



# Fortissimo Success Stories

Fortissimo`s Small & Medium, Manufacturing Enterprises

5<sup>th</sup> Edition - Volume II



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[www.ec.europa.eu](http://www.ec.europa.eu)

[www.fortissimo-project.eu](http://www.fortissimo-project.eu)



# The Fortissimo Marketplace

The Fortissimo project is funded by the European Commission within the I4MS initiative (ICT Innovation for Manufacturing Small & Medium Enterprises) framework. It consists of two phases: the first phase began in July 2013 and ended in December 2016; the second phase began in November 2015 and will end in October 2018.

## THE AIM OF FORTISSIMO

The aim of Fortissimo is to strengthen the global competitiveness of European industry. Fortissimo drives the uptake of advanced modelling, simulation and data analytics by European engineering and manufacturing Small & Medium Enterprises (SMEs) and mid-caps. Such an uptake will deliver improved design processes, better products and services, and improved competitiveness. For the European Union as a whole this means improved employment opportunities and economic growth.

## THE CHALLENGE

In the past, gaining access to the resources required for digital simulation has often posed serious technical and financial challenges to SMEs. Through the use of High Performance Computing (HPC) simulations available via a cloud-based infrastructure, opportunities for business benefits can be identified and applied across the complete value chain, thus saving companies time and money and improving their competitive position.

## THE MARKETPLACE

The Fortissimo Marketplace – launched in October 2016 – provides all European businesses, in particular Small & Medium Enterprises (SMEs), with permanent, simple and cost-effective access to the hardware, software, and expertise required for computationally intensive simulations, via an on-demand, pay-per-use, “one-stop-shop” model.

Improvements resulting from the Fortissimo Marketplace approach are manifold, including: better and more precise design of complex components and systems; acceleration of time-to-market; and cost savings in development, production and operation.

For further information, please visit: [www.fortissimo-project.eu](http://www.fortissimo-project.eu)

## SME PARTICIPATION

Fortissimo collaborates with SMEs, technical experts, independent software vendors (ISVs) and HPC-Computer centres to demonstrate the business benefits of Cloud-based-HPC simulations. SMEs can propose potential experiments through “open calls”. During the 18-month duration of an experiment, the Fortissimo partners provide the participating SMEs with free access to HPC-resources via a cloud-infrastructure and support them in the planning, implementation and realisation of their experiment.

## SUCCESS STORIES

A success story is a summary of an experiment focusing on the resultant business benefits. It has four main sections, the first presents the organizations involved in the experiment – SME as the end user, HPC provider, technical expert, and ISV; the second presents the challenge where the reason for the experiment is described; the third presents the technical solution deployed in the experiment; the fourth presents the benefits resulting from the exploitation of the solution.

## THE BOOKLET

This booklet presents eleven success stories from the second phase of the project. Further success stories will be added as the respective experiments are completed.



Joint review of I4MS projects in Edinburgh.



## Core Partners

For each Fortissimo experiment one of the core-partners acts as a provider of high performance computing resources and expertise, enabling the other project partners to make best use of HPC in their solution. Providing HPC resources on a pay-per-use basis removes the need for the other partners to invest in their own HPC hardware, cutting costs. The core-partners benefit by generating income from the services via the Fortissimo Marketplace, and by developing new partnerships with users of those services. This helps keep them at the forefront of innovative support for industry.



### THE UNIVERSITY OF EDINBURGH

EPCC is a leading European centre of excellence in advanced research, technology transfer, and the provision of high-performance computing services to academia and industry.  
[www.epcc.ed.ac.uk](http://www.epcc.ed.ac.uk)



### ARCTUR

Arctur is the leading service provider of supercomputing in Central Eastern Europe. Following the XaaS model, it leases the supercomputer along with the services of system administration, code optimization or parallelization. Arctur delivers HPC services and solutions to industrial and scientific users in various technologically intensive industries.  
[www.hpc.arctur.net](http://www.hpc.arctur.net)



### ATOS

Atos is a leader in digital services, with circa 100,000 employees in 72 countries. Its deep technology expertise and industry knowledge has allowed it to build global client base across many different business sectors.  
[www.atos.net/en](http://www.atos.net/en)



### FUNDACION CENTRO TECNOLOGICO DE SUPERCOMPUTACION DE GALICIA

Fundación Pública Galega Centro Tecnológico de Supercomputación de Galicia is a public foundation committed to the advancement of Science and Technical Knowledge, by means of research and application of HPC, communications and other IT resources for the benefit of society.  
[www.cesga.es](http://www.cesga.es)



### CONSORZIO INTERUNIVERSITARIO

CINECA's mission is to enable the Italian and European research community to accelerate the scientific discovery using HPC resources in a profitable way, exploiting the newest technological advances.  
[www.cineca.it](http://www.cineca.it)

### GOMPUTE

Gompute is a leading HPC Cloud company, offering expert services and full support to a large number of users worldwide. It delivers comprehensive solutions for High Performance Computing, both in-house and as a service.  
[www.gompute.com](http://www.gompute.com)



### HLRS – UNIVERSITY OF STUTTGART

The High Performance Computing Centre (HLRS) is one of three national computing centres affiliated to the University of Stuttgart. It operates and provides compute resources to research groups and industry.  
[www.hlrs.de](http://www.hlrs.de)



### INTEL

Intel (NASDAQ: INTC) is a world leader in computing innovation. The company designs and builds the essential technologies that serve as the foundation for the world's computing devices.  
[www.intel.com](http://www.intel.com)



### SCAPOS

Scapos was founded in 2009 for the sales, marketing and support of software for technical computing and of advanced software solutions. Its customers range from large industrial corporations and research institutes to SMEs.  
[www.scapos.com](http://www.scapos.com)



### SICOS

Provides access to big data's analysis, simulation and high performance computing. The Sicos BW GmbH, headquartered in Stuttgart, was founded in 2011 by the Karlsruhe Institute of Technology (KIT) and the University of Stuttgart in order to facilitate especially small and medium enterprises (SMEs) access to big data's analysis, simulation and high performance computing.  
[www.sicos-bw.de](http://www.sicos-bw.de)



### SURFSARA

SURFsara supports research, education and industry in the Netherlands in the areas of HPC and big data, through the development and provisioning of advanced ICT infrastructure, services and expertise.  
[www.surfsara.nl](http://www.surfsara.nl)



### XLAB

XLAB Research is recognized in Slovenia as one of the strongest computer science research teams outside the academic world. Their expertise lies in security and distributed systems.  
[www.xlab.si](http://www.xlab.si)





## Experiment Partners





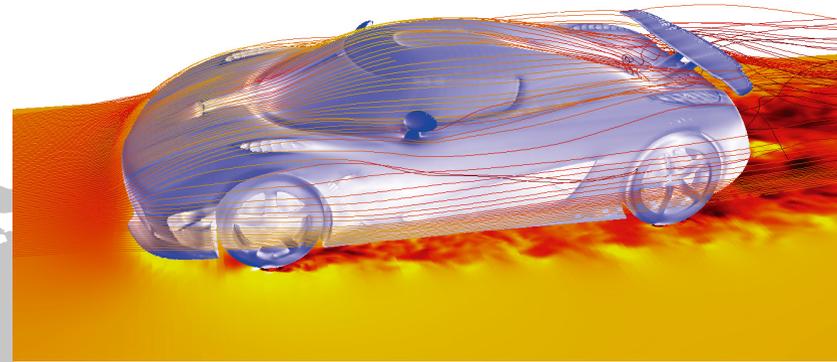
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# Cloud-based simulation for vehicle engineering



## EXPERIMENT #701 HIGHLIGHTS

Industry Sector: **Automotive**  
Country: **Sweden**  
Software used: **iconCFD®**

### THE COMPANIES

Koenigsegg Automotive AB is a Swedish SME whose core business is the development and production of high-performance, high-quality, limited-edition motor vehicles – so called hyper-cars. ICON Technology & Process Consulting Ltd is UK company which specialises in Computer Aided Engineering (CAE) services together with IT/web/multimedia capabilities to manage and present data.



End User



[www.koenigsegg.com](http://www.koenigsegg.com)

HPC Expert and Provider



[www.epcc.ed.ac.uk](http://www.epcc.ed.ac.uk)

ISV



[www.iconcfid.com](http://www.iconcfid.com)

### THE CHALLENGE

Analysing how air flows around a vehicle is essential to making it faster and more efficient. Physical testing is expensive due to the costs of models and test facilities. Computer simulation removes the need for these, and enables the engineers to make changes to the design more easily. However, simulating airflow with the required degree of accuracy requires computing power beyond the reach of most designers, mainly due to the capital costs of the equipment.

### THE SOLUTION

The solution developed by ICON is to provide cost-effective and easy-to-use access to high-performance computing. The ease of use is achieved by providing browser accessible 'apps' which provide the necessary features to set up and analyse simulations. The apps connect to HPC-systems which provide pay-per-use access; capital costs are avoided altogether, as is the need for experienced personnel to run the HPC systems. The result for the end-user is a feature-rich interface connected to computing resources capable of rapidly returning simulation results. The entry cost and operational costs are very attractive for small companies.

### BUSINESS IMPACT

Obtaining an in-house capability for rotating wheel aerodynamic simulation requires an initial investment of €200,000 - €300,000 including hardware, and software licences allowing approximately 50 simulations per year. In addition, an annual maintenance and operational cost of approximately €100,000 including hardware warranties, electricity, software licences, etc. is required. This is a prohibitive cost for SMEs.

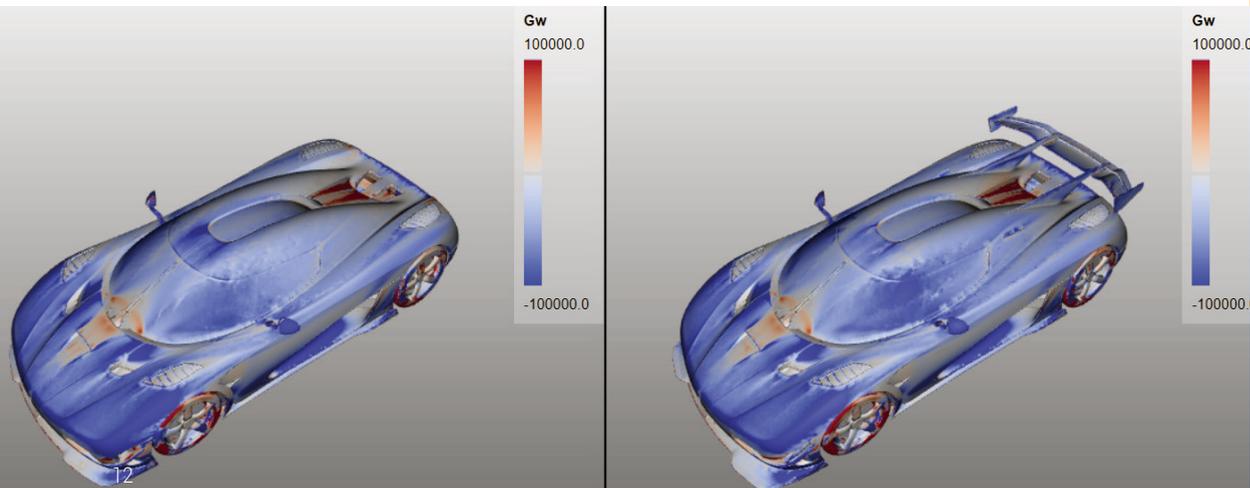
In comparison, a streamlined process accessed on-line and benefitting from on-demand HPC and ISV expertise could cost as low as €900 per simulation to the end user, therefore making high-end simulation affordable to SMEs. This can reduce or even eliminate the need for physical testing, saving further time and money on models and wind tunnels.

The experience of Koenigsegg is that around €100,000 can be saved annually on design costs by using this technology that was previously only affordable to large companies.

For ICON, the apps they have developed will allow them to offer their services to new clients in the automotive SME sector.

### BENEFITS

- €100,000 annual saving on design costs – saving 30% over previous solutions.
- High-end simulations for as little as €900 per simulation.
- No need for SME to purchase expensive equipment.
- Significant time saving as there is no need for physical testing.





# Optimising gas and flame detector layouts in hazardous manufacturing and production plants

## THE COMPANIES

Micropack is a British SME which designs, manufactures and installs its own range of detectors for use in fire and gas safety. It also consults on fire and gas safety design and gas dispersion. Gexcon AS is a Norwegian company and the market leader in dispersion, fire and explosion modelling software for hazardous production areas. Gexcon develops the multi-physics modelling application FLACS, a simulation tool used worldwide for safety studies.



End User



HPC Expert and Provider

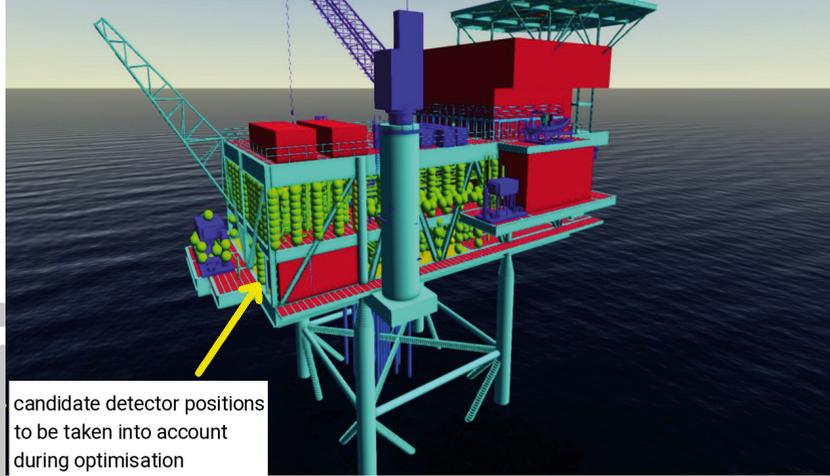
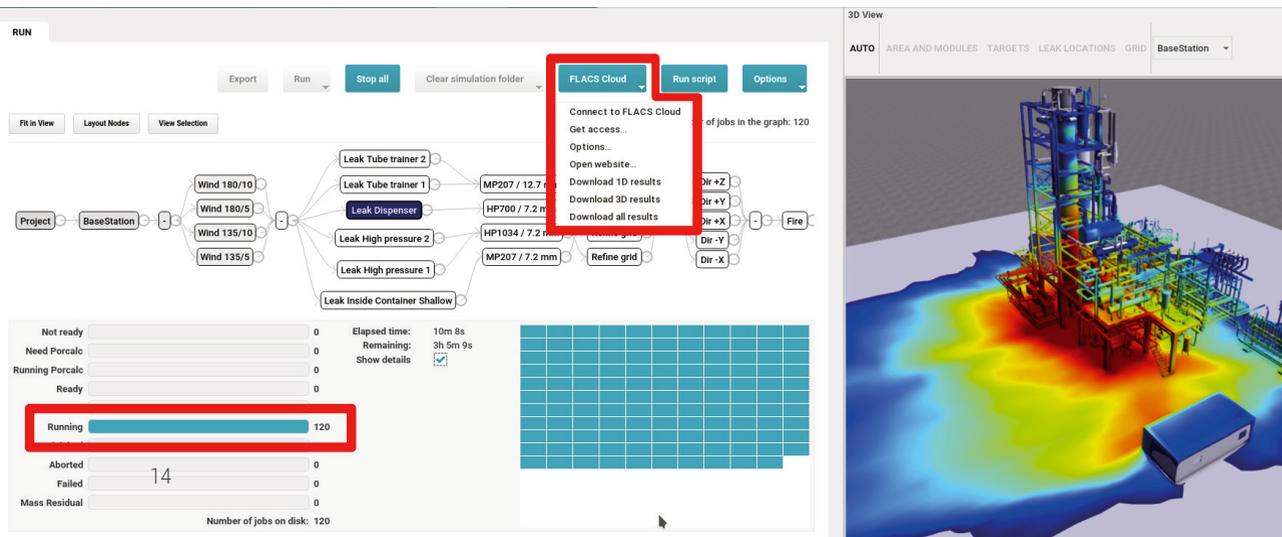


ISV



## THE CHALLENGE

Gas detectors are commonly installed in manufacturing and production facilities where hazardous substances are processed (such as oil and gas installations), to automatically alarm and trigger safety measures in response to leak events. Gexcon, the software provider, produces FLACS, a CFD modelling software used for safety studies. To date, the amount of computing power required for a CFD-based optimisation of gas detector layouts has been prohibitive in terms of both costs and time. Gexcon and Micropack joined forces to develop the next-generation methodology for gas detection system design.



candidate detector positions to be taken into account during optimisation

## EXPERIMENT #702 HIGHLIGHTS

Industry Sector:  
Oil and Gas Processing

Country:  
United Kingdom

Software used:  
FLACS Risk and FLACS Cloud

## THE SOLUTION

The goal of the Fortissimo experiment has been to provide FLACS as Software as a Service (SaaS) offering, with the usage of HPC fully integrated in the FLACS GUIs, under the new product name "FLACS-Cloud". The new service enables Gexcon's customers to tap into powerful HPC-cloud resources seamlessly from the GUI, so that it appears no different to the user compared to accessing a local cluster. The key difference is that the users only pay for the time that they use, making it much more cost-effective. The access to HPC computing resources available through the FLACS-Cloud service renders it feasible to apply proper CFD-based optimisation to the placement of gas detection systems. This is expected to result in reduction of the costs for the installation and maintenance of the detection system, and lowering the risk of severe accidents in a facility.

## BUSINESS IMPACT

Using FLACS-Cloud, Micropack and other users can improve safety and reduce the costs of detector installations and ongoing operational expenses in industrial and manufacturing facilities that incur potential risks of gas leaks, explosions, fires, and other hazards.

Optimisation means that fewer detectors are needed to cover the same space. The cost savings of one or more detectors per sector of the detection system can quickly add up to figures in excess of €100,000. Typical gas detection systems can easily comprise multiple tens of detectors, so the savings can run into millions of Euro per installation.

The use of on-demand resources is attractive to Micropack, as they save tens of thousands of Euro on computing equipment. Using HPC, a project's computing phase can also typically be shortened by up to a factor of ten (compared to using in-house resources), which will allow to service more clients, and offer a better client experience.

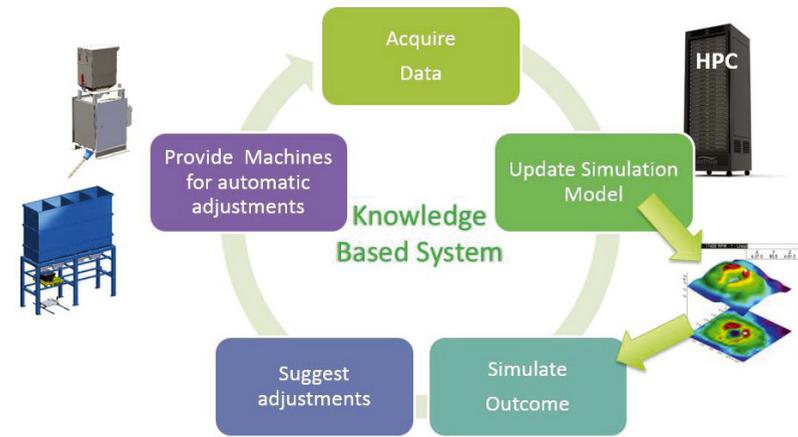
Gexcon will offer FLACS-Cloud via the Fortissimo Marketplace and continue to develop cloud-based industrial safety software and business models.

## BENEFITS

- Potential savings into the millions of Euro for a typical installation.
- The realisation of FLACS-Cloud, creating revenues for Gexcon.
- Computational speedup, up to a factor of 10, using HPC over traditional resources.
- Improved placement of detectors, therefore improving safety.



# Advanced, cloud-based HPC simulation in the foundry business



## EXPERIMENT #703 HIGHLIGHTS

Industry Sector: Automotive

Country: Italy

Software used: Optimus, ITACA and elasticLM

## THE COMPANIES

ProService s.r.l. is an SME based in Italy. Founded in 2002, it provides machines, tools and consultancy services for the metal casting industry, focusing on iron foundries. Noesis Solutions is a Belgian system integrator and independent software vendor. Its research areas include integrated simulation frameworks, large-scale optimization and high-performance computing. Fraunhofer SCAI is the Institute for Algorithms and Scientific Computing of the Fraunhofer Society, based in Germany.

End User



[www.proservicetech.it](http://www.proservicetech.it)

HPC Expert



[www.noessisolutions.com](http://www.noessisolutions.com)

ISV and Domain expert



[www.scai.fraunhofer.de](http://www.scai.fraunhofer.de)

HPC Provider



[www.hlrs.de](http://www.hlrs.de)

## THE CHALLENGE

The goal of this experiment was to reduce the scrap rate of the foundry process. A service was needed which could predict the behaviour of the current batch of metal to reduce the amount of waste. If it were possible to adjust the process in real time, the foundry could lower energy consumption and production costs. Using historical data from previous production runs was seen as the key to this problem, but this entails data analytics requiring computing resources far in excess of those available to foundries or consultants like ProService.

## BUSINESS IMPACT

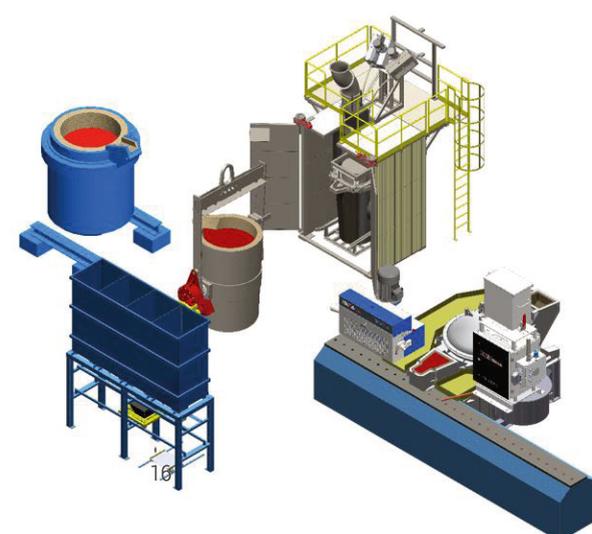
For ProService, the tools developed in the experiment mean it can realistically expect to reduce the scrap rate of a foundry customer from a current rate of around 3% to 2.5%. For a small foundry, this translates to a saving of €50,000 per year – with the number growing to €500,000 for the largest facilities. The ability to deliver this kind of saving to a customer puts ProService at a significant advantage over its competitors.

The experiment partners plan to offer the foundry optimisation tools as a service, marketed to end-users via the Fortissimo Marketplace. This is expected to provide an annual revenue of €236,000 for ProService.

The EU is one of the largest steel producers in the world, second only to China in terms of output. Around 11% of steel worldwide comes from EU foundries. With increasing demand for cast metal products from developing countries, ensuring the competitiveness of European foundries is key to tapping into a global market. Europe has more than 1,900 foundries. If just 10% of them were to use this system, with each saving the minimum potential of €50,000, this would mean savings for the sector in excess of €9.5M per year. The potential of this service is therefore extremely high.

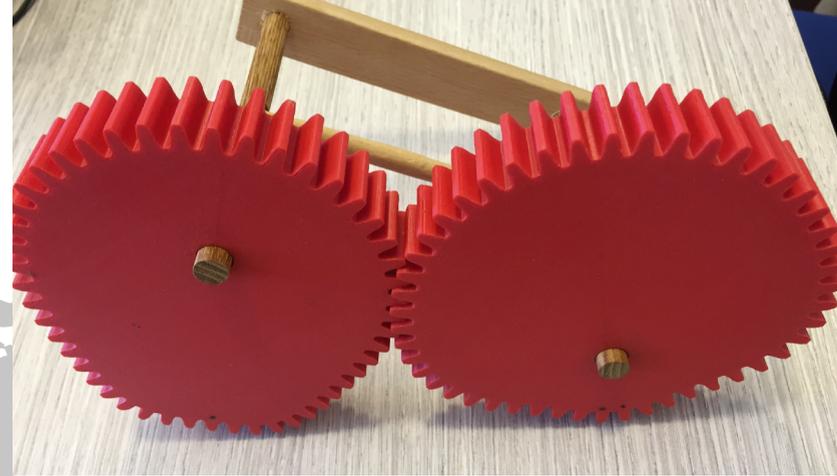
## BENEFITS

- Decrease in foundry scrap rate by 0.5%, saving up to €500,000 per year.
- Increase in revenue of €236,000 per year for ProService and ability to offer service via the Fortissimo Marketplace.
- Massive potential saving for EU foundry industry.





# HPC-based design of non-circular gears



**EXPERIMENT #705 HIGHLIGHTS**  
Industry Sector: **Mechanical Engineering**  
Country: **Italy**  
Software used: **Noesis Optimus, Maple, Matlab**



## THE COMPANIES

STAM is an Italian engineering and manufacturing firm. Since 2011, it has pioneered the development of Non-Circular Gears, which are used in many sectors such as automation & robotics, defence & security, aerospace, transport, and energy. Noesis solutions is a Belgian system integrator and independent software vendor.

End User



[www.stamtech.com](http://www.stamtech.com)

ISV



[www.noesisolutions.com](http://www.noesisolutions.com)

HPC Provider



[www.arctur.si](http://www.arctur.si)

## THE SOLUTION

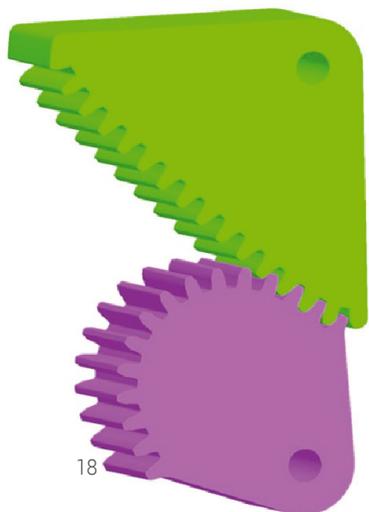
The partners developed an HPC-based engineering workflow for NCG design. The workflow, CloudGear, allows STAM to optimise the design of an NCG in less than 3 minutes, providing fast feedback concerning potential modifications and improvements. Previously, just the computation phase of the workflow would take 25 minutes, not including set-up and results delivery. Due to the near-real-time delivery of results, STAM is able to significantly speed up its internal design process.

Using Noesis' Optimus software, the design process was automated and the most computationally expensive part of the process sent to an HPC system. CloudGear will also be offered by Arctur through the Fortissimo Marketplace.

## THE CHALLENGE

Non-Circular Gears generate a prescribed motion with great precision, regardless of external factors. This is a highly desirable feature in advanced transmissions. Designing these gears is a complex process that requires a significant amount of expertise and expensive, computationally intensive iterations. In-house computing systems are not powerful enough to perform these calculations.

A cloud-based engineering workflow would significantly shorten the time required to design and deliver an NCG. A key element of this is cost-effective access to the necessary computing power.



## BUSINESS IMPACT

Customers of the CloudGear workflow will be able to design better NCG-based solutions at lower costs. This in turn benefits users of their machinery, plants, prototypes and other products. Five potential customers for CloudGear have already been identified.

STAM sells a custom NCG solution for approximately €15,000 each. The CloudGear approach will allow them to sell 8 new solutions in the first year, 10 in the second, and 12 in the third. The reduction in development time and lower manufacturing costs give STAM a significant advantage.

Noesis will benefit through an increase in sales of the Optimus software directly related to the sales of the CloudGear solution, as CloudGear is built on the Optimus platform. The Optimus optimization tool is extremely flexible and can easily capture the simulation needs of end-users in a number of different industries.

## BENEFITS

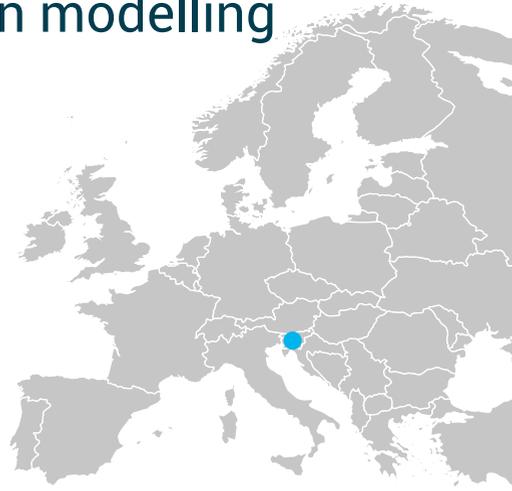
- Increase in turnover, rising to 20% after 7 years, for STAM, due to sales of NCG-based solutions and software.
- NCGs can be designed faster, and with more advanced features that would not be possible to simulate without HPC.
- Noesis expects a 3% increase in total sales, worth a total of €1.6 M over five years.



# HPC based high-resolution modelling of magnets

## THE COMPANIES

Magneti Ljubljana is a Slovenian SME that has produced permanent metallic and systems magnets for the European market for over 60 years. These have many uses in a variety of sectors. XLAB is a Slovenian R&D company with a strong research background in the fields of distributed systems, cloud computing, system security, information visualization and image processing.



End User



[www.magneti.si](http://www.magneti.si)

HPC Expert



[www.xlab.si](http://www.xlab.si)

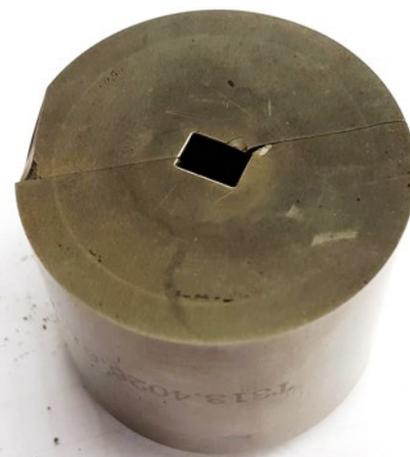
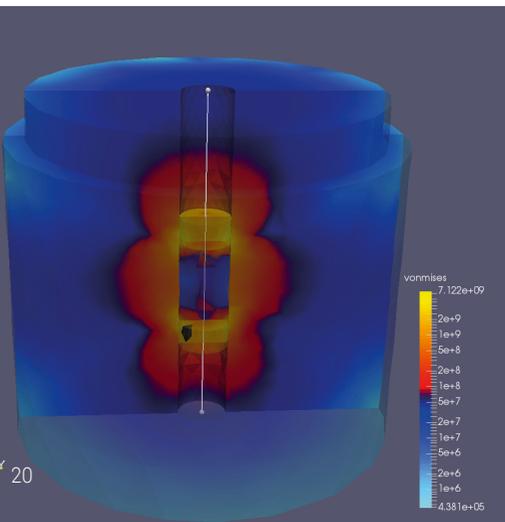
HPC Provider



[www.arctur.si](http://www.arctur.si)

## THE CHALLENGE

Magneti produces its magnets through a process called compaction, which uses a hydraulic press to apply pressure to magnetic powders until they solidify. The hydraulic press is made up of several very expensive parts which regularly wear out and must be replaced. The pressing tool needed to be optimized, so it could be used for longer and with lower material costs, but doing this requires the ability to automatically detect yielding of the tool under a given pressure. This requires many iterations of computer simulation and post-processing, which exceeds in-house capabilities.



## THE SOLUTION

To tackle the problem of pressing tool optimization, XLAB developed a set of software services based on open-source solutions. XLAB built a computer model of the pressing tool and its behaviour during the compaction process. This model is highly configurable, so Magneti can reuse it for other applications.

The optimization service runs as a web application, which provides an easy-to-use interface. The application connects to Arctur's HPC system and submits an HPC job according to configuration and input parameters from the end user. This means that even inexperienced users are able to design and run experiments using HPC resources, avoiding the need for costly training. Magneti only needs to pay for the computing resources it uses, providing the company with a cost-effective solution.

## BUSINESS IMPACT

The partners in this experiment have derived a number of benefits from their involvement in the Fortissimo project.

For Magneti, there are several benefits. Due to the optimized geometric properties of the pressing tool, the quantity of excess material in an existing tool was reduced by around 32%, reducing material costs. This has reduced the cost of making the pressing tool by 27%, which represents an annual saving of €87k. The pressing tool is also of a higher quality, containing narrower coils which consume less power. Assuming Magneti replaces all of their pressing tools with those designed by the HPC tool, this will save another €16.2k annually.

XLAB has broadened its software development expertise to the field of magnet production, and gained knowledge about developing complex software with the help of open-source tools. The existing software developed for Magneti can be extended and modified to potential new customers coming from the same or similar industries.

Arctur has increased its reputation in the research community, potentially allowing it to attract new customers from the magnet production industry.

## EXPERIMENT #706 HIGHLIGHTS

Industry Sector: **Automotive**

Country: **Slovenia**

Software used: **ELMER, ParaView, NetGen**

## BENEFITS

- Design of a better pressing tool that saves money, does not need to be replaced as often, and uses less energy.
- Savings of over €100,000 per year for Magneti and ability to create new services based on improved pressing tool.
- Magneti and XLAB both gained experience in simulation.



# Cloud-based-HPC optimisation of manufacturing processes



## THE COMPANIES

EMO is a Slovenian SME specialising in the production of tools and dies for stamping, particularly sheet metal, in the automobile and aerospace industries. EMO utilises laser metal deposition (LMD) technology. AIMEN is a Spanish not-for-profit organization with expertise in laser technologies, manufacturing processes and the development of monitoring systems for industrial applications.

End User



[www.emo-ordjarna.com](http://www.emo-ordjarna.com)

Domain Expert



[www.aimen.es](http://www.aimen.es)

HPC Provider and Expert

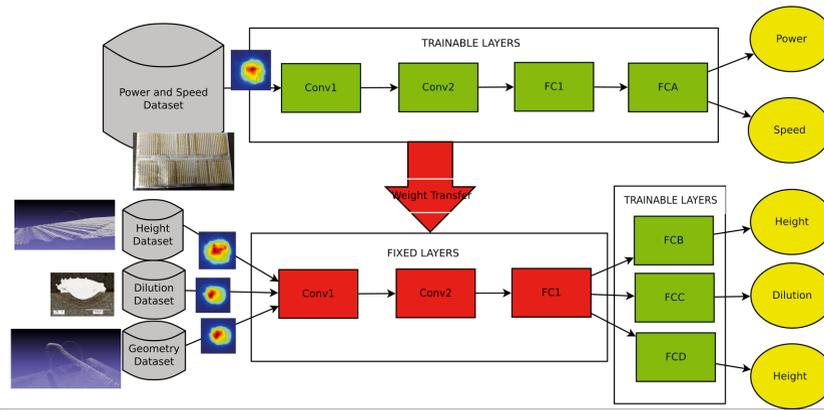


[www.cesga.es](http://www.cesga.es)

## THE CHALLENGE

LMD is an additive manufacturing technology that enables the generic 3D printing of large metal parts. Additive manufacturing is a rapidly growing sector, as it allows for complex components to be produced with short lead times. However, the lack of sufficient control remains a barrier, as it can result in unnecessary reworking, waste and an increase in 3D printing times. This reduces both profits and efficiency.

This experiment aimed to overcome the current deficiencies in online monitoring and control of laser processing, so that EMO can realise the full benefits of additive manufacturing and create better quality products.



## EXPERIMENT #707 HIGHLIGHTS

Industry Sector: Automotive

Country: Slovenia

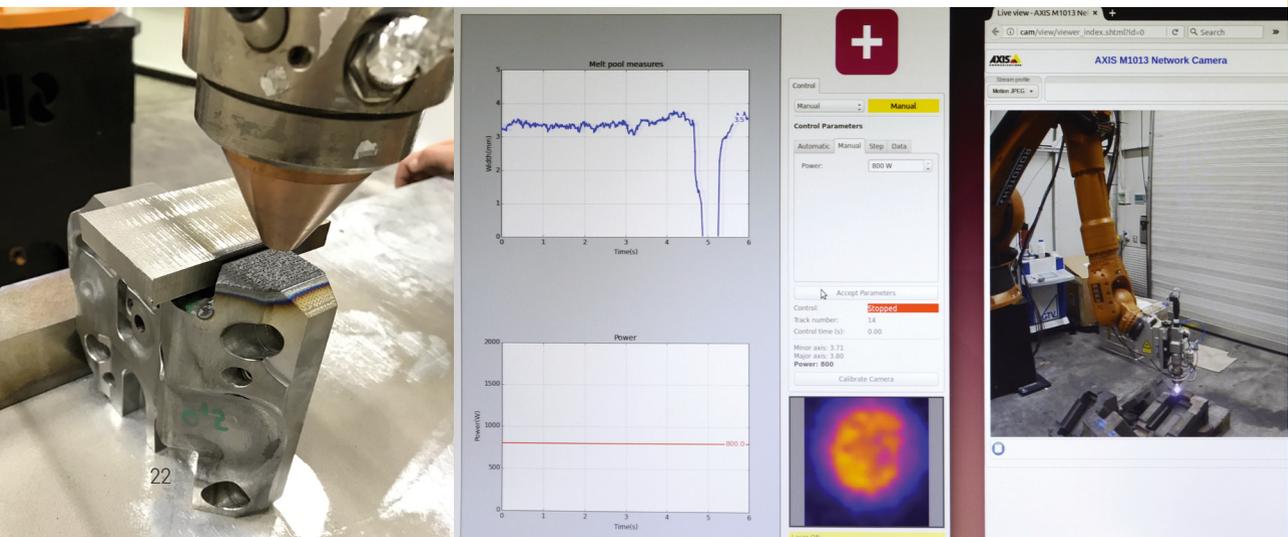
Software used: TensorFlow

## THE SOLUTION

### THE SOLUTION

EMO currently uses LMD. As part of this process, EMO needs to gather and analyse significant amounts of data. A more efficient workflow would enable it to complete more projects without extra investment. A new system has been developed in this experiment that exploits recent advances in AI for image analysis and in data acquisition from images of the process.

The new technology, called CyPLAM, is a novel approach to the online monitoring of LMD. It uses deep-learning principles, working on the Fortissimo infrastructure, to enable online and real-time quality control and monitoring of key features such as dilution and clad height. CyPLAM has been validated by testing on a repair application using LMD.



## BUSINESS IMPACT

CyPLAM addresses the quality issues of LMD-created parts, putting EMO at an advantage as they are first to use the technology. Future CyPLAM users can expect to cut production times by over 30%, as well as producing a higher-quality product needing less reworking. Overall, end users can expect a 20% saving in operational costs and a 30% reduction in lead-time, compared to traditional approaches.

AIMEN will use CyPLAM technology to support its recently launched CLAMIR system, a commercial process control system for Laser Additive Manufacturing.

The experience and knowledge acquired during this experiment have allowed CESGA to obtain new projects and contracts within the industry. They have also created a training course on Machine Learning.

3D printing and other additive manufacturing technologies have had a major impact on the European manufacturing industry, allowing fast and flexible prototyping and part creation. This industry is home to many SMEs due to the comparatively low cost of entry, and is growing fast. The worldwide 3D manufacturing industry is growing at a rate of 25% per year, and is expected to be worth 6.5 billion USD in 2019.

## BENEFITS

- Using HPC, EMO can reduce operational costs by 20% and save over 2,000 machine hours per year.
- Users of CyPLAM can stay competitive in the global Additive Manufacturing market.
- As a result of the expertise gained in this experiment CESGA is offering a new Machine Learning service (SaaS) based on TensorFlow.



# Cloud-based HPC processing for knowledge generation in camshaft manufacture



## EXPERIMENT #708 HIGHLIGHTS

Industry Sector: **Automotive**  
Country: **Spain**  
Software used: **M3**

### THE COMPANIES

EPC Group Europe is headquartered in Spain. It specialises in the manufacture of large camshafts (over 2 meters long) for use in the naval industry, agriculture, military, generators, and other sectors. TRIMEK is a Spanish SME founded in 1993. TRIMEK is one of the main manufacturers of metrological systems and solutions worldwide, and is the 4th worldwide provider and the leading company in the Basque Country and Spanish markets of Coordinate Measuring Machines (CMM).

End User



[www.engpwr.com](http://www.engpwr.com)

ISV



[www.trimek.com](http://www.trimek.com)

HPC Expert



[www.cesga.es](http://www.cesga.es)

### THE CHALLENGE

EPC manufactures more than half a million camshafts every year. The company needs to ensure that it produces high-quality parts. Monitoring of the manufacturing process generates a massive amount of data which could be used as a basis for machine learning to improve the production process. However, current software solutions are not able to fully process the data fast enough, so the potential knowledge that may be generated from it cannot be exploited.

In order to function alongside a busy production line, the solution requires significant computational power, together with the application of novel machine learning technologies.



### THE SOLUTION

TRIMEK developed a metrological module of its M3 software, which enables the use of big data resources for data analysis. The new module is able to analyse scanning and measurement data and compare parts much faster than before by using cloud-based HPC. The production process is therefore more time-efficient. The time savings enables more of the produced parts to be checked in the same amount of time, increasing the overall production quality.

Reducing the processing time for data analysis allows a higher knowledge and control of the quality of the production process and of its needs, such as maintenance requirements. By using this system, the end-user receives a higher-quality product, saving time and money, leading to benefits for their own client.

### BUSINESS IMPACT

TRIMEK, as service expert, developed a new software module for statistical analysis. Due to the optimized data-processing software developed in this project, TRIMEK expects an increase of 20% in new licences sales.

EPC has tested and used the new M3 capacities within their production site, proving its ability to improve production capacity and speed. In a short time, the expected benefits to the internal production process will reduce the number of defective parts to almost zero, resulting in a cost reduction of €1.5M over the next five years.

CESGA will exploit the experiment results in its big data platform, which has been analysed and improved to fulfil the requirements of its commercial customers. As initial step, CESGA has created a white paper to show the capabilities of the infrastructure to use as marketing tool to attract other companies to use it. CESGA expects to be able to increase its SME projects and services in the next years to reach the strategic indicators for 2020.

### BENEFITS

- 20% increase in turnover over five years for TRIMEK.
- EPC can save €1.5M over five years using the new solution.
- The number of defective parts is reduced to almost zero.



# Cloud-based simulation of box framed timber beams



## EXPERIMENT #709 HIGHLIGHTS

Industry Sector: **Construction**  
Country: **Spain**  
Software used: **ANSYS Mechanical**

### THE COMPANIES

Maderas Besteiro is a Spanish SME that specializes in timber solutions for structural applications, such as house-building. It has recently taken an interest in offering a new product line of box framed timber beams made from Eucalyptus globulus. USC-PEMADE is the Structural Timber Engineering Department of the University of Santiago de Compostela.



End User	Domain Expert	HPC Provider
<a href="http://www.mbesteiro.com">www.mbesteiro.com</a>	<a href="http://www.pemade.com">www.pemade.com</a>	<a href="http://www.gompute.com">www.gompute.com</a>

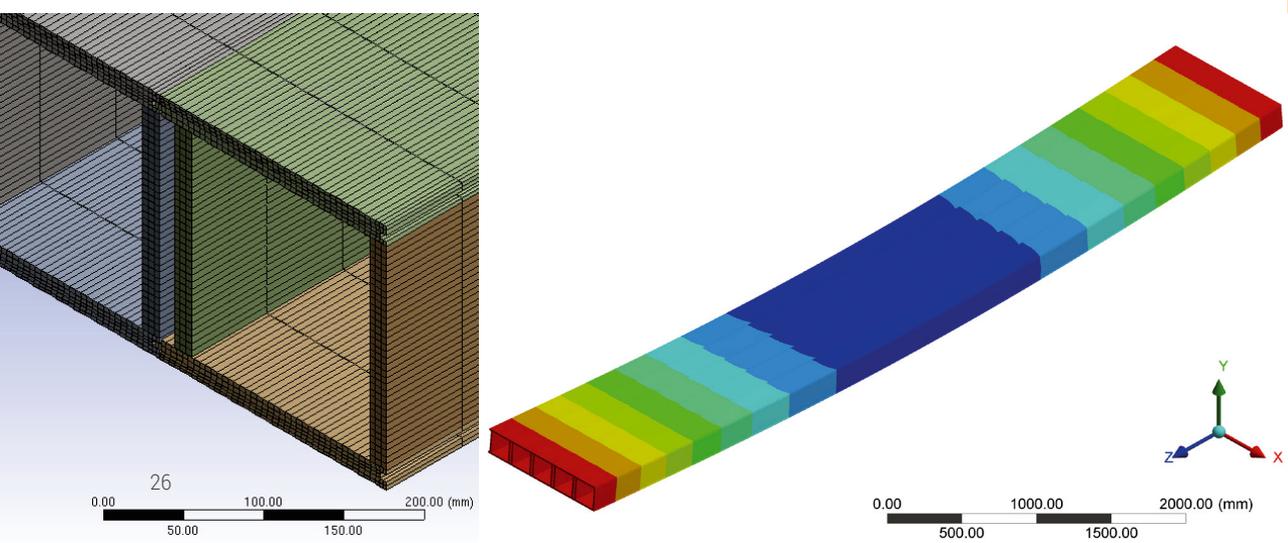
### THE SOLUTION

A virtual engineering workflow was designed and validated. The workflow combines the design, calculation and virtual validation stages of the process, through access to a Cloud-based HPC platform provided by Fortissimo. Using this solution has allowed Madera Besteiro to reduce their development costs and design times. A pay-per-use HPC model significantly reduces the computational costs compared to using in-house resources, and results in a better, more refined end product. The company can now optimise Eucalyptus-based solutions at minimum 19% faster than before the experiment. This will allow them to offer a better product at a lower cost than their competitors.

### THE CHALLENGE

Eucalyptus is ideal for structural purposes because of its high quality and resistance. Using this wood can allow construction companies to build homes faster, with less waste and less energy, in line with European Union housing guidelines.

Designing and testing a new structural product is an extremely costly process. As an SME, Maderas Besteiro faces a challenge to develop new products due to its small number of staff and lack of sufficient financial resources. A cost-effective computer simulation process would help to solve this problem.



### BUSINESS IMPACT

Thanks to the virtual design process offered by the Fortissimo Marketplace, Maderas Besteiro has significantly reduced their cost per m<sup>2</sup>, when comparing the new box framed timber beam with the traditional framing system. Using eucalyptus instead of other hardwoods, their turnover is increased €40k per year. More importantly, Maderas Besteiro is now able to easily optimize new designs, meaning that it has a competitive advantage in its industry.

From now on, PEMADE will be able to simulate more complex models than before, including complete engineering structures. Moreover, the ability to simulate hardwood species such as eucalyptus will make it the leading academic group in Spain in this field.

End users of this workflow can reduce their computing costs by up to 81%. From a business perspective, it has an enormous potential as the timber industry has over 400,000 active companies. Gompute is now ready to offer a complete solution in the Fortissimo Marketplace for customers who need to simulate timber structures in a fast, easy and affordable way.

### BENEFITS

- Maderas Besteiro can improve its overall productivity by 23%, thanks to optimisation of just one of its products.
- Increase in turnover of €40,000 per year and ability to easily optimise new designs.
- PEMADE have gained the ability to simulate whole complex structures, as opposed to their previous capabilities.



# Near Real-time Analysis of Airframe Certification Test Data



## EXPERIMENT #710 HIGHLIGHTS

Industry Sector: **Aeronautics**

Country: **Netherlands**

Software used: **Pivotal**

### THE COMPANIES

Colosso is a Dutch SME specialized in the design, analysis and physical testing of high-tech materials and structures, such as those used in the aerospace industry. Within this context, the key focus of Colosso is on the improvement of its processes and products. KE-Works is a Dutch software company. It develops KE-chain, a modelling platform for engineering applications.



End User and Domain expert

ISV

HPC Provider and Expert



[www.ke-works.com](http://www.ke-works.com)

[www.gompute.com](http://www.gompute.com)

### THE CHALLENGE

The development of aircraft for civil aviation is driven largely by the economics of the materials constituting the airframe. Improvements in strength and durability can reduce aircraft weight and allow regulators to increase the inspection intervals.

There is a continuous demand for better materials and a greater understanding of how these materials perform in aircraft components. However, introducing a new structural material for an airframe is costly and takes several years, so there is a significant need for better certification processes.

### THE SOLUTION

One of the ways of reducing the cost and lead-time of the material qualification process is to improve the predictive capability of material models. Improved models lead to a reduction of the amount of testing required to achieve an reduction in the overall weight of the airframe.

The approach taken in this experiment was to use KE-chain, together with Colosso's data analysis and storage framework to calibrate a new algorithm to model materials based on data from fatigue tests. An HPC environment provided by Gompute was used to provide on-demand computing resources. This resulted in an improved ability to predict crack propagation in airframe components and a reduction in the required amount of fatigue testing.

### BUSINESS IMPACT

The results of this experiment directly contribute to the further development of a Colosso's advanced physical and virtual test data monitoring and analysis tool (Pivotal). KE-works will integrate the developed features and infrastructure deployment options in the offerings of KE-chain.

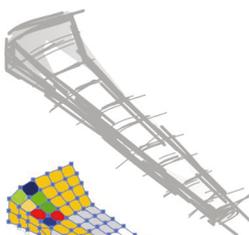
Using HPC will enable (near) real-time data processing and evaluation. A cloud-based, pay-per-use HPC system means that using Pivotal and KE-chain is much more cost-effective than using in-house resources, making these offerings more competitive.

The experiment, supported by the cloud infrastructure provided by Gompute, strengthened the competitive position of both KE-works and Colosso. Because of the increased potential and capabilities of KE-chain and Pivotal, an increase in yearly revenue of €50-100,000 is predicted.

### BENEFITS

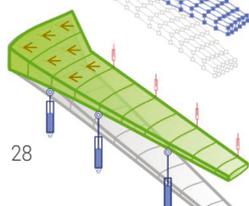
- Improvements to the material model for testing airframe components, which will allow better components to be manufactured.
- Development of a new, promising software product, Pivotal, which will be offered together with KE-chain.
- Increase in revenue of up to €100,000 per year.

Design

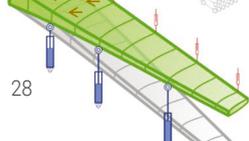


Sizing

- Open hole tension
- Stiffener pop-off
- Bearing
- Interrievet buckling
- Local skin buckling
- Maximum strain



Validation





# Cloud-based-HPC simulation of railway infrastructure for high-speed trains

## THE COMPANIES

Alstom Ferroviaria S.p.A. is the Italian branch of Alstom Transport, a multinational leader in the railway transportation sector. Alstom Transport has a presence in over 60 countries and employs over 28,000 people. A promoter of sustainable mobility, Alstom Transport develops and markets the most complete range of equipment and services in the railway sector.



End User



[www.alstom.com](http://www.alstom.com)

Application Expert



[www.hypertecs.it](http://www.hypertecs.it)

HPC Provider and Expert

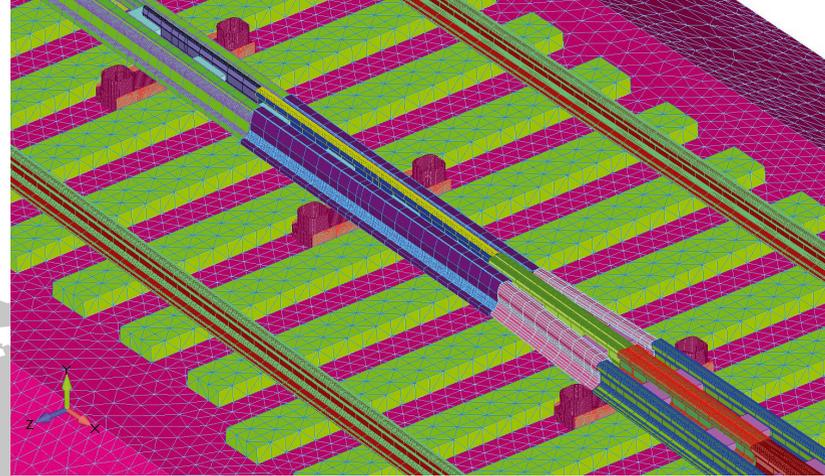
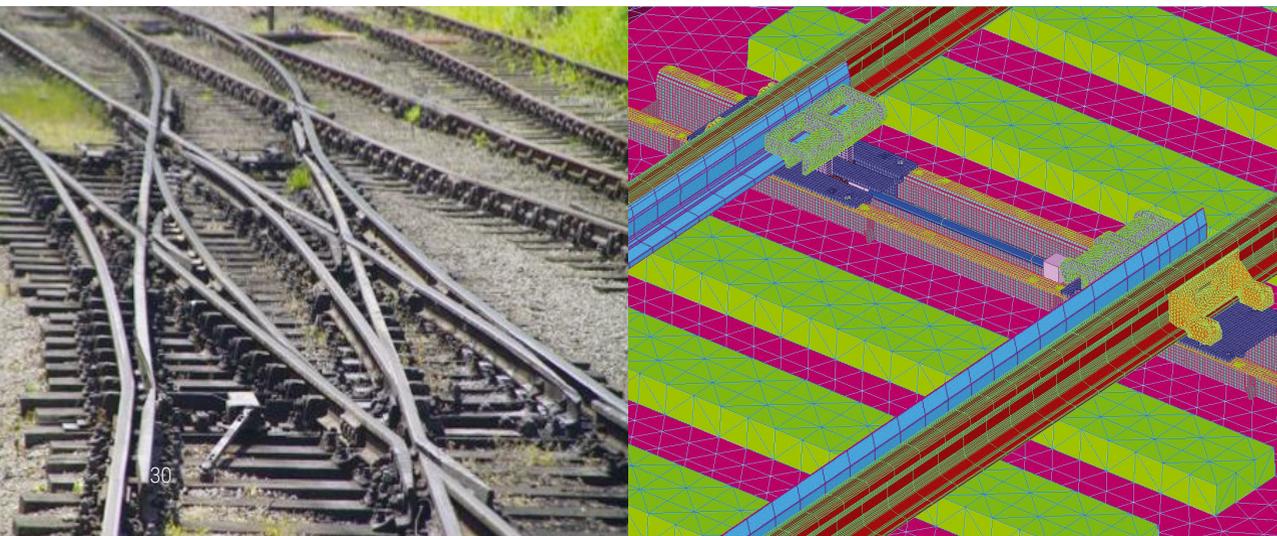


[www.hpc.cineca.it](http://www.hpc.cineca.it)

## THE CHALLENGE

Alstom is investing huge effort in creating new services for the railway industry and other transportation fields. One of the main areas of investment currently is the development of a diagnostic service to automatically schedule maintenance intervals.

A diagnostic service would need to: understand how parts degrade and determine which would need to be serviced at each interval; automatically plan availability of spare parts or consumables; and quickly report to engineers what needs to be done in order to service the train and the network, as efficiently as possible.



## EXPERIMENT #713 HIGHLIGHTS

Industry Sector:  
**Mechanical Engineering**

Country: **Italy**

Software used:  
**Siemens NX**

## THE SOLUTION

This experiment focused on predicting the effects of failures in different components of the turnout (or set of points), one of the basic part of railways infrastructure, with high accuracy. HPC was necessary as the turnout is a complex and large-sized system, which became even clearer during the course of the experiment. The dynamic interactions between the basic components of the system were studied by taking into account the dynamic load due to the transit of high-speed trains and the failure modes of the turnout. Hypertec Solutions, an Italian SME, was responsible for the development of the model, adapted by CINECA into the Fortissimo cloud environment.

## BUSINESS IMPACT

The major benefits reported by the partners are:

For Alstom, replacing the system based on field measurements with an effective diagnostic monitoring based on simulation has resulted in up to a 50% decrease in time-to-results (from between 16 & 22 months to 8 months), with a corresponding cost saving of between €50k and €70k per application. In the best case scenario, this will result in a saving of €280k per year.

For Hypertec, the experiment allowed it to increase its engineers' skills, enabling new services for Hypertec's industrial customers in many areas of CAE Simulation. It is estimated that, as a consequence, HPC-related revenue will increase 87% in 2017 to €45k. By 2020, this is expected to reach €100k per year.

## BENEFITS

- 50% decrease in time required to create a new diagnostic system for a railway component.
- Savings up to €280k per year for Alstom, based on optimising four applications per year.
- A predictive service developed which will more accurately monitor the railway network and schedule service interventions when necessary.



# Predictive diagnosis services for the automotive industry

## THE COMPANIES

TEXA, an Italian SME founded in 1992, designs, produces and sells diagnostic instruments for cars, motor bikes, and other vehicles. This allows for services such as real-time monitoring of fleet vehicles. T2I is an Italian research organisation that supports companies through the design, development and testing of new products and services.



End User



www.texa.com

Application Expert



www.t2i.it

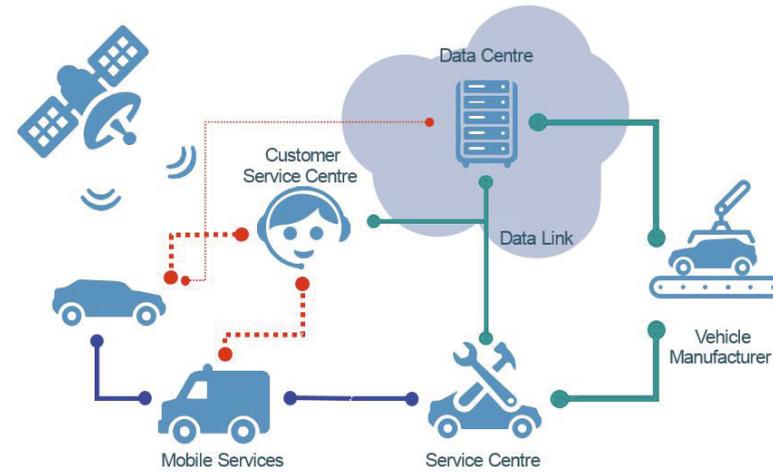
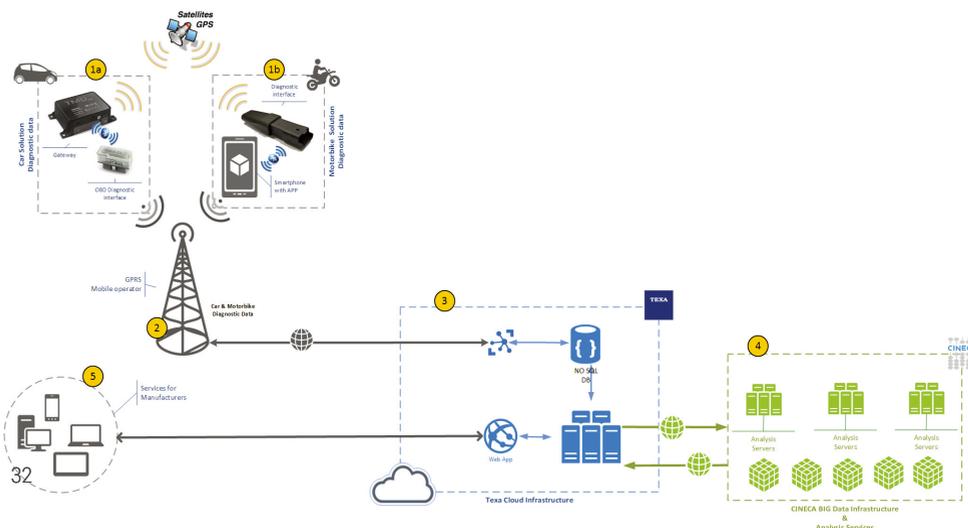
HPC Provider and DA Expert



www.hpc.cineca.it

## THE CHALLENGE

Vehicle manufacturers generally have limited knowledge of a vehicle's life once it leaves them. A service that can predict failures, mechanical problems or damage at the component level, and offer detailed information on these components, would be extremely valuable, saving manufacturers and fleet managers time and money. This service would gather and analyse data from TEXA's sensors, which could be used to redesign parts and modify maintenance schedules. This type of analysis requires significant computing power.



## EXPERIMENT #714 HIGHLIGHTS

Industry Sector: Automotive

Country: Italy

Software used: R, R Shiny

## THE SOLUTION

During the experiments, four Data Analytics prototype services were defined. These are based on information gathered from on TEXA's On-Board Diagnostics (OBD) systems. These services cover areas that may affect the reliability, condition, or service needs of a vehicle - such as how it is driven, failure patterns, and overall health of the vehicle.

A Cloud HPC-powered workflow was developed. This was designed to easily integrate into TEXA's existing automotive Data Analytics services. A service architecture has been defined that connects the existing TEXA infrastructure, equipped to collect data from installed black boxes, to an HPC Cloud provider.

## BUSINESS IMPACT

For TEXA, the Net Present Value of these new services is estimated to reach an overall value of €1.2 M over the next 3 years. The ability to use an HPC-enabled workflow to analyse data from their diagnostics systems will enable better oversight of fleet vehicles and predict failures in time for these to be addressed quickly.

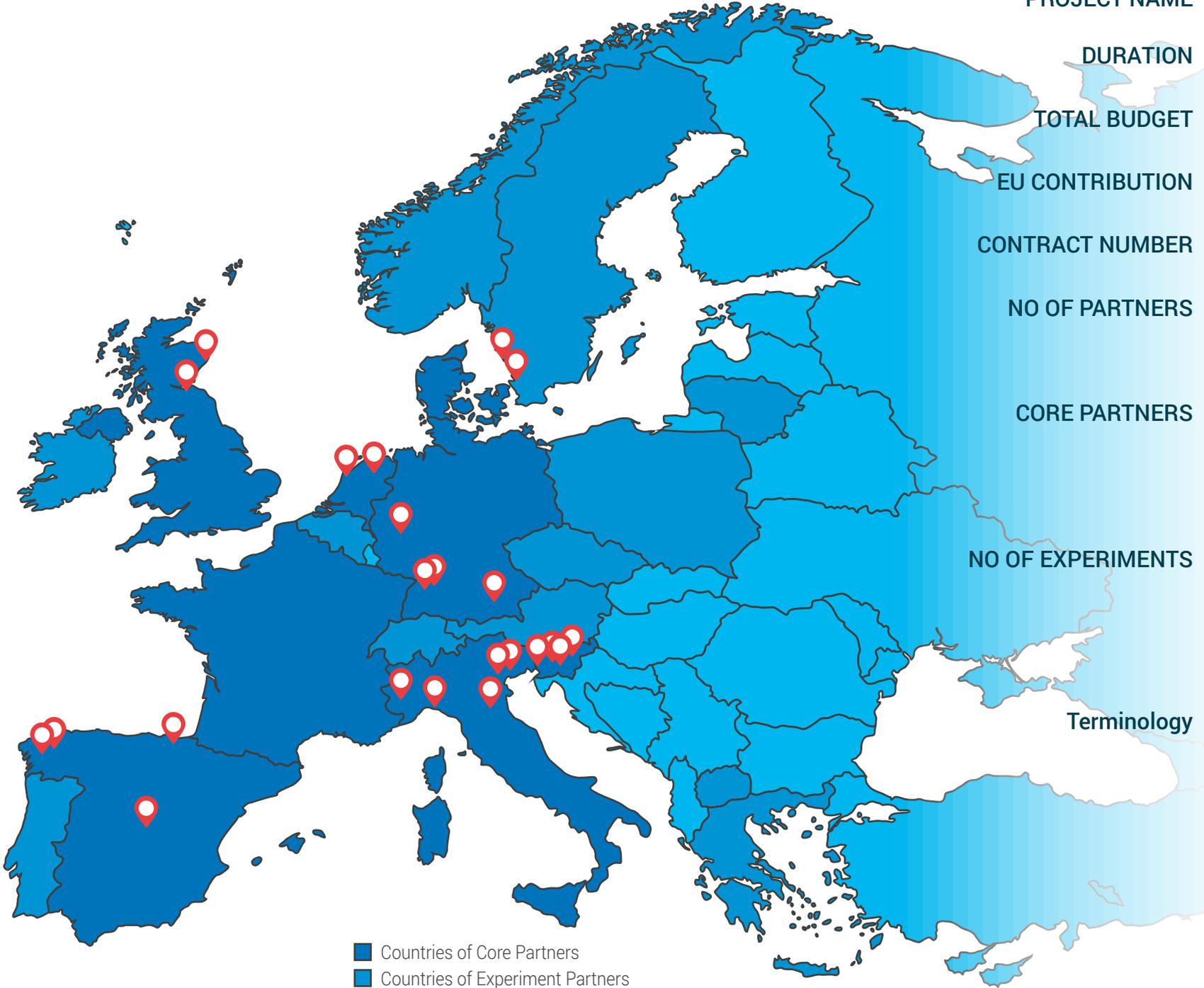
T2I will apply the principles developed here to offer HPC for predictive maintenance in other similar fields (mainly highly "sensorized" products in sectors like home appliances, smart buildings, and energy). T2I estimates a 5% increase in commercial revenues from related services, in years 2018 – 2020, worth up to €105k.

## BENEFITS

- Development of a service using TEXA's "black boxes", which can monitor and predict failures in fleet vehicles. This has value for both TEXA and its customers.
- New services have an overall value of €1.2 M over three years for TEXA.
- T2I increase revenue by 5% per year, worth up to €105k over three years.



# Map of 2<sup>nd</sup> phase Success Stories and Core Partners



# Projects at a Glance

<b>PROJECT NAME</b>	Fortissimo - Factories of the Future Resources, Technology, Infrastructure and Services for Simulation and Modelling
<b>DURATION</b>	1 <sup>st</sup> phase: July 1 <sup>st</sup> 2013 - December 31 <sup>st</sup> 2016 2 <sup>nd</sup> phase: November 1 <sup>st</sup> 2015 - October 31 <sup>st</sup> 2018
<b>TOTAL BUDGET</b>	1 <sup>st</sup> phase: 21.7 M€ 2 <sup>nd</sup> phase: 11.1 M€
<b>EU CONTRIBUTION</b>	1 <sup>st</sup> phase: 16.0 M€ 2 <sup>nd</sup> phase: 10.0 M€
<b>CONTRACT NUMBER</b>	1 <sup>st</sup> phase: 609029 under the 7 <sup>th</sup> Framework Programme 2 <sup>nd</sup> phase: 680481 under the H2020 Framework Programme
<b>NO OF PARTNERS</b>	1 <sup>st</sup> phase: 122 in total (14 Core Partners and 108 Partners in Experiments) 2 <sup>nd</sup> phase: 38 in total (12 core Partners and currently 26 Partners involved in Experiments)
<b>CORE PARTNERS</b>	1 <sup>st</sup> phase: The University of Edinburgh (EPCC), Arctur, Bull, CESGA, CINECA, GENCI, Compute, University of Stuttgart (HLRS), INRIA, Intel, Scapos, Sicos BW, SURFsara and Xlab. 2 <sup>nd</sup> phase: The University of Edinburgh (EPCC), Arctur, Atos, CESGA, CINECA, Compute, University of Stuttgart (HLRS), Intel, Scapos, Sicos BW, SURFsara and Xlab.
<b>NO OF EXPERIMENTS</b>	Both phases comprise in total 92 experiments, of which 67 have already finished and 25 are currently running. The first phase included 53 experiments in total, 33 of which were added as the result of two open calls. The second phase (Fortissimo 2) includes 39 experiments, 10 of which have been added through the first open call from early 2016 and 15 have been added through the second open call from early 2017.

**Terminology**

**Open Call:** Is a call for proposals made by the Fortissimo project for new experiments to add to the current portfolio. The call is aimed at involving additional end-user partners and their business relevant experiments.

**Experiment:** A end-user-relevant case study demonstrating the use of Cloud-based HPC and the benefits it brings to the value chain from the end-user to the HPC-infrastructure provider.

**Success Story:** Is a resumé of an experiment that has been conducted within the Fortissimo project. This resumé focuses on the business benefits resulting from the experiment.



ICT Innovation for Manufacturing SMEs  
[www.i4ms.eu](http://www.i4ms.eu)



Seventh Framework Programme  
[www.cordis.europa.eu/fp7](http://www.cordis.europa.eu/fp7)



Horizon 2020  
[www.ec.europa.eu/programmes/horizon2020/](http://www.ec.europa.eu/programmes/horizon2020/)



European Commission  
[www.ec.europa.eu](http://www.ec.europa.eu)

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