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PROPOSAL SUMMARY

Measurement of charged current cross sections and structure functions using BEBC and a bare-target neutrino beam.

Bari[1] - Birmingham[2] - Brussels[3] - Ecole Polytechnique[4] - Rutherford[5] - Saclay[6] Collaboration

J. Alitti[6], N. Armenise[1], J.P. Baton[6], R. Belusovic[2], G. Bertrand-Coremans[3], V. Brisson[4], D.C. Colley[2], O. Erriquez[1], M.T. Fogli-Muciaccia[1], T. Francois[4], J.G. Guy[5], G.T. Jones[2], C. Kochowski[6], L. Lowe[2], A.G. Michette[5], H. Mulkens[3], S. Natali[1], M. Neveu[6], S. Nuzzo[1], S. O'Neale[2], P. Petiau[4], F. Romano[1], S.J. Sewell[2], M. Tyndel[5], C. Vander Velde-Wilquet[3], W. Van Doninck[3], W. Venus[5] (*)

We propose to measure charged current cross sections and structure functions as precisely as possible over the widest energy and Q^2 range available at the SPS with a view to testing QCD more rigourously. The events obtained would also be used to test QCD predictions for the characteristics of the final hadron state (eg Q^2 evolution of fragmentation functions, thrust and spherocity distributions etc) up to the highest possible Q^2 values. The experiment requires exposure of BEBC filled with a neon-hydrogen mixture to a bare-target neutrino beam (wide $\sim 1\lambda$ target, no focussing, no sign selection), together with supplementary detailed measurements in the North Area of the $\pi^{\pm}$ and $K^{\pm}$ yields from the target and proton energy used. This would provide

(a) A single coherent data set spanning the whole energy and Q^2 range available at the SPS.

(b) Events within that range having a near-optimum energy distribution for testing QCD.

(*) Spokesman

(c) Neutrino and antineutrino fluxes determinable very precisely from the supplementary North Area measurements because of the simplicity of the beam.

(d) Adequate statistics from a relatively short run.

In order to cover the widest possible energy and Q^2 range and maximise the event rate we wish to use the highest possible proton energy that is consistent with sufficiently clean EMI conditions that low energy muons can be identified reliably. We therefore request a run of 10^{18} 450 GeV protons on target extended over a ∿30-day period in the expectation that, with the improved shielding plus (if necessary) a collinator downstream of the target, this will prove consistent with the over-riding clean-EMI requirement. The expected event rates are shown in table 1.

Table 1

Energy Range	cc ν events	cc $\bar{\nu}$ events
10 - 20 Gev	5,000	2,500
20 - 40 "	10,000	3,500
40 - 80 "	13,000	3,000
80 - 160 "	8,000	1,200
>160 "	3,000	200
Total	39,000	10,400

Expected numbers of events in the visible volume of BEBC assuming 10^{18} 450 GeV protons on target and a heavy (∿75 mole-%) neon-hydrogen filling. In practice (see text) we anticipate measuring fully only those $\bar{\nu}$ events and ∿40% of the ν events occurring in a restricted ∿$10m^3$ (7 tons) fiducial volume, ie ∿ 12000 events in all, for the cross section and structure function analysis. The same energy distributions would be expected inside the fiducial volume.