PS/BT/Note 83-3
31.3.1983

Notes from the meeting held on the 23 March concerning the problems of septum magnet blockages in the PS and SPS

General

This problem is seen to occur with slow pulsed and dc septa. The slow pulse characteristics are approximately 200 msec rise and fall of current with up to 2 sec flat top, the nominal flat top current being of the order of 20 KAmps. The dc septa concerned operate with currents up to 4 KAmps. The magnets which have had this blockage problem are:

PS Div.	AA	INJECTION/EJECTION SEPTA
	PS	INJECTION SM42 SEPTUM
	Booster	BT1 SMV10, BT4 SMV10 SEPTA
SPS Div.		18 MAGNETS, EXTRACTION WEST AND NORTH

The blocking of the cooling ducts in these magnets first manifests itself as a gradual increase of the magnet temperature, due to the reduction of water flow. Once the blocking process has started, it doesn't stop unless there is a change in the water quality or the magnet is unblocked by passing a weak acid solution through it.

PS experience

The septum magnets which have blocked have up to 64 1/min of demineralised cooling water passing through them, with speeds of between 6-10 m/s. The maximum copper temperature (AA) is of the order of 70°C and the water delta temperature = 23°C. It has been noticed recently (AA) that when a magnet temperature rises and the water flow is reduced, the water conductivity has risen. During normal operation when temperatures are stable, the conductivity value is of the order of 0,1 to 0,2 µSiemens. When the conductivity has been at levels between 0,7 to 1,0 µSiemens for a few days, the blocking process starts and the water flow reduces. These observations are shown on the two graphs for SM1 and SM2. This blocking has been seen to take place under conditions of high and low radiation, the last AA blockage taking about 1 week to reduce the flow by about 15%. (Some reversibility is also evident.) This was at the start of the present period when there were only infrequent injections of protons via the loop, with very little radiation present to accelerate the blocking process. The conductivity measurements are made at the water plant and not at the magnet positions in the ring. This fact might explain the observed delay between conductivity variation and increase of magnet temperature.

SPS experience

The two groups of 9 magnets used for the West and North extraction of beams each have their own demineralised water plant. The magnet water speeds are between 10 and 12 m/sec with the maximum copper temperature = 40°C. Normally, the input water temperature is 17°C producing a water temperature at the output of a magnet of about 35°C. The water hole diameters used are 2.8mm (compared to 2.3mm in the AA). The working range of water conductivity used is between 0.05 to 0.1 µSiemens. When the first magnet blockages were seen they used a similar acid treatment to that used recently in the PS. However, they also found that if the unblocking was frequently done on a magnet with the acid the blocking up of the magnet also became more frequent.

Without the acid treatment, the rate of blocking of SPS magnets in general seems to be slower than those in the PS, 3 to 6 months to lose 20% - 30% of water flow. Could this be because of the tighter control of water quality - in particular the conductivity? If the demineraliser is stopped, it has been noted that the concentration of copper in the water increases quite rapidly, which increases its conductivity. Since early in 1979, no unblocking of magnets has been done using the acid method. This new turn of events is due to the draining of magnets when the partial blockage becomes unacceptable (say 30% flow reduction) and replacing the "old" water with "new". This technique alone produces an automatic unblocking of the magnets. As said before, the blocking takes between 3 to 6 months and after the water change the unblocking is said to take about 3 days. The conductivity of the "new" and "old" demineralised water is not sensibly different (the new is often worse than the old on the µSiemens scale) so that conductivity alone is not the reason for unblocking partially blocked magnets.

Conclusion

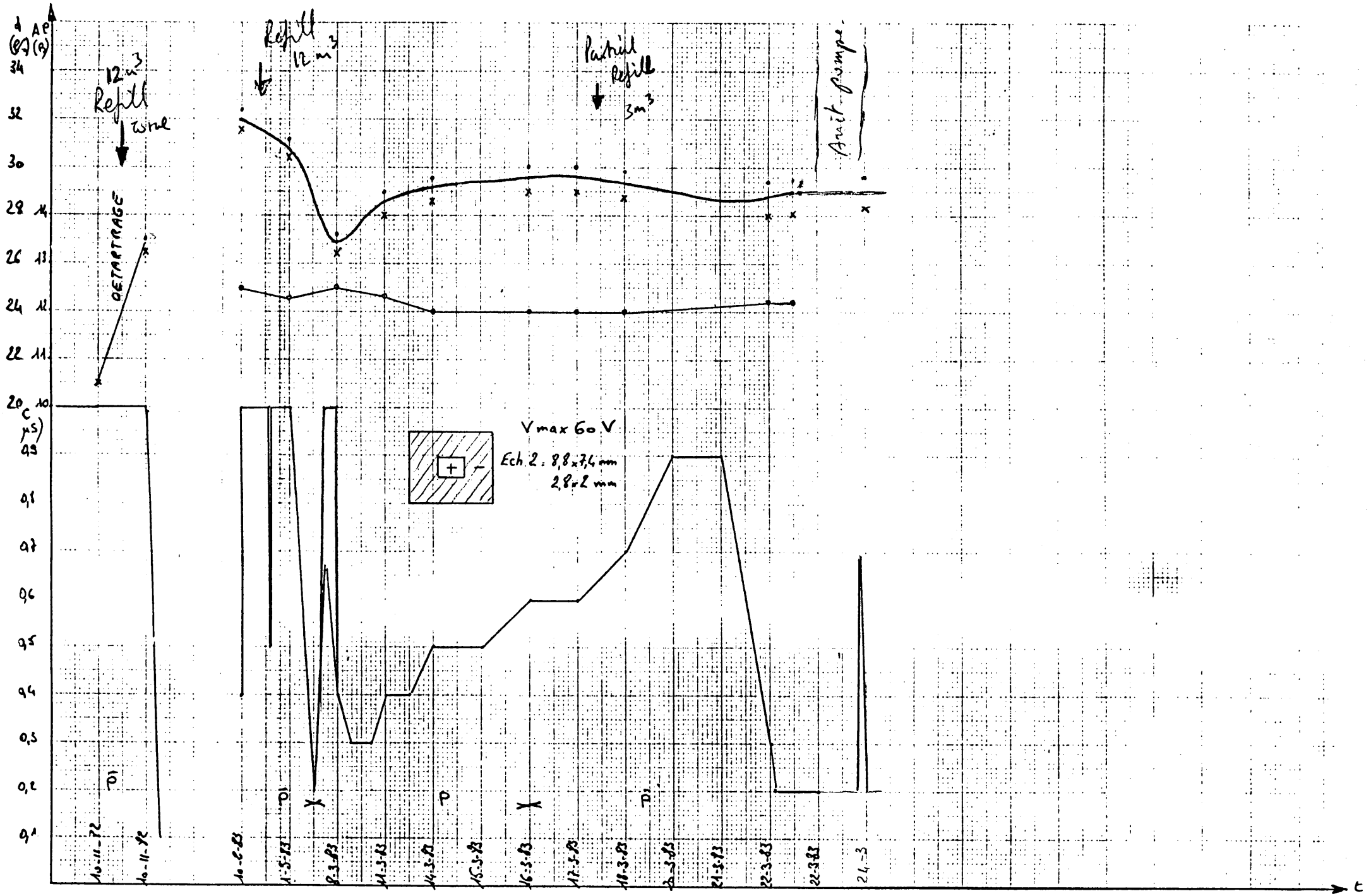
It appeared to all that there is a change in the SPS water quality or chemical composition during its lifetime in the cooling system. Monitoring of the conductivity at the SPS is no guide to the onset and continuation of blockage and to date no quality difference has been detected between their "old" (blocking) and "new" (unblocking) water. In the PS recent observations suggest that blockage is influenced by conductivity (at least in the range 0,1 - 1,0 µSiemens) - however, further accumulated evidence would be needed to confirm this conclusion. The initial and final pH values of the water are not monitored at present in the SPS. It could be said that the water is slightly acid to begin with, and it is this which unblocks the magnets!

It was agreed with the SPS that at the next water change a sample of the old water plus one of the new would be taken for analysis. Also, during the 3 days unblocking period, regular samples would be taken and analysed as well.

P.D. Pearce

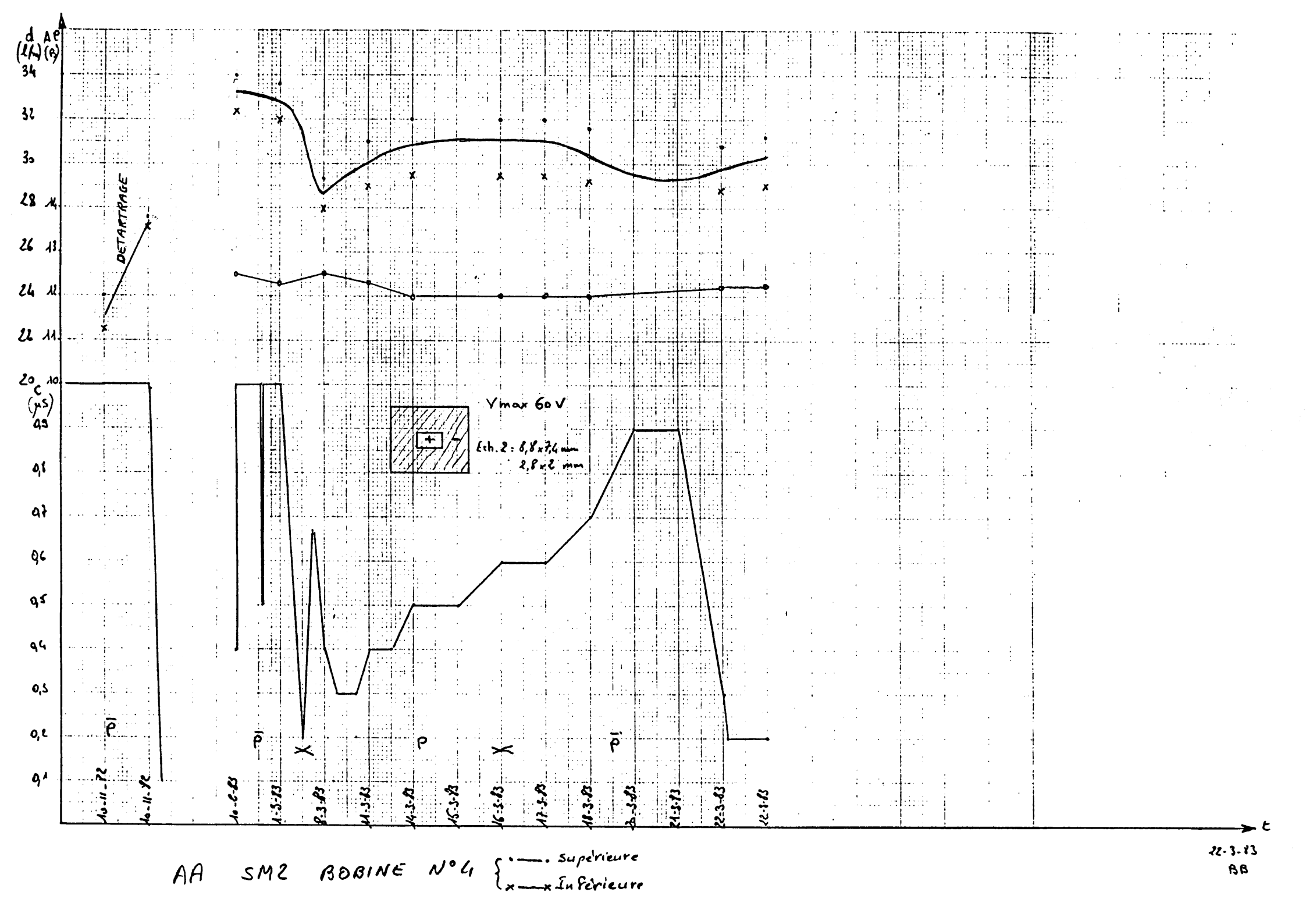
Distribution

G. Berardi - PS
B. Boileau - PS
R. Bonvin - SPS
J. Dupin - SPS
D. Fiander - PS
G. Le Dallic - PS
J.C. Schnüriger - PS
H. Ullrich - PS
R. Valbuena - PS
W. Van Cauter - PS



AA SM1 BOBINE N°6 { ·—· Supérieure ×—× Inférieure

22-3-83
BB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(Ω)
34
32
30
28
26
24
22
20
C (µS)
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DETARTRAGE
Vmax 60 V
Ech. 2 : 8,8 x 7,4 mm
2,8 x 2 mm
P
P1
P
P1
X
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10-11-82
16-11-82
10-2-83
1-3-83
8-3-83
11-3-83
14-3-83
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AA SM2 BOBINE N°4
supérieure
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