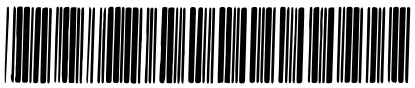


ISR-VA/EJ/mh

23rd March, 1972

ISR PERFORMANCE REPORT

Run 146; 26 GeV/c; 20b; Ring I ; 26 FB
and Run 151; 22 GeV/c; 20b; Ring II; 22 FB

Pressure Bumps and Lifetimes - Comparison between Rings I and II

11.1 Amps was stacked in Ring I and 9,0 Amps in Ring II.

Conclusion on Pressure Bumps

Pressure bumps $\geq 10^{-9}$ torr were observed in sectors 11, 21, 50, 71 and 81 of Ring I and 22, 30, 32 and 42 of Ring II.

The situation in Ring I is given in Fig. 1 at 10.985A after stacking had stopped at 11.1 Amps - pressure bump in sector 50 had persuaded the CE's to drop out in A5. The stack was made with suppressed buckets (see S. Hansen for RF details) and the RF scans are shown in Fig. 2 . The stack was stopped on the way up at 9A for a scan - it is seen that there is room for about another 9A before hitting the scraper. The scan marked 9.13A was taken after stacking to 11.1 Amps and suffering 2 Amps of beam loss due to CE's dropping out in A5.

The situation in Ring II is given in Fig. 3 at 8.973A after stacking had stopped at 9.0 Amps. Beam was decaying at greater than 10^{-2} A/sec at which $dI/_{dt}$ the beam dump was set to trigger - it did. The $dI/_{dt}$ for the beam dump was set at 2×10^{-2} A/sec for subsequent stacks. No scan was made at 9 Amps because the beam dump trigger was too quick for us. The next stack of 8.5 Amps, not quite reaching 9 Amps this time because of rapid beam decay, was scanned however and is shown in Fig. 4. All parameters in Ring II were kept as closely as possible the same as were used in Ring I - (the changes were mostly due to difference in momentum). Again one notes enough room for at least 6 more amps - the upper limit to Ring II should be therefore about 15A at 22 GeV/c.

Both Rings used the FB working lines and stacking was carried out between CL + 48mm and CL - 18mm in Ring I and between CL + 44mm and CL - 10mm in Ring II. The outside aperture limitation in Ring I was presumably CL + 49mm (the holes in the vacuum chamber in I6 were made just about half an hour after stacking to 11.1 Amps). The outside aperture limitation in Ring II was measured to be CL + 53mm.

The r.m.s. and pktopk horizontally and vertically of the closed orbit at injection was 1.3, 6.5mm (H) and 1.2, 5.6mm (V) respectively in Ring I. The same parameters in Ring II were 1.1, 5.1 (H) and 1.1, 3.9 (V).

Also shown in Fig. 4 is a twin stack which was made in order to see whether the different shape of potential well gave differences in the pressure bump situation. The average pressure at the start of the twin stack was 2.85×10^{-10} and at the start of the normal stack a little lower at 2.4×10^{-10} torr. The pressure bumps were indeed on the average fewer and lower with the twin stack - see Fig. 5 and 6 but this effect may have been due to "vacuum cleaning" which is knew to occur sometimes but only rarely !

It is usual now to roll out the "excuses" for these pressure bumps. One can find the usual ones - like leaks (S50) ageing and inadequate baking because of complicated systems for the rest of the sectors. The one greatly disturbing feature of these results is that sector 22 exhibited a pressure bump. This region was recently equiped with sublimation pumping which was supposed to eliminate the pressure bumps. However the region in Sector 22* SS236 near the VG 240 actually contains no pumping whatsoever, not even a Vac-ion sputter pump. There appears to have been no suitable place to put one because the vacuum chambers in this region were redistributed in such a manner as to increase the pumping speed near the Septum magnet at the expense of eliminating altogether the pumping at SS236.

* See Fig. 8 : Pressure have been rising in this region recently anyway in spite of SU's. Do we have a leak !

LIFETIME

	RING I					RING II			
ck	τ ppm/min	p_{NS} Torr	I Amps + (No. of pulses)	Suppressed Buckets	Stack No.	τ ppm/min	p_{NS} Torr	I Amps + (No. of pulses)	Sup-pres-sed Buckets
	60	1.0×10^{-10}	3.04 (58)	No	1	251 stack in Ring I at the 8A time giving 6×10^{-9} torr in I5	9.2×10^{-11}	3,18	No
	380	1.1×10^{-10}	5.00 (97)	No					
	18	1.1×10^{-10}	7.03 (138)	No	2	33 (No current in Ring I)	9.7×10^{-11}	5.02 (69)	No
	44	1.2×10^{-10}	9.01 (178)	No	3	23 (No current in Ring I)	1.1×10^{-10}	6.97 (111)	No
	3800	2.1×10^{-10}	9.13* (228)	Yes	4	Rapid loss, beam dumped.	6.4×10^{-9}	8.97 (212)	Yes

* This lifetime corresponds to that after 2 Amps of beam loss from 11.1 Amps due to CE's dropping out in A5 (Pressure bump was maximum in I5).

Microwaves

The e were observed in the 1.3 to 1.6 GHz range in Ring II during the stacking described above.

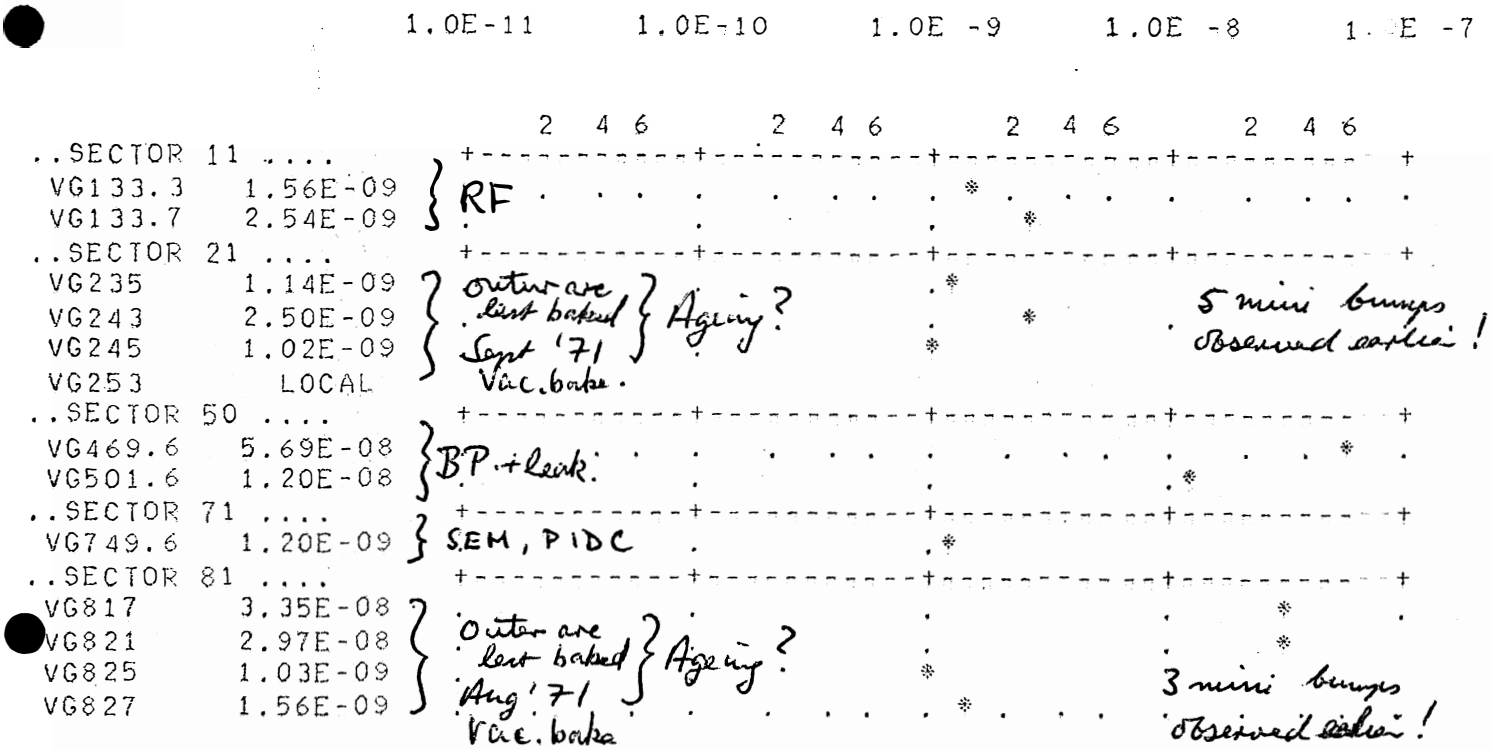
A typical photograph is given in Fig. 7. These results will be commented upon more fully later. The signals do not appear to depend upon total current stacked.

E. Jones

K. Hübner

PLVG(R1,1.0E+3)

--- PRESSURE PLOT OF ULTRA-HIGH VACUUM GAUGES ---
-- IN TORR --

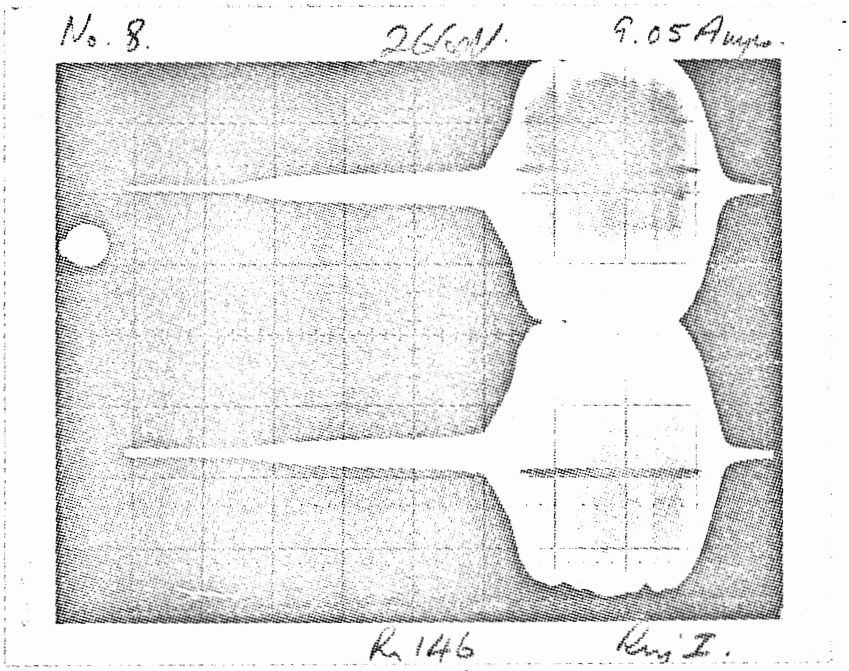


--- BEAM CURRENT: I = 10.985 A ---
--- MAGN. FIELD : M = 0.000 GEV/C ---

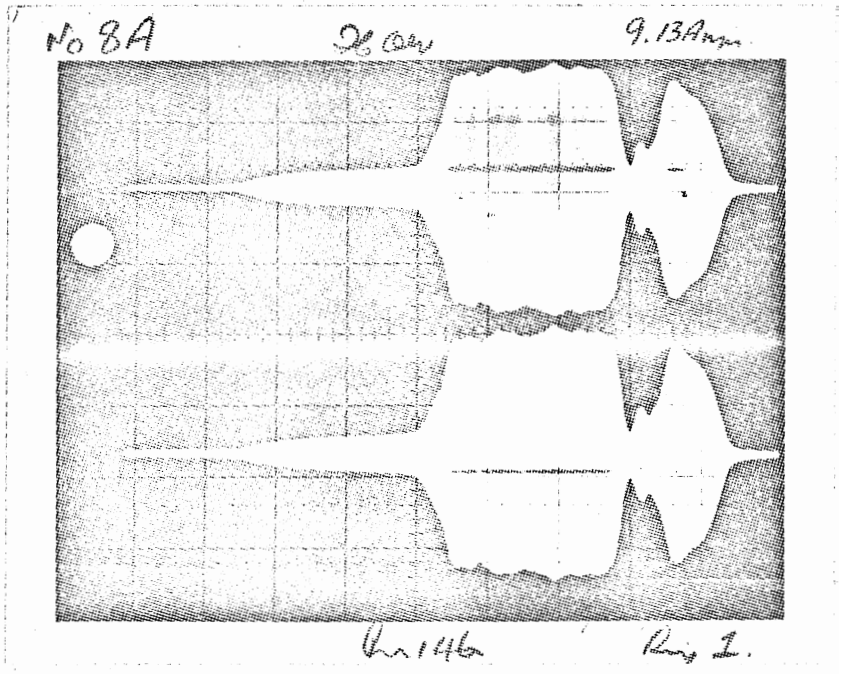
TIME: 17H 18M 32S DATE: 1972-03-15

Fig 1.

Fig 1. R1 P- bumps after stacking to 11.1 Amps.



RF scan at 9.05A



RF scan at 9.13A after 2 Amps beam loss.

Fig 2. R.F. Scans in RI.

PLVG(R2,1.0E+3))

--- PRESSURE PLOT OF ULTRA-HIGH VACUUM GAUGES ---
-- IN TORR --

1.0E-11 1.0E-10 1.0E -9 1.0E -8 . 1.0E -7

2 4 6 2 4 6 2 4 6 2 4 6

..SECTOR 22 ....

VG232.1 2.12E-09 } SMI but has SU's.
VG232.5 2.88E-09 }
VG232.6 3.74E-08 }
VG240 5.32E-08 Has no pump at all !!!!
SS 236
VG248.1 1.82E-09

..SECTOR 30 ....

VG300.5 7.89E-09 } Beam dump region.
VG306 2.19E-08 } Last baked ~~Dec'71~~ Feb'72. N_2+Vac bake.
VG312 2.29E-09 } Mini-bumps observed earlier

..SECTOR 32 ....

VG316 3.62E-09 } Sector Valve baked and
VG318 2.57E-09 } polluted system !

..SECTOR 42 ....

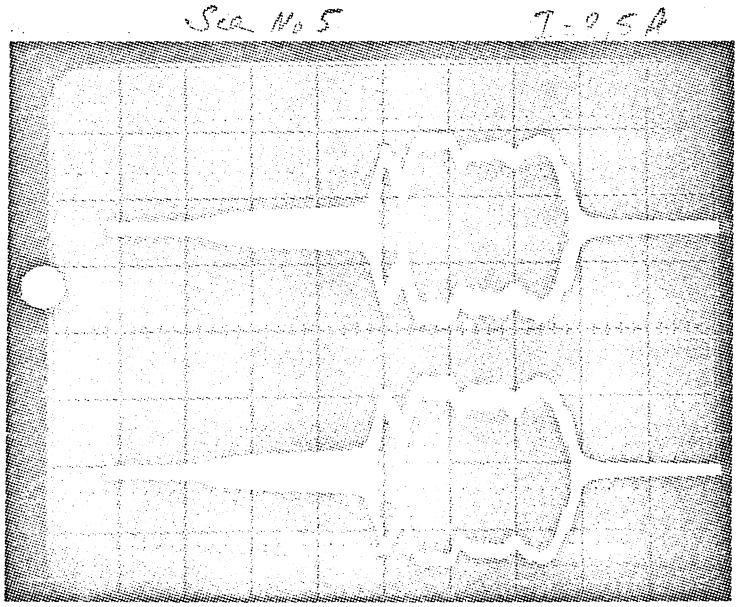
VG432.1 1.36E-08 } Was CG's in for. but
VG440 3.59E-09 } recently baked March'72 ! Vac. bake.

--- BEAM CURRENT: I = 8.973 A ---
--- MAGN. FIELD : M = 22.456 GEV/C ---

TIME: 16H 22M 51S DATE: 1972-03-22

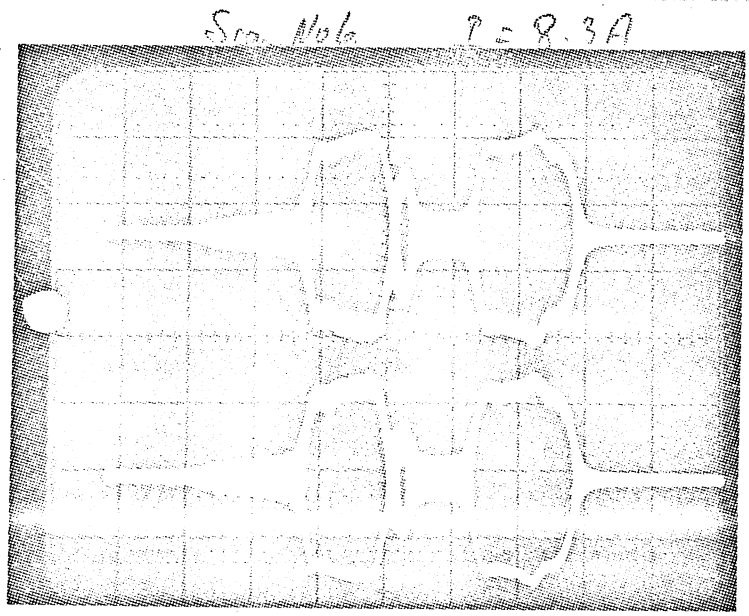
Fig 3.

Fig 3. R2, P - bumps after stacking to 9.0 Amps.



(a)

RF scan at 8.5A



(b)

RF scan at 8.3A

Fig 4. R2 RF Scans of (a) Nomad (b) Twin stack.

PLVG(R2,1.0E+3))

--- PRESSURE PLOT OF ULTRA-HIGH VACUUM GAUGES ---
-- IN TORR --

```
                    1.0E-11      1.0E-10      1.0E-9       1.0E-8       1.0E-7
                       2 4 6        2 4 6        2 4 6        2 4 6
..SECTOR 22 ....   +------------+------------+------------+------------+
 VG232.1   1.62E-09 .  .  .  .  .  .  .  .  .  *  .  .  .  .  .  .  .  .
 VG232.5   2.20E-09 .           .           .  *
 VG232.6   2.45E-08 .           .           .           .     *
 VG240     3.87E-08 .           .           .           .        *     .
 VG248.1   1.50E-09 .           .           .  *
..SECTOR 30 ....   +------------+------------+------------+------------+
 VG300.5   8.10E-08 .           .           .           .              *
 VG306     2.73E-07 .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  *
 VG312     3.14E-09 .           .           .     *
..SECTOR 32 ....   +------------+------------+------------+------------+
 VG316     2.88E-09 .           .           .     *
 VG318     1.65E-09 .           .           .  *        .              .
..SECTOR 42 ....   +------------+------------+------------+------------+
 VG432.1   5.43E-09 .           .           .        *
 VG440     1.74E-09 .           .  .        .  *
```

Normal Stack.

Fig 5. Normal Stack

--- BEAM CURRENT: I = 8.289 A ---
--- MAGN. FIELD : M = 22.456 GEV/C ---

TIME: 16H 46M 15S DATE: 1972-03-22

PLVG(R2,1.0E+3))

--- PRESSURE PLOT OF ULTRA-HIGH VACUUM GAUGES ---
-- IN TORR --

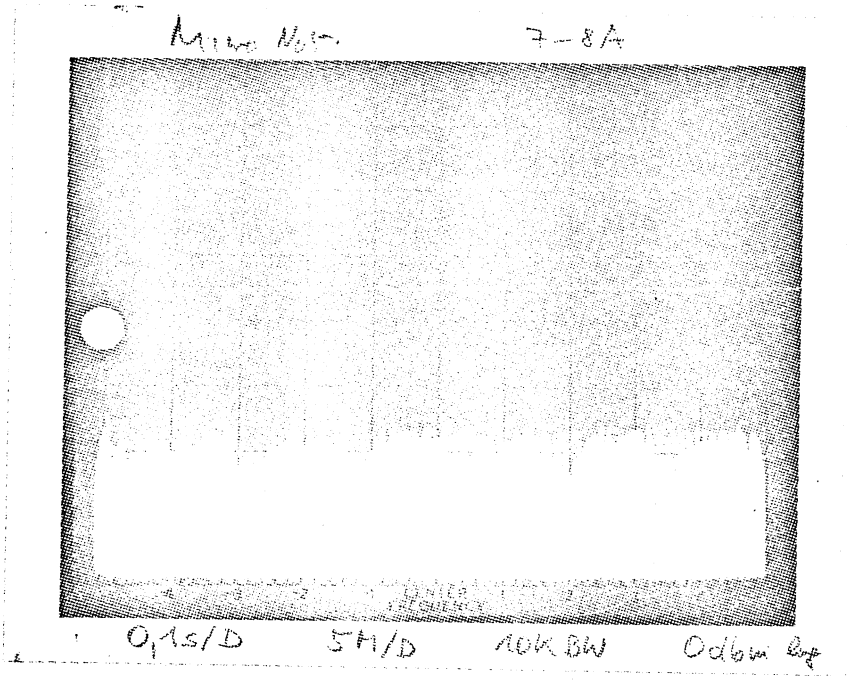
```
                    1.0E-11      1.0E-10      1.0E-9       1.0E-8       1.0E-7
                       2 4 6        2 4 6        2 4 6        2 4 6
..SECTOR 22 ....   +------------+------------+------------+------------+
 VG232.6   6.68E-09 .  .  .  .  .  .  .  .  .  .  .  .  *  .  .  .  .  .
 VG240     1.10E-08 .           .           .              *
..SECTOR 30 ....   +------------+------------+------------+------------+
 VG300.5   8.74E-08 .           .           .           .              *
 VG306     2.95E-07 .           .           .           .              *
 VG312     3.26E-09 .           .           .     *
..SECTOR 32 ....   +------------+------------+------------+------------+
 VG316     2.67E-09 .           .           .     *
 VG318     1.53E-09 .  .  .  .  .  .  .  .  .  *  .  .  .  .  .  .  .  .
..SECTOR 42 ....   +------------+------------+------------+------------+
 VG432.1   1.09E-09 .           .           *
```

Twin Stack

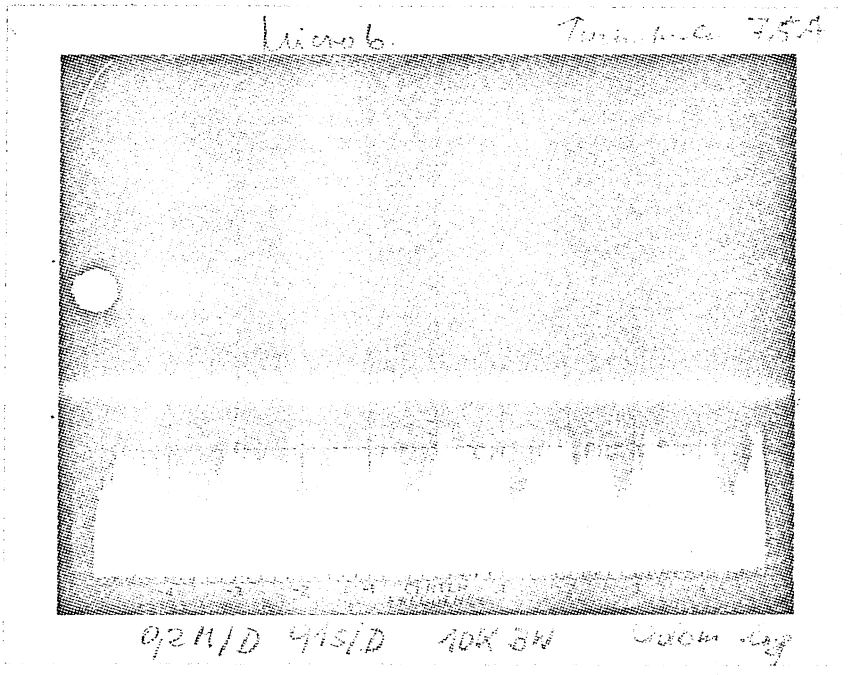
--- BEAM CURRENT: I = 8.296 A ---
--- MAGN. FIELD : M = 22.456 GEV/C ---

TIME: 17H 7M 4S DATE: 1972-03-22

Fig 6 Twin Stack.

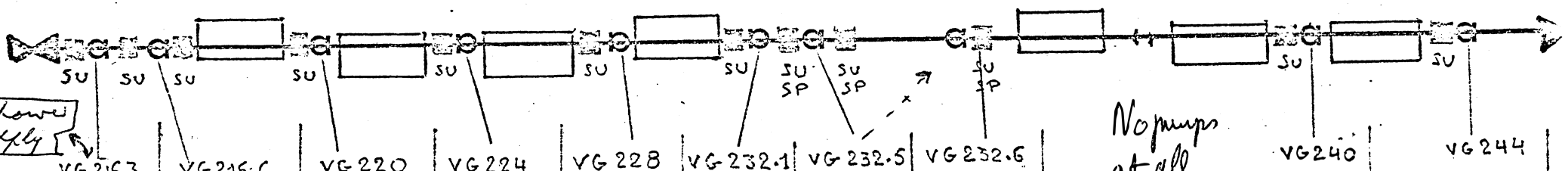


Microwave signals at 7 to 8 A - Normal stack.



Microwave signals at 7-8A - twin stack.

Fig 7. Microwave signals in R2.



	VG 216.3	VG 216.6	VG 220	VG 224	VG 228	VG 232.1	VG 232.5	VG 232.6	No pumps at all.	VG 240	VG 244
le 13-03-72		$3,2^{-10}$	not on	$6,5^{-11}$	not on	$3,7^{-11}$	$9,2^{-11}$	$3,2^{-11}$		$9,3^{-11}$	Gauge fault
14-03-72		$2,4^{-10}$		$6,0^{-11}$		$3,7^{-11}$	$8,2^{-11}$	$3,2^{-11}$		$9,3^{-11}$	
16-03-72		$2,3^{-10}$		$8,9^{-11}$?		$3,3^{-11}$	$8,2^{-11}$	$3,15^{-11}$		$8,9^{-11}$	
17-03-72		$2,3^{-10}$		$8,9^{-11}$		$3,3^{-11}$	$8,2^{-11}$	$3,15^{-11}$		$8,9^{-11}$	
17-03-72		Acclimations — Bump: $9,0^{-9}$		← $2,0^{-10}$				→		Bump $4,0^{-9}$	
20-03-72		$4,0^{-11}$		$8,65^{-11}$		$2,4^{-11}$	$1,0^{-10}$	$1,3^{-11}$		$8,1^{-11}$	
22-03-72 (1700)		$4,2^{-11}$		$8,7^{-11}$		$1,2^{-10}$	$2,1^{-10}$	$4,0^{-10}$		$1,2^{-8}$	← faisceau
23-03-72 (930)		$4,8^{-11}$		$1,0^{-10}$		$6,1^{-11}$	$1,1^{-10}$	$6,2^{-11}$		$1,8^{-10}$	

24

$5,3 \times 10^{-8}$ $1,8 \times$

↑ BT. Section

2×10^{-9} $2,9 \times 10^{-9}$ $3,7 \times 10^{-8}$

Le : 23-03-72.

~~Pressions lues~~

Pressions corrigées

MAGNETS :

Fig 8 //