NIRLAB

ON-DEMAND SOLUTIONS

The Revolution
of Substance Analysis

Empowering your organization to develop mobile lab applications that enable instant analysis of anything, anywhere.

NIRLAB AG

Mobile AI lab to analyze anything anywhere instantly.
Established in 2018, NIRLAB AG, a Swiss spin-off from the University of Lausanne, has revolutionized the way professionals and organizations analyze materials using NIR and Raman spectroscopy and advanced machine learning.
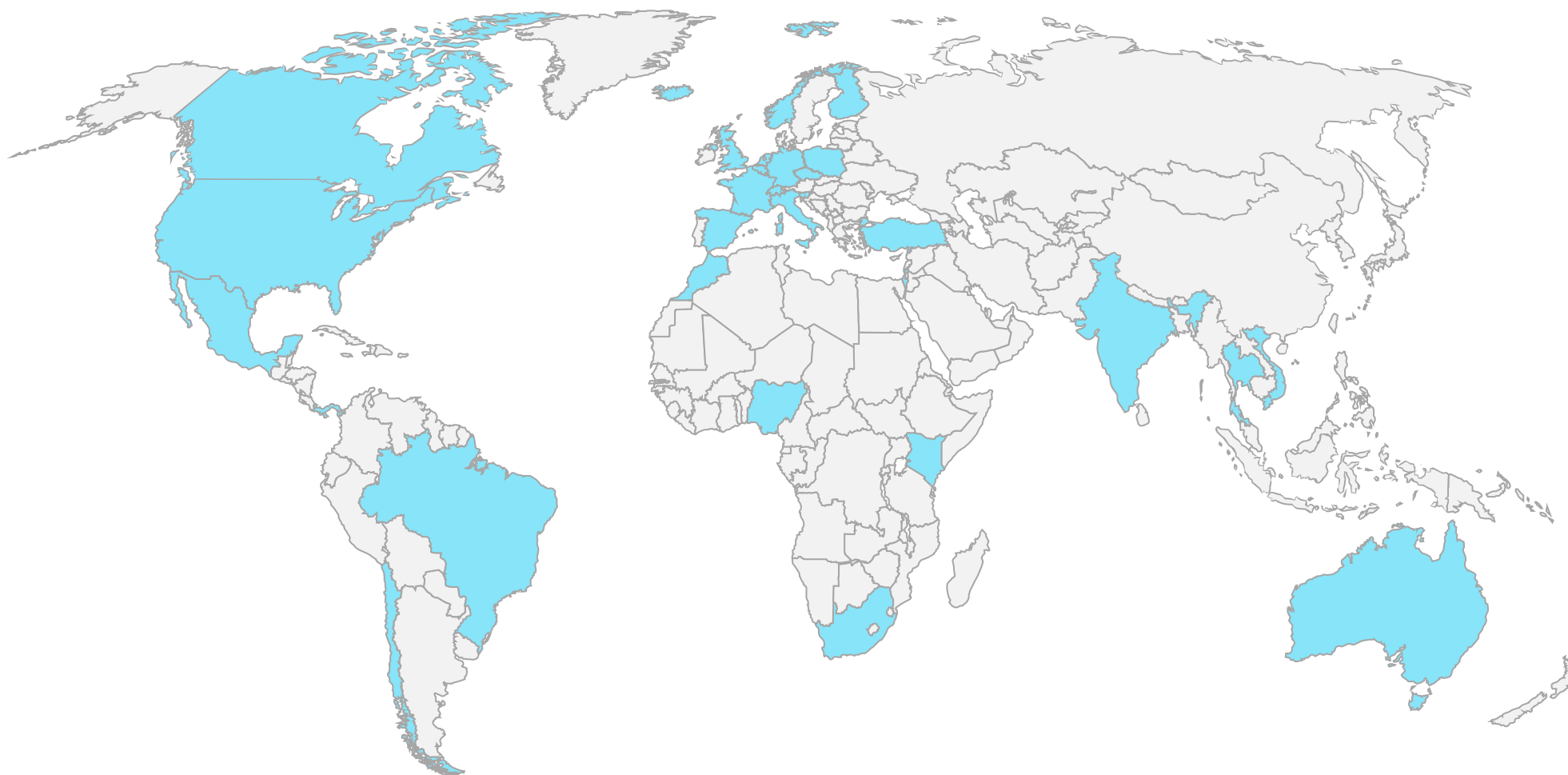
"With our digital ecosystem we bring high precision labs to the field and enable rapid decision making based on trustable data."

Florentin Coppey, Founder NIRLAB AG

GLOBAL PRESENCE

Scanning Substances in +35 Countries across the Globe

Pioneering Scientific Innovation

At NIRLAB, we're more than just a business; we're at the cutting **edge of scientific discovery**.

Our esteemed partnership with the **Forensic Institute of the University of Lausanne** in Switzerland has made us a recognized name in global scientific circles.

Our **contributions to top-tier forensic, science, and pharmaceutical journals** validate our commitment to advancing knowledge and pushing technological frontiers.

UNIL | Université de Lausanne

RESEARCH ARTICLE

Cloud-Enabled Handheld NIR Spectroscopy: A Transformative Approach for Real-Time Forensic Analysis of Cannabis Specimens

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Robert Deschenaux on the occasion of his retirement

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Providing illicit drugs results in five seconds using ultra-portable NIR technology: An opportunity for forensic laboratories to cope with the trend toward the decentralization of forensic capabilities

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ABSTRACT

The analysis of illicit drugs faces many challenges, mainly regarding the production of timely and reliable results and the production of added value from the generated data. It is essential to rethink the way this analysis is operationalised, in order to cope with the trend toward the decentralization of forensic applications. This paper describes the deployment of an ultra-portable near-infrared detector connected to a mobile application. This allows analysis and display of results to end users within 5 s. The development of prediction models and their validation, as well as strategies for deployment within law enforcement organizations and forensic laboratories are discussed.

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New perspective for the in-field analysis of cannabis samples using handheld near-infrared spectroscopy: A case study focusing on the determination of Δ⁹-tetrahydrocannabinol

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ABSTRACT

The aim of the present study was to explore the feasibility of applying near-infrared (NIR) spectroscopy for the quantitative analysis of Δ⁹-tetrahydrocannabinol (THC) in cannabis products using handheld devices. A preliminary study was conducted on different physical forms (entire, ground and sieved) of cannabis inflorescences in order to evaluate the impact of sample homogeneity on THC content predictions. Since entire cannabis inflorescences represent the most common types of samples found in both the pharmaceutical and illicit markets, they have been considered priority analytical targets. Two handheld NIR spectrophotometers (a low-cost device and a mid-cost device) were used to perform the analyses and their predictive performance was compared. Six partial least square (PLS) models based on reference data obtained by UHPLC-UV were built. The importance of the technical features of the spectrophotometer for quantitative applications was highlighted. The mid-cost system outperformed the low-cost system in terms of predictive performance, especially when analyzing entire cannabis inflorescences. In contrast, for the more homogeneous forms, the results were comparable.

The mid-cost system was selected as the best-suited spectrophotometer for this application. The number of cannabis inflorescence samples was augmented with new real samples, and a chemometric model based on machine learning ensemble algorithms was developed to predict the concentration of THC in those samples. Good predictive performance was obtained with a root mean squared error of prediction of 1.75 % (w/w). The Bland–Altman method was then used to compare the NIR predictions to the quantitative results obtained by UHPLC-UV and to evaluate the degree of accordance between the two analytical techniques. Each result fell within the established limits of agreement, demonstrating the feasibility of this chemometric model for analytical purposes.

Finally, resin samples were investigated by both NIR devices. Two PLS models were built using a sample set of 45 samples. When the analytical performances were compared, the mid-cost spectrophotometer significantly outperformed the low-cost device for prediction accuracy and reproducibility.

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The Solution
for Your Organization

FIELDLAB for Onsite Analysis Tailored to your Needs

We provide your organization with high precision labs for the field in the fastest possible way.

Substance Library

The substance library consists of highly precise data models for the specific application areas and acts as reference library.
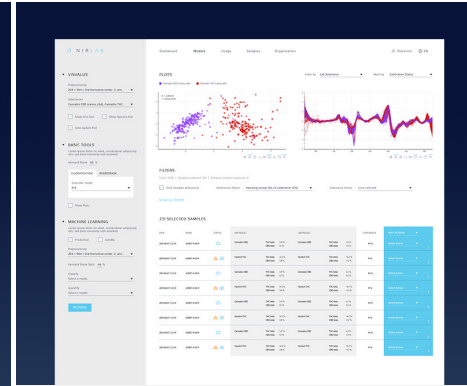
NIRLight

Substances can be easily scanned with NIR handheld devices. Device can be rapidly connected to a mobile NIRApp via Bluetooth.
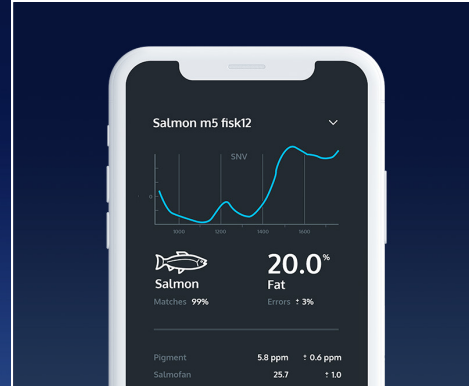
NIRApp

NIRApp (iOS/Android) displays the analysis results instantly and enables standardized data collection and processing in the field.

NIRWeb

Desktop app and browser-accessible platform for data, license and application management. Various dashboards enable valuable insights across all scans and devices.
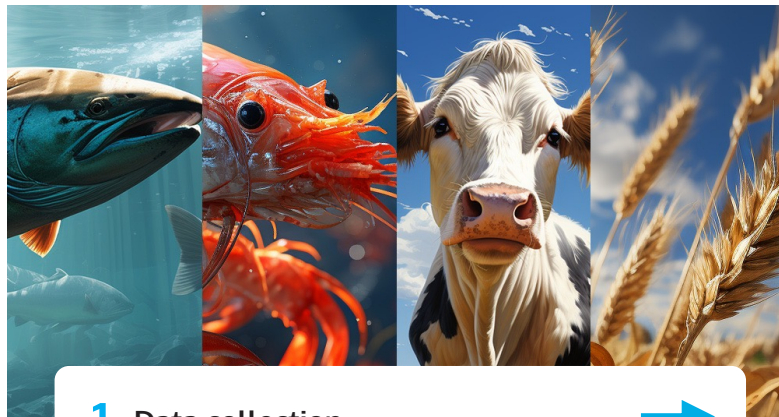
NIRCloud

Secure, high-speed server where analysis results and prediction models are trained and stored. Hosted on the University of Lausanne campus secured data center.

The Ecosystem for a Fast Go-to-Market

We provide an end-to-end solution to industries where instant identification and quantification of materials is required.

1 Data collection

R&D support

Data collection

Creating reference library

Associate laboratory results

2 Data Modelling & Calibration

Chemometric Suite

Modelling & dataset development

Data management & machine

learning

Validation

3 Release & Go-To-Market

Fieldlab

Handheld NIR-device

Mobile app with instant reporting

Desktop app- and browser-accessible platform

How it works

From data acquisition to production, a highly automatized and customizable solution.

| Create Reference Library | → | Associate Laboratory Results | → | Modelling, Dataset Selection | → | Machine Learning | → | Validation Phase | → | Release to production |
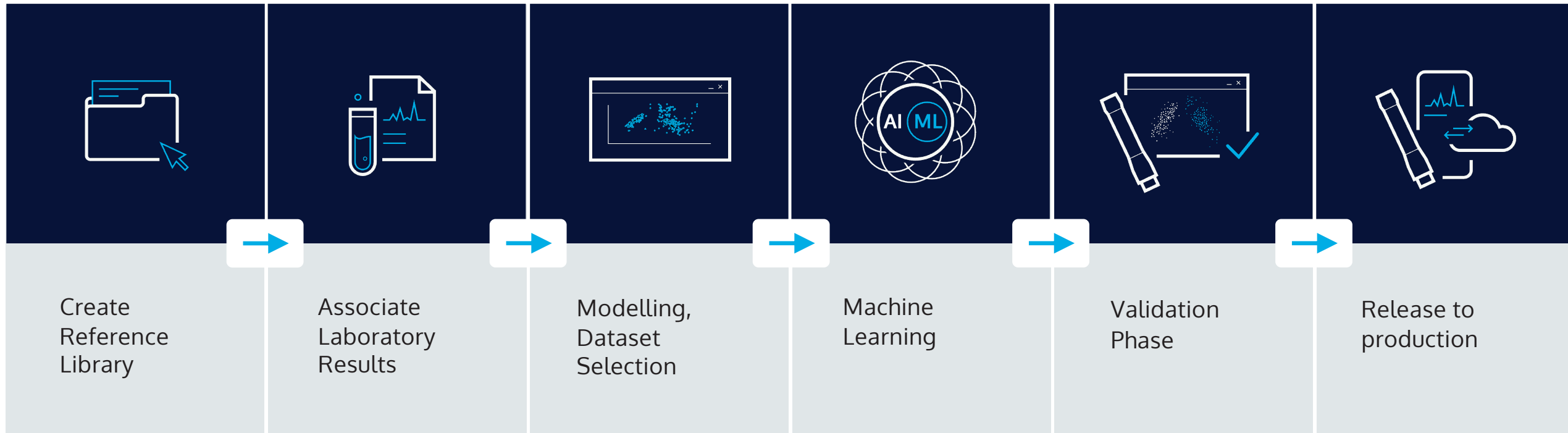
FIELDLAB by NIRLAB

High-precision handheld screening device for identifying and
quantifying of substances across various industries.

NIRLight

+ **Signal to Noise Ratio**
  Among the highest in the field of handheld devices.

+ **Wireless, compact, rugged and ergonomic.**
  Designed for use in the field as well as in the laboratory.

+ **IP65 and IP67 rated**
  Made for wet and dusty environments.

+ **Destruction-free analysis**
  Little or no sample preparation is needed. No special training required.

+ **No maintenance**
  No maintenance is required. The glass and lamp are replaceable if broken.

+ **Long battery life**
  USB charging and 10 hours of continuous use.

+ **Bluetooth and USB**
  Simple and fast connectivity to tablet or PC.

NIRLab Mobile App

+ **User-friendly interface**
  Easy to use app and straight-forward results on screen.

+ **Instant reporting**
  Scanning results are shown on screen within seconds.

+ **Wireless usage**
  NIRLab app pairs with NIRLight via bluetooth and
  communicates with   servers via Wi-Fi or 3G.

+ **Easy and fast download**
  The iOS and Android app can be downloaded from
  Apple or Google store.

+ **Secured cloud**
  Complete set of applications communicating with a
  secured cloud to manage measures and results.
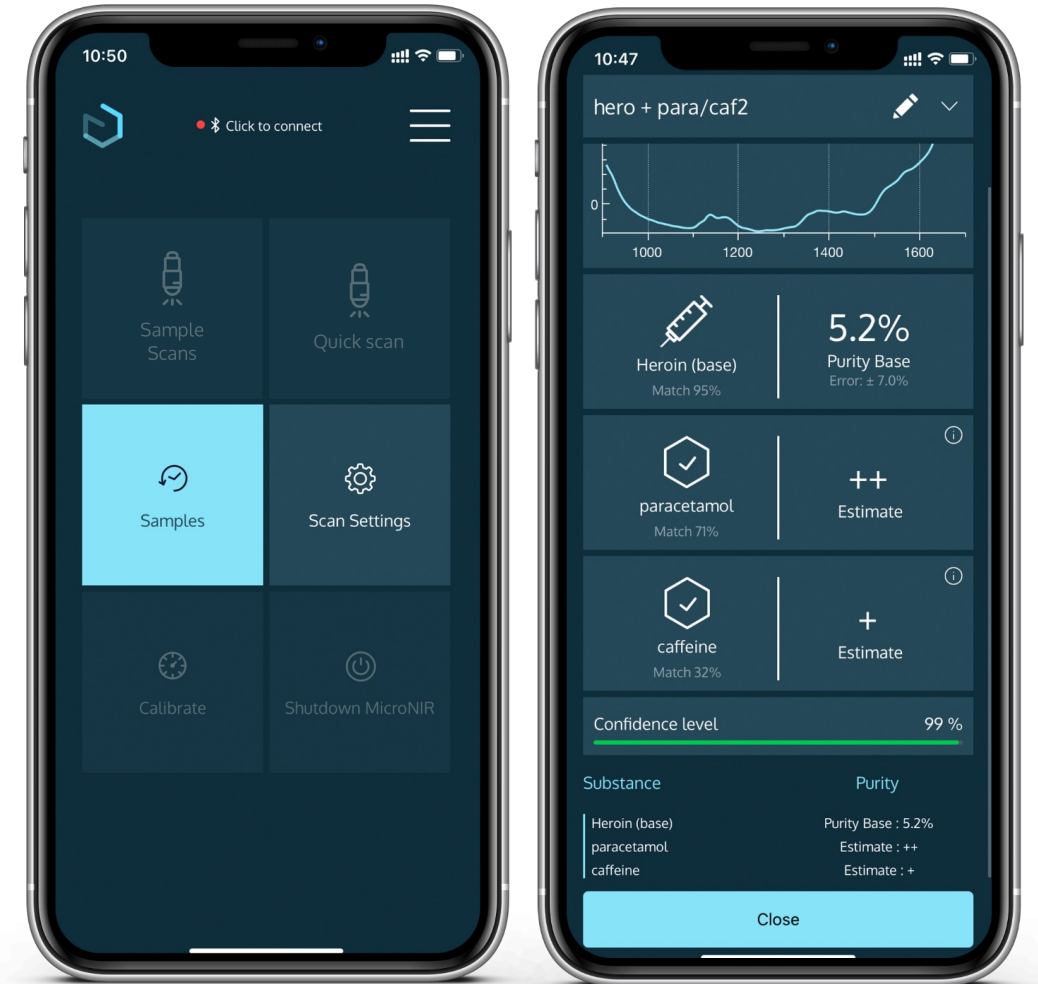
NIRLab Web App

THE SOFTWARE

Desktop app- and browser-accessible platform for data management.

+ Report history
Track, manage and compare scans across devices at one place.

+ Simple data management
Name, mark, delete or edit analysis results.

+ Export of data
Simple data export to Excel sheet.

+ Save as PDF
Download the analysis report and save it in PDF format.

+ User Management
Organizations and user management tool

Data Security

+ **Secured data center**
Cloud developed by top-level IT group from the School of
Computer Sciences in EPFL, Lausanne, hosted on the
university   campus secured data center.

+ **Encrypted**
Encrypted communication between mobile app and server.

+ **Full control**
Full control of the information shared in the cloud.

+ **Geolocation**
Geolocation of measurements can be turned on or off.

+ **No sensitive data**
Sample names are coded, and no suspect information is
shared.

On-Demand Developments

NIRLAB provides tailor-made services and on-demand development projects to companies across various industries.

+ **Development of new application areas for the identification and quantification of new material and substances**

+ **Integration of new NIR and Raman devices into the existing setting**

+ **White-labelling of our mobile and web application**

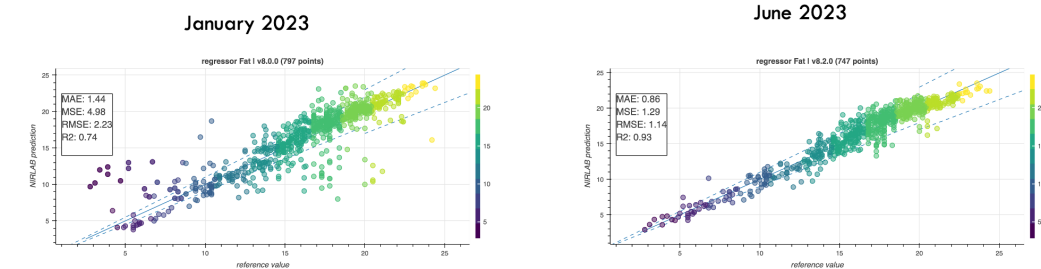+ **Consulting services on data acquisition, data modelling and calibration**

Example:
Falsification of medicine – the case of Viagra
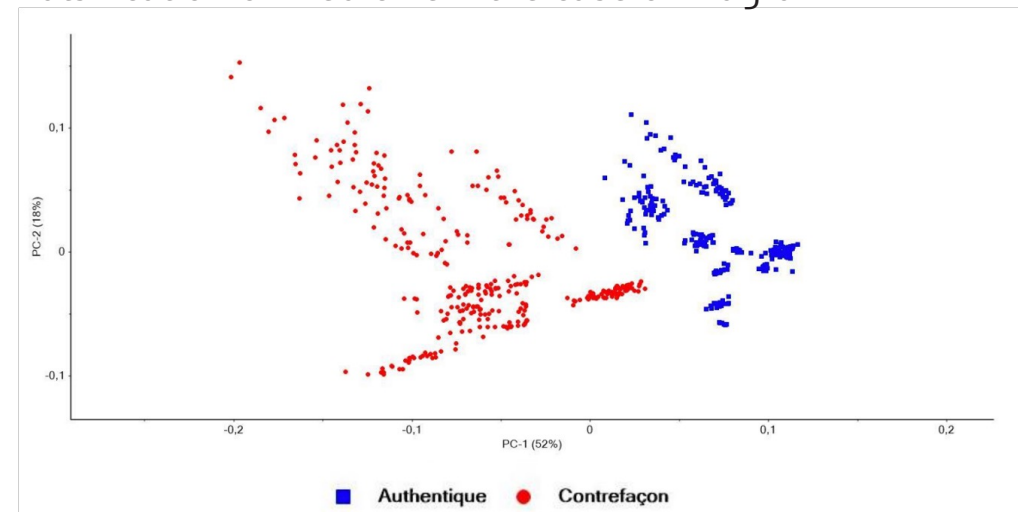
Example:
Fat content in fish


Root mean squared error reduced by 50% from 2.23 to 1.14

How it works

How it works

1. **Connect**
   Pairing of NIRLAB app and device is done automatically via Bluetooth connection following two steps:
   a) Turn on the device
   b) Open NIRLab app on mobile phone

2. **Scan**
   To perform a scan, point the device on a questioned substance and press the multifunctional button. Scan can be performed with direct contact or through a thin plastic bag.

3. **Read**
   After a few seconds, result of the scan is shown on the screen of your mobile phone.
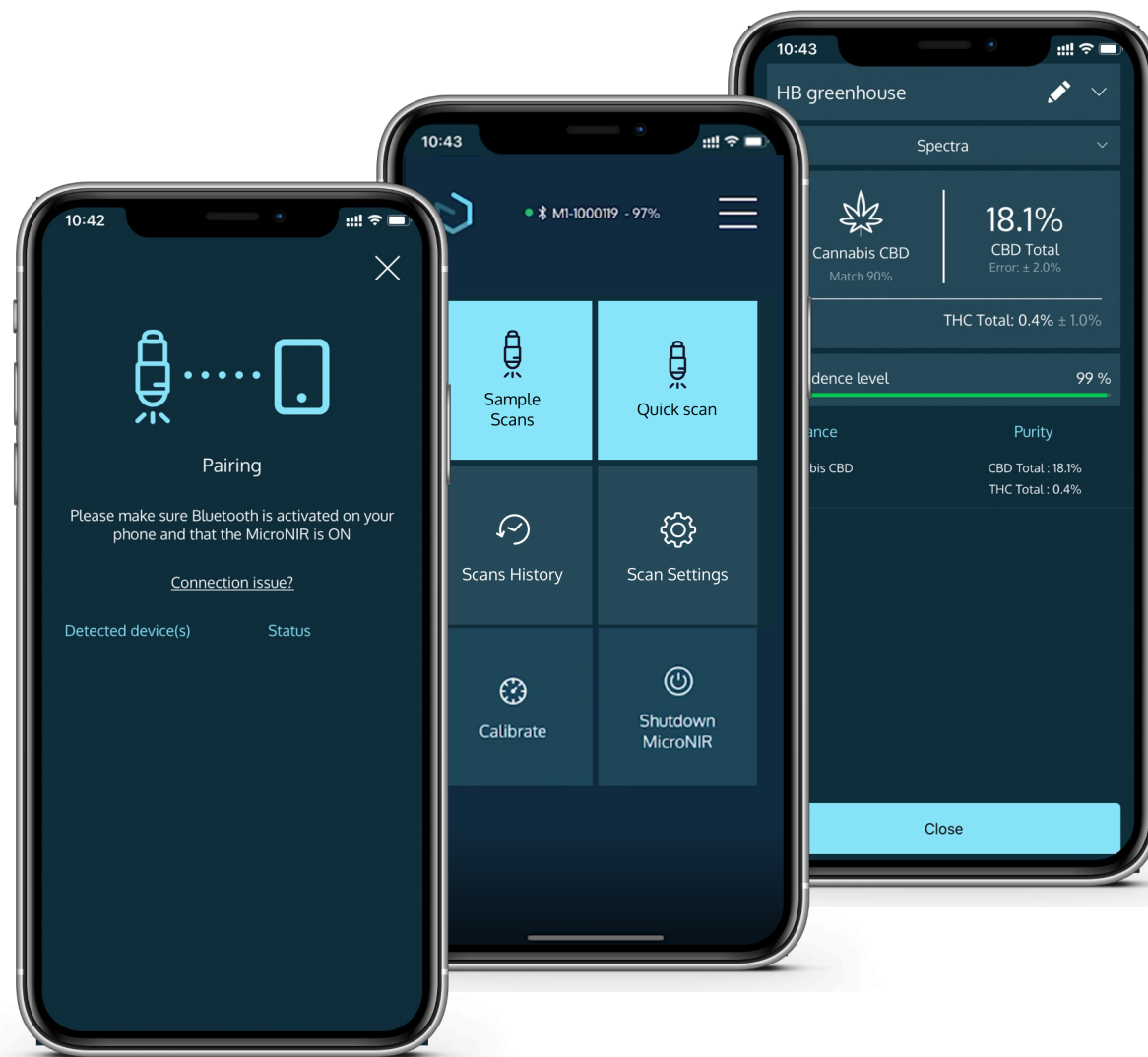
Calibration

At every start of the app, calibration needs to be performed.

1. To perform a calibration, apply the white reference mirror to the device.

2. Then click on *Calibrate* in the main menu of the app and push the multipurpose button on the device.

3. The process takes a few seconds and is done automatically.

TIP: We recommend to calibrate the device regularly according to the app's notification.
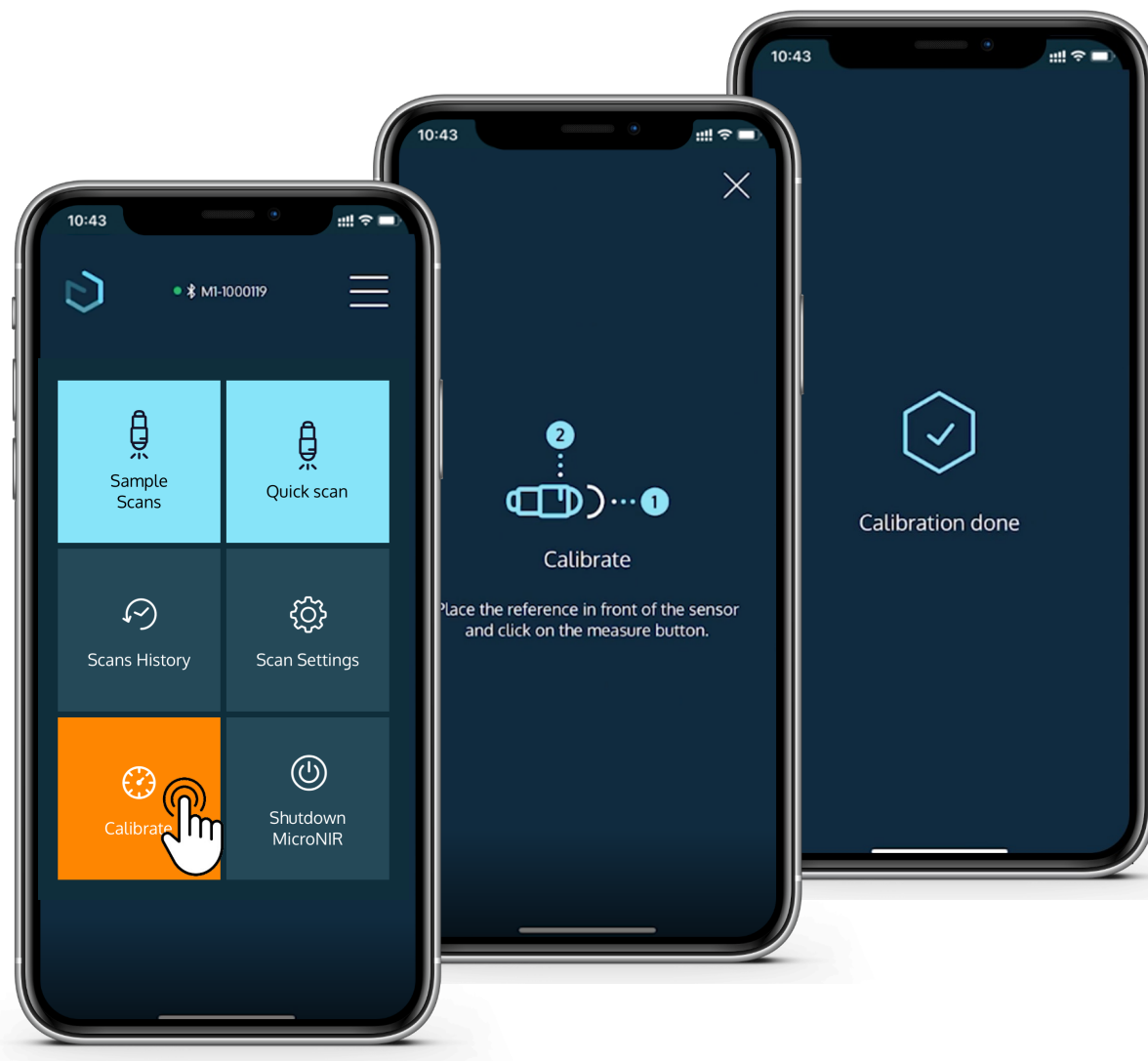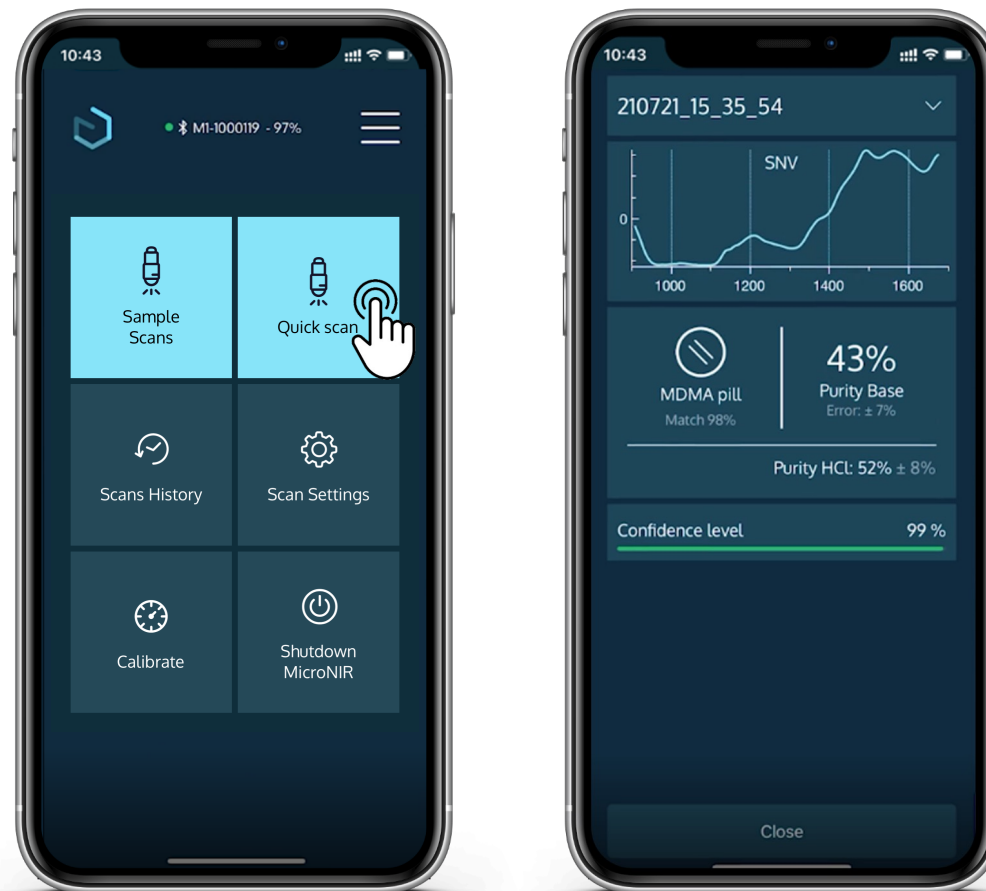
Quick Scan

Click on *Quick Scan* for rapid identification and quantification of a substance.

Procedure:

       1. Push the device button
       2. Wait a few seconds
       3. See the result on screen!

Sample Scan

Click on *Sample Scan* to get an average result of multiples scan to improve accuracy of quantification.

Procedure:

      1. Click on *Sample Scan*
      2. Fill in information about your sample
      3. Push the device button
      4. Wait a few seconds

      Repeat step 3. and 4. as many times as you need

      5. See the averaged result on the screen.

Scanning Tips

\+ **All substances can be measured in direct contact or through thin plastic.** Direct contact produces the best accuracy, especially for quantification.

\+ **The sapphire glass should be cleaned** before each scan. This can easily be done by a bit of ethanol on a tissue.

\+ **To better assess homogeneity,** *Sample Scans* mode is recommended for powders and high quantity samples.

\+ **Small samples** should be measured in an aluminum cup which has a neutral effect on the spectrum.

\+ **Point device downwards** when scanning. It is NOT recommended to measure with the device pointing upwards.

www.nirlab.com

- [CLICK HERE to watch a tutorial video.](www.nirlab.com)
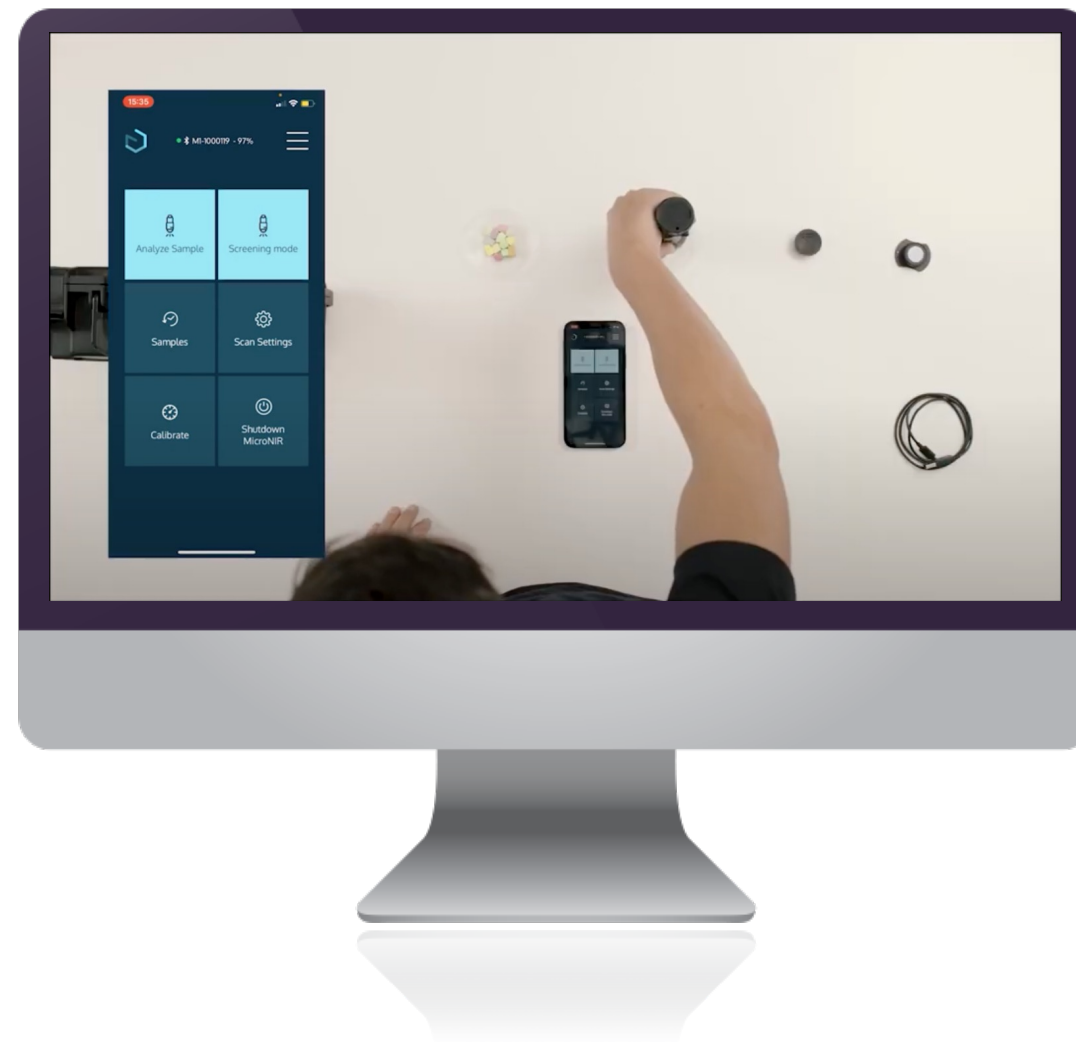
Thank you
for your attention

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