Ref.: CERN/ISRC/69-5 Add.7. Date: 9.11.1973

M E M O R A N D U M

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To/A : H. Schopper, Chairman of the ISRC

From/De : M.G. Albrow, D.P. Barber, J.A. Bogaerts, B. Bošnjaković, J.R. Brooks, Ch. Chang, A.B. Clegg, F.C. Erné, P. Kooyman, F.K. Loebinger, N.A. McCubbin, P.G. Murphy, A. Rudge, J.C. Sens, A.L. Sessoms, J. Singh, J. Timmer.
CERN/Holland/Lancester/Manchester Collaboration.

Subject/Objet:

RE:- Status and intentions CHLM collaboration.

In response to a request by the ISRC (CERN/ISRC/73-31) and further to our memorandum "Status and intentions exp. R201" (CERN/ISRC/69-5 Add.6) (referred to as I) we outline below the series of measurements which remain to be done until the experiment on single particle production at ISR energies can be considered as completed. In a separate document we furthermore present a new proposal on a study of correlations in association with diffractively produced states of high mass.

A) Diffraction dissociation. The purpose of the measurement is to obtain the detailed shape of the high momentum end of the spectrum of inelastic protons, with accurate relative normalization and approximately equal ranges in t for data taken at different total energies. To date, such spectra have been measured at 11/11 GeV ($0.15 < t < 1.0$), 11/15 ($0.15 < t < 0.6$), 11/22 ($0.15 < t < 0.5$) and 11/26 ($0.15 < t < 0.45$). This set of data will be followed by

1) $\sim$60 hours of clean beams at 11/31 GeV, i.e. $s = 1460$ GeV^2, the maximum s obtainable for $t_{min} = 0.15$ GeV^2

2) A period of $\sim$48 hours of data taking with clean beams in which the energy of beam 1 is left at 11 GeV, while beam 2 is at 11 GeV

for 6 hours, 15 GeV for 12 hours, 22 GeV for 12 hours, 26 GeV for 6 hours and 31 GeV for 12 hours. These periods allow for a luminosity measurement at each setting; the times required for stacking beam 2 and, if necessary, restacking beam 1 are not included. By running in this way we expect to be able to reduce to the minimum possible the systematic uncertainties in the luminosity monitors. Such uncertainties arise in part from the different background conditions during the various unequal energy runs. The running times mentioned here are estimates: while the total is not expected to change much, the partition over the various beam 2 energies will be updated depending on the off-line analysis now in progress.

3) 40 hours at 22/31 GeV. These data, together with data at 22/22 GeV already on tape, extend the range in s for the data with $t > 0.5$ to $500 \lesssim s < 2800$ GeV^2.

For 1) and 2) requests have been made to the coordinator (Memo's 13/6/73, 19/9/73). With 3) we wait until some feedback from the 11/X GeV has been obtained.

B) Inclusive π^- production at high x, in the range $p_T > 0.35$ GeV/c. Such data are of interest since they can be analysed in terms of the Mueller/Regge picture for non-leading particles, and provide information on baryon trajectories at very high energy. Fig. 1 shows a π^+ spectrum (obtained by this group approx. one year ago) compared to a triple-Regge fit with a nucleon trajectory.

Since the data rate is low, and the s-dependence is expected to be weak it is intended to do this measurement at two energies only: 11/11 GeV and 22/22 GeV (this latter energy is frequently scheduled for operational reasons), both at high currents. It is expected that apprx. 100 hours at 7A/7A at each energy will be

required to obtain a minimum set of data that can be analyzed. For example, at $x = 0.75$, $p_T = 0.35$ GeV/c the rate at 7A/7A would be $\sim$ 5 events/hour , for an expected invariant cross-section of 60 $\mu b/GeV^2$.

C) Search for particles heavier than the proton.

No search for heavy, integrally charged particles has yet been made at small angles. Since all known particles are abundantly produced there, one might speculate that this is a good place to look for new ones, provided one is able to prevent the high rates of known particles from blocking the trigger and clogging the off-line computers during the analysis phase.

To this end, we have recently performed tests with a view of using all ISR time between periods in which the conditions are prescribed by A) or B) above to investigate the spectrum of masses above that of the proton. The spectrometer is set e.g. for $x = 0.1$, $p_T = 0.1$ GeV/c (where the yields of other "produced" particles is high), negative particles, and with π^- rejection in the hardware trigger by means of Cerenkov counters. The mass spectrum is then obtained from times of flight along parts of the (30 m long) spectrometer. In practice, a ratio $\pi^-/\bar{p} < 1$ is obtained with this trigger; the system is then no longer dead time limited and fully efficient for accepting rare events.

In order to estimate the running time required we note that at 7A/7A we expect 1 particle/3 hours per $\mu b/GeV^2$ (this number is obtained from observed $\bar{p}$ yields). 300 hours of data taking would thus result in a limit of 10^{-32} cm^2/GeV^2 if the background can be kept at the level of < 1 event.

In this way, useful limits for the small angle production

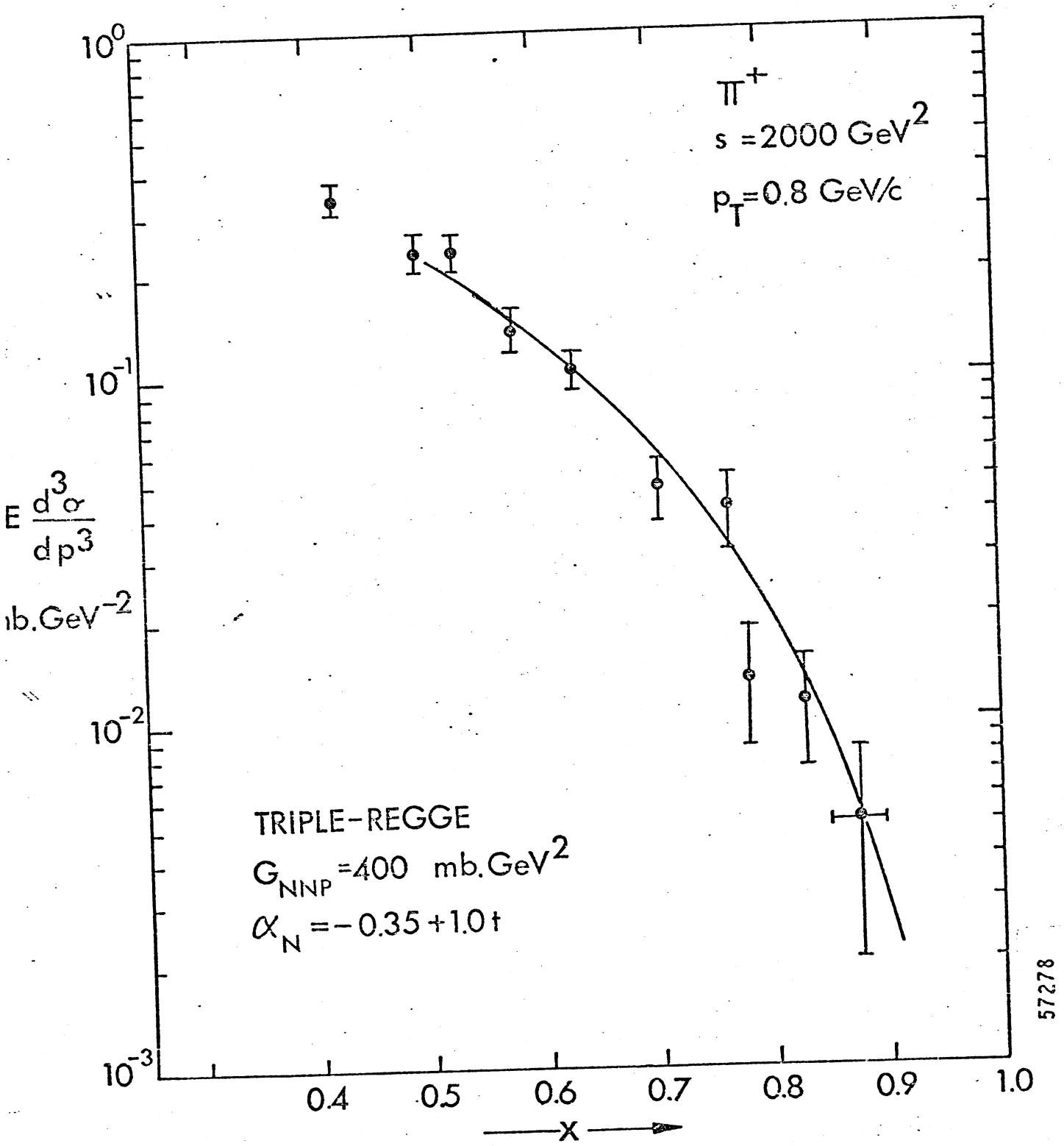
of masses up to several GeV can be obtained. The limits would be expressed in terms of the $\bar{p}$ yields, for which the cross-sections are known; hence no luminosity data are required.

Adding the various parts of this program we conclude that a total of approximately 650 hours of running time at the specified energies and intensities is required in order to terminate the experiment.

SUMMARY:

EXPERIMENT R201 - RUNNING TIME REQUEST.

TOPIC	ENERGY (GeV)	INTENSITY	REQUEST (hrs)
Diffraction Dissociation	11/31	4A/HIGH	60
Diffraction Dissociation	11/X	4A/HIGH	48
Diffraction Dissociation	22/31	4A/HIGH	40
High x Negatives	11/11	HIGH/HIGH	100
High x Negatives	22/22	HIGH/HIGH	100
Heavy Mass Search	ANY/ANY	HIGH/HIGH	300


10^0
10^{-1}
10^{-2}
10^{-3}
$E\frac{d^3\sigma}{dp^3}$
mb.GeV^{-2}
π^+
s =2000 GeV^2
p_T=0.8 GeV/c
TRIPLE-REGGE
G_{NNP}=400 mb.GeV^2
α_N = −0.35 +1.0 t
0.4
0.5
0.6
0.7
0.8
0.9
1.0
X
57278