



ITEA2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT



## HPC projects contributing to European competitiveness and well-being

TERATEC Forum, 28 June 2011

Rudolf Haggemüller - Chairman ITEA2



# Content

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- ITEA, the EUREKA cluster  
on software-intensive systems and services
- PARMA, a gold award winner on  
Parallel-programming for multi-core architectures
- H4H: hybrid architectures for high performance computing
- HIPIP: high performance image processing in medical  
applications
- ITEA a sustainable eco-system for research and innovation  
in high performance computing



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## ITEA, the EUREKA cluster on software-intensive systems and services



# ITEA 2's Public Authorities and Board



- Members of the ITEA 2 Authorities Committee (ITAC)

- The ITEA 2 Board members are:

Airbus, Alcatel-Lucent, Barco, Bosch, Bull, Daimler, Italtel, Nokia, Philips, Siemens, Technicolor, Telefónica, Telvent, Thales and Turkcell Technology

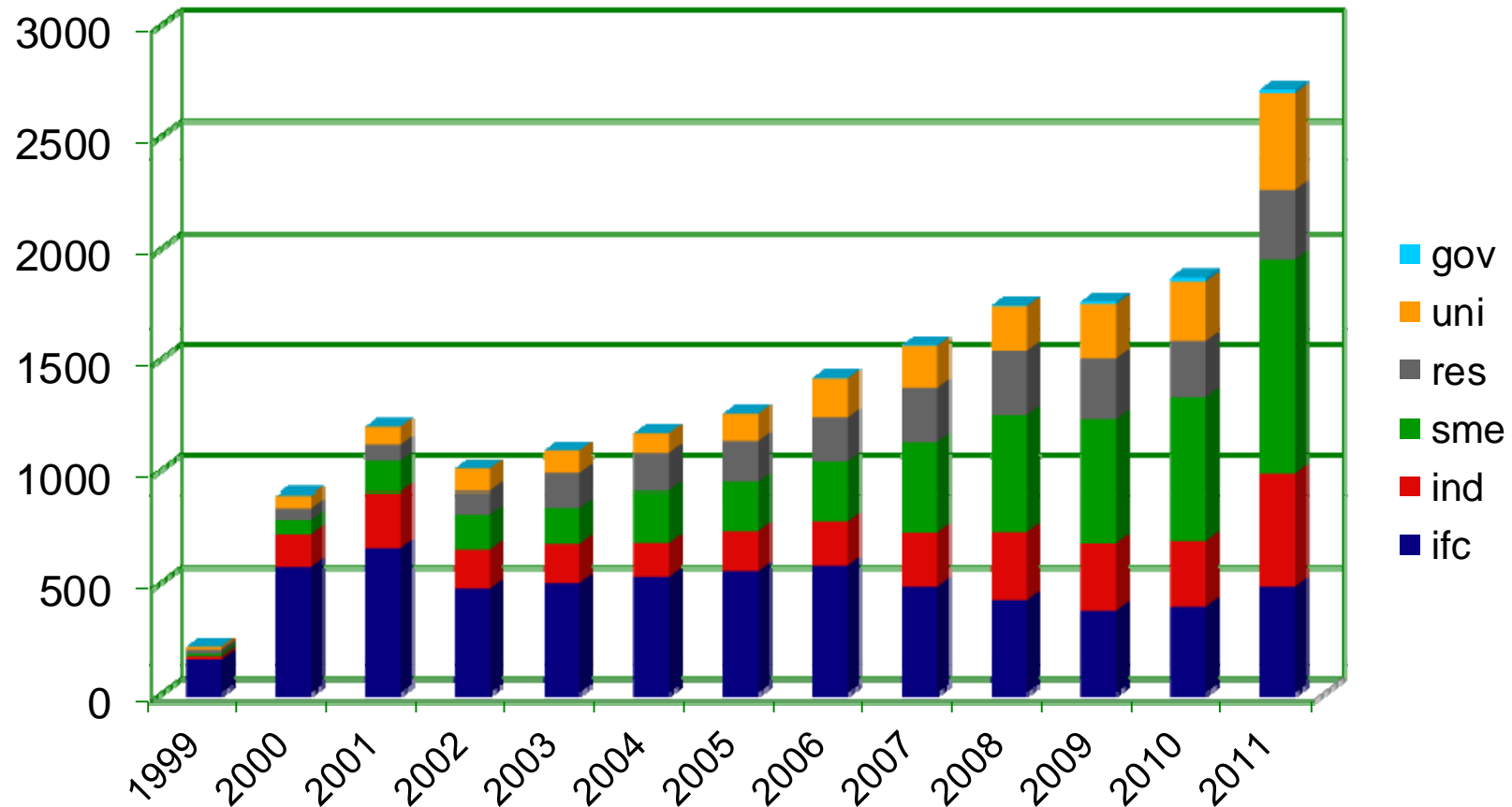


## Mission & Ambition

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- Contribute research excellence to Europe's competitive software-intensive systems and services
- Combine research excellence with innovation
- Deliver tangible results
- Address societal needs
- Contribute to European competitiveness and well-being through ICT-based innovation

# The growth of our community person years per partner type



# Successful and promising key areas

- High Definition TV
- Systems & Software Engineering
  - Product line engineering
  - Agile Innovation
  - Testing
- Automotive Open System Architecture: AUTOSAR
- Digital media
- **High Performance Computing**
- Web of Objects
- Service creation and management
- Healthcare and wellbeing
- Mobile NFC services
- Energy efficiency
- Ambient intelligence in the Home domain



# ITEA 2 PO days 2009 – Istanbul

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*Contributing research excellence and innovation to Europe's competitive  
Software-Intensive Systems and Services*

**ITEA2**  
Project Outline  
Preparation Days  
2010



*Berlin*

1-2 February 2010



# ITEA2 Project Outline Preparation Days 2011



Contributing research  
excellence and  
innovation to  
Europe's  
competitive  
Software-  
Intensive  
Systems  
and  
Services

Paris  
15 & 16  
February



FORUM ON TECHNOLOGY FOR EUROPEAN ADVANCEMENT





# 12 YEARS *of* ITEA

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Achievements & results of the EUREKA programmes ITEA & ITEA 2



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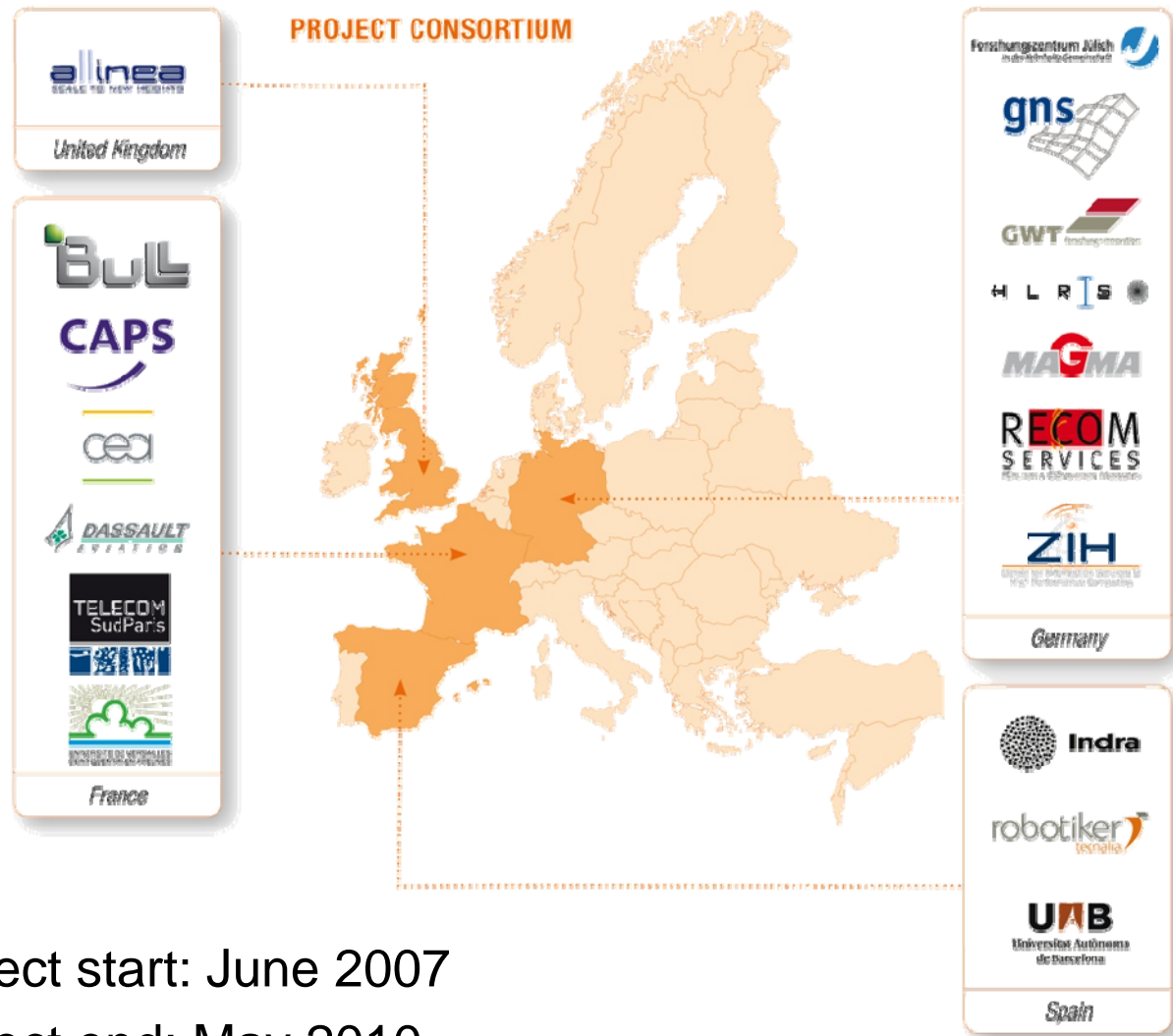
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## PARMA, a gold award winner on parallel-programming for multi-core architectures



# ParMA: parallel-programming for multi-core architectures in HPC and simulation



- Project start: June 2007
- Project end: May 2010

# ParMA

## Parallel programming for multi-core architectures

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# // ParMA

- The ParMa project developed advanced technologies to exploit the power of multicore architectures, delivering substantial performance improvements in:
  - hardware: e.g. bullx, named as **world's best supercomputer** by HPCWire (November 2009), partly optimised by ParMA
  - tools: e.g. the **UNITE package** developed in ParMA makes it possible to install and use the tools as a powerful, comprehensive and integrated set of functions.
  - applications: simulation in combustion, casting, and metal forming.


# ParMA

## RECOM an SME in combustion simulation


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RECOM Services GmbH – Business Area

Computer-Aided combustion optimisation in fossil-fueled power stations



Dr.-Ing. Benedetto Risio – RECOM Services GmbH

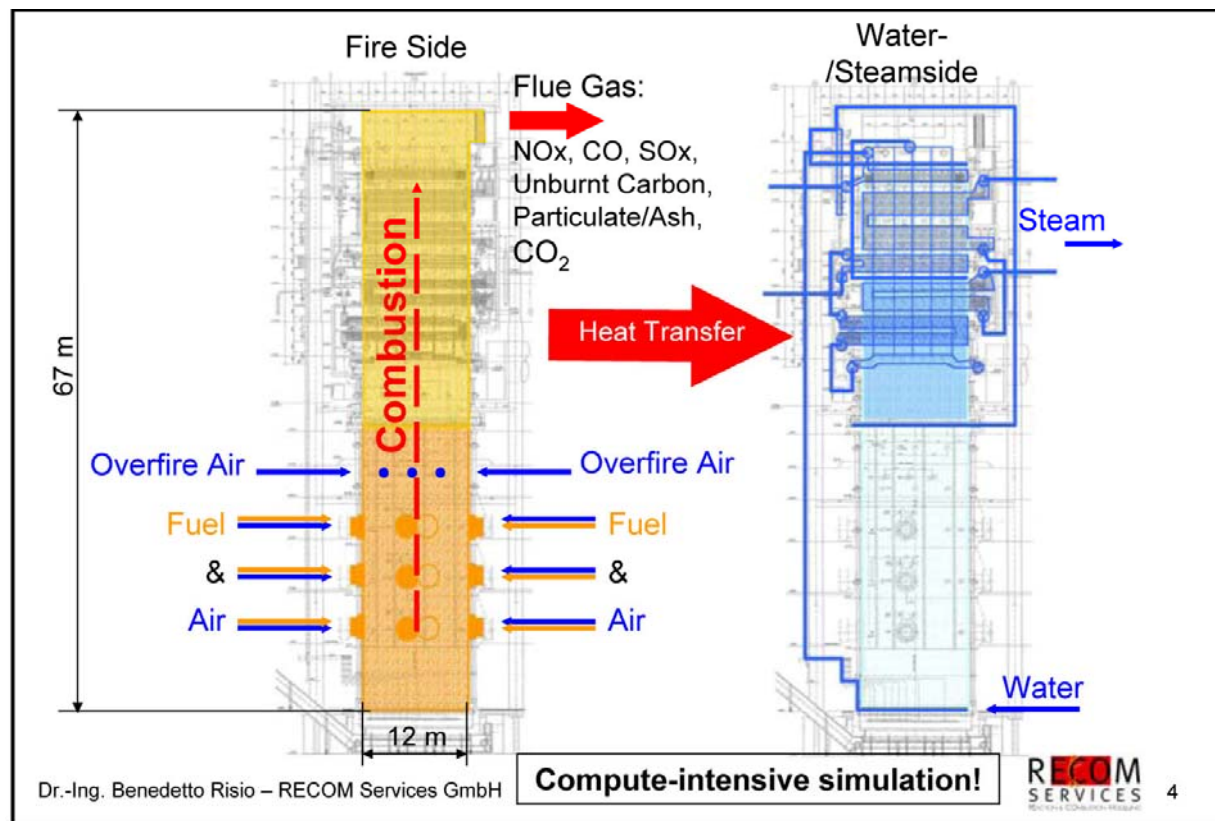


3

# ParMA

## Combustion simulation

Schematic overview of power generation in fossil fueled power stations





# ParMA

## ParMA results in combustion simulation

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Since 1999 RECOM Services commercially applies 3D-combustion modelling for minimizing operating costs and technical risks in industrial furnaces and boilers. The company offers these engineering services to the power and process industry.

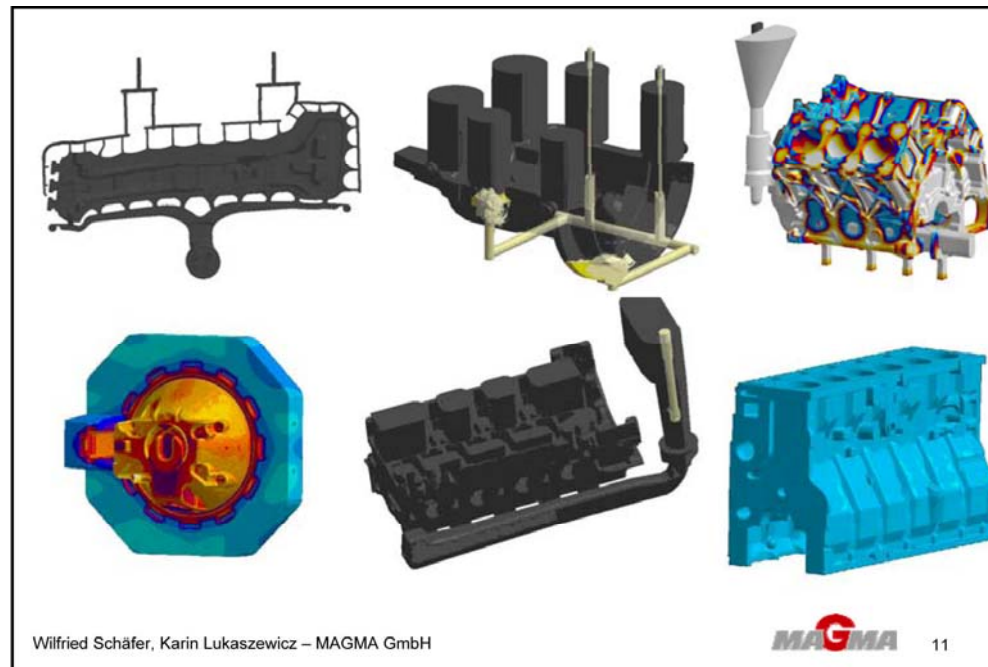
- ParMA resulted in a generic algorithm for an automatic 3D-combustion optimisation in a plant that involves billion possible combinations of parameters.
- As a result it is possible to reduce fuel consumption.
- Thus saving around €125,000 a year, while **reducing CO<sup>2</sup> emission by 16,000 tonnes a year**

# ParMA

## Casting simulation: a core innovation

Casting process simulation has helped to put the German foundry industry in the global vanguard in terms of productivity and quality:

- 87,000 employees in 600 foundries
- Revenues of 14 billion euro
- Germany is #1 in Europe and #5 world wide



# ParMA

## MAGMA an SME in casting simulation

MAGMA offers engineering services for the design and optimisation of casting components and casting processes.

MAGMA models the whole production process, starting with filling of the mould, solidification and cooling, heat treatment and machining, including the development of stresses.

### MAGMA software MAGMASOFT

- has become an industry standard world wide
- is used by 1100 companies in 51 countries
- through PARMA the runtime of the complete simulation is reduced by 23 %

- **MAGMAfill**
  - Optimisation of the MPI communication with Scalasca
  - Replace collective by asynchronous communication
  - Overall MPI runtime cut by 3200 seconds (almost by 50%)
  - Overall runtime of the complete simulation reduced by 23%.
- **MAGMASolid**
  - Integration of a new linear equation solver and optimisation with Scalasca
  - Optimisation of the CG-Solver with MAQAO
- **MAGMAstress**
  - Optimisation of the communication with Scalasca
  - MPI time approx. reduced by 50%

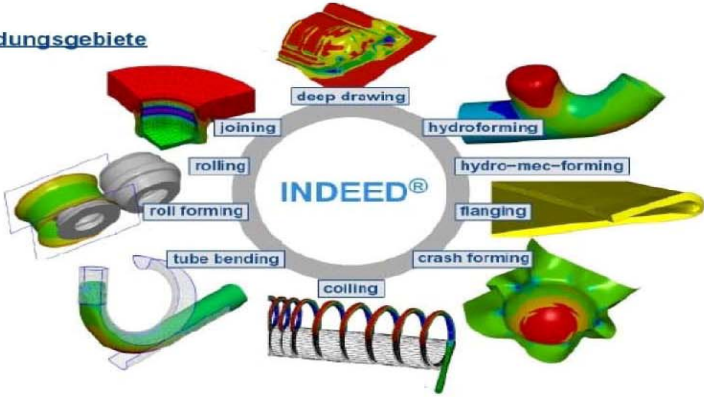
# ParMA

## GNS an SME in metal forming simulation

GNS provides engineering services and software products mainly for customers in the automotive industry.


With their INDEED software system they offer a unique range of innovative high precision calculation models for the numerical simulation of forming processes.

Anwendungsgebiete



- Implicit Finite Element program for the simulation of metal forming processes.
- Vectorized data structures (Cray, NEC).
- Shared memory parallelism with OpenMP pragmas (since 2000).
- Distributed memory parallelism using MPI standard (started in 2005).

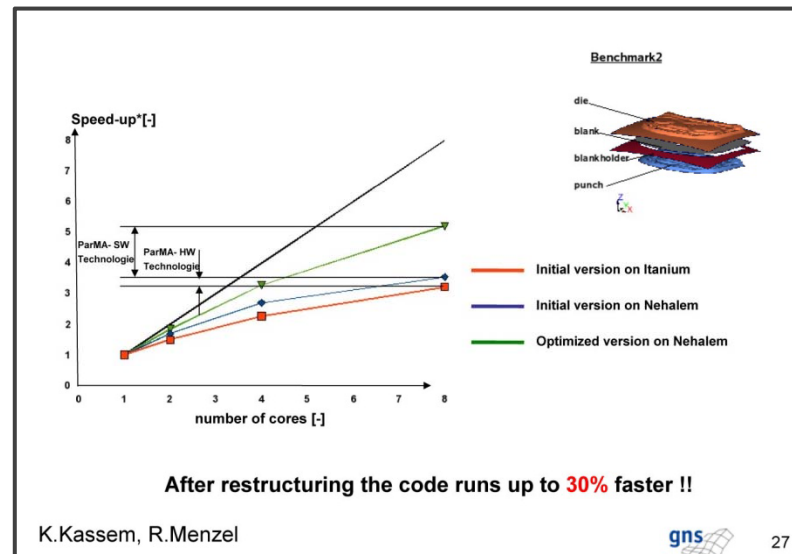
K.Kassem, R.Menzel


22

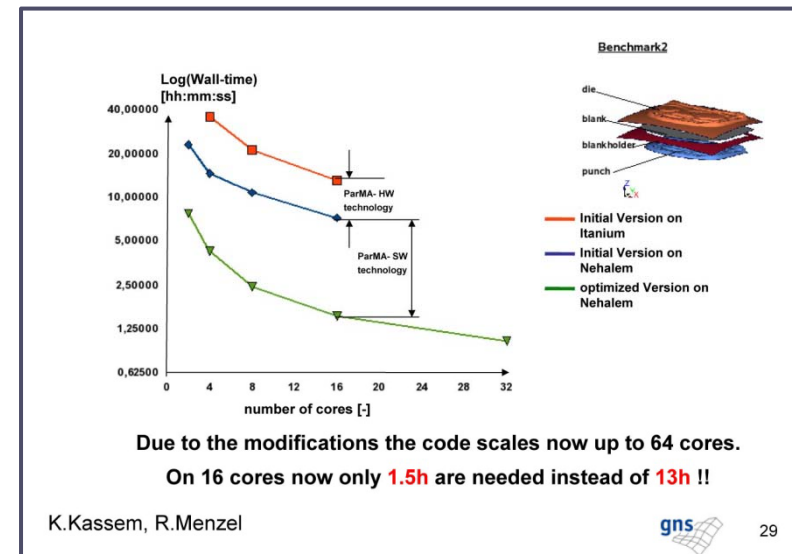
# ParMA

## ParMA results in metal forming simulation

### OpenMP version: performance gain



### MPI version: performance gain





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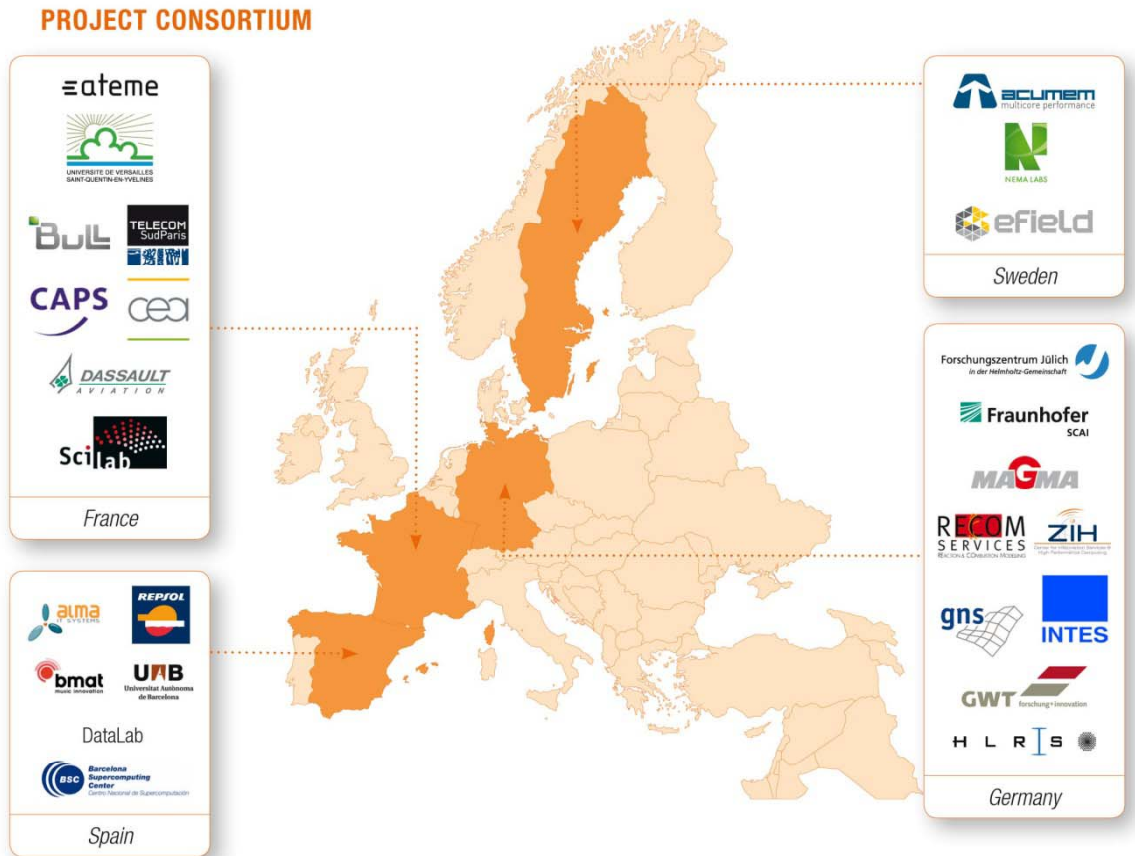


**H4H: hybrid architectures for high performance computing**

**HIPIP: high performance image processing in medical applications**



# H4H hybrid architectures for HPC



- Project start: June 2010
- Project end: May 2013

# H4H

## Hybrid4HPC

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The objective of H4H is to develop a highly efficient hybrid programming environment for heterogeneous computing clusters, the basis of latter-day supercomputing.

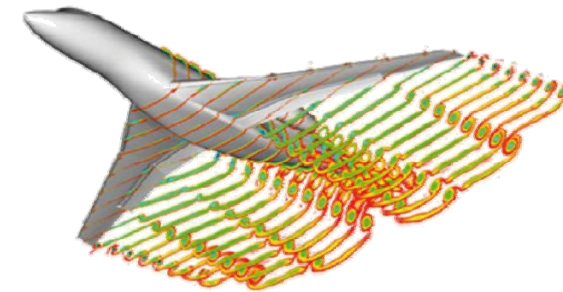
- New **hybrid heterogeneous architectures** are providing even greater power, but need expertise in a wide range of programming models, methods and tools to take full advantage of them.
- The H4H project is developing a **hybrid programming environment** that will enable the European research and industry to compete globally in the strategically important HPC market.



# H4H additional application domains

## aircraft design

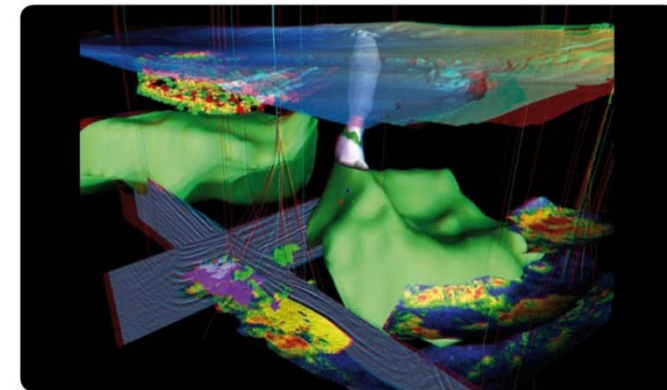
Dassault Aviation will consider several key numerical kernels of their Computational Fluid Dynamics (CFD) software to be studied with the H4H technology.



*CFD-based simulation of vortex shedding behind a Falcon during take-off phase. Courtesy of Dassault-Aviation, France*

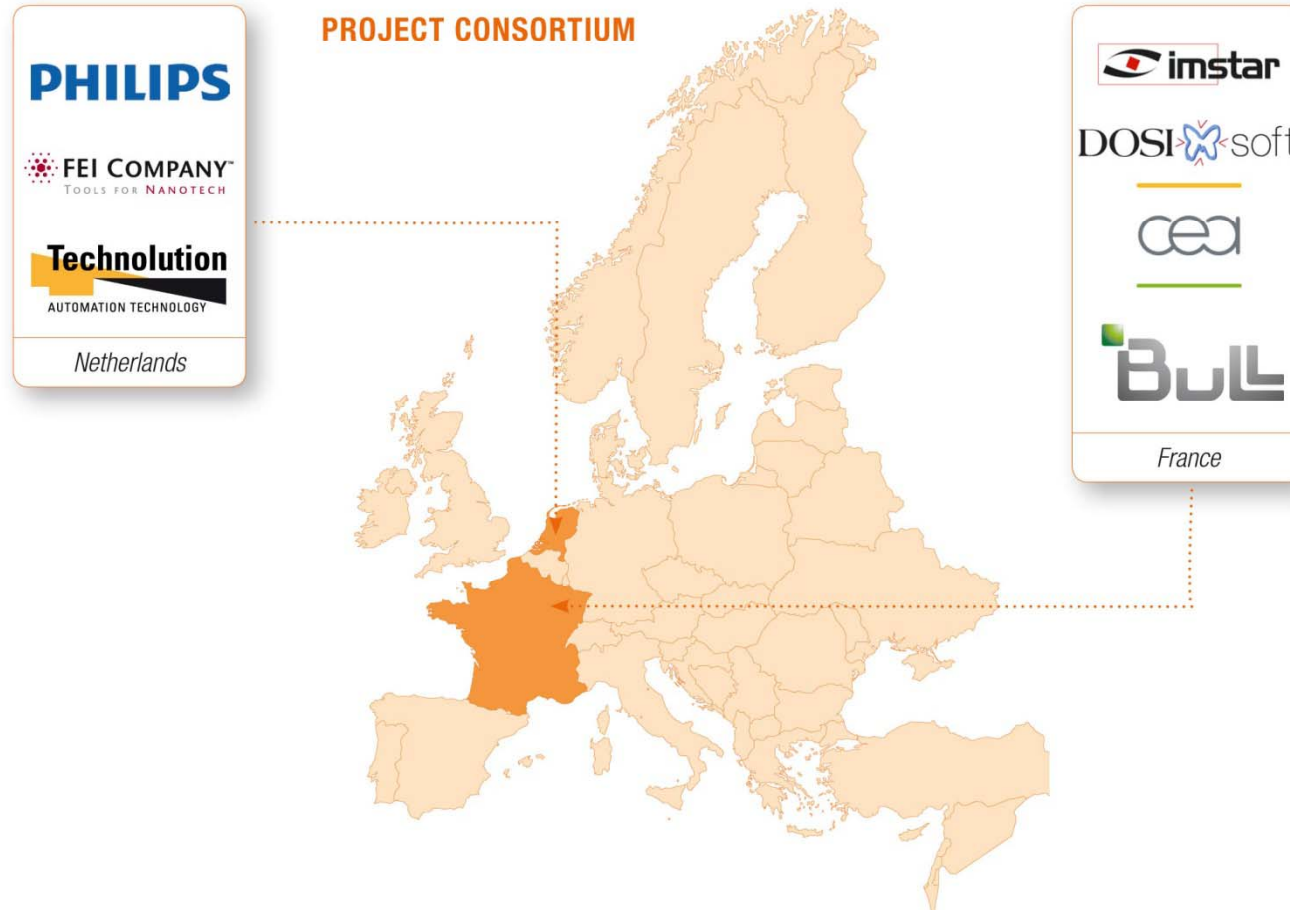
## seismic imaging and reservoir simulation

REPSOL will develop reservoir simulation software for new projects and will use H4H as a proof of concept.



*3D picture of the subsurface in the Gulf of Mexico (The Geological Society)*

# HiPiP: high performance image processing in the medical domain



- Project start: October 2008
- Project end: August 2011

# HiPiP

## high performance image processing

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HiPiP is setting out to obtain high throughput image processing of often very large and heterogeneous data sets.

HiPiP is addressing 4 main areas:

- Computer-aided surgical procedures in minimal invasive surgery
- Computer-aided diagnosis through detailed brain imaging
- Real-time radiotherapy simulation
- Early detection of disease





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## ITEA a sustainable eco-system for research and innovation in high performance computing



# Joint declaration from EUREKA Chair and the Clusters, Jerusalem 22 June 2011

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The EUREKA Chair and the Clusters state together that:

- The Clusters are the core engine for industrial innovation and economic growth. They have a prominent and active role to play in bringing innovation to the market.
- The Clusters have created with their partners (large companies, SMEs, research organisations, academia), and with the strong support of Public Authorities, an **important organisational ecosystem and a unique network for pan-European cooperation.**
- EUREKA Clusters are key instruments to reach the objectives set in the EUREKA Road map.

## ITEA 2 Board statement on ITEA 3

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- The EUREKA framework with its ITEA 2 cluster programme is a unique mechanism that supports innovation partnerships in which competitive advantages can be developed in international partnerships between large industries, SMEs, universities and research institutes.
- All this will still be true beyond the last call of ITEA 2 in 2013.
- In order to secure continuity in our business needs, the industries want to guarantee continuity through the establishment of ITEA 3.



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