Activity report of NICT/Kashima VLBI group

NICT Kashima Space Technology Center

Space-Time Standards Laboratory

M.Sekido, E.Kawai, K.Takefuji, H.Ujihara, M.Tsutsumi, S.Hasegawa, T.Kondo, Y.Miyauchi

Members of NICT/Kashima VLBI Group

Family, Given Name	Activities, Charges
Sekido Mamoru	Group Leader, VLBI observation for Frequency Link, IVS session operation with 11m stations.
Kawai Eiji	Maintaining Kashima 34m, Kashima 11m, and Koganei 11m VLBI stations. IVS session operation with Kas34m.
Takefuji Kazuhiro	Correlator development, Signal processing.
Ujihara Hideki	Development of Broadband Feed
Tsutsumi Masanori	Computer/Network maintenance.. Hardware maintenance support
Hasegawa Shingo	IVS/AOV operation support: Data conversion and data transfer. Maintenance support
Miyauchi Yuka	Software development
Kondo Tetsuro (SHAO)	K5/VSSP software correlator maintenance/updating. Bandwidth Synthesis
Shinotsuka Kumiko	Secretary for administrative support.

Participation to IVS, AOV sessions

2017

	Kas34	Kb		Kas11	K1		Kog11	Kg
	IVS	AOV		IVS	AOV		IVS	AOV
1	RD1701	16		CRF98	13		T2117	13
2	RD1702	17		T2116			CRF99	
3	T2126	18		T2117			T2118	
4	R1779			CRF100			T2119	
5	R1780			CRF101			CRF102	
6	R1782			R1802			APSG40	
7	T2117			APSG40			CRF103	
8	R1787			R1806			T2120	
9	R1788			R1808			APSG41	
10	T2120			T2120			T2121	
11	AUA029			R1810				
12	T2122			APSG41				
13				T2121				
14				C1701-14				

2018

	Kas34	Kb		Kas11	K1		Kog11	Kg
	IVS	AOV		IVS	AOV		IVS	AOV
1	T2123	19		T2123	20		APSG42	20
2	R1870	28		CRF105	23		T2124	23
3	R1871	29		CRF106	24		T2125	26
4	R1872			APSG42	26		APSG42	
5	R1873			T2125			CRF107	
6	T2129			T2126			T2126	
7				APSG43			APSG43	
8				T2127			CRF108	
9				CRF104			T2128	
10							CRF109	
11							T2129	

Trouble and Shooting

Kashima34m

Issue	Description
Damage of back up structure of main reflector due to corrosion.	Repair work has conducted for the period from May-Sep. 2018. Some part of steel square pipes were cut&replaced. Degradation of surface accuracy has been recovered by holography measurement and reflector panel adjustment.
Maintenance of AZ/EL drive motor & breaks	During summer, maintenance works has made for two of four AZ drive motors. Break-release switch signal does not return properly from of AZ#2 drive sometimes. Since it causes loss of observation in automated start of experiments, we stopped sensing of the break-release signal, tentative counter measure. We ordered new breaks for replace.
Wave-guide switch for cold-load is broken for X-band.	We are planning repair.
22GHz receiver temperature is extremely high by unknown reason.	We need investigation

Trouble and Shooting

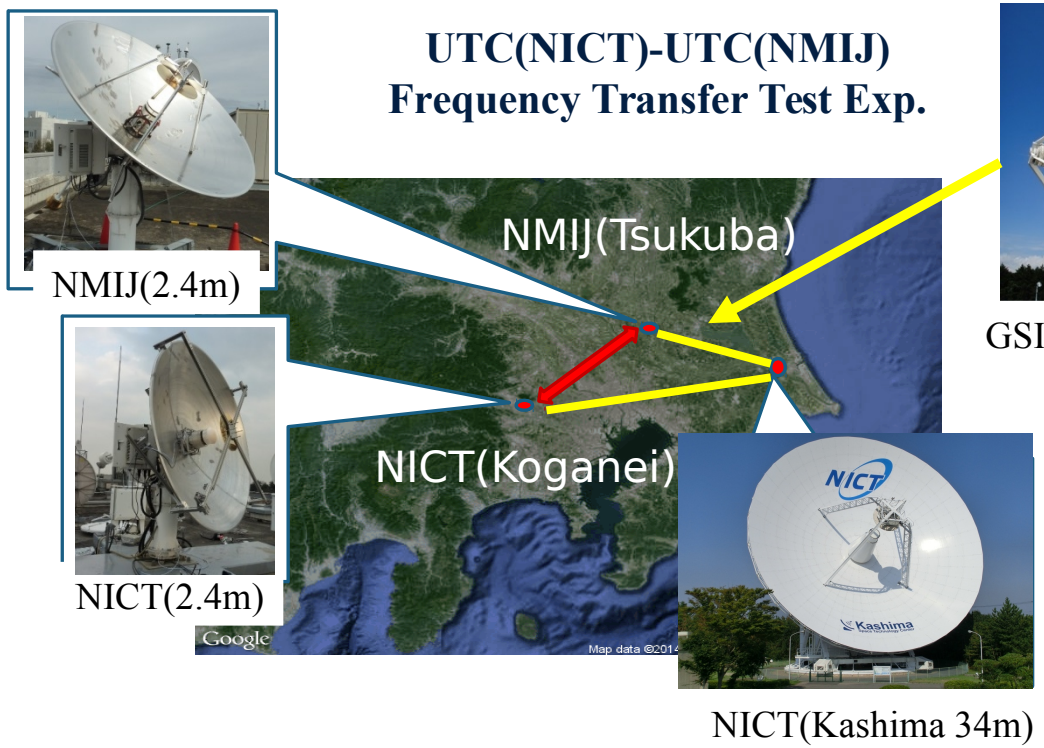
Kashima11m

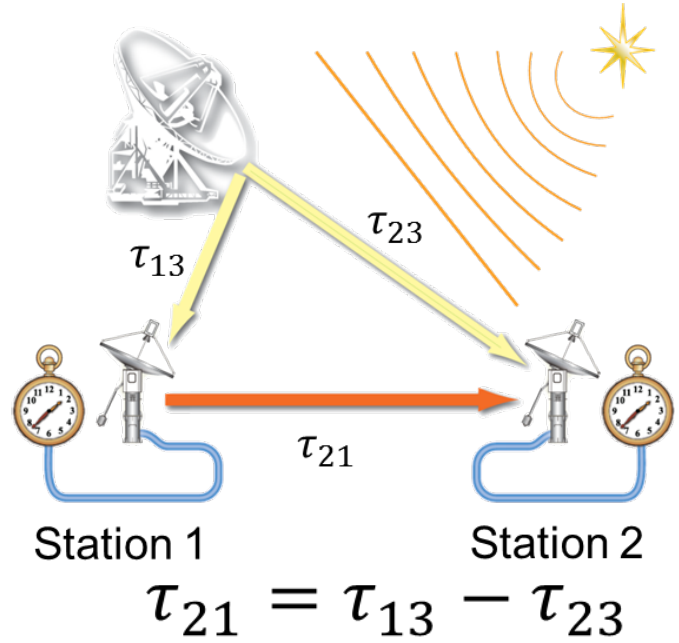
Issue	Description
Antenna Control Unit (ACU) was broken in Aug. 2018.	Az Encored data cannot be obtained, then Encoder power supply circuit in ACU must be broken. Thunder storm is suspected to be the cause.. Spare ACU did remain, then antenna is recovered by replacement of ACU.

Koganei 11m

No particular problem

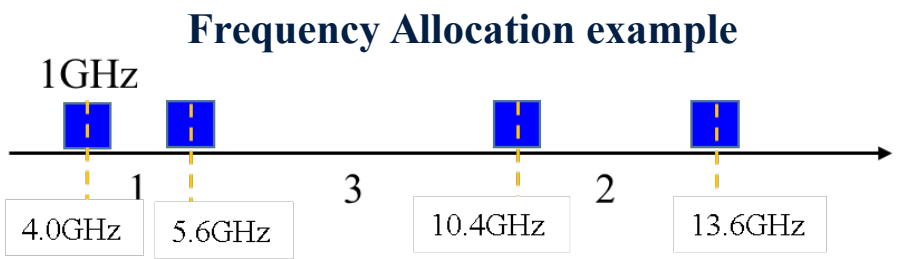
Technology Development: Broadband VLBI System GALA-V

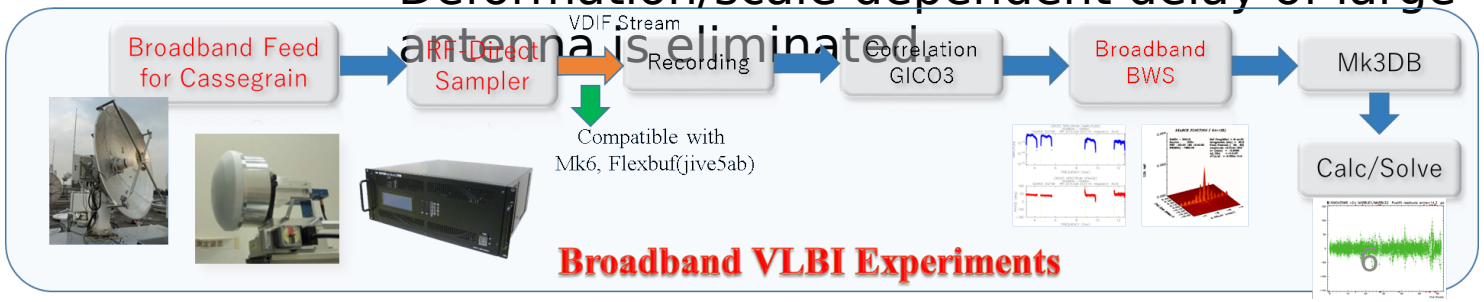




$$\tau_{21} = \tau_{13} - \tau_{23}$$

- Broadband (3-14GHz) ->VGOS Compatible
  - Precise (~1psec) delay observable is available
- Using closure delay for transportable Small antenna
  - Using Large antenna for SNR booster
  - Deformation/scale dependent delay of large antenna is eliminated





34m Antenna Main Reflector backup structure

For safety reason, repair work of corrosion damage at backup structure has been urgent issue.

- Repair work period: May-Sep. 2018
- Some part of steel pipes had to be cut & replaced.
- Precision of reflector height might be changed.

⇒ Reflector panel adjustment is necessary!

Example of the most heavily damaged steel pipe.

(Photo taken in Nov. 2016)

Issue in reflector adjustment

Reflector panel adjustment mechanism exists in Kashima 34m antenna. However it has never been used for a long time after the construction.

They are fixed by nut to avoid unintended changes.

We had to work for

- Removing painting on the bolt
- Releasing nut.
- Clean[illegible]d lubrication.

Surface flatness measurement by Holography

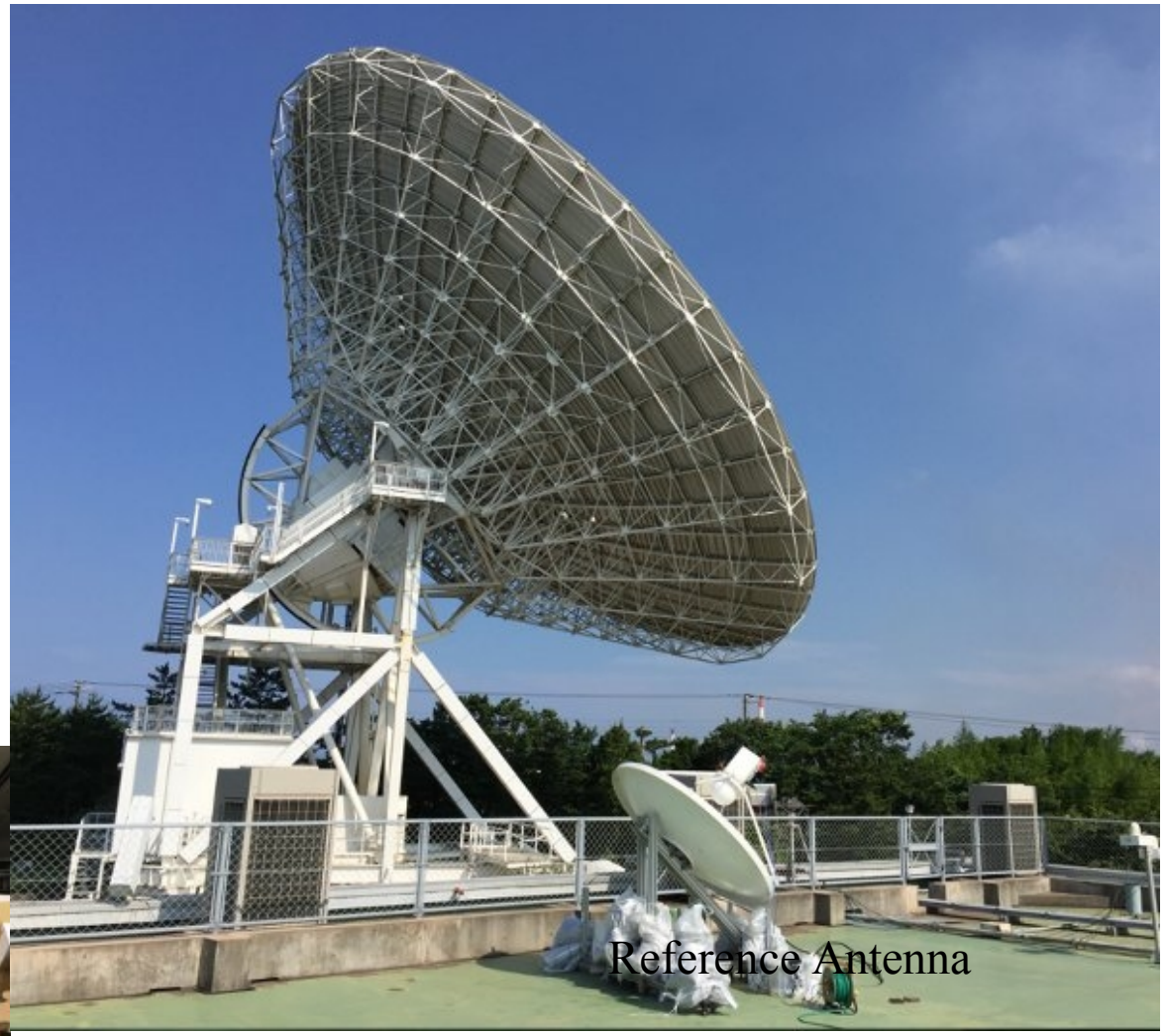
Beam pattern(Complex) ⇔ EM field distribution on the reference plane of antenna

Fourie Transformation

Complex (amplitude, Phase) Beam pattern of 34m antenna was measured by using satellite signal.

Resolution: λ/W =0.8m W=1.7deg. Angular width

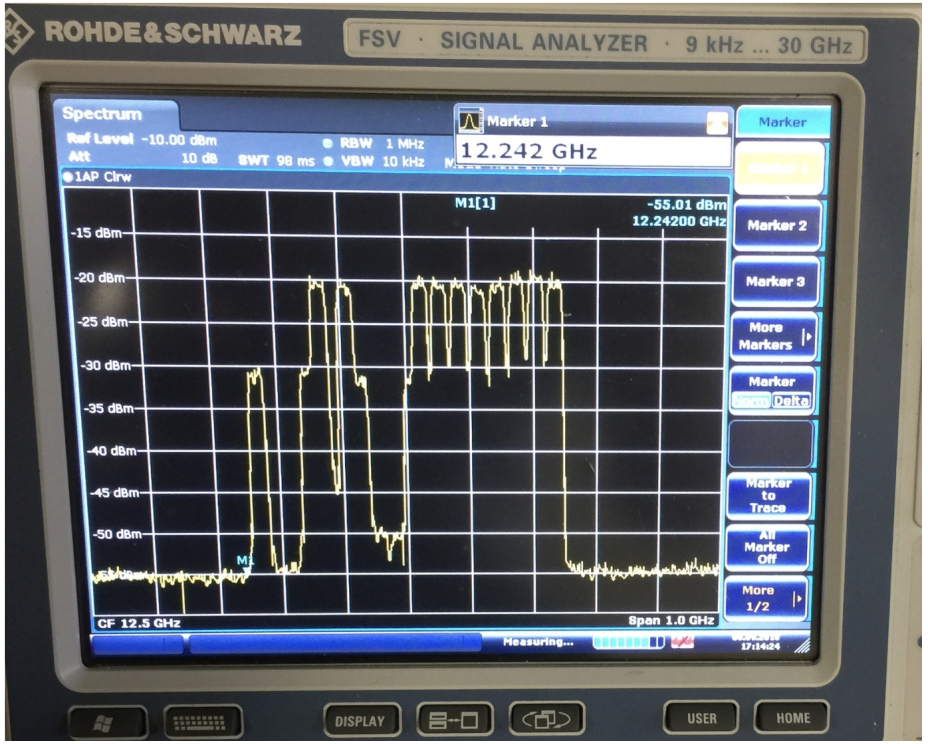
Reference antenna: 1.6m diameter
Receiver: wideband NINJA-feed for 34m and reference 1.6m.
Radio source: JCSAT-3A at AZ,EL=(200.87 deg, 46.241 deg)
Frequency: 12.15GHz, V-pol
Sampling :16MHz-4bit sampling
Processing: Zero baseline Correlation processing.



Reference Antenna

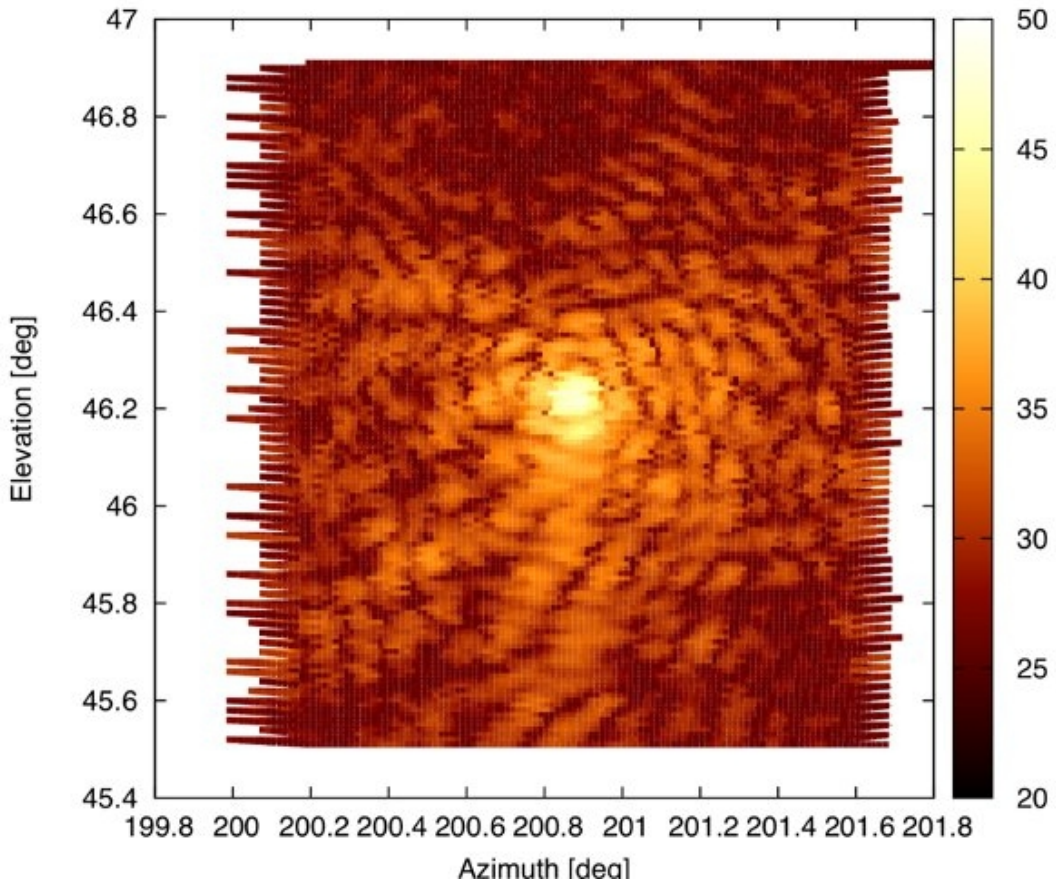
Surface flatness measurement by Holography

Broad signal can be used for correlation



Reference Antenna is prepared by recycling use of 1.6m dish used for former GALA-V

Measurement data: Complex Beam pattern



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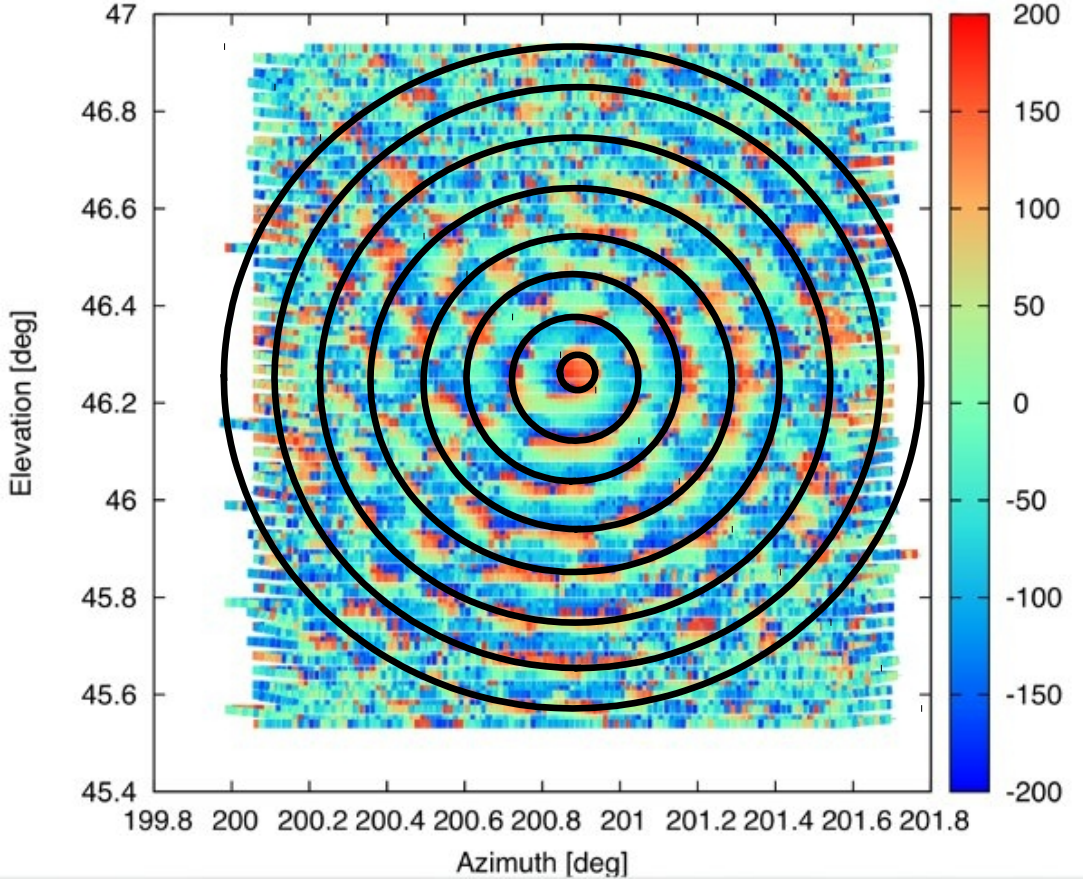
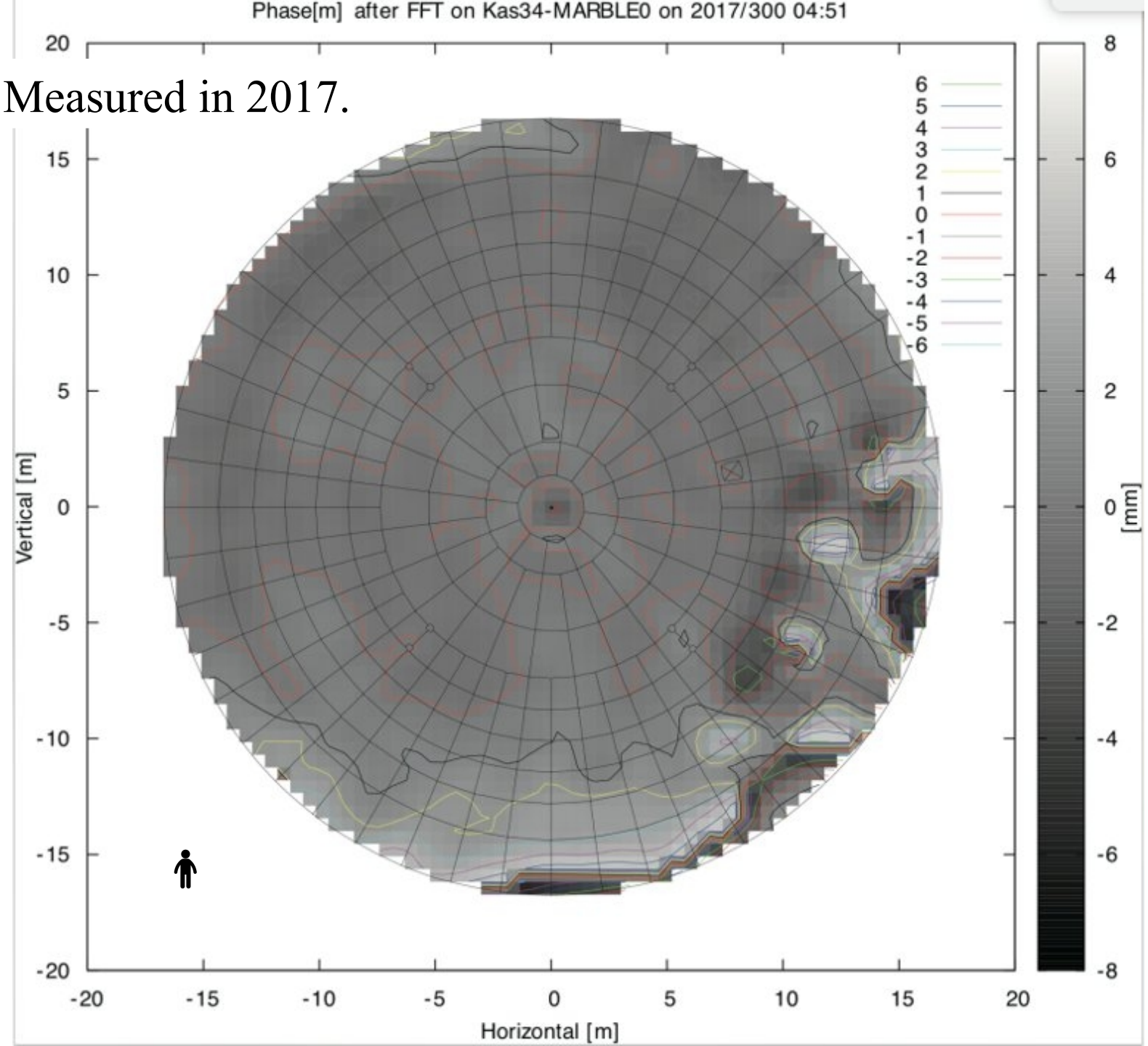


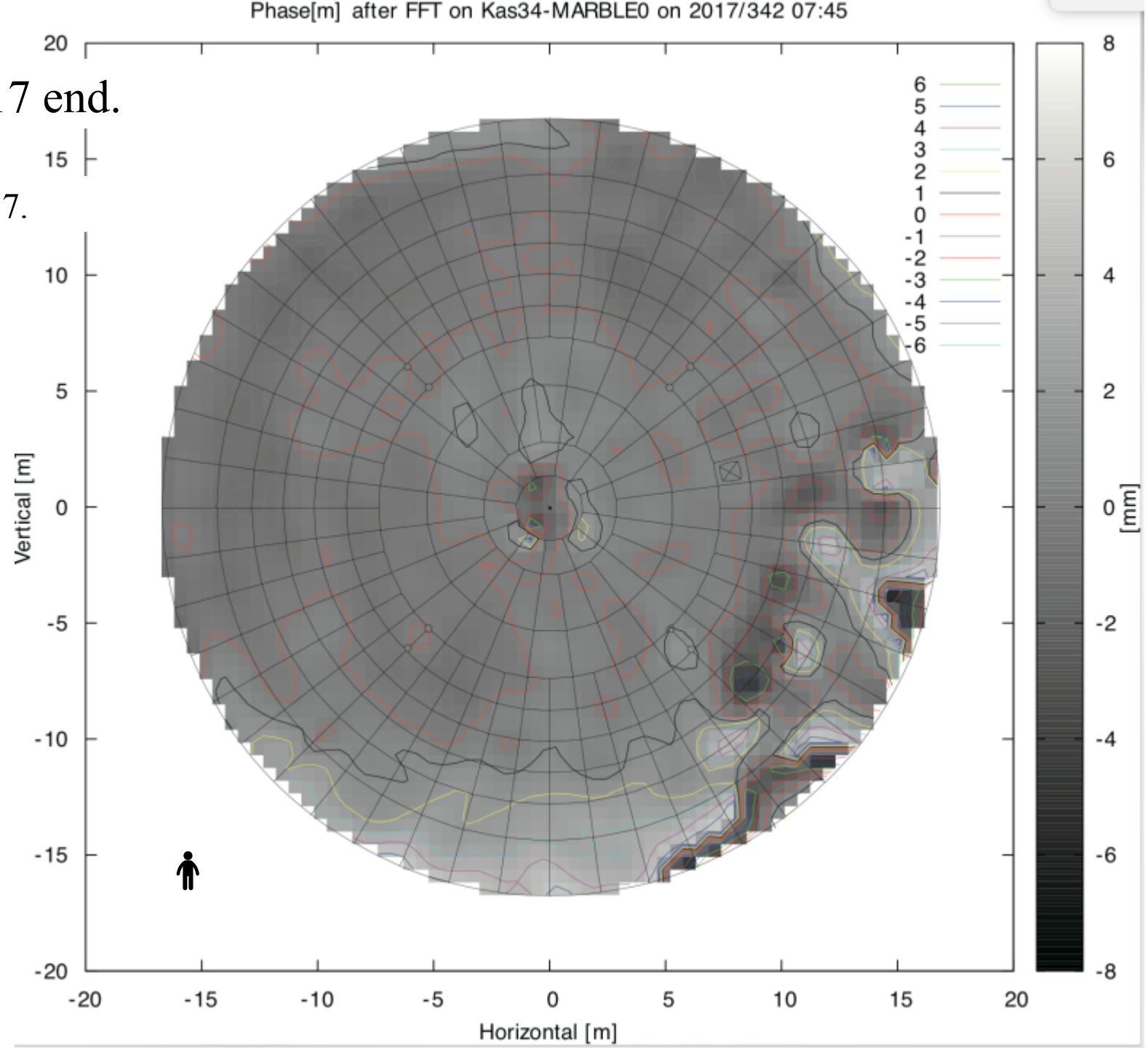
Initial surface flatness Measured in 2017.

Deformations are appeared at lower right side.

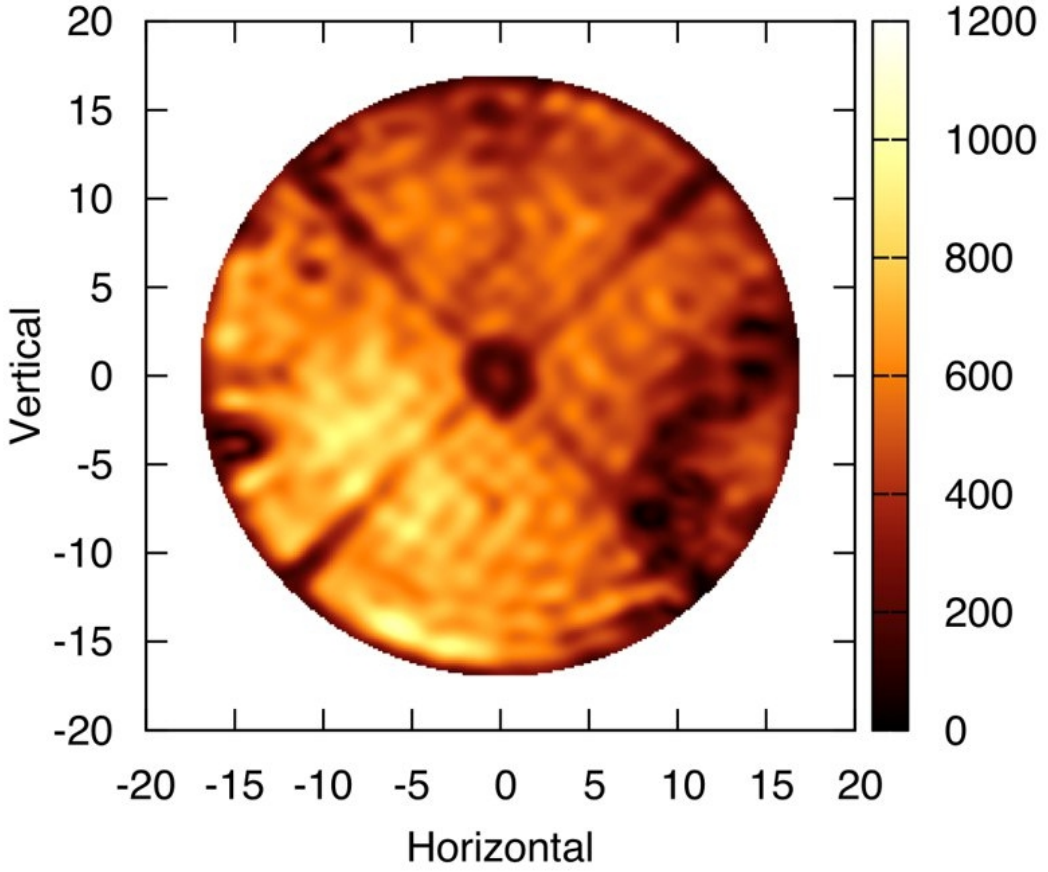


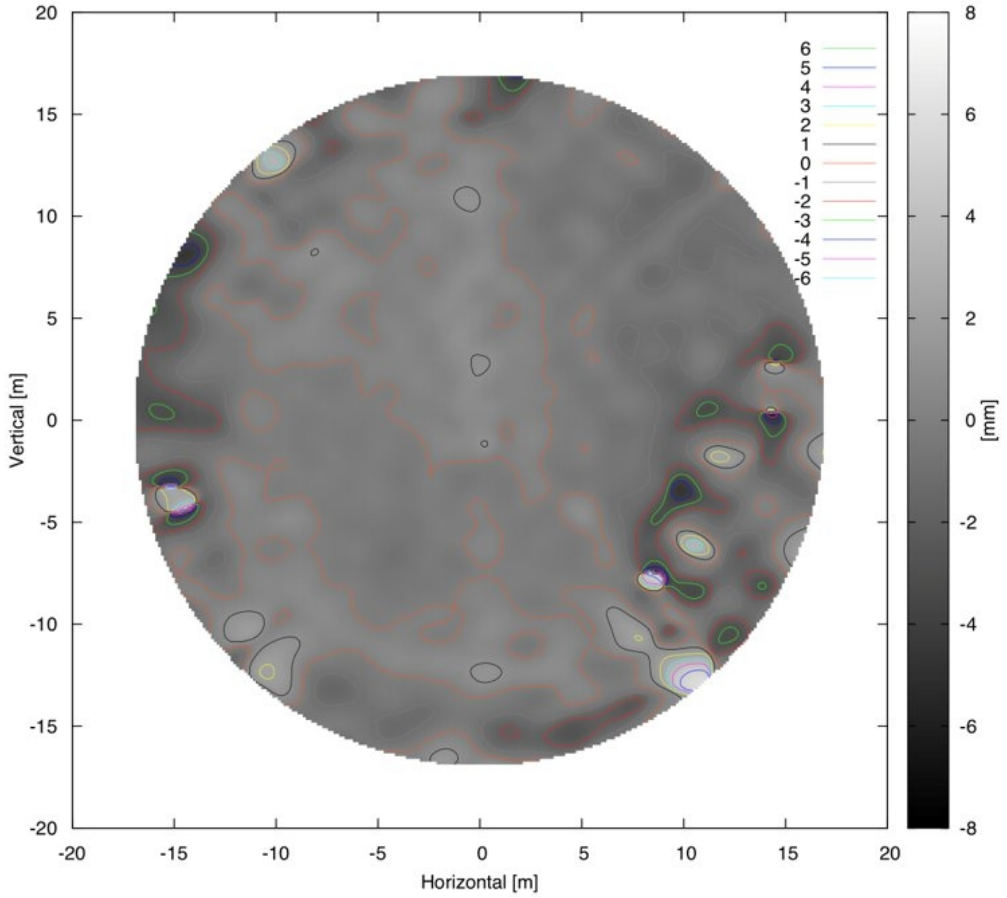
Surface flatness in 2017 end.

Bottom edge was fixed in 2017.



Measurement just after
the backup structure repair work (9th Sep. 2018)

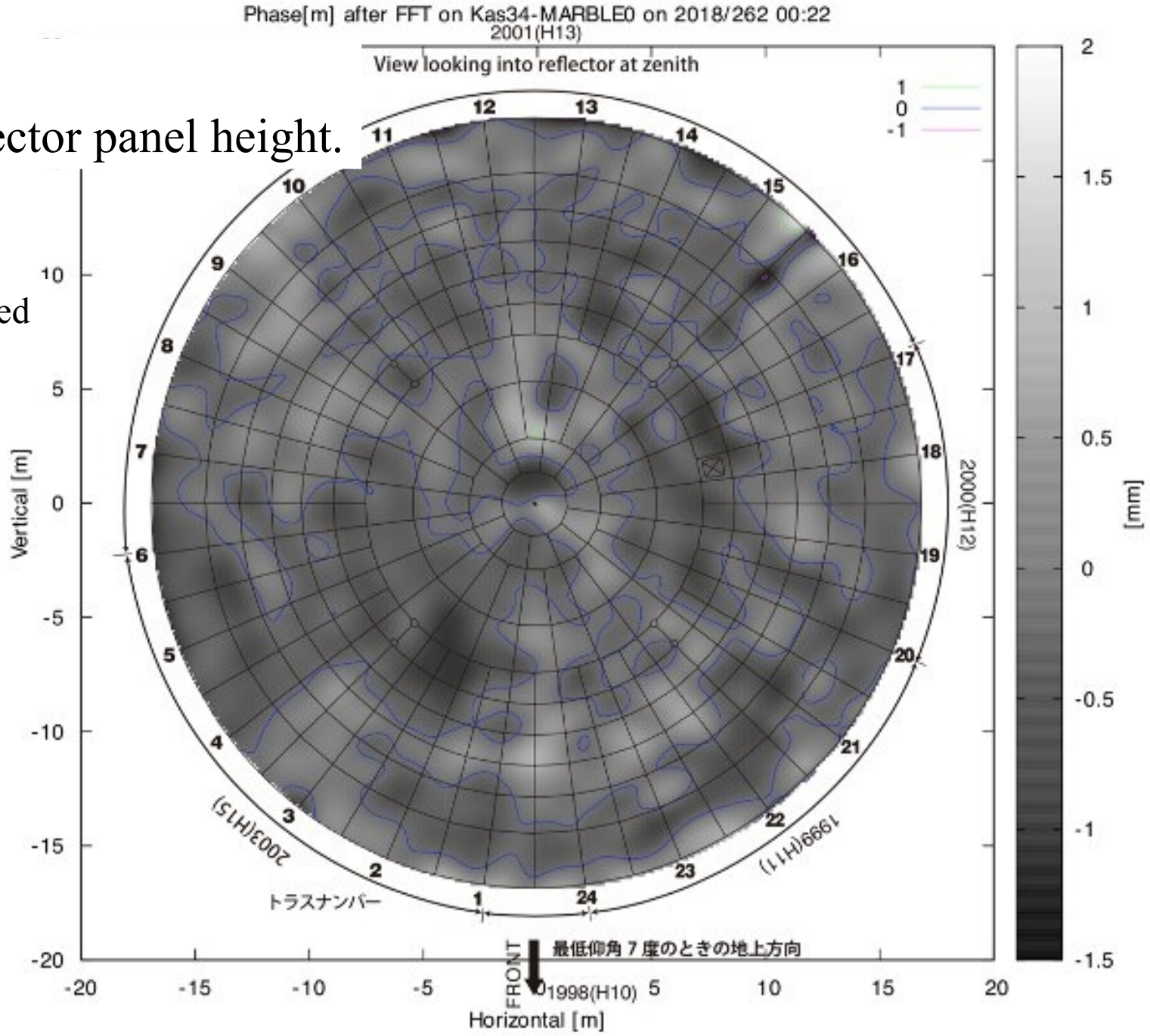




Additional deformations were occurred by the repair work in the summer of 2018.

Final surface flatness after Iterative correction of reflector panel height.

Height variation has been converged within 1mm peak-peak.



Thank you for attention.