STU SvF
SLOVENSKÁ TECHNICKÁ UNIVERZITA V BRATISLAVE
STAVEBNÁ FAKULTA
KATEDRA KONŠTRUKCIÍ POZEMNÝCH STAVIEB

UVP

LABORATORIES OF THE DEPARTMENT OF BUILDING CONSTRUCTION

LAB
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NAVIGATION

You can activate fullscreen mode by tapping the *ctrl+l* keys

CONTENT

By clicking on a picture or title you can choose a specific section:

WHO WE ARE?

LABORATORIES KKPS

ABOUT US

Laboratories of the Department of Building Construction, Faculty of Civil Engineering, Slovak University of Technology in Bratislava. Laboratories deal with the research and testing of various components of building constructions from physical point of view. The laboratories have undergone extensive modernisation that have led to improved quality of the environment and equipment. The laboratories are equipped with professional instruments about which you can learn more in this presentation.

A LIST OF LABORATORIES

To select an appropriate laboratory click on its icon:

- Laboratory of Thermal Properties of Buildings
- Laboratory of Acoustics of Buildings I
- Laboratory of Acoustics of Buildings II
- Laboratory of Building Aerodynamics I
- Laboratory of Roof Research
- Laboratory of Building Aerodynamics II
- Laboratory of Hydrodynamics of Buildings
- Laboratory of Daylighting and Building Insolation
- Laboratory of Energy Efficacy of Buildings and Solar Energy Research
- Non-destructive Laboratory Testing of Construction and Building Materials in-situ

Laboratory of Thermal Properties of Buildings

Instrumental equipment

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DESCRIPTION OF LABORATORY

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

Description:
Laboratory of Thermal properties of buildings is located in basement rooms of the block B in the Faculty of Civil Engineering STU on Radlinského street no. 11 in Bratislava.

Laboratory of Thermal properties of buildings is equipped with a unique facility – the Large Climate Chamber - allowing the modelling of synergistic phenomena of heat transfer, diffusion of water vapour and air filtration under stationary and non-stationary boundary conditions. Laboratory instrumentation enables the recording of thermal and humidity parameters of details, components and systems of building structures in laboratory conditions as well as in real conditions in- situ.

Instrumental equipment:

- The Large Climate Chamber
- Testo 435-4
- S11V01 instrument
- JSE 1301 Control Unit
- Testo 410-2 instrument
- Testo 606-2 instrument
- Infrared temperature measuring instrument Testo 845
- Instrument Voltcraft IR-1001A
- Fluke 576 Precision Infrared Non-Contact Thermometer
- ThermaCAM B2 Infrared Camera
- Flir T620 Infrared Camera
- Infrared camera Mobir M4 – mobile pocket size IR camera
- Agilent 34970A Data Acquisition / Switch Unit
- Agilent 34980A Data Acquisition / Switch Unit
- Sensors for measuring physical quantities
- AMS 111 Weather Station
- Multinorm MI 6201 multifunctional instrument
- GMI 15 instrument for determination of moisture in wood and building materials
- PMICRO LCD instrument
- PMICRO T data logger

INSTRUMENTAL EQUIPMENT

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

Click on the image to select a specific device / equipment:

The Large Climate Chamber

S11V01 instrument

Testo 410-2

Fluke 576 Precision Infrared Non-Contact Thermometer

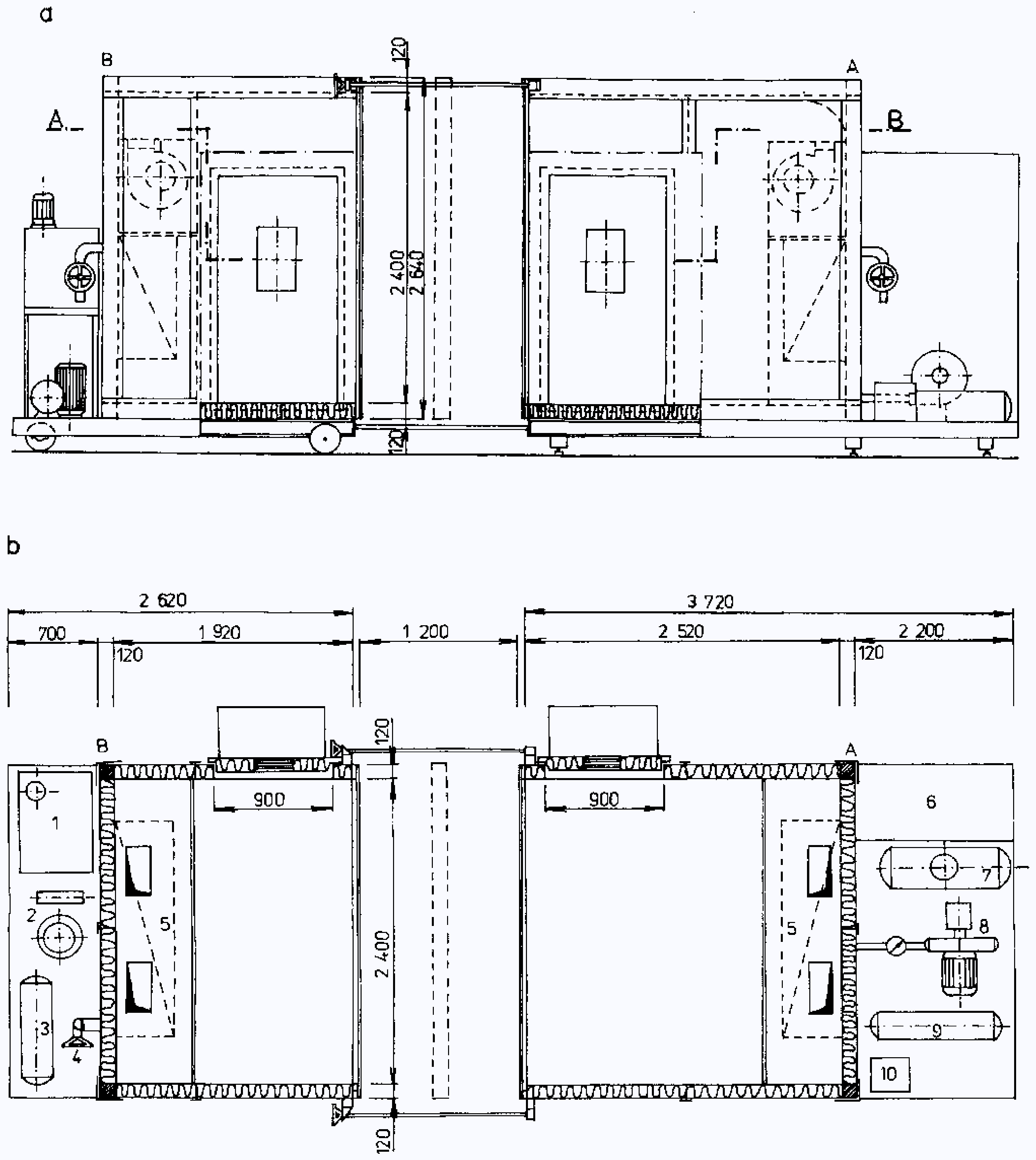
Flir T620 Infrared Camera

Agilent 34970A Data Acquisition / Switch Unit

AMS 111 Weather Station

THE LARGE CLIMATE CHAMBER

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS



Technical specification of cold chamber:

- Circuit of cold and heat: -35 °C to +60 °C,
- Circuit of positive and negative air pressure: -1500 Pa to +1500 Pa,
- Circuit of air humidity: 20 to 90 % r. h.,
- Circuit of air velocity: 0.5 to 10 m/s ,
- Circuit of solar radiation: 100 to 1000 W/m^2.

Technical specification of heat chamber:

- Circuit of cold and heat: +5 °C to +60 °C,
- Circuit of positive and negative air pressure: -1500 Pa to +1500 Pa,
- Circuit of air humidity: 20 to 90 % r. h.,
- Circuit of air velocity: 0.5 to 10 m/s.

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Scheme of large climate chamber for modelling synergistic phenomena of heat transfer, vapor diffusion and air filtration.
1 – thermostat, 2 – cooling compressor, 3 – cooler, 4 – drain valve, 5 – the exhaust blower duct, 6 - control panel, 7 - cooling compressor 8 - fan with filter, 9 - cooler, 10 – regulation of an indoor air circulation

THE LARGE CLIMATE CHAMBER

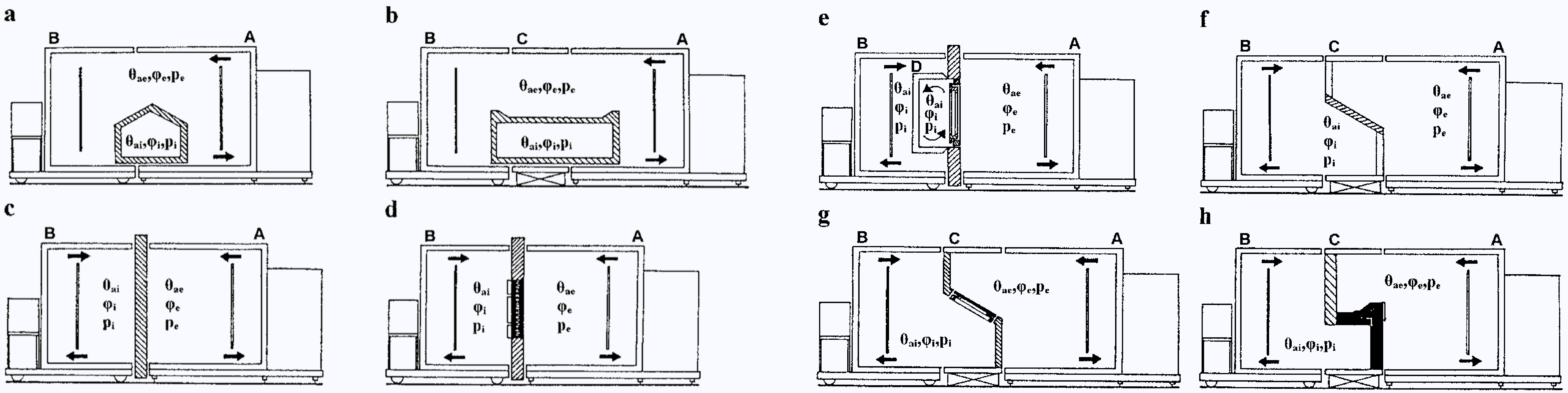
LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

The Large Climate Chamber was made by WEISS-TECHNIK Company (Germany) on the basis of the technical task worked out by the department. In 2015 it was restored within the project of University Science Park granted by EU structural funds. During comprehensive modernisation all facilities and the control unit have been replaced with the aim of increasing the measurement range and accuracy of measurement parameters.

The chamber is unique of its type in Slovakia and abroad. It consists of a fixed climatic chamber with modelled outdoor climate conditions, of a mobile climatic chamber with modelled indoor climate conditions, of a mobile intermediate chamber without technology, expanding the interior space of the climate chamber and allowing the measurement of inclined and spatial elements. Part of the chamber is also a smaller mobile climate chamber – HOT-BOX, essential for accurate measurements of basic thermal characteristics of building envelope constructions (e.g. U-value) with modelled indoor climate conditions. The device operates autonomously, according to the program saved in the memory of the microcomputer and also under simulated dynamic conditions of the external climate. The device is used to detect thermal properties of building structures (heat transfer coefficient U (W/(m^2.K)), thermal resistance R ((m^2.K)/W), surface temperatures θ_{si} (°C), temperature fields) within the range of -35 to +60 ° C. The chamber includes technological zones of heat, cold, humidity, solar radiation simulation, pressure and air velocity, controlling and regulating zones, measurement and documentation of all regulated and sensed quantities, documentation and evaluation of a thermovision camera with a high resolution of 640×480 pixels.

THE LARGE CLIMATE CHAMBER

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS



Basic measurement assemblies of large climate chamber

a - direct connection of cold (A) and hot (B) chamber,
b - direct connection of cold (A), hot (B) and the mobile intermediate chamber (C),
c - connection of cold (A) and warm (B) chamber during experimental monitoring of an external wall in vertical position,
d - connection of cold (A) and warm (B) chamber during experimental monitoring of an external wall in masking panel,
e - connection of cold (A) and warm (B) chamber during experimental monitoring of a window placed in masking panel by using mobile HOT-BOX (D),
f - connection of cold (A), hot (B) and mobile intermediate chamber (C) for experimental monitoring of sloping elements,
g - connection of cold (A), hot (B) and mobile intermediate chamber (C) for experimental monitoring of roof windows,
h - connection of cold (A), hot (B) and mobile intermediate chamber (C) for experimental monitoring of connection of external wall to flat roof.

THE LARGE CLIMATE CHAMBER

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

View of the Large Climate Chamber for modelling synergistic phenomena of heat transfer, vapour diffusion and air filtration.

View of the Large Climate Chamber for modelling synergistic phenomena of heat transfer, vapour diffusion and air filtration.

S11V01 INSTRUMENT

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

S11V01instrument and expander for measuring temperature and relative air humidity

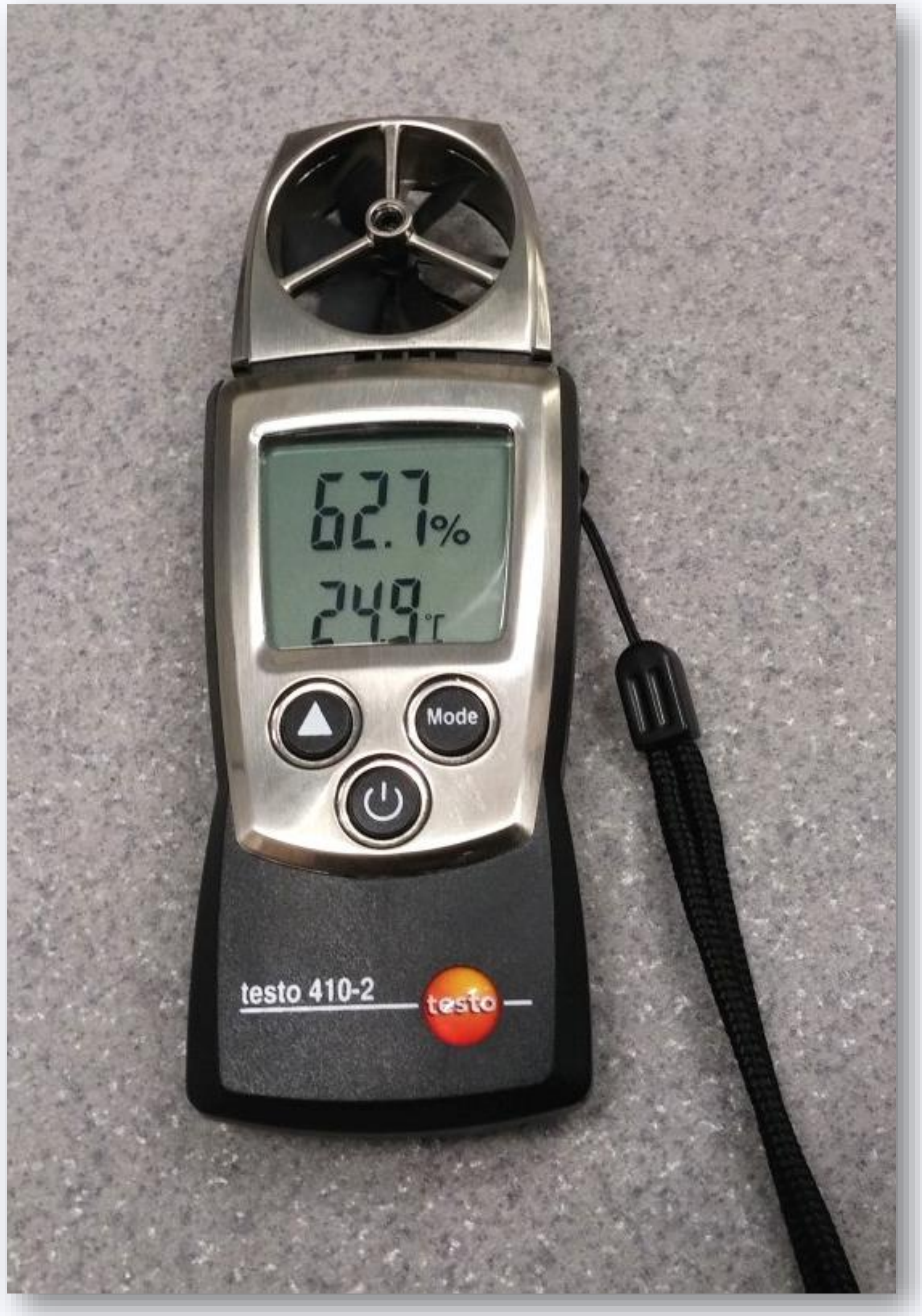
The instrument is used to measure temperature and relative air humidity. The instrument S11V01 and expander i20 are used to measure humidity and temperature by sensors from Sensirion Company- SHT1x and SHT7x series - connected via digital interface – Digital Sbus. Expander i20 allows connection of up to 20 sensors to the logger. Accuracy and measurement conditions are set by specifications of sensors (Sensirion). The logger with expander is powered by battery cells thereby achieving independence from the mains and allows measurements even in the field where there is no power grid available. Measurement results are stored on an SD memory card (Secure Digital).

Technical data for SHT75:

- air temperature -40 to +100 °C ± 0.3 °C in range +10 to +40 °C,
- air humidity 0 to 100 % ± 2 % in range 10 to 90 %,
- dimensions 200 × 100 × 40 mm,
- weight 700 g (without batteries 4 × 1.2V AA).

TESTO 410-2 INSTRUMENT

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS



Testo 410-2 multi-function instrument

The instrument is a vane anemometer with integrated humidity measurement and NTC sensor for air temperature measurement, including protective cap, batteries and calibration protocol.

Technical data:

- air temperature -10 to +50 °C ± 0.5 °C,
- air humidity 0 to 100 % ± 2.5 %,
- air flow 0.4 to 20 m/s ± 0.2 m/s + 2% of measured value,
- dimensions 130 × 45 × 24 mm,
- weight 110 g (including battery 2 × 1.2V AAA).

FLUKE 576 PRECISION NON-CONTACT THERMOMETER

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

Precision infrared thermometer Fluke 576

The Fluke 576 IR non-contact thermometer is used in predictive and preventive diagnostics of buildings. It has a wide range of temperatures and is equipped with a 3 points laser system for exact measurement location and very precise measurement results. The built-in digital camera makes photos of a measured area and its ‘surroundings. The Fluke IR thermometer offers very fast and precise temperature measurements or balance control of distant parts of a building.

Technical data:

- temperature range -30 to 900 °C,
- response time 250ms (95% of reading),
- resolution 0.1°C of reading up to 900 °C,
- repeability ± 0.5% of reading or ± 1 °C,
- accuracy ± 0.75% of reading or ± 0.75 °C ,
- emissivity adjustable from 0.10 to 1.0 by 0.01

FLIR T620 INFRARED CAMERA

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

The Flir T 620 IR camera measures and images the emitted infrared radiation from an object.
The fact that the radiation is a function of object surface temperature makes it possible for the camera to calculate and display this temperature. The camera system also features a laser pointer, a 4.3" touch-screen LCD, an IR lens, a removable battery and a range of accessories. It is possible to capture and store images to the camera's internal memory. The images can be analysed either in the field by using the real-time measurement functions built into the camera, or on a PC using FLIR Tools software.

Technical data:

- detector type FPA, uncooled microbolometer 640 × 480 pixels,
- spectral range 7.5 – 14 μm,
- FOV 25° x 19°,
- temperature range -40 °C to +650 °C,
- accuracy ± 2 °C or ± 2 % of reading,
- display 4.3´´ touch/screen color LCD, 800 × 480 pixels in IR image,
- laser LocatIR class 2, semiconductor AlGaInP Diode laser, 1 mW/635 nm,
- battery type Li/Ion,
- weight 1.3 kg including battery,
- dimensions 143 × 95 × 195 mm with 17 mm lens.

Infrared camera Flir T620

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34980A MULTIFUNCTION SWITCH/MEASURE UNIT

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

This instrument is used for the measurement of physical quantities and logging outputs from sensors.
It has high accuracy for measuring for AC/DC voltage and current. It is also suitable for measuring by Pt100 sensors, thermocouples and other sensors with outputs performed in voltage, current or resistance. It is able to switch up to 160 sensors in eight plug-in modules upwards.

Technical data:

- DC Voltage 0.1 V to 300 V ±0.09 %/year,
- AC Voltage 0.1 V to 300 V ±0.14 %/year (10 Hz to 20 kHz),
- resistance 100 Ω to 1 MΩ ±0.01 %/year (±1 °C),
- RTD sensors 49 Ω to 2.1 kΩ ± 0.06 °C (-200 to +600 °C),
- dimensions 350 × 425 × 145 mm,
- weight 8.8 kg.

34980A Multifunction Switch/Measure Unit

34980A MULTIFUNCTION SWITCH/MEASURE UNIT

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

Sensors for measuring physical quantities

It is possible to connect sensors to Agilent 34972A data acquisition switch unit as follows:

- Air flow sensor EE66 VC5 0 to 2 m/s ± 0.06 m/s + 2% of measured value,
- sensor for measuring relative humidity Sensorika HP-1212420 0 to 100% ± 2%,
- differential pressure sensor 0 to 200 Pa,
- Pt100 sensor of surface temperature and air temperature,
- Sensor of surface temperature and air temperature via thermocouples and others.

Sensor for measuring relative humidity Sensorika HP-1212420

Differential pressure sensor

Pt100 sensor of surface temperature and air temperature

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AMS 111 WEATHER STATION

LABORATORY OF THERMAL PROPERTIES OF BUILDINGS

The station is used for outdoor environmental monitoring. It is able to monitor the following quantities – wind speed and direction, air temperature, relative air humidity, precipitation amount and global solar radiation. It is powered by batteries. If there is enough solar radiation, the battery is continuously recharged during the day. It allows continuous recording of the above parameters and storing them on a memory card for two weeks.

Technical data:

- air temperature -40 °C to +60 °C ± 0.1 °C,
- humidity 0 to 100 % ± 1.5 %,
- wind speed 1 to 40 m/s ± 0.5 m/s or ± 5%,
- wind direction 10° to 350° ± 3°,
- precipitation 0 to 60 mm/h ± 2 %,
- solar radiation 0 to 2000 W/m^2 ± 2 %.

AMS 111 weather station

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Laboratory of Acoustics of Buildings I

Instrumental equipment

LAB

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DESCRIPTION OF LABORATORY

LABORATORY OF ACOUSTICS OF BUILDINGS I

Description:
The laboratory of acoustics of buildings is located in the basement in Block B of the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava on Radlinského street No. 11 in Bratislava. The laboratory includes acoustical chambers for the measurement of acoustical parameters of smaller building elements - window and door panels.

COOPERATION POSSIBILITIES:

- determination of weighted sound reduction index R_w (dB) of non-transparent and transparent parts of envelope constructions, ceilings and partitions of buildings,
- determination of weighted sound reduction index R_w (dB) of glass systems for transparent constructions of buildings (windows, glass walls),
- determination of impact and airborne sound insulation of ceilings and floors,
- determination of absorption of materials intended for elimination of noise in interior and in road transport.

Instrumental equipment B&K:

- Hand-held Analyzer B&K type 2250
- Microphone B&K type 4189
- Omnidirectional sound source B&K type 4292-L

Instrumental equipment Norsonic:

- Sound Analyser Nor 140, 2 pcs
- Microphones Nor 1225, 2 pcs
- Preamplifiers Nor 1209, 2 pcs
- Microphone Calibrator Nor 1251
- Dodecahedron loudspeaker Nor 276
- Power Amplifier Nor 280
- Tapping machine Nor 277
- Nor 850 Control and evaluation program for measurement and evaluation of building-acoustical parameters
- Central controlling and evaluation unit Nor 850/D

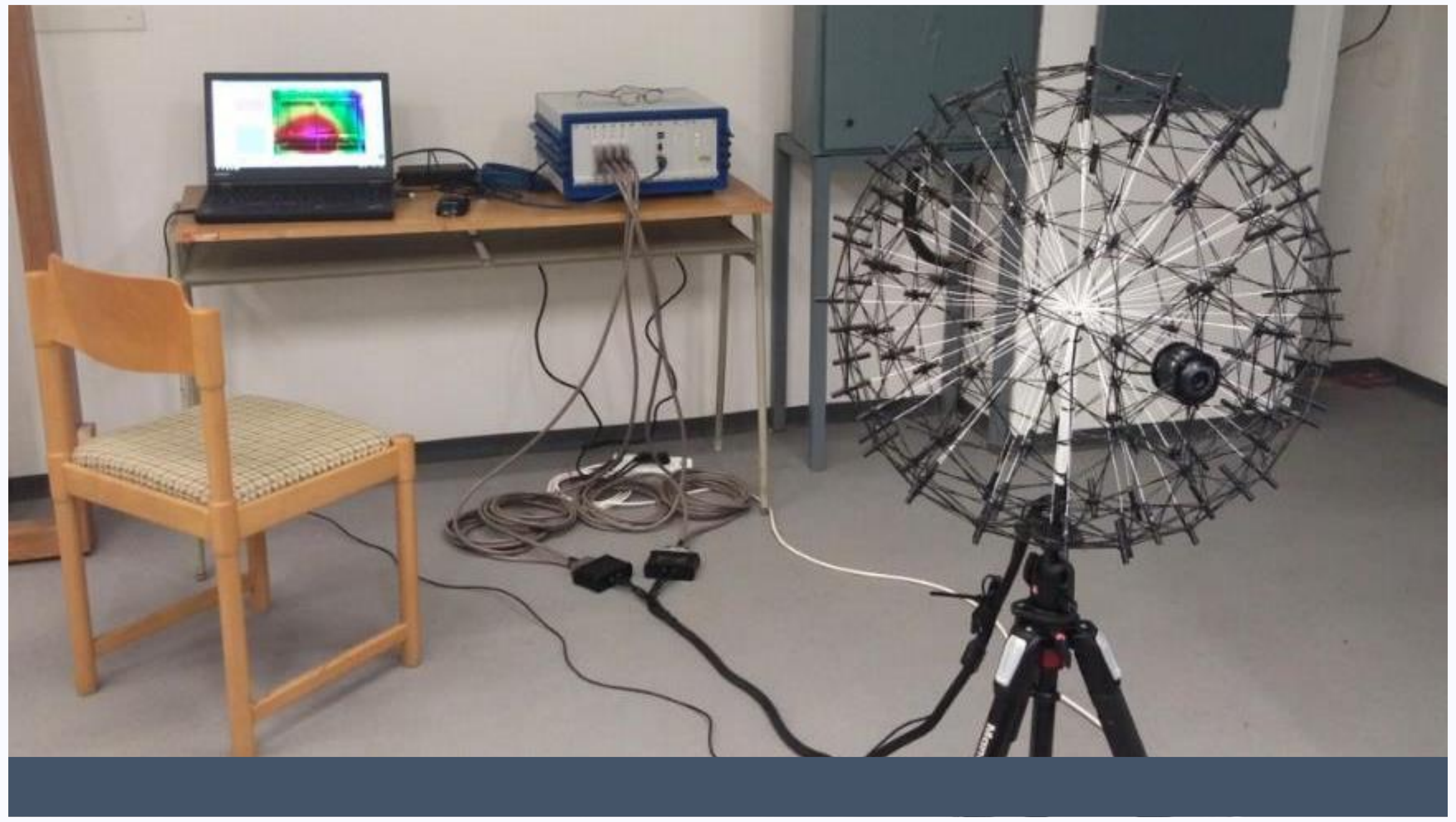
INSTRUMENTAL EQUIPMENT

LABORATORY OF ACOUSTICS OF BUILDINGS I

Click on the image to select a specific device / equipment:

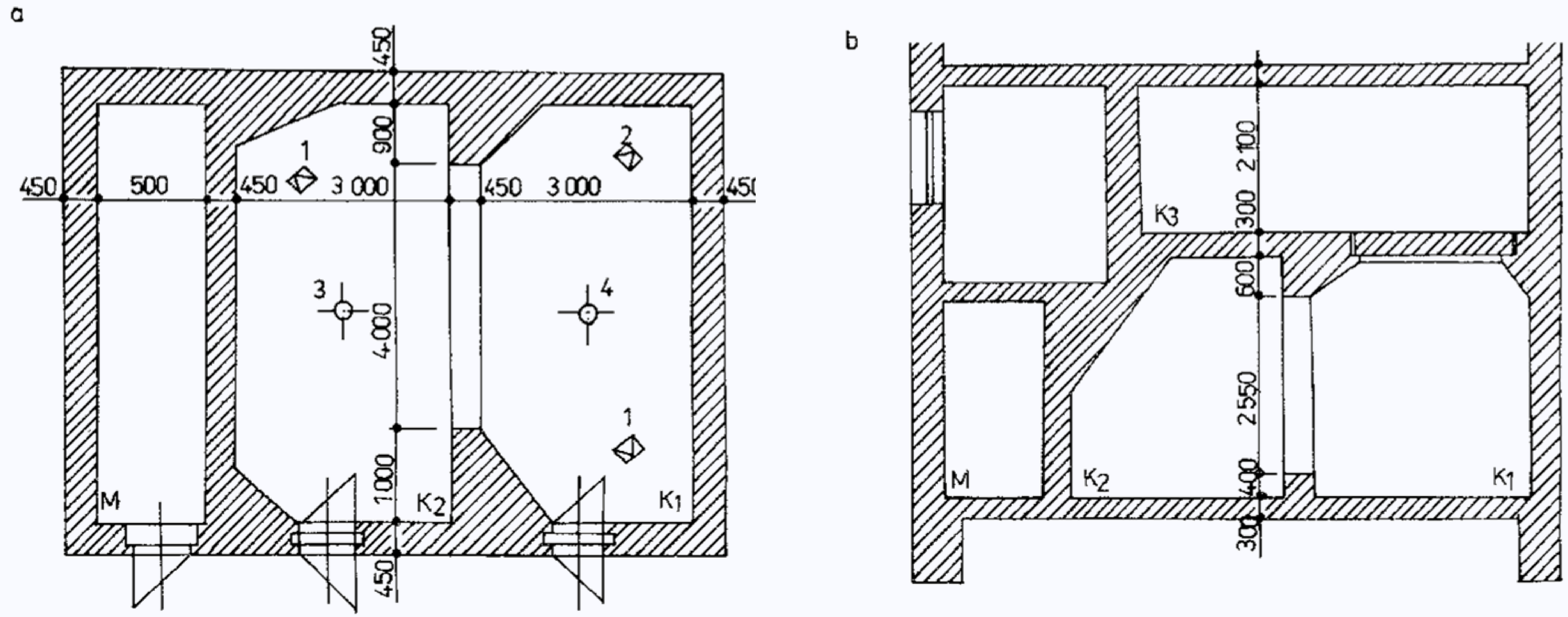
Acoustical chambers for the measurement of acoustical parameters of small building elements

Acoustical camera gfai



ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS I



The construction scheme of acoustical chambers of the Laboratory of physics of buildings and constructions at the Faculty of Civil Engineering of Slovak University of Technology in Bratislava
a – ground plan, b – section through chambers
K1 – receiving chamber, K2 – source chamber, K3 – source chamber, M – measuring central, 1 – loudspeaker (for diffusivity of acoustical field), 2 – loudspeaker (for reverberation time), 3 – microphone, 4 – microphone

ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS I

The acoustical chambers of the Faculty of Civil Engineering of Slovak University of Technology in Bratislava on Radlinského street No. 11 were built for the testing of window and door panels, partitions and ceiling constructions. The chambers are located next to each other and on top of each other with the volume of over 53 m^3. They were put into operation in 1980.

Acoustical laboratories, using a loudspeaker system, enable the production of high sound pressure levels in source chamber K2 for vertical constructions (K3 for horizontal constructions) and receive the acoustical signal after passing through the measured element in the receiving chamber K1. Sound pressure levels are recorded by a microphone located on a stand in six positions in the source and also in the receiving room which provides a representative recording of an acoustical field. A recorded signal of sound pressure is recorded using a phonometer in the frequency range from 50 Hz to 5 kHz and in it is in a digital form prepared for further processing.

Each measured element fixed in testing measuring opening is simulated in situ on a building site.

When measuring floors, in addition to the airborne sound insulation, the impact sound insulation is measured. In this case the standard tapping machine is used for arousing in the source chamber.

ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS I

Interior of source chamber of the acoustical chambers with loudspeaker system Brüel & Kjaer type 4292-L. In testing, opening the airborne sound insulation of aluminium window with the vertical acoustical ventilation grille

Interior of the receiving chamber, in testing the opening is a fixed double window made of plastic

ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS I

View of the system of wireless transfer of measured data and control of the process of measurement of building-acoustical properties using a PC

View of the tapping machine Nor277 with remote control

View of the omnidirectional sound source - Dodecahedron loudspeaker Nor276

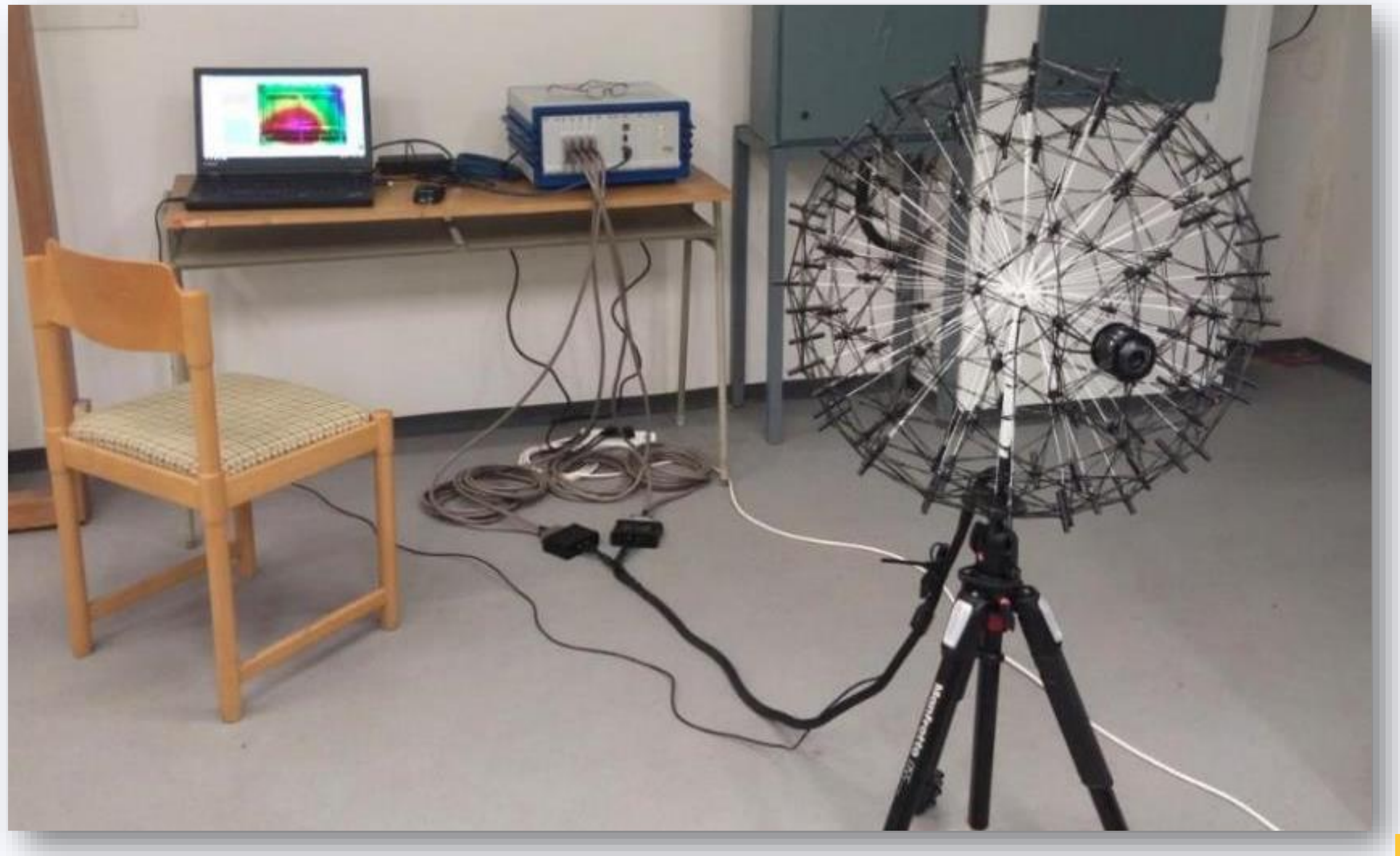
ACOUSTICAL CAMERA GFAI

LABORATORY OF ACOUSTICS OF BUILDINGS I

The acoustical camera for measurement and imaging of acoustical fields in the internal and external environment. The complex measurement system consists of a camera system for visualization of monitored recorded objects in static (separate photographs) or dynamic (video) mode and a special microphone field for various types of acoustical measurements. The microphone field enables with sufficient precision the localization of various sound sources with representation of analyzed space in 2D and 3D representation (visualization), detailed recording of sound sources from the distance of minimum 0.5 m. Measurement using this system enables the elimination of access to analyzed sources of acoustical energy. The system enables an immediate evaluation of share and contributions of particular sound sources in the tested space in place of receiving - measurements, without the necessity of elimination of sources
by other means - attenuation, switching of sources, etc.

Technical specification:

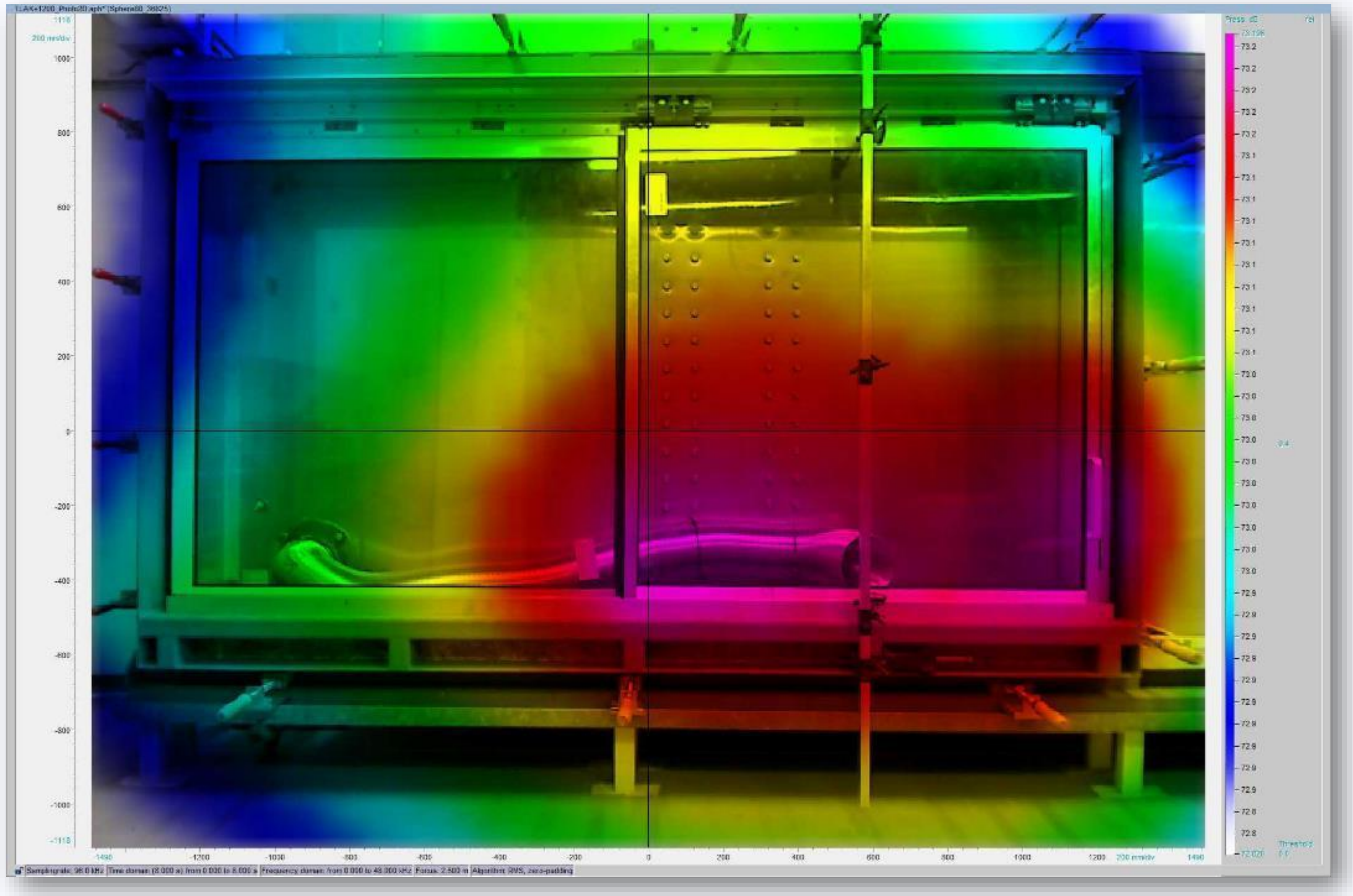
- number of microphone channels: 96 (number of connected microphones 80),
- sampling frequency of system: 192 kHz, for each analogue channel 6 MS/s,
- possibility of network connection with PC,
- measurement distance minimum 0.3 – 1.5 m,
- measurement range: 20 Hz – 20 kHz,
- maximum sound pressure level: 130 dB.



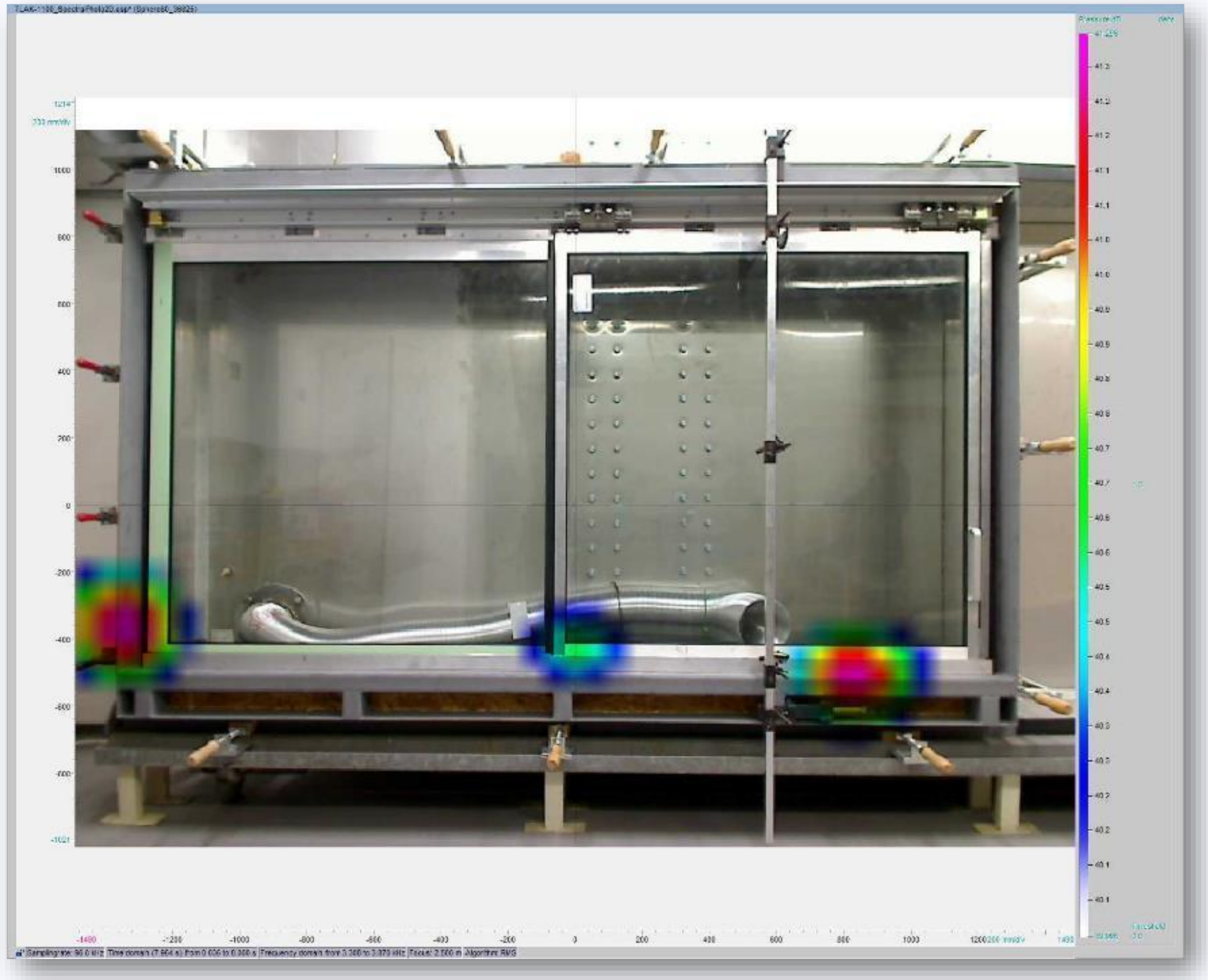
View of the set of acoustical camera gfai while measuring in the laboratory of the department of building constructions

ACOUSTICAL CAMERA GFAI

LABORATORY OF ACOUSTICS OF BUILDINGS I



A recording of an acoustical field by camera gfai on a sample of balcony glazing in the frequency range of 20 Hz to 20 kHz



A recording of the acoustical field by camera gfai on a sample of balcony glazing in a narrow frequency range

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Laboratory of Acoustics of Buildings II

LAB
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Instrumental equipment

DESCRIPTION OF LABORATORY

LABORATORY OF ACOUSTICS OF BUILDINGS II

Description:
The Laboratory of Acoustics of Buildings II is located in the area of the Central Laboratories of the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava - Trnávka, Technická street No. 5.

The acoustical chambers were built in 2000 and they are used for the testing of bigger building elements (glass walls, transparent facades, lightweight claddings, etc.), partitions and ceilings in accordance with effective standards. The chambers are located next to each other and on top of each other with the volume of over 75 m^3.

Instrumental equipment:

- Real Time Analyser Norsonic type 840
- microphones Norsonic type 1230
- preamplifiers Norsonic type 1201
- loudspeaker system Norsonic type 229
- Norsonic Sound Calibrator type 1251
- amplifier Wattec MA 850
- testing sound: noise generator or standard tapping machine B&K 3204
- filters: 1/3 octave

INSTRUMENTAL EQUIPMENT

LABORATORY OF ACOUSTICS OF BUILDINGS II

Click on the image to select a specific device / equipment:

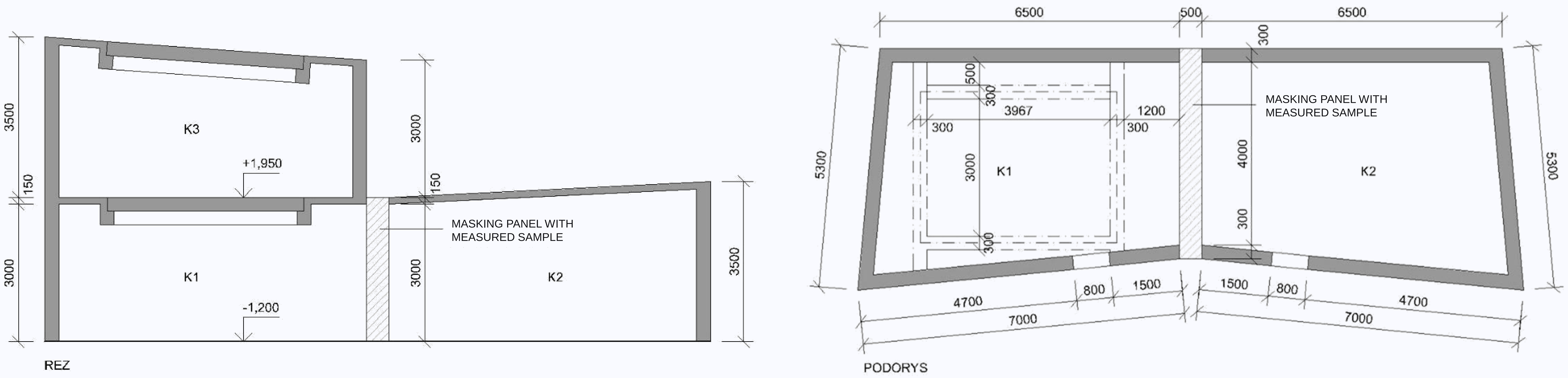
Acoustical Chambers of the Faculty of Civil Engineering in the Central Laboratory in Trnávka

Reverberation chamber

ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS II

The acoustical chambers of the Faculty of Civil Engineerng of Slovak University of technology in Bratislava in Central laboratory in Trnávka are in a collaboration with the company Applied Precision, s.r.o. certified, authorized and notified for performing tests according to relevant acoustical standards.



The scheme of acoustical chambers of the Faculty of Civil Engineering of the Slovak University of Technology in Bratislava in the Central laboratory in Trnávka

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ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS II

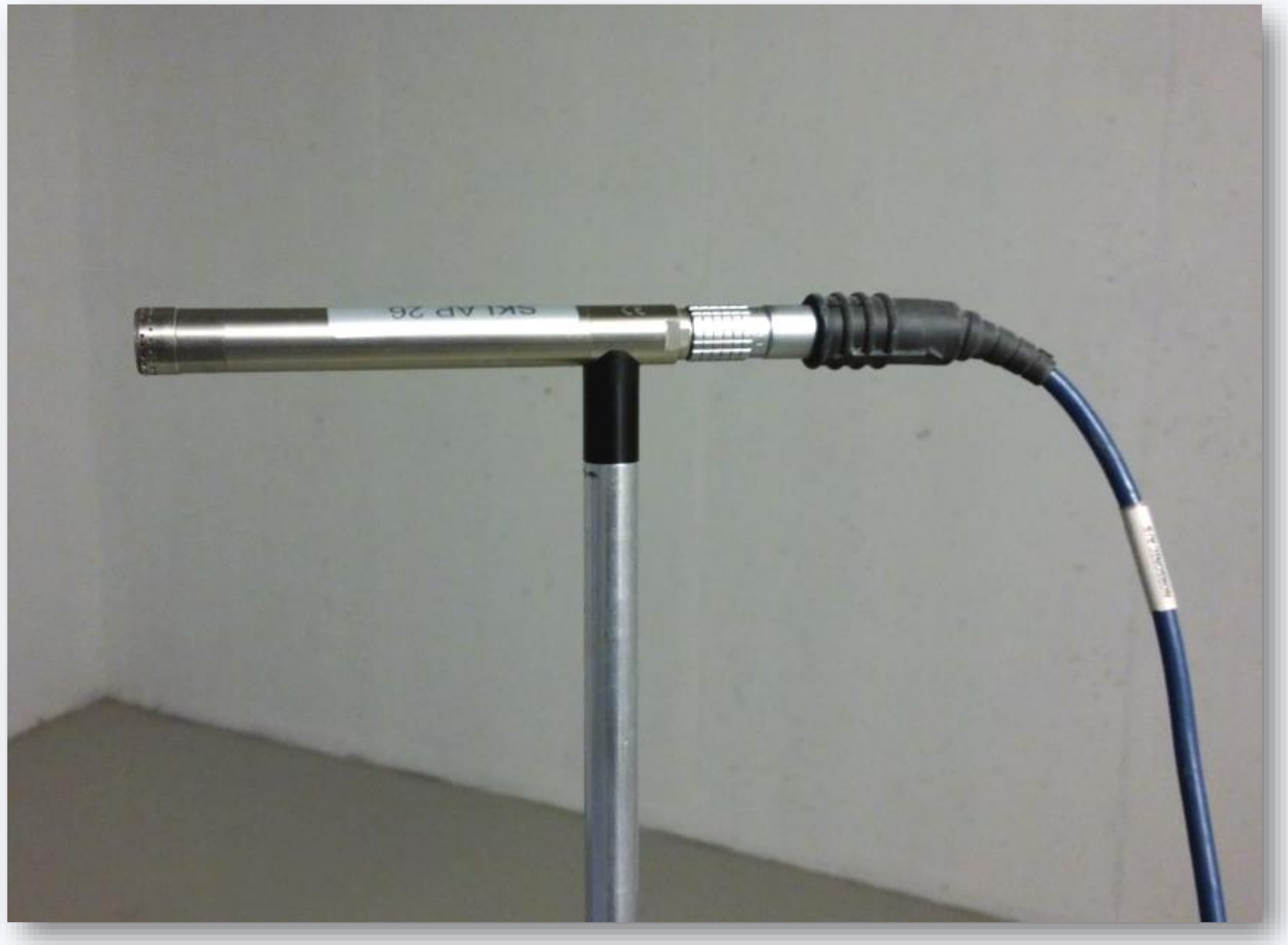
The view of the acoustical chambers of the Faculty of Civil Engineering in the Central Laboratory in Trnávka

The view of an element facade fixed in masking panel of acoustical chambers

ACOUSTICAL CHAMBERS

LABORATORY OF ACOUSTICS OF BUILDINGS II

The view of the Real Time Analyser 840 - Norsonic in the measurement room



Microphone Nor 1230 with preamplifier Nor 1201

Omnidirectional loudspeaker system Nor 229

REVERBERATION CHAMBER

LABORATORY OF ACOUSTICS OF BUILDINGS II

The reverberation chamber is used for the measurement of absorption of materials and separate elements. It has a right-angled shape with the dimensions of 8241 × 4693 × 5493 mm (length × width × height), the volume of the reverberation chamber is 213 m^3 and its total area is 219 m^2. A diffuse sound field is achieved using 8 diffusers, 4 pcs with dimensions of 1900 × 1000 mm and 4 pcs with dimensions of 1000 × 900 mm.

The view into the reverberation chamber of the laboratory

Laboratory of Building Aerodynamics I

Instrumental equipment

LAB
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DESCRIPTION OF LABORATORY

LABORATORY OF BUILDING AERODYNAMICS I

Description:
The Laboratory of Building Aerodynamics I is located in the area of the Central Laboratory of the Faculty of Civil Engineering STU in Bratislava – Trnávka. It is equipped with a low speed boundary layer wind tunnel.

COOPERATION POSSIBILITIES:

- measuring the aerodynamic characteristics of speed profiles and models from the building engineering sector and from engineering (buildings, airplanes, cars, trains, ships and theirs parts or the whole geometry),
- measuring of pressure distribution and pressure fields on a models surface and determination of the external pressure coefficient on the model surface,
- measuring of stream fields and vortex fields near to modeled objects,
- measuring of wind stream fields not only in standard terms, but also in difficult topographical terms; impact of topography on resulting stream fields,
- measuring of emissions dispersion over modeled terrain in the vicinity of an emissions source,
- flow visualization (smoke, helium bubbles).

Instrumental equipment:

- Atmospheric Boundary Layer Wind Tunnel
- 3D printer

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INSTRUMENTAL EQUIPMENT

LABORATORY OF BUILDING AERODYNAMICS I

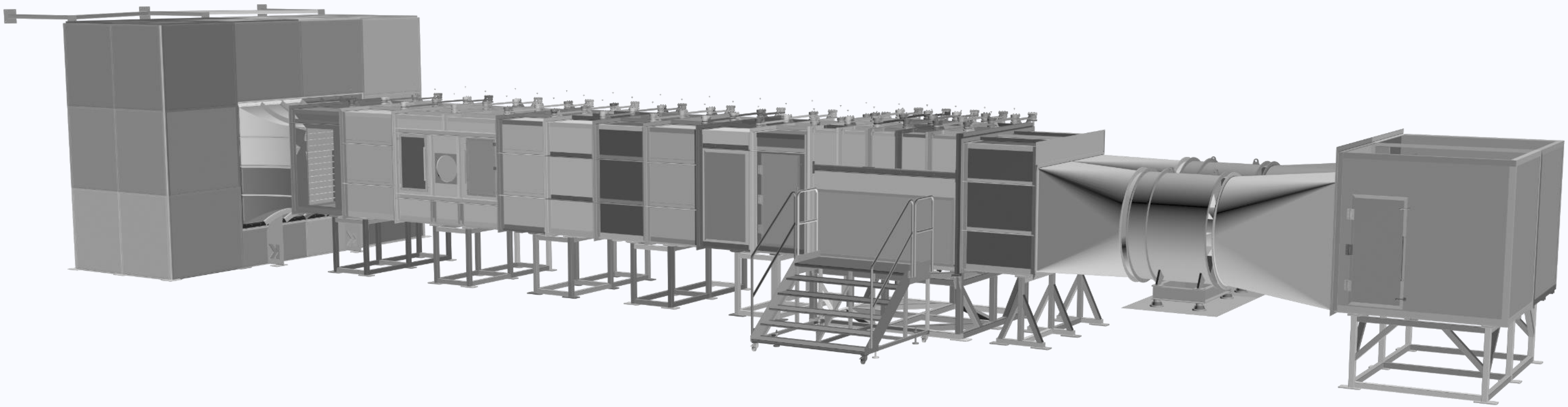
Click on the image to select a specific device / equipment:

Atmospheric Boundary Layer Wind Tunnel (BLWT)

3D printer ProJet 260C

BOUNDARY LAYER WIND TUNNEL

LABORATORY OF BUILDING AERODYNAMICS I



Scheme of the atmospheric boundary layer wind tunnel

BOUNDARY LAYER WIND TUNNEL

LABORATORY OF BUILDING AERODYNAMICS I

The wind tunnel was designed by Výzkumný a zkušební letecký ústav, a.s. (Research and Testing Aerospace Institute, jsc.) in Prague and realized by the company Konstrukta – Industry, a.s. Trenčín (Konstrukta – Industry, jsc.). The wind tunnel is constructed as an open-circuit tunnel with the total length of 26.4 m and with cross section of 2.6 x 1.6 m. The volume airflow is 52 m^3/s and the total pressure difference is 915 Pa. The facility allows the simulation of the random character of wind – wind in an atmospheric boundary layer, as well as a steady flow with a uniform velocity distribution. This simulation is possible in two test sections, which are in serial arrangement:

- The measuring space no. 1 is located in the front part of the wind tunnel behind guidance lamel grid. It is determined for laminar flow research. The width of the measuring space is 2.6 m, and its length is 3.0 m. The height is variable from 1.1 m to 1.6 m. The measuring space is adapted for insertion of a contraction part. This allows to adjust net height and decrease it by 0.3 m. The laminar flow is in the wind range from 3 m/s to 32 m/s.

- The measuring space no. 2 is located in back part of the wind tunnel in front of ventilation unit. It is determined for turbulent flow research. The width of measuring space is 2.6 m and its length is 3.0 m. The height is variable from 1.1 m to 1.6 m. This space is optimal for model tests with the simulation of the atmospheric boundary layer. Maximum velocities are in the range of 0.3 m/s to 15 m/s.

BOUNDARY LAYER WIND TUNNEL

LABORATORY OF BUILDING AERODYNAMICS I

General view of the atmospheric boundary layer wind tunnel


General view of measuring space for turbulent flow

BOUNDARY LAYER WIND TUNNEL

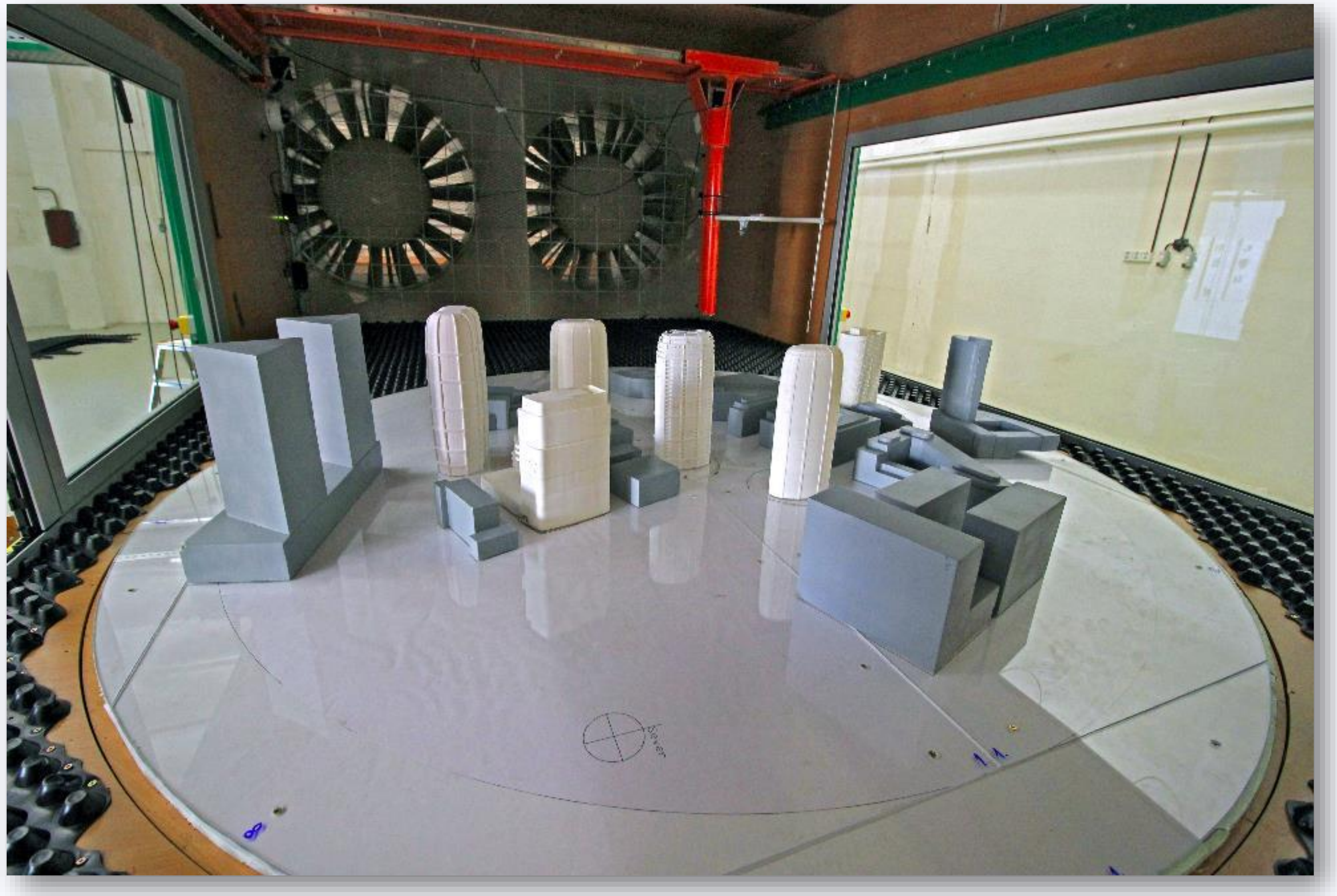
LABORATORY OF BUILDING AERODYNAMICS I

The view of a model testing the mutual interaction of three elliptical tall buildings placed in a wind tunnel

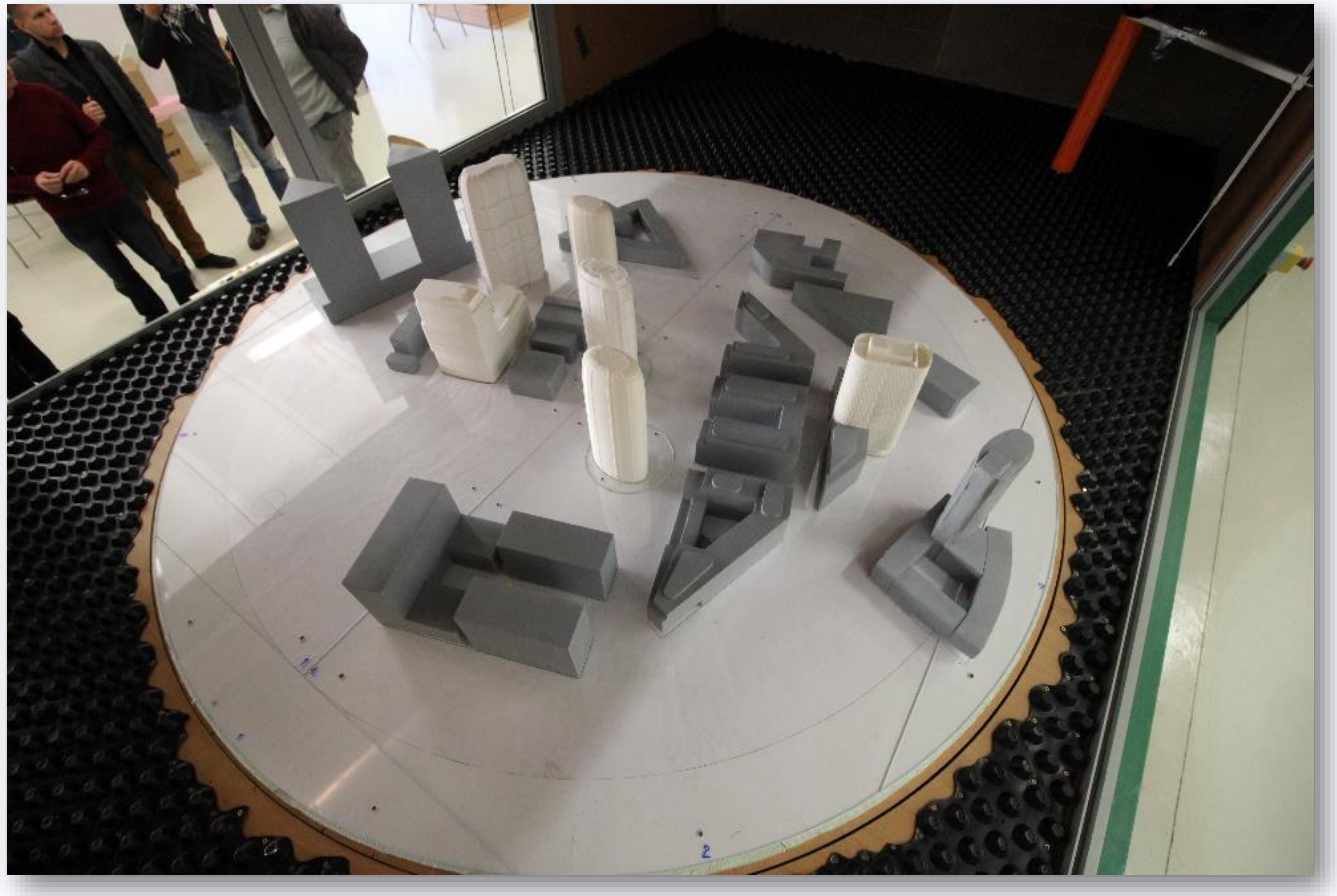
The pressure scanner DSA 3217

BOUNDARY LAYER WIND TUNNEL

LABORATORY OF BUILDING AERODYNAMICS I



The view of a model testing the mutual interaction of three elliptical tall buildings placed in a wind tunnel



The view of a model testing the mutual interaction of three elliptical tall buildings placed in a wind tunnel

3D PRINTER ProJet 260C

LABORATORY OF BUILDING AERODYNAMICS I

3D printer ProJet 260C serves as printer of 3D objects for the purpose of testing in a wind tunnel.

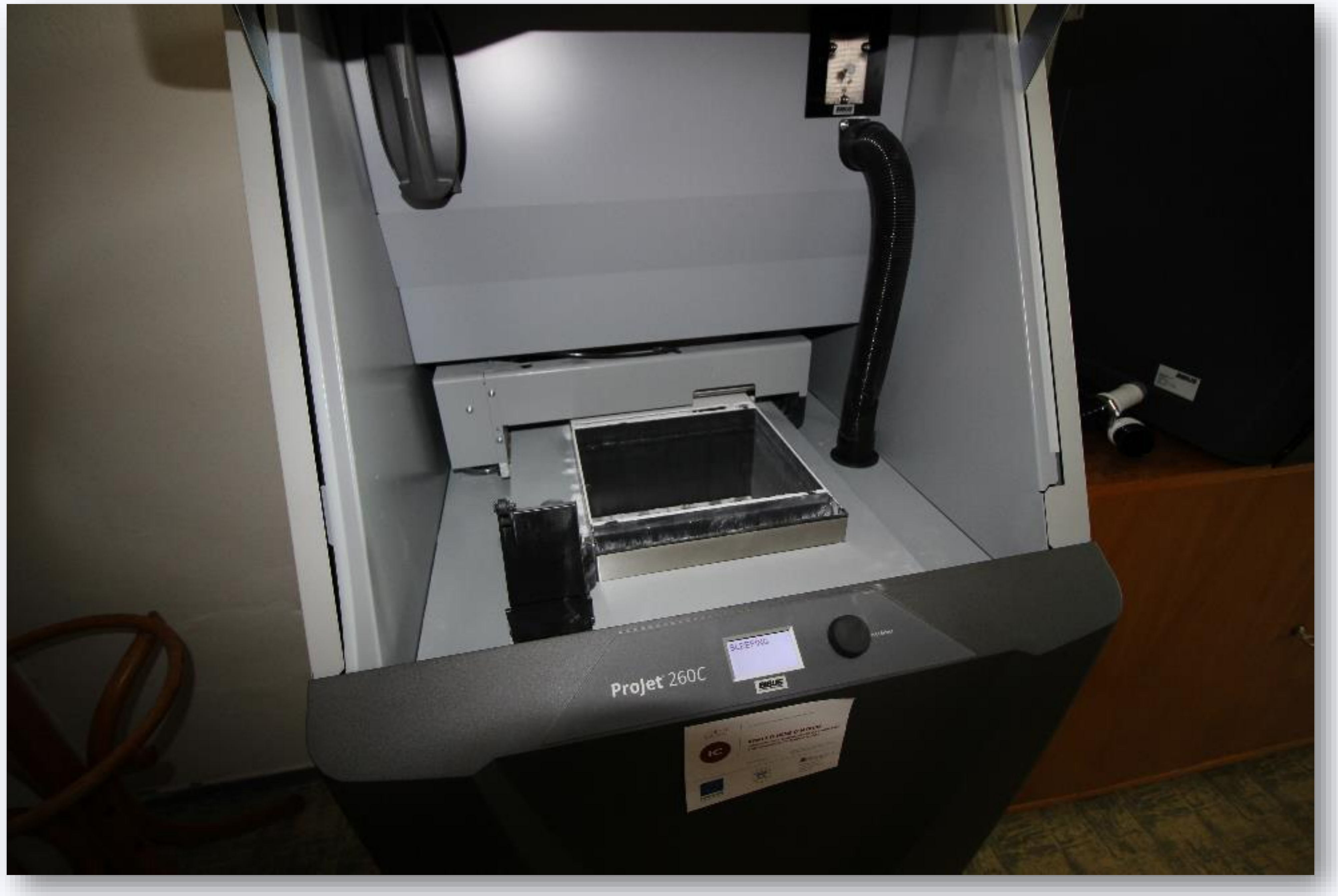
Technical specification:

- automatic insertion / removal / recycling powder,
- fast insertion of the cartridge with the binder,
- resolution 300×450 DPI, minimum size is 0.41 mm,
- 64 CMY colors,
- Separate chamber to remove powder from samples,
- dimensions of print area: 185×236×132 mm,
- dimensions of printer: 740 × 790 × 1400 mm (with closed cover),
- 740 × 790 × 1830 mm (with open cover),
- weight: 166 kg,
- maximum ambient temperature: od 10 – 29,4 °C,
- maximum humidity: od 15 % – 70 % (non-condensing),
- noise level: printing: 57 dB, discharge of the powder : 66 dB, vacuuming: 86 dB,
- power supply: 230 V~, 2.75 A, 50 – 60 Hz.

3D PRINTER ProJet 260C

LABORATORY OF BUILDING AERODYNAMICS I

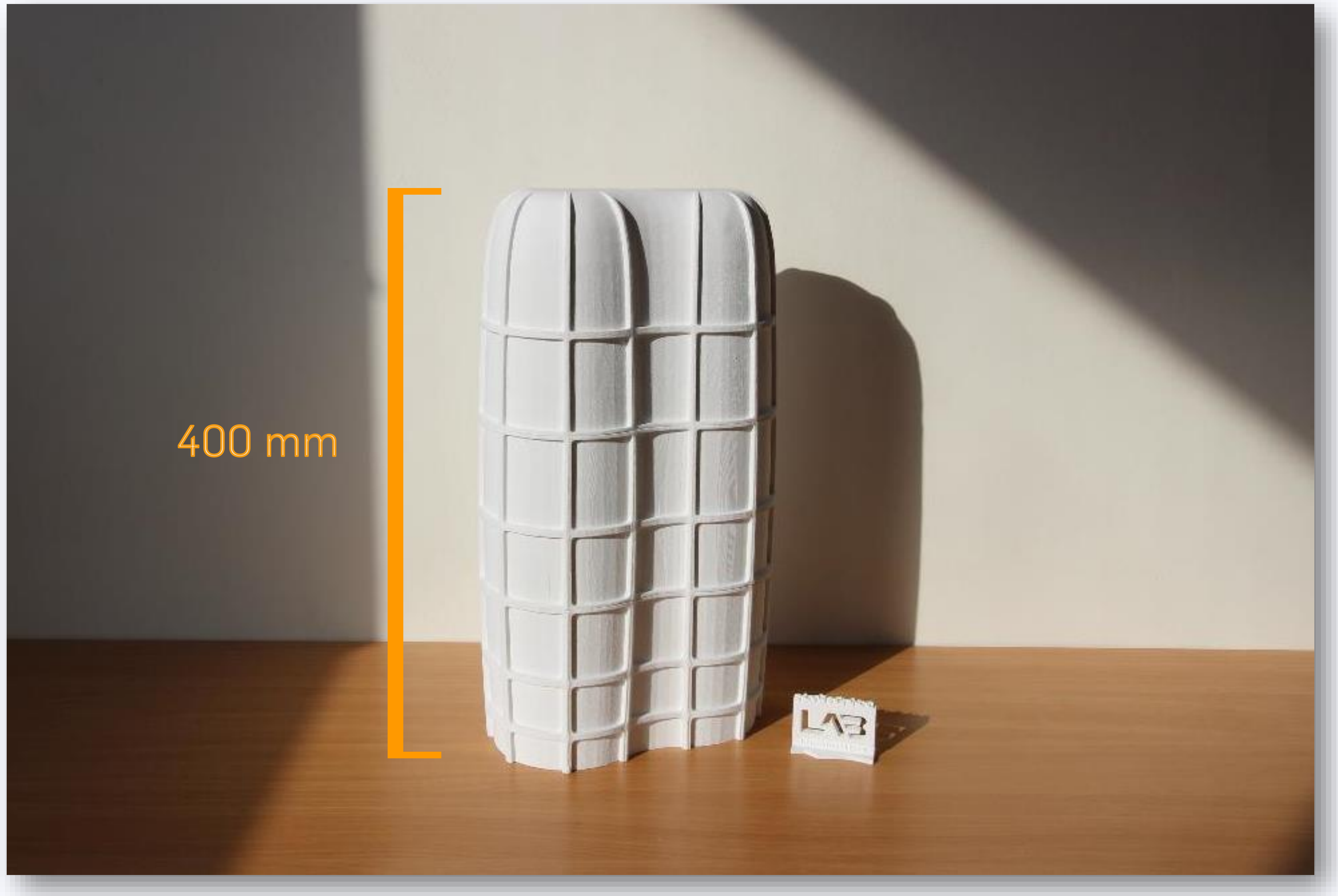
3D printer with chamber to remove powder



Printing area of 3D printer

3D PRINTER ProJet 260C

LABORATORY OF BUILDING AERODYNAMICS I



The view at a model from 3D-printer

The view at a model from 3D-printer

Laboratory of Building Aerodynamics II

LABORATORIES KKPS

Instrumental equipment

DESCRIPTION OF LABORATORY

LABORATORY OF BUILDING AERODYNAMICS II

Description:
The Laboratory of Building Aerodynamics II is located in basement rooms of the block B in the Faculty of Civil Engineering STU on Radlinského street no. 11 in Bratislava. It is equipped with a small pressure chamber for experimental research of air filtration through sealing profiles and with a big pressure chamber for experimental research of air filtration through construction details and through elements of buildings envelope under the load of a net air pressure. The laboratory is equipped also with the Blower door test apparatus for buildings envelope airtightness quantification.

Instrumental equipment:

- The Small Pressure Chamber
- The Big pressure Chamber
- The device RETROTEC Q46-240V – Blower door test

COOPERATION POSSIBILITIES:

- determination of physical and technical characteristics of a sealer in terms of sealing profiles air permeability under different compression conditions,
- determination of volumetric air permeability coefficient Q_V of new construction materials,
- experimental testing of contacts between parts of exterior walls in terms of air filtration,
- experimental testing of windows in terms of air infiltration,
- determination of the building airtightness with a Blower door test using the pressure gradient method in accordance with STN EN 13 829 (determination of the total air exchange rate n_{50} at a pressure difference of 50 Pa).

LABORATORIES KKPS

INSTRUMENTAL EQUIPMENT

LABORATORY OF BUILDING AERODYNAMICS II

Click on the image to select a specific device / equipment:

The Big Pressure Chamber

The device RETROTEC Q46-240V – Blower door test

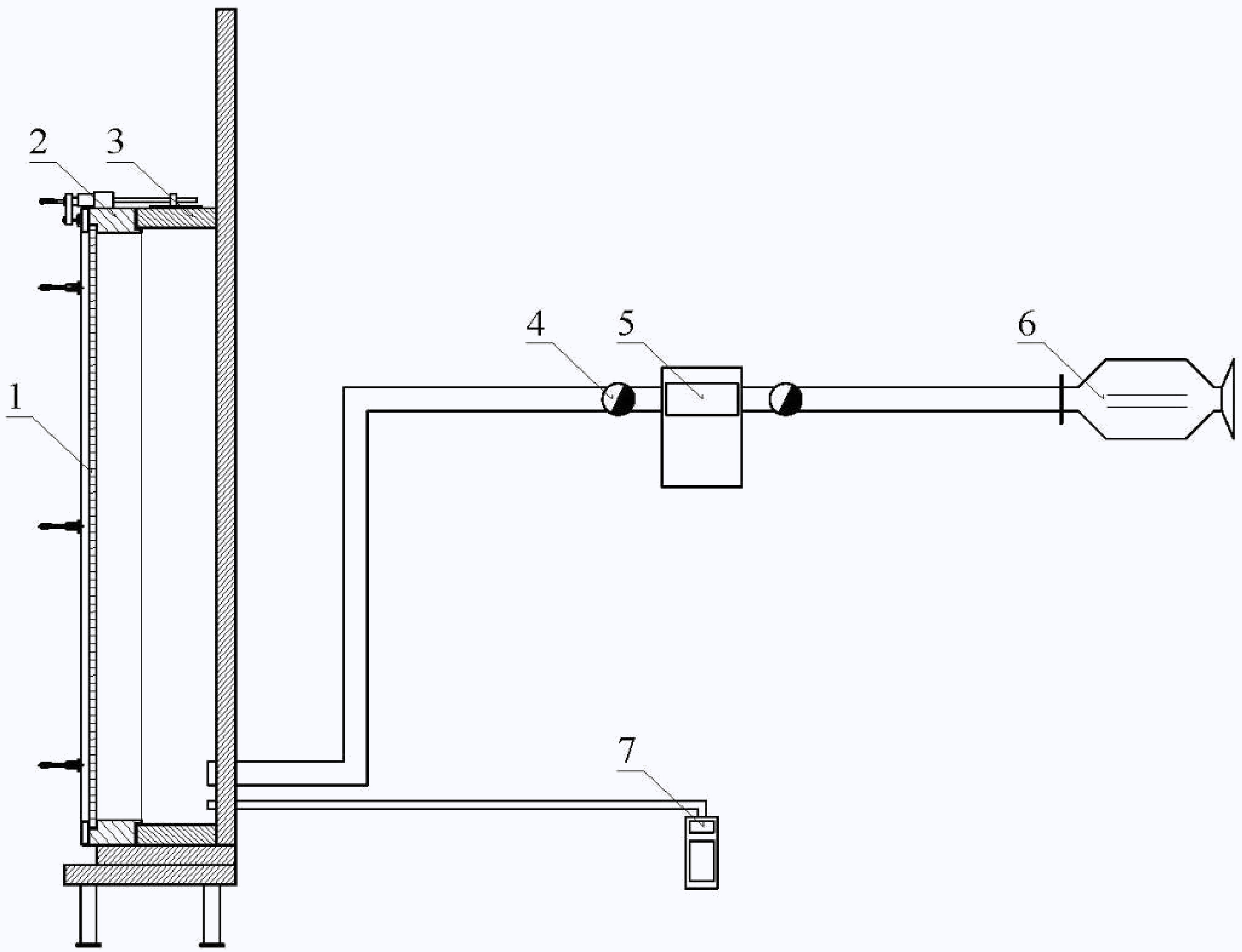
THE BIG PRESSURE CHAMBER

LABORATORY OF BUILDING AERODYNAMICS II

The big pressure chamber used for research of air infiltration through construction details (contact between parts of exterior walls) or through elements of building envelopes (windows, glazed walls) depending on net air pressure load *Δp* (Pa). It allows quantification of physical and technical characteristics of building envelopes elements in terms of air permeability as an important factor that affects energy consumption of buildings and their ecology. This pressure chamber allows experimental tests of analyzed elements in terms of air infiltration under load:

- wind flows with steady velocity or in bursts from 0 m/s to 45 m/s,
- constant air pressure difference from 0 Pa to 1200 Pa.

The chamber is equipped with air sources, air cycler (windbursts) and with an exact air flow meter



Scheme of the big pressure chamber
1 – specimen, 2 – frame, 3 – test pressure chamber, 4 – air flow regulator, 5 – air flow meter 6 – fan, 7 - barometer

THE BIG PRESSURE CHAMBER

LABORATORY OF BUILDING AERODYNAMICS II

The big pressure chamber

The window with ventilation grid in the big pressure chamber

THE DEVICE RETROTEC Q46-240V

LABORATORY OF BUILDING AERODYNAMICS II

This device is used to measure the air tightness of low-energy houses and in infiltration (exfiltration) measuring through building envelopes and through separating building constructions. The equipment consists of a fan (to create a vacuum or overpressure in the space), of a central unit (consisting of a differential barometer), of a control section (for fan control) and of air flow measuring. The Blower door test is used mainly in low-energy houses to determine the airtightness as important information about the construction quality. The essence of the test according to EN 13829 is to determine the air change at a pressure difference of 50 Pa.

Technical specification:

- air pressure -750 to +750 Pa ± 1 Pa or ± 2 %,
- airflow 0 to 15000 m^3/hour ± 2.5 %,

Power supply:

- measuring part 6 V (battery or power supply),
- fan network 230 V.

Demonstration of the use of equipment RETROTEC Q46-240V when measuring leakages in a flat house

Laboratory of Hydrodynamics of Buildings

LABORATORIES **KKPS**

Instrumental equipment

DESCRIPTION OF LABORATORY

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

Description:
The Laboratory of Hydrodynamics of Buildings is located in basement rooms of the block B in the Faculty of Civil Engineering STU on Radlinského street no. 11 in Bratislava.
The Laboratory of Hydrodynamics of Buildings is equipped with an integrated large pressure and rain testing chamber for experimental examination of air and water tightness of details, components and building envelope systems in boundary conditions containing wind-driven rain.

COOPERATION POSSIBILITIES:

- experimental testing of exterior walls, envelope elements and its connections in terms of water penetration,
- experimental testing of transparent structures of buildings (windows, glazed wall, transparent facades) in terms of water tightness.

Instrumental equipment:

- Large Pressure and Rain Testing Chamber

INSTRUMENTAL EQUIPMENT

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

Click on the image to select a specific device / equipment:

Large Pressure and Rain Testing Chamber

LARGE PRESSURE AND RAIN TESTING CHAMBER

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

A large pressure and rain testing chamber is used for experimental examination of air infiltration and water penetration phenomena observed by details, elements and components of building envelope. The inner surface also as the whole rain chamber is made of stainless steel. It is equipped with internal lighting and inlet opening. This laboratory device consists of technological circuits of positive and negative air pressure, constant flow of suppling water, wind-driven rain, airflow velocity, controlling and regulating parts also as a multichannel pressure and airflow velocity measurements.

Specifications of particular technological circuits:

- circuit of positive and negative air pressure:: - 3000 Pa to +3000 Pa, with the possibility of max. positive and negative air pressure cycling, adjustable in the period of 5 to 100 s,
- circuit of airflow - airflow shocks ranging from 0.05 to 100 $m^3/h \pm 2$ %,
- Circuit of wind-driven rain intensity with ability of wind-driven rain pressure factor rendering - variable nozzles set: 0.01 to 0.2 $m^3/h \pm 2$ %,
- circuit of constant supply flow of water, which following the intensity of wind-driven rain falls above the analyzed spot and gravitationally moves downward: 0.05 to 1.0 $m^3/h \pm 2$ %.

LARGE PRESSURE AND RAIN TESTING CHAMBER

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

Dimensions for the pressure and rain chamber are 2500 × 2500 × 1400 mm with examination opening 2400 × 1800 mm.

The water flow circuit for tightness measurements is closed, equipped with water recirculation and is able to maintain desired operational pressure in the range from 1 to 6 bar. The circuit of pneumatical fixation of the examined samples together with the air pressure generator and distribution channels enables the fixation sample to the frame of chamber in 20 spots in the range of 20 to 200 mm.

Part of the equipment is an electronic system of deflection measurement in 12 spots on the measured samples in the range of 0 to 50 mm with the accuracy of ± 0.02 mm.

View of a large rain testing chamber with modelling of complex effects of wind-driven rain

LARGE PRESSURE AND RAIN TESTING CHAMBER

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

Circuits of wind airflow and differential air pressure are synchronized. The set of nozzles produces raindrops (in size and weight), depending on the desired rain intensity. This compliance is ensured by interchangeable splitters - sprayers. The tested sample complies with the requirements of building hydrodynamics in terms of water tightness, when under the boundary conditions based on the hourly and daily intensity of wind-driven rain there is no penetration of water (a condition where the rain reaches the inner surface of a test structure).

the inner surface of a test structure).
Measurements and logging of regulated and readout units runs in the LabView software environment under the NI cRIO-9066 system from Nation Instruments.

View of a large rain testing chamber with modelling of complex effects of wind-driven rain

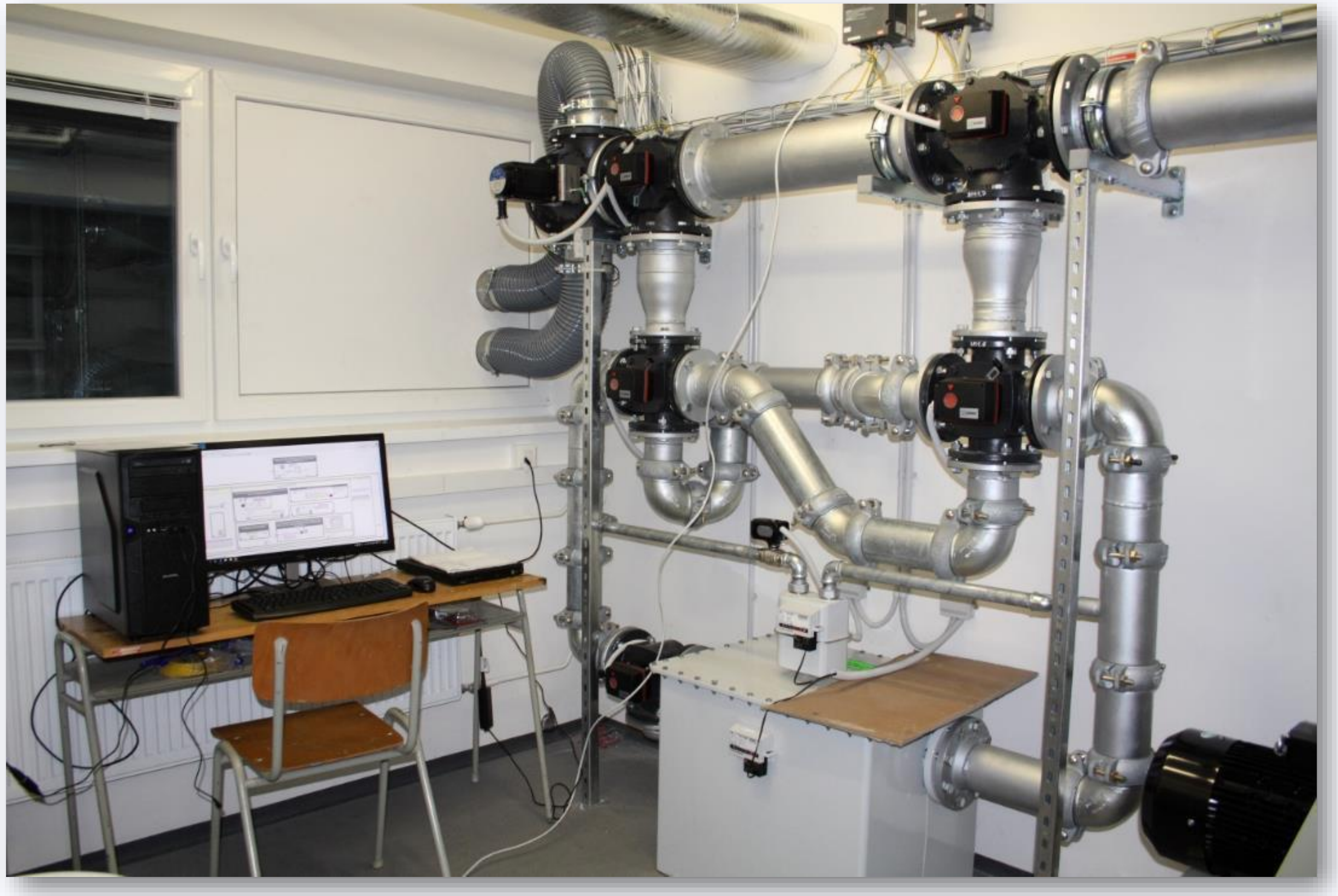
LARGE PRESSURE AND RAIN TESTING CHAMBER

LABORATORY OF HYDRODYNAMICS OF BUILDINGS

An additional measurement of physical units from universal sensors according to the requirements of experiment is available through the datalogger KeySight 34980A with 60 measurement slots in the range of 0 to 10 V ± 0.004 %/a.

The software system allows the autonomous operation of the whole device with the possibility of controlling all process variables and checking all measured variables through a PC connected to the network according to user preferences.

Besides the listed parameters, the rain chamber meets the requirements of STN EN 1027 and STN EN 1026.



View of the technological part of a large rain testing chamber modeling complex effects of wind-driven rain

Laboratory of Daylighting and Building Insolation

Instrumental equipment

LAB
LABORATORIES **KKPS**

DESCRIPTION OF LABORATORY

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

Description:
The main purpose of the laboratory is to carry out measurements of daylight and sun radiation. It´s equipped with high quality devices designed to measure and evaluate daylight environment characteristics in buildings from the perspective of chronobiology and circadian photometry. The possibility to measure various characteristics of indoor and outdoor daylight is also provided by the use of the scale model of the rooms placed on the roof of Faculty of Civil Engineering - block A. Programs for the processing and analysis of measurement data are also part of the laboratory.

COOPERATION POSSIBILITIES:

- development of daylight technical reports, particularly in terms of requirements and criteria of Slovak technical standards STN 73 4301, STN 73 0580-1, 2.
- measurement of sun radiation and daylight including spectral characteristics in the internal and external environment,
- measurement of the spectral transmittance and reflectance of materials and additional calorimetric measurements,
- evaluation of circadian parameters of daylight environment.

Instrumental equipment:

- Spectrophotometer Konica Minolta CM-5
- Spectrophotometer Konica Minolta CL-500A
- Data logger Almeno 2590 with sensors to measure illuminance FLA 623 VL
- Chroma meter Konica Minolta CS 100A
- LightWatcher data logger
- Pyranometer CMP3 with appropriate data logger – Weather Station AMS II
- Luxmeter HAGNER Digital type EC1
- Sensor ML-020S-O for the measurement of illuminance
- The device YK-35UV designed by Lutron Electronic

INSTRUMENTAL EQUIPMENT

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

Click on the image to select a specific device / equipment:

Spectrophotometer
Konica Minolta CM-5

Spectrophotometer
Konica Minolta CL-500A

Data logger Almeno 2590
with sensors FLA 623 VL

Chroma meter
Konica Minolta CS 100A

LightWatcher
Data logger

Pyranometer CMP3
with appropriate data logger

Luxmeter
HAGNER Digital type EC1

The device YK-35UV designed
by Lutron Electronic

SPECTROPHOTOMETER KONICA MINOLTA CM-5

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

The portable spectrophotometer can be used independently or in combination with a PC by the use of the program called Spectramagic NX. The device was constructed to provide a wide range of measurements of the spectral reflectance of a surface, powders, granules placed on the top of this device and the spectral transmittance of spectral filters and fluid placed inside the spectrophotometer.

It can be used in the construction industry to measure the spectral properties of glazing, foils and to measure the spectral reflectance of a surface. The measuring range, from 360 to 740 nm, represents the visible light spectrum with 10 nm steps. It is possible to change the mask (upper disc with a hole) to measure the surface reflectance for Ø3, Ø8 or Ø30 mm. There is the adjustable implemented standard illuminant A, D65 and F set. It enables measuring color in the Lab color space; xyz and offers adjustability of the standard observer 2 ° or 10 °.

Measurement of the spectral reflectance of colored wallpaper

SPECTROPHOTOMETER KONICA MINOLTA CL-500A

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

The portable hand-held spectrophotometer allows complex evaluation of the lighting climate quality of an internal environment. The device can be used independently or in combination with a PC with the use of the program Microsoft Excel. It is powered by a built-in battery or connected to a PC.

The device enables a variety of operations:

- measurement and display continuous course of the visible spectrum from 360 nm – 780 nm in steps of 1 nm,
- measurement of photopic illuminance *Ev* [lx],
- definition of the color within the coordinate system x, y,
- measurement of correlation temperature of the color, color rendering index $R_1 - R_{15}$ as well as total color rendering index R_a.

The device can be set for a single measurement or for the recording of measured data continuously by the selected time step.

The view of the spectrophotometer Konica Minolta CL-500A with a PC connection cable

DATA LOGGER ALMENO 2590

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

Data logger Almemo 2590 is a universal data logger for recording data from four selected sensors that record, for example, illuminance, temperature, air quality and others. The device is equipped with a 220 V adapter or AA batteries which enable the recording of data for several weeks. Long-term data recording is enabled by a memory card slot.

The sensor FLA VL 623 is an excellent choice for measuring illuminance, since its course is nearly identical with a standardized photopic curve V_λ. The measuring range of the sensors is 380 – 720 nm with a maximum at 555 nm. There are two channels, one allows to measure illuminance ~20 klx and another one to ~170 klx.

Data logger Almemo 2590 with two sensors FLA 623VL

CHROMA METER KONICA MINOLTA CS 100A

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

Chroma meter CS 100A is a practical portable device to record the luminance and color chromaticity X, Y. It is powered by a battery and is easy to hold to focus on a target. The measurement angle of the device is 1 ° with a measuring range of 0.01 – 299 000 cd/m^2.
The device is suitable for the measurement of an internal environment in terms of controlling the level of luminance and color variations of light sources, including miniature LED light sources.
This device can be connected to the PC by the use of the serial port RS-232C, or powered by a battery of 9V.

Chroma meter CS 100A

LIGHTWATCHER DATA LOGGER

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

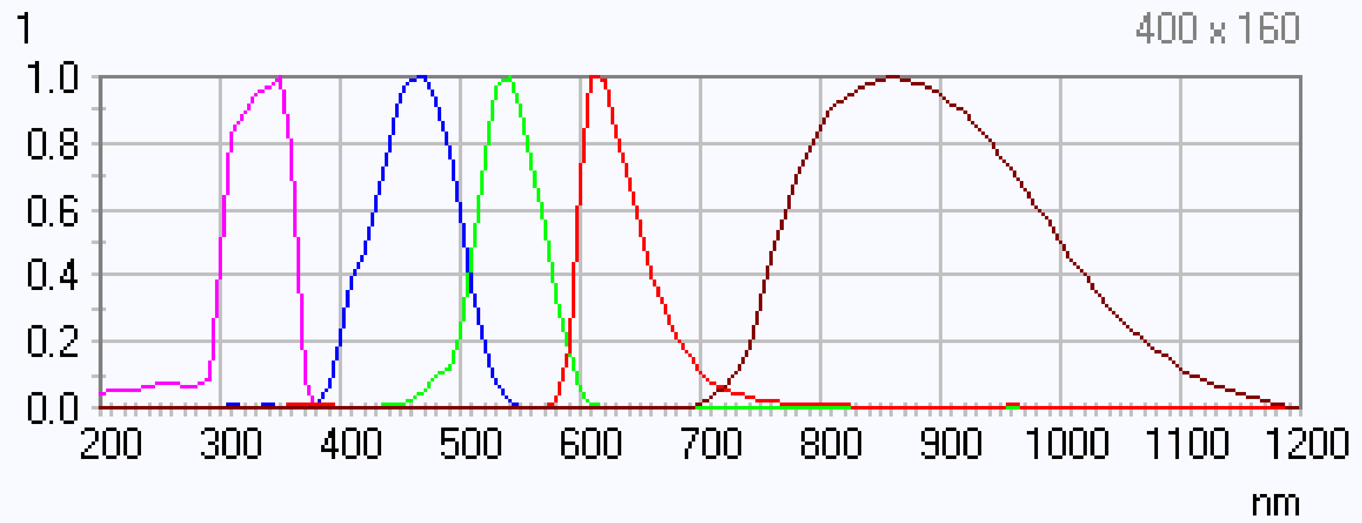
LightWatcher is miniature device to measure lighting parameters and it stores the data in a memory card. Its miniature dimensions 20 mm × 50 mm × 10 mm with a weight of 12 g predetermine the device to be used for continuous recording in conjunction with the daily activities of the user. The device has been designed for the examination and evaluation of lighting in terms of its biological effect on humans.

The device is widely used and enables continuous recording within intervals of 0.5 seconds to 30 minutes.

LightWatcher enables recording of the following parameters: illuminance E_V [lx], irradiance (UV, red (R), green (G), blue (B), IR), movement in the internal space (actiwatch), temperature, measurement of barometric pressure and relative humidity.

The device uses the program OT-Senzor, which works in MS Windows and enables device setting and data downloading and processing.

The view of Lightwatcher



The spectral sensitivity courses of the colored sensors for UV, R, G, B, IR

PYRANOMETER CMP3 WITH DATA LOGGER

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

The pyranometer is a small portable device for measuring solar radiation in W/m^2. This device records data from the sensor of the hemisphere. Construction of the pyranometer was designed for continuous measurement in external climatic conditions. The device is able to distinguish radiation in the range of 300 – 2 800 nm and the radiation level of 2 000 W/m^2. The sensitivity of the sensor is 10 μV/W/m^2 with a reaction time of <18 in the boundary conditions of -10 °C to +40 °C with an error of 5 % .
The operational temperature of the device is from -40 °C to +80 °C with a deviation <1 %/rok.
There is a rectification platform within CMP3 designed for the positioning of the device and also a waterproof connector with a cable length of 10 and 30 m.
There is a typical connector powered from an earlier version of Weather Stations AMS II, which is battery powered and enables recording and power even for a month.

Pyranometer CMP3 with battery connected to Weather Station AMS 111II

LUXMETER HAGNER DIGITAL TYPE EC1

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

The device was designed for use in internal spaces. It is easy to operate for the immediate measurement of illuminance levels. Dimensions of the device are 135 mm × 75 mm × 35 mm with a weight of 200 g. The measuring range of the digital device is 0.1 lx – 200 000 lx.

The spectral sensitivity of the device is almost identical to a standard photopic curve V_λ according to CIE.

The producer states that the accuracy of the device has an error rate of ≤ 3 %.

Luxmeter HAGNER Digital type EC1

THE DEVICE YK-35uv

LABORATORY OF DAYLIGHTING AND BUILDING INSOLATION

This device was constructed to measure UVA and UVB radiation for the monitoring of negative effects of solar radiation, radiation produced by welding etc. It can be a used to examine degradation of materials and also in the laboratory when working with UV radiation in general.

Technical specification:

- range of UV radiation 290 to 390 nm,
- measurement range 0 to 2 W/cm^2 ± 4 % FS + 2 dgt
  0 to 20 W/cm^2 ± 4 % FS + 2 dgt,
- dimension 200 × 68 × 27 mm,
- weight 350 g (batteries included 1 × 9 V).

Measurement device YK-35UV designed by Lutron Electronic

Laboratory of Energy Efficacy of Buildings and Solar Energy Research

Instrumental equipment

LAB
LABORATORIES **KKPS**

DESCRIPTION OF LABORATORY

LABORATORY OF ENERGY EFFICACY OF BUILDINGS AND SOLAR ENERGY RESEARCH

Description:
The Laboratory of Energy Efficacy of Buildings and Solar Energy Research is located in the area of the Central Laboratory of the Faculty of Civil Engineering STU in Bratislava – Trnávka.
The Laboratory of Energy Efficacy of Buildings and Solar Energy Research is involved in the concept of measuring pavilions. The core of the research is the real modeling of an outdoor climate.

COOPERATION POSSIBILITIES:

- Determination of the U-values (W/(m^2.K)) of glazing systems and entire transparent structures of windows and glazed walls, taking into account the light transparency,
- Testing to quantify passive solar building systems (solar walls, solar roof, solar window glass solar glazed space – energy, buffer or temperature cavity, etc.).

Instrumental equipment:

- TWIN-BOX

INSTRUMENTAL EQUIPMENT

LABORATORY OF ENERGY EFFICACY OF BUILDINGS AND SOLAR ENERGY RESEARCH

Click on the image to select a specific device / equipment:

TWIN-BOX

LABORATORIES KKPS

TWIN-BOX

LABORATORY OF ENERGY EFFICACY OF BUILDINGS AND SOLAR ENERGY RESEARCH

The device consists of two identical test cells – areas (HOT BOX) used as the comparative study of heat transfer through transparent and non-transparent systems of buildings. Basically, it sets up an effective value of the coefficient of heat transfer U (W/(m^2.K)) of a measured fragment, which is significantly more accurate than the U-value established by laboratory techniques during so-called dark hours if the fact, that the structure of the fragment is also exposed to solar radiation, is neglected. If one of the identical cells is considered to be the reference one, the comparison of the results with the other one precisely determines the impact of any change to the structure of the fragment (e. g. windows). Measured and a reference sample are mounted to the facade with orientation to the South. Adjacent testing cells are placed in an air conditioned room within the building serving as a compensation space.

The device can be used to quantify the following passive solar building systems: direct, indirect, isolated, convective and combined circuits, glazing areas with the function of energy, or temperature cavities.

TWIN-BOX

LABORATORY OF ENERGY EFFICACY OF BUILDINGS AND SOLAR ENERGY RESEARCH

The view of the TWIN-BOX set and control panel placed in compensation room

The view of insulation glass placed in the openings of TWIN-BOX

Laboratory of Roof Research

Instrumental equipment

LABORATORIES KKPS

DESCRIPTION OF LABORATORY

LABORATORY OF ROOF RESEARCH

Description:
The Laboratory of Roof Research is located in basement rooms of the block B in the Faculty of Civil Engineering STU on Radlinského street no. 11 in Bratislava.
The laboratory is primarily built to carry out tests under laboratory conditions in order to determine damage to materials and coatings. It is equipped with quality instrumentation technology to measure and evaluate the impact of the environment and the aging of building materials and instrumentation to measure tensile strength of sheet roofing.

COOPERATION POSSIBILITIES:

- simulation of accelerated UV aging to verify/ verifying the resistance of coloured finishings of building materials,
- determination of the useful life of implemented roof covering (SBS, APP, EPDM, PVC-P, TPO) under the action of UV radiation,
- demonstration of tensile strength of sheet roofing based on SBS, APP, EPDM, PVC-P, TPO,
- volume and mass stability testing of sheet roofing based on SBS, APP, EPDM, PVC-P, TPO and other materials at different temperatures.

Instrumental equipment:

- Chamber for testing of building roofs reliability
- Solar simulation and humidity chambers model QUV/spray and model Q-SUN
- Tensile testing machine – 20 kN
- Hot air chamber with forced air circulation
- Digital laboratory balances with high sensitivity
- Laboratory balance for drying programs / Moisture analyser
- Digital thickness gauge
- Digital caliper

INSTRUMENTAL EQUIPMENT

LABORATORY OF ROOF RESEARCH

Click on the image to select a specific device / equipment:

Chamber for testing of building roofs reliability

Solar simulation and humidity chambers

Tensile testing machine – 20 kN

Hot air chamber with forced air circulation

Digital thickness gauge

CHAMBER FOR TESTING OF BUILDING ROOFS RELIABILITY

LABORATORY OF ROOF RESEARCH

The chamber carries out accelerated weathering tests in laboratory conditions under the action of repeated alternation of negative and positive temperature in combination with moisture for the purpose of conduct detection, damage and absorption of various building materials. The test chamber offers in addition to the substitution/ alternation of negative temperatures - 40 °C and a positive + 180 °C, also a possibility of inclusion of moisture as a factor in stress testing. Humidity range (climatic/climate chamber): from 5% to 98% of relative humidity.

The doors for climatic chamber are equipped with 6 layered heated window glass panels for observing ongoing processes, as well as integrated insulated gloves which allow handling of the test sample at temperatures from -20°C to +100°C. The capacity of testing samples at full load of all the shelves is up to 100 kg.

View of the chamber for testing of building roofs reliability

CHAMBER FOR TESTING OF BUILDING ROOFS RELIABILITY

LABORATORY OF ROOF RESEARCH

Dimensions:

- test area volume 350 l,
- test area dimensions 650 × 720 × 750 mm,
- shelves dimensions 620 × 600 mm (the maximum load of each shelf is 35 kg, together max. 100kg).

Thermal testing:

- temperature range -40°C to +180°C,
- temperature fluctuation ≤ +0.3 K over a period of time.

Climatic testing:

temperature range -10°C to +95°C,
Temperature fluctuation ≤+ 0.3 K over a period of time,
Humidity range 10% to 98% of relative humidity,
Dew point temperature range I. +7°C to +94°C,
Dew point temperature range II. -10°C to +7°C,
Relative humidity fluctuation (steady state regime)
For dew point temperature range I. ≤ +1.5 % relative humidity in a period of time
For dew point temperature range II. ≤+3 % relative humidity in a period of time.

View of the glass door of the chamber and two openings for integrating gloves to handle with test samples

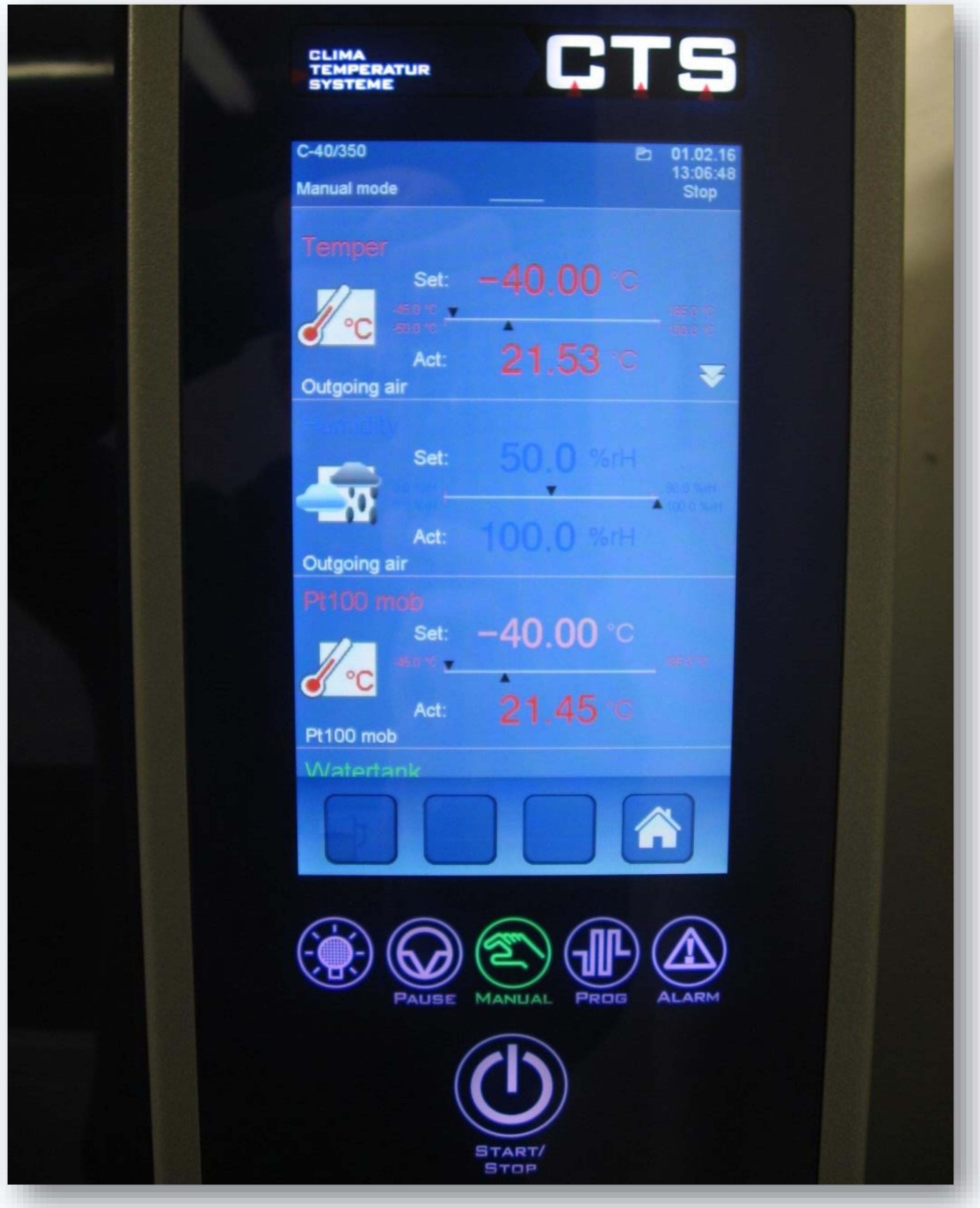
LAB
LABORATORIES KKPS

CHAMBER FOR TESTING OF BUILDING ROOFS RELIABILITY

LABORATORY OF ROOF RESEARCH

COOPERATION POSSIBILITIES:

- simulation of repeated alternating positive and negative extreme temperatures (-40°C to +180°C) to verify behavior and degradation of various building materials,
- simulation of repeated alternation of positive and negative temperatures (-10°C to +180°C) in combination with moisture to verify/ verifying behavior and degradation of various building materials,
- simulation of specific weather conditions to determine the absorption of the various building materials in their integration,
- detection of volume changes of materials due to thermal stresses,
- detection of volume changes of materials under the influence of humidity and temperature,
- interaction of materials of different properties when changing extreme positive and negative temperatures,
- simulation of accelerated UV aging of material connections.



LED control panel with touch screen

SOLAR SIMULATION AND HUMIDITY CHAMBERS

LABORATORY OF ROOF RESEARCH

The device QUV is designed for accelerated weather test implementation in laboratory conditions for the purpose of damage detection of materials and their surface layers influenced by sunlight, rain and moisture. The samples may/ might be exposed with a controlled cycle of light and humidity exposure to elevated temperature. The device QUV simulates the effect of the UV component of sunlight with a fluorescent UV lamp as well as moisture in achieving condensation conditions. The test conditions of exposure can be set according to the requirements determining the resistance of various environments.

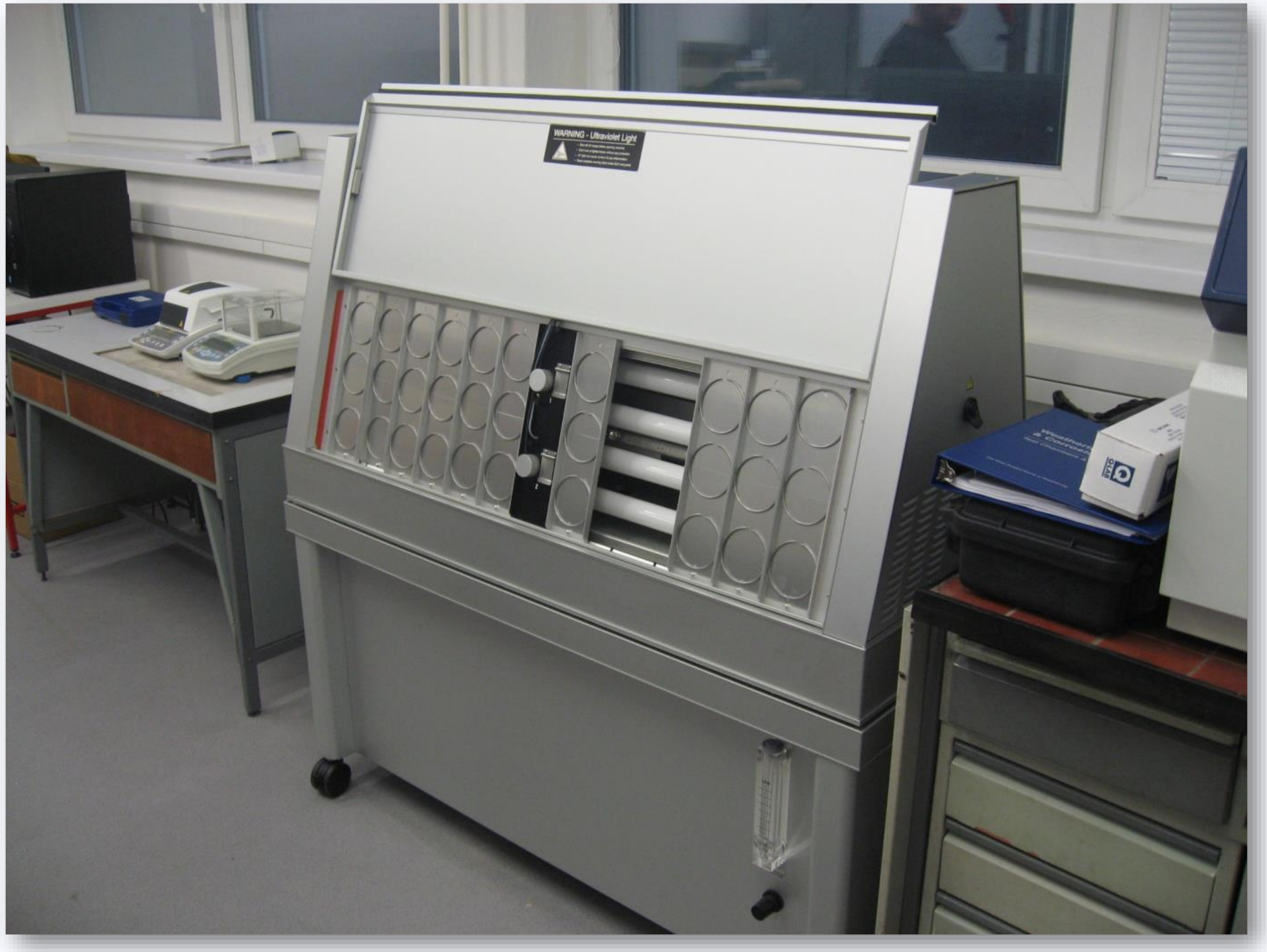
Technical specification QUV/spray :

Temperature range:

- 50 °C – 75 °C for UV test period,
- 40 °C – 60 °C for condensation period,

Range of radiation intensity:

- min. 0.35 W/m^2, max. 1.55 W/m^2,
- ability to test 48 samples with dimensions 75 × 150 mm.



View of QUV/spray tester

SOLAR SIMULATION AND HUMIDITY CHAMBERS

LABORATORY OF ROOF RESEARCH

The Q-SUN Xe 1S tester is a device with a xenon lamp simulating a wide basic range of solar radiation intensity and temperature in the chamber during the test with programmable demineralized water spray.

COOPERATION POSSIBILITIES:

- simulation of accelerated UV aging to verify/ verifying the resistance of coloured finishings of building materials determined for outdoor implement (roofing tile, metal sheet covering/ metal roofing with PU coating and other),
- determination of the life expectancy of sheet covering (SBS, APP, EPDM, PVC-P, TPO) and resistance to UV radiation,
- determination of the useful life of implemented roof covering (SBS, APP, EPDM, PVC-P, TPO) under the action of UV radiation,
- simulation of accelerated UV aging of material connections.

View of Q-SUN Xe 1S test chamber

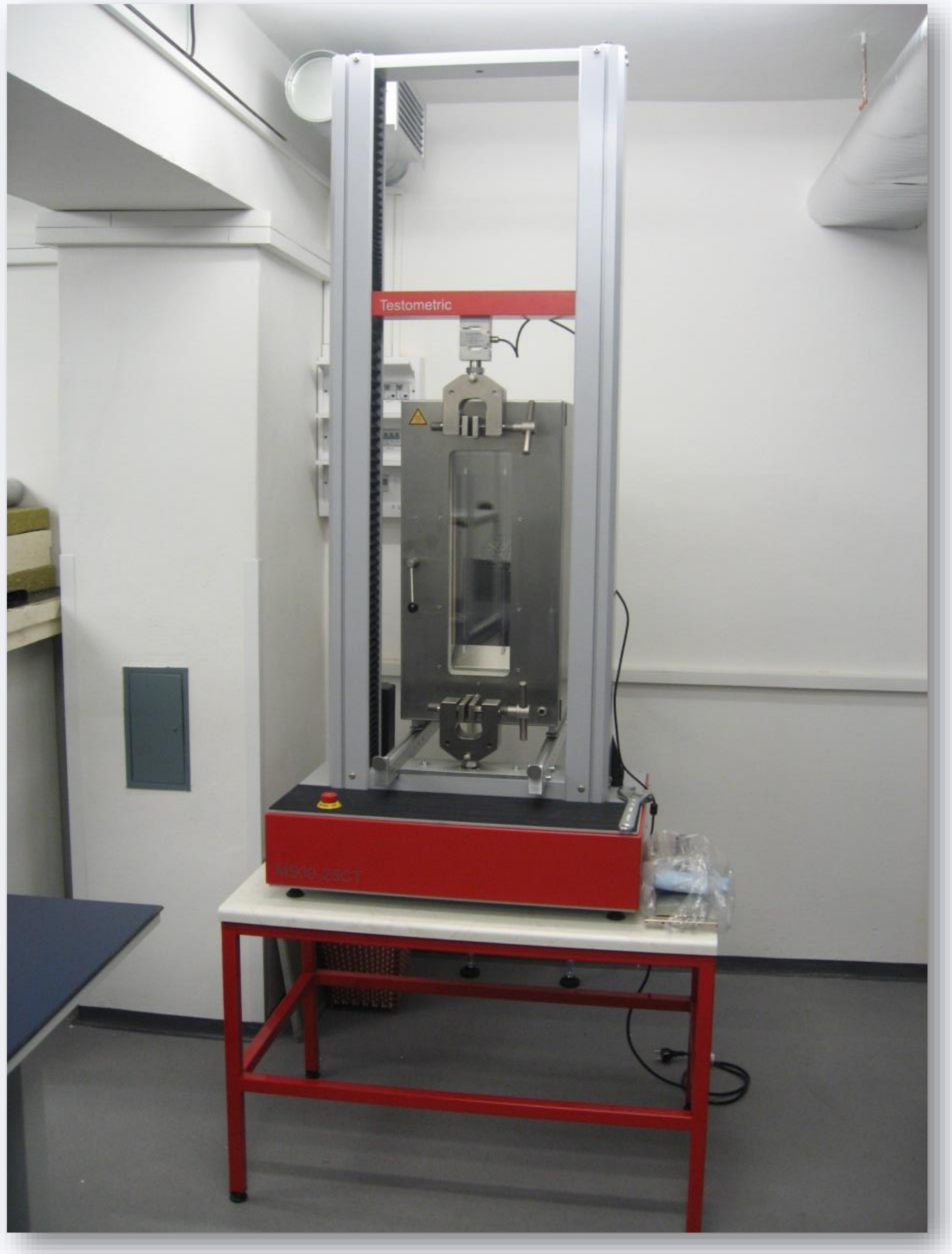
TENSILE TESTING MACHINE – 20 kN

LABORATORY OF ROOF RESEARCH

Table-top 2 post universal machine for testing the tensile strength of building materials computer controlled with maximum load of 20 kN. The testing machine allows the testing of mechanical properties of building materials and their connections at negative and positive temperatures.

COOPERATION POSSIBILITIES:

- demonstration of tensile strength of sheet roofing based on SBS, APP, EPDM, PVC-P, TPO,
- demonstration of shear resistance of roofing connections based on SBS, APP, EPDM, PVC-P, TPO and their combinations e.g. with other materials (concrete, aerated concrete, brick, waterproofing membranes based on PU and PMMA),
- demonstration of the roofing materials resistance in connection or their combinations when peeling roof material (peel test),
- demonstration of tensile strength, shear resistance of roofing materials and their combinations at different temperatures from -70° to +280°C.



View of Tensile testing machine – 20 kN

HOT AIR CHAMBER WITH FORCED AIR CIRCULATION

LABORATORY OF ROOF RESEARCH

The laboratory drying chamber is equipped for material testing for thermal aging. This drying unit ensures the heating of an interior space to reach high positive temperatures which results in changing physical, mechanical and visual material properties of testing materials. It is equipped with forced air circulation for uniform temperature distribution in chamber.

Technical specification:

- temperature range from +5°C above ambient temperature up to+300°C,
- possibility of continuous operation,
- setting the temperature difference,
- ventilation flap + small chimney ø 50 mm.

COOPERATION POSSIBILITIES:

- volume and mass stability testing of sheet roofing based on SBS, APP, EPDM, PVC-P, TPO and other materials at different temperatures,
- testing of material mutual incompatibility at persistent elevated temperatures using the combination of sheet roofing based on SBS, APP, EPDM, PVC-P, TPO with thermal insulated materials based on MW, EPS, XPS, PIR.

View of the hot air chamber

DIGITAL THICKNESS GAUGE

LABORATORY OF ROOF RESEARCH

The digital thickness gauge FNF-INT is an apparatus designed to measure coatings on ferromagnetic and non-ferromagnetic materials. It is equipped with two probes. The integrated combined probe can be employed to measure non-magnetic coatings on ferromagnetic substrates using the principle of magnetic induction (e.g. coating of colour, rubber, AL, Cr, Cu, etc. on the steel and alloy of iron substrates) and to detect the thickness of non-conductive layers on conductive materials using the principle of swirling flows (e.g. coating of rubber, colour, plastics, etc. on aluminium, brass and stainless steel substrates).

Technical specification:

- measuring range: 0 – 1250 µm,
- precision: ± 1 – 3% or ± 2.5 µm,
- measuring area 6 mm^2.

View of the digital thickness gauge FNF-INT

Non-destructive laboratory Testing of Construction and Building Materials in-situ

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Instrumental equipment

DESCRIPTION OF LABORATORY

NON-DESTRUCTIVE LABORATORY TESTING OF CONSTRUCTION AND BUILDING MATERIALS IN-SITU

Description:
The laboratory includes instruments for the testing of mechanical and strength parameters in building constructions, scanning for infrastructure cables in building constructions and glass thickness under real conditions in-situ.

Instrumental equipment:
- Hilti Tester Mark 5
- Leica Geosystems DIGICAT 200 Underground Service Locator
- Wall scanner BOSCH D-TECT 100
- GC 2000 – Digital Glass Thickness Meter
- Schmidt Hardness Tester Concrete Model N34
- Testo 319-1 Endoscope

INSTRUMENTAL EQUIPMENT

NON-DESTRUCTIVE LABORATORY TESTING OF CONSTRUCTION AND BUILDING MATERIALS IN-SITU

Click on the image to select a specific device / equipment:

Hilti Tester Mark 5

GC 2000 - Digital Glass Thickness Meter

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HILTI TESTER MARK 5

NON-DESTRUCTIVE LABORATORY TESTING OF CONSTRUCTION AND BUILDING MATERIALS IN-SITU

The tester is used for testing the strength of small and medium fastening anchors. It consists of a mechanical assembly of hydraulic cylinders and pressure indicator showing the instantaneous power and the maximum power achieved in anchor pullout testing. The accessories encompasses a large number of extension pieces and adapters that allow testing of different types of fastening anchors.

Technical specification:

- pull-out strenght 0 to 25 kN,
- dimensions 590 × 390 × 140 mm (in portable case),
- weight 2.2 kg.

Hilti Tester Mark 5

Portable case of Hilti Tester Mark 5

GC 2000 – DIGITAL GLASS THICKNESS METER

The glass test equipment is designed for the measuring of thickness of glass in an insulating double glazing and triple glazing system as well as the thickness of the air cavity. It can identify whether there is a low emission coating on the first or second glass. The digital glass meter G2000 is designed for the measuring of transparent glass and is used for measurement of the laser beam reflected from the surfaces of any glass.

Technical specification:

- minimum thickness of glass 1.5 mm,
- minimum thickness of air cavity 5 mm,
- measurement precision ± 0.4 mm,
- laser wavelength 630 – 680 nm,
- dimensions 140 × 90 × 32 mm,
- weight 0,4 kg,
- operating temperature 0 °C to +40 °C.

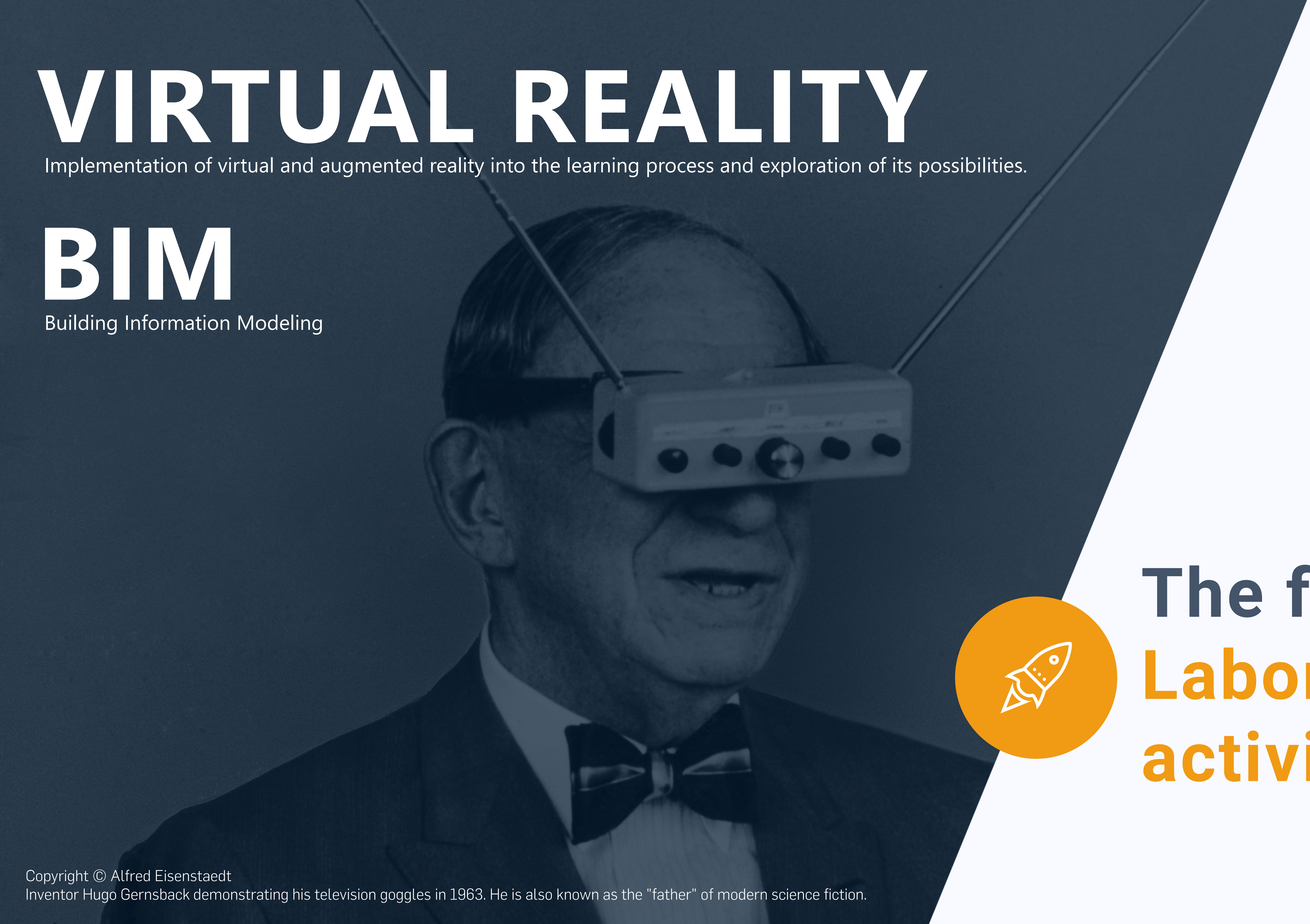
GC 2000 – Digital Glass Thickness Meter

VIRTUAL REALITY

Implementation of virtual and augmented reality into the learning process and exploration of its possibilities.

BIM

Building Information Modeling



The future
Laboratory activities

Inventor Hugo Gernsback demonstrating his television goggles in 1963. He is also known as the "father" of modern science fiction.

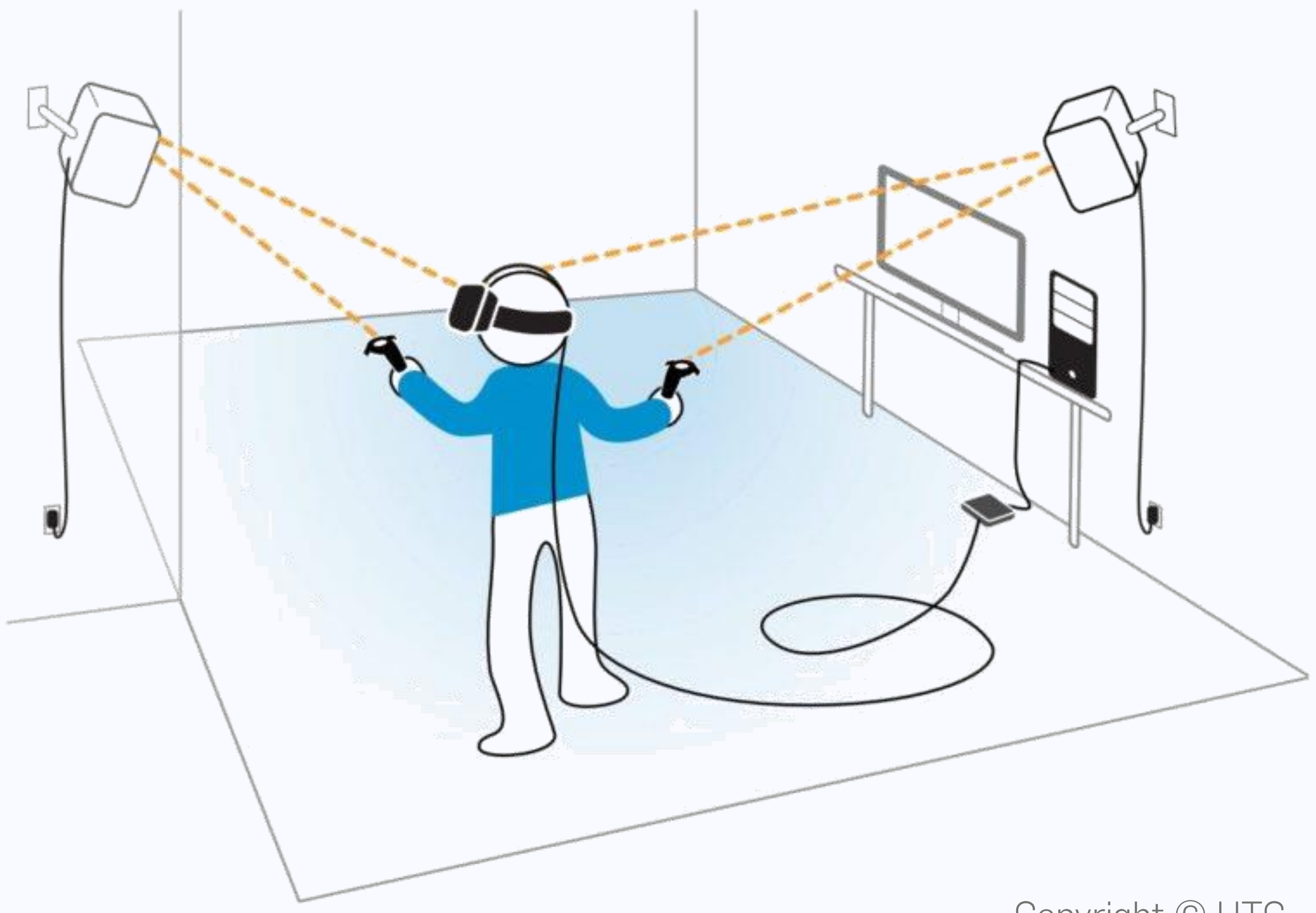
VIRTUAL REALITY

Implementation of virtual and augmented reality into the learning process and exploration of its possibilities.

The aim of virtual reality (VR) is the representation of spatial models and scenes and the ability of manipulation in the most realistic way, creation of a real world simulations, in its parts with all rules and laws implemented, movement in 3D space and all this rendered in a real time. In VR the basic computer graphics techniques are implemented.

VR is actually a shift from simple (two-dimensional) human interaction with computer, to a position, where this interaction takes place in a three-dimensional environment.

These methods are enhanced by the use of special periperal devices to provide image, tactile, audio and positional interaction.
In order to see the virtual world, the user needs to wear a helmet (or googles) with mounted displays in front of each eye. The helmet also includes a motion sensor to detect the position of head and the direction the user is looking at. The computer uses this information to render the image of the virtual world - for each eye separately - in the user´s direction of view to a corresponding display in helmet device. (source: virtualnarealita.eu)



VIRTUAL REALITY

Implementation of virtual and augmented reality into the learning process and exploration of its possibilities.

Using the device for virtual reality. Copyright © Jessica Lee Star/Digital Trends

Device for virtual reality. Headset, motion controllers and motion sensors. Copyright © The Vexit

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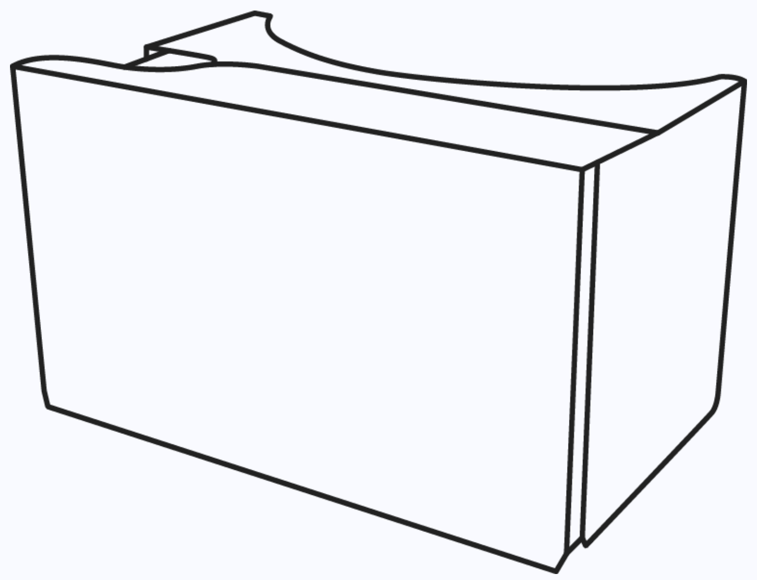
VIRTUAL REALITY

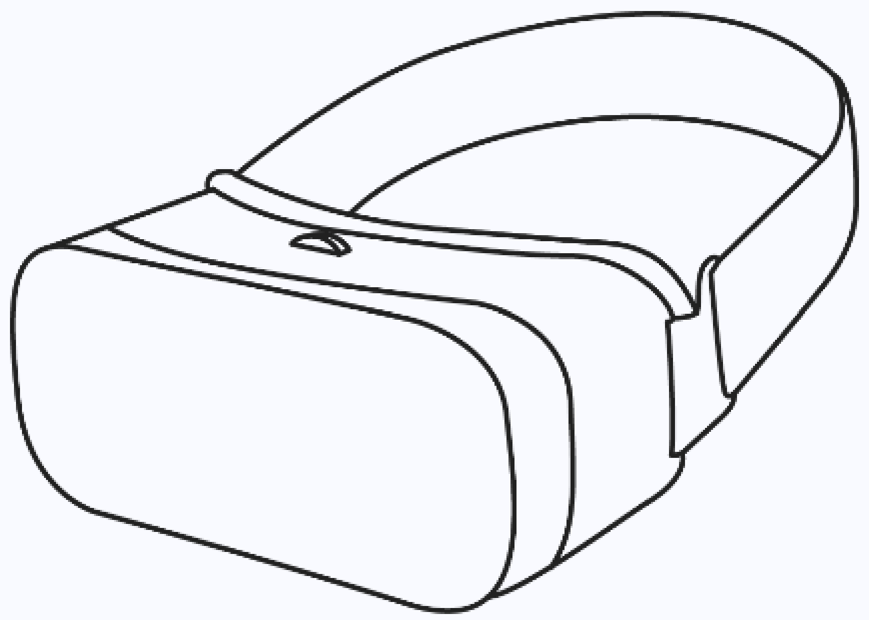
Implementation of virtual and augmented reality into the learning process and exploration of its possibilities.

The most widely used devices for virtual reality:



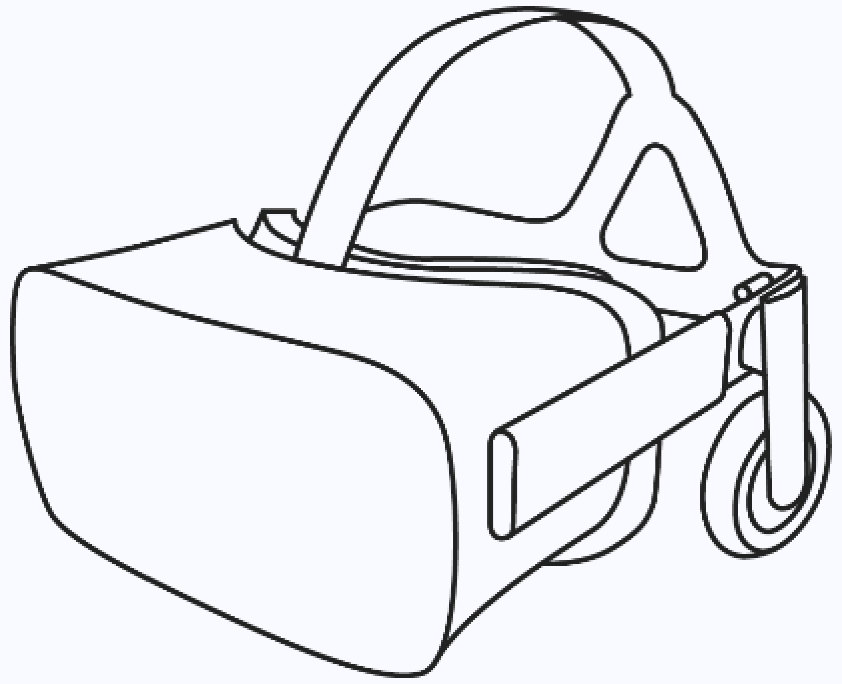
Google Cardboard

Virtual reality goggles for smartphones. Cardboard is the cheapest form of virtual reality.



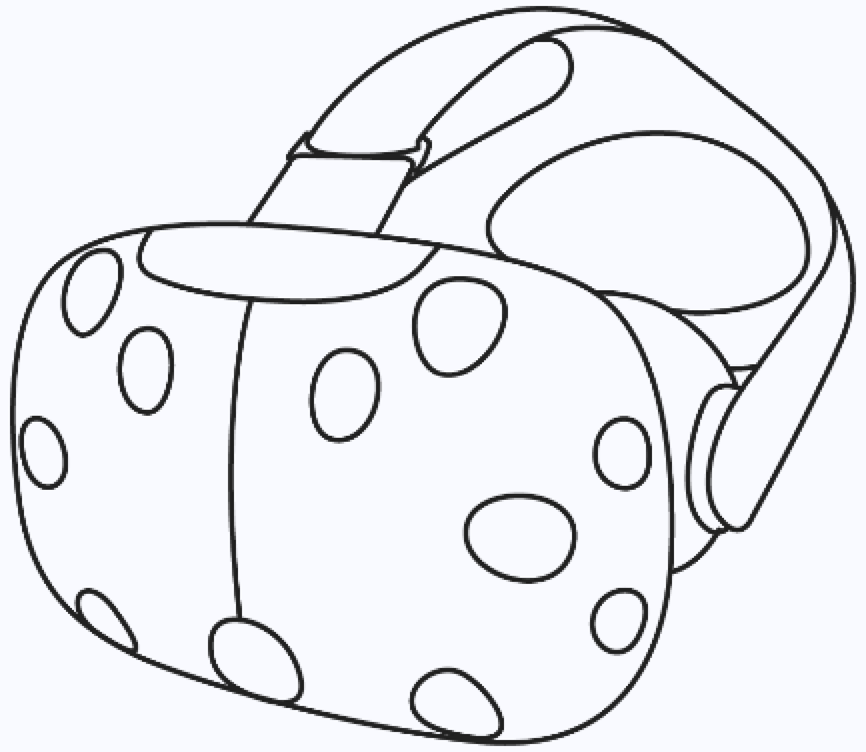
Samsung gear VR

Samsung Gear VR. Goggles for virtual reality with a range of 360° with 96° field of view.



Oculus Rift

Headset Oculus Rift uses a pair of OLED displays with a total resolution of 2160×1200 pixels. The frequency of displays is 90 Hz.



HTC Vive

Goggles for virtual reality with a range of 360°, total resolution is 2160×1200 pixels, frequency of displays is 90 Hz. Device contains 32 motion sensors.

VIRTUAL REALITY

Implementation of virtual and augmented reality into the learning process and exploration of its possibilities.

Presentation of virtual reality.

Presentation of virtual reality.

AUGMENTED REALITY

The future – mixed or augmented reality (AR). It combines real world and virtual reality.

Augmented reality (AR) means direct or indirect view of a physically real environment whose parts are digitally, mostly enriched in text or picture form to add additional information relevant to the real objects the user is viewing. These information are obtained from a various sources using off-line or on-line applications. This process is usually done in real-time and in semantic context with parts of the environment: the current action in the restaurant, the nearest ATM, the nearest Twitter user, etc. (source: virtualnarealita.eu)

Combination of virtual and augmented reality is "mixed" reality

	Augmented reality	Mixed reality	Virtual reality
Connects the real world with useful information.	☑	☑	
Merges holograms with real world.		☑	
Is able to transfer you to virtual world.		☑	
Substitutes the real word.			☑

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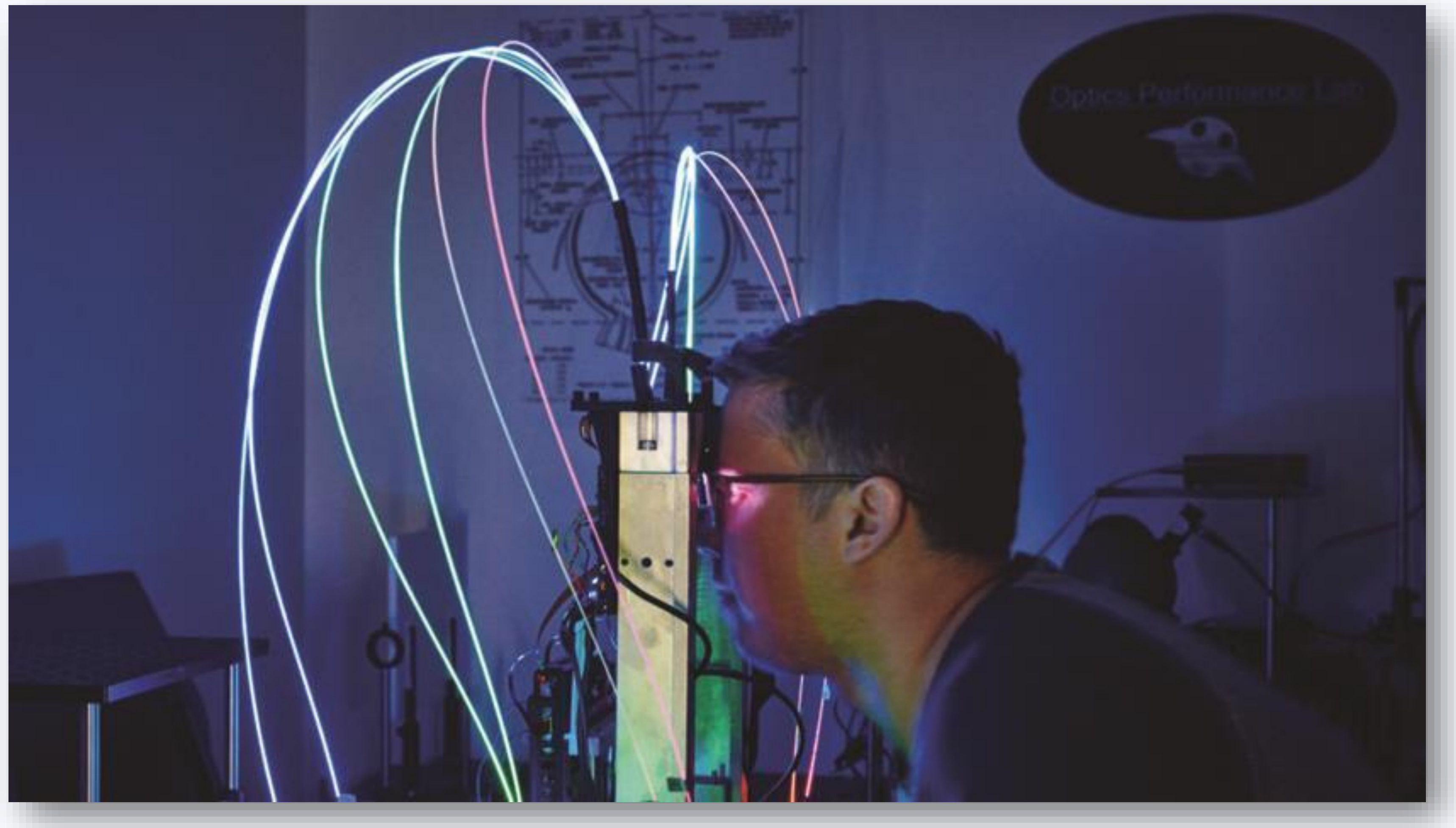
AUGMENTED REALITY

The future – mixed or augmented reality (AR). It combines real world and virtual reality.



Magic Leap

Magic Leap is an American startup company that develops a major virtual retinal display that displays computer – generated 3D models in the real world. This image creates a projection of the digital light field directly into the user´s eye. The company is trying to create a chip using a silicon photonics technology.

https://www.magicleap.com

https://www.wired.com/?p=1999666

Microsoft Hololens

Microsoft Hololens is the first fully autonomous holographic computer that allows the user to interact with holograms (3D objects) with high resolution matching the real world.

https://www.microsoft.com/microsoft-hololens

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BIM

Building Information Modeling

BIM means Building Information Modeling. This term was used for the first time in 2002. It is a relatively new term, therefore it has multiple definitions:

„Builiding Information Modelling is a process of creation and managing of data about the building throughout its life-cycle."

(source: www.wikipedia.org)

„Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition."

(source: NIBS-National Institute of Building Sciences, USA)

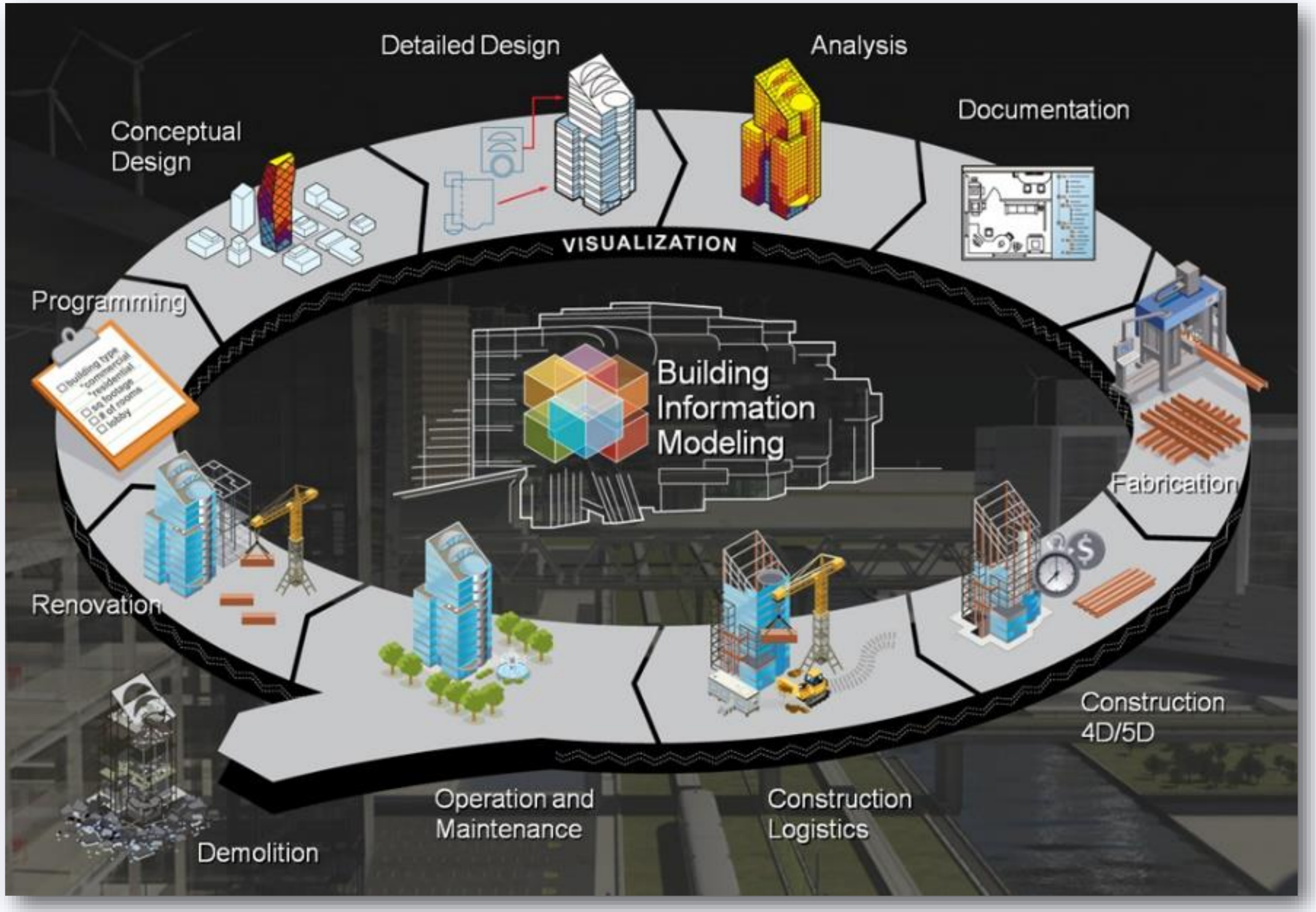
„BIM is an organized approach to data acquisition and its use throughout the project. In the middle of this effort is a digital model containing graphical and descriptional information about the design, structures and maintenance of building objects."

(source: Strategy Paper for Government Construction Client Group from the BIM Industry Working Group, UK)

It means that in Building information modelling the building should be meant more as construction, because it consists of the whole constructional process from the design through to the demolition. It should be noted that BIM is not a computer program, which is what most people think. Nor is it a 3D model of a building, which is only a part of the whole information system. It is a process and compilation of the information the software programs are working with under the BIM.

BIM

Building Information Modeling



The process of creating the Building Information Modeling. Copyright © Buildipedia.com

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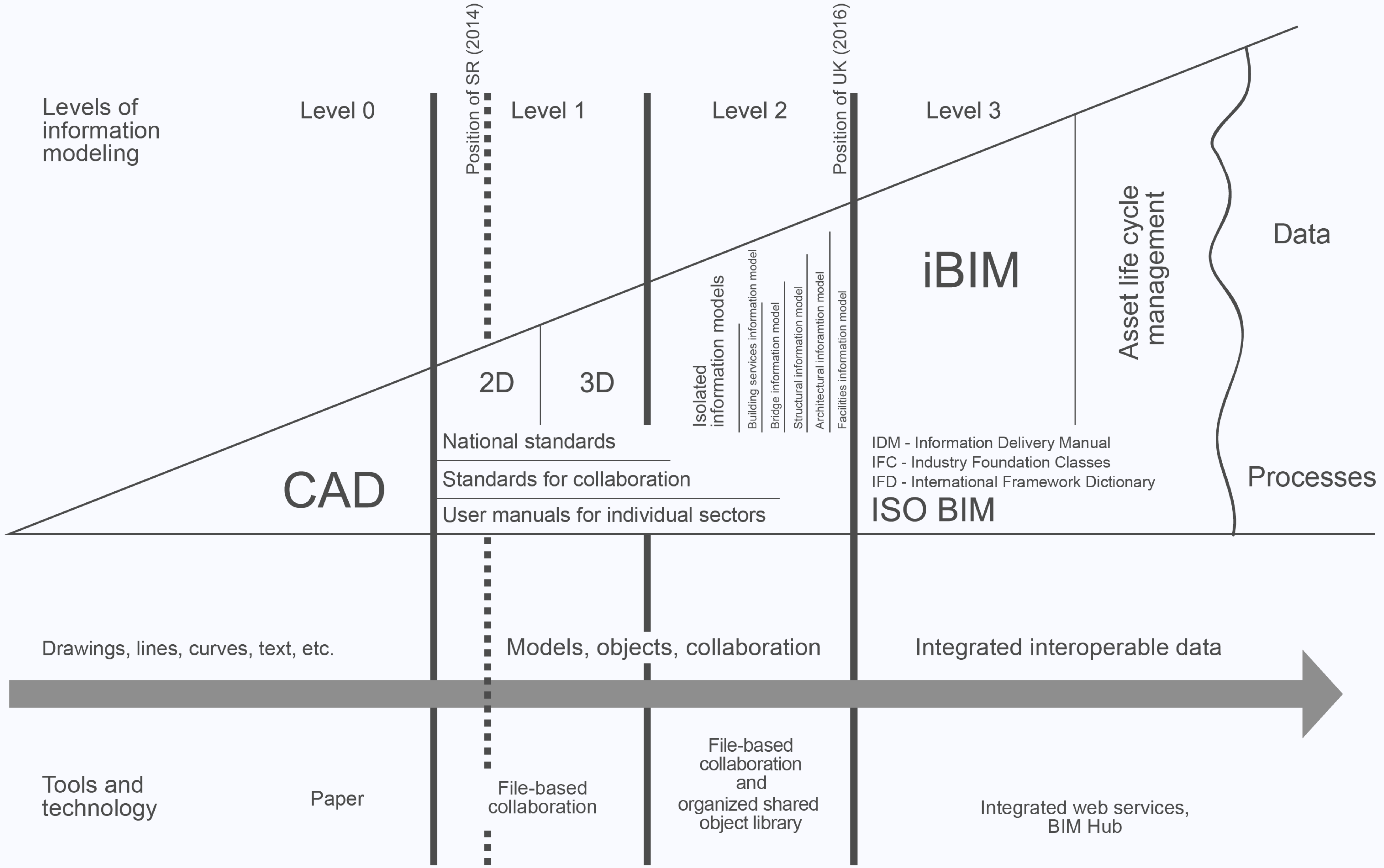
BIM

Building Information Modeling

The diagram depicts how the building information modelling design differs from the traditional way of designing. One significant difference is the shift from traditional working methods to 3D modelling with the focus on information processing. To achieve greater efficiency, closer cooperation among all stakeholders is needed. BIM allows coordination at a much higher level.



Source: Bew and Richards 2008
Modification: Ing. Lukáš Bosák, 2014

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