# The latest advances in artificial intelligence, precision, robotics and composites, new developments from IDEKO for the Machine Tool Biennial

- ***The research centre will offer various workshops about new digital tools to optimise maintenance and improve productivity at its stand C-14, B-15 located in Hall 1***
- ***The company will show how photogrammetry-based 3D vision systems help robots increase accuracy in machining tasks***
- ***IDEKO will showcase the manufacturing process of parts made with UV-cured glass fibre reinforced polyester.***
- ***The Machine Tool Biennial is held at the BEC in Barakaldo from 13 to 17 June***

Industrial processes are in the midst of a new revolution led by the pursuit of efficiency and productivity. If automation was at the centre of the so-called Industry 4.0, it now is sharing space and prominence with a new phase in which artificial intelligence acts as an integrating element between humans and machines, robotics is becoming increasingly precise, and technology has opted for more robust, flexible, sustainable and versatile materials.

In order to consolidate this new production scenario, close collaboration between all the players in the industrial ecosystem is necessary to design innovative solutions to bring about a better productive fabric and an easier transfer of knowledge to society in general.

In this scenario, the research centre IDEKO, a member of the Basque Research & Technology Alliance (BRTA), will be present at the 31st edition of the Machine Tool Biennial, 31BIEMH, with innovative solutions in several of the areas that are set to lead this paradigm shift, such as artificial intelligence applied to manufacturing and precision, two of the main driving forces of the research plan recently approved by the company.

The research centre, with **stand C-14, B-15 in Hall 1** of the BEC, will showcase its capabilities in artificial intelligence applied to manufacturing through different workshops that can be attended in person and via *streaming*. Furthermore, the advances made in precision and robotics are displayed, as well as the composite material parts manufactured for the

aeronautical and railway sectors, and finally the solutions for chatter suppression in the machine tool sector.

## 1. Artificial intelligence applied to manufacturing

IDEKO's presence at the Machine Tool Biennial is the result of the commitment that the technology centre has made over the last few years to design and implement artificial intelligence (AI) solutions capable of optimising the productivity and efficiency of the productive fabric, especially SMEs. This commitment, which is also the result of close collaboration with the entire industrial ecosystem, has led to the implementation of several pilot programmes aimed at monitoring critical machine components and detecting anomalies in the operation of machinery.

These programmes have been made possible thanks to the collection of countless data from the sensor networks installed on various machines around the world, which allow the operation of the machinery to be monitored and thus obtain the necessary information to optimise different processes. In this regard, IDEKO monitors more than 700 machines that are connected to the cloud, collecting data from around 200 sensors on each machine that send data constantly. This continuous flow of data capture enables IDEKO to monitor the status of components and detect anomalies.

Artificial Intelligence is fed huge amounts of data from sensor networks deployed in industrial machinery. Thanks to the application of artificial intelligence in manufacturing, companies can avoid breakdowns and unscheduled production downtimes, increase equipment availability and ensure optimum performance in the production of high value-added parts and components.

### AI solutions to improve business competitiveness

Artificial intelligence developments have much to contribute to the improvement of in-plant production, and facilitate the processing of a huge volume of data that aid in streamlining decision making and achieving greater competitiveness in an increasingly complex market.

In that respect, IDEKO will bring to the Biennial its know-how in artificial intelligence applied to *manufacturing*, which revolves around several axes:

### Component monitoring

The collection, processing and management of data on the performance of various indicators on hundreds of industrial machines allows the monitoring of the behaviour of components that are critical to their operation, in particular axes and spindles.

Failures of this kind are often very costly and lead to production stoppages of several days, so it is essential to detect any early signs of a problem to take preventive measures or, if necessary, plan a production stoppage with the lowest possible cost impact for the company. This pilot

programme for monitoring critical components has enabled us to detect several problems at an early stage on machines distributed by companies in our area, to the point that this option has become a digital service of its own with which industrial customers can optimise their production.

## Anomaly detection

The IDEKO system compares the daily operating data provided by the sensor networks installed on the new machines to the usual pattern of the machinery, and a warning is issued in the event a fault or a parameter that is out of the norm is detected. This system helps to detect problems before they become serious failures.

## Job Manager

Tagging or logging of incidents that occur during machine operation is essential to train the artificial intelligence algorithm and teach it to detect similar malfunctions in the future. To facilitate this process, IDEKO has developed a Job Manager system that requires operators to enter these tags when incidents are recorded. The system interrupts machine operation until the operator has made a detailed recording of the events. These data enable the system to detect similar anomalies on other machines and to improve the overall performance of all machinery connected to the system.

## Sensorisation of old machinery

The deployment of sensor networks on older machines has become a necessary service to minimise the risk of serious breakdowns. This sensorisation is of particular interest the older the components get because this is when they start to fail on a regular basis, and when the risk of serious failures is greatest. IDEKO has extensive expertise in the field of component sensorisation and has solutions tailored to the needs of each company to increase efficiency.

## Artificial Intelligence pills for industrial companies

At stand C-14, B15 Hall 1 at the Machine Tool Biennial, **IDEKO** will host **five workshops** between **13 and 17 June** discussing the advantages of implementing artificial intelligence processes for industrial companies. IDEKO's head of the ICT and Automation research group, Iñigo Bediaga, will explain the benefits for companies of transforming data into useful information through these digital tools with a view to optimising production processes.

The talks, which can be followed live via streaming, will cover the following topics:

- **Towards the digitisation of machines. IoT platform for data capture and analytics** *(14 June at 11:00 a.m.)*. During this talk, the SAVVY Edge and SAVVY Industrial Cloud platform is presented, developed by IDEKO and the company SAVVY Data Systems for transformation of data into valuable information.

- **Predictive maintenance on machine tools. Machine fingerprint or self-diagnostic tests** *(14 June at 12:00 noon)***.** Iñigo Bediaga will present several success stories obtained through machine fingerprinting. This technology provides a fast, automated insight into the condition of critical components such as rotary and linear spindles and axes, anticipates possible anomalies and performs predictive, condition-based maintenance.

- **The leap from R&D to industry. Artificial intelligence pilots** *(15 June at 11:15 a.m.).* The head of ICT and Automation will explain several case studies of pilot experiences of artificial intelligence applied to the detection of anomalies with industrial SMEs in our environment. These programmes have made it possible to detect anomalies, breakage of cutting tools, predict grinding wheel wear and thermal damage in grinding processes, and even optimise production for stock management.

- **SAVVY Platform for improving equipment efficiency** *(16 June at 11 a.m.).* In this talk, Iñigo Bediaga and Fernando Sáenz, CEO of SAAVY Data Systems will present the SAVVVY-MEC solution under the SAVVY Industrial Cloud platform aimed at the machining and metal-mechanical transformation sector, developed by SAVVVY Data Systems, Fagor Automation and IDEKO. This tool enables the improvement of OEE *(Overall Equipment Effectiveness)* of industrial equipment.

- **Standardisation of data collection. How to share information with European data spaces** *(17 June at 11 a.m.).* The workshop given by the head of ICT and Automation at IDEKO and Michel Iñigo, Senior Project Manager at Mondragon Corporation, discusses how to share data collected on different machines and with different software in order to optimise the information flow between companies in other environments and improve the efficiency of artificial intelligence tools. Specifically, the need to implement IDS *(International Data Spaces)* connectors on machines to share this information securely and reliably within the European data spaces, known as *EU Manufacturing Data Spaces*, will be discussed. Thanks to the new digital trend of AAS *(Asset Administration Shell)*, the properties and functions of the monitored asset can be accessed, regardless of the technology and manufacturer.

## 2. Robotics for more precise and flexible manufacturing

The introduction of robotics in production processes and manufacturing environments enables the automation of multiple industrial processes. By using robotic solutions, it is possible to automate heavy and dangerous tasks reliably and safely. However, robots still have much room for improvement in terms of accuracy.

Applying robotics solutions offers great advantages to the machine tool sector because of their flexibility and versatility in operations with low machining forces, sanding, drilling or trimming processes for stock removal, among other processes.

At the BIEMH, IDEKO will show its capabilities in precision applied to robotics. One of which is portable multi-camera vision systems, used to increase the accuracy of robots for certain processes such as metrology at a much more affordable cost than manual processes. These multi-camera vision systems enable the robot to perform simple machining tasks more accurately.

To showcase this technology IDEKO will be demonstrating at the trade fair how the incorporation of vision systems enables a robot to increase the precision of machining operations. The cell on display consists of two robots equipped with the latest technology for the part grinding process and for inspection.

The first robot integrates laser technology that informs of the shape of the finished part so that the trajectory is adapted to perform a finishing operation on it.

The second robot finishes the part. This solution, focused on parts with complex geometry or requiring the removal of a large volume of material, includes a process control to compensate for the effect of tool wear, ensuring a homogeneous finish.

In addition, thanks to the multi-camera vision system, based on **photogrammetric 3D vision** technology, the robots are able to define the measurements, dimensions and spatial location of objects by taking multiple photographs, and thus obtain improved accuracy.

This solution is focused on parts with complex geometry that require a significant amount of the material to be removed and a mark-free finish. It is also suitable for operations with low machining forces, light machining of materials such as aluminium or composites, for finishing processes such as trimming, and for drilling tasks.

Precision robotics can be applied in other fields such as machining where it is possible to improve the capabilities of robots to handle soft materials such as fibre, composite or aluminium in operations that do not require high precision. Robots can also perform operations that are usually carried out manually, e.g. repetitive and time-consuming operations such as polishing and sanding parts, or removing impurities or marks, with external assistance systems, among others, a vision system. Hence, people are relieved of tiresome tasks and can dedicate their time to higher-value work, e.g. robot monitoring or quality control.

IDEKO has implemented this technology for an aeronautical and dental application, in which the software is designed to identify, detect and measure natural markers for the robot.

The research centre also has several robotic cells in its workshop to research and transfer its expertise in machine tools to the field of robotics, within the R&D area.

## 3. Composites to improve the automated manufacture of parts for the aeronautical and railway industries

Research into and development of composites is an area of great importance for critical sectors such as aeronautics, wind power, shipbuilding, etc. because it makes the design of new high-strength materials possible to meet certain needs or respond to specific mechanical properties, such as tensile, compressive or impact strength. Their lightweight property makes them suitable materials for solutions in areas such as transport or sustainable mobility. Nowadays there is a wide variety of manufacturing processes depending on the production rate and the size of the part.

IDEKO has been involved in the field of research into these composite materials for more than a decade and has become a benchmark in the formulation and synthesis of new resins, and of equipment for characterising and monitoring the infusion and curing process: from moulds and *hot drape formers* to vacuum pumps, ovens and furnaces, heat monitoring and control equipment, and inert atmosphere systems for reaction control, among others.

As a result of this research, the Basque centre is currently working on two composite material technologies:

- The manufacture of **glass fibre reinforced plastic** (GFRP) **parts** using ultraviolet (UV) curing resins. In this field IDEKO is working to consolidate the technology from the point of view of manufacturable geometries and in the development of resins with higher mechanical and fire-resistant capacities.

- The production of **carbon fibre composite parts,** CFRP, from dry fibres and fabrics (NCF, tape, etc.). The centre has launched a project that aims to develop fibre NCF tapes equipped with sensors to optimise manufacturing processes of parts, and to provide information on the conditions of use of the component, its health and its life cycle. For example, the use of carbon fibre composites in the manufacture of parts has found widespread use to make lighter weight aircraft in the aeronautical sector, to reduce costs because of the use of more expensive prepreg materials, and to provide an energy-efficient solution.

This technology has several advantages: Resins require less curing time and therefore contribute to increased productivity. In addition, the costs of storage and alternative curing processes are lower, resulting in cost savings. Finally, they offer improved mechanical properties compared to other solutions.

In addition, IDEKO has developed high-speed controlled part manufacturing processes, which guarantees complete monitoring of the process and the variables to ensure the quality and repeatability of the new components.

The Machine Tool Biennial will be the stage of the research centre to exhibit two model pieces of the technology it is working on. Specifically, a carbon fibre part for the aeronautical sector will be presented and another in fibreglass for railways, for which newly developed sustainable and efficient processes were applied during the manufacture, increasing the presence of

composites and consequently a reduction of the weight of vehicles and a lesser impact of transport on the environment.

A video will also show the manufacturing process of parts made with UV-cured glass-fibre reinforced polyester. This process involves two stages:

1. The **manufacturing process of composite material** pre-impregnated with UV-curable resin fibres that can be stored anywhere, but always away from ultraviolet radiation.

2. The **process of manufacturing the part**, using the pre-impregnated materials, a mould, a membrane press and an ultraviolet light lamp. The pre-impregnated materials are deposited on the mould; they are then pressed by the press to extract the air and compact the different layers. Finally, ultraviolet light is projected through the membrane and the part is solidified in a few minutes.

This solution, which is the result of four years of research, is already in the process of industrialisation with several end users and potential customers.

## 4. Improvement of dynamic behaviour of machines and processes

**Chatter** during the operation of machinery is one of the main challenges faced by manufacturers of industrial equipment as it **limits productivity and undermines the quality** of manufactured components.

IDEKO research has accumulated extensive *expertise* in the dynamic behaviour of machines and the correction of malfunctions that affect productivity. Because of the constant commitment to maximum quality in the production of parts, the efficiency of processes and the useful life of equipment we have become a benchmark in the control and suppression of chatter and other manufacturing problems.

Over the last few years, IDEKO has accumulated extensive theoretical-experimental knowledge of the *chatter* effect produced in industrial processes, which has enabled us to promote technologies and systems for damping and eliminating self-excited vibrations.

At the BIEMH, the Basque centre will showcase several innovative systems that effectively diagnose such problems and apply corrective measures to suppress chatter on machines, parts and machining processes. These solutions include verification and setting by testing the performance of the machines.

The Biennial will be the stage on which IDEKO will showcase various solutions for improving the dynamic behaviour of machines and processes:

 development of technology for **characterisation, modelling and design of solutions** for enhanced dynamic performance of machines

 design of **damping** systems in machine structures, parts and tools

devising **advanced control algorithms** for the suppression of forced and self-excited chatter

## 5. Competitive intelligence to drive business success

Digital channels have become a very useful source of information for checking market developments and the competitive position of a company. However, the abundance of resources and channels that have emerged in the digital ecosystem makes it impossible to manually process all the information emanating from these sources.

To carry out this process effectively requires a system capable of **capturing and filtering all relevant information** that impacts on a company's strategic and operational decisions. This type of technology, which is based on competitive intelligence and technology watch systems, has become a key element in the articulation of strategic decision-making processes because it facilitates access to relevant and quality information about a company's sector and competitive environment.

IDEKO has used its knowledge of digital tools, competitive intelligence and technological watch systems to design the [INNGUMA](INNGUMA) software, which will be exhibited at the next Machine Tool Biennial. This system is able to automatically track and monitor data of interest for a company by collecting information from websites, social media, videos, patents, tenders, grants, alerts and even prices.

All this information is stored in a file accessible to the members of the organisation, with the aim of making more efficient strategic decisions and reducing risks. The technology of this competitive monitoring platform is the result of building up experience and knowledge in the sector for more than 20 years, which has helped us to create a portfolio of almost a hundred clients from eight different countries.

Its value proposition lies in enhancing the potential of its software offering comprehensive information management. This makes it a tool capable of offering added value across the board and improving a company's competitive position.

Eneko Arza, CEO of INNGUMA, will address implementing this tool from the point of view of efficiency during a talk to be held on the **16th at 12.00 noon**. This talk, entitled **"Competitive Intelligence for Industrial Companies",** can be followed live in person and via *streaming*, just like the other talks on artificial intelligence.