p_{lab}, GeV/c	$\sigma_{tot}^{[3]}$, mb	α	β	χ^2	Degrees of freedom
1.11	34.03	0.32 ± 0.07	0.27 ± 0.06	28	27
1.28	43.23	0.29 ± 0.07	-0.06 ± 0.04	30	26
1.34	44.86[1)]	0.36 ± 0.08	0.06 ± 0.06	59	25
1.40	46.49	0.10 ± 0.08	0.01 ± 0.06	18	25
1.70	47.55	-0.10 ± 0.08	0.01 ± 0.08	48	43

[1)]Interpolated value.

k are the velocity and momentum of the incident proton, and $\hbar = c = 1$. The parameters α and β were fitted by least squares.

The results are listed in the table. Figure 3 shows the values of the parameter α, calculated on the basis of the dispersion relations, as well as the experimental data in the momentum interval 1.1 - 1.7 GeV/c. Our values of α agree well with the theoretical predictions and differ strongly from Dutton's data.

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SINGLE MUON SPECTRA IN THE PROCESSES $p + N \to \mu^+ + \mu^- +$ (HADRONS) AND $W(\to \mu + \nu)$ + (HARDONS) WITHIN THE FRAMEWORK OF THE PARTON MODEL

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In connection with the searches for the intermediate W boson in the reaction

$$p + N \to W^{\pm} + \text{hadrons} \quad (1)$$

with the accelerator of the Institute of High Energy Physics (IHEP) [1], it seems important to obtain theoretical estimates of the expected cross sections

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of the process (1), and particularly the angular and energy distributions of the muons from the decay

$$W^{\pm} \to \mu^{\pm} + \nu. \tag{2}$$

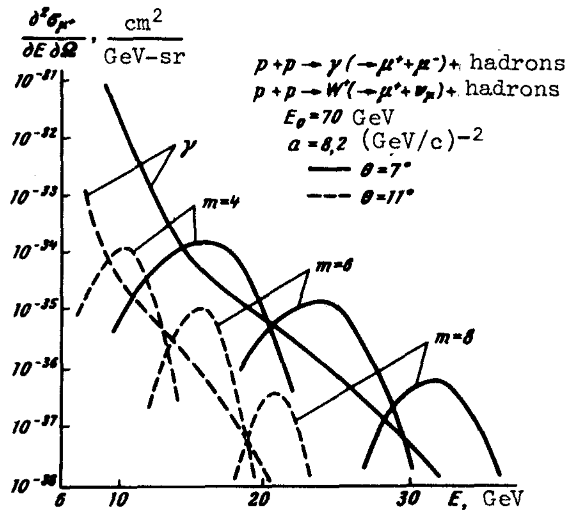
At the present time there are published estimates [2, 3] of the total cross section of W-boson production as a function of its mass m_W in pN collisions. These estimates are based on the conserved vector current hypothesis and on experimental data on the mass spectrum of the $\mu^+\mu^-$ pair in the reaction

$$p + N \to \mu^+ + \mu^- + \text{hadrons} \tag{3}$$

at a primary energy 29.5 GeV. W-boson production cross sections of the same order of magnitude are obtained on the basis of the parton model [4]. Predictions within the framework of the one-pion exchange model [5] and other models [6] contain appreciable uncertainties. We present here the calculated muon spectra for the processes (1) and (3) within the framework of the quark parton model (QPM) developed in [4], where it was assumed that the hadrons consist of valent quarks (minimally needed for the construction of the hadrons) and a "sea" of quark-antiquark pairs. The QPM parameters were chosen in [4] on the basis of experimental data on deep-inelastic ep scattering and account well not only for the results of these experiments, but also for the order of magnitude of the experimental results in [3]. These successes give grounds for hoping that more detailed information on the processes (1) and (3), obtained on the basis of the QPM, will be useful in the performance of the corresponding experiment and in the analysis of the experimental data. The QPM predicts that the main contribution to the cross section of the reaction (3) is made by the process of annihilation of a pointlike quark and antiquark, $q + \bar{q} \to \gamma \to \mu^+ + \mu^-$. Analogously, $q + \bar{q} \to W \to \mu + \nu$ for the reaction (1). The momenta of q and $\bar{q}$ are directed practically along the cms momenta of the colliding nucleons. The virtual γ quantum and the W-boson also move in this direction. Unlike [4], where the transverse quark motion was neglected, we take this motion into account and assume that the distribution of the quarks with respect to the transverse momenta $k_\perp$ is of the form $(a/\pi)\exp(-ak_\perp^2)$, where $a = 8.2$ $(\text{GeV}/c)^{-2}$ and the rms value is $[\langle k^2\rangle]^{1/2} = [a^{-1}]^{1/2} = 0.350$ GeV/c.

The parton model is assumed to be valid at large secondary-lepton transverse momenta ($p_\perp > 1$ GeV/c). It is therefore reasonable to carry out the calculations in the region of muon emission angles θ and l.s. energies given by the inequality $p_\perp \approx E \sin\theta > 1$ GeV/c.

It is obvious that the total cross section of the process (3) is much larger than the cross section of the process (1) [2], since the former is due to electromagnetic interaction and the latter to the semi-weak interaction. However, in view of the rapid decrease of $d^2\sigma/dEd\Omega$ with muon energy in process (3) at fixed muon emission angles, there is hope that process (1) can be separated against the background due to the reaction (3) by using the following effect: since the



Energy distribution of μ^+ mesons produced in $p + p \to W^+(\to\mu^+ + \nu) + $ (hadrons) and $p + p \to \gamma(\to\mu^+ + \mu^-) + $ (hadrons) collisions at angles $\theta = 7$ and $11°$ to the direction of the incident proton with energy E = 70 GeV, for W-boson masses m = 4, 6, and 8 GeV.

W-boson is produced in the process (3) with a momentum along the motion of the primary proton beam, the muons from its decay (2) will have a transverse-momentum distribution

$$\frac{dN}{dp_\perp} \sim p_\perp\left(\frac{m_W^2}{4} - p_\perp^2\right)^{-1/2} dp_\perp , \qquad (4)$$

i.e., they will have predominantly $p_\perp \approx m_W/2$. The transverse motion of the partons leads to the appearance of a small transverse momentum also for the W boson ($p_{\perp W} \sim \sqrt{2/a}$), which leads to a smearing of the square-root infinity in (4). The energy distributions of the muons from the W boson at fixed observation angles θ will then have narrow peaks near

$$E \approx m_W/2\sin\theta . \qquad (5)$$

Observation of such peaks against the background of the decreasing spectra of the muons from the process (3) will make it possible not only to establish that the W boson is produced, but also to measure its mass on the basis of (5). This conclusion and relation (5) are quite general and do not depend on the model, since they are based on purely kinematic properties of the decay (2). The background from the decays $\pi \to \mu + \nu$ and $K \to \mu + \nu$ is suppressed by the nuclear screening and is separated in experiment from the processes [1]. The figure shows the calculated $d^2\sigma/dEd\Omega$ at muon production angles $\theta = 7$ and 11° (the angle 9° corresponds to the location of the muon-duct axis in the experiment of [1], the aperture of the muon duct is $\Delta\theta = \pm 2°$). It is seem from the figure that the W boson can be observed in the experiment of [1] at a cross section 10^{-37} cm² if its mass is $m_W \lesssim 8$ GeV.

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MOBILITY OF POSITIVE IONS IN SOLID HELIUM

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A vacancion mechanism of ion mobility in a solid is proposed. Two cases of mobility are considered, diffusion and kinetic. The results are compared with the available experimental data.