AUSTRALIAN NATIONAL UNIVERSITY

DEPARTMENT OF NUCLEAR PHYSICS

14UD TANK OPENING REPORT NO.24

9th January, 1981

(1 day open)

REFERENCES: Earlier Tank Opening Reports are referenced by the notation 12/4 etc, meaning Report No.12, page 4.

REASON FOR THE TANK OPENING

Failure of the terminal foil changer.

PREAMBLE

The 14UD was last closed on November 28th and during the 48 days since then performed well and with excellent stability. By Christmas the machine was almost back to the conditioned level before we had to open the tube to install the new terminal spinnings (21/2). Two weeks before Christmas excessively hot weather began to provoke chiller failures and also cause the electronic controller of the source turbo pump to fail repeatedly. In view of these hazards, and because there was little demand for machine time between Christmas and New Year, it was decided to let the source and its vacuum system up to argon and turn off the magnets and other chiller-dependent devices. The 14UD was secured and left to spend Christmas in its own way, with friends popping in now and then in case it needed anything.

On January 2nd the source and machine were started again and all was well, both with stability and conditioning threshold.

On January 7th an experimental group, accelerating bromine, ran into what appeared to be transmission problems and abandoned their run. Next day a silicon run was in the same trouble, but more attention was paid to terminal foils. The characteristic dip in beam when foils are changed was much smaller and the beam changed very little in intensity. It became clear that something was wrong in the foil changer and we concluded that somehow the magnets, which transmit torque through the wall of the stripper unit, had got out of alignment and were putting two foil holders partly in the beam instead of one foil directly across it. A few attempts were made to make the magnets slip back to correct alignment by increasing the pressure of the actuating gas and attempting to jerk one magnet with respect to the other; this, however, failed and there was no alternative but to open the tank.

THE TANK OPENING

When the doors were opened it turned out to be one of those occasions when the smell inside the tank was unbearable; sometimes it happens and at others it is possible to go in and work straight away. We ventilated the tank for about half an hour and then made the usual examination of everything before taking off the terminal. On the last occasion we found, on the re-entry after the installation of our new oilers, a great deal of oil on the H.E. castings (23/5) and gave an explanation for it. No oil was expected this time because there had been no accidental trapping of tank gas in the oiler vessel. We found a surprisingly extensive film of oil on casting 15, the first below the terminal, and cruised apprehensively down the rest of the H.E. column finding, as we went, decreasing amounts of oil with little or none in the last ten units.

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We removed the upper terminal spinning and set about finding out what was wrong with the stripper. It was actuated several times and the counter moved, as it had been seen to do on T.V.; also the Geneva mechanism, and its magnet, were behaving correctly. We then uncoupled the Geneva mechanism and found that the internal system was much more stiff than usual and could easily have caused the magnets to slip.

It was decided not to close the Weisser valve, which isolates the stripper volume from the accelerator tube, in order to find out exactly what was wrong before moving anything; also we could not risk closing the knife edges of the valve against a foil holder which might be lying on top of the lower half of the stripper tube. Therefore the entire tube had to be let up to atmospheric pressure and this was a considerable blow because of the effect of gas disturbance on conditioning (15/3).

The tube was let up to argon over half an hour through the inflection magnet and the stripper unit was taken out.

One of the Chalk River foil holders, put in last time (23/3), was lying on the floor of the stripper housing and ten more in a neat heap in the well of the strip[illegible]r section on the accelerator axis. None of the ANU holders had been dislodged. (We should point out that nothing can fall into the lower accelerator tube other than through the quarter inch canal which projects an inch or so above the floor of the well.) Later another Chalk River foil holder was found to be dislodged and jamming the foil chain. The Chalk River holders are aluminium rings, 19mm O.D. which are[illegible] meant to be clipped to N.E.C. type foilchangers. Our mechanism is based on the N.E.C. design but is different in some details. We checked that the CRNL foil holders cleared the foil holder mechanism when it was separated from the machine. The clearance between the foil holders and the withdrawn seats of the isolation valve was insufficient, and caused the clash. Thus our assumption that the foil chain was merely out of synchronization with the proper poles of the sextupole magnet was wrong. The external components of the actuator, including the counter and drive sextupole, worked correctly. The jam only allowed the chain to change orientation slightly before snapping back to the position where it was stuck on a broken foil.

Noisy bearings had been heard in the upper shaft and six were considered to b[illegible] worth changing.

We reported (23/3) that chain spark shields had been introduced at all castings with stabilizing idlers in the hope of reducing spark damage to the idler shafts. Casting 25 was opened to check shaft damage. There was no evidence of wear or ot[illegible] damage and we were satisfied that the shields were performing to some extent, though more time is needed for convincing results.

Foils:

All foils on the chain were examined and all remaining Chalk River foil holders removed. Vacant spaces were filled with 38 standard foils and about 100 'baggy' ones. Chalk River had given us some unmounted foils which we tried to float off onto local foil frames. One survived and was put in the machine.

When the stripper assembly was out the Weisser isolation valve was closed and the tube was roughed from the inflection magnet over 30 minutes. After loading the foils the stripper volume was roughed with a vacsorb and then the isolation valve was opened. The tube pumped down very well and it was time to begin to worry about the degree of loss of conditioning.

PUMPING TIME SCALE

DATE	TIME	OPERATION	L.E. VAC	H.E. VAC
9 Jan 81	9.45 to 10.30	Argon at atmospheric		
	12.00 to 12.30	roughing		
	13.54		mid 10^{-6}	mid 10^{-6}
	14.00	open stripper isolation valve	"	"
	15.02		2.1×10^{-6}	8.7×10^{-7}
	16.11	300 litre/sec pump on	7×10^{-7}	5.6×10^{-7}
	18.21		3.4×10^{-7}	3.5×10^{-7}
10 Jan 81	07.00	gas up SF_6	2.4×10^{-7}	1.4×10^{-7}
12 Jan 81	11.50	operating 13.3 Mv with beam	4.4×10^{-8}	8.1×10^{-8}

The 300 litre/sec pump is the one fitted on the L.E. inside the tank (21/4).

Bearings:

The six noisy bearings on the upper shaft were replaced. A couple of others were mildly noisy but not to the degree that spending time on them was justified.

Other matters:

Since the column was quite clean we did not blow with nitrogen as usual but mollified our consciences by carrying out the other sacrament of tacragging with great reverence. After metering checks the usual charging tests were made and performance was good.

Button-up was at 7 pm on the same day the tank was opened. Both authors wish to accord their very grateful thanks to two of the experimental staff, George Dracoulis and John Durell. They stayed on for the last two hours in the heat, and at the expense of part of the Friday conference, to tac-rag, help put things straight, and put in and tighten the 40 massive bolts on the two doors. We are confident that, even if they had not been most anxious to run the next day, Saturday, their inherently nice natures would still have brought them to our rescue, even as ours were devoted to their interests. The experience will be of much consequence to Daresbury when Dr Durell returns there.

Performance:

Next day, Saturday, the tank was gassed up early and by lunchtime data was being taken, at 13.5 MV - with eerie stability - by two cheerful experimenters, invigorated by their healthy exertions of the previous evening.

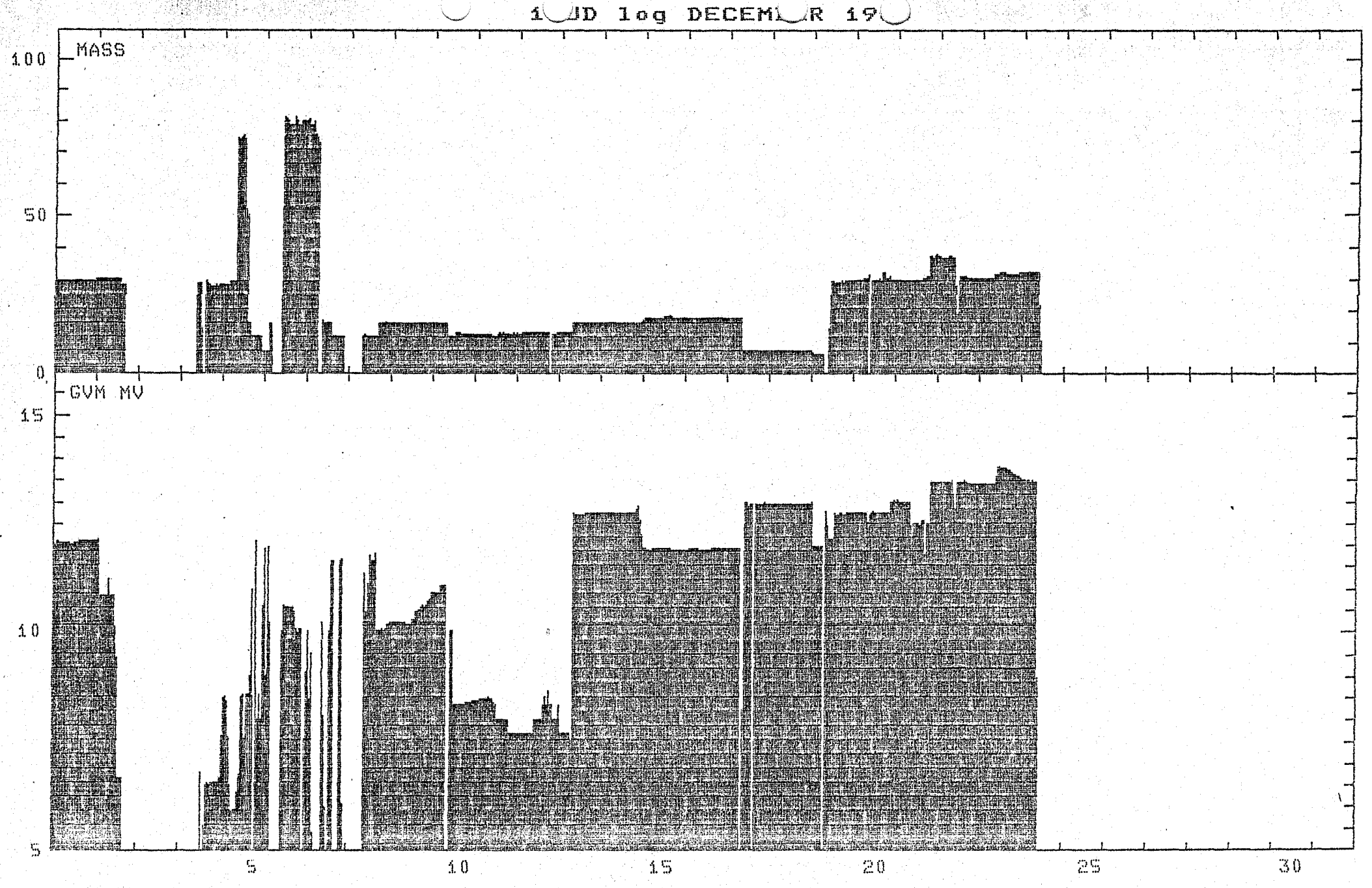
D.C. WEISSER

T.A. BRINKLEY

12th January, 1981.

Addendum:

The machine ran for about 90 hours at 13.3 MV. Then, at the end of the run, it conditioned up to 14.2 MV in 2 hours. We feel that this result well justifies the care taken about turbulence in the tube.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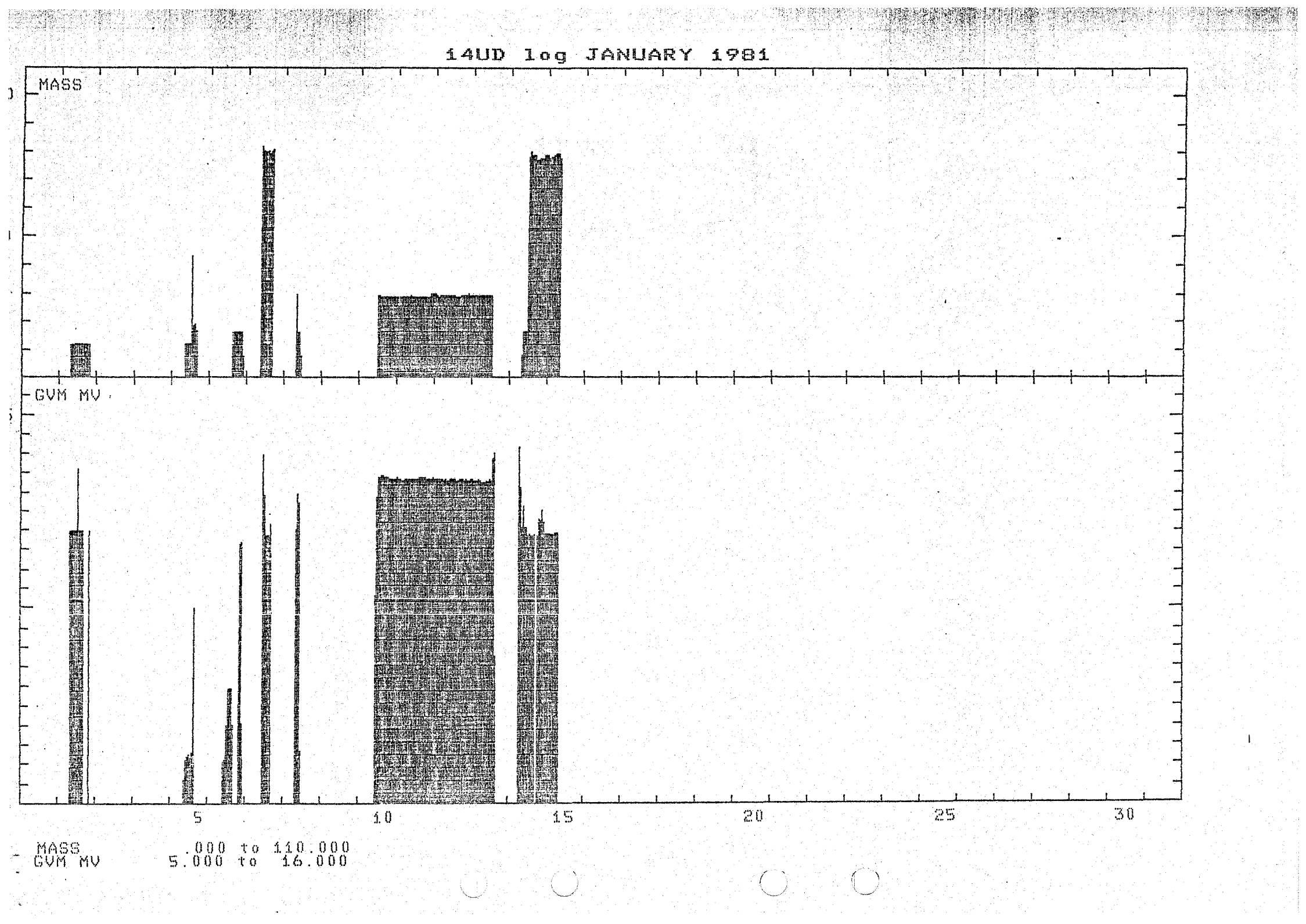
GVM MV 5.000 to 16.000


14UD log JANUARY 1981
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