

Portuguese high energy physics is centred on CERN, supported by a national hub at the Laboratory for experimental high energy physics and related R&D projects (LIP), with centres in Lisbon (Head, Jose Gago, right) and Coimbra (Head, Armando Policarpo).

workshop. Piero Monacelli, the laboratory's director, reiterated Gran Sasso's enthusiasm for the project, and described how present infrastructure might be adapted, and new halls added to accommodate such experiments.

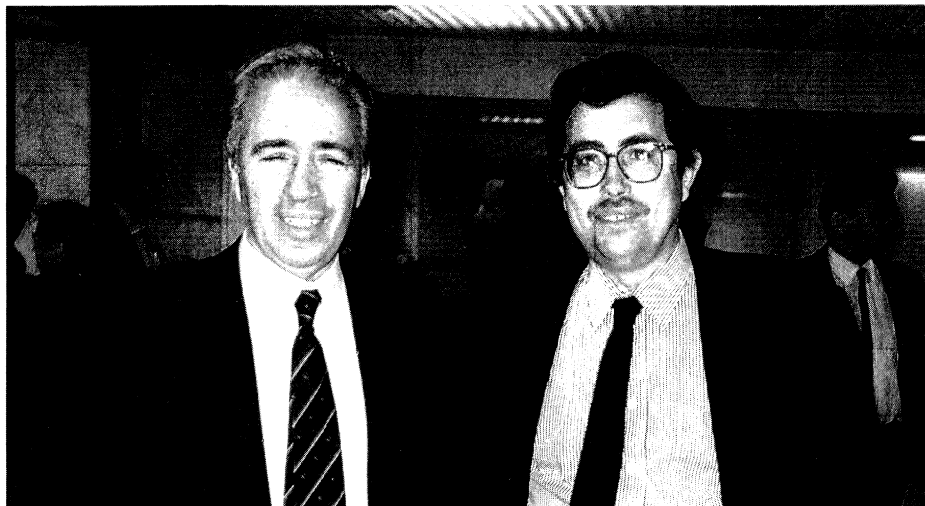
Possible designs to steer a CERN neutrino beam to Gran Sasso, and two proposals for dedicated detectors were presented. Carlo Rubbia gave a status report on the ICARUS detector (April 1993, page 15), saying that an intermediate half kiloton liquid argon calorimeter would be brought to Gran Sasso in the near future. Apart from being an important test bed for ICARUS, this detector could also perform interesting research into atmospheric neutrinos and proton decay. For the long baseline study, another 'Baby ICARUS' detector could be installed at CERN.

CERN and Portugal

In its continual tour of CERN Member States, the European Committee for Future Accelerators (ECFA) visited Lisbon, Portugal, on 21-22 April, where it met at the Instituto Superior Tecnico, a technical university with 9,000 students.

Portuguese particle physics is in a particularly healthy situation, having developed considerably following Portugal's admission to CERN in 1985. With support from Brussels, scientific infrastructure has developed rapidly, although the science base has yet to attain the levels seen in larger nations.

The 45-strong population of experimentalists in Portugal, including 14 PhDs, represents a 2.5-fold increase since Portugal joined CERN ten years ago and is in line with the



goal stated at the time. This successful development of experimental particle physics has benefited much from physicists returning from abroad (mainly France and the UK).

The direct result of the efforts of a few individuals (notably J.M. Gago), this splendid achievement provides an excellent role model for new and potential CERN Member States.

At present, particle physics represents some 30% of all Portuguese physics publications. This very special role (and the financial support it implies) provides a visible target, but one which can be defended as it provides a catalyst for other national scientific developments.

The national hub is the Laboratory for experimental high energy physics and related R&D projects (LIP), with centres in Lisbon (Head, J.M. Gago) and Coimbra (Head, A. Policarpo). LIP, with close links to two universities in Lisbon and to the University of Coimbra, has developed into a centre of expertise and training in electronics, computing and software engineering.

Present LIP funding is some 2 million Swiss francs/year (70% in

Lisbon and 30% in Coimbra), covering most of the salaries of the non-university people, the remainder being supported by grants from Portuguese and European programmes. Portugal's contribution to CERN's 1995 budget is 10.3 million Swiss francs. This is 75% of the eventual national contribution, rising on a sliding scale established when Portugal joined CERN ten years ago. This 'discount' in Portugal's contribution to the CERN budget goes into its national effort. Hopefully this funding will not suffer once the CERN contribution reaches its cruising altitude.

With no national accelerator, Portuguese research in particle physics is fully focused on CERN, with prominent participation in LEP (Delphi) and in heavy ion research (NA 38). Portuguese researchers also collaborate in the NA 50 and 51 experiments and in CP-LEAR, as well as some solid state research based on the Isolde on-line isotope separator.

For the future, there is some involvement in both in ATLAS and CMS experiments for the LHC proton-proton collider and in related

Physics monitor

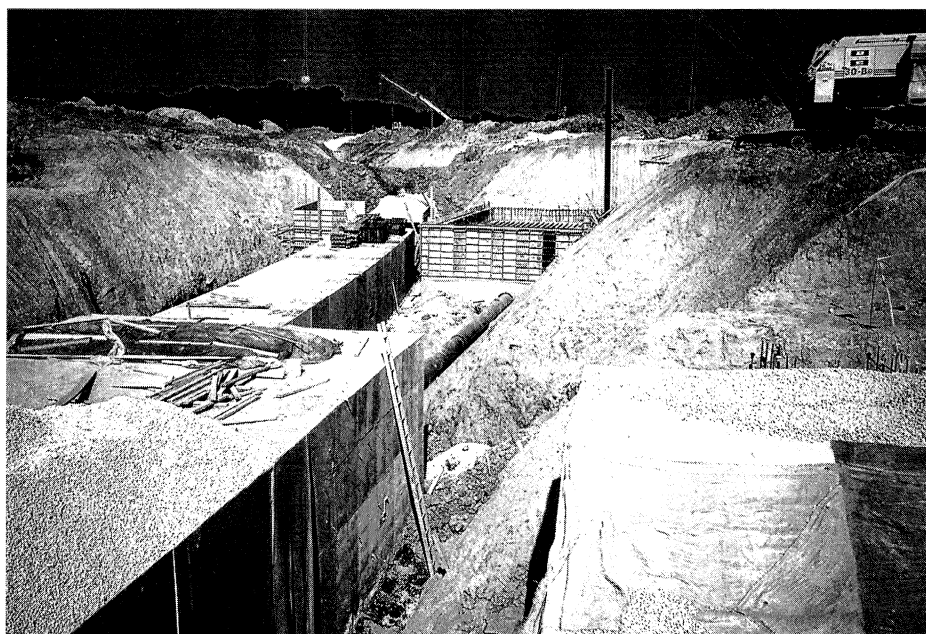
research and development (gaseous detectors, RICH techniques, liquid xenon calorimetry, scintillating fibre calorimetry and read-out systems and data transfer). LIP plans to participate to both Atlas and CMS, contributing to the tile calorimeter and calorimetric trigger respectively. Because of this involvement in specific detector elements, Portugal is able to make important contributions to these two major LHC experiments.

Theoretical particle physics has also boomed, with the number of theorists more than doubling. Currently there are 36 researchers (26 PhDs) in a national network based at Lisbon's GTAE (Grupo Teorico de Altas Energia, Head G.C. Branco) and including CFIF (Study of Fundamental Interactions) at Lisbon's Instituto Superior Tecnico. GTAE also supports astrophysics.

With the university system expanding, there has been no problem so far finding positions for good young researchers, but this expansion cannot continue indefinitely. The need for stable research positions, independent of those offered by the universities, is already pressing.

The Portuguese-CERN Committee, set up in 1986, has played an important role, and the value of contracts for Portuguese industry has increased significantly. Portugal is exemplary in its willingness to develop its scientific research as a support to its budding high-tech industry.

At Fermilab, construction is now underway for the new 150 GeV Main Injector. The pipe to the right of the tunnel is an abort line.



Accelerator update

When the Accelerator Conference, combined International High Energy and US Particle versions, held in Dallas in May, was initially scheduled, progress nearby for the US Superconducting Supercollider was high on the preliminary agenda. With the SSC voted down by Congress in October 1993, this was no longer the case. However the content of the meeting, in terms of both its deep implications for ambitious new projects and the breadth of its scope, showed that the worldwide particle accelerator field is far from being moribund.

A traditional feature of such accelerator conferences is the multiplicity of parallel sessions. No one person can attend all sessions, so that delegates can follow completely different paths and emerge with totally different impressions.

Despite this overload, and despite the SSC cancellation, the general

picture is one of encouraging progress over a wide range of major new projects throughout the world. At the same time, spinoff from, and applications of, accelerators and accelerator technology are becoming increasingly important.

Big machines

Centrestage is now CERN's LHC proton-proton collider, where a test string of superconducting magnets is operating over long periods at the nominal LHC field of 8.36 tesla or more. The assignment of the underground areas in the existing 27-kilometre LEP tunnel is now quasi-definitive (see page 3).

For CERN's existing big machine, the LEP electron-positron collider, ongoing work concentrates on boosting performance using improved optics and bunch trains. But the main objective is the LEP2 scheme using superconducting accelerating cavities to boost the beam energy (see page 6). After