Dr Skinner

As Pickavance told you we now have sufficient evidence to persuade us to choose cylindrical poles instead of tapered. There are four main arguments which are as follows:-

(1) Experiments show that for the same gap Cylindrical Poles give somewhat greater energy than Tapered Poles for all magnetic currents and particularly for low currents. Corresponding figures are 147 and 142 MeV at large currents and 115 and 100 MeV at medium currents.

(2) An air gap of 12" has been chosen to start with and after experience with this gap it will be possible to reduce to 10" or 8" if the higher energy is required. If this is done with Cylindrical Poles it is a quite straightforward modification. With Tapered Poles however for optimum results a New Taper is required but a compromise on this could readily be done using a cylindrical pole tip, though some loss of energy would result.

Experiments show however that the gain in reducing the gap is greater for Cylindrical than Tapered Poles if the taper is unchanged and only the gap altered.

Hence in the light of possible future reduction of Gap Width in order to obtain higher energy Cylindrical Poles are best.

(3) With Cylindrical Poles the central field is lower than with Tapered Poles and hence the maximum frequency required is lower.

This considerably eases the oscillator problem as the performance of the oscillator falls off with higher frequency and the feeder lines coupling it to the Dee lines are less frequency sensitive at the lower frequency.

Hence from the point of view of the oscillator and ease of coupling it to the Dee Circuit Cylindrical Poles are best.

(4) The Dee capacity for Cylindrical Poles is higher than that for Tapered Poles because of the larger Dee diameter. If maximum frequency were the main consideration then this would be a disadvantage. However, using a third line with the F.M. capacity at the end it is fairly easy to obtain the frequency required. The depth of frequency modulation required is about 25% and to obtain this a larger size of condenser is required for Cylindrical Poles than for Tapered Poles if the condenser be mounted right on the Dee. We may, therefore say that the condenser size scales

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up in the same order as the Dee in going from Tapered to Cylindrical Poles for this type of circuit. However with the F.M. condenser at the end of a stub, as in our system, we transform our condenser requirement from one of a large capacity at low voltage to one of a smaller capacity at a higher voltage. In addition because the transformation of the line converts the capacity change to an inductive change at the Dee, the percentage F.M. is determined almost entirely by the fractional change of inductance. The main effect of increasing the Dee capacity is to increase the current carried by this effective inductance or in practice to increase the voltage on the condenser.

The net effect of increasing Dee capacity is therefore to increase the operating voltage of the F.M. condenser. In going from the Dee required for Tapered Poles to that for Cylindrical Poles the condenser voltage goes up by about 30%.

Hence Cylindrical Poles somewhat increase the problem of designing a F.M. condenser.

We therefore feel that cylindrical poles are the best design. Initially we shall work at low Dee voltage and low recurrence frequency - you will remember that the Americans expect that there will be an optimum recurrence for each value of Dee voltage and that this recurrence frequency will increase with Dee voltage - and when satisfactory operation is attained shall try to increase both these factors in order to improve the beam intensity.

25.4.47.