Sveučilište u Rijeci
University of Rijeka

LABORATORY EQUIPMENT CATALOGUE

CVT BIOtech

CENTRE FOR HIGH - THROUGHPUT TECHNOLOGIES

CENTRE FOR ADVANCED COMPUTING AND MODELLING

CENTRE FOR MICRO - AND NANOSCIENCES AND TECHNOLOGIES

GF

FACULTY OF CIVIL ENGINEERING

Europska unija
Ulaganje u budućnost

STRUKTURNI I INVESTICIJSKI FONDOVI

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IMPRESSUM

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EDITORIAL

Within the framework of the Project entitled “Research Infrastructure for Campus-based Laboratories at the University of Rijeka“, whose realisation was funded through non-refundable grants of the European Regional Development Fund, the University of Rijeka has, since 2014, ensured the essential infrastructure necessary for improvement of scientific-research work and for the achievement of significant results through several new research centres. In particular, the Centre for Micro and Nano Technologies, the Centre for High-Throughput Technologies, the Centre for Advanced Computing and Modelling, as well as the Faculty of Civil Engineering laboratories.

By ensuring new, top-notch equipment, these centres have obtained a strong incentive to start with their research work and develop new ideas.

This capital research infrastructure currently acts as the *sine qua non* within the scope of momentous and globally competitive work in the field of science development. For the University of Rijeka, even the fact that this advanced equipment is certainly set to facilitate scientific productivity, significant effects are likewise expected on the commercial level, which is a key point.

A case in point is the recently realised collaboration between the University of Rijeka and the Company *Rimac Automobili (Rimac Automobiles)* that will be utilizing the UNIRI Bura SuperComputer in its future technological solutions and innovations.

This brochure succinctly presents the basic characteristics - “an Identification Card“ - of the scientific equipment that the University of Rijeka has procured for its newly founded research centres through non-refundable grants of the EU Funding Programmes.

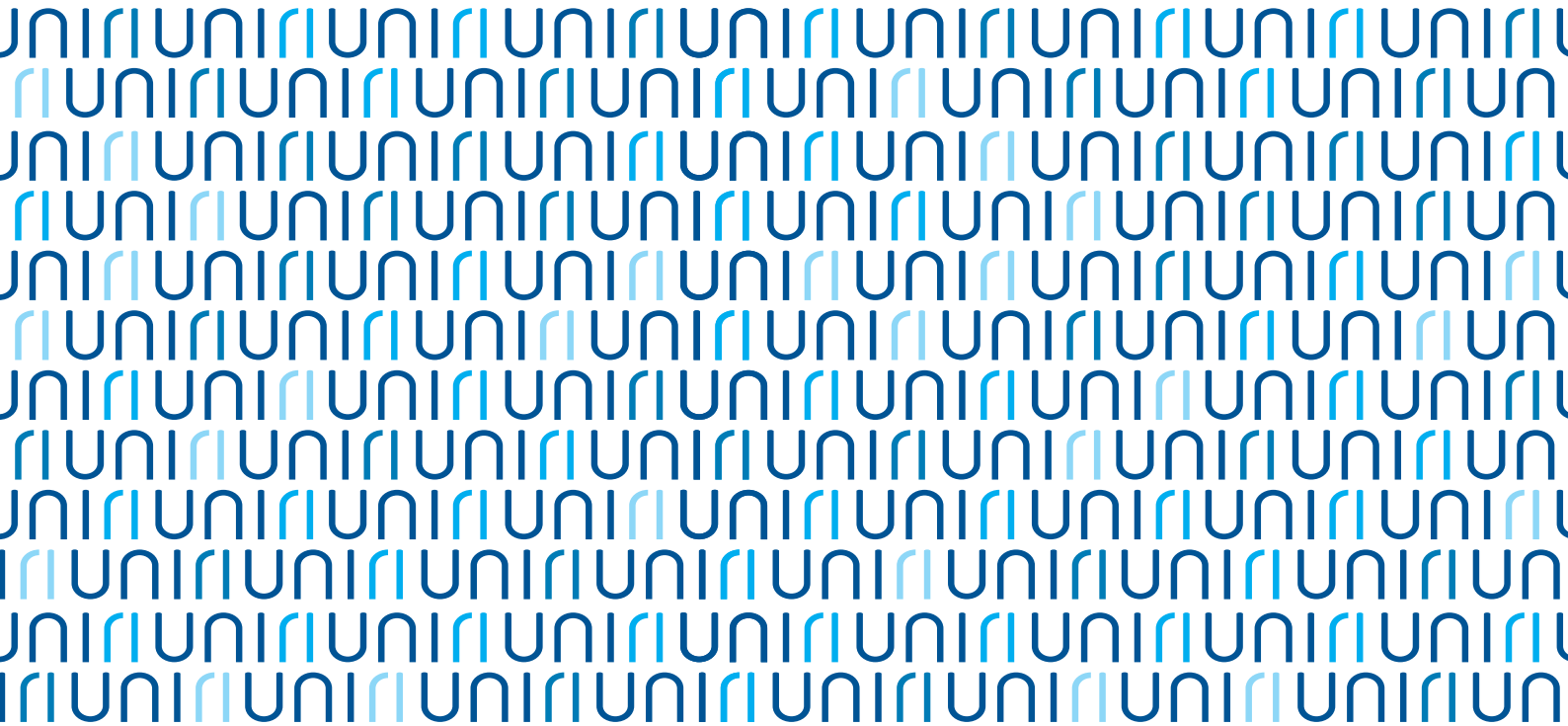
Our desire is to emphasise the different dimensions of these scientific resources, to further encourage their optimal utilization within the Campus, as well as the local and even national community, in order for this infrastructure equipment to actualise existing and future projects on the international scientific scene to boot.

Rijeka, February 2018

University of Rijeka Rector
Prof. Snježana Prijić-Samaržija, Ph.D.

CUT BIOtech

LABORATORY EQUIPMENT CATALOGUE OF THE CENTRE FOR HIGH - THROUGHPUT TECHNOLOGIES



1

HIGH-THROUGHPUT ANALYTICS

Instrument	**Mass Spectrometer MALDI-TOF/RTOF MS (BrukerUltrafleXtreme)**
Laboratory affiliation	**Laboratory for High-Throughput Analyses O-275**
Equipment category	**Measuring Machine**

Photograph

Short description	A high resolution machine that allows a fast and highly accurate analysis of the molecular mass, records the molecular mass spectra with the support of the chemical fingerprint method, and allows a precise structural characterisation of the molecule.
Main purpose	- MALDI MS and/or MS/MS scanning of pure analyte, tryptic protein digestion, glycan spectra. - MALDI TOF MS fingerprint scanning (fingerprinting) of the complex composite-analyte (without prior separation) - Definition of the molecular mass of pure analyte, post-translational protein modifications, precise structural analysis of the intact molecules and protein identification. - Sample purity analysis – detection/confirmation of impurities in the sample
Technical specifications	■ 2 kHz speed in TOF mode and 1 kHz in TOF/TOF mode ■ Smartbeam-II™ laser of the newest generation ■ Reflectron and linear mode measurement ■ PAN™ technology which allows a resolving power up to 40000 ■ FlashDetector™ combined with 4 GHz digitizer ■ Newest TOF/TOF technology based on the LID-LIFT process
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Mass Spectrometer UPLC-QQQ (Waters Xevo TQD)**
Laboratory affiliation	**Laboratory for High-Throughput Analyses, O-275**
Equipment category	**Measuring Machine**

Photograph

Short description	A high resolution machine that allows a fast and highly accurate analysis and quantification of small molecules.
Main purpose	- MS and/or MS/MS spectra screening - Definition of analyte molecular mass - Analysis of serum metabolites - Analysis of serum drugs - Neonatalscreening
Technical specifications	- LC ionisation interface - Analyzers: two quadrupoles mass analyzers, a collision cell - Mass range: 2 to 2048 m/z - Detector: photomultiplier - MRM sensitivity ESI+: 1 pg reserpine injected on column, on a throughput of 0,8 mL/min, must provide a signal-to-noise ratio (S/N) bigger than 10000:1 for the transition from m/z 609 to 195 - MRM sensitivity ESI-: 5 pg chloramphenicol injected on column, on a throughput of 0,8 mL/min, must provide a signal-to-noise ratio (S/N) bigger than 200:1 for the transition from m/z 321 to 152 - A software specifically intended for neonatalscreening, in accordance with the ISO 13485 and compatible with the machine.
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

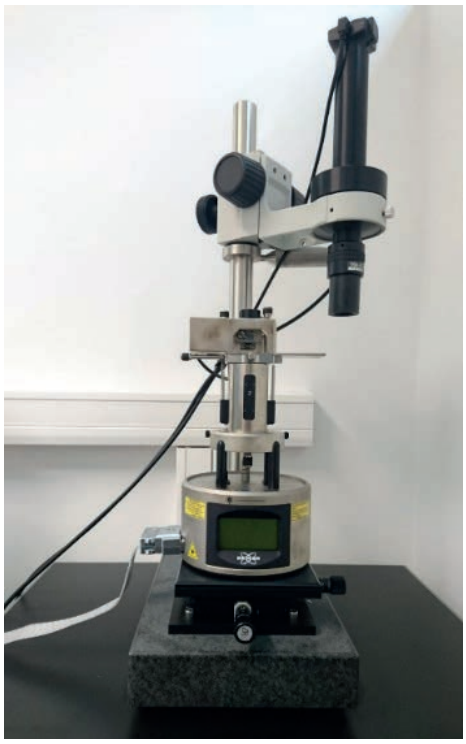
Instrument	**Mass Spectrometer UPLC-Q TOF with ion mobility option (Waters Synapt G2-Si)**
Laboratory affiliation	**Laboratory for High-Throughput Analyses, O-275**
Equipment category	**Measuring Machine**
Photograph	
Short description	A high resolution machine that allows an automated, highly accurate analysis of the molecular mass and a precise structural characterisation of a wide range of molecules, based on the ratio between mass and charge, as well as on the collision cross-section, (CCS).
Main purpose	- Dependent Analysis (DDA) and Independent Analysis, (DIA), MS and/ or MS/MS screening of tryptic protein digestion spectra - Qualitative and/or quantitative analysis of a wide dynamic range of proteomes - Post-translational protein modification analysis
Technical specifications	- Analytes separation by nano-liquid chromatography, single-pump trap option, on throughputs of 0,3 µl/min - Nano LC-ESI (electro-sprey) ionic source Z-spray Waters with additional ion throughput by StepWave module - CID (Collision Induced Dissociation) and ETD (Electron Transfer Dissociation) fragmentation - Possibility to separate ions based on their mobility during the gas phase - Quadrupole analyzer with mass range up to 8.000 m/z - TOF analyzer with mass range up to 32000 m/z - Maximum mass measurement resolution in ESI positive and negative ionization method amounts to 50000 - Proteomic dana analysis: PLGS, Mascot, PROGENESIS QiP, DriftScope
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contact	cvt@uniri.hr

Instrument	**Mass Spectrometer UPLC-QTOF**
Laboratory affiliation	**Laboratory for High-Throughput Analyses, O-275**
Equipment category	**Measuring Machine**
Photograph	
Short description	A high resolution machine that allows a fast and highly accurate analysis of the molecular mass of small molecules and a precise structural characterisation of molecules.
Main purpose	MS and/or MS/MS spectra sample screening, definition of the bond's molecular mass and sample purity analysis – detection/ confirmation of impurities in the sample.
Technical specifications	■ Sensitivity at a femtogram level thanks to the iFunnel technology ■ Screening resolution from 45k ■ Uses the MassHunter program for sample quantification and identification ■ Enables selective and non-selective sample analysis
Source of funding	The equipment has been procured within the framework of the Project "The Development of Research Infrastructure at the University of Rijeka Campus", co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Mass Spectrometer UPLC-QQQ**
Laboratory affiliation	**Laboratory for High-Throughput Analyses, O-275**
Equipment category	**Measuring Machine**
Photograph	
Short description	A high resolution machine that allows a fast analysis and quantification of small molecules.
Main purpose	MS and/or MS/MS spectra sample screening, confirmation and quantification of small molecules in a sample.
Technical specifications	LC/MS Spectrometer - quadrupole mass filter, collision cell and high resolution and high accuracy analyzer ■ Polarity switching: polarity switching from positive to negative in less than 1.5 s ■ Ion source: Electrospray (ESI) ■ Sensitivity in the MS working method: 1 pg reserpine or 1 pg buspirone injected on column provides S/N≥500:1 ■ Sensitivity in the MS/MS working method: 1 pg reserpine or 1 pg buspirone injected on column provides S/N ≥1.000:1 ■ raspon masa: 50 – 10.000 m/z ili bolje
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

2

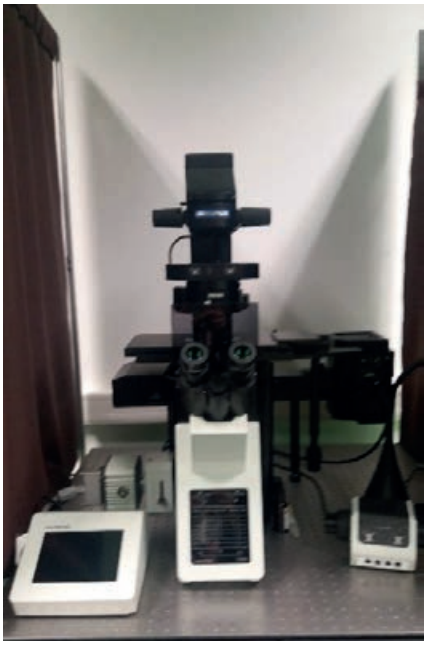
MICROSCOPY

Instrument	**Atomic Force Microscope (AFM) MultiMode 8**
Laboratory affiliation	**CVT - Area O-251**
Equipment category	**Measuring and Test Machine**
Photograph	
Short description	The Atomic Force Microscope allows to record images of the surface thanks to a detector, used to measure forces that cause deviations from the sample (any strong material or biological sample; dry or in solution) providing, in this way, a topography of nanometric dimensions.
Main purpose	- Topography test of materials' surfaces and their physical properties, such as softness - Biological materials test: topography, softness
Technical specifications	■ SPM standard controller ■ AS-130VLR scanner – 125µm x 125µm XY and 5µm Z range (vertical engage), improved resistance in liquids ■ Laser Class 2M, 1mW maximum at 690nm (IEC and US CDRH) ■ OMV, optical microscope with 10X objective for the visualisation of samples, lasers and types (video output through the NanoScope software) ■ NanoScope 9.1 software
Source of founding	The equipment has been procured within the framework of the Project "The Development of Research Infrastructure at the University of Rijeka Campus", co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

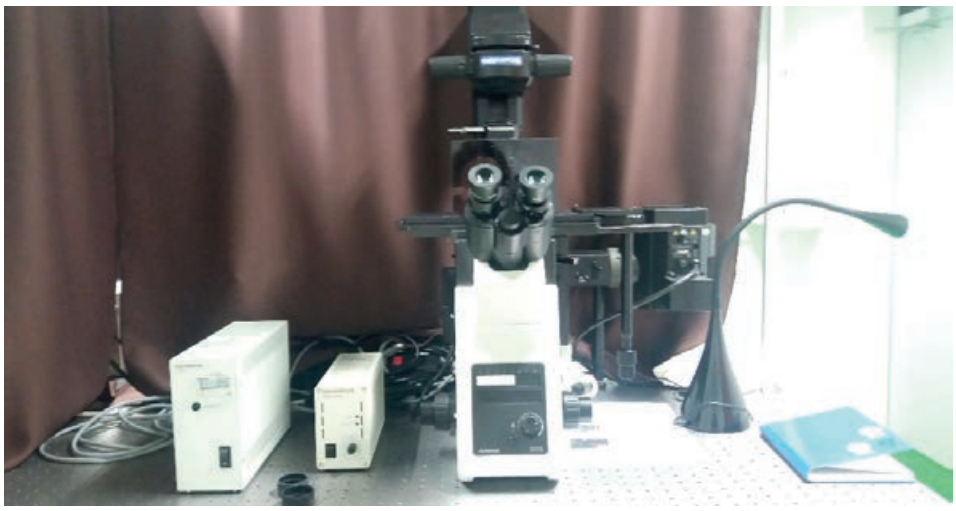
Instrument	**Confocal Microscope LSM 880 Airyscan**
Laboratory affiliation	**CVT - Area O-251**
Equipment category	**Test Machine**
Photograph	
Short description	A contemporary confocal microscope that allows a fast and quality analysis of fluorescently marked biological samples, with a 4,8 times higher so called signal-to-noise ratio (SNR) and a 1,7 times higher resolution.
Main purpose	Screening fluorescently marked biological samples (immunocytochemistry) and analysis (colocalization, quantification, modelling).
Technical specifications	■ 2 multi-alkali i 1 GaAsPspectral R/FL detector ■ 5 lasers: 458, 488, 514, 543 and 633nm ■ Real time control electronika ■ Zensoftware for sample acquisitio n,analysis and quantification ■ Epifluorescent filters: 38 HE, 43 HE and 49 for sample visualisation
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Fluorescent Motorized Inverted Microscope IX83**
Laboratory affiliation	**Room with Olympus Microscopes O-239**
Equipment category	**Test Machine**

Photograph



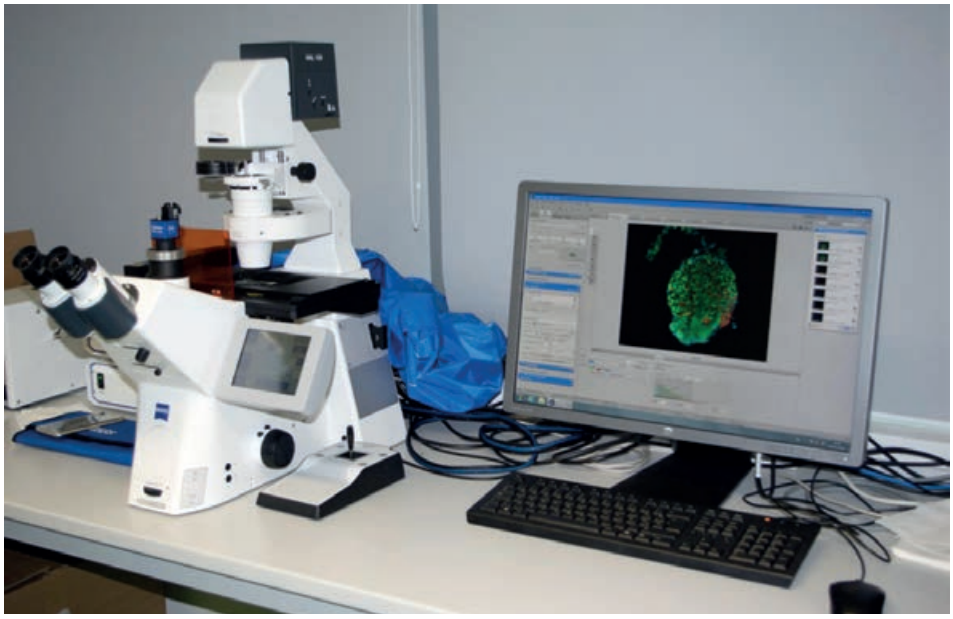
Short description	A completely motorized fluorescent inverted microscope, that allows a fast and highly accurate screening of fluorescently marked biological samples, as well as the acquisition of video recordings to follow the dynamics of cell processes (growth, differentiation, migration).
Main purpose	- Taking images of fluorescently marked biological samples - Video recording (the so called live cell imaging) - Analysis and elaboration of fluorescent recordings
Technical specifications	■ Invered optical microscope with fluorescent and light microscopy (bright-field and Differential Interference Contrast) ■ Epifluorescent filters: U-FUNA, U-FBW, U-FGW ■ Z-drift compensator ■ Hamamatsu Orca R2 CCD camera ■ Fluorescent illuminator: Xenon lamp ■ CellSens Olympus software
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Fluorescent Inverted Microscope IX73**
Laboratory affiliation	**Room with Olympus Microscopes, O-239**
Equipment category	**Test Machine**
Photograph	
Short description	A standard fluorescent inverted microscope, that allows fluorescently marked biological sample testing.
Main purpose	Visualisation of fluorescently marked biological samples.
Technical specifications	■ Inverted optical microscope with fluorescent and light microscopy (brightfield and Differential Interference Contrast) ■ Epifluorescent filters: U-FUNA, U-FBW, U-FGW ■ Fluorescent illuminator: Xenon lamp
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Wide Diameter Fluorescent Stereomicroscope MVX10**
Laboratory affiliation	**Room with Olympus Microscopes, O-239**
Equipment category	**Test Machine**
Photograph	
Short description	Wide diameter fluorescent stereomicroscope that allows a compromise between a micro and a macro fluorescent visualisation of tissue cells or living organisms.
Main purpose	To test fluorescent protein expressions such as GFP in tissues, organs and living organisms (in vivo research).
Technical specifications	■ Stereomicroscope for the visualisation and dissection of transgenic laboratory animals ■ Visualisation of fluorescent molecules: GFP, CY3 and YFP ■ Fluorescent illuminator: Xenon lamp
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**Phase Contrast/Inverted Microscope with Fluorescence - RISK**
Laboratory affiliation	**Laboratory for systemic BioMedicine and Genomics, O-274**
Equipment category	**Test Machine**

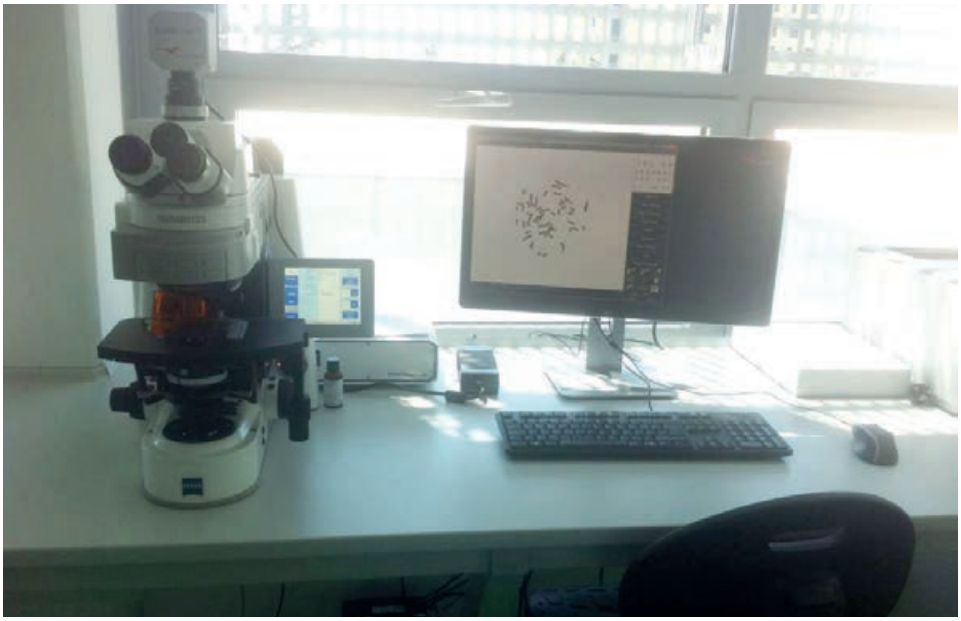
Photograph



Short description	The machine is composed of 3 parts; a manual, a semi-manual and a completely automatic part. It is composed of a table, a control screen, a connector, a light source (UV lamp, visible spectrum), lenses, an ocular, a joystick, a device for controlled energy supply, a computer and softwareZen.
Main purpose	The machine is used to test cell cultures, tissue preparations and human biological materials, to test intercellular processes in living cells, to test cell interactions, mobility and cell growth, etc.
Technical specifications	■ Microscope dimensions: 295x805x707 mm ■ Weight: 36 kg ■ Filters: 20 Rhod, 38 HE GFP, 43 HE DsRed, 09 AF 488, 49 DAPI ■ Lenses: EC PlnN 5X/0.16 DICO, EC PlnN 10X/0.3 DICI, EC PlnN 40X/0.75 Ph 2 DICII, Pln Apo 63X/1,4 Oil DICIII ■ Cameras: Axiocam 105 color Axiocam 506 mono
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

Instrument	**System for Karyotypization**
Laboratory affiliation	**Laboratory for za Human Genetics and Reproduction, O-134**
Equipment category	**Test machine**

Photograph



Short description	An interactive imaging system, composed by the microscope Zeiss Axio Imager M2, connected to the high resolution camera MetaSystems and to the software solutions for karyotypization (Ikaros) and flourescence imaging (Isis).
Main purpose	- Karyotypization of eukaryotic cells - Screening and elaboration of fluorescent images - Sample analysis after the mFISH and mBAND marking - Sample analysis after the comparative genomic hybridization (CGH) - Telomere analysis (signal quantification) - Saving, organisation and elaboration of collected data
Technical specifications	■ Zeiss Axio Imager microscope, M2 motorized model - Lenses: Plan-Apochromat 63x/1,4 immersion lens, Plan-Apochromat 10x/0,45, EC Plan-Neofilter 5x/0,16; Ocular: PI 10x/23 insures the uniformity of the obtained image along the entire visual field; Light source: halogen lamp 12V/100W; Filters: DAPI, FITC/Spectrum Green, TRITC/Spectrum Orange/Cy3, MetaSystems Triple band filter set Aqua/Green /Orange; Photo Fluor LM-75 ■ Camera: MetaSystems Cool Cube 1m ■ Computer: Dell Optiplex XE2 ■ IKAROS Karyotyping System, Version 5.7.1 ■ ISIS FISH Imaging System, Version 5.7.1
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

3

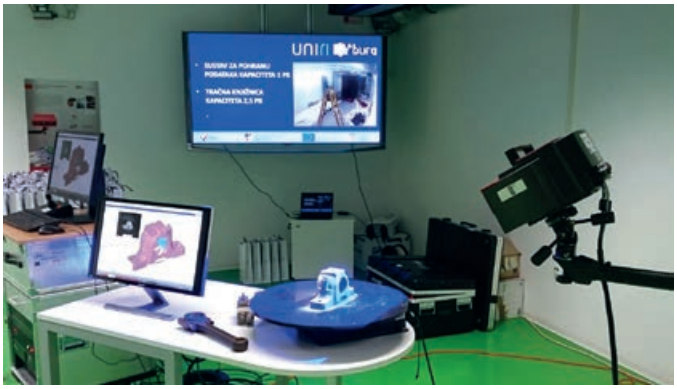
OTHER MEASURING MACHINES

Instrument	**Monochromator- CM Infinite - RISK** **Monokromator - CM Infinite**
Laboratory affiliation	**Laboratory for systemic BioMedicine and Genomics, O-270**
Equipment category	**Measuring Machine**
Photograph	
Short description	The machine is composed of: Software and -control 1.11 and of the mere machine, which contains 3 optical sets, 3 detectors for the measurement of fluorescence, absorbance, luminescence and a computer.
Main purpose	The machine is used for the measurement of absorbance, fluorescence and luminescence. For the quantification of DNA, RNA, protein, the study of ion channels, ion throughputs, immunoassays, ELISA assay...
Technical specifications	■ Light source: UV xenon lamp ■ Wave length choice: Quad4 monochromator system (2 excitation and 2 emission monochromators) ■ Wave: fluorescence: Ex 230 – 850 nm, Em 280 – 850 nm absorbance: 230 – 1000 nm ■ Area for the measurement of microtiter plates: 6 to 384 microtiter plates, cuvettes, NanoQuant plates
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	cvt@uniri.hr

LABORATORY EQUIPMENT CATALOGUE OF THE CENTRE FOR ADVANCED COMPUTING AND MODELLING

Instrument	**GOM Atos Triple Scan**
Laboratory affiliation	**Laboratory for HPC, Grid and Cloud Computing**
Equipment category	**Measuring Machine**

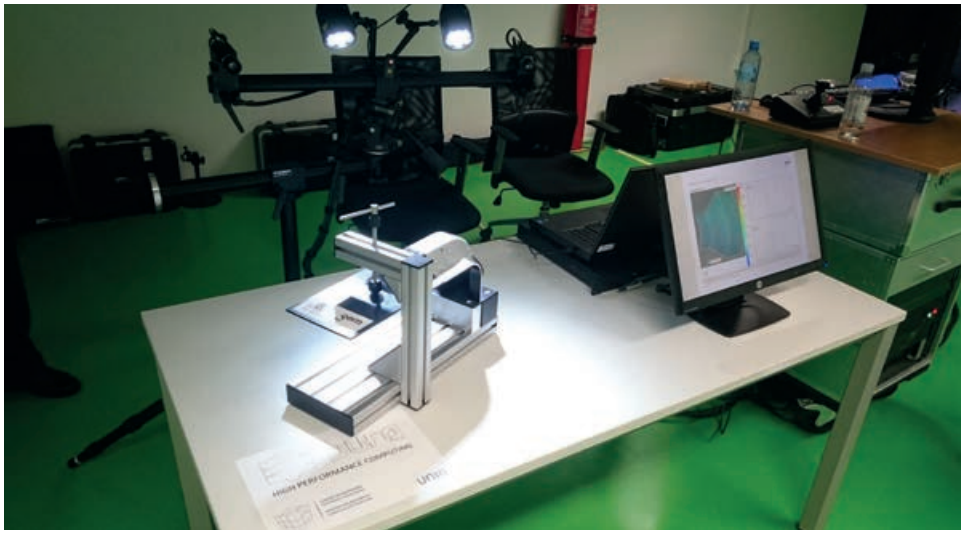
Photograph



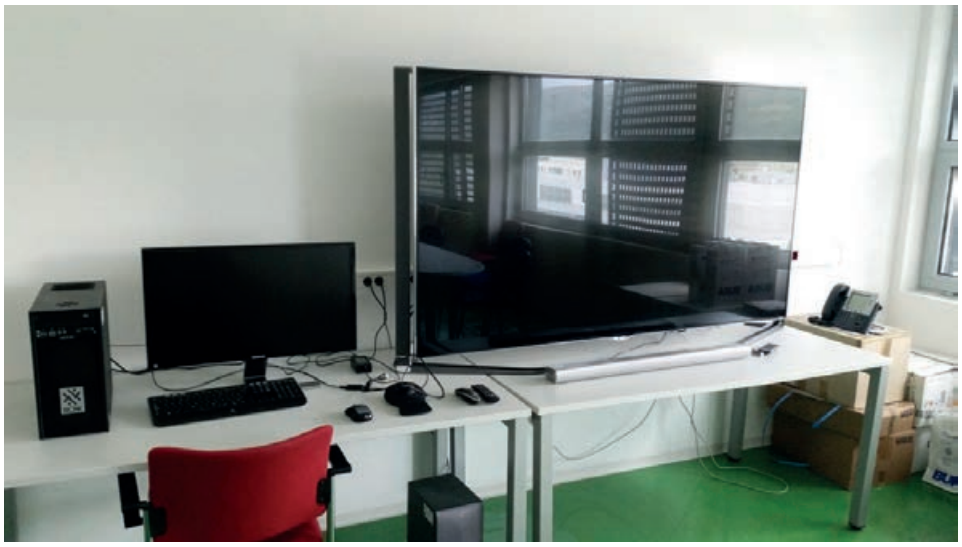
Short description	The GOM Atos Triple Scan measuring machine is composed of a rotating surface, a computer with an installed programming environment, as well as a measuring device with related base and a stock of labels which are used as reference points.
Main purpose	- 3D scanning with the purpose of measurement and reconstruction of measuring objects
Technical specifications	■ The precision of the measurement is a line of the size of micrometers. ■ 2 different measuring volumes ■ Non-contact measurement
Additional information	http://www.gom.com/metrology-systems/atos/atos-triple-scan.html
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Prof. D.Sc. Zlatan Car / zlatan.car@uniri.hr

Instrument	**GOM Aramis**
Laboratory affiliation	**Laboratory for HPC, Grid and Cloud Computing**
Equipment category	**Measuring Machine**

Photograph

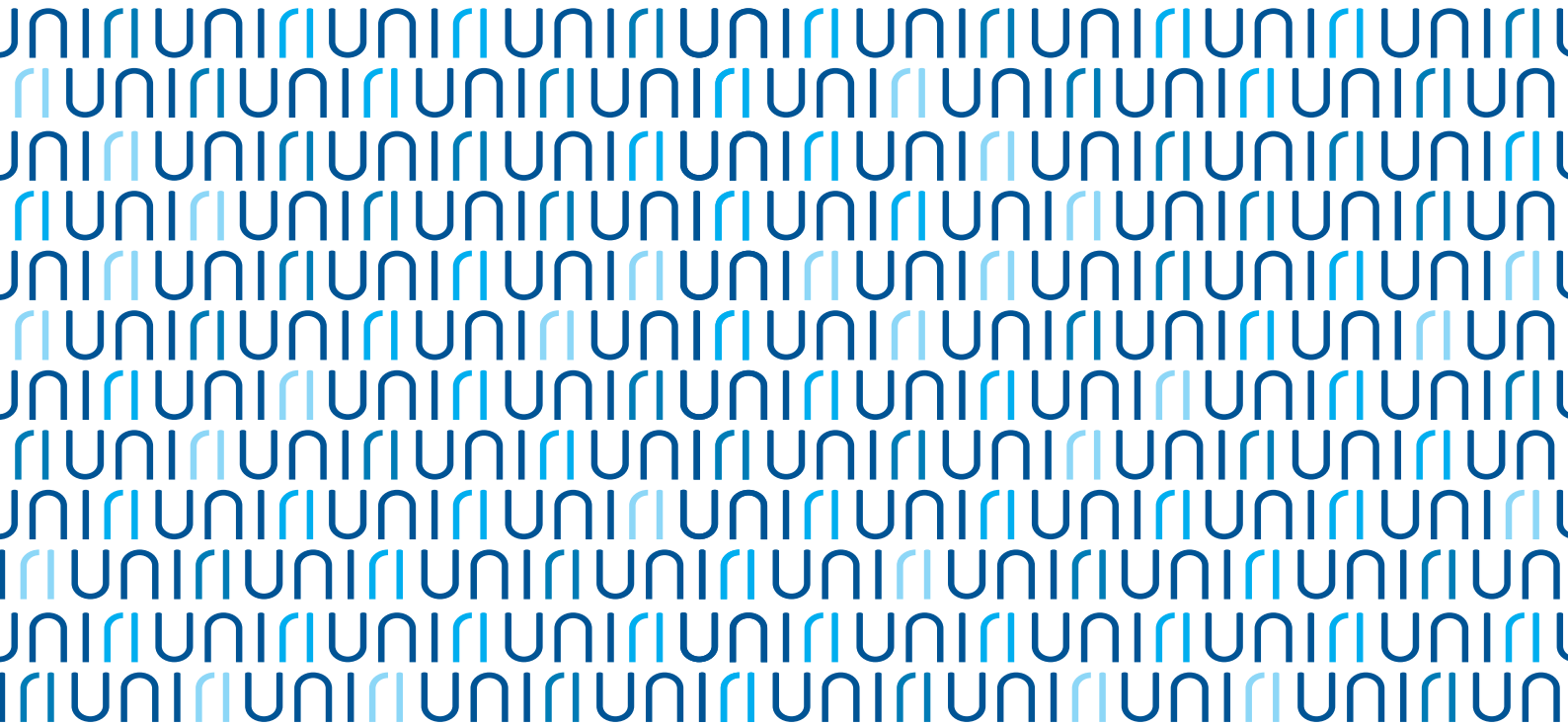


Short description	The GOM Aramis measuring machine is composed of a base on which two cameras, with corresponding illumination, are setup. The control system is constituted by a laptop with a programming environment and a control device.
Main purpose	- Measurement of deformations on materials in real time
Technical specifications	■ Non-contact measurement ■ Wide range of materials suitable for measurement
Additional information	http://www.gom.com/metrology-systems/aramis.html
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Prof. D.Sc. Zlatan Car / zlatan.car@uniri.hr

Instrument	**System for the visualisation of scientific results received on the Supercomputer**
Laboratory affiliation	**Laboratory for AI, CAE, DSP and simulation modelling**
Equipment category	**Other**
Photograph	
Short description	The system for the visualisation of scientific results is composed by a working station, with a Nvidia Quadro M6000 graphics card (Inv.No.R-005181), a screen resolution of 4096x2160 pixels (Inv. No. R-005182).
Main purpose	The calculation results, obtained on the Supercomputer infrastructure, have to be visualised in order to be comprehensible to users. Considering that the calculations contain a multitude of details, it is necessary to have a screen with a larger diagonal and higher resolution. With the aim to elaborate faster the data visualisation, the working station is equipped with a higher quality graphics card.
Technical specifications	■ A detailed representation of the simulation results ■ A graphics card for the elaboration of large amounts of data ■ A screen with diagonal of 200 cm with a resolution of 4096x2160 pixels
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Prof. D.Sc. Zlatan Car / zlatan.car@uniri.hr

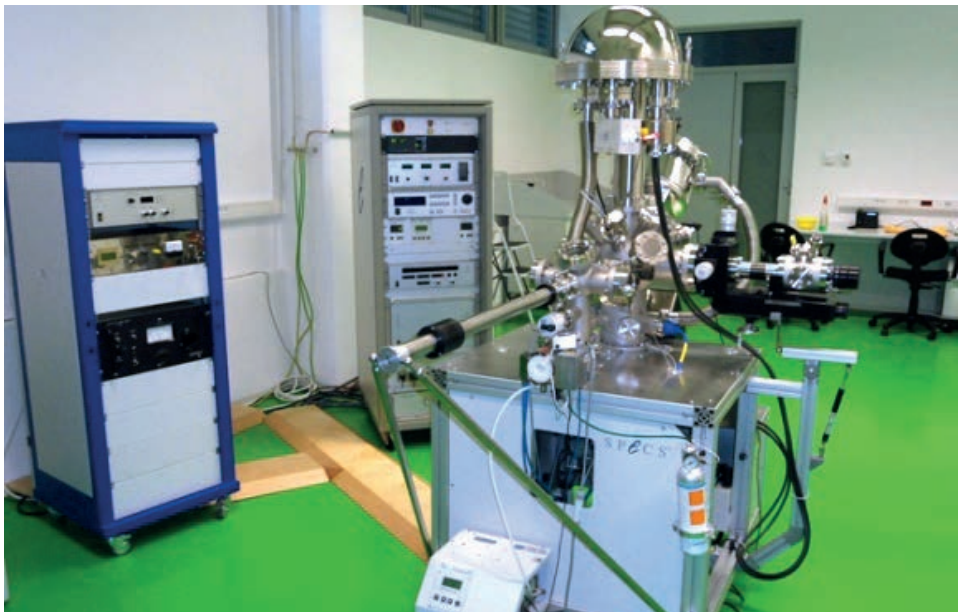
Instrument	**Supercomputer Bura**
Laboratory affiliation	**Data Center of the Supercomputer Bura**
Equipment category	**Other**
Photograph	
Short description	The Supercomputer Bura is based on a hybrid computer architecture which is composed by multiprocessing and multicomputer systems that are interconnected in a high throughput and low latency network. The Data Centre covers a 100m2 surface area.
Main purpose	- The Supercomputer is intended for scientific purposes such as computational chemistry, bioinformatics, artificial intelligence and physics, where users have the availability of three different architectures.
Technical specifications	■ The obtained result on the High Performance Linpack benchmarku amounts to 233,6*106 FLOPS ■ SMP, CPU and GPU clusters ■ 1PB space for data storage with additional 2.5 PB space for archiving ■ InfiniBand FDR interconnection
Additional information	https://cnrm.uniri.hr/bura/
Source of founding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Prof. D.Sc. Zlatan Car / zlatan.car@uniri.hr

LABORATORY EQUIPMENT CATALOGUE OF THE CENTRE FOR MICRO - AND NANOSCIENCES AND TECHNOLOGIES

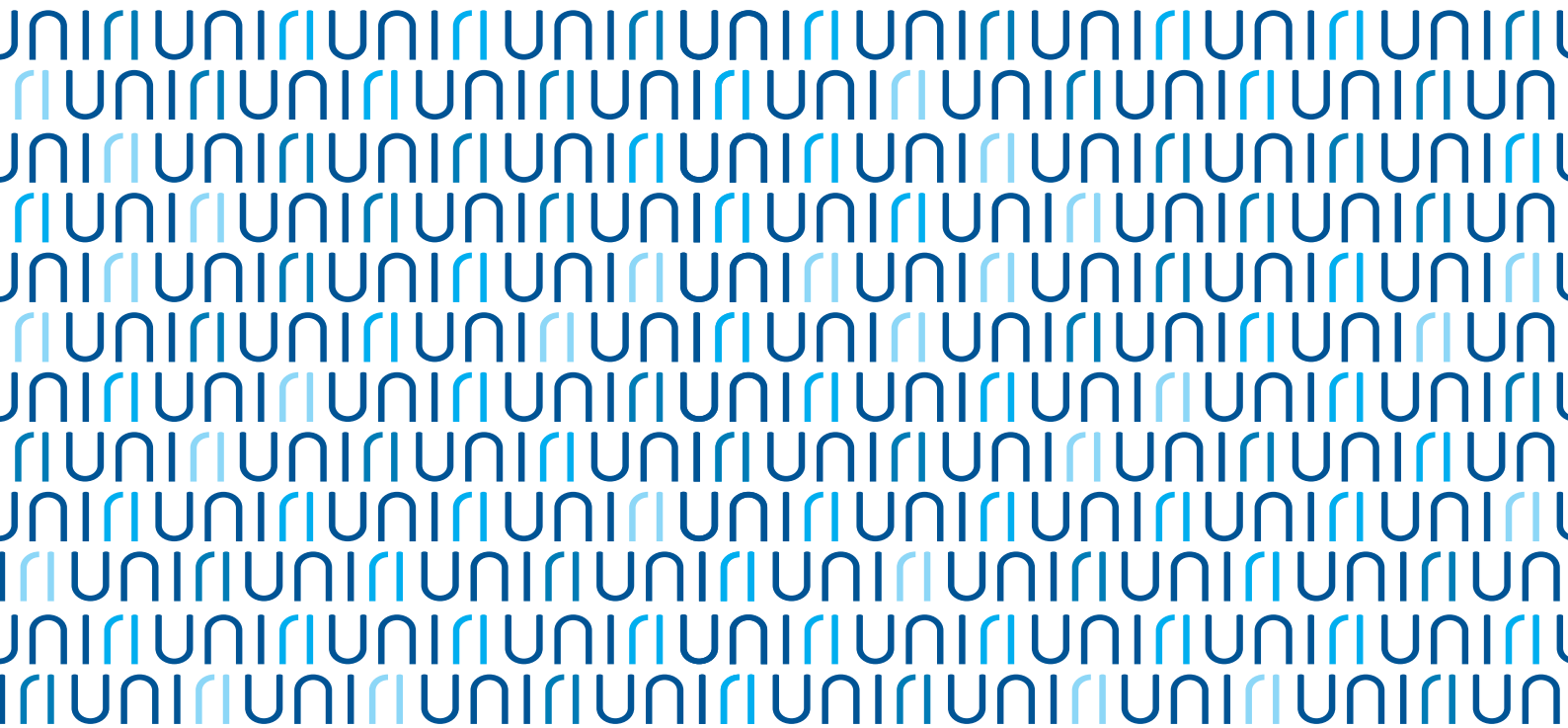


1

EQUIPMENT OF THE LABORATORY FOR SURFACE SCIENCE

Instrument	**X-ray Photoelectron Spectrometer (XPS)**
Laboratory affiliation	**Laboratory for Surface Science**
Equipment category	**Device for chemical and elemental characterisation of materials**
Photograph	
Short description	**X-ray Photoelectron Spectroscopy (XPS)** uses soft (low energy) X-rays for elemental and chemical characterization of the surface of material
Main purpose	The X-ray beam excites the electrons of the sample atoms and if their binding energy is lower than the X-ray energy, they will be emitted from the parent atom as a photoelectron. Only the photoelectrons at the extreme outer surface (10-100 Angstroms) can escape the sample surface, making this a surface analysis technique. XPS provides elemental information, but because the technique is detecting the binding energy of emitted electrons, it can also provide some chemical bonding information. Depending on what elements the parent atom is bound to, the binding energy of the emitted photoelectrons may shift slightly. The instrument is sensitive enough to detect these electron energy shifts and use them to determine what chemical compounds are present.
Technical specifications	X-ray Photoelectron Spectrometer is a SPECS system equipped with: ■ X-ray source with monochromator (FOCUS 500) - Al Kα (1486.74 eV) or Ag Lα (2984.3 eV) ■ hemispherical electron energy analyser (PHOIBOS 100 MCD-5): ■ electron gun (FG 500) ■ ion gun for low-energy ions of inert and reactive gases (IQE 11/35) ■ ion gun for low-energy ions with differential pumping (IQE 12/38) ■ Residual Gas Analyser, RGA (Prisma Plus QMG 220)
Additional information	http://phy.uniri.hr/en/divisions-and-laboratories/102-en/divisions-and-laboratories/division-of-experimental-and-applied-physics/801-xps.html
Year of manufacture	2009
Source of founding	Croatian Science Foundation
Contacts	Assoc. Prof. D. Sc. Ivana Jelovica Badovinac (+385 51 584607, ijelov@uniri.hr) Assoc. Prof. D. Sc. Robert Peter (+385 51 584621, rpeter@uniri.hr)

Instrument	**Secondary Ion Mass Spectrometer (SIMS)**
Laboratory affiliation	**Laboratory for Surface Science**
Equipment category	**Device for elemental and in-depth characterisation of materials**
Photograph	
Short description	**Secondary Ion Mass Spectrometer (SIMS)** is a microanalytical technique used to understand the composition (isotopic, elemental, and/or molecular) of a predefined microvolume of solid material, by irradiating it with energetic ions.
Main purpose	SIMS derives compositional information by directing a focused ion beam to the surface of interest. The primary ions induce the emission of atoms and molecules from the solid's surface, a small percentage of which exist in the ionized state. The emitted secondary ions are then collected and passed through a mass spectrometer. SIMS measurements can be performed in three operating modes: - Static SIMS: measurement of mass spectra of the specimen surface - Dynamic SIMS: depth profiling of selected elements or molecules in the sample - Surface imaging: elemental imaging of the sample surface
Technical specifications	The SIMS instrument is a Hidden system with the following equipment: ■ ion gun for low-energy ions of inert and reactive gases (IG20) with energy range of 0.5 – 5 keV (O_2^+ or Ar^+ ions) and ion-beam diameter of 100 μm ■ Caesium ion gun (IG5C) with energy range of 0.5 – 5 keV and ion-beam diameter of 100 μm ■ quadrupole mass analyser (MAXIM HAL7) with mass range: 1- 500 amu and Puls Ion Counting Electron Multiplier detector ■ ionization source for Residual Gas Analyser (RGA) / Sputtered Neutral Mass Spectrometry (SNMS) mode ■ electron gun (FG 500 – SPECS system) –neutralization of surface charging effects
Additional information	http://phy.uniri.hr/en/divisions-and-laboratories/102-en/divisions-and-laboratories/division-of-experimental-and-applied-physics/802-sims.html
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Ivana Jelovica Badovinac (+385 51 584607, ijelov@uniri.hr) Assoc. Prof. D. Sc. Robert Peter (+385 51 584621, rpeter@uniri.hr)



2

EQUIPMENT OF THE LABORATORY FOR THIN FILMS

Instrument	**Atomic Layer Deposition (ALD)**
Laboratory affiliation	**Laboratory for Thin Films**
Equipment category	**Device for thin film deposition**
Photograph	
Short description	**Atomic Layer Deposition (ALD)** is a technique used for a deposition of thin anorganic films, characterized with an excellent precision of thickness of deposited films (in Å-nm range).
Main purpose	ALD can be used to coat wafers, planar objects and porous bulk materials, as well as particles and complex 3D objects. The essence of this technique is to alternately expose surface of the substrate to two different gas compounds (precursors), and this process is repeated in a cyclic manner. The self-limiting aspect of ALD leads to excellent step coverage and conformal deposition, i.e. the deposited film is homogenious and non-porous. Most commonly synthesized materials in our ALD system are semiconductor or isolating thin films such as oxides: ZnO, Al_2O_3, TiO_2, SiO_2 and nitrides: AlN, TiN, Si_3N_4
Technical specifications	Atomic Layer Deposition (ALD) instrument is a Beneq TFS 200 system. ■ substrate temperature range: 25 - 500 °C ■ maximal substrate dimensions (regular chamber): 200 mm in diameter, 3 mm in height ■ maximal substrate dimensions for 3D chamber: 200 mm in diameter, 95 mm in height ■ capacitive coupled plasma system (operates at RF of 13,6 MHz and plasma power up to 300 W) ■ ozone generator (ozone can be used as an oxygen source for ALD synthesis) ■ 4 liquid sources attached to the instrument
Additional information	http://phy.uniri.hr/en/divisions-and-laboratories/50-en/divisions-and-laboratories/823-atomic-layer-dep.html
Year of manufacture	2015
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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3

EQUIPMENT OF THE LABORATORY FOR SCANNING ELECTRON MICROSCOPY

Instrument	**Scanning Electron Microscope (SEM)**
Laboratory affiliation:	**Laboratory for Scanning Electron Microscopy**
Equipment category	**Device for characterisation of materials on the nanoscale**
Photograph	
Short description	**Scanning Electron Microscope (SEM)**: a type of electron microscope that permits the observation and characterization of heterogeneous organic and inorganic materials on a nanometre (nm) to micrometre (μm) scale.
Main purpose	The SEM is capable of obtaining 3D-like images of the surfaces of a very wide range of materials. The surface area to be examined or the micro-volume to be analysed is irradiated with a finely focused electron beam, which may be swept in a raster across the surface of the specimen to form images or may be static to obtain analyses at one position. Signals produced from the interaction of the electron beam with the sample are in the form of secondary electrons (emitted from the sample) or backscattered electrons (from the impinging electron beam). Signals are obtained from specific emission volumes within the sample and can be used to examine many characteristics of the sample (surface topography, crystallography, chemical composition, etc.).
Technical specifications	The SEM is a JEOL Field Emission Scanning Electron Microscope (JSM-7800F) with maximal resolution of 0.8 nm, accelerating voltage of 0.01 – 30 kV and the magnification range: ×25 - ×1000000. It is equipped with the detectors: ■ Lower secondary electron detector (LED) ■ Upper secondary electron detector (USD) ■ Backscattered electron detector (BED) ■ Scanning Transmission Electron Microscopy (STEM) detector ■ Energy dispersive X-ray spectrometer (EDS) – used for the analysis of the elemental composition of the specimen.
Additional information	http://phy.uniri.hr/en/divisions-and-laboratories/102-en/divisions-and-laboratories/division-of-experimental-and-applied-physics/803-sem.html
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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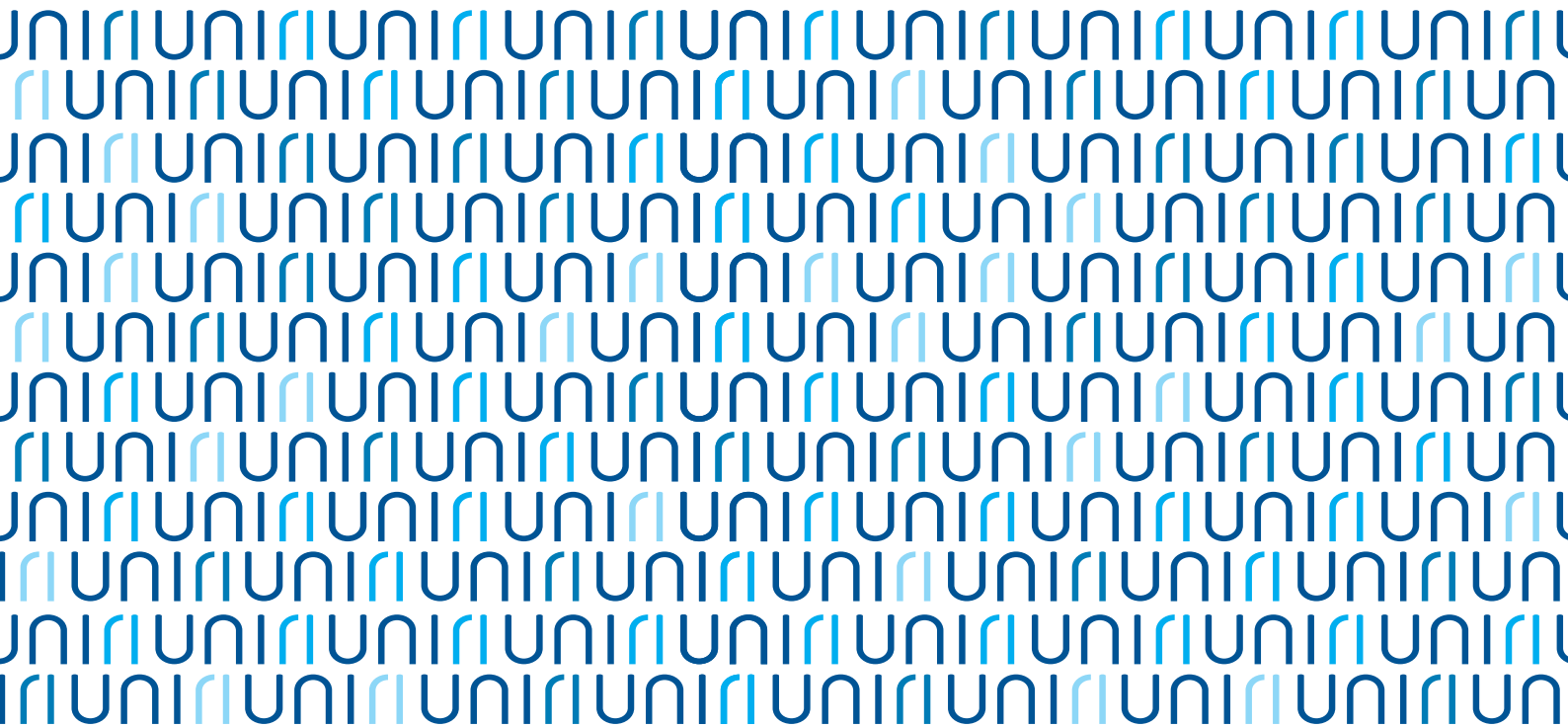
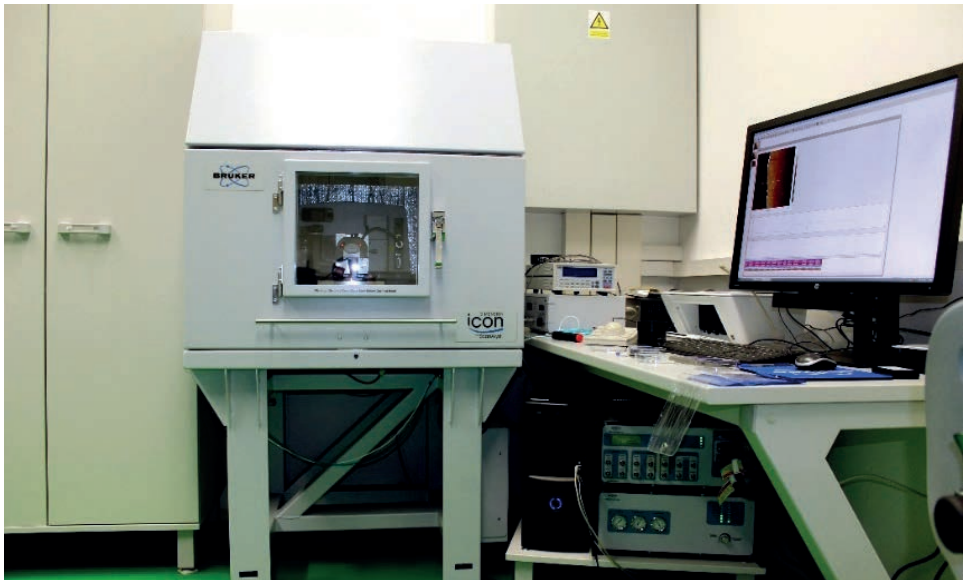
Instrument	**Sample preparation instruments**
Laboratory affiliation	**Laboratory for Scanning Electron Microscopy**
Equipment category	**Devices for sample preparation**
Photograph	
Short description	Various precision instruments
Main purpose	Instruments for preparing samples
Technical specifications	■ Precision Etching and Coating System (Gatan PECS II Model 685) – uses dual ion source for the etching of solid samples by low energy Ar^+ ions (energy range 0.1 – 8 keV) and can be used for sample coating with C, Au, Pt/Pd, Cr or Pt. ■ Precision Ion Polishing System (Gatan PIPS II Model 695) - uses dual ion source for the polishing of solid samples by low energy Ar_+ ions (energy range 0.1 – 8 keV), used primarily for the sample preparation for Scanning Transmission Electron Microscopy (STEM) measurements. ■ Critical point dryer (Quorum K 850) – used for dehydrating biological tissue (by replacing water with liquid CO_2) prior to examination in the Scanning Electron Microscope (SEM). ■ Precision diamond wire saw (Well 3242) - uses a stainless steel wire with diamonds embedded into the surface of the wire as a cutting tool; produces smooth, sharp-edged surfaces on variety of materials. ■ Precision saw with diamond discs (Buehler Isomet 1000) – used for cutting various types of materials (metals, composites, laminates, plastics, biomaterials) with minimal deformation, by only using gravity fed force.
Additional information	http://phy.uniri.hr/hr/ustroj/29-hr/ustroj/laboratoriji/794-laboratorij-za-pripremu-sem-uzoraka.html
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts:	Assoc. Prof. D. Sc. Ivna Kavre Piltaver (+385 51 584618, ivna.kavre@uniri.hr)



4

EQUIPMENT OF THE LABORATORY FOR PRECISION ENGINEERING AND MICRO - AND NANOSYSTEMS TECHNOLOGIES

Instrument	**Bruker Dimension Icon Scanning Probe Microscope (SPM)**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Device for characterization of materials and surfaces on atomic scale**
Photograph	
Short description	Scanning probe microscope encompassing the functionality of an Atomic Force Microscope (AFM) and a Scanning Tunnelling Microscope (STM) with control software
Main purpose	The SPM enables measurements of elasticity modulus, adhesion, lateral force (LFM), spectroscopy and force modulation, electrochemical analysis, electric field and magnetic forces, surface potential, piezoelectric forces; enables also nanolithography, … Option to measure in liquid for biotechnical applications and measurements with heating/cooling of the samples
Technical specifications	■ Supports contact and tapping mode measurements, which limits the contact forces to < 200 pN, i.e. a value far lower than the tapping forces of other devices – PeakForce tapping ■ Imaging of measured data on 5'120 x 5'120 pixels. ■ Scan range up to 90 µm x 90 µm, Z range 10 µm ■ Samples fixed to the support via a 210 mm vacuum chuck can be up to few mm in size and 15 mm thick ■ Bidirectional positioning repeatability 3 µm on 180 x 150 mm inspectable area ■ Includes heat (creep < 200 pm/min) and vibration isolation (1" Si damping cushion + compressed air → < 30 pm RMS), microscope and 5 Mpx CCD camera, … ■ CE certified
Additional information	https://www.bruker.com/products/
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
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Instrument	**Keysight G200 Nanoindenter**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Device for measurement of materials' properties on micro- and nano-scale**
Photograph	 
Short description	Nanoindenter with data analysis software
Main purpose	Accurate determination of elasticity modulus and hardness according to ISO 14577., i.e., quantitative measurement of mechanical properties of small volumes of material
Technical specifications	■ 4 samples in a 100 x 100 mm sample holder with a scanning resolution of 0.1 µm and 1 µm accuracy ■ Electromagnetic actuation (voice coil principle), i.e. load generation: max 0.5 N with a 50 nN resolution; additional built-in high-load system with 0.1 mN … 10 N load range ■ Loading system stiffness (guided by leaf springs): 5.10^6 N/m ■ Capacitive displacement measurement: resolution < 0.01 nm for >500 µm indentation depth ■ Total indenter travel: 1.5 mm ■ Obtainable straightness in a 100 mm range is within 10 nm ■ Enables LFM with a ≤ 2 mN resolution and max lateral force ≥ 250 mN ■ Berkovich, cube corner, conical, spherical and Vickers tips with calibration and conformity certificate of each tip ■ System for sample visualization (10x and 40x zoom), and microscope with CCD camera ■ Thermally as well as dynamically (and acoustically) isolated
Additional information	http://www.keysight.com/en/pc-1678689/nanoindenters?cc=US&lc=eng
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
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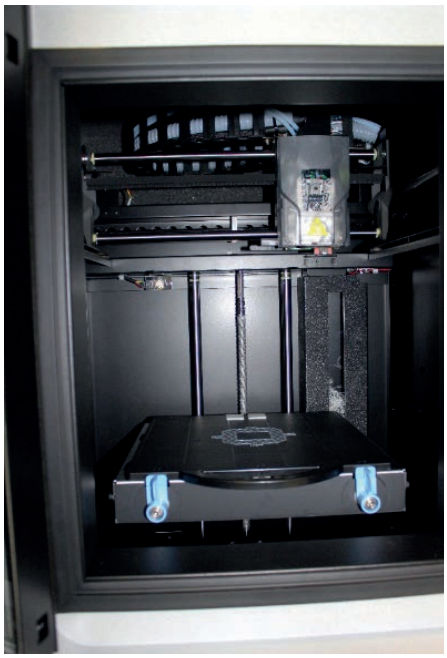
Instrument	**Stratasys Fortus 250 mc 3D printer**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Device for additive manufacturing via 3D printing**
Photograph	 
Short description	3D printer with control software
Main purpose	Create a free-shape three-dimensional object in which layers of material are deposited under computer control
Technical specifications	■ FDM (Fused Deposition Modelling) technology (heating and extrusion of thermoplastics) ■ Material: ABSplus (acrylonitrile butadiene styrene). ■ For models with dimension of up to 254 x 254 x 305 mm ■ 178 µm layer thickness ■ Positioning accuracy of 240 µm ■ 2 heads for building and support material ■ Import of STL (Standard Tessellation Language) 3D models from CAD environment ■ SW for printing process optimization (including support structure optimization)
Additional information	https://proto3000.com/fortus-250mc.php
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Prof. D. Sc. Saša Zelenika (+ 385 51 584 633, sasa.zelenika@uniri.hr) D. Sc. Ervin Kamenar (+ 385 51 584 766 , ekamenar@uniri.hr)

Instrument	**DAVID SLS-2 3D Scanner**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**3D non-contact scanner**
Photograph	
Short description	3D scanner comprising a projector, the camera, calibration panels and a rotating table – with control software
Main purpose	Capturing real world data and converting it into 3D models Basis for reverse engineering (and, in combination with 3D printers, of rapid prototyping)
Technical specifications	■ The distance and the angle of the camera with respect to the projector are known, i.e. the distortion of the reflected light pattern (fringes) depends on object's geometry ■ 500 mm scanning area ■ Resolution/accuracy: 1‰ of the object size ■ Includes SW environment ■ Mobile with tripod ■ Enables exporting of data to formats compatible with standard CAD SW (e.g. STL)
Additional information	http://www.david-3d.com/en/support/david4/sls-overview
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
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Instrument	**HAAS Office OM-2A milling machine**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Machine tools for sample preparation**
Photograph	

Short description	CNC milling machine characterized by small dimensions as well as outstanding performances and exceptional benefits for the end users
Main purpose	Transforms a stock piece of material into a finished product by means of a controlled material removal process
Technical specifications	■ Dimensions within an 1.7 x 0.84 x 1.9 m envelope ■ Enables 5-axes machining with up to 20 automatically interchangeable tools ■ Machining volume 305 x 254 x 305 mm ■ 1 μm displacement resolution ■ Spindle velocity of up to 30'000 rpm ■ 3.7 kW power ■ Includes user-friendly interface and a HAAS/Fanuc control unit
Additional information	https://www.techspex.com/machining-centers/haas-automation(2501)/4489
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Prof. D. Sc. Saša Zelenika (+ 385 51 584 633, sasa.zelenika@uniri.hr) D. Sc. Ervin Kamenar (+ 385 51 584 766 , ekamenar@uniri.hr)

Instrument	**HAAS Office OL-1 lathe**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Machine tools for sample preparation**
Photograph	
Short description	CNC lathe characterized by small dimensions as well as outstanding performances and exceptional benefits for the end users
Main purpose	Transforms a stock piece of material into a finished product by means of a controlled material removal process
Technical specifications	■ Dimensions within an 1.3 x 0.84 x 1.98 m envelope ■ 2-axes machining with 12 tools ■ Turning diameter of up to 125 mm ■ 1 µm displacement resolution ■ Spindle velocity of up to 6'000 rpm ■ 5.6 kW power ■ Includes user-friendly interface and a HAAS/Fanuc control unit
Additional information	http://int.haascnc.com/lathe_intro.asp?intLanguageCode=1033
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
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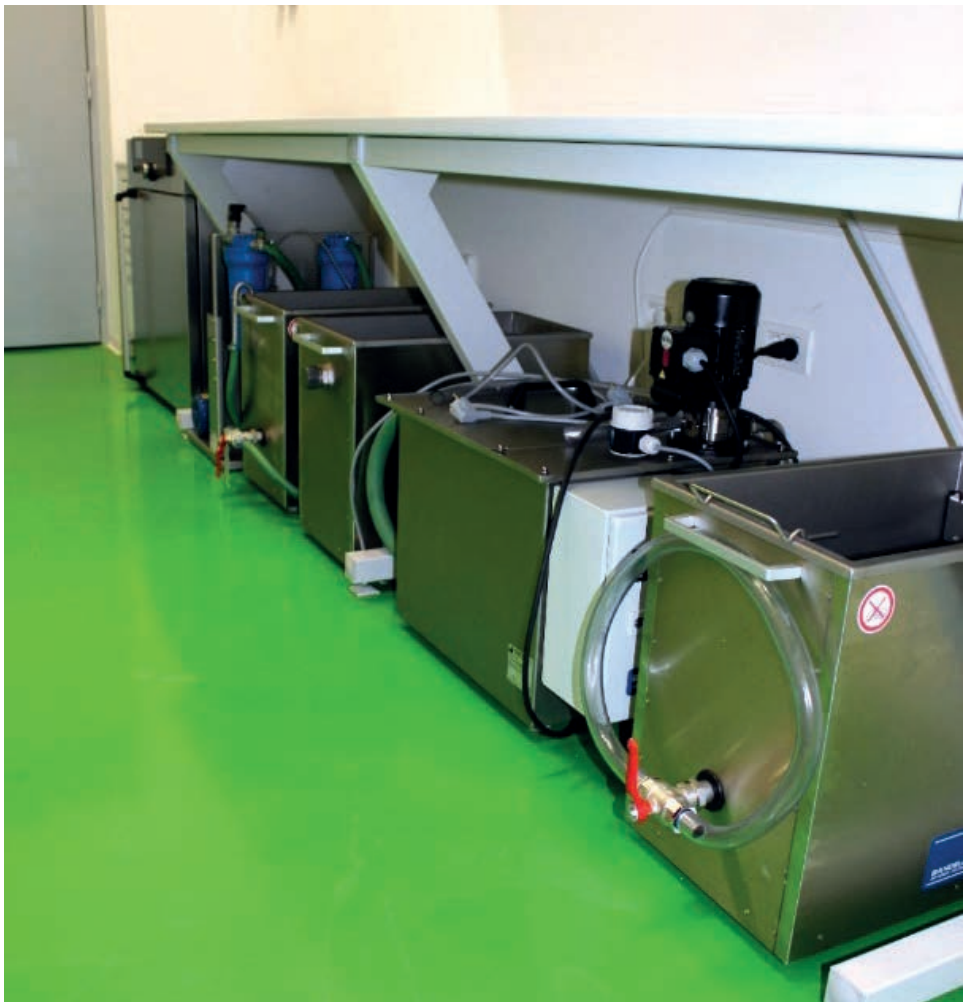
Instrument	**Ultrasonic cleaner SONOREX Technik RM40**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Ultrasonic cleaning of samples for (ultra-high) vacuum**
Photograph	
Short description	Ultrasonic cleaning device with multiple components
Main purpose	Equipment for ultrasonic cleaning of samples for (ultra-high) vacuum
Technical specifications	■ 1. heated (up to 70 °C) prewash with oil separation ■ 2. ultrasonic cleansing (10 PZT inverters, 40 kHz, 500 W continuous and 2 kW peak power) in a 45 l heated stainless steel bath with a “soft” (pH 9.9) detergent and with filtering of media (particles’ separation) ■ 3. 2 baths for rinsing in demineralized water with heating (1.2 kW, 30 … 80 °C) ■ 4. drying with hot air (up to 300 °C)
Additional information	http://monmouthscientific.co.uk/image/data/Ultrasonic/SonorexTechnikTechSheetPricelist2012.pdf
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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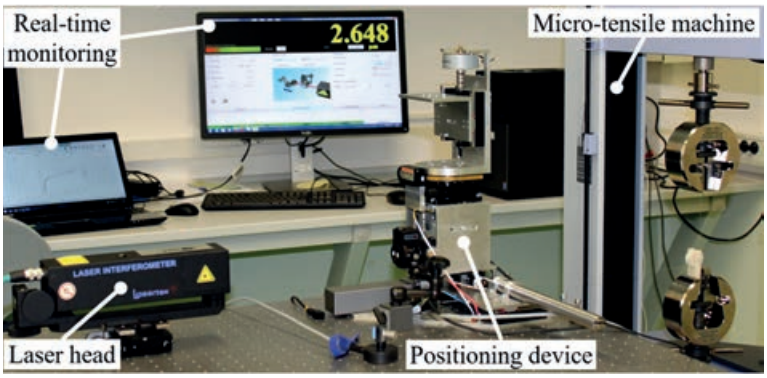
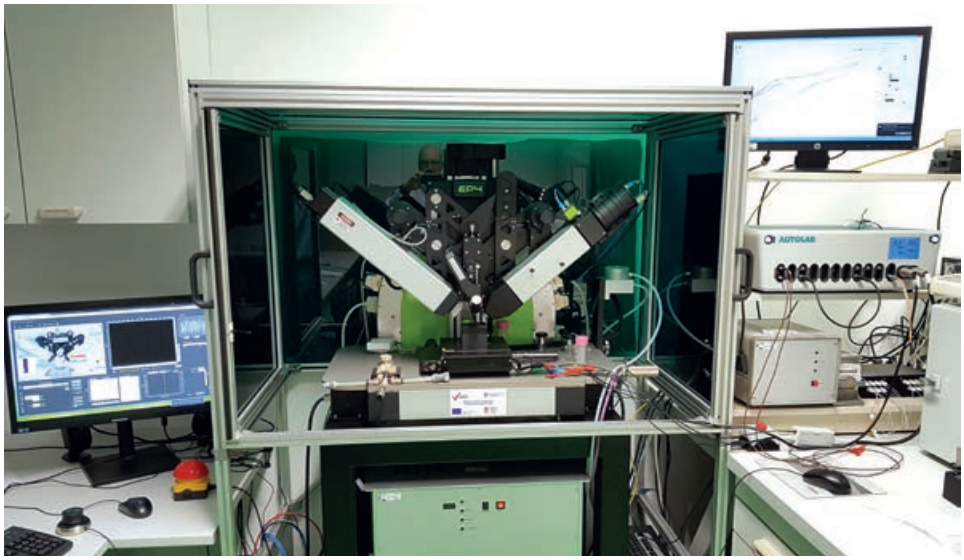
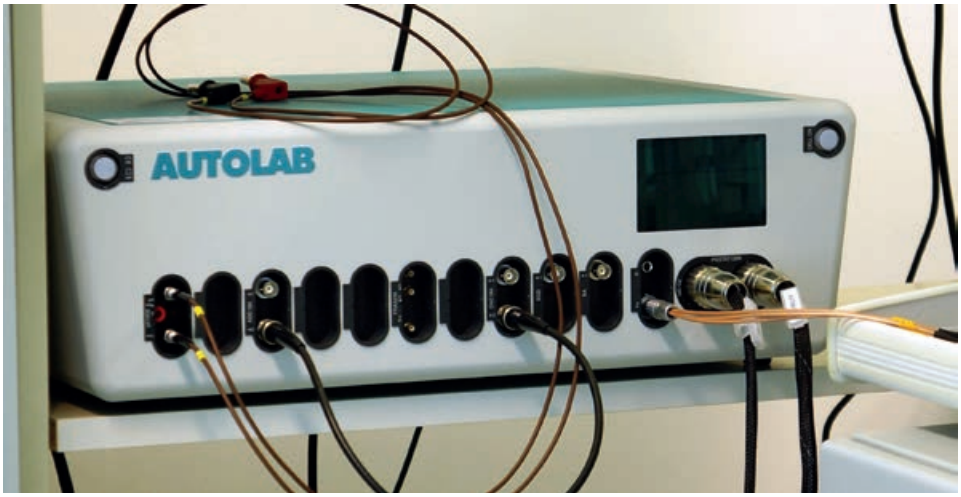
Instrument	**Shimadzu Autograph AGS-X**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Measurement of mechanical properties of materials**
Photograph	
Short description	Micro-tensile machine
Main purpose	Tensile machine for accurate measurement of mechanical properties (elasticity modulus, strength, tensile tests, compression tests, bending tests, …) of materials with superior performances and practical testing solutions
Technical specifications	■ Loading range up to 5 kN ■ Loading resolution 2 mN ■ Displacement resolution 10 µm ■ Characterisation of mechanical properties of metals, ceramics, polymers, rubber and composites ■ Offers real-time auto tuning of control parameters, based on measured test force and strain data ■ High-speed sampling of 1 ms ensures no missed strength changes
Additional information	https://www.ssi.shimadzu.com/products/literature/Testing/C224-E057.pdf
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Prof. D. Sc. Saša Zelenika (+ 385 51 584 633, sasa.zelenika@uniri.hr) D. Sc. Ervin Kamenar (+ 385 51 584 766, ekamenar@uniri.hr)

Instrument	**Electro-opto-mechanical components**
Laboratory affiliation	**Laboratory for precision engineering and micro- and nanosystems technologies**
Equipment category	**Tools for sample preparation and characterisation**
Photograph	
Short description	Electro-opto-mechanical tools and devices
Main purpose	Tools for sampling, preparation and characterisation of materials
Technical specifications	■ Newport optical table RS 2000™ with 4 adjustable legs (passively damped working surface, metric) ■ Pillar drilling machine BOSCH PBD 400 (digital display, d_{max} = 13 mm, adjustable rotation speed) ■ Oscilloscope Keysight (bandwidth 100 MHz, 4 analog + 8 digital channels, 2 GS/s, WVGA color display) ■ Multimeter Fluke x 4 (measurement of I, U, R, C, f, temperature) ■ UV Exposure Box for Printed Circuit Boards UV (4 x 15 W, 350 x 250 mm) ■ Soldering station Weller PUWAD101 (80 W, temp. span 150-450 °C, 1 output) ■ Laboratory power supply - Welleman (digital, 3 outputs, regulation of voltage 0-30 V and regulation of current 0-3 A) ■ Battery drill/screwdriver BOSCH (M = 30 Nm, 18 V Li-Ion, n_{max} = 1250 min^{-1}) ■ Micro drill/grinding machine Welleman/Proxxon (125 W, n = 10'000 – 30'000 min^{-1}) ■ Electric hand drilling machine FEIN BOP6 (1500 W, drilling diameter up to 14 mm, rotational speed up to 4000 rpm) ■ Laser distance measurement device (for distances up to 10 m with mm resolution) ■ Laboratory calibrated weights (1 mg - 0,5 kg, calibration standard – class F1) ■ Digital micrometers SCHUT (0-150 mm, resolution 1 µm) ■ Various hand tools
Additional information	/
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Prof. D. Sc. Saša Zelenika (+ 385 51 584 633, sasa.zelenika@uniri.hr) D. Sc. Ervin Kamenar (+ 385 51 584 766 , ekamenar@uniri.hr)

5

EQUIPMENT OF THE LABORATORY FOR COLLOIDS, POLYELECTROLYTES AND INTERFACES

Instrument	**Spectroscopic imaging ellipsometer Accurion EP4**
Laboratory affiliation	**Laboratory for Colloids, Polyelectrolytes and Interfaces**
Equipment category	**Thin film characterization**
Photograph	
Short description	Spectroscopic ellipsometry is a well-known non-destructive optical method for determining the thickness and opto-electronic properties of thin films. Imaging ellipsometry combines the power of ellipsometry with microscopy and overcomes the limits of classical ellipsometers
Main purpose	The modularity of the Accurion EP4 Imaging Ellipsometer offers many advantages: Spectroscopic ellipsometry with highest lateral resolution (2µm) – mapping the dielectric function; 3D thickness maps. The EP4 model software enables fitting the thicknesses and iso- or anisotropic dielectric functions for stacked layers of different optical materials. The solid-liquid and electrochemical cells enable measurements in contact with liquid medium, and under electrochemical bias (in combination with potentiostat Autolab PGTSAT 128 N). Brewster angle microscopy - a high contrast image of liquid surfaces without use of dies. Surface plasmon resonance measurements with lateral resolution of 2µm. Typical applications are in the triangle between physics and biophysics, material chemistry and nanotechnology.
Technical specifications	■ AOI: 45-70 deg. ■ wavelength range for SE: 380-1700 nm ■ measurement method: nulling ellipsometry ■ optical magnification: 5x, 10x, 20x
Additional information	https://www.accurion.com/thin-film-characterization-imaging-ellipsometry/nanofilm_ep4
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF.
Contacts	Assoc. Prof. D. Sc. Duško Čakara (+385 51 584555, dcakara@uniri.hr)

Instrument	**Autolab PGSTAT128 potentiostat for electrochemical measurements**
Laboratory affiliation	**Laboratory for Colloids, Polyelectrolytes and Interfaces**
Equipment category	**Electrochemical measurements**
Photograph	
Short description	Autolab PGSTAT 128N is a state-of-the-art potentiostat offering measurements with three- or four-electrode electrochemical cells. In combination with the NOVA software, it offers a wide range of methods frequently used in preparative and analytical electrochemistry, including chronoamperometry, chronopotentiometry, voltammetry with a range of different potential sweep modes. The additional bipotentiostat module offers the potential sweep at 2 different electrode terminals, while the FRA32 module offers measurements of electrochemical impedance spectroscopy (EIS)
Main purpose	Electrochemical measurements: cyclic voltammetry, electrochemical impedance spectroscopy, chronoamperometry, chronopotentiometry
Technical specifications	■ Electrode connections: 2, 3 and 4 ■ Potential range: +/- 10 V ■ Maximum current: +/- 800 mA ■ Current ranges: 1 A to 10 nA ■ Current resolution: 0.0003 % (of current range) ■ Input impedance: > 1 TOhm ■ Potentiostat bandwidth: 500 kHz ■ FRA32 M: frequency range 10 μHz - 1 MHz; ■ Frequency resolution: 0.003 % ■ Input range: 10 V ■ Signal types: 1 sine, 5 sine, 15 sine ■ AC amplitude: 0.2 mV to 0.35 V rms inpotentiostatic mode ■ Data presentation Nyquist, Bode, Admittance, Dielectric, Mott-Schottky… ■ Graphical equivalent circuit modelling and fitting in NOVA
Additional information	http://www.metrohm-autolab.com/Products/Echem/NSeriesFolder/PGSTAT128N
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Duško Čakara (+385 51 584555, dcakara@uniri.hr)

Instrument	**Brookhaven NanoBrook OMNI zetasizer**
Laboratory affiliation	**Laboratory for Colloids, Polyelectrolytes and Interfaces**
Equipment category	**Nanoparticle sizing and electrophoretic mobility measurement**
Photograph	
Short description	The particle size distribution measurement is based on principles of Dynamic Light Scattering (DLS), while Doppler velocimetry (electrophoretic light scattering, ELS) is used for zeta potential measurement. The instrument also includes Phase Analysis Light Scattering (PALS) measurements for samples with low mobilities, while the available three scattering angles (90°, forward and backscattering) allow optimal experimental conditions for sizing of small particles and polyelectrolytes (< 50 nm) or aggregated turbid samples.
Main purpose	The NanoBrook Omni particle size and zeta potential analyser is an instrument for size and electrophoretic mobility measurements in suspensions of nanoparticles and polyelectrolytes, including proteins
Technical specifications	■ Particle size range: < 0.3 nm to 10 µm ■ Three measurement angles: 15°, 90°, and 173° ■ Dynamic light scattering at 173° and 90° ■ Sizing: Globular proteins, nanoparticles, and small polymers as well as most colloidal-sized materials in any non-absorbing liquid ■ Zeta Potential: Proteins, nanoparticle, polymer and colloidal-sized materials, suspended in any non-absorbing liquid, with relative permittivity (dielectric constant) > 1.5 and viscosity < 30 cP ■ Mobility range: 10-11 to 10-7 m2 /V*s ■ Zeta potential range: 220 mS/cm, covering saline and PBS solutions for proteins, sample dependent ■ Concentration range: Sizing: 0.1 ppm to 50 mg/mL, depending on refractive index and concentration ■ Zeta potential: 40% v/v, sample dependent ■ Laser: 35 mW red diode laser, nominal 640 nm wavelength
Additional information	https://www.brookhaveninstruments.com/nanobrook-omni
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Duško Čakara (+385 51 584555, dcakara@uniri.hr)

6

EQUIPMENT OF THE LABORATORY FOR MACROMOLECULAR RESEARCH

Instrument	**Fourier Transform Infrared (FTIR) Spectrometer with Universal Attenuated Total Reflexion (UATR)**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**Infrared spectrometer**
Photograph	
Short description	Fourier Transform Infrared Spectrometer
Main purpose	**Fourier Transform Infrared (FTIR) Spectroscopy** is a technique used to obtain the information about molecular structure on the base of absorption or emission infrared spectra. Particularly it is used in organic chemistry for identification of functional groups. It is often applied to analyze structural parameters of various materials, but also in biomedical research as a powerful method for the rapid differentiation and identification of microorganisms, contributing to clinical medicine. Particularly, in our laboratory this technique is mostly applied for monitoring structural parameters of polymers and polymer composits and their changes caused by ageing or high energy radiation.
Technical specifications	■ Spectral range: 8,300 – 350 cm-1 ■ Spectral resolution 0,4 cm-1 ■ Wavenumber Precision 0.008 cm-1 at 2,000 cm-1 ■ Wavenumber Accuracy 0.02 cm-1 at 2,000 cm-1
Additional information	http://www.perkinelmer.com/product/frontier-mir-spectrum-10-std-l1280002
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Prof. D. Sc. Srećko Valić (+ 385 51 651 135, svalic@uniri.hr) Assoc. Prof. D. Sc. Damir Klepac (+ 385 51 651 187, damir.klepac@uniri.hr)

Instrument	**Thermogravimetric Analyzer with Mass Spectrometer**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**Mass spectrometer**
Photograph	
Short description	Thermogravimetric analyser
Main purpose	**Thermogravimetric analyser** continuously and precisely measures mass while the temperature of a sample is changed over time. Mass, temperature, and time in thermogravimetric analysis are considered base measurements while many additional measures may be derived from these three base measurements. The thermogravimetric data collected from a thermal reaction is compiled into a plot of mass or percentage of initial mass on the y axis versus either temperature or time on the x-axis. A TGA can be used for materials characterization through analysis of characteristic decomposition patterns. Particularly, when coupled with mass spectrometry it is a powerful tool in the determination of chemical composition. It is an especially useful technique for the study of polymeric materials, including thermoplastics, thermosets, elastomers, composites, plastic films, fibres, coatings, paints, and fuels. Therefore this technique is very useful in the field of environmental science and food, pharmaceutical and petrochemical industry.
Technical specifications	■ Temperature range from room temperature to 1000 °C ■ Precision from ± 1 °C, accuracy from ± 0.4 °C ■ Balance sensitivity from 10-6 to 10-7 (from 0.1 to 1 µg/g) ■ Balance precision 0.001%, Balance accuracy ± 0.02% ■ All accessories needed for attaching MS to TGA. ■ Set of appropriate TGA pans (1000 pcs)
Additional information	http://www.perkinelmer.com/category/thermogravimetry-tga-instruments
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Prof. D. Sc. Srećko Valić (+ 385 51 651 135, svalic@uniri.hr) Assoc. Prof. D. Sc. Damir Klepac (+ 385 51 651 187, damir.klepac@uniri.hr)

Instrument	**Gas Permeation Chromatograph (GPC)**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**GPC**
Photograph	
Short description	Gas permeation Chromatograph (GPC)
Main purpose	**Gel permeation chromatography (GPC)**, also known as size exclusion chromatography (SEC) separates analytes on the basis of the molecular size in solution. The technique is often used for the analysis of various macromolecular systems, particlularly natural and sinthetic polymers. Basically, this technique give a possibility to measure molecular masses of such compounds, based on their hydrodynamic volume in solution. Additionally, polydispersity index (PDI) or molecular mass distribution (MMD) can be also determined by this technique. These data are very important for mechanical properties of materials, related to their practical application
Technical specifications	■ RI and Light Scattering detectors ■ Column porosity 3, 5, 10 μm ■ Column capacity: 5 x 30 cm ■ Max flow rate: (analysis) 2.0 mL/min (solvent exchange) 0.3 mL/min ■ Pump flow rate: 0.01 to 10.00 mL/min, programmable soft start
Additional information	http://www.pss-polymer.com/products/lc-instruments-and-detectors/seccurity2-gpc-system/
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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Instrument	**Dynamic Mechanical Analyzer (DMA)**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**DMA**
Photograph	
Short description	Dynamic mechanical analyser
Main purpose	**Dynamic mechanical analysis (DMA)**, also known as dynamic mechanical spectroscopy, is a technique used to study and characterize various materials. It is often applied for studying the viscoelastic behaviour of polymers. A sinusoidal stress is applied and the strain in the material is measured, allowing one to determine the complex modulus. The temperature of the sample or the frequency of the stress are often varied, leading to variations in the complex modulus; this approach can be used to locate the glass transition temperature of the material, as well as to identify transitions corresponding to other molecular motions.
Technical specifications	■ Temperature range from -190 °C to 600 °C ■ Frequency range from 0 to 300 Hz ■ Frequency resolution 0.001 Hz ■ Dynamic Displacement from 0 to ±1000 μm. ■ Modulus resolution 0.0001 Pa; modulus range ~103 to 1016 Pa ■ Tan Delta resolution 0.00001 ■ Maximum Sample Size: 52.5 mm x 12.8 mm x 8.0 mm ■ TMA Mode: ■ Measurement range ±1000 μm; ■ Sample size up to 10 mm ■ Geometry: tension and compression ■ Sensitivity: 10 nM ■ Force load min/max 0.002 N / ±10 N
Additional information	http://www.perkinelmer.com/product/dma-8000-analyzer-qtz-window-ssti-clamp-n5330101
Year of manufacture	2015
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Prof. D. Sc. Srećko Valić (+ 385 51 651 135, svalic@uniri.hr) Assoc. Prof. D. Sc. Damir Klepac (+ 385 51 651 187, damir.klepac@uniri.hr)

Instrument	**Gas Adsorption Porosimeter**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**Porosimeter**
Photograph	
Short description	Gas Adsorption Porosimeter ASAP 2020
Main purpose	**Gas Adsorption Porosimeter** is an instrument which gives the possibility to characterize the surface as well as the free volume in various types of materials (polymers, ceramics etc.). The technique is based on the gas absorption, and the results indicate the size and size distribution of free volume holes inside the investigated sample. This powerful technique can be very useful in the study and production of pharmaceuticals, catalysts, adsorbents, materials for separation technologies, pigments, cosmetics and construction materials. Additionally, it can be applied for geological investigations.as well as to identify transitions corresponding to other molecular motions.
Technical specifications	■ Gas temperature measurement resolution: 0.01 °C ■ Two vacuum independent degassing stations with two temperature zones up to 450 °C ■ Specific surface area:~ 0.01 m^2/g and above (N_2/77K); ~0.0005 m^2/g and above (Kr/77K) ■ Specific pore volume: from 0.0001 cc/g ■ Pore size range: 0.32-500 nm in pore diameter ■ Maximum inlet pressure ~150 kPa ■ Pressure measurement accuracy better than 0.25% ■ Temperature stability: ±0.1°C ■ Coolant system: Liquid nitrogen and liquid argon with automatic level control. Automatic Dewar raising and lowering ■ Degasser unit accuracy: ± 1 % of full scale temperature.
Additional information	http://www.micromeritics.com/Product-Showcase/ASAP-2020-Plus-Chemisorption.aspx
Year of manufacture	2015
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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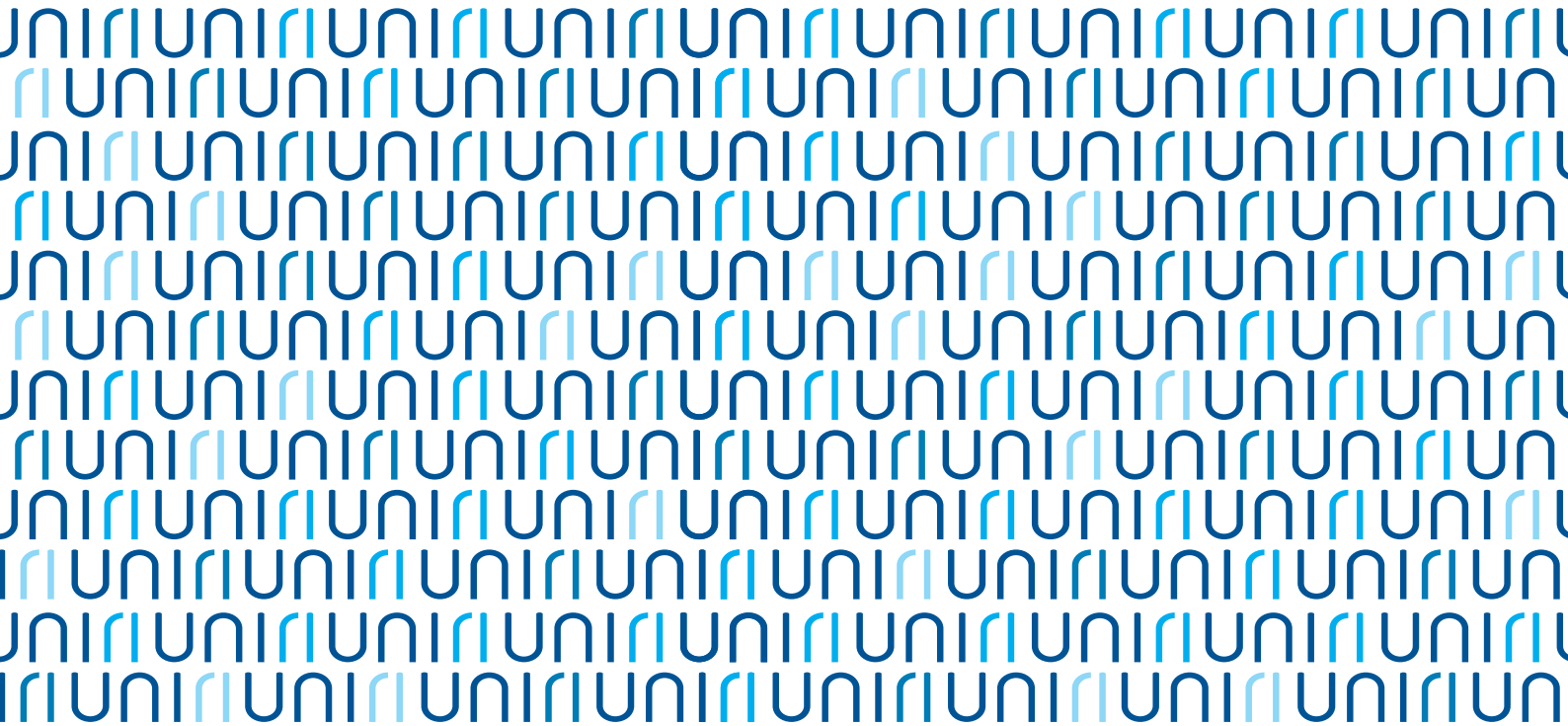
Instrument	**Testing Machine**
Laboratory affiliation	**Laboratory for Macromolecular Research**
Equipment category	**Characterisation of mechanical properties**

Photograph

Short description	Testing machine
Main purpose	**Testing machine** allows to measure mechanical properties of materials. In our laboratory it is predominantly used for measuring stress-strain curves of various elastomers and their composites, in one or multiple cycles under the control of frequency and amplitude. We possess standard matrices of various shapes for the sample preparation.
Technical specifications	■ Testing load range: from 0.5 to 5 kN ■ Height: 1000 mm ■ Accuracy of the set speed: 0.05 % of set speed ■ Repetition accuracy: ±2μm
Additional information	http://www.ssi.shimadzu.com/products/product.cfm?product=eztest
Year of manufacture	2015
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Prof. D. Sc. Srećko Valić (+ 385 51 651 135, svalic@uniri.hr) Assoc. Prof. D. Sc. Damir Klepac (+ 385 51 651 187, damir.klepac@uniri.hr)



7

EQUIPMENT OF THE LABORATORY FOR QUANTUM AND NONLINEAR OPTICS

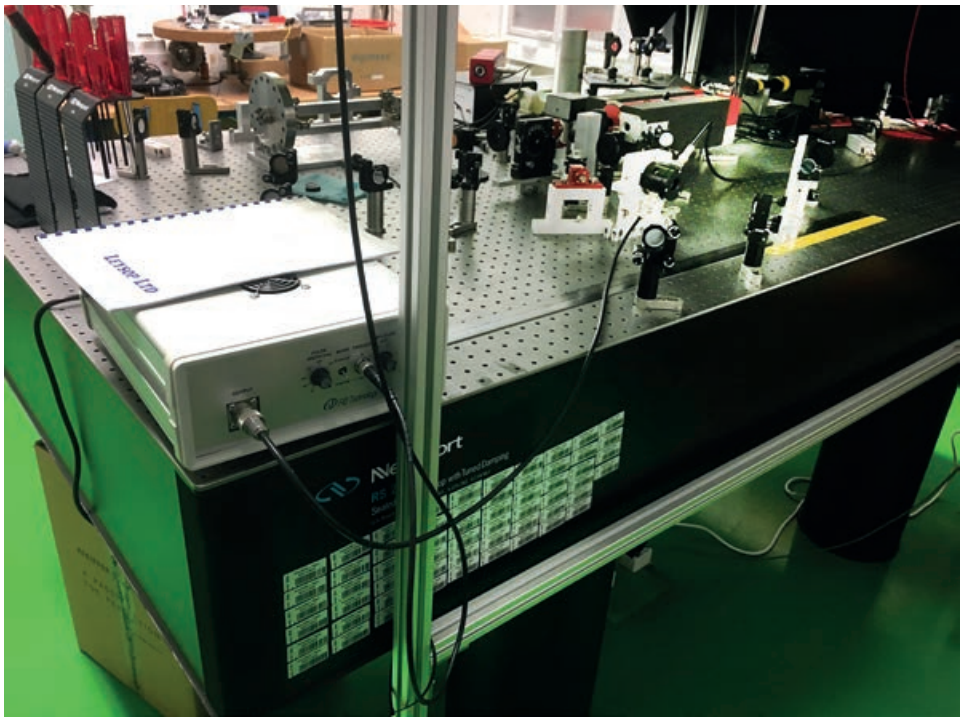
Instrument	**Light source**
Laboratory affiliation	**Laboratory for quantum and nonlinear optics**
Equipment category	**Light source**
Photograph	
Short description	Ultra-Narrow Linewidth CW DPSS Green Laser is based on a Non-Planar Ring Oscillator (NPRO) configuration. The output from Nd:YAG NPRO is frequency doubled in an efficient periodically poled crystal. Output power up to 100 mW is available at green wavelength. In addition, the depleted 1064 nm beam is also available, with output power up to 1.5 W. Linewidth, frequency tuning, frequency stability and noise of both green and IR beams are determined by the unique properties of NPRO and low noise electronics. The Noise Eater circuitry eliminates residual pump diode and relaxation oscillation noise at frequencies below 1 MHz.
Main purpose	Light source for precision measurements in metrology and quantum optics.
Technical specifications	■ Laser power 20 mW @532 nm and 1000 mW @1064nm ■ Laser control electronics – analog, stand alone ■ Continuous wave ■ TEM00 spatial modelling Thermal and PZT tuning ■ single frequency ■ coherence length > 1 km ■ Spectral linewidth ~ 1 kHz
Additional information	https://www.coherent.com
Year of manufacture	2013
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Marin Karuza (+385 51 584 611, mkaruza@phy.uniri.hr)

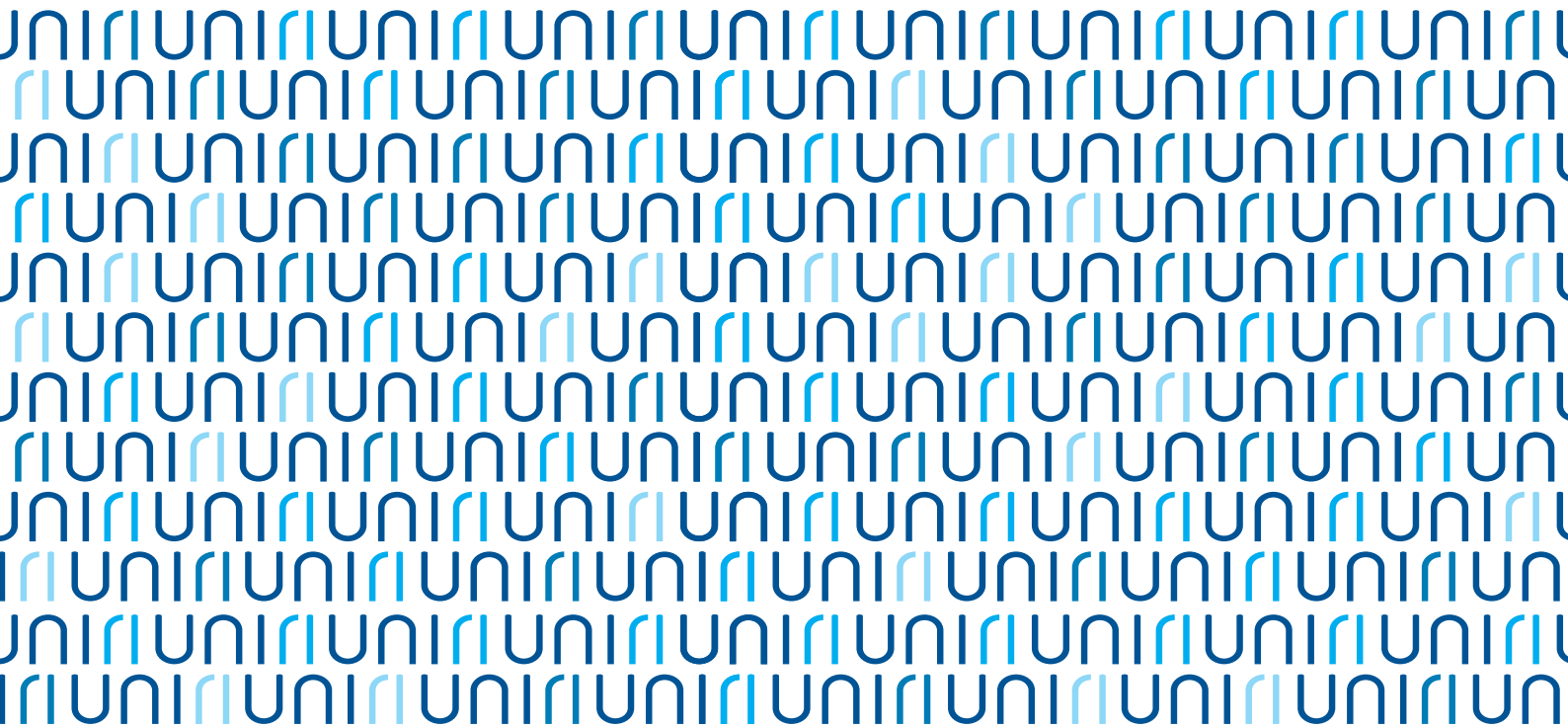
Instrument	**Oscilloscope**
Laboratory affiliation	**Laboratory for quantum and nonlinear optics**
Equipment category	**Measurement device**

Photograph

Short description	Oscilloscopes are used to observe the change of an electrical signal over time, such that voltage and time describe a shape which is continuously graphed against a calibrated scale. The observed waveform can be analysed for such properties as amplitude, frequency, rise time, time interval, distortion and others. Modern digital instruments may calculate and display these properties directly. Originally, calculation of these values required manually measuring the waveform against the scales built into the screen of the instrument.
Main purpose	Measure and display of electrical signals as waveforms on the screen.
Technical specifications	■ 4 input channels ■ analog bandwidth 1 GHZ ■ rise time 350 ps ■ Input coupling AC, DC, GND ■ input impedance 1 MΩ, 50 Ω ■ input sensitivity 1mV/div t0 10V/div (1 V/div @50Ω) ■ vertical resolution 8 bits
Additional information	https://www.tektronix.com
Year of manufacture	2013
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Marin Karuza (+385 51 584 611, mkaruza@phy.uniri.hr)

Instrument	**Analog to digital and digital to analog converters**
Laboratory affiliation	**Laboratory for quantum and nonlinear optics**
Equipment category	**Data acquisition and signal generation**
Photograph	
Short description	Data acquisition (DAQ) is the process of measuring an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound with a computer. A DAQ system consists of sensors, DAQ measurement hardware, and a computer with programmable software. Compared to traditional measurement systems, PC-based DAQ systems exploit the processing power, productivity, display, and connectivity capabilities of industry-standard computers providing a more powerful, flexible, and cost-effective measurement solution.
Main purpose	Measure and generate electrical signals and process, visualize and store them on a computer
Technical specifications	■ Accepts 3U PXI Express, CompactPCI Express, and hybrid slot compatible PXI-1/CompactPCI (PICMG EXP.0 R1.0) modules ■ 5 peripheral slots in a rugged, compact chassis with universal AC input, and automatic voltage/frequency ranging ■ Integrated MXI-Express controller ■ rise time 1.4 ns, bandwidth 250 MHz, ENOB up to 7.6 ■ real time sample rate 2.5 GS/s, RIS up to 50 GS/s ■ jitter < 200 fs, amplitude resolution <0.1 dB ■ amplitude settling time 0.05 dB of final value < 500 ms ■ VSWR < 1.8:1, typical, output impedance 50 Ω
Additional information	https://www.ni.com
Year of manufacture	2013
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Marin Karuza (+385 51 584 611, mkaruza@phy.uniri.hr)

Instrument	**Optical table with optical and optomechanical elements**
Laboratory affiliation	**Laboratory for quantum and nonlinear optics**
Equipment category	**Parts and devices for high sensitivity measurements**
Photograph	
Short description	Optical tables provide damping for applications such as biomedical imaging, scanning microscopy, spectroscopy, interferometry, electrophysiology, precision measurements and more. The optical and optomechanical elements provide the capability to design and construct custom oriented measurement setups. Spherical lenses are used for beam focusing and beam expansion
Main purpose	Support and setup precision experiments and measurements.
Technical specifications	■ Two precision tunable dampers concentrate damping where it's needed ■ Trussed honeycomb core improves table stiffness ■ Excellent vibration immunity for a passive table top ■ Triple core interface increases point loading capability ■ Mounting holes individually sealed with conical polymeric cup ■ 100-TPI adjusters ■ Hardened carbide pads ■ N-BK7 or UV grade fused silica substrates ■ Uncoated or AR coated optics ■ lens range f = -50 mm to 1500 mm
Additional information	https://www.newport.com
Year of manufacture	2014
Source of founding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Assoc. Prof. D. Sc. Marin Karuza (+385 51 584 611, mkaruza@phy.uniri.hr)



8

EQUIPMENT OF THE LABORATORY FOR SYNTHESIS OF FUNCTIONAL MATERIALS

Instrument	**UV system for polymerization (INTELLI-RAY 600)**
Laboratory affiliation	**Laboratory for Synthesis of Functional Materials**
Equipment category	**Polymerization system**

Photograph

Short description	Microprocessor
Main purpose	The INTELLIRAY is a compact microprocessor controlled UV flood curing system or UV polymerization of monomers in the presence of initiator sensitive on light.
Technical specifications	■ 600W UVA enhanced arc lamp ■ X Microprocessor control of time & intensity vIntegrated exposure shutter ■ 175 mW/cm^2 Intensity ■ 8” x 6” curing area ■ Shielded benchtop curing chamber
Additional information	https://www.brookhaveninstruments.com/nanobrook-omni
Year of manufacture	2014
Source of founding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
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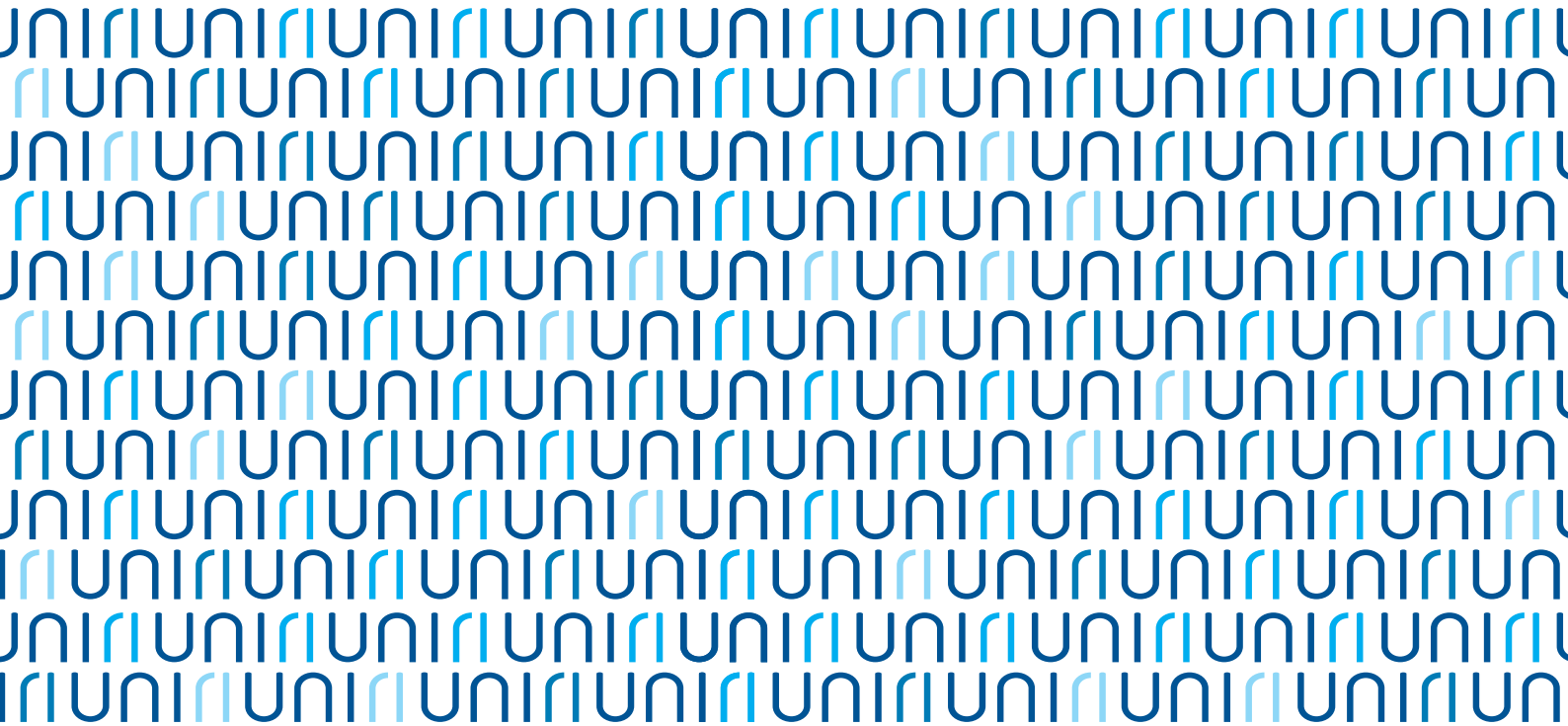
GF

LABORATORY EQUIPMENT CATALOGUE OF THE FACULTY OF CIVIL ENGINEERING



1

EQUIPMENT OF THE CONSTRUCTION LABORATORY

Instrument	**Single Girder Bridge Overhead Crane SPB INŽENJERING d.o.o. type JMD 5t/8,6m with Crane Runway**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Others**
Photograph	
Short description	Single girder bridge overhead crane SPB INŽENJERING d.o.o. type JMD 5t/8,583m with crane runway length 16 m
Main purpose	Lifting and transferring cargo.
Technical specification	■ Crane capacity 5 t ■ Crane span 8,583 m ■ Lifting height 7,28 m ■ Lifting speed 4/1,3 m/min ■ Trolley speed 20/6,7 m/min ■ Crane speed 20-5 m/min ■ Crane runway length 2 x 16 m
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Dragan Ribarić / dragan.ribaric@uniri.hr

Instrument	**Portable Hydraulic Device for Applying Force - MATEST S222-01, S226-1, C405-15, S224-21, S226-05, S226-06**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**
Photograph	
Short description	Portable hydraulic device for applying force - MATEST S222-01, S226-1, C405-15, S224-21, S226-05, S226-06
Main purpose	Portable hydraulic device for applying force.
Technical specification	■ Capacity 100 kN ■ Small hydraulic aggregate 12V DC
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Davor Grandić / dgrandic@uniri.hr

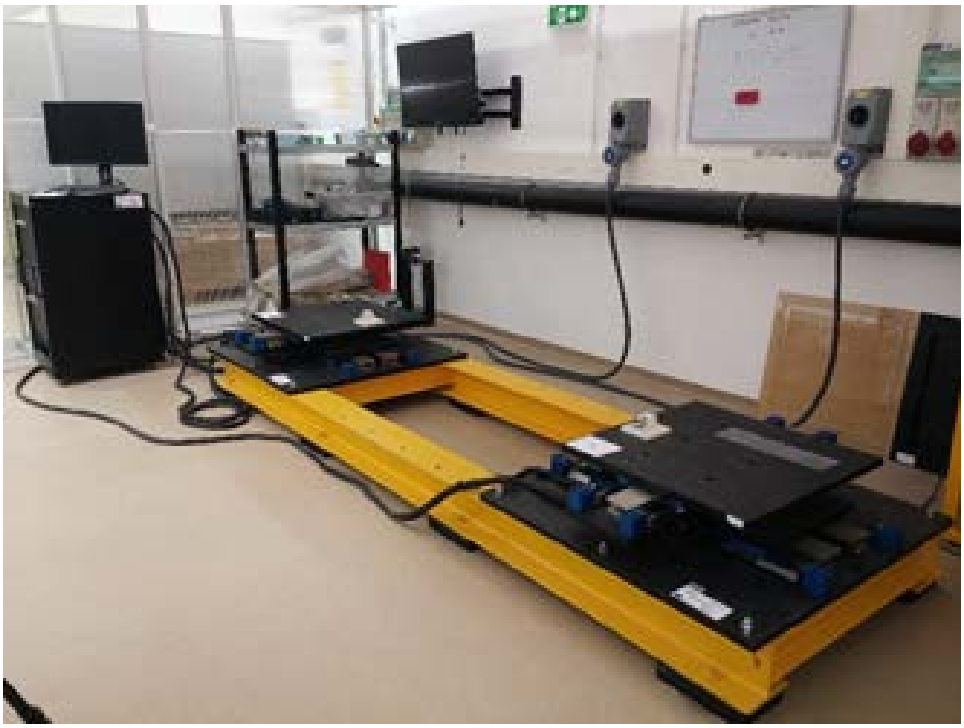
Instrument	**Optical Measuring System GOM mbH PONTOS 3D 4M**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Measuring Device**
Photograph	
Short description	Optical measuring system GOM mbH PONTOS 3D 4M: head with two cameras, cables, support, calibration object, lenses, laser pointer, LED lights, cases
Main purpose	System with two cameras for 3D non-contact optical measuring of deformations and strains. After the initial calibration, cameras are used to film the whole experiment. By tracking the surface of the experimental model, which has to be treated adequately beforehand, the positions of all the points on the surface of the model are obtained.
Technical specification	■ Filming speed up to 168 fps with resolution 2400x1728 piksels, or up to 1300 fps with resolution 2400x168 piksels ■ One pair of lenses with focal length 20 mm for measuring volumes from 125 x 90 mm^2 up to2150 x 1600 mm^2 ■ Calibration object for measuring volumes from 350 x 260 mm^2 up to 500 x 370 mm^2
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Gordan Jelenić / gordan.jelenic@uniri.hr

Instrument	**Equipment for Measuring Displacements NI SCXI-1000NI SCXI-1000, NI SCXI-1600, SCXI-1540, SCXI-1315, SCXI-1374, SCXI-1361**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Measuring Device**
Photograph	
Short description	Equipment for measuring displacements NI SCXI-1000NI SCXI-1000, NI SCXI-1600, SCXI-1540, SCXI-1315, SCXI-1374, SCXI-1361
Main purpose	Equipment for measuring displacements NI SCXI-1000.
Technical specification	■ 16-bits data acquisition module ■ 3x 8-channel LVDT input module
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Davor Grandić / dgrandic@uniri.hr

Instrument	**Cyclic Corrosion Test Chamber – Ascott CC1000ip**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**
Photograph	
Short description	Cyclic corrosion test chamber – Ascott CC1000ip
Main purpose	Cyclic corrosion test chamber designed for an accelerated test of material resistance on the impact of corrosion from atmosphere that contain a sodium chloride as a main component.
Technical specification	■ Chamber capacity: 1000l
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Davor Grandić / dgrandic@uniri.hr

Instrument	**System with Two Dual-axis Shaking Tables Quanser STI-III**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**

Photograph



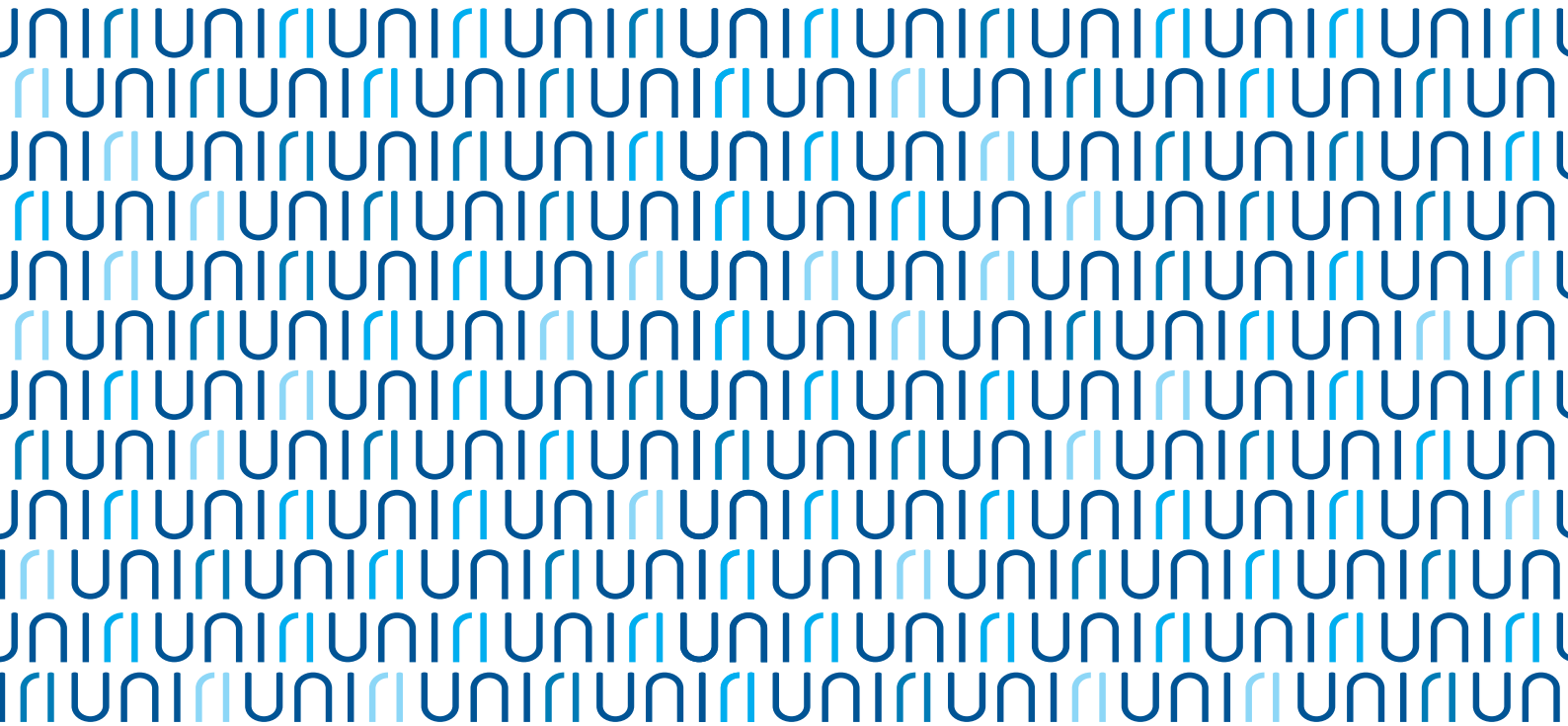
Short description	System of two biaxial shaking tables Quanser STI-III actuated by electromagnet motors (control unit, hardware + software)
Main purpose	Used for model experiments with dynamic excitation (such as earthquake, harmonic excitation and other). Two shaking tables can be used independently in two experiments at the same time, or together in a way that the model is sitting on both tables. When the tables are used together, the mass of the model can be greater, while the excitation can be the same on both of the tables (synchronous excitation) or different (asynchronous excitation).
Technical specification	■ Dimensions of each platform 625 x 625 mm ■ Each platform can move along 15 cm in each direction, span of work frequencies is from 0 up to 20 Hz ■ Maximum load on each platform is 130 kg with 1g acceleration in each of the two directions ■ With no load each platform can go up to 2,8 g of acceleration in x direction and 4,5 g in y direction ■ The distance between the two platforms can be from 1 m up to 2,5 m
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Gordan Jelenić / gordan.jelenic@uniri.hr

Instrument	**Portable Phased Array Ultrasonic Flaw Detector for Steel PHASOR XS**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Measuring Device**
Photograph	
Short description	Portable phased array ultrasonic flaw detector for steel (LCD, probes, cables, software) PHASOR XS
Main purpose	Portable phased array ultrasonic flaw detector and thickness gauge work in Conventional and Phased array modes.
Technical specification	■ Conventional mode: DAC and (DGS) AVG ■ Phased array mode: TOPView, Overlay TCG, Fullsector scan ■ VGA full-colour display
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Mladen Bulić / mbulic@uniri.hr

Instrument	**Portable Combined Hardness Tester for Steel MIC 20 TFT**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**
Photograph	
Short description	Portable combined hardness tester for steel MIC 20 TFT (two sets of probe, cables, software)
Main purpose	The MIC 20 supports the quasi-static hardness testing according to the UCI method (Vickers prism) and dynamic hardness testing according to the rebound method
Technical specification	■ UCI Method: Probe 98 N (10 kgf) (Vickers prism) ■ Rebound Method: rebound impact device, Tungsten-Carbide Metal Tip, Ø=3 mm
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Mladen Bulić / mbulic@uniri.hr

Instrument	**Steel Load Frame with Two Eervo-hydraulic Testing Actuators Zwick Roell Capacity 500kN and 250 kN**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**
Photograph	
Short description	Dimension of steel load frame 5,0 x 3,6 m, has the possibility of extending to 7,0 m in the longitudinal direction and to 6,0 m in height. Capacity of actuators are 500 kN and 250 kN. Actuators have been specially designed for dynamic material testing for determining the fatigue strength of material and components of structure. The entire system is controlled via a computer program Cubus.
Main purpose	The main purpose of the actuator is to provide precise static and dynamic testing of prefabricated elements and various components of civil engineer structure and other types of structures. The possibility of testing with displacement and force control.
Technical specification	■ Possibility of cyclic test with a frequency up to 10 Hz with a possible cylinder displacement of 250 mm and power of the hydraulic pump 95 kW.
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Mladen Bulić/ mbulic@uniri.hr

Instrument	**Universal Tension-compression Test Machine with Temperature Chamber**
Laboratory affiliation	**Construction Laboratory**
Equipment category	**Testing Device**
Photograph	
Short description	Universal tension-compression testing machine Zwick Z 600E with capacity 600 kN and electro-mechanical drive. Testing machine consists of two work-spaces. The upper workspace is primarily designed for tensile tests, while the lower working space is designed for compression and bending tests.
Main purpose	The main purpose of the test machine is monotonic static test. In addition, low-cyclic tests up to 0.5 Hz are also possible. Experiments on the testing machine can be performed with the force control, displacement control, and the strain control (with extensometers).
Technical specification	■ Speed of test for displacement control mode 0,001 do 320 mm/min ■ Specimen fixing - hydraulic jaws (600 kN), pneumatic jaws (10 kN) and mechanical jaws (10 kN). ■ Tools and specimen grips for the steel testing of round and rectangular cross sections, wood testing and plastic testing
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Željko Smolčić/ zeljko.smolcic@uniri.hr



2

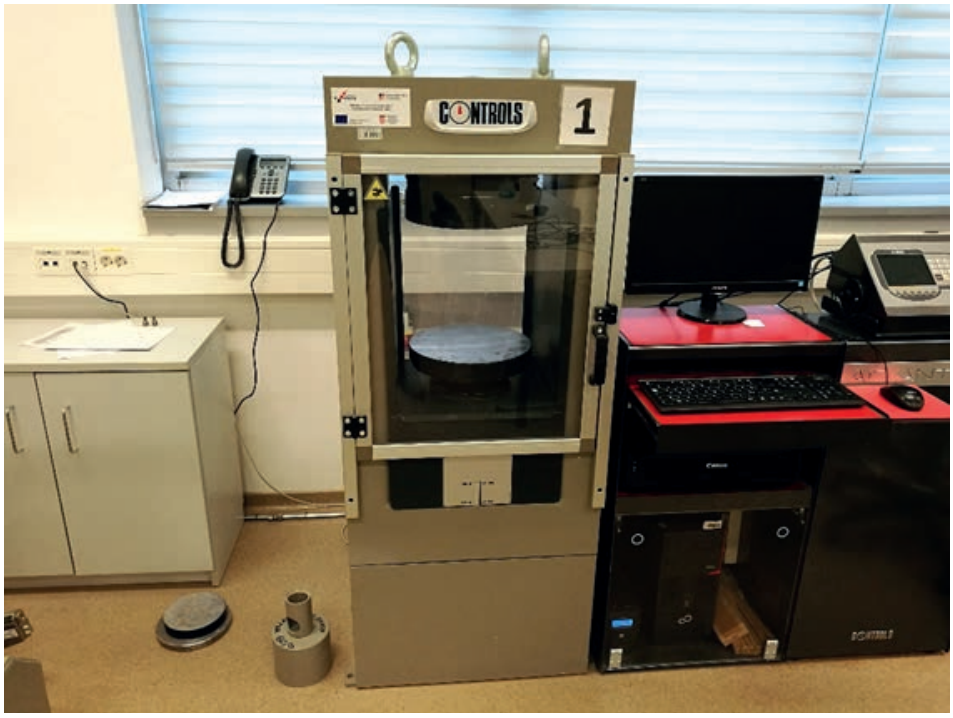
EQUIPMENT OF THE MATERIALS LABORATORY

Instrument	**Climatic Chamber**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Preparation of specimens**
Photograph	
Short description	A multipurpose climatic chamber suitable for testing various construction materials such as aggregates, cement, concrete, bricks, blocks, asphalt etc. It has monobloc stainless steel cabinet with shelves capable of holding heavy specimens. It is designed to condition the air circulating in the cabinet. The temperature is controlled by a sensor which is movable inside the cabinet area and can also be located inside the test sample. During test data can be monitored. Chamber is equipped with software for data transfer to a computer.
Main purpose	Simulation of thermal and weathering properties: freezing and thawing cycles, wetting and drying cycles.
Technical specification	■ Capacity 520 l ■ Function controller: cycle programmer for 50 programs and 1000 segments ■ Digitally controlled temperature range from -25°C to +70°C ■ Digitally controlled humidity range from 10% to 95% ■ Internal air circulation ■ Shelves loading capacity: 4 shelves, 60 kg each ■ Programmable
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	Doc.dr.sc. Silvija Mrakovčić / silvija.mrakovcic@gradri.uniri.hr

Instrument	**Water Permeability Device**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Durability Test Equipment**
Photograph	
Short description	The water permeability device consists of a robust steel frame with clamping system incorporating the hydraulic circuit, valves, gauge to check the water pressure and measuring transparent burettes mounted on top of the tester. The clamping system can accept cube or prismatic specimens up to 200 mm side and cylinders up to 300 mm height. It is supplied complete with gaskets for 150 mm cube specimens. It has to be fit with a suitable air compressor, max. working pressure 10 bar.
Main purpose	To determine the depth of penetration of water under pressure in the cube and prismatic concrete specimens according to standard HRN EN 12390-8.
Technical specification	■ Number of test positions: 6 ■ Supplied with gaskets for 150 mm cube specimens ■ Max. working pressure: 1000 kPa ■ Net weight: 155 kg ■ Operating temperature: + 10 to + 40°C
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	Doc.dr.sc. Silvija Mrakovčić / silvija.mrakovcic@gradri.uniri.hr

Instrument	**Chloride Ion Penetration Meter Device**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Durability Test Equipment**
Photograph	
Short description	Chloride penetration meter is used for measuring the electrical resistance of concrete against the penetration of chloride according to the standard methods. The test device is equipped with 4 independent channels and 4 test cells suitable to perform tests on up to 4 specimens. Equipped with vacuum saturation apparatus necessary to fully saturate the specimen with water.
Main purpose	To determine resistance of concrete to the penetration of chloride ions according to ASTM C1202 standard. The measurement data derived from this test methods can be used to estimate the chloride diffusion coefficient of concrete in service life predictions and structure design, as well as durability-based quality control of concrete.
Technical specification	■ Testing up to 4 specimens ■ Every channel is independent ■ Programmable test duration ■ Adjustable measuring rate starting from 1 minute ■ Measurement and record of the test temperature during the whole test ■ Unlimited data storage on SD card ■ Accuracy: +/-0.1V, +/-1mA
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	Doc.dr.sc. Silvija Mrakovčić / silvija.mrakovcic@gradri.uniri.hr

Instrument	**Oxigen Permeameter Device. Cembureau Method**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Durability Test Equipment**
Photograph	
Short description	The oxigen permeameter device consist of aluminium permeability cell used to house the test sample; rubber sleeve used to prevent oxygen permeation along the lateral face of the sample; air chamber to keep the rubber sleeve well attached to the sample and wall panel. Wall panel is supplied with 3 flow meters, bubble type, used to measure oxygen flow; 1 digital pressure gauge complete with pressure transducer; 1 high precision flow control valve to control the input pressure and 1 distribution panel with valves to activate the flow meters. The devices is fitted with a suitable air compressor.
Main purpose	To determine permeability of the cast and cored cylindrical concrete specimens 150 mm diameter, 50 mm high to oxygen by the Cambureau method. The test result is the mean specific coefficient of oxygen permeability.
Technical specification	■ Panel (l × d × h) 700 x 1100 x 120 mm, mass 14 kg ■ Cell (d × h) 345 × 80 mm, mass 19 kg ■ High precision pressure regulator ■ Digital readout unit and pressure transducer ■ Permeability cell for specimens 150 mm diameter, 50 mm height
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	Doc.dr.sc. Silvija Mrakovčić / silvija.mrakovcic@gradri.uniri.hr

Instrument	**Compression Testing Frame - 3000 kN capacity**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Test Machine**
Photograph	
Short description	The servo-hydraulic compression frame 3000 kN capacity can be used to perform various building material tests. It is suitable for testing cubes up to 200 mm and cylinders up to diameter 160 x 320 mm. The frame is completed with suitable distance pieces conforming to the specimen size .
Main purpose	The test machine is used for compression tests on concrete cubes, cylinders and blocks according to the standards EN 12390-4 and EN 772-1.
Technical specification	■ Capacity: 3000 kN ■ Calibration accuracy: class 1 ■ Platens diameter: 300 mm ■ Ram travel: 50 mm ■ Max. vertical daylight: 350 mm ■ Horizontal daylight: 370 mm ■ Power supply: 230 V 1 ph 50 Hz 750 W
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	dr.sc. Natalija Bede / natalija.bede@gradri.uniri.hr

Instrument	**Universal Testing Flexure Frame - 300 kN capacity**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Test Machine**
Photograph	
Short description	The servo-hydraulic flexure test machine has C-shaped open structure for loading specimen and high stiffness closed structure during the test. It is connected to control console capable of applying load in displacement and strain rate control. The test machine is supplied with displacement transducer for measurement of crack opening (CMOD according to EN 14651), accessories for measurement of beam deflection and toughness, for energy absorption test on square (EN 14488-5) or round slabs, for kerb slabs and accessories for compression tests.
Main purpose	The test machine can be used for testing in flexure various building materials (three- or four-point bending tests), deformability tests, CMOD tests, energy absorption tests and ductility index.
Technical specification	■ Max. load: 300 kN ■ Calibration accuracy: class 1 ■ Load sensor: strain gage load cell ■ Rate: load, displacement and strain rate ■ Max. vertical daylight without accessories: 546 mm ■ Distance between accessory lower rollers: adjustable from 80 to 1500 mm ■ Distance between accessory upper rollers: adjustable from 80 to 500 mm ■ Piston travel: 110 mm
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
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Instrument	**Le Chatelier Water Bathe**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Preparation of specimens**
Photograph	
Short description	The internal chamber and the insulated exterior case of the bath are manufactured from stainless steel. It has timer which is used to set the time for reaching the boiling point in 30 minutes by using two heater units. The bath is supplied complete with a 12 place Le Chatelier mould rack.
Main purpose	For the determination of the soundness of cement paste, fly ash for concrete and lime. Le Chatelier Water Bath is used with Le Chatelier moulds for the determination of the soundness of cement paste according to HRN EN 196-3.
Technical specification	■ Capacity 10 l ■ Timer for automatic heating ■ Raise the water temperature from 20 ± 2°C to boiling point in 30 ± 5 min ■ Maintain the water at boiling point for 3 hours ± 5 min. ■ Supplied complete with a 12 place Le Chatelier mould rack ■ Mains supply: 230V, 50 - 60 Hz, 1ph
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
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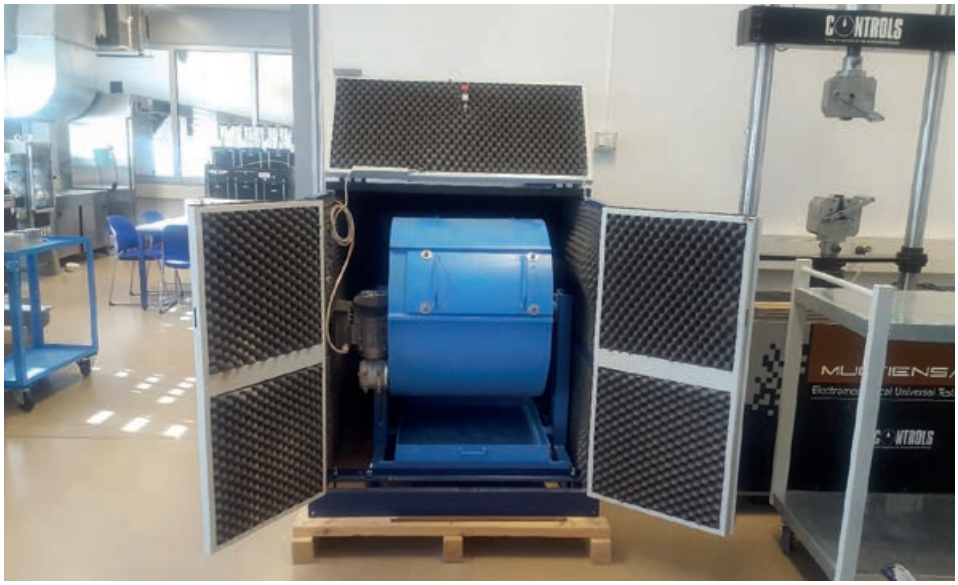
Instrument	**Motor Operated Flow Table**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Test Machine**
Photograph	
Short description	The machine consists of motorized flow table and automatic digital counter. Motor operated model conrorming to EN standards is driven by a motor speed reducer. The number of drops is set on the counter and the machine stops automatically at the end of the cycle. The flow table is manufactured from stainless steel and has a 300 mm diameter table. The conical mould is made of brass and has dimensions of 100 mm base diameter x 70 mm top diameter x 60 mm height. This model is supplied complete with tamper and the filling hopper.
Main purpose	To determine the consistency of mortar, building lime and cement specimens conforming to HRN EN 459-2 and HRN EN 1015-3.
Technical specification	■ Motorized with counter ■ Table diameter: 300 mm ■ Height of drop: 10 mm ■ Conical flow mould (base × diameter × height) 100 mm × 70 mm × 60 mm ■ Power: 180 W
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
Contacts	dr.sc. Natalija Bede / natalija.bede@gradri.uniri.hr

Instrument	**Los Angeles Abrasion Machine**
Laboratory affiliation	**Laboratory for Materials**
Equipment category	**Test Machine**
Photograph	
Short description	The machine consists of an electronic control unit and a rolled steel drum having an inside diameter of 711 mm and internal length of 508 mm. The drum is rotated by a speed reducer driven by an electric motor at a speed of 31 to 33 r.p.m. The machine is equipped with an automatic counter. It is possible to set 2 different test procedures: the required number of revolutions of the drum or the total working time. It is supplied with set of 12 abrasive charges conforming to EN standards. The machine is upgraded with the noise reduction and safety cabinet.
Main purpose	The Los Angeles abrasion machine is widely used for testing coarse aggregates resistance to abrasion. It can be used for determination of the particle loss (abrasion) of porous asphalt mixtures and the determination of the resistance of a bituminous mixtures or pavement to aviation fuel.
Technical specification	■ High stiffness welded steel frame ■ Graphic display and membrane keyboard ■ Power: 740 W ■ Weight approx.: 350 kg ■ Dimensions approx.: 1005 mm x 820 mm x 950 mm
Additional information	http://www.controls-group.com
Source of funding	The Development of Research Infrastructure at the University of Rijeka Campus (EFRR)
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3

EQUIPMENT OF THE GEOTECHNICAL LABORATORY

Instrument	**Soil Extruder**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Device for sample preparation**
Photograph	

Short description	The machine consist of a movable table and a hydraulic piston which can be adjusted either in horizontal or vertical position.
Main purpose	Extruding samples from proctor moulds and borehole samplers .
Technical specification	■ Power: 750 W ■ Max. load: 60 kN ■ Max. ram stroke: 900 mm ■ Max. working ram speed: 6 mm/sec. ■ Max. external diameter of sample tubes: 160 mm ■ Overall dimensions: ■ Horizontal working position (lxwxh): 2730x409x1180 mm ■ Vertical working position (lxwxh): 1025x409x1080 mm without accessories
Additional information	http://www.controls-group.com/eng/soil-testing-equipment/soil-extruder-motor-operated.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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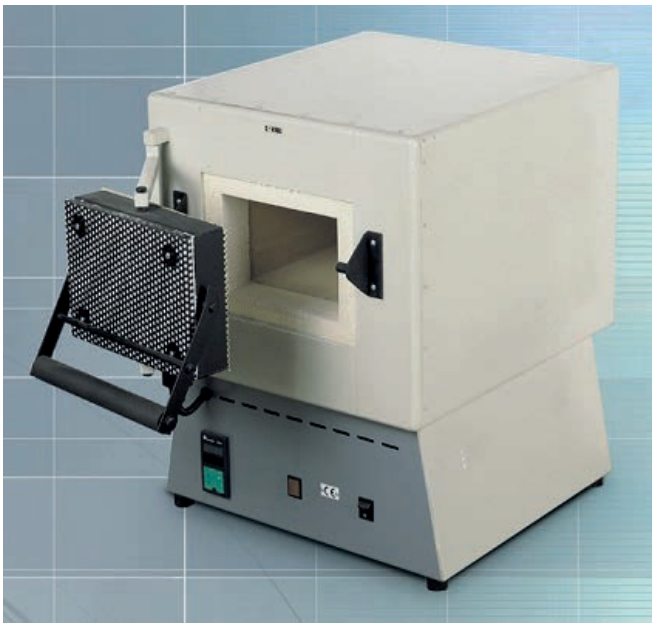
Instrument	**Muffle furnace**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Other**
Photograph	
Short description	Muffle furnace used for cobustion of organic materials.
Main purpose	Main purposed to determine the amount of residual mineral matter in the binder extract.
Technical specification	■ Max. temperature: 1100°C ■ Power: 3.9 kW ■ Chamber dimensions (lxwxh): 210x320x145 mm ■ Outside dimensions: 510x750x660 mm ■ Weight approx: 89 kg
Additional information	http://www.controls-group.com/eng/asphaltbituminous-mixture-testing-equipment/muffle-furnace-for-incineration.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Laboratory oven**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Other**
Photograph	
Short description	Machine used for drying material. It consists of three grid shelves, cooling fan and temperature gauge.
Main purpose	Drying of samples.
Technical specification	■ Nominal capacity: 250 l ■ Max. temperature: 200 °C ■ Power: 2100 W ■ Internal dimension: 554x660x700 mm ■ External dimensions: 951x1056x970 mm ■ Number of grid shelves: 3 ■ Weight approx.: 130 kg
Additional information	http://www.controls-group.com/eng/general-lab-testing-equipment/laboratory-ovens.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Laboratory crusher**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Production device**
Photograph	
Short description	Device used for crushing coarse material into finer size.
Main purpose	Crushing of materials.
Technical specification	■ Jaw opening: 100 x 60 mm ■ Jaw crushing adjustment: 2 to 18 mm ■ Capacity: 100 to 400 kg/h ■ Power: 736 W ■ Dimensions: 885 x 390 x 1169 mm (w x d x h) ■ Weight approx.: 135 kg
Additional information	http://www.controls-group.com/eng/aggregates-testing-equipment/laboratory-crusher.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Fiac Air compressor**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Other**
Photograph	
Short description	Machine consists of compressor, tank for condensed air and dessicator.
Main purpose	Supply of compressed air to other testing equipment in the laboratory.
Technical specification	■ Engine power: 15 HS ■ Tank capacity: 500 l ■ Noise: 65 dB ■ Dimensions (wxdxh): 2040 x 630 x 1430 mm ■ Weight approx.: 390 kg ■ Max. pressure: 13 bars
Additional information	http://www.fiac.it/wwwfiac/main.php?p=wi_pag08_b_01e
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Trinocular microscope, Sole-Mark**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Other**
Photograph	

Short description	Microscope with a digital camera and an USB cable. It can be used in combination with a computer.
Main purpose	Enlargment and analysis of small objects. The possibility of taking Photographs using adapter and digital camera.
Technical specification	■ Digital camera: 5.5 MP ■ Zoom range: 0.67x – 4.5x (enlargment factor: 6,71:1) ■ Max. Enlargment: 45X ■ Base dimensions: 270x210x30 mm ■ Column dimensions: height 315 mm, diameter 32 mm ■ Weight: 4 kg
Additional information	http://www.optikamicroscopes.com
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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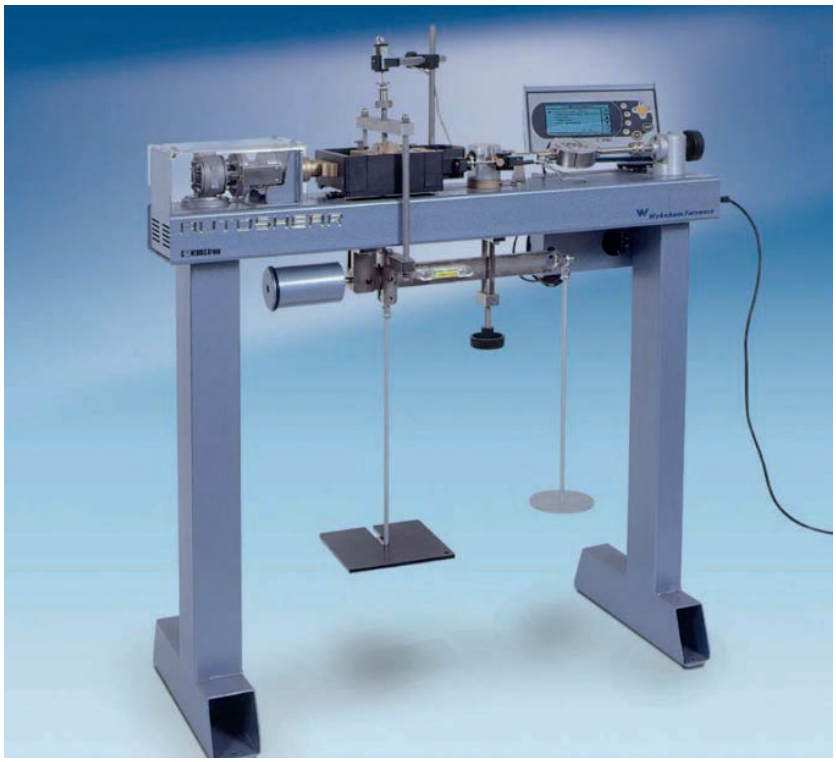
Instrument	**Direct and residual shear testing machine**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	The device consists of electromotor, measuring cell, two LVDT and weights for vertical load.
Main purpose	Determination of shear strength of sands and fine grain materials.
Technical specification	■ Test speed: from 0.00001 to 9.99999 mm/min ■ Maximum shear force: 5000 N ■ Maximum vertical load: 500 N or 5000 N using 10:1 cantilever device ■ Maximum horizontal travel: 20 mm ■ Digital display: LCD 4 rows of 20 symbols. ■ Sample type size: 60 and 100 mm^2, 50; 60; 63,5 i 100 mm diametrically. ■ Power supply: 110-220 V, 50-60 Hz, 1 ph , 100 W ■ Dimensions: 953x387x1180 mm
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/digital-shear-testing-machine.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Oedometer, front loading**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Additional parts of the machine are: moulds for samples with all the parts (cap, ring, porous stone, screws), weights, LVDT for measuring vertical displacement and burette for measuring permeability coefficient.
Main purpose	Determination of compressibility of soil.
Technical specification	■ Three hanger positions:: 9:1, 10:1, 11:1 ■ Max. load (using 11:1 beam ratio): 1848 kg; ■ Sample diameter: 50 mm; ■ Overall dimensions: 500x200x750 mm; ■ Weight approx.: 21 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/oedometers-front-loading.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Compactor Proctor**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Device for sample preparation**
Photograph	
Short description	Additional parts of the device are: rammer and two moulds for samples of diameter 100 and 150 mm.
Main purpose	Determination of compaction and optimum moisture of materials.
Technical specification	■ Main purposed for moulds of diameter 100-102 mm and 150-152,4 mm ■ Rammer drop height: 300, 305, 450 i 457 mm ■ Number of blows per minute: 30 ■ Power: 740 W ■ Overall dimensions: 521x403x1438 mm ■ Weight approx.: 140 kg
Additional information	http://www.controls-group.com/eng/soil-testing-equipment/autoproctor-automatic-proctor_cbr-compactor.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Multispeed press CBR**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	Press used for CBR testing and determination of uniaxial strength of soil samples. It is used in combination with the Proctor rammer. It consists of adapters for CBR and uniaxial strength, LVDT, measuring cell and an USB for dana transfer.
Main purpose	CBR (California Bearing Ratio) and uniaxial strength of soils.
Technical specification	■ Maximum capacity: 50 kN ■ Test speed: from 0.05 to 51 mm/min or from 1 N/sec to 1000 N/sec ■ Power: DC motor 750 W ■ Sampling frequency: 50 Hz ■ Horizontal cleareance (distance between columns): 270 mm ■ Maximum vertical clearance: 730 mm ■ Platen travel: 100 mm ■ Dimensions: 392x495x1213 mm
Additional information	http://www.controls-group.com/eng/universal-testers-_-steel-re_bar-s-testing-equipment/uniframe-compact-automatic-stand_alone-universal-compressionflexural-tester.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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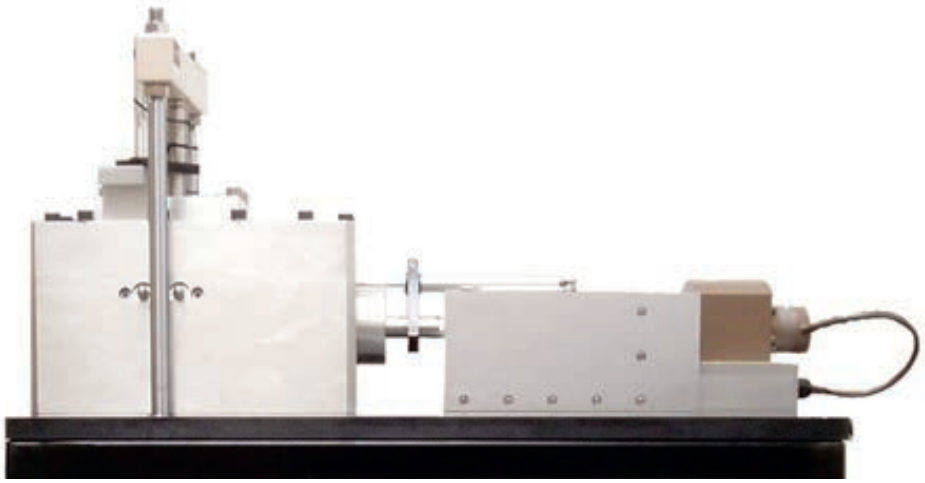
Instrument	**GDS back pressured shear box**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Device consists of external hydraulic unit for controlling the pressure in the chamber, central control unit, servo pump for obtaining internal strain in the sample and bender elements.
Main purpose	Determination of shear strength of soil in saturated and unsaturated conditions. Possibility of measuring very small strains (10E-5) while using bender elements.
Technical specification	■ Sample size: 100 x 100 mm ■ Max. normal and shear stress: 10 kN ■ Power supply: 110-240 V, 50-60 Hz, 1 ph ■ Max. vertical displacement: 15 mm ■ Max. horizontal displacement: 25 mm ■ Dimensions (L x W): 850 x 350 mm
Additional information	http://www.gdsinstruments.com/gds-products//gds-back-pressured-shear-box
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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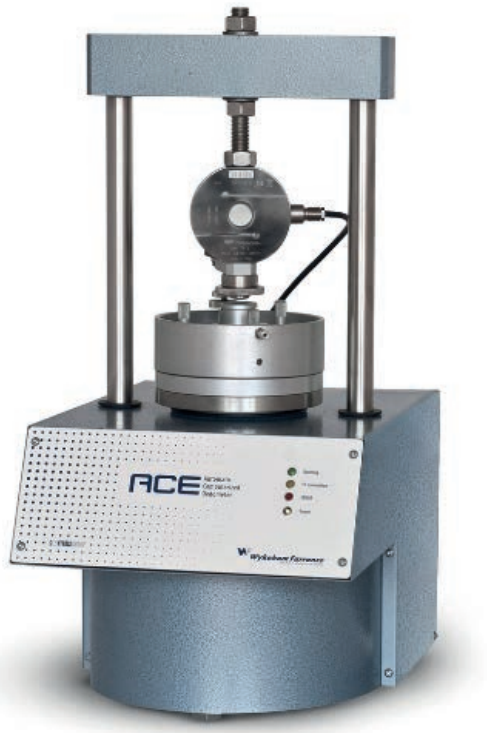
Instrument	**Automatic oedometer ACE**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	

Short description	Additional parts of the device are: mould for sample with all the parts (cap, ring, porous stone, screws) and LVDT for measuring vertical displacement and burette for measuring permeability coefficient.
Main purpose	Determination of compressibility of soil under automatic pressure control.
Technical specification	■ Maximum vertical force: 15 kN ■ Displacement transducer: 10 mm maximum travel ■ Maximum air pressure supply: 10 bar. ■ Specimen size: diameter from 50.47 to 112.80 mm ■ Measurement accuracy: ±1 % ■ Overall dimensions: 280x300x600mm (w x d x h) ■ Weight approx.: 25 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/ace-_-automatic-computerized-oedometer.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Triaxial apparatus**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Triaxial cell. Consists of: LVDT, measuring cell, pressure transducers. Triaxial cell can be changed depending on the sample size. Possibility of using benders and on-sample transducers.
Main purpose	Determination of strength of soils (fine-grained and coarse-grained) under triaxial state of stress.
Technical specification	■ Soil sample size diameter: 38, 50, 70 and 100 mm ■ Test speed: from 0.00001 to 99.99999 mm/min ■ Maximum compression force: 50 kN ■ Maximum tensile force: 5 kN ■ Vertical clearance: from 335 to 1100 mm ■ Max. horizontal clearance: 364 mm ■ Platen diameter: 158 mm ■ Platen travel: 100 mm
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/triaxial-load-frame-tritech.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Doc.dr.sc. Vedran Jagodnik, mag.ing.aedif (vedran.jagodnik@gradri.uniri.hr)

Instrument	**Triaxial cell for unsaturated soils**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Other**
Photograph	
Short description	Triaxial cell with double walls and 25 kN measuring cell.
Main purpose	Research of unsaturated soil behavior.
Technical specification	■ Soil sample diameter: 70 mm ■ Maximum working pressure: 2000 kPa ■ Maximum cell height: 690 mm ■ Cell diameter (with valves) : 478 mm ■ Weight approx.: 30 kg ■ Number of inlet ports: 6
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/double-wall-triaxial-cells-for-unsaturated-tests.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Resonant column**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Device for testing resonant characteristics of fine grained soil. Pedastel for 50mm sample, LVDT, brass and steel calibration rod
Main purpose	Determination of small strain and soil resonance. Torsional shear test and torsional soil behaviour.
Technical specification	■ Maximum torque: 1.2 Nm ■ Maximum torque: 1.2 Nm ■ Maximum angular deformation: 10° ■ Maximum cell and back pressure: 1 MPa. ■ Two electro-pneumatic converters for cell and back pressure ■ Excitation frequency: Dynamic (RC) 1-300 Hz; Cyclic (TS) from 0 to 50 Hz maximum ■ Dimension: Control Box 51x45 x 35 cm (h x w x d); Cell 55 cm x 27 cm (h x diam.) ■ Weight: approx 50 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/resonant-column.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Dynamic cyclic triaxial system**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	Contains: cell for triaxial test with dynamical/cyclic load, LVDT, measuring cell and pressure transducers. Depending on the sample size, triaxial cell can be changed. Possibility of testing samples of diameter: 38, 50 and 70 mm. Can simulate earthquake accelerations.
Main purpose	Research of cyclic and dynamic soil characteristics under medium and large axial cyclic shear deformations.
Technical specification	■ Dynamic load capacity: ±5 kN or ±14 kN ■ Static load capacity: 50 kN or 100 kN ■ Nominal operating frequency: to 10 Hz (depending on the type of test) ■ Max. diameter sample: 150 mm ■ Max. cell and back pressure: 1000 kPa
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/dynamic-triaxial-systems-1000-kpa.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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Instrument	**Continuous consolidation cell CRS**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Inner cell contains sample, outer cell used for loading, ring for sample preparation, LVDT with pressure transducers.
Main purpose	Determination of soil compressibility under constant rate of strain.
Technical specification	■ Sample dimensions: 25.4 mm height x 63.5 mm diameter. ■ Maximum pressure: 800 kPa ■ Maximum load: 50 kN ■ Dimensions: 240x410 mm (h) ■ Weight approx.: 10 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/continuous-consolidation-cell-crs.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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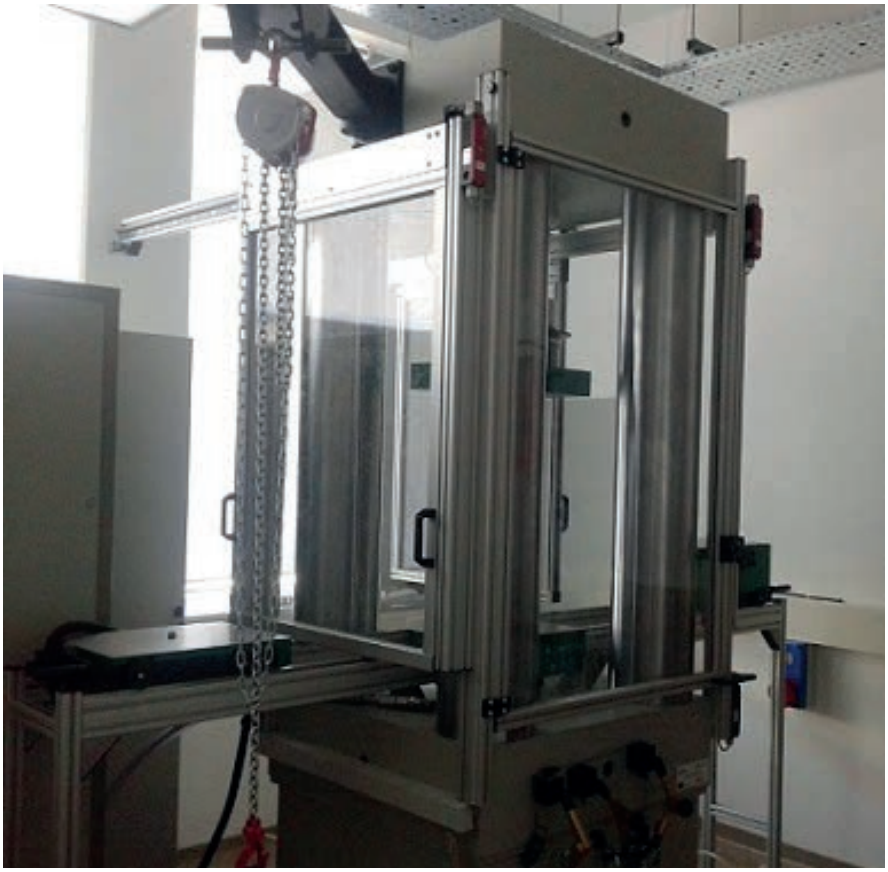
Instrument	**Hidraulic oedometer, Hydrocon**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	Cell used for measuring compressibility and retention curve. Contains ring for specimen preparation, LVDT and pressure tranducers.
Main purpose	Determination of soil compressibility under saturated and unsaturated conditions. Possibility of water and air pressure control.
Technical specification	■ Sample diameter: 100 mm ■ Maximum working pressure: 3500 kPa ■ Dimensions (diameter x h): 260x450 mm ■ Weight approx.: 10 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/hydraulic-consolidation-cell.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Doc.dr.sc. Vedran Jagodnik, mag.ing.aedif (vedran.jagodnik@gradri.uniri.hr)

Instrument	**Large Shear apparatus**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	

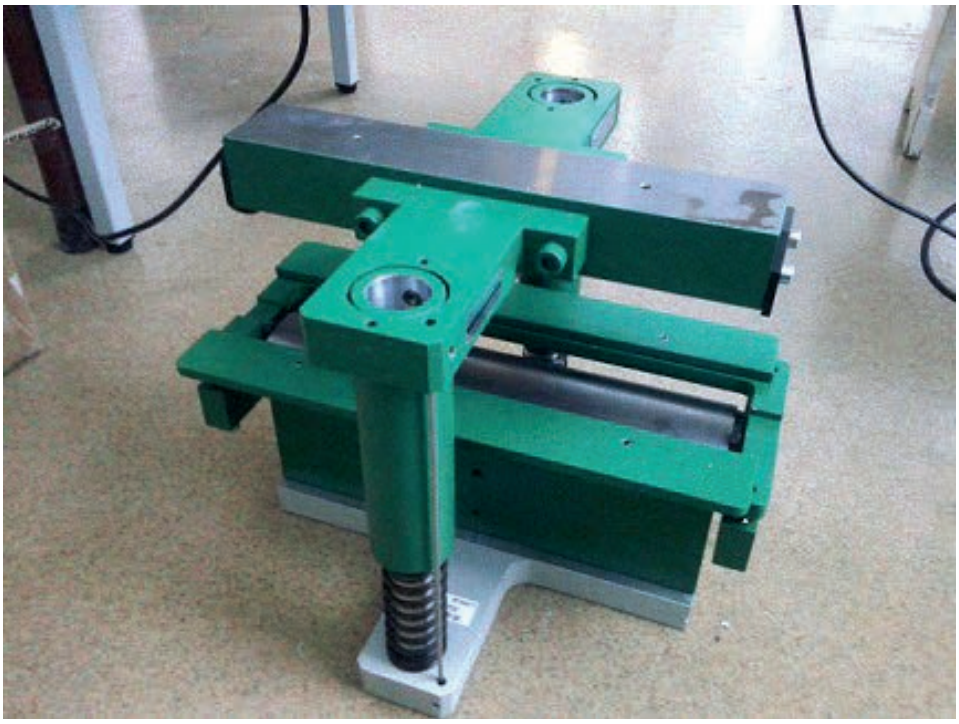
Short description	Machine used for direct shear of samples dimensions 30 x 30 cm. LVDT: horizontal and vertical, shear platen used for better grip sample.
Main purpose	Determination of shear strength of coarse-grained soil.
Technical specification	■ Sample size: 300 x 300 mm ■ Shear and vertical force: 100 kN ■ Test speed: from 0 to 11.00000 mm/min ■ Maximum travel: 75 mm ■ Steps of consolidation: up to 50 ■ Power: 2000 W ■ Overall dimensions (wxdxh): 1470x758x1570 mm ■ Weight approx.: 800 kg
Additional information	http://www.controls-group.com/eng/soil-mechanics-testing-equipment/large-shear-testing-machine.php
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Doc.dr.sc. Vedran Jagodnik, mag.ing.aedif (vedran.jagodnik@gradri.uniri.hr)

Instrument	**Universal press for rock testing**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**

Photograph



Short description	Hydraulic unit, triaxial cell, sample stand, sample deformation gauges, uniaxial strength and tensile strength adapters.
Main purpose	Determination of uniaxial, triaxial and tensile strengths of rocks.
Technical specification	■ Maximum load: 2000 kN ■ Sample size diameters: 57, 82 and 102 mm ■ Piston stroke: 50 mm ■ Distance between columns: 400 mm ■ Dimensions of upper and lower pressure plate: 320x420x75 mm ■ Overall dimensions: 2700x1900x2670 (h) mm ■ Power supply: 2,5 kVA 50 Hz 3x400+N+PE ■ Weight: 11000 kg
Additional information	http://www.formtest.de/en/
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
Contacts	Doc.dr.sc. Vedran Jagodnik, mag.ing.aedif (vedran.jagodnik@gradri.uniri.hr)

Instrument	**Jaws for testing tensile strength**
Laboratory affiliation	**Geotechnical laboratory**
Equipment category	**Test device**
Photograph	
Short description	The device consists of two parts, one comprising a movable part on the spring. The entire device is placed under the rock press.
Main purpose	Determination of tensile strength of rocks. Used in the combination with Universal press for rock testing (I/N 4986)
Additional information	http://www.formtest.de/en/
Source of funding	The equipment has been procured within the framework of the Project “The Development of Research Infrastructure at the University of Rijeka Campus”, co-financed by the European Regional Development Fund (ERDF).
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4

EQUIPMENT OF THE LABORATORY OF TRANSPORTATION ENGINEERING

Instrument	**Controls water bath**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for conditioning specimens**
Photograph	
Short description	Circulating water bath with digital termoregulator.
Main purpose	Conditioning of specimens before testing.
Technical specification	■ Capacity 110 litres, ■ Temperature range: ambient to testing to 95 °C, ■ Resolution 0,1 °C, ■ Accuracy ÷0,5 °C, ■ Continuous recirculation.
Additional information	http://www.mag-commerce.com/zastupnistva/kompresori/klipni-kompresori/fiac-new-whisper-ab-360/
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Inko water bath**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for conditioning specimens**
Photograph	
Short description	Circulating water bath with digital termoregulator..
Main purpose	Conditioning of specimens before testing.
Technical specification	■ Capacity 160 litres, ■ Resolution 0,1 °C , ■ Continuous recirculation, ■ Connection to water supply system for cooling.
Additional information	http://inko.hr/hr/home
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Alfametal mixer LM-75 with electrical heating**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for preparation**
Photograph	
Short description	Mixer with heaters for heating materijal.
Main purpose	Laboratory preparation bitumen mixes conforming HRN EN 12697-35.
Technical specification	■ Mixer volume 75 litres, ■ Mixer capacity 30 litres, ■ Minimal capacity 6 litres, ■ Mixing speed 56 rpm.
Additional information	http://www.alfametal.hr/
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Memmert laboratoty oven UF260,glass door**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for conditioning specimens**
Photograph	
Short description	Ventilating laboratory oven with glass door.
Main purpose	Drying and conditioning of samples.
Technical specification	■ Volume 256 litres, ■ Temperature range + 10 °C to 300 °C, ■ Ventilation regulation in 10 steps, ■ Adjustment of pre-heated fresh air admixture by air flap control in 10 steps, ■ Two stainless steel grids, ■ Glass soor.
Additional information	https://www.memmert.com/products/heating-drying-ovens/universal-oven/UF260/
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Memmert laboratoty oven UF260**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for conditioning specimens**
Photograph	
Short description	Ventilating laboratory oven.
Main purpose	Drying and conditioning of samples.
Technical specification	■ Volume 256 litres, ■ Temperature range + 10 °C to 300 °C, ■ Ventilation regulation in 10 steps, ■ Adjustment of pre-heated fresh air admixture by air flap control in 10 steps, ■ Two stainless steel grids.
Additional information	https://www.memmert.com/products/heating-drying-ovens/universal-oven/UF260/
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Memmert compressor cooled incubator ICP110**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for conditioning specimens**
Photograph	
Short description	Movable conditioning chamber with four locable castors.
Main purpose	Conditioning of samples.
Technical specification	■ Volume 108 litres, ■ Working temperature range od -12 °C do 60 °C, ■ Adjustment of pre-heated fresh air admixture by air flap control in 10 steps, ■ Two stainless steel grids.
Additional information	https://www.memmert.com/products/incubators/compressor-cooled-incubator/ICP110/
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Trailer mounted falling weight deflectometer-GRONTMIJ Primax 1500**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Measuring device**

Photograph

Short description	Trailer mounted mobile device for defection measurement. On bord generator for power supply. PC computer for dana collection programme.
Main purpose	Measuring pavement deflection with impact loading.
Technical specification	■ Load range to 150 kN, ■ Beam with 9 geophones, ■ Temperature sensors (air, pavement surface, pavement layers), ■ PC computer with data collection software.
Additional information	http://www.pavement-consultants.com/falling-weight-deflectometers/primax-fwd-roads.aspx
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Lightweight deflectometer**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Measuring device**
Photograph	

Short description	Portable device for deflection measurement. Loading plate 100 nad 300 mm diameter. One integrated and two additional geophones. Device for wireless data acquisition system.
Main purpose	Deflection measurement of in situ materials.
Technical specification	■ Drop weight 10 kg, ■ Additional drop weight 5 kg, ■ Automatic dana collection integrated in measuring device, ■ Wirelss and cable tranfer of stored data.
Additional information	http://www.pavement-consultants.com/media/5691/PRIMA100_LWD__product_sheet_.pdf
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**PC controlled gyratory compactor**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for sample preparation**
Photograph	
Short description	Gyratory compactor for preparation of samples in cylindical mould 100 and 150 mm dia. Electrical extruder.
Main purpose	Sample preparation according to HRN EN 12697-31.
Technical specification	■ Internal angle of gyration adjustable from 0 to 3°, ■ Internal angle of gyration preset to 0,82°, ■ Measuring shear resistance during compaction.
Additional information	http://www.controls-group.com/eng/asphaltbituminous-mixture-testing-equipment/pavelab-gyrocomp-research-gyratory-compactor.ph
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Automatic electro mechanical slab compactor**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Device for sample preparation**
Photograph	
Short description	Slab compactor for sample preparation.
Main purpose	Sample preparation according to HRN EN 12697-33.
Technical specification	■ Vertical force to 30 kN, ■ Vertical force control to 30 kN and trolley speed up to10 cycles in minute.
Additional information	http://www.controls-group.com/eng/asphaltbituminous-mixture-testing-equipment/standard-asphalt-slab-roller-compactor-procomp.p
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Automatic electro-mechanical compression tester min. capacity 50 kN**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Compression tester with load cells of 2,5 and 50 kN. Test set for stability and indirect tensile test.
Main purpose	Testing samples according to HRN EN 12697-23 and HRN EN 12697-34.
Technical specification	■ Test speed from 0,1 to 50 mm/min, ■ Two testing load cells 2,5 kN and 50 kN, ■ Data storage in MS Office.
Additional information	http://www.controls-group.com/eng/asphaltbituminous-mixture-testing-equipment/multispeed-automatic-universal-tester-with-touch-screen-digital-speed-control-and-data-acquisition_.php
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Double wheel tracker**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Device for testing plastic deformations (rutting) of asphalt pavements. Moulds for testing samples prepared by slab compactor, gyratory compactor and field drilled pavement specimens.
Main purpose	Testing samples according to HRN EN 12697-22 procedure B.
Technical specification	■ Testing temperature from ambient to 70 °C, ■ Possibility for testing in water, ■ Data storage in MS Office.
Additional information	http://www.controls-group.com/eng/asphaltbituminous-mixture-testing-equipment/pavelab-dwt-double-wheel-tracker-en-version.php
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

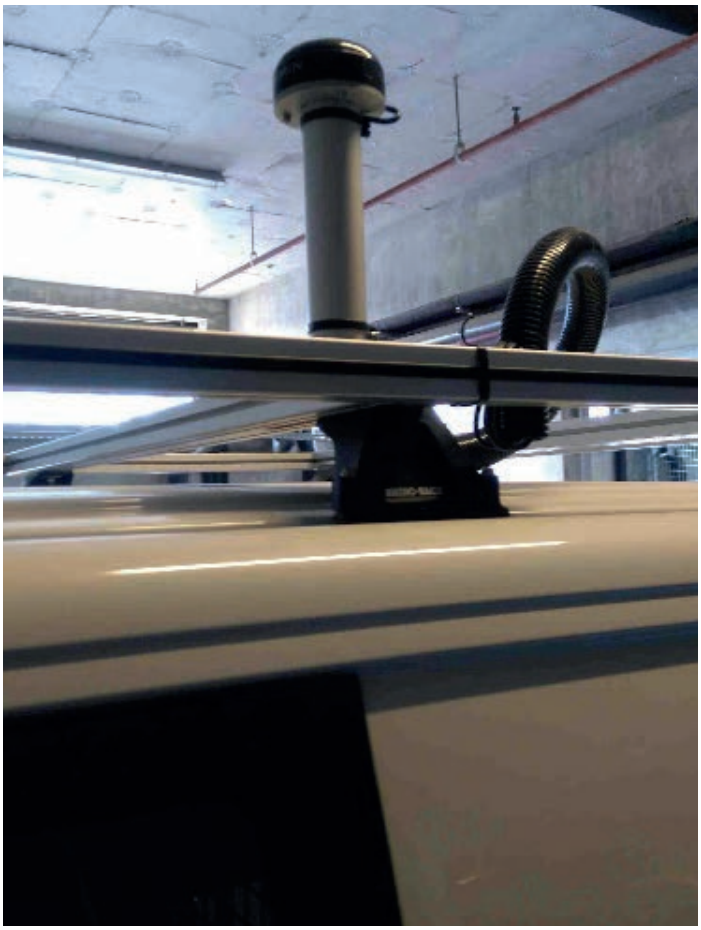
Instrument	**Dynamic device for asphalt stiffness and fatigue testing**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Dynamic device for asphalt stiffness and fatigue testing. Moulds for fatigue and stiffness testing on cylindrical and prismatic samples. PC with monitor.
Main purpose	Testing samples according to HRN EN 12697-24 and HRN EN 12697-26
Technical specification	■ Testing temperature adjustable from -25 to 60 °C, ■ Servo-hydraulic frame capacity to 30 kN, ■ Dimensions of prismatic samples to 70x70x400, ■ Diametar of cylindrical samples 100 or 150 mm.
Additional information	http://www.controls-group.com/eng/special-lists/superpave-bitumen-mixes-fundamental-properties-determination_32
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Laser profiler- beam with 5 laser measurement sensors ARRB HAWKEYE 2000**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Five laser measurement sensors with accelerometer on a front mounted beam.
Main purpose	Testing of longitudinal road profile, rut depth, and pavement surface texture (macrotexture).
Technical specification	■ Adjustable recording rate, ■ Survey speed from 20 km/h to 110 km/h, ■ Longitudinal profile accuracy ±0,5 mm, ■ Transverse profile accuracy ±0,5 mm, ■ Operating temperature from 0 to 40 °C.
Additional information	https://www.arrb.com.au/Equipment-services/Hawkeye-2000-Series.aspx
Source of funding	"Research Infrastructure for Campus-based Laboratories at the University of Rijeka" project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**Digital imaging system ARRB HAWKEYE 2000**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Video camera in waterproof enclosure connected with laser profiler measurement system.
Main purpose	Imaginig captures during laser profile measurement to enable accurate inventory recording, condition and measurement.
Technical specification	■ Lens type 3,8 mm to 13 mm, ■ 3x optical zoom, ■ Angle of view from 80 to 28°, ■ Resolution 1600x1200 pixels, ■ Picture size 1600x1184 pixels.
Additional information	https://www.arrb.com.au/Equipment-services/Hawkeye-2000-Series.aspx
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**GPS system ARRB HAWKEYE 2000**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**

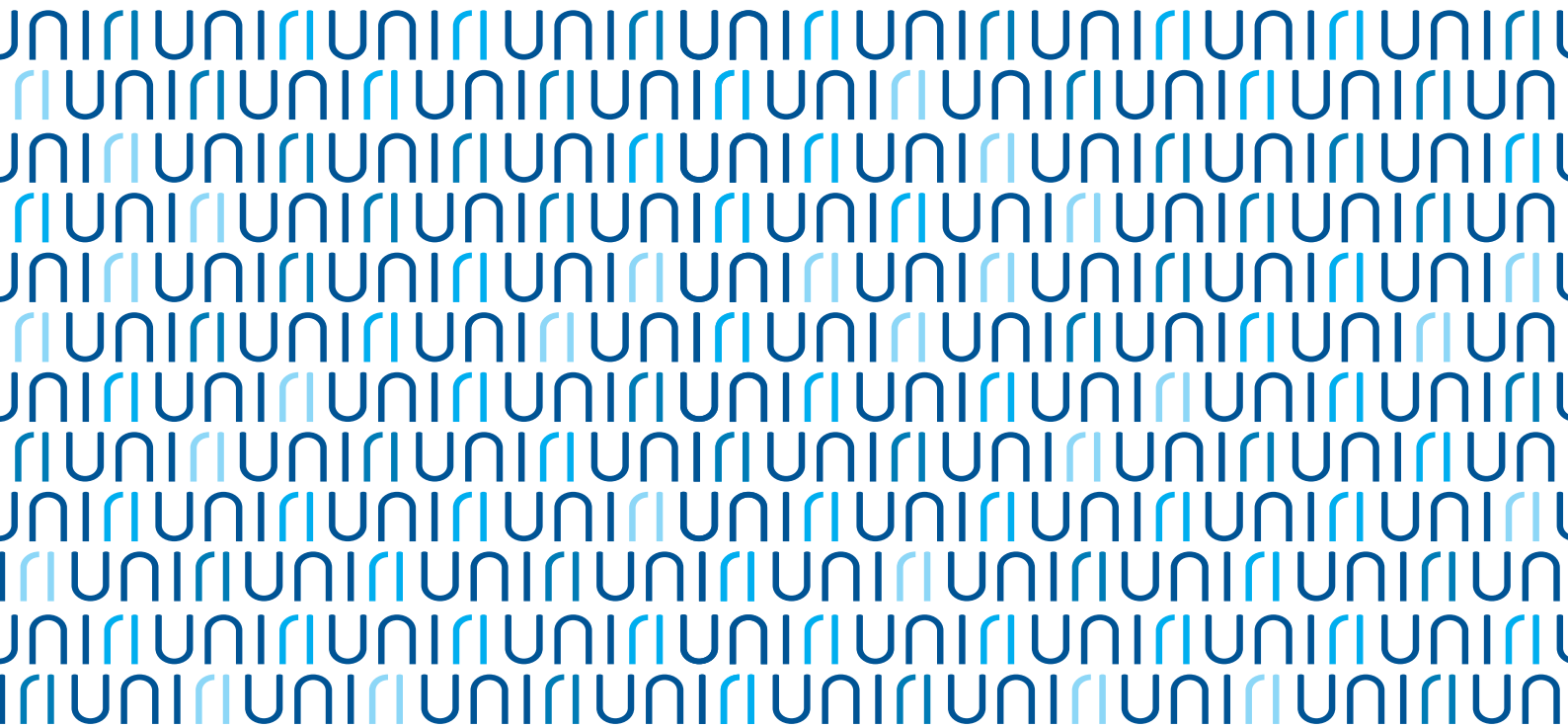
Photograph



Short description	GPS antenna integrated with GPS Acquire Manager system.
Main purpose	Recording GPS positions during laser profile measurement to enable the referencing measurement dana against GPS coordinates.
Technical specification	■ High performance recivers tracks up to 12 satellites, ■ Operating temperature from -30 to 85 °C, ■ Acquisition speed 15 sec (hot weather), 45 sec (cold weather), ■ Accuracy 5 m, ■ Format NMEA 0183 version 2.0 ASCII.
Additional information	https://www.arrb.com.au/Equipment-services/Hawkeye-2000-Series.aspx
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**PC with data acquisition software “Onlooker live” and office based anaysis software “Processing toolkit”**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**PC for data processing and analysis**
Photograph	
Short description	PC with own power supply. Software package for collection data (Onlookcr Live) and processing and analysis of data (Prosessing Toolkit).
Main purpose	Data aquisition during measurement nad processing and analysis of measurement dana from laser profiler.
Technical specification	■ Data processing according to: World Bank Technical Paper 46-Class1, ISO 13473,TRL Lab Rep. 639, AASHTO PP37, AASHTO PP38.
Additional information	https://www.arrb.com.au/Equipment-services/Hawkeye-2000-Series.aspx
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr

Instrument	**GEORADAR-IDS RIS-HI PAVE- PC computer with application**
Laboratory affiliation	**Laboratory for transportation engineering**
Equipment category	**Testing device**
Photograph	
Short description	Antenna 2 GHz and dual frequency antenna 400-900 MHz. High speed survey wheel for distance measurement, mechanical frame to install system on vehicle and PC for data aquisition.
Main purpose	Ground Penetrating Radar for non destructive imaging of pavement layers
Technical specification	■ Aquisition speed to 130 km/h, ■ High speed survey wheel for distance measurement, ■ PC for data aquisition, ■ Multi channel control unit DAD MCH Fast-Wave.
Additional information	http://idsgeoradar.com/products/ground-penetrating-radar/ris-hi-pave
Source of funding	“Research Infrastructure for Campus-based Laboratories at the University of Rijeka” project financed by ERDF
Contacts	Marijana Cuculić, dipl.ing.građ. / marijana.cuculic@gradri.uniri.hr



5

EQUIPMENT OF THE HYDRAULIC LABORATORY

Instrument	**3D printer**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Samples preparation device, production device**
Photograph	
Short description	■ 3D printer Stratasys Connex 500 ■ Desktop computer Lenovo ThinkCentre ■ LCD LG 22M45, 2 pieces ■ UPS Riello Sentinel Pro ■ High pressure water cleaning apparatus for 3D models - Krumm
Main purpose	3D printing of physical models
Technical specification	■ Printing area 500 x 400 x 200 mm ■ PolyJet technology ■ The option of printing several different materials, 14 combination of materials within a single model ■ Resolution 600 DPI by XY, layer thickness 0.016 mm - 0.03 mm
Additional information	https://www.cati.com/3d-printing/objet-connex-printers/connex-500/
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Experimental flume – GUNT HM-162**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Test device, measuring device**
Photograph	
Short description	Experimental groove ■ Monochromatic wave generator ■ Pump for sediment transport ■ 50 piezometers ■ 10 thermometer range 0-50 C° ■ 4 moving carrier for measuring converters
Main purpose	Hydraulic testing of hydraulic structures and hydraulic processes
Technical specification	■ Cross section: 309 x 450 mm ■ Length: 12,5 m ■ Tilt range -0,5… + 2,5% ■ Maximum flow: 132 m^3/h ■ Electromagnetic flow meter ■ All parameters are controlled by computer
Additional information	http://www.gunt.de/en/products/hydraulics-for-civil-engineering/hydraulic-engineering/open-channel-flow/experimental-flume-309x450mm/070.16200/hm162/glct-1:pa-148:ca-179:pr-675
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Experimental pool with wave generator**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Test device, measuring device**
Photograph	
Short description	Experimental pool with a wave generator for testing of physical models of naval construction and deformation of waves. The experimental pool offers also the possibility of modeling ocean currents.
Main purpose	To study the interaction of water eaves and floating structures.
Technical specification	■ 600 x 300 x 40 cm ■ 6 blades with backwash sensors with the ability to generate rhythmic and nonrhytmic waves parallel to the generator or angled ■ Control of the wavelength generator by computer and specification of different spectrum of waves ■ The ability to model monochromatic waves to height of 0.25 m
Additional information	http://www4.edesign.co.uk/
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Pump (2 items)**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	Pump with non-contact flowmeter and multi-parameter interface that defines pump dynamics. All pump operation parameters are controlled by the computer.
Main purpose	The pump is used for water circulation in experiments carried out in the laboratory.
Technical specification	■ Flowrate range 9-21 m^3/h ■ Management of pump and meter data via computer ■ The increment of flow changes 0.1 l/min
Additional information	http://www.gunt.de/en/products/fluid-machinery/turbomachines/centrifugal-pumps/centrifugal-pump-standard-design/070.36511/hm365-11/glct-1:pa-148:ca-723:pr-865
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Wind tunnel**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Test device, measuring device**
Photograph	
Short description	Wind tunnel for testing aerodynamic characteristics of different physical models.
Main purpose	The wind tunnel is used to define the pressure fields over physical models in the test chamber. Data acquisition for velocity and pressure is conducted continuously on a computer.
Technical specification	■ Dimensions of the test chamber (width × height × length): 305 mm x 305 mm × 600 mm ■ Air speed: 0 to 40 m/s ■ Bus with 32 connecting places ■ 32 channels for pressure measurement ■ Scales for the measurement of lift and drag ■ Equipped with a variety of physical demonstration models ■ Visualization of the flow through the smoke generator
Additional information	https://www.tecquipment.com/subsonic-wind-tunnel
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Chamber for advanced hydrological studies**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Test device, measuring device**
Photograph	
Short description	The advanced hydrological test chamber is equipped with 8 nozzles that can be used to model various hydrological conditions.
Main purpose	The chamber has a sloping bottom and can be used to analyze surface erosion. It is equipped with two flow meters and the rainfall simulation nozzles are controlled by the computer so different rainfall conditions.
Technical specification	■ 8 nozzles into 4 groups by two jets ■ The flow through the nozzle 1-4,7 L/min ■ Maximum flow through pumps 1500 L/h ■ The water tank capacity 220 L ■ 19 meters: 300 mm WC ■ Dimensions: L x W x H: 2300 x 1100 x 1950 mm
Additional information	http://www.gunt.de/en/products/hydraulics-for-civil-engineering/hydraulic-engineering/seepage-flow/advanced-hydrological-investigations/070.14500/hm145/glct-1:pa-148:ca-181:pr-546
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

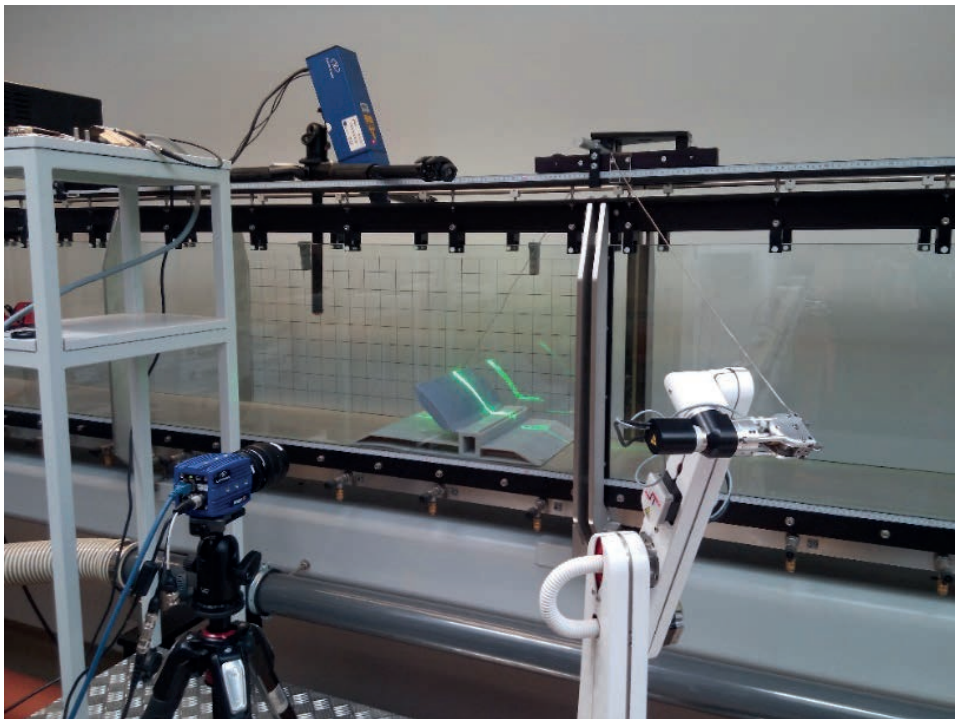
Instrument	**Vectrino profiler**
Laboratory affiliation	**Vectrino profiler**
Equipment category	**Vectrino profiler**
Photograph	
Short description	Vectrino profiler is used for measurement the velocity vector along a water column with length between of 0.5 m to 3 cm.
Main purpose	Vectrino profiler can be used in a laboratory environment, but also in-situ.
Technical specification	■ Speed range: increment of 0.1 m/s to maximum 3.0 m/s ■ Adaptive ping interval: once, once per second up to 1 / h ■ Accuracy: ± 1% measured ± 1 mm/s ■ Sampling time: 1-100 Hz ■ The minimum/maximum range: 20 mm up to 2 m ■ Embedded temperature sensor ranges from -4 °C to 32 °C ■ Resolution of the thermo sensor: 1 °C / 0.1 °C5
Additional information	http://www.nortek-as.com/en/products/velocimeters/vectrino-ii
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Vectrino (4 pieces)**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	The instrument is used to measure the velocity vector at a point in the flow space. The instrument works on the basis of ultrasonic technology, thereby significantly reducing the interaction with the measured field.
Main purpose	The measuring transducer can be used in a lab environment, but also in-situ.
Technical specification	■ Speed range: increment of 0.1 m/s to a maximum of 3.0 m/s ■ Adaptive ping interval: once, once a second to 1/h ■ Accuracy: ± 1 % of measured value ± 1 mm/s ■ Sampling time: 1-100 Hz
Additional information	http://www.nortek-as.com/en/products/velocimeters/vectrino-ii
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**Aquadopp profiler – ADCP 2MHz**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	ADCP allows measurements of characteristics of sea currents.
Main purpose	Intended for oceanography in shallow waters, < 100 m. It is used for monitoring port, research in rivers and lakes.
Technical specification	■ Operating frequency: 2.0 MHz ■ Range of measured profile: 4-10 m ■ Number of rays: 3 ■ Maximum sampling speed 1Hz ■ Sensors: temperature -4 °C to 30 °C, magnetometer (compass), pressure gauge 0-100 m
Additional information	http://www.nortek-as.com/en/products/current-profilers
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**AWAC - 1MHz (2 pieces)**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	Acoustic Waves and Currents (AWAC) is used for measuring the flow characteristics of sea currents and waves at depths up to 10 m.
Main purpose	The equipment is intended for in-situ studies of sea currents and waves.
Technical specification	■ Operating frequency: 1 MHz ■ Range of measured profile: 4-10 m ■ Number of rays: 4 ■ Modes: either alone or „online monitoring“ ■ Recording water currents: to 30 m ■ Recording of waves: maximum depth 35 m (1 MHz)
Additional information	http://www.nortek-as.com/en/products/wave-systems/awac
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**StreamPro ADCP - Compass**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	ADCP is designed for surface recording of flow characteristics in rivers and lakes.
Main purpose	The device is used to obtain the kinematic and geometric characteristics of the flow in rivers and lakes.
Technical specification	■ Frequency: 2 MHz ■ Measure the speed of the water to 3 m/s ■ Accuracy: +/- 1% ■ Resolution: 0.5 cm/s ■ The maximum number of cells by depth: 128 ■ The size of the load cells: 7-150 mm
Additional information	https://eiva.com/products/webshop/streampro-adcp-with-compass-and-tablet-pc
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr

Instrument	**PIV**
Laboratory affiliation	**Hydraulic laboratory**
Equipment category	**Measuring device**
Photograph	
Short description	The synchronized high-speed camera and laser assembly allows the reconstruction of the flow field in a flow plane.
Main purpose	The equipment offers the possibility of reconstructing the velocity field and all relevant kinematic flow parameters in the same plane (vorticity, circulation, turbulence intensity,..)
Technical specification	■ Camera: ImagerLX ■ Laser: Shuttered CW Laser ■ Timing Unit: PTU 9 (Programmable Timing Unit) ■ Optics: Sheet Optics (divergent) ■ Software: FlowMaster
Additional information	http://www.lavision.de/en/techniques/piv-ptv/
Source of funding	The development of research infrastructure on the Campus of the University of Rijeka (EFRR)
Contacts	Assoc. Prof. dr. sc. Vanja Travaš / vanja.travas@gradri.uniri.hr