CORE STRUCTURE OF EAS AT ENERGY RANGE 10^{14} - 10^{16} eV AND HIGH P_t JET PRODUCTION*

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1. Introduction

Baksan Air Shower array was described elsewhere (Alexeyev et al., 1975) and at the time of Paris conference results of multicore showers analysis were published (Chudakov et al., 1981) . It was shown also that cross-section of high P_t events, as estimated from our data, was in remarkable agreement with QCD calculation results for jet production at Collider energy (Horgan & Jacob, 1981), giving an evidence of jet origin of subcores. Considering subcores as generated by jets of particles, we transformed this "jet" cross-section to the inclusive one for pions. Now, when inclusive cross-section at high P_t is measured at CERN $p\bar{p}$ Collider, there is a possibility to make direct comparison with our previously published results.

We present also new data, in which statistics of very high P_t events is greatly improved.

2. Cross-section of high P_t events

Left part of fig. 1 reproduces fig. 3 from (Chudakov et al., 1961) with one additional feature. This is experimental points of UA1 collaboration (Arnison et al. 1982) integrated from $Ed^3\sigma/d^3p$ form to $d\sigma/dP_t$ (in fact, invariant cross-section was multiplied by $2\pi P_t \Delta y$ where Δy is rapidity interval). Fairly good agreement with "inclusive" cross-section of ours is obvious (there is a tendency of UA1 points to be somewhat higher, but it is very reasonable thing, as we can not register whole jet and some part of it should be missed). This is a strong evidence of our analysis of multicore showers and estimation of cross-section being quite right. Fig. 1 represents also a new piece of data which is given only for region of largest P_t . Here agreement with QCD prediction is excellent. Inclusive curve was also calculated for this sample of data. It gives a kind of prediction for future inclusive experiments, but one must be careful about this prediction because very simple jet fragmentation model was accepted.

3. New data sample

For present experiment new trigger was organized. Previously total energy release of shower in central part of array - the "Carpet"- was used as the trigger. It is also used in new operational series, but the threshold this "trigger 1" is reduced from 5500 particles down to only 50.

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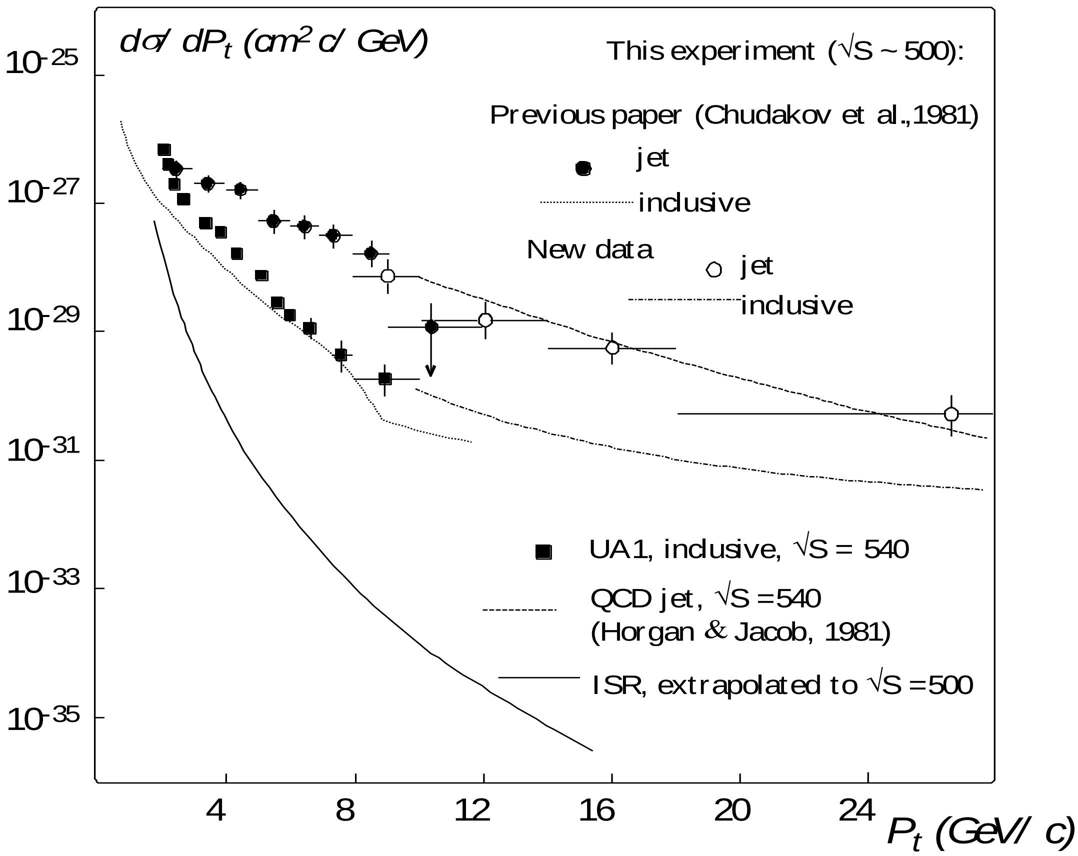

Fig. 1 Jet and inclusive cross-sections for high P_t events

Besides, the coincidence of trigger 1 with trigger 2 is required, the last one being proportional to energy release in anyone of detectors . In different series of measurements the threshold for trigger 2 was different: 170, 400, 600 and 1900 particles per detector. The time of operation with these values was 30, 143, 240 and 3130 hours, respectively. As a result of changing of triggering conditions shower selection efficiency rised from 8%, up to 68%.

4. Core size distribution

Analysing multicore showers we used as a measure of a subcore the "core size" value - the sum of densities in four maximal detectors. Fig. 2 presents distribution of core size (N_{c4}) for all showers. It is compared with shower size distributlon (N_e) and maximum density (N_c) distribution. Both N_{c4} and N_e distributions have definite knee and to the left of it there is an interval where relation $N_e \approx 20\ N_{c4}$. To the right from knee core size distribution after a littte bump falls down sharply . This is very similar to what must be because of saturation of photomultipliers. N_c distribution confirms this conclusion. But there is also strange steepening of N_{c4} and N_c distributions at low densities. Probably this is connected with local cascades from surviving primary protons, as new trigger is especially effective for narrow showers.

There is slow decrease of mean ratio N_c/N_{c4} with N_{c4} increasing. This can be considered as evidence of flattening of core at large shower size, this was observed by Sydney group (Bakich et al., 1970) as decrease

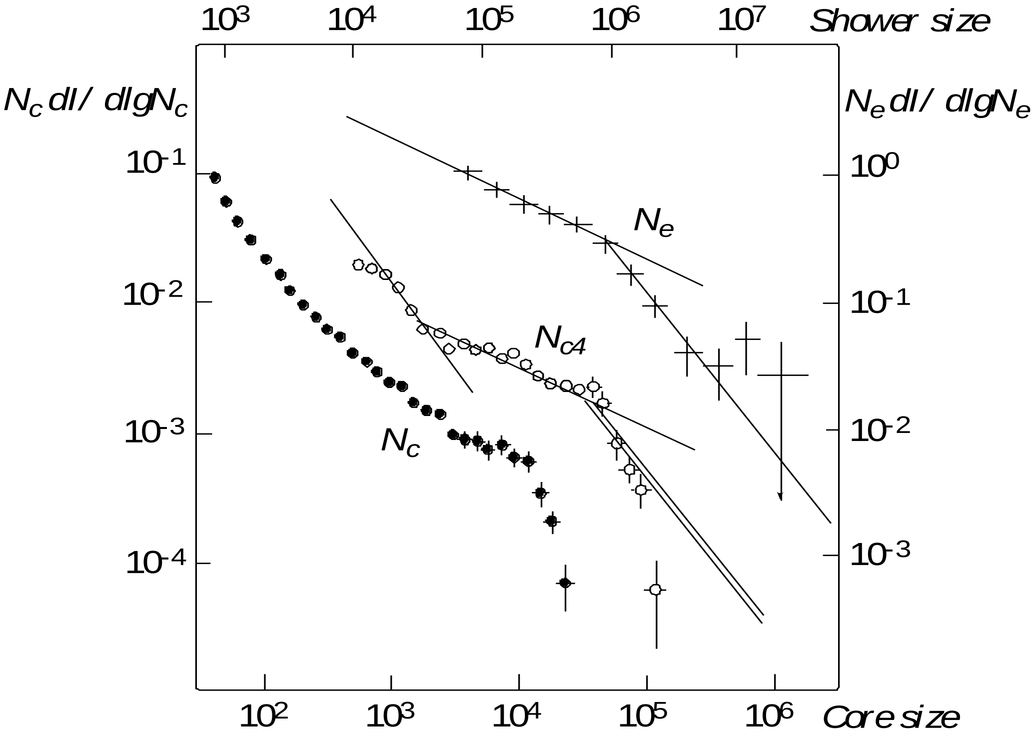

Fig. 2 Core size and shower size distributions
(═══════ corrected for PM saturation effect).

decrease with shower size of number of showers with given value Δ_1/Δ_2 ratio of maximum density and next to it) . Earlier (Alexeyev et al., 1977) we did not find this effect, statistical accuracy was not enough for it. Now new data give some evidence in favor of flattening.

5. New type of events

Between new multicore events there are several very unusual. Earlier we have had a number of double core events with practically equal core sizes. We call them Elbrus type events after famous Caucasus double peak mountain . Two examp1es of Elbruses were published (Alexeyev et al., 1977) . Probably underlying interaction in Elbrus type showers and binocular events of Brasil-Japan collaboration (Bellandi Filho et al., 1979) is the same . But now we have also events with core size of subcore many times greater than that of main core. Fig. 3 presents example of such an event. There are no doubts (due to axial symmetry of the whole shower) that less dense core is the main one. Standard procedure of P_t estimation gives for this enormous subcore the value ~ 50 *GeV/c*.

6. Conclusion

Inclusive cross-section obtained from multicore showers analysis is in reasonable agreement with data of UA1 experiment at CERN. New results on cross-section of very high P_t subcores even better agree with QCD based calculation for jet production. This permits us to consider subcores in

3	7	5	7	8	9	10	10	10	10	7	6	5	5	5	5	3	3	4	1
5	5	7	6	6	9	11	11	10	8	6	7	6	10	3	4	0	7	3	1
6	6	6	6	8	8	11	11	12	13	10	6	5	5	5	6	5	4	0	2
5	7	8	9	11	11	16	16	14	14	11	6	7	8	6	5	6	2	6	4
6	5	7	10	10	13	19	27	17	13	10	9	6	7	8	6	0	5	5	3
6	6	7	8	11	14	16	20	18	13	8	11	9	9	7	8	5	4	4	3
6	8	8	10	13	14	13	16	15	0	10	6	5	9	7	5	7	4	3	4
8	10	10	10	12	13	13	12	7	11	14	10	9	6	9	7	6	5	4	5
7	9	10	10	11	11	12	12	11	10	11	9	9	8	8	11	7	5	4	1
10	8	8	10	10	10	12	11	12	9	11	10	7	7	7	6	8	7	5	4
7	8	9	12	7	12	12	13	13	13	8	9	9	7	8	9	10	6	4	4
8	9	8	12	13	16	13	11	12	10	9	10	9	7	4	7	7	6	4	4
10	11	11	12	14	18	16	14	15	13	15	13	12	9	8	8	7	6	6	4
11	9	9	12	16	17	15	14	13	12	11	13	10	9	8	5	6	6	5	3
9	11	12	13	17	17	14	14	14	13	11	10	10	8	8	6	6	3	5	5
12	13	12	13	13	18	14	13	12	12	10	10	8	9	8	6	8	6	5	3
9	12	11	12	13	13	14	15	13	11	12	9	9	8	8	7	7	7	4	4
11	12	13	12	15	13	15	16	12	9	12	8	10	6	7	7	7	7	7	6
12	12	10	11	15	13	11	12	12	9	8	8	10	9	7	4	8	4	4	6
8	8	10	11	11	11	12	11	10	9	8	12	10	7	8	6	4	4	5	5

Fig. 3 Largest P_t shower. Density in each detector is given in logarithmic scale ($\rho = 8 \cdot 1.25^n$)

multicore showers as generated by jets and so the hypothesis of high P_t hadrons as subcores origin, existing in shower structure studies for two decades of years is practically confirmed .

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