BBS
(calibration)

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- Software to calibrate (LOFAR) visibility data
  - Direction dependent effects (DDE)
  - Data volume

Input and output

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- Inputs
  - Reduction strategy (configuration file)
  - Observed visibility data
  - Source catalog
  - Initial values for the model parameters
- Outputs
  - Calibrated visibility data
  - Updated model parameters
  - Processing logs

Processing

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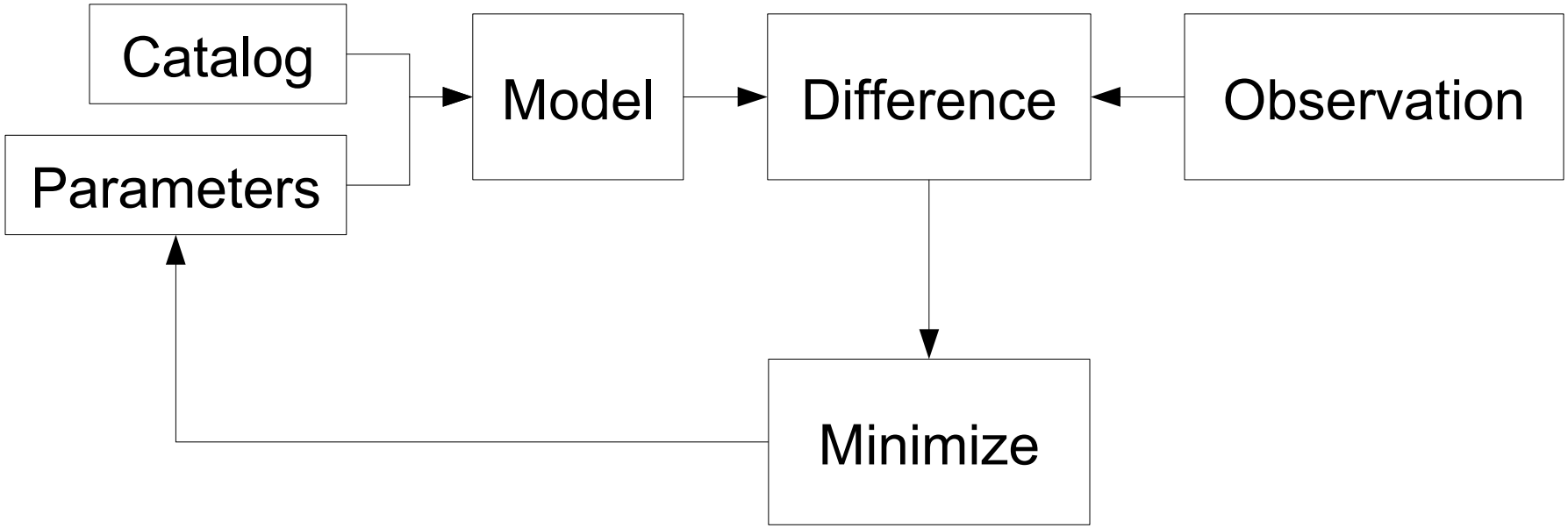
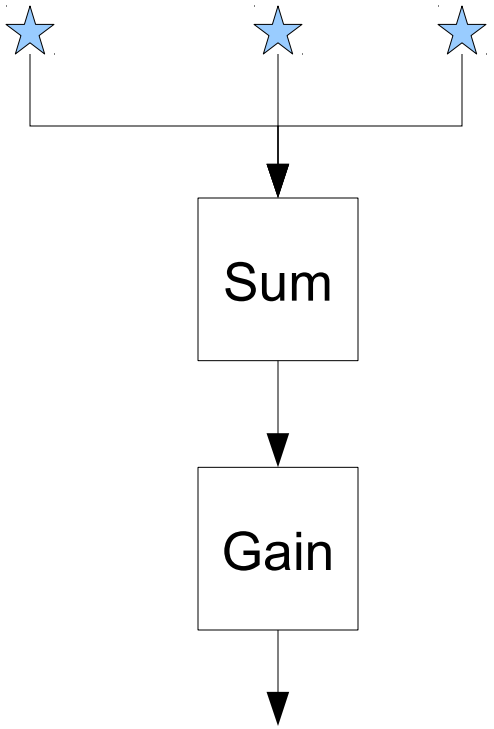
- Full resolution data volume is huge!
  - 50 stations, 8 hours, 1 s resolution, 248 subbands, 256 channels per subband ~ 65 Tb
- Process data in chunks
- Execute reduction strategy on each chunk
- Supported operations:
  - Simulation
  - Subtraction, Addition
  - Correction
  - Parameter estimation

Inverse problem



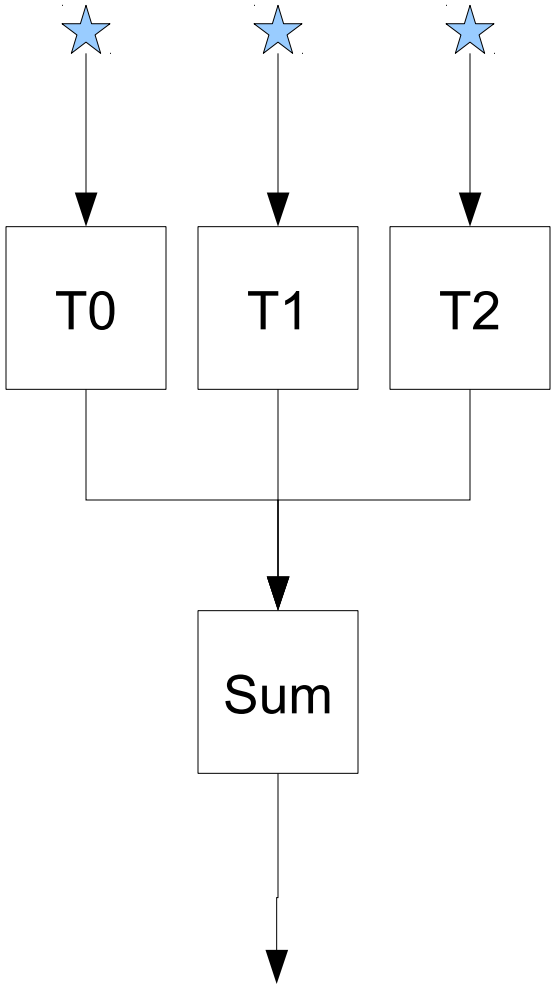
Model

- Source catalog
- Predefined effects:
  - Electronic gain
  - Directional “gain”
  - Station beam
  - Ionosphere



Directional “gain”

- Introduce a separate transformation for each direction of interest
- Number of directions is limited
- Not obvious how to interpolate to other directions



Ionosphere (EXPION)

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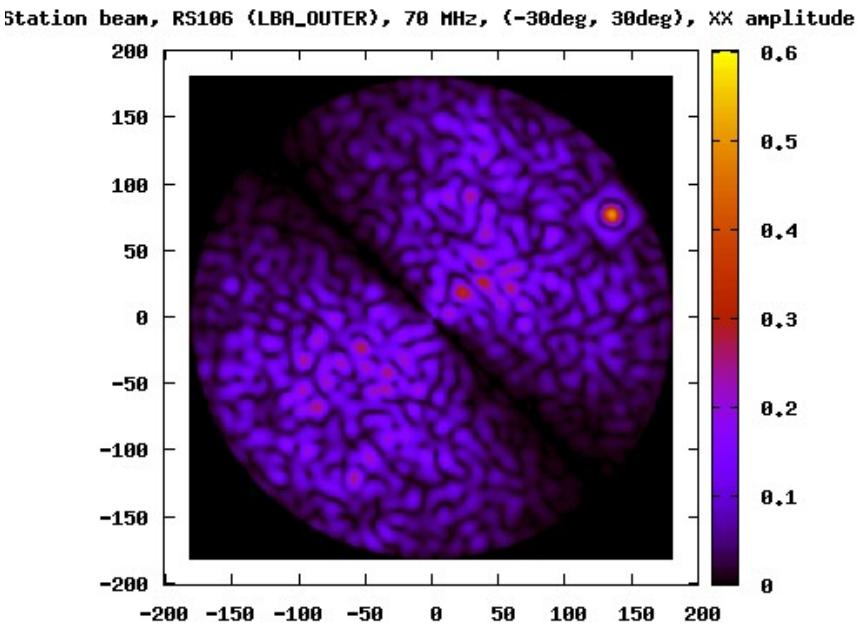
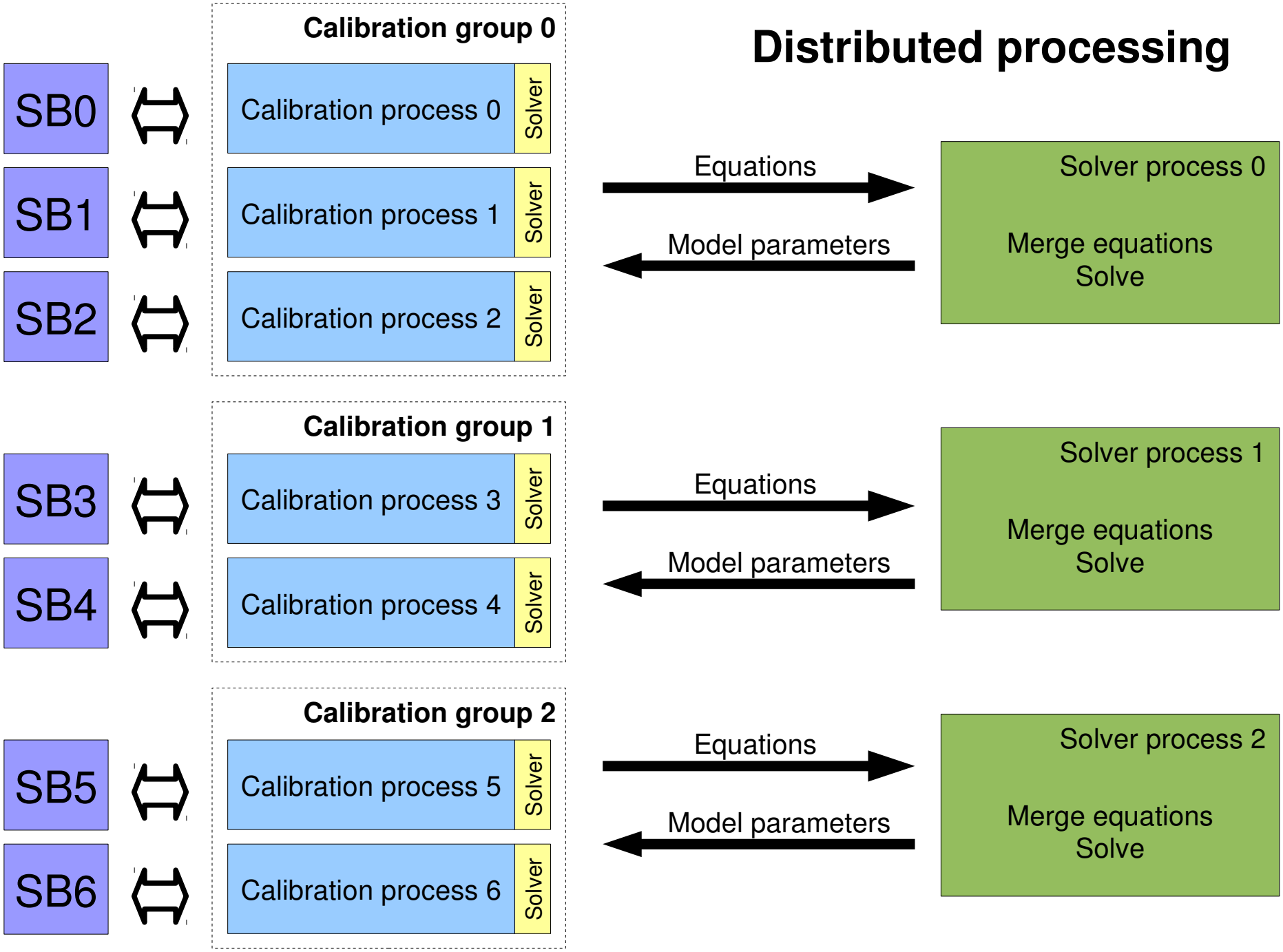
- Model of the total electron content along the line of sight
- Based on ionospheric physics
- Estimated from directional gains

Station beam model

- Models the combined effect of:
  - The geometric delay for the direction of interest
  - Beamforming at the tile (HBA)
  - Beamforming at the station
- Assumptions:
  - All elements are identical
  - No mutual coupling
  - No shadowing



Distributed processing



Future work

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- Learn how to (better) calibrate LOFAR data in practice
- Algorithms
  - Robust estimation
  - Estimating Faraday rotation
- Implementation
  - Performance
  - Distributed processing
  - Visualization of estimation statistics
- Models
  - Source models
- … (many more) ...

Questions

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Questions?