

Big Science, bigger outreach

Miguel-Angel Sanchis-Lozano argues that today's "Big Science" has valuable messages for society, beyond the dissemination of results and technologies.

In 1609 Galileo Galilei made the first recorded telescope observations of the night sky – an event that is being celebrated all through 2009 in the International Year of Astronomy. He soon ran into trouble with the ecclesiastical authorities, partly because he used Italian instead of Latin in many of his letters and books, which gave people access to his new scientific interpretation of the world. Fortunately things have changed since then and today the scientific community and the relevant authorities on scientific policies share a general consensus on the importance of conveying to society the main results and general consequences of research.

Take high-energy physics as an example: over the past few years, dedicated working groups and projects have been set up to develop outreach activities. A good example of an annual activity of this kind, aimed at young students in physics and high-school teachers, is the EPPOG Masterclasses, which involves the participation of some 80 research institutes and universities across Europe (see www.physicsmasterclasses.org/mc.htm). Recently several African and American institutes joined the project.

Permanent or travelling exhibitions are another interesting means for the "large-scale" dissemination of high-energy physics information, showing the public the still-unresolved mysteries of the universe and the gigantic equipment needed in particle accelerators (such as the LHC), detectors and computing systems (such as the Grid).

These valuable initiatives have been unquestionably successful but their real reach to society is limited because of the relatively reduced number of participants and the competition from other fields (scientific or not) already on the market, such as websites, video games and so on. We can think of taking advantage of these more loosely related activities such as the film adaptation of Dan Brown's bestselling novel, *Angels & Demons*, currently in cinemas around the world. While artists should be allowed creative



freedom and their view on science should not be rejected, they sometimes risk being somewhat misleading. I am not particularly enthusiastic about spreading the idea that a bomb made of antimatter stolen from CERN could destroy the Vatican (or any other city). Nonetheless, the association of physics (and more generally, science) with other social and cultural manifestations should be mutually beneficial and deserves closer attention.

Despite the universality of its principles, methodology and objectivity of results, the advancement of scientific knowledge has proved to be socially dependent, from the golden age of Pericles and the "invention" of democracy to the Renaissance and the rise of humanism together with the birth of modern science. Society itself may fuel scientific advancement in a particular direction: thermodynamics was driven by the need for building more efficient heat engines at the beginning of Industrial Revolution, thereby decisively contributing to the foundations of classical physics in the 19th century.

As an example from particle physics, CERN was created as a free forum for nuclear science in a Europe devastated by the Second World War "to encourage the formation of research laboratories in order to increase international scientific collaboration..." (as stated at the Fifth UNESCO Conference in Florence, 1950). The CERN convention was gradually ratified during 1953–54 by the 12 founding member states, while the Treaty of Rome that founded the European Union was signed in 1957. Science often goes ahead of society.

In this regard the Web – born at CERN – has represented a dramatic democratization

of knowledge, teaching and information. Virtually free for everybody on the planet (wherever electricity is available), it was an almost direct consequence of the free circulation of scientific data among researchers. More generally, big scientific collaborations are genuine examples of worldwide co-operation between different scientists and technicians regardless of their age, gender, religious beliefs or nationality.

Social needs, in turn, continuously demand technological achievements that ultimately stem from fundamental research. Nuclear and particle physics, for instance, have provided crucial tools for medical diagnosis, from the discovery of X rays to modern medical-imaging techniques.

Undoubtedly outreach must convey to society the excitement of scientific discovery and the importance of technological returns. However, in my opinion, the message from science should not stop there. Galileo's *Sidereus Nuncius* (Sidereal Messenger) was heralding in 1610 not only the existence of mountains on the Moon or satellites around Jupiter, but also the dawn of a new epoch. Indeed, the social impact and controversy turned out to be much greater than with *De revolutionibus* by Nicolaus Copernicus (1543) or Johannes Kepler's *Astronomia nova* (1609) – because it was easier to read.

We are currently witnessing crucial developments of society globally, from a more just economy to extended human rights, environmental protection and nature conservation. While keeping the possible misuse of scientific and technological applications in mind as a warning, we should ensure that the virtues that are traditionally associated with "Big Science", historically entangled in the social progress of humanity, are praised as an example to counteract ignorance, obscurantism and fanaticism. *Miguel-Angel Sanchis-Lozano, IFIC (University of Valencia-CSIC), and Spanish representative on the European Particle Physics Outreach Group (EPPOG).*

If you can't answer the following questions, you need a **control system integrator**:

- How many of your control projects did you really finish on time and on budget?
- How many had the scope, time and budget defined at all?
- How often did you write up the documentation?

Use Cosylab, the world leader in the field of control system for particle accelerators, synchrotron radiation beamlines and radio telescopes.



cosylab
CONTROL SYSTEM LABORATORY



we make accelerators work

Customer testimonies

COSYLAB supplied the booster control system as well as controls for storage ring magnet power supply, apple2 undulator and protein crystallography and powder diffraction beamlines to the Australian Synchrotron. I confirm that the Synchrotron Controls team were able to work collaboratively with COSYLAB staff to arrive at a good solution which met all requirements. The systems were delivered on time to their contractors and that the software worked "straight out of the box".



Alan Jackson, former Technical Director of the Project (ASP)



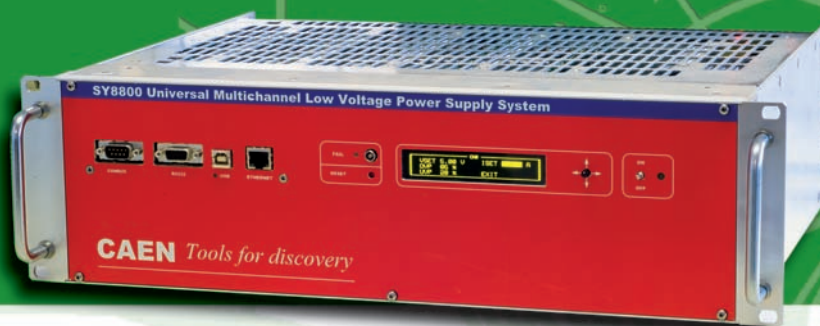
We have been working with Cosylab since many years, always to our complete satisfaction. Cosylab has given an essential contribution to both the design and the implementation of the ACS platform and they are still for us a reliable resource for development and maintenance. A Cosylab engineer has always proved that they are very competent, helpful and reliable, delivering consistently according to plans and responding promptly to requests for support. In many cases we have profited from Cosylab experience and knowledge on edge technologies to steer our architectural and technical choices for ACS and the ALMA project. We rely on them not only for long term development outsourcing, but also to cope with unexpected load peaks.

Gianluca Chiozzi, Head of the Control and Instrumentation Software Department (ESO)

Working with, for and at over 30 major facilities all over the globe:

Low Voltage Power supplies - SY8800

Universal Multichannel Low Voltage Power Supply System



- 3U x 19" x 35 cm crate size
- Floating channels
- Local and Remote Control
- Remote control via Ethernet, USB, CANBUS and RS232
- Max output power: 2.5kW @ 220Vac, 1.5kW @ 115Vac
- Up to 8 independent channels
- Low noise
- Individual channel ON/OFF and TRIP
- Sense wires for the voltage drop recovery
- 4 Analog Input, 4 Digital Input, 4 Digital Output
- Fans embedded for vertical cooling

The Mod. SY8000 is a high density floating low voltage power supply system, designed to power low noise electronics with medium and high currents.

Safety features include:

- Over / Under voltage protection
- Programmable maximum channel output voltage limit
- Over current detection
- Channels can be enabled or disabled through the Interlock logic (using the 4 Analog/Digital Inputs)

The voltage output Ramp Up/Down time may be selected independently for each channel in 5ms steps.

Module control can take place either locally, assisted by a Graphic colour display or remotely, via Ethernet, USB, CANBUS and RS232.

Mod. SY8800 power Modules

Module	Voltage Range	Channels per module	Max Current	Max Power	Module width	Vset/Vmon res.	Iset/Imon res.
M01	2V÷7V	1	110 A	550 W	1	10 mV	100 mA
M21	2V÷7V	1	220 A	1100 W	2	10 mV	200 mA
B01	± 7V÷16V	2	23 A	550 W	1	10 mV	20 mA
B21	± 7V÷16V	2	46 A	1100 W	2	10 mV	40 mA
B02	± 20V÷28V	2	11 A	550 W	1	10 mV	20 mA
B22	± 20V÷28V	2	22 A	1100 W	2	10 mV	40 mA