POLICY BRIEF

RESEARCH INFRASTRUCTURES

INTRODUCTION: PROJECT TITLE AND PROJECT OBJECTIVES

CALL: HORIZON-INFRA-2022-TECH-01
TOPIC: HORIZON-INFRA-2022-TECH-01-01
PROJECT: New science in Radio Astronomy: applying cutting-edge technology to enhance the entire data chain, from receiver to final output (RADIOBLOCKS).
PROJECT: Objectives

- The development of common building blocks needed for the development of new correlators, which can efficiently exploit powerful new commercially available accelerator hardware (GPUs). This development will directly benefit the large radio arrays from metre to sub-mm wavelengths (namely the EVN+eMERLIN/JIV-ERIC, LOFAR/ILT, and ALMA/IRAM), well aligned with the spirit of the EU call.

- The development of common building blocks in cutting-edge frontend technologies, addressing the generation and real-time handling of wide band and multi-band data, in particular for the creation of novel detectors and components, both RF and IF, as well as the design of backends, with built-in RFI mitigation.

- The development of common building blocks for multipixel (PAF/FPA) receivers, ranging from cm to submm wavelengths, suitable for large single dish facilities, with special relevance for future collaborations with pan-European and global RIs (e.g. SKA-VLBI).

- The implementation of a generic software toolkit (consisting of common building blocks) to handle the post-processing of the resulting (very) large data streams, to be used for the creation of specialised pipelines, including the application of RFI mitigation techniques and the use of advanced data-processing algorithms.

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POLICY IMPLICATIONS AND RECOMMENDATIONS

RADIOBLOCKS has started in March 2023. In the course of the first twelve months of the project, all activities have started and gained momentum. The first year of the project has been dedicated to exploring the technological landscape where RADIOBLOCKS will build its results. It is worth noticing that most deliverables will be technology products that will be delivered at the end of the project.

In this Policy Brief, a summary of the policy implications and recommendations will be presented for the results obtained during the first reporting period (March 2023 – February 2024). Many policy areas listed in the provided template may not apply because it is still too early in the project to assess the impact or the results are still under development.

- **Implementation of research infrastructures**.
  No specific highlight at this early stage of the project. However, the workflows, tools and applications currently being developed in RADIOBLOCKS are intended to be utilised by researchers using multiple research infrastructures.
- **Access to research infrastructures.**

No specific highlight at this early stage of the project.

- **Funding of research infrastructures**.
  Not applicable.
- **International co-operation of research infrastructures**.
  There is an ongoing viability study for a next-generation ALMA GPU correlator upgrade in collaboration with ESO, KASI, and NAOJ. The work in WP4 is helping to address the challenge of open access since all program codes and publications are or will be open access.

  RADIOBLOCKS WP5 tasks 5.1 and 5.2 internally collaborated on establishing common interfaces to data. Through international collaboration with NRAO (USA), these discussions have been taken to a wider level. This resulted in the request from a research group with years of expertise in the same fields from SARAO (South Africa) to join the RADIOBLOCKS project. The aim is to get global consensus on the data format for the upcoming and future radio astronomy research infrastructures.

  A Memorandum of Understanding is in preparation to explore common challenges and prospective collaborations between RADIOBLOCKS and the Horizon Europe project ARGOS-CDS.
- **Employment and skills in research infrastructures**.
  RADIOBLOCKS WP2 is a strong collaborative effort with nine tasks involving eighteen partner institutes. The regular interactions within the team allow us to share work, questions, solutions, and ideas. These increased skills are crucial to meet the objectives of the project.
- **Greening of research infrastructures**.
  The use of GPU and tensor-core technology significantly reduces energy consumption for key signal-processing tasks. No further highlight at this early stage of the project.
- **Interaction of research infrastructures with industry**.
  Ties to the industry will have been tightened and, ideally, also new industry partners will have been found. No further highlight at this early stage of the project. An industry advisory board is being set up by WP1 and it will become active in the second reporting period of the project.
- **ERIC legal framework**.
  Thanks to the participation of ILT in the project, which is now LOFAR ERIC, we will benefit from the VAT deduction applicable to ERICs for the purchase of computer hardware for RADIOBLOCKS.
- **Technology development, data and digital services, digitalisation**.
  We are learning and demonstrating how to use new network and GPU technology for signal processing at 400 Gb/s data rates. Traditional methods did not scale beyond 100 Gb/s, while the higher data rates are necessary for scientifically more capable instruments. The use of GPU technology for our signal-processing pipelines accelerates processing times and reduces energy for CPU-based processing.

  The various instruments will have new or upgraded correlator/beam formers that utilize the latest technologies for efficient processing. The development of such technologies started in the first year of the project and key results are expected in the following reporting period. Moreover, key software components will be shared through common, open-source repositories ("radio blocks").
- **Level of connection of your RI to EOSC**.
  No specific highlight at this early stage of the project.
- **Contribution to other research areas and to broader EU priorities.**
  Not applicable.
- **Sustainability of research infrastructures.**
  Not applicable.