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Saturn Rings Tour Mission Concept

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392 Section -- Mission Design and Navigation

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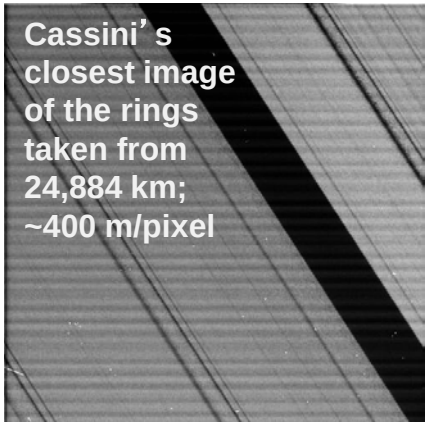
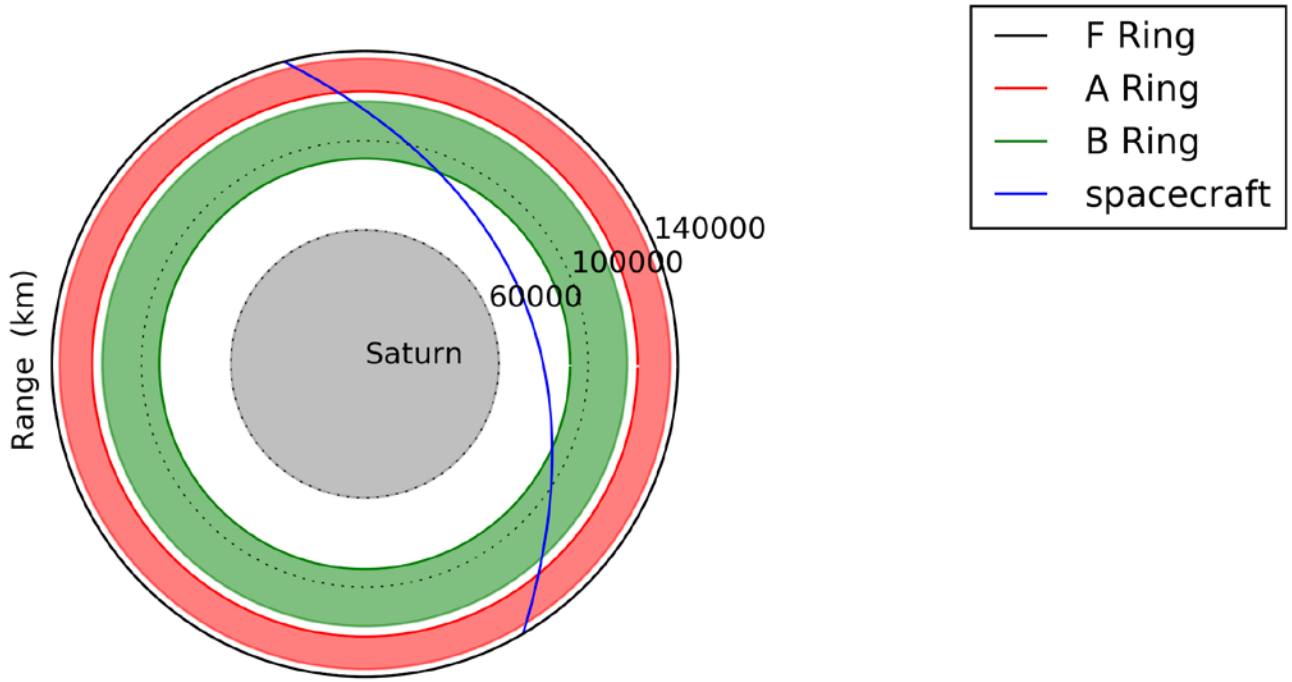
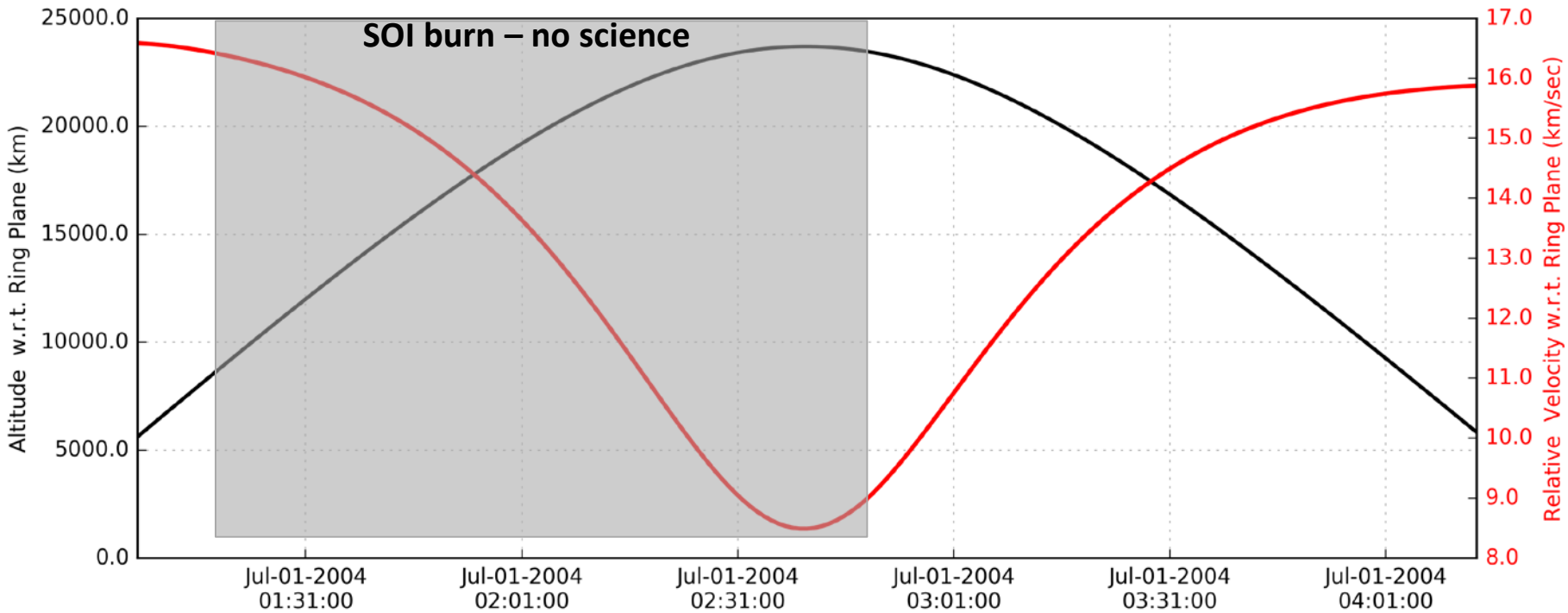
Cassini SOI Trajectory







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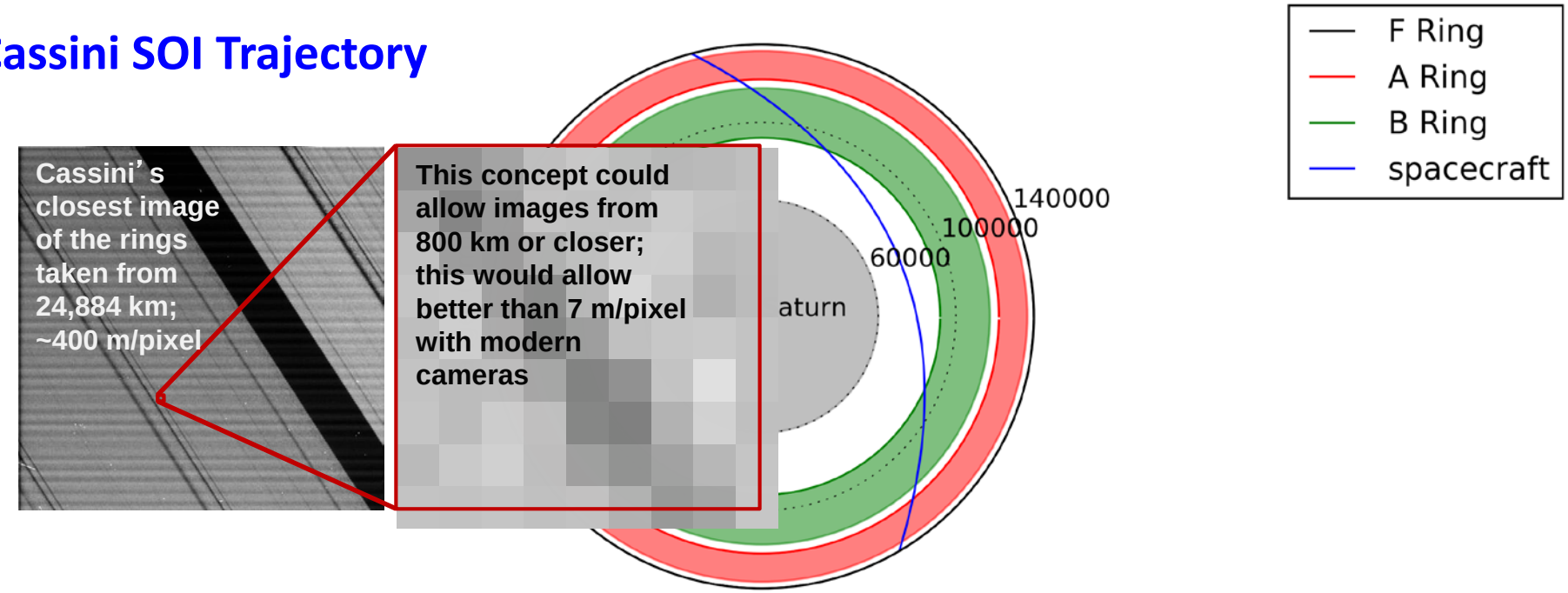
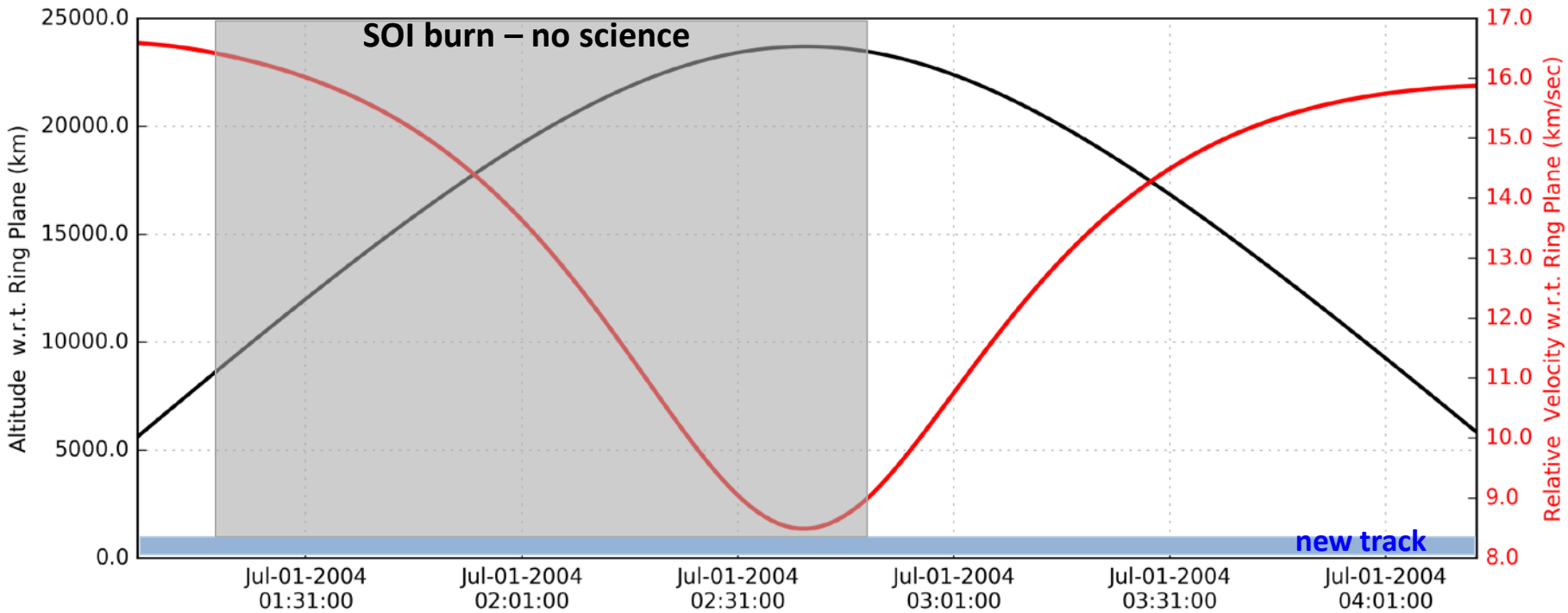
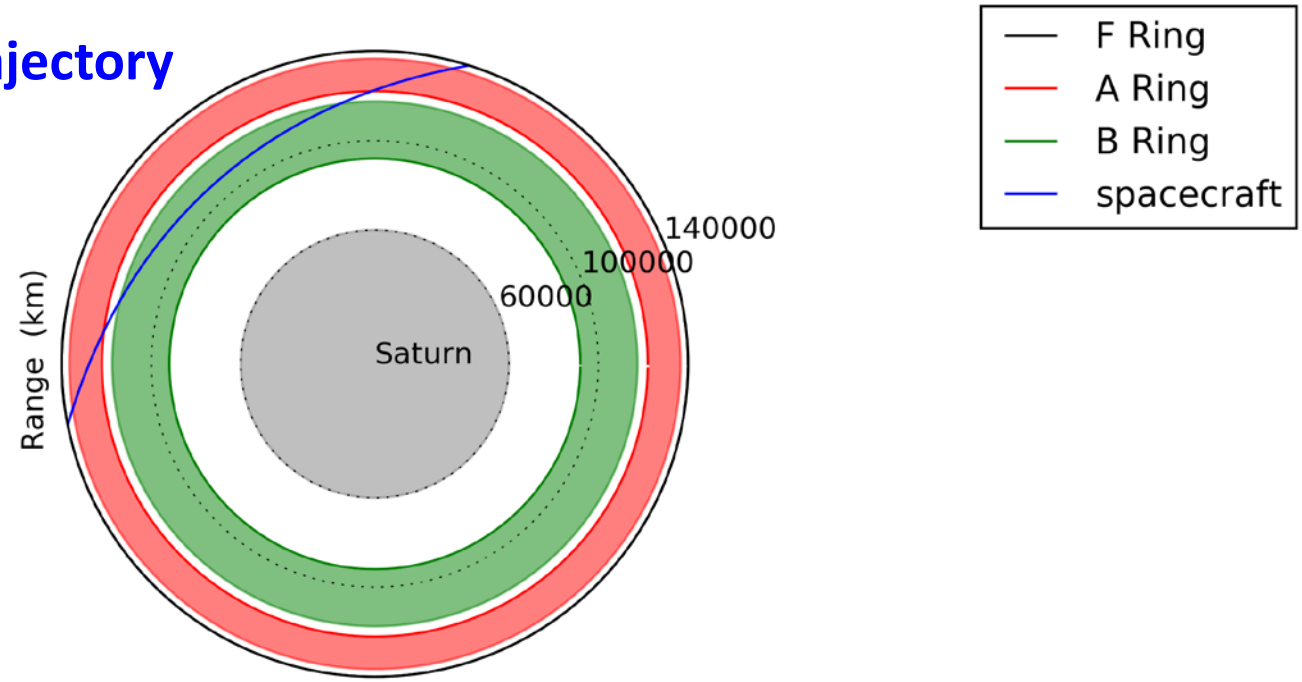
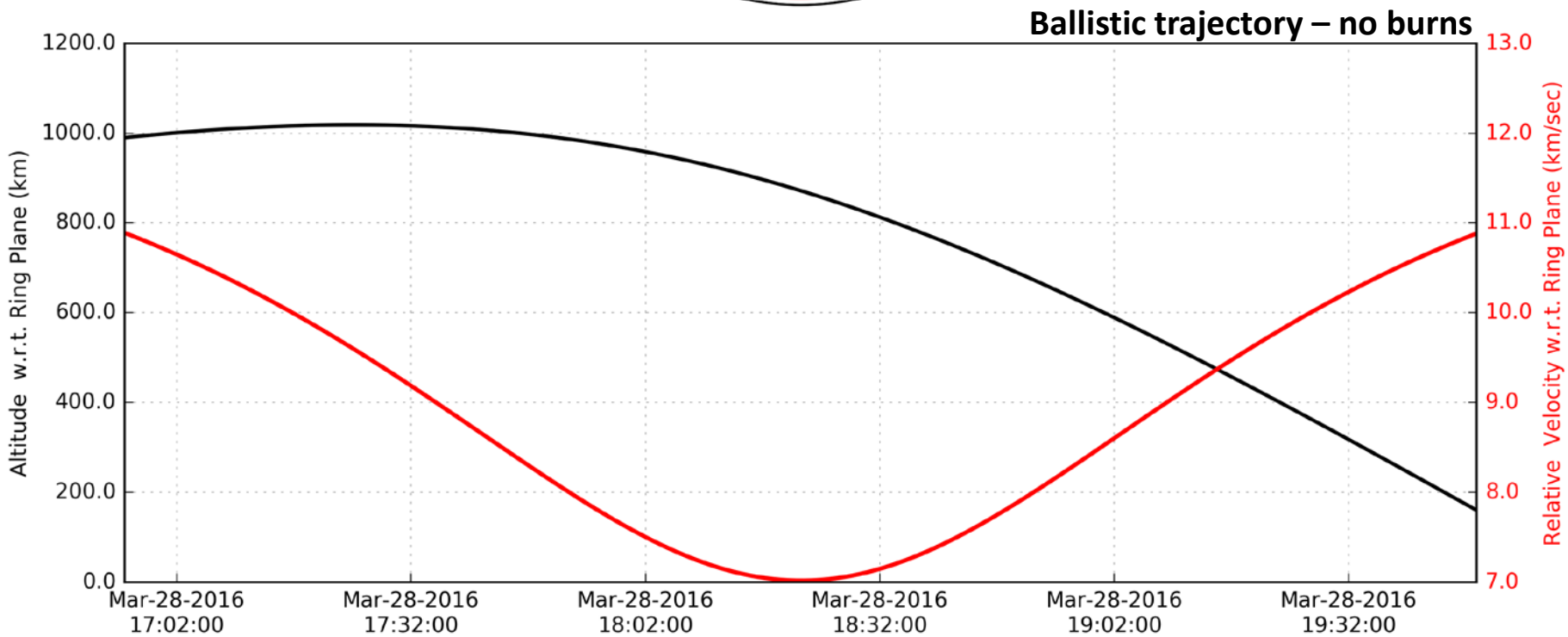




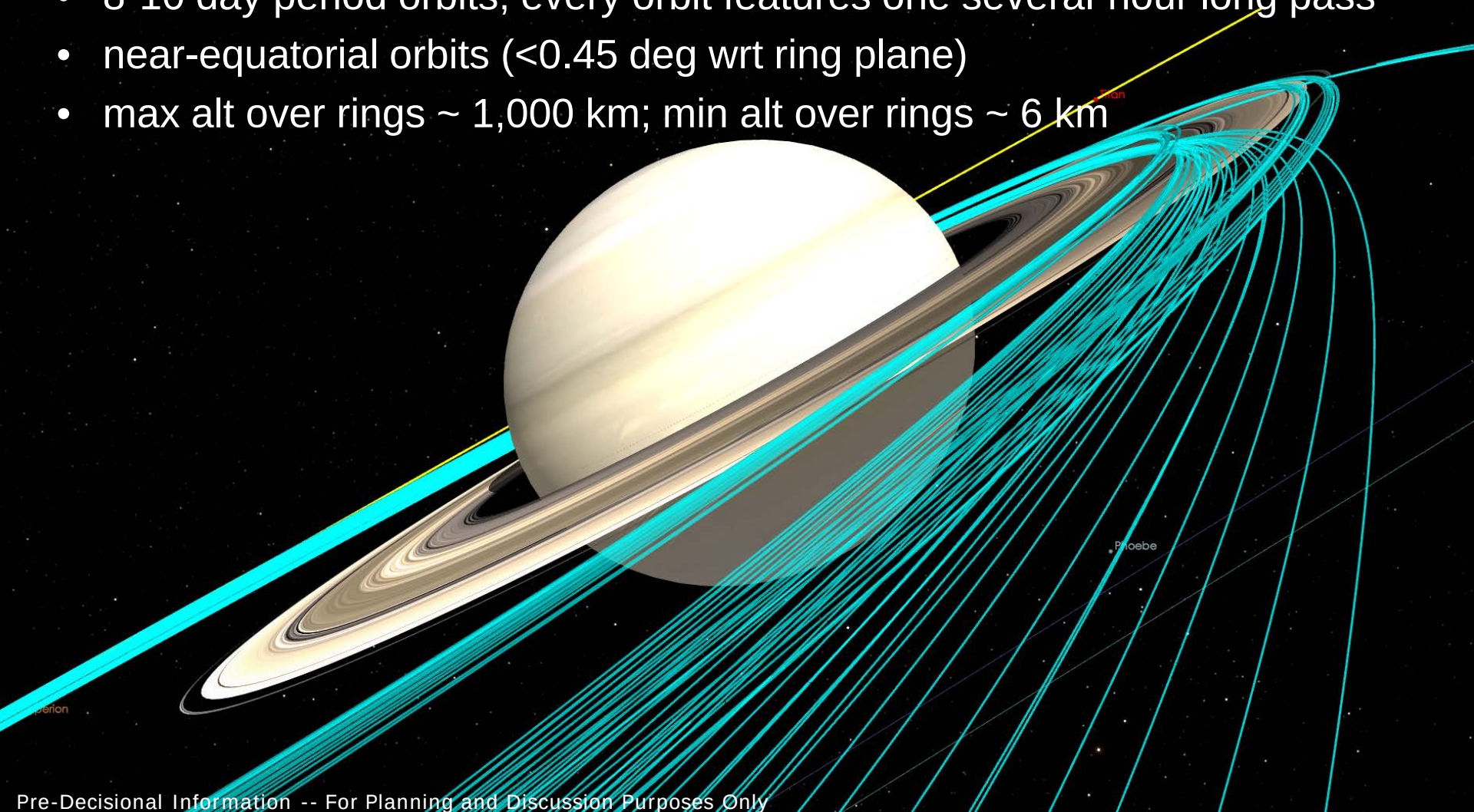
Sample Ring Flyby Trajectory



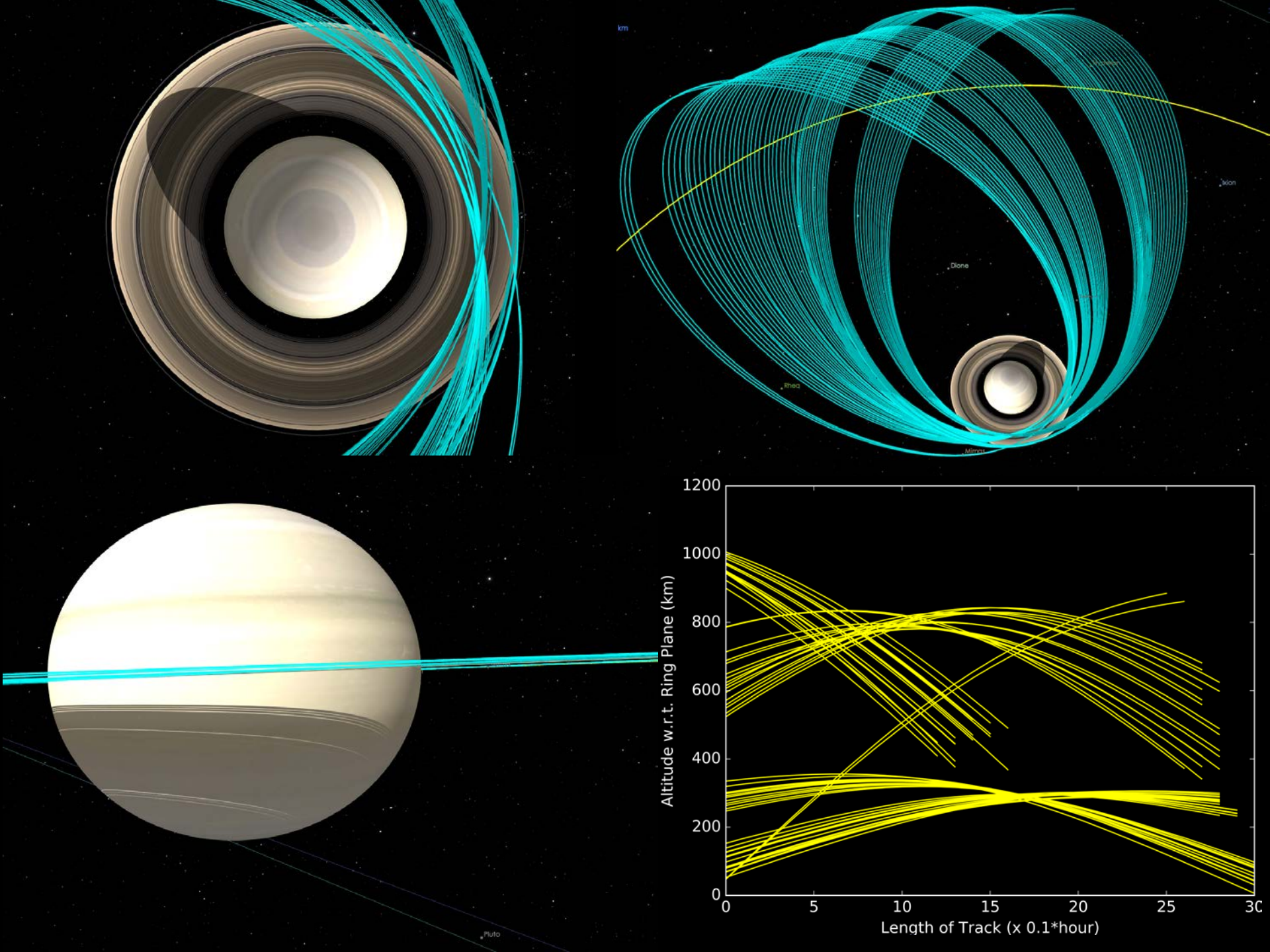


Sample Tour 1: Above the Rings

- 2 year tour
- DV = 0 m/s; 4 Titan, 10 Enceladus, 4 Dione, 5 Rhea flybys
- 64 passes over the rings
- 8-10 day period orbits; every orbit features one several-hour long pass
- near-equatorial orbits (<0.45 deg wrt ring plane)
- max alt over rings ~ 1,000 km; min alt over rings ~ 6 km

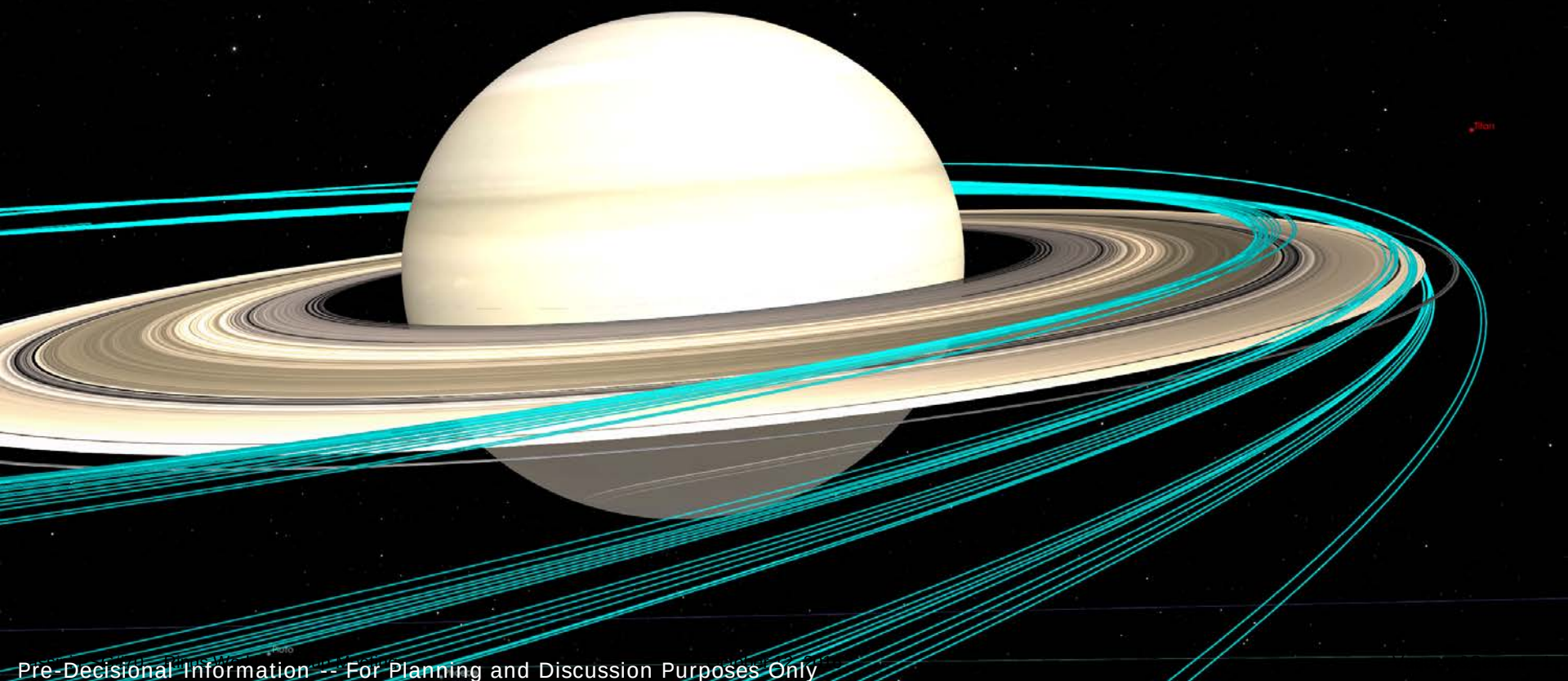


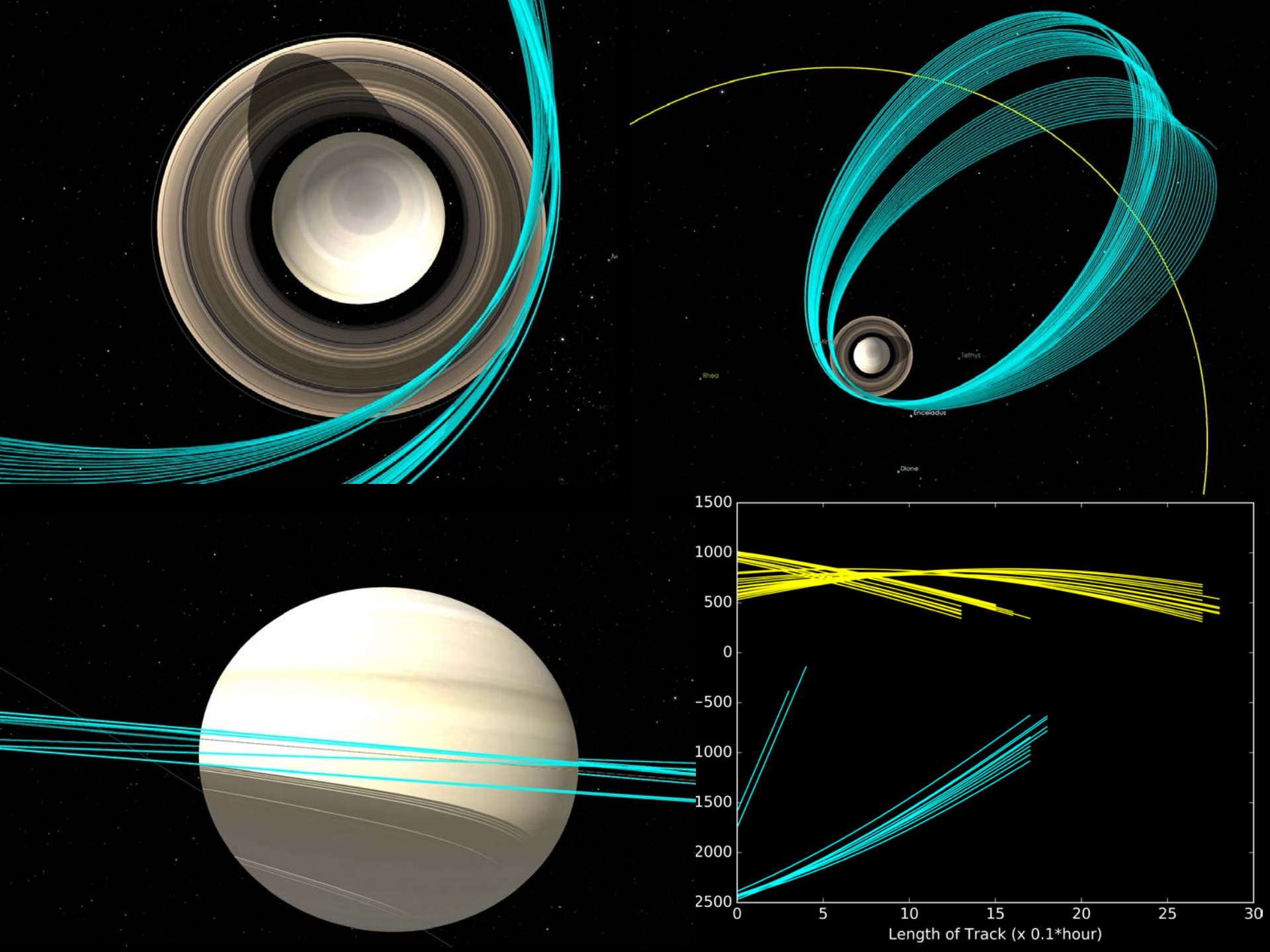
Pre-Decisional Information -- For Planning and Discussion Purposes Only


km
Ixion
Dione
Rhea
Mimas
Pluto
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
Altitude w.r.t. Ring Plane (km)
Length of Track (x 0.1*hour)

Sample Tour 2: Above & Below the Rings

- 1.5 year tour
- One deterministic DV to change the orbital plane
- 42 passes over the rings
- 8-10 day period orbits
- maximum alt over rings ~2,200 km; minimum alt over rings ~1000 km
- Flybys: Titan (4), Enceladus (6), Dione (1), Rhea (3)




Tethys
Rhea
Enceladus
Dione
1500
1000
500
0
−500
1000
1500
2000
2500
0
5
10
15
20
25
30
Length of Track (x 0.1*hour)

Uniqueness of Mission Concept

- Does not require new technology
- Could have been flown by Cassini in March 2016
- Features 3-4 ring passes per month, several hours long
- Potentially all regions of the rings are explored
- Low delta-V requirements
- Simplified architecture and operations schedule

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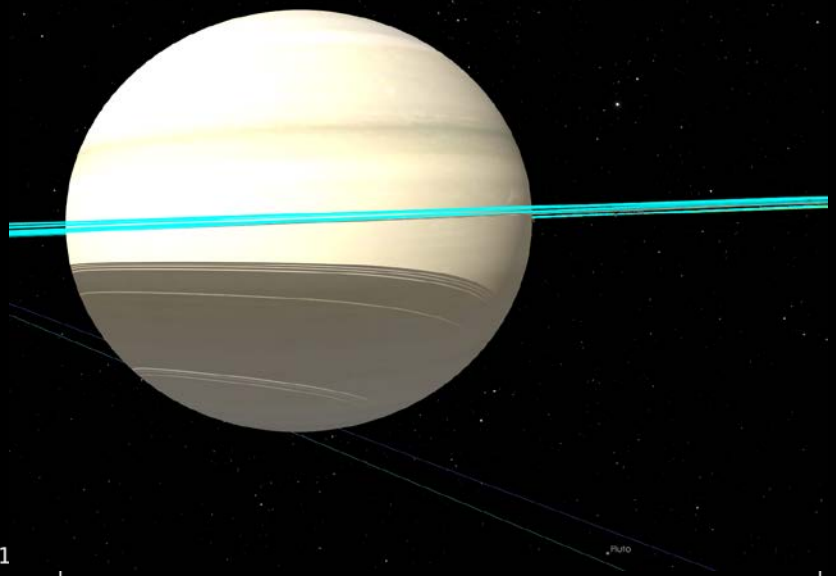
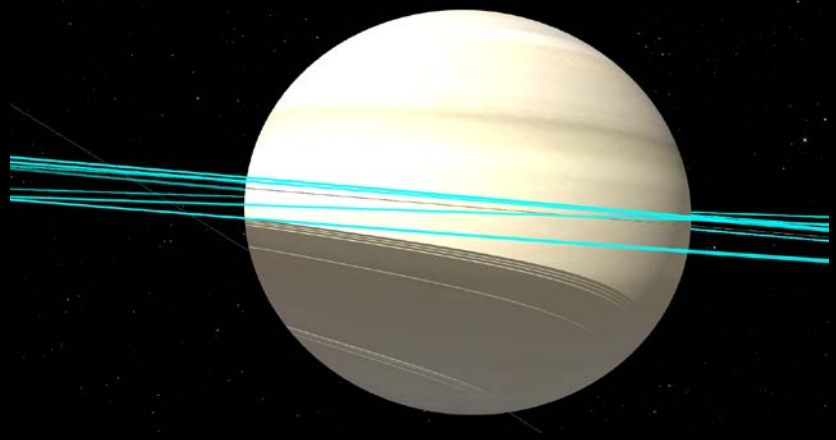
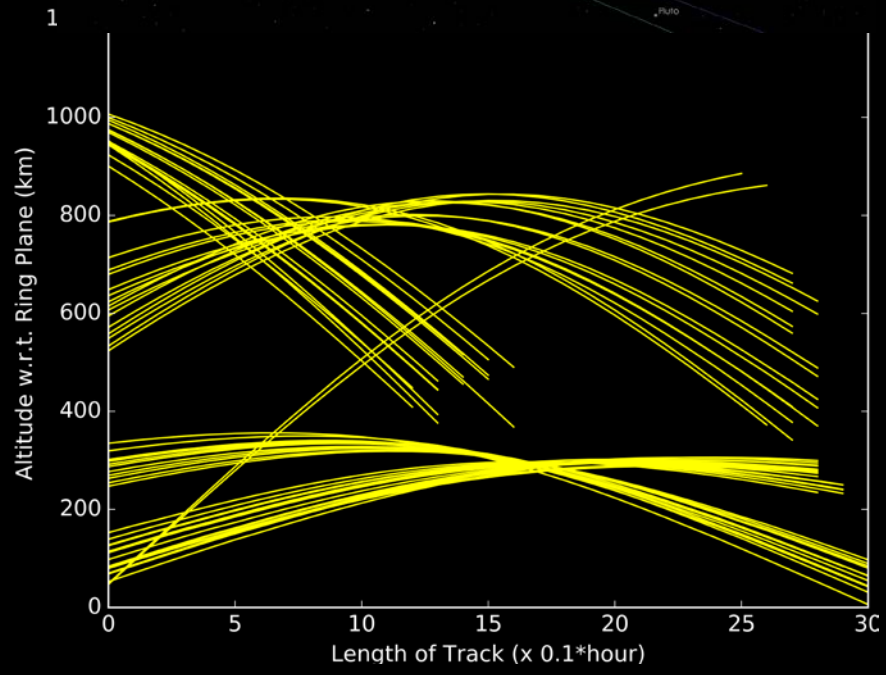
Next Steps

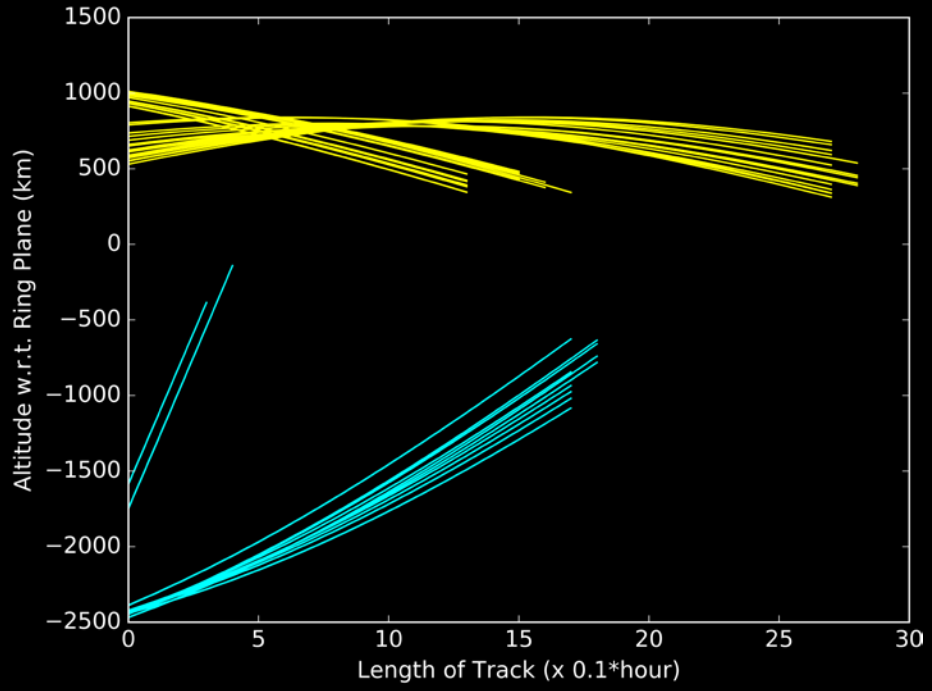
- Gather feedback from ring science community to design science-driven tours
  - What regions are of most interest?
  - Repeatability of ring passes
  - Lighting conditions: are there any particular desired arrival dates?
  - Minimum length of time over the rings?
  - Maximum relative velocity?
- Design of current sample tours based on astrodynamics goals
- Motivate potential new mission studies (New Frontiers or Discovery class)

Backup






1
1000
800
600
400
200
0
Altitude w.r.t. Ring Plane (km)
0
5
10
15
20
25
30
Length of Track (x 0.1*hour)


1500
1000
500
0
−500
−1000
−1500
−2000
−2500
Altitude w.r.t. Ring Plane (km)
0
5
10
15
20
25
30
Length of Track (x 0.1*hour)