# The SOS-W - A Two Colour Kilohertz SLR System

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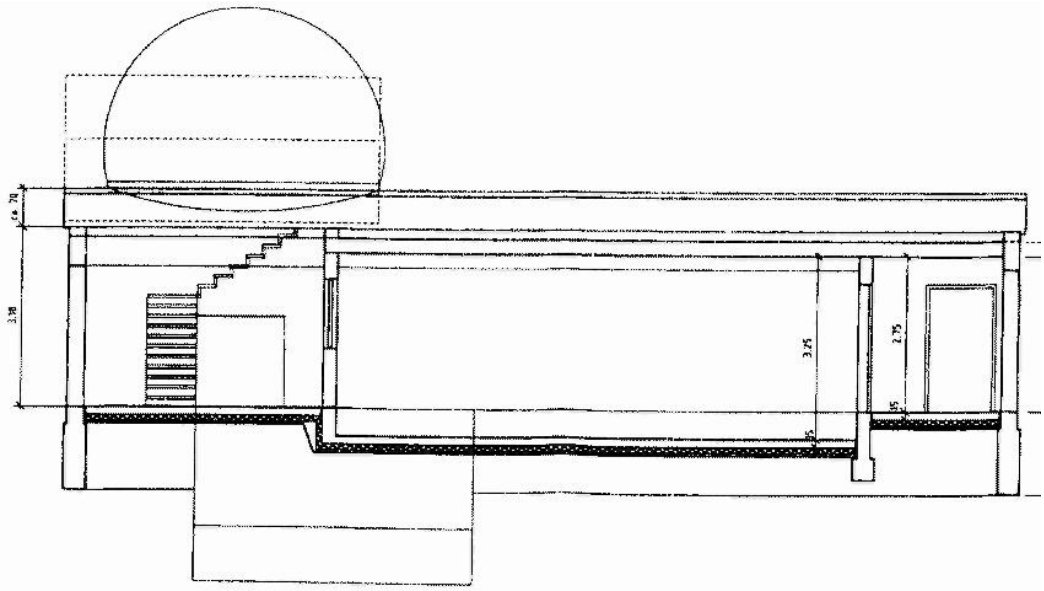
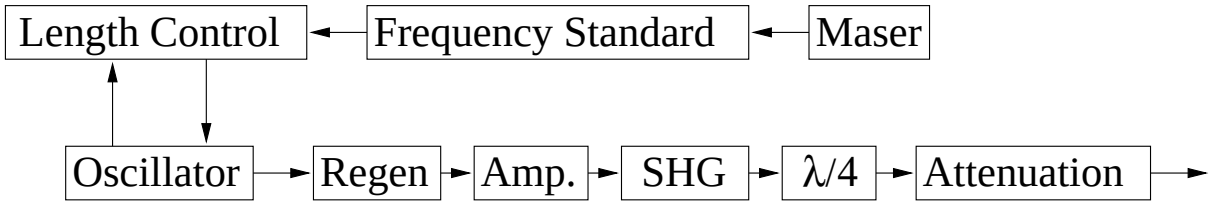
# Design Constraints

- permanent two colour operation, day and night
- single photon mode
- utmost timing precision and reproducibility
- utmost spectral and spatial filtering
- external calibration with paralax compensation
- internal calibration at any pointing direction
- beam pointing verification at any pointing direction
- point ahead mode / aberration compensation
- support of kilohertz repetition rates
- closed / pressurized optical chain

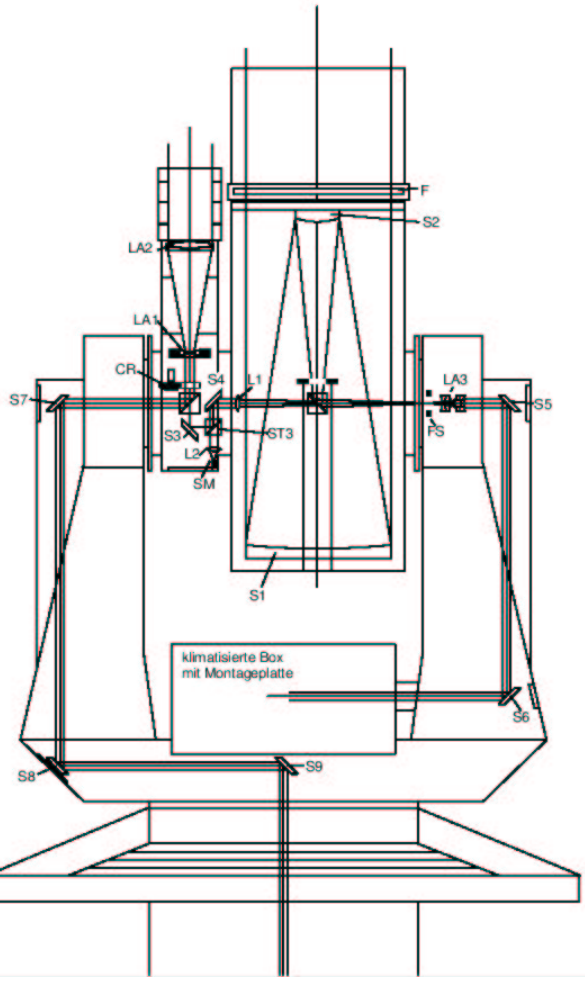


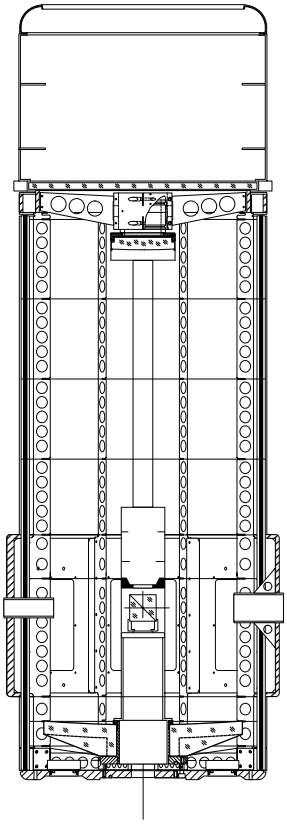
# Laser Specification




- 850nm/425nm Ti:SAP CW oscillator, passive modelocking by SESAM
- 50 ps pulselength at 850nm, TBP $<$ 1
- pulse to pulse jitter $<$ 1 ps
- active oscillator length control referenced by frequency standard down to +- 1Hz
- frequency stability $<$ 4GHz
- regenerative and linear amplifier generating 1W CW-power at 1kHz repetition rate
- contrast ratio $<$ 1:1000
- variable SHG conversion rate
- M**2 $<$ 1.5 at both harmonics
- output power $<$ 2 percent rms
- circular polarization at both harmonics

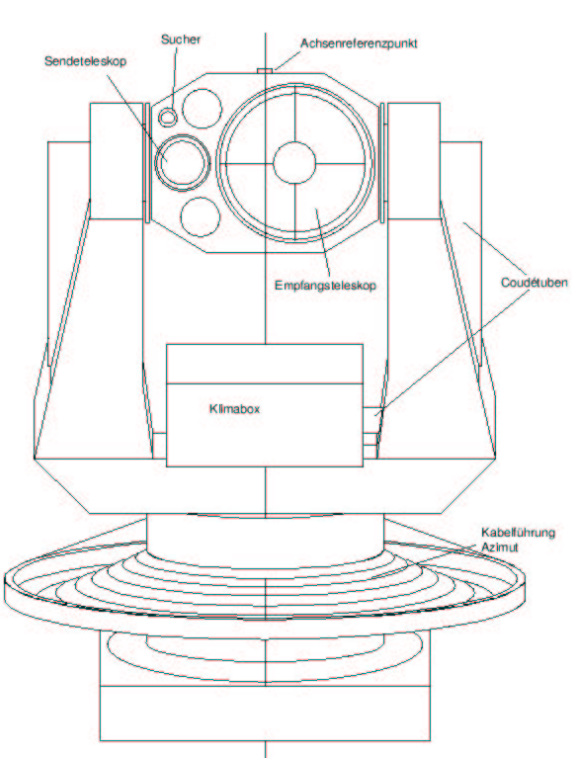
# Telescope Design

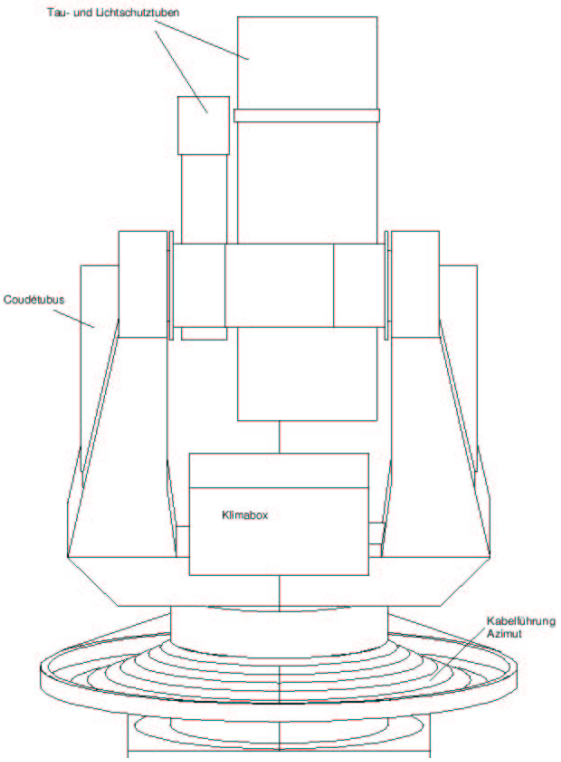


- 50cm f/3 primary mirror, light weight construction, centric mount
- f/11 secondary focus
- lightweight telescope tube sealed by BK7 window
- 16cm transmit achromat
- optical design enables for diverse calibrations

# Telescope Mount



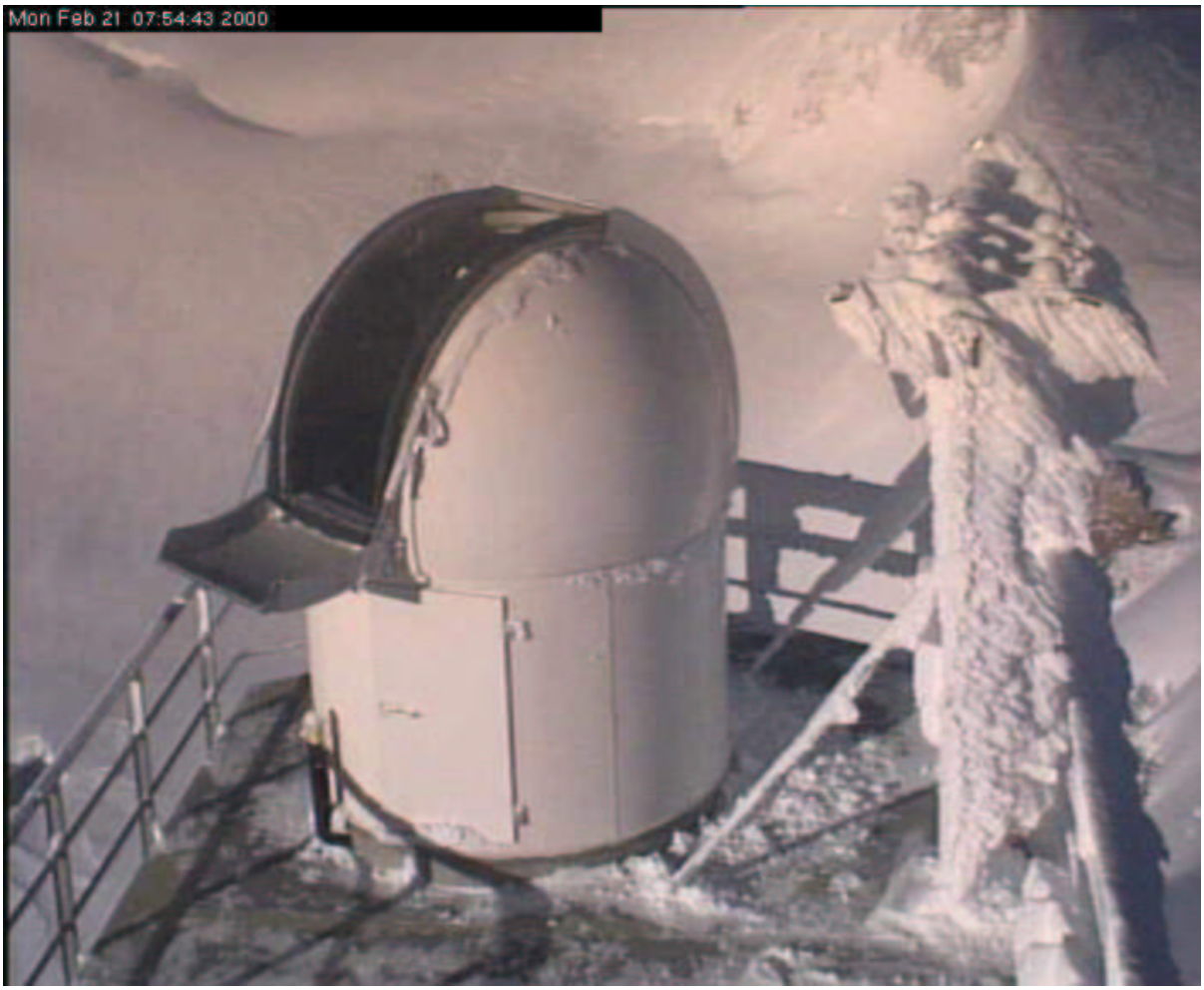




- pointing accuracy $< 1$ asec
- pointing correction devices
- direct drive
- max. velocities 20deg/sec in azimuth, 10deg/sec in elevation
- open cable wrap
- will be built by Baader-Planetarium

# Dome Features

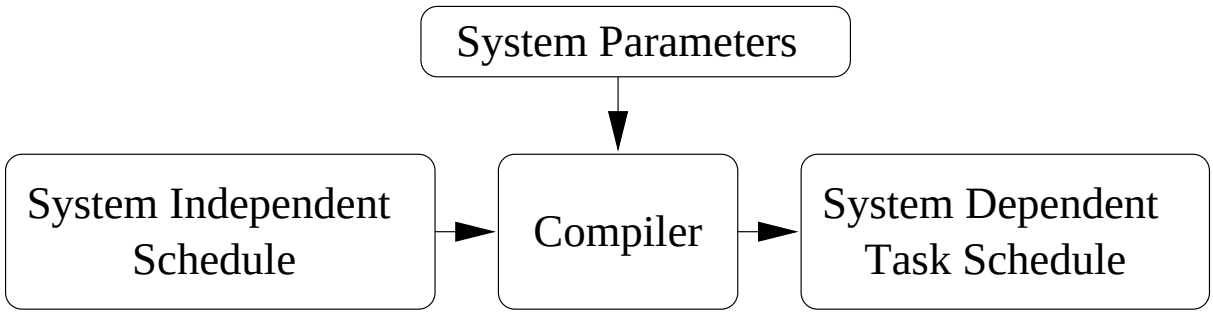
- Baader Planetarium guarantees 10 years serviceless operation
- turbulence/seeing limiting design
- high quality surface finish
- up to 30 deg/sec Velocity

# Dome Features (2)



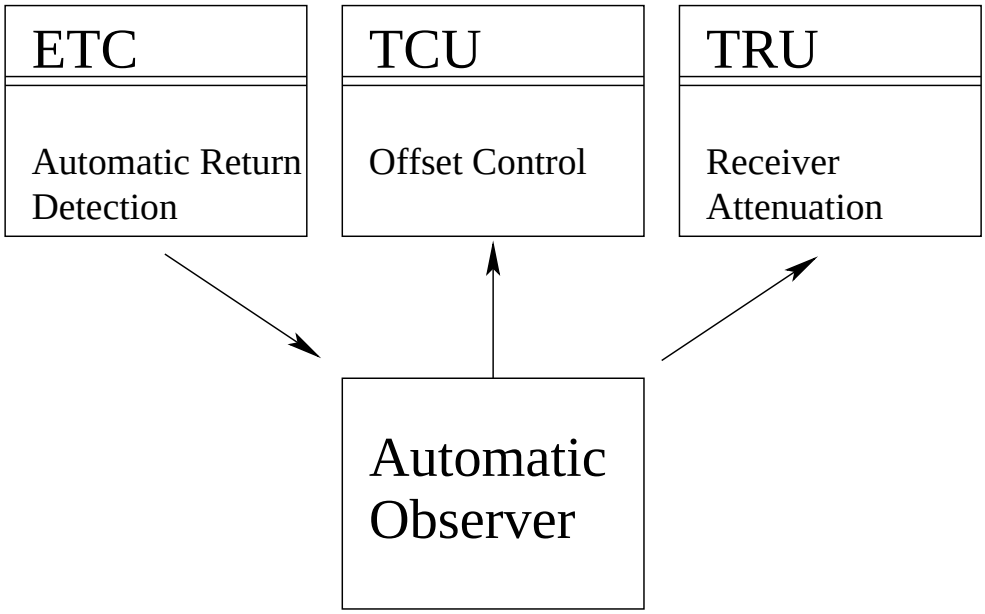

- sustains harsh environmental conditions
- hermetically sealed (when closed)
- ambient dry air at outside temperature
- integrated heavy duty lifter (for Telescope)

# Software Development



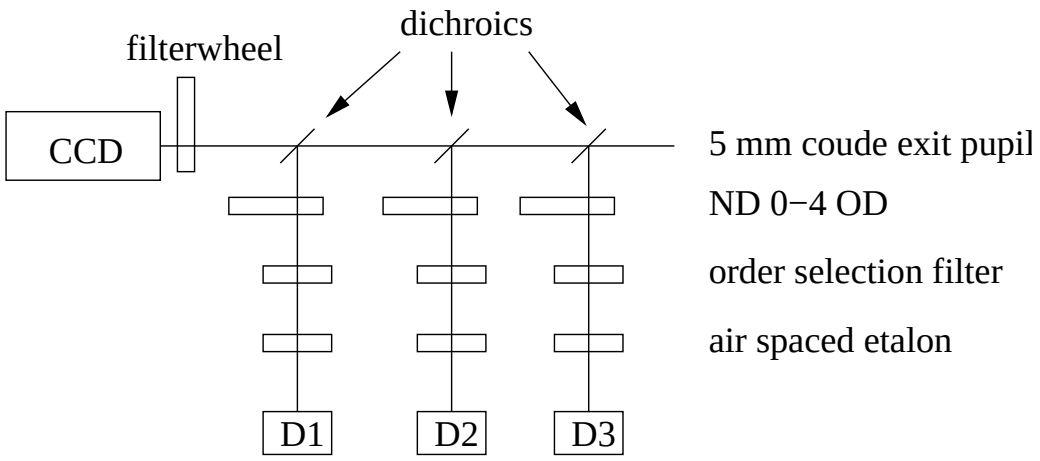

- Adaption of VLBI-field-system software philosophy, which enables for
  - synchronous task scheduling
  - system independent observation schedule
  - support of diverse hardware due to flexible adaptation philosophy
  - manual Intervention of automatic observations
- upgrade of existing control system will provide task schedule support
- goal: SLR-field-system realized with open source software

# Closed Loop Tracking




- automatic return detection based on residual histogram
- subsystem server control with high level API
- redundant server check mechanism (heartbeat)
- control cycle period $>$ 1 sec (satellite dependent)
- permanent pointing optimization (no quadrant detector)

# Detection Package




- narrow air-spaced FP Etalon (BW $<$ 0.05nm, T$>$90%)
- high transmission (approx. 90%) high blocking ( 5 OD) order selection filter
- return rate control by variable ND filter (0-4 OD)
- MCP detectors at both wavelengths (TTS $<$30ps)
- housed in climate box on Nasmyth (Azimuth) platform)
- custom discriminators at detectors
- realized with OEM components


# Expectations


- autonomous / remote operation
- submillimeter LAGEOS Normal Point Accuracy (Internal)
- refraction correction:
  - approx. 3mm for LAGEOS (internal)
  - submillimeter for STELLA
- single photon ranging down to 20 degree sun proximity
- support of global coordinated experiments (Time Transfer, Transponders)
- nice open source project