

Report from the Short Term Mission – STM

PERSON NAME:	Marcis Bleiders
HOME INSTITUTE	Ventspils, Latvia
HOST COLLABORATOR	Contact person: José Antonio López Fernández e-mail: ja.lopez@oan.es
HOST INSTITUTE	Yebes Observatory, IGN, Spain
DATE OF THE STM:	5.06.2017 – 16.06.2017

Report:

1. TOPIC

The main topic of this STM visit was to get practical introduction and experience with technologies related to development and employment of wideband radio astronomy receiving systems at Yebes Observatory. As VIRAC is planning to invest and employ the BRAND receiver in their antenna in the future, it is necessary to familiarize its staff with following topics. One of the main goals was to learn more about correct RFI measurement and mitigation techniques, because RFI is one of major issues in case of BRAND receiver design and employment. Second goal was to learn basics of cryogenic receiver design, because it is planned that VIRAC will perform assembling and installation of BRAND in Irbene RT-32 telescope by themselves. Third topic of the visit was to acquire practical experience in radio holography measurement procedure, because due to relatively low surface efficiency of RT-32 it is planned to perform such procedure in order to increase the performance in EVN network.

2. PROPOSED AND PERFORMED WORK

During visit at Yebes observatory, various different tasks was proposed and performed. It included introduction to receiver developments, participation in RFI workshop and carrying out radio holography measurement procedure.

In relevance to receiver development, first of all general introductions to work at Yebes development labs were provided. Then more detailed familiarization with low noise amplifier developments, with emphasis on cryogenic LNA characterization procedure were carried out. After that detailed introduction of cryogenics lab, which included taking part in practical disassembling of cryostat and familiarization with different technologies, technical challenges and solutions of designing and maintaining the cryostat. During the visit it was chance to meet young engineers of Yebes, and during the everyday work together it was possible to learn about corrugated feed horn design procedure (tutorial: theory, simulation software, design flow), downconverter and microstrip filter design (simulation software, practical measurements) carried at Yebes. Also introduction to single dish calibration techniques implemented at Yebes 40 m telescope was covered, which will help to improve calibration procedures (amplitude calibration, pointing calibration) and thus calibration quality at Irbene telescopes.

One of main goals was to learn more about RFI measurement and mitigation. During the STM, participation was done at “Detection and measurement of RFI in radio astronomy Yebes Observatory” workshop which was organized at Yebes, June 8 – 9. At the workshop, it was possible to learn about different RFI problems, measurement solutions and mitigation approaches presented by representatives of other observatories, which will help to implement RFI monitoring equipment at Irbene. Important part of the workshop was hands-on tutorial of Yebes portable RFI measurement equipment. VIRAC is planning to borrow this equipment for comparable characterization of RFI situation at Irbene site, which is needed in conjunction with BRAND development.

During the last part of the visit, radio holographic measurement at Yebes 40 m telescope was carried out. During the procedure, introduction to measurement hardware and algorithm was



provided. Full measurement procedure was carried from preparation to final aperture error map: preparation of holography system was carried (holography feed focusing, measurement equipment and signal checks), preparation of holography measurement script and its parameters, pointing calibration of 40 m RT carried, measurement of 32x32 point maps and data reduction with ALMA holography software. During the measurements it was possible to monitor all signals including spectrum of GEO satellite beacon, amplitude and phase, and total power during the raster scanning, which provided valuable feel of process and details of the procedure. Few issues (which strengthened the experience of procedure though) was experienced, which included few software problems, increased phase error due to problems with synchronization, and increased RMS of obtained aperture error map due to carrying out holography procedure at daytime and increased ambient temperatures.

3. CROSS-DISCIPLINARITY

As VIRAC engineers have relatively small experience in radio astronomy related system design and employment, proposed collaboration will increase practical experience and field of view. It will help to better understand how improve existing development and telescope facilities of VIRAC, for example implementation of correct routine RFI measurement system will greatly benefit for future RFI mitigation at Irbene site.

Radio holographic measurement knowledge will help to improve current Irbene radio telescope performance, because currently such measurement system is not implemented at Irbene. Also, it is planned to carry out first holographic measurements of Irbene RT-32 surface within possible doctoral thesis of applicant.

4. IMPACT

Expanded practical experience and field of view of VIRAC staff knowledge will positively impact Irbene radio telescope system performance as EVN station. In addition to that, VIRAC is directly connected to Ventspils University College (VUC), and improved quality of local engineering, research and development activities will help to attract future engineering students, improve existing study quality as a result higher level specialists will potentially be prepared for work in technical fields related particularly to communication technologies.

It was valuable to acquaint the new colleagues of the same field which will definitively help VIRAC to solve future problems more efficiency.

5. PUBLICATIONS

There are two topics identified which potentially will result in publications and/or conference reports. One of them is about RFI measurement system implementation and RFI measurements at Irbene site. Second topic is related to radio holography system implementation and measurement of Irbene RT-32 radio telescope surface. Also, topic of radio holography will potentially be basis of PhD thesis of M. Bleiders.

The project leading to this publication has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730562 [RadioNet]