

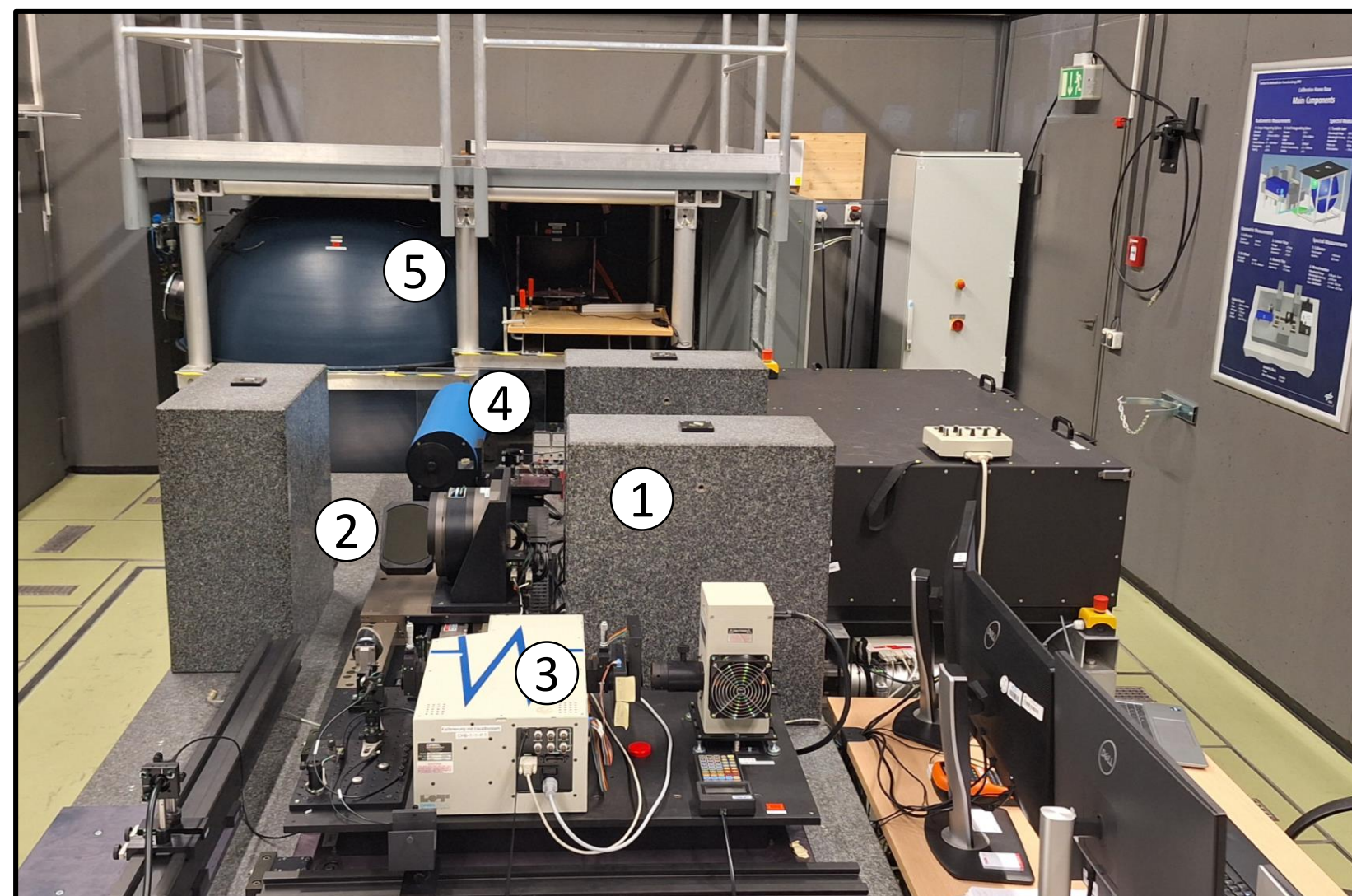
DLR's Calibration Home Base (CHB) for Imaging Spectrometers: Equipment and Knowledge for Air- and Spaceborne Instruments

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What is the CHB?

- Calibration laboratory for airborne imaging spectrometers
- Equipment + knowledge also for spaceborne instruments
- Established in 2007, partly funded by ESA
- Ongoing improvements
- Open to third party customers



CHB laboratory: calibration bench (1), folding mirror (2), monochromator (3), collimator (4), integrating sphere (5)

Capabilities

Geometric calibration

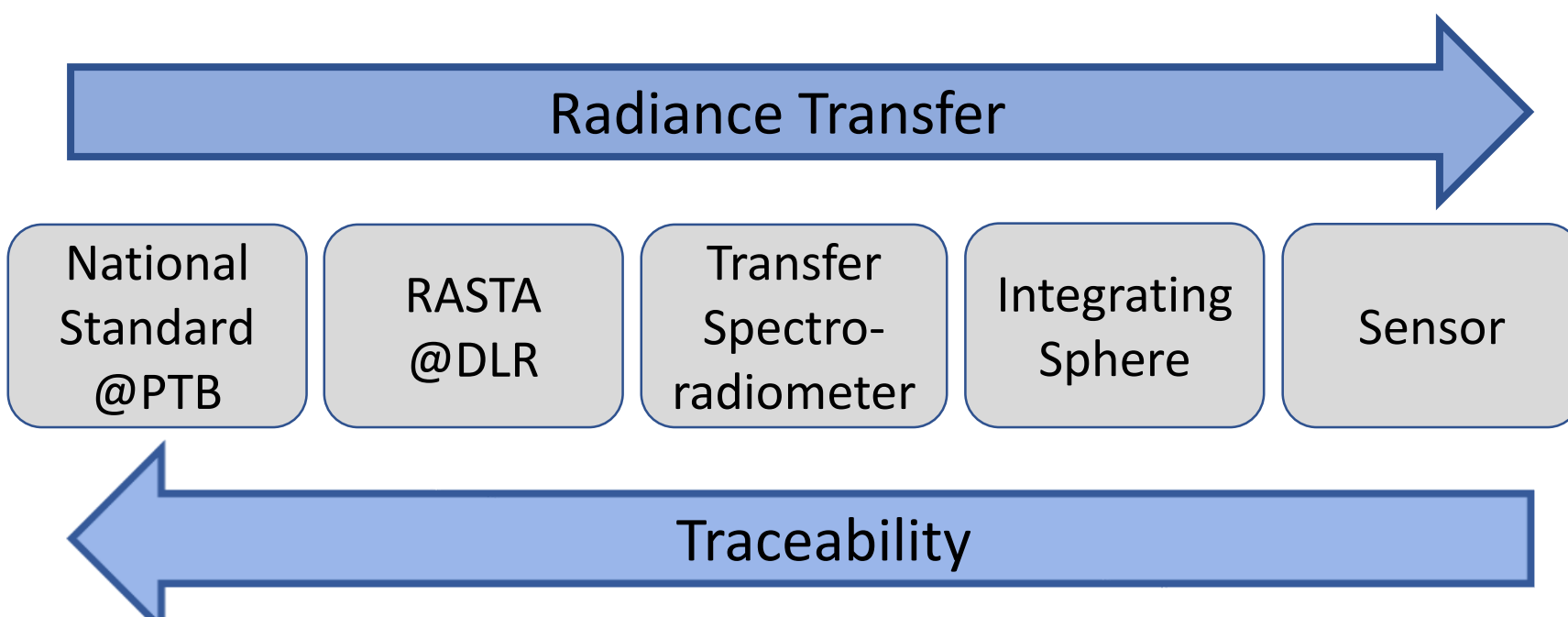
- Automated collimator setup with several targets
- Angular range: $\pm 25^\circ$ with $\pm 6 \mu\text{rad}$ accuracy
- Sensor aperture: $\varnothing < 10 \text{ cm}$

Spectral calibration

- Monochromator setup
- Spectral range: 380 - 2500 nm
- Uncertainty: $\pm 0.1 \text{ nm}$ (VNIR), $\pm 0.2 \text{ nm}$ (SWIR)

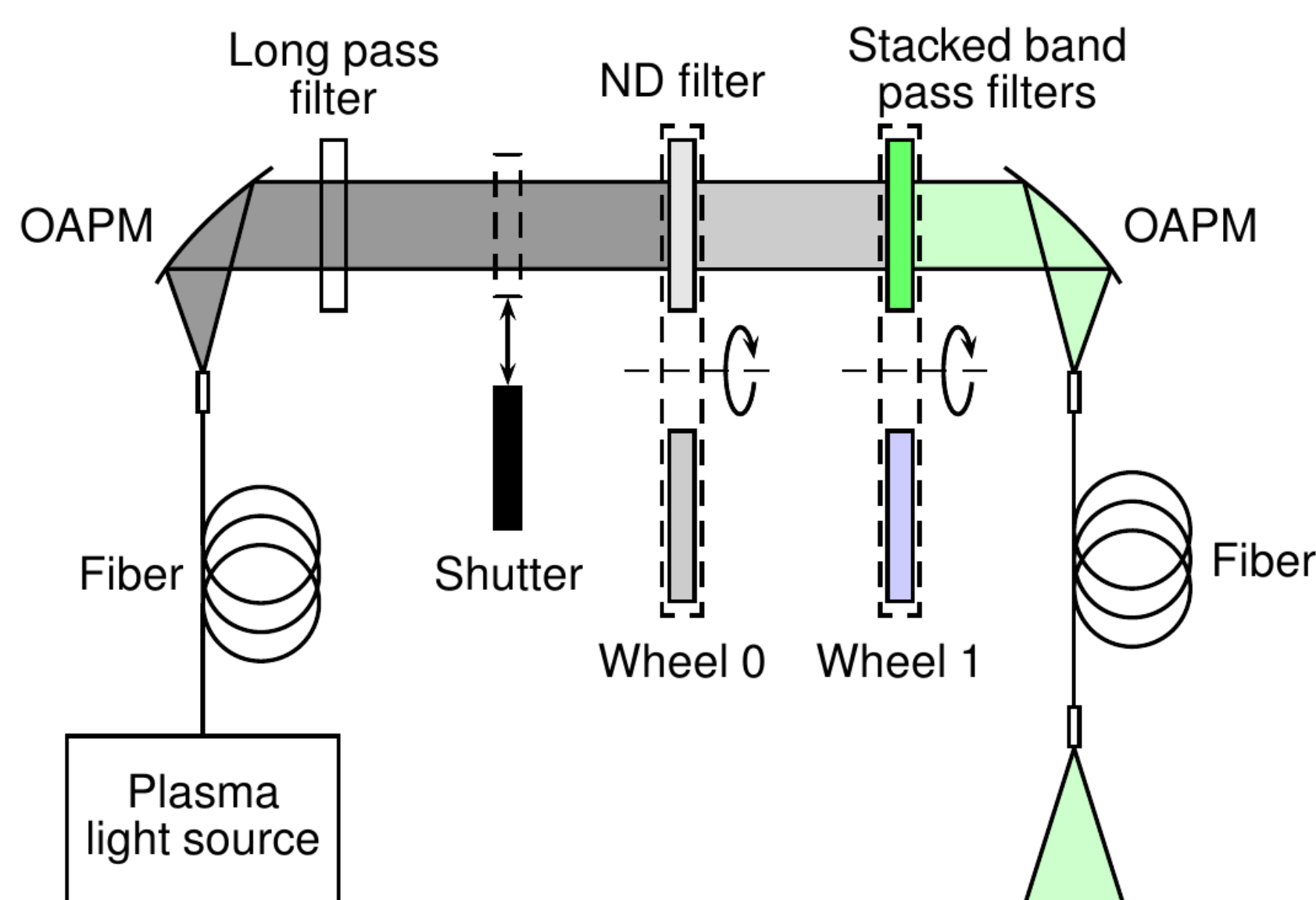
Radiometric calibration

- Traceable to PTB (German Metrology Institute)
- RASTA: self-monitoring secondary RAdiance STAndard
- Integrating sphere with diameter of 165 cm
- Radiometric uncertainty (after transfer): $< 3\%$ ($k = 2$)



Stray light calibration

- Stray Light Test Source (SLTS) developed by DLR
- Combination of 15 stacked bandpass and 11 ND filters
- SLTS output guided to collimator via optical fiber
- Out of band suppression $> 80 \text{ dB}$



Non-linearity calibration

- Broadband Attenuable Light Source (BAyLIS)
- Light addition method
- Spectral range: 350 - 2500 nm

Polarization sensitivity calibration

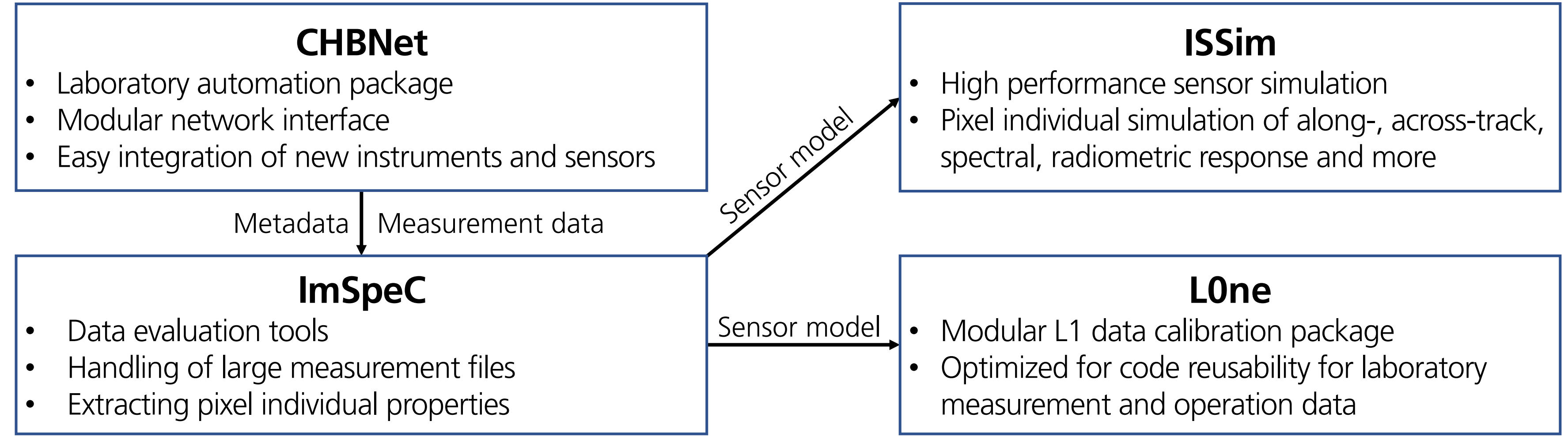
Broadband wire grid polarizer

Temperature response calibration

Scalable temperature controlled enclosure

Software

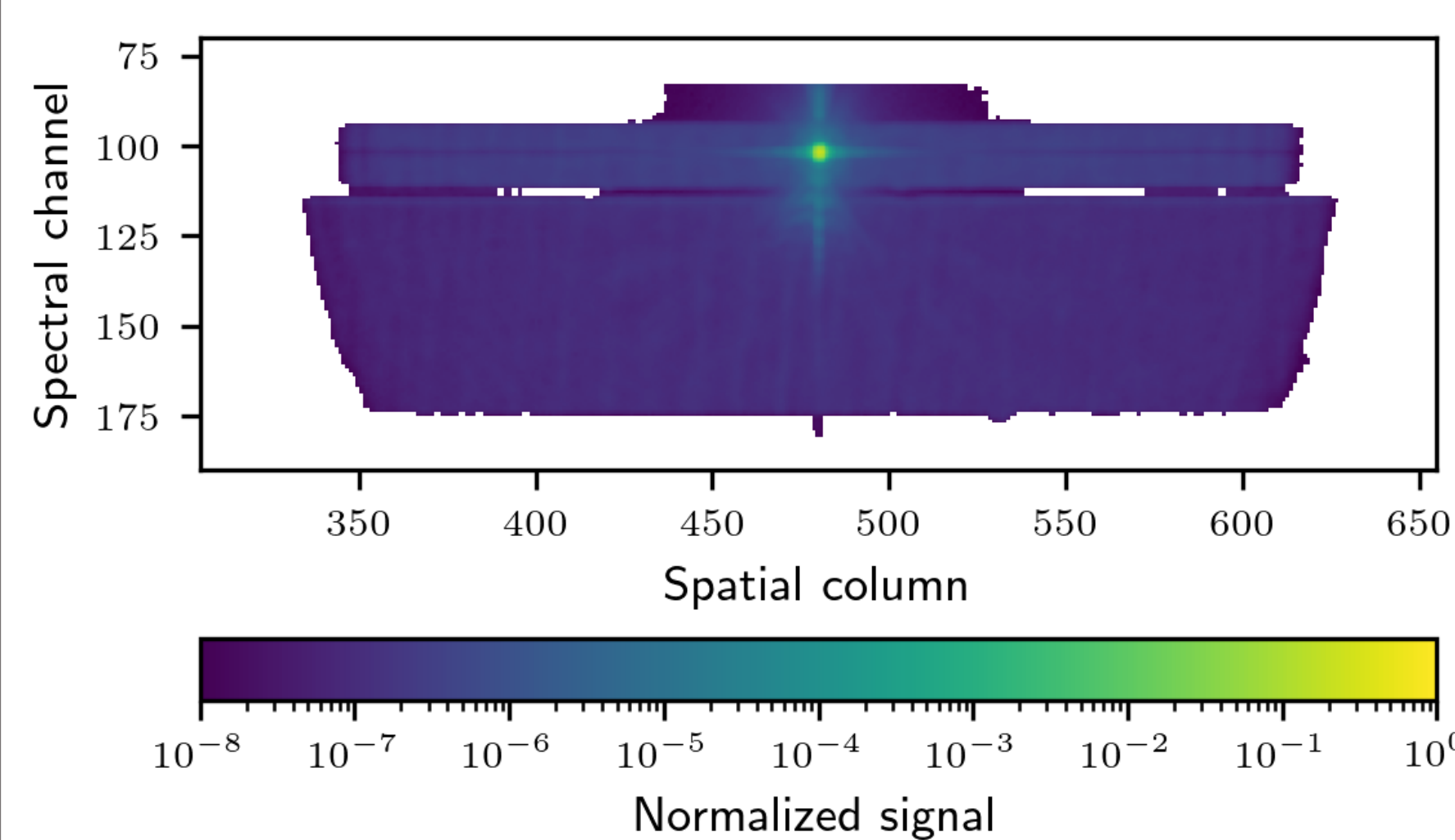
Developed and used in the context of CHB



Selected Activities

EnMAP mission (OHB)

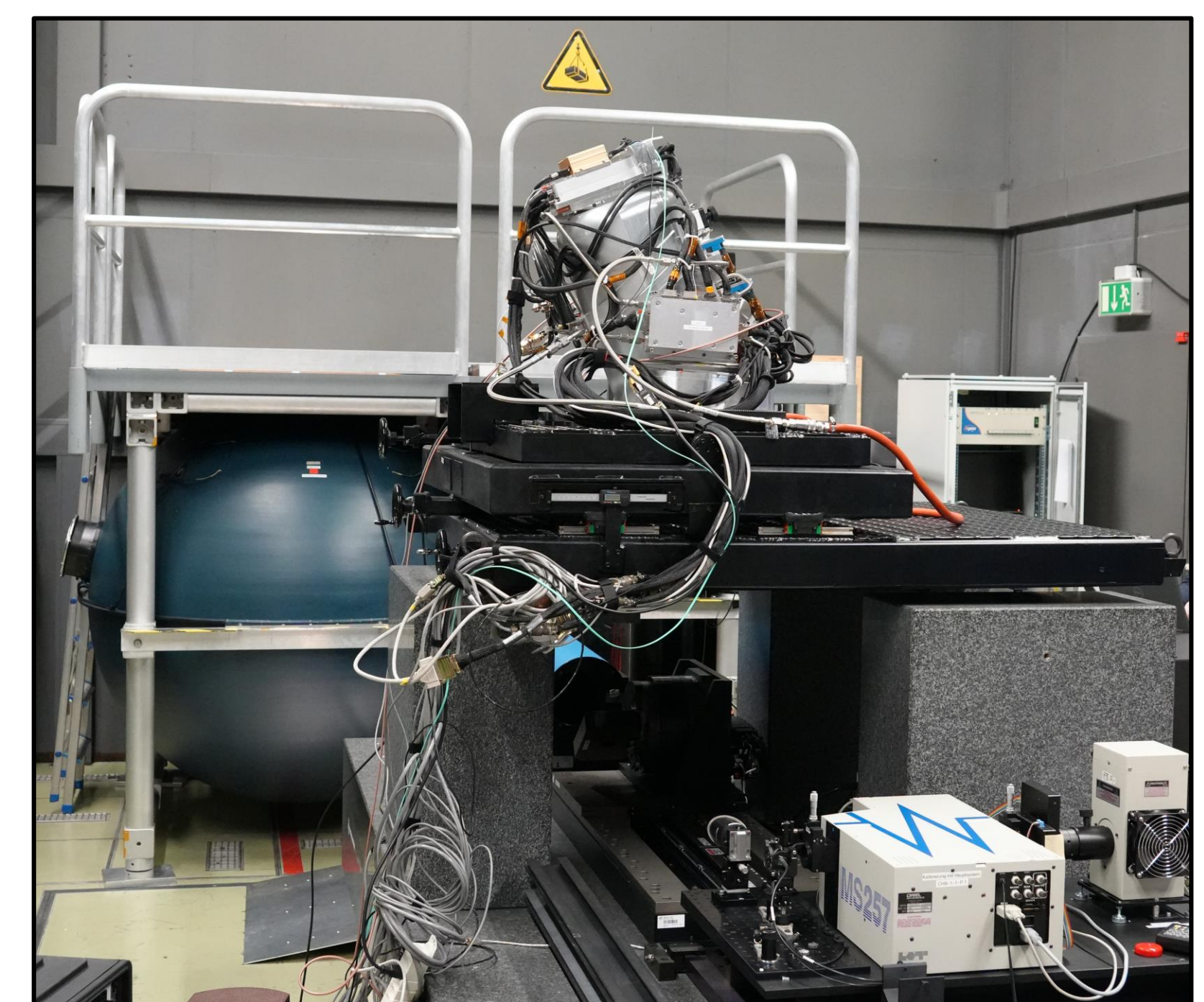
- Consultancy
- Radiometric calibration using CHB's
 - RASTA (RAdiance STAndard)
 - Transfer spectroradiometer
 - Integrating sphere
- Stray light calibration under lead of CHB personnel with CHB's Stray Light Test Source (SLTS)



Stray light point spread function of EnMAP's VNIR spectrometer

UZH's AVIRIS-4 (NASA/JPL)

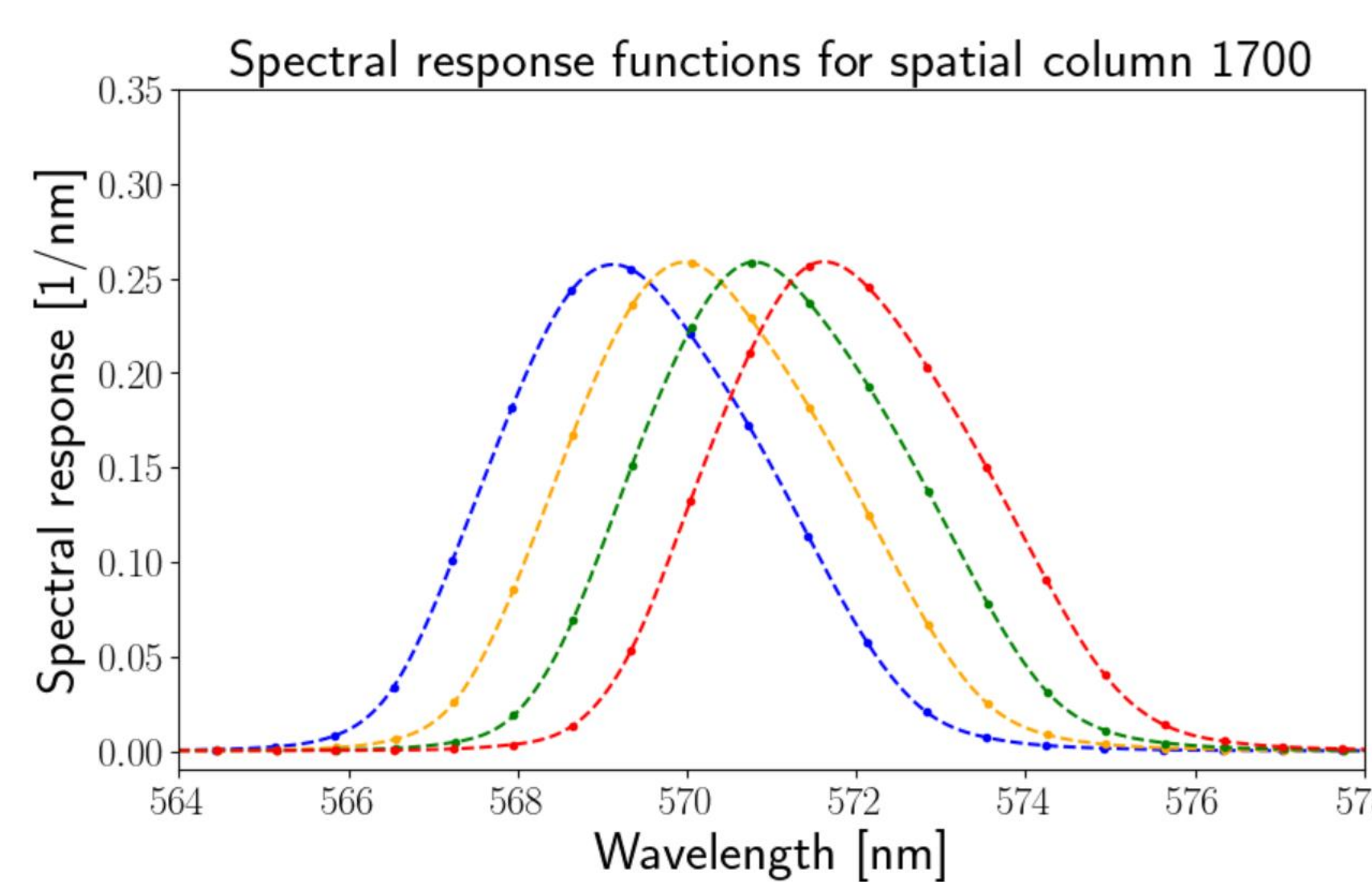
- Operated by University of Zurich, Switzerland
- October 2024: initial calibration of geometric, spectral and radiometric properties
- Further campaigns for stray light, polarization, etc. are planned



AVIRIS-4 mounted for geometric and spectral calibration

DLR's HySpex VNIR-3400N and SWIR-384 (NEO)

- Our own instruments
- Recurring calibrations
- Testbed for improving and developing new calibration methods



HySpex VNIR-3400N's spectral calibration results

Upcoming improvement: Tunable laser system

- Ekspla NT262
- Spectral range: 210 - 2600 nm
- Spectral calibration (coupled to integrating sphere)
- Stray light calibration (coupled to collimator)
- Delivery January 2025

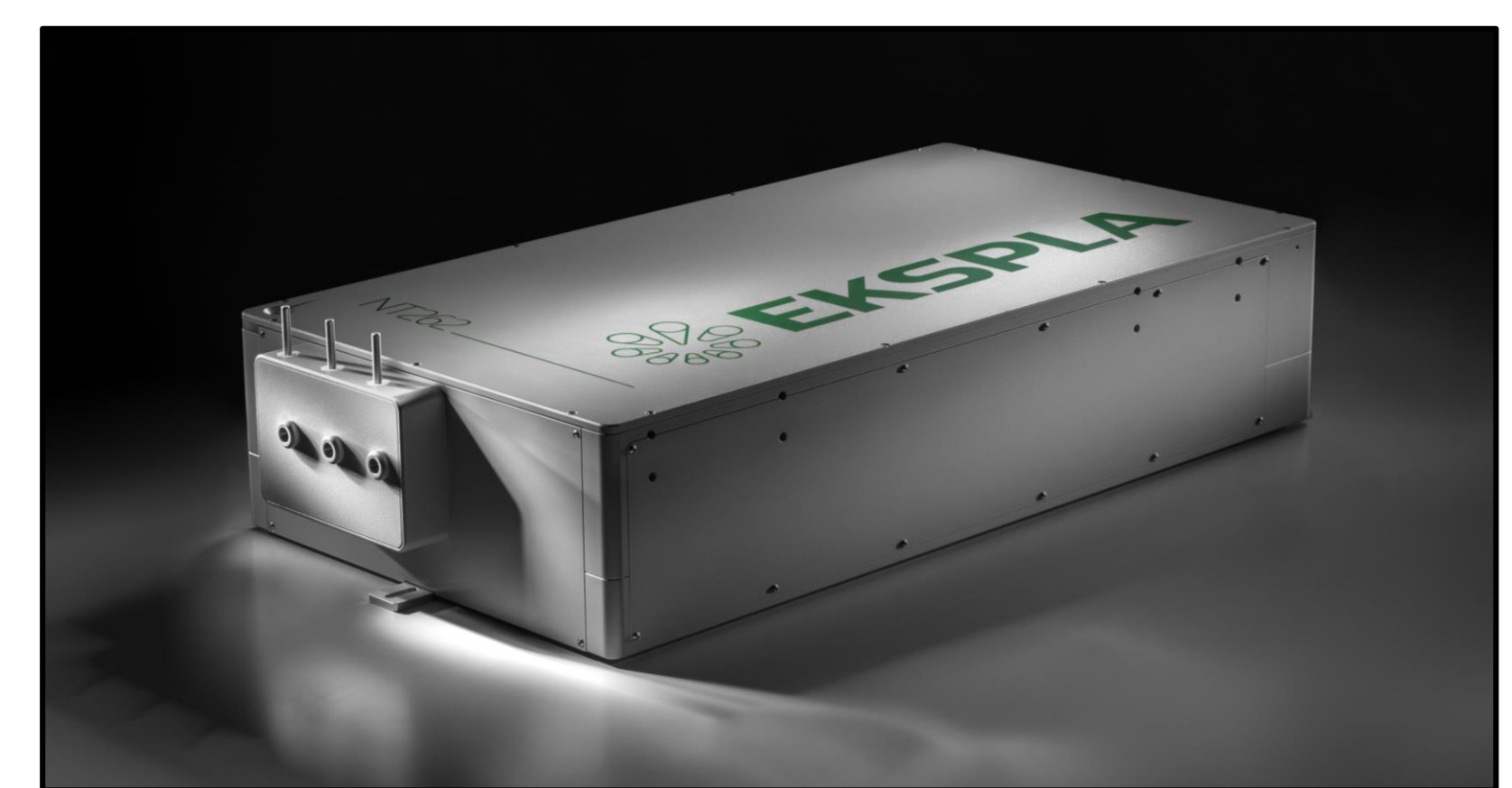
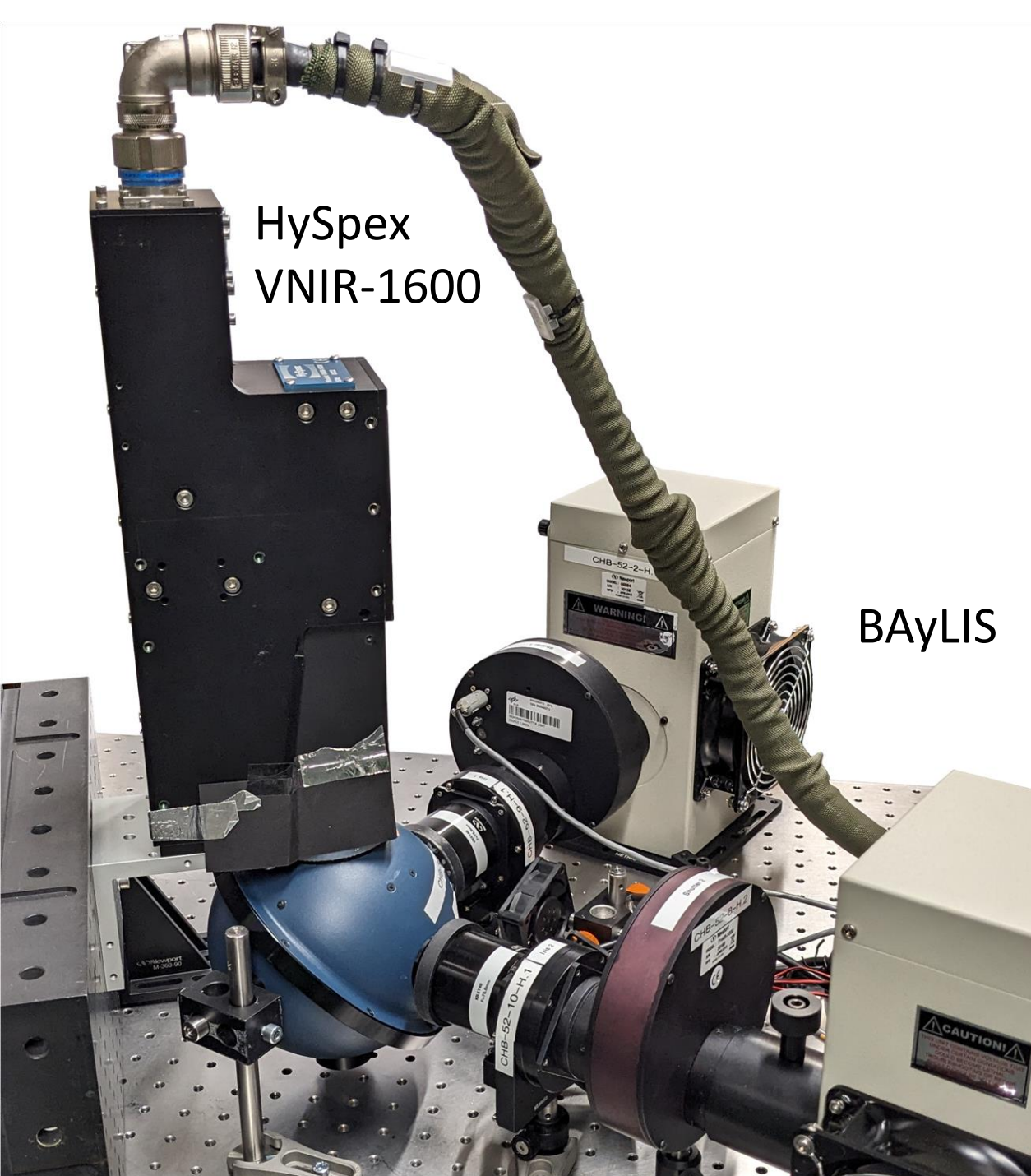


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Link to CHB's website for further readings and contact
<https://www.dlr.de/en/eoc/research-transfer/expertise/spectrometry/calibration-home-base>

