EXPERIMENT : The Evolution of a freshly RF-deposited precooled $\bar{p}$ Bunch under the Influence of Stack Tail Δp Cooling.

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Experiment:

By using a pulse generator to turn on the S.T. Δp system for short time intervals one can observe the evolution of the stack tail with a spectrum analyzer using the resonant Schottky pick-up. Georges Carron has attached a gate which forces the S.T. system on. To keep it from working according to normal timing signals, one can leave the precooling shutters open.

The pictures of the process of S.T. cooling on the following pages were taken during the last hours of an accumulation run for the ISR. The M.F. $\sim$ 6, $\bar{p}$/h $\sim$ 2.5, 3/5 PS cycles. The steady state of the tail is shown as the light trace of photo 1. After a few minutes the tail evolved to that shown as the bright trace on photo 1 after the $\bar{p}$ request was removed. The S.T. Δp and HF Δp systems were switched off and one pulse of $\bar{p}$'s was requested. Thus between 2.5 and 3.0 x 10^6 $\frac{V}{\bar{p}'s}$ were precooled, adiabatically RF captured, moved, and deposited according to the attached RF program. The deposited beam can be seen in photo 2. The deposit frequency 1852.67 kHz is the centre of the photo. The span corresponds to 256 Hz/cm.

Here one can see that the density of the deposited beam is rather well matched to the density of the steady-state tail. This theoretically anticipated condition seems to have been achieved by the empirical optimization of the RF parameters based on the accumulation rate.

At this point in the experiment the precooling shutters were opened, disabling the S.T. Δp cooling, and the manual S.T. Δp switch was turned on. Then the S.T. Δp was controlled by a pulse generator using Georges' gate. The following photos, 3 through 9, then show how the pulse of $\bar{p}$'s moves under the influence of the S.T. Δp cooling. The total elapsed cooling time is shown in the upper left of each photo. The light trace is the t = 0 distribution.

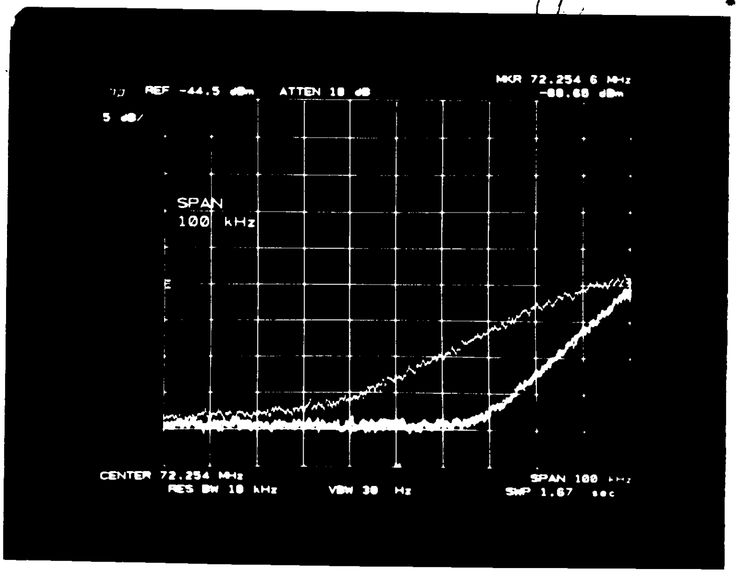
One might conclude that the cooling is too slow, taking > 5 seconds to clear the beam to be ready for the next pulse of $\bar{p}$'s. There seemed also to be no evidence of instability of the high frequency side of the injected pulse at these intensities and cooling levels.

Photos 10 through 14 show the same experiment repeated for different values of the S1 delay. The light trace is the initial distribution and the bright trace is the same beam after 1600 ms of S.T. Δp cooling. Photo 5 is the same picture for the initial conditions of S1 at 0.2 ns, 5 dB, S2 at 0.6 ns, 6 dB. S1 = 0.1 ns seems marginally better.

Photo 15 shows a freshly deposited bunch of $\bar{p}$'s on the tail in its steady state condition but only 2/6 PS cycle per supercycle. The two traces correspond to immediately before and immediately after a fresh bunch has been deposited.

Reported by Rol Johnson

(1) 1.

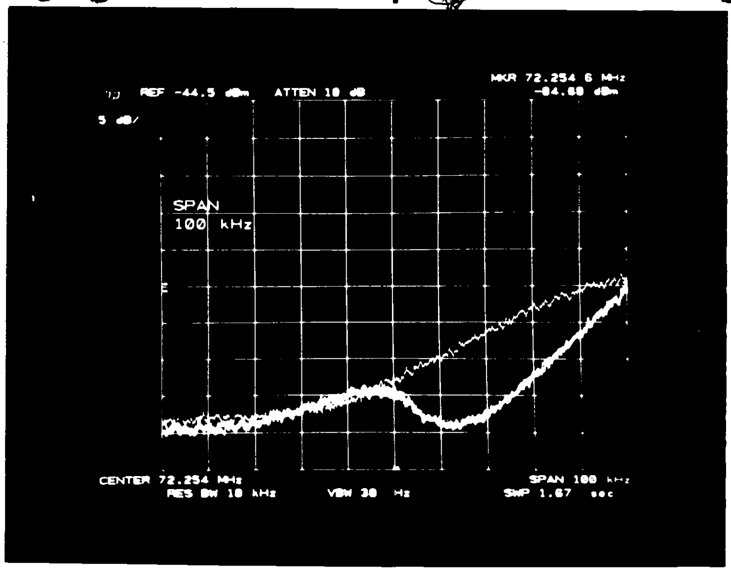


All cooling on.

LIGHT ~ Steady State

BRIGHT ~ After a few minutes

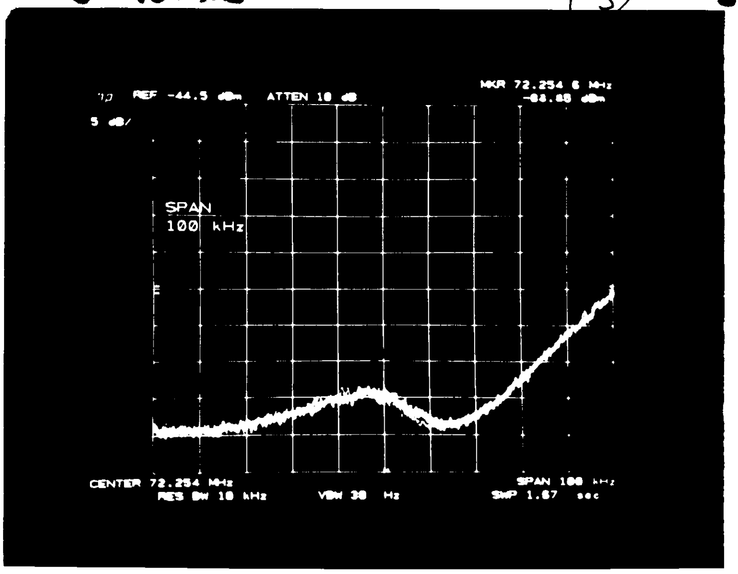
t=0 (2) 2.



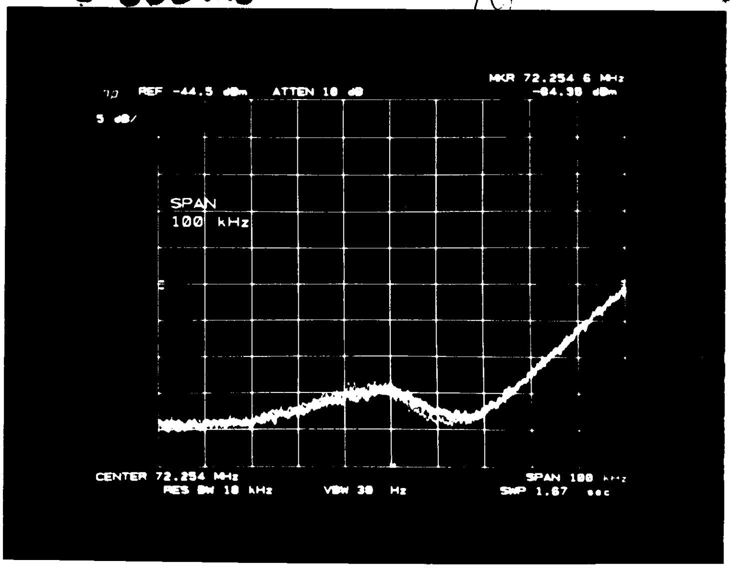
COOLING OFF

BRIGHT ~ After 2.5 to 3.0×10^6 $\bar{p}$ are deposited (becomes the LIGHT trace on the next 7 pictures)

t= 400 ms (3) 3.

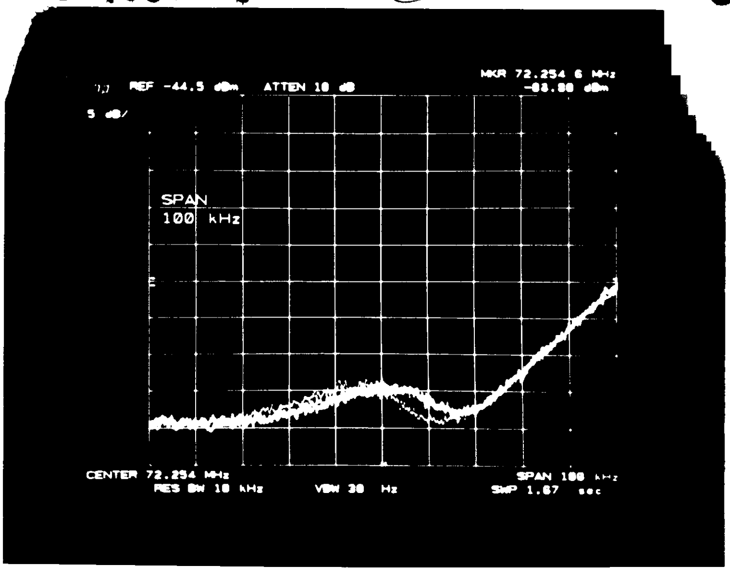


Bright ~ after 400 ms of S.T. Δp cooling t=800ms ④ 4.



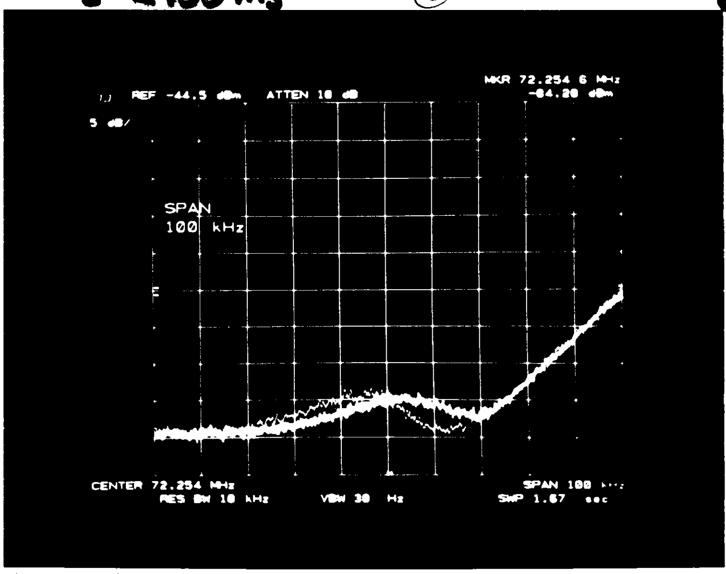
After 800 ms

t=1600 ms ⑤ 5.



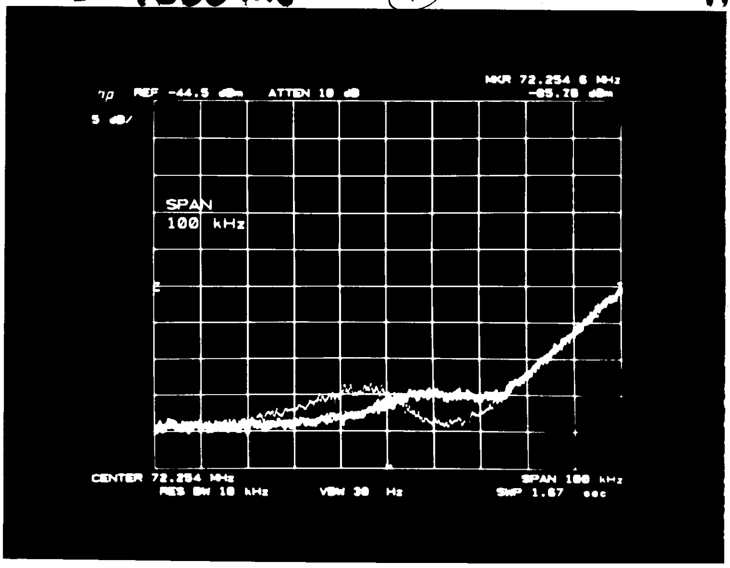
1600 ms

t=2400 ms ⑥ 6.



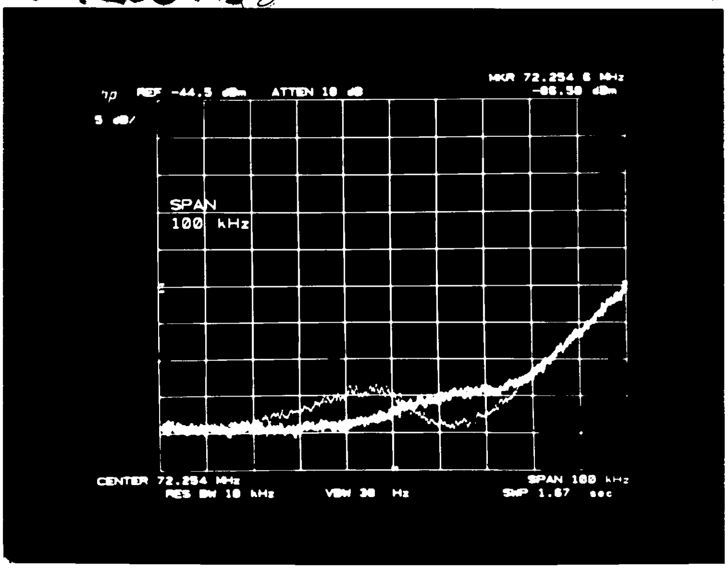
2400 ms

t=4800 ms (7) 7.



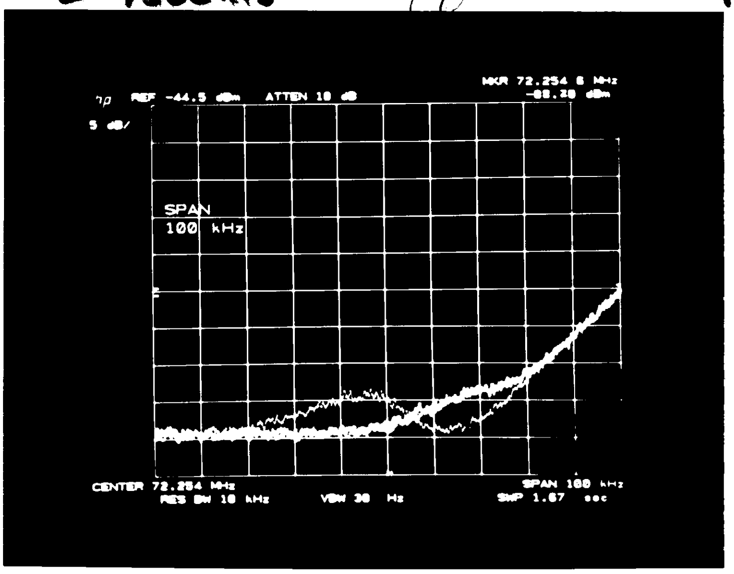
4800 ms

t=7200 ms (8) 8.



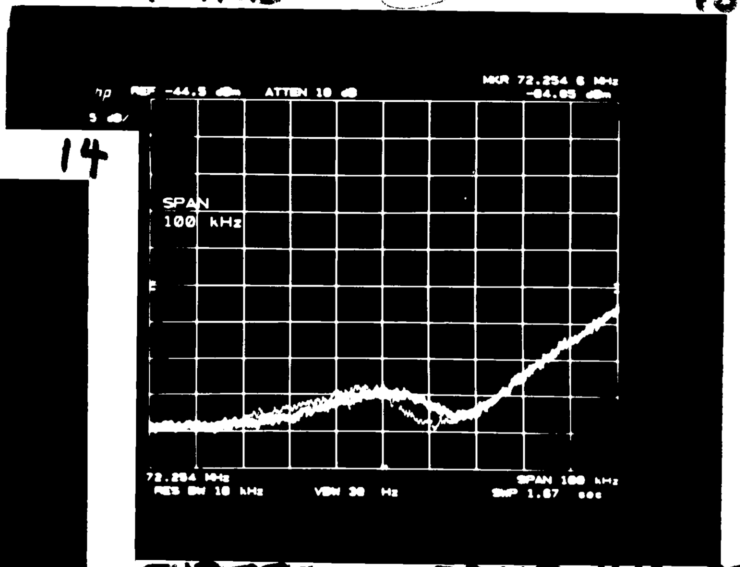
7200 ms

t=9600 ms (9) 9.



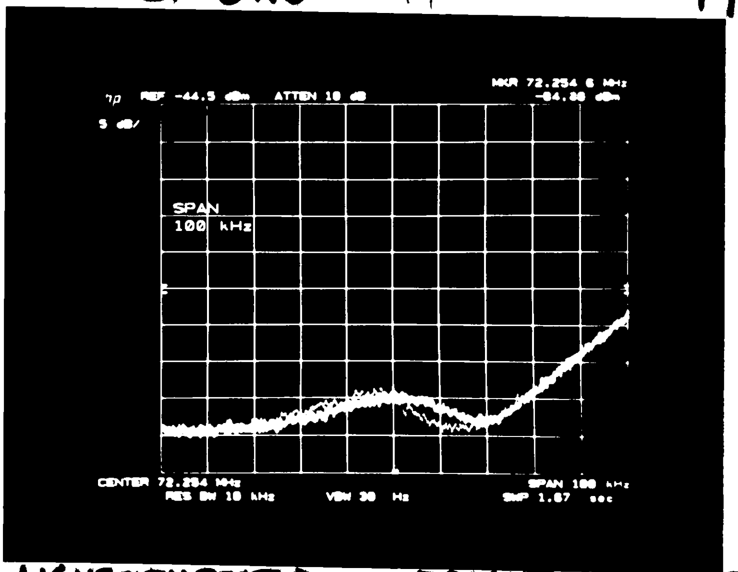
9600 ms

SI=.1ns (13) 13



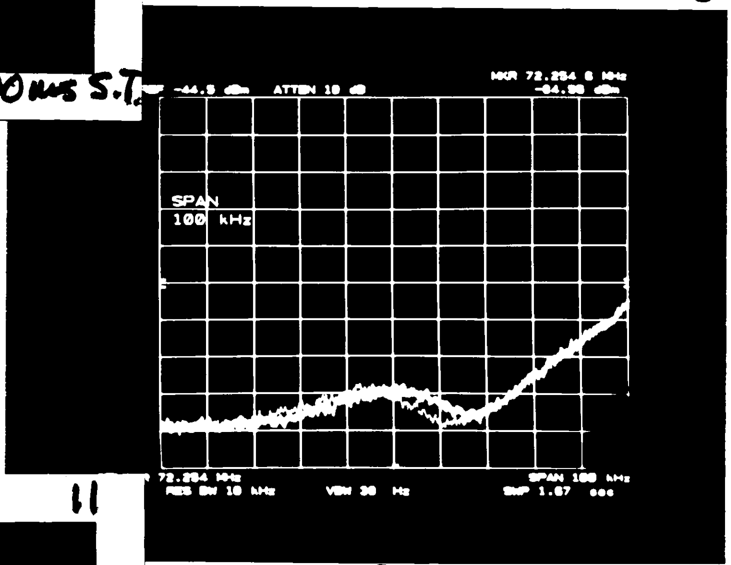
INJECTED BRIGHT≈1600ms S.T.

SI=Ons 14 14



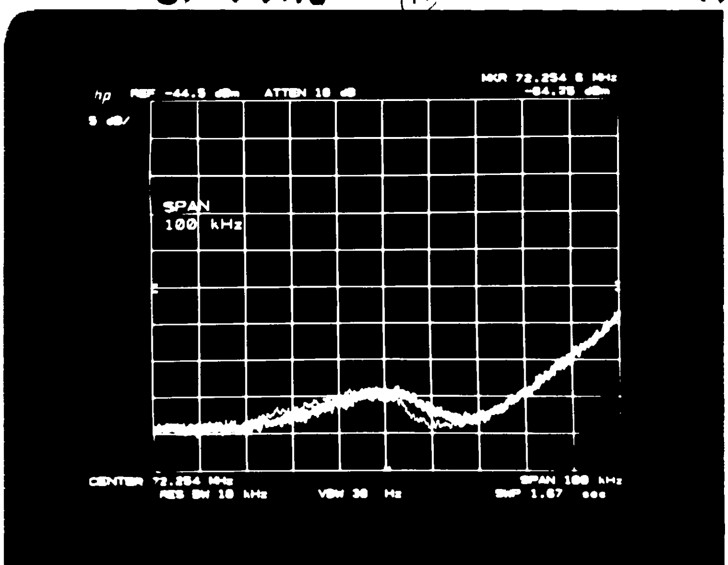
LIGHT≈INJECTED BRIGHT≈1600ms S.T.

SI=.3ns 10 10



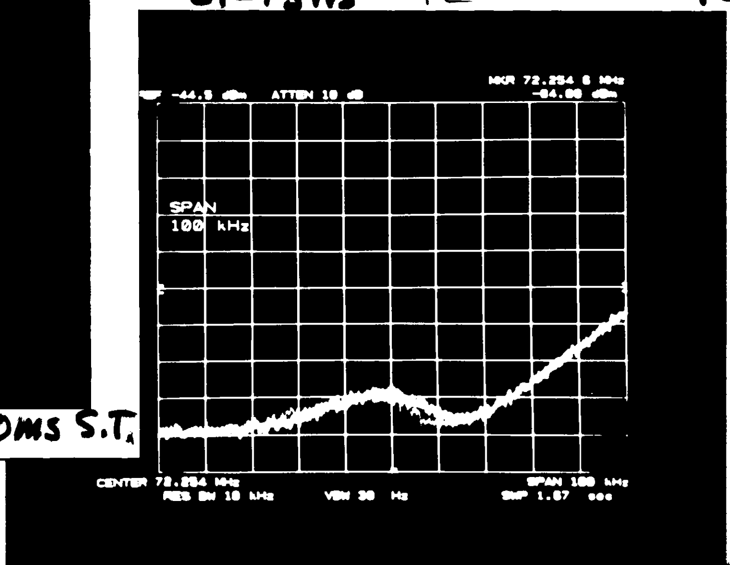
INJECTED BRIGHT≈1600ms S.T

SI=.4ns (11) 11



LIGHT≈INJECTED BRIGHT≈1600ms S.T.

SI=.5ns 12 12



LIGHT≈INJECTED BRIGHT≈1600ms S.T.

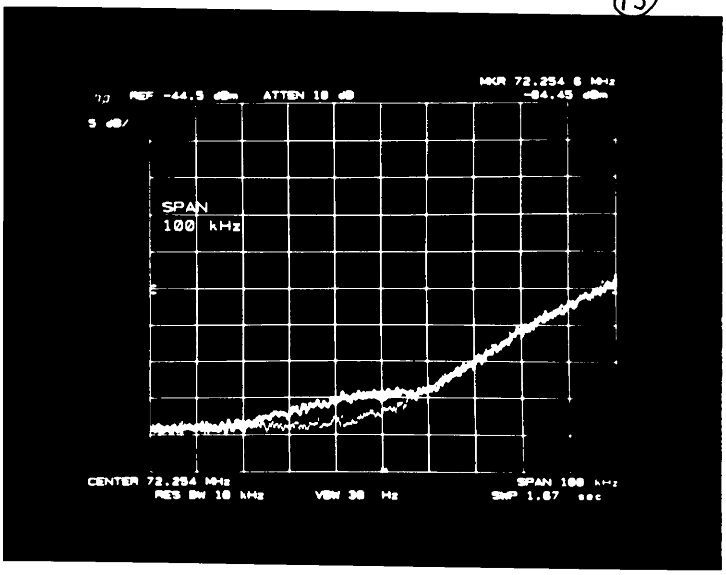


Fig 15. Immediately before and after the precooled bunch of $\bar{p}$'s is deposited on a tail ~~of~~ made with 2/6 PS cycles/supercycle.