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ESTIMATE OF PARTICLE FLUXES FROM THE IR'S AT THE SSC*

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There exists a considerable amount of interest in exploring the possibility of doing secondary beam physics at SSC. There are at least three obvious ways of obtaining secondary beams at the SSC, namely:

a) extraction of the primary stored beam and its subsequent targeting to generate secondary beams.

b) generation of secondary beams from internal target, either gas jet or thin wire or foil.

c) utilization of particles produced in the primary collisions in the interaction regions.

This note summarizes some calculations performed on the yields generated via the third mechanism.

The calculations are based on the MINBIAS events generated by the program ISAJET.[1] These events are meant to simulate the total inelastic cross section i.e., a minimum bias trigger. The procedure followed was to generate a large number of the MINBIAS events, and then to count the number of particles generated which satisfied the chosen angular and energy cuts.

The data are displayed in two different ways. In Fig. 1 we plot the yield at 0° into a 0.1 μster solid angle for several different particles as a function of their momentum. It should be emphasized that because of the procedure followed this is not a true differential yield at 0°. Because the cross section falls off away from 0°, the true differential yield will be somewhat higher. This correction is insignificant for lower energy particles ($E \lesssim 1$ TeV) but becomes appreciable at several TeV.

In Fig. 2 we display the yield as a function of transverse momentum (p_T) plotted for several different bands of total energy. Note that even though the abscissa is labelled in terms of the first power of p_T, the yield is calculated per $\Delta p_{\parallel}$ of 1 GeV/c and $\Delta {p_T}^2$ of 1 $(\mathrm{GeV}/c)^2$. Both Figs. 1 and 2 integrate only over one of the two small angle jets (near 0° and 180°) that will normally be present.

The data in Figs. 1 and 2 are calculated for *pp* collisions with 20 TeV in each beam. The calculations were also performed for 20 TeV protons incident on stationary target. In general the yields in the kinematic domain investigated are smaller by roughly a factor of 1.5. As an example the yields of π^+'s are shown in Fig. 3. The effects of a thick target and production by means of secondary interactions have been neglected.

Finally, we should mention that these calculations totally neglect any other possible production mechanism that is not included among the MINBIAS possibilities. Thus the yield of electrons, which here are due solely to Dalitz decays of π°'s and η's is probably grossly underestimated. It is very likely that the most copious source of e's and μ's at SSC will be large forward production of charm particles with their subsequent decay via the semileptonic mode.[2]

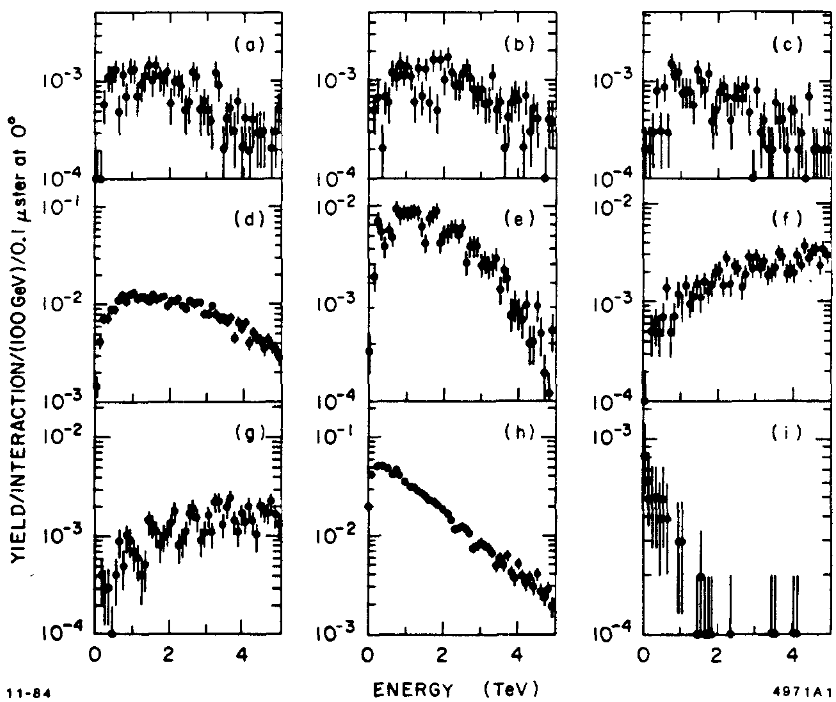

Fig. 1. 0° yields of secondary particles from the interactions of 20 GeV protons on 20 GeV protons: a) K_L° , b) K^+ , c) K^- , d) π^+ , e) π^- , f) p , g) n , h) γ , i) e^- .

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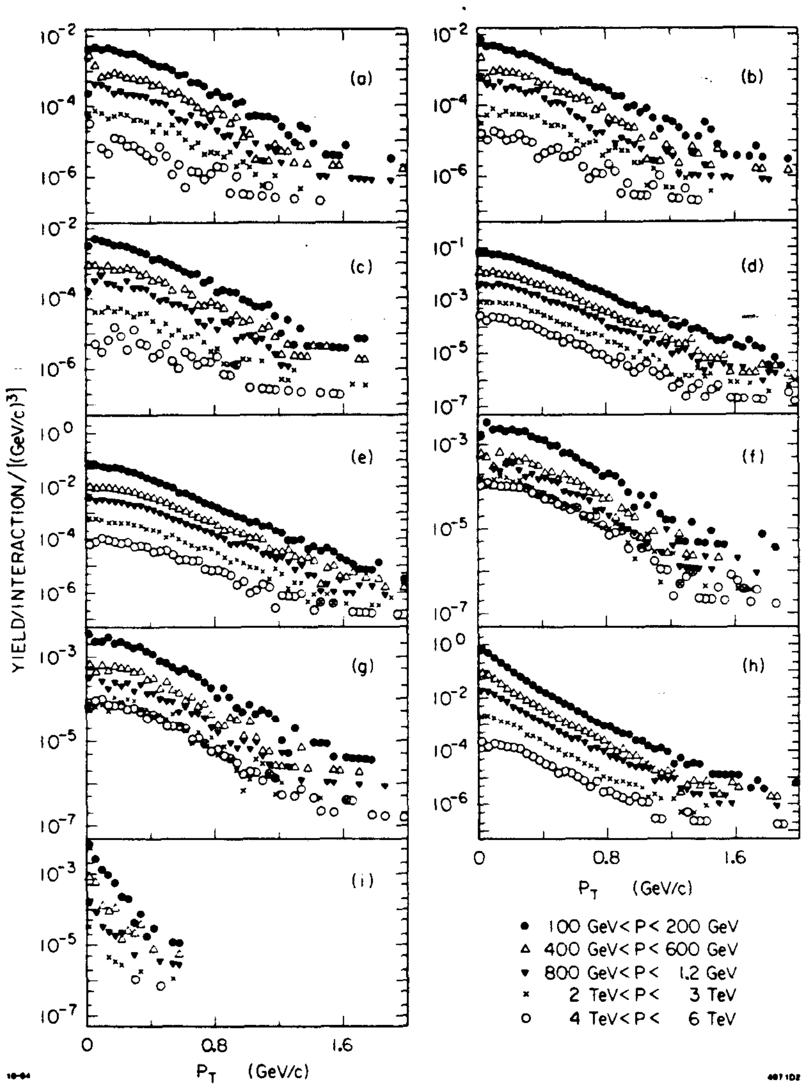

Fig. 2. Yields of secondary particles in five different energy bands as a function of transverse momentum (p_T). The incident particles are 20 TeV protons on 20 TeV protons. The particles plotted are a) K_L° , b) K^+ , c) K^- , d) π^+ , e) π^- , f) p , g) n , h) γ , and i) e^- .

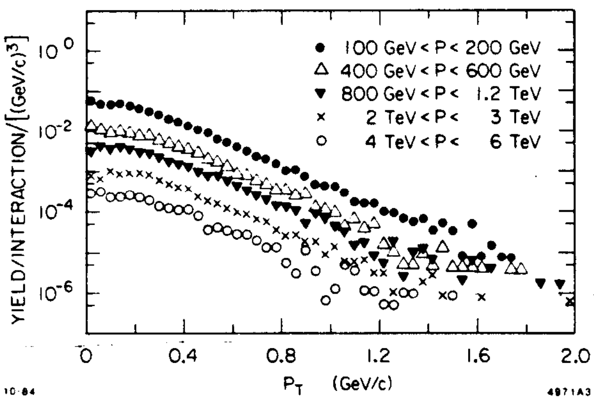

Fig. 3. Yields of π^+ in five different energy bands as a function of transverse momentum (p_T). The yields are calculated per interaction of a 20 TeV proton on a stationary proton target.

Because of many theoretical uncertainties these yields should not be taken literally, but rather should serve as a rough guide of potential fluxes that can be anticipated. They are clearly large enough to provide good test beams and conceivably secondary beams intense enough for physics experiments. The experimental challenge that has not been addressed in this note is the question as to how efficiently they can be extracted out of the machine.

Acknowledgements

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REFERENCES

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2. see for example A. De Rujula and R. Ruckl, Neutrino and Muon Physics in the Collider Mode of Future Accelerators, Proceedings of the SSC Fixed Target Workshop, The Woodlands, Texas, January 26-30, 1984.