

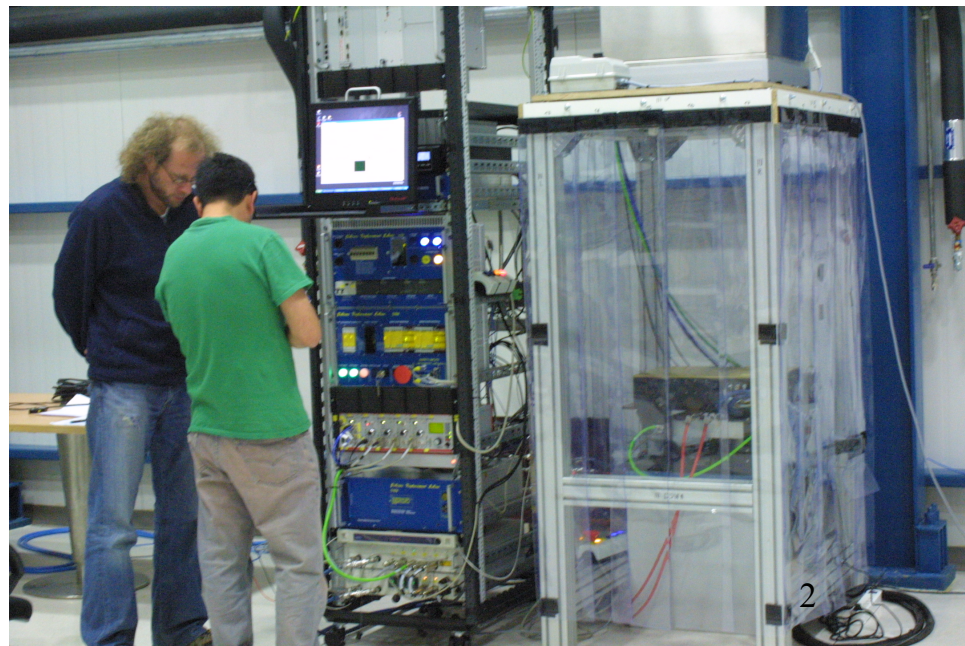
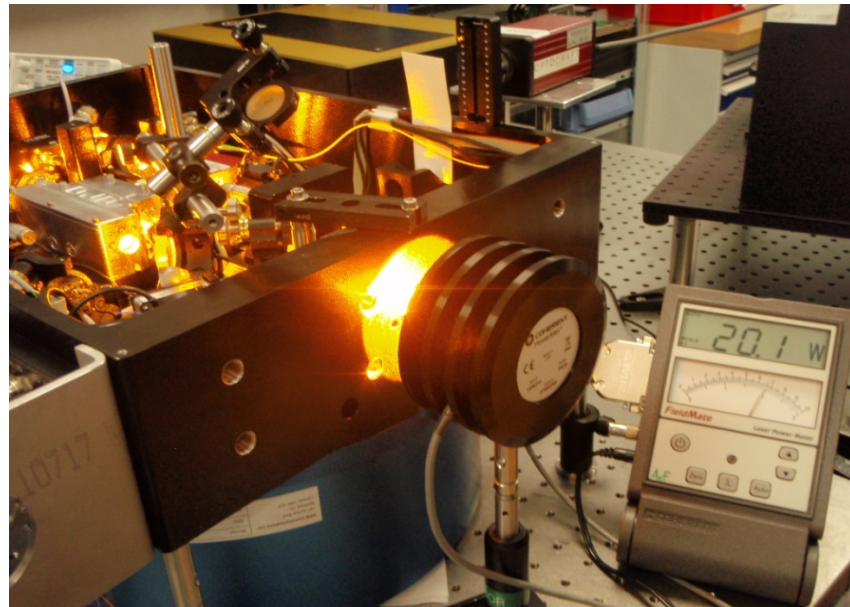
The ESO current activities on LGS Systems



D.Bonaccini Calia, I.Guidolin, W.Hackenberg, T.Pfrommer, , R.Holzlöner ,S.Lewis,

On LGSF systems:

1. The experimental fiber laser PaRla is operating in Paranal since Feb 2013
2. The Paranal LGSF is working regularly since. The laser is in the LCR



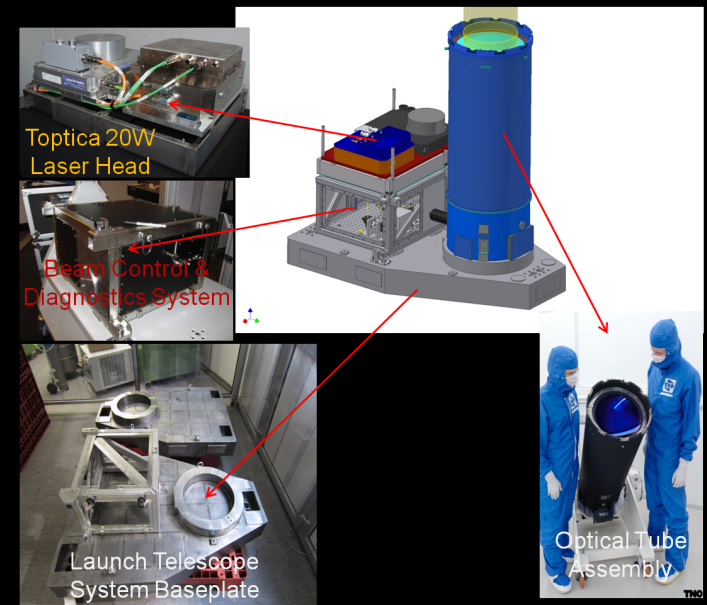
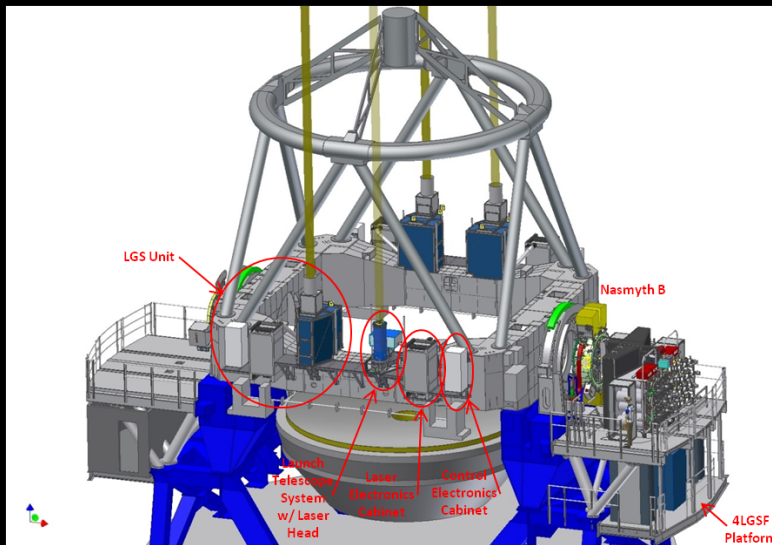


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On 4LGSF systems:

1. We are very very busy with the AOF/4LGSF. We have a review coming to send the first LGSU to Paranal and Commission it



2. The engineered Topica lasers have been delivered and accepted (4 units)

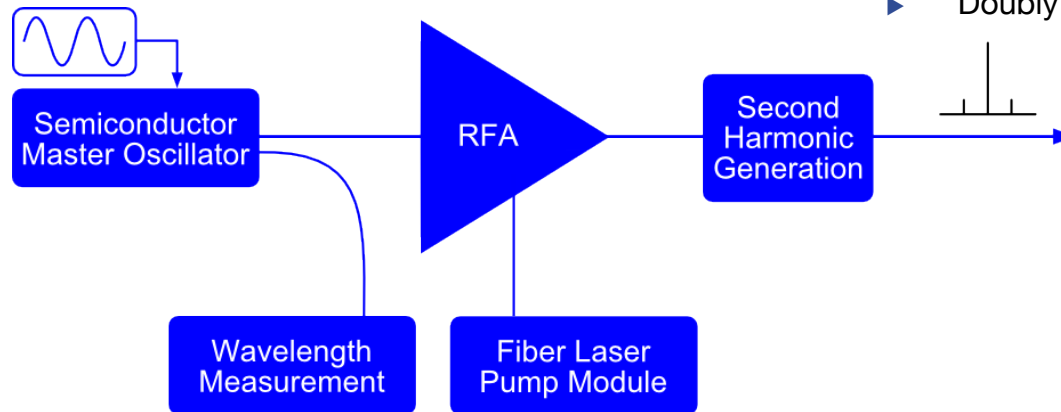
Laser Concept



- ▶ Seed diode laser @ 1178 nm
- ▶ ~1 MHz linewidth
- ▶ Sideband generation for D₂b repumping via current modulation

- ▶ Narrow-band amplification
- ▶ Efficiently suppressed SBS
- ▶ 36 W @ 1178 nm

- ▶ Efficient SHG
- ▶ 22 W @ 589 nm
- ▶ ~5 MHz linewidth
- ▶ Diffraction-limited output
- ▶ Doubly resonant cavity



- ▶ Solid state wavelength meter
- ▶ 10 MHz resolution
- ▶ Absolute calibration with stabilized HeNe reference laser

- ▶ All-fiber design
- ▶ Polarization-maintaining setup
- ▶ 100 W @ 1120 nm



System Integration

- ▶ Centerpiece integration possible
 - ▷ Gravity-invariant operation
 - ▷ No heat source: Surface temperature within 1.5 K from ambient
 - ▷ Vibration-free liquid cooling: 5 l/min

- ▶ Suitable for Chile and Hawaii
 - ▷ Earthquake proof
 - ▷ Suitable materials (ozone-resistant)

- ▶ Easy maintenance
 - ▷ Line-replaceable units

- ▶ Additional flexibility for telescope integration
 - ▷ Electronics Cabinet: main heat sources, < 600 W
 - ▷ Laser head: < 100 W with integrated control electronics



Performance - Reproducibility

Test	Unit	ESO Spec.	PPU	LU1	LU2	LU3	LU4
Beam quality							
wavefront error (rms)	[nm]	< 70	23	16	18	14	23
Polarization							
PER	[dB]	> 20	> 24	> 24	> 23	> 22	> 24
Laser linewidth (measured with 1GHz FPI)							
FWHM	[MHz]	< 250	< 4.5	< 4	< 6	< 5	< 8
Power Consumption (@ BOL)							
overall efficiency	[%]		3.6	3.9	3.8	3.6	3.5

Summary

▶ Laser concept:

- ▶ Diode laser – tunable, narrow linewidth, fast toggling, easy modulation
- ▶ RFA – polarization-maintaining, linewidth-conserving, high efficiency
- ▶ SHG – efficient, diffraction-limited beam due to resonant cavity
- ▶ Repumper integration without harming beam quality

▶ System integration:

- ▶ Pump diodes and power supplies (heat sources) are separated from Laser Head
- ▶ Laser Head can be directly integrated into launch telescope
- ▶ Optional remote pumping scheme
- ▶ High wall-plug efficiency > 3%
- ▶ Ease of use (low maintenance, no daily tune-up, fast warm-up)

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4LGSF systems (see Montreal SPIE Proceed.)

The engineered Toptica lasers have been delivered and accepted (4 units)

Fully tested, cumulated >2000 hours laser operation overall

Polishing up the SW and interlocks – support from Toptica

Will Commission one LGSU in April-May on UT4



“Wendelstein” LGS Unit



The ESO current activities on LGS Systems



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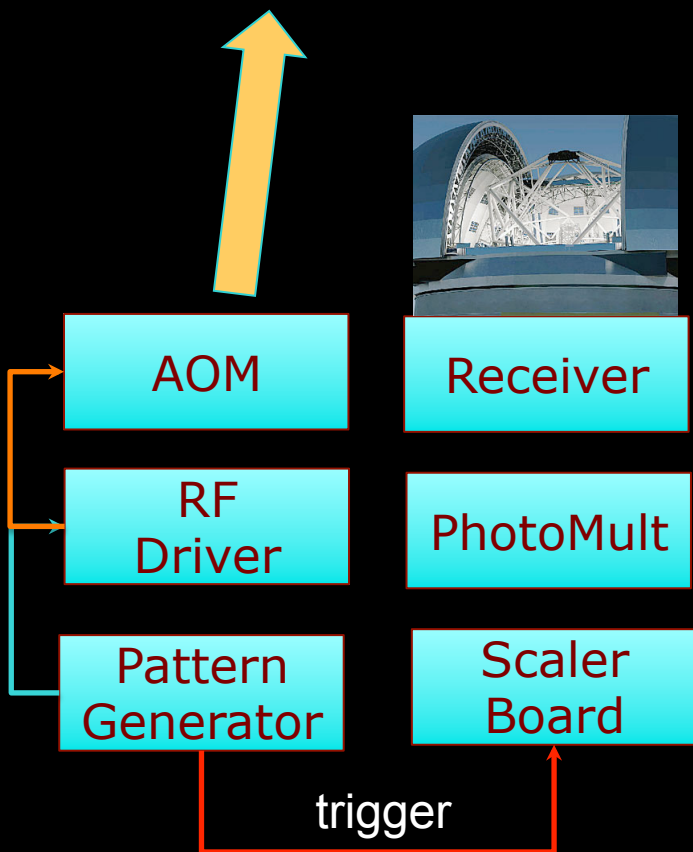
OnR&D activities:

1. The experimental Laser guide star unit Wendelstein has been at LZT
 - 2014 LZT (8447-45), line-of-sight sodium profile measurement technique
 - 2015: Now preparing for return flux systematic tests at IAC- OT Tenerife
 - 2016-17 field test LGS-AO at Canary reproducing EELT geometry

line-of-sight sodium density profile – LZT experiment



- Modulate 10% uplink laser amplitude with pattern [19W eff]
- Use an AOM in WLGSU at ~10 MHz
- Repeat the modulation patterns at regular intervals
- Acquire signals with photomultiplier
- Trigger/time-tag counts, cross-correlate data set with pattern



Thanks !

