Karlsruhe Institute of Technology

Laser concept of the mobile ATMONSYS-lidar and its application during CHEESEHEAD

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Discussion and furhter details via email <vogelmann@kit.edu>

KIT-Campus Alpin
IMK-IFU: Atmospheric Environmental Research

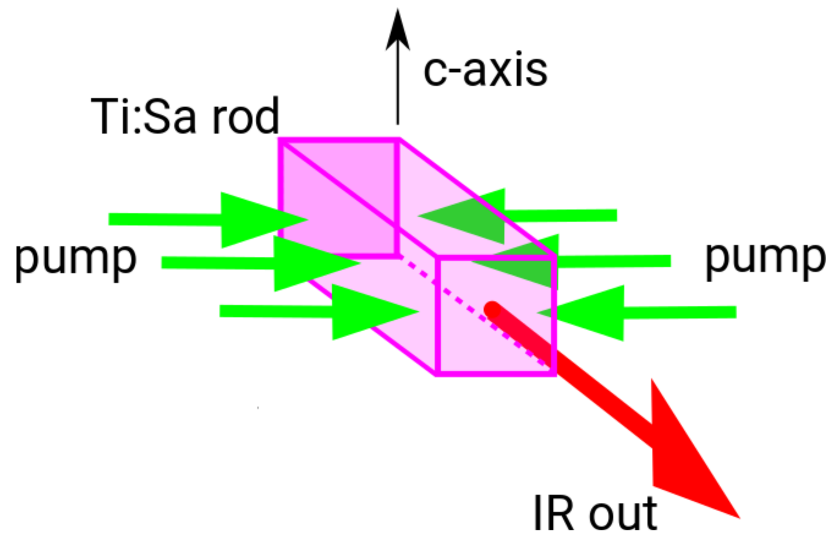
Principle concept of the Laser design

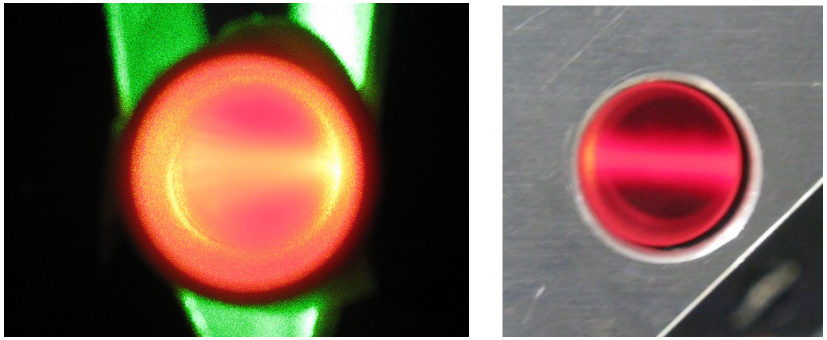
- Transversely pumping allows for higher pumping power

- Orientation of crystal c-axis parallel to polarization of pump and IR

- Rod in rectangular cut (not Brewster)

- Rod can be much longer than in a longitudinal pumping setup



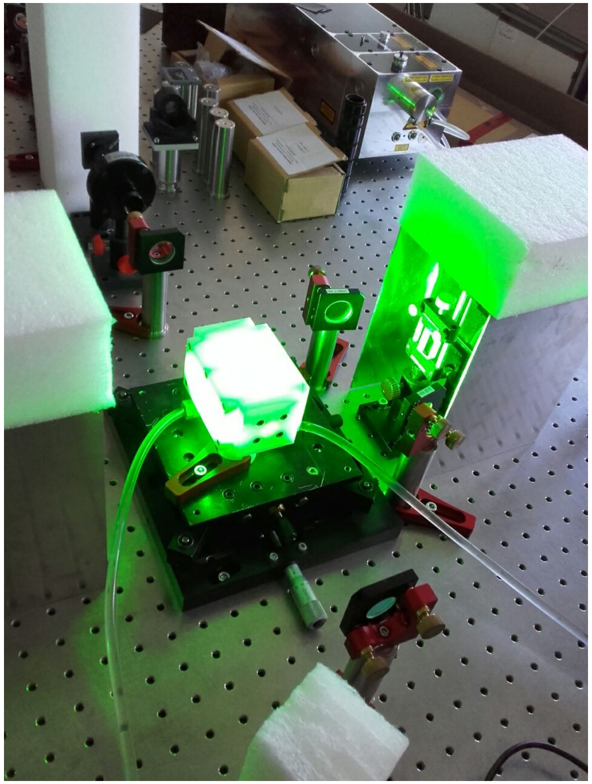


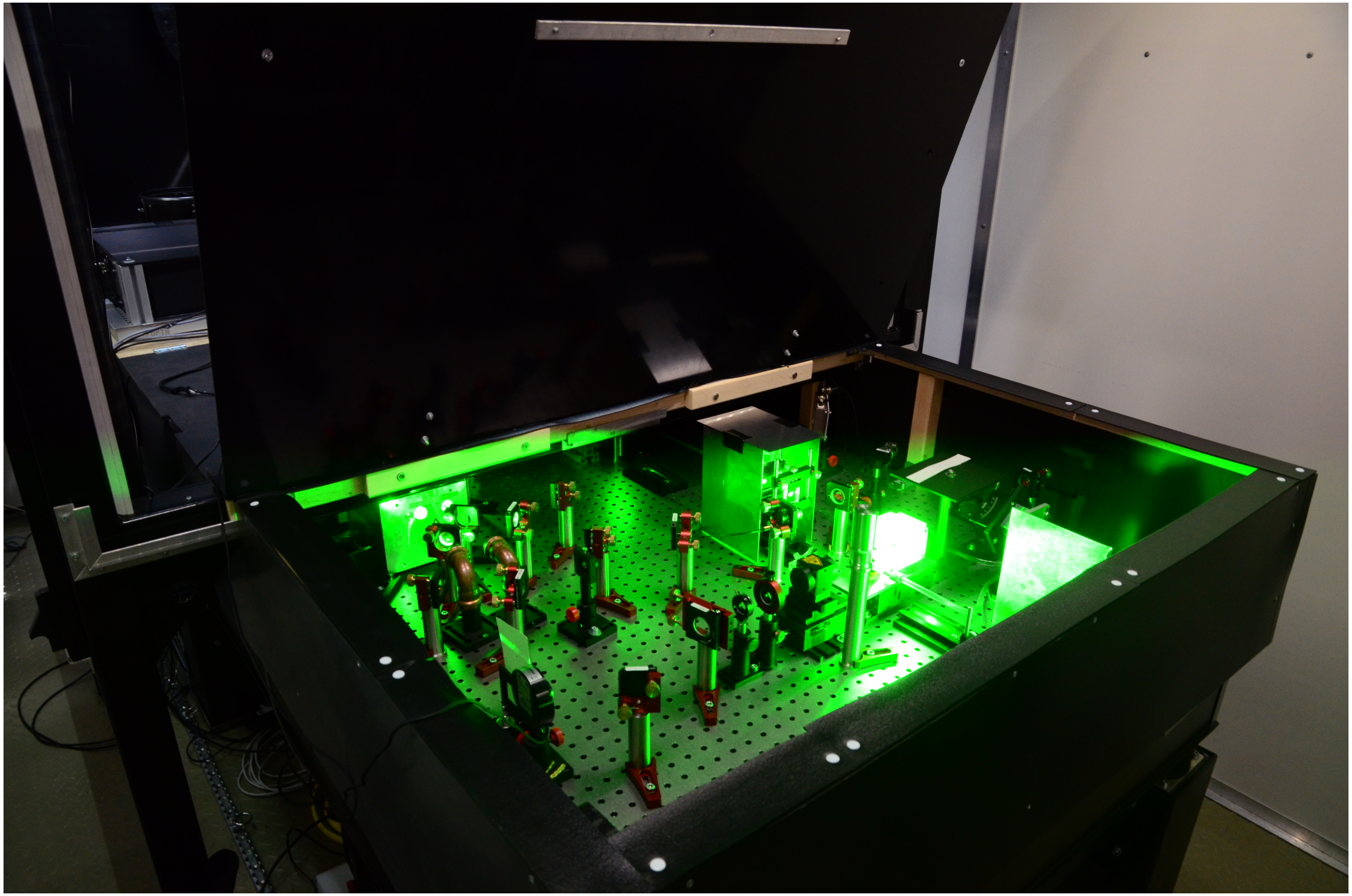
Fluorescence inside a cylindrical rod pumped from one (left) or two sides

Concept of cooling

The Ti:Sapphire rod is floated with water inside a pump chamber with two side windows (AR coated for 532nm).

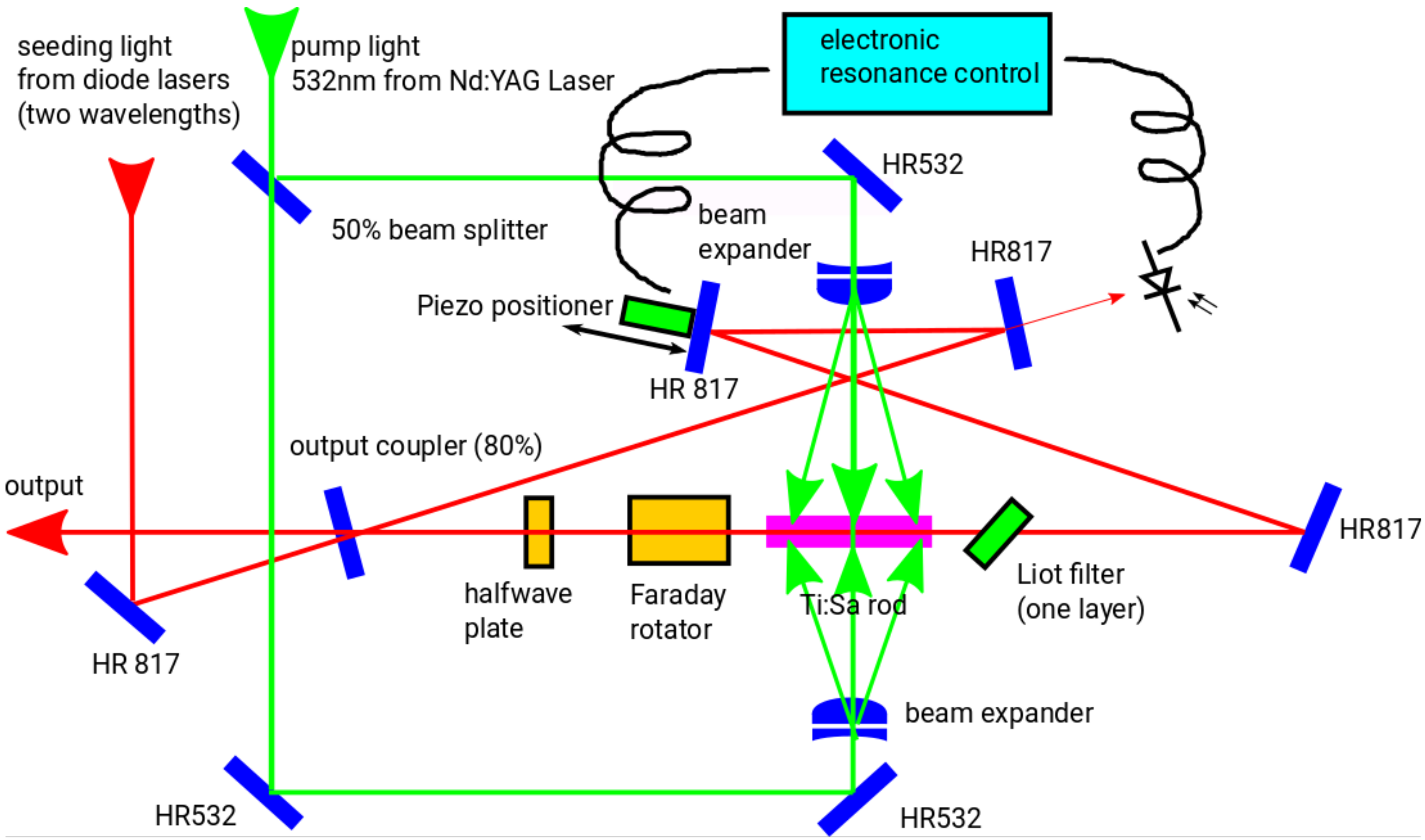
The water is circulated through a small cooling device (100 W Colling power).





Transversely pumped Ti:Sapphire in its operating setup

Resonator design



Setup similar to Metzendorf et al., ILRC 2017, Bucharest

Electronic concept of seeding and resonator control

General conept:

- Resonator is tuned to the on wavelength from the the seed laser

- The off wavelength is tuned to fit into the resonator

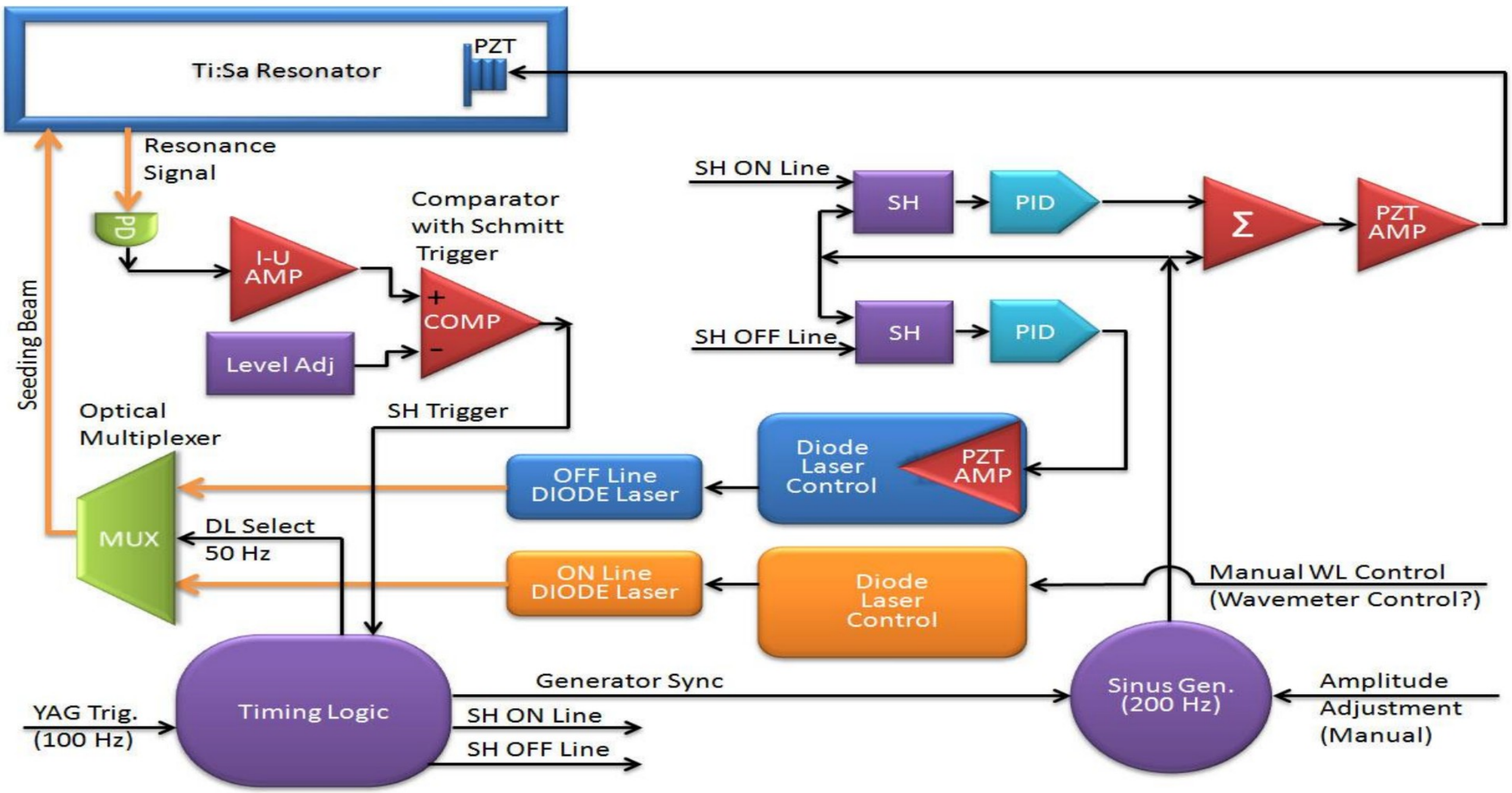
Technical implementation:

- The tuning mirror of the resonator is driven with a 200 Hz sine (Laser runs with 100Hz).

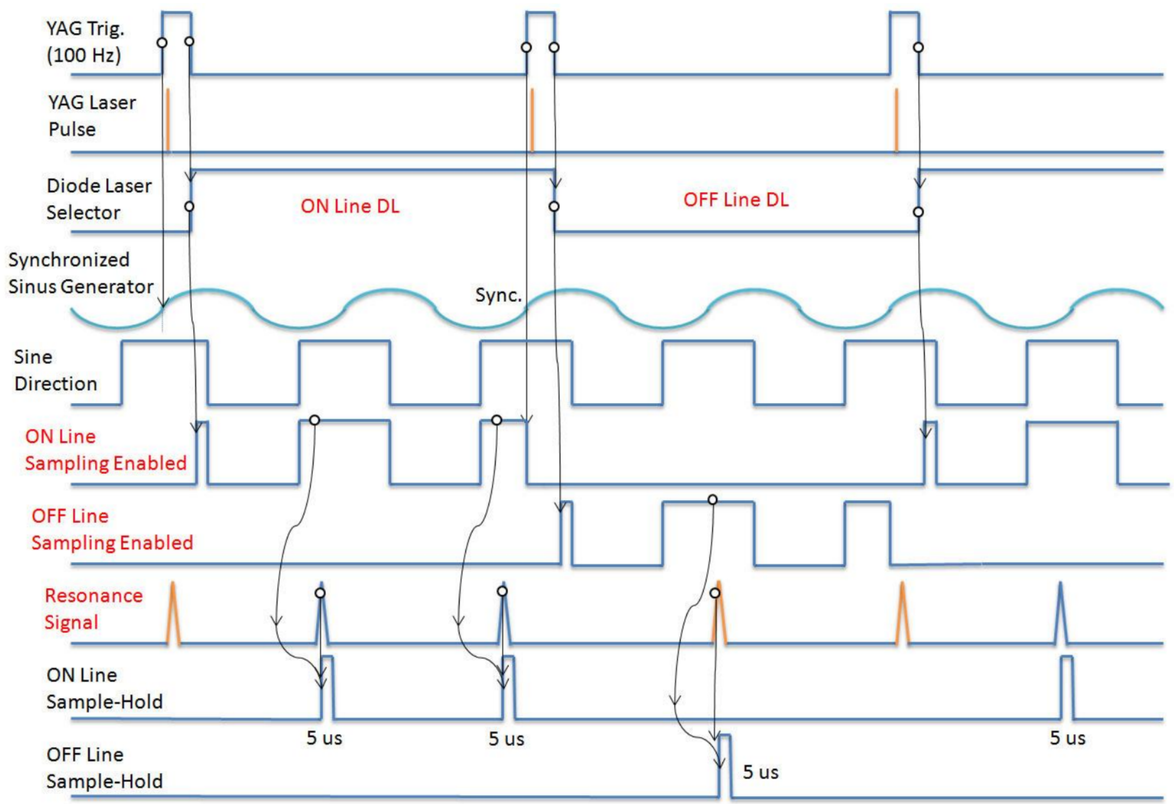
- Via a sample and hold circuit fed into a PID control, an offset is added to the sine until resonance of the on wavelength is reached and kept stable.

- A second sample and hold circuit detects the resonance of the off wavelength. Via a second PID control this wavelength is electronically tuned (resonator length of seeding laser) and also kept stable with respect to the main resonator tuning for the on wavelength.

Electronic concept of seeding and resonator control



Timing and logical cycle of seeding an resonance



Details and explanation in personal discussion via email.

Achieved specifications

Pumping: - 100Hz
- 27W @ 532 nm

Output: - 2.9 W @ 817 nm (approx. 2 W in stable operation)
- Beam divergence < 2 mrad
- Beam diameter 4mm
- Spectral purity > 99%
  (estimated from absorption in humid air)
- Pulse length about 50ns

Drawbacks in current the setup during the CHEESEHEAD campaign:

- very sensitive to temperature changes caused by the hysteresis of the air condition.
- very sensitive to vibrations from mechanical devices as cooling aggregates, ventilation.

Further Steps

- Better stabilization of the temperature of the laser setup.

- Mechanical decoupling from vibrations of cooling divices and other sources of noise.

- Characterizing the laser in more detail (e.g. precicesely measuring M^2)

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Thank you for attention!

Acknowledgments:

Bundesministerium für Wirtschaft within the ZIM Program for funding the development of the transversely pumped Ti:Sapphire laser used in this project.

Radiant Dyes Lasers & Accessories GmbH for developing the control electronics of the master oscillator and the motorized wavelength control of the seed lasers.

University of Hohenheim (V. Wulfmeyer, A. Behrendt, S. Metzendorf and F. Späth) for their technical support and sharing experiences from a development of a laser for the same purpose.