

Inclusion of LARES-2 in the ILRS products



D. Sarrocco, V. Luceri, A. Basoni
e-GEOS S.p.A., ASI/CGS - Matera

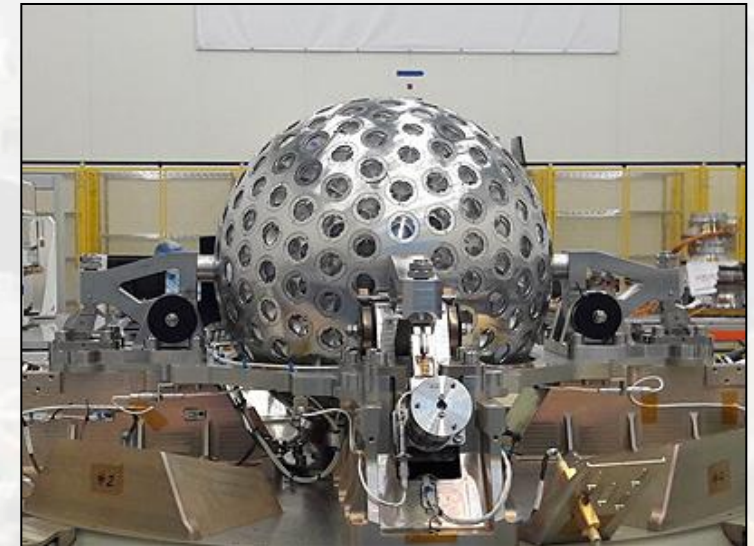
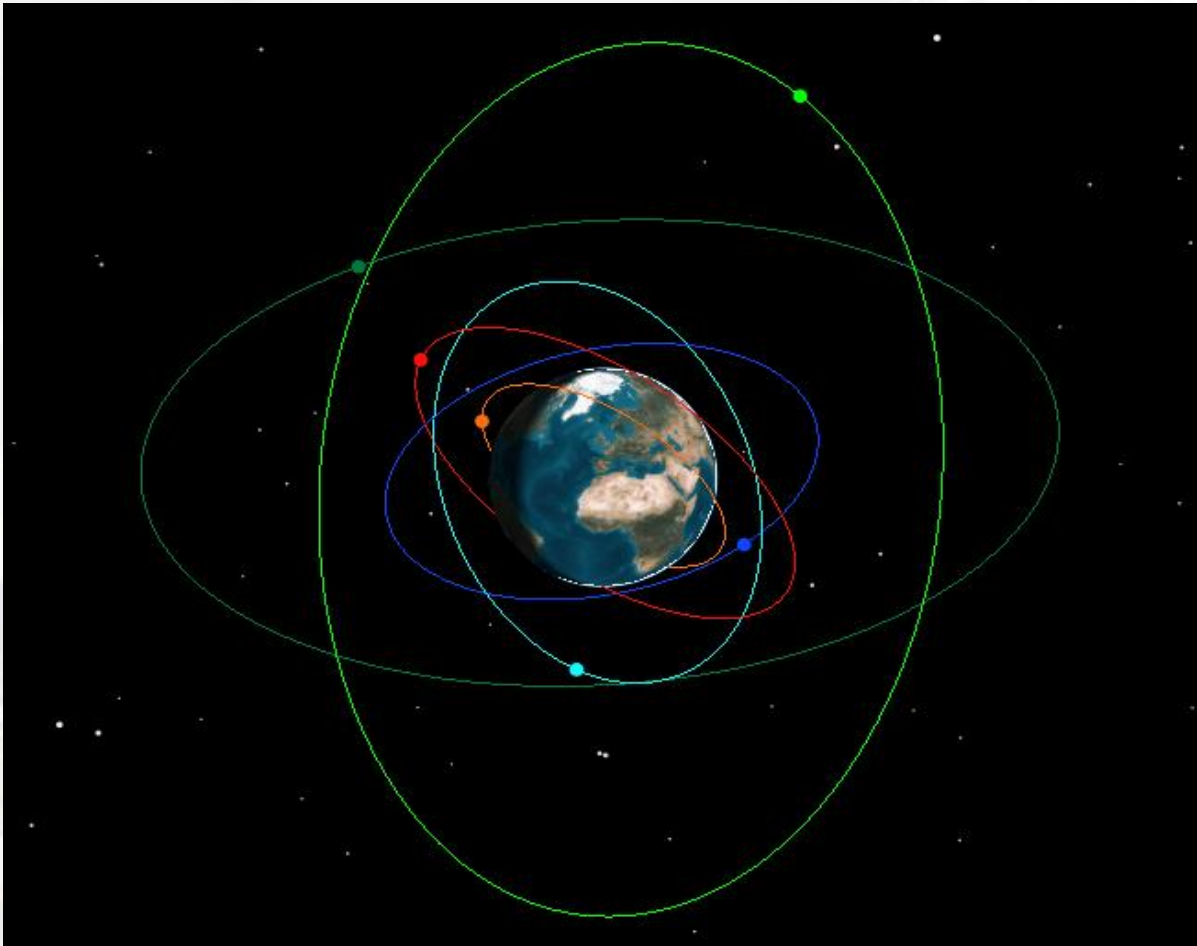


G. Bianco
Agenzia Spaziale Italiana, CGS - Matera

LARES-2 in the ILRS framework

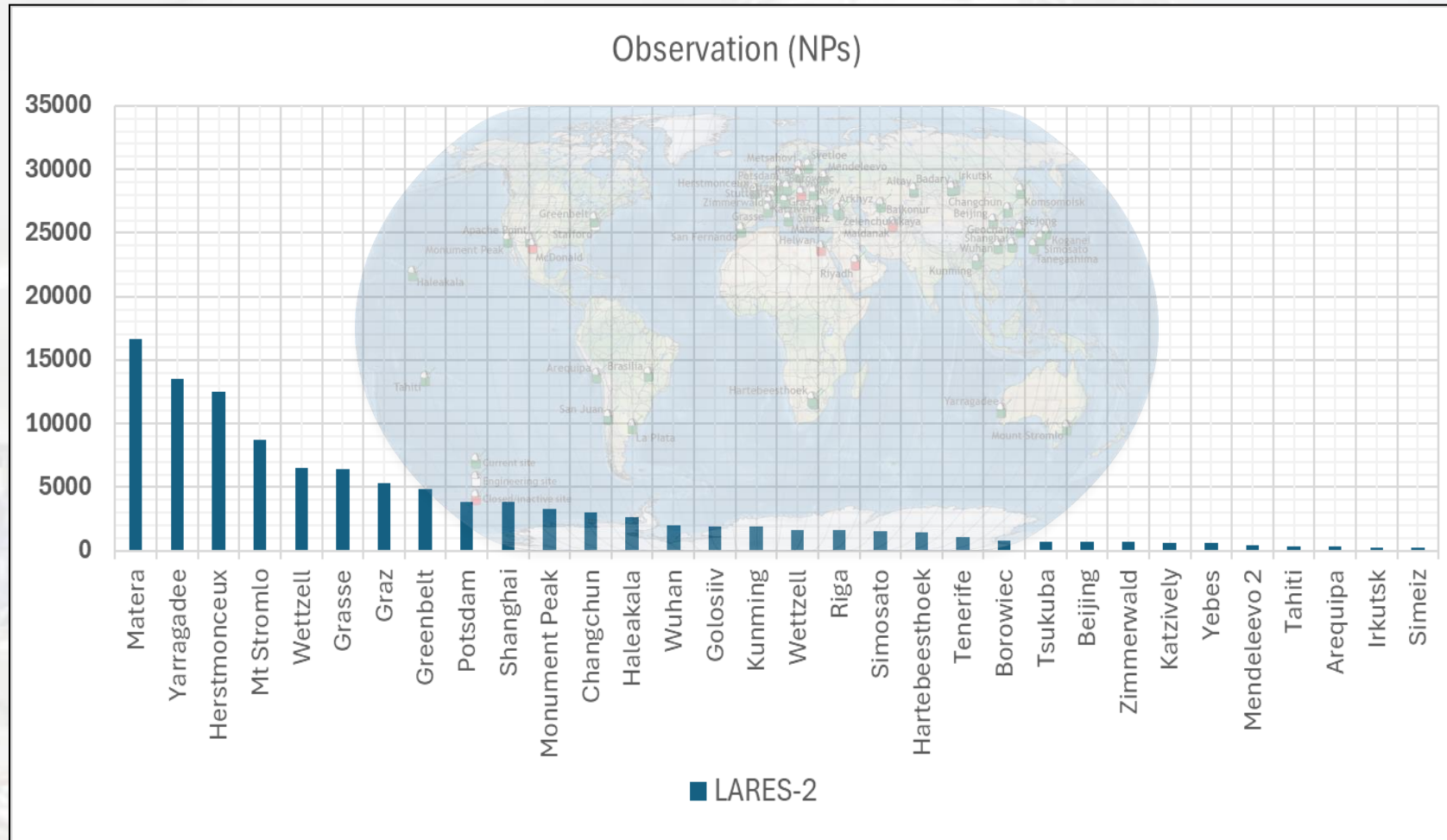
Etalon1 Etalon2
LAGEOS LAGEOS2

LARES-2 (13 July 2022)



	LARES-2	LAGEOS	LAGEOS2
Mass	294.8 kg	411 kg	405.4 kg
Diameter	42.4 cm	60 cm	60 cm
Altitude	5893 km	5860 km	5620 km

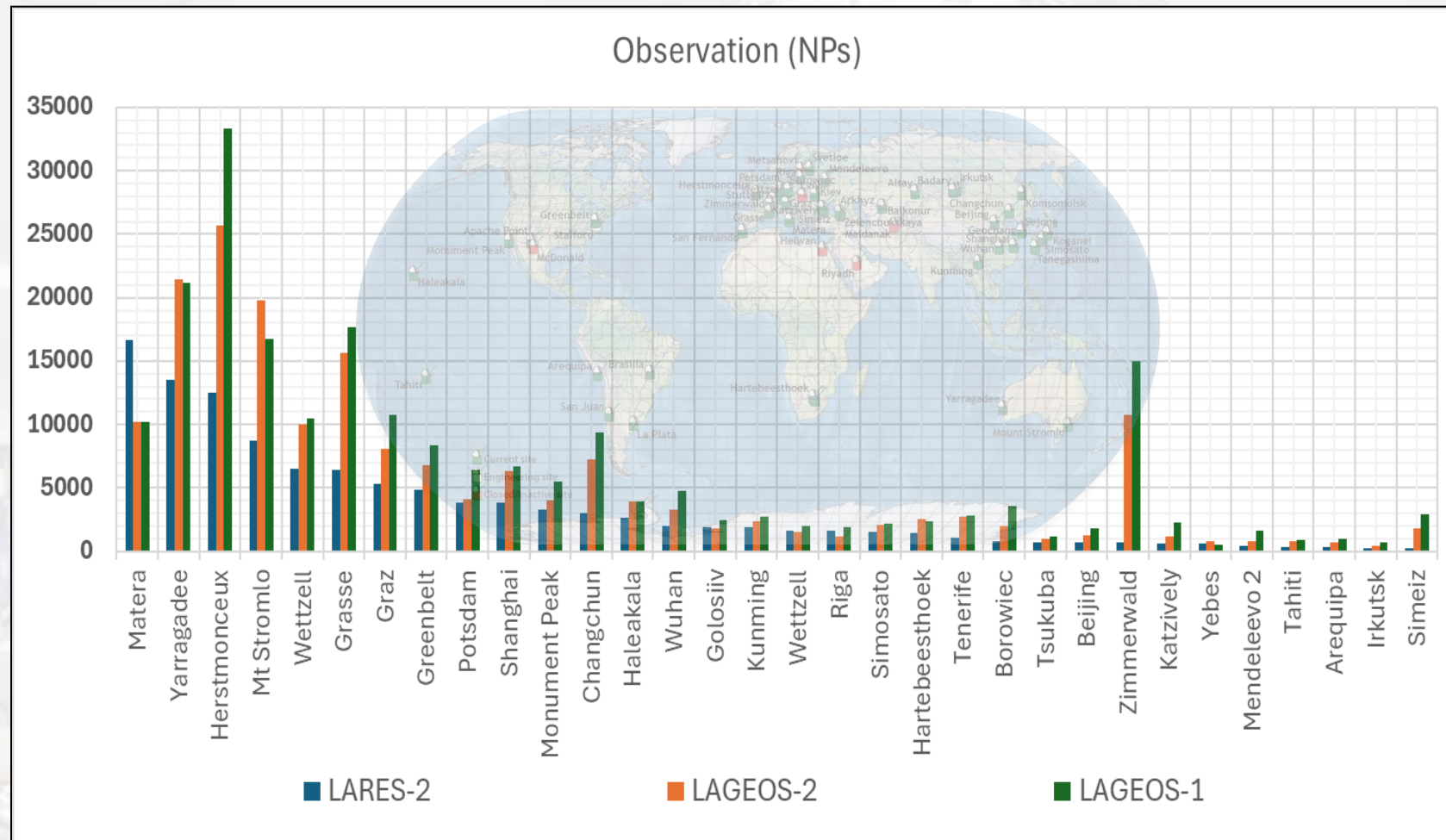
LARES-2 acquisition data from ILRS Network



Total NPs from July 2022

LARES-2 : 109791

LARES-2 & LAGEOS acquisition data from ILRS Network



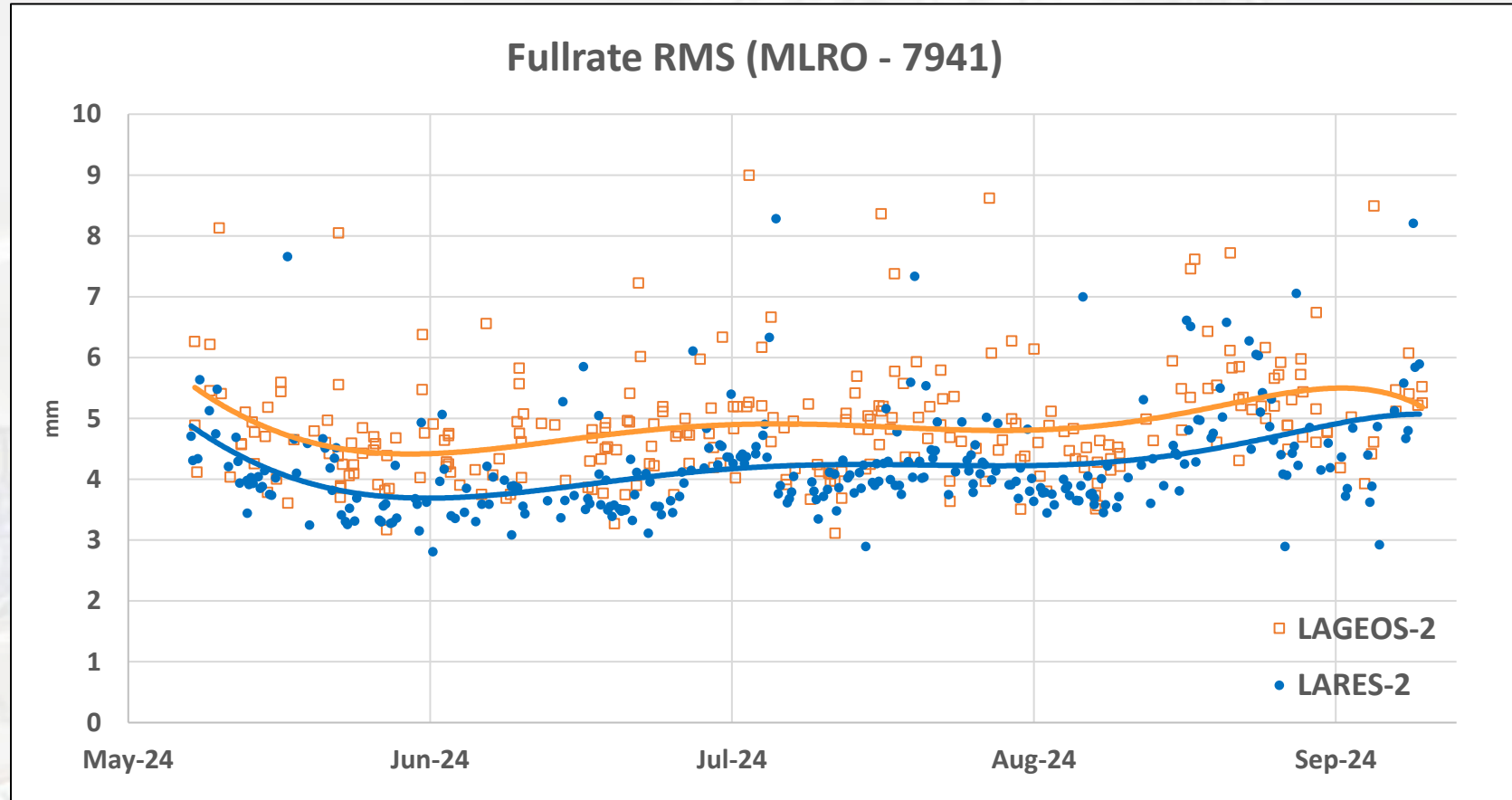
Total NPs from July 2022

LARES-2 : 109791

LAGEOS-1: 189064

LAGEOS-2: 225305

LAGEOS & LARES-2 acquisition data from ILRS Network



RMS mean Values

LARES-2: 4.23 mm

LAGEOS-2: 4.87 mm

LARES-2 inclusion *strategy* in the ILRS Official Products

	ASI
	BKG
	DGFI
	ESA
	GFZ
	JCET
	NSGF
	CNES

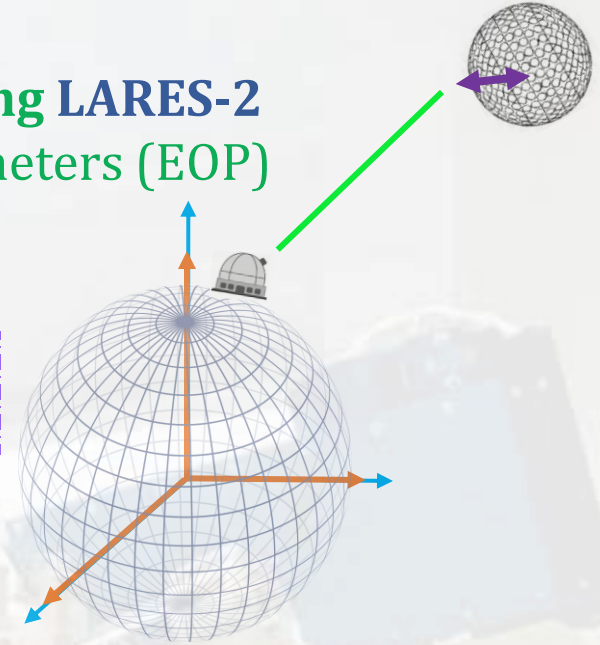
ASI/CGS
ILRSA Primary

JCET
ILRSB Backup

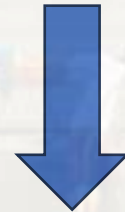
➤ **Station Range biases estimated** for solutions **including LARES-2** together with **site coordinates, Earth Orientation Parameters (EOP)**

➤ Using an update **Satellite Center of Mass correction**

ID	DMY	START	DMY	END	1	CoM		
1824	10	10	2021	01	01	2050	532	174.8
1868	01	09	2012	01	01	2050	532	172.5
1873	01	08	2000	01	01	2050	532	173.2



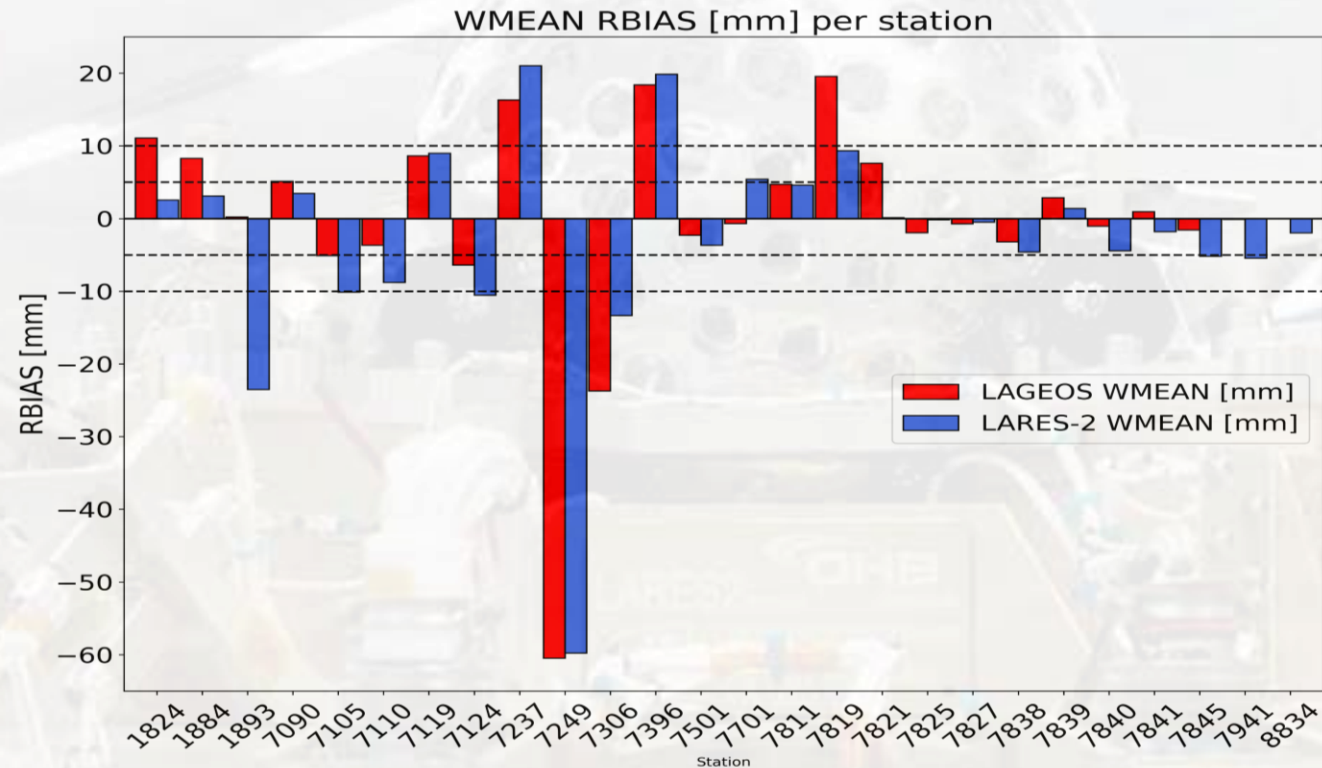
- Analysis since **07-08/2022** (LARES-2 launch)
- Weekly **estimation of coordinates, EOP and range biases RB**
- Data: LAGEOS , LAGEOS 2, ETALON1-2, **LARES-2**



Data Handling File with a set of **mean range biases** (for specific time period) **also** for **LARES-2** obtained from the **ILRSA-combined** time series

LARES-2 Bias Estimation

- Range Bias Estimation



- WMEAN on the **whole period** (for each station): July 2022 – September 2024
- Refinement are done considering eventually **specific time period**

LARES-2 Bias Estimation & Data Handling file

• Range Bias Estimation

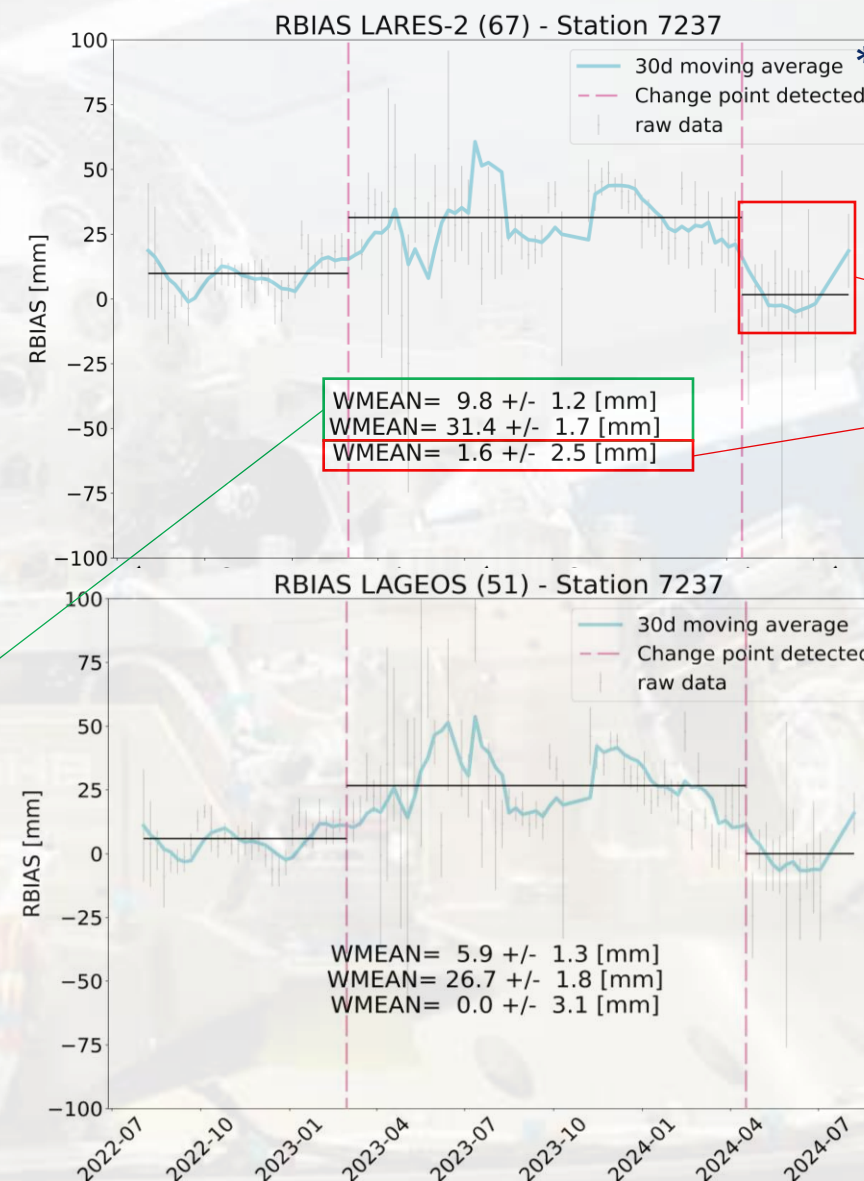
Example for **7237 station**:

- 9.8 mm before first discontinuity
- 31.4 mm after first discontinuity
- 1.6 mm after second discontinuity

Data Handling File Extract:

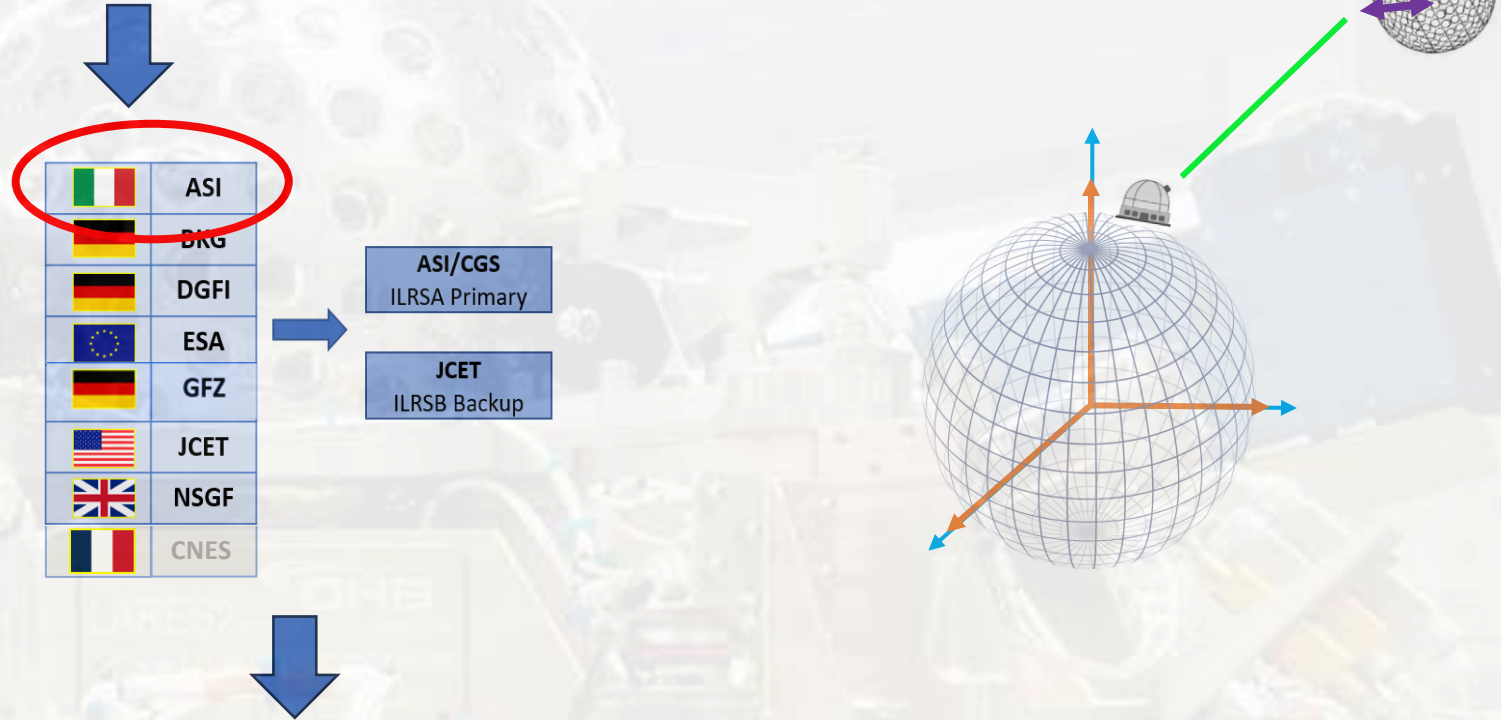
```
.....  
7237 67 501 A 22:212:00000 23:057:00000 R 9.8 1.2 mm  
7237 67 501 A 23:057:00000 24:112:00000 R 31.4 1.7 mm  
.....
```

*using a PELT automatic Algorithm for break identification



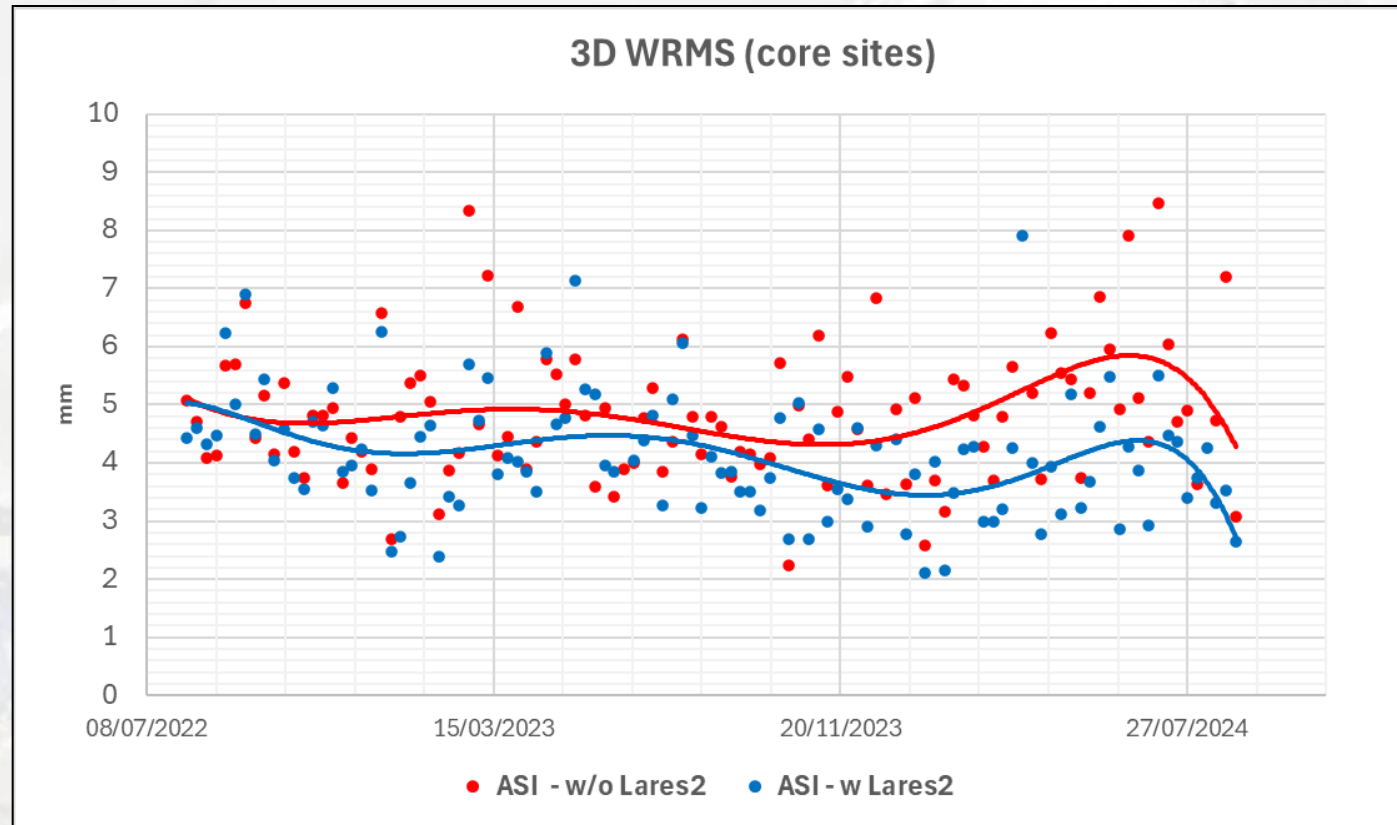
*LARES-2 inclusion **strategy** in the ILRS Official Products*

Data Handling File with a set of **mean range biases** (for specific time period) **also** for **LARES-2** obtained from the **ILRSA-combined** time series



- Analysis will be done since **07-08/2022** (LARES-2 launch)
- Weekly **estimation of coordinates, EOP with application biases RB**
- Data: LAGEOS , LAGEOS 2, ETALON1-2, **LARES-2**

ILRS weekly products: w-w/o Lares2

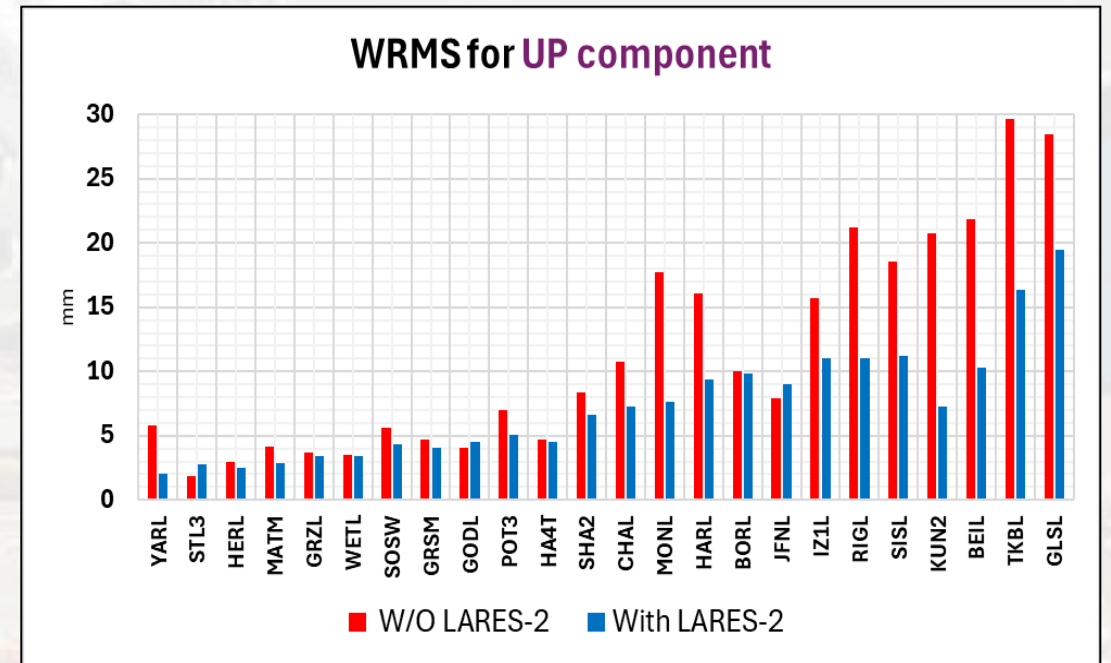
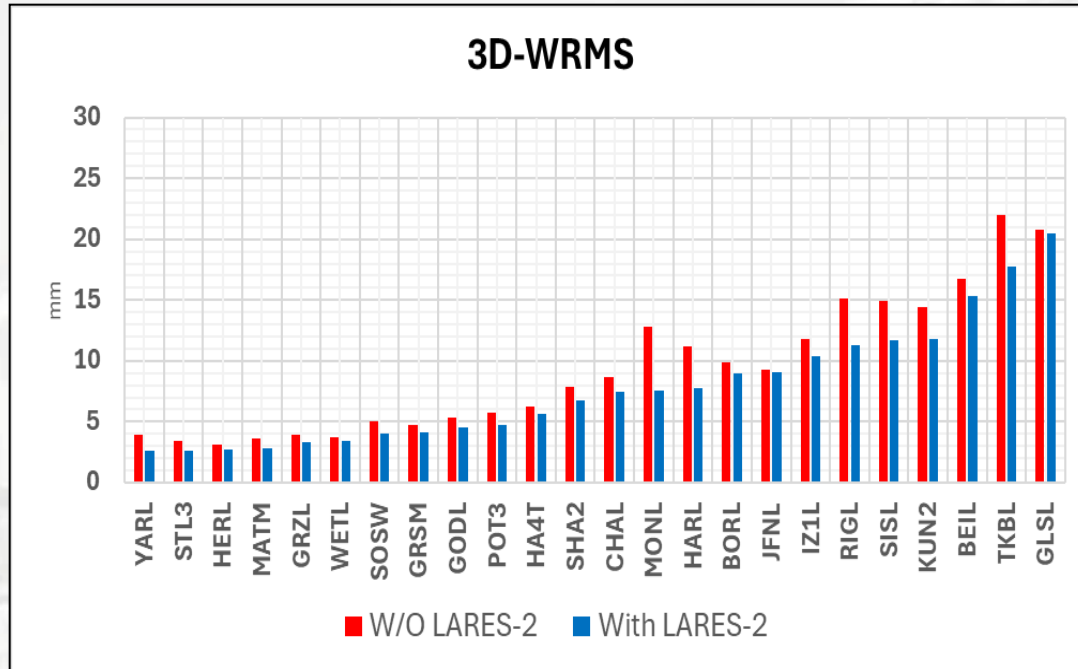


ACs	Wmean
ASI - w/o Lares2	4.84
ASI - w Lares2	4.11

Global Network (core site) 3D WRMS for each solutions [07/2022 – 09/2024]

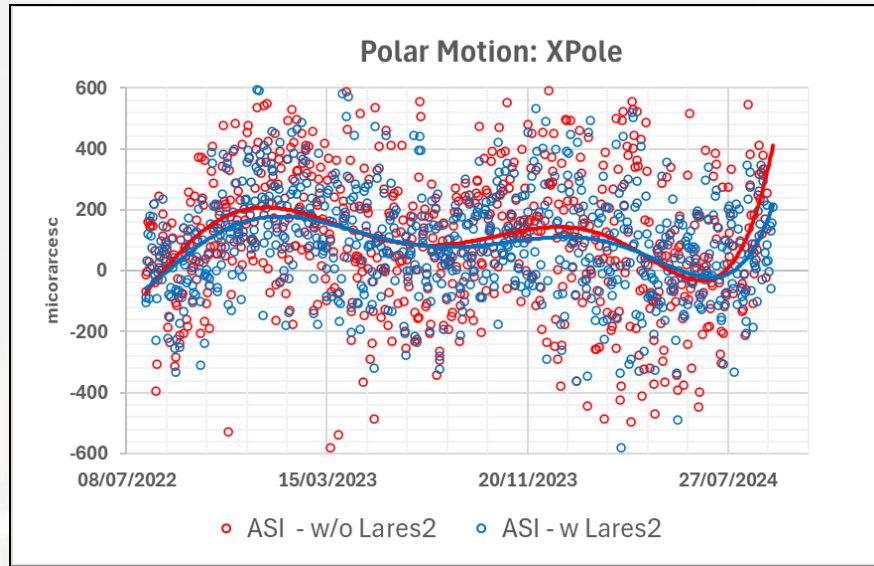
ILRS weekly products: w-w/o Lares2

Quality for the Station Position Estimates (**ASI AC solutions**)

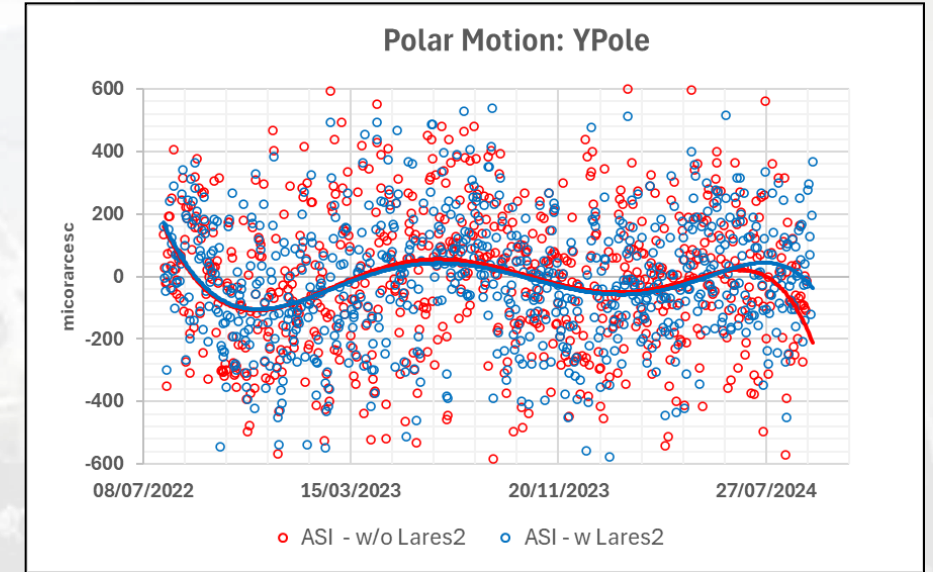


Improvement on the accuracy for the 3D position estimates, especially on Up components

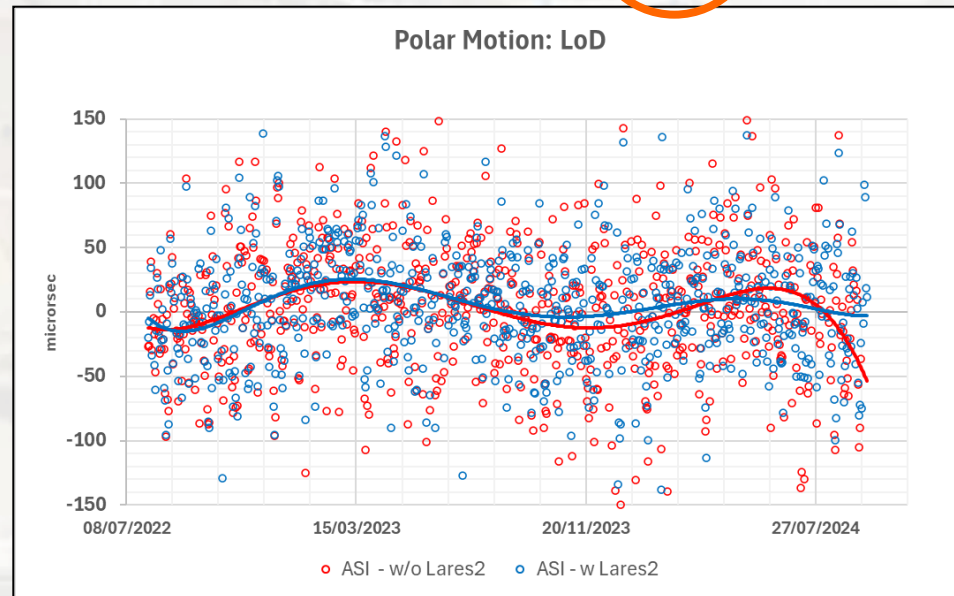
ILRS weekly products: w-w/o Lares2



AC	WMEAN	WRMS
ASI - w/o Lares2	0,90	49,73
ASI - w Lares2	4,01	41,57



AC	WMEAN	WRMS
ASI - w/o Lares2	104,99	229,90
ASI - w Lares2	86,85	181,52



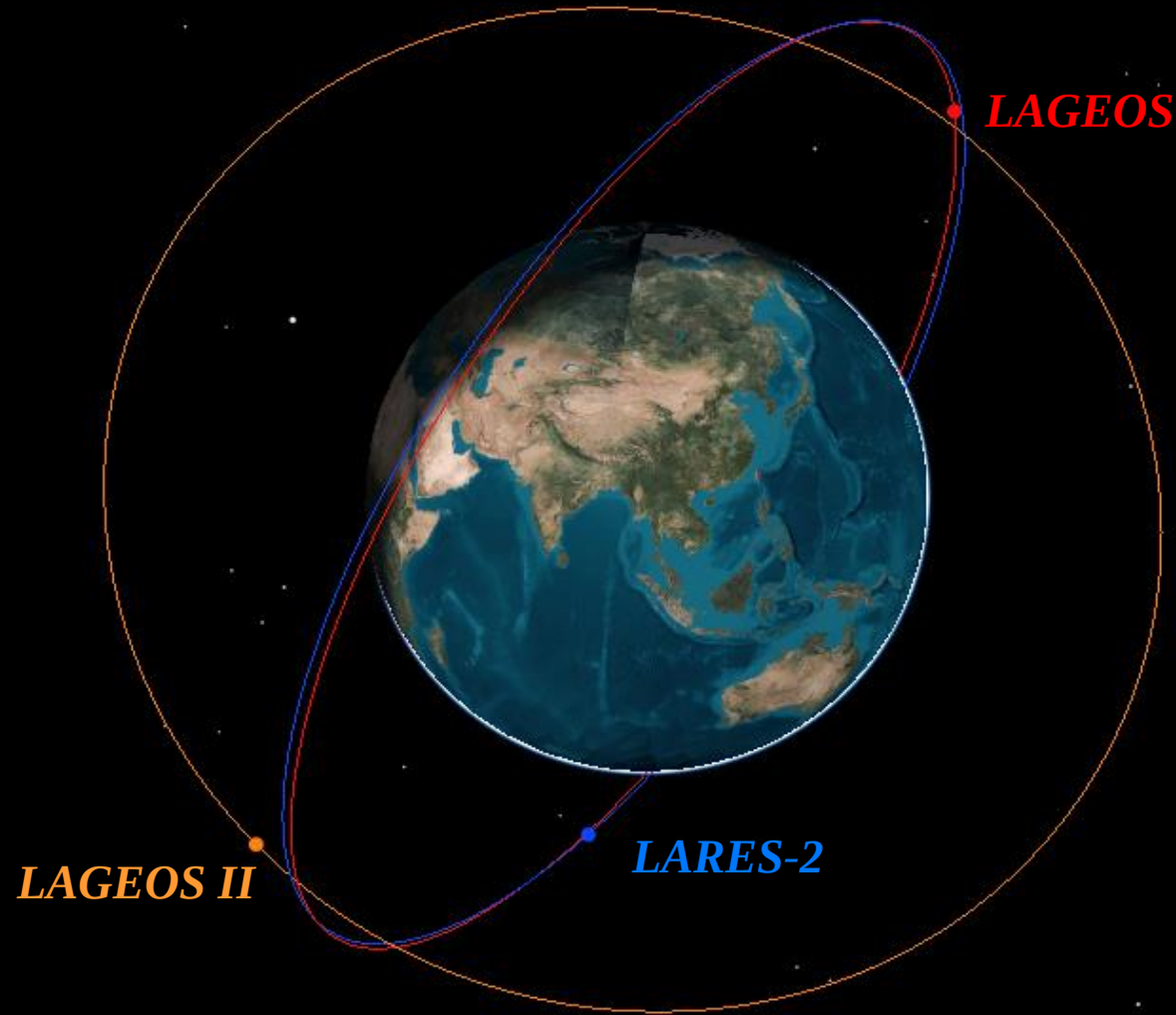
ACs	Wmean	WRMS
ASI - w/o Lares2	-8,55	217,24
ASI - w Lares2	-10,19	185,79

EOP w.r.t. USNO appears to be less scattered

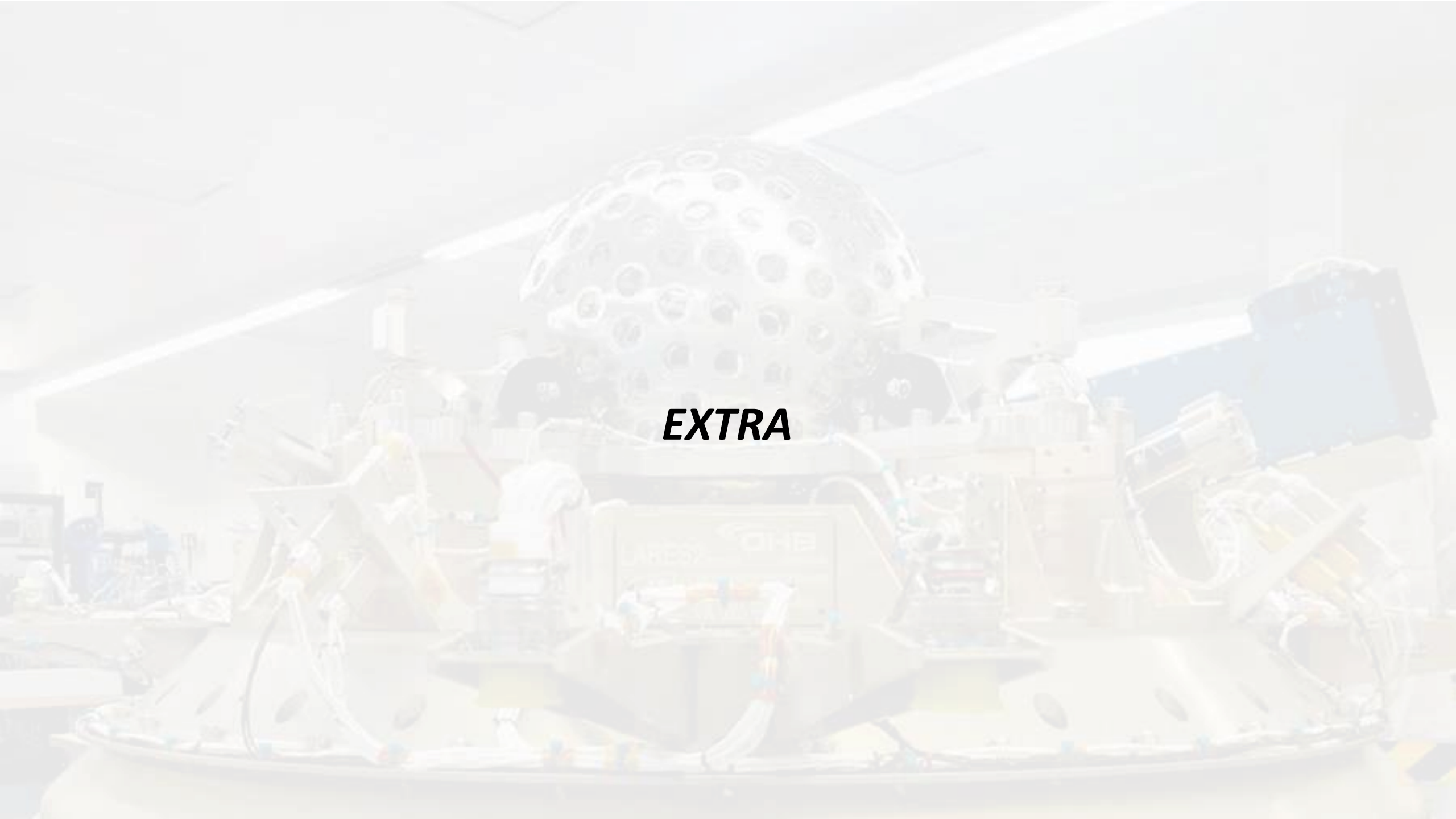
Summary and next Steps

- LARES-2 is efficiently acquired by the ILRS Network: the number of Normal Points (NPs) is (nearly) comparable to LAGEOS.
- Range bias has been estimated for each station for LARES-2 through an ad-hoc combined ILRSA solution.
- The addition of LARES-2 and the application of such bias to the **ASI Analysis Center** weekly solution has shown:
 - Improvement in the whole (core) 3D-WRMS (position estimates with respect to ITRF2020)
 - Improvement in single station 3D-WRMS (especially in the UP component)
 - Earth Orientation Parameters (EOP) estimations with respect to USNO show less scattered behavior
- **The next step** is to analyze the **ILRS combination of all Analysis Centers'** solutions with LARES-2 (Bias applied).

Thank you



Actual configuration (more or less) for LAGEOS/II and LARES-2 **NOW**: 23/10/2024, at 11:45 (Kunming time). FROM STK.



EXTRA

Quality for the Station Position Estimates

