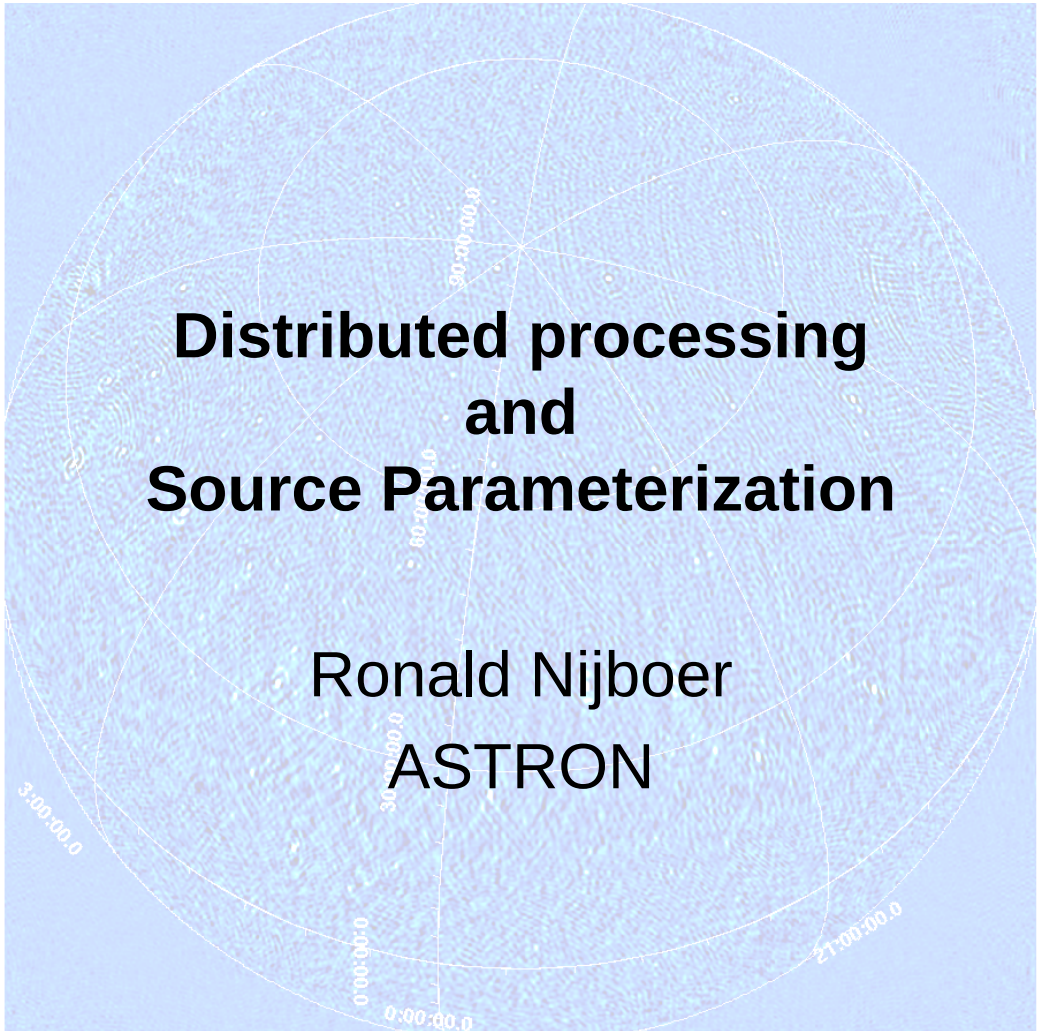


Distributed processing and Source Parameterization

Ronald Nijboer
ASTRON

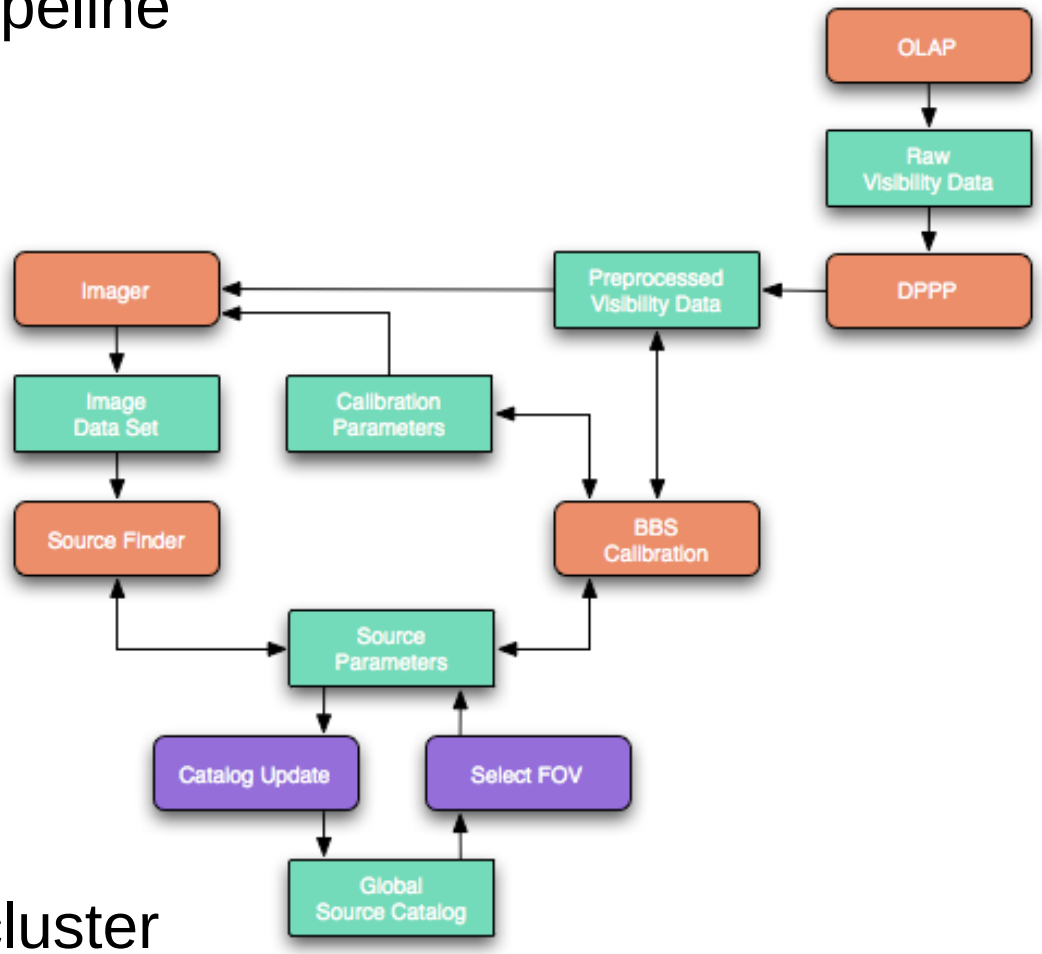
ASTRON is part of the Netherlands Organisation for Scientific Research (NWO)

ASTRON in ALBiUS

- ASTRON's aim is to extend the LOFAR distributed data processing pipelines and / or to make those suitable for APERTIF
- ASTRON's effort for ALBiUS is embedded in the larger LOFAR / APERTIF software development effort
- Within ALBiUS ASTRON focuses on
  - Distributed processing
  - Automated data quality control
  - Source parameterization

LOFAR Imaging pipelines

- Standard Imaging Pipeline
- Precursor for
  - Surveys pipeline
  - EoR pipeline
  - Transients pipeline
  - Magnetism pipeline
  - Solar pipeline



- Runs on dedicated cluster

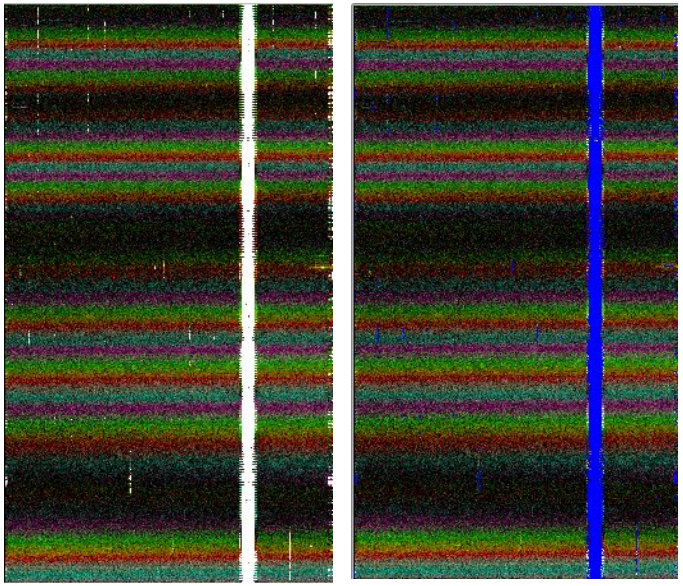
MSSS Processing steps

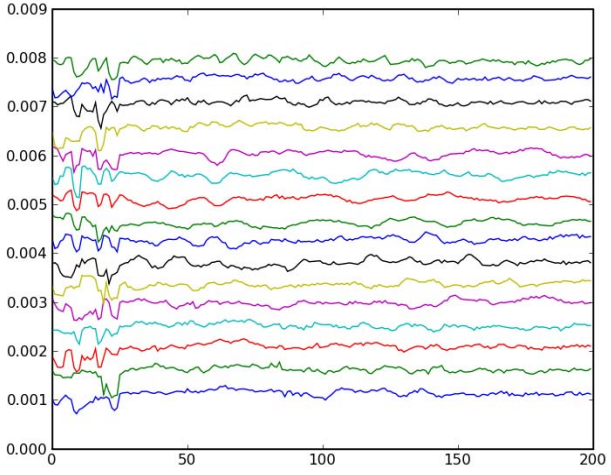
- Pre-processing of the data
  - Flagging of RFI, …
  - Correction for global bandpass
  - Correction for clock drifts
  - Solving for and subtraction of the A-Team
  - Compression of data
- Uv-plane calibration
  - Phases
  - Gains
- Direction dependent calibration
  - Total Intensity calibration (using Cat I sources)
    - Ionospheric phase: SPAM based
    - Beams
- Cat II subtraction
- Imaging in facets
  - Correction per facet
- Image combining
- Source finding
  - Sky model update

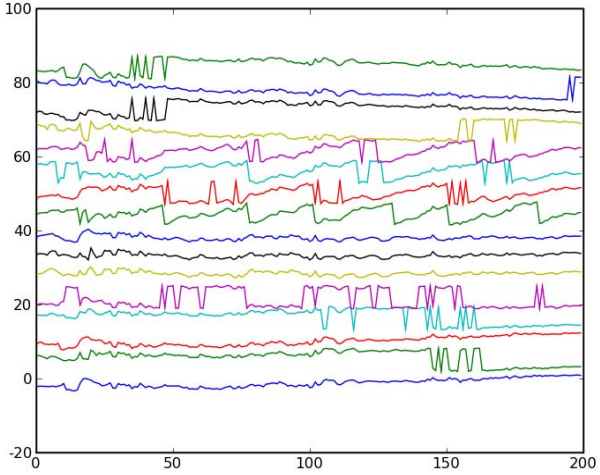
Data Products

- Uv-data sets
- Image cubes
- RM cubes
- LSM / GSM
- Meta data
  - Calibration solutions

Uv-data: before and after Flagging

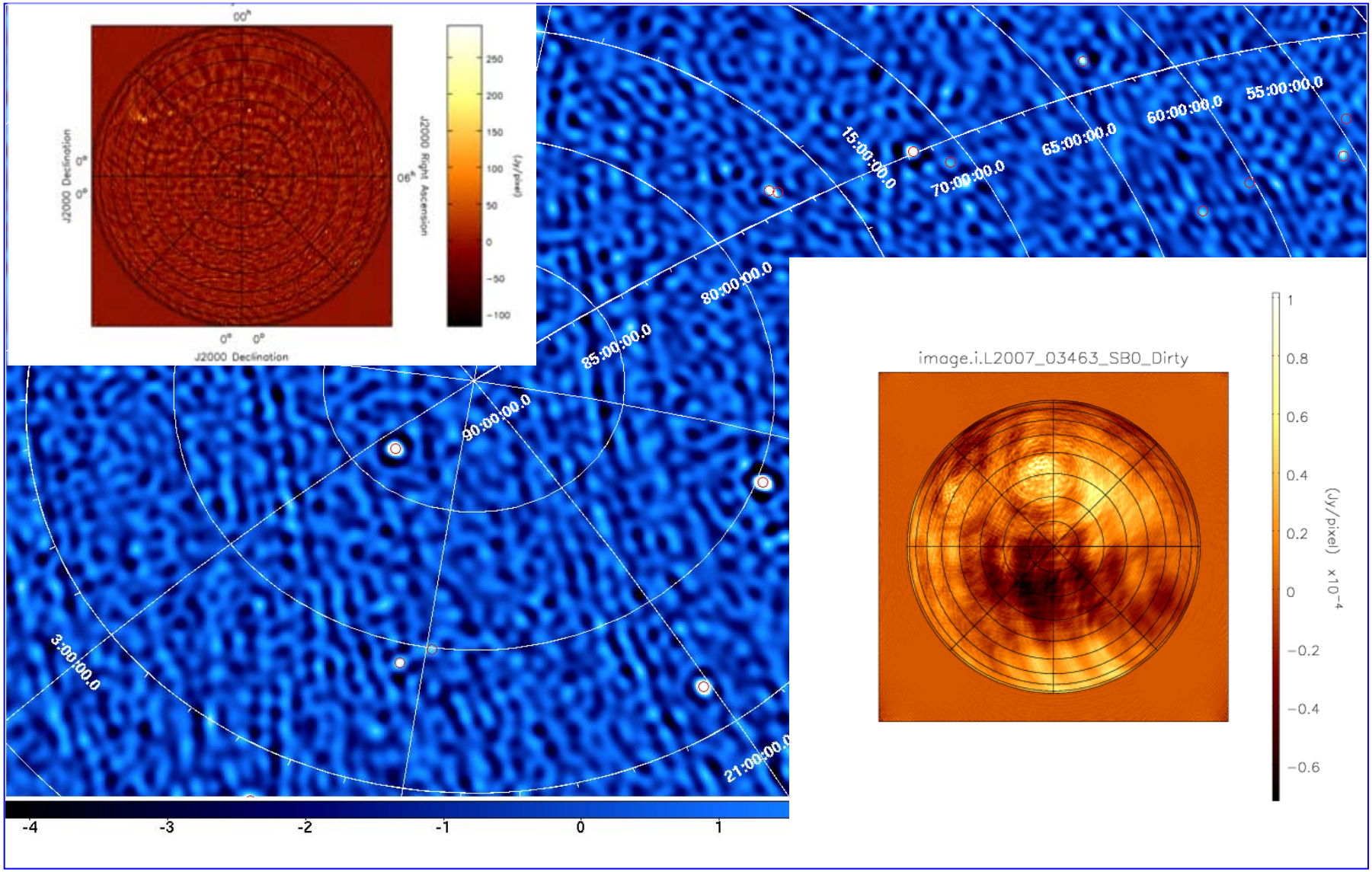




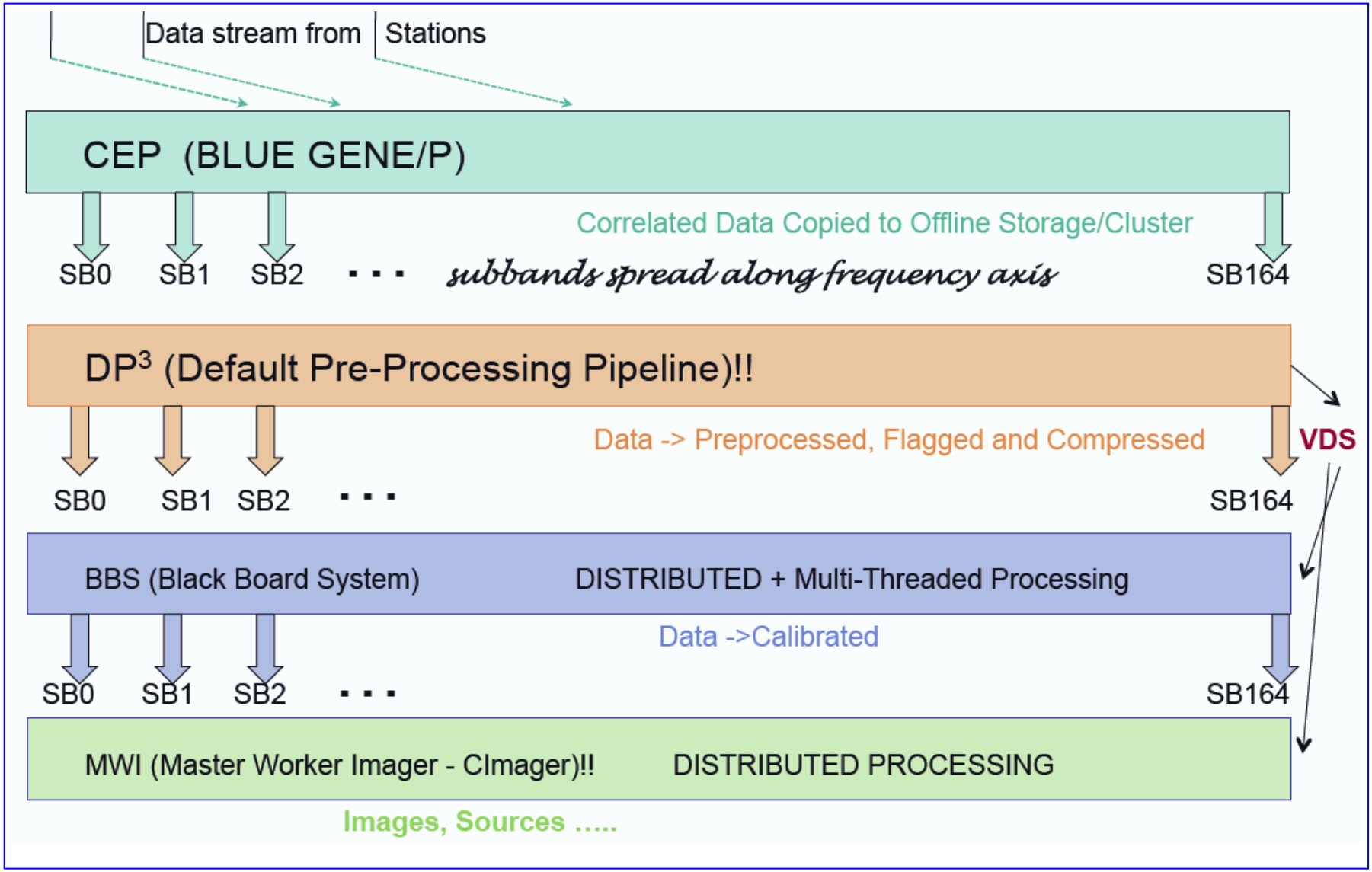


Gain and phase solutions from BBS

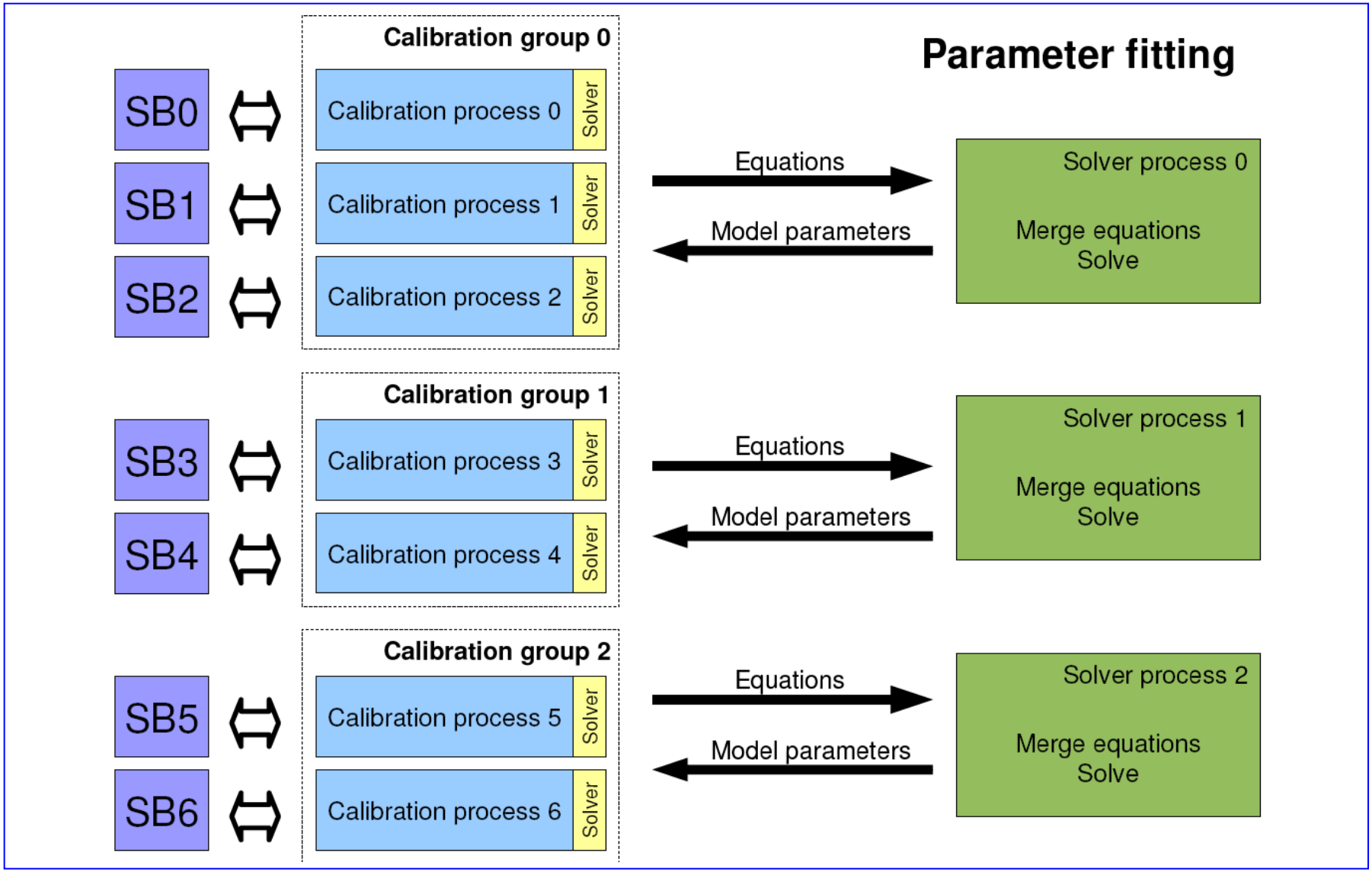
Images & cubes



LOFAR distributed processing



BBS distribution & Global Solver



Distributed processing

- Processing Framework is in place
  - Based on C++, build on top of CasaCore,
- Data formats
  - CASA MS (v3.0), CASA tables (i.e. Images), HDF5
    - With options to export to FITS
  - PostgreSQL, MySQL databases
  - LOFAR Data Access Library (DAL)
  - Python interface through PyDAL, PyRap
- Algorithms need to be deployed and / or further developed …
  - Ionospheric calibration
  - Beam calibration
  - Real time calibration
- … or extended for APERTIF …
- … and other partner contributions will be useful
  - Tropospheric calibration
  - Global fringe fitting for E-LOFAR

Distributed Processing @ Oxford

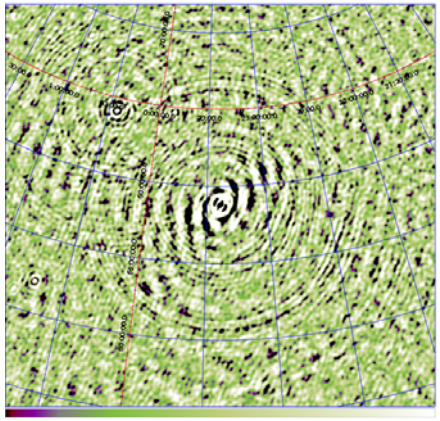
- Distribution of data subsets
- Exploring distributed data analysis
- Loads of GMRT data in FITS (or GMRT internal format)?
- Grid computing at Oxford e-Research Center?

Automated Data Quality Control

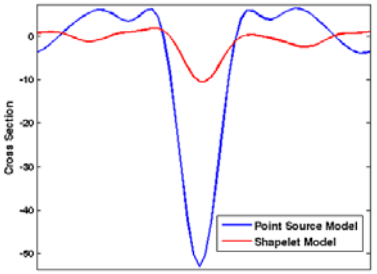
- Automatic processing pipelines need automatic data quality control
  - For decision making
  - For final acceptance of the data products
- Examples:
  - DPPP flagger statistics
  - BBS solution based flagging statistics
  - Image quality after Major Cycle iteration
  - LSM acceptance test before GSM update

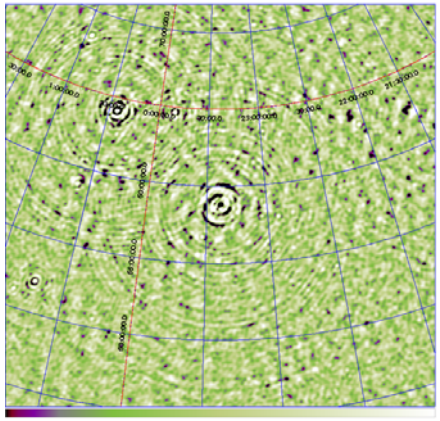
Source Parameterization

- High dynamic range needs accurate description of extended sources
- Automatic, (near-) real time processing requires computational efficiency
- Shapelet techniques might be a solution

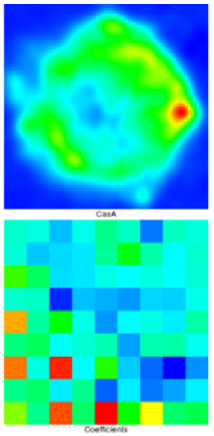


Point Source Model



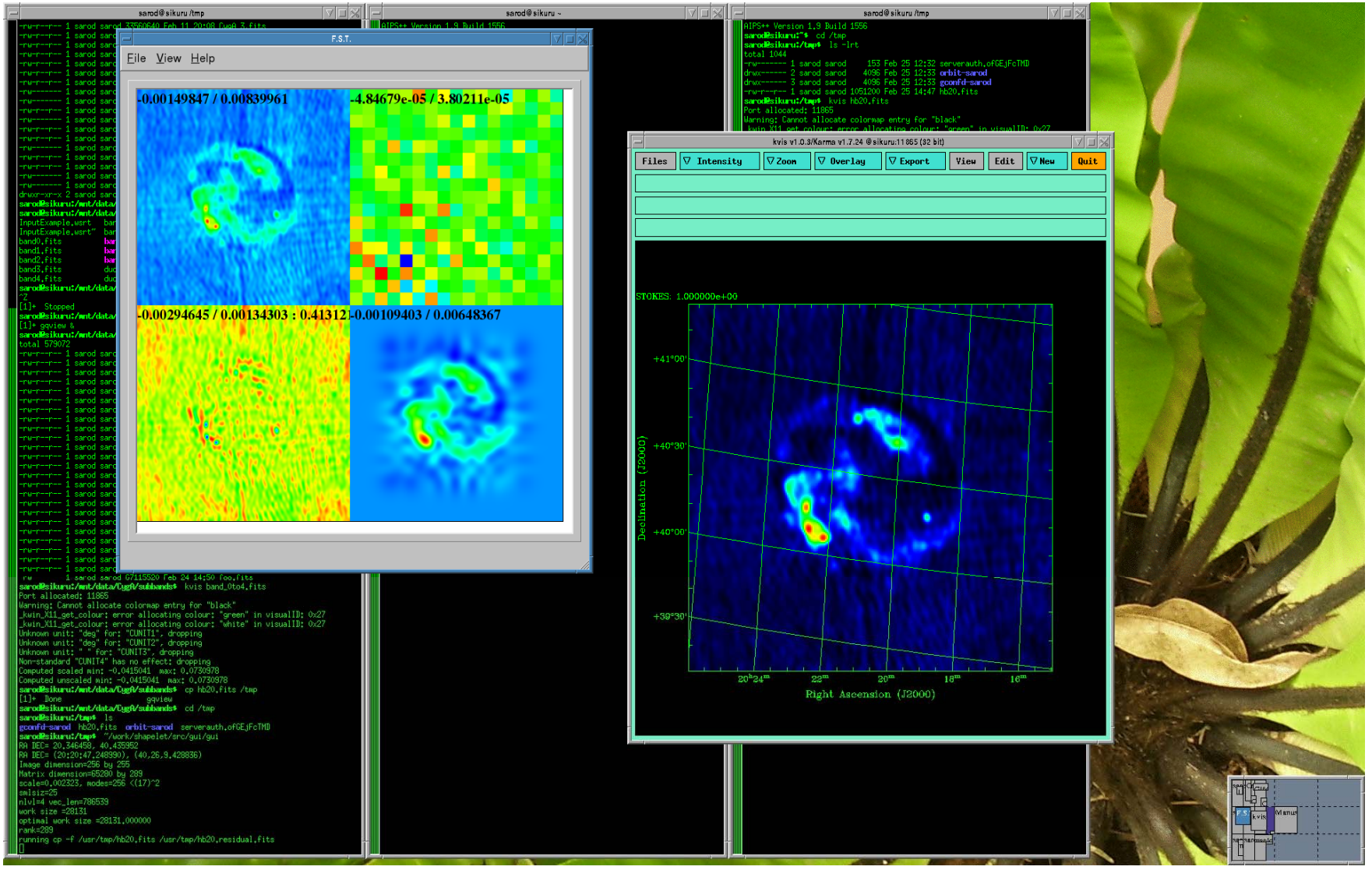


Shapelet Model



Result by Sarod Yatawatta

Shapelets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Files
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Zoom
Overlay
Export
View
Edit
New
Quit
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