Additive Manufacturing of 3D Microfluidic MEMS for Lab-on-a-Chip applications

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M3DLoC Project Open Day 2022

Preliminary Agenda

V2.3

Date: 24 June 2022

Time: 09:00 – 16:30 (CET)

Venue: Lavrion Technological & Cultural Park
1 Athens-Lavrion Avenue
GR19500, Lavrion,
Greece

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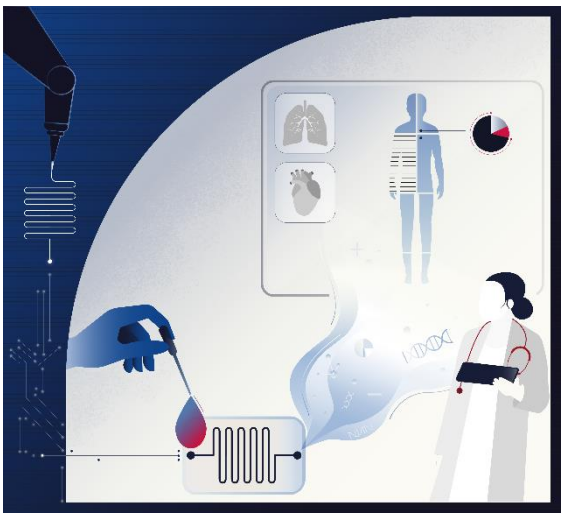
Contents

M3DLoC Project

The **M3DLOC** aims at the employment of multi-material 3D printing technologies for the large-scale fabrication of microfluidic MEMS for lab-on-a-chip and sensing applications. The concept is based on the combination of multimaterial direct-ink-writing method and an extrusion-based 3D printing pilot line, in order to fabricate microstructured detection devices with the ability to perform all steps of chemical analysis in an automated fashion.



The functionality of these devices is evaluated based on their ability to streamline all steps needed to obtain mobility and binding-based identity information in one continuous biochemical detection system. Optimum inline control systems will be incorporated in various stages of the fabrication process, to achieve precise control and repeatability. Microfluidic MEMS are increasingly recognized as a unique technology field for the development of biomedical devices (BioMEMS), due to their functional performance on the microscale, at the dimensions of which most physiological processes are operative. Applications near micro- and nanoscale are promising in the field of intelligent biosensors, where it enables the monolithic integration of sensing devices with intelligent functions like molecular detection, signal analysis, electrical stimulation, data transmission, etc., in a single microchip.

M3DLoC Project Open Day 2020

The **1st Project Open Day Workshop and Exhibition** took place on the **23rd January 2020** at the Crowne Plaza Hotel (Rue Gineste 3, Brussels, 1210 Belgium).

Participants of the M3DLoC Open Day 2020 Workshop and Exhibition were senior members coming from leading bio-medical and healthcare organisations such as: **GSK, GE Healthcare (Whatman), Viscofan, Fluigent, Keralty** among others. **Fluigent i**s coordinator of the HoliFAB project with a similar aim and the meeting was an opportunity for discussion of project clustering.

M3DLoC Project Open Day 2022

The 2nd M3DLoC Project Open Day will be a great opportunity to meet the **M3DLoC** partners and learn about activities and the results of this project, from the project partners presentations and exhibitions on our EXPO website (www.m3dloc.eu/EXPO). Participants attending in person, will have the opportunity to visit the M3DLoC Pilot Line.

M3DLoC Open Day 2022 - Venue Information

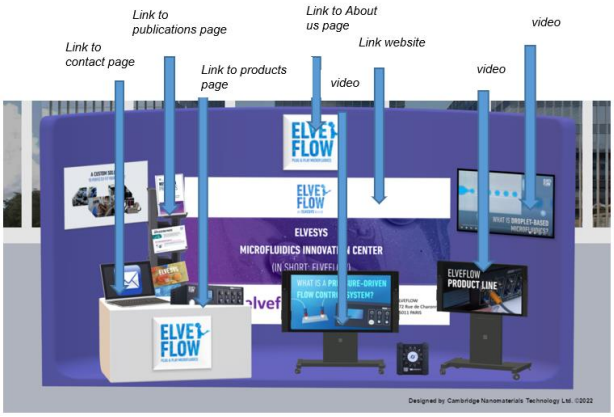
The second **M3DLoC Open Day** will be taking place as a hybrid meeting on the **24th June 2022**. The in-person event will be held at:

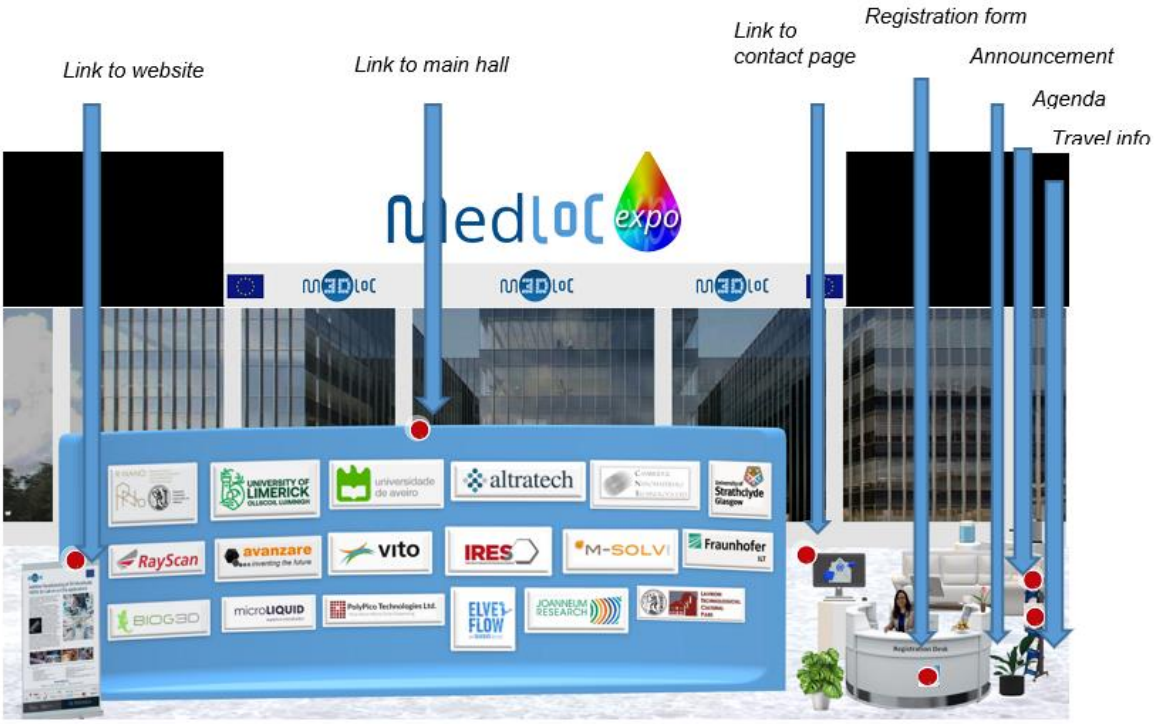
Lavrion Technological & Cultural Park
1 Athens-Lavrion Avenue
GR19500, Lavrion,
Greece

M3DLoC Virtual Exhibition

In preparation for the 2nd M3DLoC Open Day Workshop, a virtual EXPO has been prepared for the M3DLoC Project, where each M3DLoC Partner has their own virtual exhibition booth. The virtual exhibition can be accessed through the M3DLoC website, **EXPO** tab (www.m3dloc.eu/EXPO).

This is a space where you can lean about each M3DLoC Partner organisation, their products and services, and also contact them at the contact page.





M3DLoC Open Day 2022 Agenda

Please note that times shown in the agenda are Central European.

Welcome Open Day

09:00 **Welcome and Opening of the M3DLoC Open Day**

Prof. Costas A. Charitidis, M3DLoC Project Coordinator, NTUA, Greece

Dr Bojan Boskovic, Managing Director, Cambridge Nanomaterials Technology Ltd (CNT), UK
M3DLoC Open Day 2022 Organiser

09:05 **Prof. Costas A. Charitidis and Dimitris Fantanas**, M3DLoC Project Coordinator, National Technical University of Athens (NTUA), Greece

Title: M3DLoC Overview and Impact

Presentation Session - M3DLoC pilot line materials, processes and metrology systems

09:15 **Eleni Gkartzou**, National Technical University of Athens -NTUA, Greece

Title: Fused Filament Fabrication (FFF) materials and process for microfluidic applications

The need for accessible and inexpensive microfluidic and Point-of-Care devices requires new manufacturing methods and materials, as a replacement for traditional soft lithography and polydimethylsiloxane (PDMS). Fused Filament Fabrication (FFF) is a versatile manufacturing technology, compatible with a wide range of thermoplastic polymers. This versatility can be exploited for pilot testing of new polymer formulations as matrices with incorporated (nano)additives, as an efficient and cost-effective way of producing new materials with tailored properties for Lab-on-Chip systems and biomedical applications. This presentation will provide an overview of material and FFF process development methodology developed within M3DLoC project, as part of M3DLoC Pilot Line.

09:30 **Dr Wenlong Chang,** University of Strathclyde, UK

Title: Nanosecond laser micro-structuring of epoxy painting surfaces adhering to an aluminum alloy

Paint materials and their thickness on the airframe affect the weight and protection of aircraft. Epoxy is one of the most popular painting materials which is widely used in the aviation industry. This material has a high resistance to chemicals, less color fading, lower oxidize, does not break down easily, and adheres well on Aluminum alloy. Avoiding icing problems different flight altitudes or in high latitude countries is becoming essential. In this study, a series of micro pattern structures on Epoxy painting surfaces was machined using high precision nanosecond laser machining. These micro pattern structures can result in smooth superhydrophobic paint surfaces. The superhydrophobic surface can improve the anti-ice, anti-fog, self-clean and reduced water adhesion properties of the finished surface. The optimal parameters for

superhydrophobic surface on Epoxy material have been found to be laser power 2W, frequency 100 kHz, pitch 10 um and spot size 15 um. Icing experiments have been conducted to establish the delays of freezing time. The results show that the best superhydrophobic surface extends freezing time by 28% compared with normal epoxy painting surfaces without any structures.

09:45 **Karsten Braun, M. Sc.** Fraunhofer Institute for Laser Technology ILT, Germany

Title: Laser processing – Laser ablation, structuring and surface polishing

Process principles, processing strategies and results within the M3dLOC project will be presented. Also, machine setups of the laser processing modules of the M3dLOC pilot line will be explained and a short outlook for further works will be given**.**

10:00 **Stephen Reilly,** PolyPico Technologies Ltd, Ireland

Title: Multi-Channel Multi-Materials non-contact print system

One of the many novel innovations resulting from the M3DLoC project is the development of a novel print system. The printer can print 8 different materials at a time and uses disposable dispensing cartridges, which completely avoid potential cross-contamination issues. A diverse range of materials such as DNA probes, conductive inks, adhesives and other reagents can be automatically loaded into the print head and printed with precision in the picolitre volume range.

10:15 *Coffee Break*
Visit partners virtual exhibition booths: www.medlocexpo.net

10:30 **Dr Elvira Villaro Ábalos,** Avanzare, Spain

Title: Carbon-based inks and formulations for functional coatings via inkjet deposition

Several formulations have been developed and tested regarding M3DLoC project aiming to obtain a functional ink with adequate electrochemical response to act as electrode in devices. This ink is deposited by inkjet printing system, and it is a key feature that is stable ink without agglomeration which could collapse the feeding. For aiming this objective, it has been selected graphene materials with appropriate lateral size and it has been dispersed by specific protocols in water-based medias. We will show the performance of the carbon inks and the applications they have.

10:45 **Dr Alexander Tselev,** Universidade de Aveiro, Portugal

Title: Hybrid scanning microscope utilizing an optical confocal sensor and near-field microwave probe

A scanning probe microscope will be presented. The microscope utilizes optical confocal distance sensor and near-fields of microwaves to probe and image samples and parts under test. The main foreseen use of the microscope is high-spatial-resolution inspection of parts with varying surface shape and/or electrical properties (dielectric constant and conductivity). The lateral spatial resolution of the microwave near-field probing of the tool has been demonstrated to be less than 1 μm, which is better than >2 μm of far-field optical imaging systems currently employed for the same purpose in industrial processes. A key issue in a number of micro- and nanometer-scale manufacturing processes is the lack of high-spatial-resolution quality control methods to check and reject defective parts before use. These may include, as examples, fabrication of microfluidic components or micro-electro-mechanical systems as well as certain processes and technological steps in semiconductor and electronics industries. The near-field

microwave probing is a test solution, which allows high-resolution control measurements to identify defective parts. The tool can be used for in-line and off-line inspection of part (sample) topography and geometry of topographic features, such as channels, depressions, protrusions in microfluidic systems and micro-electro-mechanical systems (MEMS). Due to the ability of microwaves to penetrate through dielectric materials, the microscope can be implemented for imaging of buried structures, for example, metal lines or voids in a dielectric material (the first case is common in interconnect and packaging solutions in electronics), which can find applications in non-destructive failure analysis of semiconductor device packaging.

11:00 **Philipp Jatzlau,** RayScan Technologies GmbH, Germany

Title: Development of an X-ray radioscopy and laminography system for in-line inspection

For in-line characterisation, testing, measuring and monitoring of the AM system, an X-ray radioscopy system was developed. The system consists of a high-resolution X-ray source providing very small focal spots and a high-resolution X-ray. In combination with a high precision object manipulator and a super-resolution algorithm platform, it is possible to capture high-resolution X-ray projection images. Several images taken from different angles allow the reconstruction of sectional images parallel to the sample surface.

11:15 **Dr George Papazetis and Tzimas Evangelos,** MTL-NTUA, Greece

Title: Pilot Line and system integration

All production line environments are complex multi-module systems, commonly requiring system integration tasks. This involves a complex hardware and software review of the systems and the requirements for production. Based on M3DLOC project requirements, the design and development for the system controller software and the automated transport system, enabled the integration of the individual workstations into a prototype pilot line for the production of bio-MEMS.
Bio-MEMS have to go through a sequence of manufacturing steps as defined in production recipes. The system controller is the dedicated software that performs the scheduling of tasks and the status monitoring for the transport system and the workstations based on the production recipes. The transport system acts as the link between the various workstations, transferring semi-finished products from one manufacturing stage to the next. Each workstation expects instructions from the system controller software to perform manufacturing operations in a fully automated mode.

11:30 *Coffee Break*
Visit partners virtual exhibition booths: www.medlocexpo.net

Demonstration Session

M3DLoC and LTCP facilities

Sessions will take place in groups and will run in parallel

12:00 M3DLoC Pilot Line Demonstration - NTUA

LTCP facilities and history - LTCP

13:00 *Lunch break*
Visiting of the partners exhibition booths and networking (in person and virtually)
Partners virtual exhibition booths: www.medlocexpo.net

Presentation Sessions: M3DLoC Microfluidics

14:00 **Dr Marlene Kopf**, ELVESYS SAS, France

Title: Elvesys – Microfluidics Innovation Center

Elvesys is an innovative company that aims to enable cutting-edge discoveries and state-of-the-art research for scientists around the world with its world-class microfluidic instruments. The company's focus is on pressure-controlled microfluidics and related elements that open up far-reaching possibilities for semi-automated handling of tiny volumes of fluids in many fields of research.

14:15 **Dr Ikerne Etxebarria,** MicroLiquid, Spain

Title: Top 3 Medical devices CDMO

E connectivity's IVD solutions team, shortest path to market. We are the partner of choice to Life Science OEMs for the design, clinical validation and manufacturing of microfluidic devices, enabling rapid diagnosis and novel treatments resulting in healthier lives.

M3DLoC Detection Techniques

14:30 **Mike Szymonik,** VITO, Belgium

Title: Detection technologies for DNA mutations – from microarrays to lab-on-chip

The detection of DNA mutations is a critical aspect of molecular diagnostics, from infectious disease to somatic mutations in cancer. We present an a comparison of the main reference techniques that have been commonly applied in clinical practice – from DNA microarrays, qPCR techniques and NGS. We then explore the use of novel approaches towards the development of cheaper, more rapid point-of-care diagnostic devices, including use of isothermal amplification technologies and integrated lab-on-chip readout systems. We demonstrate how rapid prototyping capabilities aid the development of novel biosensor devices. We showcase the techniques discussed with data from clinically-relevant samples.

14:45 **Tim Cummins**, CTO, AltraTech Limited, Ireland

Title: BeadCAP-based detection

- Introduction to Altratech Ltd and its role in M3DLoC.
- ALTRA's novel PNA-BeadCAP assay for viral RNA detection
- HIV & COVID-19 SARS-CoV-2 test cases overvie
- Bead-capacitance detection method, with CMOS semiconductor electrodes
- Bead-capacitance detection method, with M3DLoC electrodes
- Detection results to date, CMOS & M3DLoC electrodes

M3DLoC Life Cycle/safety framework

15:00 **Panagiotis Karagiannis and Dr Foteini Petrakli,** Innovation in Research and Engineering Solutions -IRES, Belgium

Title: LCA & Nanosafety assessment in M3DLoC Pilot Line

The M3DLoC pilot line involves the synergistic use of a variety of different technologies employed to manufacture the M3DLoC microfluidic devices. Each pilot line workstation entails a specific set of safety hazards, while they are also characterised by a distinctive environmental footprint, given the prototype nature of the M3DLoC equipment and the unique materials used. Additionally, the use of nanomaterials is an important part for M3DLoC's innovations, which introduces nanosafety elements within the Pilot Line, as well as aspects of possible environmental impacts. In order to study the environmental and safety aspects of the M3DLoC Pilot Line, Life Cycle Assessment (LCA) and nanosafety studies were conducted and updated throughout the progression of the project. LCA is a standardized methodology based on ISO 14040:2006 and ISO 14044:2006. A cradle-to-grave approach was followed excluding use phase. Sensitivity analysis was performed in terms of both the EoL treatment and the electricity grid (Average EU vs GR). Manufacturing stage was identified as the main contributor. As FU has been defined the Life cycle of 1 3D printed substrate. The software and database used were the SimaPRO v9.1.1 and ecoinvent v3.6 respectively. In terms of nanosafety, the main focus was the study of possible nano- and micro- particle releases into the workplace air, which could present an inhalation hazard. To address this, a series of occupational exposure assessment measurement campaigns were conducted both within the pilot line premises and in dedicated workspaces, to investigate emissions from the function of the workstations and the materials applied. An extensive inventory of measurement devices was employed, following the OECD ENV/JM/MONO(2015)19 protocol.

Through these activities, the main hotspots in terms of environmental footprint and safety issues were identified, and actions to mitigate impacts were defined, where possible. The present talk will outline the methodologies followed to conduct the studies and present the main outcomes of the assessments.

M3DLoC Business Planning

15:15 **Dr Bojan Boskovic,** Managing Director, Cambridge Nanomaterials Technology Ltd (CNT), UK

Title: Overview of current market and current trends and innovation management

An overview of current patenting and market trends in the field of microfluidics, 3D printing and nanocarbon medical devices will be given including key players and ongoing projects. The importance of innovation management and modern exploitation tolls will be introduced, as they are having an essential role in supporting the exploitation of cutting-age interdisciplinary technologies, such 3D printed nanocarbon microfluidic medical devices. The introduction of nanocarbon materials such as graphene for 3D printed lab on chip (LoC) medical applications required stakeholders to understand and apply innovation management tools to secure translation from excellence of science, scaling-up of manufacturing processes and establishment of an industrial nanomedicine sector.

Dissemination and Networking Session & Closing

15:30 Discussion, visiting partners exhibition booths, poster session and networking

Partners virtual exhibition booths: www.medlocexpo.net

16:30 Closing of the Open Day Workshop

Prof. Costas A. Charitidis, M3DLoC Project Coordinator, NTUA, Greece

Dr Bojan Boskovic, Managing Director, Cambridge Nanomaterials Technology Ltd (CNT), UK
M3DLoC Open Day 2022 Organiser

Note *It is planned that all presentations would be followed by Q&A discussion. The organisers reserve the right to change the programme, speakers or venue should circumstances require. For any further enquires please do not hesitate to contact directly the* ***M3DLoC Exploitation and Dissemination Manager*** *Dr Bojan Boskovic on info@m3dloc.eu or Bojan.Boskovic@CNT-Ltd.co.uk or on his mobile phone +447780874335.*

M3DLoC Open Day 2022 – Speakers

Prof. Costas A. Charitidis (M3DLoC Project Coordinator & Organiser)
School of Chemical Engineering NTUA
Department of Materials Science and Engineering
National Technical University of Athens,
Greece

Prof. Constantinos Charitidis is Professor in the School of Chemical Engineering of the National Technical University of Athens and Director of the Laboratory of Advanced, Composite, Nano Materials & Nanotechnology. He is member of the General Assembly of the Hellenic Foundation for Research and Innovation and since 2018 President of the Body. He has been elected in the Deanship of the School of Chemical Engineering of NTUA since 2017. From 2010 to 2016 he has been Director of Section III: Materials Science & Engineering of the School, while from 2011 he is Director of the Interdisciplinary Postgraduate (MSc) Program: Materials Science & Technology (NTUA). He has more than 25 years of experience in the fields of Materials Science & Nanotechnology, Carbon-based materials and Safety impacts of Nanotechnology. He has extensive R&D experience through collaborations with international research centers since he has participated in more than 60 European and National funded projects, in many of them as Scientific Coordinator (most recent are: Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, Resource Efficient Economy with a Sustainable Supply of Raw Materials NMP FP7, Horizon 2020). He is a referee in International scientific journals, evaluator & scientific advisor of R&D projects. He is the author of several scientific books, chapters in international text books and more than 240 scientific publications in peer reviewed international journals and conference proceedings and cited ~3700 by other researchers (h-index 33). He has been supervisor of 15 PhD Theses and member of the examining committee of more than 50 PhD theses.

Dr. Bojan Boskovic (M3DLoC Partner & Organiser)
Cambridge Nanomaterials Technology Ltd
14 Orchard Way, Cambourne
Cambridge CB23 5BN
UK

Dr Bojan Boskovic has more than 20 years of hands-on experience with carbon nanomaterials and composites from industry and academia in the UK and Europe. Previously, he worked as a R&D Manager at Nanocyl,. He also worked on carbon nanotube synthesis and applications as a Principal Engineer-Carbon Scientist at Meggitt Aircraft Braking Systems, as a Research Associate at the University of Cambridge, and as a Senior Specialist at Morgan Advanced Materials. During his PhD

studies at the University of Surrey he invented low temperature synthesis method for production of carbon nanomaterials that has been used as a foundation patent for the start-up company Surrey Nanosystems. He was a member of the Steering and Review Group for the Mini-IGT in Nanotechnology that advised the UK Government on the first nanotechnology strategy policy document. Dr Boskovic was working as an advisor for the European Commission (EC) on Engineering and Upscaling Clustering and on setting up of the European Pilot Production Network (EPPN) and European Materials Charaterisation Cluster (EMCC). He has experience in exploitation and dissemination management on a number of FP7 and H2020 European projects, including UltraWire, NanoLeap, OYSTER, M3DLoC, Genesis and nTRACK. Also, in UK Government InnovateUK funded projects, such as UltraMAT and GRAPHOSITE He is also a leader of a private Nano-Carbon Enhanced Materials (NCEM) consortium.

Dimitris Fantanas (M3DLoC Partner & Organiser)
Researcher
National Technical University of Athens,
9 Heroon Polytehniou
15773 Zografou, Athens,
Greece

Dimitris Fantanas is an Electronic Engineer (University of Surrey), with an MSc in Nanomaterials and Nanoelectronic Devices (University of Surrey) during which, he worked on the 'Development and characterization of plasmonic transparent electrodes for solar cells'. His EngD studies were on Micro and Nano materials and technologies and were funded by EPSRC. The focus of his thesis was on 'Investigation of the mechanism for current induced network failure for spray deposited silver nanowires.'. After his studies, he worked on the private sector as a Research Engineer and a Technical Lead, where he was leading a variety of engineering and scientific projects with various printed electronics and automation related applications, both for private companies and H2020. His interests include nanomaterials, nanoelectronics, printed electronics, thin films, process development, additive technologies and machine design.

Eleni Gkartzou (M3DLoC Partner & Organiser)
National Technical University of Athens
9 Heroon Polytechniou St., Zographos
Athens,
Greece GR-157 73

Eleni Gkartzou holds a BSc in physics and MSc in Materials Science and Technology. Her research interests include the development of advanced engineering materials for Additive Manufacturing and AM process optimization based on application/material-specific criteria. She has been involved in various technical implementation activities related to European funded projects.

Dr Wenlong Chang. (*M3DLoC Partner*)
Research Associate
University of Strathclyde
75 Montrose Street,
Glasgow, UK,
G1 1XJ

Dr Wenlong Chang achieved his PhD at Heriot-Watt University (2012) where he initiated a novel hybrid micromachining approach with the award of a prestigious Scottish Overseas Research Studentship.

Currently he is an EPSRC and Horizon 2020 Postdoc Research Associate within the Centre for Precision Manufacturing at DMEM at University of Strathclyde.
His research interests include micro-precision machining technologies, short pulse laser machining, laser assisted micro machining, machine tool design and system integration

Karsten Braun, M. Sc. (*M3DLoC Partner*)
Scientist
Fraunhofer Institute for Laser Technology ILT
Steinbachstr. 15
52074 Aachen. Germanv

After finishing his Master's degree in Physics at the RWTH Aachen in Germany, **Karsten Braun** started working at the Fraunhofer ILT as a Scientist in 2016. Science then he has been working on laser material processing with the focus on laser polishing of glasses and polymer materials in a brought range of industries.

Stephen Reilly (M*3DLoC Partner*)
Mechanical Engineer
PolyPico Technologies Ltd.
Unit 10 Airways Technology Park, Rathmacullig West,
Ballygarvan,
Co.Cork, T12 DY95, Ireland

Stephen Reilly is a Mechanical engineer at Polypico Technologies Ltd. Stephen oversees design and manufacture of standard Polypico systems as well assisting in R&D of new systems and technologies. Stephen has a M.Eng. in Mechanical Engineering from the University of Limerick.

Dr Elvira Villaro Ábalos (*M3DLoC Partner*)
R+D
Avanzare Innovacion Tecnologica SL
Avd Lentiscares 4-6,
26370 Navarrete, La Rioja
Spain

Dr Elvira Villaro Ábalos has a PhD in Chemistry, focused on nanoparticles and composite materials to obtain new functional applications. Expertise in preparation and characterization of graphene materials and its dispersion in matrixes as thermoplastics, thermosets and liquids, producing masterbatches or inks, among other products.

Dr Alexander Tselev (*M3DLoC Partner*)
Principal Researcher
CICECO-Aveiro Institute of Materials,
University of Aveiro
Campus Universitario de Santiago
3810-193 Aveiro, Portugal

Dr. Alexander Tselev is a Principal Researcher at CICECO-Aveiro Institute of Materials. He obtained his PhD in Materials Science from Dresden University of Technology, Germany, in 2000, and before joining the University of Aveiro in 2016, he held research positions at several universities in the USA, as well as at the Oak Ridge National Laboratory in the USA. His research interests include development and implementation of the scanning probe microscopy techniques, nano-scale physics, and physics of

nanomaterials. He has co-authored over 130 scientific papers in peer-reviewed journals and holds one US patent. Alexander Tselev is a Senior Member of IEEE.

Philipp Jatzlau (*M3DLoC Partner*)
Project engineer
RayScan Technologies GmbH
Klingleweg 8
88709 Meersburg
Germany

Philipp Jatzlau studied Aerospace Engineering at Technical University of Munich (TUM). He has 7 years' experience in non-destructive testing, including 2 years of project engineering regarding X-ray computed tomography at RayScan.

Dr George Papazetis (*M3DLoC Partner*)
Research Associate
Manufacturing Technology Laboratory, School of Mechanical Engineering,
National Technical University of Athens,
NTUA Zografou Campus
9 Heroon Polytechniou Str.
15780, Athens, Greece

George Papazetis is Production & Management Engineer. His engineering diploma was awarded by Democritus University of Thrace (DUTH), in 2012. He continued his post-graduate studies in the School of Mechanical Engineering of National Technical University of Athens (NTUA), where he successfully completed "Automation Systems" M.Sc. program, in 2014. From February 2015 until July 2020, he worked as PhD Researcher in Manufacturing Technology Laboratory of NTUA School of Mechanical Engineering, when he was awarded a Ph.D. degree in the field of Additive Manufacturing. During this period, he provided services to the manufacturing industry in the field of Metrology and Reverse Engineering using 3D-Scanners. He also contributed as assistant for teaching in under-graduate and post-graduate level in the School of Mechanical Engineering. From December 2019 until July 2020 he worked as Additive Manufacturing Engineer in the Greek industry and currently he is Research Associate to Manufacturing Technology Laboratory of NTUA.

Tzimas Evangelos (*M3DLoC Partner*)
Research Associate
Manufacturing Technology Laboratory, School of Mechanical Engineering,
National Technical University of Athens,
NTUA Zografou Campus
9 Heroon Polytechniou Str.
15780, Athens, Greece

Evangelos Tzimas was born in Athens in December of 1988. He studied Mechanical Engineering in the National Technical University of Athens (NTUA) where he obtained his diploma in 2016 after successfully defending his thesis, titled "Support of setup procedures for machine-tools with the help of Augmented Reality". After graduating, he worked for five years in Greek Industries as buyer and production planner, gaining experience in the industrial supply chain workflow and the production process. For the last year, he has been working as a research associate for the Manufacturing Technology Laboratory of NTUA.

Dr Marlene Kopf (*M3DLoC Partner*)
Head of Innovation
Elvesys
172 Rue de Charonne
75017 Paris,
France

Dr. Marlene Kopf graduated in mechanical engineering from the Karlsruhe Institute of Technology (KIT), Germany, with a focus on materials science, medical technology and microsystems engineering. Her studies were followed by a PhD where she worked with a major OEM on the development of MEMS sensors and micromechanical manufacturing technologies. After subsequently working on assembly and packaging technologies for microsystems, she joined Elvesys as a member of the company's Innovation Unit.

Dr Ikerne Etxebarria (*M3DLoC Partner*)
Head of R&D
Microliquid (TE connectivity)
Goiru Kalea, 9
20500 Arrassate (Gipuzkoa)
Spain

Dr Ikerne Etxebarria received her BSc degree in Chemical Engineering in 2009 and a Master's degree in New Materials in 2010 from the University of the Basque Country. In 2014 she got the PhD degree in Materials Science and Technology by the same university. She has been involved in several projects and she has been working in fields like organic electronics, smart active materials and microfluidics.

Mike Szymonik (*M3DLoC Partner*)
R&D Professional
VITO
Boeretang 200
Mol, 2400
Belgium

Mike Szymonik has been working on the development of innovative biosensor devices for almost a decade, with expertise both at the solid-state interface and the biochemical recognition elements. He has worked on a variety of initiatives, including the development of protein and nucleic acid sensors. Mike currently works within the Sustainable Health department of the Flemish research institute VITO, developing solutions towards early diagnostics and prevention-driven healthcare.

Tim Cummins (*M3DLoC Partner*)
CTO
Altratech Ltd
Forge Hill,
Cork, T12 F867 - Ireland

Tim Cummins is CTO and co-founder of AltraTech Ltd, an SME biotechnology startup in Ireland. He is an electronics design engineer, specialising in semiconductors and sensors, most recently for viral RNA analysis. He has founded three startup companies, holds over 20 patents, has published in Journal of Solid-State Circuits, and is a visiting lecturer at University of Limerick.

Dr Foteini Petrakli (*M3DLoC Partner*)
Project manager
IRES
Rue Koningin Astridlaan 59B, 1780, Wemmel
Belgium

Dr. Foteini Petrakli (F), Project Manager holds a BSc in environmental engineering; during her MSc studies in the field of Materials Science and Technology (NTUA), she dealt with environmental aspects. During her PhD studies in NTUA, she specialized in the development, synthesis (through wet chemical routes) & characterization, of advanced composite ceramic nano-materials for specialized applications in extreme environments. Since today, Foteini has the authorship of 8 published papers in ISI journals, a book chapter, up to 40 participations in national & international conferences and has twice awarded for published research work in national level. Having occupied in several EC and national funded projects, her research interests include composites, life cycle analysis (LCA), Life Cycle Costing (LCC), Circular Economy, eco-design, nanomaterials synthesis, mechanical properties, materials Characterization/testing, heavy metals adsorption, R&D, production process, risk management and data management.

Panagiotis Karagiannis (*M3DLoC Partner*)
Safety & Risk Manager
IRES
Rue Koningin Astridlaan 59B, 1780, Wemmel
Belgium

Panagiotis Karagiannis, holds a BSc in Mining and Metallurgical Engineering and an MSc Degree in Material Science and Technology. During his studies, he was extensively engaged in nanomaterial synthesis on a laboratory scale and in the Risk & Safety assessment of nanomaterial processes. His work experience includes involvement in the Risk assessment of Oil & Gas infrastructure and industrial installations and providing supportive work in environmental impact assessment. He is interested in research fields such as Nanotechnology, Biomaterials, Ceramic Materials, Nanotoxicology, Risk Assessment, Computational Fluid Dynamics, Composite Materials and Quality control.

M3DLoC Open Day 2022 - Partners & Participating organisations

M3DLoC Partner Organisations

Avanzare Innovacion Tecnologica

Web: www.avanzarematerials.com

Avanzare Innovacion Tecnologica SL (AVAN) is a Spanish SME specialized in the production of nanomaterials, nanomaterials dispersions and nanotechnology based solutions. The company is specialized in the development & commercialization of special additives, mainly for different matrices and industrial sectors: plastics, rubber, paints, paper, etc., with international presence in the automotive, aeronautic, fabric, plastic, rubber, paint and building industries, the wire & cable sector and manufacturers of household appliances and packaging wood, paper, among others. AVANZARE is the European leader in graphene and other artificial 2D nano-materials such as n-Mg(OH)2, n-Zn(OH)2 and LDHs (double layered hydroxide) among other materials. With 6,000 m2 of facilities and more than 300 Tm of nanomaterials produced in 2018, AVAN has become one of the top 3 producers of nanomaterials in last decade.

AltraTech

Web: www.altratech.com

AltraTech is a HPSU startup company in Ireland with an experienced team of scientists and engineers bringing together nanobiotechnology, chemistry and semiconductors to radically change the accessibility of high content genetic data. Rapid Viral Detection anywhere in the world; Portable RNA detection & quantification; PNA probe design software tool & probe synthesis.

BioG3D

Web: www.biog3d.gr

BioG3D is a company which specializes in 3D Printing Technologies and Toxicological Assessments of engineered materials, headquarter in the premises of Technological and Cultural Park of Lavrion in Greece. BioG3D is equipped with advanced 3D printing systems and designing software to deliver upon request, advanced products with increased accuracy and precision. 3D printing and 3D scanning are employed to reduce production time and costs, thus making advanced manufacturing accessible to everyone. The ISO certified laboratory with high quality instrumentation, operating under Good Manufacturing Process (GMP), is an invaluable tool for bringing novel products to market since human and environmental safety are re-assured. BioG3D aims to remove the barriers towards innovation and allow new products with advanced functionalities to gain access to the market. The ultimate goal is to boost up personalised fabrication and make “smart” materials easily accessible and widely accepted. BioG3D is intended to be an effective provider of know-how to international industrial players to generate high-value 3D printed products, thereby fostering the growth of specific branches of the market.

Cambridge Nanomaterials Technology Ltd

Web: www.cnt-ltd.co.uk

Cambridge Nanomaterials Technology (CNT) Ltd is an innovation management and nanotechnology consulting company based in Cambridge, UK. It is closely linked with a sister company in Brussels, CNT Innovation (www.cnt-innovation.be). The CNT Ltd helps companies, academic and government institutions to develop world-class innovative solutions for nanomaterials related R&D and IPR strategy, partnership, products, technologies, funding and markets. CNT Ltd is specialised in carbon nanomaterials R&D consulting and collaborative R&D project management, including exploitation and dissemination management, consortium and supply chain building. CNT has done a number of patent landscaping and market research analysis studies regarding production and use of various nanomaterials helping to link inventors and technology developers with end-users and investors. The CNT Ltd is a leader of two private membership based consortiums: Nano-Carbon Enhanced Materials (NCEM) and the new Advanced Materials for Additive Manufacturing (AMAM) with members coming from leading multinational companies and research institutions.

ELVESYS

Web: www.elveflow.com/group

ELVESYS is an innovative company who develops and provides microfluidic chips and scientific instruments for microfluidic researches. ELVESYS now proposes the world widest brand of microfluidic flow control products. The second main mission of the company is to enhance the technological transfer of microfluidic innovations from research laboratories to medical diagnostic and cell biology market. ELVESYS management team already created four innovative companies related to microfluidic in the last five years. ELVESYS developed the FASTGENE technology which is the world fastest qPCR system. This technology was distinguished in 2014 by the Worldwide Innovation Challenge jury as one of the innovation projects that will have significant implications for the French economy, and led to the creation of a spin-off company. ELVESYS Innovation Unit is currently involved in several research consortia to address the current challenges in the field of aging and human longevity, developing innovative tools to better understand human body and to detect and cure the diseases affecting it.

Fraunhofer Institute for Laser Technology ILT

Web: www.ilt.fraunhofer.de

The **Fraunhofer Institute for Laser Technology ILT** is part of the Fraunhofer-Gesellschaft, with 72 institutes, more than 25,000 employees and an annual research budget of 2.3 billion euros. The Fraunhofer ILT is worldwide one of the most important development and contract research institutes of its specific field. The activities cover a wide range of areas such as the development of new laser beam sources and components, precise laser based metrology, testing technology and industrial laser processes. As a tool, light is indisputably an innovation driver. Germany occupies a top position worldwide in the field of optical technology and is holding its own as the world leader in laser manufacturing technology. And, thanks to the intensive research it carries out at the cutting edge between science and practice, the Fraunhofer ILT has been making its own contribution to this success - for more than 30 years. The range of services offered by Fraunhofer ILT covers the entire value creation chain from process development through the design and implementation of new system components all the way to the construction of system concepts for the specific customer requirements. Inside the M3dloc project Fraunhofer ILT will develop a new laser based toolchain for the fabrication and measurement of micro-fluidic devices. From a fundamental understanding of the laser processes and the interaction with the material ILT will build a prototype production line.

IRES

Web: innovation-res.eu

IRES, an R&D consulting company founded in 2015, is dedicated to new and innovative nanotechnology solutions. Headquartered in Brussels (Belgium), IRES is a team of key collaborators that provide supporting services such as IP, market research, environmental solutions and marketing advice. Our mission is to deliver to our customers world-class innovative solutions for development of materials based products. Customised and tailored solutions on demand, often in tool form, successfully identify possible business risks and provide sustainable directions. For this, the whole lifecycle of products is considered, through a holistic evaluation of social, environmental and economic aspects based on EU standards and regulations. IRES in collaboration with external bodies and related initiatives, is part of new technological events, arising innovative technologies and strategic research trends.

microLIQUID

Web: www.microliquid.com

We are experts in development and manufacture of microfluidic products. **microLIQUID** is a one-stop provider of end-to-end Bioscience solutions, spanning all the microfluidic value chain from cartridge to equipment. Starting with design and proof of concept, we work with our company customers from development to mass-production of potentially fully certified microfluidic IVD or Pharma solution. This is possible as we have under one roof Bioscience, Engineering and New Product Introduction expertise.

M-Solv Ltd

Web: www.m-solv.com

M-Solv Ltd is a manufacturing company that employs 70 people and it is based in Oxford, UK with an Asian support facility in Hong Kong. Its activities target the printed, large area and flexible electronics market. M-Solv is part of the Hong Kong-based CN Innovations group which is a broad-based manufacturing organisation, particularly active in the mobile sector. M-Solv has a development lab with 12 in-house built processing machines including inkjet and spray systems with a range of printheads and capabilities and laser processing stations with different sources and optics: wavelengths from 10µ to 266nm and pulse lengths from CW to 200 fs with processing areas up to about 1m2 plus roll-to-roll. We believe that for a successful development a close working relationship is needed between process provider, material provider, machine developer and end user. So we have developed an extensive network of materials suppliers and other process providers, to align with this philosophy. We operate a "foundry" for large-area electronic device manufacturing. It is a Class 10,000 (ISO7) cleanroom, with multiple production tools and is ISO 9001:2015 accredited.

National Technical University of Athens - R-NanoLab

Web: nanolab.chemeng.ntua.gr

The "**Research Unit of Advanced, Composite, Nano Materials & Nanotechnology", R-NanoLab** is situated at the School of Chemical Engineering (Department of Materials Science and Engineering) of **National Technical University of Athens** (NTUA). It is established since 2006; its research group has extensive experience in Design, Production and Characterization of Advanced-, Composite- and Nano-Materials. R-NanoLab has a strong presence in European Research Activities in Materials Science, through participation in numerous EU and national funded projects. As part of the European Technological Community, R-NanoLab is an active member of several Clusters: European Materials Characterisation Council (EMCC), European Pilot Production Network (EPPN), European NanoSafety Cluster (NSC) taking part in establishment of new standard methodologies, provide suitable background for regulation and nanosafety, and support EC policy development.

Lavrion Technological and Cultural Park (LTCP)

Web: www.ltp.ntua.gr/home_en

Lavrion Technological and Cultural Park (LTCP) of the National Technical University of Athens (N.T.U.A.) is a place with significant value for Greece and Europe. Ancient Greeks started mining and metallurgy in the Lavreotiki area around 3.000 BC. During the 5th century BC, Lavrion used to be a large scale silver mining and metallurgy center, providing to the city of Athens the necessary wealth for its cultural development and military superiority. After several centuries of inactivity, during the end of

19th century a Greek mineralogist Andreas Kordelas and an Italian-French entrepreneur J.B. Serpieri revived the mining and metallurgical activities in Lavrion. The French Mining Company of Lavrion (FMCL) operated for more than a century (1875-1981). It was the first and biggest foreign investment in Greece and also driver of major technological advancements till it ceased operation. The enterprise's activity was a major contributor to the genesis of an industrial urban space, the town of Lavrio. This created a modern tradition for technical innovation, and an important national and European monument of industrial archeology. N.T.U.A., having decided to preserve this heritage and tradition, has safeguarded a good part of the FMCL industrial complex and undertook the ambitious project to convert the former metallurgical site into a Technological Cultural Park and Museum of Technology. During the 2nd and 3rd Structural Framework Programs (EU and National funding) two major projects were undertaken by the LTCP and resulted to the restoration and rehabilitation of almost one third of the total building capacity and to the completion of the soil restoration for the park's surrounding environment. Since 1998, when LTCP started its operations, more than 40 companies have been incubated in the park. Some of them grew and moved out successfully, some are still active in the park and some failed. Furthermore, NTUA's research and educational activities, mainly those related to the broader area, are hosted in the LTCP.

PolyPico Technologies

Web: www.PolyPico.com

PolyPico Technologies Ltd.
Pico-Nano-Micro Drop Dispensing

PolyPico Technologies Ltd is a provider of liquid dispensing technology and based in Cork, Ireland. Founded in 2012, the privately owned company designs and manufactures, fluid dispensing solutions for both Life Science and Industrial applications. PolyPico's core platform technology is based on a patented innovation in non-contact ultra low volume acoustic dispensing technology. This platform technology brings new features, benefits and possibilities to applications where precision fluid dispensing is required. We are focused on revolutionising the way bio-materials and other liquids are printed and dispensed. Our versatile technology combats challenges such as: cross-contamination; dispenser clogging; wastage; and system complexity, through the use of simple disposable fluid cartridges. PolyPico has worked with several of the worlds largest and smallest pharmaceutical companies, industrial companies and research organisations. Our multidisciplinary team have a broad range of expertise in areas such as: micro-fluidics; electronics; software development; mechanical engineering; physics; business development and bio-technology. We offer customised solution and services for the Life Sciences and Industrial applications and invite you to contact PolyPico and learn how these innovations can help your company.

RayScan

Web: www.rayscan.eu

RayScan

We are experts in industrial Computed Tomography. Technical challenges are our day-to-day routine, either in the form of system specific innovations, or in the first-time accomplishment o f completely new applications and in the evaluation of specifically designed systems and scanning concepts. **RayScan** systems are particularly suitable for the development, optimisation and control of new materials and complex components with very high accuracy requirements as well as their manufacturing methods. Typical fields of application, besides defect detection, are dimensional measurement, comparison of CAD data and reverse engineering. We particularly focus on intuitive operation, reliable technology and appealing design of our systems. Among the customers of RayScan Technologies GmbH are leading companies in the fields of automotive and aerospace as well as service providers and renowned institutions of science and technology.

The University of Aveiro

Web: www.ua.pt

The **University of Aveiro** (UA) is a young university, founded in 1973, with over 15500 full-time students (Grad. and Post-graduation). The University has a strong research profile, a unique model of governance (16 Departments, 4 Polytechnic Schools and various training centre's). The UAVR seeks to develop and maintain a supportive research environment, where individuals are valued and provided with the support they require. Students and researchers can count with a solid and experienced administrative, financial and legal structure composed by several offices, integrated in different services, from which we highlight: the Research Support Office (GAI), the Management of Human and Financial Resources, the Technology Transfer Office (UATEC) and the Mobility Centre. CICECO - Aveiro Institute of Materials, is an Associated Laboratory of the UA and joins some 389 chemists, physicists and materials engineers making it the largest Portuguese Materials Science and Engineering (MS&E) institute (www.ciceco.ua.pt). Created in 2002, the institute has contributed to the development of scientific and technological knowledge necessary for the innovative production and transformation of materials, for a sustainable development and the benefit of society, (from ceramics to soft matter and hybrids). With a solid international profile, 44 % of 41 full-time researchers, 30% of 104 post-docs and 18% of 119 PhD students are foreigners. CICECO national and international scientific recognition is reflected in the participation on several European Excellence Networks. Moreover, in the last National Science Foundation (FCT) research assessment, CICECO was ranked 24.5 in 25 points (Excellent) and placed among the top 5% of research units in all fields of knowledge. In 2017, 431 SCI papers were published (57% Q1), 31 PhD and 103 MSc theses were finished, and 6 patents (2 international) were filed.

The University of Limerick

Web: www.ul.ie

The **University of Limerick** (UL) is one of the leading universities in Ireland and has an excellent track record of attracting national, European and industrial funding for research. The Bernal Institute within UL comprises over 300 researchers active in materials and surface science research with a strong focus on microscopic, nanoscopic and spectroscopic characterisation of materials important for health, energy, transport, clean technology and manufacturing. In recent years, UL has received national funding over €40 M to continue as a national facility for state-of-the-art materials and surface characterisation. The UL team is a partner of CURAM, the Science Foundation Ireland National Centre for Biomedical Devices. The UL team has a strong track record of using state-of-the-art characterization techniques and developing cutting edge and innovative techniques of characterization of materials, surface and interface, drug-device combinations, and molecular biology/protein biochemistry. The UL team coordinated the FP7 project LANIR, a project that built a super-resolution label-free nanoscope based on infrared finger-printing of materials, and the FP7 project BioElectricSurface.

University of Strathclyde (UOS)

Web: www.strath.ac.uk

The **University of Strathclyde** (UOS) is a top ranked university in the UK national Research Excellence Framework. The Centre for Precision Manufacturing (CPM) at UOS has over 40 researchers who conduct internationally leading researches in Precision-Forming and Micro-Manufacturing, Precision Engineering, and Light Metals Advanced Technology. The goal of CPM is to be a world-leading advanced manufacturing research centre delivering "total" precision manufacturing solutions for next

generation high value-added products. With the accessibility to 40 million pounds worthy world-class manufacturing research facilities, the centre conducts cutting-edge researches in Micro-Manufacturing Technology, Precision Forming Techniques, Ultra-Precision Machining Techniques, Micro/Nano-Machining Technology, Ultra-Fine Grained Metal Technology, Light-Weight Metals Processing Techniques, Multiscale Modelling, and Manufacturing systems for Ultra-Precision and Micro/Nano-Manufacturing. The centre aims to facilitate collaborations across different manufacturing themes and disciplines. The CPM has engagement with worldwide industries and research communities (e.g. worked with more than 30 industry companies from 13 EU countries and currently working with more than 20 companies in various funded projects). The researchers of the group have generated a series of products, processes, tools and machinery designs, and analysis results respectively for material, electronic, automotive, aerospace, and machinery industries.

VITO

Web: www.vito.be

VITO is a leading, independent Flemish research organization that provides sustainable technological solutions to industry and public authorities. It also offers scientifically based advice and support in the research domains of Energy, Materials, Chemistry, Land use and Health in order to stimulate sustainable development. VITO-Health aims at technological innovations for sustainable health and disease prevention. Our R&D focus is on assay and technology development for molecular diagnostics and personalized medicine. Our strengths are: Targeted approaches for enrichment and analysis of extracellular vesicles from liquid biopsies; Nanotechnology-enabled biosensing; Biomarker development and validation using LC-MS based proteomics, peptidomics and MALDI imaging.

Joanneum Research – Institute for Biomedicine and Health Sciences

Web: www.joanneum.at/en/health/

JOANNEUM RESEARCH Forschungsgesellschaft mbH develops solutions and technologies for businesses and industries across a wide range of sectors and conducts top-level research at an international level. With a focus on applied research and technology development, the INNOVATION COMPANY plays a key role in the transfer of technology and know-how in South-East-Austria.

HEALTH - Institute for Biomedicine and Health Sciences – provides a link between basic medical research and industrial application. By forming strategic partnerships with both regional and international partners in the scientific and industrial sectors, HEALTH develops comprehensive, interdisciplinary solutions to problems encountered in the fields of medicine, pharmacy, medical technology and health care research.

M3DLoC Open Day 2022 – Participating Guests Organisations

AnotherBrain

Web: www.anotherbrain.com

We are creating a new kind of new Artificial Intelligence: bio-inspired, frugal (low data and energy) and human-friendly, an alternative to deep learning, for people

NTUA – School of Mining & Metallurgical Engineering

Web: http://eng.metal.ntua.gr/

The onset of our School was the **Department of Mining and Metallurgical Engineering of the National Technical University of Athens (NTUA**) that was founded by government decree on February 27th, 1946. According to this decree, the School of Chemical Engineering was subdivided into three Departments: (a) the Department of Chemical Engineering, (b) the Department of Mining Engineering, and (c) the Department of Metallurgical Engineering.

University of the Aegean/Nanoplasmas PC

Web: www.nanoplasmas.com/en

Nanoplasmas is a spin-off company of NCSR Demokritos, with expertise in micro-nanotechnology and surface engineering, preparing high-end consumables for health, food safety, agricultural and environmental applications. Its patented technology has been incorporated into microfluidic devices creating lab-on-chip diagnostics. Nanoplasmas has several other products in the pipeline based on its innovative plasma nanotexturing technology.

Helmholtz Centre for Infection Research

Web: www.helmholtz-hzi.de/

The Helmholtz Centre for Infection Research (HZI) is a publicly funded research institute based in Braunschweig, Germany. HZI is a member of the Helmholtz Association of German Research Centres, the largest non-university scientific organisation in Germany.
Entrance to the Helmholtz Centre for Infection Research
The centre focuses on investigating infectious diseases caused by bacteria and viruses. Further research topics are the immune system and the development of novel anti-infective drugs.