LOFAR OBSERVING: INTERACTION USER – RADIO OBSERVATORY

S. Ter Veen

ASTRON

RO PEOPLE

LOFAR

ASTRON

➢ A large number of software and hardware engineers, astronomers and others who designed, constructed and keep LOFAR operational

➢ ASTRON's Radio Observatory Science Support Group

| Roberto Pizzo | Richard Fallows | Marco Iacobelli | Luciano Cerrigone | Sander ter Veen | Aleksandar Shulevski | Matthijs van der Wiel |

➢ Radio Observatory Operators

sciencesupport@astron.nl

| Geert Kuper | Jurjen Sluman | Richard Blaauw | Henk Mulder | Paul van Dijk |

observer@astron.nl

➢ Telescope Astronomers

| Michiel Brentjens | Emanuela Orru' |

+ Operations and maintenance
+ Software Support

Station signals collected in the station cabinets

Signal sent to COBALT for correlation

I. CEP4

I. CEP3

Products sent to the long-term archive

Data sent to CEP4 for initial RO processing – products might get copied to CEP3

➢ Entire process is overseen by Operators, Science Support and Software Support groups

LOFAR

ASTRON

- ➤ Two observing Cycles every year:

  - ➤ May 15 – November 14
  - ➤ November 15 – May 14

- ➤ Proposal call: 4 months before start of the Cycle (January, July)

- ➤ http://www.astron.nl/radio-observatory/observing-proposals/regular-proposal-call-instructions/regular-proposal-call-instr

- ➤ Proposal deadline: 2 months before the start of the Cycle (March, September)

- ➤ Advertisement of new functionality for the coming Cycle

- ➤ Available observing and processing hours

International LOFAR Telescope

Proposal Call to the Worldwide Community

Cycle 7: 15 Nov 2016 - 14 May 2017

Submission deadline Wednesday 14 September 2016, 12 UT

This file in PDF form.

Submission only via the online tool NorthStar.

** Proposers must ensure that their justification files adhere to the instructions given below and in Northstar, repeated online here. **

SYSTEM CAPABILITIES: The International LOFAR Telescope (ILT) is a powerful next-generation radio telescope for frequencies below 240 MHz that offers revolutionary new observing capabilities thanks to its phased-array technology with digital beam-forming. LOFAR delivers correlated visibility data for synthesis imaging, plus in/coherently added single and multiple station data (several beam-formed modes) as well as transient buffer read-out, for example for studies of pulsars, transients, and cosmic rays. For Cycle 7, pipeline processing will be performed on the new CEP4 cluster, which is being commissioned at the moment. The high resolution (arcsecond) imaging capability of the array has been significantly enhanced with the addition of three stations in Poland, bringing the total number to 38 in the Netherlands and 12 in other European countries. LOFAR capabilities are described in detail online.

LOFAR

ASTRON

➢ Use the LOFAR web pages as a reference during the proposal preparation

➢ LOFAR pages: http://www.astron.nl/radio-observatory/radio-observatory

➢ Note: extensive description of LOFAR system available in van Haarlem et al. 2013
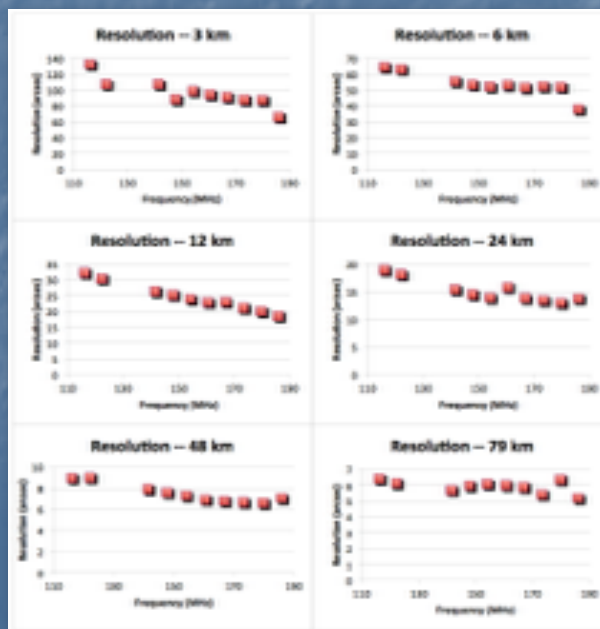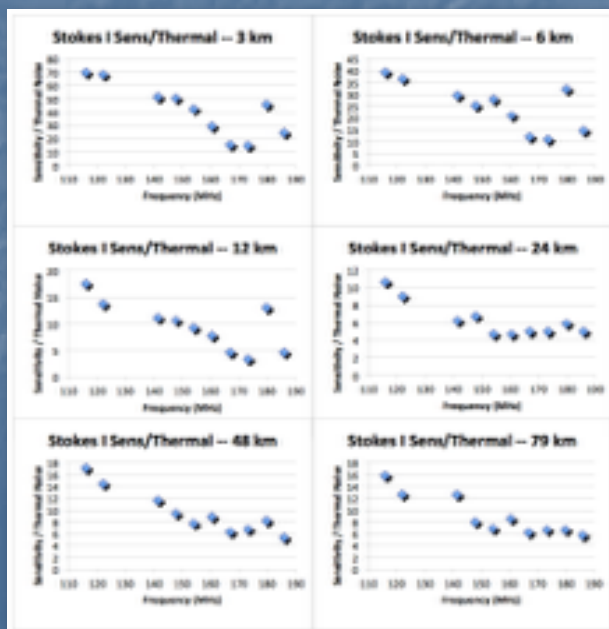
➢ LOFAR pages: http://www.astron.nl/radio-observatory/radio-observatory

➤ Interferometric mode web page (mode fully supported):

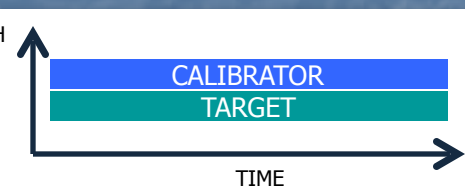   http://www.astron.nl/radio-observatory/astronomers/array-configurations/3-telescope-parameters-and-array-configurations

➤ Observing strategies (LBA, HBA) + Calibrators

➤ Imaging Pipeline -> see E. Orru's lecture

➤ Characterization: achievable noise, resolution and required processing time for various pipeline processing strategies

I. WORKING ON PROPOSAL: OBSERVING STRATEGIES

➢ Interferometric mode web page:

http://www.astron.nl/radio-observatory/astronomers/array-configurations/3-telescope-parameters-and-array-configurations

➢ **LBA**: half of the available bandwidth on the target field and half on the calibrator

➢ **HBA**:

- Continuous in time/Hour Angle observation of the target with a short calibrator run before (and/or after)

- Interleaved calibrator observations (eg. 2 min) with target field (eg. ~ 30 min), quasi-continuous in HA

- Two beams, one on the target and a second on a "phase calibrator" if present within the analog beam of the HBA tiles (experimental strategy for advanced users). The "phase calibrator" should be a bright point like source selected by the user form other catalogues.

- Three quarters of the bandwidth dedicated to the target and one quarter on the "phase calibrator"

- If the user has a good initial model of the target field at his/her disposal, observations could be performed using the full bandwidth on the target

➤ Note LOFAR Tools

➢ Visibility Calculator

- ➤ Proposal review process lasts for ~ 6 weeks

- ➤ Technical review panel assesses the technical feasibility of the projects

- ➤ National consortia distribute their reserved access hours in the form of must- and may-sponsor hours

- ➤ LOFAR Programme Committee complete allocations by detailing allocations to the may-sponsor list of proposals and by distributing open skies fraction of time

- ➤ Allocations known after the PC meeting at

    http://www.astron.nl/ radio-observatory/cycles/ cycles

FIRST CONTACT WITH PI's

➢ Science Support works out the observing schedule for the upcoming Cycle. This is advertised on ASTRON website:

➢ http://www.astron.nl/radio-observatory/cycles-allocations-and-observing-schedules/cycle-6-schedule/cycle-6-schedule

➢ Contact e-mail to PI's -> preparation of observing templates in MoM
  ➢ Strict deadlines on response time to fix issues

MoM: MANAGEMENT OF MEASURAMENTS

- ➤ https://lofar.astron.nl/mom3/

- ➤ Description available at

  https://lofar.astron.nl/
  mom3/help/mom2.jsp

- ➤ Reference tool for preparation and inspection of the observing/ processing templates and status of observations and pipelines

- ➤ To have access, register as a new user

- ➤ After login, you will be able to see only the projects you are involved in

MoM PROJECTS

➢ Organized in folders

➢ Full inspection of observing observing setups might require some clicking – things will improve in the future

MoM: OBSERVATION FOLDERS

LOFAR

ASTRON

➢ Statuses:

    ➢ Project: open, active, finished, suspended

    ➢ Observations / pipelines: open, approved, scheduled, running, finished, aborted

    ➢ Ingests: approved, scheduled, running, finished, aborted

MoM: MULTI BEAM OBSERVING SETUPS & DETAILS

MoM: MULTI BEAM OBSERVING SETUPS & DETAILS

MoM: INTERLEAVED OBSERVING SETUPS

MoM: INTERLEAVED OBSERVING SETUPS

OBSERVATION PERFORMED: RO REPORT TO PI

Dear Colleague,

the following message contains information regarding a LOFAR Cycle 6 project for which you are listed as the contact author. Please, forward this information to the suitable individuals

We would like to inform you that an observation related to your LOFAR Cycle 6 project has been performed. Please find detailed information below

General notes: -> any fundamental remarks
Observations: -> details of performed observations
Performance of the system: -> any issues to report with stations or CEP cluster?
Data recording: -> any data missing?
Data processing: -> status of processed data
Archiving: -> started or in the queue

Remarks: please analyze the validation plots at https://proxy.lofar.eu/inspect/HTML/ within 24 hours after this notification and get in contact with sciencesupport@astron.nl in case you need to report problems about their quality. After this time window has passed, we will assume that your judgment is that the observation was successful and we will complete the actions described above to support your run. From the moment the data are made available to you at the LTA or, if requested, on CEP3, you will have two weeks available to check their quality and to report problems to the Observatory. After this time window has passed, no requests for re-observation will be considered

Actions: If you need any further clarification, please do not hesitate to contact us

RADIO OBSERVATORY OBSERVING POLICIES

- ➤ http://www.astron.nl/radio-observatory/observing-capabilities/depth-technical-information/cycle-1-observing-and-processin

- ➤ Most relevant ones are:

  I. In the case of malfunctioning stations or locus nodes, an observation will be considered failed if more than 5% of the data are missing on disk. Processing will be considered failed if more than 5% of the resulting processed data are missing with respect to the raw visibilities. In other cases, observations may be considered failed on a case-by-case basis, according to the science goals of the relevant proposal

  II. The only raw data inspection available to users prior to data reduction is via the inspection plots which are created automatically immediately after the associated observation has finished

  III. From the moment the data are made available to the users at the LTA or, if requested in the original proposal, on CEP3, they will have two weeks available to check the quality of their data and report problems to the Observatory. After this time window has passed, no requests for re-observation will be considered

  IV. In the case that an observation is considered failed, it may be repeated only once if the observing schedule allows it.

  V. All Cycle projects with priority "A" that cannot be completed by the end of the Cycle they refer to will remain active only during the following semester and they will be observed then with second priority with respect to the new Cycle projects. Priority "B" projects will not be observed in the next Cycle.

➢ See tutorial at http://www.astron.nl/radio-observatory/observing-capabilities/depth-technical-information/data-quality-inspection/data-qu
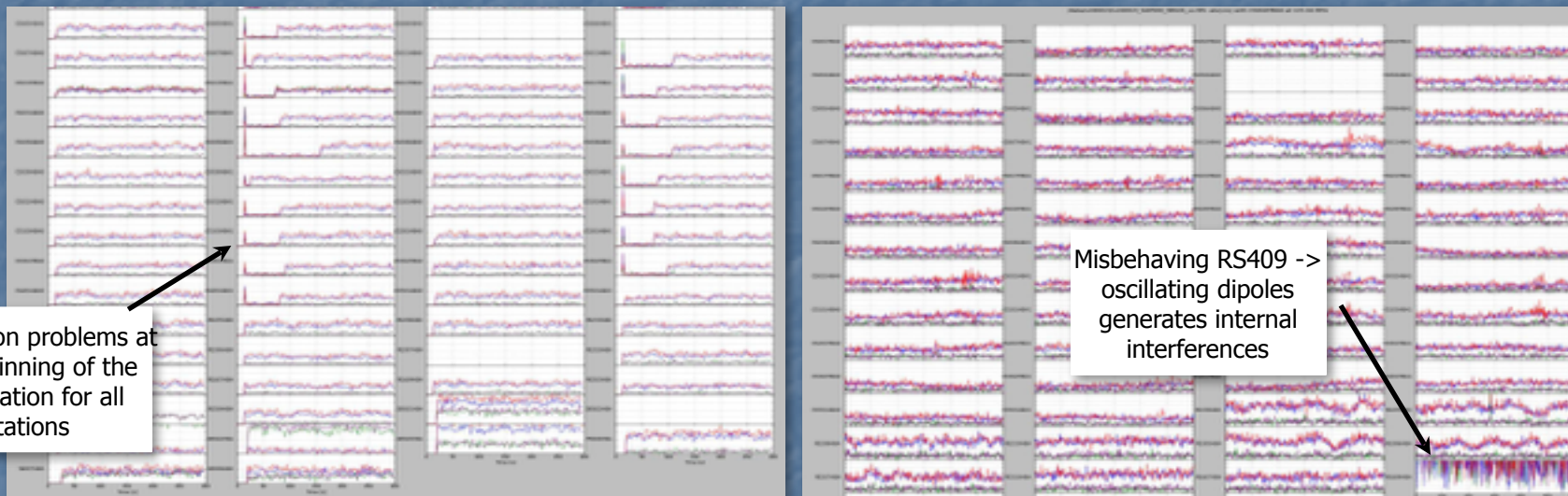
Connection problems at the beginning of the observation for all stations

Misbehaving RS409 -> oscillating dipoles generates internal interferences

INSPECTION PLOTS: VISIBILITY AMPLITUDE
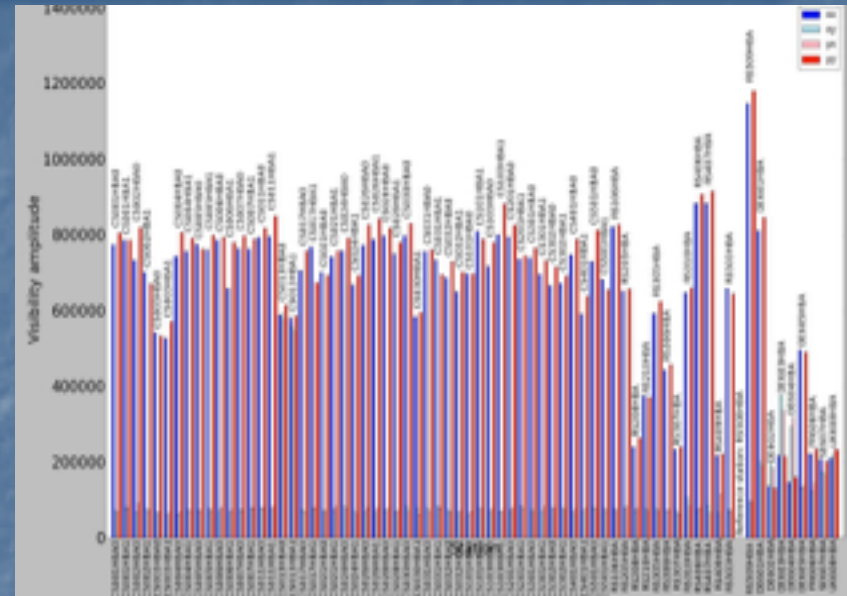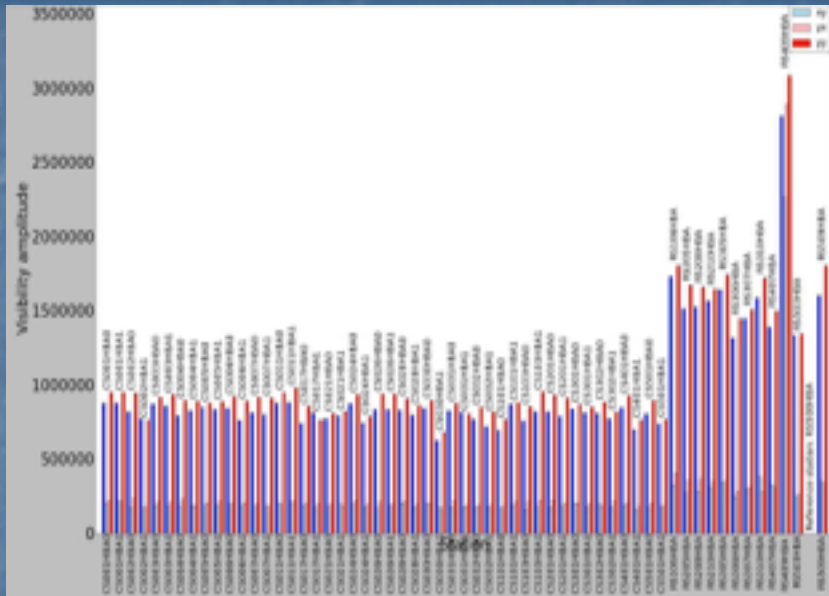
➤ Stations with the same characteristics, e.g. all CS should have more or less the same amplitudes; when their values differ too much the sensitivity of the station is not good (in this case RS409)

➤ It is good to check on a long baseline a frequency with high S/N which is relatively clean of interferences (e.g. correlator SB 77 in HBA and 301-302 in LBA)

➤ A way to identify the presence of Solar bursts is to check if the amplitude visibilities scales of CS have much higher values than the remote station or CS in quiet conditions.

➤ Visibility amplitude 3C196 (resolved at long baselines)

➤ Different amplitudes values among RS and IS are due to the fact that some baselines detect and resolve source structure and some other do not.

➤ Knowing the layout of the telescope and the characteristics of the source are the key to interpret these plots.

See tutorial at http://www.astron.nl/radio-observatory/observing-capabilities/depth-technical-information/data-quality-inspection/data-qu

➢ Statistics for each station
➢ Spectrum every second
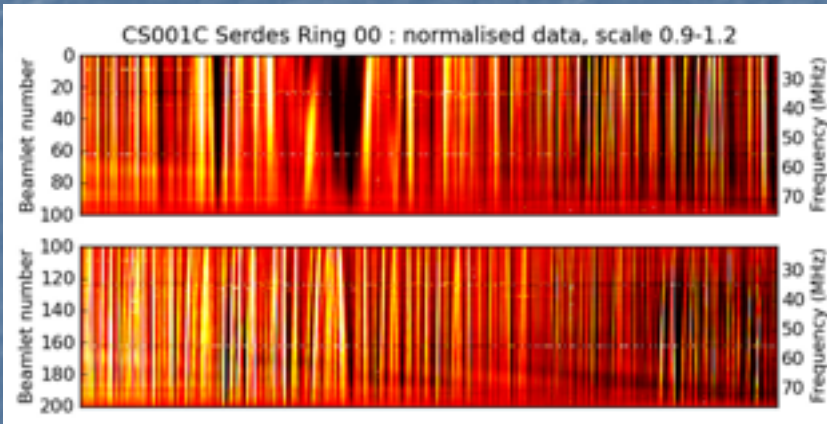
➢ Scintillation (LBA)
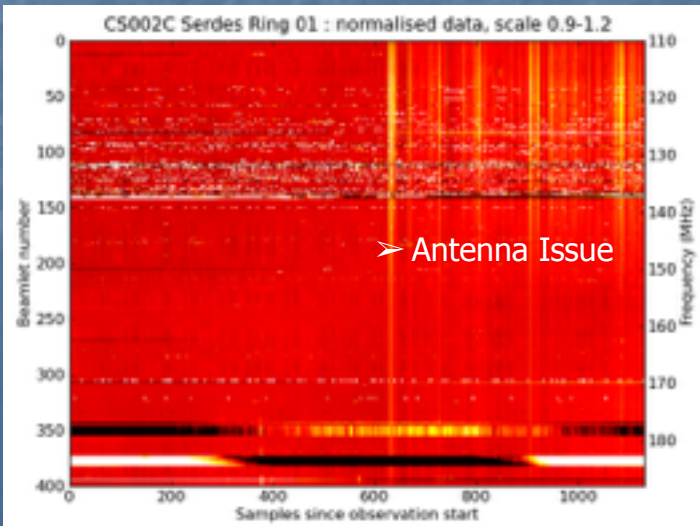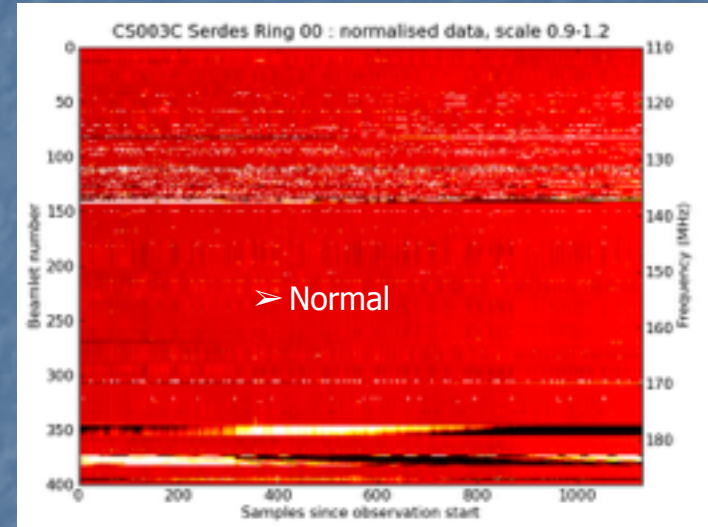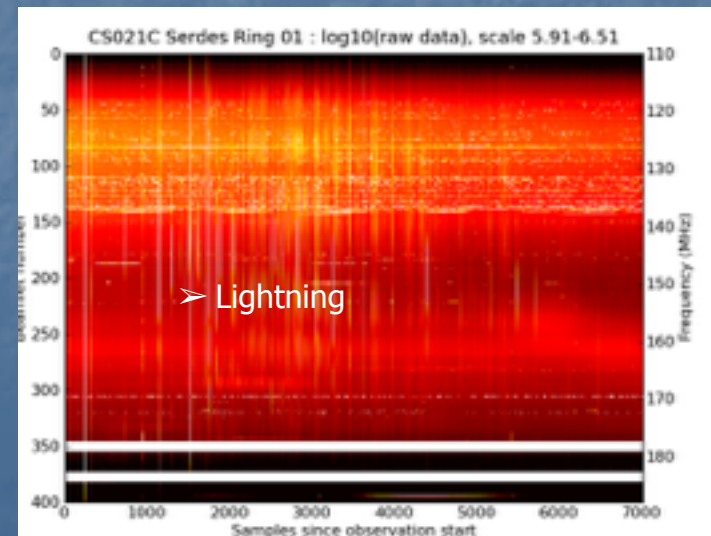
➤ Strong source in sideline
➤ HBA regular pattern
➤ Shifts in time per station
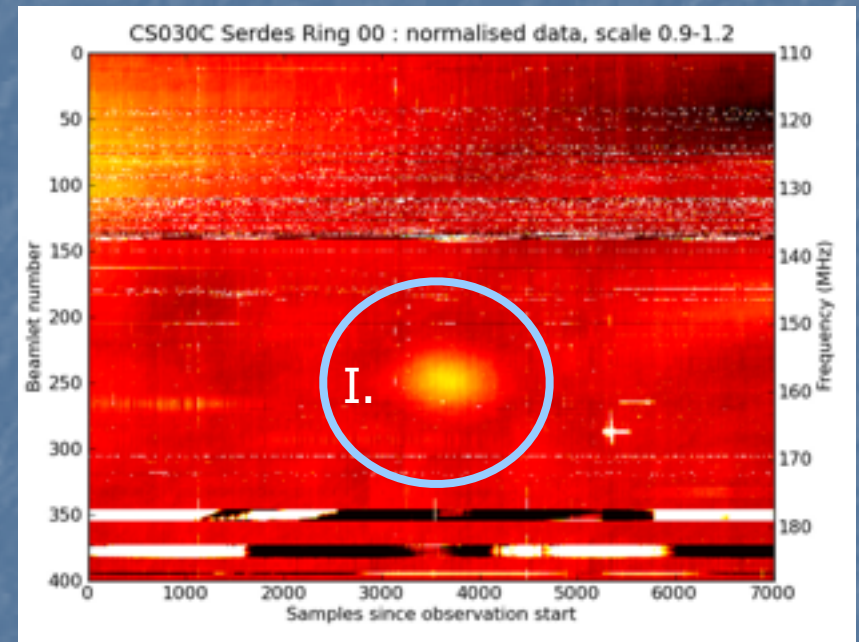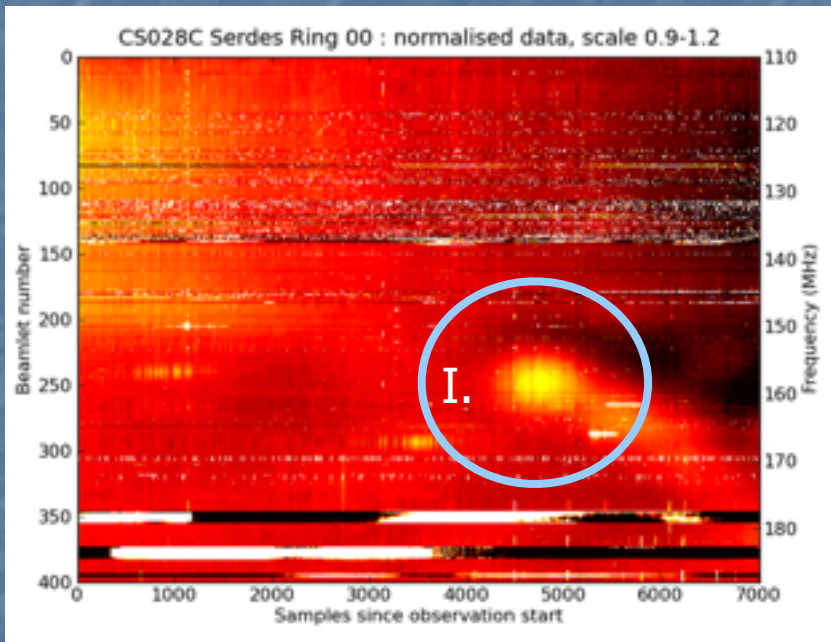
LTA: LONG-TERM ARCHIVE

LOFAR

ASTRON

- ➤ Ingests are initiated by Science Support / operators in MoM. Currently, the PI should actively check the status of the ingest in MoM

- ➤ LOFAR Tools: http://www.astron.nl/radio-observatory/lofar/lofar-tools/lofar-tools

  ↓

  ASTROWISE -> http://lofar.target.rug.nl/

  ↓

  HowTo -> http://www.lofar.org/wiki/doku.php?id=public:lta_howto

- ➤ See Lecture L. Cerrigone

I. INSPECT PROCESSED DATA: LOFAR IMAGING COOKBOOK

THE LOFAR IMAGING COOKBOOK

Version 19.0

June 13, 2016

Edited by Aleksandar Shulevski

- ➤ http://www.astron.nl/radio-observatory/lofar/lofar-imaging-cookbook
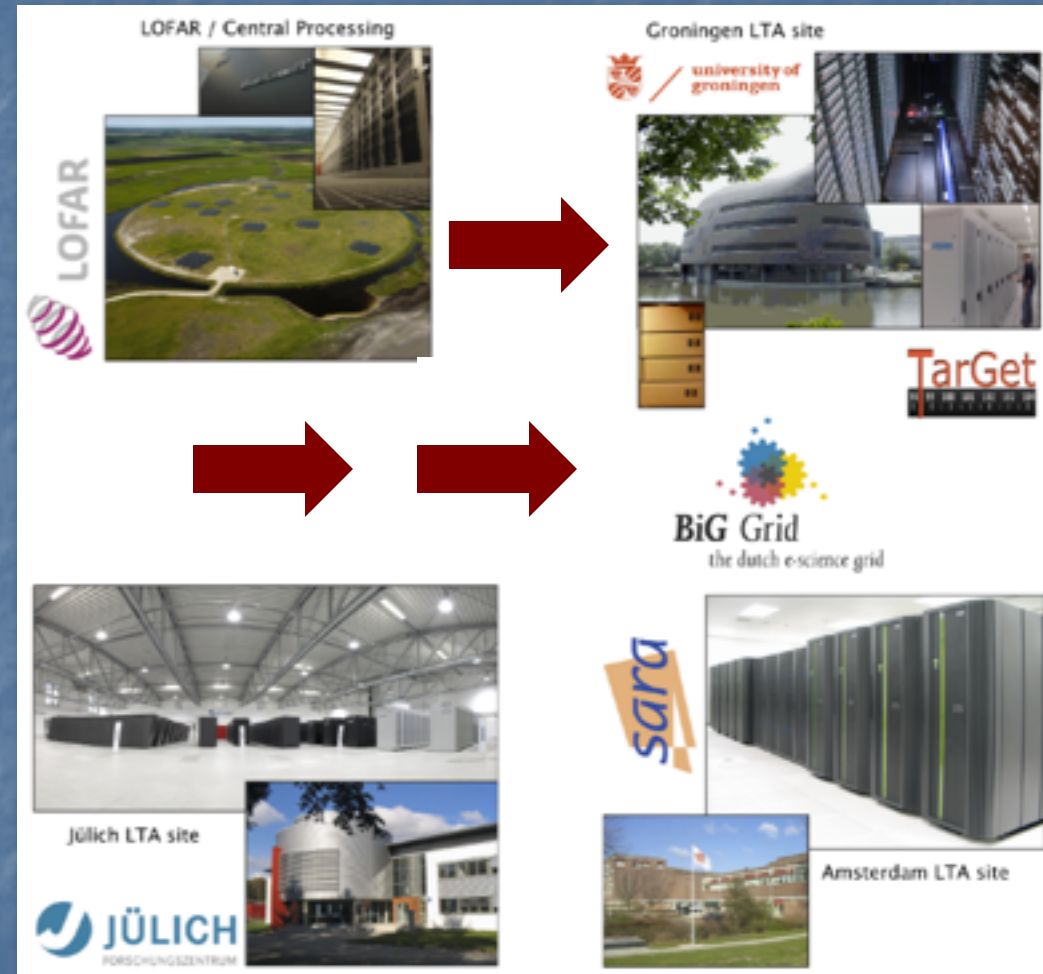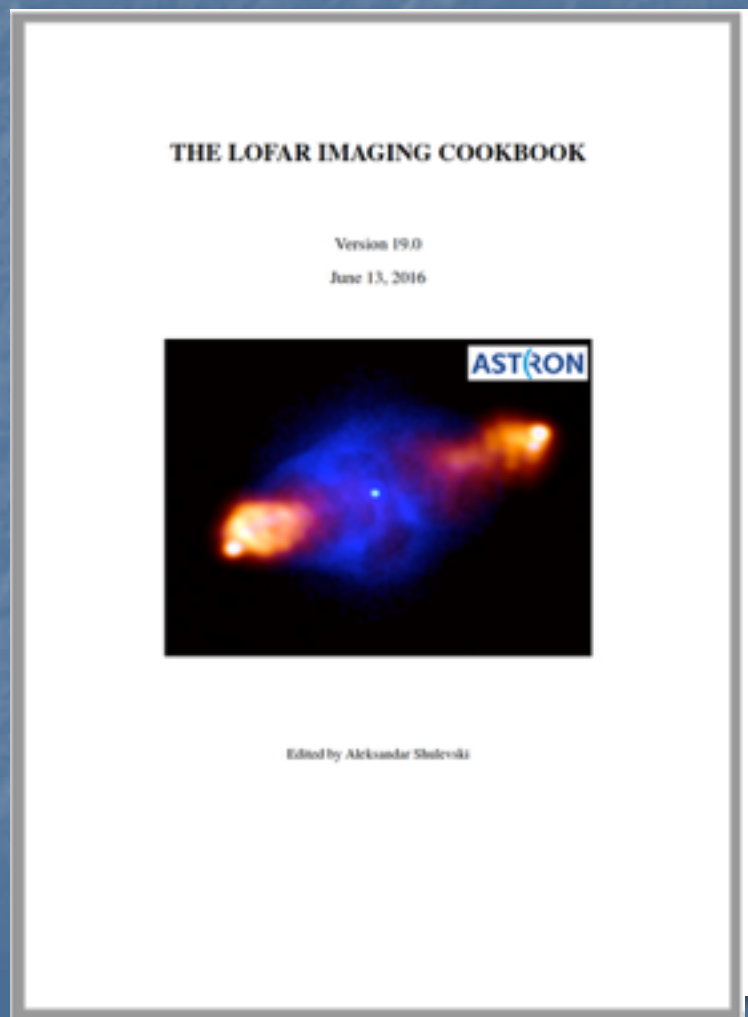
- ➤ Important overview and description of tools to inspect, reduce, and analyze imaging data

- ➤ Supplemented by online material

- Title Page
- Changes
- Table of Contents
- 1 Getting Started
- 2 Data Inspection
- 3 Imaging pipeline
- 4 The AOFlagger – RFI Console
- 5 The New Default Pre-Processing Pipeline (NDPPP)
- 6 Calibration with BBS
- 7 LoSoTo: LOFAR Solution Tool
- 8 SAGECAL
- 9 The AW Imager
- 10 Source detection: PyBDSM
- 11 Automated Self-Calibration
- 12 Sky Model Construction Using Shapelets
- 13 Practical examples
- 14 Useful resources
- 15 Acknowledgments
- A GNU screen
- B LOFAR simulation software and new Demixing approach

- ➤ Editor A. Shulevski

- ➤ Authors: experienced LOFAR commissioners

CEP3: TIMELINE & POLICIES

➢ CEP3 will be used to run the commissioning processing routines, testing production software and, in selected cases, to perform advanced Cycle processing by the Cycle users

➢ Observing, CEP4 processing time and the use of CEP3 are allocated by the LOFAR Programme Committee and the ILT director during the regular proposal evaluation stages, or under Director's Discretionary Time

➢ Access privileges limited in time (8 weeks by default). Automatic notification will be sent to users one week before the expiration of access privileges. Users can request extension of their access, in case this is justified. The user's data products generated on the CEP3 nodes will be removed regularly after the expiration of the access privileges

➢ You will be using CEP3 for the School tutorials

➢ CEP3 information is available on the wiki: http://www.lofar.org/operations/doku.php?id=cep3:start

I. APPLYING FOR COMMISSIONING TIME

- ➤ LOFAR users who want to suggest observing experiments aimed at commissioning specific aspects of the instrument can apply for 'commissioning time' at any moment

- ➤ Requests should be sent to R. Pizzo (pizzo@astron.nl) and M. Brentjens (brentjens@astron.nl), who jointly will decide whether there is room in the schedule for such experiment and it is useful enough to take some specified amount of Science Support and Software Support

- ➤ In case of rejection, the proposers can appeal to the Director of the Radio Observatory

- ➤ People who achieve scientific results from commissioning time obviously have to go through the Builders List

- ➤ For more details see

  I.   http://www.astron.nl/radio-observatory/asking-time/asking-time

THANKS