



Scintillation

Stefan J. Wijnholds
e-mail: wijnholds@astron.nl

CS1 meeting
Dwingeloo, 5 March 2008



LBA monitoring



Measurements:

- 18 January 2008: preparation of LBA monitoring
- 18-21 January 2008: LBA monitoring

Goal: validate station calibration

Problem: large gain variations

Reason: mismatch between model and data

Suspects: element beam pattern, scintillation

Action: scintillation measurement



Scintillation measurement



Description

- Started 15:31:38 UTC on 14 February 2008
- Subbands: 160, 192, 224, ..., 416
- Rotating 19 x 5 min with 1 s integration
- RCU mode 3, clock at 200 MHz

Data reduction for 50 MHz (sb 256)

Appetizer

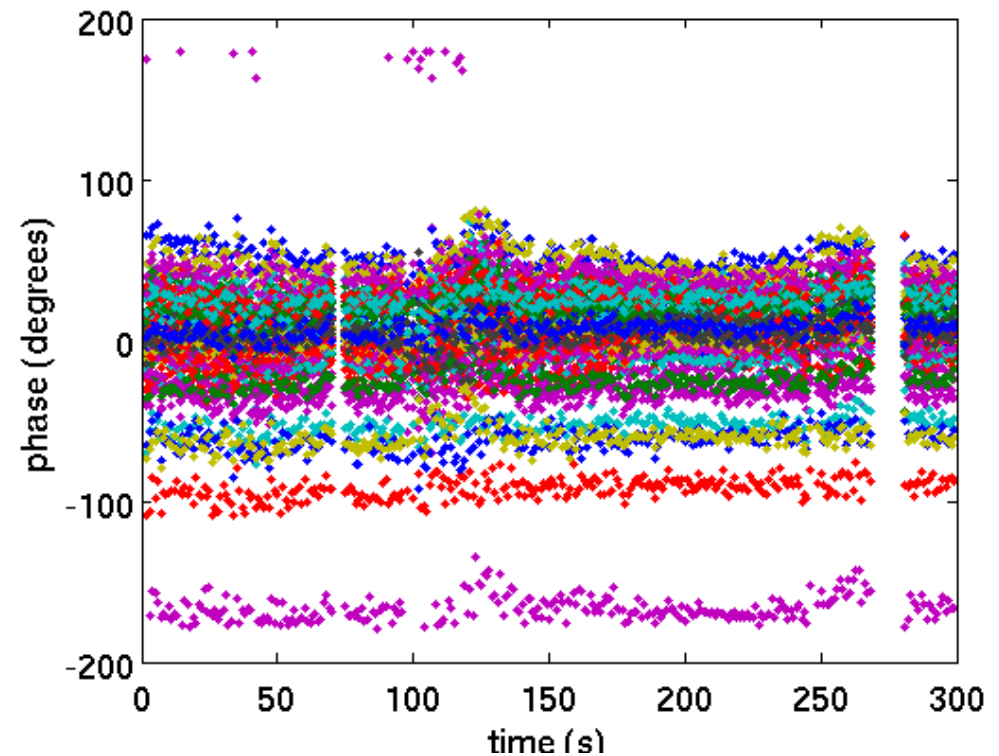
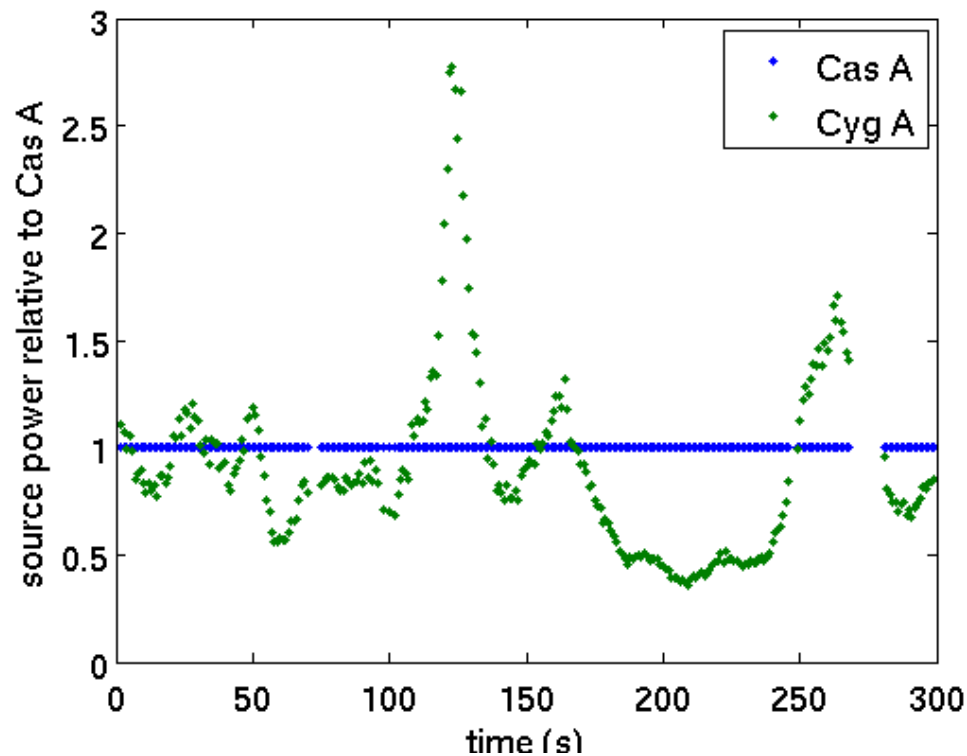
- Snapshot 15 (started 2:18:47 UTC on 15 Feb.)



Calibration results (1): snapshot 15



Source powers (left) and gain phases (right)



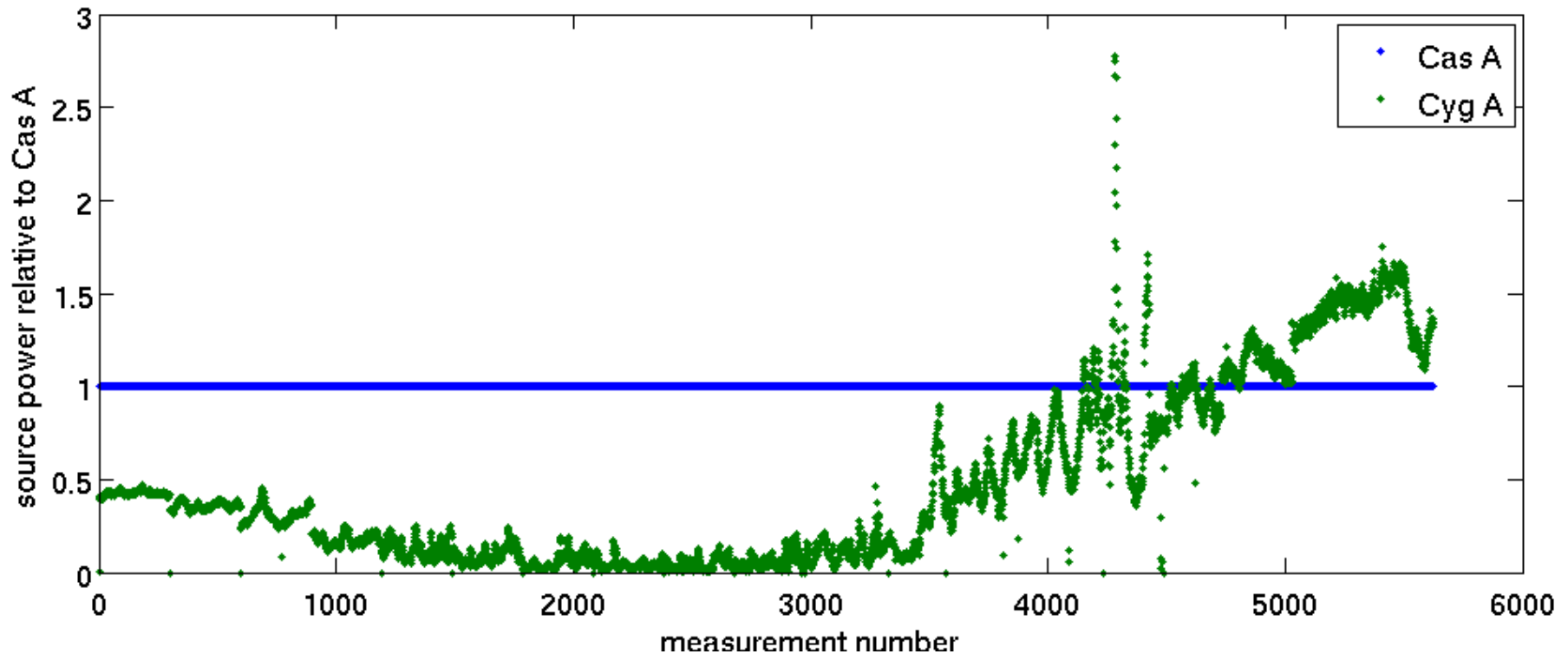
Source power estimate stabilized gain solution



Calibration results (2): source powers



Source power estimates over 19 observations

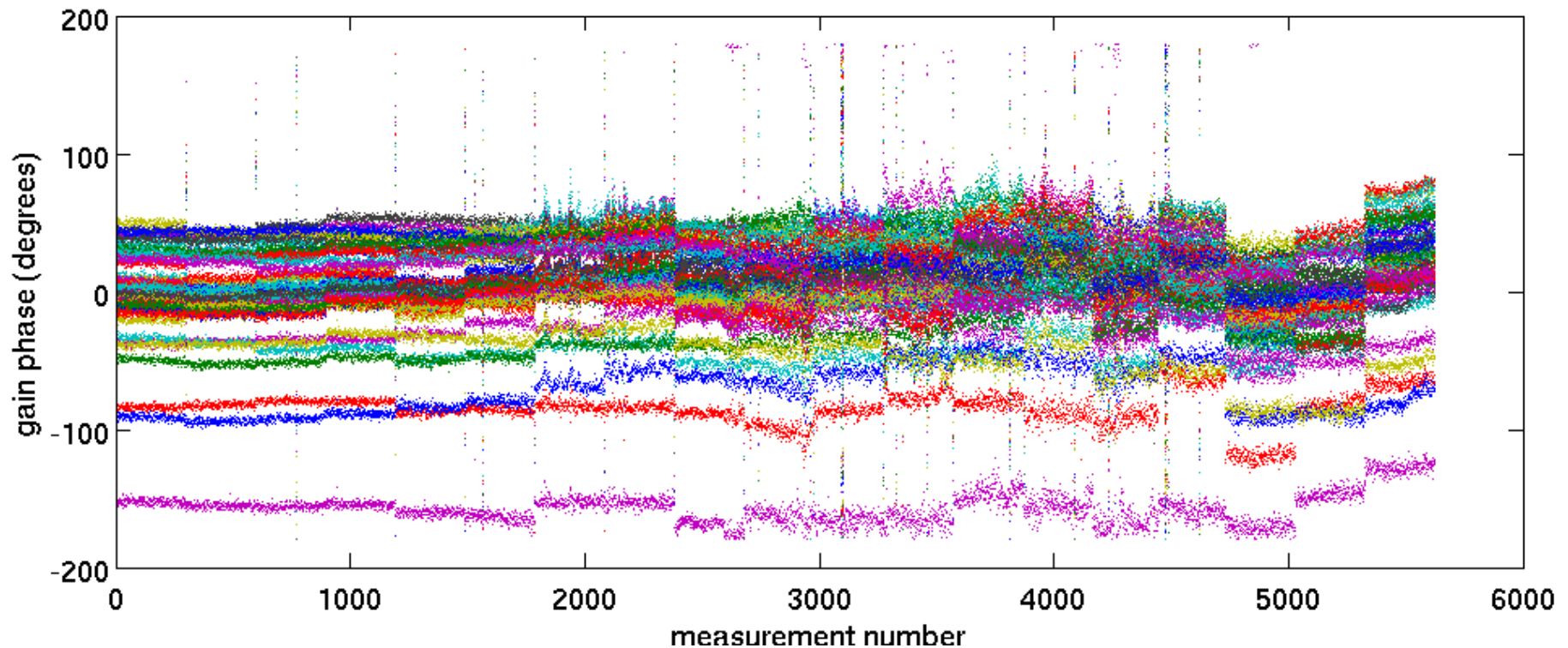


scintillation in periods, element beam pattern

Calibration results (3): gain phases



Gain phase solution over 19 observations



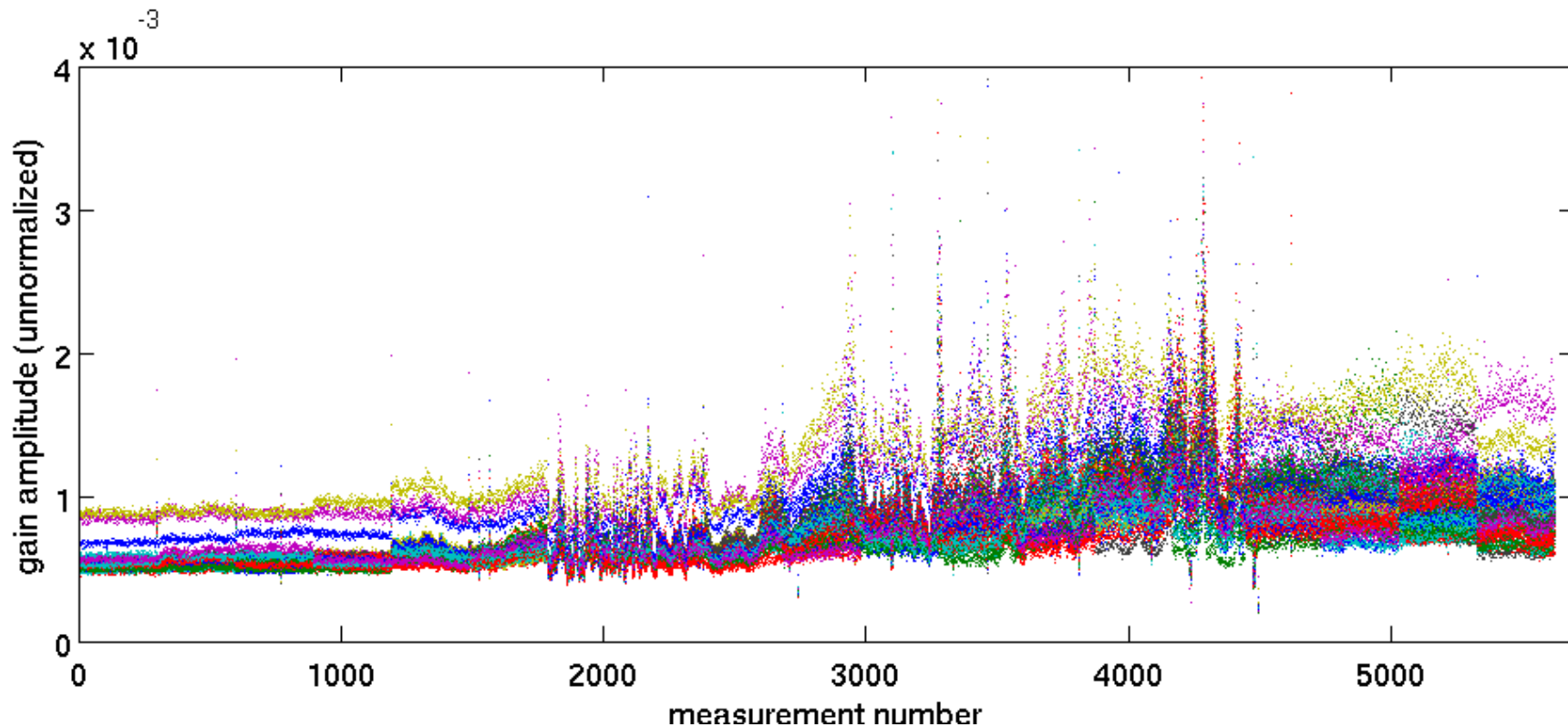
Slow variations, but probably not all instrumental



Calibration results (4): gain amplitudes



Gain amplitude solution over 19 observations



Rapid variations in scintillation periods





Normalization of gain amplitudes

- digital beam former, limited number of bits
- normalize median to 1, reject over factor 3 diff
- no physical units to CEP

Normalization of gain phases

- one reference element or reference point?
- what if reference element is broken?



WALS method with analytic solutions

- omnidirectional complex gains
- source powers
- additive term on short baselines

This took 1 min per 1 s observation

With “dirty” but clever shortcut: 0.4 s per subband

Levenberg-Maquart solver drowned!





Understanding the variations

- Ionospheric scintillation
- Element beam pattern
- Other sources?

24 hour measurement with station correlator

- single subband
- 1 s integration