



# Introduction to SHAPE

## Removing barriers to HPC for SMEs

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**SHAPE**  
*SME HPC Adoption Programme in Europe*



## Small and Medium Enterprises

- ▶ SMEs are the backbone of the European Economy
  - ▶ 99/100 businesses are SMEs
  - ▶ In 2015, just under 23 million SMEs generated €3.9 trillion in value added and employed 90 million people (source: EC SME Performance Review 2015/2016)
- ▶ How many can realistically benefit from HPC?
  - ▶ In 2008 a study in Scotland found around 1,400 companies *could* use HPC, with 300 of these *likely* to
- ▶ Scaling across Europe indicates around 142,000 potential SME HPC users and 30,000 that are likely to





## SMEs and HPC: opportunities

- ▶ Enable development of **new products**
- ▶ **Reduce** time-to-market and R&D **costs**
- ▶ **Increase quality** of services and products
- ▶ Reduce manufacturing costs
- ▶ **Innovation**
- ▶ Next five years will see HPC and Data Analytics systems merging (HPDA)
  - ▶ Great **opportunities** for HPC in new sectors



## SMEs and HPC: barriers

- ▶ Cost of operation
  - ▶ A first project can easily cost €60K-100K
  - ▶ This is a lot of money for an SME
- ▶ Lack of expertise
  - ▶ No in-house experience
  - ▶ Cost of consultancy
- ▶ Lack of resources
  - ▶ No access to appropriate hardware
- ▶ Risk!
  - ▶ If never used HPC before, high risk, but ... potentially high benefit





# SHAPE: SME HPC Adoption Programme in Europe

- ▶ Supported by PRACE
  - ▶ launched in 2013
- ▶ Programme to raise awareness and assist SMEs in taking advantage of HPC
  - ▶ aimed primarily at HPC “first-timers”
- ▶ Regular calls for applications, which are judged on
  - ▶ Strength of business case
  - ▶ Achievability, commitment from the SME and innovation
  - ▶ Social and economic impact for society



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SME HPC Adoption Programme in Europe



## SHAPE process

- ▶ SME applies to a call (6 monthly)
  - ▶ Online form to complete
  - ▶ Prior detailed knowledge of HPC not required
  - ▶ **Advice available** from PRACE centres at this stage
- ▶ Applications reviewed
  - ▶ Mixed panel – PRACE board, industry and centre representatives ...
- ▶ Successful applicants get
  - ▶ **Effort** from a PRACE partner expert (typically 2-6 months)
  - ▶ **Machine time** on a PRACE machine
- ▶ In return, the SME
  - ▶ Supplies domain expertise and in-kind effort to work with the PRACE expert
  - ▶ Produces a white paper, publicity, feedback etc



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# SHAPE projects

- ▶ To date, 41 SMEs have been helped
  - ▶ From 11 different countries
  - ▶ 7<sup>th</sup> Call closes 1st June



Engineering Solutions and Innovations

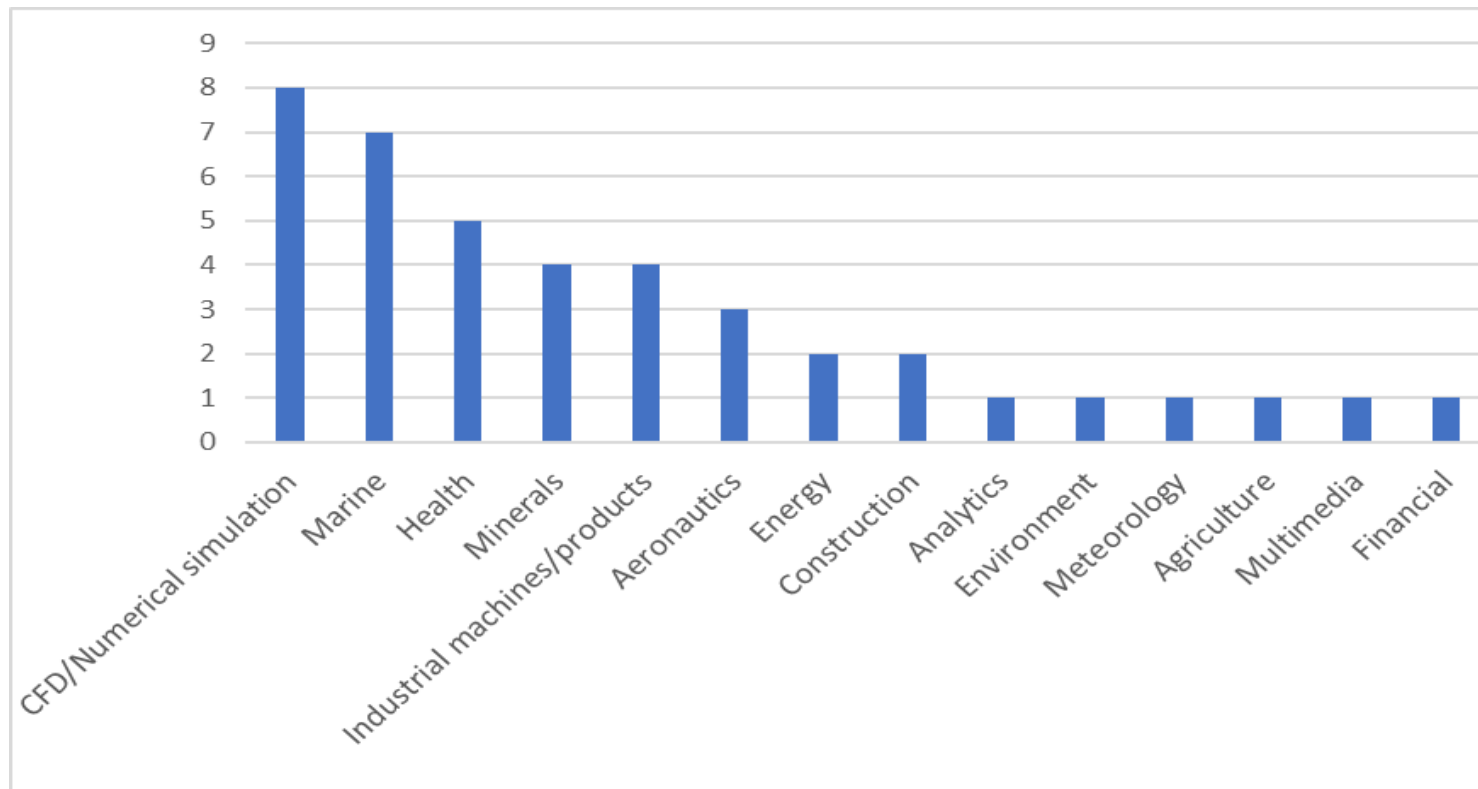


# SHAPE

SME HPC Adoption Programme in Europe



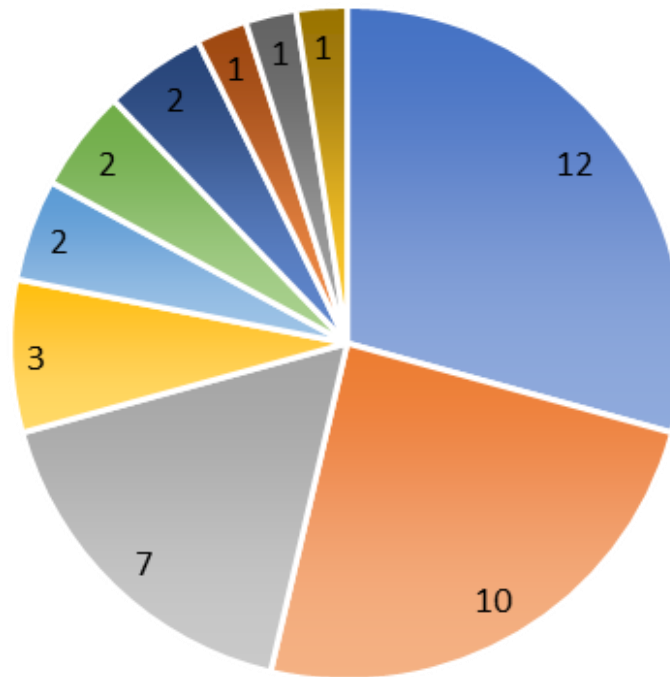
## SHAPE SME Industry Domains







## SHAPE SME Country of Origin



- Italy
- France
- Spain
- Sweden
- Germany
- UK
- Finland
- Ireland
- Switzerland
- Czech Republic





## Working with SMEs: HPC?

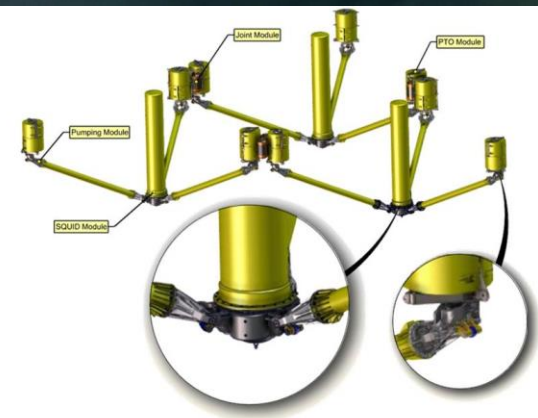
- ▶ To SMEs, HPC can mean many things
  - ▶ GPU acceleration
  - ▶ Going from serial to parallel (10s of cores)
  - ▶ Optimisations (algorithmic)
  - ▶ Data (analysis, volume)
  - ▶ Tool chain
  - ▶ Service provision
- ▶ All can have a profound impact on the way the SME does business
  - ▶ It's not just about the petaflops



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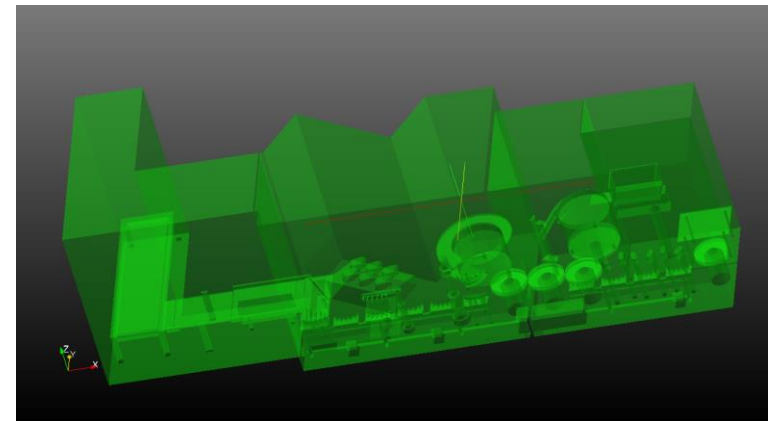
# SHAPE success stories

- ▶ AlbaTERN: modelling of innovative wave power generation devices
  - ▶ Gained expertise to expand their simulation capability to large km-wide device arrays



## SHAPE success stories

- ▶ Optima PHARMA: airflow simulations
  - ▶ Used OpenFOAM to simulate airflow in “clean rooms” used in various industries, particularly for pharmaceutical products
- ▶ More at <http://www.prace-ri.eu/hpc-access/shape-programme>





## SHAPE Current projects

- ▶ **Milano Multiphysics s.r.l.s**, Italy, an Italian company hoping to use HPC acceleration to improve prediction of erosion and corrosion due to flowing liquid metals
- ▶ **E&M Combustion S.L.**, Spain "High-fidelity simulation of an industrial swirling combustor"
  - ▶ Makes combustion systems, such as burners and boilers, mainly for the energy sector, oil and gas, steel and metal industries.
  - ▶ Hope to use HPC in optimising their combustor designs to reduce emissions and increase combustion efficiency.
- ▶ **Brabant Alucast International**, Italy "Multiphasic simulation in high pressure die casting process in HPC platforms using open-source CFD":
  - ▶ Design and development of high pressure die casting components for the automotive industry.
  - ▶ Looking at HPC and open-source technologies to evaluate potential benefits on cost, time-to-results for designs, and quantity of designs they can investigate in a day.





## SHAPE Current projects

- ▶ **Svenska Flygtekniska Institutet AB, Sweden "AdaptiveRotor"**:
  - ▶ “AdaptiveRotor” is a development project aiming at increasing the propulsive efficiency in propellers for aircraft and thereby reducing the impact of pollution and noise from these systems.
  - ▶ Going to use HPC to evaluate different design candidates for propeller blades.
- ▶ **AxesSim, France "HPC for connected objects"**
  - ▶ The company produces electromagnetic simulation software
  - ▶ Aiming use HPC to perform these simulations in a reasonable timescale for connected objects – looking for example at how the E-M waves produced by small antennae interact with biological tissues.
- ▶ **Disior Ltd, Finland "Numerical optimization of bone fracture treatment"**:
  - ▶ The company make software which helps with pre-operative planning of bone fracture treatments.
  - ▶ They plan to use HPC to develop a very fast method for implant optimisation, which would impact on surgery costs and patient quality of life





## SHAPE **measurements**

- ▶ Follow-up with SMEs post project
- ▶ Return on Investment
  - ▶ Jobs created
  - ▶ Reduced costs
  - ▶ Contracts won
  - ▶ Commitment to continue working with HPC (in-house and/or via third party)
  
- ▶ Intangible measures
  - ▶ Optimism that improved service/software solution will lead to an increase in customers
  - ▶ R & D accelerated





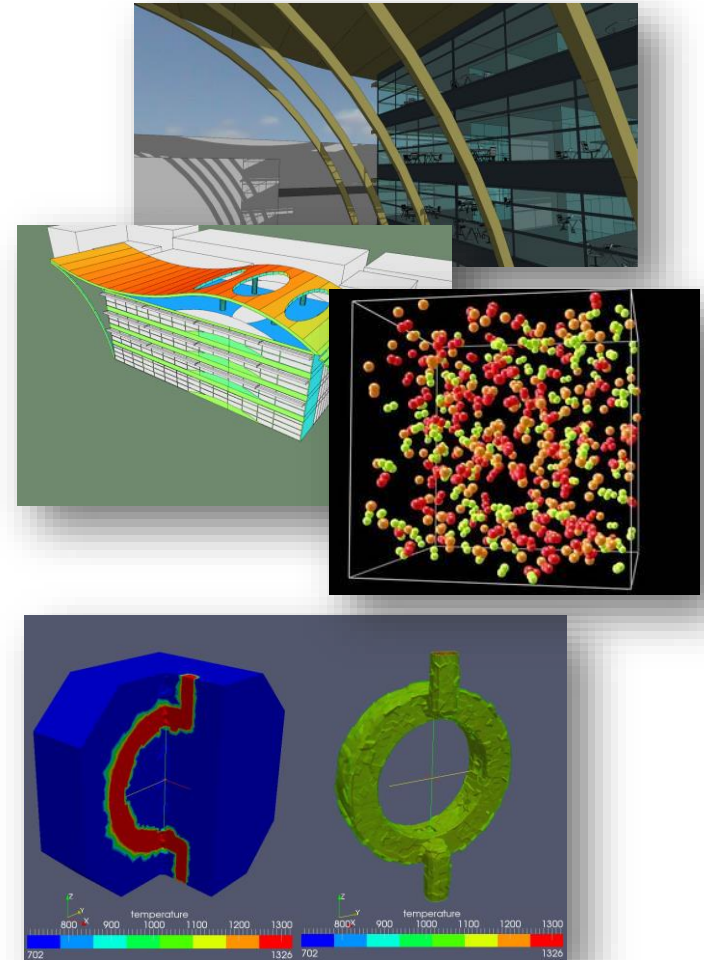
## SHAPE Future plans

- ▶ 41 SMEs helped to date
  - ▶ Call 7 ongoing
- ▶ Will continue under the next PRACE phase
  - ▶ Calls at six-monthly intervals, **current 1 Apr – 1 Jun**
- ▶ Challenges to be tackled
  - ▶ **Publicity**: ensure SHAPE is far-reaching both geographically and in terms of the SME industry domains
  - ▶ **Post-SHAPE**: what happens to the SME once they have finished?
- ▶ Ongoing evaluation of SHAPE process to ensure it remains relevant and appropriate for the SMEs



## SHAPE Conclusion

- ▶ SMEs are **key** to a thriving economy
- ▶ Many SMEs would benefit from using HPC
  - ▶ Reduction in costs, time to market, etc
  - ▶ ... but, there are barriers to this
    - ▶ Initial cost, risk, access...
- ▶ **SHAPE** helps SMEs to overcome these barriers
  - ▶ Delivers tangible benefits to their business





Thanks - Any questions

- ▶ SHAPE: <http://www.prace-ri.eu/hpc-access/shape-programme/>
- ▶ SHAPE co-ordinator: Paul Graham [p.graham@epcc.ed.ac.uk](mailto:p.graham@epcc.ed.ac.uk)

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