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Report for Intersecting Storage Rings Committee April 1972

Future Plans for Experiments R203 and R204

1) THE WIDE ANGLE SPECTROMETER

A) Low Momentum Inclusive Particle Spectra

Up to now, data have been taken at four energies and at four laboratory angles between 45° and 90°. For particles produced with momenta between 0.2 and 1.4 GeV/c, at each angle and energy we have approximately 10^4 pions of each sign, 10^3 protons, 500 anti-protons and 500 kaons of each sign. These numbers are for uncorrected gross yields.

By the beginning of July we hope to have taken data which will multiply the above numbers by a factor of at least 3 enabling us to make a significant improvement in our kaon and anti-proton measurements. In addition we will also have made measurements between 35° and 45°.

We would also like to carry out some short runs (at least two runs of 12 hours each) in which the two ISR beams are run at different energies. This could allow our spectrometer to cover smaller c. of m. angles and at the same time the medium angle spectrometer (Experiment R202) could observe larger angles so enabling an overlap between the experiments. We request two such runs with one beam at 26GeV and the other at either 11.5 or 15 GeV depending on the requirements of R202.

B) Search for Particles with High Mass (and $\geq$ 2/3 charge)

Short test runs have been carried out in which momentum and time-of-flight cuts have been imposed in order to trigger on particles with a mass greater than that of the proton. It looks possible to reject low mass particles very cleanly and by the end of September we hope to have spent at least 400 hours running in such a mode. Over this period we will be sensitive to one high mass particle in the 10^8 to 10^9 particles (depending on luminosity) that pass through our equipment.

We are also very interested (see also 2B below) in the possibility

C) High Momentum Inclusive Particle Spectra

A rearrangement of the equipment on the spectrometer arm, together with the addition of two large high pressure gas threshold Cerenkov counters, will enable us to separate pions, kaons, and protons in the momentum region 1.5 GeV/c to 5.0 GeV/c. We hope to make these changes in October of this year and after a setting-up period, to begin data-taking in November or December. These measurements are expected to continue after the shut-down until at least June 1973.

It may be possible to extract an unseparated high momentum spectrum with the existing arrangement of equipment (running both magnets with a high current) and preliminary tests are being made. This measurement, if feasible, could be carried out in late July of this year.

2) THE MUON DETECTOR

A) Muon Search

It is proposed to continue the search for machine-produced high momentum muons and we shall continue to press for high luminosity, high energy running of the ISR. We are aiming at a sensitivity to cross-sections of certainly 10^{-34} and probably 10^{-35} cm^2 by the early summer of 1973.

B) Very High Energy

We are particularly interested in the possibility of 31 GeV beams as this is above a possible threshold for the copious production of high momentum muons. Such a threshold has been suggested in the work of the Keuffel group at Utah[1] and corresponds to a laboratory energy of 1.9 TeV. We feel very strongly that even a remote possibility of such a threshold should be investigated urgently.

C) Coincidence Measurements

We intend to carry out some measurements in which the muon detector is put in coincidence with the spectrometer arm (which also includes a small muon detector). If muon pairs are produced from heavy virtual photons, some models predict large opening angles[e.g.2]. It is clearly worth looking for

two muons in coincidence at 180^0 to each other. Even though the solid angle covered by the spectrometer arm is so much smaller than that of the muon detector, it should be possible to observe such processes with a cross-sectio of the order of 10^{-32} to 10^{-33} cm^2.

3) CONCLUSION

We have a full programme of measurements that will take us at least until the early summer of 1973. At that time it is probable that there will still be many useful measurements that could be made with the same equipment to continue this work.

However, by the summer of next year, the present British/Scandinavi collaboration will be seriously depleted and if it is intended to continue the physics programme with this equipment, it will be necessary to form an essentially new collaboration.

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On behalf of British / Scandinavian Collaboratic

REFERENCES

1) P.R.L. 27 3,160 (1971)
2) Nuc.Phys. B 33 221 (1971)