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EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

PHYSICS I

ELECTRONIC EXPERIMENTS COMMITTEE

PROPOSAL FOR

A FIRST COLLABORATIVE ELECTRONIC EXPERIMENT AT SERPUKHOV

Allaby et al. and M.S.S. et al.

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INTRODUCTION

As a first electronic experiment performed jointly by a CERN Serpukhov group it is proposed to measure the fluxes of particles produced at small angles in 70 GeV/c proton - nuclei collisions together with some measurements of total cross sections in the region of 50 GeV/c. The scope of this experiment is summarized in the attached table and will be discussed in the following paragraphs. The experiment would be performed jointly with the Čerenkov counter group (Denisov - Prokoshkin) at Serpukhov.

BEAM SITUATION

The first beam available will be of negative particles emitted essentially in the forward direction and covering a momentum range of about 40 - 60 GeV/c, with the machine running at say 70 GeV/c. Three azimuthally fixed target positions situated inside magnet unit 24 have been selected to allow negatively charged particles of 40, 50 and 60 GeV/c, produced at 0°, to come out down the chosen beam channel. It is also possible for particles emitted at non forward angles to pass down the beam channel by suitable choice of target and radial displacement.

SCOPE OF MEASUREMENTS

The first part of the table shows the proposed range of production spectrum measurements for 70 GeV/c protons. The target radial displacements (Δr) from the equilibrium orbit do not seem unreasonable. In order to make a good comparison with the small angle production experiment (S61) being performed at CERN, it would be wise if possible to run the Serpukhov machine at 19 GeV/c and measure the π^- fluxes in the same beam channel at $(19/70) \times 40$, 50 and 60 GeV/c. By this means uncertainties in the acceptance of the detection system could be eliminated. The difference in target efficiencies between 19 and 70 GeV/c could be determined by a radio chemical method.

The scope of the total cross section measurements, using particles produced at 0^{o}, is indicated in the latter part of the table.

From flux estimates of Hagedorn and Ranft (private communication) it appears that the π^- and K^- cross sections can be readily measured up to 60 GeV/c. For $\bar{p}$ this is not clear. The overall accuracy aimed at would be $\sim \pm 1\%$. In order to check the overall systematic uncertainties of the measurements the cross sections for the particles would be measured at around, say, 15 GeV/c where they are already well determined.

EQUIPMENT NEEDED

The most important item for these measurements, namely the DISC and its associated calibration equipment, will be set up and running for the S61 experiment at CERN. In this operating condition it would be well prepared for work at Serpukhov. Associated nanosecond electronics and scintillation counters would be on hand together with a 2 m liquid H_2 target if needed.

TIME SCALE

The S61 production experiment will run from November 1967 to May 1968. It would seem realistic to envisage that Serpukhov measurements could begin around September 1968. The time at which the experiment will end is hard to fix due to uncertainties in the facilities available (e.g. liquid hydrogen and the possibility to use it) and the machine running schedule. A preliminary guess might be during the first half of 1969.

Table 1

Measurements of $\frac{d^2N}{d\Omega dp}$ for π^-, K^-, $\bar{p}$

Incident momentum p_o = 70 GeV/c.

	p_o (GeV/c)	Θ_s(mrad)	Δ_r(mm)
Target 1	60	0	- 28
	50	-7	0
	40	-14.5	+28
Target 2	60	+ 9	-33
	50	0	0
	40	- 9	+33
Target 3	60	-	-
	50	+12.5	-14
	40	0	+28

Incident momentum p_o = 19 GeV/c; $\frac{d^2N}{d\Omega dp}$ for π^-.

Target 1	16.3	0	-28
Target 2	13.6	0	0
Target 3	10.8	0	+28 .

Measurements of σ_{tot}

Momentum GeV/c	π^-	K^-	$\bar{p}$
40	✓	✓	✓
50	✓	✓	✓
60	✓	✓	?
~ 15	✓	✓	✓