The New SLR Station of GFZ Potsdam : A Status Report

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Background

The planned relocation of the Potsdam SLR station to the new dome opened the opportunity of upgrading with special emphasis to the optical- mechanical subsystem. For several reasons the time for design and construction was much longer than expected. To avoid any gap during the CHAMP mission, it has been decided to keep the present station operational during the engineering phase of the new system and to conduct a few months parallel ranging.

Fig.1: The Twin Telescope on Top of the New Tower. Status: Oct. 2000

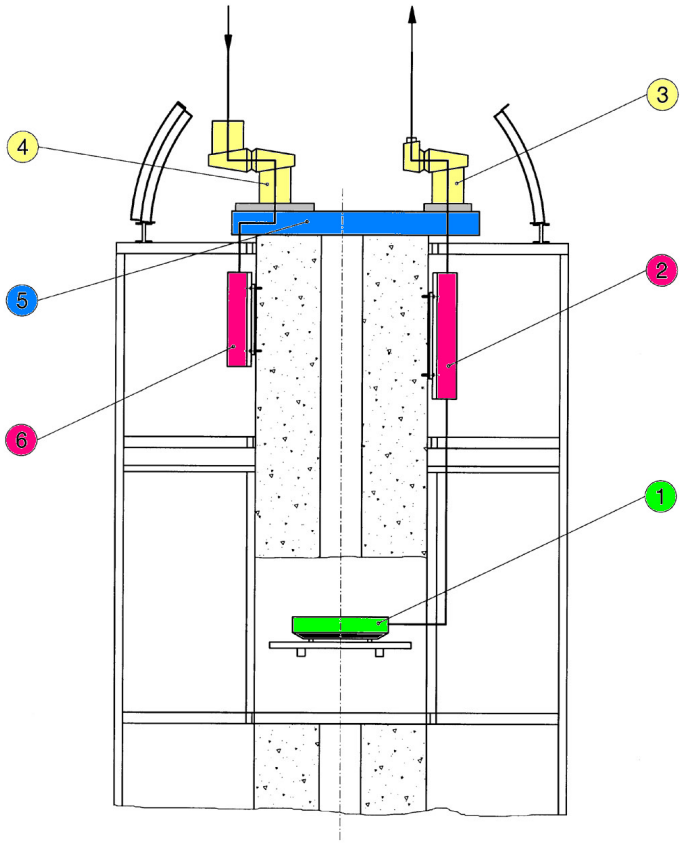
Description of the System

Two separate telescopes for transmitting and receiving are used. The design of this telescope system has been described in some detail already [1]. The configuration avoids the necessity of a transmit- receive switch and minimises the reception of atmospheric back-scattering. Furthermore both telescopes are encapsulated by separately driven housings.
The laser is an upgraded version of the system described in [2]. It is based on a diode-laser pumped Nd-YAG oscillator with two modelockers (66.7MHz and 1333MHz resp.). Two external pockels cells enable the selection of any number of pulses from the mode locked train. The selected pulses are amplified by two flash lamp pumped laser rods.
The electronical subsystem is similar to the operating station and uses standard components as far as available. The measurement cycle is controlled by a single PC communicating via serial

as well as GPIB interfaces. The telescopes have their own controllers and are connected to the PC by serial ports. The not time critical tasks (laser control, beam divergency, receiver FoV etc.) are controlled by a separate PC.

Specifications

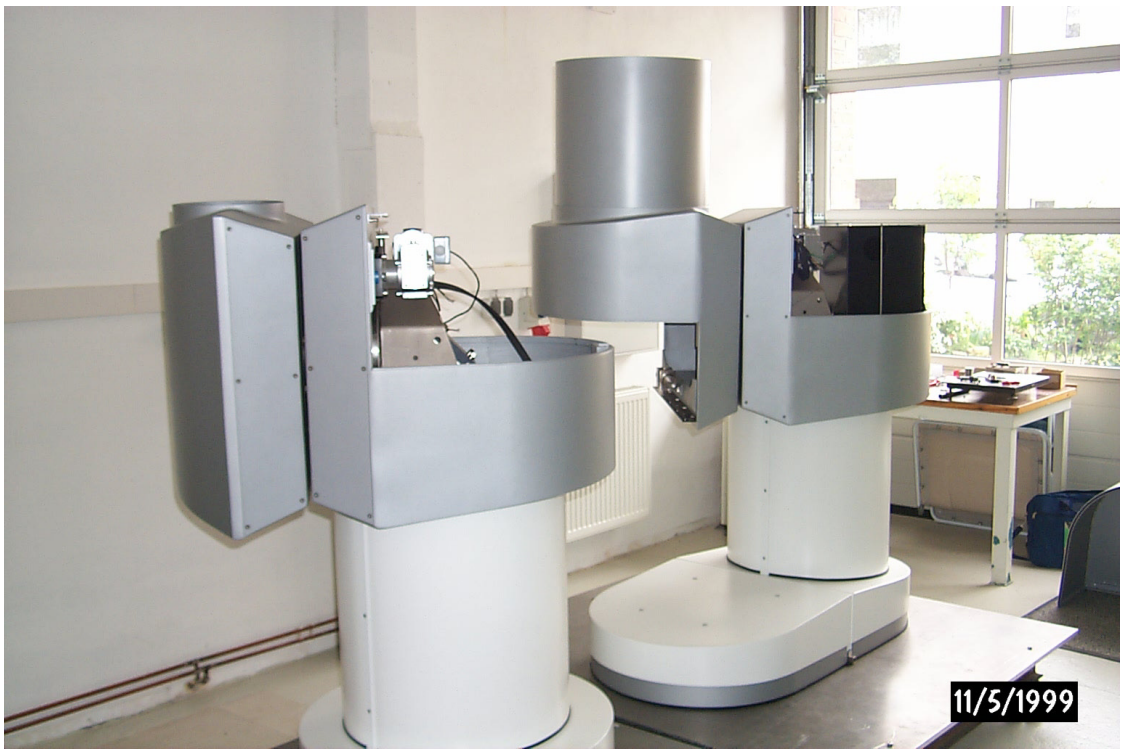
Mount	
General	Az-Alt, direct drives, digital servo, separately driven housing
maximum velocity ; acceleration	20°/s ; 4°/s²
pointing precision ; accuracy	< 1“ ; <5“
Transmitting telescope	
General	Coude-Refractor, afocal, achromatic
Entrance Aperture ; Output Aperture	45mm ; 130 mm (□= 2.9)
Receiving telescope	
General	Coude-Cassegrain, afocal, plane window on housing
Entrance Aperture ; Output Aperture	440 mm ; 48 mm (□=9.12)
Transmitting focal unit	
General	variable beam expander, guiding system (CCD)
Entrance Aperture ; Output Aperture	11 mm ; 45 mm
Receiving focal unit	
General	Apochromat 100/600 , 2 CCD’s, PMT, SPAD
System focal length (incl. receiver telescope)	5.47 m
Laser	
Type	Diode-laser pumped Nd-YAG, 2 amplifiers
Single pulse data	10mJ (532nm), 50 ps, 10 Hz, 1...10 pulses/shot
Electronics	
Time Base	HP58503B GPS receiver
Epoch Timer Resolution	100 ns
Range Gate Resolution	10 ns
Time Interval Counter	SR620



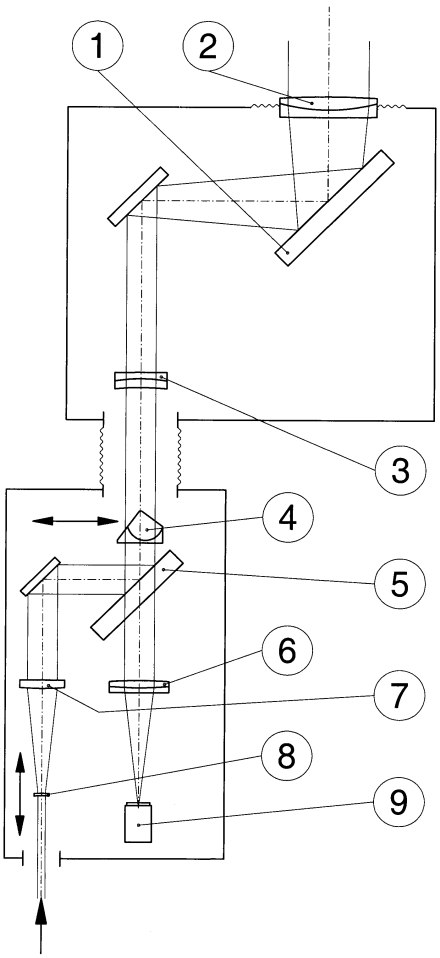
General Arrangement of Optics:

1 - Nd:YAG Laser
2 - Transmit package
3 - Transmit telescope
4 - Receive telescope
5 - Telescope base
6 - Receiver package

(containing the photo-detectors and related optics)

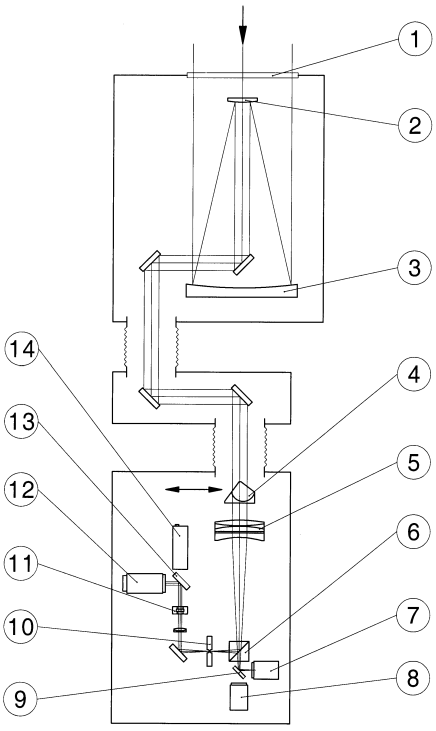


Transmit and receive telescopes after integration (partially dismantled)



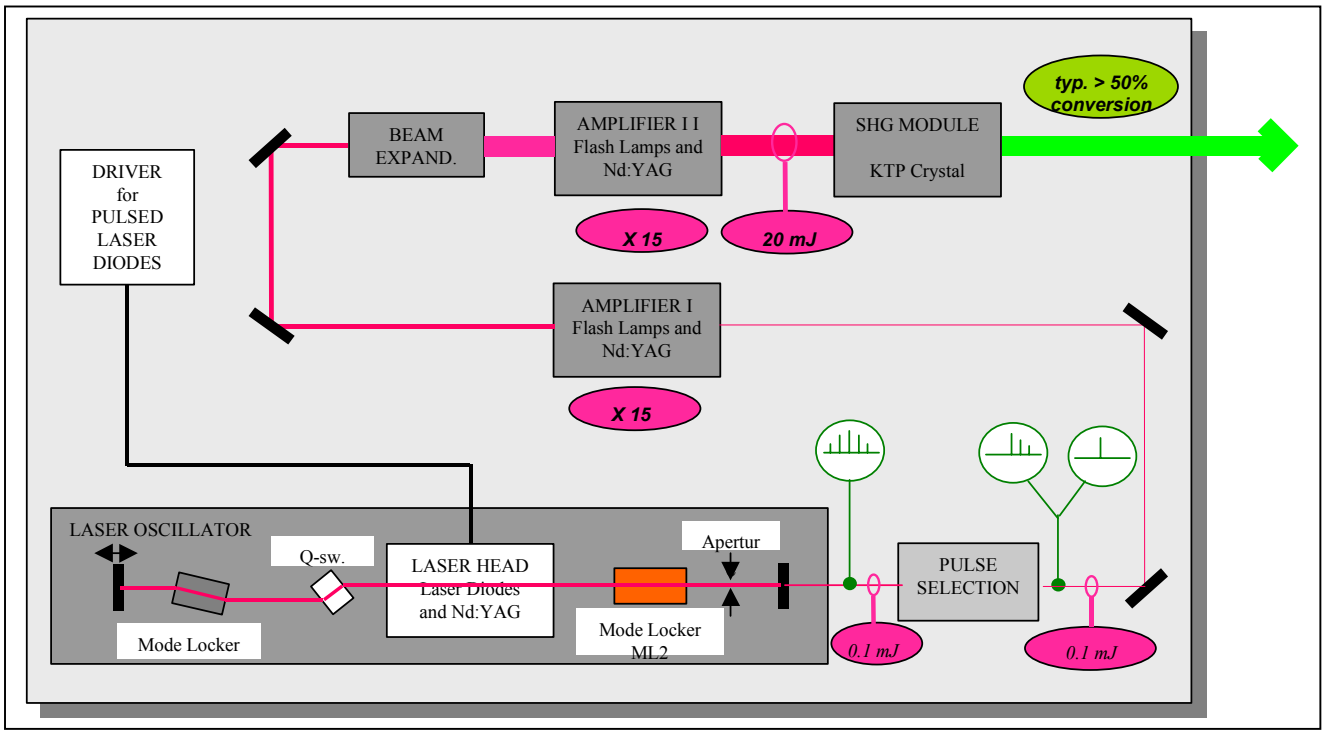
Optical Diagram of the Transmitting System:

1: Plane Mirror
2: Positive Achromat 130/1950
3: Negative Achromat
4: Cube Corner (for alignment only)
5: Dichroic Beam Splitter
6: Achromat 80/1000
7: Positive Lens
8: Negative Lens (Divergency Control)
9: CCD Camera

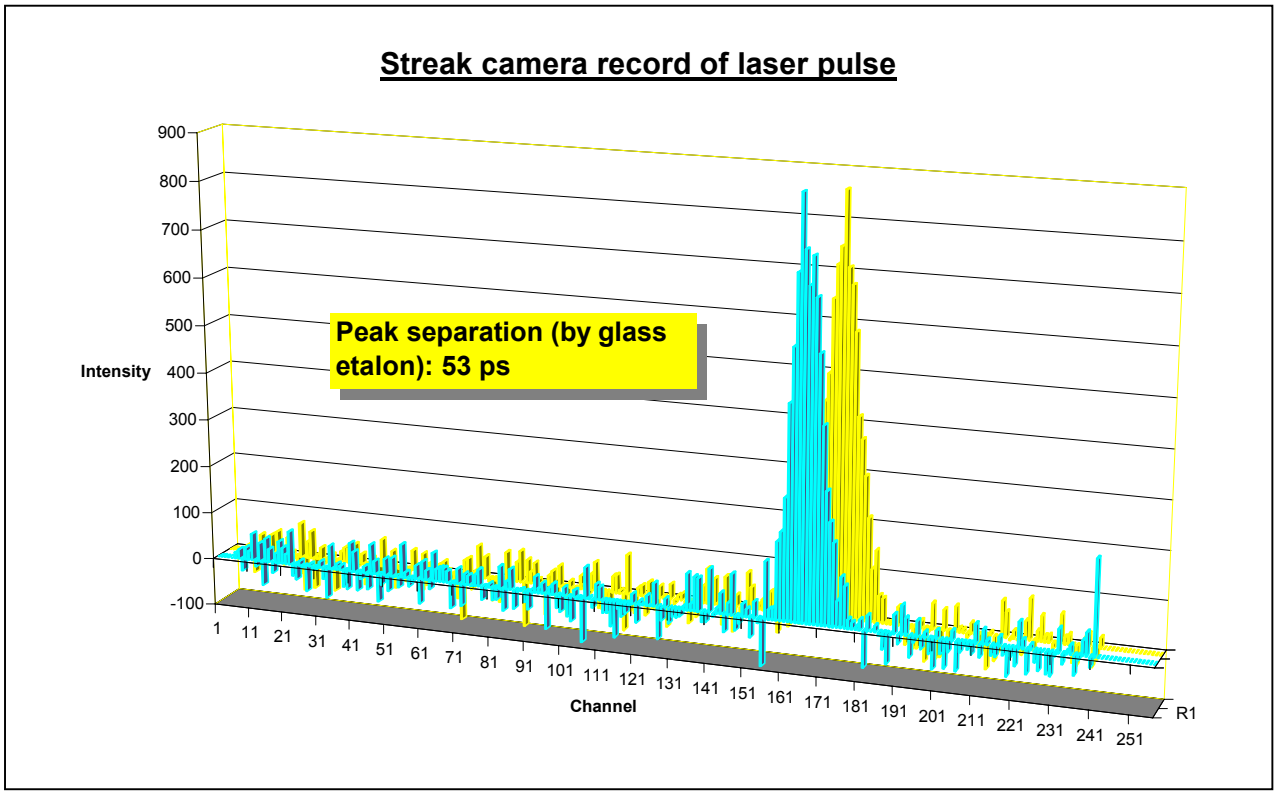


Optical Diagram of the Receiving System:

1: Window
2: Secondary Mirror
3: Main Mirror (Diameter 450 mm)
4: Cube Corner
5: Achromatic Triplett
6: Dichroic Beam Splitter
7: IR - CCD
8: Intensified CCD
9: Flip Mirror
10: Field Stop
11: Spectral Filter
12 / 14: Receivers (SPAD/PMT)
13: Flip Mirror



Optical Diagram of the Laser



Status of Implementation:

- The hardware (except focal units) has been completed and integrated
- The optical and mechanical system is under alignment at the site
- It is expected to conduct first ranging experiments in 2001

References:

[1] R.Neubert, L. Grunwaldt, G.Sesselmann, M.Steinbach,
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Lidar Techniques II, Florence, Italy , September 1999, SPIE Vol.3865, p.83

[2] F.Maßmann, A.Hase, H.Voss,
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