

Low frequency science with LOFAR2.0: future perspective

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LOFAR ARRAY

52 dipole antenna stations distributed across EU

10-250 MHz

Low band antenna (LBA; 4800 dipole pairs, 96 LBA per station, Area ~ 75200 m2; 10-90 MHz)

High Band Antenna (HBA; 47616 dipole pairs, 48/96 tiles per station in NL/EU, Area ~ 57000 m2; 110-250 MHz)

Several observing modes (imaging, BF, BF+IM, TBB)

96 MHz bandwidth (multi-beam option)





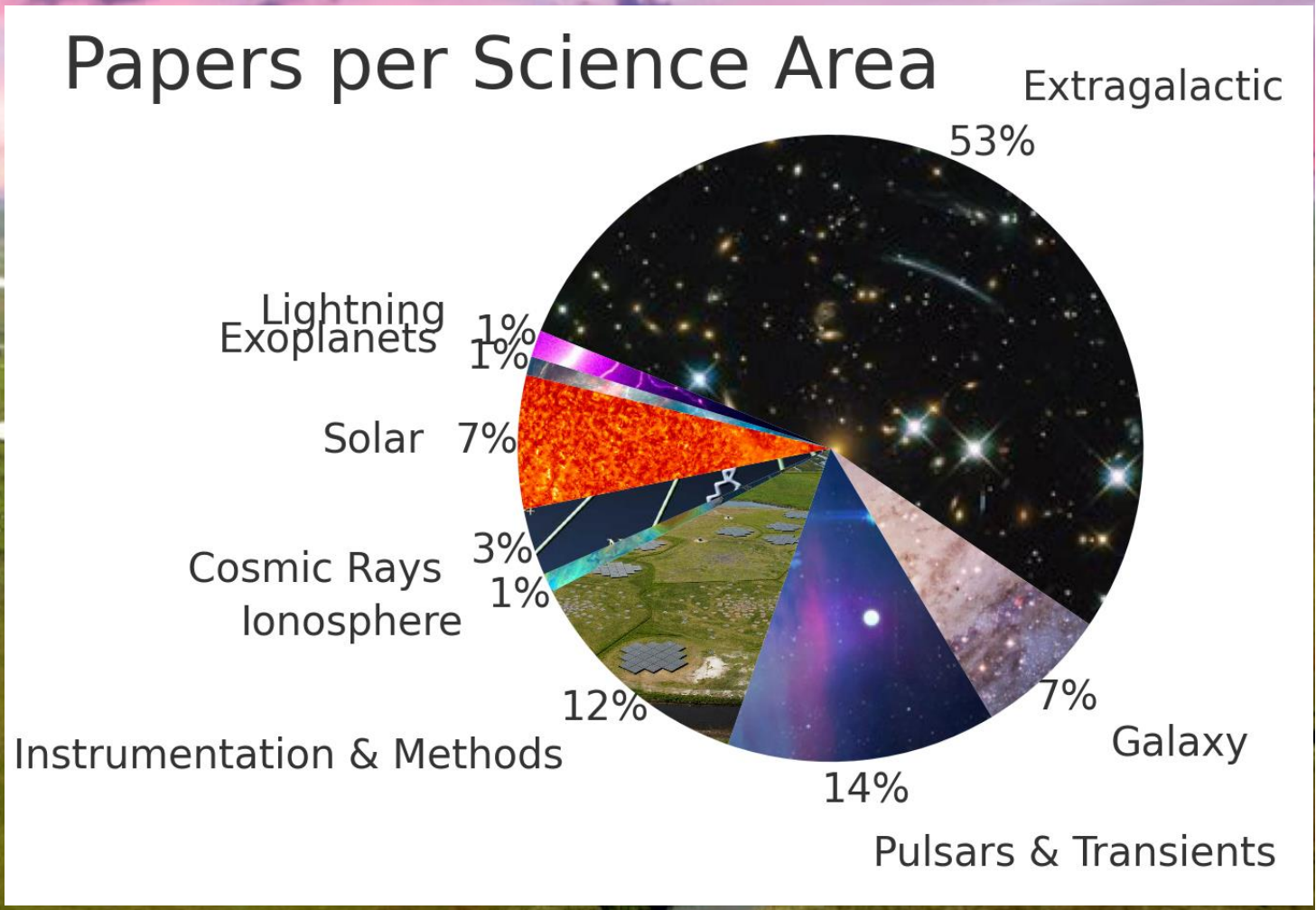




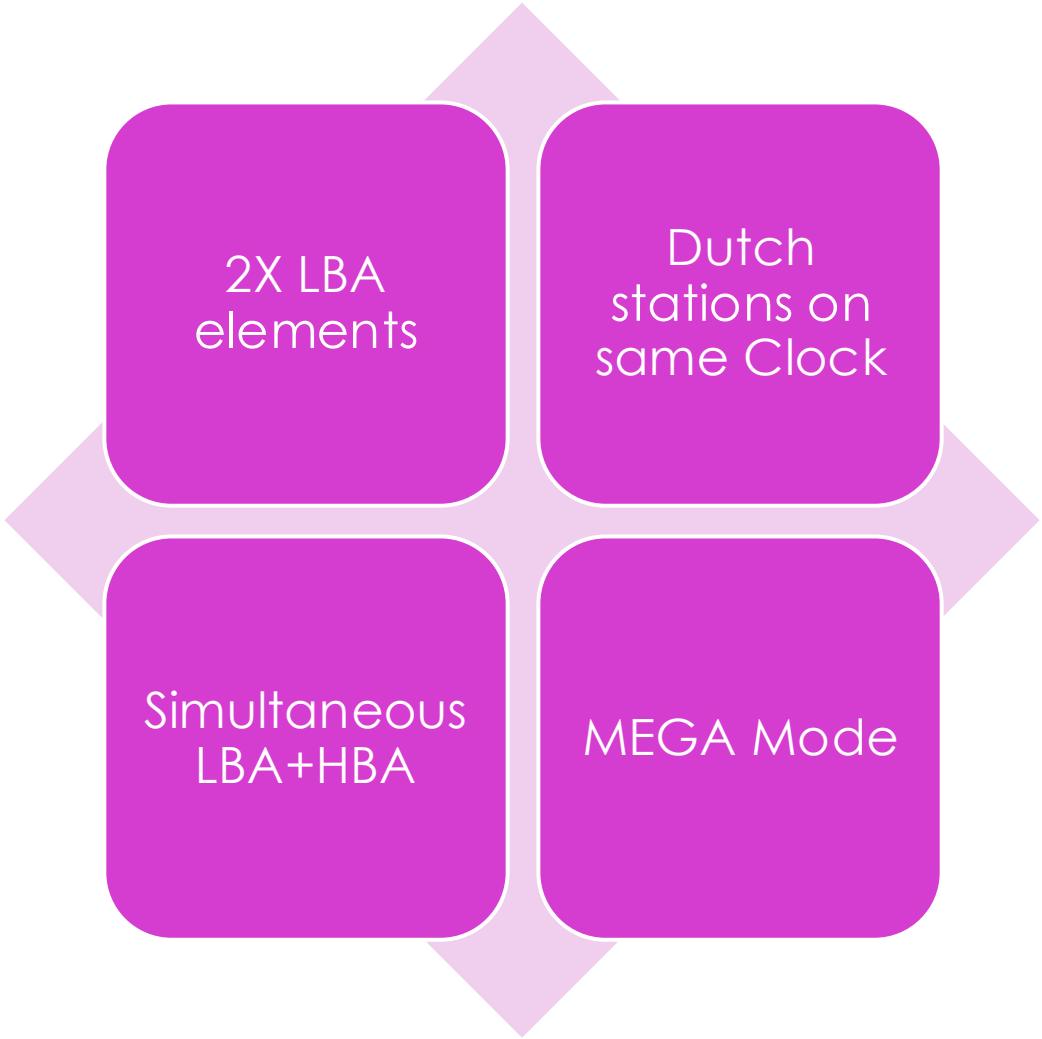
LOFAR SCIENCE

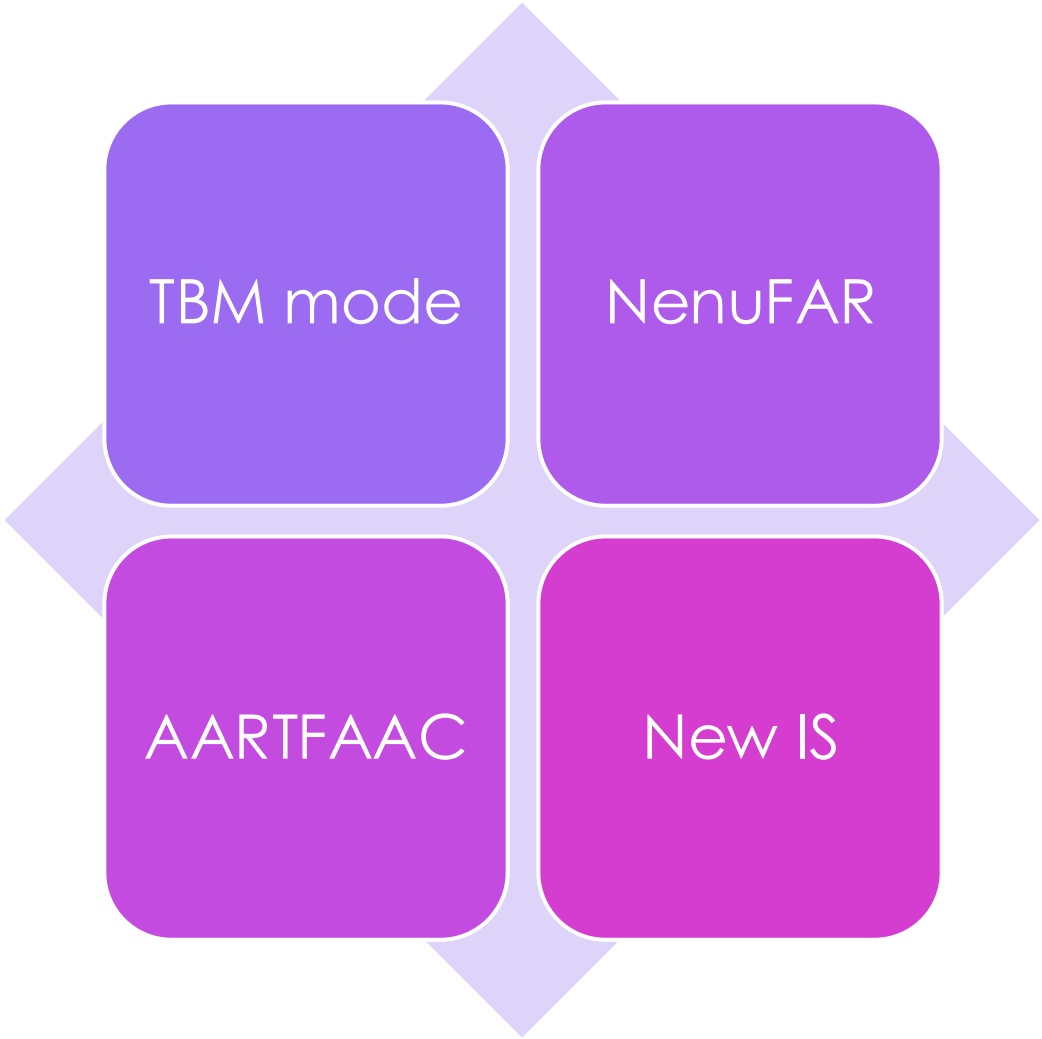
✓ Rate of 100 papers per year





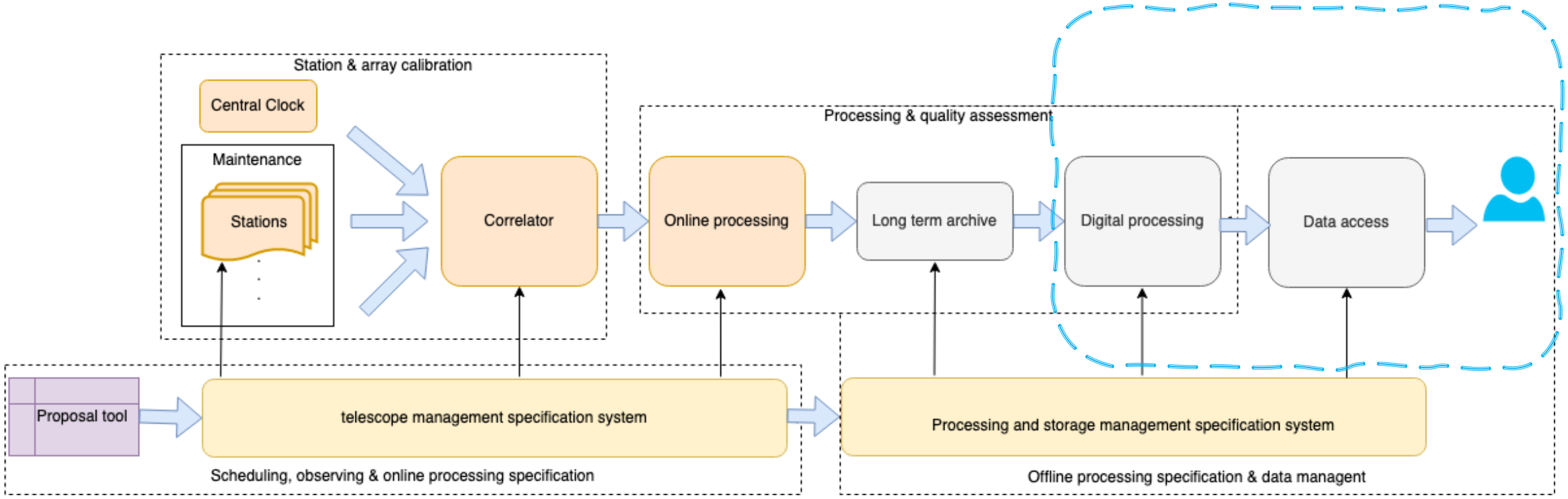
LOFAR2.0 Dupplo

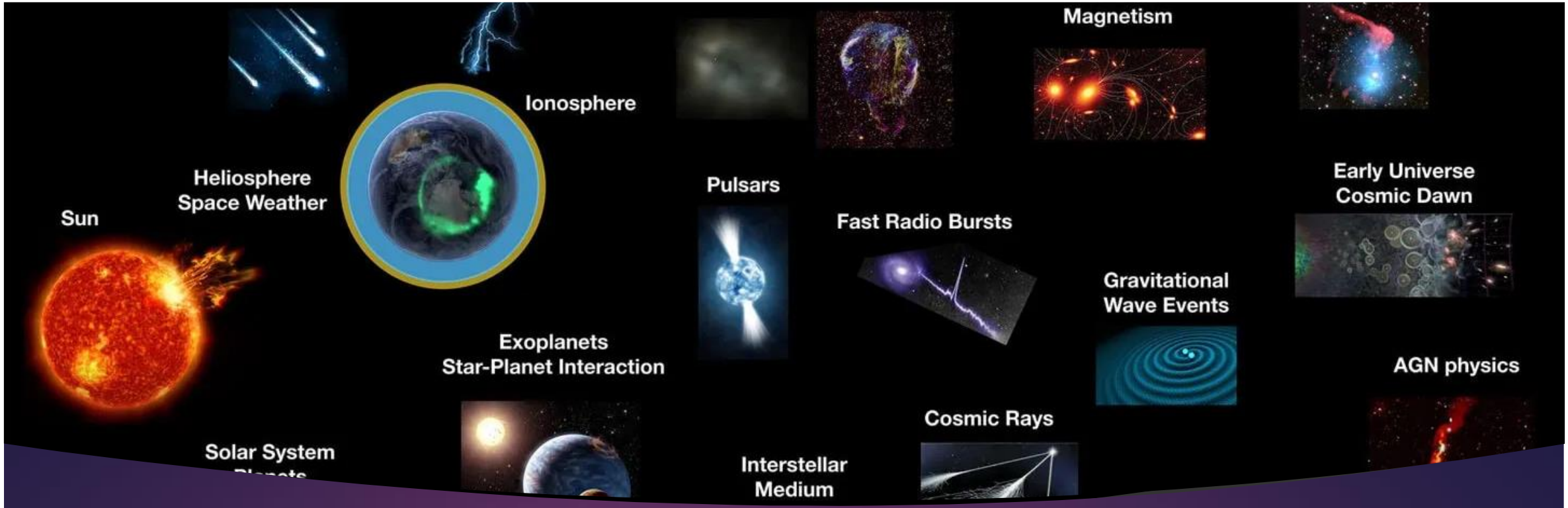




Add-on

LOFAR 2.0 Operational processes





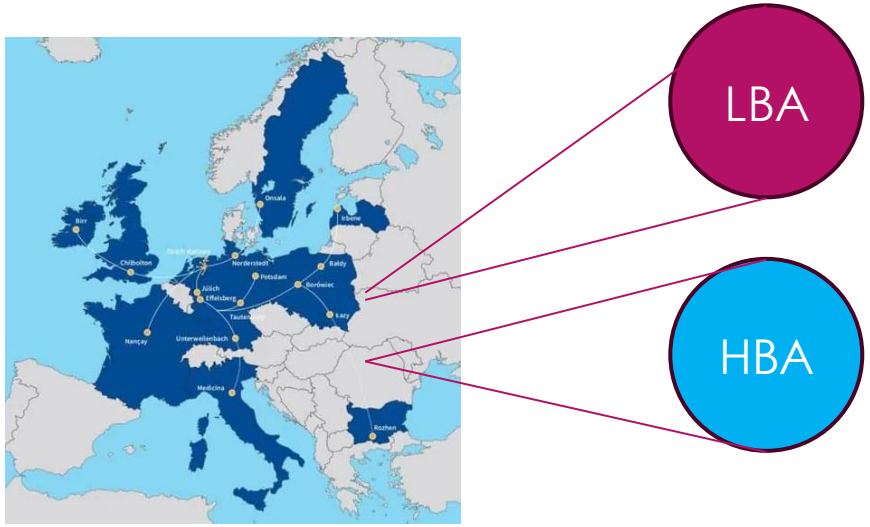
Science cases

- 15 Large programs
- 44 Science Cases

Science cases vs LOFAR2.0 functionalities: LBA+HBA

Simultaneous observation of HBA+LBA.

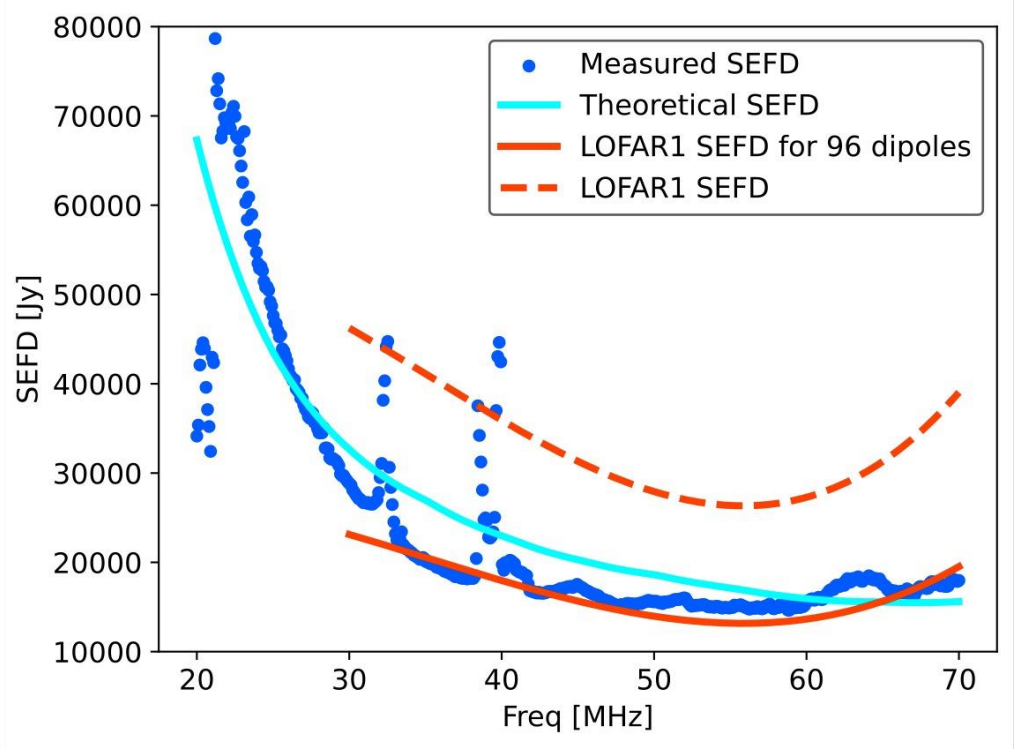
- **Deep fields: Transfer HBA solutions to LBA to ease the LBA calibrations.**
- **Survey speed observing efficiency**

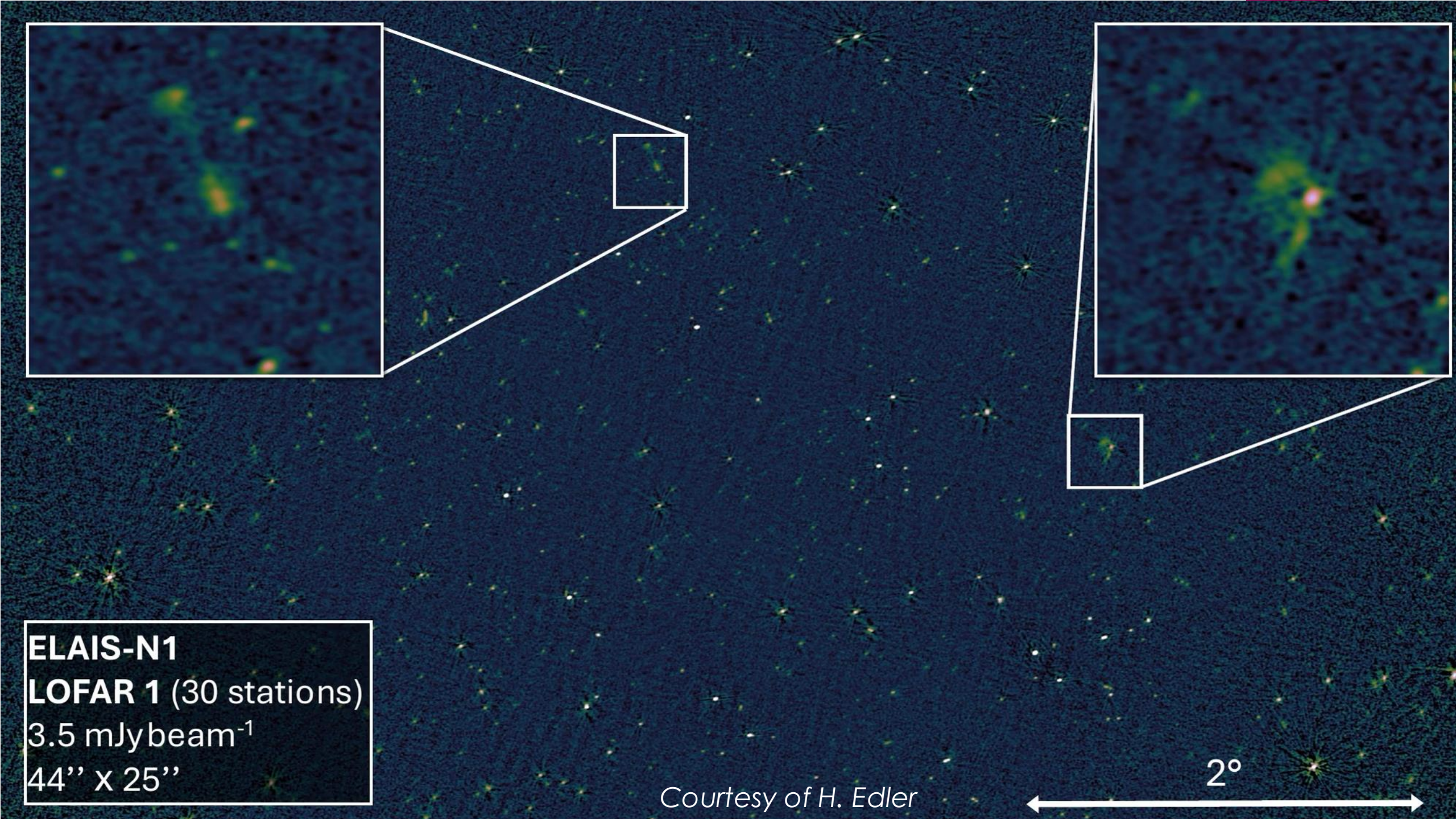


Science cases vs LOFAR2.0 functionalities: 2 X LBA

Double the amount of LBA elements with respect to LOFAR1.

- Increase the sensitivity of the LBA
- Depends on the collective area
- Deeper images , lower noise
- More sources to be used as calibrators
- See next slide
- Start deep LBA observations Surveys & Deep fields




ELAIS-N1
LOFAR 1 (30 stations)
3.5 mJy beam-1
44’’ x 25’’
2°
Courtesy of H. Edler

Science cases vs LOFAR2.0 functionalities: single clock

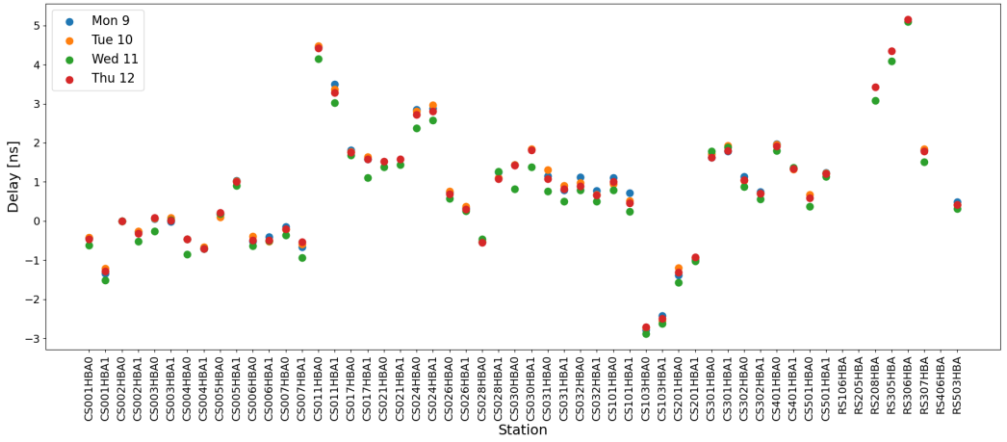
All NL stations are locked to a single clock.

- **Beam Formed (tide array mode) improves the sensitivity of this mode.**
  - **Allows to include the RS to the PSR observations**
- **Imaging reduces the delays between the stations of the NL Array making the calibration easier.**

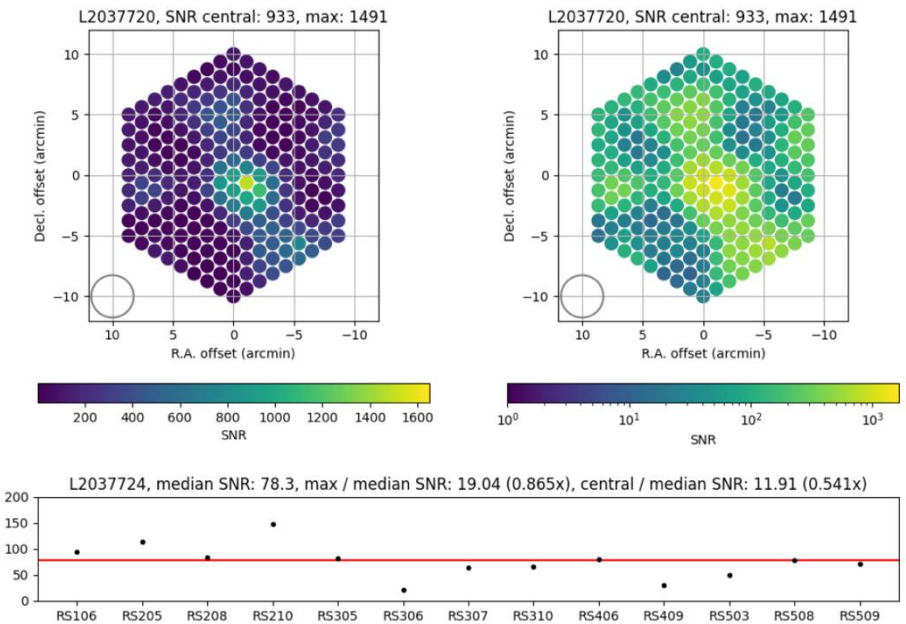
LOFAR1



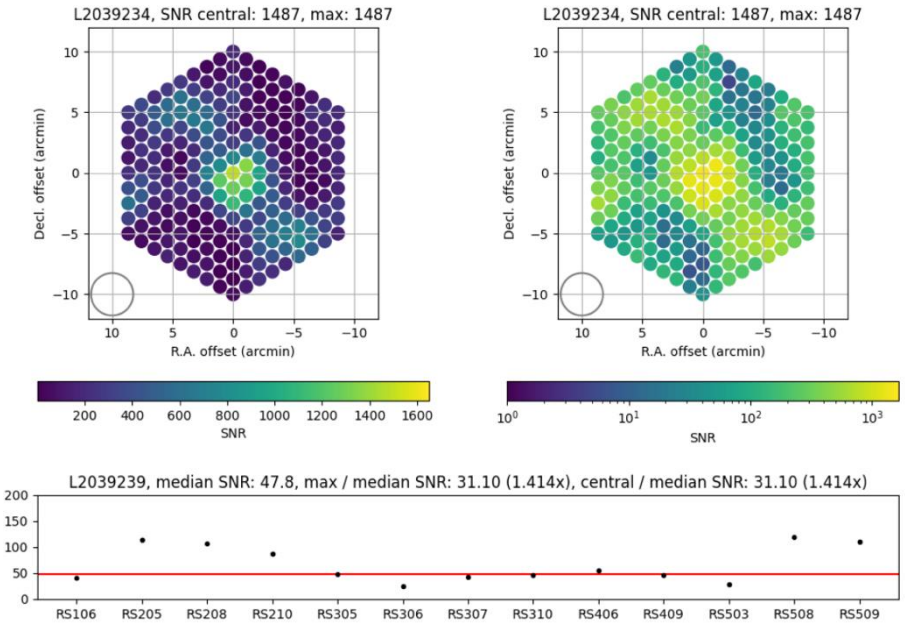
LOFAR2.0



Original



New delays

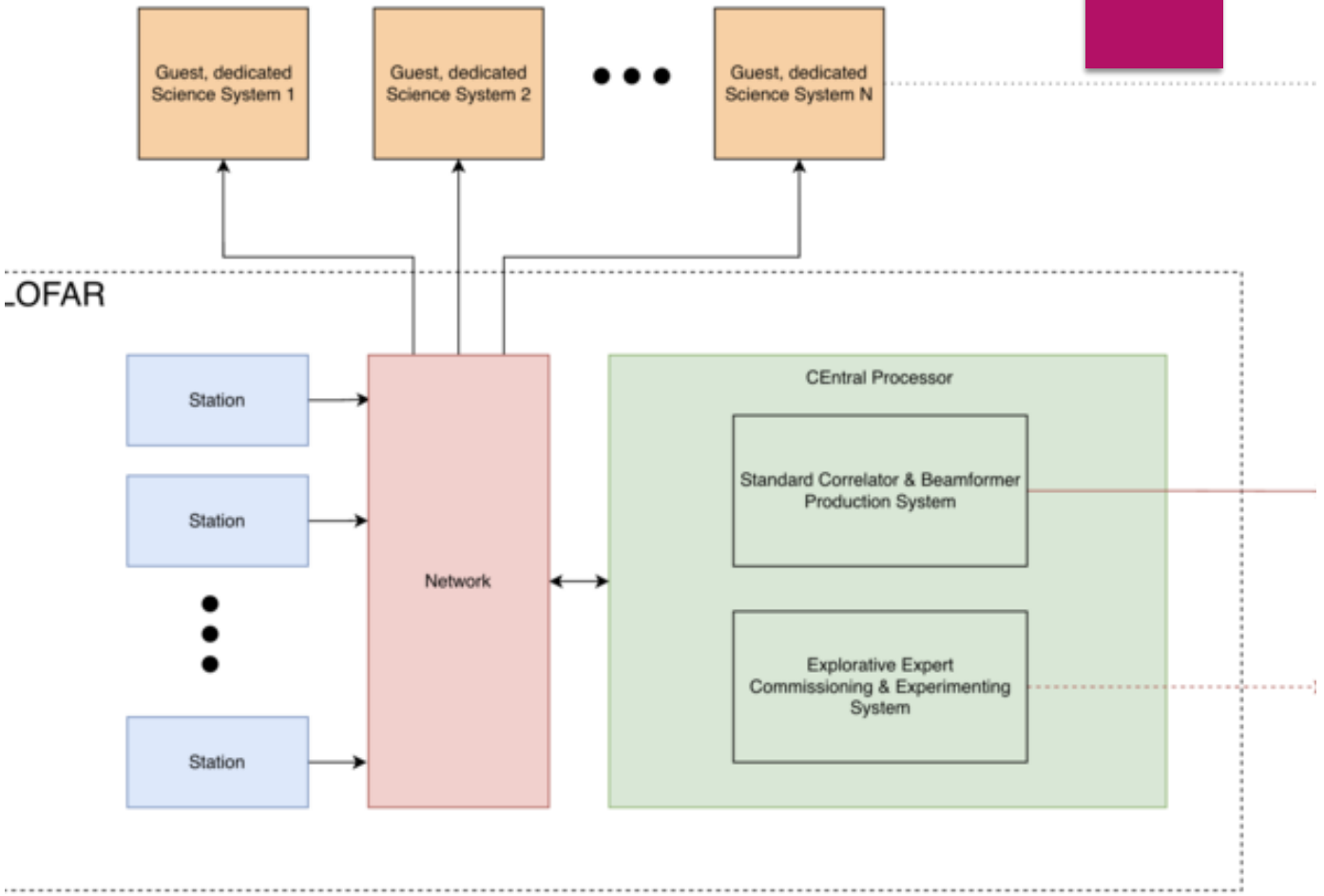


Measuring coherence BF

Science cases vs LOFAR2.0 functionalities: MEGA MODE

Stations send data to multiple correlators

- **Transient project**
- **EUROCLUSTER receives data from stations while other projects are observing (e.g. HBA Survey I-LoTSS)**
- **Correlate the station data in TAB mode to see if there are any transient detected.**



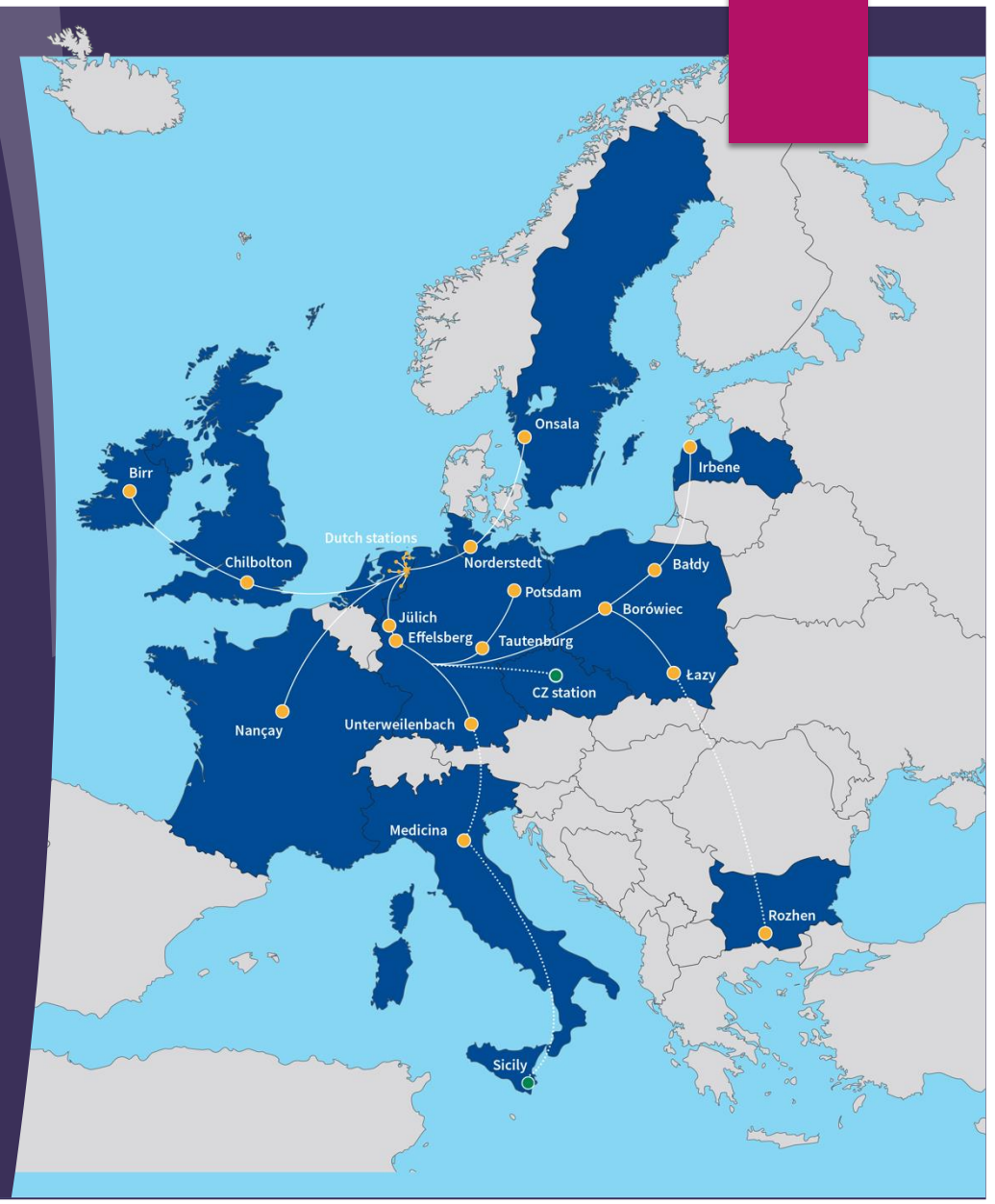
Science cases vs LOFAR2.0 add-on functionalities: New IS & NenuFAR

Addition of new International stations

- **Long N-S long baseline**
- **Fill up the uv-plan for intermediate long baselines**
- **Power up the long baseline science**

Addition of the new LBA Super Station NenuFAR

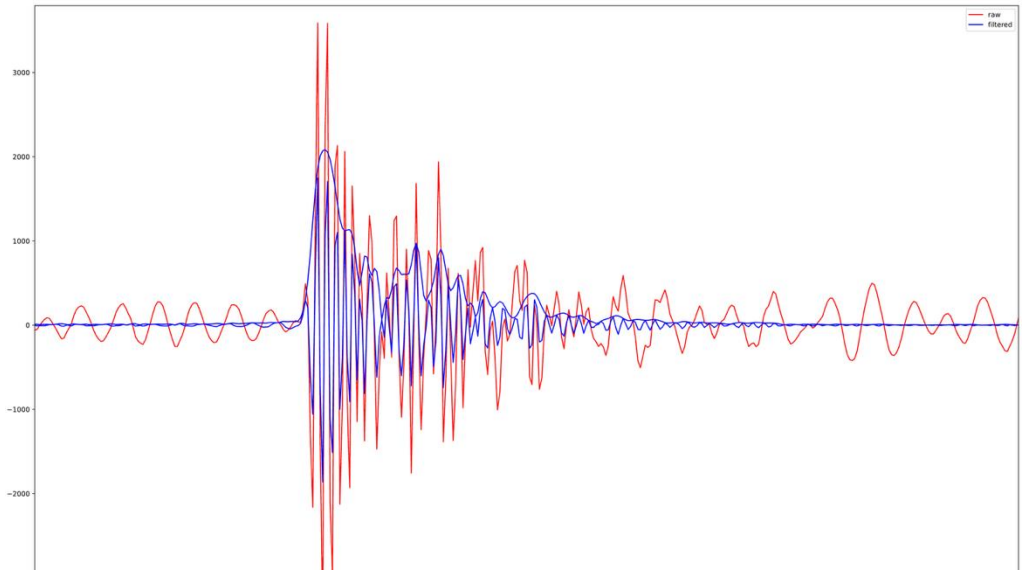
- **Increase LBA sensitivity over long baselines**
- **Transient science**

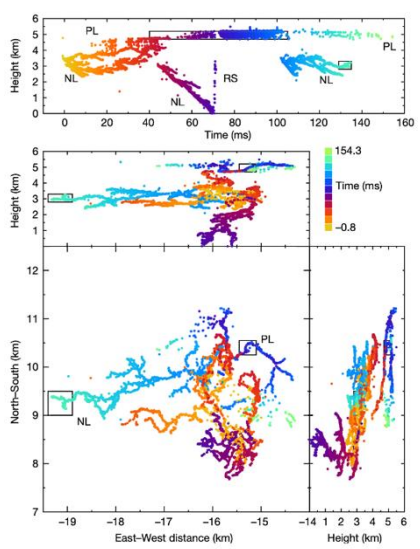


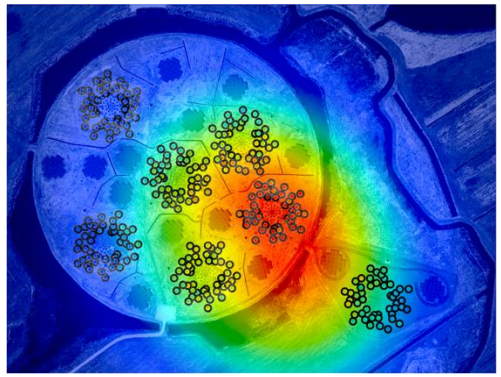
Science cases vs LOFAR2.0 functionalities: Transient Buffer Mode

Transient buffer captures raw station data at resolution of 5ns for a duration od <1s.

- **Cosmic rays science**
  - **Piggyback mode**
- **Lightening science**



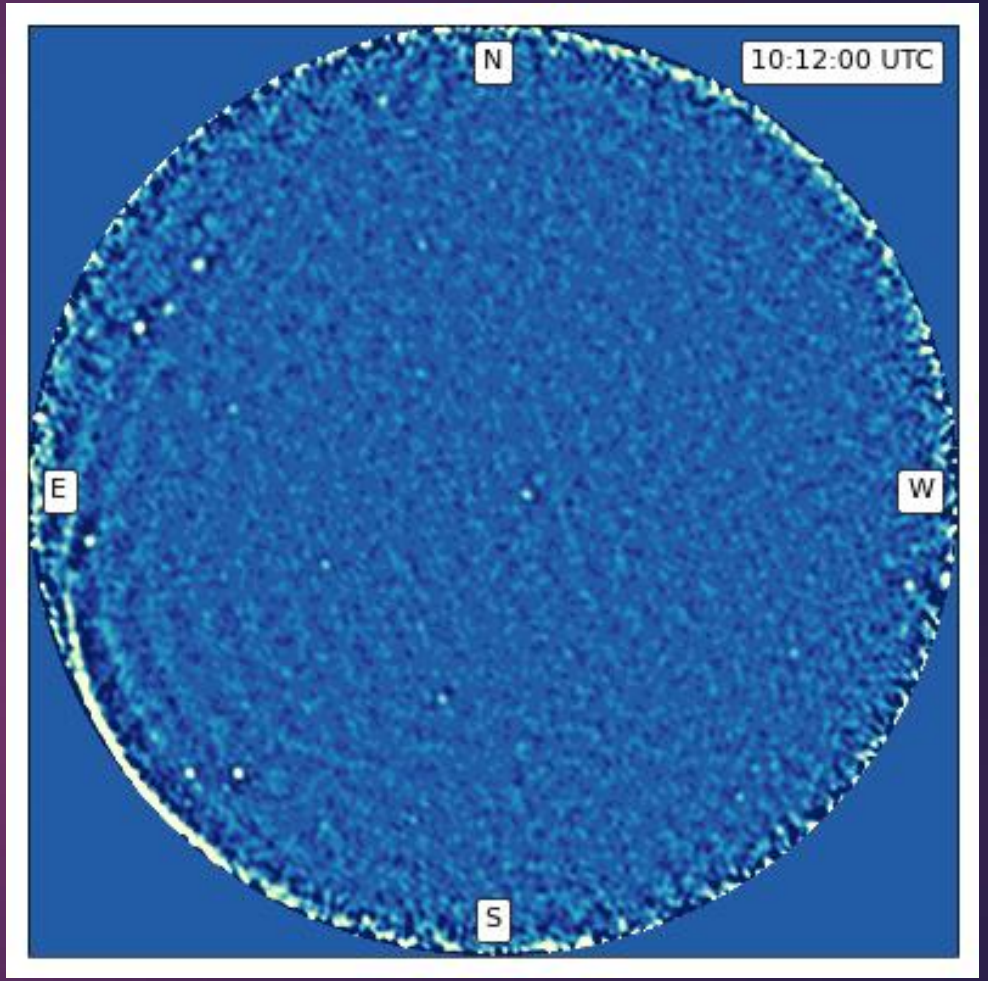




Science cases vs LOFAR2.0 functionalities: All sky imaging

AARTFAAC2.0 monitoring observations

- **AARTFAAC2.0 streaming LBA antenna data of 12 Stations, 48 antenna each, which are correlated in real time**
- **Transient science**
- **Space weather science**
- **EoR science**

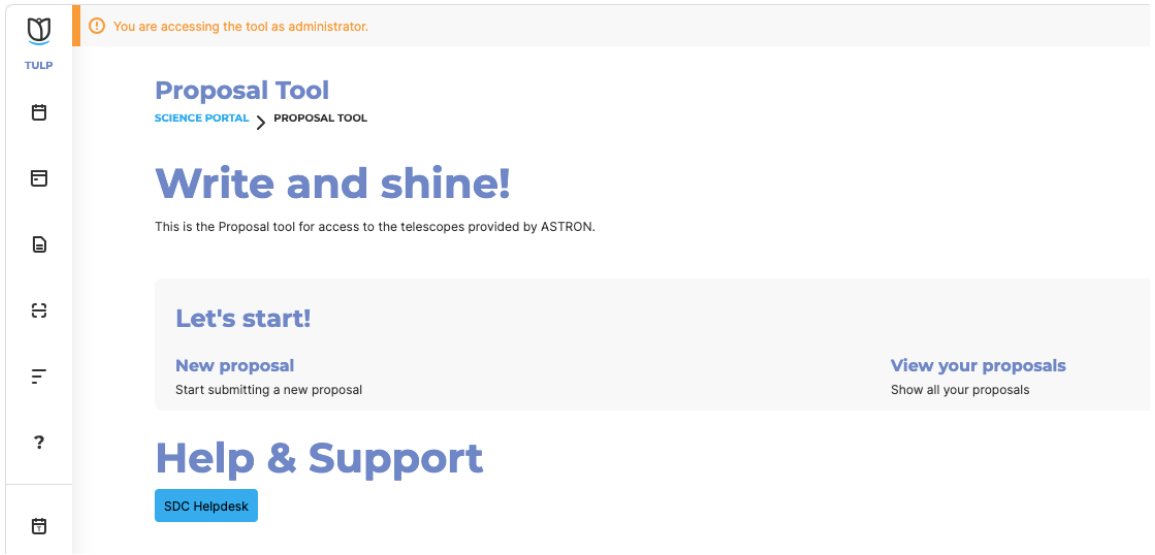


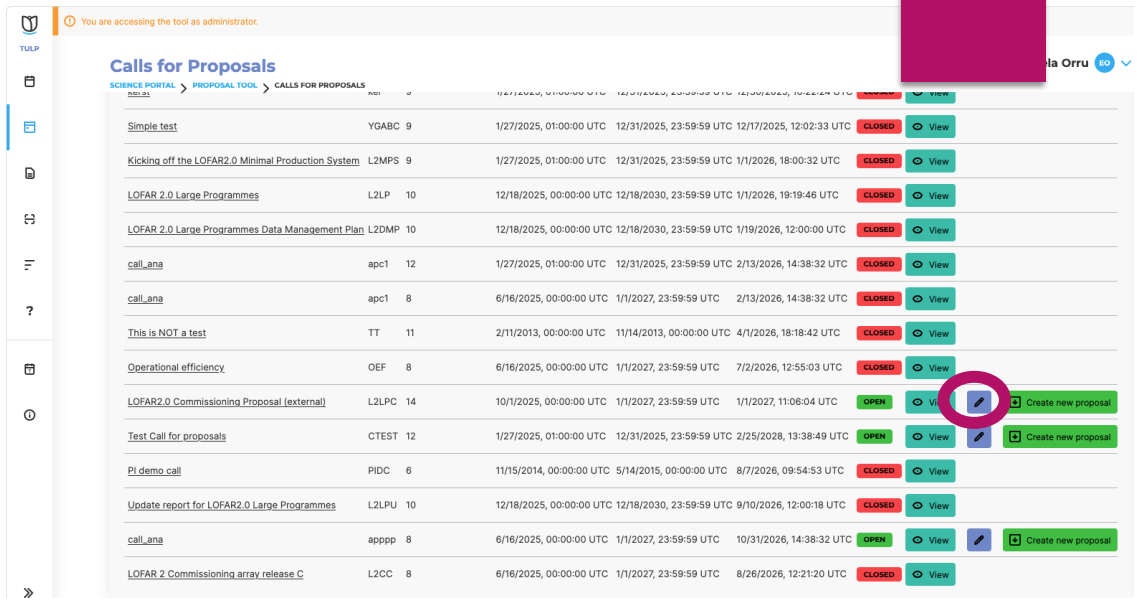
Science Data Center

New Proposal tool

SDC processing

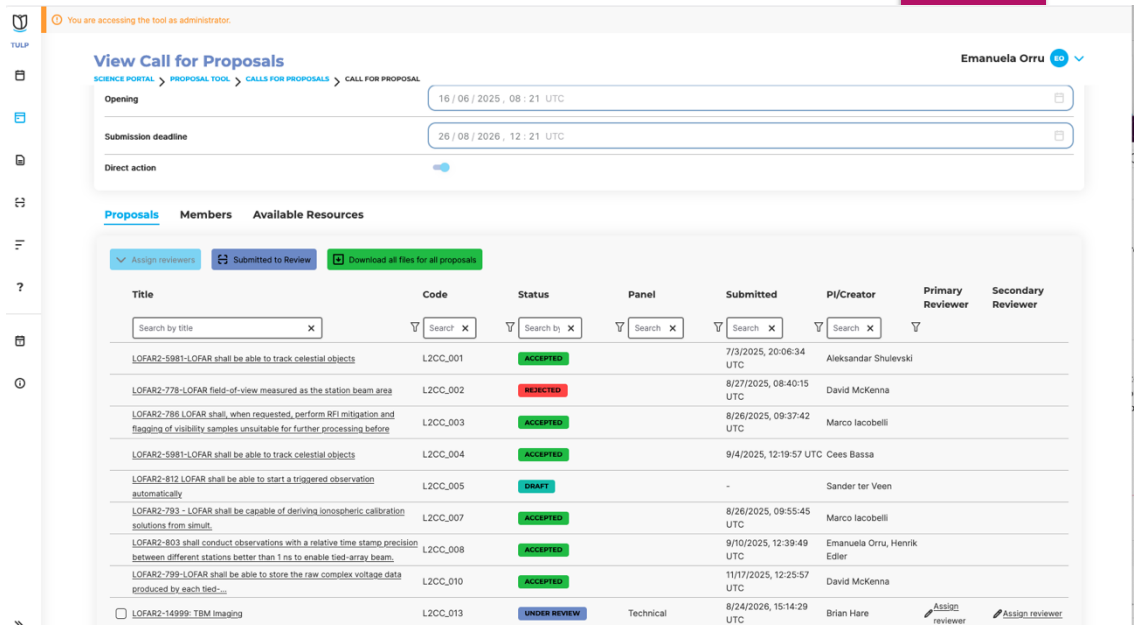
Federated model towards centralized model



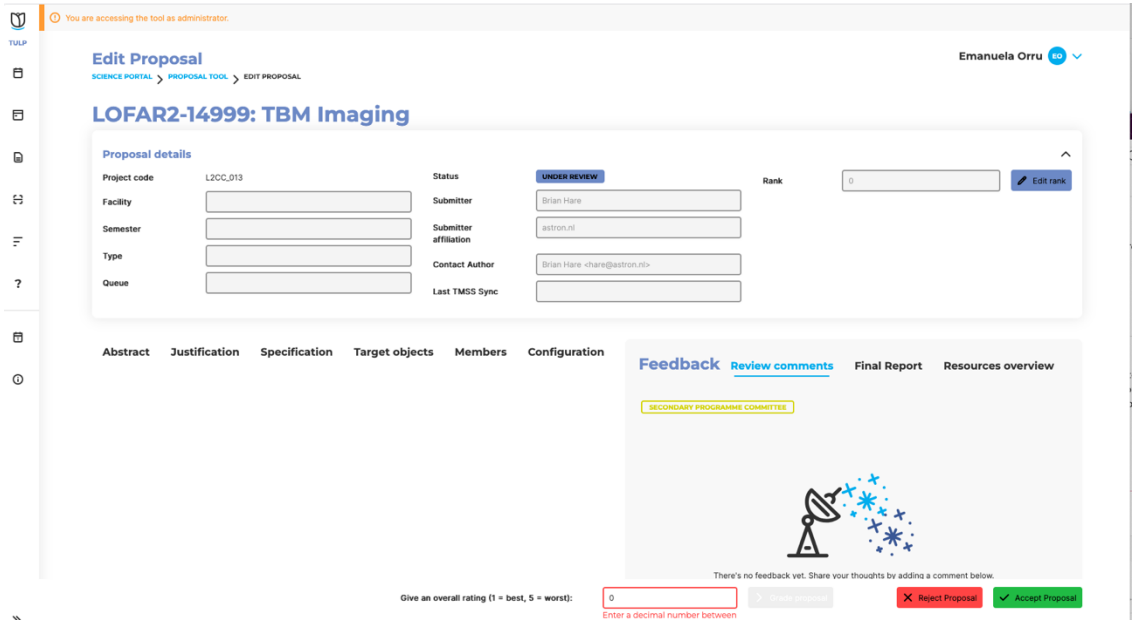


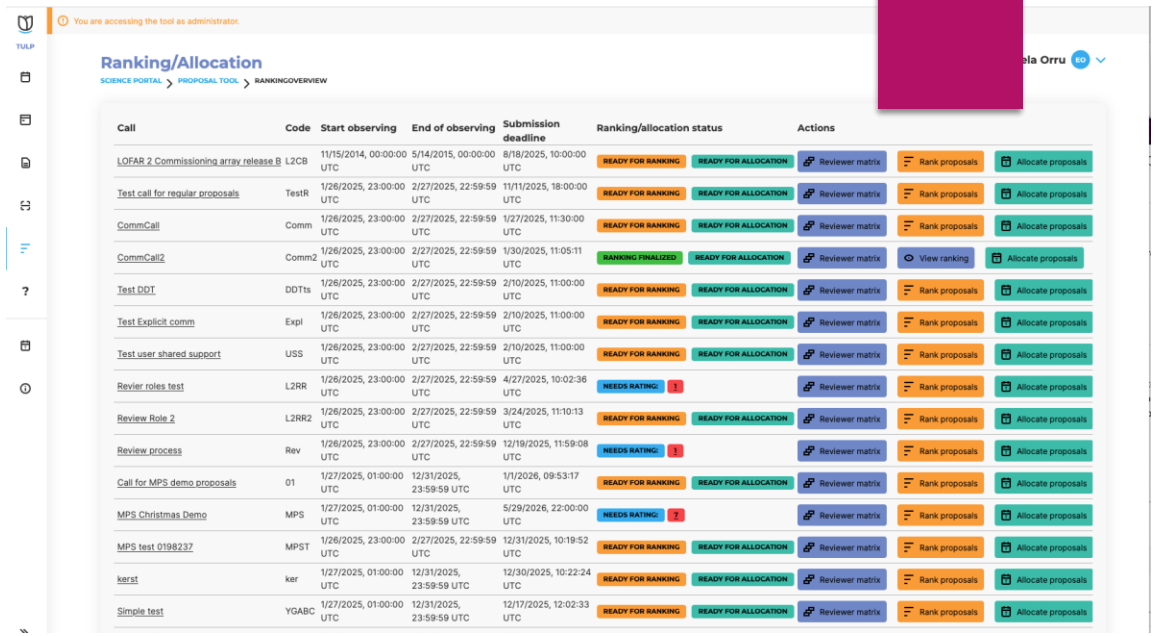
Proposal tool: TULP https://tulp.sdc.astron.nl/





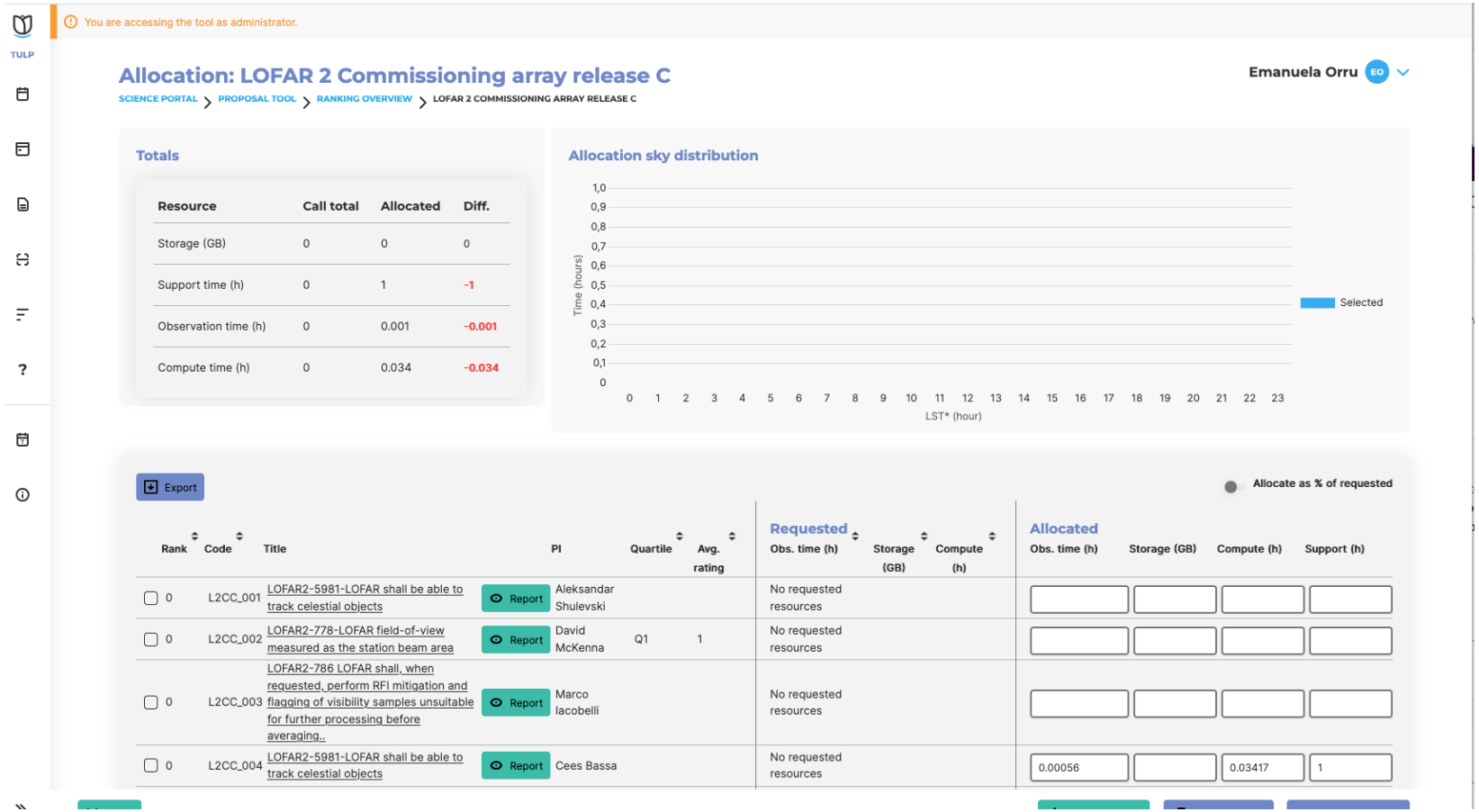
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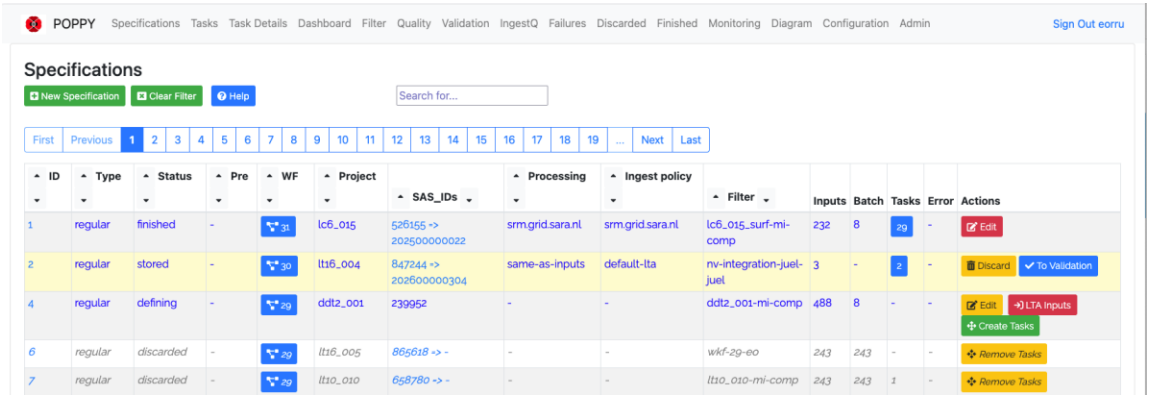


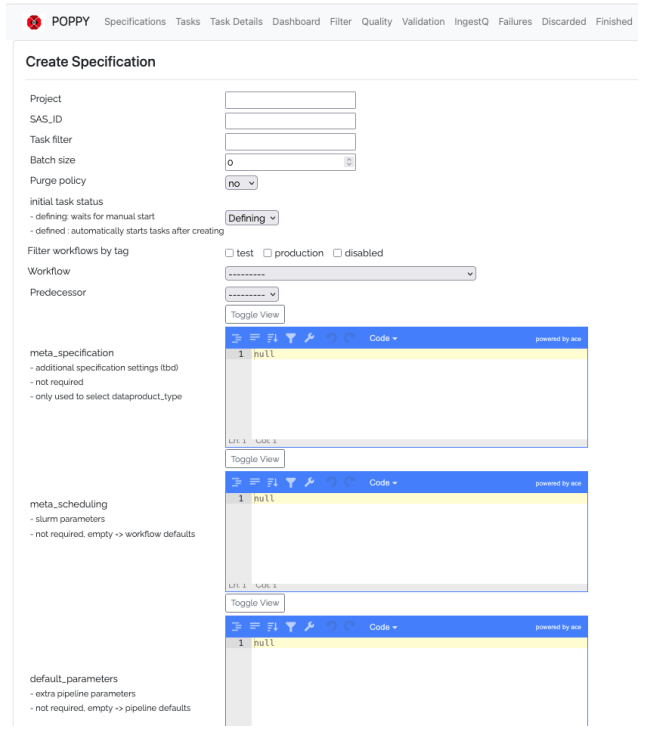


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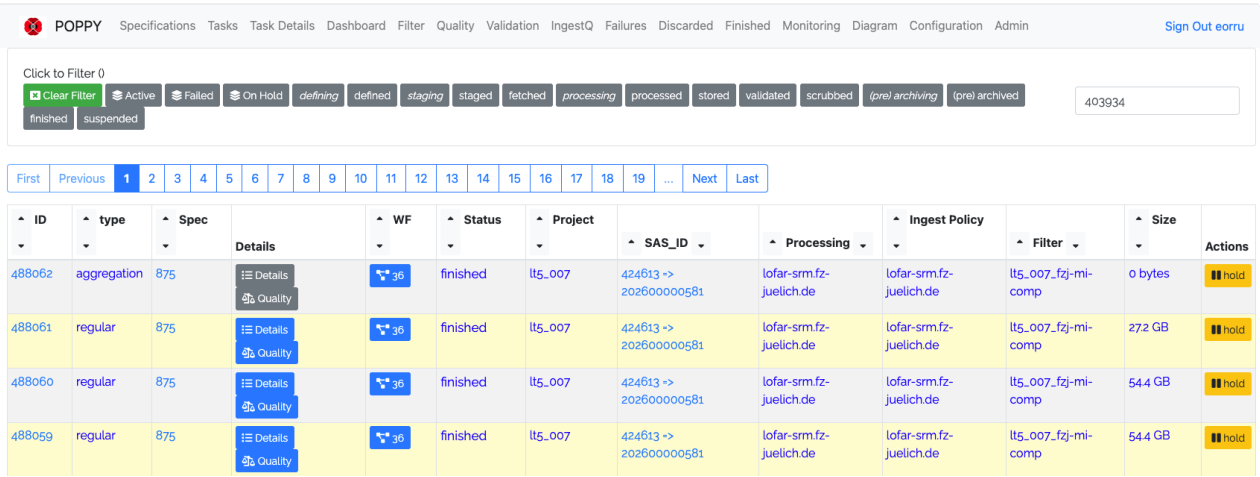
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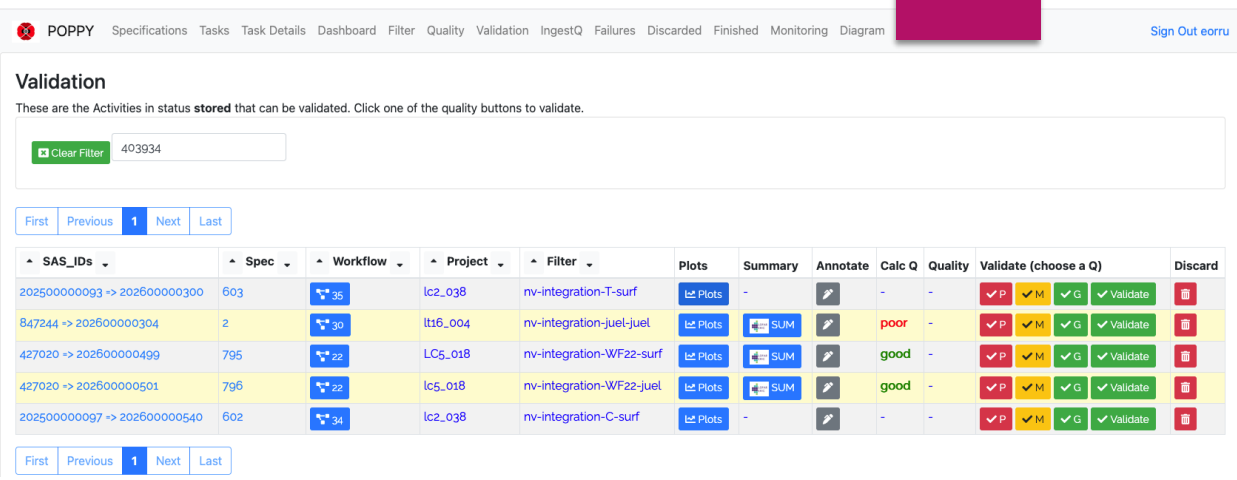






LTA processing





LTA processing

Examples of science ready data

- VO

ASTRON **The VO @ ASTRON**

Welcome to the ASTRON VO data center.

In addition to the services listed below, on this site you probably can access numerous tables using TAP or form-based ADQL.

Please check out our site help.

Services available here

Services marked by [P] require authorisation to access the data.

By Title | By Subject | By Author

- ADQL Query
- Apertif DR1 - Continuum images
- Apertif DR1 - Field calibrated visibilities
- Apertif DR1 - Field raw visibilities
- Apertif DR1 - Flux calibrator raw visibilities
- Apertif DR1 - HI spectral cubes
- Apertif DR1 - Polarization calibrator raw visibilities
- Apertif DR1 - Polarization cubes
- Apertif DR1 - Source catalogue
- Apertif DR2 - Continuum images
- Apertif DR2 - Field calibrated visibilities
- Apertif DR2 - Field raw visibilities
- Apertif DR2 - Flux calibrator raw visibilities
- Apertif DR2 - HI spectral cubes
- Apertif DR2 - Polarization calibrator raw visibilities
- Apertif DR2 - Polarization cubes
- Apertif DR Bootes - Catalogue
- Apertif DR Bootes - Mosaic
- Apertif Elais - Catalogue
- Apertif Elais - Mosaic
- Apertif Lockman - Catalogue
- Apertif Lockman - Mosaic
- Apertif Time Domain FRB detection cone search (DR1)
- Apertif Time Domain FRB detection cone search (DR2)
- Apertif Time Domain FRB observation cone search (DR1)
- Apertif Time Domain FRB observation cone search (DR2)
- LBCS Calibrator Search
- LoLSS - Image Cutout Service
- LoLSS source catalog
- LoTSS-DR1 Cross-Matched Source Catalogue
- LoTSS-DR1 Image Archive
- LoTSS-DR1 Image Cutout Service
- LoTSS-DR1 Raw Radio Catalogue Cone Search
- LoTSS-DR2 Gaussian catalog cone search
- LoTSS-DR2 mosaics
- LoTSS-DR2 Source catalog cone search
- LoTSS-DR3 Gaussian catalog cone search
- LoTSS-DR3 mosaics
- LoTSS-DR3 pointings
- LoTSS-DR3 Source catalog cone search
- LoTSS-PDR Image Archive
- LoTSS-PDR Image Cutout Service
- LoTSS-PDR Source Catalogue
- MSSS Verification Field Images
- MSSS Verification Field Sources
- SAURON HI Survey Images
- SAURON HI Survey Velocity Fields
- TGSSADR Image Archive
- TGSSADR Image Cutout Service
- TGSSADR Source Catalogue
- The Apertif Science Verification Campaign
- The VO @ ASTRON TAP service

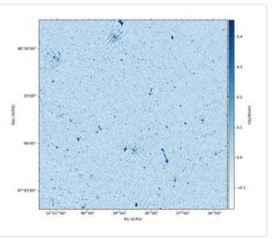
- Surf Data Repository

Published February 16, 2026 | Version v1

Dataset | Open

The LOFAR Two-metre Sky Survey (LoTSS) VII. Third data release (HP-393)

Shimwell, T. W. ; Hardcastle, M. J. ; Tasse, C. ; Drabent, A. ; Botteon, A. ; Williams, W. L. ; Best, P. N. ; Röttgering, H. J. A. ; Brüggen, M. ; Brunetti, G. ; Callingham, J. R. ; Chyży, K. T. ; Conway, J. E. ; De Gasperin, F. ; Haverkorn, M. ; Horellou, C. ; Jackson, N. ; Miley, G. K. ; Morabito, L. K. ; Morganti, R. ; O'Sullivan, S. P. ; Schwarz, D. J. ; Smith, D. J. B. ; van Weeren, R. J. ; Vedantham, H. K. ; White, G. J. ; Ahmadi, A. ; Alegre, L. ; Arias, M. ; Asabere, B. ; Bahr-Kalus, B. ; Barkus, B. ; Bilicki, M. ; Böhme, L. ; Brentjens, M. ; Brienza, M. ; Bomans, D. J. ; Bonafede, A. ; Bonato, M. ; Bonnassieux, E. ; Boxelaar, J. M. ; Camera, S. ; Cassano, R. ; Chilufya, J. ; Cianfaglione, M. ; Croston, J. H. ; Cuciti, V. ; Dabhade, P. ; De Rubeis, E. ; de Jong, J. M. G. H. J. ; Dallacasa, D. ; Dettmar, R. J. ; Duncan, K. J. ; Di Gennaro, G. ; Edler, H. W. ; Groeneveld, C. ; Gürkan, G. ; Hajduk, M. ; Hale, C. L. ; Heesen, V. ; Hoang, D. N. ; Hoeft, M. ; Holties, H. ; Horton, M. A. ; Iacobelli, M. ; Jamrozy, M. ; Jarvis, M. J. ; Jelic, V. ; Kadler, M. ; Kondapally, R. ; Kunert-Bajraszewska, M. ; Loose, M. ; Magliocchetti, M. ; Małek, K. ; Manzano, C. ; McKean, J. P. ; Mevius, M. ;



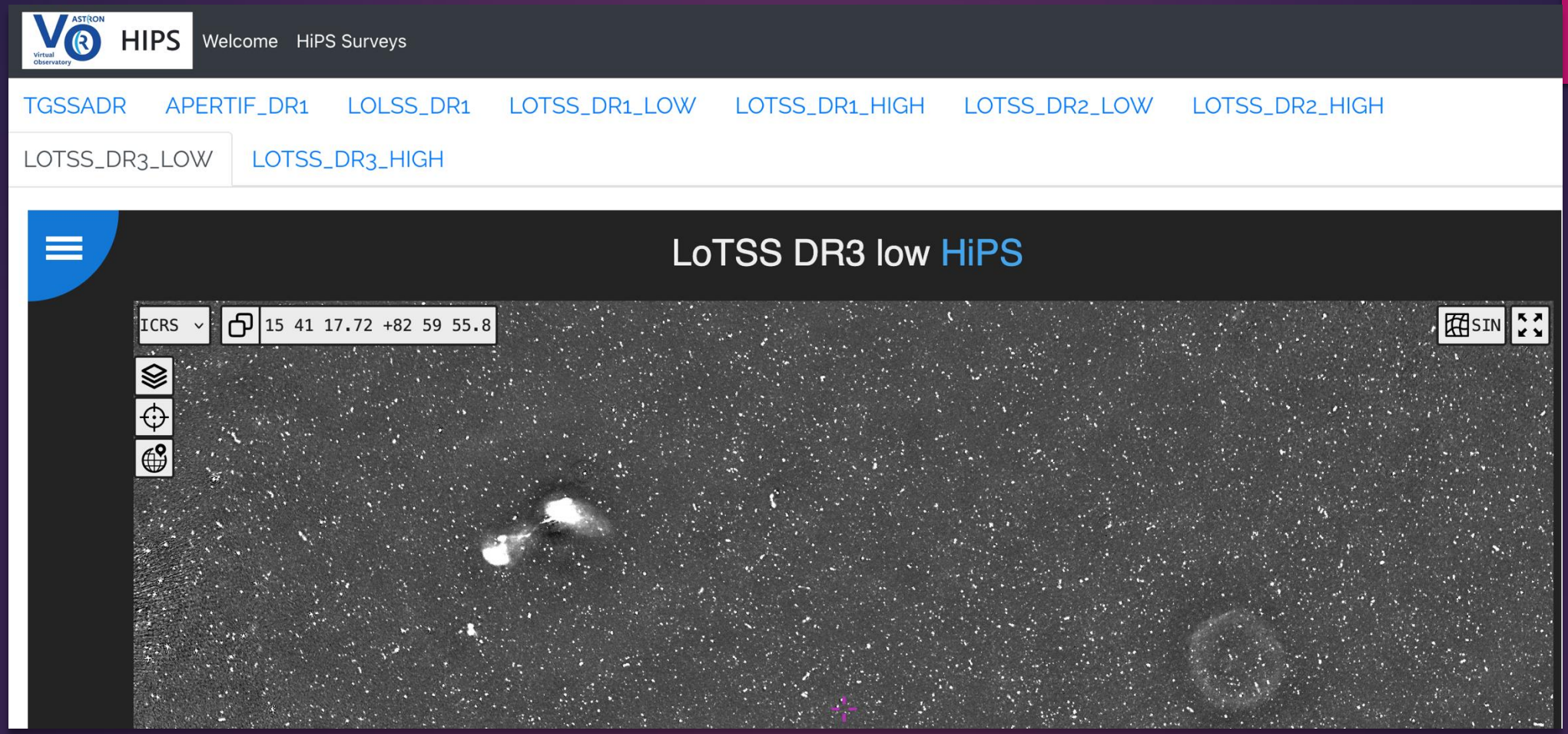
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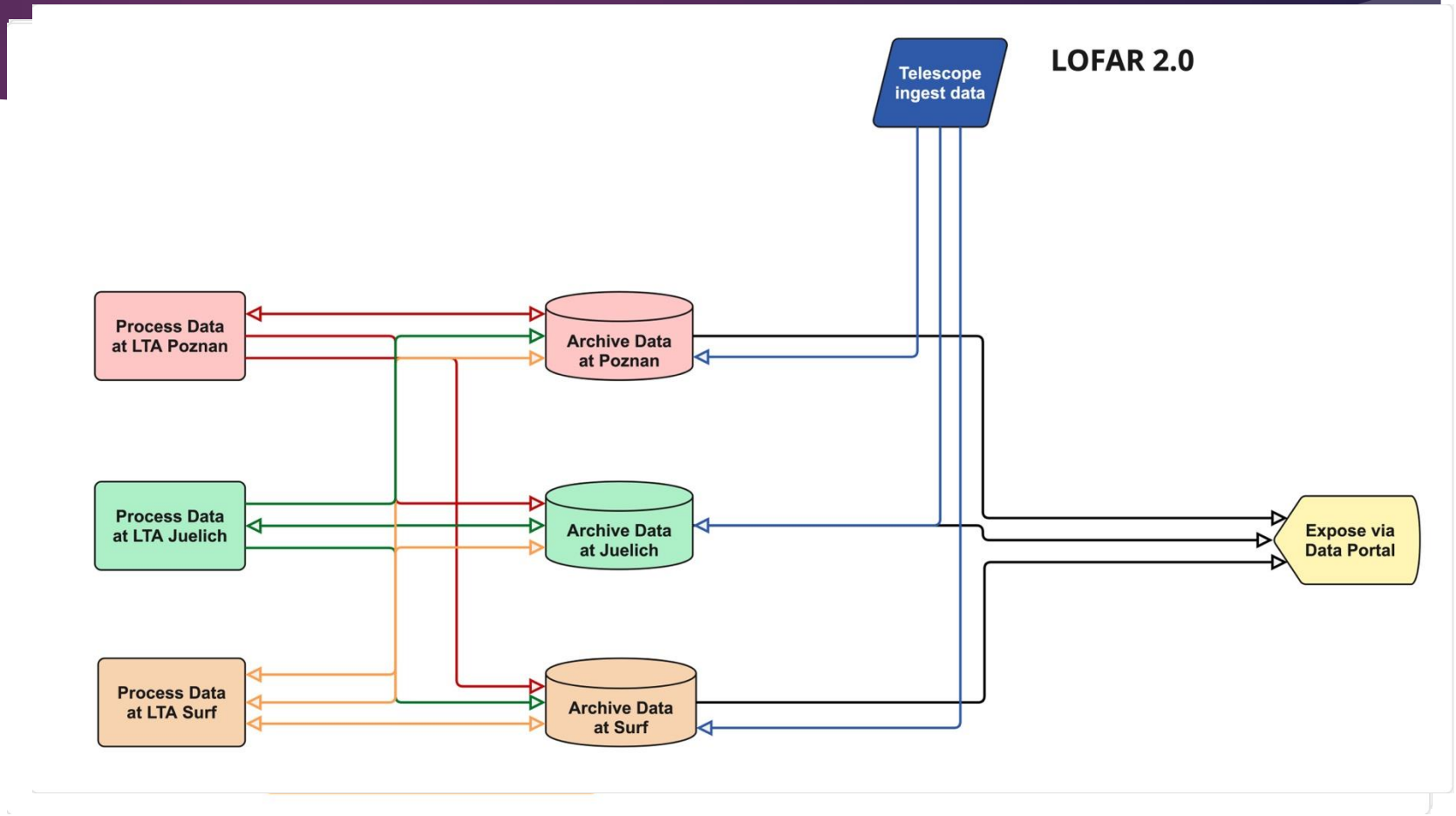
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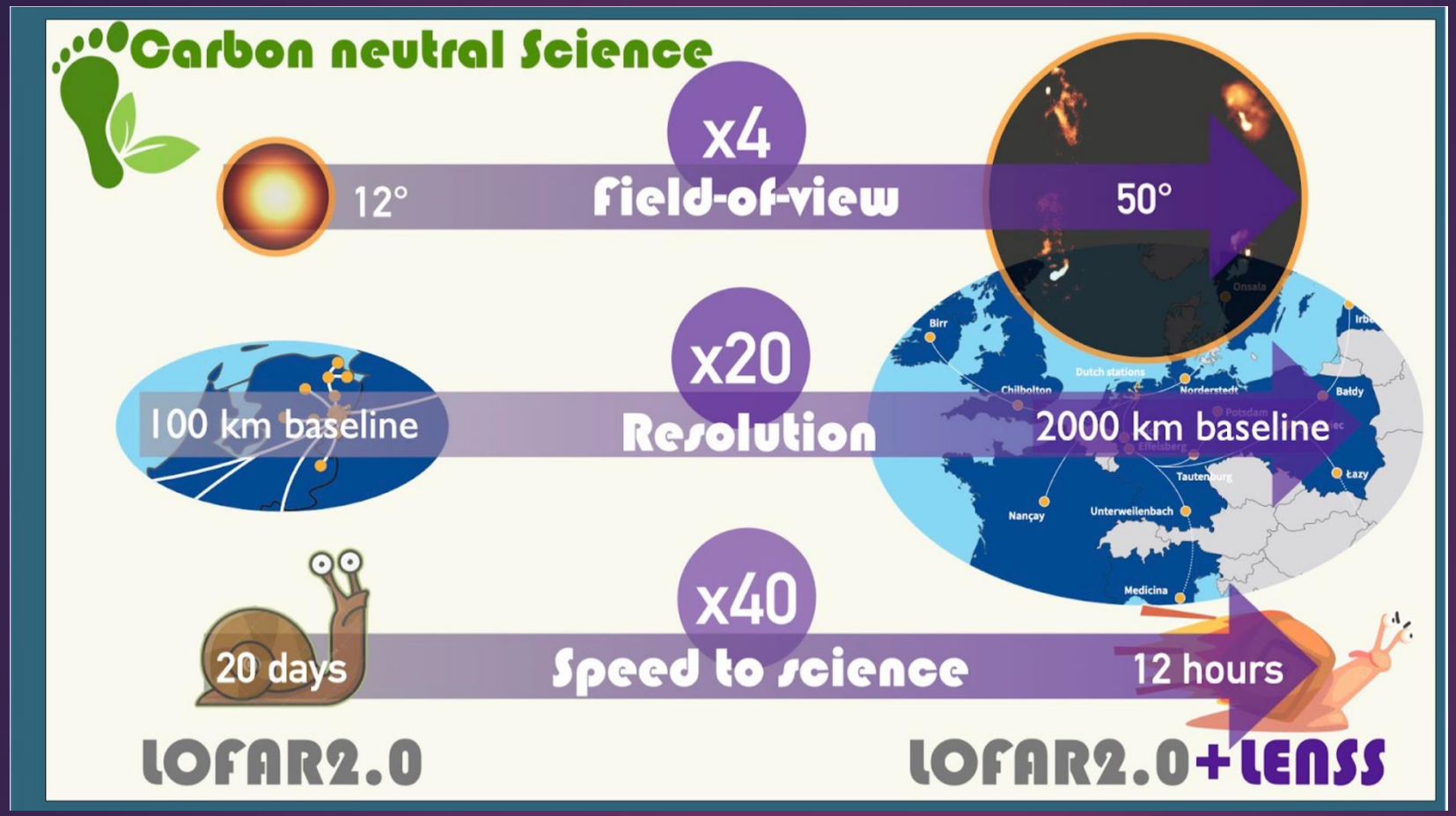


https://hips.astron.nl/hips

LOFAR data processing system

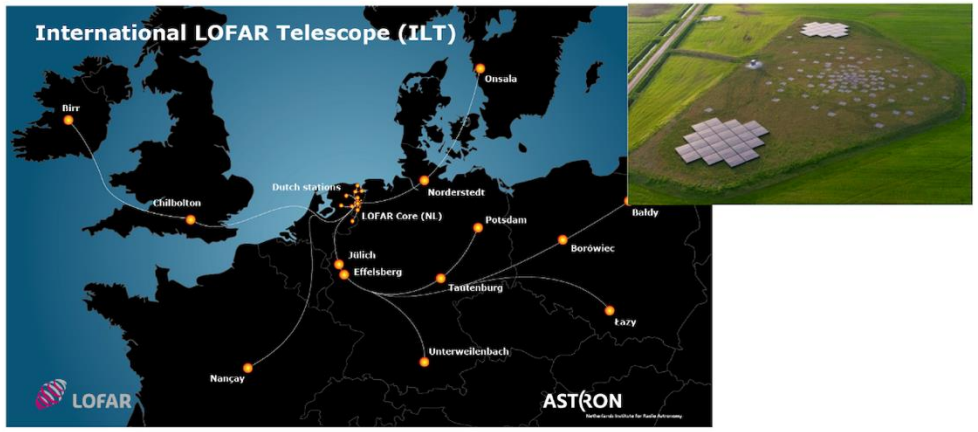
- Processing system from LOFAR1 towards LOFAR2.0.
- Complexity increases needs scalability to be sustainable
- Growth of the breadth of data products types hosted in the LTA





Beyond LOFAR2.0: LENSS

LOFAR2.0 in the SKA era





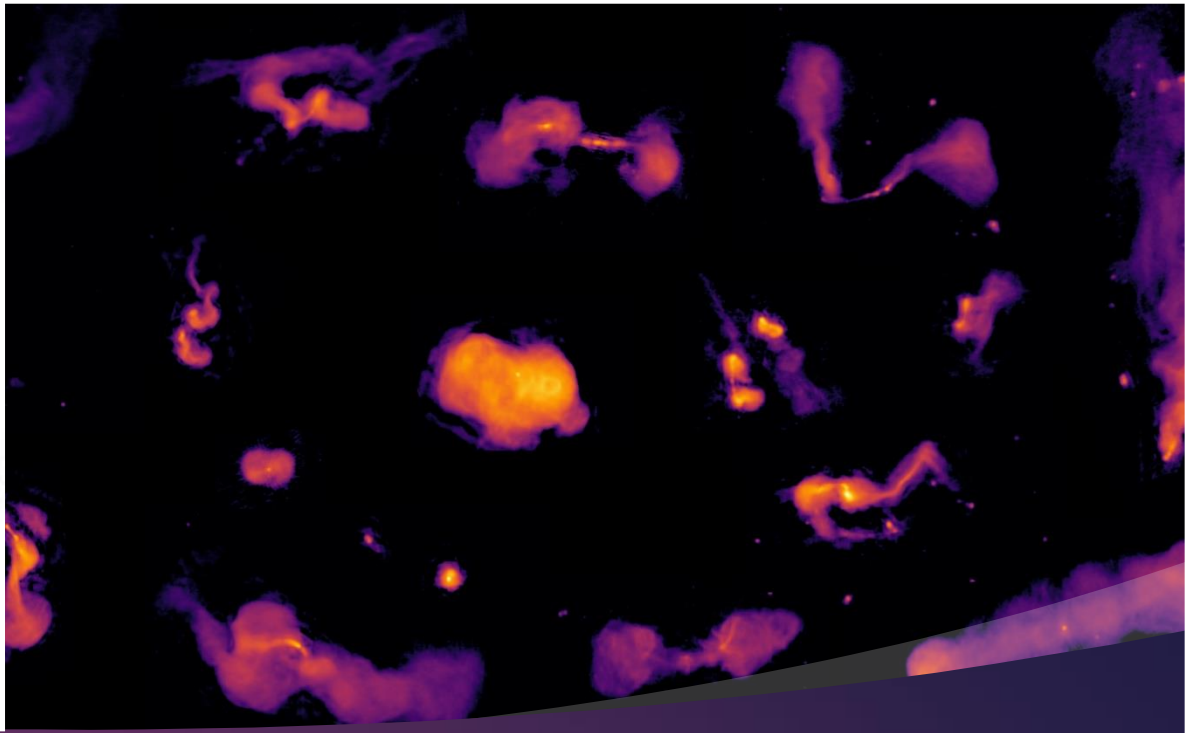
LOFAR2.0

- Reaches 2X lower frequency
- >10X higher resolution

SKA-low Phase 1

- Reaches 2X higher frequency
- >10X higher collective area





What's in your hands?

- Learned about LOFAR in the e-learning
- Learned about calibration at low frequencies
- Made images of radio galaxies and Sun, detected PSRs and transients
- Made sub-arcseconds images
- Using LOFAR2.0 data.