

Overview and status of station calibration

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Imaging Busy Week
Dwingeloo, 17 January 2011

Idea: use cal. table derived from cal. observations

Calibration procedure

- LBA: 24-h all-sky measurement
- HBA: 6-h tracking of strong source (Cas A)
- determine calibration table
 - constant amplitude, linear phase over frequency

During observations

- run CalServer for SHM (metadata TBD!)
- use calibration table in BeamServer

Model based calibration

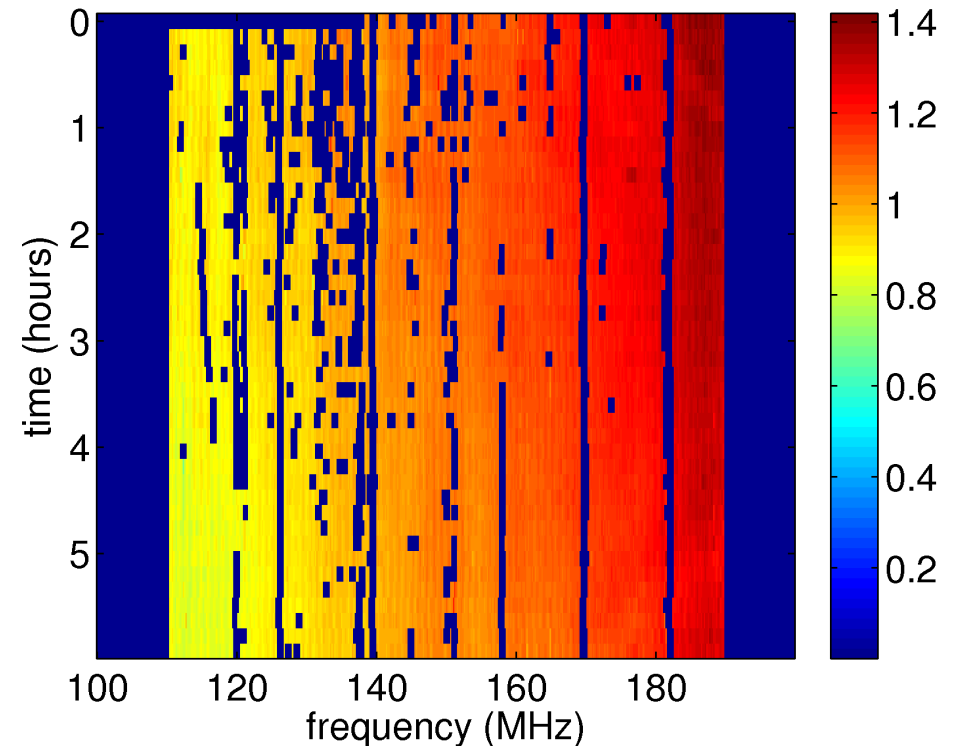
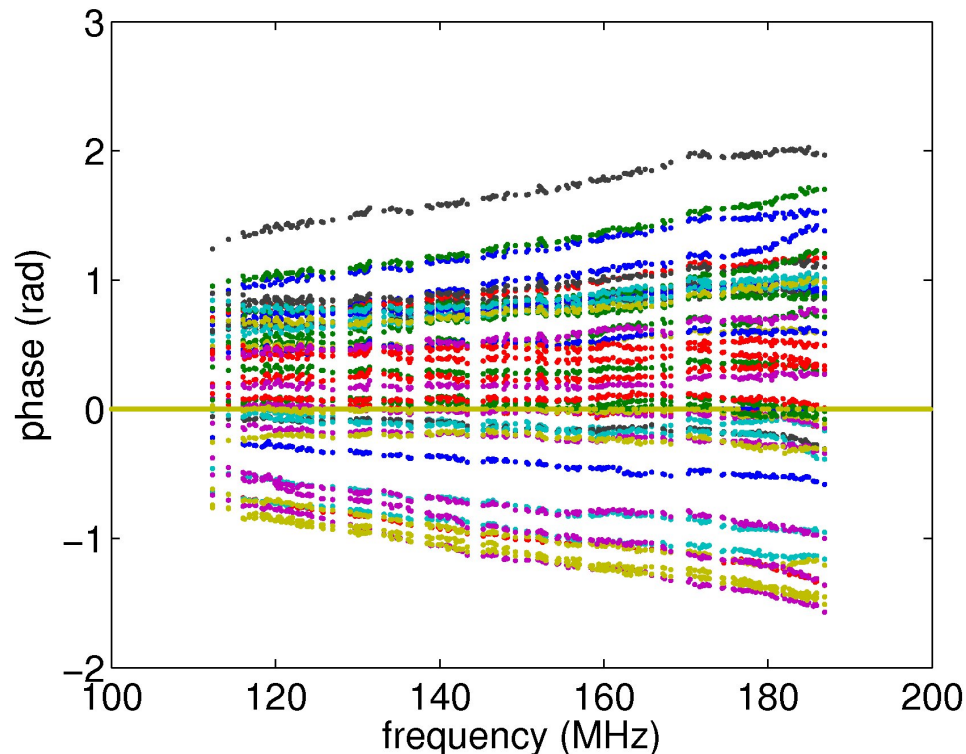
S.J. Wijnholds & A.J. van der Veen, IEEE TrSP, Sep. 2009

S.J. Wijnholds & A.J. van der Veen, EuSiPCo, 2009

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left: tile based gain solutions, single point source model

right: phase of single tile over time and frequency

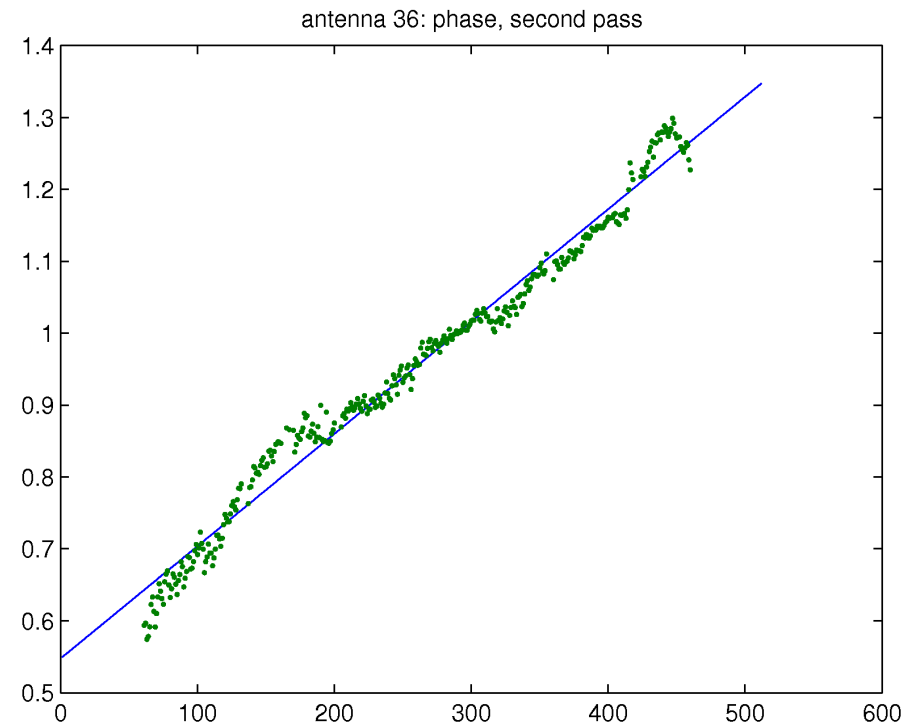
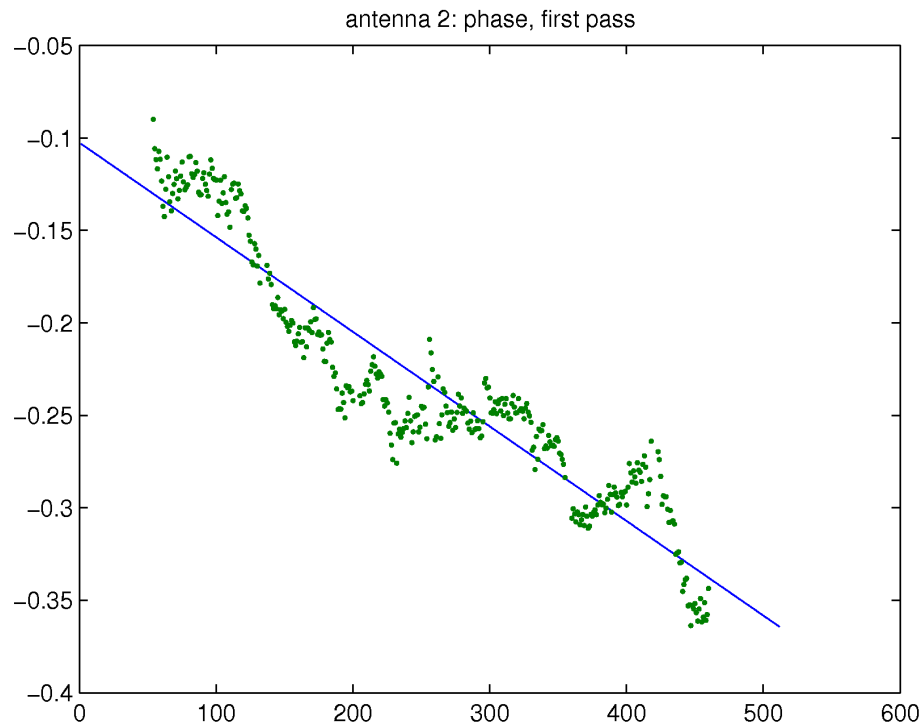


Phase model accuracy

Below: examples of linear phase fits

Max. systematic deviations ~ 0.05 rad (~ 3 degrees)

Not fitted yet to avoid over-interpretation of the data



- Decorrelation: $1 - \cos(\Delta\varphi_{\text{RMS}}) = 0.03 \%$ ($\Delta\varphi_{\text{RMS}} = 1.5^\circ$)
- Phase error main beam: $1.5^\circ / N^{1/2} = 0.2^\circ$
- Amplitude error main beam 1% / $N^{1/2} = 0.14 \%$

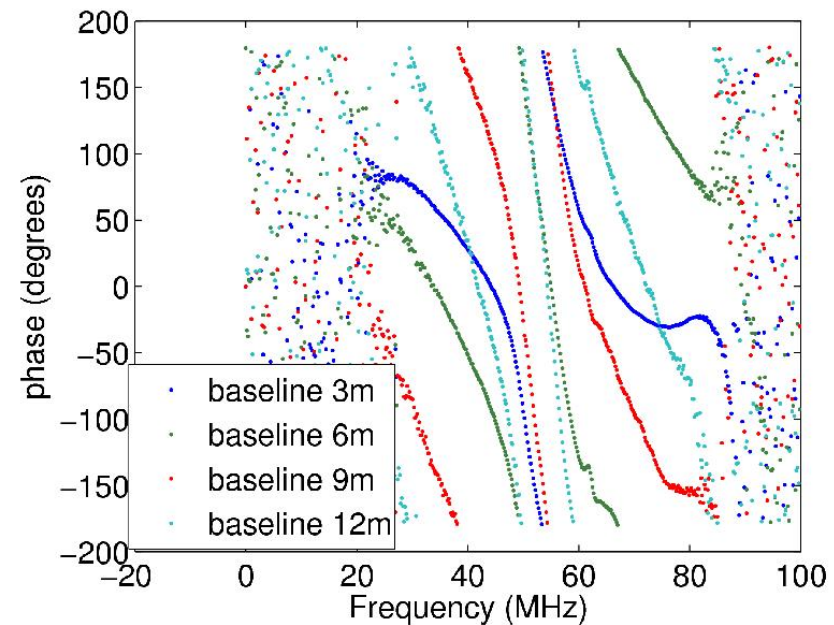
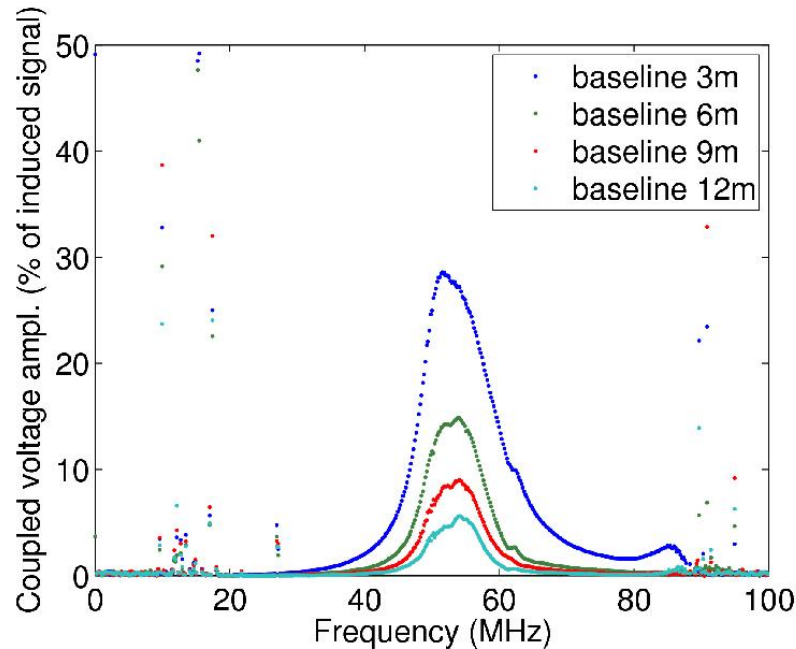
Comparison with other effects

- correlation offset between substations: $\sim 0.1 \%$
- mutual coupling in substation:
 - 10% RMS on 84 edge elements: $\sim 0.1 \%$
- **Cal. table accuracy in line with other effects**

Understanding mutual coupling

S.J. Wijnholds, AJDI, 1 September 2009

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Crosstalk between substations

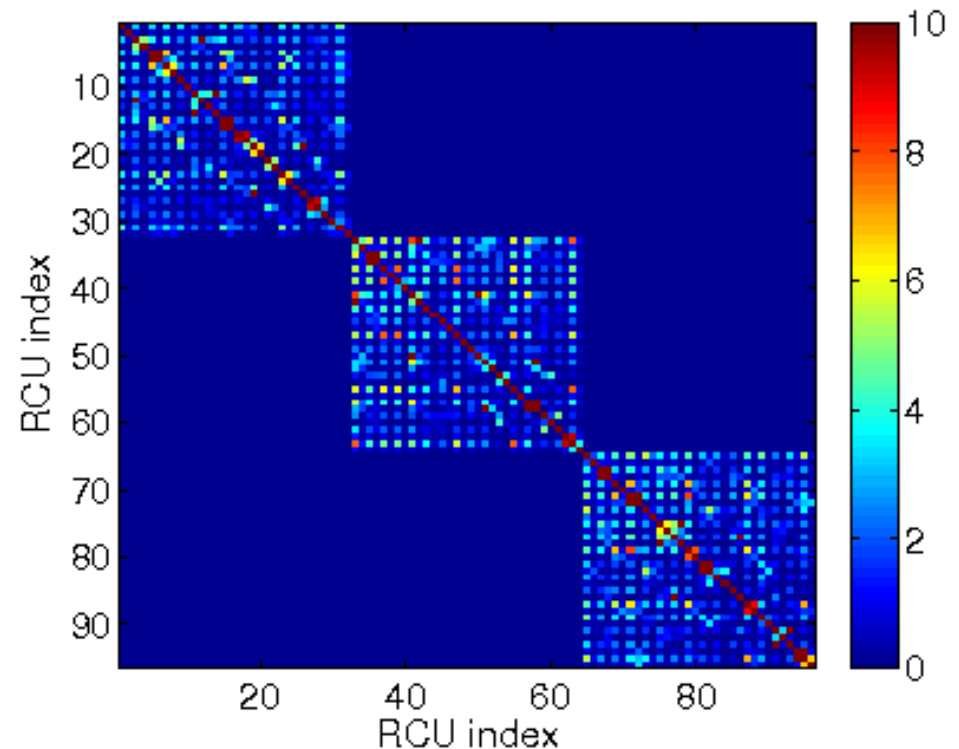
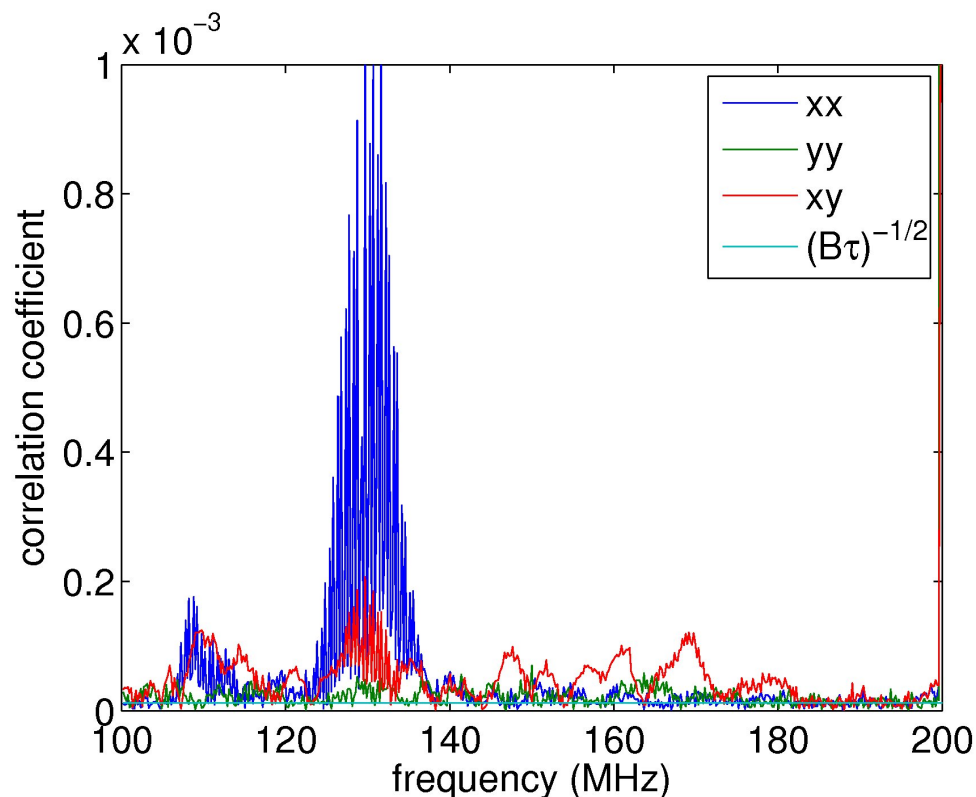
S.J. Wijnholds, LSM, 8 Jul. 2009

S.J. Wijnholds, LOFAR-ASTRON-RPT-253, 6 Sep. 2010

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Substations share one subrack

Crosstalk in subrack gives crosstalk between substations



Status of station calibration

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- Strategy for all modes
- Steady progress
- Now in “good” season
- Minor station based issues
- Most tables ready



DE601 (Effelsberg)
 DE602 (Garching)
 DE603 (Tautenburg)
 FR606 (Nancay)
 UK608 (Chilbolton)



- 0.1% station beam accuracy possible
- Open questions
 - stability
 - nominal beam shape
- Next steps:
 - impact substation crosstalk on imaging/EoR obs.
 - holographic beam measurements
 - analysis of mutual coupling data
 - repeated observations on given field (LEA 128)