in the cooling system.' Senator Clinton P. Anderson championed LAMPF in the senate just as Senator Pete Domenici is doing today. Four other laboratories were in competition for a meson factory, but our proposal was the most daring and the most risky.

Finally we were allocated one-half-million dollars for preliminary design work, so that cost estimates could be firmed up. We used most of the money to explore the integrity of the rock that would support the linac. By the time the $0.5M was spent, we had excavated the entire length of the tunnel. It came as quite a surprise to one of the AEC commissioners when he saw it on a flight into Los Alamos. The legality of the expenditure was never questioned, but that feat has never been repeated.

Four years later we achieved the beam we are today celebrating. That, too, did not come easily. Fortunately, we had decided to pioneer complete computer control. Without that the turn-on task would have been hopeless. As I now look back, what stands out most vividly in my memory and gives me the most satisfaction is the experience of working with the marvelously capable and dedicated and devoted participants in the project, of all ranks, who joined in the vision to create a great arena where accomplished researchers, young scientists starting their careers, students, engineers, technicians, and support staff could together learn and teach the science and art of multidisciplinary problem solving.'

WORKSHOP
Scintillating crystals

Scintillating crystals are one of the big spinoff success stories of particle physics, and from 22-26 September an international workshop in Chamonix in the French Alps looked at the increasing role of these materials in pure and applied science and in industry.

The meeting brought together some 200 participants from all over the world and all walks of crystal life – high energy and nuclear physicists and astrophysicists, together with specialists in nuclear medicine and nuclear security, and those with responsibilities in the protection of major construction projects and sensitive areas, in non-destructive industrial controls, and in geological and mining prospection. As well as crystal users, suppliers were also well represented.

The presentations and ensuing discussions underlined the importance of an interdisciplinary approach to the development of new materials. Industrial participation in these developments and the setting up of closer cooperation agreements would pay dividends if competition barriers can be avoided.

The meeting also showed how large projects in pure research, such as experiments for CERN's future LHC proton collider, could go on to play a major role in developing new technologies which could go on to find more widespread applications.

Following the recommendations of a CERN research and development project, two LHC experimental groups are proposing electromagnetic calorimeters requiring hundreds of tons of a new scintillator, cerium fluoride. The large scale manufacture of these crystals, with their faster response and increased resistance to radiation than the traditional bismuth germanium oxide (BGO), could open up important new possibilities both inside and beyond pure research.

At the Crystal 2000 meeting in Chamonix, France – Conference Organizing Committee Chairman Marcel Vivargent (left) and Paul Lecoq of CERN.

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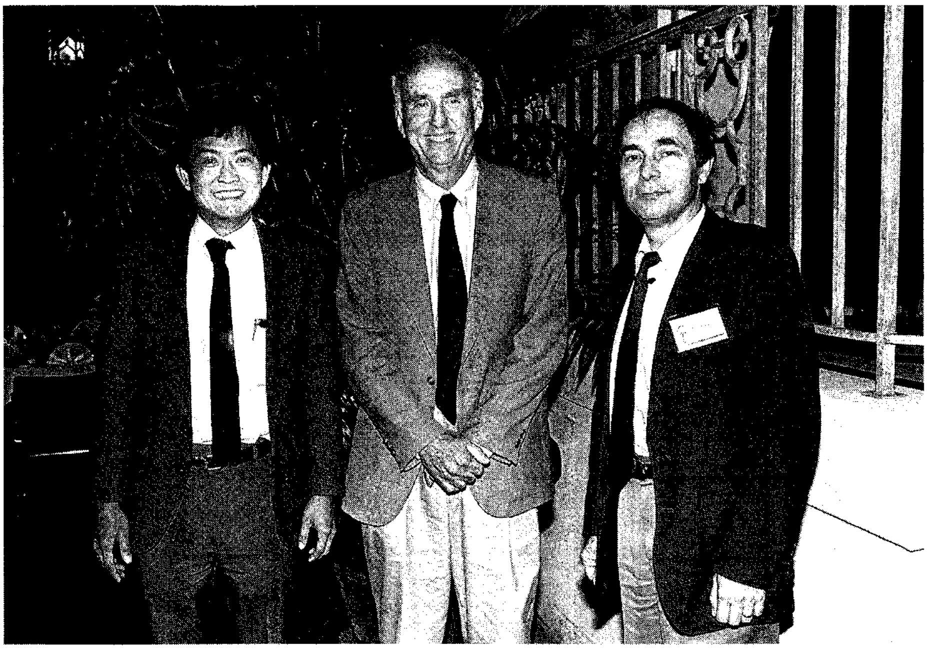
At the workshop it also emerged that a large amount of information on the scintillation properties of several materials and ions already has been compiled. In particular, cerium compounds can offer advantages when fast scintillation (some 20 ns) is needed. For ultrafast (nanosecond) scintillation, only crystals exhibiting special 'crossover' transitions can be considered, with the drawback of emitting in the vacuum UV. Similar expertise was gathered from extensive work in solid state chemistry and crystalline defects.

The Chamonix meeting was organized jointly by CERN, the French CNRS and the Italian INFN.

Tau lineup. At this year's workshop on tau lepton physics, the second in the series, and hosted by Ohio State University, tau pioneer Martin Perl is seen with workshop chairman K.K. Gan (left) and Michel Davier, one of the chairmen of the first workshop, held in Orsay, France, in 1990.



Tau leptons

Once an oddity, tau leptons are now being mass produced at electron-positron colliders, and tau physics is becoming daily life. This was reflected at the Second Workshop on Tau Lepton Physics, held at Ohio State University, September 8-11. This workshop was the sequel to the successful workshop organized by Michel Davier and Bernard Jean-Marie at Orsay in 1990.

The tau lepton, heavy cousin of the electron and the muon, was discovered in 1975 by Martin Perl and collaborators using the SLAC-LBL Spectrometer (Mark I) at the SPEAR electron-positron collider at SLAC, Stanford. This unexpected discovery broke the symmetry between quarks and leptons. This symmetry was partially restored with the discovery of the fifth quark (bottom) at Fermilab in 1977. Almost two decades after its discovery, the tau is giving interesting and vital results.

The workshop opened with a talk on new measurements of the tau mass. At the Beijing electron-positron collider, seven events were observed in a scan of the tau production threshold yielding a new measurement of the tau mass (July, page 13) an order of magnitude more precise than the previous measurement by DELCO (SPEAR) in 1978. In addition, ARGUS (DORIS) and CLEO (CESR) have reported new measurements of the mass using high statistics data samples collected near the bottom quark production threshold that are consistent with, albeit with larger errors, the Beijing result.

The meeting then focused on the tau lifetime and leptonic branching ratios, where the precision of these measurements (CLEO of the branching ratio into electron, ALEPH and OPAL of the lifetime) is now better than 2%. Together with the tau mass measurement, these measurements provide a stringent test of electron-muon-tau democracy (lepton universality). However despite the improvement in the precision of the measurements, there is still a nagging discrepancy.

Tau decays with one or three charged hadrons in the final states were the subject of two full sessions. New measurements from ARGUS (DESY, Hamburg), CLEO (CESR, Cornell), and the LEP experiments at CERN were impressive, some rivaling the old world averages in their precision. CLEO reported the observation of a new decay mode in which the tau decays into three charge pions and two neutral pions with a surprisingly large rate. A new method for measuring the tau neutrino mass based on this large decay rate was presented.

Tau physics could also help look beyond the confines of today's Standard Model. Jose Valle of Valencia emphasized that the search for exotic decay modes is a probe of the tau neutrino mass. In the session on tau neutrino mass and cosmology, ARGUS presented a new upper limit of 31 MeV of the tau neutrino mass.