Pavia, September 1997

Use of Multimedia in Physics Teaching and Learning

The 1996 multimedia workshop in Munich was the first step in uniting European research efforts on this subject. It was also an opportunity to form the 'Multimedia in Physics Teaching and Learning' European Group. The second workshop was held at the University of Pavia in Italy from 8 to 10 September 1997. Its aims included the following: describing the pattern of what is going on in Europe, such as different approaches, operating conditions, diffusion of multimedia tools, social acceptance and teachers' reactions; and establishing a tradition of working together and continuing to forge a synergistic approach.

Initially, attention was focused on ways of implementing (*ie* including in courses) multimedia experiments and the roles played by experiments and simulations in physics learning; and on problems created by the large amount of information available via the Internet and its quality (how to filter and how to manage the need for refereeing); and also on areas of education in which multimedia can offer new solutions and better quality materials.

The educational value of materials on the Internet can be seriously limited if students are not helped to look at the information with a critical eye and to discern the good from the bad from different sources. Students should be guided and learn how to explore the multimedia world effectively, to reflect and interiorise the 'good' information for their disciplinary and cultural enhancement.

The problem of teachers' preparation in using multimedia and the Web was analysed and it was recognised that, particularly in the field of teacher training, possibilities for building interaction between different integrated environments could be offered, such as resources on disciplinary topics, history and epistemology. It was recognized that very good materials exist which could form the basis of a library of digitised videos open to consultation and usage in real time. This, of course, poses questions of hardware, telephone costs *etc.* Taking into account the fact that sometimes sites are not reachable for a variety of reasons (too much traffic on the Internet or computers temporarily shutting down) it becomes increasingly difficult to use interactive materials directly while connected: materials should be downloaded and used off-line.

The discussion offered the opportunity to confront ideas about exchanging information on multimedia products, refereeing multimedia products, creating valid homepages, Websites, software packages. Good and bad examples of www Sites were considered and the need for developing evaluation criteria was recognized. It was decided to reflect, in particular, on the evaluation criteria for Websites, starting from the work presented by the research group of the University of Torino (Italy), and to discuss, by email, proposals for additional criteria.

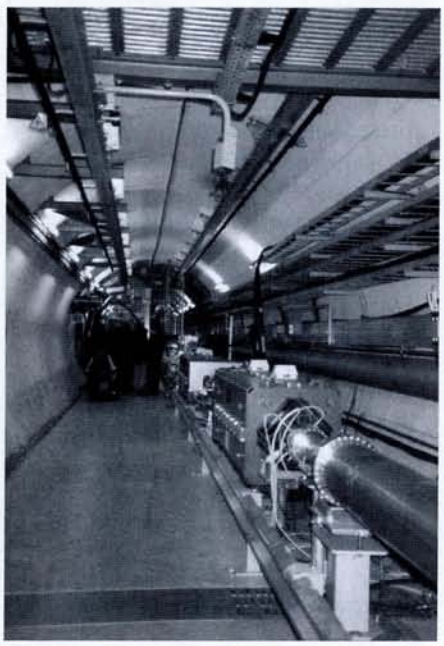
The third European workshop will be held in Lille, France (28 to 29 September 1998), organized by Monique Vindevoghel (monique.vindevoghel@iemn.univ-lille1.fr).

At the German national level there will be a third Arbeitskreis Multimedia in Kiel, Germany (11 to 13 June 1998) organized by M. Euler (euler@ipn.uni-kiel.de).
For further information on the multimedia workshop contact H.J. Jodl
Fachbereich Physik, Universität
Kaiserslautern, Germany
fax +49 631 205 3677
e-mail jodl@physik.uni-kl.de
Website www.physik.uni-kl.de/w_jodl/mmeuro.html

CERN, February 1998

Nexus Trip to CERN

Below In the distance...students at CERN



In early February, 35 students from universities across England, Scotland and Ireland joined me on a long sunny weekend in Geneva (6 to 9 February 1998). The purpose of our mission was to visit CERN, one of the 'Physics wonders of the world', though a strong interaction with snow prompted the added bonus of a practical demonstration in projectile physics (a snowball fight), *writes Sue Jackson.*

Patrick Deglon, a (University of Geneva) PhD student at CERN, was our local expert and ensured a most enjoyable trip with just the right mix of Physics, socialising and Swiss culture. Like me, Patrick is on the committee of the International Association of Physics Students, and had invited Danish and other students to CERN at the same time as our visit to give the trip a truly international flavour.

One of the best talks of the weekend was by Alvaro de Rujula, head of the Theoretical Division at CERN. Equally superb was the unexpected appearance of Frank Close, joining our tour of the L3 experimental area on the LEP ring. CERN straddles the border between France and Switzerland so our time was spent between two nations. Our final day took us over the border again to France to see the Nomad and Chorus neutrino experiments and also to the splendid Microcosm interactive display centre.

Seeing the CERN accelerator and main experiments in real life was a great thrill. The mammoth scale of the pieces and the sheer spaghettiness of wires was incomprehensible.

Our group created a very positive image of international physics students. To my relief I can report that all CERN-trippers returned back safely, with not even a snowball injury between them.

Nexus is the student arm of the UK's Institute of Physics, and is extremely grateful for the generous financial support of the Institute of Physics, the European Physical Society, PPARC, EEV Ltd, Oxford Instruments and Taylor Woodrow

Diary

Supercomputing, Collision Processes and Applications
14 to 16 September 1998; Belfast (Northern Ireland)
Philip G. Burke formally retires on 30 September 1998. This conference will be held to mark the occasion and to celebrate Professor Burke's career. It will provide an opportunity to review the current state of light particle (ie electron, photon and positron) collisions with atoms and molecules and high performance computing as well as discussing several applications of such data.
contact D Crothers, Department of Applied Mathematics and Theoretical Physics,
The Queen's Univeristy of Belfast,
Belfast BT7 1NN, UK
email d.crothers@qub.ac.uk
tel +44 1232 335 048; *fax* +44 1232 239 182

Electron-molecule Collision Data for Modelling and Simulation of Plasma Processing
21 to 24 September 1998; Lyon (France)
A workshop to discuss the role of electron collisions in those plasmas used in the manufacture of microstructures and the deposition of high quality films. Elastic, inelastic, ionization, dissociation, and attachment processes will be discussed as wil the latest experimental and theoretical advances. Further details may be found at www.cecam.fr/workshops/program98.html
Attendance at the workshop is by invitation only.
contact N.J. Mason, Department of Physics and Astronomy, University College London,
Gower Street, London WC1E 6BT, UK
email nigel.mason@ucl.ac.uk
tel +44 171 380 797; *fax* +44 171 419 3460

NATO Advanced Research Workshop: Ferrimagnetic Nano-crystalline and Thin-film Magnetooptical and Microwave Materials
Organized by the Institute of Electronics, Bulgarian Academy of Sciences
27 September to 3 October 1998; Sozopol (Bulgaria)
Presentation of latest achievements and results, and exchange of information and ideas in the field of magneto-optical and microwave applications of ferromagnetic layers and nanoparticles. The program will consist of invited and contributed papers as well as posters. The papers presented will be published by Kluwer Academic Publishers in NATO ASI Series.
Co-Directors of the workshop are:
Marcel Ausloos, SUPRAS Dept. of Physics, University of Liege, Liege, B-4000, Belgium
Ivan Nedkov, Institute of Electronics, Bulgarian Academy of Sciences, Sofia, Bulgaria
contact Dora Beneva
email beneva@center.phys.acad.bg
Chavdar Ghelev
email chghelev@center.phys.acad.bg

Beijing, November 1997

International Conference on Accelerators and Large Experimental Physics Control Systems

Almost 450 control specialists from 26 different countries distributed over 5 continents and representing more than 100 organizations (scientific institutes and industry) came together in the Beijing International Hotel, November 3 to 7 1997, to exchange their views on the latest developments and trends in control systems for accelerators and large experimental physics facilities, *write In Soo Ko and Axel Daneels.*

Xu Zhihong, Member and Vice President of the Chinese Academy of Sciences, Fang Shouxian, Member of the Chinese Academy of Sciences and Zhu Xuan, General Secretary of the Chinese Academy of Sciences, opened the conference.

Zheng Zhipeng, Director of IHEP, introduced the facility, a multi-discipline institution under the Chinese Academy of Sciences that closely collaborates with major high energy physics laboratories in the world. IHEP, with a staff of 1400, is mainly engaged in basic high energy physics research involving the Beijing Electron Positron Collider (BEPC) and the Beijing Spectrometer (BES) and their further developments. IHEP is also engaged in applications relating to synchrotron radiation, nuclear analytical techniques, and in free electron laser research. In addition, IHEP carries out cosmic ray research at Yangbajing in Tibet, research into particle and nuclear theory *etc.* Since the completion of the BEPC in 1988, some important results have been obtained in the area of high precision measurement of the tau mass and in the study of Psi Ds and glueball. As far as tau charm physics is concerned, IHEP has attained a leading position world-wide. IHEP's achievements have benefited from close international co-operation.

In his welcome speech Axel Daneels reminded that this series of conferences started 10 years ago in 1987 in Villars-sur-Ollon, in Switzerland, following on some earlier initiatives in Berlin (EPS Conference on Computing in Accelerator Design and Operation, September 1983) which was followed by a specific workshop in 1985 at Brookhaven in the context of the control system of the NSLS (National Synchrotron Light Source), and the International Workshop on Accelerator Control Systems in Los Alamos, also in 1985. ICALEPCS 97 thus celebrated an anniversary, a second Lustrum.

On behalf of the Experimental Physics Control Systems' community he expressed their gratitude to the Chinese Academy of Sciences and the Institute of High Energy Physics for having been invited to hold their conference in Beijing, the capital city of a country that is one of world's most ancient civilizations, a country that is the birthplace of many advanced technologies and that saw the implementation of many Titanic engineering works.

In Soo Ko, from the Pohang Accelerator Laboratory in Korea, wrapped up the conference by highlighting its salient technical aspects while Shin Ichi Kurokawa, KEK Tsukuba, closed the event on a poetical note, praising the community's enthusiasm by citing a poem of Cao Cao (153-220 AD), the king of Wei in the "three countries period."
Old horse, obliged to lie in a stable,
His will leaps over one thousand miles,
Brave man, although in the evening of life,
Can not help being enthusiastic.

Back to ICALEPCS 97

The record participation at ICALEPCS 97 was partly due to the fact that the organisers allowed industrial companies to invite some of their clients (mostly Chinese) to participate to the topical seminars that were organised within the framework of ICALEPCS 97. Even so, two thirds of the 450 participants, *ie* around 300, came from a scientific environment. This is quite remarkable in itself especially when taking into consideration the severe budget cuts in all experimental physics organizations world-wide.

These budgetary restrictions are a major concern and were reflected in the ICALEPCS 97 program. In addition to the classical sessions such as status reports of ongoing control projects, trends in hardware and software, man machine interfaces, databases, networks and fieldbusses, *etc*, there were several sessions that addressed issues resulting from this financial situation: inexpensive systems, industrial off-the-shelf systems, software sharing, economically promising hardware and software technologies, *etc.* In addition, several presentations concerning 'exotic', non-accelerator, control systems, are an indication that we also look outside of the HEP environment in search of existing solutions that might be applicable to us as

well. Finally, the ultimate goal of any control system is to strive towards fully autonomous operation and as such some sessions were devoted to control theory, feedback and automation.

The Conference discussed the most advanced control systems that have been developed in various laboratories, highlighting the techniques that were used and the performances that have been achieved. Close attention was also paid to the latest development techniques and their possible application to the field of controls. The economic aspect is considered to be a design criterion and the potential economic benefits obtained the application of engineering methods, project management techniques and standards were therefore given due consideration.

Training Session

The Conference was preceded by a three day training session on 'Development Tool Kits for Control Systems' during which EPICS (Experimental Physics and Industrial Control system) and Vsystem (Vista Control Systems Inc.) were introduced. The courses were given by six teachers and attended by about 100 people.

Status Reports

The progress of new control systems that are currently being developed, either new developments (such as for the KEKB, the LHD that is scheduled to be operational by the end of March 1998, the RHIC in the autumn of 1998, the VLT due in 2000, the U-70, ...) or upgrades to existing systems (*eg* the control system of the BEPC, the NSRL, ...) were reported together with the status of systems which are already operational and for which the performances were analysed in a critical but constructive way (*eg* SPring-8 in operation since March 1997). Most can be characterised by their size and the large number of computers involved (often more than 100) which have been put together in highly distributed networks.

All these systems are based on what throughout successive conferences has been referred to as the 3-level 'standard architecture' (*ie* workstations and servers, front-end, equipment controllers) but with a tendency to incorporate more and more commercial, off the shelf, and public domain products.

Size and complexity mandates the use of both modern software engineering practices, *ie* the application of standards of which those set-up by the European Space Agency (ESA-PSS-05) are a typical example, and project management practices.

Engineering

The importance of software engineering standards and project management practices was explained at length in the Engineering session. ESA-PSS-05 was initiated by the ESA in 1984 and brought into the public domain in 1994. It has gained acceptance in several scientific organizations and forms the basis for many quality management systems. Examples were also given of the application of modern, industrial style, project management practices. It is recognised that the application of such practices is a determining factor in the successful commissioning of modern control systems.

Software Sharing and Object Oriented Technologies

As a typical example of software sharing, several laboratories are basing their control systems on EPICS, which is continually undergoing evolution: *eg* its Common Message LOGging System (CMLOG) and the Common DEVice (CDEV).

Organizations, people and information are naturally distributed and correspondingly so are the associated computer systems. However, these systems are expected to be integrated and interoperable. Modern object oriented technologies such as CORBA (Cooperative Object Request Broker Agency) supports the development of flexible and reusable distributed services and applications and hence provide independence of platform, network technology, operating systems and programming languages. Several laboratories have constructed, or are constructing, object oriented applications, while others are already experimenting with CORBA and Java and have obtained encouraging results that demonstrate the possibility to communicate between different control systems.

Hardware Aspects

DSP (Digital Signal Processors) are widely used for fast, high precision data processing. They find their application for the control of accelerator beam orbit, RF, for processing the plasma movement in Tokamaks *etc*. Transient recorders are used for RF and quench protection because of their very high sampling rates. Transcient recorders are in general not synchronised and work is being performed to integrate these devices into a global system.

Feedback, Control Theory, Automation

Control systems are often required to have high dynamical performance and robust behaviour, yet at the same time expected to cope with complex processes and to provide full automation facilities; these systems are thus required to be 'intelligent'. 'Intelligent Systems' are based on PID, FSM, fuzzy logic, neural networks, and knowledge-based decision making mechanisms, to configure dynamically optimization and control algorithms. Such techniques have demonstrated their value for optimising machine operational conditions, to automate complex event scheduling operations, for automatic beam alignment, in real-time orbit feedback systems or for ensuring the alignment of the physical components of accelerators that are particularly sensitive to floor motions.

Man-Machine Interfaces

The World Wide Web is becoming popular as a common interface for viewing information. Many commercial interfaces are now available on the market that provide the requested functionality and performances at low cost. These systems were reviewed in the light of object oriented technology and Java. The emphasis is on user friendliness which is seen as a critical factor for safe and efficient operation of the highly sophisticated experimental physics set-ups.

Specific Systems

Since the series of ICALEPCS conferences began 10 years ago, and despite attempts to open up their scope, the conferences have been dominated by accelerator control systems. At ICALEPCS 97, for the first time, we had reports of control systems of several different—or should we say 'exotic'—applications: liquid waste treatment, radiation-chemical processes of composite material, medical applications (cancer therapy) the latter being characterised by the need for tight and stable control of beam position and energy and secure operation to ensure the safety of the patient.

Industrial, Off-the-Shelf Systems

Previous sessions often hinted at the increasing use of industrial, off-the-shelf systems and PLCs. These aspects were handled *in extenso* in this dedicated session that addressed the problems of installing industrial systems for various applications in the experimental physics world or the issue of how to integrate such

systems in existing infrastructures. Issues relating to interfacing, network connections, software integration, ... were presented. Furthermore, work practices were recommended for ensuring the successful implementation of such systems.

Inexpensive Systems

Considering the budgetary restrictions that affect most of the experimental physics laboratories, the economical aspects of control projects are a major concern. Several institutes have demonstrated that it is possible to implement even large control systems with good performance using rather inexpensive PCs with Windows NT and / or Windows 95 at the client's level. Some went as far as introducing PCs at the front end level, *eg* inside regulators for beam transport magnets.

Databases

Control systems have permeated most aspects of the experimental physics laboratories to become an indispensable link in the chain from the physicist to physics, and strengthening their relations to other domains in an organization which increasingly rely on information technology. Controls are no longer stand alone systems but rather part of a web which ties physics to other areas, both technical and administrative, of the organization in a so-called Computer Integrated Manufacturing (CIM) environment. The advantages of a central database that holds all project data thus becomes evident. Due to their functionality and flexibility, Relational Data Base Management Systems (RDBMS) and more recently, with the advent of object oriented technologies, also the Object Oriented Data Base Systems (OODBS) have been given great attention. Advanced techniques are applied *eg* to support quality control of production, and to assist in the understanding of machine behaviour by tracking the relevant data in the database so as to improve the machine performances.

Network and Fieldbusses

Networks are an integral part of the so-called 'standard architecture' for most current experimental physics control systems; their performances thus determine to a large extent the performance of the overall system. Methods were recommended not only to provide redundancy but also for monitoring the performances of these networks.

Fieldbusses are increasingly used as they provide flexibility and are open for future developments. In an environment where groups need to work together and to connect their devices into common systems, it is essential to avoid a proliferation of too many types of fieldbusses. Under the auspices of the European Physical Society's Interdivisional Group on Experimental Physics Control Systems (EPS-EPCS) and CERN, a working group compared the various products offered by the market and came up with some recommendations.

Java and the WWW

Recent years have witnessed an explosion of WWW applications and development tools. In parallel, industrial control systems increasingly offer Internet interfaces, thus allowing world-wide access. The WWW is therefore increasingly popular for accessing process information and documentation, on-line logbooks, historical trend data, life status displays, database updates, for interfacing to trouble reporting systems, *etc.* Finally, object oriented technology simplifies the development of fully encapsulated components in a distributed environment. It should thus be no surprise that all these technologies have found their way into experimental physics controls as well.

Round Table Discussion

Several collaborations between experimental physics laboratories have yielded most interesting results. An example in the technical area is the development of highly sophisticated components that should have a significant impact on the efficiency of controls. In a more political context, one should mention the Russian federal program for creating a nation-wide network of supercomputers for science and education.

Discussions also indicated that for large systems with a dominant social impact, it is practically impossible to predict the implication of all technical and human factors. In such cases the behaviour of these systems remain to a large extent uncertain and thus difficult to control with traditional techniques.

Tutorials and Topical Seminars

Several tutorials and topical seminars on state of the art technological developments were held in the context of ICALEPCS 97 by some of the companies that also participated in the industrial exhibit.

Hewlett-Packard gave overviews of their test and measurement organization, of the application of their high performance computing in the nuclear industry, as well as an extensive presentation on high reliability solutions and CORBA technology.

Motorola introduced their embedded and their PCI technologies. Their corresponding products as well as Motorola's latest VME products were also presented. SUN presented the status and their views on the evolution of Java.

Finally, Force Computers presented new technologies such as the fast Ethernet and high speed real-time networks.

Industrial Exhibit

The industrial exhibition gave several advanced high technology industrial companies the opportunity to demonstrate their latest products. Among these companies were Hewlett-Packard, Motorola Electronic, Digital Equipment, Force Computers, Creative Electronic Systems (Switzerland), Vista Control Systems (USA), Mitsubishi Electric (Japan), Yokogawa Electric (Japan), Hua Guang Group (China), IMAG (China).

ICALEPCS 97, the 6th in the series of biennial International Conferences on Accelerators and Large Experimental Physics Control Systems, was organized by the Institute of High Energy Physics (IHEP) of the Chinese Academy of Sciences (CAS) and co-organized by the European Physical Society's (EPS) Interdivisional Group on Experimental Physics Control Systems (EPCS) and the Center for International Scientific Exchanges. It was chaired jointly by Zheng Zhipeng, Director of IHEP and Axel Daneels, of CERN. The local organization was endorsed by Jijiu Zhao, IHEP, and her colleagues.

The next International Conferences on Accelerators and Large Experimental Physics Control Systems, ICALEPCS 99, will be held in Autumn 1999. It will be hosted by Sincrotrone Trieste.

For information, please contact:
Daniele Bulfone
Trieste Synchrotron Radiation Facility
ELETTRA, Accelerator Division
Controls Group, SS 14, Km 163.5 Basovizza
34012 Trieste, Italy
tel +39 40 375 85 79
email bulfone@elettra.trieste.it
Details will be made available in due time at www.elettra.trieste.it