

LEAR looks ahead

The beam switchyard at CERN's LEAR Low Energy Antiproton Ring. Ideas for the future of the very popular LEAR project were aired recently at a meeting at Tignes in the French Alps.

(Photo CERN 457.10.83)

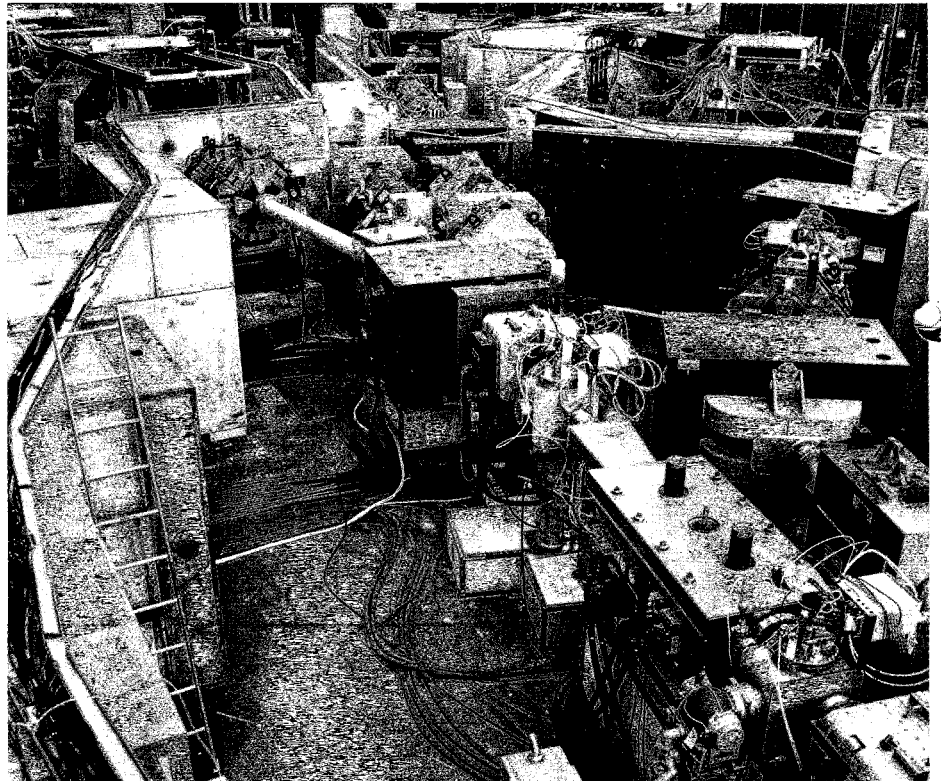
From 19 to 26 January in Tignes in the French Alps, 180 members of CERN's newest physics community met to review progress and discuss plans for the future. These physicists use the LEAR low energy antiproton ring which came into action in 1983 and whose unique low energy beams have attracted an unanticipated level of participation from all over the world.

In February 1984, construction began for CERN's new Antiproton Accumulator (ACOL), which will complement the present Antiproton Accumulator (AA) ring. ACOL is designed to provide a tenfold increase in the rate at which the precious antiprotons can be collected (6×10^{10} particles per hour).

The Tignes meeting included reviews of the machine status in and around LEAR. Roy Billinge kicked off with a general survey of CERN's antiproton facilities, and Eifion Jones followed up with a progress report on ACOL. Construction should take a total of 3½ years and installation a further eight months, so that the machine is scheduled to be ready in 1987.

Attention then turned to LEAR itself. Pierre Lefèvre covered the current status of the machine, while Daniel Simon dealt with the experimental areas. At the moment, LEAR experiments are confined to the South Hall at the CERN Proton Synchrotron (which decelerates the antiprotons prior to injection into LEAR). To satisfy the big interest in LEAR, additional beamlines could be provided in the South Hall, and users are hoping to gain a foothold in other experimental areas.

Dieter Möhl described the technical aspects of future LEAR options such as internal targets, co-rotating beams of negative hydrogen ions and antiprotons, colliding



proton and antiproton beams, and additional antiproton deceleration, and followed up with a design for a superconducting 'Super-LEAR'.

Other talks covered control and diagnostic systems, cooling of circulating beams (with illustrations from other cooling rings) and ideas for cooling and deceleration of the extracted beam.

After the daily ration of machine sessions, attention turned to the wide variety of physics which has attracted so many users.

The first physics session was given over to nucleon-antinucleon interactions. As well as the important and still largely unexplored area of particle-antiparticle annihilations at low energy, talks covered resonance searches, proton-antiproton atoms, spin effects, elastic scattering, and the possibility of introducing the added attraction of anti-neutrons.

The spectroscopy session covered the mesons expected to be accessible in proton-antiproton annihilations at LEAR and Super-LEAR energies. New effects are observed at LEAR in meson production mechanisms from annihilations at rest, but so far there is no confirmation of 'baryonium' states (narrow resonances seen only in annihilation). Experimentalists are keen to dig deeper into the rich meson gold mine of annihilation, looking for glueballs (mesons made of gluons rather than quarks), hybrid quark/gluon mesons, and baryonium, using new detectors and new approaches (comparison of different angular momentum states in annihilation at rest, jet targets, polarization experiments, etc.). The recent investigation of charmonium (charmed quark-antiquark states) at the ISR using a gas jet target

gives support to Pietro Dalpiaz' push for quarkonium spectroscopy at Super-LEAR energies.

In the sessions on rare decays, results on the annihilation into an electron positron pair, and charge-parity violation and the mysteries of the neutral kaon system got plenty of coverage. Here LEAR could play a vital role in testing ambitious new theoretical ideas, especially with the high intensities expected with ACOL.

In the antiprotons and nuclei session, clear results were presented from exotic atom spectroscopy, from scattering experiments,

and evidence has been seen for annihilations of antiprotons both inside and on the surface of nuclei.

In the 'new ideas' sessions, proposals were aired to test the gravitational properties of antimatter, where it is important to check whether antimatter falls down, or whether it 'falls' up! Trapping of extremely low energy (almost stationary) antiprotons in magnetic 'bottles' were discussed, together with very high precision experiments. The idea of studying proton-antiproton atoms produced in flight was aired, and imagination went as far as considering the pro-

duction and storage of antihydrogen (an antiproton nucleus with an orbital positron) — which would be the first example of the production of stable neutral antimatter.

The detector session began with a survey by chief detector guru Georges Charpak, who claimed 'the limitations of particle detectors are usually not solely intrinsic but are also determined by the nature of their interaction with the particles, the geometry, and the cost. Very often the advertised limits are illusory'. The unusual physics at LEAR is also acting as fertile ground for detector innovations.

Science transfer for development

by Abdus Salam

The author, who shared the Nobel Physics Prize in 1979 with Sheldon Glashow and Steven Weinberg, is founder and Director of the International Centre for Theoretical Physics in Trieste, Italy. A native of Pakistan, Abdus Salam has long advocated increased Third World participation in first rate scientific research. The article published here is extracted from a fuller text which first appeared in 'Third World Affairs 1985', published by the Third World Foundation for Social and Economic Studies, London.

Despite the recent realization that science and technology are the sustenance and major hope for economic betterment, the third world (barring a few countries — Argentina, Brazil, China, India...) has taken to science — as distinct from technology — as only a marginal activity.

This is also true of the aid-giving agencies of the richer countries, of the agencies of the United Nations and also unfortunately of the scientific communities of the developed countries which might naturally have been expected to be the third world scientists' foremost allies.

Policy makers, prestigious commissions (like the Brandt Commission), as well as aid-givers, speak

uniformly of problems of technology transfer to the developing countries as if that is all that is involved. Very few within the developing world appear to stress that for *long term effectiveness, technology transfers must always be accompanied by science transfers*; that the science of today is the technology.

Science transfer is effected by and to communities of scientists. Such communities (in developing countries) need building up to a critical size in their human resources and infrastructure. This building up calls for wise science policies, with long-term commitment, generous patronage, self-governance and free international contacts. Further, in our countries,