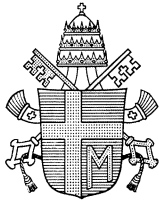


Physics in collision



Sa Sainteté Jean-Paul II
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larly to spread information on these matters and above all to inform those responsible for the technical applications, urging them to ensure that the results of scientific research, however remarkable they may be, are never turned against man and are used only for the common good by men and women inspired with the greatest love for mankind.

In conclusion I want to make a wish. It is that scientists in their profession may be constantly aware of the transcendence of mankind in the world and of the transcendence of God over man, and that their actions may be guided by their awareness of the universal significance of their own discipline and the universal significance of brotherly love, a yearning for which was instilled in us particularly by Jesus. I would like to repeat the appeal I made at UNESCO: 'Yes, the future of man will depend on his culture! Yes, world peace will

depend on the predominance of the spirit! Yes, peace for man in the future will depend on love.'

*Reply by U. Vattani,
Vice-President of CERN Council*

'We who are associated with this Institution, whose purpose it is to conduct scientific research of a strictly peaceful nature, have followed your message with the greatest interest, based as it is on the view that science is 'one of the paths to follow in the disinterested search for truth'. This indeed is the aim to which physicists are steadfastly dedicated and in CERN's laboratories is transformed into daily reality.

That is why everyone was so moved by the way in which you have presented and analysed these ideas, and we feel particularly honoured that you should have chosen CERN as the place from which to broadcast your message to the world. On behalf of all those present, on behalf of the Laboratory, its staff, its Council and its Member States, I have the honour to express to you our deep gratitude. All of us — physicists, engineers, technicians, administrators, diplomats and politicians alike — have reaped great benefit from your words as well as strong encouragement to pursue our collective research activities in a spirit of quiet conviction and humility.'

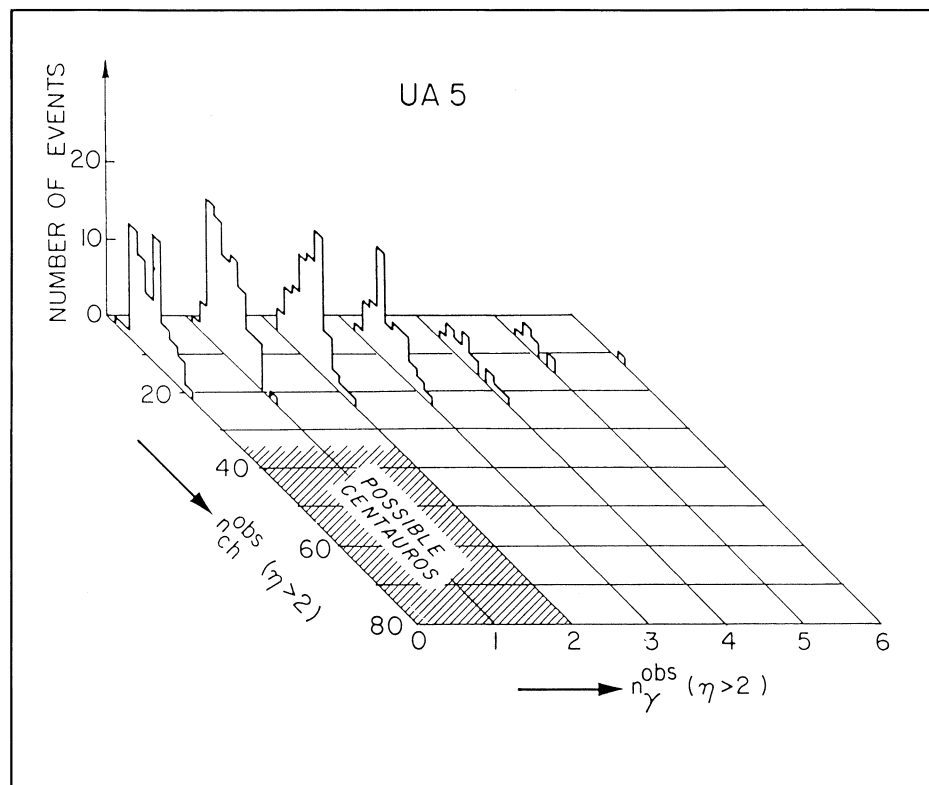
The 2nd international conference 'Physics in Collision' took place in Stockholm from 2 — 4 June. Some 160 delegates from all over the world gathered together to learn and to discuss about the most recent results from proton-proton, proton-antiproton and electron-positron colliders. The first conference in this series was held in May 1981 in Blacksburg, Virginia, and next year's meeting is scheduled for Lake Como, Italy.

The importance of basic fundamental research was stressed by Jan-Erik Wikström, Swedish minister of education and cultural affairs, in his opening address. It is sufficient to state, said Mr. Wikström, that the quest for knowledge of the structure of matter is part of our culture and thus pure science is an inevitable part of cultural activities. He could also promise to Swedish scientists an increase of the support of basic science for the next fiscal year.

Hard scattering processes, in which two constituents scatter or interact, was the subject of the first talk by Norman McCubbin. Recent results from the CERN Intersecting Storage Rings were reviewed. It has recently become possible to study proton-antiproton interactions at the ISR and a comparison with proton-proton interactions was made by Maurice Jacob. Differences on the few percent level are expected and observed for the dominant hadronic features. More sizable effects are expected to show up when the luminosity is increased enough to study lepton pair production, elastic scattering etc.

Much time was devoted to the most recent results from the experiments at the CERN SPS proton-antiproton collider. Although no new data has been taken since last December, substantial progress has been made in the analysis of the

Presented at the Stockholm conference were these results from the UA5 experiment at the CERN SPS proton-antiproton collider. For selected events (pseudorapidity greater than 2), the observed charged particle multiplicity is shown for different numbers of produced photons. The region which would be populated by Centauro events (many charged particles and few photons) is shown shaded, showing that no Centauro behaviour is seen at 540 GeV.



different experiments. Martti Pimiä summarized the status of the UA1 experiment and showed that the transverse momentum spectrum of charged hadrons follows closely theoretical predictions up to 10 GeV (see June issue, page 178). Qualitative agreement has been observed with cosmic ray experiments in that the transverse momentum spectra are steeper for events with lower multiplicity. Correlations are observed, both of long and short range.

The UA2 data was presented by Peter Jenni. Inclusive eta meson production at 90° was estimated to be 0.55 that of neutral pions, and no significant signal of direct photons was observed. Preliminary data was presented on inclusive charged particle production at 90° as was an upper limit on the production of free quarks.

Working together with the UA2 is

the UA4 experiment and their results were presented by Bertus Koene (see also page 271). Antiproton-proton elastic scattering has been measured in the squared momentum transfer range from 0.05 to 0.20 GeV² with a behaviour which extrapolates nicely from lower energies. They also gave a first preliminary result on the antiproton-proton total cross-section of 66 ± 7 mb at the newly available collision energy of 540 GeV (see page 271).

David Ward summarized the most recent results from the UA5 experiment. New data were presented on production of photons and of strange particles. The excess of photons over charged particles in the central region can be explained by assuming an eta to neutral pion ratio of about 30 per cent. The inclusive strange particle spectra showed average transverse momenta significantly higher than at lower energies.

This could be due to an increase in charm production.

The last talk on collider results was given by Narendra Yamdagni who compared event structure in collider and cosmic ray experiments. One of the most exciting results seen in cosmic ray experiments is the so-called Centauro phenomenon, events in which a large number of secondaries are produced but with no or very few photons. The results obtained so far by the UA5 experiment show no evidence for such phenomena at 540 GeV. One may speculate that the threshold for the production of such strange events has not yet been reached.

J. D. Bjorken started the second day's talks by trying to answer 'what have we learnt about hadronic interactions from colliders and cosmic rays?'. He stressed the importance of measuring jets at the collider and indicated the possibility of observing quark-gluon plasma in collisions between uranium nuclei.

The production and decays of states containing heavy quarks were covered in two talks. Lucien Montanet reviewed heavy flavour production in hadronic collisions. A large number of experiments aim at detecting both charmed states and open beauty. Results from electron-positron colliders on the decays of heavy flavour states were reviewed by Thomas Ferguson. With the increasing statistics available on D-mesons, a number of branching ratios have been measured and compared with theories. Semileptonic decay of the charmed lambda baryon has now been seen. The calculated lifetime of B-mesons, containing one beauty quark, is even shorter than that for charmed mesons, less than 10^{-13} s, and only upper limits are available. Semileptonic and more exotic decays were reviewed.

A review of two-photon physics

was given by Susan Cooper. In her conclusions she stressed that this particular field is alive and doing well at electron-positron rings. In particular, the first results on the photon structure function are very successful. In addition to the well-established particle states made up of quarks, there may exist pure gluon bound states, usually called gluonia or glueballs. Experimental evidence for such states were reviewed by Elliott Bloom. Two possible states are the iota (1440) and theta (1640) and preliminary results were given.

Murdock Gilchriese presented new results on the physics on the upsilon region. The new results presented were on a search for new narrow states, leptonic branching ratios, and hadronic and electromagnetic transitions between different upsilon states. The importance of increasing the luminosity of the electron-positron machines was stressed. A review on electroweak effects in electron-positron reactions by Beate Naroska ended the second day. She concluded that the presence of weak neutral currents is clearly established in annihilation into muon pairs, with dominance of the axial vector coupling, whereas the situation is less clear in the experimentally more difficult annihilation into tau pairs.

The last day was mostly devoted to jets, with results from PEP and PETRA and a theoretical review. Horst Oberlack reviewed jet studies at PETRA and could report on a small average charge carried by jets in two-jet events, on four-jet production and that the present estimate of the strong coupling constant somewhat depends on the type of fragmentation model used. Jonathan Dorfan reported that data taken so far at PEP has been with a total collision energy of 29 GeV. Most data has been taken with the Mark II de-

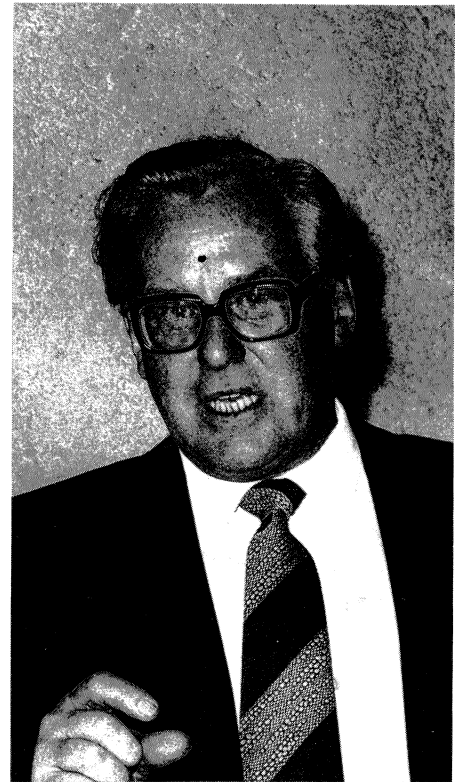
tector. The talk included discussions of scaling violations, energy correlations, heavy quark fragmentation and results on the tau lepton.

Bo Andersson, in his review on jet fragmentation, pointed out that the experimentalists do not see partons but 'big fluffy hadrons', and one should compare angular energy flow on the partonic and the hadronic level. The concluding lecture 'Is there a desert behind mountains' was given by Chris Llewellyn-Smith, who pointed out that the present arguments for a desert, with no new physics between currently available energies and approximately 10^{14} GeV, rest on a tower of untested — but appealing — ideas. There are many alternative theories which predict instead a lot of new physics.

(Report by Per Carlson. Some more recent physics results were subsequently presented at the Paris meeting. A detailed report will follow in our October issue.)

A line-up of speakers at the recent Stockholm 'Physics in Collision' conference: left to right, B. Andersson, J. Dorfan, N. Yamdagni, P. Jenni, S. Cooper, D. Ward, M. Pimiä, C. Llewellyn-Smith and L. Montanet.

(Photo Sten Hellman)



The second international 'Physics in Collision' conference held in Stockholm from 2–4 June coincided with the celebrations for Gösta Ekspong's 60th birthday. He came from Uppsala to the newly created chair in physics at the University of Stockholm in 1960. He is a frequent visitor to CERN, where his duties have included being Chairman of the Scientific Policy Committee (1972–74).