The new MST radar on Andøya/Norway

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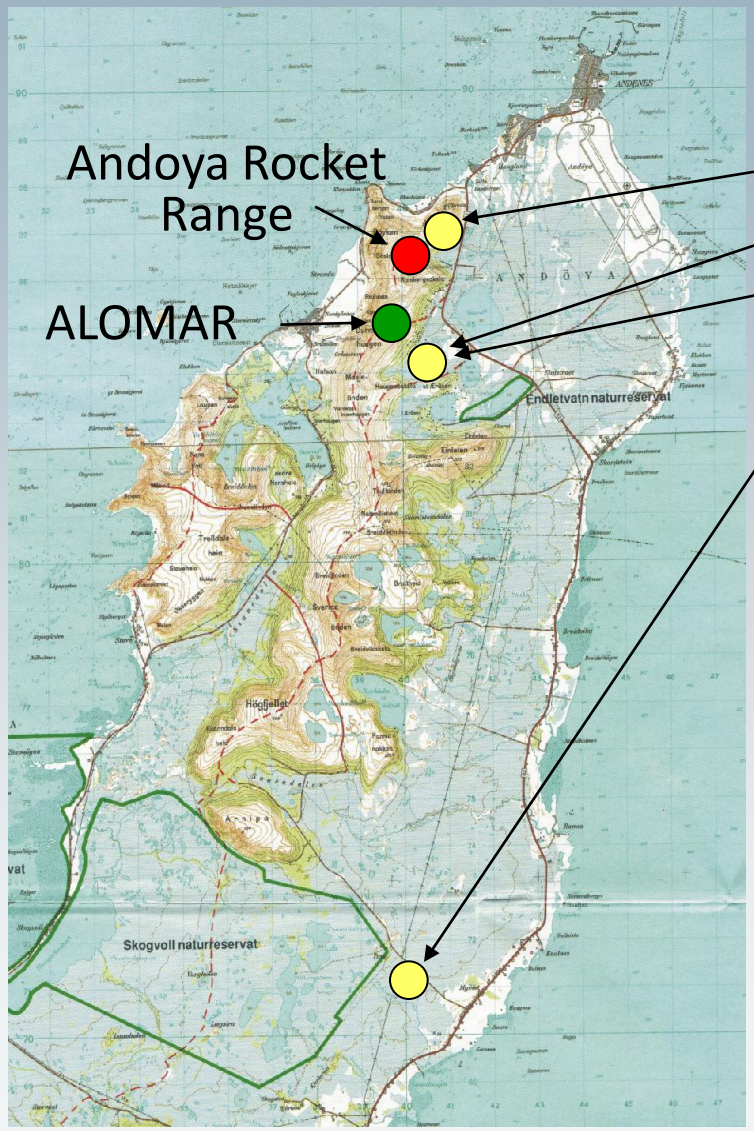
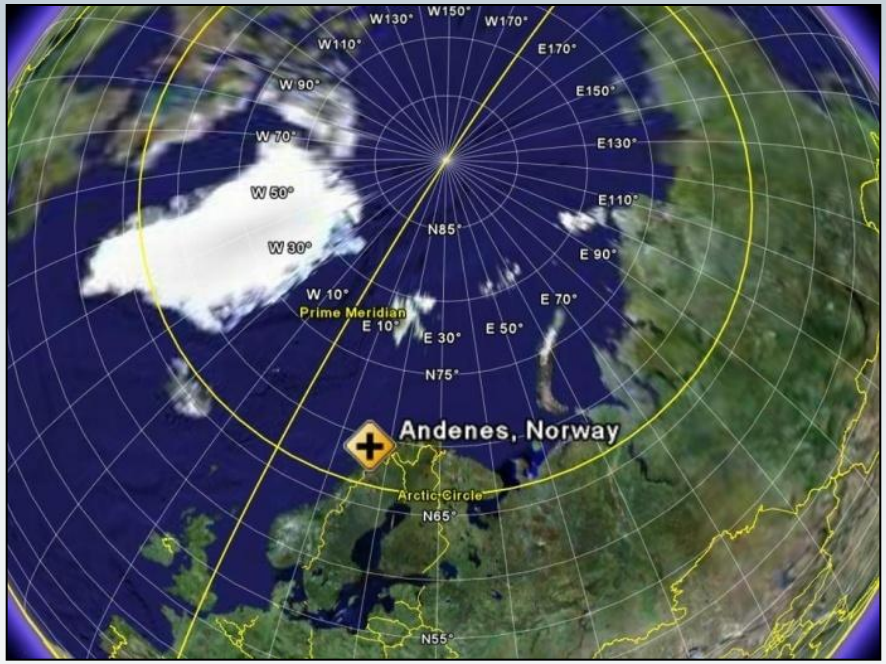
Radar experiments on Andøya island (69°N)



- **ALWIN VHF radar (53.5 MHz)**
- SKiYMET meteor radar (32.5 MHz)
- ALOMAR MF radar (1.98 MHz)
- Saura MF radar (3.17 MHz)



The old ALWIN antenna array as seen in GoogleEarth

Number of transmitter modules	6 (6 kW)
Peak power	36 kW
Number of antennas	144
Directive gain of antenna array	28.3 dBi
HPFW of antenna beam	6°
Beam directions	9

Image © 2008 DigitalGlobe
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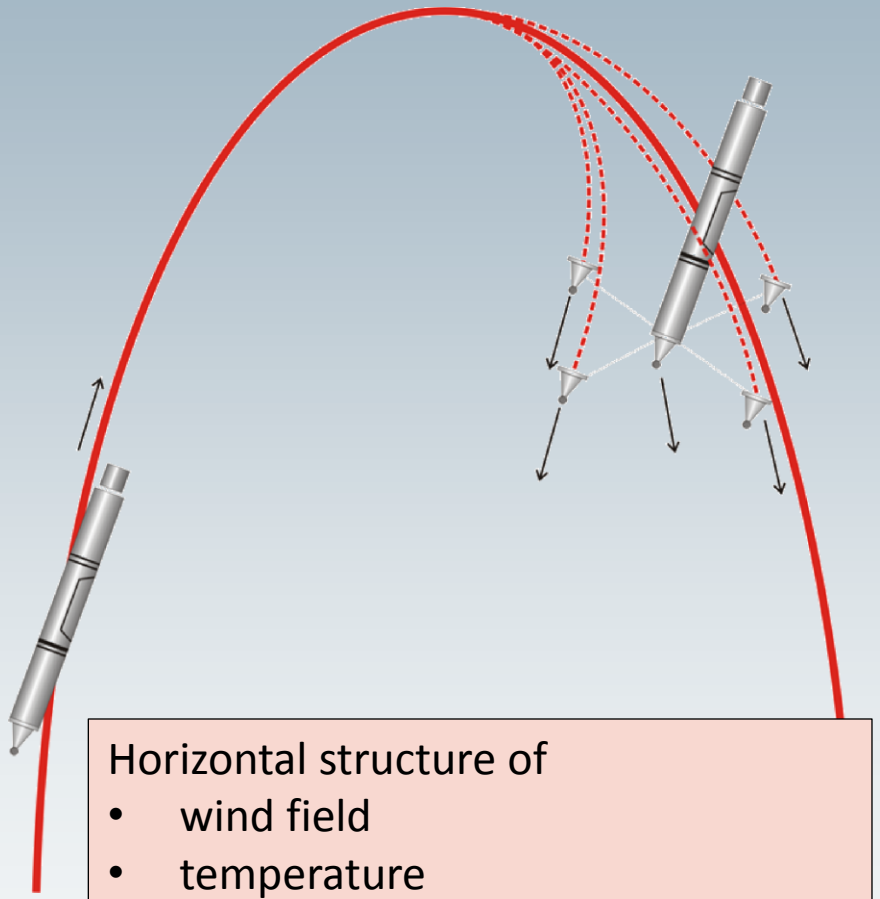
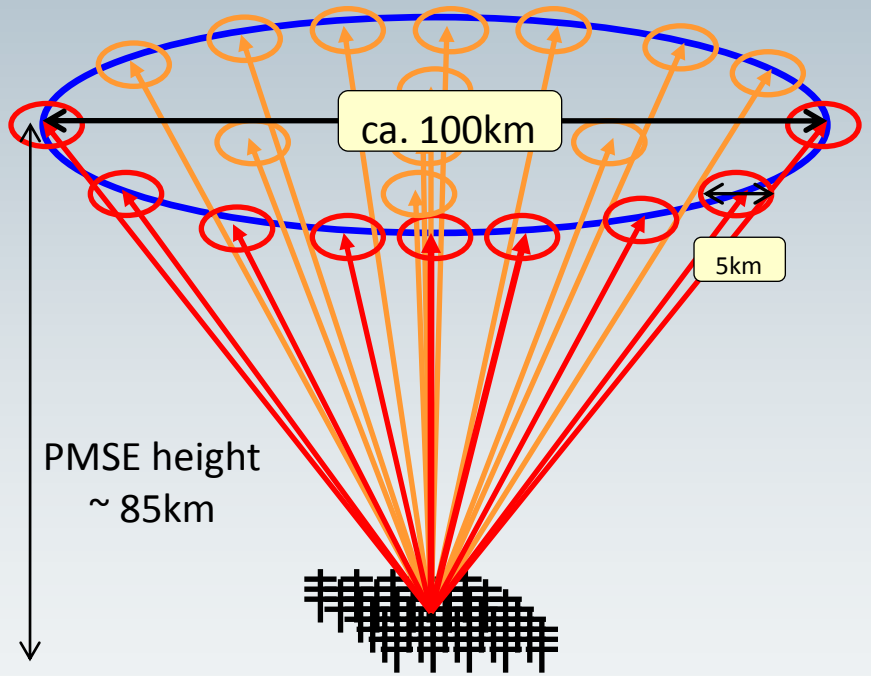
Motivation: Determination of horizontal structures of PMSE

„Mother-Daughter payloads“



scanning with free steerable radar beam down to 30° off-zenith



Horizontal structure of
- wind field
- temperature
- turbulent engergy dissipation rate

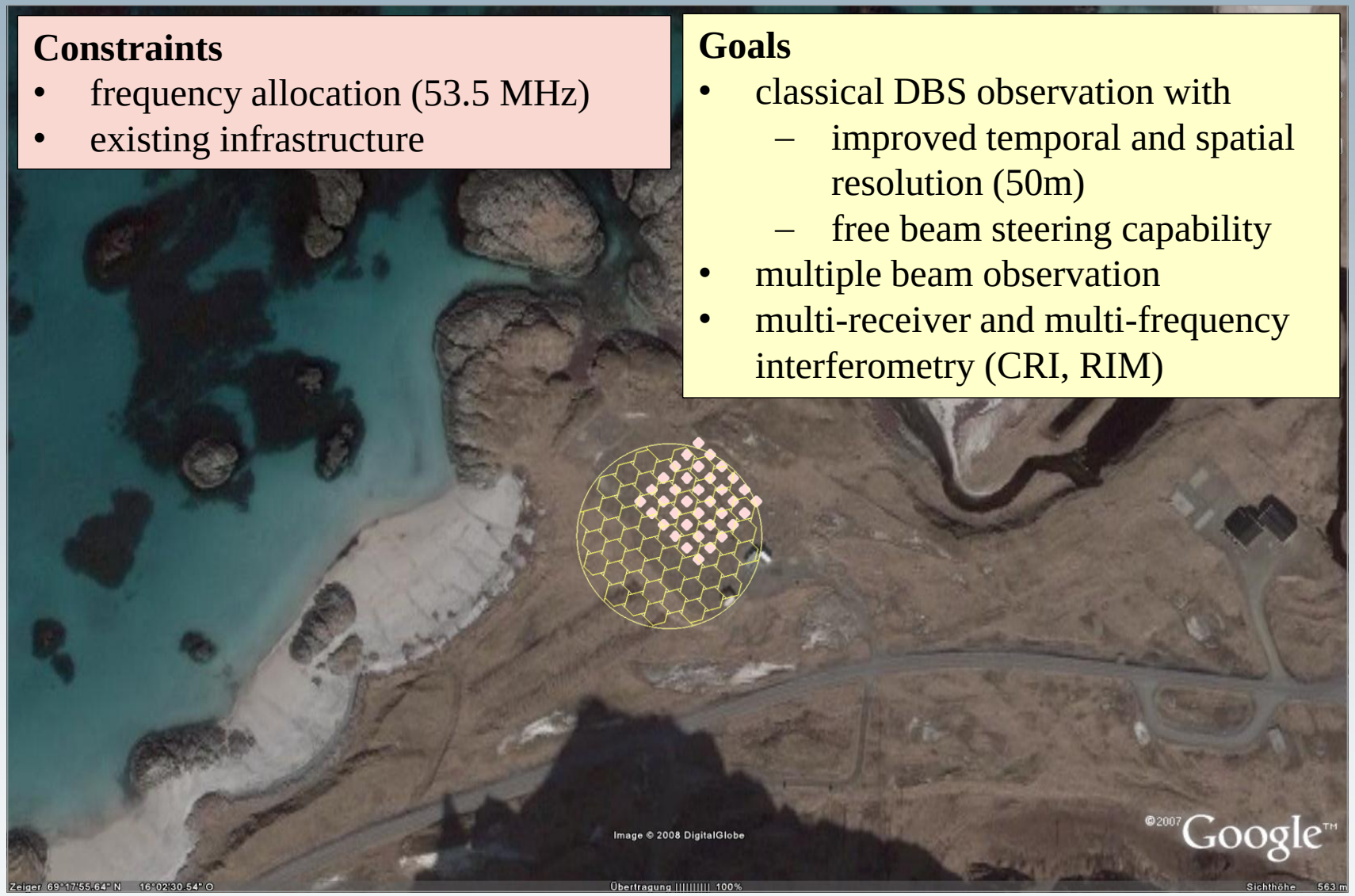
The ALWIN2 idea

Constraints

- frequency allocation (53.5 MHz)
- existing infrastructure

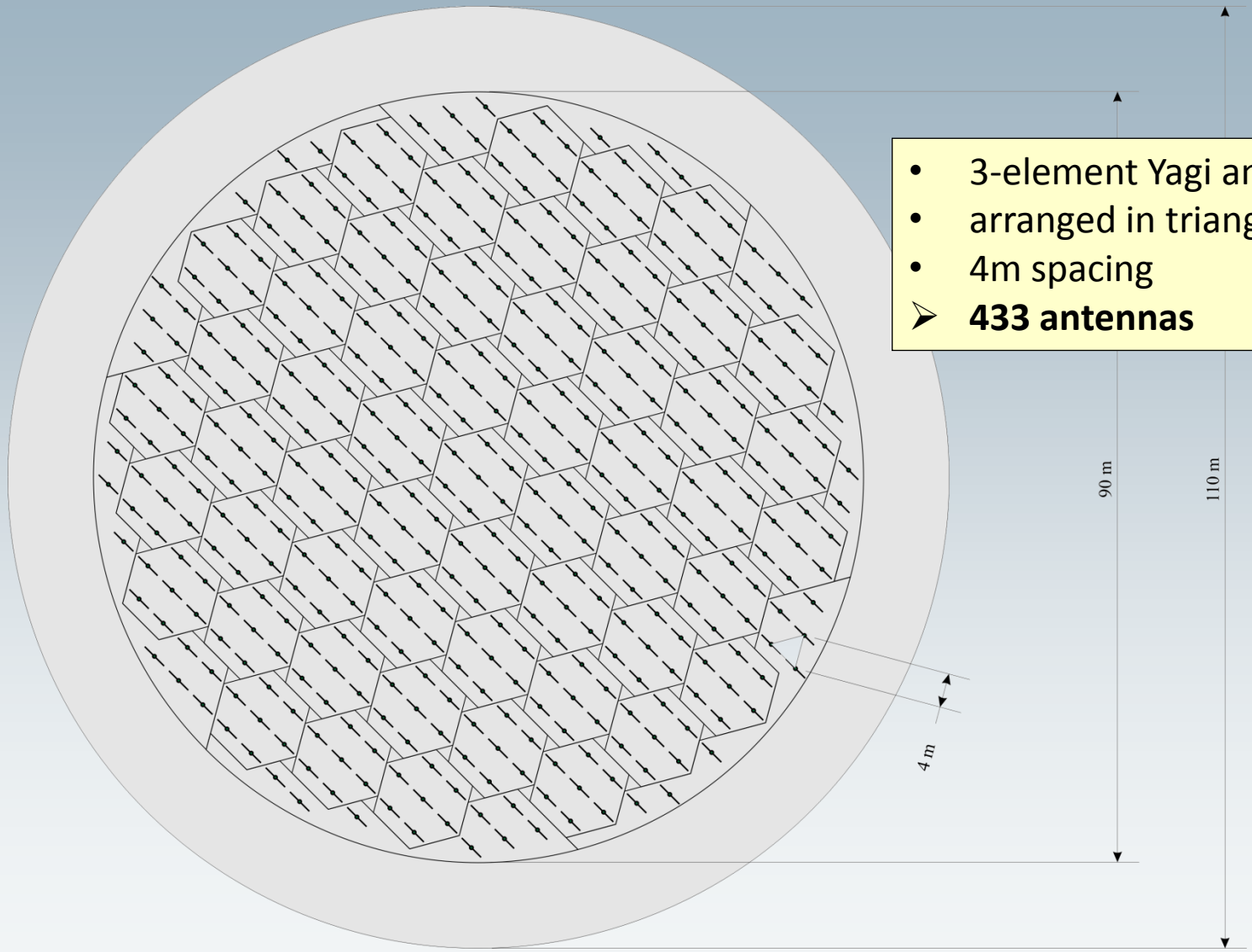
Goals

- classical DBS observation with
  - improved temporal and spatial resolution (50m)
  - free beam steering capability
- multiple beam observation
- multi-receiver and multi-frequency interferometry (CRI, RIM)



ALWIN2

The dimension and structure of the planned antenna array

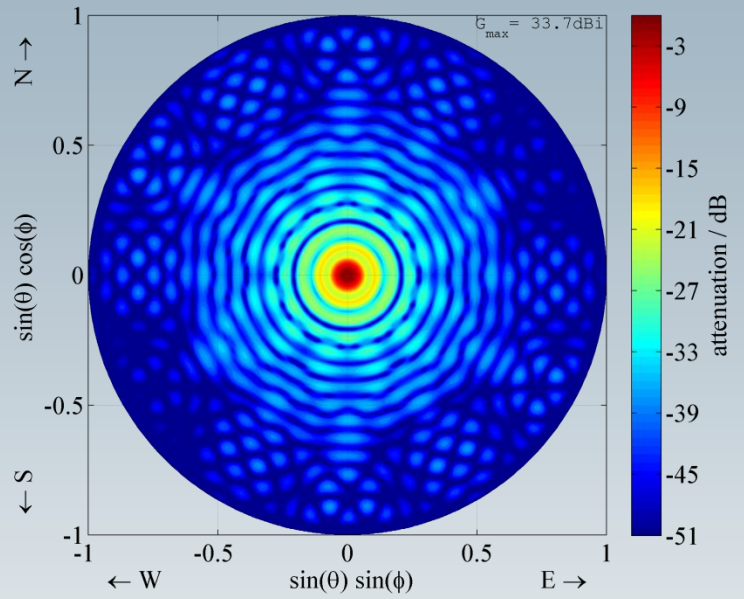


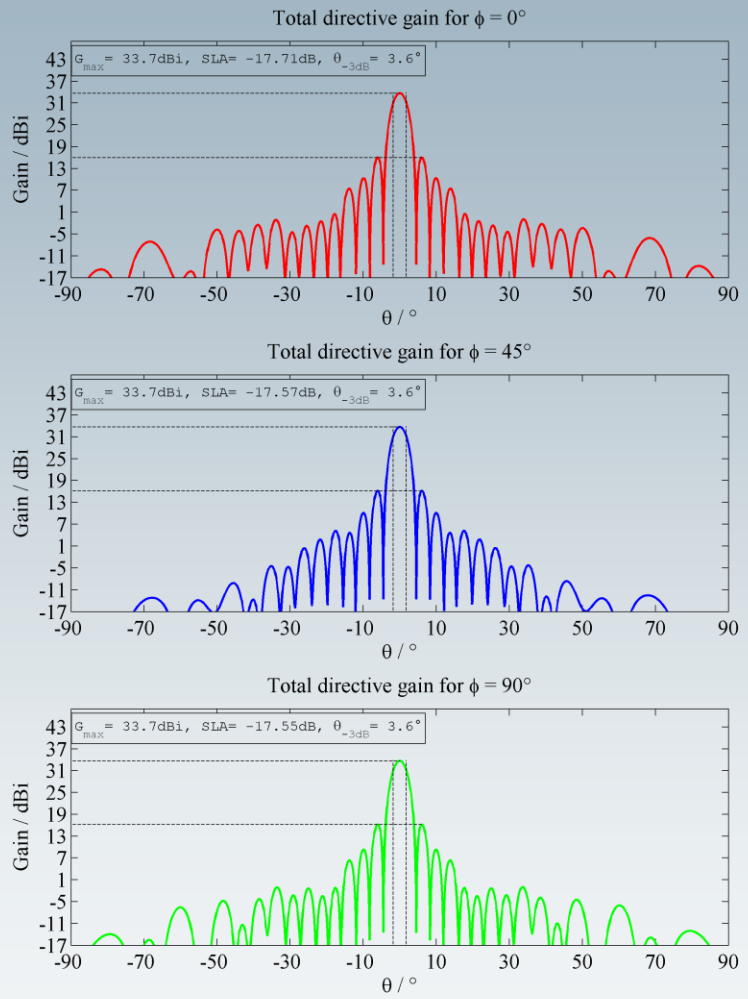
- 3-element Yagi antennas
- arranged in triangular grid
- 4m spacing
- ➢ **433 antennas**

Prototypes of the ALWIN2 antenna

ALWIN2 – array of 433 3-element Yagi antennas

Radiation pattern for ϕ=0°, θ=0°

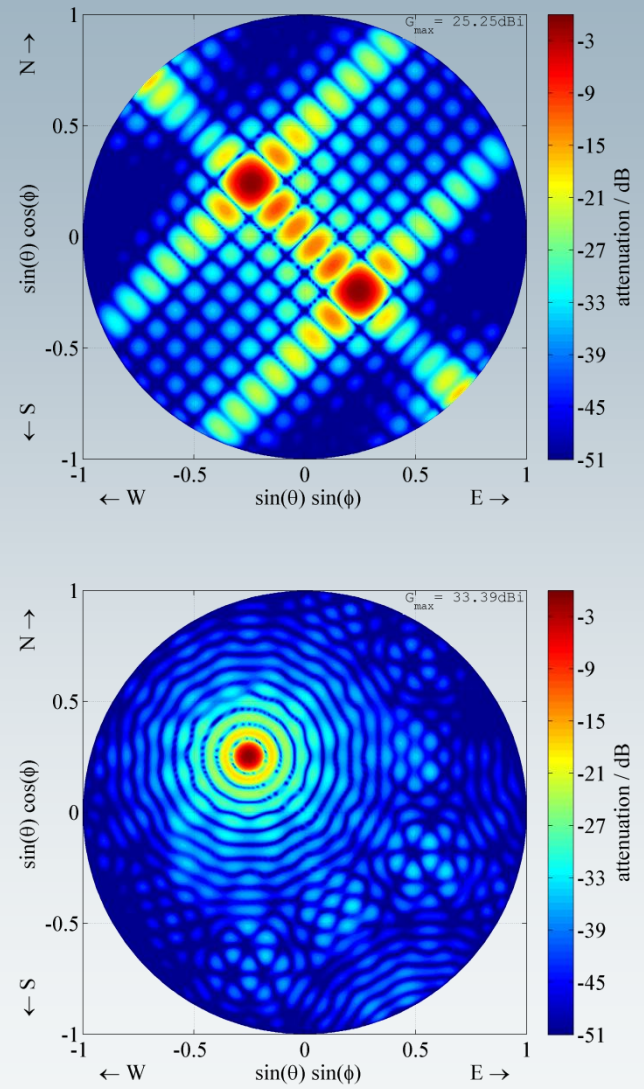


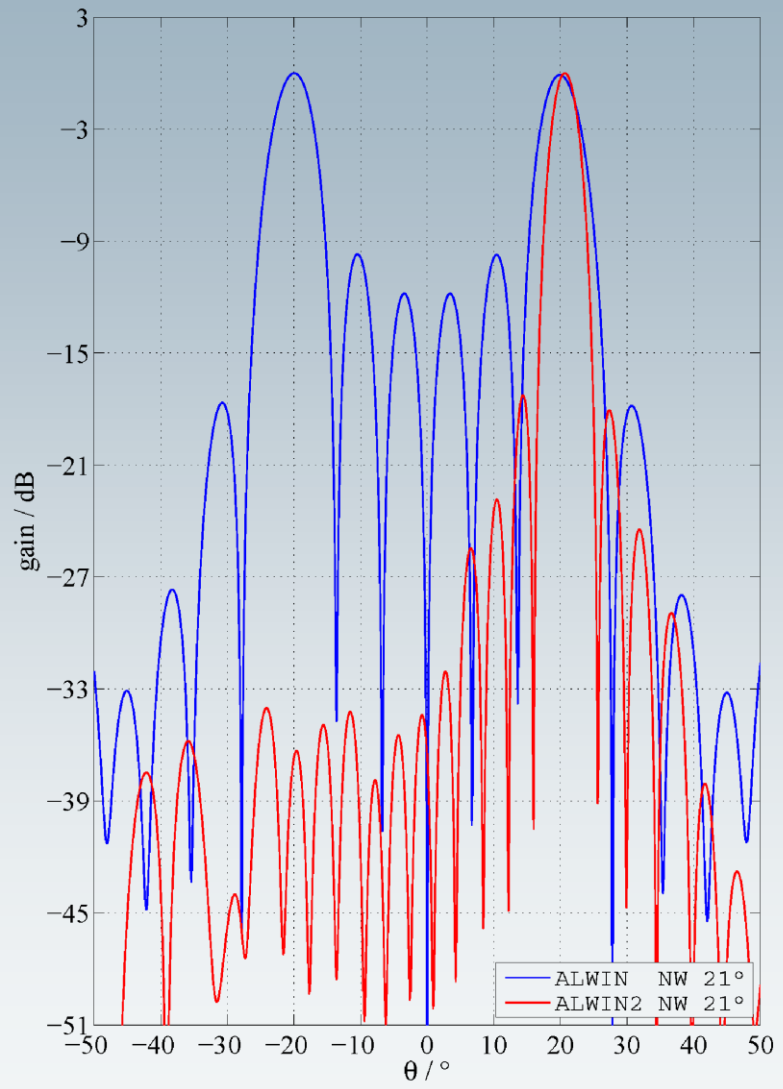


Number of antennas	433
Directive gain of array	33.7 dBi
HPFW of main lobe	3.6°
Side lobe attenuation	-17.7 dB

ALWIN – ALWIN2

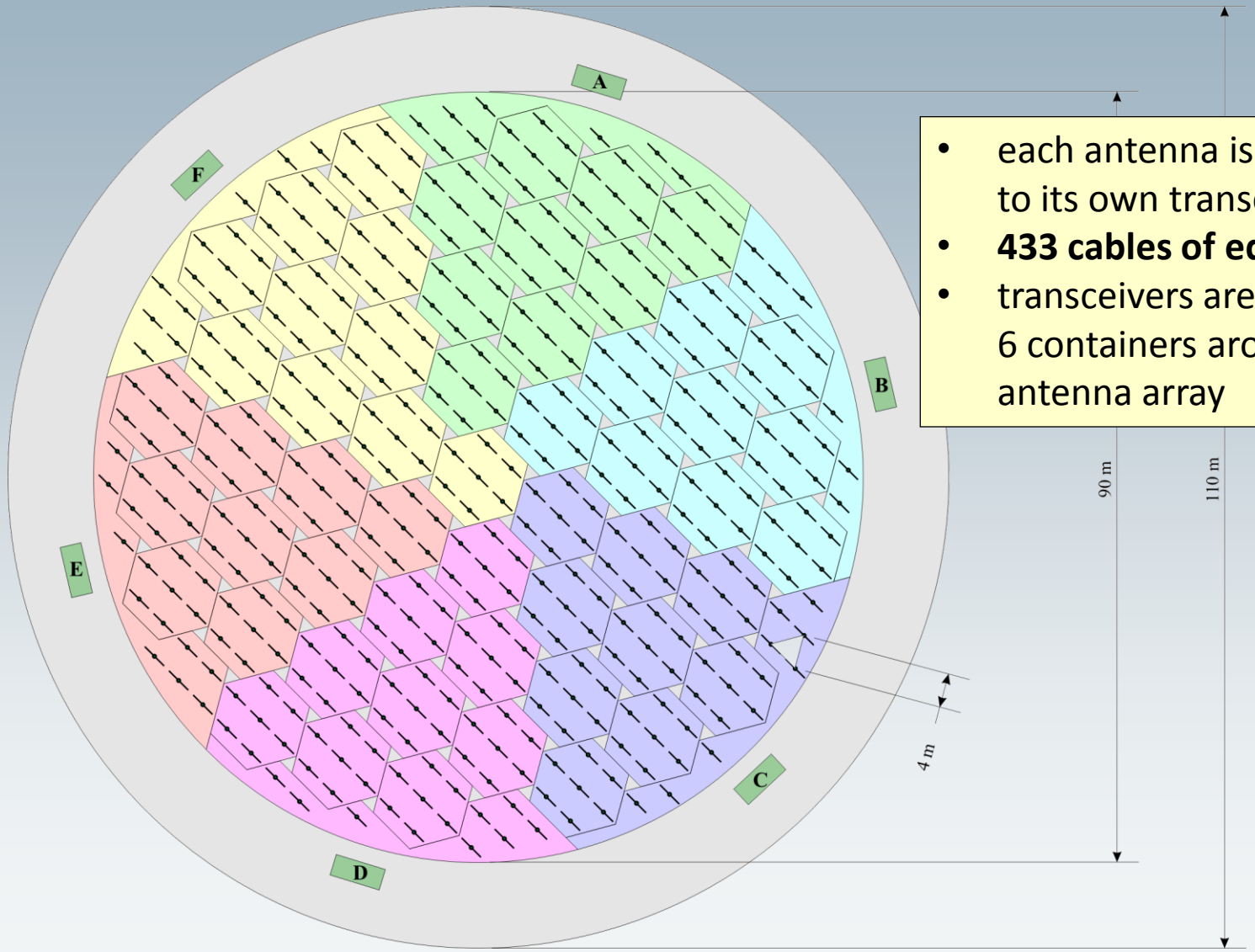
Radiation patterns for ϕ=315°, θ=21°





ALWIN2 radar

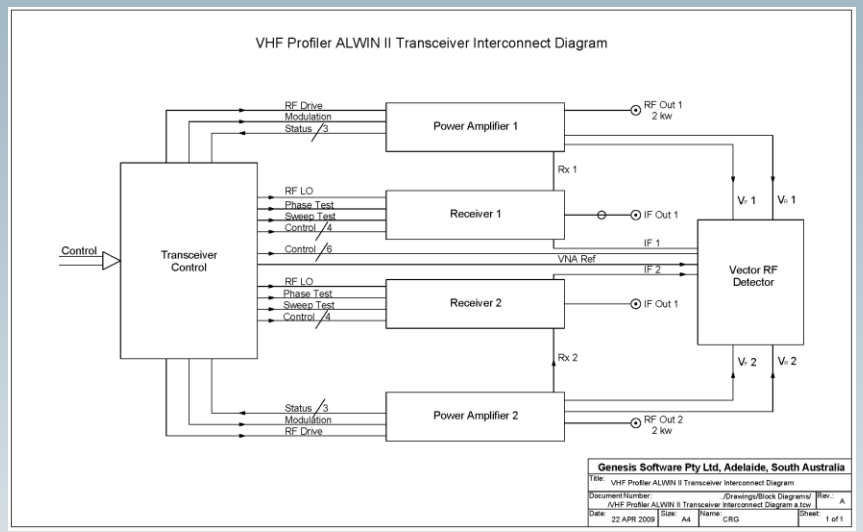
allocation of antennas to 6 transceiver containers



- each antenna is connected to its own transceiver
- **433 cables of equal length**
- transceivers are located in 6 containers around the antenna array

ALWIN2 radar

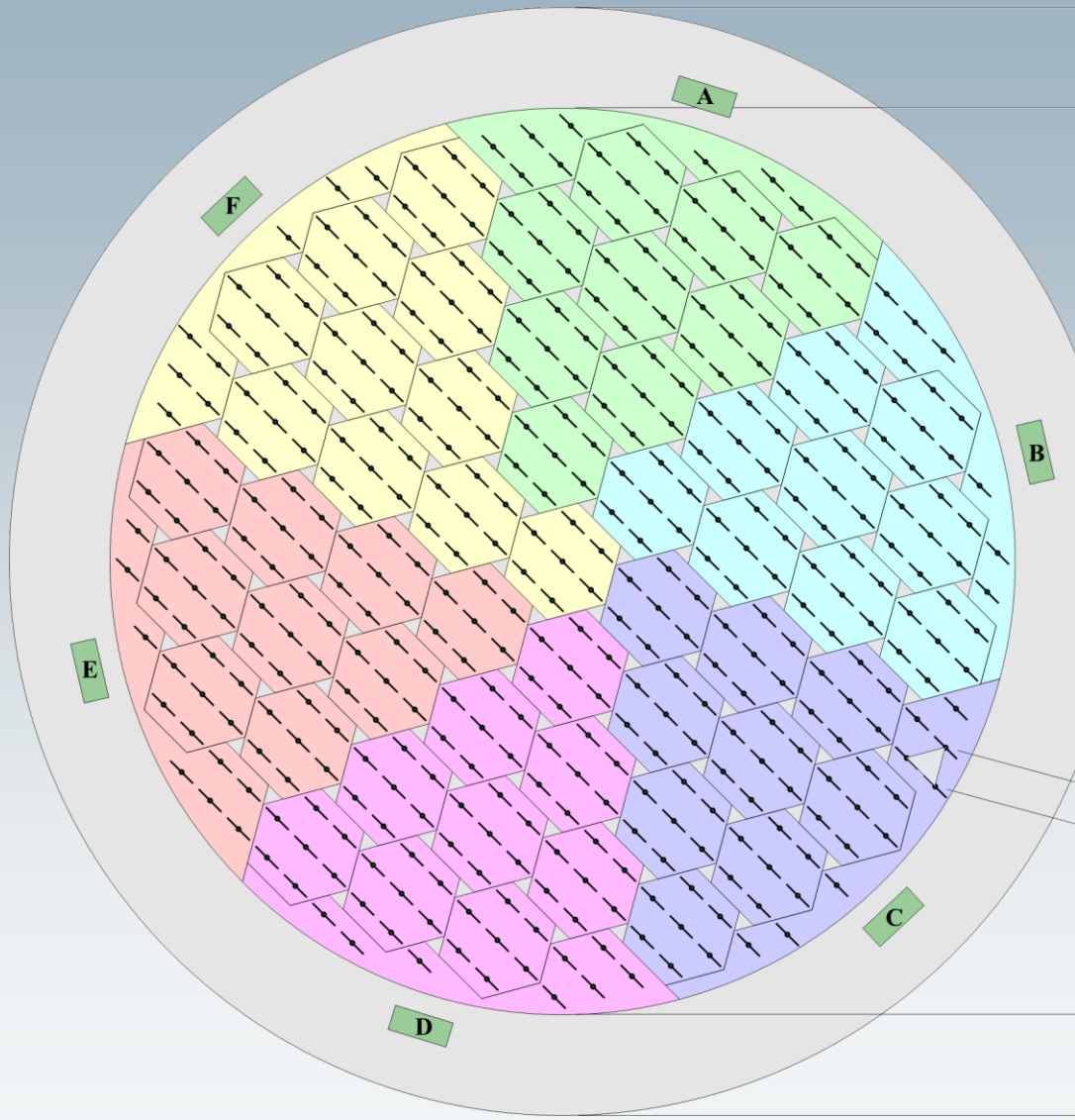
transceiver block diagrams



- a state of the art VHF solid state pulsed transmitter and down converter
  - 53.5 MHz
  - 2kW peak power
- widely programmable operating parameters:
  - frequency,
  - phase
  - amplitude
  - pulse shapes
  - pulse lengths (≥ 0.33µs)
- vector RF detection circuitry for continuous monitoring on a pulse-to-pulse basis of
  - output power
  - phase
  - load impedance

ALWIN2 radar

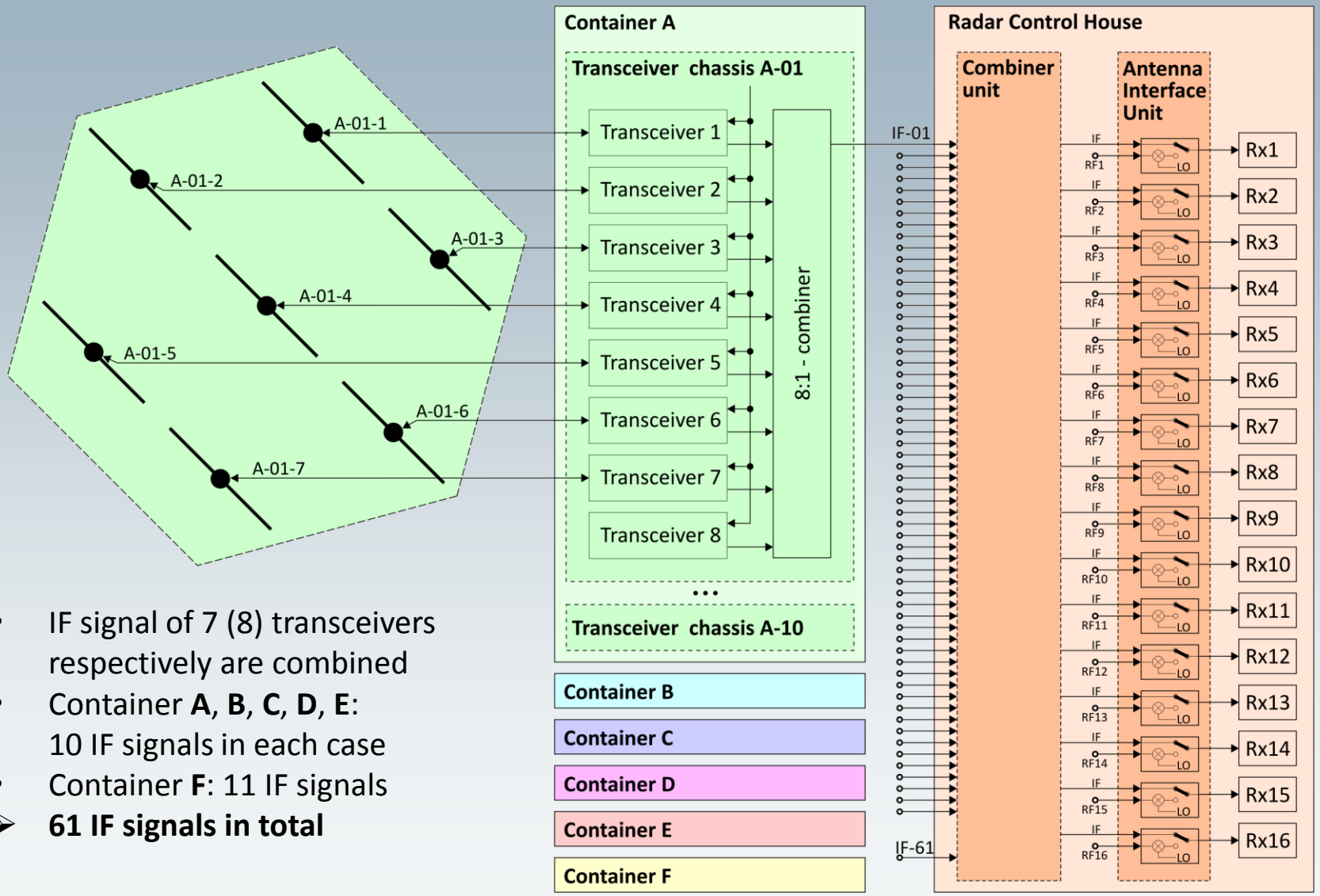
allocation of antennas to 6 transceiver containers



- IF signals of 7 transceivers are combined (hexagons)
- ➢ 61 IF signals are connected to RDAS in control house

ALWIN2 – Radar

Block diagram of receive signals

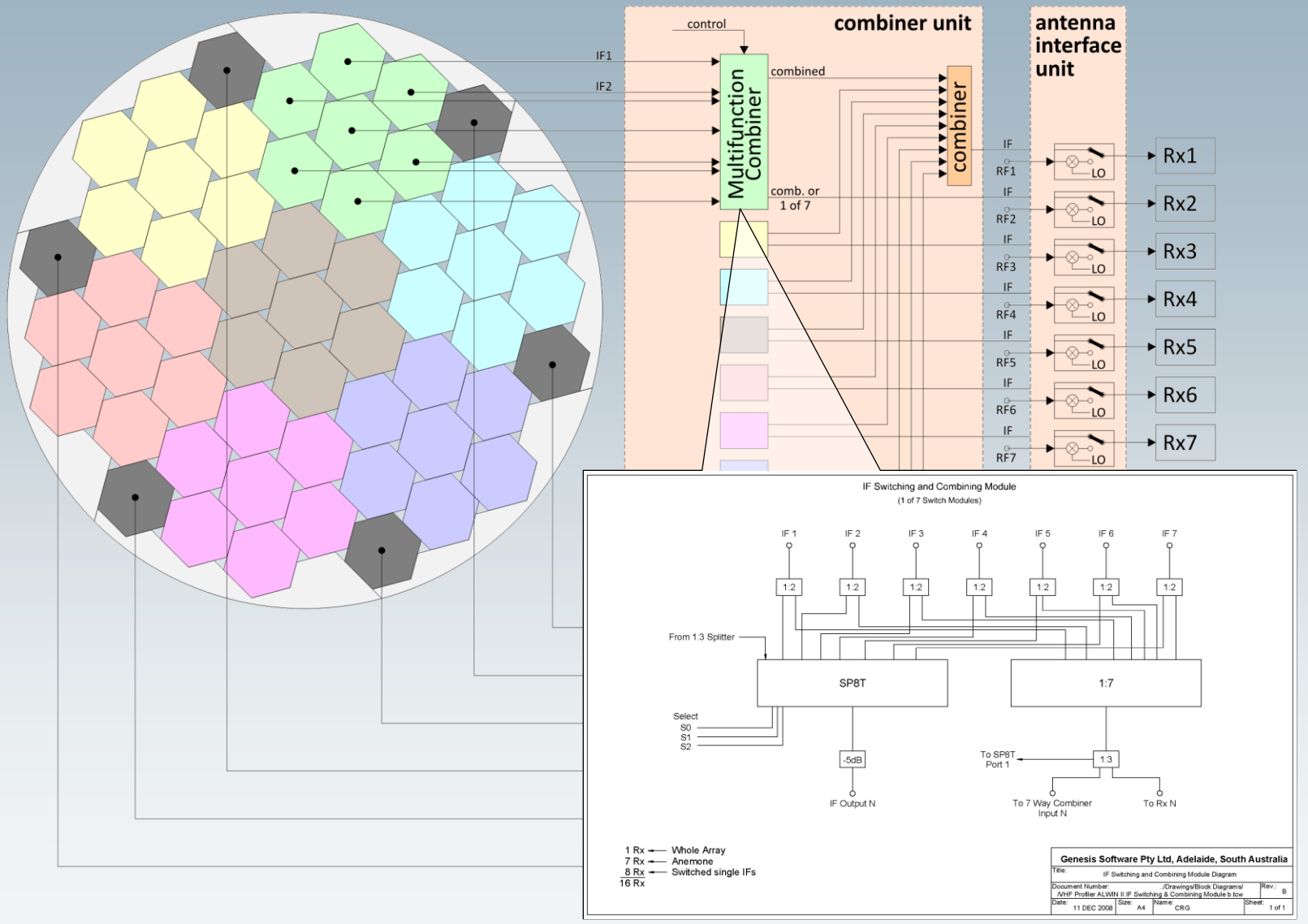


- IF signal of 7 (8) transceivers respectively are combined
- Container **A**, **B**, **C**, **D**, **E**: 10 IF signals in each case
- Container **F**: 11 IF signals

➢ **61 IF signals in total**

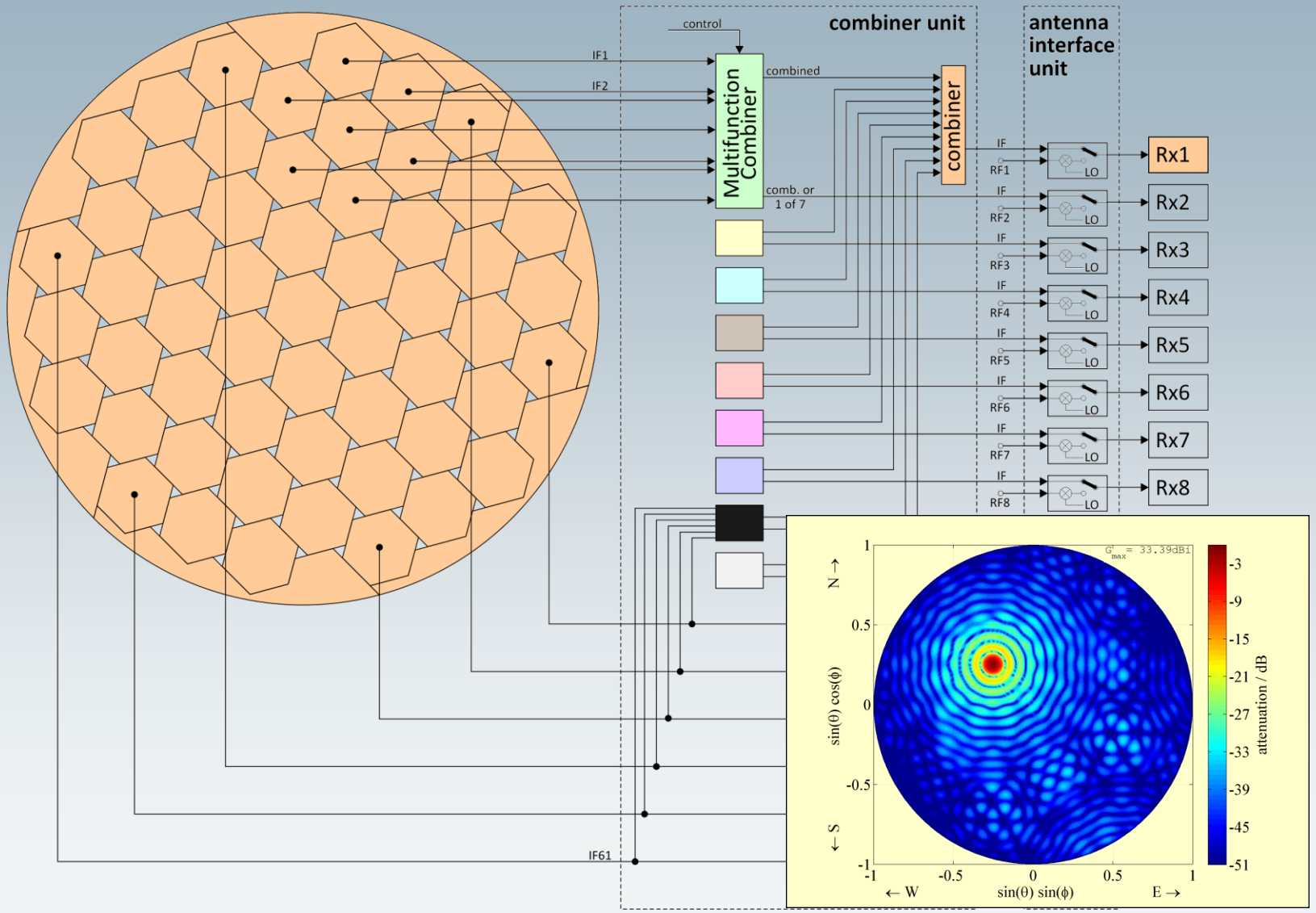
ALWIN2 – Radar

Allocation of 61 IF signals to 16 baseband receivers



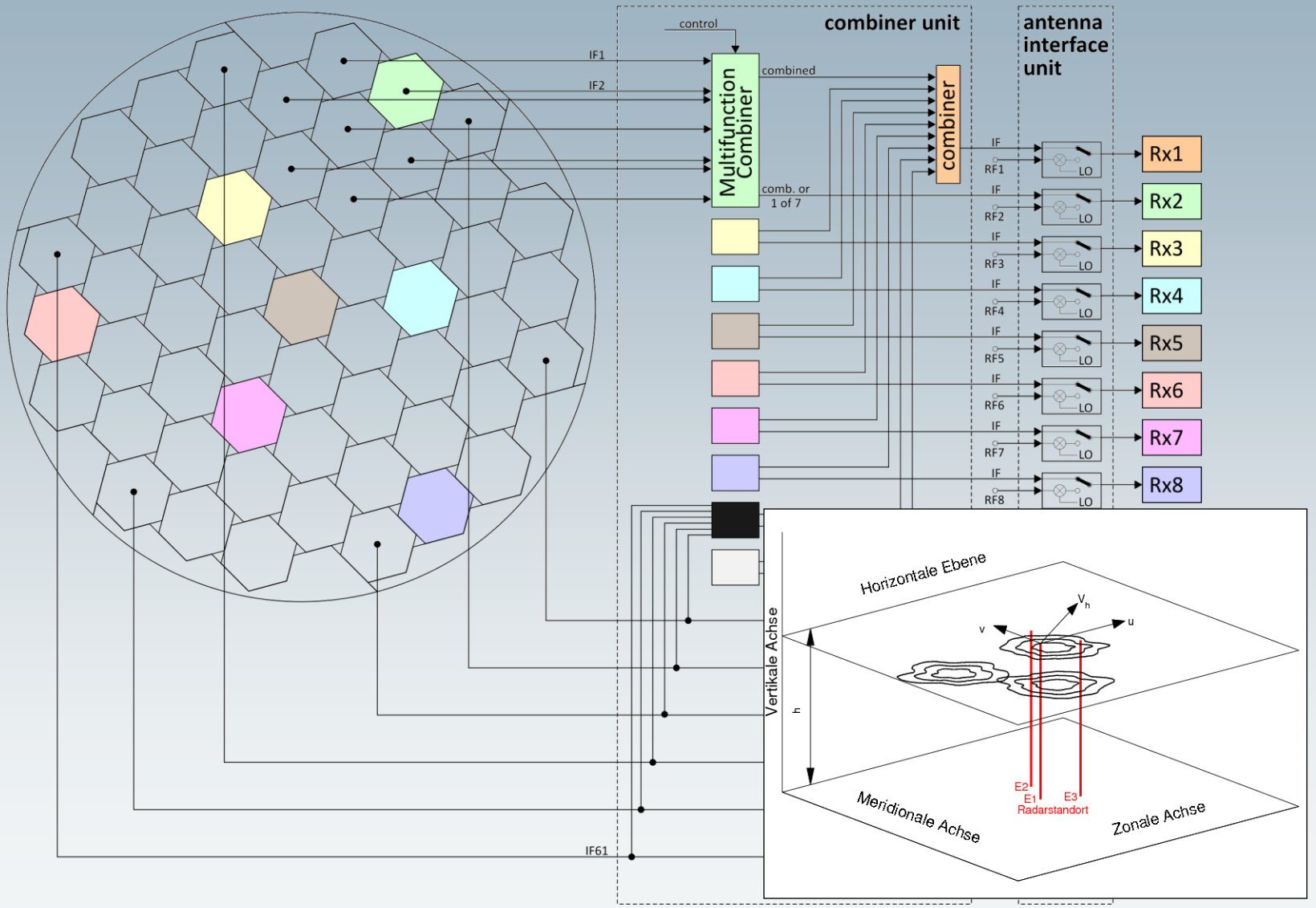
ALWIN2 – Radar

permanent DBS configuration combined to reciever 1



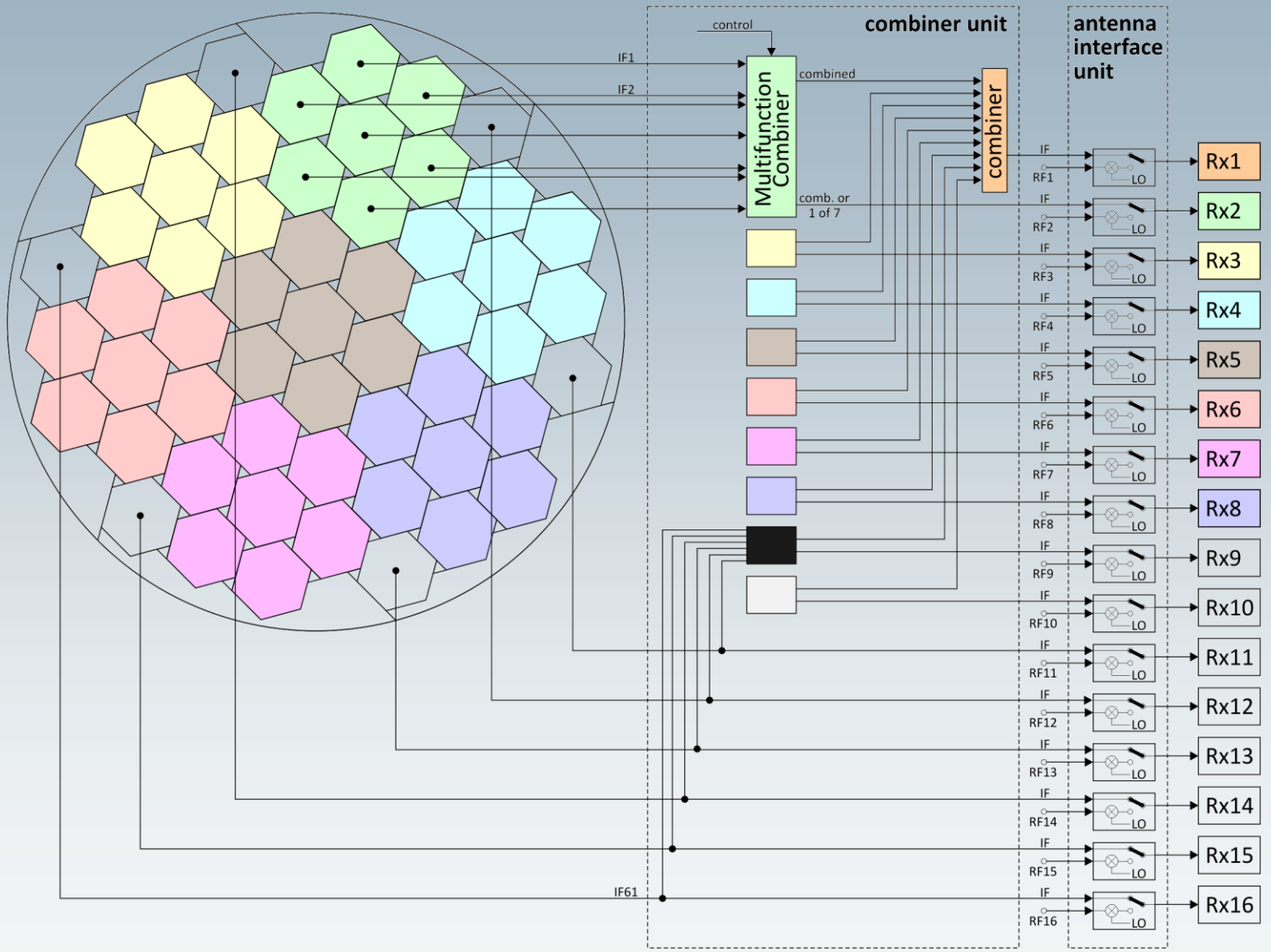
ALWIN2 – Radar

example of a spaced antenna receiving configuration



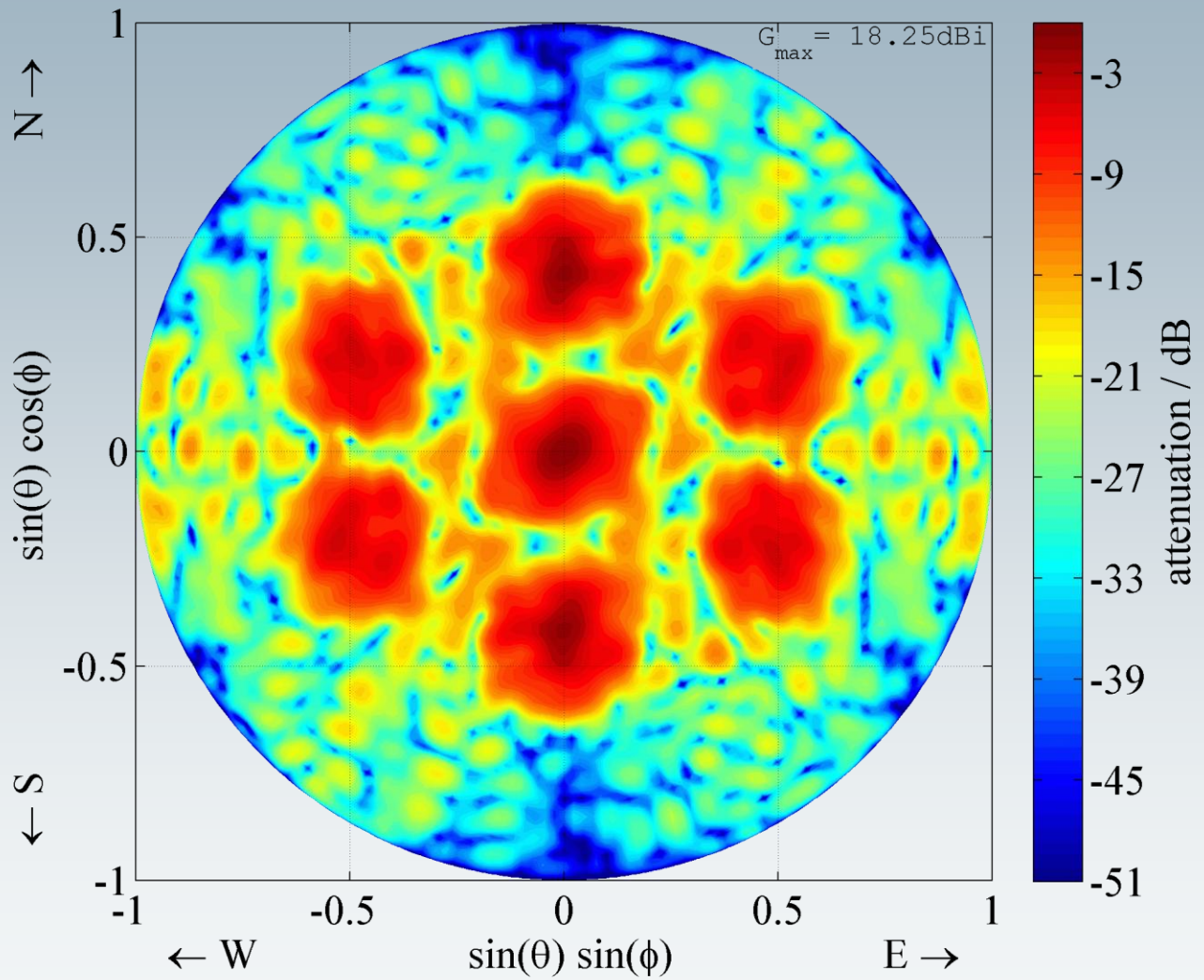
ALWIN2 – Radar

example of a spaced antenna receiving configuration



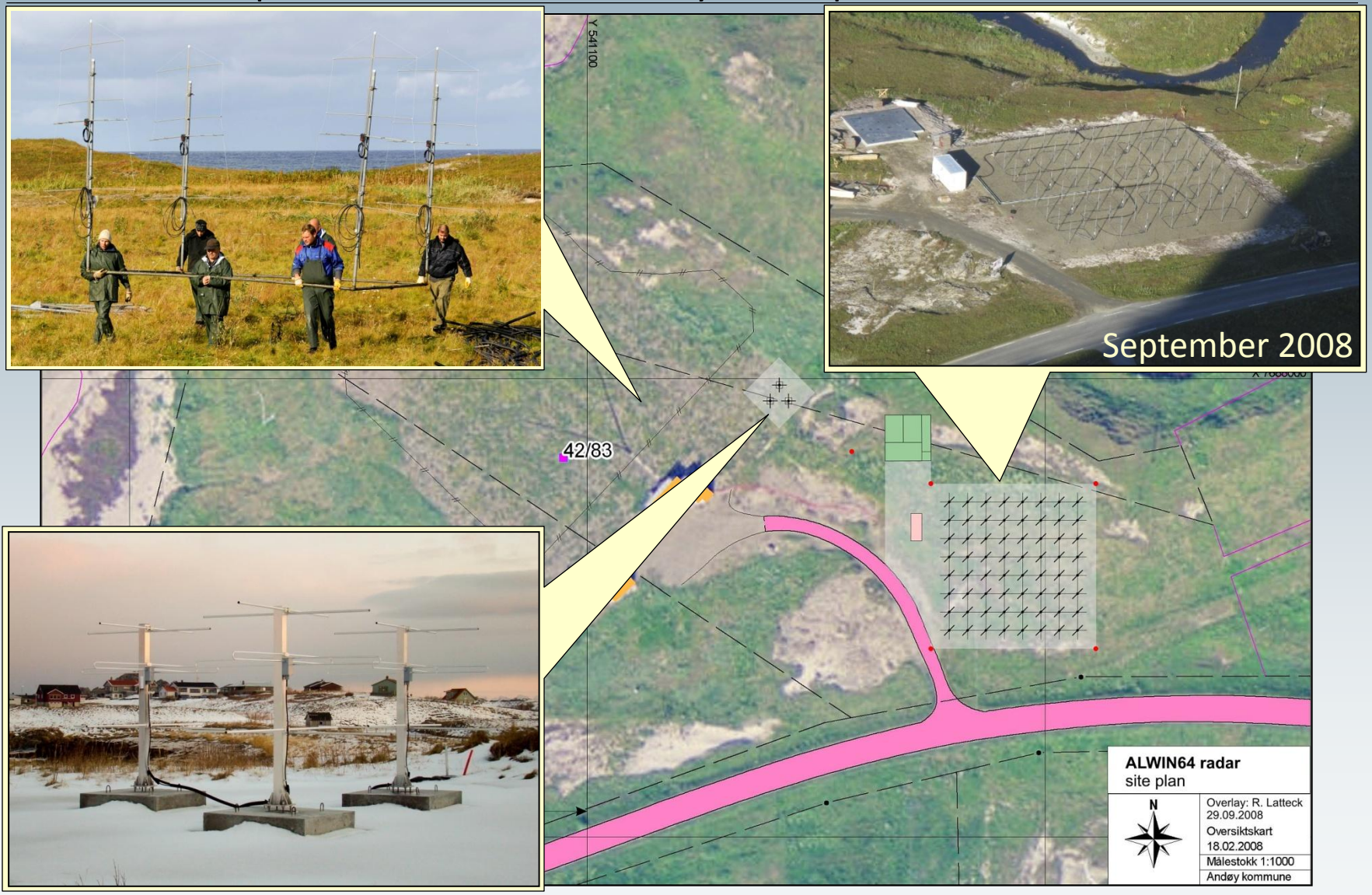
ALWIN2 – Multibeam mode

antenna radiation pattern for 7 beams



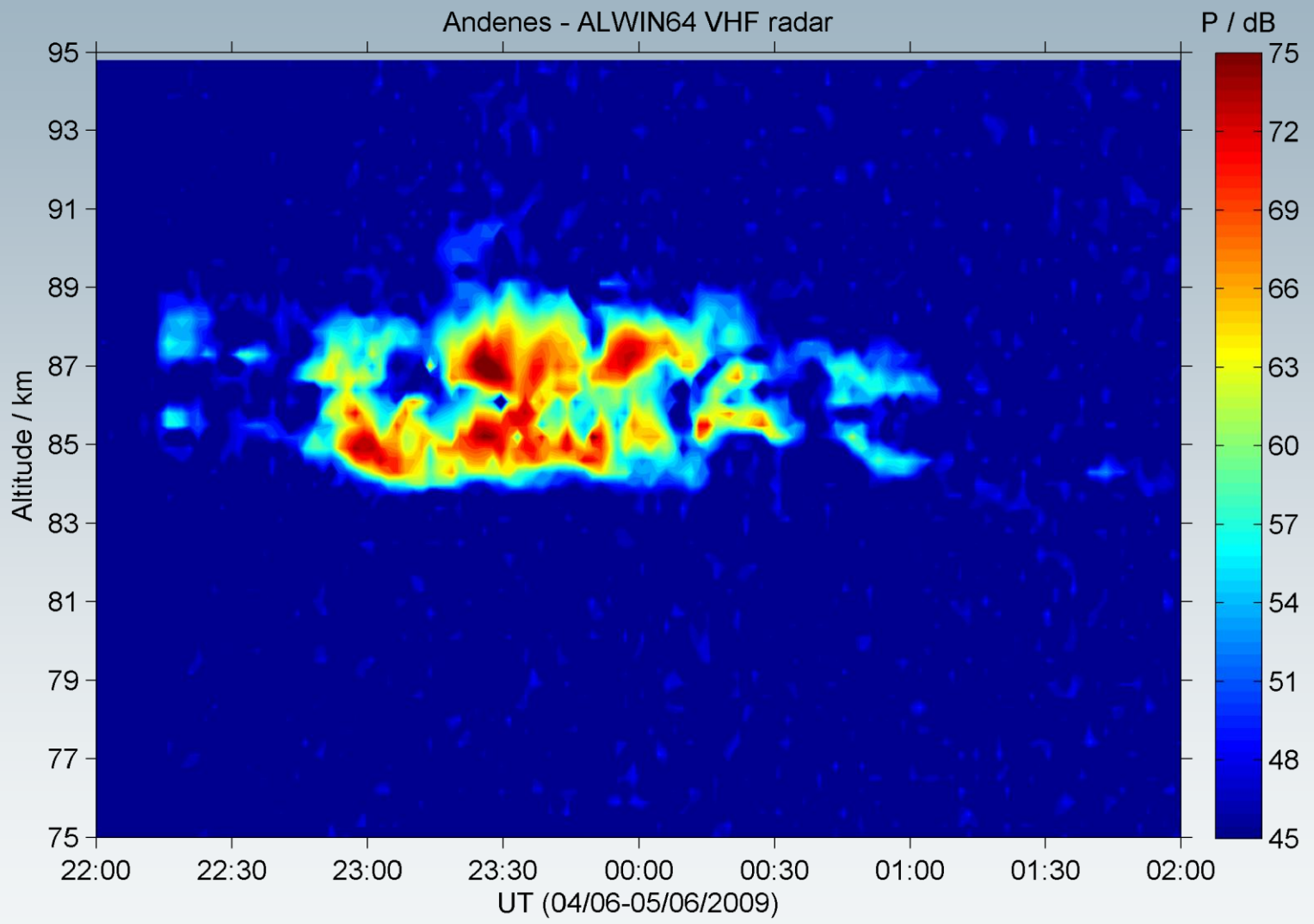
ALWIN64 – the interim solution

siteplan with 64-antenna array and separate Tx antennas



ALWIN64 – the interim solution

PMSE observation at Andenes during construction of the new ALWIN2 radar

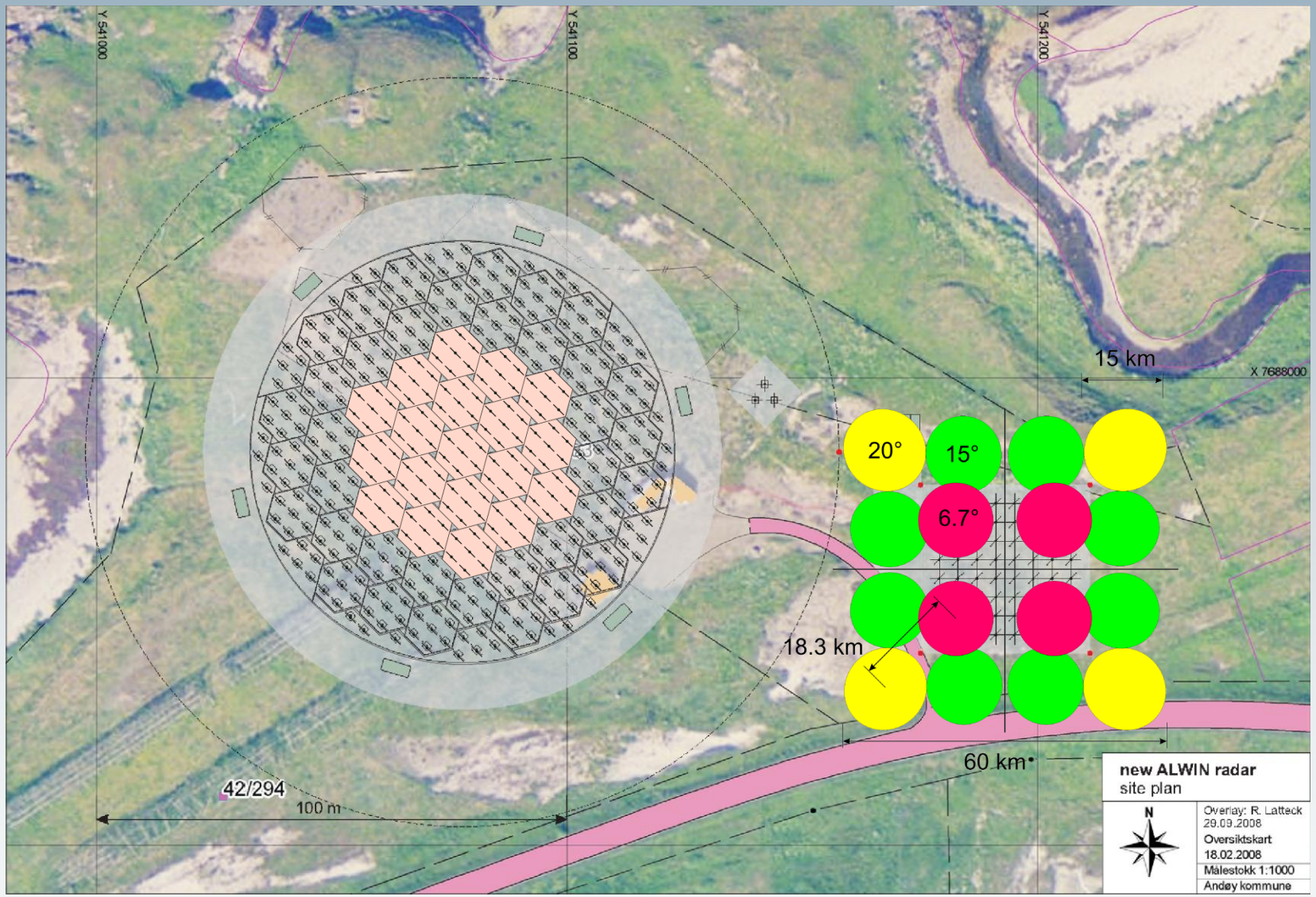


ALWIN2

progress of construction

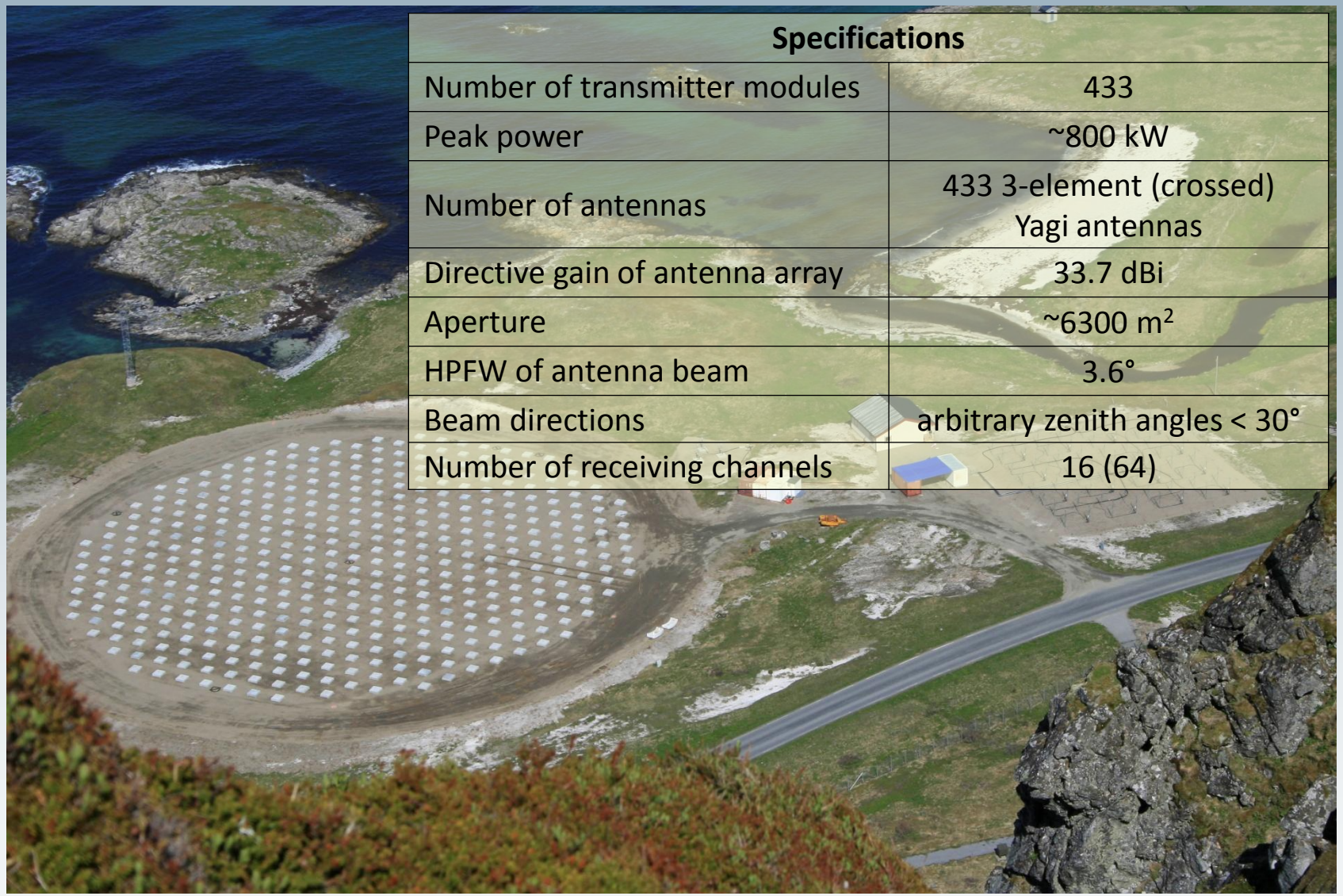
ALWIN2

expansion stage scheduled for September 2009



ALWIN2

progress of construction & specifications



Specifications	
Number of transmitter modules	433
Peak power	~800 kW
Number of antennas	433 3-element (crossed) Yagi antennas
Directive gain of antenna array	33.7 dBi
Aperture	~6300 m^2
HPFW of antenna beam	3.6°
Beam directions	arbitrary zenith angles < 30°
Number of receiving channels	16 (64)