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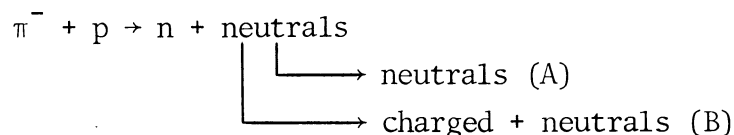
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21 October 1970

M e m o r a n d u m

To: Members of the EEC
 From: Karlsruhe-Pisa-Vienna
 Subject: Serpukhov Experiment

INTRODUCTION

Following the invitation of the EEC to present suggestions for future experiments at Serpukhov we propose to perform an experiment on the reactions



All outgoing particles are detected and the following quantities will be measured

neutron : emission angle and time of flight (complete determination)
 gammas : angle and energy (complete determination)
 charged : directions only.

PHYSICS

The main aim is research on neutral boson resonances. Apart from searching for resonances also $d\sigma/dt$ for the reactions can be measured. Events with $|t| \gtrsim 0.04 \text{ (GeV/c)}^2$ will be accepted.

Two types of triggers are simultaneously recorded:

A) Purely neutral decay modes like the strong decays into π^0 's and electromagnetic decays. This is a very selective trigger. Most resonances do not appear in these channels. Therefore, for the remaining ones the ratio of peak to physical background should be good. Moreover, a highly overconstrained fit is possible and will give pure samples of $2\pi^0$, $3\pi^0$, etc.

The quantum numbers for the $2\pi^0$ system are restricted to the values $J^P = 0^+, 2^+, 4^+, 6^+, 8^+, \dots$. The 0^+ and 2^+ resonances, the ϵ and f , are known. Any further bumps at higher masses in the $2\pi^0$ system then almost certainly have $J^P = 4^+, 6^+, \dots$. This seems to be the best chance to establish a series of resonances.

B) General decay into charged and charged-plus-neutrals. Also here kinematical reconstruction is possible. In addition to all $I \geq 1$ resonances detected in the proton missing mass experiment, also $I = 0$ resonances should show up. Moreover, as small $|t|$ are also accepted additional resonances which are produced very peripherally can be detected.

PERFORMANCE

The total detection efficiency for each resonance will be comparable to that of the CERN-Serpukhov proton missing mass experiment. The lower efficiency for the detection of the neutron is balanced by the acceptance of a wide momentum transfer interval which typically includes about 2/3 of the total cross-section. With the neutron detectors at 12 m distance from the target, the missing mass resolution is comparable to that of the proton missing mass spectrometer.

EXPERIMENTAL SET-UP

The set-up consists of the following elements (see Fig. 1).

- 1) A 40 cm hydrogen target with localization of the interaction point by Čerenkov light (for reaction A only, for reaction B the vertex is determined by tracing back the charged tracks).
- 2) Two sets of neutron detectors, each with eight scintillators $240 \times 16 \times 16 \text{ cm}^3$ with which time of flight and emission angle of the neutron are determined (neutron missing mass spectrometer).
- 3) Detection system for the decay products
 - a) Charkap and wire chambers with lead converters in between to get the conversion point of the γ 's and to determine the direction of the charged particles.
 - b) A matrix of lead glass counters to measure the energy of the γ 's.

4) A counter system around the target which distinguishes between reaction A and B and indicates also extra particles which are not going into the detection system of point (3).

5) An on-line computer for compressing the information before writing on tape and for control and preliminary analysis of the data.

Parts 1, 4, 5, and one set of 2 are existing. The second set of 2 is under construction. These parts have been used successfully in the Pisa-Karlsruhe experiment. The detection system for the decay products (point 3) has to be constructed.

POSSIBLE TIME SCHEDULE

1) Test experiment in 1972 at CERN with 17 GeV/c beam in the East Hall. The mass region up to ~ 2.4 GeV can be explored.

2) Serpurkhov 1973 with the 25 to 45 GeV/c beam. The missing mass range can be extended to about 4 GeV.

Collaboration with a USSR group is very welcome.

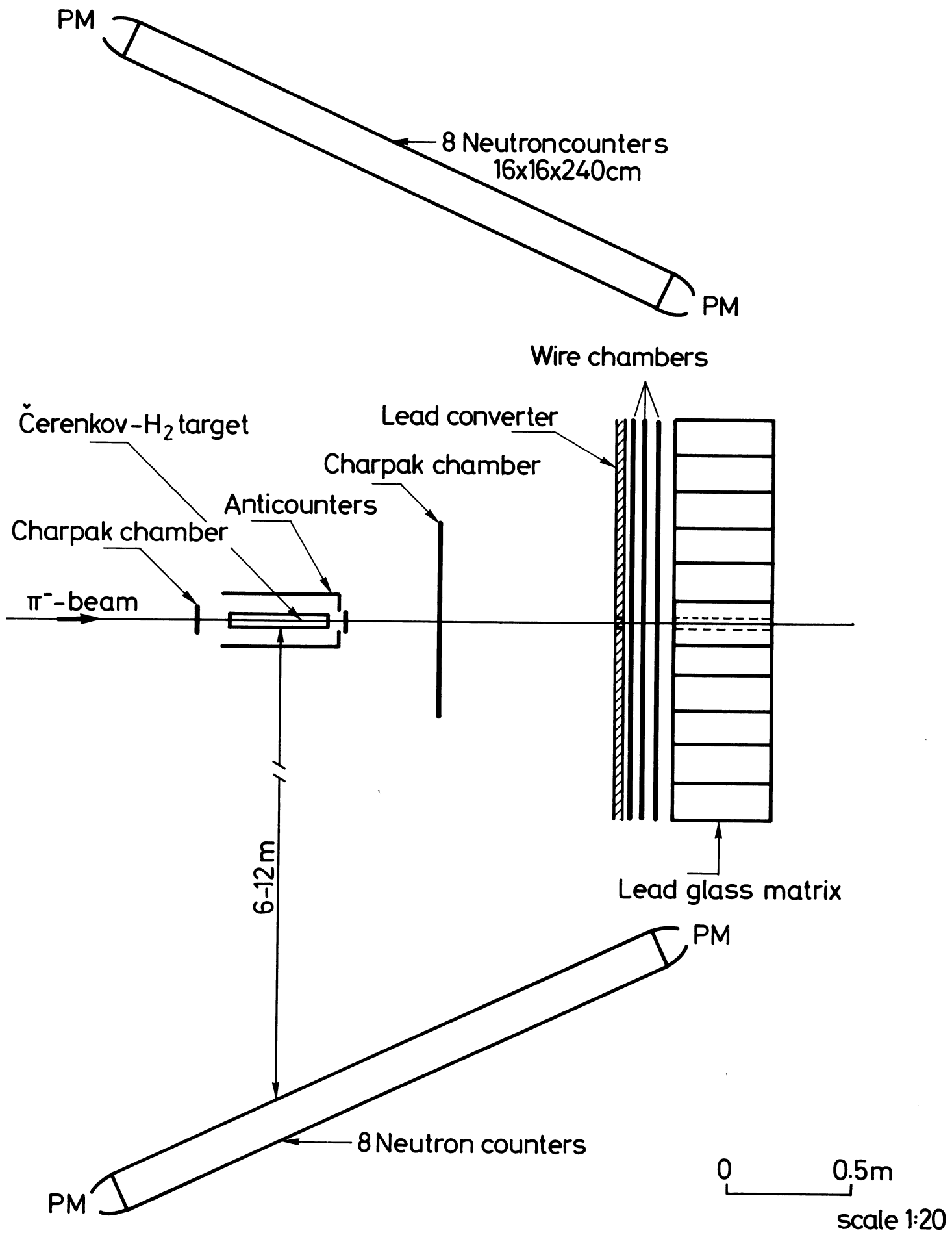


FIG.1