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ISR PERFORMANCE REPORT

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Test of the new automatized set-up for transverse Schottky scans

The first transverse Schottky scan instrumentation installed in the control room was there to experiment the feasibility of such a signal processing. Once we had enough experimental knowledge of the range of operation as well as mode of operation, we designed and built new controls and interfacing boxes with the aim of making this set-up very easy and reliable to operate. The tuned transformers as well as the front end amplifiers were also redesigned in order to obtain the maximum $\frac{S}{N}$ ratio within the specified bandwidth. This new set-up allows all the data of one ring to be measured in parallel, i.e. the direct and shifted transverse side-bands both vertical and radial.

The set-up did perform as expected but the front-end amplifiers with tuned transformer needed some modifications. This was done during controlled accesses and all four channels are now equipped with the new amplifiers. The resulting bandwidth (170 kHz around 10.942 MHz) is twice that of the experimental set-up. The resulting $\frac{S}{N}$ is slightly better and is enough to distinguish easily the useful noise signal from the instrumentation noise. It also helps to reduce the integration time to about 10 min total for one ring's data.

The vertical signals are taken from normal clearing electrodes (SS. 309-308) The horizontal signals are taken in R2 from small special electrodes in the non-linear lens and in R1 from HSPU 349 made of two clearing electrodes installed horizontally. The horizontal signals in R2 are too weak and a new HSPU 416 is in preparation.

Performances

The over-all set-up frequency precision has been checked with a synthesizer and is as follows: ±0.1 div on the graticule with 5 kHZ/div, which corresponds to a precision for Q_V and Q_H readings of about 1‰.

We found during the test of the set-up a phenomenon on the radial signals which can upset the interpretation of the scans:

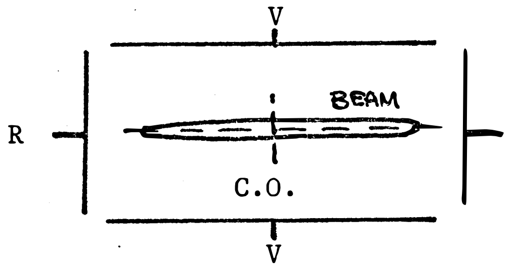


Fig. 1

Since the beam is wide horizontally, all protons are situated at mid-distance between the two vertical plates, but radially only the protons being on central orbit are in the same situation (see Fig. 1). Therefore, if the difference signal between the two plates is well balanced, there will be no longitudinal or harmonics of the revolution frequency in the vertical signal. In the radial one, however, protons outside the central orbit will induce longitudinal harmonics proportional to their transverse radial position. This effect can be seen on picture 2, picture 3 showing the corresponding density longitudinal scan. It is this information, relation between signal amplitude and position (in this case analysed in the frequency domain), that we will use to try the feasibility of Schottky signal use for stack vertical position information.

In the case of the analysis of transverse motion side-bands, however, this longitudinal harmonic signal is disturbing because of its large relative amplitude, especially in large stack cases. Since the set-up uses a wide band mixer to shift the fast side-band down, the large longitudinal harmonics may produce harmonics of the local oscillator within the side-band of interest. This can be seen on picture 4 where the shifted side band (lower trace) contains a line not existing in the upper trace. We shifted the local oscillator by -10 kHz which produces equally a shift of 10 kHz on the fast side band (see picture 5) but the line did move by 30 kHz, which shows that it was in relation with the third harmonics of the local oscillator. We will cure this effect by introducing a narrow tunable filter before the mixer in order to attenuate these strong longitudinal harmonics.

An additional improvement of the set-up is in preparation: the resulting averaged longitudinal and transverse scans will be transferred to the computer for recording purposes and in order to avoid the picture taking.

J. Borer - D. Cocq

Transverse - longitudinal scan R1

R1

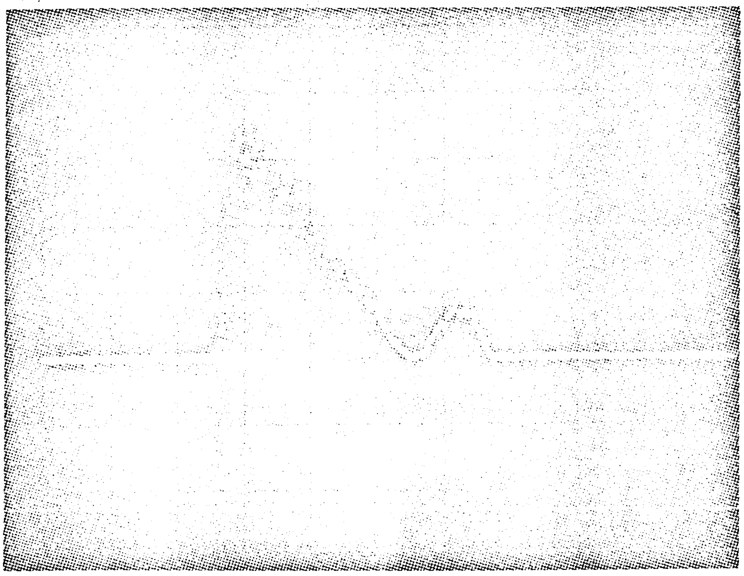


Fig. 2

6.5.74 18A

C.O.

Longitudinal R1

R1

R2

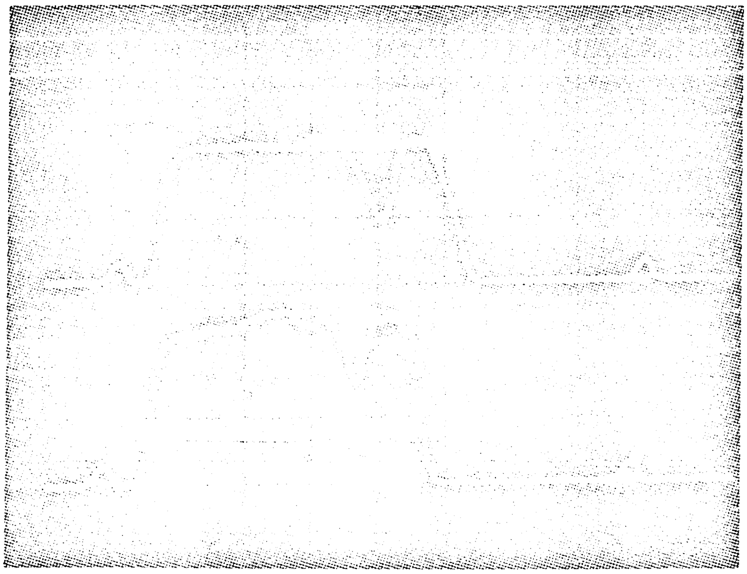
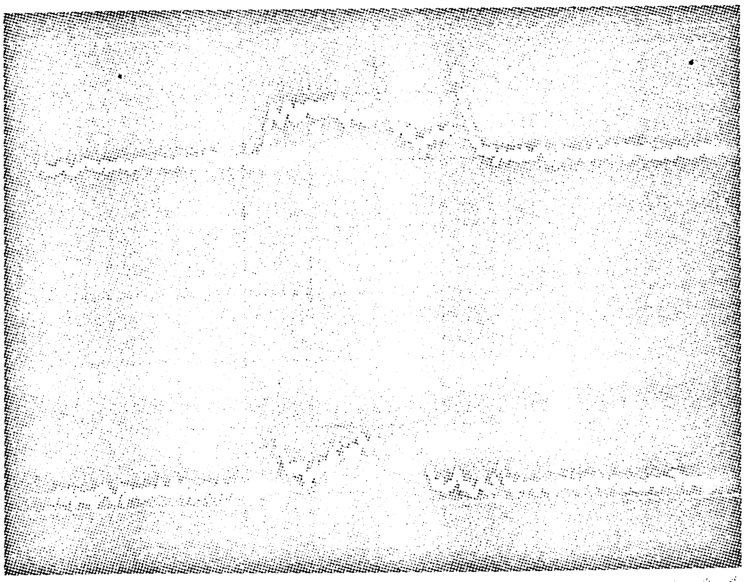


Fig. 3

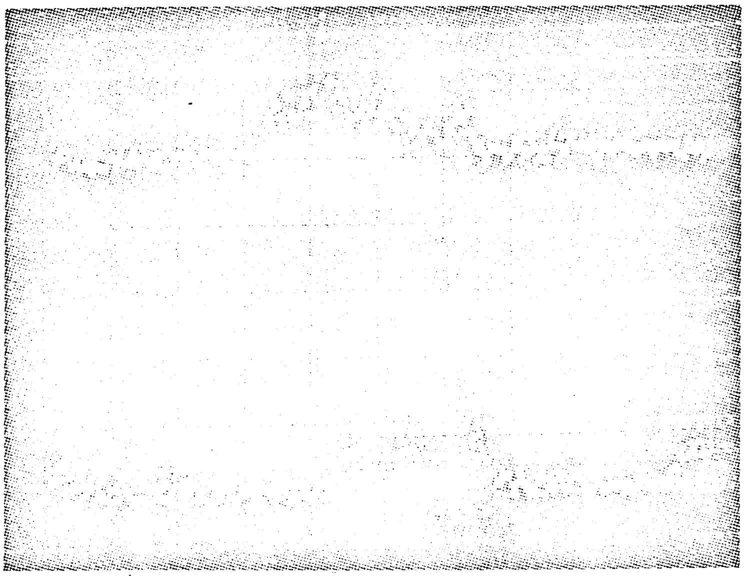
6.5.74 18A



10 K/D Δf ≥ 70 K R R1

Fig. 4

Radial R1



10 kHz/div Δf ... 10 kHz ≥ 70 - 10 kHz

Fig. 5