



INSTITUTE
OF NEXT
Barcelona

2019年科技大桥

连接巴塞罗那和中国
科技生态系统。

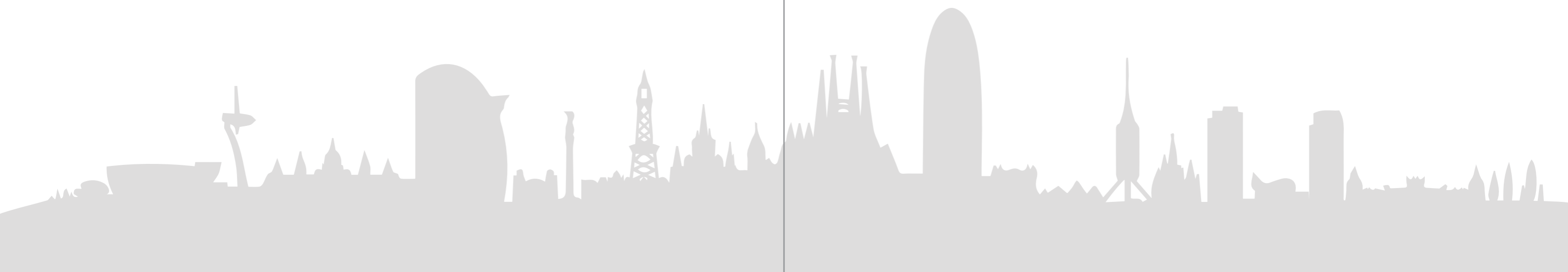




INSTITUTE
OF NEXT
Barcelona

2019 S&T Bridge

Connecting **Barcelona** and **China**
science and technology ecosystems.





Alfons Cornella, President of The Institute of Next Barcelona.

With a degree in Theoretical Physics (University of Barcelona, Spain), Alfons Cornella holds an MS in Information Resources Management (Syracuse University, USA) and an MBA (ESADE Business School, Barcelona).

He was a professor at ESADE Business School and now works as a counselor for innovation projects in China for ESADE, such as the Barcelona School of Curiosity.

He has published more than 30 books about innovation, management and education. His last books are *Innovation Manual* and *Education for Humans in a World of Smart Machines. 100 Ideas and Thoughts About the New Education Our Society Needs*.

He is a well-know international speaker. Through his conferences and seminars on innovation, he personally transmits his ideas and experiences to about 10,000 people annually.

He has managed over 150 innovation projects, especially in the private sector.

He is a trusted professional in the science and technology sectors in Barcelona. He understands Sci&Tech and can identify market opportunities while respecting the value S&T contributes to our society.



Barcelona Innovation and R&D

Barcelona received the **most R&D investment** and showed the **highest number of R&D jobs** in all continental Europe (FDi Markets), making the city a key innovation hub not only in Spain but in Europe as a whole. Innovation and R&D activities benefit from efficient tax deduction schemes, as well as from lower corporate tax rates than those in neighbouring countries. Some cases of cutting edge multinationals performing R&D in Barcelona include **HP, Amazon, Facebook, Nestlé, Bayer, Nissan, Roche** and **BASF**.

The main sectors in Barcelona regarding R&D investment are software & IT services, business services, business machines and equipment, and communication. **ICT** is indeed a very powerful sector in Barcelona, with more than 15,000 companies that account for almost 16,000 million euros of annual revenue. Together with a consolidated industrial economy, Barcelona stands out as a significant location for developing projects in the **Industry 4.0** sector, a revolution in the digitalization of manufacturing processes.

Leading scientific infrastructures



Barcelona Science Park



Barcelona Biomedical Research Park



UAB Research Park



IDIBAPS



Barcelona Supercomputing Center



ALBA Synchrotron



Barcelona Synchrotron Park



National Centre for Microelectronic



Applus+ IDIADA



Biocat



The Research Centres Network of Catalonia



Eurecat



Barcelona a competitive environment

Barcelona enjoys a dynamic, industrial, diverse and extremely business friendly economy, making it a great location for innovation, entrepreneurship and R&D activities.

Barcelona is a magnet for professionals, researchers and students all over the world, and holds the title of **1st European Capital of Innovation**, according to iCapital Prize.

With **leading scientific facilities**, such as the ALBA Synchrotron, the MareNostrum supercomputer, the Biomedical Research Park and the Scientific Park of Barcelona or ICIQ, Catalonia has a well-established innovation scene that will help you achieve your innovation goals.

Talent attraction

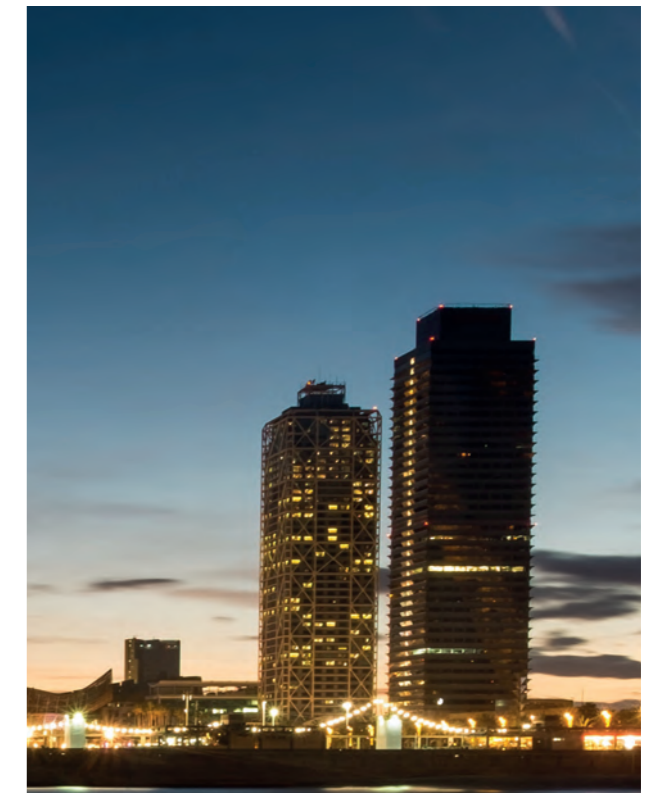
The availability of top-notch talent, with a wide range of profiles, will adapt to any of your company's innovation needs. Barcelona has strengthened its position as one of the world's leading cities in international talent attraction, with the number of **professionals employed in R&D activities increasing around 4%**. The amount of researchers in Catalonia is also growing by 4%.

With more than 1,050 degrees and masters, and over 236,000 university students, Catalonia has one of the **highest student populations in Europe**. Catalonia's scientific publication is outstanding, and patents and technology transfer collaborations are growing at a healthy pace. With 0.1% of the planet's population, **Catalonia accounts for 1% of worldwide and 3.7% of EU-28 scientific production**. Also, Catalan requests for European patents showed a relevant increase of 15.7% in 2017.

Start-up ecosystem

Barcelona is home to more than 1,200 start-ups that share a passion for innovation and thrive in sectors like Internet and mobile software and services, eCommerce and big data. A global landmark, Barcelona is the third city preferred by entrepreneurs to create a new start-up, only behind London and Berlin. Check the **Barcelona and Catalonia Startup Hub database** to browse through all the start-ups based here.

Also, **Barcelona is the 5th European region in terms of start-ups**, according to several renowned international rankings such as the EU-Startups and Startup Heatmap Europe. The city has become a clear benchmark in Europe in the creation of new companies, especially those with a technological base.



Innovation Connectors in Barcelona since 1999



At the Institute of Next we are fascinated by China's accelerated innovation and we are encouraging the Barcelona S&T entrepreneurs to learn about the Chinese innovation ecosystem. We believe that we can build bridges between Barcelona and China.



China will greatly improve its innovation capability, make breakthroughs in major areas and see a significant increase in its overall competitiveness, beyond industrialization.

China will create an atmosphere that will support and foster an entrepreneurial mindset, and will develop a skilled manufacturing talent pool.

Now, Barcelona S&T entrepreneurs have the opportunity to scale up in China thanks to TusStar.



Accelerated innovation in China

Alfons Cornella and Mònica Alonso pointed out that the acceleration process that China has experienced over the past decades is arguably unlike any other in the last two centuries.

The Institute of Next has organized different innovation events to share some figures from the Chinese innovation ecosystem with Barcelona's innovation ecosystem. For instance, China went from a per capita income (PCI) of \$195 in 1980 to a PCI of \$8.123 in 2016. Also since 1980, 600 million people have moved from rural areas to cities. Four of the world's leading resource banks (tier-1) are Chinese. Half of the Chinese population can now be considered middle-class. China's overall investment in R&D already exceeds that of the United States. China has gone from 856,000 university students in 1978 to 26 million students in 2015.

In particular, the Chinese Government's commitment to science, technology and innovation is materialized in its successive medium- and long-term plans. Their goal is to transform China's economy into an innovation based economy by 2020, and to be at the forefront of global scientific research by 2050. Some Chinese universities are already at the top of scientific production, such as Tsinghua University, which has rapidly risen in the rankings and is expected to reach first place in 2019 or 2020. The most important fields for public and private investment include (nano)materials, artificial intelligence, biochemistry, space exploration, and quantum computing and communication.

Tusstar & The Institute of Next's agreement

On 26th February 2019, TusStar Barcelona and the Institute of Next signed an agreement to build bridges between these two innovation ecosystems.

Tus-Holdings Co. Ltd. is a large integrated enterprise established on July 2000 in reliance on Tsinghua University. It takes full responsibility for developing, constructing, operating and managing the Tsinghua University Science Park (TusPark) Development Center, set up on August 1994. It is also one of the first National Demonstration Enterprises in the modern service industry.

Kimi Chen, manager of TusStar Barcelona, and Mònica Alonso, partner and CEO of the Institute of Next, signed the agreement. Lin Nan, consul general of the People's Republic of China in Barcelona; David Navarro, director general of Casa Asia; Han Wei, vice general manager of TusStar Incubator, and Alfons Cornella, founder of the Institute of Next, celebrated the agreement.



6 BARCELONA'S OUTSTANDING S&T INITIATIVES

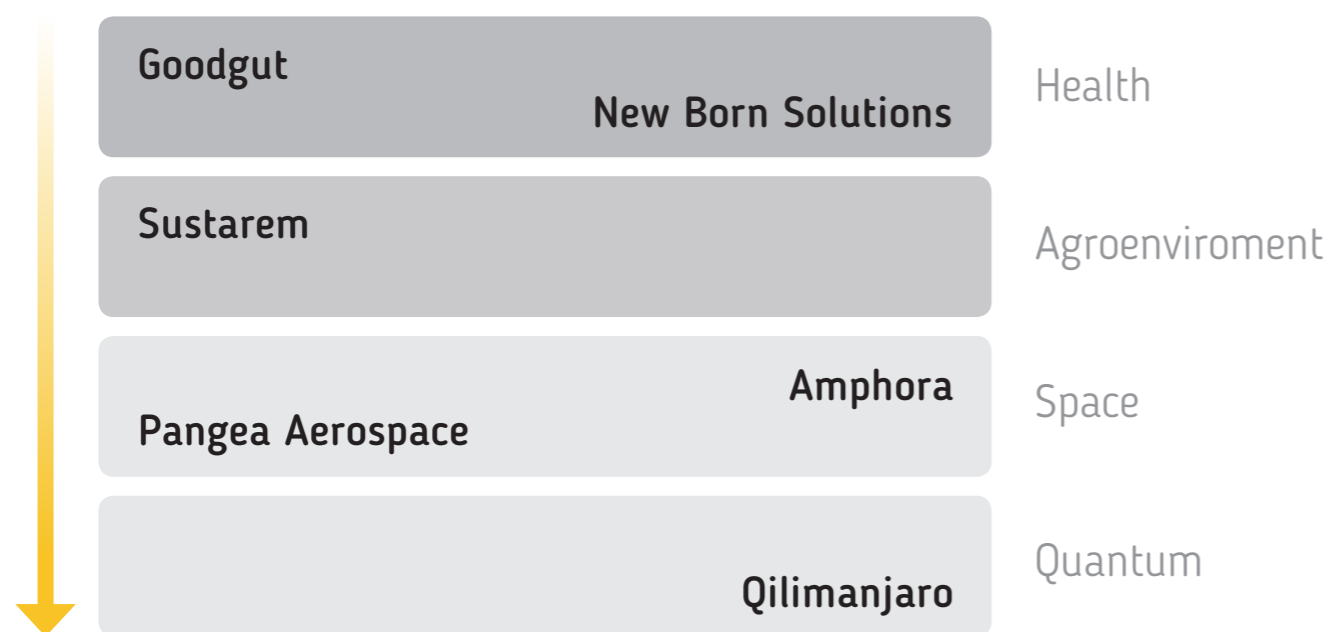
The Institute of Next's team has chosen six outstanding initiatives from Barcelona S&T with great potential to scale up in the Chinese market through TusStar.

The goal is to set out a brief DEC to build bridges between TusStar and entrepreneurs from Barcelona.

The Institute of Next's team has chosen different initiatives for TusStar from diverse industries: quantum computing, life and health, and rockets.

These six leading initiatives are just a selection among many emerging developments offering strong impact on global value creation and potential solutions to societal needs.

Mid-term applicability



Long-term breakthrough

Goodgut

一家生物公司开发用于诊断和治疗消化系统疾病的非创新系统。

A bio Company developing non-innovative systems for diagnosis and treatment of digestive diseases.

New Born Solutions

一家健康公司，可以更好地检测脑膜炎和其他感染。

A health Company enabling better detection of meningitis and other infections.

Sustarem

一种农业技术，以加强从地下水去除硝酸盐。

An agrifood technology to enhance nitrate removal from groundwater.

Amphora

一个生物技术集团，应用先进的黑化真菌为太空探索提供食物。

A biotech group to apply advanced melanized fungi to supply food for space exploration.

Pangea Aerospace

一家航空航天公司，开发独特的新一代微型发射器火箭。

An aerospace company developing the distinctive new generation of micro-launcher rockets.

Qilimanjaro

量子技术公司设计和开发相干量子退火计算机和工具集相应的最优算法。

A quantum-technology Company designing and developing a coherent quantum annealing computer and the toolset corresponding optimal algorithmic.

Mid-term applicability



Long-term breakthrough

Goodgut

一家生物公司开发用于诊断和治疗消化系统疾病的非创新系统。

A bio Company developing non-innovative systems for diagnosis and treatment of digestive diseases.



We are biotechnology company dedicated to the **research and development** of non-invasive systems to support the diagnosis and treatment of **digestive diseases** based on the **intestinal microbiota** as a determinat factor



GOODGUT 5M€



RAID-CRC

Risk Assessment for Intestinal Disease- Colorectal Cancer (RAID-CRC) is a non invasive tool able to detect colorectal cancer before having clinical signs based on intestinal microbiome.

MARKET

- CRC is the worldwide second leading cancer in incidence and mortality.
- World Health Organization guidelines recommend **CRC prevention** based on screening the **population risk** (all >50-years-old population). In China, this population represents a 425,817,397.
- The current organized screening programs use Immunological Fecal occult blood Test (FIT) base on detecting blood in feces. But, because blood is not a specific marker of CRC, using FIT in its maximum sensitivity implies a high rate of false positive and induce a large number of unnecessary colonoscopies (30%), which is an invasive technique with 1/1000 risk of severe complications and expensive (RMB 5,800 – 23,000).
- In China, since the number of colonoscopies unnecessary is unaffordable its CRC screening program is based on FIT and questionnaire. Nevertheless, the performance of this approach is 14% of participation and just 3,32% of precancerous lesions detection.
- Specific noninvasive screening tools focused on **detection at early stages** become a keystone in order to prevent CRC.

OUR PROPOSAL

- Risk Assessment Intestinal Disease- for colorectal cancer (RAID-CRC) is a patented noninvasive system that complements FIT screening with determination CRC **microbiological signature** in fecal sample.
- 61% reduction of FIT false positive rate.
- Increased sensitivity for precancerous lesion up to 59%.
- Cost would not exceed 10€/analysis.
- Using the same FIT collector.

- ✓ Signatures comes from a 20 years-old consolidated research line from Universitat de Girona and Hospital Universitari Dr. Josep Trueta devoted to understand the intestine as an ecosystem.
- ✓ Microbiological signature defined in 80 intestinal biopsies of individuals with CRC and normal colonoscopy. The identification of these bacteria in adherent intestinal mucosa allows us to avoid their vulnerability to dietary changes in different populations.
- ✓ Microbiological signature optimized in fecal sample of 450 Spanish cohort with compatible CRC symptomatology and 189 spanish cohort of FIT+ screening population. Its validation has been performed in two clinical studies.
- ✓ Its validation has been done in 327 screening population FIT+. The validation in 2,800 FIT+/- screening population is on going in collaboration with DKFZ center in Germany.

DEFINITION	OPTIMIZATION	VALIDATION
Biopsy sampling 80 individuals	450 subjects with compatible CRC symptomatology 189 FIT+ subjects of screening population	327 FIT + subjects of screening population 2.800 FIT+/- screening on going

- ✓ The introduction of RAID-CRC in the Chinese CRC screening program will represent a saving just in unnecessary colonoscopies of 463M RMB, an increase of participation and an increase of precancerous lesion detection.

TIMELINE This 2019 aim to finished the clinical validation in german screening population (n=2.800) and launch RAID-CRC to the market in 2019 with total financial needs of 2M€.



Founders Team

- Jaume Amat**
Co-Founder and Strategic consultant
IESE PDD
Serial Biotech& Medtech entrepreneur
President in CataloniaBio Healthtech
- Mariona Serra**
Co-Founder and Chief Executive Officer
DVM, PhD, IESE PDD
6 years experience in immuno diseases (NIH&UAB)
4 years in executive business administration
- Xavier Aldeguer**
Co-Founder and Medical Director
Gastroenterologist, MD, PhD
IBD&Microbiology key opinion leader
Head of Gastroenterology Department
- Jesús García-Gil**
Co-Founder and Scientific Manager
Microbiology professor, PhD
Over 30 years experience in microbiology and IVD development

Advisory board

- Antoni Castells**
Gastroenterologist, PhD, MD
Medical Advisor CRC
- Gabriel Masfurroll**
IESE PDD
Strategic Advisor Private Health Policy
- Fermin Mearin**
Gastroenterologist, PhD, MD
Medical Advisor IBS
- Julià Panés**
Gastroenterologist, PhD, MD
Medical Advisor IBD

Roadmap

- Q1 2020**
Results German Clinical Validation
- Q4 2019**
Obtaining CE market indication for positive population to the fecal occult blood test
Pilot test in Vall d'Hebron, Germans Trial i Pujol Hospital, Joan XXII Hospital
- Q1 2020**
Software design and final prototype
- Q2 2020**
Obtaining CE market indication for the entire screening population
Obtaining CE market for population of screening positive for the fecal occult blood test
- Q3 2020**
Spanish market launch
Obtaining CE mark indication for the entire screening population (over 50 positive and negative to the fecal occult blood test)
- Q1 2021**
International market launch

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FOUNDER TEAM



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DVM, PhD, IESE PDD
6 years experience in immuno diseases (NIH&UAB)
4 years in executive business administration



Xavier Aldeguer
Co-Founder and Medical Director
Gastroenterologist, MD, PhD
IBD&Microbiology key opinion leader
Head of Gastroenterology Department



Jesús García-Gil
Co-Founder and Scientific Manager
Microbiology professor, PhD
Over 30 years experience in microbiology and IVD development



TEAM



Marta Serrano
Quality Manager
PhD, Medical Device Msc
8 years of molecular biology R+D
2 years experience in quality system implementation and product registration



Roser Sanchez
Administrative
Management and Business Administration
4 years experience in finance and administration



Sara Ramió
Project Manager
Microbiologist, PhD
8 years experience in microbiology and molecular biology development



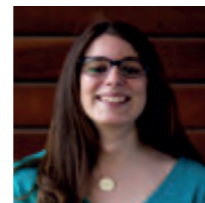
Achim Baldus
Data Analytics
Mathematics&Physics
13 years experience in Machine Learning and Artificial Intelligence



Joan Amoedo
RAID-CD Line researcher
Msc, PhD Student
3 years experience in Microbiology and Inflammatory Bowel Disease



Lia Oliver
PREVIPECT Line researcher
Biologist
5 years experience in microbiology and molecular biology analysis



Marta Malagón
RAID-CRC Line researcher
Msc, PhD Student
3 years experience in Microbiology and CRC

ADVISORY BOARD



Antoni Castells
Gastroenterologist, PhD, MD
Medical Advisor CRC



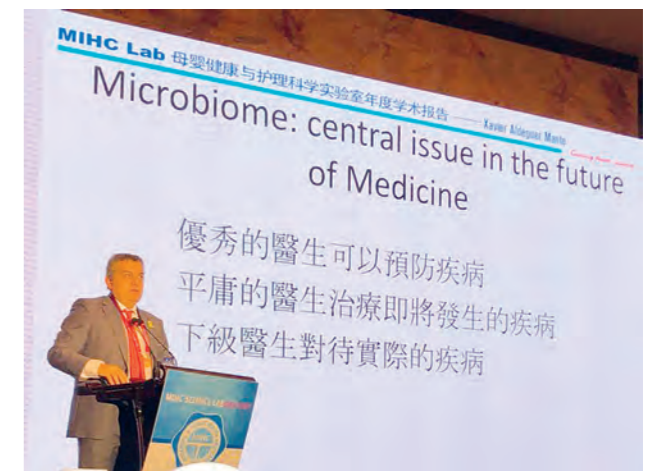
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Medical Advisor IBS



Julià Panés
Gastroenterologist, PhD, MD
Medical Advisor IBD



Mid-term applicability



Long-term breakthrough

New Born Solutions

一家健康公司，可以更好地检测脑膜炎和其他感染。

A health Company enabling better detection of meningitis and other infections.



NEW BORN SOLUTIONS

We are the Company that will enable quick, easy, painless and cost-efficient detection of infections in superficial body fluids, starting with infant meningitis where the need is most urgent. We have developed a hand-held high-resolution ultrasound-based medical device with an unprecedented sensitivity to white blood cell concentration count, as an established diagnostic marker of meningitis and other infections within our scope.

Tag line: quick detection of infections without needles

NBS
NEWBORN.SOLUTIONS



NEOSONICS

- Hand-held high-resolution ultrasound-based device and disposable cover to non-invasively screen for meningitis through the fontanel of the infant, the soft spot of the baby's head where the bones are not fused, by means of detecting an elevated count of white blood cells in the cerebrospinal fluid right below.

MARKET

- At a global level, every baby younger than 30 days with fever exceeding 38°C should receive by protocol a lumbar puncture, an invasive, long, difficult, painful and cost-inefficient procedure, to rule in or out meningitis, a very aggressive disease that kills in a matter of hour or leaves survivors with life-long disabilities, such as deafness, epilepsy or limb amputation, if not detected early.
- In the 15.000 hospitals in Europe, 250.000 lumbar punctures are performed to infants younger than 12 months and 95-98% are negative.
- In neonates, up to 50% of lumbar punctures are contaminated with blood lowering results reliability. In addition, out of those patients under intensive care 5% are suspected of meningitis and do not tolerate a lumbar puncture because of elevated intracranial pressure, coagulopathies, etc. In all these cases, preventive treatment and hospitalization is indicated costing EU hospitals 1.5BEUR every year.
- The Infant meningitis market is 1BEUR and a CAGR of 4% is projected until 2025. The total superficial body fluids infection market including Peritonitis, Septic Arthritis, Pleuritis, Uveitis, etc. is 35BEUR.

OUR PROPOSAL

- We are creating the new standard to detect superficial body fluids infections with 0 false negatives and hospital costs reduction in the management of the infant patient suspected of meningitis from 40-60% based on hospital type.
- Our strength is know-how generation and protection to, ultimately, sell the commercialization and/or manufacturing rights to a large corporation with global distribution capabilities.
- Our scalability potential goes through the several applications in other superficial body fluids and the use of the massive data we will be collecting in a non-invasive manner. Feasibility studies in other applications are under way.
- We have protected our technology in EU, China, Japan, India, Canada and USA. We have an IP protection strategy that includes method, device, algorithms, disposable and design.
- To get there, we have internalized the experience and expertise to clinically validate, industrialize and obtain regulatory approval to commercialize our products.
- Price of the device 10.000EUR (Cost of Goods - COGS: 1.000EUR). Price of the disposable cover (1 use per patient): 50EUR (Cost of Good - COGS s: 2EUR).
- All figures and projections are backed by outsourced independent studies conducted by acknowledged companies and research institutions.
- We are interested in strategic partnerships with Chinese mass manufacturer to produce our products at a global scale while helps us in further reducing COGS.



TEAM

We represent more than 20 years of experience in R&D, IP, medicine, industrialization, regulatory, commercialization and business deals in health.

TIMELINE

2020 Q3
Clinical validation
2019 Q4
Industrialized product
2020 Q1
Strategic agreement with mass-manufacturer
2020 Q4
Scale up industrialization
2021 Q3
CE MARK, FDA, CFDA
2021 Q4
200 pre-release units
2022 Q4
2.000 units sold



NEW BORN SOLUTIONS: 3M€

CORE TEAM



Founder, CEO
Javier Jiménez
PHD, MBA

Entrepreneur, engineer and Spanish innovator under 35 of Spain in 2016.



Founder, CFO
Pablo García
Economist

20 years of experience directing financial departments.



Global Health Researcher,
Clinical Advisor
Dr. Quique Bassat
PHD, MD

One of the ten most outstanding young persons in the world according to the Junior Chamber International.



Clinical Advisor
Dr. Fernando Cabañas
PHD, MD

First Pediatrician performing a brain ultrasound scan in Spain



Quality & regulatory lead
Rita Quesada
PHD, MSc

Successful experience in CE regulatory approval of medical devices



Technical Lead
Carlos Surribas
MSc

Expertise in technical project management and development.



Data Scientist
Alvaro Navarro
MSc

Data analysis, features extraction and artificial intelligence



Mechanical Engineer
Luca Paroni
MSc

Engineer versed in experimentation and materials



Industrialization Advisor
Toni Miró
MSc

Founder Linking Innovations



Technical Advisor
Luis Elvira
PHD

25 years of experience in ultrasound theoretical models and applications



Commercialization Advisor (tentative)
Manfred Falke
Ex-Director Latin America
Siemens Healthcare



Investment Raising Advisor
Albert G. Zamora
MBA
CEO at Virtual Reality Works Serial entrepreneur in health



Business Strategy Director
Marta Princep
PHD, MBA

27 years building, transferring innovation in Pharma, Biotech and public-private institutions

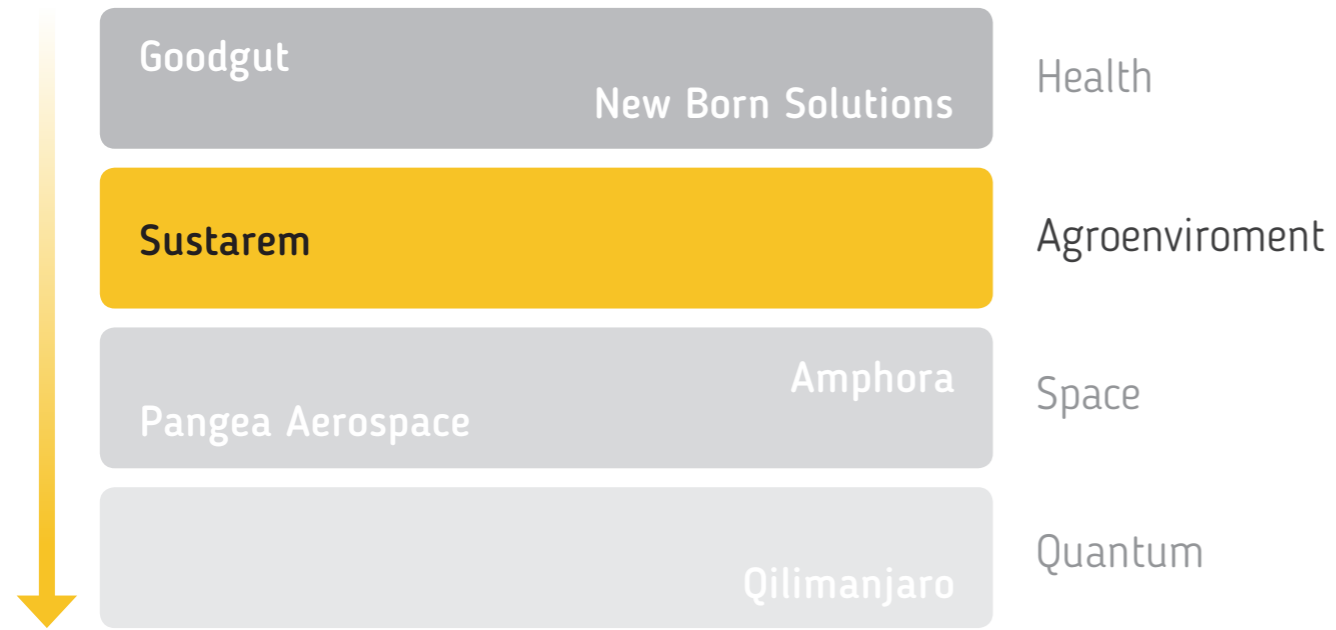


Business Advisor, Investor
Dr. Frederic Llordachs
MD, MBA

Co-founder & Partner at Doctoralia



Mid-term applicability



Long-term breakthrough

Sustarem

一种农业技术，以加强从地下水去除硝酸盐。

An agrifood technology to enhance nitrate removal from groundwater.



SUSTAREM

Sustainable advanced-constructed wetlands to enhance nitrate removal (and other pollutants) from groundwater and agriculture water discharges

PIs: Marc Viñas and Rafaela Cáceres

GIRO Program, Institute of Agrifood Research and Technology (IRTA), Torre Marimon, E08140 Caldes de Montbui, Barcelona, Catalonia, Spain. E-mail: marc.vinas@irta.cat Rafaela.caceres@irta.cat.



SUSTAREM: 5,5M€

SUSTAREM

BACKGROUND

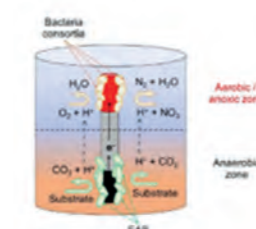
- Contaminated groundwater with nitrates is ubiquitous in Chinese deep aquifers as well as shallow groundwater (and surface water). Agriculture activity is one of the primary causes of nitrate contamination in groundwater (Zhang et al., 2019)¹. Despite recent improvements in the provision of clean drinking water, it is estimated that more than 200 million people in China are still using unsafe water sources (Tao and Xin, 2014²; Liu, 2015³). China's Central government has released an ambitious plan, **Water Pollution Prevention and control action plan** (10-point Water Plans released in April 2015⁴), to tackle the nation's water pollution crisis (Han et al., 2016)⁵

OUR EXPERIENCE: ADVANCED SUSTAINABLE CONSTRUCTED WETLANDS TO TREAT OLIGOTROPHIC POLLUTED WATER (GROUNDWATER AND HORTICULTURE LEACHATES)

- Horticultural leachates are oligotrophic water, poor in organic matter such as groundwater, which needs to be supplied with additional electron donors to enhance microbial denitrification processes by means of the amendment of organic compounds (i.e. acetate, lactate sources).
- Since 2012, under the framework of an Ecoinnovation project (2012-2017) (Clean-leach project, <http://www.cleanleach.eu/default.asp?id=eng>) and Democlean-leach project (2018-2019), circular organic subproducts (brewery effluents, wood pellets, rice husk, and rice straw), and the utilization of demolition wastes have been successfully implemented to enhance denitrification in CW to treat oligotrophic water containing 200-300 mg NO₃/L (1m³/day in CW of (21m x 3m x 0,6m)) . Pilot plant (IRTA) and full scale CWs at field conditions to treat leachates from a real plant nursery (Sala Graupera, <http://www.salagraupera.com/en>) have been developed. Last CW results have been presented at AquaConSoil 2019 (<https://www.aquaconsoil.org/>) as a good alternative to treat polluted groundwater and agriculture leachates.

OUR PROPOSAL

- To develop sustainable constructed wetlands (CW) with high nitrate-removal capabilities fed with functionalized rice straw/Rice Husk or wood pellets or other lignocellulosic materials, as electron donors to boost microbial denitrification and the removal of other emerging pollutants from groundwater and agriculture discharges.
- To develop a new bioelectrochemical system (biocathode) built within the CW to promote the biological utilization of electrons collected from solar panels, by using potentiostates, to enhance microbial denitrification driven by specialized exoelectrogenic bacterial biofilm in the deep layers from CW. Exoelectrogenic biofilm are enriched on the biocathode materials (grown in graphite/biochar/chalcoar) are capable to use external electrons (from solar panels) to respire nitrates, under certain poised redox potentials, transforming to innocuum N₂ gas, minimizing transient N₂O emissions. This process could be also used to treat other emerging contaminants that need to be reduced (i.e chlorinated compounds)
- To develop microbial electro technical technologies (MET) to enhance denitrification processes in eutrophized lakes enriched in nitrates. By using nailed conductive materials crossing deep sediment layers (rich in organic matter) is possible to enhance denitrification in water phase.
- Exoelectrogenic anodophile bacteria in the sediment are capable to transfer electrons, when oxidizing organic matter, to a conductive solid material (graphite or Carbon fiber) which promotes electron migration throughout redox gradients (sediment-water phase) to hypoxic zone (in the water phase), were other exoelectrogenic bacterial community (in the cathodic zone) are able to transfer the electrons to nitrate, enhancing denitrification in the water phase by using sunk electrons in the organic matter in the sediment. This technology could be also used in the CWs to treat other emerging contaminants.



Source: Ramirez-Vargas et al., 2018⁶

¹Zhang, H., Yang, R., Wang, Y., & Ye, R. (2019). The evaluation and prediction of agriculture-related nitrate contamination in groundwater in Chengdu Plain, southwestern China. *Hydrogeology Journal*, 27(2), 785-799. ²Tao, T., Xin, K., 2014. A sustainable plan for China's drinking water. *Nature* 511, 527e528. ³Liu, H., 2015. China's long march to safe drinking water. *China Water Risk*, 44pp. ⁴Central People's Government of the People's Republic of China, 2015. *Water Pollution Prevention and Control Action Plan* (in Chinese) released on April 2015 and available at: http://www.gov.cn/zhengce/content/2015-04/16/content_9613.htm. ⁵Han, D., Currell, M. J., & Cao, G. (2016). Deep challenges for China's war on water pollution. *Environmental Pollution*, 218, 1222-1233. ⁶Ramirez-Vargas, C., Prado, A., Arias, C., Carvalho, P., Esteve-Núñez, A., & Brix, H. (2018). Microbial electrochemical technologies for wastewater treatment: principles and evolution from microbial fuel cells to bioelectrochemical-based constructed wetlands. *Water*, 10(9), 1128.

Core team

Marc Viñas

Expert in microbial ecology, bioremediation, and Dr. in Microbiology <https://orcid.org/0000-0002-4124-3602>

Rafaela Cáceres

Agronomist, environmental technologist, and Dr in Environmental horticulture

Francesc Prenafeta

Agronomist, mycologist, and Dr in Environmental Biotechnology <https://orcid.org/0000-0001-9514-7029>

Miriam Guivernau

Laboratory technician, MSc Molecular Biotechnology

ROADMAP

a) Advanced desnitrication and emergent water pollutant biodegradation in Constructed amended with lignocelulosic subproducts (circularity of agrifood materials) such as rice straw and rice husk biomass. (1st-12th month) Pilot scale (0,25 M€)

b) Fundamental insight to utilize advanced conductive materials (biochar, mature compost, active carbon, carbon fiber) to optimize microbial metabolism linked to biodegradation of contaminants and denitrification in polluted groundwater, agriculture effluents and eutrophized lakes. (6th-24th month). Lab-Pilot scale (0,5 M€)

c) To promote the utilization of electrons from solar panels by exoelectrogenic microbiota enriched on the biomass of biocathode materials built inside the CW (submerged) to accelerate denitrification and degradation of microcontaminants in CW (12th and 24th month) (potential collaboration with the university of Nankai) (0,5 M€)

d) Enrichment and isolation of complex exoelectrogenic microbial inoculum, enclosing denitrifying and / or emerging-pollutant degrading bacteria (6th and 24th month). (0,25 M€)

e) Evaluation of the capacity of CW and functionalized CW (with conductive materials) for the transformation / retention / elimination of PFOs in polluted groundwater (Perfluorinated compounds) as the main emerging priority pollutants in near future in water systems (PFOs have high solubility and toxicity). (1-24 months) (0,5 M€)

f) Scaling up advanced CW to full scale in different scenarios. 12-24 (Spain) 24-36th month (China) (1 M€)

INSTITUTE OF AGRIFOOD RESEARCH AND TECHNOLOGY (IRTA)

Integral Management of Organic Waste (GIRO) Sustainability in Agrosystems

CORE TEAM



Marc Viñas
Expert in microbial ecology,
bioremediation, and
Dr. in Microbiology
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Rafaela Cáceres
Agronomist, environmental
technologist, and
Dr in Environmental horticulture



Francesc Prenafeta
Agronomist, mycologist, and
Dr in Environmental Biotechnology
<https://orcid.org/0000-0001-9514-7029>

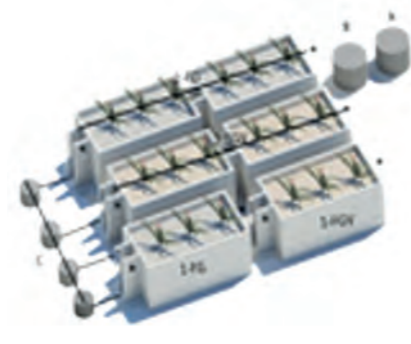


Miriam Guivernau
Laboratory technician,
MSc Molecular Biotechnology

PROTOTYPE IMAGES

Constructed wetlands at Pilot Scale (IRTA, Cabrils (Barcelona), Spain)

Constructed wetlands (CW) at Full scale in Sala Graupera (plant nursery) facilities
(CW equipped with a pump and a solar panel to collect leachates from a tank)



Constructed wetlands (CW) at Full scale in Sala Graupera (plant nursery) facilities
(CW equipped with a pump and a solar panel to collect leachates from a tank)



CW + Brewery effluent (BE) (2015-2017)



CW + Wood pellets (WP) (2018-2019)



CW + Wood pellets (WP) (2018-2019)

1. Organic materials as electron source to enhance denitrification and pollutant biodegradation in CW



Brewery effluent



Rice Husk / Rice Straw



Grape Pomace

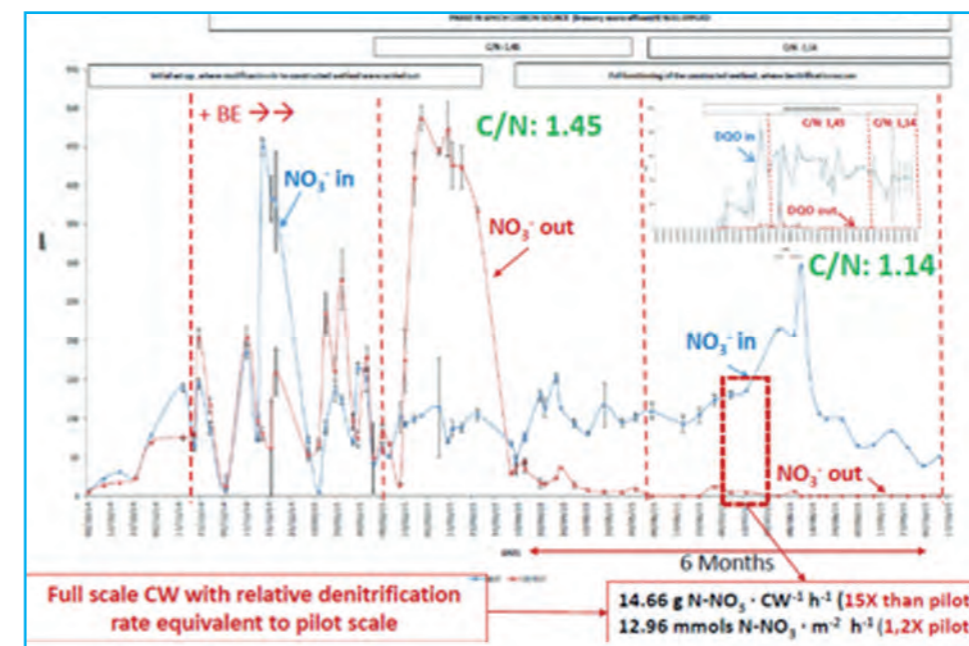


Wood Pellet

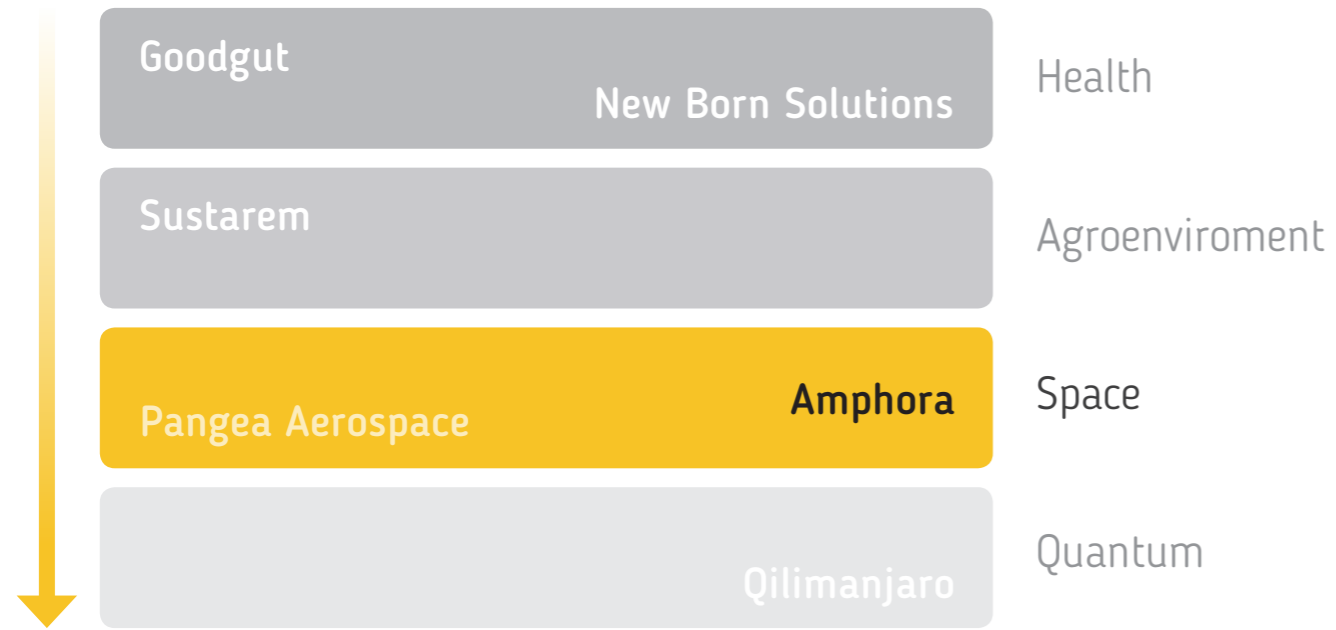
2. Electrons, harvested from solar panels to drive denitrification and pollutant degradation, fed to exoelectrogenic bacteria in CW

3. Electron migration enhanced through organic conductive materials (biochar, active carbon, carbon fiber, graphite) to drive advanced denitrification and pollutant biodegradation in CW

Denitrification in a **full scale HSSF-CW** fed with
Brewery effluent (12-Month assay)



Mid-term applicability

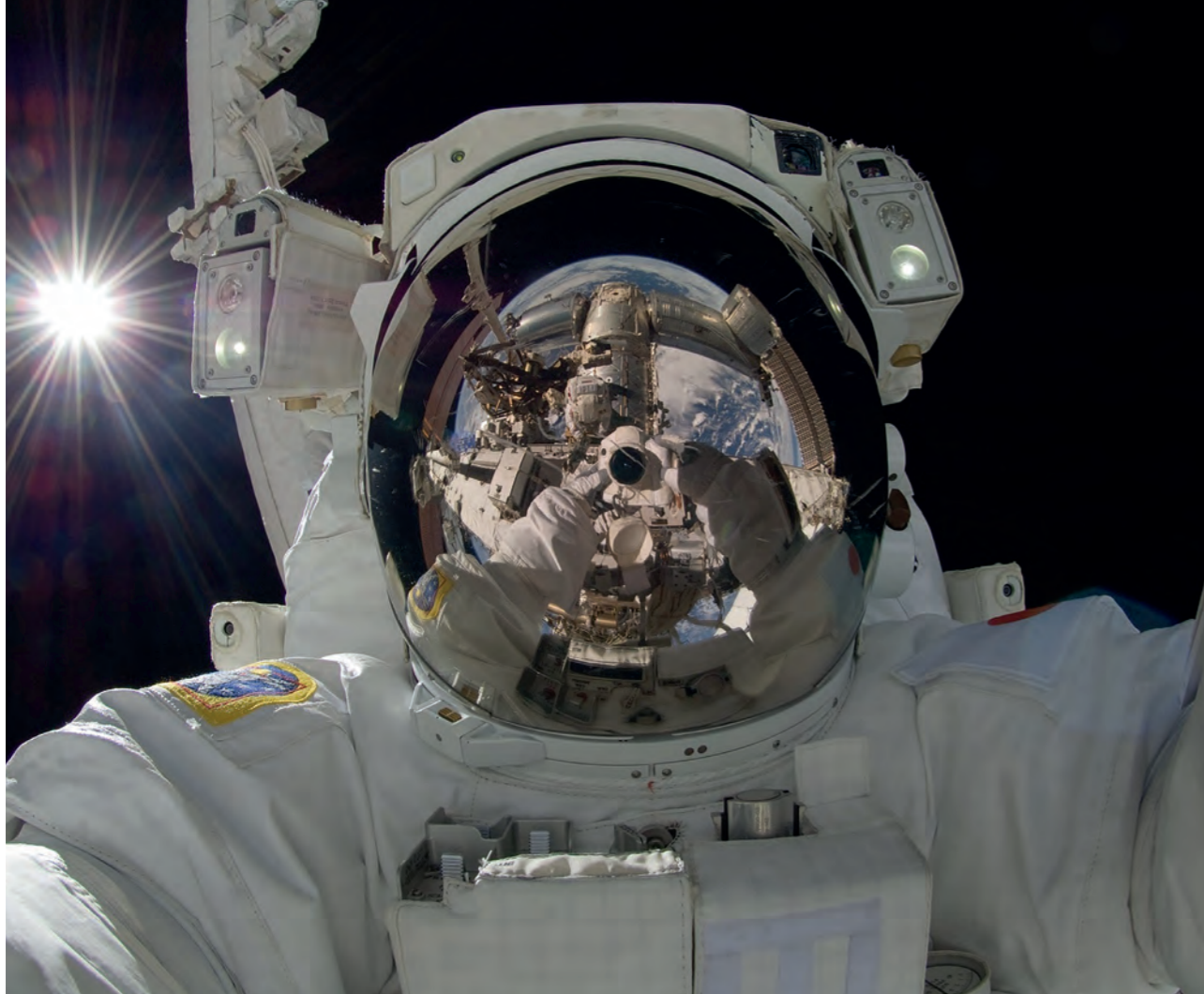


Long-term breakthrough

Amphora

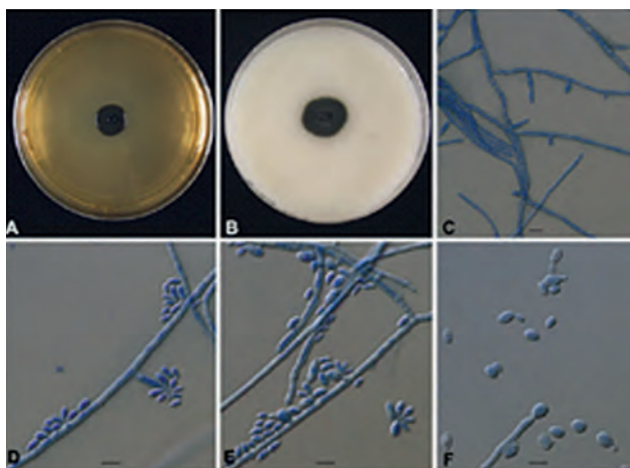
一个生物技术集团，应用先进的黑化真菌为太空探索提供食物。

A biotech group to apply advanced melanized fungi to supply food for space exploration.



AMPHORA

Advanced Melanized fungi as PHotolytoautotrophic Organisms:
a new prospective in space Research and Applied biotechnology



AMPHORA



THE CHALLENGE

- The AMPHORA was a key element in supplying food during expeditions of the ancient world and, consequently, in the Mediterranean Greco-Roman expansion. Similarly, space missions in the near future are being confronted with the need of ensuring bioresources to sustain the crew during prolonged isolation.
- The technological solutions that have been proposed so far are based on the ecological paradigm of recycling nutrients and gases through the process of photosynthesis by higher plants. Current closed-loop prototypes are complex, cumbersome, and vulnerable to space ionizing radiation.

OUR PROPOSAL

- Recent scientific evidence has shown that certain fungi, known as the black yeasts because of their intense melanization, might be able to carry out a process analogous to photosynthesis from high energy photons associated to cosmic rays.
- The key to this process is melanin, which acts as an antenna pigment that absorbs a broad spectrum of ionizing radiation. Therefore, melanin is also a very effective shielding biomaterial that could be used for radioprotection.

OUR EXPERTISE

- Over the later years, we have been developing and applying selective techniques for the isolation, selection, and cultivation of harmless black fungi from the environment. We have also proven a number of physiological features that are interesting for space biotechnology:
 - Black yeasts are extremely hydrophobic and can absorb complex mixtures of volatile organic compounds in confined environments, like in a spacecraft, improving air quality.
 - Some species withstand very high doses of ionizing radiation without any significant biological inhibition (more than $6600 \text{ mW}\cdot\text{s}\cdot\text{cm}^{-2}$ of UVC).
 - Preliminary experiments indicate that fungal absorption of radiation might be linked to the use of CO_2 as a carbon source (autotrophic production of biomass).

MARKET

- Since 1987, the European Space Agency (ESA) is promoting the project MELiSSA, aimed at developing a viable closed-loop of bioregenerative life-support system (BLSS) for human space missions (i.e. the colonization of mars).
- During the MELiSSA workshop of 2018, other space agencies showed a strong interest in contributing to the development of BLSS technologies (NASA, ROSCOSMOS, and JAXA).
- BLSS technologies have several earth applications as well, related to closed-loop agriculture for a more sustainable food production (vertical farms).

RESOURCES & DELIVERABLES

- By the end of the project we will have a fungal bioreactor prototype for the capture and valorization of volatile contaminants and ionizing radiation in confined environments. We will also develop a melanin-based material (coating and/or textile) with radioprotective properties to be launch to the technical clothing market (protech).

Core team

Francesc Prenafeta
Agronomist, mycologist, and
Dr in Environmental Biotechnology

Marc Viñas
Expert in microbial ecology,
bioremediation, and
Dr. in Microbiology

Miriam Guivernau
Research Technician,
Specialist in Microbial Ecology, and
MSc in Molecular Biotechnology

ROADMAP

2019
Optimization and scaling-up of fermentation technology for the production of melanized biomass

2020
Novel industrial applications of whole-cell bioreactor technology

2020
Development of melanin purification techniques and functionalization of materials

INSTITUTE OF AGRIFOOD RESEARCH AND TECHNOLOGY (IRTA)

Integral Management of Organic Waste (GIRO)
Sustainability in Agrosystems

AMPHORA: 5,5M€

CORE TEAM



Francesc Prenafeta
Agronomist, mycologist, and
Dr. in Environmental Biotechnology



Marc Viñas
Expert in microbial ecology,
bioremediation, and
Dr. in Microbiology



Miriam Guivernau
Research Technician,
Specialist in Microbial Ecology,
and MSc in Molecular Biotechnology



EXPOSE-E platform installed on the International Space Station to verify the survival of melanized fungi to Martian-like conditions (Source: ESA).

Other apps:



BIOCOMPATIBLE PROTECTIVE MATERIALS FOR ONCOLOGY PATIENTS DURING RADIOTHERAPY



TECHNICAL TEXTILES AND COATINGS FOR ENHANCED RADIOPROTECTION



REMOVAL OF VOLATILE CONTAMINANTS AND PURIFICATION OF INDOOR AIR



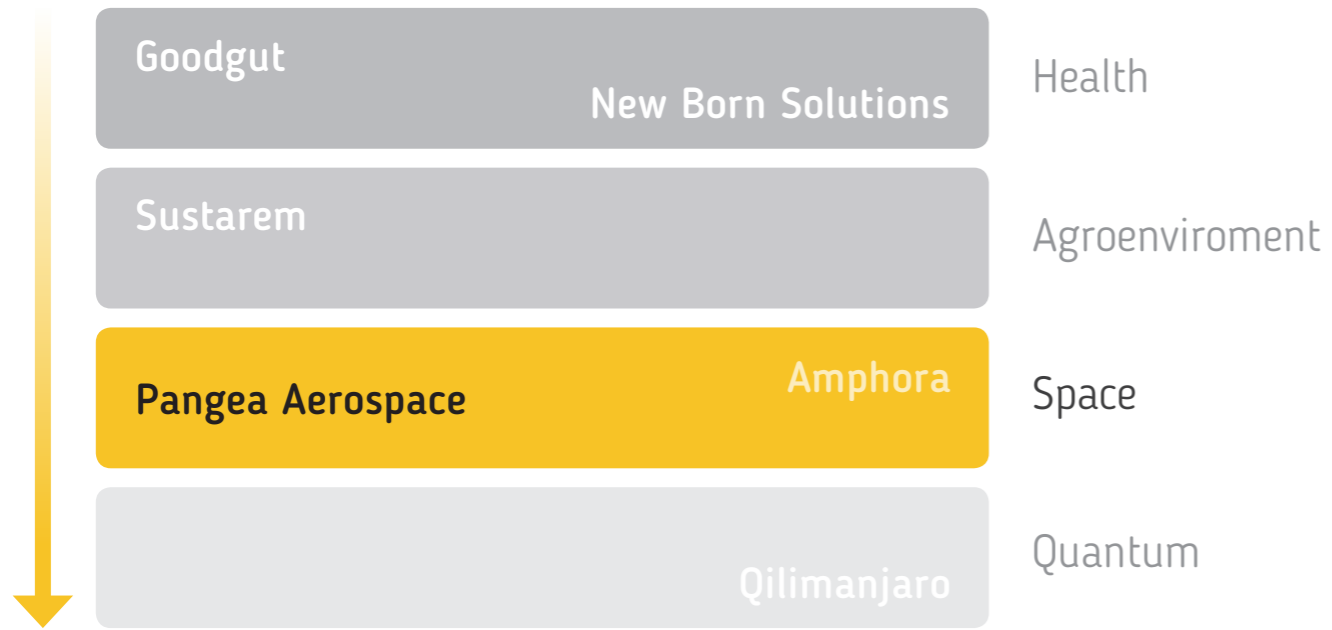
Top: laboratory test on the fixation of isotopically labelled CO₂ upon exposure to ultraviolet C (253 nm) by cultures of black yeasts incubated in quartz tubes. Bottom: subsequent measurement of the label recovery in the biomass by GC-IRMS (Source: own experiments).



Demonstrative MELiSSA life support system for the recycling of gases, water, and nutrients in prolonged space missions (source: ESA).

IRTA

Mid-term applicability

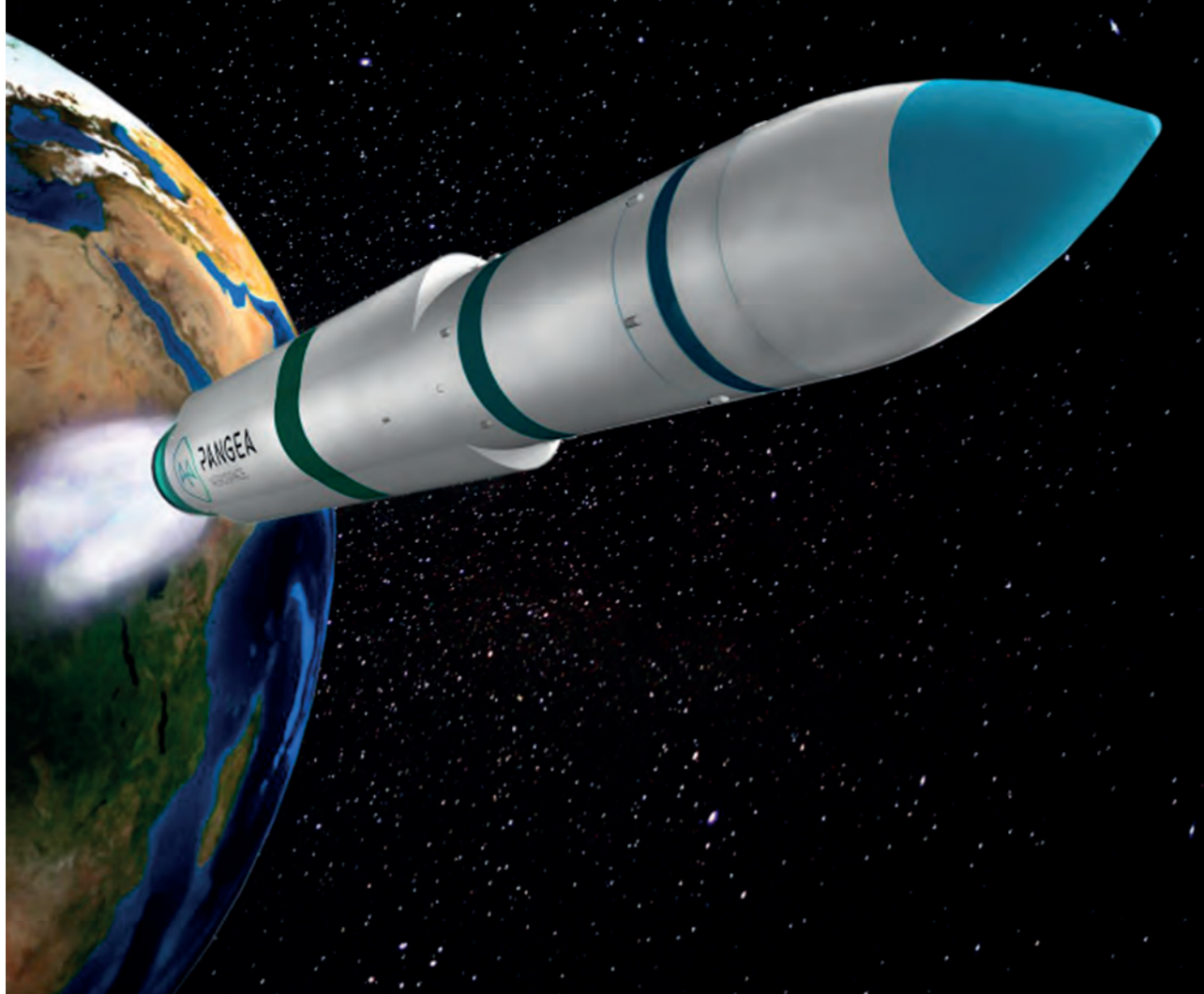


Long-term breakthrough

Pangea Aerospace

一家航空航天公司，开发独特的新一代微型发射器火箭。

An aerospace company developing the distinctive new generation of micro-launcher rockets.



MARKET – SMALL SATELLITE LAUNCH

- The commercial possibilities opened in space thanks to the lower costs and miniaturization of the technology have led to the **privatization of the space industry (NewSpace)** with a new space race. More than \$20Bn has been invested since 2009 in the private space industry to finance various projects.

Satellites are gradually being reduced in size, with more functionalities and lower price. That is why the trend of sending smaller satellites into space is growing, and will continue to do so in double digits every year for the next decade. Most small satellites will orbit the Earth in low earth orbit (LEO).

\$8,5B
Market value
2008-2017

1,187
Small sats launched
2008-2017

>80%
% commercial
satellites in 2027

\$38B
Estimated
2018-2027

7,038
Small sats to be launched
2018-2027



Pangea Aerospace is devising the next generation of micro-launcher technology.

COMPETITIVE ENVIRONMENT – MICROLAUNCHERS

- Access to space (launch services) is today the bottleneck of the value chain and in this context, specialized tailor-made launch services are needed to service the small satellite growing market. Most pioneer micro-launcher companies (first movers) do not have a focus on efficiency and reusability. They have simply copied the technology of heavier rockets to a smaller scale in order to meet market demand. Our vision is to develop the technologies that will disrupt the current ones in order to propose the most cost-efficient missions using a micro-launcher.

OUR PROPOSAL – TECHNOLOGY AND MESO

- Pangea Aerospace is developing two disruptive technologies:
 - A reusable aerospike engine that is 10% to 12% more efficient than current bell engines
 - A proprietary recovery system that eases reusability as the system offers high controllability and does not use the main engine.
- These two technologies will allow the MESO launch vehicle to be the most cost-effective micro launcher in the market.

PANGEA AEROSPACE: 8M€

TEAM

ADRIÀ ARGEMÍ - CEO
Aerospace engineer
ISAE Supaero - Airbus

XAVIER LLAIRÓ - COO
Business Administration
ESADE – Caisse des Dépôts

FEDERICO ROSSI - Head of Propulsion Aerospace Engineer
Bologna University - Avio

RASMUS BERGSTRÖM - Head of Recovery
Aerospace Engineer
KTH - OHB

NICOLA PALUMBO - Head of Mechanics
Aerospace Engineer
Sapienza – Northrop Grumman

LUIS BELLAFONT - CFO
Business administration - ESADE HI Partners (Blackstone)

ADVISORY BOARD

J.J. DORDAIN
Former European Space Agency
CEO (2003-2015)

Y. D'ESCATHA
Former CNES president
(2003-2013)

A. TEMPESTA
Thales Alenia Italy institutional
relations

J. DE DALMAU
International Space University president

H. IMMICH
Former propulsion engineer at Astrium

PANGEA

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Barcelona (Spain)

DEVELOPMENT – PROTOTYPES AND FUNDING



Aerospoke injector hot fire testing

+€1M

In private funding (seed round)



Recovery system prototype tested (CONFIDENTIAL)

€125k

In public funding



Test bench development

+€7M

Public funding requested in 2019

TECHNOLOGY – KEY ELEMENTS



300kN reusable Aerospoke engine



MESO rocket with the proprietary recovery system

AEROSPIKE ENGINE – KEY ELEMENTS

METALLIC 3D PRINTING

- Engine highly studied in the past but with no orbital flights due to its manufacturing complexity. The complex geometries of the cooling channels can only be manufactured with cutting-edge metal 3D printing techniques. Our partner (world leader in metallic 3D printing) is able to print with copper alloys, improving efficiency. The fact that everything is 3D-printed as a single piece significantly reduces weight, assembly costs, the necessary manufacturing machinery, and human error.

GREENER PROPELLANTS

- By using liquid oxygen together with liquid methane we obtain one of the most efficient and environmentally friendly chemical reactions, compared to other traditional solid propellants.

REUSABLE

- The engine is being designed to be reusable. Thanks to its propellant mixture there is minimal soot.



ROADMAP

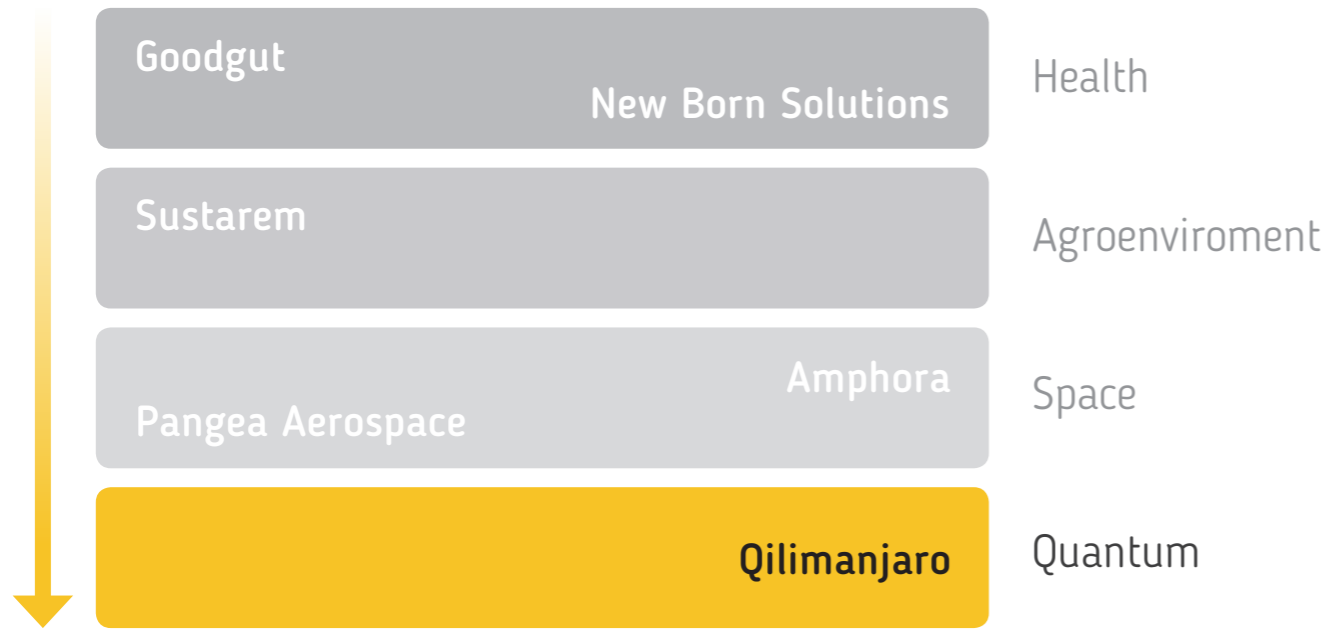
2020
RMB 40M Series A

2021-2022
Engine and recovery system validation

2025
First maiden flight

2026
First commercial flight

Mid-term applicability



Long-term breakthrough

Qilimanjaro

量子技术公司设计和开发相干量子退火计算机和工具集相应的最优算法。

A quantum-technology Company designing and developing a coherent quantum annealing computer and the toolset corresponding optimal algorithmic.



QILIMANJARO

We do coherent quantum computing.

QILIMANJARO will deliver a first-to-market full-stack.

Variational Quantum Machine

A coherent quantum annealing computer of superconducting flux qubits with an easy-to-access advanced quantum variational algorithmic toolset to effectively address complex optimization problems in multiple real-world industry use cases.



QILIMANJARO

QUANTUM RACE

- Quantum computers will process massive and complex datasets more efficiently than classical computers. They use the fundamentals of quantum mechanics to speed up the process of solving complex computations.
- QC is expected to become a multi-B\$ IT market in ten years according to multiple market analysts:

- Gartner Group describes this as the 4th major technology disruption after the industrial, computer and internet ones.
- Deloitte expects hundreds of million \$ in the 2020's and tens of billions in the 2030's for QC business.
- The Boston Consulting Group panel of experts expects, in the coming decades, productivity gains by end users of QC, in the form of both cost savings and revenue opportunities, to surpass \$450 billion annually.

China has become a leading player in the quest for quantum technologies.

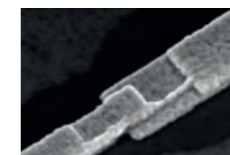
In July 2015, Alibaba's Aliyun cloud unit and the Chinese Academy of Sciences established a research facility based in Shanghai called the Alibaba Quantum Computing Laboratory.

At present, the most advanced quantum research teams in the USA correspond to Google, IBM, Rigetti, IonQ and Microsoft.

Europe is opting for a superconducting qubit strategy in the OpenSuperQ Flagship initiative and a ion quantum computer through Alpine Computing.

QILIMANJARO PROPOSAL

- QILIMANJARO will deliver a first-to-market full-stack Variational Quantum Machine: a coherent quantum annealing computer of superconducting flux qubits with an easy-to-access advanced quantum variational algorithmic toolset to effectively address complex optimization problems in multiple real-world industry use cases.
- "Full stack" means developing: 1) high-level algorithmic solutions; 2) a toolset and cloud access to quantum computers; and 3) a coherent quantum annealer hardware system.
- "Variational Quantum Machine" means a focus on addressing cross-industry optimization problems with orders of magnitude better performance.
- "Coherence" addresses the needed time for a quantum computer to remain in the quantum regime. Non-coherent computers are bound to only perform as classical ones.
- "Optimization problems" are faced across industries including software design, logistics, finance, web search, genomics, and more. While the toughest optimization problems in these industries stump classical computers, they are well-suited for being solved on a quantum machine.
- The Boston Consulting Group has highlighted QILIMANJARO as one of the contenders in the full-stack and in the quantum-annealing sector (November 2018).
- QILIMANJARO has already proven traction with customers:
 - Quantum algorithmic consulting, spanning both pure quantum, hybrid quantum/ classical algorithms in different industries.
 - Quantum lab setup for third-parties, including staff training, lab installation and lab management processes.
- Current contracts add up to 1 M€/year for three years.



WHO ARE WE

- The QILIMANJARO scientific team is a tightly knit team of QC experts with over thirty years of a successful international research track record, currently based in first-class academic institutions: Barcelona Supercomputing Center (<https://www.bsc.es>), a leading top-5 European supercomputing centres with 400 staff, the Institute of High Energy Physics (<http://www.ifae.es/eng/>), a leading experimental physics research centre in close collaboration with CERN, and the University of Barcelona (<http://ub.edu>), a leading top-5 research institute in Spain.
- QILIMANJARO is lead by a successful IT international executive, and is supported in terms of finance and legal operations by an experienced M&A consultant.

Founders team

Victor Canivell
Chief Executive Officer (CEO)

José Ignacio Latorre
Chief Science Officer (CSO)

Artur García-Sáez
Chief Software Architect

Pol Forn-Díaz
Chief Hardware Architect

Jordi Blasco
Chief Financial & Legal Officer

TIMELINE/ ROADMAP

2019

Team and lab build-up, complementing the academic labs.
On-going delivery of first customer consulting projects.

2020

First coherent quantum annealer tested with flux superconducting qubits.

Release of the quantum algorithms toolset.

Release of the quantum High-Performance-Computing backend connector.

On-going delivery of customer consulting projects.

2021

Production release of cloud access to the first Variational Quantum Machine.

New quantum toolsets.

New backend interfaces to third party quantum cloud services.



QILIMANJARO: 15M€

CORE TEAM



Victor Canivell - Chief Executive Officer (CEO)

Dr. Canivell has a PhD in Theoretical Physics from the UB and an MBA from ESADE, and has an extensive international track record in the IT industry of over thirty years. He has held Vice-President and Director business positions with European-wide responsibilities for Hewlett-Packard, Silicon Graphics-Cray Research, 3Com and PerkinElmer working out of their headquarters in the UK, Switzerland, Germany and the US. He has also led as CEO and as Chairman of the Board several IT start-ups in the fields of security (Safelayer, startup from UPC, later sold to KeyCard) and of bioinformatics (Integromics, startup from CNB-CSIC, whom he led the sale to PerkinElmer).



José Ignacio Latorre - Chief Science Officer (CSO)

Dr. Latorre is Professor in Physics at the UB and has a long-term visiting position at the Center for Quantum Technologies of the National University of Singapore. He has directed twelve PhD thesis and published over 100 research papers in Quantum Information and Particle Physics. He is a member of Singapore National Research Foundation's Quantum Taskforce. During his career he has worked as a Fulbright Fellow at MIT and as postdoc at the Niels Bohr Institute in Copenhagen. He is the Director of the Centro de Ciencias Pedro Pascual of Benasque. He is one of the pioneers in the study of quantum computing algorithms in Spain and has spent the last twenty years focusing in this field and building a corresponding research team.



Artur García-Sáez - Chief Software Architect

Dr. García-Sáez received his PhD at The Institute of Photonic Sciences (ICFO) working on classical and quantum correlations. He has since worked at UB and at the CN Yang Institute for Theoretical Physics of Stony Brook University (SBU). Upon his return from SBU, he is currently working at the BSC on optimization problems and Machine Learning applications. He is the head of BSC's QUANTIC algorithm team.



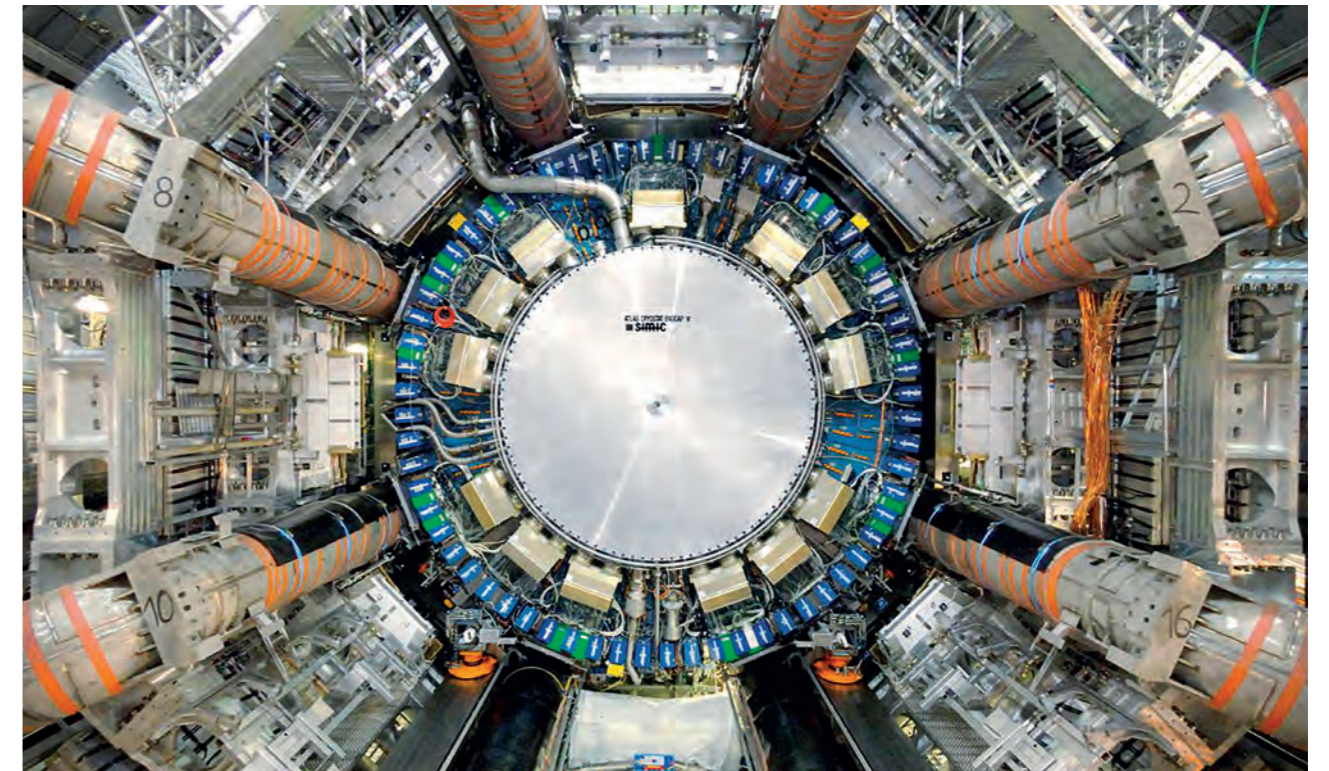
Pol Forn-Díaz - Chief Hardware Architect

Dr. Forn-Díaz obtained his PhD from TU Delft in 2010, with a study of superconducting flux qubits and the limits of the interaction strength to a superconducting resonator. After his PhD he became a visiting scholar at Prof. W. D. Oliver's Quantum Engineering Systems lab at MIT. He subsequently held a postdoctoral researcher's position in the Kimble Lab at the California Institute of Technology working on interfacing cold atoms and photonic waveguides. He later became a postdoctoral fellow at the Institute for Quantum Computing (IQC) at the University of Waterloo, Canada, working on superconducting qubits interacting with propagating microwave fields. Upon his return to Spain from IQC he has held research positions at BSC and is currently Group Leader of the Quantum Computing Technology Group at IFAE.



Jordi Blasco - Chief Financial & Legal Officer

Mr. Blasco is an M&A and corporate finance expert, and a Board of Directors advisor. He holds a lawyer's degree from the Universitat Autònoma de Barcelona (UAB). He has a Tax Diploma (EADA Business School), a Master in Auditing (UAB and the Catalan Chartered Accountants Institute), an Executive MBA (EADA Business School) and a postgraduate degree in business administration (IESE Business School). He has founded several companies and firms, among them the law firm BLASCO SELLARES legal + tax, and the boutique investment consultancy for corporate finance and mergers & acquisitions advice, ARS Corporate. He is a member of several Boards of Directors in different sectors, including media, infrastructures, consulting, technology and education. He is also a lecturer on M&A and Corporate Finance studies at EADA Business School and the Catalan Economists Bar Association.





Barcelona is FUTURE

- 7 universities with more than 150.000 students
- World-class business schools
- A networks of leading-edge research centers
- An ecosystem of 2.000 startups



Barcelona is EXCHANGE

- A world-class airport&harbour
- Headquarters of international companies
- Capital of worl-class events
(Mobile world Congress, Smart City Congress)
- Thousands of SME's in many industries
- Art, Music & Sports capital
(Seat of Football Club Barcelona)
- Attracting 8 million people a year



Barcelona takes CARE of you

- First-class hospitals
- Mediterranean healthy local food
- Thousands of restaurants about 30 with Michelin stars
- 40 Markets and thousand of friendly shops



Some clients of The Institute of Next

Futbol Club Barcelona
 LEGO
 HP
 TELEFONICA
 VODAFONE
 BASF
 SUEZ
 CAF
 VOLKSWAGEN
 REPSOL
 IBERDROLA
 FERROVIAL
 TOTAL
 THYSSEN KRUPP
 NOVARTIS
 SANOFI
 ABBVIE
 GB FOODS
 DANONE
 PEPSICO
 PUIG
 DESIGUAL
 BANCO SANTANDER
 BBVA
 CAIXABANK





INSTITUTE
OF NEXT
Barcelona

2019 S&T Bridge

Connecting **Barcelona** and **China**
science and technology ecosystems.

