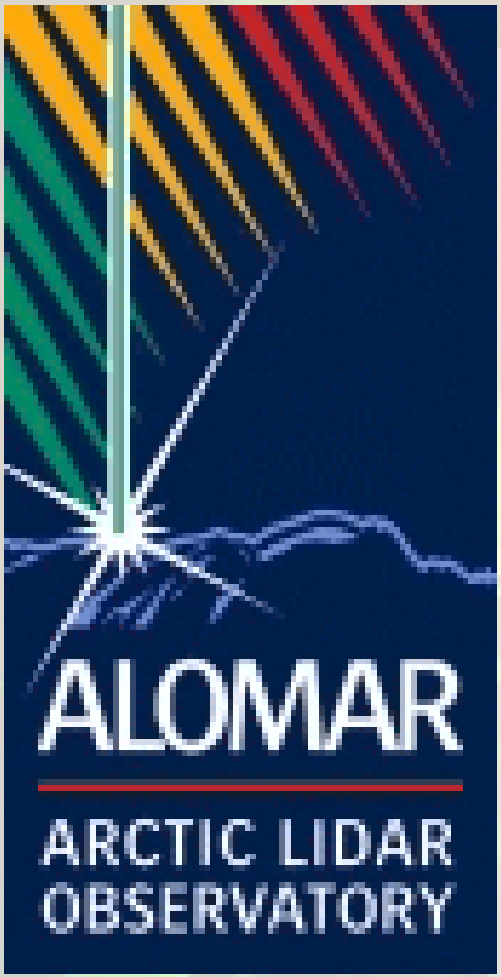
ALOMAR (69N 16E)

Arctic Lidar Observatory for Middle Atmosphere Research



ALOMAR and the Andøya Rocket Range in Northern Norway

Michael Gausa

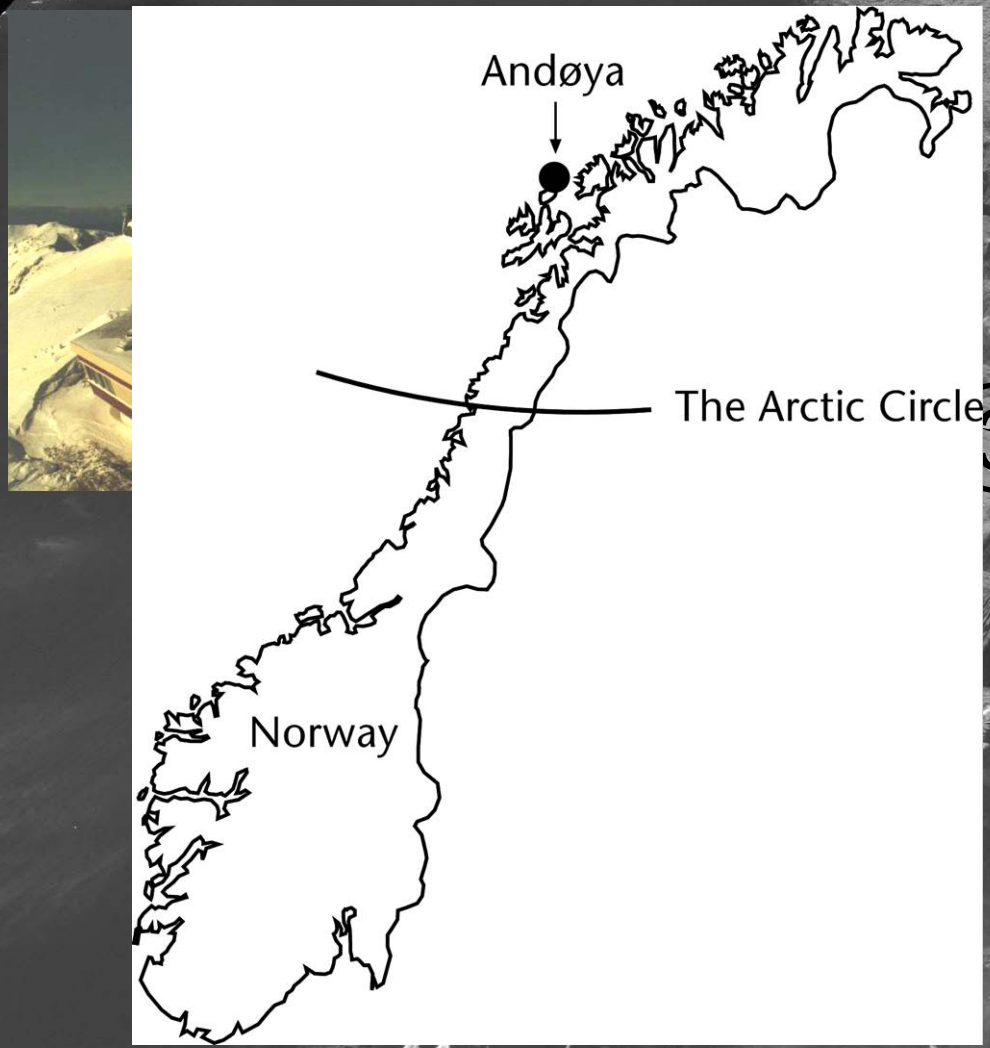
Andøya Rocket Range

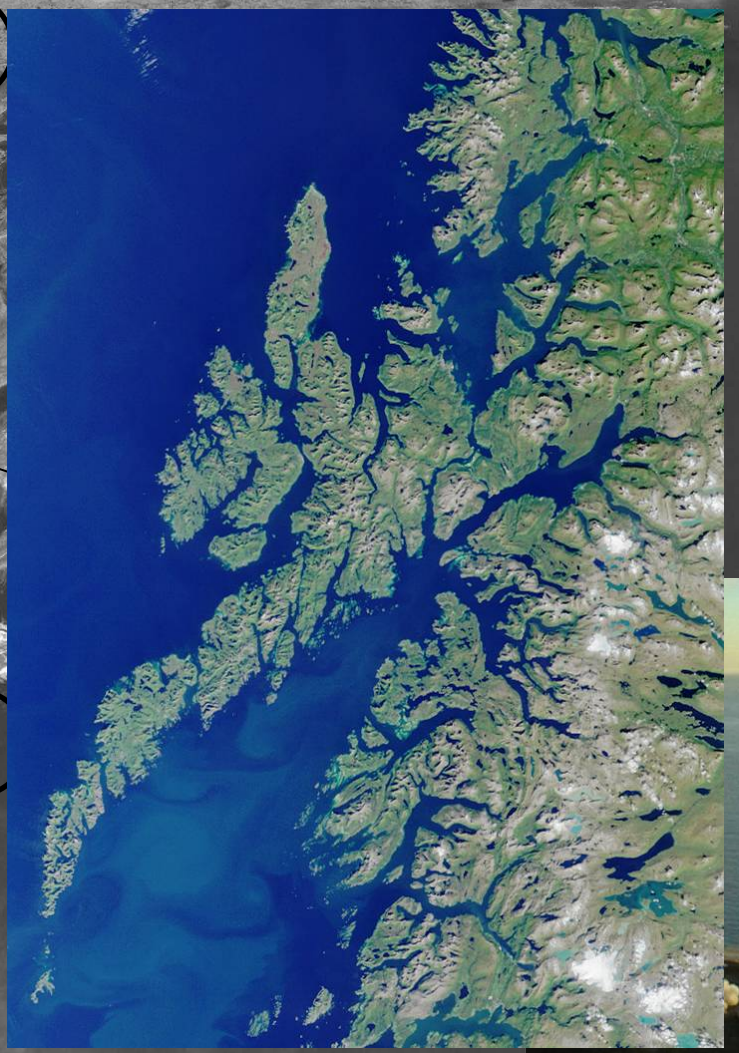
PO Box 54, Andenes, Norway

Michael.Gausa@rocketrange.no

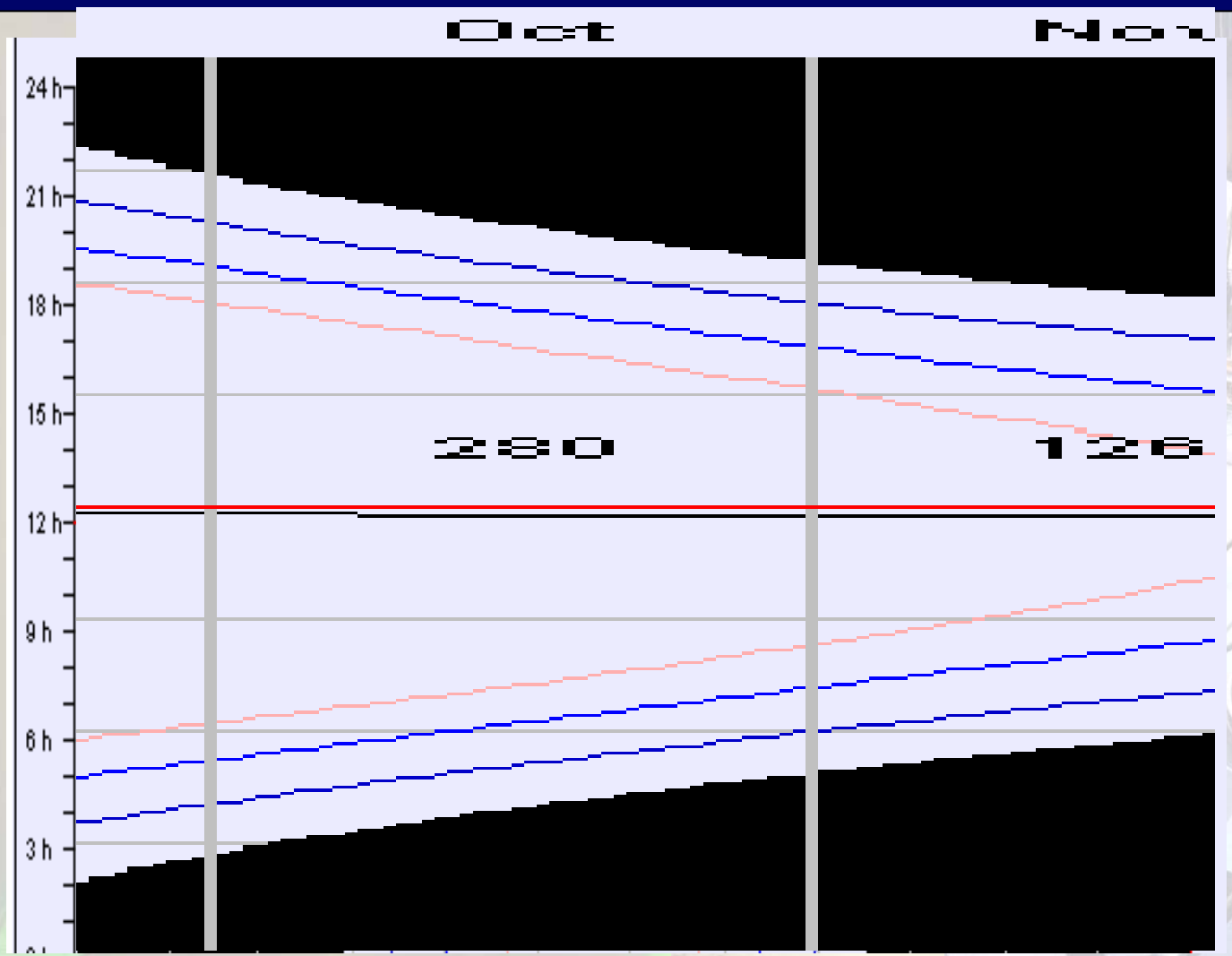
http://alomar.rocketrange.no

Location of Andøya Rocket Range, ALOMAR and Remote Sites





ALOMAR, 69,2N 16,0 O



FACTS

Established 1962
- First sounding rocket launched 18 August 1962
- Limited company from September 1997

Ownership
- Ministry of Trade and Industry 90 %
- Kongsberg Defence & Aerospace 10 %

Launches
- 900 sounding rockets
- 500 stratospheric balloons

A Scientific Toolbox

ANDØYA ROCKET RANGE

A Compact and Cost-effective Range

- Modern and flexible infrastructure
- Skilled and experienced personnel

A Centre for Space Research

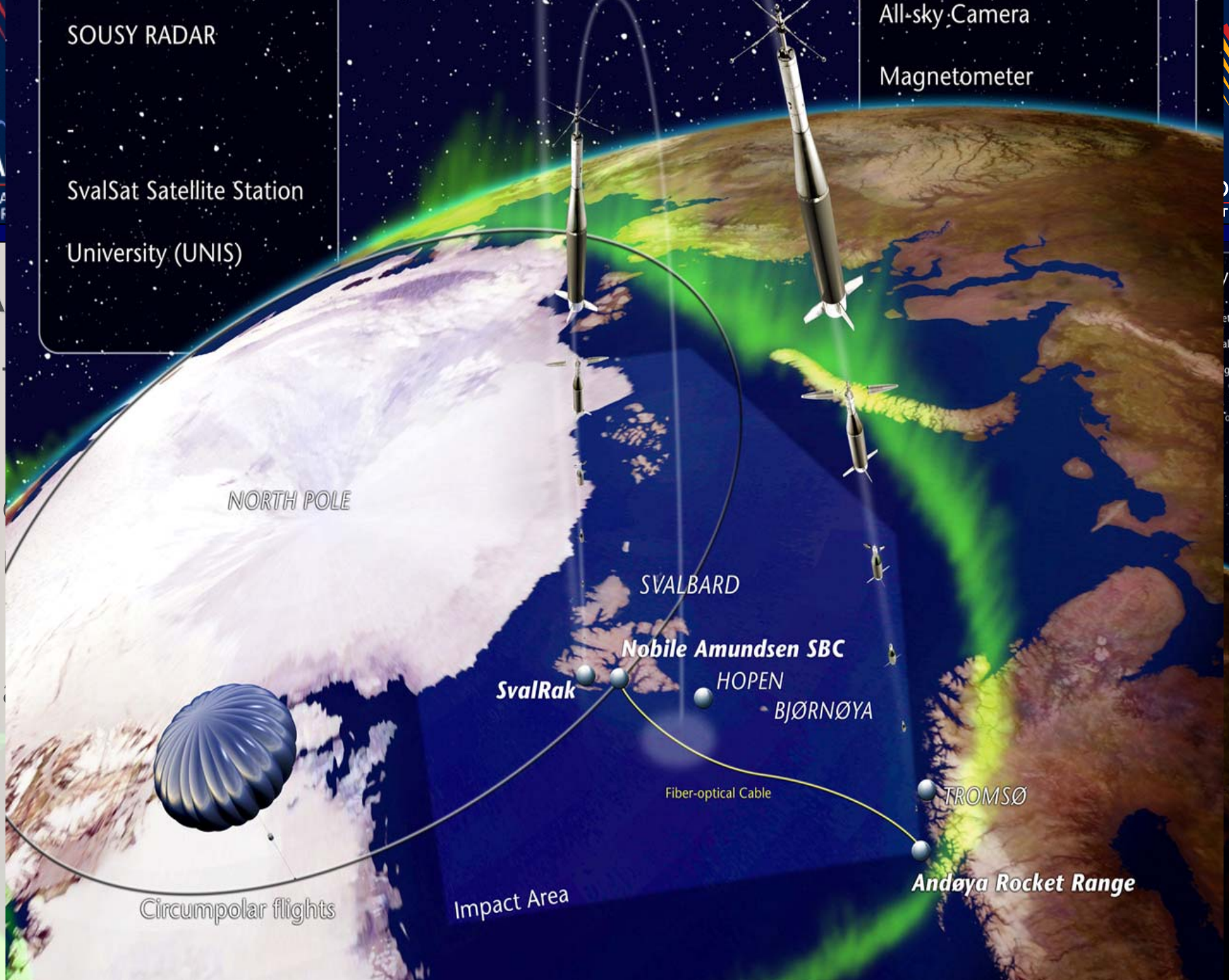
- Sounding rockets
- Stratospheric balloons
- Groundbased instrumentation

Long Duration Balloons

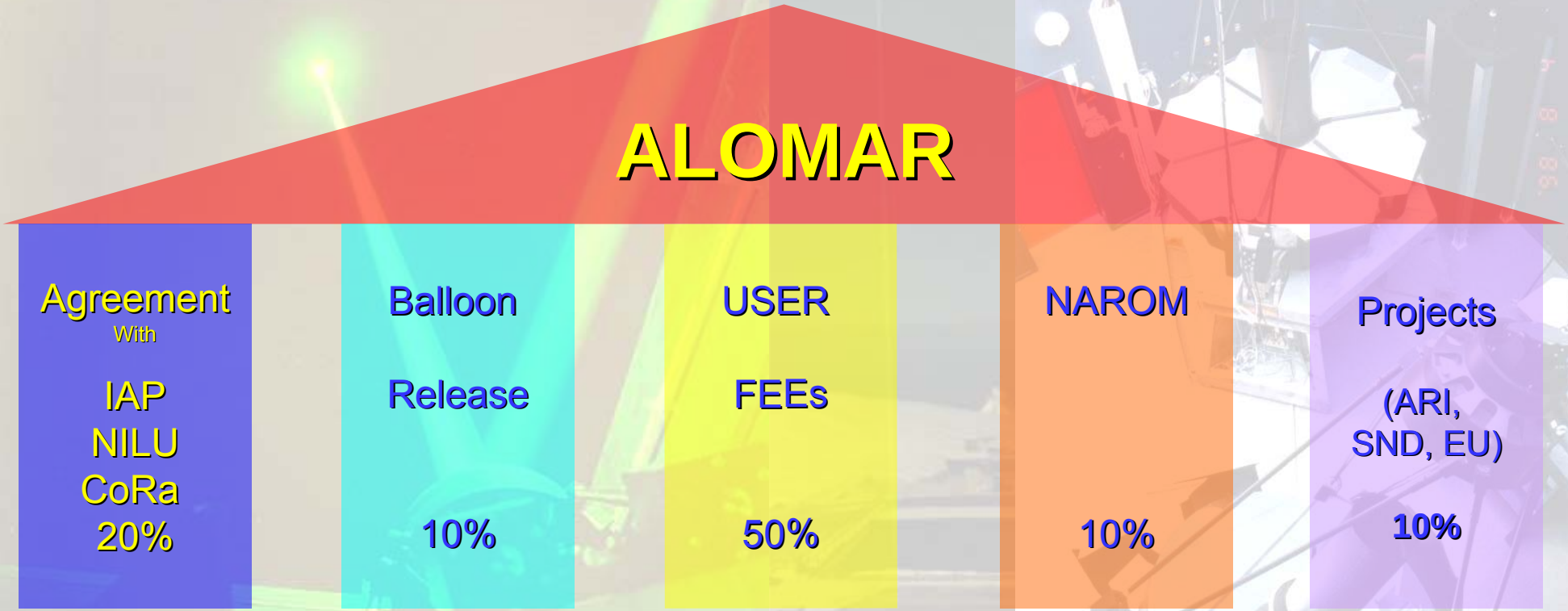
- Launch from Svalbard
- Good conditions for circumpolar flights
- Recovery from Svalbard or Greenland

Advantages

- Extended scientific discoveries
- Safe location away from populated areas
- Qualifying satellite instrumentation
- Long term observations (weeks –months)


SOUSY RADAR
SvalSat Satellite Station
University (UNIS)
All-sky Camera
Magnetometer
NORTH POLE
SVALBARD
Nobile Amundsen SBC
SvalRak
HOPEN
BJØRNØYA
Fiber-optical Cable
TROMSØ
Andøya Rocket Range
Impact Area
Circumpolar flights

ALOMAR's Economy



A possible margin is used for new installastions and instruments

ALOMAR – A Multinational Research Infrastructure at the Andøya Rocket Range

ALOMAR
ARCTIC LIDAR OBSERVATORY

ANDØYA
ROCKET RANGE

CRL

Colorado State University
Knowledge to Go Places

CNRS
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

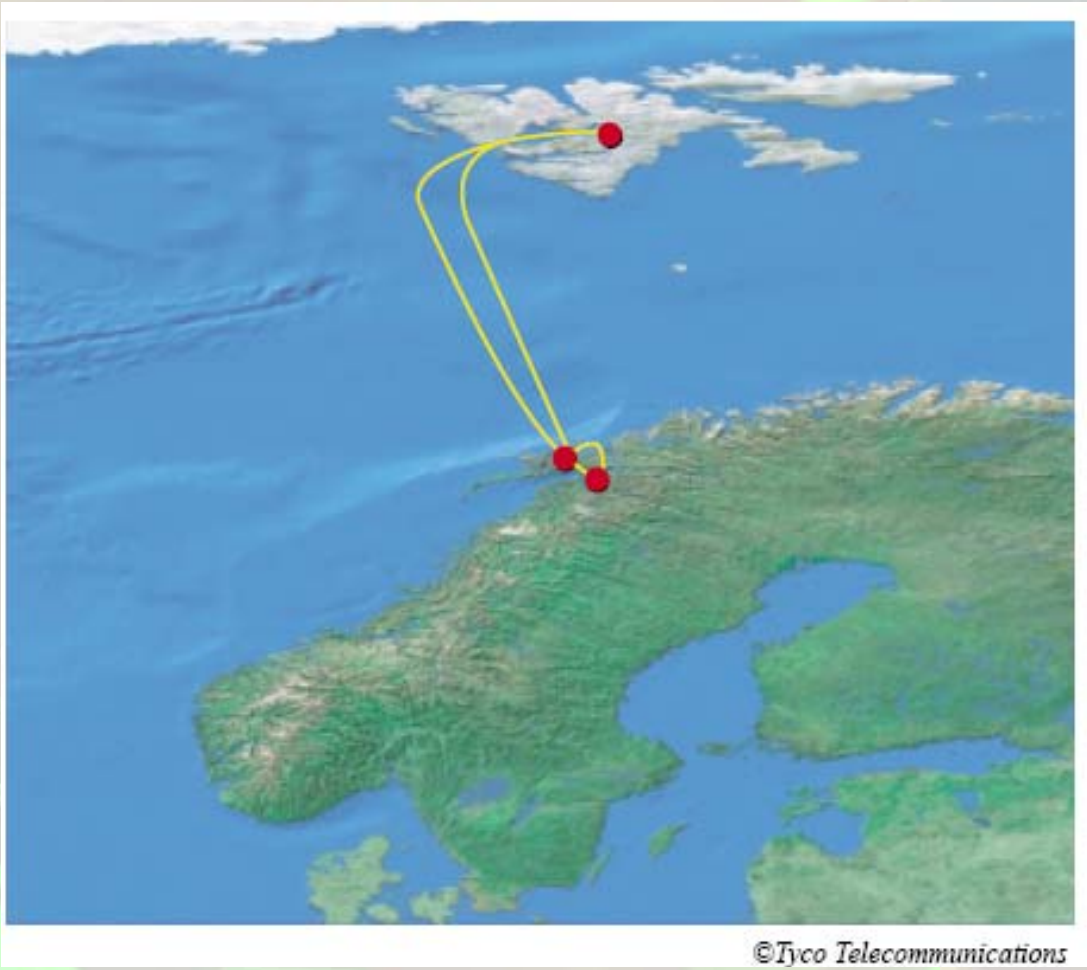
The UNIVERSITY of WESTERN ONTARIO
London, Canada N6A 5B8 519-661-2111

Coordination

New USOC


PR. 1
Saura MF radar - latest DBS results
Watch for new SEC web site design on Oct 1, 2004
SOHO EIT 195
Latest Image
Saura MF radar - latest DBS results
Saura MF radar - latest DBS results
ALWIN radar - Troposphere observation - latest results
SOHO EIT 171
Latest Image
Saura MF radar - latest DBS results
Saura MF radar - latest DBS results
Saura MF radar - latest DBS results
SOHO EIT 171
Latest Image

Communication and Coordination



Glas fiber from Svalbard – Harstad by the Norwegian Space Center

ARR has available 2.5 Gbit/s

1 Gbit is reserved for Scientific use, the rest can be used for commercial purposes

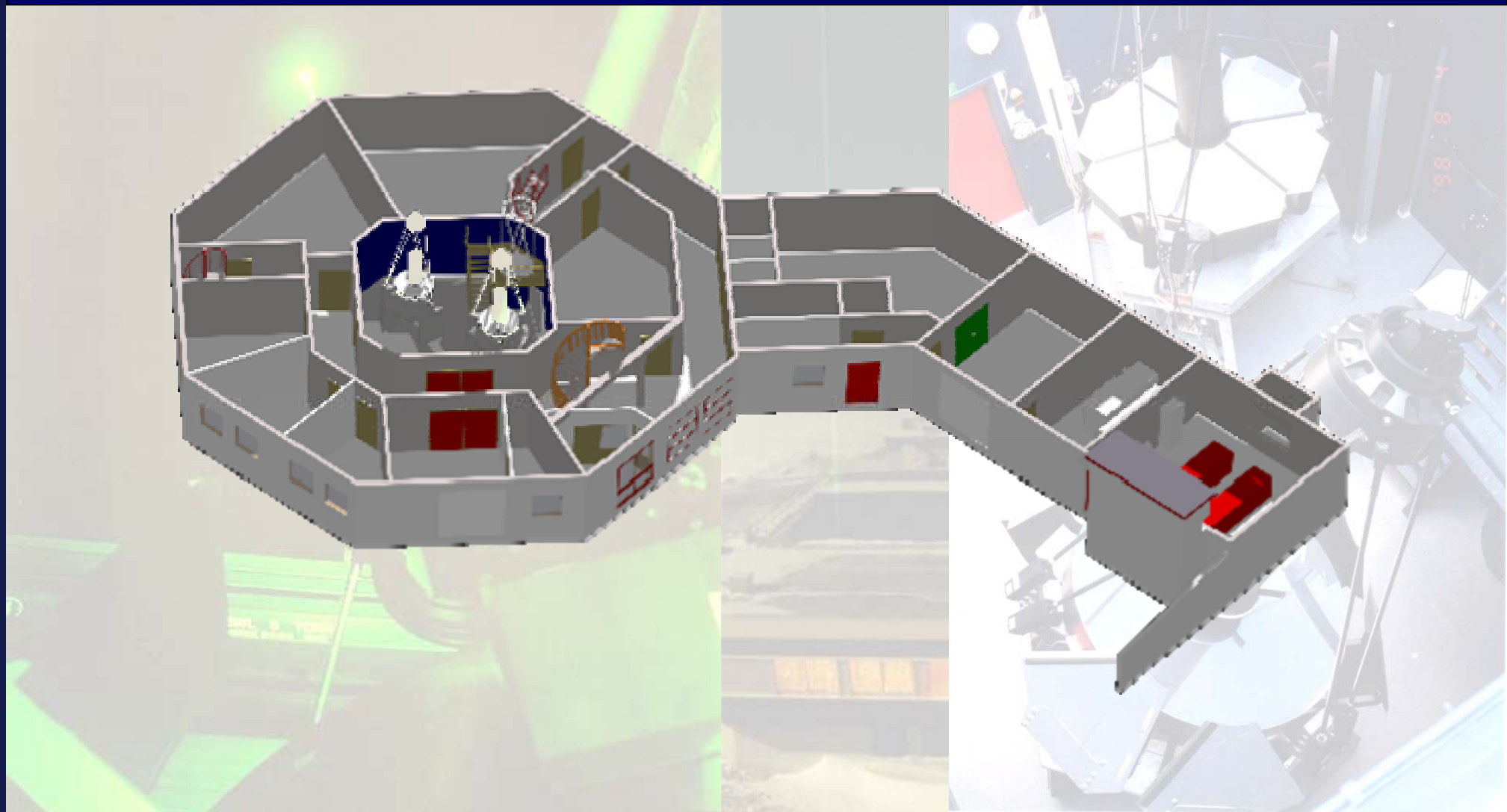
> real time data communication between Andøya and Svalbard

Technical Data:

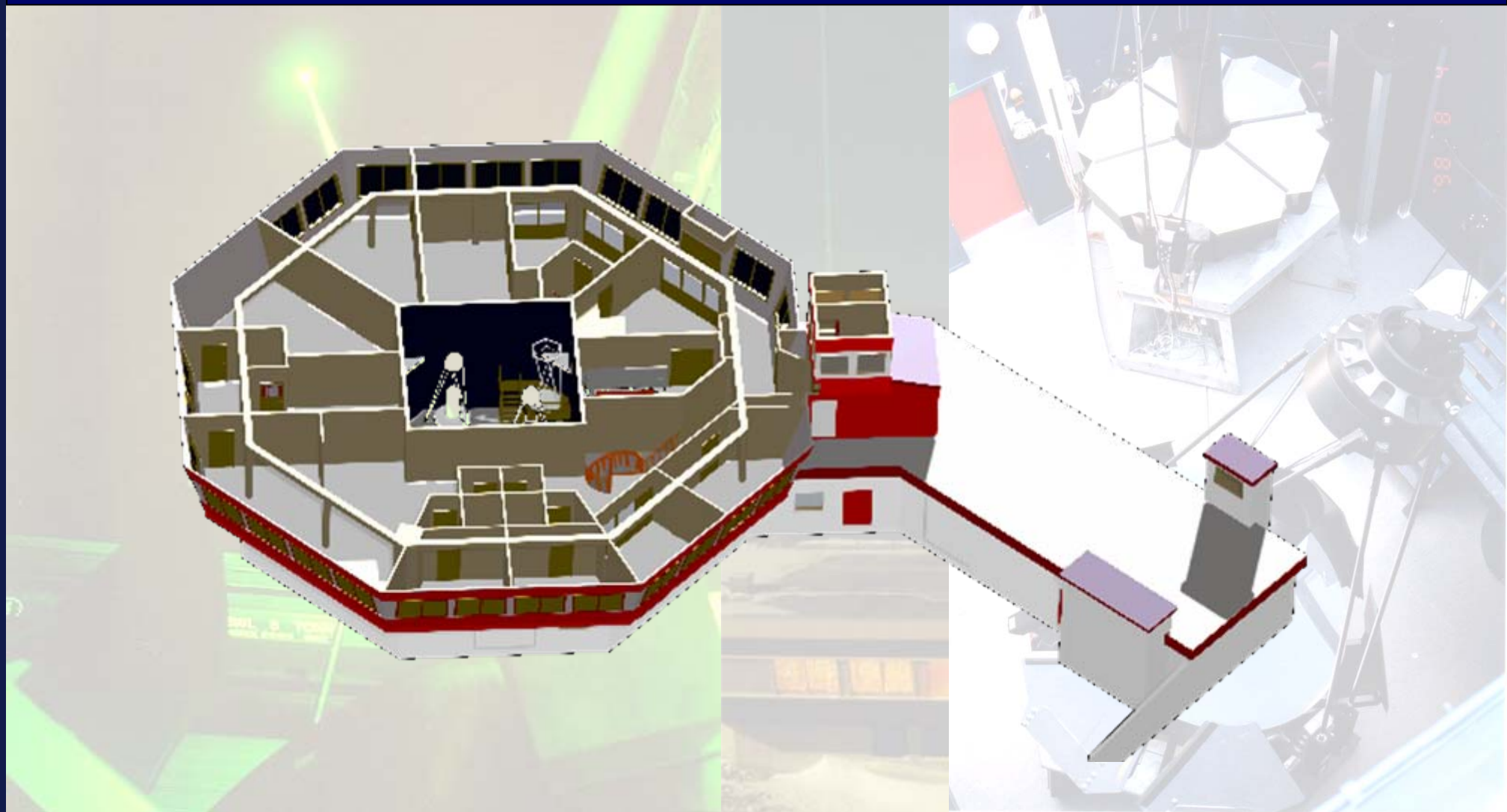
Length 2x 1300 km

up to 1600 m deep

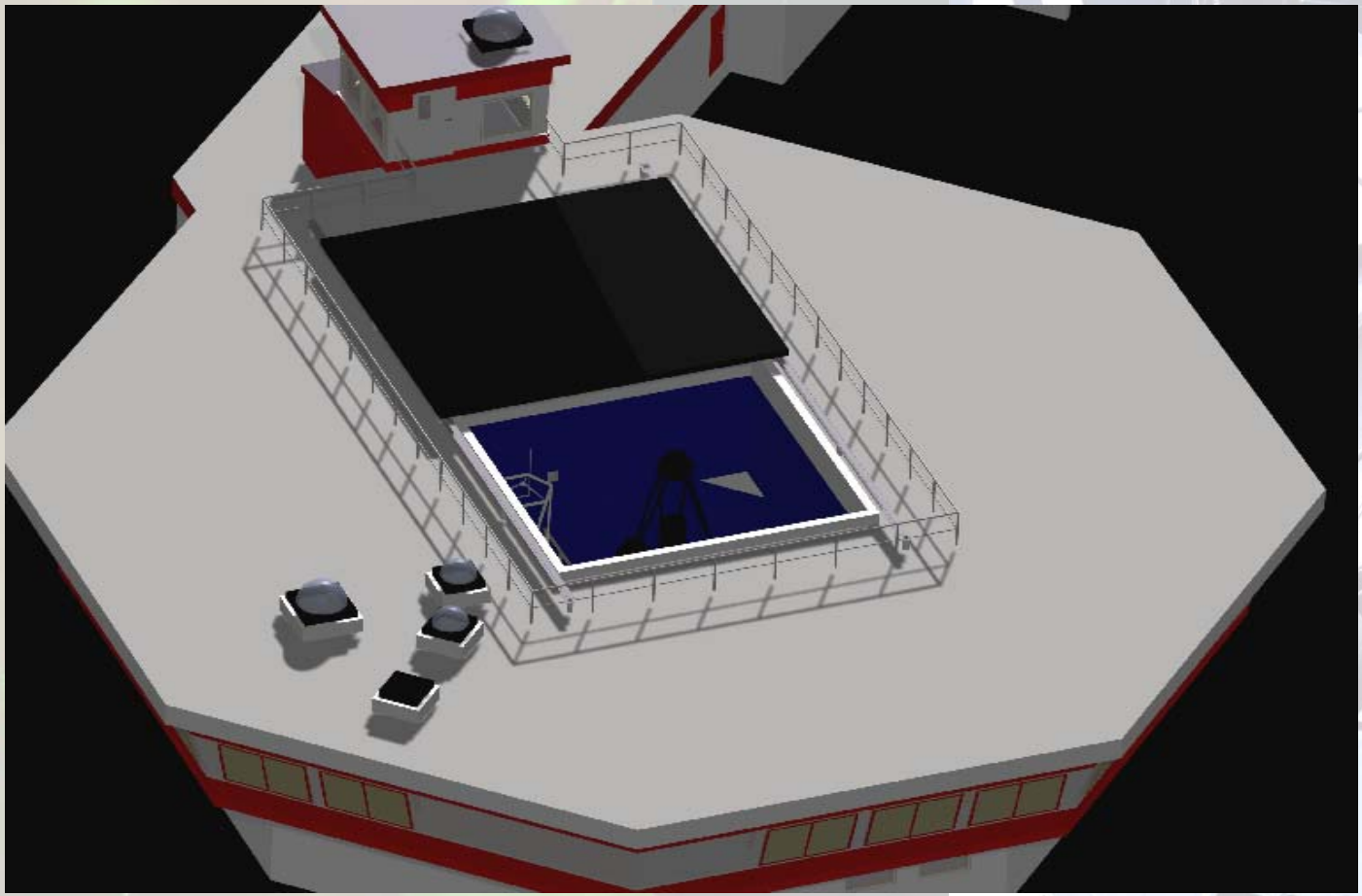
The ALOMAR building I



The ALOMAR building II



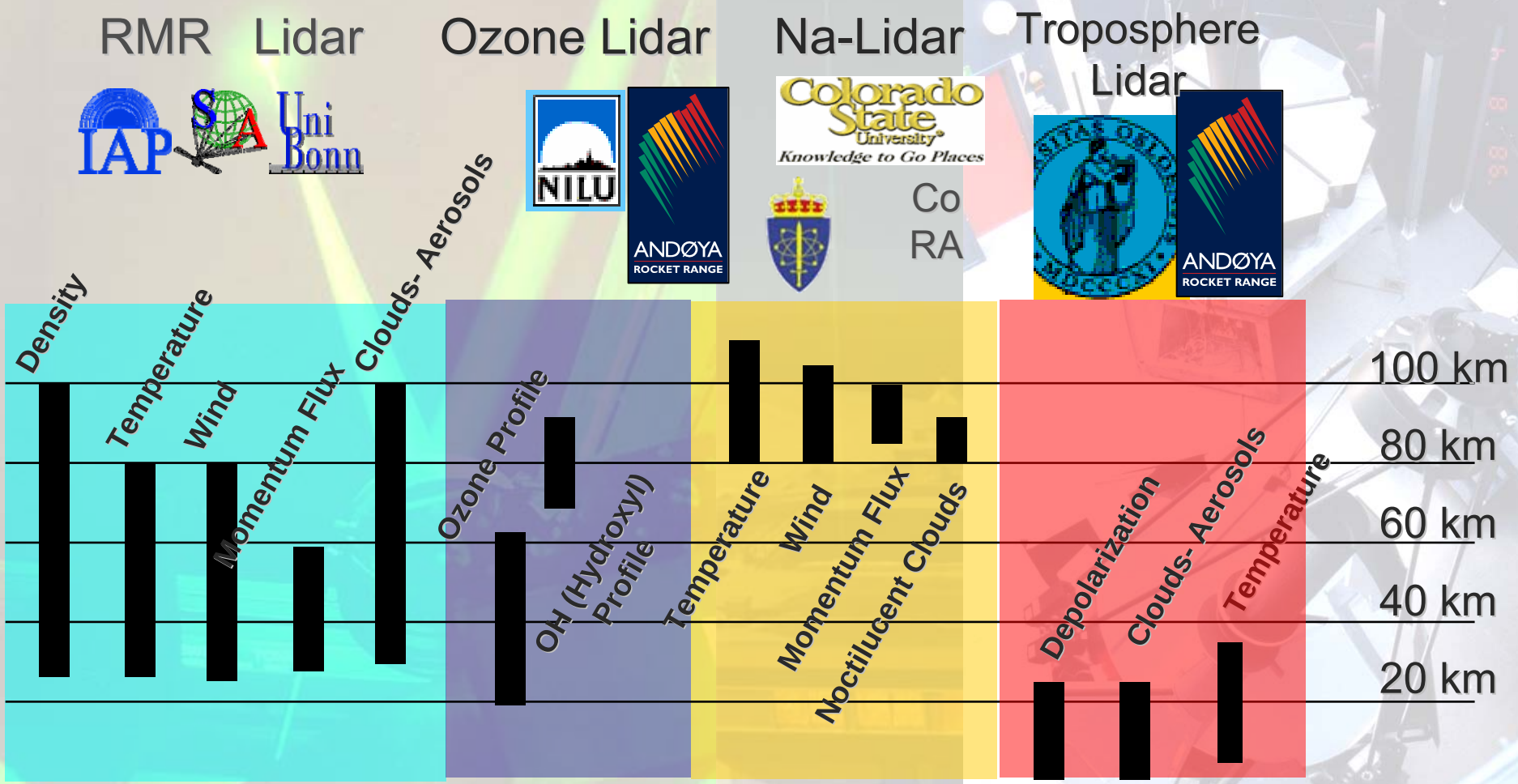
The ALOMAR building III



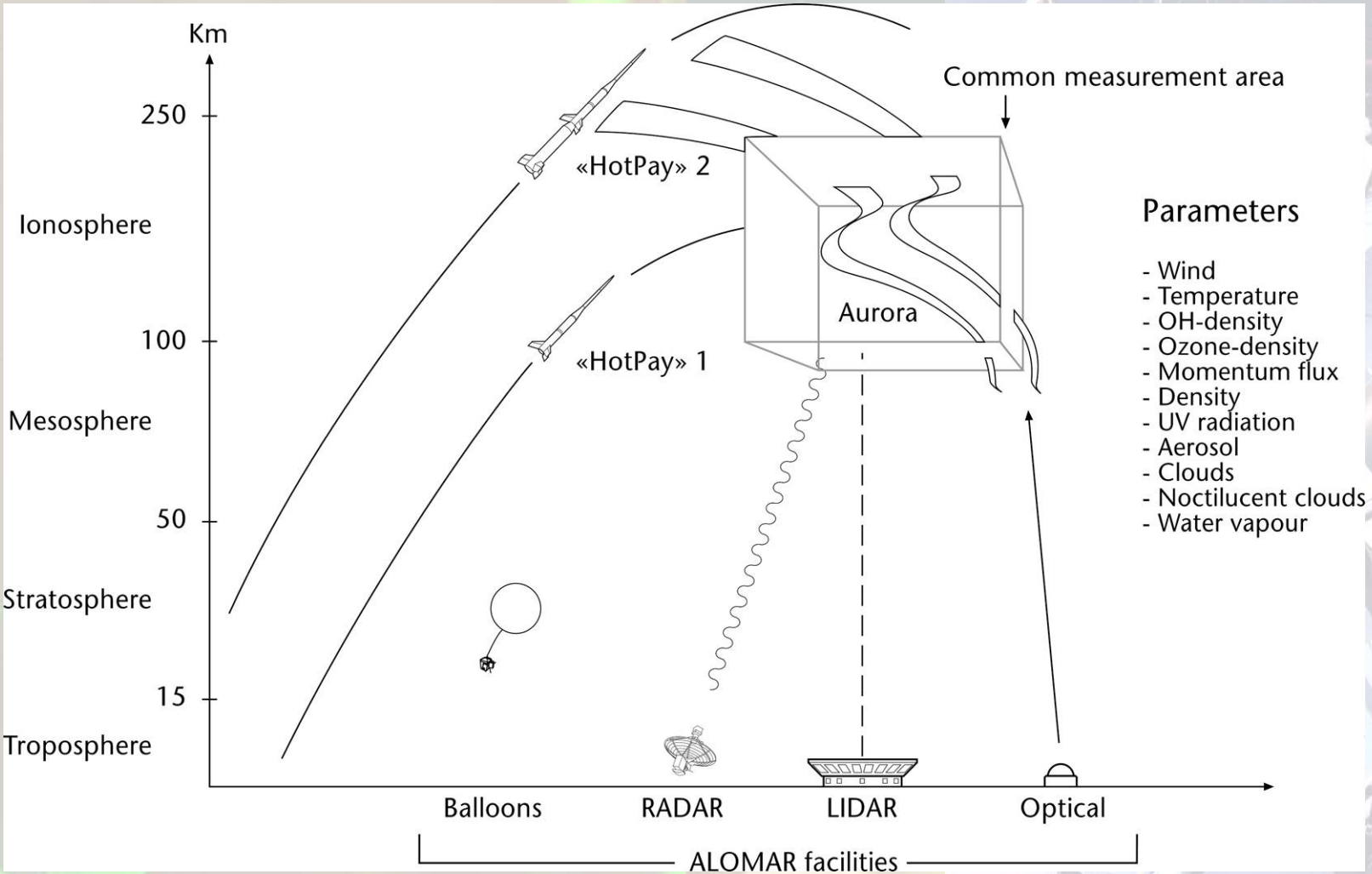
The ALOMAR Lidar Systems

ALOMAR
ARCTIC LIDAR OBSERVATORY

ANDØYA ROCKET RANGE



Unique Opportunities at Andøya



ALOMAR
ARCTIC LIDAR OBSERVATORY

ANDØYA
ROCKET RANGE

Pictures by G. Baumgarten, K. Bekkelund and M. Gausa

ALOMAR eARI

ALOMAR
ARCTIC LIDAR OBSERVATORY

CORDIS

Sixth Framework Programme

ANDØYA
ROCKET RANGE

ALOMAR Facility

The ALOMAR (Artic Lidar Observatory for Middle Atmosphere Research) is located on top of the Ramnan, 378 m above sea level, near Andøya Rocket Range (ARR) in the northern part of Norway (69N). It is a unique ensemble of ground-based instruments, installed and operated by scientific groups from seven countries.

By means of ALOMAR eARI, ARR offers to the scientists the opportunities for in-depth studies of the Arctic atmosphere and ionosphere, 7 days a week and 24 hours a day all through the year. A set of lidar, radar and passive systems monitor dynamic, chemical and physical parameters from ground level up to 120 km.

Possibilities at the ALOMAR Facility

A selection of ground-based instruments:
- Lidar • Radar • Riometer
- Ionosonde
- All-sky Camera
- Magnetometer

Laboratory Space
Scientist can bring their own instruments to ALOMAR for individual measurements.

Personnel
Technical-, Engineering and Scientific Support

Radiosonde Station
Radio-, Ozone- and Radac sondes

Full services are provided with meteorological balloons, users pay only for the hardware.

All travel & subsistence cost, as well as transport cost for scientific instruments are covered.

Scientific Studies

Arctic climate parameters in general, as w
change.

- Ozone depletion and destruction
- UVB
- NLC (Noctilucent Clouds)
- PMSE (Polar Mesospheric Summer
- PSC (Polar Stratospheric Clouds)
- Aurora Borealis
- Aerosols and pollutants

Closing Dates for Applications

15th Feb, 15th May, 15th September in 2
2006 and 2007.

Available Ground Support Instruments
ALOMAR, USOC, AIRIS, EISCAT and CUTLASS
The costs for the launch Vehicle, launch operation, service section and technical support are covered, while the scientists must provide funding to develop and build their own instruments.

HOTPAY Services

For the HotPay Services through the ALOMAR eARI, we offer scientists the opportunity to mount instruments in newly developed, small, standardised payloads called «Hotel Payload» to be launched from Andøya.

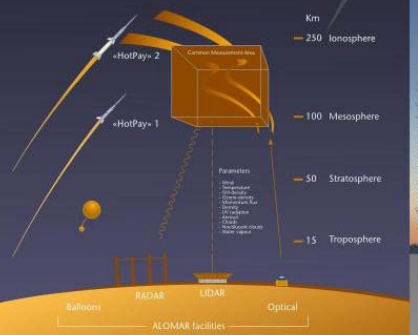
ALOMAR eARI

As part of the EU Commission's programme «*Structuring the European Research Area: Research Infrastructures*», the ALOMAR eARI offer scientists from the European Union and associated countries two possible approaches to apply for transnational access.

1. ALOMAR Facility
Access to a selection of ground based instruments.

2. HOTPAY Services
Access to an instrument platform on a sounding rocket.

EU cover transport, travel and subsistence costs related to these defined projects.



By the EU's 6th FP, we invite scientists to participate and exploit the advantages of our unique site and

Andøya Rocket Range

ANDØYA ROCKET RANGE

The Andøya Rocket Range (ARR) represents a very sophisticated infrastructure for scientific studies of the Arctic atmosphere and ionosphere.

ARR provides scientists with unique experimental tools that comprise the use of modern launch facilities in northern Norway (69N) for sounding rockets and balloons as well as highly sophisticated ground-based instrumentation. ALOMAR (Arctic Lidar Observatory for Middle Atmosphere Research) near the Range is the most complex example of the ground-based facilities.

ARR with ALOMAR provides scientists with the unique year-around opportunity of both long- and short-term monitoring of Climate change parameters, performed by a variety of ground-based state-of-the-art instruments, which can be combined with rocket- and balloon-borne measurements.

ALOMAR
ARCTIC LIDAR OBSERVATORY

ALOMAR
PO Box 54
N-8483 Andenes
NORWAY

http://alomar.rocketrange.no

alomar@rocketrange.no

eARI

Enhanced Access to Research Infrastructure

Transnational Access: ALOMAR eARI

Status: Project started January, 1th 2004

Services:

1. "ALOMAR Facility"

   Access to selected instruments at the ALOMAR Observatory

2. "HotPay Services"

   Co-ordination of two rocket launches

3. Travel and subsistence under participation, transport of equipment

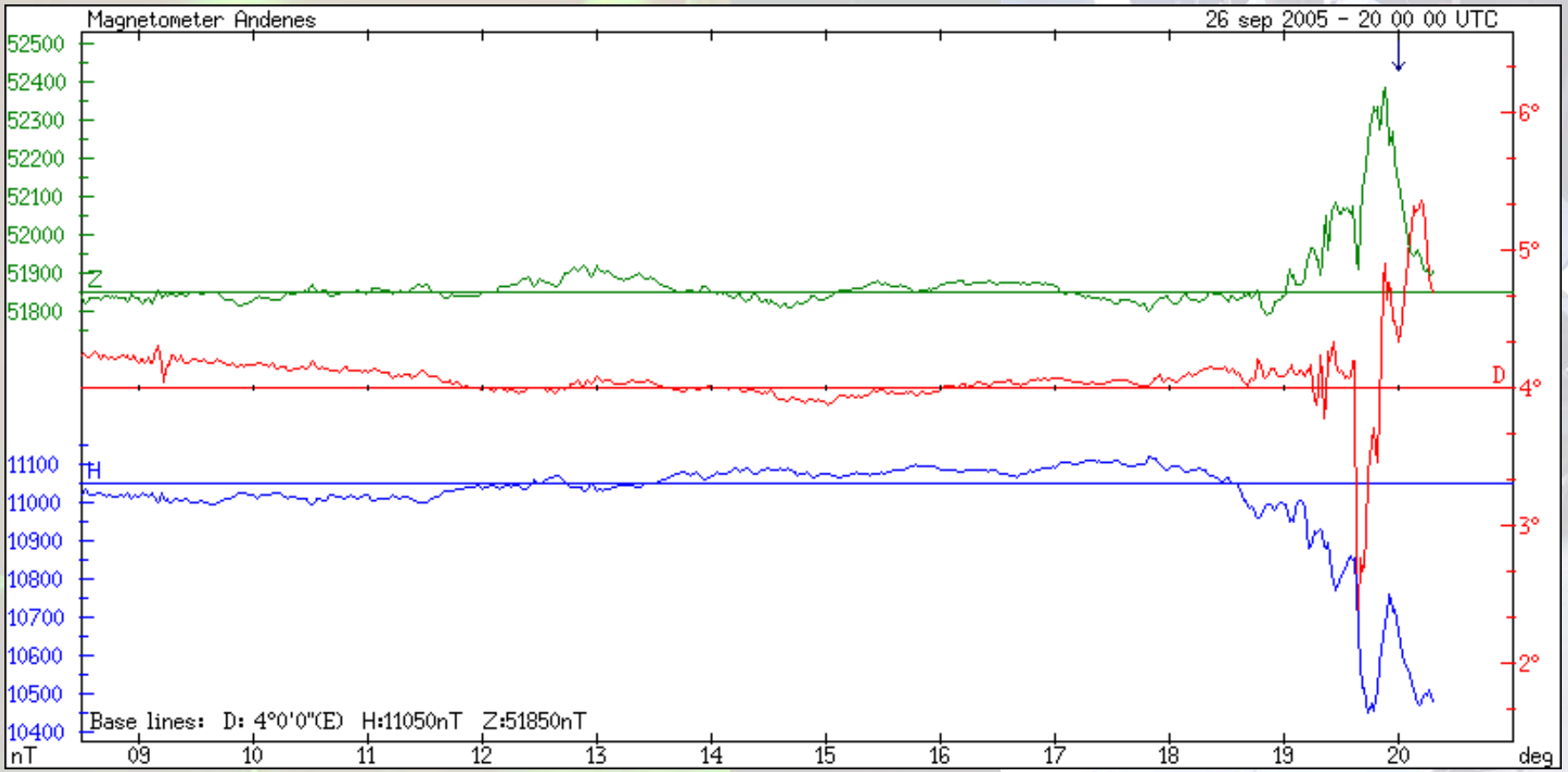
Networking opportunities with the Beobal Project

- Exchange of technical and scientific personnel
  - make use of the ALOMAR eARI funding and Beobal's own funding

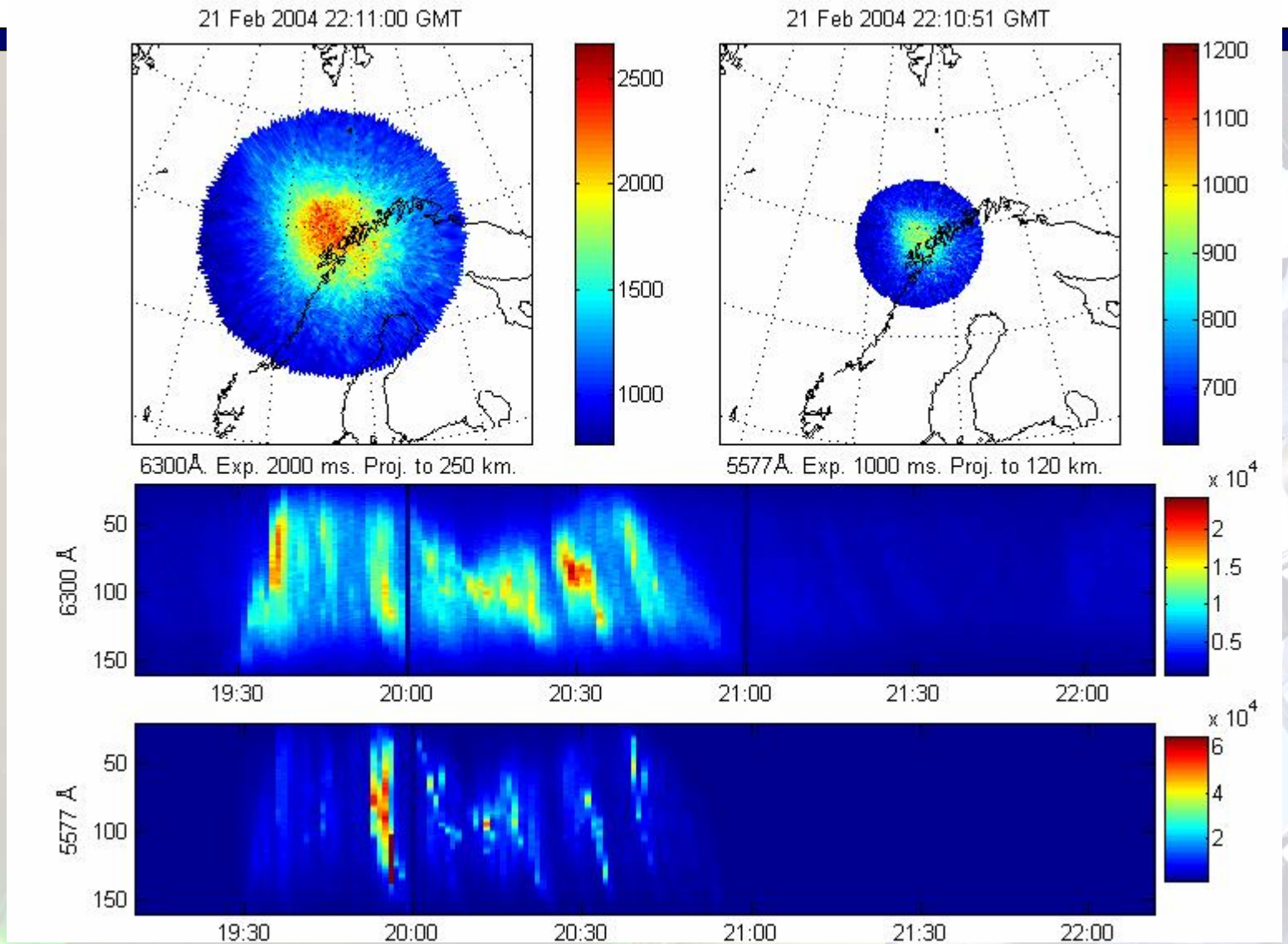
- new activities in the 7th FP, similar to "Station Managers" forum in FP 5's ENVINET Project

- distinct measures to ensure the data quality of collected data (key word monitoring in FP 7)

Magentometer



All-Sky-Camera, (UiO, ALOMAR)



Photometer at Andøya, decided

557.7 nm, [OI]

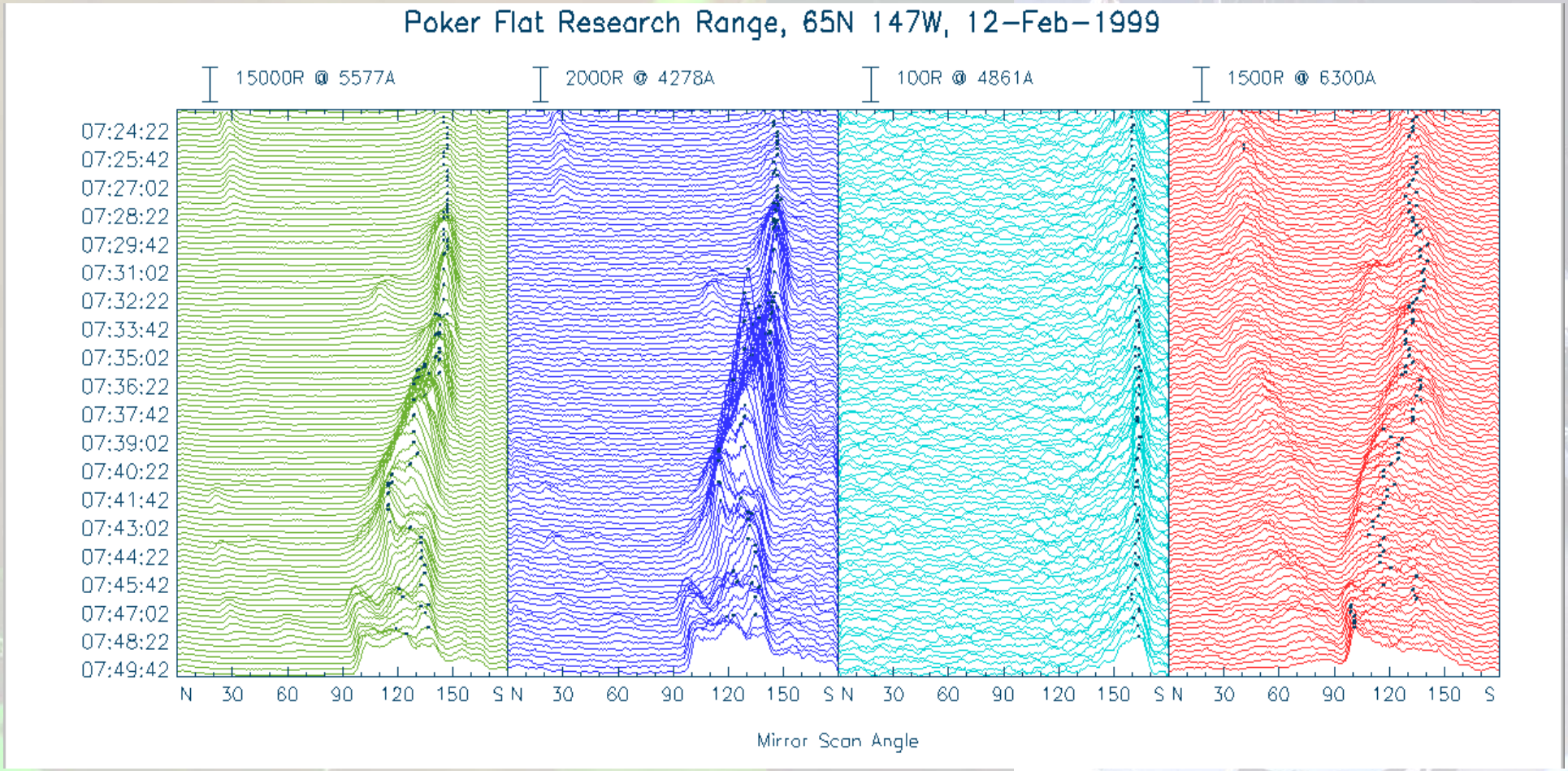
630.0 nm, [OI]

427.8 nm, [N2+ 1Ng]

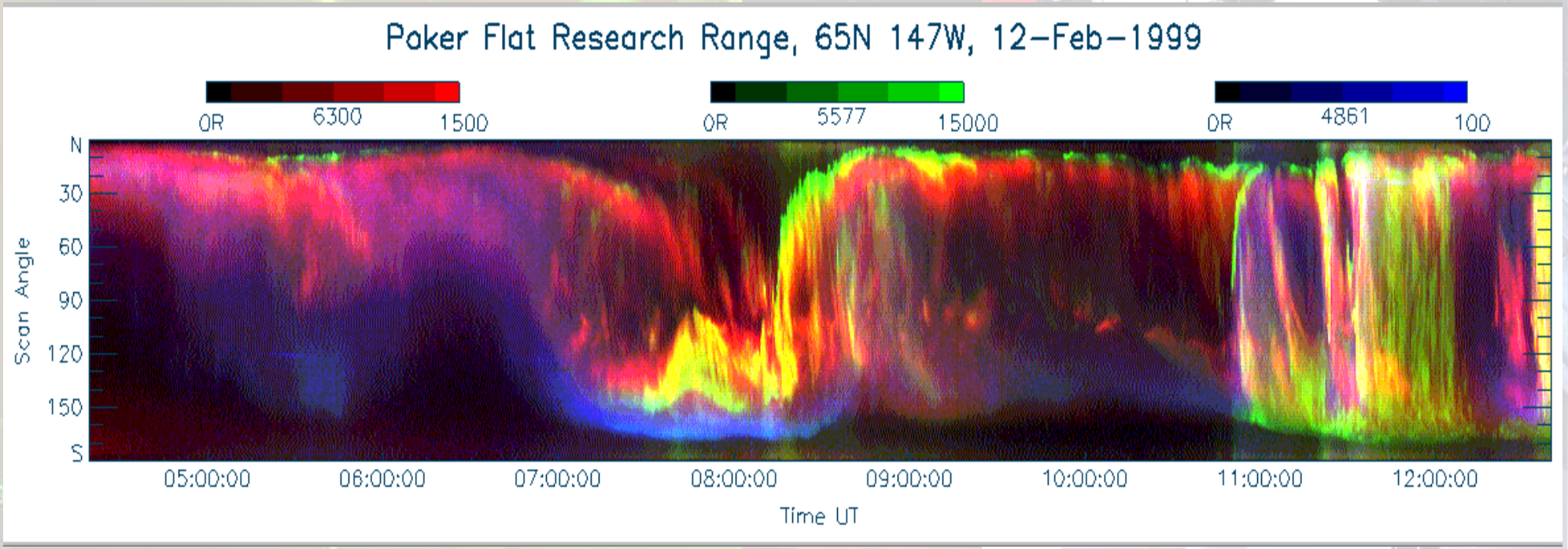
486.1 nm, [Hβ]

844.6 nm, [OI]

MSP, Mmeridian Scanning Photometer

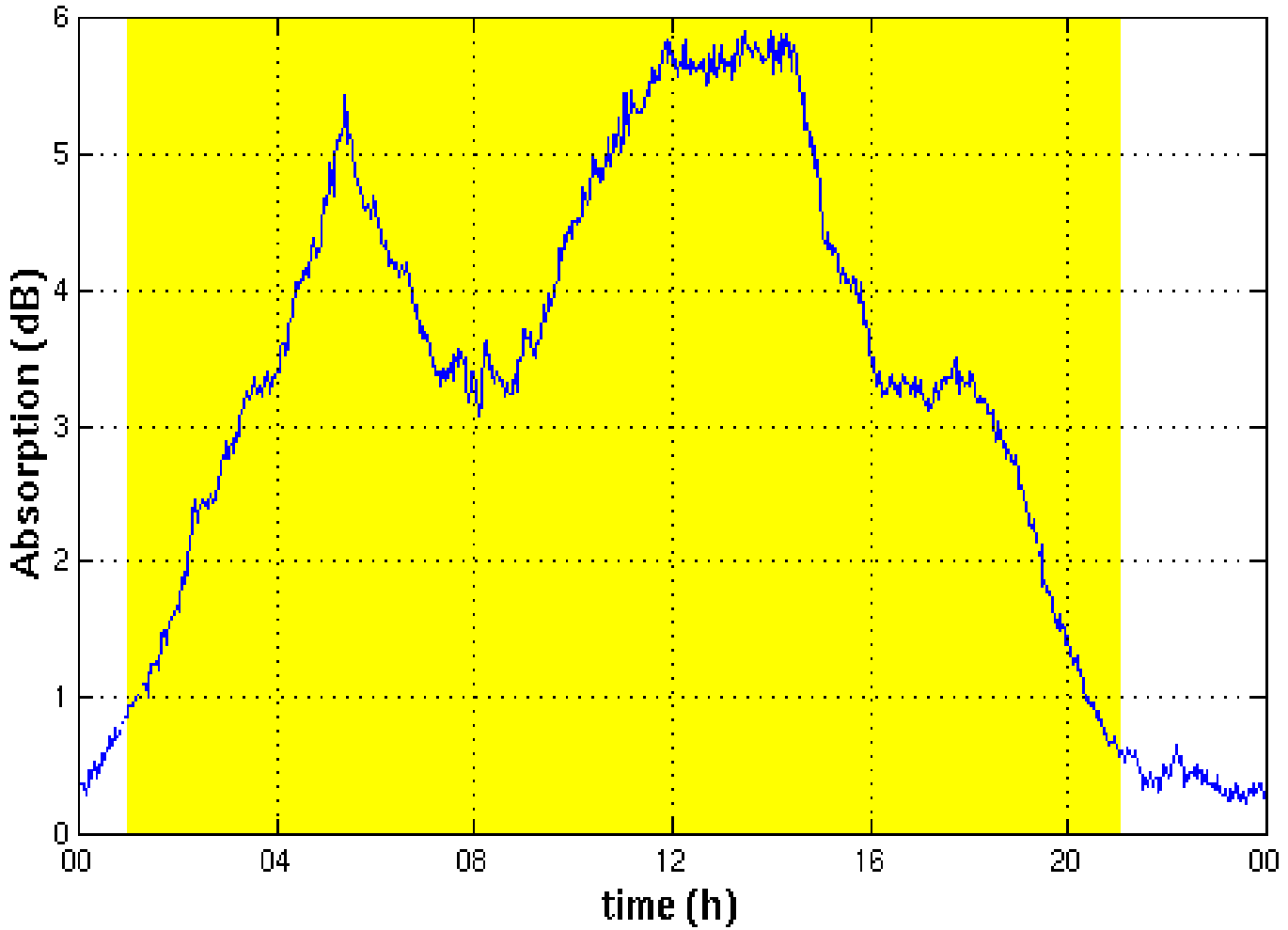


MSP, Mmeridian Scanning Photometer



Riometer, AIRIS

Absorption / time (widebeam)
00:00:00 UT 21/04/1998 – 00:00:00 UT 22/04/1998 @ 2 m res.
Kilpisjärvi, Finland (69.05° N, 20.79° E)



AIRIS, Imaging Riometer

Collaboration ADD & Lancaster Univ., UK

0.05 dB

array

W

PGA)

l coupl.

(20)

e

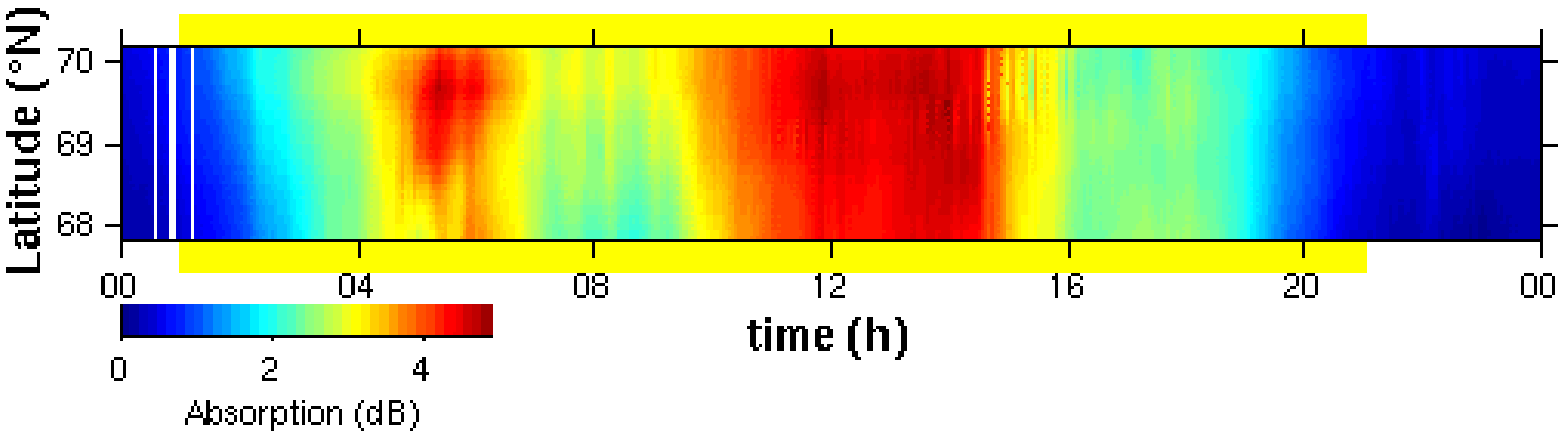
and the ionosphere.

Auroral effect on the occurrence of late season PMSE

IRIS (Absorption / time) keogram

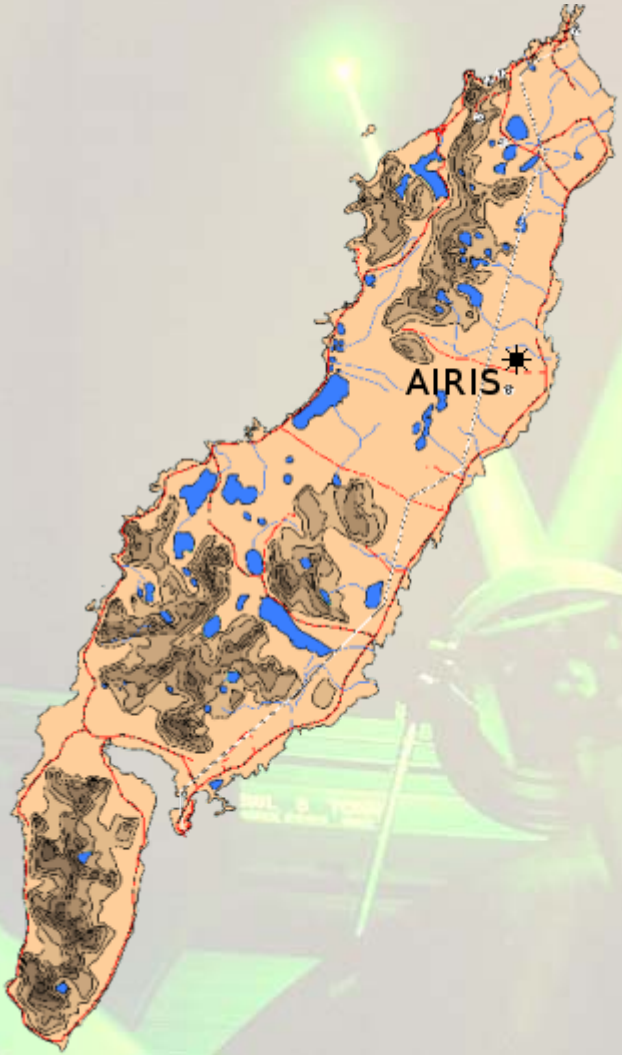
Kilpisjärvi, Finland, 19.2° E 67.8 – 70.2 (in 0.1)° N

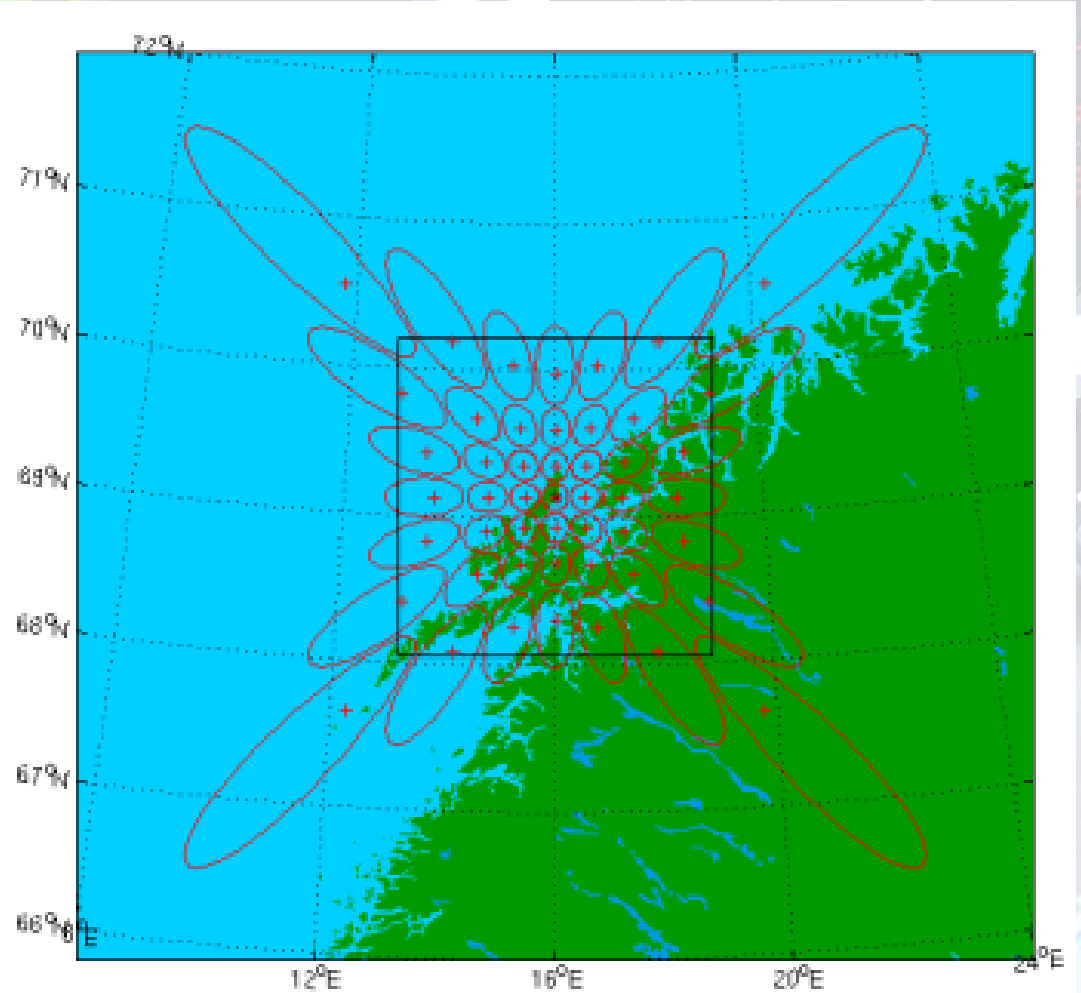
00:00:00 UT 21/04/1998 – 00:00:00 UT 22/04/1998 @ 2 m res.



Plan View

AIRIS, Imaging Riometer



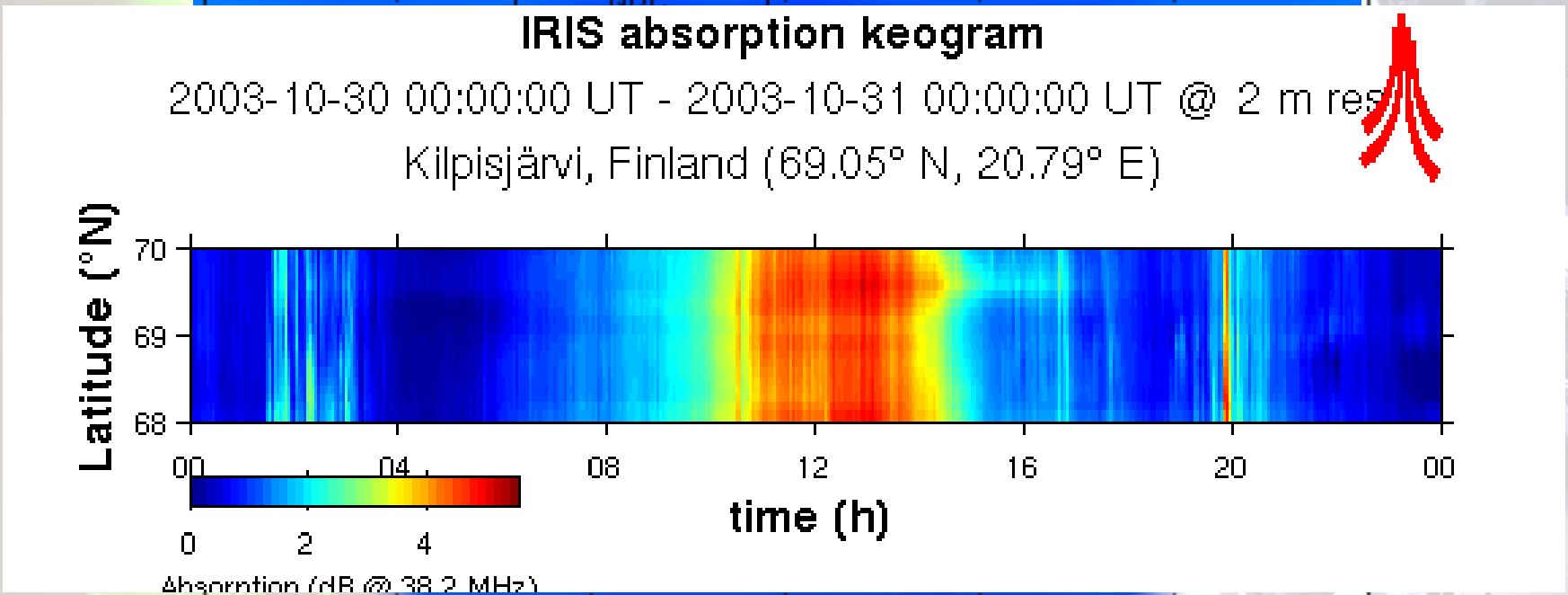


AIRIS, Imaging Riometer
technical details (Univ. Lancaster, ALOMAR)

AIRIS Technical data:

- 38.2 MHz, BW: 250 kHz, Sens: 0.05 dB
- 64 (8x8) crossed dipoles, filled array
- 49 narrow beams, 12 degrees BW
- Spatial resolution: 20 km
- Sampling rate: 1 second.
- Digital Rx and beam shaping FPGA
- Fixed circular polarization
- 45 deg. antenna angle to minimize mutual coupling.

30.10.2003

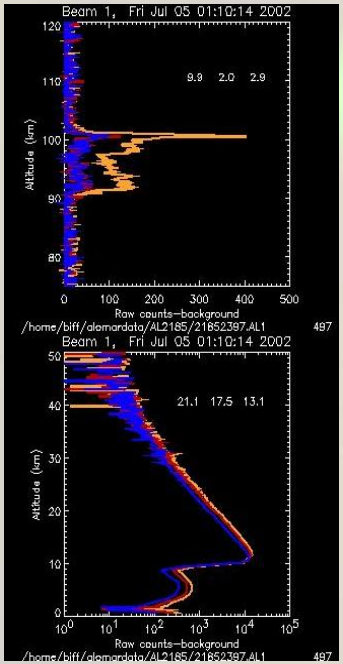

IRIS absorption keogram
2003-10-30 00:00:00 UT - 2003-10-31 00:00:00 UT @ 2 m res
Kilpisjärvi, Finland (69.05° N, 20.79° E)
Latitude (°N)
70
69
68
00
04
08
12
16
20
00
time (h)
0
2
4

-104
RX Power
-118
00
04
08
12
16
20
00
time (h)

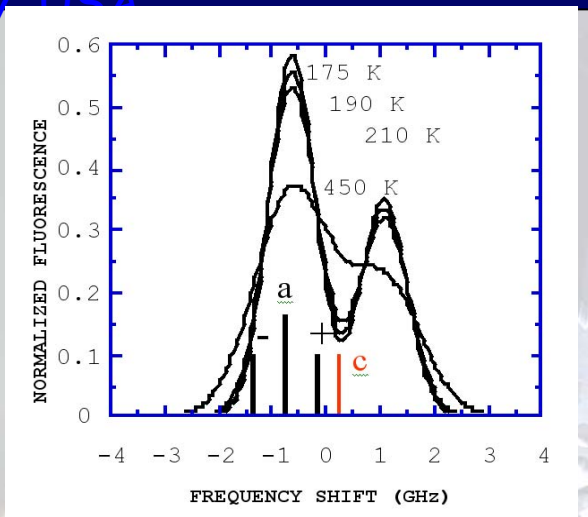
Sodium-lidar

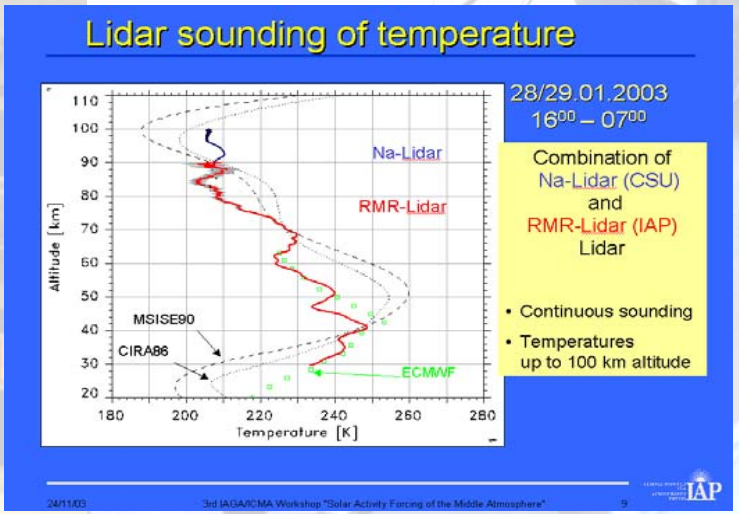
Na D_2 Transition and Narrowband Na Fluorescence Lidar, λ_0 = 589.158 nm

Colorado State University, USA



1. 3 laser frequencies: At the top of the left peak +-0.63GHz on each side of the peak.
2. Temperature derived from the ratio of the peak frequency signal to the 2 side frequency signals.
3. Radial wind speed derived from the difference of the 2 side frequencies normalized by the peak.





Process Studies at High Latitudes

- new Opportunities since spring 2004:
  - Glas fiber from Svalbard – Harstad by Norwegian Space Center
  - ARR has available 2.5 Gbit/s
    - 1 Gbit reserved for Scientific use,
      the rest can be use for commercial purposes
    - > real time data communication between Andøya and Svalbard
    - Technical Data:
      - Length 2x 1300 km
      - 1600 m deep
      - 350 mill kr total investment

ALOMAR's Participation in the EU's Frame Programmes

ALOMAR
ARCTIC LIDAR OBSERVATORY

ANDØYA ROCKET RANGE

ALOMAR eARI

CORDIS

Sixth Framework Programme

Access to Research Infrastructures

4th Frame Programme, 1998 - 2000: Large Scale Facility

5th Frame Programme, 2000 - 2003: ALOMAR ARI

6th Frame Programme, 2004 - 2007: ALOMAR eARI

ALOMAR Remote Sites (4)