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M e m o r a n d u m

To : E.E.C.

From : GMC-RHEL-DNPL-Liverpool Collaboration

Subject : A letter of Intent

Physics

The existing S99 experiment will produce angular distributions for the channel $\bar{p}p \rightarrow \pi^+\pi^-$ at 20 momenta in the momentum range 0.7 - 2.4 GeV/c. Of the three channels we are studying, this process is likely to yield the most information on resonances in \bar{p} -p formation since a) the final state has constraints of zero spin and G parity, plus b) a $\pi\pi$ state of angular momentum J may be formed only from initial $\bar{p}p$ states of $L = J \pm 1$, consequently the channel is described by only two amplitudes. There exists the opportunity for a phase shift analysis, if polarization data is measured as well as the differential cross sections. The two sets of measurements would therefore allow a strong statement to be made about the existence of resonances in this channel, in \bar{p} -p formation, in the mass region of the T and U mesons. This statement applies equally to the existence of high mass low spin states, i.e. information on the daughter trajectories. We wish to submit a proposal to extend S99 into a measurement of the asymmetry of the production of $\pi^+\pi^-$ of a polarized proton target. We would also obtain data on the elastic and K^+K^- channels, but the experimental design would be optimised for the $\pi^+\pi^-$ channel.

Hardware

The existing counters, spark chambers, and electronics would be used in the polarization experiment, with some mechanical rearrangement around the polarized target.

The magnetic field of the target will analyse the outgoing particles, so we will not need the AEC magnet.

In order to achieve momentum resolution a small new detector, a spark chamber with capacity readout, will have to be built to localise the trajectory inside the field, close to the target.

A 15 cm x 2.5 x 2.5 cm butanol target is required. The target and cryostat used in S102 by the CERN-ETH-ICL-Saclay group would be adequate if available. The magnet for the target may be obtained by modifying an existing polarized target magnet at RHEL. A design study has demonstrated the feasibility of this modification.

Beam

The m_{11} beam provides sufficient flux for the measurement at $p \geq 1.2$ GeV/c. One small bending magnet will be necessary for steering the low momentum beam on the target.

Timescale

Our present allocated time for S99 provides 4 PS weeks of data collection beyond the 71-72 PS shutdown. The magnet and mechanical modification to S99 could be ready for installation 6 months after approval of the experiment.

If the target and cryostat used in S102 by the CERN-ETH-ICL-Saclay group are not available, a new one could be provided by the CERN polarized target group on a similar time scale. We envisage a 3 month period between the end of S99 and our first look at the reaction with the polarized target. We should be able to collect some sample data before the 72-73 Winter shutdown. To collect several thousand $\pi^+\pi^-$ events at each of 10 momenta would require 8 PS weeks during 1973.

We are seeking approval of this experiment from the Rutherford and Daresbury Laboratories before submitting a proposal to the EEC.

Manpower

The present S99 experiment involves 11 physicists from the U.K., 1 CERN Fellow, 2 research students and 3 technical staff. Of these, 15 are at present resident at CERN. The group will be enlarged by the addition of 2 physicists and 2 students. For the polarization experiment we would expect 9 or 10 people to be resident at CERN and an equal number resident in the U.K. working on the S99 analysis, but available if necessary for main user runs.

We therefore feel that on the time scale indicated we have adequate strength to prepare and run the proposed experiment without prejudicing the progress of S99.