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SHORT COLUMN PROGRESS REPORT

Ion Source

Much attention has been paid to the duoplasmatron Mark II output oscillations by changing the following parameters:

a) Plasma expansion cup geometry.

b) Anode - intermediate electrode distance (ℓ).

c) Source aperture (ϕ).

In general, oscillations are of small amplitude ($<$ 3%) in cup geometries smaller than about .3 in., source aperture of .040 in., ℓ = .280 in. and beam intensities as high as 250 mA. Larger cups with lower beam density have also to be checked out in the short column (its preliminary structure is based on a density of 100 mA/cm^2). However, larger cups ($>$ .3 in.) show oscillations, which amplitudes are influenced by the above mentioned geometrical parameters. An important result obtained so far is that for larger cups the source aperture ϕ has to be increased, reaching an optimum diameter for each cup size. Earlier results showed already an optimum ℓ value.

The choice of the appropriate cup dimensions becomes more complicated by the requirement of an extracted "clean" beam; this is a beam with a rectangular or elliptical phase space diagram measured after the extractor. Harold Wroe found such a clean beam for a very small cup (ϕ .060 in.) and small intensity in the Mark I source (see HW-2). For larger cups however, aberrations were always found. Measurements with Pierce shaped cups and variable extractor gaps continue.

Short Column

An H.V. test of the short column without inner structure has reached 650 kV after four days of continuous conditioning. Figure 1 shows a plot of the sparking rate in time. After these promising results, we decided to stop conditioning, to install the inner-structure of the column and to condition at the same time the large surfaces of the inner structure. The R.D.I. power supply worked fine up to 650 kV at least; the H.V. bushing sitting in oil was a right solution up to now. The control panel of the R.D.I. will be rewired and the equalization resistances around the filter capacitances will be used as measuring resistance after a careful calibration. Not much success was obtained in tests with modified Machlett rectifiers to replace eventually the very expensive Machlett tubes ($250), bought via Radio Dynamics Corporation. The general layout of the H.V. equipment in Building 905A seems to work for at least 650 kV.

The radial alignment of the electrodes ($\sim$ .006 in.) was complicated; spacers were added to the "buttons", which hold the electrodes. With this experience, W. Schneider will design new buttons with a more flexible arrangement for the spacers.

An important setback in our final goal has been caused by loosening of two ceramic-aluminum joints of the column, the top one and the bottom one. The bottom plate loosened on April 14 during installation of the assembled column on the top of its final test stand. The column hanging vertically several inches above the bottom plate then dropped on the bottom plate during the following night; the top plate hanging in the hoist. No visual damage to the rest of the column has been observed.

The present joints of the column cannot be trusted anymore; a study on an existing three section column will start as soon as possible and recommendations will be included in a report of the above mentioned failures (in preparation by W. Schneider).

The joints will be repaired as soon as possible; if the misalignments are not serious and no other damage has been done to the column, our H.V. tests can start again at the end of this month.

Lectures concerning conventional and more progressive preinjectors have been started for collaborators around the column.

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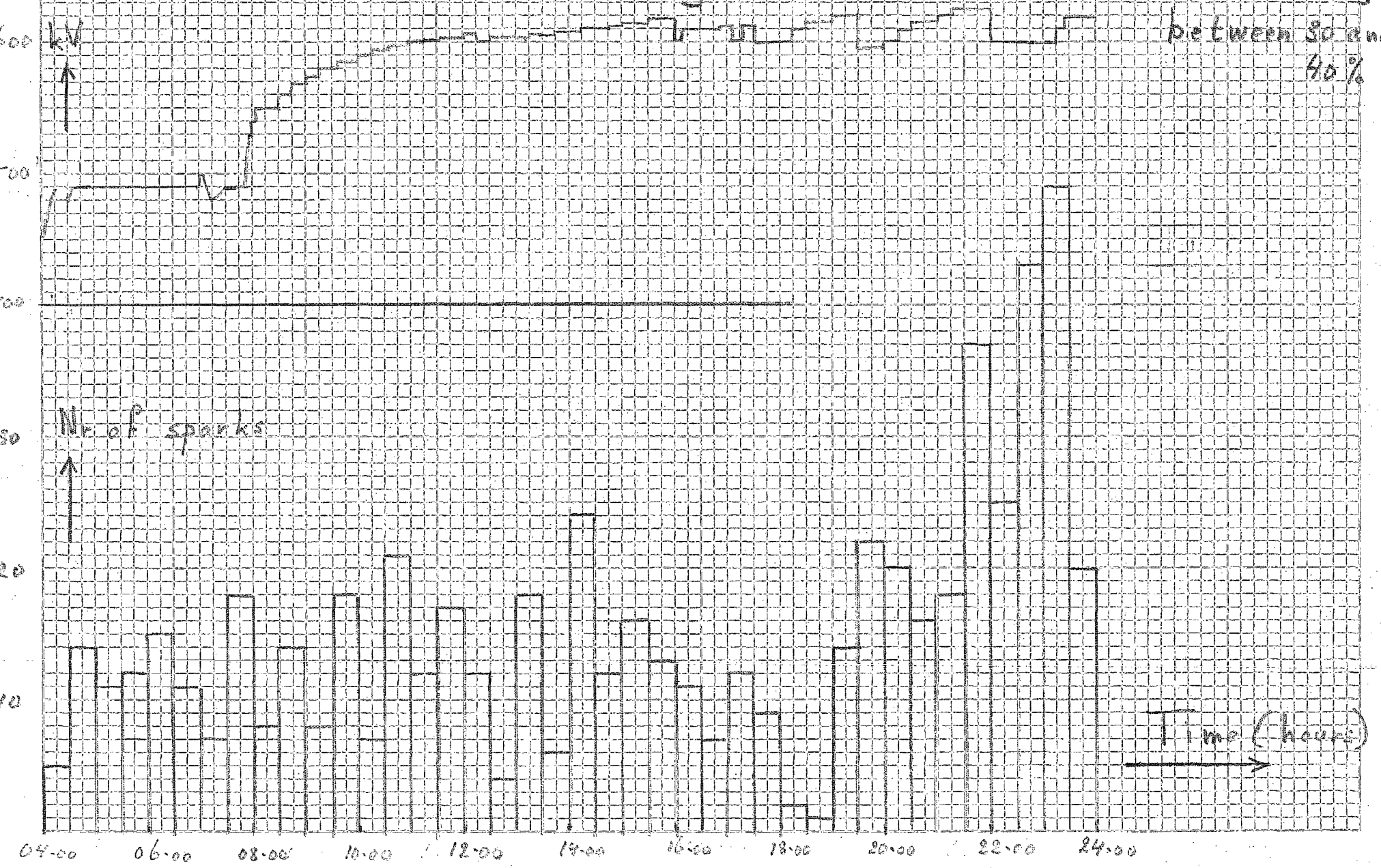
Fig. 1 Sparking rate of short column without inner structure on 9/24/66 during conditioning. Pressure 10^{-5} - 10^{-6} mm Hg. Humidity between 30 and 40 %