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The hypothesis on the possible existence in Nature of monopoles with the magnetic charge $g = 68.5$ e.m advanced by Dirac [1] is subjected to the practically continuous experimental verification, but so far, these experiments have yielded negative results[2,3]. We consider the pair-production of monopole-anti-monopole ($g, \tilde{g}$) with masses up to $5.5\ m_p$ and velocities above the emission threshold of Vavilov-Čerenkov radiation in the transparent medium with $n=1.5$ to be possible at the 70 GeV Serpukhov proton-synchrotron. The use of Vavilov-Čerenkov radiation facilitates the search for magnetic charges among the large number of charged particles because of the following properties:

1. The ratio of Vavilov-Čerenkov radiation intensities (in a medium with the refractive index $n = \sqrt{\varepsilon}$) from the fast monopole with the magnetic charge g and the particle with the electric charge, according to[4] is $W_g / W_e = g^2 \varepsilon / e^2$ (at the same particle velocity). At $g = 68.5\ e$ ($m = 1$) $\sqrt{\varepsilon} = 1.5$ $W_g = 10^4\ W_e$.

2. As Frank has first noted[5], the polarization of Vavilov-Čerenkov radiation from the g and e charges differs in rotation of the electric vector field radiation by 90°.

The distance features of our experiment resides in the fact that the detection of monopole production should be done with the help of Vavilov-Čerenkov radiation immediately after their appearence in the combined target radiator. This allows one to search for even unstable magnetic charges with life-time $\tau_g > 10^{-10}$ sec. Based on the above-mentioned criteria, the experimental device for the Dirac monopole search has been designed and placed in the internal beam of the Serpukhov PS. The schematic view of this device is shown in Fig.1.

The 70 GeV proton beam is slowly directed to the conical target-radiator (see Fig. 2) fabricated from radiation resistant quartz ("Herasil I"). The Vavilov-Čerenkov radiation generated in the target is ejected from the vacuum chamber of our experimental apparatus through 8 windows. Each window is connected to the so-called "Optical sleeve" which consists of the lense, film polaroid, and a system of plane and conical mirrors. Each optical sleeve extracts a part of the radiation cone (within $\pm 4°$ in azimuth) which is focused and collected on the photocathode of 58 AVP photomultiplier tubes located at the angle of 100° to the direction of the proton beam. The polaroids are oriented so that in 6 "sleeves" the radiation is emitted from the magnetic charges, and in two others from the electric charged particles. To separate the Vavilov-Čerenkov radiation from the primary proton beam a screen of 6.5 cm width is installed in the phocal plane of each sleeve. The monitoring of incident proton beam on the target was performed by two monitors (of 3 scintillation counters each, with the $7\times7\times3$ mm^3 crystals) which have recorded the particle scattering at the 90° to the 70 GeV proton beam.

The electronics block is shown in Fig.3. The amplitude analysis obtained from the latter dynodes of all 8 photomultipliers has been performed with the help of two 5-ray oscillograph which were triggered after six-fold coincidences of the pulses with amplitudes above 250 photoelectrons from the 58 AVP photocathodes. The monopole production events might be followed by the simultaneous appearence of large pulses in 6 sleeves (with $\perp$-shaped polaroids) and the absence of those in two other sleeves (with $\parallel$-shaped polaroids).

The apparatus efficiency for the fast monopole detection (g and $\tilde{g}$) was calculated by the Monte-Carlo method taking account of the process kinematics $P + N \rightarrow P' + N' + g + \tilde{g}$, the nuclei internuclear motion inside the SiO_2 target, as well as the apparatus design features and a shape of 70 GeV proton beam aimed at the target. For the magnetic charge with $g = 68.5$ e and masses $m_g = 4$ and $5\ m_p$, and for the monopoles mass $m_g = 3\ m_p$ the detection efficiency was $\xi = 0.2$ and 0.1, respectively. When considering the multiplicity k of 70 GeV incident proton beam on the SiO_2 target-radiator of 9 g/cm^2 in beam width ($k = 8.3$ calculated and obtained from the experiment), the total proton flux was about 3.5×10^{15}.

In processing the data from 5-ray oscillographs it has been found that not a single event satisfying the above-mentioned criteria of g-detection was observed.

This denotes the cross section upper boundary of the monopole production (g, $\tilde{g}$) by 70 GeV protons on the SiO_2 target nuclei to be for $m_g = 4$ and $5\ m_p$ $\sigma(95\%) < 8\times10^{-40}$ cm^2 and for $m_g = 3\ m_p$ - $\sigma(95\%) < 1.6\times10^{-39}$ cm^2, respectively.

Our experiment is in progress.

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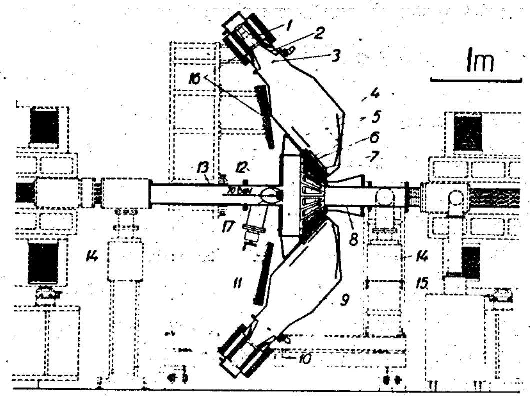
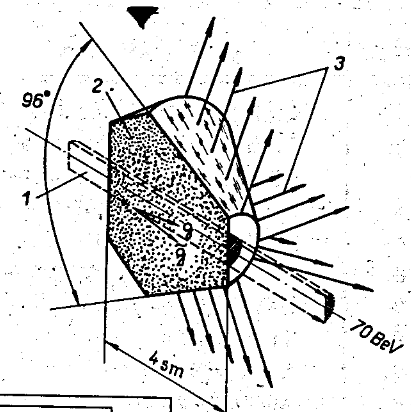


Fig. 1. Schematic view of the experimental device:
1 - photomultiplier 58 AVP (the diameter of the photocathode is 110 mm); 2 - conical mirrors; 3 - the screen; 4 - plane mirrors; 5 - film polaroids; 6 - the collecting lense with f = 150 cm; 7 - transparent glass, 8 and 13 - the connecting tubes; 9 - the light-proof housing of the "optical sleeve"; 10 - photomultiplier magnetic shielding; 11 - vacuum chamber of the experimental device; 12 - the fused silicon target-radiator; 14 - titanic pumps; 15 - pumping system; 16 - lead shielding; 17 - lock for target-radiator lead-in.

Fig. 2. The conical fused silicon target-radiator:
1 - 70 GeV proton beam; 2 - plane blacked face;
3 - Vavilov-Čerenkov radiation.



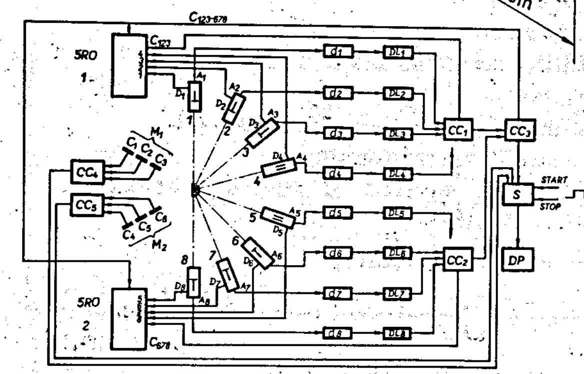


Fig. 3. Electronics block diagram
1 - A_1, $D_1 \div A_8$, D_8 - anodes, last dynodes of the photomultipliers; 2 - $d_1 \div d_8$ - discriminators; 3 - $DL_1 \div DL_8$ - delay lines; 4 - $CC_1 \div CC_5$ - coincidence circuits (with $\tau = 5\times10^{-9}$ sec and $\tau = 10^{-8}$ sec); 5 - 5RO (1 and 2) - 5-ray oscillographs; 6 - S-scalers; 7 - DP -digital printer; 8 - C_{123}, C_{678}, $C_{123\,678}$ - trigger pulses from coincidence circuits.