



Establishing metrology standards in
microfluidic devices

6th Newsletter

05 / 2024

MFMET.eu

EMPIR



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

Welcome

I welcome you with great pleasure but also with some nostalgia to our final MFMET newsletter. We take this opportunity to provide the final outcomes and achievements of our project.

In the last six months all tasks of each work package were concluded.

Our 6th project meeting was held in a hybrid format (online and at IPQ, Portugal) in May 2024 with 23 participants.

The partners were also involved in several dissemination activities, mainly the final MFMET workshop for scientists and metrologists held at IPQ, on the 22nd of May 2024, with more than 60 participants from all over Europe. The project partners published 8 reports, one white paper and one peer reviewed publication since November 2023 and participated in several national and international conferences.

Six deliverables were sent to MSU, namely, one from WP1, two from WP2, two from WP4 and D9 that is related to standardisation dissemination.

A webinar with 6 sessions was developed by the project partners and is available online on the webpage of the project <https://MFMET.eu>.

I hope you will find the information in this newsletter valuable. It was my pleasure to coordinate this project during the last 3 years and I believe the outcomes will benefit both the microfluidic community as it will the metrology community.

I would also like to thank all 17 project partners involved in this project for their outstanding commitment, namely IPQ, CETIAT, CMI, DTI, LNE, NEL, NQIS, RISE, Tubitak, CEA, EnablingMNT, HSG-MIT, IMTAG, INESC MN, Microfluidic ChipShop, BHT and UofG. A big thanks to our advisory board and all our Stakeholders and Collaborators that followed and contributed to the project outcomes.

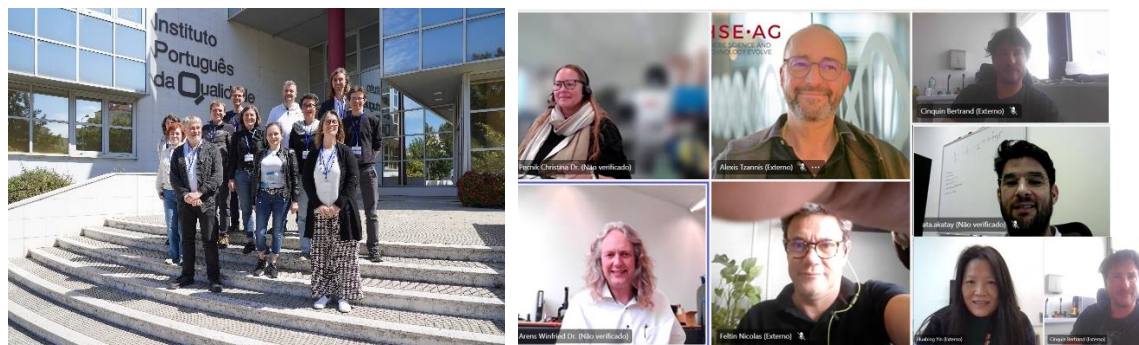
This project had the premise to metrology standards in microfluidic devices, and this is what we have achieved. We will continue to work on improving measurements and standardization in microfluidics.

Hope to see you soon!!!

Elsa Batista
Coordinator of Project MFMET

News and facts

- The M36 project meeting was held at IPQ, the National Metrology Institute for Volume and Flow in Portugal on 23 of May 2024, with 23 participants, both on-site and online. The final outcomes of the project were discussed.



- Six new deliverables were prepared and are already available on the website:
 - Deliverable 2 - Guidelines for the implementation of consensus-based flow control specifications in the microfluidics industry supply chain.
 - Deliverable 3 – Calibration guide for the evaluation of flow-related quantities in microfluidic devices.
 - Deliverable 4 – Report on test protocols for liquid properties in microfluidic devices for use in pharmaceuticals, biomedical and mechanobiology applications.
 - Deliverable 7 – Landscape document identifying standardization requirements for microfluidic component design and manufacturing with respect to modularity and heterogenous integration.
 - Deliverable 8 – Measurement protocols for dimensional characterisation of microfluidic components.
 - Deliverable 9 - Evidence of contributions to or influence on new or improved international guides, recommendations and standards with a specific focus on the following committees: ISO/TC 48/WG 3 and WG 5, ISO/TC 69/SC 6, ISO/TC 229, ISO/TC 276, IMEKO TC 7, CCM-WGFF, CEN/TC 332/WG 7 and EURAMET TC-Flow.
- The workshop “Workshop on Standardization of Test Methods in Microfluidics.” organized between the MFMET project and The Microfluidics Association was hosted by IPQ, the National Metrology Institute for Flow and Volume in Portugal on 22nd of May 2024, with the cooperation of INESC MN. This workshop aimed to present the scientific outcomes of the project MFMET and also how scientist and industry are applying standardization in the microfluidic activities and research. The workshop was attended by 62 participants from 8 European countries. 5 Institutions exhibited their products during the event. Fourteen (14) oral presentations were given by the project partners related to the final scientific outcomes of project MFMET. Several experts from organisations working on microfluidics product development and research presented their work on microfluidics and standardisation. It was also possible to identify the problems and challenges of industry and academia in metrology and standardization of microfluidic devices.



- On 7 and 8 of March 2024, the Microfluidic Association (MFA) held a workshop to discuss the challenges and opportunities around the integration of sensors and electronics in microfluidics. The workshop was hosted and supported by the Belgium Research Institute imec (Interuniversity Microelectronics Centre) and also received support from the EMPIR MFMET project. The workshop was held with the objective of providing input for a shared technology roadmap for the microfluidics industry. With over 100 attendees, mostly from the industry sector, the workshop surpassed the number of attendees at our earlier workshop last November at CETIAT, Lyon.



- Microfluidic ChipShop organized a one-day workshop on standardization in Microfluidics in Jena, Germany on May 16th. The event aimed to address the importance of standardization in microfluidics and had the participation from MFMET, UNLOOC, and AGRARSENSE partners.



- Since the project's start, the website has been viewed over 53359 times from 68 countries, in average 1438 views per month and more than 2300 downloads were made of the documents prepared within the project.
- 8 technical reports/protocols/guidelines and one guideline "On the road to standardization in Microfluidics and Organ-on-Chip" have been produced by the consortium and are available in the webpage <https://MFMET.eu>.

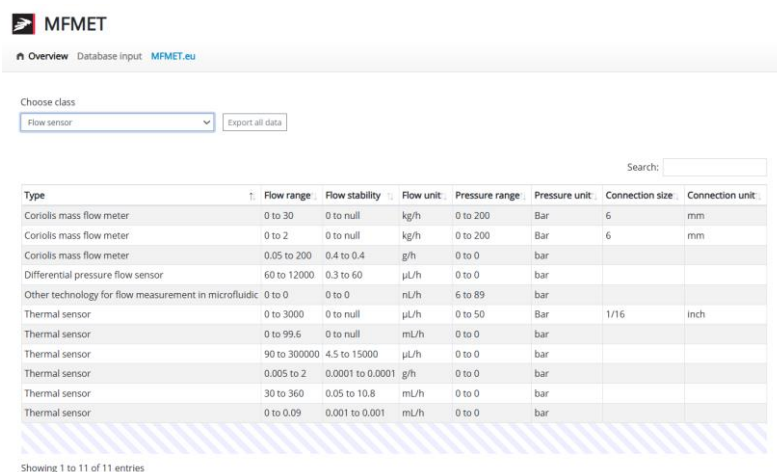
- To this date, the project has the support of 37 stakeholders, The Microfluidics Association being our chief stakeholder.
- The project partners continued their involvement in the work of ISO/TC 48/WG 3 – Microfluidic Devices (one of the Members of the Consortium is now the Convenor of this WG, Vania Silverio from INESC MN).
- The MFMET webinar, with 6 different sessions, was prepared by project consortium partners and is available in the webpage <https://MFMET.eu>:
 - MFMET webinar – 01. The role of Metrology and Standardization in microfluidic technology development.
 - MFMET webinar – 02. Flow in microfluidics.
 - MFMET webinar – 03. Wettability and surface roughness.
 - MFMET webinar – 04. Leakage in Microfluidic Devices – detection and quantification. Link
 - MFMET webinar – 05. Interfacing of microfluidic devices.
 - MFMET webinar – 06. Measuring the dimensions of microfluidic devices using optical methods.

Highlights from the Project

The major achievements by work package are:

WP1 - Consensus-based flow control specifications for microfluidics

Finalization of Deliverable 2 - Guidelines for the implementation of consensus-based flow control specifications in the microfluidics industry supply chain and Report A1.1.5 - Communication report on the definition of flow control concepts, terms and components used in microfluidics and related database.



The screenshot shows the MFMET website interface. At the top, there is a navigation bar with 'Overview' and 'Database input: MFMET.eu'. Below this, there is a 'Choose class' dropdown menu set to 'Flow sensor' and an 'Export all data' button. A search bar is located on the right side of the table. The table itself has the following columns: Type, Flow range, Flow stability, Flow unit, Pressure range, Pressure unit, Connection size, and Connection unit. The table contains 11 entries, with the first few rows showing various flow meters and sensors with their respective specifications.

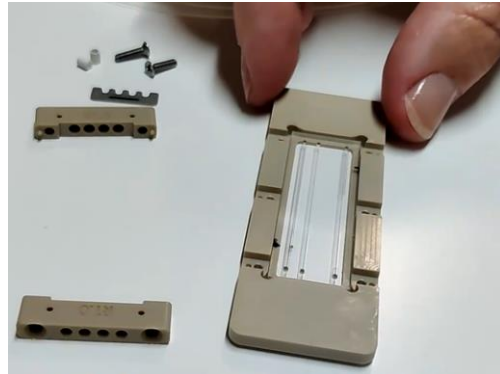
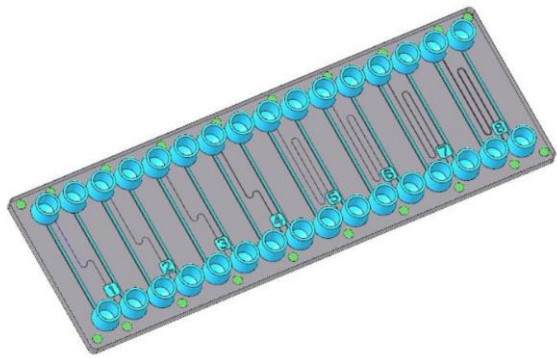
Type	Flow range	Flow stability	Flow unit	Pressure range	Pressure unit	Connection size	Connection unit
Coriolis mass flow meter	0 to 30	0 to null	kg/h	0 to 200	Bar	6	mm
Coriolis mass flow meter	0 to 2	0 to null	kg/h	0 to 200	Bar	6	mm
Coriolis mass flow meter	0.05 to 200	0.4 to 0.4	g/h	0 to 0	bar		
Differential pressure flow sensor	60 to 12000	0.3 to 60	µL/h	0 to 0	bar		
Other technology for flow measurement in microfluidic	0 to 0	0 to 0	nL/h	6 to 89	bar		
Thermal sensor	0 to 3000	0 to null	µL/h	0 to 50	Bar	1/16	inch
Thermal sensor	0 to 99.6	0 to null	mL/h	0 to 0	bar		
Thermal sensor	90 to 300000	4.5 to 15000	µL/h	0 to 0	bar		
Thermal sensor	0.005 to 2	0.0001 to 0.0001	g/h	0 to 0	bar		
Thermal sensor	30 to 360	0.05 to 10.8	mL/h	0 to 0	bar		
Thermal sensor	0 to 0.09	0.001 to 0.001	mL/h	0 to 0	bar		

Showing 1 to 11 of 11 entries

Reports are available on the MFMET website <https://MFMET.eu>.

WP 2- Measurement protocols for different flow related quantities and liquid properties

Measurements of the golden transfer standards manufactured on glass by IMT and on polymer by MFCS completed with elaboration of report A2.4.3 – Transfer standard test protocol.



Measurements performed for flow, flow resistivity, volume, channel dimensions, roughness, and surface energy. The Transfer Standards - golden standards - are held by CEA for a period of at least three years under cleanroom conditions and are available for loan.

Conclusion of Deliverable 4 – Report on test protocols for liquid properties in microfluidic devices for use in pharmaceuticals, biomedical and mechanobiology applications.

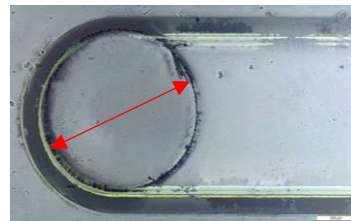
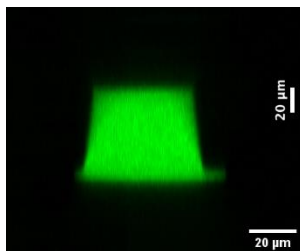
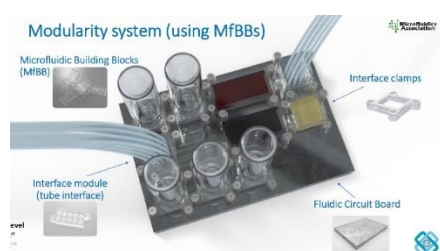


WP3 - General standards and guidelines for interfaces and connectivity

This WP was concluded during 2023.

WP4 - Development of guidelines for the standardisation of dimensions and accuracy for modularity and sensor integration

Conclusion of Deliverable 7 – Landscape document identifying standardization requirements for microfluidic component design and manufacturing with respect to modularity and heterogenous integration and Deliverable 8 – Measurement protocols for dimensional characterisation of microfluidic components.



Dissemination of work since December 2023

The following reports were prepared and made available on the [project website](#):

A5.1.7 - Report on reasons for failure of microfluidic devices.

A3.2.5 - Documented example of wettability test protocol.

A2.2.3 - Documented example of the test protocol for hydrodynamic resistance, flow rate and volume.

A3.3.4 - Report on the geometry and dimension of microfluidic component ports.

A4.1.4 - Current state of the art of modularity and heterogenous integration of microfluidic systems.

A1.3.5 - Gaps in microfluidic flow control methodologies.

A2.4.3 – Transfer standard test protocol.

A1.1.5 - Communication report on the definition of flow control concepts, terms and components used in microfluidics and related database.

8 Oral Presentations:

- MFMET and MeDDII projects, EPM workshop, Caparica, IPQ, January 2024, presented by Elsa Batista from IPQ.
- Microfluidic and Organ-on-Chip roadmapping, workshop Leuven, February 2024, Belgium. Presented by Henne van Heeren.
- The role of Metrology and Standardization in microfluidics, MFA workshop at IMEC, Leuven, March 2024, Elsa Batista from IPQ presented.
- Chip sensing and actuation strategies for microfluidic devices and how these could serve metrological purposes, MFA workshop at IMEC, Leuven, March 2024, Vania Silverio from INESC MN presented.
- MFMET-Summary Measurement technologies for microfluidics, UNLOOC Standardization Workshop, 16th of May 2024, hosted at and by Microfluidic ChipShop, Jena, Germany. The workshop has topics such as on standardization and microfluidic chips.
- Lab-on-chip applications and metrological traceability, LABSUMMIT, Coimbra, 17 May 2024, presented by Elsa Batista from IPQ
- Drivers for and focal points of standardization μ fls & OoC, IVAM high tech summit, May 2024, Frankfurt. Presented by Henne van Heeren.
- Establishing Metrology Standards - research projects outcomes, May 2024, HSBooster Training Session, presented by Elsa Batista from IPQ online.

One peer reviewed paper was published:

1. Batista E., Alves e Sousa J., Saraiva F., Lopes A., Silverio V., Martins R.F., Martins L. (2024) The Importance of Dimensional Traceability in Microfluidic Systems. *Metrology*, 4(2):240-253. <https://doi.org/10.3390/metrology4020015>

Several members have participated in the development of the roadmap of the Focus Group on Organ-On-Chip of CEN-CENELEC.

Apart from all the documents above, former documents and publishable summaries can be found in the [project website](#).

How to contact us

MFMET project coordination

Elsa Batista, IPQ, Portugal

Email: ebatista@ipq.pt

Scientific leader

Vania Silverio, INESC MN, Portugal

Email: vsilverio@inesc-mn.pt

Project website: <https://MFMET.eu>