



FF4EuroHPC

connecting business with
cutting-edge technologies

FF4EuroHPC – Connecting business with cutting-edge technologies

Agenda

13:00 Jisika Yono, FF4EuroHPC project manager, HLRS - High Performance Computing Center Stuttgart: **Boosting industrial usage of HPC+ with business experiments and National Competence Centres**

13:20 Professor Mark Parsons, EPCC Director, The University of Edinburgh: **HPC for SMEs - Getting the benefits of HPC, HPDA and AI**

13:50 Sam Ward, Head Of Research And Development, CCell Renewables: **Zyba Success Story: Cloud-based optimisation of a multi-body wave energy device**

14:10 Tomi Ilijas, Arctur CEO: **Enabling SMEs to benefit from HPC: How to participate in the FF4EuroHPC Open Call?**

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Hello and welcome to the FF4EuroHPC webinar!

- If you will have any **further questions**, you can address them to our email: ff4eurohpc@hls.de.
- Want to **be inspired by success stories** from your sector?
Please visit: www.ff4eurohpc.eu/en/success-stories/
- Want to get more info on Open Call?
Please visit: www.ff4eurohpc.eu/open-call/
- Why use HPC and **what benefits can you gain as an SME**?
Please visit: www.ff4eurohpc.eu/en/open-calls/get-inspired/

Enjoy the webinar!

Boosting industrial usage of HPC+ with business experiments and National Competence Centres

Jisika Yono, FF4EuroHPC project manager, HLRS

Why use HPC in business?

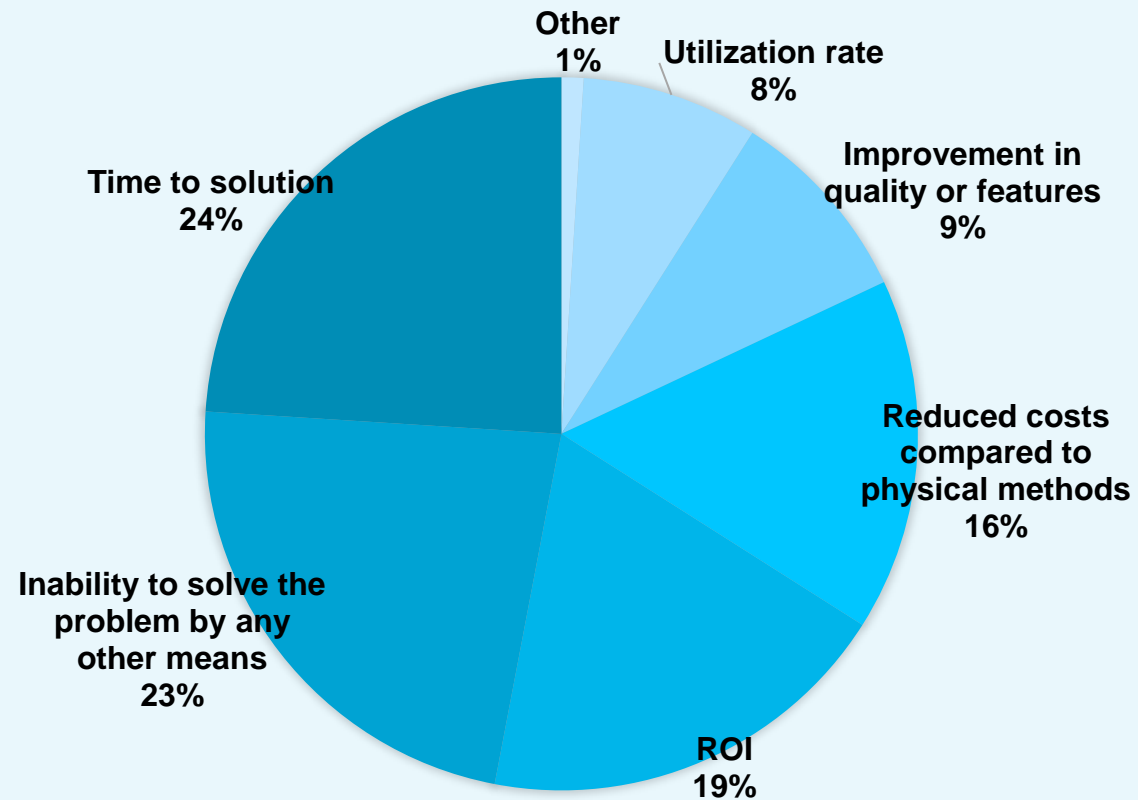


- High Performance Computing (HPC), High Performance Data Analytics (HPDA), Internet-of-Things (IoT), Artificial Intelligence (AI) and Machine Learning (ML): **Indispensible tools for INDUSTRY 4.0**
- The current digital revolution is driven by data and intelligence and builds on those tools.
- The increasingly complex, connected and digitized world creates a flood of data – HPC and the new technologies allow us to generate meaning and knowledge from the data → better products, models or processes in virtually all applications
- Advanced HPC services can enable European companies to focus on quality and innovation – and thus be able to prosper in the global marketplace
- Many industrialized economies (both developed and developing) have identified HPC as a key tool for innovation – in the U.S. the phrase “to out compute is to out compete” has been used to make the case to Government

Why use HPC in business?



BENEFITS OF HPC (SOURCE: COUNCIL OF COMPETITIVENESS)



National and European Level

National Level



- HPC+ = HPC and associated technologies
- A lot of activities ongoing in the different nations
 - Depth and maturity activities depend on the national strategy



European Activities



- Interlinked with some national activities
 - Not all players
 - Not all Nations

European Level

European
Infrastructures

European
Research

European
Centres of
Excellence

European
Technology
Platforms

European
Strategic
Activities

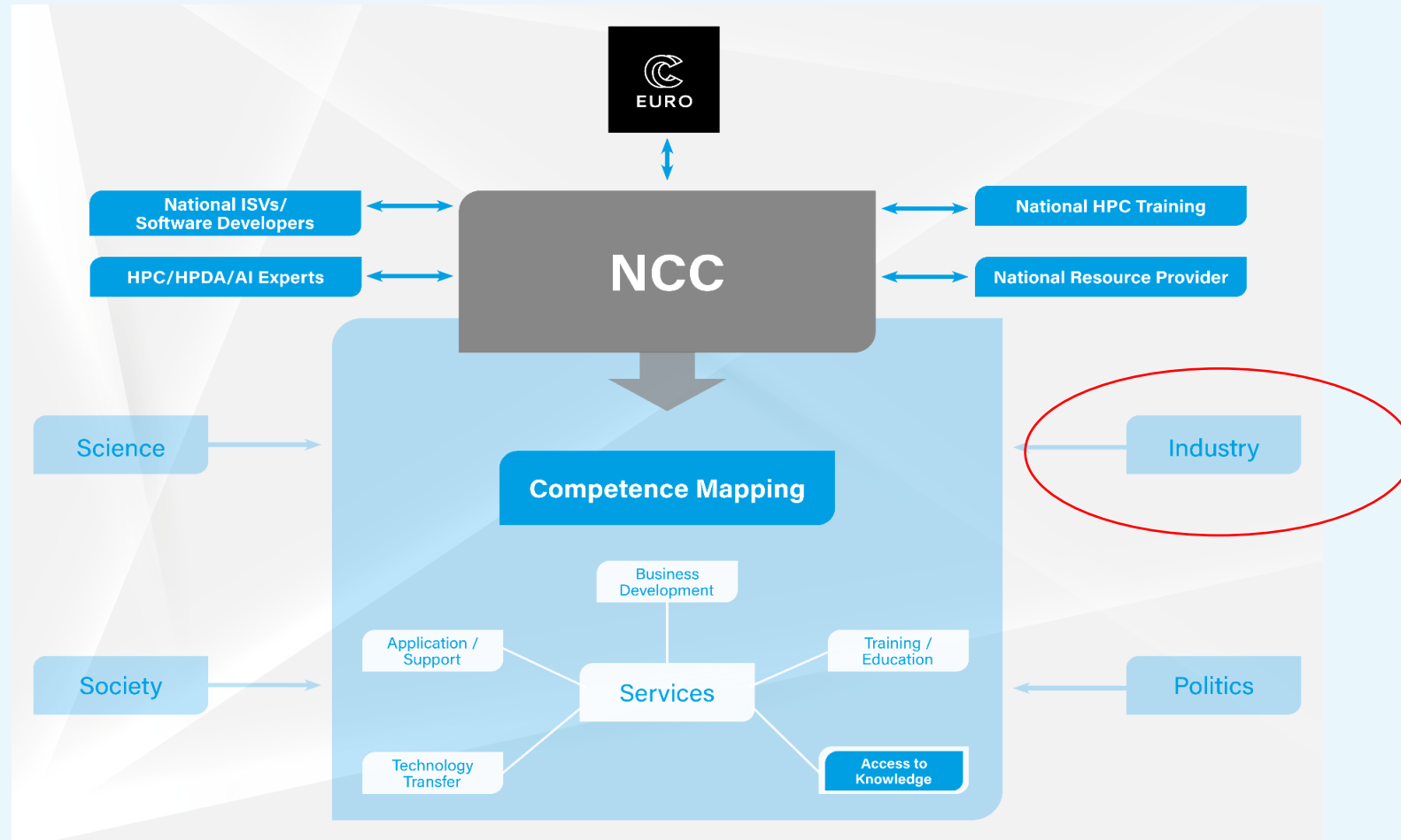
European ...

EUROCC – Setting up the National Competence Centres



- EuroCC to set up National Competence Centres (NCCs)
 - Mission:
 - To take into account the different levels of maturity and activities within each participating Nation
 - To implement for the first phase a structure, to allow for better overview and management of the overall activity and to set up the necessary frame for the implementation of the NCCs
- What should be the focus?
 - During the design phase of EuroCC we identified commonalities in terms of main topics to address:
 - Training and Skills Development
 - Technology Transfer/Business Development
 - Industrial Collaboration
 - Competence Mapping
 - Facilitation of access to scientific and technical expertise and knowledge pools
 - Awareness Creation

Structure of a NCC



Facts and Figures



- Research and Innovation Action (RIA), 24 months duration
 - 36 main participants , 33 nations
- Started: 01/09/2020
- <https://www.eurocc-project.eu/>
- LinkedIn: EuroCC
- Twitter: @EuroCC_project
- Germany, Bulgaria, Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom, France, Netherlands, Belgium, Luxembourg, Slovakia, Norway, Switzerland, Turkey, Republic of North Macedonia, Iceland, Montenegro



Maximizing synergies

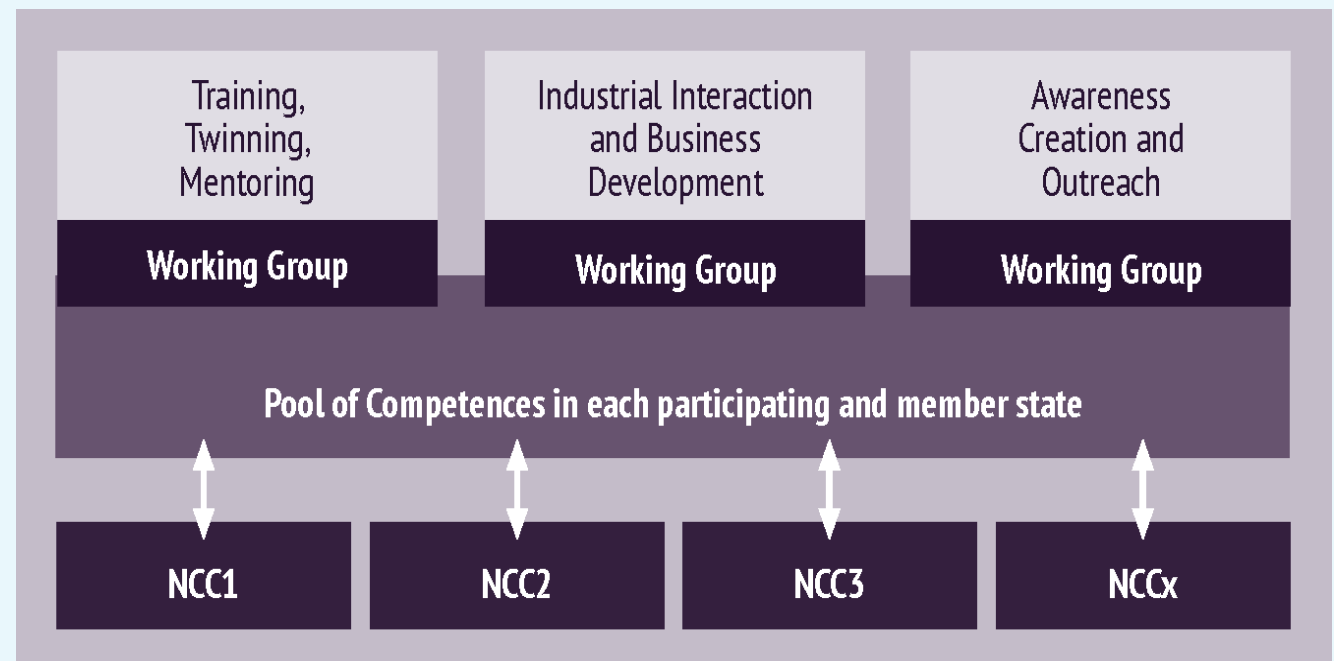


- Implementation of a Coordination and Support Action – CASTIEL
 - Same coordination team as in EuroCC
 - Focus on the support of the NCCs in the different topics of interest
 - Integration of the NCCs in the choice and definition of workshops on common topics of interest
 - Training, Twinning, Mentoring
 - Industrial Interaction and Business Development
 - Awareness Creation and Outreach
 - Elaboration on best practices to strengthen the NCCs
 - Support by enabling access to knowledge, expertise and success stories
- } via Working Groups

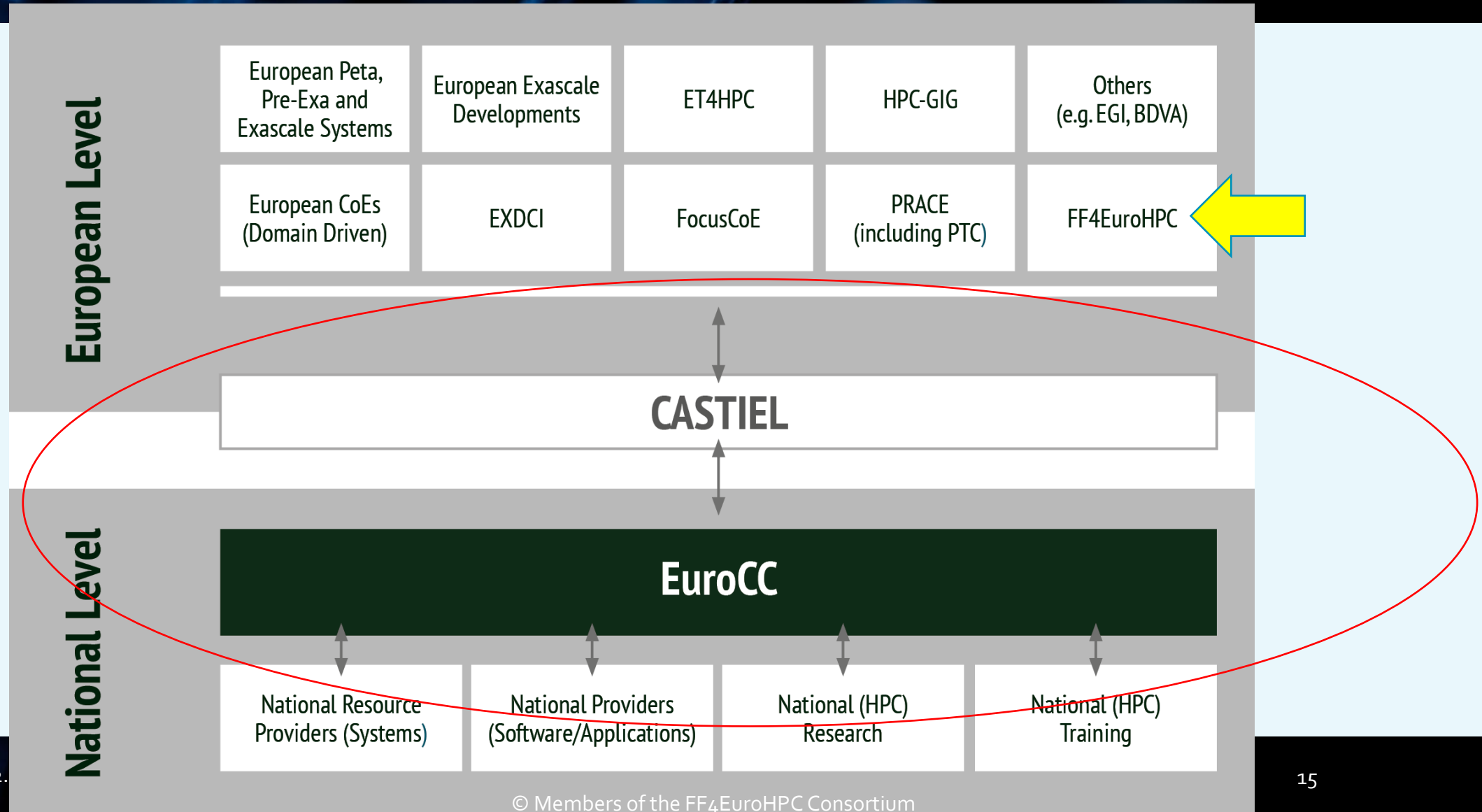
CASTIEL – Facts and Figures



- Coordination & Support Action, Started 01/09/20, Runtime: 24 months
- <https://www.castiel-project.eu/>
- LinkedIn: CASTIEL, Twitter: @CASTIEL_project
- Coordinated by: HLRS
- Partners: ARCTUR, CESGA, TERATEC, CINECA



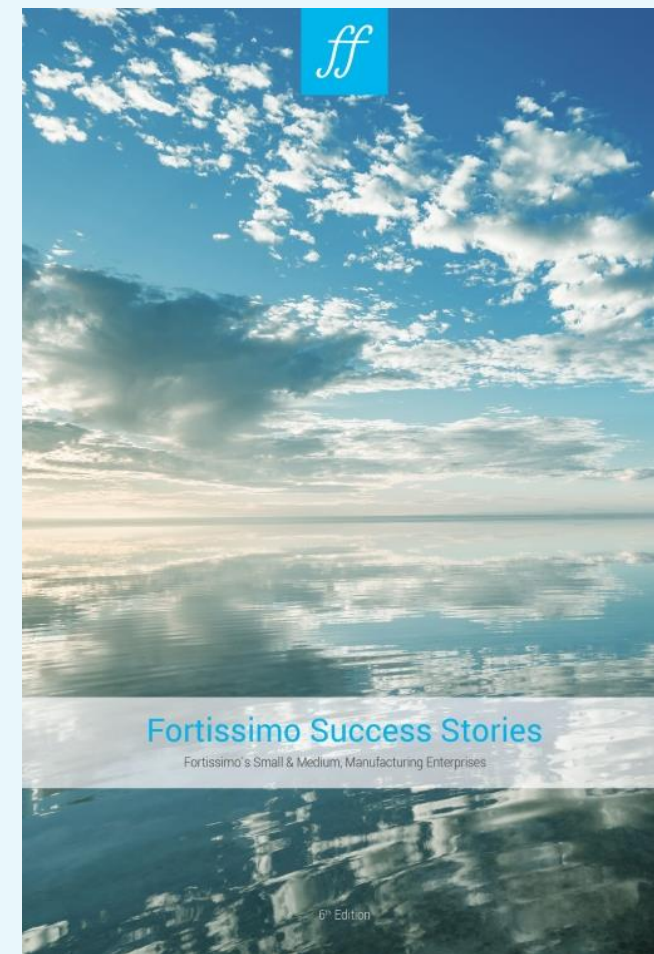
FF4EuroHPC in the context



The Fortissimo Approach



- Central theme: the successful execution of „experiments“ with SMEs, delivering **real business impact** through HPC
- The bulk of project funding is used for those experiments and the highest quality, innovative SME-oriented experiments are acquired through the execution of **open calls for proposals**
- Two prior projects (Fortissimo and Fortissimo-2) executed 92 experiments generating 79 impressive, business-oriented success stories



Stimulating the innovation potential of SMEs



The FF4EuroHPC project aims to

- To successfully extend and continue the mission of Fortissimo and Fortissimo2
- Increase the innovation potential of industry, and in particular of SMEs, using advanced High Performance Computing (HPC) infrastructures, applications and services.
- Provide access to HPC-based infrastructures and services to a wide range of users for new and emerging data and compute-intensive applications and services.
- Foster wider innovations, for example by exchanging and promoting best practice use cases or application experiences.
- Provide an effective mechanism for inclusion of innovative, agile SMEs lowering the barriers for small actors to enter the market and exploit new business opportunities.
- Achieve a portfolio of business-oriented application “experiments” that are driven by SME end-users needs
- Support of and collaboration with future national HPC Competence Centres

Conclusion



- Obviously a lot of activities on National and European Level
- Competences not only in terms of technology, but e.g. also in terms of interaction with potential users (e.g. industry)
- EuroCC and CASTIEL to start exploring synergies and to support knowledge and experience transfer in Europe
- FF4EuroHPC as the booster for exploring further potentials for use of HPC+ by industry



FF4EuroHPC

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cutting-edge technologies

HPC for SMEs

Getting the benefits of HPC, HPDA and AI

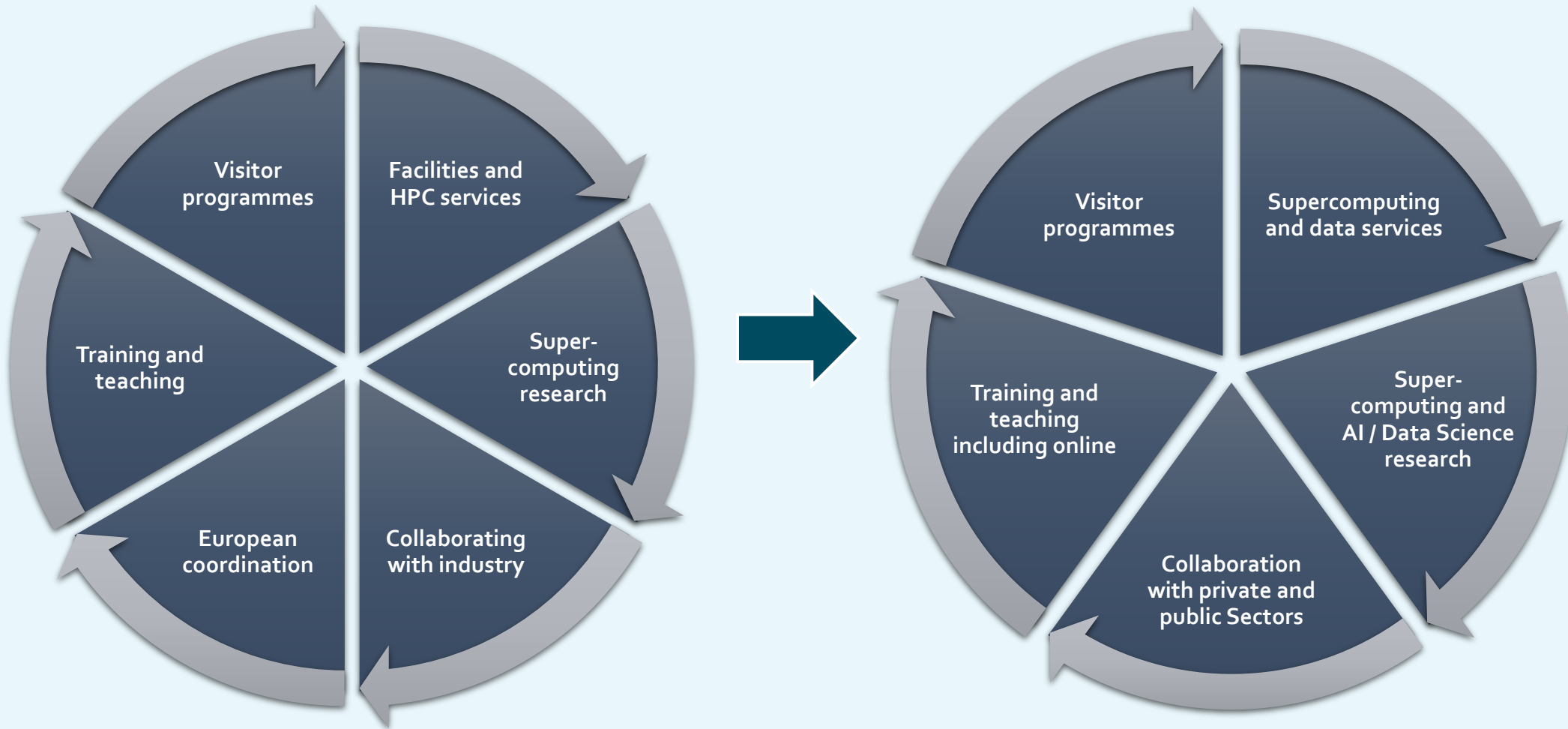
Prof Mark Parsons, EPCC

Outline of talk



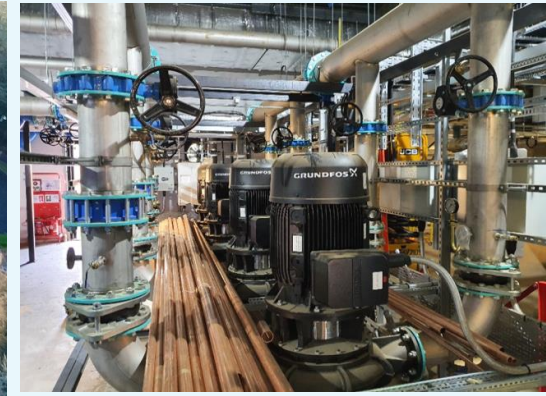
- EPCC has work with industry for 30 years
- One of our major activities over the past few years has been the Fortissimo projects
- This talk will look at these projects and the general issue of takeup of HPC, HPDA and AI solutions by industry and commerce in Europe

Supercomputing centres are changing



EPCC has grown from 70 to over 110 staff largely due to data science activities

Infrastructure for the whole economy



Developing national infrastructure for local and national economic benefit

£20m – New computer room
£8m – 30MW additional power

Cirrus – EPCC's industry system

- SGI ICE XA (now HPE 8600)
- Bought for
 - EPCC industry activities
 - Edinburgh Genomics “factory”
- Expanded in March 2017 to 13,000+ cores as part to become EPSRC National Tier 2 HPC service
- And again in March 2020 to add 152 NVIDIA V100 GPUs
- Many cycle sales users from industry – **70 companies this year**



Industrial Collaboration



EPCC has worked with industry since we were founded in 1990

Over 1000 companies in past 30 years

Domains:

- Numerical modelling and simulation
- Code design, parallelisation, optimisation and re-engineering
- Large scale data integration and data mining
- Cloud computing, software architecture
- Data processing, machine learning
- Facilities Access, Consultancy and Training

Strong research dimension

- Distributed & Cloud Computing
- Data Science
- Energy Efficient Processors
- GPUs, FPGAs
- Parallel programming languages & tools
- Exascale



Rolls-Royce

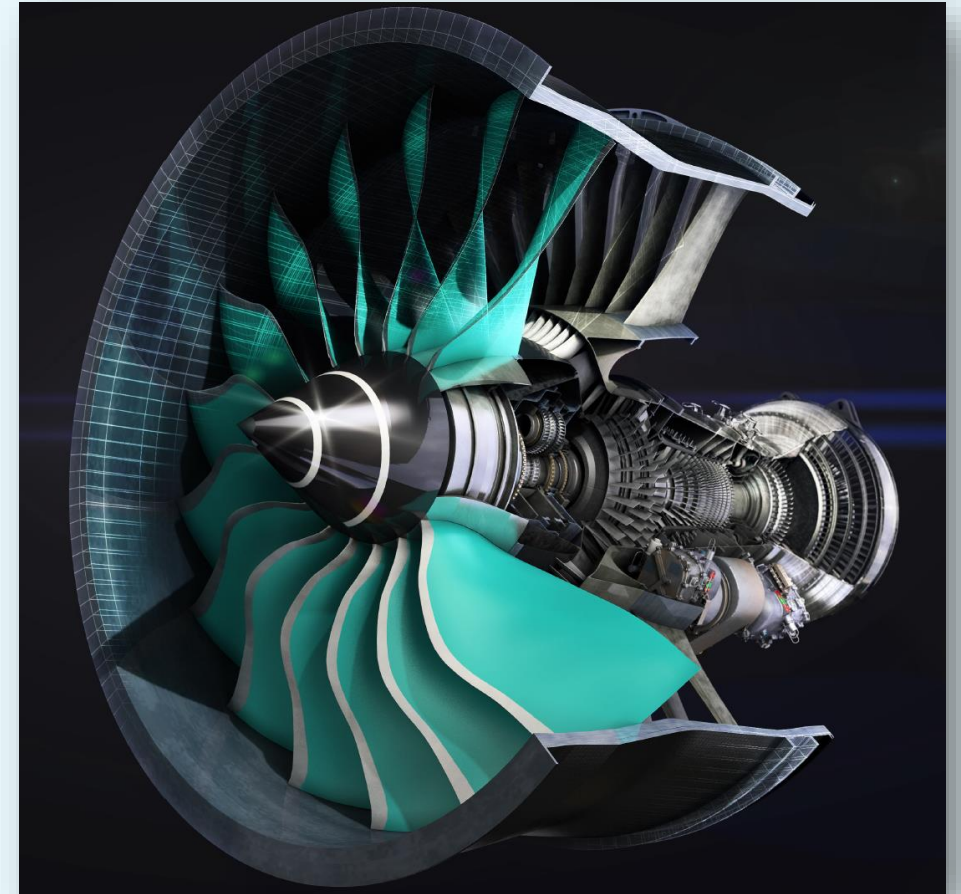


BAE SYSTEMS



Prosperity Partnership with Rolls Royce

- 5 year programme - £14.7m project
- World's first high-fidelity simulation of a gas turbine engine in operation
- Structure / Thermodynamics / Fluid dynamics / Electromagnetics
 - A trillion degrees of freedom
- Engineering challenge for Exascale era
 - 3 companies and 5 universities
- ... **however few industry projects are this large**



Typical local SME projects

- **Rock Solid Images**
 - Applying ML to petrophysical software to optimise product (7 days to matter of minutes)
- **Sustainably**
 - Data & Software architecture support.
- **DeepMiner**
 - Software development for product launch
- **Artificial Lift Performance**
 - Applying ML to enable ESP performance to be predicted
- **Global Surface Intelligence (GSI)**
 - Data & product hosting on Cirrus HPC infrastructure
- **DJ Alexander**
 - Data & Software architecture / development support for new online product offering (Apropos)



So what's the problem?

- Many new users of HPC and HPDA are put off due to the initial cost
- A first project can easily cost €60K-€100K
 - Particularly if the company has never used HPC before
 - This is a lot of money for an SME
 - Many SMEs also worry about lack of skills
- A key objective for Fortissimo has always been to challenge this
 - Solving real business challenges and developing a set of business-focussed case studies
 - Overall goal is to convince others to adopt

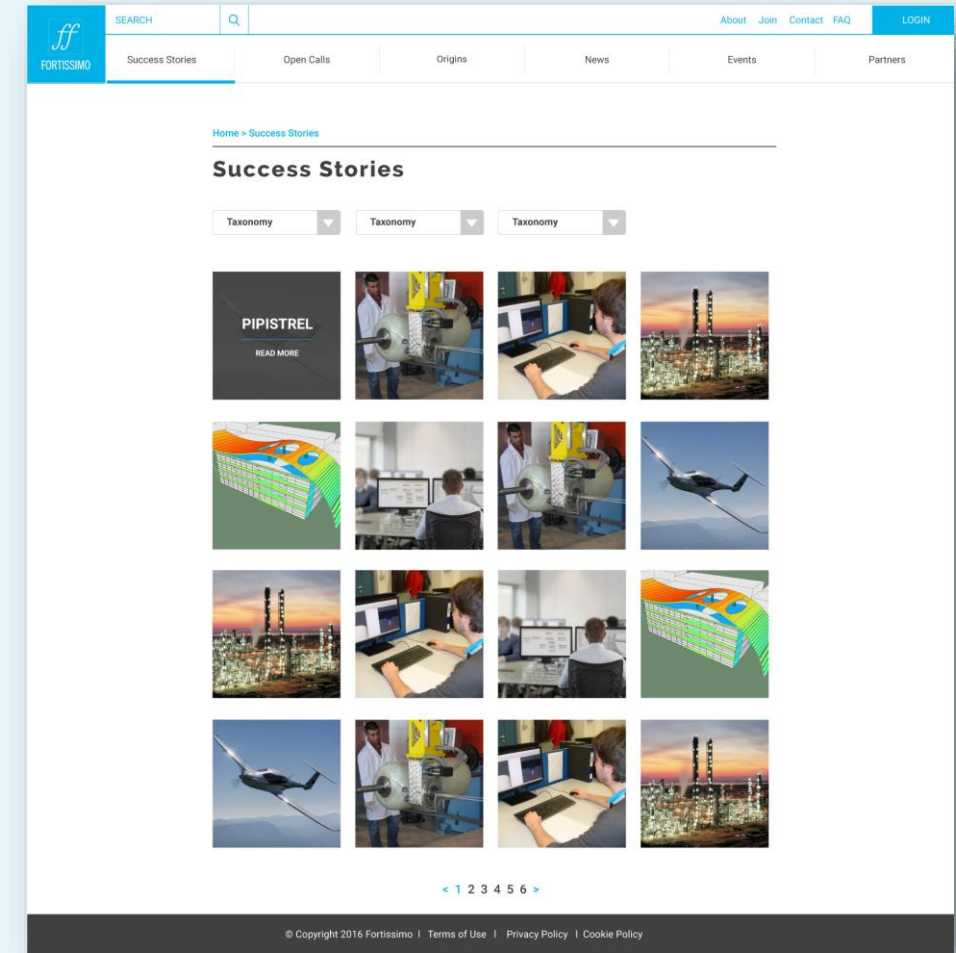
Why is uptake of HPC so limited by SMEs?



- There are many barriers to uptake:
 1. First use may be expensive
 2. Target is normally a company “expenditure” department
 - E.g. R&D department
 3. Access to computing and software resources
 4. Access to expert help
 5. Lack of success stories from other companies
- Fortissimo targets (3), (4) and (5) to help (2) make the case for (1) ...

Similar model for Fortissimo 1 & 2

- Focussed around sets of 'experiments'
- Open Calls for experiments
- Experiments lasted 18 months and involved 3-5 partners with funding up to €250,000
- Key outcome was a Success Story to show other companies who they can benefit
- Plus a solution for the SME



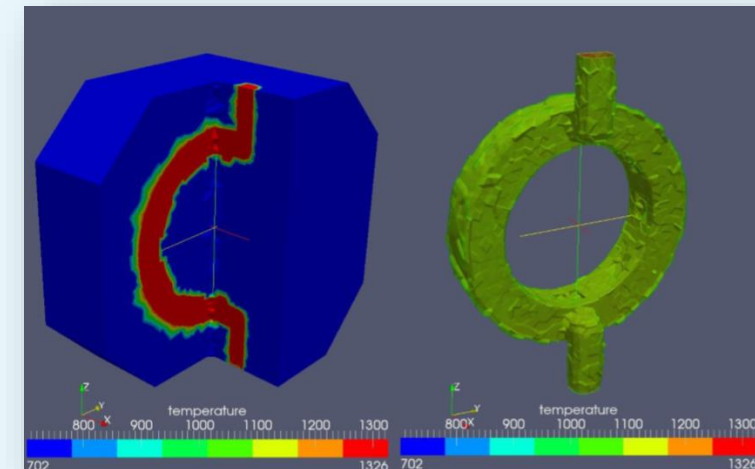
CFD simulation for Hypercars

- Koenigsegg are EU Hypercar manufacturer ... and an SME
- In-house CFD too expensive
– Cloud is compelling option
- Impressive results
 - 250% increase in downforce with only 15% increase in drag at 250kph
- 30% saving in design costs plus 50% reduction in wind tunnel and physical testing
- Development savings of €90K per year PLUS 30% decrease in time to market
- **€4m benefit to company over 5 years**



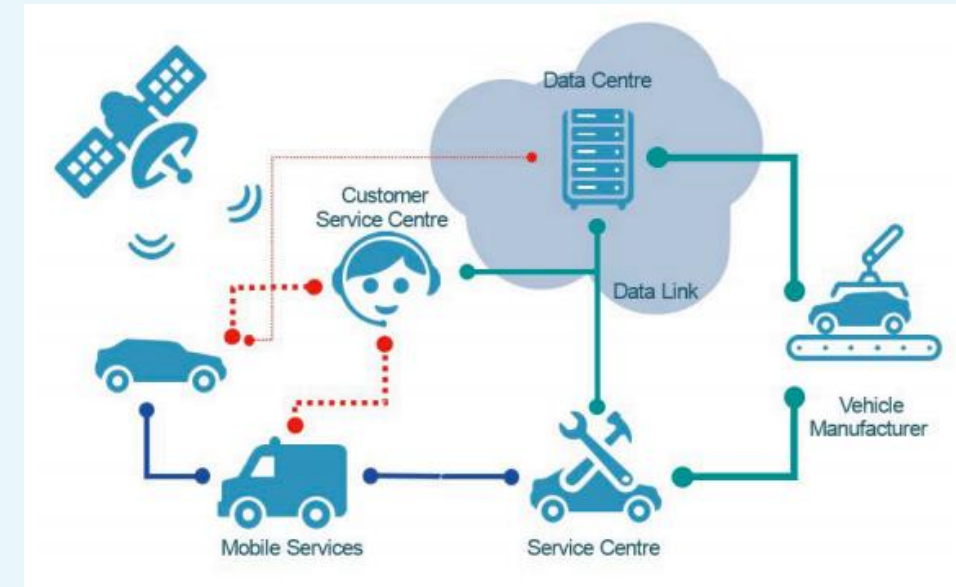
Low-pressure die-casting of copper alloys

- Simulation experiment
- Focus on optimisation of copper alloy moulds
- Costs of testing a new mould are high - €40K per mould
- Simulation saves around €6K per mould – fewer failures
- Annual savings of around €50K already accruing to IMR



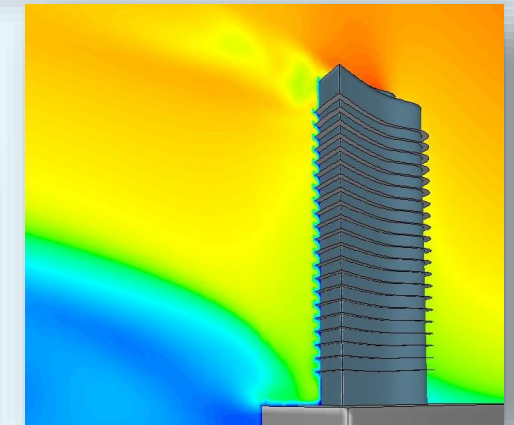
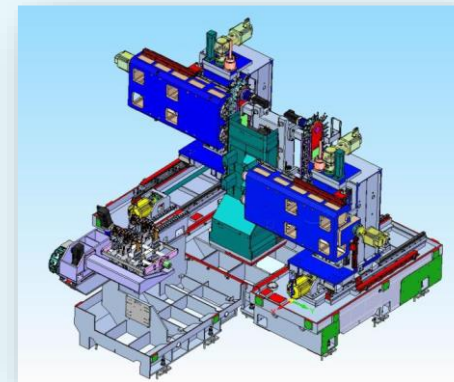
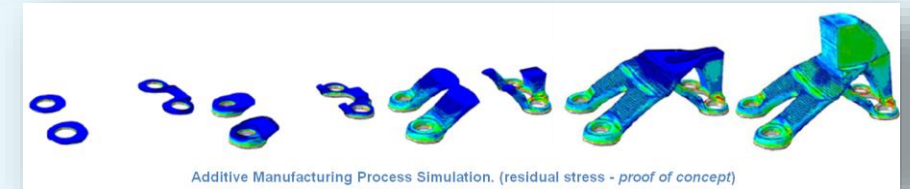
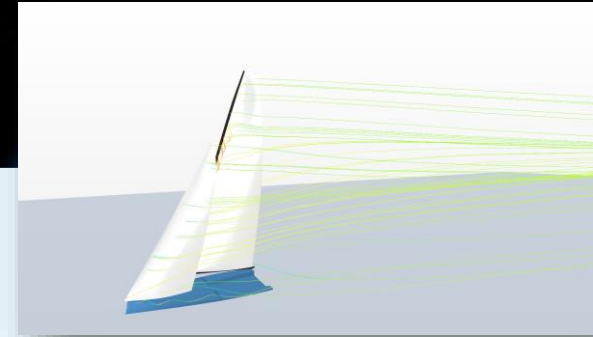
Predictive diagnostics for automotive

- High performance data analytics from CINECA
- Prediction of component failure in automotive industry
- Data services developed in the experiment allow TEXA to analyse data from fleet vehicles
- 2TI further developing for different applications
- New services valued at €1.2 million over next 3 years



Further examples

- Cloud based design of yacht sales (Cape Horn Engineering)
- Additive manufacturing simulation (HPE and Exemplar)
- Small wind turbine microsite design (Kliux Energies)
- Crankshaft machining HPDA (ETX)



Lessons learned



- The best experiments:
 - Properly planned their work from the start
 - Picked an achievable project – not too small, not too large
 - Made sure they had access to all of the software required or understood how it would be developed
 - Put together a clear business case – where the business benefit over the subsequent 3-5 years greatly exceeded the funding requested
 - Planned how to go from the initial experiment to production use from the outset

Lessons learned

- The best HPC centres:
 - Worked closely with their Experiment Partners to develop the proposal
 - Carefully understood the effort required and how they would staff the project
 - Worked with the Experiment Partners to support them as they developed their business model
 - Were pragmatic if more access to HPC or HPDA resources were required than initially envisaged
 - Were responsive to requests from the Project Management Team

Conclusions



- FF4EuroHPC provides an excellent opportunity for new companies to adopt HPC, HPDA and AI into their businesses
- It's a great way for national and regional HPC centres to engage with companies and grow services to local industry
- There are well demonstrated business benefits to be found through the adoption of these technologies

Data Driven Innovation for European businesses!

The background of the slide is a vibrant, high-resolution image of a tropical beach. The top half shows a clear blue sky and turquoise water with a few palm trees and thatched-roof huts on the shore. The bottom half is an underwater view of a diverse coral reef with various types of coral and small fish. A yellow 3D model of a wave energy device is overlaid on the left side of the image.

CCell Success Story

Cloud-based optimisation of a multi-body wave energy device

THE PROBLEM – COASTAL EROSION

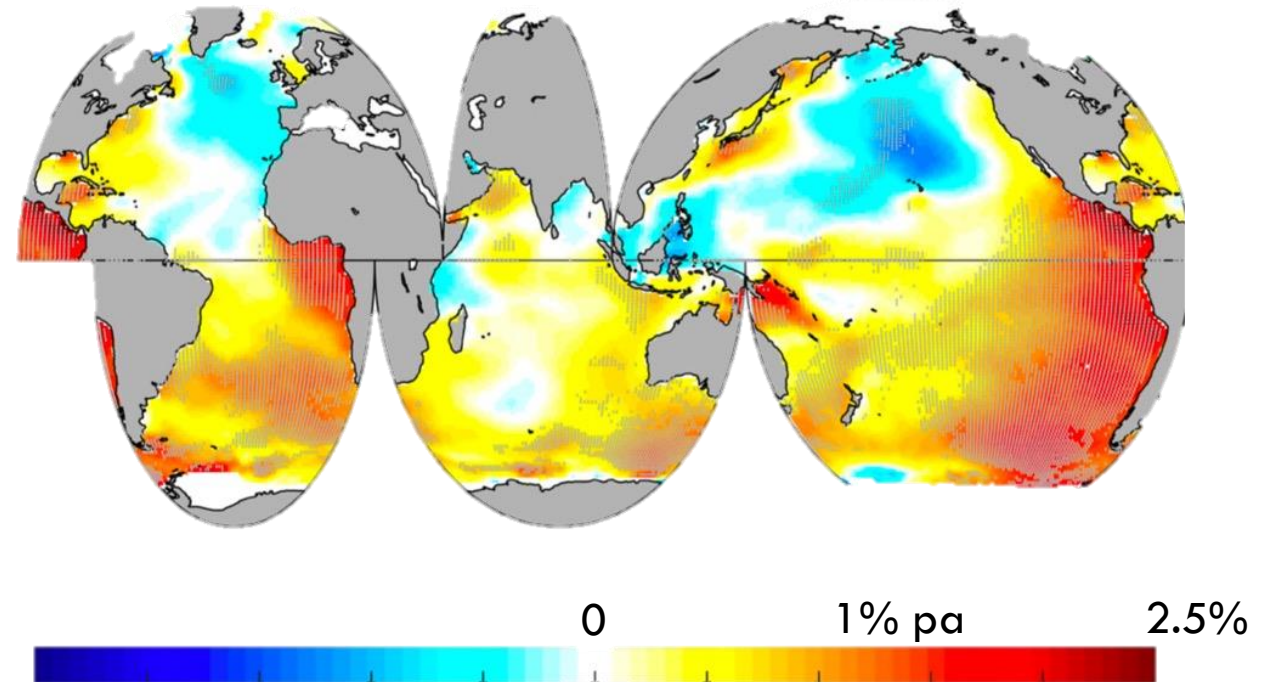


THE PROBLEM – COASTAL EROSION



70% OF COASTLINES EXPERIENCE INCREASED EROSION

<https://www.nature.com/articles/s41598-018-24630-6>



25% INCREASE IN WAVE ENERGY OVER 60 YEARS
(~0.41% P.A)

<https://www.nature.com/articles/s41467-018-08066-0>

NATURAL REEFS - BENEFITS



97%

REDUCTION IN
WAVE ENERGY

<https://www.nature.com/articles/ncomms4794#Bib1>



200M

PEOPLE
PROTECTED

<https://www.nature.org/content/dam/tnc/nature/en/documents/CoastsatRisk.pdf>

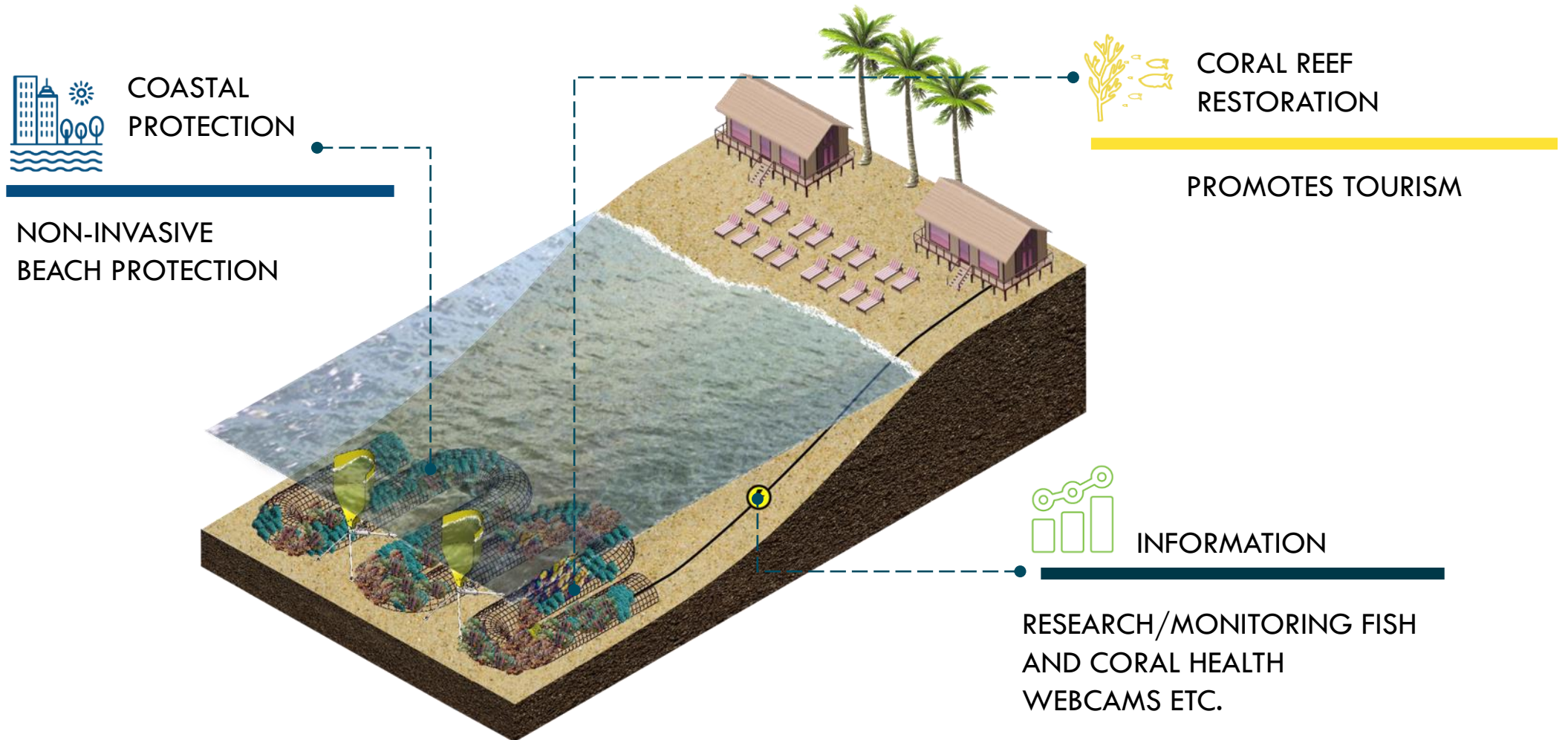


25%

OF MARINE
SPECIES

<https://www.noaa.gov/education/resource-collections/marine-life/coral-reef-ecosystems>

OUR SOLUTION

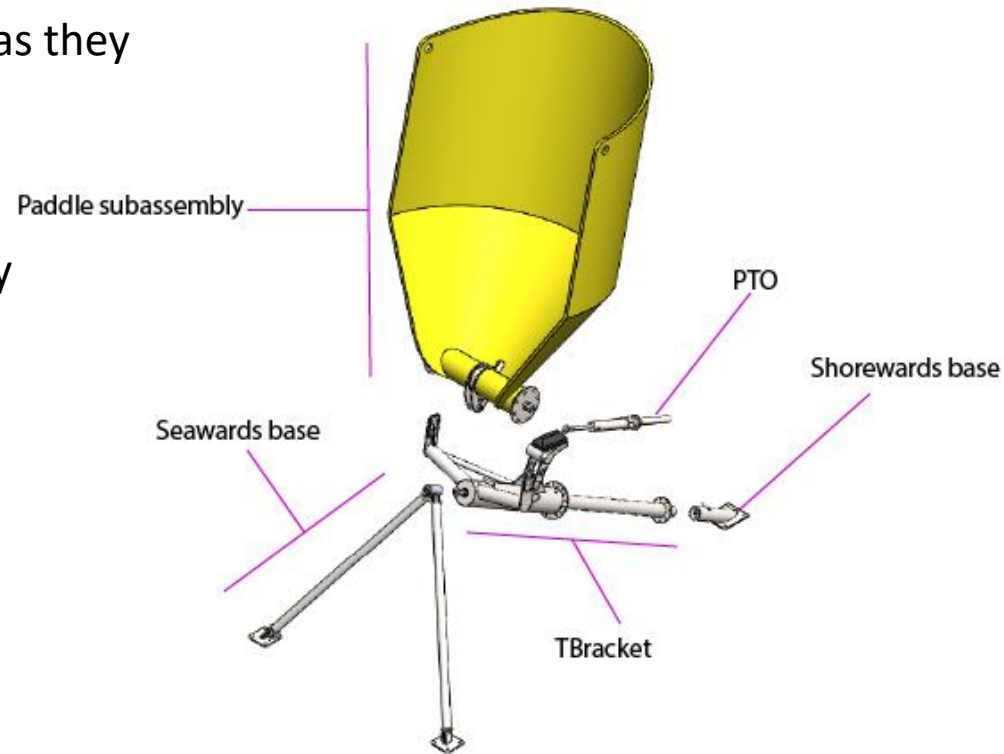


WAVE ENERGY PADDLE OPTIMISATION

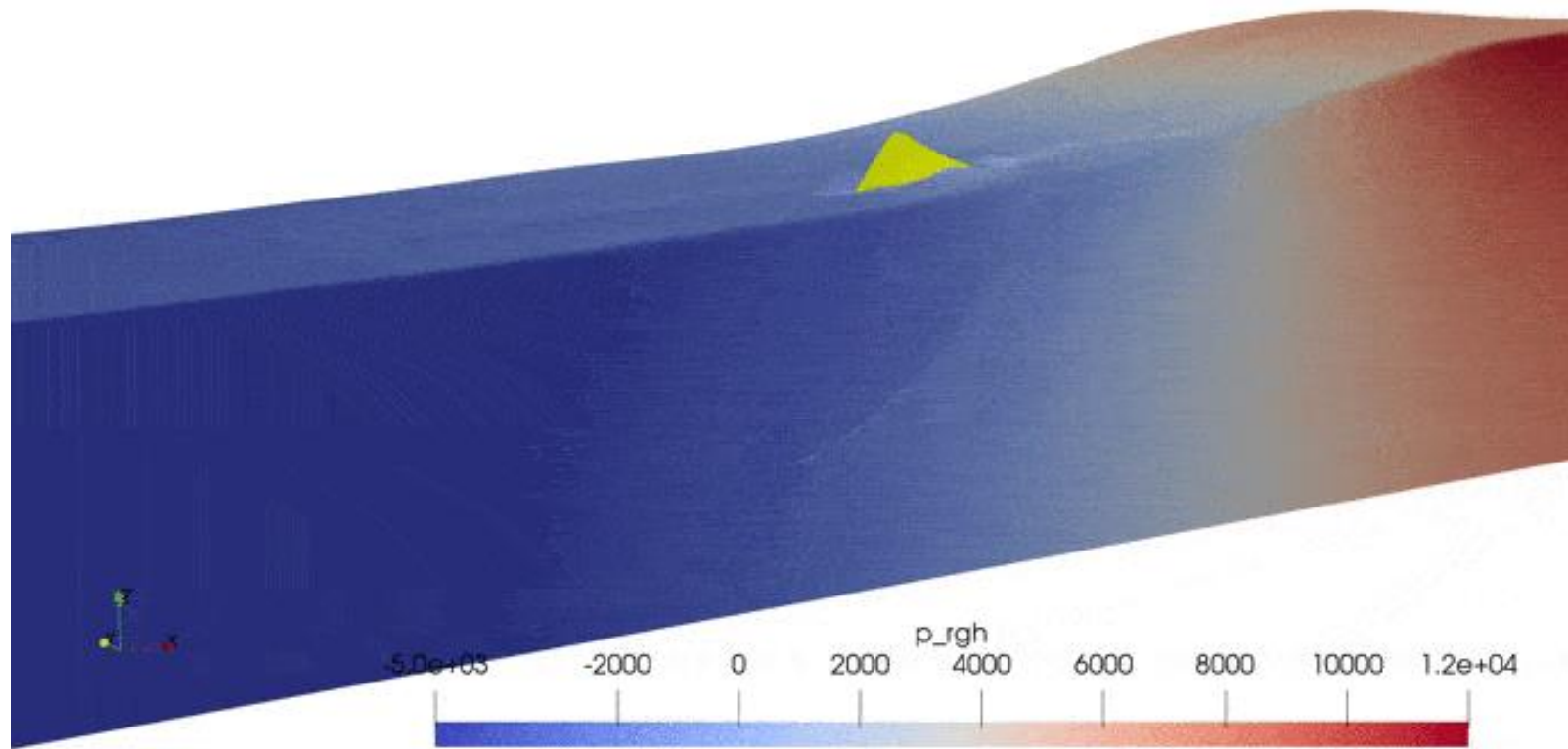
Paddle extracts energy from waves as they pass over

Shape and PTO optimised for energy extraction

HPC allowed many iterations to be compared



WAVE ENERGY PADDLE OPTIMISATION

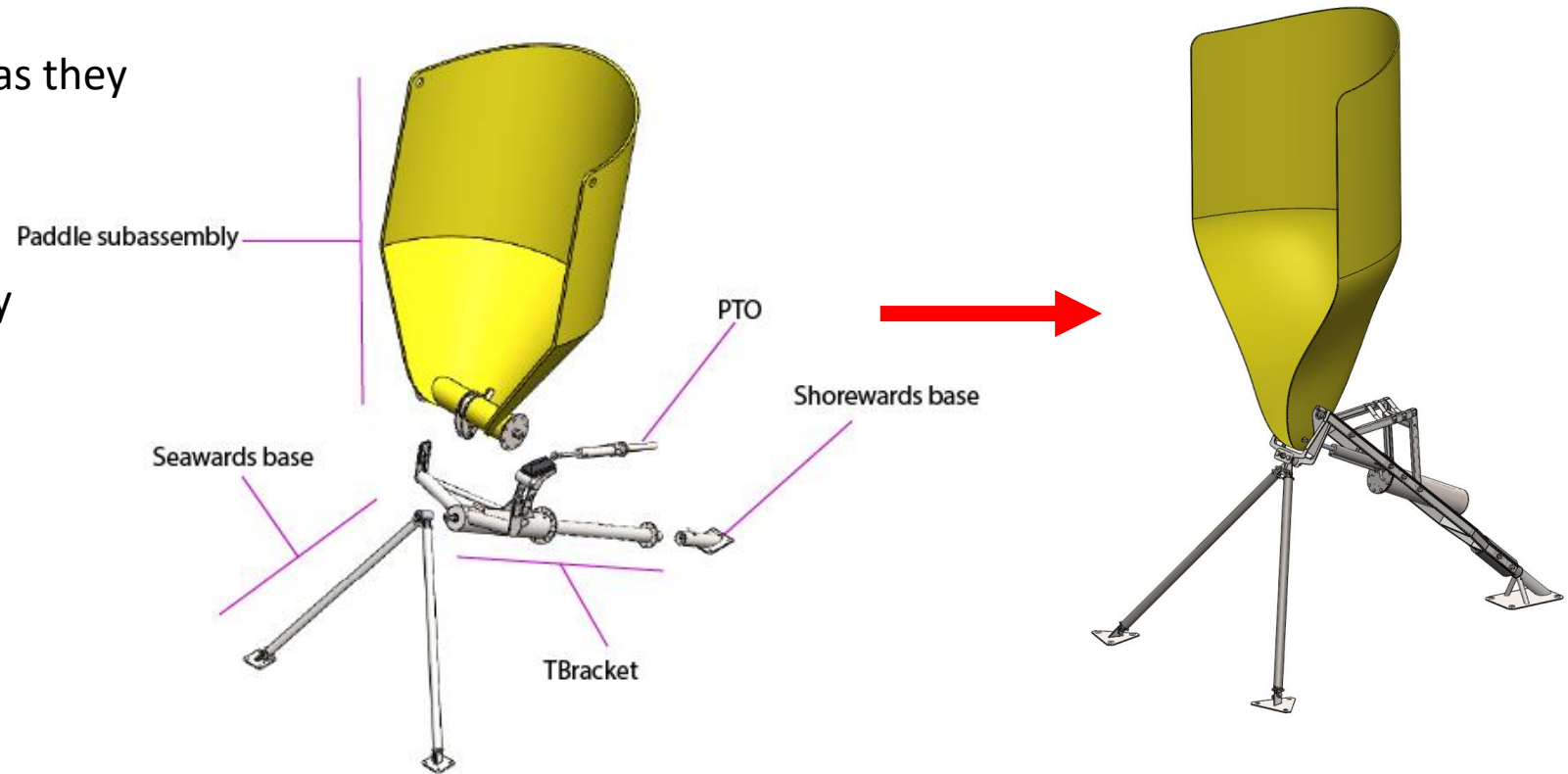


WAVE ENERGY PADDLE OPTIMISATION

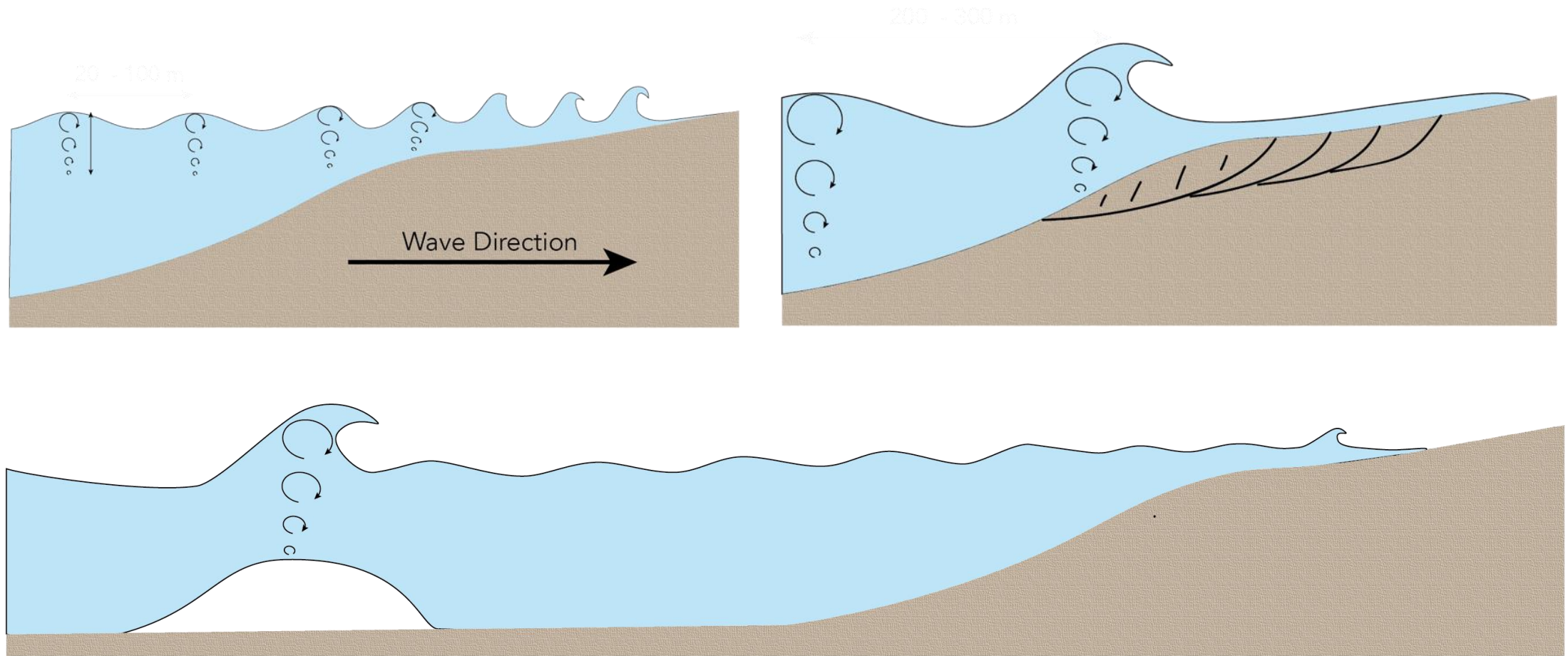
Paddle extracts energy from waves as they pass over

Shape and PTO optimised for energy extraction

HPC allowed many iterations to be compared



BREAKING WAVES

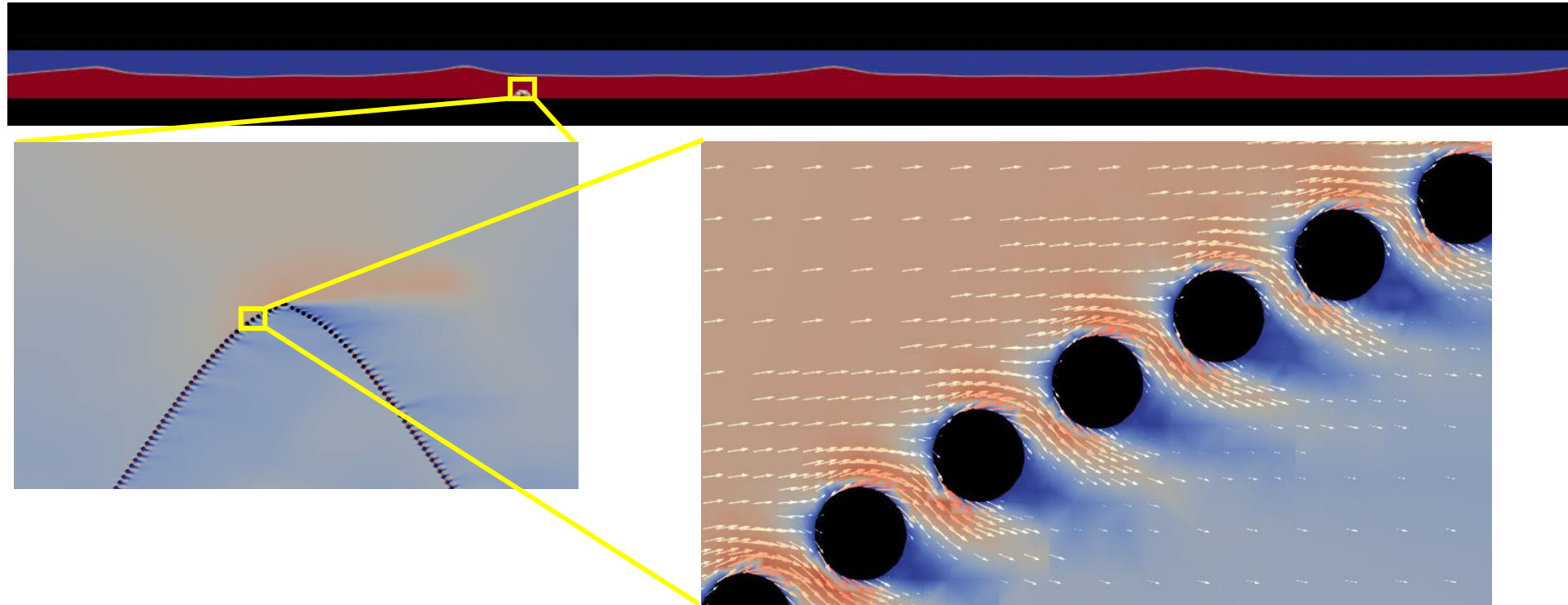


MODELLING SAND MOVEMENTS



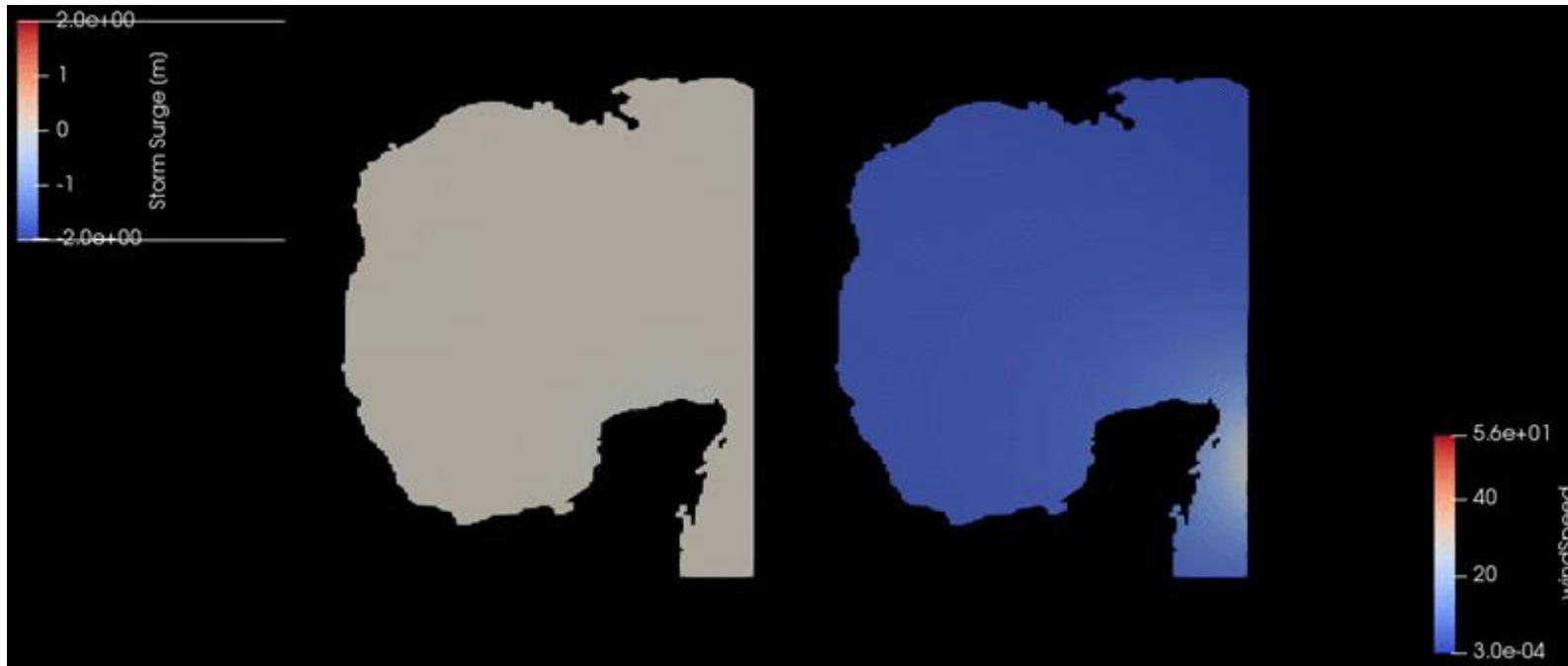
CASE STUDY - WAVE MODELLING

- 2D OpenFOAM numerical wave tank model
- Domain length ~200m
- Artificial reef model located part-way along
- ~200,000 cells



CASE STUDY – HURRICANE STORM SURGE

- 2D OpenFOAM model
- ~25,000 cells
- Solving "shallow water equations"
- Model 'real time' duration of ~5 days
- Model run time up to 1 day (standard PC)"



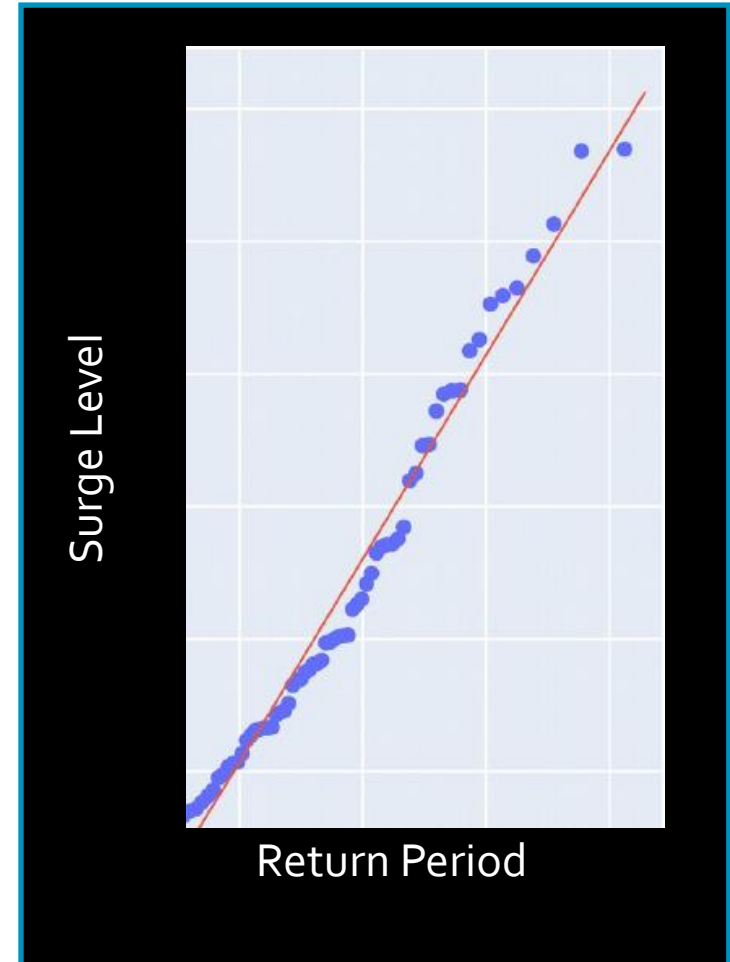
CASE STUDY – HURRICANE STORM SURGE

High-Performance Computing

Increased parallelisation through OpenFOAM

Run times down to 30-60 mins

100+ hurricanes for Yucatán since 1950





THANK YOU

WILLIAM BATEMAN

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www.ccell.co.uk



@CCellUK

OTHER BENEFITS

✓ DIVE TOURISM

✓ FISHERIES

✓ DATA ACQUISITION

FF4EuroHPC

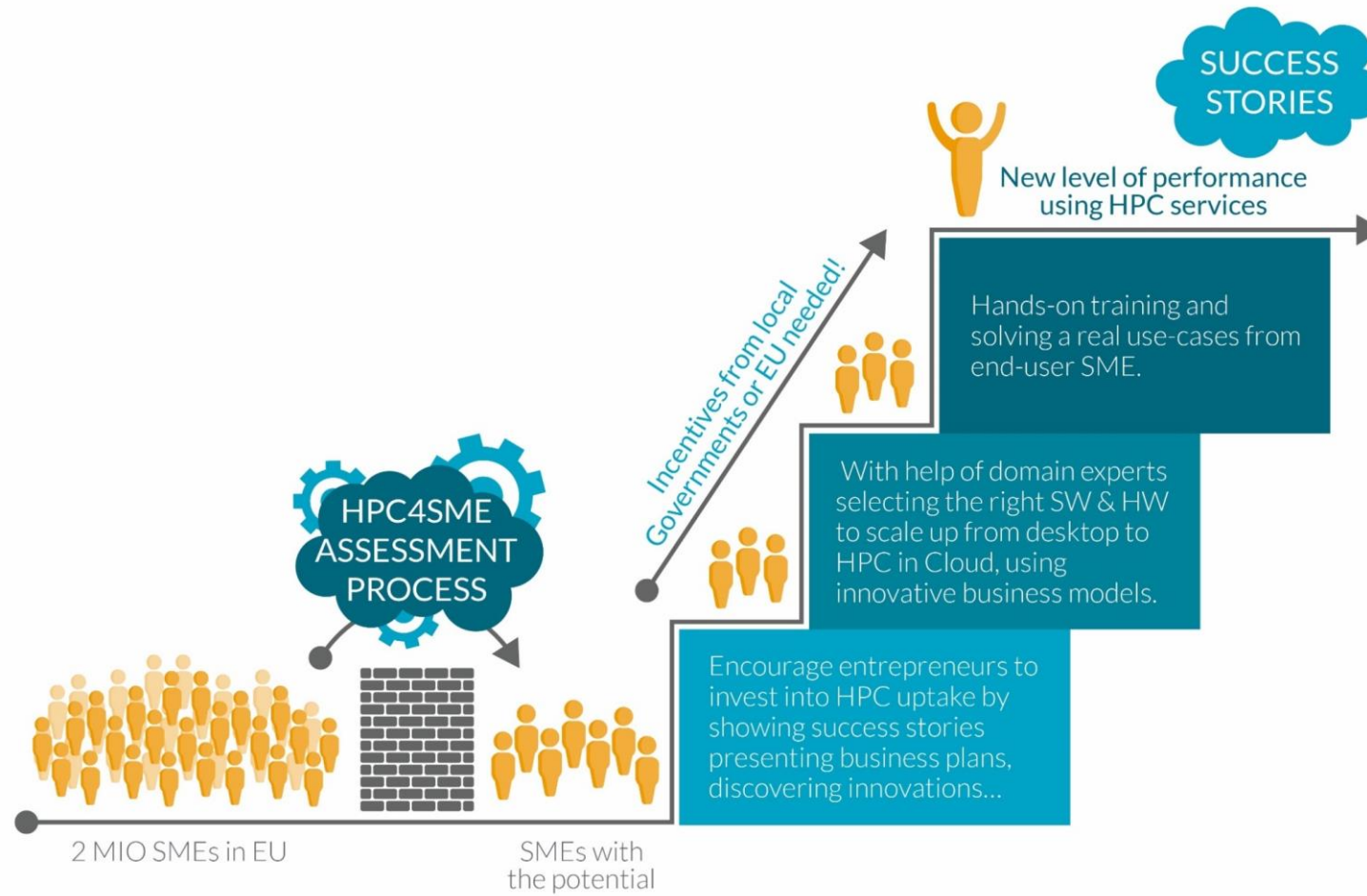
Enabling SMEs to benefit from HPC

OPEN CALL 1

Tomi Ilijaš, Arctur d.o.o.



HPC 4 SME background



The FF4EuroHPC project

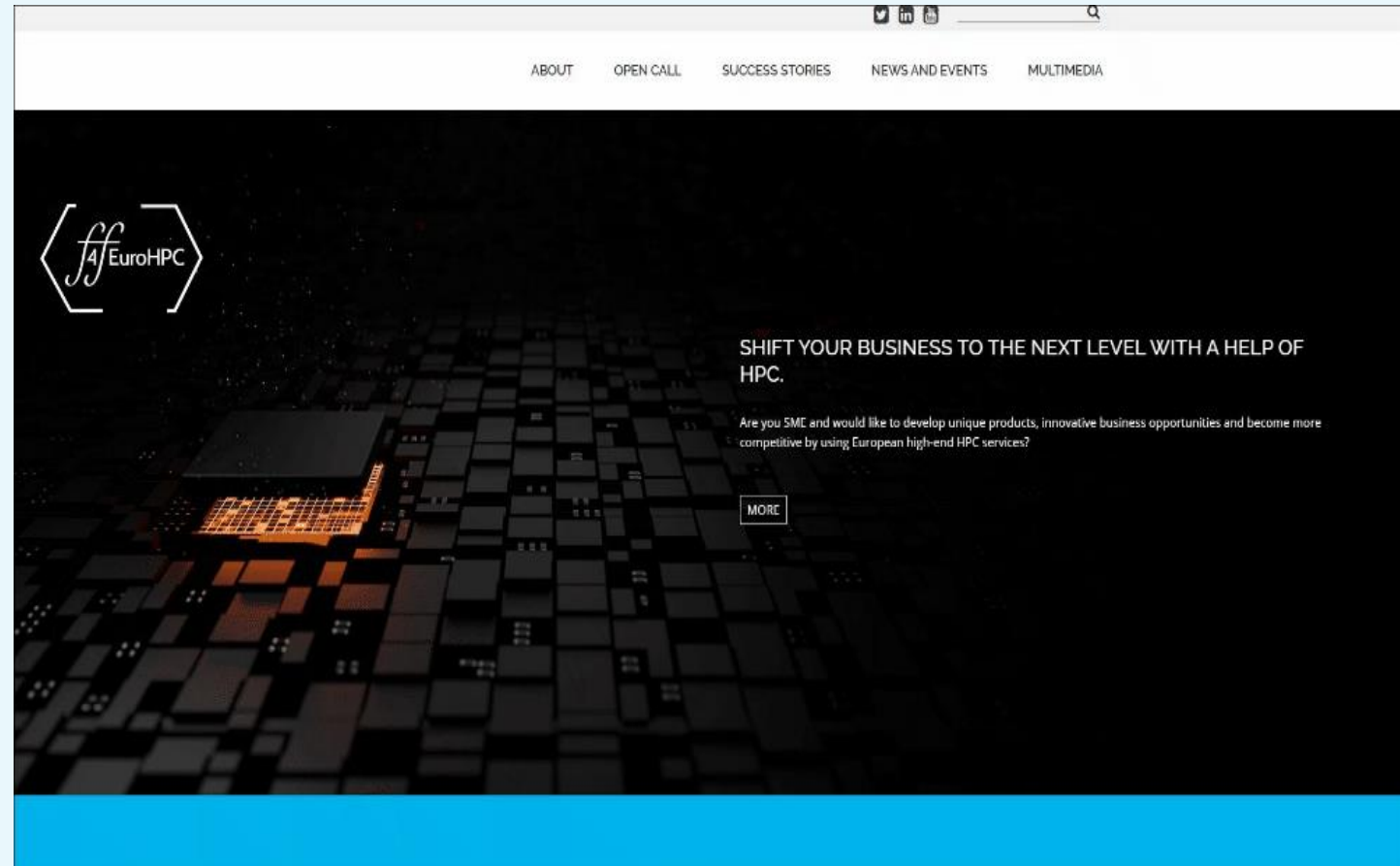
FF4HPC: HPC Innovation for European SMEs

- Funded under the H2020-JTI-EuroHPC-2019-2 Call
- Commenced 1.9.2020; 36 months duration

→ Coordinator



→ Other Partners



www.ff4eurohpc.eu

Stimulating the innovation potential of SMEs

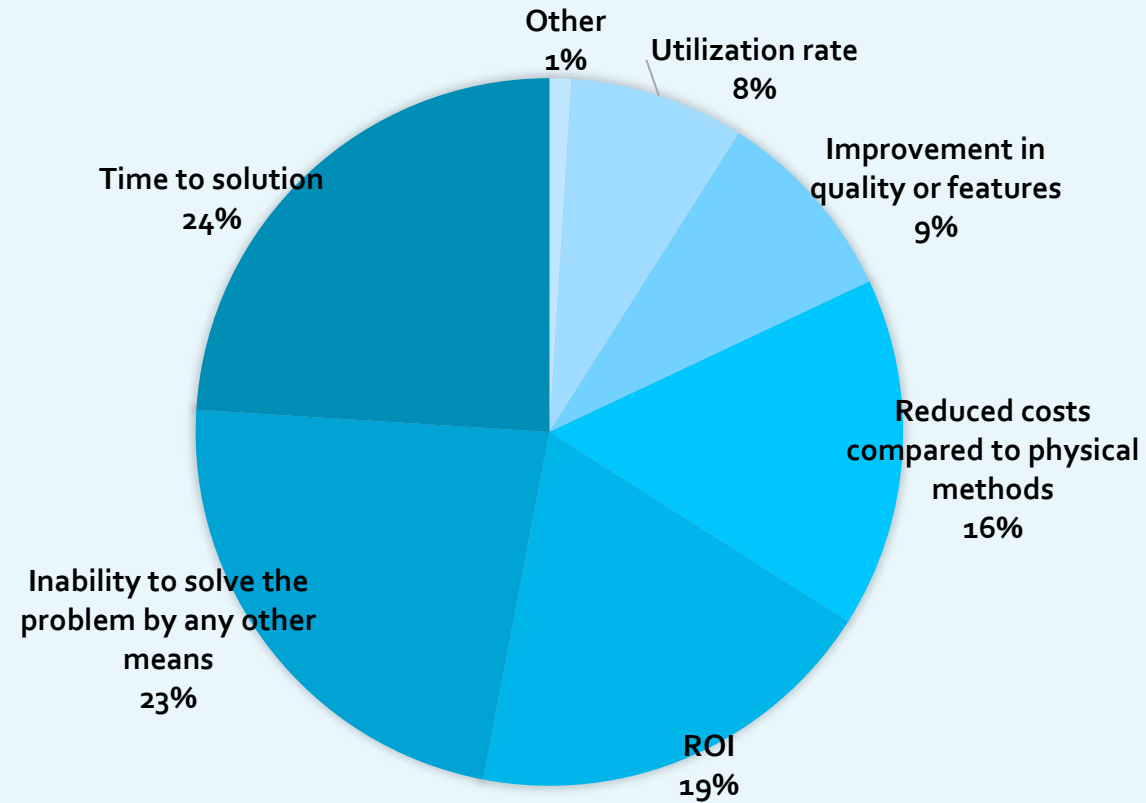
The FF4EuroHPC project aims to

- Increase the **innovation potential of industry**, and in particular of SMEs, using advanced High Performance Computing (HPC) infrastructures, applications and services.
- Provide **access to HPC-based infrastructures and services** to a wide range of users for new and emerging data and compute-intensive applications and services.
- **Foster wider innovations**, for example by exchanging and promoting best practice use cases or application experiences.
- Provide an effective mechanism for **inclusion of innovative, agile SMEs lowering the barriers** for small actors to enter the market and exploit new business opportunities.

Why use HPC in business?

BENEFITS OF HPC

(SOURCE: COUNCIL OF COMPETITIVENESS)



Shift your business to the next level with the help of HPC – OPEN CALL 1

The FF4EuroHPC mission is to **support EuroHPC** to promote **industrial uptake of HPC technology** and increase **the innovation potential**.



Call for proposals targets **highest quality experiments** involving **innovative, agile SMEs** and with work plans built around innovation targets arising from **the use of advanced HPC services**.

OPEN CALL-1 objectives

- Experiments should address business challenges from European SMEs from varied application domains
- Preference being given to engineering and manufacturing, or sectors able to demonstrate fast economic growth or particular economic impact for Europe.
- Priority will be given to consortia centred on SMEs that are new to the use of advanced HPC services

Expectations for experiments

→ **Involve all necessary parties** required for the effective and efficient execution of the investigation and impact demonstration to address SME business challenges through the use of HPC

→ **Define the resources they need and budget for them**

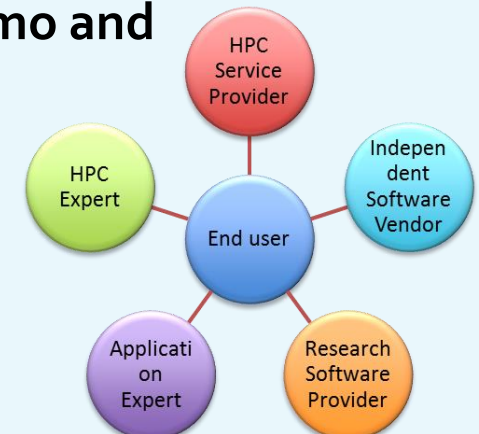
FF4EuroHPC will not be in a position to provide computing resources.

→ **Define the data protection and data/information access issues** that impact its proposed work plan and ensure that the operation of the experiment adheres to those requirements.

→ **Generate publishable success stories** based on solution of the SME's real-world problems that clearly identify the business benefits realised or obtained.

→ **Align, where appropriate, with regional priorities**, such as industrial specialisation areas.

→ **Be complementary to those already included in the past Fortissimo and Fortissimo 2 projects.**



Key Call Details

- Submission Deadline: **27th January 2021, 17:00**
Brussels local time
- Funding for Call-1: The indicative total funding budget is **EUR 3 M.**
- Expected duration of experiments: **maximum 15 months** with expected commencement **1st June 2021**
- Maximum funding request per proposal:
EUR 200,000 (covering all participants)
- Proposal submission: in **electronic form**
- Language: **English**
- Submission site:
<https://www.ff4eurohpc.eu/calls/submission>



Key Call Details

Proposals must comprise 2 parts:

→ **Part A (administrative information)**

Cover page and a set of tables to provide administrative data – no additional info to be included!

→ **Part B (body of the proposal)**

Cover page + max. 10 pages

Proposals not adhering to the page limit & content guidelines will be rejected!

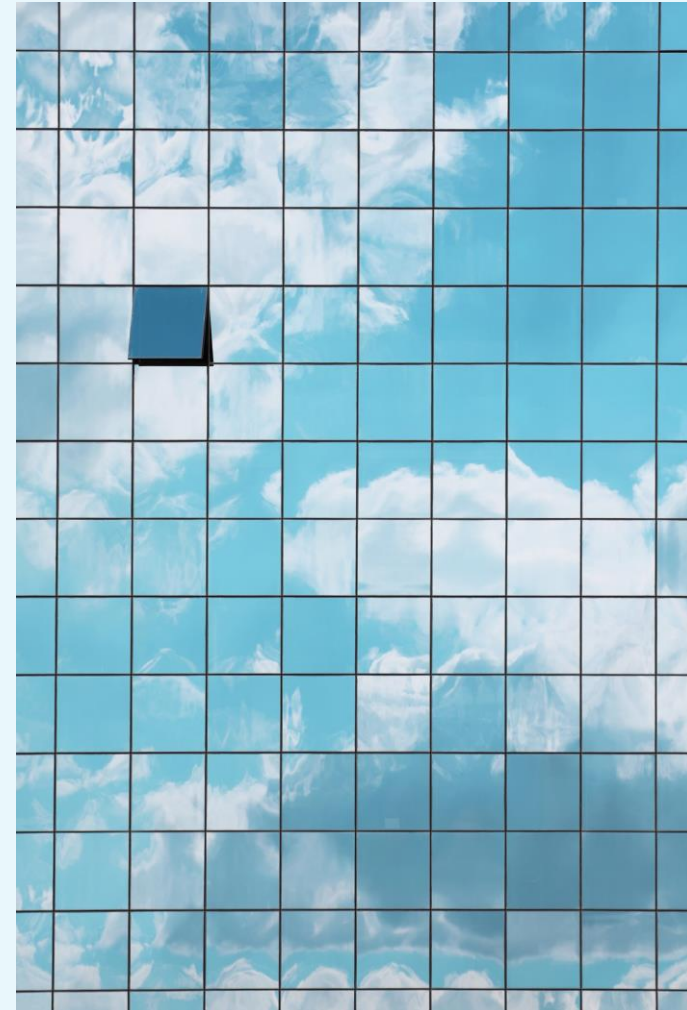


Evaluation criteria

The criteria for evaluation will comprise:

1. Impact including industrial relevance and exploitation plans;
2. Soundness of concept, innovation and quality of the work plan;
3. Quality of the consortium as a whole and of the individual proposers;
4. Effective and justified deployment of resources

For Criteria 1 to 4, each criterion will carry a score ranging from 0 to 5. Criterion 1 will have a weight of 2, Criteria 2 to 4 a weight of 1 (leading to a maximum score of 25 points). A threshold score of 3 will apply to the first three criteria.



Have more questions?

Find the answers in FAQ →

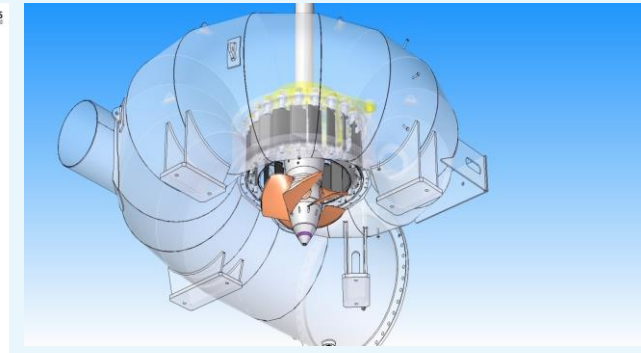
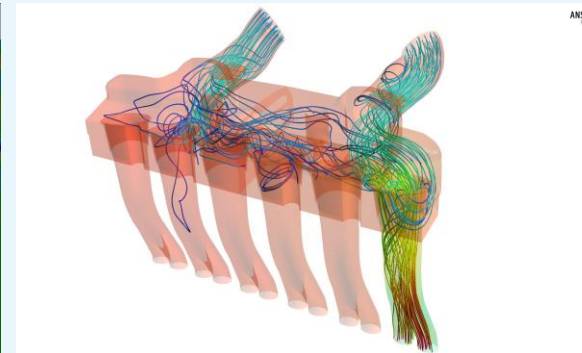
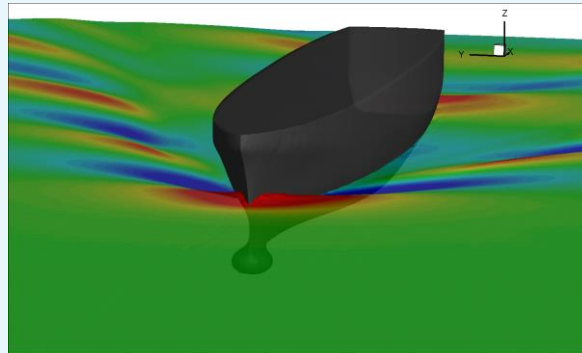
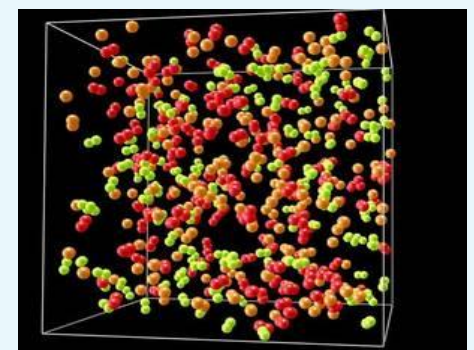
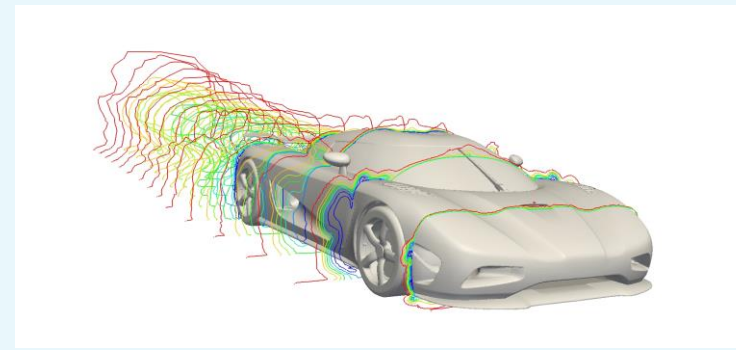
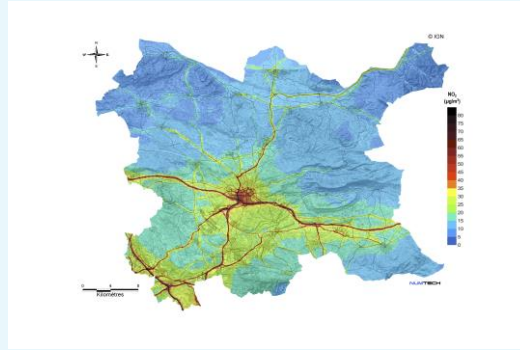
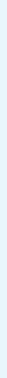
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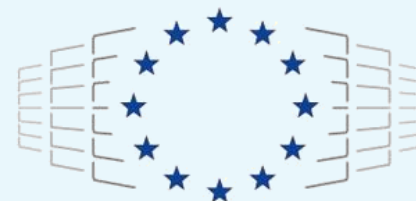
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