CONFIRMATION OF THE NEW 3700 MeV NARROW RESONANCE IN e^+e^--COLLISIONS

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The two new, very narrow resonant states discovered at Brookhaven and SLAC [1] were confirmed at the storage ring DORIS and DESY in e^+e^--colliding beam experiments (see also ref. [2]).

The experiment reported here (PLUTO) uses a detector consisting of cylindrical proportional wire chambers in a homogeneous magnetic field, parallel to the beam axis. The field is produced by a superconducting solenoid coil with an inner usable diameter of 1.4 m and 1.05 m length. Details of the detector have been published elsewhere [3]. The magnetic field integral along the beam axis was made equal to zero by two additional compensating coils. Operation of the storage ring was quite uncritical under these conditions up to 20 kG. The data were taken with a field of 10 kG. Luminosities obtained were about 1×10^{29} $cm^{-1}\,sec^{-1}$, averaged over the beam life of 4–6 hrs.

The detector was triggered by a wire logic, using signals from porportional chambers in the $r\phi$-plane (r = radius, ϕ = azimuth). The trigger has two stages [4]. In the first fast stage track elements defined by two closely spaced chambers are selected. The second, slower stage recognizes tracks over several chambers and counts them.

The actual trigger used in the resonance search demanded two coplanar tracks, or two tracks spaced in their azimuthal angles by 40° to 140°, or more than two tracks not restricted in angles. The luminosity was monitored by using small angle Bhabha scattering.

Fig. 1 shows the excitation curve of the two resonances as observed by PLUTO. As our event patterns

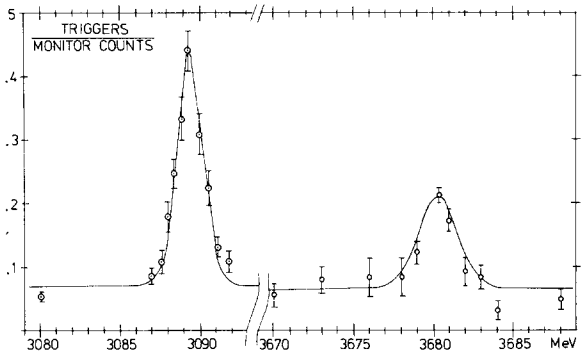

Fig. 1. Events with more than three tracks as counted by the trigger logic versus total energy of the two beams.

obtained at the resonances contain a high percentage of multiprong final states, we plot here the number of observed events with more than three charged prongs, related to the monitor counts. No corrections have yet been applied. In particular we have not subtracted a constant background of non beam-beam events originating from electroproduction and cosmic rays.

The widths of the resonances are consistent with the expected energy width of the beams. A fit with a constant background and a gaussian distribution to the experimental points yields the following widths (r.m.s.) and resonant masses:

$\sigma(3100) = 0.96 \pm 0.15$ MeV $m(3100) = 3089.5$ MeV,

$\sigma(3700) = 1.04 \pm 0.15$ MeV $m(3700) = 3680.3$ MeV.

Note that the absolute calibration of the DORIS energy is uncertain within about 1%, which is therefore also

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the uncertainty in the resonance masses. In addition to the multiprong events we also see at the first resonance a strong signal in the collinear twoprongs. A striking feature we observe at the second resonance is the abundance of events with multiplicity greater than four. The analysis of the collected events is in progress.

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References

[1] J.J. Aubert et al., Phys. Rev. Letters 33 (1974) 1404; J.E. Augustin et al., Phys. Rev. Letters 33 (1974) 1406; C. Bacci et al., Phys. Rev. Letters 33 (1974) 1408.
[2] DASP-collaboration, Physics Letters 53 (1974) 393.
[3] L. Criegee et al., Proc., 1973 Intern. Conf. on Instr. for high energy physics, 633 and 707 (1973).
[4] E. Iarocci, P. Waloschek, DESY-Report 72/12 (1972); H. Mehrgardt et al., Proc., 1973 International Conf. on Instr. for high energy physics, 287 (1973).