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Market Research Report HoloZcan Project

Industry Analysis And Forecast (2020-2030)

The Study Offers:

- A detailed understanding of the current market dynamics and growth opportunities
- An in-depth analysis and forecast for various product types and end-user industries of market
- Impact of COVID-19 on the market studied
- An analysis of the competitive landscape, including key strategies and business developments of the top vendors in the market



PART 1 – HoloZcan DHM, DDB, AUXT

- **CHAPTER 1. Executive Summary and Key Findings**
- **CHAPTER 2. Method of the marker analysis**
- **CHAPTER 3. Market dynamics**
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PART 2 – HoloZcan AIRS

- **CHAPTER 6. Executive Summary and Key Findings**
- **CHAPTER 7. Competitive Analysis**
- **CHAPTER 8. Global Air Sampler Market**
- **CHAPTER 9. Key Market Players AIRS**
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Disclaimers



Executive Summary and Key Findings

CHAPTER 1



AI-enabled, automatic, portable, sensitive and fast biodetection and sampling system that is affordable

Improve the ability to detect/measure ambient and exhaled bio-aerosol and improve the accuracy of triggering in emergency situations.

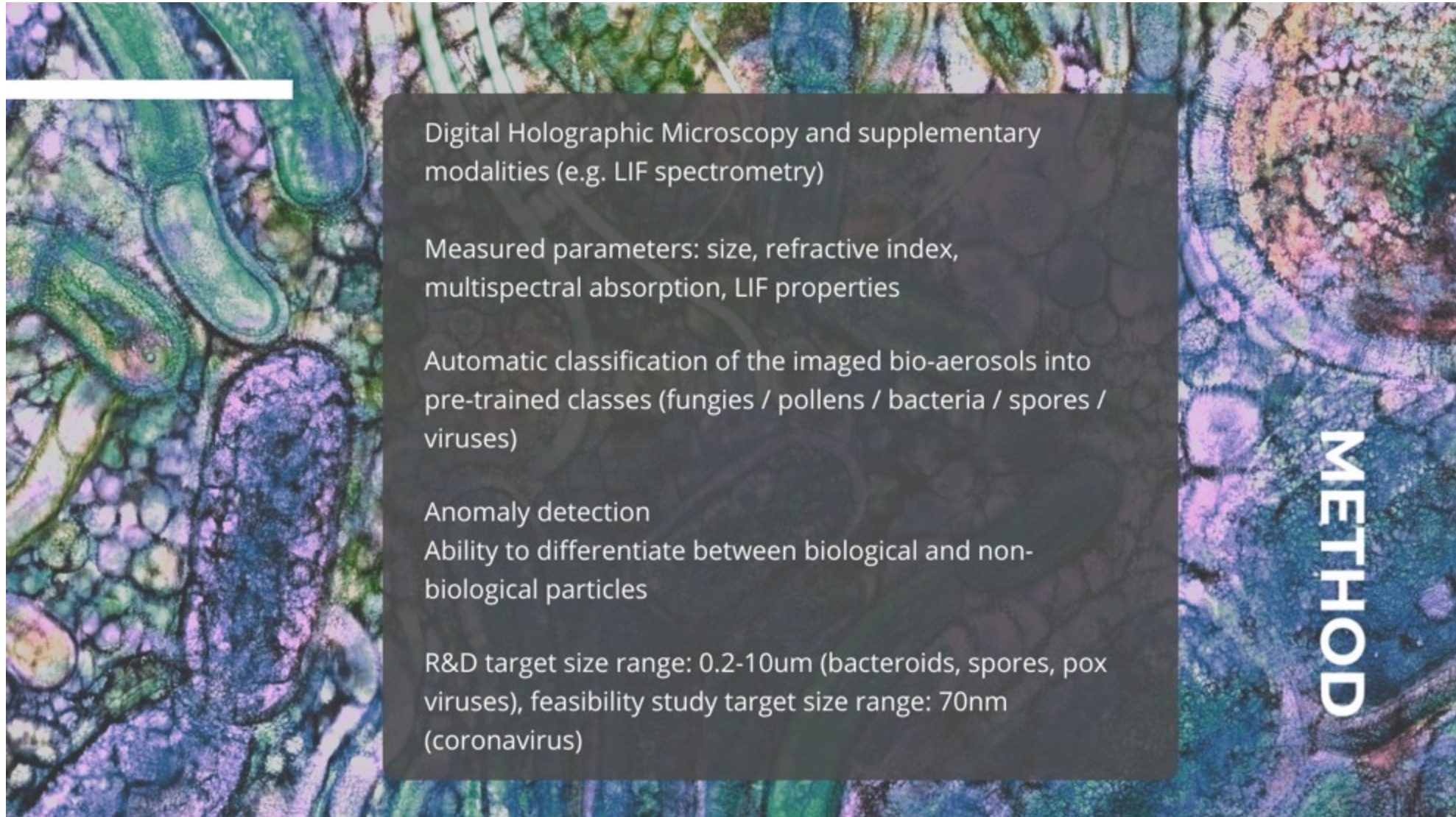
Timely detection, classification and characterization of airborne bio-threats and particles

Development of testing, validation and calibration protocols to the specific use cases and scenarios

Quality assurance, quality control and operation procedures

Training mechanism and train-the-trainer materials

HoloZcan



Digital Holographic Microscopy and supplementary modalities (e.g. LIF spectrometry)

Measured parameters: size, refractive index, multispectral absorption, LIF properties

Automatic classification of the imaged bio-aerosols into pre-trained classes (fungies / pollens / bacteria / spores / viruses)

Anomaly detection

Ability to differentiate between biological and non-biological particles

R&D target size range: 0.2-10um (bacteroids, spores, pox viruses), feasibility study target size range: 70nm (coronavirus)

METHOD



Database – pathogens and images

Digital Holographic Microscope

Air Sampler Systems

Auxiliary Technologies

DDB

DHM

AIRS

AUXT

04

03

02

01

The database market size is a derivative of the DHM market. We calculate with a ballpark estimate of 30% share of each DHM sold.

We provide a full market research report as detailed in this presentation

We provide a detailed market analyses and best estimates of market size and values, as well as we develop an AIRS device and technology by ourselves.

Additional technologies include AI algorithms, potential alternative pathogen detection and imaging methods. Since these are just basic research level topics, no exact market size can be estimated yet.

Key Exploitable Technologies, HoloZcan



key exploitable results	Manage by	Exploitation	IPRs	Application
DHM microscope	Sioux-CCM	Licensing	Copyright or Patents	CBRN, Environmental monitoring, Healthcare, Veterinarian applications
DHM platform technology	IDEAS	Licensing	Proprietary licence, Copyright	CBRN, Environmental monitoring, Healthcare, Veterinarian applications
Microscopy Image Processing software kit	Polimi, IDEAS	Licensing	Proprietary licence, Copyright	CBRN, Environmental monitoring, Healthcare, Veterinarian applications
Auxiliary Technologies: Sample preparation methods	LODZ, DSLabs, IP	Licensing	Sampling protocols	Medical technology, diagnostics and monitoring
Auxiliary Technologies: Bioinformatic validation and fine tuning of SW components	DSLabs	Licensing	Proprietary licence, Copyright	Health Informatics and biosignal monitoring
Database – pathogens and images	LODZ, DSLabs, IP	Licensing	Proprietary licence, Copyright	Health Informatics and biosignal monitoring
Air sampler system	Zug Medical	OEM technology supply	Potential patents and design patents	Medical technology, diagnostics and monitoring
Data sampling: filter analysis	Zug Medical	Potential manufacturing by French-Hungarian SME	Technical files and proprietary manufacturing protocols	Clean building ventilation, smart homes, hospitals, shopping centres and large-scale constructions.

The HoloZcan project increases (environmental and exhaled) bio-aerosol sensing/measurement capability of CBRN practitioners by developing a high resolution, large throughput, automatic and highly portable detection system for making automatic classification of pathogens and particles. HoloZcan develops of a novel holographic microscopy and imaging technology for rapid and cost-efficient screening of potential biological threats and unknown, potentially dangerous substances, combined with methods of artificial intelligence and machine learning. It establishes a framework of a dynamic feature selection and validation algorithm to support the continuous innovation capability of the system in the field of adaptive learning and database optimization for specific bioinformatics applications. The project also develops comprehensive and innovative means of respiratory, ventilation and environmental biological data sampling that can be used in a real-time, standoff or in mobile bio-detection context.

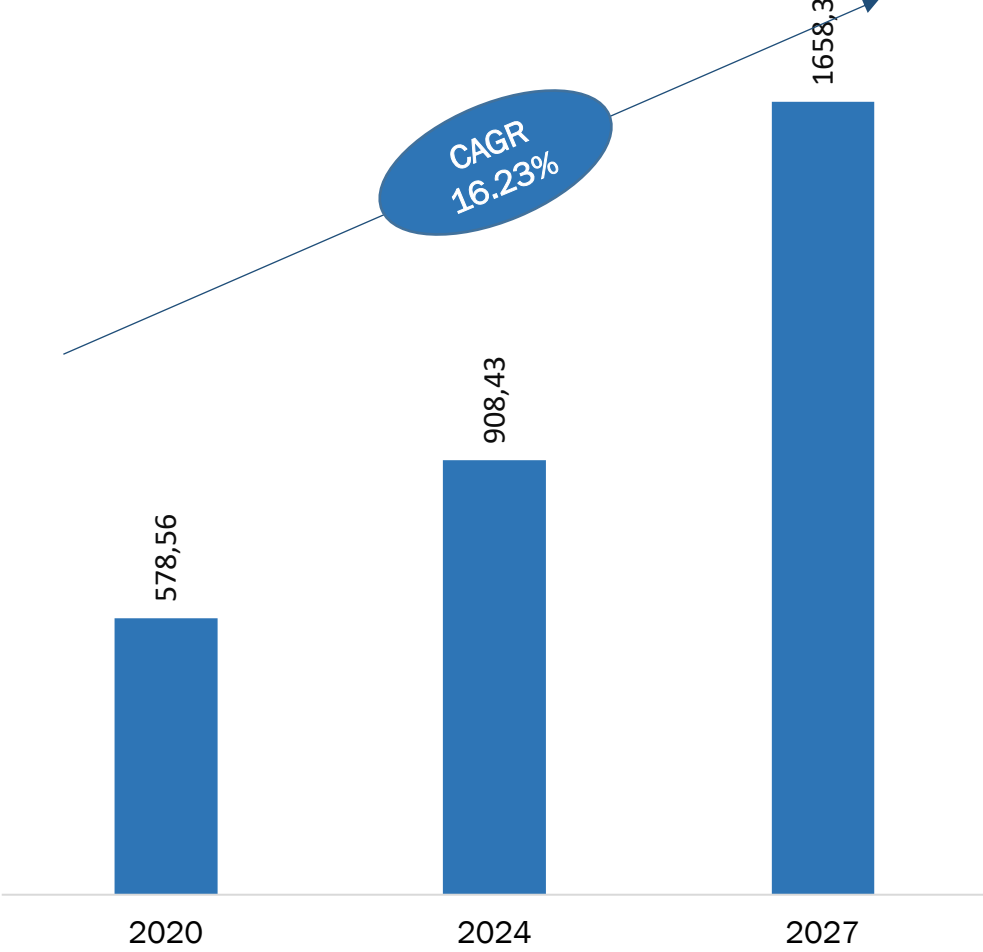
The core technology of the Holozcan project is Digital Holographic Microscopy (DHM). The global DHM market was valued at USD 578.56 Million in 2020 and it is expected to reach USD 1658.37 Million by 2027, registering a CAGR of 16.23% during the forecast period.

Digital holography, the technological core of HoloZcan, is a particularly powerful technology for metrology applications, as a number of recording and processing systems have been developed to study optical wave parameters.

CCD and imaging technologies have opened new industrial horizons. In imaging applications, digital holography is a new technique that also simplifies the complex sampling process of detection.

New holographic technologies such as 3D technology are also expected to contribute to the growth of the digital holographic microscopy market.

Digital holographic Microscopy Market Revenue in USD Million, Global, 2020-2027



Data source: M.Market Research

The initial costs of purchasing digital holographic microscope equipment or holographic screens are high. The technology is often costly, with the use of objective lenses and specialised digital imaging systems accounting for the bulk of the expenditure. In addition, the scope of the technique is limited by the high computational cost of processing holograms. Computing holographic reconstructions requires high processing power, memory and storage when holography is applied to 3D imaging techniques.

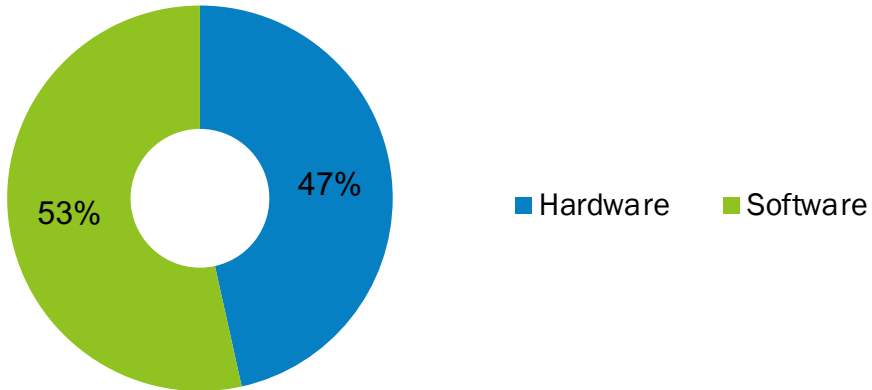
Digital holography is being used in an increasing variety of applications. However, professionals usually have little knowledge of this key technology.

The software segment dominates the market, accounting for 53% of the market value. Software algorithms are used in computers to reconstruct holographic images. These algorithms produce high quality 3D images in advanced systems in a shorter time. The hardware segment is expected to grow at a CAGR of 15.79% over the forecast period.

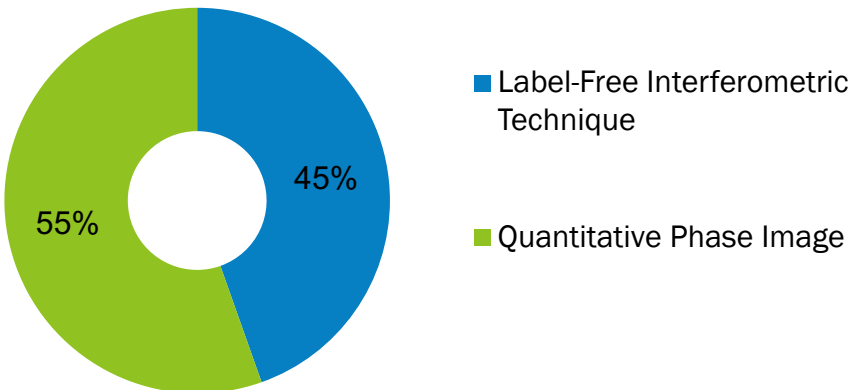
In industrial applications, this technique is increasingly used for micro-level analysis of fabricated surfaces. The health care and medical education segments are also expected to grow with the increased use of digital holography and 3D visualisation displays to make learning easier and more interesting. Companies introducing cutting-edge technology such as 3D kits for medical students and doctors are likely to help them practice surgery without using real bodies and organs. Underwater imaging with digital holography is another promising development. The use of DHM microscopy to study the quality of seawater and freshwater is an important area.

North America is the market leader in the digital holographic microscopes market. Moreover, North America is home to major digital holographic solutions manufacturers; the growing demand for holographic solutions in various industries such as commercial, aerospace and defense, medical, and others is a major driving force in establishing the market in the region.

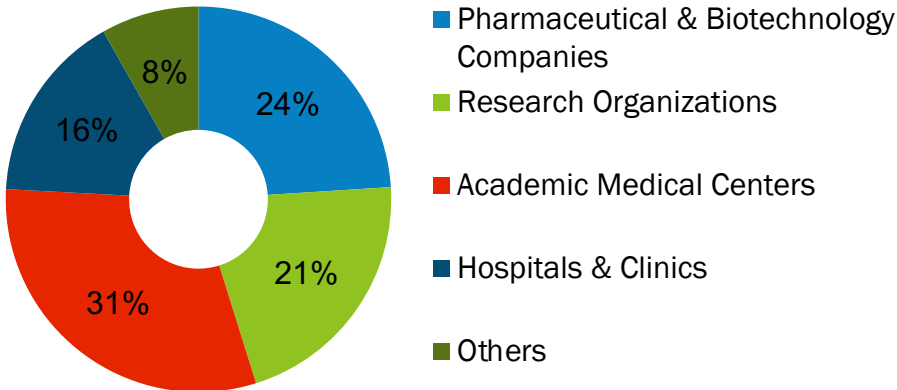
Digital Holographic Microscopy Market
Revenue Share (%), by Offering, Global, 2020



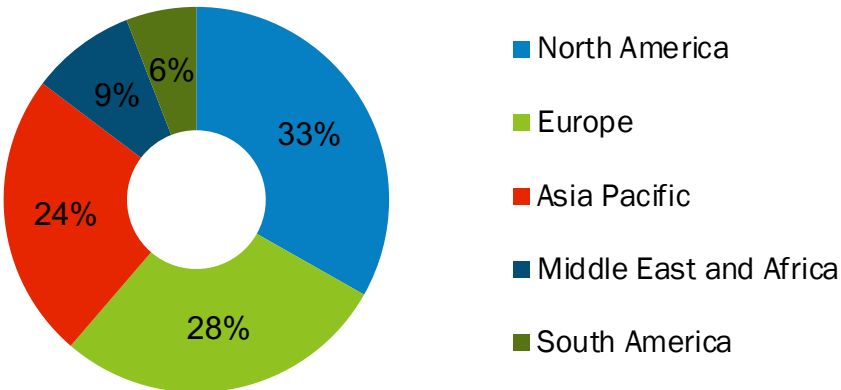
Digital Holographic Microscopy Market
Revenue Share (%), by Type, Global, 2020



Digital Holographic Microscopy Market
Revenue Share (%), by Application, Global, 2020



Digital Holographic Microscopy Market
Revenue Share (%), by Region 2020



Data source: M.Market Research

Digital holographic microscopy (DHM) is one of the comparatively new technology in the field of high-resolution microscopy. Substitution of conventional holography photochemical procedures by electronic imaging create the opportunity to apply microscope visualization to a wide range of possible applications from other fields e.g. microbiology, medicine. New inventions were carried out to conduct quantitative phase and fluorescence imaging at the same time, and thus this newly invented method served to be the new foundation technology for the visualization of biological tissues and cells. New technologies are further developed in digital holographic microscopes for improving light usage efficiency.

The digital holographic microscopy market is expected to grow as many organizations are ready to purchase digital holograms for their products as they provide greater protection against piracy. Similarly, the high demand for holographic displays for near-eye applications, as well as rising investments in digital holography, will provide ample new opportunities.

Furthermore, the increased capability of present computers in numerical processing provided the DHM the superiority in regard to robustness, measurement rates and easiness in use.

Holographic imaging is gaining popularity in the education and training industries, it can add value to remote and hands-on learning by simulating learning environments for better understanding and retention of concepts. Moreover, factors such as product availability and a broad range of applicability are driving revenue growth in the holographic imaging market.

In microorganism microscopy DHM can offer an advantage by furnishing label-free, minimally invasive and particularly sensitive technique of imaging exquisite shifts in physiological and physical states of microorganism and their properties.

The growing demand for digital holography in medical imaging for accurate diagnosis. The increasing demand for high-tech solutions in the manufacturing and healthcare industries is also driving the demand for digital holographic microscopy and the digital holographic microscopy market.


In sum, a positive trend for the HoloZcan project is that the market for digital holographic microscopy is expected to grow. Increasing investment in digital holography will provide ample new opportunities, which could lead to growth in the digital holographic microscopy market



Method

CHAPTER 2


Stakeholders Programme



Programme details and Letter of Intent

HoloZCAN's approach is to propose to the Community of Users a possibility to join our Stakeholders' Programme. The goal is to have a focus group to (i) share selected issues for discussion, and (ii) engage in individual dialogues to understand the specific needs from each representative of the selected application areas, based on pre-identified scenarios. Each Stakeholder has to sign a Letter of Intent to join.

Stakeholder's Horizon



Marlène Gaboriau is a specialist in Environmental Studies, Ecology and Evolution. She contributes to HoloZCAN Stakeholder groups. # Industrial detection needs and # Gender / Women in Science. About the project she says:

"HoloZCAN is a promising interdisciplinary project that could potentially improve the response management system for first responders in emergency situations. Bridging engineering and biology, the development of this technology would be an exciting step in the field of CBRN detection."

Marlène Gaboriau is a Field Application Scientist at Bertin Technologies, France.

The objective of the report is to present a comprehensive analysis of the Holographic Microscopy and Air Sampling Market including all the stakeholders of the industry.

The report presents the current state of the industry and forecast market size and trends, building on M. Market and Research market analysis.

The report includes an introduction to the key players and calculates the potential impact of microeconomic factors along the lines of market dynamics analysis.

The external and internal factors that should influence the business, positively or negatively, are presented. The market study also made extensive use of a wide range of primary (interview with CBRN users, industry experts and manufacturers) and secondary data sources (e.g. Annual reports, Journals, Publisher Repository etc.)

We build on the results of the ENCIRCLE project carried out and published to date.

For the analysis of market size estimations; market forecasting; market breakdown in this study, we used the M.Market and Research paid database.

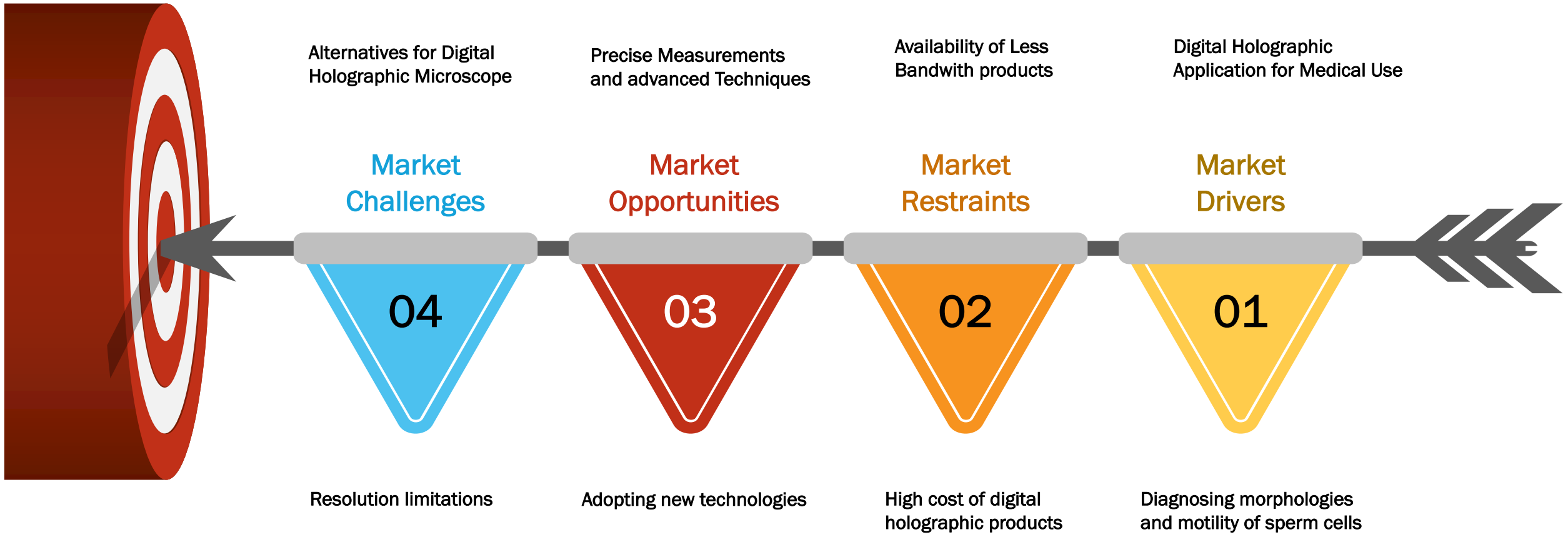
System architecture and service design, testing, demonstration activities, design and evaluation are driven by user needs. Use cases were developed in collaboration with stakeholders.

In the framework of the project's stakeholder programme, we established a partnership with Bertin Technologies SAS, which was involved in the development of use cases and prototype testing.



Maket dynamics

CHAPTER 2



Accessibility of HoloZcan approach for research, education, and biomedical applications

- DHM was also applied to determine the inflammation degree both in experimental colitis and in human biopsies, as well as for sperm quality analysis, enlarging even more the possible applications in biomedical sciences and diagnosis.

Digital Holographic Microscopy Application for Detection of Infectious Diseases

- DHM technique has already been used to detect other infectious diseases in vitro or in human samples, such as Plasmodium-infected cells, or infection by Babesia microti,
- DHM has even been reported for SARS-Covid-19 detection in infected patients by analyzing morphological changes in their red blood cells (RBCs).
- Other viral infections, such as vaccinia virus (VACV), herpes simplex virus (HSV), and rhinovirus (RV), were revealed by DHM in different cell types according to oscillations in the infected cell volume. The reduction in the refractive index of macrophages infected with Salmonella typhimurium also allowed the classification of macrophages between non-infected and infected ones.

Digital Holographic Microscopes' potential use in diagnostics

- DHM technology can also find easier, large applications in the diagnosis of diseases requiring cutting-edge cellular imaging technology, such as cancer or red blood cell disorders. Indeed, both biology (marine biology, parasitology, cell biology) and human diagnosis research (tissue 3D organization and dynamics) are very active fields on these research fronts and several proof-of-concepts have already been published.

Lensless digital holographic microscopy and smartphones with holographic imaging

Increasing usage for accurate measurement

- Digital holography quantifies the form and displacements of things by capturing holograms using digital cameras and numerically reconstructing them. The technique allows for the rapid and exact measuring of 3D geometry

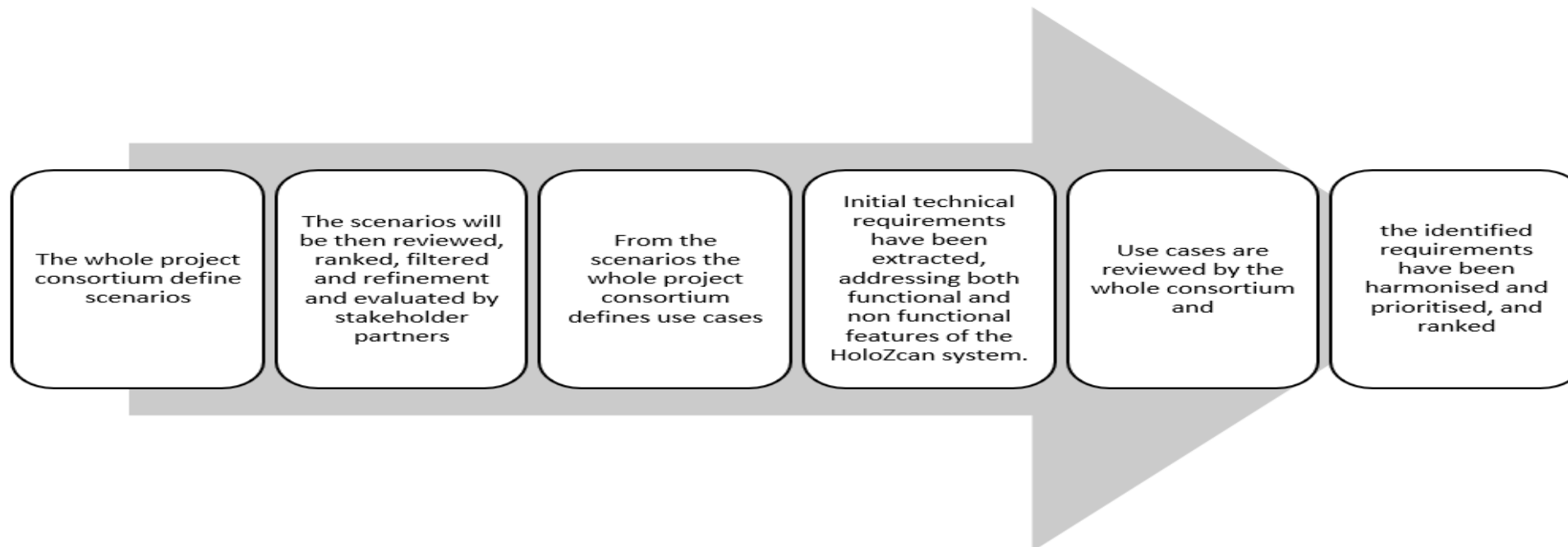
Using DHM and 3D methods for red blood cells (RBCs) classification

The technique can be adapted for the analysis of various cellular dynamics

- DHM allows the early detection of morphological changes and apoptotic cells both in adherent 136 and suspension cells 137. Therefore, the technique can be adapted for the analysis of various cellular dynamics, such as drug-induced changes in cells 138, to monitor laser microsurgery on cells, for quantitative evaluation of the damage and repair of cells, for drug screenings, and to monitor cellular organelles in real time.

DHM could also be easily applied to veterinary medicine and animal disease transmission studies

The HoloZcan project uses a number of techniques to explore scenarios, use cases, requirements and user needs for the system and its main components. Scenarios were defined in several rounds. In the first round, scenarios were defined as a broad use case and presented on the HoloZcan website. Gradually, feedback was collected from all stakeholders on the selection of these application areas by signing a letter of intent during the registration process. Use cases of interest to stakeholders and initial technology concepts were discussed in a stakeholder workshop in December 2021.

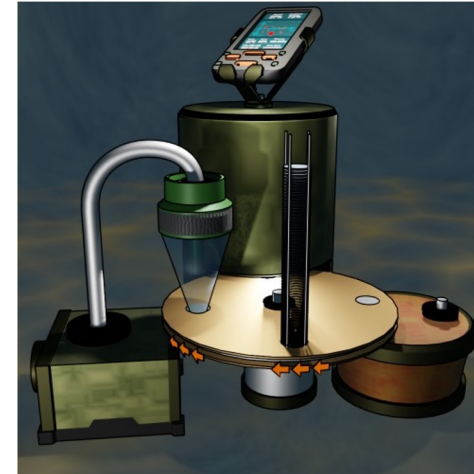




HoloZcan
Exhaled Breath
Collection device
and cartridge
system for
microscopic
analysis



HoloZcan
Handheld or
light setup with
different
sampling heads
for parcel scan
and on-site
works



HoloZcan
Automated
and continuous
indoor air bio-
agent
monitoring with
integrated dry-
collector



HoloZcan
HoloZcan on a
disposal robot
with remote
control.



HoloZcan
Micro-fluid setup
for aerosol
continuous
monitoring



Automated and continuous indoor air bio-agent monitoring with integrated dry-collector & Micro-fluid setup for aerosol continuous monitoring

- HoloZcan project is developing a system that can monitor and detect certain infections. It can be used to monitor the ventilation system or to check the indoor air quality in public spaces.



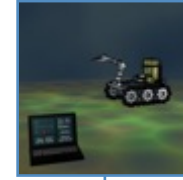
Exhaled Breath Collection device and cartridge system for microscopic analysis

- HoloZcan makes entry and exit screening more effective by providing users with a highly accurate filtering tool to identify those who should be screened further (secondary screening undertaken in isolation room by medical doctor or clinical nurse).
- COVID-19 transmission control
- respiratory diseases control (-Viruses: Paramyxoviridae; Orthomyxoviridae; Coronaviridae; Adenoviridae; Parvoviridae; Polyomaviridae AND- Bacteria: Corynebacteriaceae; Legionellaceae; Streptococcaceae; Mycobacteriaceae; Pseudomonadaceae; Chlamydiaceae)



Handheld or light setup with different sampling heads for parcel scan and on-site works

- the HoloZcan project develops a third-generation optical-based bio-detection system that combines a confocal and a digital holographic microscope (DHM) and other modalities for mail and parcel detection and detecting new potential threats.



HoloZcan on a disposal robot with remote control.

- to assess contamination of environmental air
- HoloZcan project develops a system capable of detecting the presence of certain biological agents within a fast response time (seconds to a few minutes).

Market Restraints DHM

Confidentiality in CBRN area:

- Norms are not globally standardised (differences between EU, UK, North America, etc.) which makes it difficult to reach global validation of products.
- HoloZcan can try to use as reference civil and/or military standardised norms and test protocols if possible (ISO, EN, BS, NFPA, ASTM, STANAG, etc.)

Technology limitations:

- Although the technology of CCD cameras is improving rapidly, they still have a limitations. The cameras with the right resolution are expensive. Factors such as the finite size of the camera and the finite pixel size of the detectores limit the performance of the digital holographic microscope.
- High material cost of digital holographic microscopy. Laser diode, optical lenses and CCDs could be very expensive.

Limitation in testing:

- Tests can be very expensive esp. full system testing.
- International export control regulations and customs procedures:
- Regulations make it sometimes difficult and costly to transport equipment and materials from/into countries, which is especially challenging when the use takes place outside the EU.
- CBRN equipment, being “dual use” by nature is often under specific import/export regulations.
- It usually takes time to obtain authorisation for export/import of materials and information,

Resolution limits and limited ability for identification:

- The concept of a holographic microscopy system must have sufficient sensitivity to the optical properties of the sample to aid particle classification. This can be broken down into sub-objectives with increasing technical difficulty: a) Detection: distinguishing microorganisms from other types of particles (e.g. dust), b) Identification: identifying different biological particles.
- HoloZcan can be primarily used for detection and classification and has limited capability to identify pathogenic particles.
- The size of bacteria is roughly 0.5 to 2 μm . The size of respiratory viruses like SARS-Covid2 is below 100nm. The size of a bacteria can change throughout its lifetime. Although the shape of different bacteria can vary, the shape of a specific bacteria is also not constant over its lifetime. This limits the use of morphological information.

Lack of technological awareness of users in the market

- Few users are aware of DHM technology, which is why the HoloZcan project is also developing online training content.
- Expertise is needed to use and operate the high-resolution digital hologram microscope.
- Digital holography is increasingly used in a wide range of applications. But there are differences in professional understanding of this key technology.

Alternatives for HoloZcan

- In the past decade, several technological advances allowed to design and elaborate of new bio-detection technologies. Miniaturization brings to reality the most expected today's requirements, i.e., efficient field-portable devices for airborne threats.
- Real-time detection area made possible to identify a variety of substances, including the possibility to pinpoint single cells in a short lapse of time. This approach combining infrared and visible sensors, ultraviolet, and terahertz lasers in order to perform the identification of biological aerosols remotely. Other technologies with long-term perspectives are Surface-Enhanced Raman Spectroscopy (SERS), Single Particle Aerosol Mass Spectrometry (SPAMS) or the hand-held portable LED microarray reader.

Alternatives for HoloZcan



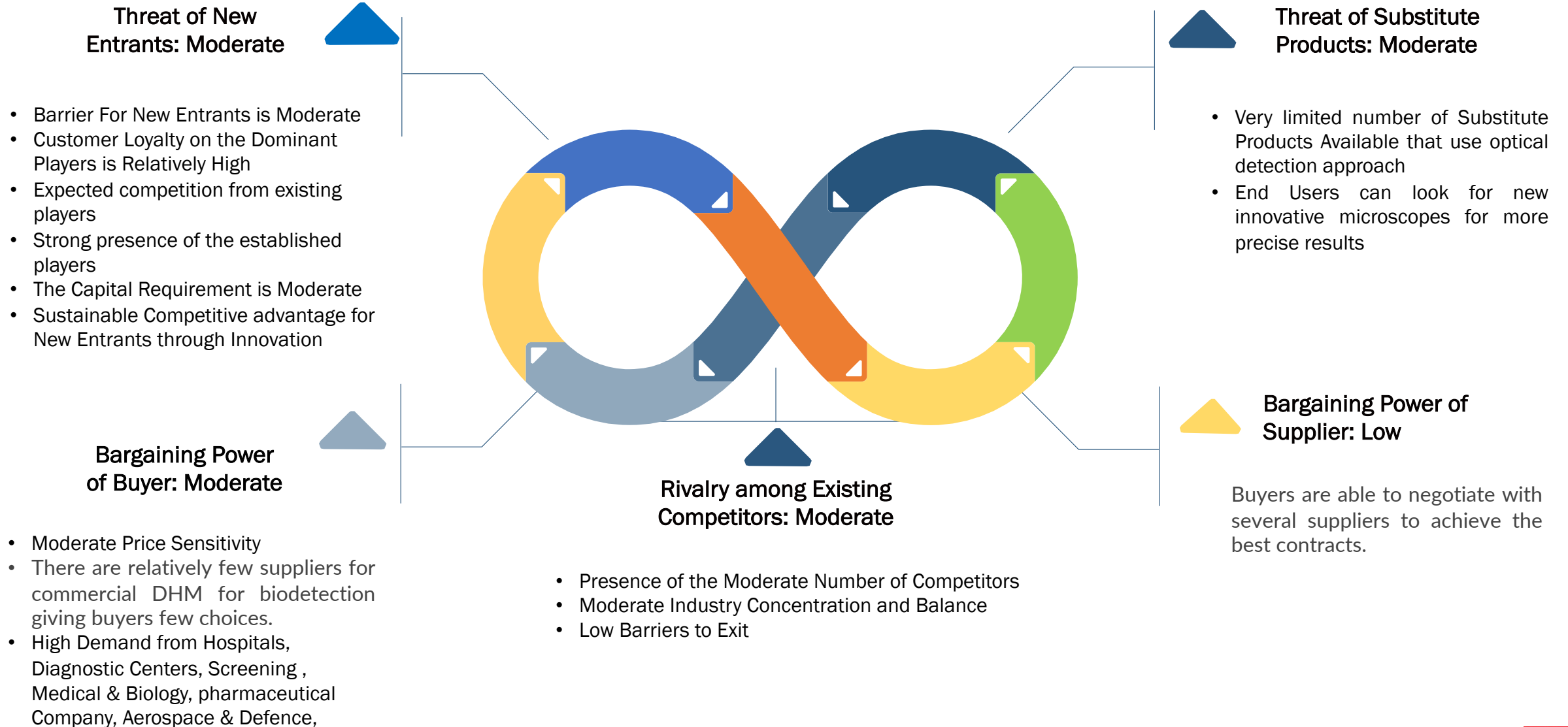
- Lot of biodetectors exists with different features on different price
- One part of them using optical methods witch is chap and fast solution, but its accuracy is lower
- Fast, mobile, easy-to-use and reusable, remotely controllable devices for first responders are missing from the market



Optical Detectors



PORTER Five Force Analysis for HoloZcan system



PESTEL Analysis



Politics

Trade regulations and tariffs related to Consumer Service

Wars and crisis bring many uncertainties >

Legal

IPRs and Data Protection laws >
In CBRN, confidential standards make the work of technology developers difficult..

Environment

The influence and effectiveness of local/federal and national level environmental and biosecurity standards and waste management policies of the local and national region >
Impact of climate change of spreading new pathogens

Economy

<
High inflation rates can make the development process and the final product more expensive
Budget deficit due to economic crisis pushes back public procurement
Supply Chain Shortage (inc. Chip shortage) can make the development process more difficult

Social

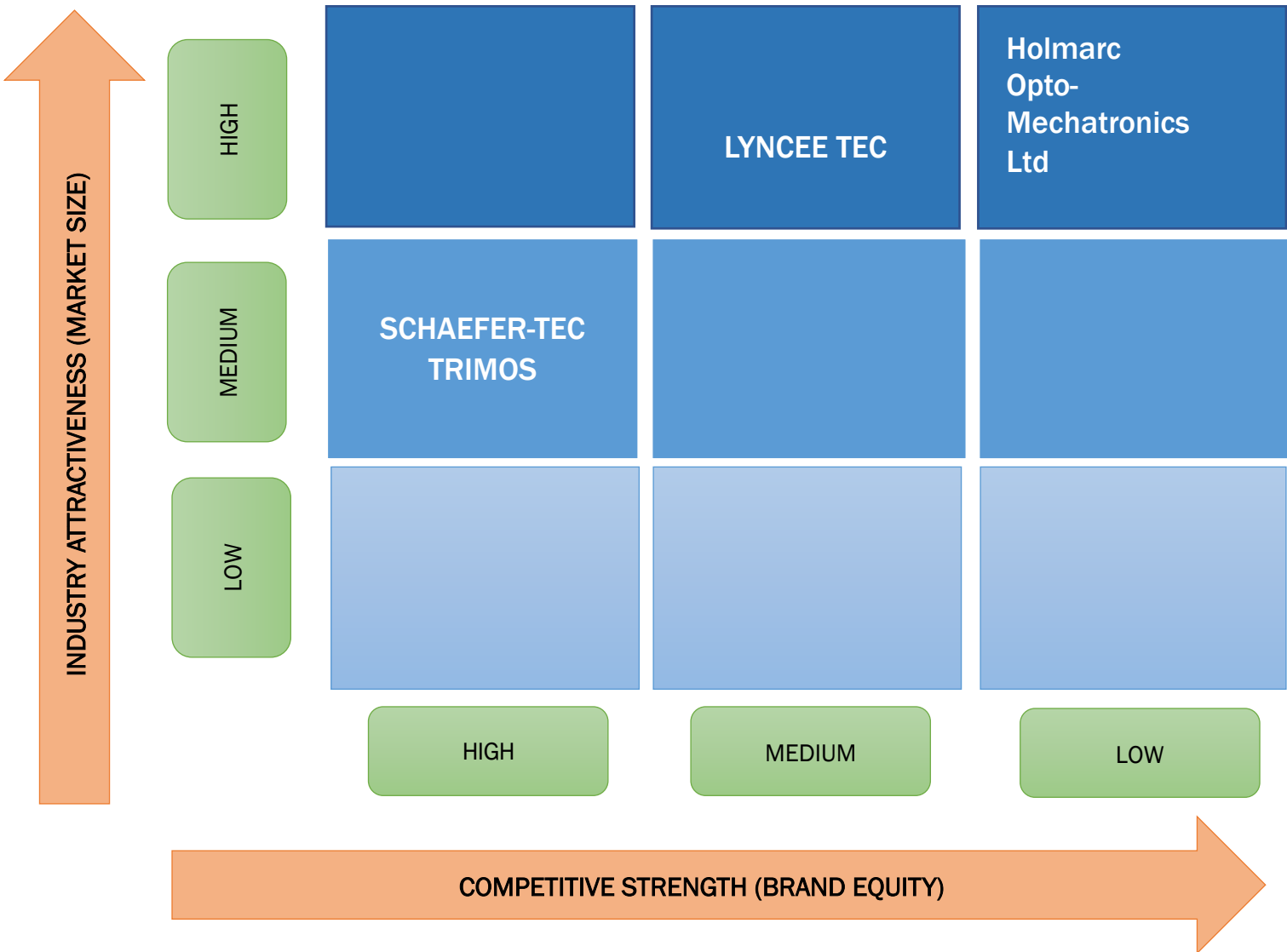
<
Level of Social Concerns & Awareness of Security in Society
New pathogens and infections can emerge and spread.

Technology

<
The market for digital holographic microscopy is undergoing a number of innovations, and these technological innovations are increasing the number of applications in which digital holographic microscopy can be used.



Competition Matrix HoloZcan



Data source: M.Market Research



Important competitors HoloZcan

Name & Ref.	Year	Light Source	Image Sensor	FOV	Architecture	Super-resolution	Lateral resolution
Holomark HO-DHM-UT01 ³³	2017	650nm LD, 5mW	2.4um 3088 x 2076 IMX178LQJ-C	185 x 124um	Off-Axis +lens 40X, 0.65 NA	Only with extra module	1um
Schaefer Italy / LynceeTec DHM T2100 ^{34 35}	2017	666nm, 794nm 0.01nm/°C 1μW/cm2	Not defined	66x66 μm 5x5 mm	1.25x to 100x	Only with extra module	300nm
Essencedesign DHMS1 / Trimos TR SCAN 3D DHM ³⁶	2020	665nm, 850nm	Not defined	250x250 μm	Off-Axis +lens 10x	Only with extra module	500nm



NATO AEP 66, AJP 3.8	ALLIED JOINT DOCTRINE FOR CHEMICAL, BIOLOGICAL, RADIOLOGICAL, AND NUCLEAR DEFENCE	Provides North Atlantic Treaty Organization (NATO) strategic and operational commanders with fundamental principles for the planning, execution, and support of NATO operations for which the threat and/or risk of intentional or accidental use of chemical, biological, radiological, and nuclear (CBRN) substances are either assessed or exist
STANAG 2352	Chemical. Biological. Radiological And Nuclear (CBRN) Defense Equipment - Operational Guidelines	To provide a NATO agreed document detailing CBRN defense equipment requirements based on the main threats from CBRN weapons or devices and potential hazards originated (resulting) from toxic industrial materials (TIM) within operational area in general and deployed NATO forces in particular.
AEP-10	Allied Engineering Publication 10: NATO Handbook for Sampling and Identification of Biological and Chemical Agents (Procedures and Techniques)	Development of a capability for the timely sampling and unambiguous identification of biological, mid-spectrum and chemical warfare agents in a battlefield environment or in operations other than war. The aim is to confirm their first use by the enemy and thereby support timely politico-military decisions concerning an appropriate NATO response to such actions
AEP-66	Allied Engineering Publication 66 Edition 1: NATO Handbook for Sampling And Identification Of Biological, Chemical, And Radiological Agents (SIBCRA)	NATO Handbook for Sampling and Identification of Biological Chemical and Radiological Agents (SIBCRA) and of the CBR FORENSIC SAMPLING TRAINING CONCEPT (FRTC) are important tasks which were identified by the JCBRN Capability Development Group (CDG) and passed on to the subordinate CDG panels.
RFI-ACT-SACT-12-02-2,	NATO Standard CBRN Sensor Interface,11 January 2013	(RFI) to support establishment of a NATO Standard CBRN Sensor Interface

Sr No.	Market Regulations	Description
1	ASTM (American Society for testing and Materials) Committee E04.11	<p>ASTM International is known for publishing many standards specifically about using microscopy. The value of these standards falls into three distinct categories.</p> <ol style="list-style-type: none"> 1). They are a quick tutorial on how to perform some operation. E 1508, "Standard Guide to Quantitative Analysis by EDS" 2). They can be utilized to standardize a test and reporting procedure. The methods are specified in E 1382, "Standard Test Methods for Determining Grain Size by Semiautomatic and Automatic Image Analysis" are examples of procedures that have been agreed upon for many years. 3). Standard practices can be used to provide accrediting agencies with evidence of accepted laboratory procedures. E 766 "Standard Practice for Calibrating the Magnification of an SEM" can be utilized.
2	ASTM (American Society for testing and Materials) E2142-08(2015)	This standard specifies the methods to be used in order to analyze images produced from light microscopy which also includes the mention of SI units that should be used during the analysis.
3	ASTM (American Society for testing and Materials) E -883	This guide outlines various methods which may be followed in the photography of metals and materials with the reflected-light microscope. Methods are included for preparation of prints and transparencies in black-and-white and in color, using both direct rapid and wet processes.
4	ASTM (American Society for testing and Materials) E -175	This standard contains the definitions of the terminology used in microscopy and it outlines various methods followed with the reflected light microscope that yield photomicrographs.

Sr No.	Market Regulations	Description
5	WHO Technical Report Series, No. 961, 2011 : WHO good practices for pharmaceutical microbiology laboratories	Microbiological testing should be performed and supervised by an experienced person, qualified in microbiology or equivalent. Staff should have basic training in microbiology and relevant practical experience before being allowed to perform work covered by the scope of testing.
6	WHO Technical Report Series, No. 961, 2011 : WHO good practices for pharmaceutical microbiology laboratories	The regulation specifies that the laboratory management should ensure that all personnel have received adequate training for the competent performance of tests and operation of equipment. This should also include training in basic techniques, e.g. plate counting of colonies, pouring, serial dilutions, aseptic technique, media preparation, and basic techniques in identification, with acceptability determined using objective criteria where relevant.
7	WHO Technical Report Series, No. 961, 2011 : WHO good practices for pharmaceutical microbiology laboratories	The clean-room classification and air-handling equipment of the sterility test facilities should be requalified at least annually by a competent person or contractor. The environment should comply with the non-viable and viable limits, and verification of high efficiency particulate air (HEPA) filter integrity and room airflows should be performed. However, an alternative frequency of the monitoring may be justified based on quality risk management (QRM). Mapping locations for sample points for routine monitoring should be documented, as well as exposure duration, and frequency of all types of microbiological environmental monitoring should be specified in written procedures

There are several CEN/CENELEC and ISO/IEC Technical Committees where the topic of detection can be raised.

CEN/CENELEC/JTC 4 Service for fire safety and security systems

- CEN/CENELEC/JTC 13 Cyber security and data protection
- CEN/TC 325 Crime prevention through building facility and area design
- CEN/TC/391/Working Group 2 -CBRNE
- CENELEC/TC 79 Alarm systems
- CEN-CLC Sector Forum on Security
- ISO/IEC/JTC 1/SC 27 Information security, cybersecurity and privacy protection
- ISO/TC 262 Risk management
- ISO/TC 292 Security and resilience
- ISO/TC 283 Occupational health and safety management
- ISO/TC 329 Consumer incident investigation guideline



**Digital Holographic
Microscopy Market
segmentations and size:
Global and Europe**

CHAPTER 4



- Local Government
- Regional Government
- National Government
- EU Policy/decision maker
- International Organisations (i.e. UN, Red IAEA, OPCW etc.)
- Border Guards
- Procurement Agencies
- Custom Authorities
- Network of practitioners
- Training Centres
- Reference Laboratory
- Health sector
- Veterinarian sector
- Water sector
- Environmental monitoring

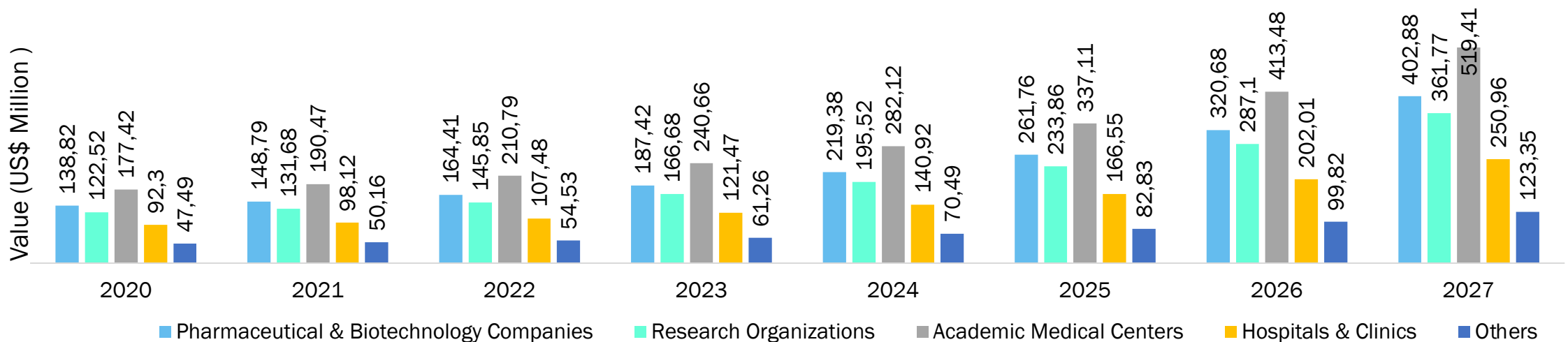
Value proposition

Customer segment:	CBRN users	
Products or segment's features <div data-bbox="155 629 1223 1282" style="background-color: #f4a460; padding: 10px; margin-top: 10px;"> <p>User-friendliness/intuitiveness of usage; Compactness (size and weight); Robustness; High screen visibility; Presence of alarms; Clear instructions/manuals; Stamp time and coordinates if the alarm is activated; Less maintenance required; Battery lifetime; Connectivity; Versatility (use for chemical, biological and radiological detection).</p> </div>	According to the ENCIRCLE market study <div data-bbox="1294 689 2379 1146" style="margin-top: 10px;"> <p>Performance benefits User-friendliness/intuitiveness of usage; Compactness (size and weight); Robustness; Versatility (use for chemical, biological and radiological detection); Battery lifetime;</p> </div>	

Global Digital Holographic Microscopy Market Size (US\$ Million) Forecast, by Application, 2020-2027

Type	2020	2021	2022	2023	2024	2025	2026	2027	CAGR%
Pharmaceutical & Biotechnology Companies	138.82	148.79	164.41	187.42	219.38	261.76	320.68	402.88	16.44%
Research Organizations	122.52	131.68	145.85	166.68	195.52	233.86	287.10	361.77	16.73%
Academic Medical Centers	177.42	190.47	210.79	240.66	282.12	337.11	413.48	519.41	16.59%
Hospitals & Clinics	92.30	98.12	107.48	121.47	140.92	166.55	202.01	250.96	15.36%
Others	47.49	50.16	54.53	61.26	70.49	82.83	99.82	123.35	14.61%
Total	578.56	619.22	683.05	777.49	908.43	1082.10	1323.09	1658.37	16.23%

Global Digital Holographic Microscopy Market size forecast, by Application, 2020-2027

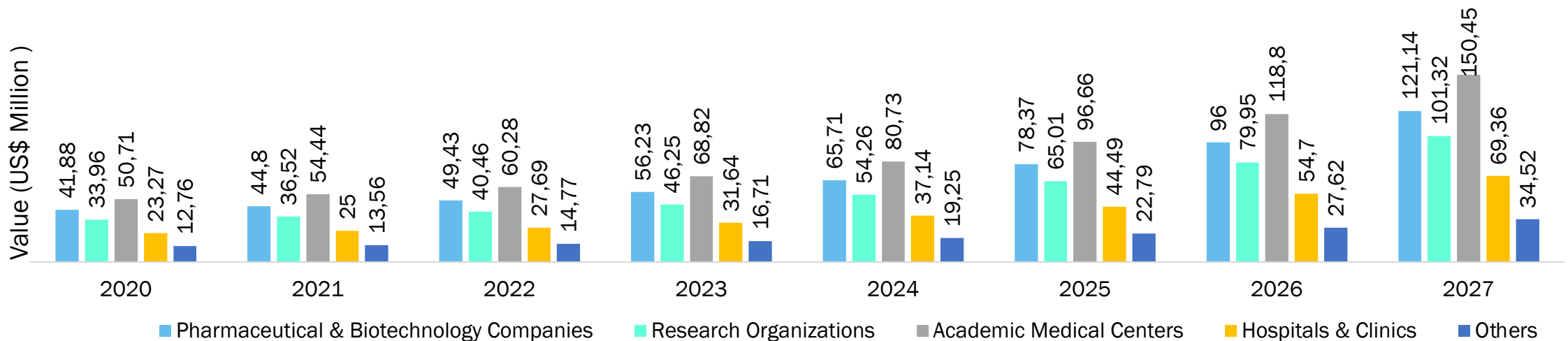


Data source: M.Market Research

European Digital Holographic Microscopy Market Size (US\$ Million) Forecast, by Application, 2020-2027

Type	2020	2021	2022	2023	2024	2025	2026	2027	CAGR%
Pharmaceutical & Biotechnology Companies	41.88	44.80	49.43	56.23	65.71	78.37	96.00	121.14	16.38%
Research Organizations	33.96	36.52	40.46	46.25	54.26	65.01	79.95	101.32	16.90%
Academic Medical Centers	50.71	54.44	60.28	68.82	80.73	96.66	118.80	150.45	16.81%
Hospitals & Clinics	23.27	25.00	27.69	31.64	37.14	44.49	54.70	69.36	16.89%
Others	12.76	13.56	14.77	16.71	19.25	22.79	27.62	34.52	15.28%
Total	162.58	174.31	192.62	219.64	257.09	307.32	377.08	476.78	16.61%

Europe Digital Holographic Microscopy Market size forecast, by Application, 2020-2027

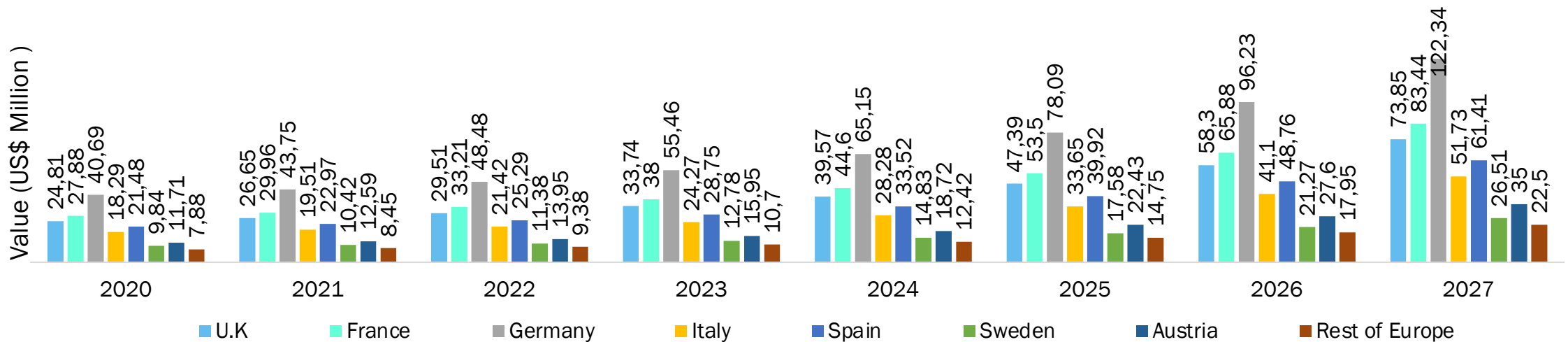


Data source: M.Market Research

European Digital Holographic Microscopy Market Size (US\$ Million) Forecast, by Region, 2020-2027

Type	2020	2021	2022	2023	2024	2025	2026	2027	CAGR%
U.K	24.81	26.65	29.51	33.74	39.57	47.39	58.30	73.85	16.86%
France	27.88	29.96	33.21	38.00	44.60	53.50	65.88	83.44	16.95%
Germany	40.69	43.75	48.48	55.46	65.15	78.09	96.23	122.34	17.03%
Italy	18.29	19.51	21.42	24.27	28.28	33.65	41.10	51.73	16.01%
Spain	21.48	22.97	25.29	28.75	33.52	39.92	48.76	61.41	16.19%
Sweden	9.84	10.42	11.38	12.78	14.83	17.58	21.27	26.51	15.22%
Austria	11.71	12.59	13.95	15.95	18.72	22.43	27.60	35.00	16.94%
Rest of Europe	7.88	8.45	9.38	10.70	12.42	14.75	17.95	22.50	16.16%
Total	162.58	174.31	192.62	219.64	257.09	307.32	377.08	476.78	16.61%

Europe Digital Holographic Microscopy Market size forecast, by Region, 2020-2027



Data source: M.Market Research



Company Profiles

CHAPTER 5

List of Key Players

Holoxica Limited, www.holoxica.com, Products: Holographic, Software, 3D Digital Holograms, Holoviewer App, Services

Hübner Photonics GmbH (and VALO Innovations GmbH), www.hubner-photonics.com, Products: Single Frequency Laser, Laser Combiners, Femtosecond Laser, Optogenetics Solutions

LYNCEE TEC , www.lynceetec.com, Products: Transmission Digital Holographic Microscopy, Digital Holographic Camera, Industrial Digital Holographic Microscopy, Highspeed Digital Holographic Microscopy, Holographic Macroscope

Nanolive SA, <https://www.nanolive.ch/technology/live-cell-imaging/nanolive-imaging/>

Holmarc Opto-Mechatronics, <https://holmarc.com/>



List of Key Players

Realview Imaging Ltd., <https://realviewimaging.com/medical/>

Musion Das Hologram Ltd., <https://musion3d.co.uk/>

MetroLaser Inc., www.metrolaserinc.com Products: Spectroscopic Sensors, Single Point Scanning Systems, Multi Point Scanning Systems, Aero-Optic Simulators

Ovizio, www.ovizio.com Products: iLine F analyzer, qMod Camera

Phase Holographic Imaging, www.phiab.com Products: App Suite Cell Imaging Software, Live Cell Imaging System, , Incubator Microscope, Cell Culture Microscope

SCHAEFER-TEC, www.schaefer-tec.com Products: Automated Recognition Systems, Nanoparticles Analysis, Physical and Chemical Analysis, Single Cell Analysis and Manipulation

TRIMOS, www.trimos.com Products: TR Surface Analysis Instrument (2D and 3D), TR Premium Surface Analysis Instrument,



Part 2



Air Sampler Market (AIRS)

Industry Analysis And Forecast (2023-2030)

The Study Offers:

- A detailed understanding of the current market dynamics and growth opportunities
- An in-depth analysis and forecast for various product types and end-user industries of market
- Impact of COVID-19 on the market studied
- An analysis of the competitive landscape, including key strategies and business developments of the top vendors in the market

Air Sampler Market: Executive Summary

Air Sampler Market: Competitive Analysis

Air Sampler Market: Segmentation

Competitive Analysis

Global Air Sampler Market

Key Market Players

Additional technologies for consideration



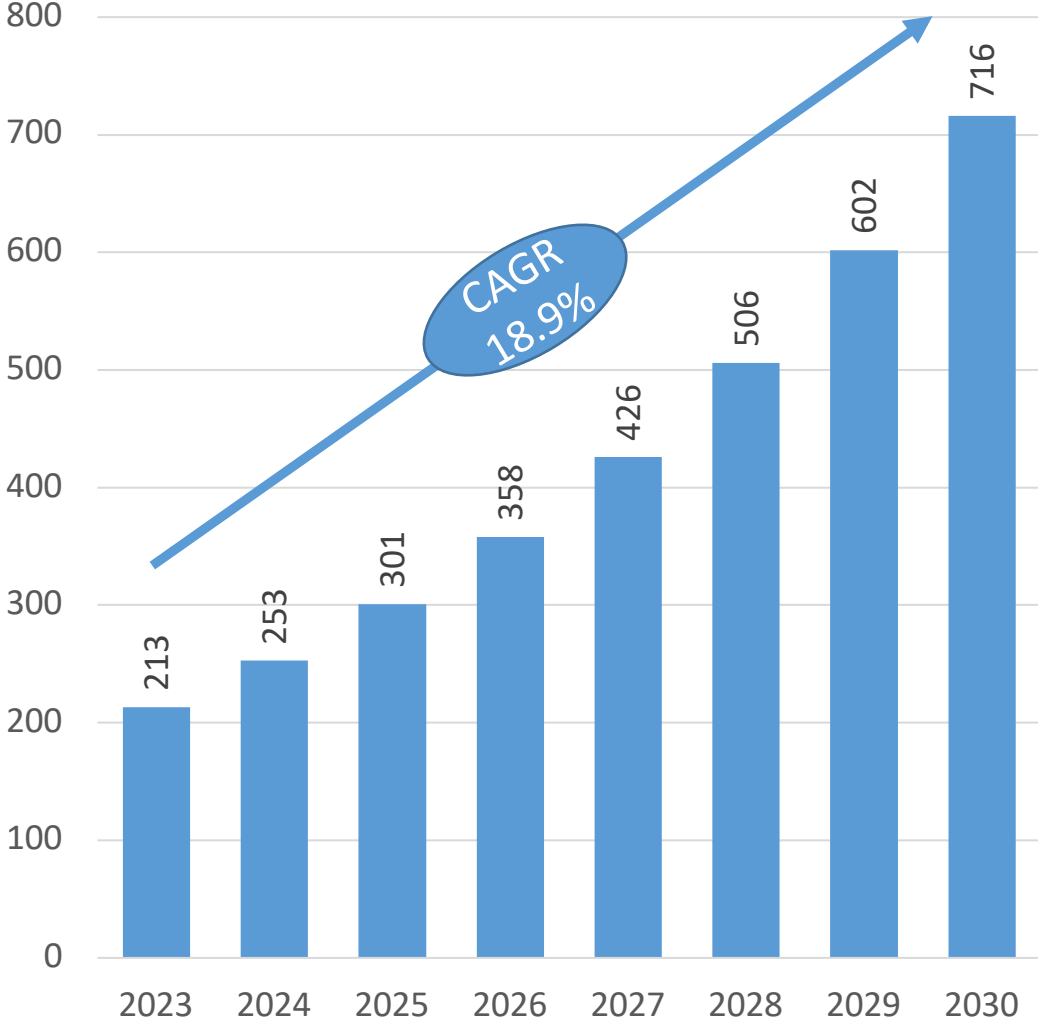
**Executive Summary
and Key findings
AIRS**

CHAPTER 6

Air Sampler Market: Introduction

- An air sampler usually consists of an inlet to direct air into a collector, a filter to screen out larger particles that might interfere with an analysis, a collector where the sample is deposited, a flowmeter and valve to calibrate the air flow, and a pump to pull air through the system
- Air samplers are utilized for microbiological examination of the air during the inspection of the microbiological contamination indoors in all rooms under the supervision of experts and in biology and in clean rooms in the pharmaceutical industry.
- The combination of air samplers with new analysis technologies like digital holographic microscopy, semiconductor antibody-based identification of proteins, DNA, RNA, and bioparticles, fast PCR, laser NIR, and Raman spectroscopy will increase the application.
- Air samplers with automatic particle identification will be important for outdoor air surveillance.
- Air samplers working independent, unsupervised plays a growing role in the environmental CBRN surveillance.

Air Sampler Market
Revenue in USD Million, Global, 2023-2030



Data source: M.Market Research

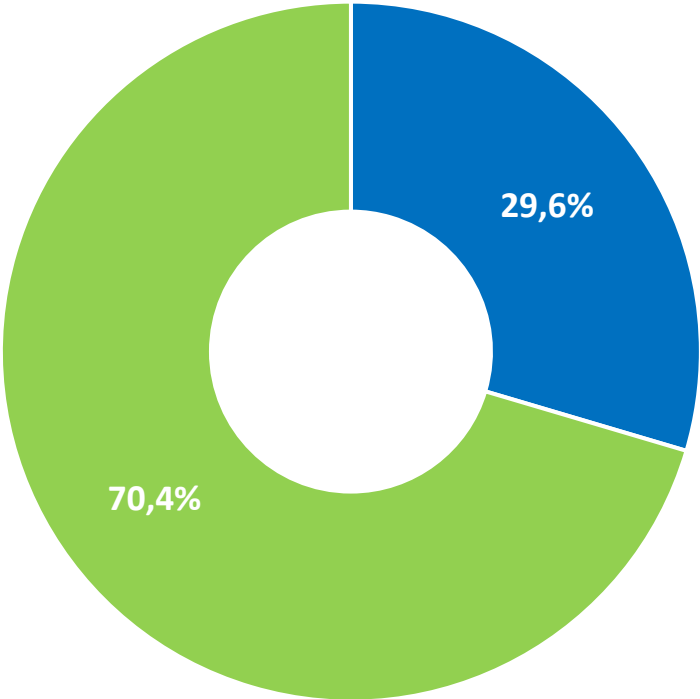
Air Sampler Market: Introduction

- An air sampler usually consists of an inlet to direct air into a collector, a filter to screen out larger particles that might interfere with an analysis, a collector where the sample is deposited, a flowmeter and valve to calibrate the air flow, and a pump to pull air through the system.
- Air samplers are utilized for microbiological examination of the air during the inspection of the microbiological contamination indoors in all rooms under the supervision of experts and in biology and in clean rooms in the pharmaceutical industry.
- The open conflicts in the world like Russian-Ukraine war, and Israel-Palestinian stimulate the application of AIRS for environmental, field and object surveillance.

Air Sampler Market: Key Drivers and Restraints

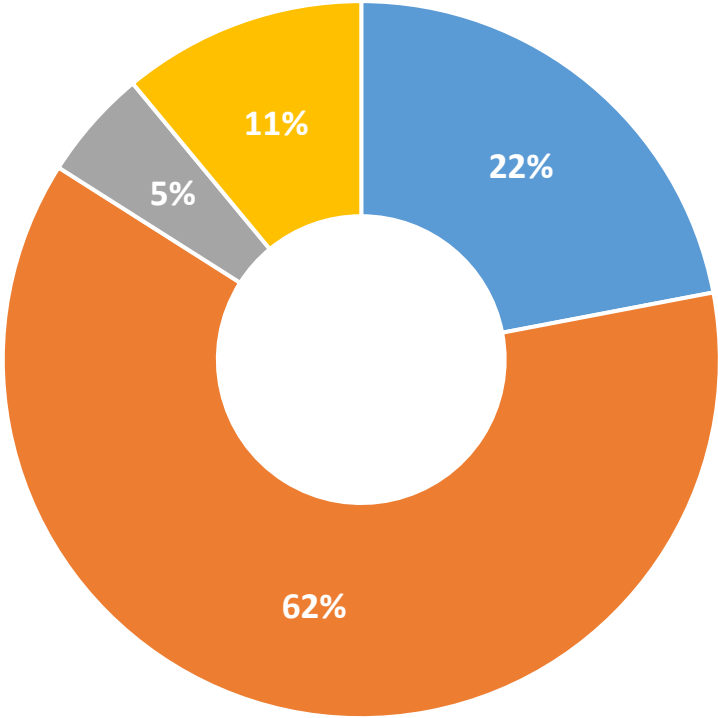
- Several industries have accepted the use of air samplers to produce a certain necessary environment for the manufacturing of their products in order to enhance productivity effectively. Interference of governments, such as amendment of laws to bring hygiene to the food and medical industries, is also fueling the global air sampler market.
- Air samplers are also used to assess the rate of decay to limit the contamination of an area's environment due to rising pollution, which in turn fuels the global air sampler market
- Rising exposure of hazardous air pollutants is boosting the need for the air quality detection for indoor and outdoor applications and consequently propel the global air sampler market
- The global air sampler market is significantly hampered by several adverse factors. Initial costs of installation of these air samplers, which are too expensive for small-scale enterprises, is a major factor that hinders the market.

Air Sampler Market
Revenue Share (%), by Offering, Global, 2023



■ Air Sampler Devices ■ Disposables

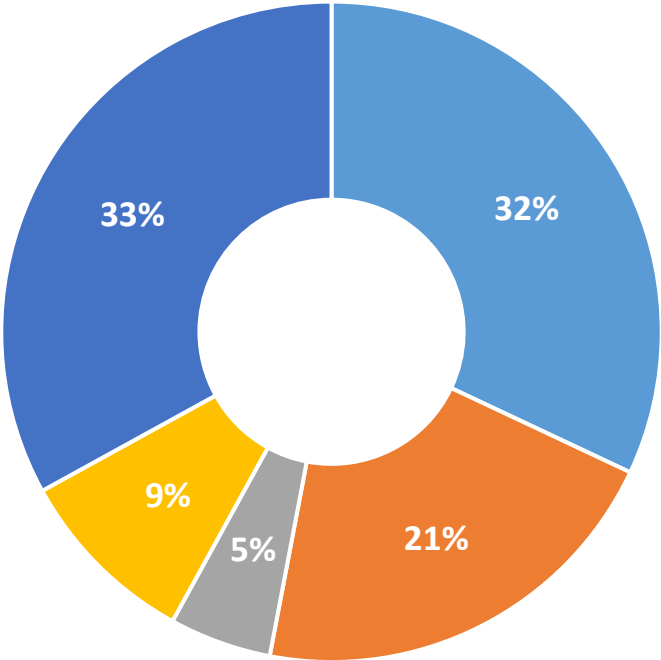
Air Sampler Market
Revenue Share (%), by Offering, Global, 2023



■ Coriolis ■ Impactor ■ Impinger ■ Electrostatic Trap

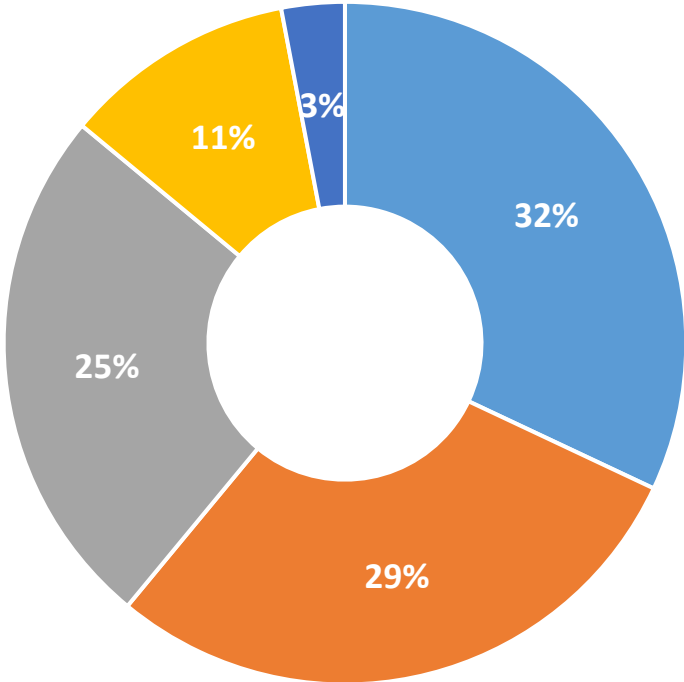
Data source: M.Market Research

Air Sampler Market
Revenue Share (%), by Offering, Global, 2023



- Pharmaceutical & Biotechnological Companies
- Academic Medical Centers
- Others
- Research Organizations
- Hospitals & Clinics

Air Sampler Market
Revenue Share (%), by Offering, Global, 2023



- North America
- Europe
- Asia Pacific
- Middle East and Africa
- South America

Data source: M.Market Research

North America to Capture Major Share of Global Air Sampler Market

- In terms of region, the global air sampler market can be segmented into North America, Europe, Asia Pacific, Latin America, and Middle East & Africa
- North America emerged as the dominant region of the global air sampler market. The market in the region is primarily driven by enactment of government laws about hygiene and cleanliness in food and medical industries. Numerous regulatory authorities including the Occupational Safety and Health Administration (OSHA) in the U.S. and the Health and Safety Executive (HSE) in the United Kingdom are enacting stringent norms to limit the exposure of bacteria and viruses in the air. These are a few key factors that are likely to drive the air sampler market in North America.
- The air sampler market in Asia Pacific is expected to expand at a rapid pace during the forecast period due to large-scale industrialization in emerging countries in the region, which in turn is projected to boost the demand for air samplers in the region. Rise in the number of awareness programs initiated by government bodies regarding rising air pollution and its consequences, which has drawn the attention of many manufacturers in this region, is estimated to propel the air sampler market in the region.

Active Air Sampler Market Size is set to record 18.9% CAGR during forecast 2022-2030

Furthermore, development of fully integrated biopsy devices extends profitable opportunities to the market players in the forecast period of 2022 to 2025. Also, emergence of liquid biopsy will assist in the expansion of the market.

Restraints/Challenges

On the other hand, concerns regarding the product recalls are expected to obstruct market growth. Also, risk of infections is projected to challenge the Active Air Sampler market in the forecast period of 2022-2030.

Covid-19

Covid-19 had a positive impact on the Active Air Sampler market. The medical services such as biopsies witnessed decline in revenues in the years 2020 and 2021 due to the outbreak of COVID-19. Major medical procedures were declined during the pandemic to prevent the risk of spreading coronavirus. However, rise in the number of biopsies is expected in the post-COVID owing to the easing of restrictions.

Military and CBRN Market

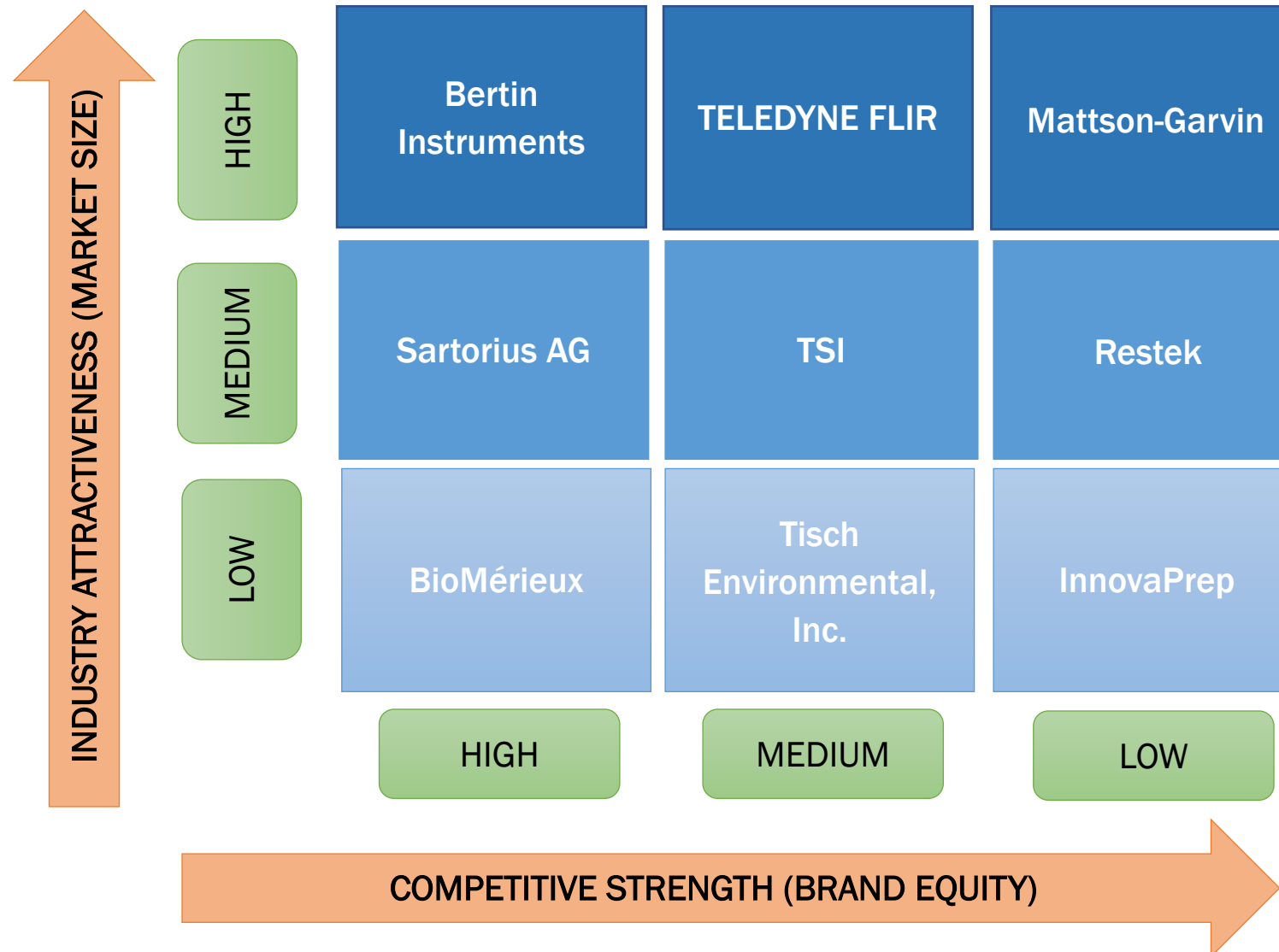
The Russian-Ukraine war changed the political situation fundamentally. Many countries increase the defense budget for protection and surveillance. This will increase the volume of AIRS.

- Deteriorating Air Quality Despite Regulations In-Place Provides the Foundation for Global Growth in Air Quality Monitoring Systems
- Russia-Ukraine War Spells Environmental Disaster for Both Air & Water
- "If You Can't Measure It You Can't Manage It" is the Reason Why it is Important to Monitor Air Quality also for CBRN
- On the Pandemic & Economic Front, Here's What's Happening. Prognosis Every Business Needs to Know
- After Omicron, Comes Stealth Omicron & Deltacron Fueling Fresh Waves of Infections Across the Globe
- With New Strains Emerging at an Alarming Rate, Focus Shifts to Booster Doses & Vaccine Tweaking Amid Waning Vaccine Immunity. But How Practical Is It to Implement Them?
- At the Dawn of 2022 After Numerous New Strains & Millions of Deaths, Challenges in Vaccine Production, Supply, Access & Technology Sharing Continue to Remain
- Split Scenarios Unfold: The Great Vaccine Divide Emerges
- The Great Vaccine Controversy & Growing Anti-Vaccination Movement Aggravates the Divide Between the Vaccinated & the Unvaccinated
- The Verdict's Out - The Pandemic Cannot Be Ended But Can be Maneuvered to Become Endemic and More Manageable
- Amid this Prolonged Pandemic, Why Should Businesses Care About Progress on Vaccinations?
- Dragging Pandemic, New Virus Strains, Fresh Societal Risks, War & Renewed Economic Disruptions Bring Weaker Growth in 2022 as Compared to 2021
- Fresh Shocks for the Global Economy in 2022 as New Bursts of Food & Energy Inflation Comes into Play Triggered by the Russia-Ukraine War
- Supply Chains Tighten Once Gain, bracing for the Widening Economic Storm Being Brewed by the Russia-Ukraine War
- Israelian and Palestinian military confrontations, and others
- The Military & Defense Industry Emerges as the Sole Beneficiary of the War
- Competition
- Competitive Market Presence - Strong/Active/Niche/Trivial for more Players Worldwide in 2022
- see also (<https://www.epa.gov/air-emissions-monitoring-knowledge-base>) Air Emissions Monitoring Knowledge Base, This website provides technical information about emissions monitoring techniques for air pollution control.



**Competitive Analysis
AIRS**

CHAPTER 7



Data source: M.Market Research



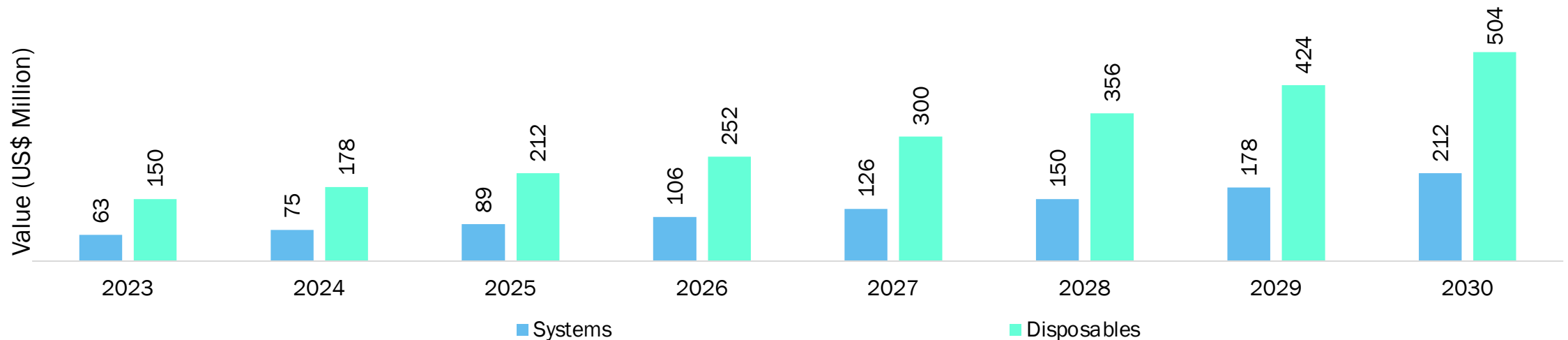
Global Air Sampler Market

CHAPTER 8

Global Air Sampler Market Size (US\$ Million) Forecast, by Offering, 2020-2027

Type	2023	2024	2025	2026	2027	2028	2029	2030	CAGR%
Air Sampler Devices/Systems	63	75	89	106	126	150	178	212	18.9%
Disposables	150	178	212	252	300	356	424	504	18.9%
Total	213	253	301	358	426	506	602	716	18.9%

Global Air Sampler Market size forecast, by Offering, 2023-2030

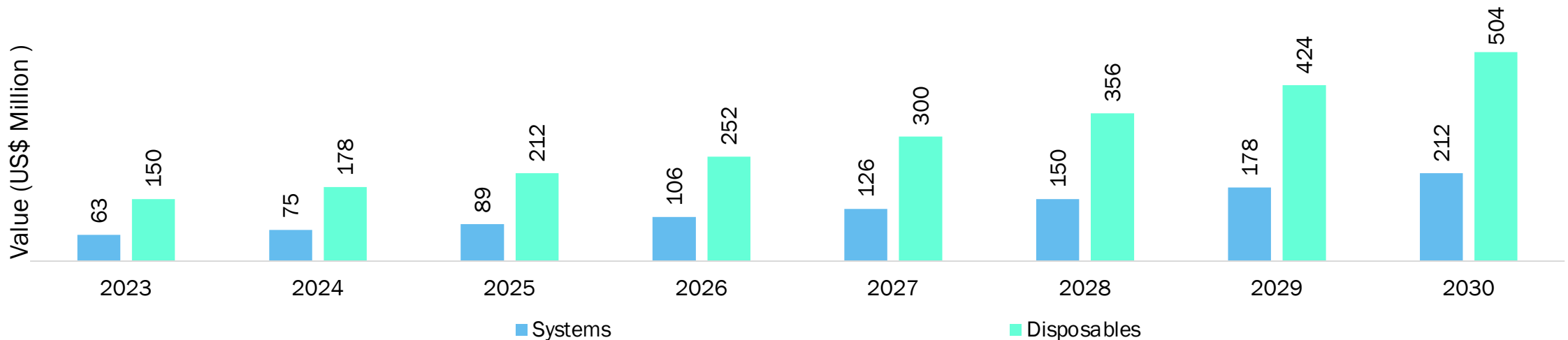


Data source: M.Market Research

Global Indoor Air Sampler Market Size (US\$ Million) Forecast, by Offering, 2020-2027

Type	2023	2024	2025	2026	2027	2028	2029	2030	CAGR%
Air Sampler Devices/Systems	20	23	27	31	35	41	47	54	15.0%
Disposables	48	55	63	73	84	97	111	128	15.0%
Total	68	78	90	104	119	137	158	181	15.0%

Coriolis Air Sampler Market size forecast, by Offering, 2023-2030

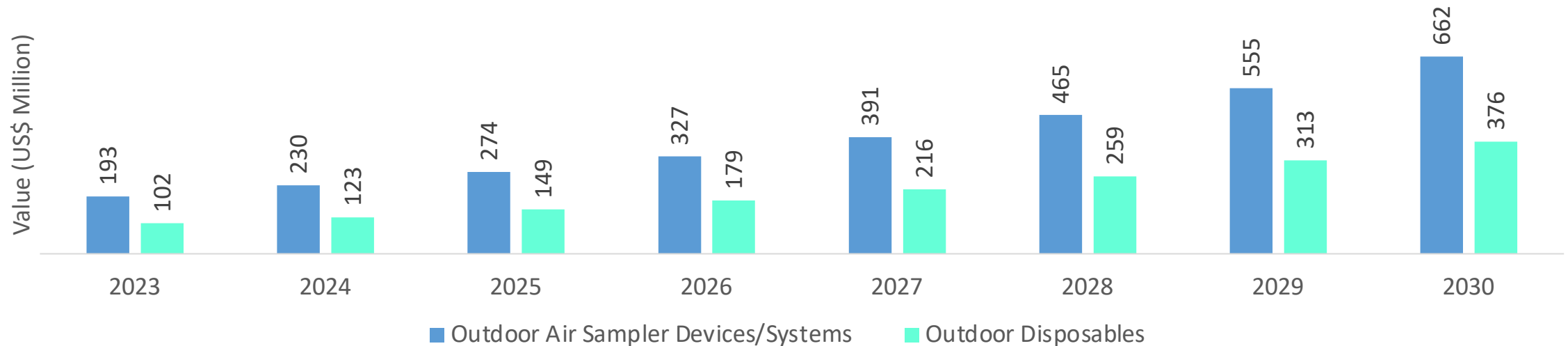


Data source: M.Market Research

Global Outdoor Air Sampler Market Size (US\$ Million) Forecast, by Offering, 2023-2030

Type	2023	2024	2025	2026	2027	2028	2029	2030	CAGR%
Air Sampler Devices/Systems	193	230	274	327	391	465	555	662	20.5%
Disposables	102	123	149	179	216	259	313	376	20.5%
Total	145	175	211	254	307	369	444	535	20.5%

Outdoor Air Sampler Market size forecast, by Offering, 2023-2027



Data source: M.Market Research



Key Market Players
AIRS

CHAPTER 9

- BioMérieux
- Bertin Instruments
- TELEDYNE FLIR FLIR IBAC / IBAC 2
- Tisch Environmental, Inc.
- TSI
- HI-Q
- InnovaPrep
- Sensocon, Inc.
- Mattson-Garvin
- Endress and Hauser
- Restek Corporation
- Horiba
- Sartorius AG
- Merck
- EMTEK, LLC
- Veltek Associates, Inc.

Key Market Players AIRS



ActiveCount100H » Microbia...
golighthouse.com



Coriolis µ Biological Air Samp...
bertin-instruments.com



SAMPLAIR™ | bioMérieux
biomerieux-usa.com



Digital High-Volume Air Sam...
vfnuclear.com



Viable Air Sampler & Microbial Sampler Produ...
golighthouse.com



MiniCapt® Remote-Luftkei...
pmeasuring.com



Coriolis Compact Dry Cyclonic ...
bertin-instruments.com



AIRWEL+ Air Sampler | Don ...
meintrup-dws.de



Aerosols Sampler and Iodine Sampler | VF, a.s.
vfnuclear.com



Coriolis µ Biological Air Sa...
bertin-instruments.com



MiniCapt® Mobiler Luftkeimsam...
pmeasuring.com



AIRWEL+ Air Sampler | Don Whitley ...
meintrup-dws.de



bioMérieux - Culture Media | prod...
biomerieux-culturemedia.com



MiniCapt® Mobiler Luftkeimsammler - Parti...
pmeasuring.com

Product information

Model/Parameter	FKC-2 air biological sampler
Sampling quantity	3.530m³/min
Speed of sampling hole	0.5 m/s, basically the same as that
Power supply	rechargeable battery DC7.4V
Speed crash	10m/s
Collection efficiency	90%
Sampling range	10-6000
Incluse	4 120x100
Weight	2.5kg
Confirmation	AC, Blower, Disinfectant, Penicillin, Destruction

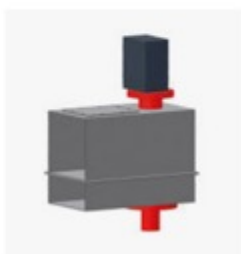
Air biological sampler FKC 2 100L...
allexpress.com - Auf Lager



Air biological sampler F...
allexpress.com - Auf Lager



MiniCapt® Remote-Luf...
pmeasuring.com



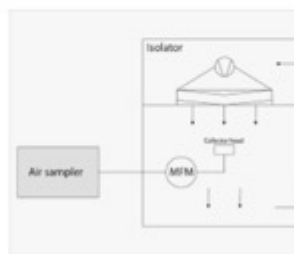
Air slide sampler by SIEB...
siebtechnik-tema.com



Monitoring changes in the composition ...
nanoporetech.com



Anderson Biological Air S...
alibaba.com



Calibration of air samplers | Br...
bronkhorst.com

Product information

Model	New platform sampler
Sampling flow rate	200L/min (0.5 m³)
Sampling volume	0-9999 (adjustable)
Speed rate	0-9999 (adjustable)
Speed rate	0.5 m / s
Battery life	3 hours or more
Dimensions	120x120x120 (mm)
Weight	1.5kg
Implementation standards	GB 18884-2011, GBY 1620-2005, GB

Sugold New type FX 10...
allexpress.com



The air sampler Coriolis µ (Micro), developed and prov...
bertin-instruments.com

Key Market Players AIRS



Coronavirus (SARS-CoV-2) Air Monitoring | Sartorius
sartorius.com



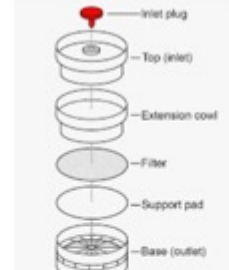
MiniCapt® Mobiler Luftkeimsam...
pmeasuring.com



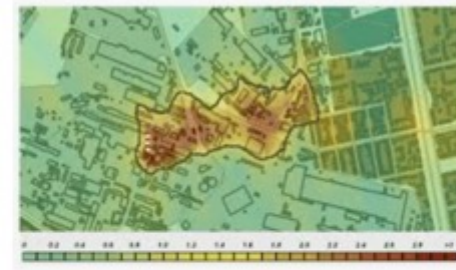
Air sampler calibration ...
scientistlive.com



Sugold New type FX 100NT Port...
allexpress.com



Collection and Extracti...
jove.com



Monitoring of Emission of Particulate Matter and ...
aaqr.org



AIR IDEAL® | bioMérieux
biomerieux-usa.com



Air monitoring SAMPLAIR...
biomerieux-diagnostics.com



Magic In The Air: The Birth O...
jpc.de · Auf Lager



Particle Measuring Systems - Cleanroom Contamin...
pharmaceutical-technology.com



Coriolis Compact Dry Cyclonic air sampler | Bertin I...
bertin-instruments.com



Jaakko Latikka and Henrik J...
researchgate.net



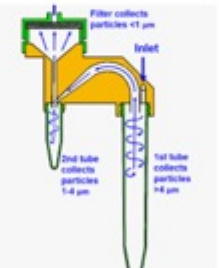
MBV: MAS-100 Microbial Air ...
linkedin.com



Russia: ENVEA equips air quality moni...
envea.global



PDF) Evaluation of phys...
researchgate.net



Collection and Extracti...
jove.com



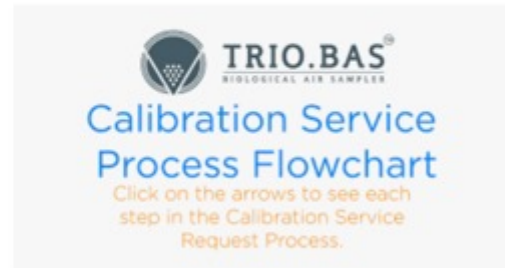
MiniCapt Mobile Microbi...
manualzz.com



Russia: ENVEA equips air qual...
envea.global



Coronavirus (SARS-CoV-2) Air Monitoring | Sartorius
sartorius.com



Trio Bas Air Sampler Calibration and Repair Services - ...
hardydiagnostics.com



Coriolis μ Biological Air Sampler - Air samplin...
bertin-instruments.com



[\(https://etserv.be/product/bertin-instruments-coriolis-recon/\)](https://etserv.be/product/bertin-instruments-coriolis-recon/)

Bertin Instruments –



[\(https://etserv.be/product/2649/\)](https://etserv.be/product/2649/)

Bertin Instruments – Coriolis® biological air sampler



[\(https://etserv.be/product/complete-air-quality-mobile-laboratory-pollution-tracker/\)](https://etserv.be/product/complete-air-quality-mobile-laboratory-pollution-tracker/)



[\(https://etserv.be/product/flying-laboratory-drone-environmental-monitoring/\)](https://etserv.be/product/flying-laboratory-drone-environmental-monitoring/)

There are more than 110 companies that are closely related to the air sampling market and producing systems for this segment or working in the field of air quality control in the widest sense. Examples are shown in the table. However, for the competition analysis were the leading producers of air sampling devices included.

Company	www
3M Company	https://www.3m.com/
Aeroqual Ltd.	https://www.aeroqual.com/company/
Bertin Instruments	https://www.bertin-instruments.com/
BioMérieux	https://www.biomerieux.com/
Emerson Electric Co.	https://www.emerson.com/en-us/
EMTEK, LLC	https://emtekair.com/
Endress and Hauser	https://www.endress.com/en/
Hangzhou Zetian Technology Co., Ltd.	http://www.zetian-tech.cn/
HI-Q	https://hiq.se/
Honeywell International Inc.	https://www.honeywell.com/us/en/
Horiba, Ltd.	https://www.horiba.com/int/
InnovaPrep	https://www.innovaprep.com/
Mattson-Garvin	https://mattson-garvin.com/
Merck KGaA	https://www.merckgroup.com/en/
NotAnotherOne Inc.	https://notanotherone.com/en/
PerkinElmer, Inc.	https://www.perkinelmer.com/en/
Plume Labs SAS	https://plumelabs.com/en/
Restek Corporation	https://www.restek.com/row/
Sartorius AG	https://www.sartorius.com/en/
Sensocon, Inc.	https://www.sensocon.com/
Siemens AG	https://www.siemens.com/de/
Teledyne Technologies Inc.	https://www.teledyne.com/en-us
Testo SE & Co. KGaA	https://www.testo.com/de-DE/unternehmen/ueber-testo
Thermo Fisher Scientific Inc.	https://www.thermofisher.com/de/
Tisch Environmental Inc.	https://tisch-env.com/about-us/
TSI Incorporated	https://tsi.com/home/
Veltek Associates, Inc.	https://sterile.com/about/

Bertin Technologies SAS
Parc d'activités du Pas du
Lac
10 bis, avenue Ampère
78 180 Montigny-le-
Bretonneux
FRANCE

After 50 years of expertise in the field of aero-fluidic sciences, Bertin Instruments has acquired competencies in different application fields linked to cyclone uses. The specific application for airborne particles collection has been studied for more than 10 years and since the beginning, a lot of partnerships have been implemented:

- in defense with the DGA (French government defense and procurement agency)
- in the context of the Legionella crisis with the LHVP (Hygiene laboratory of the city of Paris)
- for pollens monitoring with the RNSA (National aerobiology monitoring network)
- for clean rooms control and especially for pharmaceutical industry

SAPHYRAD - NEW multiprobe military survey meter by Bertin Instruments

Bertin has developed the new multiprobe military survey meter under a contract awarded by the French Defense Procurement Agency. This latest generation portable monitor is designed to detect and measure radioactivity in harsh environment.

FLEXNET | Wireless protection surveillance platform by Exensor

The Flexnet solution, developed by Exensor, is a user-friendly, flexible, comprehensive surveillance solution combining a wide range of sensors (passive infrared, seismic and acoustic, and intelligent motion cameras) with a proprietary command & control software. This self-healing Mesh network allows for detection, classification & identification of any threat. The Flexnet sensor platform is a Force Multiplier that can be used for several applications, ranging from force protection tasks, such as airbase protection, camp protection, patrol and self-protection tasks, to Intelligence Gathering, Surveillance, Reconnaissance and Target Acquisition (ISTAR) tasks.



TELEDYNE FLIR

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Teledyne FLIR designs, develops, manufactures, markets, and distributes technologies that enhance perception and awareness. We bring innovative sensing solutions into daily life through our thermal imaging, visible-light imaging, video analytics, measurement and diagnostic, and advanced threat detection systems.

Teledyne FLIR offers a diversified portfolio that serves of applications in government & defense, industrial, and commercial markets. Our products help first responders and military personnel protect and save lives, promote efficiency within the trades, and innovate consumer-facing technologies. Teledyne FLIR strives to strengthen public safety and well-being, increase energy and time efficiency, and contribute to healthy and intelligent communities. Acquired by Teledyne Technologies in 2021, FLIR has rebranded as Teledyne FLIR. Teledyne FLIR operates in many locations around the globe and employs a total of over 3,000 dedicated employees.

Mattson-Garvin Air Samplers

6449 South Tex Point,
Homosassa, Florida 34448,
United States

[\(352\) 628-0200](tel:(352)628-0200)

Barracorp@gmail.com

The Mattson-Garvin family of air samplers were first designed and manufactured in 1971.

Many of the early models are still in regular use today. Design changes and upgraded components over the years have served not only to improve efficiency and to ease operation but remain a continuing commitment to stay in keeping with the demands of the industry and the end-user alike. As commercialization of microbiology increases and diversified and as governmental regulations continually change, it is increasingly necessary to assess occupational exposure to bio arsenals. The M/G range of air samplers represents a highly efficient method of generating such data, and they are designed with ease of operation as a primary factor.

These slit-to-agar impaction samplers capture a true cross-section of the bacterial content of the air or gas sampled, unlike settling plates which collect only heavier particles and whose results are adversely affected by air movement.

Who can benefit from the information that is obtained by using an M/G sampler?

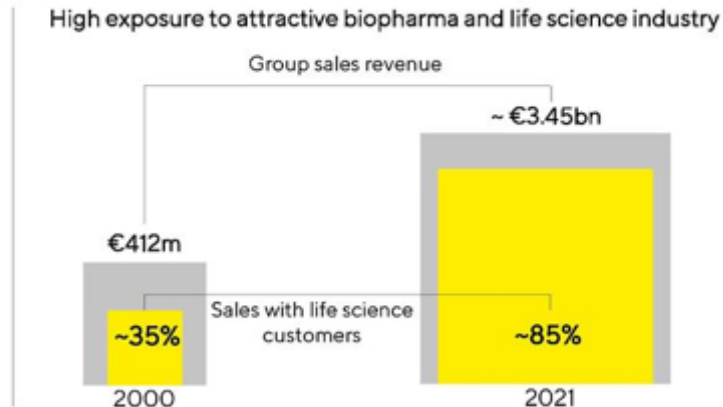
- Indoor Air Quality Studies,
- Pharmaceutical Manufacturing
- Brewery Fermentation
- Food Processing Plants
- Hospital Environments
- Grain Processing & Transportation
- Filter & Clean Room Efficiency Studies
- Sewage Treatment Plants
- Cosmetic Manufacturing
- Animal Care Laboratories

SARTORIUS

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Sartorius at a glance

- € ~€3.45bn
Sales revenue 2021
- ~22%
Sales CAGR¹ 2016-2021
- 34.1%
EBITDA margin² 2021
- 60+
Locations worldwide,
HQ in Göttingen, Germany
- ~15,800
Employees 06/2022



The Group's central management entity is the Executive Board of Sartorius AG. In collaboration with the Supervisory Board, the Executive Board defines the Group's strategy, is responsible for the operational management of the Group and controls the distribution of resources within the organization. At Sartorius, we empower scientists and engineers to simplify and accelerate progress in life science and bioprocessing, enabling the development of new and better therapies and more affordable medicine. We are a magnet and dynamic platform for pioneers and leading experts in our field. We bring creative minds together for a common goal: technological breakthroughs that lead to better health for more people.

The air sampling of virus aerosols using the gelatin membrane was established in 1992.

¹In constant currencies ²Excluding extraordinary items



TSI Incorporated

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Shoreview, Minnesota 55126 USA*

Call Us:
800-680-1220 / +1 651-490-2860

Tsi Inc /mn/ is an incorporated in the state of Minnesota. Tsi Inc /mn/ is primarily in the business of industrial instruments for measurement, display, and control. For financial reporting, their fiscal year ends on March 31st. This page includes all SEC registration details as well as a list of all documents (S-1, Prospectus, Current Reports, 8-K, 10K, Annual Reports) filed by Tsi Inc /mn/.

Aerosol monitors, commonly referred to as dust monitors, particulate monitors, light scattering laser photometers, and nephelometers, are used to measure dust, smoke, mist, fume, condensates, and fog. TSI Aerosol Monitors offer real-time, direct-reading results, which is quickly becoming an industry best practice in occupational hygiene, indoor air quality, and outdoor environmental fugitive emissions monitoring.

Direct-Reading Aerosol Monitoring and Analysis

TSI Aerosol Monitors enable real-time, direct-reading aerosol monitoring and analysis in a variety of indoor and outdoor applications including:

Dust monitoring

Ambient monitoring

Work area monitoring

Personal exposure monitoring

Outdoor environmental fugitive emissions monitoring

HVAC and LEV monitoring

Indoor air quality monitoring



Restek Corporation
110 Benner Circle
Bellefonte, PA 16823
UNITED STATES

Founded in 1985, our headquarters located in Bellefonte, PA, offers full, local product and service support to analysts in the United States, Canada, and around the globe. Founded in 1985, we are a leading developer and manufacturer of chromatography columns, sample preparation and collection products, reference standards, and instrument accessories. We work with analysts around the world, providing them with tools to monitor the quality of air, water, soil, foods, botanicals, pharmaceuticals, and chemical and petroleum products.

Restek is a 100% employee-owned company with a long [history](#) and strong corporate [culture](#). We are independent, and that means we are not bound to a specific brand of instrument. Whether your chromatograph is a time-tested workhorse or your newest investment, we are ready to help you get the most out of it. We serve everyone equally, and we appreciate your loyalty every time you choose Restek. Located in [offices around the globe](#), we believe our unique perspectives strengthen our organization, but some things are the same no matter where you live or how you choose to engage with Restek. We pride ourselves on delivering the best customer experience to every analyst we work with. Wherever you are, we are ready to build a long-lasting partnership with you and your lab, through top-quality products backed by expert education and superior technical service.

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BIOMÉRIEUX S.A.

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bioMérieux SA is a French multinational biotechnology company founded and headquartered in Marcy-l'Étoile, France, close to Lyon. bioMérieux is present in 44 countries and serves more than 160 countries through a large network of distributors. bioMérieux, a world leader in the field of in vitro diagnostics, today releases its business review for the nine months ended September 30, 2021. Organic growth of **12.1%** at constant exchange rates and scope of consolidation over the first nine months of the year: €2,452 million in sales. Up 8.2% as reported.

BIOMÉRIEUX WORLDWIDE

bioMérieux's development strategy is based on an international, long-term vision to meet the healthcare challenges related to infectious diseases all over the world. Our headquarters are based in Marcy-l'Étoile, France. Located in 44 countries, we serve more than 160 countries with the support of a large network of distributors. We generate more than 93% of our sales outside France. bioMérieux is present on all continents through 15 major production sites, 14 R&D centers, subsidiaries and offices. Almost 13,000 team members contribute to our public health mission while respecting the human-centered values upheld by the Mérieux family.



SALES BY APPLICATION



SALES BY REGION





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Tisch Environmental is the benchmark for high volume air sampling, particulate, metals, volatiles, and specialty monitoring equipment. Since the company's inception in 1954 as General Metal Works, our product line has expanded from the first high volume air sampler to include high-tech and custom samplers. Our clients are professionals from every sector of the regulatory and industrial markets.

We are the experts in high volume air sampling, lead sampling, lead samplers, particulate monitoring, particulate emissions, pesticide monitoring, pesticide sampling, total suspended particles, particulate samplers, Federal Reference Method PM-10, Federal Reference Method PM2.5, EPA Method TO-4A, EPA Method TO-9A, EPA Method TO-13A, and much more.

TEI is a family business located in the Village of Cleves, Ohio. TEI employs skilled personnel who average over 20 years of experience each in the design, manufacture, and support of air pollution monitoring equipment. Our modern well-equipped factory, quality philosophy, and experience have made TEI the supplier of choice for air pollution monitoring equipment. Now working on the fourth generation, TEI has state-of-the-art manufacturing capability and is looking into the future needs of today's environmental professionals.



INNOVAPREP |
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InnovaPrep® is engaged in product development, sales, and out-licensing of a collection of novel tools for modern microbiology. InnovaPrep products provide the critical macro-to-micro interface™ between real world samples and the input volumes of modern molecular methods for analysis. InnovaPrep tools increase sensitivity and enable a faster, easier, and more efficient means of delivering the most highly concentrated sample possible for subsequent analysis for a variety of biomonitoring applications.

Our 50 pending and awarded patents apply to highly efficient collection and concentration of biological particles from air, surfaces, and liquids. InnovaPrep's Wet Foam Elution™ process underlies many of these patents and enables instant recovery of particles from filters, membranes, surfaces, and objects. The primary utility for these technologies is to greatly improve the way biological samples, especially dilute samples, are collected and prepared for analysis. Specifically, these technologies allow the most advanced biological detection systems to contribute their full potential.

The InnovaPrep Wet Foam Elution™ technology was first developed for integration into advanced biodefense and biodetection systems, but it has application for any detector or analysis method where increased sensitivity is needed. Fields of application include, but are not limited to, industrial microbial control, water safety; medical and veterinary diagnostics research; metagenomic research; disease monitoring; and environmental monitoring. Our current products include the Concentrating Pipette, the LVC kit, the Bobcat Air Sampler, and the SpinCon II Air Sampler, as well as integratable forms of these instruments. InnovaPrep technologies are scalable, integratable, patent protected and available for license.

[Bertin Instruments](#)

based in Montigny-le-Bretonneux, FRANCE

Bertin Instruments subsidiary of CNIM Group, relies on its long history of innovative engineering to develop, produce and market systems and instruments worldwide. Among its 450 employees, there are 2/3 engineers and high-level managers.

[Michell Instruments Ltd](#)

based in ELY, UNITED KINGDOM

Michell Instruments is a worldwide leader in the field of humidity and oxygen measurement. Our purpose is to help companies around the world benefit from energy savings, comply with industry standards, reduce damage to equipment.

[EuroSMC S.A.](#)

based in Madrid, SPAIN

We are a leading company that designs, manufactures and market a range of electronic products and solutions for electrical testing, tests and measurement equipment related to the commissioning and maintenance in substations.

[CNIM - Constructions industrielles de la Méditerranée](#)

based in Paris, FRANCE

Founded in 1856, CNIM is a French equipment manufacturer and industrial contractor operating on a worldwide basis. The Group provides its products and services to major public and private sector organizations, local authorities.

[European Tech Serv NV \(ETS\)](#)

based in Diksmuide, BELGIUM

European Tech Serv was founded in 1995 as a company mainly trading in components for sampling systems for the Petro-chemical industry. From 1997, ETS NV started to design and built its own sampling systems.

[Southern Scientific Ltd. - a LabLogic Company](#)

based in Henfield, UNITED KINGDOM

Southern Scientific is part of the LabLogic Group. Southern Scientific is a specialist supplier of radiation detection equipment for the Nuclear, Medical, Security, Defence, Industrial & Research sectors.

[Coriolis Micro - Microbial Air Sampler for AirBio-Contamination Control](#)

Coriolis μ is a Biological Air Sampler for bio-contamination quality control compatible with all analysis methods thanks to its liquid output. Coriolis μ is an innovative biological sampling system.

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[Acoem UK](#)

based in Severn Drive, Tewkesbury, UNITED KINGDOM

Part of the ACOEM group, we are committed to sustainable development and helping companies and public authorities limit their environmental impact. We offer products and services that prevent and control air, noise and vibration pollution, increase of particles.

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[IMICROQ, S.L.](#)

based in Tarragona, SPAIN

iMICROQ is a technology-based company, founded in 2010 as a spin-off company of the Universitat Rovira i Virgili. The promoter team of the company was formed with three researchers from Advanced Technology Innovation Centre (ATIC).

[IMICROQ - Coriolis Micro Air Sampler](#)

Coriolis μ Air Sampler is a portable microbial air sampler for indoor and outdoor air bio-contamination monitoring. The equipment concentrates airborne particulates in a liquid sampling solutions.

[Young Calibration Ltd](#)

based in Shoreham by Sea, UNITED KINGDOM

ISO/IEC 17025 accredited calibration laboratory for gas flow, air velocity, fluid flow, pressure, temperature, humidity, electrical, frequency and temperature simulation parameters.

[Krohne Messtechnik GmbH](#)

based in Duisburg, GERMANY

KROHNE is a global leader in design, development and manufacturing of process instrumentation, providing measurement solutions to all industries worldwide. KROHNE is a worldwide technological leader in the development, manufacture and distribution ...

[OPTIMASS - Model 2400 - Coriolis MassFlowmeters](#)

The OPTIMASS 2400 is the world's highest capacity Coriolis mass flowmeter for liquids and gases. With its twin or four straight tube design, the Coriolis meter is ideally suited for bunkering operations.

[Glen Mills Inc](#)

based in Clifton, NEW JERSEY (USA)

Glen Mills Inc. is a forty-year-old company providing solutions primarily in the field of sample preparation to lab professionals, researchers and engineers around the world. We can help with grinding and comminution equipment (wet and dry).

[Flowquip Limited](#)

based in Sowerby Bridge, UNITED KINGDOM

Flowquip, the UK's leading provider of flow meters, flow metering systems and process solutions. Flowquip are the leading supplier of flow meter solutions for liquids, compressed air, gas and steam to a vast number of industries including Oil.

[Flowhire Limited](#)

based in Sowerby Bridge, UNITED KINGDOM

Flowhire UK's leading flow meter hire specialists with the largest portfolio of flow meters available for hire. We stock a wide range of industrial flow meters and measurement systems for Air, Gas, Steam and Liquids.

[MSE Hiller Limited](#)

based in Chesterfield, UNITED KINGDOM

MSE Hiller specialize in the sales and rental of sludge dewatering and effluent clarification equipment. Centrifuges are available to thicken or dewater from 1 to 150 m³/hr. Polyelectrolyte make up and dosing systems screw compactors.

[ABB Measurement Products](#)

based in Zurich, SWITZERLAND

ABB is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 130,000 people.

[ABB CoriolisMaster - Model FCM2000 - CoriolisMass Flowmeters](#)

A wide range of meter sizes provide precise measurement of mass flow, volume flow, density, temperature and concentration. ABB's CoriolisMaster series has a history of success in a wide variety of industries and applications.

[Southern Scientific Ltd. - a LabLogic Company](#)

based in Henfield, UNITED KINGDOM

Southern Scientific is part of the LabLogic Group. Southern Scientific is a specialist supplier of radiation detection equipment for the Nuclear, Medical, Security, Defense, Industrial & Research sectors. We develop both installed and handheld devices.

[C2 Coriolis Whole Body Contamination Monitor](#)

The Coriolis whole body contamination monitor achieves the best possible performances in Alpha, Beta and Gamma radiation detection with current.

[iCenta Controls Ltd](#)

based in Salisbury, UNITED KINGDOM

iCenta Controls is an independent company that specializes in the supply of flow meters, level sensors, instrumentation and control systems to engineering, manufacturing and process industries throughout the UK and overseas.

[Coastal Controls & Instrumentation Inc. \(CCII\)](#)

based in Bedford, NOVA SCOTIA (CANADA)

Coastal Controls & Instrumentation Inc. (CCII) was established in April 2000. CCII is an Atlantic Canadian owned and operated company focusing its efforts as a manufacturer representative for sales and service in the Power Utility, Refinery.



**Additional
technologies for
consideration
AIRS**

Add-on

Respiratory Research, Inc.

PO Box 202108
Austin, TX 78720
USA



The RTube is designed for ease of use even by the unsupervised patient in the home, workplace, laboratory, hospital, or clinic. This non-invasive handheld device is fully self-contained and disposable. As the subject breathes normally into the device, the RTube gathers breath condensate in a transportable/maillable cartridge. This unique feature allows for easy integration of the RTube into existing studies and allows large amounts of EBC data to be collected with ease from subjects in the clinic, hospital, home, workplace, school, or any other reasonable environment. The simplicity and environmental flexibility of this collector offers the potential for rapid development of clinical diagnostics utilizing EBC pH and other biomarkers.

Our special valve assembly is the key to efficient sample collection and allows unsupervised subjects to easily gather and store contaminant-free samples. Typical condensate fluid yield is 100 microliters/minute for a child and 200 microliters/minute for an adult at normal tidal breathing effort.

The unique one-way valve provides maximal particle impaction on the condensing surface and also acts as a plunger. The ability to pool the sample near the upper end of the tube allows for maximum sample recovery in seconds.

Analyze the Sample

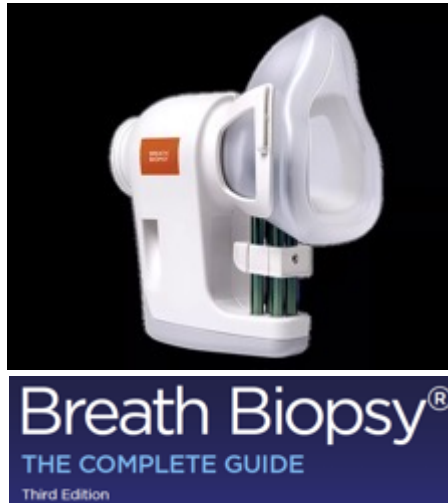
This step is dependent on the substance of interest. The substance may be unstable, and require rapid analysis, or it may be very stable (as is the case for pH) and be analyzed anytime.

The RTubeVENT is designed as a disposable, single use item. The cooling sleeve, the insulating cover and the plungers are fully reusable.

A key feature is the ability to collect the condensate sample, store the sample, transport the sample, and analyze the sample all in the same RTube. No transfer of condensate fluid into another device is generally required, minimizing complexity in the lab and at the patient's home. Opportunities for contamination are virtually eliminated and labor required for sample processing is minimized. Every step has been painstakingly thought out and this design created to minimize the effort and complexity for the patient, researcher, and lab technician. The system is designed for ease of use even in very large clinical studies



Owlstone Medical Ltd
Cambridge, UK
183 Cambridge Science Park
Milton Road
Cambridge CB4 0GJ
T: +44 (0)1223 428200



Company Profile: Key players



The Breath Biopsy Collection Station, featuring the ReCIVA® Breath Sampler and CASPER™ Portable Air Supply enables reliable, reproducible collection of breath VOCs for a wide range of applications. Subjects breathe a controlled supply of air, and samples of their breath are captured and stabilized on Breath Biopsy Cartridges, which can be shipped for processing and analysis at our specialized Breath Biopsy Laboratory.

Using an advanced analysis platform built on GC-Orbitrap™ technology we can support high-resolution targeted and untargeted biomarker investigation, performing statistical analyses and providing detailed reporting of results to help identify and develop biomarkers of interest for a range of applications.

This approach can also be combined with exogenous VOC (EVOC®) Probes, which further increase sensitivity by targeting specific biological processes for exhaled VOC analysis.



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Chapter 9

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Objective

This form is related to the Security Sensitivity Assessment procedure which will assure that no sensitive information will be included in the publications and deliverables of the HoloZcan project.

Security sensitive information means here all information in whatever form or mode of transmission that is classified by Council Decision on the security rules for protecting EU classified information (2011/292/EU) and all relevant national laws and regulations. The information can be already classified, or such that it should be classified.

In practice the following criteria is used:

- Information is already classified
- Information may describe shortcomings of existing safety, security or operating systems
- Information is such, that it might be misused.
- Information that can cause harm to
 - European Union
 - a Member State
 - society
 - industry and companies
 - third country
 - citizen or an individual person of a country

Project	HoloZcan: Deep Learning Powered Holographic Microscopy for Biothreat Detection on Field Grant Agreement No: 101021723
Deliverable:	D5.4
Dissemination Level	PU-public
EU Project Officer	Patricia E. Rischitor
Actual Submission Date	31 August 2022
WP Leader	DMI
Authors	The Zugmed Team



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No: 101021723

Assessment form for the main author



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Date 31-08-2022

Name: On behalf of the Security Advisory Board (SAB) dr Marcin Niemcewicz

A handwritten signature in blue ink, appearing to read "M. Niemcewicz", enclosed in a light blue rectangular box.

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