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# JUICE

## *RIME/ Data Volume & Global Coverage Estimation*

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## 1 PURPOSE OF THIS DOCUMENT

The aim of this document is to provide to the science and technical community, involved in the Rime project, the main orbital parameters of the Juice SC on Ganymede.

Sites should be preferably located in the outer anti-Jovian quadrant , in order to protect the radar circuits from the Jupiter's radio emission during the acquisitions.



## 2 JUICE OVERALL ORBITAL PARAMETERS OVERVIEW

### Juice Space Craft Altitude

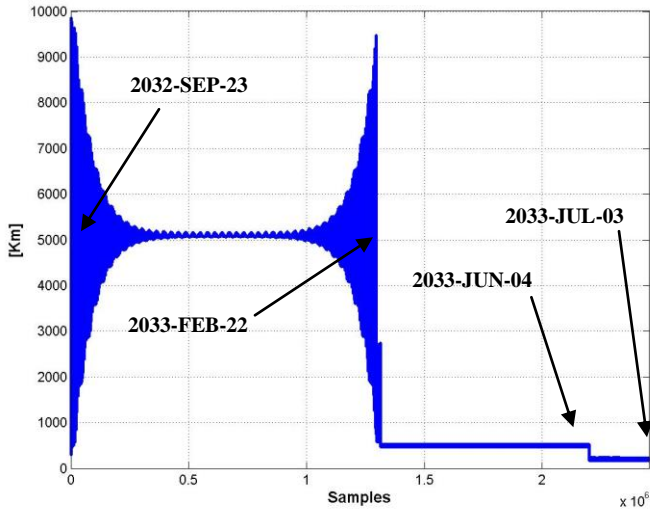


Fig. 2.1

### Juice Space Craft Latitude

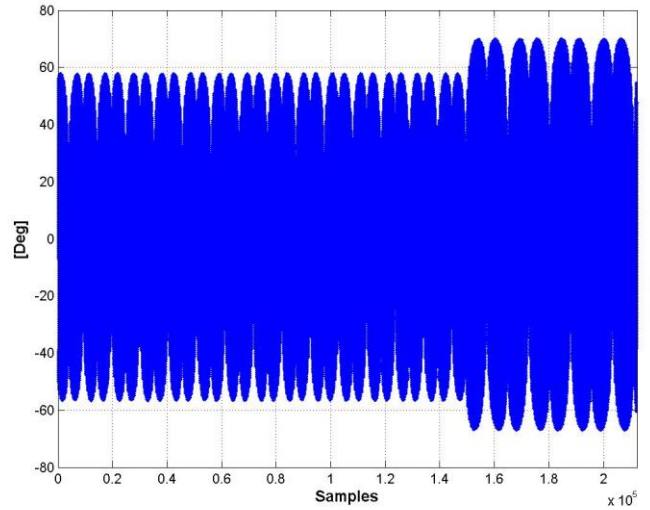


Fig. 2.2

### Juice Space Craft Altitude [500/200 Km]

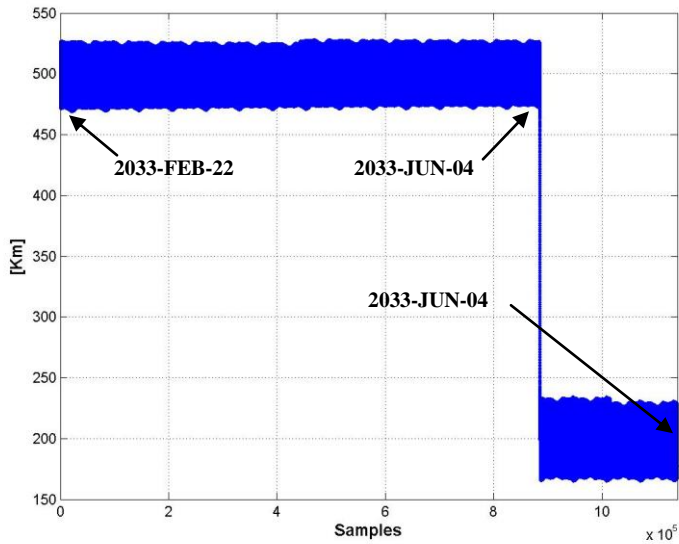


Fig. 2.3

### Juice Sun Elevation Angle

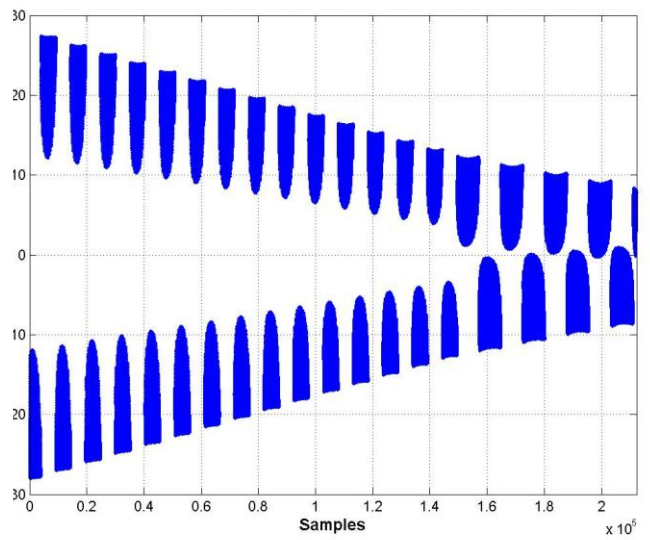


Fig. 2.4



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### 3 JUICE ORBITAL PARAMETER ANALYSIS “ORBIT @ 500KM”

#### 3.1 SCHEMATICS

- Average Duration Per Orbit = 3.0752 hr
- Number of Orbits = 799 (2033-02-22T03:20:20.000 : 2033-06-04T12:47:50.000)

#### JIOVIAN & ANTI-JIOVIAN

- Minimum SC Altitude = 469.0564 Km.
- Maximum SC Altitude = 527.8243 Km.
- Minimum Tangential Velocity = 1.7585 Km/Sec
- Maximum Tangential Velocity = 1.7915 Km Sec
- Minimum Radial Velocity = -0.0162 Km/Sec
- Maximum Radial Velocity = 0.0163 Km/Sec

#### ANTI-JIOVIAN 1:149494

- Minimum SC Altitude = 474.0273 Km
- Maximum SC Altitude = 523.8458 Km
- Minimum Tangential Velocity = 1.7612 Km/Sec
- Maximum Tangential Velocity = 1.7889 Km/Sec
- Minimum Radial Velocity = -0.0159 Km/Sec
- Maximum Radial Velocity = 0.0160 Km/Sec



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### 3.2 VISUALIZATION OF THE MAIN ORBITAL PARAMETERS @ 500 KM

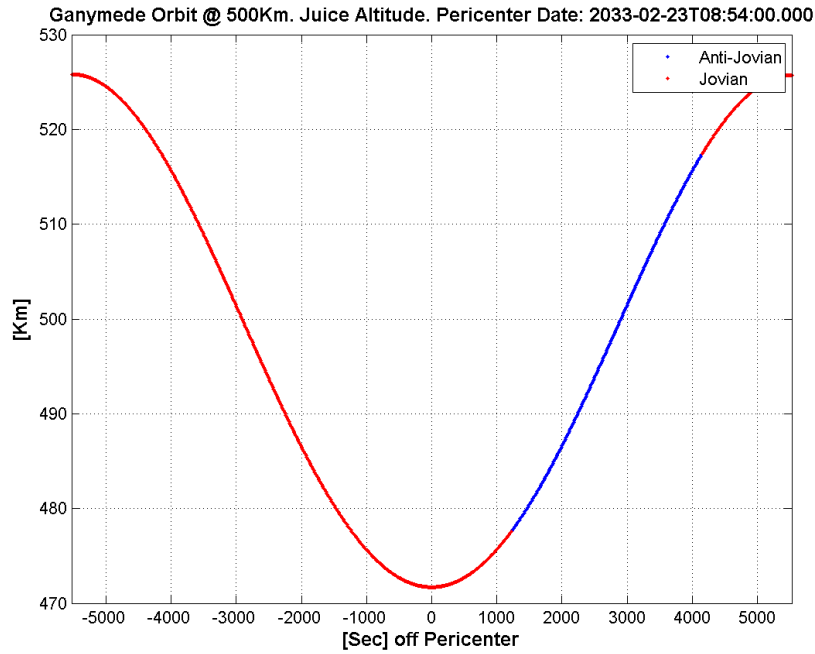


Fig. 3.2.1

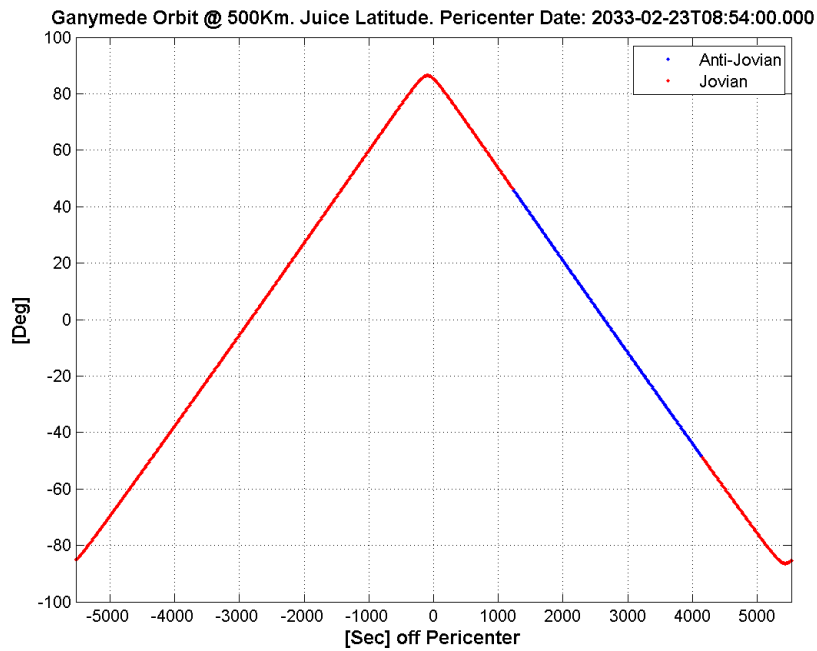


Fig. 3.2.2



### JUICE/RIME

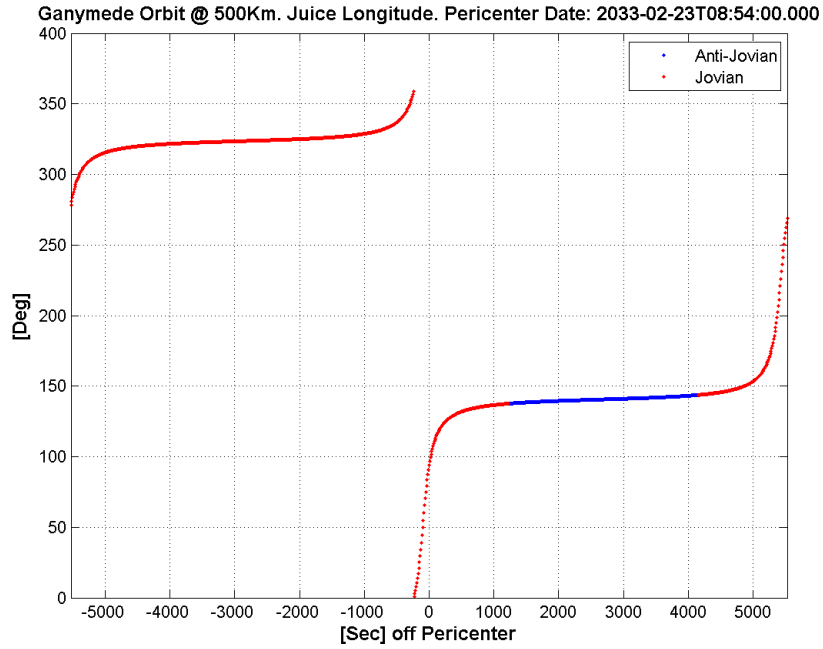


Fig. 3.2.3

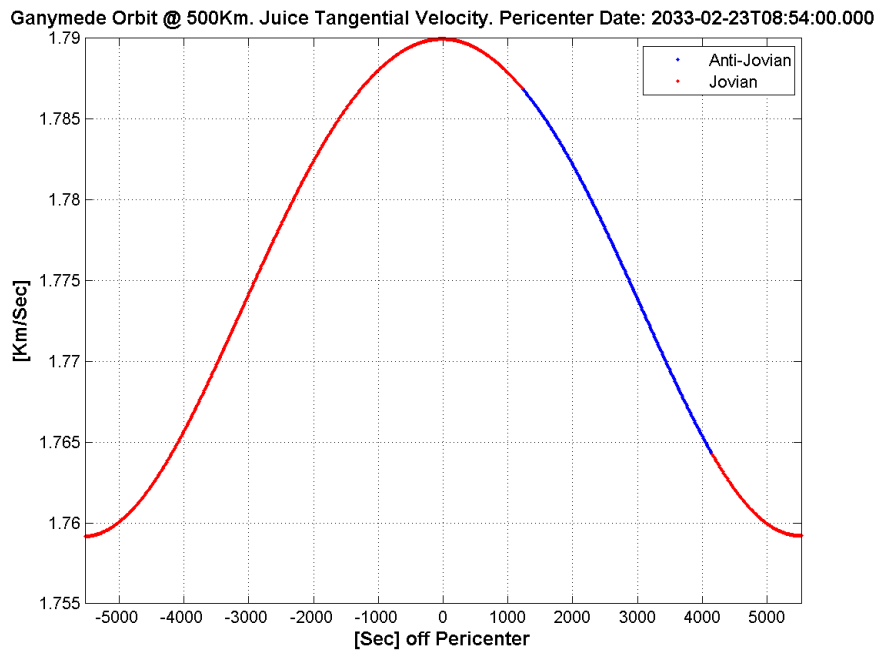


Fig. 3.2.4



### JUICE/RIME

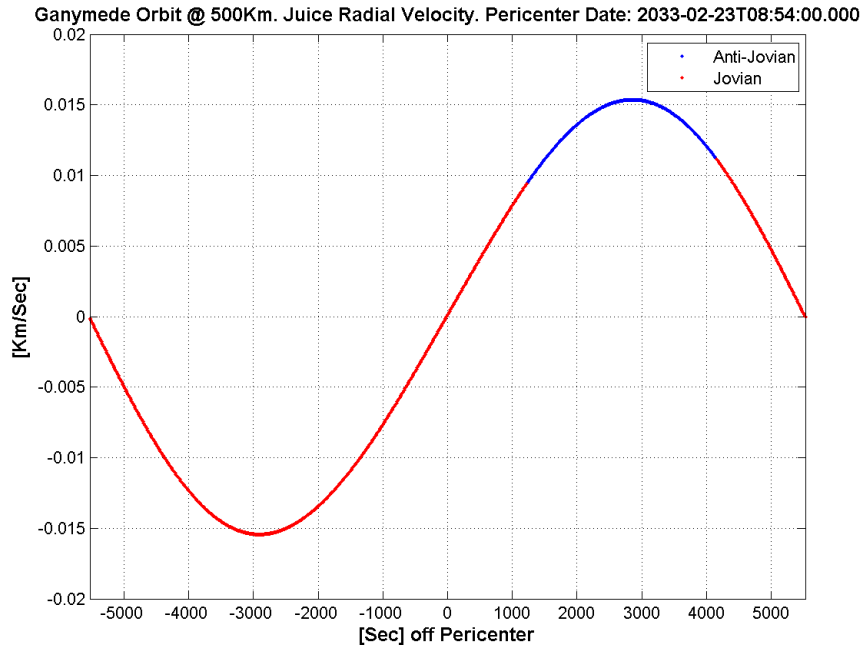


Fig. 3.2.5

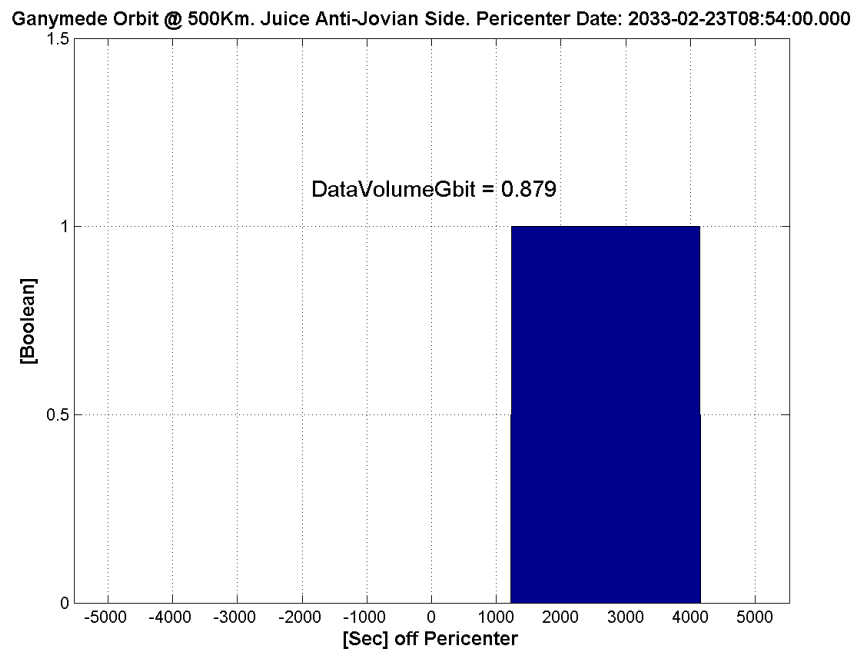


Fig. 3.2.6



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Juice Ground Track On Ganymede. Orbit: 10. Pericenter Date: 2033-02-23T08:54:00.000

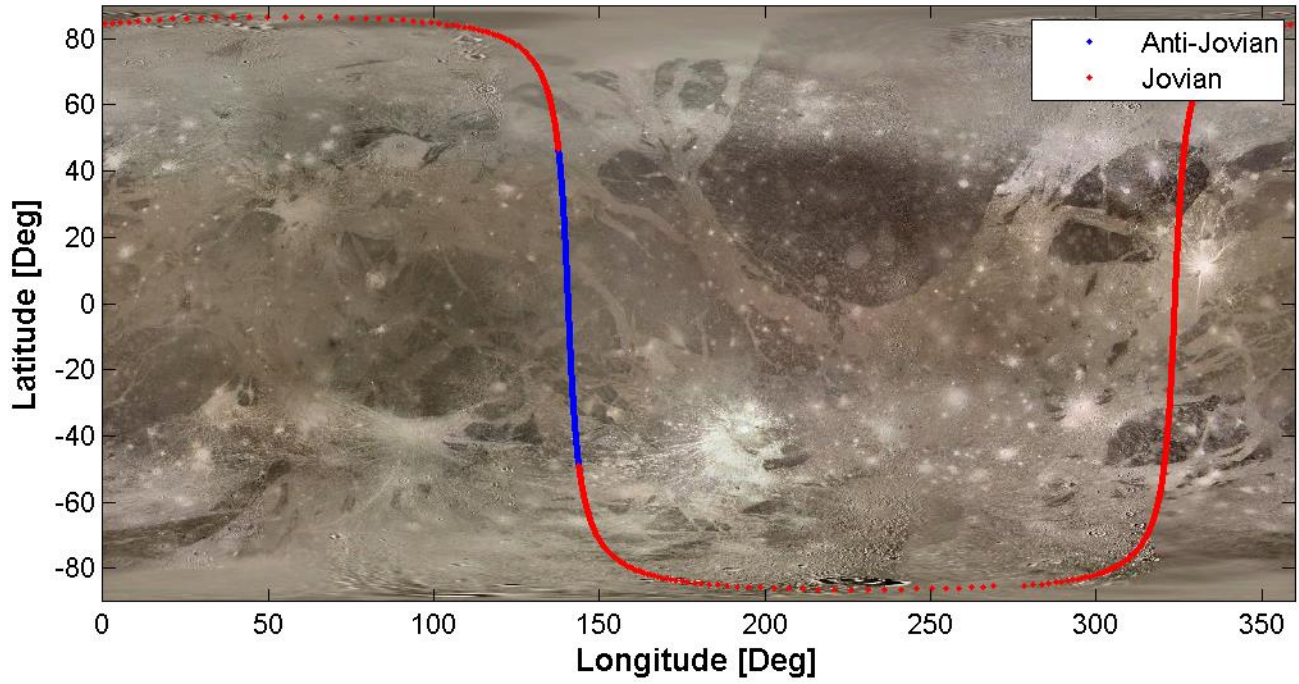


Fig. 3.2.7



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# 4 JUICE ORBITAL PARAMETER ANALYSIS “ORBIT @ 200KM”

## 4.1 SCHEMATICS

- Average Duration Per Orbit = 2.6442 hr
- Number of Orbits = 274 (2033-06-04T12:47:50.000 : 2033-07-04T17:29:50.001)

### JIOVIAN & ANTI-JIOVIAN

- Minimum SC Altitude = 165.1746 Km
- Maximum SC Altitude = 234.0798 Km
- Minimum Tangential Velocity = 1.8437 Km/Sec
- Maximum Tangential Velocity = 1.8893 Km/Sec
- Minimum Radial Velocity = -0.0227 Km/Sec
- Maximum Radial Velocity = 0.0228 Km/Sec

### ANTI-JIOVIAN

- Minimum SC Altitude = 168.5524 Km
- Maximum SC Altitude = 230.5059 Km
- Minimum Tangential Velocity = 1.8462 Km/Sec
- Maximum Tangential Velocity = 1.8868 Km/Sec
- Minimum Radial Velocity = -0.0224 Km/Sec
- Maximum Radial Velocity = 0.0219 Km/Sec



## 4.2 VISUALIZATION OF THE MAIN ORBITAL PARAMETERS @ 200 KM

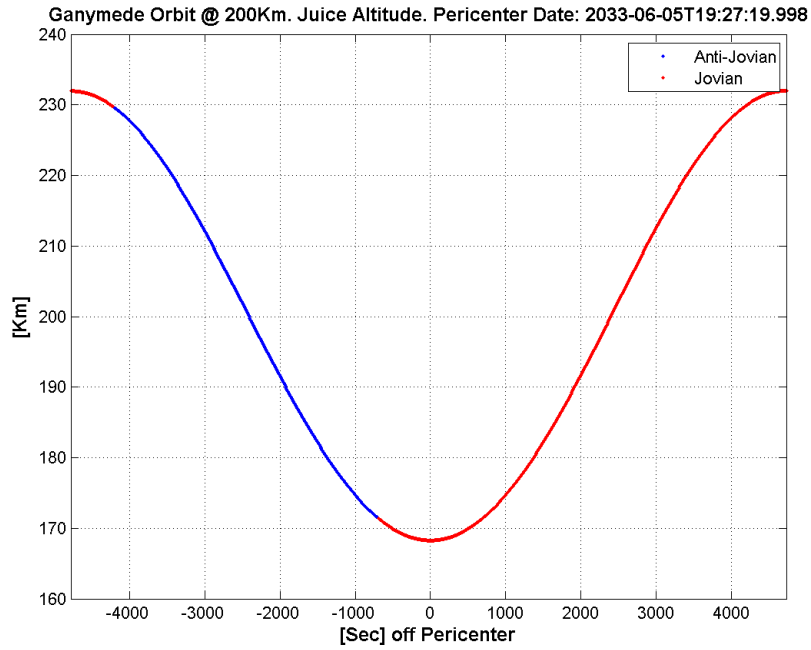


Fig. 4.2.1

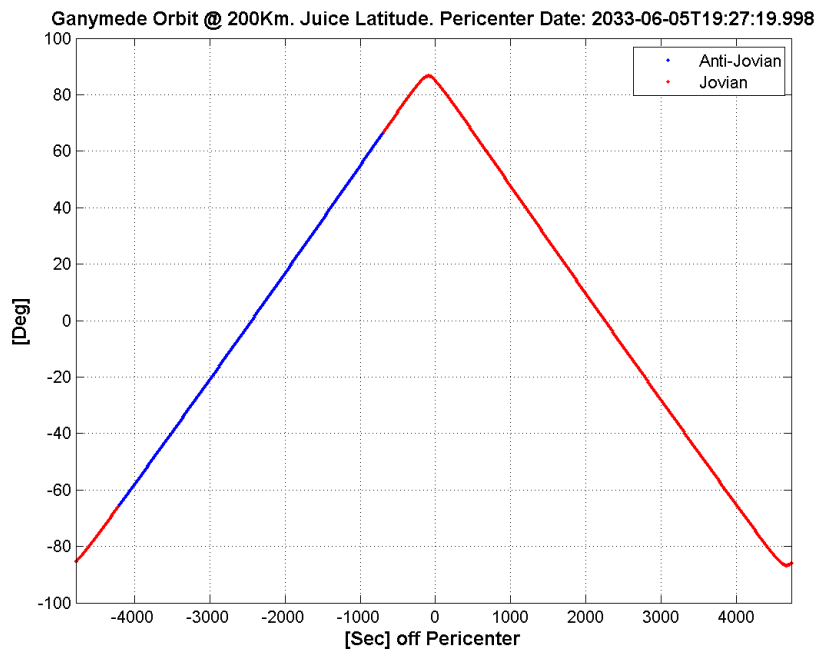


Fig. 4.2.2



### JUICE/RIME

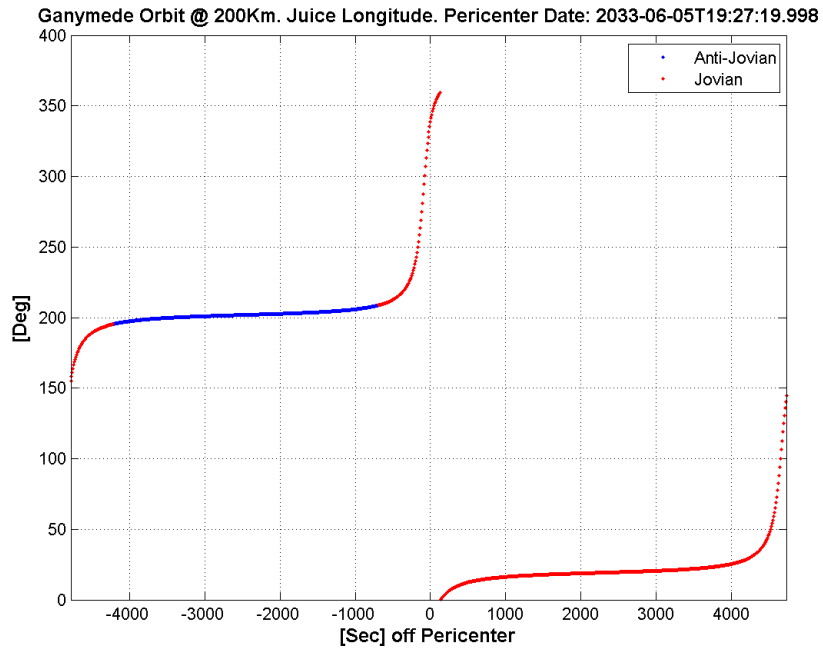


Fig. 4.2.3

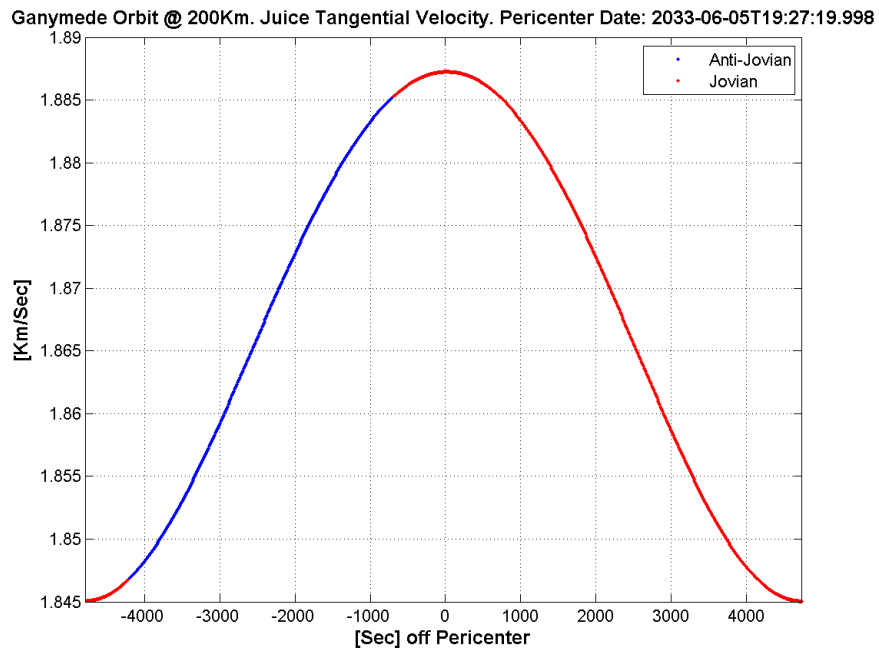


Fig. 4.2.4



### JUICE/RIME

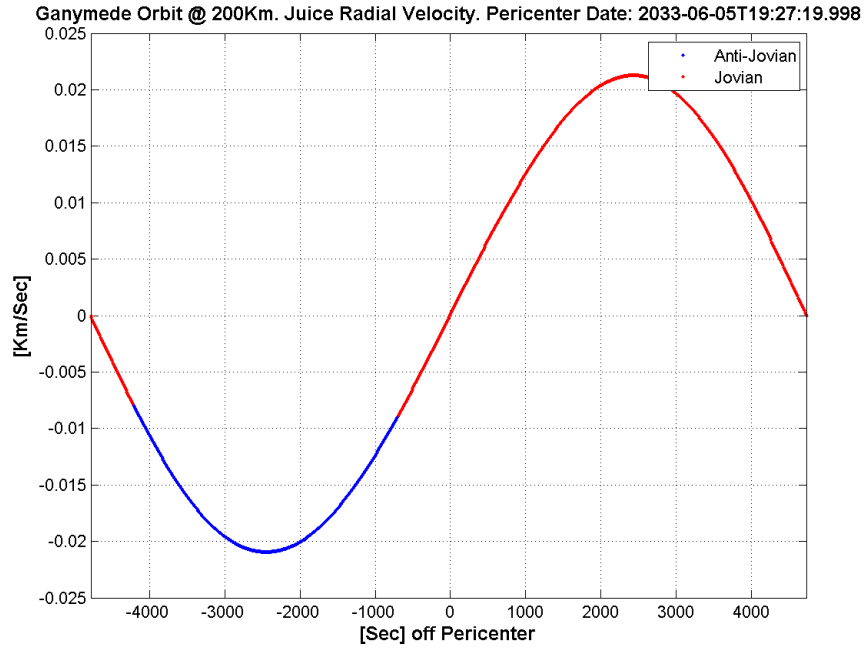


Fig. 4.2.5

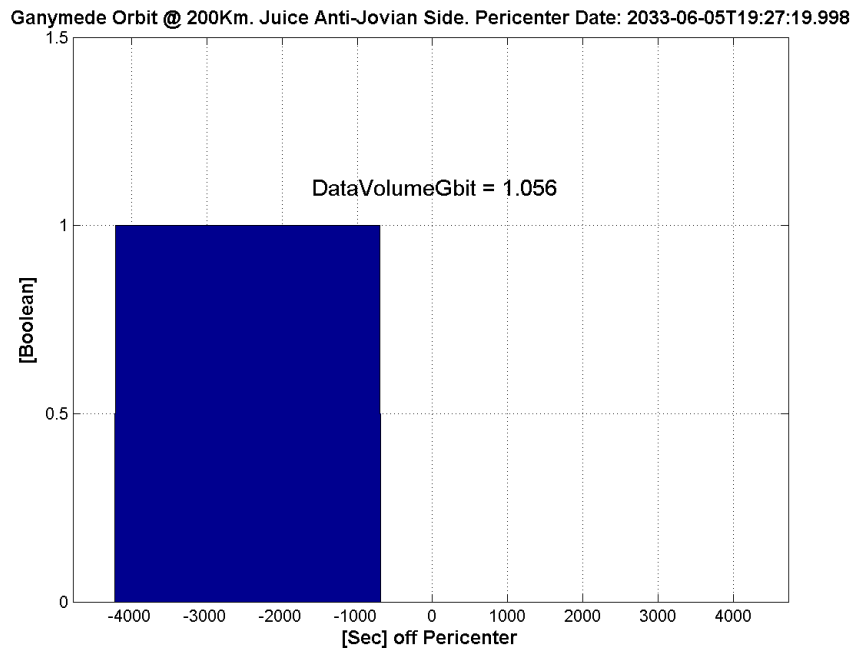


Fig. 4.2.6



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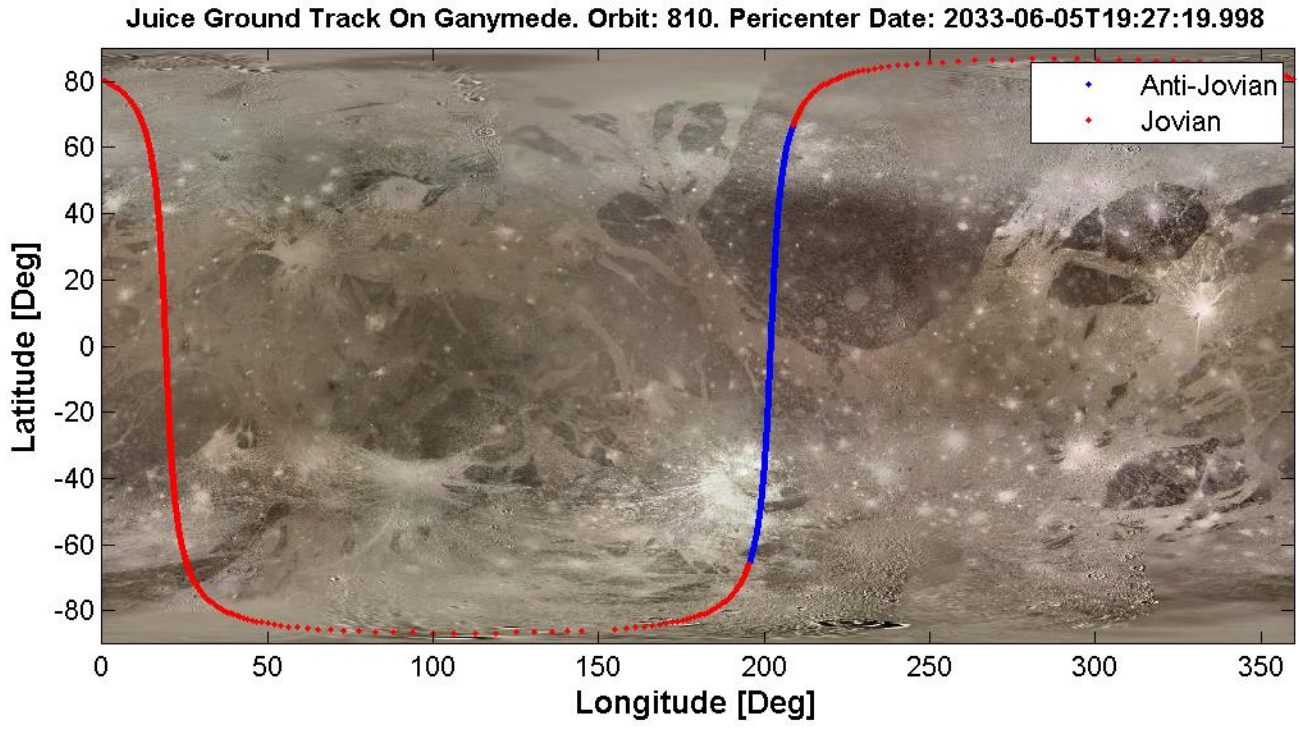


Fig. 4.2.7



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### 5 RIME PREDICTED GLOBAL COVERAGE ON GANYMEDE

Ganymed Predicted Coverage - Anti-Jovian & Altitude  $\leq 500\text{Km}$

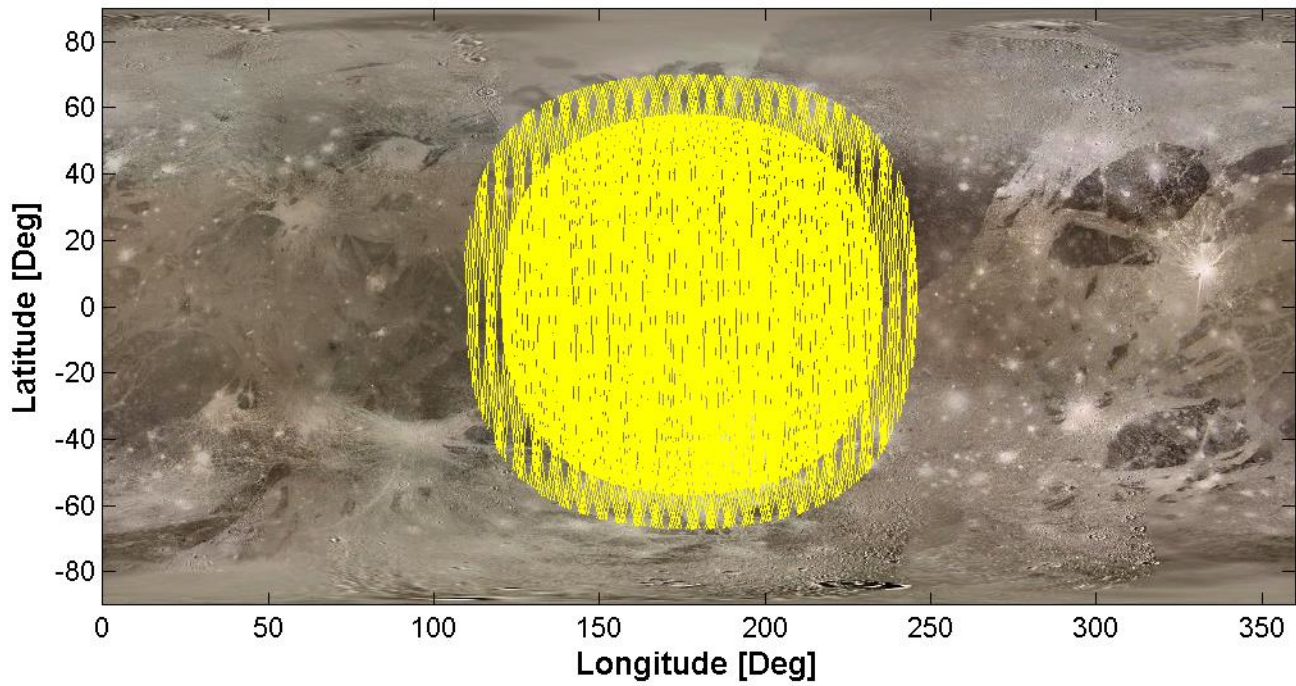


Fig. 5.1

Global Coverage < 25%

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## 6 RIME PREDICTED DATA VOLUME ON GANYMEDE

### OVERALL MISSION DATA VOLUME

1. Assuming 1.4Gbit of downlink able Data Volume per day.
2. Considering 131 days on Ganymede
3. Total Mission Data Volume = **183.4 Gbit**
4. Percentage reserved to IPR ?

### ICE PENETRATING RADAR MAXIMU DATA VOLUME (Fig. 6.1)

5. Total Operation Duration during Anti-Jovian and SC Altitude within 500 Km = 2122500 sec.
6. Assuming a Data Rate = 300 Kbps.
7. Total Data Volume Produced during 2122500 sec of Operations → Data Volume **633.018 Gbit**
8. Pick Daily Data Volume = **9.9 Gbit**.

### CONSIDERATION

It is evident that the data volume produced, just by the radar, considerably exceeds the entire mission data volume. Indeed, from the total Data Volume of 633,018 Gbit it would be necessary to remove the quantity of daily DV in which the radar is not operative, despite being in the anti-Jovian quadrant, in order to allow the ground data downlink.

In order to have an estimation of this lost DV, it would be necessary to know at least the daily duration of the communication phase towards the ground; in practice not all orbits will be available for the science acquisitions, despite being in the anti-Jovian quadrant.

Another parameter that can certainly contribute to the estimation of the data volume is the behaviour of the instrument bit rate, which for this preliminary study was supposed to be constant and equal to 300 Kbps. It is also necessary to understand, if during the downlink phase of the SSMM, it is possible to perform science acquisitions.



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IPR Daily Data Volume On Ganymede. Total DV = 633.018Gbit. Peak DV= 9.9Gbit. Data Rate =300Kbps

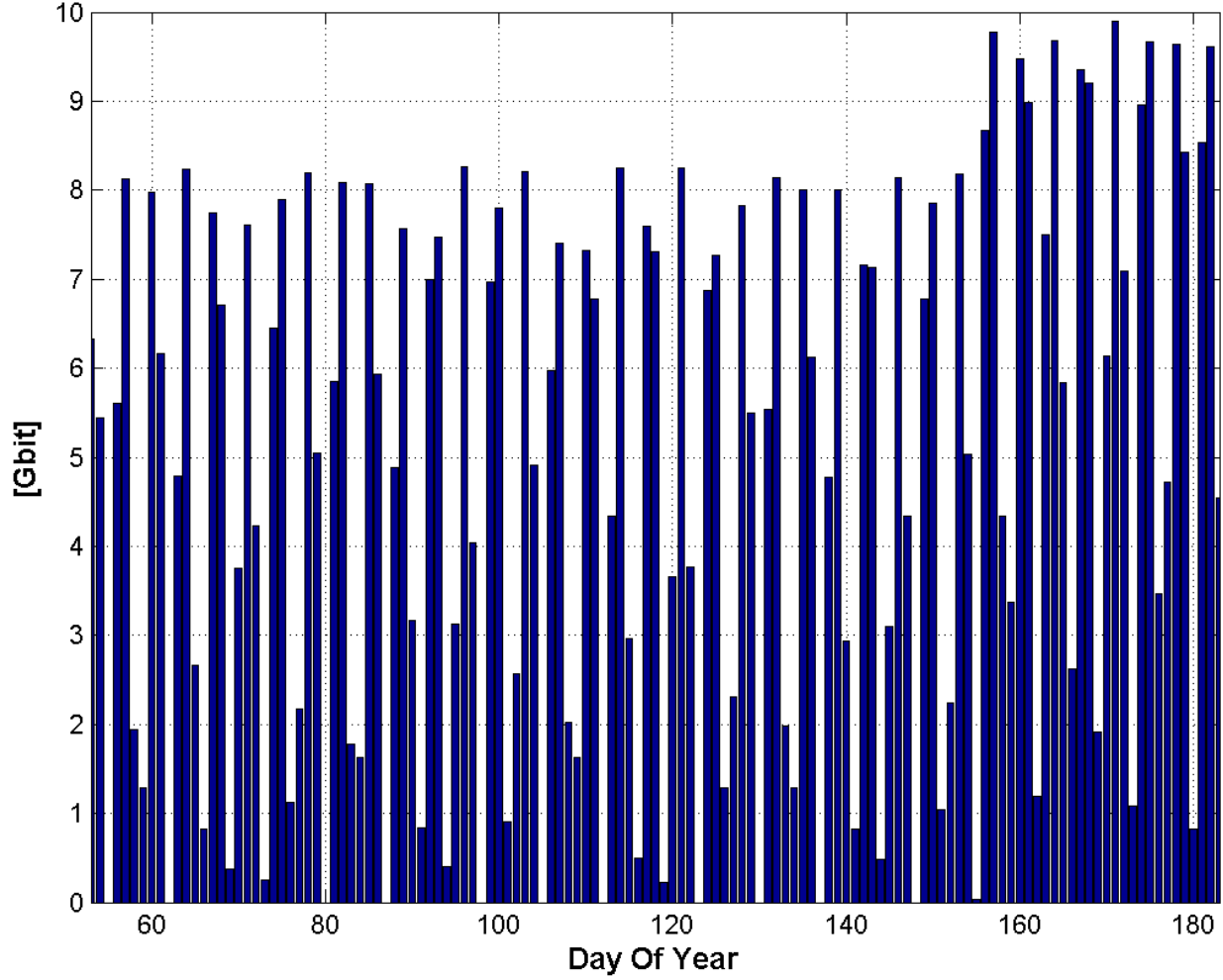


Fig. 6.1