**LOFAR NEWSLETTERS MARCH- APRIL 2021**

Previous LOFAR newsletters are collected here.

Announcements:

- **Lofar School:** The 6th LOFAR Data School 2021 took place on 22-26 March as a fully virtual event. The aim of the School was to introduce the LOFAR system to new members of the LOFAR community and present the analysis techniques for processing both interferometric and high time resolution beamformed LOFAR data. The School was attended by over 100 students, postdocs and staff, from all over the world, but with a large proportion from ILT member countries. Lectures and demos were provided via Zoom and in addition, online material was provided for hands-on data processing sessions. Slack was used as a forum for interaction and networking between the participants and lecturers. The slides from the lectures and tutorials are available on the School website; video recordings will also be made available in due course.
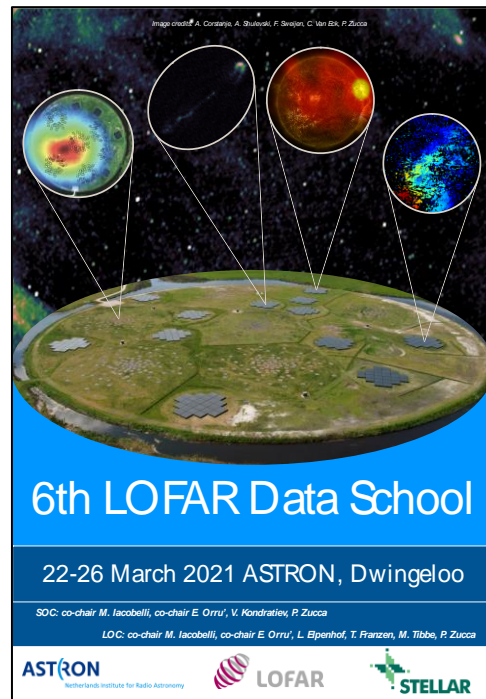
- **Review of proposals for Cycles 16-19:** long-term proposals for Cycles 16-19 and single-cycle proposals for Cycle 16 are currently being reviewed. A total of 31 proposals were received. In Cycle 16, 1778 observing hours are available; the oversubscription rates are 2.9 for the observing time, 2.5 for the processing time and 1.2 for the LTA storage. The PC meeting will take place on 11-12 May. Proposers can expect to receive feedback after that.

- **Download issues from Poznan LTA site:** downloading data from Poznan using globus-url-copy is currently not possible, on modern OS-es that have disabled SSL2.0, due to the use of this deprecated protocol at Poznan. The SDCO is in contact with Poznan about updating their LTA environment, which is the best solution to avoid security problems.

Array & observing system status:

- 38 stations operational in the Netherlands: 24 core and 14 remote stations. 14 international stations in operations: DE601, DE602, DE603, DE604, DE605, FR606, SE607, UK608, DE609, PL610, PL611, PL612, IE613, LV614.

- A new international station will be built in Italy. Station deployment will start in 2022. The station is expected to be fully functional in 2023.

- The overview of non-operational antenna elements for LBA and HBA is available here.

- No major failures were experienced on CEP hardware/software over the past couple of months. The system administrators performed a mid-life upgrade of the operating system and operational software stack of the CEP4 cluster starting in January. Some initial difficulties were encountered but these were handled by operations and software support and did not cause disruption of the observing schedule. It did delay the final steps of the upgrade somewhat, but these have been successfully concluded by mid April.

- Station calibration: LBA_Sparse_Even calibration tables have been updated at CS031, CS302, CS401, RS205, RS210, RS406 and RS509 using a new method developed by Michiel Brentjens. Some of these stations never had the tables installed and others had a poor performance. The LBA_Sparse_Even is now used for the LBA survey and is offered as an operation mode as of Cycle 16. The currently installed calibration tables already show an improvement. A selection for the best calibration tables is still to be made for these stations.

Observing Programs

- Cycle 15 started on 1 December 2020 and will run till 30 May 2021.

- The figure on the right shows the completion levels of the last five cycles. The completion target is indicated by the red line: this is set at 95%. At the end of observing week 17 (19-25 April), the completion level of Cycle 15 was 88%. The average observing efficiency so far in Cycle 15 has been 71%. The observing schedule can be found here.
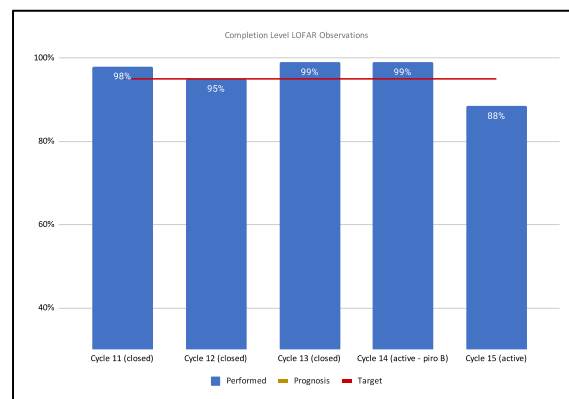
PROJECTS

Holography (M. Brentjens)

- The current way of calibrating LOFAR stations by all-sky imaging and straight-forward self-calibration is rather sensitive to local RFI. By cross-correlating stations that are tens to hundreds of km apart, holography eliminates that problem.

- In the first quarter of 2021 we have held several "busy-weeks" in which we made LOFAR's HBA holography process much more robust and user-friendly. We are now close to operational use.

- We have:
    - Captured the entire process in a Jupyter notebook
    - Made it simple to generate such a notebook for a particular observing session
    - Made the determination of delays more robust
    - Added extensive software tests

- What remains to move to full operational use are a few training and debugging sessions with the operators. We foresee those happening before the summer. We have also attracted a PhD student to work on LBA holography over the summer. We expect to be able to report on that in the fall.
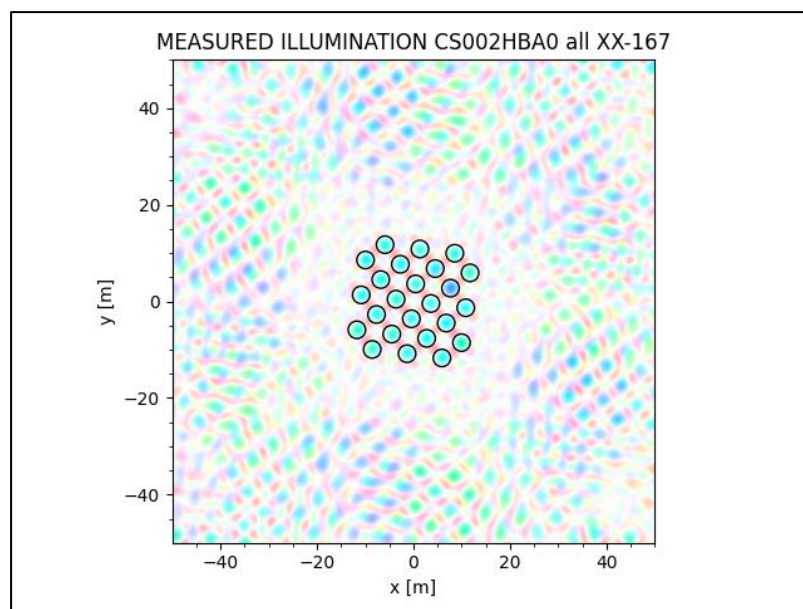
Illumination maps for many LOFAR stations at 167.97 MHz. Brightness is amplitude, and colour is phase error. The overall state is great, and problematic antennas stand out like a sore thumb!]

Telescope Manager Specification System (TMSS; R. Pizzo, S. ter Veen, M. Iacobelli)

- TMSS (Telescope Manager Specification System) will be a brand-new software application for the specification, administration, and scheduling of LOFAR observations. it will enable the required support for LOFAR2.0 use cases, while also streamlining LOFAR operations and improving the adaptability and maintainability of software for future extensions.

- Over the past two months, several improvements were applied to the user interface to streamline both the monitoring of the observing program and templates preparations. An important milestone was reached in March through the successful execution of various dynamically-scheduled observations and pipelines. A flexible engine that is able to generate reports tailored to the users' needs is now available. A federated solution is now in place to authenticate users. Eventually, an important achievement was also made in the area of stakeholder engagement. From early April, users are able to track the project progress through the TMSS infographics, which provide a quick and insightful summary of the overall progress of the project and clarify the focus for the current and future developments sprints. A few screenshots taken of the various TMSS interfaces are presented in the image below.
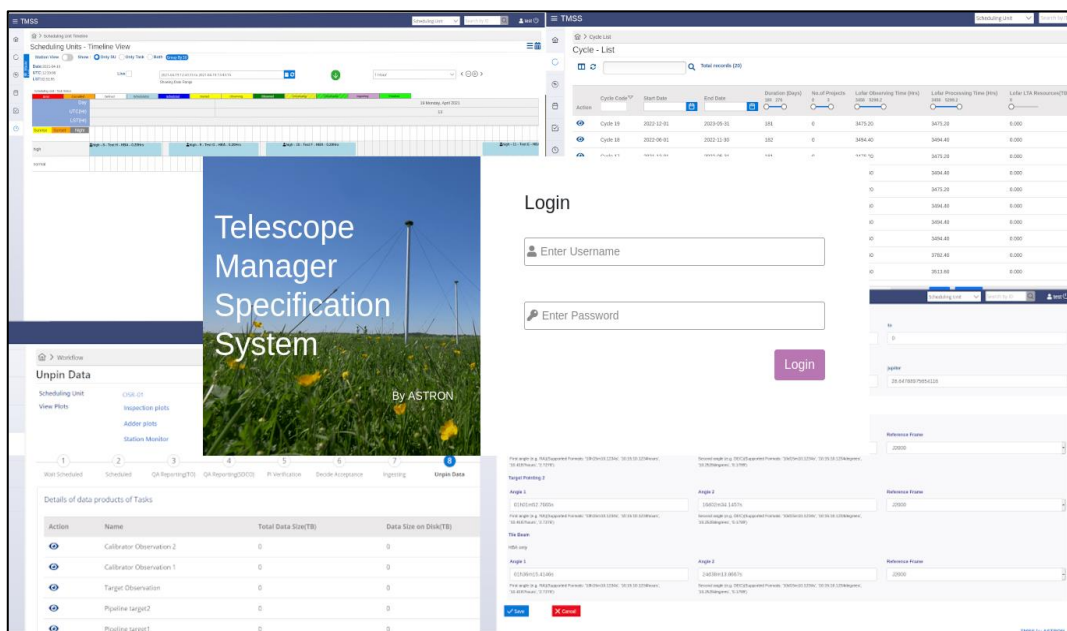

- The next sprints will see the implementation of additional priority classes in the dynamic scheduler, the support for additional use cases (including the BF modes and responsive telescope), and the implementation of project roles in the federated AAI solution now in place.

- TMSS phase 1 will end in June 2021. A second phase of TMSS development will start after that to support more science use cases and realize further streamlining of the operational processes. We will report on this in future newsletters.

LOFAR2.0 Program (W. van Cappellen)

- LOFAR2.0 progress highlights are presented every two months in the LOFAR2.0 Newsletter (https://www.astron.nl/lofar2-0-newsletter/).

- A LOFAR2.0 White Paper is being prepared to help advertise the project, its science goals, and to assist ILT partners with science text that they can use in their local funding drives. The document is being written collaboratively with inputs from dozens of LOFAR community scientists.

- The ILT Board approved the outcome of the LOFAR2.0 down scope. The main conclusions are:

    o The transient buffer functionality is down scoped. The firmware delivering this functionality will not be implemented now, but can be added later by a firmware update. A scientist already anticipated on this situation and submitted a funding proposal from which the transient buffer can be reinstated. Fingers crossed!
    o After May 2022, procurement for the LOFAR2.0 rollout will start and final hardware quantities must be known. Some station owners need more time to secure the funds for their station upgrade. Consequently, LOFAR will temporarily become a hybrid system from 2023, with both LOFAR1 and LOFAR2.0 stations in operation. The ILT board has agreed on the intention to stop the compatibility with LOFAR1 stations by the end of 2026.
    o The updated high-level planning and some changes to the LOFAR2.0 budget have been approved.

SDC Program (J. Swinbank)

- Work on the foundations of the SDC Program has continued apace since the last update. This has included developing on the big picture "vision" of the SDC, as well initial work on the facility architecture. The facility will be based around a Data Product Repository, which provides bulk data storage and management capabilities, a Processing Service, which executes batch processing jobs like pipeline execution, and a Portal, which provides data discovery, access, and interactive data analysis functionality. This is illustrated in the accompanying figure.
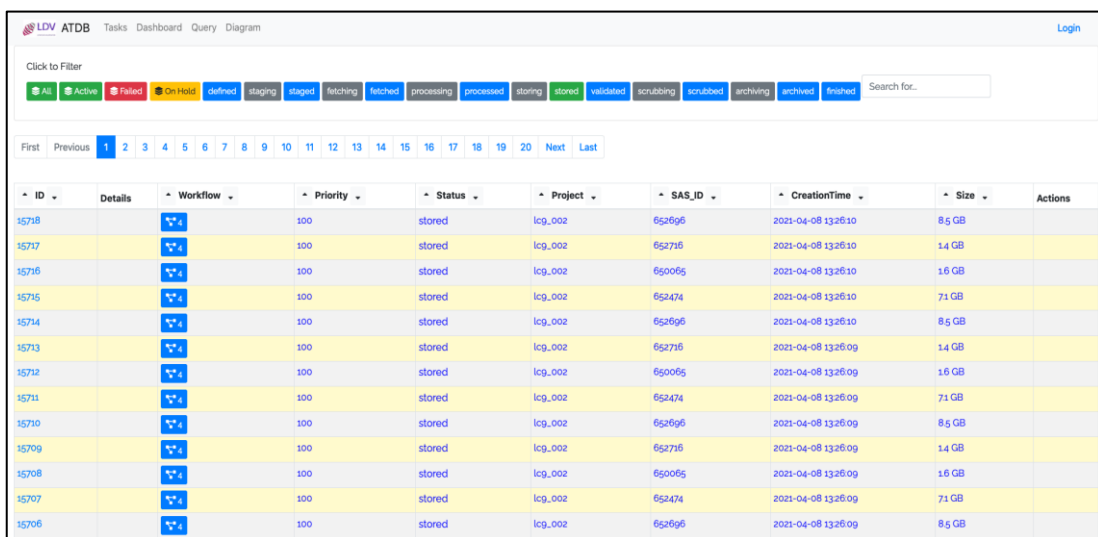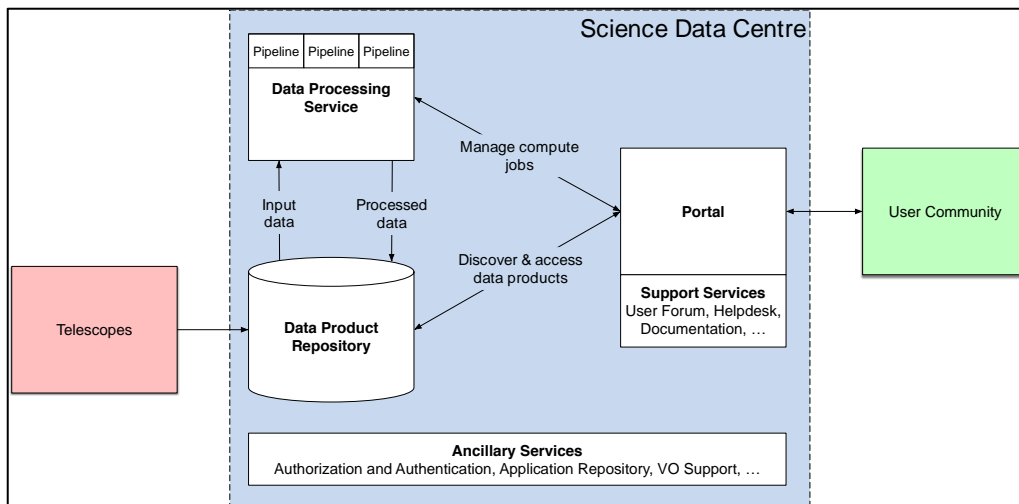
- The SDC Program is also moving to adopt a work methodology based on the Scaled Agile, or SAFe, framework. We are confident that this will provide us with a good structure for building reliable and innovative software while sticking to predictable schedules. This transition started with training session held in April, and will continue over the next several months.

- Substantial progress has also been made on more technical aspects of the SDC. Highlights include:

  o Development of the pipeline execution system which is used for at-scale data processing within the LDV project. This work is now almost production-ready; we expect LDV to be using it for bulk data processing during May (see LDV section in these newsletters).
  o Execution of the "Rapthor" direction-dependent calibration & imaging pipeline on the Spider cluster at SURF.
  o Program approval for the the overall relationship between the SDC and the LOFAR2.0 system.

Science Delivery Framework – Production Pipeline Enhancement (J. Swinbank, T. Shimwell)

- The SDF-PPE project concludes at the end of April, with the SDC Pipelines team — part of the SDC Program, described above — taking responsibility for ongoing development of the Prefactor pipeline. The SDC team is now focused on developing Prefactor to meet the needs of the LDV effort: a detailed development roadmap will be forthcoming.

- Many thanks to everybody who was involved with the SDF-PPE project, and good luck to the new development team for the work ahead!

LOFAR Data Valorization (R. Pizzo, C. Baldovin)

- The LOFAR Data Valorisation (LDV) project will bring the data currently hosted in the LTA archive from level L0-L1 (uncalibrated) to L2+ (advanced data products, including direction-dependent calibrated images). LDV will significantly increase the scientific output of LOFAR since more users will be able to more easily access the advanced data products and use them for cross-domain science. It will also streamline data processing operations at the LTA through a gradual adoption in production of the LTA processing interface. By doing so, LDV will prepare SDCO (SDC Operations) for routine LTA operations towards the LOFAR2 surveys.

- LDV started in September 2020 and will last until June 2024. Data processing will be performed in phases and will be applied to both imaging and BF data.

- Significant progress was made on the 'Workflow Execution Framework', which will manage the processing tasks at the archive site. An example screenshot of the main interface is presented below. We expect that this will be completed in May and that LDV production operations will start then.

- The data products generated through the LDV project will be made available to the community in subsequent data releases.

- As part of the deliverables of LDV, we have also profiled the content of the LTA and identified about 2 PB of data currently hosted at SURF that could already be deleted because either related to pre-production observations or to projects run outside the Cycle programs. The list is under consideration by the ILT director.

Calendar next LOFAR activities:

The dates of LOFAR Status Meetings, roll-outs and stop days are listed in an online calendar that is available here. In particular, we emphasize:

- Next LOFAR bulletin: June 2021