DLR‘s Falcon 20-E5, D-CMET – a part of the DEEPWAVE-project

DLR Flight Experiments
Flight Facility Oberpfaffenhofen

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Falcon 20-E5 D-CMET	Do228-212 D-CFFU	Cessna C208B D-FDLR	G550 D-ADLR

DLR Flight Experiments operates a fleet of research with base at Braunschweig and Oberpfaffenhofen, Germany. Currently at Oberpfaffenhofen a fleet of four highly modified aircraft are being operated worldwide for a number of science organisations, universities, agencies and companies.

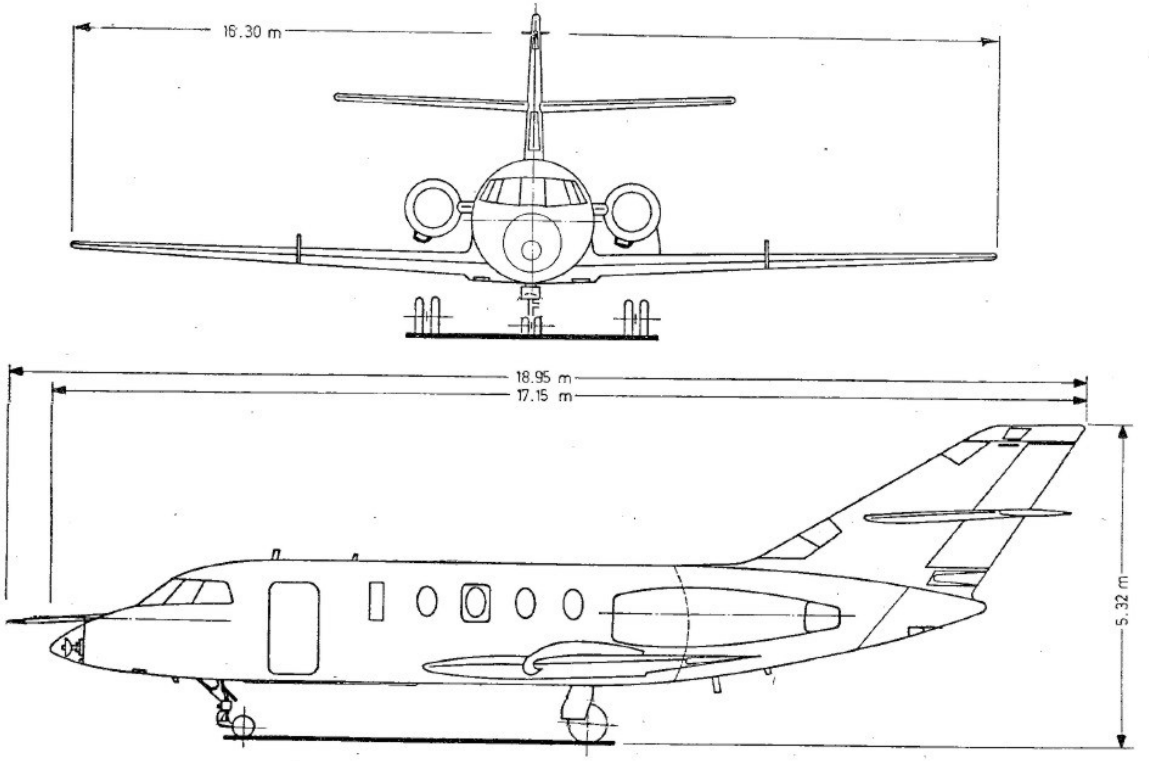
Dassault Falcon 20-E5, D-CMET - modifications

- 2 large bottom openings (515 mm)
- 4 roof openings (80 mm)
- Side opening (250x570 mm)
- Back hardpoint
- Bottom hardpoint
- Underwing hardpoint (4x) – not in use for DEEPWAVE

- Noseboom with flow angle sensor
- Basic sensor system
- Data acquisition+quicklook system
- Optional dropsonde release station

Falcon 20-E5, D-CMET

MTOW:	13,755 t
wingspan:	16.3 m / 53.5 ft
length:	18,95 m / 62.2 ft
height:	5,32 m / 17.5 ft



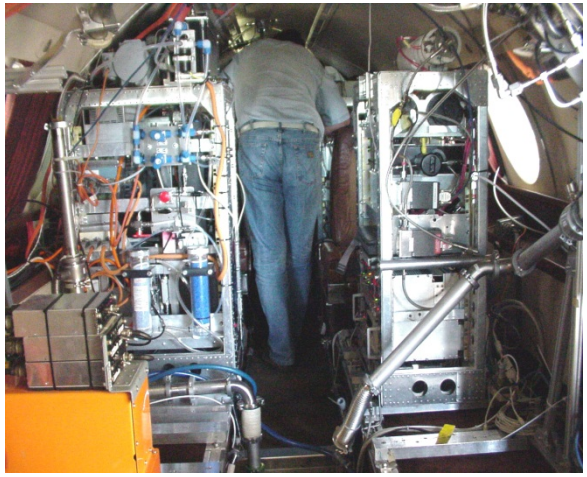
Falcon 20-E5, D-CMET

Basic instrumentation and communication

- Set of basic meteorological data and aircraft position
- VHF, UHF, HF
- Iridium and Inmarsat
- EFIS
- Turbulence weather radar
- Radio altimeter
- EGPWS
- GPS, VLF-Omega, LORAN-C
- IRS (Honeywell Laserref)
- NDB 2
- VOR/DME
- Mode-S Transponder
- RVSM-approved
- not ADS-B equipped

The aircraft as platform for user-specific experimental installations

Falcon cabin before experiment installation



Falcon cabin after experiment installation

Falcon 20-E5, D-CMET – flight crew

- max. 6 POB:
- 2 pilots
- 1 aircraft mechanic
- up to 3 instrument operators

All DLR pilots hold professional pilots‘ licenses and are experienced in execution of research flights. All of them have JAR licenses.

Falcon 20-E5, D-CMET – team

- Up to ~30 persons during peak/exchange times:
- 2 pilots, 1 aircraft mechanic (DLR-FX)
- 1 person operations, 2 of sensor & data team (DLR-FX)
- Forecasters, instrument operators, scientists, technicians from DLR-IPA, University of Mainz, University of Innsbruck (A)

Airport of operation

- base for D-CMET: Christchurch (NZCH)

DEEPWAVE –June/July 2014 – Falcon contribution

planned schedule:

28 May - 06 June:

instrument installation, ground and flight test (EDMO)

14 – 20 June**:** transfer flight Oberpfaffenhofen (EDMO) – Christchurch
(including extra measurement flight on the way)

21 June: crew rest, day-off;

--- assuming preparation of first local flight on 22 June ---

23 June–11 July: time window for local measurement flights

12 July: crew rest, day-off

13*) – 19 July: transfer Christchurch – EDMO
(including extra measurement flight on the way)

21 - 23 July: de-installation of instruments at EDMO

*) final weight of balance will show if transfer time can be reduced by one day

Falcon measurement flights:

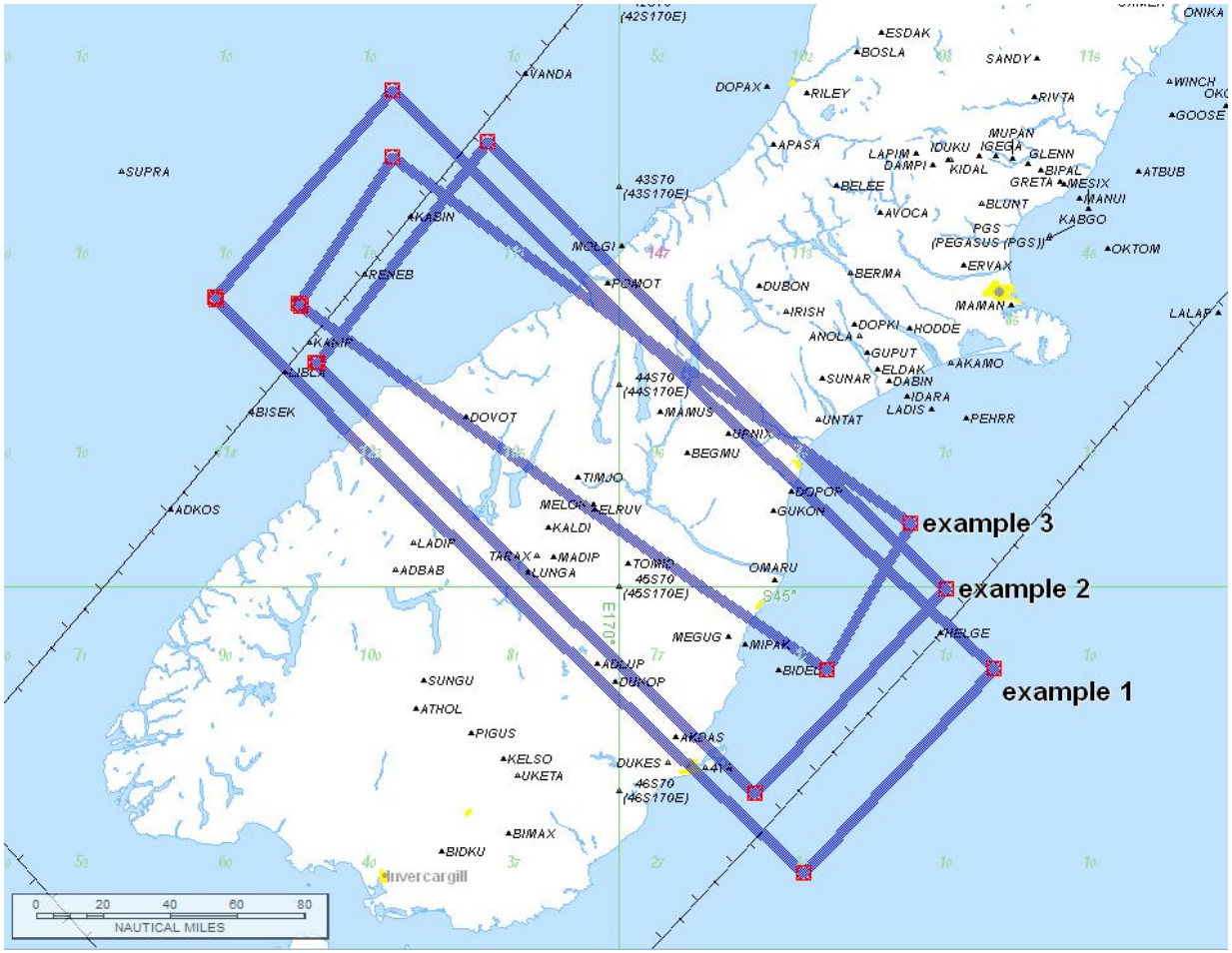
- available flight hours: ~60 hours block time
- Max. duration of a flight: 3:30 – 4 hrs
- 15-18 flights expected

- 2 flights per day/night possible, limitations if required on consecutive days (preparation of flights, duty time – only one crew available)
- Flights possible during day and night

- Typical crew duty time: 10 hours. Can be extended to max. 12/14 hours depending on time of the day (reduced max. duty time at night; max. 2 * 14 hrs / 4*12 hrs within 7 a days duty-period). Rest time has to be extended accordingly.
- Day-Off has to start at the 7th consecutive duty day at the latest.

Falcon measurement flights:

rectangular or triangle pattern, variable size/orientation, some examples plotted in the map below; FL270 – FL350



Falcon 20-E5, required infrastructure at Christchurch

- Hangar
- Offices with telephone/fax and internet access
- Storage room for boxes and equipment
- Place for one 20-ft sea-container
- Access to offices/hangar/aircraft 24/7
- Fuel: Jet A1
- GPU, tug
- NOTAMS, weather briefing, FPL submittance
- Payment mode for hangar, offices, communication, fuel, landing fees, etc?
- Accomodation

Falcon 20-E5, power supply

D-CMET doesn't need a GPU for aircraft starting. However, the scientists need power on the aircraft when working in the cabin on ground, mainly in the hangar, eventually outside before/after a flight.

For indoor use DLR will bring its own GPU (sea freight container) – for use outside USAP/PAE provides their GPU.

(Falcon requires 28VDC @ 40 Amps.)

plug to the aircraft:

standard 28V DC Connector per MIL 7974D / ISO 461 -2 (Style 1B, page 3)

15 kVA (500A @ 28VDC continuous - 1200A for aircraft start)

Radiosonde Launches from Lauder

DLR, LMU Munich, Innsbruck University

(1) Väisälä radiosonde station of the LMU Munich
60 .. 80 sondes with 600 g balloons

(2) GRAW radiosonde station of the University of Innsbruck
20 sondes with 600 g balloons

Purposes:
- the determination of wind, temperature and humidity from the surface up to about 30 km altitude
- the determination of the tropopause height
- the characterization of gravity waves in the troposphere and stratosphere

Different **launch techniques** can be applied in coordination with the other Radiosonde stations deployed during DEEPWAVE-NZ

- simultaneous launches of two balloons with different gas fillings
- series of balloon launches every 90 min or 180 min during IOPs

DLR

3 Dec 2013 06 09 12 15 18 21 00 03 06 UTC 4 Dec 2013

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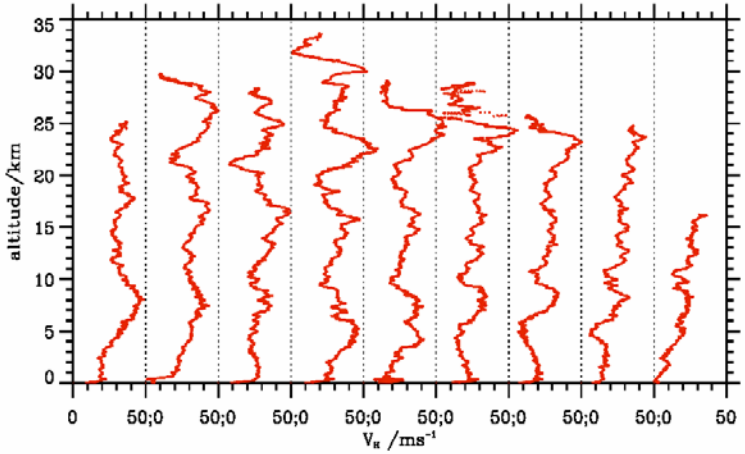

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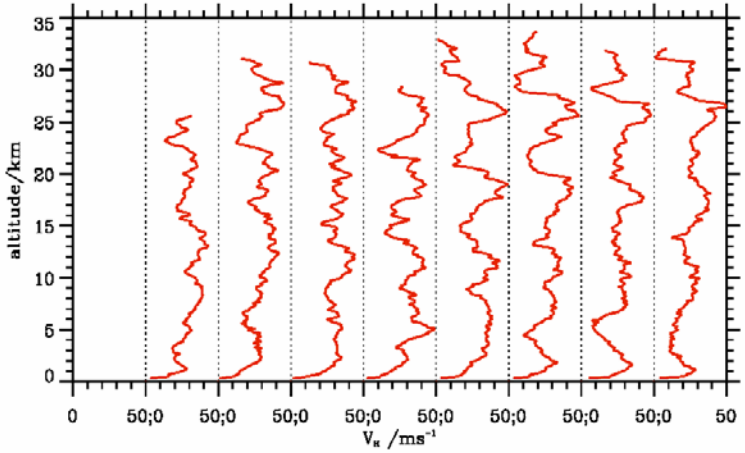

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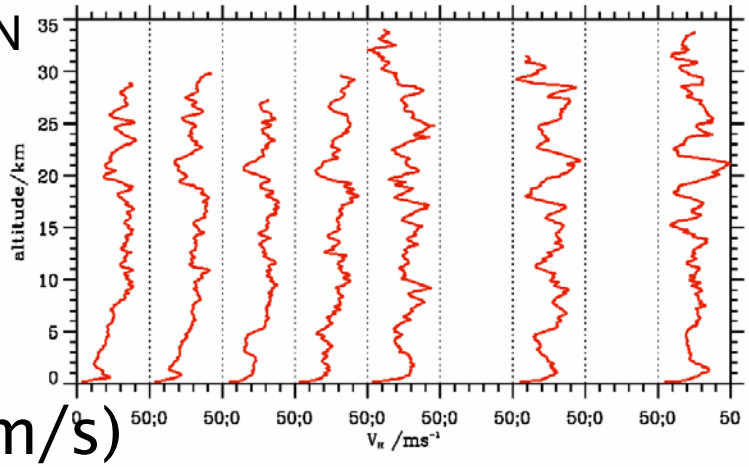
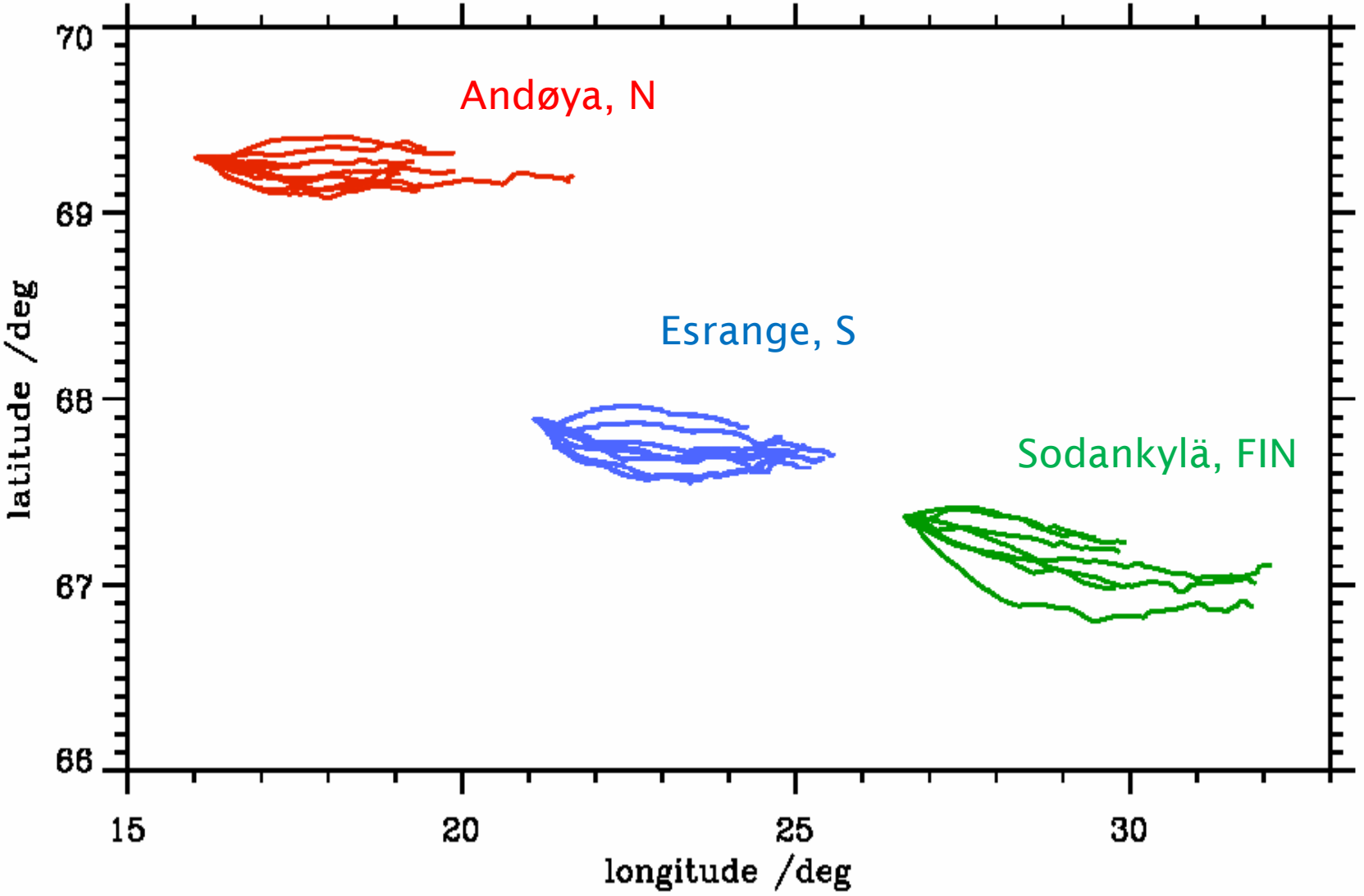


Horizontal Wind (m/s)

IOP 1 Simultaneous Radiosonde Launches every 3 h

3 December 2013 06 UTC - 4 December 2013 06 UTC



Sodium-Rayleigh-Brillouin-Raman Lidar (Na-RBR)

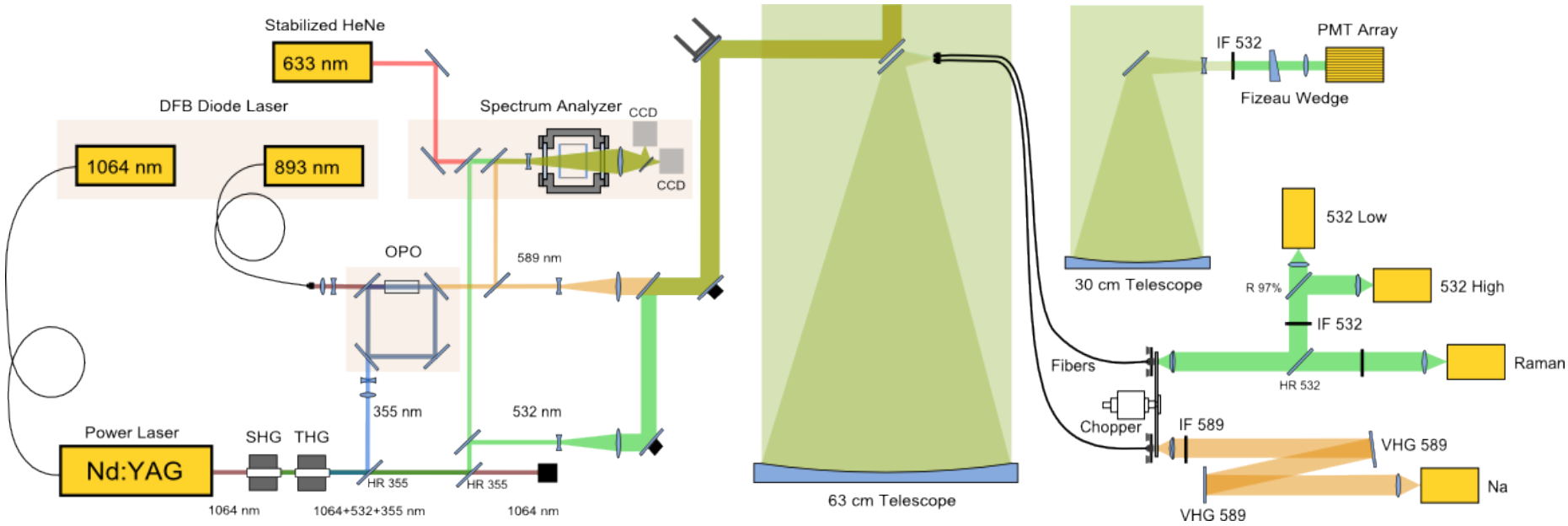
Transmitter

0.5 W at 589 nm (Sodium resonance)
10 W at 532 nm

100 Hz reprate
Bandwidth <100 MHz

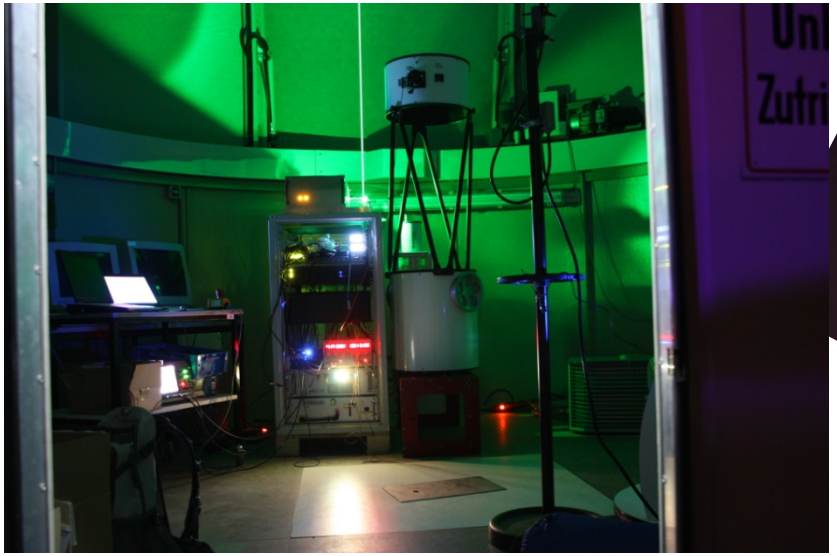
Receiver

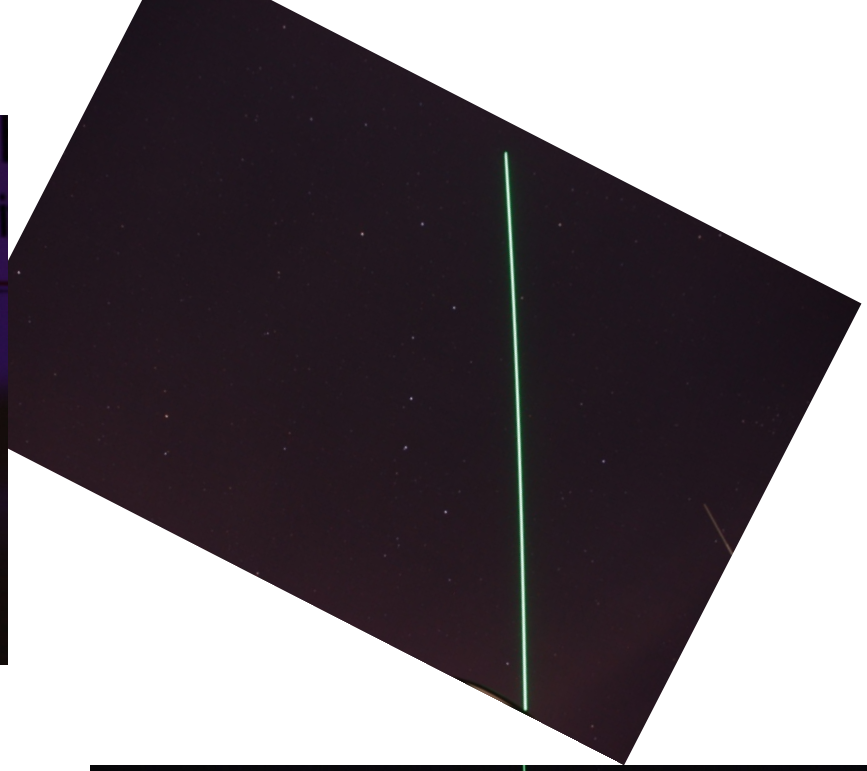
1 Channel at 589 nm
1 Raman channel at 608 nm
2 Channels at 532 nm
1 Rayleigh-Brillouin channel

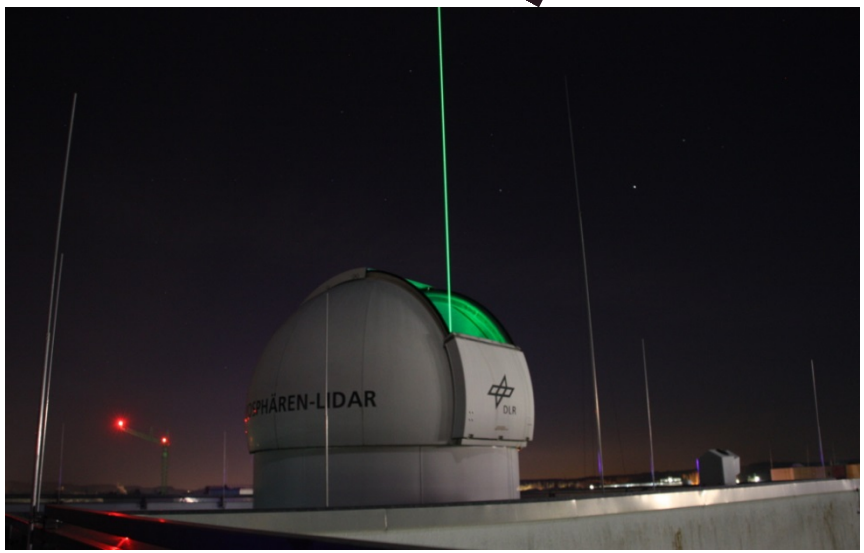


Na-RBR Lidar

Operation	Ground based system; remote/autonomous operation Real-time data analysis, quicklook plots on webpage
Metal	Sodium (589 nm wavelength)
Measurements	Temperature (5-105 km) Sodium density (80-105 km) One horizontal wind component (80-105 km) Aerosol (5-35 km)
Resolution	2 km, 15-60 min depending on altitude; 1-2 km, 20 min within metal layer
Observations in daylight	Currently not planned, degraded performance in daylight conditions
Output power	0.5 W at 589 nm, 10 W at 532 nm
Telescope aperture	63 cm
Field of view	365 microrad (sodium), 200 microrad (Rayleigh/Raman)






PHÄREN-LIDAR