Newsletter

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`http://lofar4sw.eu/`

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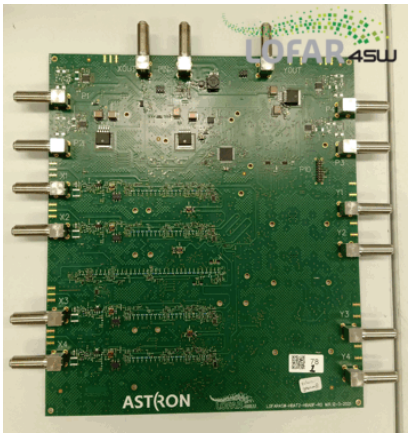
If you have any questions or want to learn more about the Project, please contact us (**lofar4sw@cbk.waw.pl**).

New LOFAR4SW HBA tile prototype

The key requirements towards the completion of the LOFAR4SW project, is to design and deliver the prototype of the HBA dual beam tile, to allow parallel astronomy and space weather observations.



HBA beamformer board. Copyright: M. Ruiter, M. Mevius.

Over the past months the project team, in particular, WP5: Hardware design group - led by ASTRON and in collaboration with Paris Observatory, Nançay group - completed the production of the hardware components to build an HBA dual beam tile. The hardware design includes: the HBA frontend, HBA beamformer boards, RF summation board and power distribution boards (the summation and power distribution boards are modifications to the current LOFAR boards). The new dual beam tile doubles the full field of view of a HBA tile, by creating a second independent analog beam. This gives the unique possibility to perform two independent experiments at the same time with the same HBA tile. The main advantage of this solution is that it's much cheaper than building two separete stations, however, strict requirements on the isolation between the beams need to be met. During the project, two technical solutions were investigated in terms of cost, complexity, beamforming efficiency and isolation. The first technology uses discrete parts, whereas the second integrates key functionality into an ASIC. The project team built the prototypes for both solutions and verified their performance. The results were then presented during the project Critical Design Review. See also website.

Development of the LOFAR4SW software pipelines

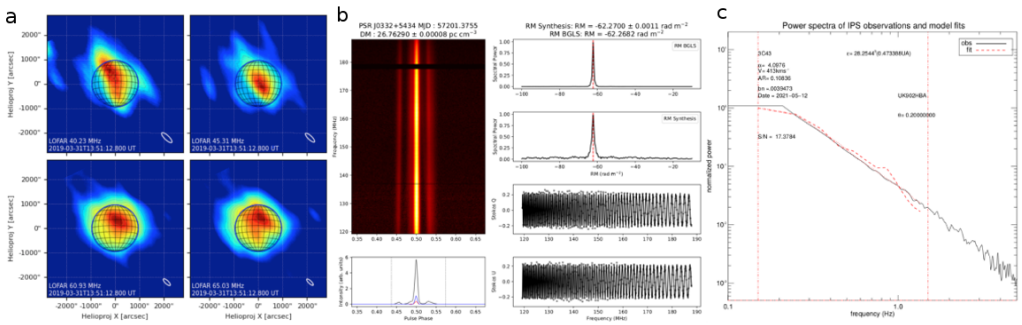
One of the LOFAR telescope strenghts lies in its flexibility achieved by using many small antennas (instead of dishes) which are digitized at an early stage in the signal chain. The instrument operations heavily rely on CPU-based software. This was from the beginning assumption also for the LOFAR4SW. The project working group 6 (WG6) responsible for the LOFAR4SW software development in the course of the project was working on the scheduling and control system and dedicated pipelines for observation processing and delivering data products. This includes:

IPS software: The Interplanetary Scintillation pipeline which uses raw beamformed HDF5 dynamic spectrum data to produce estimates of solar-wind velocity and of g-levels (the normalised scintillation index, a measure of line-of-sight plasma density).

Faraday Rotation pipeline (FR): The Faraday Rotation pipeline which takes raw beamformed HDF5 data recorded during pulsar observations and analyses these to obtain time series of interplanetary/interstellar dispersion and Faraday rotation.

Solar Imaging: The Solar Imaging pipeline which takes raw measurement sets (MS) and passes them through the standard imaging routines that all LOFAR MS undergo e.g.,

auto-weighting, flagging (of the calibrator only), averaging, complex gain prediction and calibration, and imaging. This is followed by a coordinate conversion to helioprojective system.



Above: a) Images of the Sun produced with 37 LOFAR core and remote stations from 40-75 MHz in steps of 5 MHz. b) Diagnostic plot of FR pipeline for data of PSR J0332+5434. c) An example of single-site IPS analysis applied to power spectra from observations made using UK902 on 12 May 2021.

The LOFAR4SW-specific software verification and assessment of the local computing needs were carried out at built specially for this purpose UK902 prototype station at the Chilbolton Observatory. The entire chain of software needed to setup observations, record data, pipeline processing, data product production and archiving were tested and led to clear identification and quantification of the needs and requirements for full operations. The prototype was deemed highly successful towards the full design of LOFAR4SW. See also website.

LOFAR4SW Critical Design Review - the major milestone completed

On September 21-23 in the form of an online meeting, took place the LOFAR4SW Critical Design Review. The aim of the meeting was to determine if the design is mature enough to provide a solid basis for future funding proposals and as a suitable pathway for future upgrade roll-outs.

The review panel consisting of specialists with both scientific and technical background in the summarising report pointed out significant improvements in the project since the PDR and its maturity, and also provided a useful guidance on what could be done in order to make the project implementation succesful in the future. This, together with the positive feedback from the workshop with stakeholders (organised online on October 14) gives a green light for the next step which is preparation of the LOFAR4SW Roadmap which will be the basis for implementing project in the future into a fully operational facility. See also website

Next steps and the Project finalisation

The LOFAR4SW project is aproaching it's official end which will be in February 2022. Before this takes place, the final online LOFAR4SW demonstration session is planned for the first half of February 2022. The aim of the meeting will be to present the outcomes of the project to the end users. More information about the event will be announced on the first days of January 2022.

The project team will also deliver to the EC the **Final Conceptual Design** in the form of a report and the project **Roadmap for Exploitation Strategy**. The latter, in particular, will present plan that outlines the short, medium and long-term activities that should be undertaken for the successful exploitation of the LOFAR4SW results and for maximal impact. It will include a strategy aimed at expedient implementation of the LOFAR4SW upgrade.

Upcoming events

- **AGU Fall Meeting**, New Orleans, LA & Online, 13-17 December 2021
- **LOFAR4SW Final Demo Session**, Online, TBD February 2022
- **15th Quadrennial Solar - Terrestial Physics Symposium (STP-15)**, Online, 21-25 February 2022
- **The official end of the LOFAR4SW project**, 28 February 2022

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