HE 6.2-14

CHARGE 4/3 LEPTONS IN COSMIC RAYS

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A cosmic ray counter telescope has been operated at zenith angles of 0°, 40°, 44° and 60° in order to look for charge 4/3 particles. A few million clean single cosmic rays of each zenith angle were analyzed.

For (4/3)e charged leptons, GUTs (Grand unified theories) propose some predictions[1,2,3]. Especially SU(5) proposed by H.Georgi and S.L.Glashow[1] predicts the existence of fractionally charged vector boson ($X_{4/3}$, $X_{1/3}$) and the proton decay, but these boson mass must be greater than 10^{15} GeV. It is hard to produce these particles by accelerators. So one must detect relic fractionally charged particles from the "big bang" by a cosmic ray telescope.

A cosmic ray counter telescope at sea level has been operated and analyzed[4,5] in order to look for charge (4/3)e particles. Four RUNs were performed at different zenith angles as the following table.

A:	RUN name	I	II	III	IV
B:	zenith angle (degree)	40°	0°	60°	44°
C:	measuring time (days)	130	130	260	150
D:	pre-triggers ($\times 10^6$)	8	16	8	8
E:	pure (4/3)e zone events	15	16	22	31
F:	single track in the column "E"	6	2	2	9

Results under adaptation of strict selection rules are shown in fig.1a, 1b, 1c and 1d. These figures show that data of zenith angles of about 40° are different from data of other zenith angles; single track events of (4/3)e zone are rich at 40° and 44°.

If a point source of fractionally charged leptons exists, that momentum must be larger than 10^{21} eV/c. The other side, our experimental trigger condition is $\beta\gamma > 4.8$ and if some of these (4/3)e zone events at 40° and

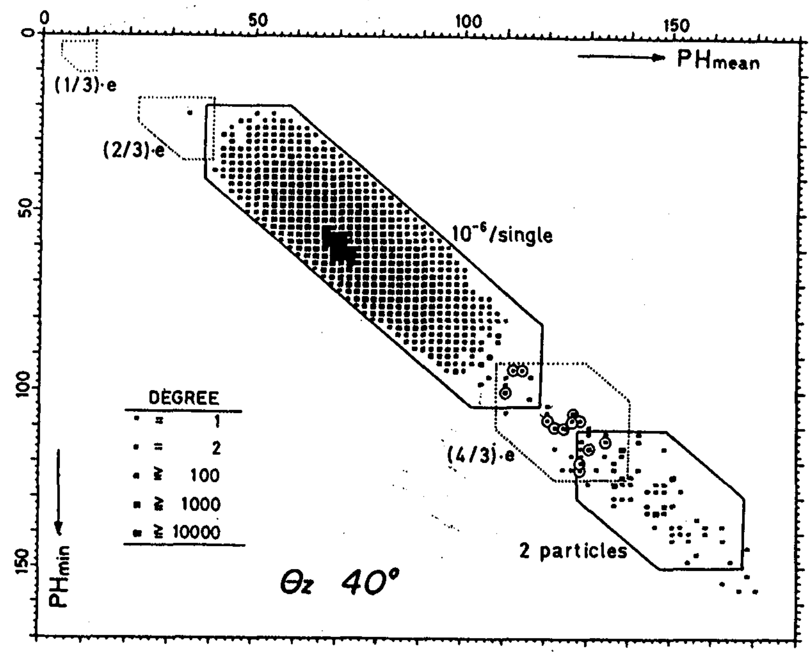

Fig. 1a. Final results of RUN I.

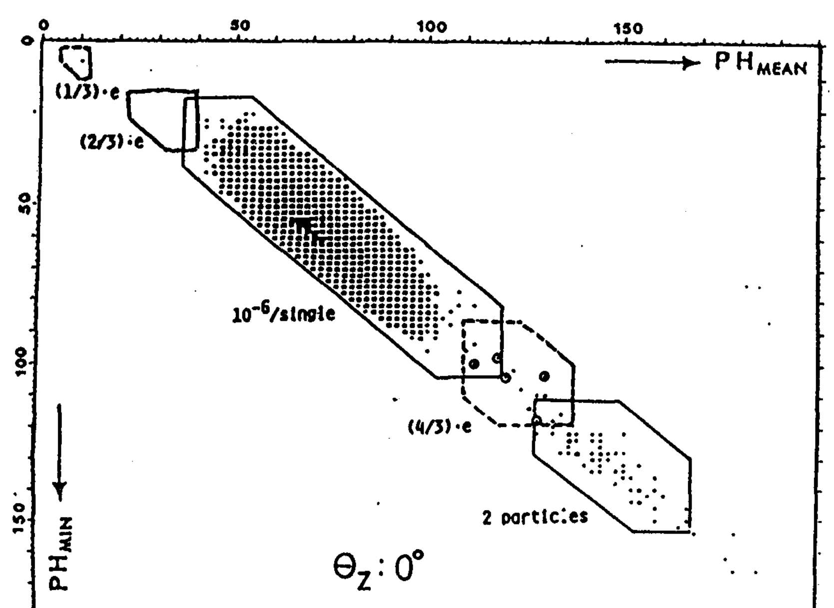

Fig. 1b. Final results of RUN II .

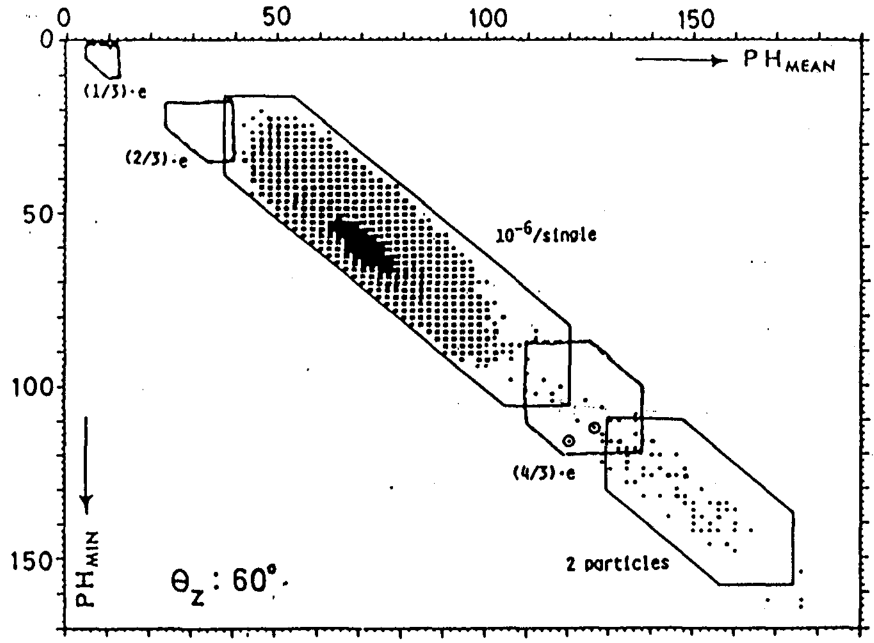

Fig. 1c. Final results of RUN III.

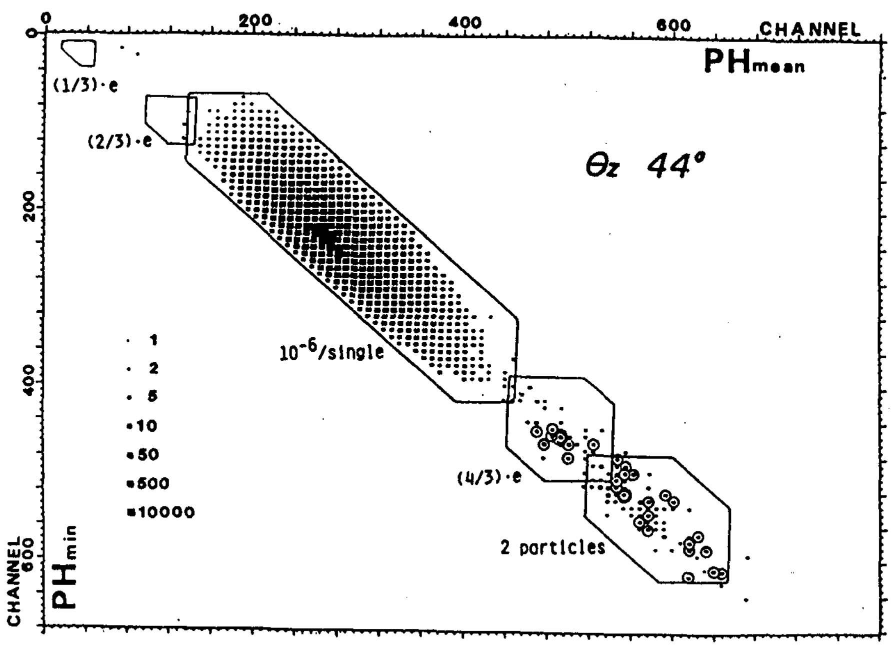

Fig. 1d. Final results of RUN IV.

44° are $X_{4/3}$ vector boson,

$$P = \beta\gamma M_{4/3} \simeq 5\times10^{15} \times 10^{9} = 5\times10^{24} \quad \text{(eV/c)}.$$

The momentum, 5×10^{24} eV/c is enough to pass through our Galaxy.

" Where did (4/3)e leptons come from ? "

Single track events of (4/3)e zone at 40° and 44° are plotted in the equatorial coordinates; fig. 2a and corresponding events of two particles zone at 44° are also plotted in the equatorial coordinates; fig. 2b. Points of fig. 2a. mostly separated into two groups, but those of fig. 2b. were spread all over the map.

In this stage, the map of fig. 2 is not clear, so our observation has continued.

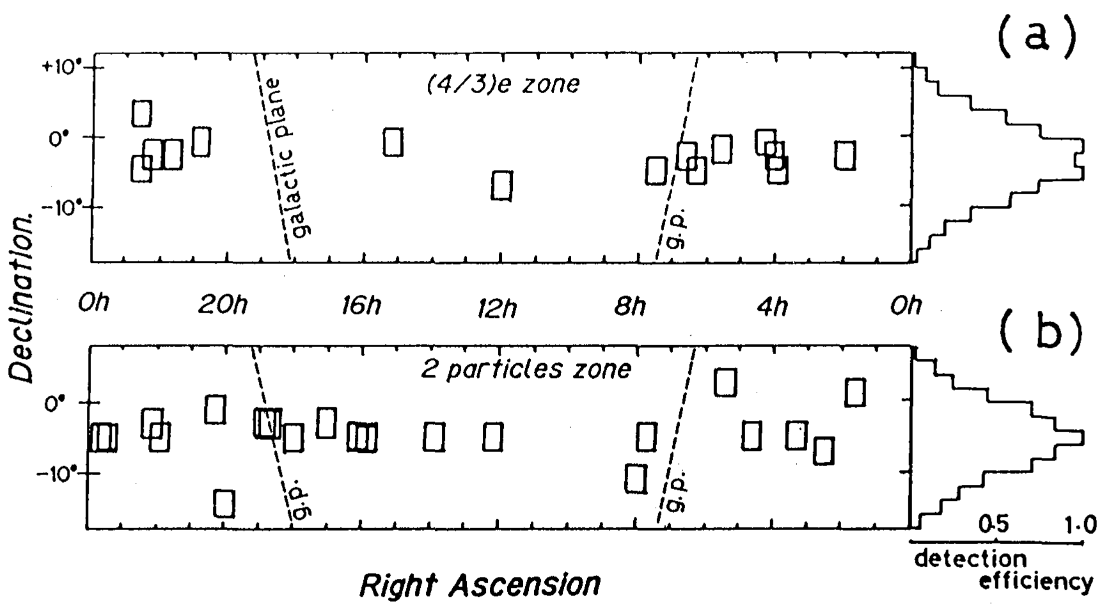

Fig. 2. Arrival directions of single track events for (4/3)e zone and two particles zone.

References

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