

20  
ANNUAL  
REPORT  
14

IK4  IDEKO  
Research Alliance

**IK4 IDEKO**  
Research Alliance

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# 01

## INSTITUTIONAL MESSAGE

01.1 MESSAGE FROM THE PRESIDENT

01.2 MESSAGE FROM THE MANAGING DIRECTOR



01.1 MESSAGE FROM THE PRESIDENT | 01.2 MESSAGE FROM THE MANAGING DIRECTOR

# 01.1

## Message from the president

CORPORATE MESSAGE



## Iñigo Ucín

President of IK4-IDEKO

Once again, I am delighted to review IK4-IDEKO's business year. Little more can be said about the role of technology centres play and should continue to play in our socio-economic environment. In a time of change, submerged in the reorganisation of the Basque Science and Technology network and faced with the new Industry 4.0. paradigm, now is exactly the time, more than ever, to be firm and keep to commitments.

Lately there has been a lot of talk about a fourth industrial revolution and only those who foresee and anticipate the change will be able to tackle it successfully. Collaboration with external partners is and will remain without a doubt one of the pillars to success in the coming years.

In this sense, IK4-IDEKO makes a difference because of the capacity to adapt to the needs of the company safeguarding scientific excellence in our specialisation at all times. A close

and direct dialogue with the industrial reality has enabled us to achieve high levels of technology transfer, an absolute necessity to ensure competitiveness of the business community. Proof of this are the 163 projects undertaken with companies in 2014.

In this drastically changing context, technology centres like IK4-IDEKO are an essential support for stability and consistency in R&D which is seen by many as one of the cornerstones for the long-awaited economic recovery.

I would like to end this review giving thanks to all those who in one way or another support and enable the continuation of this adventure year after year. I would like to thank the government for its support in our development and specialisation, companies for trusting our abilities and contributions and our partners in the IK4 Alliance and other agents of the Basque Science and Technology Network. And last but not least, all those who because of their effort and enthusiasm make this R&D wheel go round and round.

Thank you.



01.1 MESSAGE FROM THE PRESIDENT | 01.2 MESSAGE FROM THE MANAGING DIRECTOR

# 01.2

## Message from the managing director

CORPORATE MESSAGE



## Ramón Uribe - Echeberría

Managing Director of IK4-IDEKO

To begin I would emphasise that, despite the economic difficulties in our sector and the limited availability of public and private funds for R&D, we closed a positive business year.

Regarding the economic figures, we achieved a turnover of 7,8M €, which is a similar to last year's figure. Of this amount, 65% originated from contracted R&D for companies, or in other words from technology transfer, while 35% came from general research financed with the support of governmental institutions.

Collaboration with and technology transfer to industry, which is ultimately the mission and raison d'être of the centre, showed an increase of 7%, a remarkable success. Obviously, these results are not coincidental, but the materialisation of the efforts made by the centre with regards to market-oriented R&D&I, along with our own relationship models with companies that enable us to effectively transfer technology that meets the needs of the companies. The availability of a set of tools for Competitive Intelligence, medium and long-term collaboration plans with our customers, etc. enable us to pursue a strategic alliance with companies. Thus, we can jointly develop the innovations required to remain competitive in a global environment in which we operate and that forces us all to be more effective and efficient in what we do. Proof of this is the market launch

of active damping technology in machine tools to cancel chatter during machining processes, which is a world first.

Technology transfer would not be possible without generic research, in which we develop technology and knowledge that enable our researchers to develop projects with companies. In this sense, we must be grateful for the pro-active attitude of the Basque and Spanish government in major R&D programs.

Further to the above, we must highlight the participation in the European Research Area who in 2013 launched the H2020 program involving major funding of R&D for the next seven years. This new H2020 program, in which we participated in 3 new projects, complements those from the previous European program. All together these programs total 15% of total revenues, which shows the strength of our presence in this important research framework.

Finally, I would like to invite you to read some more on the highlights of the year 2014, which are outlined below.

# 02

## DEPARTMENT OF TECHNOLOGICAL RESEARCH AND DEVELOPMENT

02.1 CONGRESSES AND PUBLICATIONS

02.2 INTERNATIONAL ACTIVITY

02.3 RESEARCH LINES

2.3.1 STRATEGIC INNOVATION

2.3.2 MACHINING AND PRODUCTION SYSTEMS

2.3.3 INTELLIGENT SOFTWARE

2.3.4 INSPECTION AND MEASUREMENT

2.3.5 DYNAMICS AND CONTROL

2.3.6 MANUFACTURING PROCESSES

2.3.7 DESIGN AND PRECISION ENGINEERING

## 02

Department of  
technological  
research and  
development

2014 was marked by the following key areas of action for the department of Technological Research and Development: the development of the research lines, relying on our expertise in manufacturing technologies, converting our research into business value for our customers through numerous transfer projects with a high technological value and establishing partnerships and networks, both on an academic level and in technology and business that support the development of the two previous key areas.

In the area of research I would like to review some of the achievements of our research teams. In the field of manufacturing processes, significant progress was made in the experimental use of cryogenic gases as refrigerants in turning processes on hard metals. The team researching intelligent software focused much of its efforts on developing a universal platform of mass monitoring on machine tools, while design and precision engineering researchers developed low-cost, low-complexity systems for volumetric calibration equipment, based on algorithmic techniques used in measurement and compensation of coordinate measuring machines. These are just some examples of our research. You will be able to read in detail many other results of our research and development in this report.

As in previous years we participated in relevant forums in the academic field of manufacturing such as CIRP. Insofar as scientific dissemination is concerned, we published 10 articles in indexed reference publications in our field of expertise.

Also, in 2014 a strong impetus was given to the inspection and measurement area and in addition to the research work much time and thought were spent on the design and development of demonstrators and prototypes with real industrial applications that will materialize in a new laboratories that will be opened in 2015.

Internationally, in 2014 we participated in 9 European projects and 3 new proposals will be launched in 2015. Our presence at forums of interest allowed us to keep contact and make new contacts with technological scientific leaders in the advanced manufacturing environment.

From an organisational point of view and with the aim of bringing together the research competencies in the key areas of our expertise, in 2014 we decided to integrate the lines of Mechanical Design and Micro and Ultra-Precision in a single research team called Design and Precision Engineering.

In relation to the second key area stated above, 2014 was a significant milestone for the department in terms of high-impact transfer projects. Throughout this year we worked with our clients in technologically advanced projects with developments from practically all our areas of expertise. Some examples are: measuring of the profile and wheel diameter of trains on passing with vision systems, the transfer of the chatter suppression system DAS or integral development of a multilayer control system adaptable to each installation.

# 02

## Department of technological research and development

This activity, driven by the Department of Innovation and Technological Development, also originated research into identifying real innovation needs to help us guide our research work.

Perhaps the clearest example of this performance was the design of the Technology Development Plan Industry 4.0 for some of our main customers, and in which IK4-IDEKO took on a major role right from the stages of research.

Therefore, at the Department of Research and Technological Development we continue to work on setting up a powerful network of partners that allows us to advance in areas complementary to our expertise and to quickly and safely reach the recipient of our research through technological developments appropriate to the needs of industry.

Some developments in this sense are our recent inclusion in international platforms such as SECPhO and EMVA in the field of photonics and Machine Vision, as well as AEND in the field of non-destructive inspection. In the latter area, we are active members of the European Forum for establishing regulatory standards in ultrasonic inspection processes for the railway sector. On the other hand, we would like to emphasize the cooperation with Olympus NDT, a world leader in the technology of ultrasonic inspection and eddy current, and EDEVIS, leader in active thermography technology.

# 02.1

## Congresses and publications

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

### Publications

TITLE	AUTHORS	REFERENCE	MAGAZINE / IN COLLABORATION WITH
1. Optimisation of face milling operations with structural chatter using a stability model based process planning methodology	· A. Iglesias · J. Ciurana · J. Munoa	January 2014, Volume 70, Issue 1-4, pp 559-571	The International Journal of Advanced Manufacturing Technology
2. Receptance coupling for tool point dynamic prediction by fixed boundaries approach	· Iker Mancisidor · Zoltan Dombovari · Aitor Urkiola · Jokin Munoa · Rafael Barcena · Mikel Zatarain	Volume 78, March 2014, Pages 18-29	International Journal of Machine Tools and Manufacture (1.57)
3. Continuous variable feed rate: a novel method for improving infeed grinding processes	· Jorge Alvarez · Iñigo Bediaga · David Barrenetxea · Ivan Gallego · Jose Ignacio Marquinez	July 2014, Volume 73, Issue 1-4, Pages 53-61	The International Journal of Advanced Manufacturing Technology
4. Cylindrical milling tools: Comparative real case study for process stability	· G. Stepan · M. Surico · J. Munoa · D. Bachrathy · T. Insperger · Z. Dombovari	Volume 63, Issue 1, 2014, Pages 385-388	CIRP Annals - Manufacturing Technology
5. A specific method for the life cycle inventory of machine tools and its demonstration with two manufacturing case studies	· Jose Zendoia · Gorka Unamuno · Udisien Woy · Aratz Olaizola · Nicola Ridgway · Apostolos Fysikopoulos · Tiina Pajula · Roland Krain	Volume 78, 1 September 2014, Pages 139-151	Journal of Cleaner Production
6. Stability analysis and optimization algorithms for the set-up of infeed centerless grinding	· David Barrenetxea · Ivan Gallego · Jorge Alvarez · Ignacio Muguerza Perello · Jose Ignacio Marquinez · Peter Krajnik	Volume 84, September 2014, Pages 17-32	International Journal of Machine Tools and Manufacture
7. Micromilling High Aspect Ratio Features Using Tungsten Carbide Tools	· Iñigo Llanos · Thanongsak Thepsonthi · Amaia Agirre · Tugrul Özel · Harkaitz Urreta	November 2014, vol. 228 no. 11 1350-1358	Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture
8. Stability analysis of milling with irregular pitch tools by the implicit subspace iteration method	· Mikel Zatarain · Zoltan Dombovari	March 2014, Volume 2, Issue 1, pp 26-34	International Journal of Dynamics and Control
9. Error Detection and Correction Methodology for Quality Assurance on Laser Milled Geometries	· Iñigo Llanos · Harkaitz Urreta · Amaia Agirre	Volume 21, 2014, Pages 195-198	Procedia CIRP
10. Chatter suppression in a high speed magnetic spindle by adding damping	· Luis Uriarte · Inigo Etxaniz · Ion Iturbe · Mikel Zatarain · Jokin Muñoa	Vol. 14, No. 4, 2014	Journal of Machine Engineering

# 02.1

## Congresses and publications

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## Congress, Conference, Trade Fairs

TITLE	PLACE	DATA
CIRP WINTER Meetings	PARIS	22-24 January 2014
ISMA 2014 - International Conference on Noise and Vibration Engineering	Leuven	5-17 September 2014
Euspen Special Interest Group: Thermal Issues	Zurich, Switzerland	19 - 20 March 2014
ECNDT 2014. 11th European Conference on Non Destructive Testing	Prague	6-10 Octubre
CIRP 24th Sustainable Design & Manufacturing Conference	Milan	2014, 14-16 April
SDM'2014 International Conference on Sustainable Design and Manufacturing	Cardiff, Wales, UK	28, 29 & 30 April 2014
VISIO 2014. Congreso Internacional sobre Vigilancia e Inteligencia Sistemática para la Innovación en las Organizaciones.	Basque Culinary Center	16 y 17 de Octubre
EUSPEN 14th International Conference & Exhibition	Dubrovnik, Croatia	2 - 6 June 2014
UMTIK 2014. 16th International Conference on machine design and production	Izmir, Türkiye	June 30 - July 3, 2014
IDEAS Investigating Dynamics in Engineering and Applied Science 2014 WORKSHOP	Budapest, Hungary	July 3-5, 2014
28th BIEMH'14 Bienal Española de Máquina - Herramienta.	BEC-Bilbao	2 al 7 de junio
HSM 2014 - 11th International Conference on High Speed Machining	Republic, Prague	11 - 12 September 2014
ASPE 2014. 29th Annual Meeting of the American Society for Precision Engineering	Boston	9-14 November



# 02.2

## International activity

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

### "The 2014 has accelerated the definition and implementation up of a diversification strategy for International activity of IK4-IDEKO"

2014 was the first year under the new European framework program Horizon 2020 (H2020) of the seven-year period 2014-2020. It proved to be another intense year, because of both the submitted proposals, and our positioning in major initiatives of H2020 influencing the topics and contributing to future programs.

Thus, from a strategic point of view, IK4-IDEKO played a significant role in the most relevant forums related to "advanced manufacturing", such as the PPP Factories of the Future (FoF) coordinated by the EFFRA association, the European technological platform MANUFUTURE, its national counterpart MANUKET, the future KIC in advanced manufacturing (planned for 2016) or forums related with smart specialisation strategy (RIS3). The fact that advanced manufacturing is a so-called KET (Key Enabling Technologies) and that it has become one of the pillars of the Basque smart specialisation strategy (RIS3) boosts the advantageous position of IK4-IDEKO because of our specialisation in manufacturing technologies.

In parallel, we have maintained contact with all institutional agents active in European research: on a regional level (Basque government, SPRI (Basque





# 02.2

## International activity

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

Business Development Agency), Innobasque (Basque Agency for Innovation), on a national level (CDTI (Industrial Technological Development Agency), Ministry of Economy and Competitiveness) and on a European level (DGs of the European Commission and EIT-European Institute of Innovation & Technology).

We have also collaborated with Innobasque in teaching the course international R&D projects, in raising awareness and preparation of industrial representatives to partake in European research.

On a more operational level, in 2014, IK4-IDEKO participated in 9 European projects (being project manager of one of them) and achieved the approval of another 3 new projects which will start at some time in 2015.

In our proposals, more importance is given than ever to factors such as industrial impact, technology transfer and future exploitability of research results, something which is considered critical by the European Commission in the H2020 program. In this sense it is worth mentioning that IK4-IDEKO proactively participated at

forums organised by the EFFRA association aimed at increasing the exploitability, technology transfer and impact of the projects as well as implementation and promotion of project clusters with the same subject matter, such as zero-defect manufacturing. IDEKO-IK4's own registered methodology for exploiting results is becoming increasingly more prominent in accepted projects as well as in new proposals being prepared.

From now on, opportunities for advanced manufacturing in H2020 will not only be found in the usual NMP-ICT-FoF programs, but also in programs related to social challenges (Transport, Energy and Health). Specifically, smart manufacturing (or the concept Industry 4.0) is making its appearance simultaneously in several scenarios, which opens new opportunities for IK4-IDEKO's know-how in this field. At the same time, the creation of public-private contractual partnerships (Spire, Robotics, Photonics, BigData) as well as institutional partnerships (JTIs ECSEL, CleanSky, Shift2Rail) accelerated the definition and implementation of a strategy of diversification for international trading of IK4-IDEKO.

# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.1 STRATEGIC INNOVATION

## A commitment to efficient management of technology

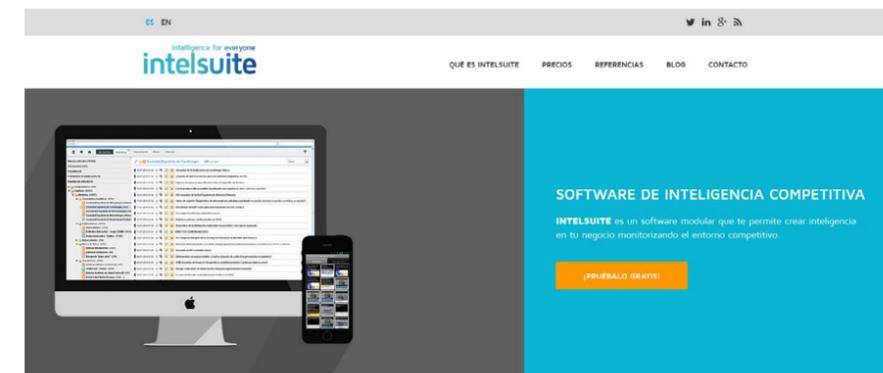
The Strategic Innovation line of IK4-IDEKO focuses on developing new methods and tools that allow a more efficient approach to innovation, management and technology transfer.

With the aim of obtaining results that combine knowledge gained from research with practical experience, the Strategic Innovation line seeks to support the definition of technological innovation processes and to provide value to the collaboration of IK4-IDEKO with customers in the field of R&D.

Hence, IK4-IDEKO continues to lead the formalisation of R&D collaboration plans with strategic customers and the Competitive Intelligence service. When the results of these services are processed and strategically used in the management plans, technology roadmaps, development of new products, state of the art technologies, study of competitors, patent monitoring, etc. our customers obtain a clear competitive advantage. Noteworthy is the redefinition in 2014 of the competitive intelligence process pursued by IK4-IDEKO. The bases of this process were redesigned for a variety of reasons but also to meet the criteria for future certification in the UNE 166002 standard (Management of R&D&I and Technology Forecasting and Competitive Intelligence). Without a doubt, one of the most significant events of the year 2014 was the creation of Intelsuite ([www.intelsuite.com](http://www.intelsuite.com)). One of the primary objectives of this initiative is to market a professional competitive intelligence software and a package of services related to the creation of Technology Forecasting/Competitive Intelligence units in companies that request this service. The Intelsuite motto is Intelligence for

intelligence for everyone  
**intelsuite**

Software de  
Inteligencia Competitiva





# 02.3

## Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

### 2.3.1

#### STRATEGIC INNOVATION

Everyone. The initiative has been a success and has already more than 2000 users. Corporations, SMEs, universities, associations and technological centres of several countries already have Intelsuite licenses. The consulting work done for the creation of a Technology Forecasting/Competitive Intelligence unit in the Patricio Echeverría Corporation and the sale of a Intelsuite-Corporate license cannot go unmentioned. And to end, we must highlight the significant participation of the line at the Technology Forecasting/Competitive Intelligence VISIO 2014 congress, in which we were member of the Committee of Experts, and presented two papers: "Competitive Intelligence as a key activity in the diversification of new business models" and "R&D behind competitive intelligence: new technologies and tools".

The research of the line focused on value assessment processes and exploitation of technologies. The new competitive conditions in the global economy mean that many centres, universities and companies choose to invest in research and development to continually bring new products and successful services and innovations on the market. But the set target is not always reached, so many developments are shelved and are not industrialised and successfully launched on the market. For this reason, and in order to promote innovation through results from research and development, in 2014 the Strategic Innovation line developed a framework for value assessment of technology based on an extensive review of relevant literature. This framework is

made up of different stages and includes a number of methods to make this model workable. The result of this work was published in a scientific magazine.

Furthermore, we studied the management of Strategy and Technology, Competitive Intelligence where, thanks to the Athenea project, we were able to improve methodological processes for the setting up, development and implementation of Competitive Intelligence units and the implementation and classification of a repository to bring together information sources for Technology Forecasting/Competitive Intelligence. In addition Athenea has served to deepen our knowledge in the study and application of data mining algorithms and extraction of information in the field of competitive intelligence. An algorithmic testing platform was developed for in-depth study of different algorithms and content recommendation systems for this purpose.

Diversification Processes is another line of research in which we continued to make progress as well as in value assessment processes and exploitation of technologies during which models to define the necessary action in exploitation and dissemination of European projects were researched and further developed. These models were fully tested in the Seventh European Framework Programme, in the project "Axleinspect" and partially in the Hippocamp and Ease-R3 projects.



# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.2 MACHINING AND PRODUCTION SYSTEMS

### Maximum efficiency in problem solving

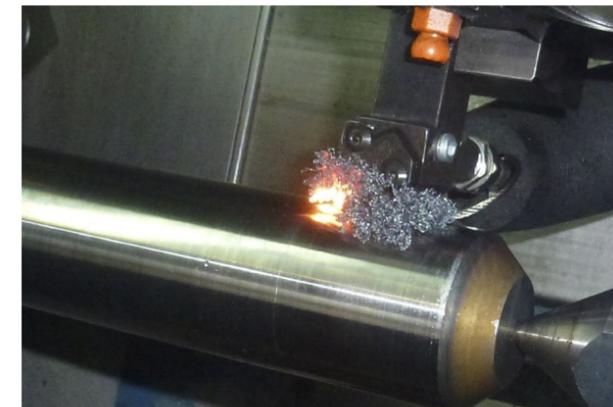
The contribution of the research line Machining and Production Systems lies in solving problems in current industrial processes.

It also seeks to analyse and propose machining alternatives that provide a differentiating factor in production to end users through the use of new cooling technologies or through implementing new tools and manufacturing cycles.

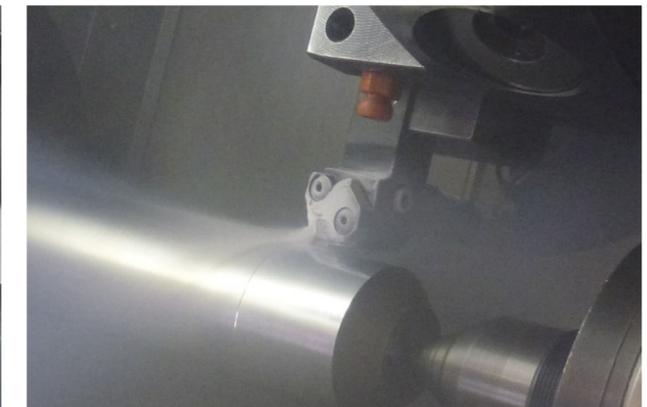
The most important results of 2014 centres around the progress made in the identification of sources of error that generate helical marks in cylindrical grinding, using models and applying techniques to cancel these marks. The work done has allowed us to define the conditions of the diamond dressing and grinding cycle that effectively prevent the formation of these helical marks.

The feasibility of cryogenic cooling in machining processes has been proven. Thanks to this research, experiential knowledge has been gained about the influence of applying cryogenic gas (CO2 as a first approximation) as a refrigerant in turning processes. The positive results of this essentially experimental project mean it is feasible to apply cryogenic gas in turning hard metals during which lower temperatures are reached; the results may even be more advantageous.

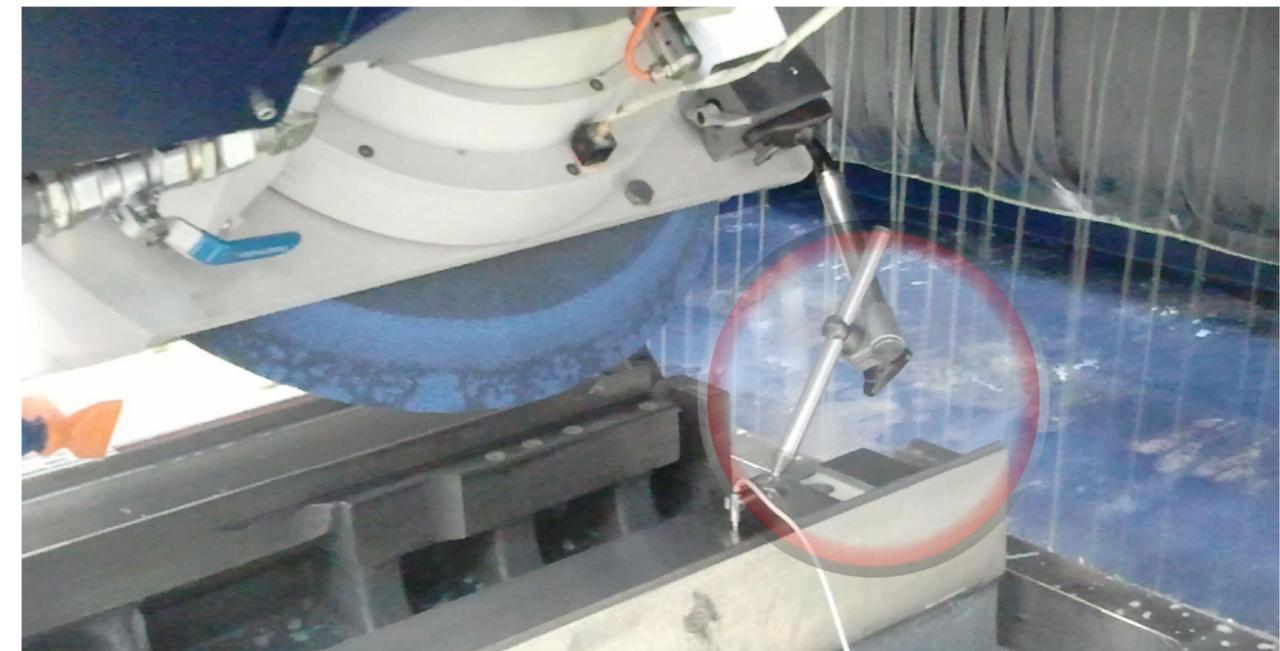
Also grinding processes were identified in which a minimum quantity or no lubricant may be more viable.



DRY TURNING



CRYOGENIC TURNING





# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

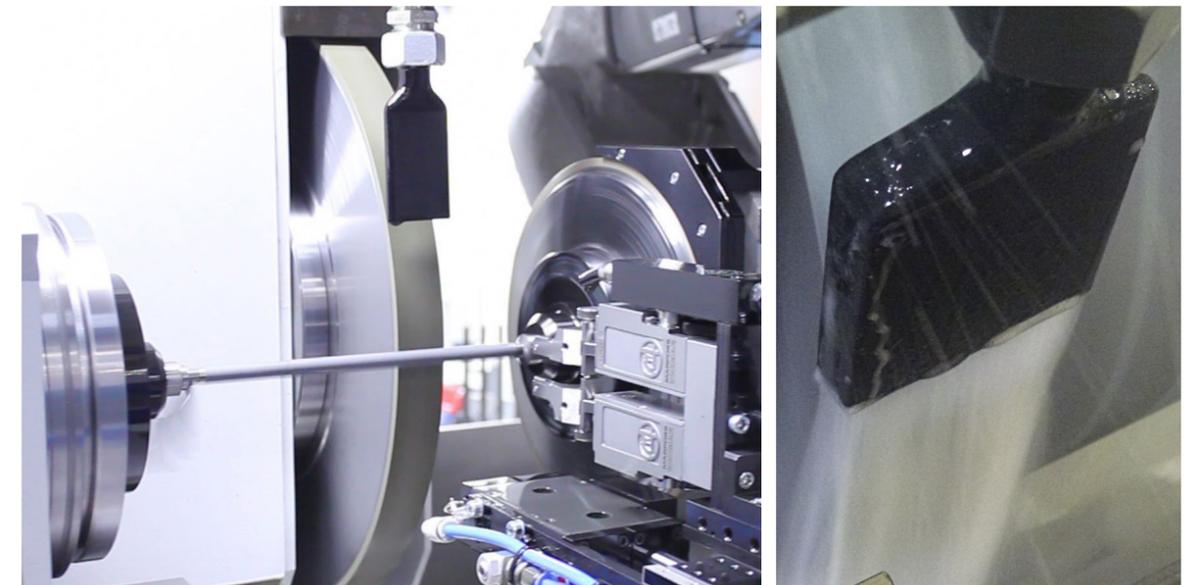
## 2.3.2 MACHINING AND PRODUCTION SYSTEMS

The machining and production systems line mainly researched in the area of turning, milling and grinding, either to solve industrial problems such as helical marks generated during grinding or otherwise to study the feasibility of new machining processes such as grinding with a minimum quantity of lubricant or using cryogenic aided cooling processes.

Of the projects carried out throughout the year, the solution for milling in the O&G sector stands out for its merit. We analysed the sector and its needs, and singled out trends, opportunities, potential demand for the coming years, competitors and currently adopted solutions. We found strategic parts for our client after which we analysed the current state of the art machining process. We established critical operations after machining tests on a typical machine with the most representative tools to test the capacity of the machine and possible improvements to the current state of the art for machining such typical parts.

We also studied the turning process for machining turbine disks for aircraft engines with the aim of achieving greater efficiency and reduced stock removal. Along with the development of this new process, the specifications were set for a new machine capable of carrying this out. This is an iterative process between process development and machine specifications to be able to eventually reach a result that can be used in industry.

Under the premise of a more efficient environmental-friendly production process, were developed more sustainable tools, processes or machines. We devised processes in which it is feasible to use no or a minimum quantity of lubricant in grinding operations. Moreover we improved the development of cooling nozzles and process performance significantly reducing the use of tools.





# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.3 INTELLIGENT SOFTWARE

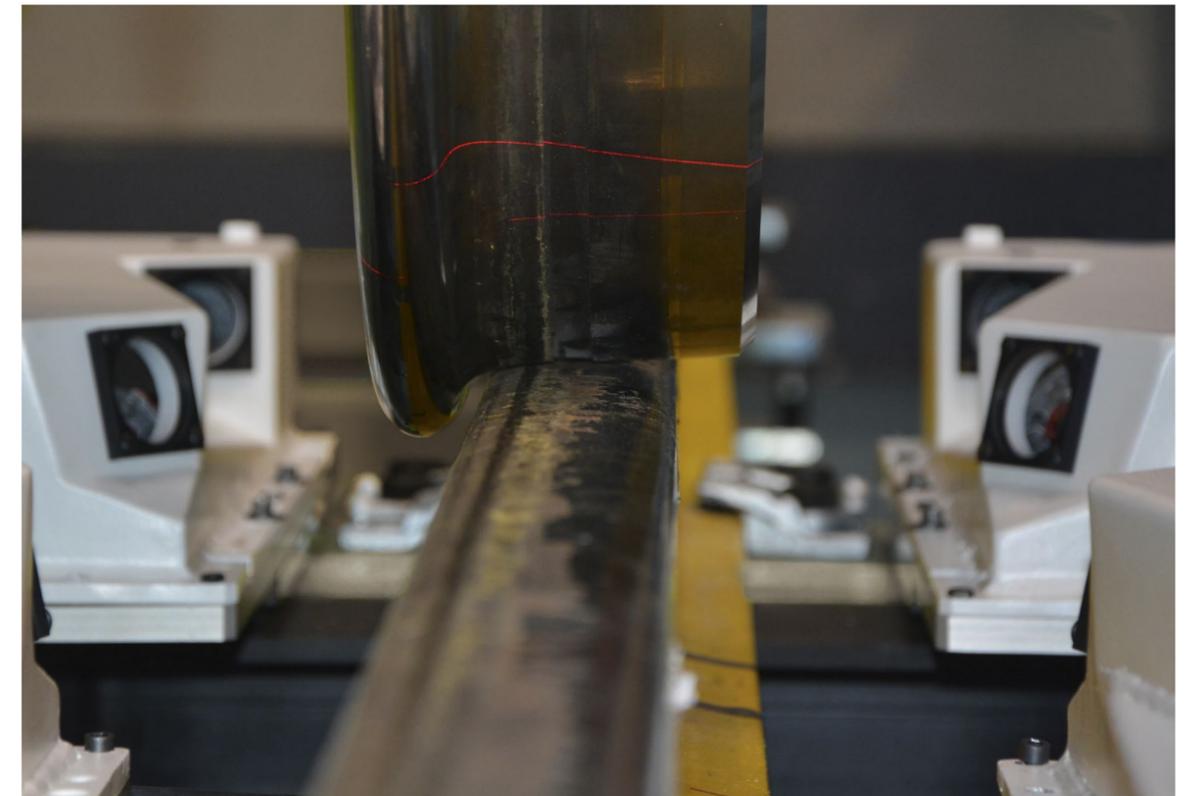
## Intelligent Software for a more competitive industry

The Intelligent Software research line aims to integrate the latest advances in ICT into the manufacturing and industrial production environment.

IK4-IDEKO develops automation and advanced software solutions using artificial intelligence to increase the efficiency of production processes on independent machines and production lines.

In this context, among the most relevant results was the development of software to use machines more efficiently, a system able to calculate and itemise energy consumption of a machine, capable of measuring and monitoring the energy use of six different components simultaneously, and of synchronizing this data with the operating status of the machine and the workpiece process. The data mining software allows customers to generate customised reports that aid in meeting the requirements of the European standards ISO 9001, ISO 14001 for machine manufacturers and of ISO 50001 for machine tool users.

The second example is the case of 3D Vision software for aligning blanks. The software decodes the CAM program and determines the optimal coordinates in 3D of optical preset references on the workpiece before setting it up on the machine. Moreover, a software module, was also developed which through



a wireless 3D vision system allows contactless measurement of optical references during machine alignment. Thus, rotating and positioning (zero offset) corrections are calculated automatically for precise and automatic set-up of the blank workpiece.



# 02.3 Research lines

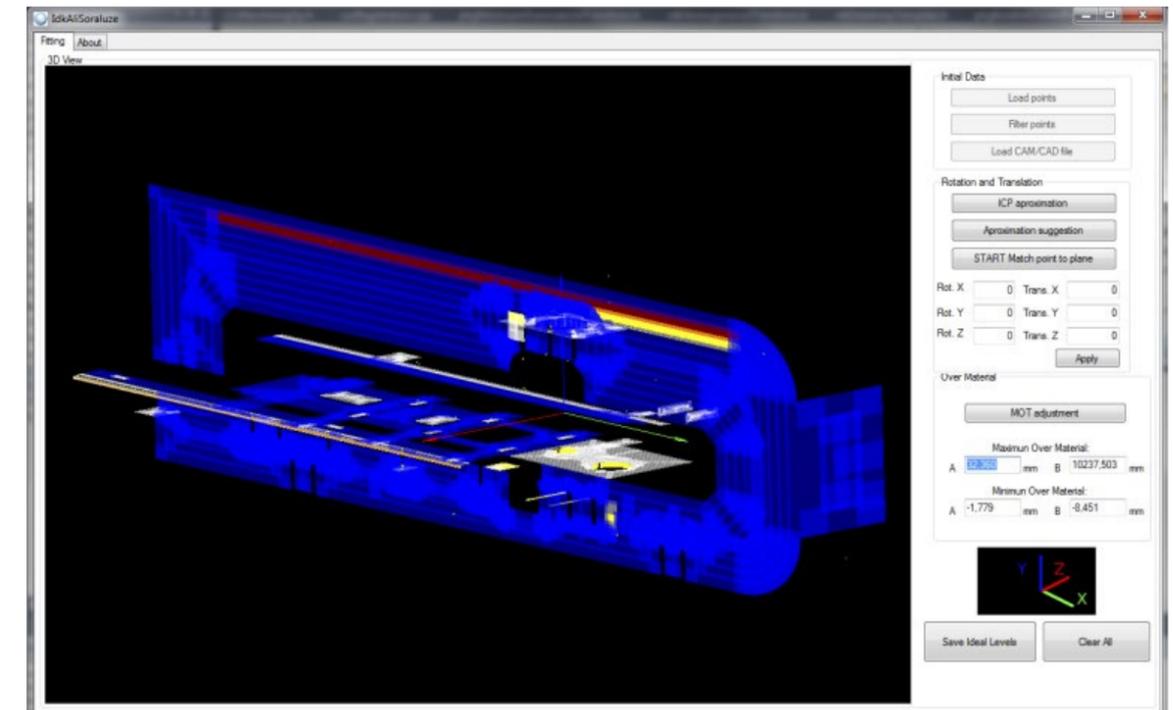
DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.3 INTELLIGENT SOFTWARE

Another solution carried out in this area is the development of software for image acquisition at high frequencies generated by triangulators. In addition, the means were made available to integrate photogrammetry algorithms and synchronization of the full equipment with automation of on-track maintenance of wheels in motion.

Also noteworthy was the work done in collaboration with the Strategic Innovation line in developing INTEL SUITE for training students of a Master in Industrial Engineering at the Faculty of Engineering of the University of Deusto, thanks to which students of the subject "Business Strategy and Innovation" can obtain basic knowledge of competitive intelligence, through a guided practice with the INTEL SUITE software (BUSINESS version) and test the benefits and efficiency of using a professional software for Technology Forecasting and Competitive Intelligence. To conclude, several Smartphones applications for machine management stand out amongst other significant developments in 2014. Because of the distributed data processing architecture, these apps can be reconfigured easily and can link machines to the mobility field and cloud computing.

Smart maintenance to extend the life cycle of machine tools incorporating augmented reality and virtual reality to repair manufacturing systems, increasing machine maintenance efficiency, extending the lifecycle of its



components and reducing production downtime to reduce costs were among the main pursuits of research last year. Technologies have been developed to process data on the evolution of the components and parts of such equipment to estimate their lifespan and to be able to predict their life cycle, better plan production downtimes for maintenance and reduce costs.



# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.4 INSPECTION AND MEASUREMENT

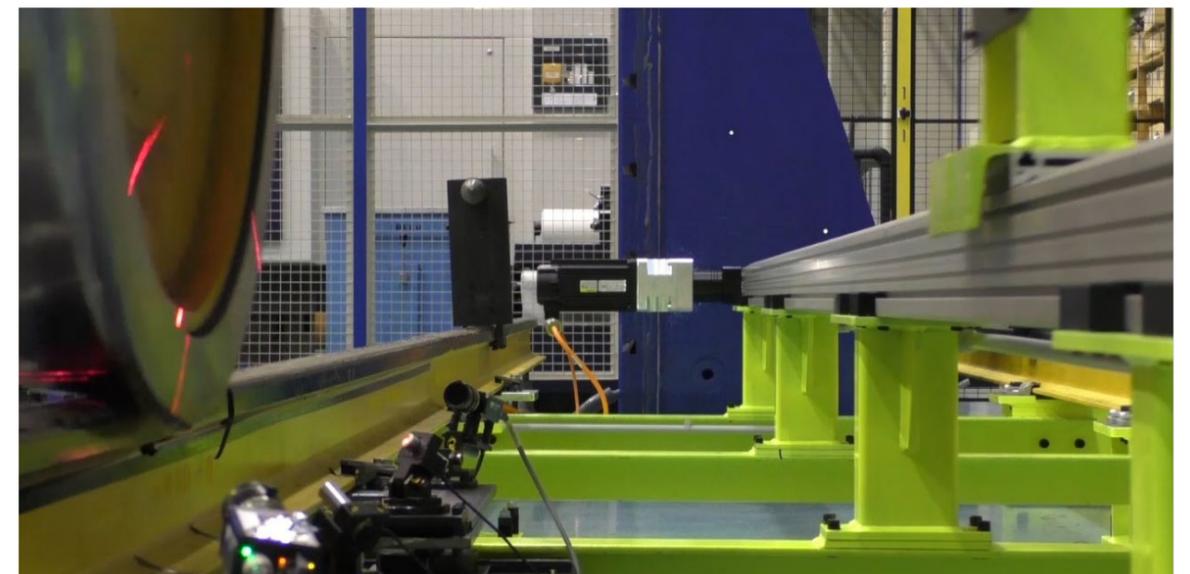
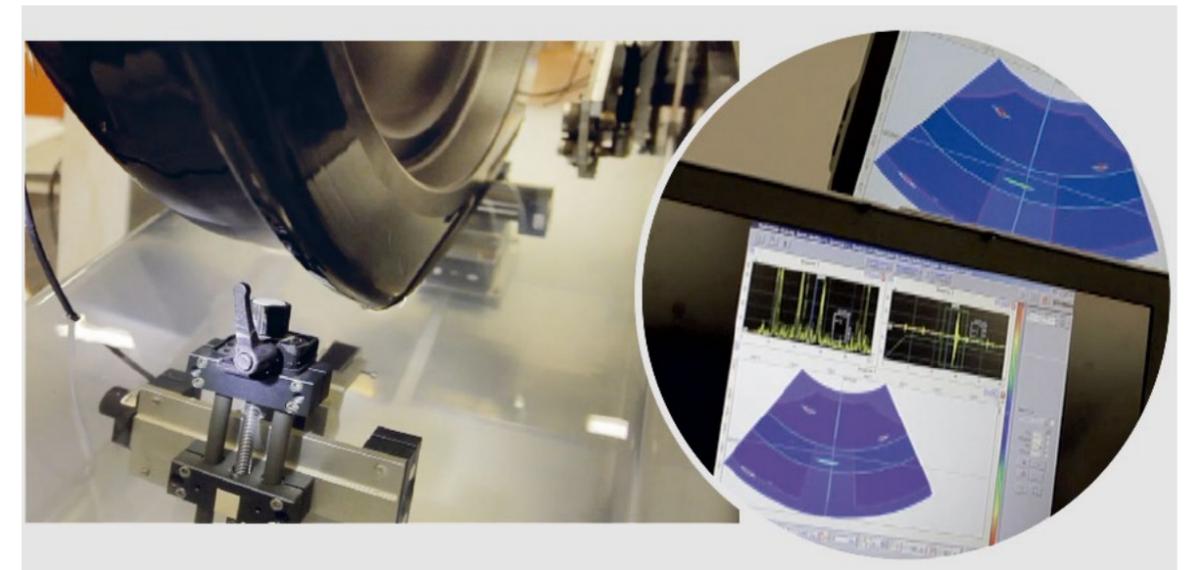
### Precision and quality control as a differentiating value

The Inspection and Measurement Line of IK4-IDEKO focuses on the design and development of advanced technologies and solutions to guarantee the quality of high value-added components and equipment used in industry.

The aim of IK4-IDEKO in this line of research is to industrialise these cutting-edge highly automated solutions. Thus, apart from mastering and developing advanced technologies internationally, we pursue to obtain optimal results for the customer.

The progress made in the field of Machine Vision stood out in 2014: we completed the development and validation of a new profile and wheel diameter measuring device for the railway sector was completed. The full profile can now be measured simultaneously. Apart from the cutting-edge performance, on a par with international benchmarks, the new solution is remarkable because of the integrated design (both of mechanical and optical components) and the calibration processes of the multi-camera system that minimise civil works and on-rail performance time for installation and maintenance.

To continue with the railway sector, within the scope of NDT we would like to highlight the design and implementation of a new phased-array solution for the inspection of internal integrity of wheels during maintenance, in collaboration with Olympus NDT. The results obtained were satisfactory and the system was validated by the customer.





# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.4 INSPECTION AND MEASUREMENT

Additionally, the support offered to DANOBATGROUP in the phases of selection, design and validation of NDT solutions and Machine Vision installed on their integral production and maintenance lines are noteworthy, in particular the solutions provided for maintenance and manufacturing of rolling stock components.

Insofar as research, the two major commitments to differentiation revolve around non-destructive inspection techniques (NDT) such as non-phased array and phased array ultrasonics, active thermography and eddy current, but also around photogrammetry measuring systems (2D/3D Machine Vision).

- **In the field of active thermography;** development of models, design methodologies of transducers (both inductive sources and laser sources), and processing techniques of thermal dynamics for inspection applications of the surface of metal components, demonstrating, by means of experimental Automated inspection solutions customised for different sectors results, the potential of this technology to replace inspection processes based on liquid penetrant and/or magnetic particles and offering maximum automation and flexibility as a differentiating factor.
- **In the field of phased array ultrasonics,** advances in the design of transducers and the latests processing techniques for the inspection of defectology in extremely restrictive applications subject to an enormous responsibility such as in the nuclear energy sector.



- **And to end, in the field of the Photogrammetry,** undertaking cutting-edge research into new models that make the uncertainty of vision measuring system predictable and controllable, using a traceability system according to international standards.



# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.5 DYNAMICS AND CONTROL

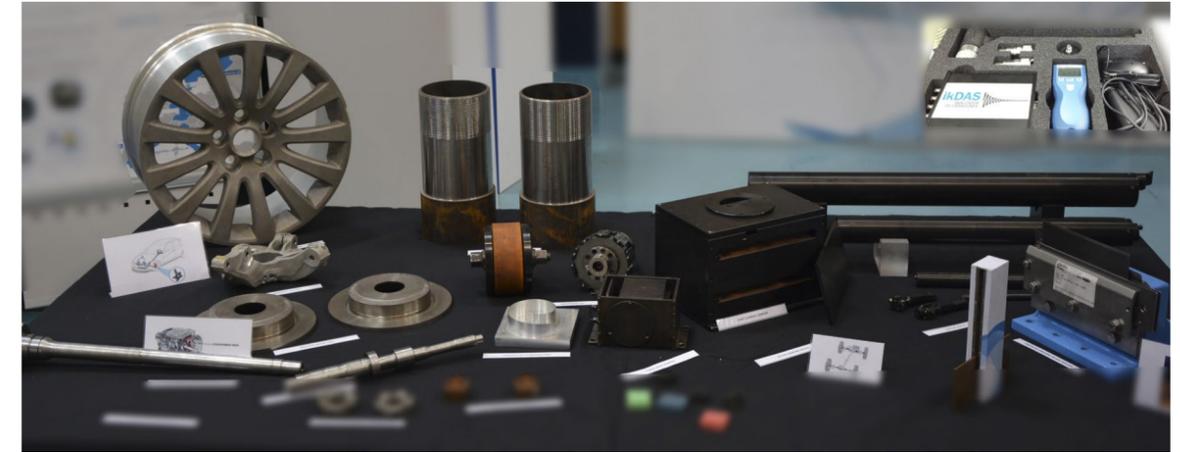
### Cutting edge technology for chatter suppression

The Dynamics and Control research line OF IK4-IDEKO addresses the design and development of new cyber-physical systems aimed at improving dynamic performance and elimination of vibrations on machinery in industrial processes.

The team of professionals of this research line obtained relevant results in 2014, one of which is the application of active dampers to increase productivity in milling processes.

The use of state-of-the-art data analysis technology makes it possible to develop user-friendly portable devices that record vibrations on machines and to process the information to identify the causes and provide adequate solutions.

Over 20 years experience in designing solutions to provide an effective response to chatter, has succeeded in identifying the key areas of analysis aimed at improving the dynamic behaviour of machines. Experts from Dynamics and control research line, have managed to identify eight areas of diagnosis related to chatter generation on which to focus to improve efficiency of the equipment with an in-house developed portable device that records and processes vibrations on machines to diagnose their potential problems. They have designed a platform that quickly and efficiently tackles this widespread problem on machines with rotary motion.



This ik-DAS development has eight different operating modules that adapt to the required functions and analyses the signal frequency and natural frequency of key components such as gears, bearings, drives and structural parts of the machinery.

In the field of vibration suppression, the following was achieved: a system for chip breaking in pipe threading processes, chatter suppression in the grinding process of discs and shafts on a grinding machine, an eddy current, self-tuning damper for chatter suppression on brackets.

In 2014, the research line investigated mainly in the application of techniques based on feedback of the signal of an accelerometer close by the cutting point to eliminate self-excited vibrations or chatter. To achieve this, the OPEN CNC concept was introduced on a SORALUCE milling machine along with an additional loop. The results were very promising and make the potential of this technique clear.



# 02.3

## Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

### 2.3.6

## MANUFACTURING PROCESSES

## New manufacturing process for tomorrow's industry

IK4-IDEKO has a line of research called Manufacturing Processes which is aimed at developing new manufacturing methods that can be automated and implemented in the industrial sector.

In this context, the technological centre addressed manufacturing mechanisms using laser, manufacturing processes of composite materials, automated Scaffolds manufacturing for cell growth and panelling techniques.

One of the highlights in 2014 was the progress made in automation of composite manufacturing processes. Worthwhile mentioning in this context here is the collaboration with the Fibre Division of DANOBAT in process development and optimisation of the design of various components to ensure proper positioning and cutting of carbon fibre fabrics.

Another area addressed in this field was the development of a system of impregnated fibre glass and on-line curing, a new fully automated high productivity process for the manufacture of composite components. This process is being studied in order to obtain the mechanical properties as established by the customer.

IK4-IDEKO invested in the acquisition of a new 5kW fibre laser source to investigate and improve laser cutting processes of materials with a very high thickness at high speed. The development of a laser cutting process





# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

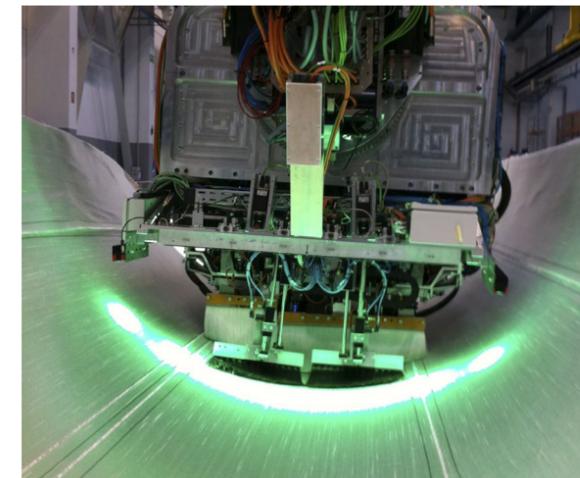
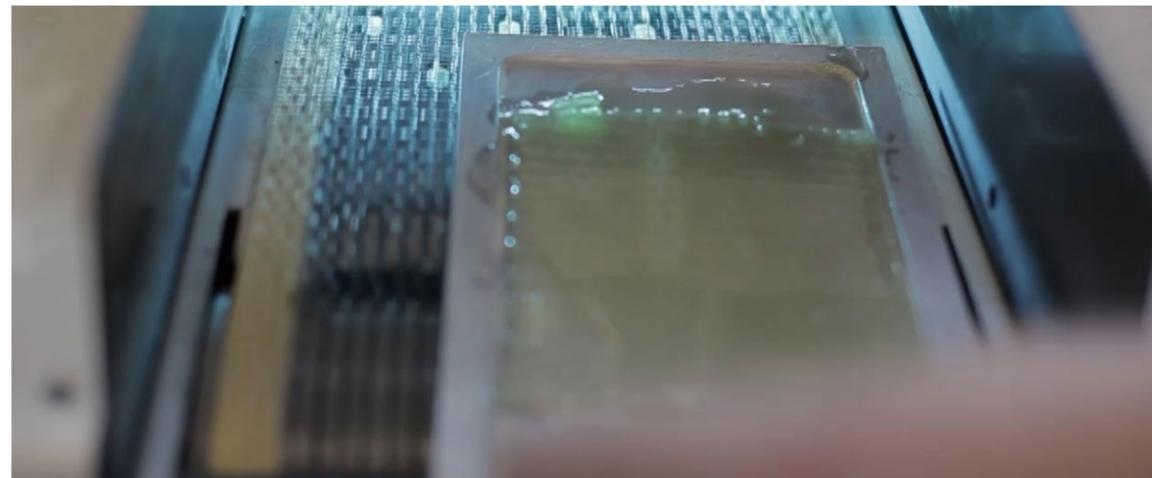
## 2.3.6 MANUFACTURING PROCESSES

with powers up to 5000W, and materials up to 20mm thick, to increase competitiveness of its customers in sheet cutting systems was a major feat in 2014.

In the field of cladding material technologies, a closed-loop system to control the power of the laser was developed using the size of the melt pool generated during the process, thus allowing greater stability and reliability of the process.

Backed by their experience and skills in manufacturing technologies and industrial production, this line developed a machine and a process for making

scaffolds, thus expanding its area of expertise to new processes for tissue engineering in the health sector. The scaffolds are matrices of biocompatible materials in which stem cells of patients are inserted. Hence, it is possible to regenerate tissue with specific information of each patient and to thus provide personalized cartilage. In this project, we studied the scaffolds manufacturing process and the influence of the design on the cell growth rate in collaboration with DANOBAT, GOITI and MONDRAGON HEALTH among others.



# 02.3 Research lines

DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.7 DESIGN AND PRECISION ENGINEERING

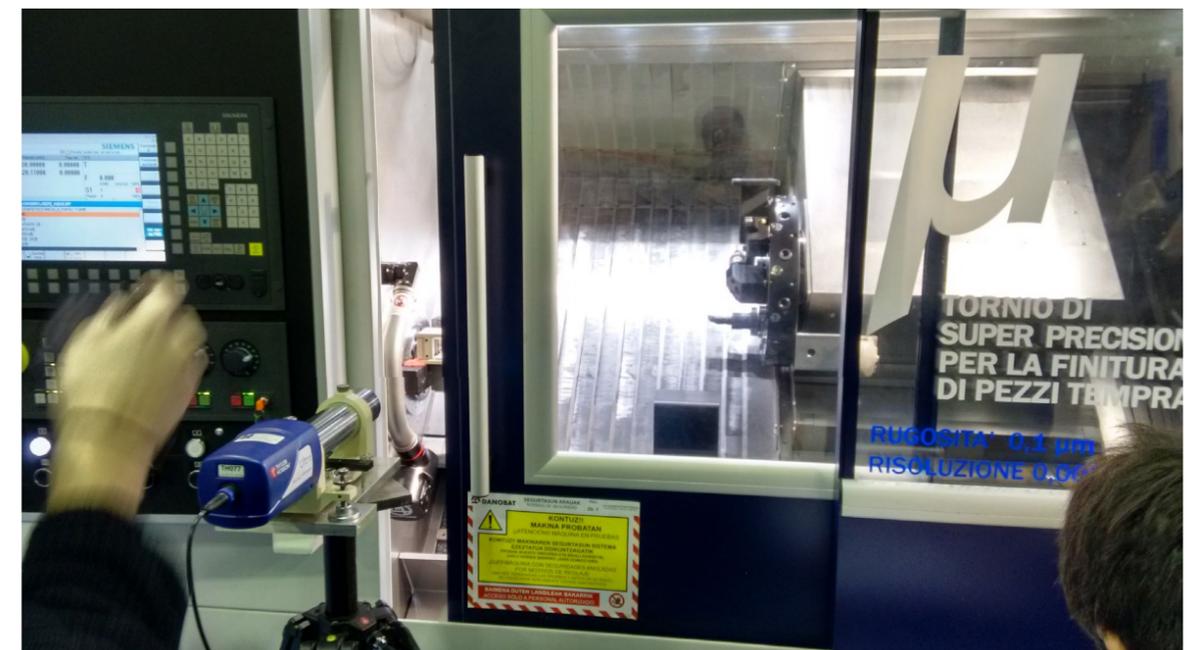
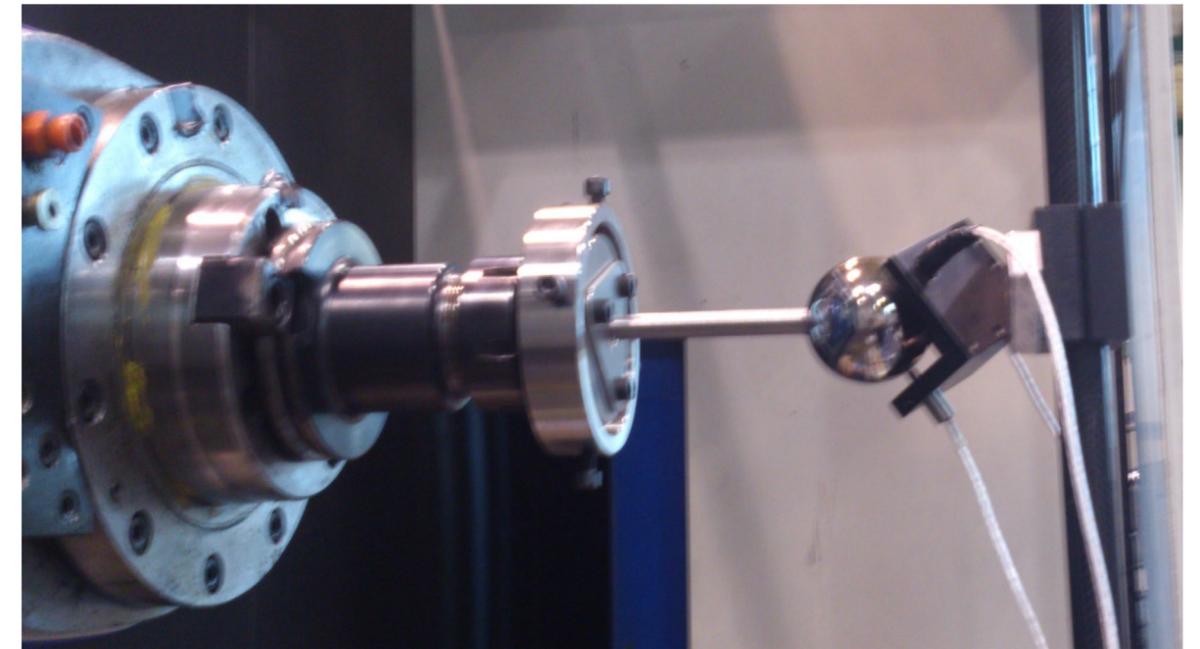
### Prototypes for a more innovative and environmental-friendly industry.

In this line of research, IDEKO-IK4 addresses the design of prototypes, mechanisms, structures, modelling and simulation of components, as well as the analysis of energy consumption on machine tools.

The researchers of this line are also responsible for developing behavioural studies of precision equipment -mainly thermal effects and geometrical errors- from experimental observation of compensation on the machine, the development of high-dynamics precision systems and calibration equipment.

In 2014, the developments of the Design and Precision Engineering line focused on the investigation of thermal compensation on machines, fine-tuning of compensation models for volumetric calibration, hydrostatic and hydrodynamic lubrication, analysis of the life cycle of machines and ecological efficiency.

Notable progress was made in thermal expansion compensation on Soraluece milling machines, obtaining geometric machine errors in the work volume and subsequent compensation.





# 02.3 Research lines

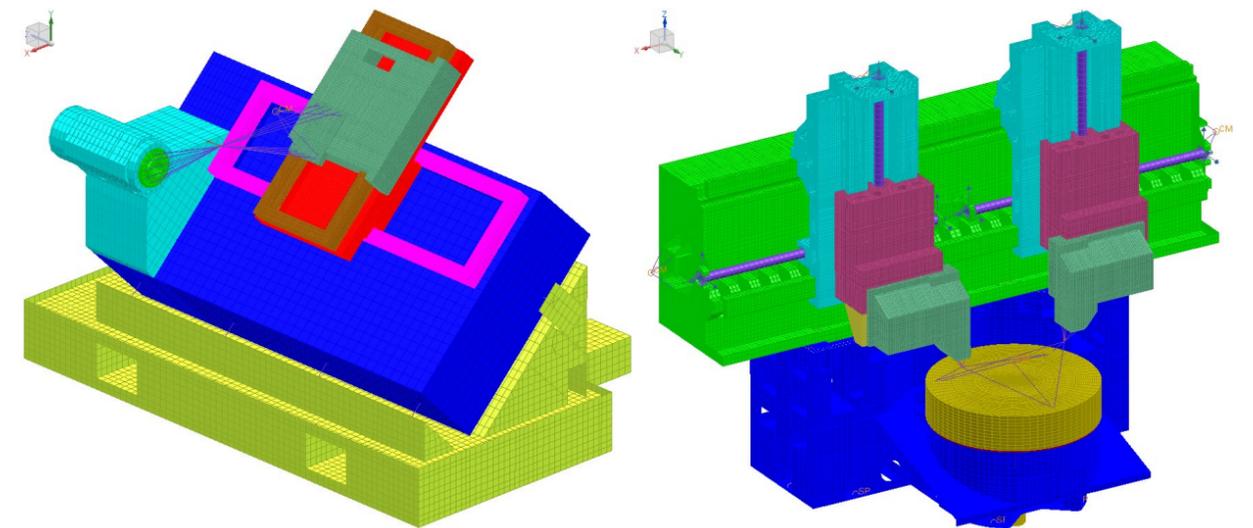
DEPARTMENT OF TECHNOLOGICAL  
RESEARCH AND DEVELOPMENT

## 2.3.7 DESIGN AND PRECISION ENGINEERING

The Design and Precision Engineering research line works on research projects related to new concepts of mechanisms where precision is of paramount importance.

To highlight some projects: tables that can be positioned in multiple degrees of freedom, and freeform machining with high dynamic tools. For this, the entire design cycle comprising the following phases is addressed: definition of specifications, conception of a mechanism and its architecture, design and simulation of behaviour with static, dynamic, thermal calculations and where appropriate multiphysics calculations, and finally the prototype phase and experimental characterisation.

Finally, and following the experimental phase of improved accuracy, work on forecasting and compensation models of thermal behaviour of machines will continue, as well as on volumetric calibration of geometrical errors on machines caused by thermal and gravitational effects. Further to the above, a system that can be fitted on a machine for calibration of machine positioning with workpieces is being developed.



# 03

## DEPARTMENT OF TECHNOLOGICAL INNOVATION AND EXPLOITATION

# 03.

DEPARTMENT OF INNOVATION AND  
TECHNOLOGICAL EXPLOITATION

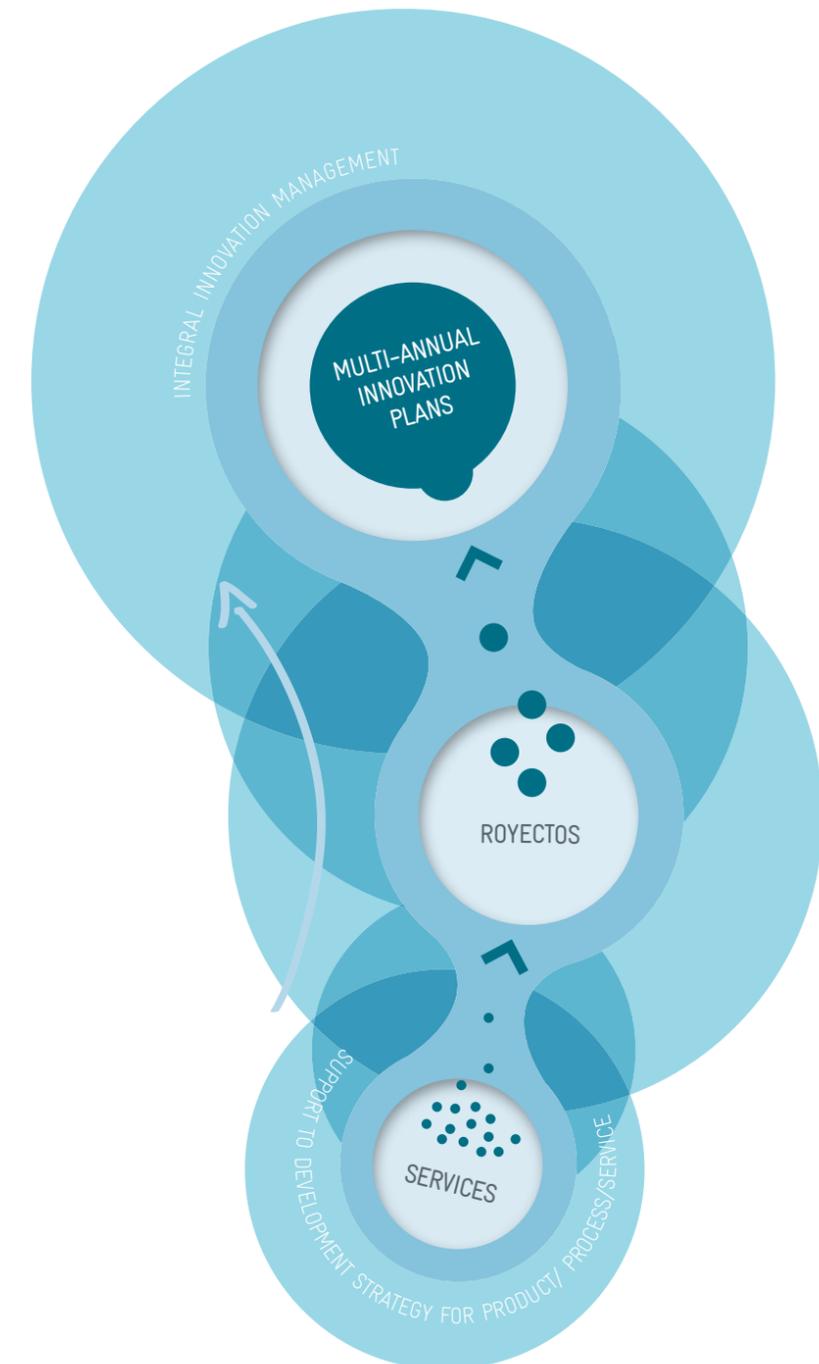
Since its inception in 2009, the Department of Innovation and Technology Exploitation has been working in different performance areas, always pursuing one single goal: to convert our research and development into technological innovation in industry.

To that purpose, the activity focused on working with companies to develop joint R&D&i plans and to exploit the results of research of IK4-IDEKO.

In 2014, the Department of Innovation and Technology Exploitation was in charge of the development of four R&D&i plans with as many strategic clients of the technology centre. We used our own collaboration model, called Comode, which continued to evolve with the addition of “integrated teams”, which, combined with the “mixed teams” strengthen business collaboration and ensure the transfer of results.

In addition to these specific partnerships in 2014, we worked with over 60 companies on 163 R&D&i projects. Thirteen of these 63 companies worked with IK4-IDEKO for the first time, which corroborates the trend in a growing customer portfolio.

The second strategic area of the department is exploitation of results. The model pursued by IK4-IDEKO spans the process from selection of ideas, to analysis and feasibility of exploiting them (using our Competitive Intelligence system) with



# 03.

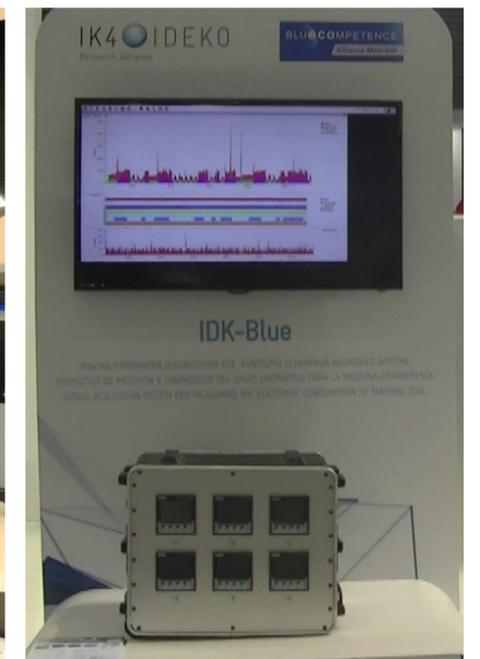
DEPARTMENT OF INNOVATION AND  
TECHNOLOGICAL EXPLOITATION

the ultimate goal of generating business from technology resulting in a variety of end results: new businesses, products, services, licenses, etc.)

A fundamental part of this process is to protect the developed knowledge and technologies. This year four new patents were filed, all of them related to sustainability in manufacturing, new materials, laser technology and vibration damping.

But the highlight of the year was probably our presence at the BIEMH held last June in Bilbao where different finished products as a result from technology

exploitation were launched on the market. The portable platform for the diagnosis and analysis of machine data IKDAS, the workpiece alignment system on the Visup3D machine, the machine and component energy consumption meter IDKBlue, and the Competitive Intelligence software Intelsuite were projects submitted in 2014 and which have started to generate positive operating ratios.



03.

DEPARTMENT OF INNOVATION AND  
TECHNOLOGICAL EXPLOITATION



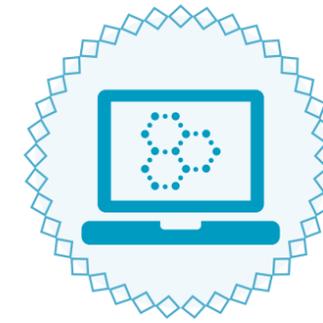
12

DISSEMINATION  
ARTICLES



169

PRESS  
RELEASES



4

IDEKONEWS



7

DIFFUSION  
CONFERENCES

20

ACTIVE PATENTS



4

PATENTS IN APPLICATION

- EP14380034.0 "DYNAMICALLY STABLE MACHINE TOOL"
- EP14380035.7 "MANUFACTURING METHOD AND APPLICATION OF A COMPOSITE MATERIAL WITH UV-CURING AND INSTALLATION FOR PERFORMING SAID METHOD"
- EP14380019.1 "MACHINING HEAD AND LASER INSPECTION".
- EP14380018.3 "PARAMETER MONITORING MACHINE OF A MACHINE".

# 04

# DEPARTMENT OF ADMINISTRATION AND ORGANISATIONAL DEVELOPMENT

04.1 FINANCIAL BALANCE SHEET

04.2 STAFF

04.3 ACCOUNT AUDIT

# 04.1

## Financial Balance Sheet

DEPARTMENT OF ADMINISTRATION AND ORGANISATIONAL DEVELOPMENT

### INCOME (thousands of €)

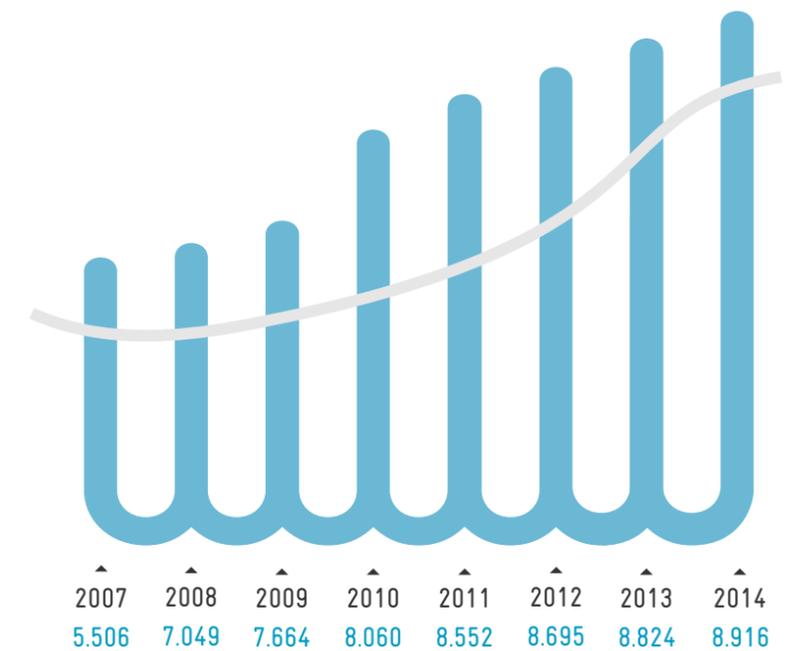
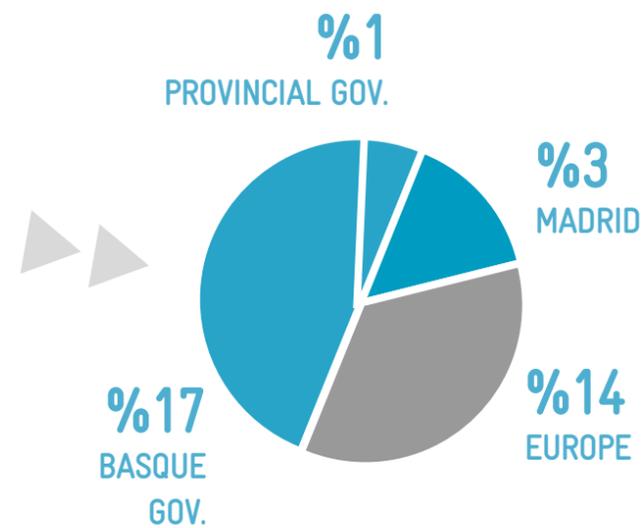
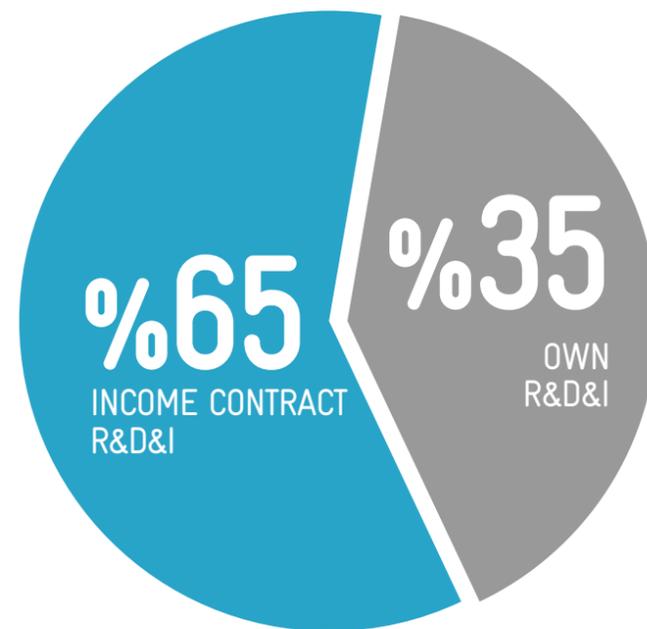
Income contract R&D&I	5.029.000 €	65%
Own R&D&I	2.746.000 €	35%
<b>TOTAL R&amp;D&amp;I</b>	<b>7.775.000 €</b>	<b>100%</b>
Other income	1.141.000 €	
<b>TOTAL INCOME</b>	<b>8.916.000 €</b>	

### BALANCE SHEET (thousands of €)

Net fixed assets	6.239,00 €
Current assets	13.005,00 €
Available assets	1.397,00 €
<b>TOTAL ASSETS</b>	<b>20.465,00 €</b>
Equity	8.104,00 €
Deferred income	5.144,00 €
Long term receivables	1.546,00 €
Short term receivables	5.847,00 €
<b>TOTAL LIABILITIES</b>	<b>20.641,00 €</b>

### PROFIT & LOSS ACCOUNT (thousands of €)

<b>TOTAL INCOME</b>	<b>8.916.000 €</b>
Income projects	7.775.000 €
Other income	1.141.000 €
<b>TOTAL EXPENDITURES</b>	<b>8.729.000 €</b>
Operating expenses	7.561.000 €
Other expenses	897.000 €
Interests of capital	271.000 €
<b>TAXABLE INCOME</b>	<b>20.465 €</b>

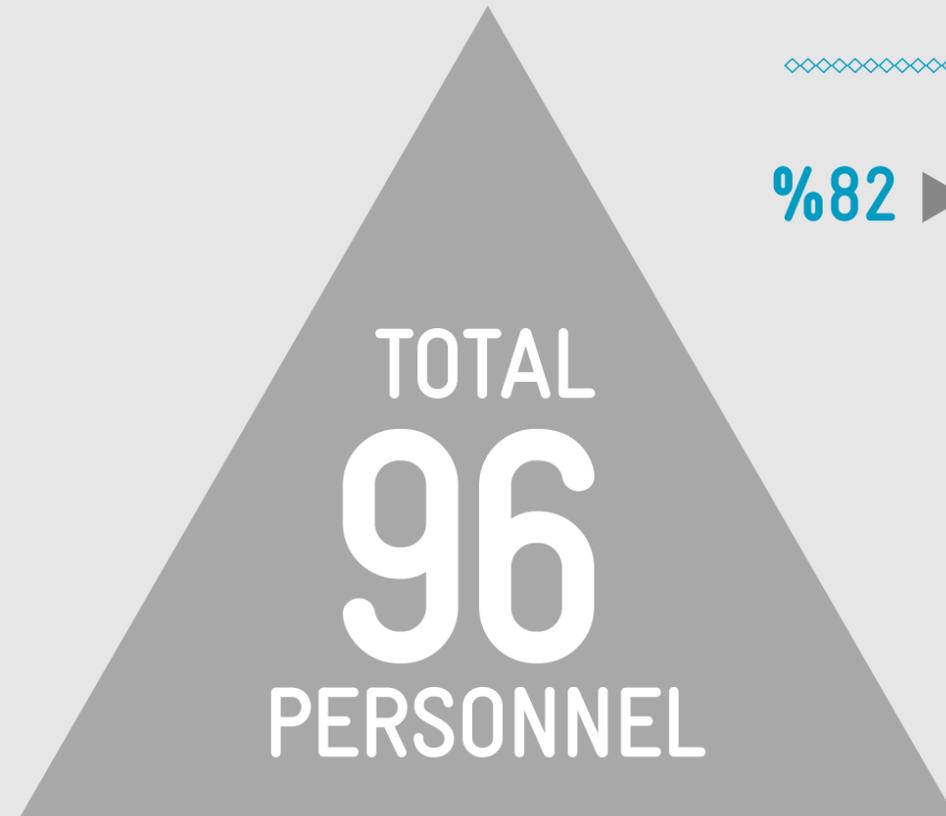
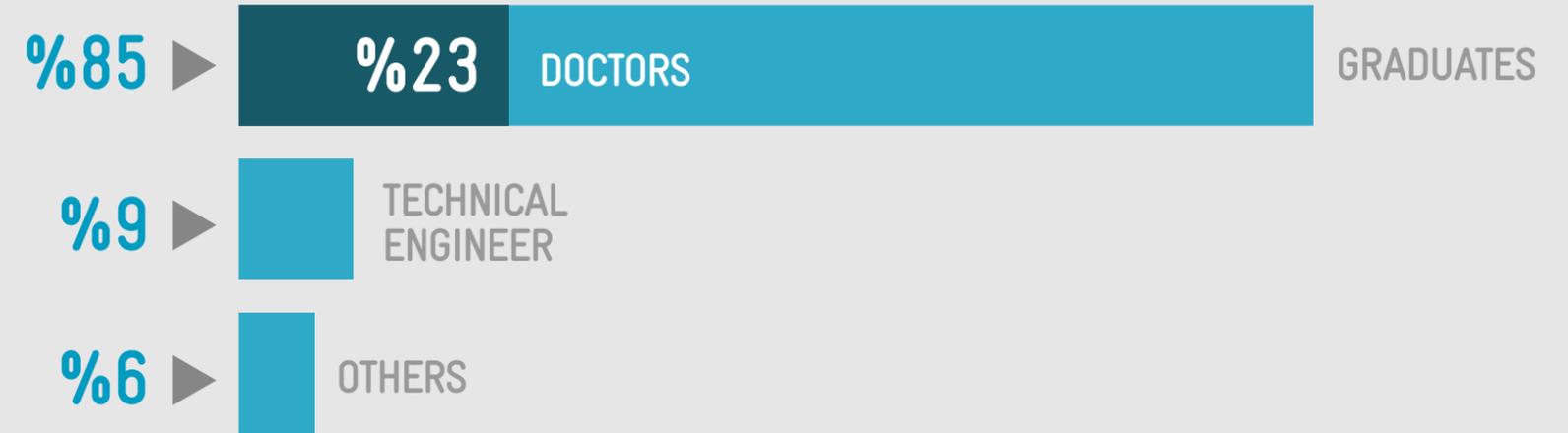


# 04.2

## Staff

DEPARTMENT OF ADMINISTRATION AND ORGANISATIONAL DEVELOPMENT

### PERSONNEL QUALIFICATION



# 04.3

## Account Audit

DEPARTMENT OF ADMINISTRATION AND  
ORGANISATIONAL DEVELOPMENT

# ACCOUNT AUDIT



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20550 ARETXABAETA (Gipuzkoa)  
T: 943 03 74 80  
F: 943 03 74 81  
lksauditores@lksauditores.es  
www.lksauditores.es

### INFORME DE AUDITORÍA INDEPENDIENTE DE CUENTAS ANUALES

A los socios de IDEKO, S.COOP.:

#### Informe sobre las cuentas anuales

Hemos auditado las cuentas anuales adjuntas de la sociedad IDEKO, S.COOP., que comprenden el balance a 31 de diciembre de 2014, la cuenta de pérdidas y ganancias, el estado de cambios en el patrimonio neto, el estado de flujos de efectivo y la memoria correspondientes al ejercicio terminado en dicha fecha.

#### Responsabilidad de los administradores en relación con las cuentas anuales

Los administradores son responsables de formular las cuentas anuales adjuntas, de forma que expresen la imagen fiel del patrimonio, de la situación financiera y de los resultados de IDEKO, S.COOP., de conformidad con el marco normativo de información financiera aplicable a la entidad en España, que se identifica en la nota 2 de la memoria adjunta, y del control interno que consideren necesario para permitir la preparación de cuentas anuales libres de incorrección material, debida a fraude o error.

#### Responsabilidad del auditor

Nuestra responsabilidad es expresar una opinión sobre las cuentas anuales adjuntas basada en nuestra auditoría. Hemos llevado a cabo nuestra auditoría de conformidad con la normativa reguladora de la auditoría de cuentas vigente en España. Dicha normativa exige que cumplamos los requerimientos de ética, así como que planifiquemos y ejecutemos la auditoría con el fin de obtener una seguridad razonable de que las cuentas anuales están libres de incorrecciones materiales.

Una auditoría requiere la aplicación de procedimientos para obtener evidencia de auditoría sobre los importes y la información revelada en las cuentas anuales. Los procedimientos seleccionados dependen del juicio del auditor, incluida la valoración de los riesgos de incorrección material en las cuentas anuales, debida a fraude o error. Al efectuar dichas valoraciones del riesgo, el auditor tiene en cuenta el control interno relevante para la formulación por parte de la entidad de las cuentas anuales, con el fin de diseñar los procedimientos de auditoría que sean adecuados en función de las circunstancias, y no con la finalidad de expresar una opinión sobre la eficacia del control interno de la entidad. Una auditoría también incluye la evaluación de la adecuación de las políticas contables aplicadas y de la razonabilidad de las estimaciones contables realizadas por la dirección, así como la evaluación de la presentación de las cuentas anuales tomadas en su conjunto.

Inscrita en el Registro Mercantil de Gipuzkoa en el Tomo 1167, folio 46, hoja SS-3389, inscripción 1ª. C.I.F. B-20419701. Inscrita en el ICAEX con el nº 3129 y en el Instituto de Contadores Públicos de España con el nº 507.

LKS AUDITORES, S. L. P.



### IDEKO, S.COOP.

Informe de auditoría independiente de las cuentas anuales  
al 31 de diciembre de 2014

Consideramos que la evidencia de auditoría que hemos obtenido proporciona una base suficiente y adecuada para nuestra opinión de auditoría.

#### Opinión

En nuestra opinión, las cuentas anuales adjuntas expresan, en todos los aspectos significativos, la imagen fiel del patrimonio y de la situación financiera de la sociedad IDEKO, S.COOP. a 31 de diciembre de 2014, así como de sus resultados y flujos de efectivo correspondientes al ejercicio anual terminado en dicha fecha, de conformidad con el marco normativo de información financiera que resulta de aplicación y, en particular, con los principios y criterios contables contenidos en el mismo.

#### Informe sobre otros requerimientos legales y reglamentarios

El informe de gestión adjunto del ejercicio 2014 contiene las explicaciones que los administradores consideran oportunas sobre la situación de la sociedad, la evolución de sus negocios y sobre otros asuntos y no forma parte integrante de las cuentas anuales. Hemos verificado que la información contable que contiene el citado informe de gestión concuerda con la de las cuentas anuales del ejercicio 2014. Nuestro trabajo como auditores se limita a la verificación del informe de gestión con el alcance mencionado en este mismo párrafo y no incluye la revisión de información distinta de la obtenida a partir de los registros contables de la sociedad.

LKS AUDITORES, S.L.P.  
Inscrita en el R.O.A.C. Nº S1054

Pedro Mª Jauregui Bidaburu

24 de febrero de 2015



Miembro ejerciente:  
LKS AUDITORES, S.L.P.

Año 2015 Nº 03/16/00510  
COPIA GRATUITA

Informe sujeto a la sanción establecida en el artículo 44 del texto refundido de la Ley de Auditoría de Cuentas, aprobado por Real Decreto Legislativo 1/2015, de 1 de julio.

# 05

## GOVERNING BODIES

05.  
GOVERNING BODIES

## GOVERNING BODIES

DANOBAT GROUP, S. COOP.	Iñigo Ucin Azkue (President)
SORALUCE, S. COOP.	Rafael Idigoras Alberdi (Vice-president)
IDEKO, S. COOP.	Pedro M <sup>a</sup> Olascoaga Arrate (Secretary)
GOITI, S. COOP.	Asier Sasiain Aldalur (Member)
DANOBAT, S. COOP.	Pello Rodriguez Zabaleta (Member)

DRS, S. COOP.	Xabier Alzaga Olañeta (Member)
FUNDACIÓN MONDRAGON	Eduardo Beltrán de Nanclares (Member)
IDEKO, S. COOP.	Juan Antonio Arrieta Etxeberria (Member)
IDEKO, S. COOP.	Mertxe Uzkudun (Member)



# 06

## IK4 RESEARCH ALLIANCE

06.1 MESSAGE FROM THE PRESIDENT

06.2 MESSAGE FROM THE MANAGING DIRECTOR

06.3 DATA 2014

# 06.1

## Message from the Chairperson

IK4 RESEARCH ALLIANCE



## Jesús María Iriondo

Chairperson of IK4

We live in changing times. Intense and dizzying. The difficult economic crisis we have experienced over the past few years has had many consequences, some of them dramatic, which have completely changed the status quo of recent decades. Now is the time, when a tentative recovery seems to be underway, to put into practice what we have learned during these tough times, by contributing insights and patterns of positive action to our economic fabric. This is our responsibility as a Technological Alliance and as a benchmark agent in the area of R&D+i.

This is also how the Basque Government interprets it, believing that the time has come to give a new boost to the efficiency of the Basque system of science, technology and innovation, as included in the new Science, Technology and Innovation Plan (PCTI). The plan designs an ambitious and demanding action horizon for all agents in the Basque system of science, technology and innovation, a horizon on which we must focus our attention and our efforts since it is the horizon on which we have to set our compass in order to accurately orient our action plans, with a north fixed on key concepts such as competitiveness and efficiency.

We welcome this plan with responsibility and enthusiasm, knowing that it represents an opportunity for IK4 and for each of its centres, as the commitment to excellence in research and specialisation that has traditionally characterized our strategy and which is written in our DNA will facilitate the transfer of the research results to the market as effectively and efficiently as possible.

In fact, a commitment to continuous improvement and self-imposed standards of excellence are two constants that we have stood by since our formation as an Alliance. Therefore, for our part, we can only welcome the new PCTI and embrace the opportunities offered by this challenge presented to us by the Basque Government to demonstrate our capacity to be better and more efficient.

It is not a question of complacency. In any case, through being more efficient, IK4's abilities and knowledge will be used by a greater number of Basque companies, our projects will have a greater impact on our customers' competitiveness and, ultimately, we will contribute more decisively to the progress and wellbeing of society.

This, apart from being reflected in a framework of action led by public administrations, has been one of our main hallmarks of identity, known and recognised by our customers, and must continue to be a basic pattern of action for IK4. And those of us who form part of the Basque network for science, research and innovation will fulfil our task successfully if all of us (technology centres, companies, Government, universities, etc.) work in alignment with each other firstly to identify the strategic and priority projects and, secondly, to tackle them as effectively and successfully as possible.

We have before us, therefore, a huge challenge and a great opportunity. And once again, I am fully confident that we are up to the task in hand.

# 06.2

## Message from the Managing Director

IK4 RESEARCH ALLIANCE



## José Miguel Erdozain

Managing Director of IK4

Just as they are emerging from the deep slump of over five years of relentless economic crisis, companies now find themselves facing a laborious recovery phase. The panorama looks complicated, under the sign of permanent change, with the challenge of having to be increasingly more competitive an essential requirement.

In this scenario of uncertainty, the work of the IK4 Technology Alliance is even more important. We must adopt a leadership role in the search for opportunities for companies and must position ourselves as a technological partner capable of adapting such opportunities to their needs and making them the focus of their strategic commitment.

In this regard, we are backed up by our experience over these past few years. Despite a very adverse economic climate we have managed to consolidate our position as one of the main European benchmarks in applied research, making us leaders in Europe in terms of the percentage of income derived from contracts with private companies, which currently stands at around 60 %.

We have also been able to maintain our annual income above 100 million euros, placing us among the top 10 private technology corporations in Europe.

These positive figures should not make us complacent, however, but rather make us reinforce our commitment with efforts to identify and

take advantage of opportunities to open new areas of action. In this respect, at IK4 we are strengthening our determined commitment to the Horizon 2020 programme. One of our most important objectives is to increase our R&D+i income from Europe by 50 %, which will mean obtaining around 130 million euros via this route over the seven-year duration of Horizon 2020.

It is an ambitious objective, one that is based on the excellent results obtained from our participation in the Seventh Framework Programme and also on our growing presence in the main R&D+i management and opinion-forming bodies at European level, a presence that is reflected in the highest levels of governance.

IK4's position in the new European scenario represents a great opportunity for Basque companies, for whom we can be an excellent vehicle through which their challenges can reach the Community research programmes. Not only because of the large amount of resources that the EU plans to allocate (80,000 million euros), but also because of the directive to favour projects that are closer to the market and are more related to the daily activity of the companies.

We must therefore strive to be increasingly efficient. These are the winds of change that are blowing in Europe, but also here at home, where the Basque Government is clearly looking in this direction for the almost 200 entities that form the backbone of the Basque ecosystem of innovation and knowledge.

This is an obligatory challenge if we want to have a say in the new map of European smart specialization (RIS3). But it is also a great opportunity for those of us who form a fundamental part of the Basque competitiveness system, as our achievements will mean the success of our companies in the extremely competitive global markets.

# 06.3

Figures 2014

## STRATEGIC AREAS



ENERGY



HEALTH



TRANSPORT AND MOBILITY



ADVANCED MANUFACTURING

## TOTAL INCOME

102 M€

59,16 % COMPANIES

20,09 % BASQUE GOVERNMENT

16,17 % EU

3,92 % SPANISH PA

0,66 % REGIONAL GOVERNMENTS

9  
TECHNOLOGY  
CENTRES

12  
SITES

93  
COMPANIES AND ENTITIES  
IN GOVERNING BODIES

1275  
PROFESSIONALS

28 % (358)  
DOCTORS

21  
PATENTS REQUESTED  
IN 2014

15  
PATENTS ATTRIBUTED  
IN 2014

IK4  IDEKO

Research Alliance

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