
MAARSY – the new Middle Atmosphere Alomar Radar System on Andøya

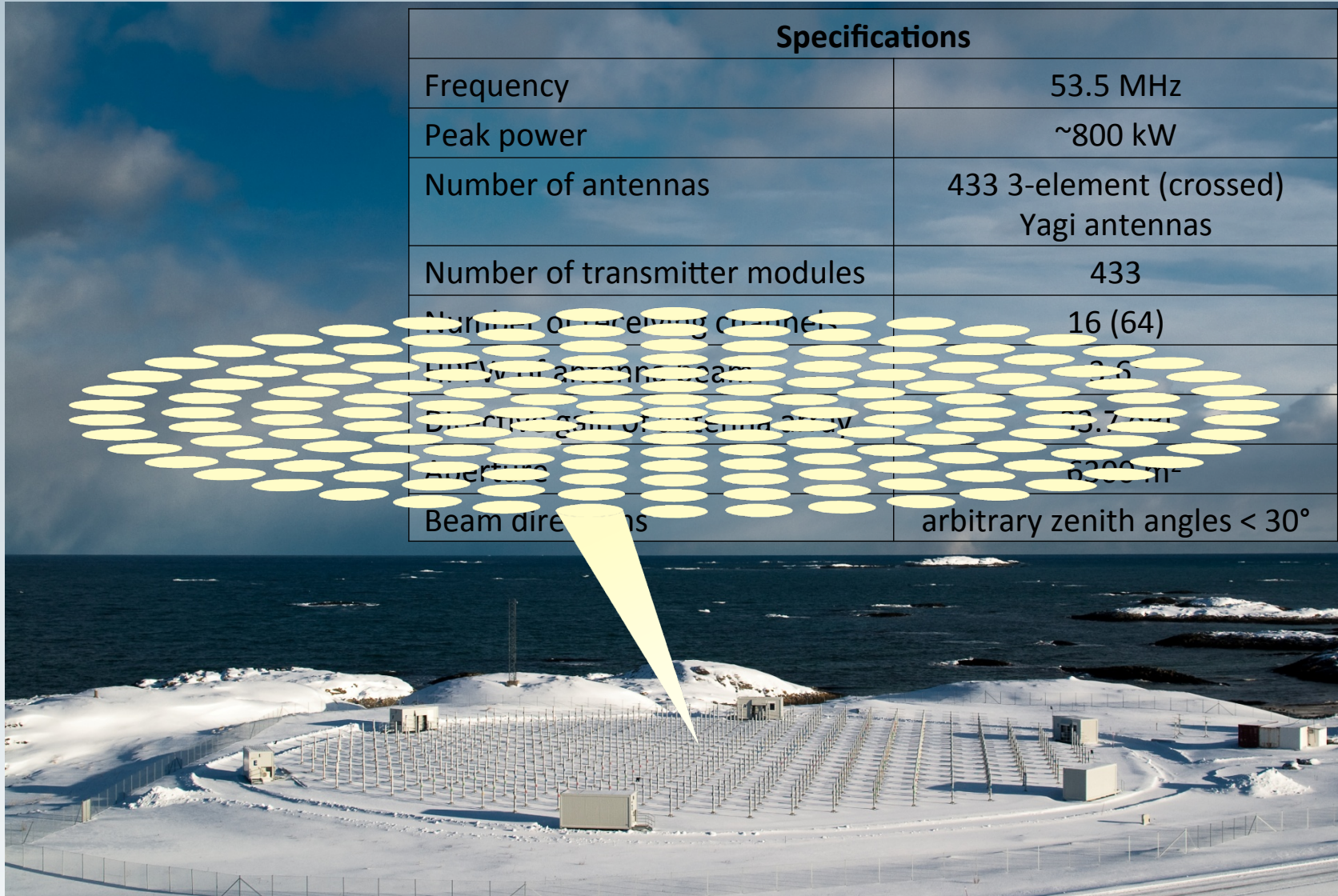
Ralph Latteck, Werner Singer, Markus Rapp, Toralf Renkwitz

presented by **Norbert Engler**

*Leibniz Institute of Atmospheric Physics at University of Rostock,
Schlossstr. 6, 18225 Kühlungsborn, Germany*

MAARSY

16 March 2010



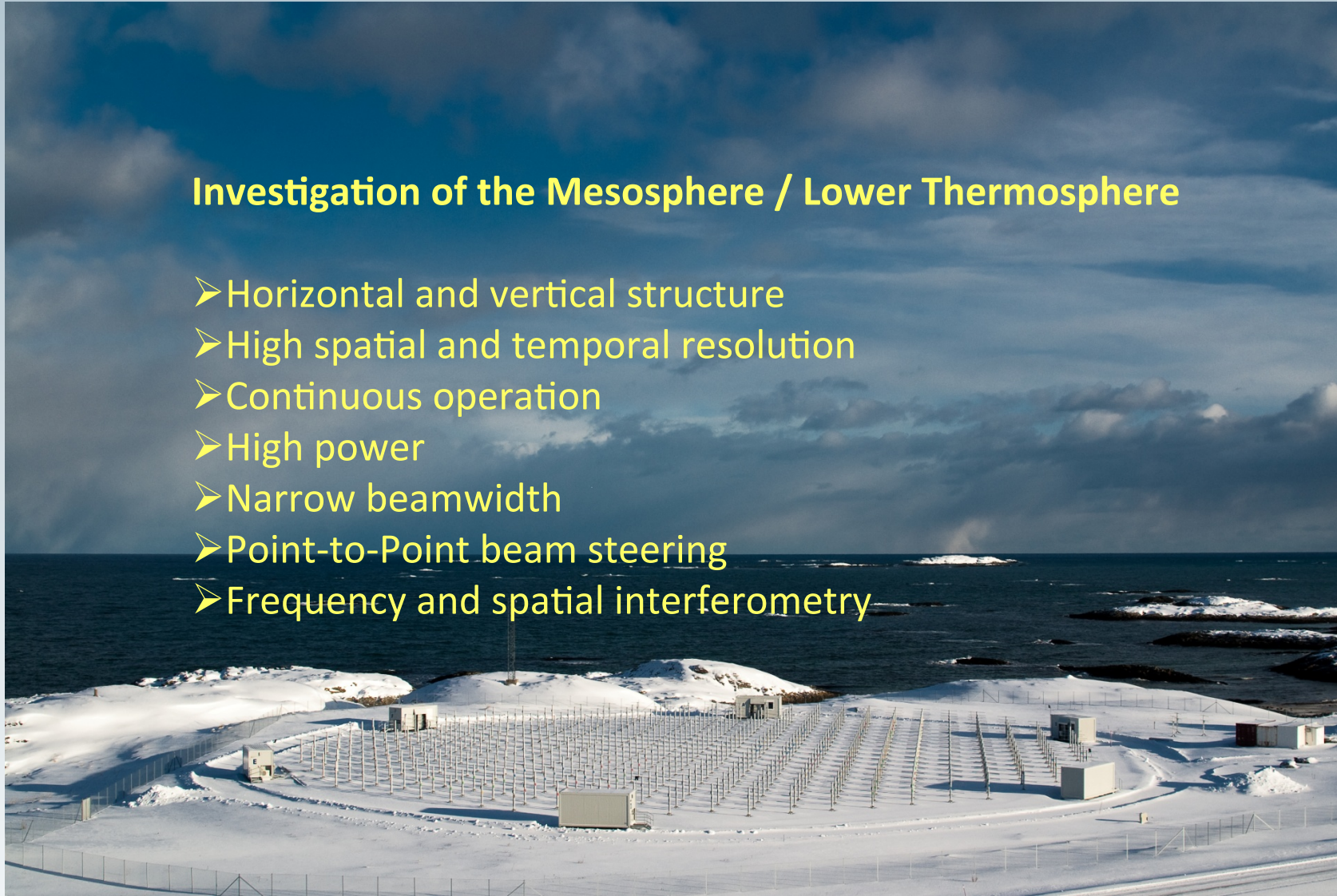
Specifications	
Frequency	53.5 MHz
Peak power	~800 kW
Number of antennas	433 3-element (crossed) Yagi antennas
Number of transmitter modules	433
Number of receiving channels	16 (64)
FWHM of antenna beam	2.6°
Directivity gain of antenna array	75.7 dBi
Aperture	6200 m ²
Beam directions	arbitrary zenith angles < 30°

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Scientific Aims

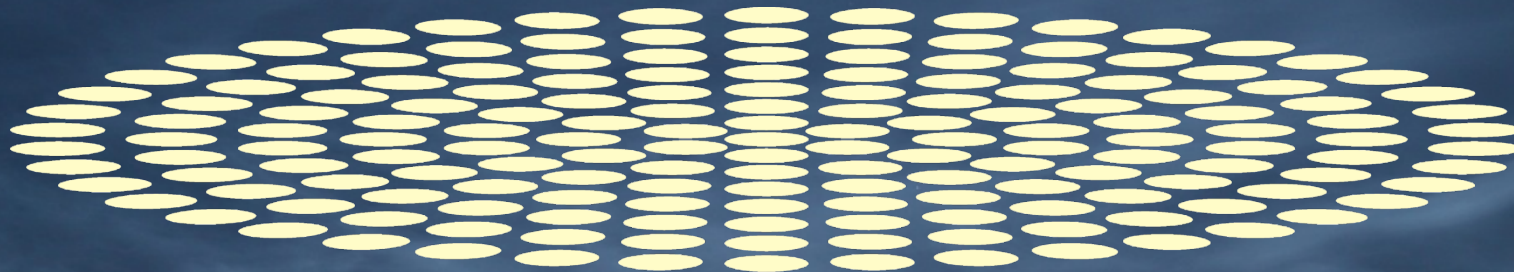
Investigation of the Mesosphere / Lower Thermosphere

- Horizontal and vertical structure
- High spatial and temporal resolution
- Continuous operation
- High power
- Narrow beamwidth
- Point-to-Point beam steering
- Frequency and spatial interferometry



Motivation

The improvement to the old facility



ca. 100 km @ 85km

- improved temporal and spatial resolution (50m)
- free beam steering capability
- multi-beam experiments
- multi-receiver and multi-frequency interferometry

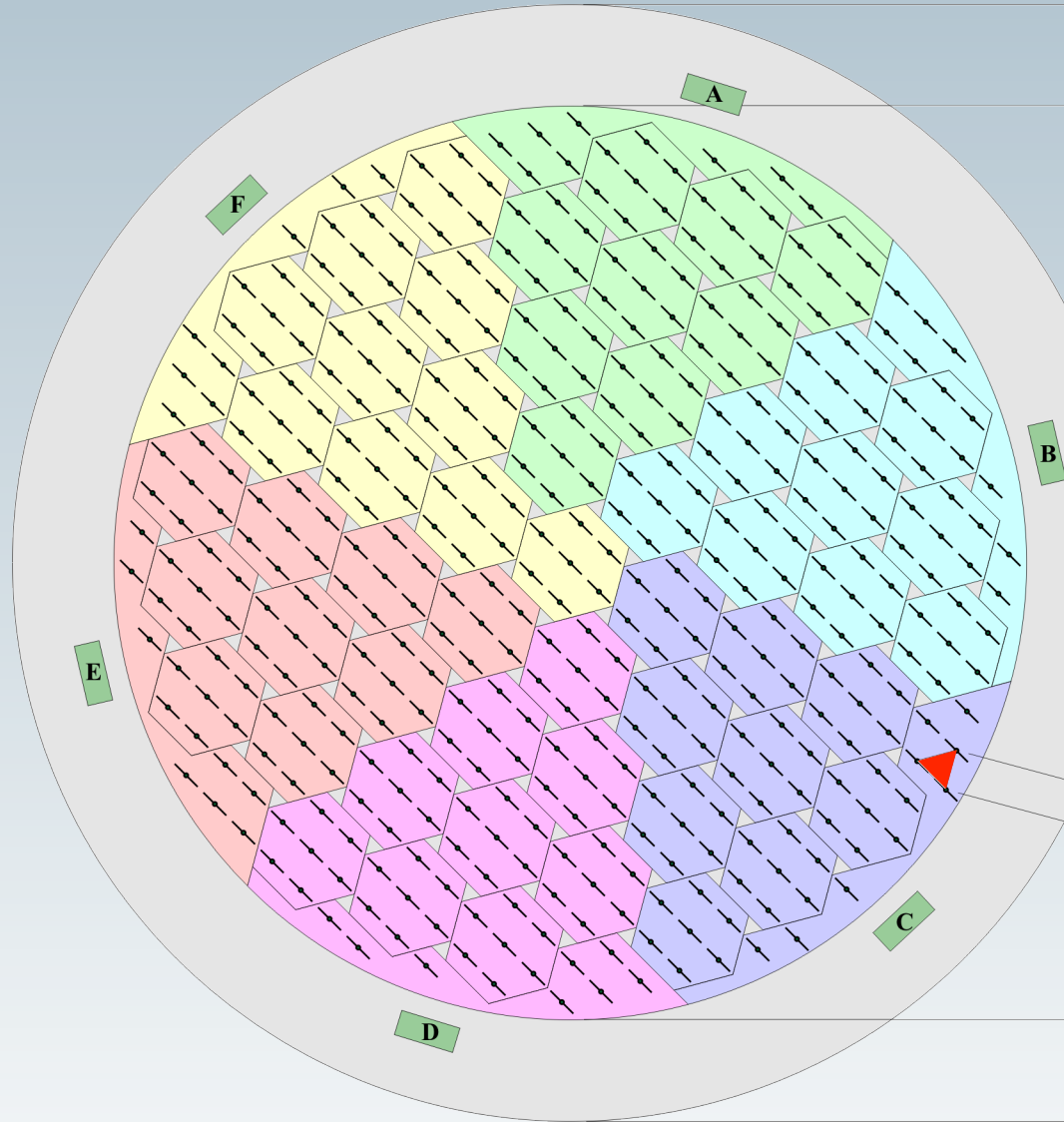
Photo: G. Baumgarten, IAP

< 5km >

IAP-50d 090801 234136.0

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The antenna field arranged in 6 areas



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

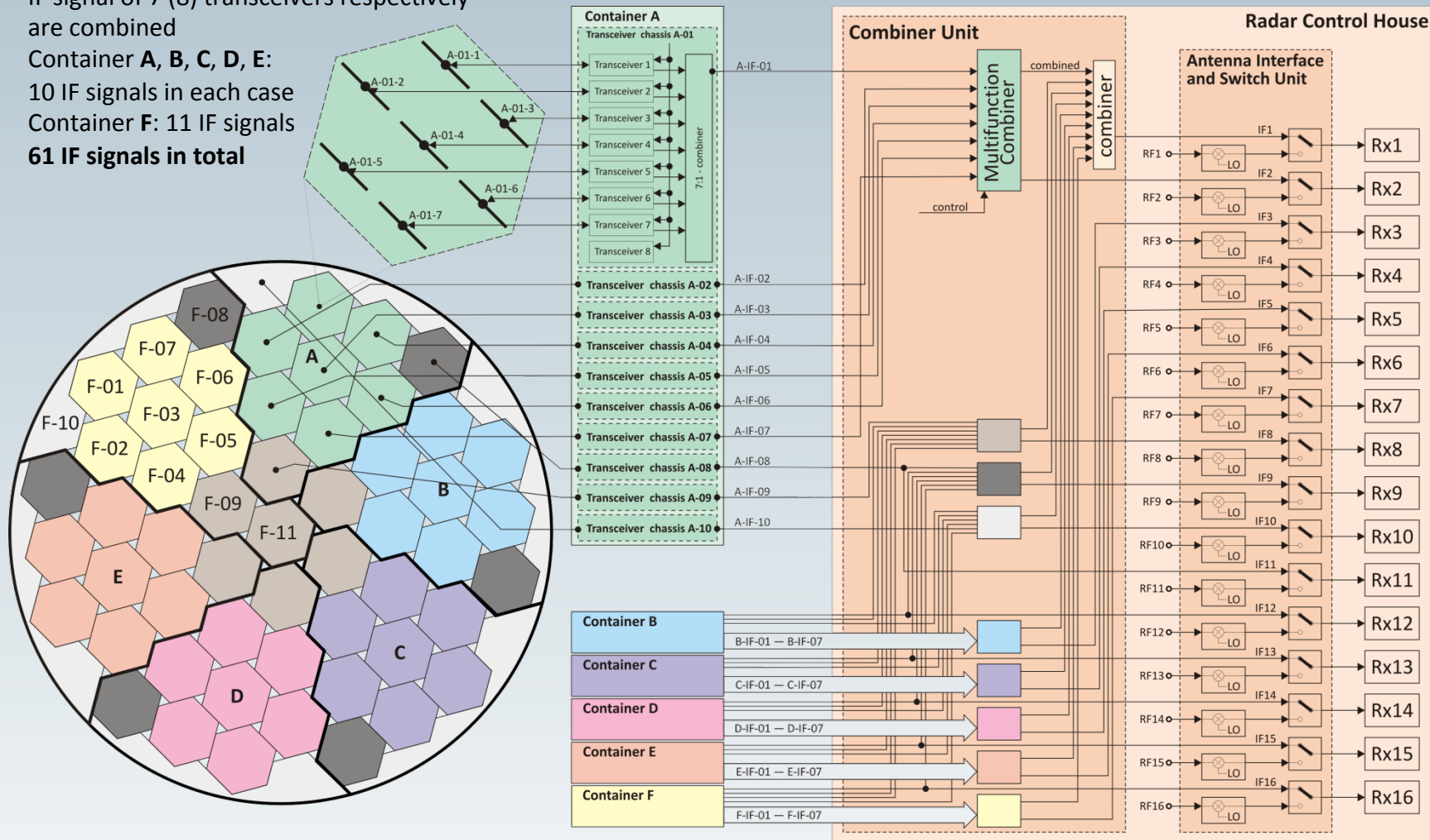
- IF signals of 7 transceivers are combined (hexagons)
- 61 IF signals are connected to RDAS in control house



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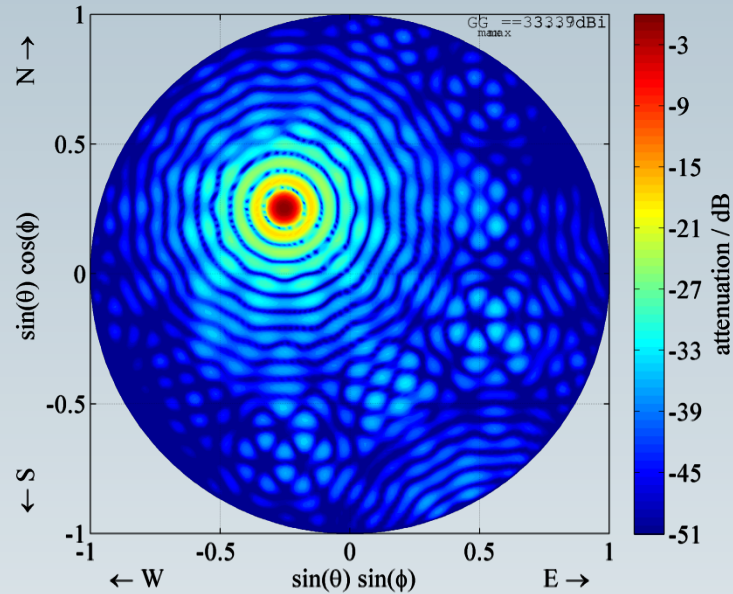
Block diagram

- 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**

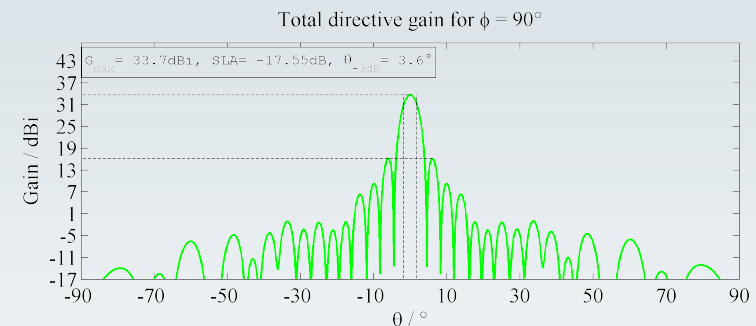
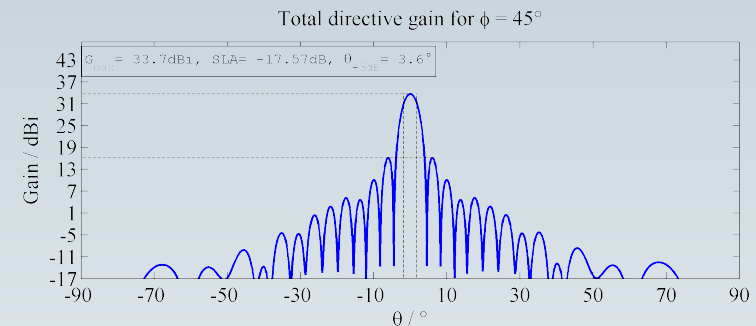
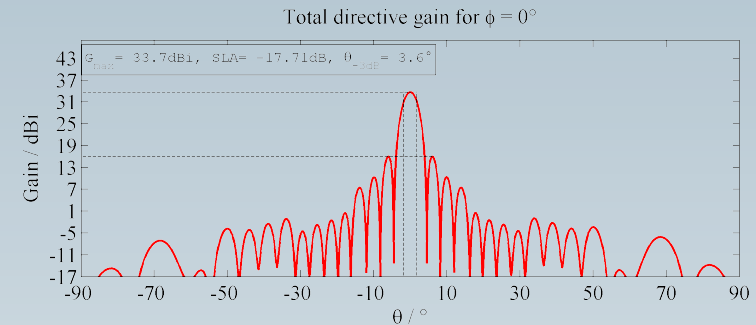


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antenna radiation pattern



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



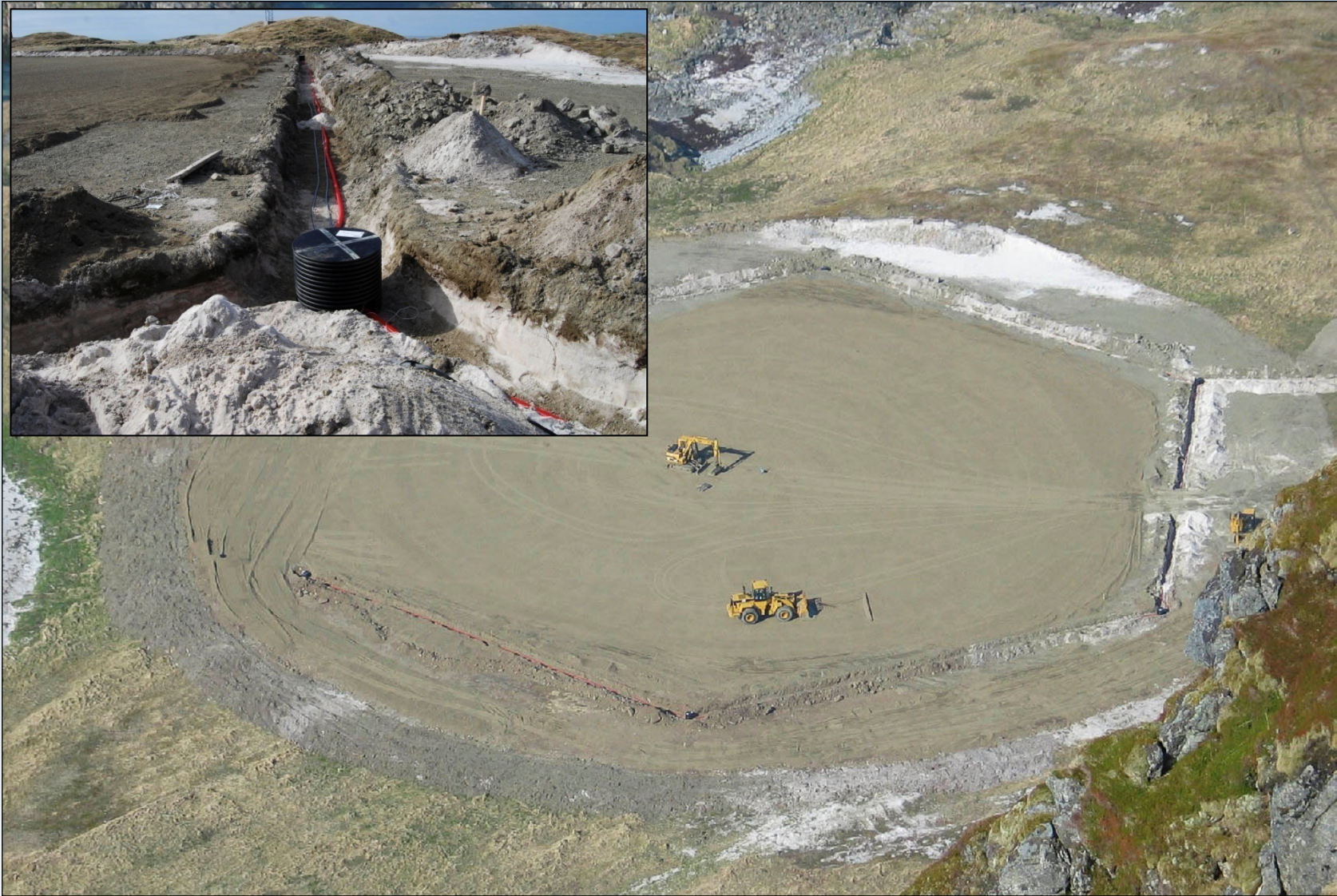
The making of MAARSY

February 2009



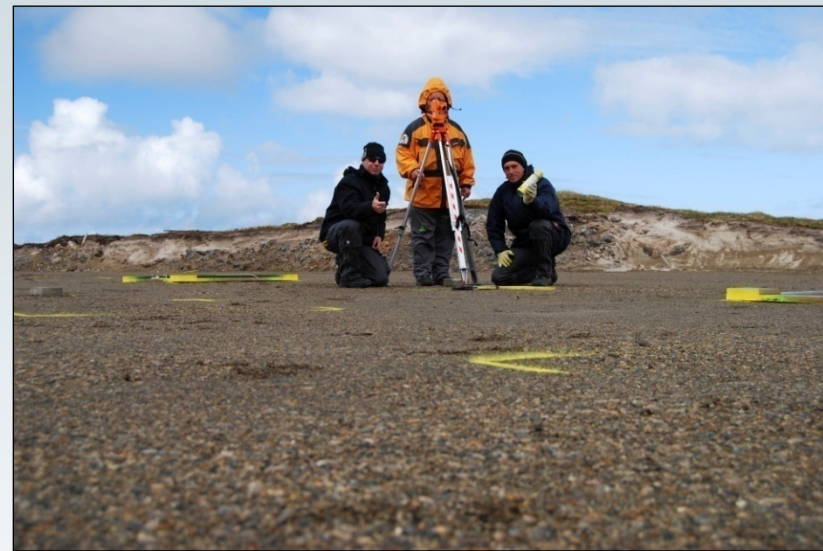
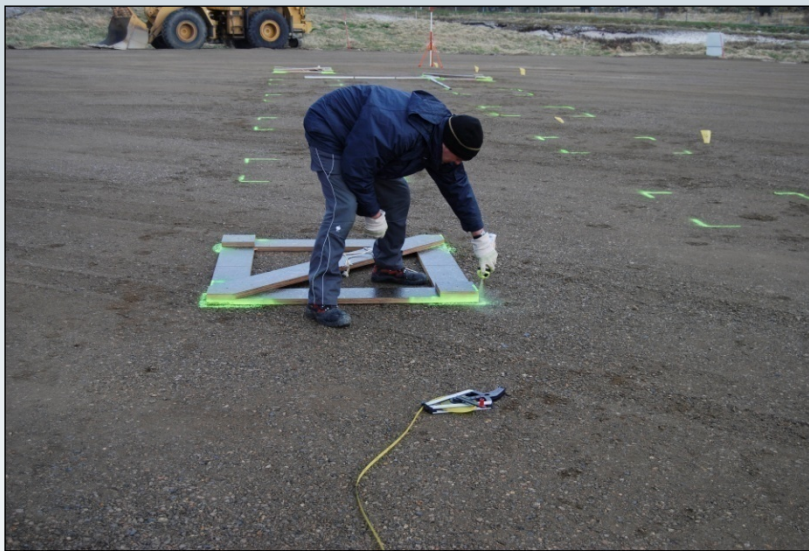
The making of MAARSY

May 2009



The making of MAARSY

May 2009 (week 21/22)



The making of MAARSY

June 2009 (week 23)



The making of MAARSY

5 June 2009, 10:30 Uhr



The making of MAARSY

June 2009 (week 24)



The making of MAARSY

June 2009: mounting of antennas



The making of MAARSY

5 July 2009, 12:35 Uhr



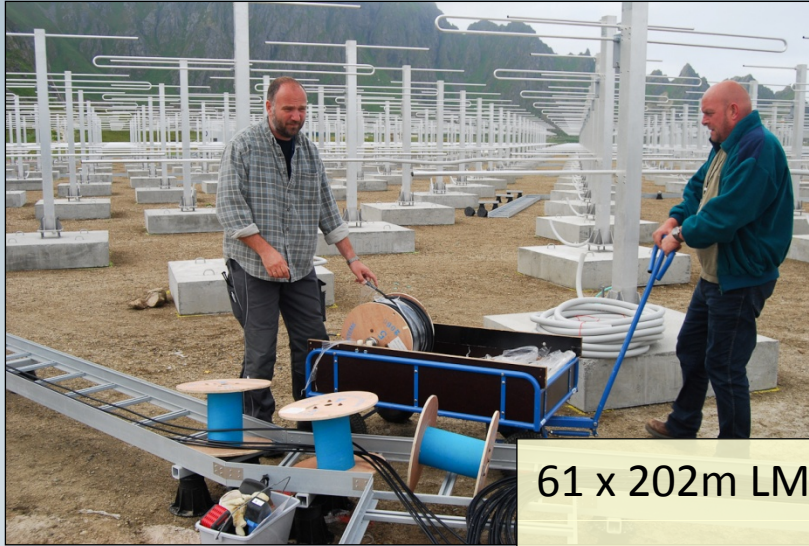
The making of MAARSY

July 2009: mounting of cable trays



The making of MAARSY

July 2009: laying of cables



61 x 202m LMR400:	12.3 km
433 x 27m LMR600:	24.7 km
total:	37.0 km



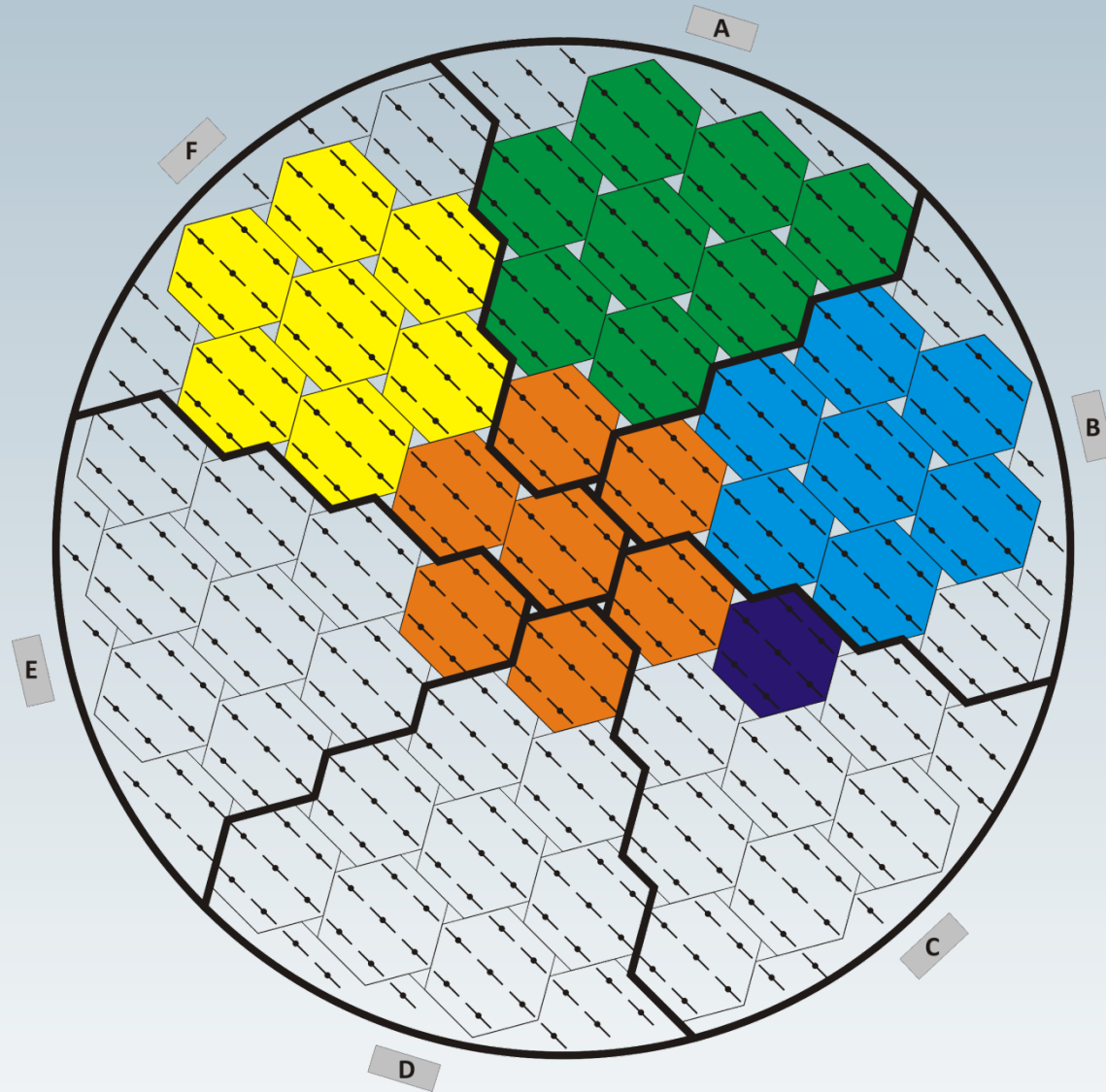
The making of MAARSY

August 2009



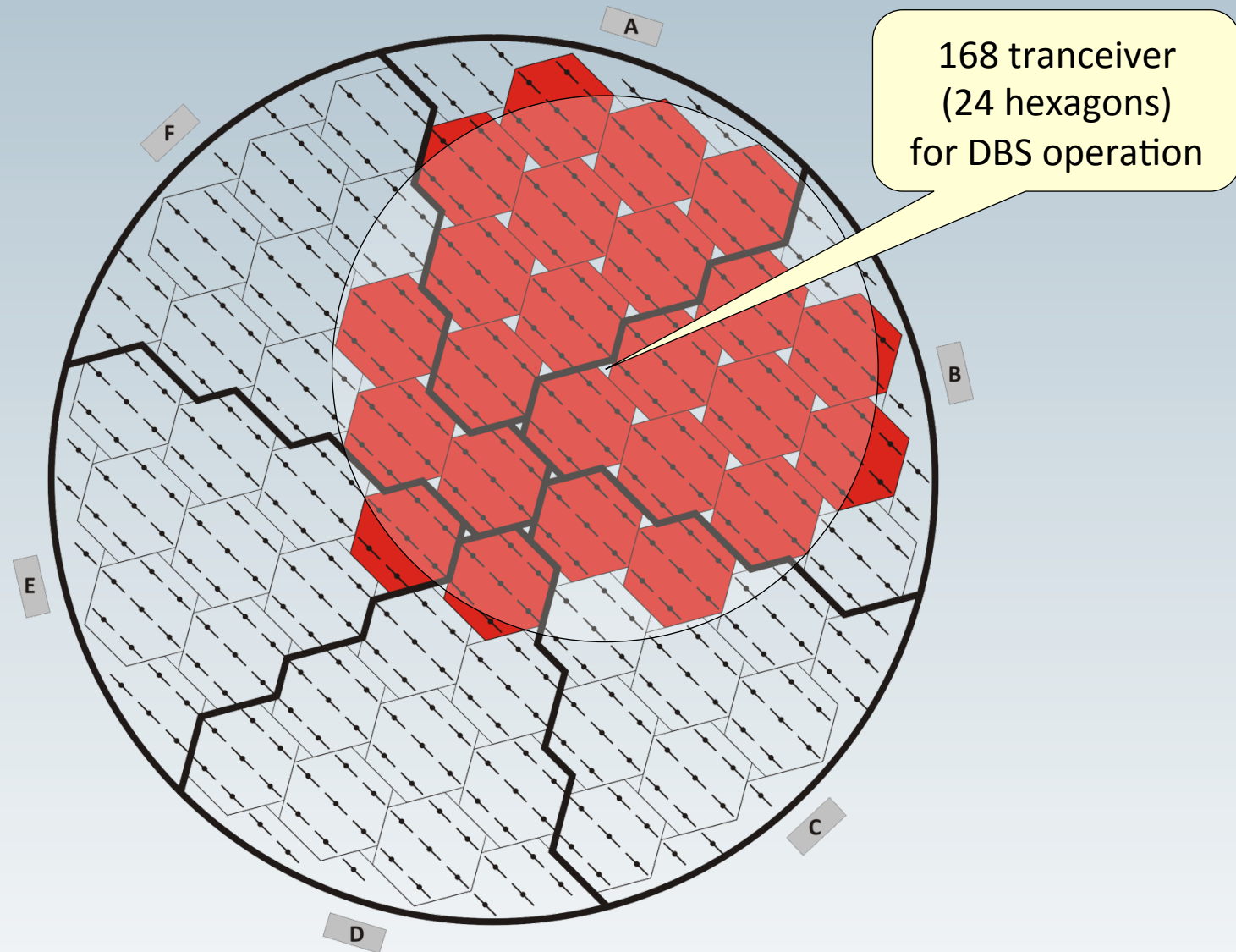
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number of transceiver modules as installed in April: $210 \approx 48\%$



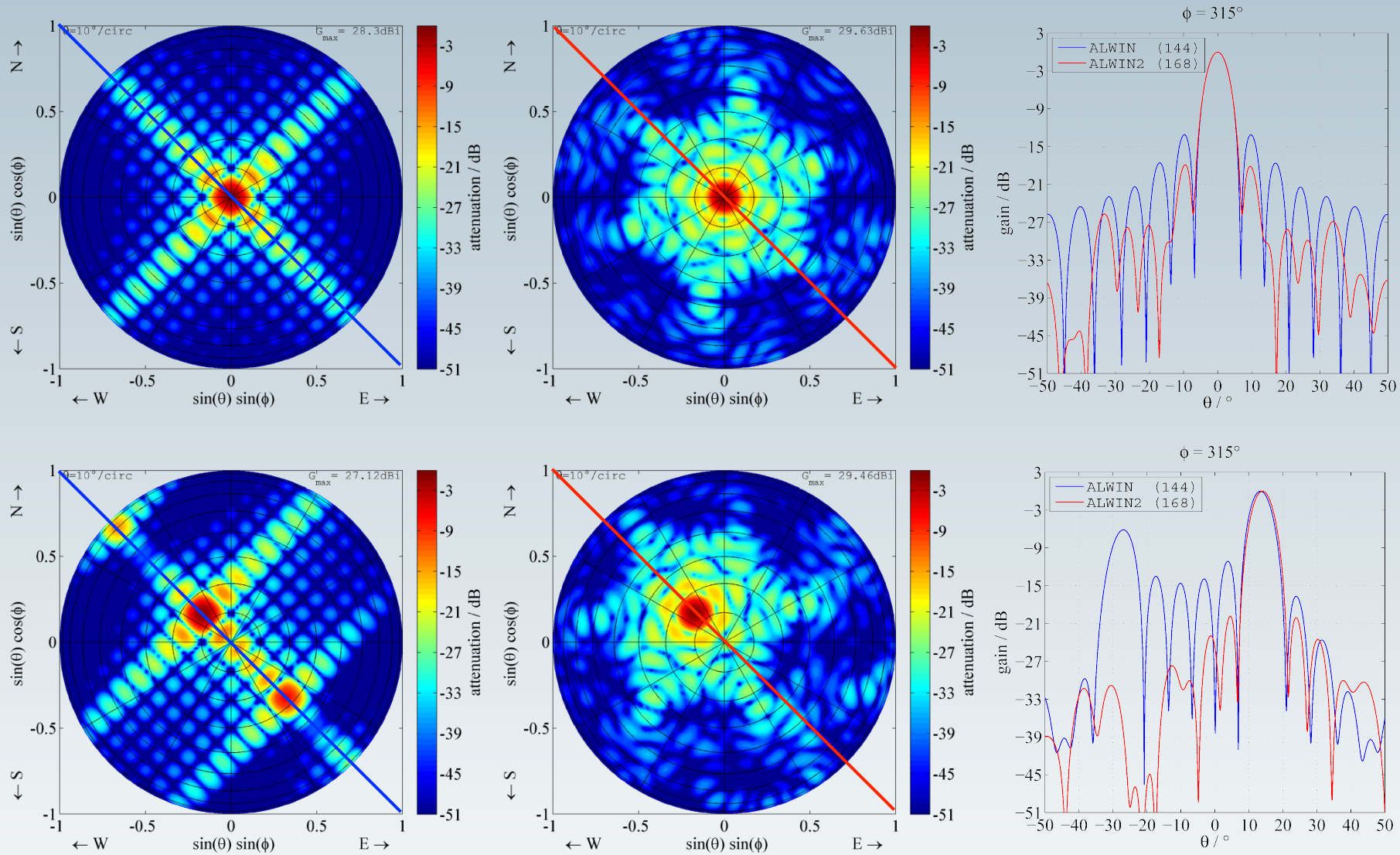
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168 transceivers used for DBS experiment in summer 2010

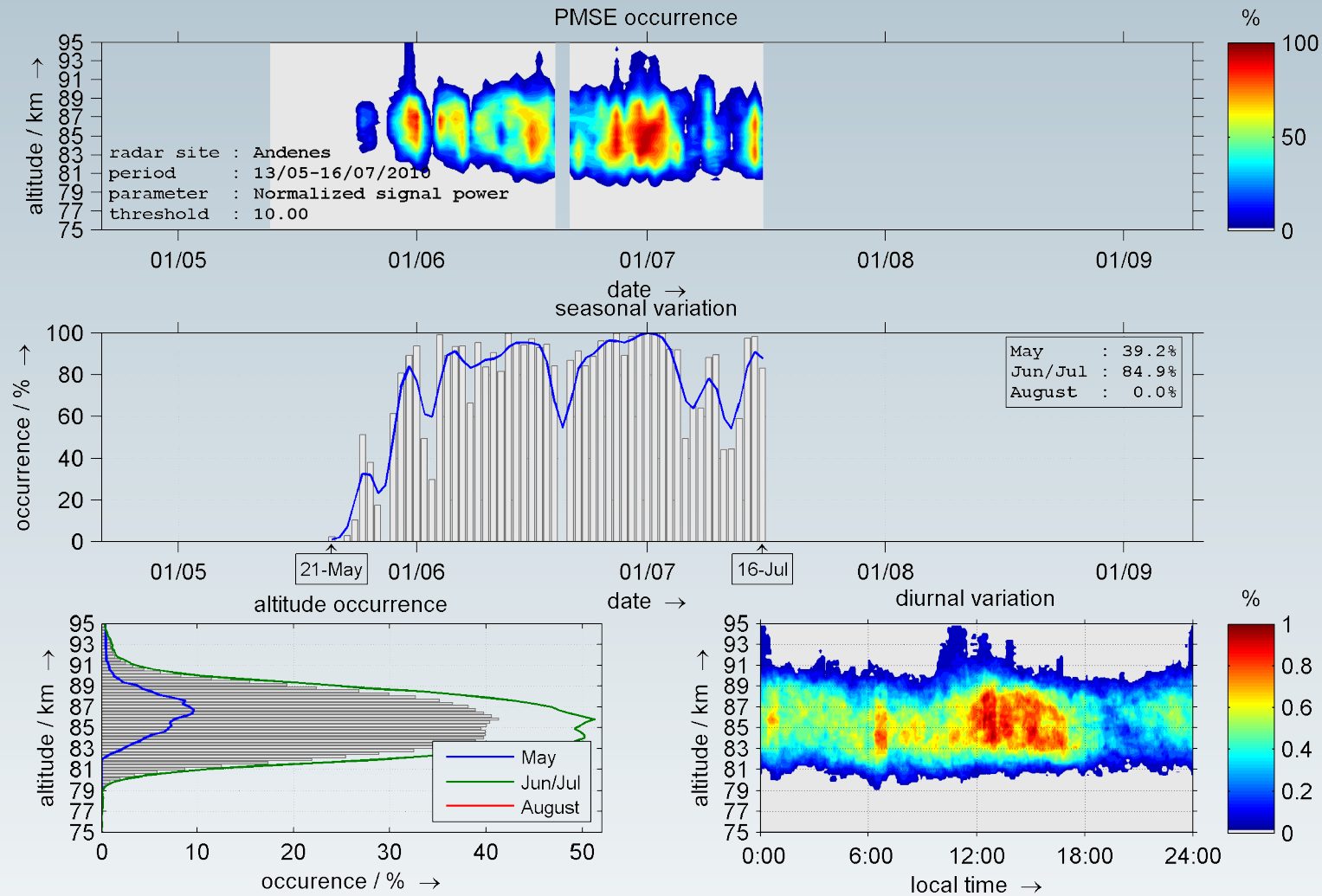


ALWIN (144) — MAARSY (168)

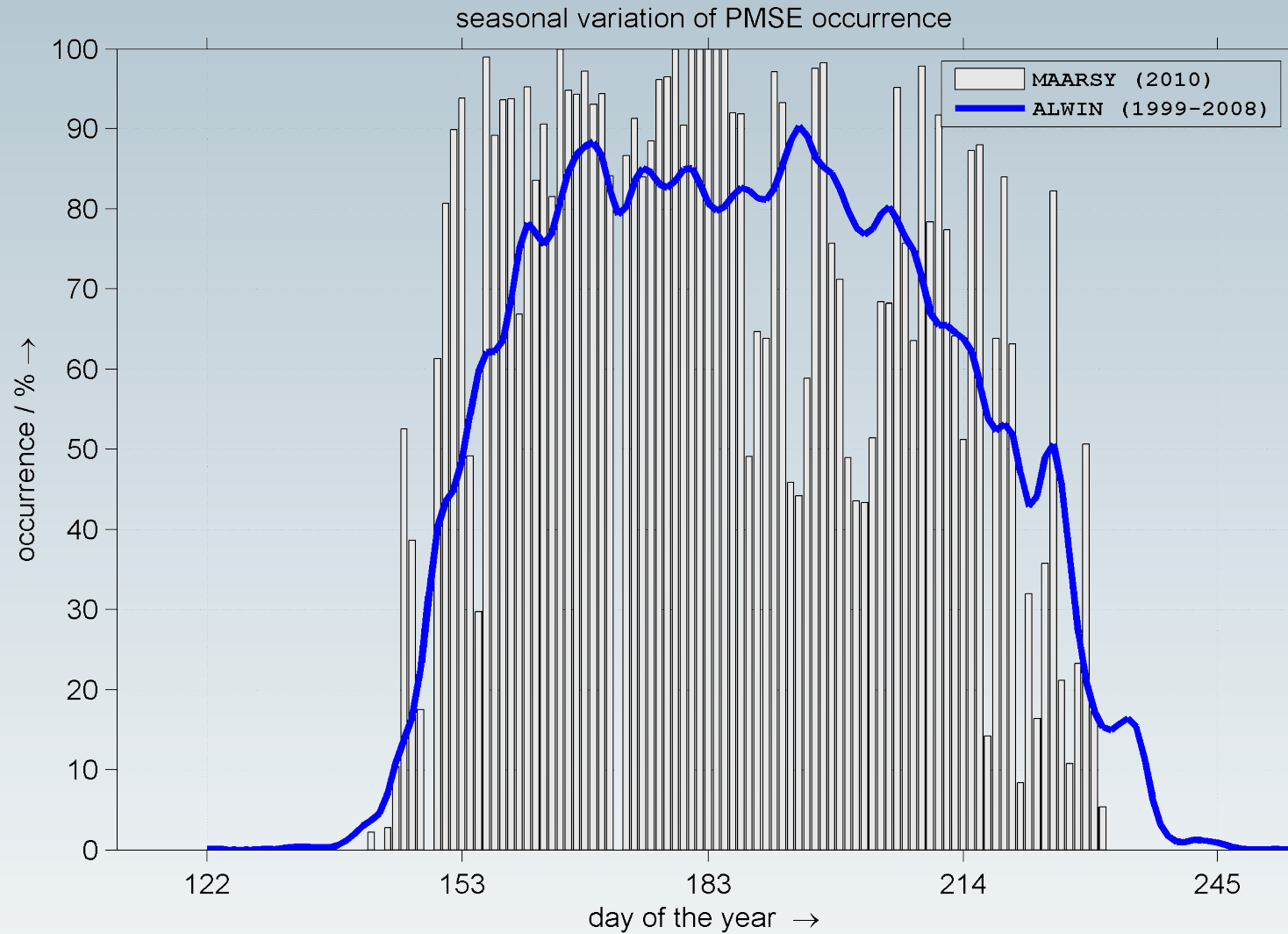
antenna radiation patterns for $\phi = 315^\circ$; $\theta = 0^\circ$ und 14°



PMSE occurrence at Andenes in 2010

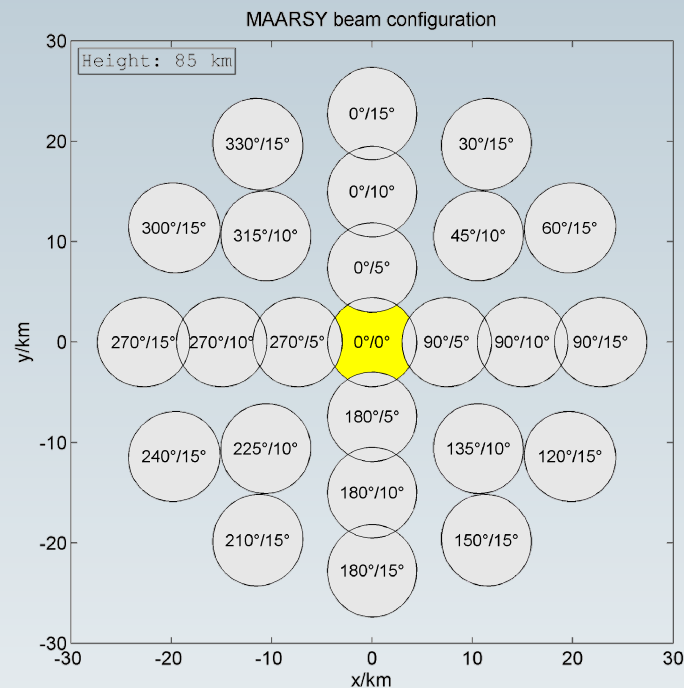


PMSE occurrence at Andenes



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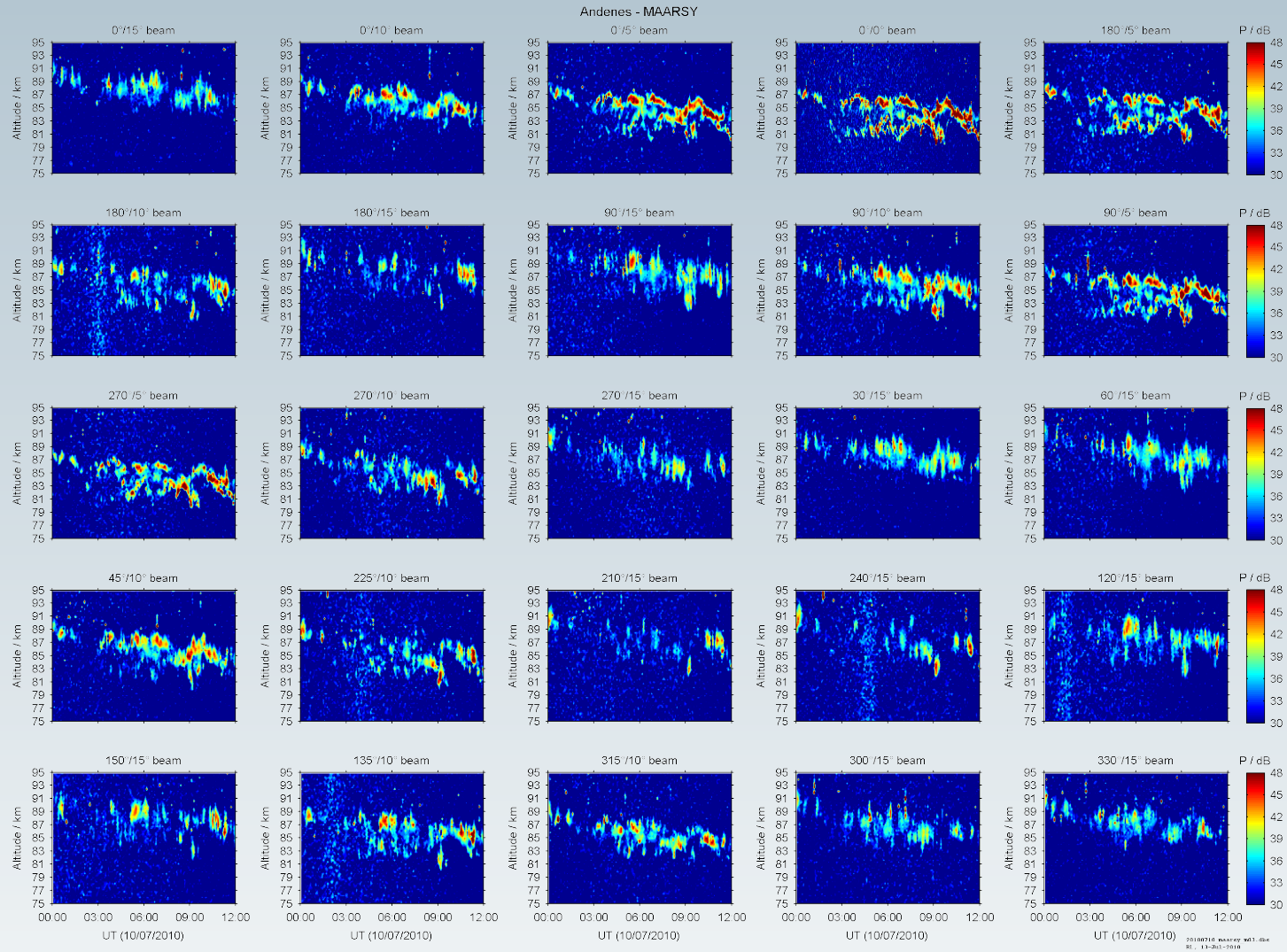
first 3D scanning experiment using 25 beams quasi simultaneously



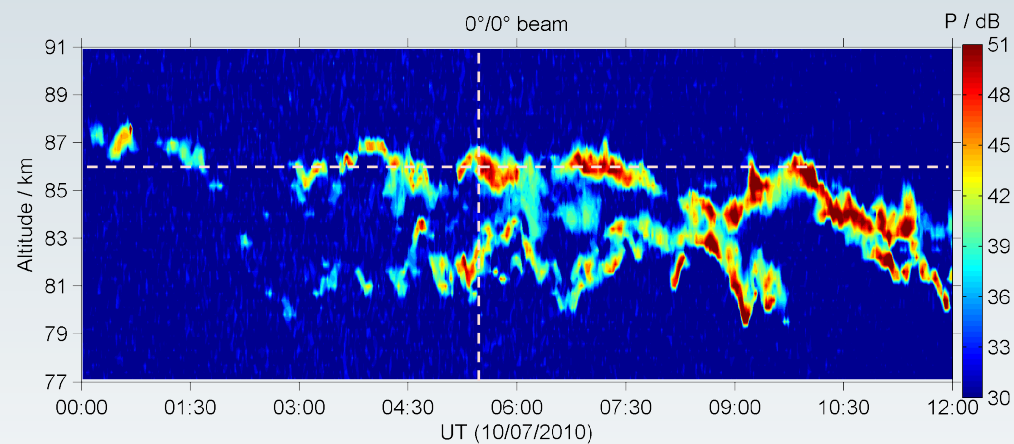
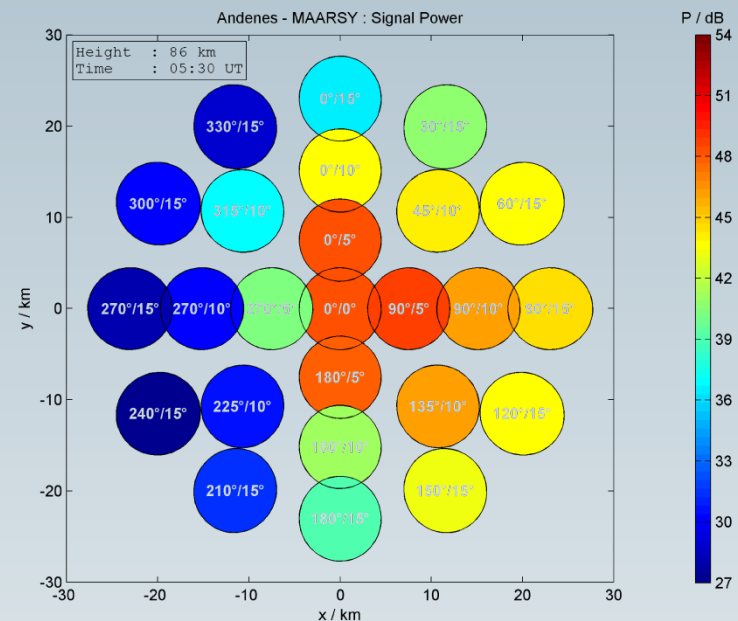
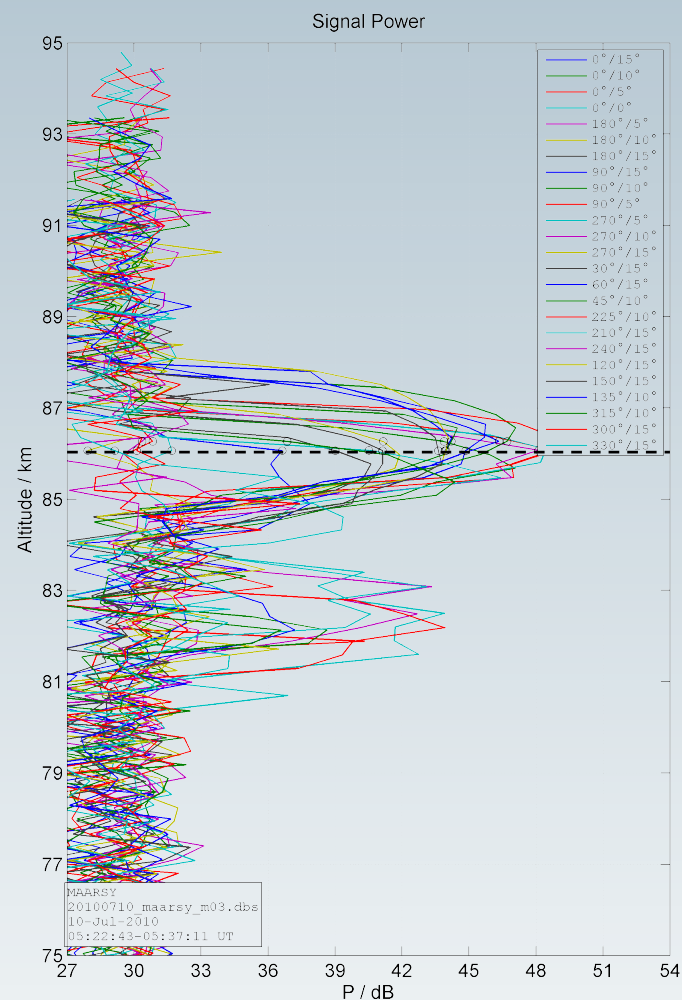
- Experiment configuration
 - 8bit coded complementary pulses; 2000ns (300m)
 - 625Hz; 4Cl; 1024 dpts;
 - 7 beams simultaneously (point-to-point)
 - 45.8s runtime
 - range: 75 – 95.4km
 - sampling res.: 300m
- Experiment sequence
 - meso003a (47s)
 - meso003b (47s)
 - meso003c (47s)
 - meso003d (47s)
 - meso001 (53s)
 - 25 individual beams quasi simultaneously
 - ~4min profile resolution

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first 3D scanning experiment: 25 HTI power plots

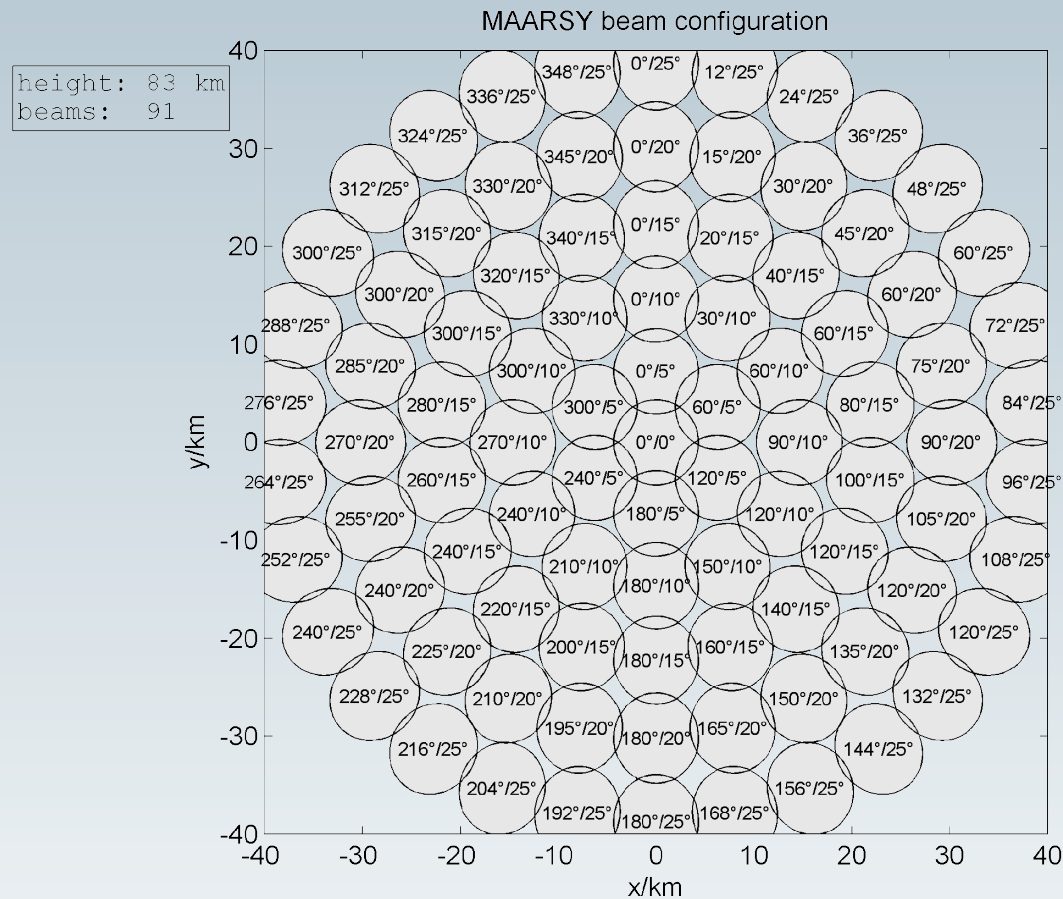


Vertical and horizontal structure of PMSE over Andenes at 86 km on July 10, 2010, 05:30 UT



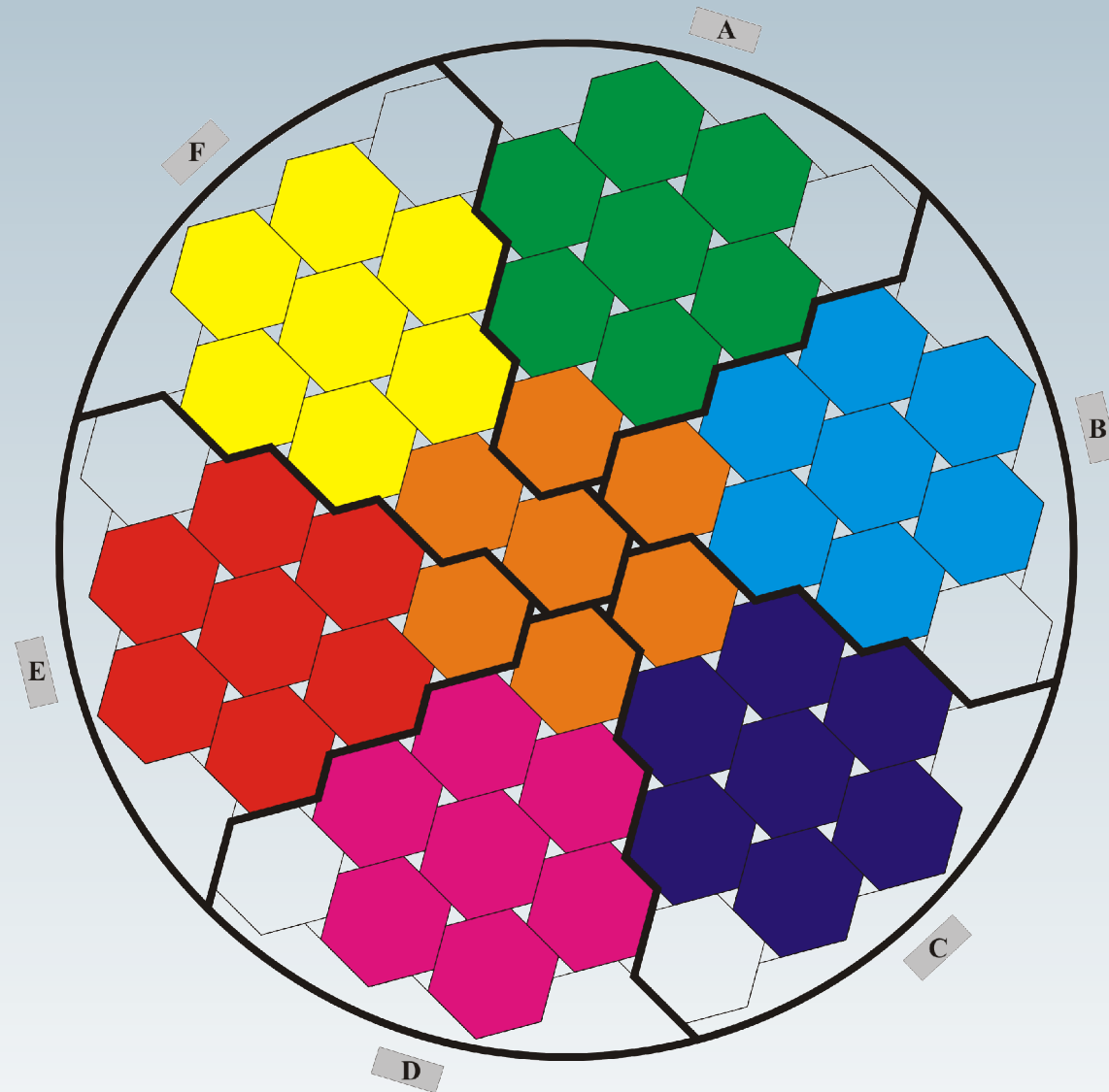
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3D scanning experiment using 91 beams quasi simultaneously



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progress of installation as scheduled for October 2010



Thank you!

Thanks to all who have contributed to the successful construction of the new facility!

New results are expected soon.

