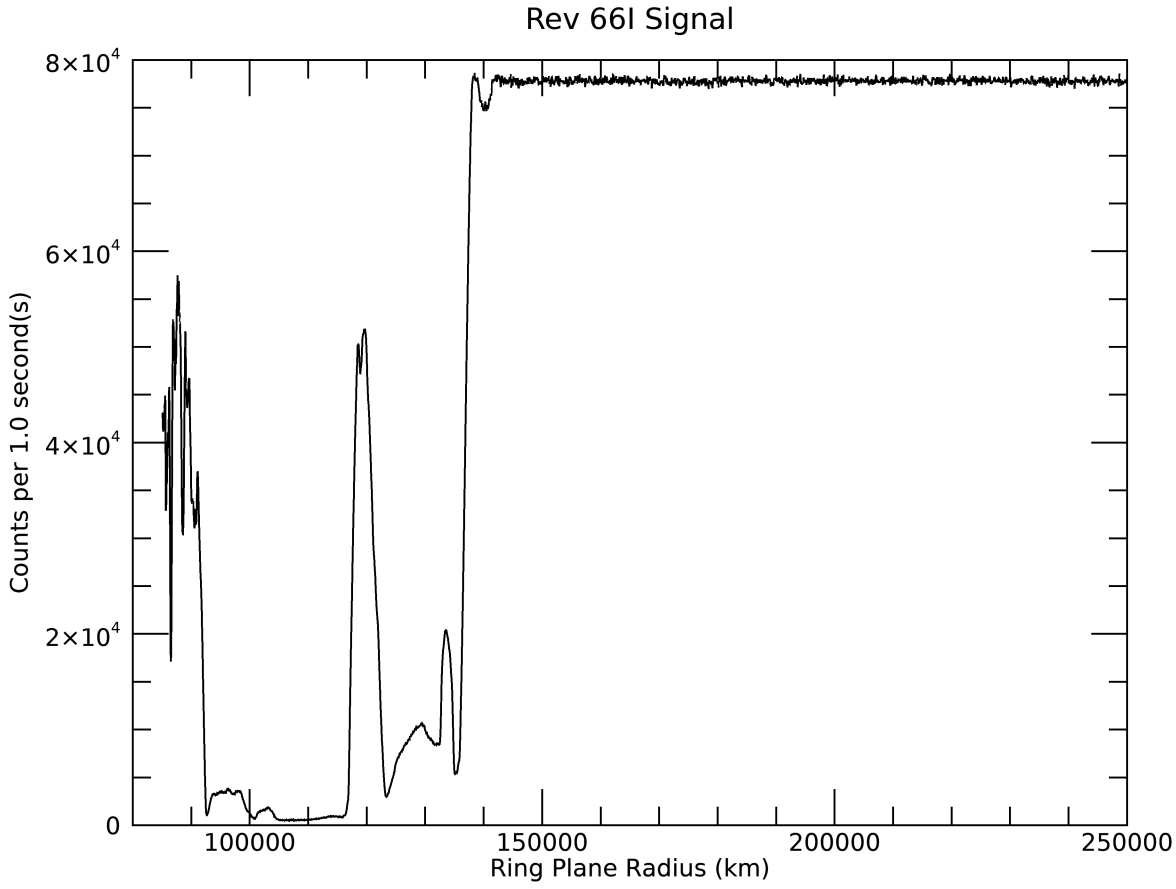


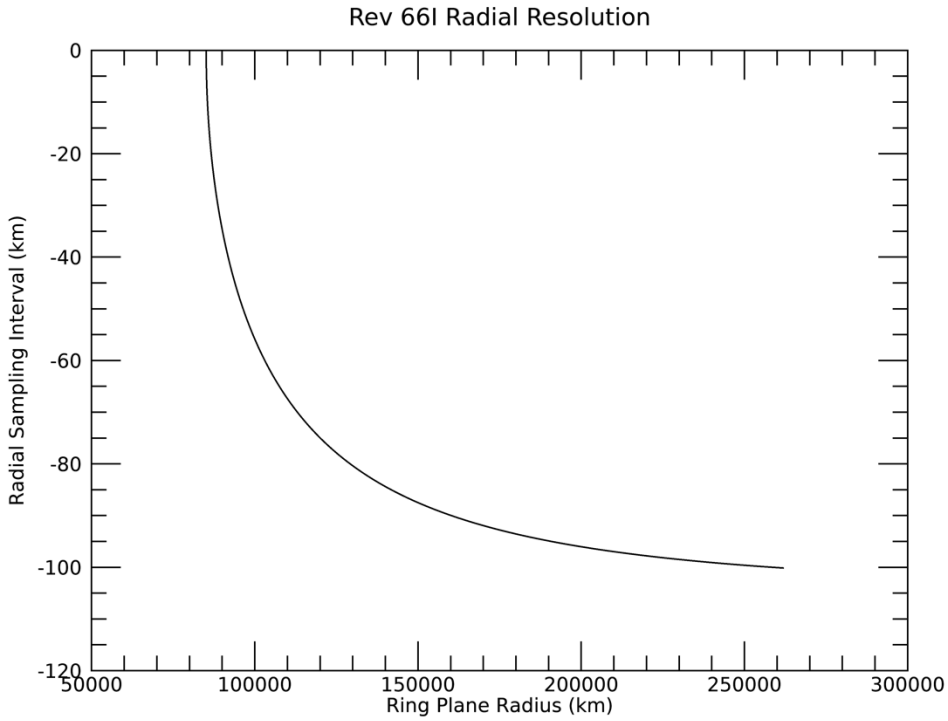
2008-111T21:10:00.000 274618.51 km

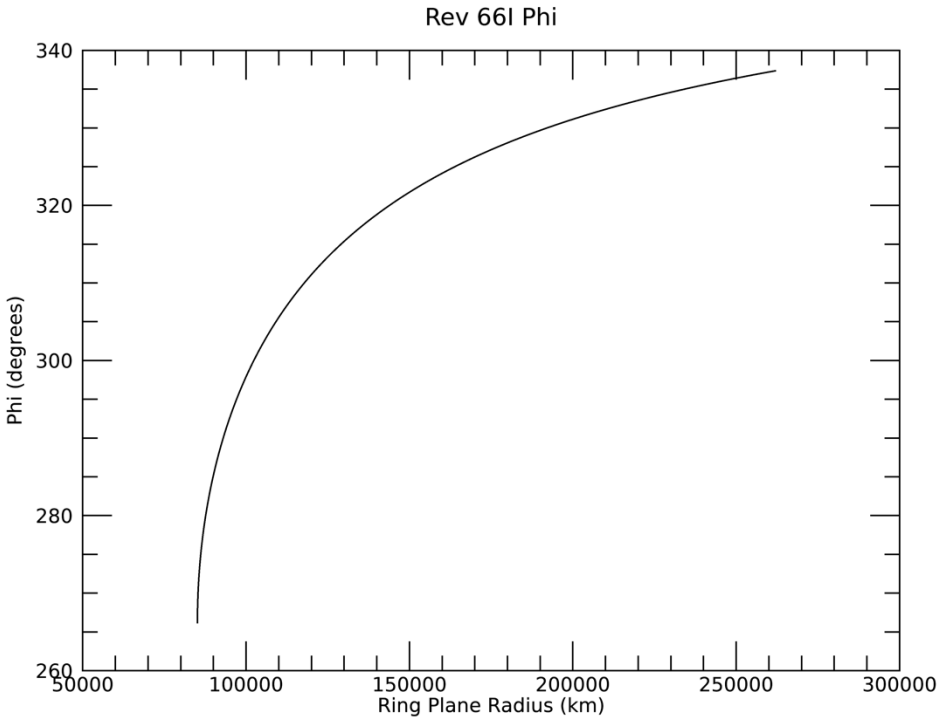
Target RA/dec: 323.88, -5.11

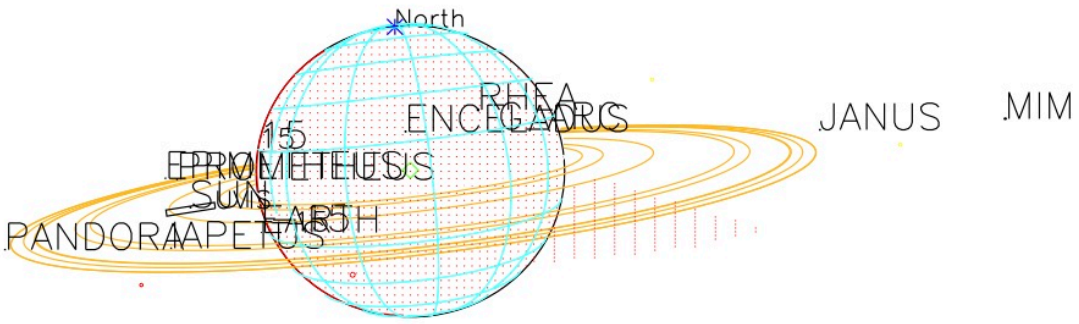
Subsolar lat/lon: -6.00, -26.59

Sub-s/c lat/lon: 3.05, 137.49


Rev 66I Signal
8×10^4
6×10^4
4×10^4
2×10^4
0
Counts per 1.0 second(s)
100000
150000
200000
250000
Ring Plane Radius (km)


Rev 66I Radial Resolution
Radial Sampling Interval (km)
0
-20
-40
-60
-80
-100
-120
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 66I Phi
Phi (degrees)
340
320
300
280
260
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)

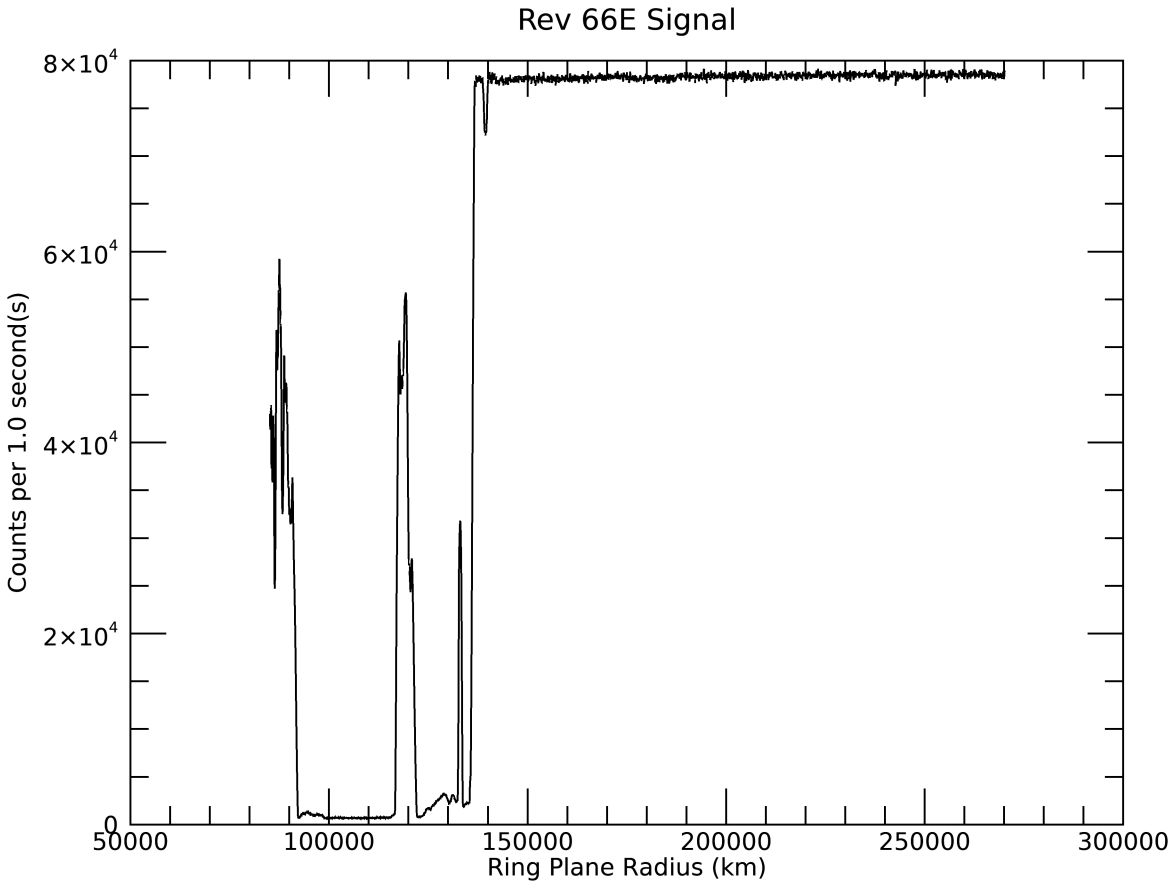


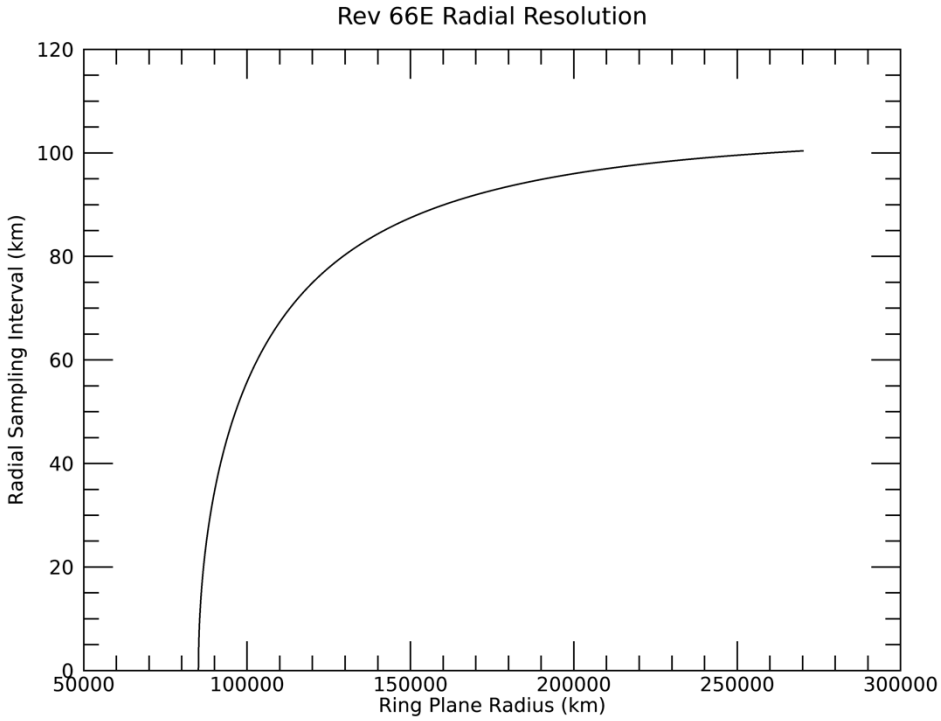
2008-121T10:04:00.000 277993.81 km

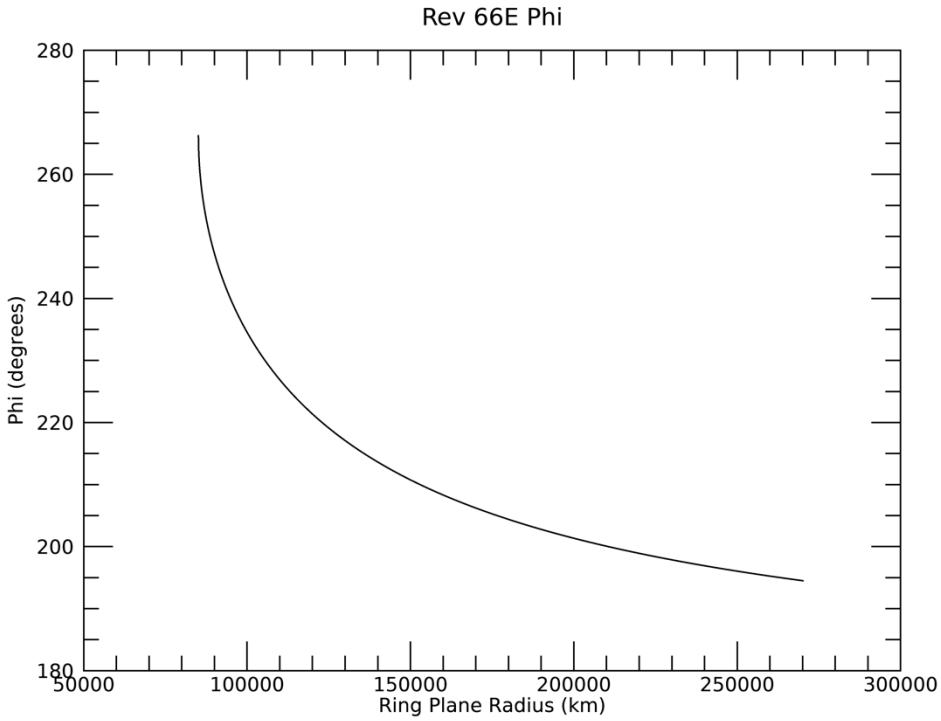
Target RA/dec: 321.87, -7.99

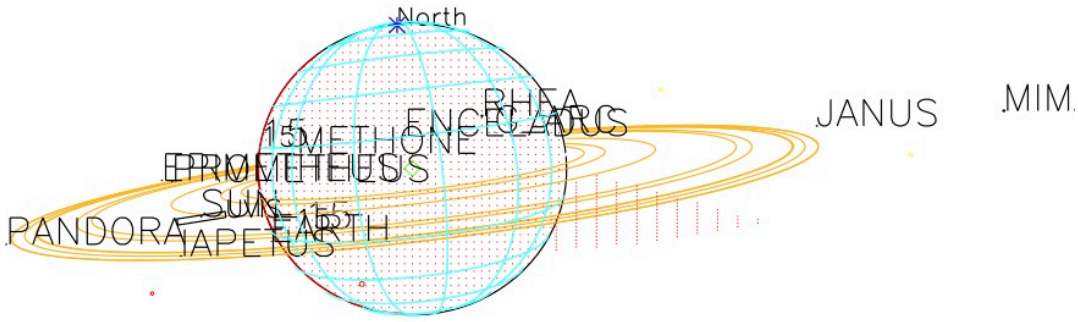
Subsolar lat/lon: -5.88, 160.77

Sub-s/c lat/lon: 5.67, -37.13


Rev 66E Signal
8×10^4
6×10^4
4×10^4
2×10^4
0
Counts per 1.0 second(s)
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 66E Radial Resolution
Radial Sampling Interval (km)
0
20
40
60
80
100
120
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)


Rev 66E Phi
Phi (degrees)
180
200
220
240
260
280
50000
100000
150000
200000
250000
300000
Ring Plane Radius (km)

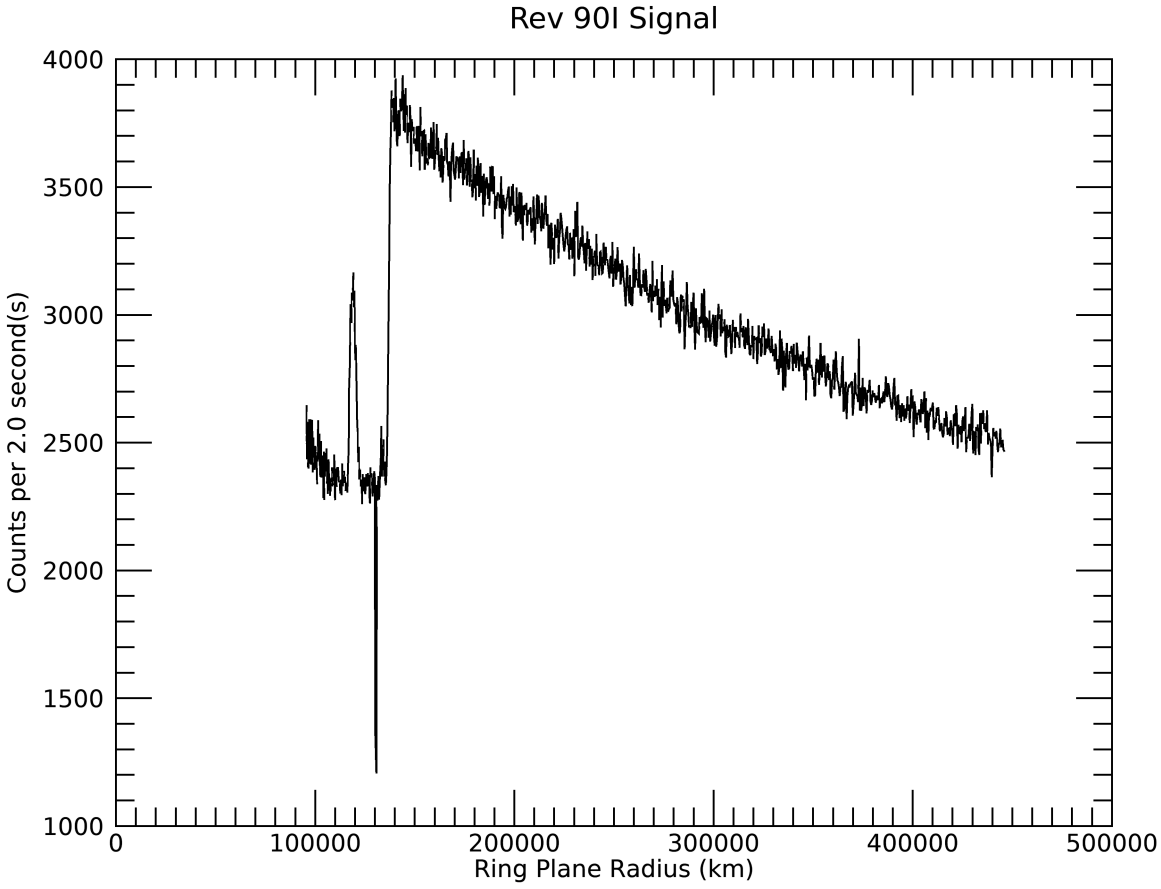


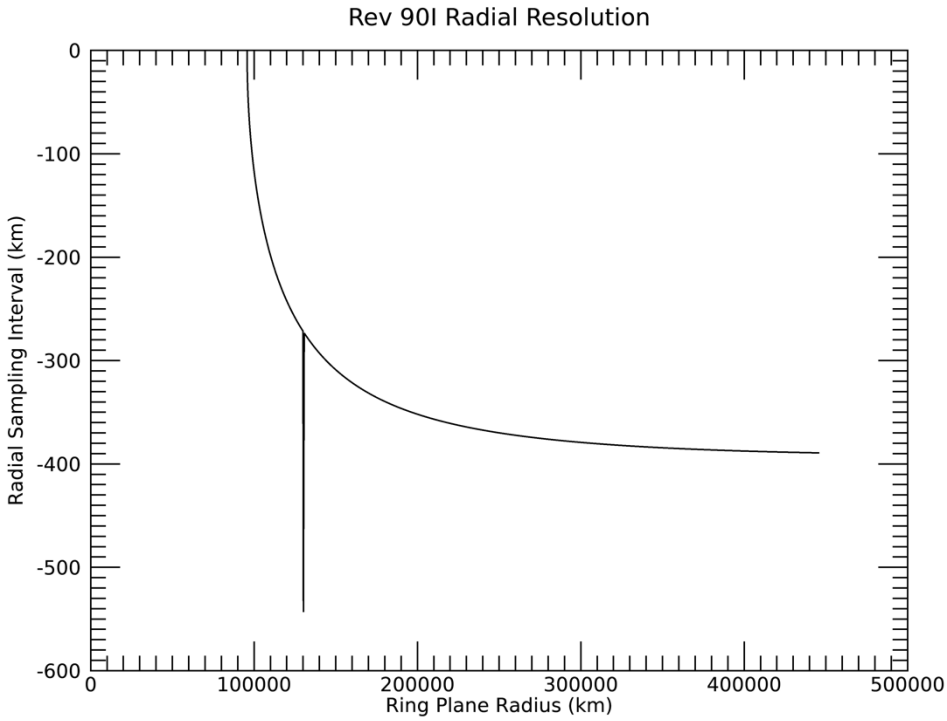
2008-121T10:10:00.000 276723.49 km

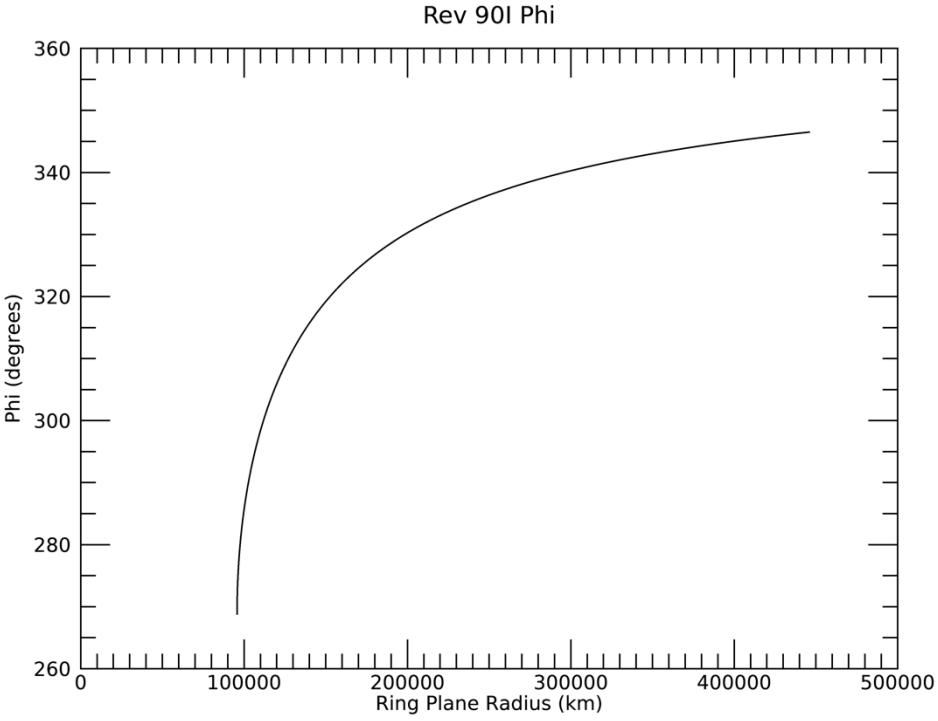
Target RA/dec: 322.48, -7.08

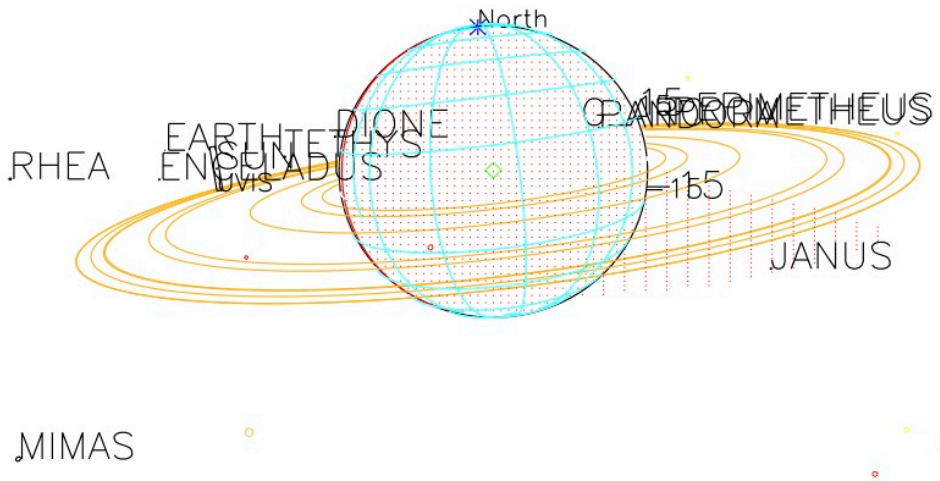
Subsolar lat/lon: -5.88, 157.39

Sub-s/c lat/lon: 4.84, -40.01


Rev 90I Signal
Counts per 2.0 second(s)
4000
3500
3000
2500
2000
1500
1000
0
100000
200000
300000
400000
500000
Ring Plane Radius (km)


Rev 90I Radial Resolution
Radial Sampling Interval (km)
0
-100
-200
-300
-400
-500
-600
0
100000
200000
300000
400000
500000
Ring Plane Radius (km)


Rev 90I Phi
Phi (degrees)
360
340
320
300
280
260
0
100000
200000
300000
400000
500000
Ring Plane Radius (km)

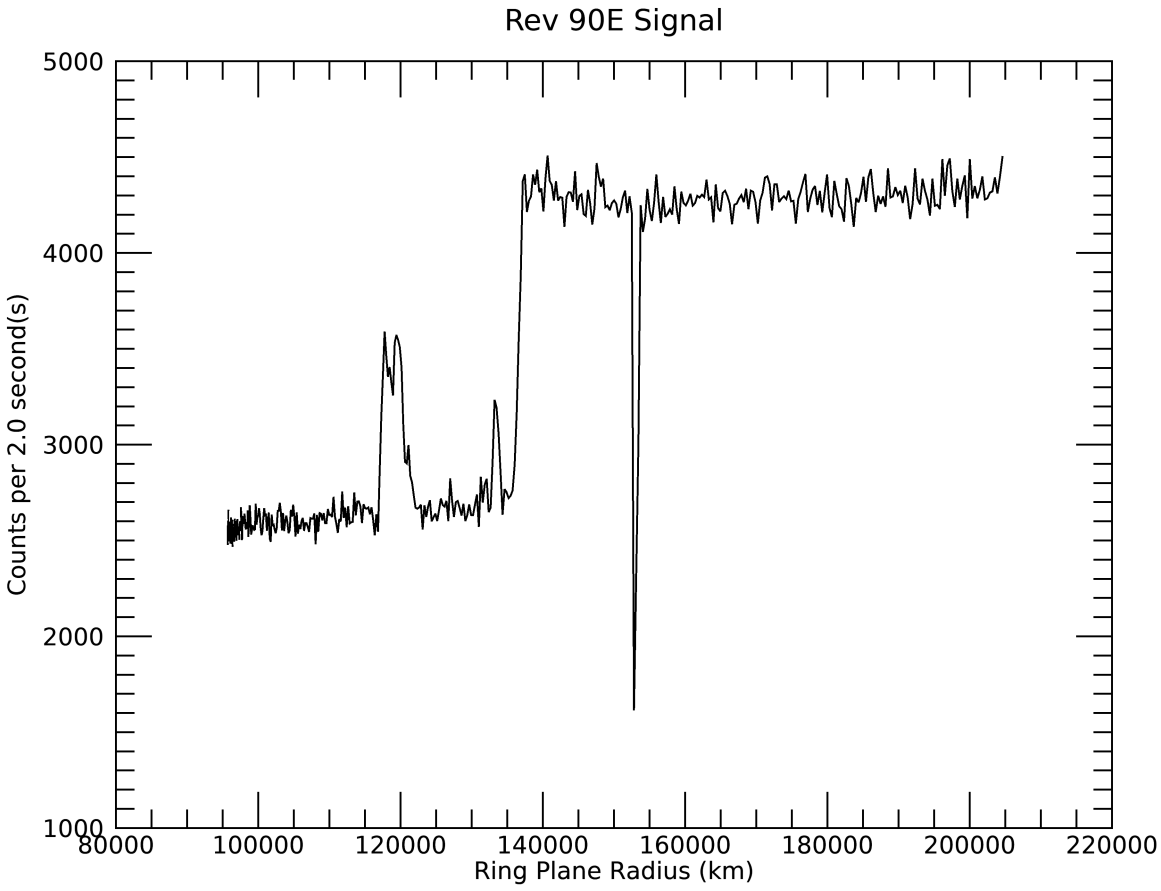


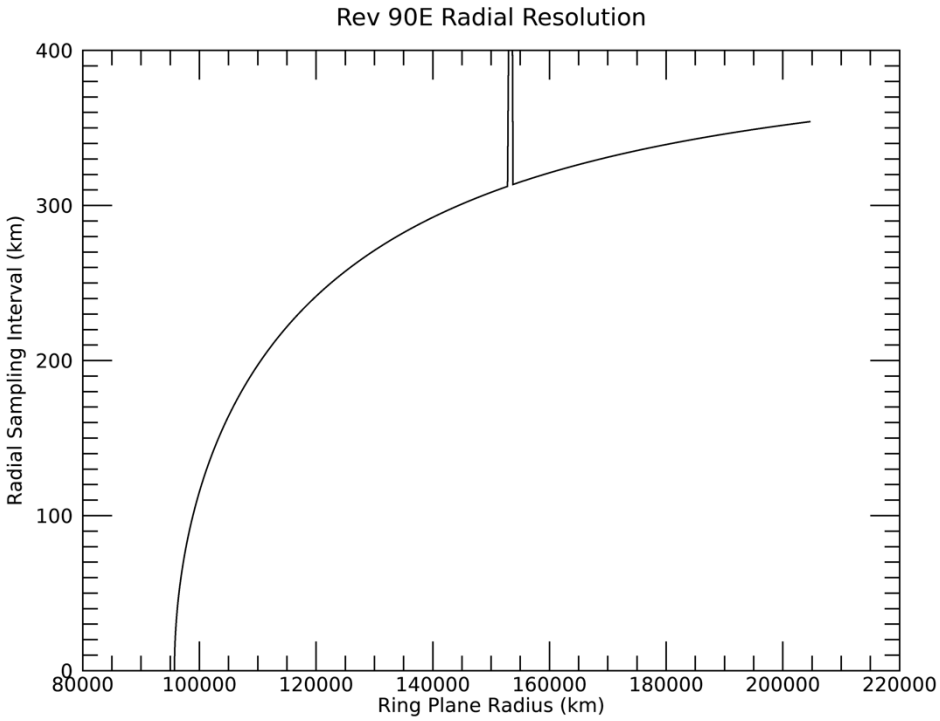
2008-298T09:28:00.000 242282.90 km

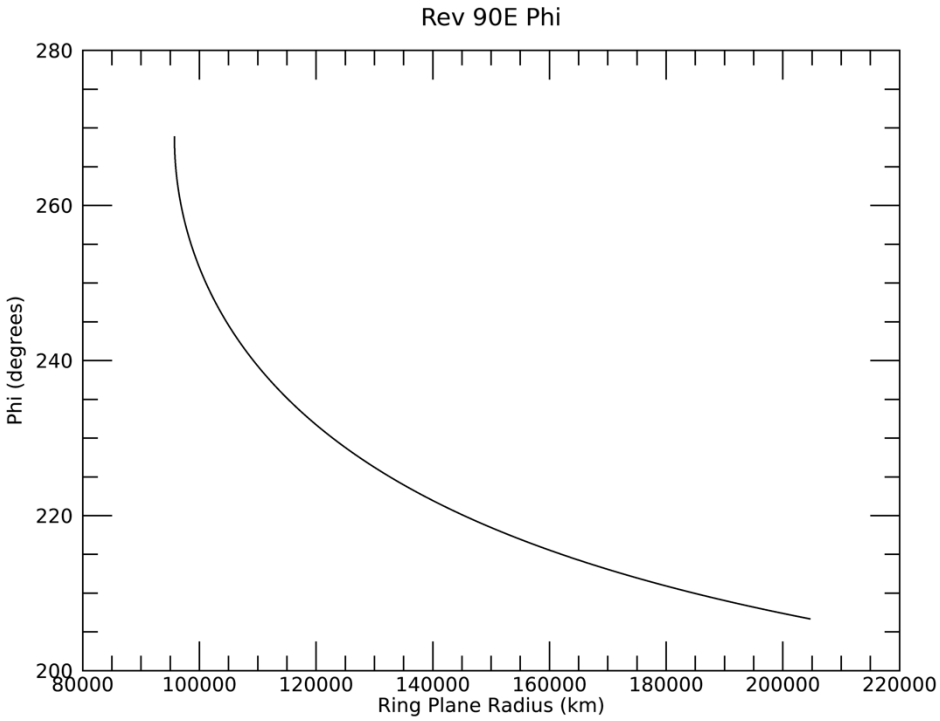
Target RA/dec: 320.58, -9.22

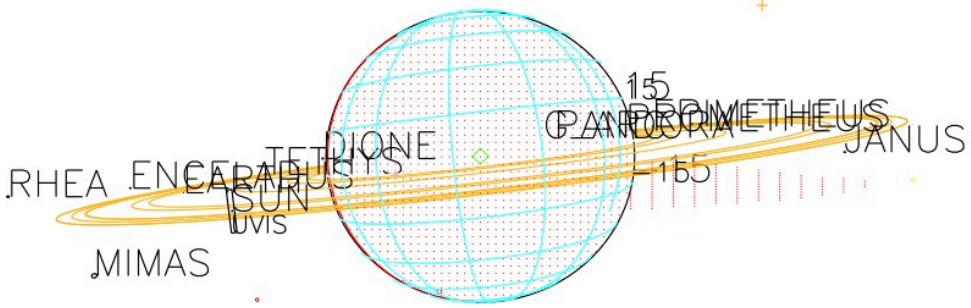
Subsolar lat/lon: -3.65, -43.90

Sub-s/c lat/lon: 6.87, 111.47


Rev 90E Signal
Counts per 2.0 second(s)
5000
4000
3000
2000
1000
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 90E Radial Resolution
Radial Sampling Interval (km)
400
300
200
100
0
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)


Rev 90E Phi
Phi (degrees)
280
260
240
220
200
80000
100000
120000
140000
160000
180000
200000
220000
Ring Plane Radius (km)



2008-298T09:53:00.000 239922.08 km

Target RA/dec: 322.75, -3.88

Subsolar lat/lon: -3.65, -57.97

Sub-s/c lat/lon: 2.13, 98.95