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**METHODOLOGY FOR VERIFICATION OF SPHERICAL
RADIOTELESCOPE SURFACE ADJUSTMENT RESULTS**

The spherical antenna adjustment is the procedure which starts with the identification of the difference between the antenna's geometric and electrical axis. Misalignment of the axis is generally caused by antenna reflector surface roughness. In this paper, the methodology of ROT-54/2.6 radio telescope's antenna surface roughness estimation is studied. The methodology can be used as a verification mechanism for the adjustment already done. A laser rangefinder is considered as a measuring device for that purpose.

Keywords: antenna measurements, surface adjustment, optical method.

Introduction. The ROT-54/2.6 located in Armenia designed by P. M. Herouni [1] is a spherical antenna which consists of 3600 solid panels. Ruze [2] analysis shows that the reflector surface errors of $\lambda/16$ decrease the gain about half of the maximum achievable. In order for the ROT-54/2.6 radio telescope's antenna to operate in sub millimeter wavelengths, the surface panels should be adjusted to the shape of a sphere greater than 100 μm .

This paper studies the methodology of estimating the ROT-54/2.6 antenna's surface deviations from the given form of the reflector. The methodology can be used as a verification mechanism after the surface adjustment.

Method description. The ROT-54/2.6's antenna surface consists of a set of solid panels carried by the supported structure. The panels themselves are not flat and repeat the shape of the sphere. To estimate the antenna's surface deviations from the given form of the reflector, the distances between the panel corners from the center of the sphere must be measured. The detailed procedure of the ROT-54/2.6's antenna's sphere center determination is examined in paper [3]. As a measuring device a laser rangefinder attached to the rotatable member is chosen which consists of two servomotors. The laser rangefinder measurement precision should be less than 0.5 mm. Servomotors should be capable of rotating in azimuthal and elevation directions at 360 and 180 degrees accordingly. The rotatable member with the carrying laser rangefinder should be placed in the intersection of the axis north - south and the main axis of the antennas sphere as shown in Fig.1.

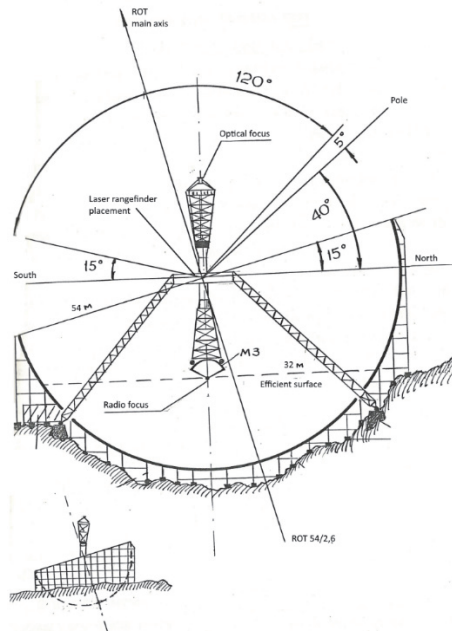


Fig. 1. The ROT-54/2.6 schematic view with a laser rangefinder placed in the center

The rotatable member's servomotors should be able to navigate the laser rangefinder beam to each panel corner, thus the movement step should correspond with the panels' length and height. The Measurement procedure is shown in Fig.2.

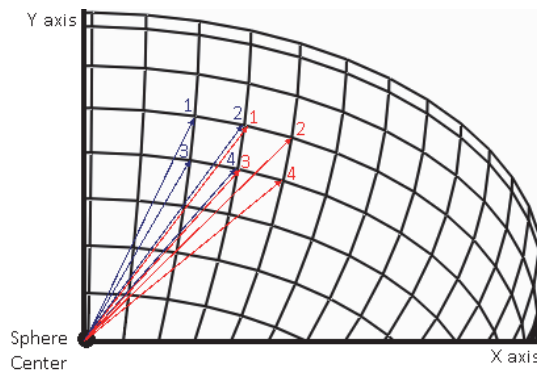


Fig. 2. Measurement procedure

The simulation example has been implemented in LabVIEW programming environment, simulating the measurement from the four corners of the surface panels and plots them on a graph. If the panel is placed in the shape of a sphere precisely, the resulting plot should look like a straight line as all the corners of the panel are equally removed from the center. In the simulation example, added

random errors are in the range between (0 ÷ 10) mm for each simulated measurement. The Nth simulation result is shown in Fig.3.

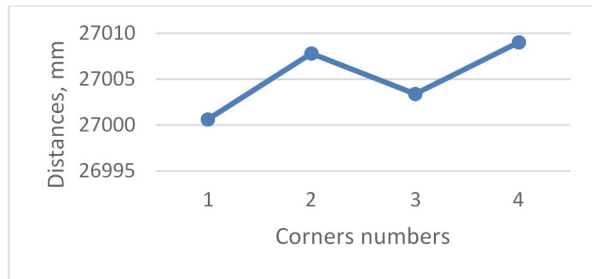


Fig. 3. The N - th panel's corner distances from the center

In Fig.4 the multiple measurements' result plotting on the same graph is shown.

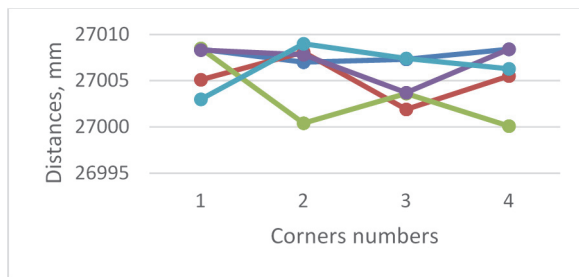


Fig. 4. Multiply panels measurement

In Fig.5, the user interface of the simulation software is demonstrated. The Interface shows information about N-th measurement, as well as all measurements on a graph and a numerical table.

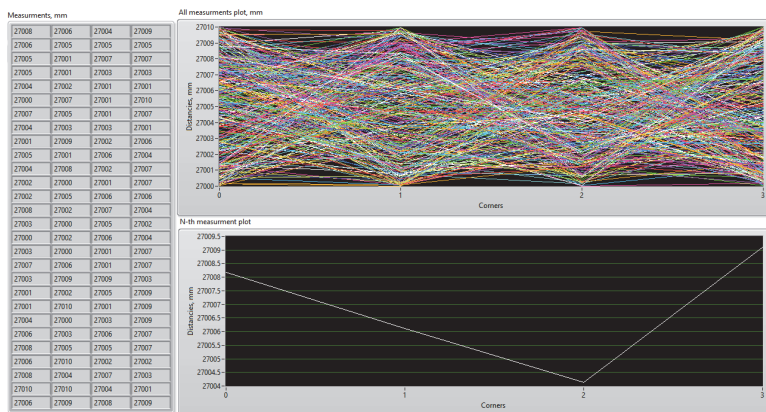


Fig. 5. Simulation application interface with results

Conclusion. The key point of bringing the radio telescope operation into submillimeter wavelengths is to estimate and eliminate the reflector surface deviations from the given form. In this paper, the methodology for verifying the antenna's surface adjustment results is studied based on the principle that in case of ideal panel placement, the corners of the panels should be removed from the center of the ROT-54/2.6 antenna's reflector equally. The methodology itself is not enough for the antenna's complete adjustment and should be used in conjunction with other methodologies.

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ՍՖԵՐԻԿ ՌԱԴԻՈԴԻՏԱԿԻ ՄԱԿԵՐԵՎՈՒԹԱՅԻՆ ՀԱՄԱԼԱՐՄԱՆ ԱՐԴՅՈՒՆՔՆԵՐԻ ՍՏՈՒԳՄԱՆ ՄԵԹՈԴԱԲԱՆՈՒԹՅՈՒՆԸ

Գնդաձև անտենայի համալարման բարդ գործընթացի սկզբնական փուլը հանգեցվում է հայելու երկրաչափական առանցքից անտենայի էլեկտրական առանցքի շեղման ստուգմանը: Առանցքային անհամաչափությունը հիմնականում հետևանք է անտենայի հայելու մակերևութային անհարթությունների: Ուսումնասիրվել է ՌՕԴ-54/2.6 անտենայի մակերևութային անհարթությունների գնահատման մեթոդաբանությունը՝ որպես համալարման արդյունքների վերստուգման միջոց: Այդ նպատակով որպես չափիչ սարք է ընտրված լազերային հեռաչափը:

Առանցքային բառեր. անտենայի չափումներ, մակերևութային համալարում, օպտիկական եղանակ:

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МЕТОДОЛОГИЯ ПРОВЕРКИ РЕЗУЛЬТАТОВ ЮСТИРОВКИ СФЕРИЧЕСКОГО РАДИОТЕЛЕСКОПА

Под юстировкой обычно понимают процесс обеспечения соответствия направления электрической оси антенны с показаниями о положении координатной системы антенны. Несовпадения осей в основном вызваны деформациями поверхности отражателя антенны. Рассмотрена методология проверки результатов юстировки антенны ROT-54/2.6. В качестве измерительного устройства рассмотрен лазерный дальномер.

Ключевые слова: измерения антенн, юстировка отражателя, оптический метод.