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REFER:

DEPARTMENT OF
PHYSICS

June 21, 1962

Dr. T. G. Pickavance
National Institute for Research in Nuclear Science
Rutherford High Energy Laboratory
Harwell, Didcot
Berkshire, England

Dear Dr. Pickavance:

Thank you for your letter authorising an extension of my stay in the U.S. and the visits to Berkeley and other laboratories. I have not completed arrangements with Washington for my return voyage, but hope to arrive at Southampton on or near the 2nd October.

In order to answer your query about the Cosmotron intensity, I talked to Mark Barton and the following is a version, once removed, of what he told me. The increase from 10^{11} protons per pulse to 5×10^{11} was the result of two things: the vacuum was improved by a factor ~ 2 the straight sections were all magnetically shielded. Previously only the R.F. section had shielding, resulting in a small asymmetry and a consequent loss of particles.

The limiting factor at present is believed to be due to space charge effects. There is slight evidence that, even if the injection current could be increased, the final intensity would soon reach a plateau. Radial space charge effects, i.e. straightforward defocussing, should not become apparent until about 10^{13} protons/pulse are obtained. However, azimuthal effects may be present and there is evidence for this in the azimuthal intensity distribution measured with R.F. pickup plates. At low intensity the distribution is smooth but at high intensity sharp bunching occurs. The theory is that this is due azimuthal Coulomb forces, which, as a result of the fact that $\partial f / \partial E < 0$ (f = frequency, E = Energy), causes particles to bunch together azimuthally, rather than spread out. This is achieved at the expense of an increase in radial separation so that particles are lost from the focussing system. I was told that they hope to overcome this difficulty by injecting a broader energy distribution. Apparently a flat or Gaussian distribution should be stable against this bunching effect. A system of three R.F. cavities, run at different frequencies, has been designed to produce a Gaussian spread, and it is hoped that it can be tried quite soon.

Our deuteron experiment is progressing quite well and we hope to obtain data suitable for publication in a run this weekend.

Yours sincerely,

M. A. R. Kemp

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