



ILT-TO face to face meeting

7 april 2016, Zandvoort

| | | | |
|----|--|-------|--------|
| 1. | Introduction | 9:30 | 10 min |
| 2. | General and NL maintenance | 9:40 | 46 min |
| | 2.7 Site visit program (Marco Drost) | | 01 min |
| | 2.8 RFI (<i>Menno Norden</i>) | | 15 min |
| | 2.9 LBA/HBA front-end, cabinet maintenance (Henri Meulman) | | 15 min |
| | 2.10 LCU replacement (Arno Schoenmakers) | | 5 min |
| | 2.11 Software releases (Arno Schoenmakers) | | 5 min |
| | 2.12 CEP 4 (Jasper Annas) | | 5 min |
| 3. | Coffee break | 10:30 | 30 min |
| 4. | Station report presentations | 11:00 | 75 min |
| | 4.7 DE601 Effelsberg (Andreas Horneffer) | | 5 min |
| | 4.8 DE602 Unterweilenbach/Garching (Ado Arnolds) | | 5 min |
| | 4.9 DE603 Tautenburg (Matthias Hoeft) | | 5 min |
| | 4.10 DE604 Potsdam (Christian Vocks) | | 5 min |
| | 4.11 DE605 Jülich (Eva Jutte) | | 5 min |
| | 4.12 FR606 Nançay (Jean-Mathias Griessmeier) | | 5 min |
| | 4.13 SE607 Onsala (Tobia Carozzi, Henrik Olofsson) | | 5 min |
| | 4.14 UK608 Chilbolton (Derek McKay) | | 5 min |
| | 4.15 DE609 Hamburg/Bielefeld Station (J Kuensemöeller) | | 5 min |
| | 4.16 PL610 Borowiec (Hanna Rothkaehl) | | 10 min |
| | 4.17 PL611 Lazy (Blazej Nikiel-Wroczyński) | | 10 min |
| | 4.18 PL612 Baldy (A Krankowski, L Błaszkiwicz) | | 10 min |
| | 4.19 KAIRA (Derek McKay) | | 5 min |
| 5. | IE613 roll-out (Peter Galalgher, Joe McCauley) | 12:15 | 10 min |
| 6. | ILT-TO action items + future meeting frequency | 12:25 | 10 min |
| 7. | AOB | 12:35 | 10 min |
| 8. | Lunch | 12:45 | 75 min |
| 9. | End of meeting | 14:00 | |

International maintenance program

Overview annual international maintenance visits

| | | 2013 | 2014 | 2015 | 2016 |
|-------|-------------|------|------|------|---------|
| DE601 | Effelsberg | w26r | w37 | | w??r |
| DE602 | Garchin | w17 | w26 | | w26 |
| DE603 | Tautenburg | w23r | w14 | w19 | |
| DE604 | Potsdam | w23 | w14 | | w37 |
| DE605 | Juelich | w17r | w26 | | w26 |
| FR606 | Nancay | w15 | w22r | | w19 |
| SE607 | Onsala | w37r | w25r | w17 | |
| UK608 | Chilbolton | w36 | w19r | | w23 |
| DE609 | Norderstedt | | w48c | w19 | w37 |
| PL610 | Borowiec | | | w41c | *w39/40 |
| PL611 | Lazy | | | w42c | *w39/40 |
| PL612 | Baldy | | | w34c | *w39/40 |
| IE613 | | | | | w??c |
| KAIRA | | | | | |



- w17: Maintenance visit week
- w17r: Remote assisted maintenance
- w17c: Commissioning visit
- *: To be decided if visit is necessary

Stations confirmed general planning shown above here. Details of the planned visits will be made between maintenance crew and station member.



RFI & Lightning

Menno Norden

ILT technical operations meeting, Zandvoort
7 April 2016

- RFI sources
 - Local broadband RFI sources (DE609, PL610, PL611)
 - DAB+ (all stations except FR606)
 - Windmills (planning core area)

- Lightning
 - Direct lightning stroke on RS305 LBA antenna
 - Impact on station electronics & antennas

RFI sources (DE609)

- RFI sources
 - A: Electric fence next to the station with sparking electrical contacts
 - B: Pulsed "welding" suspected to originate in nearby power line
 - C: DAB signal that saturates the receivers

- LOFAR-ASTRON-RPT-359, "DAB technical impact analysis DE609 "
 - Azimuth and Elevation Tile beam scans to find saturation positions
 - Saturation in the ADC can be reduced with 5 bit attenuator (3-4 dB)
 - RSPDriver.conf (step size 0.25 or 1dB (DE601) + Extra attenuation)
 - Direction dependent attenuation (not implemented)
 - Modify RCU filters (192), but maybe also part in HBA-FE (1536)
 - Linearity study HBA-FE, Summator, RCU summer 2016

DE609 DAB+ ADC saturation

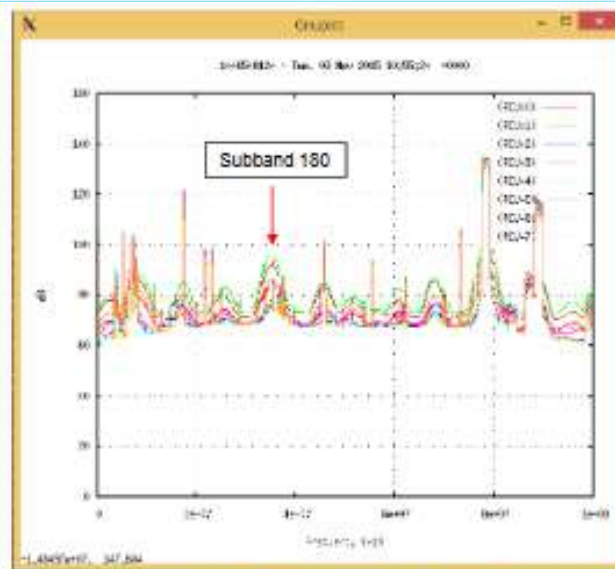


Figure 3: HBA spectrum pointing south with normal attenuation

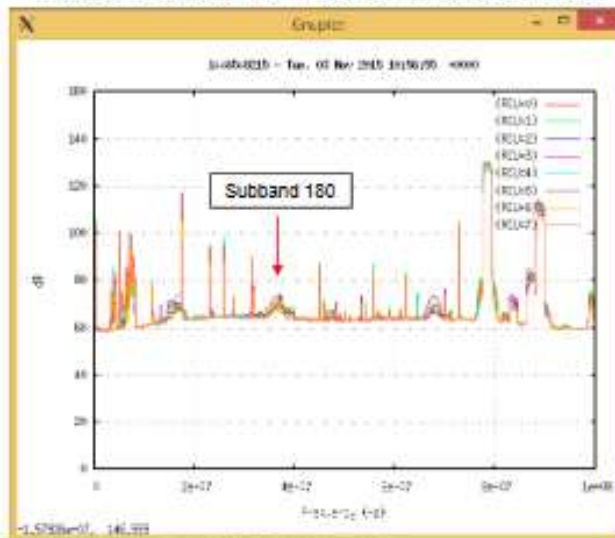
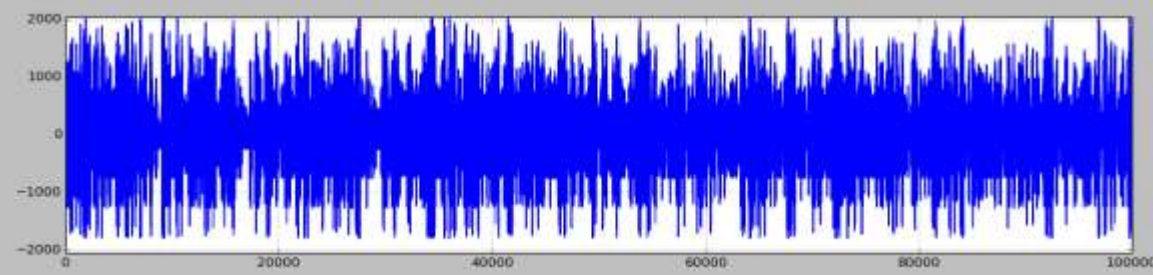


Figure 4: HBA spectrum pointing south with maximum attenuation

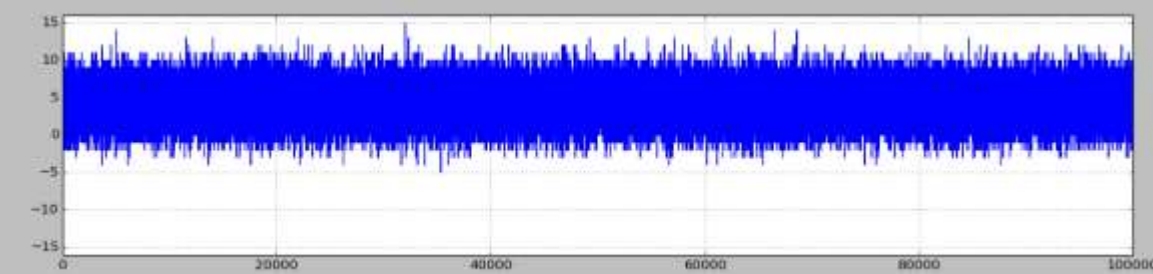
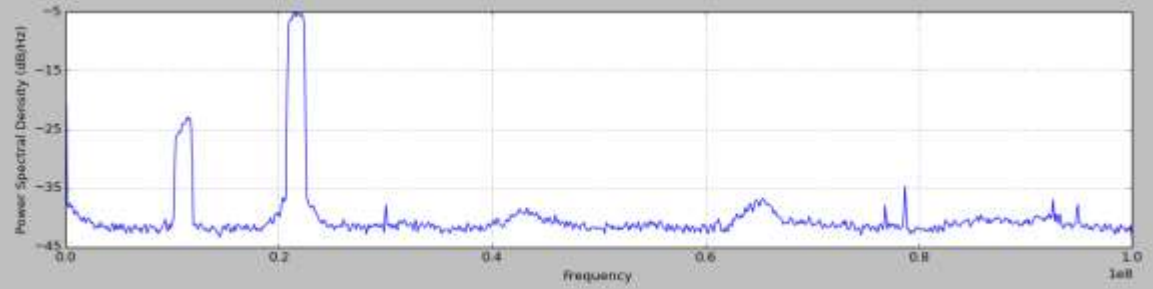
DE609 nominal
(south)

DE609 maximum att.
(south)

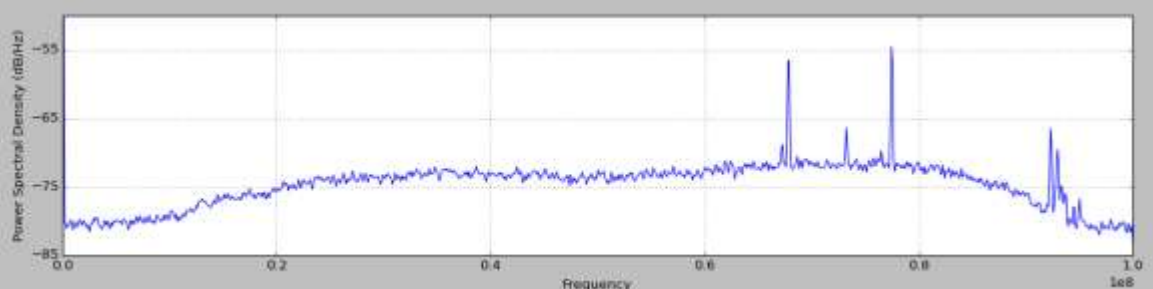
DE609 & FR606 comparison (TBB data)



DE609



FR606

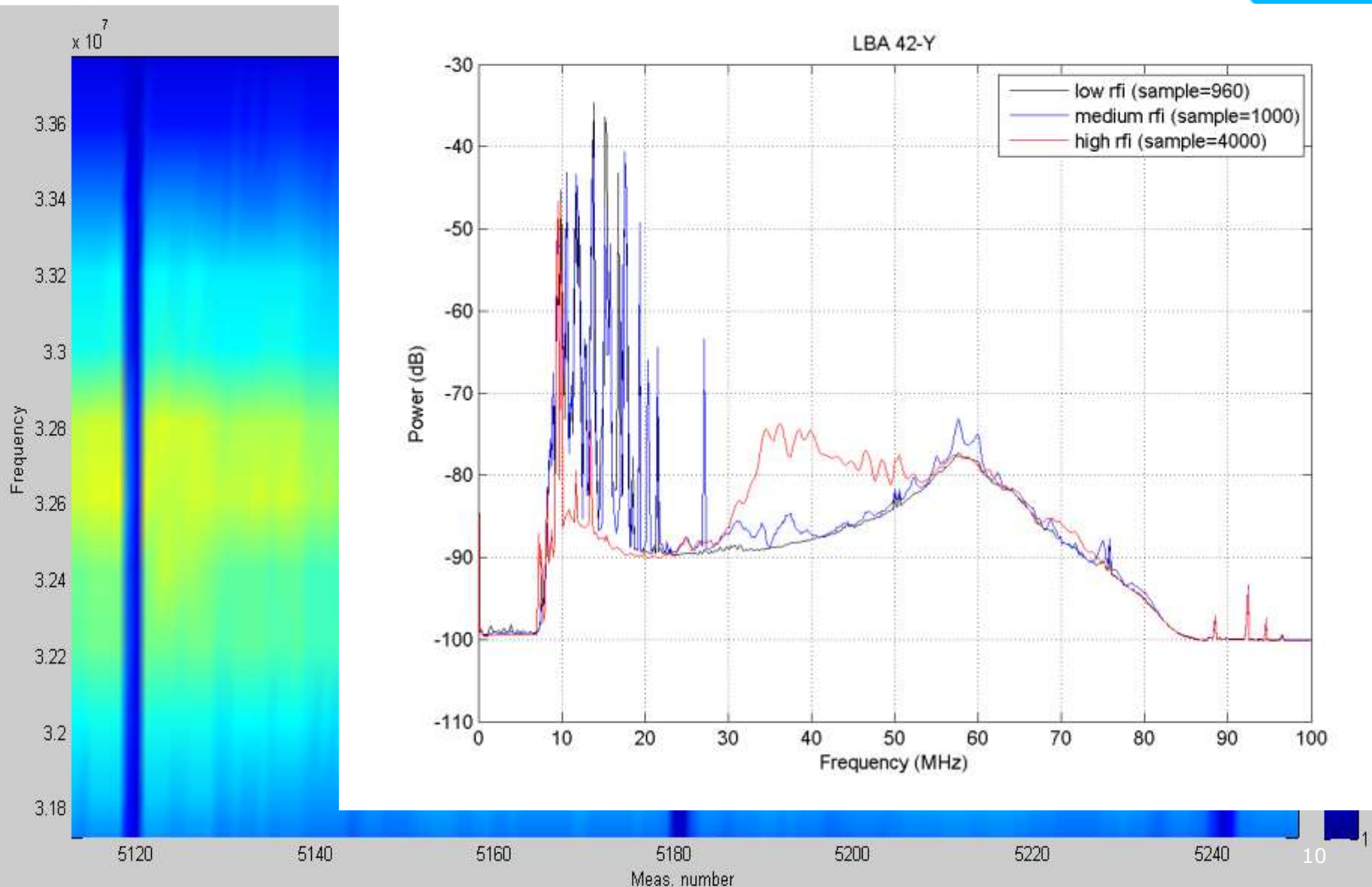


PL610 Borowiec (Strong source)

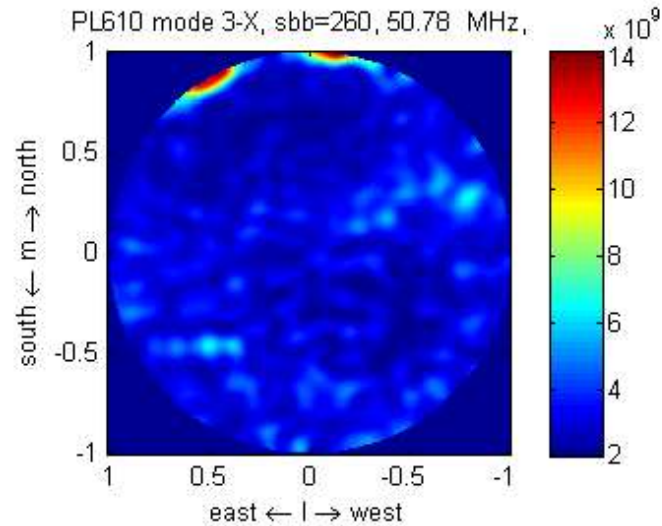
- Unknown broadband RFI sources (no LBA calibration possible)



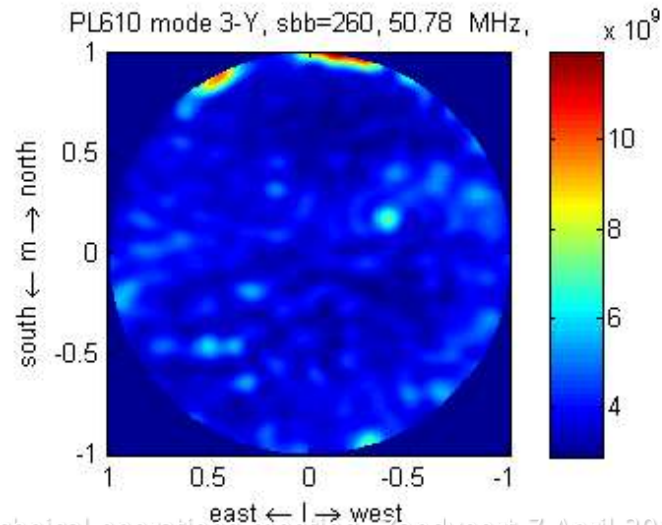
PL610 Borowiec (Weaker source)



PL610 Borowiec (Weaker source)



Video



PL611 Lazy

ASTRON



RFI sources

- 50 Windturbines
- 3 MW each
- 198m tip height
- 3-4 placed inside zone 2
- Between 3..8km Superterp
- Complains before 20-4-16

Concerns

- RFI from inverters
- Reflection rotor (radar cross section)
- AM/PM changing rotor speed

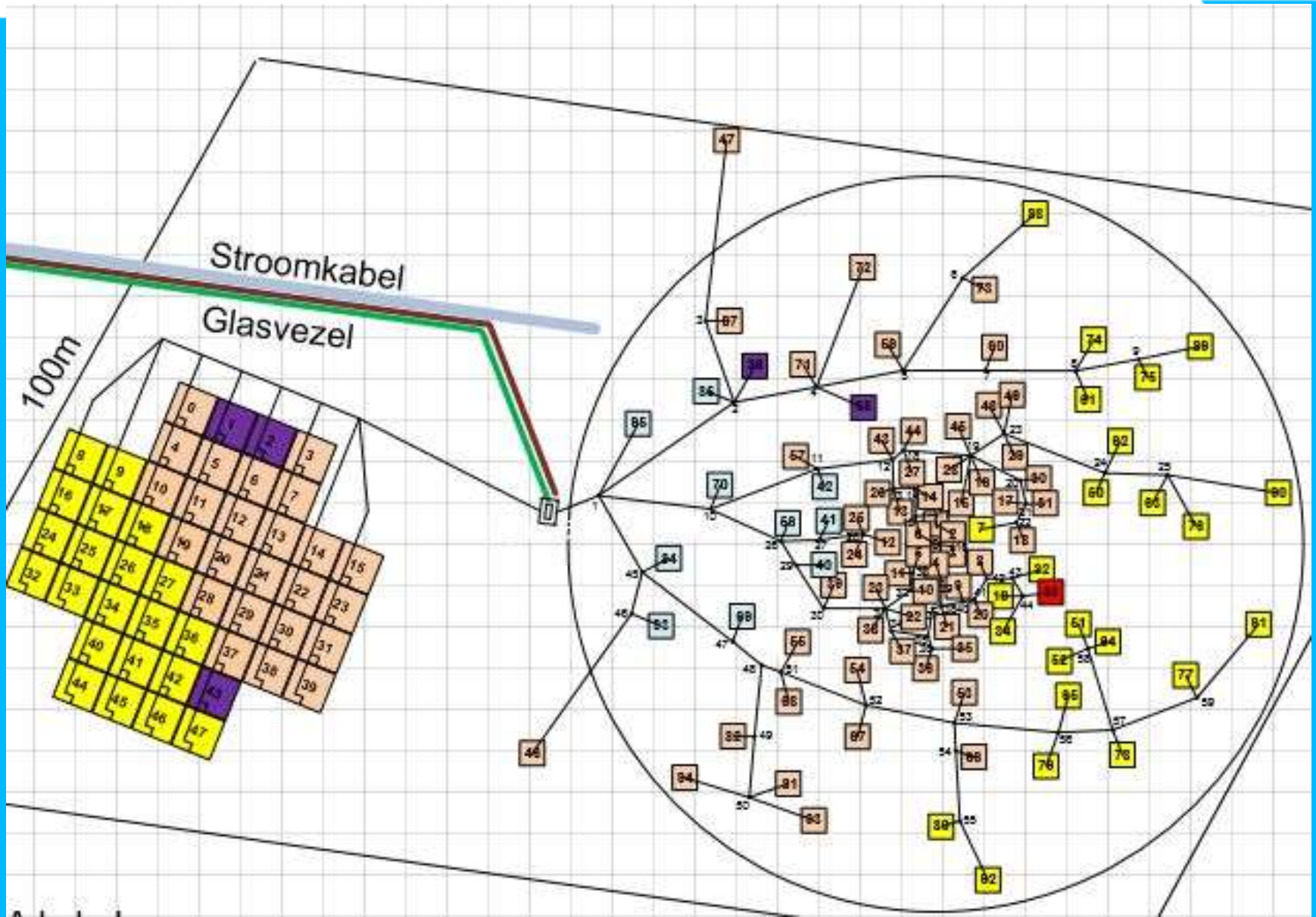


Lightning damage RS305 (5 July 2015)



- **LBA-33 destroyed**
- **RCU-66,67 copper trace vaporized**
- **Coax cables good**
- **Daily image 6-7-2015 (more info)**

Lightning damage RS305



Lightning damage RS305



- LBA damages

| LBA | Flat (open?) | Osc./Clipping | Short |
|-----|--------------|---------------|-------|
| 53 | 24 | 26 | 3 |

- LBA connected damages RCU related damages
 - Current limiter 0.5A RCU not fast enough
 - Q16 bias FET; D-S=360k Ω ; G-D=230k Ω

| RCU serienr | Antenne | RCU | Q16 (D-S) | Q16 (G-D) |
|------------------|---------|-----|-----------|-----------|
| RCUC-09230-00326 | 68_X | 41 | 92 Ohm | 0.5 Ohm |
| RCUP-09160-01427 | 58_Y | 20 | 175 Ohm | 0.5 Ohm |

Lightning damage RS305

- HBA related damage (only RCU's)
 - HBA tiles with communication problems (3).
 - All 3 RCU's pin 18 (RX input PIC16LF87) damaged
 - RCUC-09230-00528 addition 15 Ω series resistor broken.

| RCU serienr | Antenne | RCU | Impedantie |
|------------------|---------|-----|------------|
| RCUC-09230-00528 | 43 | 87 | 22.2 kOhm |
| RCUC-09170-02154 | 1 | 3 | 39.9 Ohm |
| RCUC-09170-02111 | 2 | 5 | 49.7 Ohm |

- Coax cables no damage found

HBA-LBA Maintenance LOFAR-NL

Zandvoort 07-03-2016
Henri Meulman

Defects

- Mechanical defects
- Electrical defects



Mechanical defects LBA Due to Animals or mowing



HBA-LBA Maintenance LOFAR-NL



PVC protection LBA RS509 (similar to DE604 Potsdam)



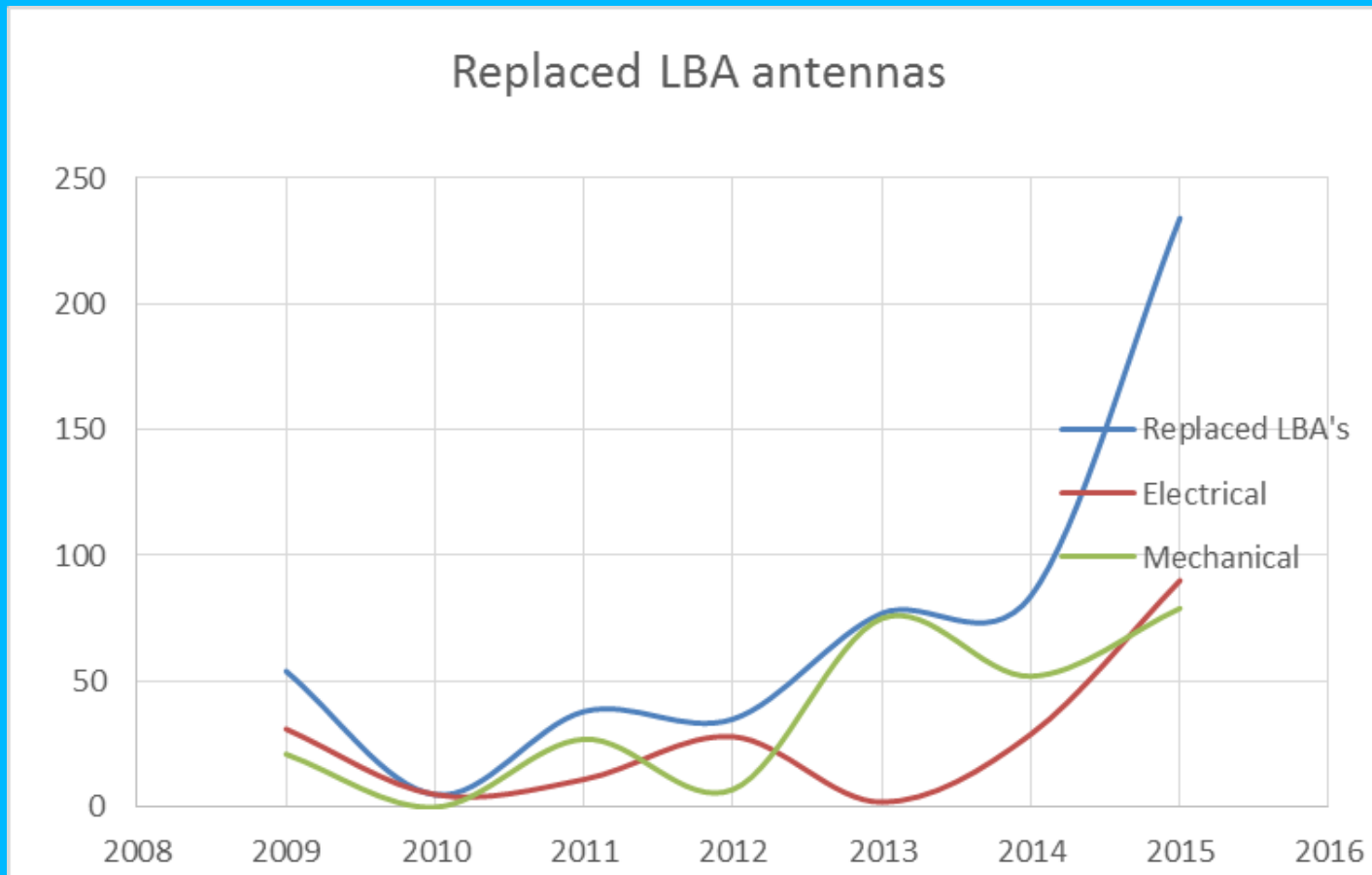
Mechanical defects LBA due to wind, water and wildlife



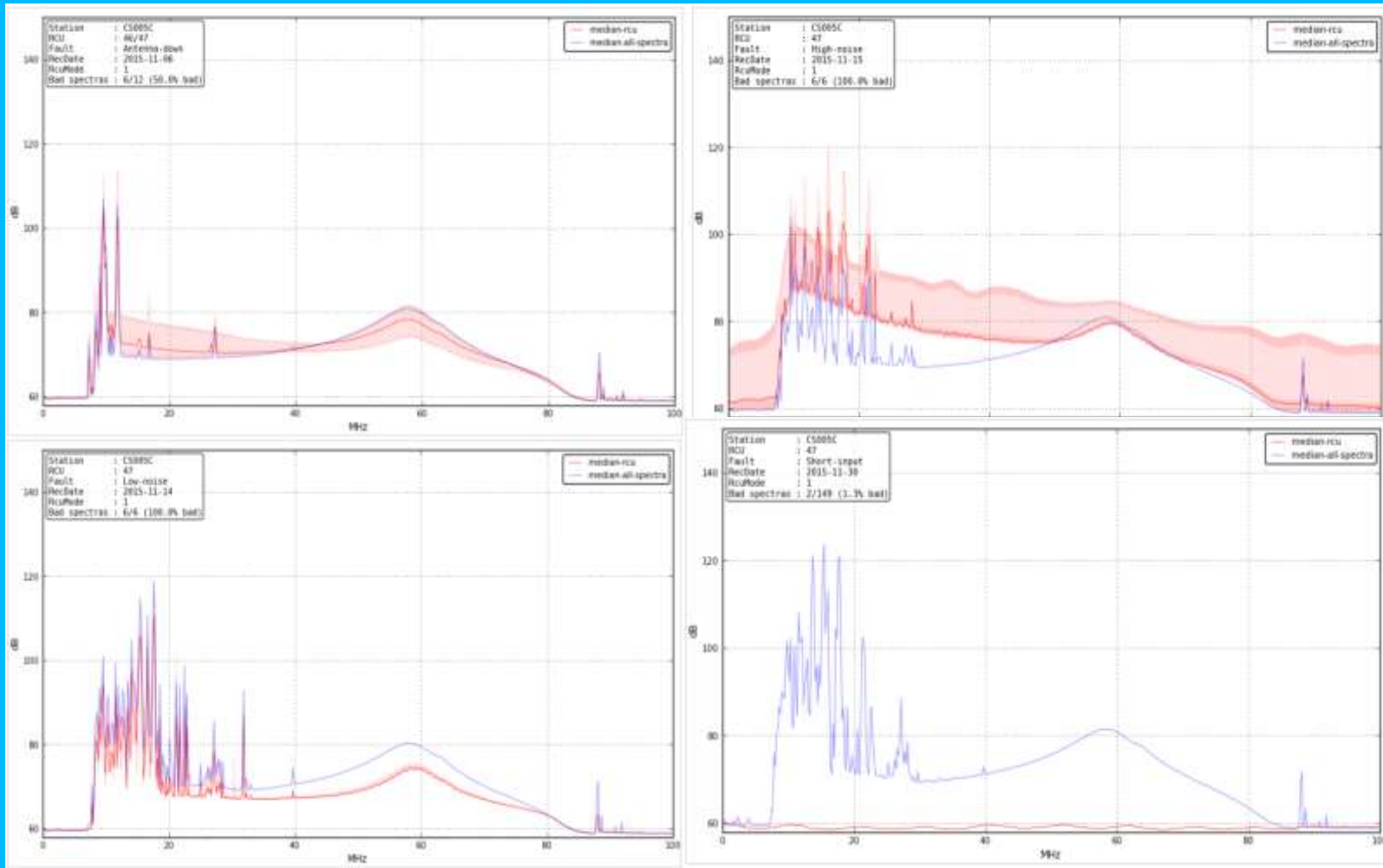
Mechanical defects LBA due to wind, water and wildlife



Defects LBA



Electrical Defects LBA

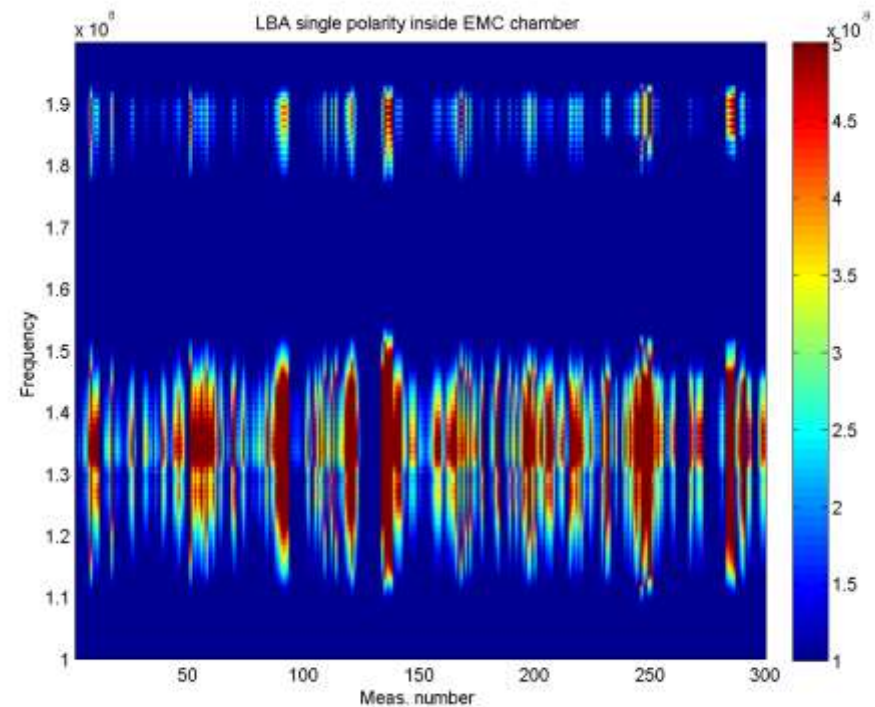
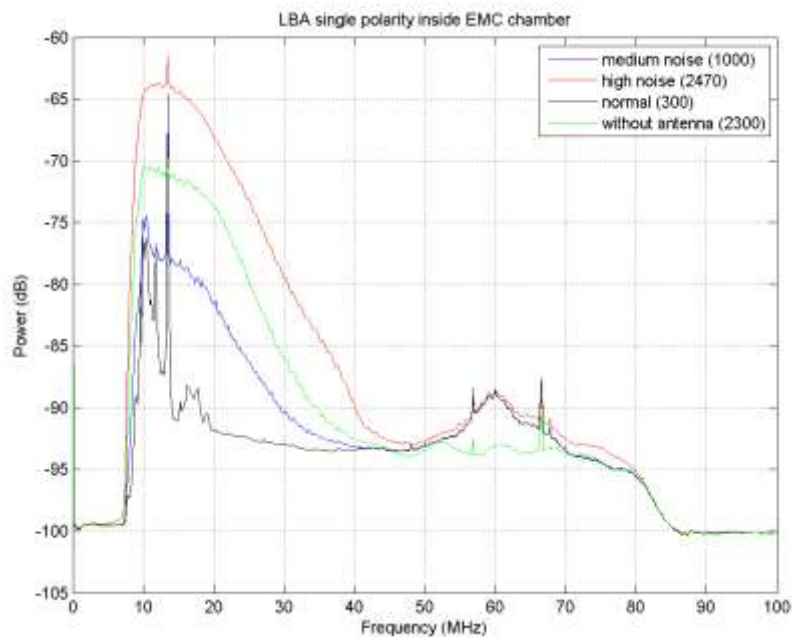


Electrical Defects LBA

- Lose connectors
- Defect LBA LNA
- Defect cable
- Corroded connectors



Defect (corroded) cable, lab test



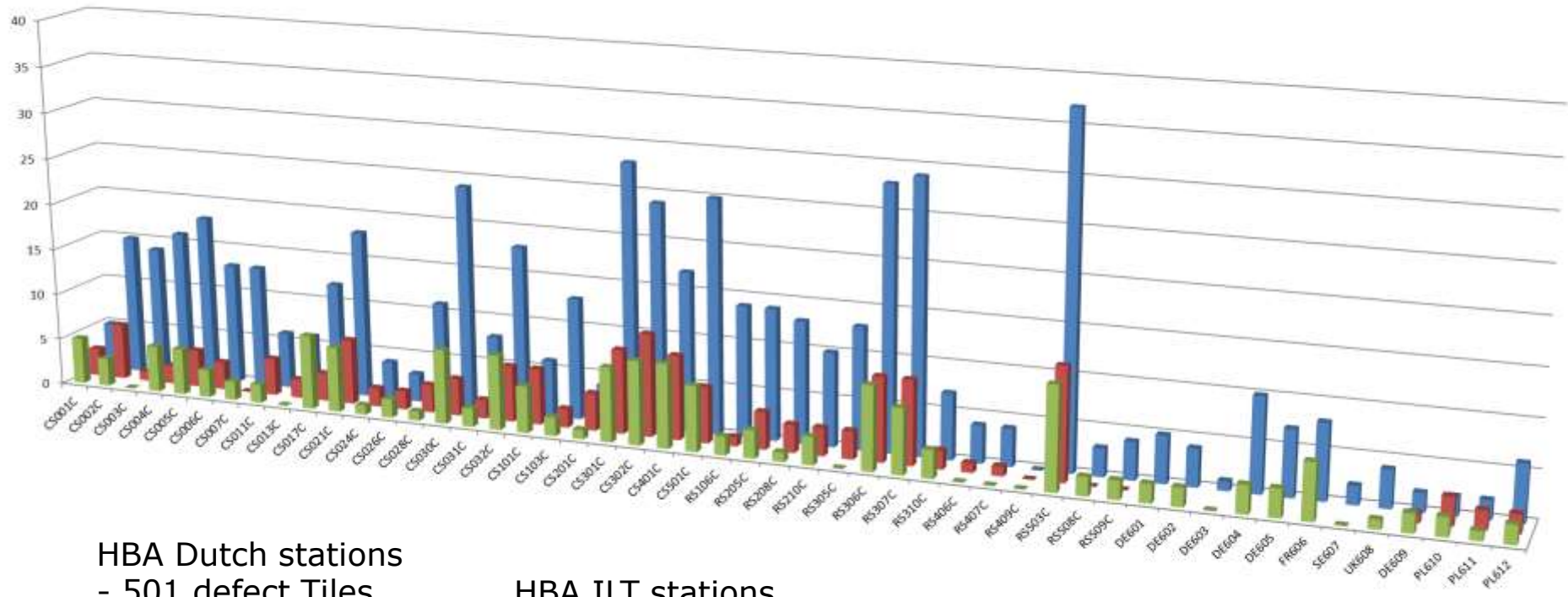
Mechanical defects HBA

- Bird pick holes
- Broken rubbers or lose S-hooks
- Broken "sticks"



HBA-LBA Maintenance LOFAR-NL

HBA fail feb. 2016



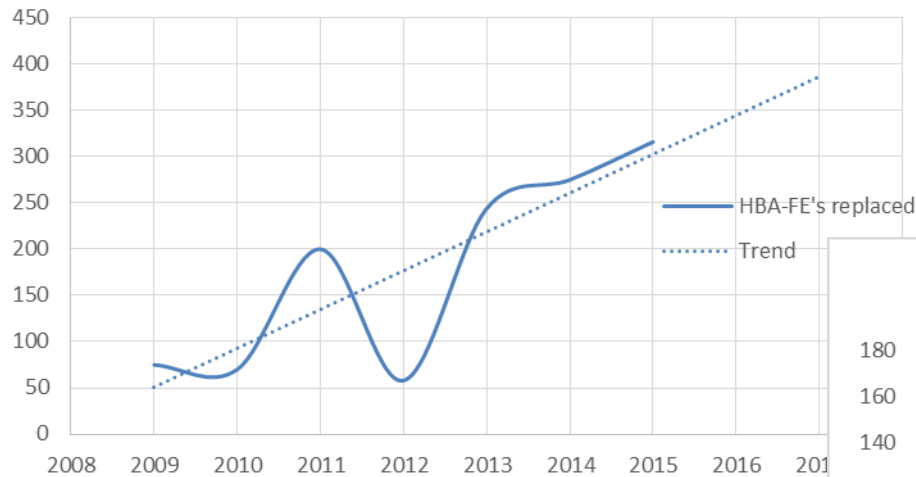
HBA Dutch stations
 - 501 defect Tiles
 - 149 rejected Tiles
 - 146 flagged Tiles

HBA ILT stations
 - 53 defect Tiles
 - 24 flagged Tiles

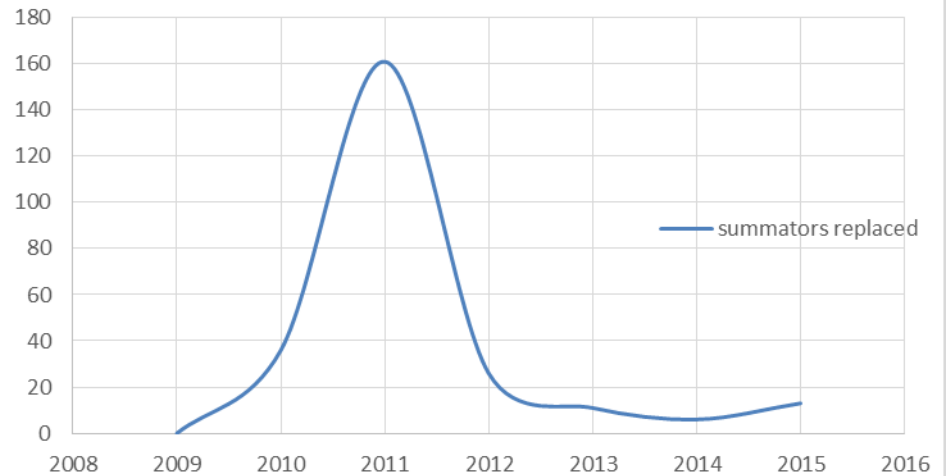
■ Flagged tiles ■ Rejected tiles ■ Defect Tiles 2016

Electrical defects HBA

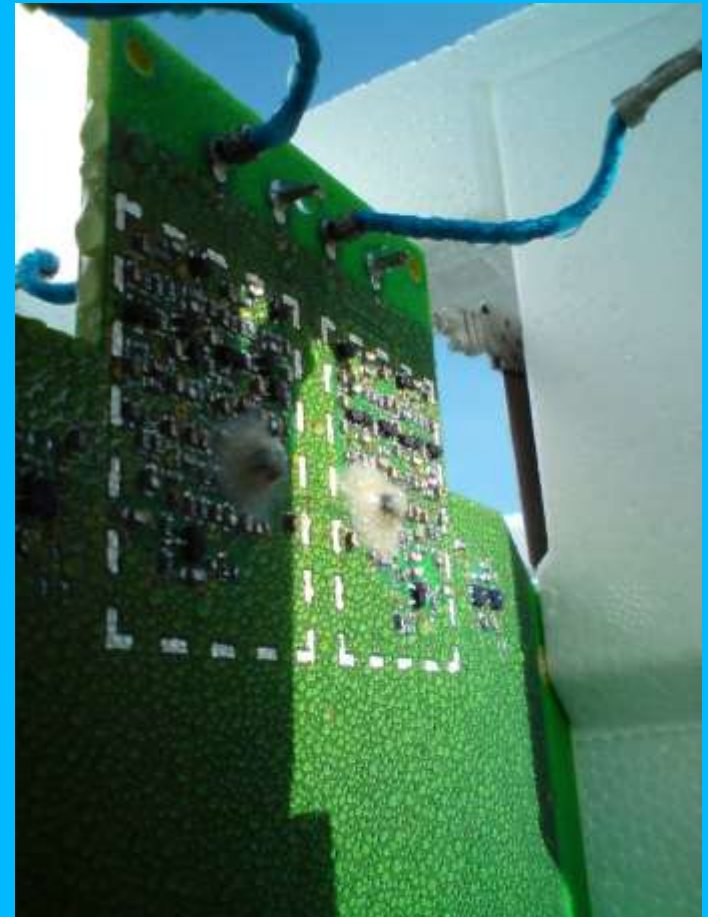
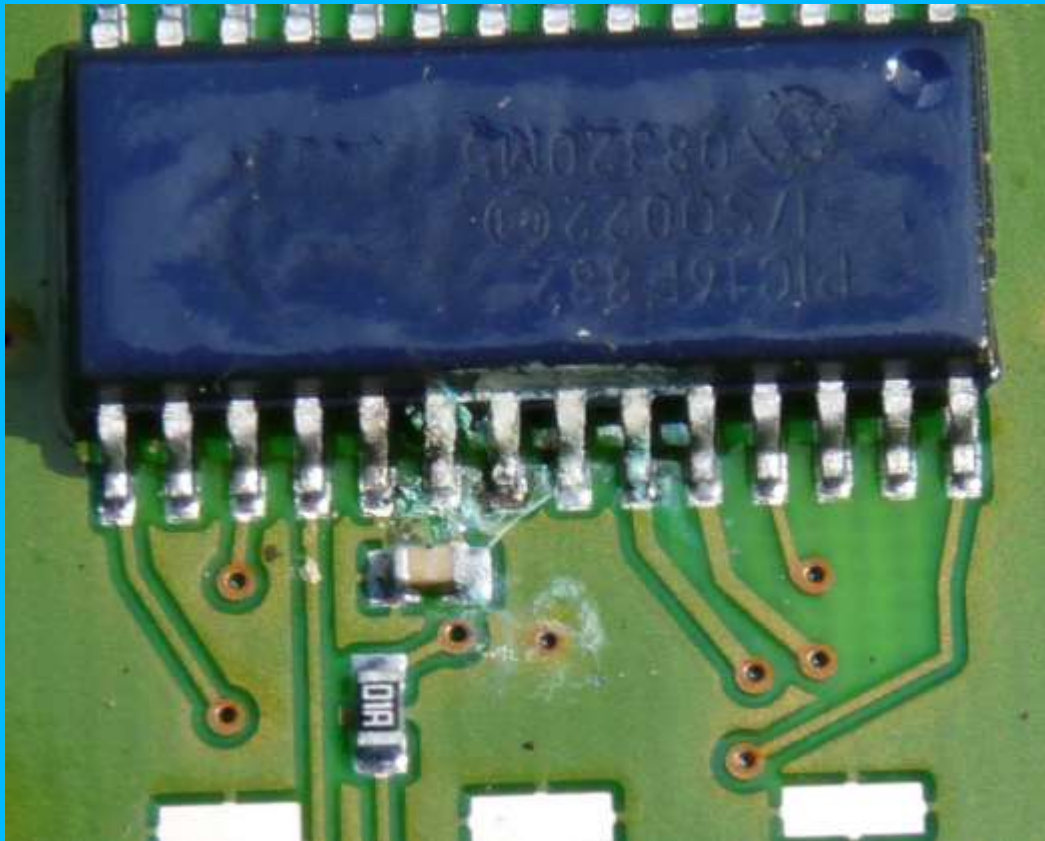
HBA-FE replaced



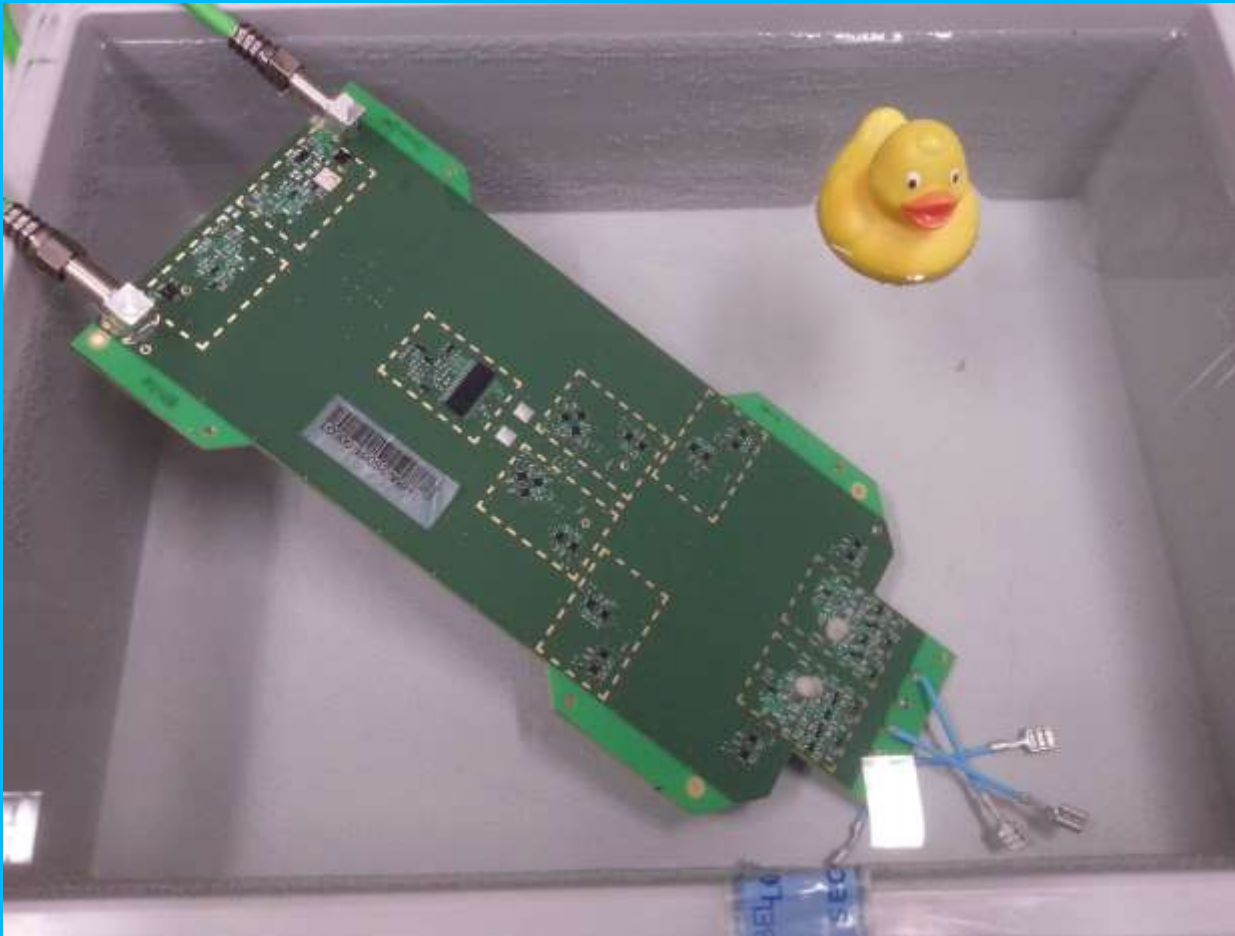
Summators replaced



HBA coating

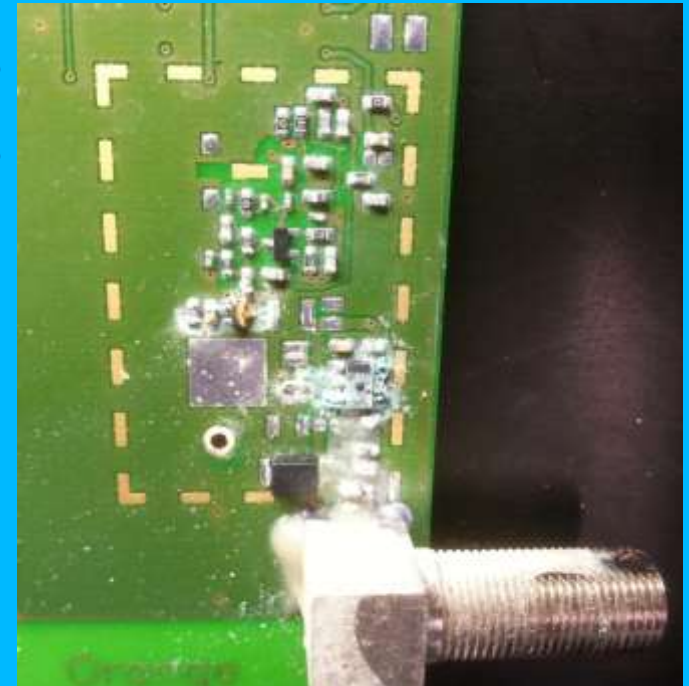


HBA submersion test



HBA submergion test

- Uncoated: 6 min 12 seconds
- Peters 1307: 2 hours 8 minutes
- Peters 1309: 3 hours 4 minutes
- Peters 1600: 3 hours 17 minutes
- Humiseal 1B73: 3 hours 17 minutes



HBA submergion test

- Humiseal 1B73: 3 hours 17 minutes
- PU: better than 3314 hours



The challenge is



Dealing with water

Cabinet Maintenance LOFAR-NL



Zandvoort 07-03-2016
Henri Meulman

Number of Cabinets

- Core stations: 24
- Remote stations: 14
- NAA : 12



Check and maintain

- Oil the door locks
- Oil the hinges
- Check/repair door-crank
- Rubber shielding
- Door contacts (cleaning and check)
- Cable entrance
- Replace Air filters
- Hinges (check replace)
- Fans

Check and maintain "Powerpukkel"

- Cabinet protective earth (4x)
- Lock powerpukkel
- Wiring
- Earth leakage protector
- Circuit breakers
- Lightning protector
- Cleaning
- Shielding

Cabinet maintenance LOFAR - NL



| nr. | Datum | Datum | KWh | Lofar Powerpukkel | | | | | | | | | | Lofar Cabinet / NAA Cabinet | | | | | | | | | | Deurstoppers | | | | Opmerkingen powerpukkel | Opmerking cabinet | | | | | | |
|----------|---------------|-------------|-----------------------------|---------------------------|--------------------|-----------------|--------------|-----------|----------|-------------------|--------------------|------------|----------------|-----------------------------|--------------------|-------------------|-------------|----------------|------------|-------------|-------------|------------------|-----------------|--------------------|-----------------|-------|------|-------------------------|-------------------|-------------------------|-------------------|---|-------------------------------|-------------------------|--|
| | | | | Bordje 'Verboden toegang' | cabinet aarde (ax) | sia powerpukkel | aarde aansl. | bedrading | zekeuren | aardlekschakelaar | bilksenbeveiliging | schonmaken | Afdichting lek | sloten smeeren | scharnieren smeren | rubber afdichting | deurstopper | EMC afdichting | schonmaken | deurcontact | kabel inoer | filters plaatsen | deurschakelaars | subrack ventilator | deur ventilator | Stang | Bout | | | Moer | Scharnier defect | MeedratendeDeurventilatoren | | | |
| CS001 | 18-9-2014 | ? | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 3 | Opmerkingen powerpukkel | Opmerking cabinet | | | | |
| CS002 | 24-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS003 | 10-2-2014 | 15-10-2014? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Back3 deurstopper verbogen. Front1 fan reageert niet op deurschakelaar kabelinvoer extreem vervuild. Deur Front1 klemt | | | |
| CS004 | 24-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Aardlek werkt niet | | | |
| CS005 | 16-10-2014 | 11-4-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Afdichting rubber los | | | |
| CS006 | 10-7-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | GPS kabel hangt los. | | | |
| CS007 | 10-7-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | GPS kabel beschadigd Printplaten nog doen | | | |
| CS011 | 19-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | aarde aan de deur vastgezet | | | |
| CS013 | 19-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Bliksembewijling stond uit. Wel spanning | | | |
| CS017 | 25-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Front fan maakt lawaai | | | |
| CS021 | 22-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS024 | 25-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS026 | 10-2-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | afdek kap kabelgoot ontbreekt | | |
| CS028 | 10-6-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | deur back0 sluit moeilijk | | |
| CS030 | 6-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS031 | 23-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS032 | 10-8-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 scharnieren vervangen | |
| CS101 | 10-8-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS201 | 10-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS301 | 10-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS401 | 13-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS501 | 13-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS103 | 14-10-2014 | | 78325 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS103NAA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS302 | 14-10-2014 | | 127930 | * | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS106 | 30-9-2014 | | 125247 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS106NAA | 30-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS205 | 30-9-2014 | | 104476 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS205NAA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS208 | 15-10-2014 | | 124084 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS208NAA | 15-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS210 | 15-10-2014 | 13-11-2014 | 19346 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS305 | 21-11-2014 | | moet no Niet aanwezig | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS306 | 15-10-2014 | | 110800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS306NAA | 15-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS307 | 23-10-2014 | | 126777 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS307NAA | 23-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS310 | 27-10-2014 | | 21153 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS406 | 10-9-2014 | | 91463 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS406NAA | 10-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS407 | 11-11-2014 | | 24417 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS407NAA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS409 | 24-10-2014 | | moet no Niet aanwezig in PP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS410 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS503 | 30-10-2014 | | 119339 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS503NAA | Geen NAA kast | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS508 | 23-9-2014 | 27-10-2014 | 91886 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS508NAA | 23-9-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS509 | 20-10-2014 | | 97893 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS509NAA | 20-10-2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CS023 | 25-9-2014 | ? | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS107 | 29-9-2014 | | 4008 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS206 | 26-9-2014 | | 3843 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS207 | 29-9-2014 | | 5621 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS411 | 10-3-2014 | | 802 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RS507 | 23-9-2014 | | No | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| totaal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Cabinet maintenance LOFAR - NL

Airfilters

256



Cleaning



Cabinet maintenance LOFAR - NL

Vandalism



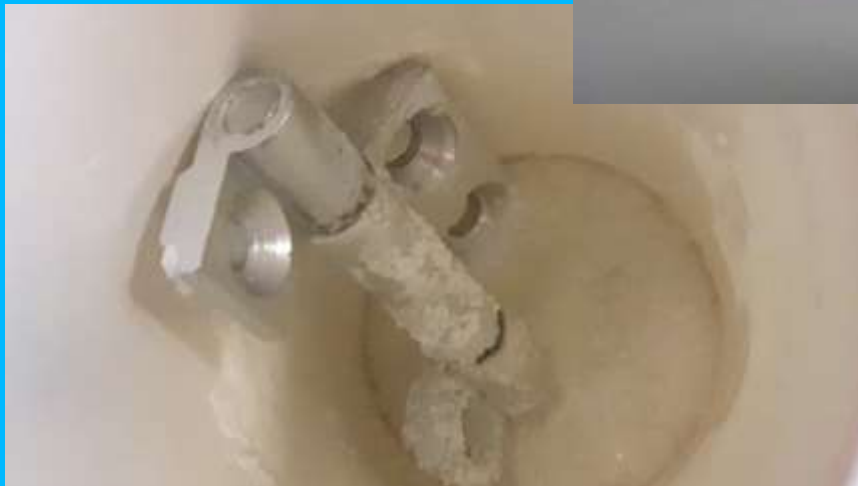
Jamming of the door



EMC leakage



Door Hinge



Cabinet maintenance LOFAR - NL

Fans

- Check
- Replace



The end



LCU replacement project & software updates

Arno Schoenmakers

ILT-TO meeting 7 April 2016, Zandvoort

- LCU = Local Control Unit; oldest batch is from 2009/2010.
- Currently planning to replace all LCUs in NL and Int. systems with new systems
 - All LCUs station based systems (12 Int + 38 NL)
 - CN001, MCU/CCU production and test systems, spare systems
 - In total: 55 systems to be purchased
- New LCUs will be installed with CentOS7.2-64b
 - No PPS kernel dependency anymore (like CS013 currently)
 - Will use Python 2.7/3 a.o.
- WinCC (PVSS) will be updated to version 3.14
 - Stay up to date with WinCC release patches (@stopdays) and yearly or bi-yearly major WinCC upgrades

Planning of the replacement project



➤ Time scheme as envisioned now:

- Specification/Purchasing/Ordering: Now - Half June
- Delivery systems: End of June
- Installation preparation and field tests: July/August
- Placement: one/two weeks in September

➤ Placement itself:

- LOFAR Tour with team of people to replace all LCUs (take out old LCU, put in new LCU, power up and test)
 - Equipment and instructions will be sent to Int. Station owners
 - Int. station owners will have to execute own work at same time
- Mixed/Hybrid array not possible for ILT operations
- LCU will be set up with latest available LOFAR Release.

➤ Local planning issues we must be aware of?

- Planning updates/coordination through ILT TO telecons

- Data disk content (local account home directories) will have to be migrated to new LCU.
- Ssh identity/access (change once)
- Newer versions of Python, etc.
 - Locally used software may have to be adapted
- Other issues that we are not aware of?
 - Please contact me (schoenmakers@astron.nl) or raise issues at ILT-TO telecons.

- Local mode now updated to recent Release version as well.
 - All Int. stations on LOFAR-Release-2.15 -> Very good!
 - LOFAR Release 2.16 available, has new mixed RCU modes

- Do announcements for new LOFAR releases reach all who should know about it?
 - Release dates and stop days now in the Wiki (http://www.lofar.org/operations/doku.php?id=public:important_dates)
 - Release notes and instructions in Wiki (requires Wiki account)

- Local configuration changes: If permanent, please communicate these to me (schoenmakers@astron.nl), so I can adapt the repository for local install.

RO Software Support

CEP 4

Jasper Annyas

Head of Software Support RO

April 7th 2016

CEP4 facts



- Nodes: 1 mgt, 2 head, 2 meta-data, 18 storage, 4 GPUs and 50 CPUs
- Tflops: 96 from CPUs, 68 from GPUs, Total 164 (CEP2 = 20)
- One Lustre filesystem: 3.4 PB
- InfiniBand network
- SLURM Batch scheduling
- Located in the CIT building of the RUG



CEP4 status

- Hardware is being handed over to Astron March/April
- SwS is installing and testing our software
- First partial results: meets CEP2 performance or better
- Tuning needed the coming months to go to higher performance
- Expected handover to ScS: begin May



Coffee and then station reports

| | | | |
|------|---|-------|--------|
| 1. | Coffee break | 10:30 | 30 min |
| 2. | Station report presentations | 11:00 | 75 min |
| 2.7 | DE601 Effelsberg (Andreas Horneffer) | | 5 min |
| 2.8 | DE602 Unterweilenbach/Garching (Ado Arnolds) | | 5 min |
| 2.9 | DE603 Tautenburg (Matthias Hoeft) | | 5 min |
| 2.10 | DE604 Potsdam (Christian Vocks) | | 5 min |
| 2.11 | DE605 Jülich (Eva Jutte) | | 5 min |
| 2.12 | FR606 Nançay (Jean-Mathias Griessmeier) | | 5 min |
| 2.13 | SE607 Onsala (Tobia Carozzi, Henrik Olofsson) | | 5 min |
| 2.14 | UK608 Chilbolton | | 0 min |
| 2.15 | DE609 Hamburg/Bielefeld Station (J Kuensemöeller) | | 5 min |
| 2.16 | PL610 Borowiec (Hanna Rothkaehl) | | 10 min |
| 2.17 | PL611 Lazy (Blazej Nikiel-Wroczynski) | | 10 min |
| 2.18 | PL612 Baldy (A Krankowski, L Błaszkiwicz) | | 10 min |
| 2.19 | KAIRA (Derek McKay) | | 5 min |
| 3. | IE613 roll-out (Peter Galalgher, Joe McCauley) | 12:15 | 10 min |
| 4. | ILT-TO action items + future meeting frequency | 12:25 | 10 min |
| 5. | AOB | 12:35 | 10 min |
| | Lunch | 12:45 | 75 min |

ILT-TO telecon action items



| Nr | Description | Assigned to | Due date | Status |
|-----------|--|--------------------|-----------------|---------------|
| 19/2 | Jean-Matthias will contact Klaas for practical network issues regarding "data-cloning" | J-M. Griessmeier | 26/02 | Open |
| 29/1 | Configure in Zabbix info on usage and error statistics of station switches | K Stuurwold | 28/1 | Closed |
| 27/1/16-1 | Support PL610 with RFI issue LBA | M Norden | 25/2 | Ongoing |
| 27/1/16-2 | Solve not working delay command (All Glow stations) | M Norden | 25/2 | Closed |
| 25/2/16-1 | Prepare maintenance report/presentation for 7 April ILT-TO Zandvoort meeting | ALL | 7/4/16 | New |
| 25/2/16-2 | Restart indicator lamp automatically after switching between ILT and local mode | M Norden | 17/4/16 | New |
| 25/2/16-3 | Supply Zabbix info to all other stations related to action 29/1 | K Stuurwold | 17/4/16 | New |

ILT-TO telephone conference frequency?



▪ Old

- Thursday, January
- Thursday, February
- Thursday, March 17
- Thursday, April 7 (Zandvoort)
- Thursday, May 12
- Thursday, June 30
- -
- Thursday, August 25
- Thursday, September 29
- Thursday, October 27
- Thursday, November 24
- Thursday, December 15

▪ New

- -
- Thursday, February
- -
- Thursday, April 7 (Zandvoort)
- -
- Thursday, June 2
- -
- Thursday, August 25
- -
- Thursday, October 27
- -
- Thursday, December 15

1.

Lunch



Save trip back home.