

Protocol of
“Herouni Mirror Telescope’s Advisory Group Kick-off” meeting

Participants: as mentioned (list below)

Date: 27th of August 2020

Meeting place: Zoom online videoconference

Discussion format: Question & Answer

Discussed questions:

1. Introduction by Dr. Uwe Bach – AG members
Introduction by Dr. Arevik Sargsyan – Local Experts
2. Presentation: Today’s situation with ROT-54/2.6 Radio/optical telescope
3. Nearest goals for ROT-54/2.6 Radio/optical telescope
4. Q&A about ROT’s declination degrees, working frequencies, receivers range and surface accuracy
5. Q&A about optical telescope on the ROT-54/2.6
6. Q&A about the receivers
7. The propose to put a receiver for test
8. Q&A about spectrum analyzer
9. Q&A about L-band receiver
10. Q&A about alloy of the panels
11. About finances and donations
12. Q&A about collaboration with Byurakan observatory
13. Q&A about the team
14. Discussion about Terms of Reference (ToR)
15. Q&A about internet connection
16. Discussion about chairman election
17. About group chat

	Name	Institute	Expertise
1.	Uwe Bach	MPIFR, DE	Effelsberg VLBI friend and EVN TOG chair
2.	Michael Lindqvist	Onsala observatory, SE	VLBI and radio astronomical observations
3.	Kees van't Klooster	ESA/ESTEC- retired	Radio telescopes and antennas
4.	Leonid Gurvits	JIVE, NL	JIVE representative, space science and radio astronomy
5.	Harro Verkouter	JIVE, NL	VLBI digital instrumentation and data engineering
6.	John Sarkissian	CASS (Parkes Observatory), AU	Radio telescope operation and development
7.	Jose A. Lopez- Perez	Dios Observatory	Engineer, head of the lab
8.	Jacob W. M. Baars	ESO, MPIFR, DE- retired	Antenna theory and radio telescope characterization
9.	Arevik Sargsyan	HUSC, AM	Antenna engineering
10.	Francisco Colomer	JIVE	Coordinator, telescopes
11.	Ashot Aslanyan	JAF, HUSC, AM	Business
12.	Karine Darbinyan	JAF, HUSC, AM	Responsible for the project, operational management
13.	Mher Markosyan	YeTRI, HUSC Scientific Committee	Computer science, ITC
14.	Vahan Avetisyan	HUSC Scientific Committee	Antenna engineering, theory and practice
15.	Armen Dekleyan	Arev laboratory, AM	
16.	Hrayr Abrahamyan	NUA, AM	Has been working for the project
17.	Harutyun Soghoyan	II, AM	Supporting science around the world
18.	Gevorg Hovhannisyan	Alikhanyan Labs, AM	Good at electronics
19.	Artavazd	NUA, AM	Arevik Sargsyan's supervisor
20.	Hasmik Eghiazaryan	HUSC, AM	PR manager of this project
21.	Karen Martirosyan	Delta Telecom, HUSC scientific committee	RF and IT engineering

1. Presentation by Dr. Arevik Sargsyan

Arevik Sargsyan showed an introductory presentation about the ROT-54/2.6 and HUSC Project, showing where the Radio Optical Telescope is placed and explaining all of its parts and how they function. Dr. Sargsyan also provides further information about the project, telling its date of construction, problems and issues it has faced and how it was developed over the time. The main goal of the HUSC project is the stable development of the Center activities both scientific and educational around the ROT.

2. Today's situation with ROT-54/2.6 Radio/optical telescope

Dr. Arevik Sargsyan describes today's situation of the ROT:

1. «The spherical main reflector is in a very reasonable state, with perspective for further improvement, so the panel setting might be well acceptable for operation in the centimeter wavelength regime» - Kees van Klooster.
2. The current status of the control of the sub-reflector and telescope assembly is, that there is no control possible.
3. There has been no movement of the cardan suspension in the last 6 years.
4. One side of the East-West axis inside the cardan housing has a defect control arm, and it is blocked on purpose and it will function after the repairing of the connecting rod.

Also Ms. Sargsyan told, that the emergency services will arrive to the ROT, to make observation and collect data about the condition of the telescope, to proof the government, that there is no risk with using and working on it. After that, all engineering works will start.

3. Nearest goals for ROT-54/2.6 Radio/optical telescope

Dr. Sargsyan also tells the main purposes of the project and what has to be done. Namely, she mentions that the revitalization of the project needs a: careful inspection of the ROT; the new control system has to be designed and installed; the RF equipment should be obtained.

Also, Dr. Sargsyan mentions that HUSC applied to the EVN for conducting scientific-technical expertise of the telescope, and that the international Advisory Group has formed, and the Local Experts Group is ready to work.

This year the main issue of the XXIII international Conference on Radio Telescopes and Radio Interferometers (18th of September, Yerevan, on line) will be the Engineering and Scientific aspects of the revitalization and Modernization of ROT-54/2.6 Radio Telescope.

Additionally, the government will allow the members of the AG (if they will decide) to visit Armenia under some special conditions.

The plans described by Arevik Sargsyan are as follows:

1. Make a full complete tract in this fixed position of the ROT on the 4.5 GHz.
2. Collect and analyze data about possible metal fatigue of the mechanical construction of tripod and the pendulum carrying the secondary mirror.

3. Design a road map for repairing works on the East-West axis.

4. Q: about ROT's declination degrees, working frequencies, receivers range and surface accuracy by John Sarkissian

A: Dr. Sargsyan mentions that the ROT is declined to South at about 15 degrees and can work from -35 to +85 degrees for declinations of observed sources, and that there used to be three different receivers for 20cm, 3cm and 8mm (with the sensitivity: 0.6 K, 0.02 K and 0.06 K), which were made by Herouni's institute, but currently they all are missing. The surface accuracy used to be 70 microns, but now it has dropped to 100 because of the surface panels, but there is goal, to reach the mm range soon.

5. Q: about optical telescope on the ROT-54/2.6 by John Sarkissian

A: Dr. Sargsyan said, that at this moment it is closed by the special cover and it is not possible to operate it even know the condition, but there are plans to repair it if it will be necessary. She also told, that it is in the same angle and axes, as the whole construction is, and we can just switch on camera in the optical focus, and the ROT can be used in both ranges, radio and optical (during the night).

6. Q: about the receivers by Jose A. Lopez-Perez

A: For the question of Dr. Jose A. Lopez-Perez, about the receivers, if they are located behind the sub-reflector, Dr. Uwe Bach mentioned, that there is a platform below the sub-reflector, where all receivers are located. Then Dr. Sargsyan added, that there is possible to place receivers weighting more than 50kg. But the problem is, that there is no cooling system there. For the question of Dr. Jose A. Lopez-Perez, if the ROT has pipes, for helium cooling method, Dr. Sargsyan gave negative answer, as there never was any pipes for helium. But in fact it is needed, especially for mm range. But however, the design of ROT is unique, and it has no noises at all. Also Dr. Sargsyan explained how they get access to the all working parts (sub-reflector, receivers, and etc.) using the shaft, which is under the control building, and it provides access to the eastern leg of the ROT tripod, and they can climb by that leg to the bridge and reach that parts for working, changing the receiver for example.

7. The propose of Harro Verkouter, to put a receiver for the test

For the propose of Harro Verkouter, to put a receiver, to make proofs for the government, that ROT is working, Dr. Sargsyan told, that they are going to make testing's in a few days, but as they have no radiometers, they will use vector-analyzer, and because of not working Cardan, it will not possible to make flexible data-collecting, moving it in X and Y coordinates, and the antenna will be stable standing in the same angle to the sky. Dr. John Sarkissian proposed to use a drift scanning method, which means, that the telescope, mirrors, sub-reflectors and receivers will be motionless, and the whole sky, with it movement will move, compared to the telescope, and it will be possible to collect data, from the whole zenith, for the demonstrations. Dr. Sargsyan agreed and told, that they are planning that kind of works, for the 2nd of September, using vector-analyzer, which will receive signals in 4.5 GHz frequency.

8. Q: about spectrum analyzer by Uwe Bach and Jose A. Lopez-Perez

A: Also Dr. Uwe Bach asked, if it is possible to record data from spectrum analyzer, and Mr. Harutyun Soghoyan gave positive answer, that it is possible to record data from it. After, Dr. Jose A. Lopez-Perez asked, if it is possible to put low noise amplifier on spectrum analyzer, for getting better accuracy of patterns, and the answer was again positive. After, Dr. Jose A. Lopez-Perez mentioned, that it must be +20db amp, for most sensitivity.

Despite the world situation with Covid-19, Ds. Arevik Sargsyan told the participants of the group, that it will be possible for them to visit Armenia and work on the project here, in case, if they can pass their board and if they pass the test for Covid-19, with negative result. It will be possible to be on quarantine in Armenia during one day just for our AG members, invited to Armenia, instead of 14 days for others.

Most members of the group told, that they cannot leave their countries, and furthermore, they can't lose two weeks on obligatory quarantine, once they return to their home countries.

9. Q: about the possibility, to place L-band receiver on the secondary mirror by Leonid Gurvits

A: Answering Dr. Leonid Gurvits's question, about the possibility, to place L-band receiver on the secondary mirror, which works in 1.6Ghz freq. and have 18cm³ dimensions, Ds. Sargsyan told, that it will be possible, because they had a practice of placing there a receiver with 60 cm³ dimensions, without any problem.

10. Q: about alloy of the panels by John Sarkissian

A: After Dr. John Sarkissian's asked, if the panels are solid and if it is made from aluminum, Dr. Arevik Sargsyan answered that the reflector panels are solid and made from duralumin, and the secondary mirror from titanium panels, which have 50 microns accuracy and are in perfect condition now. Also she mentions that there are heating and drainage systems under the dish, and the rainwaters or melted snow can be easily removed from the dish.

Dr. Sargsyan mentioned, that they need new automatic control system, as the old one is missing, though there were 28 separate automatic control systems, which were controlling the whole antenna (legs, secondary mirror, RF focus, optical telescope parts, etc.). But as the system was analog, it had not great accuracy (2"/arch – that time!), compared with today's systems, that's why, ROT needs new digital systems and other equipment.

11. About finances and donations

Dr. Sargsyan told the members of the conference, that the ROT will ask from Government 200K\$/yearly, for stable working, and they will try to seek the finance and donations, technical and in-kind assistance not only from Armenian government, also from other companies and organizations, like NI/Armenia (National Instrument Armenia), Acronis (Software company), which will build data storages for ROT in five years, and for the whole project will be allocated around 10M\$ equivalent technical support, as mentioned Mr. Armen Derderyan and Mr. Ashot Aslanyan.

12. Q: about collaboration with Byurakan observatory by John Sarkissian

A: When Dr. John Sarkissian asked about collaboration with Byurakan observatory, Dr. Arevik Sargsyan told, that HUSC and Byurakan observatory often work together, they participate to each other's conferences, making presentations, etc. and Dr. Areg Miqaelyan (head of Byurakan observatory) mentioned many times, that it would be the best, to have ROT nearby in Armenia, also scientific school of radio astronomers will grow up, because of this instrument, etc. She also told, that the biggest mirror of the Byurakan observatory, which was made in Leningrad (nowadays St. Petersburg), was made in double copy, and the second one was brought by Herouni's institute, and placed in Herouni's ROT.

13. Q: about the team by John Sarkissian

A: Giving an answer to Dr. John Sarkissian's question, about the team, Dr. Arevik Sargsyan told, that she has a team of different kind of engineers, which consists of thirty to forty people who work there as volunteers for now (including her).

Then, Dr. Arevik Sargsyan told, that according to the plan, the movement of ROT must be repaired during a month after the beginning, and asked Dr. John Sarkissian, what he think about the transportation of receiver, and got the answer, that it is necessary to find the receiver compatible.

After discussing about the receiver position in sub-reflector at rainy days, Dr. John Sarkissian promised to look for working receiver, if he can find any, and will see what he can do for that.

14. Discussion about Terms of Reference (ToR)

Later the team starts the discussion about the Terms of Reference. Dr. Arevik Sargsyan told, that HUSC project covers some expenditure for local travelling and meal, but not for accommodation, and also they can get some funds from the Jumping JIVE project. Mr. Ashot Aslanyan added, that he will ask the government for some financial aid for that part of the project.

By the point of ToR, the AG will issue a report of its activities before the end of 2020, and final evaluation report before the end of 2022, as a public document to the HUSC management. Dr. Arevik Sargsyan told, that the first Report will be report of current situation, like scientific technical expertise, it will be presented with business concept they have, to assure government that AG is working, and it will take into account the opinion of abroad experts. The group set a goal, to issue the report, before the end of 2020, and to show it the government. As everyone agreed on the Terms of Reference, they remain unchanged.

15. Q: about internet connection by Harro Verkouter

A: Answering Dr. Harro Verkouter's question, Arevik Sargsyan says that there is no separate internet connectivity, but it will be set up, starting with low speed of internet, but it will become faster over time. The team will find the closest place with the best price.

Answering to Dr. Karen Martirosyan's question, Dr. Uwe Bach says that the minimal speed has to be at least 1 Gbit per second.

16. Discussion about AG chairman election

Also was discussed the chairman electivity problem, who will be public person for the HUSC.

Dr. Uwe Bach says that the chair election can be postponed, also says that he can't be the chair himself but he will work as a Coordinator of the AG. He suggests that the group has another meeting in 4 to 6 weeks, in October for example, so there is time left to think about everything connected with the project.

Arevik Sargsyan says that the government will ask who is the chair, because of the bureaucracy is. The group decided to discuss the question in a week and then choose a chair.

17. About group chat

Arevik Sargsyan suggests the Advisory group to have a chat for Q&A, short questions and fast answers in general. It was decided to use "Mattermost" system.

The first report is decided to be a bit earlier and be something brief that shows some progress, later the reports will be carried out once in 6 months.