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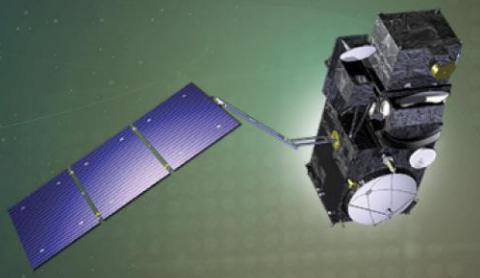

7th Sentinel-3 Validation Team Meeting 2022

18-20 October 2022 | ESA-ESRIN | Frascati (Rm), Italy

Instrumental and Absolute Calibration

Pablo G.[1], Albert GM.[1], Adrián F .[1], Stelios M.[2], Antonio M.[3]

[1]isardSAT, [2]Technical University of Crete, [3]RAME

Outline

- Instrumental Calibration
  - CAL1
  - CAL2
  - AutoCal
  - Thermal
  - USO

- Absolute Calibration
  - Sigma-0 Leonessa Transponder Status
  - Processing Results

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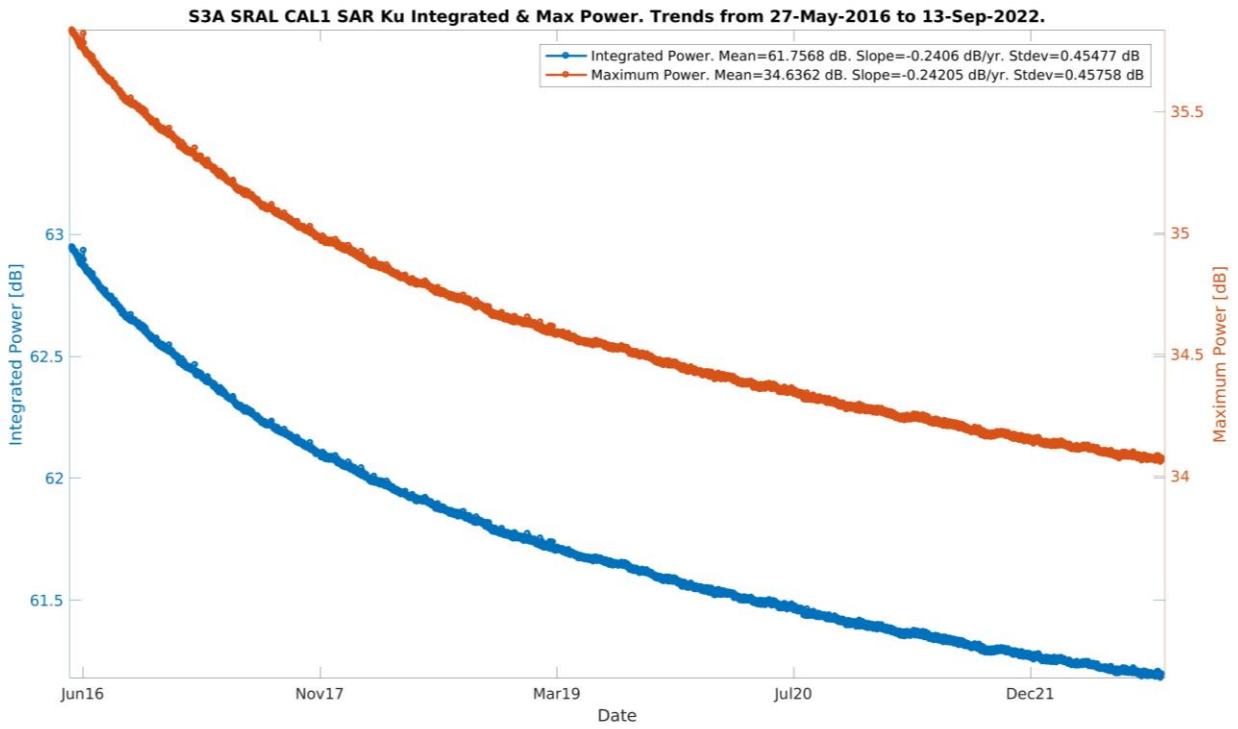
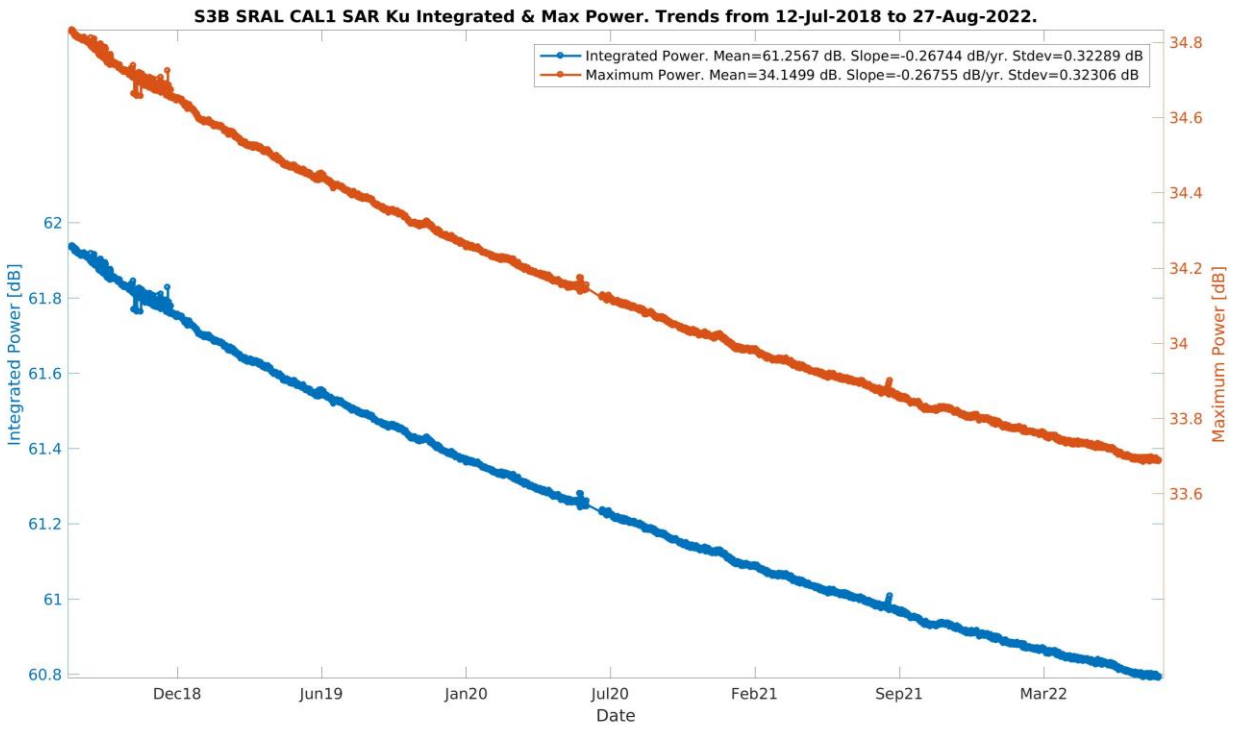
Instrumental Calibration

Main message to give: both S3A and S3B missions are in good shape.

CAL1 SAR Ku Power is now stabilized

S3A: -0.24 dB/year ------- S3B: -0.27 dB/year -------- S6: -0.9 dB/year

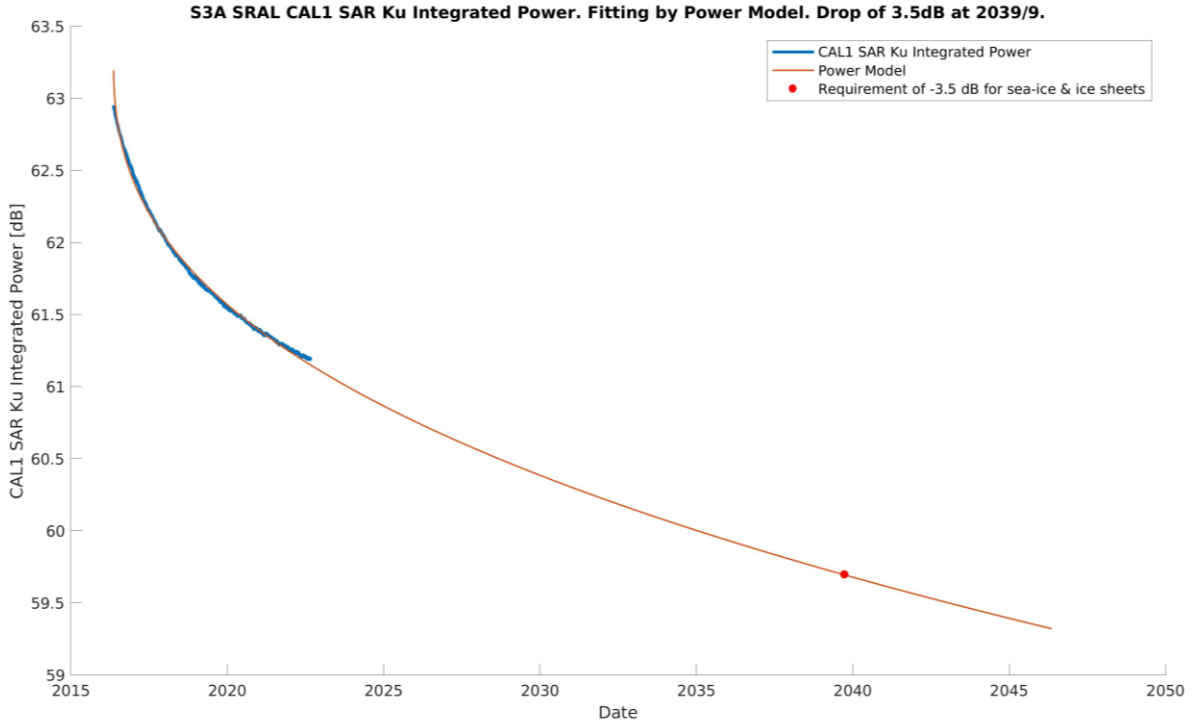


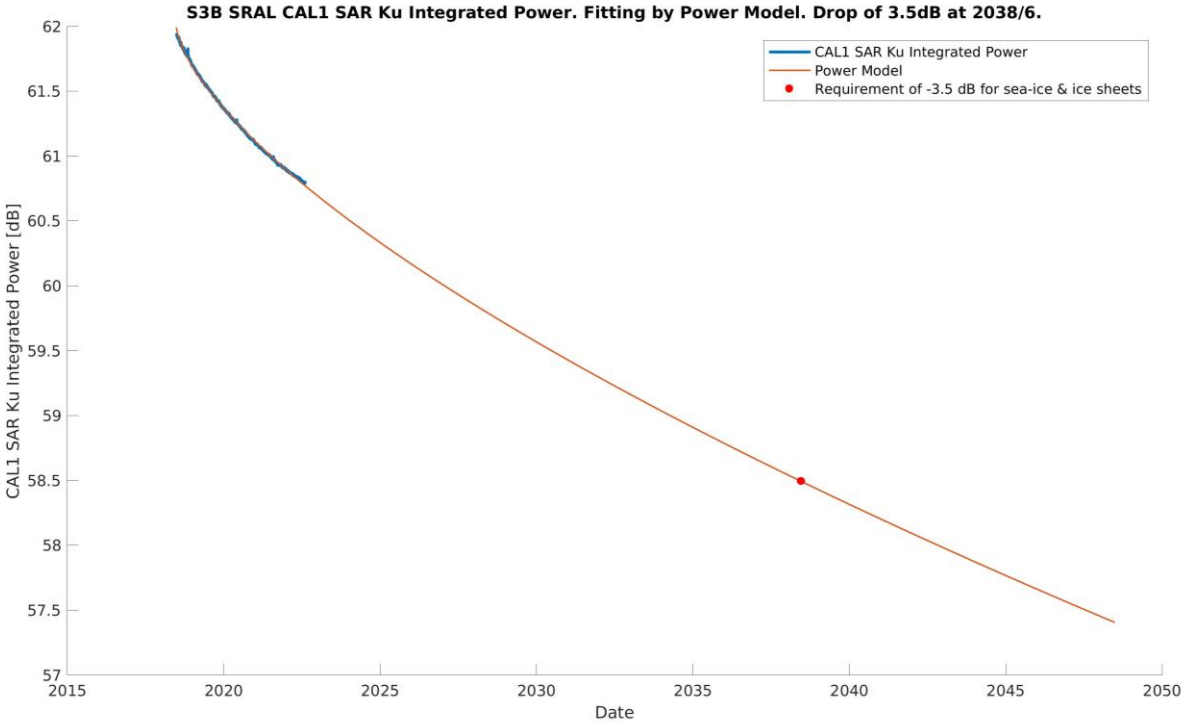


Instrumental Calibration

CAL1 SAR Ku Power is now stabilized

Around 20 years of mission to reach the critical SNR point.

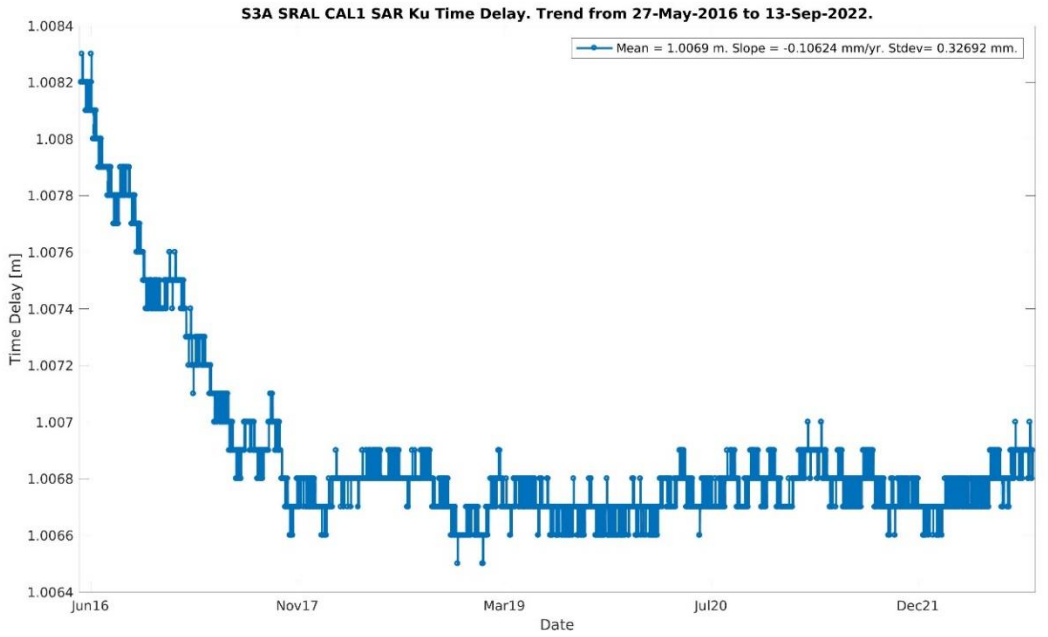


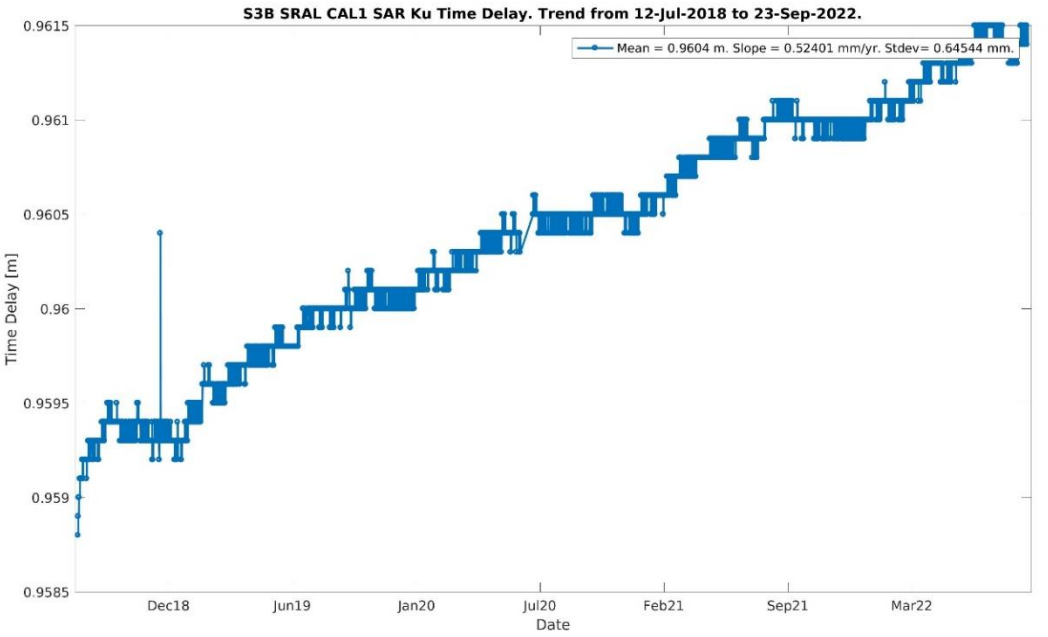


Instrumental Calibration

CAL1 SAR Ku Delay

S3A: -0.1 mm/year ------- S3B: 0.5 mm/year -------- S6: -5.3 mm/year

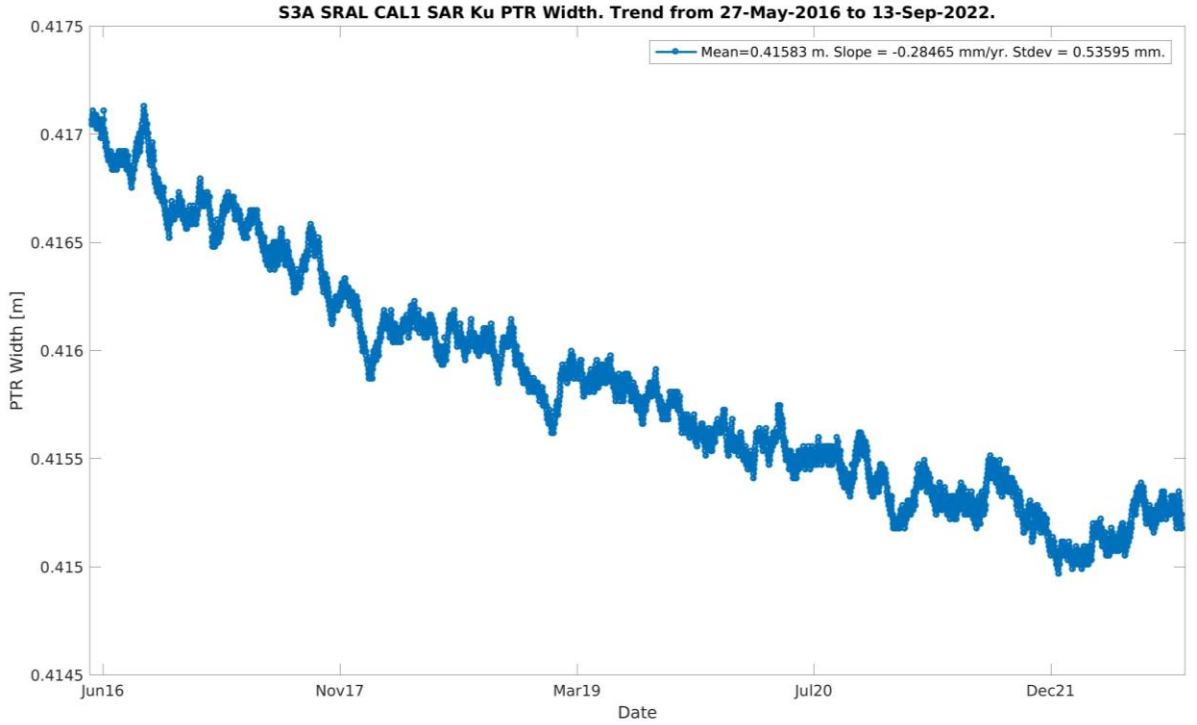


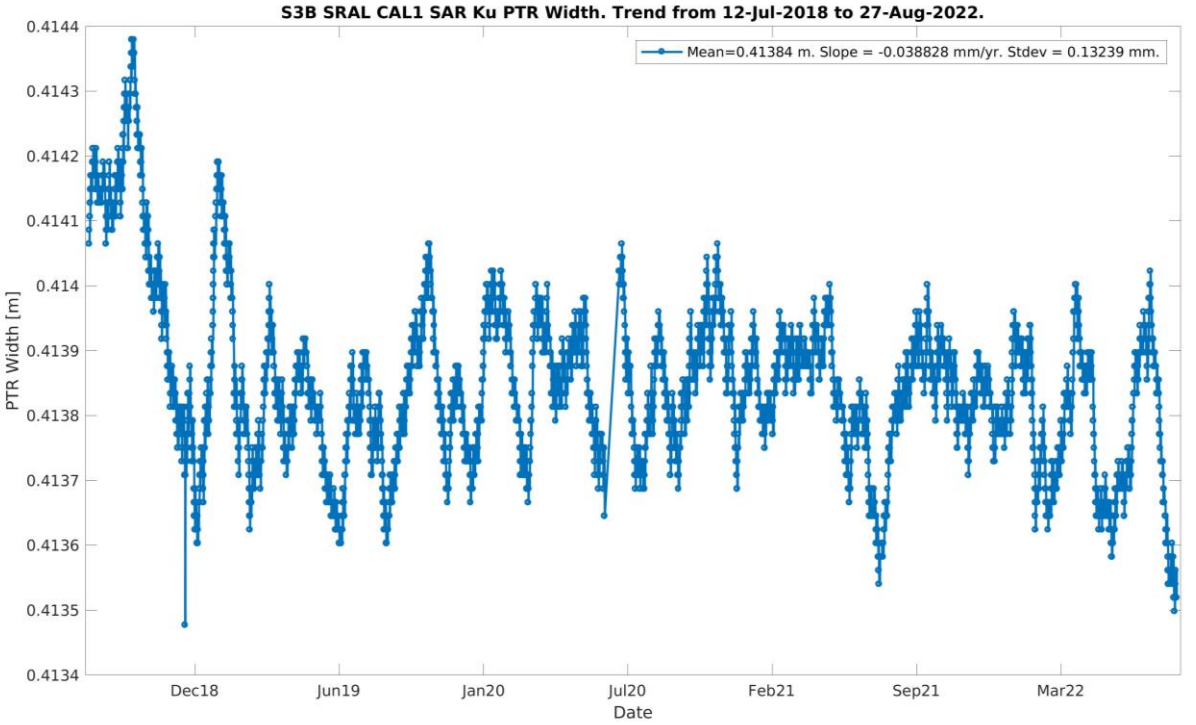


Instrumental Calibration

CAL1 SAR Ku PTR width

S3A: -0.3 mm/year ------- S3B: 0 mm/year -------- S6: -0.4 mm/year



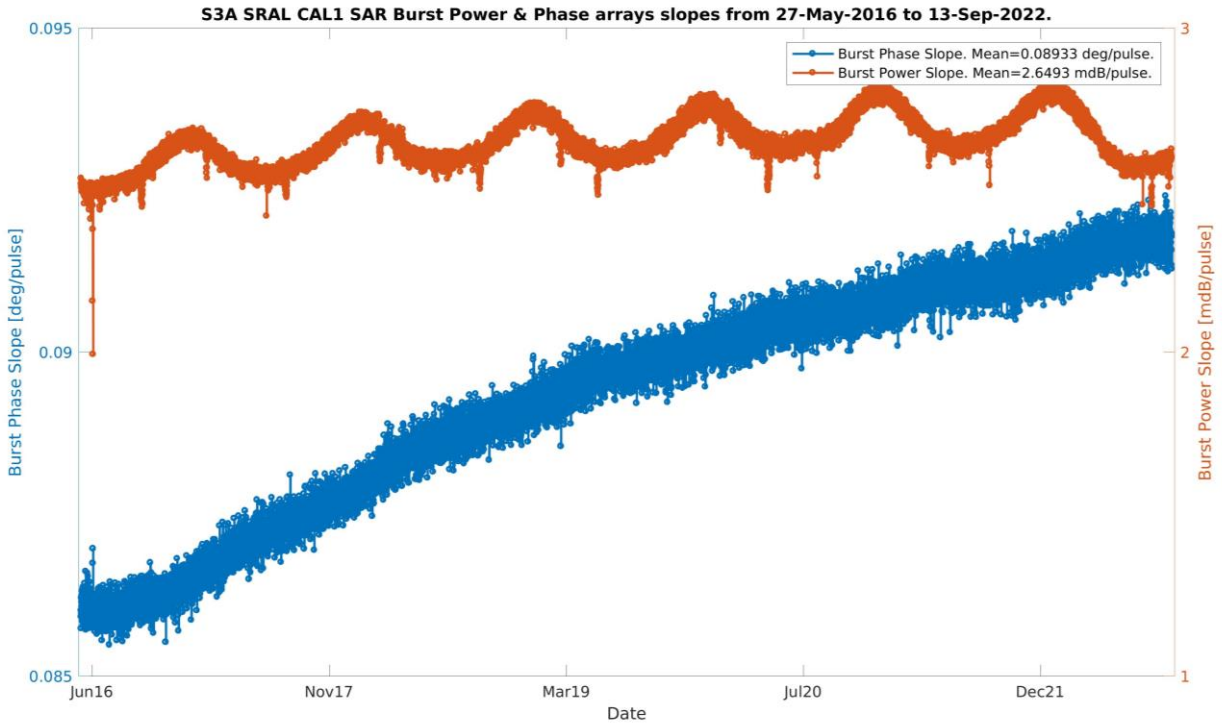


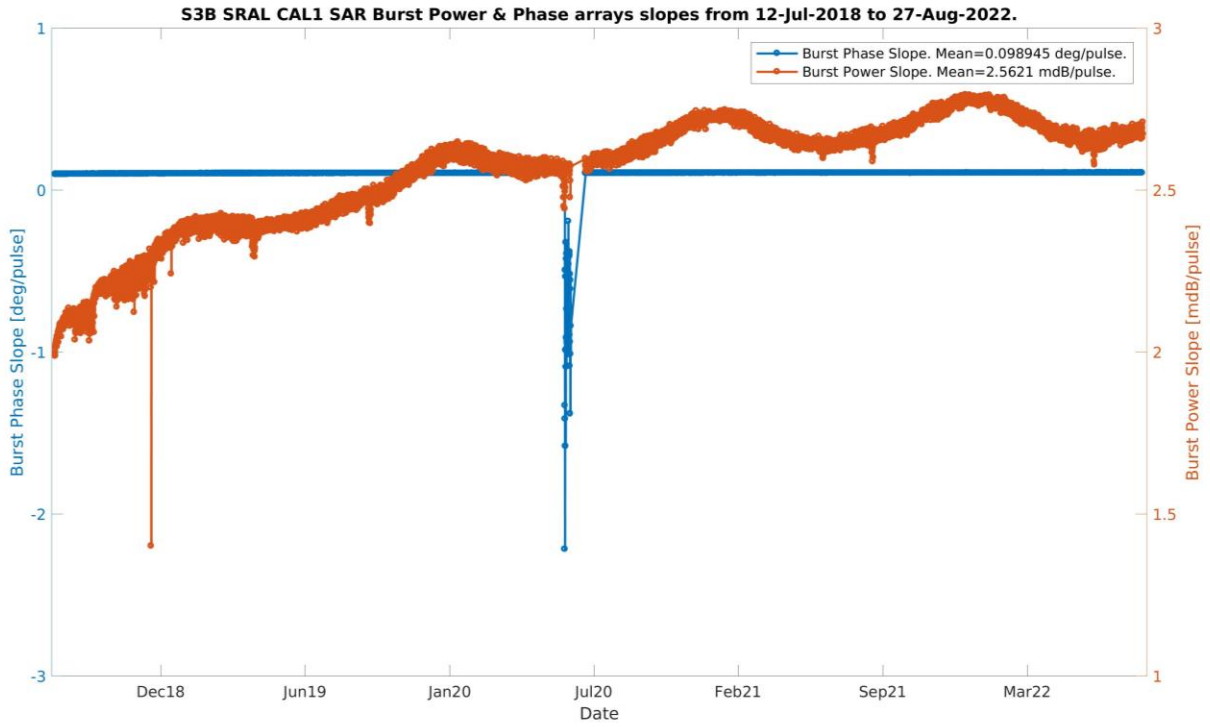
Instrumental Calibration

CAL1 SAR Ku Burst Corrections

Mean Burst Phase → S3A: 0.09 deg/pulse ------ S3B: 0.10 deg/pulse -------- S6: -0.003 deg/pulse

Mean Burst Power → S3A: 2.65 dBe-3/pulse --- S3B: 2.56 dBe-3 /pulse ---- S6: -0.44 dBe-3 /pulse

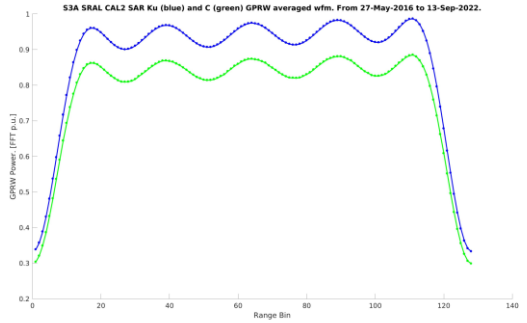


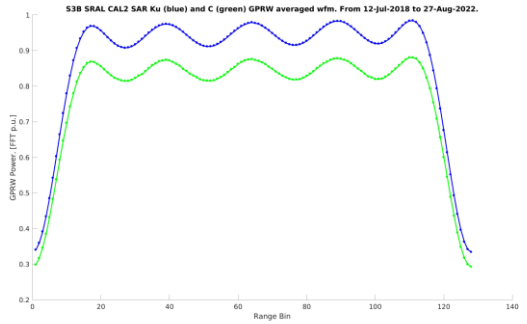


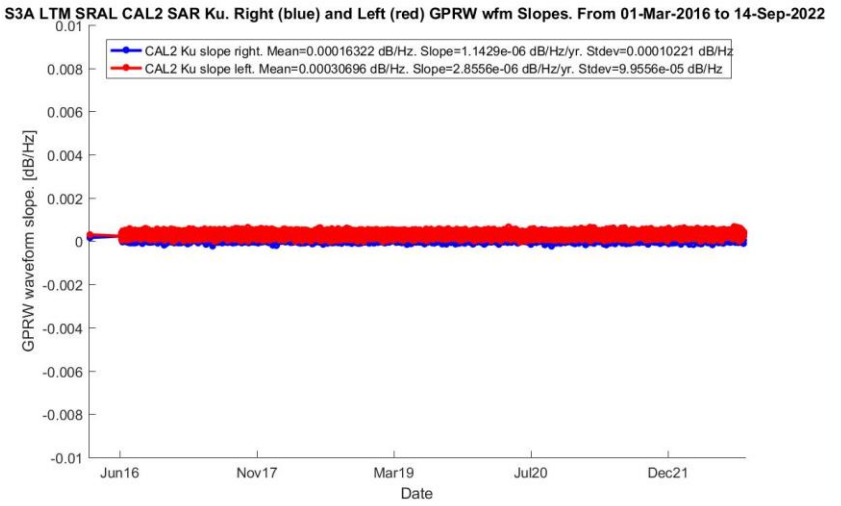
Instrumental Calibration

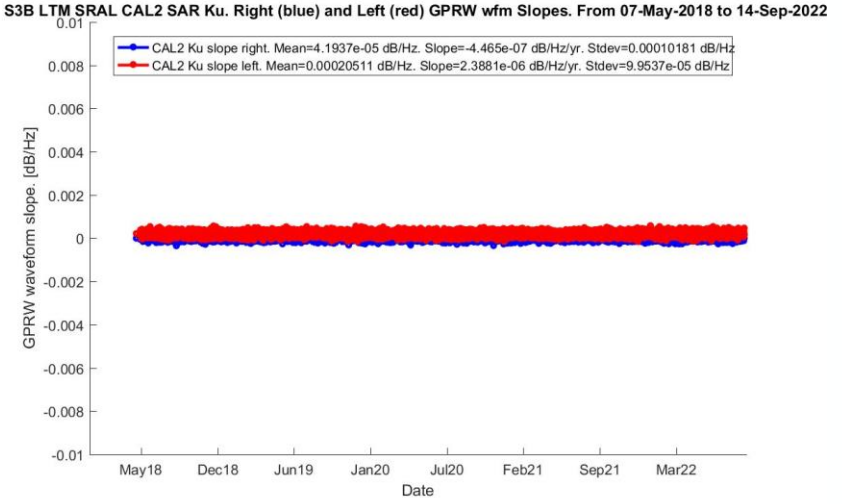
CAL2 SAR Ku

Stable behaviour of the Rx channel Transfer Function







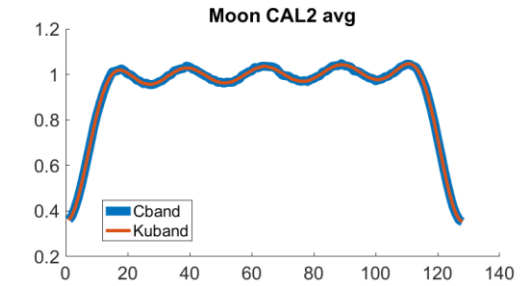


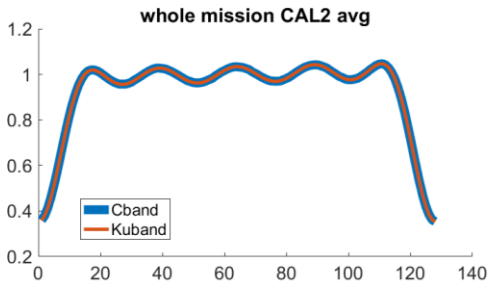
Instrumental Calibration

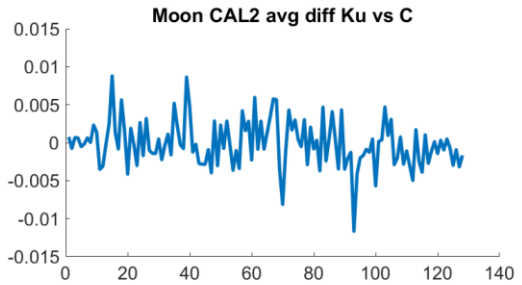
CAL2 SAR Ku

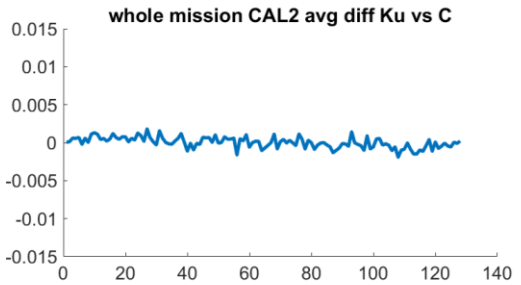
Moon Calibrations

S3A

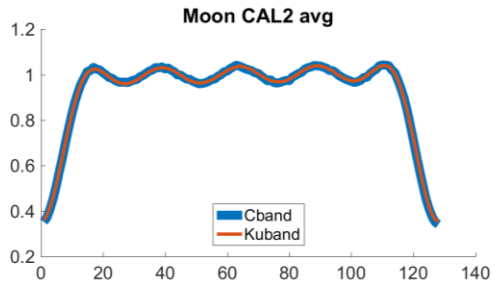


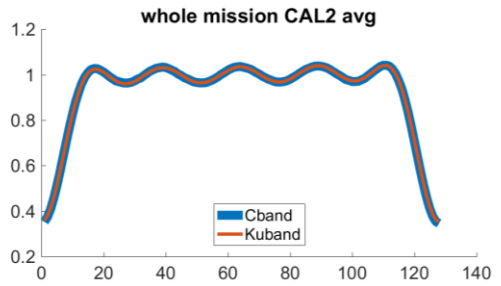


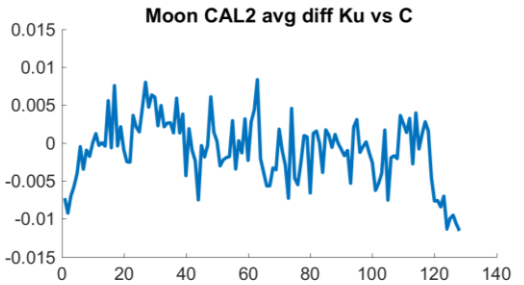


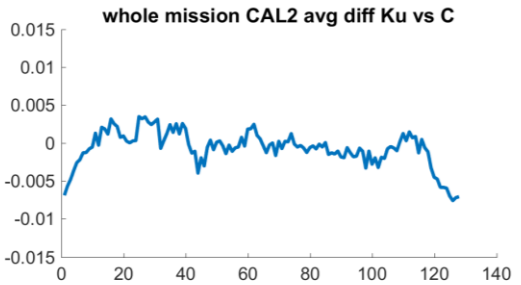


S3B





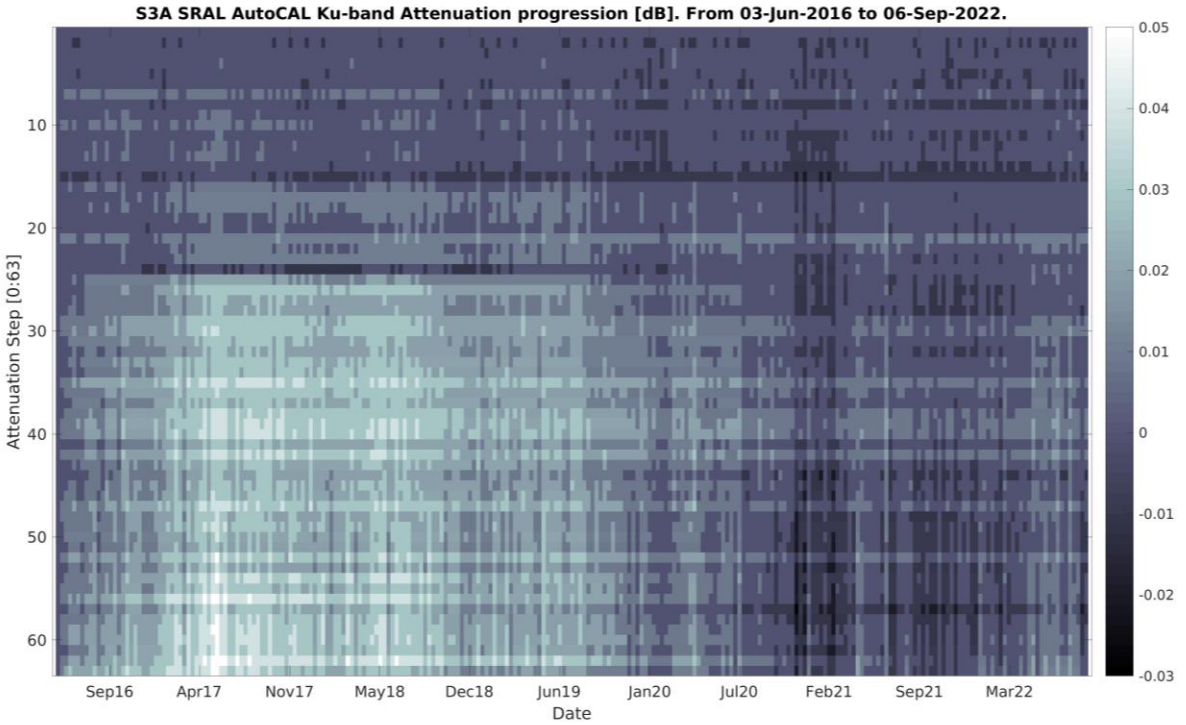


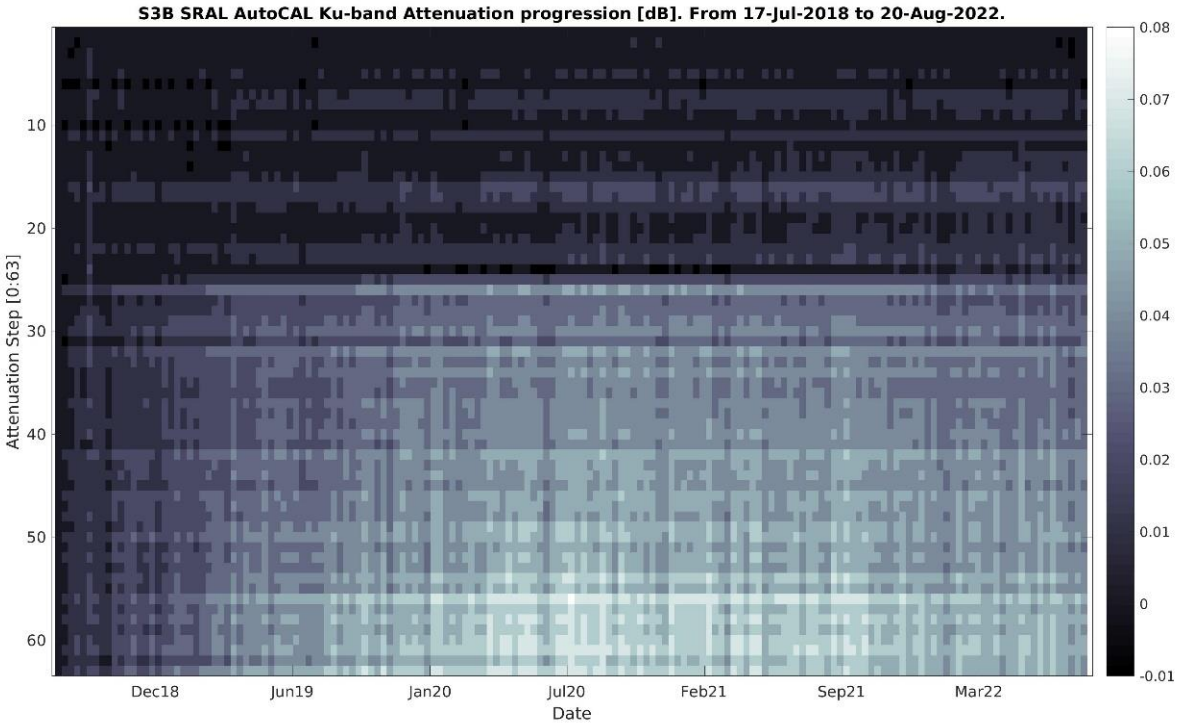


Instrumental Calibration

AutoCal

Small power excursions of the ATT steps actual attenuations

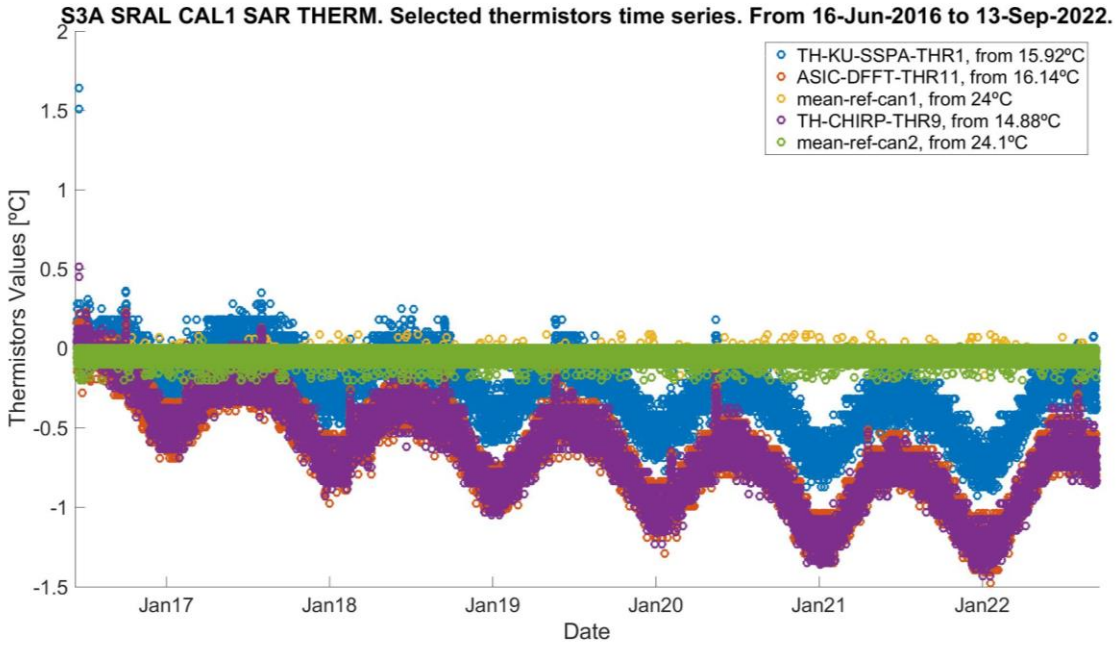


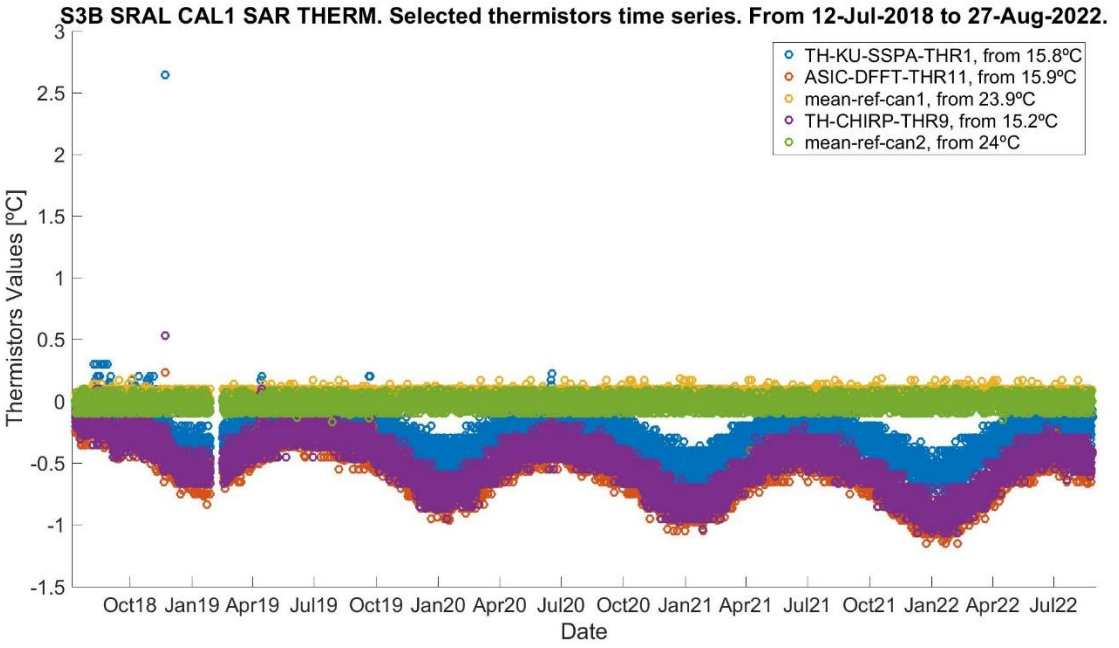


Instrumental Calibration

Thermal behaviour

Annual oscillations and some spikes due to SLSTR decontamination events or switch-off/on.

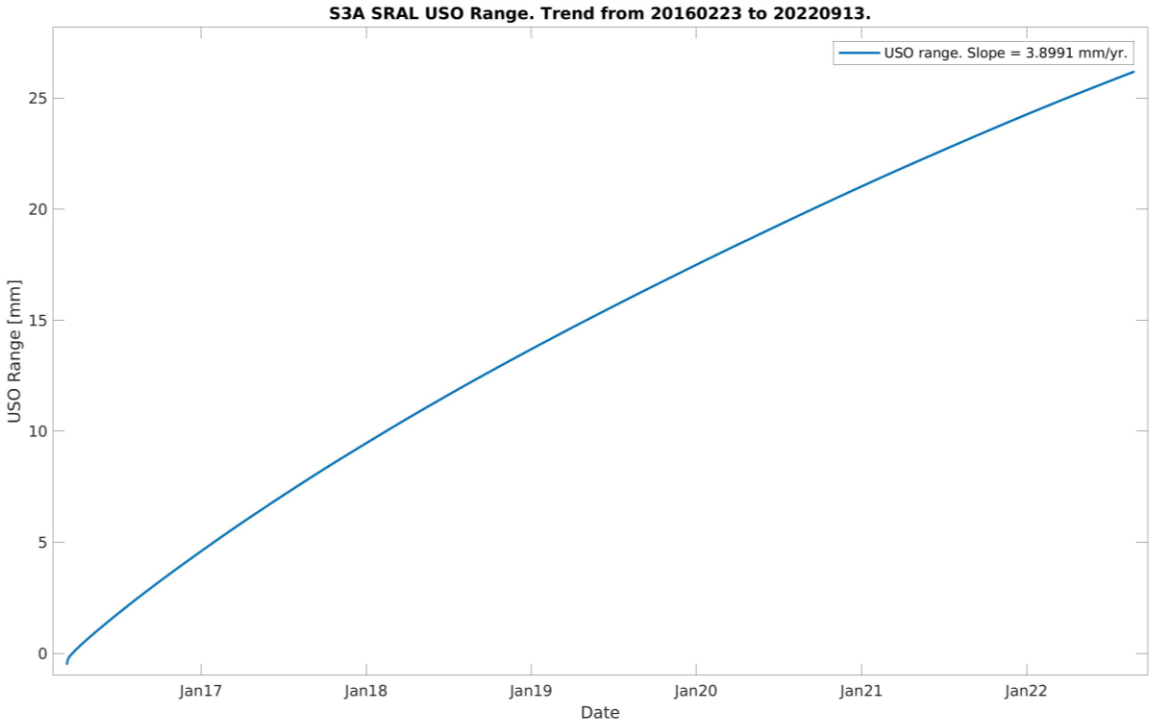


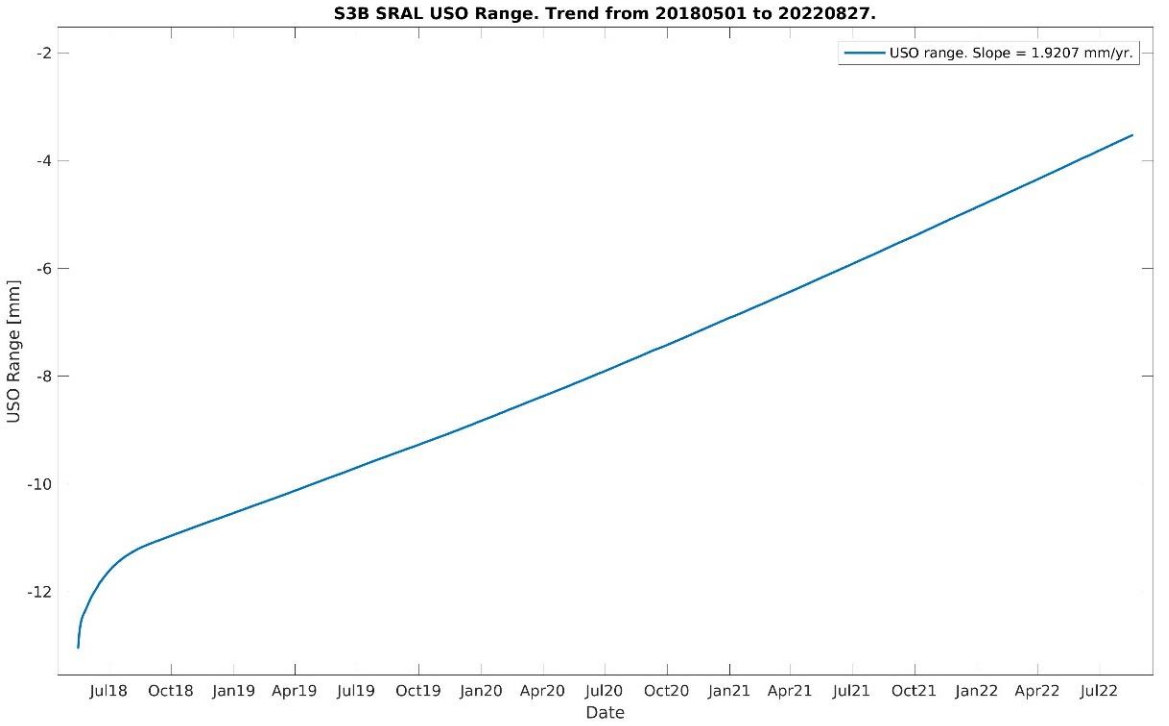


Instrumental Calibration

USO frequency impact in the range

Expected behaviour: S3A: 3.9 mm/year ------- S3B: 1.9 mm/year -------- S6: 3.2 mm/year





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S3 Absolute Calibration Infrastructures

Transponders Range & datation

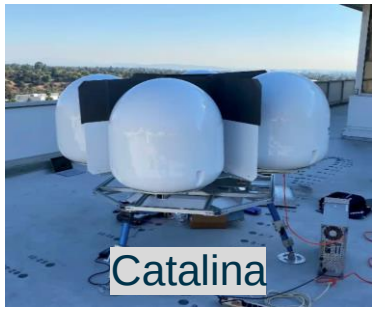
esa

ΠΟΛΥΤΕΧΝΕΙΟ ΚΡΗΤΗΣ
TECHNICAL UNIVERSITY OF CRETE

Transponder Sigma0

r.a.m.e.

Transponder Range, datation, sigma0, Ku & C

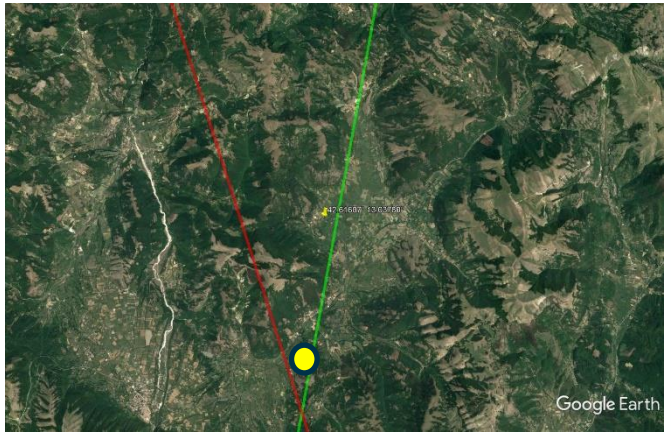


JPL
Jet Propulsion Laboratory
California Institute of Technology

Corner Reflector Range, datation, sigma0

isardSAT

S3 Absolute Calibration Infrastructures: The Leonessa Sigma0 TRP



- 400 m to S3B desc. pass
- 2.6 km to S3A asc. pass

Fenced area, equipped with a box for sheltering auxiliary instrumentation:

- weather station
- telecom station (modem, antenna and network)
- UPS backup power
- remote PLC board controlled by PC
- PTZ cameras for surveillance.

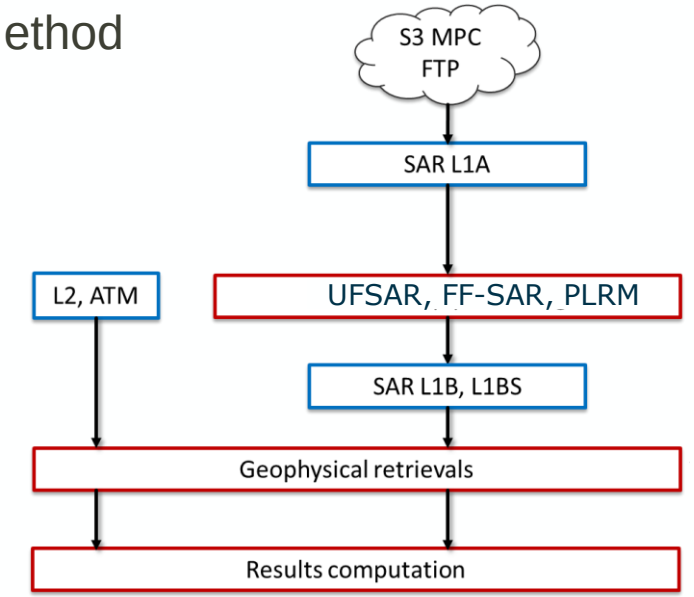
First overflight test: 4 days ago

SUCCESFUL!!

S3 Absolute Calibration: **Crete** TRP processing

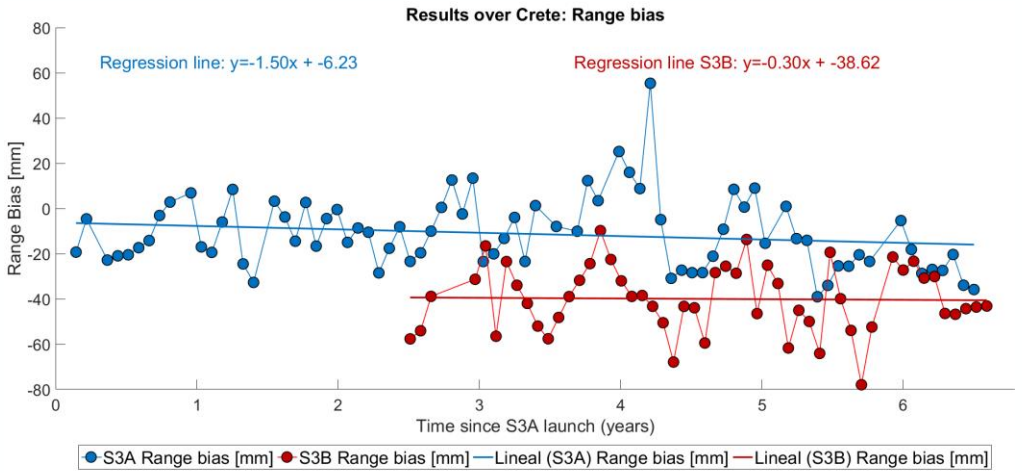
- Input data:
  - L1A data processed with IPF-SR-1 version 6.20
  - L2 data: Pole Tides + Ocean Loading.
  - In situ measurements: Atmospheric delays as Dry & Wet Tropospheric + Ionospheric, and the Solid Earth Tide

- Method

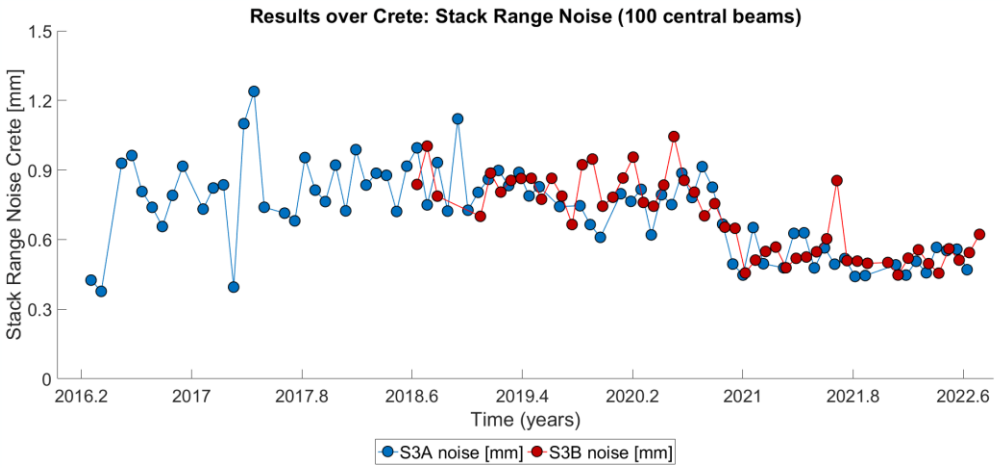


S3 Absolute Calibration: **Crete** TRP - S3A (78 passes) and S3B (52 passes)

RANGE BIAS



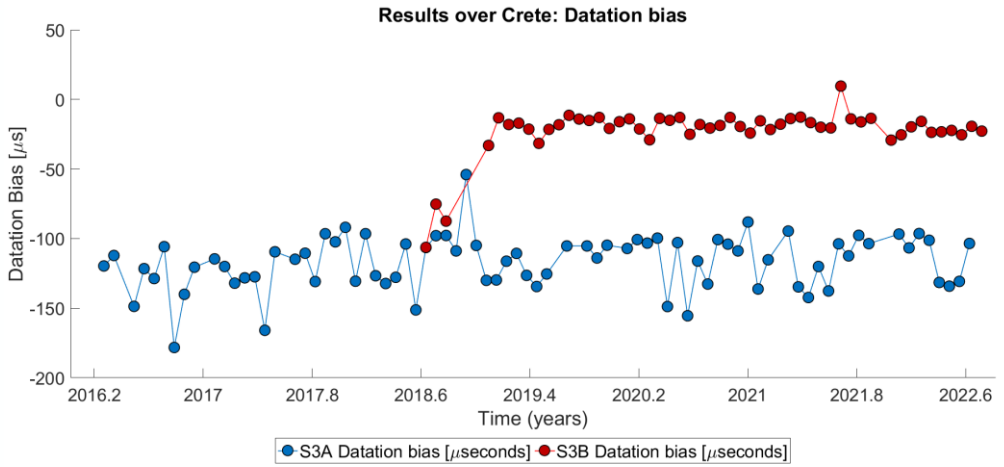
STACK RANGE NOISE



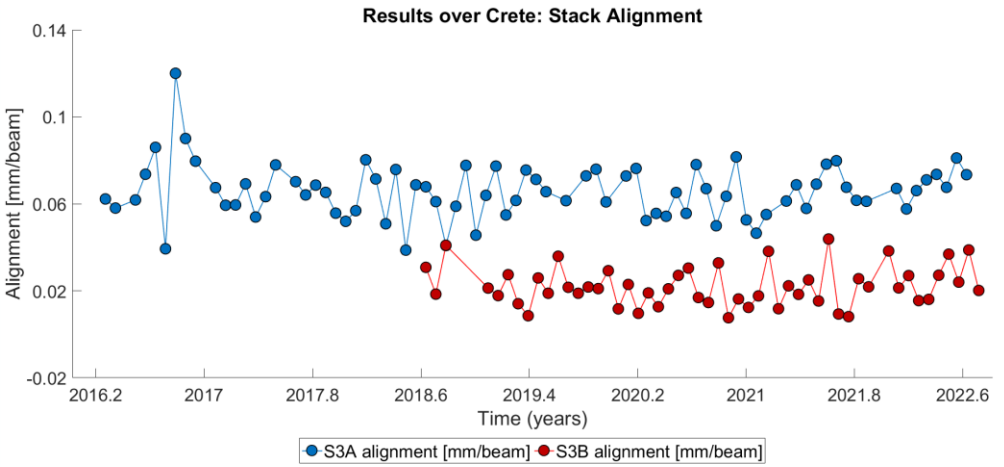
CRETE			Range bias [mm]	Datation bias [microseconds]	Stack Alignment [mm/beam]	Stack Noise [mm]
S3A	78 passes	Mean	-11.19	-117.23	0.06	0.73
		Standard Deviation	15.97	19.39	0.01	0.18
S3B	52 passes	Mean	-39.99	-22.67	0.02	0.69
		Standard Deviation	14.76	18.20	0.01	0.17

S3 Absolute Calibration: **Crete** TRP - S3A (78 passes) and S3B (52 passes)

DATATION BIAS



STACK ALIGNMENT



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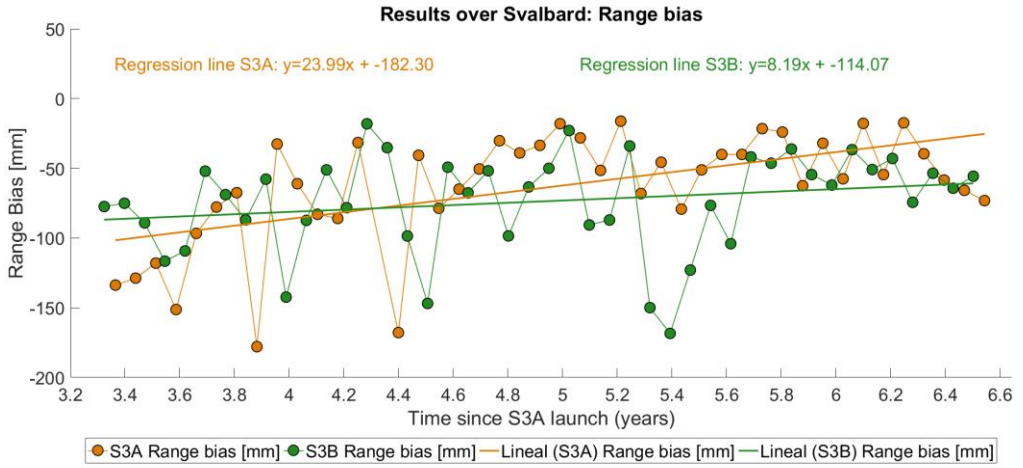
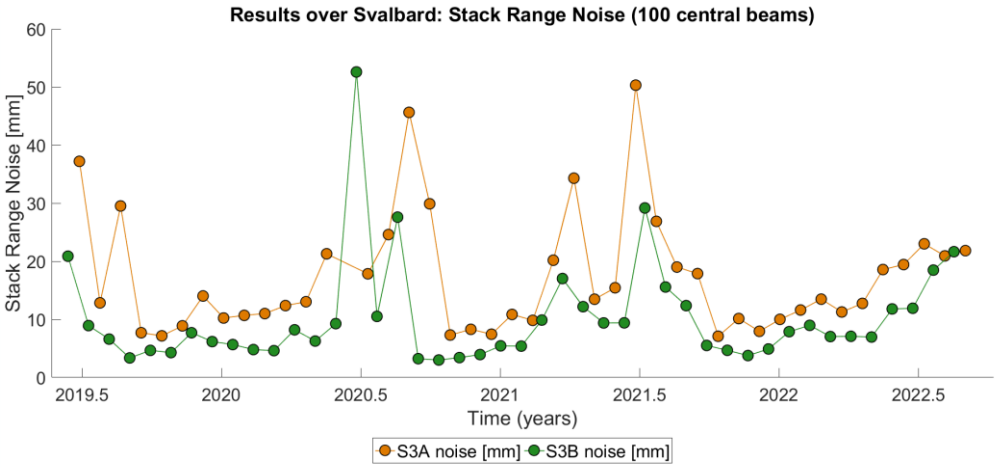
S3 Absolute Calibration: **Svalbard** TRP - S3A (43 passes) and S3B (44 passes)

RANGE BIAS



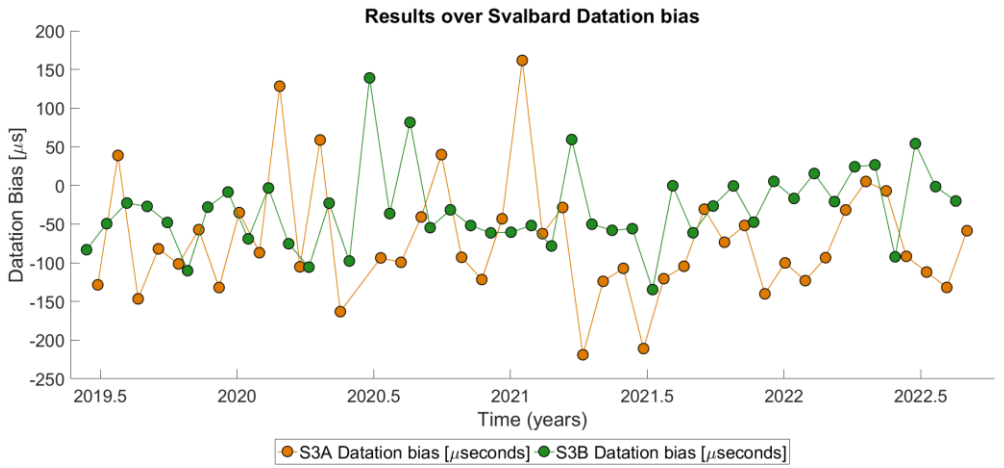
STACK RANGE NOISE



SVALBARD			Range bias [mm]	Datation bias [microseconds]	Stack Alignment [mm/beam]	Stack Noise [mm]
S3A	43 passes	Mean	-63.11	-72.58	0.06	17.28
		Standard Deviation	40.36	76.48	0.04	10.23
S3B	44 passes	Mean	-73.81	-30.88	0.02	10.27
		Standard Deviation	35.02	52.26	0.04	9.02

S3 Absolute Calibration: **Svalbard** TRP - S3A (43 passes) and S3B (44 passes)

DATATION BIAS



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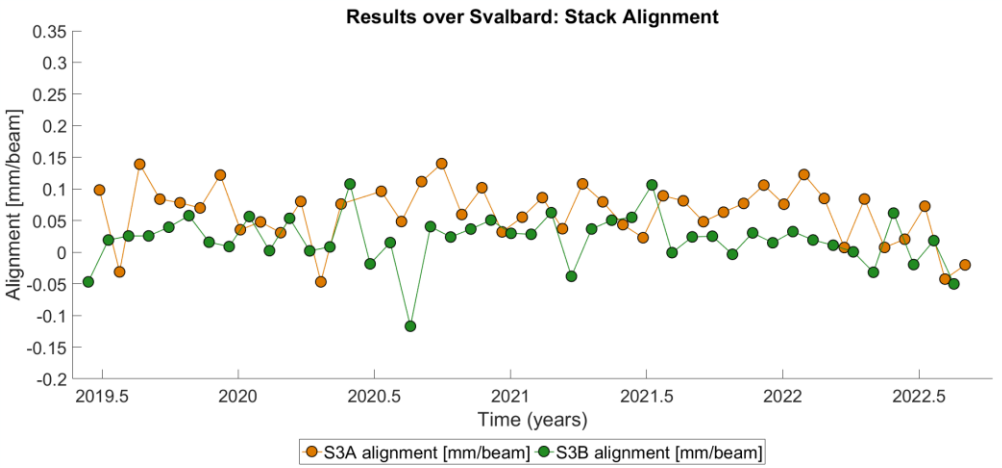

SVALBARD			Range bias [mm]	Datation bias [microseconds]	Stack Alignment [mm/beam]	Stack Noise [mm]
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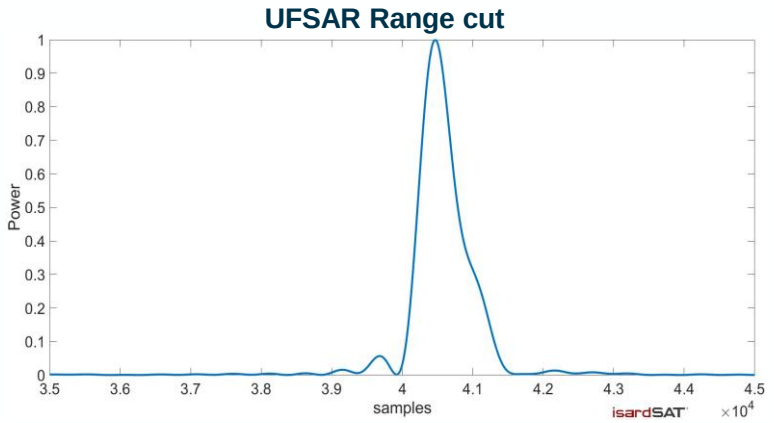
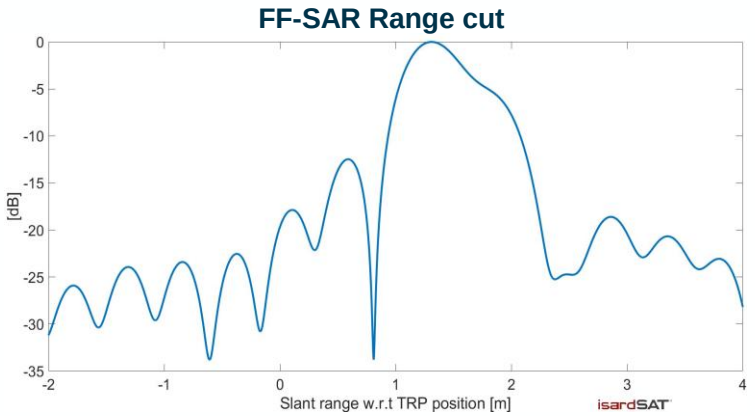
S3B	44 passes	Mean	-73.81	-30.88	0.02	10.27
		Standard Deviation	35.02	52.26	0.04	9.02

S3 Absolute Calibration: **Santa Catalina** TRP - S3A (5 passes)





Similar distortion seen in the S6 passes presented by Jean-Damien Desjonqueres in the S6 Transponder Working Group

5 passes		Range bias [mm]	Datation bias [microseconds]	Pu Antenna Flange bias [dB]
UF-SAR	Mean	1315	235.77	1.76
	Standard Deviation	12.54	55.89	0.52
FF-SAR	Mean	1304	99.92	2.9
	Standard Deviation	18.22	15.96	1.5

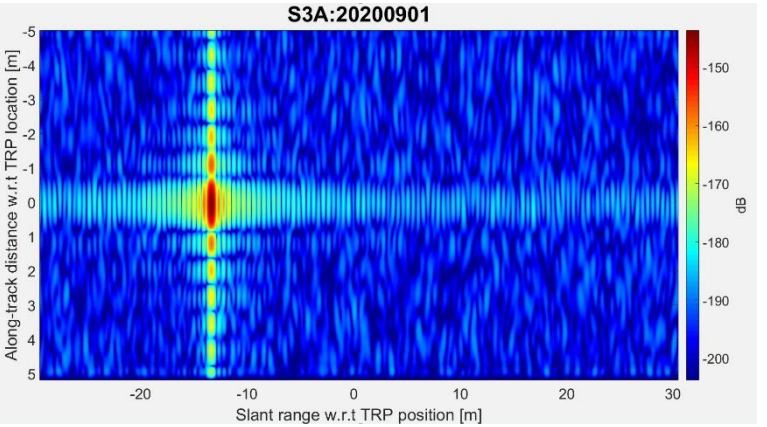
- Input data
  - L1A data (STC) processed with IPF-SR-1 version 6.20
  - Atmospheric corrections from L2
  - TRP position :
    Lat: 33.446692629º
    Lon: -118.479718873º
    Alt: 35.4290m
  - Internal delay : 6.5354 m (2-way)

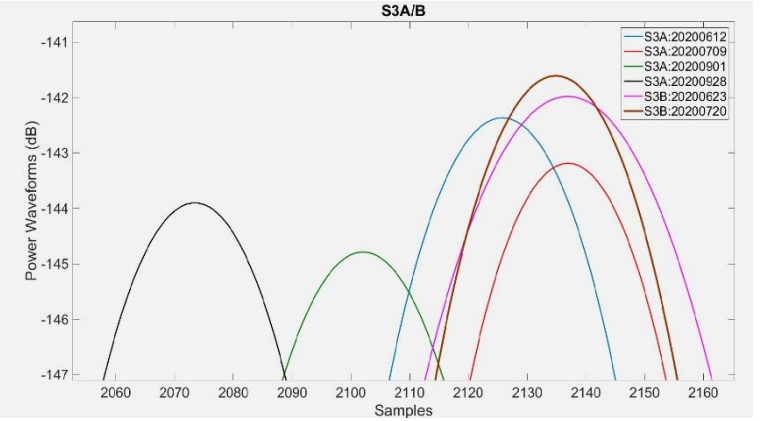
Results under investigation

S3 Absolute Calibration: **Leonessa Sigma0** TRP

From the previous campaign

Date	Mission	AGC (dB)	Atmospheric Correction 1-way (dB)	Delay Doppler SAR		FULLY FOCUSED SAR	
				RF Unit Input power (dB)	RCS (dBm^2)	RF Unit Input power (dB)	RCS (dBm^2)
12/06/20	S3A	13.2	0.52	-142.4	69.65	-142.77	69.28
23/06/20	S3B	0	0.55	-142.0	69.27	-142.36	68.91
09/07/20	S3A	0	0.55	-143.2	68.86	-143.17	68.89
20/07/20	S3B	0	0.57	-141.8	69.45	-142.4	68.85
01/09/20	S3A	0	0.51	-144.8	67.26	-143.67	68.39
28/09/20	S3A	0	0.48	-143.9	68.07	-143.47	68.5
Average				-143.01	68.76	-142.97	68.80
Expected values from SeRAC09 doc				-143.45	67.89	-143.45	67.89
Bias				**0.44 dB**	**0.87 dB**	**0.36 dB**	**0.91 dB**
Standard Deviation				**1.1 dB**	**0.92 dB**	**0.55dB**	**0.32 dB**





Thanks