

Inter-Agency Space Debris Coordination Committee



WG1 ASI activities

ASI activities

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- **Delegation and AI and IT ASI participation**
- **Optical facilities:**
SCUDO, RESDOS, MITO, SURGE, mini-SURGE
- **RADAR facilities:**
BIRALES

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ASI Delegation



- ASI – Coordination.
- Alessandra di Cecco

- University of Rome – La Sapienza – Optical measurements
- Fabrizio Piergentili
- Lorenzo Mariani



- INAF – Radioastronomical Institute – Radar measurements
- Germano Bianchi



- Politecnico di Milano – Radar Measurements
- Pierluigi di Lizia
- Mauro Massari
- Marco Felice Montaruli



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AI and IT participation

ASI

- **AI 38.2 - “Attitude motion characterization of LEO upper stages using different observation techniques**

Optical measurement of different targets to evaluate through light curves if they has stable attitude. The optical observation were made by two Sapienza observatory (RESDOS and SCUDO). All Tracking Data Message (TDM) observative campaign were made. **Coordinator: Fabrizio Piergentili**

- **IT 39.2 - “Permanent IT on Fragmentation”**

Six break-up events were observed. For each fragmentation Gabbard diagrams and semi-axes/eccentricity graphics were made with observed and found fragments in NORAD catalogue. The impulse range during the explosion and the TLE of unknown fragments were found through a new graphic method. **Coordinator: Fabrizio Piergentili**

- **IT 34.1 - “Feasible options to study Molniya population of space debris”**

The aim is to make an analysis and a list of options to statistic surveillance of Molniya debris. The S5Lab has also proposed a new IT to evaluate the light impact of mega-constellation during optical observations. **Coordinator: Lorenzo Mariani**

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Italian activities

Optical facilities

MITO

Mid-latitude Italian Observatory



Lens diameter	203 mm
Focal length	812 mm
Sensor	CCD
Field of View	2.54° x 1.7°
QE	50%

RESDOS

Remote Space Debris Observation System



Lens diameter	400 mm	150 mm
Focal length	2800 mm	750 mm
Sensor	CCD	sCMOS
Field of View	0.5° x 0.5°	1.27° x 1.07°
QE	96%	60%

SCUDO

Sapienza Coupled University Debris Observatory



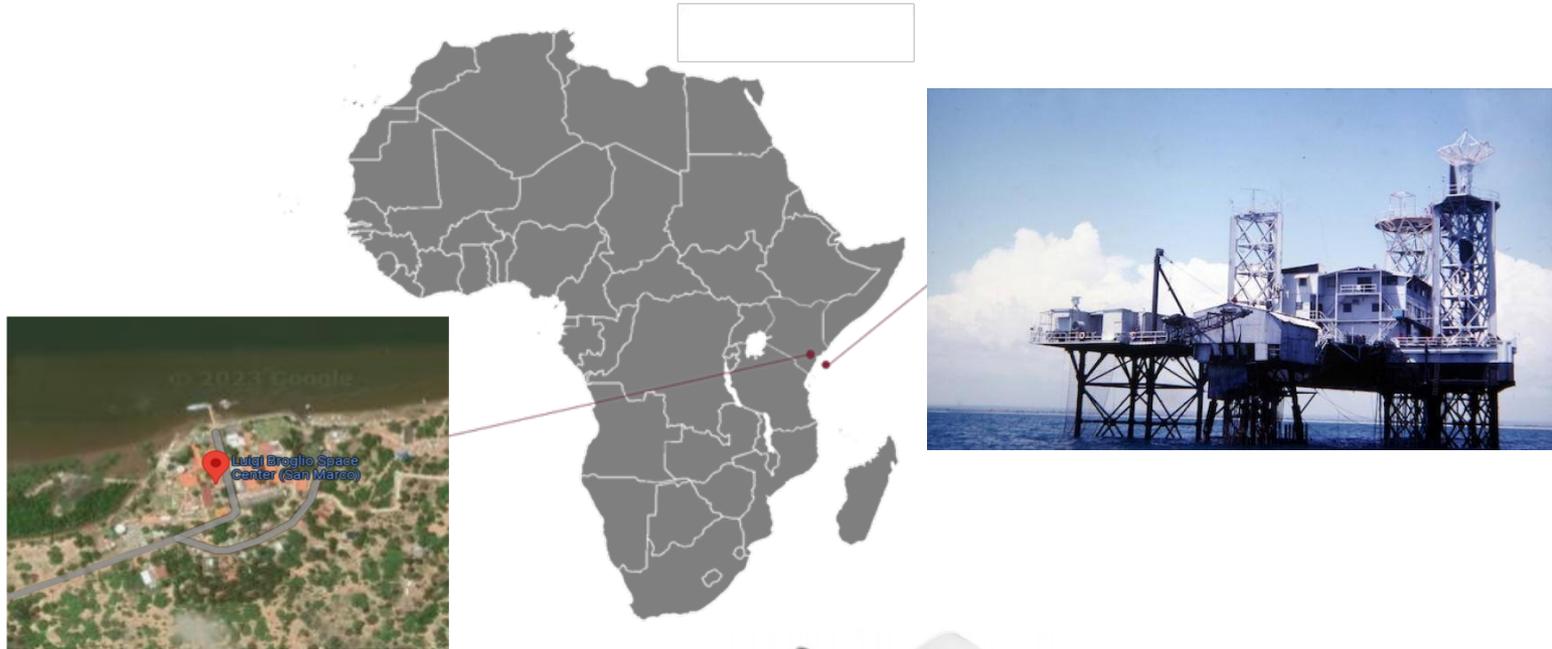
Lens diameter	250 mm	150 mm
Focal length	1200 mm	750 mm
Sensor	sCMOS	sCMOS
Field of View	1.07° x 1.07°	1.27° x 1.07°
QE	95%	60%

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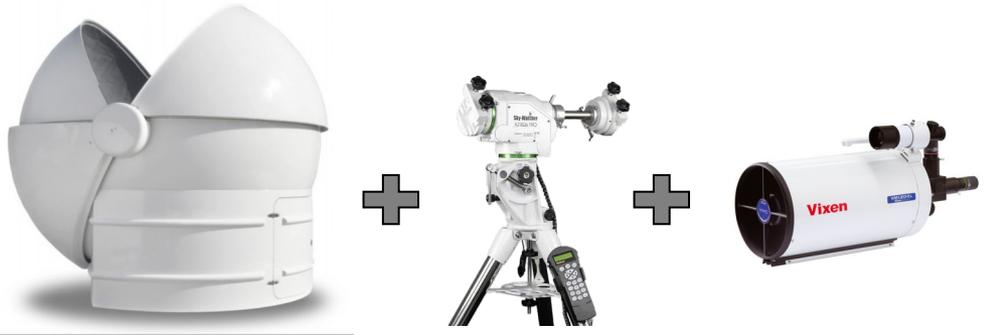


Optical facilities

Updating ongoing – September 2023 operations



	LAT: -2.9957° LON: 40.1948°
	AltAz mount and clamshell dome automatized and remote controlled, optimized for SST duty
	<ul style="list-style-type: none">• Low and mid inclination satellite observation and survey• Join observation with same meridian observatories of the s5lab network• Re-entry event monitoring

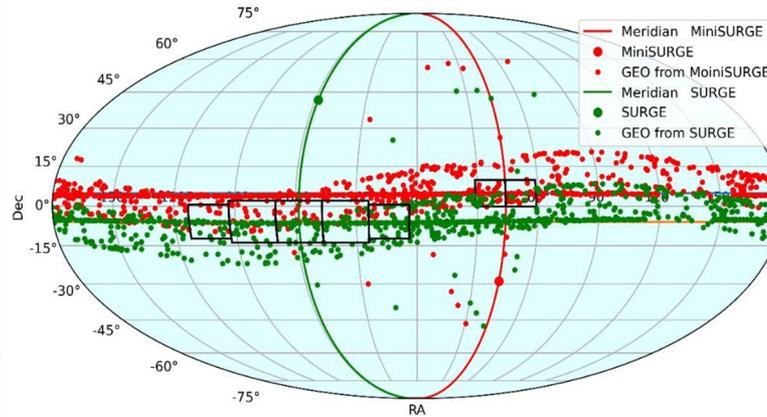


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Italian activities

Optical facilities



N cameras	Structure size
Currently from 1 to 6 (up to 16)	ND
Resolution [px x px]	Focal length [mm]
5472 x 3648	85/100/135
FOV single cam [deg x deg]	Total FOV [deg x deg]
23x16 - 20x13 - 15X10	100.8 x 10.2
Sensor size [mm x mm]	Pixel size [um]
35.8 x 23.9	6.55

N cameras	Structure size
2	0.5 m x 0.6 m x 0.6 m
Resolution [px x px]	Focal length [mm]
5472 x 3648	135
FOV single cam [deg x deg]	Total FOV [deg x deg]
15.4 x 10.2	30.8 x 10.2
Sensor size [mm x mm]	Pixel size [um]
35.8 x 23.9	6.55

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Optical facilities

Observation capabilities

Observatory	RESDOS	SCUDO	MITO	SURGE	mini-SURGE
Operational mode	 Follow Up  Sidereal  Survey	 Follow Up  Sidereal  Survey	 Sidereal  Survey	 Survey	 Survey
Frames/night	~ 15 k	~ 15 k	600	400	400

- **Survey**

IOD

Fragments detection and characterization

Aimed orbital regime survey (GEO, etc.)

Tumbling motion detection

- **Follow-Up and sidereal**

IOD and OD

Light-curve

Tumbling motion detection

Attitude reconstruction

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Optical facilities

AI 38.2 – Tumbling motion observation campaign

 Start: 2020-11-30

 End: 2021-12-31

IADC WG1 AI 39.1
 “Astrometrics and photometrics data exchange format”

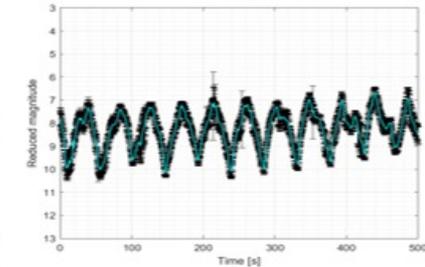
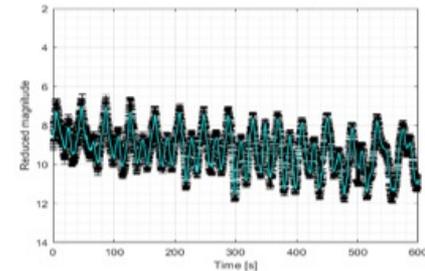
TDM available

```
CCSDS_TDM_VERS = 2.0
CREATION_DATE = 2021-03-31T15:41:54.826000
ORIGINATOR = S5LAB
```

```
META_START
TIME_SYSTEM = UTC
START_TIME = 2021-03-31T01:42:52.000
STOP_TIME = 2021-03-31T01:46:12.000
PARTICIPANT_1 = RESDOS
PARTICIPANT_2 = 27453
MODE = SEQUENTIAL
PATH = 1,2
ANGLE_TYPE = RADEC
REFERENCE_FRAME = EME2000
META_STOP
```

```
DATA_START
ANGLE_1 = 2021-03-31T01:42:52.000 31.026739
ANGLE_2 = 2021-03-31T01:42:52.000 57.288094
ANGLE_1 = 2021-03-31T01:42:52.100 31.029648
ANGLE_2 = 2021-03-31T01:42:52.100 57.295470
ANGLE_1 = 2021-03-31T01:42:52.200 31.028766
ANGLE_2 = 2021-03-31T01:42:52.200 57.306567
ANGLE_1 = 2021-03-31T01:42:52.300 31.029824
ANGLE_2 = 2021-03-31T01:42:52.300 57.315322
ANGLE_1 = 2021-03-31T01:42:52.400 31.030929
ANGLE_2 = 2021-03-31T01:42:52.400 57.326596
ANGLE_1 = 2021-03-31T01:42:52.500 31.033323
```

Light-curves available



SSN	Celestrack name	Light-curves	Measurements (RA-DEC)
11804	Cosmos 1181 Rocket	11	29020
18340	Cosmos 1875 Rocket	24	90140
23088	Cosmos 2278 Rocket	9	19400
23405	Cosmos 2297 Rocket	10	23800
25637	ARGOS Delta Rocket	0	0
40879	CZ-4C R/B	7	19400
41847	CZ-11 R/B	24	34450
41858	CZ-2D R/B	0	0
39198	PEGASUS R/B	22	34000
		107	250210

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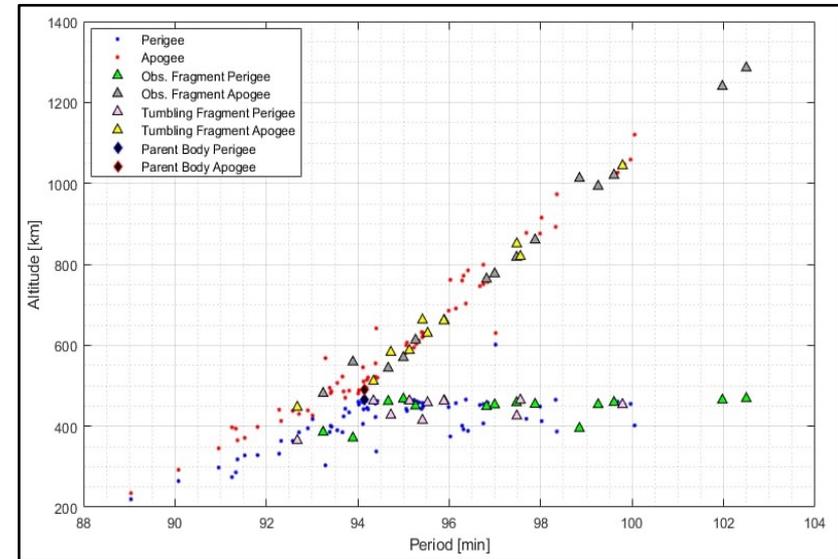
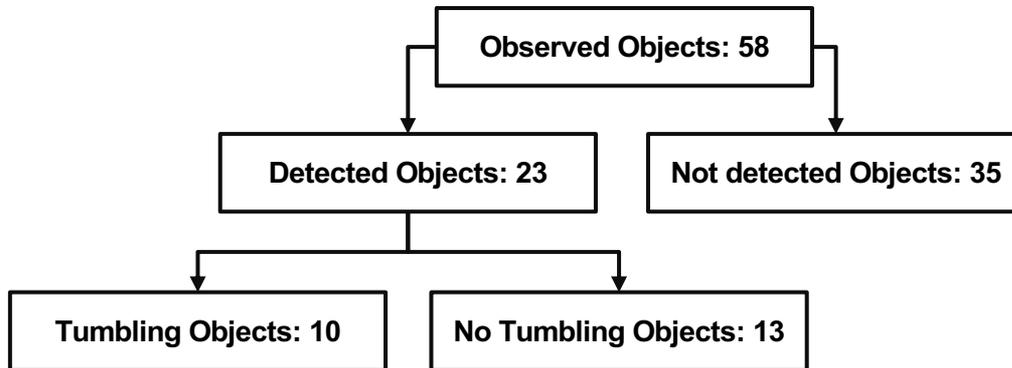


Optical facilities

IT 39.2 - Fragmentation event COSMOS 1408



NORAD ID	13552
Int. Design.	1982-092A
Fragmentation epoch	15/11/2021 02:48:00.000 UTC
Detection epoch	24/11/2021 10:08:48.085 UTC
Type	ASAT
Number of debris by EUSST	1379



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Optical facilities

IT 34.1 – Ongoing campaign to study Molniya population

SSN	Sat_Name	30-May-2023	31-May-2023	1-June-2023	2-June-2023	3-June-2023	4-June-2023	5-June-2023	6-June-2023	7-June-2023	8-June-2023	9-June-2023	10-June-2023	Observed
6192	COSMOS 520													
6916	COSMOS 606													
7376	MOLNIYA 2-10													
11057	MOLNIYA 3-10													
12078	COSMOS 1223													
12907	COSMOS 1030 DEB													
13080	COSMOS 1341													
15350	COSMOS 1604													
16446	SL-12 R/B(AUX MOTOR)													
18374	SL-12 R/B(AUX MOTOR)													
18701	COSMOS 1903													
19170	SL-12 R/B(AUX MOTOR)													
19755	SL-12 R/B(AUX MOTOR)													
19856	SL-12 R/B(AUX MOTOR)													
20081	SL-12 R/B(AUX MOTOR)													
20330	COSMOS 2050													
20596	COSMOS 2076													
20630	SL-12 R/B(AUX MOTOR)													
20631	SL-12 R/B(AUX MOTOR)													
20707	COSMOS 2087													
21012	SL-12 R/B(AUX MOTOR)													
21220	SL-12 R/B(AUX MOTOR)													
21226	SL-12 R/B(AUX MOTOR)													
22321	COSMOS 2232													
22671	MOLNIYA 1-86													
23402	SL-12 R/B(AUX MOTOR)													
23403	SL-12 R/B(AUX MOTOR)													
23947	USA 125 DEB													
24761	COSMOS 2340													
24960	MOLNIYA 1-90													
25327	COSMOS 2351													
27884	COSMOS 917 DEB													
27901	COSMOS 1261 DEB													
36406	SL-12 R/B(AUX MOTOR)													
37143	SL-12 R/B(AUX MOTOR)													
42974	SL-12 DEB													
43110	CZ-3B R/B													
43247	CZ-3B R/B													
48349	SL-12 DEB													
48417	SL-12 DEB													

Observed objects	Observable objects	Observation days	Bad weather
21/40	18/18	12 days	5 days

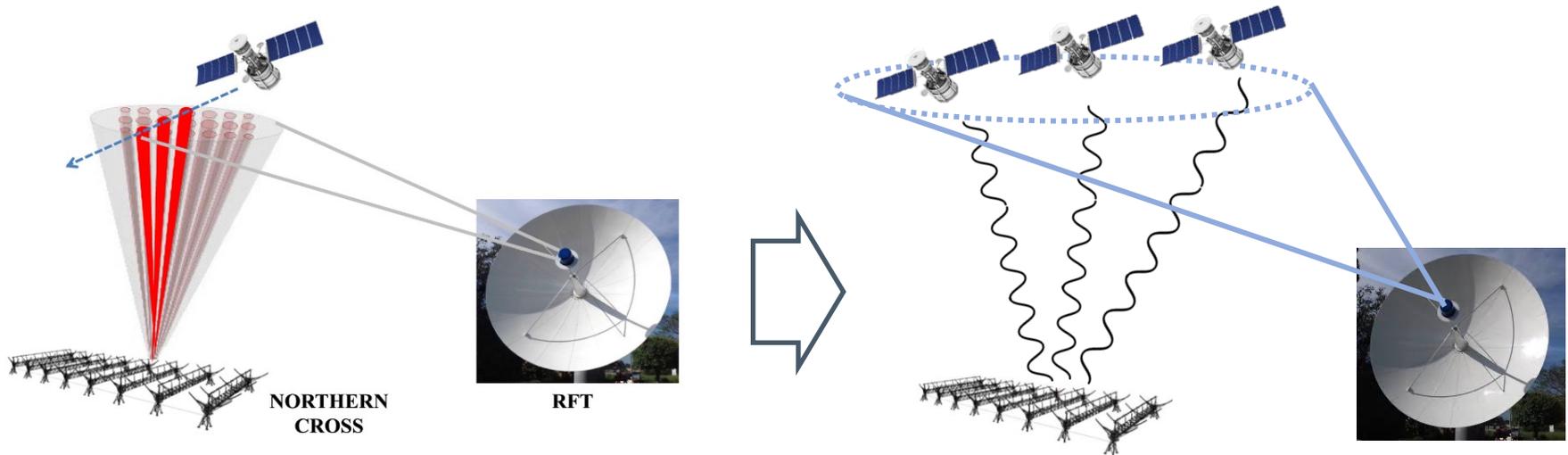
Legend	
	to be observed
	observed
	in visibility but not observed
	observed but not detected
	already observed
	not in visibility
	bad weather

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RADAR Facilities: BIRALES

From static multibeam to adaptive beamforming (ongoing to enable operational use)



Medicina
(Bologna)

Salto di Quirra
(Sardinia)

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RADAR Facilities: BIRALES

News

- BIRALES new transmitter is under construction to improve sensitivity and field of view (work proceed on schedule)
- New developed algorithms for BIRALES data processing, aimed at the improvement of angular accuracy, have been refined to improve sensitivity and are being tested on real data (see dedicated talk)
- New developed algorithm for BIRALES data processing has been extended to allow detection of multiple objects in the field of view (see dedicated talk)
- IT 34.1 – Ongoing campaign to study Molniya population: BIRALES transmitter malfunction did not allow to take part to preliminary observations.

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