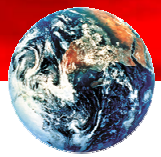
K A Y S E R - T H R E D E



Earth
Space
&
Future

Operationeller Wasserdampf-Profiler (Raman Lidar) für das Meteorologische Observatorium Lindenberg

3rd Workshop " Lidar Research Water Vapor and Wind "
Universität Hohenheim
15. – 16. September 2004

DWD

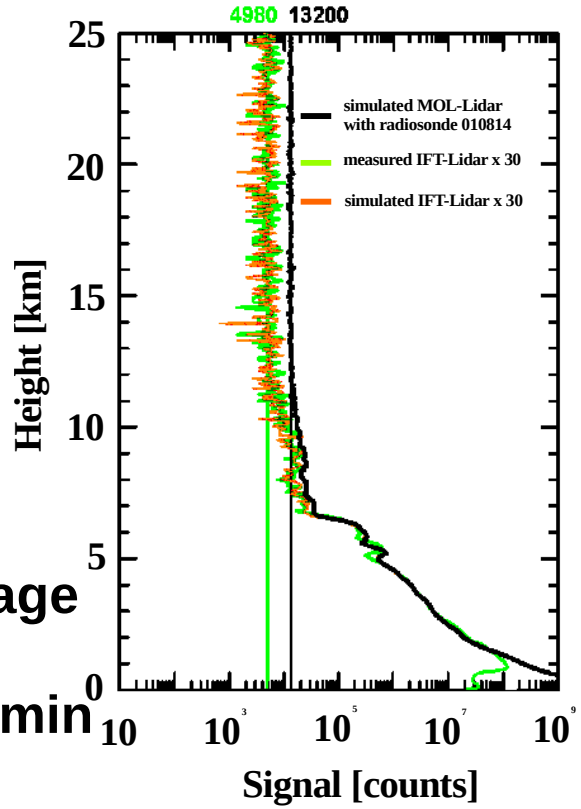
iflt

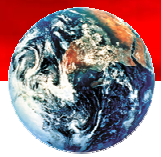
www.kayser-threde.de

KAYSER-THREDE

Requirements

- Tropospheric water vapor profile
- Autonomous operation
- Range coverage 100m – 7km
- Dual telescope approach for extended range coverage
- Vertical resolution 600m NFOV (30m WFOV), Δt =15min
- 24” far field telescope (8” wide field telescope)
- Laser output power 150mJ@355nm with 30Hz





Raman Lidar for Autonomous Operation

- Flash lamp pumped Nd:YAG laser
- “Oversized” far field telescope
- Autonomous neutral filter bank
- Task sharing computer network
- Multi sensor housekeeping system with remote access

Housing

20ft standard container

2 air conditions & 1 heat exchanger

Temperature stability ±1°

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20ft standard container

2 air conditions & 1 heat exchanger

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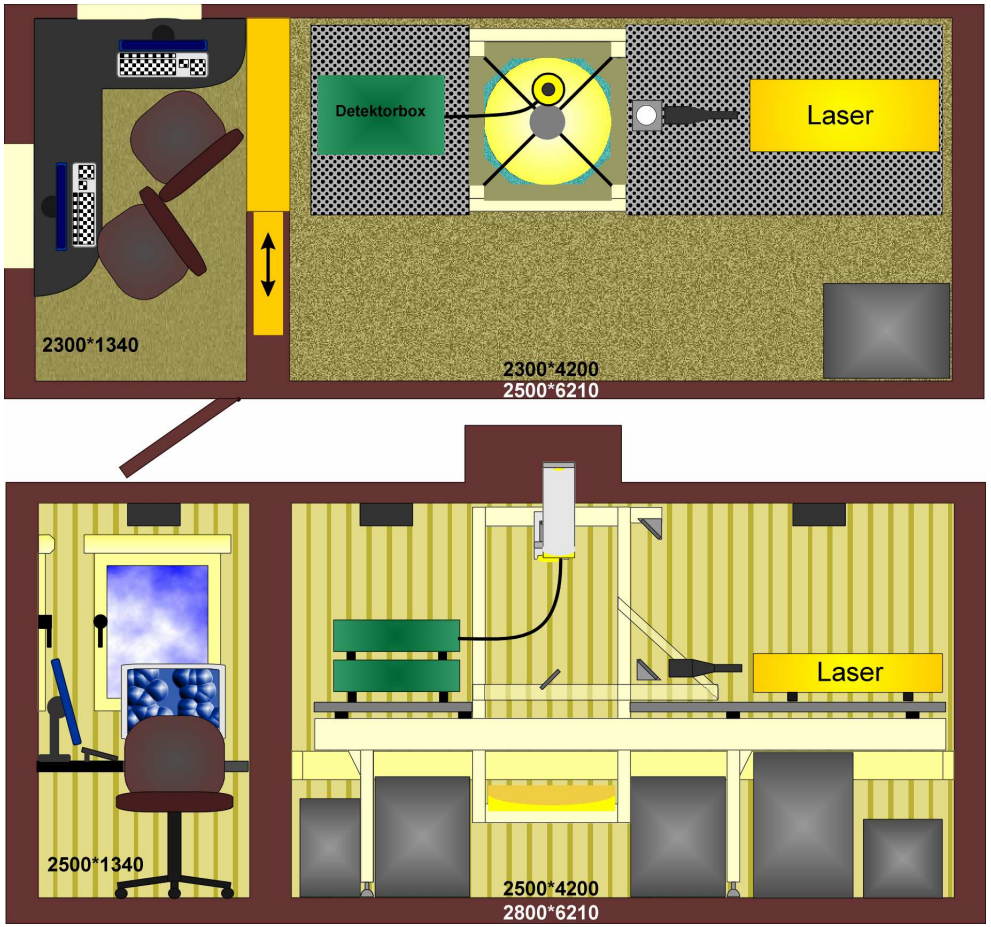


optical bench

- Total size: 4000 x 1200 mm²
- Aluminium brackets

  200 x 80 mm², I_y=2182cm⁴
- Total weight about 950kg
- Bending < 1/10mm
- 2 Breadboards

Laser

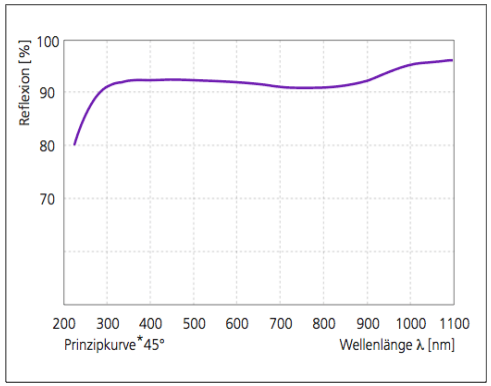
Continuum Powerlite 9030

- Repetition Rate 30Hz
- Energy 400mJ@355nm (operation at 300mJ)
- Divergence 0,5mrad
- Injection seeded

Telescopes

Narrow field of view

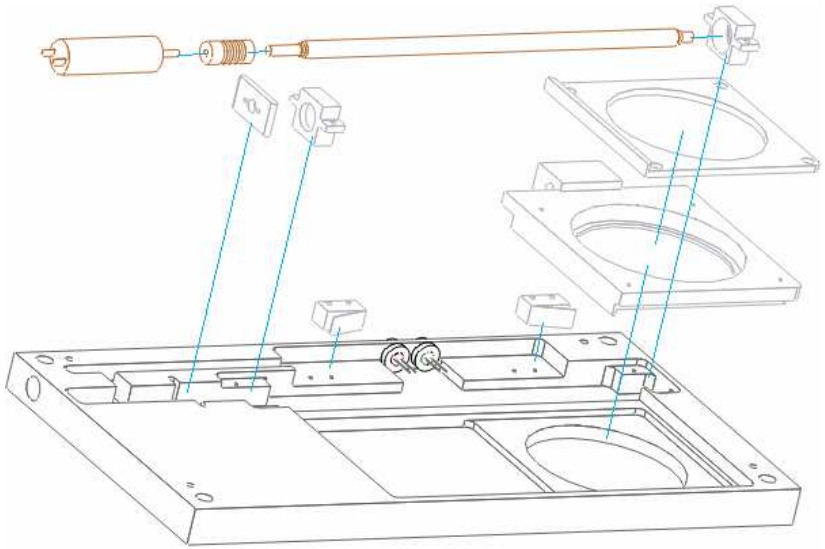
- Cassegrain (parabolic primary mirror *f* 2.5, hyperbolic secondary mirror), *f* 7.4
- Ø 32“ (~80cm)
- Protected Aluminium coating (R > 85%@355nm)
- Surface roughness 2λ P-V (rms ~0,6 λ)



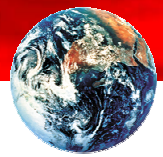
Wide field of view

- Dall-Kirkham (elliptical primary mirror, spherical secondary mirror) with reducer, *f* 3.3
- Ø 8“ (~20cm)
- Fiber coupled, Ø 1,7mm
- Enhanced Aluminium coating (R > 85%@355nm)

Attenuation



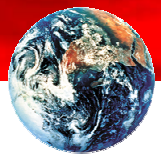
- Motorised attenuation stack
- Standard filter sizes up to 2” diameter
- Filters and optical path completely covered
- Electronic feedback of filter status
- Can be stacked in unlimited numbers
- 2^n attenuation levels for n units (200 x 100 x 17 mm^3)
- BCD-code addressing through standard PC interface



Filters & Beam splitters

Barr Associates Inc.

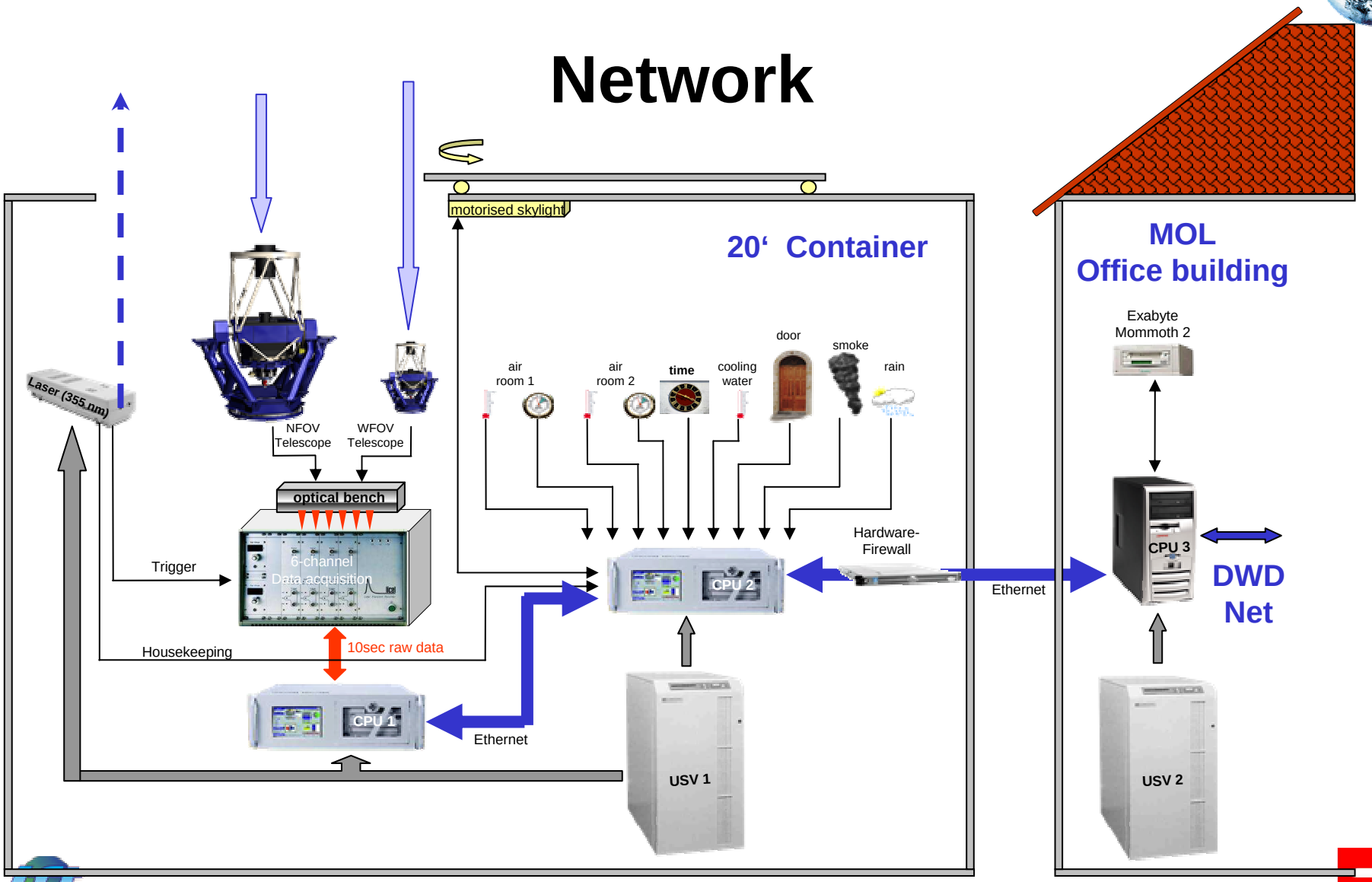
- **Interference Filters (355, 387 & 408nm)**
  - **Transmission > 80% (>60%@355nm)**
  - **Bandwidth (2,0 ± 0,4)nm**
- **Dichroit Beamsplitter (387 & 408nm, 45°)**
  - **Transmission > 90%**
  - **Reflection > 90%**

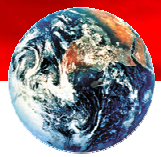


Technical Data

Transmitter:	Nd:YAG laser (355 nm), 300 mJ@ 30 Hz
Receiver telescope 1:	(Wide field of view) Ø 200 mm, f/D 3.8, fiber coupling
Receiver telescope 2:	(Narrow field of view) Ø 813 mm, f/D 7.3
Receiver channels:	2 x [355 nm, 387 nm, 408 nm]
	Hamamatsu PMT (R4220P) or EMI
Data acquisition:	Licel, 6 x photon counting (250 MHz)
	(optional 20 MHz@12 Bit analog)
System control:	LabView 7.1

Network


motorised skylight
20‘ Container
MOL
Office building
Exabyte
Mommoth 2
Laser (355 nm)
NFOV
Telescope
WFOV
Telescope
optical bench
6-channel
Data acquisition
Trigger
Housekeeping
10sec raw data
air
room 1
air
room 2
time
cooling
water
door
smoke
rain
CPU 1
CPU 2
CPU 3
Hardware-
Firewall
Ethernet
Ethernet
USV 1
USV 2
DWD
Net



Autonomous Operation

- Autonomous start-up in the evening via Sunset-Time (currently night time operation only)
- Several external sensors looking for environmental conditions (cloud base, rain, brightness)
- External sensor ‘ok’ → open skylight
- Internal sensors ‘ok’ → looking for correct optical attenuation for each channel
- Start measurement
- Sensor signal above critical value → stop measurement and close skylight
- Sensor signal ‘ok’ → continue
- Autonomous finalise measurement at daybreak