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TESTS OF ROT-54/2.6 BEFORE THE DE-CONSERVATION

The paper describes the experiments made by the ROT- 54/2.6 radio-optical telescope before its de-conservation. The calculated data of a radio telescope parameters at a frequency of 4.5 GHz are described: taking into account a micro strip patch antenna installed in the focal region. The results of two measurements made with a difference of 13 days and their analysis are given.

Keywords: antenna, radio telescope, observation, measurement.

A series of tests were performed on the ROT-54/2.6 radio-optical telescope in the Herouni United Space Centre (HUSC) in the period of September-December of 2020. The radio sources were chosen from the Radio sources catalog, we appointed out that the sources would be able to be watched by the ROT-54/2.6 antenna in its current state. The HUSC team received professional support in this regard from Dr. John Sargsyan, a leading expert at Parks Observatory in Australia. Based on the calculation of their coordinates and local sidereal time in the sky, the time points for the tracking of ROT-54/2.6 radio telescope antenna through the meridian were determined for that day. Using special geodetic devices, the position of the pendulum bearing the secondary mirror of the ROT-54/ 2.6 radio telescope antenna was measured with a certain allowable accuracy for two axes in relation to the zenith direction from the angle of the azimuth and declination.

Using the credit of the Technical University of Eindhoven (NL) for utilizing Grasp, some predicting calculations were performed [1]. The predicted radiation pattern for a spherical wave expansion representing a micro strip patch antenna mounted in the focal point in the large radio telescope is shown in Fig.1 and Fig.2. One assumption has been made and checked: the part beyond ~32 meter is ignored in the physical optics calculations, as its contribution goes to a low level.

Two-dimensional representation of the total telescope pattern is shown in Fig.3. It is noted that the micro strip patch antenna with its asymmetrical feeding point causes an increase of the asymmetry in the cross pol-level. This calculation presents the result for the feed representation in the focus: no beam-shift. Two lines at about +0.01 and -0.01 relates to $\pm 0.57^\circ$ (in the case of manually drawn pendulum). It is to stress the pointing accuracy needed, in order to catch a point source during the observation, with a somewhat arbitrary boundary limit of $\pm 0.01 = \pm 0.57^\circ$.

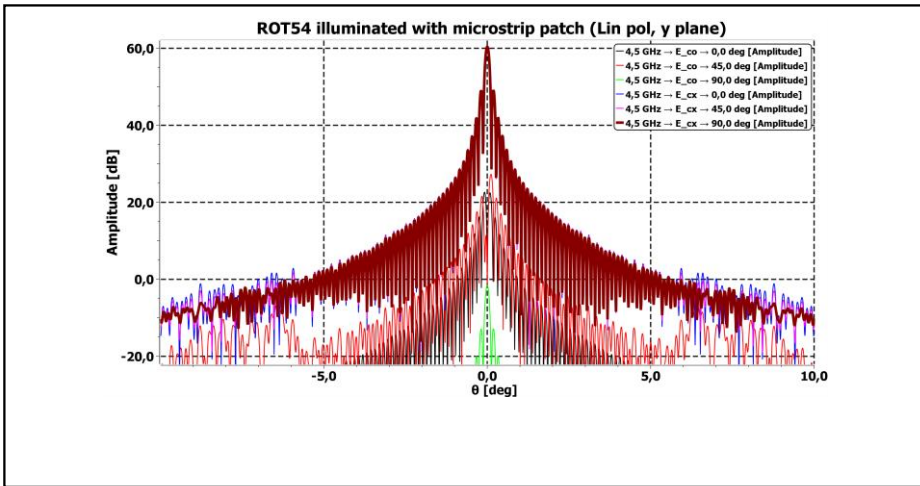


Fig. 1. ROT-54 illuminated with micro strip patch (Lin pol, y plane). The micro strip patch is linearly polarized, asymmetric feeding point. Spherical wave expansion patch co-aligned with ROT-54 focal position

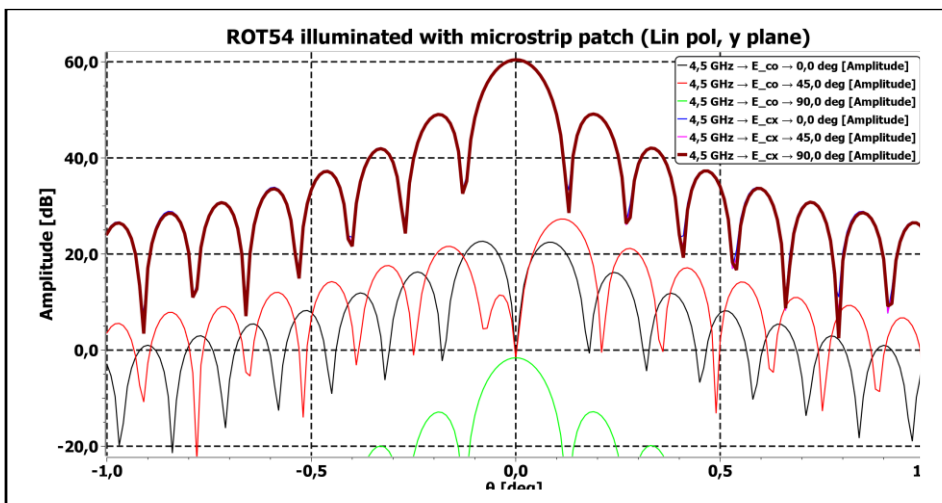


Fig. 2. ROT-54 illuminated with micro strip patch (Lin pol, y plane). The micro strip patch is linearly polarized, asymmetric feeding point, resulting asymmetry in cross-polar pattern. Spherical wave expansion patch co-aligned with ROT-54 focal position

Since it is impossible to scan an antenna pattern at declination angle today due to the forced immobility of the East-West axis, it was intended to observe at the multiple sources of CygX in the Cygnus constellation that make up the so-called Loop of Cygnus on December 3 (see results of signal processing on Fig.4).

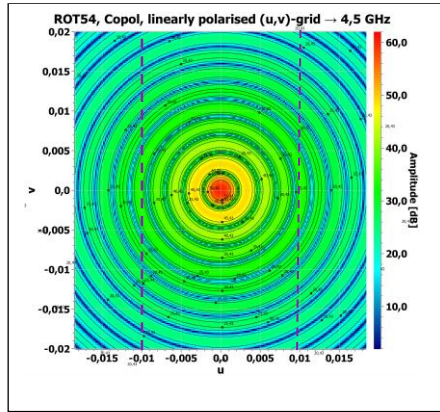


Fig. 3. ROT54, Copol, linearly polarized (u,v)-grid → 4,5 GHz, 1.15 deg is distance between -0.01 and +0.01 ($\arcsin(0.02) \sim 1.15$).

It was decided to repeat the observation of the same part of the sky at the same time of the observation in the Cyg Loop and, comparing the first and second recordings to conclude that the radio telescope is "breathable" based on the ratio of clearly measurable time deviation of the obtained images.

So, on December 16th the second observation for repeating the previous one was done on the time calculated for "presence" of the same piece of the sky around the zenith sector for the ROT54. The comparative result of the signal processing is shown in Fig. 5.

The curves are matched by those visual similarities and expected time of appearance. There is an approximate difference around 54 minutes between December 3 and December 16 measurements. Since there is a problem with synchronization and time stamping, time mismatch might exist and the error can be accumulative. It is possible to see an interesting correlation, digital datasets could possibly be correlated and the visual similarities let us assume, that the measurements the received results correlate to each other (red highlight in Fig. 5).

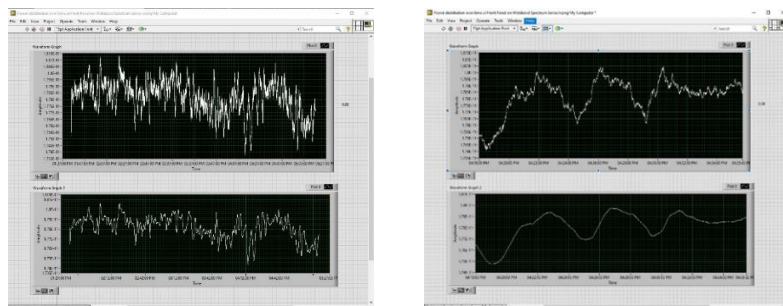


Fig. 4. Observation results in general (left) and averaged (right) pictures

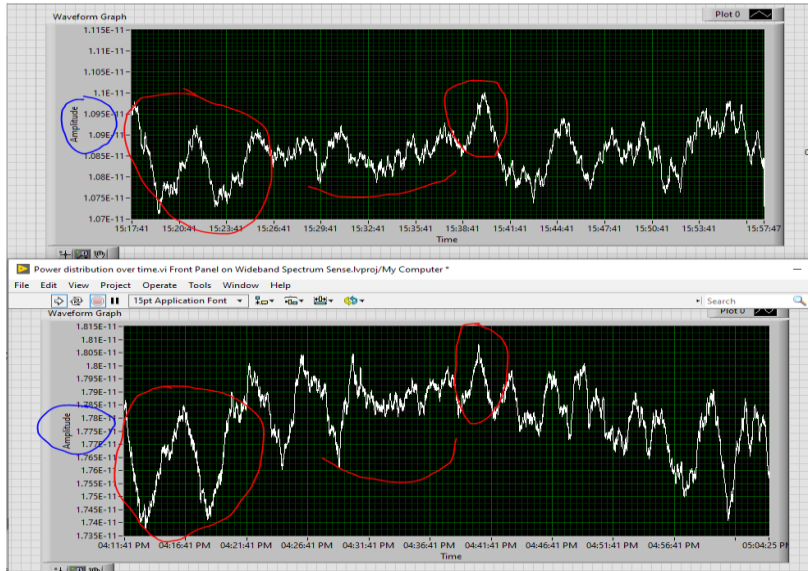


Fig. 5. Highlights of similarities between two days' measurements

In addition, as it is seen, there is around 7pW difference of average received power levels (blue highlight) between the two days' data. Our assumption is that it might be a result of the existing snow at the bottom of the large mirror (Fig 6.). According to the curves (Fig. 7), the 4.5GHz frequency penetration is around 8cm, which means that a significant part of our dish might not even work: what might result is a coaxial aperture with increased 1st side lobe, and as a result – we received less integral power.



Fig. 6. ROT-54/2.6 on December 16

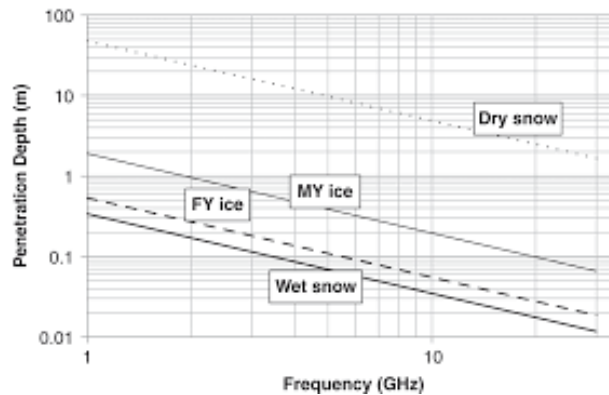


Fig. 7. Sea Ice Observations [2]

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ՓՈՐՁԱՐԿՈՒՄՆԵՐ՝ ՆԱԽՔԱՆ ՌՕԴ-54/2.6 ԱՊԱԿՈՆՍԵՐՎԱՑՈՒՄԸ

Նկարագրված են ՌՕԴ- 54/2.6 ռադիո-օպտիկական աստղադիտակով արված փորձարկումները՝ նախքան դրա ապակոնսերվացումը: Նկարագրված են ռադիոդիտակի բնութագրերի հաշվարկային տվյալները 4.5ԳՀց հաճախականության դեպքում՝ հաշվի առնելով ֆոկալ տիրույթում տեղադրված միկրոշերտային տպասալային անտենան: Բերված են 13 օր տարբերությամբ իրականացված երկու չափումների արդյունքները և դրանց վերլուծությունը:

Առանցքային բառեր. անտենա, ռադիոդիտակ, դիտում, չափումներ:

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ИСПЫТАНИЯ РОТ-54/2.6 ПЕРЕД ЕГО РАСКОНСЕРВАЦИЕЙ

Описаны эксперименты, проведенные на радиооптическом телескопе РОТ - 54/2.6 перед его расконсервацией. Рассмотрены расчетные данные параметров радиотелескопа на частоте 4.5 ГГц с учетом микрополосковой печатной антенны, установленной в фокальной области. Приведены результаты двух наблюдений, выполненных с разницей в 13 дней, и их анализ.

Ключевые слова: антенна, радиотелескоп, наблюдения, измерения.