



Report from the Short Term Mission – STM

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Report:

1. TOPIC

- *Please describe briefly the topic of the performed visit addressing its relevance to the RadioNet goals.*
- Development of high temperature superconducting (HTS) filters for radio frequency interference (RFI) mitigation. The increase of RFI signals deteriorate the performance of high sensitivity radio astronomy receivers saturating low noise amplifier, for this reason, it is very important for the radio astronomy community to mitigate their effects in the observations. H2020 Radionet4 project plans to build a prototype broad-band VLBI receiver in the range 1.5 - 15.5 GHz, the performance of this receiver will be distorted by RFI signals due to different services, like WiFi, UMTS, Bluetooth, WiMax... whose working frequencies are inside of operating band of this receiver. Therefore, it's necessary to build HTS filters to minimize RFI impact of it.

2. PROPOSED AND PERFORMED WORK

- *Describe the goals of your visits and achieved work. Specify the highlights and occurred problems, providing the solution.*
- The main goal of the visit was the assembly and characterization of HTS filters for interference (RFI) mitigation. A first prototype of filter was been designed and manufactured on superconducting substrate. In this case the assembly of two types of filter was done, a S-band filter for Yebes and a C-band for INAF-IRA.

The assembly was performed using K connectors and there were small problems with the assembly of its glass bead. These problems could be solved replacing the damaged bead by a new one.

After assembly, cryogenic measurements of the filter scattering parameters were performed, obtaining good results in the transmission parameter.

However, the measured S11 was not very good and the final value didn't match with the simulation results, having a fairly high value but was acceptable. One of the possible reasons may be the difficulty in performing a good cryogenic temperature calibration. Another possibility is an error in the simulation for not taking some parameters into account.

It's a research line for futures filters.

3. CROSS-DISCIPLINARITY

- *Please specify the cross-disciplinary fertilization; especially transfer of scientific knowledge to the next generation of scientists and engineers.*
- The mission will allow young a PhD student to learn the HTS filter technology developed by INAF in order to apply it the radio astronomy receivers of the Spanish Yebes Observatory. These works could be the seed for a thesis on this topic. The work done in Bologna will be the starting point of the PhD thesis focused on this theme.

4. IMPACT

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



- The impact of radio frequency interference (RFI) on astronomical and geodetic observations is one of the major problems in all observatories around the world. The existence of RFI can damage the amplifying stages of ultra low noise receivers or drive them into saturation and, hence, generate intermodulation. These effects impede the detection of cosmic radio signals or even blind the receiver, making it useless. Therefore, it is very important develop mitigation techniques, like HTS filter, to avoid unwanted effects on sensitive receivers. The results of the works on HTS could be used by industry for similar applications demanding ultra-low insertion loss filters and high rejection of interference signals, like future mobile communication services or space-to-Earth RadioNet has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 730562 communications of satellites and deep-space probes.

5. 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]