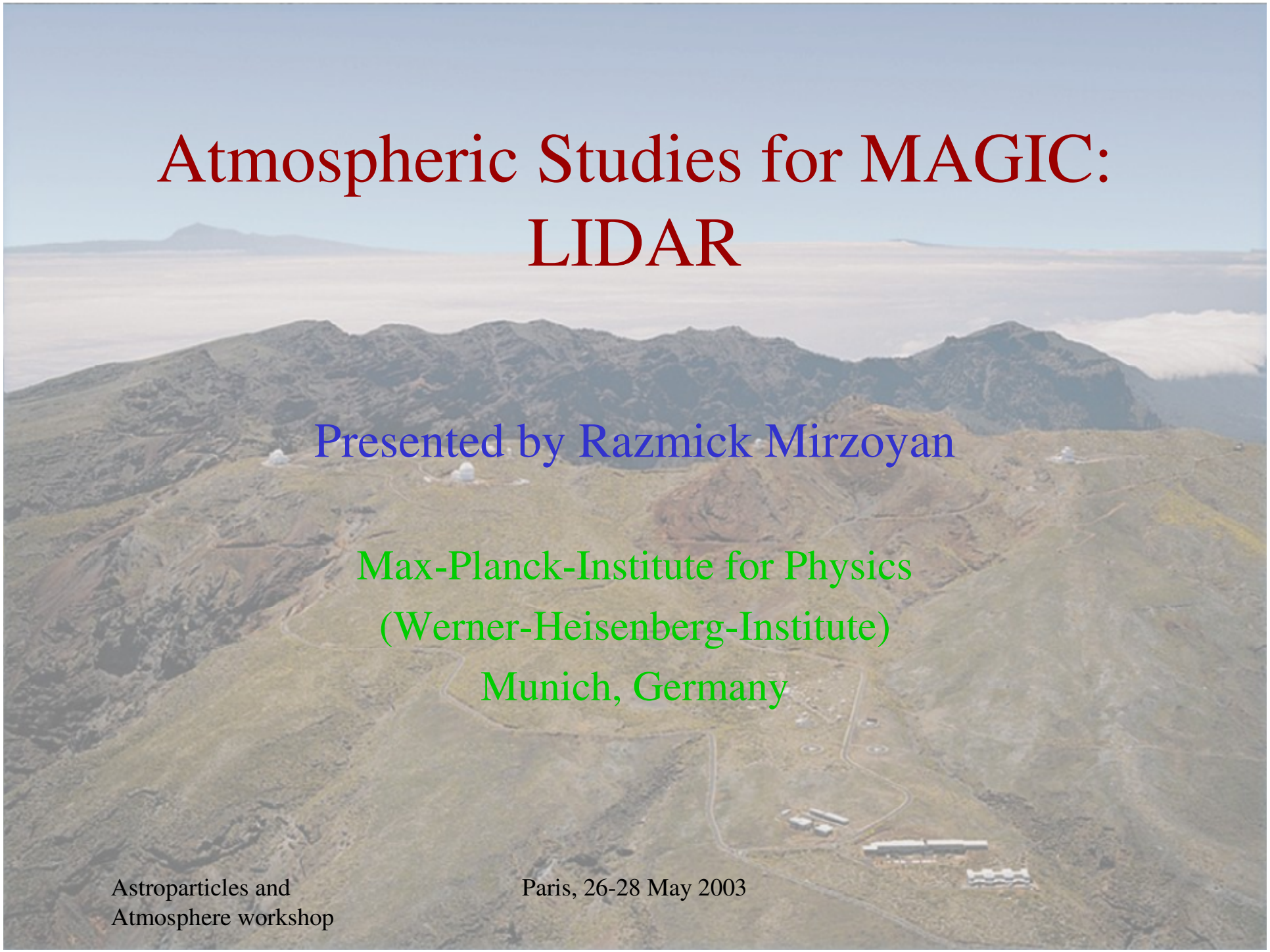


Atmospheric Studies for MAGIC: LIDAR

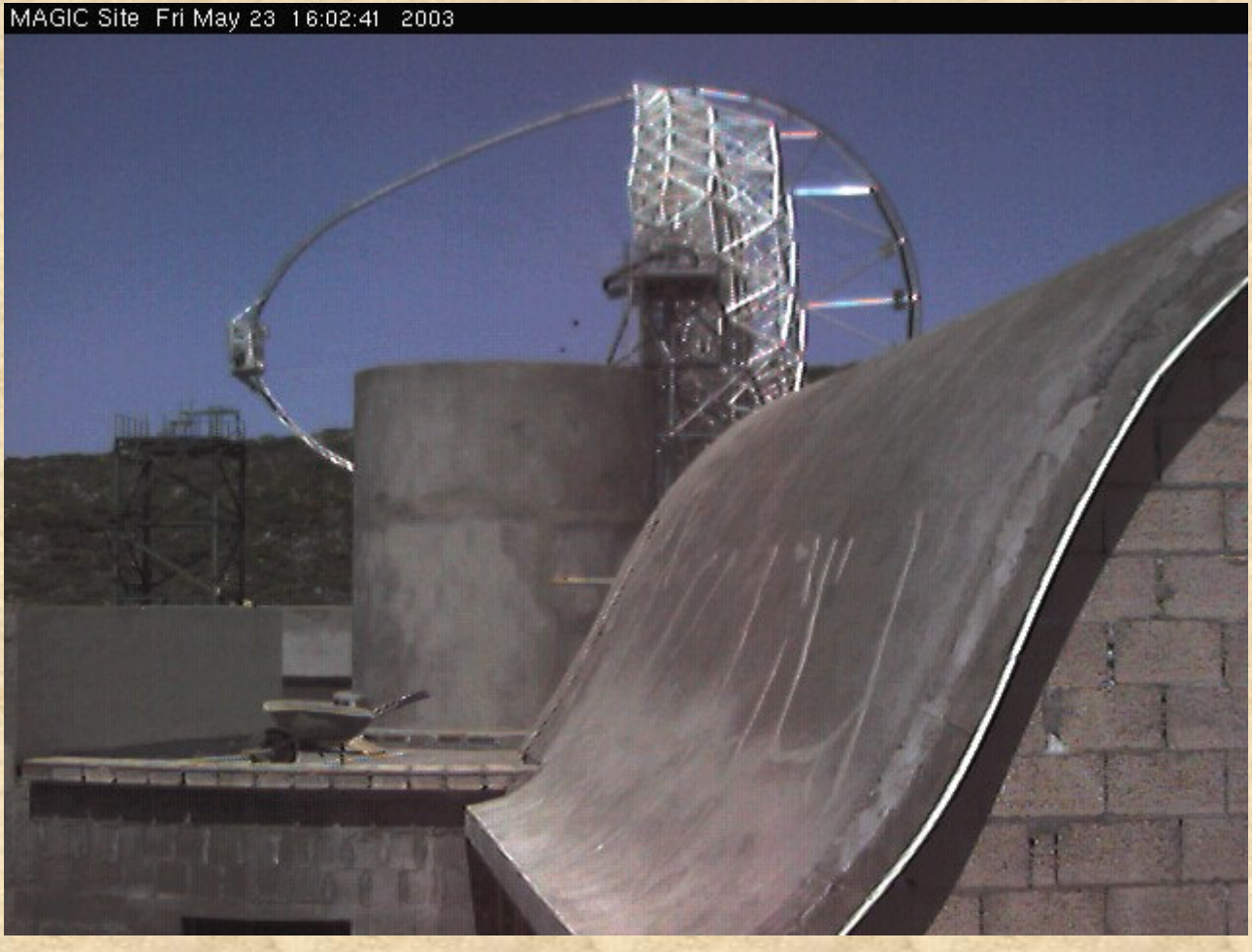
Presented by Razmick Mirzoyan

Max-Planck-Institute for Physics
(Werner-Heisenberg-Institute)
Munich, Germany

Astroparticles and
Atmosphere workshop

Paris, 26-28 May 2003

The MAGIC Telescope



The MAGIC Telescope: Status

Astroparticles and
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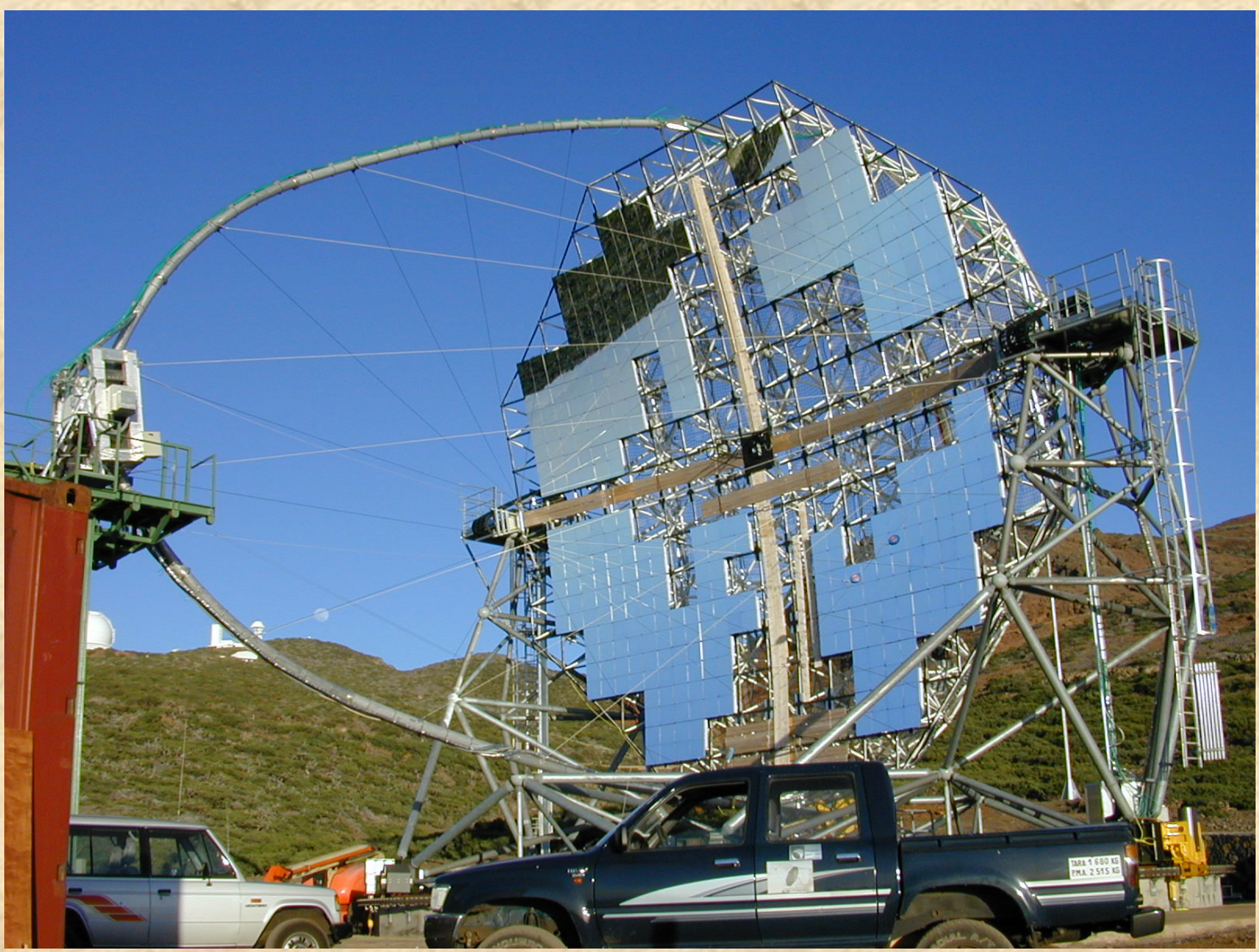
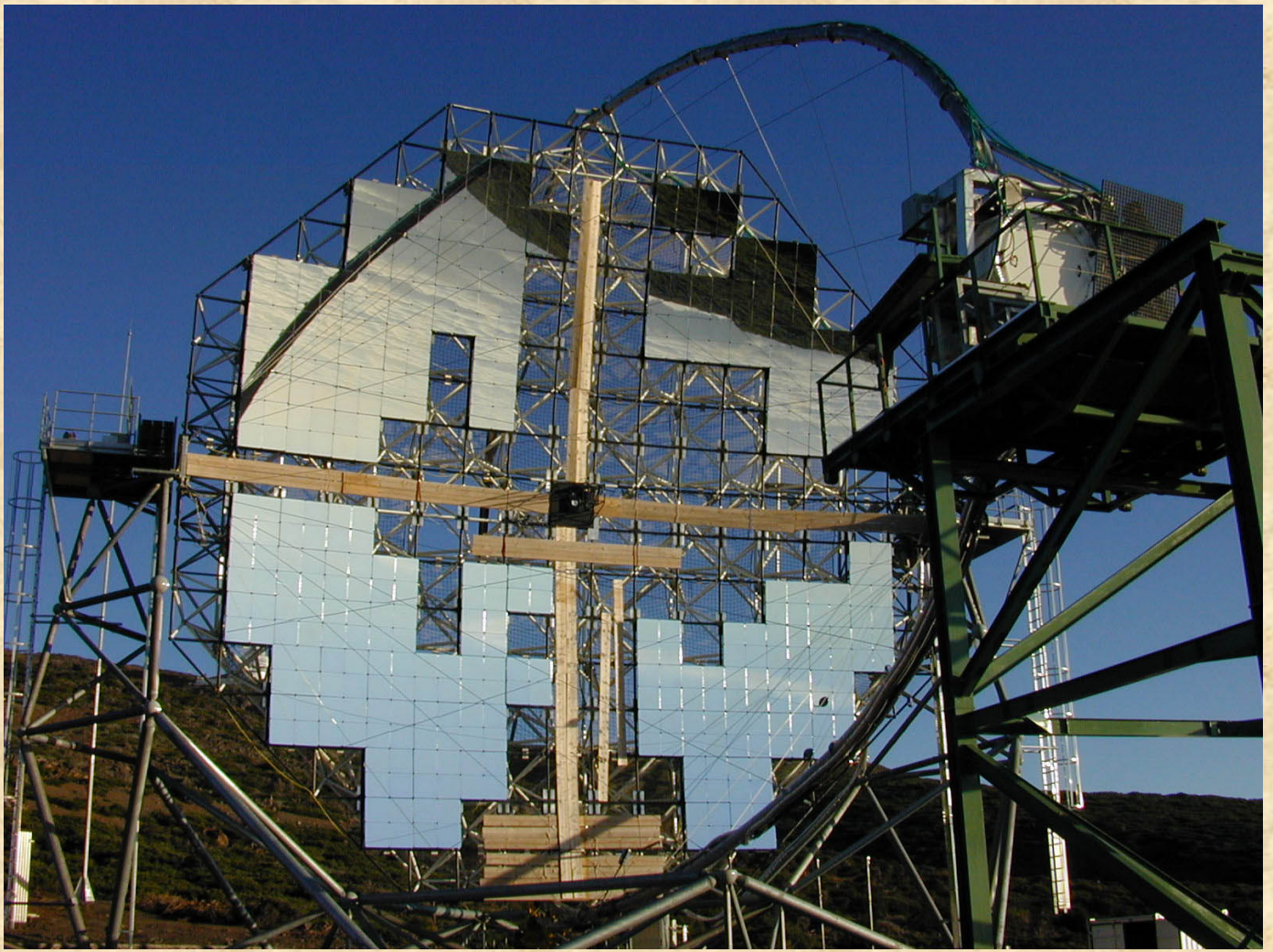
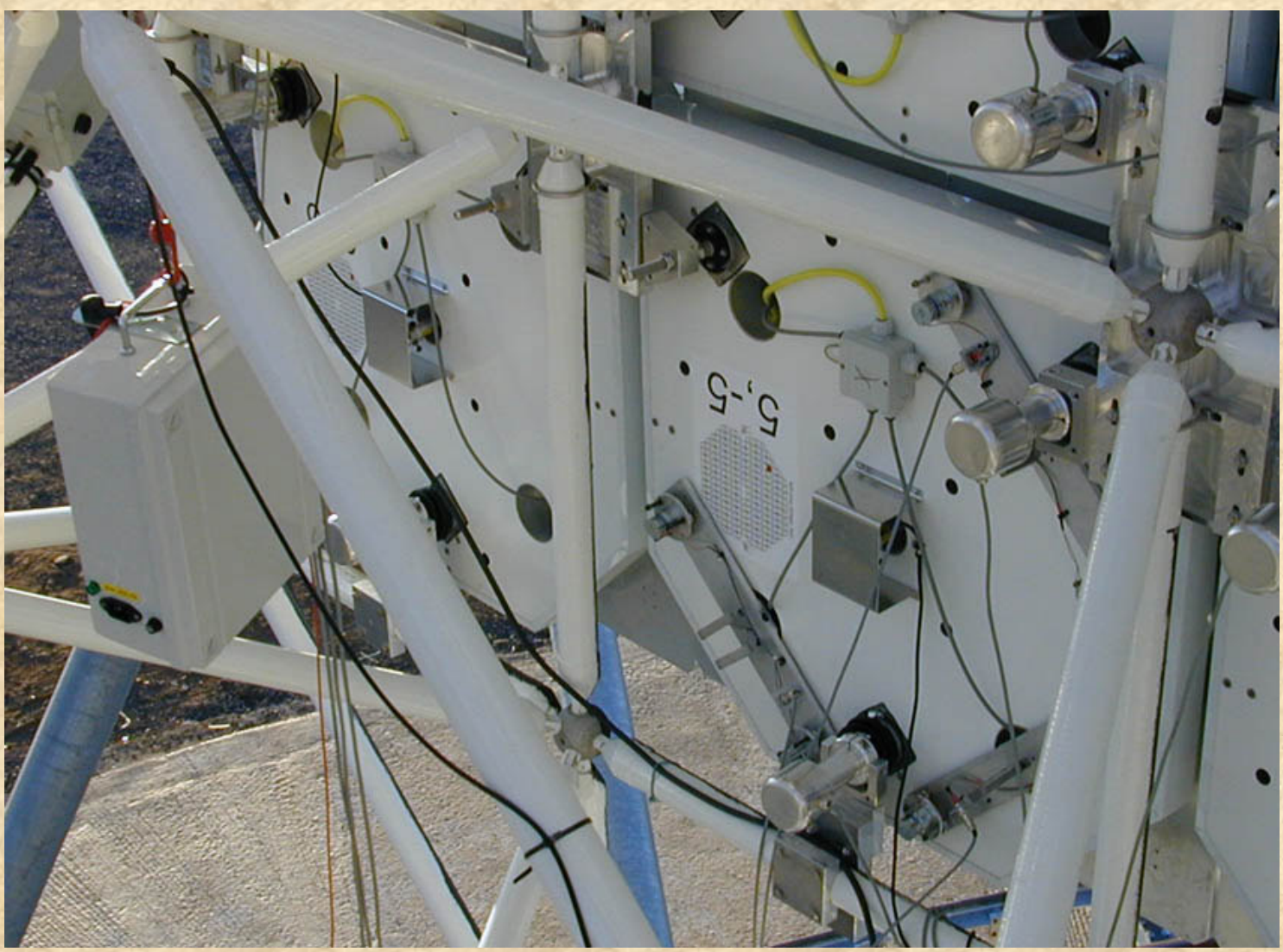
Recent photo of MAGIC



Recent photo of MAGIC



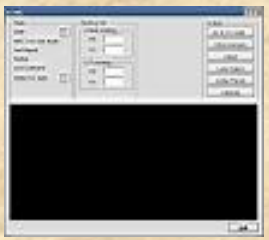
Some details of the active mirror control

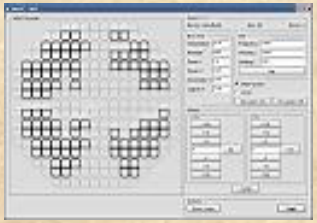


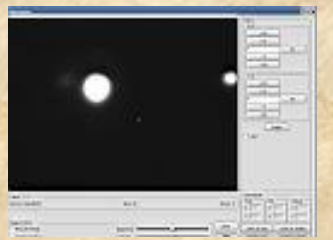
Progress of the MAGIC Telescope

- mirror mounting and focussing -

- May 2003 -







The pictures above show the present graphic user interface of the AMC software.
The centre window allows one to operate each of the mounted panels.
The window on the right is used to focus individual panels, the bright spot is the image of the moon on the camera lid
- on the upper right is a spot of one panel that was not yet aligned.

The pictures above illustrate the alignment procedure.
The spots are the images of the ~1km distant lamp mounted on the Roque.
Above one can see the spot after the fine alignment of 103 panels (May 2003).
The picture on the left show the focussed spot of 102 panels (one panel is out of focuss)

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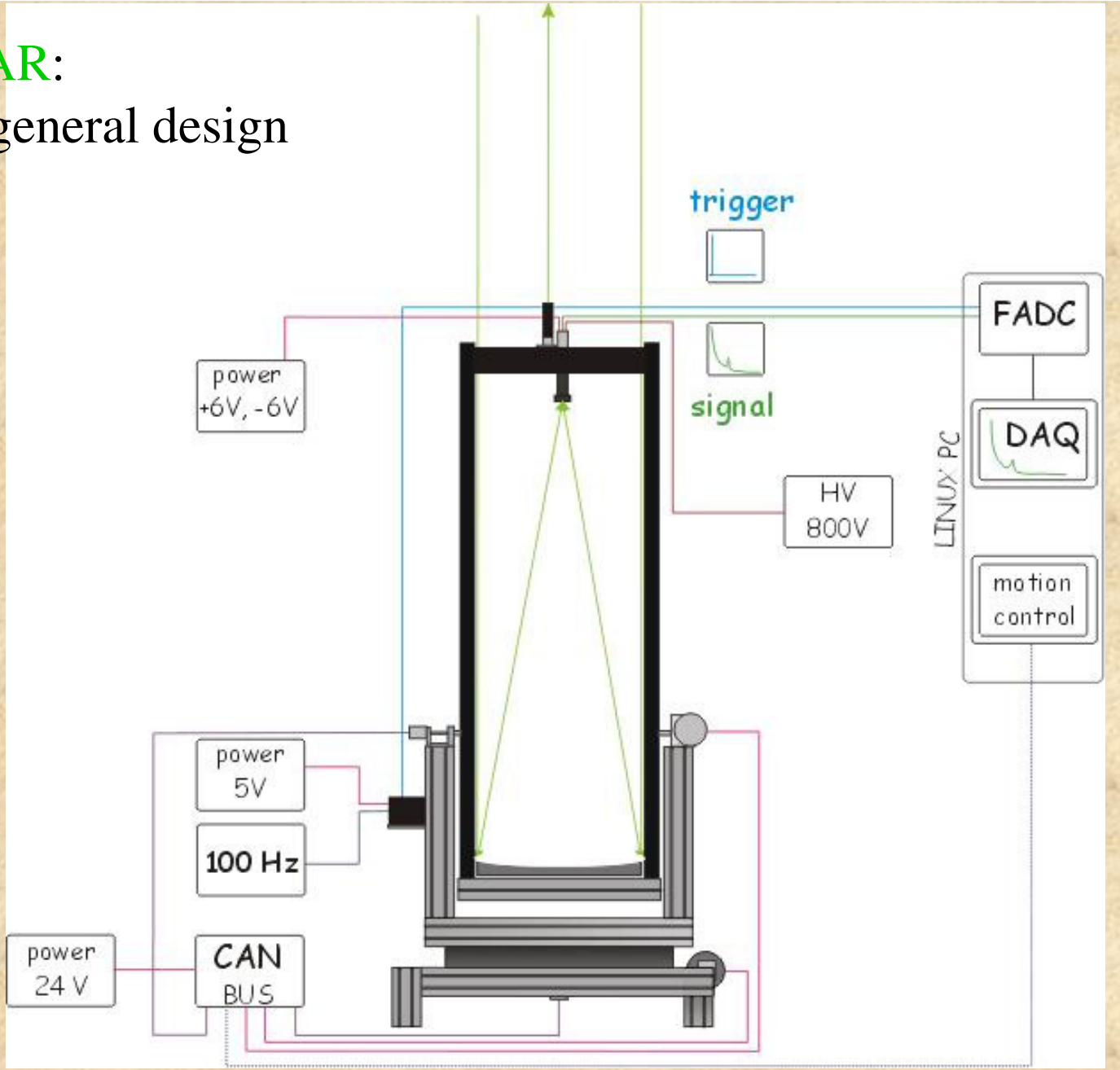
LIDAR:
The general design



For the time being a Hamamatsu R7400P single photoelectron PMT is used as light sensor in the LIDAR

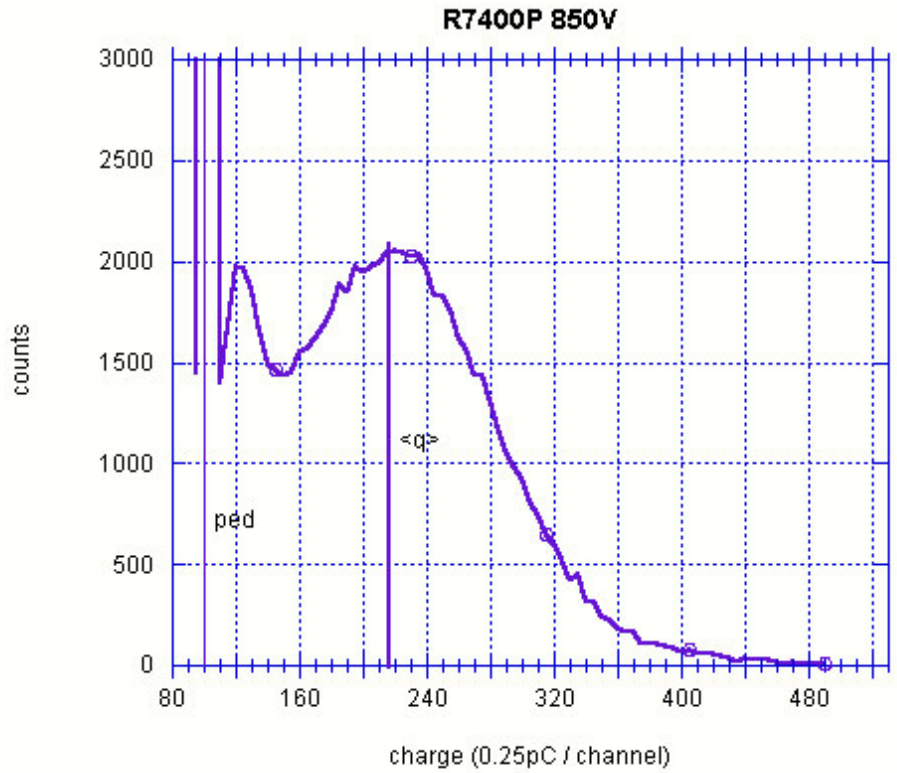


Photo of the LIDAR.

Nd:Yag passive locked laser: 2 μJ per Pulse, ~0.5 ns FWHM, rate up to 3 kHz, 2nd harmonic @532 nm.

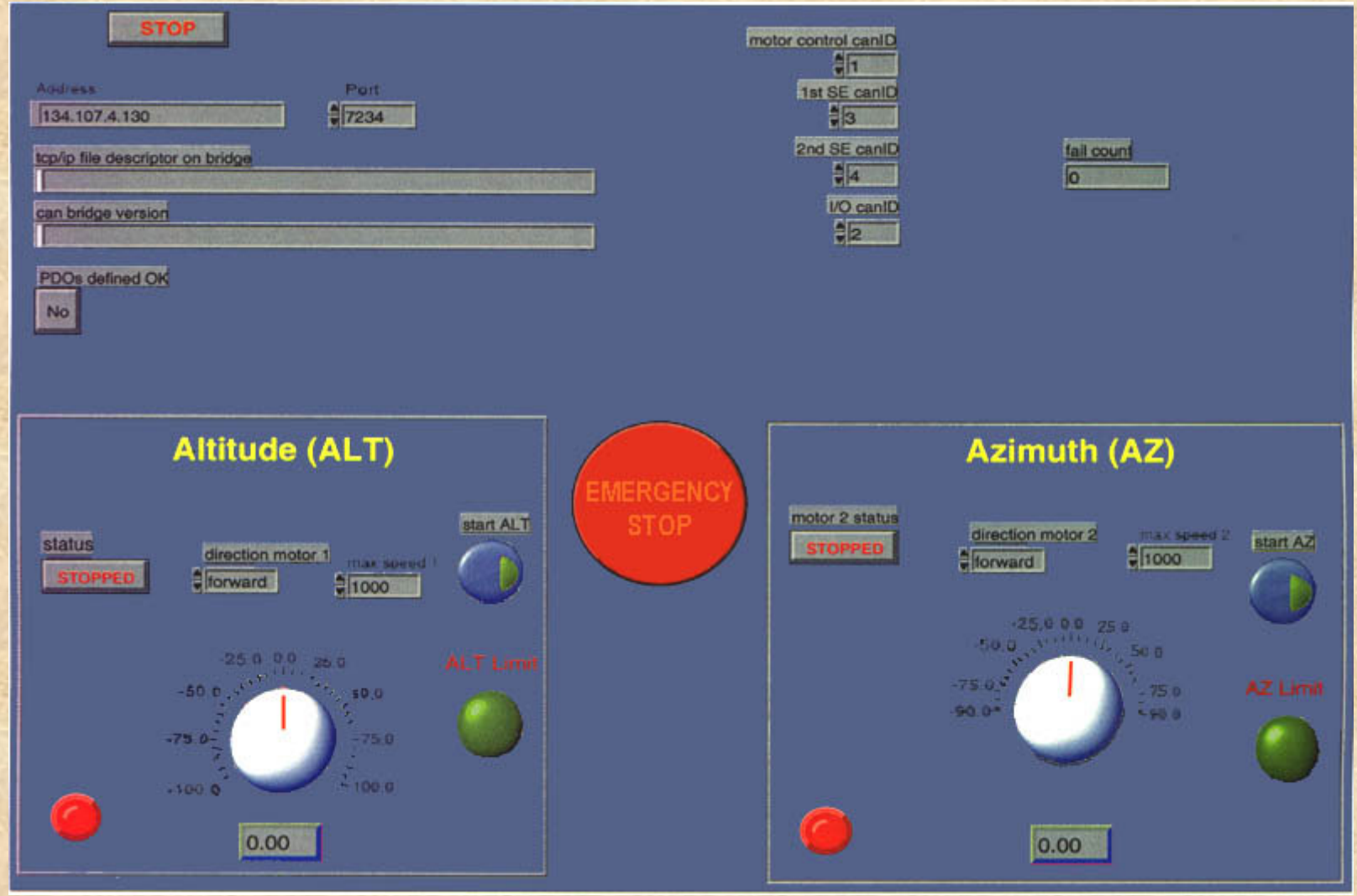
Light sensor module: PMT R7400P
+ amplifier + a system of lenses
+ interference filter (3 nm)
+ adjustable diaphragm

Elevation angle shaft encoder, 14 bit

Elevation stepping motor + gear box

Massive Al mirror, diamond polished, 50 cm diameter, F/3

LabView screen for steering the LIDAR



Test measurement in the yard of the Max-Planck-Institute

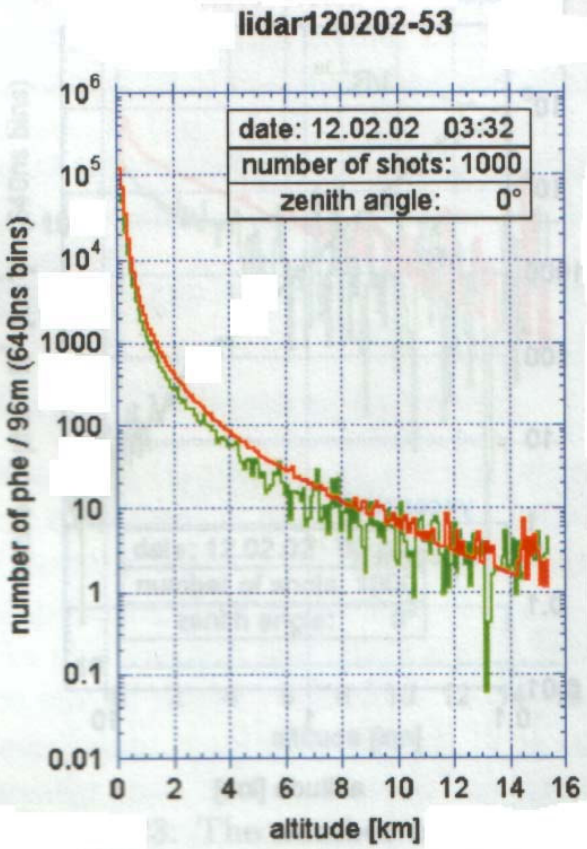


Figure 6.19: Run lidar120202-53 on February 12th at 03:32. The *phe* are summed up for each 640 ns bin equivalent to 96 m vertical resolution. Simulated background is added to the red calculated curve for Rayleigh scattering.

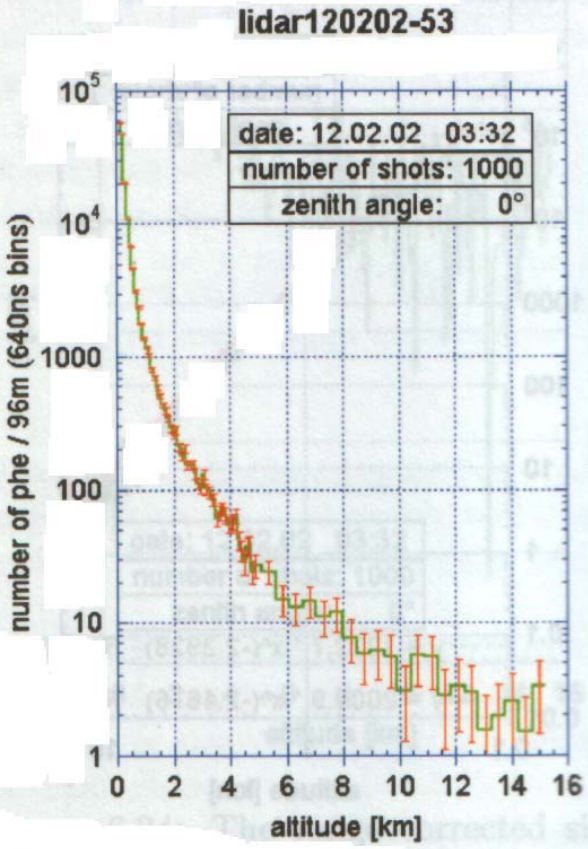
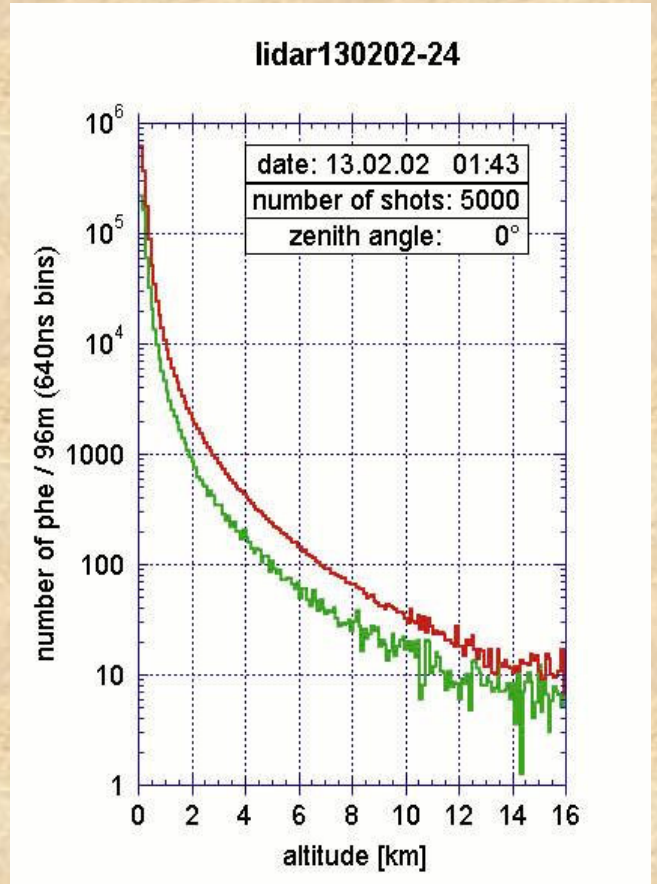
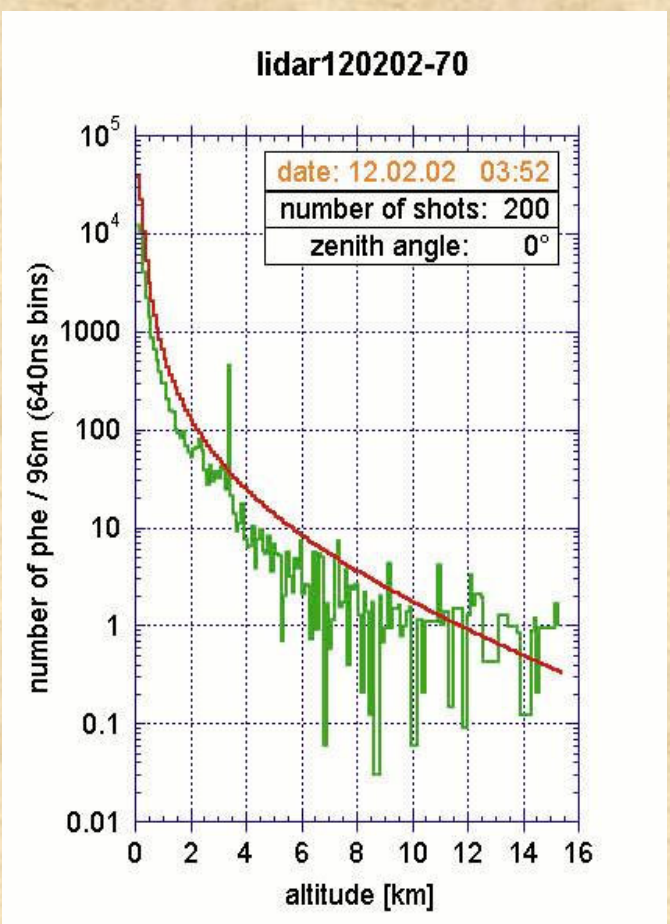
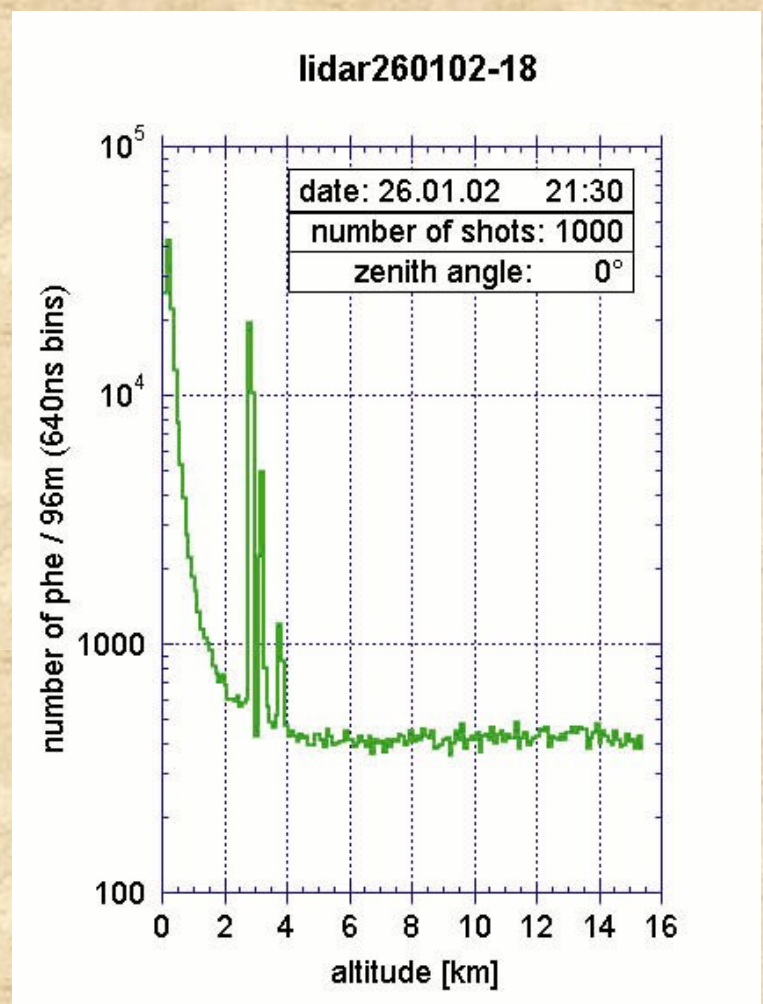
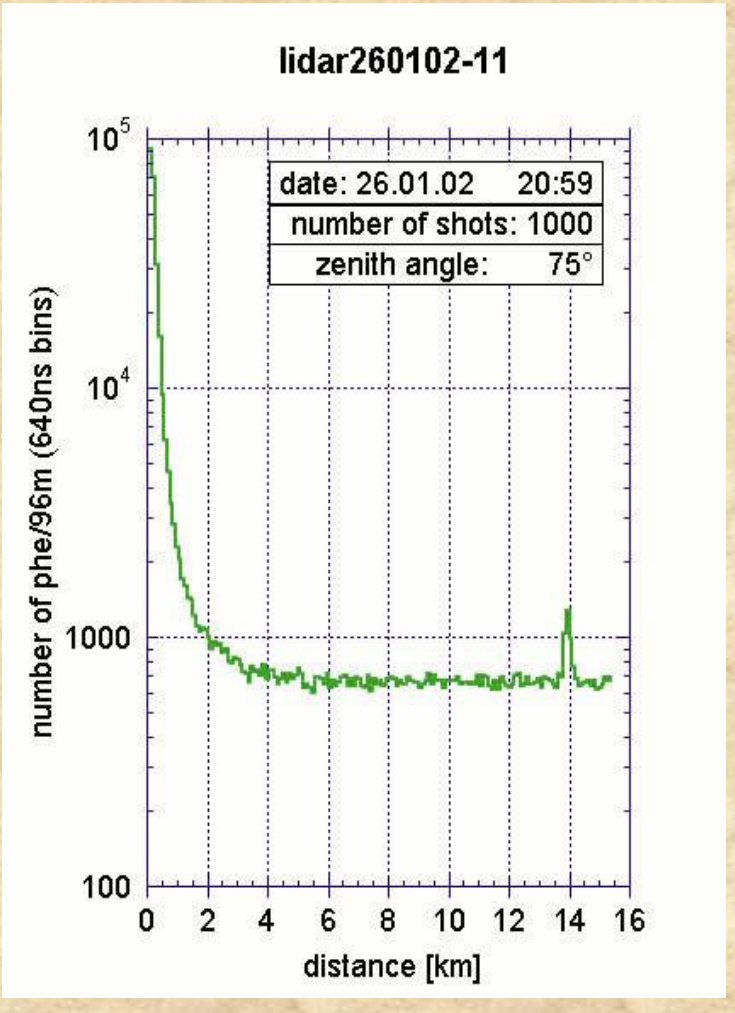


Figure 6.20: The error-bars show the fluctuations in the amplitude.


lidar130202-24
date: 13.02.02 01:43
number of shots: 5000
zenith angle: 0°
number of phe / 96m (640ns bins)
altitude [km]


lidar120202-70
date: 12.02.02 03:52
number of shots: 200
zenith angle: 0°
number of phe / 96m (640ns bins)
altitude [km]


lidar260102-18
date: 26.01.02 21:30
number of shots: 1000
zenith angle: 0°
number of phe / 96m (640ns bins)
altitude [km]


lidar260102-11
date: 26.01.02 20:59
number of shots: 1000
zenith angle: 75°
number of phe/96m (640ns bins)
distance [km]

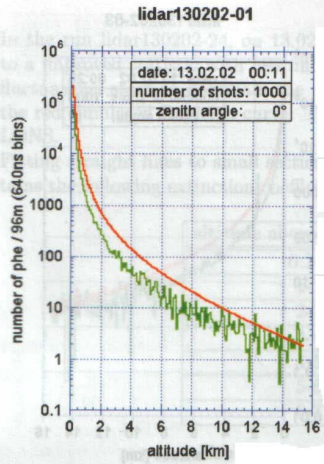


Figure 6.31: Run lidar130202-01 on February 13th. On the first look the atmosphere seems to be clear.

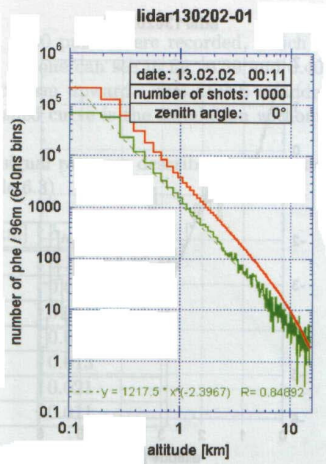


Figure 6.32: Log-log plot of 6.31, a "step" appears to be between 2 to 3 km.

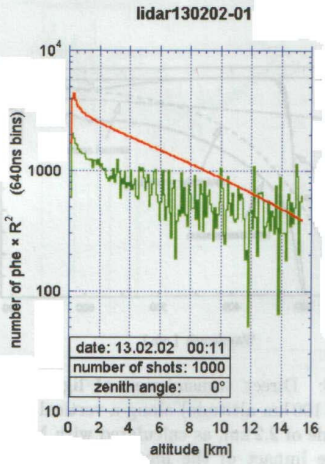


Figure 6.33: On the range corrected plot the discontinuity of the slope indicates aerosols.

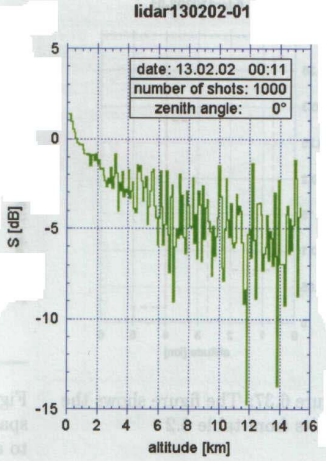


Figure 6.34: Plotting S, the step in the slope becomes even more obvious.

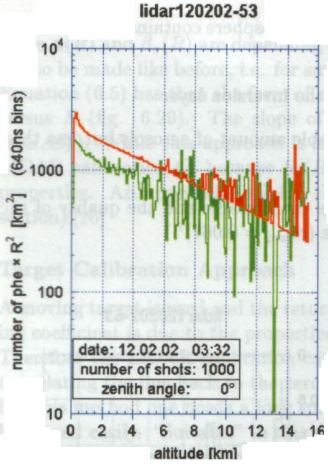


Figure 6.23: The number of *phe* are multiplied by R^2.

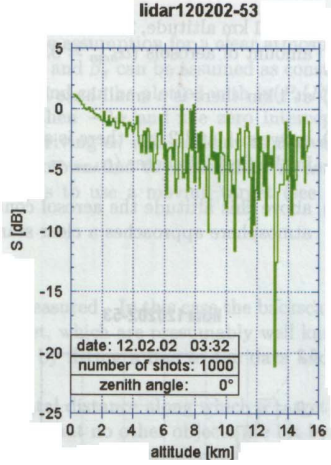


Figure 6.24: The range corrected signal ratio S (equation (2.33)) in decibels.

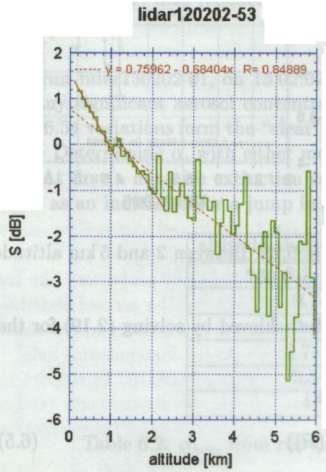


Figure 6.25: The first 6 km of fig. 6.24 with a linear fit (broken line). The slope of the line represents -8.7α for a clear atmosphere. Indicated are also the fits for the first kilometers.

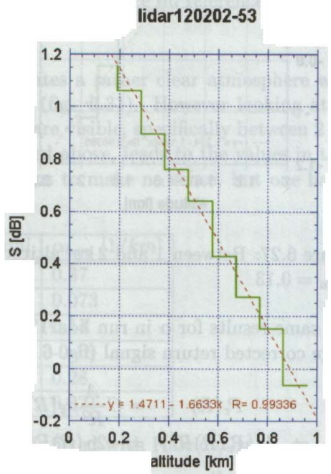
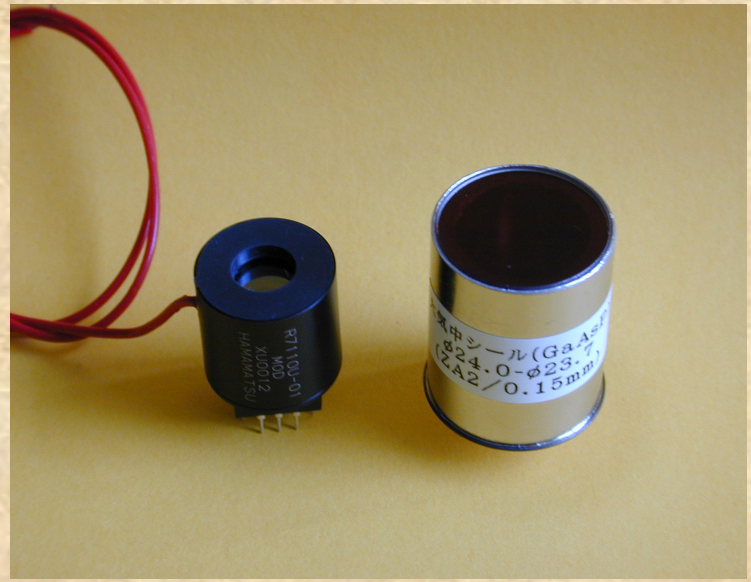
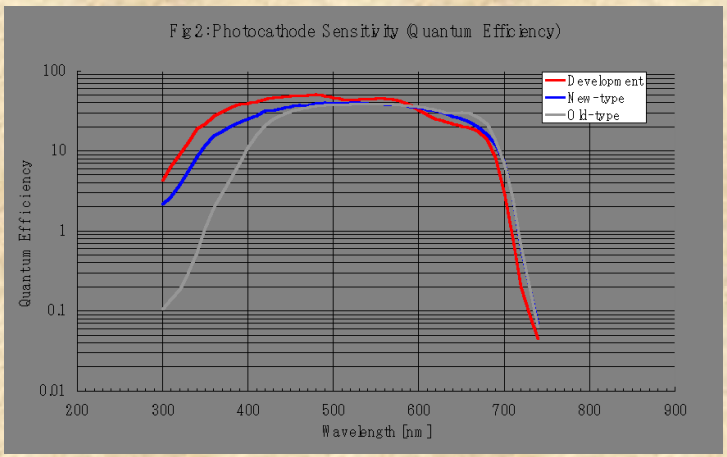


Figure 6.26: α_{hom}=0.19 for the first km

Outlook

- Soon we will use a Hamamatsu hybrid PMT with GaAsP photocathode instead of the usual bialkali PMT. The QE will increase ~8 times: bialkali PMT QE ~ 5 % & hybrid PMT QE ~ 40 % @532nm (the LIDAR operating range will increase by more than 2.5 times).





Roque de los Muchachos Observatory (ORM)

ORM

Astroparticles and
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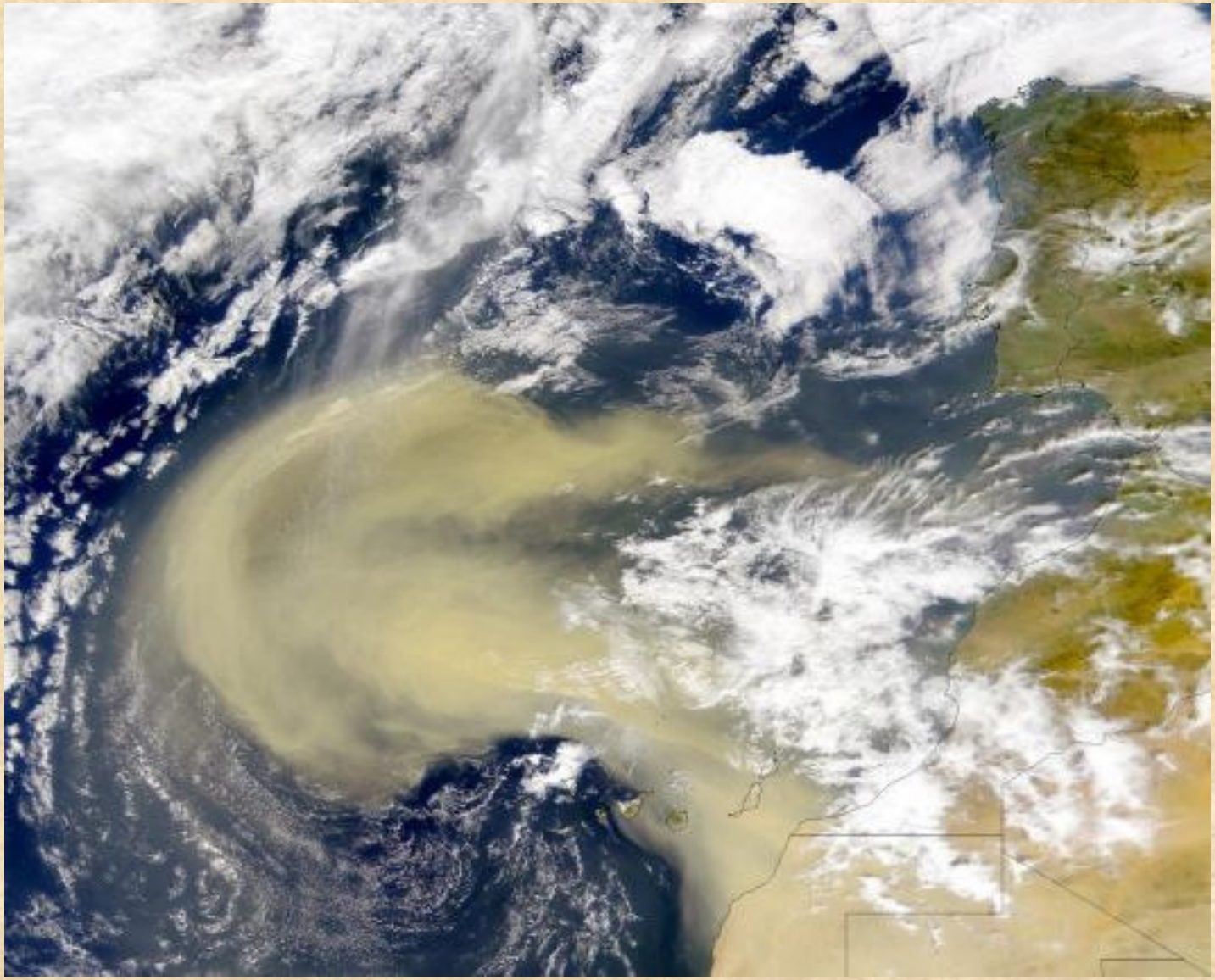
Paris, 26-28 May 2003

Kalima (dust from Sahara) cloud over the Atlantic on 26.2.2000



European North Observatory (ENO)

- At present, there are several automatic weater stations at ORM. They provide data on wind (direction, velocity & gusts), humidity, pressure & temperature. Currently we are trying to coordinate all the existing data.
- A new weather station will be installed at the pre-selected site for an Extremely Large Telescope (ELT) (this is a project of ESO for 50 – 100 m diameter optical telescope).

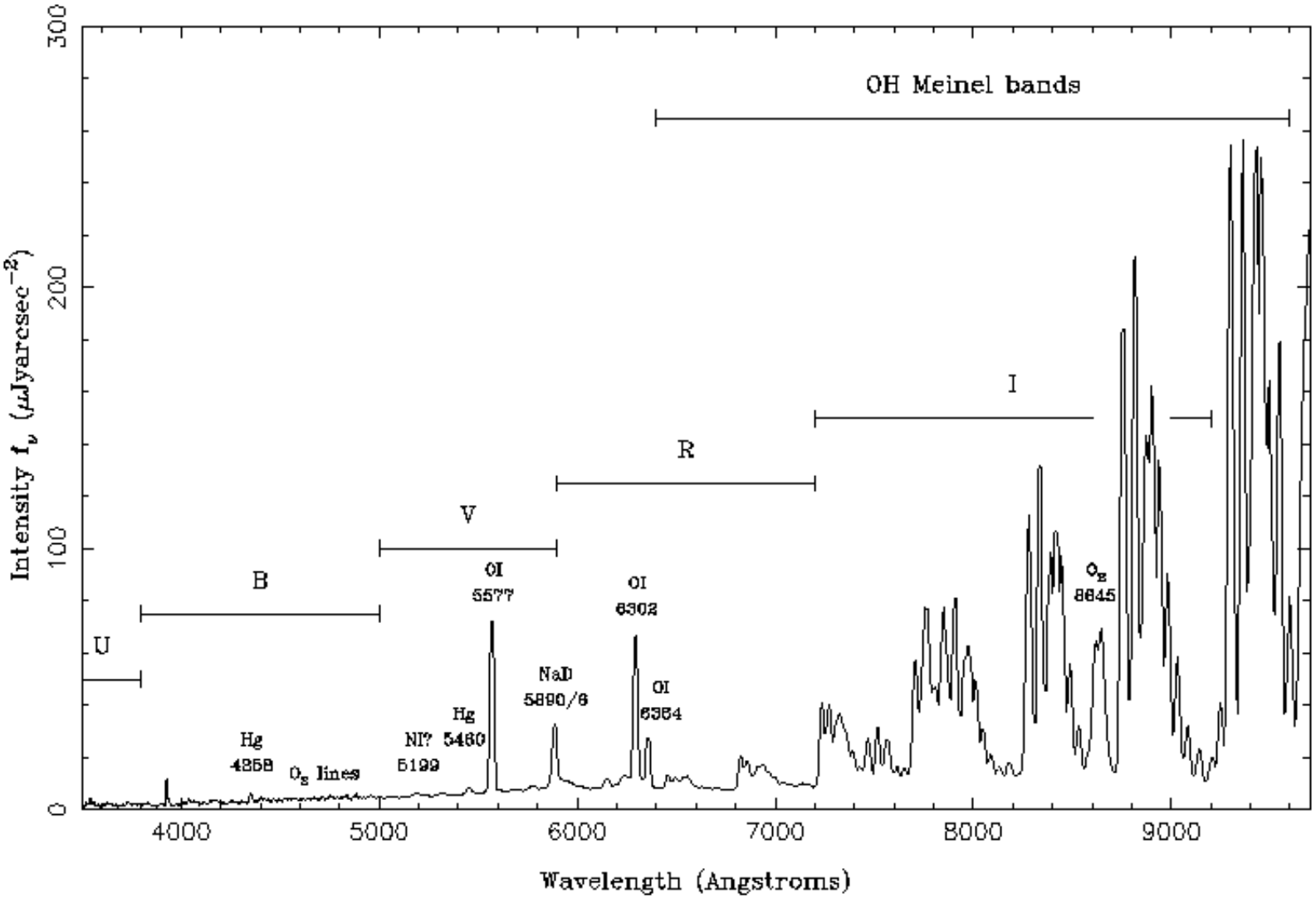
European North Observatory (ENO)

- The ORM is one of the 6 pre-selected sites (along with Big Bear California; Haleakala, Hawaii; Panguitch Lake, Utah_Sacramento Peak, New Mexico y S. Pedro Martir (Mexico)) for the new Advanced technology solar Telescope (ATCT).
- In fact, the ORM is the only candidate within the territory of any European country. The ATCT is a 4m diameter solar telescope funded by NSF (USA).

European North Observatory (ENO)

- The aim of the SUCOSIP committee is to bring together individual efforts currently running (the Mercator, LT, TNG, CMT, ING, NOT, MAGIC telescopes, IAC, ...) measure regularly the meteorological data, Dust, Extinction & Sky Background) in order to get a more complete and consistent view of the sky quality at the premier astronomical observing site in Europe.

Typical measurement of the light of night sky at La Palma



European North Observatory (ENO)

- A joint operation of coordinated techniques, SCIDAR (atmospheric turbulence), DIMM Statistical seeing data), ... is planned to get the turbulence and wind profiles. This will be shared with all interested astronomical institutions.

Summary

- There is quite some activity in ENO at ORM to unify, integrate and make joint efforts by different European countries/telescopes and instruments on characterising the atmosphere and to make the entire multitude of results available for the whole scientific community.