JETS IN AIR-JET FAMILY

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ABSTRACT

The A-jet families of the Brazil-Japan Collaboration on Chacaltaya Emulsion Chamber Experiments are analyzed by the study of jets which are reconstructed by a grouping procedure. It is demonstrated that large-$E_J R_J$ events are characterized not only by small number of jets and two-jet like asymmetric shape, i.e. the binocular events, but also by the other type. This type has a larger number of jets and more symmetrical shape in the p_t plane.

INTRODUCTION

Event shape is examined by using the following two quantities;

a) energy-weighted distance from the center of a family of reconstructed jet, $\overline{E_J R_J}$(TeVcm),

b) symmetry coefficient/1/ of jet, b_J, as defined

$$b_J = (\Sigma E_{Ji} Y_{Ji}^2)_{min.} / (\Sigma E_{Ji} X_{Ji}^2)_{max.}$$

The symmetry coefficient measures azimuthal symmetry, which will have a value of 0 for the case of in-line event and of 1 for the completely symmetrical azimuthal distribution. All the quantities with a letter of J are obtained after a grouping procedure to reconstruct jets. The energy weighted distance used is defined as $\chi_{ij} = R_{ij} E_i E_j / (E_i + E_j)$ and the cut-off value $\chi_c = 25$ TeVcm as usual/2/. For this grouping procedure cascades with $E \geq 2$ TeV are used, γ-ray and hadronic components are treated equally and energies of hadronic cascades are used without correction of Kγ.

RESULT

To grasp gross features of the A-jet families, are used all the 218 A-jet families including hadron-rich and exotic events. After the jet-grouping, 215 events have more than one jet. Then $\overline{E_J R_J}$ and the symmetry coefficient are calculated for each event.

We can see from Fig.1 that $\overline{E_J R_J}$ distribution has a peak at around 20 TeVcm and a very long tail over 300 TeVcm. On the other hand the b_J distribution is almost flat with a sharp peak at around $b_J \cong 0$. This sharp peak should include the contributions of the binocular events/3/ and some excess of the experimental data can be seen at b_J near to 1, comparing with the tendency of the Monte-Carlo simulation/1/. While we can see the correlation between b_J and $\overline{E_J R_J}$ exists, the dependence of b_J on $\overline{E_J R_J}$ is shown clearly in Fig.2, in which b_J distributions are given separately for three intervals of $\overline{E_J R_J}$. As increasing $\overline{E_J R_J}$ the fraction of $b_J=0$ is rising. It means that large $\overline{E_J R_J}$ is realized by two-jet like events, i.e. binocular-type events. We note that inspite of the very rapid decreasing of the fraction towards larger b_J's there exist non-zero experimental data at b_J near to 1 even at the highest-$\overline{E_J R_J}$ group.

The correlation between number of jet N_J and $\overline{E_J R_J}$ as given in Fig.3 shows that larger $\overline{E_J R_J}$'s are shared by less number of jets. That is large $\overline{E_J R_J}$ region is occupied by binocular-type events. And also some events are found to have very large N_J even at the highest-$\overline{E_J R_J}$ group.

It may be concluded that there exist those A-jet families which have large and comparable $\overline{E_J R_J}$ with the binocular events, but which contain many jets so as to give rise to very symmetrical azimuthal distribution. The reconstructed jets with the use of the cut-off value $\chi_c=25$ TeVcm seem to have a jet-size less than the actual size of the two clumps, because the N_J distribution of the group $\overline{E_J R_J} \geq 80$ TeVcm has a rather broad peak between 2 and 10.

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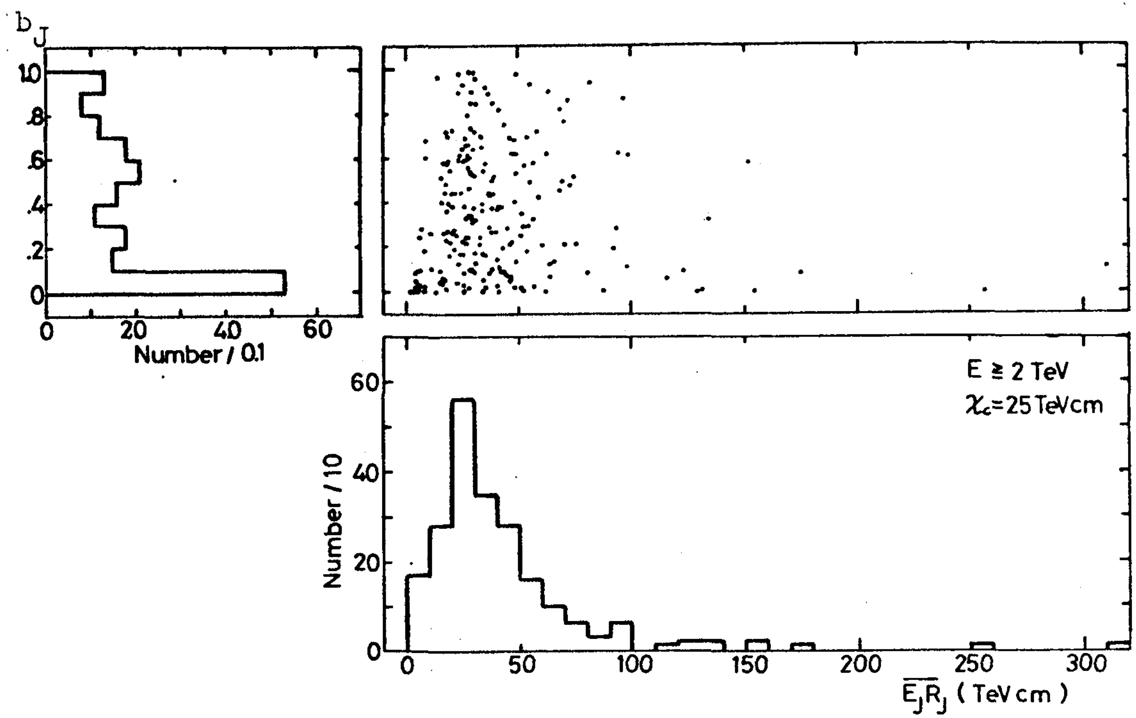

Fig. 1 The scatter plot of symmetry coefficient b_J/1/ of jet vs. $\overline{E_J R_J}$ of the A-jet families.

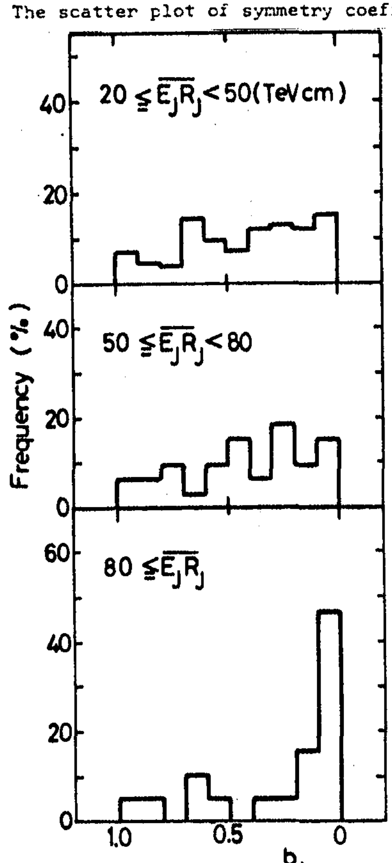

Fig. 2 The symmetry coefficient b_J distribution.

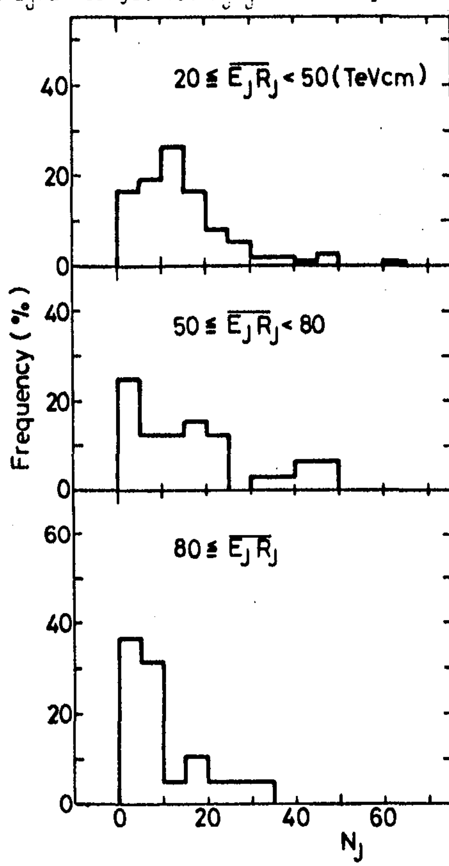

Fig. 3 The distribution of number of jet.