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New Proposal for T 86 Experiment Electromagnetic Production of Resonances and the Decay Width of $\rho \to \pi\gamma$ ($\Gamma_\rho \to \pi\delta$). II.

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I. In April we proposed (CERN/TC/COM/64-37) an experiment of 16 GeV/c π^- incident on Au (Z = 79) to observe the channel $\pi^- + Au \to \rho^- + Au$. From the cross-section of this reaction one can calculate the decay width $\Gamma_\rho \to \pi\gamma$.

This experiment was approved to run in May after the completion of the N6 experiment. However, since the magnet of the bubble chamber did not work properly, it was impossible to make the run. Therefore, we would like to run this experiment in September.

II. Physics obtained from experiment

Besides measuring the decay width of $\rho \to \pi\gamma$ which is very important to the theoreticians, we would make a systematic study of electromagnetic interactions in general. For example, all resonances (such as ρ, B, A_1, A_2, etc.) which can decay into $\pi^-\gamma$ should be produced in these interactions.

It will be possible to continue our study of diffraction events into 3 and 5 pions. Our last experiment of 16 GeV/c π^- on C, Fl and Cl was very successful in producing the A_1 resonance. With Au as the target, one can observe the effect of the size of the nucleus used for diffraction.

Only about 1/5 of the beam tracks will interact in the Au. Thus it will be possible to use the interactions in the liquid from beam tracks not interacting in Au to add to our statistics of diffraction dissociations into 3 and 5 pions.

It is clear that a similar physics can also be done with incident protons. For example, one could observe interactions of the type

$P + Au \to \Sigma^+ + Au$ – i.e. Σ^+ of very high energy

$P + \text{Nucleus} \to N^* + \text{Nucleus}$, $N^* \to p + \pi^0$ – to give $\Gamma_{N^* \to p + \delta}$

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III. Experimental Details

The target for this experiment would be one of two possibilities:

(1) if this experiment would follow the N6 experiment without the P.S. stopping for two shifts, we would use the target made for the run in May. That is, use the N6 target as a support for 6 pieces of Au spaced at intervals of 5 cm.

(2) if there is a break before the run, we will use a target of lead (Z = 82) in the form of a plate of 1 cm. thickness. This target would give about the same number of electromagnetic interactions in the lead and three times as many interactions in the liquid, since it would be possible to use four beam tracks per photo in place of one. Either of these targets will give about two $\pi^- + Au \rightarrow \rho^- + Au$ per 1,000 photos with approximately $10^0/o$ background.

We would like a minimum of 100,000 photos, which would give at least 50 clean, measurable events (for $\rho \rightarrow \pi+\gamma$ = .5 MeV). This would require 4 days of P.S. time, assuming $15^0/o$ of the P.S. at a 1.8 second rate and 21 GeV/c. If time permits, we would like to take about 20,000 photos with incident protons.

IV. Conclusion

The measurement of the $\rho \rightarrow \pi\delta$ will help theoreticians understand the coupling constants for electromagnetic processes. A systematic study of electromagnetic interactions of this type will be the first experiment of this nature. The study of diffraction events in Au will give a better understanding of the effect of the nuclear size.