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EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

INTERSECTING STORAGE RINGS COMMITTEE

PROPOSAL PARTICLE PRODUCTION EXPERIMENT

CERN/HOLLAND - LANCASTER/MANCHESTER COLLABORATION

CERN/ISRC/69-9

M E M O R A N D U M

To : The members of the ISR Committee.

From : A.B. Clegg, C. Daum, F.C. Erné, A.D. Kanaris, D. Locke, P.G. Murphy, J.C. Sens and F. Udo (CERN/Holland - Lancaster/ Manchester Collaboration).

Subject: Proposal particle production experiment.

Some time ago a team of physicists was formed with the aim of performing an experiment on the production of charged stable particles at the ISR. The participating physicists originate partly from the present CERN/ Holland team, partly from a collaboration at Daresbury (NINA) between the Universities of Manchester and Lancaster. The team will be sponsored by the Foundation for Fundamental Research of Matter in the Netherlands and by the Science Research Council in Great Britain.

In a letter of intent (19 September 1968) the reasons for doing this experiment were outlined. Also indicated were some aspects of the design which were then under study.

We have now completed the necessary calculations on orbit-tracking, rates, backgrounds etc., to be able to freeze the design of three spectrometers with which the experiment can be performed. The results of these calculations are contained in the accompanying proposal.

In the proposal it is shown that, although the rates are low by PS standards, this experiment has high intensity relative to other experiments which can be considered for the ISR. Although the thermodynamical model, on which the rate calculations are based, may be wrong in details, it can be hoped to be correct at least in order of magnitude estimates of the particle yields. In any case, if, for lack of rate, this experiment should not succeed, no other one will.

The experiment, if approved, will require close collaboration with ISR engineers in the detailed design of the apparatus. This concerns in particular three points:

i) Two septum magnets will be necessary to reach the minimum angle of ~ 15 mrad aimed at in the experiment. Since septa are presently being studied by the ISR division in connection with beam dumps and transfer to the West Hall, the detailed design of the septa is obviously best done by the experts in that division.

ii) A special vacuum chamber with movable parts and thin-walled flares is required which can be maintained at a pressure of 10^{-11} Torr N_2.

iii) Frames and supports are required to hold one of the spectrometers in place above one of the rings and to be able to rotate and displace at least four elements of this spectrometer with good accuracy.

Some other aspects of the experiment, relevant to the Committee, are:

a) Location of the experiment. As shown in the proposal it is possible to extract particles from the intersection along the downstream direction down to ~ 15 mrad without affecting the circulating beams and without excessive power requirements. This is done by placing the septum magnets mentioned above as close as possible to the intersection and using the remaining space to sweep the secondaries away from the next downstream ISR element. In the calculations a space of 9.8 m has been assumed between the intersection and the next ISR element, i.e. an "ingoing" section. An "outgoing" section (~ 7 m) would raise the minimum observable angle to ~ 40 mrad, no matter by how much the power in the septa is raised. Therefore, only I_2 or I_6 are suitable for the experiment. Of these two, preference goes to I_2 since the low momenta emitted at large angles are measured by time-of-flight for which ~ 9 m is required, which is available in I_2 but not in I_6. A second choice would be I_6 where ~ 7 m is available which would still be adequate for a large part of the low momenta, although the accuracy would be less.

b) Power requirements. If all three spectrometers described in the proposal are run simultaneously (this is obviously best from the viewpoint of required ISR time), the total power is ~ 4.4 MW. The "small angle" spectrometer alone takes 2.2 MW, the "medium angle" spectrometer 1.5 MW, the "large angle" spectrometer 0.7 MW. The septa can be powered with a 20 kA, 30 V supply which is currently on order in the ISR division.

c) At this stage and in view of the many unknowns in the problem (ISR performance, rates, vacuum, sharing between experiments), it does not

seem realistic to include any request for "machine time". If desired, an estimate can be obtained from the rates/day listed in Tables 8, 9 and 10 of the proposal.

Parts of this report have been the subject of seminary by C. Daum (June 1968), J.C. Sens (October 1968) and A.D. Kanaris (December 1968).