

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

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CM-P00046553

CERN/SPSC/80-113  
SPSC/P 153/S  
29 September 1980

PROPOSAL

DIRECT PHOTON PRODUCTION IN HADRON-HADRON COLLISIONS AT THE SPS

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### ABSTRACT

We propose to measure the production of direct real photons with large transverse momentum in pion-nucleon collision at the SPS (H8 beam) using the NA3 spectrometer with an upgraded  $e\text{-}\gamma$  calorimeter. We intend to proceed in steps of increasing complexity :

- i) measurement of the direct  $\gamma$  cross-section in  $\pi^\pm C \rightarrow \gamma + X$  and search for the annihilation process  $\bar{q}q \rightarrow \gamma g$  by measuring the charge asymmetry at 200 GeV/c;
- ii) determination of the gluon structure function of the pion and the nucleon;
- iii) use of the  $\pi^-\text{-}\pi^+$  difference on carbon, if found experimentally, to extract the gluon fragmentation from the  $\gamma$ -hadron correlations.

For comparison, the quark fragmentation function can, in principle, be extracted from processes where the Compton scattering  $qg \rightarrow q\gamma$  dominates and compared with data from D.I.S. as a test of the method.

The existing standard NA3 spectrometer is well suited for this type of physics. Good  $\pi^0$  rejection is achieved on the trigger level by selecting  $e^+e^-$  pairs from  $\gamma$  conversion in a thin lead radiator. This trigger offers the advantage of being highly selective for single  $\gamma$ 's and technically feasible with the present cathod cell chambers, already used in the dimuon experiment.

In order to improve the direct photon selection of the existing electron-photon calorimeter we intend to add a fine-grained shower chamber.

The program of measurements described above requires 160 days of beam time in 1981-82.

The impact on this experiment of a future high-energy antiproton beam is briefly discussed at the end.

