Report from
the Short Term Mission – STM

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RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under the grant agreement No 730562

Report:

TOPIC

– *Please describe briefly the topic of the performed visit addressing its relevance to the RadioNet goals.*

Feasibility study of an optical pointing and tracking system for the Sardinia Radio Telescope

PROPOSED AND PERFORMED WORK

– *Describe the goals of your visits and achieved work. Specify the highlights and occurred problems, providing the solution.*

The goal is to collaborate with the INAF researchers in studying the feasibility and assessing the requirements of an optical pointing telescope (star tracker) to be installed on SRT for pointing and tracking diagnosis as well as for pointing coefficient derivation and monitoring.

In particular, the goal is to collaborate in a preliminary study aiming at determining: the type and size of the optical telescope and of its mount type and mount location, the type of CCD camera with a suitable plate scale with sufficient number of pixels and sensitivity to achieve the desired spatial resolution and field-of-view, the control system, and data acquisition and analysis system. The CCD detector will have extended near-infrared sensitivity for possible daytime operation. The hardware will be specified not to generate Radio Frequency Interferences (RFIs).

CROSS-DISCIPLINARITY

– *Please specify the cross-disciplinary fertilization; especially transfer of scientific knowledge to the next generation of scientists and engineers.*

The proposed project offers an excellent opportunity for a cross-disciplinary exchange between researchers with know-how on radio astronomy techniques at INAF-Osservatorio Astronomico di Cagliari and the applicant, who has a background in the optical field. The exchange will greatly benefit both the hosting institution and the applicant who will have the opportunity to familiarize with the radio astronomy techniques and with the Sardinia Radio Telescope. The planned activity will help the researchers of the hosting institution in reinforcing their knowledge in the optical field, while the competencies that will be acquired by the applicants in radio astronomy techniques will be transferred at its home institution for possible future research.

IMPACT

– *Please explain the impact on collaboration of European radio astronomy engineers with industry and a wider community (scientific, technical, industry).*

An optical telescope mounted to observe an optical beam parallel to the radio beam can be used to improve the SRT telescope pointing and tracking system capabilities. The main benefits associated with the use of a small optical telescope with diameter of order 10-20 cm mounted in parallel with the SRT radio beam are: a) there are many more bright stars which can be used as sources than radio pointing sources; b) with a CCD camera, optical data acquisition can be done in few seconds, as opposed to the minute time scales necessary for radio pointing measurements; c) positions of optical stars can be derived to sub-arcsecond accuracy. Although the atmospheric seeing will limit the actual resolution of the optical

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telescope to about 1-3 arcsecond, the ability to find the centroid of a star is proportional to the actual resolution divided by the signal-to-noise of the measurement, thus determining a pointing precision of much less than the actual resolution. Currently, the pointing accuracy of the SRT radio beam in K-band (18-26.5 GHz) is ≤5 arcsec, within the specification of ≤ 1/10 FWHM. However, it is important to enhance the pointing performance of the SRT telescope in view of its future operation at Q-band (33- 50 GHz) and 3-mm band (≈100 GHz), where the specifications on pointing and stable tracking of the radio astronomy sources are more stringent (pointing accuracy specification ≤1 arcsec at ≈100 GHz). The information gathered by the optical star tracker mounted in parallel with the SRT can be used to assess the stability and accuracy of the SRT radio tracking system and the stability of the SRT radio telescope pointing behaviour, thus providing very useful information that can be used to improve the SRT performance and its observing efficiency.

PUBLICATIONS

- *In case of future publication - please provide additional information: place & date. Remember to insert the acknowledgment of the RadioNet support:*

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]

All gained experience will be distributed in various forms focused on different audience in our region.

University staff and students

Our university can be proud of a number of talented and gifted students. As a lecturer and supervisor of master's thesis I am interested in their progress as young scientists and researchers. That's why after coming home I am going to develop an instruction or manuals for students of our university about winning grants and successfully preparing projects.

Some meetings and seminars with staff and students will be organized to share experience concerning the SRT and my work there.

Of course, my experience also would be described and placed at the university website to promote our university.

Other high school students

Being a member of Expert Committee Member in the Minor Academy of Sciences I am going to inform students of high schools about possible ways to get involved in different international projects. It could be useful to encourage them to become researchers in the future. It also will help young people to make a choice with their future education.

Media

In addition, my research work could be highlighted in local mass media and namely TV channels "Halychyna" or "3-d Studiya"; newspapers "Galka" and "Firtka". It could be an interview or articles.

Finally my participation in Horizon 2020 can enhance university's reputation and visibility at local, national and international level. It could be considered as evidence to promote international projects such as Marie Skłodowska-Curie actions.

Up to today the article devoted to the visit of the Sardinia Radio Telescope has been placed on

- **university website** (http://nung.edu.ua/news/%D1%83%D0%BD%D1%96%D0%BA%D0%B0%D0%BB%D1%8C%D0%BD%D0%B8%D0%B9-%D0%B4%D0%BE%D1%81%D0%B2%D1%96%D0%B4-%D1%81%D1%82%D0%B0%D0%B6%D1%83%D0%B2%D0%B0%D0%BD%D0%BD%D1%8F-

%D0%B2-%D0%B0%D1%81%D1%82%D1%80%D0%BE%D0%BD%D0%BE%D0%BC%D1%96%D1%87%D0%BD%D1%96%D0%B9-%D0%BE%D0%B1%D1%81%D0%B5%D1%80%D0%B2%D0%B0%D1%82%D0%BE%D1%80%D1%96%D1%97-%D0%BD%D0%B0-%D0%BE%D1%81%D0%B0%D1%80%D0%B4%D0%B8%D0%BD%D1%96%D1%8F

- **local online newspaper**
  https://kurs.if.ua/news/dotsent_ifntung_proyshov_stazhuvannya_v_astronomichniy_observatorii_na_ostrovi_sardyniya_foto_67840.html
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