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
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
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)
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

ETC
Automatic Return Detection

TCU
Offset Control

TRU
Receiver Attenuation

Automatic Observer

- 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