



LOFAR OVERVIEW AND FEEDBACK FROM 2nd LOFAR USERS MEETING

R. F. Pizzo

ARRAY STATUS

International LOFAR Telescope (ILT)



Onsala



Dutch stations



Baldy



Chilbolton



Birr



Borówiec



Łazy



Tautenburg



Unterweilenbach

LOFAR Core (NL)

Jülich

Effelsberg

Potsdam

Norderstedt

- 50 operational stations completed
- 38 NL stations, 12 international stations
- 1 new station funded – it will be built in Ireland



Nançay



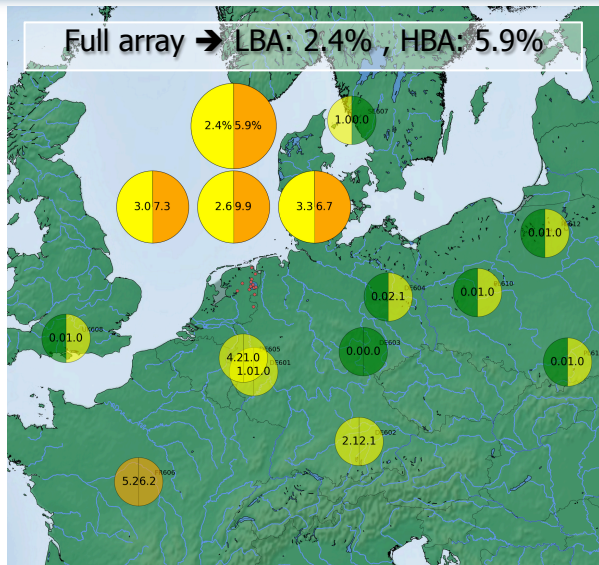
ASTRON

Netherlands Institute for Radio Astronomy

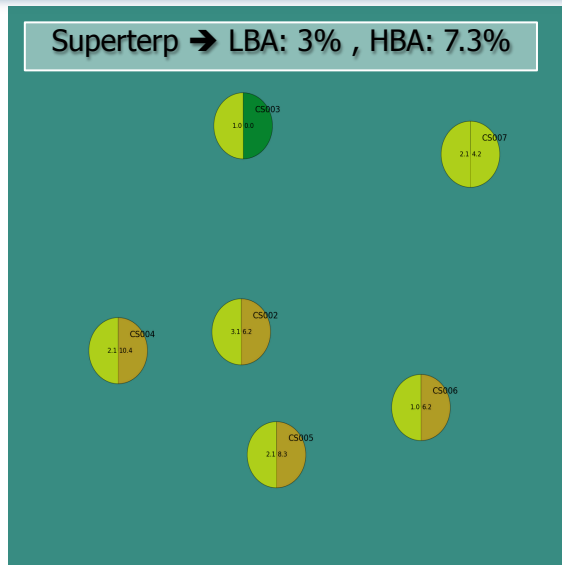
ANTENNA ELEMENTS STATUS



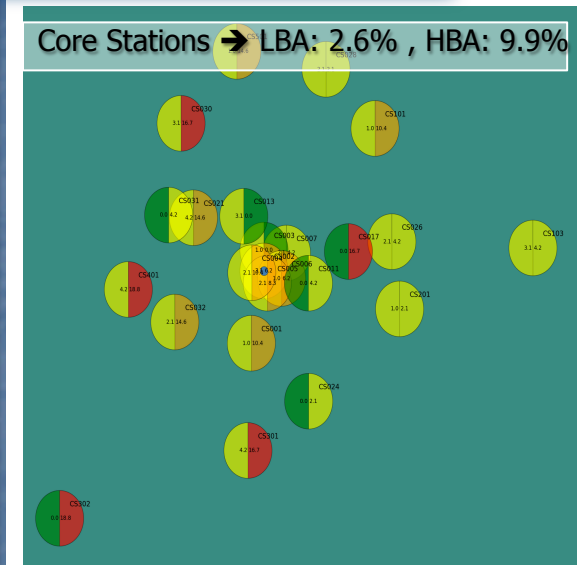
Full array → LBA: 2.4% , HBA: 5.9%



Superterp → LBA: 3% , HBA: 7.3%



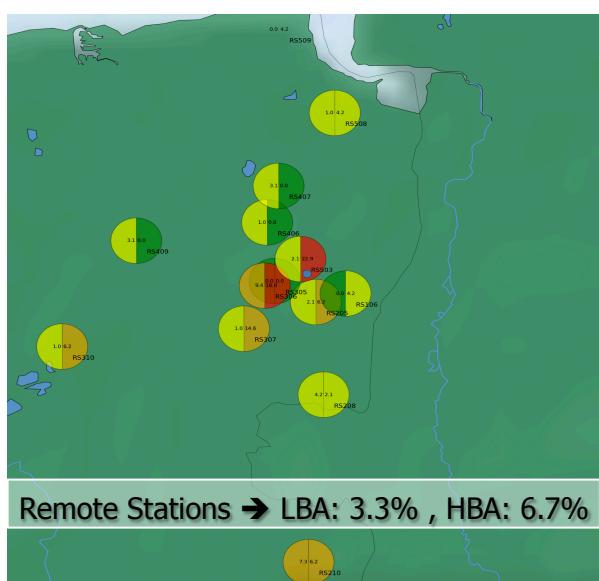
Core Stations → LBA: 2.6% , HBA: 9.9%



All operational
 < 5% not operational
 < 15% not operational
 > 15% not operational

- Current status available at <https://proxy.lofar.eu/array/status/>
- Maintenance starting soon

Remote Stations → LBA: 3.3% , HBA: 6.7%



STATION CALIBRATION



Station	mode 1/2	mode 3/4	mode 5	mode 6	mode 7
CS001	23-06-15	21-09-15	19-02-15	23-12-15	11-02-15
CS002	23-06-15	21-09-15	11-02-14	23-12-15	24-02-15
CS003	18-06-15	21-09-15	11-02-14	23-12-15	24-02-15
CS004	18-06-15	21-09-15	11-02-14	23-12-15	19-02-15
CS005	18-06-15	21-09-15	11-02-14	23-12-15	19-02-15
CS006	18-06-15	13-07-15	11-02-14	21-01-16	19-05-14
CS007	18-06-15	21-09-15	11-02-14	23-12-15	24-02-15
CS011	18-06-15	21-09-15	19-02-15	23-12-15	24-02-15
CS013	17-09-14	05-08-14	19-02-15	23-12-15	19-02-15
CS017	18-06-15	13-07-15	19-02-15	23-12-15	24-02-15
CS021	18-06-15	05-08-14	19-02-15	13-01-16	19-02-15
CS024	18-06-15	21-09-15	19-02-15	23-12-15	19-05-14
CS026	18-06-15	21-09-15	19-02-15	23-12-15	19-02-15
CS028	18-06-15	21-09-15	19-02-15	23-12-15	24-02-15
CS030	18-06-15	21-09-15	19-02-15	23-12-15	19-02-15
CS031	20-09-12	05-08-14	19-02-15	23-12-15	24-02-15
CS032	18-06-15	13-07-15	19-02-15	23-12-15	24-02-15
CS101	18-06-15	21-09-15	19-02-15	23-12-15	24-02-15
CS103	13-07-15	21-09-15	19-02-15	23-12-15	24-02-15
CS201	18-06-15	21-09-15	19-02-15	23-12-15	19-02-15
CS301	18-06-15	21-09-15	19-02-15	23-12-15	24-02-15
CS302	18-06-15	21-09-15	19-02-15	23-12-15	19-02-15
CS401	18-06-15	15-10-12	19-02-15	23-12-15	24-02-15
CS501	18-06-15	21-09-15	19-02-15	23-12-15	24-02-15
RS106	18-06-15	21-09-15	20-04-15	23-12-15	21-01-16
RS205	18-06-15	21-09-15	04-11-15	23-12-15	04-11-15
RS208	18-06-15	12-11-13	04-11-15	23-12-15	04-11-15
RS210	18-06-15	22-07-14	04-11-15	23-12-15	21-01-16
RS305	13-07-15	21-09-15	04-11-15	23-12-15	04-11-15
RS306	18-06-15	21-09-15	04-11-15	23-12-15	04-11-15
RS307	18-06-15	21-09-15	04-11-15	23-12-15	04-11-15
RS310	18-06-15	22-07-14	04-11-15	23-12-15	21-01-16
RS406	18-06-15	21-09-15	04-11-15	23-12-15	04-11-15
RS407	18-06-15	21-09-15	21-09-15	23-12-15	04-11-15
RS409	18-06-15		04-11-15	13-01-16	04-11-15
RS503	18-06-15	21-09-15	20-04-15	23-12-15	21-01-16
RS508	18-06-15	21-09-15	04-11-15	13-01-16	04-11-15
RS509	18-06-15	21-09-15	04-11-15	23-12-15	24-02-15
DE601		04-11-15	19-10-15	23-12-15	19-10-15
DE602		13-07-15	20-04-15	23-12-15	24-08-15
DE603		04-11-15	19-10-15	23-12-15	19-10-15
DE604		03-10-13	19-10-15	23-12-15	19-10-15
DE605		13-07-15	19-10-15	23-12-15	19-10-15
FR606		04-11-15	04-11-15	23-12-15	04-11-15
SE607		04-11-15	19-10-15	23-12-15	19-10-15
UK608		04-11-15	19-10-15	23-12-15	19-10-15
DE609		03-04-15	21-09-15	23-12-15	21-09-15
PL610			29-01-16	29-01-16	29-01-16
PL611		29-01-16	03-02-16	03-02-16	03-02-16
PL612		29-01-16	29-01-16	29-01-16	29-01-16

- Current status
 - <http://www.astron.nl/radio-observatory/astronomers/current-status>
- Significant progress made since last year meeting:
 - more regular updates
 - Tables for mode 6
- Station calibration still competing with Cycle operations
- Contact points: (L. Cerrigone + observers)
- New station calibration method to be finalized: Holography.
 - It will make both data collection, handling and reduction (much) easier!

ACHIEVEMENTS AND ISSUES

MAIN OPERATIONAL ACHIEVEMENTS 2015-2016

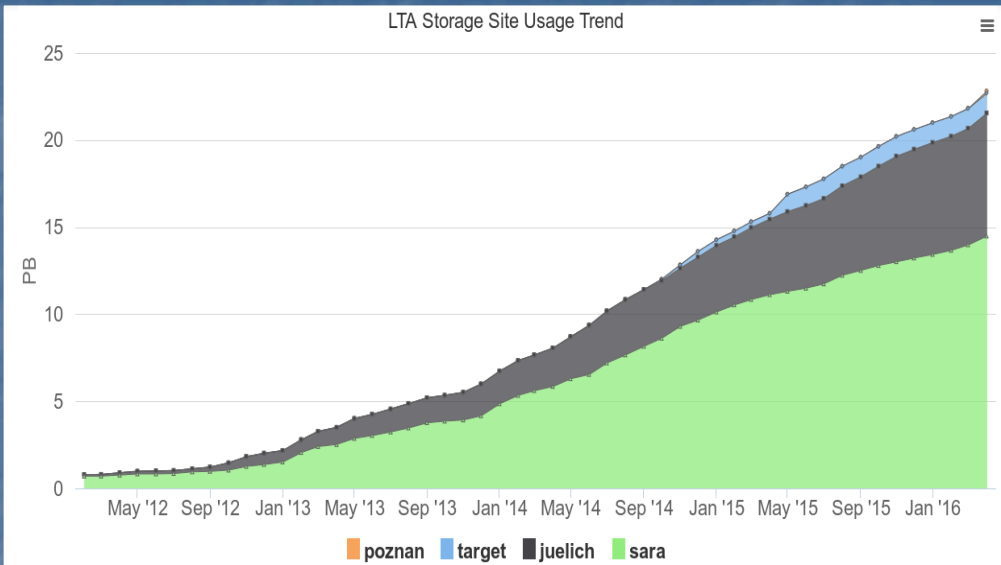
ASTRON

- Network reconfiguration: 18-29 May 2015
- CS013 rotated to originally planned orientation – regularly adopted in production observing since December 9
- Polish Stations
- Mode 6 operational
- LBA sparse implemented and caltables in progress
- Poznan LTA now operational

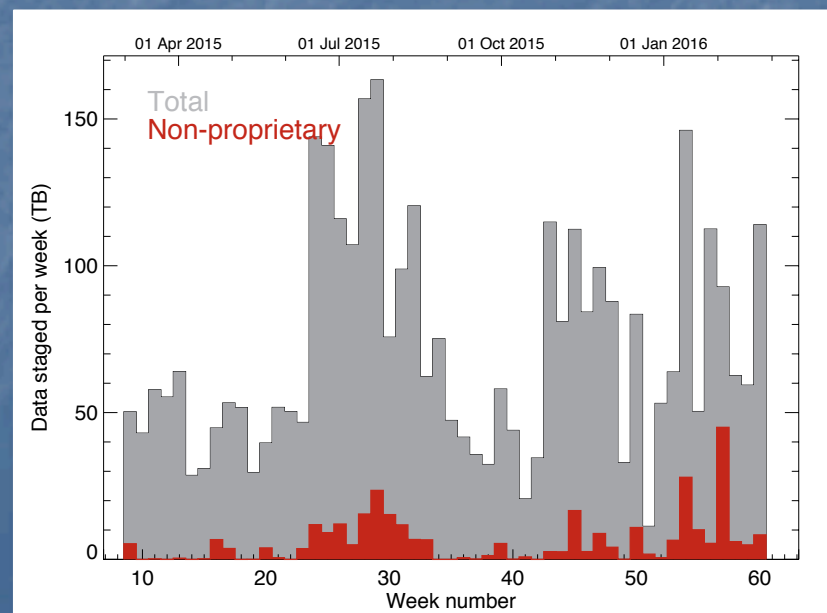
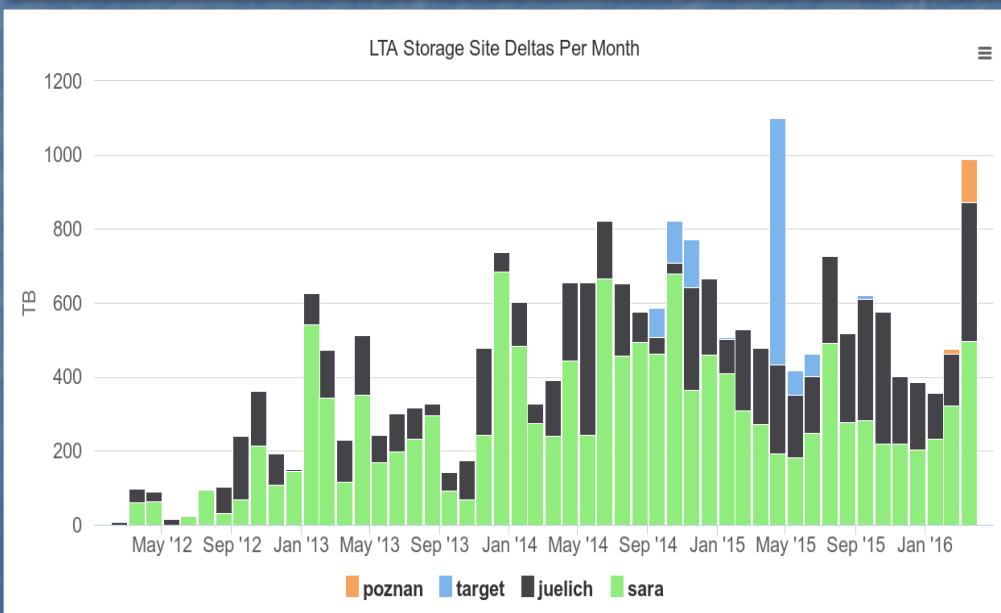


MAIN OPERATIONAL ACHIEVEMENTS 2015-2016

ASTRON



- > 22.5 PB of LOFAR data in the LTA!
- Public data being actively retrieved by non-proprietary users
- LTA survey closed on 1 April – results will be advertised



OPERATIONAL ISSUES



- I. Several Dutch stations suffered from the **warm summer temperatures** -> a few imaging and BF runs were postponed
 - Hardware improvements implemented at all NL stations
- II. **Ingest system instability**-> long ingest queue -> CEP2 (production cluster) full
- III. **CEP2 instability** -> swpping
- IV. **Preparing and supporting Cycle, DDT, and commissioning observations still remain *very manual procedures*, which put a *significant* burden on the Science Support group (and also inevitably lead to human errors). *These routines still await significant automation.***

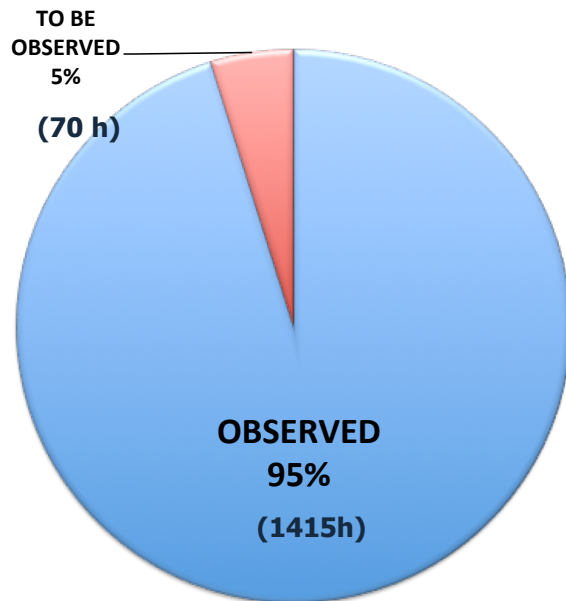
**IMPROVEMENTS IN THESE AREAS WILL IN TURN DELIVER
HIGHER OBSERVING EFFICIENCIES**

SCIENCE OPERATIONS

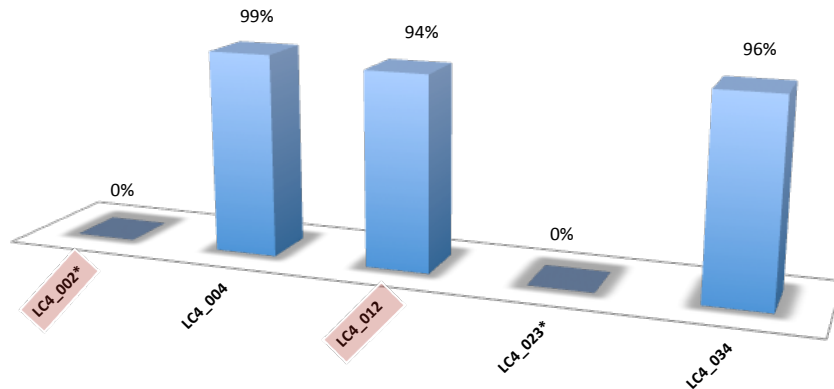
CYCLE 4 & 5 OBSERVING PROGRAMS



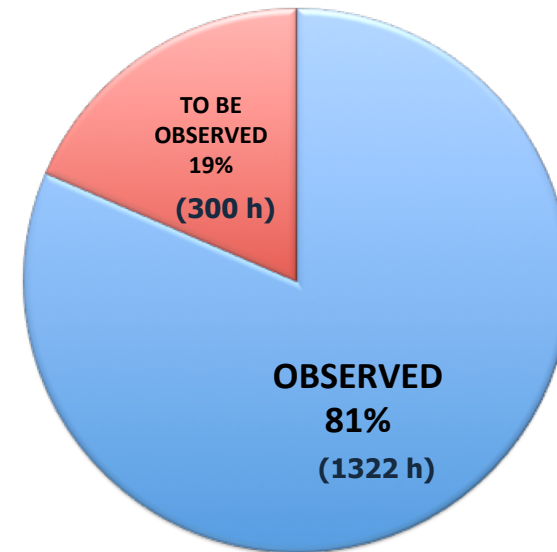
STATUS CYCLE 4



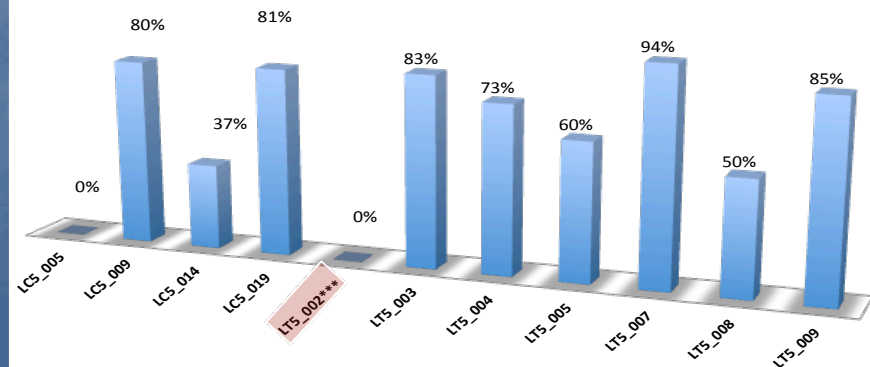
Status of active Cycle 4 projects



STATUS CYCLE 5



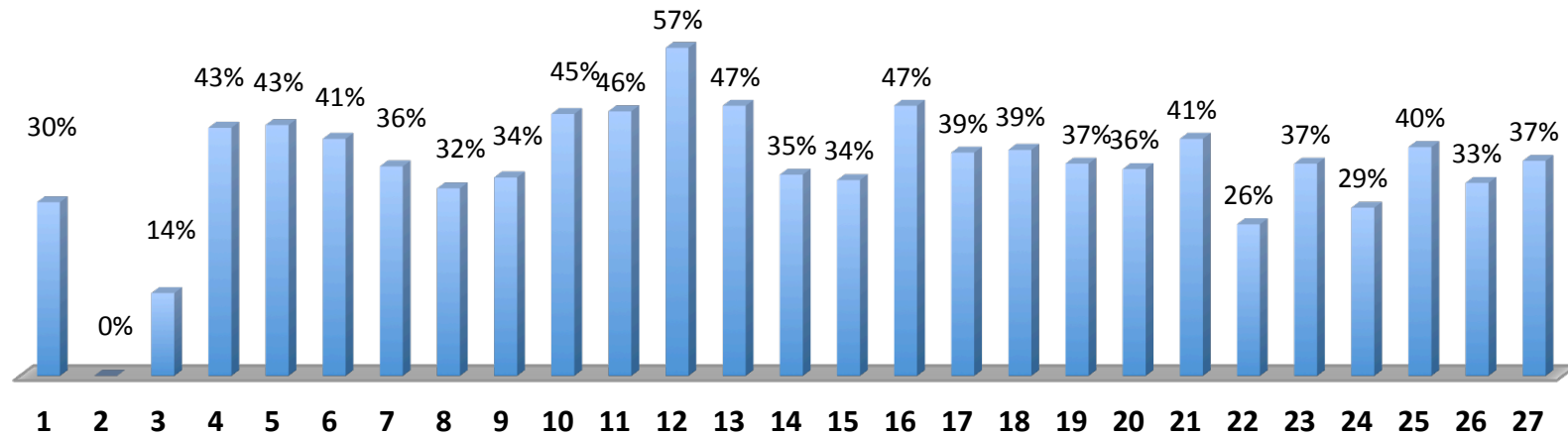
Status of active Cycle 5 projects



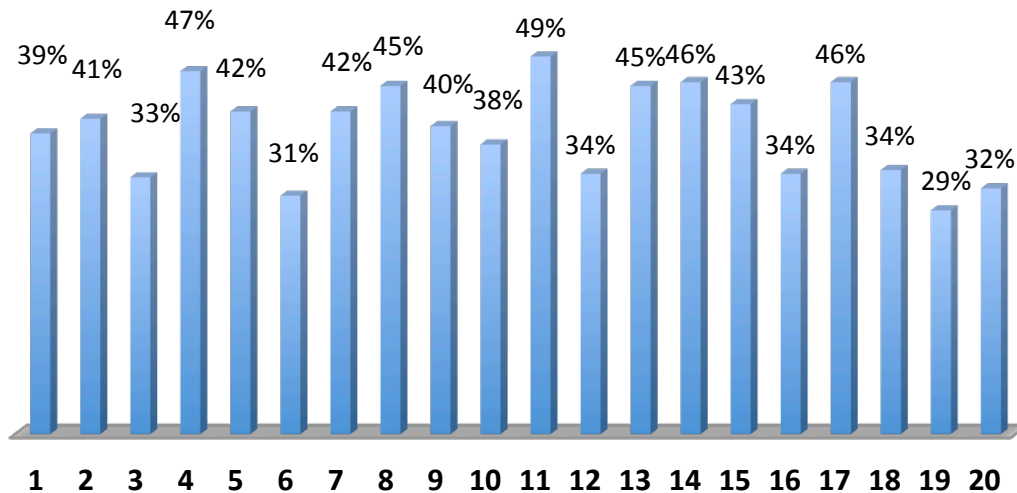
OBSERVING EFFICIENCY



LOFAR observing efficiency during Cycle 4



LOFAR observing efficiency during Cycle 5



➤ Average ~ 39% → improved by 4% w.r.t. Cycle 3

➤ Issues:

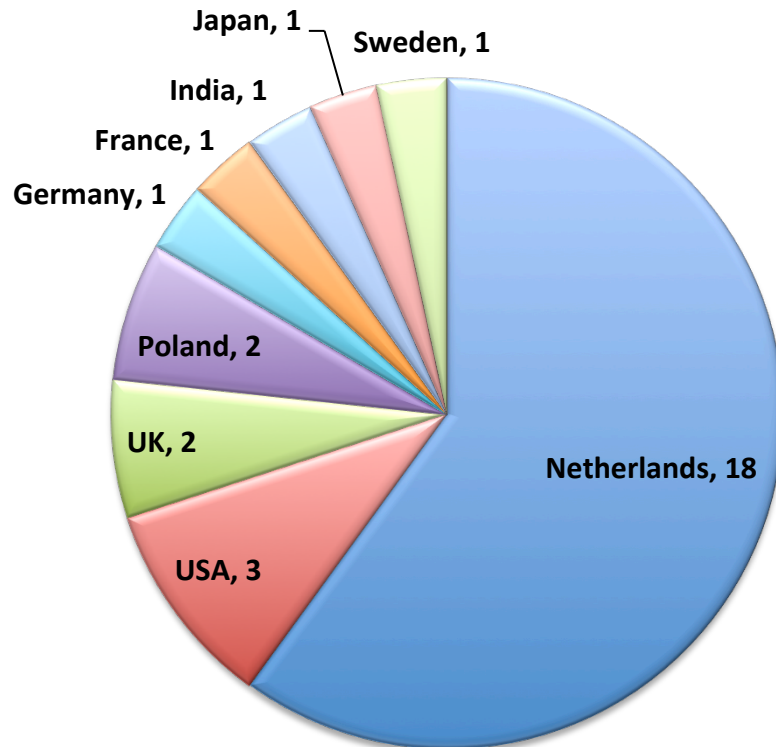
- System robustness (LTA instability, CEP instability, ...)
- Manual procedures...

CYCLE 6 PROPOSALS



- 30 regular proposals received
- Oversubscription:
 - Observing -> 1.2
 - Processing -> 1.6

LOFAR CYCLE 6: affiliation of first author

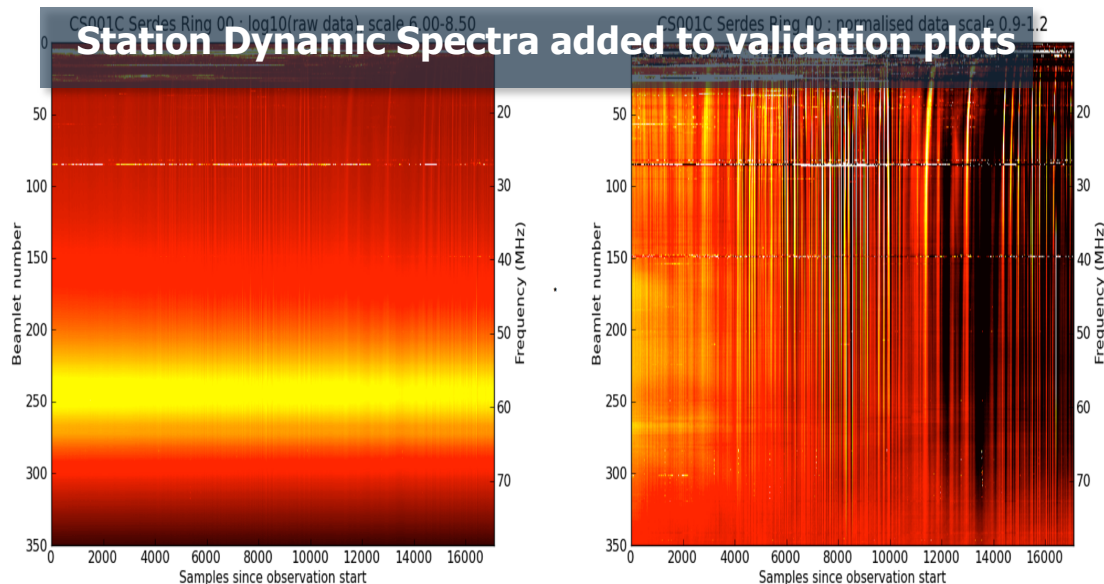


Observing mode	Fraction of proposals
IM	63%
BF	20%
BF+IM	13%
TBB	3%

Science Area	Fraction of proposals
Extragalactic	37%
Transients	27%
Planets	17%
Galaxy	7%
Ionosphere	7%
Stellar	3%
Solar	3%

TOOLS AND DOCUMENTATION

Station Dynamic Spectra added to validation plots



Measurement type Beamformed Interferometer Image noise

LOFAR data size and Processing time calculator

UV Data:

Amount of core stations [int]
 Amount of remote stations [int]
 Amount of international stations [int]
 HBA dual
 Channels Per Subband [int]
 Subbands [int]
 Integration Steps

Data size: 2270.324 GB

Pre-processing

Mode	Nr. Demixed Sources	Nr. SBs	Processing time [hours]
LBA	0	80	0.20
LBA	1	80	0.30
LBA	2	80	1.00
LBA	0	244	0.60
LBA	2	244	1.60
HBA	0	122	0.90
HBA	1	122	1.00
HBA	0	244	1.00
HBA	2	244	4.50
HBA	0	366	1.40
HBA	1	366	2.20
HBA	0	380	1.50
HBA	0	460	1.40

Imaging

Mode	Max. baseline [km]	FoV [deg]	Processing time [hours]
LBA	3.5	12	0.80
LBA	50	8	1.20
HBA	3.5	5	0.90
HBA	50	5	1.30

Long baseline

Mode	Obs. strategy	Dwell time	Processing time [hours]
HBA	Snapshot	Cal = Tgt	5.50
HBA	Snapshot	Cal < Tgt	4.00
HBA	Simultaneous	N/A	5.00

LOFAR Frequency Calculator

Instrument
 LBA
 HBA

Clock
 200 MHz
 160 MHz

Filter

Subband 197

Manual selection:

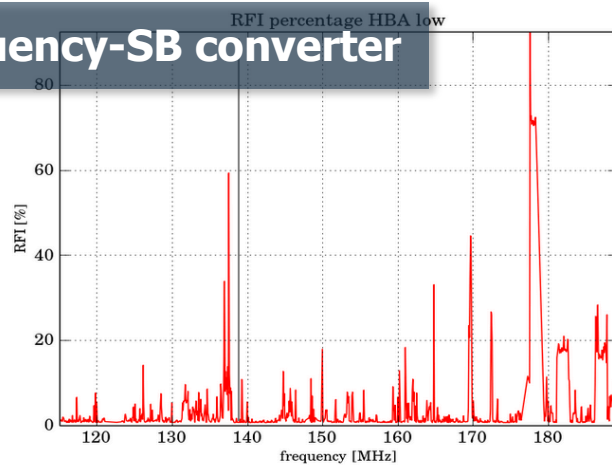
Frequency MHz

Manual selection:

Note: The RFI plot in the right panel is intended to be only a navigation aid.

LOFAR Frequency-SB converter

HBA
 200 MHz
 110-190 MHz
 Subband: 197
 Corresponds to: 138.4765625 MHz
 Frequency: --- MHz
 Corresponds to: invalid sub-band
 RFI percentage: 0.70585 %



TOOLS: GITHUB



The screenshot shows the GitHub repository page for 'lofar-astron / LOFAR-Contributions'. The repository has 77 commits, 2 branches, 0 releases, and 5 contributors. The latest commit is by 'tammojan' on 20 Dec 2015, titled 'Merge branch 'petschow-master''. The commit history shows several updates to the README.md file. The README.md file is displayed below, containing the following text:

LOFAR-Contributions

3rd party contributions for LOFAR data processing

The MAINTAINED, UNMAINTAINED and OBSOLETE sub-folders contain data analysis scripts contributed by LOFAR users. Short descriptions about the scripts are given in a README file in each sub-folder.

Note that the following general rules apply:

- all script are made free for LOFAR community,
- user are welcome to edit/improve and re-share tools in the UNMAINTAINED and OBSOLETE folders; to this aim please contact Science Support,
- each script in the MAINTAINED sub-folder has an author responsible for it; for any question/suggestion users should first contact Science Support as listed in the Readme.txt file.

- LOFAR user contributed scripts have been migrated to GitHub and are now available to the entire user community.
- <https://github.com/lofar-astron/LOFAR-Contributions>
- The repository is also documented in the latest release of the LOFAR Imaging cookbook.

DOCUMENTATION



Home About ASTRON Astronomy Group Radio Observatory R & D Laboratory

RADIO OBSERVATORY LOFAR web pages:

www.astron.nl

LOFAR TECHNICAL INFORMATION

View Edit Revisions

LOFAR, the Low frequency Array, is a next-generation electronically steered phased array radio telescope. LOFAR's capabilities are revolutionising the astronomical capabilities in the 10-240 MHz range.

These web pages describe the general signal path, major observing modes, and their post processing options from the perspective of the potential user. In some instances, some modes are noted as being "Expert Mode": These are generally modes which require more manual intervention than the regular modes and are offered only to users who are familiar with them from their own commissioning work.

A more detailed description of the LOFAR array can be found in van Haarlem et al. 2013 (<http://arxiv.org/abs/1305.3559v7>)

Major Observing modes

- Interferometric mode
- Beam formed mode
- Commensal Beam Formed and Imaging mode
- Direct storage mode

Signal Path

Antennas Description

Station Description and Configuration

Array Configuration

Imaging Capability and Sensitivity

Frequency and Subband Selection

Beam Definition

Transient Buffer Boards

Data Products and Management

Data quality inspection

CEP facilities

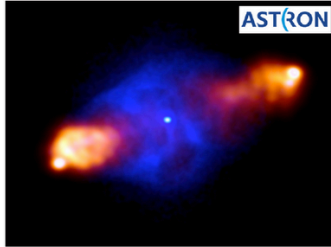
Functionality enhancements

System notes

radio_observatory

THE LOFAR IMAGING COOKBOOK: Manual data reduction with the imaging pipeline

Version 18.0
November 11, 2015



Edited by Aleksandar Shulevski

Home About ASTRON Astronomy Group Radio Observatory R & D Laboratory

RADIO OBSERVATORY

LOFAR Slides

LOFAR Slides

Summary

LOfar Cookbooks

LOFAR SLIDES

View Edit Revisions Translate

Selected presentations from the LOFAR data school (November 2014). Slides can be used in presentations with appropriate affiliation.

Pizzo - Selection of LOFAR science highlights (but see also the [Science Highlights](#) page)

Brentjens? - LOFAR overview

Mol - correlator and online processing

de Bruyn - an introduction to (LOFAR) calibration

Norden - station processing

LOFAR Policies

Home About ASTRON Astronomy Group Radio Observatory R & D Laboratory

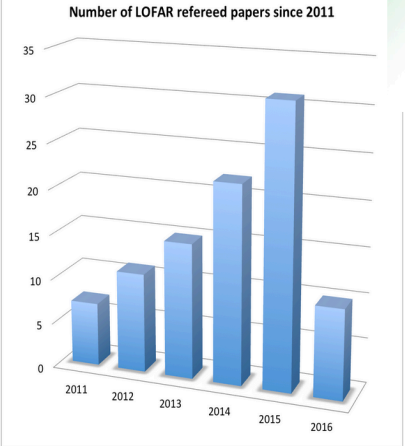
RADIO OBSERVATORY

LOFAR Papers

LOFAR PAPERS

View Edit Revisions

An overview of LOFAR publications for the period of 2011 - 2016 (last updated March 14, 2016):



Year	Number of LOFAR refereed papers
2011	8
2012	11
2013	15
2014	22
2015	30
2016	8

LOFAR publications for the period of 2011 - 2016 (March)

2016

Bultink S, Corstange A, Falcke H, et al., 2016, Nature, 530, 'A large light-mass component of cosmic rays at 10^{17} - 10^{18} electron-volts from radio observations.'

Flögel A, van der Meer B, Brentjens M, et al., 2016, MNRAS, 456, 3331, LOFAR M51C

Plus:

LOFAR Wiki → www.lofar.org/wiki

LOFAR Bulletins → <http://www.astron.nl/radio-observatory/lofar-newsletters/lofar-newsletters>

LOFAR Status Meetings slides → http://www.lofar.org/operations/doku.php?id=public:lsm_new:start

LOFAR CALENDAR



Home » Radio Observatory » Calendar LOFAR Activities

CALENDAR LOFAR ACTIVITIES

The calendar of planned LOFAR activities - such as stop stays, Weeks, Meetings - can be found at the link below:

<https://calendar.google.com/calendar/embed?src=2jkmjaro6ek0kh7tmf9brpf8pk%40group.calendar.amsterdam>

- (Observing Proposals
- (Asking for time
- (LOFAR Science
- (LOFAR Data Archive
- (LOFAR Documentation
- (LOFAR Tools
- (Observing Capabilities
- (Cycles: Allocations and Observing Schedules
- (LOFAR Newsletters
- (Subscribe to LOFAR news and LSM mailing lists
- (Calendar LOFAR Activities**
- (Weekly schedule
- (LOFAR Policies
- (LOFAR MSSS
- (Station Status
- (Roll-out status

Calendar of planned LOFAR activities - such as stop stays, roll outs, Proposal deadlines, Busy Weeks, Meetings

FEEDBACK FROM 2ND LOFAR USERS MEETING



LOFAR USERS MEETING 2015 – ENHANCED OBSERVING FUNCTIONALITY



Rotation CS013 (various)	
RCU mode 6 observing (EoR)	
Automatically flash station boards with AARTFAAC firmware after a 48v reset (transients)	
Responsive Telescope functionality (transients)	
TBB operational (cosmic rays)	
Request of online RFI flagging, which would allow rejection of single stations: currently not prioritized (transients)	
Writing out data as 8, 4, 2, 1-bit samples: currently not prioritized (transients)	





LOFAR USERS MEETING 2015 – PROPOSALS AND DATA MANAGEMENT



NorthStar improvements (various)	 A yellow triangular warning sign with a black border. Inside the triangle is a black silhouette of a person sitting at a desk with a computer. Below the silhouette, the words "WORK IN PROGRESS" are written in black capital letters.
MoM – difficult to check observation/pipeline settings (transients)	 A yellow triangular warning sign with a black border. Inside the triangle is a black silhouette of a person sitting at a desk with a computer. Below the silhouette, the words "WORK IN PROGRESS" are written in black capital letters.





LOFAR USERS MEETING 2015 – PROCESSING & LTA



Running multiple pre-processing pipelines on the same raw data (surveys)	
Updated beam model – see M. Brentjens' talk (various)	
More metadata (e.g. flagged tiles written to BF headers, BF calibration table) (transients)	
Automation interfaces to the Catalog and the staging service: see http://www.lofar.org/wiki/doku.php?id=public:lta_tricks (surveys)	

LOFAR USERS MEETING 2015 – DOCUMENTATION



Software development updates at LSM (various)	
Collection of LOFAR slides, list of LOFAR papers, science highlights (various)	
Repository for scripts and tools developed and shared by user - GitHub (surveys)	
Better documentation on installation LOFAR software at external computing facilities http://www.lofar.org/operations/doku.php?id=public:user_software:start (various)	

THANKS !