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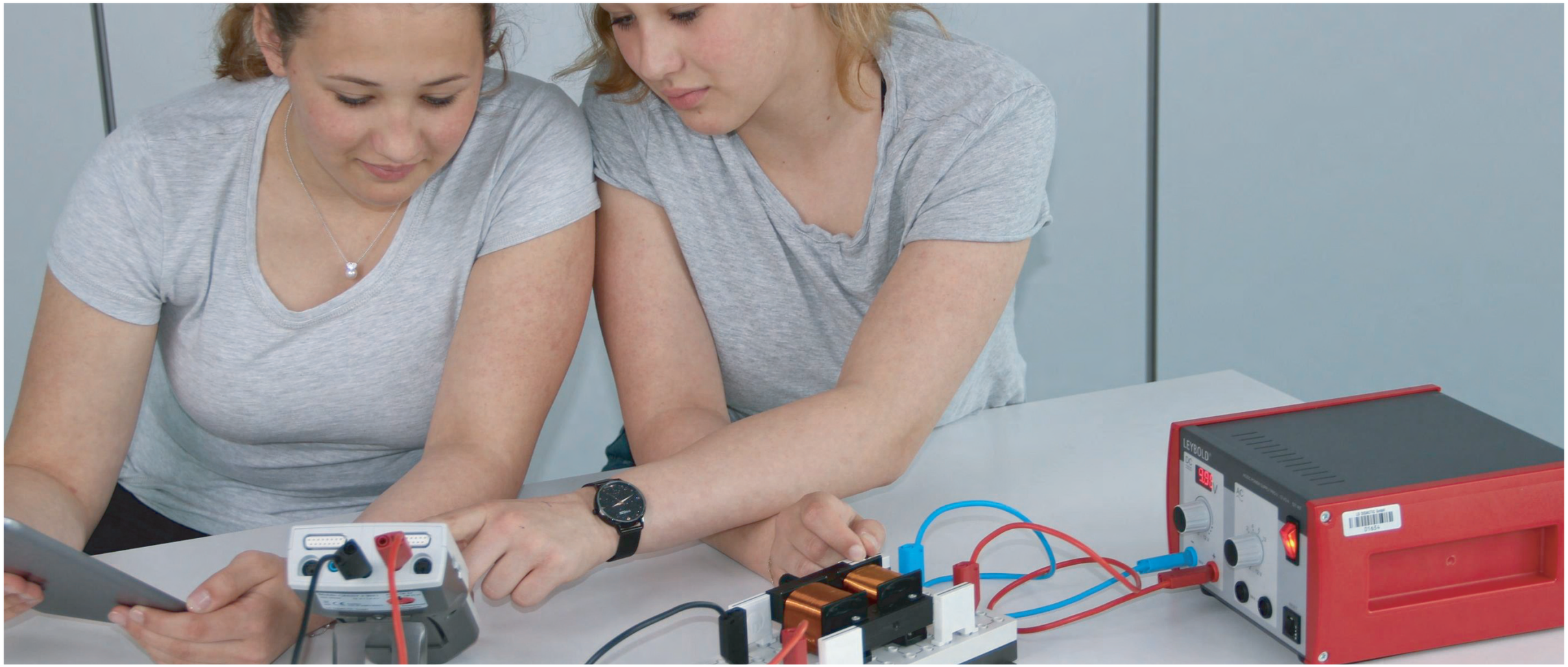
NATURAL SCIENCE HIGHLIGHTS 2023



1. Science Lab: Student experiments system offers new experiment topics
   I. Science Lab Genetics
   II. Science Lab Fuel Cell
2. Lab Docs: Interactive, digital experiment instructions in new design
3. Learning Management System – Use the LMS for student experiments
   I. Integration with MS Teams for Education and Moodle
4. LEYBOLD X-RAY APPARATUS: *MODERN MEASUREMENT WITH CASSY LAB 2*
5. NEW EXPERIMENTAL SETUP: PLANCK CONSTANT

SCIENCE LAB – OVERVIEW OF EXPERIMENT EXPERIMENT TOPICS

PHYSICS

- MECHANICS
- ENERGY
- ELECTRICITY & ELECTRONICS
- OPTICS
- ATOMIC AND NUCLEAR PHYSICS

Over 440 experiments

CHEMISTRY

- GENERAL AND INORGANIC CHEMISTRY
- ORGANIC CHEMISTRY
- PHYSICAL CHEMISTRY
- TECHNICAL CHEMISTRY & BIOCHEMISTRY
- FUEL CELLS

Over 275 experiments

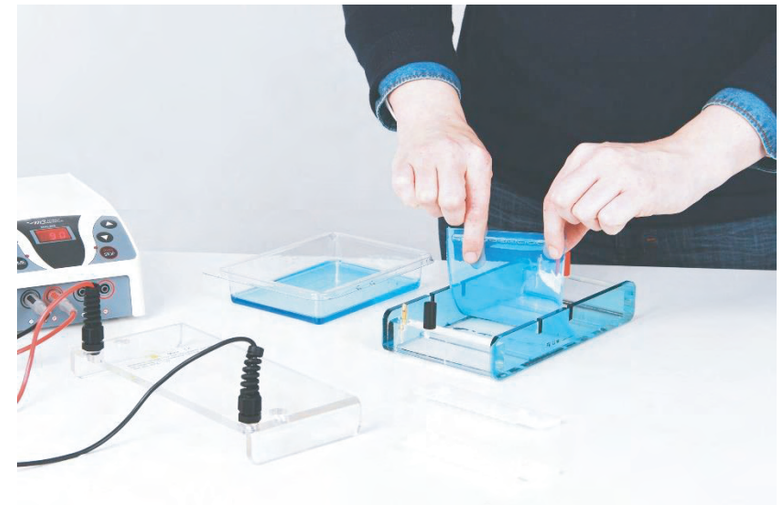
BIOLOGY

- HUMAN BIOLOGY
- BOTANY
- ECOLOGY
- CELL BIOLOGY
- GENETICS
- HYGIENE

Over 170 experiments

SCIENCE LAB GENETICS

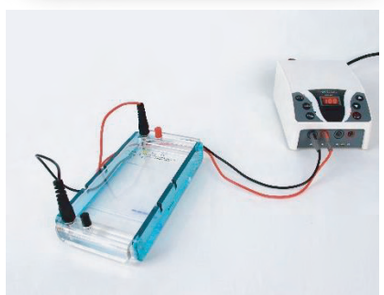
- Teaching the basics of genetics and genetic engineering methods in student experiments
- Methodology - from casting a DNA agarose gel to performing electrophoresis
- Various applications, e.g. genetic fingerprinting or paternity analysis
- Analyses of forensic and medical diagnostics



EXPERIMENT SUBJECTS

- Methods of DNA analysis
- Analysis of bacterial plasmid DNA
- Electrophoresis of lambda DNA
- Paternity analysis
- Genetic fingerprint

LB5B Science Lab Genetics - Classic

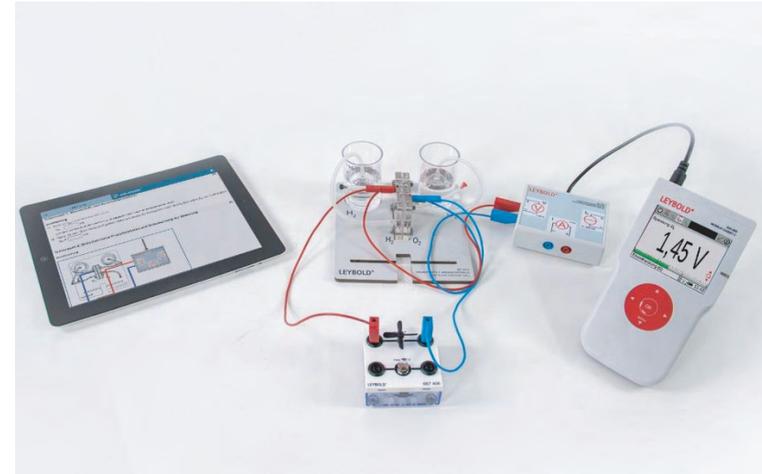


BENEFITS AT A GLANCE

- Device container for 11 experiments
- Carry out modern biology experiments in the student experiment
- Methods and equipment knowledge: Work with equipment that is also used in biological laboratories
- Application reference through the use of experimental compilation to paternity analysis and genetic fingerprinting
- Little preparation time required by the teacher

SCIENCE LAB FUEL CELL

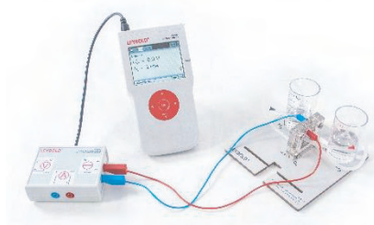
- From the subject area “Renewable Energies”
- Electrolytic production of hydrogen and the associated use of solar energy
- In-depth, qualitative presentation of the effect of the electricity generated by using the consumers
- Quantitative evaluation with Mobile CASSY 2 Wifi and Electrochemistry box M, e.g. for calculating efficiencies
- This facilitates an understanding of the current discourse around fuel cell technology as well discussion of the advantages and disadvantages



EXPERIMENT SUBJECTS

- The reversible fuel cell
- The electrolyser
- The fuel cell
- The solar module
- Energy use

LC6.1A Science Lab Fuel Cell - Digital

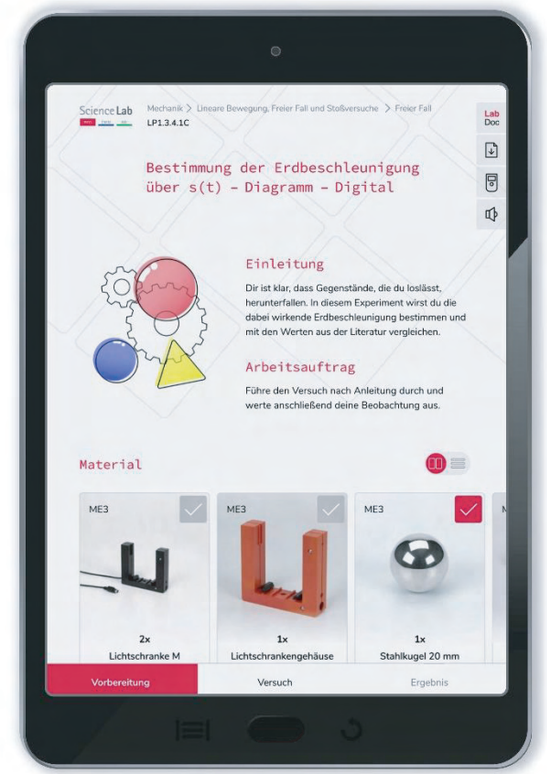


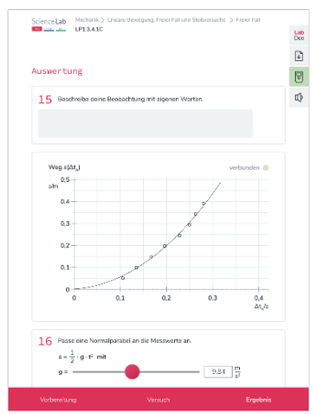
BENEFITS AT A GLANCE

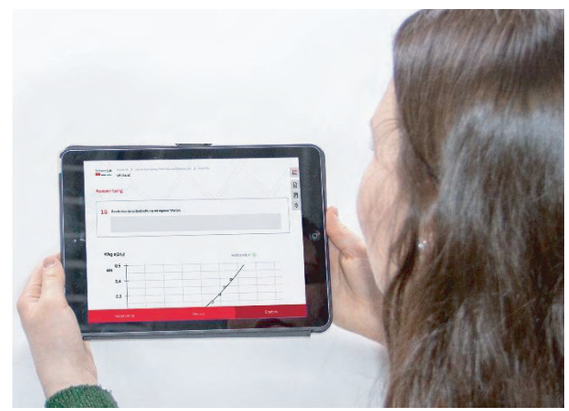
- Device container for 15 experiments
- With the Electrochemistry box M no separate power supply unit is necessary
- The reversible fuel cell can be used as a fuel cell and electrolyser
- The electrolyser generates the required hydrogen: no separate hydrogen source necessary

LAB DOCS: INTERACTIVE, DIGITAL EXPERIMENT INSTRUCTIONS IN NEW DESIGN

- Unique Lab Docs are available in a new interactive design
- Modern design inspired by media world familiar to students
- Even more intuitive operation thanks to self-explanatory design elements and horizontal “swiping”
- Works on all end devices, regardless of operating system and manufacturer
- Clearer and more structured layout of experiment protocol
- Experiment instructions also made easier to understand and more interesting thanks to greater integration of graphic elements







USE OF LEARNING MANAGEMENT SYSTEM (LMS) FOR STUDENT EXPERIMENTS

The distribution of digital experiment instructions has never been so easy!

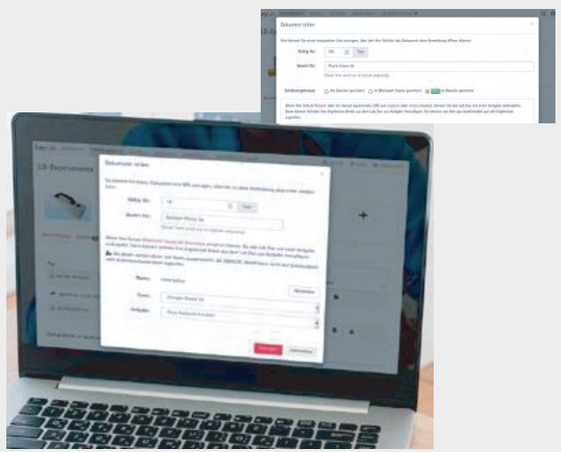
Use modern experiment instructions via your LMS by linking the Lab Docs to an assignment in the learning platform.

Lab Docs are already supported by the following learning platforms:

- Microsoft Teams for Education
- Moodle
- Other Moodle-based platforms

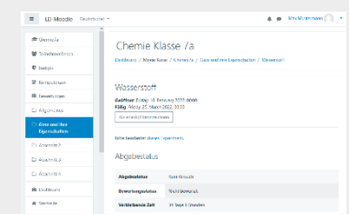
1 Easy sharing of the Lab Doc in LeyLab

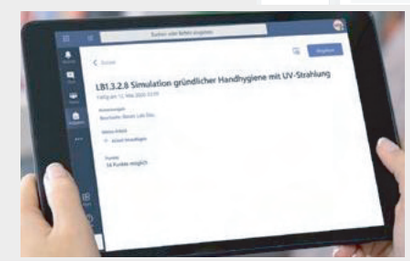
- Simply share the Lab Doc in LeyLab with just a few clicks
- Link it to an assignment in the LMS



2 Students open the Lab Doc via LMS

- Students receive assignments in the LMS
- Students open Lab Docs directly via link in the assignment

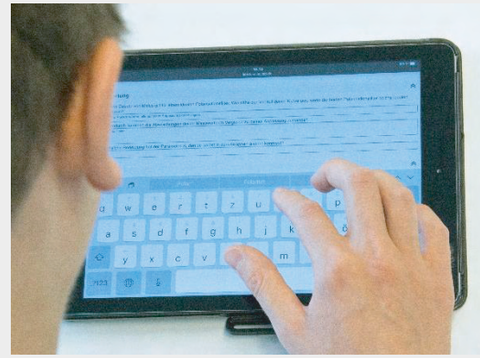




LINK LAB DOCS WITH YOUR LMS

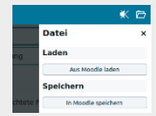
3 Students perform the experiment

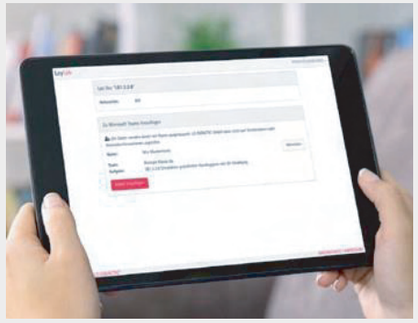
- Setting up and performing of experiment
- Evaluating the experiment directly in Lab Docs
- Creating an individual, digital experiment protocols



4 Students save their results in LMS

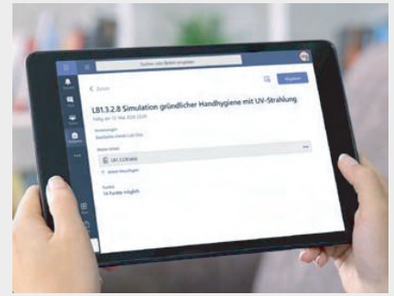
- Students can save Lab Doc in LMS via a button in the Lab Doc
- Results are stored in the LMS assignment
- Intermediate status can be reloaded and changed at any time

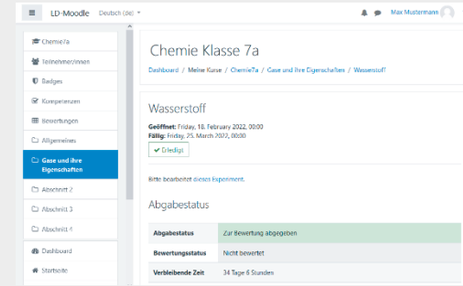




5 Students submit assignments in LMS

- Students can submit assignments to the teacher in LMS



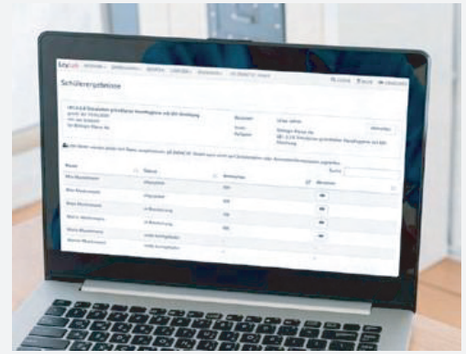


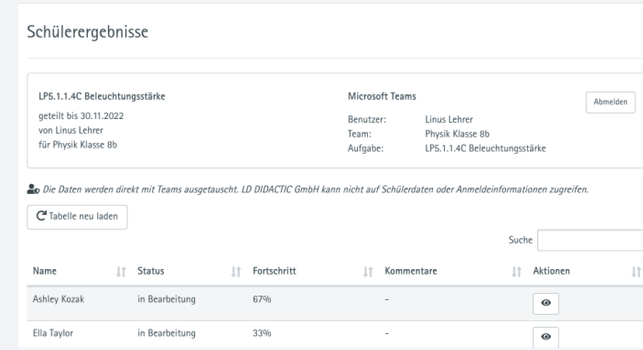
STUDENT RESULTS IN LEYLAB

6 Overview of student results in LeyLab

- Overview of current processing status of the Lab Doc in LeyLab
- Directly view the students' results
- Save answers of entire class in a table (csv)

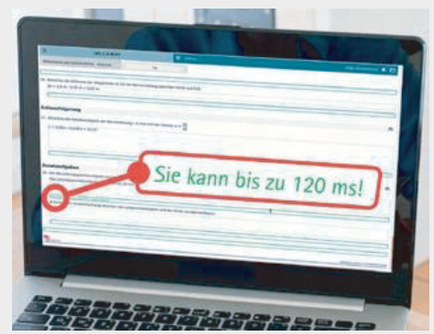
LeyLab

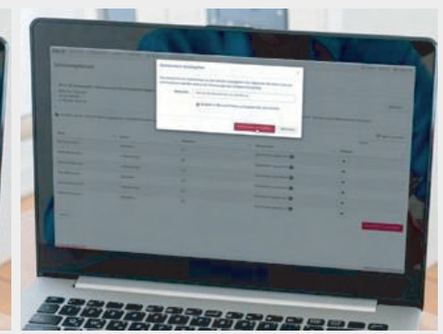


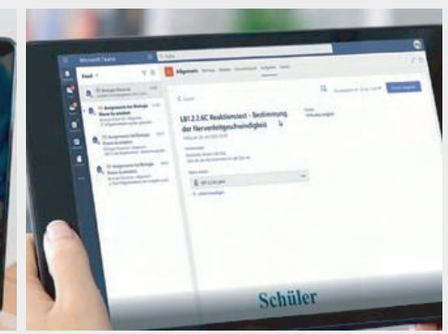


7 Evaluation of assignment via LeyLab

- Completed Lab Doc can be commented individually when opened via the LeyLab overview
- Once corrected, the Lab Doc can be returned to the student via LMS
- Lab Doc can be edited using the annotations or archived as a PDF or printed out
- Alternatively, the evaluation/comment function of the LMS can be used

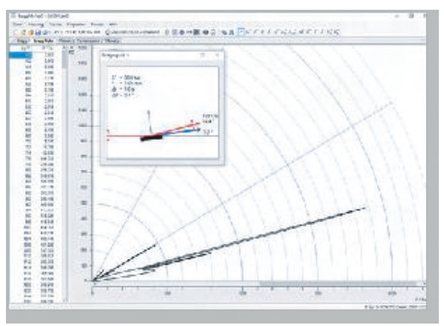




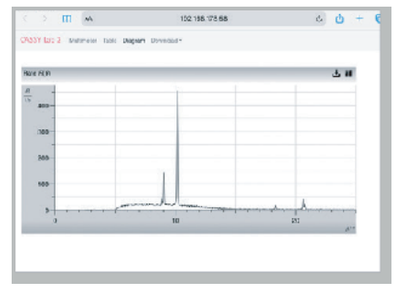


LEYBOLD X-RAY APPARATUS: MODERN MEASUREMENT WITH CASSY LAB 2

- Recording and evaluating the measurement data of the X-ray apparatus
- Detailed and integrated help also offers prepared experiment examples
- Live distribution of spectra during measurement via the school network
- Simple information transfer via QR codes to all digital end devices of the students (Windows, Android, iOS, MacOS, Linux)
- Free formulas for any desired conversions of the recorded spectra
- Display of Bragg spectra in polar diagrams
- Support of high resolution of the HD add-on X-ray
- Simultaneous use of CASSY with CASSY Lab 2 licence

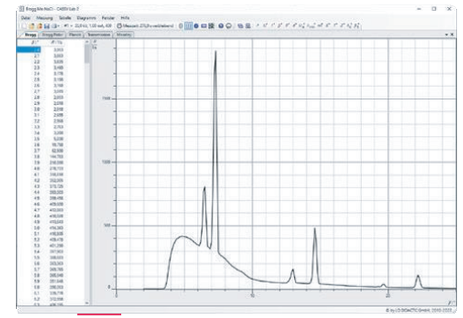


Bragg spectrum of a Mo anode on a NaCl single crystal in polar plot against the sensor angle 2ϑ. The peaks in the diagram thus correspond exactly to the visible geometry in the X-ray apparatus.



When using the HD additive X-ray (554 835), the Bragg spectrum already shows fine splitting of the Kβ line in the first order and fine splitting of the Ka line in the second order if a LiF crystal is used instead of the NaCl crystal.

Bragg spectrum of a Mo anode on a NaCl single crystal versus target angle

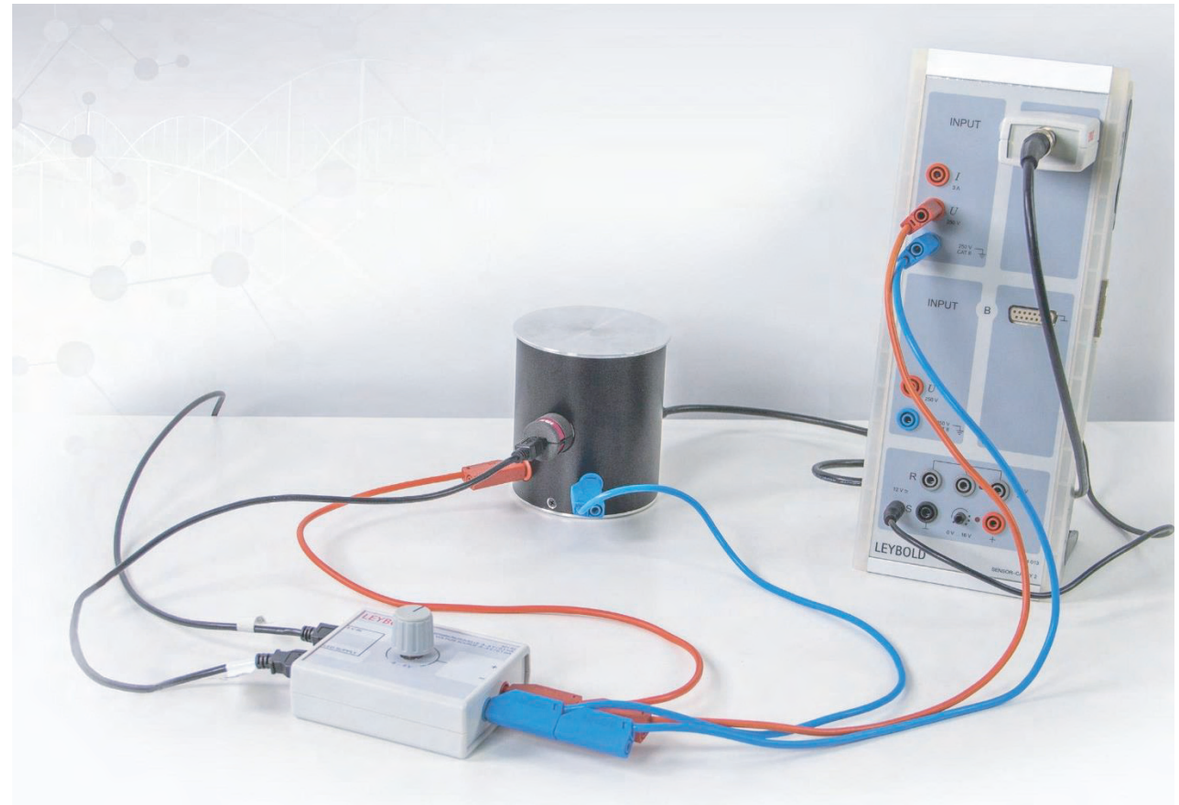


The same Bragg spectrum on an iPad as distributed live by CASSY Lab to virtually all digital devices

NEW EXPERIMENTAL SETUP: PLANCK CONSTANT

Determining the Planck constant –
Recording the current-voltage characteristics, measuring in a compact assembly (P6.1.4.6)

- In the experiment, the light of different coloured LEDs falls on the photocathode
- Reverse voltage at the anode is varied and the resulting current is measured with high sensitivity
- Planck constant h is determined from the change of the characteristic curves when illuminated with different wavelengths
- A characteristic voltage is determined as the reverse voltage for each characteristic curve, above which only a few electrons reach the anode



NEW EXPERIMENTAL SETUP: PLANCK CONSTANT

What makes this demonstration experiment so unique?

- Convenient and easy-to-understand set-up on the table
- Significant reduction of leakage currents thanks to the set-up
- Determination of the Planck constant possible with LEDs as well as with the high-pressure mercury lamp in combination with interference filters
- Current measurement via new nanoampere box
- Measurement takes place with the Sensor-CASSY 2

Table-top housing with photocell

Interference filter holder

LED lamps in different colours

Voltage source -5... 5 V