

NA3 Dissemination

Brussels

30 March 2011

Partners

- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, CIEMAT, Spain
- Chalmers University, Sweden
- IPP Max Planck, Germany

Deliverables & Milestones

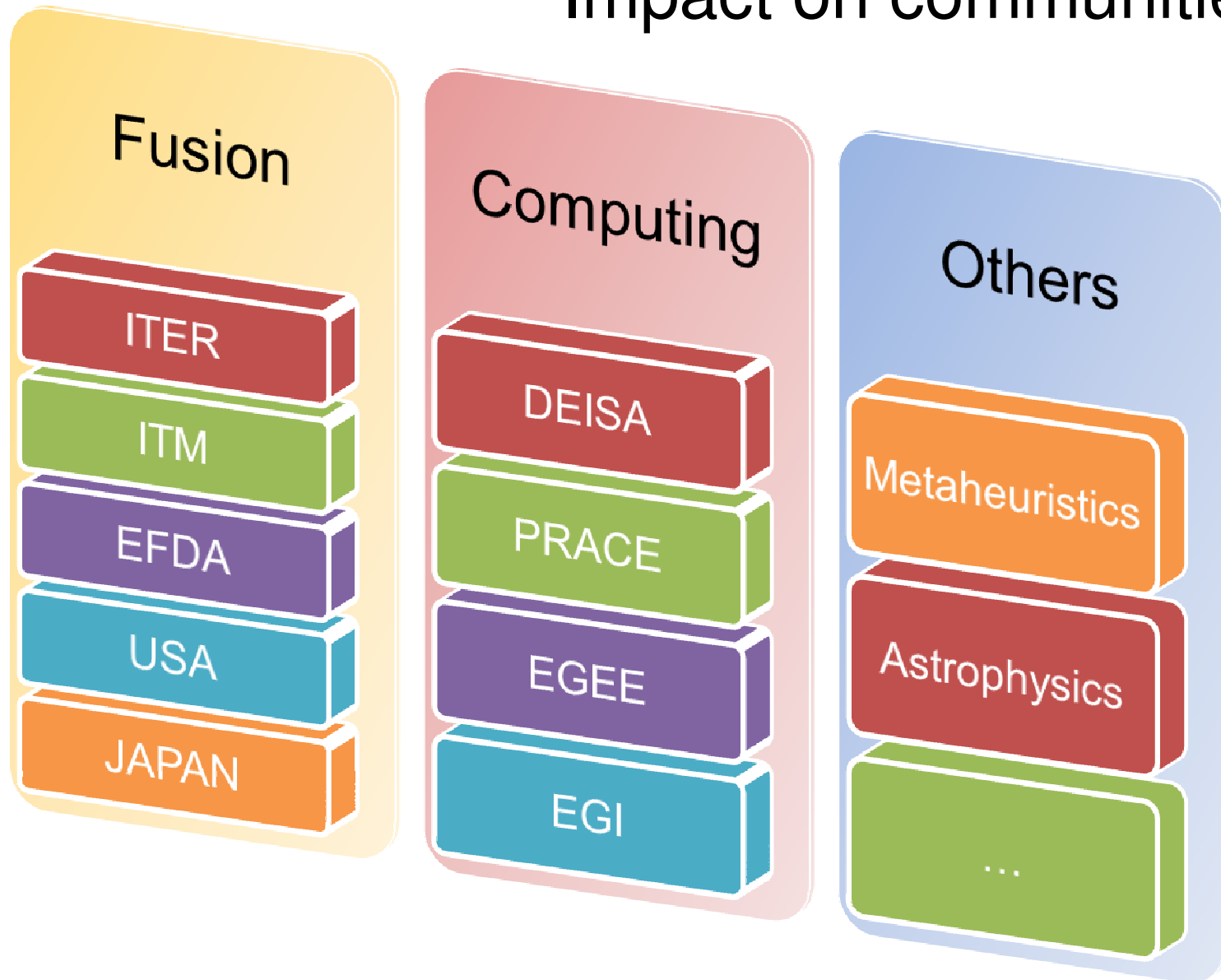
- Deliverables
 - M1 Dissemination Plan
 - M2 Project Website
 - M12 Progress Dissemination Report
 - M 30 Final Plan for Using and Disseminating Knowledge Foreground
 - M18 & M24 Update-Review of *Dissemination* Plan DN3.1
- Milestones
 - M1 Website
 - M2 Templates publication

NA3 activity

“Dissemination will be essential in identifying, reaching and providing an accurate image of the project and its potential use to the prospective users.”

From DoW

Impact on communities



Global Dissemination Strategy

- The foundation of the dissemination activity has been based on the establishment of a **Global Dissemination Strategy**.
- Creation of a **corporate image**.
- Provide a clear identification of the **branch EUFORIA**.

Global Dissemination Strategy

- Support and foster the **external communication**.
 - Web site as repository of the highlight of the project: publications, companion guides, developments, etc
 - Creation of entries in different languages in Wikipedia

The screenshot shows the Wikipedia page for the EUFORIA project. The page is in Spanish and features a search bar, a navigation menu, and a main content area. The main content area includes a description of the project, a table of contents, and a diagram illustrating the project's timeline and key milestones. The diagram shows a flow from 'Grid' to 'Fusion' to 'HPC', with various sub-tasks and milestones marked with dates and labels.

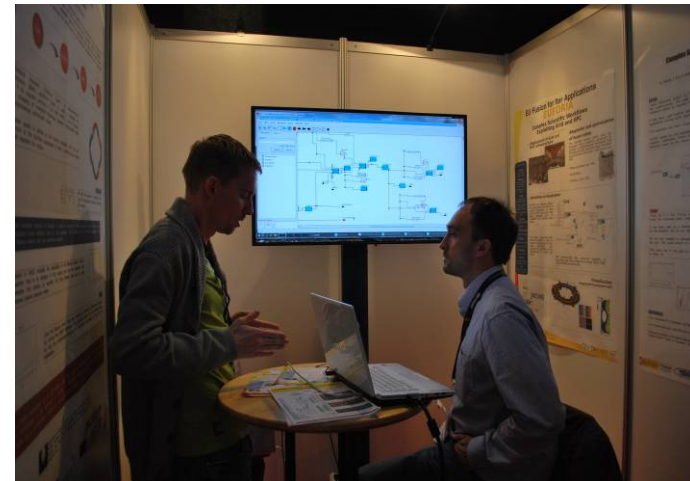
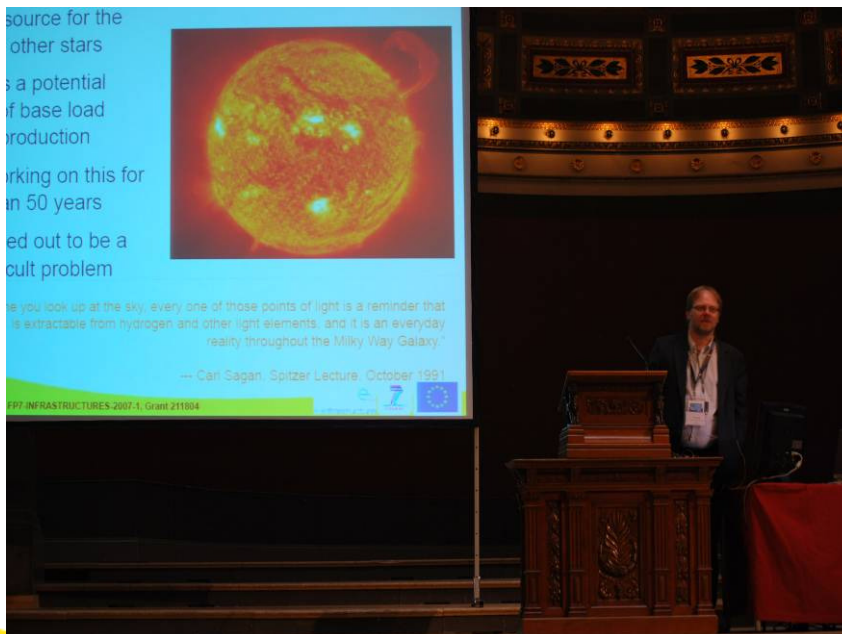
Global Dissemination Strategy

- Training activities
 - GridKA 2009 Karlsruhe
 - EFDA/ITM Jülich 2009
 - ITM Lisbon 2010
 - GoTIT Garching 2010



Global Dissemination Strategy

- Events
 - 5th EGEE User Forum 2010
 - ITM Lisbon 2010
 - Supercomputing Conference 2009 & 2010
 - ECRI 2010 Barcelona.



Global Dissemination Strategy

Complex Scientific Workflows exploiting Grid and HPC

Determining plasma confinement in TJ-II stellarator

M. Owsik, T. Zik, F. Casas, A. Gómez-Iglesias, M. Pionerik

Several characteristics of the plasma can be used to determine the quality of its confinement. The main are the equilibrium, the linear stability, the ballooning criteria and the resistive (NC) transport. Here we present a workflow that, given a configuration of the TJ-II stellarator, performs a parameter scan taking into account these 3 characteristics. With them, we wanted to optimize the confinement in the stellarator considering the NC transport.



WMEC (Variational Moments Equilibrium Code), a three-dimensional magnetohydrodynamic (MHD) equilibrium solver is used to calculate the configuration of the magnetic surfaces in TJ-II. WMEC is a sum of squares is minimized, consisting of weighted differences between physics-based target values and independent configuration values.

The configuration space is defined by the control variables, which are the Fourier harmonics of the cylindrical coordinates R and Z describing the shape of the external magnetic flux surface.



$$\sum_{m,n} \left(\frac{\partial \chi}{\partial \alpha_{mn}} \right)^2$$

We use this expression to determine how good the configuration balances with respect NC transport.

WMEC and the evaluation function to consider it could be enough for single applications, but if we want a more complete optimization, more functions have to be calculated. That is why we run, as another component of the workflow, the Mercator criterion and the ballooning stability.

MERCATOR
The last version of WMEC includes the calculation. What we perform here is an analysis of the value determine whether this criterion is reached. For it specify a desired plasma pressure value.



This is a single evaluation of our parameter scan. The parameters to be scanned or modified must be specified prior to a configuration could be complete.



Complex Scientific Workflows exploiting Grid and HPC

Astra - Truba. Mixed HPC - Grid workflow

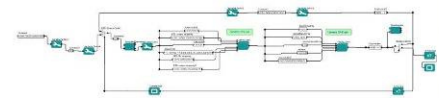
M. Owsik, T. Zik, F. Casas, A. Gómez-Iglesias, M. Pionerik, J. L. Vázquez-Poletti, D. López Bernal, A. Casas

ASTRA (Automated System for Transport Analysis) [1] is a transport code that runs on a shared memory computer or any supercomputer. The code is used for transport simulations of tokamak and stellarator plasmas. It solves difficult problems subject to magnetic fusion plasmas.

It has been used together with other applications by means of developing new modules of the code which called other applications sharing some values through shared memory. This is how it has been typically used with Truba.

This approach has been changed so the code can be used with Kepler.

ASTRA needs for the calculations different models for the process and steps of heat and particles, as well as for its transport coefficients. These models are very complicated and CPU-time expensive to be calculated. For instance, if absorbed power by the plasma is estimated as a heat source for ASTRA.

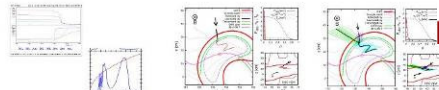


TRUBA [2] is a Ray Tracing code that calculates the trajectories and power deposition of a preset number of rays, i when the microwave beam enters inside the reactor to be deposited.

It has been used as a module of Astra, sharing some variables through shared memory. This scenario has been changed so the workflow can be run with Kepler.

All the rays needed to simulate the beam are independent and can be estimated in different computational resources in the grid. The usual amount of rays needed to simulate the beam is between 100 and 1000.

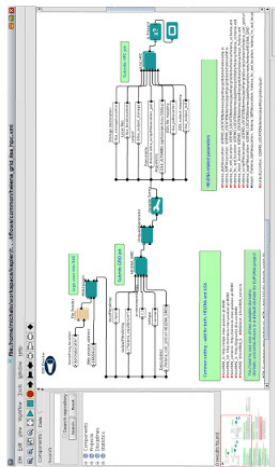
This code runs in the grid. It uses some input files coming from the Astra execution on HPC and will return some data to Astra [3].



REFERENCES
[1] M. Pionerik, P. N. Yushman, ASTRA - Automated System for Transport Analysis. 14th Plasma Physics Conference, IPP Report, IPP 546, February 2002.
[2] M. Tschentscher et al., 36th EPS Conf., ECA 27 A, 2003.
[3] Dynamic simulation of the Electron Beam Ion Heating under NBI conditions in TJ-II plasmas, A. Casas, D. López Bernal, F. Casas, M. Owsik, J. L. Vázquez-Poletti, F. Imshin, E. Ascaso, J. M. Reyes, and M. Tschentscher. Contributions to Plasma Physics, in press.



Complex Scientific Workflows Exploiting Grid and HPC



EUFORIA aims to demonstrate the feasibility of having a scientific workflow engine to launch jobs to the GRID and to HPC facilities. EUFORIA enables the necessary middleware tools to make possible the submission of jobs to the Grid and to HPC systems using Kepler as workflow manager.

The EUFORIA project collaborates with DEISA and Egee in order to ensure a wide adoption of the tools developed and deployed by EUFORIA in the infrastructure of DEISA and Egee.

We demonstrate the technical feasibility of launching jobs from Kepler running in the user's desktop to a mixed DEISA and Egee.

You can find more information in the EUFORIA booth.

EU Fusion for Iter Applications

EUFORIA

Complex Scientific Workflows Exploiting Grid and HPC

Deployment of Grid and HPC infrastructure

Adaptation and optimization of fusion codes

The EUFORIA project works with the European fusion modelling community to provide a comprehensive framework and infrastructure for core and edge transport and turbulence simulation, linking grid and HPC.

- Mixed workflows Grid - HPC
- Exploitation
- Training in Grid - HPC

Workflow orchestration

EUFORIA has adapted Kepler to enable fusion modellers to submit simulations to both grid and HPC resources from their desktops and to visualize the results they obtain.

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We demonstrate the technical feasibility of launching jobs from Kepler to a mixed DEISA, Egee and EUFORIA environment.

Visualization

Integrated visualization tools

- FINLAND**
University of Jyväskylä
- UNITED KINGDOM**
Rutherford Appleton Laboratory
- FRANCE**
CEA-CEM
- SLOVENIA**
Jozef Stefan Institute
- POLAND**
The National Centre for Nuclear Research
- ITALY**
INFN-FUSION



EUFORIA

Global Dissemination Strategy

EU Fusion for Iter Applications

EUFORIA Heterogeneous Work-Flows Grid - HPC

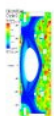
The EUFORIA project works with the European fusion modelling community to provide a comprehensive framework and infrastructure for core and edge transport and turbulence simulation, linking grid and high performance computing.

Who we are
 CHINA: Chongqing Institute of Technology
 GERMANY: Max-Planck-Gesellschaft für wissenschaftliche Forschung und Technologie
 ITALY: Consiglio Superiore de Investigaciones Cientificas
 JAPAN: Centro de Investigaciones Energéticas, Medio Ambientales y Tecnológicas
 KOREA: Institute of Space and Aeronautics Technology

Adaptation and optimization of fusion codes

The ported applications have been used in order to make up complex workflows, in homogeneous environment and heterogeneous, grid-HPC, environments. These complex workflows simulate more detailed the physics occurring in ITER. The simulations improve the understanding of the underlying physics in the device.

The coupling of different computational codes requires a large element of coordination, structured data management and resource scheduling to be performed efficiently. In Euforia, Kepler workflow engine is used to manage applications workflows.



Heterogeneous Work-Flows

EUFORIA has adapted Kepler a workflow orchestration tool, to enable fusion modellers to submit simulations to both grid and HPC resources from their desktops and to visualise the results they obtain.

The project collaborate with DEISA and EGEE-III in order to ensure a wide adoption of the tools developed and deployed by EUFORIA in the infrastructure of DEISA and EGEE-III.

We demonstrate the technical feasibility of launching jobs from Kepler to a mixed DEISA, EGEE-III and EUFORIA environment.

Integrated visualization tools

In order to perform an end-to-end numerical simulation, several complex codes will need to be coupled. But also it is necessary to provide easy and efficient access to these tools and the ability to efficiently make many runs with different parameters they will be integrated as actors in the scientific workflow package Kepler.

There is also a need for unified visualization support so that scientists can use it without having to learn to use specific tools for each code that has been integrated.

Codes Ported to HPC

- BITI
- CENTORI
- ELMIRE
- ESOL
- GENE
- ISDEP
- SOLPS
- TYR

Codes Running in Euforia Grid

- ERENE
- GEN
- BITI
- Helepa
- MOISA
- ISDEP
- DAE
- VMEC

LECTURES-2007-1, Slide 211804

EU Fusion for ITER Applications

EUFORIA Success Stories on Fusion Applications

Adaptation and optimization of fusion codes

Within the fusion community, a large number of codes are in use to simulate various aspects of the plasma behaviour. With very few exceptions, these codes have been written by physicists with an emphasis on the physics, with a much smaller emphasis on using the latest technologies available from the computer science community. Euforia is improving this scenario increasing the performance of the existing codes, adapting to Grid and/or HPC platforms, or improving the parallelization of them.

Adaptation of fusion codes to HPC

Codes ported to HPC

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Adaptation of fusion codes to Grid

Codes running in Euforia Grid

- ERENE
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- MOISA
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- DAE
- VMEC



The codes have been ported to three supercomputers in order to demonstrate the feasibility of running these programs widely within the European fusion community. This represents a major advancement in the use of the codes, used by a exclusively

The criteria to select the applications ported to the grid are two-fold. On one hand, the structure of the code must be suitable to run efficiently in distributed architectures, like

EU Fusion for Iter Applications

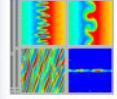
EUFORIA Heterogeneous Work-Flows Grid - HPC

Visualization activity is aimed at providing a set of unified visualization tools for the codes integrated in the platform. Some of these tools will be used for post-processing of the data generated by the codes, others will be integrated into the Kepler Workflow to allow visualization and monitoring of the results during the execution of the workflow. The visualization tools developed in JRA4 will be based on existing open source software like Python, numpy and matplotlib on the one hand and VTK within Vist on the other hand.

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Objectives

- To provide a set of unified visualization tools available within the Kepler workflow to visualization data remotely available on a computational Grid.
- To implement more powerful visualization tools that can be used to post-process the computed data.
- To develop a new lossy variable based data compression tool in order to handle the very large amount of data generated by some of the codes.
- To develop specific visualization tools for a 4D or 5D distribution function.



Achievements

Python is now able to read and write fusion data through the UAL. We have developed the Python bindings for UAL which make possible the read and write entire CFD UAL users with little background in computer science can analyze interactively their UAL database with python interface.

We provide this ability for Kepler users through a Python actor to visualize the results of a workflow during its execution. This actor is particularly useful when it comes to evaluating expression that use variables (CPDs) passed by others actors.

For large dataset visualization we have developed a lossy compression scheme and a tool for interactive exploration of multidimensional datasets. The PlasmaViz tool combines a method of visualization through multiple 2D slices and the compression libraries.

We also decide to integrate these tools in the Vist software as a plugin. Then the user interface will be provided by Vist, which ensure ease of use and a good level of maintainability.



EUFORIA FP7-INFRASTRUCTURES-2007-1, Slide 211804

EU Fusion for ITER Applications

EUFORIA

Building comprehensive framework and e-infrastructure to the fusion modelling community

Who we are

SWEDEN
 Chalmers Tekniska Högskolan (KTH)

GERMANY
 Max-Planck-Gesellschaft für wissenschaftliche Forschung und Technologie

SPAIN
 Consejo Superior de Investigaciones Cientificas
 Centro de Investigaciones Energéticas, Medio Ambientales y Tecnológicas
 Barcelona Supercomputing Center

FINLAND
 CSC - IT Center for Science Oy
 Abo Akademi

UNITED KINGDOM
 EPCC, University of Edinburgh

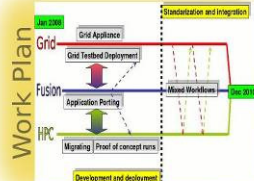
FRANCE
 Commissariat à l'Énergie Atomique
 Université de Strasbourg

SLOVENIA
 Univerza Ljubljana

POLAND
 Polish Supercomputing and Networking Center

ITALY
 Ente per le Nuove Tecnologie, Energia e Ambiente

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EU Fusion for ITER Applications

EUFORIA

Heterogeneous Work-Flows Grid - HPC

Deployment of Grid and HPC Infrastructure



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EUFORIA

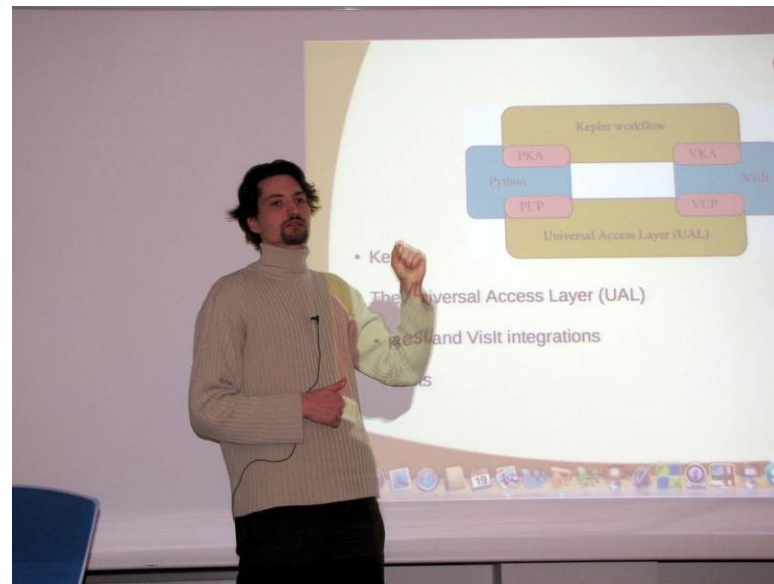


Global Dissemination Strategy

- Strong commitment with the organization of the adequate **events** → disseminate the outcomes of the project.
 - Supercomputing conf. 2010 “Birds-of-a-feather on High-Performance Scientific Workflow”.
 - “EU-US Workshop on software Technologies for Integrated Modelling” Gothenborg, 2010.

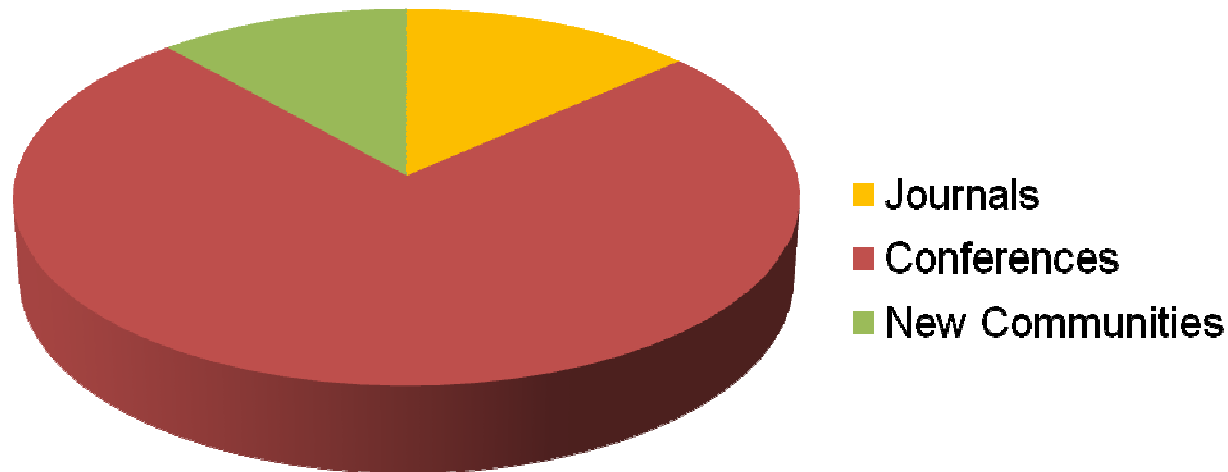
Global Dissemination Strategy

- Special session on “Grid and High Performance Computing for Nuclear Fusion Applications” steers by EUFORIA project in **Euromicro PDP 2010 and 2011**.
- EUFORIA is engaged beyond the lifetime of the project.



Global Dissemination Strategy: external

- Publications:
 - Success case in the dissemination activity.
 - A total of **45 peer-reviewed papers** in conferences (**6 outside fusion**).
 - A total of **7 journal papers published**.



Quality Criteria

Website



Use of internal wiki



Statistical of access



Mailing lists



Project meetings



Open days



Contact database



Access to training courses



New communities

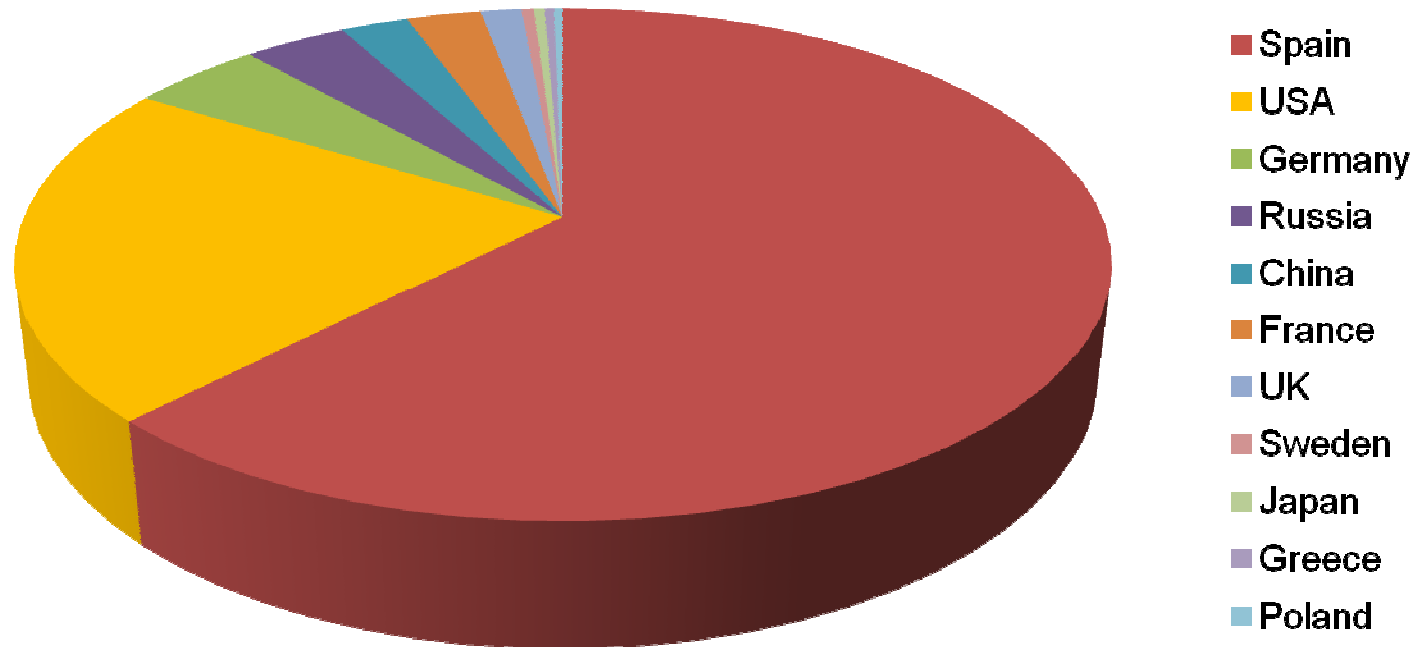


Press cuts



Website

Websites accesses by country



Internal Wiki	External Wiki
11,561 views	188,768 views
1,722 edits	1,719 edits
1,765 pages (58 legitimate)	1,498 pages (26 legitimate)

Long term sustainability

- Material developed with the lifetime of EUFORIA will be valuable **beyond the end of the project** (mainly companion guides, promotional material or software developments).
- The web will act as **repository** during the two years after the end of the project.
- Besides, **updates** of relevant information (i.e. deliverables) will be performed during this period.

Thank you

EUFORIA

EUFORIA FP7-INFRASTRUCTURES-2007-1 Grant 211804

