

Top, the spectrum of the phi meson plus pion combination seen in the CLEO detector at the Cornell CESR electron-positron ring, showing the clear F meson signal at 1970 MeV. The phi mesons are picked up from their decay into two kaons. Bottom, using kaon pairs away from the phi mass makes the signal disappear.

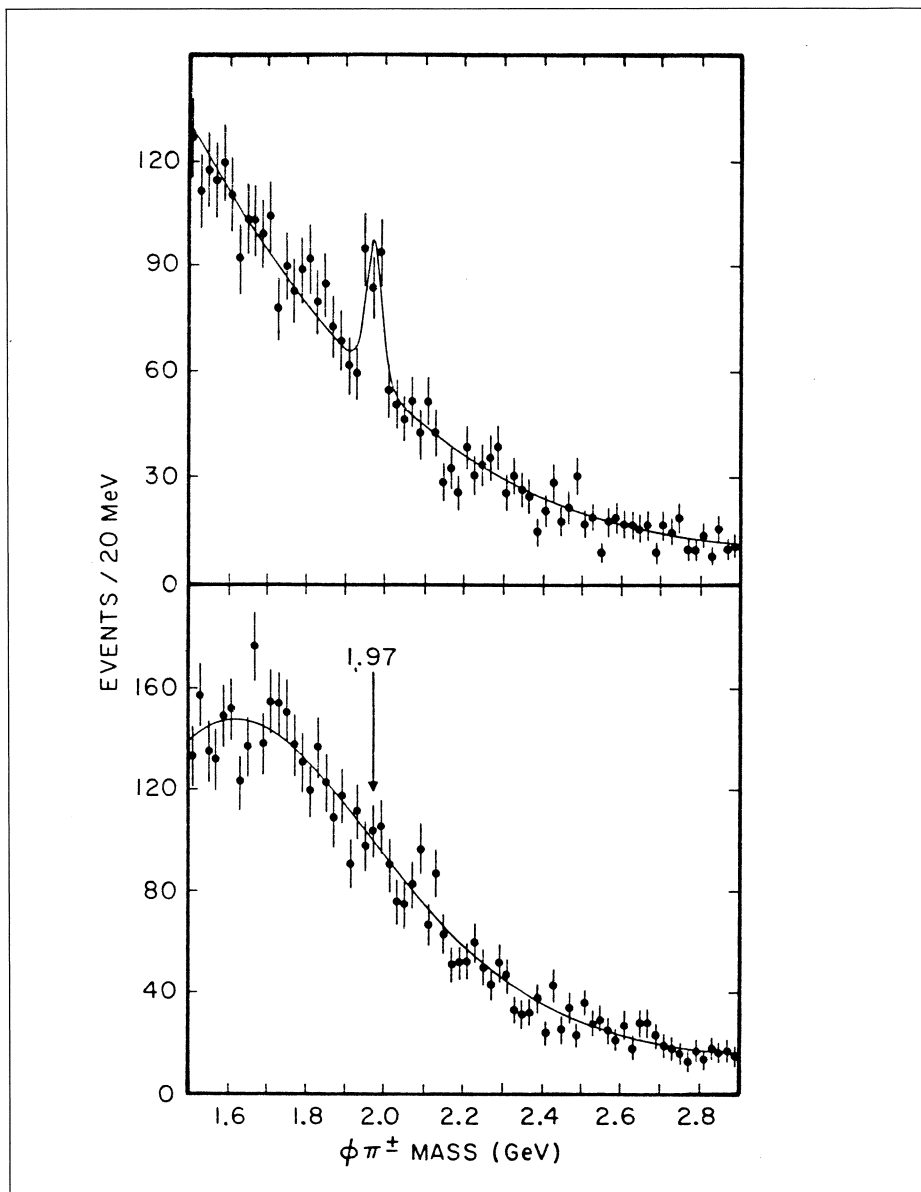
Getting under way is an extensive programme of testing and calibration of production shower counters, hadron calorimeters and tracking chambers, using Tevatron beams. If all goes well, there will be a preliminary test run of the partially completed detector with colliding beams of low luminosity in 1985. Most of the central and forward calorimetry should be in place, but it is unlikely that the complete tracking, trigger, and data acquisition systems will be available until the full physics runs begin in 1986.

CORNELL CLEO's F

The CLEO (Cornell / Harvard / Ithaca College / Ohio State / Rochester / Rutgers / Syracuse / Vanderbilt) collaboration working at the CESR electron-positron ring at Cornell has found an F meson candidate in a new decay mode and at a lower mass than previously observed. The charmed F meson is the strangeness-carrying partner of the D mesons, and consists of a charmed quark bound with a strange antiquark.

Although observations of D mesons are routine, the F meson has remained elusive. A DASP (DESY) electron-positron annihilation experiment and a more recently CERN photon experiments utilizing the Omega spectrometer provided the strongest F evidence. The Omega experiments gave the F mass as 2020 ± 15 MeV.

The F meson can be observed through the weak decay of its charmed quark into a strange quark. The decay modes most accessible to experimental detection are those in which the new strange quark and the original strange antiquark combine to form either an eta or a phi meson, with a few pions being produced by



the weak decay of the charmed quark. The previous experiments have relied on detection of one or more pions along with an eta, observed through its decay into two photons. In the CLEO detector, the phi-pi mode was observed by reconstructing the phi from two charged kaons.

Phi-meson candidates were identified from combinations of oppositely charged tracks interpreted as

kaons. A clear phi signal above a substantial background was observed in the two-kaon mass spectrum. Charged kaon pairs, consistent with the phi mass, were selected for further analysis. They were combined with other charged particles, assumed to be pions, to give a phi plus pion mass spectrum, and the mass peak at 1970 ± 5 MeV has a width consistent with the experimental resolution. No mass peak is

At the DESY Theory Workshop — Gerhard Mack and Harry Lehmann (right).

(Photo DESY)

observed if two-kaon masses above or below the ϕ are used to create the ϕ - π mass spectrum. This underlines that the observed peak is due to ϕ mesons and not background combinations.

Further evidence that this enhancement is the F meson comes from examining its production and decay. In background electron-positron annihilation, charmed quark production accounts for 40 per cent of the event rate. The momentum fraction (momentum/beam energy) distribution of F events agrees with those of D events measured earlier by CLEO. Also, the product of the F production rate and the relative occurrence of the ϕ - π decay is one-third of the product for D^0 production followed by decay to kaon plus pion, in good agreement with a simple quark counting argument.

Angular distributions of the two kaons and the pion further support the proposition. The ϕ meson has spin 1, the pion has spin zero, and the F meson should have spin zero. These assignments lead to two characteristic angular distributions, which are in good agreement with the data in the peak, after subtracting background.

This observation of an F signal at 1970 MeV in the ϕ - π spectrum was announced last summer and has been confirmed by the ARGUS experiment at DORIS (see December 1983 issue, page 423).

DESY 45 GeV — and still topless!

Late in the evening of 9 December, the champagne was broken out at DESY. The PETRA electron-positron storage ring passed from 44.98 GeV total energy to 45.01, thus surpassing the 45 GeV design value for the



PETRA improvement programme which began back in 1982. From 37.2 GeV, the energy was nudged to 40.2 towards the end of 1982, and reached 43.19 last July (see October 1983 issue, page 311). To achieve 45 GeV, the PETRA r.f. power and the number of accelerating cavities were eventually doubled.

To run at 45 GeV, all the available space is filled by accelerating cavities. There are now 112 of them working at 500 MHz, with a total of 672 cells. In addition, 24 cavities running at 1 GHz with a total of 152 cells are used to improve the acceleration process. This 1 GHz system is used at lower energies to increase the bunch length.

The energy required to run this system amounts to about 17 MW (from the mains) of which 9.6 reach the cavities. Since they are not superconducting, the cavities' losses are high — only about 1 MW is finally used by the beam to compensate for emitted synchrotron radiation. These energy losses underline the potential usefulness of superconducting cavities for handling high energy electron beams.

Theory workshop

Concentrating on the common ground between current theory and experiment, the annual Theory Workshop is now a traditional event

in the DESY calendar. The sixth such workshop, held a few months ago, explored the new jet information culled from the summer conference season. However the number of outstanding questions in this area still appears to exceed that of clear answers.

The organizing committee, L. Stodolsky (chairman), K. Schilling (deputy chairman), H. Joos and T. Walsh had in the back of their minds a comparison of simple models with standard quark-gluon gauge theory (QCD). However, it became clear that the qualitative successes of QCD have so shaped our thinking that simple models don't generate much enthusiasm any more. On the other hand quantitative tests of QCD are only at an accuracy of about 20 per cent, which leaves much theoretical and experimental work to be done.

Discussion of observed jet structure was fuelled by comparison of results from proton-antiproton collisions and electron-positron annihilation. Although mainly gluon jets are studied in proton-antiproton collisions at the CERN Collider and quark-antiquark jets in electron-positron interactions, the jet similarities are nevertheless striking. However K. Fialkowski mentioned that multiplicity of different types of jets at medium energies could differ.

For a quantitative explanation of jet structure, the theoretical input to