ASTRON

LOFAR

Netherlands Institute for Radio Astronomy

LOFAR station processing

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Third LOFAR processing school, Dwingeloo
17-21 November 2014

ASTRON is part of the Netherlands Organisation for Scientific Research (NWO)

LOFAR station processing

- Antennas
  - Low band antenna (LBA)
  - High band antenna (HBA)
- Station types
  - 24 Core Stations (CS)
  - 14 Remote Stations (RS)
  - 12 International LOFAR telescope stations (ILT)
- Receiver Unit (RCU)
- Digital Processing
- Station Clock

Low band antenna (LBA)

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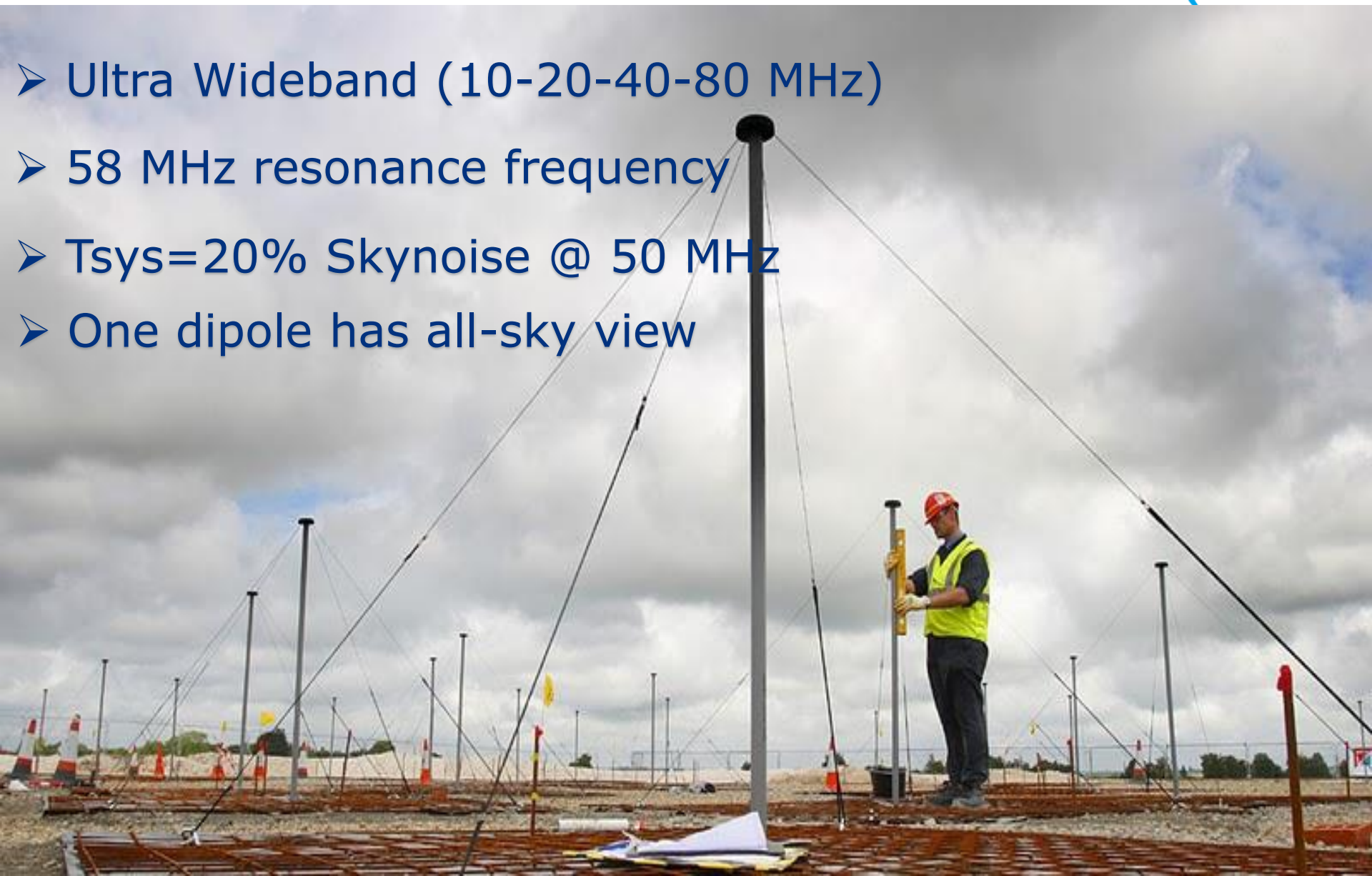
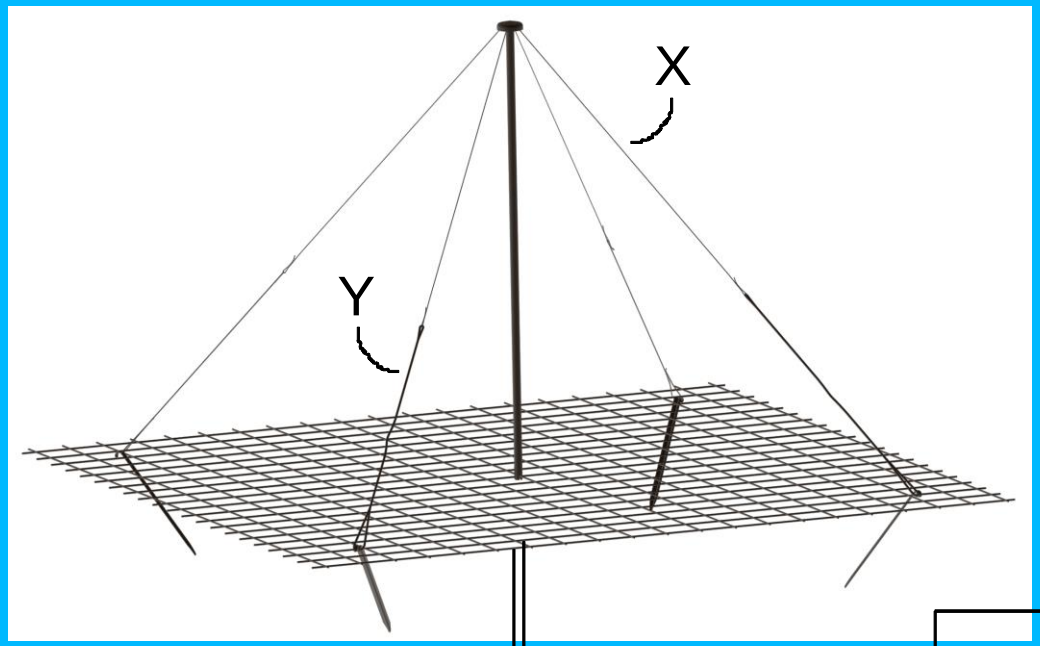


- Ultra Wideband (10-20-40-80 MHz)
- 58 MHz resonance frequency
- Tsys=20% Skynoise @ 50 MHz
- One dipole has all-sky view

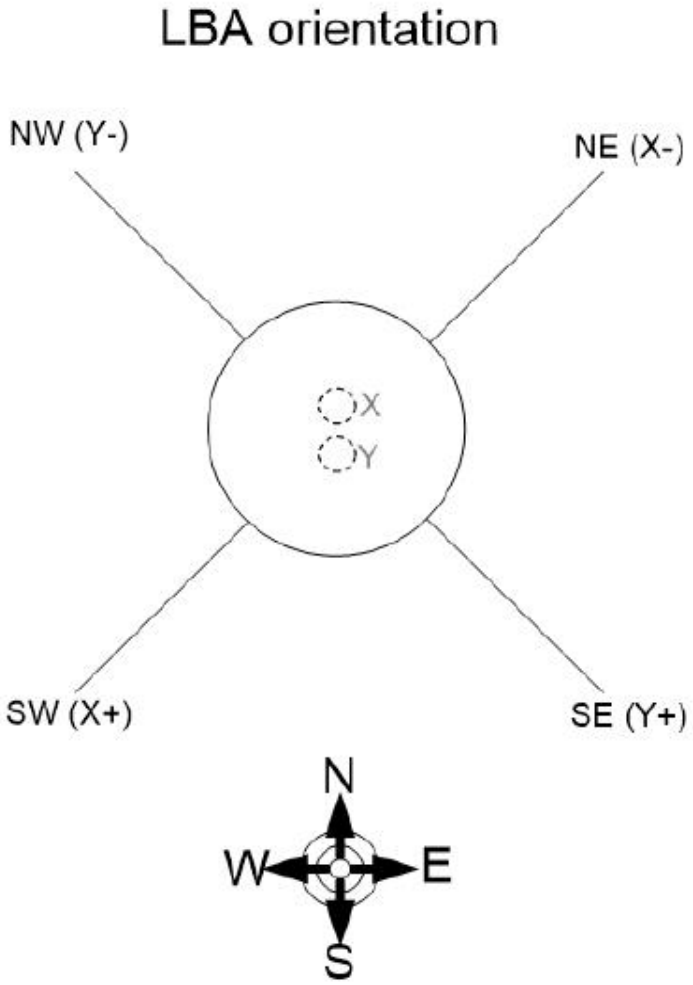
Low band antenna (LBA)



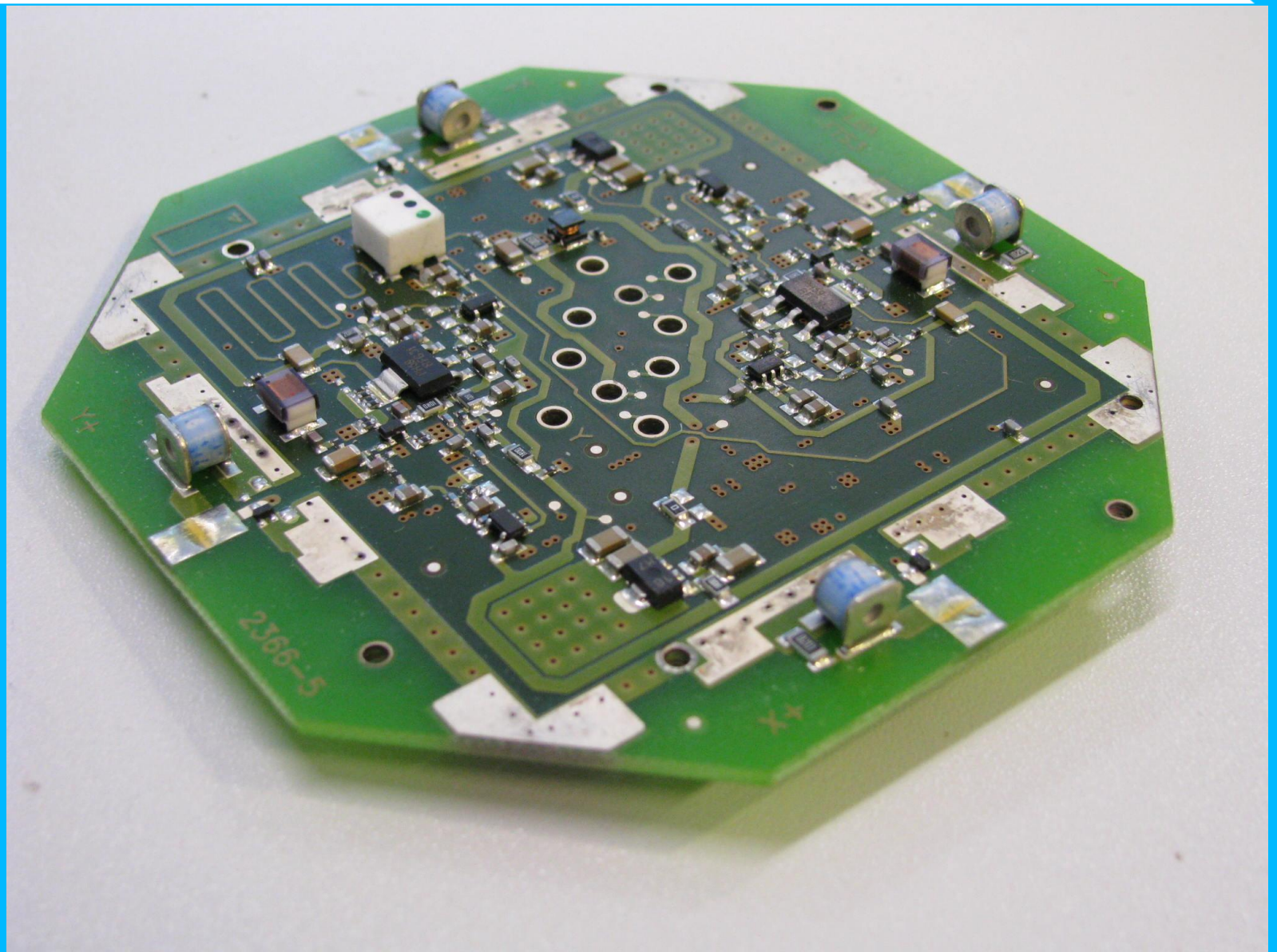
RCU-X

RCU-Y

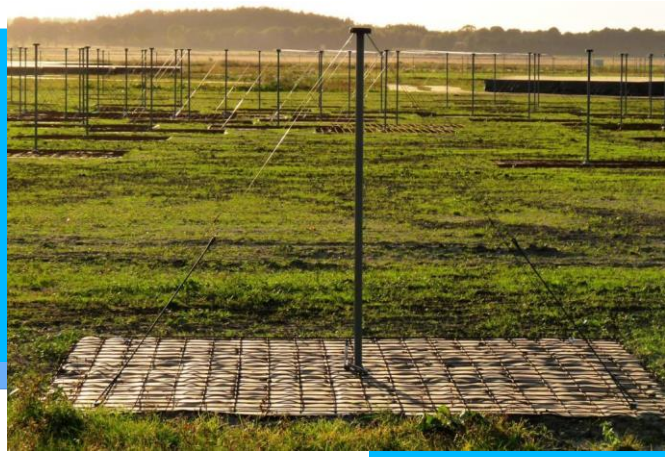
Low band antenna (LBA)



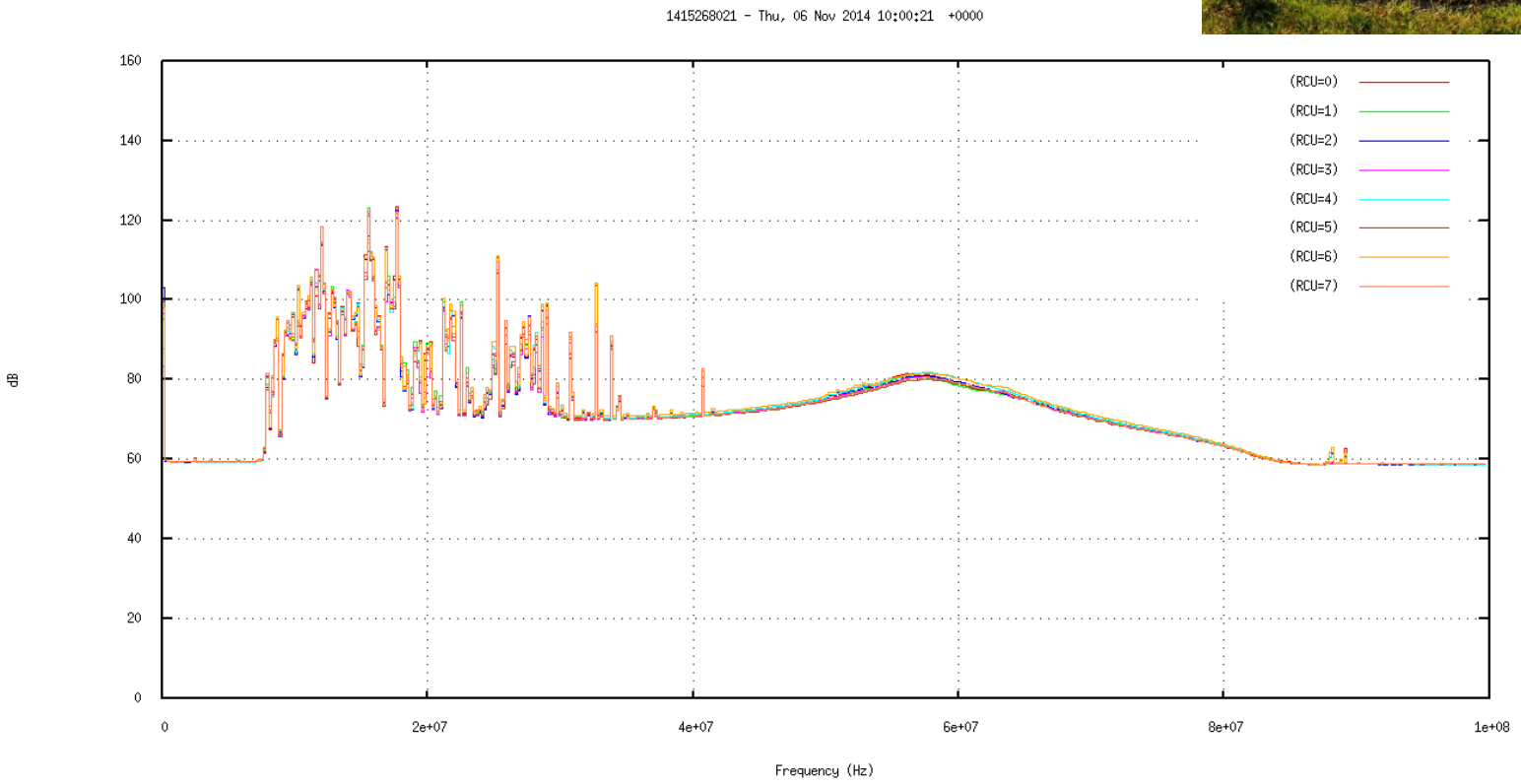
Low band antenna (LBA)



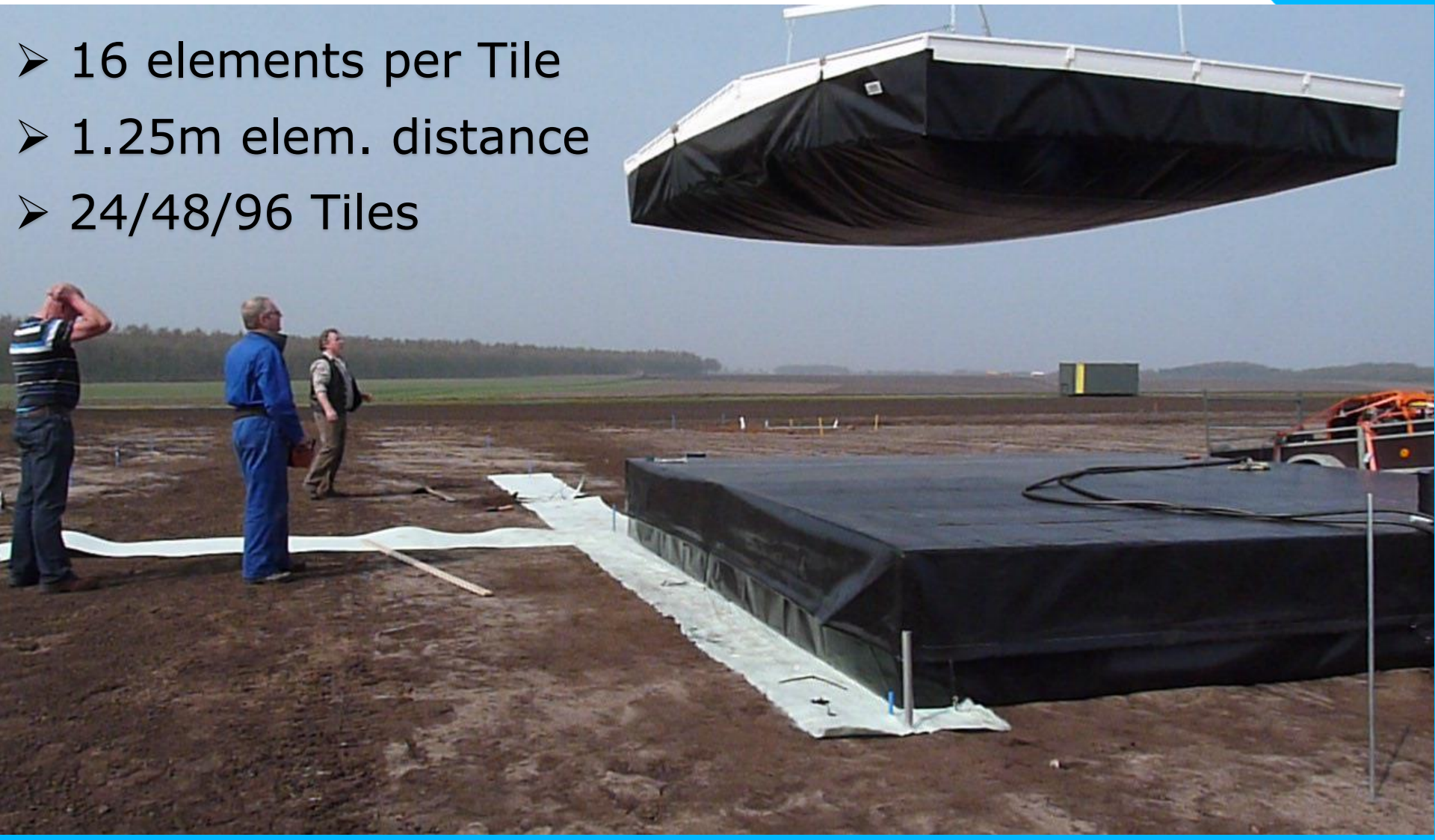
Low band antenna (LBA)



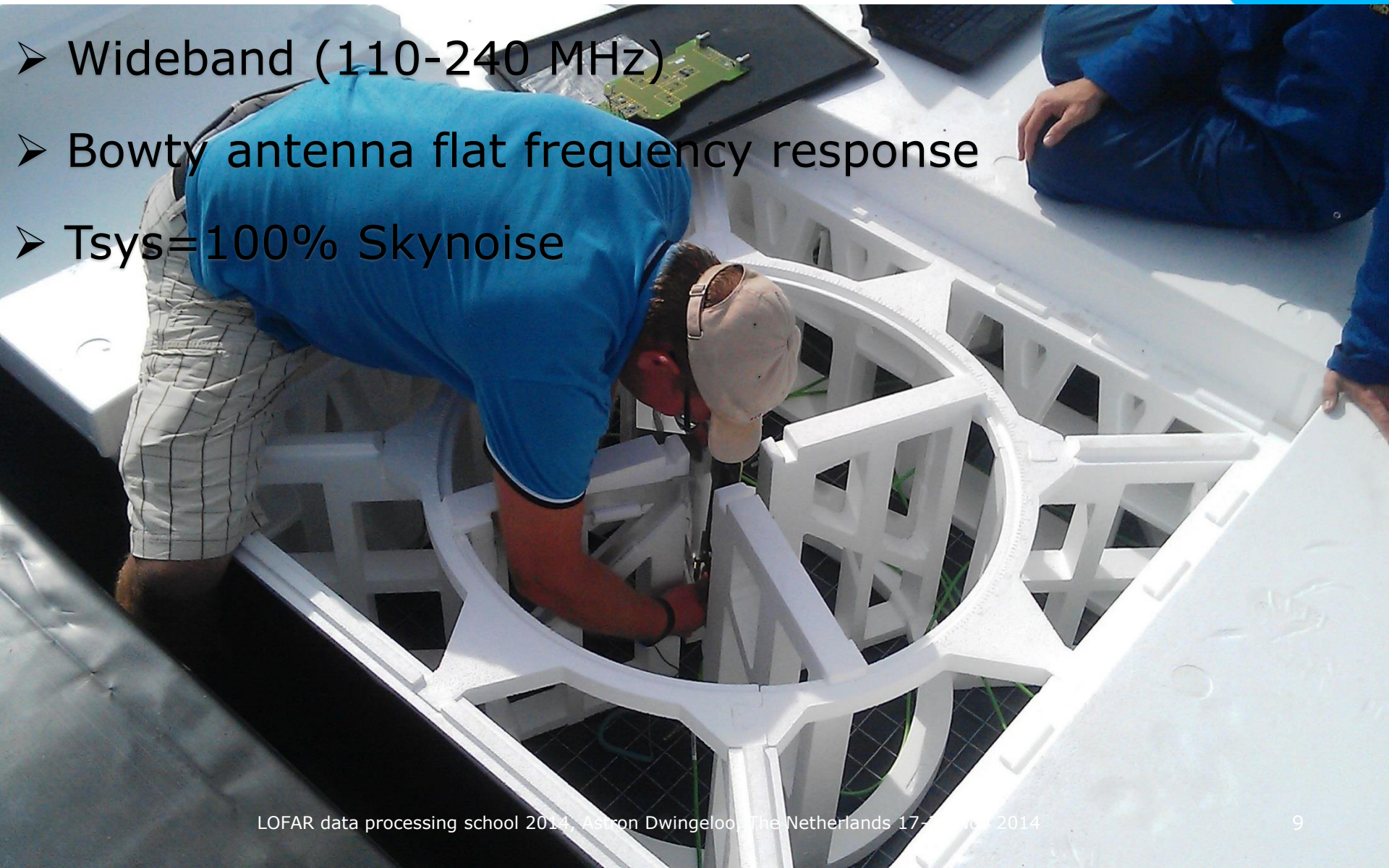
Gnuplot



High band antenna (HBA)

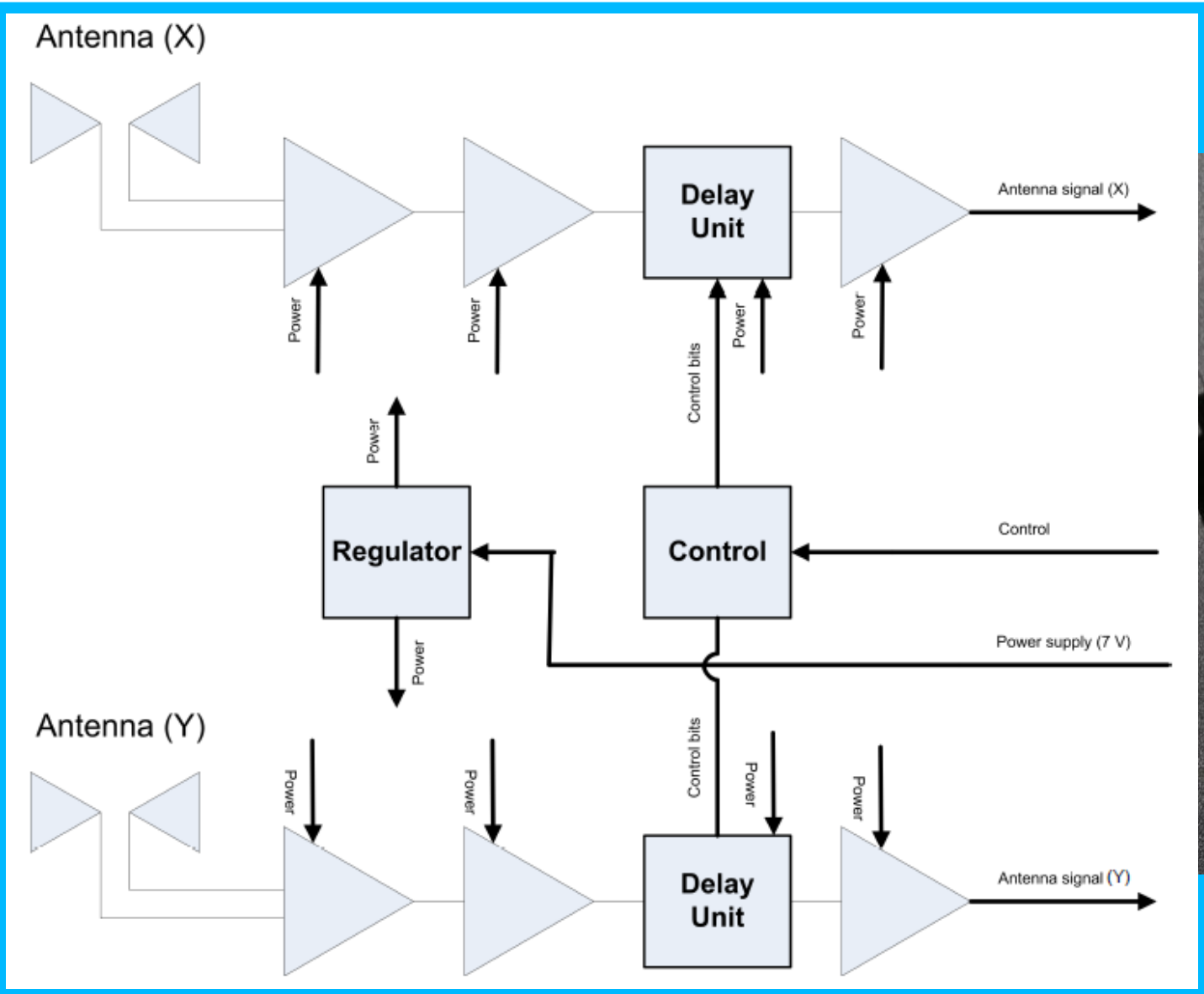


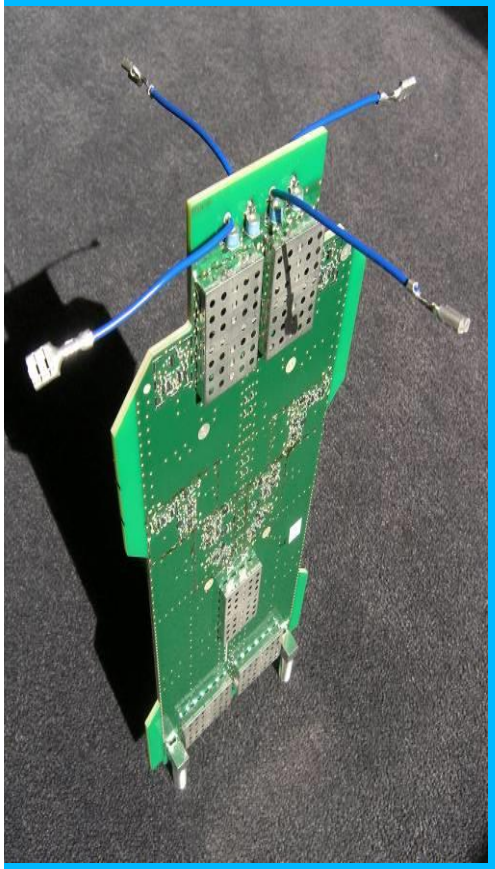
High band antenna (HBA)



- Wideband (110-240 MHz)
- Bowty antenna flat frequency response
- Tsys=100% Skynoise

High band antenna (HBA)





High band antenna (HBA)

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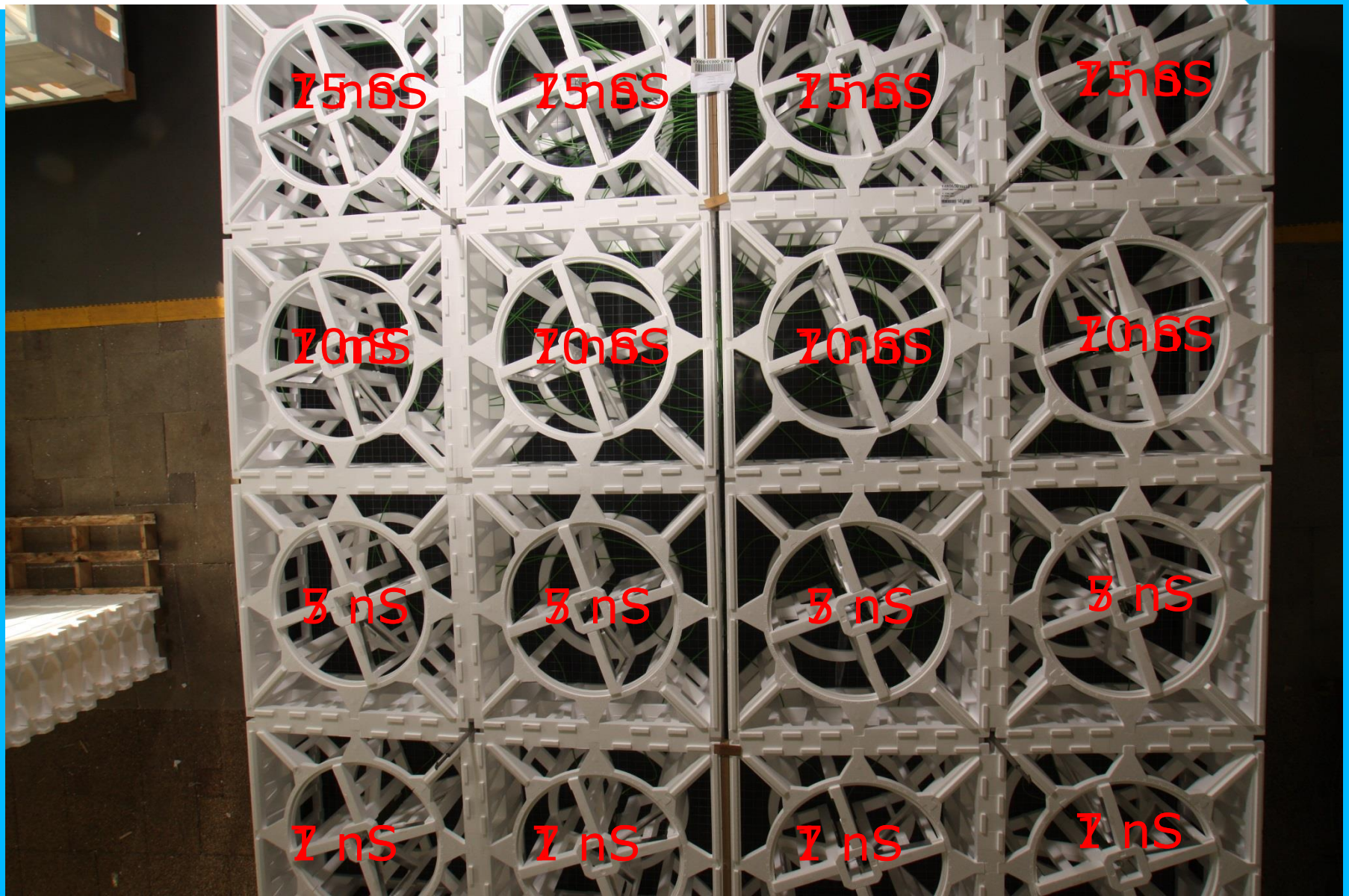
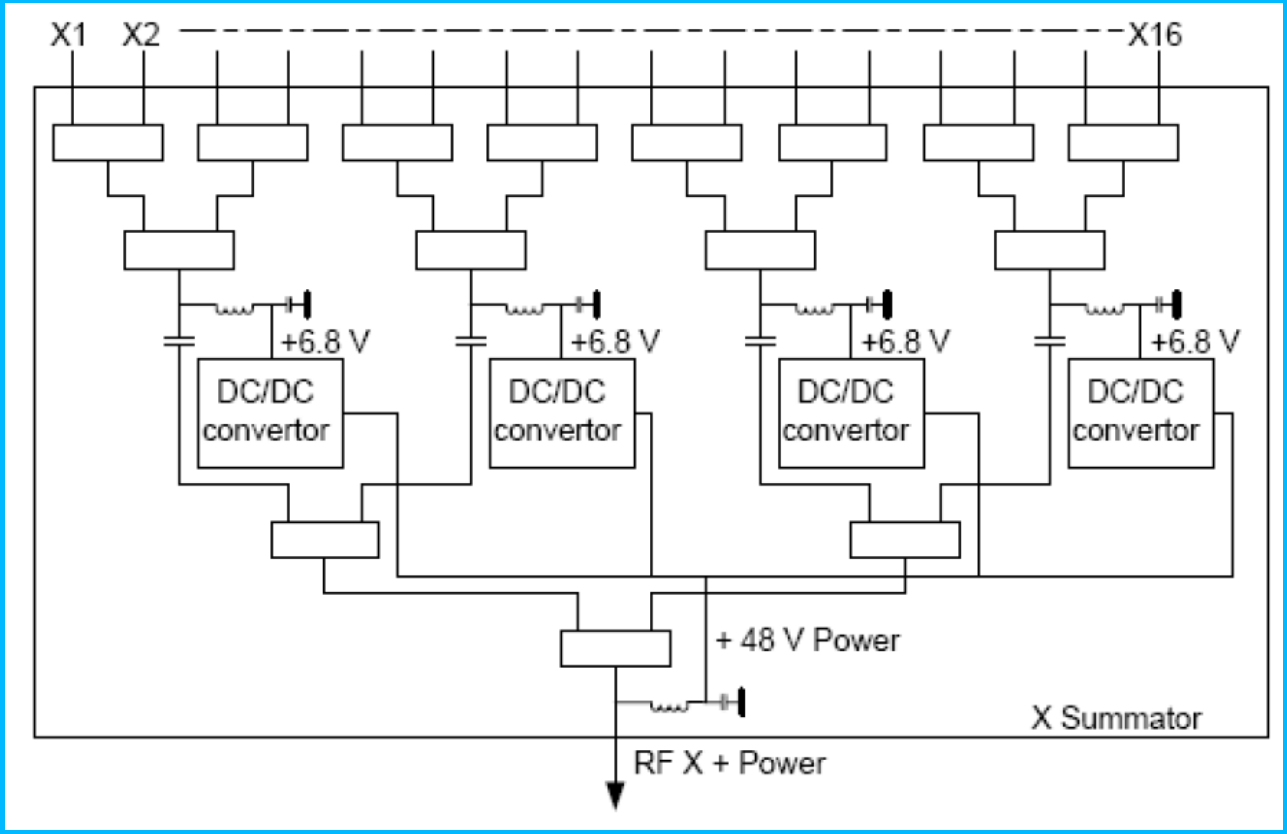


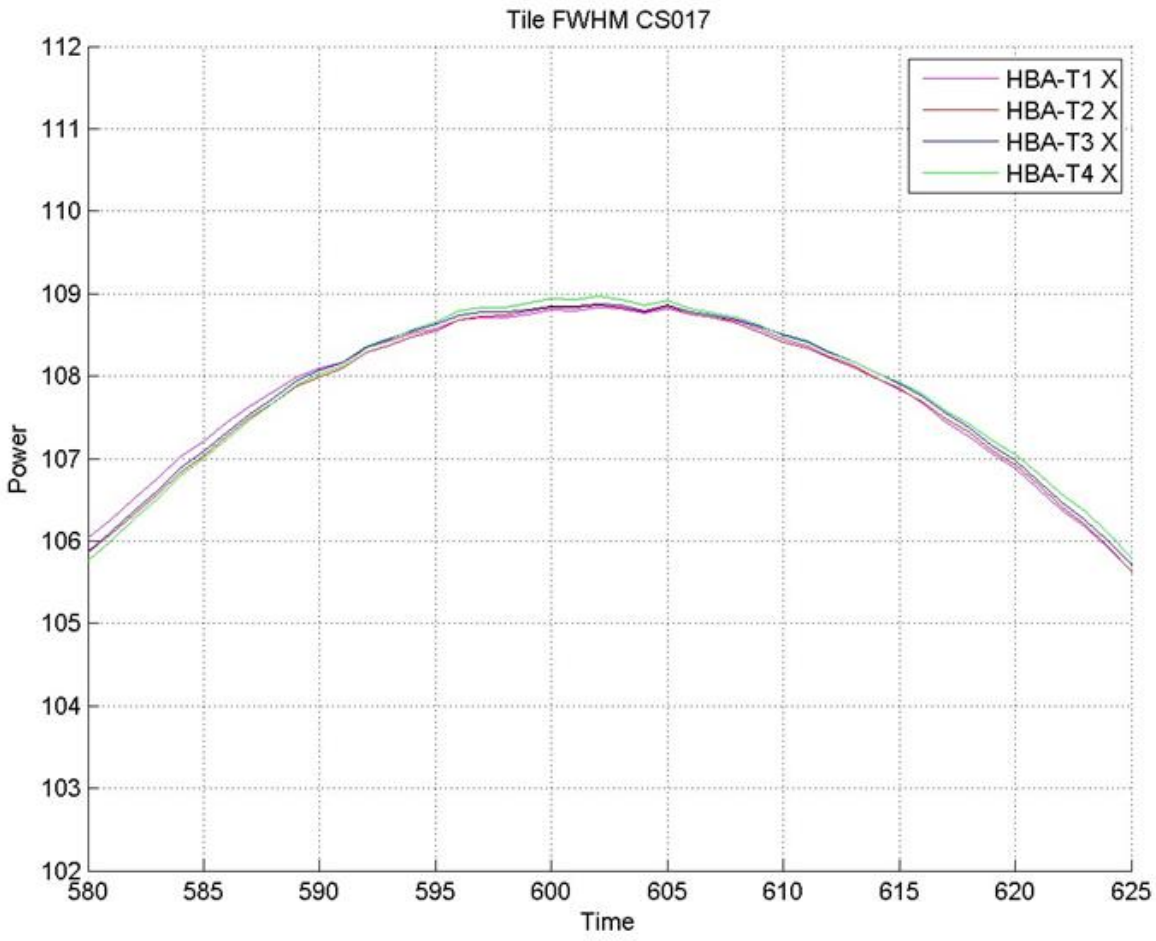
High band antenna (HBA)

X - Summator

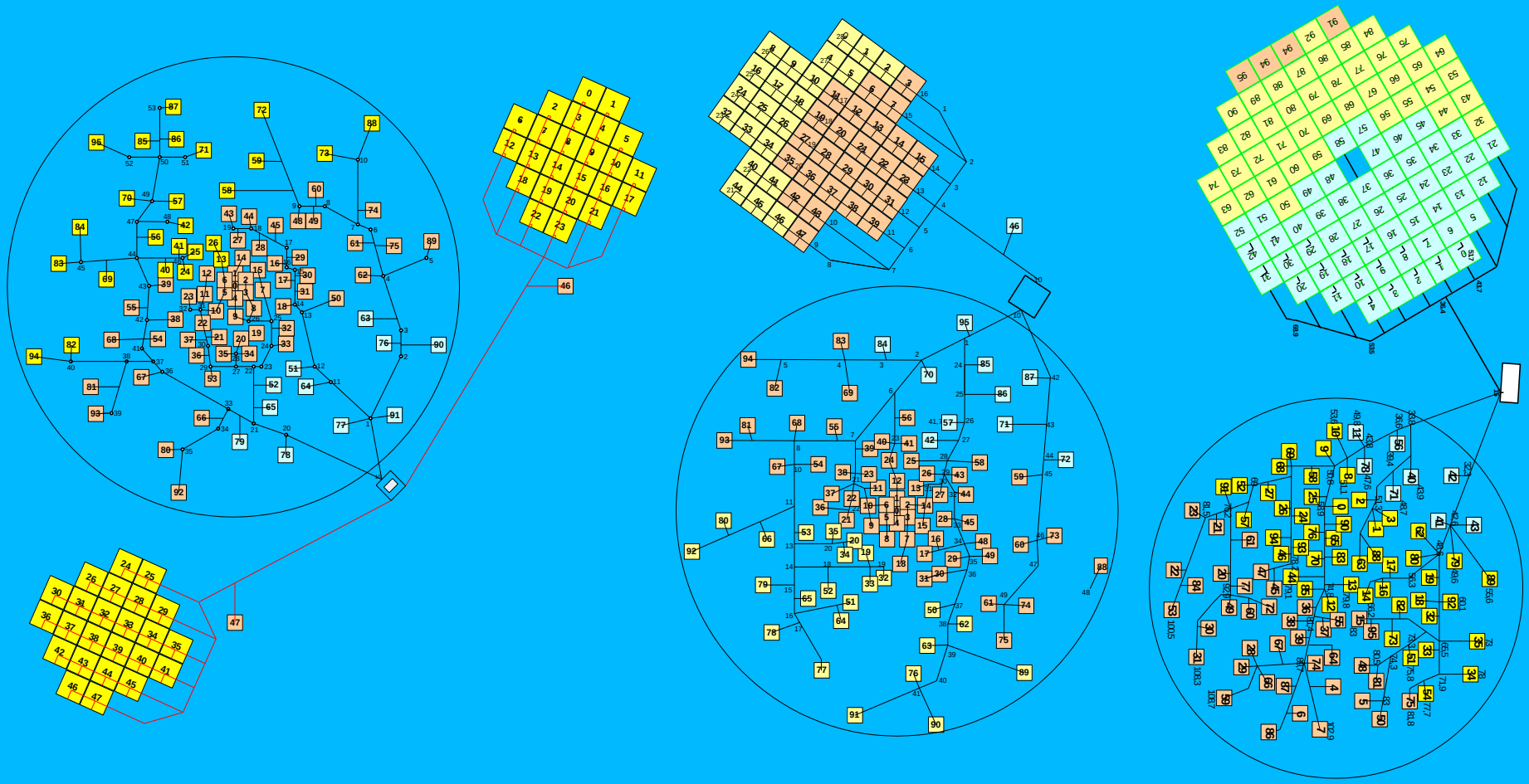


High band antenna (HBA)

- NOAA-19 Weather Satellite ~ 137 MHz



Station types



CORE (24) **REMOTE (14)** **INTERNATIONAL (12)**

Core (24)

- Two HBA arrays (HBA0 & HBA1)
- Ringsplitter (2 * 3 Gbit/sec)
- 48 LBA_INNER or 48 LBA_OUTER
- Single clock

Station types

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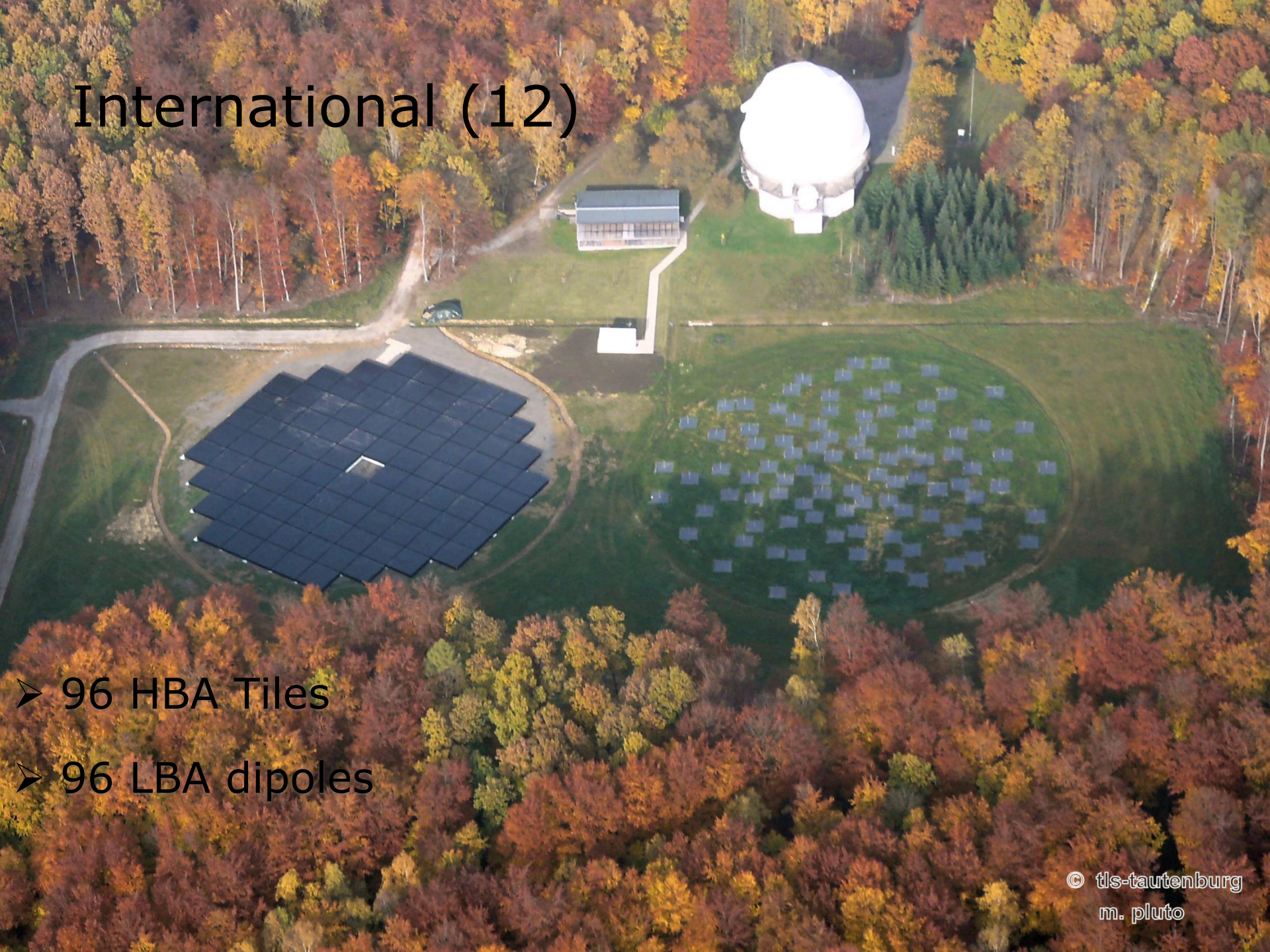
Remote (14)

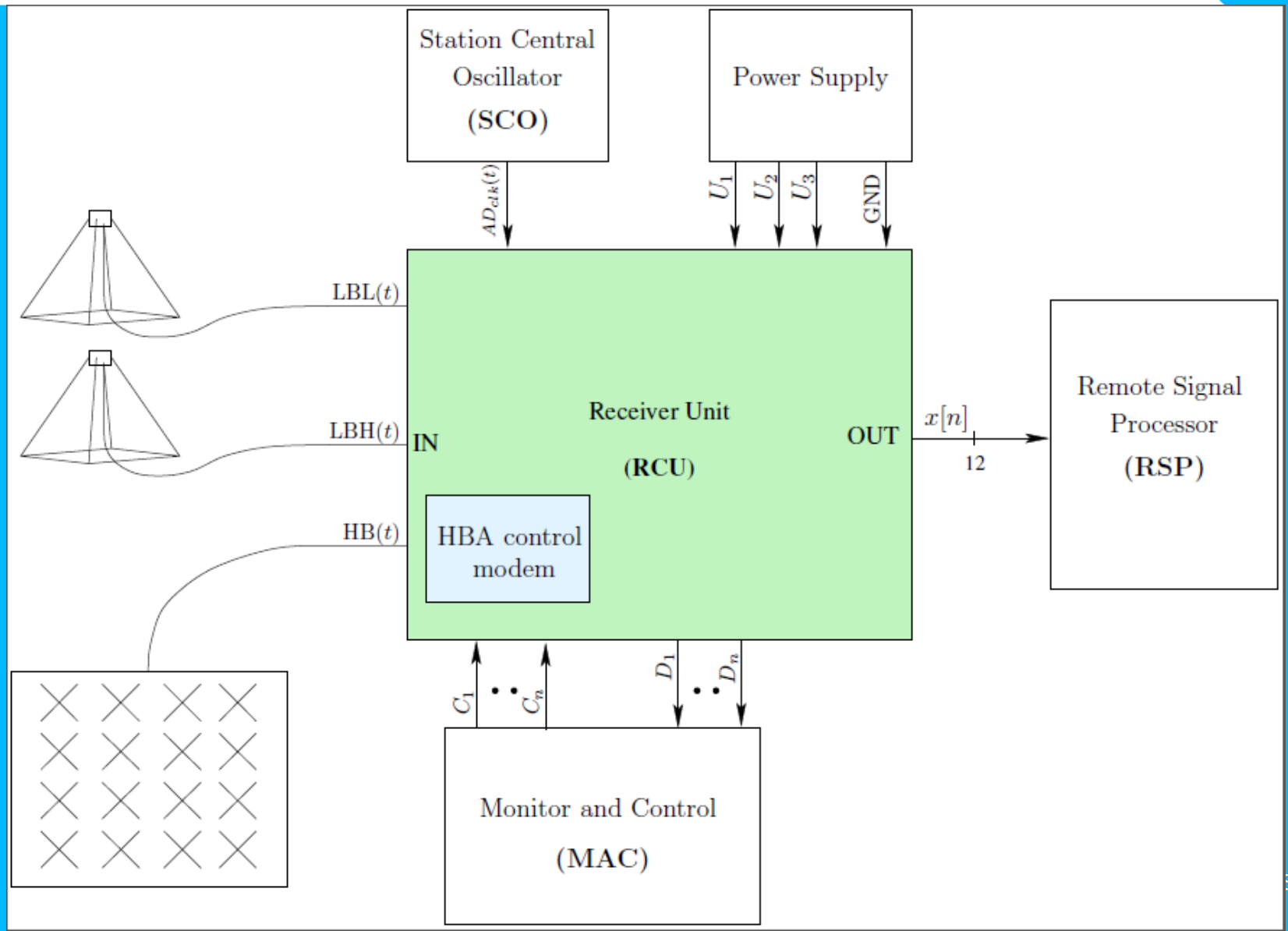
- 48 HBA tiles (or inner 24)
- 48 LBA_INNER
- 48 LBA_OUTER

International (12)

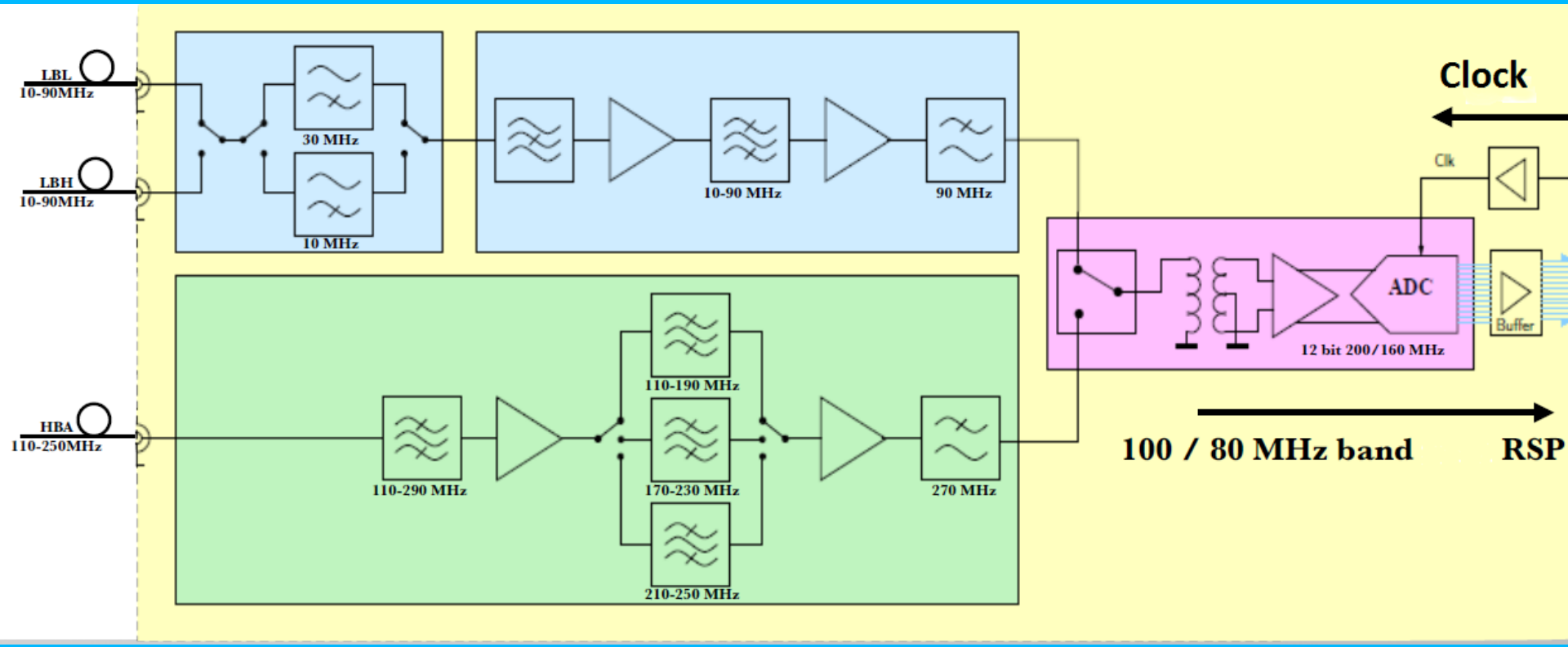


- 96 HBA Tiles
- 96 LBA dipoles

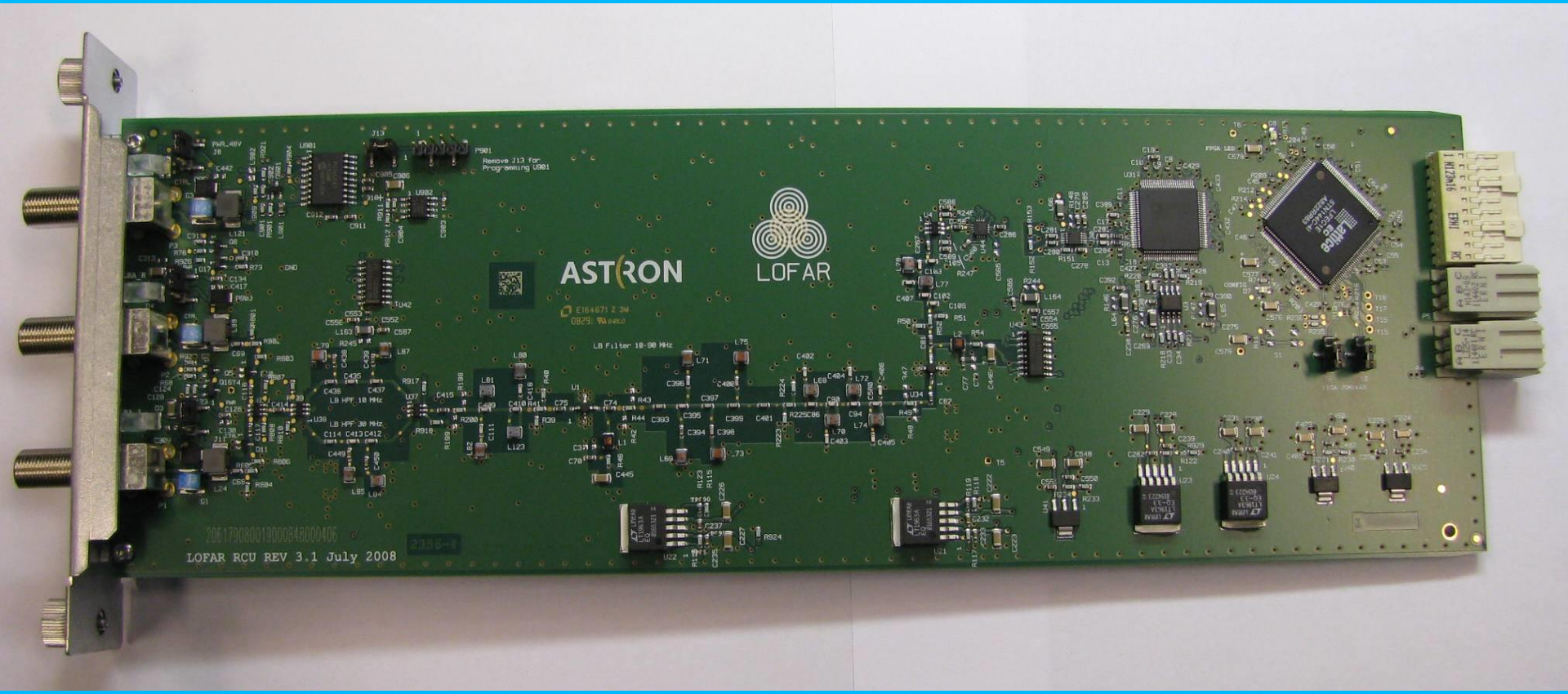
Receiver unit (RCU)

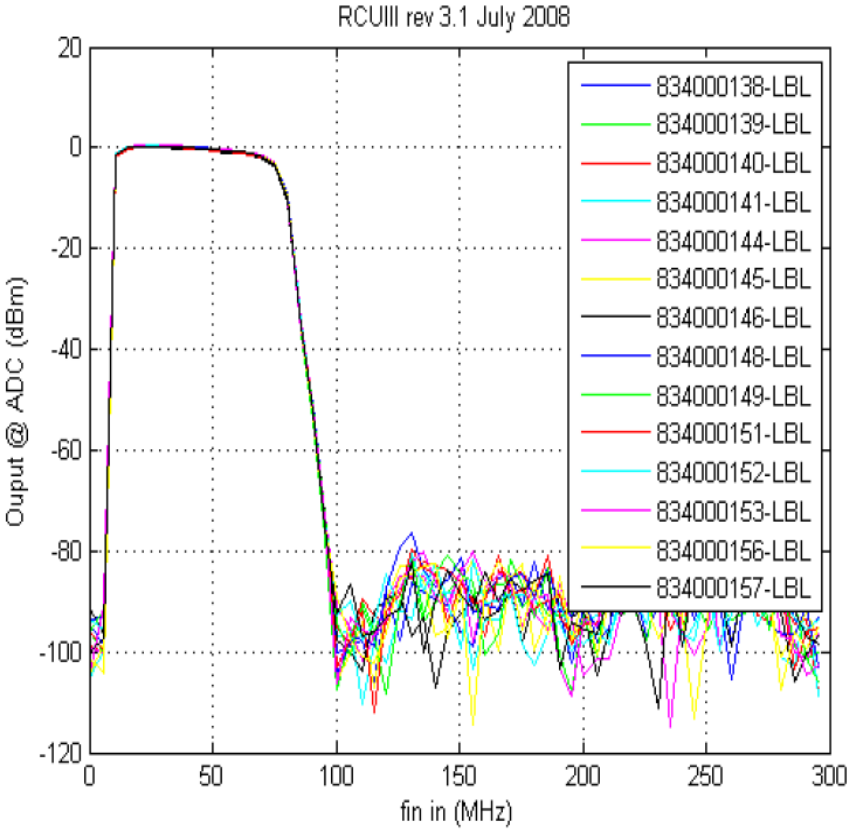


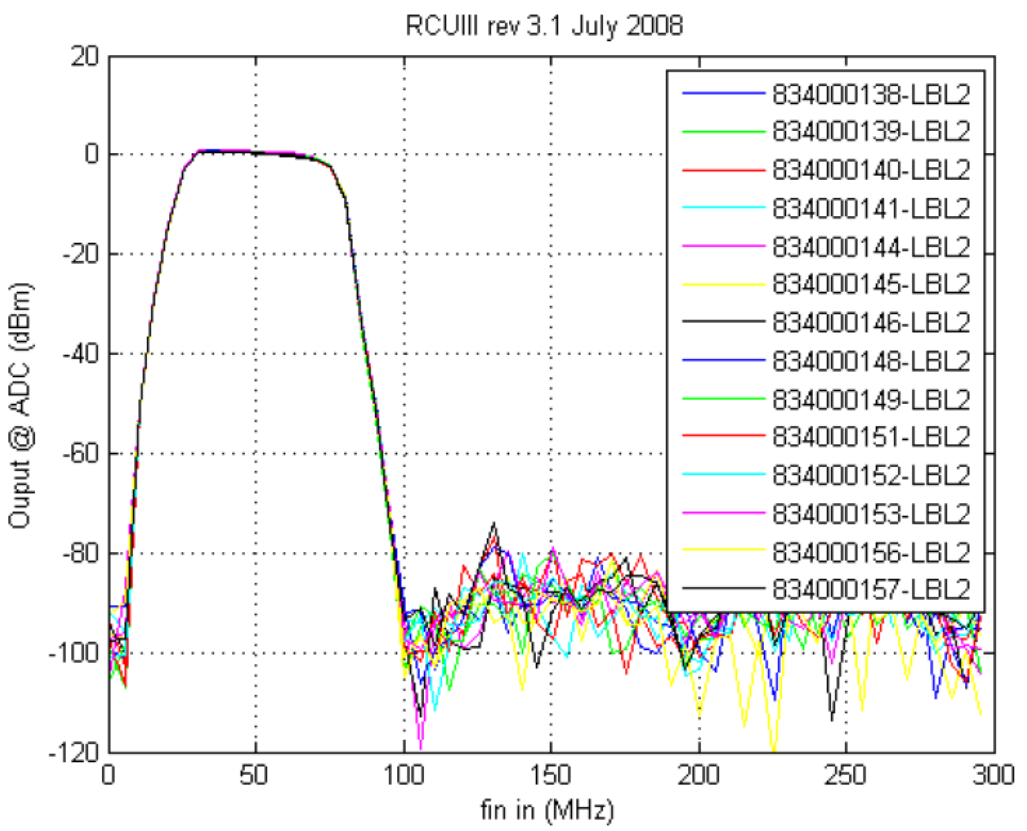
Receiver unit (RCU)

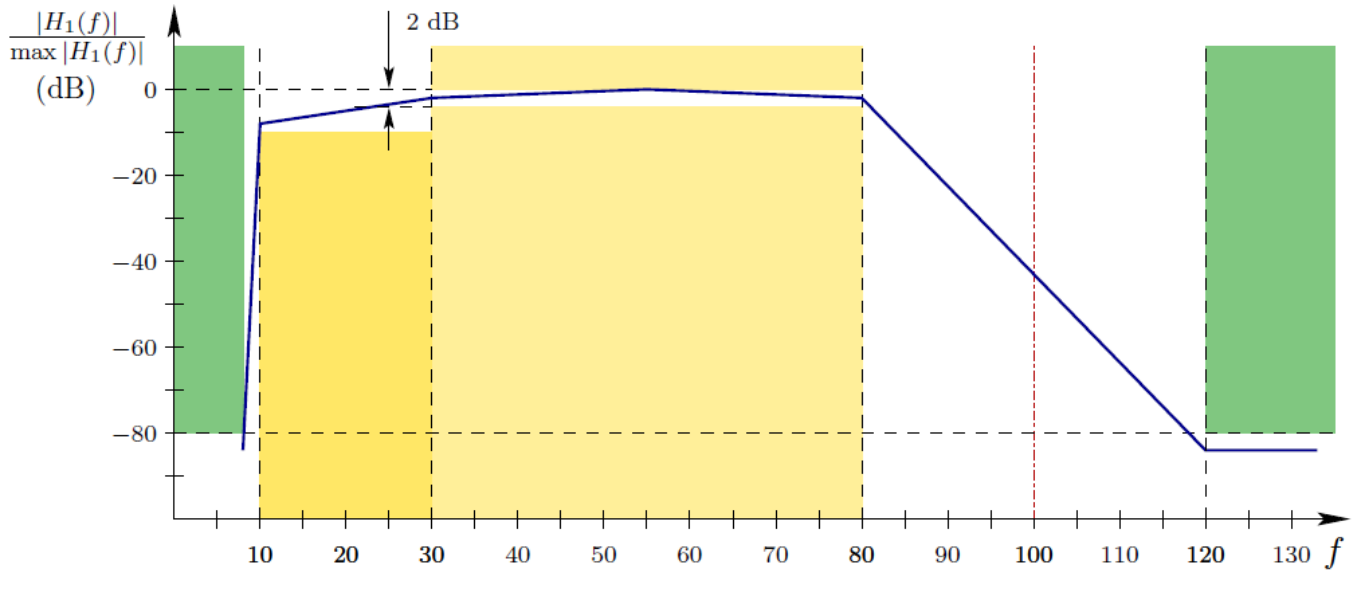


Receiver unit (RCU)




RCUIII rev 3.1 July 2008
Ouput @ ADC (dBm)
fin in (MHz)
834000138-LBL
834000139-LBL
834000140-LBL
834000141-LBL
834000144-LBL
834000145-LBL
834000146-LBL
834000148-LBL
834000149-LBL
834000151-LBL
834000152-LBL
834000153-LBL
834000156-LBL
834000157-LBL


RCUIII rev 3.1 July 2008
Ouput @ ADC (dBm)
fin in (MHz)
834000138-LBL2
834000139-LBL2
834000140-LBL2
834000141-LBL2
834000144-LBL2
834000145-LBL2
834000146-LBL2
834000148-LBL2
834000149-LBL2
834000151-LBL2
834000152-LBL2
834000153-LBL2
834000156-LBL2
834000157-LBL2


$\frac{|H_1(f)|}{\max|H_1(f)|}$ (dB)
2 dB
f

Receiver unit (RCU)

RCUMODES	INPUT	Frequency [MHz]	Clock [MHz]
0	-	-	-
1	LBL	10-90	200
2	LBL	30-90	200
3	LBH	10-90	200
4	LBH	30-90	200
5	HBA	110-190	200
6	HBA	170-230	160 *
7	HBA	210-270	200

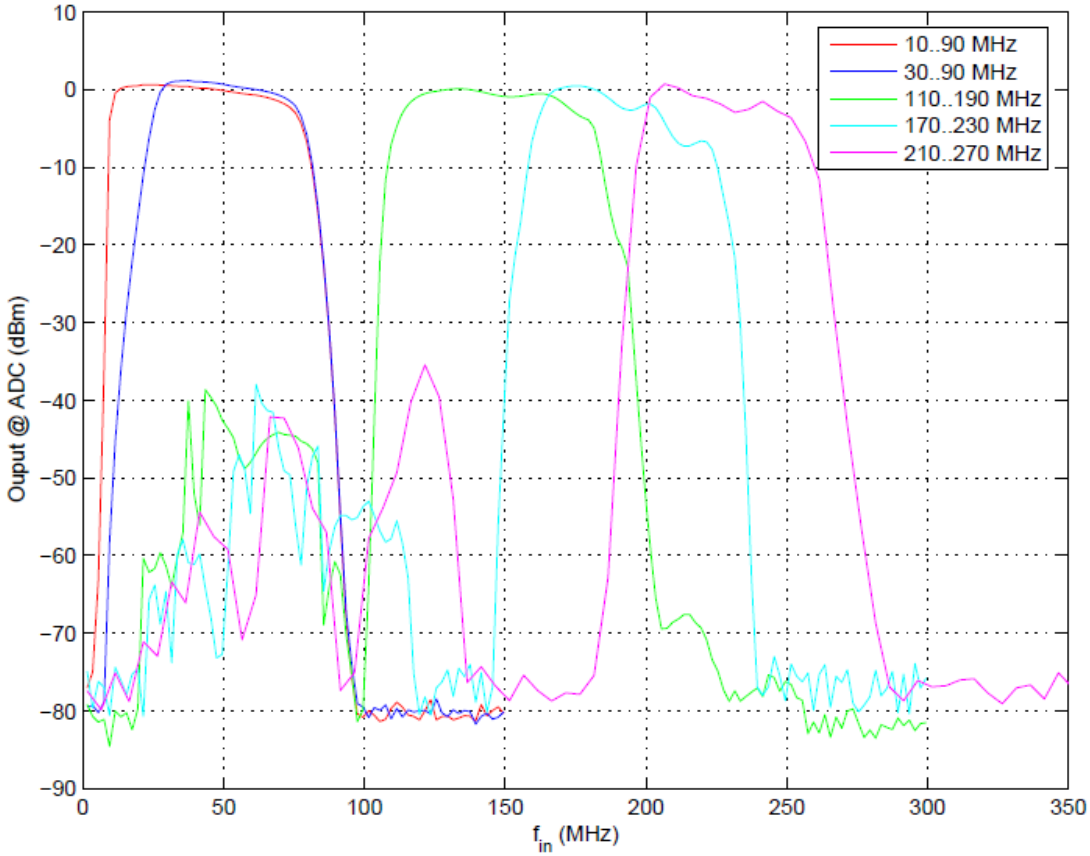
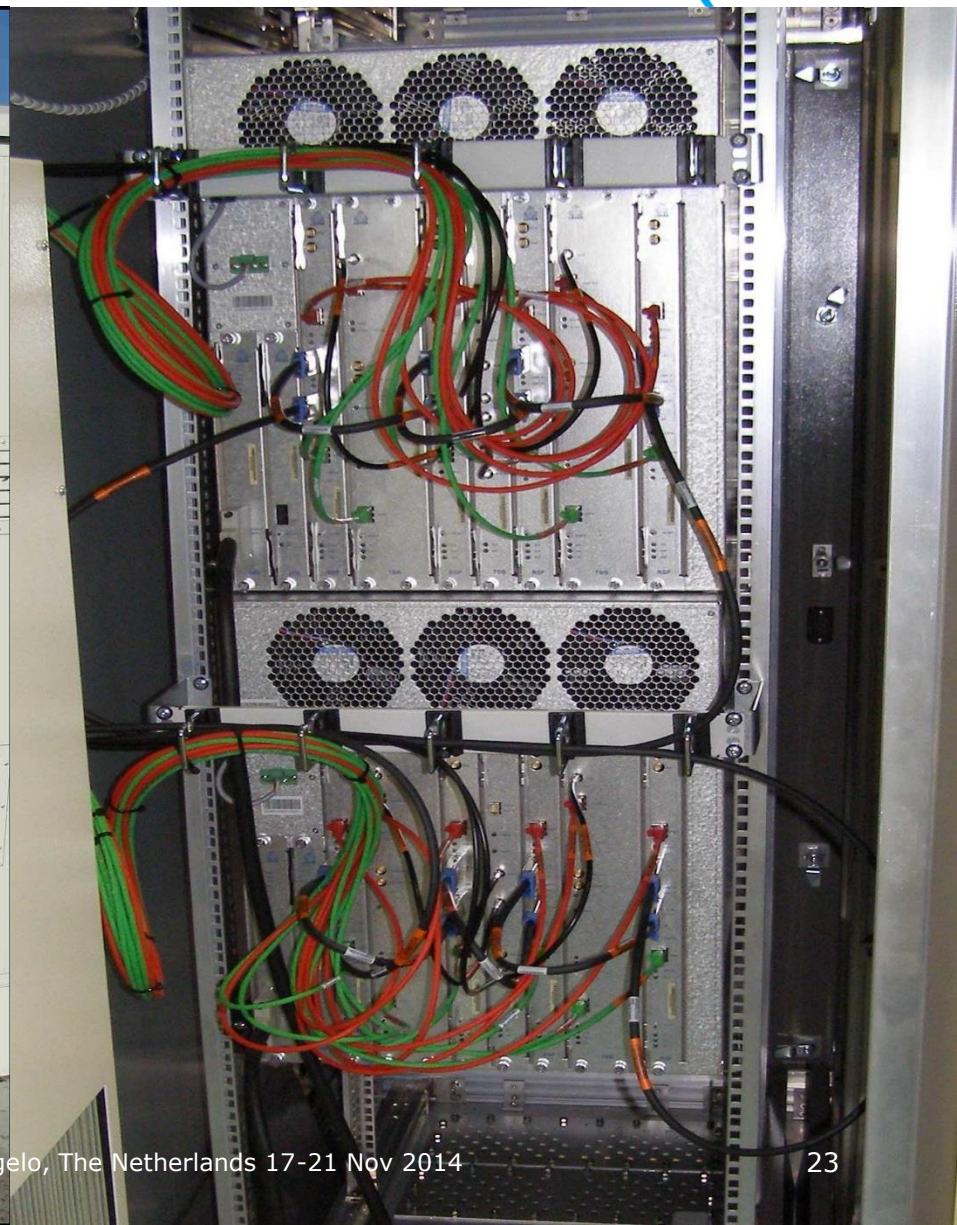
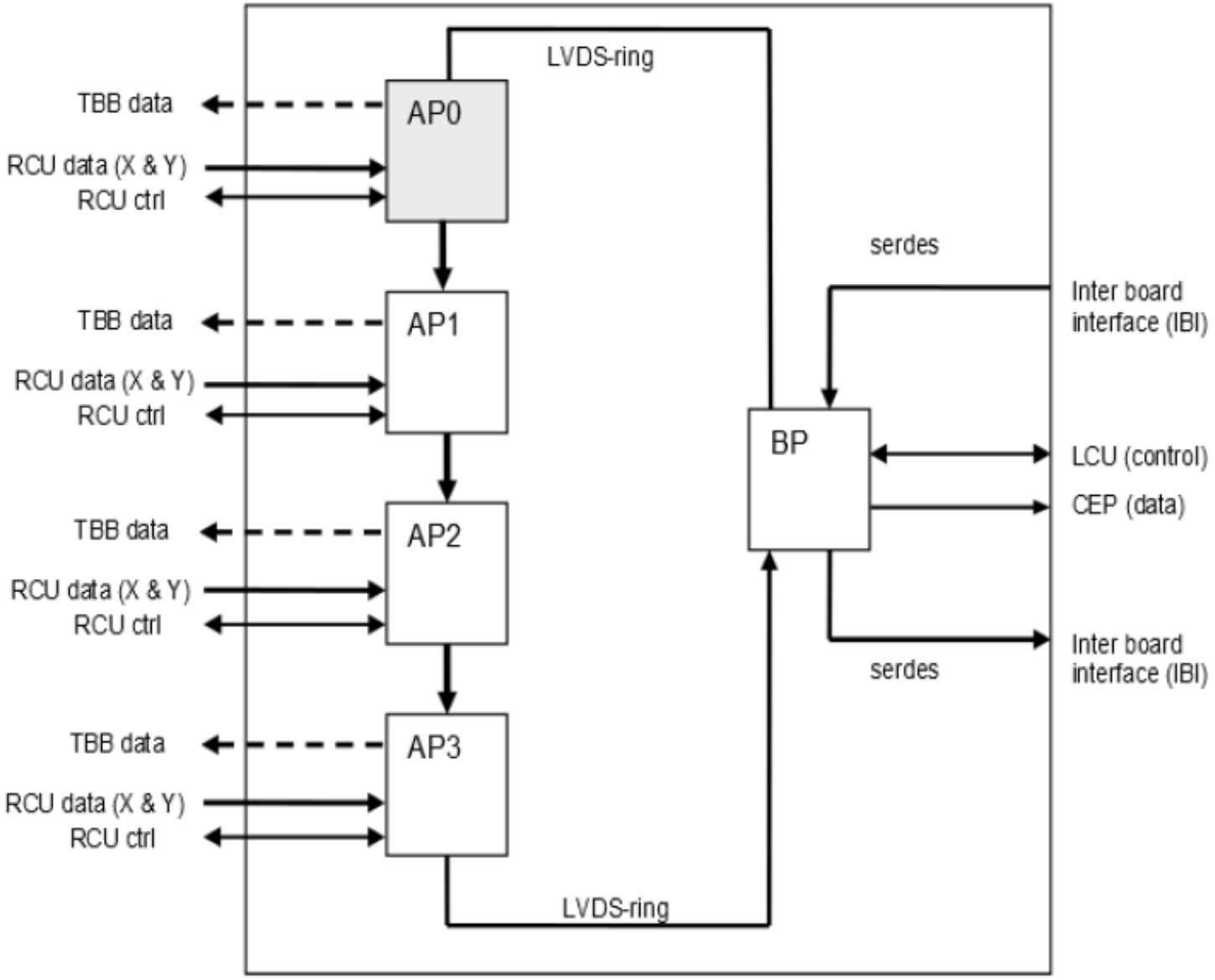


Figure 24: *Combined Frequency response of all sub bands.*

Station Cabinet (CS & RS)



Remote Station Processing (RSP)



Remote Station Processing (RSP)

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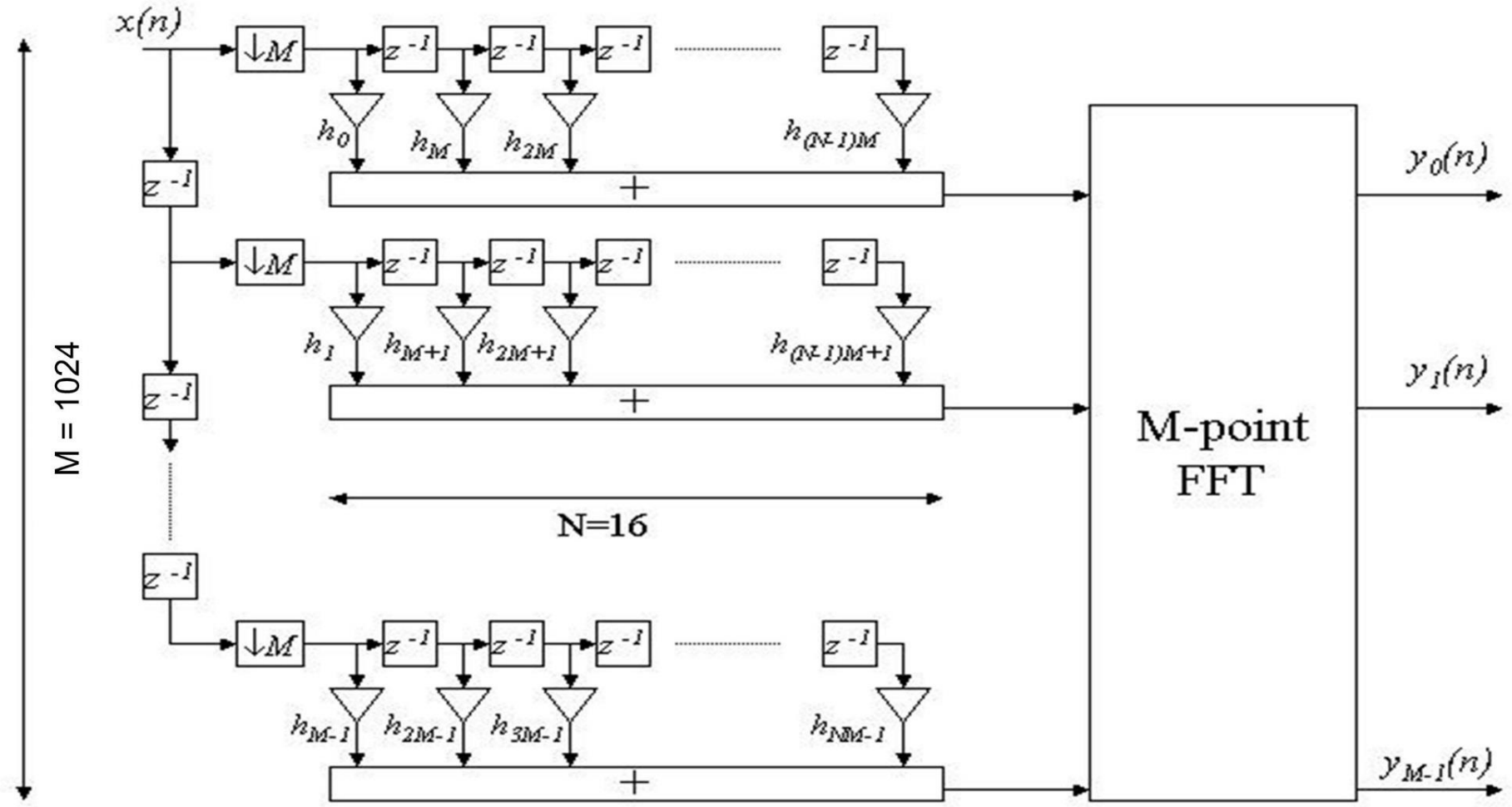
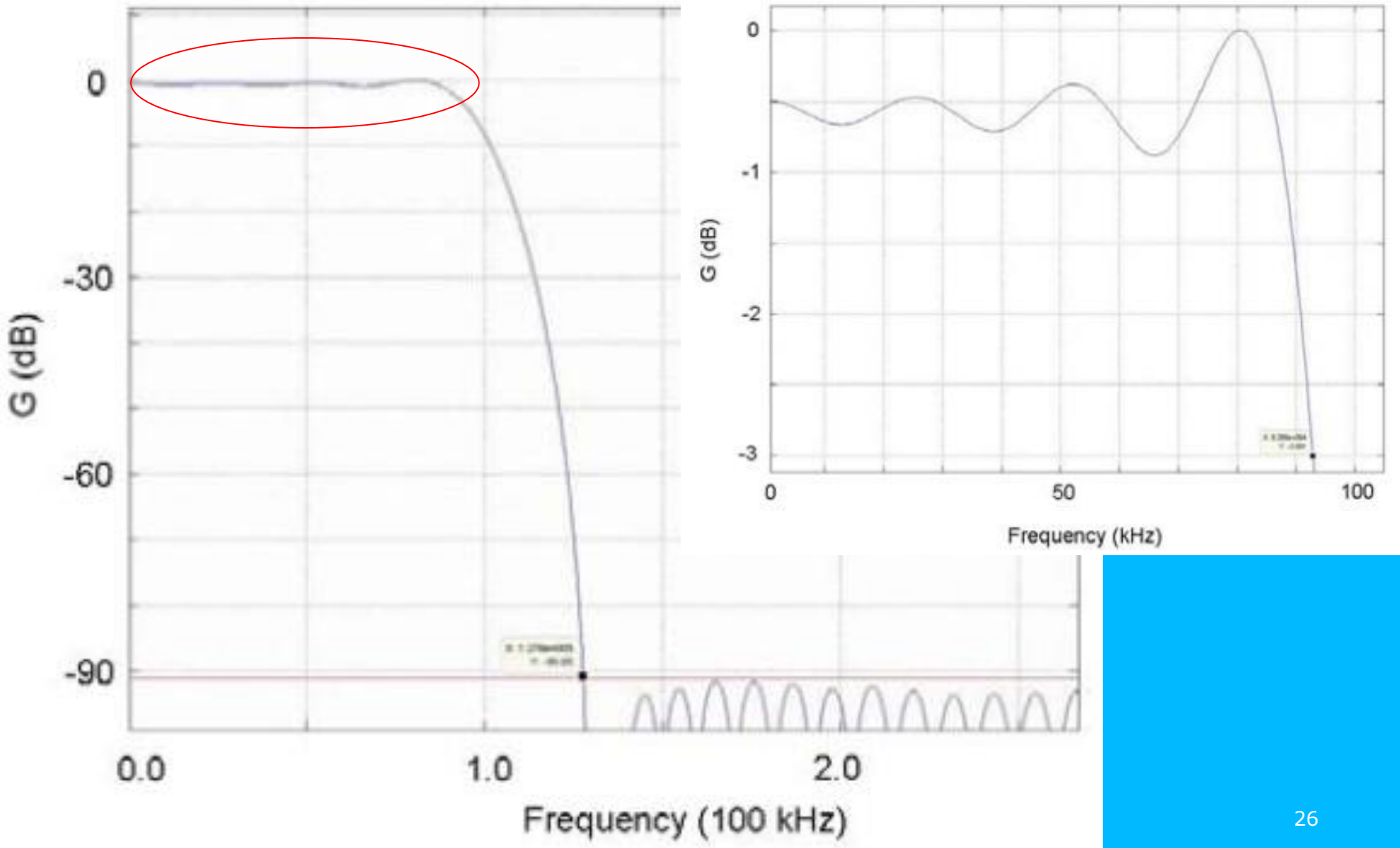
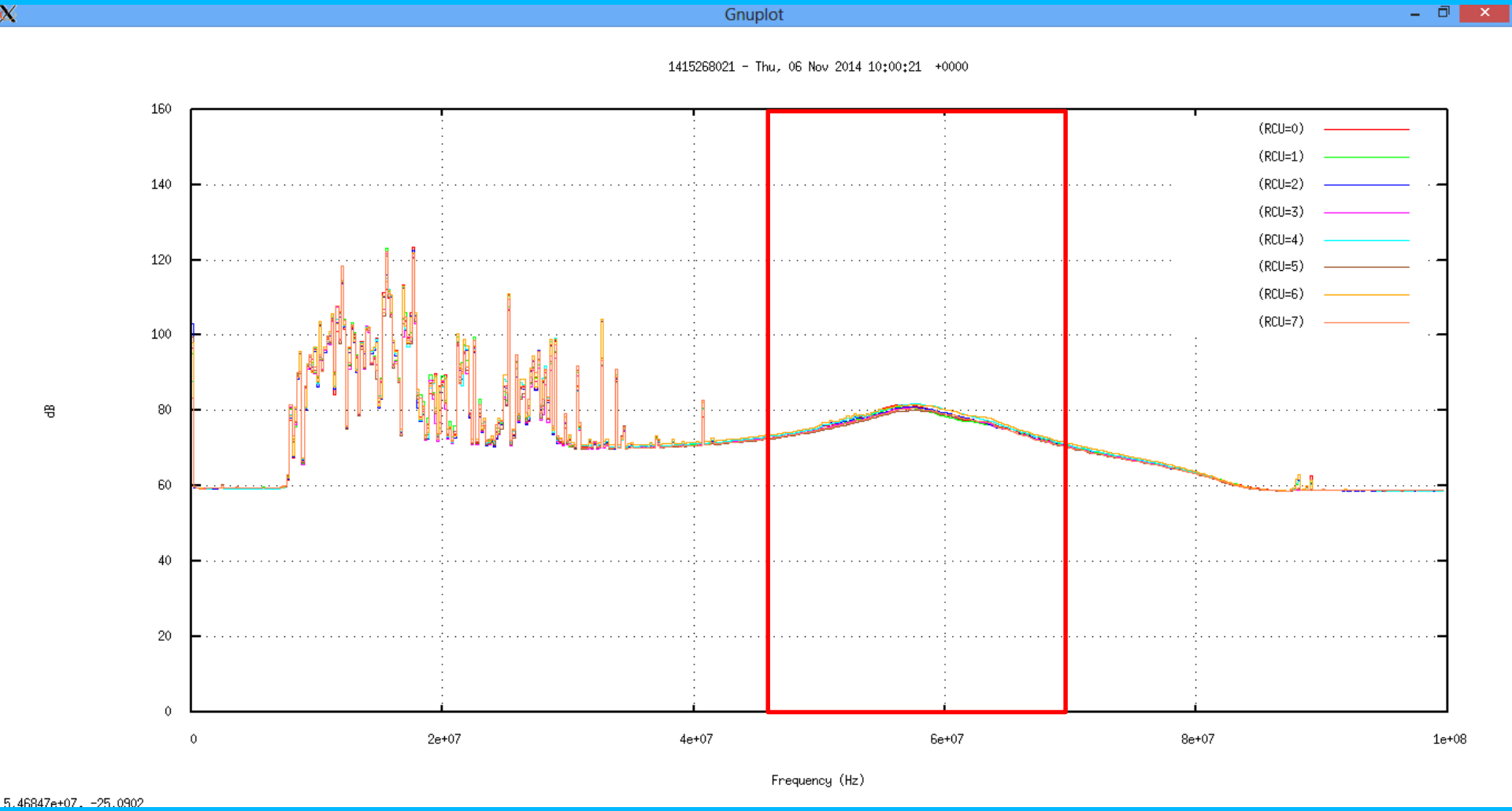


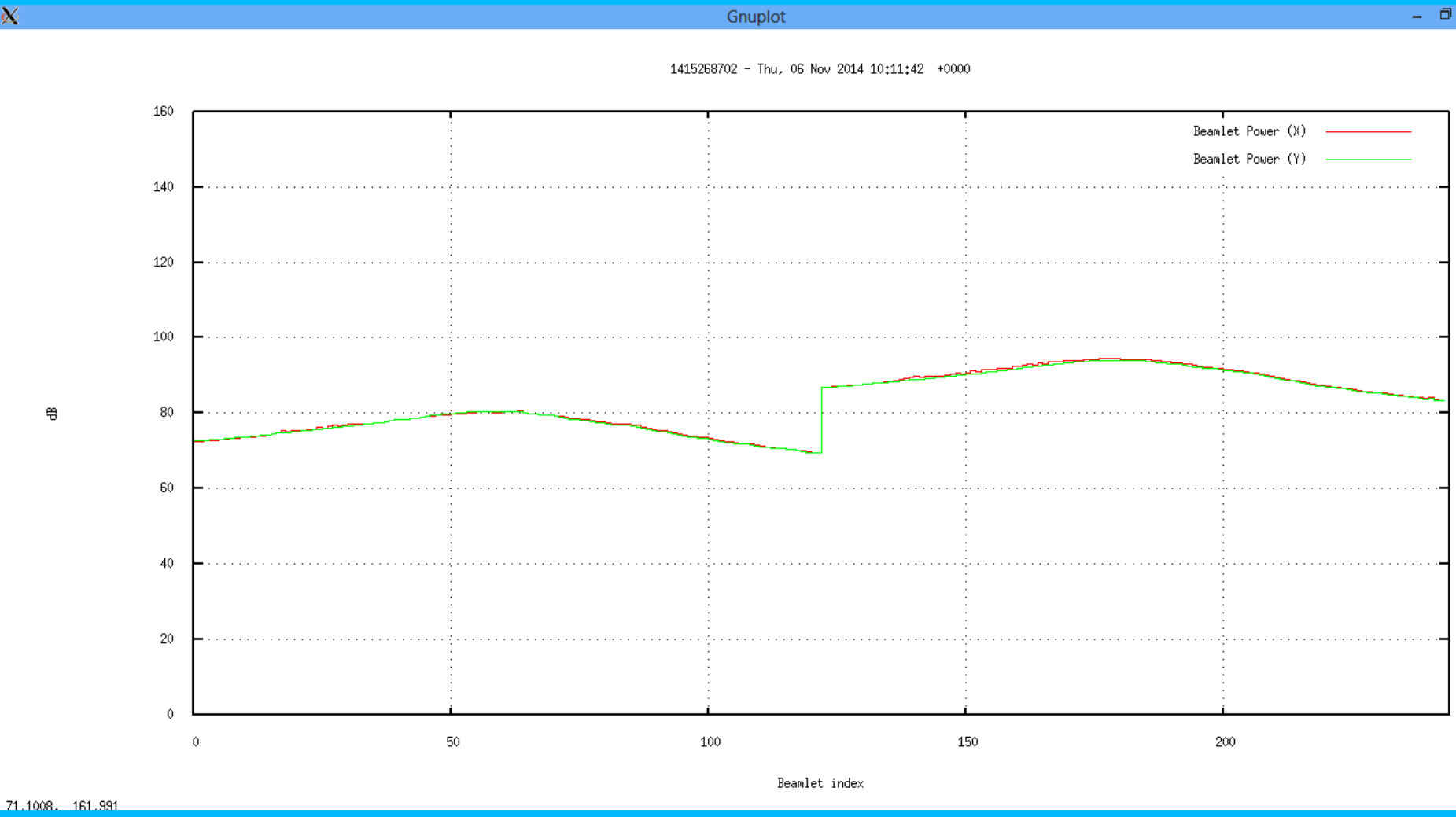
Remote Station Processing (RSP)



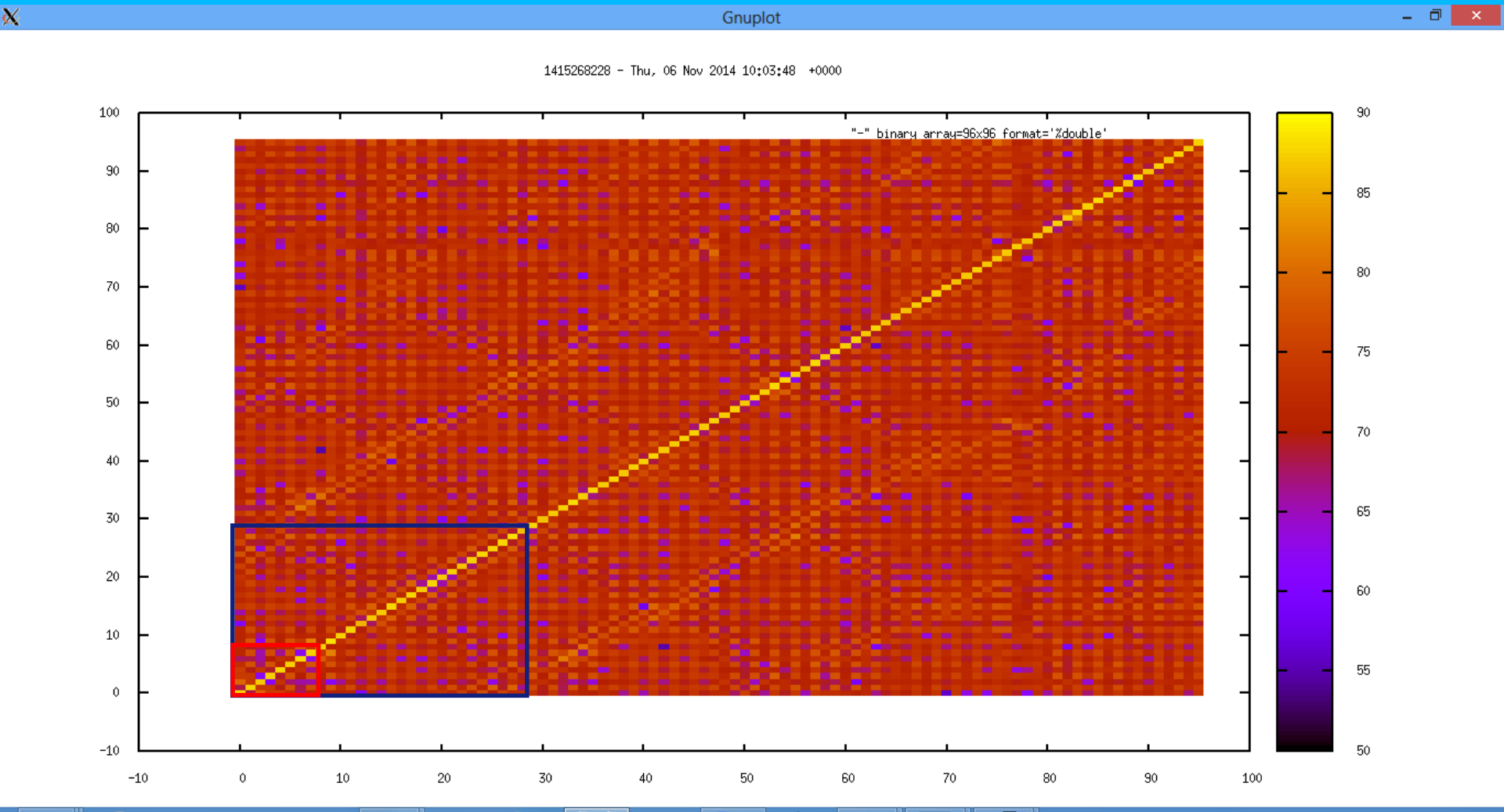
Subband Statistics (SST)



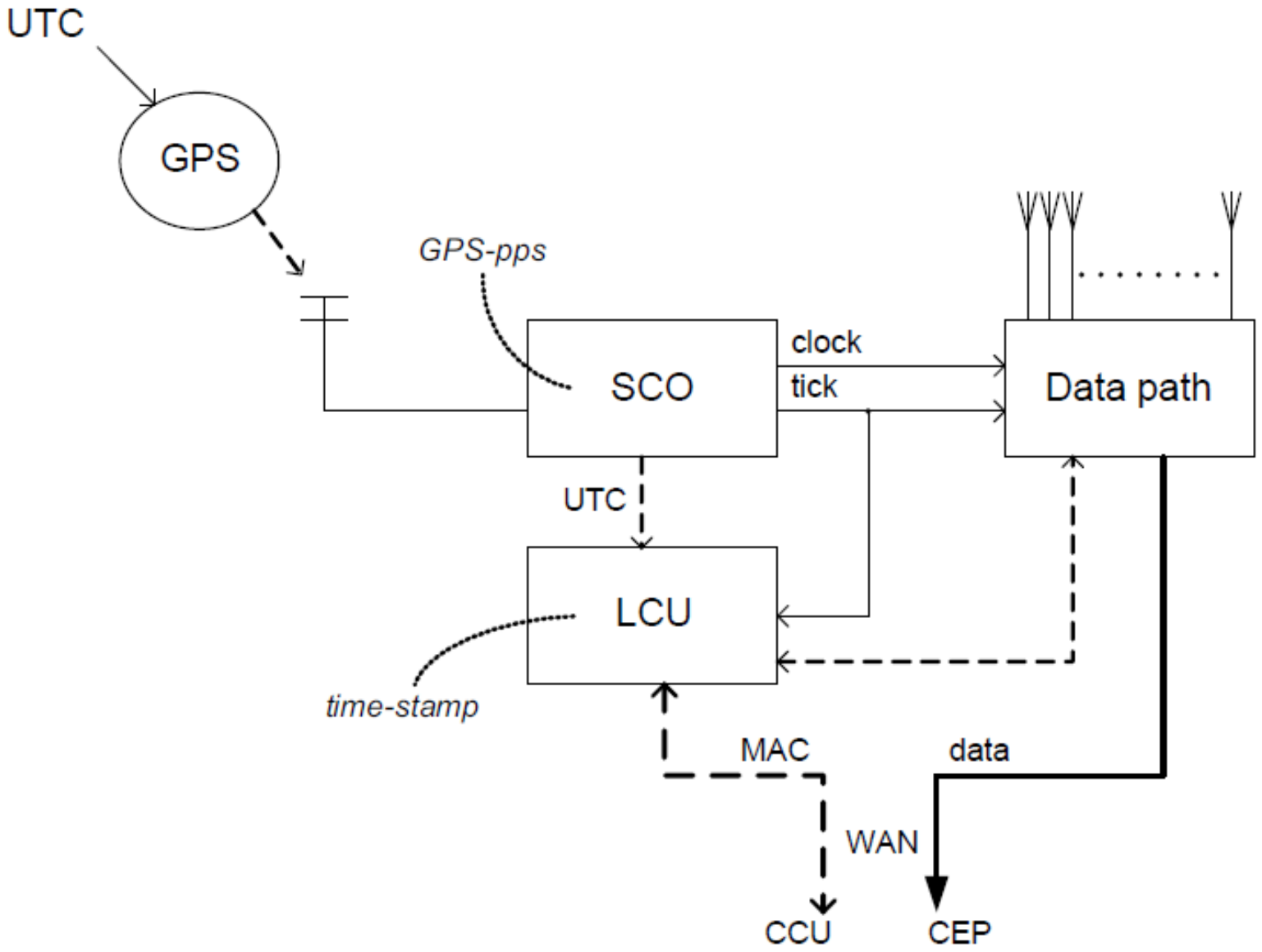
Beamlet Statistics (BST)



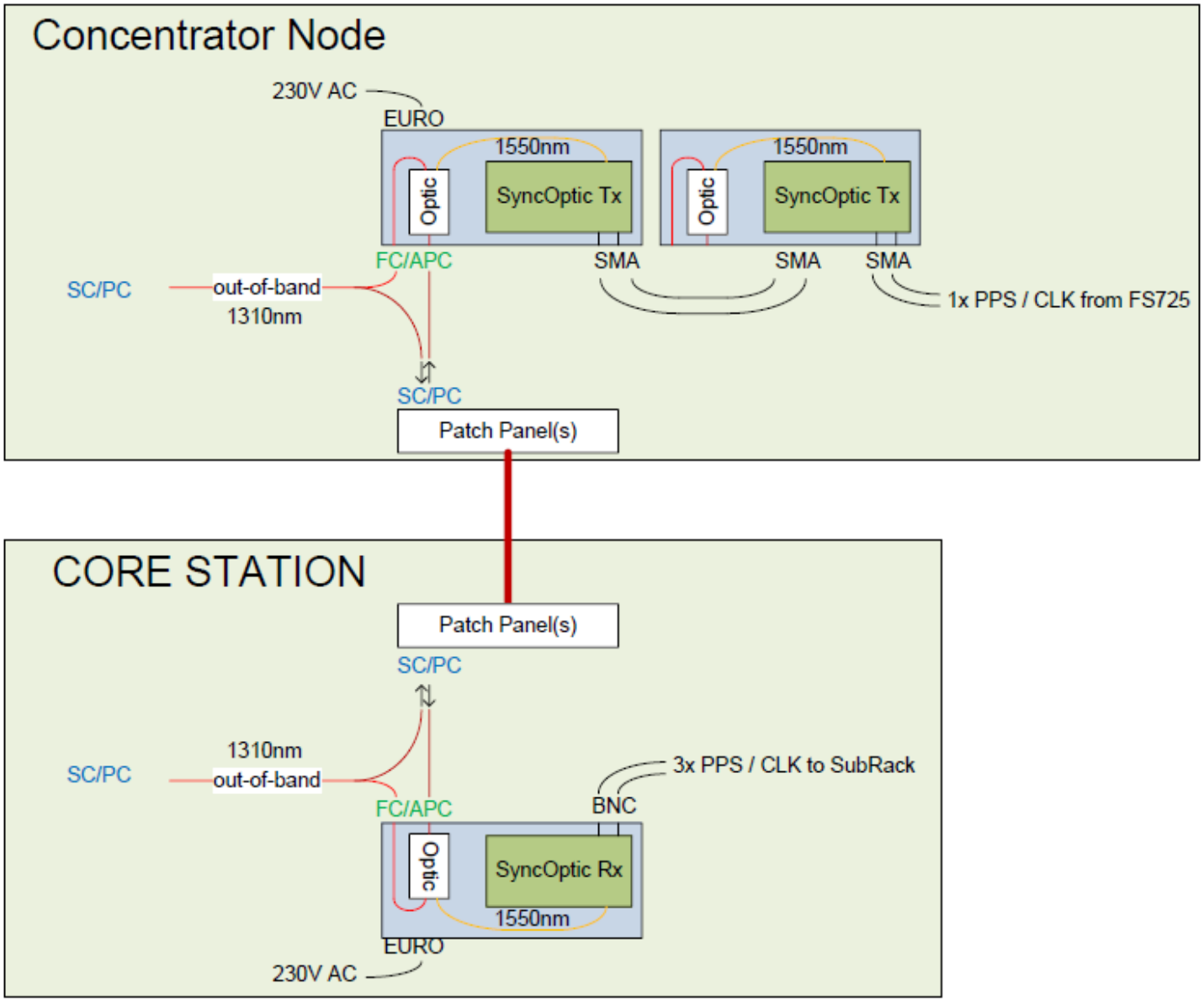
Crosslet Statistics (XST)



Station clock

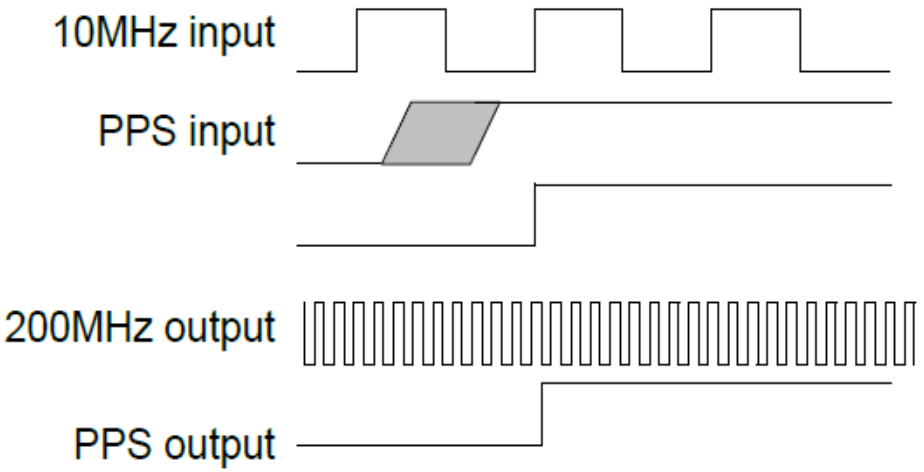


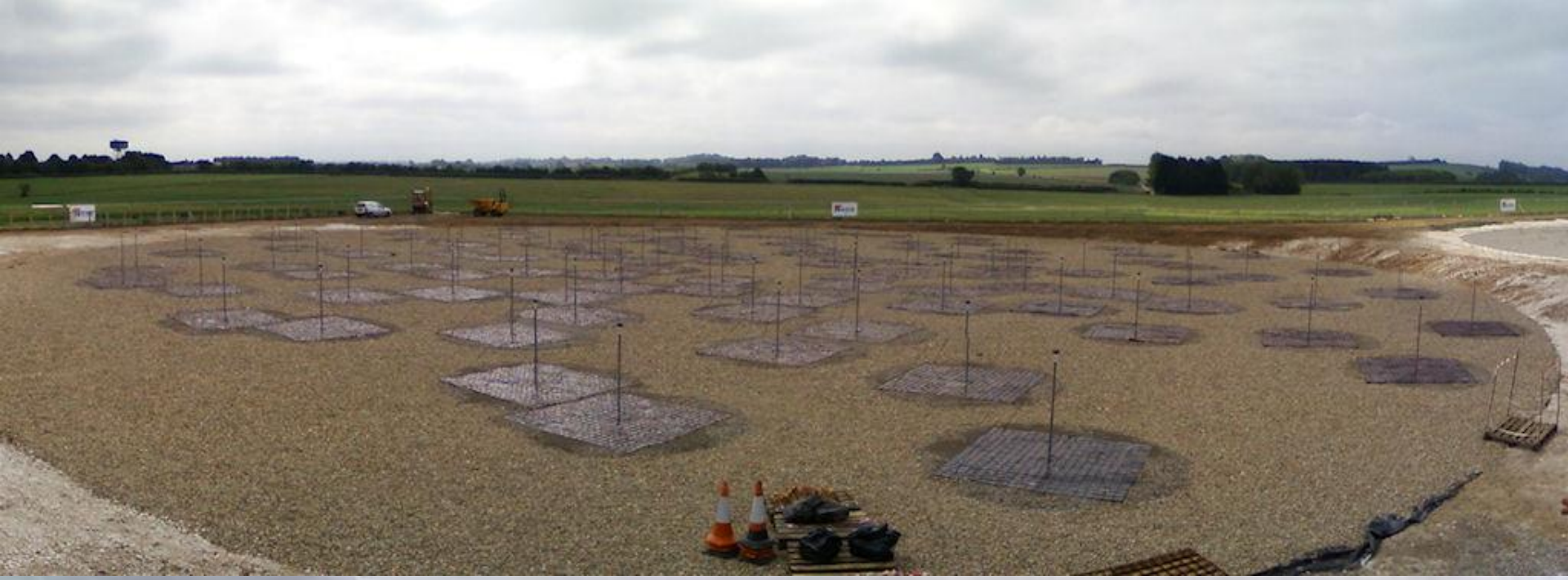
Single Clock Core Stations



SyncOptics Clock Stability

- Temp. from 10°C–40°C
- Original Tj=3.6 nS
- SyncOptics Tj=0.4 nS





Questions ?