



CENTRE NATIONAL D'ÉTUDES SPATIALES



SARAL / ALTIKA



- SARAL Program is a joint mission conducted by ISRO and CNES dedicated to environmental, mainly oceanic, monitoring.
 - ◆ SARAL and ARGOS-3/SARAL MoU signed on February 2007
- Two missions are on-board the SARAL satellite which is based on the ISRO SSB (Small Satellite Bus) platform :
 - ◆ ALTIKa mission
 - ◆ ARGOS-3 mission

} SARAL ⇔ Satellite with ARgos and ALtika
- SARAL Orbit:
 - ◆ Polar (incl. = 98.55°) and Sun-Synchronous orbit
 - local time at ascending/descending node : 6 am / 6 pm
 - ◆ 800 km altitude, low eccentricity
 - ◆ same orbit/ground-track as ENVISAT, complementary to Jason2 ground-track
 - ◆ Ground-track repetition period : 35 days
 - Ground-track stability requirement: +/- 1 km
- SARAL mission lifetime requirement : 5 years of exploitation,
 - ◆ to be continued as long as the satellite and ground components will be operational
 - ◆ ARGOS-3/SARAL lifetime requirement: 5 years of operations, *objective : 7 years*
 - ◆ AltiKa/SARAL lifetime requirement: 3 years of operations, *objective : 5 years*

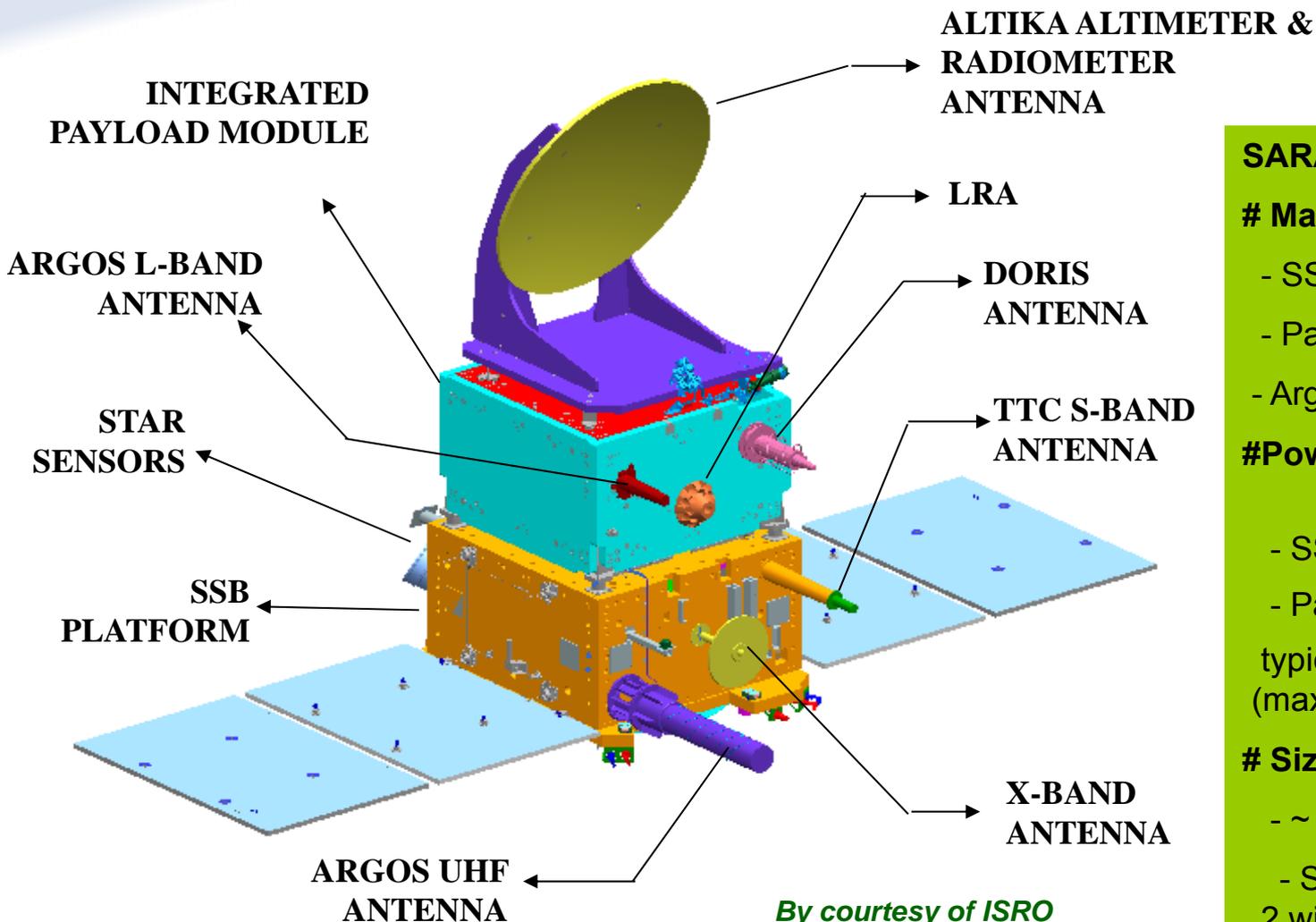
AltiKa mission is an answer to the need expressed by scientific oceanography community (IGOS, GODAE, OSTST,..) since 2000: « *Continuity of high accuracy, high resolution near-real time observations of the ocean surface topography is required. At least, 2 simultaneous altimetry missions are required (including one of the Jason reference class) »*

-  This required to prepare a post-ENVISAT mission that would fly at the same time as JASON2 (launched on June 2008), to fill the gap between JASON1&2/ENVISAT and JASON3/SENTINEL3A.

■ AltiKa mission

- ◆ **Approved by CNES Governors Board on December, 2005**
- ◆ **Research oriented altimetry mission but with operational products**
 - new instrument with higher frequency (**Ka-band**), larger chirp bandwidth (480 MHz), PRF ~4KHz (variable along the orbit):
 - enhanced performances expected from the improved spatial & vertical resolutions
 - but with a consolidated architecture : conventional **nadir** altimeter,
 - DORIS/DIODE aiding and DEM tracking modes are available (same modes as on JASON2)
 - embedding a bi-frequency K/Ka band radiometer sharing the same antenna.
 - **Operational** products: Near Real Time (OGDR) and Off-line products (IGDR, GDR)
- ◆ **AltiKa scientific objectives**
 - Main mission objective remains the ocean meso-scale variability study,
 - But with expected contributions to :
 - coastal altimetry, inland waters and ice sheets monitoring, light rainfall and clouds climatology,
 - geodetic reference system determination thanks to Doris and to Laser Retro-reflector Array

SARAL satellite



By courtesy of ISRO

SARAL sat. characteristics

Mass : < 400 kg

- SSB platform : ~215kg
- Payload Module : 163 kg
- Argos UHF antenna: 5 kg

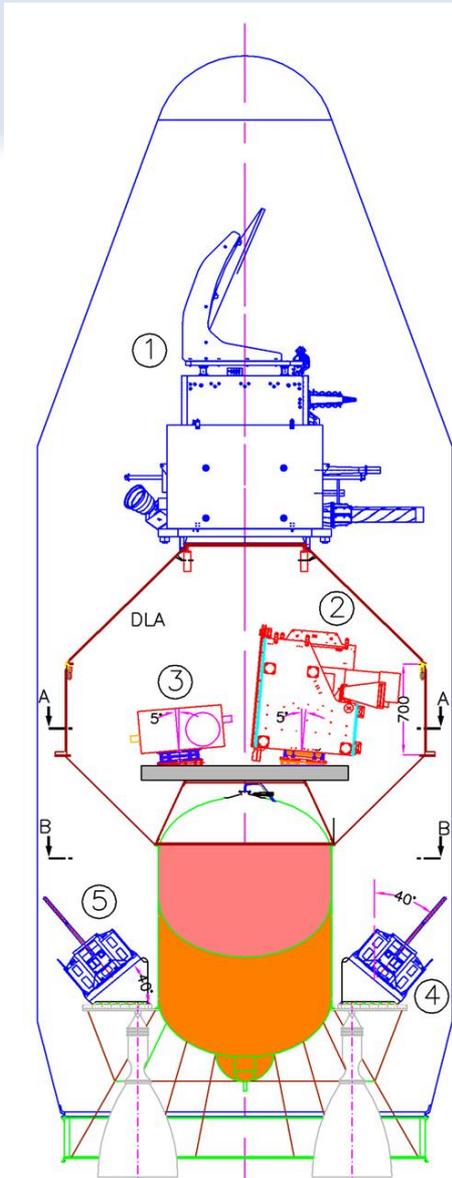
#Power : 850W / 720W (BOL / EOL)

- SSB platform: ~ 200W
- Payload Module:

typical consumption <250 W
(max consumption < 350 W)

Size

- ~ 1m x ~1m x 2.7 m
- Solar panels :
2 wings of 1.2m x 1.62m



S. No.	SPACECRAFT (MASS kg)
1	SARAL (400)
2	SAPPHIRE (160)
3	NEOSAT (82)
4	NLS-8.1 (14)
5	NLS-8.2 (14)
6	NLS-8.3 (3)
7	DLA (200)

■ SARAL will be launched on PSLV-C20

■ SARAL Launch date : 2nd quarter of 2012

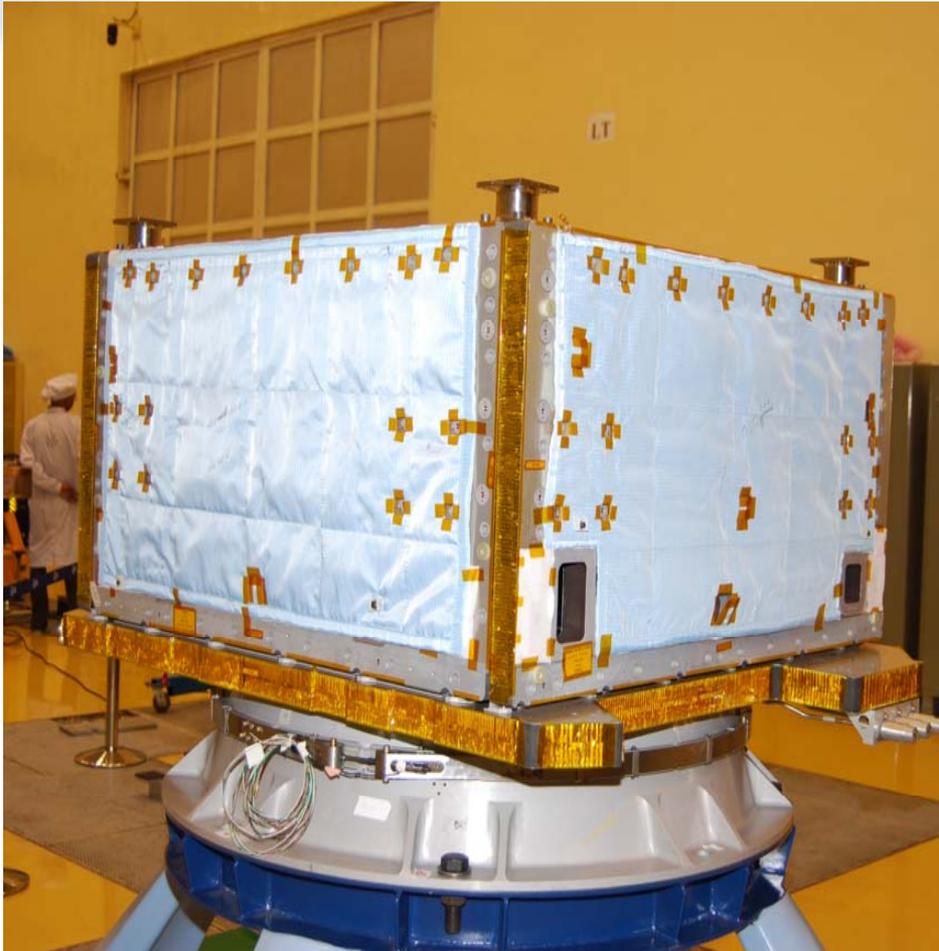
- ◆ Megha-Tropiques, PSLV-C18 : launched on Oct 12th, 2011
- ◆ RISAT-1, PSLV-C19 : beginning of Q1-2012

By courtesy of ISRO



- SARAL PIM has been fully integrated and qualified in France
 - Qualification tests completed on July 2011
 - Presently stored in THALES/Toulouse premises
 - *SSB platform integration is currently going on in ISRO/ISAC*

SARAL PIM during mechanical qualification tests (June 2010- THALES/Cannes facilities)



- SSB structure delivered in July '11
- SSB Sub-systems FM deliveries range from July to November '11
- SSB platform integration and validation is to be completed by ISRO before end of 2011

By courtesy of ISRO

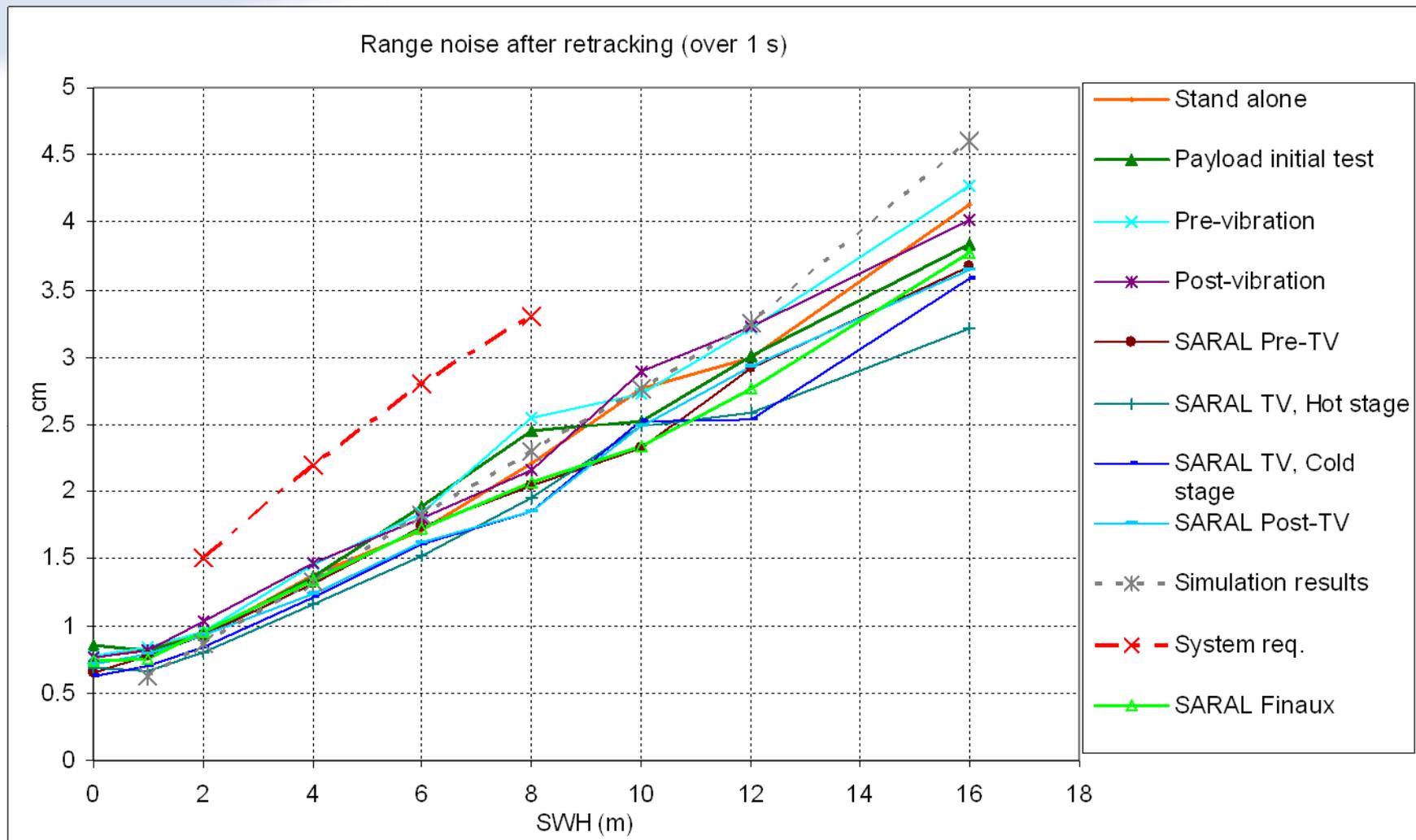


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 - Qualification tests completed on July 2011
 - Presently stored in THALES/Toulouse premises
 - *SSB platform integration is currently going on in ISRO/ISAC*
 - PIM delivery to ISRO/ISAC (Bangalore) is planned : Dec. 2011 / Jan. 2012

- PIM Qualification tests :
 - all PIM instruments performances are fully compliant with the mission specifications,
 - Radiometer sensitivity better than 0.16 K (K band) / 0.17 K (Ka band)
 - Radiometer absolute bias better than +/- 0.2K in K and Ka bands.

SARAL PIM during mechanical qualification tests (June 2010- THALES/Cannes facilities)

Example of AltiKa altimeter performances through PIM qualification tests



AltiKa Data Products error budget (in cm)

(for 1s average, 2m SWH, 1dB σ)	OGDR 3 Hours	IGDR 1.5 days	GDR 40 days	GOALS
Altimeter noise	1.5	1.5	1.5	1
Ionosphere	0.6	0.3	0.3	0.3
Sea state bias	2	2	2	2
Dry troposphere	1.5	0.7	0.7	0.7
Wet Troposphere	1.2	1.2	1.2	1
Altimeter range after corrections (RSS)	4.5	3.5	3.5	2
Orbit (Radial component) (RMS)	Req : 30 Goal : 10	Req : 4 Goal : 2.5	Req : 3 Goal : 2	2
Total RSS Sea Surface Height	Req : 30.5	Req : 5.3	Req : 4.6	2.8

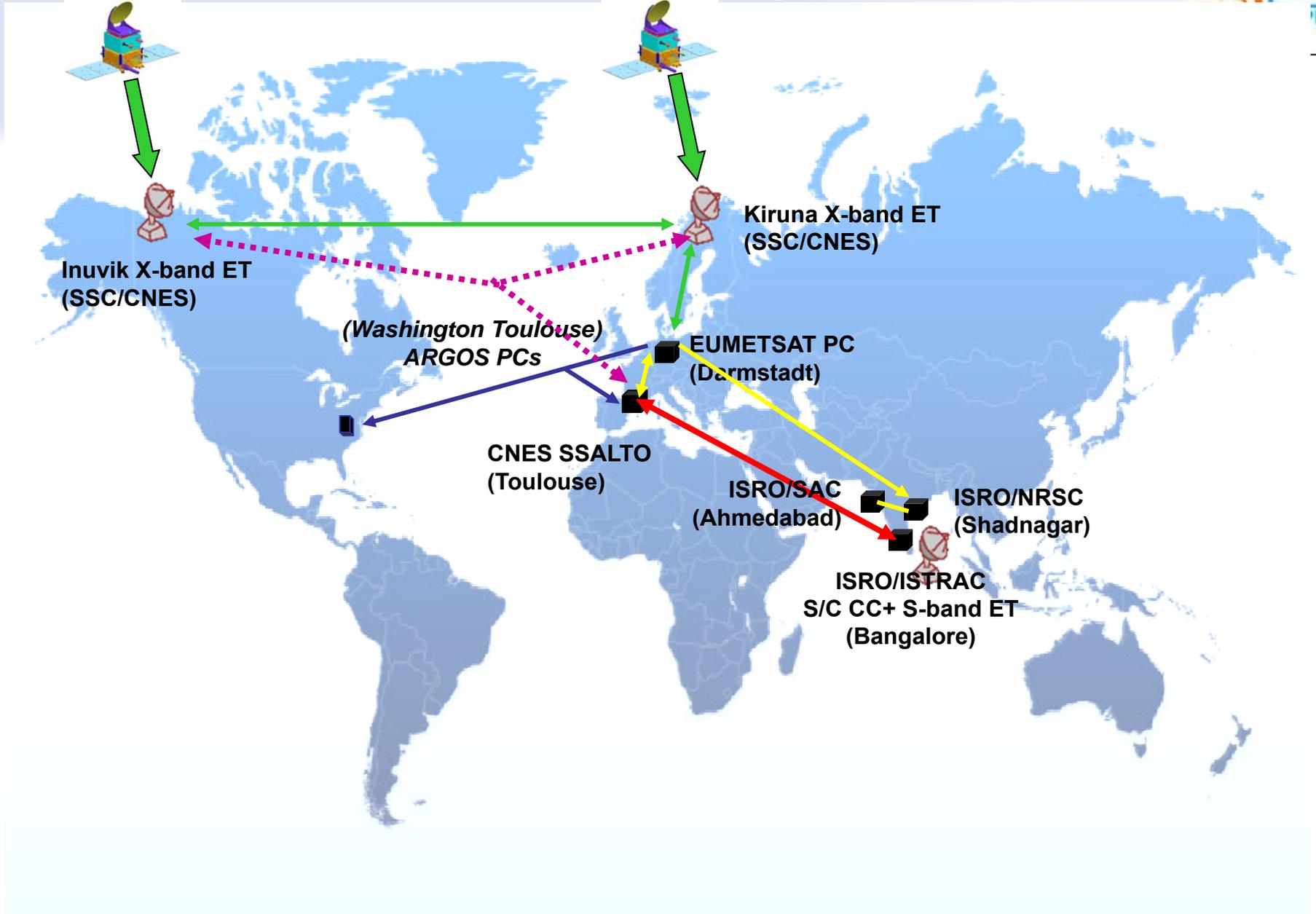
better than 5cm rms (radial component) expected thanks to the use of DORIS/DIODE software issue 11

Product	OGDR	IGDR	GDR
Content	geophysical level 2 product Fast QC&C	geophysical level 2 product QC&C	fully validated geophysical level 2 product
Latency	3-5 hours	< 1.5 days	~ 40 days
1-Hz	OGDR-SSHA	IGDR-SSHA	GDR-SSHA
1-Hz 40-Hz	OGDR	IGDR	GDR
Waveforms	-	S-IGDR	S-GDR
Structure	acquisition segment	pass	pass
Packaging	segment	day	7-days arc

“Official AltiKa products” : same standards as JASON 2, but...

Prototyping of different algorithms for retracking over ice and coastal areas, for wet tropospheric delay correction, for correction of rain and clouds impacts on waveforms, ... is foreseen;

Release of “unofficial products” for evaluation (PISTACH) is anticipated.



- **April 2009** : 1st SARAL/AltiKa Science Workshop held in ISRO/SAC Ahmedabad
 - ◆ 1st meeting of ISRO-CNES SARAL Joint Science Working Group
- **December 2009** : Release by ISRO & CNES of the SARAL/AltiKa Announcement of Opportunity for carrying out scientific research towards the utilization of SARAL/AltiKa data.
- **April 2010** : Selection by ISRO & CNES of SARAL/AltiKa PIs who will form the SARAL/AltiKa Science Team
 - ◆ 2nd meeting of ISRO-CNES SARAL Joint Science Working Group
 - ◆ **Total of 64 PIs selected** :
 - 23 proposals from Indian Institutions
 - 16 proposals from 7 French Institutions
 - 27 proposals from “foreign” Institutions: USA (11), Europe (10) (Spain 3, Germany 3, UK 2, Portugal 1, Greece 1), Australia (3), Taiwan (1), Japan (1), Brazil (1)
 - ◆ **Good coverage of the topics / adequacy to the call** : CALVAL global & *in situ*, parameter analysis & reprocessing, coastal/regional altimetry & ocean dynamics, operational/model/assimilation, continental waters, ice, mean sea level, bathymetry...
- **March 2011**: 2nd SARAL/AltiKa Science Workshop held in ISRO/SAC Ahmedabad
 - ◆ 3rd meeting of ISRO-CNES SARAL Joint Science Working Group
 - ◆ Validation and release of “**ALTIKA Science Plan**” and “**SARAL/AltiKa CALVAL Plan**” documents : *available on AVISO and MOSDAC websites*

SARAL Mission Phases and associated responsibilities

