



# International LOFAR Telescope Technical Operations Meeting April 2012

ILTO 2011-04-17,18  
*Harm Munk*

# Agenda



- Tuesday, April 17
  - 12:30 – 13:00 Lunch
  - 13:30 – 15:00 Meeting
  - 15:00 – 15:30 Coffee break
  - 15:30 – 16:00 Meeting
  - 18:30 – .. : .. Dinner at "Harrys", Kungsbacka

# Agenda



- Tuesday, April 12
  - 09:30 – 10:00 Meeting
  - 10:00 – 10:30 Coffee break
  - 10:30 – 11:00 Meeting
  - 11:00 – 12:30 (LOFAR Status meeting)
  - 12:30 – 13:30 Lunch, end of meeting
  - 13:30 - ...      Visit to the Onsala LOFAR station

# Introduction



## ■ Participants

Leif Helldner	Onsala, SE
Tobia Carozzi	Onsala, SE
Henrik Olofsson	Onsala, SE
Simon Casey	Onsala, SE
Lars Pettersson	Onsala, SE
Miroslav Pantaleev	Onsala, SE
John Conway	Onsala, SE
James Anderson	Effelsberg, DE
Andreas Horneffer	Effelsberg, DE
Benedetta Ciardi	Garching/Unterweilenbach, DE (remote) (Wednesday)
Mathias Hoeft	Tautenburg, DE
Michael Pluto	Tautenburg, DE
Christian Vocks	Potsdam, DE
Eva Jütte	Jülich, DE
Jean-Mathias Griessmeier	Nancay, FR (remote)
Derek Mckay-Bukowski	Chilbolton, UK (Tuesday)
Nico Ebbendorf (roll out)	ASTRON, NL
Menno Norden (sys. eng.)	ASTRON, NL
Henri Meulman (hw engineer)	ASTRON, NL
Harm Munk (head TO)	ASTRON, NL

## Open meeting

- Discuss operations structure and processes for the International LOFAR Telescope (ILT)
  - Maintain an operational ILT from
    - 10 owners owning 45 (38) stations
    - connected through a network run by ~10 providers
    - data processed at the CIT (Centre for Information Technology) of the Groningen University
    - data stored in Amsterdam, Groningen, and Jülich coordinated by ASTRON's Radio Observatory
  - Maintain the ILT components
- Discuss station construction and maintenance, exchange experience

# Topics



- Developments
  - Dutch stations
  - International stations
  - Planned stations
- Technical Issues
- Plans
- Network
- CEntral Processing
- Long Term Archive
- Miscellaneous
- System Development

# Topics



- Organisation
- Station Maintenance
- Station operation

# Developments April 2011 – April 2012



- Stations
  - Dutch stations



# Developments – Dutch Stations



- Drainage problems
- HBA Repairs
- Windturbines
- Wind damage
- CS013

# Developments – Dutch Stations Drainage Problems

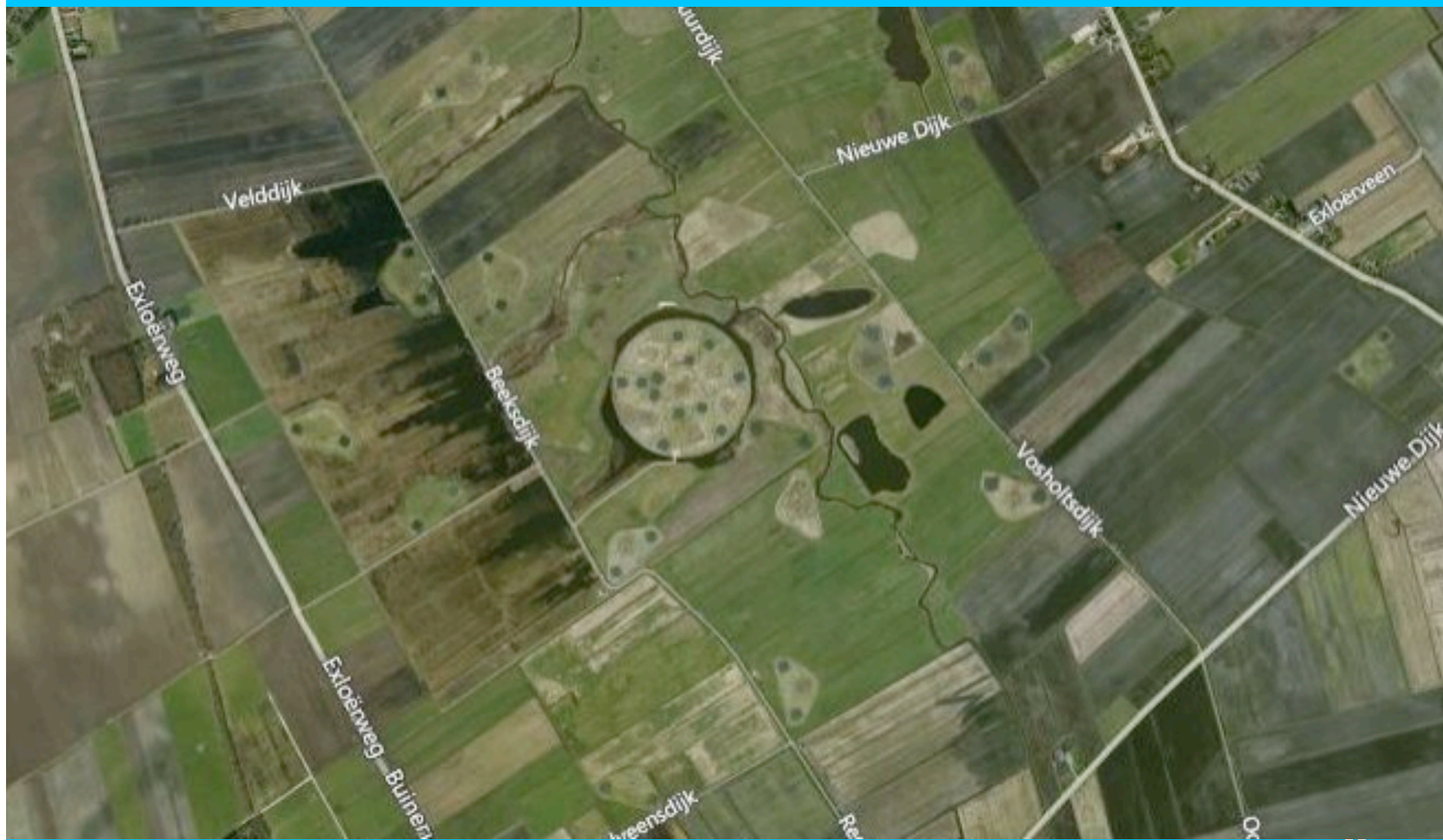


- Many core station built on wet soil
- 'bathtubs edges'

## Measures

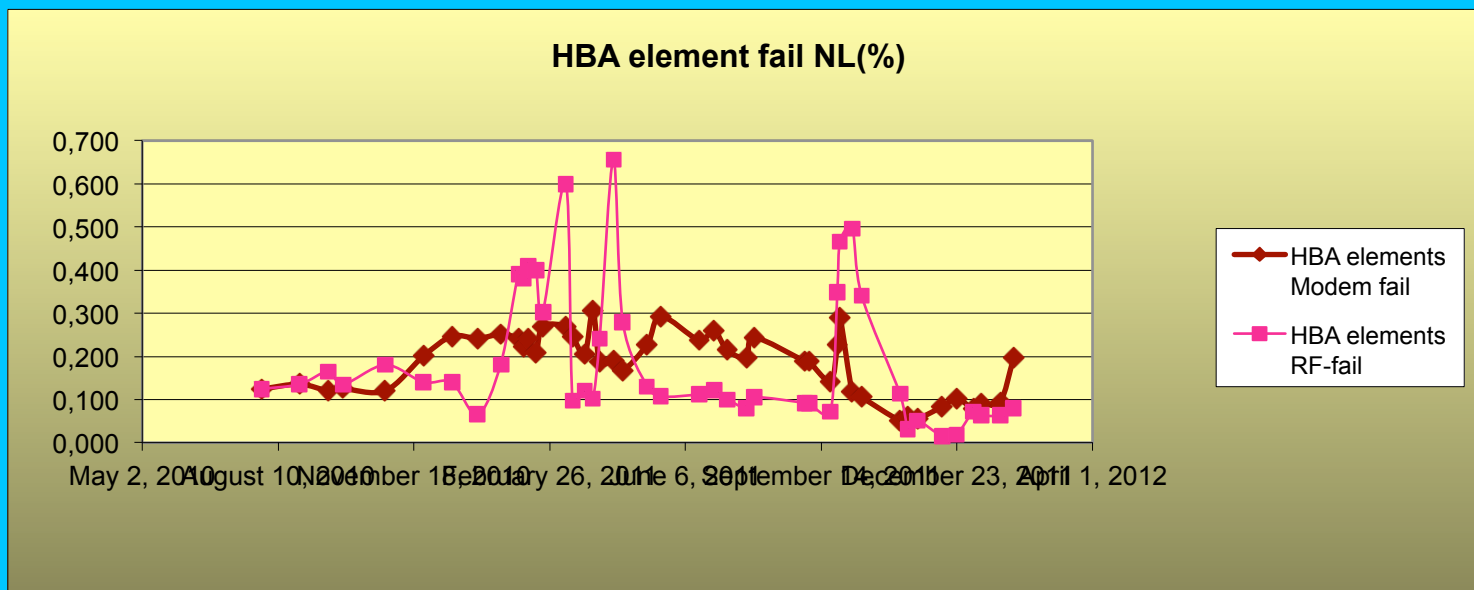
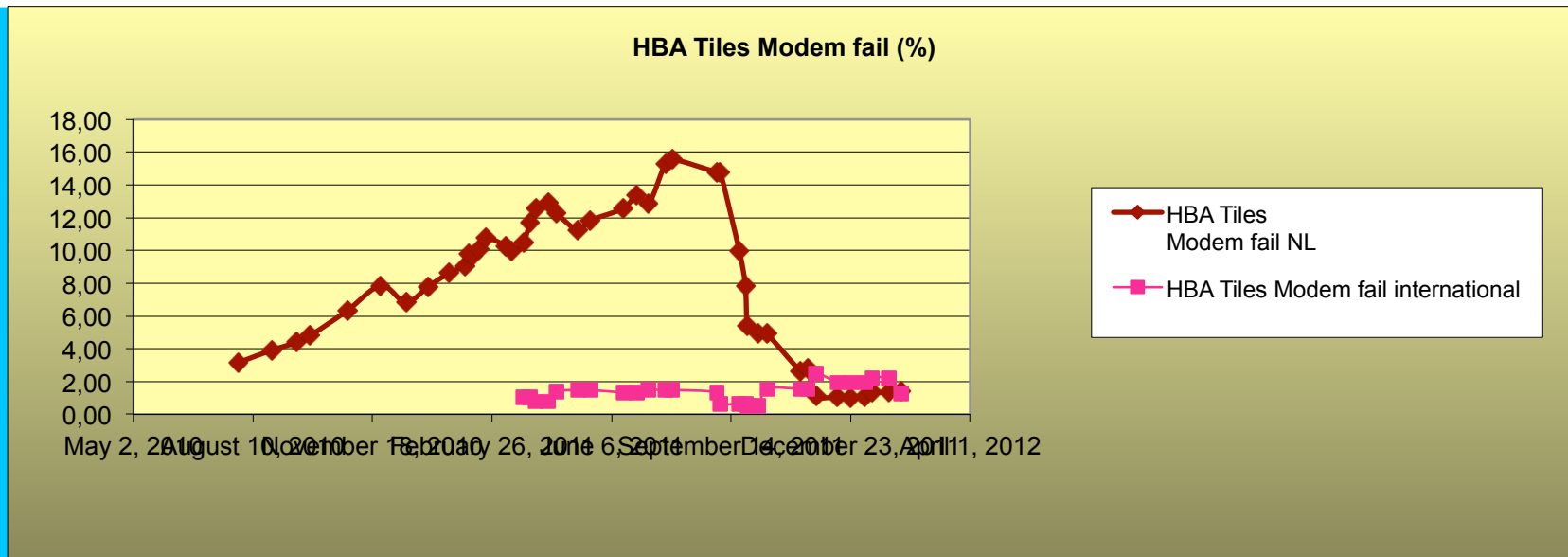
- Superterp: soil removed between antenna fields
- 'bathtub edges' removed
- Ditches near HBAs

# Developments – Dutch stations



# Developments – Dutch Stations

## HBA tile repairs



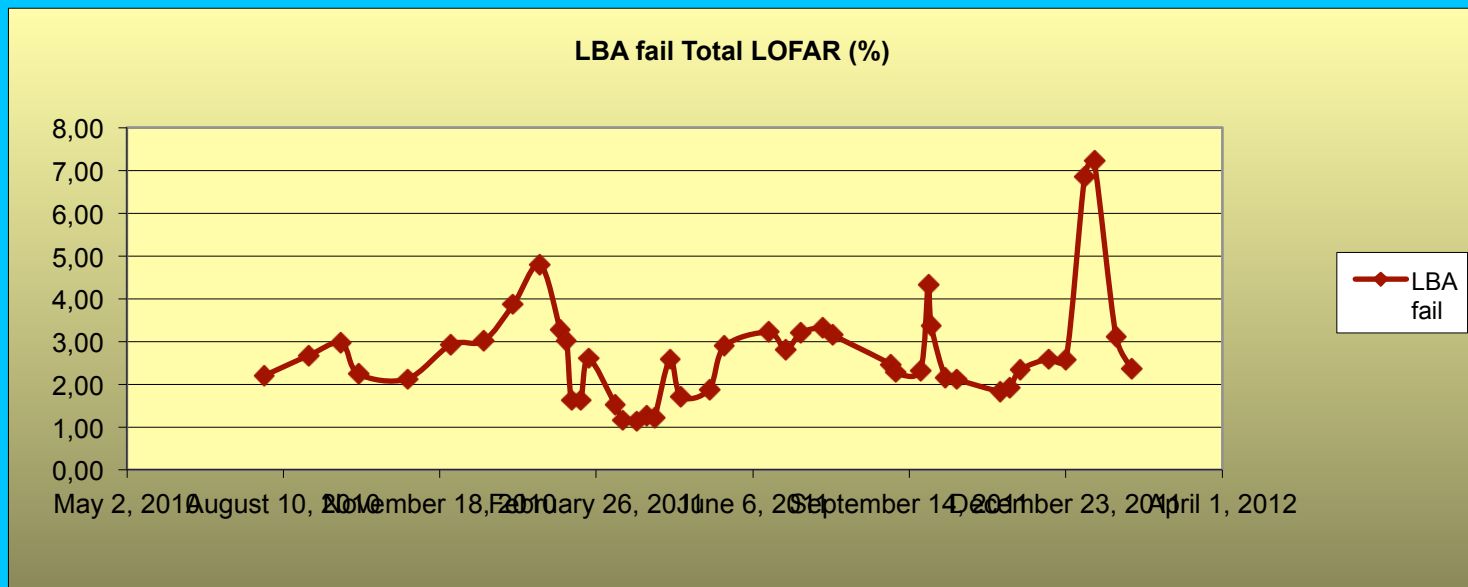
# Developments – Dutch Stations

## HBA tile repairs

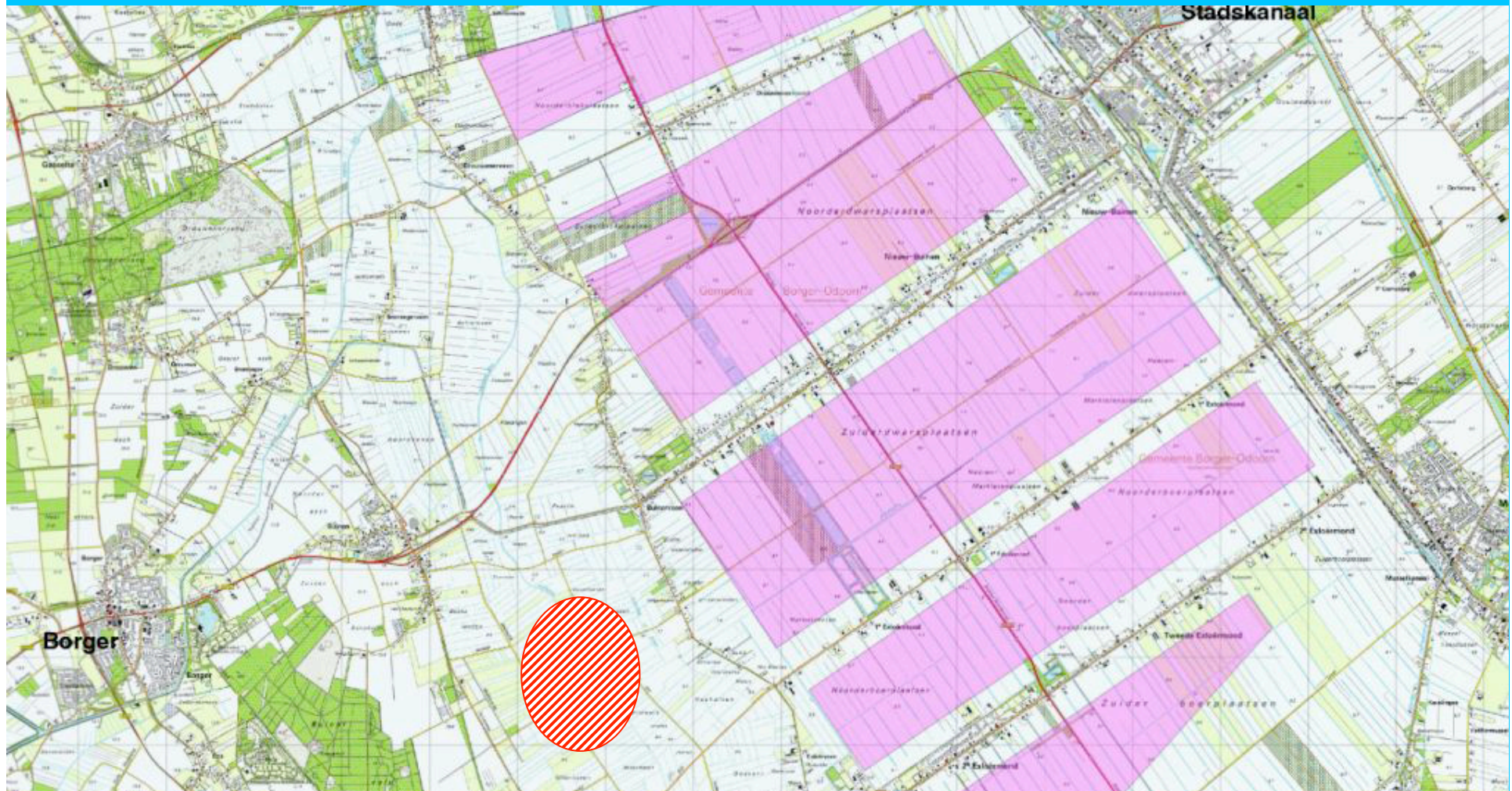


- Corrosion caused by
  - High humidity
  - Constant DC on coax
  
- Bad P- and C-summatoms replaced
- Bad RF Front Ends replaced
- New RCU firmware patch flashed
  - DC switched off between communications
- Improved Summator design
  - Fully sealed

# Developments – Dutch Stations HBA tile repairs



# Developments – Dutch Stations Wind turbines



# Developments – Dutch Stations

## Wind turbines



- Dutch government initiative
- 150m tower height, 220m blade tip height
- Generators
- Control system electronics
- Static electricity bleeder conductors in blades
  - In combination with tower: act as changing diffraction slits
  - Reflects (distant: 120 km) transmitters, periodically



# Developments – Dutch Stations

## Wind turbines



### Measures

- At least 5 km distance between turbine and LOFAR stations
- Environmental impact study (independent company)
- Stations to be built: look for alternative sites
- Political pressure through municipalities, province, and MP's

Bottom line: Dutch government initiative

# Developments – Dutch Stations

## Wind damage



- Extremely high winds in early January 2012
- Minor damage to two HBA tiles (on different stations)

Attracted attention to loose top covers

- Deformed?
  - Due to high summer temperatures?
  - And/or constant pull from rubber bands?

Measures:

- Extra knot
- Replace rubber band with rope

# Developments – Dutch Stations CS013



HBA tile rotation 45% off (all tiles)

- Discovered early 2012
- Production error

Remedies

- Compensate in processing (software)
  - Under investigation
  - Limited to high elevation

# Developments – Dutch Stations CS013



## Remedies, continued

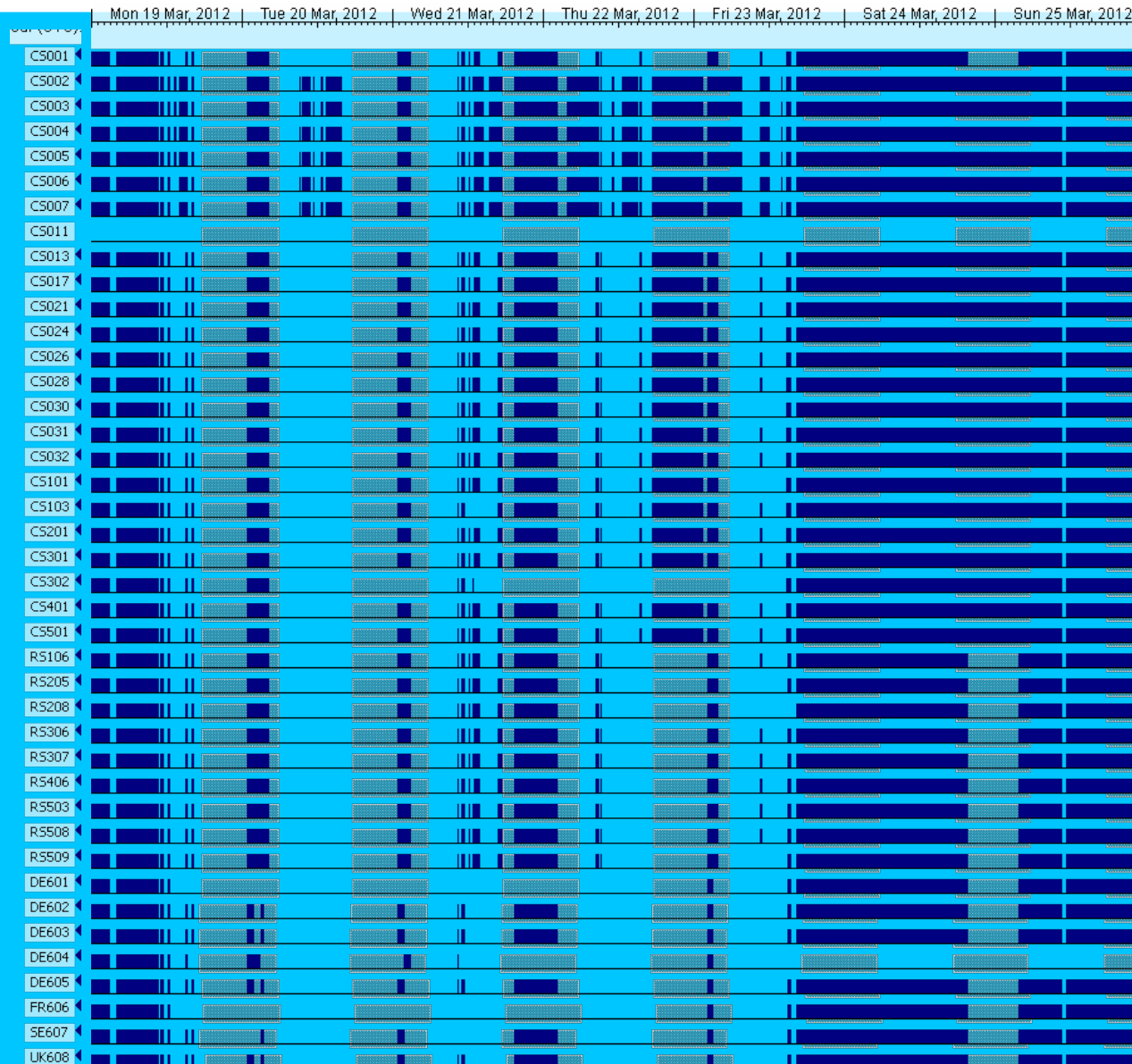
- Correct rotation
  - In the field: not possible
  - Resurrect production facility
    - Near the core?
    - At the WSRT?
  - Replace with tiles already produced: no tiles available
  - Produce new tiles
    - Wait for next production run

Decision to be made.

# Developments – International Stations



# Developments – International Stations Usage – week 2012-12



# Developments – International Stations Usage January – mid April 2012



	<b>MSSS</b>	<b>LB</b>	<b>Solar</b>	<b>Other</b>
DE601	43	4	3	6
DE602	38	4	3	10
DE603	57	4	3	9
DE604	52	4	3	11
DE605	57	2	3	9
FR606	61	4	1	10
SE607	70	4	3	10
UK608	59	2	3	8

# Developments – International Stations

## Reports from the stations



- DE601: Effelsberg
- DE602: Unterweilenbach (Garching)
- DE603: Tautenberg
- DE604: Potsdam
- DE605: Jülich
- FR606: Nancay
- SE607: Onsala
- UK608: Chilbolton
- XXnnn: KAIRA



# Developments – International Stations Station Cookbook



# Issues - The RSP clock problem



# Plans - TBB Upgrade



- Increase TBB memory capacity from 2 Gbyte to 8 Gbyte
  - time buffer: 1.3 sec to 5.2 sec
  - Minimum dictated by system trigger time (WAN, CEP)
    - Processing time to raise trigger
    - Trigger transmit time

# Plans - TBB Upgrade



## Phased

1. Test 2 x 4 GByte module on one MP (1/4 TBB): done
2. Test 4 x 2 x 4 Gbyte modules on one TBB: done
3. Test 6 x 4 x 2 x 4 Gbyte modules on one station
4. Install 4 Gbyte modules on all Dutch stations

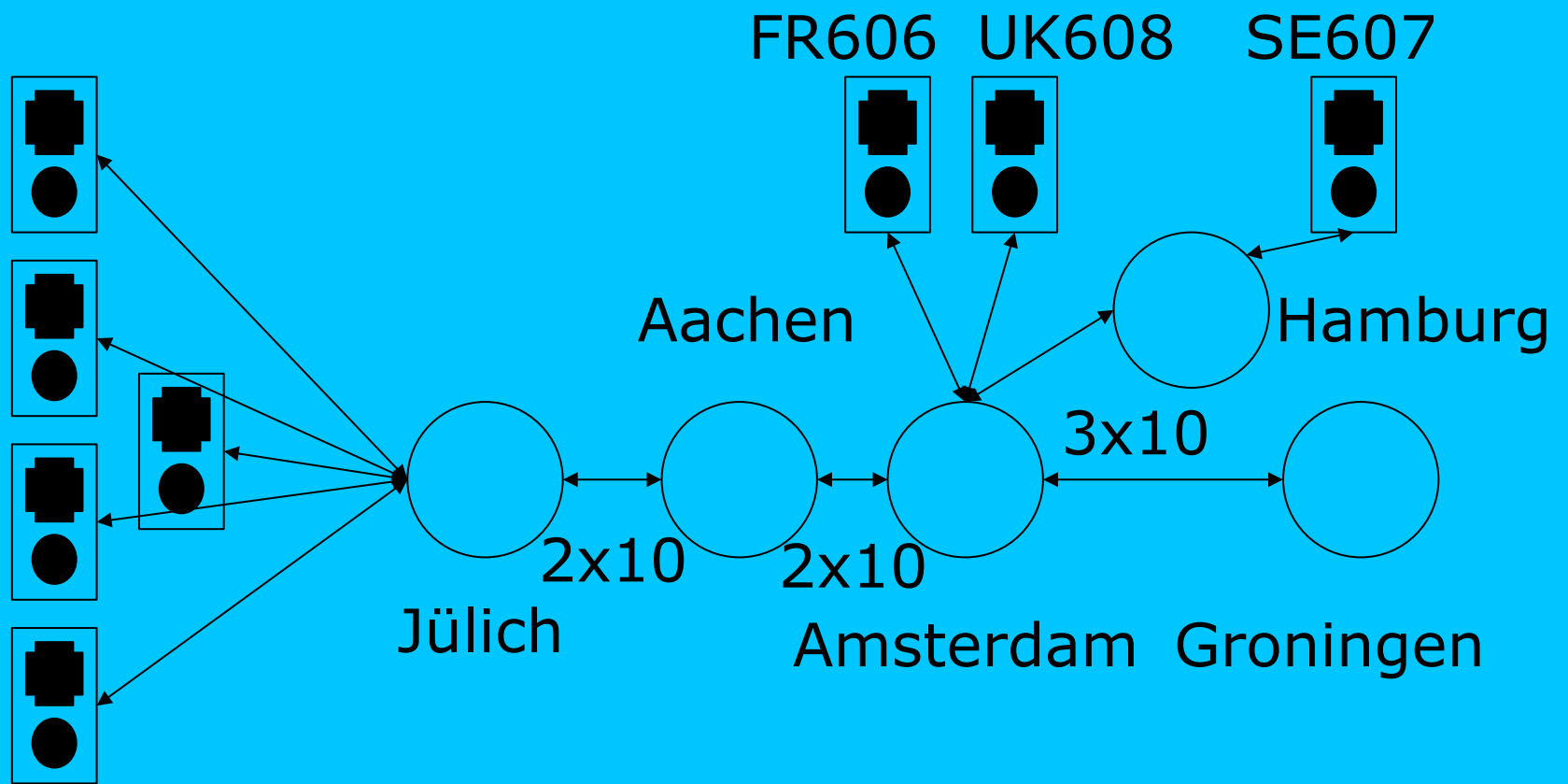
4 Gbyte module = €112 (incl. VAT)

40 x 6 x 8 = 1,920 modules = € 215,040

International station: 12 TBBs

Cost: 12 x 8 x €112 = € 10,752 per station

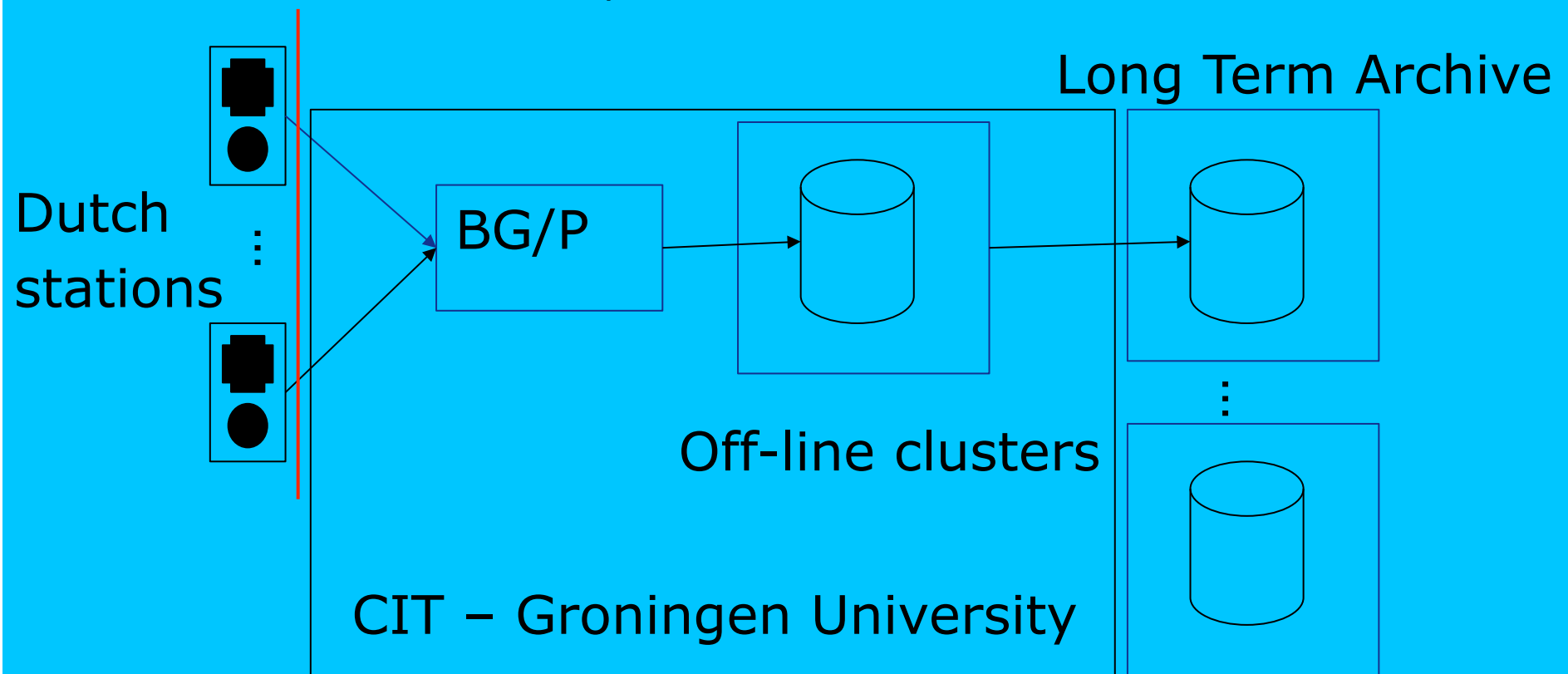
- Simplified Network topology



DE601..605

## Simplified Central Processing setup (CEP)

Road works, January 2012



- CEP off-line cluster
  - CEP I off-line cluster
    - 24 storage node, 480 TB total
    - 72 compute nodes, 5 TFLOPS total
    - Maintenance contracts ends May 2012
  - CEP II off-line cluster
    - 100 storage+compute nodes, 2 PB, 20 TFLOPS total
    - Available since end of April 2011
    - Long history of problems
    - Mainly used for MSSS
  - CEP I restructuring
    - Staging area for Long Term Archive (LTA): 20 storage nodes
    - SW development

# Long Term Archive



## Long Term Archive (Sky $\neq$ Archive)

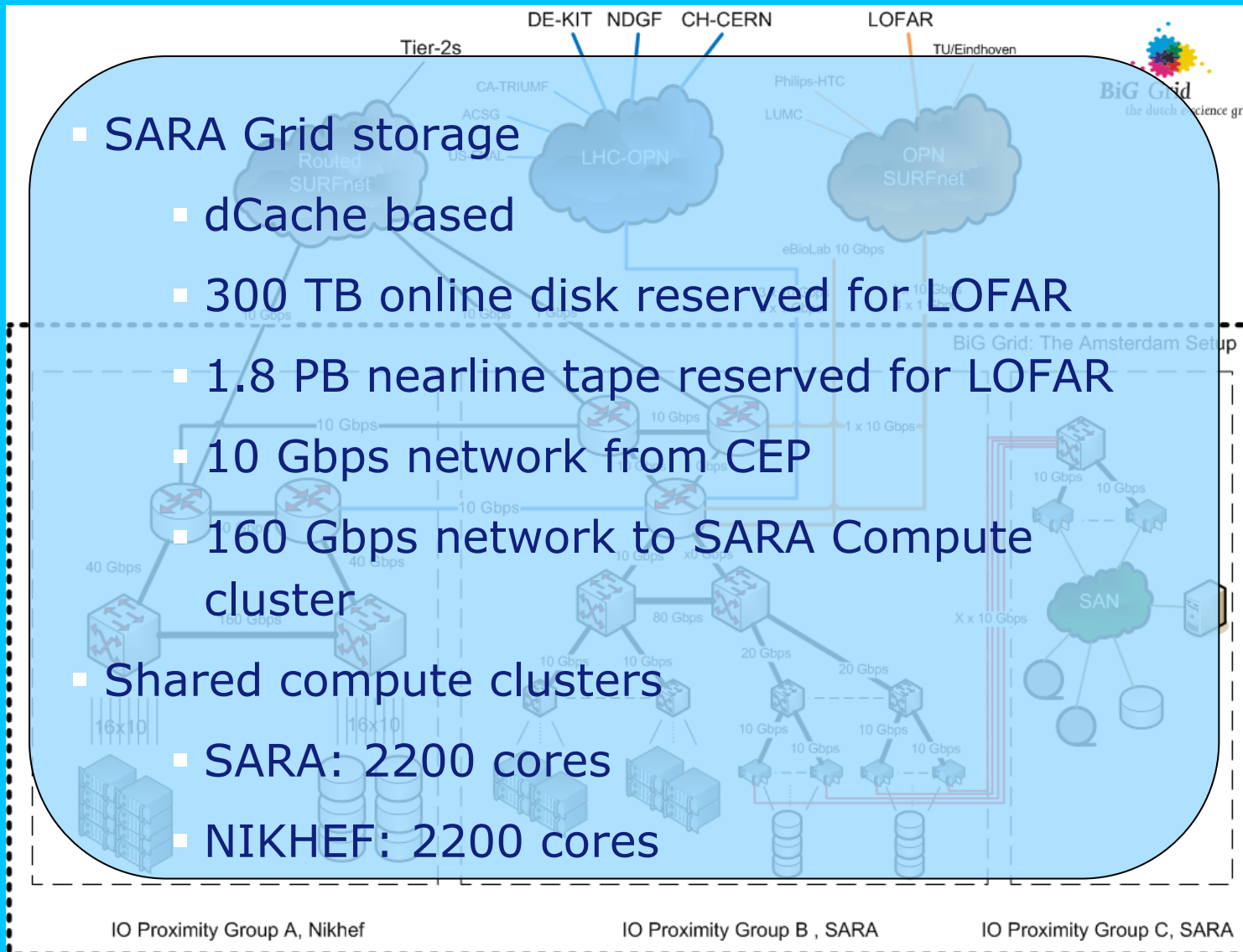
- Three sites:
  - Amsterdam (SARA: BiG Grid)
  - Groningen (TarGet project)
  - Jülich
- Storage
  - Pipeline products
  - Sometimes raw data
  - Backup important data
- pipeline processing



# Amsterdam



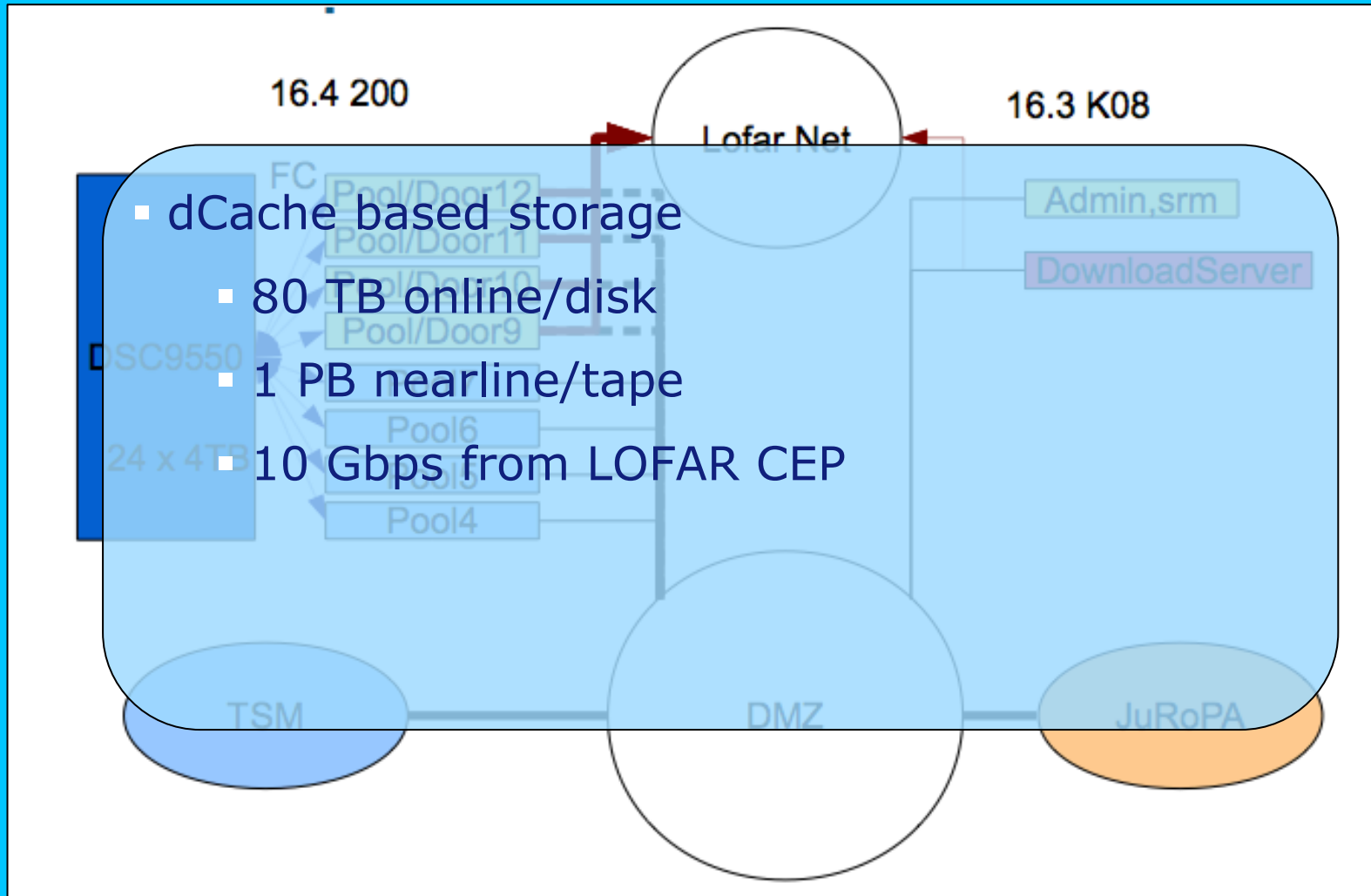
- SARA Grid storage
  - dCache based
  - 300 TB online disk reserved for LOFAR
  - 1.8 PB nearline tape reserved for LOFAR
  - 10 Gbps network from CEP
  - 160 Gbps network to SARA Compute cluster
- Shared compute clusters
  - SARA: 2200 cores
  - NIKHEF: 2200 cores



IO Proximity Group A, Nikhef

IO Proximity Group B, SARA

IO Proximity Group C, SARA



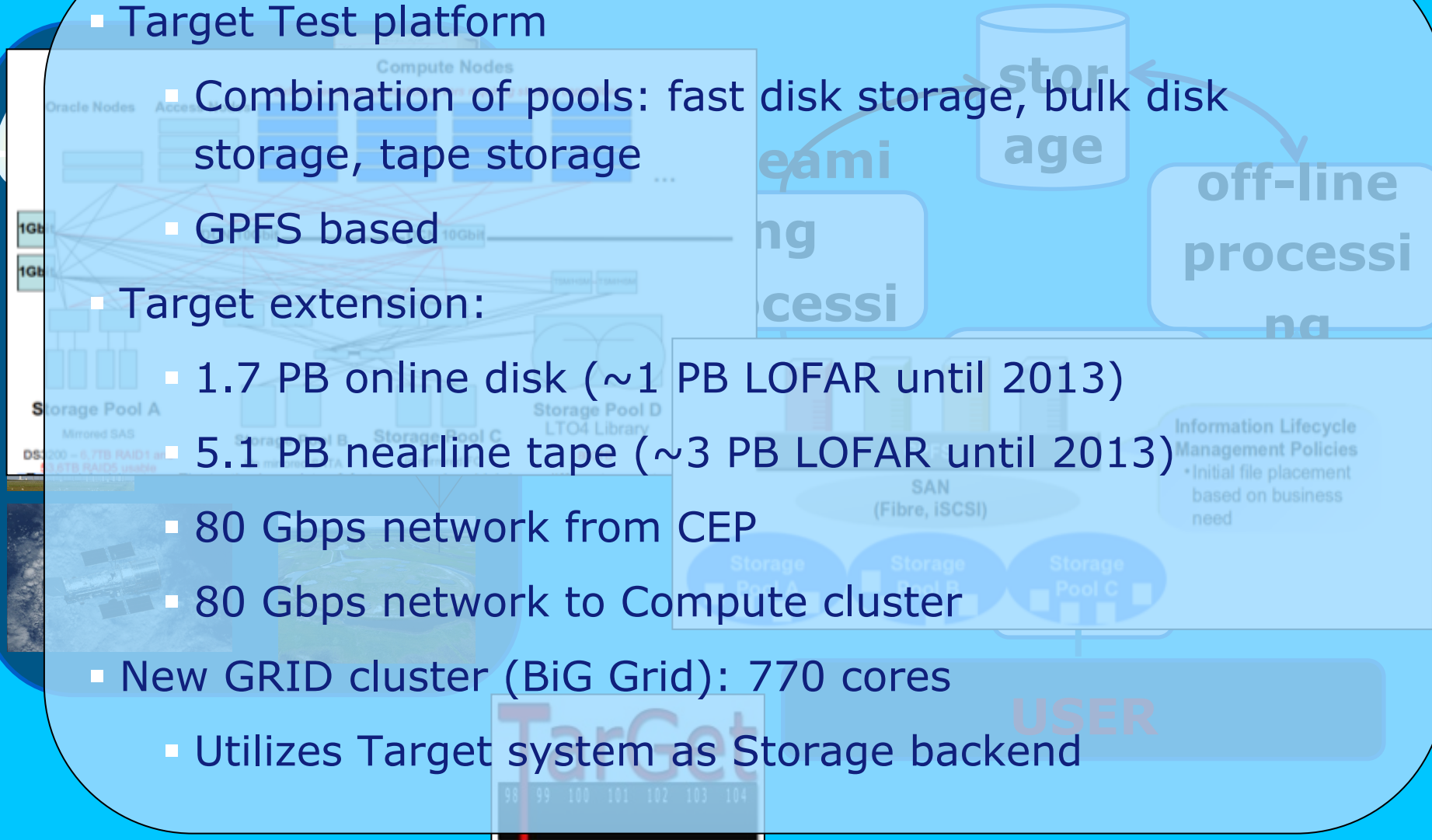
- Target Test platform

- Combination of pools: fast disk storage, bulk disk storage, tape storage ...

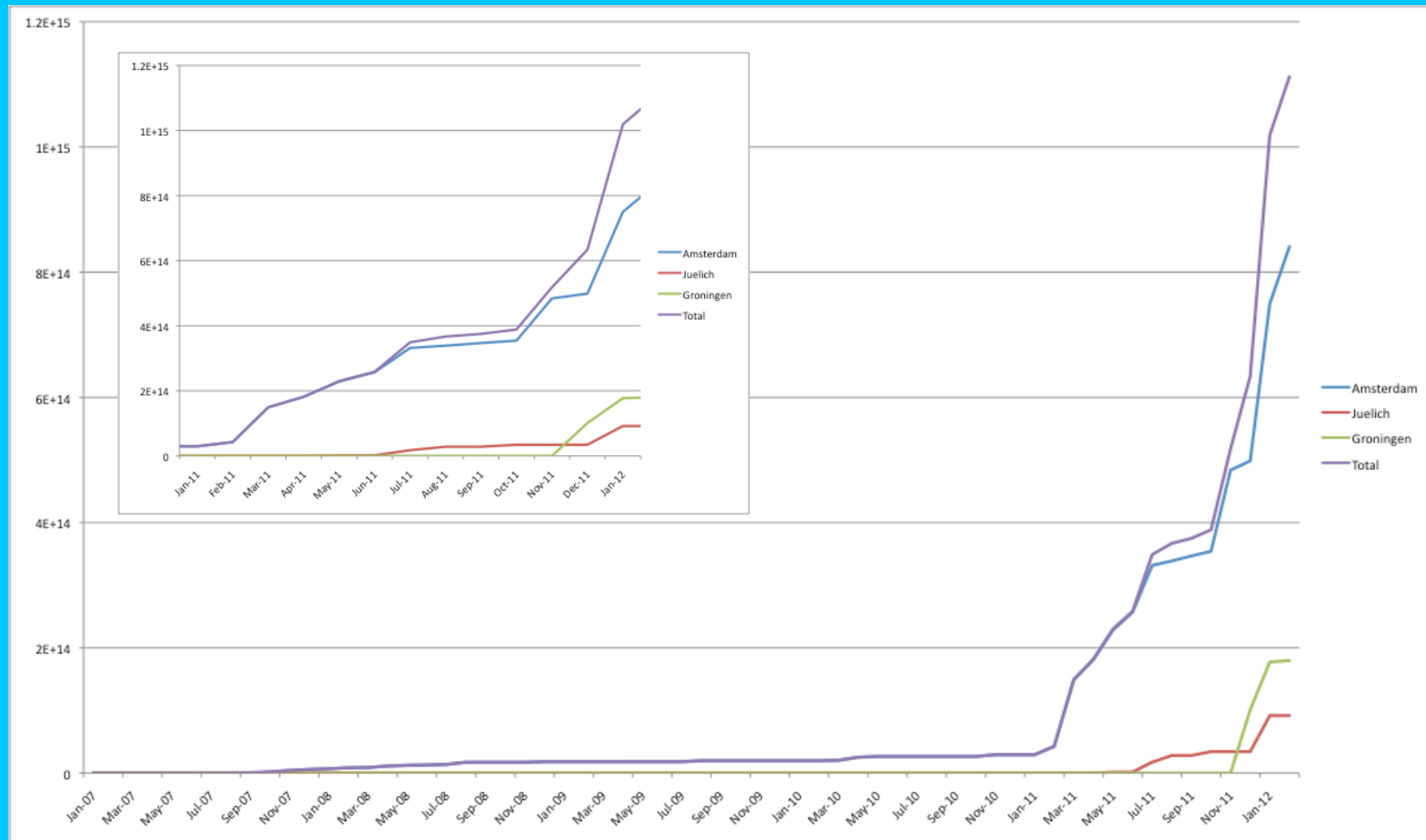
- GPFS based

- Target extension:

- 1.7 PB online disk (~1 PB LOFAR until 2013)
- 5.1 PB nearline tape (~3 PB LOFAR until 2013)
- 80 Gbps network from CEP
- 80 Gbps network to Compute cluster
- New GRID cluster (BiG Grid): 770 cores
  - Utilizes Target system as Storage backend



# Current LTA Volume



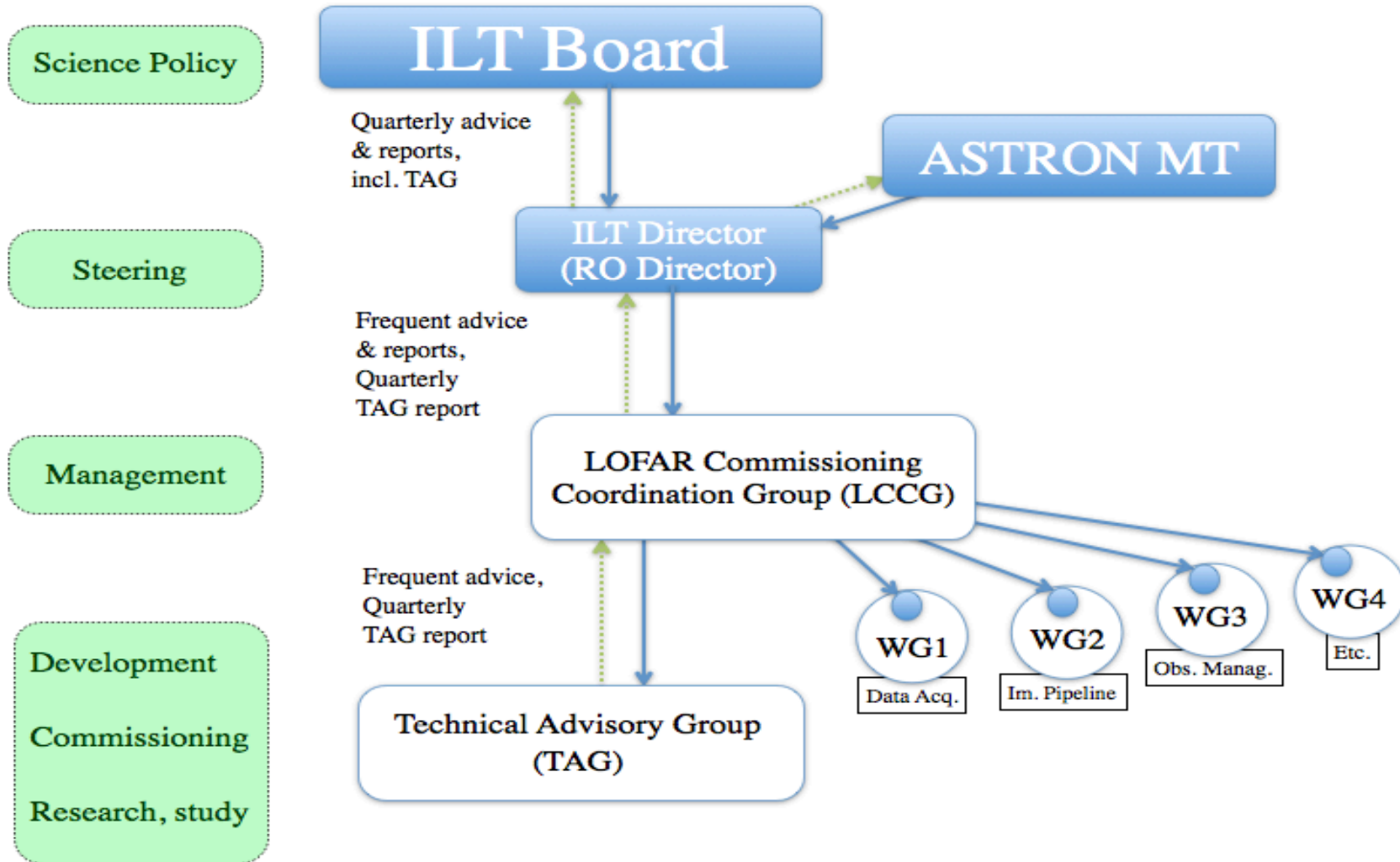
All in TB	Disk 1/2012	1/2013	In use 1/2012	Tape 1/2012	1/2013	In use 1/2012
SARA	300	500	60	1800	3700	1600
TARGET	300	1000	200	0	1700	0
FZJ	80	?	80	1000	?	100

- Superterp single clock
  - All core stations on a single clock: under construction, expected fall 2012
  - Possibly extended to all CN connected stations
  
- Successor to BG/P
  - Lease contract ends December 31, 2013
  - Various alternatives under study

# New stations, initiatives



# System Development





## LOFAR Commissioning Coordination Group

- Michael Wise: chair
- Ronald Nijboer: long term sw development planning
- Antonis Polatidis: commissioning, observations
- Harm Munk: short term sw development planning, day to day development

# System Development - planning



- LOFAR v1.0: release date April 20, 2012
  - Basic capabilities: Imaging (MSSS-like), Beam formed (pulsar)
  - Fully automatic after observation & processing specification
  - From proposal to Long Term Archive ingesting
  - Basis for CfP May 15, 2012
  - Followed by upgrades (no added observing functionality)

# System Development - planning



- LOFAR v2.0 planned release date October 2012
  - Parallel observations (including sub-arrays and piggy-backing)
  - Operability (improved metadata, etc.)
  - LTA integration (complete ingest, limited processing)
  - Data & system quality tracking
  - Initial responsive telescope (generating triggers, overrides/priority system, TBB dumps)
  - Long baseline imaging in expert mode
  - Start of fast Imaging pipeline design and development
  - 8-bit mode observing enhancements
  - Extended imaging pipeline (best-effort basis)

# System Development - planning



- LOFAR v3.0 planned release date April 2013
  - Fully responsive telescope
  - TBB sub-band mode
  - Fast imaging pipeline
  - Long-baseline imaging pipeline
  - Dynamic calibration server
  
- Setting up Surveys (Surveys, Pulsars, MKSP)
- CR processing & data handling (CR)
- Tracking Solar system objects (Solar, TKP)
- Non-MSSS like Imaging
- Extensions to pulsar pipeline

# System Development – Process



- Software development process
  - Changed from centrally led to Agile/Scrum
    - Astronomers + team responsible for high level planning
    - Team responsible for implementation planning (Team = RO and R&D sw developers)
  - Short development cycles (sprints): 3-4 weeks
  - Frequent, short coordination meetings (scrums)
    - 3 times a week, 15 minutes

# System Development – Process

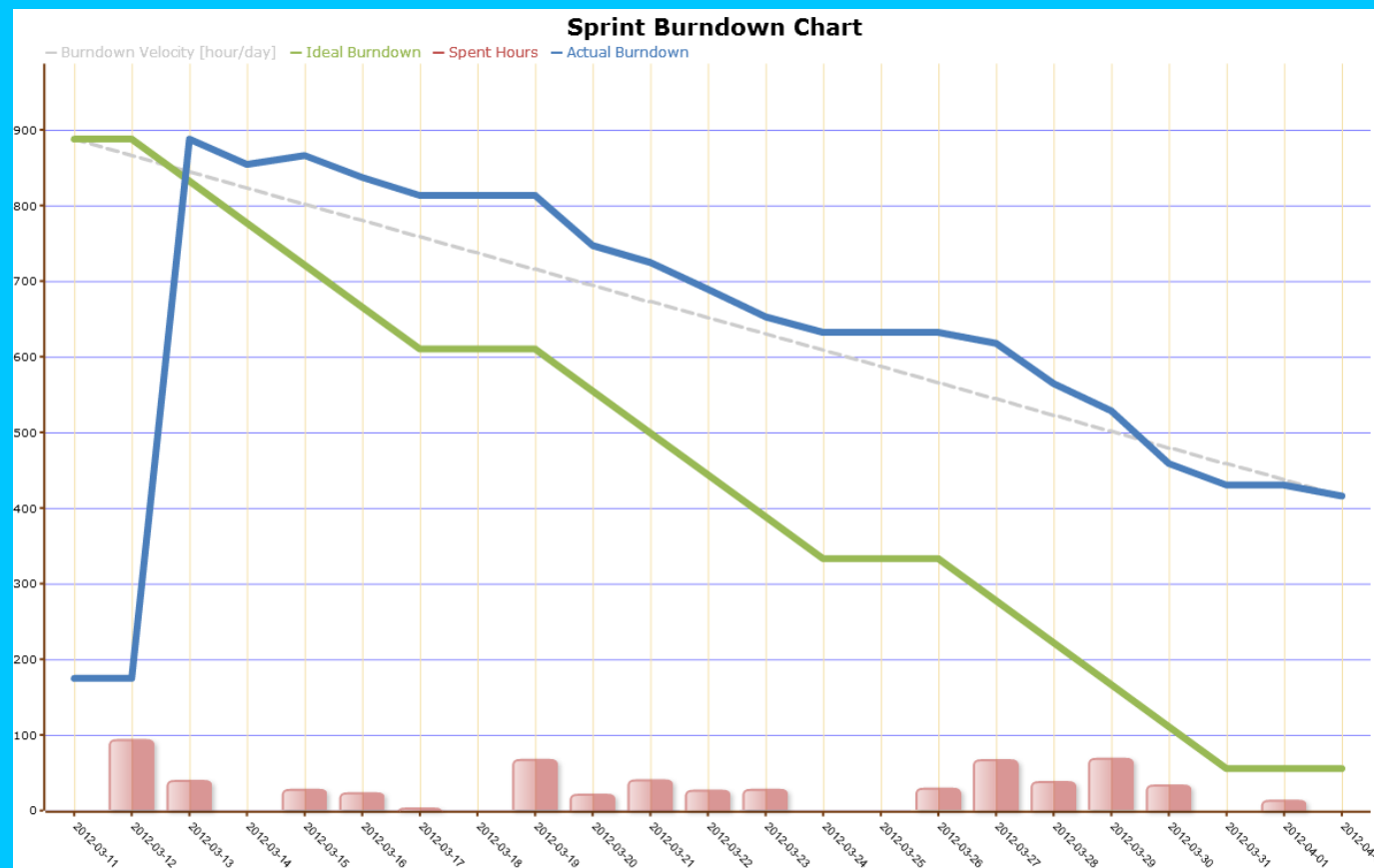


- Agile/Scrum: easy to understand, extremely difficult to master
- Complicating factor: experts
- Team is now in Sprint 0.95: 3 weeks, ~ 500 pnts planned

Sprint 0.8	4 weken	643 ptn totaal	160 ptn/week
Sprint 0.9	3 weken	722 ptn totaal	240 ptn/week
Sprint 0.91	4 weken	636 ptn totaal	159 ptn/week
Sprint 0.92	3 weken	361 ptn totaal	120 ptn/week
Sprint 0.93	3 weken	384 ptn totaal	128 ptn/week
Sprint 0.94	3 weken	472 ptn totaal	157 ptn/week

# System Development – Process

- Agile/Scrum: easy to understand, extremely difficult to master



# System Development - LCCG Groups



- Remaining working Groups
  - PULSAR, IMAGING, TRANSIENTS, MAGNETISM, LONG BASELINES
- 'Observation management' working groups meet ad-hoc
- Working groups report to LCCG biweekly



# Organisation - LOFAR station representatives



- Station representatives
  - organisational, day-to-day operations, technical support
- Day-to-day operations:
  - ILT TO page on LOFAR Wiki:  
<http://www.lofar.org/operations/doku.php>

# Organisation



- **ILT**
  - **Partners**
    - **NL, DE, SE, UK, ASTRON**
    - **LOFAR CV (partnership with managing and silent partners)**

# Organisation



	<b>Station</b>	<b>Fin. &amp; Org.</b>	<b>Operations</b>	<b>Support</b>
DE	Effelsberg	M. Kramer	James Anderson	
	Garching/ Unterweilenbach		Benedetta Ciardi	
	Tautenburg	A. Hätzes	Mathias Hoeft	
	Potsdam		Christian Vocks	
	Jülich		Meike Jahn	Enno Middelberg
FR	Nancay		Jean-Mathias Griesmeier	Ivan Thomas
SE	Onsala		Leif Helldner	Henrik Olofsson
UK	Chilbolton		Derek McKay	Alan Doo
NL	Dutch stations	R. Vermeulen	H. Munk	ROCR

# Organisation, meetings



- Telephone conferences
  - Station managers
    - monthly, preceding CEP stop day
    - April conference replaced with TO meeting
    - CEP stopdays: 1<sup>st</sup> Monday of the month
  - Weekly on observation schedule
    - From several weeks before 1<sup>st</sup> observation semester (mid September 2012)
- Wiki
  - LOFAR Wiki: ROCR whiteboard
  - LOFAR Cookbook
- Email exploders

# Station Maintenance



- Station maintenance NL
  - LBA damage
    - Small deer; rodents
    - Downed LBAs detectable through station test
    - Surprisingly immune to lightning (so far)

# Station Maintenance



- Station maintenance NL
  - HBA damage
    - Birds: damaged covers
    - Rodents: rubbers
    - Mice (occasionally)
    - Climatic effects
      - Moisture
      - High winds, in combination with low temperatures
  - Cable damage
  - Gras, weeds, etc

# Station Maintenance



- Outsourcing routine station maintenance and repair
  - 4 visits / station / year
  - 2 people: expert + technician
  - Working on new, simplified maintenance support system
- In house specialised station trouble shooting and repair
  - Difficult problems, cause analysis
- Extra, quick inspection after adverse weather conditions:
  - High winds
  - Heavy precipitation
  - Low temperatures

# Station Maintenance



- International stations
  - Effelsberg
  - Tautenburg
  - Garching/Unterweilenbach
  - Potsdam
  - Jülich
  - Nancay
  - Onsala
  - Chilbolton
- Maintenance visit from ASTRON once a year (ILT)



# Station Maintenance



- International Stations
  - Airconditioning unit: local maintenance
  - Container RFI cabin check: COMTEST
- Spare parts
  - Four extra stations have depleted spare parts stock
  - HBA repairs have depleted spare parts stock even further
    - Stored HBA tiles (for Dutch stations) cannibalised
    - New production run completed
- Broken parts replacements financed by ILT
  - Transportation costs for 'station owner'
  - Please add your address to LOFAR Wiki

# Station Maintenance



- Station Tests
  - Weekly test, international stations included
    - Waiting for test (pilot) transmitter
    - Results to be available on [LOFAR web](http://lcs023.control.lofar/stationstatus/startup.html) (already in ROCR for Dutch stations):  
<http://lcs023.control.lofar/stationstatus/startup.html>

# Station operation – First CfP

## Division of time 1<sup>st</sup> semester



- Further commissioning (33%)
  - Maintenance (7%)
  - Director's discretionary time (5%)
  
  - Open Skies access (5.5%)
  - NLLAC reserved access (31.9%)
  - GLOW reserved access (9.35%)
  - FLOW, LOFAR-Sweden, LOFAR-UK reserved access (2.75% each)
- [Local station-owner stand-alone operations (5.5%)]
- After a year, the fraction of Open Skies will be increased, and the fraction required for commissioning is expected to decrease

# Station Operation



- 62/61 beamlets
  - RSP Firmware problem: not understood
- Switching between Stand-alone and ILT-mode
  - Customised script for each IS
  - Available for DE601, DE603, FR606, and UK 608

# Station Operation - MSSS



- Commissioning project
  - Develop imaging pipeline
    - Under construction
    - Works well away from A-team
  - 72% of LBA observations completed
  - HBA observations under test
    - HBA\_INNER\_JOINED
  - Bootstrap imaging

# Station Operation – MSSS HBA status

