Fermilab Proposal No. 327

Scientific Spokesman:

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Tests of Particle Identification by Ionization Loss (ISIS)

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University of Oxford

R. Yamamoto
Massachusetts Institute of Technology

July 1, 1974

UNIVERSITY OF OXFORD · DEPARTMENT OF NUCLEAR PHYSICS

Nuclear Physics Laboratory, Keble Road, Oxford, OX1-3RH

Telephone (STD 0865) 59911

12th June, 1974

Dr. R. Huson,
Fermilab,
P. O. Box 500,
Batavia,
Ill. 60510,
U. S. A.

Dear Rus,

Tests of particle identification by ionisation loss (ISIS)

Further to the encouraging and useful discussion we had last week I write to give you more details etc. in writing and to ask for written approval for the tests to allow us to approach the Rutherford Laboratory for funding for travel etc.

We have good evidence from tests carried out on our I m drifting test module that the ISIS method of collecting multiple ionisation samples on many tracks simultaneously can be made to work (Oxford preprint 17/74 and Nuclear Inst. and Meth. to be published). Further tests including some on a channel of electronics with multitrack capability will continue at Rutherford until September.

What is not entirely clear is how this ionisation depends on the velocity of the particle - nor how the error on the ionisation from such a device varies. Fig. 1 shows a number of data points for the ionisation loss (most probable in this case) as a function of p/mc. A calculated curve is shown giving a 50% relativistic rise. It differs dramatically from the 70% rise predicted by Sternheimer (Phys. Rev. B3, 3681, (1971)). On the other hand the data which are based on electrons at the higher velocities are in mutual disagreement. Taking the pessimistic view (curve shown) the separation of π/K/p would depend on velocity as shown in fig. 2. The range of separation is limited.

To resolve the situation we propose to make some tests with a chamber (which does not involve drifting) using the gas and sample thickness proposed for a full scale ISIS. Data on the complete Landau distribution at each velocity together with a study of δ rays will enable us to show the momentum range over which ISIS will identify K/π/p and also to clear up uncertainties in the theory of the ionisation loss in thin gas samples.

After setting up parasitically in enclosure 114 we would like 1 shift data taking runs at a number of $+^{ve}$ beam momenta (e.g. 25, 50

100, 175 GeV/c) and at least one $-^{ve}$ beam momentum to get data checks $\pi^+ \equiv \pi^-$ and 25 GeV $\pi^- \equiv$ 175 GeV proton. We would like a long spill or at least 4 spikes of less than or equal to 20 particles/burst. We hope to use the Cerenkov signals and some scintillators already in the beam. Our chamber will be designed so that less than 1% of an interaction length is presented to the beam.

After testing in England we would hope to start setting up in enclosure 114 at the beginning of October and to be ready for first data runs by the end of October. We would hope to be through in 4 weeks, your schedule and problems permitting. You mentioned that consummables (gas etc.) and the loan of standard items (scopes etc.) could be covered by Fermilab. This would certainly be appreciated and Dick Yamamoto as our NAL anchor man has promised to look after this side of things for us.

Of course as I said last week our plans depend on the funding we can get from the Rutherford Laboratory for travel, subsistence and some non-standard items. However on receiving your approval for the tests we will approach Rutherford immediately.

Yours sincerely,

Wade Allison

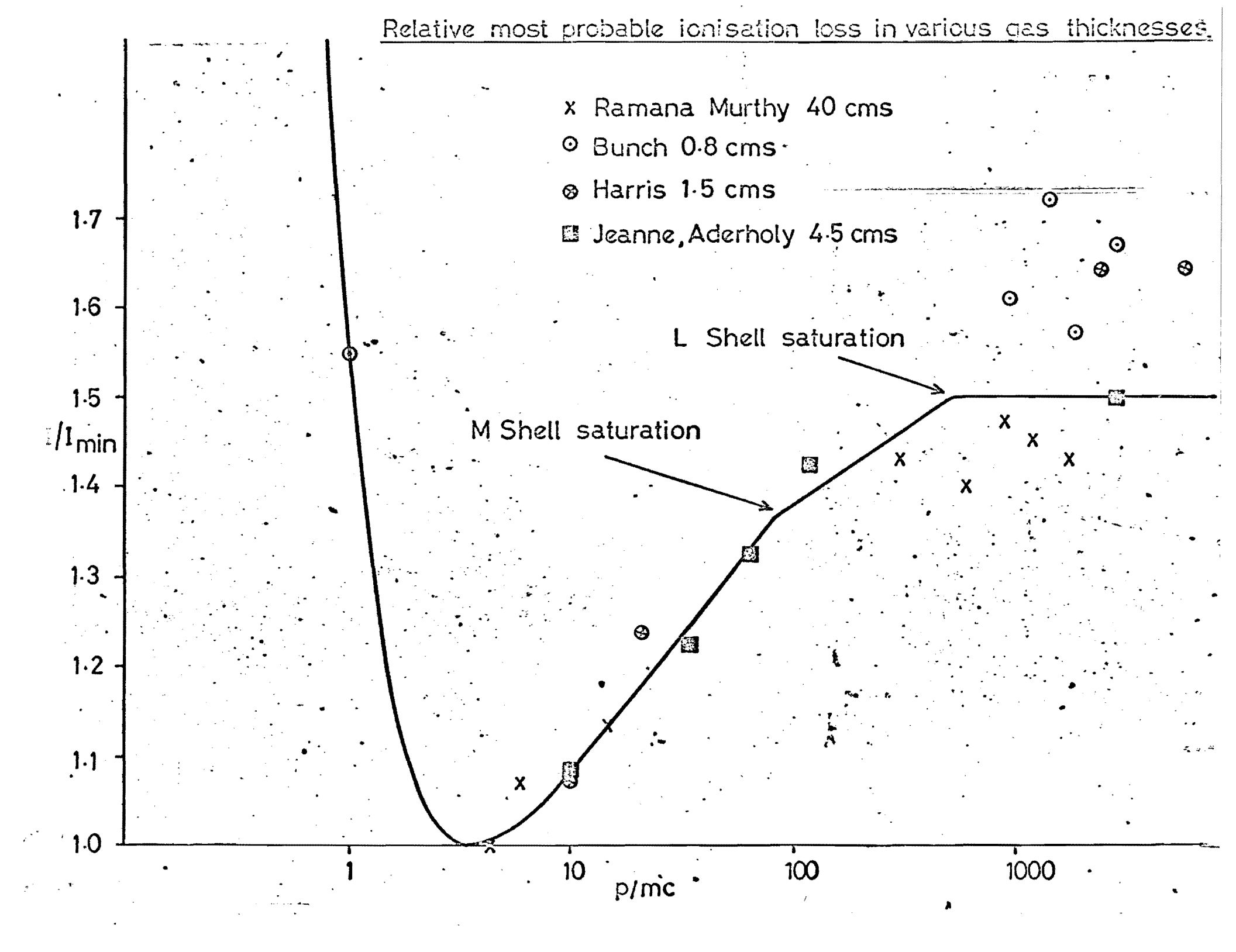
W. W. M. Allison

P. S. Perhaps it would be useful for you to know the members of our team in addition to myself who are likely to come to NAL.

C. B. Brooks	Senior Engineer (whom you met)
P. Shield	Junior Engineer
J. N. Bunch	Graduate Student

Enc.

Copy: R. Yamamoto


Relative most probable ionisation loss in various gas thicknesses.
x Ramana Murthy 40 cms
⊙ Bunch 0·8 cms
⊗ Harris 1·5 cms
▣ Jeanne, Aderholy 4·5 cms
L Shell saturation
M Shell saturation
1·7
1·6
1·5
1·4
1·3
1·2
1·1
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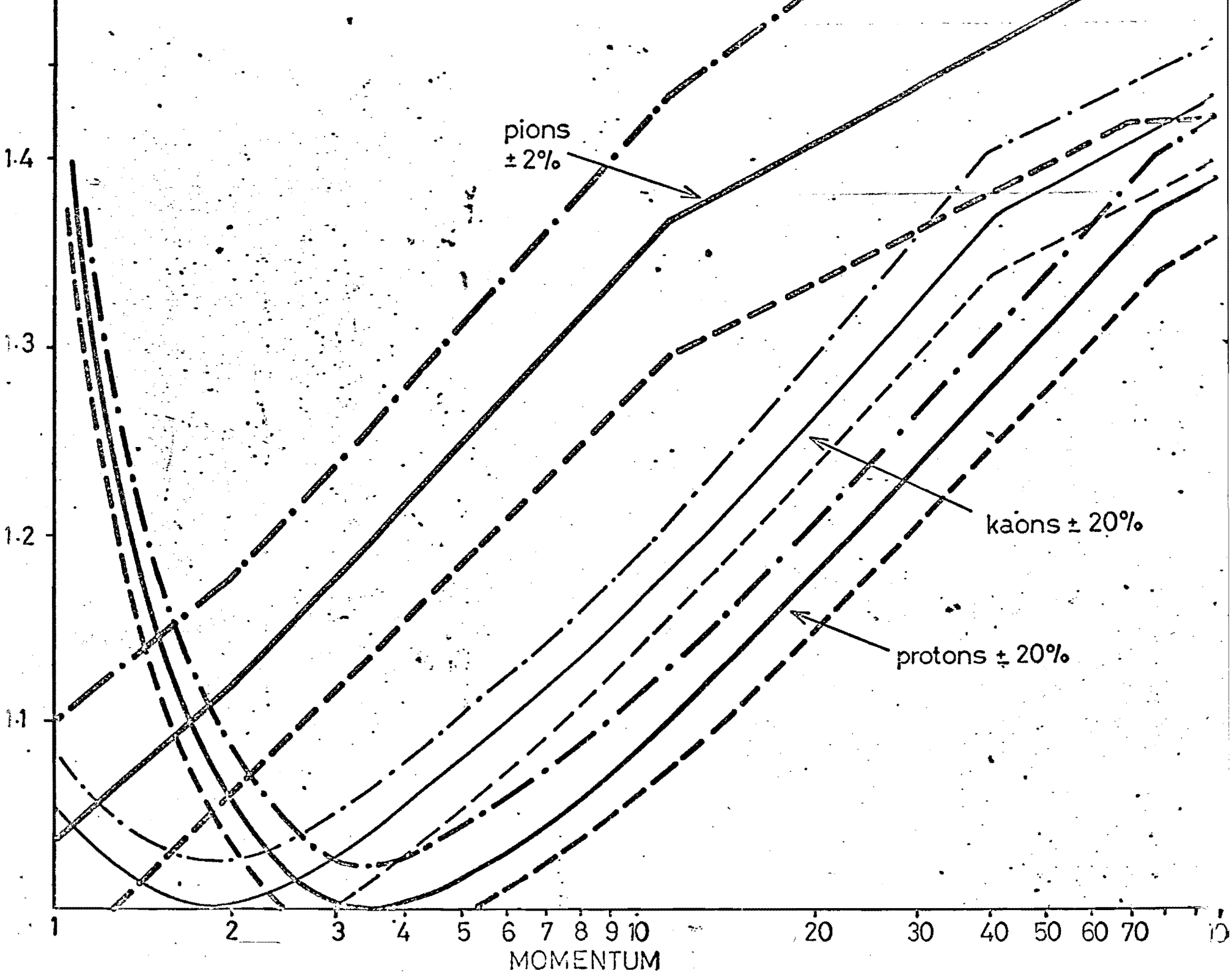
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MOMENTUM

NATIONAL ACCELERATOR LABORATORY

P.O. BOX 500
BATAVIA, ILLINOIS 60510
TELEPHONE 312 840-3000

July 31, 1974

Dr. Wade W.M. Allison
Nuclear Physics Laboratory
Oxford University
Keble Road
Oxford OX1 3RH, England

Dear Dr. Allison:

At the London Conference Russ Huson discussed with me the conversations in which you and he agreed to arrange tests for the equipment of your ISIS project. At that time I indicated to Dr. Huson that commitments of the kind you were discussing should properly be made only through the Director's Office at Fermilab and only with the knowledge and concurrence of Dr. James Sanford who is in charge of our overall program planning. We do not normally set aside time for the independent disposition of the various experimental areas. Nevertheless, in view of the particular circumstances and convenience of your conversations with Dr. Huson in London, I agreed that he might give you the assurances contained in his letter with the proviso that they were contingent on the approval of Dr. Sanford.

Dr. Sanford and I have now discussed your plans, and he has talked further with Dr. Huson. We are quite ready to approve the tests as you have suggested them, but we feel that to preclude possible misunderstandings in the future your request for test runs should be in the form of a proposal. I shall accept your letter of June 12 as a description of that proposal, and the proposal is hereby approved. We shall assign number T-327 to your test runs. Dr. Sanford will be in touch with you regarding the details of arranging an Agreement to cover your needs for your tests. If you have any questions I suggest that you address them to him.

Sincerely,

Edwin L. Goldwasser

cc: Russ Huson

Proposal File No. T-327
Master
DO
JRS

W W M Allison

Nuclear Physics Laboratory,
Oxford University
Keble Road
OXFORD
OX1 3RH

9 July 1974

Dear Wade

As we discussed when you visited Fermilab recently, we are interested in the further development of your ISIS project. The potential of this apparatus for high energy physics experiments is obvious.

Thus we in the neutrino area are willing to provide the following for your tests

1. Space for your equipment either in one of our enclosures or in a porta kamp.

2. We can loan you standard equipment and provide consumables. We will arrange this with Dick Yamamoto who is collaborating with you.

3. We will provide scintillator and Cerenkov signals to your equipment.

4. Over a period of about 4 weeks during the fall of this year we will provide you with approximately ten shifts of beam in either the 30" or 15' bubble chamber beam lines.

The above will be treated as tests for the neutrino area and as such will have to be fit into our normal operating schedule in such a way as to minimize interference with experiments in progress.

We will be looking forward to the successful operation of your tests.

Yours sincerely,

F R Huson
Department Head
Neutrino Area
Fermilab

cc. J. Sanford for scheduling.