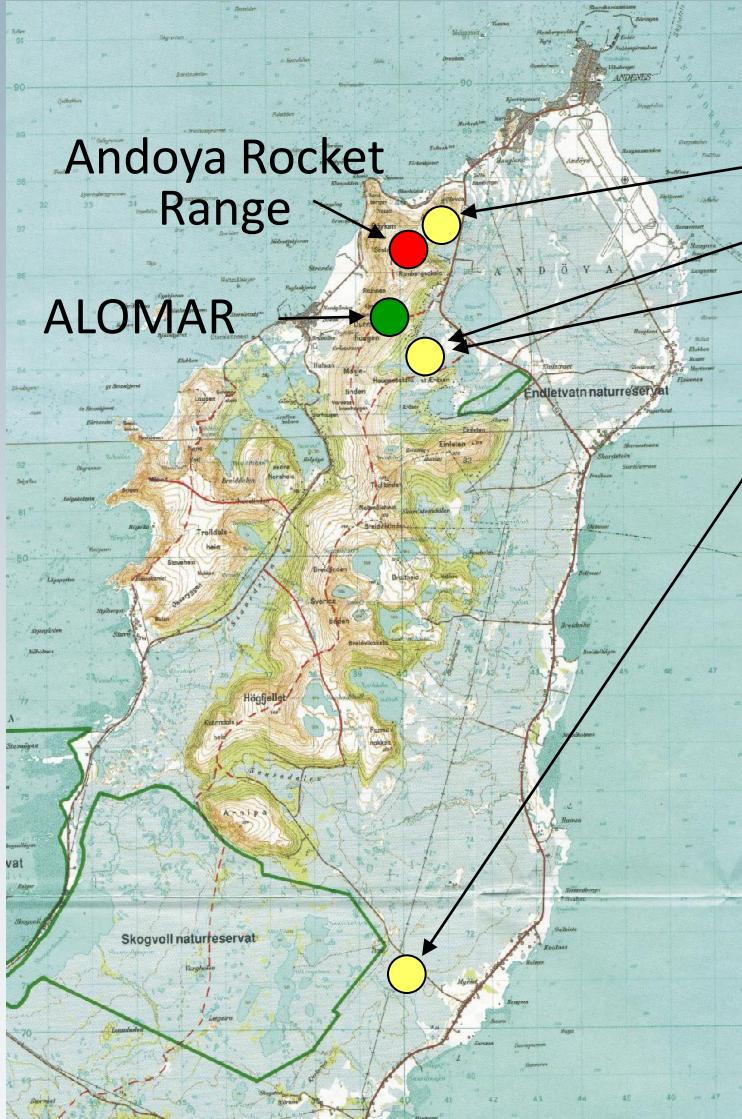

The new MST radar on Andøya/Norway

Ralph Latteck, Werner Singer, Markus Rapp, Toralf Renkwitz

Leibniz Institute of Atmospheric Physics,
Schloss-Str. 6, 18225 Kühlungsborn, Germany

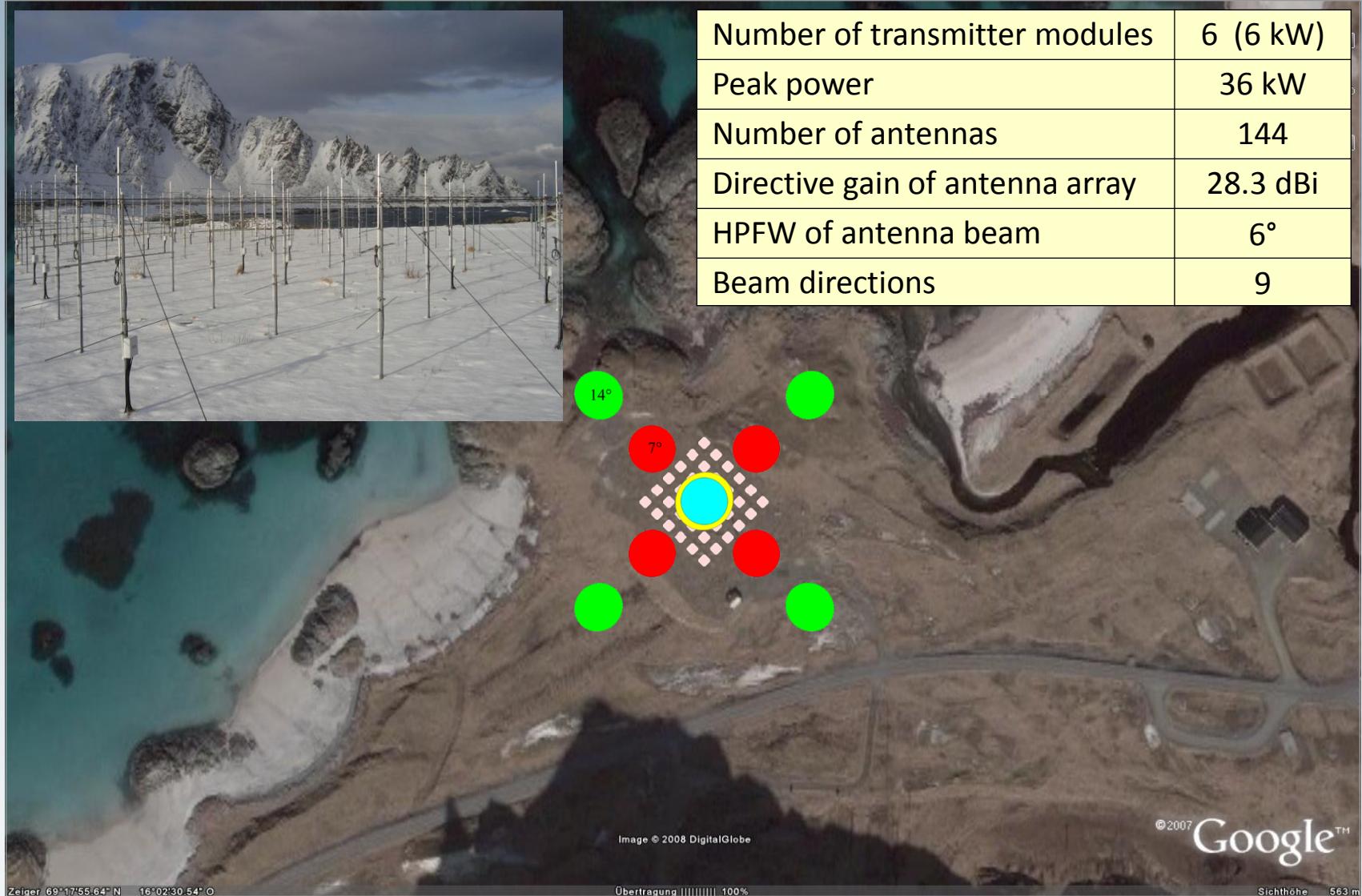
Radar experiments on Andøya island (69°N)



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

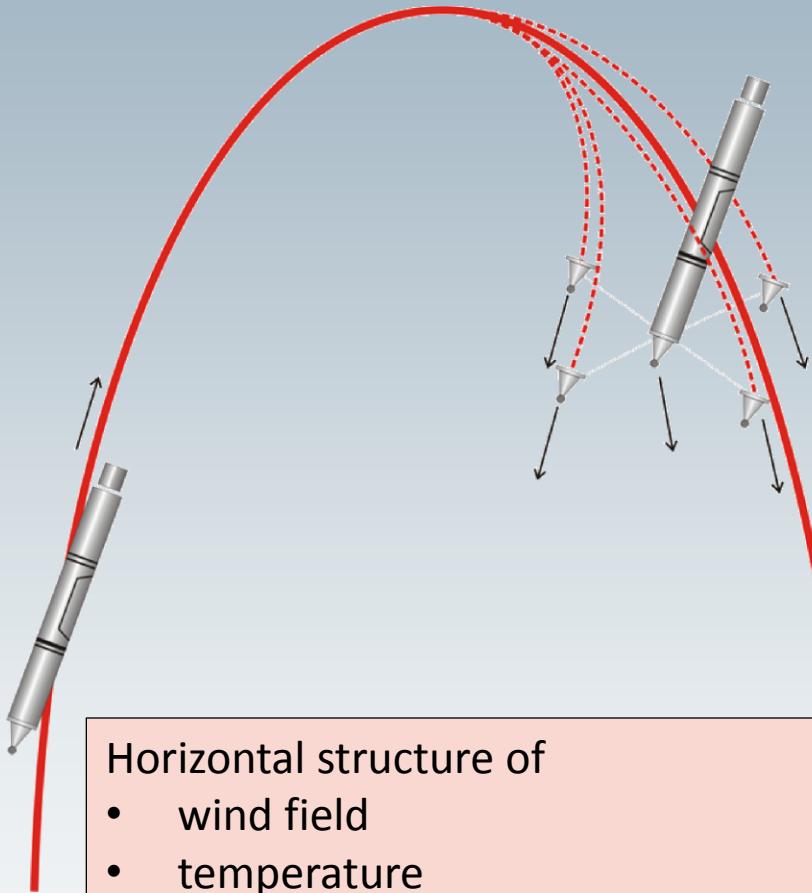


The old ALWIN antenna array as seen in GoogleEarth



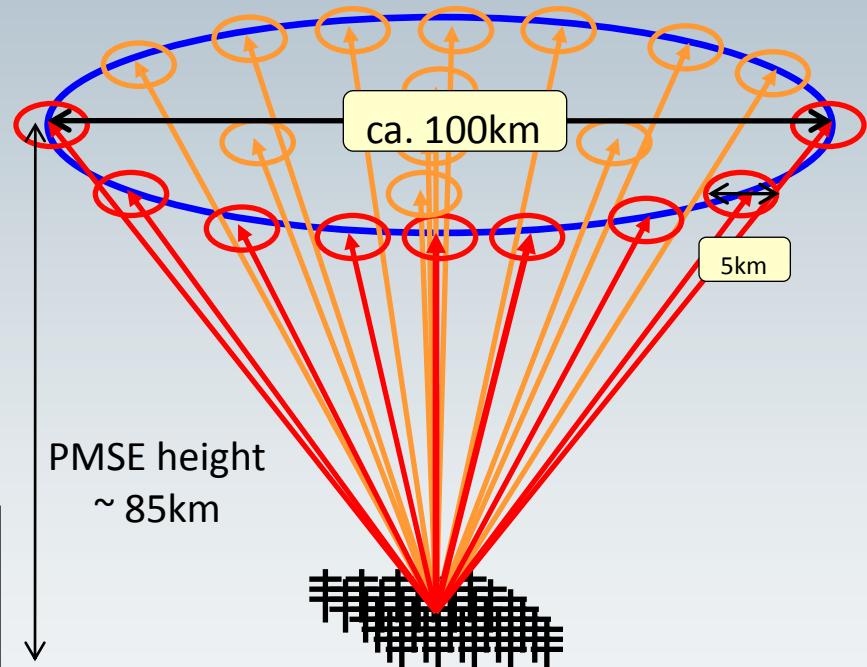
Motivation: Determination of horizontal structures of PMSE

„Mother-Daughter payloads“



Horizontal structure of
• wind field
• temperature
• turbulent energy dissipation rate

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



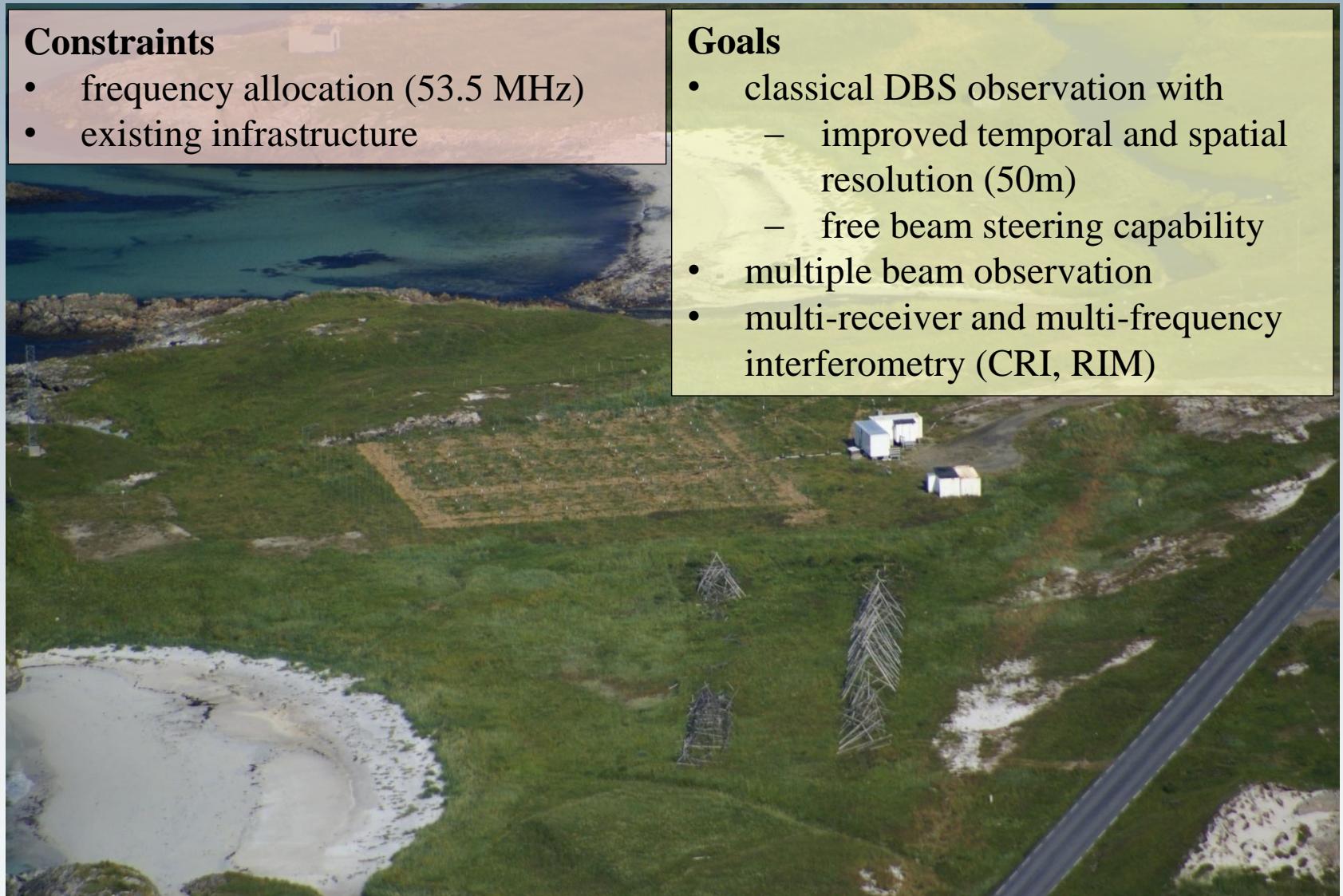
The ALWIN2 idea

Constraints

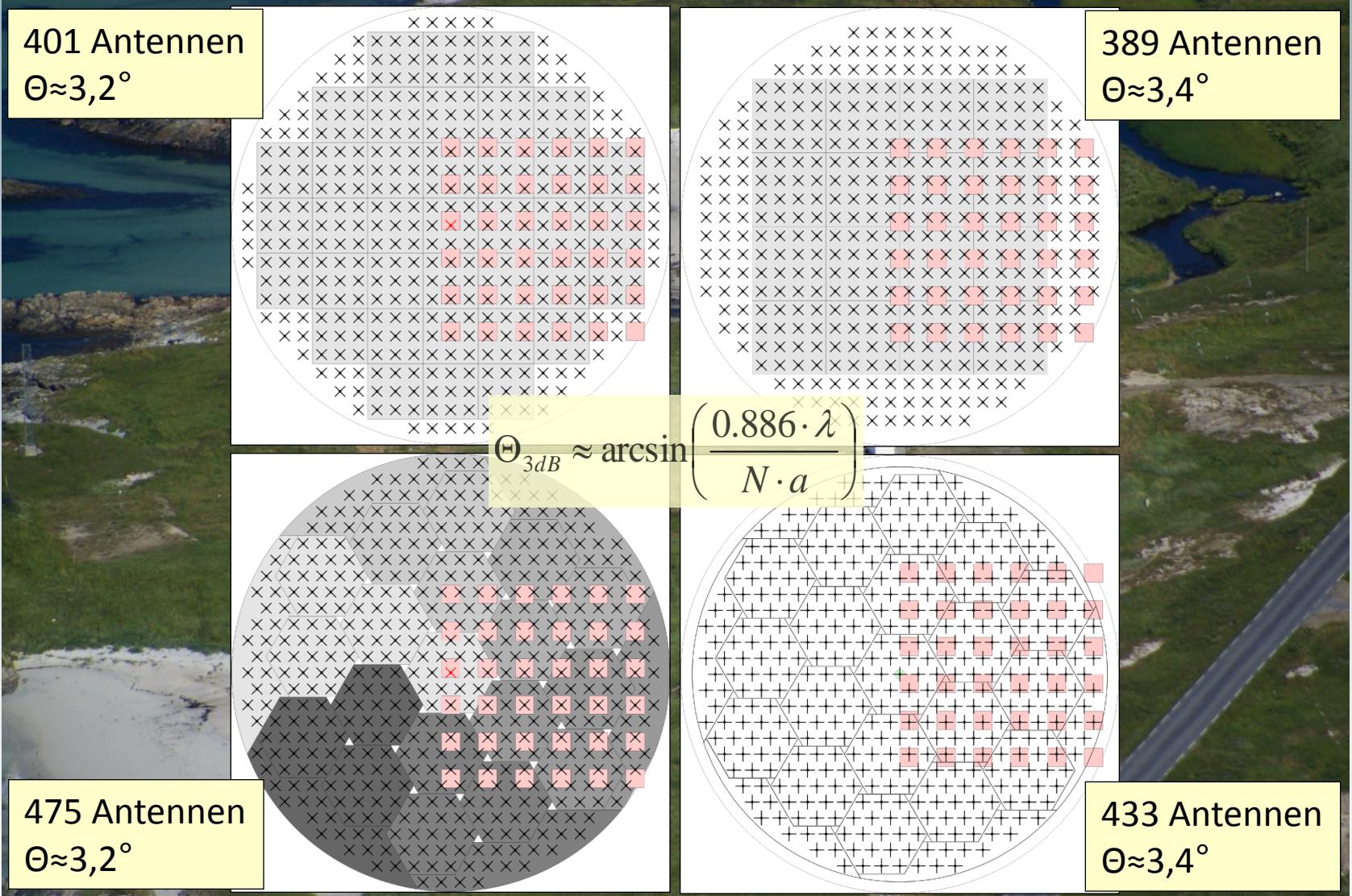
- frequency allocation (53.5 MHz)
- existing infrastructure

Goals

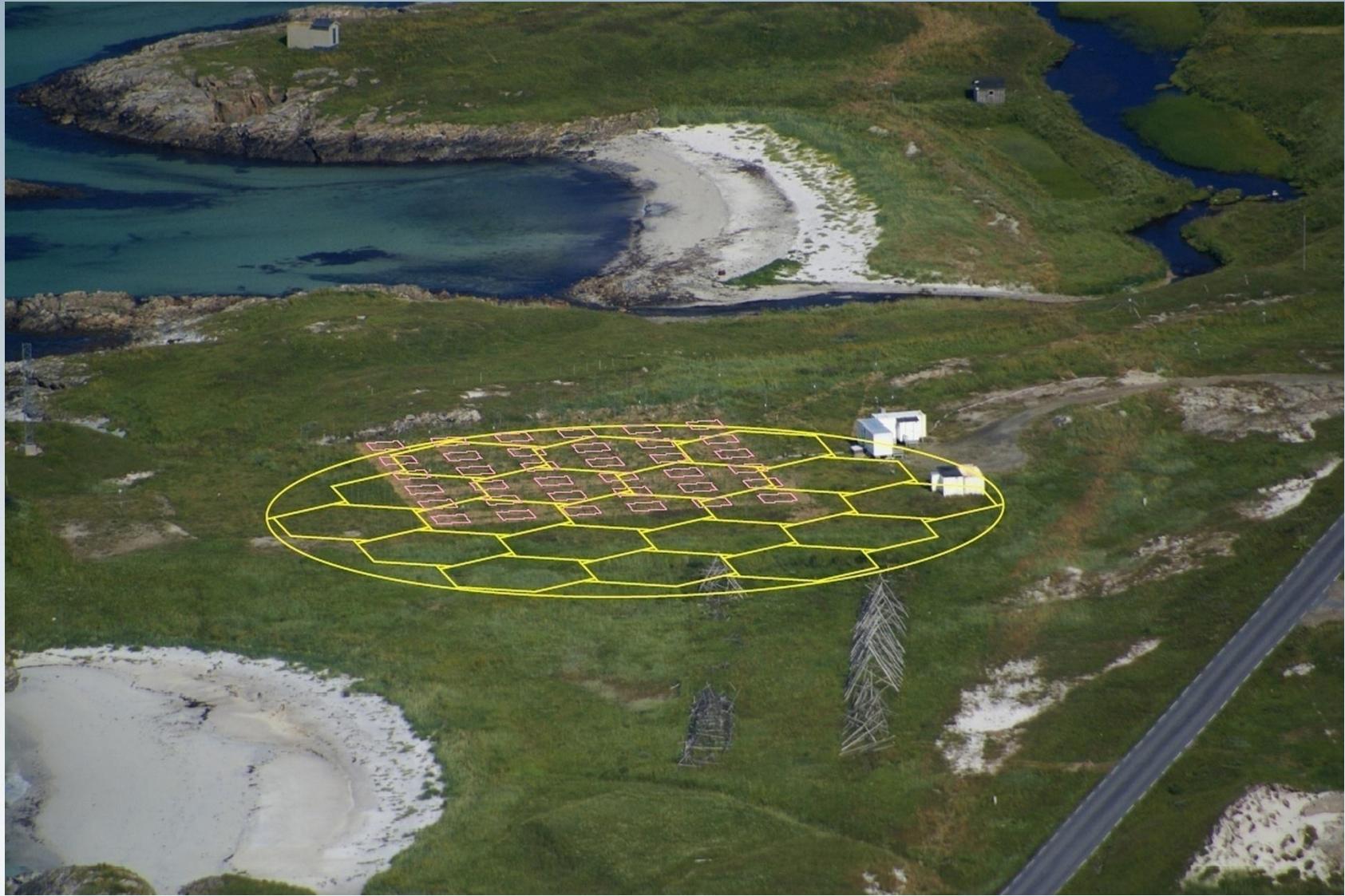
- classical DBS observation with
 - improved temporal and spatial resolution (50m)
 - free beam steering capability
- multiple beam observation
- multi-receiver and multi-frequency interferometry (CRI, RIM)



ALWIN2 – antenna array studies

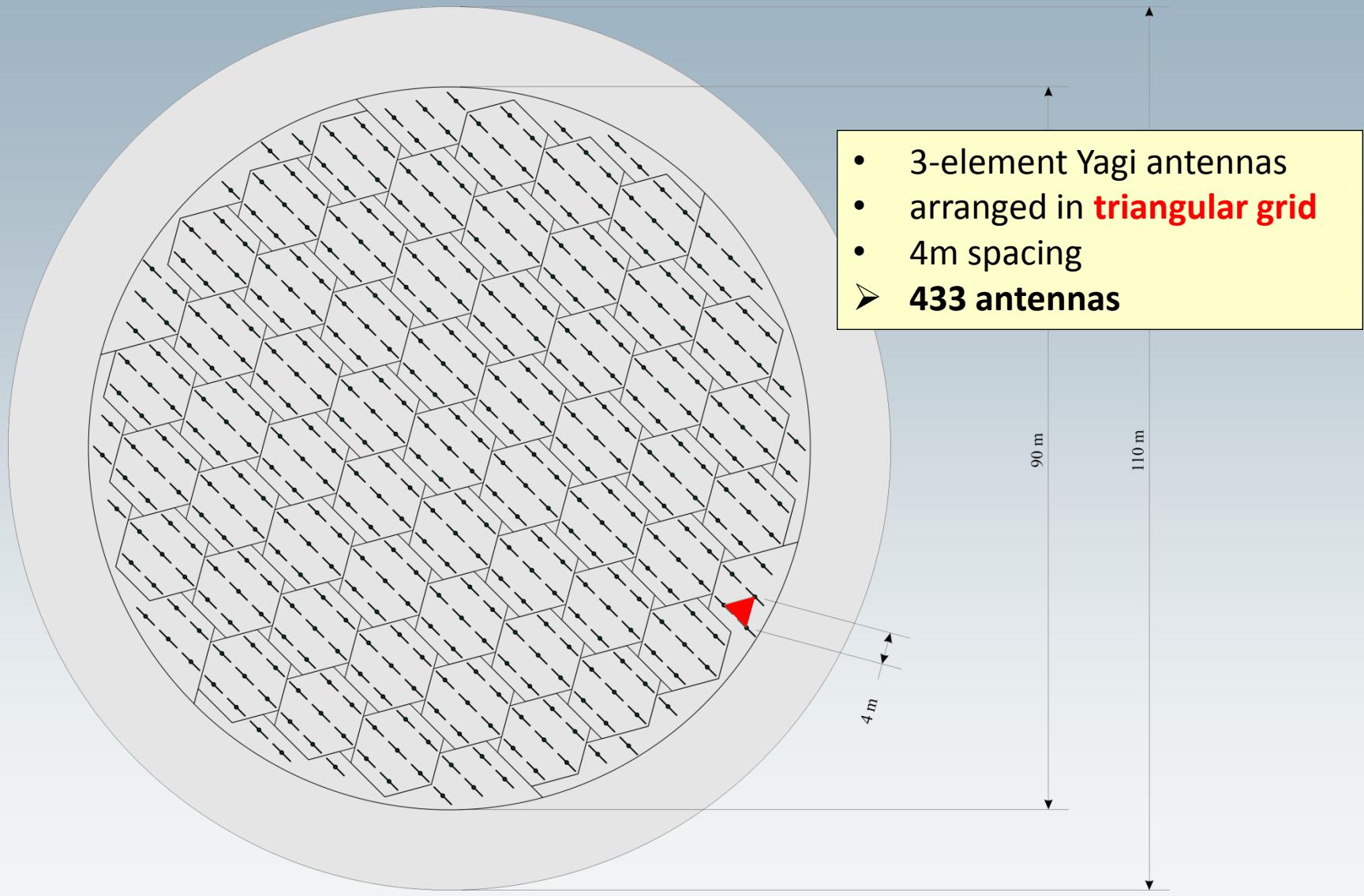


ALWIN2 – the first array idea



ALWIN2

The dimension and structure of the planned antenna array

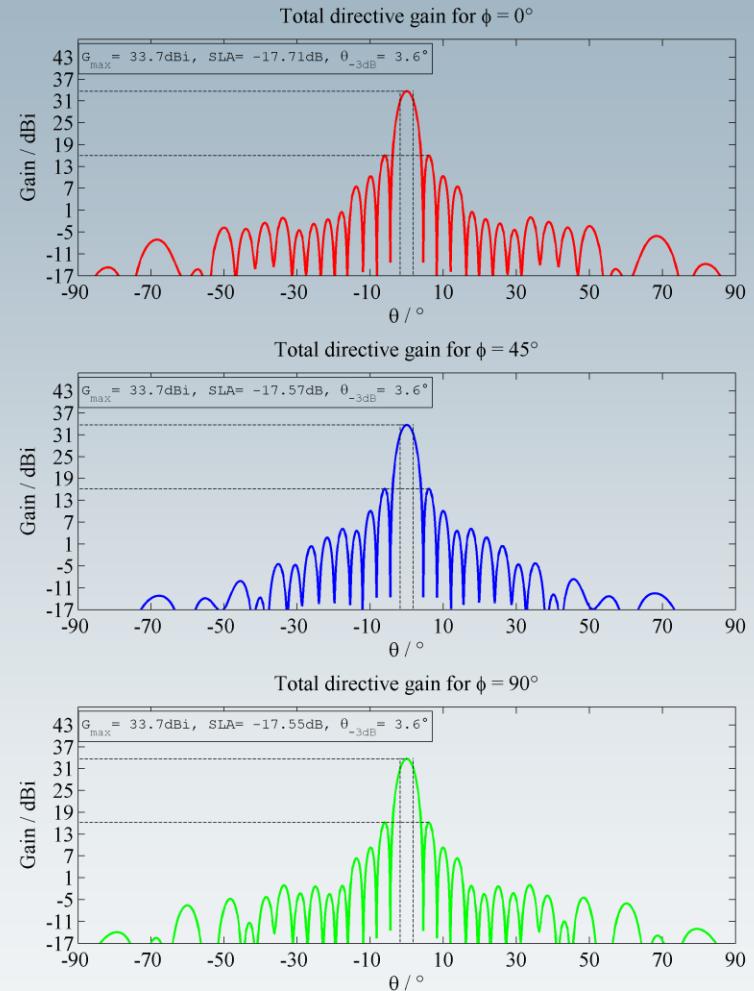
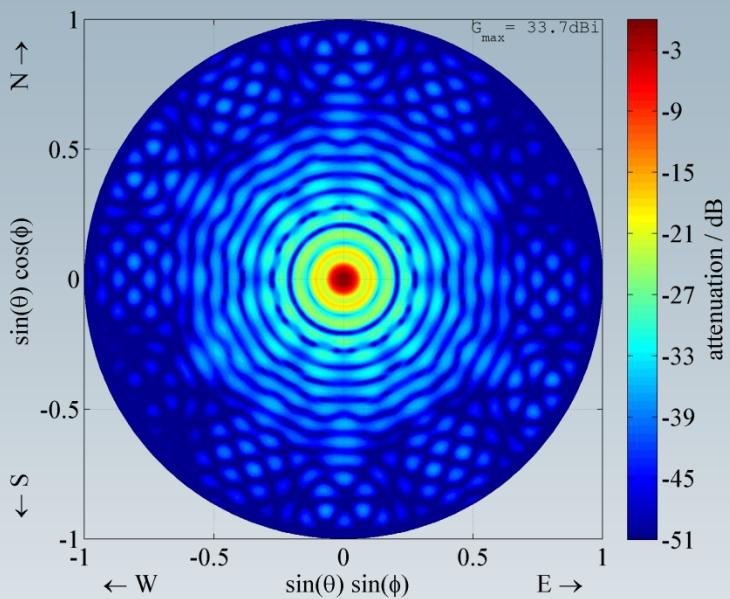


Prototypes of the ALWIN2 antenna



ALWIN2 – array of 433 3-element Yagi antennas

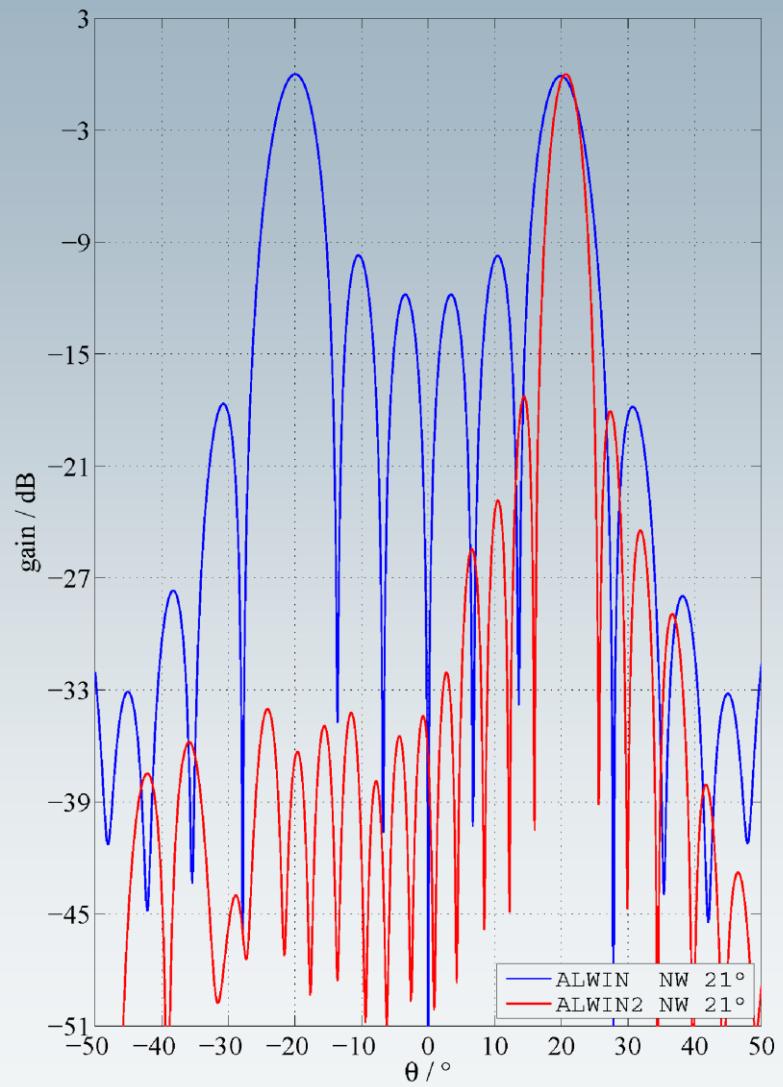
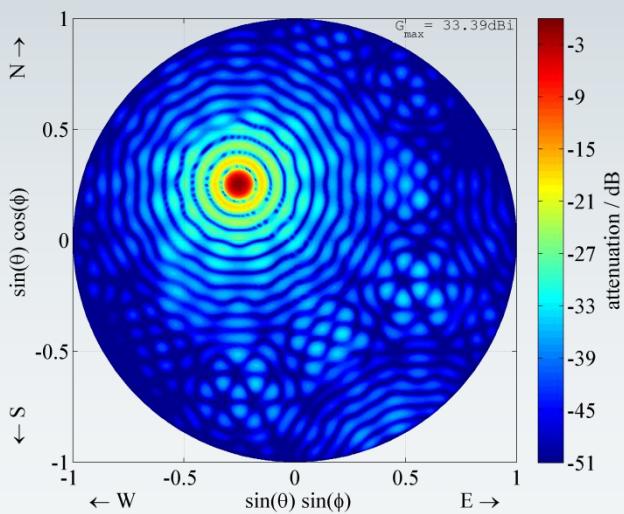
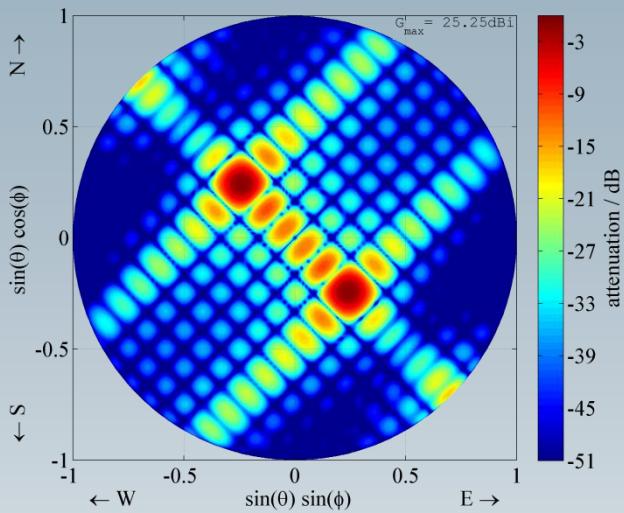
Radiation pattern for $\phi=0^\circ, \theta=0^\circ$



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

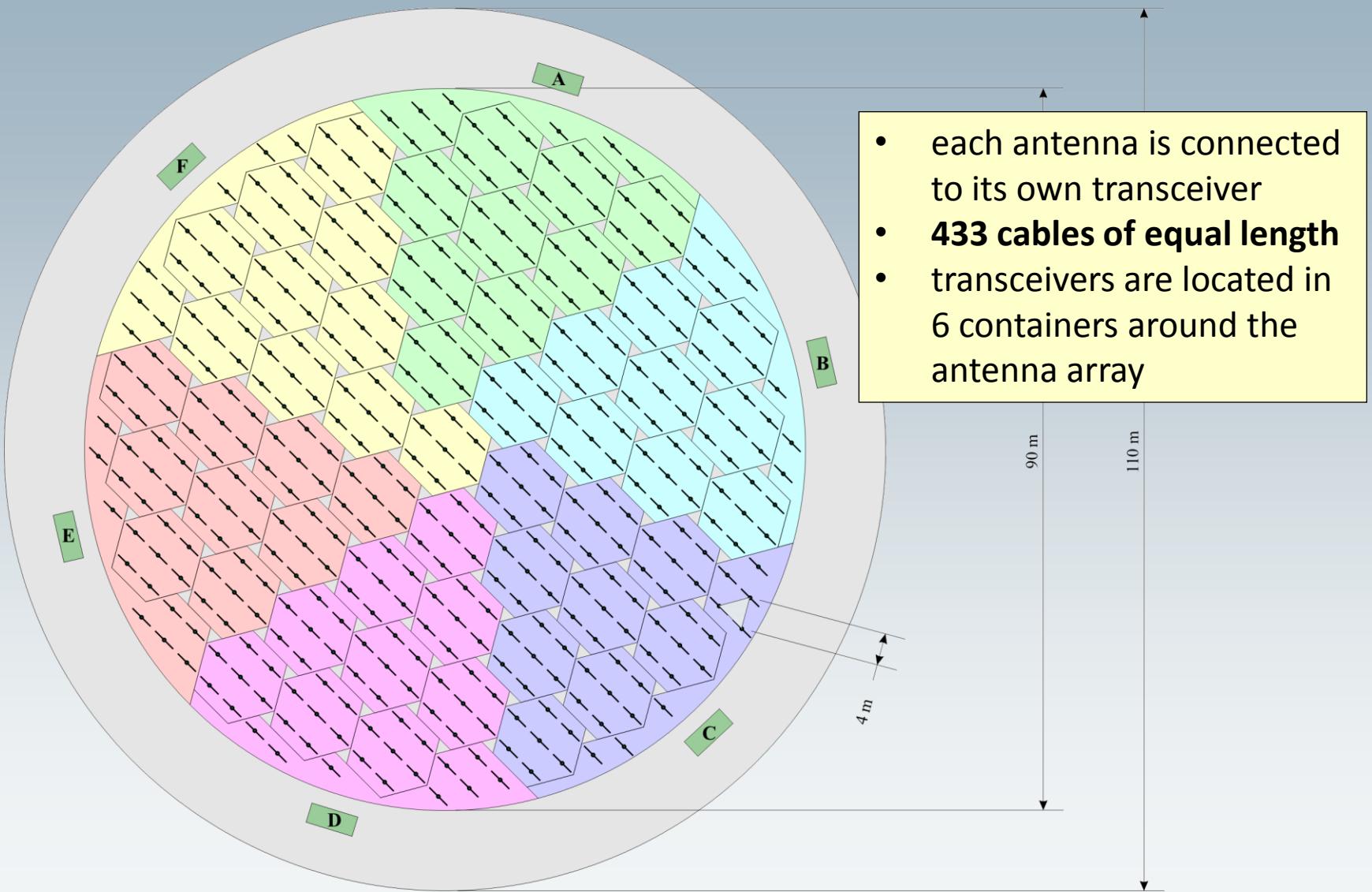
ALWIN – ALWIN2

Radiation patterns for $\phi=315^\circ$, $\theta=21^\circ$



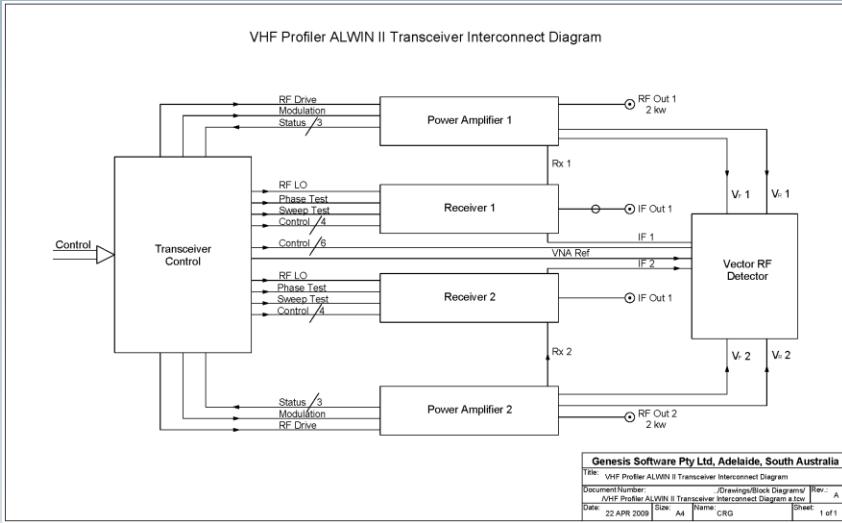
ALWIN2 radar

allocation of antennas to 6 transceiver containers



ALWIN2 radar

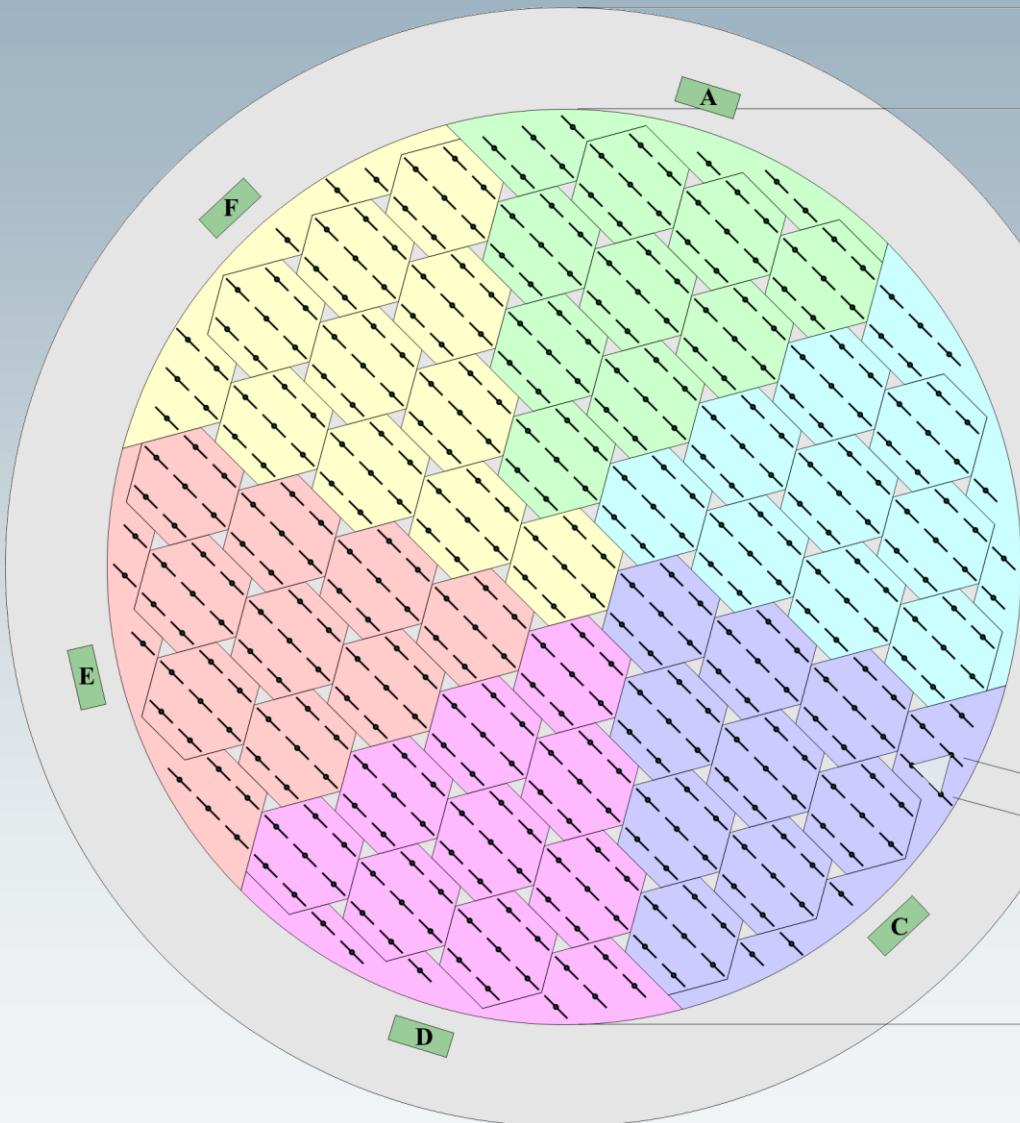
transceiver block diagrams



- 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 ($\geq 0.33\mu s$)
- 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

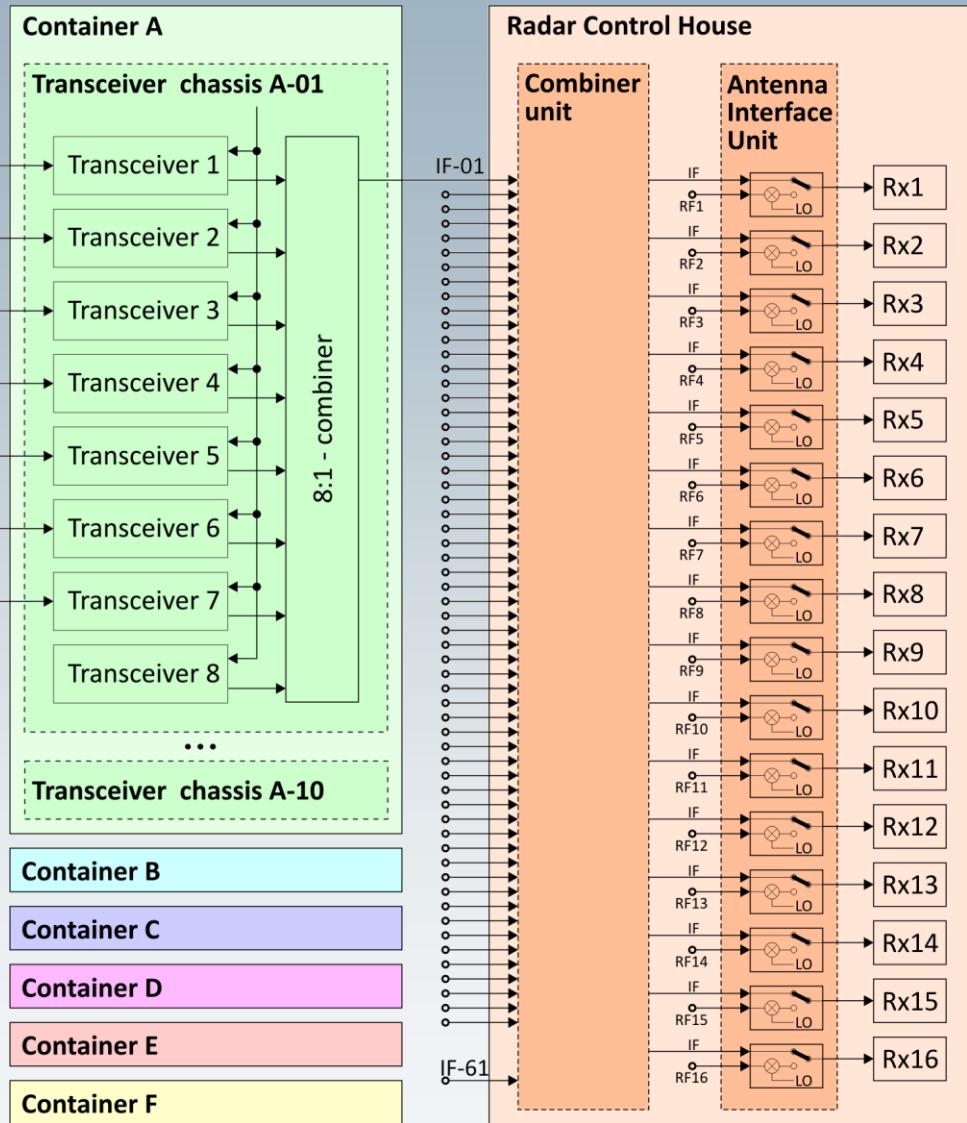
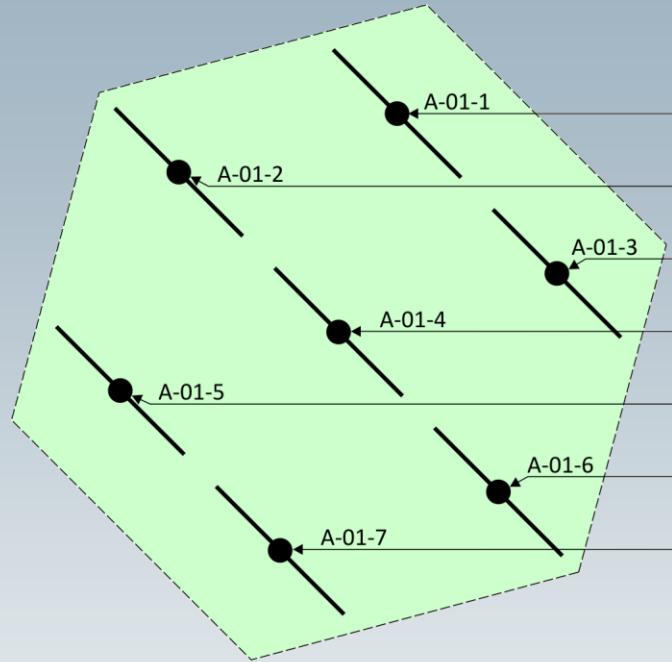


- IF signals of 7 transceivers are combined (hexagons)
- 61 IF signals are connected to RDAS in control house



ALWIN2 – Radar

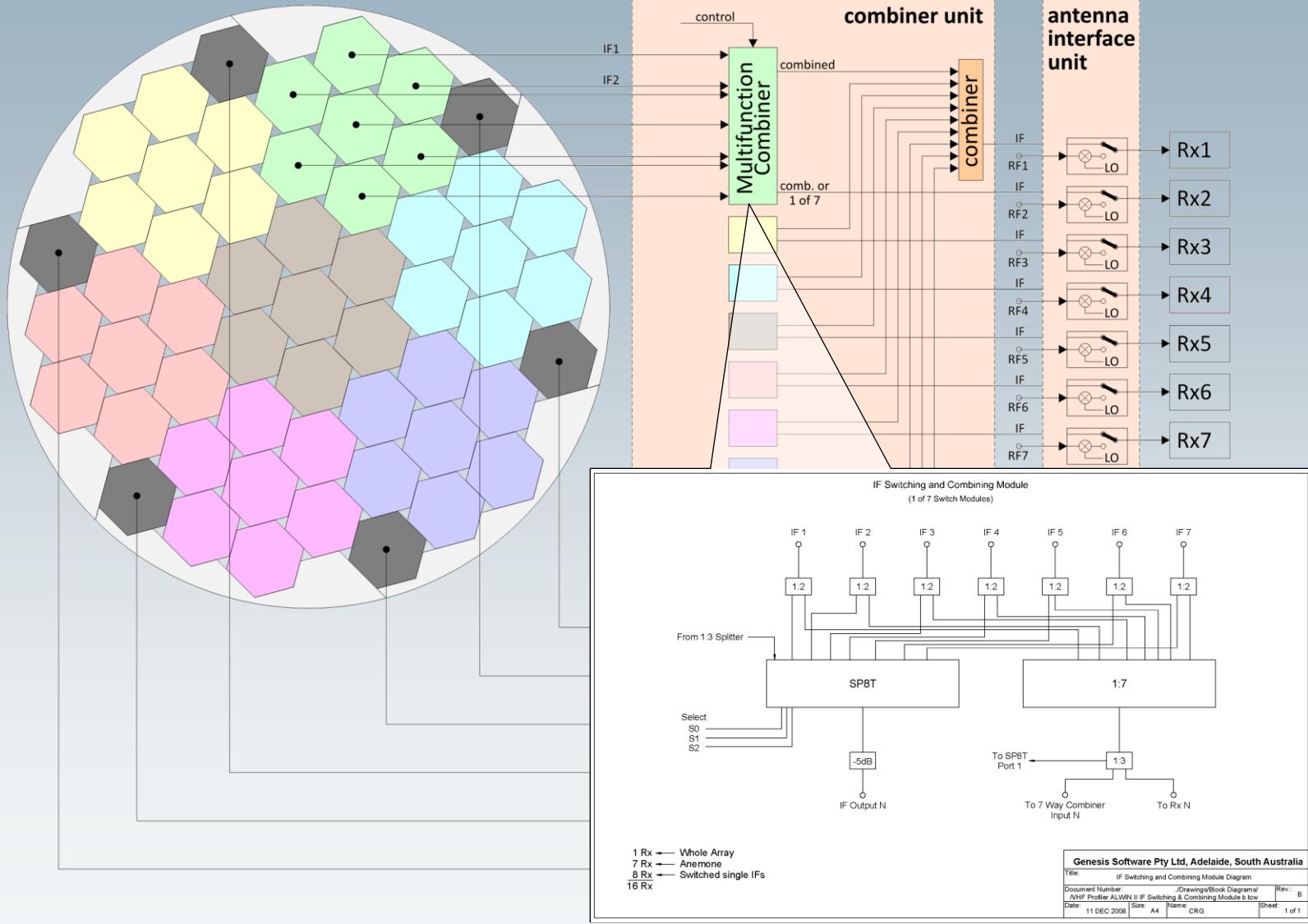
Block diagram of receive signals



- 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**

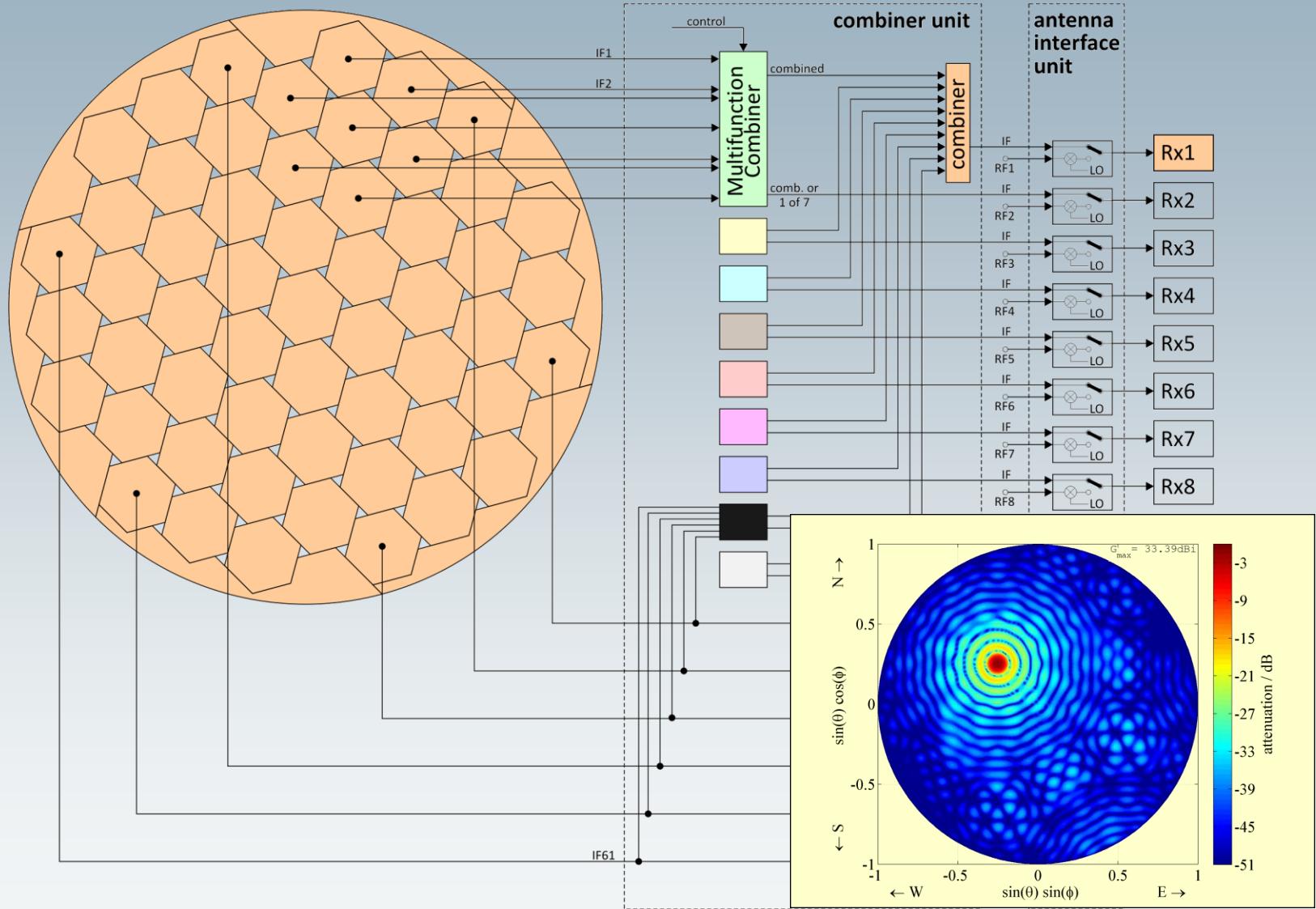
ALWIN2 – Radar

Allocation of 61 IF signals to 16 baseband receivers



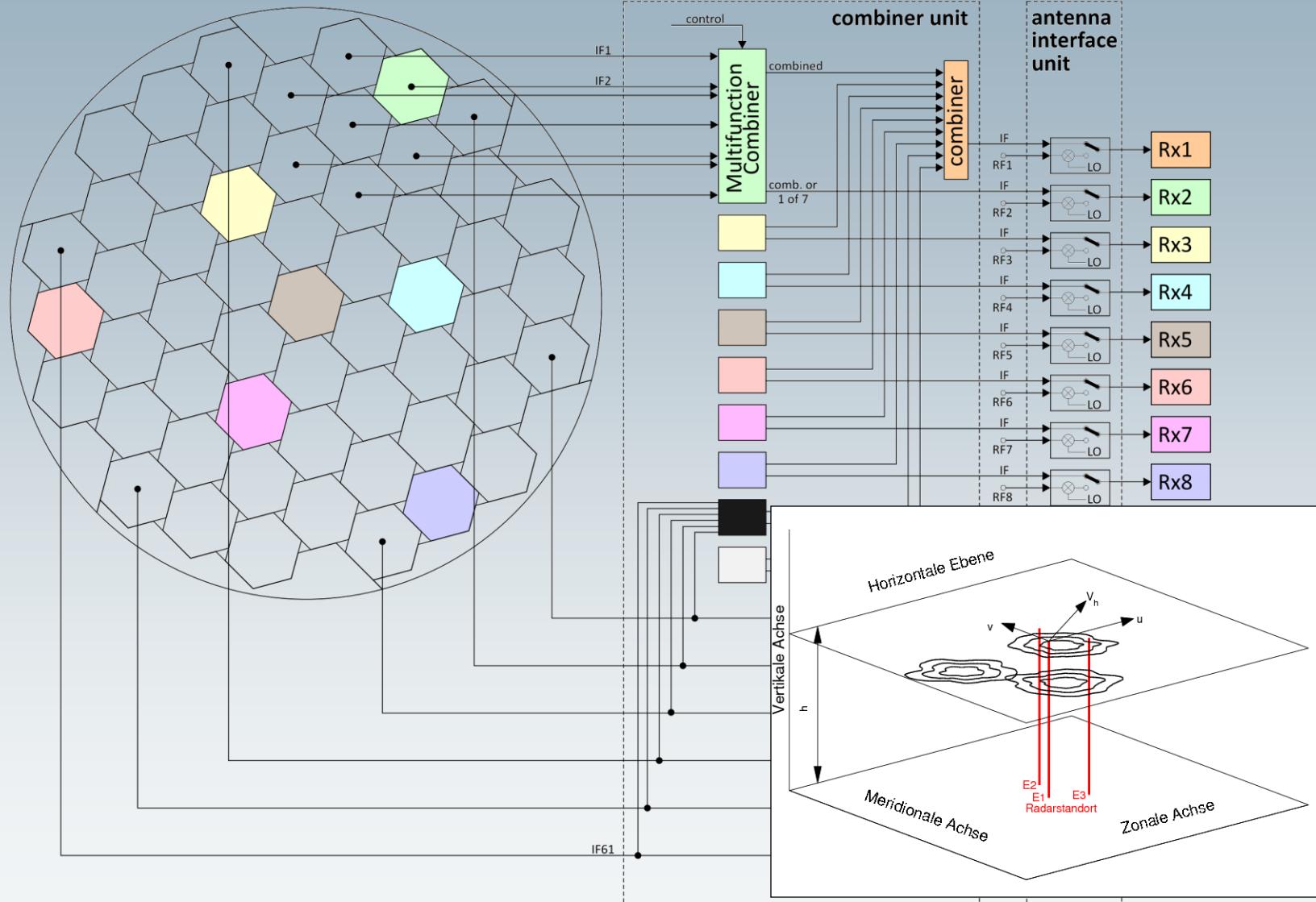
ALWIN2 – Radar

permanent DBS configuration combined to receiver 1



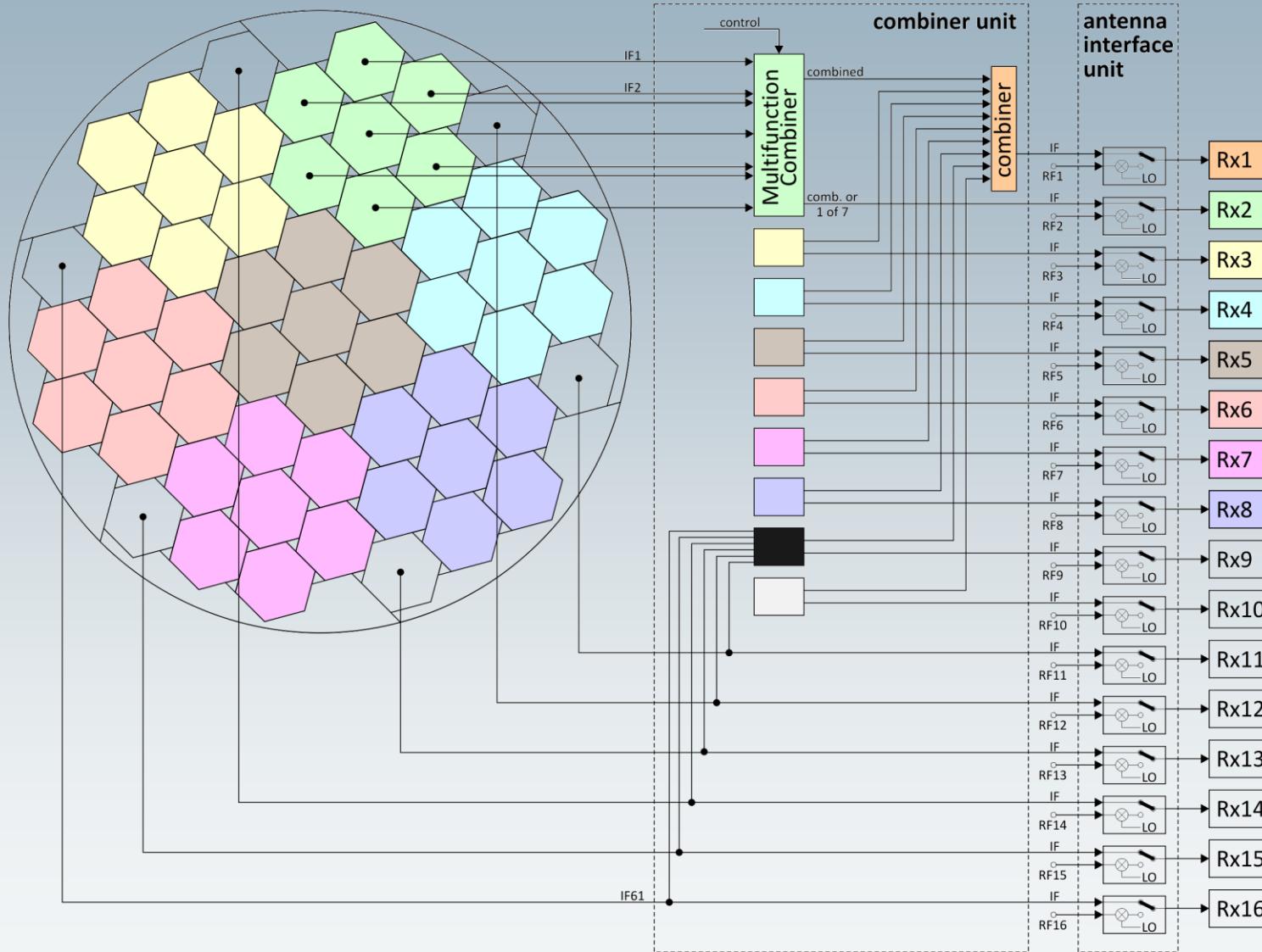
ALWIN2 – Radar

example of a spaced antenna receiving configuration



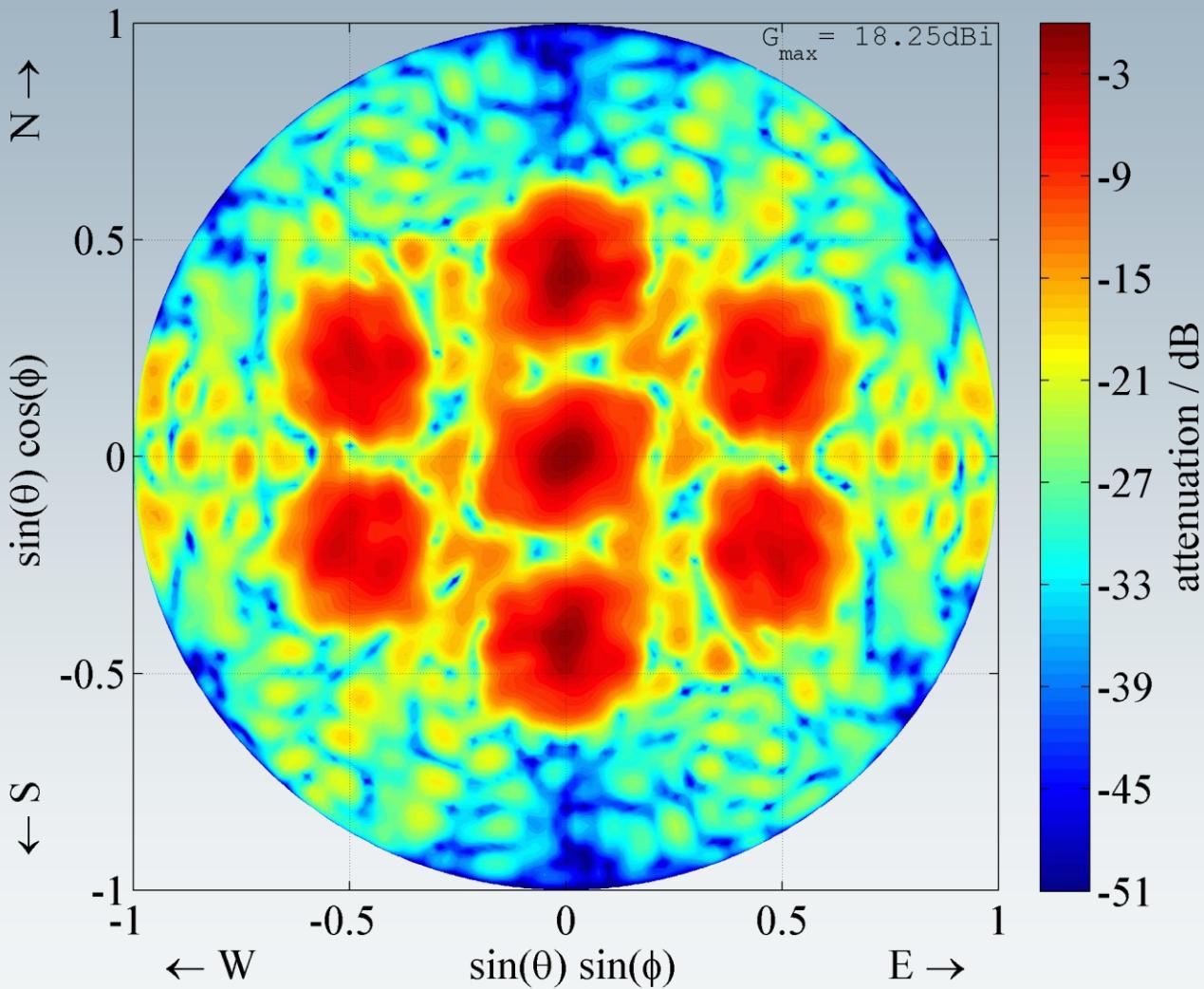
ALWIN2 – Radar

example of a spaced antenna receiving configuration



ALWIN2 – Multibeam mode

antenna radiation pattern for 7 beams



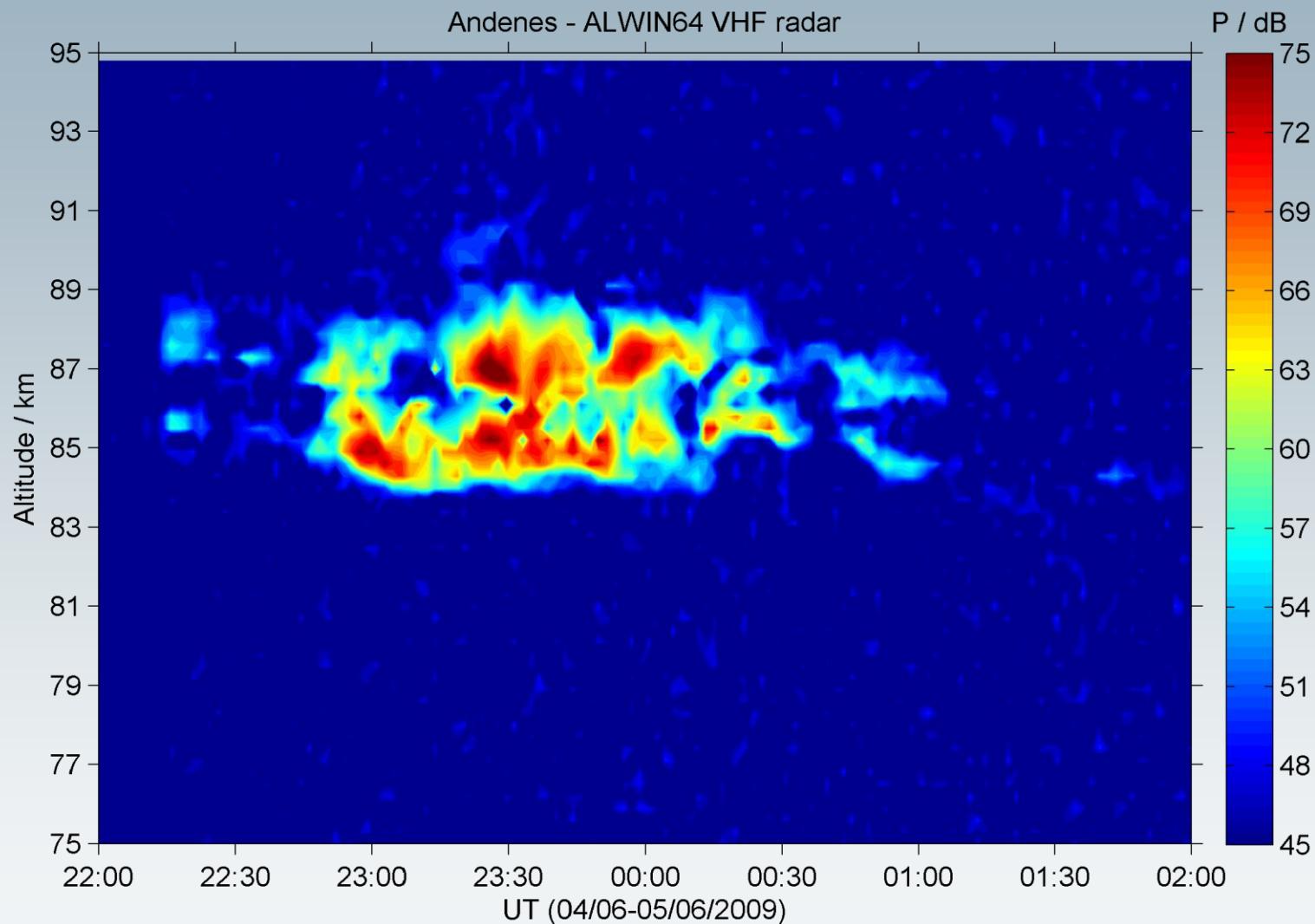
ALWIN64 – the interim solution

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

history of construction – August 2007



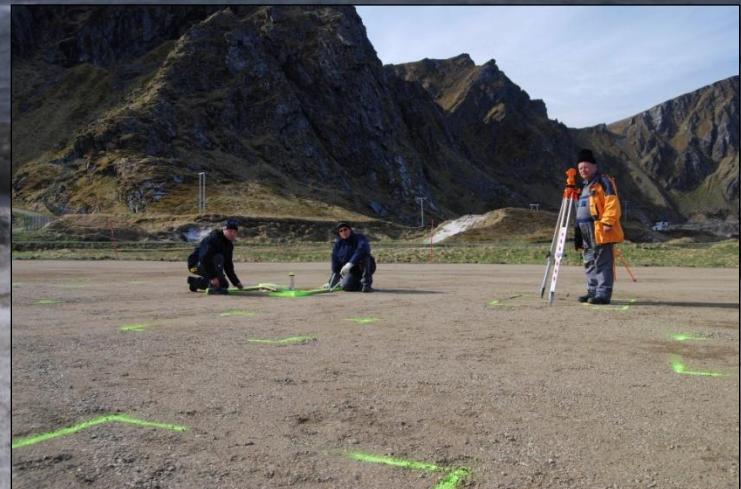
ALWIN2

history of construction – the first idea



ALWIN2

history of construction – spring/summer 2009



ALWIN2

history of construction – July 2009



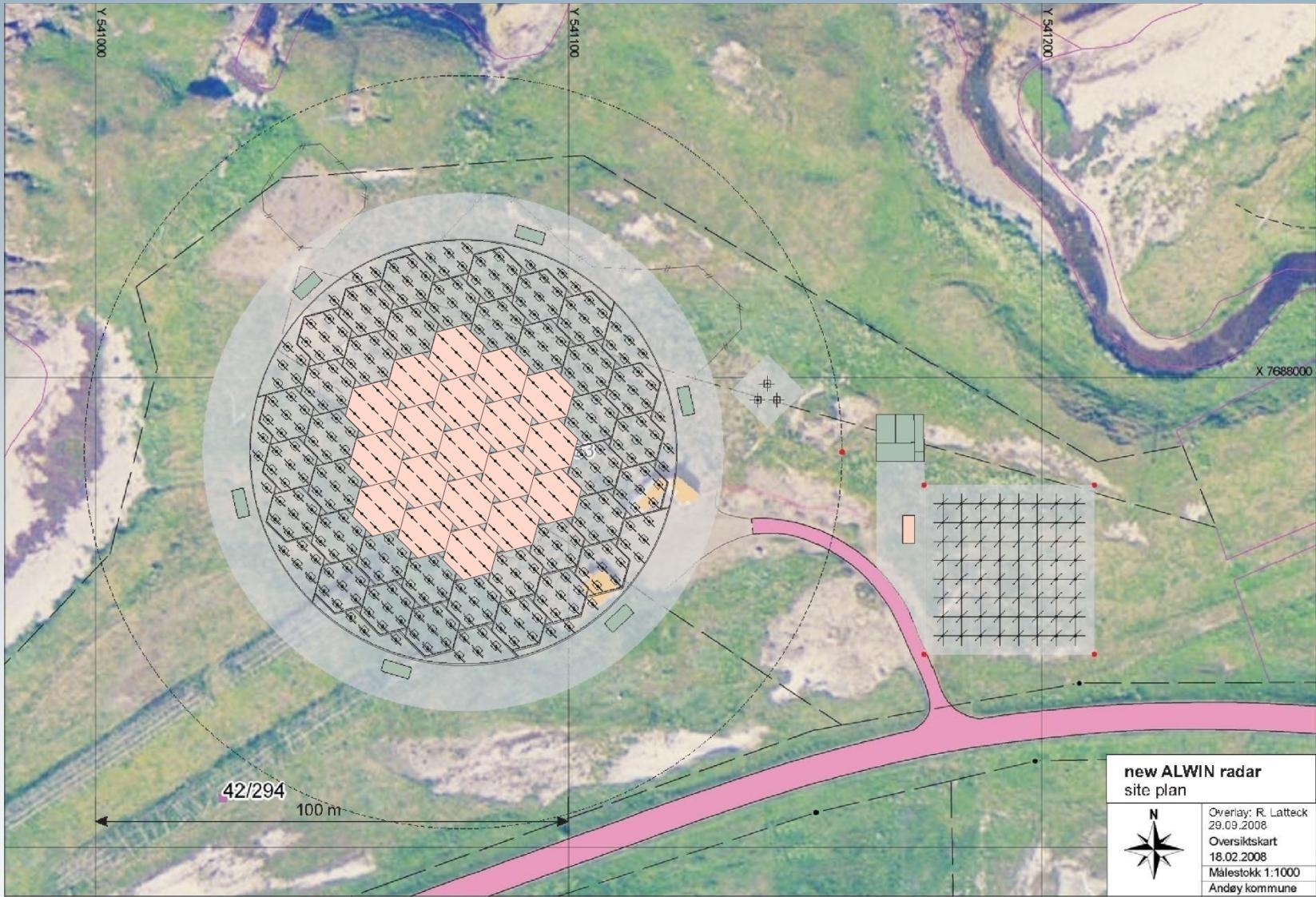
ALWIN2

history of construction – August 2009



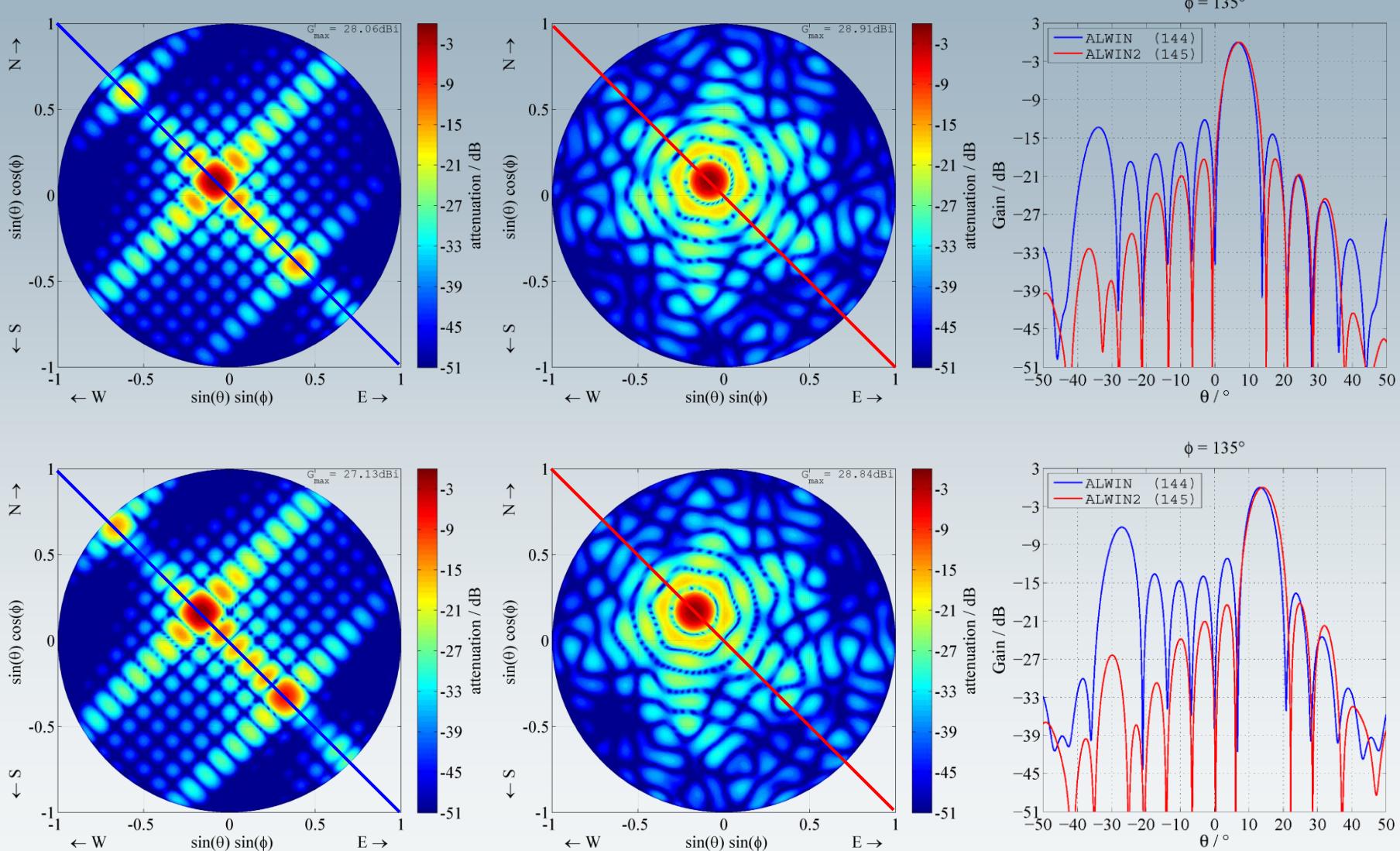
ALWIN2

expansion stage scheduled for October 2009



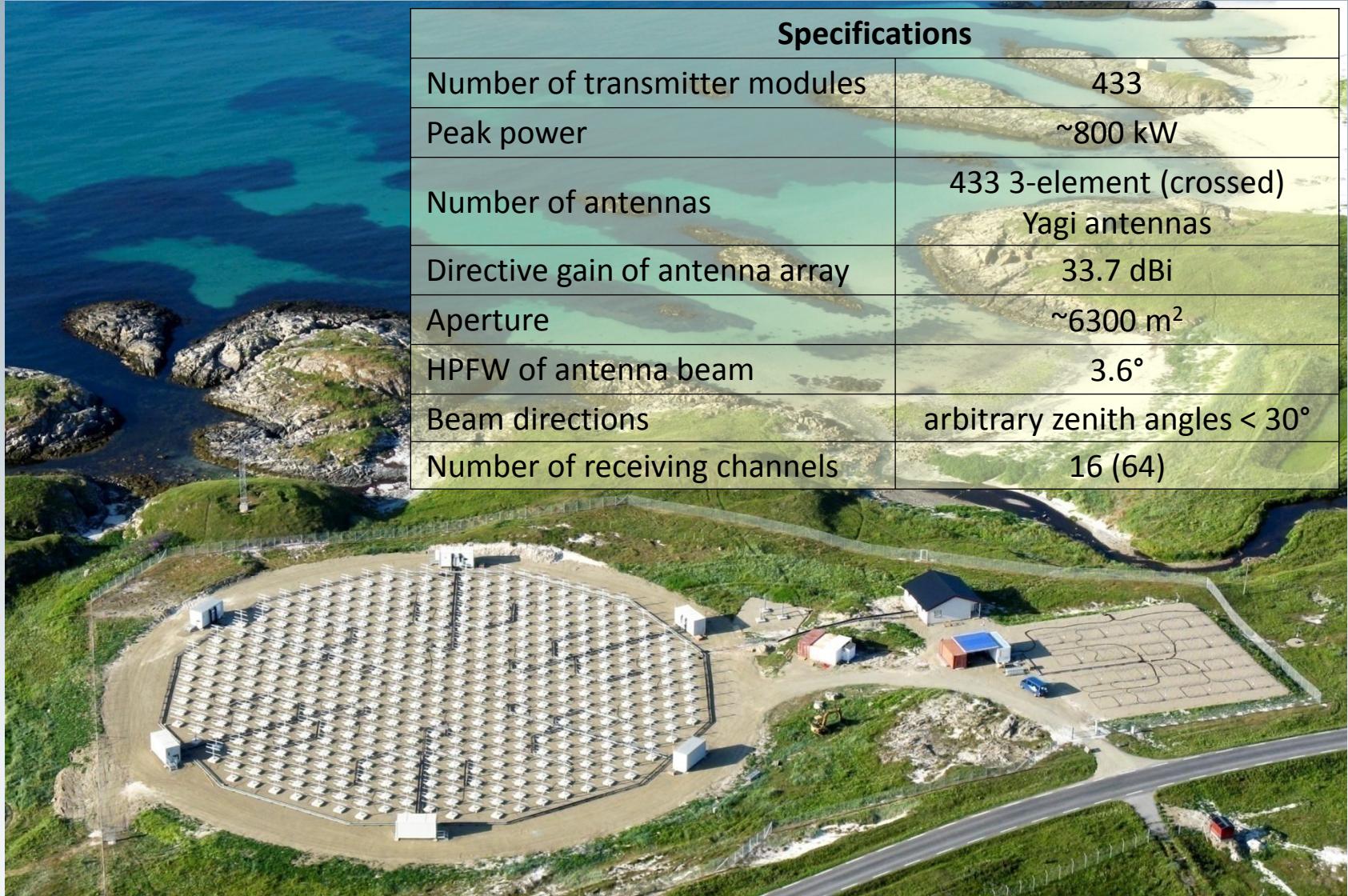
ALWIN (144) – ALWIN2 (145)

Radiation patterns for $\phi = 315^\circ$; $\theta = 7^\circ$ und 14°



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)