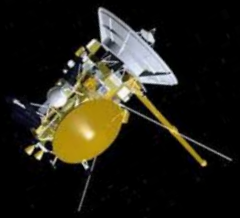
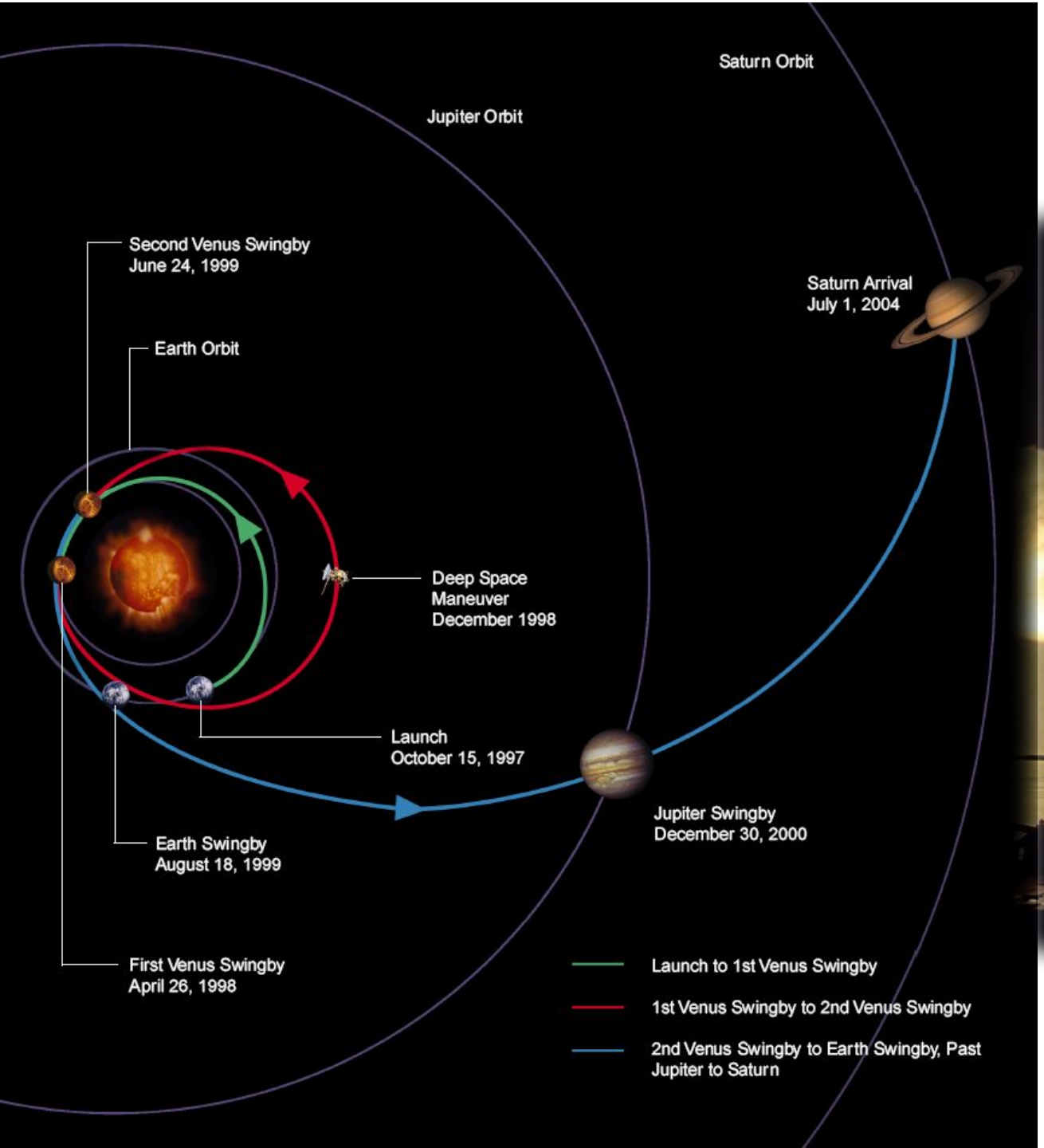
PROFONDITÀ DI UN MARE EXTRATERRESTRE



Marco Mastrogiuseppe

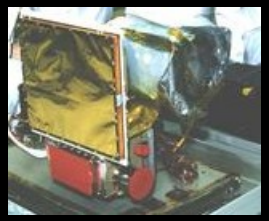
MISSIONE CASSINI – HUYGENS: GRAN FINALE

15 Febbraio 2018
Università La Sapienza
Roma


Saturn Orbit
Jupiter Orbit
Second Venus Swingby
June 24, 1999
Saturn Arrival
July 1, 2004
Earth Orbit
Deep Space
Maneuver
December 1998
Launch
October 15, 1997
Jupiter Swingby
December 30, 2000
Earth Swingby
August 18, 1999
First Venus Swingby
April 26, 1998
Launch to 1st Venus Swingby
1st Venus Swingby to 2nd Venus Swingby
2nd Venus Swingby to Earth Swingby, Past
Jupiter to Saturn

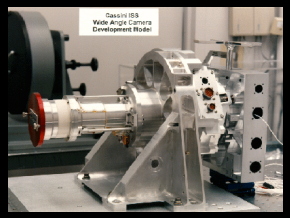
Radar & Radio Science

VIMS



ISS

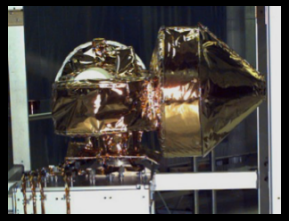
Non è possibile visualizzare



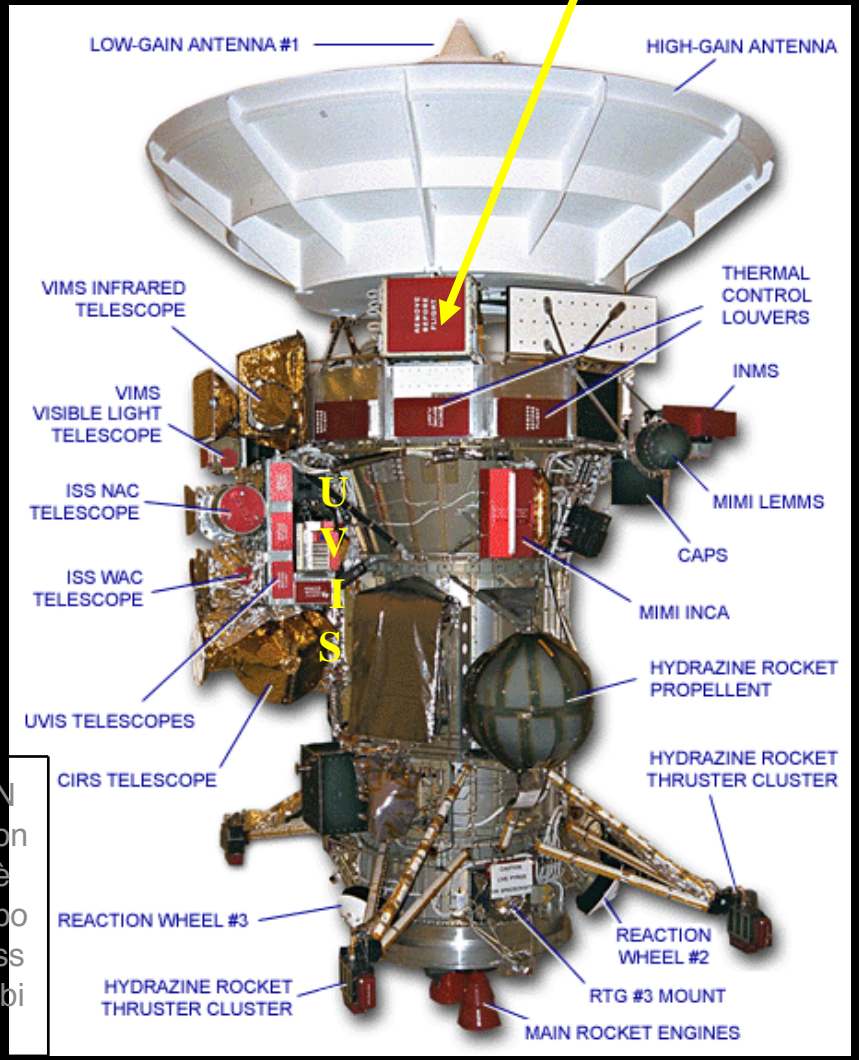
UVIS

Non è possibile visualizzare questa

CIRS



Non è possibile

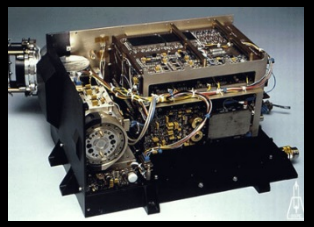


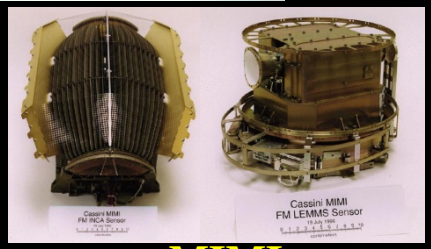
MAG

Non è possibile visualizzare questa

Non è possibile visualizzare

INMS



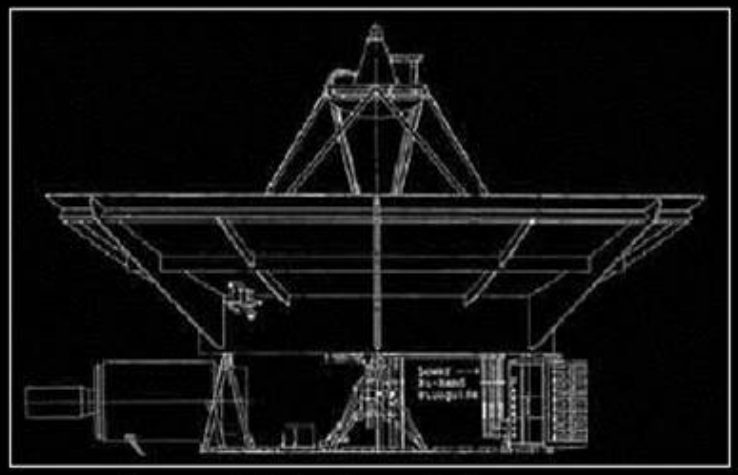


MIMI INCA & LEMMS

CDA

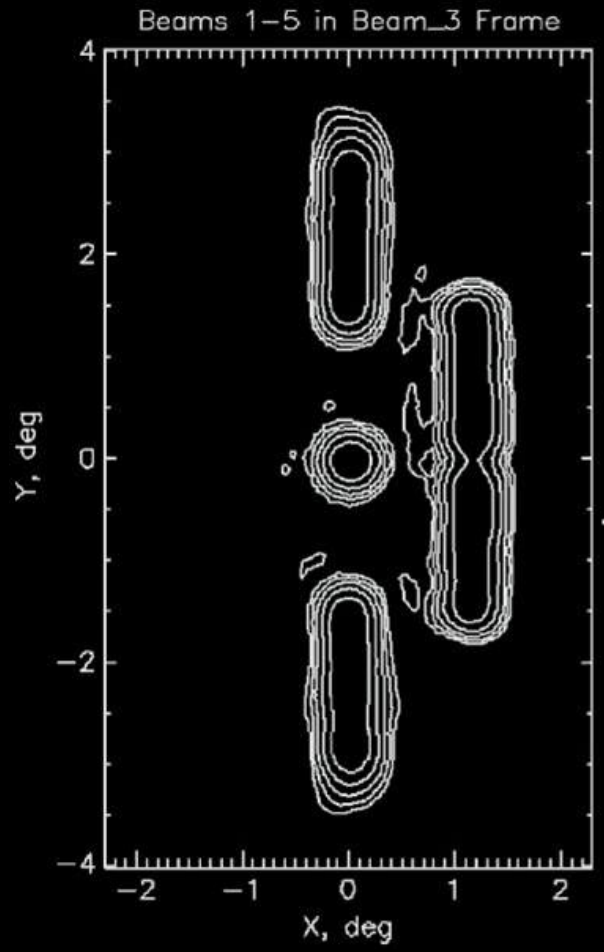
CAPS

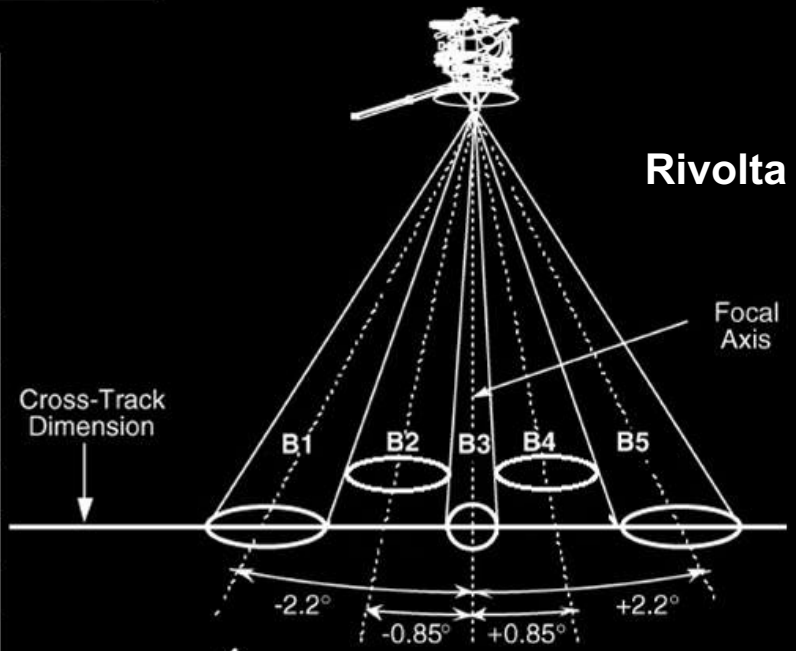
RPWS



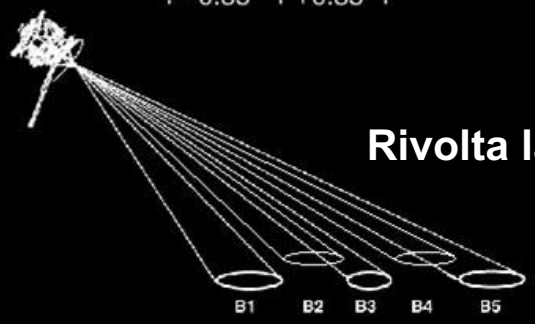
High Gain Antenna

ASI ha selezionato Alenia Aerospazio a Roma come 'contractor' sia per l'high gain antenna (HGA) che per il RADAR Radio Frequency Electronics Subsystem (RFES).





Rivolta al nadir - Altimetrie



Rivolta lateralmente – Immagini

Cassini: A Multimode RADAR

- **Hi-Res SAR**

  Altitude 1000-1500 km, Resolution 380 (azim.) x 600 (range) m

- **Low-Res SAR**

  Altitude 1500-4000 km, Resolution 600 x 2500 m

- **Hi-Res Altimetry**

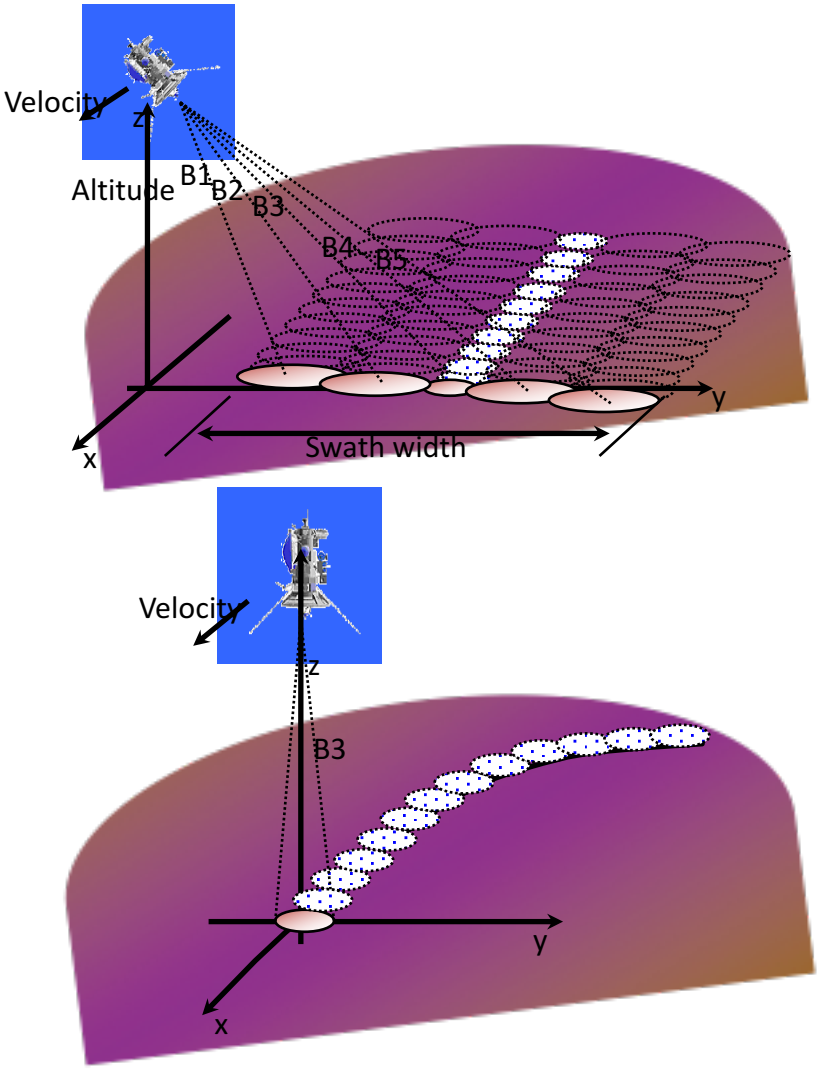
  Altitude 4000-9000 km, Footprint few tens of km, Vertical resolution 35 m

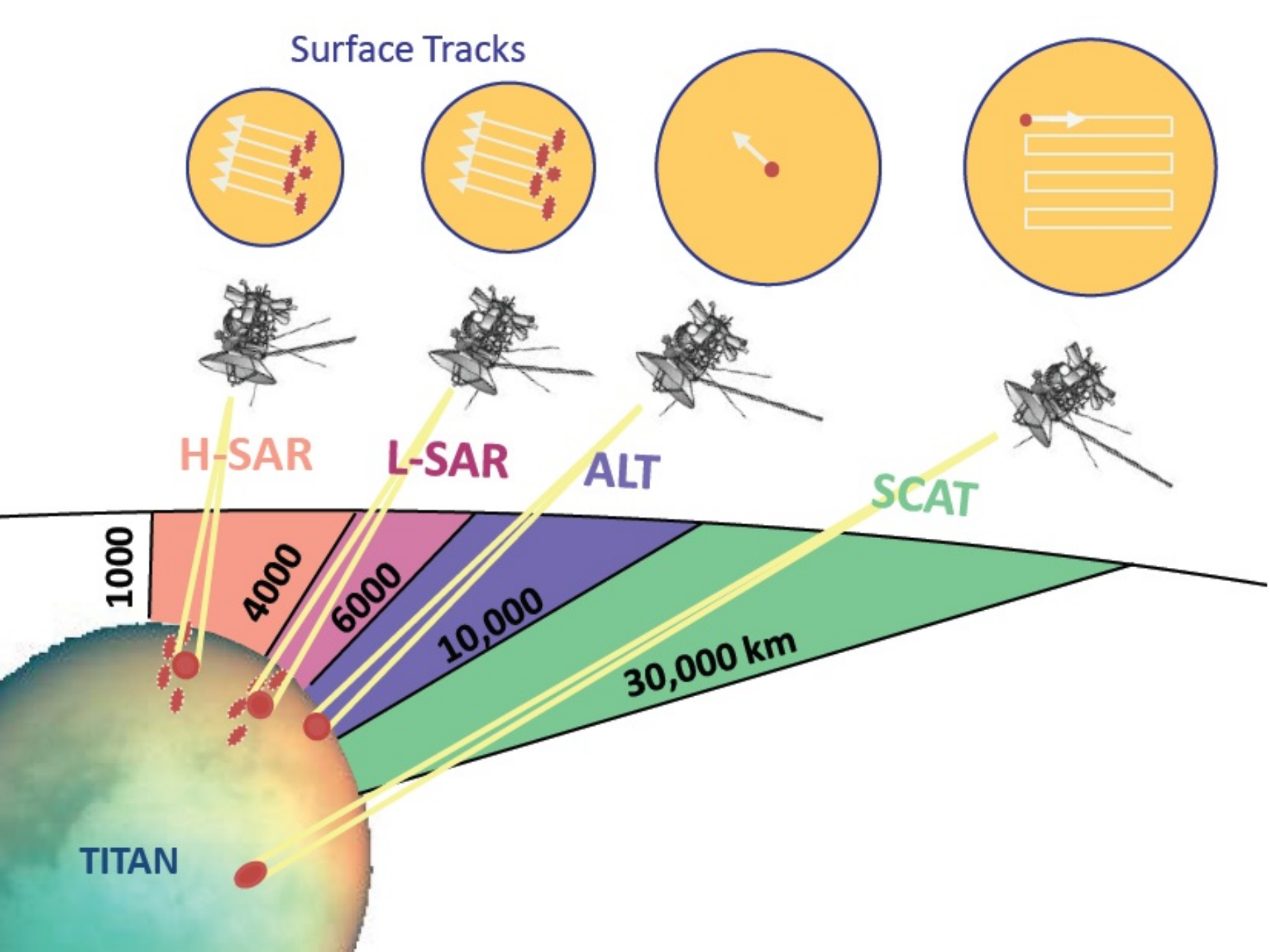
- **Low-Res Altimetry (Scatterometry)**

  Altitude 9000-22500 km, Footprint hundreds of km, Vertical resolution 1415 m

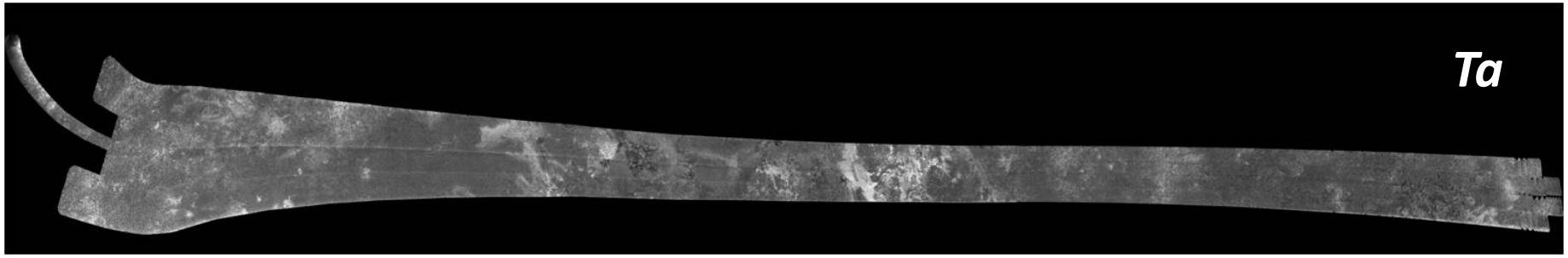
- **Radiometer**

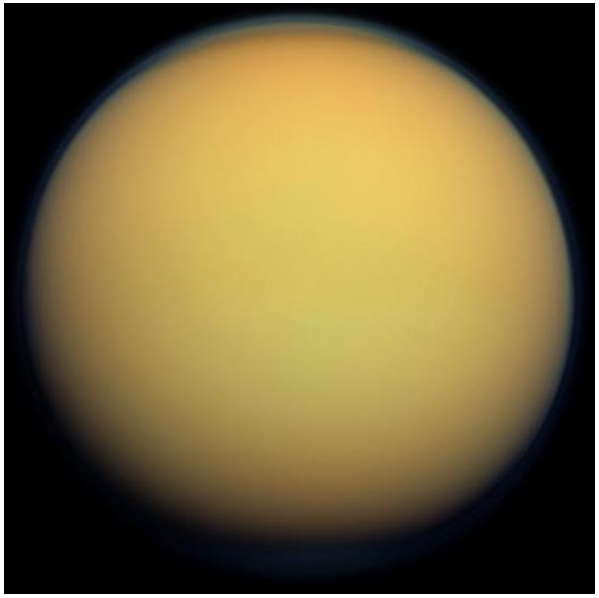
  Altitude 1000-100000 km, 1-sec 1-σ noise = 0.025 K, Half power beamwidth 0.35 deg

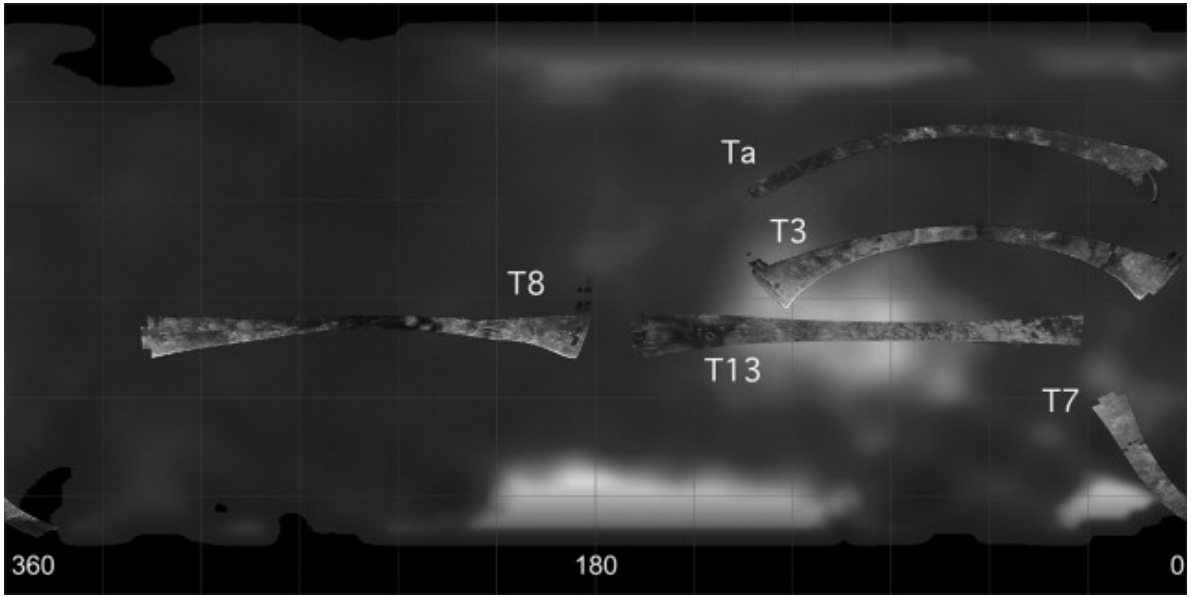


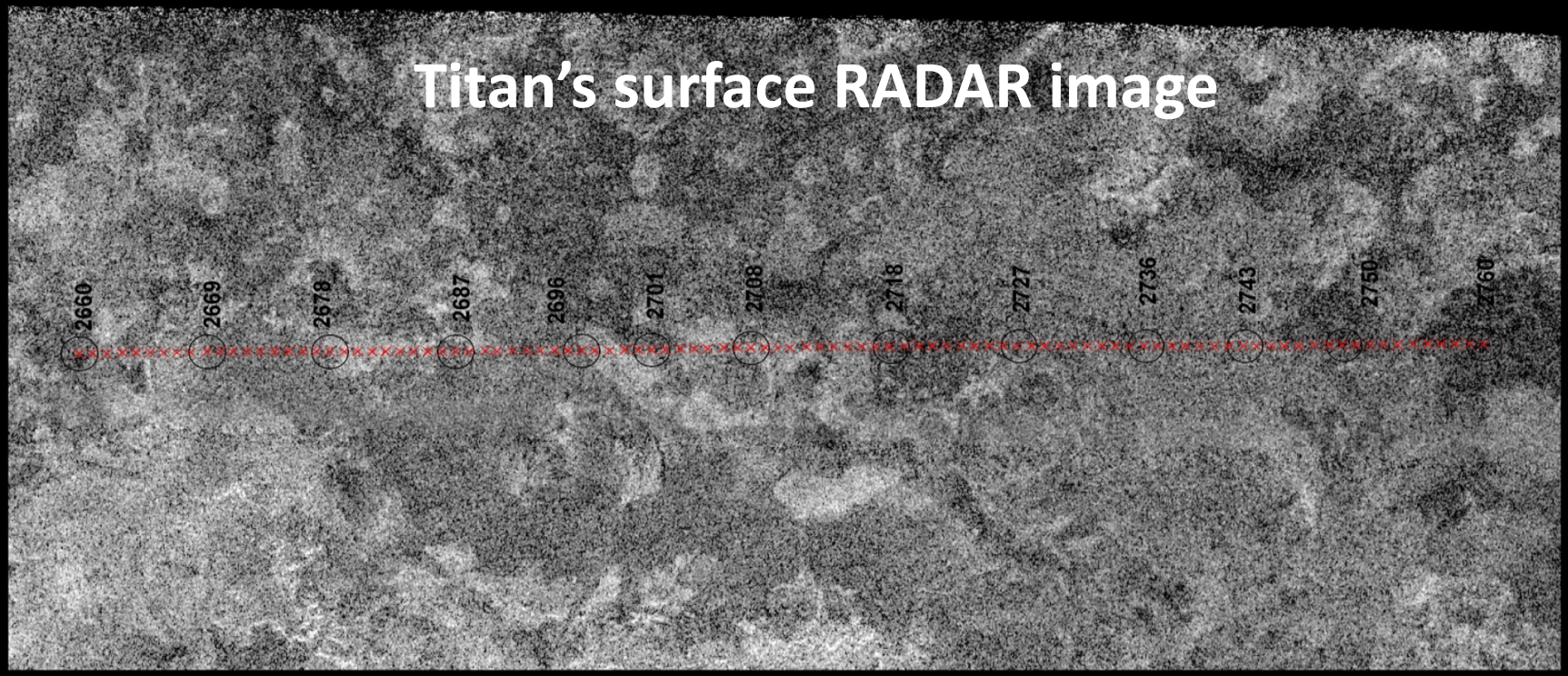

Surface Tracks
H-SAR
L-SAR
ALT
SCAT
1000
4000
6000
10,000
30,000 km
TITAN

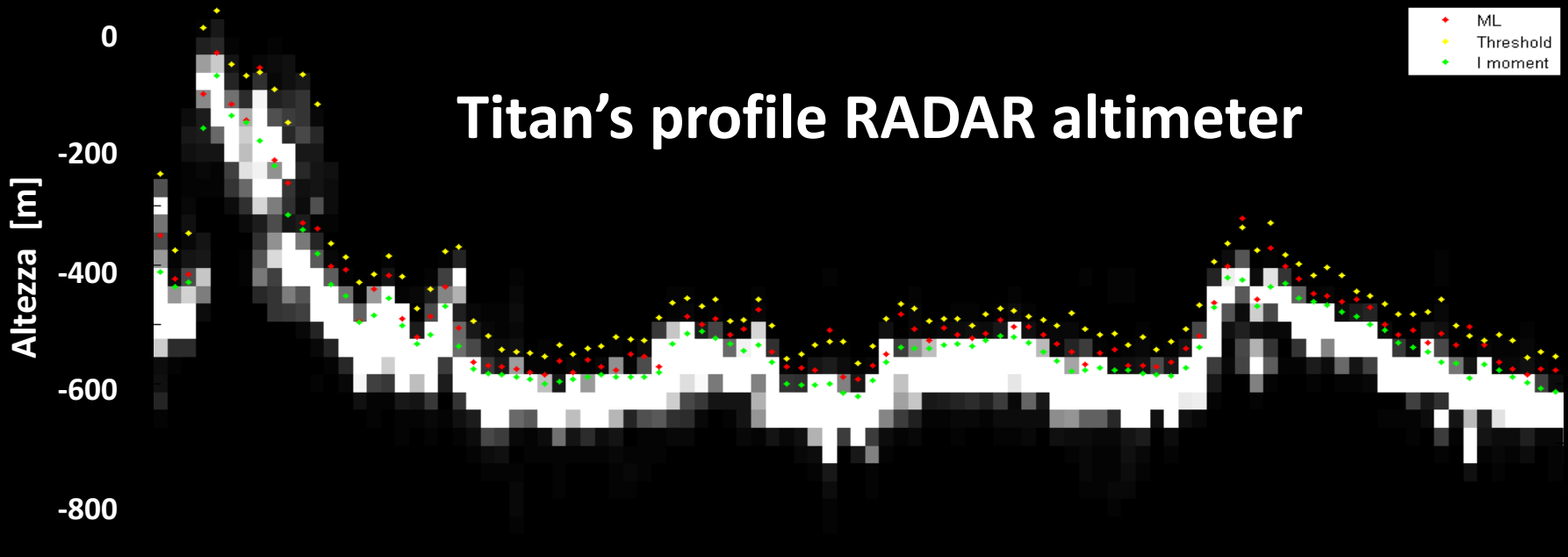
Ta: First RADAR image of Titan

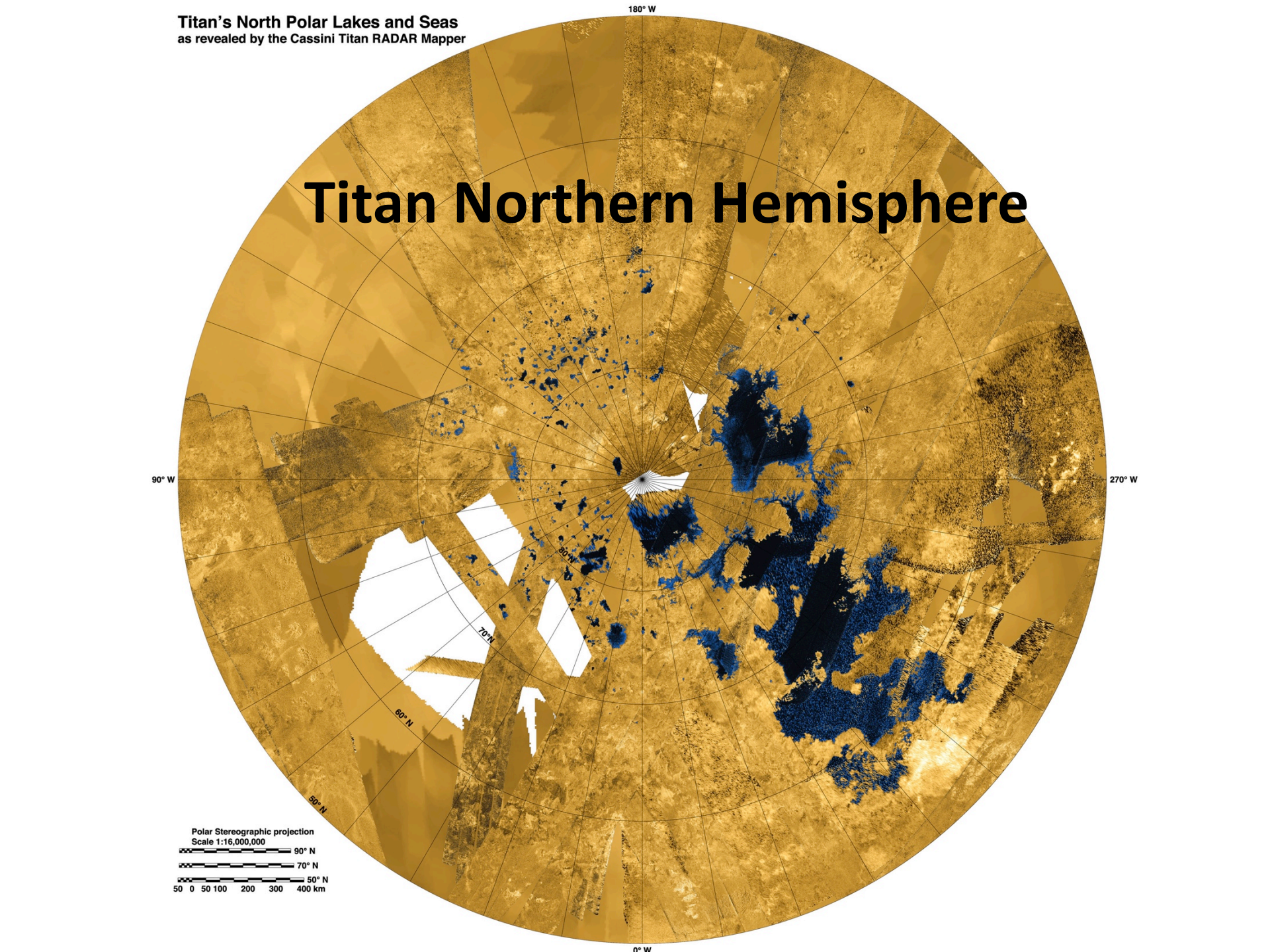


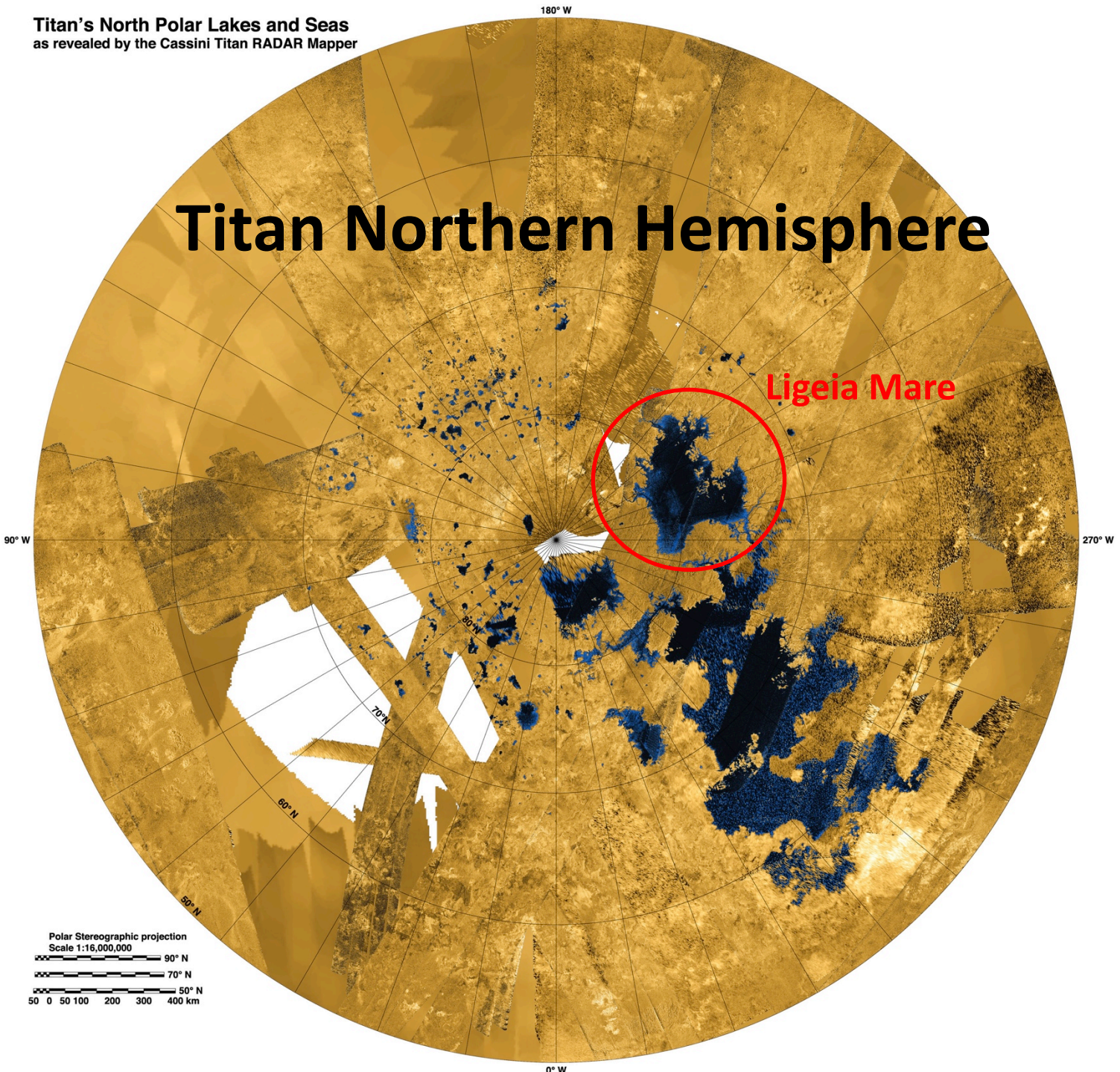


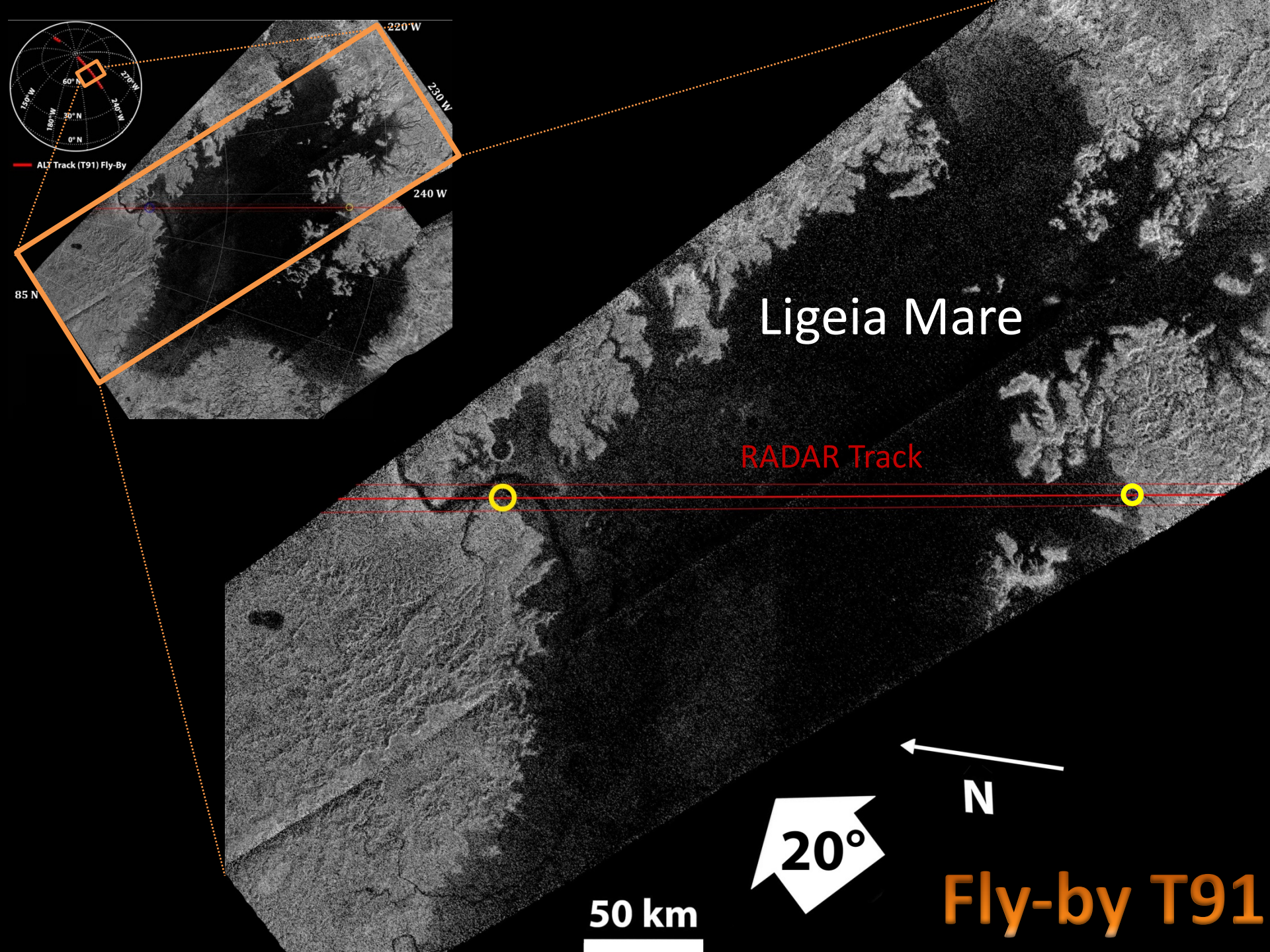



Titan’s surface RADAR image
2660
2669
2678
2687
2696
2701
2708
2718
2727
2736
2743
2750
2760

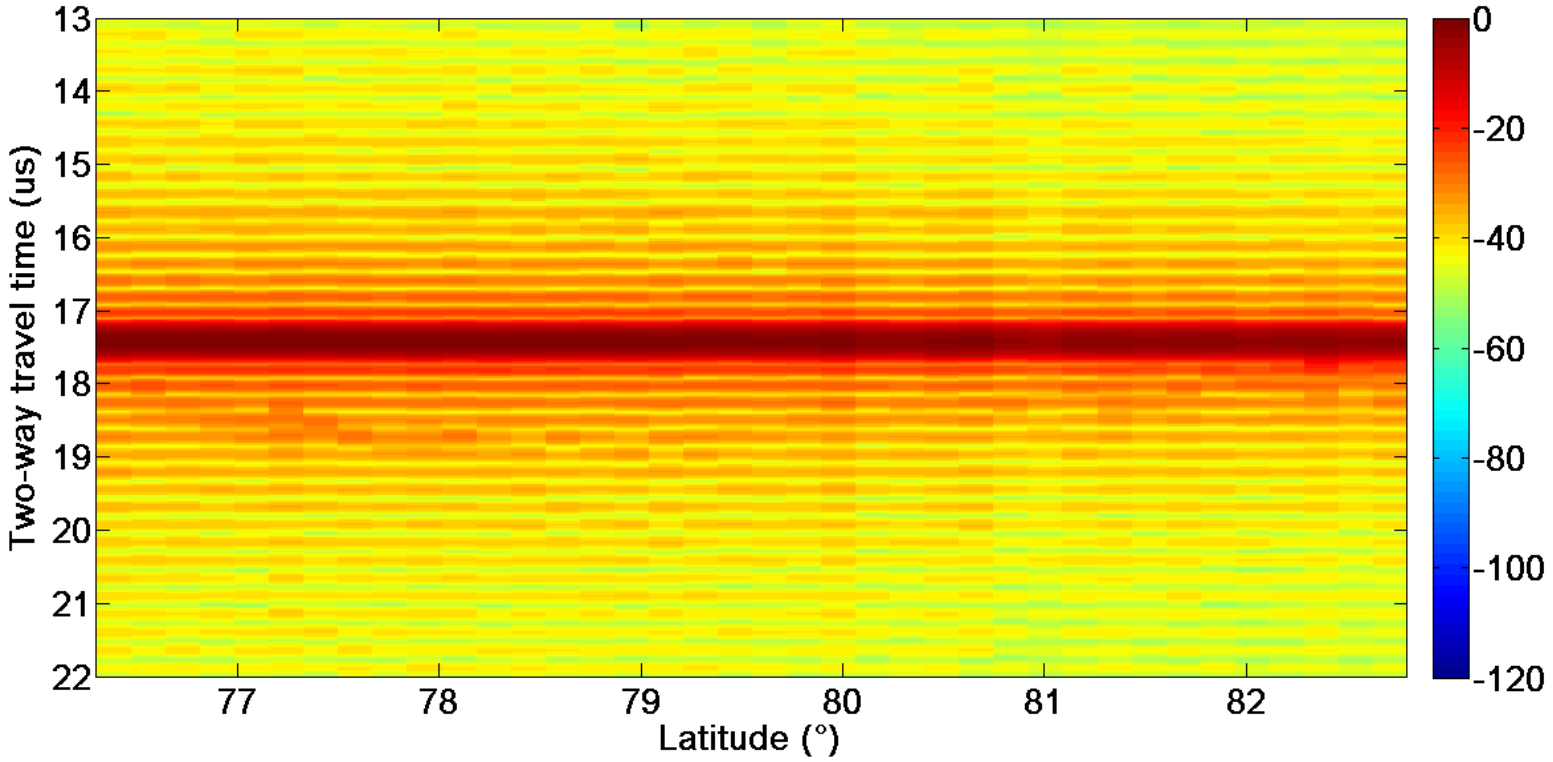

Titan’s profile RADAR altimeter
ML
Threshold
I moment
0
-200
-400
-600
-800
Altezza [m]


Titan's North Polar Lakes and Seas
as revealed by the Cassini Titan RADAR Mapper
Titan Northern Hemisphere
180° W
90° W
270° W
0° W
80° N
70° N
60° N
50° N
Polar Stereographic projection
Scale 1:16,000,000
90° N
70° N
50° N
50 0 50 100 200 300 400 km


Titan's North Polar Lakes and Seas
as revealed by the Cassini Titan RADAR Mapper
Titan Northern Hemisphere
Ligeia Mare
180° W
90° W
270° W
0° W
80° N
70° N
60° N
50° N
Polar Stereographic projection
Scale 1:16,000,000
90° N
70° N
50° N
50 0 50 100 200 300 400 km

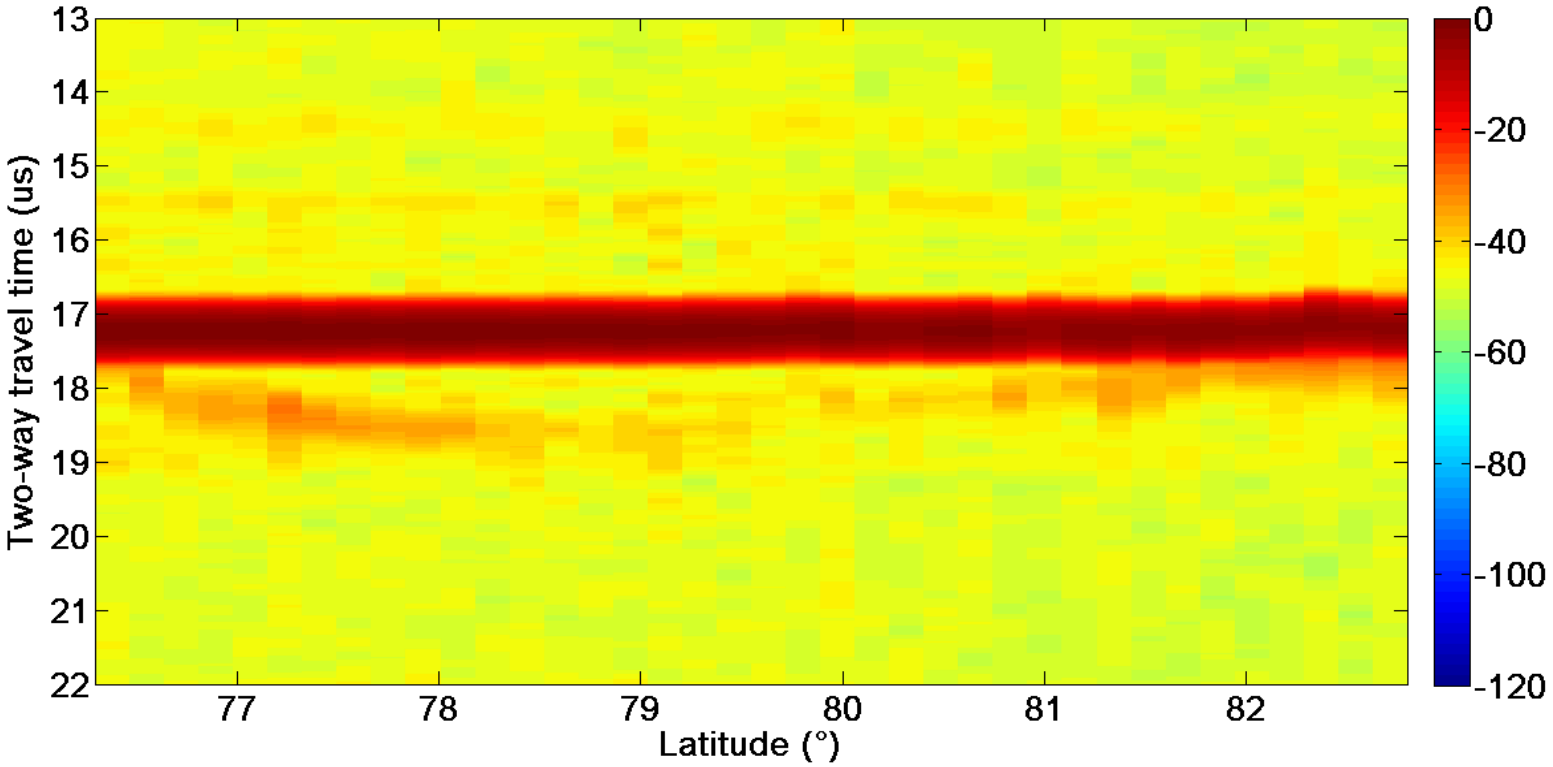

220 W
230 W
240 W
85 N
60° N
150° W
180° W
270° W
240° W
30° N
0° N
ALT Track (T91) Fly-By
Ligeia Mare
RADAR Track
N
20°
50 km
Fly-by T91

Data Processing



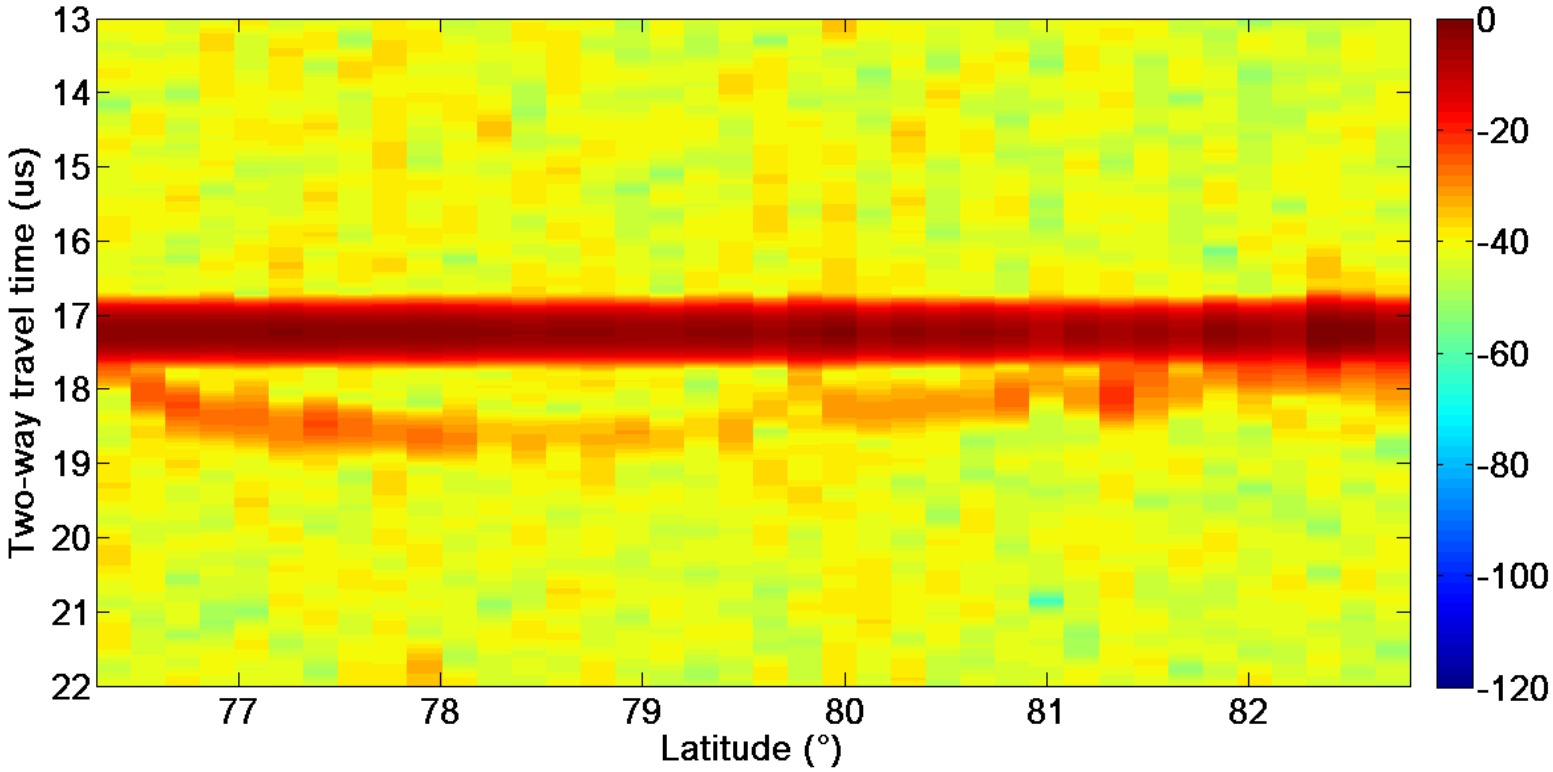
I step processing

Data Processing



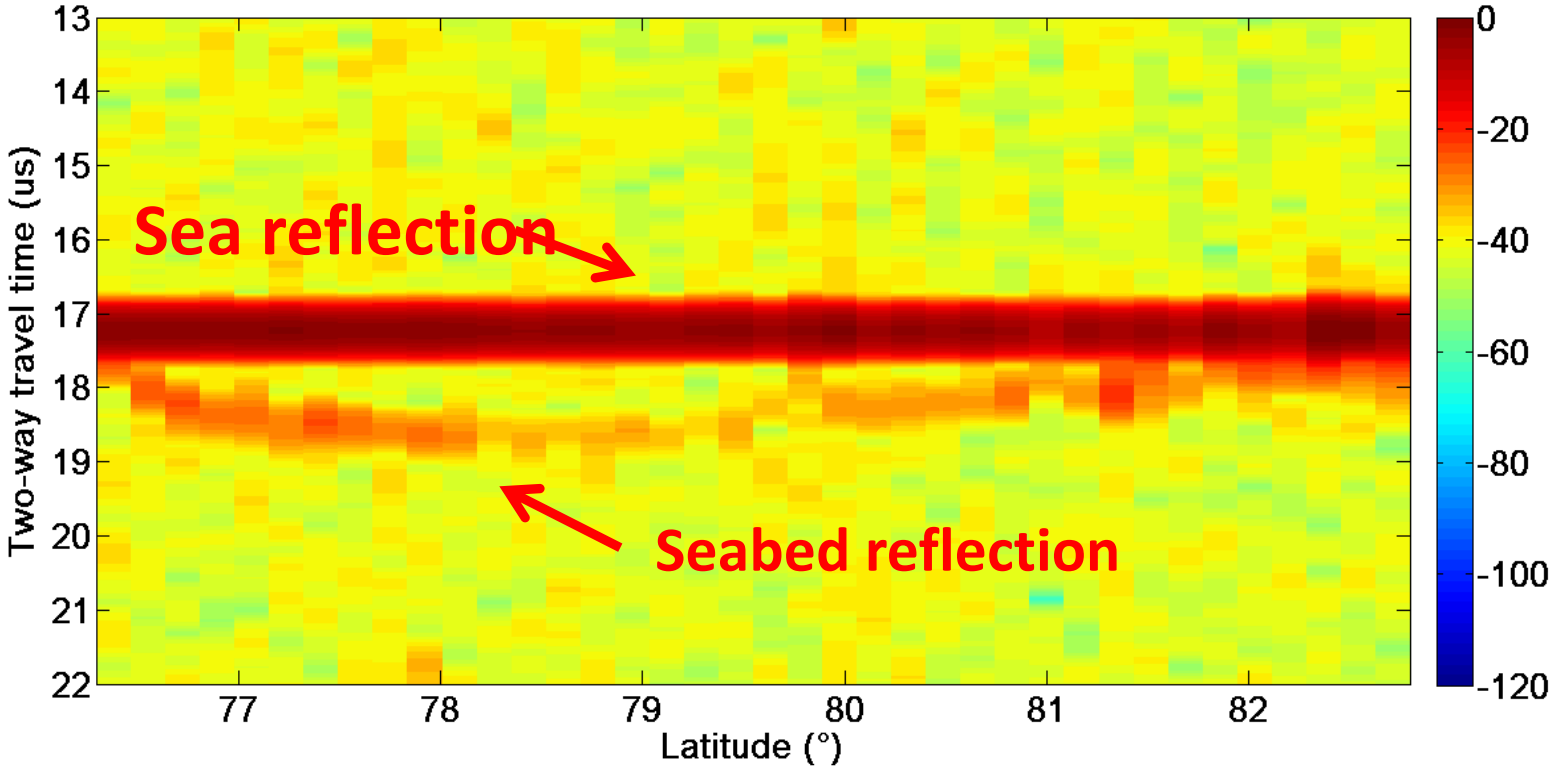
II step processing

Data Processing

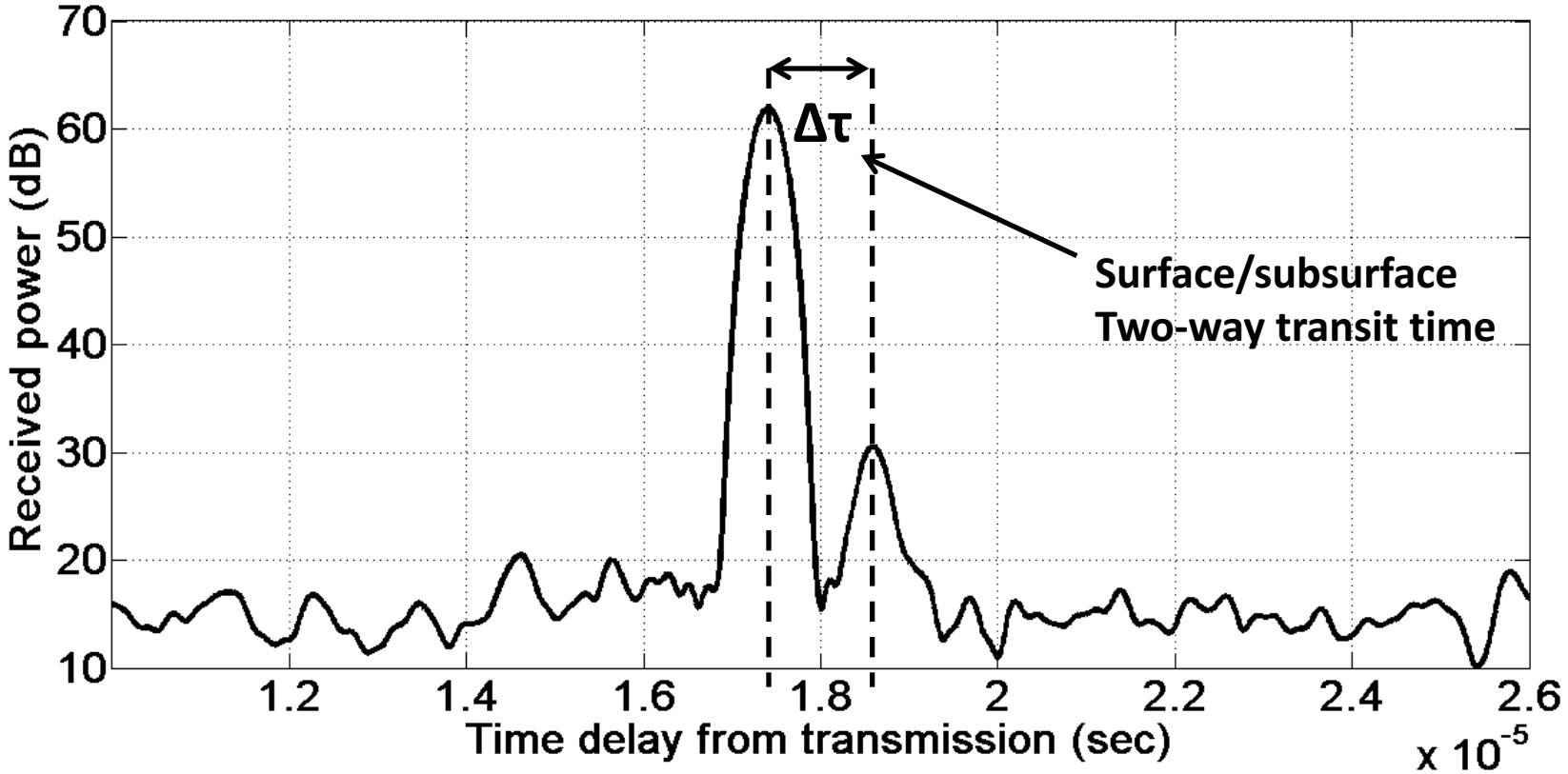


III step processing

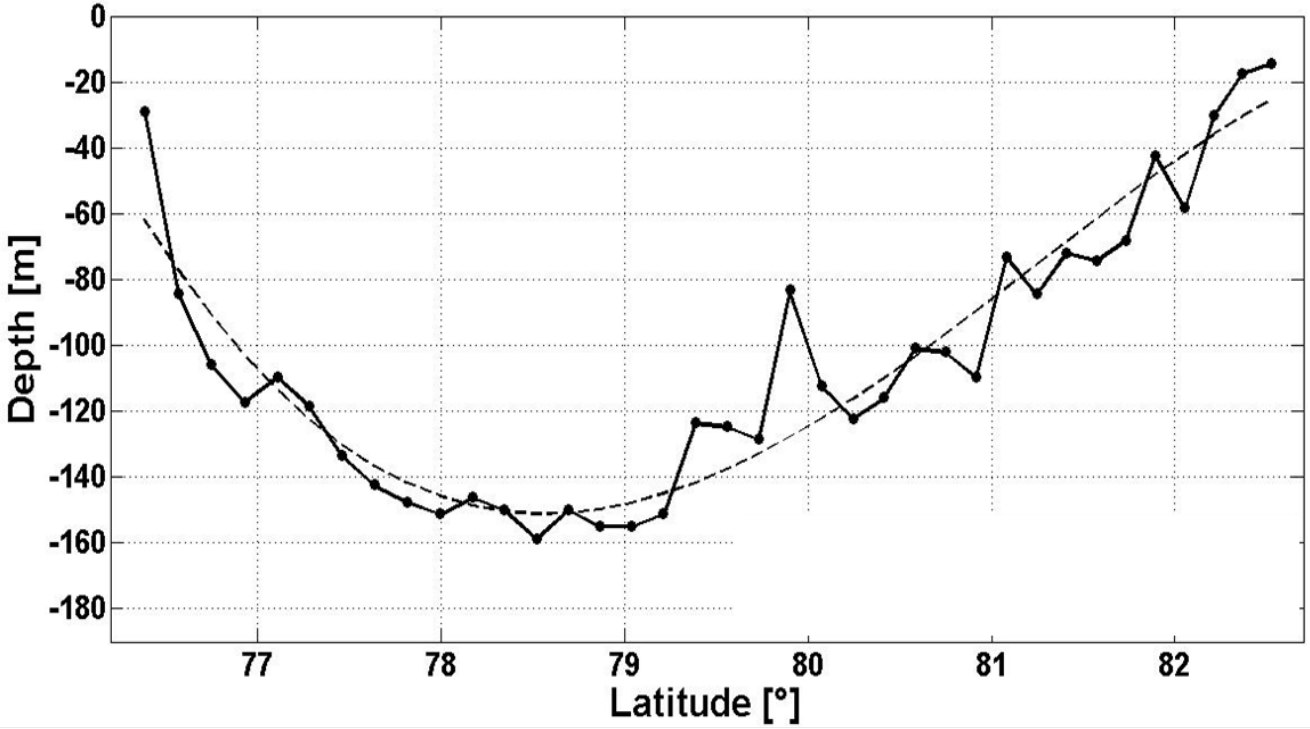
First radargram of Ligeia



Depth Measurements



Ligeia Mare Bathymetry

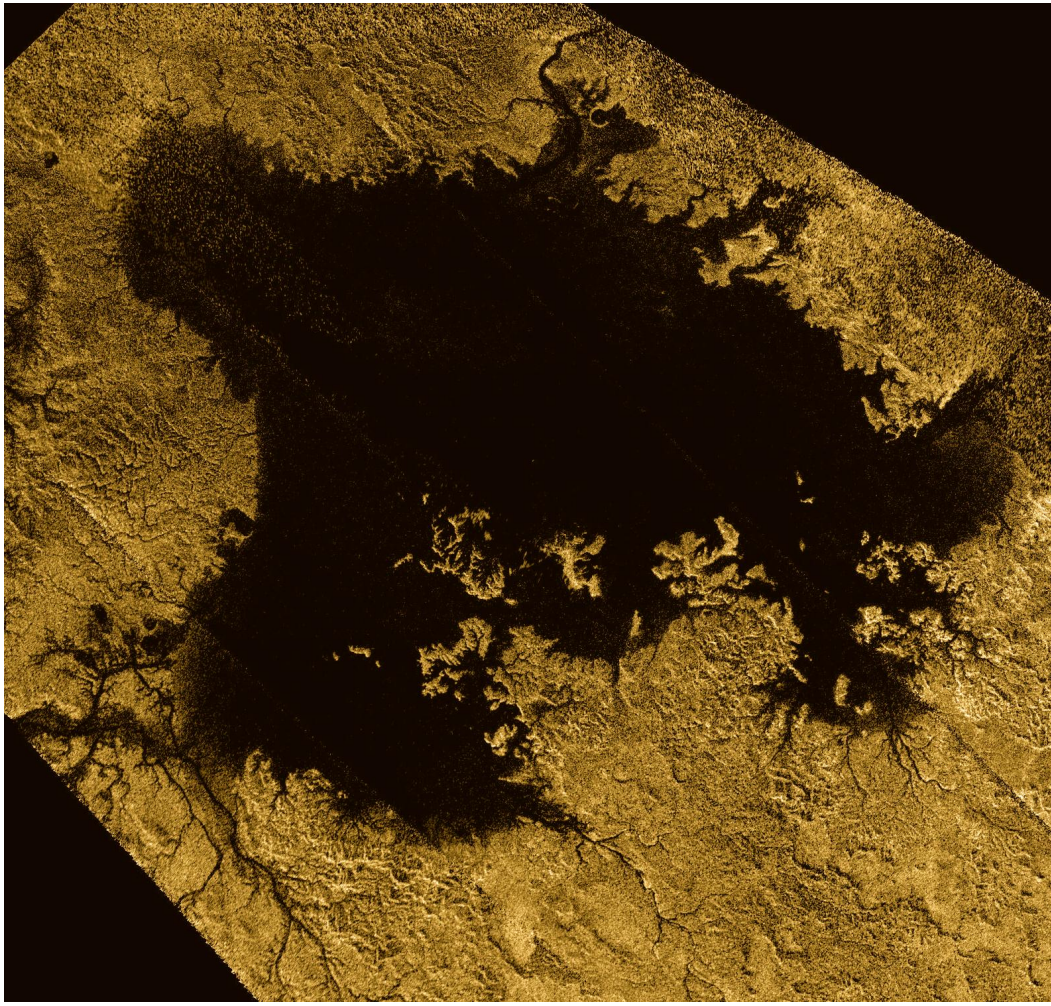


Maximum depth 160m

Implications: Total volume

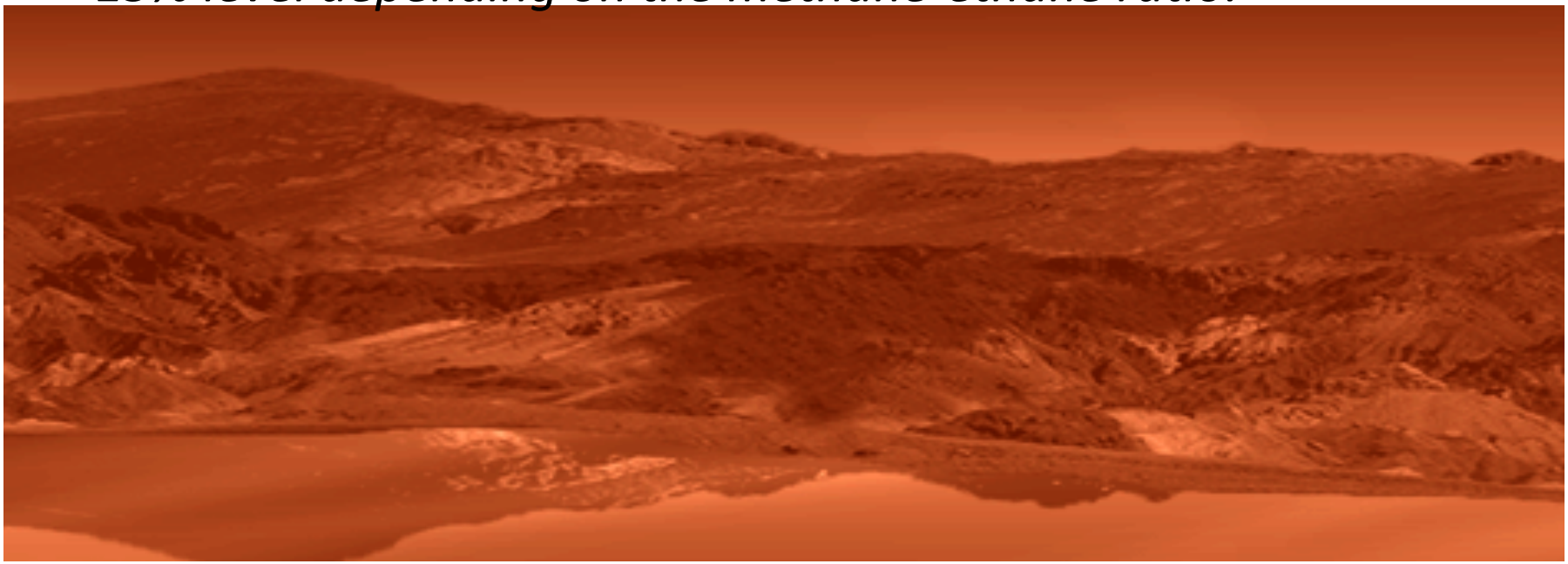
Extrapoled total liquid volume of Ligeia Mare: ***about 3,500 cubic miles (14,000 cubic kilometers) OR 8,000 gigatons of carbon***

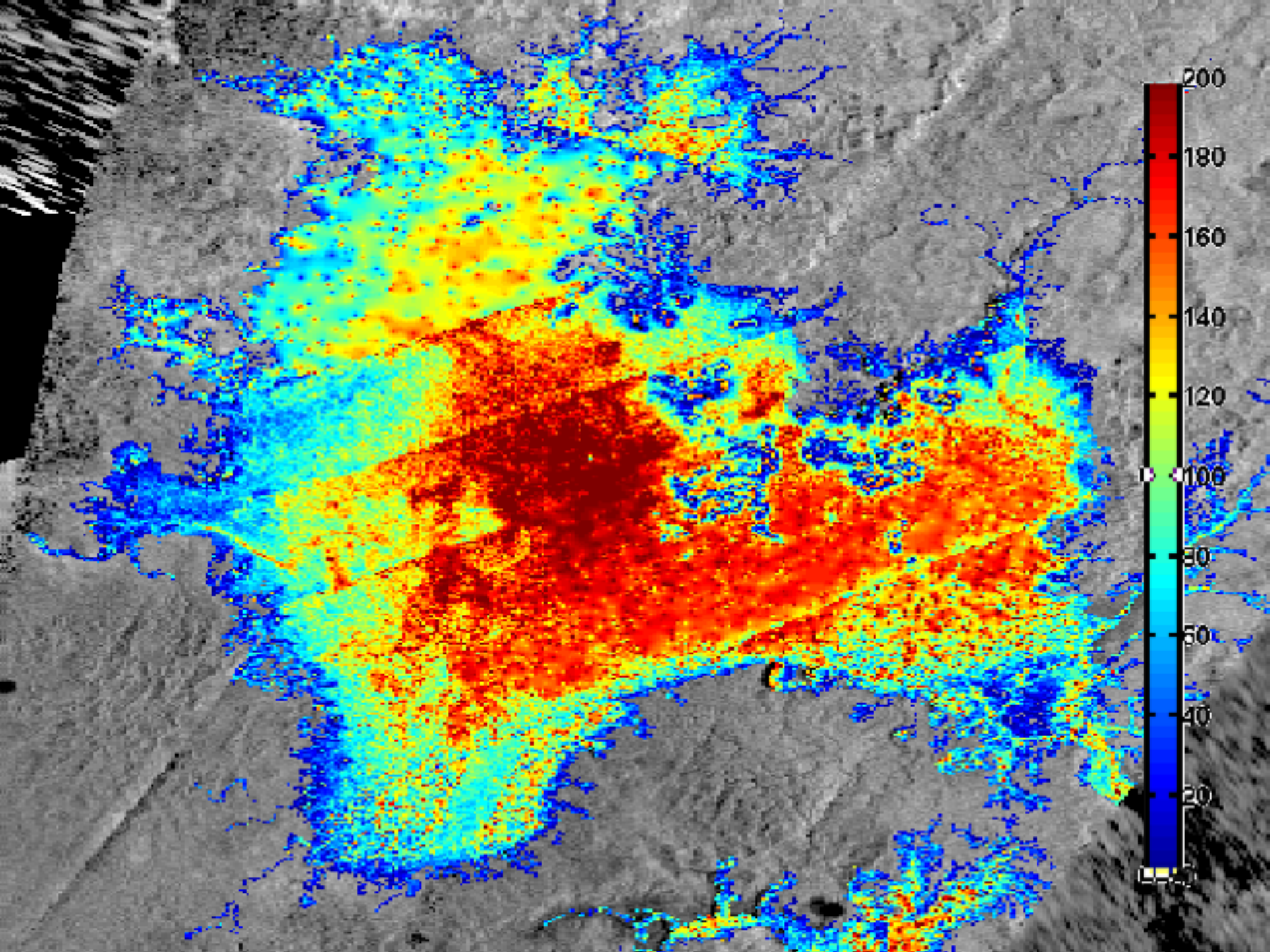
About ***55 times the proven oil reserves on Earth*** *!*



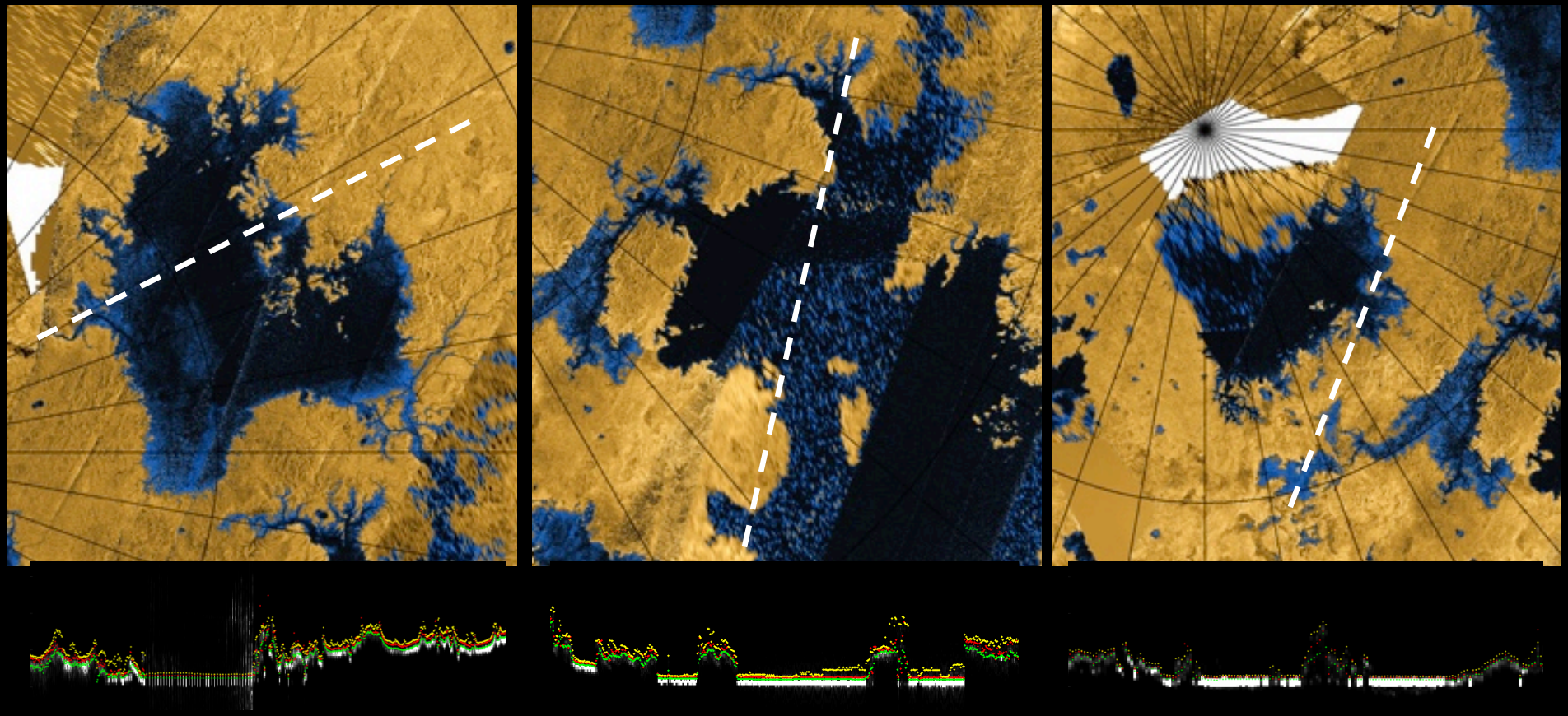
Liquid Composition

- *The analysis of Cassini radio signal attenuation through the sea demonstrates that the liquid is remarkably transparent, requiring under Titan conditions a composition that is* ***nearly pure methane-ethane.***
- *Molecular nitrogen, which will be dissolved in the liquid at the 5-15% level depending on the methane-ethane ratio.*

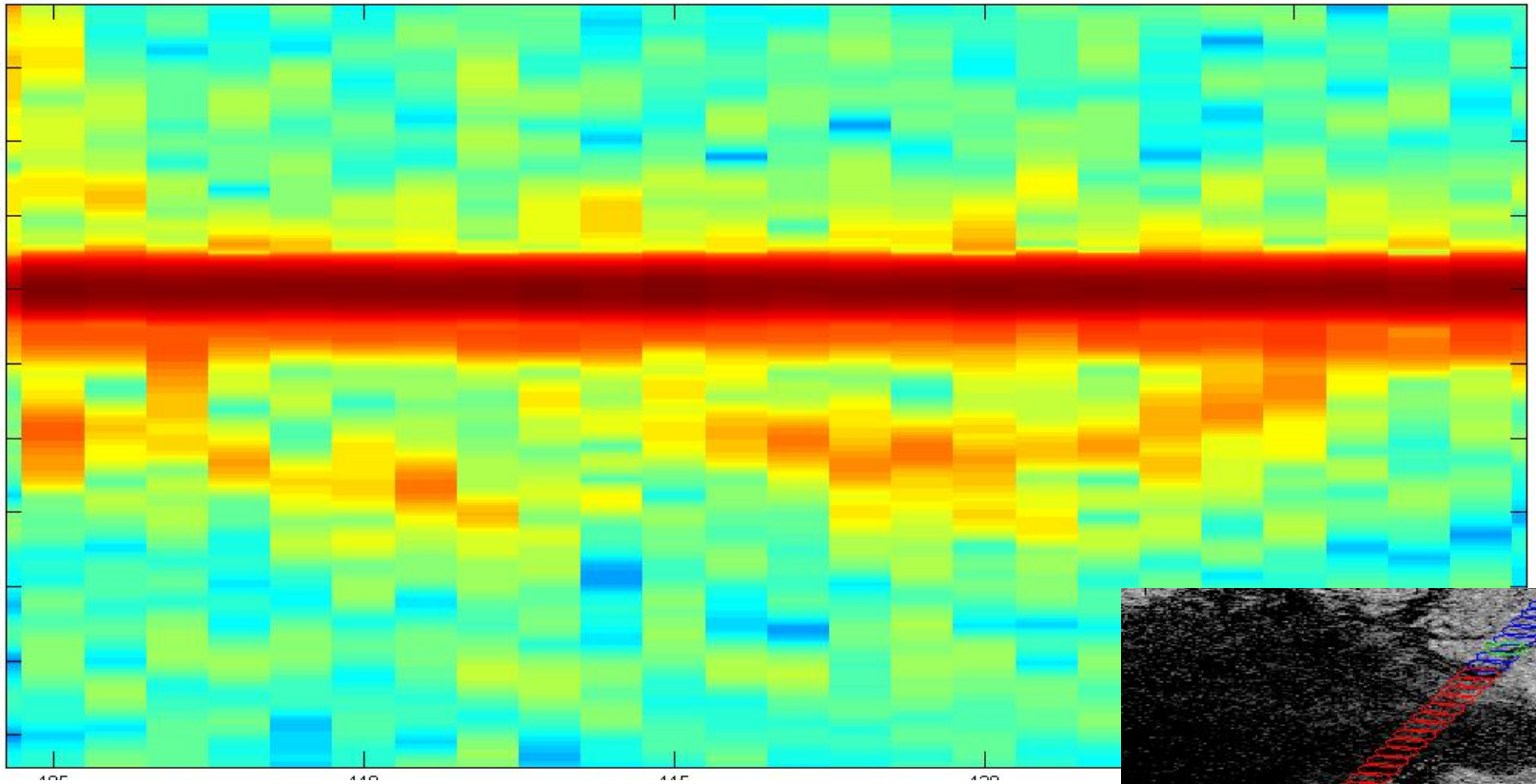


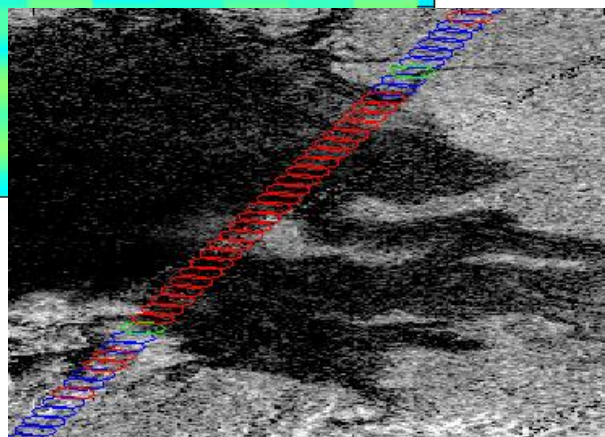

200
180
160
140
120
100
80
60
40
20
0

Bathymetry and Composition of Titan's Northern lakes from the Cassini RADAR Altimeter

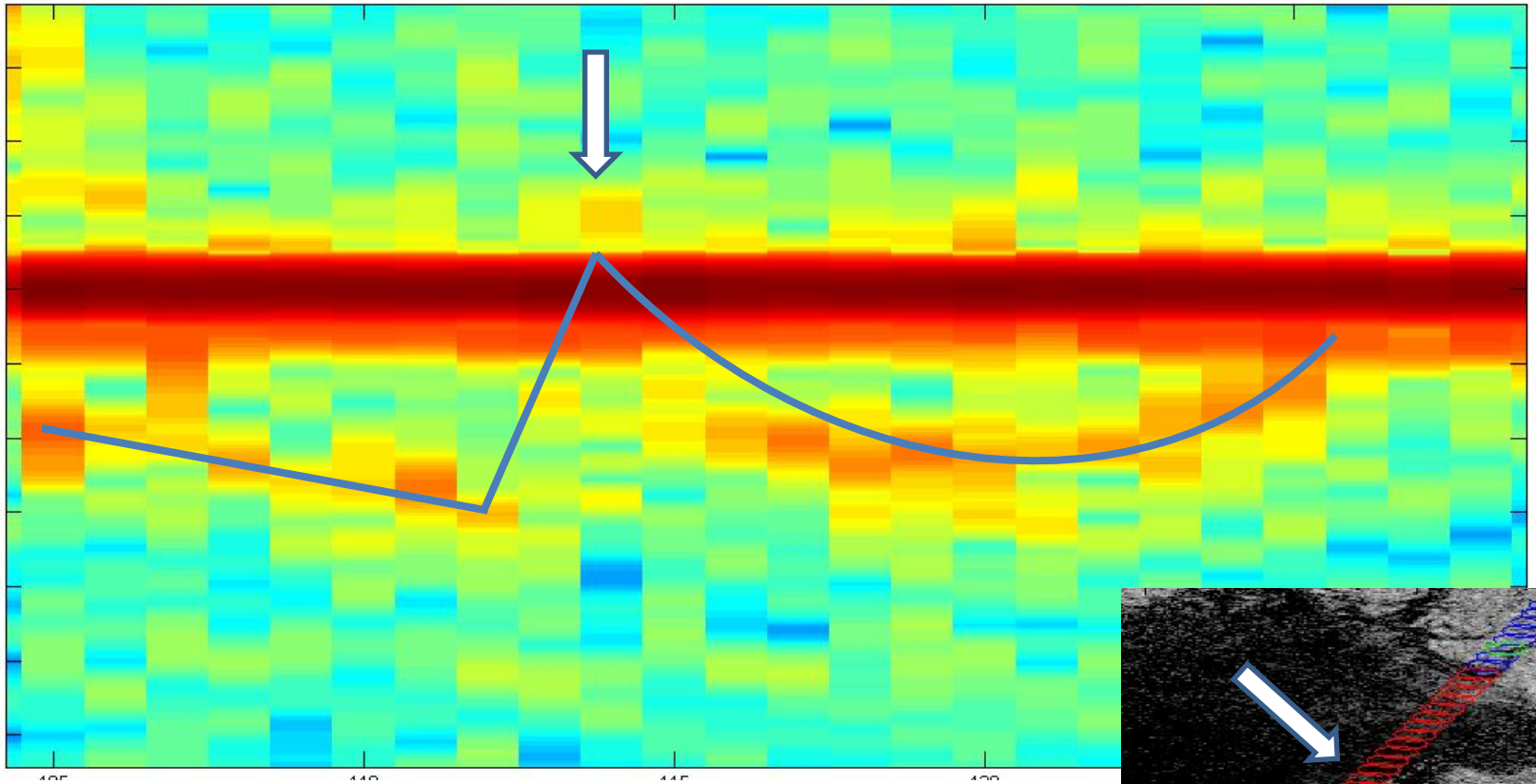


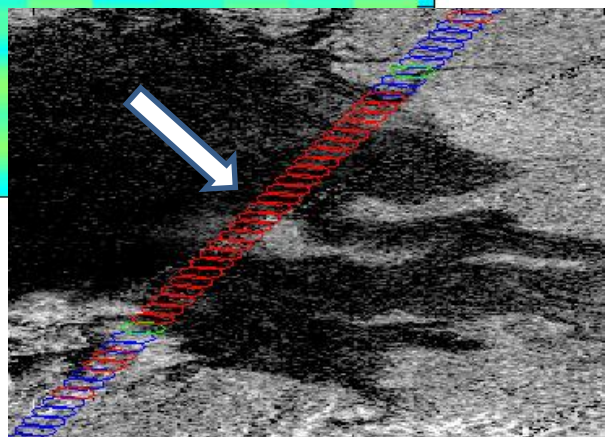
T108 Punga Mare





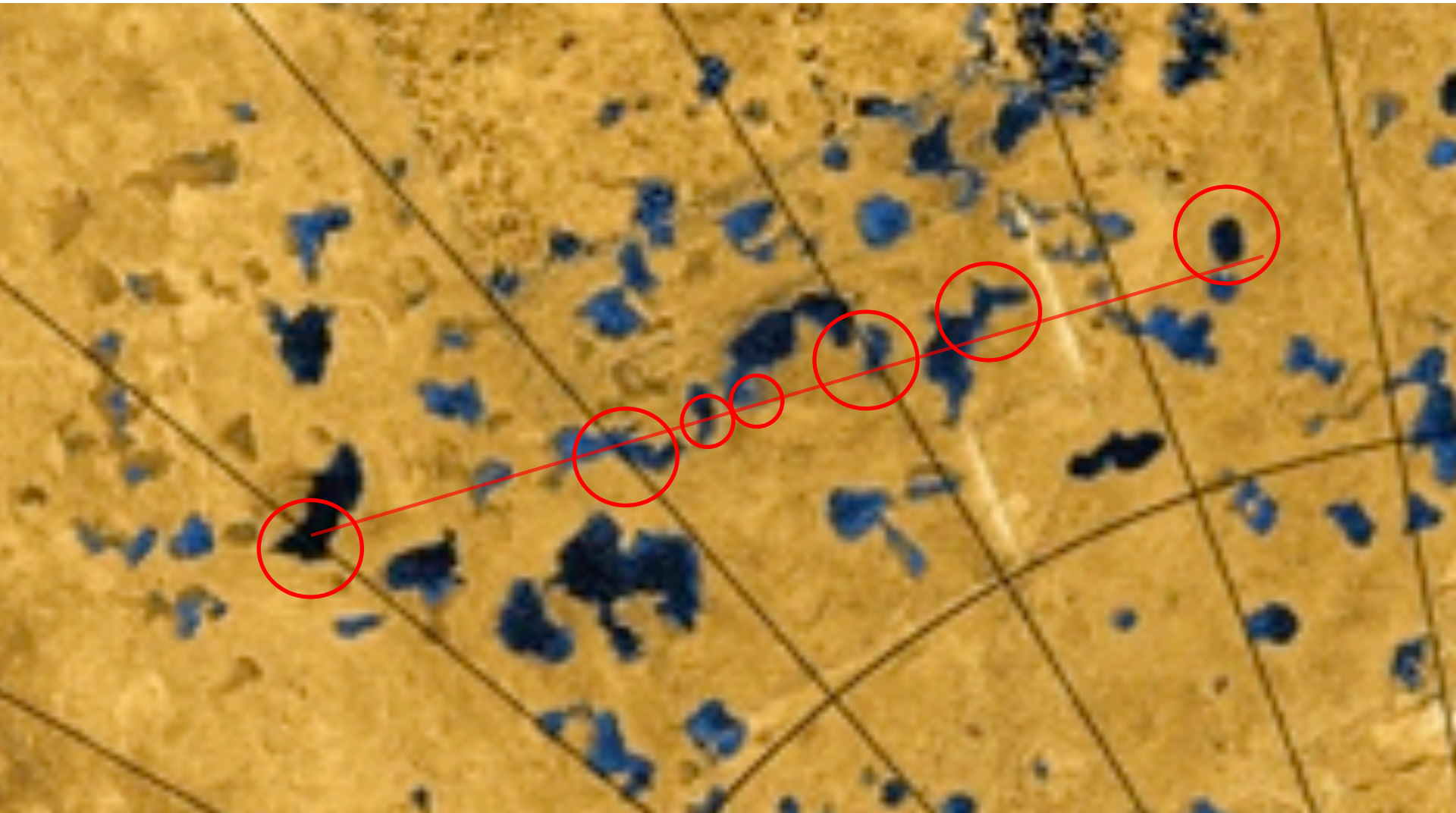
T108 Punga Mare

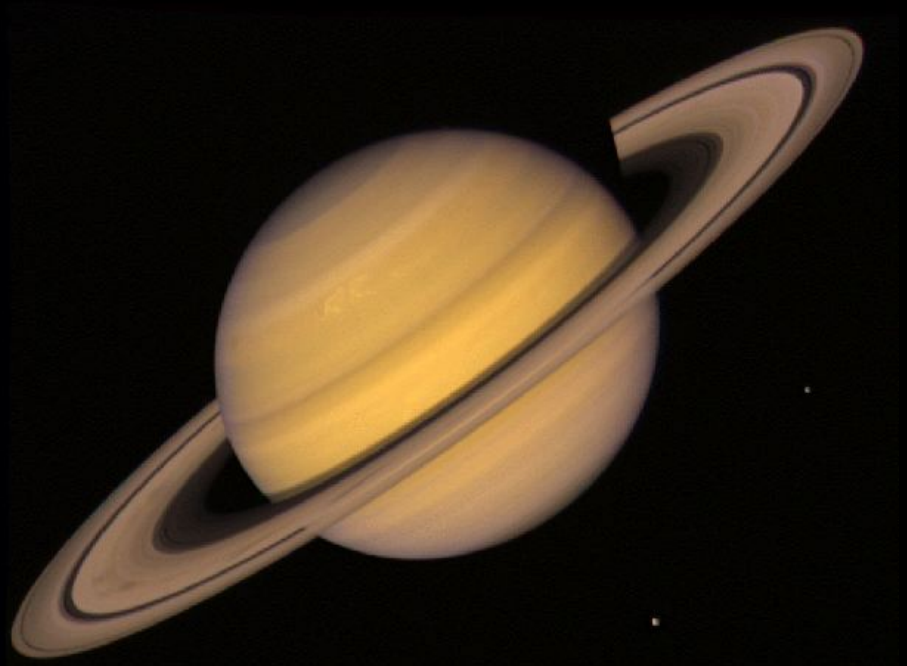


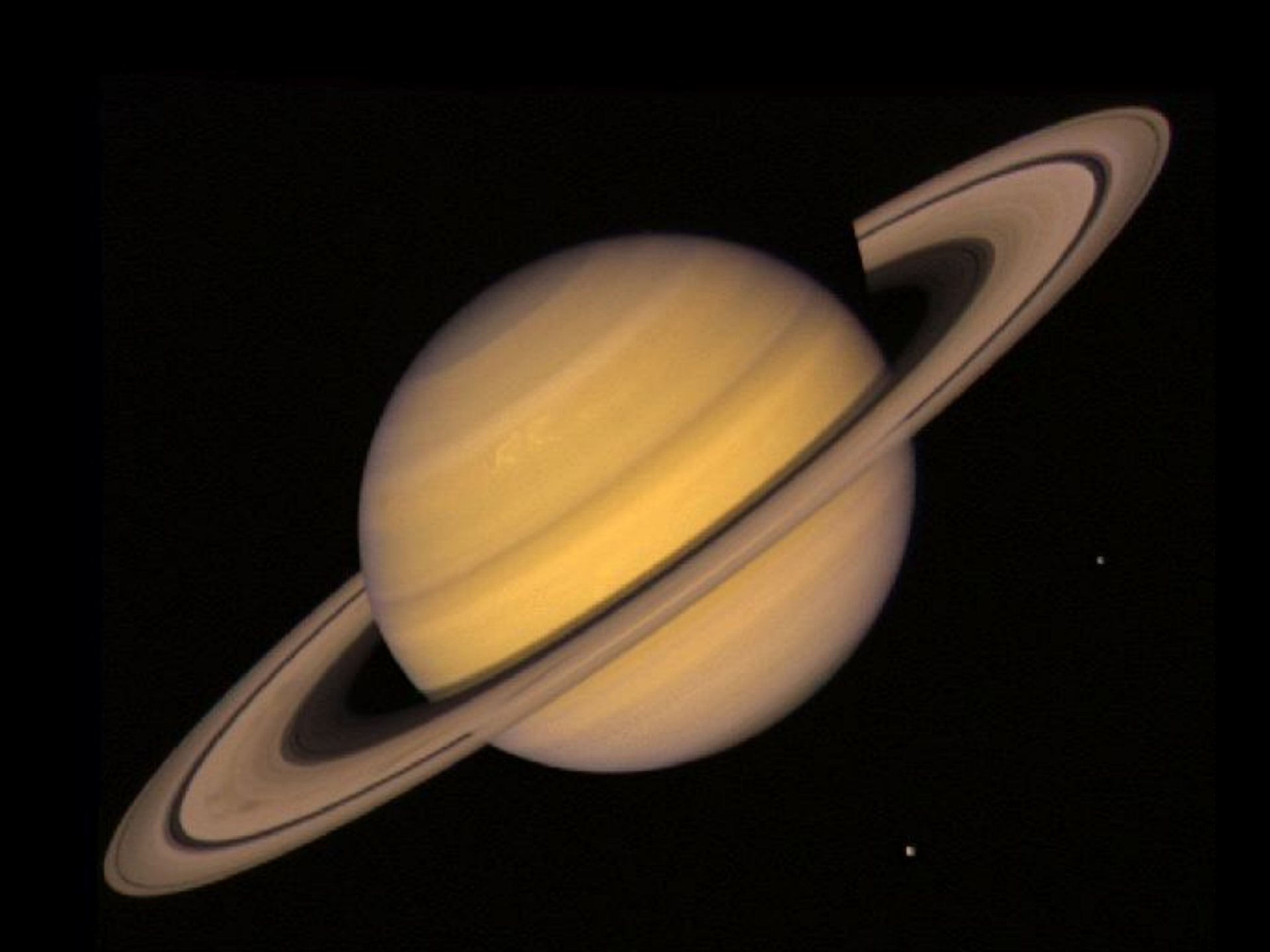


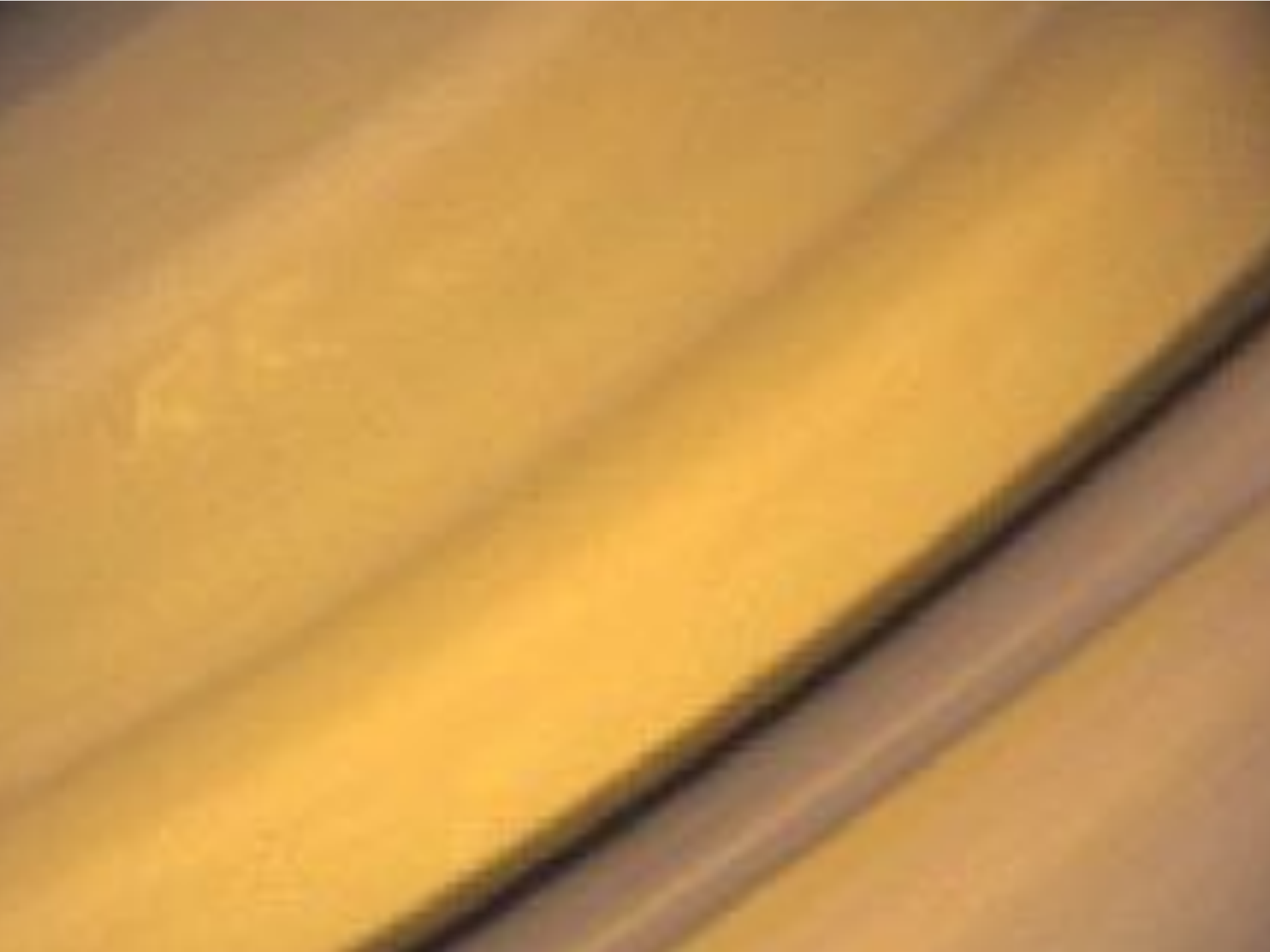
T126 Fly-by (April 22nd 2017)

T126 Cassini footprint : 6 km









END