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CINECA EPCC BSC HLRS IDRIS SARA PSNC PARALLAB TCD CASPUR NTUA

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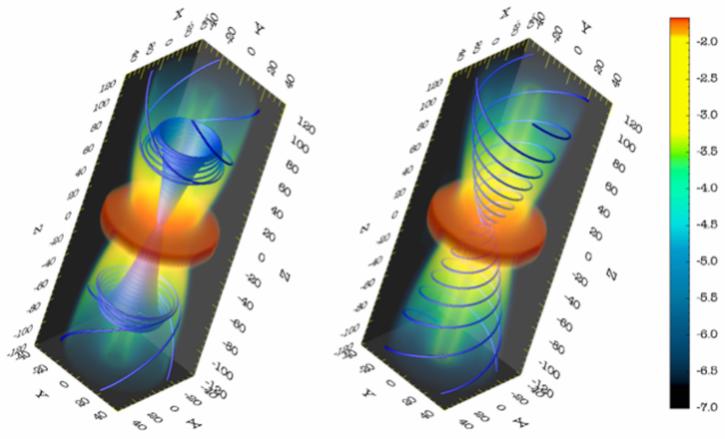
Claudio Zanni

A consistent part of my Ph.D., achieved at the University of Torino in March 2005, dealed with MHD simulations of the acceleration process of Herbig-Haro jets from magnetized accretion disks around young stars. Anyway, I was not completely satisfied with the results presented in the thesis. On one hand, I needed to perform large scale simulations which could follow the evolution of the accretion-ejection system for long timescales with an adequate spatial resolution. Moreover, the number of parameters which characterize the problem required to carry out several simulations.
On the other hand, I was looking for opportunities to establish contacts with researchers with a solid experience on the subject in order to improve my physical insight.
The HPC-Europa project offered me the perfect chance to accomplish my tasks. I applied for a 13 weeks research visit at IDRIS in Paris, which took place from May to July 2005. There I had the possibility to access ZAHIR, an amazing 1024 processors IBM SP4: the excellent technical and logistical support offered by all the IDRIS team, Nathalie Matsimouna and Marc Rugeri in particular, allowed me to install the code (FLASH, University of Chicago) and run the first simulations just after a couple of days after my arrival. Moreover at the Observatoire de Paris –Meudon, which I chose as host department, I found an exciting and stimulating scientific environment, thanks mainly to the availability of Prof. Christophe Sauty and Dr. Zakaria Meliani.
In the simulations performed at IDRIS I studied in particular the effects of the magnetic diffusivity operating in the disk, including the issues of an anisotropic resistivity and of Ohmic heating. The powerful resources available at IDRIS turned out to be crucial for the attainment of my results:
the simulations had a spatial resolution around five times higher than the one adopted in similar works available in literature, showing how strongly the dissipative phenomena depend on numerical resolution. Moreover the simulated timescales were around four times longer than what I was able to do in previous test cases. Two examples of the results obtained are shown in the picture, where I show a 3D rendering of density maps with sample magnetic field lines wrapped around a magnetic
surface superimposed.
The HPC-Europa visit turned out to be an extremely fruitful experience: besides of providing scientific results which are going to be published very soon, it allowed me to live and work in one of the most exciting European capitals. I would definitely advise any researcher working on computation issues to apply for an HPC-Europa visit: to have access to the top European computing centers is an opportunity not to be missed.

Curriculum

Dr. Claudio Zanni is currently a post-doctoral fellow at the Laboratoire d'Astrophysique de l'Observatorie de Grenoble, France. He took his degree (2001) and the Ph.D in Physics (2005) at the University of Torino, Italy. His research interests deal mostly with the numerical modelling of accretion disks and jets in different astrophysical settings.



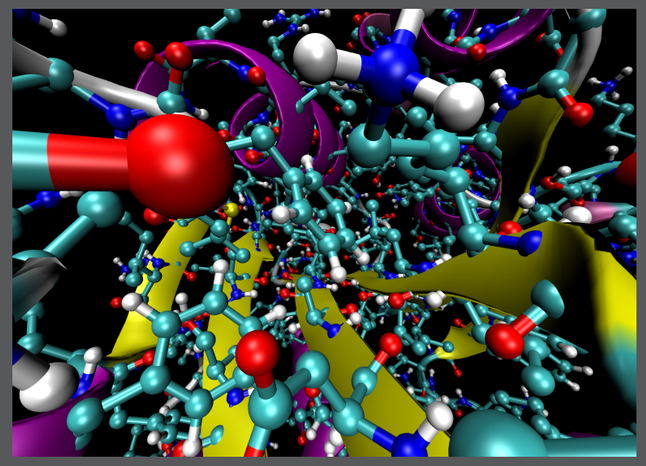
3D rendering of density maps for two simulation performed. Sample fieldlines along a magnetic surface are also plotted

HPC-Europa

Pan-European Research Infrastructure on High Performance Computing

HPC-Europa is now reaching the half of its way! During this second year, the advanced computational services, provided to the European researchers by the Access HPC Centres, have been increased a lot allowing to noteworthy push the scientific progress: 305 applications were made to the programme in 2005. The selection panel offered places to 222 user-projects, with an acceptance rate of 73%. These users spent some 405 visitor-months at the six different infrastructures, and used 2.395.913 Allocation Units, corresponding to more than a million of CPU hours on the supercomputers available at the six HPC centres.

To give an essay of the importance of the scientific results obtained so far with the HPC-Europa programme, this issue is completely dedicated to the experience done by the Visitors in different fields of Science.



contact

access@hpc-europa.org

CORDIS

Peter Bailey

My work at HPC Cineca, in Bologna, Italy was in the area of turbulent flow motion, studying the mixing of two decaying homogeneous turbulence fields in the absence of mean shear. Mean shear is a principal source of turbulence energy, investigations in the absence of this source allow finer fundamental mechanisms of turbulent flow motion to be highlighted, where / how the energy dissipates and mixes, and at what rates. Such interaction of turbulences is common in nature and in engineering practice, the ability to predict and to control the likelihood of turbulence in a flow would allow more efficient and effective designs in applications where turbulent mixing occurs.

This type of investigation requires a high resolution computational procedure, thus the use of Cineca's computational resources were advantageous due to the processing power available, but also the ability to store large data sets prior to post-processing.

The main parameter involved in my study was the ratio of energy between the two turbulence fields. A number of studies had been carried out in this area, both experimentally and numerically, but with differing levels of success. It was previously thought that in the absence of mean shear and of macro- scale gradient that the turbulence field remains free of turbulence intermittency. However, the current study showed that flow field becomes intermittent, and that a scaling law exists for energy ratios up to 1000. Beyond this value the turbulent penetration tends to a finite limit, with the intermittency increasing as an asymptote to a maximum at an energy ratio of infinity. The detailed datasets generated in this work have now been made available to a wider network of researchers via the iCFDdatabase. It is anticipated that further study will be carried out beyond this initial investigation. Results of this work have been accepted to be presented to the next EFMC6 conference to be held in Stockholm, 2006.

Curriculum

Peter Bailey graduated from the University of Leicester, UK, in 2005 with a Master of Mechanical Engineering degree. In his final years he specialised in the area of thermo-fluids, and spent a year of the course working on thermodynamics applications in the reactor safety division of Siemens-Framatome Advanced Nuclear Power, Germany. In 2006 he began a PhD in Computational Fluid Dynamics at the Politecnico di Torino, Italy.

Prior to arriving at the HPC centre I was a novice user of the Unix / Linux operating systems, having previously used other systems. However, with support from my fellow HPC-guests (of varying disciplines and computing experience) and assistance from the staff of Dr. Erbacci's group, I was soon able to begin submitting jobs. Indeed I was eventually able to have access to two supercomputers, IBM and Intel, which allowed me first hand experience of issues specific to each architecture.

The HPC centre itself is situated in Casalecchio di Reno, a bus ride away from the centre of Bologna. This is the perfect base point from which to explore any part of Italy, and I was able to get away from the computer screen to refresh at weekends. I would like to thank Francesca and Paola for their assistance during my stay, and the staff of Dr Erbacci's group; Roberto, Gerardo and Christiano for their patient computing support.

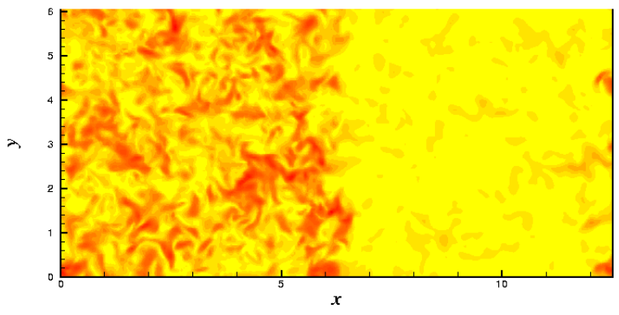
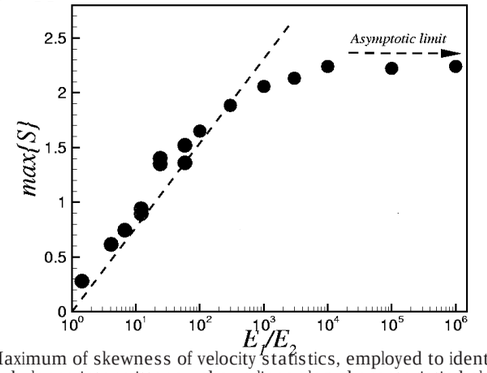


Image shows a contours of kinetic energy, high energy field on the left, and low energy on the right, separated by a mixing layer (2þ x 4þ grid).



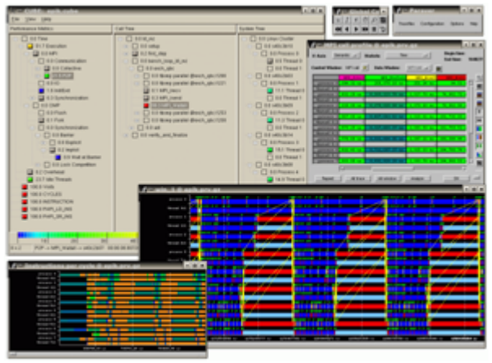
Maximum of skewness of velocity statistics, employed to identify turbulence intermittency, shows linear log characteristic below energy ratios of 1000 and an asymptotic behaviour thereafter

Bernd Mohr

I've heard about HPC-Europa in various conferences (such as ISC2005, SC05, etc.) and through email. The main reason I applied to this program was to collaborate with Prof. Jesús Labarta at Barcelona Supercomputing Center (BSC), due to his well-known research in trace analysis and his excellent research group. But only a longer visit can establish a lasting collaboration. For this reason, I applied for an extended research visit with HPC-Europa last year and got accepted immediately.
Once I agreed with Prof. Labarta to stay 4 weeks at BSC, I arrived to Barcelona where on the first day I had access to all machines in order to start with my research. My 4 weeks at BSC were successful due to my face-to-face meetings with my host and his group and we succeeded in integrating the tools in my own project (KOJAK) with the tools provided by Prof. Labarta and the HPC-Europa environment called PARAVER. Thanks to my work during the visit at BSC, I now can take measurements with my tool and export the data to PARAVER, and use my analysis tools and PARAVER to analyze the data I measured in order to get much more comprehensive results. This is an improvement for my group and Jesús' group, too. This would have never been possible without the stay in Barcelona. I think that the first step to start a successful scientific collaboration is too meet in person and I am sure we will continue with this research project. I really think that the program HPC-Europa accommodates these needs. Furthermore, I am sure we will continue this research we now started, because I already recommended this program to one of my colleagues in my research group and he will apply shortly.
I also took the opportunity to learn from BSC the special issues for performance tools which arise with applying them to very large machines such as MareNostrum. This is very important to us, now that Jülich has got the largest machine in Europe and we need to learn how to use tools on these large systems effectively. This experience and the stay here at BSC have been really important for my career as a researcher in parallel computing. However, I would not mind to have stayed longer at BSC (minimum of 8 weeks) to get more involvement with my research and really get good results from it.
The support given by both my host as well as BSC has been excellent. They helped me to find a nice apartment with an excellent location. All information provided by HPC-Europa was clear enough to understand the procedure before, during and after my visit. I really can recommend this program to the HPC community. Beyond my research, I think Barcelona is a really nice city where you can find good weather, food and nice people. I will certainly recommend it to my colleagues in Jülich. I regard these type of programs funded by EU extremely beneficial for the HPC research community

Curriculum

Dr.-Ing. Bernd Mohr has received his diploma in computer science and his doctor in engineering from the University Erlangen-Nürnberg, Germany. He is Senior Scientist at the Research Centre Juelich, the largest German national laboratory and one of the largest computing centers of Europe, where he is the leader of the group "Programming Environments and Performance Optimization". He is the inventor of the performance tool frameworks SIMPLE, TAU, and KOJAK. He is founding member and work group leader of the European Community IST working group on automatic performance tools (APART) and he is Secretary of the IBM Scientific User's Group ScicomP.



Paraver - Kojak