Automatic wavelength calibration module for GoyaLab visible spectrometers

Introduction

Maintaining wavelength accuracy is critical in spectroscopy. Over time, optical components may undergo thermal, mechanical, or aging effects that introduce small spectral shifts. Such deviations, even of a few nanometers, can affect analytical precision and long-term reproducibility.

To ensure consistent performance across all its visible spectrometer models, **GOYALAB** has developed a universal **AutoCal module**.

This add-on device enables **automatic wavelength calibration** for all GoyaLab spectrometers operating in the **visible range (380–780 nm)**. When connected, AutoCal is recognized directly by the **SpectroLab software**, where it activates a dedicated calibration interface designed to perform full-spectrum wavelength correction in a single step.

Objective

The goal of this study is to demonstrate the operating principle and efficiency of the **AutoCal module**, showing its ability to:

- Automatically detect and correct wavelength drift across all visible spectrometers
- Perform multi-point wavelength calibration using internal fluorescent standards
- Maintain long-term accuracy and reproducibility of GoyaLab spectrometers without external reference lamps

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Methodology

Spectrometer description

The **AutoCal module** is fully compatible with all **GoyaLab spectrometers operating in the visible range**, including the **IndiGo VIS series (380–780 nm)**.

Module description

The **AutoCal module** is designed to be **mechanically mounted onto the IndiGo spectrometer**. Once attached, it is powered and controlled directly by the IndiGo.

Upon launching **SpectroLab**, the software automatically detects the presence of the AutoCal module and unlocks a dedicated calibration tab named **Auto-Calibration**.

The system integrates a **UV LED excitation source at 365 nm**, which illuminates a **fluorescent glass tile doped with rare-earth elements**. This reference tile emits **more than ten characteristic fluorescence peaks** evenly distributed across the visible spectrum, serving as stable wavelength calibration points for the instrument.

Calibration principle against laboratory references

The autocalibration sequence is fully managed through the **SpectroLab** software:

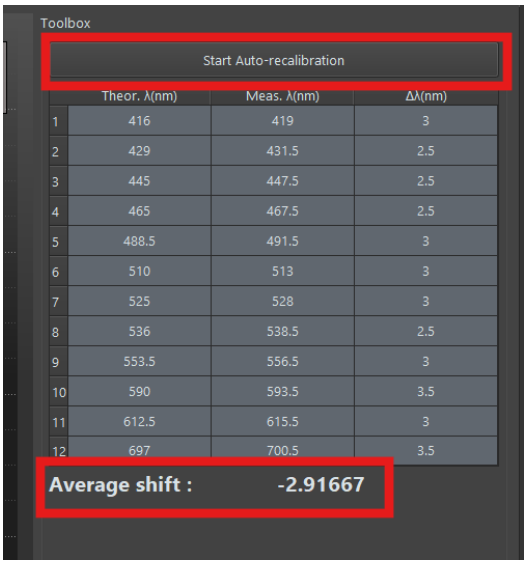
1. The user clicks **“Start Auto-recalibration”**, which activates the **UV excitation source (365 nm)** and begins the calibration process. The initial spectrum is then **recorded and displayed in white** on the screen.
2. The software **detects the fluorescence peaks**, compares them to the **theoretical**

wavelength database, and calculates the **average spectral shift (Δλ)**.

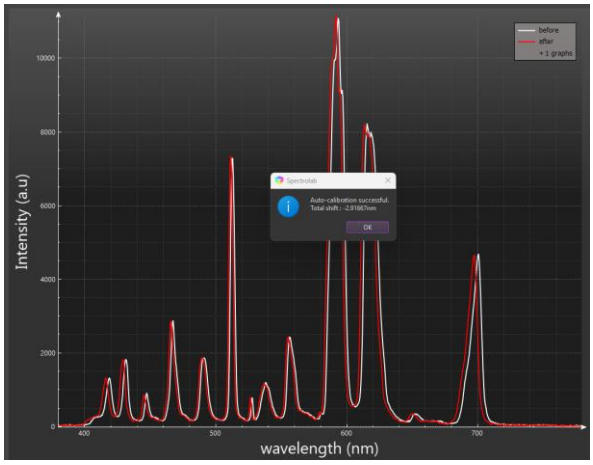
3. This correction factor is **automatically applied** to recalibrate the instrument's wavelength scale.

4. A **new corrected spectrum** is then acquired and displayed in **red**, aligned with the reference peaks.

This automated process completes in **less than 30s**, with **no user intervention** or external reference required.



The figure below illustrates a typical automatic wavelength calibration performed using the AutoCal module.
Before correction (white curve), a small offset was observed between measured and theoretical peaks. After correction (red curve), all peaks are perfectly aligned.



This result confirms that the AutoCal module accurately detects and compensates for systematic wavelength drift, maintaining sub-nanometric precision across the entire visible spectrum.

Discussion

The **AutoCal module** brings a new level of reliability and autonomy to GoyaLab's visible spectrometers. Its integrated fluorescent reference eliminates the need for external calibration lamps or manual realignment procedures.

By automating the wavelength correction process, AutoCal ensures that each measurement begins with a spectrometer that is **immediately and precisely calibrated**, regardless of usage conditions or time since the last calibration.

This approach guarantees:

- **Full-spectrum accuracy** using more than ten reference peaks
- **Real-time correction** of any spectral drift
- **Improved reproducibility and traceability** of spectral data over time

AutoCal transforms calibration from a manual operation into a **fully automated, reliable process**, enhancing both productivity and measurement confidence.

Conclusion

The **AutoCal module** is a **dedicated calibration accessory** for all **GoyaLab IndiGo VIS spectrometers (380–780 nm)**.

By providing a fully automated, fluorescence-based wavelength calibration directly integrated into **SpectroLab**, AutoCal ensures long-term **accuracy, stability, and ease of use**.

This innovation strengthens the analytical reliability of GoyaLab's spectrometers for all visible-light applications — from colorimetry and fluorescence analysis to industrial process monitoring.