DETAILED STUDIES OF THE ELECTRON LATERAL DISTRIBUTION IN EXTENSIVE AIR SHOWERS WITH ENERGIES AROUND 10^{16} eV.

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I. The experimental procedure.

Using the Lodz extensive air shower array, we have performed detailed studies of the electron lateral distribution in extensive air showers. The showers were grouped according to their particle densities around 20 m from the core. The grouping was made in very narrow intervals of the densities. For every group of showers and for every distance interval /changing by 5 m/ histograms of the numbers of electron counters discharged have been obtained. The trays of G.M counters were located at following distances from the centre of the triggering detectors array : 16 m, 76 m, 117 m, 137 m, 141 m and 147 m, /Dzikowski et al., 1979/.

Every histogram then has been fitted with particle density spectrum described by the gamma distribution

$$P(\varrho) = \frac{b^p}{\Gamma(p)}\, \varrho^{p-1} \exp(-b\varrho)$$

taking into account the exact probabilities of the discharge of the given number of counters. The parameters p and b were calculated from the experimental histograms. Those parameters gives the average density and the width of fluctuations from the formulae /Dzikowski et al., 1977/.

$$\langle\varrho\rangle = \frac{p}{b} \qquad \frac{\sigma}{\langle\varrho\rangle} = \frac{1}{\sqrt{p}}$$

In the present work we are analysing only the average densities as a function of the shower core distance.

The errors of the densities were obtained by Monte Carlo method following way. Taking the experimentally obtained distribution of densities in the form of the gamma function histogram of the expected discharged counters has been simulated. This procedure has been repeated 10 times. For every obtained histogram new values of the p, b parameter have been obtained. The spreads of the parameters values have been taken as a measure of the errors.

II. Results.

The obtained lateral distributions are compared in fig.1 with the commonly used Nishimura, Kamata, Greisen /N K G/ formula. As it is known the formula is /Greisen, 1956/

$$\varrho(r) = \frac{N_e}{r_1^2} C(s) \left(\frac{r}{r_1}\right)^{s-2} \left(1+\frac{r}{r_1}\right)^{s-4.5}$$

where s is the formal age parameter and r_1=79 m the so called Moliere distance unit. The values of the obtained shower sizes and age parameters are given in table I.

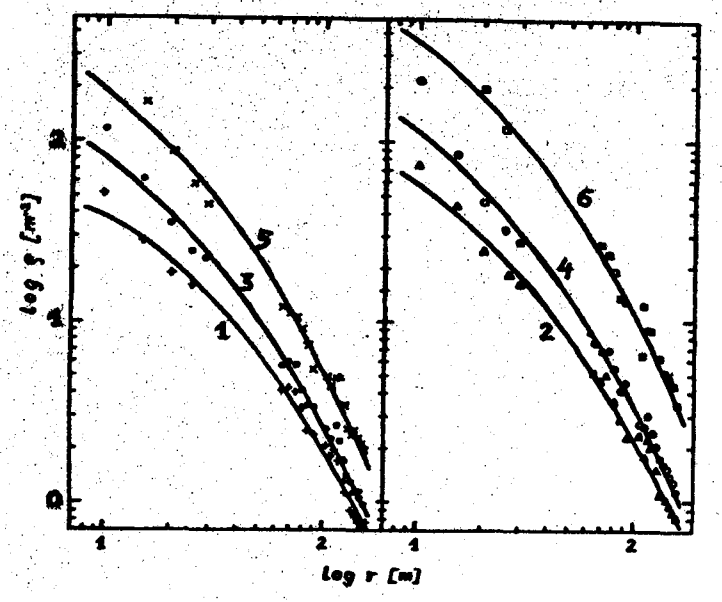

Figure 1. Experimental elektron lateral distribution for different shower sizes. The curves represent lateral distribution calculated from N K G formula for parameters summarised in table I.

Table I.

Number and symbol	N_e	s
1. +	3.99×10^5	1.59
2. △	4.59×10^5	1.50
3. ●	5.53×10^5	1.45
4. ○	7.07×10^5	1.42
5. ×	1.13×10^6	1.39
6. □	2.26×10^6	1.41

It is interesting to note that the obtained lateral distributions are relatively wide /high value of the „s" parameters/ and that the NKG formula relatively well describes the lateral distributions at the distances above 50 meters from the core, whereas at the smaller distances the experimental distributions are slightly steeper.

III. Conclusions.

The electron lateral distribution at distances 60-150 m from the core seems to be well described by the NKG function with relative large values of the shower age parameter. The curves at smaller distances appear to go lower then the experimental points.

References.

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