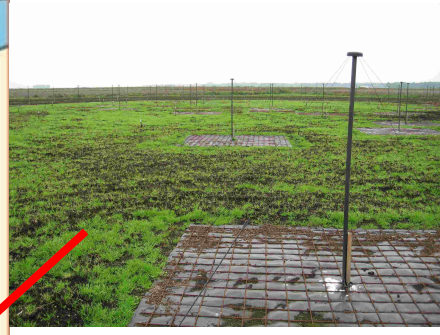
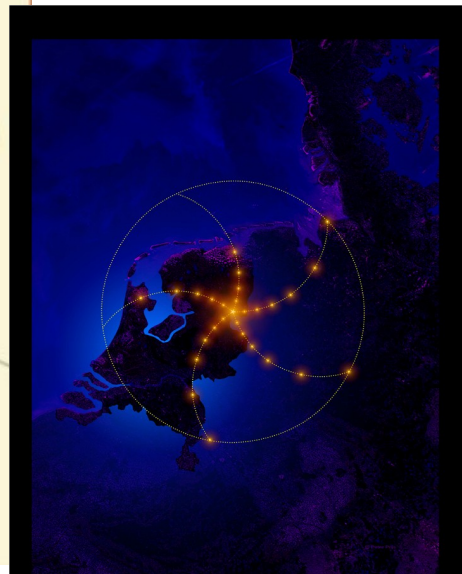
LOFAR Station Processing

André W. Gunst
ASTRON

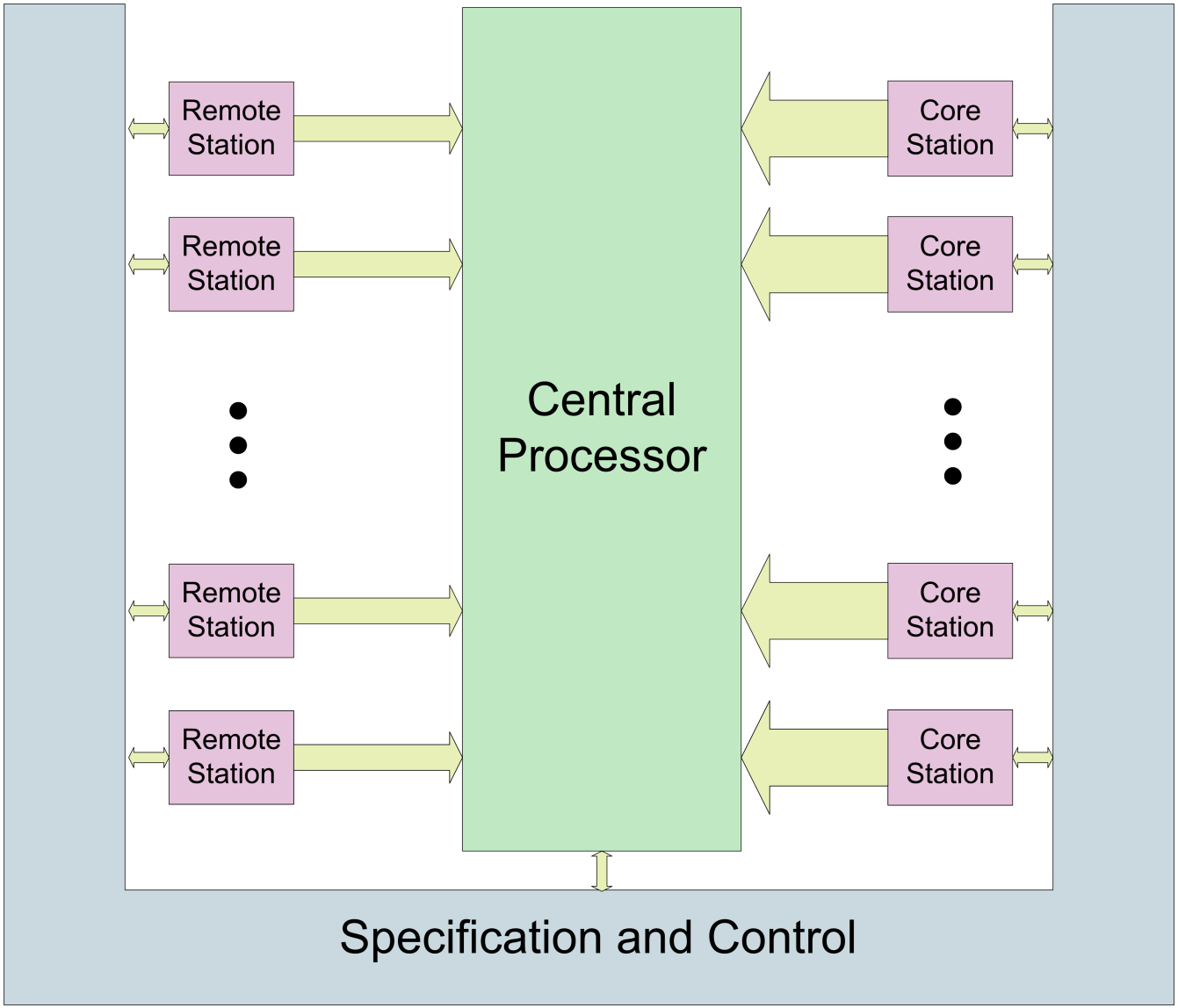
The Instrument



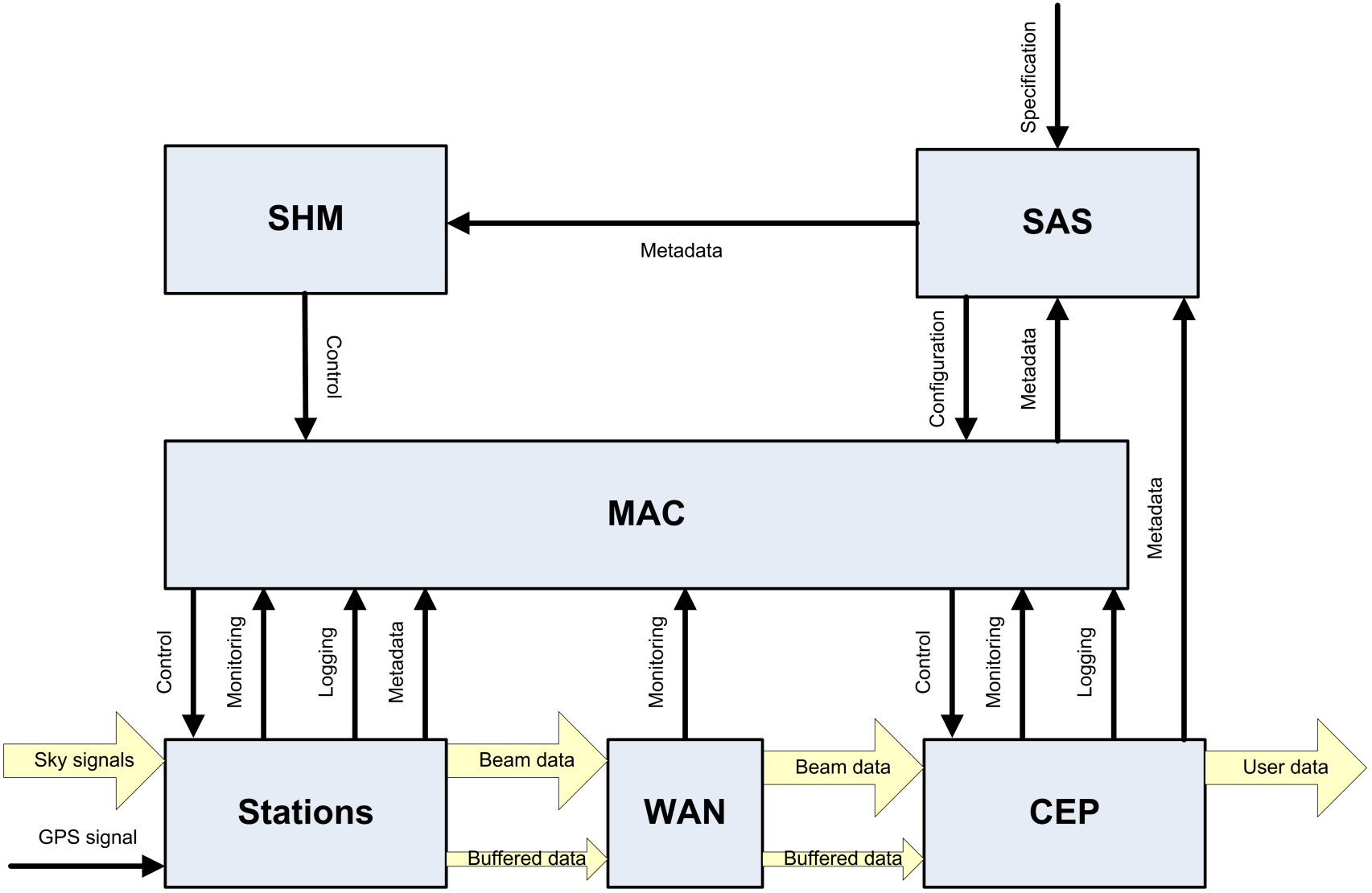


Friesland
Groningen
Drenthe
Leeuwarden
Groningen
Assen
Exloo
Eemshaven
Emden
Delfzijl
Harlingen
Sneek
Drachten
Heerenveen
Veendam
Emmen
Meppel
Hoogeveen
Coevorden
Meppen
Emmeloord
Den Helder
Alkmaar
Lelystad
Zwolle
Amsterdam
Almere
Deventer
Apeldoorn
Amersfoort
Utrecht
Enschede
A31
N31
A32
A7
A6
A50
A28

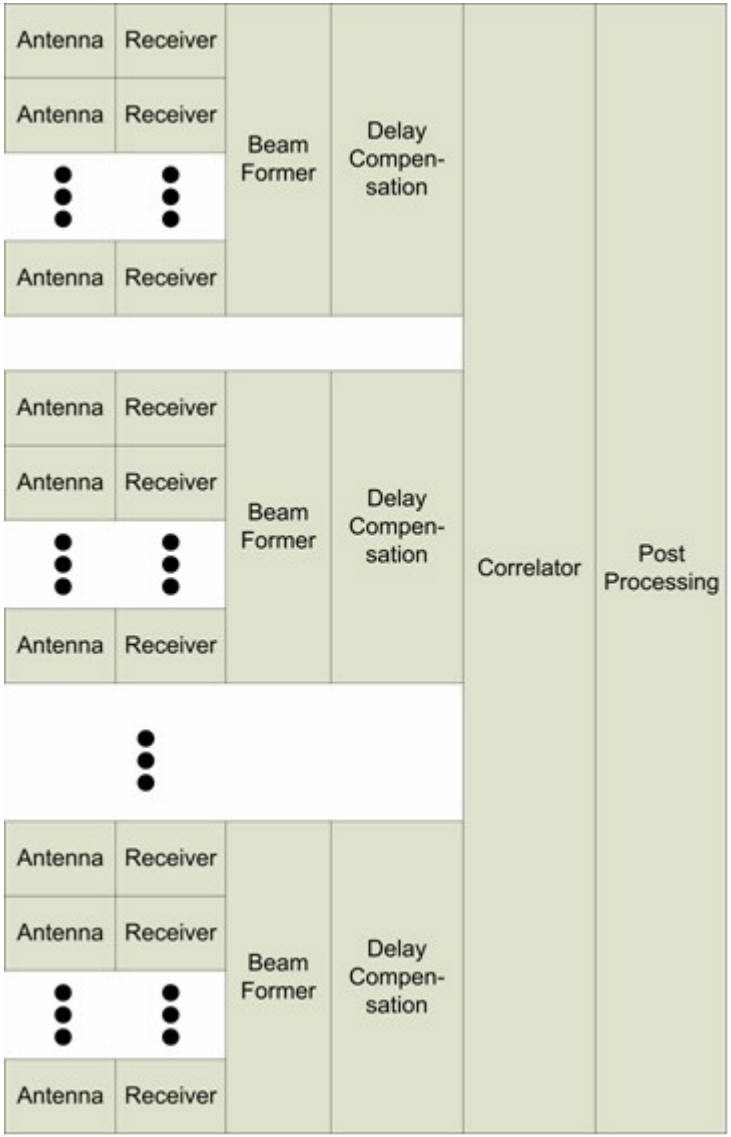
LOFAR System Overview



Top level architecture



Signal Processing Chain

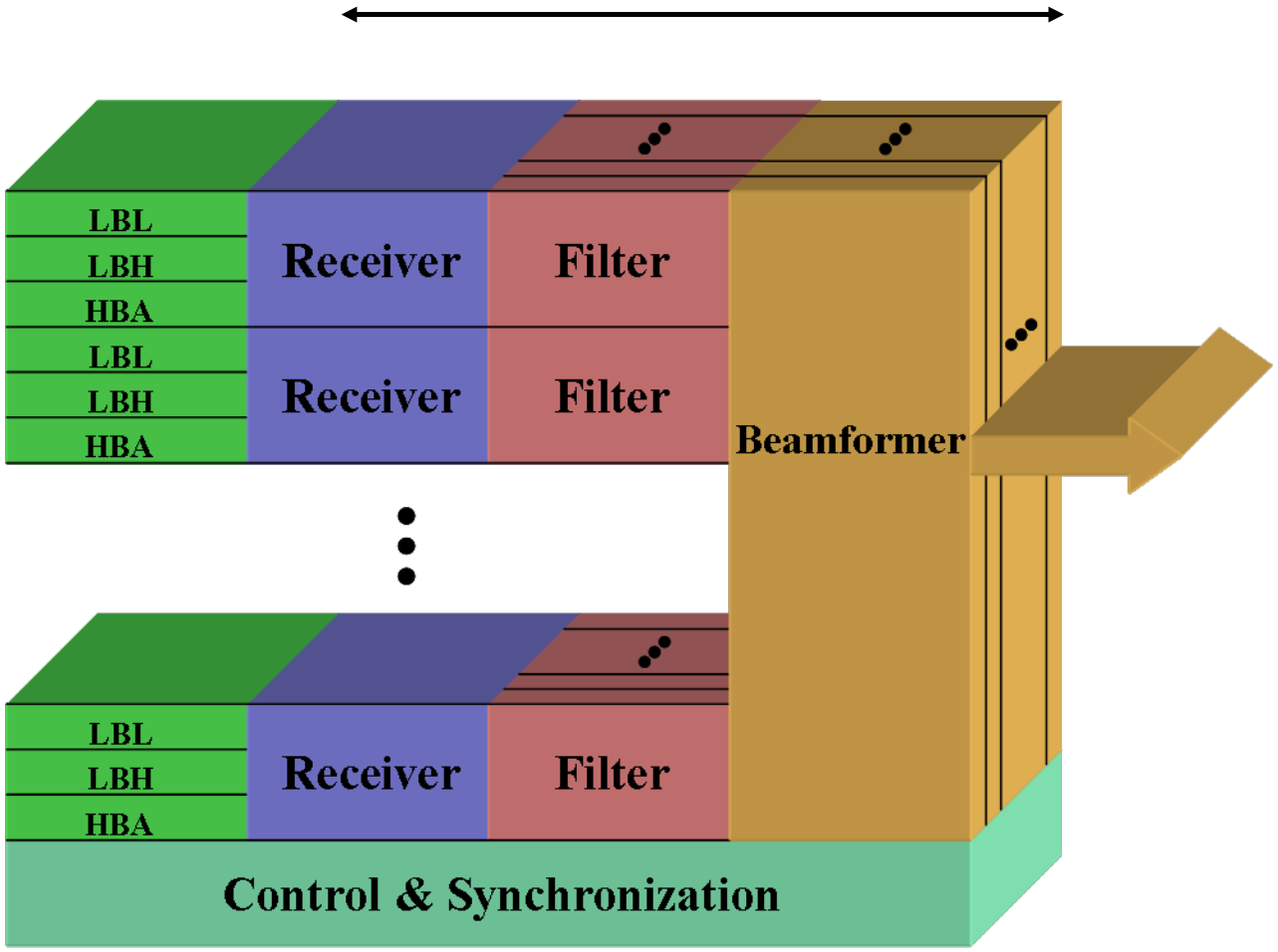


Remote Station Architecture

Optional
10- … MHz

30-80 MHz

120-240 MHz

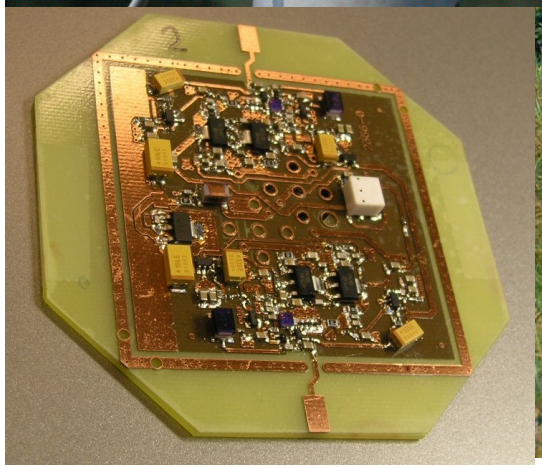


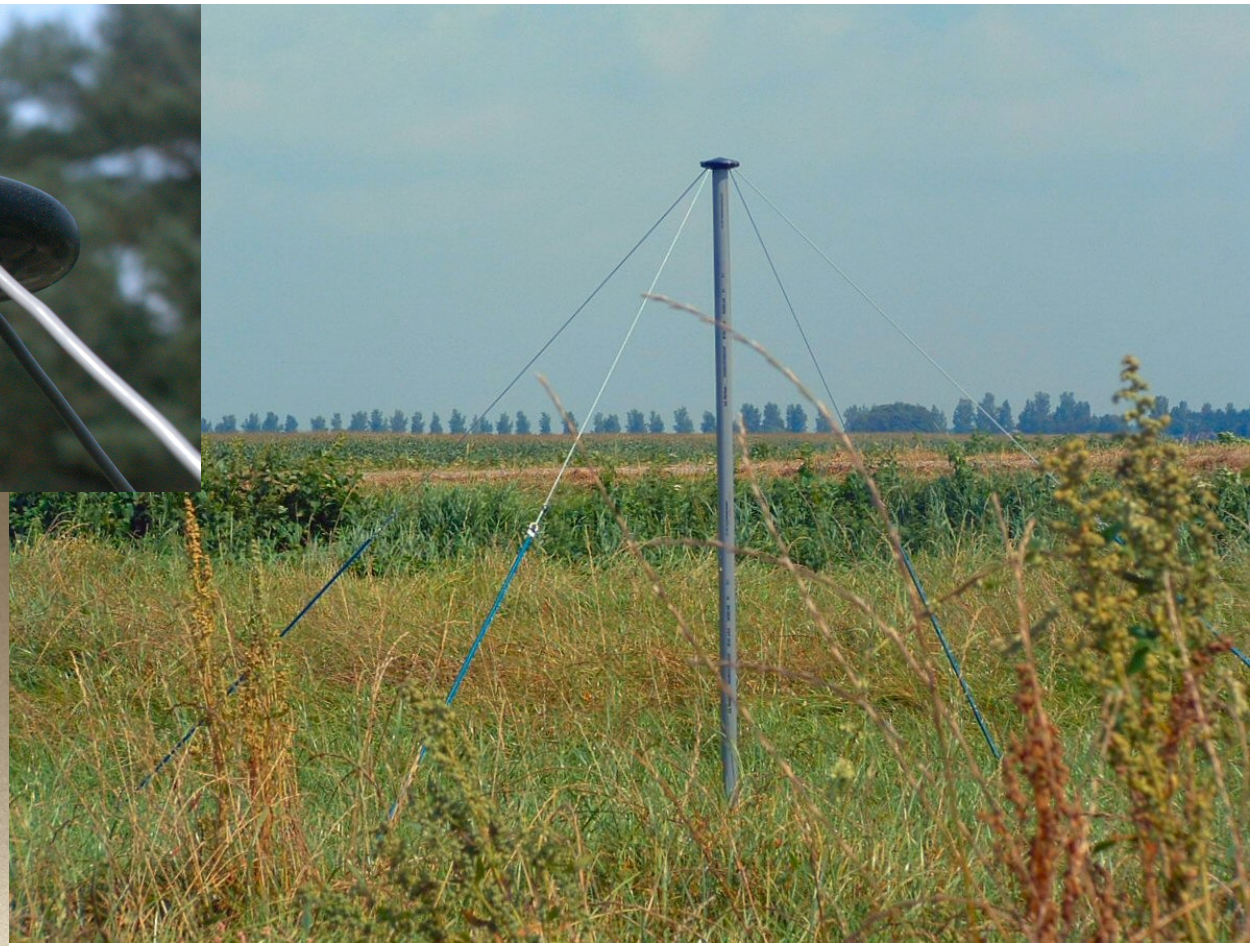
Key Numbers

Description	Value	Unity
# subbands	512	
Max. number of beams (B = 4 MHz)	8	
Min. number of beams (B = 32 MHz)	1	
A/D converter resolution	12	bit
Sample frequency	200 / 160	MHz
Number of polarizations	2	
Output word width (complex)	16+16	bit
Aggregate output bandwidth	32	MHz
Output data rate	2048	Mbit/s
Transient buffer storage period	1	s

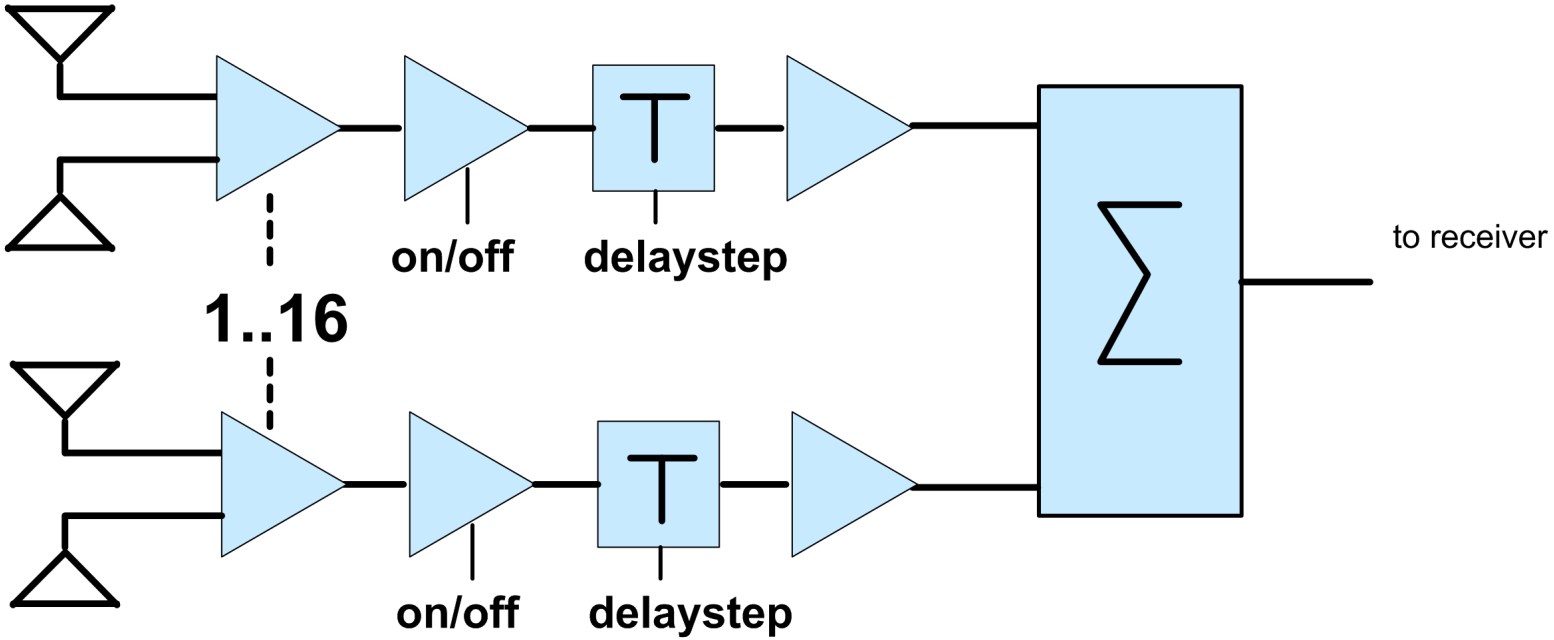
Description	Value for fs of		Unity
	160 MHz	200 MHz	
Subband width	156	195	kHz
Number of beamlets	206	165	

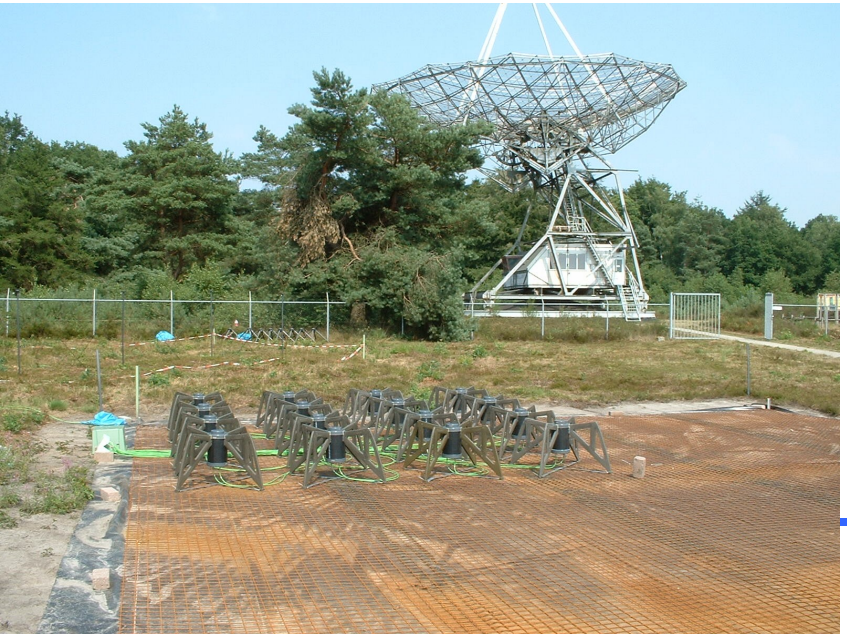
Low Band Antenna (30-80 MHz)



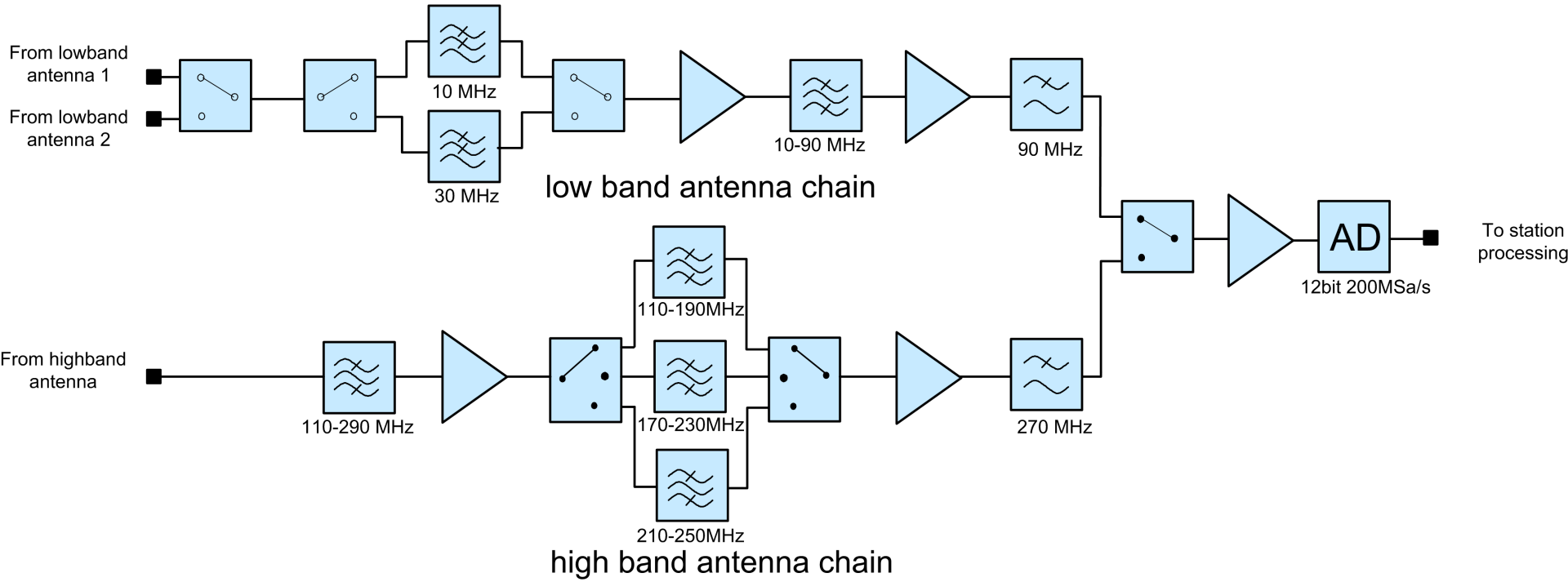


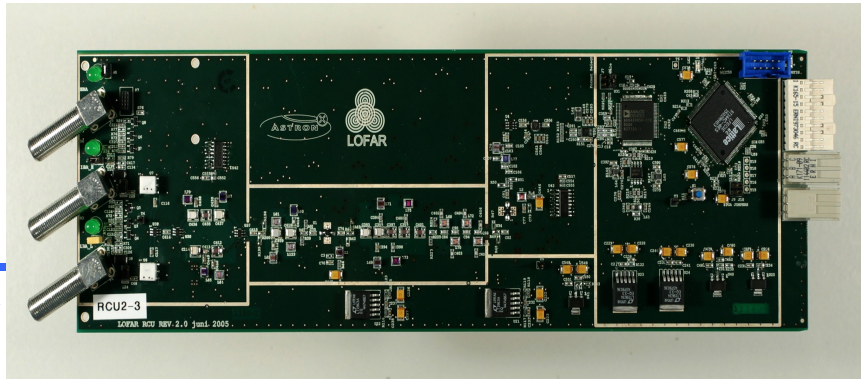
High Band Antenna (120-240 MHz)



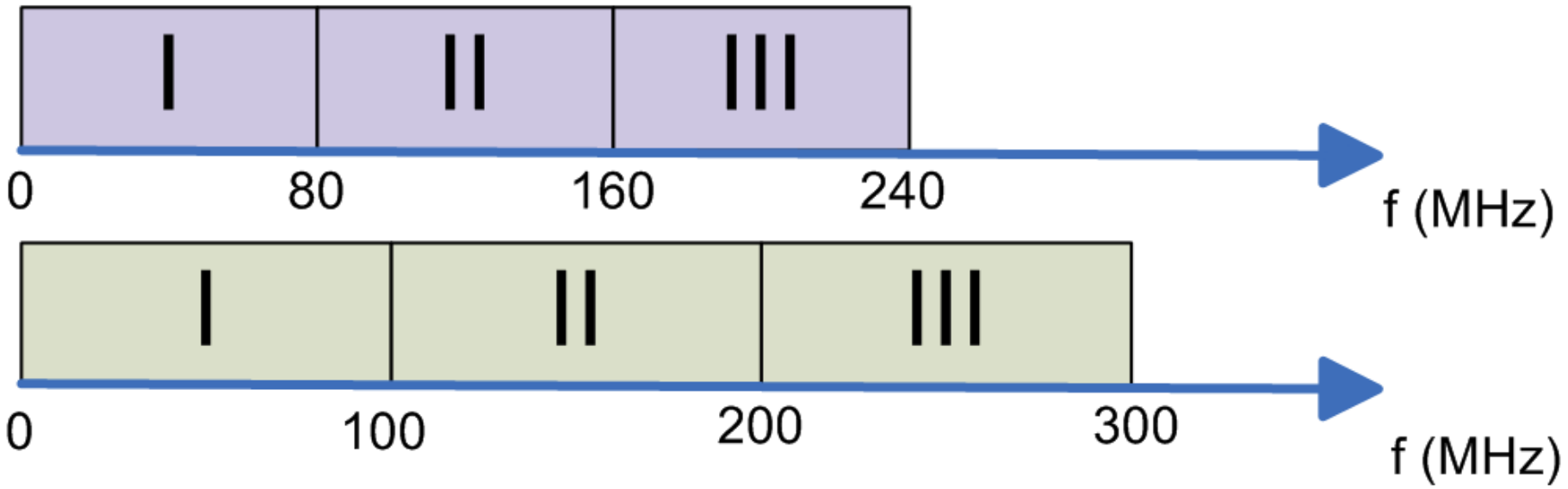


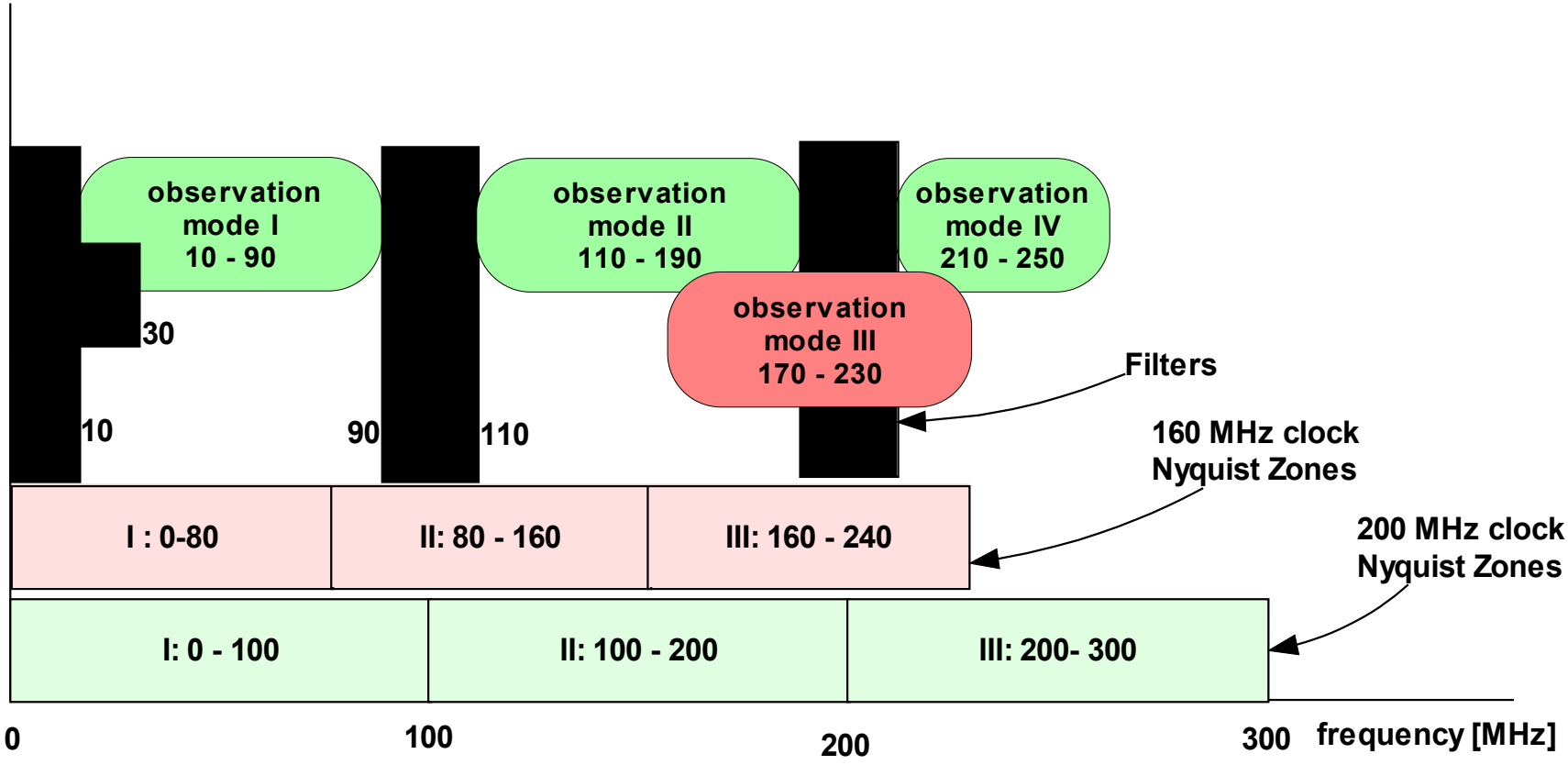
Receiver



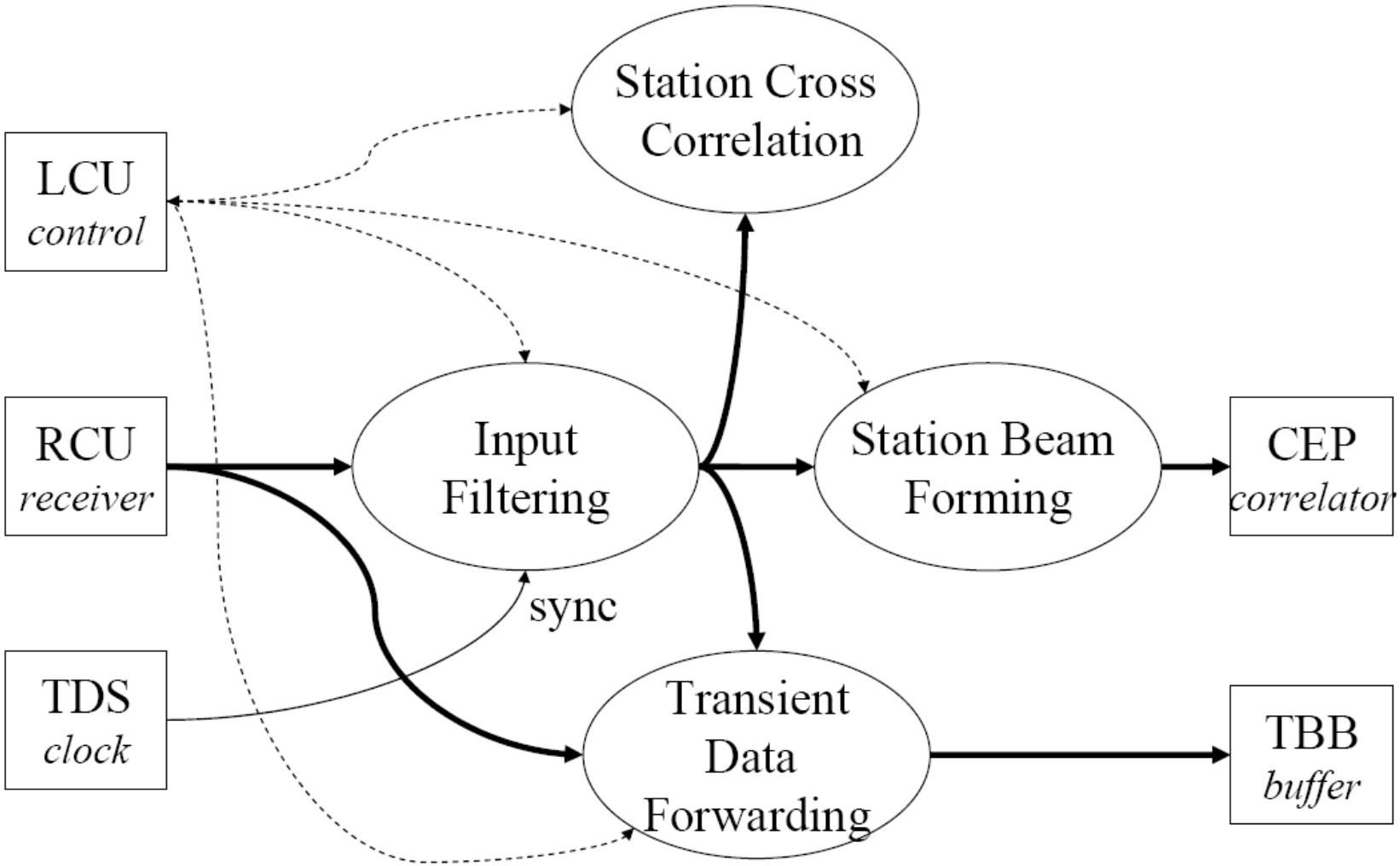


Receiver Bands

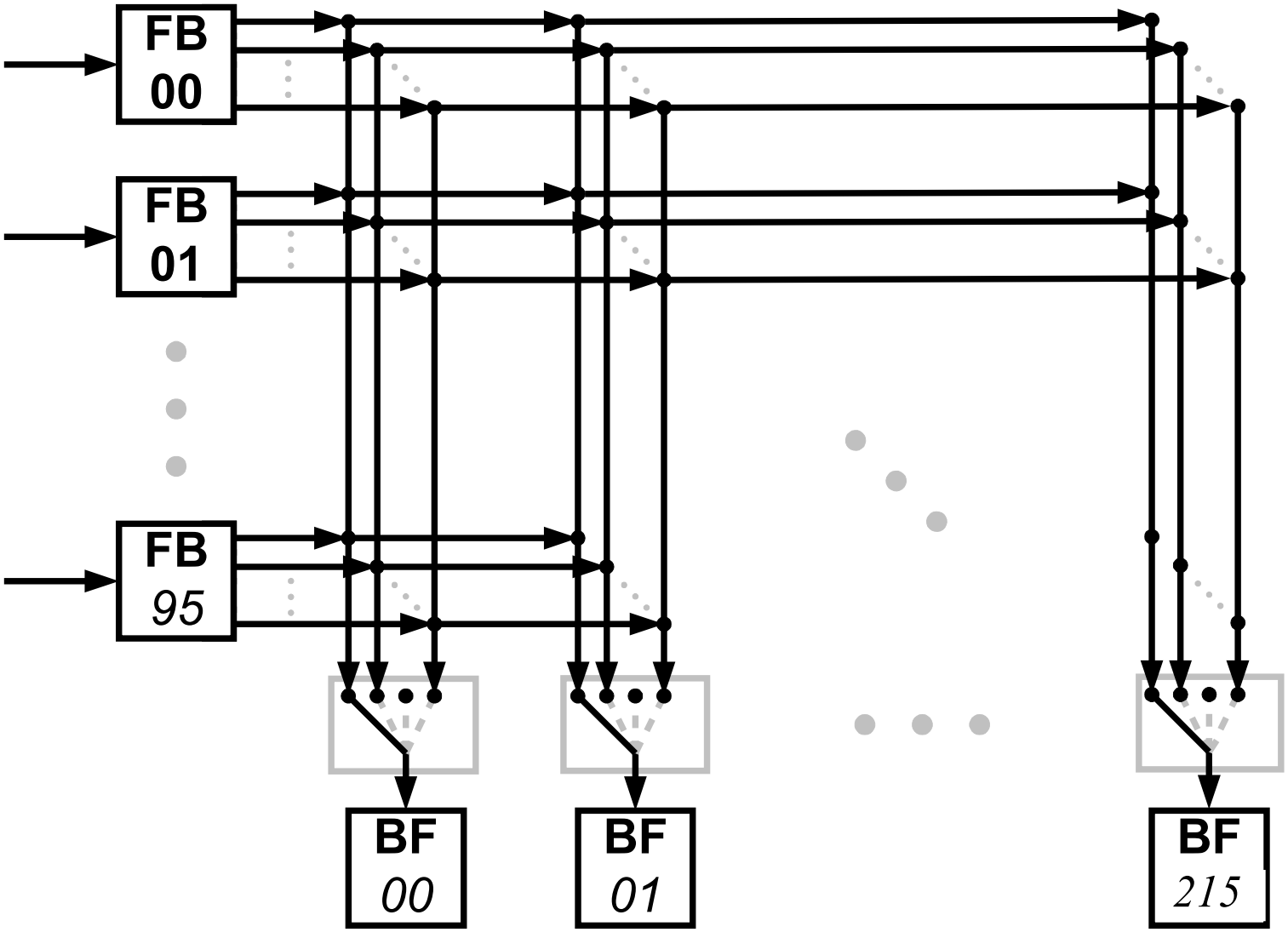



observation
mode I
10 - 90
observation
mode II
110 - 190
observation
mode IV
210 - 250
observation
mode III
170 - 230
30
10
90
110
Filters
160 MHz clock
Nyquist Zones
I : 0-80
II: 80 - 160
III: 160 - 240
200 MHz clock
Nyquist Zones
I: 0 - 100
II: 100 - 200
III: 200- 300
0
100
200
300
frequency [MHz]

Top Level Digital Processing Functions

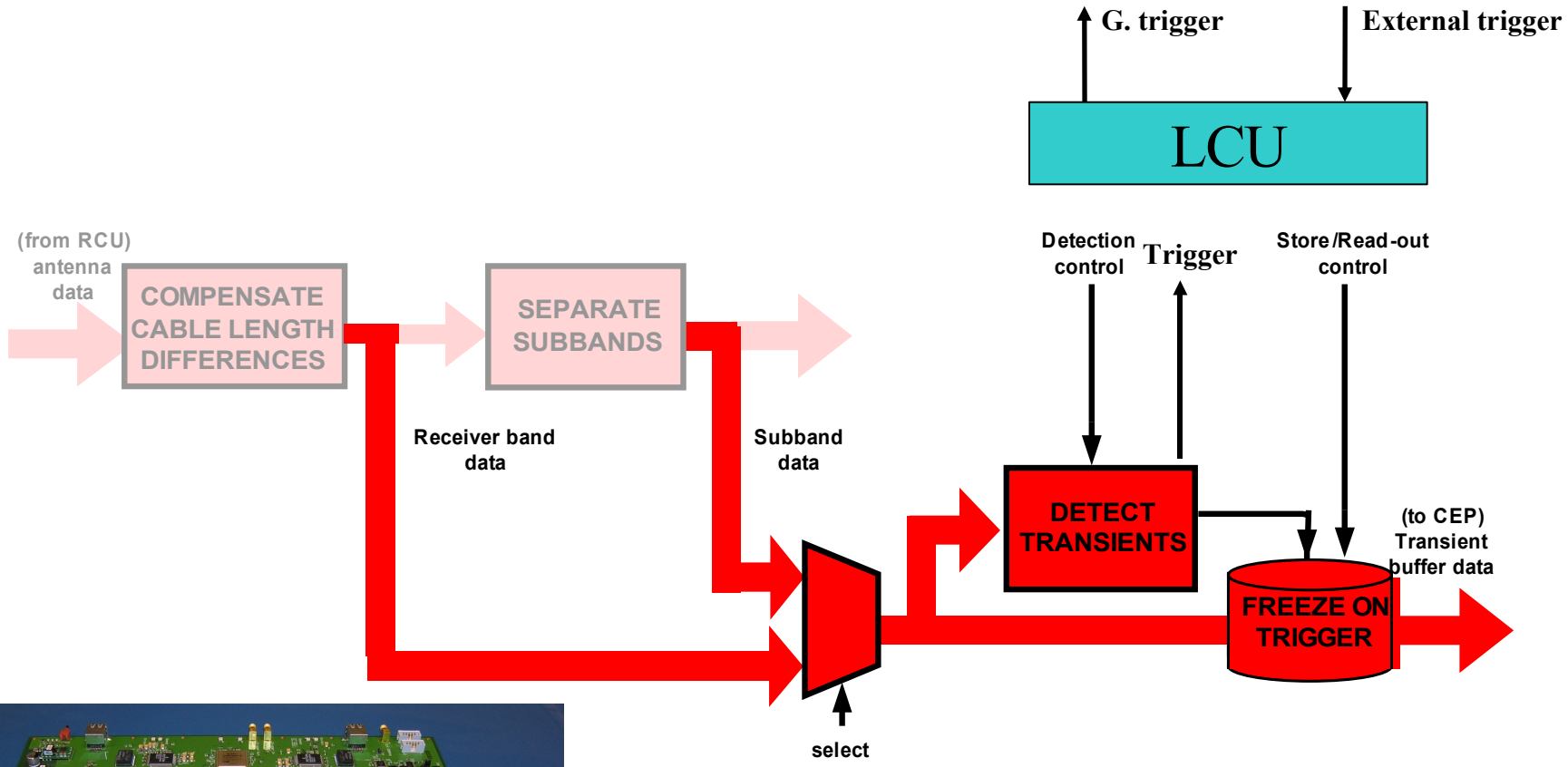


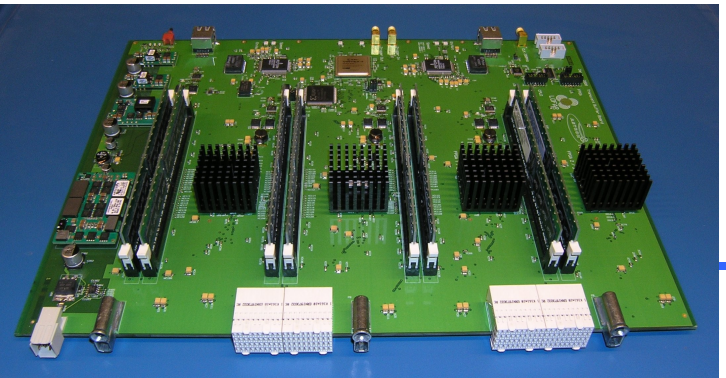
Selecting subbands



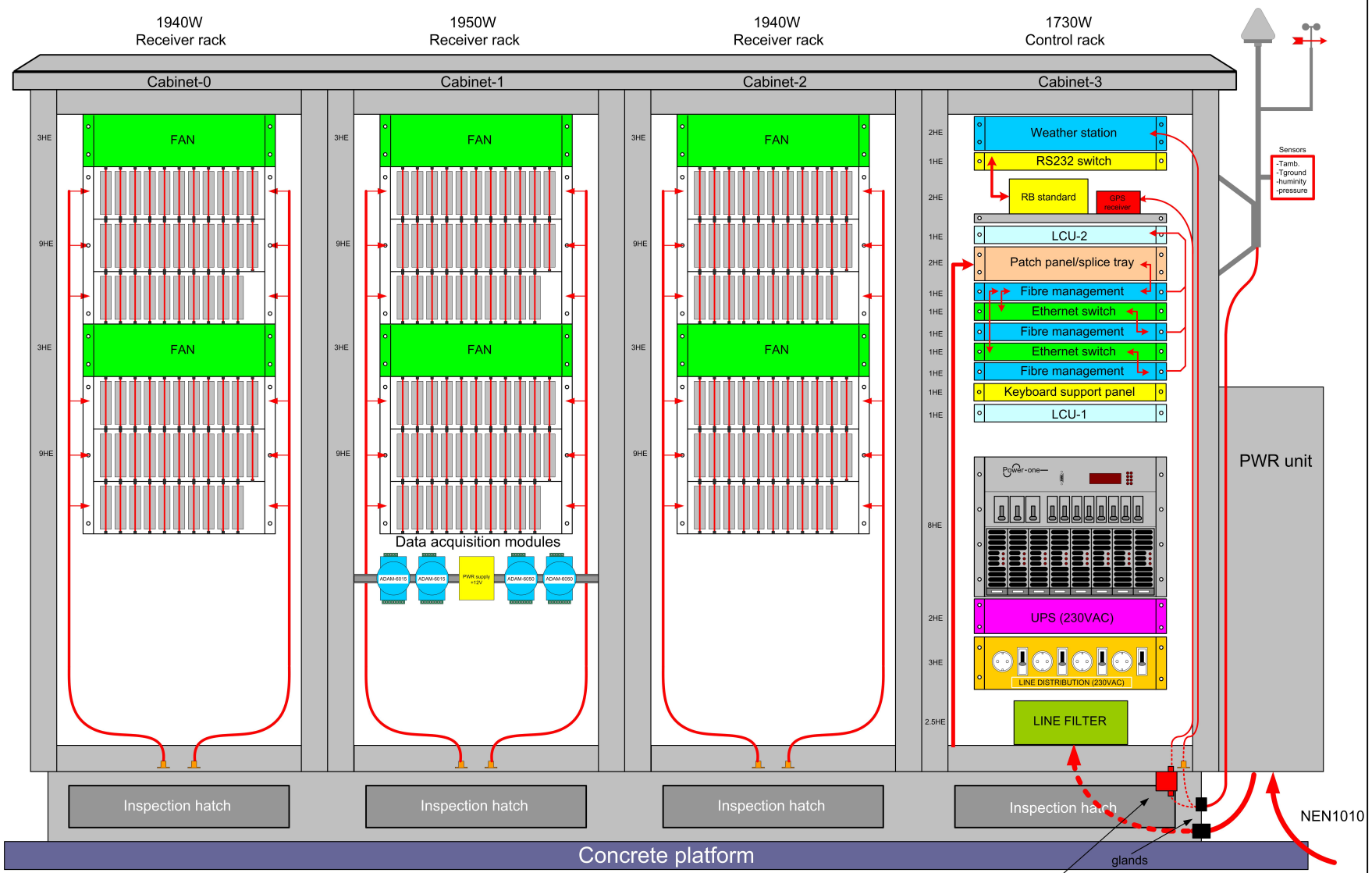
Remote Station Processing Board

Transient Buffering





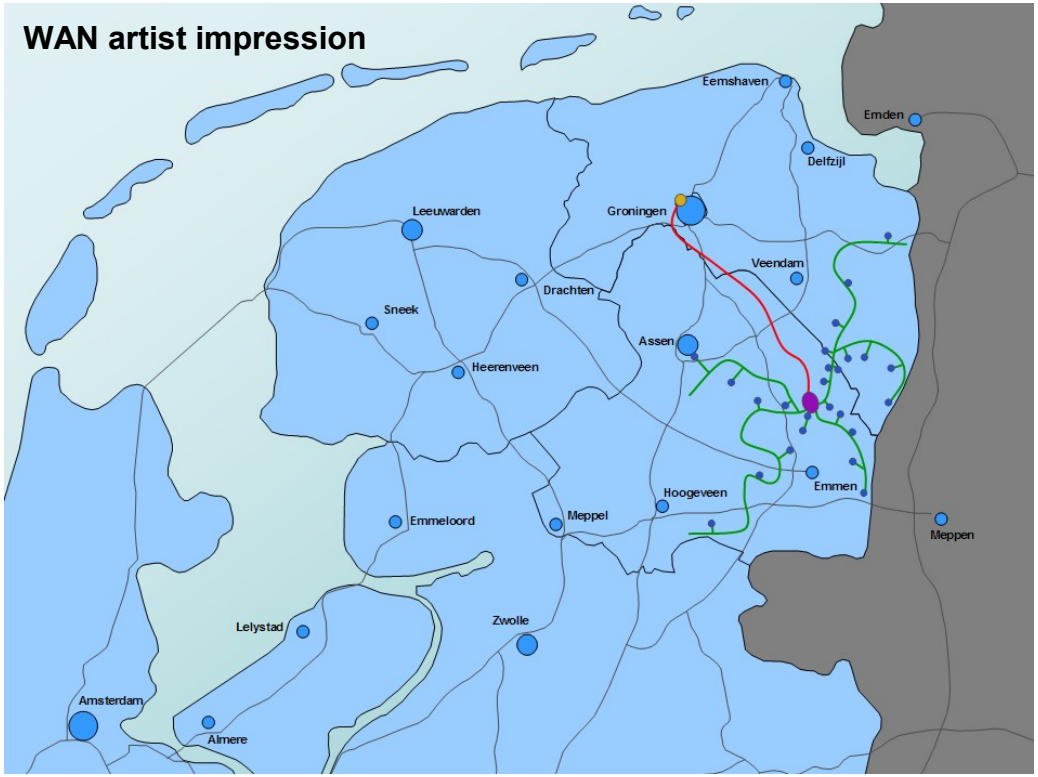
Remote Station Cabinets



Front view
19" profiles 36 HE
Total height 2000 mm

LOFAR			
Title: Sketch of Station Unit (4 cabinets)			
Document Number File: Sketch of Station Unit 2	Y. Koopman	REV	
Date: 18-apr.'06	Sheet 1 of 1	Size A3	

LOFAR-WAN: Characteristics



LOFAR - Core

- ~ 32 stations
- 2 Gb/s per station initially
- 12 Gb/s per station after upgrade
- Intra Core distance < 5 km

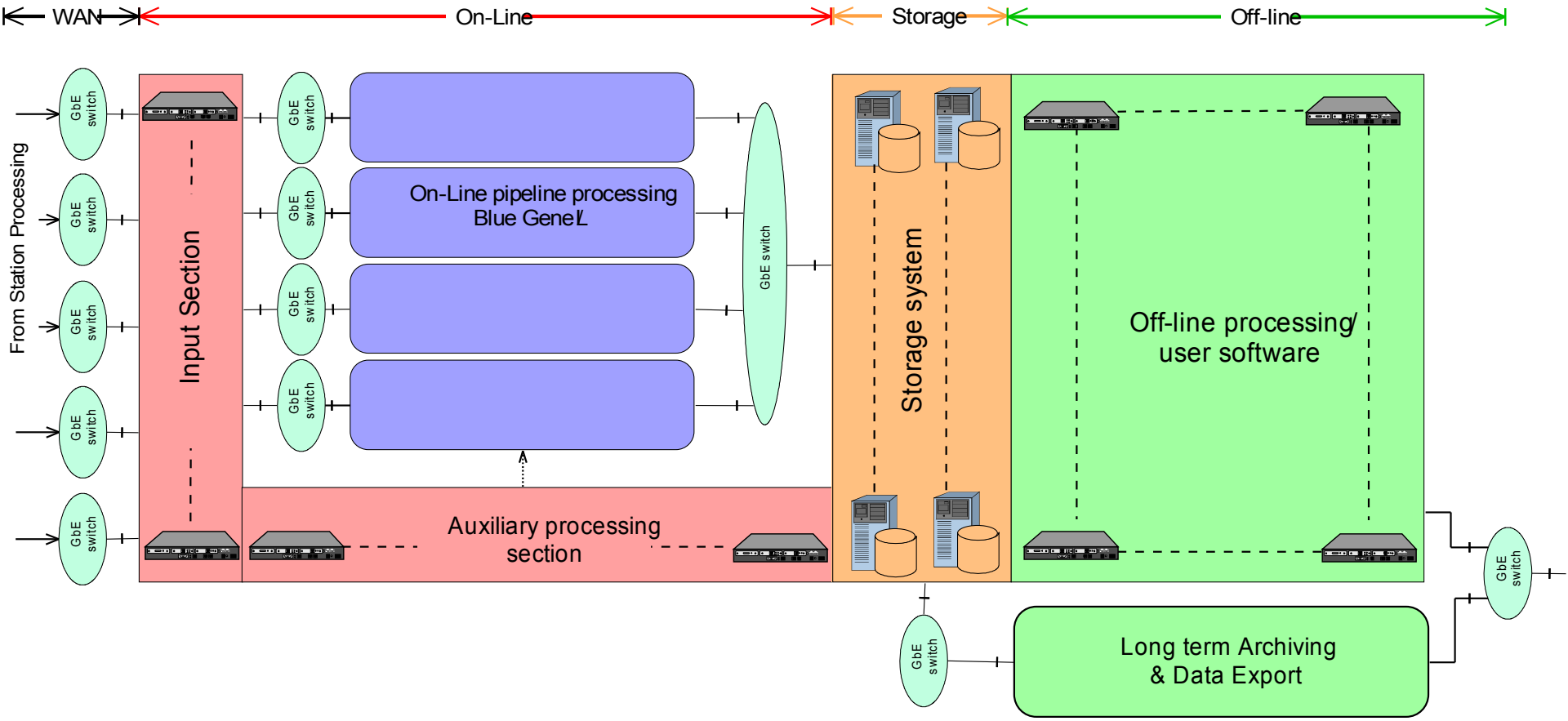
LOFAR - arms

- ~ 45 stations
- 2 Gb/s per station
- Distance to LOFAR - Core < 120 km

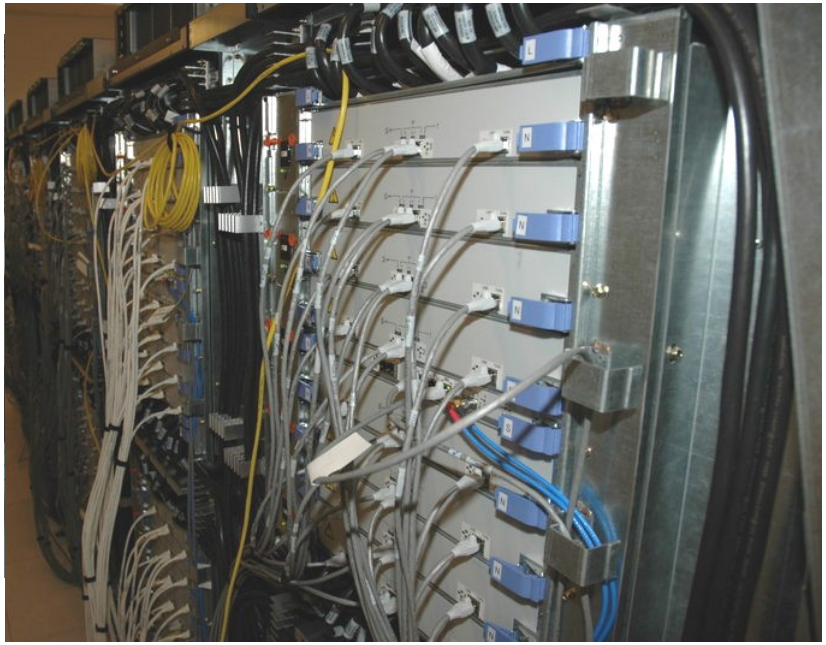
LOFAR - WAN characteristics

- Unidirectional data transport
- No data routing
- Upgradeable

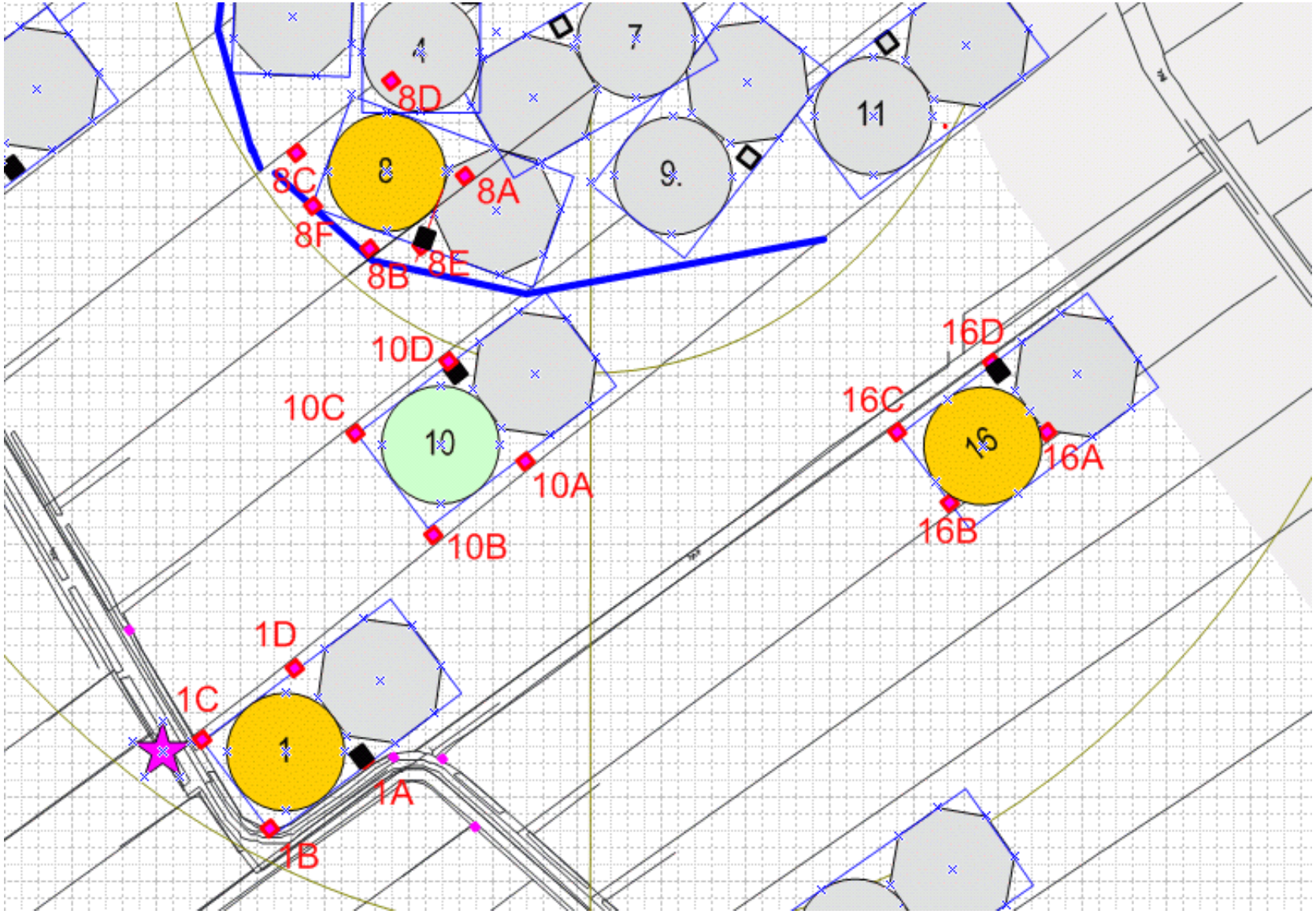
CEntral Processing Facility



Blue Gene/L installation April 2005



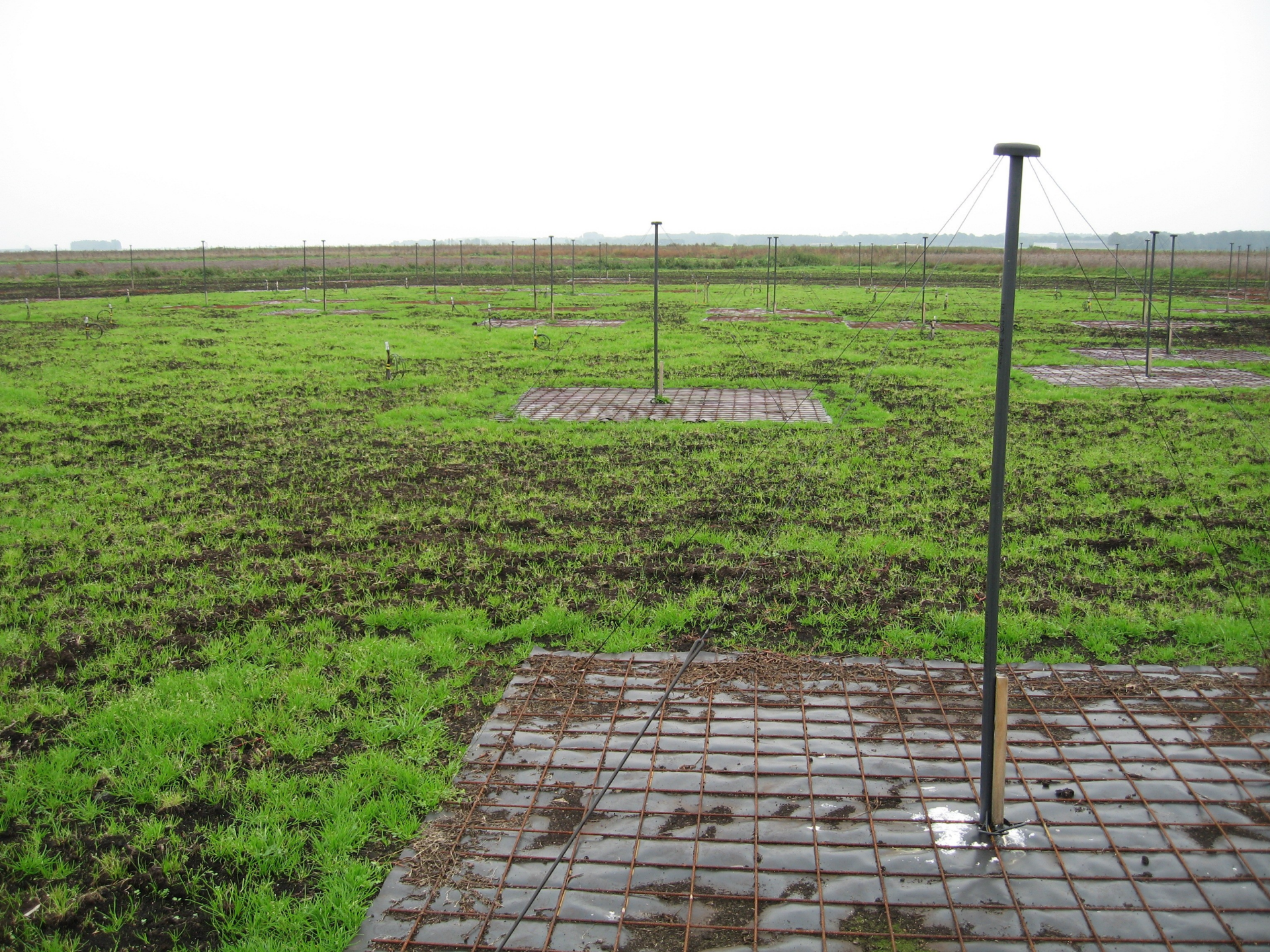
The Realization




CS-08
CS-10
CS-01
CS-16


CS-08


CS-10



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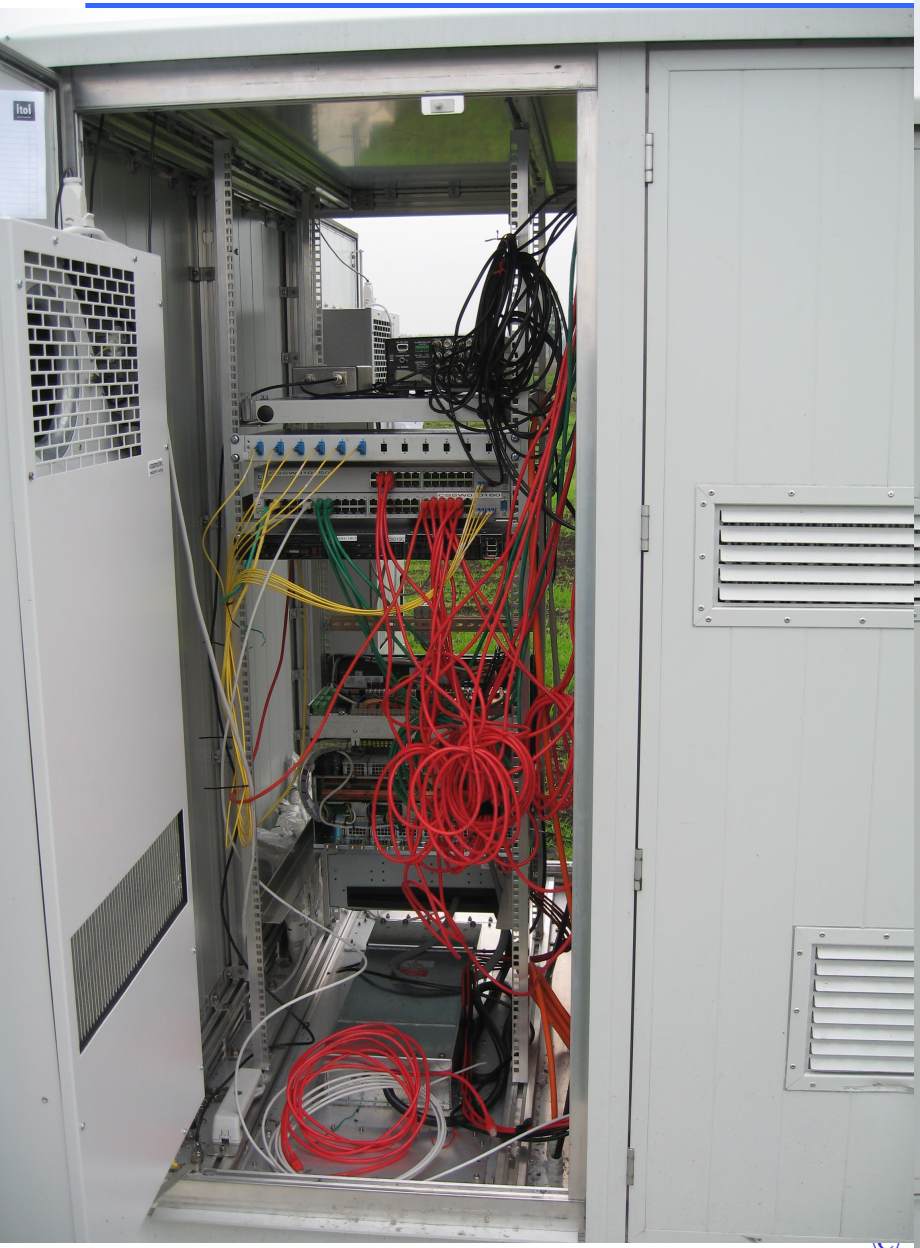
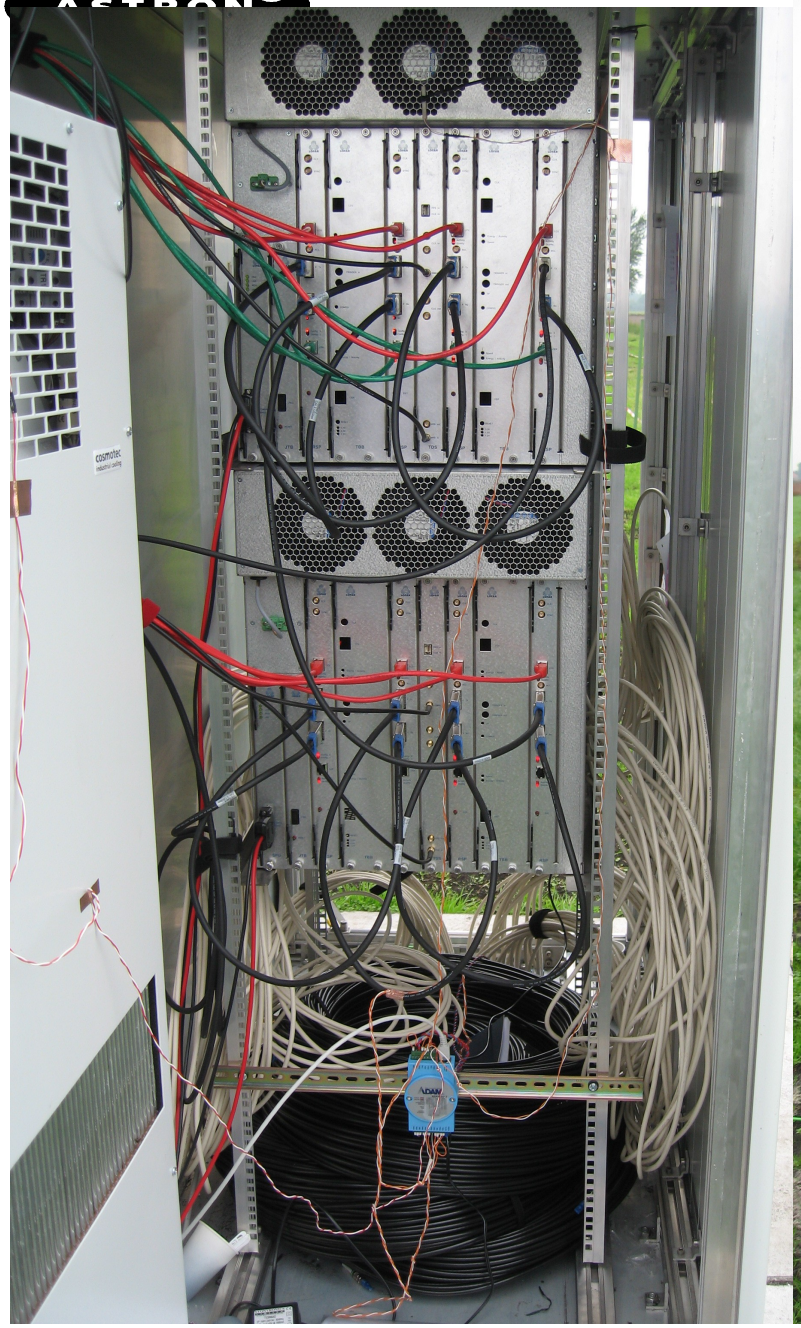



cosmotec



Conclusions

- Processing pipeline works from antenna to dataproduct
- The first LOFAR stations are operational in the field
- Ready to roll out more stations