ANNUAL REPORT 2022

SAL

SAL
SILICON AUSTRIA LABS

Silicon Austria Labs (SAL) is a top European research center for electronic based systems (EBS). At three locations, Graz, Villach, and Linz, the application-oriented center offers cooperative research along the value chain of EBS – from wafer to intelligent system – and develops innovative solutions for industrial production, health, energy, mobility, safety and more.

silicon-austria-labs.com

173
PROJECTS

128
PUBLICATIONS

289
EMPLOYEES

450
MEDIA REPORTS

Leonore Gewessler
Federal Minister
for Climate Action,
Environment, Energy,
Mobility, Innovation and
Technology

In these often challenging times, it is important to not lose a positive outlook on the future. Crises can offer opportunities and foster positive change, but they need to be recognized and seized at an early stage. We want to be at the forefront in Austria and continue to have world market leaders in environmental technology in our country in the future. With our investment in electronic based systems (EBS), we have taken the right step to focus on long-term solutions and support R&D directly in Austria to stay internationally competitive.

Marion Mitsch
CEO Austrian Associa-
tion for the Electric and
Electronics Industry

It is essential to master strategic technologies, actively promote cutting-edge research and bundle know-how within a country to be successful in international competition – a goal which can be achieved through the joint effort of politics, industry, economy and society. As a shareholder of SAL, it is of great importance to the Austrian Association for the Electric and Electronics Industry (FEEI) to strengthen the Austrian business location through distinctive and meaningful research promotion. A strong business location can subsequently ensure job opportunities, secure prosperity and enable solutions – for today and for the future.

Barbara Eibinger- Miedl
Provincial Minister for
Economics, Science and
Research (Styria)

Microelectronics are the industry of the future. Here, key technologies of digitalization are developed. Within this rapidly growing sector, Silicon Austria Labs has become an important actor. Thus, financially supporting SAL until 2030, as agreed upon by all partners, is of utmost importance for the success of Styria as a business and research location. By further developing the top research center, we can accelerate research on microelectronics and strengthen our international positioning. I would like to thank the entire team at SAL for their great commitment and I wish them a successful future!

Gaby Schaunig
Provincial Minister for
Technology (Carinthia)

Opening Austria's biggest research cleanroom at the High Tech Campus Villach marked another milestone along the way of Silicon Austria Labs' development to becoming a leading actor in non-university research in Europe. The new facilities covering 1,100 m^2 will be used to conduct applied research on Photonic Systems and More-Than-Moore-Microsystem Technologies up to small-series productions. The successful execution of this lighthouse project shows the great unbroken commitment of all partners to expand Silicon Austria Labs.

Markus Achleitner
Provincial Minister
for Economics and
Research (Upper
Austria)

In Linz, Silicon Austria Labs is developing key technologies for a wirelessly connected factory of the future with research on the new generation of wireless communication, 6G. This is opening up entirely new business opportunities for the digitized industrial production. The business and innovation location Upper Austria thus has an important actor at the interface between science and economy. With our involvement in SAL via the Upper Austrian Research GmbH, we want to establish Linz as a center for 6G research to secure the foundation of our value chain for the future.

Ingolf Schädler
Chairman of the SAL
Supervisory Board

Onto the next period of growth for SAL

After three eventful years since the foundation of SAL, 2022 was a year of consolidation with reduced growth in employment and investment. We made good use of the time and prepared important decisions coming into effect in 2023. SAL launched an international search for a Chief Technology Officer (CTO) to add to our team, which yielded successful results by the end of 2022 with Bruno Clerckx, a full professor at Imperial College London and a distinguished researcher with a strong background in industrial cooperations within the EU and Asia.

In spring 2022, we paved the way for a variety of long-term strategic cooperation projects by implementing strategic research talks with key account customers from the industry, which we will continue to develop and expand in the future to lay the foundations of long-term strategic planning with the industry.

In June, the Supervisory Board adopted the refined Multi-Annual Strategic Plan (MASP), turning strategic research plans into concrete financial figures based on SAL's long-term "Vision 2030". In August, the MASP was then successfully turned into a declaration of SAL's shareholders from public administration and the industry at the European Forum Alpbach, in which they committed themselves to support SAL for the next financial period from 2024 to 2026. By the end of the year, these declarations were summarized in a framework agreement, laying the ground for the next period of growth for SAL.

Thus, SAL's journey will continue, and we all hope you will join us!

Klaus Bernhardt
Deputy Chairman of the
SAL Supervisory Board

Key Technologies for Europe

Over the last years, politics has become increasingly aware of the great importance of key technologies for a functioning national economy. Electronics and software-based systems are the key technology to meet ever-present challenges of humankind, such as climate change and resource availability in a smart and efficient way. The European Commission responded to these challenges with the European Chips Act. The intention of this act is to advance digital technologies while also facilitating their implementation in Europe. In the past, the European weakness of conducting research on new technologies without implementing them on the market has led to problems in the European economy, such as the chip crisis. With the European Chips Act, a first step to combat these problems has thus been taken.

In Austria, the need for high technologies has been recognized early on. Public initiatives led to the founding of Silicon Austria Labs – at the same time, the industry has invested greatly into the business location Austria. As a result, Austria is at the top of European high-tech countries in terms of value creation as far as the production of microelectronics is concerned.

In this dense ecosystem of microelectronics and embedded software established in Austria, SAL plays a major role as an innovation driver, strengthening existing fields like Power Electronics and creating opportunities for new success stories by connecting research and development with the industry and partner companies.

Gerald Murauer
Chief Executive Officer

Research Power for the Green Transformation

Another challenging year comes to an end. The COVID-19 pandemic was followed by a war in Europe, a commodity and energy crisis as well as very high inflation we have not seen in decades. Companies are certainly part of this challenge, and so is SAL. But every crisis offers new chances: The power and duty of research and the growing importance of the EBS industry are increasing year by year.

With our SAL Vision 2030, we strive for higher impact until 2030. Under the guiding principles "EBS for Green – EBS for Europe – EBS for Austria", we conduct research on trustworthy and sustainable EBS along the entire value chain. In doing so, SAL uses and creates synergies, bundles them in its five lighthouses Photonics, More-than-Moore, High Power Density Converters, 6G and Dependable EBS, and offers industry the most flexible opportunities for cooperation. The long-term goal is to position Austria as a key player in the European EBS landscape, in cooperation with partners from industry and academia. With the joint declaration by high-ranking representatives from politics and industry at this year's Forum Alpbach, we can also count on the long-term support of our shareholders on the way to the SAL Vision 2030.

In order to become a world-class research center, we need motivated and excellent researchers, innovative projects and beyond-state-of-the-art infrastructure. Particularly noteworthy is the Tiny Power Box (TPB) project, which was completed this year and is now continued in the follow-up project Tiny Power Box 2. In our award-winning Tiny Power Box more than 1,000 components were put together through the excellent work of 35 engineers and scientists. The Tiny Power Box 2 now paves the way to an even smaller and more powerful onboard charger. This success story demonstrates our research power for the green transformation.

With all these important milestones and our focus on key technologies, we are getting closer and closer to achieving our mission to become one of the top EBS research centers in Europe. A heartfelt thank you goes out to all our dedicated SAL researchers and employees who accompany us on this tough SAL journey! Only together we can create a greener, smarter and better future.

Bruno Clerckx
Chief Technology Officer

Top international researcher Bruno Clerckx joins SAL as new CTO

With Bruno Clerckx, SAL was able to recruit an internationally renowned researcher as the new Chief Technology Officer (CTO). The Belgian holds a professorship in Electrical Engineering at Imperial College London and is a specialist in wireless communications and signal processing. Having worked at Samsung's headquarters in Seoul, he played a leading role in the research and development of the 4th generation of wireless communications (4G) from 2006–2011. To date, Clerckx has published over 250 scientific articles and is the inventor of numerous patents. His outstanding research has been rewarded with the prestigious Blondel Medal by the French Association of Electrical Engineering, Electronics, Information Technology and Communication (SEE), among other prizes and best paper awards. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE).

At SAL, he is responsible for all Research Divisions – and we will benefit immensely from his international experience and his network in both Europe and Asia, as innovative research always thrives on international cooperations. Starting from January 9, 2023, Clerckx assumes his position at SAL's headquarters in Graz, ushering in a new era of application-oriented research and aiding SAL in gaining cross-border visibility!

SAL Leadership Team

In everything we do, we aim for the highest level of excellence and integrity. Our core values are about mutual respect of individuals, recognition of their contributions, and about open communication. They provide the framework for how we work together as one SAL team and implement our strategy. They guide the leadership team and all employees in their day-to-day business.

Gerald Murauer
CEO

Bruno Clerckx
CTO (from January 2023)

Christina Hirschl
Head of Research Division Sensor Systems Site Manager

Thomas Buchegger
Head of Research Division Intelligent Wireless Systems Site Manager

Alfred Binder
Interim CTO (until end of 2022), Head of Research Division Power Electronics (from February 2023)

Rudolf Krall
Head of Research Division Power Electronics (until January 2023)

Mohssen Moridi
Head of Research Division Microsystems

Emily Knes
Head of Human Resources

From A to V: Diversity at SAL

To date, SAL is counting nearly 300 employees – who hail from forty different countries, starting from A as in Algeria to V as in Vietnam. With such a large number of nationalities represented within our ranks, internationality and diversity are a living reality. This kind of diversity not only makes for a multilingual workplace, enriching the day-to-day business life with various different languages and dialects spoken at every office corner, but also for a very productive one, enabled through the variety of different backgrounds, professional trainings and experiences that each and every employee contributes to our research center.

Jean Temga, Cameroon
Jean Temga is a Canadian originally from Cameroon. He studied his PhD in China and has previously worked in the PolyGrames Lab at the Ecole Polytechnique of Montreal in Canada, and at NICT & RIECT in Japan. He is now a mmWave and sub-THtz Senior Scientist at SAL.

Marcus Vieira-Soares, Brazil
Marcus Vieira-Soares is originally from Brazil and at SAL, he is working on a low inductance grid-tied inverter control design and implementation on FPGA in the Research Division Power Electronics.

Sabine Lengger, Austria
Sabine Lengger has lived and worked in three continents over the past 15 years and was an Assistant Professor in Chemistry in the UK before moving back to Austria. At SAL, she is now working on chemical sensors, thin film electrodeposition of functional polymers, and sustainability topics.

Giovanna Grosso, Italy
Giovanna Grosso is originally from Italy and at SAL, her research focus is on multidomain numerical simulations and reduced order modeling of electromagnetic, thermo-mechanical and thermo-fluidic processes in electronic based systems.

Pooja Thakkar, India
Pooja Thakkar is originally from Gujarat, India, and she is an experimentalist. At SAL, her research focus is on building and characterizing micro-optical systems. She also works on test bench development for integrated photonic sensors.

Atefeh Kordzadeh, Canada
Atefeh Kordzadeh is originally from Canada and at SAL, she is working on electromagnetic simulations for transceiver passive elements like transmission lines, transformers and baluns.

Female Power at SAL

Teamwork is the name of the game – and yet it is equally important to acknowledge and celebrate the individual milestones of our employees within the big picture! Enjoy some research highlights of four of our colleagues in 2022.

Madeleine Petschnigg
Junior Scientist Thin Film Technologies

In 2022, I had the pleasure to join Penn State University in Pennsylvania as part of my PhD program in Materials Science and Engineering. The team of Prof. Susan Trolier-McKinstry at the Materials Research Institute works on the reliability of ceramic thin films. Working towards a better understanding of factors governing the long-term stability of the material facilitates the development of new devices with improved performance. I highly appreciate having had the great opportunity to collaborate with Penn State and being a graduate student in Prof. Susan Trolier-McKinstry's research group.

Mahin Atiq
Scientist Wireless Communications

At SAL, my research focus is wireless TSN, 5/6G and enabling industrial automation. I am part of the EU Horizon project Deterministic6G where I am working on time synchronization aspects of the 6G architecture. I'm also part of the SAL research documentation team.

Annalisa DePastina
Senior Scientist Piezoelectric Microsystem Technologies

One of the most exciting research activities I participated in in 2022 was the strategic project Microfluidics, a fruitful collaboration between SAL and and JKU, which focused on the development of an acousto-fluidic system for particle focusing in lateral mode. The fabrication was carried out in the SAL cleanroom. As a result, we obtained complex Si glass microfluidic channels equipped with a commercial piezoelectric actuator for experimental testing. The project results were recently admitted to the Transducers 2023 Conference in Japan. The integration of piezo-electric thin films on chips and the acquisition of fluid testing equipment would enable unprecedented performance and tackle a wide range of relevant applica-tions, such as the detection of impurities in food or water or the development of bioassays to detect DNA, viruses or bacteria.

Katrin Unger
Senior Research Engineer Electronic Sensors

I started working in the Electronic Sensors Research Unit at SAL in November 2022. My responsibility is setting up the new Validation Lab in our headquarters in Graz. In this lab, we are testing electronic components under a wide range of environmental conditions. I have already met many wonderful colleagues here at SAL who are experts in various fields. As a materials physicist, I am looking forward to pushing various components to their limits, characterizing them, and thereby gaining insights into developing more durable electronic components.

HIGHLIGHTS 2022

12/2018
Foundation of Silicon Austria Labs GmbH

07/2020
SAL joins the Research Financing Act

12/2021
SAL exceeds number of 250 employees

03/2022
Lab infrastructure at SAL Linz is growing, installation of Wafer Prober

04/2022
Start of long-term SAL program Chip2Sys with 17 partners

06/2022
Research Unit Microsystems has grown to more than 40 researchers and becomes Research Division

06/2022
Opening of the new HTC2 building in Villach

06/2022
First SAL cooperative research project Tiny Power Box has successfully ended after 3 years

08/2022
Press conference "SAL Vision 2030" at the European Forum Alpbach

09/2022
First 200 mm MEMS wafer produced at SAL MicroFab

10/2022
SAL co-hosts EWSN conference in Linz

11/2022
Tiny Power Box wins OVE Innovation Award

12/2022
Successful completion of COMET program ASSIC

SAL Vision 2030

ON AUGUST 25, 2022, THE FUTURE OF SAL WAS SECURED.

During a press conference at the European Forum Alpbach, high-ranking representatives from politics and industry declared their ongoing support for SAL in a joint declaration – a crucial milestone marking four years since the founding of SAL at the Forum Alpbach in 2018.

By 2030, SAL intends to become a leading player in non-university research in Europe with more than 600 researchers and employees at the three sites in Graz, Villach and Linz. Gerald Murauer, CEO at SAL, presented our vision for the upcoming years at the press conference.

"The SAL Vision 2030 focuses on three main ideas: With our research on electronic based systems, we want to face the challenges of climate change upfront. We also want to continue developing the research location Austria and increase Austria's share on the global electronic semiconductor market. With the support of our shareholders and partners, we will rise to the Champions League of top European research!"

GERALD MURAUER
CEO

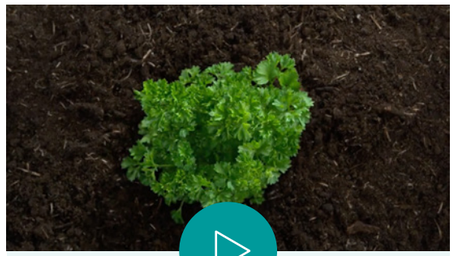
From left to right – Christoph Ludwig (SFG), Gaby Schaunig (Federal State of Carinthia), Gerald Murauer (SAL), Leonore Gewessler (BMK), Wilfried Enzenhofer (UAR), Sabine Herlitschka (Infineon Austria, FEEI), Marion Mitsch (FEEI).

EBS for Green

Sustainability is an omnipresent concept in the modern world, with climate change being one of the central challenges of our time – a challenge which we can only address together as a unified front. This is where our first pillar EBS for Green comes into play. By advancing the use and development of novel key technologies regarding future-oriented solutions for energy, mobility, health or the environment, we can make significant contributions to a smarter and greener world. However, many of the necessary key technologies for lasting changes are still in their early stages of development.

Here at SAL, we are advancing these developments by promoting future- and application-oriented research in different areas and through various projects with partners from industry and academia.

We are working on sustainable printed sensors, a battery-sharing system for electric bicycles, simulations of electromagnetic compatibility for sustainable design processes and sustainable photovoltaics, to name just a few projects and areas of expertise represented at SAL.



YouTube
Video "SAL's vision for a better future"

With the pillars "EBS for Green", "EBS for Austria" and "EBS for Europe", SAL wants to further strengthen the Austrian and European EBS ecosystem and become a one-stop-shop for EBS research.

YouTube
Video "Printed and flexible electronics and sensor applications at SAL"

PRINTED ELECTRONICS

Our research team around Jürgen Kosel, Head of the Research Unit Sensor Applications, works on a wide range of sensors based on state-of-the-art technologies. One particular focus is on printed electronics which make it possible to manufacture sensors with minimal material and energy consumption. This field of research is particularly important as electronic waste is the fastest-growing waste component across the EU. Printed electronics can be realized on practically any material, making it possible to produce sensors from regenerative and biodegradable materials. Material consumption can be further minimized by printing on both sides of the respective material.

EBS for Austria

SAL is dedicated to strengthening Austria's position as a global player on the electronic semiconductor market. By acting as a connector between fundamental research at universities and industrial applications, we are using our interdisciplinary positioning to our advantage for synergies along the entire EBS value chain.

In doing so, we are significantly contributing to the development of the EBS location Austria, living up to our second pillar EBS for Austria. At our three locations in Graz, Linz and Villach, we are working on future-oriented solutions for health, energy, mobility, safety and more, and are thus "unfolding the future" in Austria.

5G TESTBED

5G in industrial applications holds enormous cost-saving potential for process and production operations. Reliable wireless communication through 5G enables high-level automation of distributed industrial plants. They can be more maintainable, flexible, and resilient to system changes.

With the support from partners, SAL established a "5G Research and Experimentation Testbed" in Linz for industry-related research at the JKU LIT Factory in 2022. The testbed will support the development and validation of industrial 5G applications for industry and SMEs.

EBS for Europe

Within the next few years, SAL intends to become a leading player in non-university research on EBS, increasing the European share of the global semiconductor market – which, as of 2020, amounted to 10 %. With the European Chips Act, the EU intends to double this number within this decade, and thus reduce European (supply) dependencies on foreign actors.

Achieving this goal will only be feasible by bundling research capacities within the non-university sector – a goal which SAL is contributing to by enabling cooperative projects with partners from all over Europe. In doing so, we are creating a hotspot for microelectronics in central and south-eastern Europe: EBS for Europe.

The CoRaLi-DAR project kick-off meeting took place at SAL in Villach.

CORALI-DAR

One example of such a joint EU-funded effort is the CoRaLi-Dar project (Collaborative Radio-Light Detection and Ranging), which SAL is coordinating. The aim is to develop an innovative sensing system for Advanced Driver Assistance System applications (ADAS) and beyond.
Together with our partners, we are going to develop an advanced detection and ranging sensor system based on a collaborative scheme, integrating both radio and light-based sensing on the same module. Within the project, a silicon photonics solid-state LiDAR (light detection and ranging) chip with an integrated laser source and driver electronics as well as a CMOS radio detection and ranging (RADAR) chip will be co-assembled on the same PCB. A processing unit will be controlling the sensors.

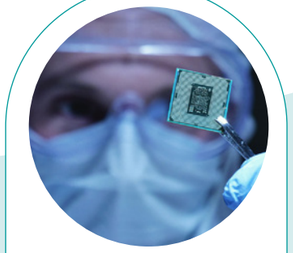
The project CoRaLi-DAR is supported by The European Union through the Horizon Europe programme (Grant Agreement project 101092834).

SAL Light-houses

The charter of SAL is to serve the broader EBS ecosystem in Austria from the semiconductor industry to system integrators and industrial users of EBS, and thereby contribute to a successful digitalization of the Austrian economy. With the SAL Lighthouses, we have identified research areas that will have a strong impact for future technologies. The Systems Integration Program focuses on research that is integral for every lighthouse.

Systems Integration Program

Model-based system engineering, multi-domain modeling, EBS verification and validation



MORE-THAN-MOORE

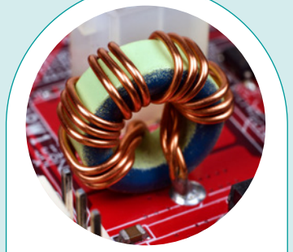
Integrated microsystems for sensors, filters and actuators

PHOTONICS

Age of light overcoming the physical limits of electronics

6G

Intelligent wireless systems for convergence of communications, radar and sensing

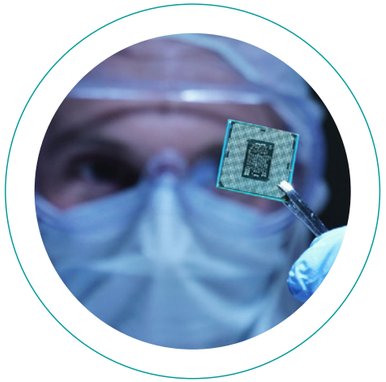


HIGH POWER DENSITY CONVERTERS

Electrification by power converters with highest power density and efficiency

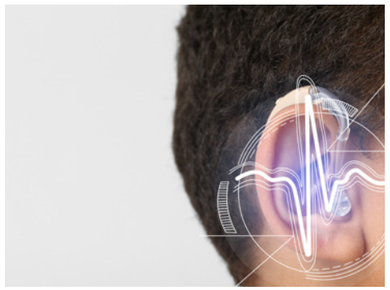
DEPENDABLE EBS

Intelligent electronic based systems in which we trust



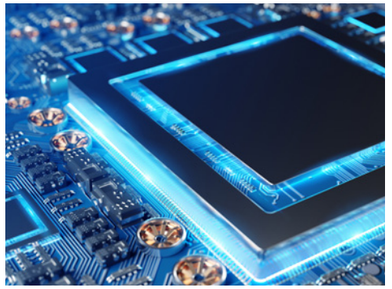
More-than-Moore

At SAL, More-Than-Moore refers to research on the reduction of complexity of components, their miniaturization and increased efficiency. Our Lighthouse covers the entire research value chain and combines it with high-tech manufacturing technologies.



LISTEN2FUTURE

Together with Infineon Technologies and 26 other international partners from seven nations, SAL is developing novel microphones and ultrasound sensors for industrial and medical applications. We will work together closely with GE Healthcare to create more efficient ultrasonic MEMS transducers for medical uses. To speed up the product development cycle, a development platform including modeling and design, microfabrication, and testing will be established.



PIEZO MICROMIRROR

MEMS or MOEMS – micro(opto)-electro-mechanical systems – are of interest for many different applications. They enable the creation of smaller systems which are more power efficient and make use of physical effects that are only dominant at microscales. Special attention is devoted to MEMS scanning micromirrors that typically rely on a reflecting area (“mirror”) in the center of the micro-scanner actuator which is used to scan a laser beam across a line or an area. We make use of MEMS scanning micro-mirrors to pave the way for new applications such as dynamic road lighting for the automotive industry, based on distance measurement.

This endeavor is realized within the framework of a four-year cooperative project involving SAL and the partners Evatec, EV Group, TDK Electronics, and ZKW who will integrate the final system in vehicles.

SAL MICROFAB

Over the last years, SAL has established a 300 m^2 ISO-5 R&D cleanroom facility at the High Tech Campus in Villach: a contamination-free environment with controlled temperature, humidity and pressure, furnished with state-of-the-art equipment to carry out microfabrication and prototyping of micro(opto)electromechanical systems (M(O)EMS), and advanced wafer level packaging. In July 2022, a new building was inaugurated, hosting an additional 1,100 m^2 of cleanroom space, making the SAL MicroFab the largest research cleanroom complex in Austria with a total area of 1,400 m^2. The new facility will be equipped with batch processing tools that will enable industrial R&D and small series prototyping, thus positioning SAL MicroFab at the junction between research development and high-volume manufacturing.

Photonics

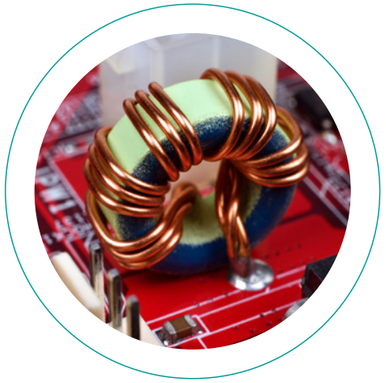
Defined as a European Key Enabling Technology, Photonics pushes the limits of a wide range of applications from sensing and metrology to (quantum)communication, lighting and photovoltaics. SAL's comprehensive know-how from photonic devices to systems backed by an advanced research infrastructure and long-term experience is unique in Austria and among few in Europe.

COMPAQT

The next generation of Quantum Key Distribution (QKD) devices will require compact footprints for transmitter and receiver modules. CompaQT brings together research partners from Austria and Germany, selected for their strengths in complementary research areas, to develop a PIC-based QKD system.

ENLIGHTEN

The space sector is currently faced with growing competition and technological disruption. To preserve independent access to space for Europe, it is vital to support the development of European space launch vehicles. In the framework of ENLIGHTEN, the goal is to improve the competitiveness of the European engine by preparing a demonstrator of an environmentally friendly high-performance engine based on liquid hydrogen.



High Power Density Converters

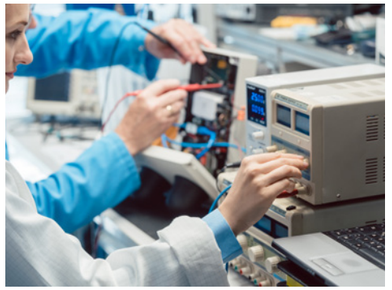
Climate change demands an energy turn-around along with stronger electrification. This is where modern efficient power converters with the highest power density and efficiency come into play as key enablers with an immense range of target applications, replacement markets and impact potential.

TINY POWER BOX

More compact, lightweight and efficient – the project "Tiny Power Box" focused on optimizing the power density of onboard chargers in e-cars. The results: reduced weight, fewer components and less space needed, all the while enabling quicker and more efficient charging and increasing environmental compatibility. Owing to the successful first project phase, the follow-up project "Tiny Power Box 2" started in fall 2022.

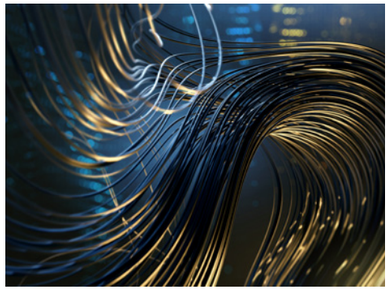
YouTube

Video "Tiny Power Box: Onboard charger for electric cars"



PREMI

Electromagnetic interferences (EMI) generated by power electronic circuits are of growing importance. In this cooperative project, we analyze day-to-day EMI prediction workflows, identify bottlenecks, and show how they can be overcome by using new modeling techniques and optimized simulation methods. Project results are toolchains and workflows tailored to the specific needs of our industrial project partners with a special focus on high voltage circuits.



CABLEMEMO

High speed cable measurement and modelling, CableMeMo for short, was a short-term successfully completed cooperative project in 2022. The scope of the project was the creation of simulation models of a custom high-speed data link harness with multiple high-pin-count connectors for signal integrity analysis. All parts of the system were modelled individually based on 3D electromagnetic simulation and measurement. The generated modular simulation testbench allows us to virtually exchange components to investigate their impact on the overall system performance and thus identify weak points in the signal transmission path.

6G

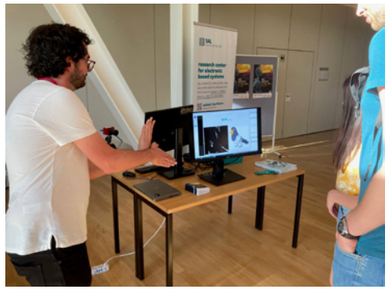
The 6th generation of wireless communication – 6G for short – enables the transmission of large volumes of data in nearly real time. Currently, the necessary fundamental research for a general market launch of 6G starting in 2030 is forming internationally, and SAL is playing among big actors, conducting research on essential enabling technologies for 6G.

INTERNATIONAL EWSN CONFERENCE

After nearly twenty years of successful EWSN conferences held all over the world, in October 2022 it was Austria's second turn to host the annual forum for presenting research results in the field of networked Embedded Systems. With 103 participants from fifteen different countries and two keynote speakers from the USA, the EWSN that took place at the JKU campus in Linz was a great success.

DETERMINISTIC6G

Future 6G technologies must ensure end-to-end (E2E) deterministic communication flows across multiple heterogeneous domains, including wired and wireless communication infrastructure, as well as across the applications hosted in the cloud. As a joint effort between key industrial players, universities, and research institutes at the forefront of 6G fundamental research, the EU-funded Deterministic6G project will address the central challenges in this context.



EVENT-BASED CAMERA

The team of the Research Unit Embedded AI is doing fundamental research on real-time hand gesture recognition which is important for safety precautions in production halls or for self-driving cars. Instead of using frame-based cameras that lead to huge loads of redundant data processing, event-based cameras are used to drastically reduce the computational load, and therefore significantly reduce energy consumption while processing data.

Dependable EBS

Electronic based systems form the backbone of digitalization, and it is essential that they are reliable and trustworthy. Our team around the Lighthouse Dependable EBS is conducting research on various technologies that contribute to the dependability of EBS, from software development for the Internet of Things to the explainability of Artificial Intelligence (xAI).

DAGSTUHL SEMINAR 2024

We are pleased to announce that our staff scientist Ingo Pill will co-organize the Dagstuhl seminar on "Fusing Causality, Reasoning, and Learning for Fault Management and Diagnosis" from January 14–19, 2024, together with international experts. Dagstuhl seminars are highly coveted academic events at Schloss Dagstuhl, Germany, organized by established leaders in their respective fields. In this seminar we will discuss the fundamental principles of fault management and diagnosis, bringing together international researchers from the fields of symbolic reasoning, machine learning, and control engineering.

SUNRISE

To secure the independent and reliable access of Europe to space and to the necessary technologies like communication and earth observation systems, new sustainable technologies such as reusable rocket carrier systems must be developed further. The research team around Sunrise is working on a future-oriented data collection concept for exactly these technologies.

TEX-HYPE

TEX-Hype aims to improve the integration of electronics and sensors into smart textiles, enabling automatic medical data collection and transfer to the responsible medical personnel, thus rendering hospital stays more efficient. To achieve the goal of flexible smart textiles, hybrid printed electronics and printing methods compatible with the textile industry are used.

Collaborations with SAL

With strategic and contract research as well as in cooperation with industrial and scientific partners, SAL conducts research on relevant key topics with future-oriented development potential.

Read more

R&D SERVICES

Our service portfolio encompasses customized solutions for our partners. From design and simulation to characterizations, measurements and testing, to manufacturing in the field of micro- and nanotechnology, we offer a wide range of R&D services for all our research areas: from Sensor Systems, Microsystems, Power Electronics, Intelligent Wireless Systems to Embedded Systems.

LISA KAINZ
Manager
Business Development & Marketing

COOPERATIVE RESEARCH

Our unique SAL cooperation model is characterized by the rapid implementation of innovative ideas. With this model, we enable our partners to implement their research idea not only quickly and unbureaucratically, but we also finance 50 % of the project costs. The industry partner solely contributes 25 % in cash and 25 % in-kind services. The costs are not dependent on the sector; however, they vary depending on the number of project partners. The IP rules for all our projects are in accordance with European state aid law and every cooperation project is publicly and anonymously advertised for four weeks to allow other suited partners to take part. This way, any project can be started within mere weeks.

HEIMO MÜLLER
Head of Business Development and Grant Office

Read more

CONTRACT RESEARCH

From the semiconductor industry to systems integrators and industrial applications: we provide our partners with the crucial competitive advantage through technology investigations, feasibility analyses, proof-of-concept studies, prototype constructions and many more! You will benefit from our state-of-the-art equipment and laboratories, quick project starts and fixed prices.

THOMAS LADSTÄTTER
Senior Manager
Business Development

Research Network

Together with our partner universities, we have formed a strong research network for EBS with the objective of making young research talents thrive and deliver excellent research results of high relevance for academic and industrial EBS ecosystems.

5
LABS

2
INNOVATION HUBS

5
UNIVERSITIES

187
AUTHORS

79
PUBLICATIONS

SAL & University of Klagenfurt

USE LAB

"The USE Lab connects AAU's research focus with SAL's competencies in heterogeneous integration of micro and sensor systems. Bundling our competencies along the entire value chain is an important asset to be a notable actor in an international research environment. Our interdisciplinary collaboration and regular exchange of research results enable problem solving on a system level. As a result, better solutions can be found in less time than would be the case with detached, sequential research."

– Hubert Zangl
Institute of Smart Systems Technologies

SAL & University of Applied Sciences Carinthia

RFFE LAB

"The RFFE Lab has been established as an innovation hub for applied research on RF integrated circuits for wireless and wireline high-speed data communication. The close interaction of researchers in the RFFE Lab is a fruitful basis for research, know-how and staff exchange. In addition, the interdisciplinary focus on IC design and heterogeneous integration supports SAL's research portfolio."

– Johannes Sturm
Department of Integrated Systems and Circuits Design

SAL & University of Applied Sciences Graz

POWER HUB

"The cooperation between SAL and the University of Applied Sciences Graz within the framework of the SAL Power Hub enables the involvement of lecturers and students in large research endeavors. The joint use of human resources and laboratory infrastructure enables synergies that significantly promote our application-oriented education and applied research. Our students can thus be involved in application-oriented research, working closely with the Austrian electronics industry as well as with international research partners."

– Martin Payer
Financial Managing Director of the University of Applied Sciences Graz

SAL & Johannes Kepler University Linz

ESPML LAB

"Signal processing, communications, and machine learning represent well-established and highly visible research fields at JKU and are also part of SAL's research focus. The eSPML lab is boosting those activities for both institutions with strategically aligned projects, joint supervision of postgraduate students, continuous knowledge exchange, and joint usage of equipment. For SAL it additionally helps to recruit highly qualified scientists."

– Mario Huemer
Institute of Signal Processing

SAL & Johannes Kepler University Linz

MMW LAB

"In the LIT/SAL mmW-Lab, we work on high and ultra-high radio-frequency circuits for next-generation communication and sensing in 6G. A unique feature of this joint lab setup is the scientific freedom and the focus on innovative aspects, which are also directly available for cooperative projects thanks to the close interaction and technical exchange. Synergies in the cost-intensive mm-wave lab equipment between JKU and SAL are especially noteworthy, allowing an overall efficient use of funds."

– Harald Pretl
Institute for Integrated Circuits
– Andreas Stelzer
Institute for Communications Engineering and RF Systems

SAL & University of Technology Graz

DES LAB

"In the Dependable Embedded Systems Lab (DES Lab) we bring together world-class researchers in AI and Verification to raise the trust in IT systems. It is a great place to learn from each other: AI provides methods to automate verification, and verification techniques improve the robustness of AI. The joint funding of TU Graz and SAL enables us to leave the comfort zones of our own expertise."

– Bernhard Aichernig
Institute of Software Technology

SAL & University of Technology Graz

GEMC LAB

"I value the collaboration with SAL in the GEMC Lab as it allows us to work jointly on fundamental research questions that are not quite interesting yet for the industry. The possibility for basic research enables us to establish new knowledge and skills we can use in joint projects with the industry, targeting higher technology readiness levels. By answering the research questions in the GEMC Lab and demonstrating our new solutions, we can offer industry partners novel, innovative solutions."

– Jasmin Grosinger
Institute of Microwave and Photonic Engineering

SAL DC

The SAL Doctoral College (SAL DC) offers young researchers in the field of EBS an opportunity to establish international connections and become future research leaders in an interdisciplinary and intersectoral environment.

SAL DC SUMMIT IN KLAGENFURT

Our SAL DC students spent three days in Klagenfurt where they were able to connect with each other, present their work and listen to interesting talks during the SAL DC Summit 2022.

FRANZ VOLLMAIER

SAL DC student and Scientist at SAL Graz

SAL provides a good environment to study scientific topics which are closely related to current and future needs of the electronic industry. Therefore, I decided to join in 2018 in the field of Power Electronics. By bringing together experts from academia and industry, SAL DC offers a great opportunity to exchange knowledge and experience and to build a professional network.

JOHANNA ZIKULNIG

SAL DC student and Scientist at SAL Villach

Since 2022, I have been enrolled as a PhD student at École Polytechnique Fédérale de Lausanne in Lausanne, Switzerland, where I have also been on site several times to attend classes on campus. It is great that my research work is compatible with my flexible part-time parental leave, and how personally enriching the stays abroad associated with the PhD are.

JULIAN KAROLINY

SAL DC student and Junior Scientist at SAL Linz

I am currently doing my PhD within the Intelligent Secure Trustable Things project (InSecTT) at SAL. In this project, over fifty partners from Europe are involved, who work on different topics in the Internet of Things (IoT) domain. This mix of universities, research organizations, and industry partners provides a great opportunity to exchange knowledge from various viewpoints.

Locations

SAL BUILDING, GRAZ

Four floors on 3,300 m² provide new offices for around 250 SAL employees in the future. A special highlight of the building are the open space areas, where team meetings, science talks and other inspirational presentations are going to take place. The new premises are handed over in March 2023. Builder: BIG www.big.at

HTC 2, VILLACH

In summer 2022, our employees in Villach settled in the additional office and laboratory areas on two floors of the new HTC 2 building. The new premises are not only going to provide space for around 155 employees but also excellent research capabilities in the newly built cleanroom with 1,100 m² of space, which our team is going to start equipping with individual tools already by July 2023.

SCIENCE PARK 4, LINZ

In 2021, the SAL team in Linz moved into the 4th floor of Science Park 4, which provides offices for more than 70 employees from the Research Division Intelligent Wireless Systems. A wafer prober and a special oscilloscope were added to the growing lab infrastructure. The 5G Testbed is also in close vicinity.

ASSIC Success Stories

AUSTRIAN SMART SYSTEMS INTEGRATION RESEARCH CENTER

The focus of the research activities of ASSIC is on intelligent systems integration based on micro- and nanotechnologies. With its research activities, ASSIC offers well-founded systems knowledge about components, technologies, materials, assembly, and connection technologies.

For the past eight years, SAL has worked together with several industrial and scientific partners on innovative projects within the scope of the ASSIC program, which ended at the end of 2022.

Visit us online

WWW.ASSIC.EU

ASSIC Austrian Smart Systems Integration Research Center | operated by SAL

Bundesministerium Digitalisierung und Wirtschaftsstandort
Bundesministerium Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
FFG Forschung wirkt.
LAND KÄRNTEN
Das Land Steiermark Wirtschaft, Tourismus, Regionen, Wissenschaft und Forschung
KWF
SFG NEUES DENKEN. NEUES FÖRDERN.

DEVELOPMENT OF AN OPTICAL MEASURING SYSTEM FOR CONDITION MONITORING OF FUEL CELL SYSTEMS

Hydrogen is becoming increasingly important as a green energy carrier, which requires innovative sensors and measurement technologies. Within this project, a demonstrator that measures hydrogen, oxygen and nitrogen with sufficient accuracy and a fast response time was developed. This will contribute to the further development and establishment of fuel cell technology in the mobile and stationary sector.

Magpylib

THE MAGPYLIB PACKAGE – FAST, FUN AND FREE MAGNETIC FIELD COMPUTATION

Magpylib is a Python package that contains many analytical solutions implemented professionally. The field computation is coupled to a position and orientation application programming interface (API) that makes it easy to work with relative object positioning. The focus is on user friendliness and on enabling fast and accurate 3D magnetic field computation for everyone.

With this in mind, SAL has decided to implement several measurements within a workplace health promotion project, which we started with a kick-off event on November 22, 2022. After a healthy and nutritious breakfast, Univ. Prof. Dr. Peter Hofmann gave an impulse lecture.

Based on a survey conducted, we will now integrate different activities into the everyday work life of our employees. There have already been several sports events like regular yoga classes or a jumping rope tournament. In May 2023, a team plans to participate in the "Business run" in Graz. In addition, focus groups will be held in 2023 to plan further specific measures.

VITAL4SAL

Workplace health promotion is a modern corporate strategy aimed at preventing illness in the workplace, strengthening health, and improving and maintaining people's well-being in the long term. It is based on the fact that the economic performance of companies depends to a large extent on qualified, motivated and healthy employees. On the other hand, people's health is strongly influenced by the conditions and stresses of their working environment.

"With our Vital4SAL project, we don't only want to raise awareness to the topic of health and vitality in our employees, but we also want to strengthen the team spirit between our sites. With joint activities we can achieve this goal. We may not have obvious physical strains at our workplace, but long periods of sitting, screen work and stress also represent burdens that we want to counteract. The aim is to reduce stress as much as possible and promote the use of resources that will keep us healthy in the long term."

TANJA KULMER
Project leader of Vital4SAL

Behind the scenes at SAL

Business Run 2022 in Graz

SAL summer party in Graz

Our colleagues in Linz at a Dragon Boat Race on the Enns

Our colleagues in Villach at a hike on Mount Furscherkarkopf at 3331 meters above sea level

Willibald Krenn sharing his expertise in the panel discussion “Data is key” at the Future Day of the Styrian Business Promotion Agency

Press conference and handover of the new HTC2 building in Villach

MNE Eurosensors in Leuven

Bernhard Auinger in a panel at EBSCON 2022

Behind the scenes at SAL

ASSIC closing

Chip2Sys Symposium

Delia Fugger and Roman Noskov meeting Alain Aspect at OPTICA

OVE innovation award for our team of the Tiny Power Box

Job Shadowing for young students at SAL Villach

Günther Mayr visits SAL in Villach

Jump rope tournament at SAL

SAL in Numbers

Research

SAL conducts research in the areas of microsystems, sensor systems, power electronics, intelligent wireless systems, and embedded systems. In these research fields, SAL conducts strategic and contract research and works on funding projects as well as on cooperative research projects with industrial and academic partners.

	2022
Publications	**128**
… in peer-reviewed journals	**53**
… at peer-reviewed conferences	**63**
Number of newly filed patents	**7**
Number of newly granted patents	**5**
Research Projects	**173**
Number of ASSIC projects	**16**
Number of funding projects	**35**
Number of cooperative projects	**50**
Number of active contract research projects	**36**
Number of strategic SAL research projects	**36**

Finances

SAL's operating performance in 2022 was EUR 41 million.
The project volume for research projects totaled EUR 32 million.
The difference to the operating performance comprises other operating income and received shareholder subsidies.

	2022
Strategic research projects	**11.010**
Cooperative research projects	**13.857**
Contract R&D projects	**987**
Funded research projects	**5.712**
Operating performance	**41.152**
Capital assets	**29.689**
Investments	**16.297**

All figures in TEUR

Communications

In 2022, SAL was able to further develop its external presence. Subscriptions to our monthly newsletter, the number of followers on LinkedIn as well as the number of media reports have increased significantly. The SAL Sharepoint, the linchpin for internal communication, has also been expanded.

External Communication	2022
Media reports	450
LinkedIn followers	8.710
Newsletter subscribers	502

SAL SCIENCE & STORIES – OUR NEWSLETTER ABOUT SAL

Every month, we provide information about current projects, research results, and topics that are relevant to us in our SAL Science & Stories newsletter. To subscribe to our newsletter, please visit our website!

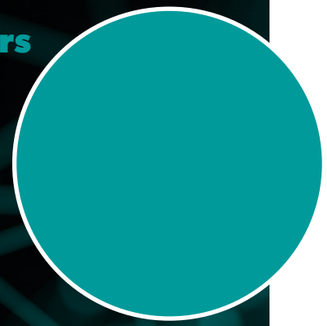
SILICON-AUSTRIA-LABS.COM/NEWSLETTER

Human Resources

In 2022, the number of employees at SAL has grown to 289. Around 90 % of employees hold academic titles, for instance, in physics, chemistry, computer science, electrical engineering, mechatronics or microsystems technology.

Employees	2022
Number of employees (heads)	289
Number of employees (FTE)	265,01
Number of researchers (heads)	234
Number of researchers (FTE)	216,16
Percentage of researchers (heads)	80,97 %
Percentage of women (heads)	25,95 %
Number of international employees (heads)	155
Percentage of women among young scientists (heads)	19 %

Shareholders



50,1 %
Republic of Austria

24,95 %
Fachverband für Elektro- & Elektronikindustrie (FEEI)

10 %
Steirische Wirtschaftsförderungs-gesellschaft mbh (SFG)

10 %
Federal State of Carinthia

4,95 %
Upper Austrian Research GmbH (UAR)

At a glance

COMPANY TYPE

Public-Private-Partnership
Limited Liability Company (GmbH/Ltd.)

Information as of December 2022.

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