Concrete plans for new stations (with LOFAR 2.0 electronics): Medicina, IT; Bulgaria (site search started)
LOFAR: STATUS AND NEW DEVELOPMENTS

In April, 1291 hours have been assigned that we will not move to Cycle 14 now and will remain in the next Cycle. The total amount of observing time offered by ASTR allocations that we will only be active in the second part of the current Cycle and will continue during the 11 months of Cycle 15.

Our March report mentioned an expected decrease of the observing efficiency in Cycle 14 compared to Cycle 13, to 75%, as in Cycle 13. This implies that for Cycle 15 up to 1089 observing hours are available for distribution. Indeed, this figure takes into account that in April, the efficiency for Cycle 13 was 840 hours.

In this section we summarise the status of failed observations over the current and past 3 Cycles. Compared to Cycle 13, we have witnessed a slight increase in the amount of failed observations (mostly because of the warm summer temperatures). A total of 94.5 hours per annum have been lost, as per ILT policy. Projects which were classified as ‘filler’ project in Cycle 14 have been formally classified as regular observing category. Note that the ‘filler’ observing category has formally disappeared in the next Cycle, as in Cycle 13.

In this section we discuss the amount of lost observing time, including lightning, hail and heavy wind. Untimed for 15% of lost observing time.

Figure 1: Average Efficiency per LOFAR Cycle.

Figure 4: Telescope time distribution.

Figure 5: Observing hours lost per month.

Operations are only minimally affected by SARS-COV-2.
In Figure 6 we report an overview of the evolution of the amount of time that international stations spent in ILT-mode for production observing, in idle/test time when in ILT-mode and the amount of local-mode time, as a function of observing cycles (note that for Cycle 14 the values are extrapolated till the end of the semester).

Figure 6: Usage of international stations.
LOFAR VISION

➤ LOFAR 2.0: be the world leading very low frequency instrument until 2030+
  ➤ spectacular science at very low frequencies (simultaneous LBA and HBA observation: 10 - 240 MHz, higher dynamic range, multiple-beams on sky)
  ➤ international stations provide outstanding resolution (0.2” over all Northern hemisphere, matches resolution of Euclid and Hubble)

➤ Develop LOFAR LTAs into Science Data Centers
➤ Improve LOFAR governance: transform to LOFAR ERIC
LOFAR 2.0

➤ LOFAR2.0 will capture and deliver standard data products to a Science Data Centre facility.

➤ LOFAR2.0 Stage 1 will include:
  Station2.0 (STAT): Simultaneous LBA/HBA Observing, Control Software, RFI mitigation measures
  Central Processing (CEP): LOFAR2.0 Megamode, Modifications to adopt LOFAR2.0 data
  Timing Distributor (TD): Central clock for all Dutch stations
  Network (NW): Upgrade of network capacities
  Telescope Manager (TM): Interface to new station control, Stand-alone mode
  Station1.0 (STAT1): Software wrapper to control LOFAR1.0 stations by LOFAR2.0 TM

➤ Out of scope of stage 1:
  AARTFAAC continuation, Antenna redesign (HBA redesign in LOFAR4SW), Implementation of LOFAR — SDC split, Integration of NenuFAR, TMSS (is part of current LOFAR1.0 budget), Replacement of CEP4, DUPLLO Survey pipeline (is part of SDC programme), LOFAR-IT delivery (will partly use LOFAR2.0 components), new stations
LOFAR 2.0 & LOFAR4SW HIGHLIGHTS

➤ Prototype of new receiver units by ASTRON and INAF

➤ Prototype for clock distribution by ASTRON

➤ Test station at Chilbolton (4 HBA tiles), beam former development in ongoing
LOFAR 2.0 — BUDGET AND TIMELINE

➤ LOFAR 2.0 development budget and timeline is under pressure:
   Delays/underestimated effort in firmware development and station control software

➤ ILT Board approved a downscoping process:

<table>
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<th>Scope</th>
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<td>1</td>
<td>Project Scientists</td>
<td>Prioritise initial list</td>
<td>Scientific</td>
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<tr>
<td>2</td>
<td>LOFAR2.0 Science Advisory Committee (L2SAC)</td>
<td>Review Advise program board and ILT Board</td>
<td>Scientific</td>
</tr>
<tr>
<td>3</td>
<td>Program Board</td>
<td>Review Re-order list</td>
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<tr>
<td>4</td>
<td>ILT Board</td>
<td>Review Re-order list Approve</td>
<td>Non-scientific</td>
</tr>
</tbody>
</table>

➤ Timeline: downscoping (Dec 2020), deadline for upgrade commitment (originally Sept 2021) will be shifted;
   original plan: Italian and Dutch stations starts 2/2022; roll-out of INT stations in 2023, LOFAR2.0 operations start 2024
LOFAR ERIC

Dominik J. Schwarz
Bielefeld University
LOFAR VISION

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Dutch Stichting “International LOFAR Telescope”

ILT Board and ILT Director

National Consortia: NL, D, PL, F, IR, IT, S, UK, LAT

38 Dutch stations owned by ASTRON

13 international stations owned by various parties (8 in D)

3 Long Term Archives (Amsterdam, Jülich, Poznan)

ILT has contracts with station owners and consortia (including LTAs)

Central operations by ASTRON, NL

ILT governance was great to pull this off the ground, but does not scale with the number of new partners, growing complexity in management and funding, not ideal for common effort in hardware procurement, operation of infrastructure on European scale
CASE FOR AN ERIC

➤ **ERIC = European Research Infrastructure Consortium**

➤ Legal entity recognised by the European Commission and EU law

➤ **Members are states and IGOs** (with a majority of EU member states)

➤ **Advantages of an ERIC**: Visibility at European level, involvement of national science ministries via Representing Entities, ERIC can own, operate, coordinate infrastructure across Europe — even in states that are no ERIC members, common procurement, VAT reduction, etc.

➤ First preparatory meeting under lead of Dutch ministry (including BMBF) took place in Feb 2020; 2nd meeting Oct 15, 2020

➤ **Timeline**: 2 step process:
   1st step April 2021 (statutes, financial annex, technical description);
   2nd step September 2021 (members, representing entities, rules of procedure, etc.);
   EC decides; Publication of statutes in Journal of EU

➤ **Start of LOFAR ERIC envisioned for April 2022**

➤ **Roll-out of LOFAR2.0 hardware starts 2022, LOFAR2.0 science starts in 2024**
Current GLOW-LOFAR Infrastructure Owners are: AIP Potsdam, FZ Jülich, MPA, MPIfR, RU Bochum, U Bielefeld, U Hamburg, TLS Tautenburg

Community will be represented by a Representing Entity (TBD)

We operate under the assumption that the total budget of the LOFAR ERIC is the same as the ILT budget (mix of cash and in-kind)

LOFAR2.0 investments on top

New partners are welcome, involvement can reach from small to contributing an extra LOFAR station (not before 2024)