S E C T I O N- II

RESULTS

The vertical muon momentum spectrum and charge-ratio as measured by the present set-up have been shown in figs. (19) and (21). The measurements were based on 1269 events. The statistics was consequently poor. The error-bars in the curve represent the statistical fluctuations in the intensity. This was obtained by dividing the intensity by the square-root of the number of particles in a particular momentum-bin. The observed spectrum was corrected by applying the corrections due to energy loss in the absorber placed above the spectrograph, errors due to measurement and scattering sources, and the correction due to bias in selecting the events. The total absorber thickness was ~100 g cm^{-2}. Assuming the mean energy loss of muons as 2 MeV $g^{-1}cm^2$ (1), the first correction amounts to 200 MeV. This correction is momentum-independent. The measurement and scattering errors have already been discussed in detail in (Sec. IV, Part A). The least count of the Mangia-spagometer was 50 μ ; consequently, this did not introduce any error in the measurements. The ratio θ_{rms}/θ_B, given by

$$\frac{\theta_{rms}}{\theta_B} = \frac{21\sqrt{x/x_o}}{300 \quad H1} \times 10^6 \quad ,$$

where x = 16 mil (total thickness of aluminium foils used in the spark chambers and the GM-counters), X_o = 9.1 cm (for aluminium), is ~8.1% and is independent of momentum. The selection bias has been discussed in the Analysis. The correction was the

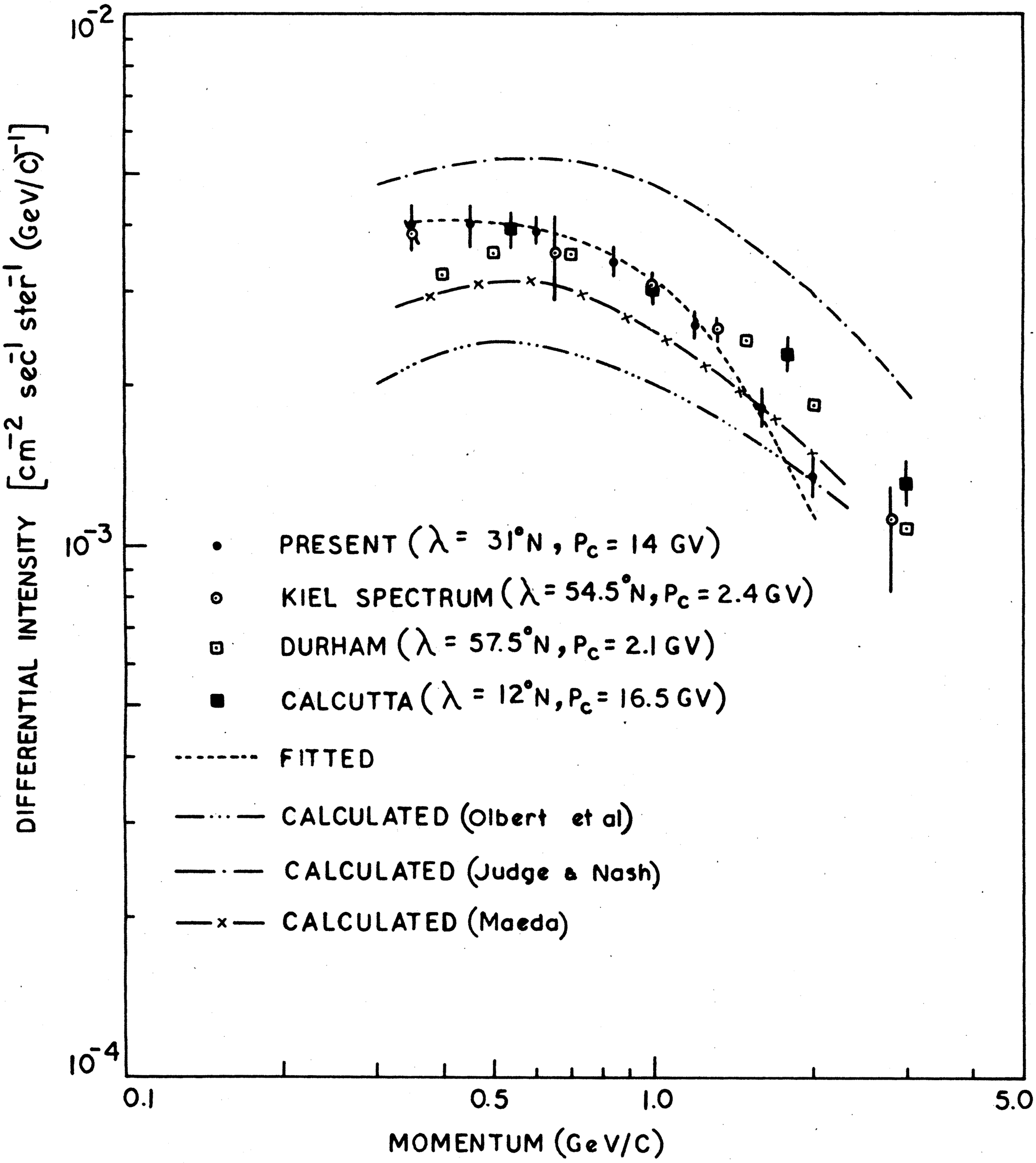

FIG. 19 VERTICAL MOMENTUM SPECTRUM OF MUONS

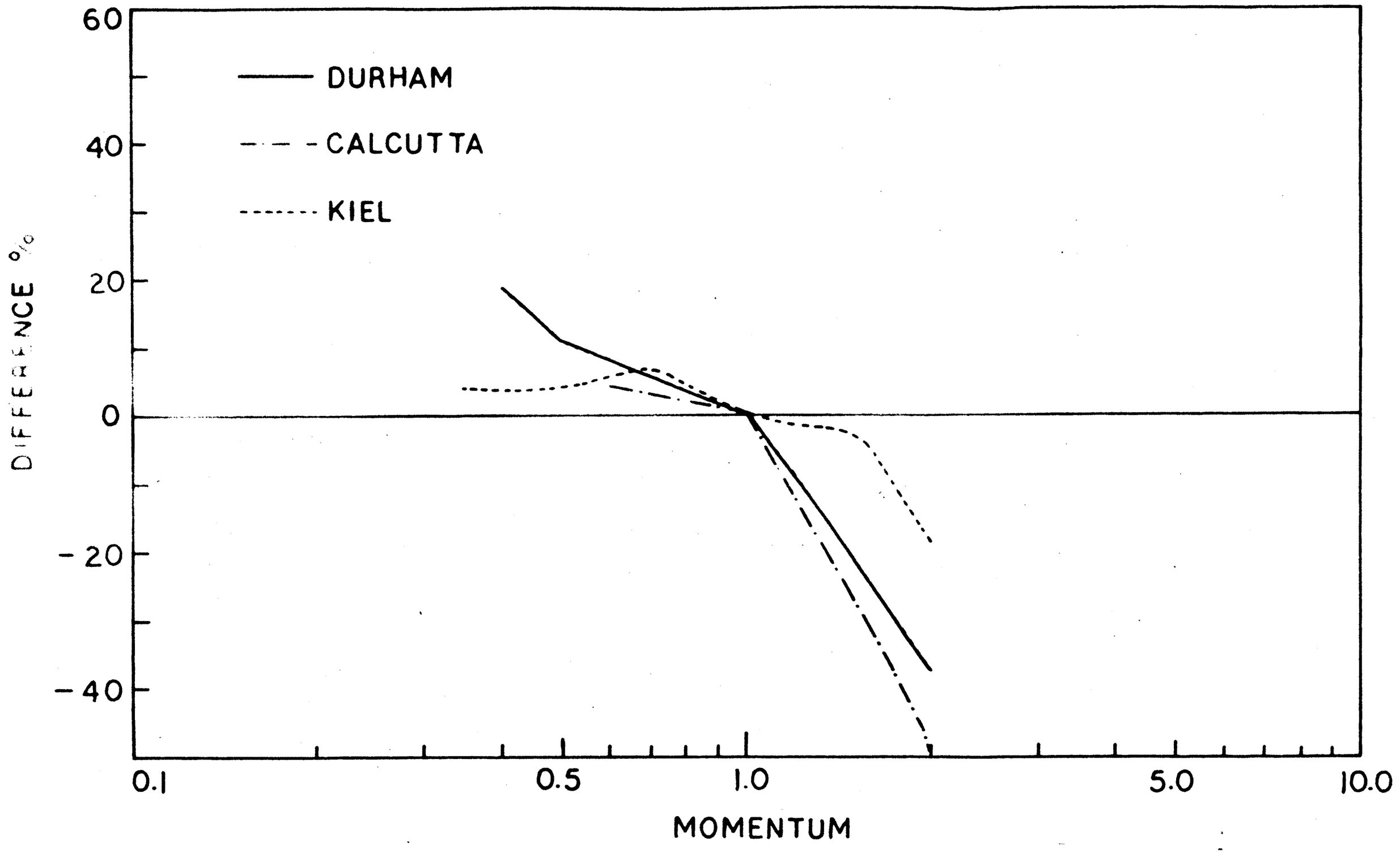

FIG. 20 COMPARISON OF THE PRESENT SPECTRUM WITH OTHER SPECTRA RENORMALIZED AT 1 GeV/C

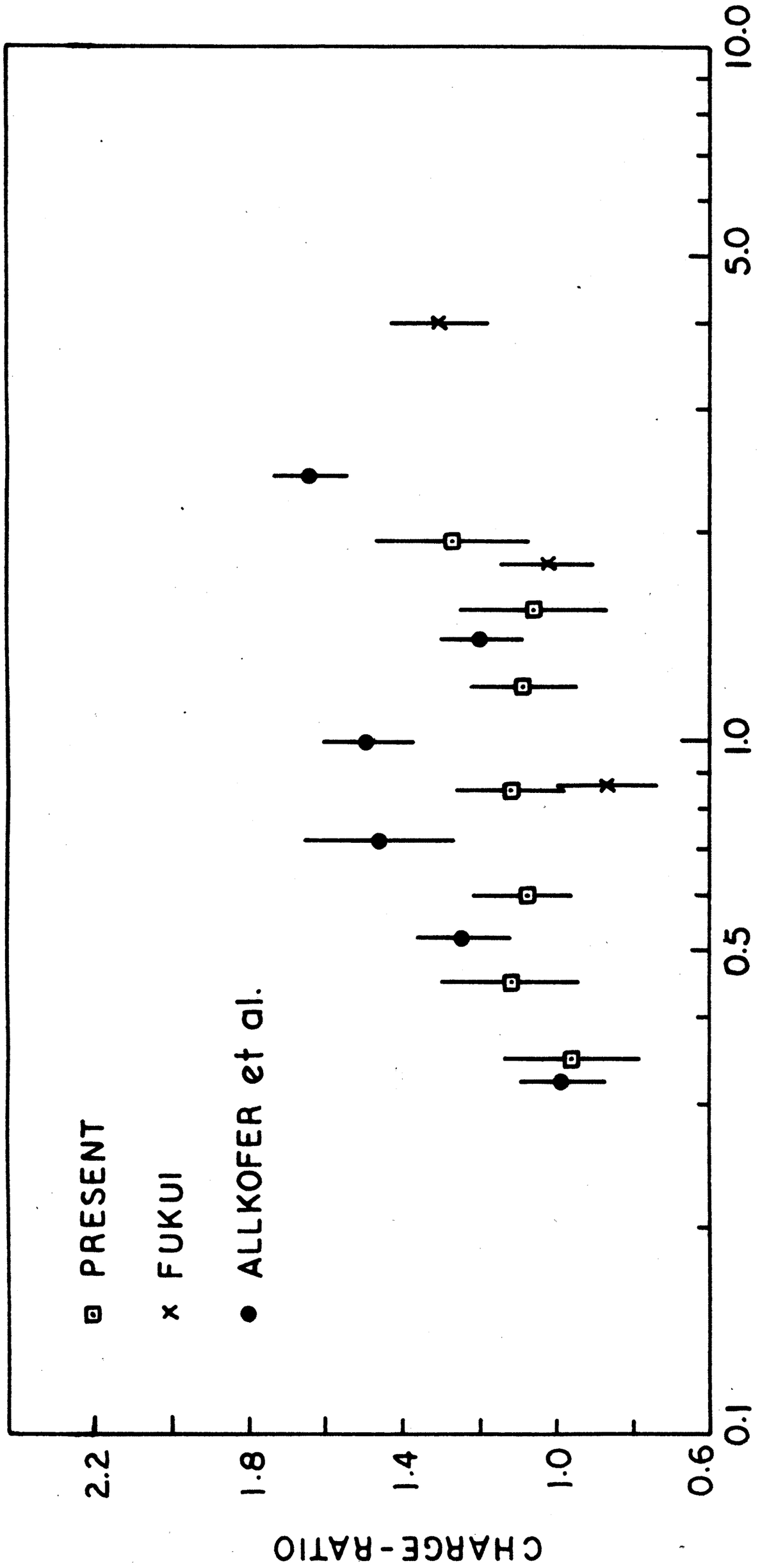

FIG. 21 CHARGE RATIO OF MUONS

maximum in the higher momentum region. No attempt was, however, made to determine the correction due to other selection criteria.

The results reported in this thesis do not represent the absolute fluxes of muon. It is rarely possible to estimate accurately the absolute muon spectrum using the same apparatus as is used for determining its shape. Such work requires a precise determination of the counter efficiencies, instrumental acceptance and total effective time of run of the instrument. All of these are difficult to measure for the large and complex experimental arrangement usually employed. Consequently, the usual practice is to normalize the measured differential spectra to an intensity of 2.45×10^{-3} cm^{-2} sec^{-1} $ster^{-1}$ $(GeV/c)^{-1}$ at 1 GeV/c which was given in 1948 by Rossi[2]. The accuracy of this intensity was questioned by Allkofer et al.[3] and subsequently by the Durham group[4-5] and other workers[6]. Using a range spectrometer working in the (0.985 - 1.287) GeV/c region of muon momentum, Allkofer et al.[7] found the most precise value of the intensity as 3.09×10^{-3} cm^{-2} sec^{-1} $ster^{-1}$ $(GeV/c)^{-1}$ at 1 GeV/c. This result was later on confirmed by Ashton et al.[8].

The present spectrum was normalized at 1 GeV/c to the value 3.09×10^{-3} cm^{-2} sec^{-1} $ster^{-1}$ $(GeV/c)^{-1}$ obtained by Allkofer et al[7]. The spectrum shown in fig. (19) is the normalized spectrum.

The vertical muon spectra calculated on the basis of the theoretical methods discussed in the previous section have been shown in fig. (19). The calculations were based on the

assumption that low energy muons are the product of the decay of pions in the lower atmosphere. As a simplifying assumption in all these calculations, it was assumed that the loss of energy of muon, as it passes through the atmosphere, is constant. The temperature and pressure effects were not included in these calculations because the meteorological data was not available. Most of the computation for this work was done on DEC 10, at TIFR, Bombay.

The distribution of the muon charge-ratio with momentum is shown in fig. (21). The error-bars represent the statistical fluctuations.

R E F E R E N C E S

1 Campbell, M.J., H.S. Murdoch, K.W. Ogilvie, and H.D. Rathgaber: Nuovo Cim., 28, 885 (1963).

2 Rossi, B: Rev.. Mod. Phys., 20, 537 (1948).

3 Allkofer, O.C., W.D. Dau, and H. Jokisch: Proceedings of the VI Interamerican Seminar on Cosmic-rays, Vol. 6 (La Paz 1970), p. 937.

4 Ayre , C.A., M.A. Hamdan, F.W. Holroyd, C.J. Hume, B.C. Nandi, M.G. Thomson, S.C. Wells, M.R. Whalley and A.W. Wolfendale: Proc. of the XII Intern. Conf. on Cosmic-rays, Vol. 4 (Hobart, 1971), p. 1309.

5 Ayre, C.A., J.M. Baxandale, B.J. Daniel, C.J. Hume, M.G. Thomson, M.R. Whalley and A.W. Wolfendale: Proc. of the XIII Int. Conf. on Cosmic-rays, Vol. 3 (Denver, 1973), p. 1754.

6 Crookes, J.N., and B.C. Rastin: Proc. Intern. Conf. on Cosmic-rays, Vol. 4 (Hobart, 1971), p. 1325 and p. 1369.

7 Allkofer, O.C., W.D. Dau, and H.Jokisch: Phys. Lett., 31B, 606 (1970); Erratum: Phys.Lett., 36B, 428 (1971).

8 Ashton, F., K.Tsuji, and A.W. Wolfendale: Nuovo Cim., 9B, 344 (1972).