SOME THOUGHTS RELATED TO CRYOGENIC LINACS

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At Argonne some thought has been given to the suitability of a linac for production of intense neutron fluxes in the range of 10^{18} per second or higher. This would envision a proton beam of approximately 20 ma on a dc basis, at an energy of about 500 or 600 Mev.

The question of whether or not a cryogenic linac would have merit in this application has been considered on the basis of rf power requirements. If one makes a plot, as shown in Fig. 1, of beam power and total rf power as a function of beam current, it is immediately evident that for a beam current of about 100 ma, the beam power approximately equals the cavity excitation power for a normal temperature linac, and that above this current the total rf power becomes mainly beam power, in which case the advantage of low excitation power of a cryogenic system is of negligible importance. On the other hand, at 1 ma and below the beam power is sufficiently low that a cryogenic system appears to have definite merit. The region of interest lies between these two points, and would require considerable study of the costs and engineering problems to determine the relative merits of the two systems.

Some problems associated with a cryogenic system might be mentioned.

1) The fact that one must have access to the inside of an rf cavity for assembly and servicing requires that end covers or other openings must be provided. This means, of course, that satisfactory rf contacts, which must be superconducting, must be devised, either by such methods as solder

joints or pressure contacts between the superconducting surfaces involved. In the superconducting cavity studied at Stanford, this problem was avoided by choosing a mode in which no rf currents flow across the contacts between the cover and the remaining walls of the cavity. But this would be less easy to achieve in a linac cavity.

Indium solder might be used, or possibly indium pressure contacts. However, the critical temperature of indium is lower than $4^{o}K$.

2) On the matter of achieving and of maintaining mechanical alignment, one would meet some very interesting problems. If alignment is done at room temperature thermal change could result in misalignment. Similarly, if some means were developed for aligning at the low temperature, thermal cycling could bring about misalignments, so that some means of frequent rechecking would be desirable.

3) The matter of tank "flattening" is also tied up with the alignment problem. "Flattening" should be done at operating temperature in order that the frequency as well as cell spacing be correct.

Discussion

K. Batchelor (Rutherford): We have considered the problem of joints and will test some in the near future.

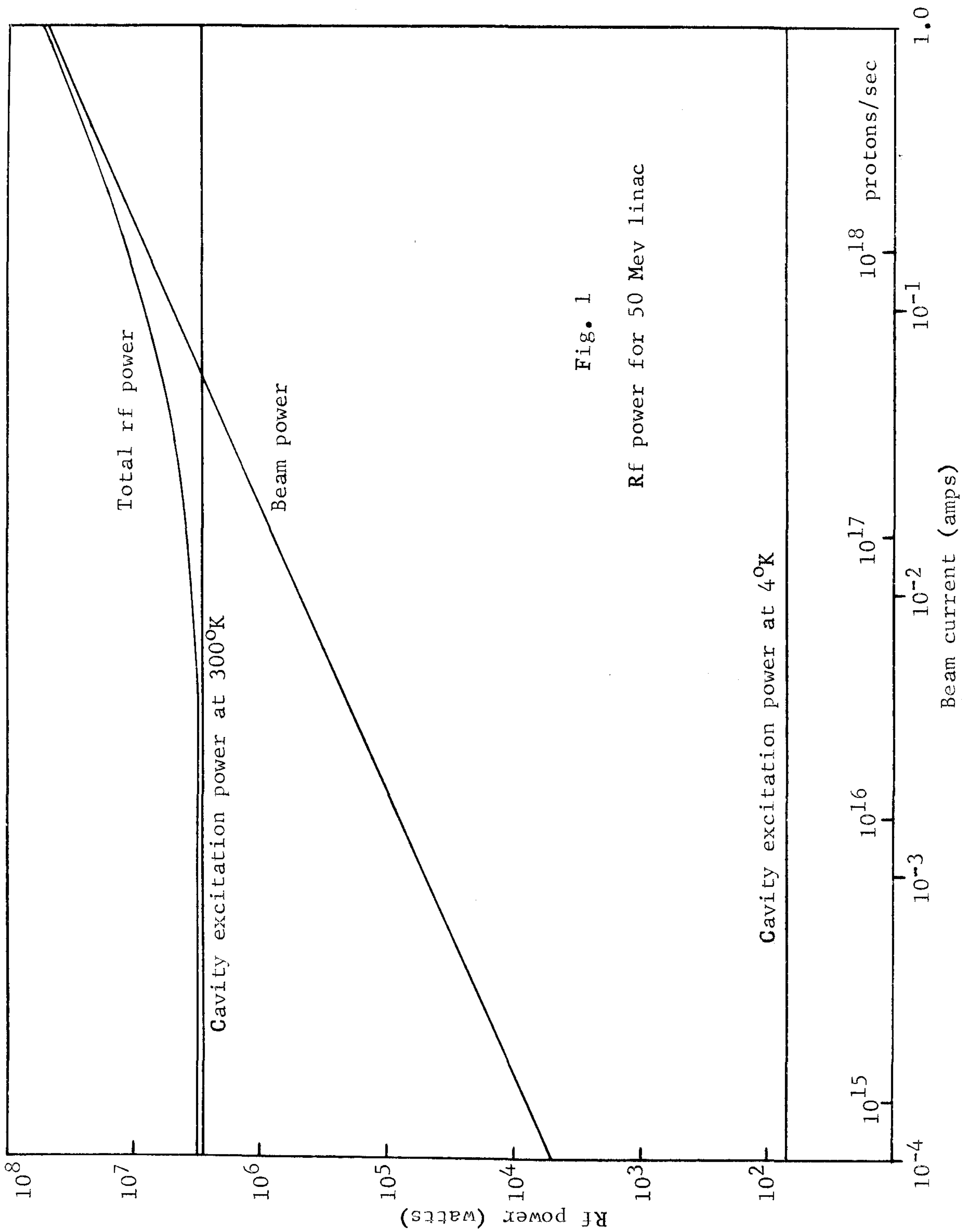

Fig. 1

Rf power for 50 Mev linac