ROSA - THE ITALIAN RADIO OCCULTATION MISSION ON-BOARD THE INDIAN OCEANSAT-2 SATELLITE

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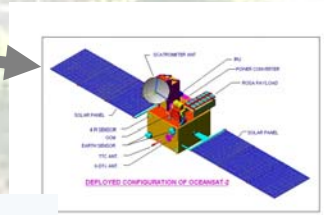
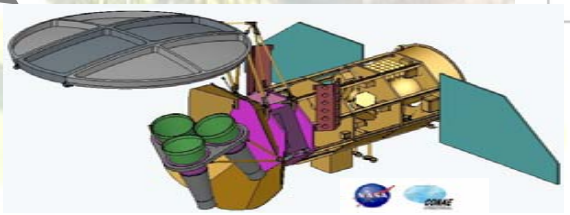
OUTLINE OF THE TALK

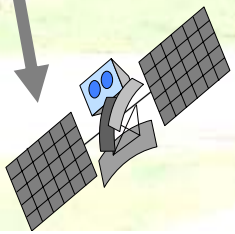
- *ASI Approach for GNSS RO*
- *Description of OCEANSAT_2 Mission*
- *Description of ROSA receiver*
- *Development of a tool for RO data processing:*
  - *Sw for RO data processing*
  - *Sw for LEO-POD*
  - *The organization of the activities in a GRID computing environment*
- *Scientific Activities under ASI umbrella:*
  - *POLITO*
  - *UNIRM*
  - *CISAS*
  - *UNICAM*
  - *ISC/CNR*
- *Conclusions*

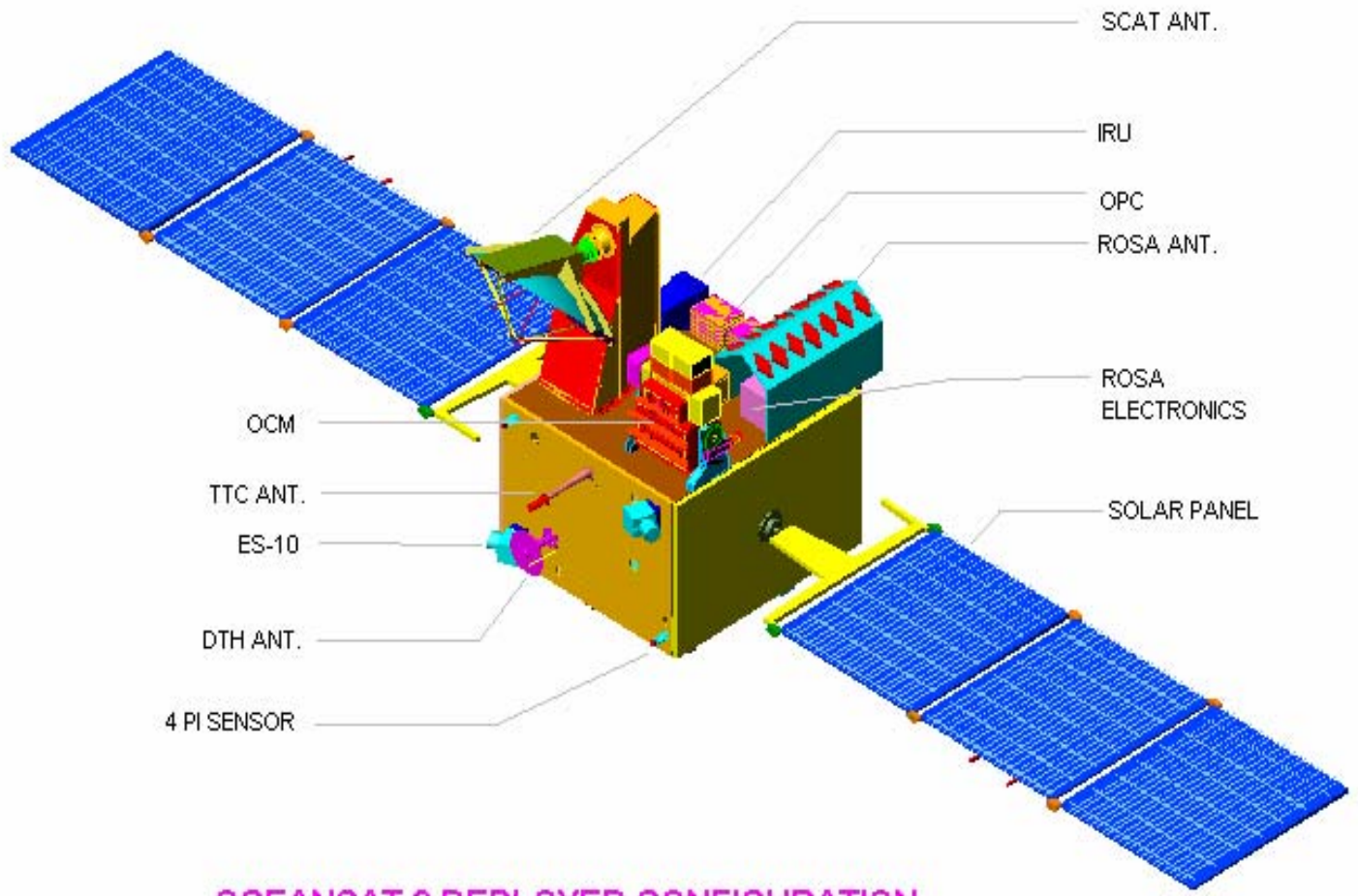
A DIFFERENT STRATEGY OF ASI

- *We have developed a GPS receiver devoted to Radio Occultation: **R**adio **O**ccultation **S**ounder for **A**tmosphere studies*
- *We don't have a space mission devoted to RO*
- *We try to embark ROSA on available national and/or international Earth space missions:*
  - *OCEANSAT_2 (Spring 2008)*
  - *SAC-D (2009 ?)*
  - *SABRINA (2010 ?)*



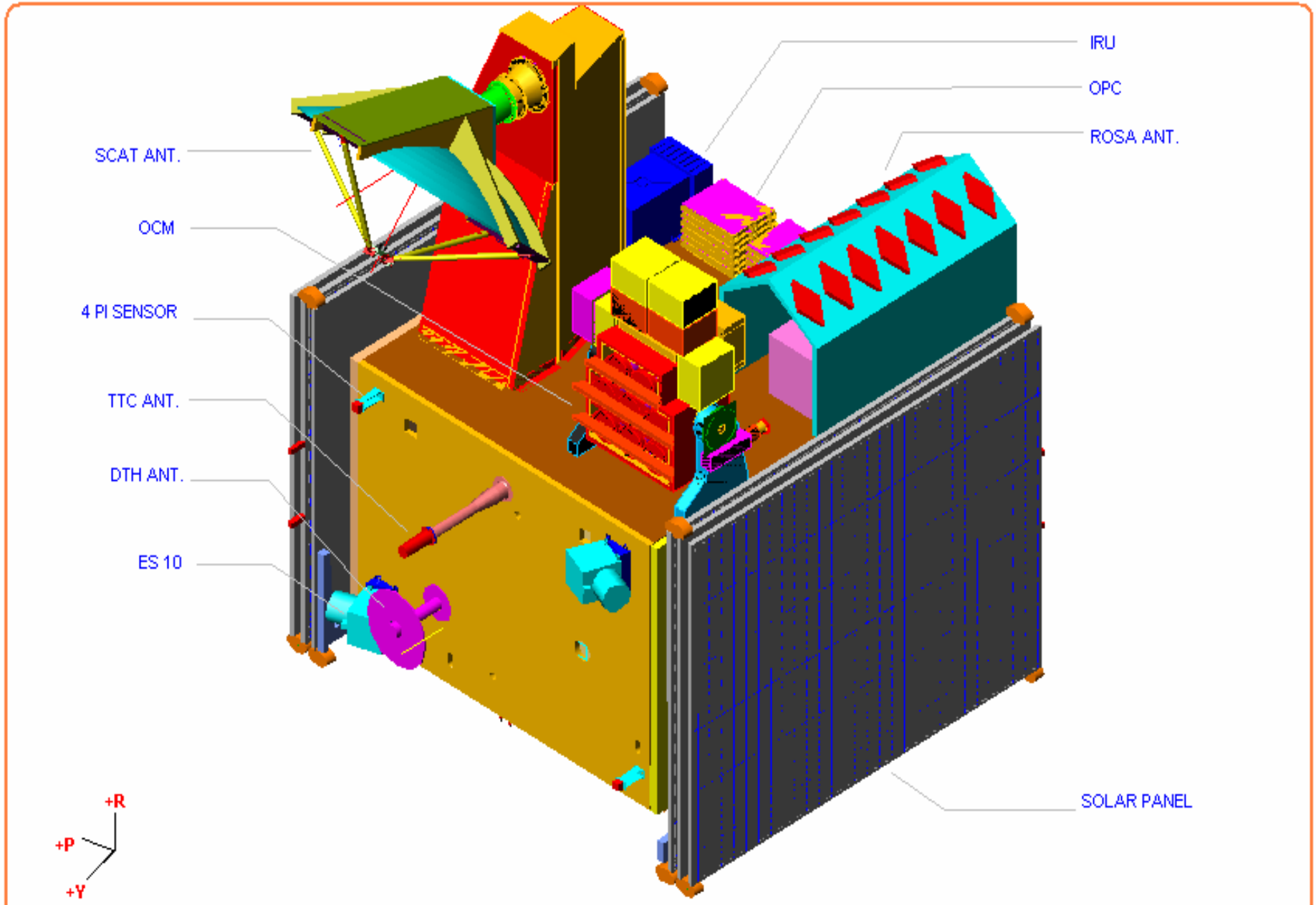






OCEANSAT-2 DEPLOYED CONFIGURATION

VIEWED FROM +Y SIDE (19.07.05 MID)



OCEANSAT-2 STOWED CONFIGURATION

VIEWED FROM +YAW SIDE (19.07.05)

OCEANSAT-2 PAYLOADS

- *OCM*
- *Scatterometer*
- *ROSA (developed by ASI, Italy)*

- ***8-narrow Band multi-spectral camera, 360 m Resolution, 1420 Kms Swath, 2 days repetevity***
- ***Ku-band (13.515GHz) radar, V & H polarisation, two-beam conical scanning***
- ***Radio occultation sounder using GPS signal to derive atmospheric parameters***

ORBIT PARAMETERS

Type	-	*Near polar sun-synchronous*
Altitude	-	*720 Kms*
Inclination	-	*98.28 Deg.*
Period	-	*99.31 mts.*
Local time of pass	-	*12 noon ± 10 mts.*
Repetevity cycle	-	*2 days*
Distance between adjacent traces	-	*1382 kms*
Distance between successive ground tracks	-	*2764 Kms*
Average ground trace velocity	-	*6.781 Kms/sec*

OCEANSAT-2 MISSION

MISSION OBJECTIVES

- To design, develop, launch and operate a three axis stabilised spacecraft in circular sun-synchronous orbit carrying a Ocean Colour Monitor and a Ku-band Scatterometer

- To develop algorithms for retrieval of Geo-physical parameters like wind vector on an operational basis.

- To provide continuity of operational Data services of Oceansat-I while promoting new applications in the areas of Ocean studies including prediction of cyclone trajectory, Fisheries, coastal zone mapping etc,.

Major applications of Scatterometer

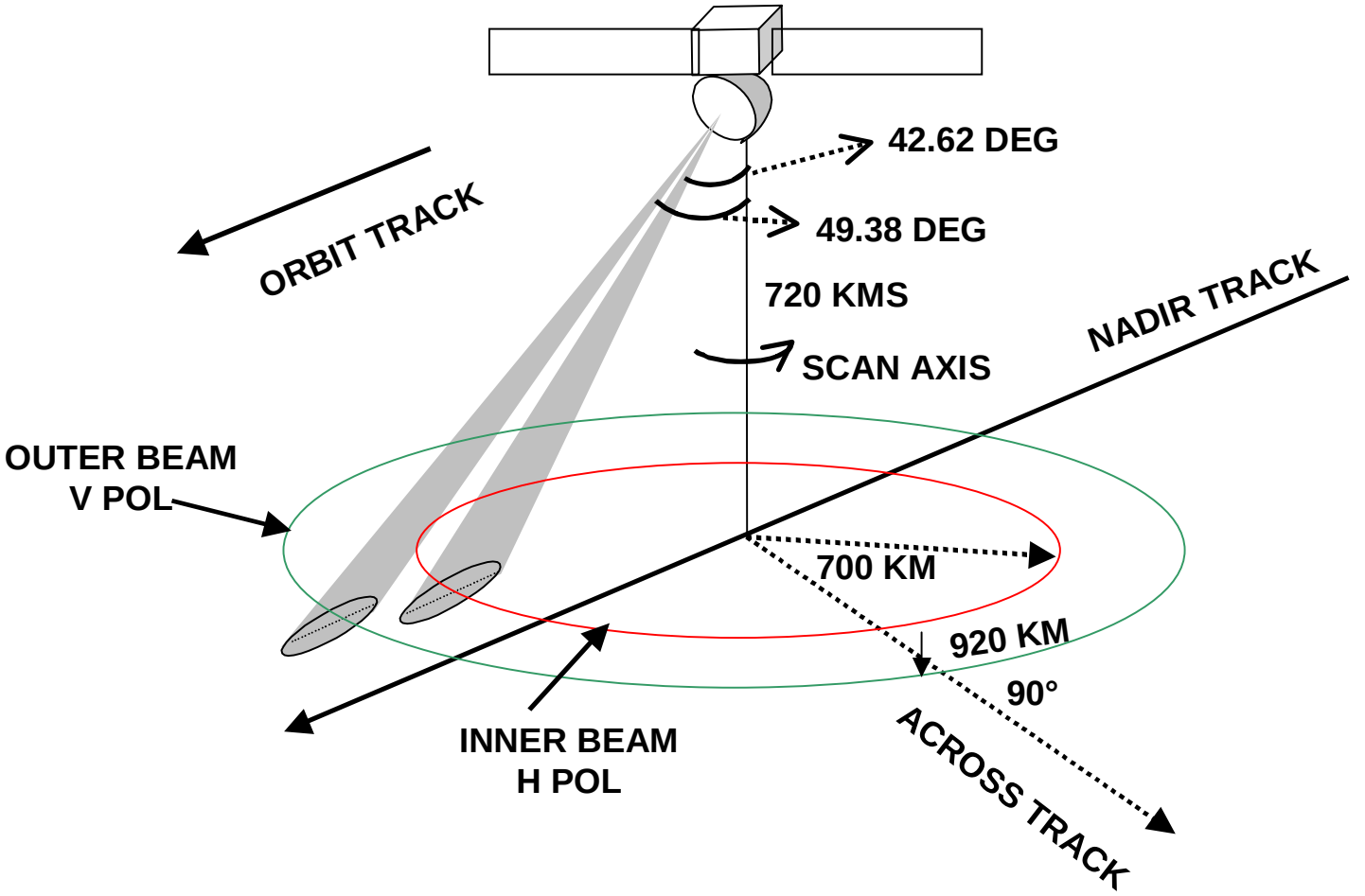
- *Weather forecasting with Global wind vector data as input*
- *Storm detection and tracking over oceans including Hurricanes (Atlantic), tropical cyclones and typhoons*
- *Global climate monitoring through study of Heat exchange between ocean and atmosphere because of surface winds*
- *Sea state forecasting for commercial ship transport industry*
- *Monsoon monitoring over Indian Ocean & South-east Asia*
- *Oil production and clean up of oil spills*

SCATTEROMETER SPECIFICATIONS

PARAMETER	VALUE
Altitude	720 Km
Frequency	13.5156 GHz
Resolution	50 km X 50 km
Polarisation	HH (Inner) and VV (Outer)
Antenna	Parabola of 1.0 m Dia
Scanning Rate	20.5 rpm
Data Rate	13.36 Mbits/sec (Raw) 250 Kbits/Sec (Processed) @ 200 Hz PRF
Transmit Power	100 W Peak
Swath	1400 km
Wind Speed Range	4 to 24 m/s
Wind Speed Accuracy	2 m/sec or 10% (Whichever is higher)
Wind Direction Accuracy	20 deg RMS

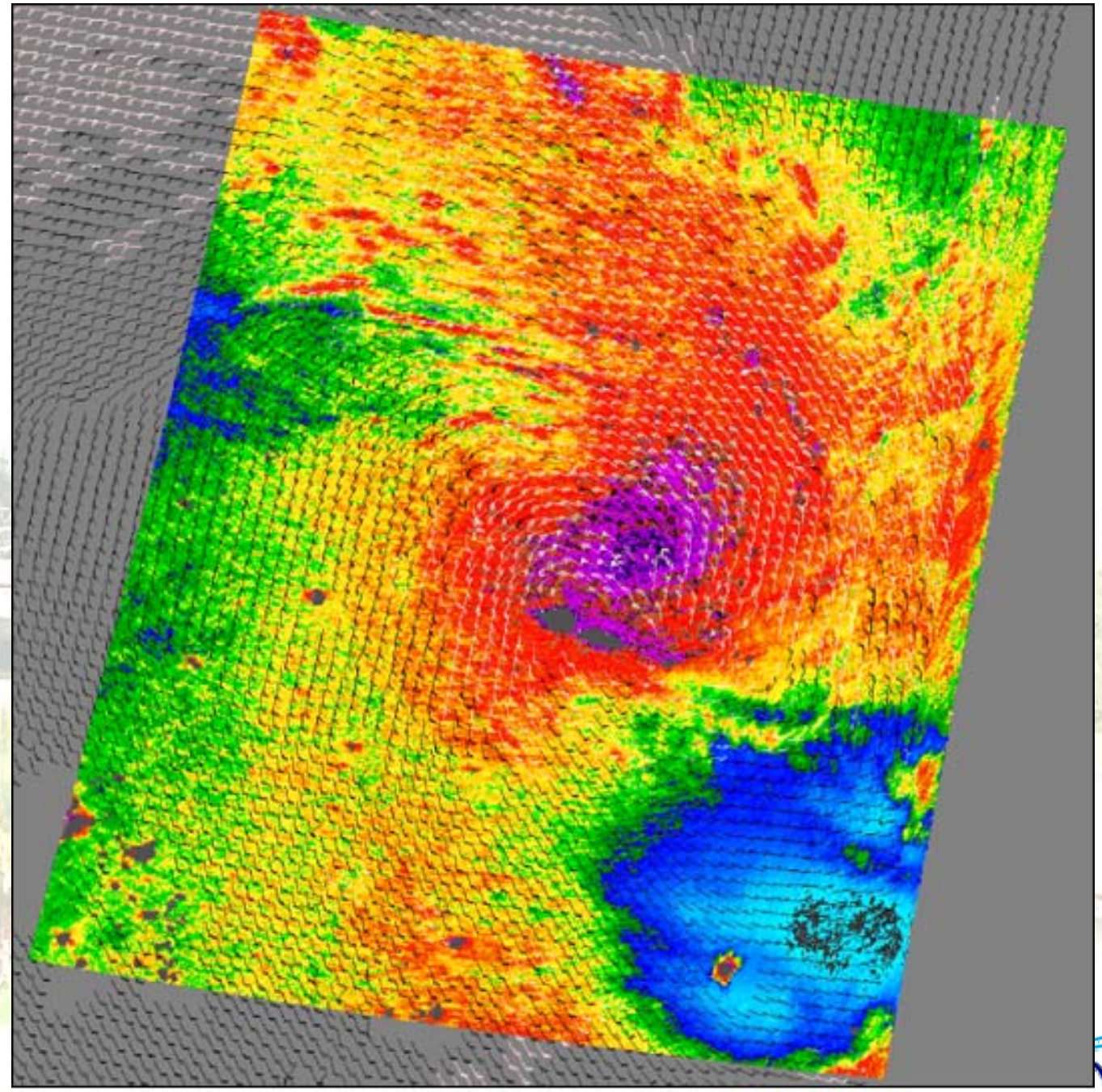
FEATURES OF SCATTEROMETER

- **Ku-band (13.515 GHz) Scatterometer is useful for measuring Sea surface wind velocity (both magnitude and direction)**
- **The Scatterometer is basically a Radar with two beams and measures the back scatter co-efficient (σ_o) in four azimuth angles from which the wind velocity is derived.**
- **A 1 mtr. diameter parabolic reflector antenna mounted at 46 deg. in R-Y plane is conically scanned about +ve Yaw axis at 20.5 RPM speed. Two off-axis feeds in its focal plane define two pencil beams (Inner and Outer) which measure σ_o .**
- **The Inner beam covers a foot print of about 42 x 30 Kms and outer beam covers 57 x 35 Kms ; the usable swath coverage is 1400 Kms.**
- **The Inner beam operates in HH polarisation while the outer beam in VV polarisation.**



GEOMETRY OF THE PENCIL-BEAM SCATTEROMETER FOR OCEANSAT-II

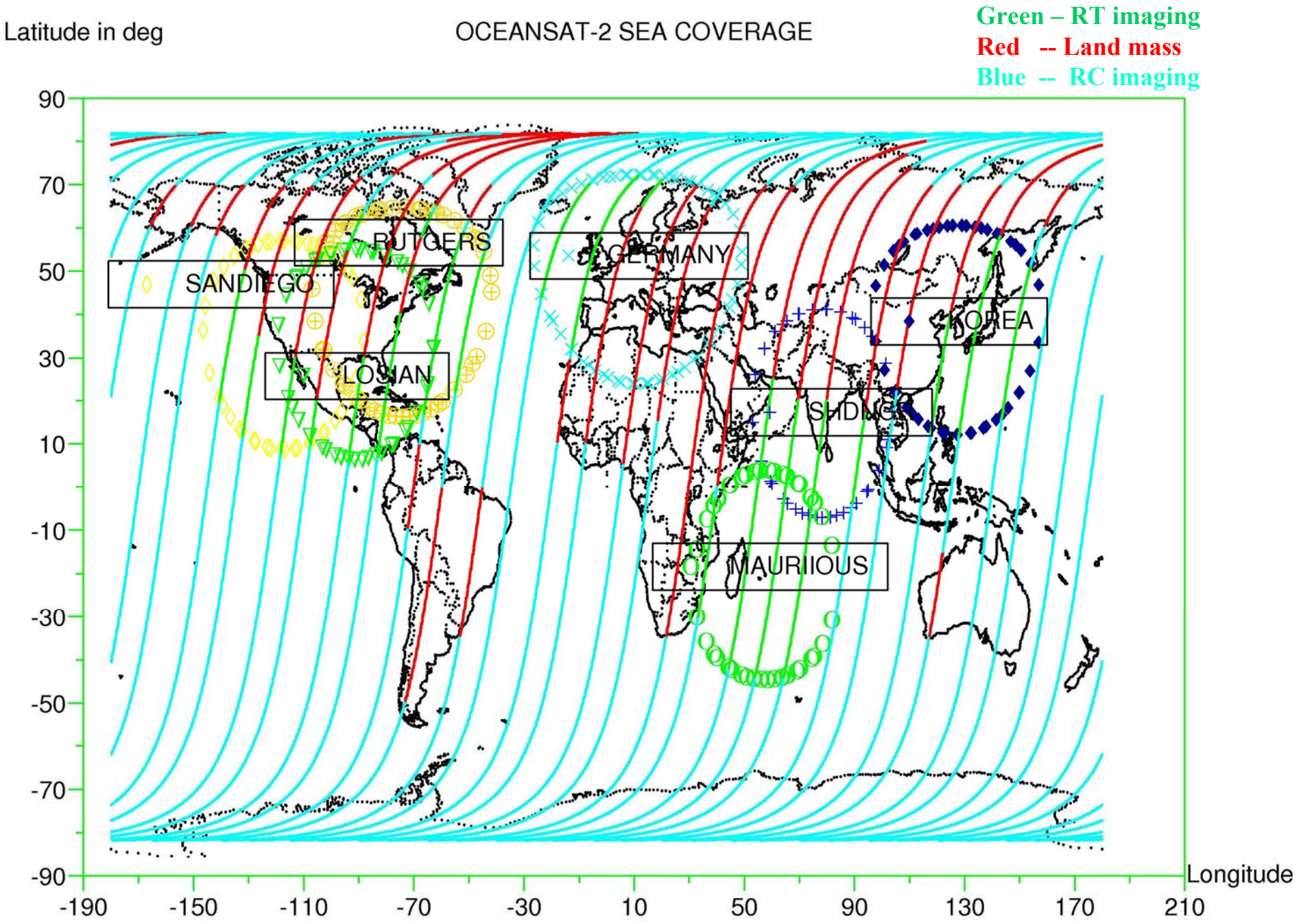
ROSA
Radio Occultation Sounder for Atmosphere



OCM SPECIFICATIONS

OCM

IGFOV (mtrs)		-	360
GSD (mtrs)		-	236
Swath (Kms)		-	1400
Spectral bands (nm)			
	Band-1	-	402 - 422
	Band-2	-	433 - 453
	Band-3	-	480 - 500
	Band-4	-	500 - 520
	Band-5	-	545 - 565
	Band-6	-	610 – 630 (660 – 680)
	Band-7	-	725 – 755 (745 – 785)
	Band-8	-	845 – 885
Quantisation		-	12 bits
SNR (@ max signal)		-	> 512
Size (mm^3)		-	701 x 527 x 470
Weight (Kgs)		-	78
Power (W)		-	134
Data rate (Mbps)		-	16.8


Latitude in deg
OCEANSAT-2 SEA COVERAGE
Green – RT imaging
Red -- Land mass
Blue -- RC imaging
RUTGERS
SANDIEGO
LOSIAN
GERMANY
KOREA
SHIDNGR
MAURIIOUS
90
70
50
30
10
-10
-30
-50
-70
-90
-190
-150
-110
-70
-30
10
50
90
130
170
210
Longitude

MATERA & SAN STATIONS RADIO-VISIBILITY

Station	Orbit No.	Time hh : mn : sec	Duration mn sec	Max.elevation Deg.
Matera	18	10 31 40	12 34	31.24
Matera	19	12 09 53	12 13	28.12
Shadnagar	22	18 14 01	13 03	55.88
Shadnagar	24	19 54 39	08 06	7.8
Matera	25	21 39 42	12 37	34.85
Matera	26	23 18 06	12 09	24.98
Shadnagar	30	06 29 29	12 56	48.09
Shadnagar	31	08 15 59	08 59	10.0

ROSA

Radio Occultation Sounder for Atmosphere

agenzia spaziale italiana