WIND-TUNNEL STUDY OF WIND PRESSURES ON ROOFING SHINGLES

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1.0 INTRODUCTION

The research reported herein represents a continuation of an earlier study, reference 1, which investigated the wind resistance of roofing shingles. The earlier study for Owens-Corning Fiberglas Corporation (OCF) had three objectives: 1) to review the published literature to determine what work had been performed which would be useful in determining wind resistance of shingles and in identifying failure mechanisms, 2) to develop a testing procedure which would provide an improved differentiation of shingle resistance to wind damage and 3) to recommend research which would provide further understanding of wind failure mechanisms to aid in product development.

The current study continued investigation into the mechanism of wind failure to exploit findings from the first study. In reference 1, a mechanism for shingle uplift was hypothesized. Separated flow over a shingle provided negative (uplift) pressure on the top of a shingle which, when of sufficient magnitude, could overcome the weight of the shingle and start the uplift process. The detailed features of the mechanism and its quantitative evaluation could not be determined from the results of the first study.

The uplift hypothesis of reference 1 left a significant factor open to question. Separated flow regions over residential roofs are quite common and would be expected to cover an area ranging from several shingles to an entire roof. While pressures acting on the top side of shingles within at least some parts of a large separated flow are often sufficient in magnitude to overcome the shingle weight, it was not clear that this uplift pressure was the primary failure mechanism. If the pressure on the under side of the shingle can vent rapidly, then the net uplift pressure across the shingle will be small. An experiment was designed for the current study to test the ability of a pressure change above a shingle to cause a pressure differential across the shingle. The anticipated result was that a pressure change alone would be insufficient to cause shingle uplift.

The flow separation can have a local manifestation, shown in Figure 1, which has the potential for sufficient pressure differential across the shingle to cause uplift. Local flow separation over the top of the shingle causes negative, or uplift, pressures on the top of the shingle. At the same time, a stagnation region forms on the front edge of the shingle which causes positive pressures (acting toward the shingle surface) in that region. The positive pressure feeds under the shingle providing a positive pressure acting towards the shingle surface from below--a pressure adding to the uplift force on the shingle. Investigation of the validity of this hypothesis with quantitative measurements was a primary objective of this study.

A final objective of this current study was to evaluate several shingles for wind resistance using the improved technique developed during the first study.

2.0 EXPERIMENTAL CONFIGURATION

2.1 Wind Tunnel

The experiments reported herein were conducted in the meteorological wind tunnel of the Fluid Dynamics and Diffusion Laboratory at Colorado State University. This is the same wind tunnel used for reference 1. The wind tunnel is schematically shown in Figure 2. This closed-circuit wind tunnel is characterized by a long (100 ft) slightly diverging test section. The test section is 6 ft 8 in. wide and 6 ft high at the location of the turntable. The ceiling is adjustable for a longitudinal pressure gradient correction. The facility is driven by a 250 Hp variable pitch, variable speed propeller with wind speed varying continuously from 0.3 mph to 80 mph. Air temperature is variable from 35°F to 180°F.

2.2 Flow Simulation

A shingle deck identical to that used in the previous study, reference 1, was installed in the wind tunnel, Figure 3. All tests on the shingle deck were made with wind perpendicular to the leading edge of the deck. For shingle wind resistance tests, shingles were mounted as in reference 1. For pressure measurements, all shingles except the center one in the third course from the bottom were stapled down. The unstapled shingle was the metric unit.

For some experiments, a gust generator was installed upwind of the shingle deck as shown in Figure 3. The gust generator was 19.5 in. long in the flow direction and 1.75 in. wide at its center pivot point. The gust generator blade spanned the width of the wind tunnel and was supported at the walls to permit rotation. The blade angle was adjusted by hand from outside the wind tunnel by means of a crank arm. The usual mode of operation was to continuously adjust the blade position, although some portions of individual runs used a constant angular position of the gust generator.

Neutral atmospheric flow was simulated as in the earlier study in the wind tunnel with a smooth floor. The approach flow characteristics were measured 15 in. upwind of the shingle deck at profile location B in Figure 3. A profile was also measured at location E. Vertical profiles of the mean wind speed and local turbulence intensity are shown in Figure 4. The turbulence intensity is defined as the root-mean-square of the longitudinal wind velocity fluctuations about the mean divided by the local mean velocity. A boundary layer about 20 in. in thickness developing over the wind-tunnel floor is evident. A boundary layer on the deck was about 1 in. thick at the metric shingle location.

The local velocity near the metric collector was measured 1 inch above the deck at the edge of the local boundary layer developing over the deck. The reference wind speed was monitored in the uniform flow region at a height of 50 in. for the pressure measurements on the shingles (see Figure 3). The reference wind speed was essentially the same as the local wind speed when the gust generator was inactive.

The technique for controlling the air temperature in the wind tunnel is described in detail in Section 3 of the preceding report, reference 1.

A photograph of the test installation is shown in Figure 5.

2.3 Flow Measurement

The mean wind speed and the local turbulence intensity profiles presented in Section 2.2 were measured using a single hot film probe in conjunction with a constant temperature anemometer (TSI Inc. Model 1050). The hot film probe consisted of a 0.001 in. diameter platinum sensing element 0.02 in. in length. The probe was carried by a vertical traverse to measure the local wind speed and turbulence intensity at different heights above the wind-tunnel floor. The data were sampled for 32 seconds at a rate of 260 samples per second. The output from the hot wire anemometer was fed to a data acquisition system consisting of a Hewlett-Packard System 1000 minicomputer and a Preston scientific analog-to-digital converter. The data were then analyzed and stored using appropriate software.

In addition, the same hot film anemometer was used to measure the approach wind speed 1 in. above the shingle surface for several time series wind-tunnel runs. The location of the probe is indicated in Figures 1 and 6. The data for these runs were obtained at a rate of 512 samples per second.

Calibration of the hot wire anemometer was made by comparing output to the reference pitot-static probe in the wind tunnel for a number of wind speeds. The calibration data were fitted to a variable exponent King's Law relationship of the form

$$E^2 = A + BU^c$$

where E is the mean hot wire output voltage, U is the mean wind speed, and A, B, and C are constants determined by data fitting. The root-mean-square speed of the fluctuating wind U_{rms} was determined from

$$U_{rms} \cong \frac{2EE_{rms}}{BCU^{c-1}} \tag{1}$$

in which E_{rms} is the root-mean-square output voltage from the anemometer.

2.4 Pressure Measurement

Pressure data were obtained at fifty positions on the flexible metric shingle surface and on the deck. Tap locations are illustrated in Figure 6. The pressure taps were connected individually by 1/16 in. I.D. plastic tubings to four pressure transducers through a pressure switch. Pressure tubes connecting to the top and bottom sides of the metric shingle used 8 in. lengths of 0.02 in I.D. tubing at the shingle connection to reduce flow disturbances. The plastic tubings were short enough so that the pressure response of the data collection apparatus was adequate to record pressure fluctuations. Only mean pressures are of interest for this study. Photographs of the instrumented shingle are shown in Figure 5.

A pressure switch transmitted the pressure to transducers without attenuation from four locations on the shingle at a time. Sequential operation of the switch permitted measurement at all fifty positions. The switch was operated by a computer-controlled solenoid drive. The pressure transducers used were Setra differential pressure transducers Model 237 with a 0.10 psid range. The reference side of the pressure transducer was connected by the plastic tubing to the static side of the Pitot-static tube mounted above the shingle model in the wind tunnel. By doing so, the reference pressure was automatically set to the static pressure of the ambient flow in the wind tunnel.

For the wind-tunnel tests in a steady flow, the pressure data were sampled at a rate of 260 samples per second for 16 seconds. A sample rate of 512 samples per second was used for the time series wind-tunnel tests with gusting and with local velocity measurement to assure that all significant information was obtained from the pressure output.

2.5 Test Program

The test program consisted of 38 tests identified in Appendix 1. The 38 tests consisted of 177 individual data runs. Tests 1-15, 24-29 and 36 were tests of shingles instrumented for pressure distribution. All of these tests included steady pressure data at 50 taps for several wind speeds and time series data on 6 taps for a few wind speeds. Most of these runs were videotaped and some had gusting action. Configuration designations were for run identification. Additional details of runs are given on pages following the summary page in Appendix 1.

Tests 16-23 were wind resistance tests similar to those performed in reference 1 with gusting included. Videotapes were made. Tests 30-35 were similar to those performed in reference 1 without gusting. These runs were also videotaped.

Tests 37 and 38 were suction tests intended to determine how rapidly pressure would vent under a shingle with a sudden negative change in pressure over the shingle. A box connected to a suction system was adhered to the shingle deck over the metric shingle with silicone sealant. Three pressure taps were monitored (one under and two on top of the shingle) while a sudden decrease in pressure was applied. One run (#37) was made on the deck as prepared for pressure tests. A second run (#38) was made with all adjacent shingle cracks (and the junction between shingles and deck at the edge of the deck) sealed with silicone sealant.

3.0 RESULTS

3.1 Pressure Distributions

For each of the pressure taps, the data record was analyzed to obtain four separate pressure coefficients. The first is the mean pressure coefficient

$$C_{p_{mean}} = \frac{(p-p_R)_{mean}}{0.5\ \rho\ U_R^2} \qquad (2)$$

where C_p is the nondimensional pressure coefficient, p is the fluctuating pressure at the tap location, ρ is the air density, p_r and U_R are the reference static pressure and velocity in the approach flow. $C_{p_{mean}}$ represents the mean of the instantaneous pressure difference between the shingle pressure tap and the static pressure in the wind tunnel above the deck, nondimensionalized by the dynamic pressure

$0.5\ \rho\ U_R^2$

at the reference velocity position. This relationship produces a dimensionless coefficient which indicates that the mean pressure difference between shingle surface and ambient wind at a given point on the deck is some fraction less or some fraction greater than the undisturbed wind dynamic pressure in the approaching wind.

The magnitude of the fluctuating pressure is obtained by the rms pressure coefficient

$$C_{p_{rms}} = \frac{((p-p_R)-(p-p_R)_{mean})_{rms}}{0.5\ \rho\ U_R^2} \qquad (3)$$

in which the numerator is the root-mean-square of the instantaneous pressure difference about the mean.

If the pressure fluctuations followed a Gaussian probability distribution, no additional data would be required to predict the frequency with which any given pressure level would be observed. However, the pressure fluctuations do not, in general, follow a Gaussian probability distribution so that additional information is required to show the extreme values of fluctuating pressure expected. The peak maximum and peak minimum pressure coefficients are used to determine these values:

$$C_{p_{max}} = \frac{(p-p_R)_{max}}{0.5\ \rho\ U_R^2}$$
$$C_{p_{min}} = \frac{(p-p_R)_{min}}{0.5\ \rho\ U_R^2} \qquad (4)$$

The values of $p-p_R$ which were digitized at 260 samples per second for 16 seconds, were examined individually by the computer to obtain the most positive and most negative values during the 16-second period. These were converted to $C_{p_{max}}$ and $C_{p_{min}}$ by nondimensionalizing with the free stream dynamic pressure.

The four pressure coefficients were calculated by the on-line data acquisition system computer and tabulated. Pressure coefficients for all tests are listed in Appendix 2. Run labels in Appendix 2 refer to test conditions identified in Appendix 1.

Distributions of the four C_p coefficients at the 50 tap locations are shown plotted in Figure 7 for Test 2 (shingle 2-75-HVY-2) for 25, 30 and 35 mph approach velocities with no gust generator. Distributions of C_p for other shingles are presented in Appendix 3. Several comments can be made. The differences between $C_{p_{max}}$ and $C_{p_{min}}$ are relatively small so that the variation in $C_{p_{mean}}$ is most significant in shingle load determination. Thus all further discussion of C_p refers to $C_{p_{mean}}$ and the subscript is dropped from the coefficient.

The variation in $C_{p_{mean}}$ from tap to tap follows a characteristic pattern which is consistent with the flow model presented in Figure 1. For a 25 mph wind prior to shingle uplift, positive surface pressures are found just upwind of the shingle step and negative pressures are found just downwind of the shingle step. A gradual transition from negative to positive is found as position advances downwind from the negative pressure at one shingle step toward the positive pressure in front of the next step. Pressures underneath a shingle are positive providing additional uplift.

The pressure distribution for 30 mph in Figure 7 shows clearly that the flexible metric collector has been lifted by the wind creating strong positive pressures on the windward side and strong negative pressures on the leeward side. These pressures add to hold the shingle up. Because the coefficients are larger when the shingle is raised, the pressures are larger. Thus the shingle will remain up once the wind has pulled it up as long as the wind speed remains constant. The influence of the raised shingle on adjacent shingles is significant as can be observed from taps 18-23. A large uplift pressure is created in the region of tap 23.

At 40 mph, the qualitative behavior of the pressure coefficients in Figure 7 remains the same as at 30 mph although the precise magnitudes differ.

Figure 8 shows a more detailed distribution of mean C_p across two courses of shingles as a function of position on the shingle for three wind velocities. The coefficient distributions are similar at the two lower wind speeds, but differ at the higher wind speed where the metric shingle has flexed up.

Figure 9 shows the variation of mean pressure coefficients at six pressure taps on nailed shingles not free to flex as a function of approach wind speed. The pressure coefficient values are approximately constant with wind speed up to 30 mph at which velocity the adjacent flexible shingle raises up disturbing the flow and hence the pressure coefficients on these adjacent shingles. The implication of the constant value of C_p up to the velocity where the flexible shingle moves is that the local flow over each shingle is Reynolds number independent. Thus, these coefficients can be applied in other situations, including full-scale situations if an <u>appropriate</u> reference wind speed is selected.

3.2 Pressure Differential

Pressure differentials across the flexible roofing shingles were obtained to analyze shingle uplift forces. The local mean pressure differential was given by

$$\Delta C_p = C_p\Big|_{\substack{\text{top}\\\text{surface}}} - C_p\Big|_{\substack{\text{bottom}\\\text{surface}}} \tag{5}$$

The ΔC_p values yield an actual pressure differential Δp when multiplied by the corresponding reference dynamic pressure. Thus,

$$\Delta p = \Delta C_p q_R \tag{6}$$

where $q_R = 0.5\rho U_R^2$

or, $$\Delta p(\text{psf}) \cong 0.00206\ U_R^2 \Delta C_p \tag{7}$$

at an elevation of approximately 5000 ft, where U_R in the above equation has units of mph.

In the wind-tunnel test data presented herein, five pairs of pressure taps were used on the top and bottom surfaces of the flexible shingles in order to determine pressure differentials. The selected pressure taps were

	tap number (see Figure 6)				
top surface	35	36	37	38	39
bottom surface	41	42	43	44	45
distance from the front edge of the shingle (in.)	0.1	1	2.5	4	5

The analysis of pressure differential was only applied to the flexible shingles which were the third course on the deck and not to the fixed shingles.

The variation of ΔC_p with position on a shingle is shown in Figure 10 for a variety of shingles at 75°F and 35°F at one wind velocity below the speed where uplift occurs. While scatter is evident in the data, due probably to the slightly different geometry of each shingle and the way it lies on the deck, the overall trend of the data is similar. This figure shows that, prior to uplift, the wind load on a shingle is largest at the outer edge. The data in this figure will be of significant use in application to full-scale structures.

The variation of pressure difference coefficient with wind speed is shown in Figure 11 for eight shingles, four at 75°F and four at 35°F. Difference coefficients are essentially constant before uplift and vary with shingle geometry after uplift. Shingles at high wind speeds at 75°F tend to have less pressure across the shingle than do the same shingle type at 35°F. The reason is that at 75°F the shingles will bend completely over while the more rigid shingle at 35°F was still sticking straight up into the wind. Figure 11 gives some indication of repeatability of data, since the figure includes data on two different experiments on the same shingle type under the same conditions. Some of the variation can probably be attributed to the pressure tap installation since small changes in geometry about the tap (especially near the front edge) can cause changes in pressure reading. However, it is likely that most of the variation in ΔC_p values can be attributed to changes in physical geometry of the shingles themselves. The step height at each shingle edge is a primary (if not <u>the</u> primary) determination of ΔC_p. There was a visible variability in the step height from one shingle deck to the next even though care was taken to ensure that the decks were manufactured in the same way. Variability in step height in field applications may be even greater. (After a period of time, the shingles in the field applications may "relax" providing a more uniform step height.)

The actual pressure differences in psf across a variety of shingles at 75°F and 35°F are shown in Figures 12 to 16. The measured shingle weight in psf is also shown for comparison. The shingle weights were not adjusted for deck angle (a 5 percent factor) to account for the fact that gravity load acts vertically downward while wind pressure forces act perpendicular to the deck. In general, the uplift pressure on the shingle had exceeded the shingle weight at the outer edge of the shingle by 25-30 mph while shingle uplift did not occur until 30-35 mph when uplift exceeded weight over a larger area of the shingle. Because the local velocity was equal to the reference approach velocity in these tests, these velocities refer, in a full-scale building, to local wind velocities over a building roof and not to wind speeds approaching the building.

One data set in Figure 16 refers to a "tapered" organic shingle. This shingle was modified in shape by filing the leading edge corner to reduce the severity of the step. If the mechanism for shingle uplift is as described herein, then tapering the front edge should decrease the uplift pressure as compared to other untapered shingles. Figure 16 indicates that tapering did not reduce uplift. Three possible reasons are evident. Tapering may not have been sufficient, pressure tap tubes may have extended above the shingle surface in the tapered region giving a false reading, and the shingle may have been installed with a larger than average gap from leading edge to the shingle below creating an effective step of similar magnitude to other tested shingles. This single test of a tapered shingle should not receive too much weight.

Figure 17 shows pressure differences across several shingles. These data were obtained by multiplication of the coefficients of Figure 10 by the q_R appropriate for each shingle test. This summary graph shows how actual pressures varied across the shingle for the cited shingles in the wind-tunnel test as it was run.

3.3 Prediction of C_p from Local Velocity Measurements

Consider the fluid flow along a streamline A-A' in Figure 1. Although the flow is turbulent, we may consider the streamline of the mean flow. We also consider the flow to be incompressible. If we neglect viscous diffusion terms in the equation of motion, then the equation reduces along the streamline to

$$q + p = \text{constant} \tag{8}$$

where $q = 1/2\ \rho U^2$, ρ is the air density and U is the velocity at the point of interest. This equation is known as Bernoulli's equation in which fluid gravitational forces have been neglected.

If the local velocity measurement position (see Figure 1) is sufficiently close to streamline A-A', then the velocity at the local velocity position (measured by a hot film anemometer in the experiment) will be representative of that on the streamline. While this approximation is not correct due to a local boundary layer between the velocity measurement and near-surface streamline, the method developed here to predict variations in local surface pressure coefficients from measured variations in local wind speed accounts for that difference in calibration of the method. It is only required that the ratio of the velocity at some point on A-A' to the local velocity measured by hot film anemometer be constant. We also assume that the pressure p on the streamline A-A' is representative of the surface pressure (to at least a constant of proportionality).

The pressure p on the streamline is related to the surface pressure coefficient by

$$C_p = \frac{p - p_R}{q_R} \tag{9}$$

where p_R is the static pressure at an upwind reference location not affected by the shingle deck or gust generator in the wind tunnel as described earlier and q_R is the dynamic pressure at that reference location. Substituting (9) into (8) gives

$$q + p_R + q_R \, C_p = \text{constant}$$

since p_R is constant

$$q + q_R \, C_p = \text{constant} = C \tag{10}$$

The constant C can be evaluated by inserting baseline values of q and C_p for one time instant when both q and C_p are known (call them q_B, C_{p_B} for Baseline values):

$$C = q_B + q_R \, C_{p_B} \tag{11}$$

Inserting (11) into (10) for C and solving for C_p:

$$C_p = C_{p_B} + \frac{q_B}{q_R} - \frac{q}{q_R} \tag{12}$$

Equation (12) allows the calculation of an estimate for the surface pressure coefficient at any time based on the constant values of C_{p_B} and q_B valid at one point in time, on the constant value of approach wind q_R, and on the local value of q at the time instant for which C_p is desired.

Equation (12) was used to calculate expected values of C_p as a function of time for several data runs with the gust generator operational. Data recorded during two runs are shown in Figures 18 and 20. The computed C_p values are compared to the actual measured value of C_p in Figures 19 and 21.

The agreement is quite good except when the local velocity position recorded short-duration gusts (a few hundredths of a second) with magnitude greater than the baseline velocity (the no-gust velocity). It is posible that when this situation arises, the size of the gust is not sufficiently large to permit establishment of an equilibrium flow locally so that the ratio of streamline velocity to local velocity is not the same value as during baseline conditions. There is significant question as to whether very short-duration gusts of this type are found in a full-scale situation. In other words, the gusting action may not have been realistic for these short-duration gusts.

3.4 Blow-up Tests

Pressures were recorded on the metric shingle after lift-up to permit determination of wind pressures acting on a shingle after lift-up. During lift-up, videotape records (augmented by slide photographs) of the shingle positions were made. A 1/2-inch wire grid immediately behind the shingle (as viewed by the camera) permitted the deflected shape of the shingle to be picked off the photographic record. This data will permit shingle stiffness properties to be evaluated. Reduction of that data is not contained in this report.

3.5 Suction Test

A test was performed to determine the ability of a pressure change above a shingle, in the absence of wind flow, to provide a pressure difference across the shingle. The purpose of this test was to determine whether or not negative pressures on a roof associated with large-area separated zones could cause a significant pressure differential across a shingle. A sealed box with one side open was attached to the shingle deck with silicone sealant. The box had dimensions of 10 in. x 14 in. x 2 in. high. The box was connected to a large volume vacuum source through a solenoid-activated valve. Three pressure taps were installed--one under the flexible shingle and two on the adjacent shingle upper surface. The valves were activated during the data run producing a step function pressure change in the box over the shingle. Tests 37 and 38 were devoted to those tests.

Figures 22 and 23 show the results of two data runs. The locations of the three pressure taps are shown on the figures. Both data runs used a 10 psf suction in the large vacuum chamber. In Figure 22, the deck was as constructed for wind-tunnel tests. In Figure 23, all cracks between shingles were sealed with silicone and the junctions between shingles and deck were also sealed.

The results of Figures 22 and 23 are quite similar. Neither shingle configuration permitted the full 10 psf of suction to be developed. A maximum of 1.5 psf and 3 psf could be developed. The implication of this is that the shingles overlying one another are quite porous. Sufficient air was supplied from under the shingles to quickly destroy any pressure differential. The fact that the tap under the shingle closely tracked the taps on top of the shingle (except during the unrealistically fast pressure rise time) means that uplift loads on shingles cannot be attributed to pressure changes over a roof.

4.0 DISCUSSION

4.1 Implications for Product Development

The experiments described herein provided quantitative measurements of wind pressures on both sides of a variety of shingles before and after uplift. Also measured were the deflected positions of the uplifted shingles. This data can be used to determine effective stiffness properties of the tested shingles at 75°F and 35°F. Comparison of mechanical properties of tested shingles with properties of products under development, using the wind loading data of this report, should permit determination of superior products from a wind resistance standpoint prior to wind-tunnel or prototype testing.

Changes in physical characteristics of proposed shingles could require additional wind-tunnel testing to obtain new ΔC_p values for use in calculating uplift pressures. The values of C_p before shingle uplift are functions of shingle geometry: height of step at the edge of a tab and distance from one upwind tab edge to the step in question (5 inches for shingles tested here). Thus a change in shingle geometry should be tested to obtain new values of ΔC_p.

4.2 Implications for Prediction of Damage Potential

The data obtained herein are valuable for product development as described above. However, relative performance between two shingles is not sufficient to determine the absolute level of performance--that is, the risk of failure per year for a shingle on a particular roof in a given city. In order to evaluate failure risk, we need sufficient information on shingle loads to relate uplift pressures to local climatic data.

Information developed within this study has shown that, for the shingle geometry studied, the uplift pressure can be predicted if the velocity over the roof just above the shingle is known. The writers of this report are unaware of any study in which wind velocities just above a roof were measured. At the same time, this study has shown that shingle uplift pressures are not correlated to wind pressure distributions over a roof. Thus, the information available in the literature reporting roof wind pressures is not useful in predicting shingle uplift pressures.

The lack of quantitative measurements correlating wind velocity near a roof surface to the approaching wind speed prevents a quantitative evaluation of failure risk. What qualitative information exists indicates that local wind velocities above a roof, and hence uplift shingle pressures, may be maximum near eaves and ridge lines.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Three types of data were collected during this investigation: 1) shingle wind resistance tests using the improved testing procedure developed in an earlier study, 2) static pressure change tests to evaluate the ability of the pressure on the bottom side of a shingle to adjust to the pressure on the top side for a pressure change without wind velocity over the shingle, and 3) measurements of fluctuating pressure on the bottom and top sides of a shingle with wind flow over the shingle to determine quantitative uplift on the shingle.

Conclusions concerning these three tests can be summarized as follows:

Test 1 - The improved wind resistance test procedure was able to differentiate between shingles whose varied properties would indicate that they might have different wind resistance.

Test 2 - Static pressure changes alone are insufficient to cause shingle uplift. A pressure change on the top of the shingle is reflected on the bottom surface almost instantaneously. Thus, information available in the literature which gives uplift pressures on building roofs cannot be used to determine uplift pressures or failure potential of shingles.

Test 3 - a) Wind velocity acting locally over a shingle can produce a negative pressure separation zone on the top and a positive pressure stagnation zone on the bottom resulting in a net uplift pressure. When this local velocity is sufficiently large, the net uplift pressure can overcome the shingle weight and lift the shingle off the roof. This mechanism appears to be the dominant factor in shingle failure due to wind. b) Quantitative measurements of pressure across shingles were obtained before and after the shingle was lifted by wind action. Uplift net pressures were largest at the outer edge of the shingle reaching values of 1 to 3 psf at the outer edge and 0.5 to 1 psf farther in before shingle uplift. (Shingle weight was about 1 psf.) c) Uplift pressures in a simulated wind without artificial gusting could be predicted through local pressure coefficients and the local wind speed near the shingle surface. With artificial gusting applied from an oscillating airfoil upwind, uplift pressures could be predicted by the same method when the rate of change of velocity above the shingles was not extreme. Uplift pressure could not always be related directly to local wind speed above the shingle in the presence of rapidly changing velocity. In these cases, this is probably due to a gust simulation which was not realistic.

5.2 <u>Recommendations</u>

On the basis of information developed during two wind-tunnel studies which have been performed to investigate wind resistance of shingles, several recommendations can be made. These recommendations are directed toward gathering additional information needed to provide a risk assessment for shingles in typical field service.

1. Additional wind-tunnel tests on shingles instrumented to obtain pressures on top and bottom sides would provide the following information:

a) Uplift pressures are needed on shingles as a function of local wind speed above the shingle and local flow angle to the shingle course. Previous tests examined just one wind direction perpendicular to the shingle course. Winds on roofs often occur at directions other than perpendicular to shingle courses.

b) Additional gust tests are needed to define how rapidly the local velocity above a shingle can change and still preserve the Bernoulli equation prediction of uplift pressure.

c) Developmental tests on modified shapes of shingles might lead to improved wind resistance. This test should be undertaken only if shingles with potentially improved aerodynamic shapes appear to be commercially producible.

2. Velocity measurements near the surface of building roofs in a variety of surroundings are needed to determine the failure risk of shingles on various portions of a roof. These tests can be performed on

small-scale models placed in a simulated atmospheric boundary layer in a wind tunnel. Geometrical modifications to buildings to decrease shingle vulnerability can also be developed during these tests.

3. The tests outlined in (1) and (2) above should enable an assessment of shingle failure risk in field installations. Instrumented shingles with appropriate velocity measurements in a full-scale situation may be desirable to confirm failure risk assessed by wind-tunnel measurements.

REFERENCES

1. Peterka, J. A. and J. E. Cermak, "Wind-Tunnel Study of Wind Resistance of Roofing Shingles," Report CER82-83JAP-JEC34 for Owens-Corning Fiberglas Corporation, Fluid Mechanics and Wind Engineering Program, Colorado State University, February 1983.

FIGURES

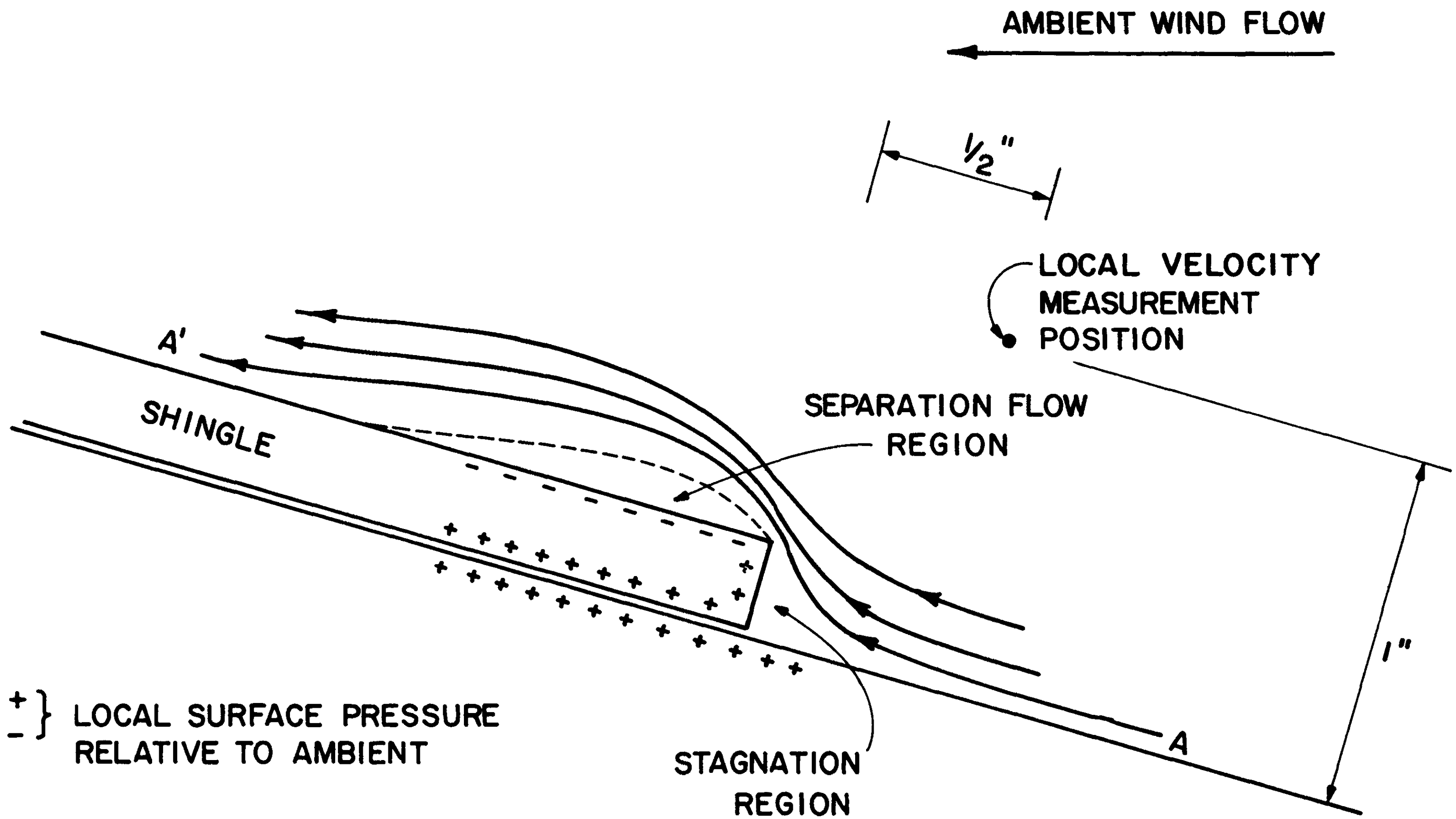
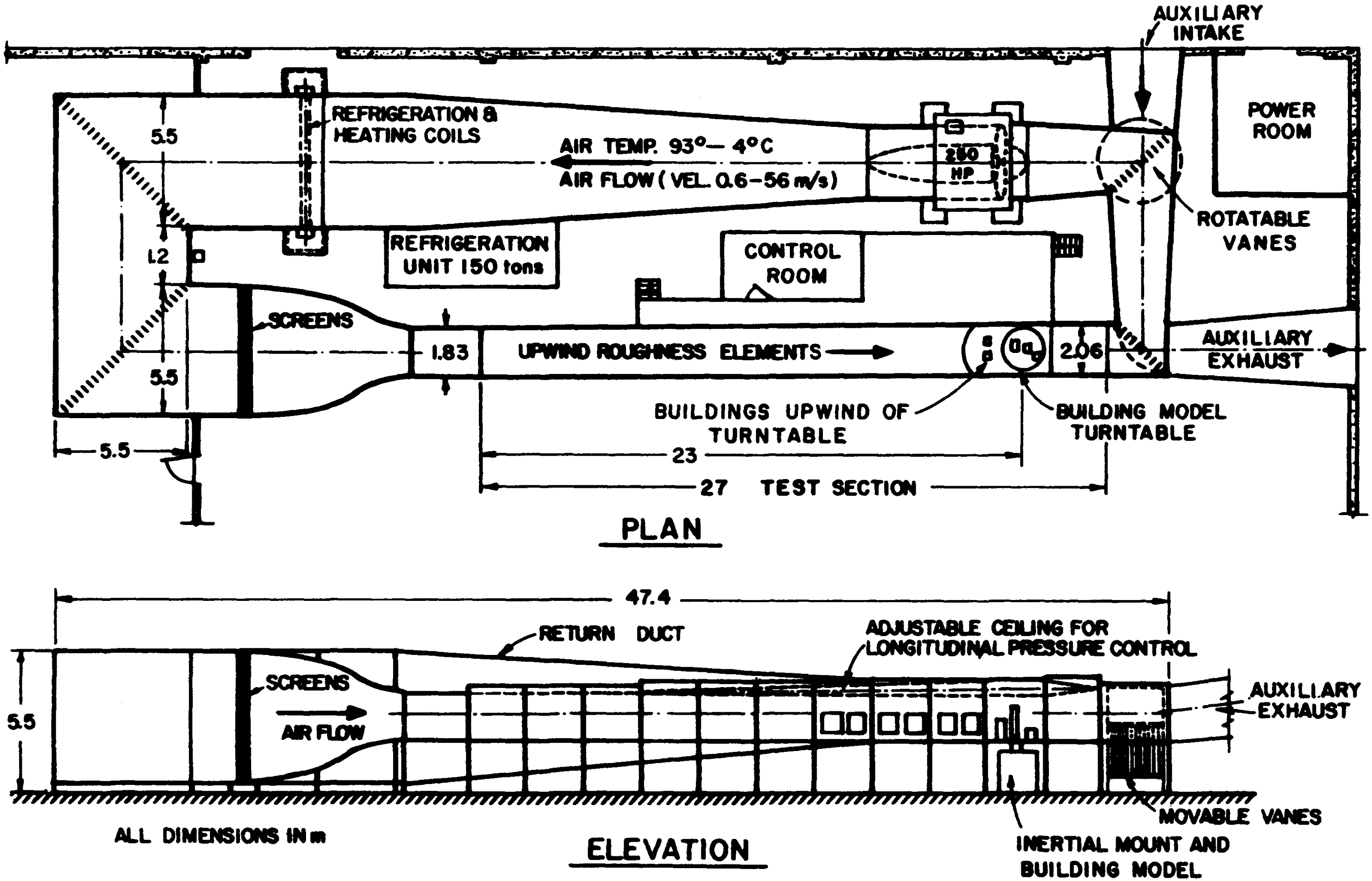


Figure 1. Local Flow Separation over a Shingle



METEOROLOGICAL WIND TUNNEL

Figure 2 - Wind-Tunnel Configuration

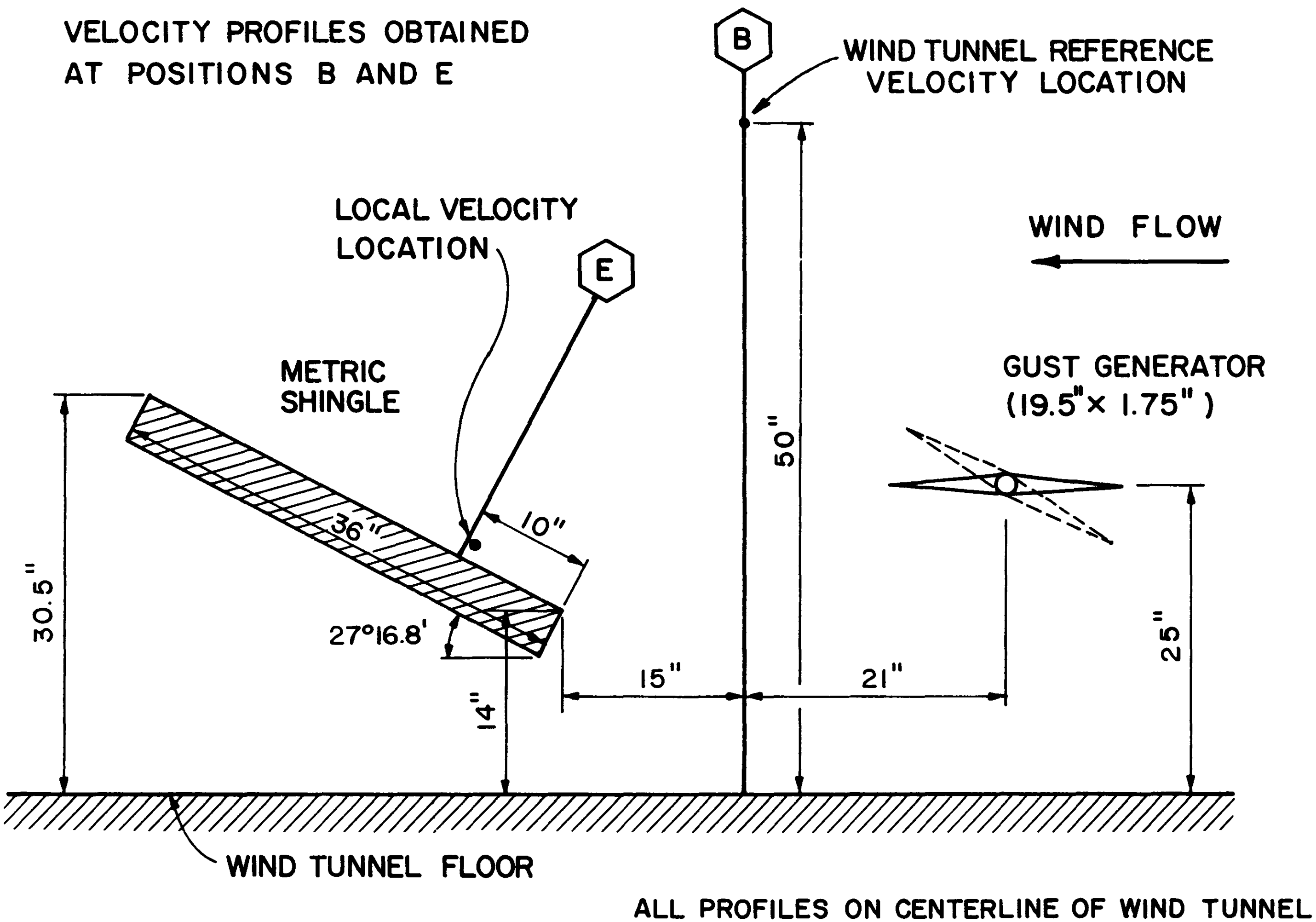


Figure 3. Test Configuration in the Wind Tunnel

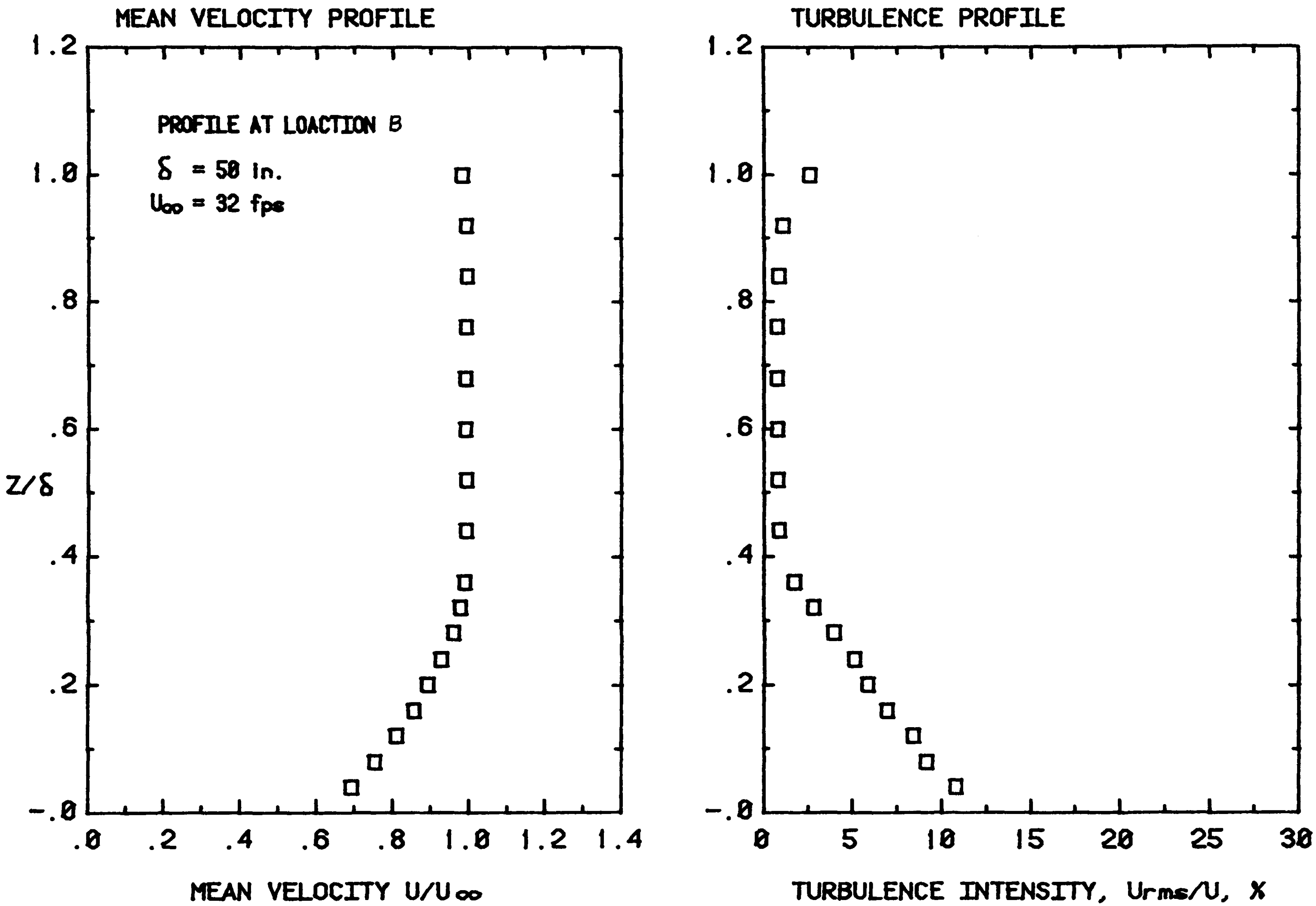


Figure 4a. Velocity and Turbulence Intensity Profiles near the Test Deck

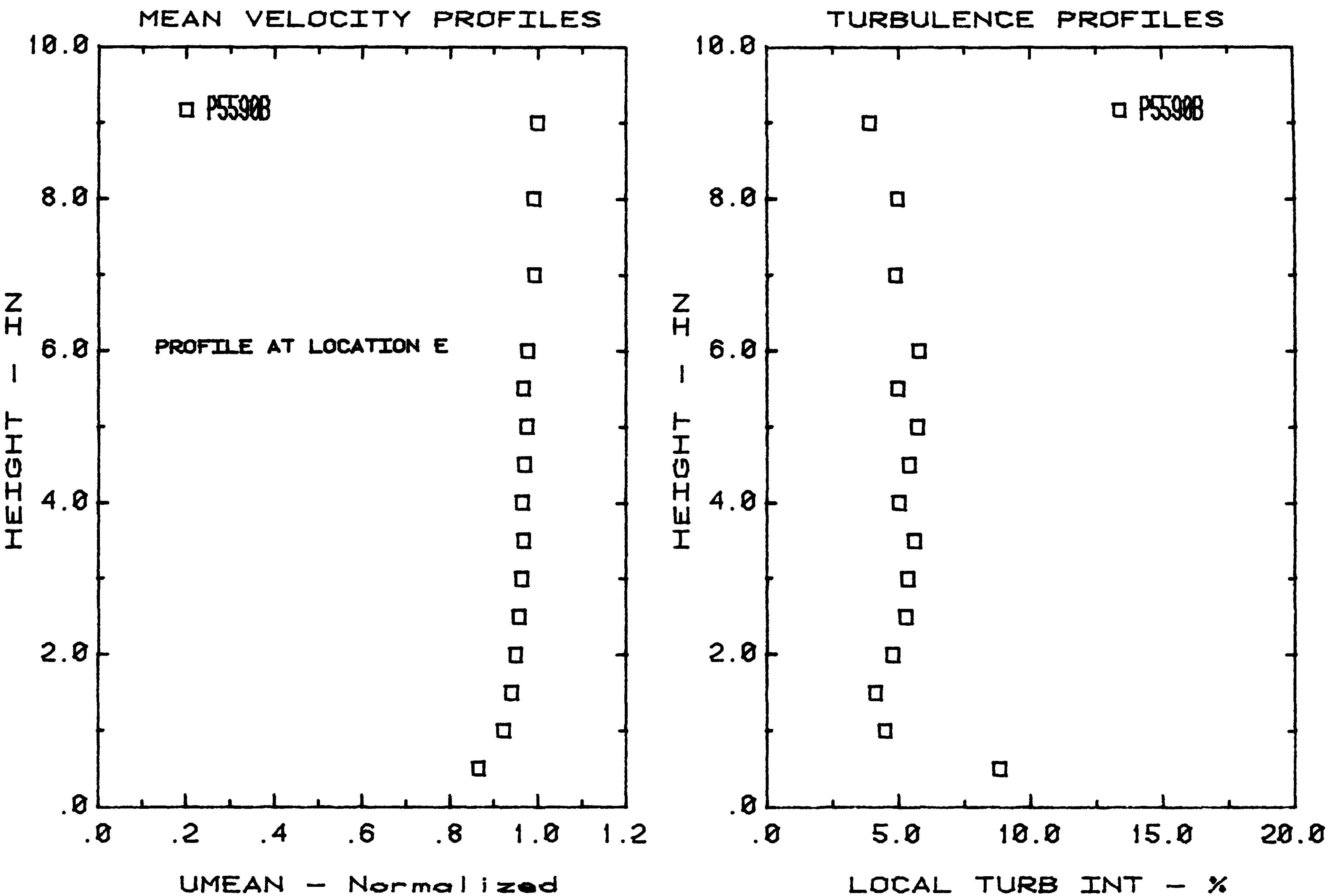


Figure 4b. Velocity and Turbulence Intensity Profiles near the Test Deck

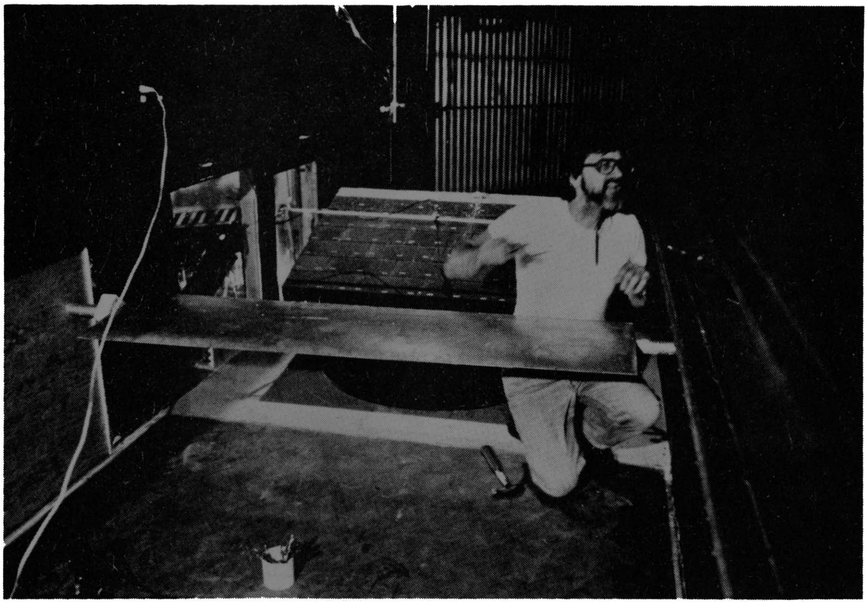


Figure 5a. Photograph of Test Installation

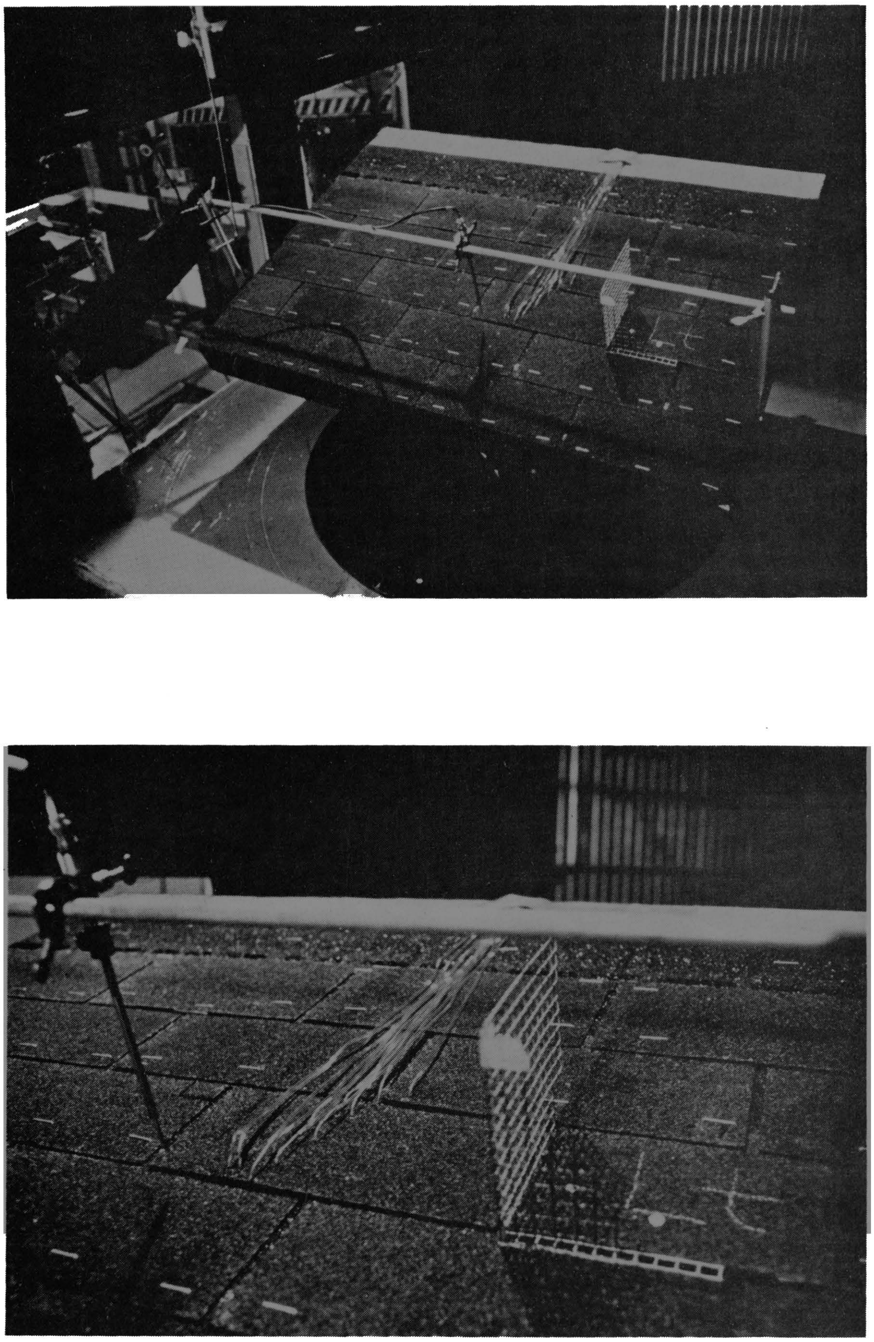


Figure 5b. Photographs of Test Installation

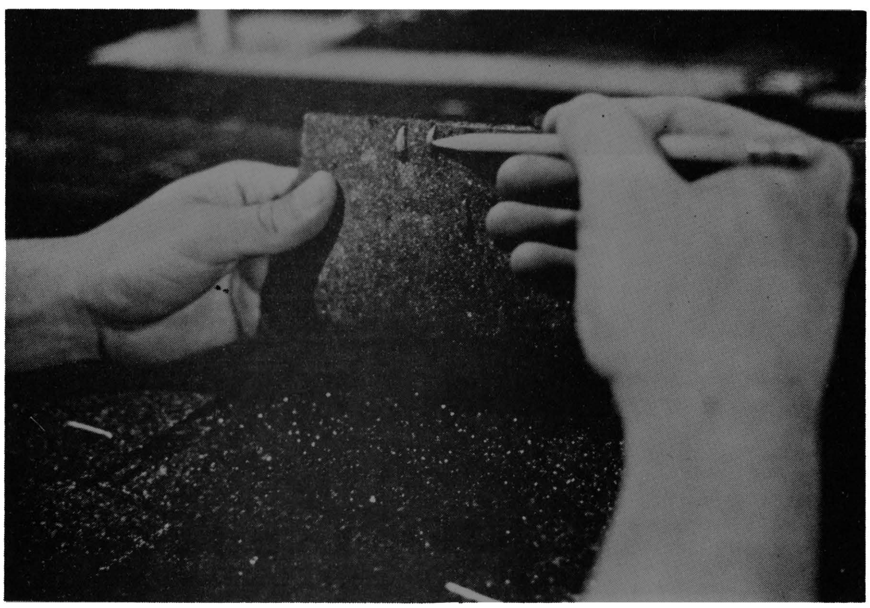
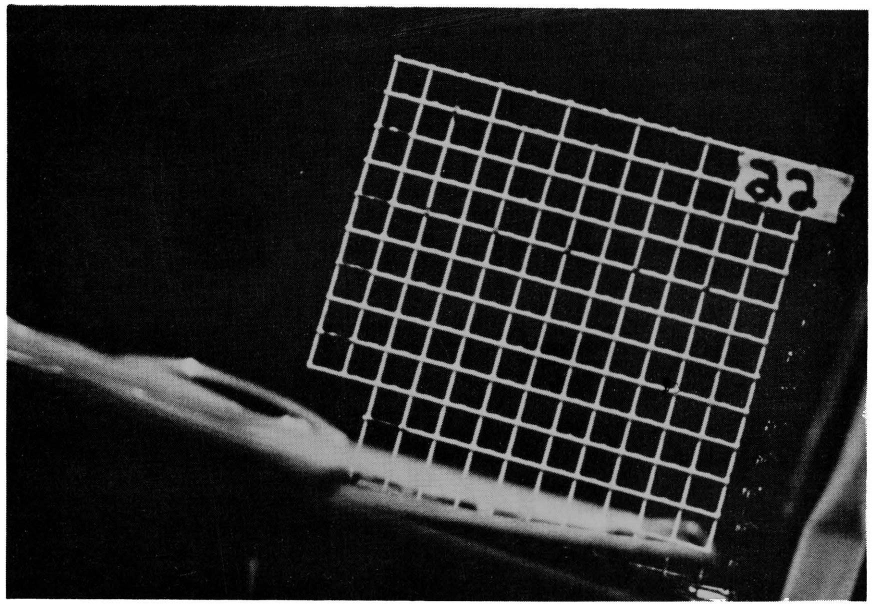


Figure 5c. Photographs of Test Installation



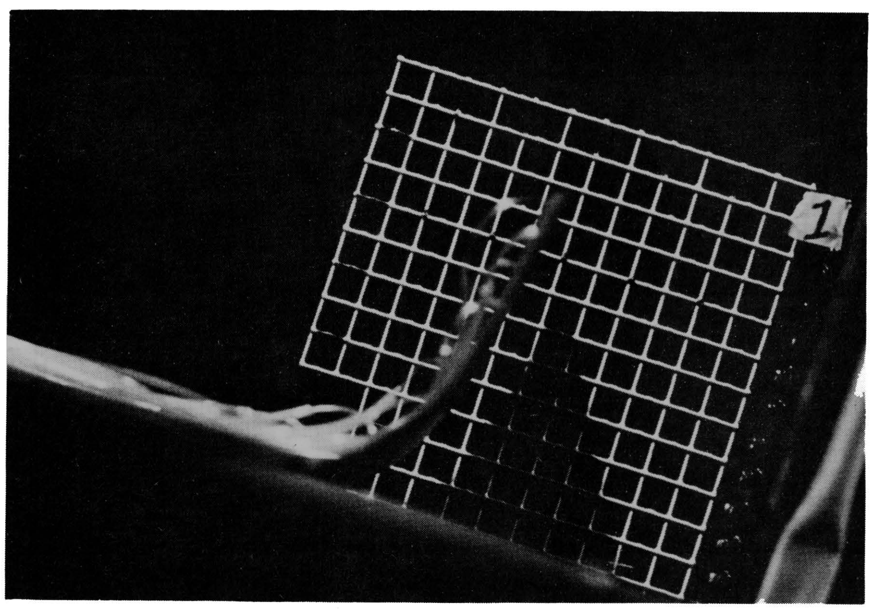
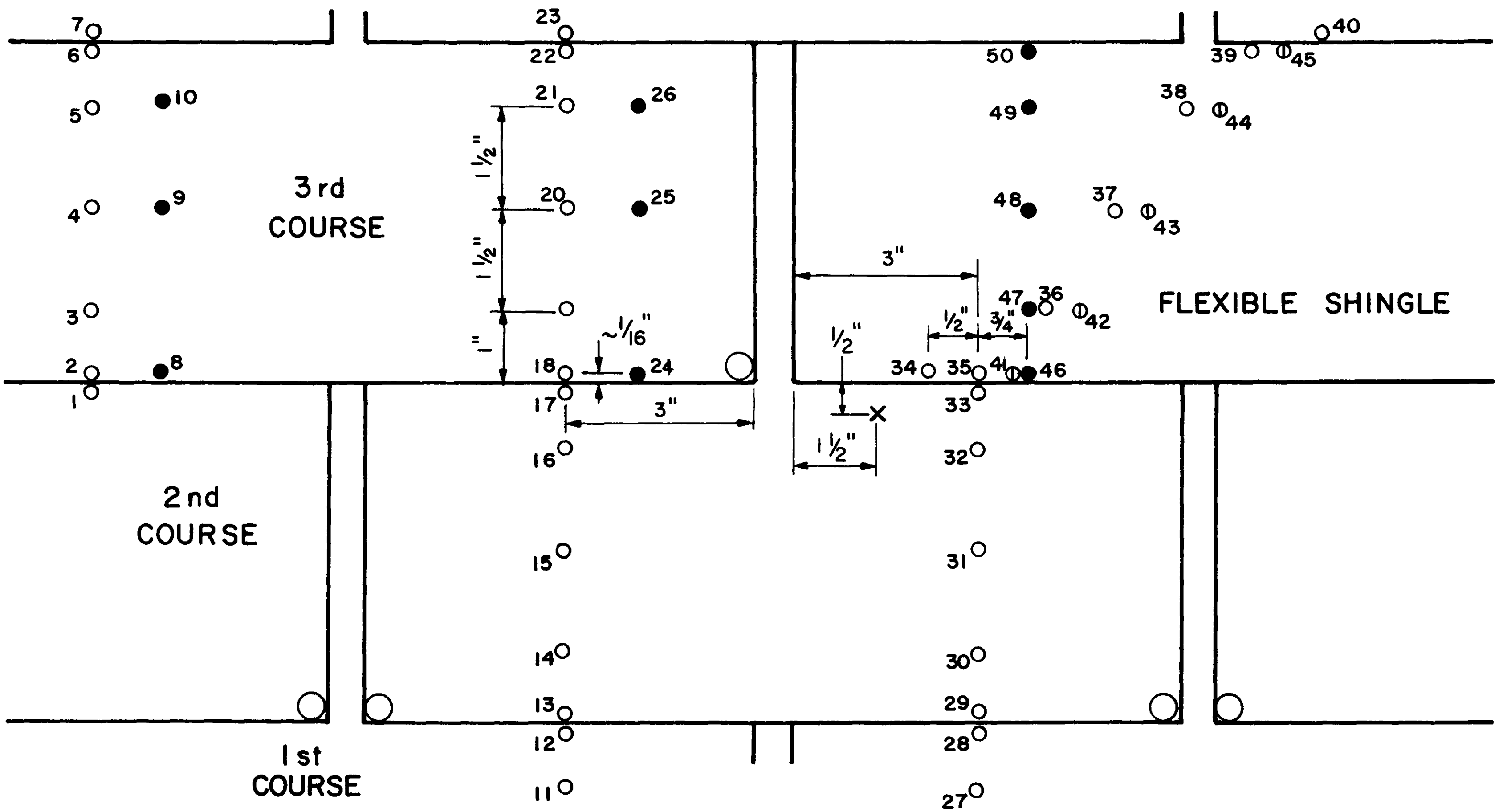


Figure 5d. Photographs of Test Installation



NOTE:

1. Vertical dimensions are typical.
2. Staggered taps on flexible shingle are 1/2 in. apart horizontally.
3. Flexible shingle was not flexed prior to final installation.

Time Series Data obtained on Taps 35,41,44 and 34,37,43

LEGEND

- ○ Top surface exposed to wind
- ● Top surface under an overlying shingle
- Φ Bottom surface of shingle (flexible shingle only)
- × Hot film location #1 above surface

Figure 6. Pressure Tap Locations on the Metric Shingle and Adjacent Deck

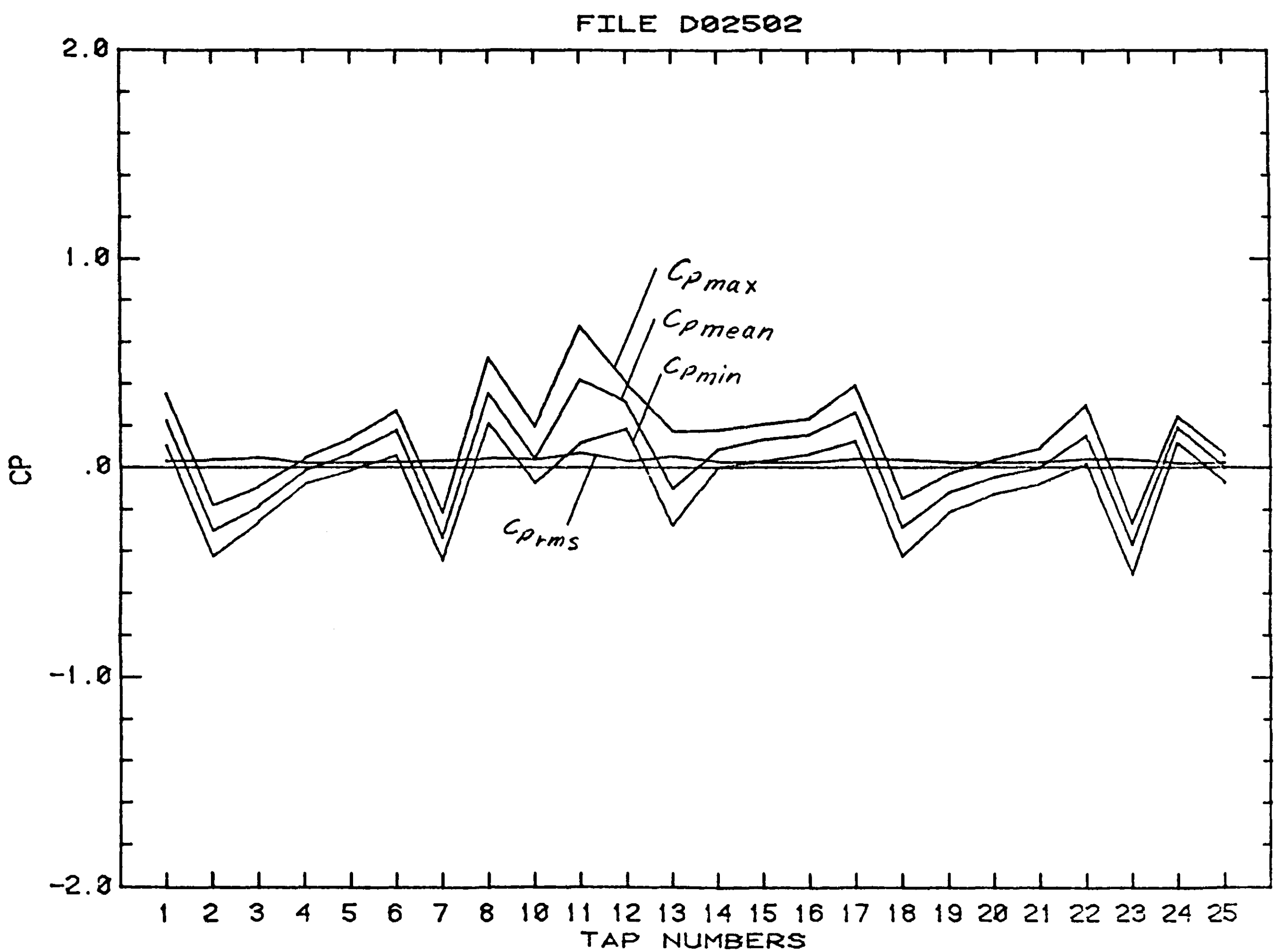


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

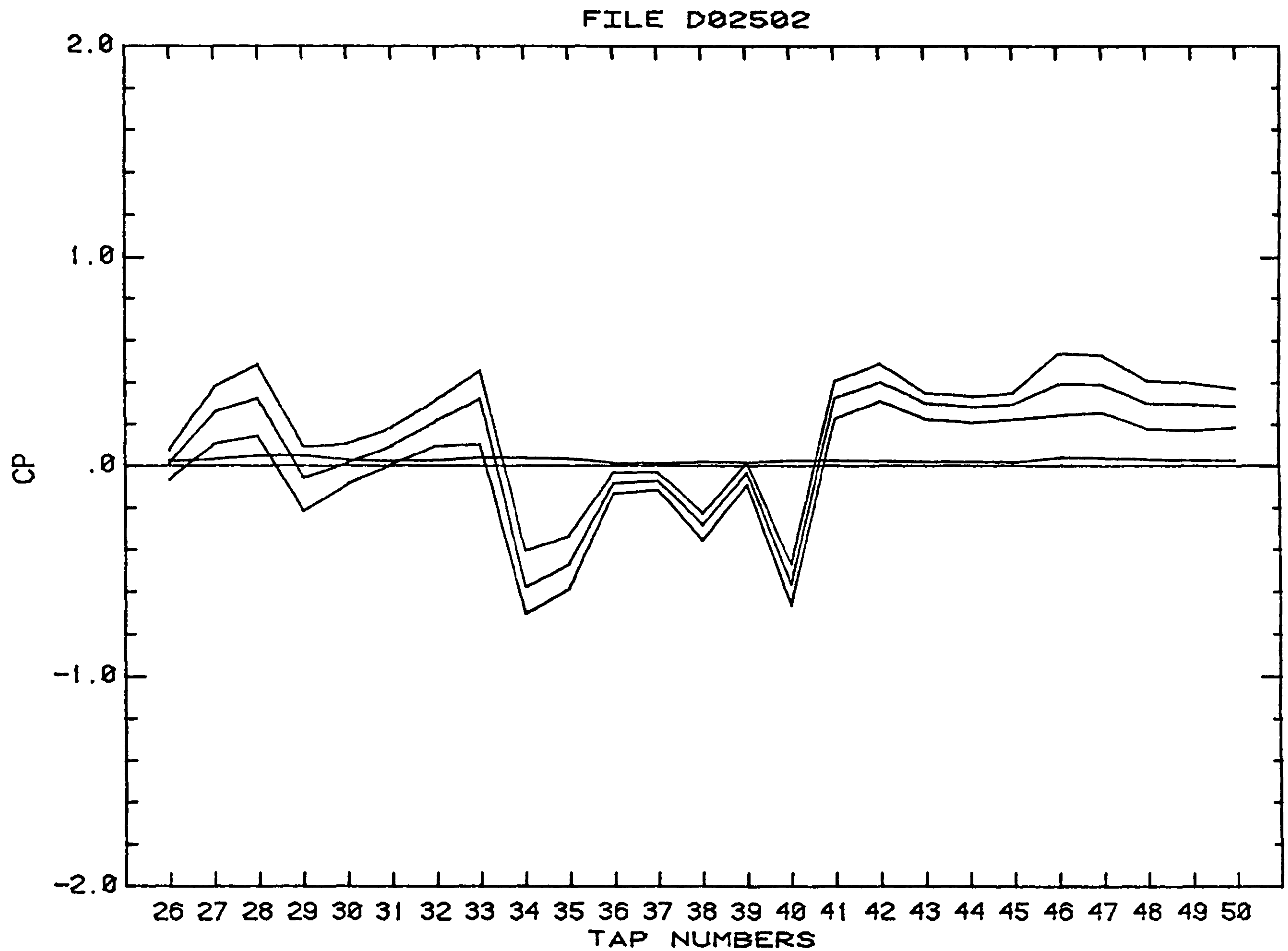


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

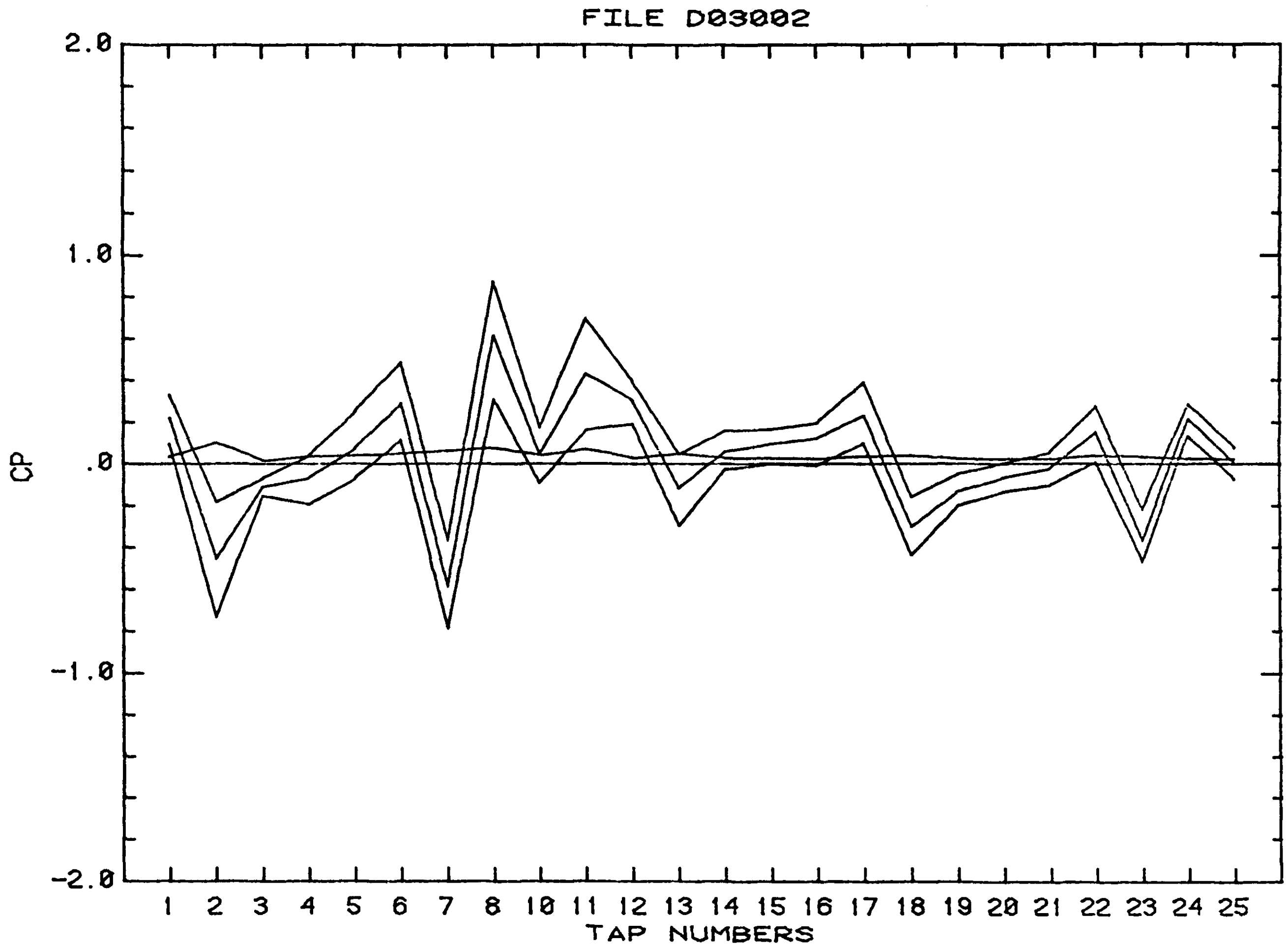


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

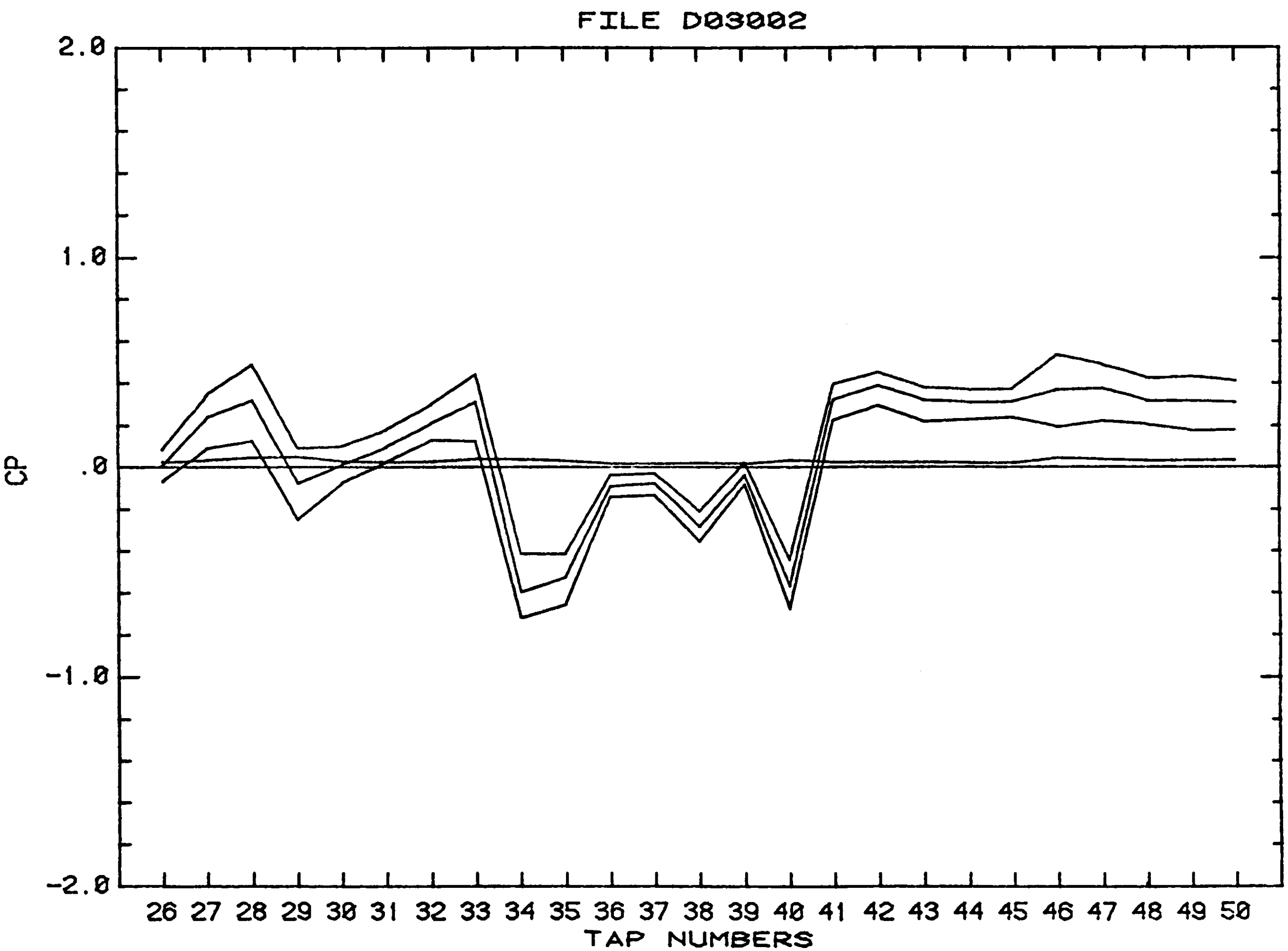


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

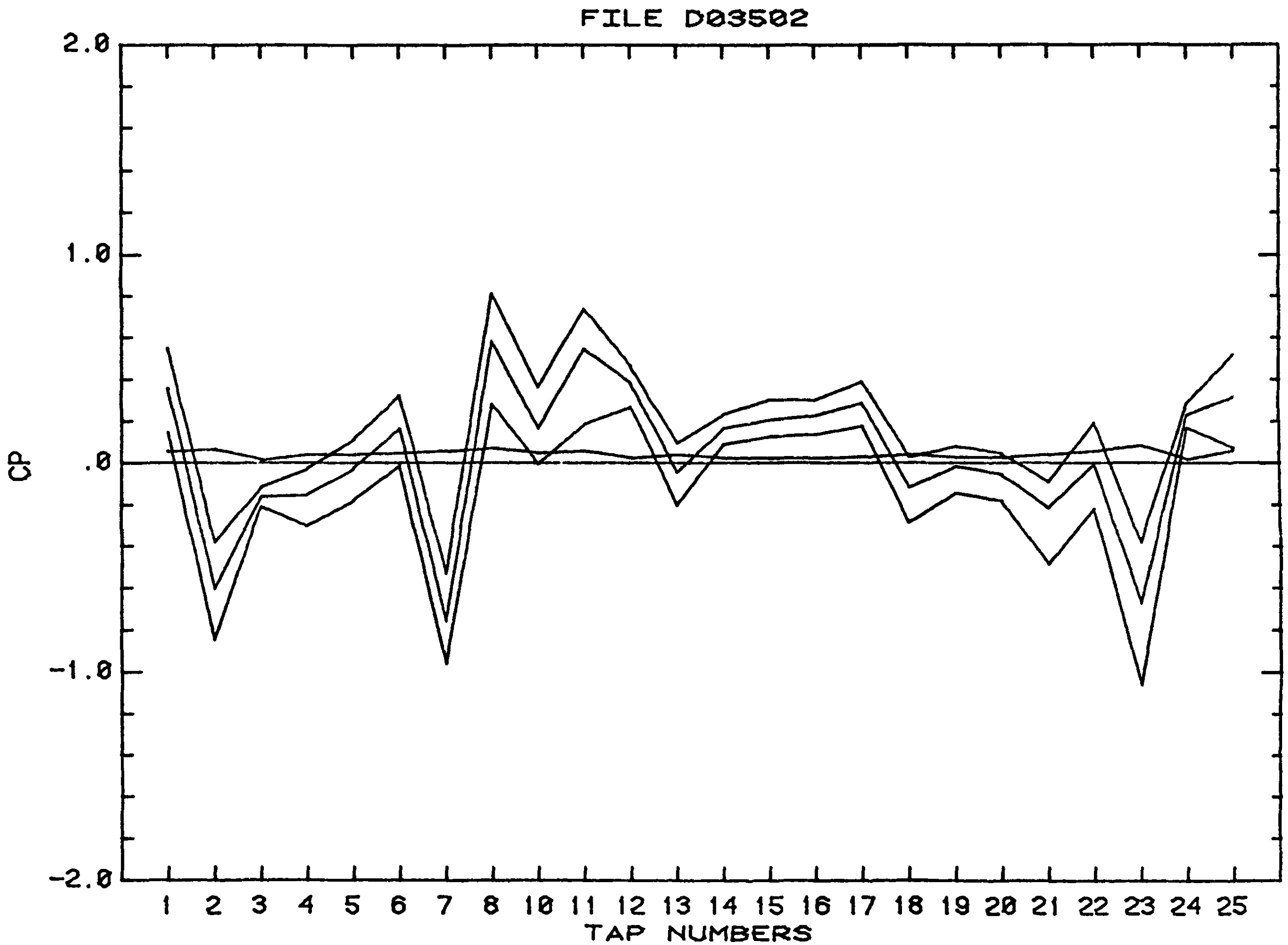


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

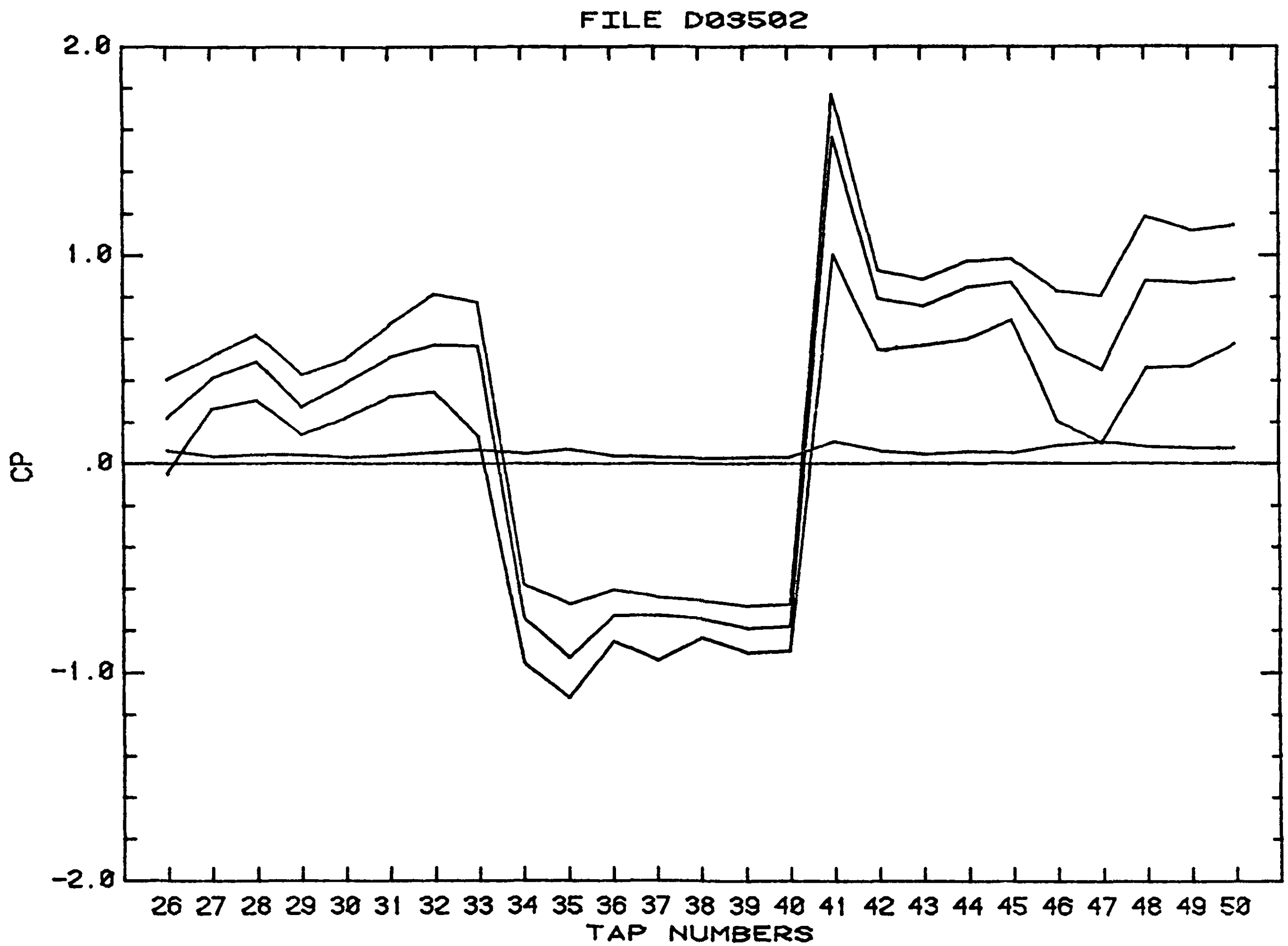


Figure 7. Pressure Coefficient Distributions among 50 Tap Locations

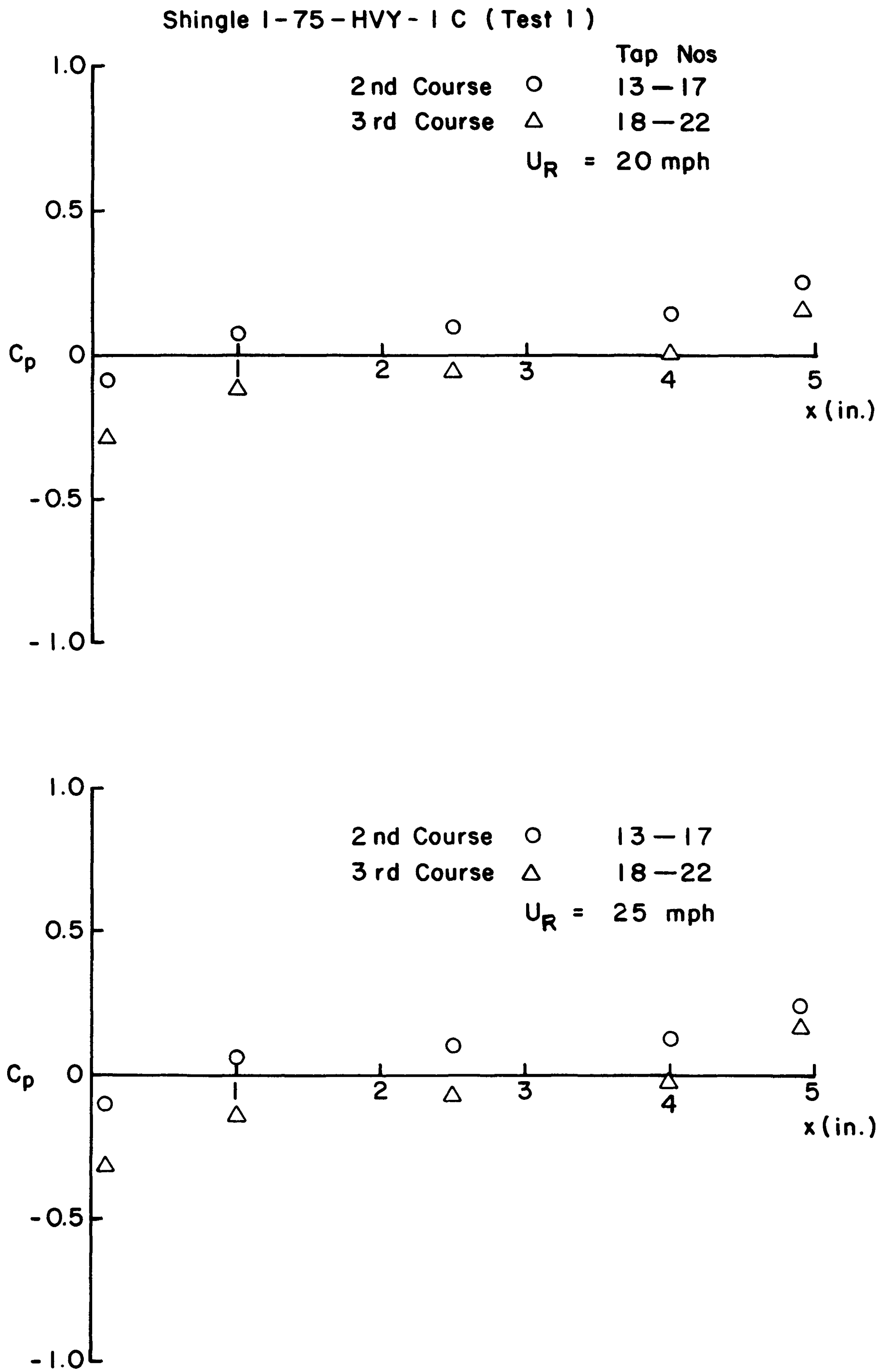


Figure 8. Pressure Coefficient Variation across a Shingle

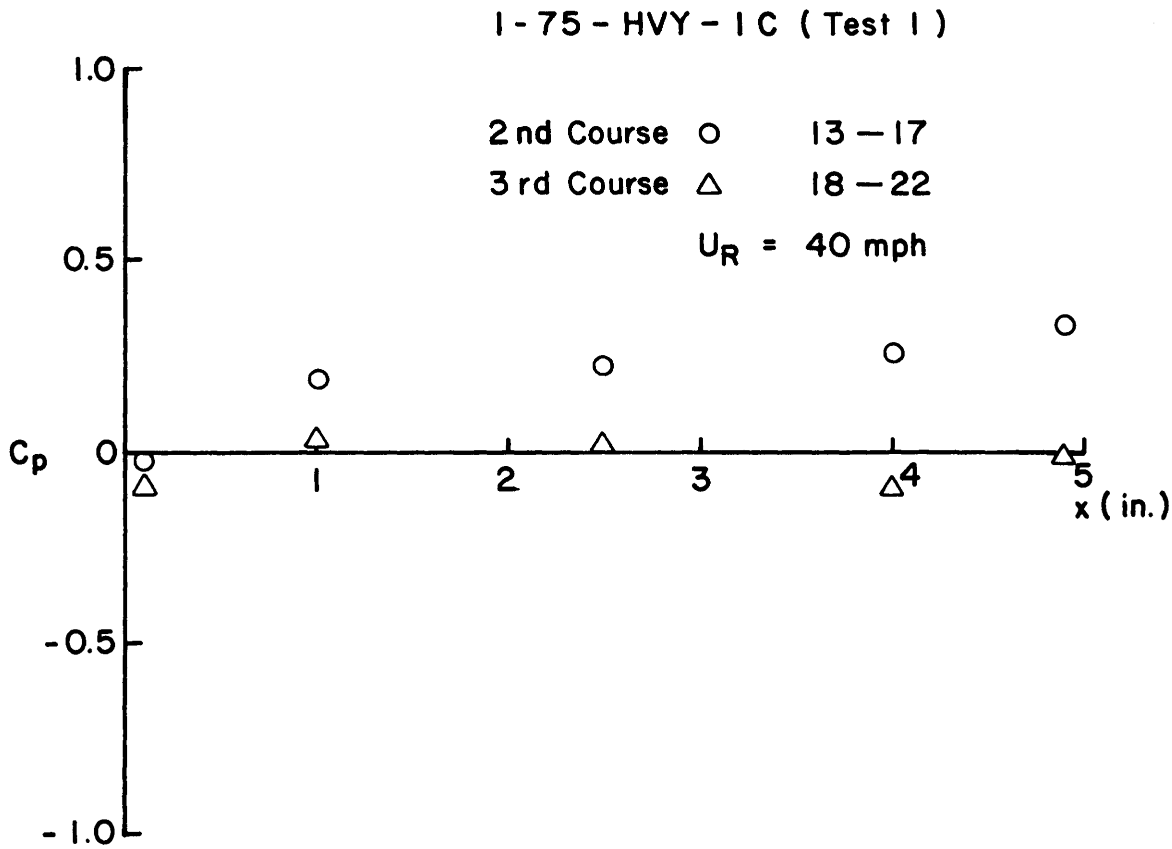
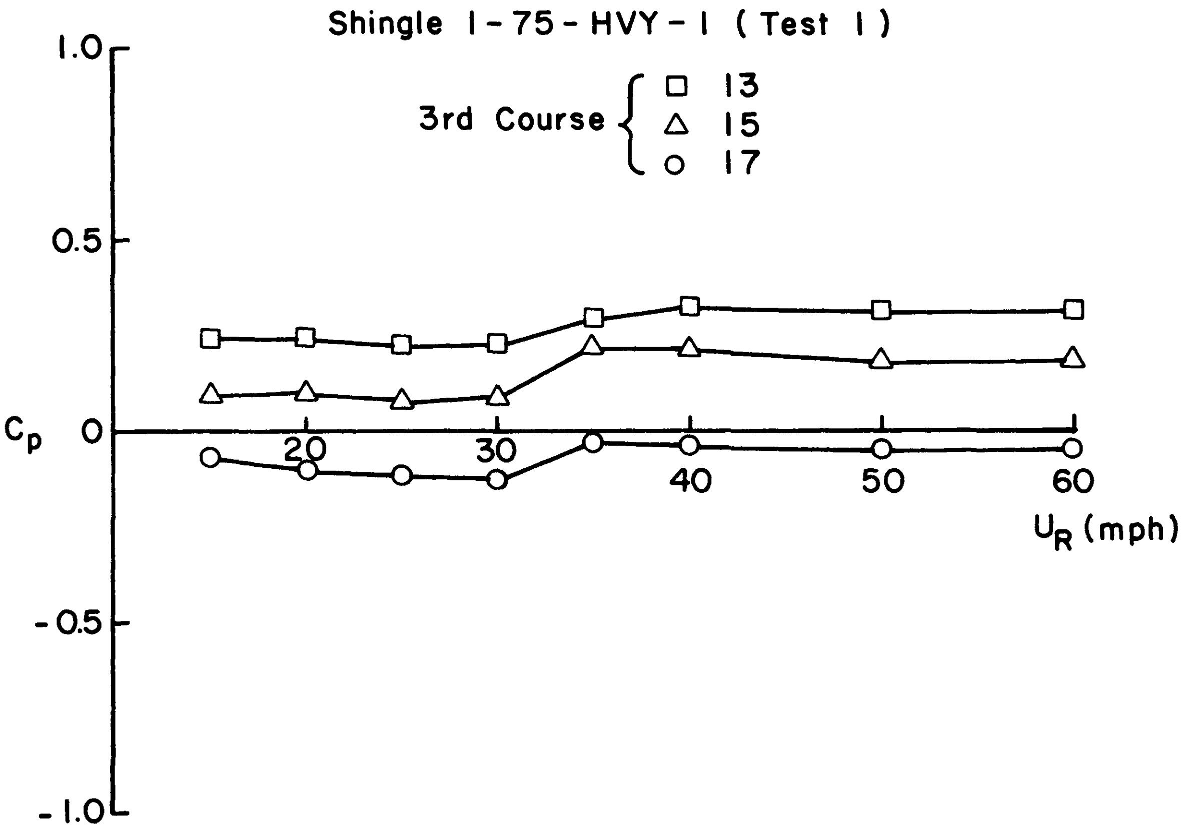


Figure 8. Pressure Coefficient Variation across a Shingle



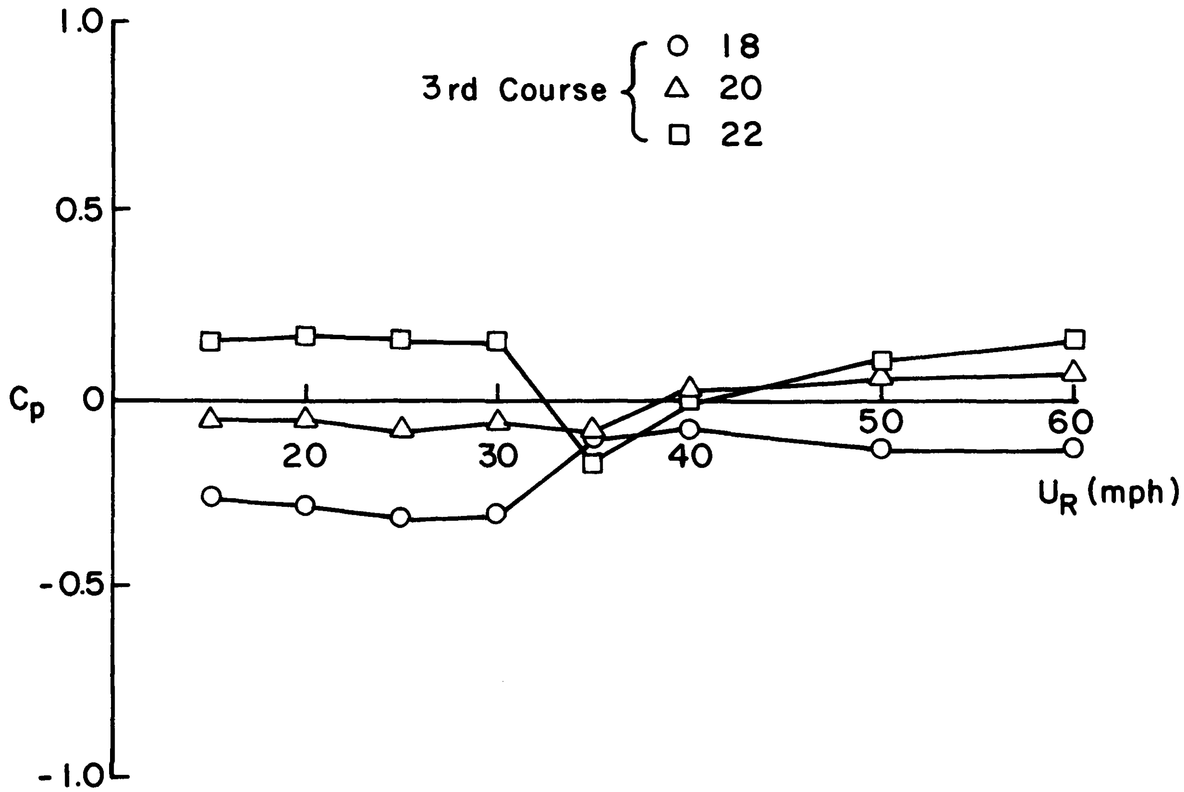


Figure 9. Pressure Coefficient Variation with Wind Speed

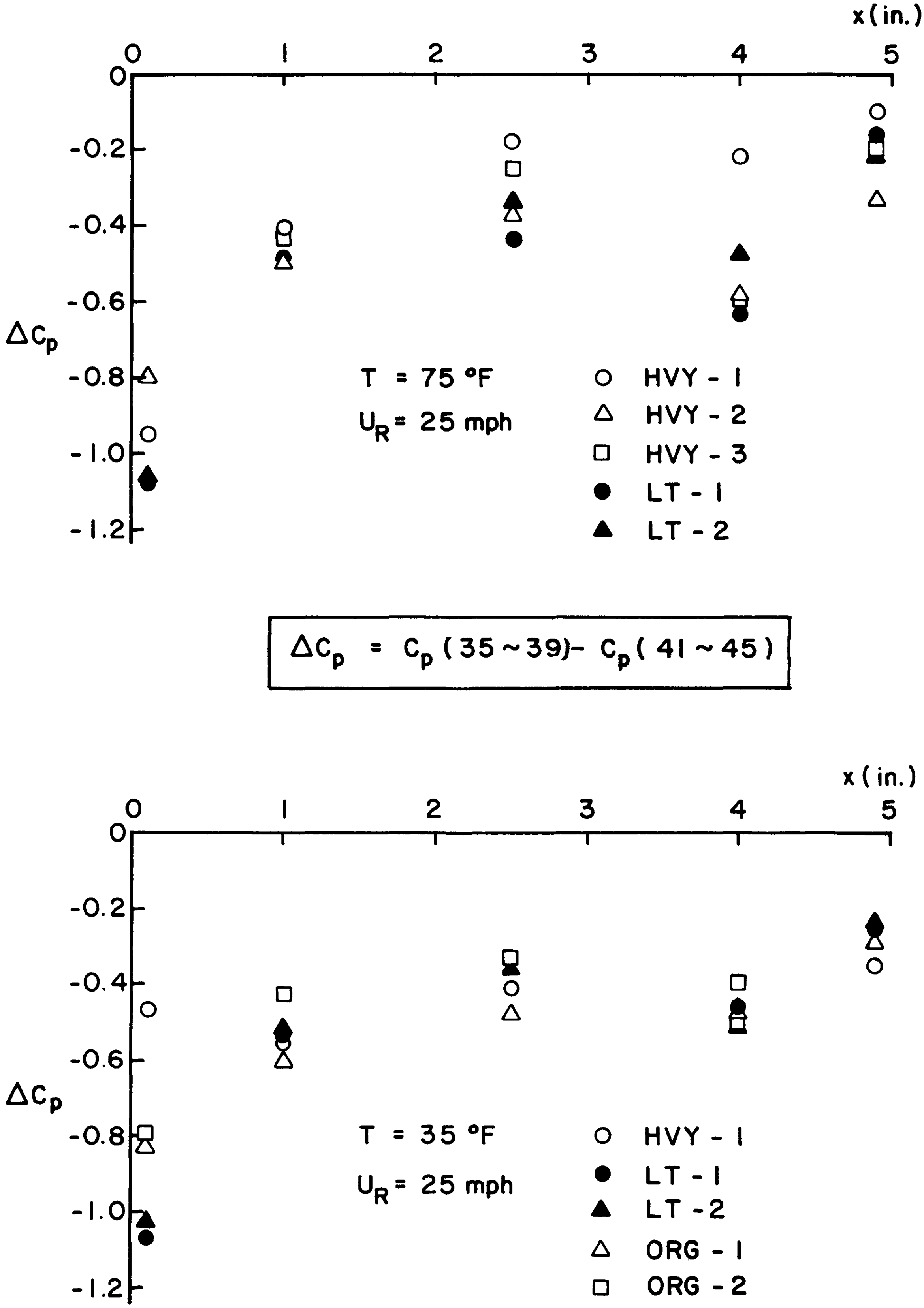
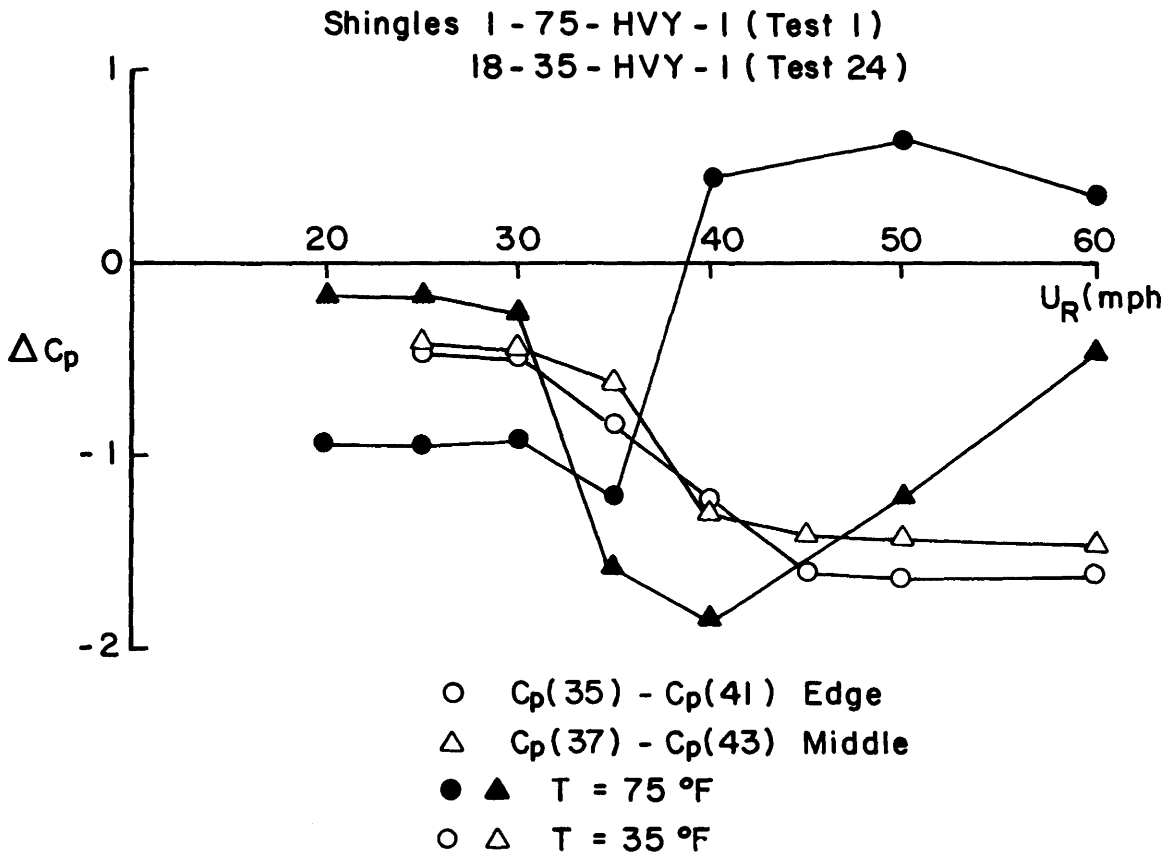


Figure 10. Variation of Pressure Difference Coefficient across a Shingle



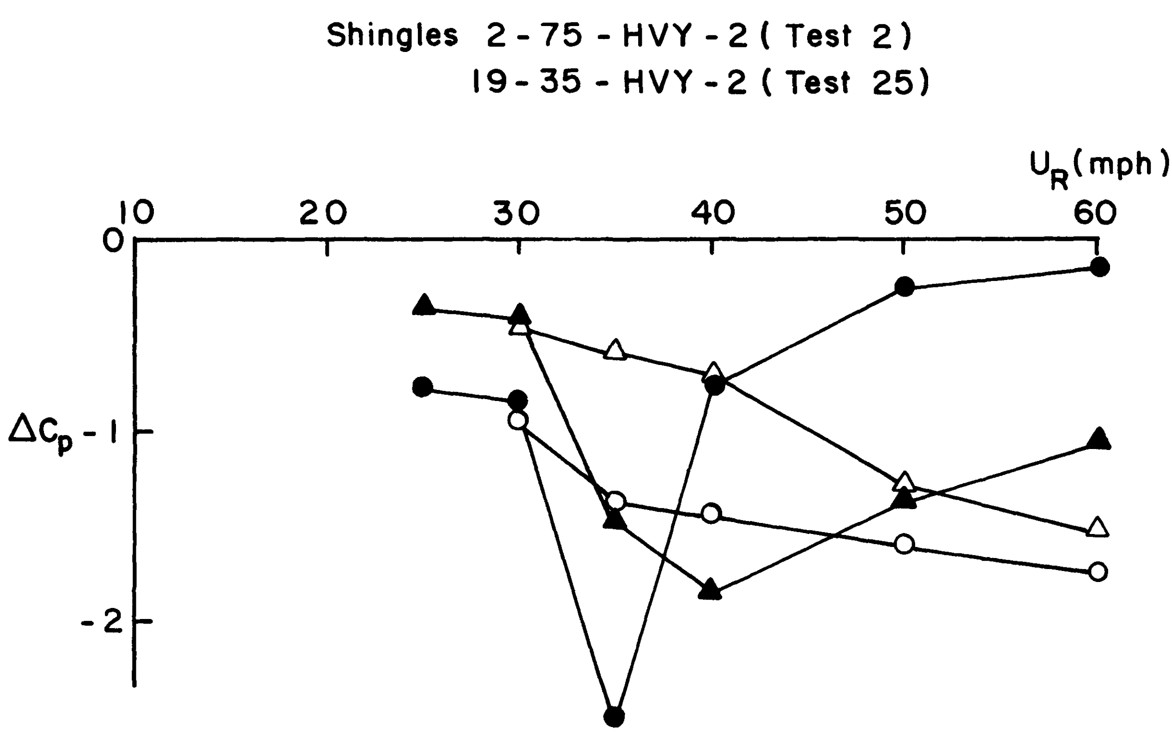
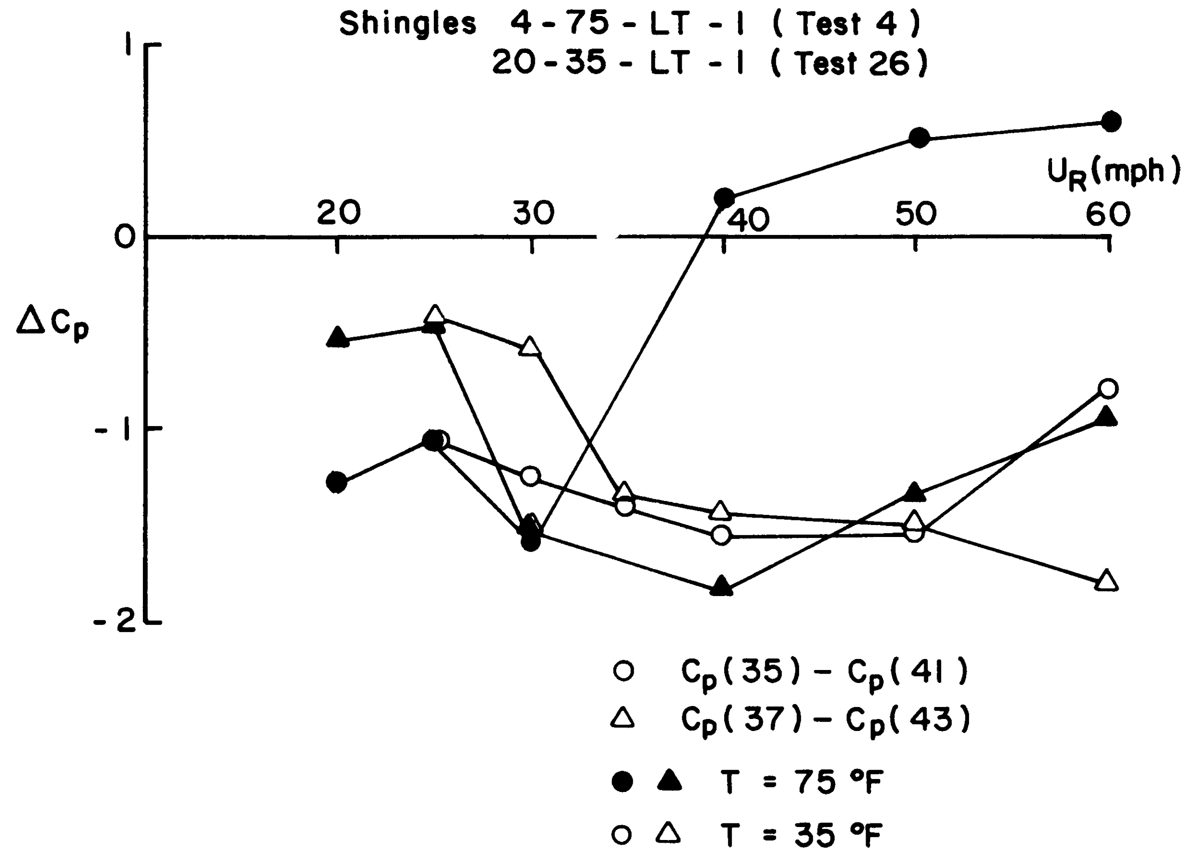


Figure 11. Variation of Pressure Difference Coefficient with Wind Speed



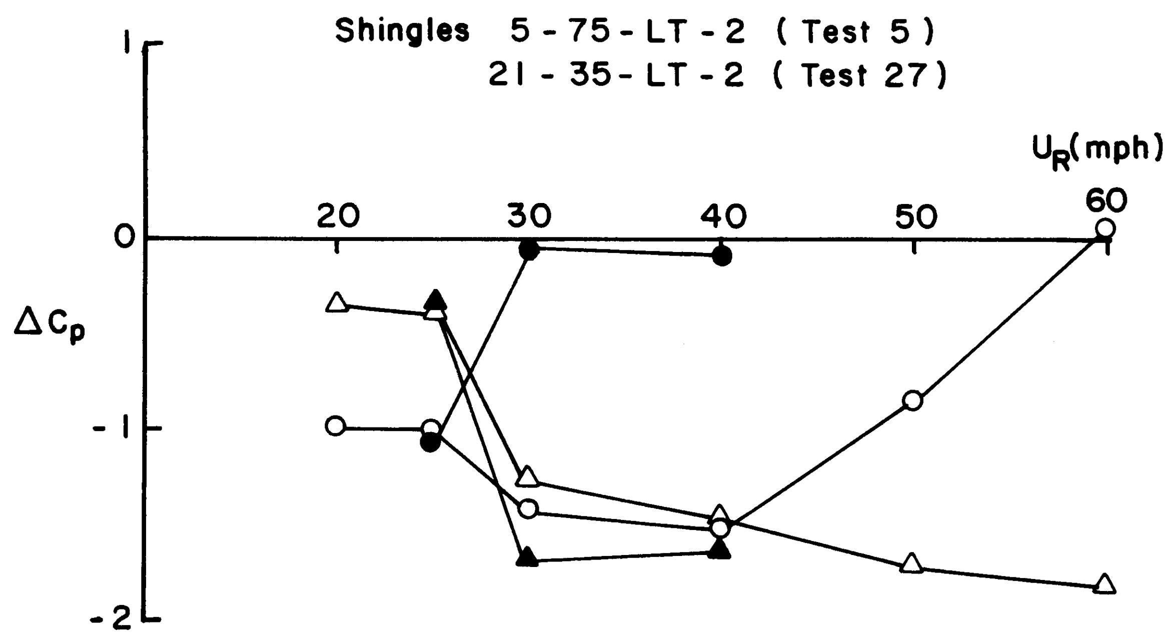


Figure 11. Variation of Pressure Difference Coefficient with Wind Speed

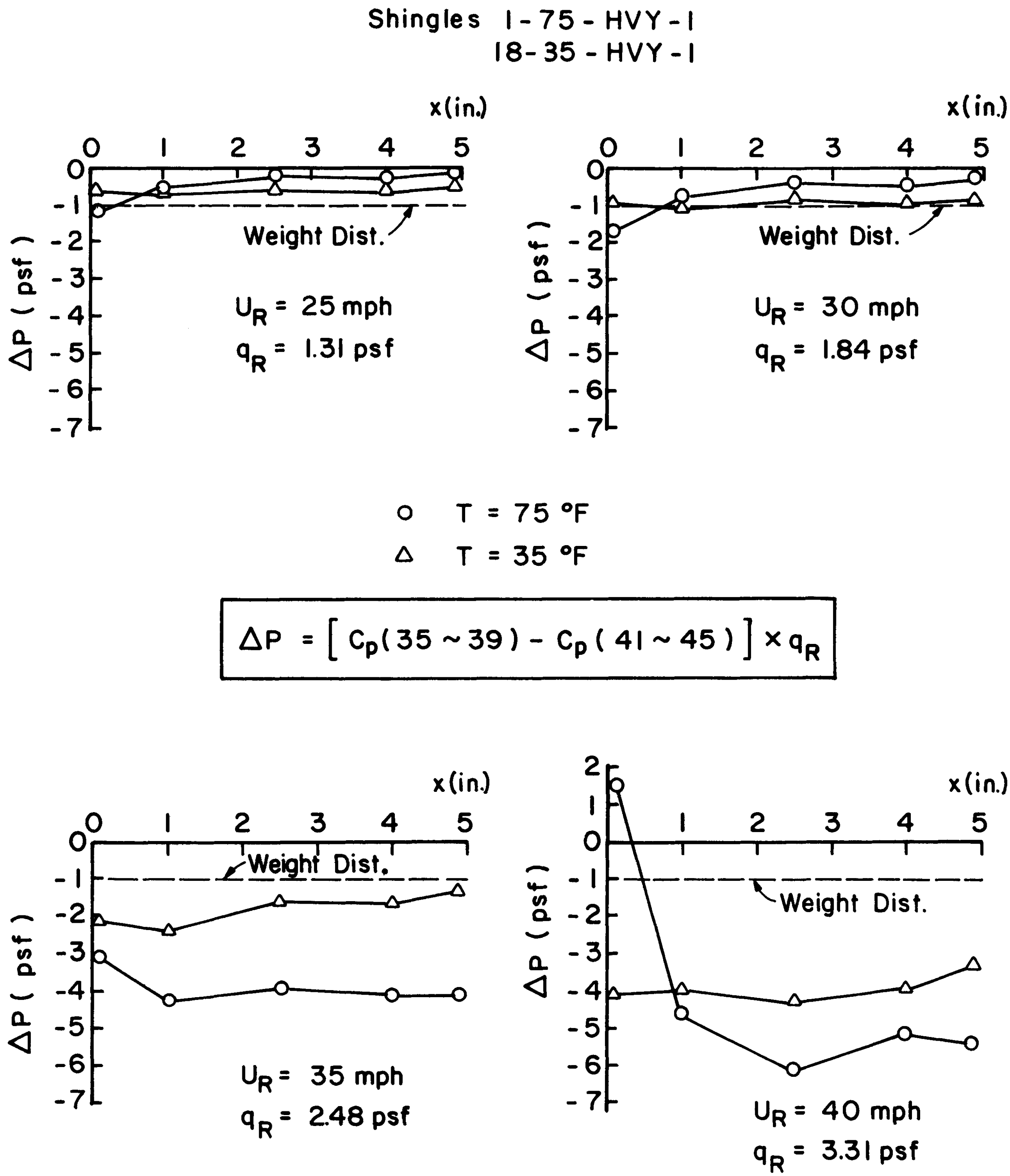


Figure 12. Pressure Difference on HVY-1 Shingles versus Position and Wind Speed

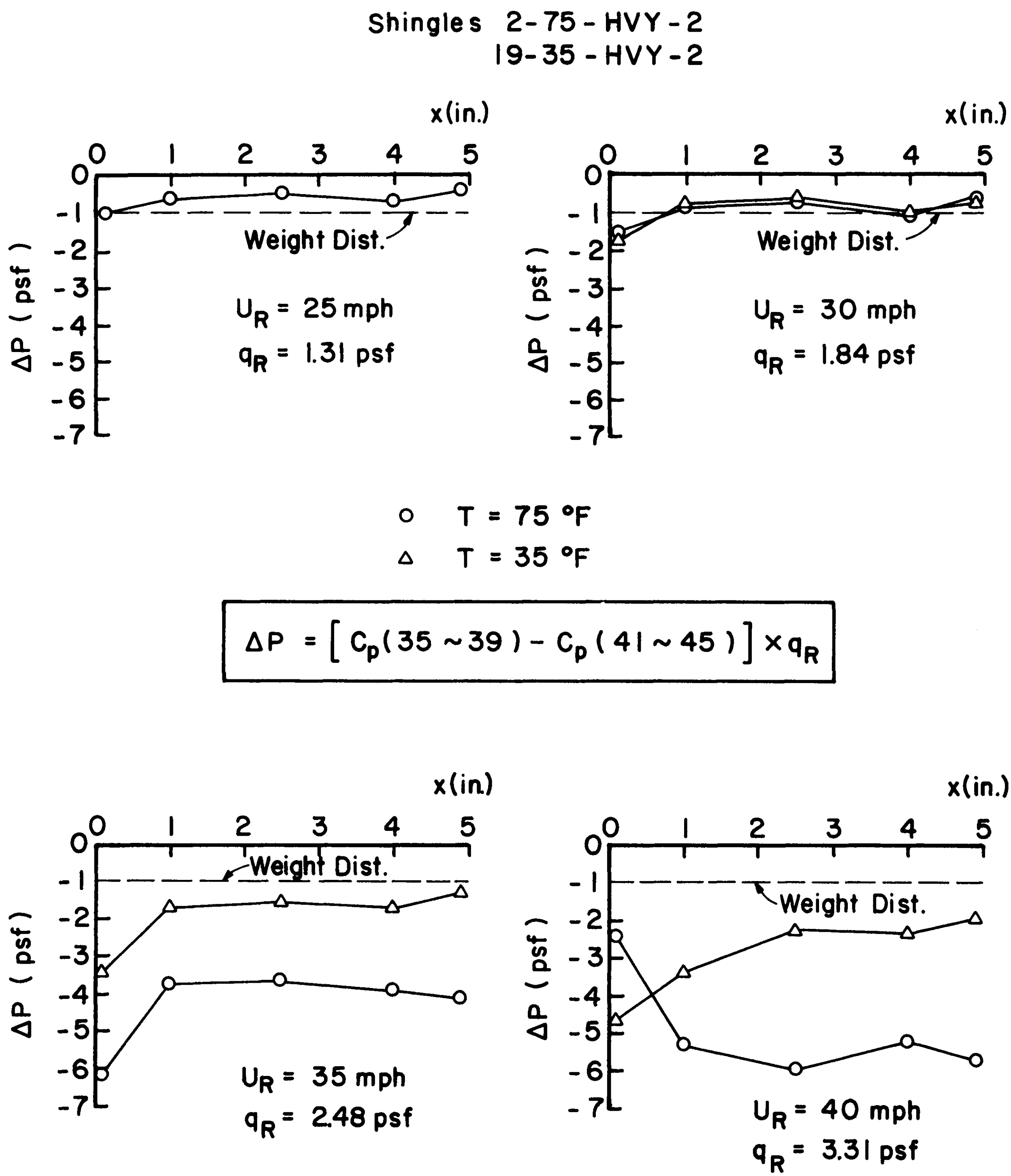


Figure 13. Pressure Difference on HVY-2 Shingles versus Position and Wind Speed

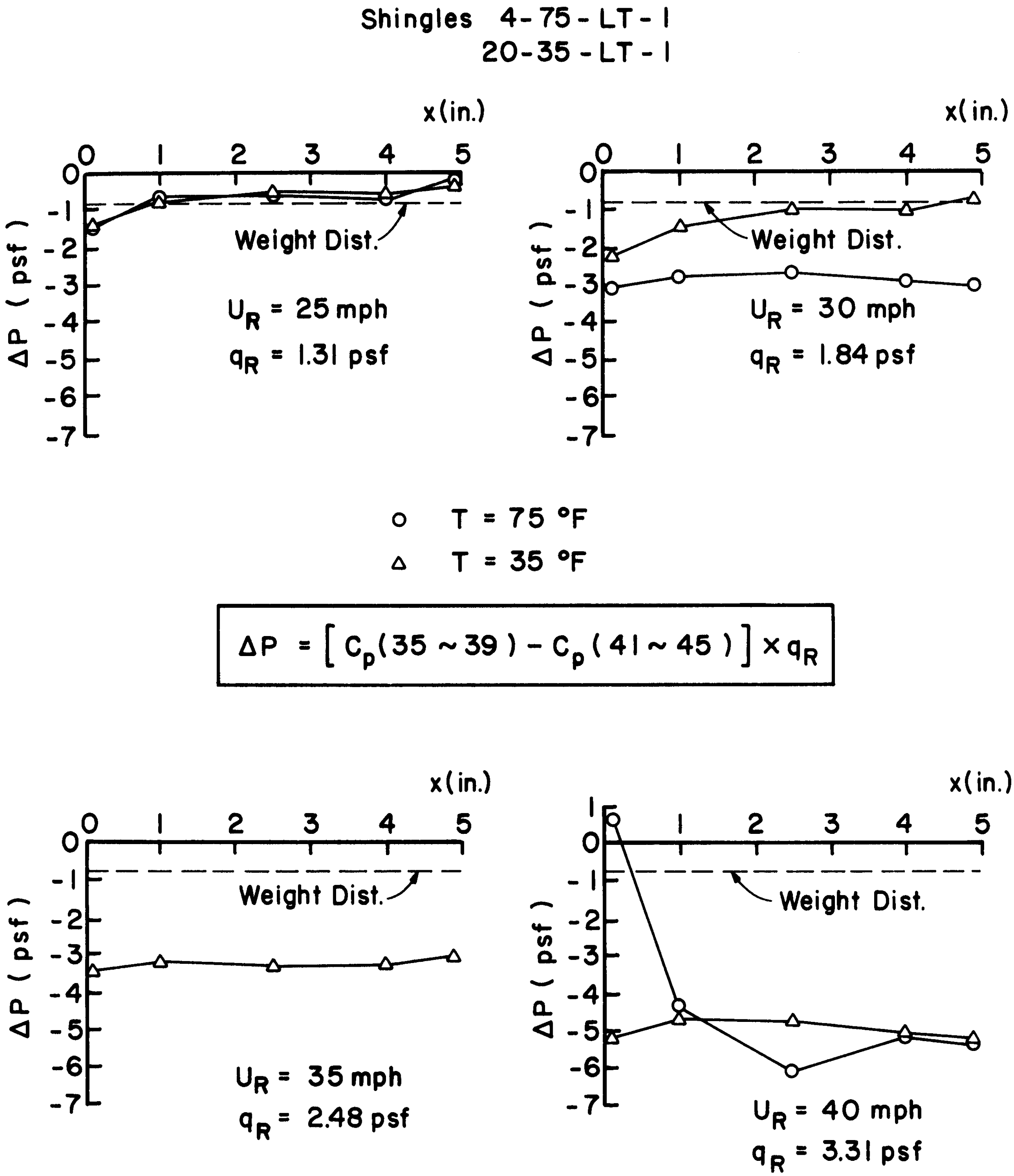


Figure 14. Pressure Difference on LT-1 Shingles versus Position and Wind Speed

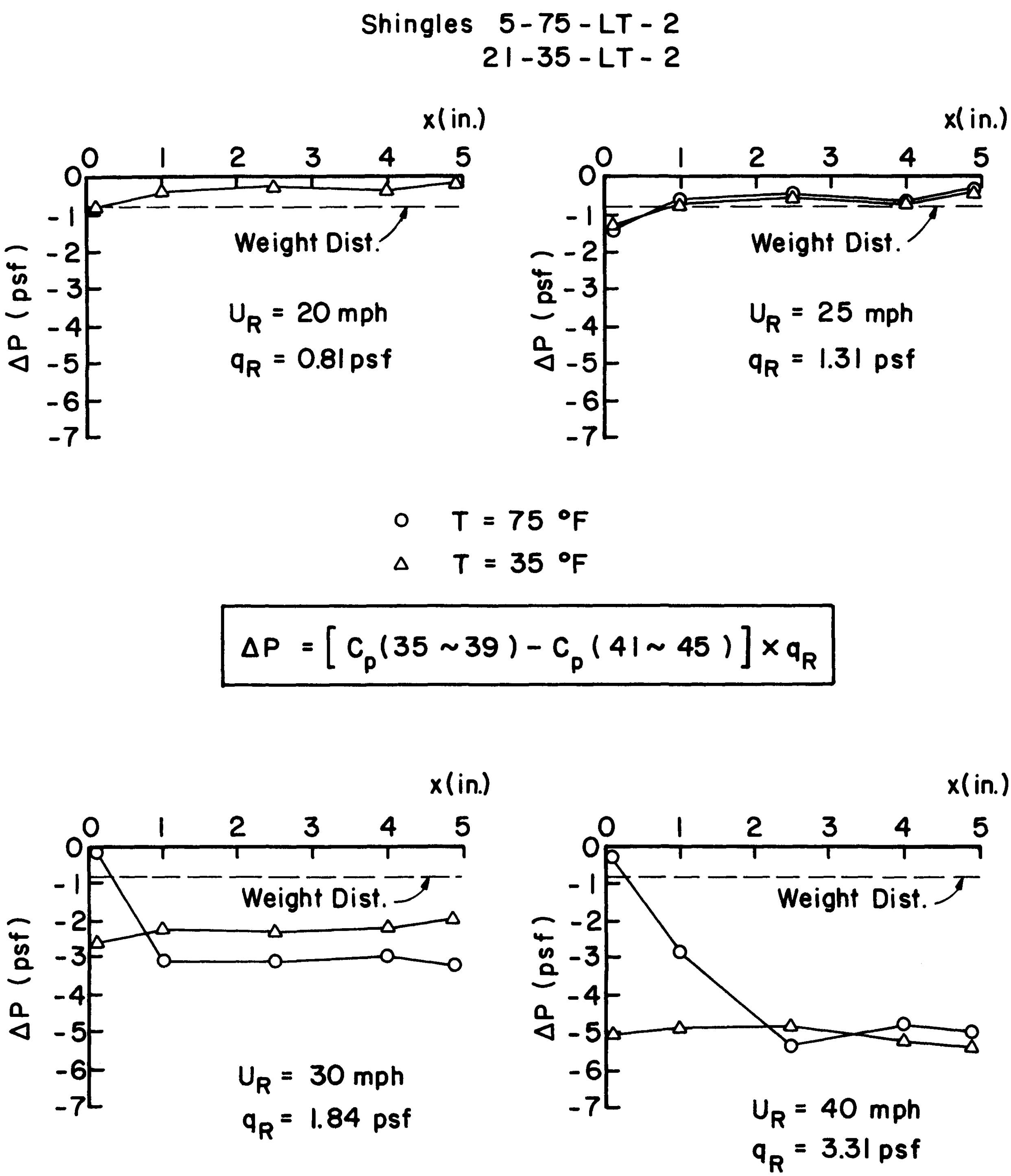


Figure 15. Pressure Difference on LT-2 Shingles versus Position and Wind Speed

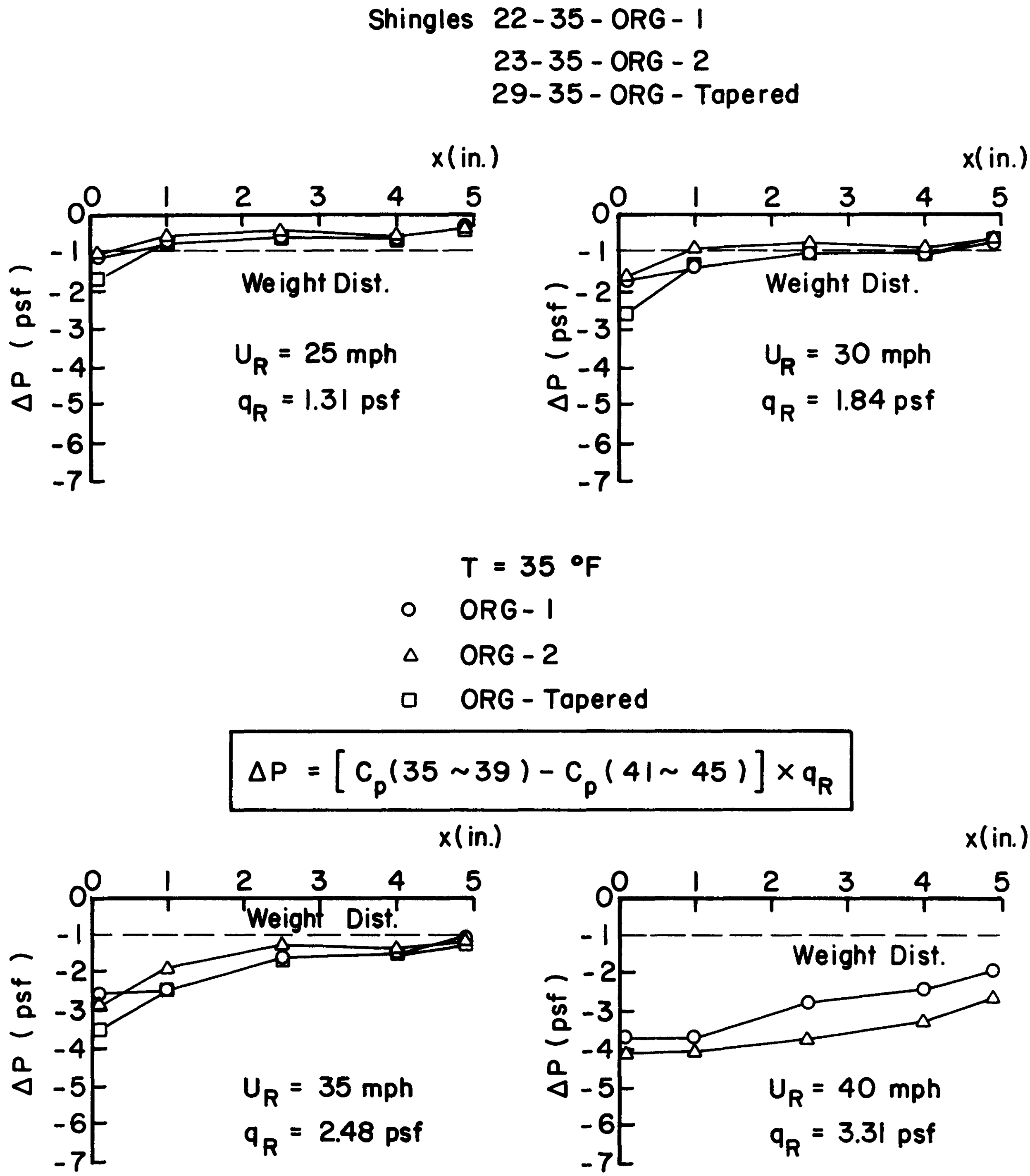


Figure 16. Pressure Difference on ORG Shingles versus Position and Wind Speed

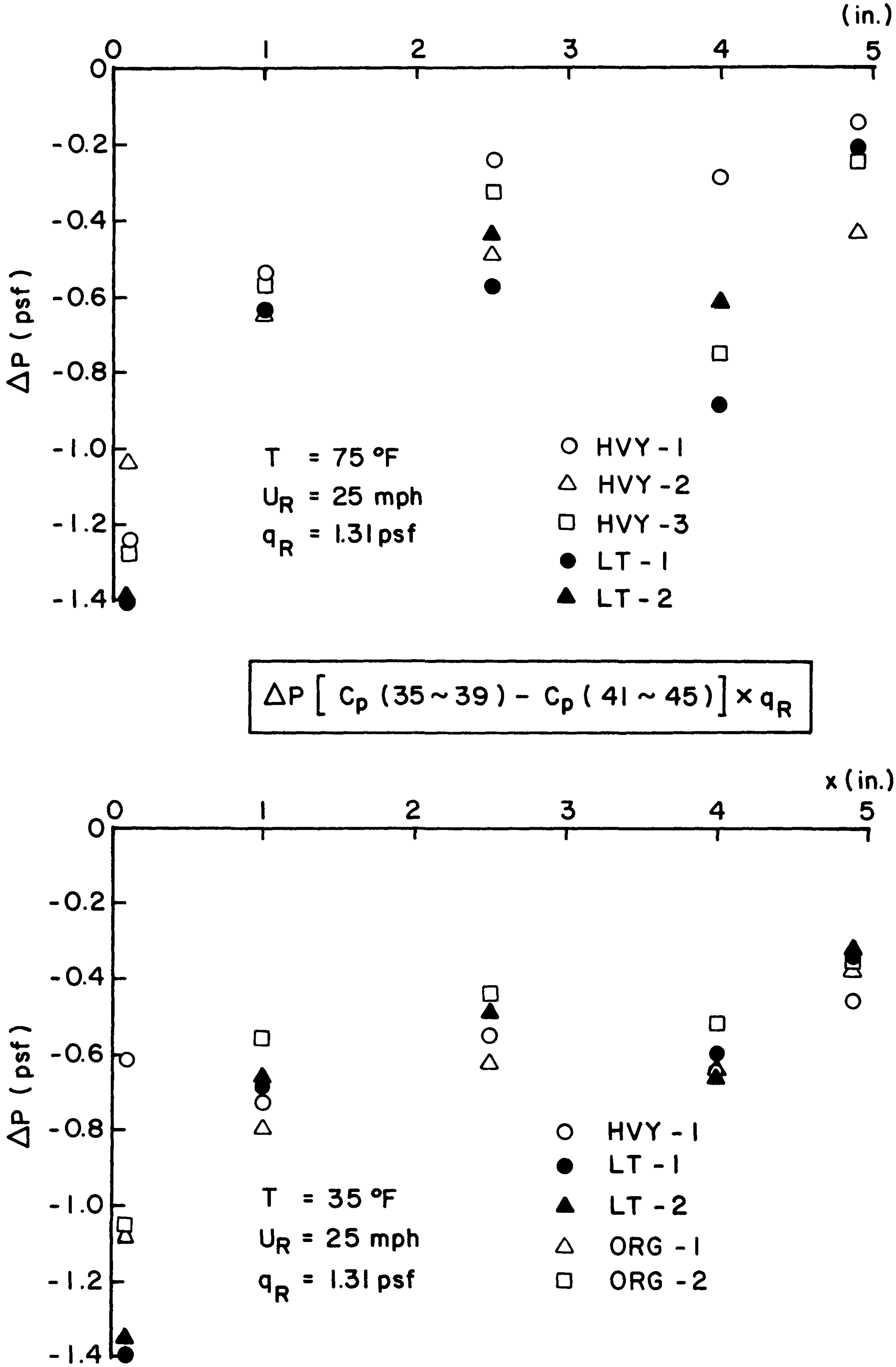


Figure 17. Pressure Difference Distribution across a Shingle

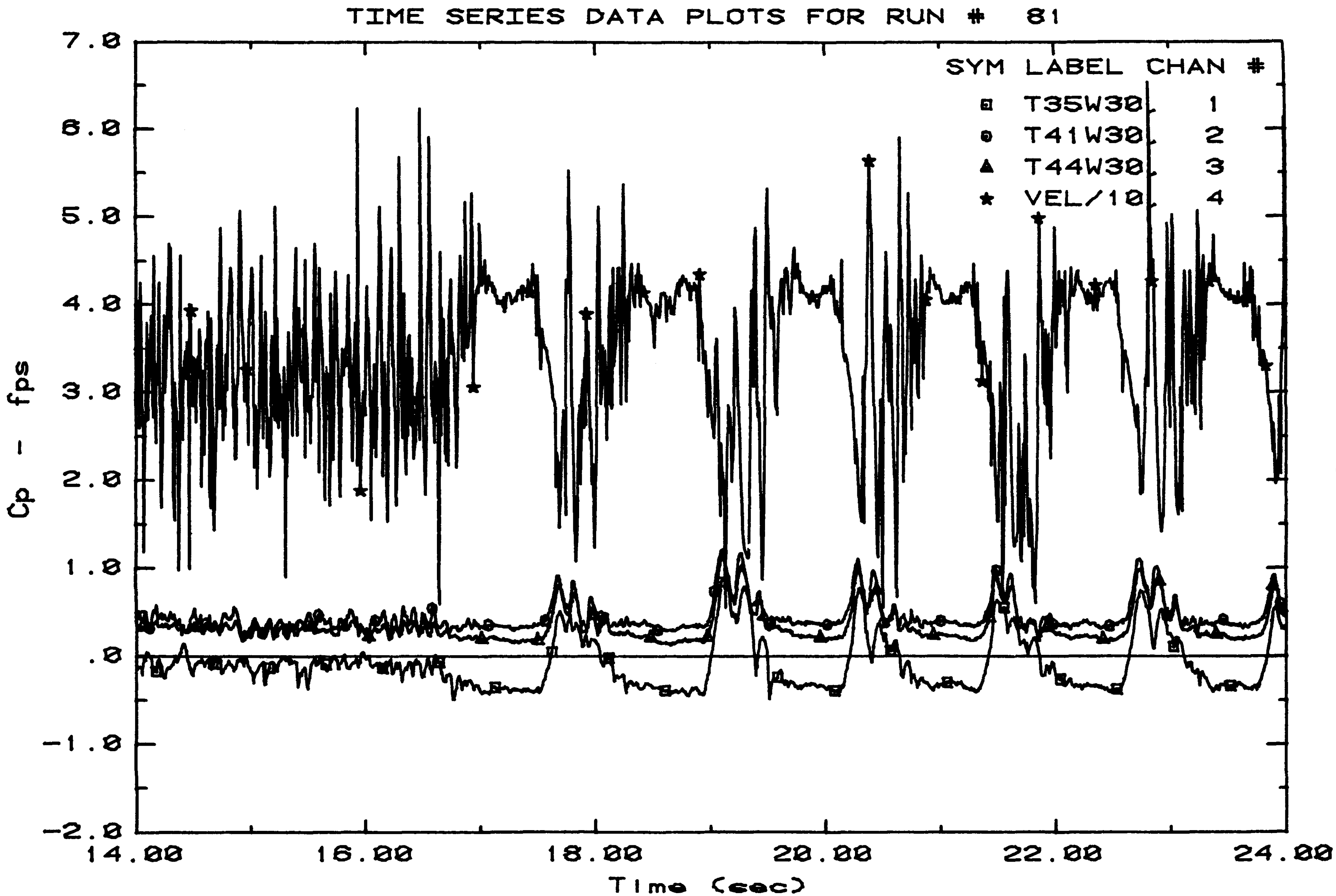


Figure 18. Velocity and C_p Values Measured during Run #81

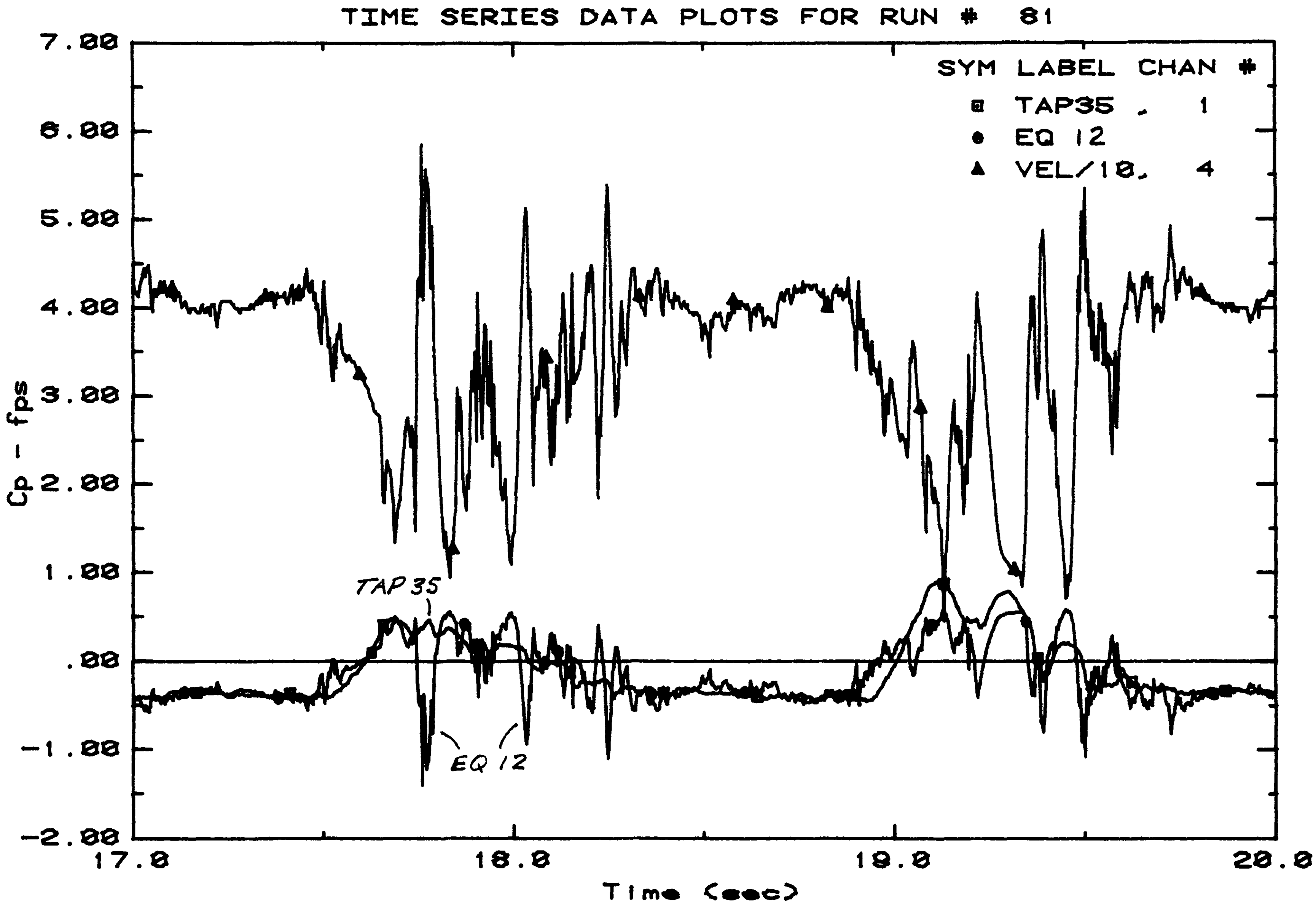


Figure 19. Comparison of Measured and Calculated C_p Values for Run #81

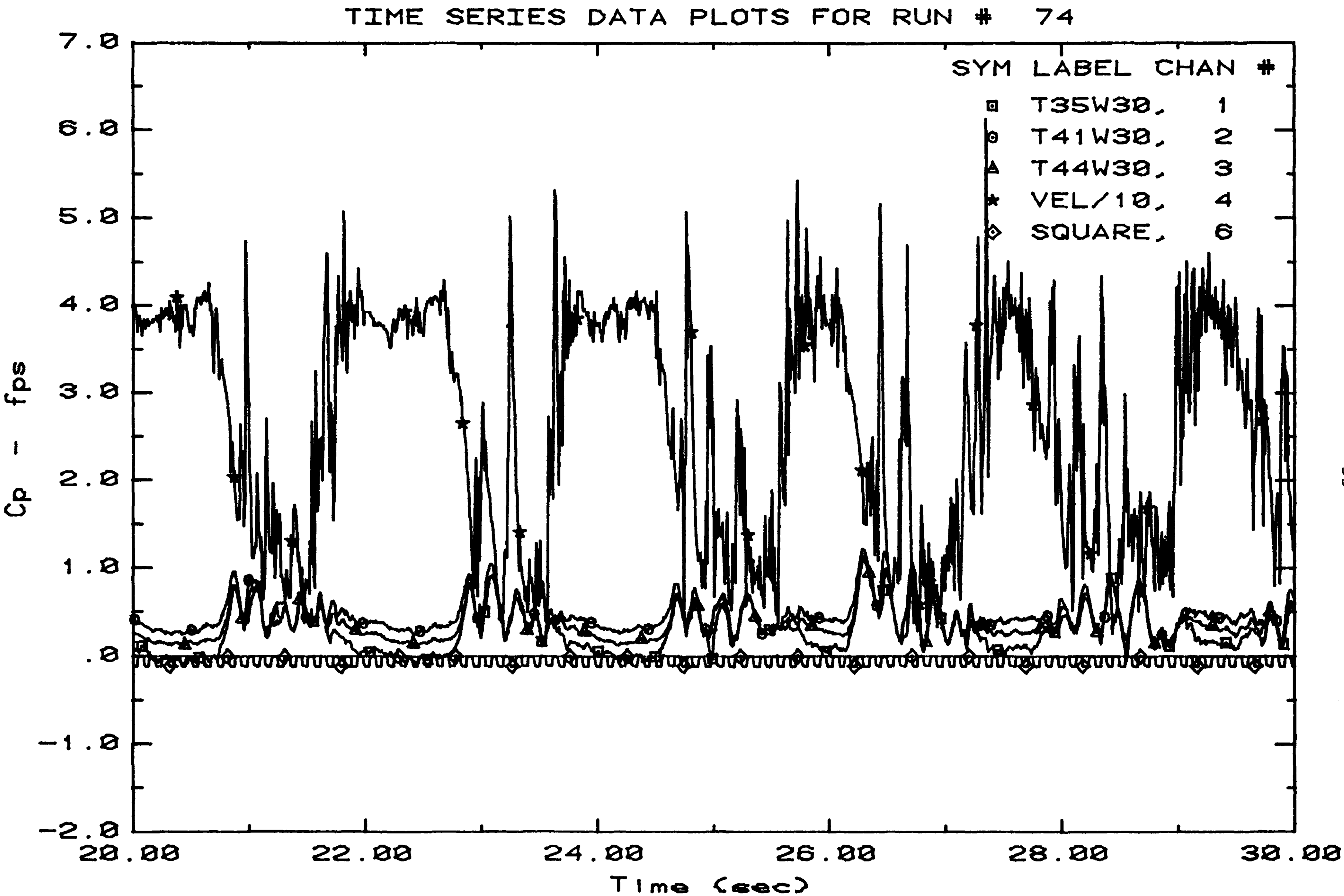


Figure 20. Velocity and C_p Values Measured during Run #74

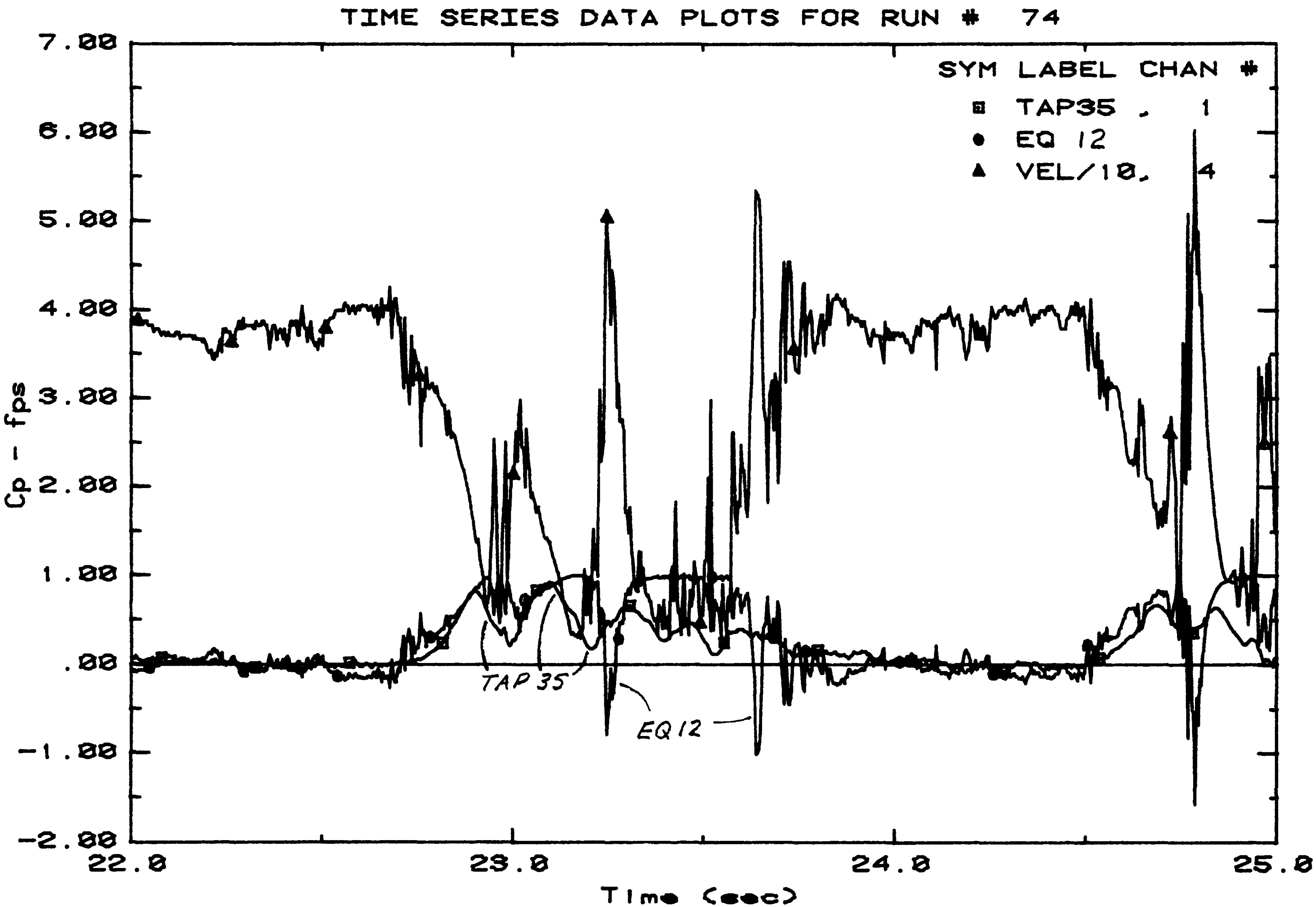


Figure 21. Comparison of Measured and Calculated C_p Values for Run #74

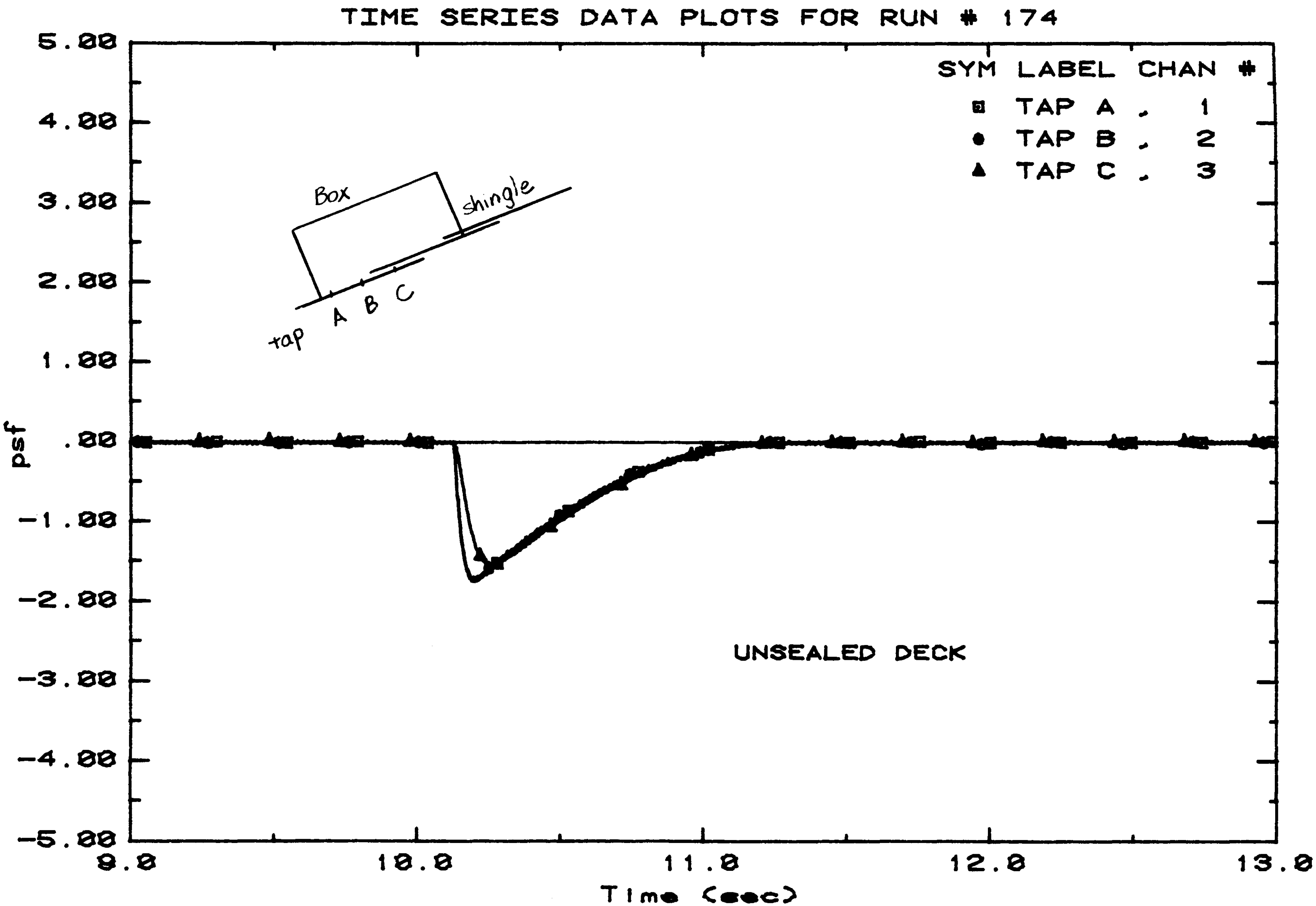


Figure 22. Results of the Suction Test for Run #174 with 10 psf Applied Suction With Unsealed Deck

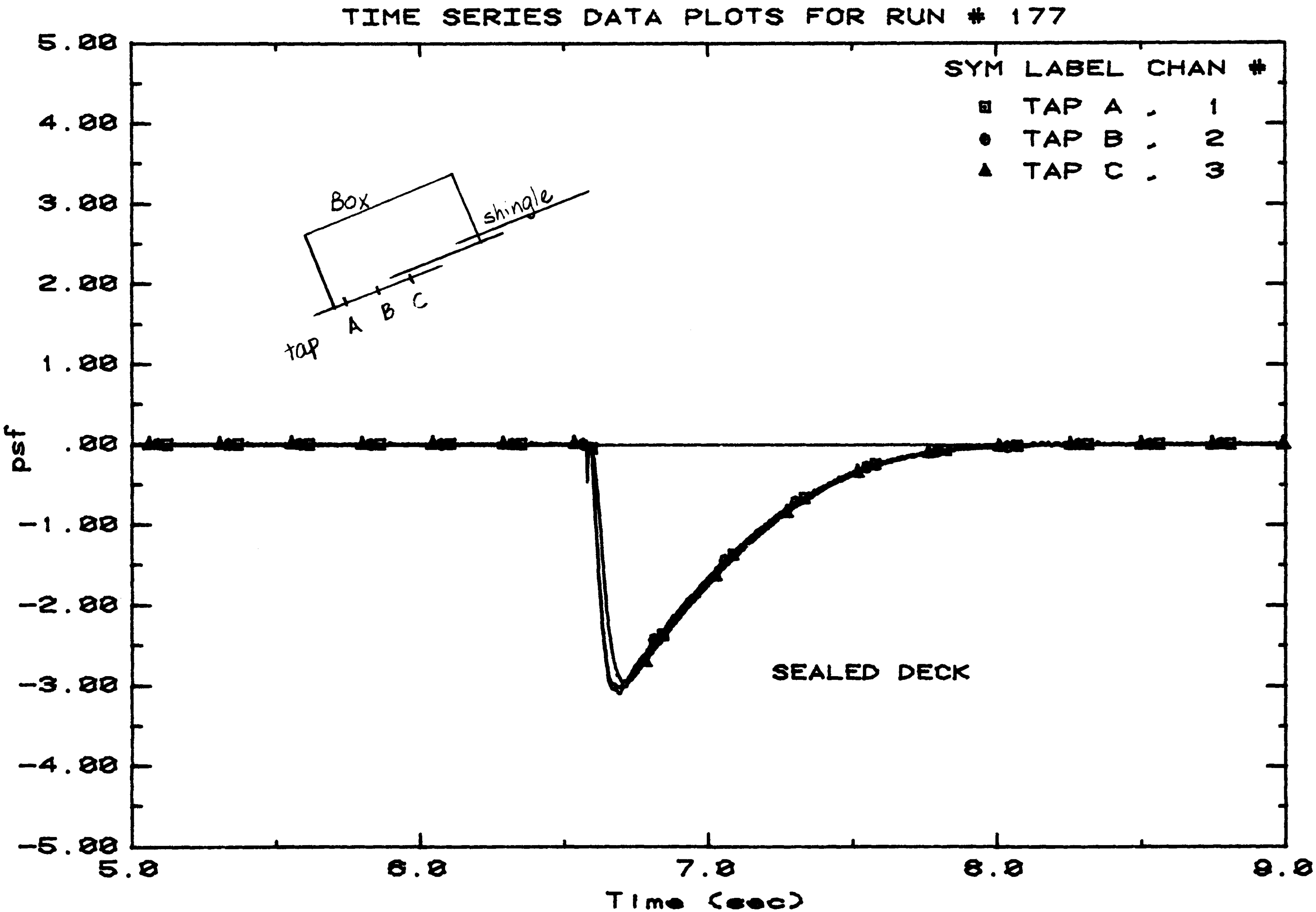


Figure 23. Results of the Suction Test for Run #177 with 10 psf Applied Suction with Sealed Deck

APPENDICES

APPENDIX 1

TEST PROGRAM

APPENDIX 1
TEST PROGRAM*

Test Number	Air Temperature (°)	Test Label	Configu-ration	Testing	wt/ft^2 (psf)
1	75	1-75-HVY-1	C	Pressure & Scol**	0.976
2	75	2-75-HVY-2	D	Pressure & Scol	1.003
3	75	3-75-HVY-3	E	Pressure & Scol	
4	75	4-75-LT-1	F	Pressure & Scol	0.777
5	75	5-75-LT-2	G	Pressure & Scol	0.770
6	75	6-75-LT-3	H	Pressure & Scol	
7	75	6-75-LT-3 w/gusting	I	Pressure & Scol w/gusting	
8	75	7-75-LT-4	J	Pressure & Scol w/gusting	
9	75	7-75-LT-4	K	Pressure & Scol w/gusting	
10	75	8-75-HVY-GUST	L	Pressure & Scol w/gusting	0.976
11	75	9-75-ORG-GUST	M	Pressure & Scol w/gusting	0.947
12	35	10-35-LT-GUST	N	Pressure & Scol w/gusting	0.853
13	35	10-35-LT-GUST	O	Pressure & Scol w/gusting	
14	35	11-35-HVY-GUST	P	Pressure & Scol w/gusting	0.922
15	35	12-35-ORG-GUST	Q	Pressure & Scol w/gusting	
16	35	-35-VMA-GUST	-	Videotape shingle action w/gusting	
17	35	-35-L92-GUST	-		
18	35	-35-JAX STD-GUST	-		
19	35	13-35-NOM-GUST	-		
20	35	14-35-DEM IMP-GUST	-		
21	35	15-35-XLT-GUST	-		
22	35	16-35-CHAP-GUST	-		
23	35	17-35-GIAS-GUST	-		
24	35	18-35-HVY-1	R	Pressure & Scol	1.003
25	35	19-35-HVY-2	S	Pressure & Scol	1.003
26	35	20-35-LT-1	T	Pressure & Scol	0.841
27	35	21-35-LT-2	U	Pressure & Scol	0.766
28	35	22-35-ORG-1	V	Pressure & Scol	
29	35	23-35-ORG-2	W	Pressure & Scol	
30	35	24-35-VMA-1	-	Videotape shingle action	
31	35	25-35-VMA-2	-		
32	35	26-35-L92-1	-		
33	35	27-35-L92-2	-		
34	35	28-35-GLASS-1	-		
35	35	29-35-CHAPP-1	-		
36	35	29-35-ORG-Tapered edge	X	Pressure & Scol	
37	-	unsealed	-	Suction	
38	-	sealed	-	Suction	

* See Section 2.5 for comments

** "Pressure" indicates steady state pressures at taps 1-50 "Scol" indicates time series records for taps 35,41,44 or 34, 38, 46

HEAVY WEIGHT SHINGLE TESTING AT 75° F

Test 1. 1-75-HVY-1, Videotape numbers 2 and 3, Configuration C, Datatape #1

MPH	Pressure	File Name	SCOL Run #	
15	015	C01502	32-2, 33-3	Videotape #1
20	020	C02002	34-2, 35-3	
25	025	C02502	36-2, 37-3	
30	030	C03002	38-2, 39-3	
35	035	C03502	40-2, 41-3	Videotape #2
40	040	C04002	42-2, 43-3	
50	050	C05002		
60	060	C06002		
70	070	C07002		

Test 2. 2-75-HVY-2, Videotape number 4, Configuration D, Datatape #1

MPH	Pressure	File Name	SCOL Run #
25	025	D02502	44-2, 45-3
30	030	D03002	46-2, 47-3
35	035	D03502	48-2, 49-3
40	040	D04002	-
50	050	D05002	-
60	060	D06002	-

Test 3. 3-75-HVY-3, Videotape number 5, Configuration E, Datatape #1

MPH	Pressure	File Name	SCOL Run #
25	025	E02502	52-2, 53-3
30	030	E03002	54-2, 55-3

Tap #9 blocked

LIGHT WEIGHT SHINGLES TESTING AT 75^{o} F

Test 4. 4-75-LT-1, Videotape number 6, Configuration F, Datatape #1

MPH	Pressure	File Name	SCOL Run #
20	020	F02002	57-2, 58-3
25	025	F02502	59-2, 60-3
30	030	F03002	61-2, 62-3
40	040	F04002	-
50	050	F05002	-
60	060	F06002	-

Test 5. 5-75-LT-2, Videotape number 7, Configuration G, Datatape #2

25	025	G02502	64-2, 65-3
30	030	G03002	66-2, 67-3
40	040	G04002	

Tap #34 leaked

Test 6. 6-75-LT-3, Videotape number 7, Configuration H, Datatape #2

25	025	H02502	68-2, 69-3
30	-		70-2, 71-3

Tap #9 blocked

75° F SHINGLE TESTING WITH GUSTING

Test 7. 6-75-LT-3, Videotape number 7-8, Configuration I, Datatapes #2
Tab was sealed down - videotaped
Tab uplift, gusting, smoke

MPH	Pressure	File Name	SCOL Run #
30	030	I03002	73-2, 74-3
40	040	I04002	75-2, 76-3 - (10/20)

Pressure taken with gusting blade horizontal. SCOL run 73-2 taken at 20 sec. of steady blade and 10 sec. of moving guster (20/10). SCOL run 74-3 taken at 10 sec. of stable blade, 20 sec. of moving guster (10/20)

Test 8. 7-75-LT-4, Videotape number 8, Configuration J, Datatape #2

30	030	J03002	77-2, 78-3 (5/10/15)

Scol taken with gusting blade horizontal for 5 sec., 10 sec. at fixed angle, 15 sec. of gusting (5/10/15)

Test 9. 7-75-LT-4, Videotape number 8, Configuration K, Datatape #3
Tab sealed down

30	030	K03002	80-2, 81-3 } (5/10/15)
40	040	K04002*	82-2, 83-3 } (5/10/15)

Test 10. 8-75-HVY-GUST, Videotape number 8, Configuration L, Datatape #3
SCOL only

30	-		84-2, 85-3, 86-3 (5/10/15)
40	-		87-2, gusting-uplift-gusting
			88-3, gusting-uplift-gusting

Test 11. 9-75-ORG-GUST, Videotape number 8, Configuration M, Datatape #3
SCOL only

30			89-2, 90-3 (5/10/15)
40			91-2, 92-3 (5/10/15)
50			Simple gusting-video only

*Data Lost

35° F SHINGLE TESTING WITH GUSTING

Test 12. 10-35-LT-GUST, Videotape number 8, Configuration N, Datatape #3

MPH	Pressure	File Name	SCOL Run #
30	130	N13002*	93-2, 94-3 (5/10/15)
40	-		95-2, uplift and gust
			96-3, uplift and gust
50	-		video only

Test 13. 10-35-LT-GUST, sealed tab, Videotape number 8, Configuration O, Datatape #3

30	130	013002	97-2, 98-3 (5/10/15)
40	-		99-2, 100-3 (10/20)

Test 14. 11-35-HVY-GUST, Videotape number 8, Configuration P, Datatape #4
SCOL only

30	101-2, 102-3 (5/10/15)
40	103-2, uplift and gust
	104-3, uplift and gust
50	video only

Test 15. 10-35-ORG-GUST, Videotape number 8, Configuration Q, Datatape #4
SCOL only

30	105-2, 106-3 (5/10/15)
40	107-2, uplift and gust (15/15)
	108-3, uplift and gust (15/15)
50	video only

*Data Lost

VIDEOTAPING VARIETY OF SHINGLES AT 35° F

with gusting

Test 16.	-35-UMA-GUST	Videotape #9
Test 17.	-35-L92-GUST	
Test 18.	-35-JAX STD-GUST	
Test 19.	13-35-NOM-GUST	Videotape #10 -40 mph 1 min, 50 mph 2 min, 60 mph 2 min, GUST 60 mph 2 min
Test 20.	14-35-DEM IMP-GUST	
Test 21.	15-35-XLT-GUST	
Test 22.	16-35-CHAP-GUST	Videotape #10 Gust at 40, 60 mph for 3 min each
Test 23.	17-35-GLAS-GUST	

HEAVY WEIGHT SHINGLE TESTING AT 35° F

Test 24. 18-35-HUY-1, Videotape number 11, Configuration R, Datatape #5

MPH	Pressure	File Name	SCOL Run #
25	125	R12502	113-2, 114-3
30	130	R13002	115-2, 116-3
35	135	R13502	117-2, 118-3
40	140	R14002	119-2, 120-3
45	145	R14502	122-2, 123-3
50	150	R15002	-
60	160	R16002	-

Test 25. 19-35-HUY-2, Videotape number 11, Configuration S, Datatape #5

MPH	Pressure	File Name	SCOL Run #
30	130	S13002	124-2, 125-3
35	135	S13502	127-2, 128-3
40	140	S14002	-
50	150	S15002	-
60	160	S16002	-

LIGHT WEIGHT SHINGLE TESTING AT 35° F

Test 26. 20-35-LT-1, Videotape number 11, Configuration T, Datatape #6

MPH	Pressure	File Name	SCOL Run #
25	125	T12502	129-2, 130-3
27	130	T13002	131-2, 132-3
35	135	T13502	133-2, 134-3
40	140	T14002	-
50	150	T15002	-
60	160	T16002	-

Test 27. 21-35-LT-2, Videotape number 11, Configuration U, Datatape #6

MPH	Pressure	File Name	SCOL Run #
20	120	U12002	135-2, 136-3
25	125	U12502	137-2, 138-3
30	130	U13002	139-2, 140-3
40	140	U14002	-
50	150	U15002	-
60	160	U16002	-

ORGANIC SHINGLE TESTING AT 35° F

Test 28. 22-35-ORG-1, Videotape numbers 11 and 12, Configuration V, Datatape #6

MPH	Pressure	File Name	SCOL Run #
20	120	V12002	141-2, 142-3
25	125	V12502	143-2, 144-3
30	130	V13002	145-2, 146-3
35	135	V13502	147-2, 148-3
40	140	V14002	-
50	150	V15002	-
60	160	V16002	-

Test 29. 23-35-ORG-1, Videotape number 12, Configuration W, Datatape #6

25	125	W12502	149-2, 150-3
30	130	W13002	150-2, 151-3
35	135	W13502	153-2, 154-3
40	140	W14002	-
50	150	W15002	-
60	160	W16002	-

Test 36. 30-35-ORG, tapered edge-1, Videotape number 12, Configuration X

20	120	X12002	158-2, 159-3
25	125	X12502	160-2, 161-3
30	130	X13002	162-2, 163-3
35	135	X13502	164-2, 165-3

Taps 1, 4 and 9 blocked

PREVIOUS PHASE I SHINGLE TESTING AT 35° F

videotape only with commentary

PHASE I TEST

Time (min)	MPH
01 (1)	40
03 (2)	50
08 (5)	60
13 (5)	70
18 (5)	Stop wind, singe relaxig
23 (5)	commentary

Test	Specimen	Videotape
Test 30.	24-35-VMA-1	Videotape #13
Test 31.	25-35-VMA-2	
Test 32.	26-35-L92-1	Videotape #14
Test 33.	27-35-L92-2	
Test 34.	28-35-GLASSLOCK-1	Videotape #15
Test 35.	29-35-CHAPARRAL-1	

* The Chaparral Shingles (35) tested at 50 mph for 30 min.

SUCTION TEST

Test 37. Unsealed deck

		SCOL Run #	
0.5 PSF	@ 3 sec	172	cannot get pure vacuum with setup
2.0 PSF	@ 4 sec	173	
9.0 PSF	@ 10 sec	174	

plot - 9 sec. for 3 sec. for Run 174

10 PSF	@ :21 sec.	175	N.G. - not in valve position
10 PSF	@ : 6 sec.	176	

Test 38. Sealed deck

10 PSF	@ : 6 sec.	177

APPENDIX 2

PRESSURE COEFFICIENTS

DATA FOR PROJECT 5590 CONFIGURATION C WIND 15 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.222	.038	.351	.091	18	-.264	.041	-.122	-.423	35	-.605	.049	-.417	-.754
2	-.280	.041	-.133	-.452	19	-.104	.027	-.014	-.207	36	-.045	.020	.014	-.114
3	-.050	.016	.009	-.086	20	-.037	.028	.082	-.122	37	-.033	.021	.044	-.109
4	-.029	.027	.056	-.098	21	.009	.030	.118	-.086	38	-.122	.019	-.045	-.184
5	.059	.029	.150	-.038	22	.159	.045	.339	.016	39	.017	.021	.083	-.056
6	.180	.033	.304	.056	23	-.449	.043	-.295	-.618	40	-.576	.029	-.452	-.661
7	-.356	.037	-.227	-.499	24	.191	.028	.281	.097	41	.338	.029	.446	.221
8	.356	.048	.552	.174	25	-.014	.029	.097	-.111	42	.369	.023	.444	.281
9	-20.15	.027	-20.02	-20.27	26	-.026	.031	.085	-.134	43	.146	.020	.203	.070
10	.020	.027	.115	-.074	27	.230	.038	.362	.074	44	.098	.020	.178	.022
11	.251	.044	.434	.056	28	.310	.056	.500	.039	45	.076	.018	.142	.025
12	.302	.036	.431	.166	29	-.071	.050	.108	-.249	46	.377	.046	.526	.200
13	-.074	.059	.118	-.303	30	.006	.032	.120	-.122	47	.366	.038	.491	.212
14	.075	.033	.178	-.026	31	.087	.027	.166	-.018	48	.132	.029	.223	.025
15	.102	.028	.203	.010	32	.191	.031	.316	.097	49	.101	.028	.200	.014
16	.139	.030	.239	.058	33	.294	.048	.477	.097	50	.077	.027	.177	-.021
17	.242	.048	.479	.082	34	-.605	.039	-.440	-.719					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 20 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.212	.036	.351	.081	18	-.283	.040	-.153	-.423	35	-.615	.055	-.409	-.752
2	-.306	.041	-.146	-.466	19	-.118	.026	.007	-.219	36	-.052	.020	.010	-.109
3	-.070	.008	-.047	-.097	20	-.050	.026	.051	-.146	37	-.042	.018	.017	-.104
4	-.044	.024	.046	-.111	21	.004	.026	.095	-.110	38	-.121	.020	-.060	-.186
5	.043	.027	.138	-.054	22	.171	.042	.334	.038	39	.002	.020	.080	-.081
6	.164	.030	.280	.060	23	-.454	.041	-.292	-.608	40	-.592	.033	-.458	-.710
7	-.373	.039	-.246	-.537	24	.202	.021	.279	.134	41	.326	.027	.408	.195
8	.338	.049	.514	.173	25	-.011	.027	.079	-.106	42	.353	.026	.423	.241
9	-1.078	.026	-1.013	-1.134	26	-.019	.027	.079	-.099	43	.136	.018	.197	.065
10	.006	.024	.095	-.082	27	.232	.037	.361	.073	44	.098	.017	.146	.036
11	.227	.043	.394	.038	28	.313	.054	.512	.107	45	.080	.018	.136	.017
12	.305	.034	.459	.146	29	-.076	.048	.100	-.257	46	.367	.044	.500	.227
13	-.096	.058	.131	-.343	30	.011	.030	.107	-.113	47	.352	.040	.500	.185
14	.070	.028	.175	-.044	31	.093	.027	.217	.004	48	.130	.027	.220	.024
15	.097	.026	.189	-.000	32	.189	.029	.279	.086	49	.102	.027	.192	.010
16	.134	.027	.219	.029	33	.296	.045	.444	.114	50	.081	.027	.171	-.039
17	.243	.044	.401	.087	34	-.628	.038	-.479	-.752					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.217	.035	.334	.079	18	-.307	.041	-.170	-.442	35	-.631	.052	-.448	-.831
2	-.314	.039	-.159	-.467	19	-.137	.024	-.064	-.221	36	-.055	.018	.011	-.113
3	-.069	.007	-.047	-.096	20	-.069	.023	.009	-.143	37	-.042	.016	.020	-.091
4	-.044	.021	.029	-.123	21	-.022	.025	.074	-.124	38	-.119	.018	-.033	-.179
5	.044	.026	.128	-.069	22	.169	.041	.318	.028	39	-.010	.022	.055	-.091
6	.167	.029	.280	.065	23	-.462	.040	-.310	-.595	40	-.624	.034	-.492	-.729
7	-.369	.038	-.212	-.494	24	.204	.023	.271	.110	41	.321	.027	.401	.217
8	.346	.044	.504	.190	25	-.012	.025	.076	-.115	42	.352	.025	.416	.275
9	2.369	.015	2.400	2.320	26	-.019	.026	.067	-.106	43	.139	.018	.203	.079
10	.008	.023	.083	-.091	27	.236	.037	.370	.093	44	.104	.018	.157	.046
11	.232	.043	.374	-.002	28	.319	.051	.496	.084	45	.095	.019	.152	.015
12	.298	.033	.429	.129	29	-.081	.052	.115	-.249	46	.366	.046	.539	.169
13	-.117	.058	.083	-.308	30	.007	.031	.119	-.097	47	.350	.039	.535	.200
14	.060	.027	.148	-.041	31	.091	.025	.180	.006	48	.139	.028	.226	.033
15	.088	.026	.175	-.037	32	.189	.030	.279	.076	49	.116	.027	.200	.028
16	.122	.026	.212	.023	33	.298	.044	.478	.089	50	.096	.027	.187	-.016
17	.233	.042	.392	.083	34	-.657	.040	-.505	-.769					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.210	.034	.311	.088	18	-.297	.040	-.170	-.438	35	-.624	.054	-.440	-.796
2	-.312	.038	-.194	-.442	19	-.128	.024	-.041	-.212	36	-.061	.018	-.005	-.122
3	-.070	.007	-.041	-.094	20	-.060	.023	.030	-.137	37	-.041	.017	.019	-.103
4	-.046	.021	.028	-.122	21	-.013	.025	.066	-.112	38	-.116	.019	-.067	-.175
5	.040	.025	.119	-.056	22	.159	.040	.297	.034	39	-.019	.022	.063	-.094
6	.159	.028	.248	-.050	23	-.461	.037	-.334	-.597	40	-.622	.037	-.477	-.734
7	-.356	.036	-.226	-.486	24	.203	.022	.269	.105	41	.309	.026	.386	.195
8	.336	.043	.534	.185	25	-.013	.026	.080	-.109	42	.352	.024	.434	.270
9	3.356	.019	3.398	3.313	26	-.019	.025	.059	-.097	43	.165	.018	.221	.098
10	.012	.024	.079	-.072	27	.225	.036	.379	.062	44	.133	.017	.182	.066
11	.228	.041	.374	.019	28	.311	.052	.476	.129	45	.124	.020	.184	.057
12	.300	.031	.398	.166	29	-.085	.050	.080	-.261	46	.356	.043	.511	.202
13	-.118	.055	.066	-.318	30	.004	.030	.105	-.097	47	.350	.037	.517	.211
14	.064	.026	.163	-.054	31	.087	.025	.181	-.011	48	.160	.031	.258	.051
15	.090	.025	.179	-.002	32	.185	.031	.278	.077	49	.143	.028	.242	.045
16	.122	.026	.214	.027	33	.294	.045	.446	.059	50	.126	.028	.215	.026
17	.232	.038	.366	.079	34	-.698	.042	-.555	-.851					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 35 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.194	.029	.301	.081	18	-.087	.039	.067	-.224	35	-.804	.044	-.611	-.938
2	-.357	.038	-.218	-.478	19	-.014	.028	.079	-.133	36	-.774	.038	-.662	-.904
3	-.115	.009	-.084	-.149	20	-.094	.032	.005	-.240	37	-.784	.038	-.659	-.914
4	-.115	.021	-.040	-.186	21	-.286	.043	-.145	-.462	38	-.789	.032	-.671	-.913
5	-.047	.025	.051	-.140	22	-.161	.086	.100	-.538	39	-.772	.030	-.662	-.865
6	.069	.026	.148	-.017	23	-.908	.091	-.658	-1.268	40	-.810	.032	-.710	-.931
7	-.490	.036	-.374	-.640	24	.249	.020	.325	.163	41	.407	.064	.621	-.079
8	.321	.041	.452	.190	25	.649	.079	.904	.269	42	.933	.055	1.061	.673
9	1.824	.017	1.883	1.776	26	.611	.072	.853	.307	43	.786	.047	.897	.625
10	.197	.033	.301	.044	27	.451	.034	.555	.325	44	.889	.046	1.004	.699
11	.318	.034	.443	.132	28	.517	.045	.661	.309	45	.899	.047	1.022	.723
12	.412	.029	.494	.310	29	.313	.040	.454	.167	46	.619	.072	.869	.220
13	-.024	.039	.136	-.145	30	.413	.033	.557	.253	47	.552	.123	.910	.063
14	.199	.025	.284	.103	31	.539	.038	.686	.400	48	.858	.074	1.070	.467
15	.232	.026	.322	.151	32	.595	.055	.614	.336	49	.874	.067	1.073	.632
16	.247	.028	.353	.105	33	.597	.054	.798	.327	50	.895	.069	1.120	.618
17	.292	.033	.401	.174	34	-.776	.037	-.634	-.881					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 40 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.202	.031	.303	.062	18	-.081	.034	.044	-.210	35	-1.042	.035	-.942	-1.146
2	-.324	.037	-.196	-.470	19	.039	.025	.124	-.052	36	-.971	.028	-.862	-1.049
3	-.080	.009	-.047	-.109	20	.029	.025	.133	-.062	37	-.981	.037	-.868	-1.081
4	-.076	.021	.005	-.141	21	-.092	.028	.008	-.203	38	-.932	.035	-.814	-1.047
5	-.001	.025	.082	-.079	22	.002	.040	.144	-.162	39	-.857	.042	-.746	-1.005
6	.111	.027	.210	-.004	23	-.792	.051	-.611	-1.014	40	-.910	.033	-.810	-1.071
7	-.396	.035	-.286	-.584	24	.289	.020	.347	.204	41	-1.489	.050	-1.324	-1.620
8	.340	.042	.483	.184	25	.593	.072	.822	.300	42	.423	.024	.500	.338
9	.865	.085	1.218	.786	26	.570	.075	.815	.256	43	.864	.045	.966	.659
10	.224	.034	.349	.106	27	.383	.034	.513	.260	44	.677	.039	.789	.530
11	.325	.039	.463	.131	28	.462	.044	.617	.278	45	.763	.044	.907	.595
12	.398	.029	.494	.296	29	.190	.043	.348	.030	46	.574	.038	.704	.413
13	-.027	.041	.129	-.167	30	.285	.029	.424	.176	47	.595	.043	.733	.408
14	.192	.024	.273	.092	31	.391	.029	.496	.255	48	.569	.078	.789	.246
15	.224	.025	.313	.147	32	.495	.035	.617	.335	49	.792	.085	1.075	.495
16	.259	.026	.363	.168	33	.535	.037	.666	.384	50	.776	.071	.985	.527
17	.333	.034	.443	.195	34	-1.008	.029	-.879	-1.093					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 50 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.222	.030	.322	.099	18	-.125	.035	.009	-.247	35	-1.052	.032	-.932	-1.159
2	-.290	.037	-.170	-.407	19	.023	.024	.101	-.073	36	-.972	.024	-.895	-1.059
3	-.045	.010	-.005	-.082	20	.058	.023	.147	-.021	37	-.967	.024	-.874	-1.049
4	-.024	.022	.044	-.105	21	.014	.024	.087	-.071	38	-.892	.023	-.805	-.960
5	.060	.023	.138	-.011	22	.104	.034	.217	-.038	39	-.934	.048	-.755	-1.054
6	.162	.024	.238	.067	23	-.584	.038	-.455	-.723	40	-.834	.025	-.747	-.914
7	-.254	.034	-.115	-.371	24	.305	.021	.368	.218	41	-1.660	.050	-1.445	-1.811
8	.352	.040	.502	.214	25	.506	.060	.773	.219	42	-.084	.019	-.016	-.145
9	.859	.036	.952	.779	26	.485	.062	.685	.270	43	.243	.029	.369	.149
10	.223	.029	.319	.107	27	.336	.033	.429	.182	44	.666	.049	.828	.498
11	.289	.035	.401	.138	28	.413	.042	.546	.236	45	.635	.037	.778	.501
12	.372	.026	.443	.263	29	.099	.042	.254	-.048	46	.461	.033	.634	.328
13	-.048	.042	.105	-.175	30	.192	.027	.282	.104	47	.510	.038	.704	.366
14	.160	.025	.241	.076	31	.296	.028	.382	.149	48	.567	.046	.743	.332
15	.194	.025	.277	.114	32	.385	.027	.500	.281	49	.577	.057	.769	.345
16	.230	.024	.311	.149	33	.433	.030	.515	.311	50	.682	.072	.926	.402
17	.316	.033	.432	.201	34	-1.010	.028	-.920	-1.101					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 60 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.231	.029	.332	.112	18	-.132	.032	-.020	-.242	35	-1.215	.048	-1.072	-1.402
2	-.232	.033	-.117	-.343	19	.025	.022	.106	-.060	36	-1.094	.031	-.995	-1.198
3	-.007	.011	.034	-.037	20	.075	.023	.167	-.008	37	-.890	.032	-.774	-.992
4	.031	.020	.085	-.038	21	.075	.023	.149	-.022	38	-.779	.027	-.674	-.875
5	.122	.022	.203	.045	22	.165	.030	.286	.068	39	-.626	.024	-.524	-.712
6	.218	.024	.301	.139	23	-.396	.034	-.268	-.535	40	-.713	.030	-.600	-.817
7	-.113	.032	-.014	-.222	24	.321	.024	.396	.221	41	-1.551	0.000	-1.551	-1.551
8	.487	.154	.892	.243	25	.452	.047	.616	.295	42	-.404	.020	-.342	-.467
9	.622	.032	.694	.539	26	.443	.049	.598	.239	43	-.410	.032	-.277	-.502
10	.237	.027	.319	.129	27	.316	.031	.436	.162	44	.692	.053	.863	.519
11	.280	.031	.413	.145	28	.390	.039	.520	.221	45	.588	.033	.719	.470
12	.357	.024	.434	.270	29	.063	.040	.194	-.071	46	.382	.029	.484	.256
13	-.049	.040	.104	-.170	30	.149	.027	.267	.034	47	.418	.033	.522	.266
14	.151	.022	.228	.076	31	.245	.025	.341	.151	48	.503	.042	.637	.269
15	.188	.023	.264	.107	32	.312	.026	.408	.219	49	.498	.055	.728	.298
16	.223	.024	.302	.134	33	.360	.029	.461	.216	50	.626	.072	.877	.349
17	.314	.032	.414	.202	34	-1.159	.037	-1.043	-1.307					

DATA FOR PROJECT 5590 CONFIGURATION C WIND 70 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.288	.071	.547	.141	18	-.107	.030	.005	-.212	35	-1.107	.027	-.956	-1.132
2	-.353	.057	-.155	-.538	19	.051	.020	.120	-.014	36	-1.109	.034	-.874	-1.132
3	.039	.017	.110	-.018	20	.116	.022	.195	.030	37	-.951	.056	-.674	-1.100
4	.132	.032	.237	.037	21	.154	.023	.233	.084	38	-.549	.060	-.345	-.725
5	.288	.038	.408	.119	22	.221	.028	.330	.091	39	-.546	.029	-.445	-.665
6	.432	.036	.584	.293	23	-.272	.035	-.154	-.409	40	-.509	.026	-.424	-.603
7	-.060	.056	.129	-.262	24	.337	.024	.413	.251	41	-1.128	0.000	-1.128	-1.128
8	.377	.039	.642	.237	25	.438	.041	.613	.271	42	-.552	.020	-.481	-.622
9	.631	.027	.710	.565	26	.431	.041	.587	.275	43	-.848	.036	-.707	-.958
10	.486	.043	.623	.335	27	.313	.028	.419	.164	44	.658	.050	.789	.493
11	.422	.103	.637	.177	28	.386	.037	.511	.186	45	.571	.031	.669	.448
12	.355	.020	.418	.288	29	.053	.037	.192	-.090	46	.352	.026	.444	.233
13	-.032	.036	.099	-.174	30	.137	.024	.219	.001	47	.377	.029	.471	.279
14	.157	.020	.225	.086	31	.228	.022	.314	.148	48	.481	.038	.616	.338
15	.197	.021	.256	.129	32	.292	.024	.376	.189	49	.491	.051	.662	.291
16	.234	.022	.308	.141	33	.338	.026	.432	.238	50	.603	.070	.879	.347
17	.322	.031	.432	.183	34	-1.125	.015	-1.010	-1.132					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.221	.031	.352	.104	18	-.289	.038	-.152	-.429	35	-.463	.034	-.330	-.583
2	-.307	.037	-.183	-.427	19	-.119	.024	-.029	-.215	36	-.080	.015	-.030	-.130
3	-.187	.047	-.093	-.260	20	-.047	.023	.035	-.129	37	-.070	.014	-.029	-.115
4	-.017	.020	.044	-.080	21	-.002	.022	.089	-.079	38	-.284	.020	-.230	-.356
5	.066	.023	.142	-.012	22	.154	.038	.300	.020	39	-.031	.017	.018	-.086
6	.181	.027	.275	.061	23	-.372	.035	-.272	-.513	40	-.567	.027	-.474	-.670
7	-.335	.033	-.222	-.448	24	.196	.020	.248	.119	41	.327	.026	.407	.228
8	.360	.042	.527	.215	25	-.007	.022	.059	-.074	42	.405	.022	.493	.315
9	-6.961	.147	-6.670	-7.294	26	.009	.021	.076	-.066	43	.303	.019	.348	.226
10	.038	.034	.189	-.080	27	.258	.034	.377	.106	44	.283	.019	.335	.208
11	.420	.072	.677	.116	28	.328	.050	.489	.145	45	.297	.018	.349	.223
12	.312	.031	.403	.185	29	-.060	.049	.089	-.221	46	.394	.041	.541	.245
13	-.107	.053	.171	-.279	30	.014	.028	.106	-.087	47	.391	.038	.532	.258
14	.086	.027	.180	-.002	31	.098	.025	.184	.007	48	.302	.029	.406	.175
15	.132	.025	.208	.030	32	.214	.028	.313	.098	49	.296	.028	.397	.171
16	.156	.024	.235	.062	33	.323	.041	.459	.102	50	.288	.028	.371	.188
17	.263	.039	.394	.126	34	-.580	.038	-.404	-.705					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.217	.034	.327	.092	18	-.304	.039	-.161	-.444	35	-.521	.032	-.413	-.650
2	-.458	.102	-.185	-.738	19	-.132	.021	-.051	-.202	36	-.091	.017	-.035	-.143
3	-.109	.012	-.070	-.155	20	-.066	.021	.006	-.133	37	-.076	.015	-.029	-.132
4	-.070	.038	.036	-.197	21	-.023	.023	.053	-.104	38	-.286	.020	-.215	-.359
5	.073	.041	.251	-.073	22	.152	.040	.278	.011	39	-.035	.016	.022	-.080
6	.291	.049	.486	.115	23	-.371	.034	-.223	-.472	40	-.572	.033	-.446	-.677
7	-.591	.063	-.370	-.794	24	.218	.023	.287	.135	41	.322	.024	.398	.227
8	.619	.076	.877	.309	25	-.001	.022	.073	-.078	42	.392	.022	.455	.296
9	1.009	.016	1.051	.965	26	.002	.022	.082	-.072	43	.322	.021	.380	.219
10	.040	.039	.171	-.097	27	.237	.034	.343	.088	44	.310	.020	.370	.229
11	.432	.070	.698	.165	28	.321	.048	.491	.127	45	.315	.020	.374	.242
12	.301	.028	.389	.194	29	-.080	.048	.088	-.253	46	.372	.044	.539	.194
13	-.121	.051	.043	-.299	30	.008	.028	.100	-.075	47	.379	.038	.491	.224
14	.060	.025	.160	-.026	31	.098	.023	.180	.023	48	.320	.030	.425	.209
15	.095	.025	.169	-.001	32	.211	.027	.302	.130	49	.318	.034	.434	.176
16	.123	.023	.197	-.010	33	.316	.041	.444	.124	50	.310	.033	.413	.182
17	.235	.037	.389	.100	34	-.595	.038	-.416	-.719					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 35 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.356	.055	.547	.144	18	-.119	.039	.028	-.287	35	-.932	.069	-.674	-1.123
2	-.609	.066	-.383	-.852	19	-.018	.028	.081	-.143	36	-.724	.038	-.602	-.848
3	-.160	.012	-.116	-.208	20	-.057	.028	.043	-.184	37	-.726	.030	-.637	-.944
4	-.154	.038	-.030	-.304	21	-.220	.042	-.098	-.488	38	-.742	.028	-.655	-.833
5	-.032	.041	.109	-.180	22	-.004	.058	.196	-.216	39	-.788	.032	-.684	-.906
6	.167	.047	.322	-.013	23	-.676	.083	-.383	-1.067	40	-.780	.032	-.674	-.896
7	-.760	.058	-.536	-.965	24	.231	.016	.282	.170	41	1.567	.105	1.773	1.006
8	.586	.072	.816	.284	25	.319	.060	.522	.072	42	.792	.059	.925	.547
9	.907	.016	.950	.856	26	.217	.060	.405	-.054	43	.756	.045	.881	.566
10	.160	.047	.359	-.011	27	.413	.033	.513	.265	44	.850	.055	.972	.599
11	.549	.057	.744	.186	28	.490	.043	.622	.308	45	.874	.050	.983	.691
12	.382	.025	.461	.269	29	.271	.040	.425	.139	46	.554	.087	.829	.206
13	-.048	.041	.091	-.206	30	.387	.032	.501	.222	47	.449	.101	.805	.093
14	.167	.023	.234	.091	31	.511	.039	.665	.322	48	.879	.082	1.186	.462
15	.209	.025	.305	.126	32	.573	.052	.815	.348	49	.866	.074	1.116	.469
16	.227	.025	.302	.139	33	.565	.066	.775	.124	50	.887	.073	1.142	.576
17	.288	.032	.390	.179	34	-.738	.047	-.580	-.951					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 40 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.196	.028	.294	.093	18	-.048	.032	.058	-.185	35	-1.000	.055	-.770	-1.138
2	-.346	.038	-.206	-.487	19	.044	.026	.135	-.076	36	-.911	.056	-.692	-1.026
3	-.096	.009	-.065	-.128	20	-.014	.027	.096	-.117	37	-.875	.059	-.674	-.997
4	-.106	.020	-.034	-.177	21	-.211	.035	-.111	-.413	38	-.797	.039	-.652	-.913
5	-.051	.022	.026	-.128	22	-.053	.072	.147	-.467	39	-.894	.038	-.804	-1.038
6	.063	.026	.148	-.039	23	-.829	.086	-.553	-1.180	40	-.874	.056	-.712	-1.175
7	-.489	.035	-.383	-.614	24	.304	.018	.363	.227	41	-.249	.036	-.135	-.350
8	.332	.040	.488	.180	25	.669	.078	.913	.360	42	.732	.027	.808	.614
9	-.941	.019	-.894	-.983	26	.638	.074	.925	.363	43	.957	.038	1.034	.738
10	.214	.033	.321	.081	27	.437	.030	.530	.285	44	.803	.031	.904	.676
11	.323	.033	.457	.163	28	.507	.039	.622	.323	45	.859	.036	.955	.721
12	.420	.024	.491	.324	29	.262	.038	.400	.122	46	.620	.042	.781	.425
13	-.009	.037	.170	-.150	30	.362	.025	.462	.272	47	.625	.052	.810	.224
14	.209	.023	.311	.133	31	.476	.030	.575	.352	48	.493	.093	.818	.211
15	.251	.023	.329	.178	32	.571	.035	.688	.430	49	.873	.091	1.220	.486
16	.272	.022	.336	.179	33	.590	.040	.728	.413	50	.828	.074	1.144	.518
17	.322	.031	.433	.176	34	-.970	.059	-.746	-1.116					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 50 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.203	.029	.301	.089	18	-.121	.031	-.005	-.225	35	-.999	.048	-.821	-1.149
2	-.327	.037	-.177	-.445	19	.017	.022	.094	-.071	36	-.899	.042	-.724	-1.046
3	-.087	.010	-.053	-.124	20	.030	.023	.101	-.040	37	-.886	.038	-.748	-1.007
4	-.085	.019	-.015	-.163	21	-.072	.022	.015	-.168	38	-.778	.029	-.676	-.860
5	-.022	.022	.047	-.112	22	.016	.037	.135	-.132	39	-.855	.028	-.740	-.941
6	.090	.024	.177	.001	23	-.610	.039	-.439	-.769	40	-.814	.033	-.647	-.914
7	-.431	.032	-.302	-.548	24	.303	.019	.374	.241	41	-.654	.037	-.535	-.774
8	.338	.036	.454	.202	25	.471	.048	.646	.231	42	.108	.019	.159	.038
9	-.304	.017	-.251	-.350	26	.475	.055	.721	.244	43	.673	.025	.750	.564
10	.184	.026	.274	.096	27	.360	.029	.461	.235	44	.738	.046	.871	.590
11	.291	.031	.401	.149	28	.434	.039	.549	.283	45	.681	.032	.768	.557
12	.381	.025	.450	.290	29	.129	.040	.282	.010	46	.501	.031	.610	.369
13	-.035	.038	.111	-.185	30	.222	.023	.305	.149	47	.538	.037	.673	.386
14	.169	.022	.240	.094	31	.328	.023	.408	.242	48	.579	.046	.779	.425
15	.209	.021	.283	.114	32	.419	.027	.504	.325	49	.565	.058	.786	.276
16	.237	.022	.310	.161	33	.462	.029	.546	.347	50	.698	.068	.941	.461
17	.318	.032	.427	.215	34	-1.023	.054	-.838	-1.180					

DATA FOR PROJECT 5590 CONFIGURATION D WIND 60 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.202	.028	.296	.092	18	-.174	.031	-.067	-.283	35	-.914	.038	-.784	-1.021
2	-.491	.073	-.281	-.713	19	-.018	.019	.049	-.084	36	-.867	.027	-.766	-.948
3	-.158	.016	-.110	-.212	20	.017	.021	.089	-.056	37	-.847	.033	-.760	-.960
4	-.119	.035	-.008	-.248	21	-.047	.021	.023	-.118	38	-.748	.025	-.655	-.829
5	-.005	.038	.112	-.152	22	.054	.027	.166	-.035	39	-.776	.021	-.701	-.835
6	.188	.041	.324	.041	23	-.527	.028	-.410	-.628	40	-.745	.028	-.650	-.835
7	-.410	.055	-.267	-.793	24	.299	.021	.378	.223	41	-.734	.036	-.592	-.843
8	.331	.037	.462	.202	25	.402	.036	.566	.268	42	-.241	.016	-.184	-.301
9	-.478	.025	-.431	-.557	26	.414	.044	.550	.249	43	.203	.016	.262	.156
10	.321	.040	.453	.153	27	.315	.028	.392	.170	44	.723	.050	.851	.527
11	.266	.052	.551	.133	28	.386	.036	.497	.238	45	.584	.029	.673	.473
12	.349	.021	.430	.273	29	.057	.037	.209	-.074	46	.389	.026	.481	.293
13	-.051	.034	.068	-.179	30	.147	.022	.225	.065	47	.418	.030	.532	.264
14	.138	.020	.203	.059	31	.243	.021	.301	.168	48	.506	.038	.614	.351
15	.176	.021	.241	.089	32	.322	.024	.404	.211	49	.484	.054	.720	.290
16	.201	.021	.272	.117	33	.363	.026	.442	.266	50	.612	.072	.973	.347
17	.289	.030	.391	.177	34	-.950	.037	-.835	-1.071					

DATA FOR PROJECT 5590 CONFIGURATION E WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.227	.033	.348	.107	18	-.339	.038	-.199	-.469	35	-.639	.033	-.480	-.728
2	-.294	.037	-.164	-.426	19	-.170	.022	-.091	-.249	36	-.079	.016	-.030	-.137
3	-.052	.006	-.026	-.072	20	-.107	.022	-.023	-.195	37	-.025	.016	.036	-.076
4	-.028	.019	.044	-.085	21	-.064	.023	.017	-.145	38	-.377	.026	-.291	-.471
5	.057	.023	.140	-.018	22	.155	.040	.312	.008	39	.014	.018	.073	-.051
6	.174	.028	.286	.065	23	-.368	.037	-.241	-.541	40	-.567	.030	-.445	-.664
7	-.323	.033	-.193	-.426	24	.197	.018	.245	.135	41	.332	.024	.403	.224
8	.353	.043	.494	.190	25	-.001	.022	.063	-.072	42	.356	.020	.415	.287
9	.269	.009	.298	.240	26	.012	.024	.093	-.072	43	.226	.020	.283	.134
10	.028	.022	.094	-.051	27	.236	.032	.355	.076	44	.198	.018	.251	.134
11	.250	.039	.386	-.001	28	.317	.048	.464	.101	45	.206	.019	.261	.137
12	.286	.031	.373	.152	29	-.080	.047	.101	-.245	46	.363	.041	.509	.128
13	-.136	.053	.071	-.330	30	.006	.026	.097	-.097	47	.358	.036	.484	.210
14	.038	.026	.134	-.068	31	.091	.023	.173	.017	48	.240	.028	.330	.128
15	.067	.024	.148	-.032	32	.193	.027	.283	.093	49	.232	.028	.317	.098
16	.093	.023	.175	.008	33	.306	.038	.431	.114	50	.207	.029	.287	.086
17	.202	.040	.332	.076	34	-.499	.024	-.407	-.574					

DATA FOR PROJECT 5590 CONFIGURATION E WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	PHS	MAX	MIN	TAF	MEAN	RMS	MAX	MIN
1	.222	.034	.373	.090	18	-.318	.038	-.164	-.447	35	-.730	.045	-.582	-.859
2	-.320	.041	-.186	-.466	19	-.140	.022	-.060	-.231	36	-.091	.016	-.032	-.151
3	-.067	.006	-.043	-.092	20	-.071	.022	.001	-.140	37	-.038	.018	.022	-.099
4	-.044	.020	.018	-.115	21	-.027	.023	.061	-.110	38	-.385	.025	-.302	-.470
5	.043	.024	.126	-.053	22	.153	.038	.311	.013	39	.011	.020	.077	-.058
6	.161	.028	.252	.061	23	-.381	.041	-.250	-.520	40	-.584	.033	-.463	-.727
7	-.349	.034	-.209	-.485	24	.213	.019	.276	.143	41	.335	.028	.428	.239
8	.354	.044	.503	.178	25	.001	.024	.086	-.073	42	.378	.022	.438	.303
9	.245	.009	.275	.213	26	.015	.024	.108	-.063	43	.278	.020	.334	.200
10	.017	.023	.090	-.056	27	.246	.034	.346	.105	44	.267	.024	.344	.186
11	.247	.041	.369	.083	28	.331	.048	.479	.159	45	.265	.020	.332	.190
12	.319	.028	.408	.203	29	-.079	.050	.089	-.279	46	.377	.043	.503	.200
13	-.123	.056	.078	-.326	30	.012	.027	.102	-.082	47	.385	.035	.509	.248
14	.064	.026	.169	-.029	31	.102	.023	.187	.013	48	.288	.032	.387	.177
15	.098	.024	.200	.014	32	.206	.028	.292	.099	49	.281	.033	.390	.168
16	.126	.024	.196	.041	33	.317	.040	.451	.159	50	.262	.032	.370	.135
17	.239	039	.388	.095	34	-.545	.027	-.441	-.621					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 20 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.268	.051	.433	.090	18	-.296	.038	-.164	-.457	35	-.659	.043	-.490	-.773
2	-.490	.066	-.287	-.768	19	-.110	.025	-.029	-.193	36	-.096	.016	-.017	-.152
3	-.142	.043	.042	-.281	20	-.047	.024	.029	-.129	37	-.203	.033	-.082	-.315
4	-.123	.044	.015	-.294	21	.022	.026	.107	-.064	38	-.305	.022	-.229	-.370
5	-.015	.046	.152	-.178	22	.110	.035	.245	.001	39	.152	.029	.244	.046
6	.216	.064	.461	-.027	23	-.364	.036	-.249	-.479	40	-.533	.027	-.441	-.638
7	-.726	.076	-.480	-.974	24	.314	.050	.488	.119	41	.619	.052	.784	.433
8	.465	.083	.763	.200	25	.028	.023	.106	-.068	42	.381	.027	.455	.279
9	2.463	.008	2.486	2.431	26	.029	.020	.099	-.041	43	.319	.025	.386	.214
10	.017	.023	.097	-.068	27	.246	.035	.356	.106	44	.305	.025	.378	.214
11	.250	.029	.351	.145	28	.299	.048	.481	.106	45	.288	.023	.350	.194
12	.284	.025	.371	.164	29	.017	.041	.147	-.159	46	.351	.053	.526	.152
13	-.078	.035	.079	-.200	30	.076	.026	.161	-.041	47	.394	.041	.547	.244
14	.044	.024	.150	-.036	31	.086	.026	.175	.001	48	.332	.036	.434	.187
15	.063	.025	.129	-.043	32	.159	.028	.245	.057	49	.319	.034	.420	.173
16	.103	.023	.179	.021	33	.309	.057	.516	-.055	50	.298	.035	.420	.173
17	.224	.042	.378	.071	34	-.636	.039	-.497	-.751					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.145	.026	.237	.050	18	-.308	.035	-.160	-.459	35	-.734	.037	-.557	-.854
2	-.280	.035	-.159	-.406	19	-.107	.022	-.032	-.173	36	-.102	.017	-.037	-.150
3	-.079	.022	-.002	-.163	20	-.045	.022	.025	-.120	37	-.105	.017	-.046	-.154
4	-.066	.022	.011	-.141	21	.023	.023	.091	-.054	38	-.300	.021	-.220	-.369
5	-.009	.022	.072	-.085	22	.107	.031	.240	-.001	39	.151	.026	.247	.059
6	.122	.032	.228	.006	23	-.373	.037	-.247	-.497	40	-.545	.027	-.457	-.636
7	-.445	.109	-.258	-.988	24	.317	.045	.494	.167	41	.341	.023	.419	.232
8	.488	.080	.810	.245	25	.026	.022	.102	-.044	42	.385	.023	.444	.274
9	-.421	.013	-.380	-.454	26	.031	.019	.089	-.036	43	.336	.021	.400	.272
10	-.003	.022	.072	-.080	27	.250	.034	.369	.098	44	.328	.021	.391	.237
11	.230	.028	.328	.119	28	.303	.046	.434	.102	45	.312	.022	.383	.234
12	.286	.022	.351	.188	29	.012	.039	.206	-.152	46	.351	.047	.518	.142
13	-.077	.033	.065	-.190	30	.073	.025	.150	-.027	47	.395	.038	.540	.265
14	.043	.023	.113	-.045	31	.082	.023	.171	-.001	48	.343	.033	.444	.221
15	.061	.022	.153	-.019	32	.154	.025	.244	.055	49	.336	.033	.427	.186
16	.102	.021	.166	.025	33	.308	.053	.499	-.070	50	.318	.033	.422	.177
17	.232	.038	.391	.109	34	-.689	.035	-.518	-.806					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.131	.026	.222	.018	18	-.133	.038	.031	-.294	35	-.778	.039	-.661	-.926
2	-.299	.034	-.176	-.433	19	-.027	.028	.059	-.130	36	-.766	.037	-.610	-.887
3	-.101	.024	-.016	-.185	20	-.109	.032	.005	-.306	37	-.740	.038	-.611	-.846
4	-.106	.022	-.035	-.198	21	-.171	.042	-.018	-.377	38	-.758	.031	-.652	-.891
5	-.073	.024	.015	-.167	22	-.066	.054	.124	-.284	39	-.798	.038	-.636	-.929
6	.061	.032	.197	-.048	23	-.725	.089	-.476	-1.071	40	-.784	.037	-.661	-.919
7	-.594	.113	-.389	-.981	24	.336	.040	.491	.171	41	.915	.063	1.033	.560
8	.367	.059	.597	.159	25	.451	.069	.723	.155	42	.791	.068	.960	.498
9	-.528	.045	-.436	-.605	26	.396	.069	.679	.099	43	.761	.060	.913	.531
10	.107	.040	.244	-.041	27	.425	.031	.525	.277	44	.859	.062	1.006	.586
11	.442	.038	.563	.316	28	.493	.040	.625	.321	45	.906	.048	1.017	.711
12	.350	.023	.416	.249	29	.340	.033	.444	.199	46	.588	.085	.832	.087
13	.030	.032	.136	-.069	30	.421	.028	.528	.315	47	.365	.138	.794	-.091
14	.150	.026	.226	.053	31	.529	.034	.654	.422	48	.902	.079	1.186	.530
15	.192	.024	.278	.108	32	.580	.047	.745	.371	49	.865	.068	1.078	.558
16	.203	.025	.313	.085	33	.572	.073	.782	.202	50	.895	.069	1.103	.546
17	.283	.034	.412	.152	34	-.748	.039	-.614	-.862					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 40 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.124	.025	.216	.027	18	-.130	.035	-.006	-.276	35	-1.017	.042	-.850	-1.127
2	-.317	.034	-.198	-.421	19	.022	.025	.105	-.099	36	-.992	.054	-.820	-1.149
3	-.106	.022	-.023	-.194	20	-.007	.025	.105	-.091	37	-.916	.057	-.728	-1.066
4	-.118	.022	-.040	-.203	21	-.063	.026	.016	-.176	38	-.827	.041	-.699	-.946
5	-.095	.023	-.017	-.192	22	-.116	.042	.053	-.385	39	-.841	.043	-.692	-.973
6	.042	.031	.156	-.060	23	-.762	.055	-.589	-1.040	40	-.895	.037	-.755	-1.065
7	-.566	.044	-.422	-.711	24	.385	.035	.508	.261	41	-1.215	.054	-1.016	-1.349
8	.262	.039	.401	.122	25	.650	.075	.884	.370	42	.298	.022	.396	.198
9	.179	.016	.211	.132	26	.635	.074	.882	.348	43	.916	.050	1.010	.651
10	.126	.030	.231	.024	27	.395	.029	.501	.269	44	.714	.042	.830	.551
11	.288	.025	.365	.180	28	.453	.037	.568	.311	45	.761	.043	.907	.578
12	.359	.020	.431	.294	29	.234	.032	.348	.132	46	.552	.035	.684	.406
13	.034	.030	.138	-.056	30	.299	.025	.389	.217	47	.584	.044	.738	.326
14	.153	.022	.234	.067	31	.363	.025	.449	.239	48	.587	.061	.769	.229
15	.193	.022	.267	.115	32	.453	.029	.583	.337	49	.632	.069	.916	.322
16	.216	.023	.299	.122	33	.513	.031	.614	.397	50	.757	.068	1.004	.496
17	.311	.032	.428	.203	34	-1.022	.036	-.891	-1.128					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 50 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.133	.024	.224	.033	18	-.195	.031	-.068	-.301	35	-.985	.032	-.860	-1.086
2	-.317	.033	-.178	-.428	19	-.011	.023	.076	-.096	36	-.925	.032	-.794	-1.035
3	-.096	.021	-.019	-.180	20	.001	.023	.073	-.082	37	-.888	.029	-.769	-.977
4	-.103	.021	-.034	-.181	21	-.006	.024	.067	-.090	38	-.792	.026	-.708	-.881
5	-.065	.022	.003	-.154	22	.004	.028	.107	-.129	39	-.807	.032	-.695	-.900
6	.069	.030	.178	-.039	23	-.580	.034	-.478	-.709	40	-.794	.029	-.668	-.895
7	-.503	.041	-.371	-.623	24	.376	.035	.506	.234	41	-1.483	.051	-1.255	-1.624
8	268	.036	.402	.137	25	.485	.051	.721	.265	42	-.368	.025	-.277	-.442
9	.198	.021	.249	.145	26	.481	.052	.684	.282	43	.431	.029	.510	.298
10	.126	.026	.211	.040	27	.334	.029	.432	.209	44	.743	.051	.897	.568
11	.260	.024	.351	.179	28	.387	.037	.491	.251	45	.596	.032	.719	.449
12	.335	.019	.399	.256	29	.140	.032	.240	-.001	46	.397	.026	.486	.290
13	-.015	.030	.084	-.121	30	.205	.022	.288	.135	47	.441	.031	.539	.327
14	.107	.021	.192	.036	31	.244	.023	.334	.157	48	.528	.039	.691	.341
15	.139	.021	.207	.064	32	.313	.025	.404	.224	49	.445	.074	.666	.156
16	.175	.022	.245	.092	33	.362	.026	.446	.250	50	.653	.080	.942	.333
17	.286	.030	.420	.176	34	-1.008	.033	-.903	-1.141					

DATA FOR PROJECT 5590 CONFIGURATION F WIND 60 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.140	.024	.214	.039	18	-.227	.032	-.114	-.346	35	-.925	.029	-.824	-1.012
2	-.400	.048	-.222	-.536	19	-.030	.021	.052	-.104	36	-.865	.025	-.776	-.966
3	-.119	.026	-.033	-.215	20	-.005	.022	.069	-.080	37	-.827	.024	-.736	-.911
4	-.125	.025	-.045	-.212	21	.002	.022	.076	-.079	38	-.755	.024	-.676	-.827
5	-.068	.028	.044	-.189	22	.032	.025	.139	-.071	39	-.750	.026	-.642	-.839
6	.103	.039	.239	-.040	23	-.501	.032	-.394	-.627	40	-.726	.028	-.634	-.816
7	-.624	.064	-.402	-.807	24	.359	.035	.460	.224	41	-1.499	.048	-1.315	-1.572
8	.414	.051	.574	.233	25	.444	.042	.579	.276	42	-.605	.023	-.516	-.694
9	.536	.034	.618	.463	26	.441	.046	.604	.267	43	.086	.022	.153	-.027
10	.266	.039	.398	.140	27	.308	.028	.393	.207	44	.614	.042	.727	.439
11	.397	.039	.550	.223	28	.358	.035	.481	.221	45	.545	.029	.644	.434
12	.320	.019	.371	.250	29	.100	.032	.208	-.025	46	.319	.027	.398	.193
13	-.036	.029	.058	-.136	30	.166	.024	.248	.082	47	.357	.027	.454	.238
14	.087	.022	.156	.001	31	.197	.022	.275	.116	48	.475	.037	.595	.313
15	.115	.020	.182	.038	32	.253	.024	.344	.143	49	.480	.062	.702	.238
16	.155	.021	.226	.065	33	.295	.024	.373	.218	50	.635	.082	.949	.326
17	.268	.030	.369	.174	34	-.940	.027	-.848	-1.052					

DATA FOR PROJECT 5590 CONFIGURATION G WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.139	.027	.228	.042	18	-.283	.034	-.154	-.399	35	-.700	.043	-.517	-.816
2	-.297	.034	-.152	-.428	19	-.098	.024	-.010	-.196	36	-.054	.016	-.003	-.108
3	-.087	.023	-.001	-.160	20	-.038	.024	.041	-.133	37	-.051	.020	.012	-.113
4	-.077	.024	.003	-.156	21	.034	.023	.108	-.052	38	-.201	.018	-.142	-.256
5	-.018	.025	.077	-.104	22	.126	.035	.266	.008	39	.059	.018	.119	-.011
6	.108	.035	.241	-.018	23	-.447	.040	-.291	-.569	40	-.605	.031	-.505	-.707
7	-.432	.042	-.285	-.587	24	.323	.047	.486	.182	41	.367	.042	.486	.172
8	.267	.046	.448	.103	25	.011	.023	.095	-.063	42	.367	.023	.440	.284
9	-.993	.012	-.949	-1.027	26	.018	.021	.087	-.054	43	.282	.020	.341	.210
10	-.019	.024	.060	-.104	27	.250	.034	.378	.120	44	.268	.021	.333	.201
11	.214	.027	.301	.111	28	.306	.045	.465	.133	45	.264	.020	.338	.191
12	.290	.022	.358	.214	29	.010	.040	.158	-.162	46	.343	.046	.507	.191
13	-.070	.035	.058	-.179	30	.076	.026	.162	-.025	47	.360	.036	.499	.225
14	.053	.023	.142	-.027	31	.077	.025	.153	-.038	48	.285	.031	.389	.178
15	.070	.024	.142	-.014	32	.151	.027	.232	.062	49	.285	.030	.393	.144
16	.110	.023	.201	.028	33	.306	.044	.498	.079	50	.275	.029	.372	.157
17	.227	.036	.354	.083	34	-.216	.047	-.083	-.399					

DATA FOR PROJECT 5590 CONFIGURATION G WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.146	.028	.248	.053	18	.006	.038	.169	-.175	35	-.876	.062	-.687	-1.032
2	-.294	.034	-.166	-.418	19	.084	.029	.199	-.011	36	-.837	.061	-.631	-.996
3	-.100	.024	-.021	-.183	20	-.026	.036	.085	-.188	37	-.791	.050	-.637	-.933
4	-.115	.023	-.028	-.196	21	-.198	.068	-.001	-.588	38	-.781	.037	-.660	-.889
5	-.108	.025	-.028	-.210	22	-.280	.140	.058	-.998	39	-.843	.037	-.743	-.972
6	.035	.034	.201	-.072	23	-.877	.149	-.367	-1.357	40	-.823	.046	-.704	-1.022
7	-.606	.043	-.472	-.748	24	.404	.040	.538	.231	41	-.808	.058	-.597	-.967
8	.270	.042	.413	.127	25	.524	.065	.747	.234	42	.849	.034	.933	.694
9	-.358	.014	-.324	-.401	26	.464	.065	.705	.221	43	.883	.043	.988	.715
10	.055	.028	.161	-.068	27	.459	.030	.548	.355	44	.839	.039	.945	.702
11	.336	.028	.430	.221	28	.519	.037	.646	.388	45	.907	.047	1.023	.757
12	.395	.024	.469	.302	29	.354	.031	.453	.254	46	.625	.050	.777	.409
13	.100	.030	.199	-.015	30	.423	.026	.525	.326	47	.643	.075	.940	.219
14	.211	.025	.289	.129	31	.514	.032	.623	.398	48	.462	.097	.804	.103
15	.253	.025	.329	.165	32	.604	.040	.750	.447	49	.890	.082	1.238	.561
16	.266	.027	.365	.165	33	.615	.049	.767	.420	50	.849	.068	1.046	.608
17	.334	.034	.459	.222	34	-.850	.055	-.650	-.992					

DATA FOR PROJECT 5590 CONFIGURATION G WIND 40 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.147	.027	.235	.041	18	-.103	.034	.017	-.217	35	-.959	.055	-.763	-1.137
2	-.287	.034	-.149	-.414	19	.051	.025	.150	-.037	36	-.885	.042	-.720	-1.008
3	-.083	.023	-.001	-.160	20	.053	.026	.145	-.035	37	-.846	.047	-.671	-1.003
4	-.093	.022	-.003	-.165	21	-.023	.027	.061	-.130	38	-.780	.032	-.649	-.885
5	-.071	.023	.004	-.140	22	-.109	.056	.087	-.393	39	-.811	.039	-.682	-.925
6	.063	.031	.168	-.049	23	-.818	.078	-.534	-1.139	40	-.846	.039	-.706	-.963
7	-.532	.044	-.375	-.731	24	.405	.038	.525	.261	41	-.876	.063	-.692	-1.094
8	.279	.039	.413	.114	25	.375	.045	.528	.222	42	-.030	.024	.058	-.107
9	.145	.017	.188	.098	26	.363	.052	.538	.145	43	.769	.030	.866	.648
10	.052	.024	.131	-.020	27	.383	.031	.484	.210	44	.660	.055	.822	.424
11	.291	.027	.390	.195	28	.437	.037	.547	.282	45	.673	.038	.787	.513
12	.362	.022	.442	.272	29	.214	.033	.335	.097	46	.512	.035	.657	.350
13	.038	.031	.141	-.086	30	.279	.026	.395	.190	47	.551	.038	.688	.393
14	.154	.024	.234	.077	31	.332	.024	.415	.246	48	.568	.050	.746	.289
15	.191	.023	.274	.085	32	.412	.027	.503	.308	49	.450	.073	.735	.127
16	.220	.023	.297	.141	33	.469	.030	.569	.367	50	.693	.082	1.010	.414
17	.316	.031	.433	.197	34	-.920	.049	-.729	-1.071					

DATA FOR PROJECT 5590 CONFIGURATION H WIND 25 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN
1	.155	.027	.245	.052
2	-.272	.034	-.160	-.404
3	-.068	.023	.020	-.160
4	-.112	.047	.052	-.277
5	-.001	.048	.178	-.165
6	.257	.063	.543	.056
7	-.805	.079	-.543	-1.075
8	.557	.092	.949	.241
9	1.231	.058	1.345	1.093
10	-.001	.046	.169	-.178
11	.458	.054	.674	.255
12	.289	.025	.368	.189
13	-.080	.035	.046	-.192
14	.046	.025	.144	-.075
15	.067	.026	.149	-.026
16	.109	.025	.198	.001
17	.223	.035	.333	.109

TAP	MEAN	RMS	MAX	MIN
18	-.343	.042	-.214	-.555
19	-.111	.024	-.030	-.196
20	-.049	.023	.050	-.133
21	.025	.026	.118	-.084
22	.125	.035	.255	-.030
23	-.418	.037	-.288	-.551
24	.321	.046	.513	.167
25	.027	.022	.097	-.061
26	.029	.021	.110	-.047
27	.256	.035	.382	.128
28	.310	.047	.452	.136
29	.020	.040	.176	-.122
30	.079	.025	.163	-.021
31	.086	.024	.163	.001
32	.170	.025	.268	.075
33	.330	.046	.491	.075
34	2.686	.023	2.726	2.651

TAP	MEAN	RMS	MAX	MIN
35	-.300	.038	-.171	-.437
36	-.171	.021	-.109	-.246
37	-.099	.020	-.025	-.169
38	-.239	.019	-.175	-.322
39	.054	.021	.127	-.033
40	-.625	.031	-.513	-.722
41	.361	.030	.462	.250
42	.393	.024	.469	.296
43	.323	.025	.404	.234
44	.312	.024	.391	.198
45	.311	.021	.367	.238
46	.361	.044	.505	.114
47	.399	.037	.531	.247
48	.342	.031	.438	.220
49	.334	.032	.442	.185
50	.320	.031	.433	.194

DATA FOR PROJECT 5590 CONFIGURATION I WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.120	.025	.202	.036	18	-.365	.045	-.194	-.493	35	-.093	.031	.032	-.225
2	-.309	.037	-.189	-.462	19	-.129	.022	-.050	-.201	36	-.184	.019	-.115	-.256
3	-.100	.021	-.030	-.178	20	-.062	.022	.008	-.136	37	-.150	.020	-.071	-.220
4	-.087	.021	-.016	-.157	21	.004	.023	.077	-.091	38	-.245	.017	-.184	-.304
5	-.032	.023	.046	-.109	22	.107	.034	.233	-.000	39	.023	.016	.083	-.040
6	.099	.035	.230	-.009	23	-.437	.039	-.297	-.583	40	-.722	.035	-.574	-.834
7	-.431	.045	-.292	-.576	24	.297	.045	.445	.158	41	.284	.024	.354	.178
8	.253	.046	.441	.119	25	-.002	.021	.081	-.067	42	.261	.020	.333	.179
9	-3.174	.024	-3.134	-3.289	26	.004	.019	.064	-.061	43	.133	.019	.191	.039
10	-.023	.021	.053	-.102	27	.215	.039	.361	.003	44	.129	.019	.191	.063
11	.191	.031	.306	-.023	28	.267	.053	.442	.051	45	.115	.017	.175	.052
12	.247	.023	.318	.156	29	-.016	.044	.135	-.189	46	.306	.045	.452	.121
13	-.106	.039	.046	-.229	30	.039	.026	.128	-.067	47	.266	.035	.374	.131
14	.010	.023	.105	-.067	31	.040	.023	.118	-.061	48	.135	.027	.247	.052
15	.038	.022	.118	-.047	32	.097	.025	.185	-.003	49	.138	.027	.223	.039
16	.076	.023	.156	-.012	33	.260	.045	.428	.108	50	.127	.026	.213	.028
17	.188	.037	.325	.033	34	1.279	.010	1.308	1.256					

DATA FOR PROJECT 5590 CONFIGURATION I WIND 40 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.143	.023	.222	.060	18	-.353	.040	-.211	-.497	35	-.065	.028	.034	-.163
2	-.295	.036	-.143	-.434	19	-.100	.022	-.024	-.176	36	-.133	.018	-.070	-.200
3	-.076	.020	.003	-.138	20	-.037	.021	.029	-.117	37	-.107	.018	-.034	-.170
4	-.066	.021	.009	-.141	21	.026	.023	.102	-.048	38	-.181	.019	-.110	-.247
5	-.014	.021	.065	-.101	22	.127	.031	.229	.027	39	.129	.017	.193	.072
6	.118	.030	.239	.003	23	-.419	.038	-.275	-.563	40	-.737	.049	-.581	-.927
7	-.418	.044	-.263	-.556	24	.317	.038	.440	.177	41	.310	.020	.379	.222
8	.288	.039	.408	.150	25	.024	.021	.106	-.047	42	.276	.018	.333	.213
9	-.351	.015	-.312	-.391	26	.029	.018	.098	-.026	43	.148	.016	.204	.095
10	.008	.023	.098	-.069	27	.256	.031	.363	.114	44	.149	.016	.213	.090
11	.237	.027	.337	.142	28	.310	.040	.434	.157	45	.152	.016	.218	.092
12	.289	.019	.350	.204	29	.011	.036	.137	-.115	46	.341	.036	.458	.206
13	-.086	.033	.039	-.228	30	.078	.023	.160	.000	47	.287	.032	.392	.178
14	.043	.020	.122	-.028	31	.083	.023	.168	-.003	48	.161	.025	.238	.076
15	.070	.021	.150	-.008	32	.138	.024	.220	.053	49	.175	.028	.276	.074
16	.105	.020	.182	.038	33	.298	.040	.445	.114	50	.169	.025	.254	.067
17	.221	.030	.325	.113	34	.971	.015	1.032	.926					

DATA FOR PROJECT 5590 CONFIGURATION J WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.167	.024	.255	.077	18	-.319	.040	-.176	-.459	35	-.619	.033	-.508	-.712
2	-.278	.033	-.173	-.417	19	-.089	.024	-.002	-.176	36	-.067	.016	-.016	-.125
3	-.058	.023	.015	-.134	20	-.027	.023	.055	-.102	37	-.050	.018	.018	-.115
4	-.046	.021	.028	-.118	21	.051	.023	.133	-.022	38	-.219	.019	-.163	-.297
5	.012	.023	.086	-.069	22	.177	.036	.309	.000	39	.039	.017	.086	-.023
6	.145	.032	.259	-.034	23	-.594	.051	-.415	-.777	40	-.731	.034	-.584	-.843
7	-.435	.043	-.297	-.602	24	.333	.041	.488	.183	41	.349	.023	.421	.268
8	.297	.042	.447	.151	25	.036	.021	.114	-.044	42	.371	.019	.427	.287
9	.244	.015	.285	.200	26	.035	.021	.098	-.038	43	.349	.022	.413	.277
10	.015	.021	.083	-.053	27	.266	.030	.378	.101	44	.354	.022	.422	.265
11	.239	.025	.317	.106	28	.325	.039	.450	.161	45	.345	.020	.405	.268
12	.302	.022	.364	.226	29	.026	.035	.158	-.119	46	.357	.040	.517	.182
13	-.068	.031	.062	-.179	30	.092	.022	.167	.016	47	.390	.033	.498	.252
14	.058	.024	.139	-.022	31	.103	.023	.205	.016	48	.357	.030	.447	.239
15	.088	.023	.165	.017	32	.183	.026	.274	.092	49	.362	.029	.447	.245
16	.121	.023	.200	.039	33	.338	.038	.485	.161	50	.358	.031	.443	.223
17	.230	.032	.342	.113	34	-.701	.036	-.562	-.805					

DATA FOR PROJECT 5590 CONFIGURATION K WIND 30 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN
1	.150	.025	.235	.061
2	-.295	.035	-.159	-.428
3	-.074	.020	-.011	-.145
4	-.061	.022	.025	-.142
5	-.004	.023	.075	-.086
6	.135	.034	.249	.002
7	-.452	.046	-.290	-.608
8	.287	.043	.459	.143
9	.164	.010	.193	.134
10	-.000	.021	.075	-.070
11	.223	.027	.314	.120
12	.280	.024	.353	.197
13	-.084	.034	.048	-.225
14	.039	.023	.113	-.036
15	.068	.024	.155	-.020
16	.104	.022	.181	.022
17	.217	.034	.327	.093

TAP	MEAN	RMS	MAX	MIN
18	-.337	.042	-.170	-.520
19	-.104	.024	-.023	-.186
20	-.040	.023	.041	-.124
21	.042	.024	.132	-.033
22	.166	.036	.310	-.011
23	-.622	.050	-.442	-.788
24	.322	.043	.472	.151
25	.018	.021	.081	-.049
26	.018	.019	.075	-.042
27	.250	.033	.377	.085
28	.304	.046	.443	.113
29	.010	.041	.161	-.150
30	.072	.024	.177	-.036
31	.074	.023	.142	-.008
32	.130	.024	.215	.043
33	.280	.041	.424	.104
34	-.436	.026	-.348	-.519

TAP	MEAN	RMS	MAX	MIN
35	-.461	.027	-.335	-.557
36	-.039	.015	.017	-.083
37	-.079	.018	-.027	-.145
38	-.229	.018	-.170	-.286
39	.025	.015	.065	-.025
40	-.805	.037	-.651	-.912
41	.290	.022	.360	.206
42	.180	.017	.240	.120
43	.126	.018	.188	.074
44	.127	.019	.204	.058
45	.124	.018	.191	.069
46	.318	.038	.469	.162
47	.231	.030	.333	.123
48	.122	.025	.204	.036
49	.143	.024	.236	.065
50	.145	.025	.230	.053

DATA FOR PROJECT 5590 CONFIGURATION 0 WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN
1	.268	.024	.347	.159
2	-.218	.039	-.049	-.346
3	.037	.022	.128	-.045
4	.044	.022	.126	-.025
5	.100	.024	.190	.014
6	.240	.035	.374	.104
7	-.377	.048	-.213	-.546
8	.396	.039	.562	.237
9	-7.355	.118	-7.172	-7.943
10	.120	.022	.206	.049
11	.344	.025	.437	.261
12	.400	.025	.483	.311
13	.022	.034	.151	-.088
14	.150	.024	.233	.061
15	.174	.024	.268	.092
16	.211	.024	.299	.127
17	.324	.033	.448	.209
18	-.244	.043	-.096	-.378
19	.003	.024	.100	-.092
20	.064	.023	.143	-.014
21	.142	.024	.241	.061
22	.270	.038	.401	.065
23	-.577	.054	-.385	-.778
24	.441	.042	.611	.298
25	.152	.022	.229	.081
26	.155	.021	.233	.077
27	.366	.033	.501	.245
28	.420	.047	.588	.245
29	.118	.040	.260	-.053
30	.179	.024	.264	.081
31	.192	.023	.287	.104
32	.243	.024	.333	.157
33	.413	.041	.569	.245
34	-.391	.026	-.294	-.467
35	.171	.061	.337	-.036
36	.070	.015	.121	.014
37	.121	.017	.182	.057
38	-.126	.018	-.048	-.190
39	.130	.015	.183	.079
40	-.666	.026	-.556	-.748
41	.413	.021	.484	.320
42	-.530	.051	-.437	-.613
43	.265	.019	.331	.201
44	.269	.019	.335	.205
45	.270	.016	.321	.214
46	.447	.037	.571	.294
47	.397	.029	.502	.241
48	.263	.024	.344	.175
49	.282	.024	.364	.187
50	.277	.023	.344	.191

DATA FOR PROJECT 5590 CONFIGURATION R WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.228	.032	.338	.105	18	-.283	.039	-.143	-.419	35	-.137	.077	.072	-.460
2	-.310	.040	-.174	-.454	19	-.099	.024	-.022	-.177	36	-.132	.017	-.068	-.191
3	-.062	.008	-.039	-.085	20	-.041	.025	.042	-.134	37	-.030	.020	.042	-.094
4	-.029	.022	.046	-.107	21	.003	.024	.090	-.078	38	-.133	.017	-.077	-.196
5	.056	.024	.139	-.039	22	.166	.041	.329	.031	39	-.005	.018	.051	-.068
6	.169	.027	.253	.054	23	-.450	.043	-.304	-.589	40	-.606	.035	-.489	-.702
7	-.345	.037	-.225	-.475	24	.347	.039	.476	.166	41	.334	.028	.427	.211
8	.359	.041	.507	.164	25	-.007	.022	.073	-.082	42	.420	.021	.489	.332
9	.044	.023	.122	-.047	26	.016	.021	.086	-.057	43	.385	.021	.455	.288
10	.021	.022	.101	-.060	27	.256	.040	.396	.044	44	.360	.018	.421	.300
11	.259	.046	.418	.004	28	.330	.057	.522	.124	45	.346	.019	.421	.277
12	.314	.033	.443	.214	29	-.022	.051	.145	-.246	46	.396	.046	.579	.187
13	-.071	.058	.085	-.307	30	.033	.029	.128	-.086	47	.422	.037	.557	.272
14	.087	.027	.180	-.022	31	.126	.025	.216	.035	48	.374	.031	.477	.230
15	.099	.026	.189	-.009	32	.237	.029	.337	.124	49	.345	.028	.442	.243
16	.146	.024	.219	.034	33	.347	.041	.514	.161	50	.365	.030	.468	.247
17	.112	.046	.305	-.091	34	-.865	.042	-.689	-.991					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.216	.032	.322	.108	18	-.291	.038	-.154	-.447	35	-.175	.072	.021	-.472
2	-.323	.041	-.170	-.454	19	-.104	.025	-.015	-.191	36	-.154	.018	-.092	-.219
3	-.073	.007	-.048	-.097	20	-.046	.026	.046	-.130	37	-.048	.019	.022	-.121
4	-.042	.021	.047	-.112	21	-.009	.026	.077	-.108	38	-.135	.018	-.061	-.198
5	.040	.025	.123	-.048	22	.192	.036	.346	.068	39	-.005	.019	.057	-.080
6	.156	.027	.264	.059	23	-.401	.041	-.262	-.543	40	-.574	.035	-.450	-.687
7	-.355	.036	-.228	-.494	24	.366	.036	.477	.216	41	.324	.031	.416	.175
8	.347	.040	.508	.178	25	.047	.022	.141	-.033	42	.429	.022	.504	.337
9	.038	.024	.123	-.039	26	.054	.023	.126	-.045	43	.421	.021	.490	.351
10	.014	.023	.099	-.072	27	.281	.039	.398	.091	44	.411	.021	.478	.327
11	.246	.045	.392	.034	28	.352	.055	.575	.161	45	.403	.023	.467	.294
12	.315	.026	.413	.206	29	.003	.056	.173	-.241	46	.399	.046	.562	.203
13	-.089	.059	.120	-.318	30	.063	.028	.164	-.053	47	.433	.041	.571	.252
14	.081	.030	.188	-.025	31	.157	.025	.242	.068	48	.420	.035	.528	.240
15	.096	.025	.179	-.000	32	.283	.031	.372	.149	49	.403	.033	.507	.261
16	.140	.026	.225	.046	33	.372	.042	.566	.155	50	.413	.034	.543	.294
17	.116	.046	.357	-.049	34	-.904	.045	-.681	-1.064					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.213	.032	.305	.099	18	-.296	.037	-.177	-.432	35	-.457	.065	-.255	-.708
2	-.332	.041	-.185	-.468	19	-.109	.025	-.029	-.217	36	-.494	.037	-.345	-.627
3	-.076	.007	-.056	-.102	20	-.052	.024	.029	-.135	37	-.124	.027	-.029	-.223
4	-.048	.022	.024	-.125	21	-.021	.026	.064	-.121	38	-.142	.020	-.068	-.214
5	.036	.025	.113	-.047	22	.150	.039	.321	.026	39	-.023	.023	.057	-.093
6	.156	.027	.252	.058	23	-.458	.042	-.311	-.599	40	-.352	.042	-.227	-.498
7	-.356	.036	-.237	-.464	24	.331	.039	.461	.184	41	.385	.038	.499	.143
8	.345	.041	.515	.211	25	.033	.029	.163	-.068	42	.461	.028	.544	.357
9	.040	.023	.117	-.043	26	.020	.024	.106	-.068	43	.508	.028	.627	.385
10	.018	.024	.099	-.072	27	.257	.041	.401	.097	44	.513	.028	.603	.395
11	.250	.044	.399	.024	28	.339	.059	.529	.092	45	.509	.028	.602	.410
12	.313	.028	.404	.224	29	-.018	.058	.168	-.226	46	.426	.051	.634	.184
13	-.101	.057	.097	-.299	30	.057	.029	.156	-.082	47	.486	.048	.641	.244
14	.081	.027	.191	-.034	31	.177	.026	.280	.081	48	.512	.046	.674	.322
15	.095	.026	.184	-.004	32	.335	.039	.463	.165	49	.519	.053	.692	.327
16	.138	.026	.210	.031	33	.398	.048	.562	.133	50	.521	.051	.706	.339
17	.118	.043	.266	-.027	34	-.944	.068	-.662	-1.175					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.201	.030	.306	.096	18	-.296	.036	-.160	-.408	35	-.615	.039	-.488	-.764
2	-.334	.042	-.199	-.494	19	-.107	.023	-.033	-.184	36	-.677	.037	-.550	-.837
3	-.081	.007	-.050	-.104	20	-.058	.023	.036	-.150	37	-.665	.047	-.499	-.862
4	-.057	.020	.009	-.123	21	-.049	.025	.033	-.149	38	-.536	.058	-.271	-.741
5	.022	.024	.110	-.075	22	.103	.035	.226	-.007	39	-.355	.063	-.128	-.532
6	.136	.024	.227	.057	23	-.502	.046	-.327	-.665	40	-.386	.075	-.073	-.646
7	-.357	.034	-.221	-.472	24	.311	.035	.428	.187	41	.607	.056	.749	.325
8	.331	.038	.489	.169	25	-.008	.038	.144	-.125	42	.508	.034	.607	.288
9	.025	.022	.106	-.062	26	-.052	.035	.076	-.234	43	.615	.035	.724	.480
10	.005	.024	.091	-.075	27	.278	.040	.435	.144	44	.642	.035	.746	.501
11	.254	.041	.386	.047	28	.355	.056	.513	.160	45	.649	.039	.780	.534
12	.323	.025	.400	.226	29	.040	.055	.228	-.160	46	.497	.056	.675	.079
13	-.099	.053	.107	-.292	30	.130	.030	.241	.018	47	.536	.061	.745	.270
14	.093	.025	.186	.008	31	.275	.032	.379	.155	48	.637	.064	.903	.418
15	.125	.025	.205	.030	32	.416	.044	.564	.261	49	.661	.077	.925	.328
16	.143	.024	.230	.038	33	.445	.050	.644	.162	50	.665	.074	.946	.396
17	.128	.039	.260	-.011	34	-.708	.038	-.575	-.857					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 145 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.197	.030	.301	.082	18	-.233	.036	-.107	-.371	35	-.783	.036	-.665	-.939
2	-.340	.040	-.202	-.474	19	-.065	.025	.044	-.146	36	-.673	.032	-.563	-.794
3	-.088	.007	-.064	-.107	20	-.041	.026	.057	-.139	37	-.708	.031	-.573	-.835
4	-.068	.021	.005	-.153	21	-.100	.027	-.015	-.253	38	-.704	.035	-.580	-.866
5	.005	.024	.088	-.072	22	.060	.038	.244	-.059	39	-.756	.044	-.569	-.917
6	.117	.025	.196	.019	23	-.629	.056	-.442	-.895	40	-.810	.053	-.576	-1.017
7	-.382	.036	-.268	-.498	24	.335	.034	.451	.207	41	.834	.071	.993	.476
8	.328	.038	.458	.174	25	.130	.052	.335	-.022	42	.580	.042	.693	.416
9	.044	.025	.139	-.042	26	.048	.050	.252	-.160	43	.706	.041	.812	.548
10	.023	.025	.108	-.063	27	.353	.040	.479	.171	44	.768	.043	.934	.619
11	.275	.038	.403	.086	28	.430	.052	.594	.239	45	.784	.048	.912	.584
12	.346	.025	.426	.250	29	.168	.053	.333	-.010	46	.547	.068	.743	.250
13	-.078	.047	.078	-.256	30	.266	.034	.388	.140	47	.550	.078	.832	.253
14	.127	.024	.207	.052	31	.413	.038	.546	.261	48	.757	.073	1.009	.455
15	.163	.025	.245	.081	32	.515	.046	.670	.341	49	.780	.079	1.067	.426
16	.182	.025	.270	.093	33	.526	.052	.716	.319	50	.780	.080	1.062	.481
17	.156	.037	.319	.006	34	-.711	.037	-.586	-.852					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.194	.029	.294	.070	18	-.192	.036	-.060	-.370	35	-.762	.040	-.634	-.910
2	-.342	.039	-.230	-.470	19	-.041	.025	.057	-.123	36	-.688	.029	-.575	-.798
3	-.093	.008	-.069	-.118	20	-.044	.025	.063	-.143	37	-.701	.026	-.614	-.796
4	-.077	.019	-.006	-.140	21	-.155	.034	-.043	-.314	38	-.718	.030	-.594	-.823
5	-.007	.023	.082	-.101	22	.039	.048	.240	-.211	39	-.781	.033	-.613	-.907
6	.105	.024	.190	.004	23	-.725	.070	-.518	-1.018	40	-.818	.037	-.690	-.958
7	-.398	.033	-.278	-.511	24	.337	.034	.438	.177	41	.889	.064	1.007	.506
8	.320	.034	.465	.183	25	.209	.058	.439	-.011	42	.627	.051	.775	.431
9	.059	.025	.152	-.038	26	.128	.055	.342	-.146	43	.734	.045	.857	.531
10	.041	.026	.137	-.060	27	.379	.036	.500	.240	44	.825	.040	.923	.665
11	.284	.036	.426	.106	28	.454	.050	.628	.255	45	.829	.046	.962	.671
12	.358	.026	.446	.258	29	.213	.050	.379	.056	46	.559	.072	.780	.280
13	-.066	.045	.103	-.212	30	.314	.032	.432	.198	47	.519	.088	.828	.245
14	.144	.025	.227	.041	31	.455	.036	.575	.316	48	.814	.075	1.055	.467
15	.184	.023	.252	.085	32	.542	.046	.706	.344	49	.837	.078	1.076	.492
16	.200	.025	.293	.080	33	.549	.053	.712	.331	50	.825	.076	1.052	.510
17	.163	.036	.298	.037	34	-.702	.031	-.604	-.804					

DATA FOR PROJECT 5590 CONFIGURATION R WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN
1	.217	.032	.319	.097
2	-.358	.038	-.230	-.497
3	-.106	.009	-.079	-.136
4	-.097	.019	-.034	-.167
5	-.038	.023	.046	-.128
6	.064	.024	.144	-.027
7	-.447	.034	-.336	-.561
8	.313	.036	.442	.186
9	.093	.026	.187	.004
10	.076	.028	.162	-.035
11	.315	.033	.426	.162
12	.386	.025	.462	.289
13	-.042	.040	.096	-.205
14	.180	.023	.263	.109
15	.224	.024	.302	.126
16	.237	.026	.326	.138
17	.178	.033	.324	.049

TAP	MEAN	RMS	MAX	MIN
18	-.103	.037	.036	-.254
19	-.000	.026	.093	-.094
20	-.065	.028	.048	-.202
21	-.265	.046	-.103	-.463
22	-.041	.084	.179	-.412
23	-.867	.099	-.532	-1.328
24	.352	.036	.471	.204
25	.384	.064	.585	.131
26	.308	.059	.490	.054
27	.427	.034	.546	.260
28	.500	.046	.644	.311
29	.289	.044	.463	.096
30	.391	.033	.525	.264
31	.519	.038	.639	.380
32	.577	.048	.729	.379
33	.588	.055	.763	.267
34	-.744	.033	-.638	-.855

TAP	MEAN	RMS	MAX	MIN
35	-.770	.034	-.651	-.889
36	-.717	.028	-.610	-.822
37	-.709	.023	-.621	-.795
38	-.737	.023	-.662	-.812
39	-.778	.027	-.700	-.881
40	-.797	.030	-.666	-.895
41	.844	.046	.965	.576
42	.825	.054	.976	.572
43	.774	.036	.886	.622
44	.886	.038	.987	.746
45	.899	.044	1.027	.716
46	.596	.078	.842	.204
47	.497	.124	.866	.087
48	.871	.077	1.168	.564
49	.891	.076	1.138	.615
50	.866	.075	1.087	.542

DATA FOR PROJECT 5590 CONFIGURATION S WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.219	.033	.332	.088	18	-.301	.040	-.148	-.434	35	-.623	.054	-.445	-.811
2	-.327	.040	-.179	-.451	19	-.106	.024	-.029	-.188	36	-.061	.020	-.007	-.137
3	-.067	.008	-.044	-.091	20	-.038	.023	.042	-.113	37	-.124	.020	-.053	-.188
4	-.041	.021	.034	-.116	21	-.012	.025	.080	-.085	38	-.215	.020	-.153	-.288
5	.042	.023	.132	-.038	22	.161	.038	.310	.027	39	-.024	.018	-.038	-.079
6	.160	.027	.248	.050	23	-.457	.043	-.311	-.603	40	-.489	.031	-.380	-.592
7	-.358	.038	-.223	-.498	24	.340	.040	.490	.182	41	.321	.028	.448	.219
8	.352	.039	.486	.207	25	.006	.022	.070	-.067	42	.400	.022	.468	.315
9	.037	.022	.110	-.038	26	.019	.022	.085	-.064	43	.342	.021	.410	.239
10	.012	.023	.094	-.069	27	.249	.040	.395	.073	44	.339	.022	.400	.257
11	.250	.046	.401	-.000	28	.325	.057	.505	.112	45	.345	.021	.419	.275
12	.316	.032	.422	.211	29	-.049	.057	.155	-.280	46	.378	.046	.545	.207
13	-.086	.060	.102	-.344	30	.019	.031	.130	-.110	47	.394	.036	.505	.241
14	.079	.027	.173	-.023	31	.113	.025	.191	.030	48	.347	.031	.450	.201
15	.111	.026	.201	.011	32	.219	.028	.319	.100	49	.352	.032	.459	.201
16	.140	.025	.223	.055	33	.332	.039	.471	.173	50	.360	.031	.456	.198
17	.114	.046	.291	-.057	34	-.622	.050	-.457	-.777					

DATA FOR PROJECT 5590 CONFIGURATION S WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.212	.032	.310	.094	18	-.299	.039	-.147	-.474	35	-.987	.055	-.789	-1.156
2	-.326	.039	-.200	-.488	19	-.107	.023	-.025	-.182	36	-.223	.028	-.136	-.338
3	-.073	.007	-.052	-.094	20	-.039	.024	.046	-.113	37	-.139	.021	-.052	-.207
4	-.044	.021	.031	-.108	21	-.019	.025	.072	-.089	38	-.209	.020	-.136	-.288
5	.038	.025	.120	-.052	22	.152	.039	.315	.017	39	-.031	.019	-.033	-.095
6	.154	.027	.247	.036	23	-.457	.043	-.312	-.630	40	-.376	.031	-.259	-.507
7	-.350	.037	-.228	-.486	24	.334	.038	.457	.180	41	.381	.032	.474	.240
8	.345	.039	.474	.171	25	.079	.025	.170	-.026	42	.441	.026	.520	.334
9	.053	.023	.134	-.031	26	.070	.026	.161	-.033	43	.464	.028	.563	.367
10	.032	.022	.108	-.045	27	.253	.040	.419	.055	44	.469	.026	.558	.362
11	.246	.043	.433	.062	28	.334	.056	.525	.107	45	.480	.027	.580	.384
12	.314	.031	.422	.205	29	-.037	.057	.148	-.240	46	.397	.049	.561	.165
13	-.100	.056	.116	-.304	30	.036	.029	.132	-.080	47	.452	.042	.609	.283
14	.079	.027	.173	-.025	31	.145	.025	.227	.062	48	.466	.043	.607	.318
15	.112	.026	.194	.030	32	.285	.036	.396	.112	49	.474	.043	.611	.315
16	.139	.027	.228	.023	33	.368	.042	.536	.182	50	.476	.042	.637	.313
17	.117	.043	.295	-.092	34	-.924	.054	-.703	-1.104					

DATA FOR PROJECT 5590 CONFIGURATION S WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.204	.032	.308	.081	18	-.303	.037	-.171	-.448	35	-.978	.068	-.684	-1.223
2	-.330	.041	-.196	-.469	19	-.109	.021	-.038	-.181	36	-.567	.043	-.394	-.721
3	-.078	.007	-.049	-.095	20	-.043	.021	.028	-.114	37	-.179	.022	-.092	-.272
4	-.049	.020	.021	-.121	21	-.030	.024	.057	-.114	38	-.198	.021	-.124	-.287
5	.030	.023	.111	-.045	22	.139	.037	.273	.015	39	-.050	.021	.034	-.124
6	.145	.026	.242	.021	23	-.465	.042	-.326	-.595	40	-.251	.034	-.140	-.393
7	-.349	.035	-.241	-.484	24	.325	.037	.454	.180	41	.455	.045	.582	.164
8	.336	.036	.457	.172	25	.108	.035	.210	-.027	42	.470	.029	.557	.361
9	.059	.022	.129	-.018	26	.088	.033	.201	-.023	43	.513	.027	.603	.423
10	.039	.023	.114	-.039	27	.266	.039	.416	.078	44	.528	.029	.617	.437
11	.245	.041	.392	.056	28	.348	.054	.504	.140	45	.555	.032	.656	.436
12	.311	.026	.389	.214	29	-.011	.055	.176	-.217	46	.434	.051	.636	.224
13	-.111	.054	.073	-.278	30	.072	.029	.175	-.023	47	.491	.049	.643	.315
14	.079	.026	.168	-.048	31	.198	.026	.303	.111	48	.536	.046	.707	.366
15	.113	.025	.205	.027	32	.356	.037	.481	.213	49	.559	.059	.784	.350
16	.136	.024	.221	.045	33	.416	.045	.574	.205	50	.553	.056	.778	.337
17	.121	.040	.268	-.038	34	-.980	.064	-.704	-1.225					

DATA FOR PROJECT 5590 CONFIGURATION S WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.200	.030	.310	.090	18	-.260	.036	-.130	-.401	35	-.931	.091	-.670	-1.237
2	-.330	.038	-.207	-.481	19	-.072	.024	.015	-.155	36	-.714	.040	-.593	-.899
3	-.080	.007	-.055	-.105	20	-.030	.024	.073	-.123	37	-.671	.051	-.482	-.875
4	-.058	.018	.010	-.113	21	-.069	.026	.026	-.167	38	-.610	.053	-.399	-.815
5	.016	.023	.094	-.079	22	.108	.032	.222	-.003	39	-.504	.063	-.254	-.703
6	.128	.026	.206	.027	23	-.482	.046	-.305	-.642	40	-.547	.074	-.199	-.780
7	-.363	.035	-.246	-.513	24	.324	.034	.440	.183	41	.665	.064	.822	.126
8	.327	.037	.455	.157	25	.090	.041	.294	-.096	42	.550	.035	.645	.439
9	.062	.025	.158	-.031	26	.063	.044	.232	-.113	43	.610	.034	.723	.469
10	.044	.024	.132	-.039	27	.321	.036	.465	.147	44	.654	.037	.770	.532
11	.270	.037	.392	.096	28	.405	.051	.559	.230	45	.720	.043	.851	.561
12	.325	.023	.411	.244	29	.108	.052	.299	-.109	46	.527	.058	.700	.280
13	-.102	.048	.048	-.269	30	.212	.032	.324	.098	47	.550	.068	.791	.302
14	.102	.024	.191	.018	31	.367	.033	.505	.230	48	.702	.069	.931	.419
15	.141	.022	.214	.064	32	.492	.044	.623	.319	49	.737	.084	1.003	.431
16	.164	.023	.238	.078	33	.509	.052	.653	.261	50	.743	.078	.996	.443
17	.145	.037	.281	.009	34	-.770	.048	-.623	-.969					

DATA FOR PROJECT 5590 CONFIGURATION S WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.193	.029	.292	.086	18	-.091	.036	.070	-.236	35	-.894	.049	-.715	-1.091
2	-.346	.036	-.218	-.473	19	.017	.027	.114	-.072	36	-.724	.028	-.618	-.808
3	-.100	.009	-.054	-.128	20	-.047	.028	.044	-.208	37	-.739	.030	-.647	-.833
4	-.092	.019	-.031	-.159	21	-.267	.047	-.126	-.438	38	-.740	.026	-.651	-.834
5	-.033	.023	.051	-.114	22	-.022	.083	.243	-.450	39	-.755	.024	-.675	-.848
6	.071	.024	.156	-.026	23	-.792	.098	-.415	-1.270	40	-.778	.026	-.702	-.884
7	-.440	.033	-.328	-.566	24	.353	.034	.484	.223	41	.835	.051	.938	.495
8	.309	.034	.418	.173	25	.443	.067	.689	.049	42	.797	.052	.918	.579
9	.127	.026	.225	.019	26	.442	.066	.659	.148	43	.765	.044	.890	.508
10	.113	.026	.209	.026	27	.420	.035	.520	.254	44	.862	.041	.969	.696
11	.314	.031	.408	.186	28	.490	.045	.619	.294	45	.893	.043	.993	.713
12	.381	.024	.457	.266	29	.278	.044	.449	.128	46	.592	.073	.852	.260
13	-.043	.040	.115	-.168	30	.379	.032	.504	.264	47	.508	.119	.883	.085
14	.181	.023	.262	.099	31	.513	.036	.645	.300	48	.853	.076	1.076	.471
15	.224	.024	.303	.126	32	.573	.046	.757	.346	49	.883	.072	1.156	.562
16	.239	.025	.316	.145	33	.583	.051	.776	.297	50	.866	.068	1.065	.517
17	.180	.033	.290	.054	34	-.742	.037	-.618	-.849					

DATA FOR PROJECT 5590 CONFIGURATION T WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.162	.041	.290	-.074	18	-.296	.066	-.099	-.523
2	-.020	.031	.095	-.152	19	-.030	.028	.068	-.129
3	-.104	.028	-.022	-.238	20	-.066	.030	.030	-.193
4	-.042	.025	.048	-.165	21	.024	.030	.115	-.124
5	.018	.027	.117	-.078	22	.182	.058	.420	.009
6	.137	.044	.286	-.030	23	-.311	.047	-.167	-.506
7	-.263	.039	-.139	-.472	24	.300	.059	.491	.093
8	.275	.045	.402	.091	25	.026	.025	.101	-.058
9	-.100	.024	-.017	-.191	26	.023	.024	.106	-.058
10	.018	.027	.108	-.091	27	.220	.073	.436	-.129
11	.212	.075	.545	-.143	28	.312	.079	.558	-.024
12	.239	.058	.437	-.017	29	-.010	.080	.265	-.431
13	.099	.058	.351	-.124	30	.119	.036	.265	-.066
14	.089	.036	.248	-.065	31	.083	.028	.194	-.087
15	.091	.033	.205	-.043	32	.208	.036	.323	.009
16	.141	.033	.253	.008	33	.338	.056	.529	.026
17	.240	.055	.424	.051	34	-.696	.048	-.510	-.858

TAP	MEAN	RMS	MAX	MIN
35	-.685	.060	-.476	-.888
36	-.085	.016	-.025	-.144
37	-.023	.017	.035	-.082
38	-.084	.019	-.013	-.153
39	.098	.021	.170	.026
40	-.559	.042	-.412	-.684
41	.381	.037	.489	.212
42	.436	.029	.531	.319
43	.393	.028	.518	.283
44	.372	.029	.484	.265
45	.354	.026	.438	.246
46	.359	.066	.599	-.072
47	.427	.050	.603	.213
48	.389	.043	.523	.234
49	.375	.044	.514	.217
50	.363	.040	.501	.213

DATA FOR PROJECT 5590 CONFIGURATION T WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.169	.039	.286	.022	18	-.308	.066	-.115	-.557
2	-.026	.031	.088	-.123	19	-.034	.029	.086	-.143
3	-.110	.029	-.002	-.220	20	-.074	.032	.025	-.177
4	-.047	.025	.040	-.140	21	.009	.030	.121	-.098
5	.016	.026	.099	-.099	22	.168	.057	.396	-.036
6	.137	.042	.296	.012	23	-.322	.046	-.184	-.479
7	-.271	.039	-.130	-.414	24	.297	.057	.524	.094
8	.277	.045	.428	.116	25	.104	.042	.245	-.036
9	-.071	.024	.005	-.144	26	.099	.040	.245	-.050
10	.037	.026	.123	-.057	27	.226	.068	.473	-.120
11	.215	.067	.487	-.116	28	.305	.075	.554	.034
12	.251	.052	.408	.066	29	-.015	.082	.262	-.315
13	.086	.051	.271	-.115	30	.129	.034	.252	-.020
14	.087	.036	.237	-.109	31	.118	.031	.219	-.006
15	.087	.032	.213	-.044	32	.289	.044	.440	.125
16	.137	.032	.233	.018	33	.383	.062	.581	-.010
17	.237	.052	.408	.025	34	-.876	.088	-.545	-1.176

TAP	MEAN	RMS	MAX	MIN
35	-.802	.084	-.437	-1.148
36	-.327	.044	-.196	-.498
37	-.070	.021	-.005	-.168
38	-.111	.024	-.020	-.217
39	.055	.026	.139	-.037
40	-.456	.051	-.298	-.623
41	.442	.058	.591	.147
42	.480	.038	.590	.356
43	.488	.037	.613	.377
44	.498	.038	.634	.346
45	.494	.038	.624	.356
46	.396	.074	.620	-.339
47	.465	.062	.674	.190
48	.508	.056	.701	.291
49	.519	.062	.715	.231
50	.509	.062	.698	.285

DATA FOR PROJECT 5590 CONFIGURATION T WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.165	.037	.281	.014	18	-.297	.060	-.102	-.511
2	-.031	.030	.120	-.152	19	-.003	.027	.091	-.099
3	-.117	.027	-.015	-.226	20	-.072	.032	.041	-.187
4	-.059	.024	.029	-.140	21	-.014	.031	.117	-.121
5	-.001	.026	.094	-.099	22	.112	.049	.361	-.065
6	.120	.040	.265	-.017	23	-.391	.056	-.203	-.647
7	-.297	.039	-.176	-.482	24	.330	.047	.498	.142
8	.284	.039	.409	.110	25	.281	.067	.512	.056
9	-.030	.023	.048	-.116	26	.260	.068	.398	.021
10	.073	.028	.183	-.032	27	.297	.066	.503	-.009
11	.257	.060	.457	-.000	28	.371	.075	.601	.121
12	.281	.045	.429	.075	29	.141	.075	.396	-.177
13	.113	.046	.298	-.075	30	.268	.038	.421	.116
14	.119	.030	.236	.005	31	.334	.042	.477	.161
15	.120	.028	.205	-.009	32	.474	.056	.680	.254
16	.177	.030	.284	.075	33	.505	.065	.706	.198
17	.270	.044	.446	.120	34	-.709	.053	-.549	-.985

TAP	MEAN	RMS	MAX	MIN
35	-.684	.054	-.504	-.933
36	-.673	.050	-.502	-.879
37	-.702	.067	-.402	-.941
38	-.651	.059	-.386	-.836
39	-.527	.067	-.252	-.707
40	-.583	.080	-.184	-.872
41	.713	.091	.936	.274
42	.632	.054	.771	.436
43	.643	.053	.779	.470
44	.695	.056	.863	.486
45	.705	.057	.861	.484
46	.519	.072	.748	-.021
47	.555	.078	.795	.269
48	.677	.087	.983	.335
49	.719	.093	1.115	.344
50	.710	.094	1.040	.425

DATA FOR PROJECT 5590 CONFIGURATION T WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.158	.036	.280	.023	18	-.241	.057	-.043	-.440	35	-.705	.041	-.587	-.876
2	-.036	.028	.077	-.138	19	.034	.031	.142	-.062	36	-.676	.037	-.552	-.823
3	-.126	.026	-.036	-.238	20	-.085	.034	.077	-.272	37	-.708	.037	-.588	-.871
4	-.078	.024	.016	-.168	21	-.098	.039	.042	-.281	38	-.744	.035	-.634	-.852
5	-.027	.025	.050	-.111	22	.066	.062	.297	-.180	39	-.744	.035	-.617	-.867
6	.098	.042	.245	-.030	23	-.576	.084	-.260	-.992	40	-.800	.042	-.650	-.947
7	-.330	.038	-.204	-.487	24	.343	.044	.506	.174	41	.842	.091	1.015	.343
8	.273	.039	.388	.123	25	.453	.093	.806	.167	42	.723	.054	.864	.493
9	.015	.023	.101	-.065	26	.432	.093	.771	.107	43	.708	.054	.866	.517
10	.097	.029	.201	-.016	27	.342	.066	.539	.048	44	.793	.057	.945	.515
11	.291	.051	.458	-.006	28	.415	.072	.616	.131	45	.800	.058	.965	.601
12	.309	.036	.430	.167	29	.231	.075	.485	-.181	46	.558	.075	.791	.153
13	.128	.037	.283	.010	30	.345	.042	.492	.138	47	.556	.087	.887	.269
14	.147	.027	.246	.040	31	.420	.046	.586	.256	48	.738	.095	1.050	.370
15	.156	.026	.251	.049	32	.523	.057	.695	.316	49	.812	.094	1.179	.430
16	.216	.028	.296	.110	33	.549	.065	.726	.293	50	.811	.094	1.133	.493
17	.289	.041	.465	.139	34	-.715	.040	-.591	-.842					

DATA FOR PROJECT 5590 CONFIGURATION T WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.150	.035	.273	.011	18	-.130	.053	.094	-.340	35	-.746	.037	-.616	-.870
2	-.040	.027	.051	-.140	19	.084	.028	.178	-.041	36	-.737	.034	-.623	-.833
3	-.142	.025	-.060	-.293	20	-.135	.038	-.002	-.336	37	-.730	.028	-.624	-.827
4	-.107	.024	-.022	-.201	21	-.197	.042	-.072	-.452	38	-.740	.025	-.660	-.812
5	-.067	.023	.016	-.148	22	-.051	.096	.324	-.384	39	-.788	.027	-.683	-.894
6	.061	.040	.202	-.071	23	-.725	.098	-.440	-1.139	40	-.809	.035	-.697	-.950
7	-.405	.039	-.282	-.533	24	.373	.045	.542	.207	41	.783	.048	.922	.501
8	.273	.036	.380	.130	25	.699	.096	1.102	.346	42	.926	.053	1.039	.695
9	.092	.024	.188	.002	26	.663	.093	.973	.242	43	.749	.051	.869	.566
10	.134	.027	.229	.029	27	.405	.061	.623	.154	44	.882	.044	.987	.717
11	.339	.043	.475	.157	28	.478	.066	.676	.203	45	.901	.050	1.034	.650
12	.355	.033	.454	.233	29	.336	.067	.569	.085	46	.624	.070	.902	.329
13	.156	.029	.254	.049	30	.434	.041	.579	.264	47	.590	.107	.914	.125
14	.194	.025	.288	.102	31	.500	.044	.652	.288	48	.740	.090	1.033	.369
15	.210	.026	.296	.117	32	.588	.053	.755	.332	49	.900	.085	1.189	.553
16	.270	.029	.373	.153	33	.604	.057	.773	.285	50	.882	.081	1.090	.547
17	.317	.037	.454	.138	34	-.737	.030	-.634	-.829					

DATA FOR PROJECT 5590 CONFIGURATION T WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.146	.033	.255	.012	18	-.135	.047	.098	-.310	35	-.962	.037	-.810	-1.093
2	-.041	.027	.078	-.151	19	.105	.026	.203	.014	36	-.942	.044	-.787	-1.046
3	-.141	.025	-.055	-.246	20	-.064	.028	.039	-.163	37	-.899	.047	-.743	-1.026
4	-.114	.022	-.048	-.186	21	-.118	.029	-.042	-.248	38	-.824	.036	-.687	-.949
5	-.077	.023	.006	-.160	22	-.033	.072	.278	-.387	39	-.887	.028	-.790	-.975
6	.049	.037	.186	-.078	23	-.760	.080	-.500	-1.106	40	-.885	.038	-.756	-1.013
7	-.414	.038	-.305	-.534	24	.394	.041	.527	.255	41	-.171	.037	-.022	-.330
8	.273	.037	.391	.144	25	.706	.090	1.010	.366	42	.634	.030	.720	.477
9	.168	.027	.267	.074	26	.647	.079	.955	.297	43	.867	.056	.992	.615
10	.153	.029	.255	.050	27	.393	.052	.587	.122	44	.793	.037	.902	.656
11	.325	.042	.461	.119	28	.454	.059	.654	.255	45	.819	.041	.933	.656
12	.357	.029	.438	.239	29	.273	.063	.467	.038	46	.583	.048	.719	.367
13	.166	.029	.254	.068	30	.375	.033	.496	.232	47	.605	.054	.783	.321
14	.196	.024	.273	.104	31	.420	.032	.541	.299	48	.574	.098	.862	.217
15	.208	.023	.286	.121	32	.513	.038	.629	.375	49	.792	.093	1.094	.402
16	.270	.027	.359	.164	33	.552	.043	.699	.392	50	.783	.081	1.046	.468
17	.330	.035	.445	.212	34	-.957	.038	-.784	-1.063					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 120 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.161	.044	.313	-.021	18	-.291	.072	-.071	-.580	35	-.616	.039	-.442	-.743
2	-.016	.033	.122	-.198	19	-.036	.040	.085	-.180	36	-.095	.021	-.014	-.175
3	-.099	.031	.007	-.218	20	-.065	.041	.064	-.200	37	.002	.019	.061	-.068
4	-.036	.027	.048	-.123	21	.016	.040	.159	-.126	38	-.113	.018	-.041	-.188
5	.027	.033	.136	-.102	22	.212	.060	.474	.019	39	.131	.022	.200	.052
6	.132	.047	.286	-.014	23	-.388	.054	-.205	-.588	40	-.427	.032	-.309	-.556
7	-.248	.041	-.109	-.409	24	.312	.062	.567	.105	41	.371	.030	.463	.245
8	.269	.052	.443	.088	25	.027	.024	.118	-.073	42	.390	.026	.480	.266
9	-.097	.024	-.014	-.184	26	.022	.026	.105	-.067	43	.346	.038	.465	.180
10	.020	.028	.109	-.075	27	.204	.083	.481	-.205	44	.337	.037	.451	.227
11	.205	.078	.497	-.150	28	.308	.083	.573	-.014	45	.316	.025	.387	.213
12	.239	.066	.444	-.010	29	.036	.080	.296	-.318	46	.376	.062	.594	.119
13	.109	.068	.383	-.207	30	.126	.038	.250	-.067	47	.398	.053	.594	.173
14	.093	.050	.275	-.092	31	.084	.031	.197	-.027	48	.332	.042	.474	.099
15	.087	.044	.248	-.092	32	.208	.036	.323	.052	49	.330	.042	.474	.159
16	.140	.045	.288	-.037	33	.346	.057	.514	-.007	50	.314	.041	.447	.173
17	.226	.065	.438	-.017	34	-.649	.041	-.456	-.777					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.168	.040	.301	.028	18	-.300	.066	-.063	-.534	35	-.669	.054	-.445	-.822
2	-.021	.030	.113	-.233	19	-.037	.030	.061	-.143	36	-.111	.020	-.039	-.185
3	-.103	.028	-.011	-.280	20	-.069	.032	.035	-.220	37	-.004	.019	.062	-.066
4	-.041	.025	.049	-.143	21	.008	.031	.116	-.105	38	-.121	.018	-.064	-.181
5	.020	.028	.113	-.096	22	.188	.056	.419	.004	39	.122	.021	.204	.053
6	.133	.045	.292	-.015	23	-.386	.054	-.207	-.571	40	-.438	.029	-.328	-.546
7	-.264	.039	-.126	-.421	24	.294	.058	.514	.087	41	.349	.036	.467	.160
8	.281	.045	.420	.122	25	.037	.027	.129	-.074	42	.392	.032	.489	.263
9	-.082	.023	-.007	-.160	26	.033	.026	.120	-.045	43	.370	.034	.485	.239
10	.024	.025	.109	-.054	27	.222	.071	.435	-.149	44	.369	.035	.490	.218
11	.214	.071	.446	-.143	28	.306	.078	.551	-.049	45	.365	.032	.468	.267
12	.242	.054	.413	.027	29	-.032	.082	.236	-.443	46	.367	.062	.560	.066
13	.090	.053	.320	-.109	30	.108	.034	.224	-.029	47	.402	.051	.573	.154
14	.085	.038	.222	-.088	31	.081	.029	.183	-.120	48	.370	.043	.506	.187
15	.084	.032	.192	-.054	32	.207	.035	.315	.050	49	.382	.044	.514	.204
16	.133	.033	.252	.010	33	.339	.055	.531	.062	50	.372	.046	.527	.217
17	.223	.054	.417	.044	34	-.684	.055	-.500	-.877					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.167	.038	.302	.031	18	-.288	.061	-.079	-.525	35	-.728	.063	-.500	-.996
2	-.028	.030	.097	-.174	19	-.013	.029	.094	-.132	36	-.686	.071	-.484	-1.025
3	-.112	.029	.001	-.250	20	-.070	.033	.035	-.191	37	-.631	.063	-.355	-.854
4	-.054	.025	.038	-.154	21	-.014	.033	.091	-.138	38	-.522	.067	-.247	-.769
5	.006	.026	.097	-.094	22	.145	.051	.346	-.023	39	-.367	.067	-.027	-.558
6	.130	.043	.272	-.045	23	-.460	.061	-.276	-.799	40	-.363	.082	-.082	-.701
7	-.289	.041	-.154	-.471	24	.319	.050	.506	.140	41	.689	.091	.897	.315
8	.286	.043	.398	.101	25	.272	.064	.538	.038	42	.531	.049	.692	.304
9	-.035	.023	.041	-.111	26	.259	.067	.544	.038	43	.621	.052	.773	.419
10	.084	.028	.187	-.005	27	.279	.072	.557	-.106	44	.672	.056	.861	.419
11	.250	.060	.484	-.042	28	.358	.075	.605	.063	45	.688	.058	.864	.488
12	.270	.046	.429	.071	29	.124	.078	.342	-.273	46	.501	.077	.770	.164
13	.105	.049	.304	-.043	30	.244	.041	.394	.070	47	.556	.077	.802	.239
14	.110	.035	.229	-.017	31	.311	.043	.442	.118	48	.645	.080	.922	.391
15	.113	.031	.219	-.037	32	.446	.056	.640	.256	49	.707	.089	.997	.365
16	.167	.032	.281	-.033	33	.502	.064	.743	.217	50	.712	.095	1.000	.329
17	.260	.049	.425	.104	34	-.650	.063	-.438	-.885					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.152	.037	.268	-.025	18	-.149	.055	.056	-.382	35	-.713	.043	-.586	-.847
2	-.042	.030	.056	-.159	19	.066	.030	.208	-.039	36	-.704	.038	-.577	-.825
3	-.135	.028	-.040	-.252	20	-.115	.038	.003	-.315	37	-.713	.035	-.590	-.839
4	-.095	.023	-.009	-.176	21	-.164	.047	.005	-.397	38	-.717	.029	-.629	-.824
5	-.051	.025	.063	-.147	22	-.001	.088	.320	-.311	39	-.732	.026	-.641	-.829
6	.077	.041	.248	-.052	23	-.753	.114	-.397	-1.250	40	-.745	.032	-.638	-.857
7	-.380	.042	-.240	-.523	24	.357	.046	.529	.177	41	.810	.086	1.003	.298
8	.278	.038	.399	.127	25	.652	.104	1.107	.310	42	.761	.069	.919	.446
9	.043	.022	.115	-.042	26	.640	.102	.992	.212	43	.734	.047	.871	.559
10	.132	.030	.227	.025	27	.379	.071	.589	.105	44	.847	.056	1.002	.646
11	.323	.048	.486	.068	28	.452	.076	.711	.200	45	.884	.054	1.015	.647
12	.336	.036	.443	.211	29	.317	.073	.586	-.155	46	.608	.077	.865	.213
13	.141	.035	.283	-.027	30	.416	.046	.573	.202	47	.564	.102	.890	.211
14	.171	.028	.264	.058	31	.491	.047	.639	.314	48	.804	.094	1.103	.439
15	.189	.027	.276	.048	32	.575	.058	.813	.317	49	.866	.091	1.140	.456
16	.250	.030	.358	.133	33	.588	.067	.776	.250	50	.880	.084	1.116	.493
17	.308	.037	.428	.116	34	-.748	.047	-.579	-.940					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.152	.036	.277	.020	18	-.077	.046	.082	-.256	35	-.879	.042	-.732	-1.003
2	-.043	.028	.046	-.146	19	.109	.029	.230	.008	36	-.849	.040	-.725	-.978
3	-.144	.026	-.049	-.258	20	-.102	.032	-.003	-.220	37	-.874	.042	-.735	-.987
4	-.116	.023	-.036	-.196	21	-.169	.039	-.055	-.394	38	-.837	.035	-.738	-.995
5	-.081	.024	.029	-.171	22	-.058	.118	.300	-.548	39	-.852	.024	-.767	-.943
6	.048	.038	.185	-.101	23	-.859	.107	-.528	-1.267	40	-.838	.031	-.736	-.942
7	-.423	.039	-.293	-.562	24	.386	.046	.539	.205	41	-.033	.052	.156	-.358
8	.271	.037	.399	.135	25	.782	.087	1.100	.432	42	.905	.037	.998	.735
9	.123	.024	.206	.032	26	.755	.086	1.102	.426	43	.807	.047	.943	.624
10	.149	.028	.245	.048	27	.412	.061	.617	.195	44	.846	.039	.946	.689
11	.340	.042	.471	.140	28	.479	.065	.717	.213	45	.895	.042	.994	.682
12	.368	.029	.457	.256	29	.336	.063	.531	-.006	46	.619	.056	.857	.400
13	.165	.029	.263	.067	30	.425	.038	.576	.230	47	.633	.073	.895	.273
14	.206	.025	.300	.112	31	.483	.040	.637	.314	48	.557	.083	.865	.252
15	.226	.023	.305	.136	32	.571	.046	.708	.278	49	.892	.092	1.223	.501
16	.287	.028	.386	.190	33	.595	.052	.752	.313	50	.837	.073	1.101	.560
17	.333	.034	.448	.204	34	-.896	.049	-.743	-1.053					

DATA FOR PROJECT 5590 CONFIGURATION U WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.167	.036	.275	.032	18	-.161	.046	.003	-.333	35	-1.027	.051	-.847	-1.190
2	-.044	.030	.064	-.160	19	.090	.024	.186	-.018	36	-.960	.046	-.785	-1.146
3	-.136	.028	-.049	-.247	20	-.041	.027	.069	-.148	37	-.914	.038	-.751	-1.054
4	-.098	.021	-.020	-.182	21	-.059	.026	.046	-.167	38	-.893	.031	-.782	-1.001
5	-.059	.023	.020	-.145	22	.027	.047	.214	-.135	39	-.884	.021	-.816	-.954
6	.059	.036	.198	-.057	23	-.731	.056	-.571	-.977	40	-.884	.032	-.733	-1.001
7	-.371	.036	-.256	-.497	24	.391	.039	.529	.261	41	-1.064	.051	-.868	-1.229
8	.259	.035	.374	.118	25	.657	.090	1.006	.387	42	.282	.025	.366	.170
9	.170	.025	.251	.076	26	.634	.084	.992	.314	43	.866	.040	.975	.661
10	.156	.028	.255	.050	27	.365	.051	.539	.172	44	.699	.043	.850	.514
11	.292	.040	.433	.110	28	.428	.060	.662	.145	45	.748	.040	.866	.595
12	.342	.025	.430	.259	29	.224	.065	.416	-.036	46	.527	.042	.670	.331
13	.155	.030	.260	.037	30	.328	.034	.438	.168	47	.560	.048	.725	.334
14	.179	.025	.304	.083	31	.359	.031	.463	.229	48	.599	.067	.780	.317
15	.189	.023	.271	.113	32	.456	.034	.567	.314	49	.601	.087	.892	.262
16	.254	.027	.343	.157	33	.501	.038	.637	.343	50	.750	.098	1.088	.431
17	.323	.034	.423	.203	34	-1.066	.052	-.858	-1.221					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 120 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-2.092	.033	-2.007	-2.148	18	-.440	.083	-.148	-.759	35	-.382	.047	-.233	-.563
2	-.296	.068	-.045	-.534	19	-.076	.040	.060	-.210	36	-.120	.020	-.055	-.206
3	-.079	.033	.049	-.226	20	.019	.040	.158	-.120	37	-.009	.019	.049	-.078
4	-2.742	.030	-2.670	-2.811	21	.081	.040	.213	-.051	38	-.050	.021	.028	-.124
5	-.851	.063	-.621	-1.056	22	.222	.060	.485	-.009	39	.150	.030	.255	.048
6	.208	.065	.478	-.011	23	-.508	.066	-.293	-.740	40	-.523	.039	-.378	-.680
7	-.376	.057	-.185	-.580	24	.342	.067	.580	.079	41	.357	.035	.464	.210
8	.375	.075	.659	.089	25	.051	.029	.133	-.070	42	.412	.026	.502	.303
9	-1.119	.022	-1.049	-1.197	26	.033	.028	.133	-.063	43	.407	.034	.512	.276
10	.049	.031	.163	-.078	27	.243	.067	.512	-.050	44	.398	.035	.512	.269
11	.270	.072	.525	-.172	28	.329	.091	.674	-.016	45	.375	.026	.461	.275
12	.311	.069	.512	-.085	29	-.173	.120	.187	-.652	46	.378	.062	.612	.138
13	-.111	.095	.206	-.433	30	.059	.034	.187	-.090	47	.421	.048	.578	.234
14	.025	.045	.172	-.148	31	.106	.031	.221	-.029	48	.408	.042	.536	.220
15	.074	.041	.206	-.071	32	.229	.037	.356	.059	49	.407	.038	.557	.255
16	.142	.041	.276	-.037	33	.387	.059	.573	-.023	50	.395	.038	.523	.255
17	.273	.074	.567	.033	34	-.841	.057	-.639	-1.051					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-.133	.047	-.027	-.216	18	-.451	.081	-.178	-.709	35	-.457	.053	-.301	-.688
2	-.310	.059	-.088	-.551	19	-.085	.034	.028	-.195	36	-.186	.023	-.102	-.284
3	-.094	.029	.010	-.193	20	.016	.032	.126	-.096	37	-.035	.021	.037	-.099
4	-.816	.040	-.747	-.901	21	.074	.033	.186	-.024	38	-.059	.020	.013	-.127
5	-.808	.042	-.660	-.950	22	.209	.055	.444	-.021	39	.134	.032	.255	.025
6	.161	.053	.353	.003	23	-.496	.068	-.272	-.733	40	-.509	.042	-.374	-.658
7	-.379	.050	-.219	-.615	24	.331	.057	.536	.088	41	.365	.042	.474	.154
8	.312	.061	.511	.078	25	.068	.032	.176	-.051	42	.412	.030	.505	.301
9	-1.035	.017	-.976	-1.082	26	.051	.031	.159	-.046	43	.434	.032	.554	.315
10	.027	.027	.123	-.069	27	.245	.056	.423	.008	44	.422	.033	.520	.302
11	.213	.057	.387	-.050	28	.329	.083	.582	-.000	45	.417	.027	.496	.314
12	.306	.057	.481	.083	29	-.230	.119	.222	-.641	46	.370	.061	.581	.106
13	-.146	.084	.135	-.426	30	.049	.032	.155	-.097	47	.429	.051	.598	.216
14	.025	.037	.143	-.092	31	.098	.031	.197	-.017	48	.438	.043	.564	.246
15	.067	.032	.169	-.075	32	.241	.036	.364	.088	49	.436	.044	.581	.259
16	.131	.035	.237	.006	33	.375	.060	.552	-.071	50	.417	.044	.573	.212
17	.259	.065	.494	.032	34	-.918	.078	-.560	-1.133					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-.439	.015	-.401	-.485	18	-.480	.074	-.179	-.710	35	-.524	.054	-.300	-.727
2	-.314	.054	-.040	-.521	19	-.089	.029	.019	-.194	36	-.345	.038	-.226	-.514
3	-.091	.028	-.000	-.193	20	.013	.026	.103	-.101	37	-.069	.021	.033	-.154
4	-1.129	.060	-1.048	-1.265	21	.071	.027	.166	-.035	38	-.068	.019	-.003	-.140
5	-.942	.044	-.768	-1.084	22	.214	.052	.428	-.009	39	.108	.034	.216	.003
6	.206	.058	.412	.009	23	-.499	.065	-.297	-.704	40	-.428	.047	-.279	-.603
7	-.435	.055	-.262	-.654	24	.343	.054	.538	.146	41	.398	.050	.526	.111
8	.381	.063	.617	.135	25	.108	.035	.230	-.023	42	.415	.032	.510	.314
9	-1.204	.017	-1.150	-1.262	26	.093	.036	.201	-.046	43	.460	.029	.546	.337
10	.057	.028	.165	-.043	27	.245	.049	.402	.003	44	.465	.032	.570	.346
11	.243	.059	.460	-.031	28	.340	.075	.579	.055	45	.458	.032	.548	.329
12	.322	.051	.481	.127	29	-.236	.112	.128	-.634	46	.376	.065	.626	.006
13	-.150	.082	.133	-.398	30	.064	.031	.181	-.061	47	.444	.056	.614	.243
14	.022	.033	.136	-.089	31	.123	.032	.233	-.023	48	.471	.049	.655	.264
15	.065	.027	.160	-.047	32	.277	.038	.407	.108	49	.476	.050	.634	.281
16	.136	.029	.244	.028	33	.387	.055	.544	-.049	50	.476	.051	.643	.317
17	.265	.060	.481	-.002	34	-.908	.087	-.606	-1.151					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-.149	.010	-.121	-.182	18	-.486	.070	-.262	-.702	35	-.560	.054	-.375	-.789
2	-.328	.050	-.147	-.515	19	-.095	.027	-.005	-.195	36	-.564	.050	-.361	-.776
3	-.093	.026	-.012	-.179	20	.011	.026	.087	-.079	37	-.148	.031	-.044	-.291
4	-.764	.012	-.729	-.794	21	.070	.026	.154	-.019	38	-.096	.024	-.013	-.187
5	-.860	.037	-.755	-.990	22	.214	.052	.402	-.001	39	.066	.035	.193	-.047
6	.172	.047	.338	.030	23	-.524	.064	-.279	-.804	40	-.311	.048	-.180	-.434
7	-.372	.048	-.224	-.540	24	.345	.052	.551	.173	41	.475	.057	.627	.177
8	.326	.051	.476	.149	25	.147	.040	.271	.001	42	.432	.036	.553	.273
9	-1.087	.013	-1.053	-1.132	26	.128	.040	.268	-.015	43	.500	.032	.589	.400
10	.058	.024	.131	-.026	27	.255	.047	.415	.056	44	.516	.035	.622	.377
11	.233	.054	.424	.019	28	.344	.074	.574	.071	45	.505	.032	.596	.367
12	.331	.048	.478	.154	29	-.228	.110	.117	-.567	46	.403	.064	.615	-.036
13	-.159	.075	.083	-.438	30	.074	.031	.187	-.073	47	.472	.055	.672	.262
14	.024	.031	.124	-.096	31	.147	.031	.275	.026	48	.509	.035	.692	.273
15	.068	.025	.154	-.026	32	.309	.041	.449	.142	49	.529	.057	.697	.328
16	.139	.026	.231	.050	33	.408	.054	.565	.142	50	.526	.059	.727	.308
17	.267	.057	.522	.090	34	-.841	.095	-.542	-1.236					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.006	.009	.037	-.023	18	-.493	.071	-.263	-.735	35	-.589	.050	-.446	-.792
2	-.326	.048	-.120	-.483	19	-.094	.026	.009	-.199	36	-.674	.053	-.467	-.889
3	-.094	.024	-.020	-.185	20	.013	.025	.110	-.098	37	-.288	.045	-.135	-.478
4	-.469	.010	-.432	-.495	21	.069	.024	.144	-.017	38	-.166	.035	-.057	-.334
5	-.854	.034	-.740	-.953	22	.206	.051	.364	-.025	39	-.002	.038	.146	-.135
6	.168	.046	.354	-.003	23	-.522	.064	-.259	-.764	40	-.183	.039	-.046	-.366
7	-.370	.048	-.202	-.551	24	.345	.050	.505	.170	41	.518	.077	.689	-.038
8	.319	.049	.481	.135	25	.175	.040	.311	.040	42	.436	.036	.545	.303
9	-1.091	.010	-1.057	-1.120	26	.159	.040	.280	.015	43	.527	.034	.628	.399
10	.065	.024	.144	-.021	27	.263	.048	.444	-.025	44	.549	.033	.646	.416
11	.239	.051	.425	.030	28	.355	.071	.603	.071	45	.552	.039	.677	.421
12	.333	.038	.479	.185	29	-.196	.111	.197	-.590	46	.427	.066	.674	.097
13	-.153	.072	.083	-.390	30	.103	.032	.210	-.071	47	.497	.060	.717	.204
14	.026	.028	.124	-.071	31	.186	.032	.301	.069	48	.548	.058	.763	.276
15	.071	.026	.166	-.034	32	.352	.044	.502	.154	49	.572	.063	.805	.345
16	.139	.025	.222	.054	33	.429	.057	.628	-.322	50	.571	.066	.811	.327
17	.268	.054	.503	.076	34	-.776	.083	-.522	-1.246					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.238	.010	.273	.210	18	-.472	.065	-.243	-.685	35	-.650	.041	-.499	-.805
2	-.329	.047	-.137	-.475	19	-.075	.026	.014	-.177	36	-.653	.045	-.526	-.938
3	-.091	.023	-.003	-.194	20	.029	.025	.125	-.067	37	-.595	.050	-.404	-.780
4	-.125	.008	-.097	-.154	21	.053	.026	.148	-.063	38	-.512	.067	-.298	-.786
5	-.862	.037	-.744	-1.006	22	.190	.051	.379	-.110	39	-.333	.068	-.086	-.552
6	.170	.045	.339	.028	23	-.523	.066	-.269	-.752	40	-.339	.070	-.070	-.541
7	-.377	.048	-.242	-.548	24	.357	.045	.519	.178	41	.653	.077	.839	.128
8	.325	.046	.467	.119	25	.209	.048	.402	.035	42	.448	.040	.556	.240
9	-1.115	.022	-1.078	-1.207	26	.187	.050	.391	.023	43	.585	.033	.682	.475
10	.081	.030	.174	-.026	27	.296	.044	.439	.112	44	.627	.037	.735	.504
11	.287	.052	.472	.086	28	.384	.065	.566	.131	45	.639	.040	.767	.512
12	.349	.034	.459	.213	29	-.117	.105	.208	-.539	46	.476	.063	.645	-.191
13	-.147	.064	.073	-.427	30	.167	.032	.268	.042	47	.521	.070	.738	.217
14	.041	.026	.123	-.052	31	.272	.035	.387	.147	48	.611	.071	.849	.370
15	.088	.022	.168	.013	32	.415	.046	.585	.225	49	.641	.079	.901	.369
16	.155	.025	.237	.069	33	.466	.055	.638	.287	50	.653	.081	.923	.294
17	.276	.050	.473	.122	34	-.682	.042	-.545	-.956					

DATA FOR PROJECT 5590 CONFIGURATION V WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN
1	.337	.010	.368	.311
2	-.337	.042	-.179	-.489
3	-.101	.023	-.022	-.186
4	.100	.009	.136	.074
5	-.821	.029	-.708	-.917
6	.136	.041	.319	-.013
7	-.402	.045	-.243	-.568
8	.305	.041	.432	.138
9	-1.072	.014	-1.029	-1.109
10	.068	.025	.156	-.021
11	.283	.042	.418	.132
12	.372	.029	.468	.261
13	-.117	.054	.067	-.297
14	.077	.025	.166	-.009
15	.131	.023	.212	.053
16	.195	.026	.278	.100
17	.288	.045	.443	.123

TAP	MEAN	RMS	MAX	MIN
18	-.382	.062	-.169	-.611
19	-.018	.030	.089	-.125
20	.041	.026	.134	-.047
21	-.021	.032	.081	-.175
22	.158	.045	.312	-.010
23	-.707	.091	-.363	-1.084
24	.370	.041	.528	.230
25	.320	.061	.578	.089
26	.290	.063	.503	.057
27	.349	.042	.493	.201
28	.430	.060	.620	.173
29	.037	.094	.320	-.271
30	.284	.033	.383	.166
31	.401	.039	.546	.257
32	.496	.049	.691	.241
33	.515	.060	.700	.251
34	-.697	.031	-.582	-.829

TAP	MEAN	RMS	MAX	MIN
35	-.698	.030	-.594	-.819
36	-.670	.029	-.570	-.771
37	-.694	.033	-.570	-.888
38	-.751	.037	-.612	-.944
39	-.737	.034	-.593	-.854
40	-.762	.043	-.570	-.973
41	.812	.082	.990	.399
42	.484	.050	.617	.286
43	.663	.041	.791	.500
44	.750	.044	.857	.592
45	.783	.053	.921	.549
46	.525	.071	.814	.240
47	.512	.093	.787	.076
48	.716	.089	1.019	.344
49	.771	.086	1.089	.461
50	.791	.087	1.074	.464

DATA FOR PROJECT 5590 CONFIGURATION W WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-.237	.020	-.179	-.294	18	-.459	.078	-.161	-.720	35	-.466	.040	-.338	-.590
2	-.296	.056	-.085	-.529	19	-.090	.028	.008	-.186	36	-.066	.020	.006	-.141
3	-.083	.027	.030	-.187	20	.001	.029	.097	-.110	37	.003	.021	.064	-.055
4	-.713	.018	-.670	-.751	21	.059	.029	.165	-.043	38	-.052	.018	.006	-.112
5	-.791	.044	-.661	-.930	22	.202	.055	.411	-.008	39	.061	.021	.127	-.007
6	.168	.051	.367	-.034	23	-.466	.063	-.265	-.746	40	-.685	.054	-.506	-.870
7	-.365	.050	-.179	-.584	24	.327	.058	.581	.133	41	.331	.030	.436	.218
8	.313	.059	.525	.116	25	.048	.023	.125	-.033	42	.361	.025	.437	.282
9	-1.049	.018	-.994	-1.105	26	.033	.023	.117	-.045	43	.340	.026	.427	.250
10	.041	.024	.133	-.068	27	.231	.055	.453	-.045	44	.344	.026	.419	.262
11	.218	.059	.470	-.111	28	.317	.082	.569	.029	45	.340	.023	.408	.270
12	.306	.052	.491	.106	29	-.268	.118	.150	-.726	46	.352	.058	.580	.165
13	-.153	.081	.089	-.390	30	.026	.035	.154	-.145	47	.353	.046	.513	.194
14	.015	.034	.127	-.089	31	.071	.030	.183	-.041	48	.320	.038	.467	.190
15	.058	.030	.165	-.089	32	.188	.033	.307	.034	49	.307	.036	.433	.152
16	.122	.030	.224	.008	33	.332	.059	.540	.100	50	.304	.034	.437	.173
17	.252	.063	.474	.017	34	-.657	.053	-.447	-.795					

DATA FOR PROJECT 5590 CONFIGURATION W WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	-.043	.010	-.011	-.073	18	-.487	.073	-.253	-.712	35	-.538	.042	-.377	-.683
2	-.319	.055	-.116	-.495	19	-.091	.026	.001	-.201	36	-.095	.021	-.014	-.178
3	-.088	.026	.008	-.187	20	.004	.028	.123	-.091	37	-.015	.019	.060	-.097
4	-.610	.019	-.566	-.652	21	.067	.027	.166	-.042	38	-.063	.017	-.008	-.126
5	-.818	.040	-.677	-.939	22	.212	.051	.417	-.002	39	.054	.021	.134	-.020
6	.178	.048	.368	-.011	23	-.465	.060	-.239	-.682	40	-.687	.058	-.453	-.898
7	-.374	.048	-.193	-.582	24	.334	.056	.545	.150	41	.323	.032	.427	.205
8	.326	.054	.513	.140	25	.052	.022	.126	-.029	42	.373	.027	.448	.276
9	-1.056	.014	-1.023	-1.093	26	.041	.023	.120	-.035	43	.368	.026	.442	.283
10	.046	.024	.134	-.048	27	.236	.051	.441	.003	44	.370	.026	.445	.280
11	.224	.057	.442	-.051	28	.326	.076	.563	.075	45	.372	.025	.448	.279
12	.315	.049	.460	.136	29	-.262	.114	.150	-.691	46	.349	.056	.560	.116
13	-.156	.079	.114	-.421	30	.030	.032	.174	-.089	47	.372	.044	.512	.218
14	.015	.032	.130	-.115	31	.079	.030	.171	-.056	48	.350	.039	.476	.194
15	.060	.028	.157	-.042	32	.200	.034	.300	.060	49	.341	.038	.476	.197
16	.129	.028	.218	.026	33	.342	.057	.581	.063	50	.327	.036	.442	.185
17	.266	.060	.451	.081	34	-.698	.059	-.444	-.870					

DATA FOR PROJECT 5590 CONFIGURATION W WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.091	.011	.128	.060	18	-.496	.072	-.270	-.753	35	-.810	.066	-.505	-.986
2	-.328	.052	-.109	-.526	19	-.094	.025	-.004	-.180	36	-.336	.046	-.194	-.566
3	-.093	.025	-.007	-.200	20	.001	.027	.100	-.089	37	-.065	.020	-.006	-.140
4	-.344	.010	-.318	-.371	21	.058	.026	.144	-.037	38	-.097	.019	-.030	-.159
5	-.810	.037	-.706	-.915	22	.210	.051	.386	-.043	39	.021	.022	.083	-.054
6	.171	.048	.335	.026	23	-.473	.059	-.293	-.687	40	-.512	.061	-.335	-.758
7	-.369	.048	-.207	-.551	24	.339	.052	.528	.181	41	.346	.036	.468	.188
8	.320	.051	.492	.131	25	.088	.028	.190	-.017	42	.415	.030	.507	.298
9	-1.053	.013	-1.017	-1.085	26	.076	.028	.162	-.024	43	.449	.029	.533	.348
10	.055	.024	.137	-.034	27	.248	.049	.437	.002	44	.461	.028	.557	.368
11	.230	.054	.435	-.034	28	.338	.076	.577	.045	45	.476	.030	.601	.340
12	.322	.037	.443	.192	29	-.238	.115	.110	-.663	46	.379	.065	.564	-.048
13	-.162	.076	.082	-.432	30	.057	.032	.155	-.093	47	.437	.052	.621	.209
14	.016	.031	.119	-.122	31	.124	.031	.224	-.024	48	.457	.048	.608	.277
15	.062	.025	.163	-.030	32	.279	.040	.429	.123	49	.463	.048	.645	.303
16	.132	.027	.221	.031	33	.378	.057	.571	-.366	50	.462	.048	.634	.292
17	.262	.057	.517	.082	34	-.834	.067	-.553	-1.067					

DATA FOR PROJECT 5590 CONFIGURATION W WIND 140 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.118	.009	.152	.084	18	-.505	.071	-.272	-.719	35	-.727	.043	-.589	-.901
2	-.336	.051	-.136	-.544	19	-.095	.026	.002	-.182	36	-.774	.050	-.562	-.993
3	-.098	.025	.004	-.196	20	.003	.026	.093	-.093	37	-.572	.057	-.332	-.762
4	-.343	.013	-.307	-.373	21	.038	.025	.130	-.061	38	-.383	.048	-.193	-.557
5	-.823	.036	-.703	-.928	22	.190	.048	.341	-.003	39	-.187	.046	-.028	-.360
6	.166	.046	.321	.004	23	-.503	.056	-.307	-.716	40	-.268	.057	-.040	-.511
7	-.381	.048	-.237	-.578	24	.346	.048	.510	.189	41	.499	.046	.628	.243
8	.319	.050	.485	.137	25	.126	.039	.260	-.034	42	.439	.034	.563	.318
9	-1.088	.014	-1.047	-1.134	26	.107	.038	.282	-.062	43	.536	.033	.628	.430
10	.073	.026	.176	-.029	27	.272	.049	.434	-.001	44	.575	.038	.702	.452
11	.248	.053	.435	.028	28	.362	.072	.566	.083	45	.587	.037	.726	.455
12	.334	.039	.472	.187	29	-.154	.110	.169	-.532	46	.448	.064	.650	.036
13	-.157	.073	.086	-.486	30	.125	.033	.232	-.014	47	.495	.064	.677	.191
14	.023	.030	.121	-.103	31	.222	.035	.353	.088	48	.557	.062	.751	.308
15	.069	.025	.162	-.032	32	.376	.046	.548	.167	49	.583	.066	.792	.375
16	.138	.025	.233	.045	33	.436	.056	.764	.153	50	.595	.071	.841	.366
17	.267	.054	.460	.079	34	-.762	.040	-.606	-.913					

DATA FOR PROJECT 5590 CONFIGURATION W WIND 150 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.230	.010	.257	.192	18	-.440	.066	-.217	-.671	35	-.714	.030	-.610	-.816
2	-.331	.046	-.174	-.479	19	-.045	.028	.065	-.148	36	-.737	.030	-.620	-.852
3	-.095	.024	-.010	-.181	20	.046	.028	.147	-.042	37	-.807	.047	-.654	-1.011
4	-.141	.011	-.109	-.171	21	.026	.027	.121	-.114	38	-.700	.047	-.479	-.885
5	-.830	.029	-.705	-.916	22	.158	.043	.339	-.010	39	-.650	.057	-.370	-.834
6	.150	.044	.311	.023	23	-.536	.063	-.328	-.831	40	-.673	.065	-.346	-.911
7	-.382	.046	-.223	-.530	24	.361	.044	.504	.169	41	.692	.056	.831	.413
8	.315	.045	.458	.142	25	.184	.047	.349	.013	42	.480	.039	.596	.298
9	-1.084	.015	-1.048	-1.131	26	.168	.046	.363	-.027	43	.594	.036	.695	.441
10	.086	.026	.178	-.005	27	.314	.044	.489	.141	44	.677	.040	.778	.506
11	.269	.046	.435	.080	28	.402	.065	.595	.175	45	.704	.045	.882	.554
12	.356	.030	.459	.240	29	-.034	.103	.283	-.383	46	.498	.063	.721	.220
13	-.140	.060	.062	-.361	30	.216	.034	.348	.098	47	.520	.076	.758	.212
14	.052	.027	.149	-.050	31	.329	.038	.463	.187	48	.630	.074	.876	.342
15	.100	.023	.180	.017	32	.453	.048	.621	.211	49	.694	.080	.969	.352
16	.170	.026	.261	.066	33	.487	.057	.698	.203	50	.709	.082	1.041	.411
17	.284	.049	.466	.119	34	-.803	.034	-.660	-.921					

DATA FOR PROJECT 5590 CONFIGURATION W WIND 160 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.289	.011	.329	.260	18	-.335	.065	-.095	-.579	35	-.726	.026	-.630	-.820
2	-.339	.044	-.146	-.523	19	.008	.029	.111	-.087	36	-.752	.027	-.642	-.833
3	-.108	.025	-.031	-.189	20	.044	.028	.154	-.070	37	-.786	.030	-.679	-.911
4	.002	.010	.034	-.028	21	-.084	.043	.048	-.276	38	-.768	.027	-.671	-.846
5	-.821	.030	-.729	-.909	22	.120	.058	.332	-.154	39	-.782	.028	-.676	-.890
6	.128	.042	.285	-.005	23	-.790	.099	-.437	-1.178	40	-.782	.034	-.633	-.925
7	-.440	.046	-.302	-.624	24	.370	.043	.527	.203	41	.871	.066	1.016	.587
8	.308	.041	.428	.149	25	.376	.058	.576	.176	42	.597	.053	.739	.413
9	-1.070	.010	-1.038	-1.102	26	.358	.056	.568	.126	43	.649	.040	.760	.486
10	.106	.026	.188	.010	27	.364	.043	.506	.197	44	.790	.045	.904	.592
11	.294	.041	.430	.100	28	.447	.061	.651	.240	45	.630	.044	.930	.680
12	.378	.029	.472	.271	29	.092	.094	.401	-.239	46	.544	.072	.822	.200
13	-.107	.054	.097	-.302	30	.318	.035	.442	.188	47	.495	.108	.818	.096
14	.091	.026	.182	-.034	31	.428	.041	.570	.287	48	.716	.093	1.036	.290
15	.147	.024	.239	.052	32	.515	.050	.676	.326	49	.613	.079	1.061	.480
16	.213	.027	.302	.125	33	.531	.060	.776	.274	50	.821	.078	1.083	.531
17	.296	.043	.448	.121	34	-.822	.030	-.710	-.913					

DATA FOR PROJECT 5590 CONFIGURATION X WIND 120 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.401	.130	.808	-.070	18	-.481	.096	-.184	-.815	35	-.874	.079	-.585	-1.140
2	-.453	.133	.014	-.883	19	-.081	.071	.081	-.251	36	-.131	.062	.016	-.268
3	-.093	.073	.099	-.265	20	.021	.068	.183	-.163	37	-.018	.098	.203	-.239
4	-.023	.091	.235	-.298	21	.100	.067	.251	-.102	38	-.049	.064	.089	-.195
5	-.082	.105	.203	-.337	22	.249	.073	.483	-.108	39	.113	.062	.261	-.037
6	.270	.122	.684	-.044	23	-.596	.088	-.328	-.900	40	-.686	.075	-.433	-.889
7	-.567	.119	-.207	-.916	24	.368	.079	.633	.107	41	.514	.110	.821	.144
8	.514	.129	.951	.144	25	.043	.053	.178	-.101	42	.423	.065	.598	.241
9	.085	.105	.365	-.161	26	.029	.054	.191	-.114	43	.441	.065	.590	.285
10	.031	.104	.307	-.207	27	.250	.074	.490	-.056	44	.436	.066	.576	.217
11	.341	.135	.873	-.200	28	.329	.094	.626	.075	45	.410	.064	.564	.267
12	.319	.086	.576	.047	29	-.227	.112	.133	-.757	46	.381	.086	.657	.036
13	-.091	.102	.190	-.462	30	.044	.059	.204	-.140	47	.445	.078	.677	.221
14	.033	.071	.210	-.170	31	.088	.057	.249	-.082	48	.445	.071	.657	.221
15	.077	.067	.251	-.122	32	.224	.056	.386	.055	49	.433	.070	.650	.241
16	.148	.069	.312	-.082	33	.373	.076	.607	-.036	50	.425	.069	.631	.247
17	.290	.089	.576	-.014	34	-.973	.081	-.658	-1.206					

DATA FOR PROJECT 5590 CONFIGURATION X WIND 125 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.264	.063	.482	.050	18	-.491	.080	-.249	-.780	35	-.957	.077	-.584	-1.225
2	-.328	.069	-.007	-.590	19	-.084	.047	.051	-.233	36	-.174	.040	-.068	-.308
3	-.092	.048	.046	-.252	20	.014	.043	.129	-.113	37	-.034	.043	.083	-.130
4	-.017	.046	.115	-.134	21	.089	.045	.212	-.056	38	-.063	.039	.040	-.152
5	-.061	.047	.095	-.187	22	.240	.063	.476	-.029	39	.101	.040	.225	-.012
6	.182	.065	.401	-.003	23	-.580	.077	-.309	-.862	40	-.667	.057	-.428	-.845
7	-.393	.062	-.195	-.586	24	.363	.063	.575	.149	41	.339	.052	.490	.176
8	.339	.067	.551	.111	25	.068	.038	.192	-.037	42	.418	.044	.537	.281
9	.060	.045	.193	-.068	26	.052	.038	.160	-.096	43	.447	.043	.561	.282
10	.027	.047	.172	-.105	27	.246	.066	.464	-.029	44	.446	.043	.549	.278
11	.225	.076	.478	-.044	28	.327	.083	.587	.070	45	.439	.042	.545	.273
12	.313	.058	.500	.105	29	-.225	.108	.141	-.645	46	.378	.071	.625	.072
13	-.081	.086	.150	-.405	30	.052	.045	.192	-.128	47	.452	.060	.665	.217
14	.034	.049	.183	-.122	31	.092	.042	.227	-.073	48	.464	.051	.637	.293
15	.073	.044	.191	-.060	32	.235	.043	.397	.081	49	.467	.051	.641	.293
16	.143	.045	.278	.010	33	.385	.059	.575	.062	50	.470	.050	.613	.313
17	.283	.072	.570	.035	34	-1.028	.083	-.685	-1.257					

DATA FOR PROJECT 5590 CONFIGURATION X WIND 130 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.259	.057	.449	.052	18	-.500	.076	-.265	-.760	35	-1.051	.099	-.712	-1.342
2	-.333	.063	-.113	-.612	19	-.086	.038	.036	-.205	36	-.306	.040	-.182	-.465
3	-.090	.039	.037	-.217	20	.013	.036	.121	-.105	37	-.070	.034	.025	-.164
4	-.018	.037	.096	-.125	21	.083	.037	.199	-.048	38	-.082	.031	.006	-.176
5	-.062	.037	.049	-.178	22	.238	.058	.439	-.057	39	.070	.033	.162	-.047
6	.176	.055	.374	.001	23	-.582	.075	-.292	-.847	40	-.564	.056	-.326	-.759
7	-.385	.056	-.196	-.585	24	.361	.055	.573	.184	41	.380	.048	.532	.132
8	.335	.058	.517	.135	25	.099	.036	.230	-.045	42	.425	.036	.525	.301
9	.069	.037	.171	-.041	26	.081	.035	.222	-.072	43	.478	.034	.580	.353
10	.039	.038	.165	-.092	27	.242	.061	.437	.024	44	.489	.037	.583	.344
11	.221	.068	.437	-.065	28	.320	.081	.596	-.008	45	.475	.037	.587	.342
12	.315	.054	.513	.118	29	-.205	.113	.143	-.748	46	.392	.067	.619	-.008
13	-.095	.086	.148	-.410	30	.064	.039	.196	-.077	47	.467	.056	.660	.251
14	.032	.041	.154	-.102	31	.115	.037	.230	-.028	48	.491	.050	.651	.286
15	.068	.036	.169	-.051	32	.268	.042	.410	.088	49	.502	.050	.669	.319
16	.139	.037	.245	.009	33	.391	.060	.602	-.231	50	.502	.050	.690	.327
17	.280	.065	.540	.091	34	-1.040	.097	-.639	-1.342					

DATA FOR PROJECT 5590 CONFIGURATION X WIND 135 TUBING NO. 2

TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN	TAP	MEAN	RMS	MAX	MIN
1	.256	.054	.427	.041	18	-.516	.072	-.305	-.767	35	-.992	.113	-.678	-1.410
2	-.332	.060	-.085	-.555	19	-.091	.032	.016	-.194	36	-.547	.047	-.373	-.718
3	-.089	.033	.013	-.190	20	.010	.032	.115	-.097	37	-.181	.039	-.036	-.398
4	-.017	.033	.086	-.113	21	.078	.031	.179	-.043	38	-.109	.031	-.006	-.207
5	-.065	.031	.037	-.162	22	.232	.053	.421	.014	39	.029	.033	.146	-.087
6	.177	.053	.399	.025	23	-.579	.070	-.331	-.822	40	-.377	.065	-.131	-.598
7	-.384	.054	-.200	-.560	24	.359	.051	.550	.173	41	.454	.049	.575	.214
8	.333	.053	.526	.114	25	.134	.039	.266	-.006	42	.453	.034	.557	.273
9	.077	.033	.184	-.027	26	.111	.038	.253	-.027	43	.513	.033	.613	.351
10	.048	.032	.154	-.048	27	.257	.058	.491	-.018	44	.536	.034	.637	.415
11	.237	.063	.455	-.036	28	.340	.077	.573	.096	45	.537	.033	.666	.430
12	.326	.048	.488	.129	29	-.185	.109	.196	-.661	46	.427	.064	.675	.135
13	-.127	.077	.106	-.409	30	.091	.037	.219	-.061	47	.491	.055	.721	.282
14	.027	.036	.139	-.100	31	.156	.037	.305	-.025	48	.538	.053	.733	.345
15	.069	.032	.170	-.038	32	.321	.044	.489	.155	49	.550	.058	.744	.329
16	.144	.032	.247	.035	33	.414	.056	.632	.094	50	.559	.057	.779	.375
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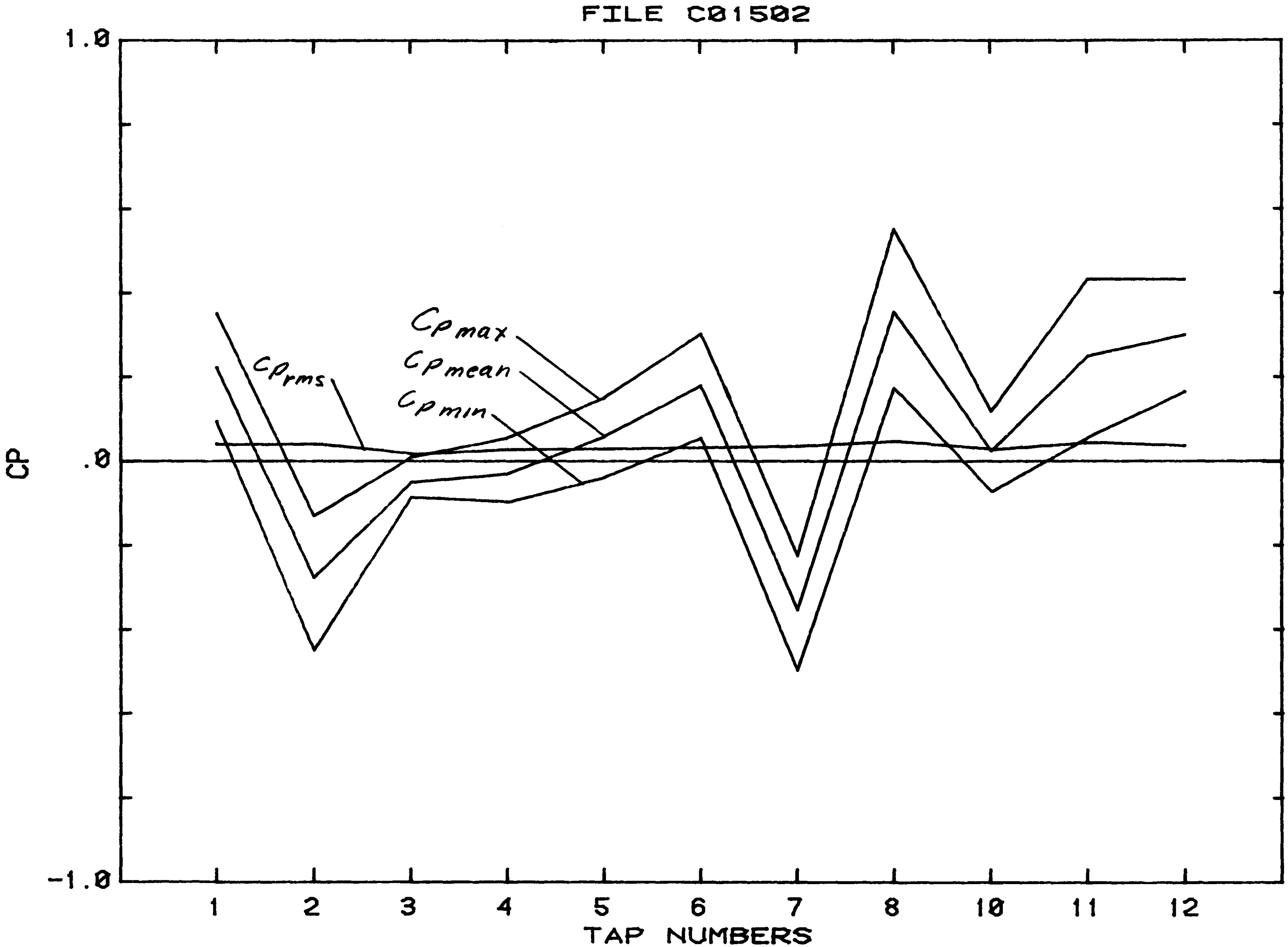
APPENDIX 3

C_p AT EACH TAP LOCATION



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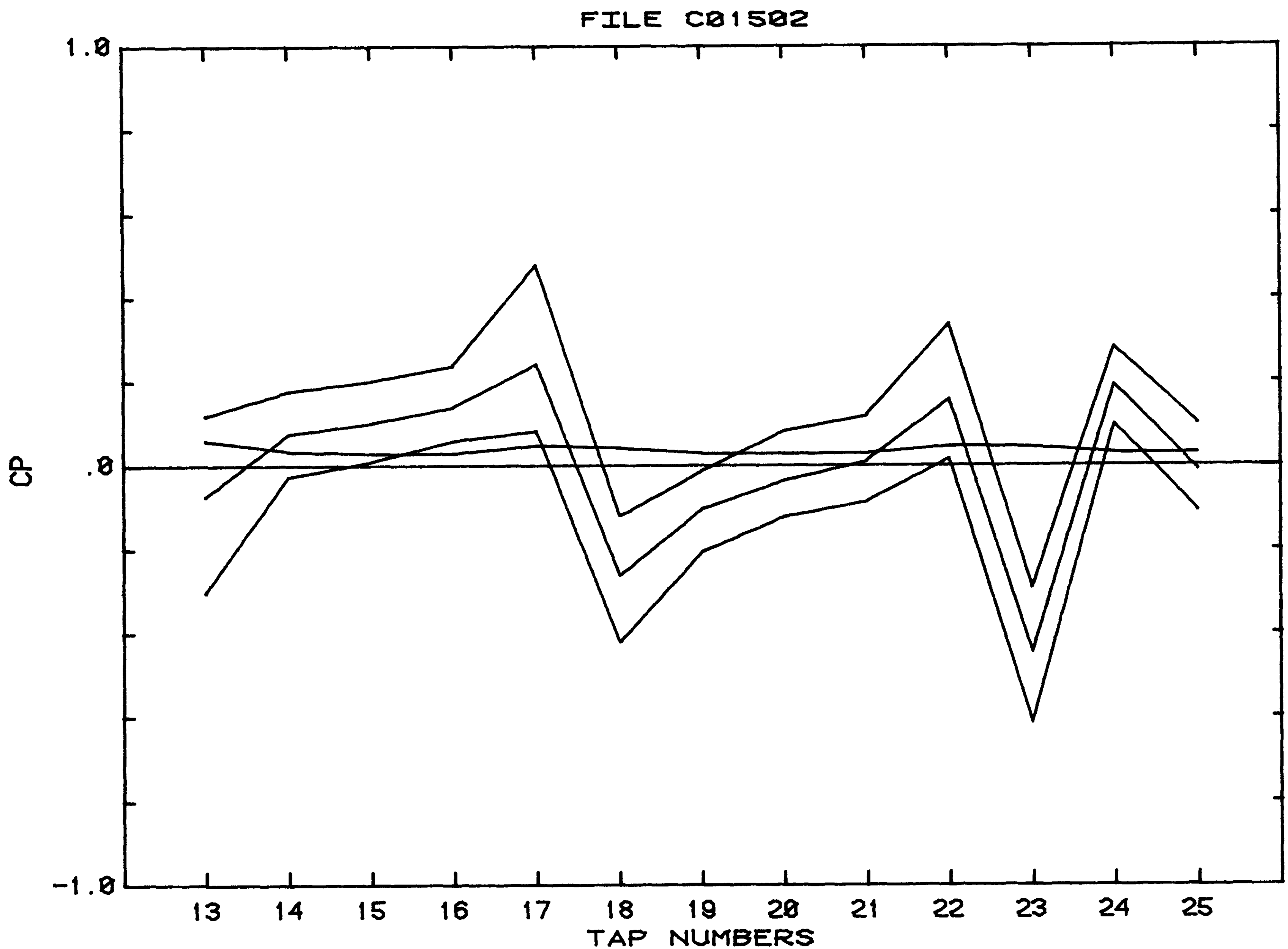

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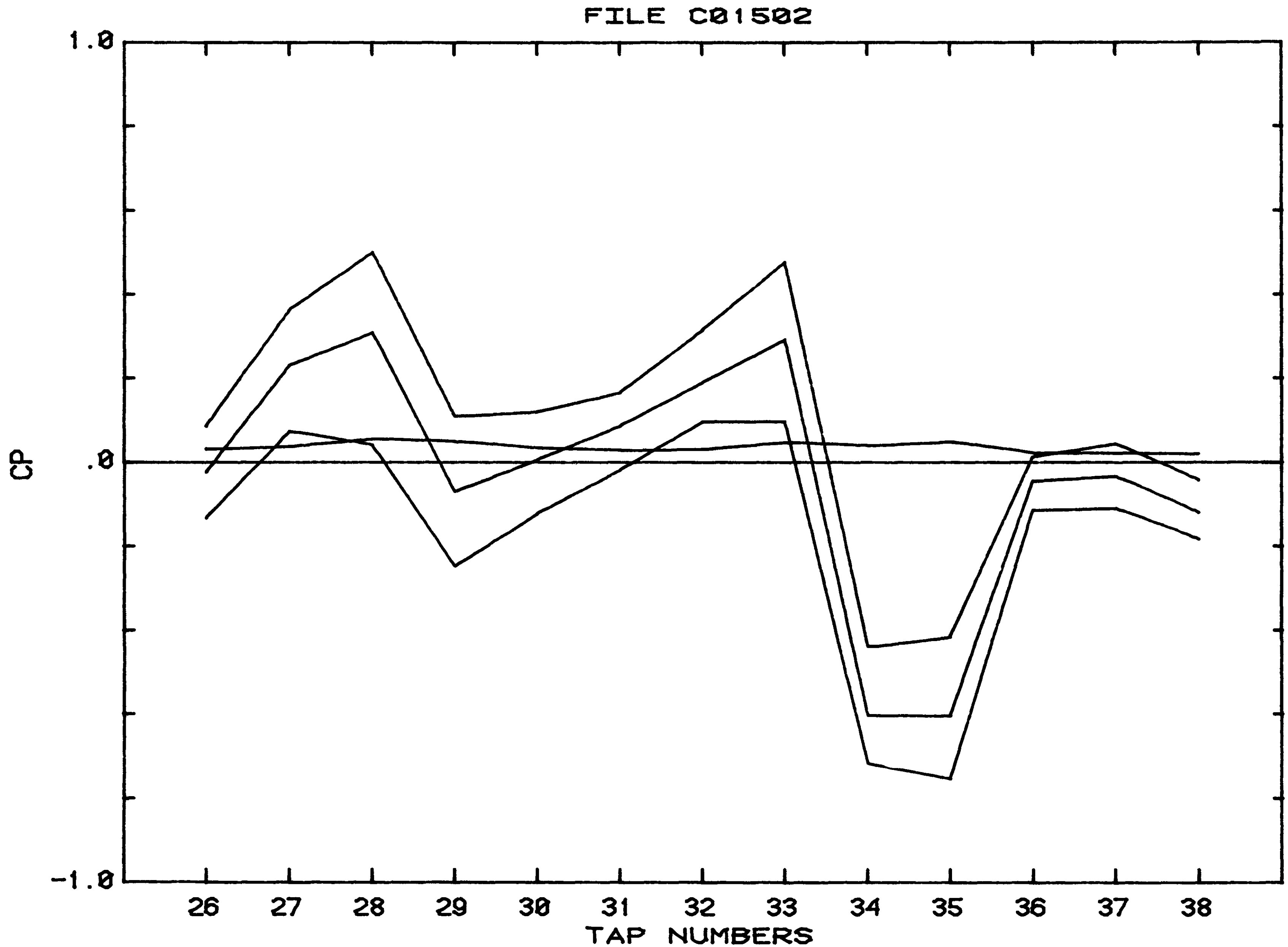
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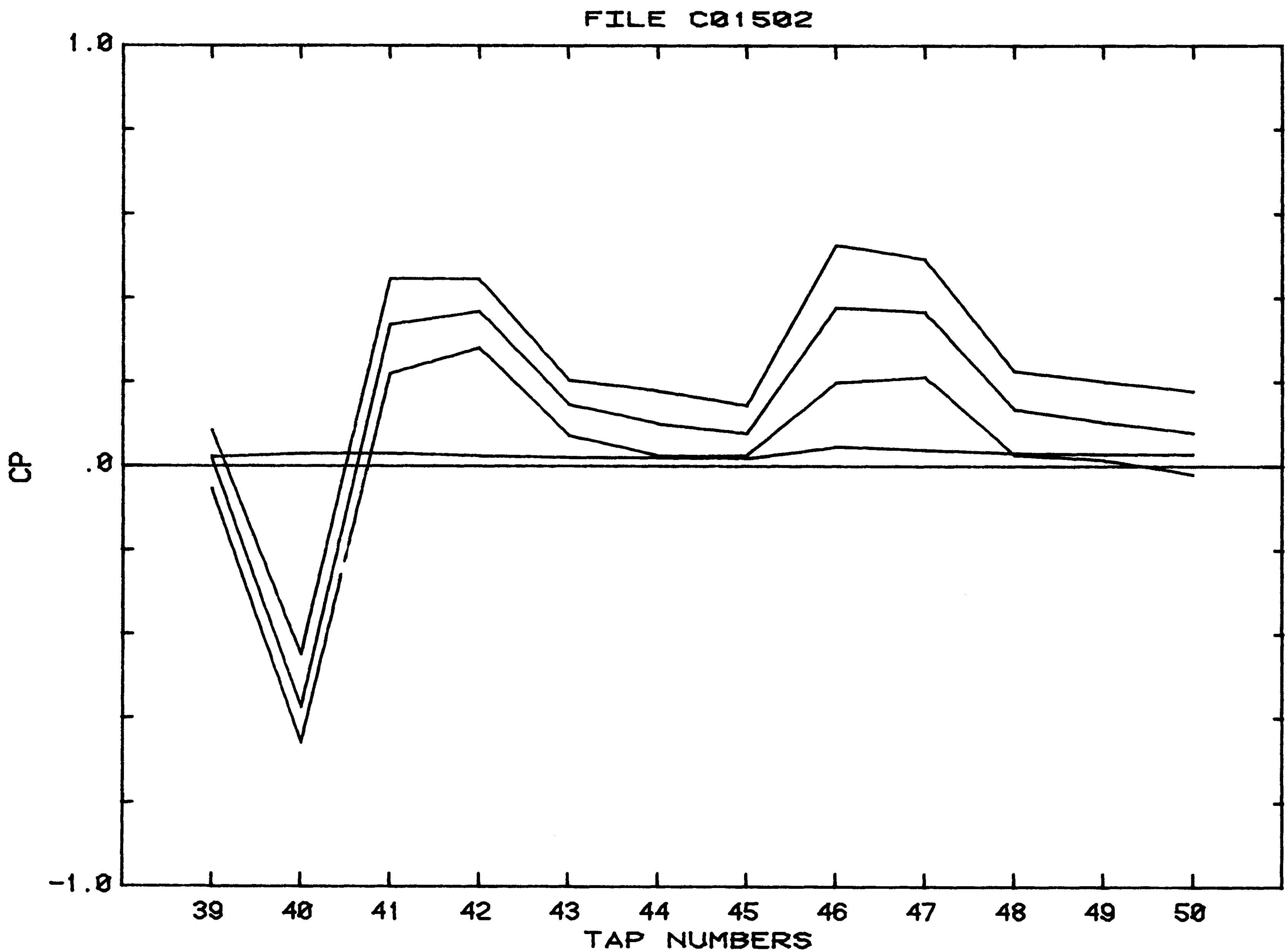
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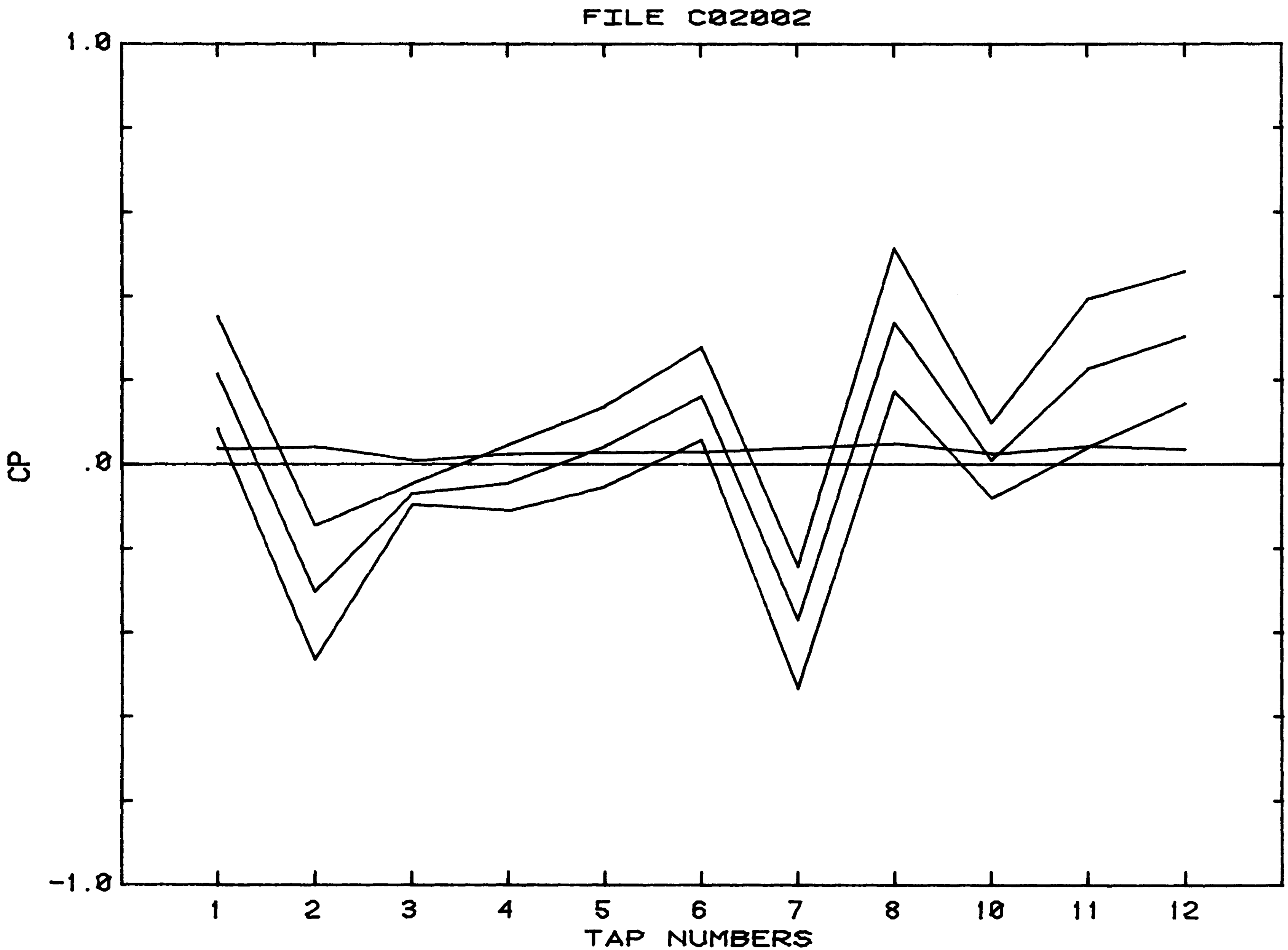
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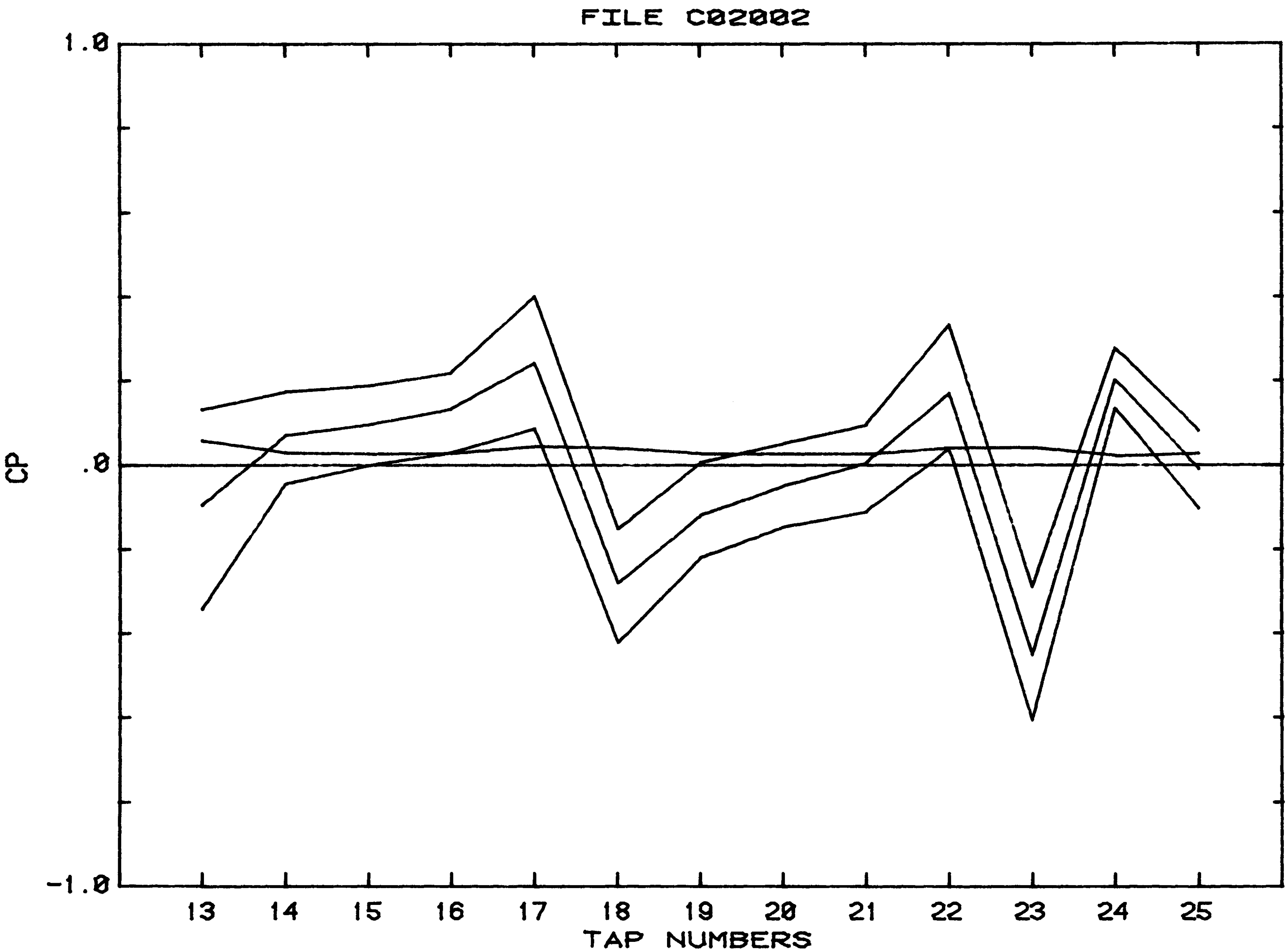
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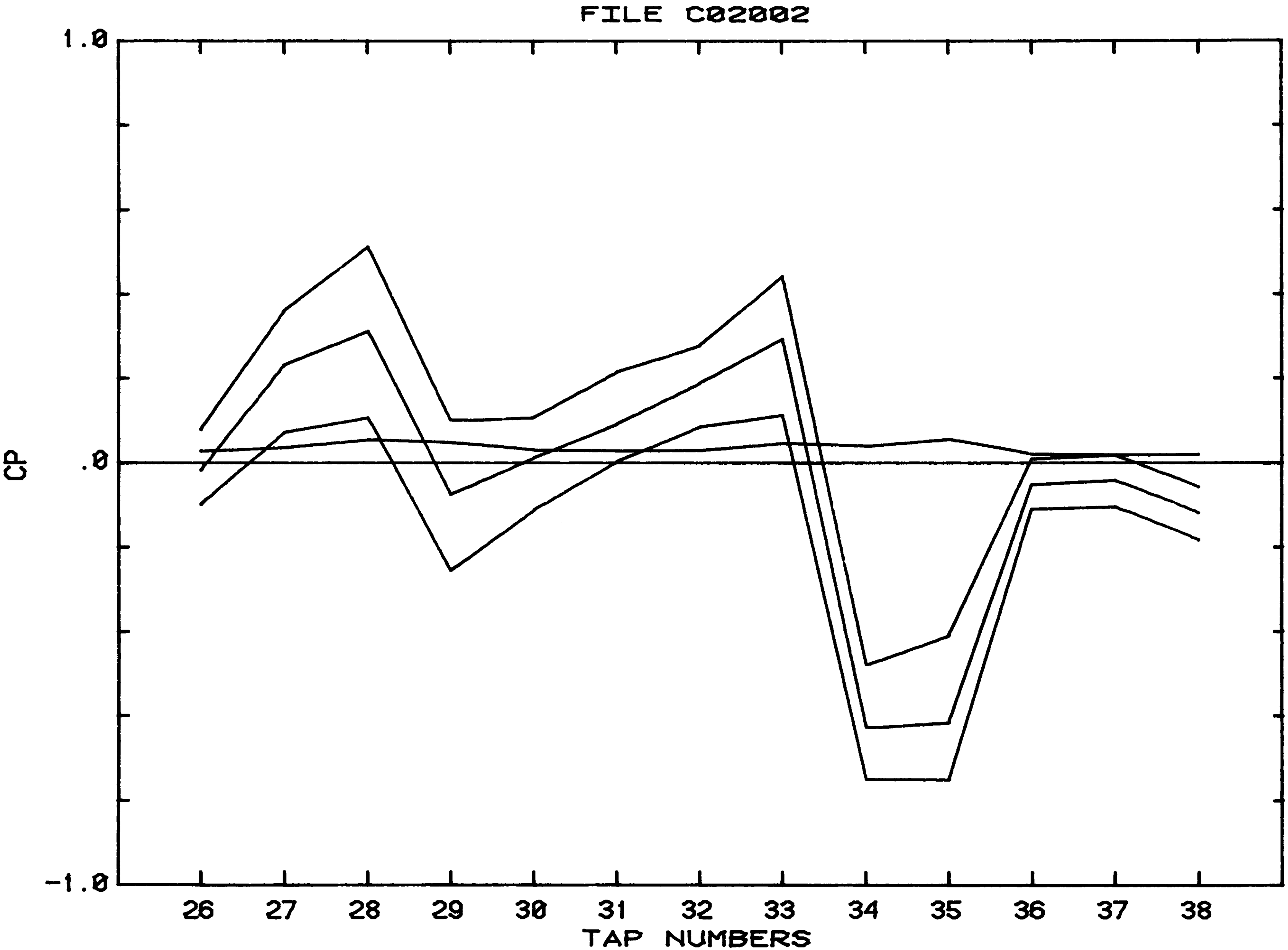
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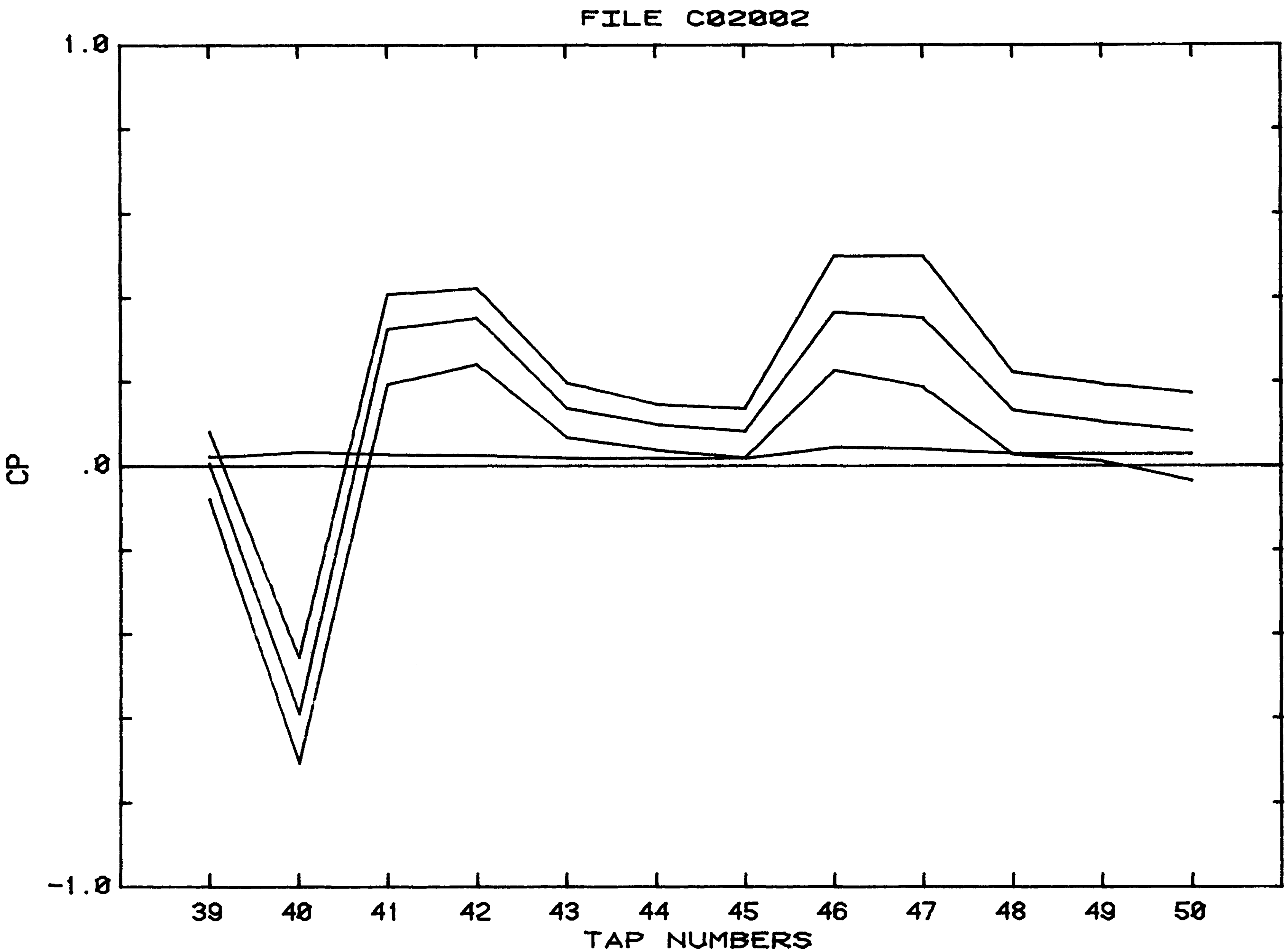
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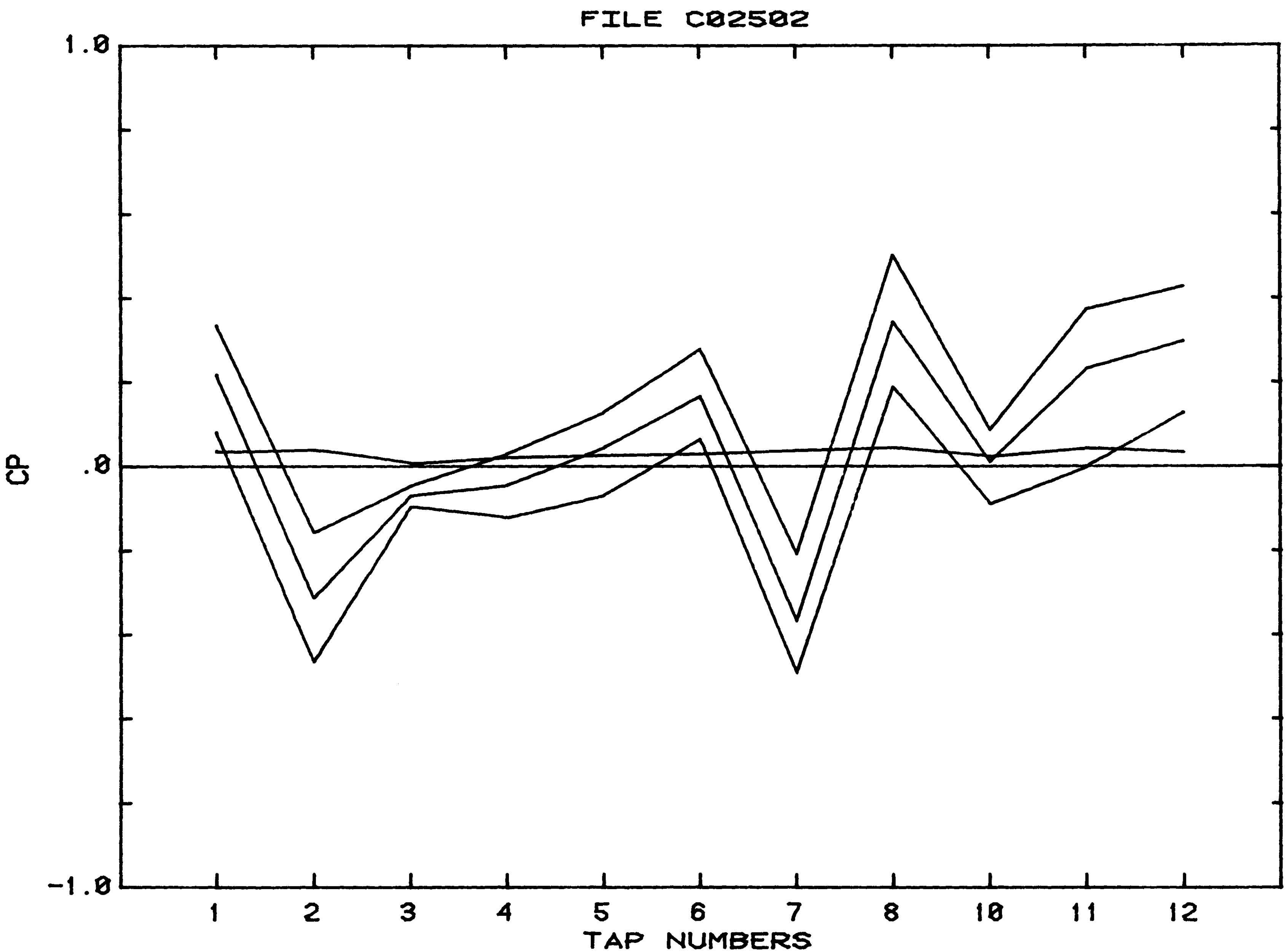

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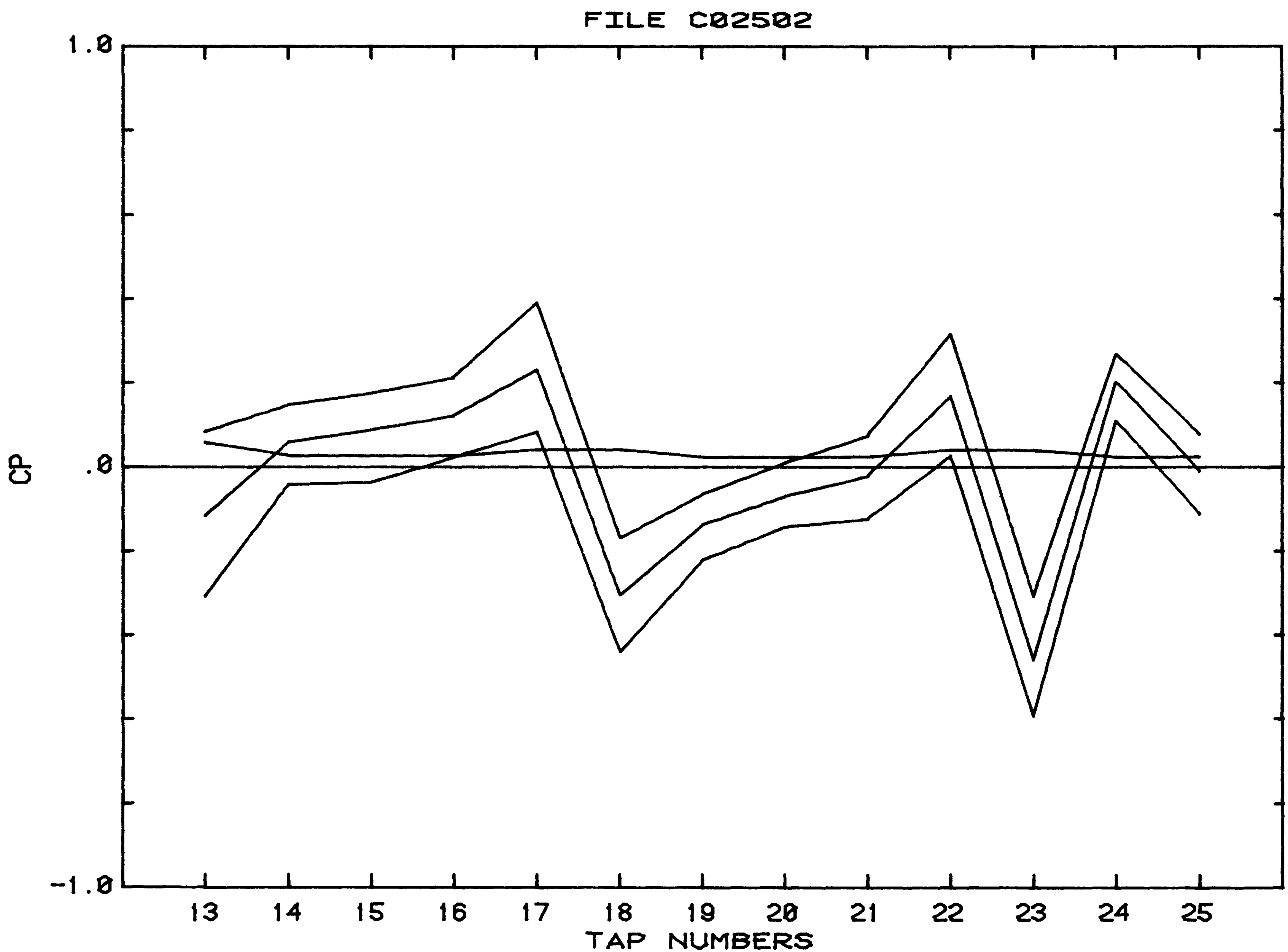
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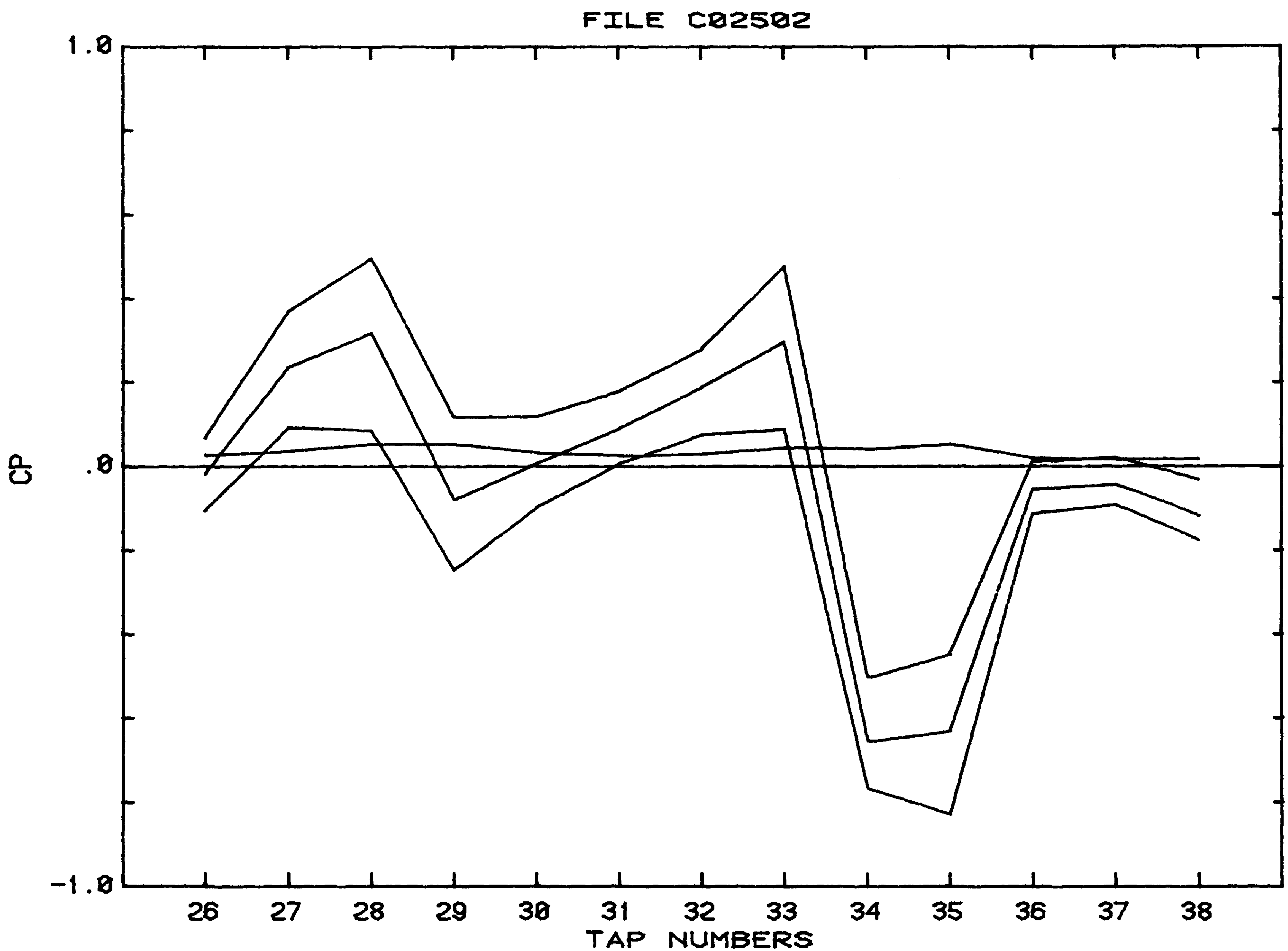
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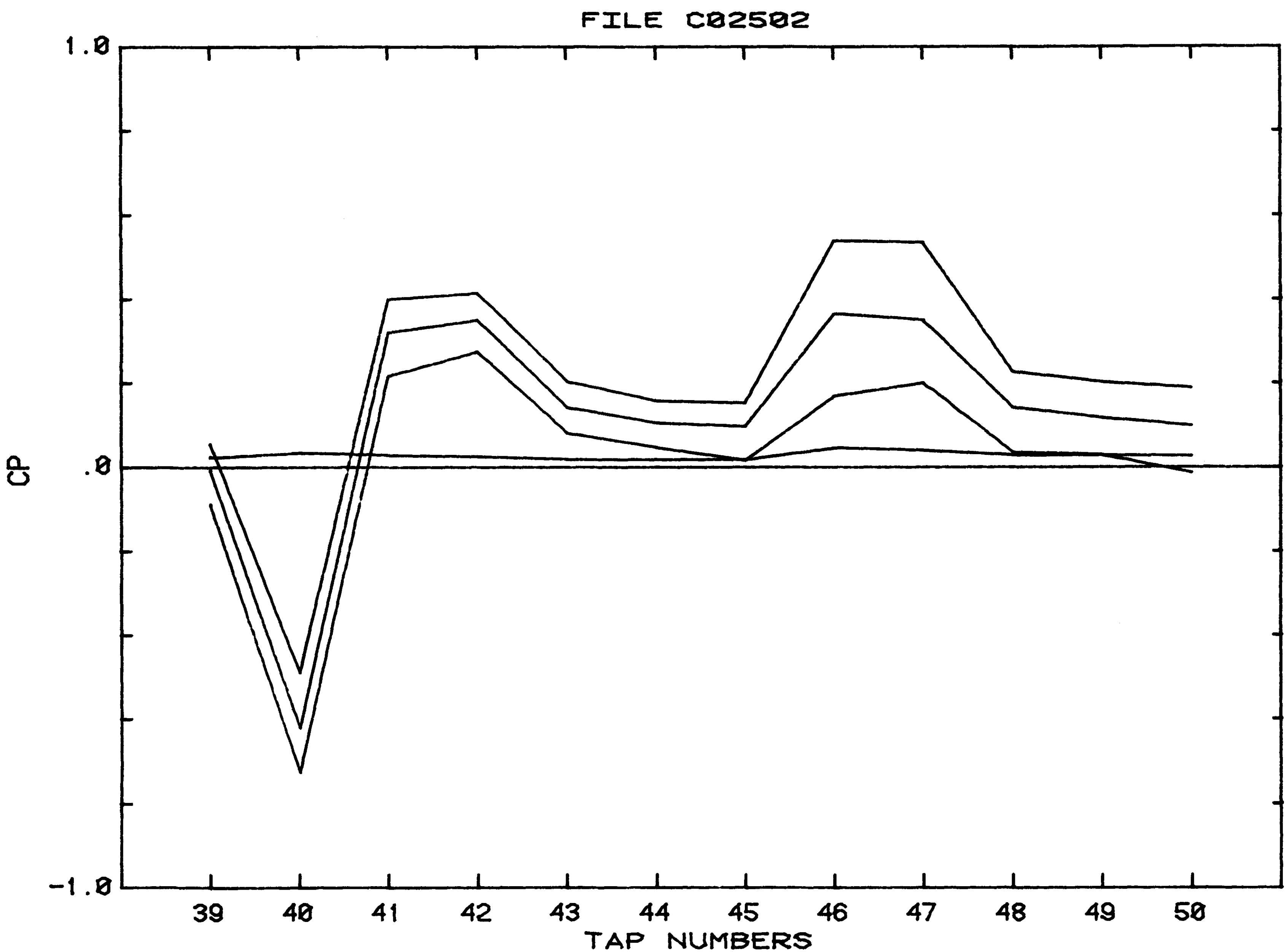
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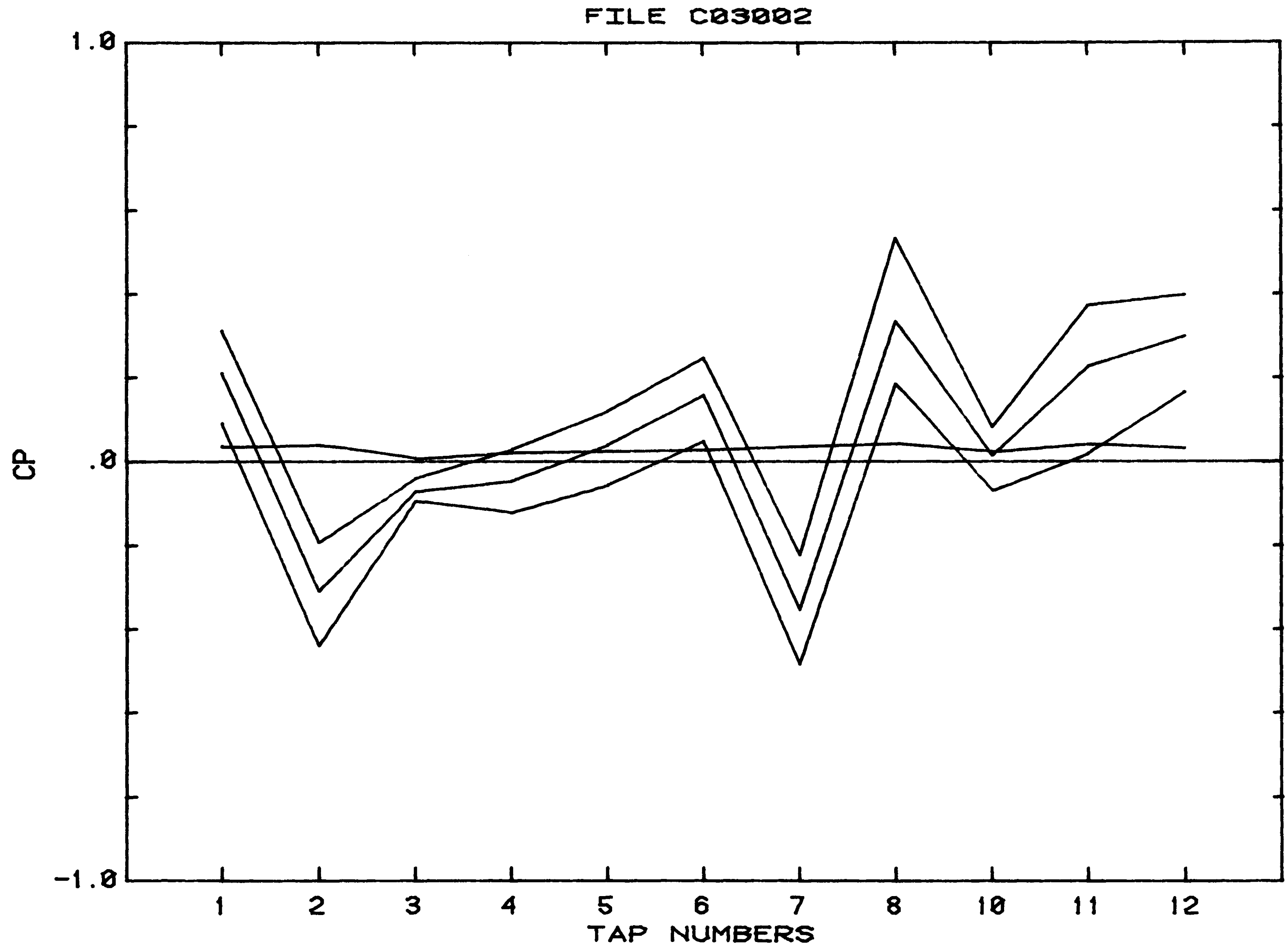
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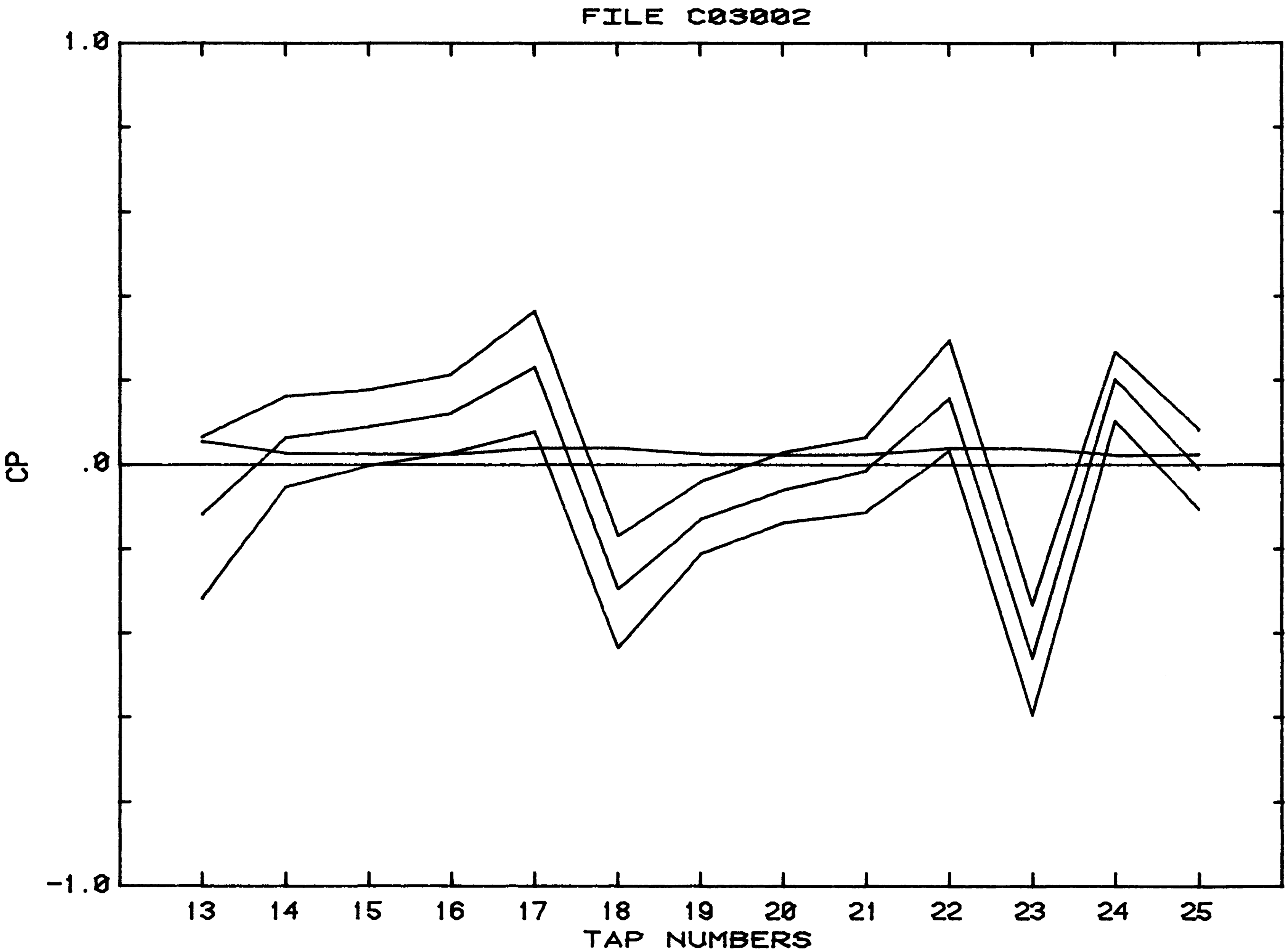
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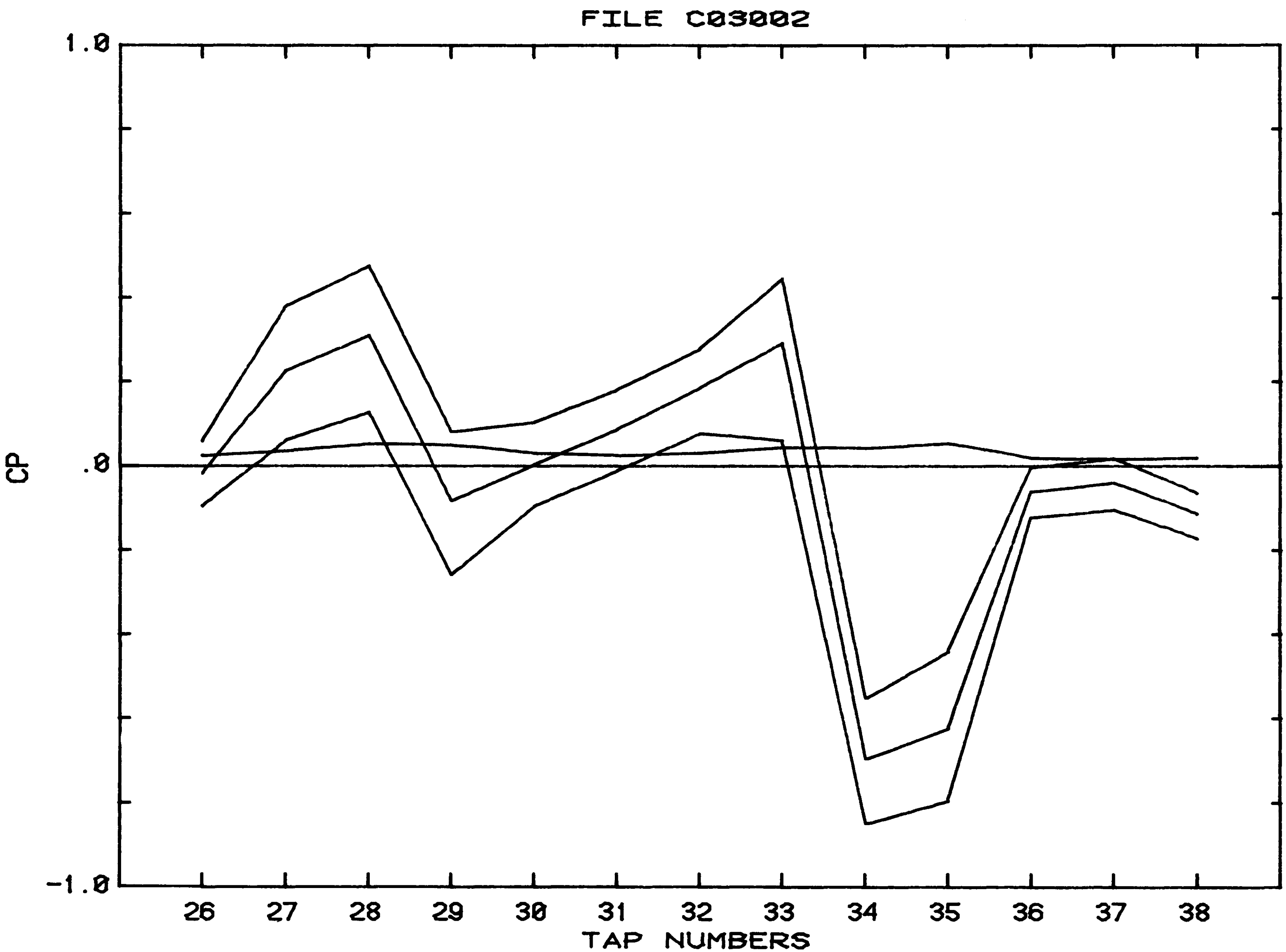
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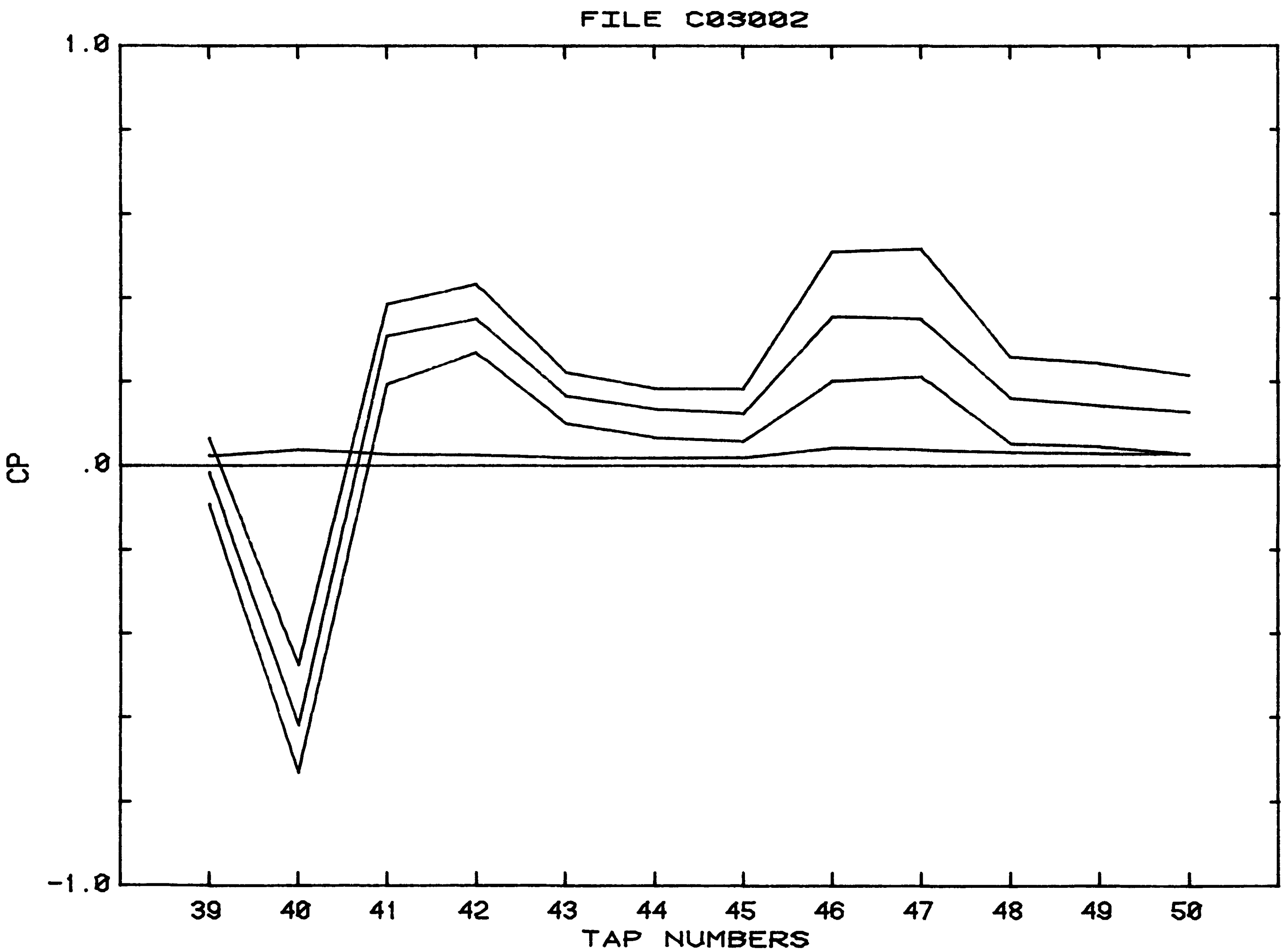
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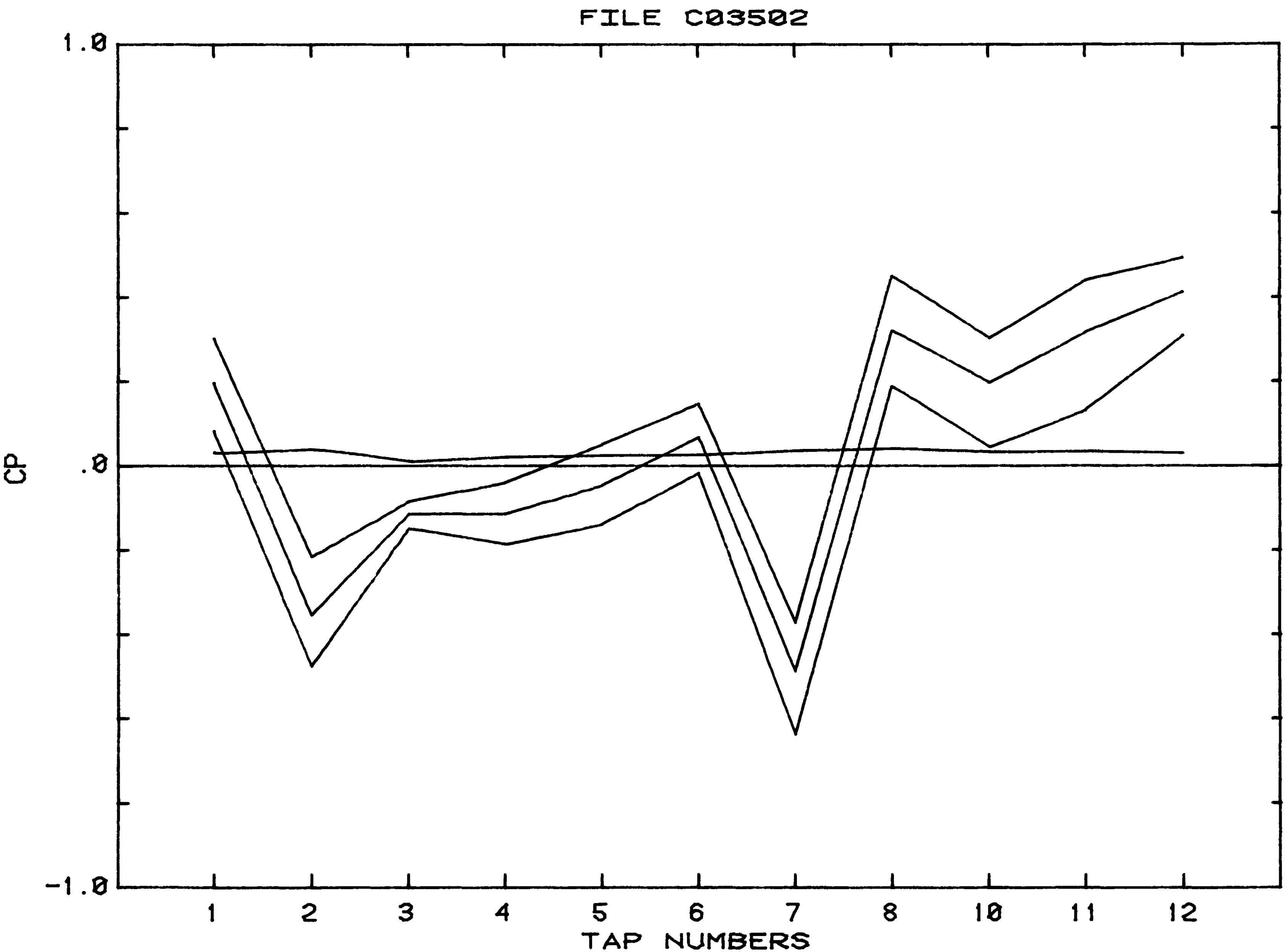
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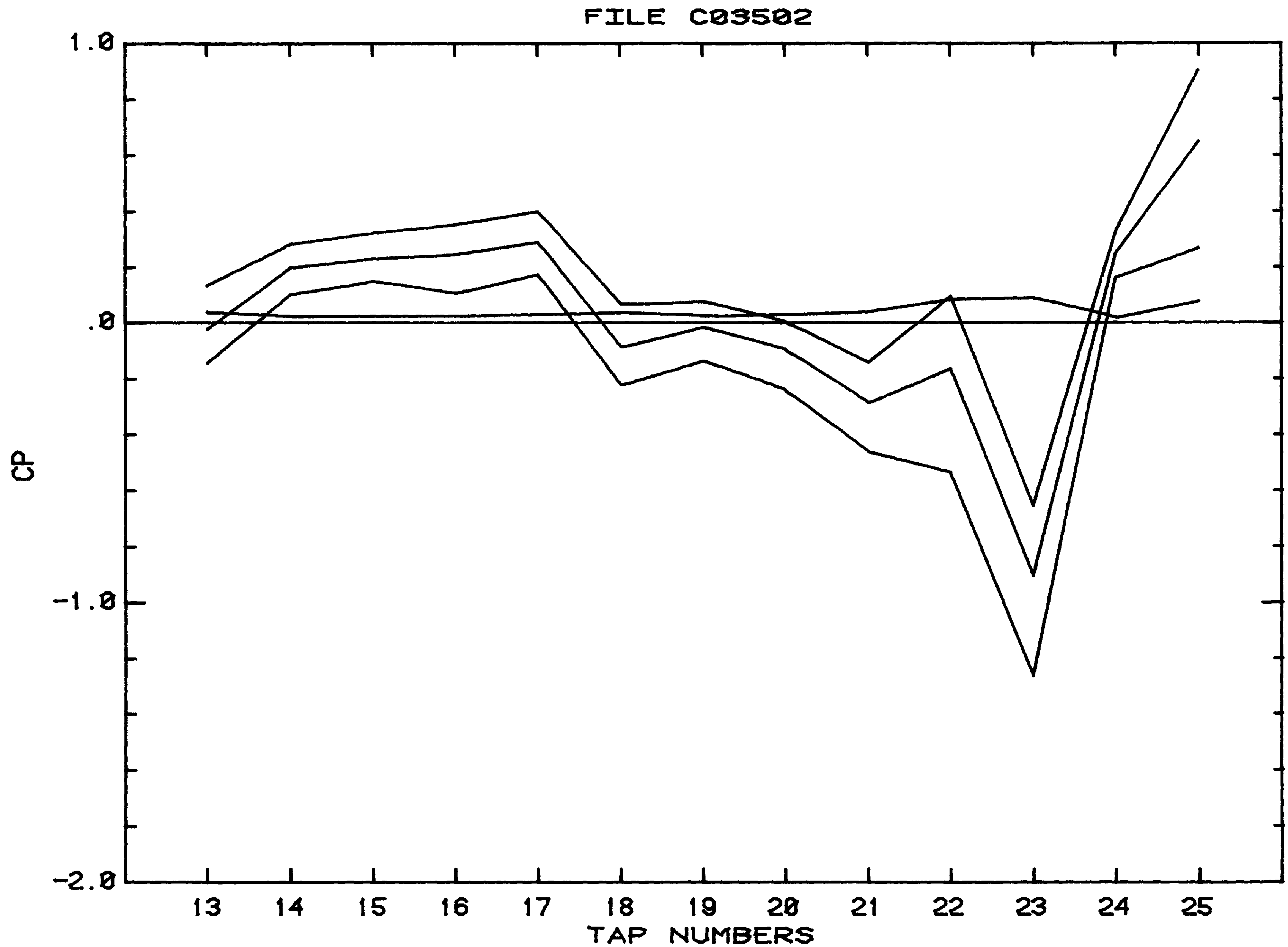
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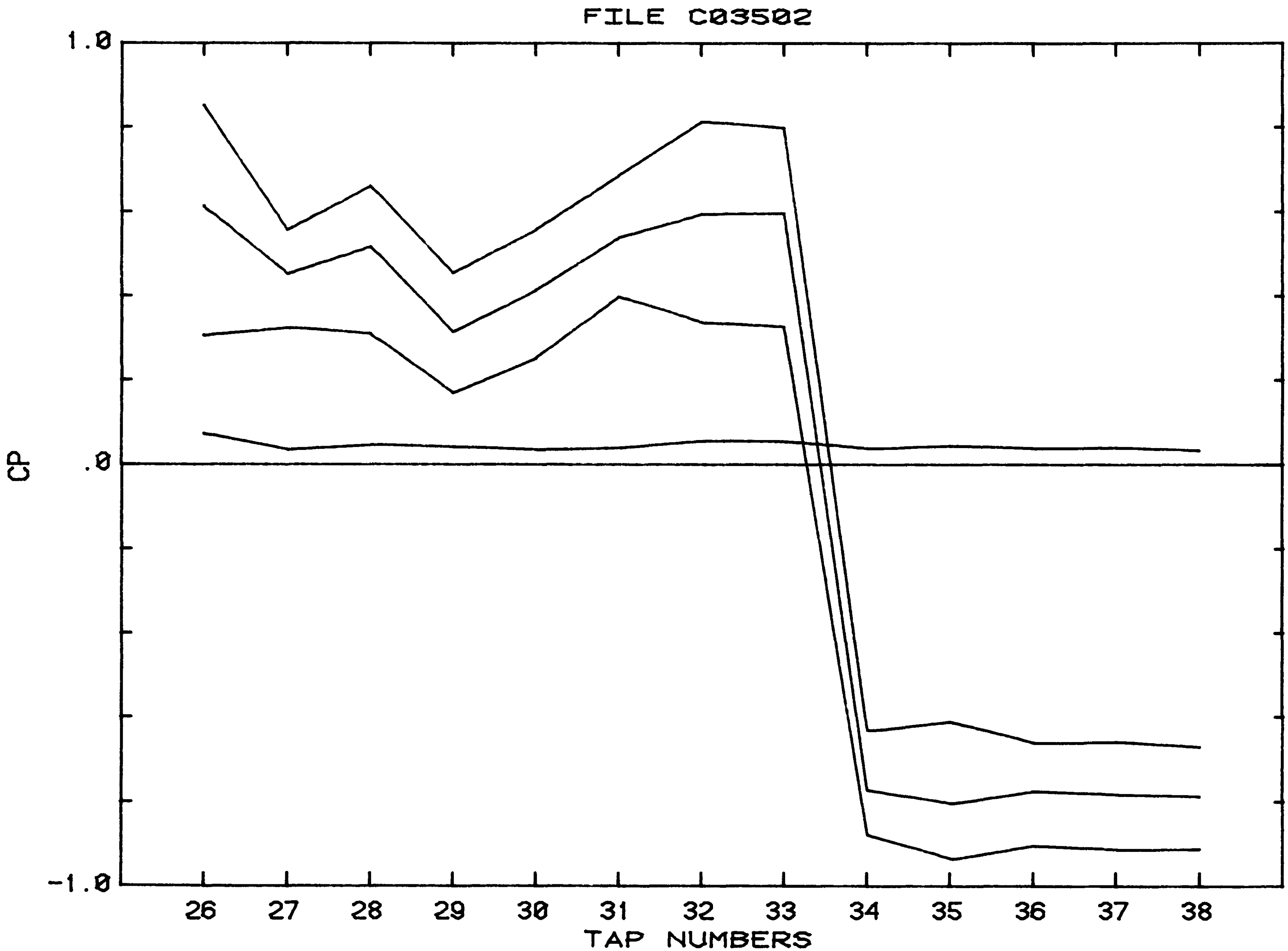
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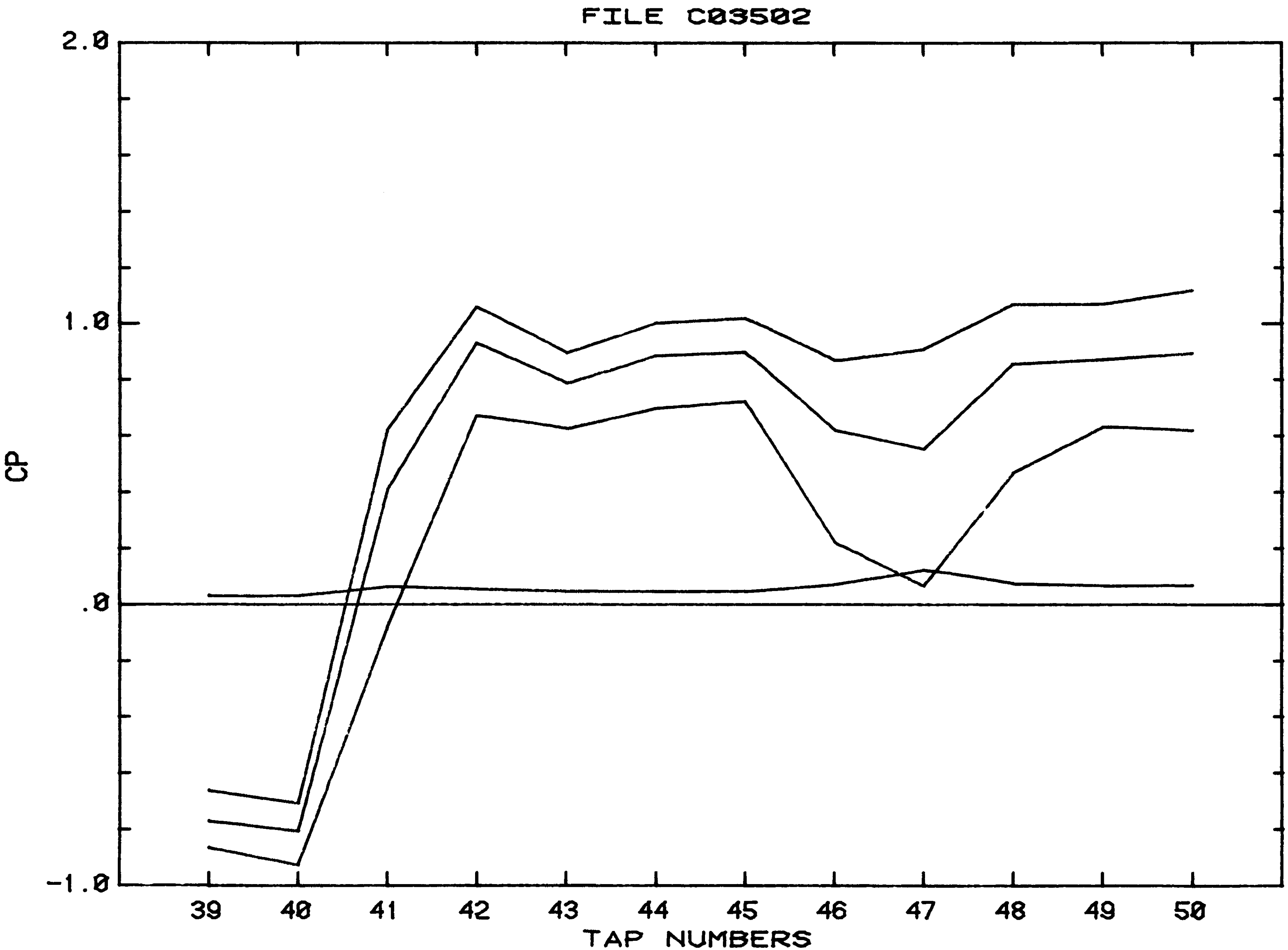
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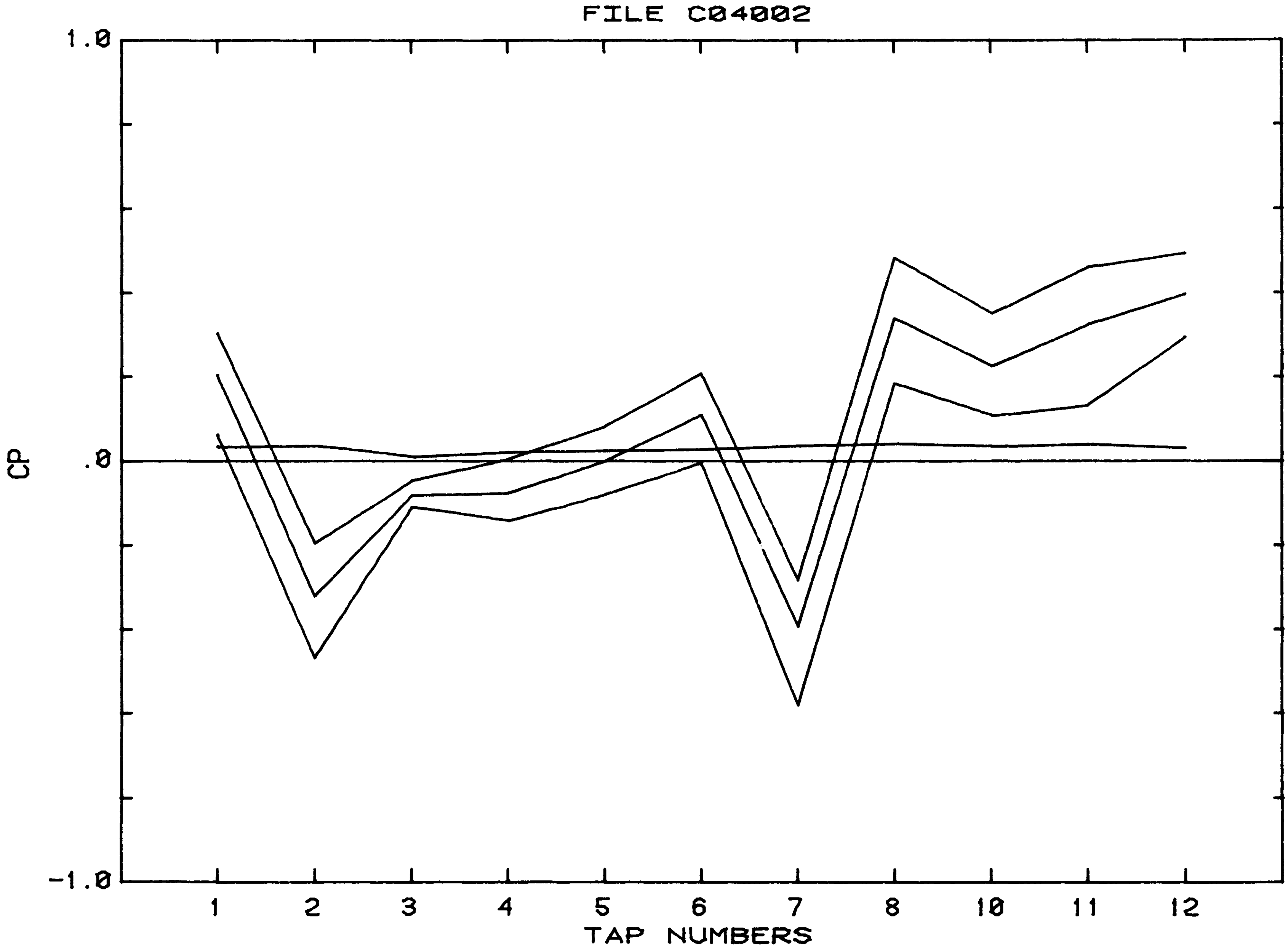
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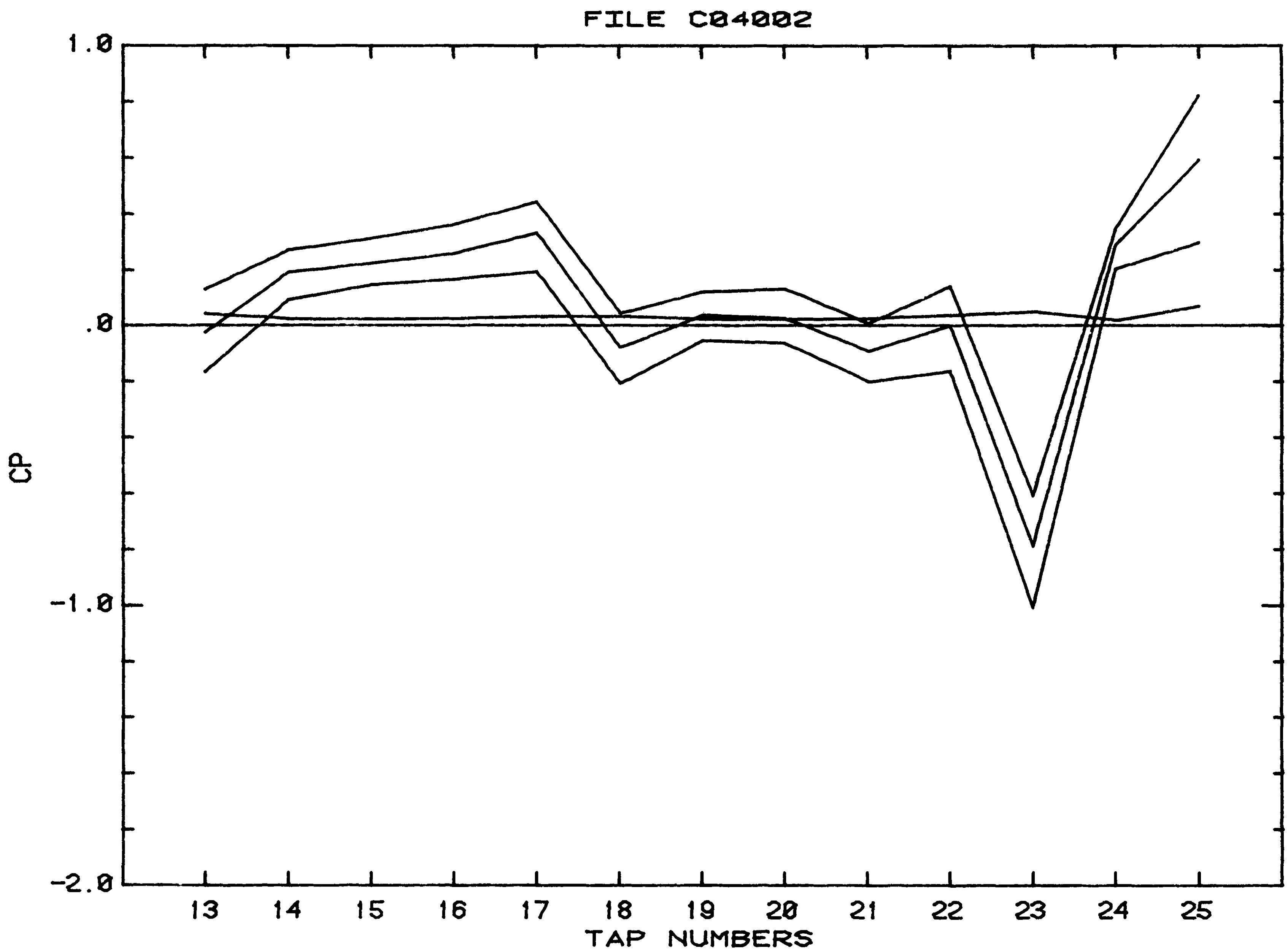
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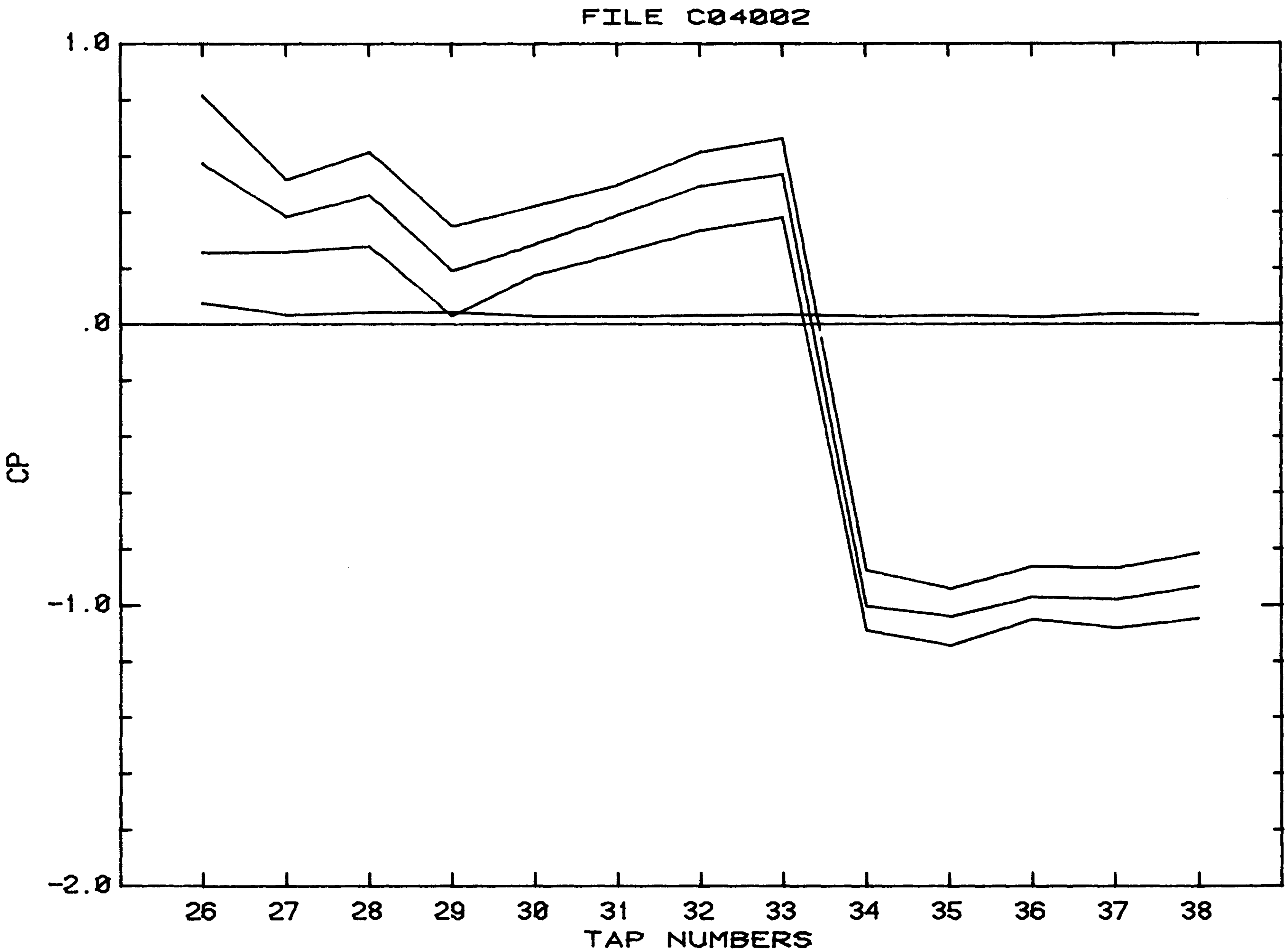
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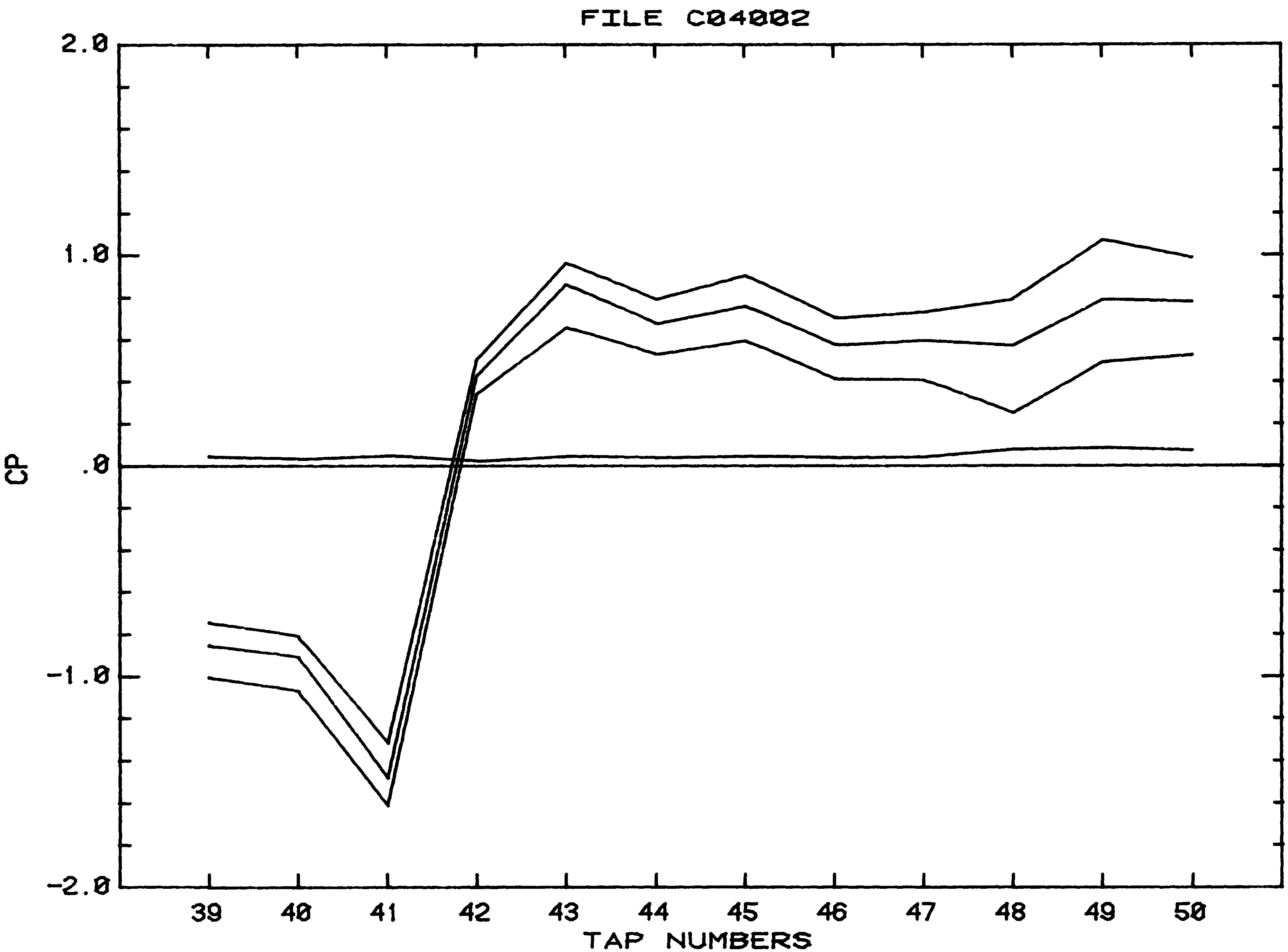
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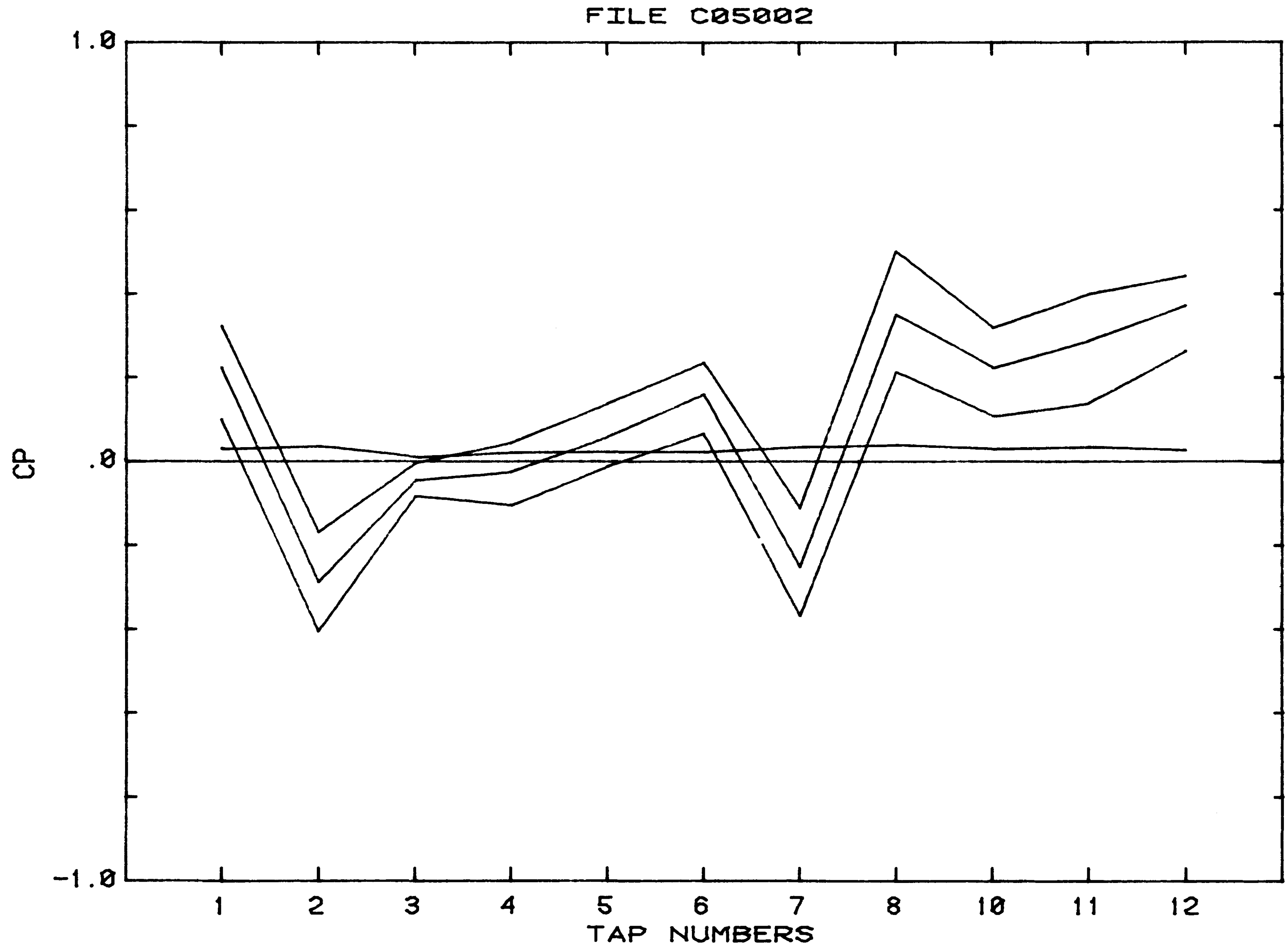
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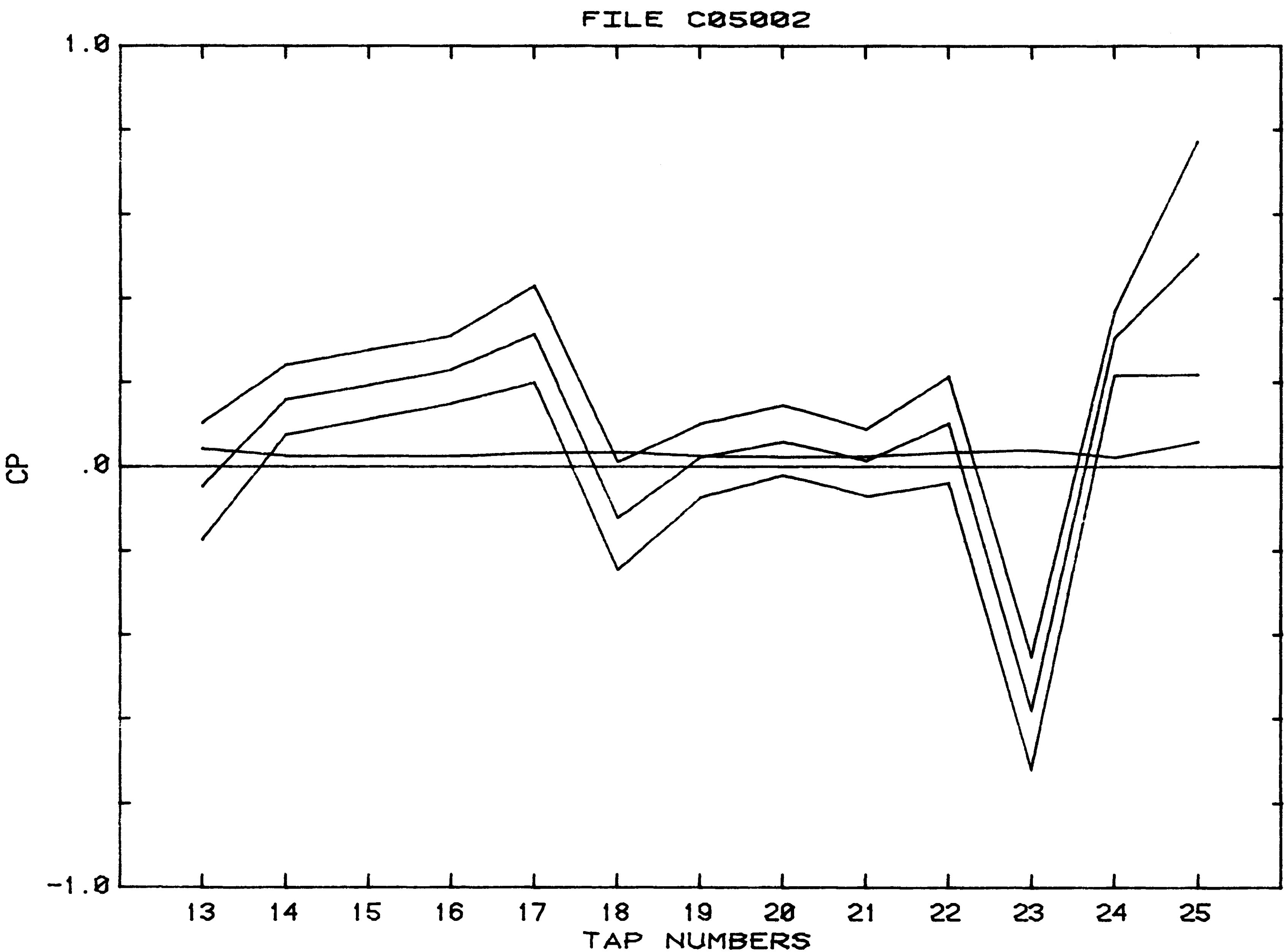
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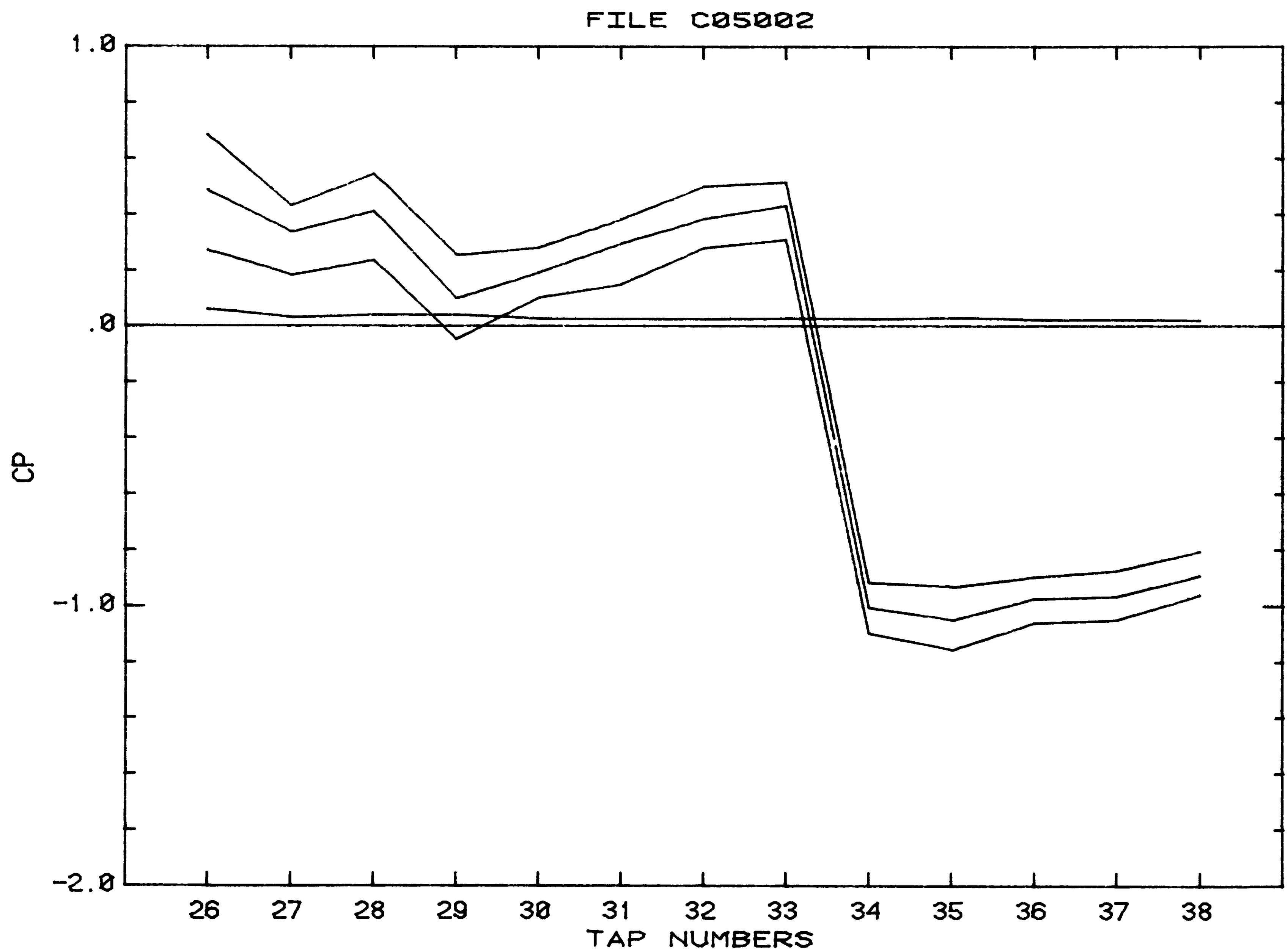

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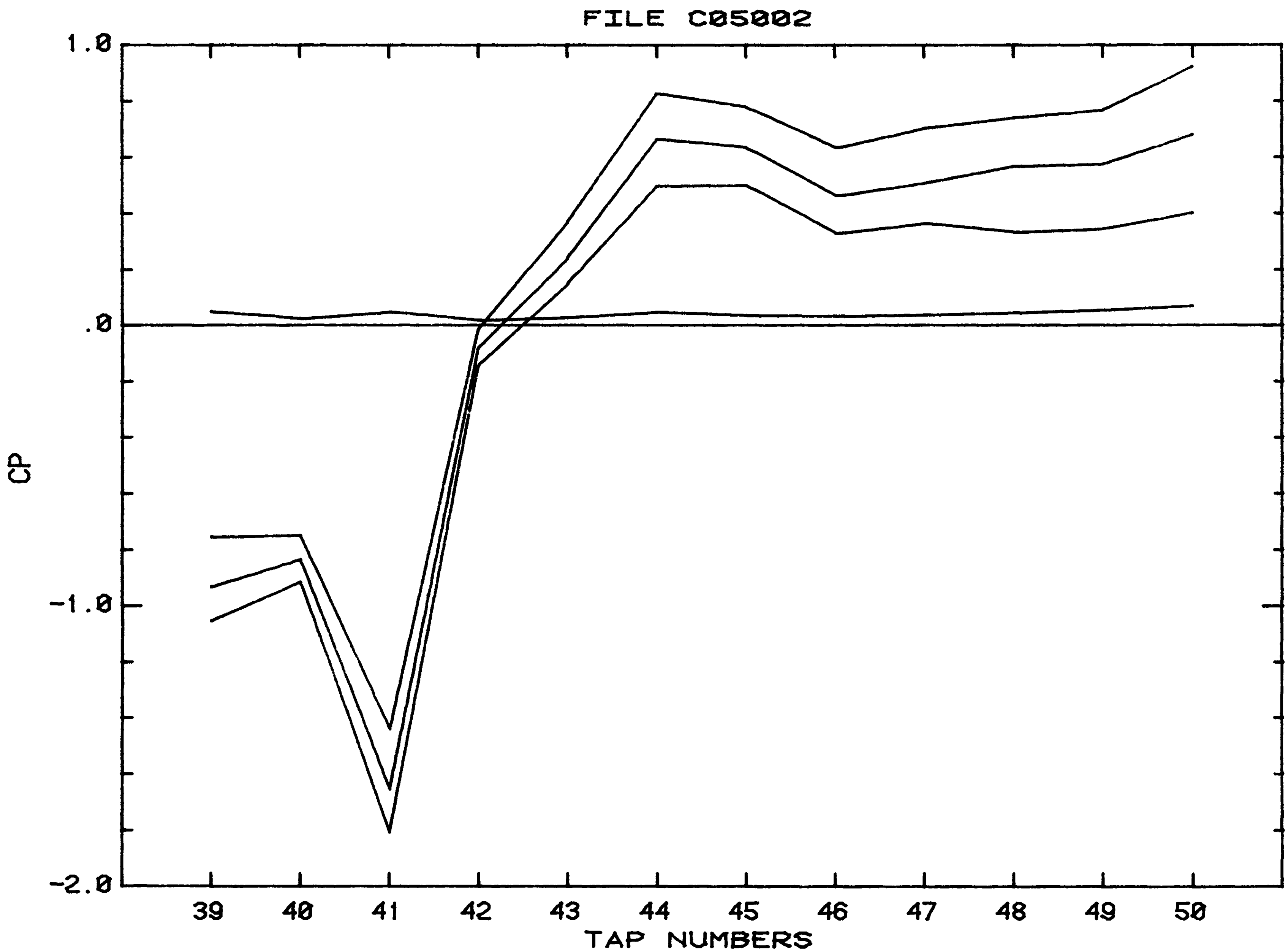
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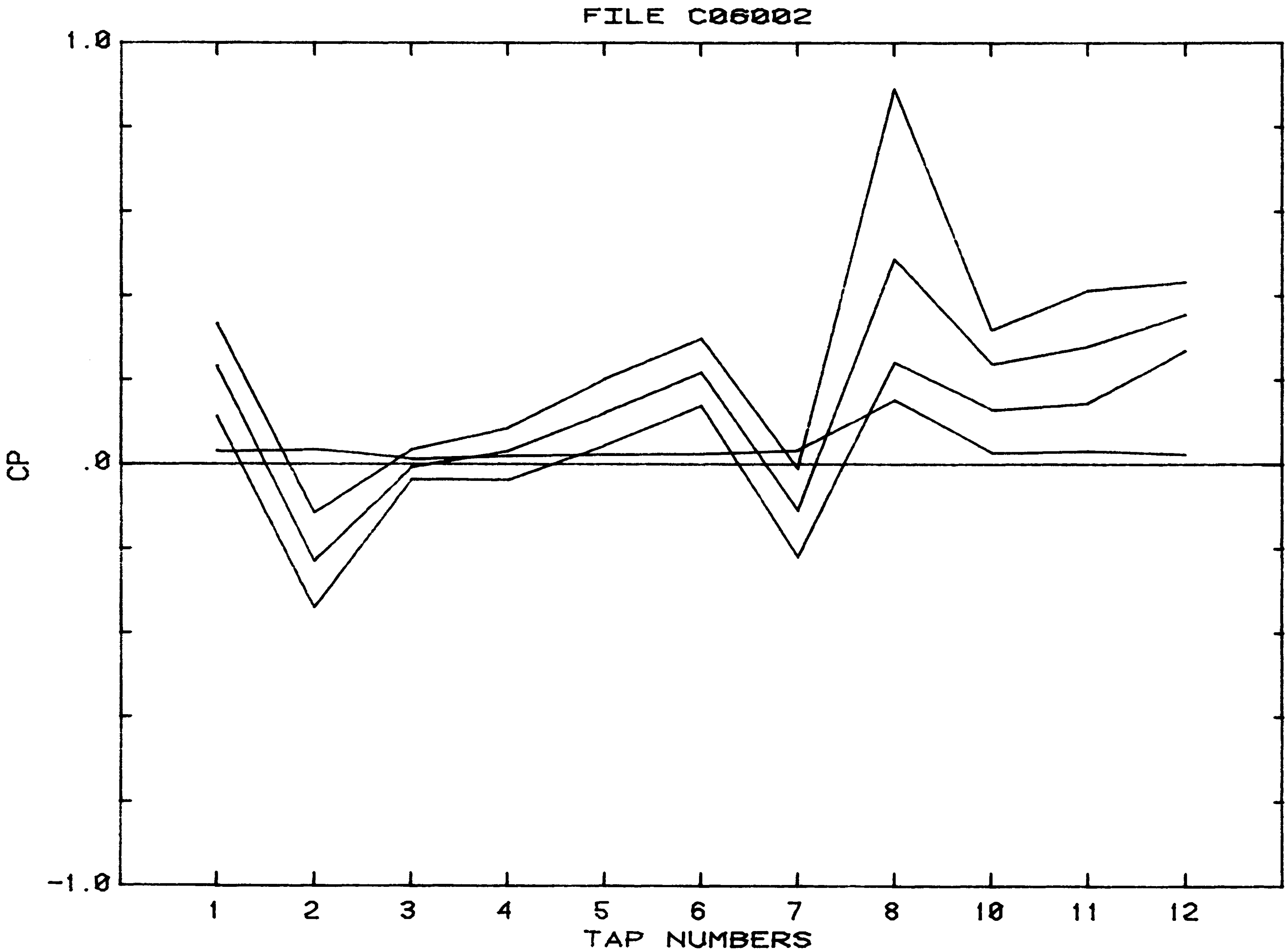

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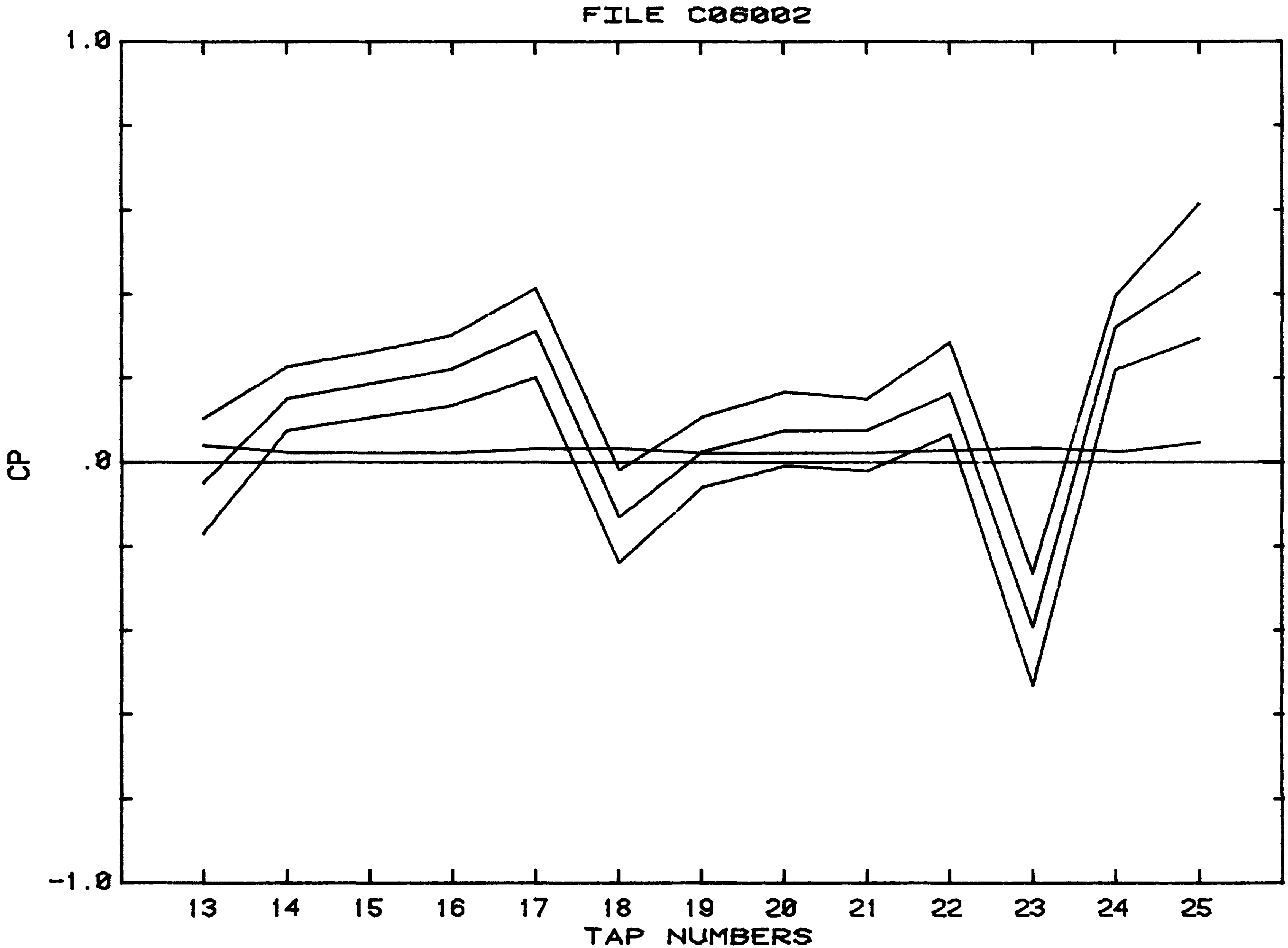

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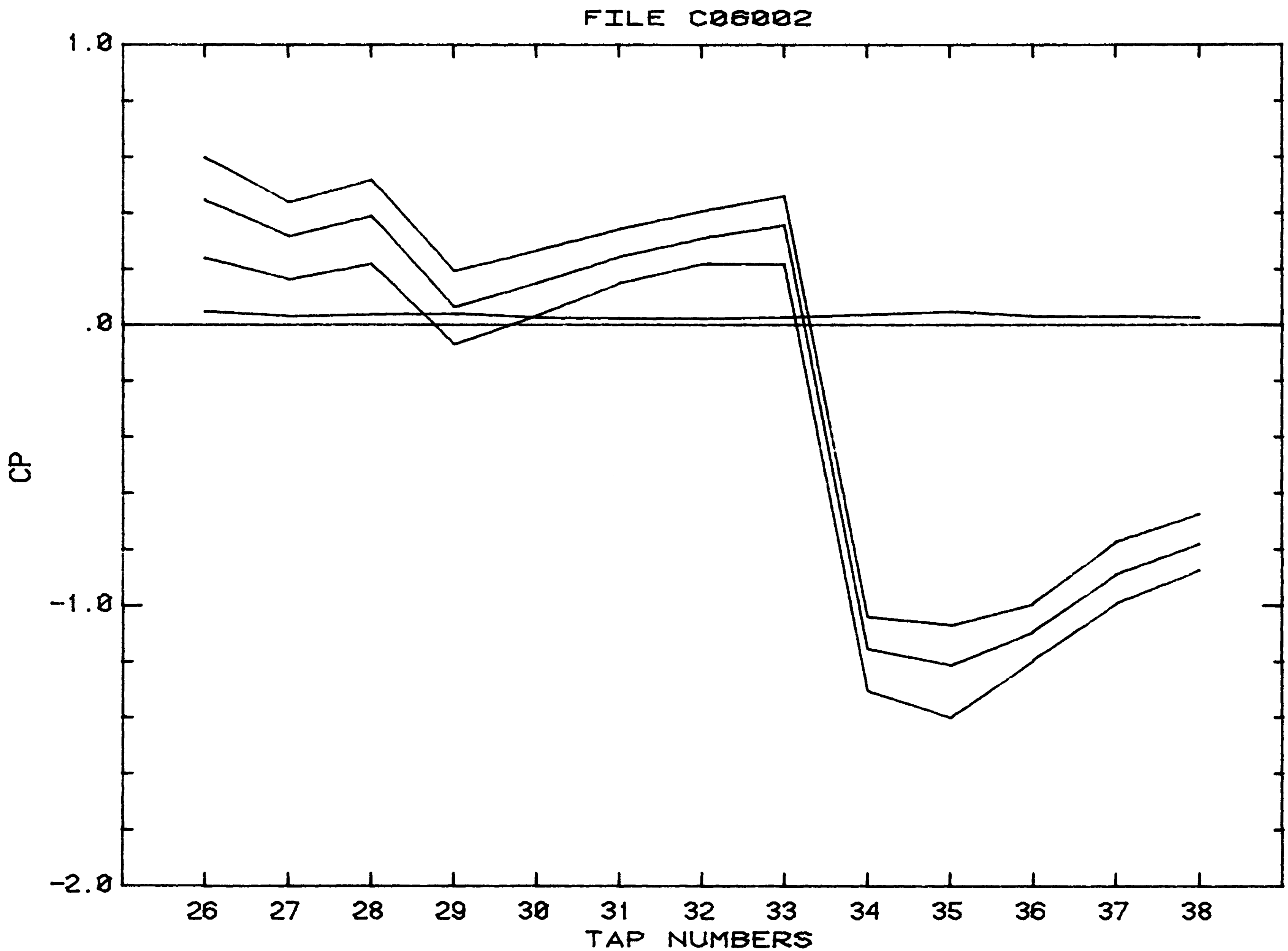
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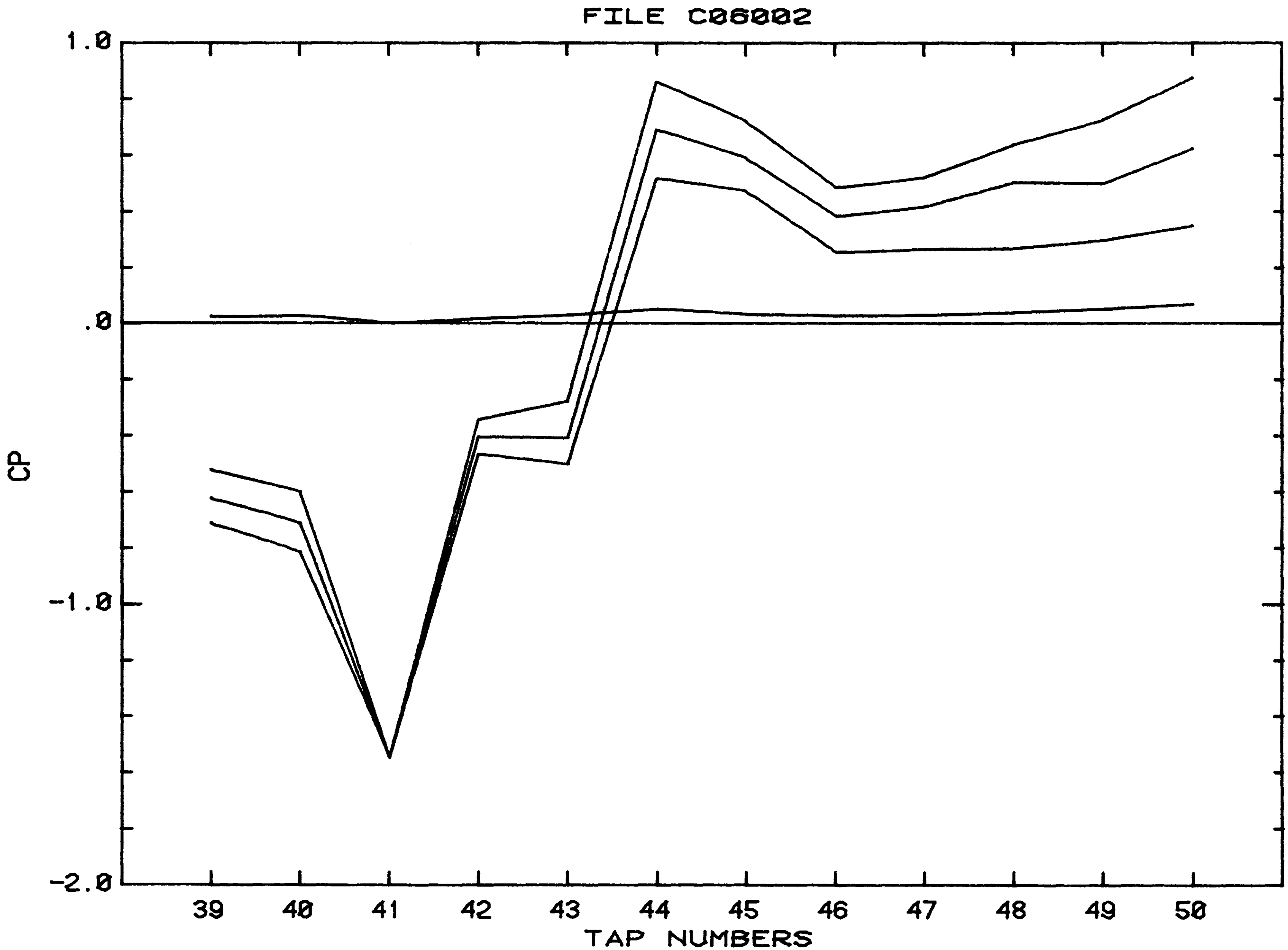
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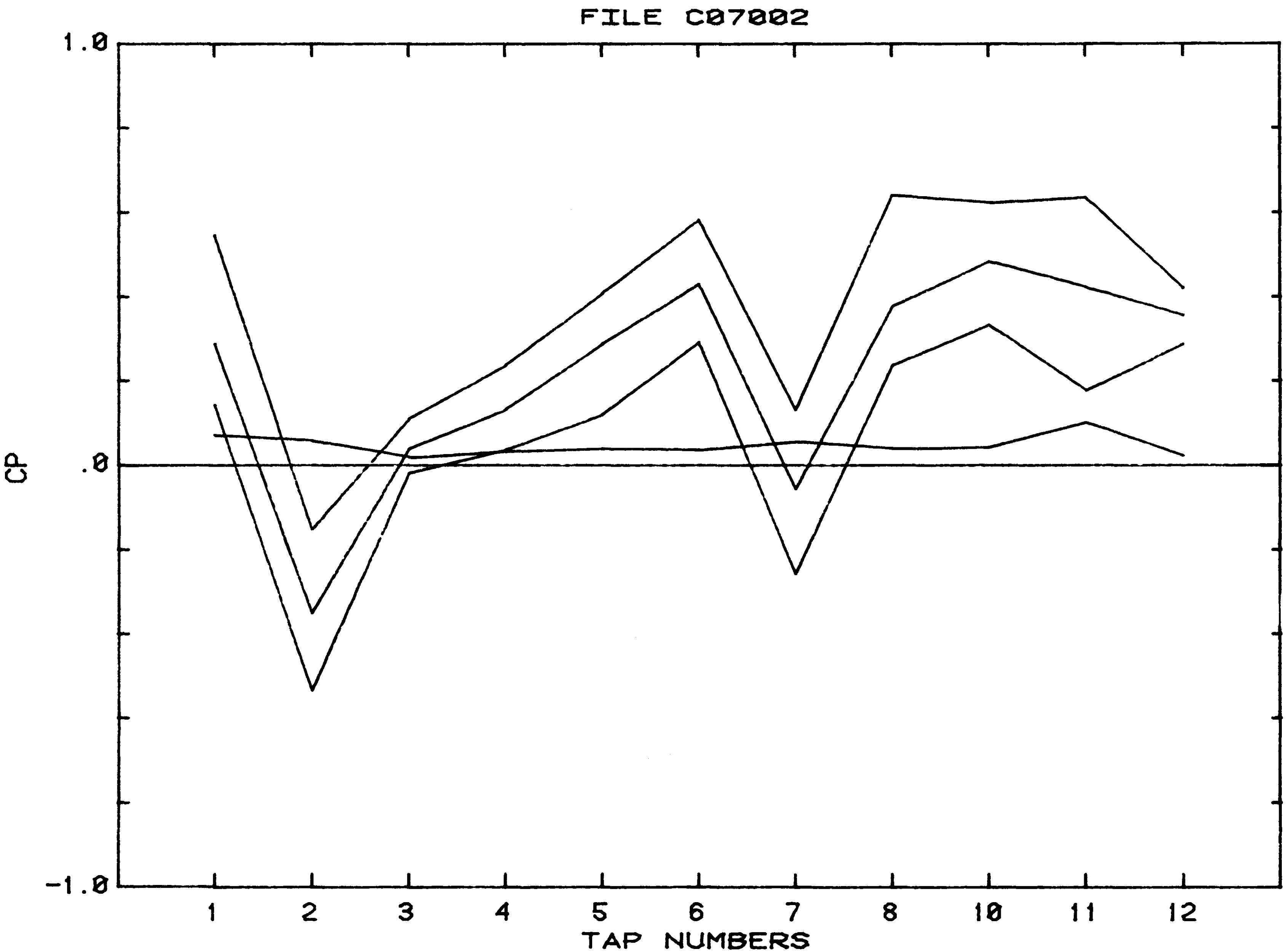
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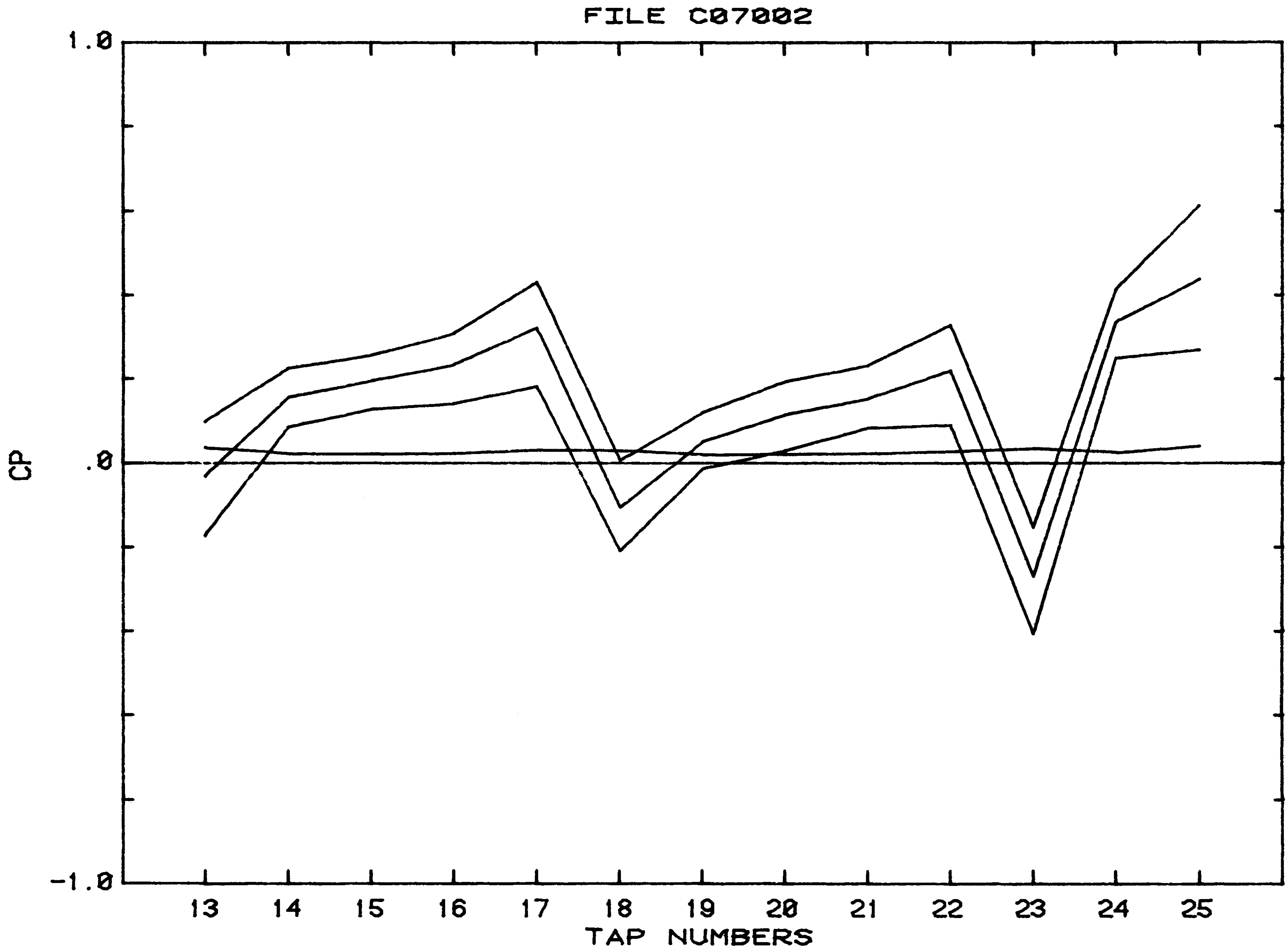
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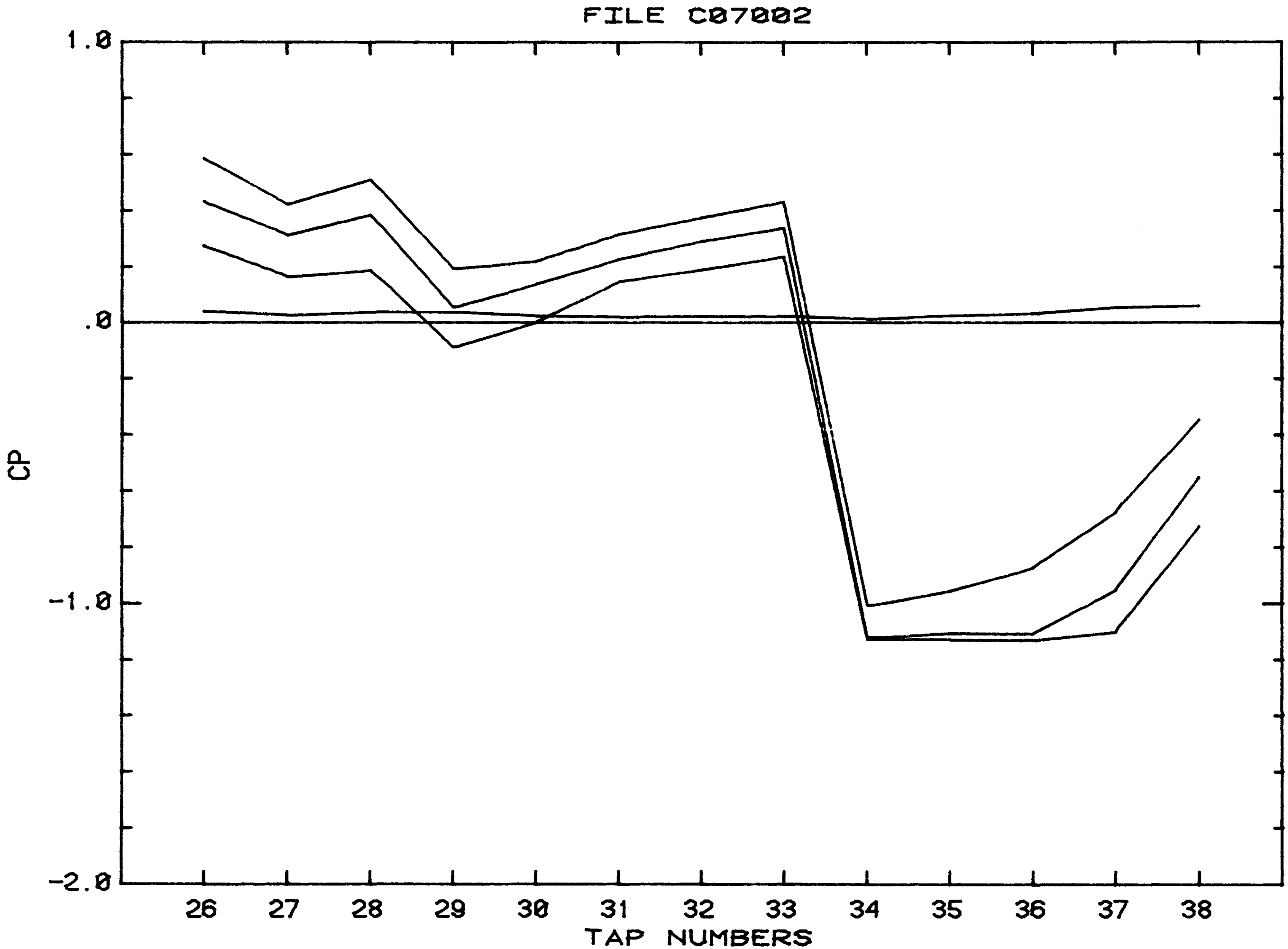
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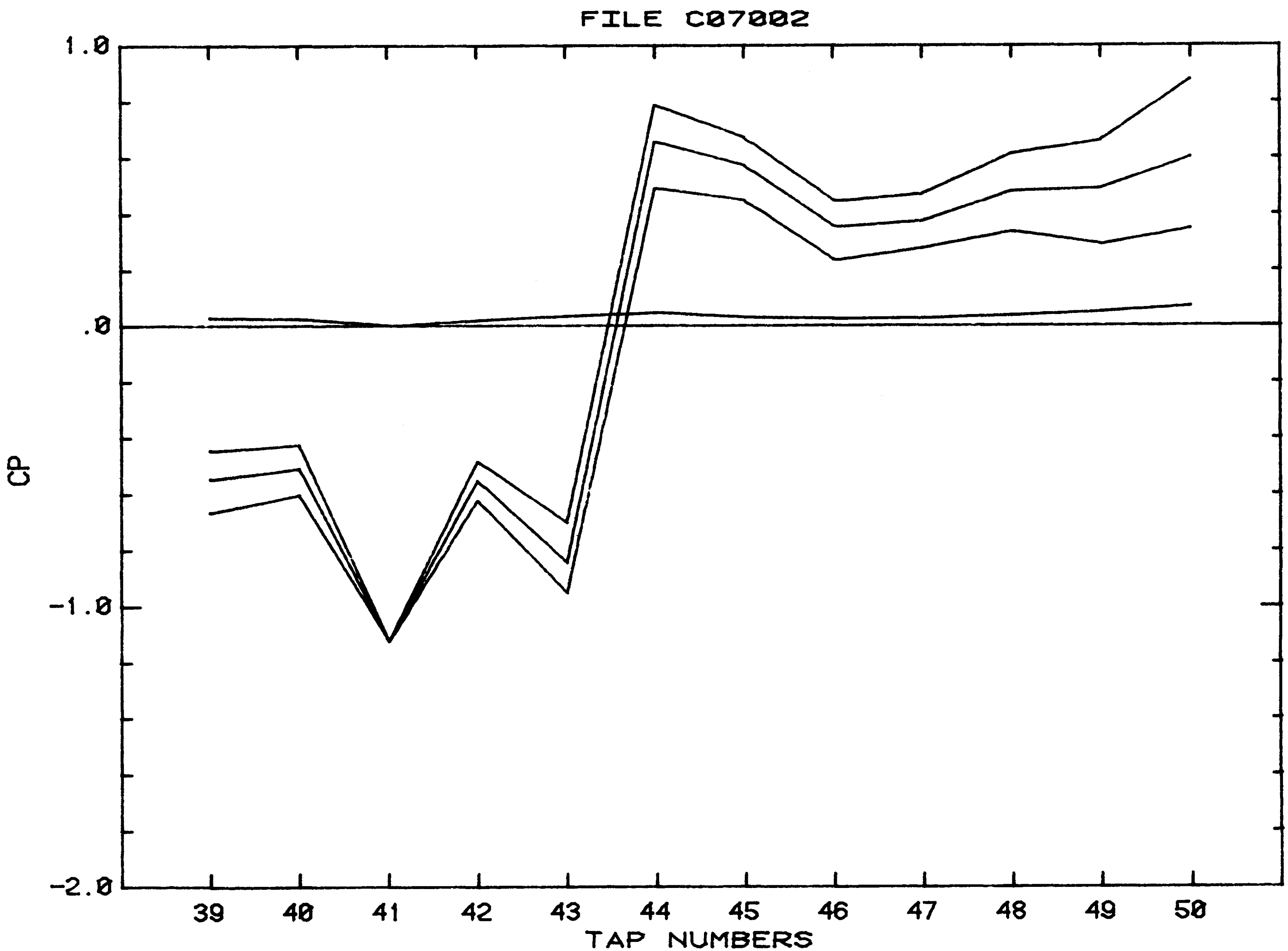
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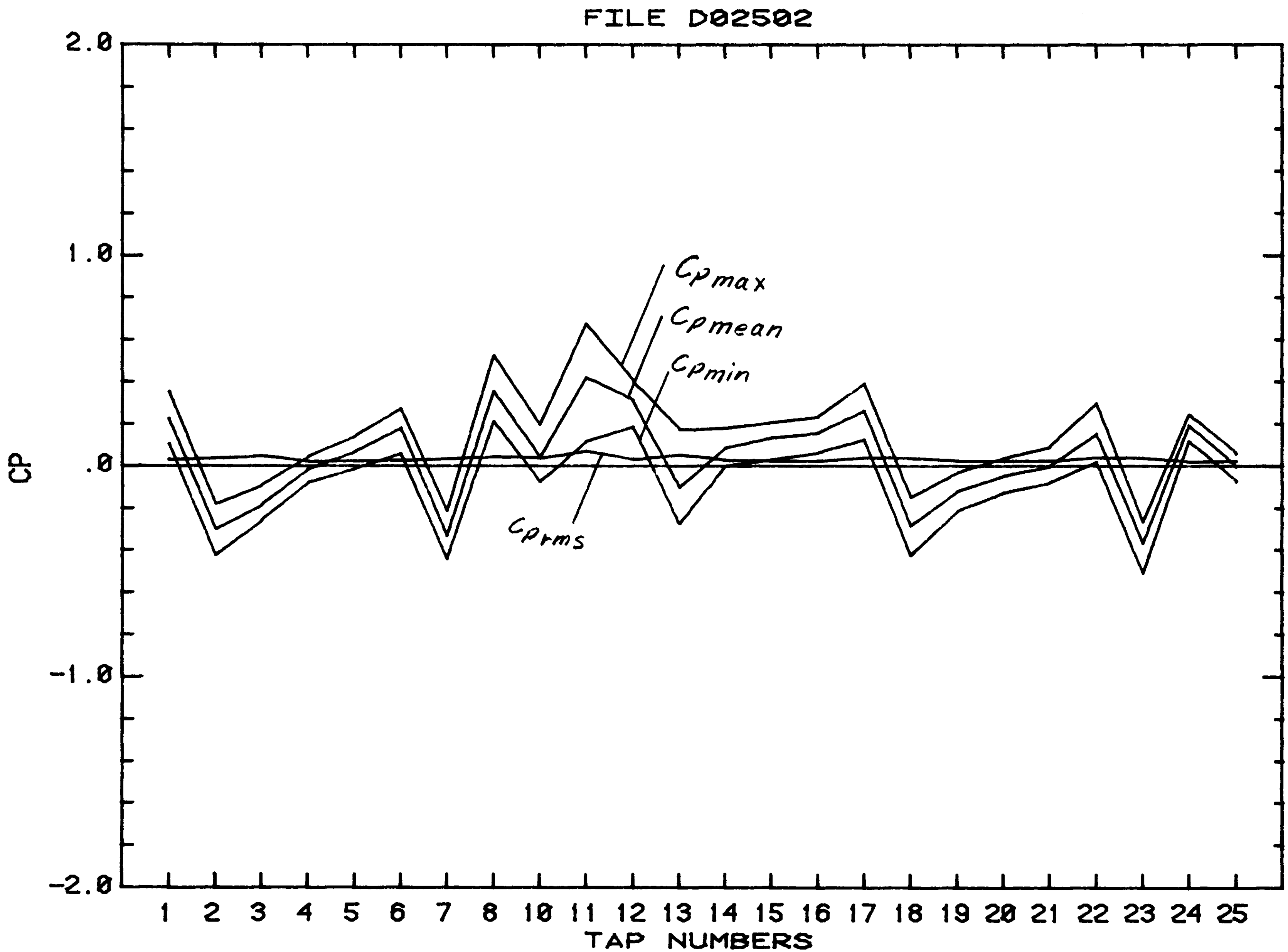
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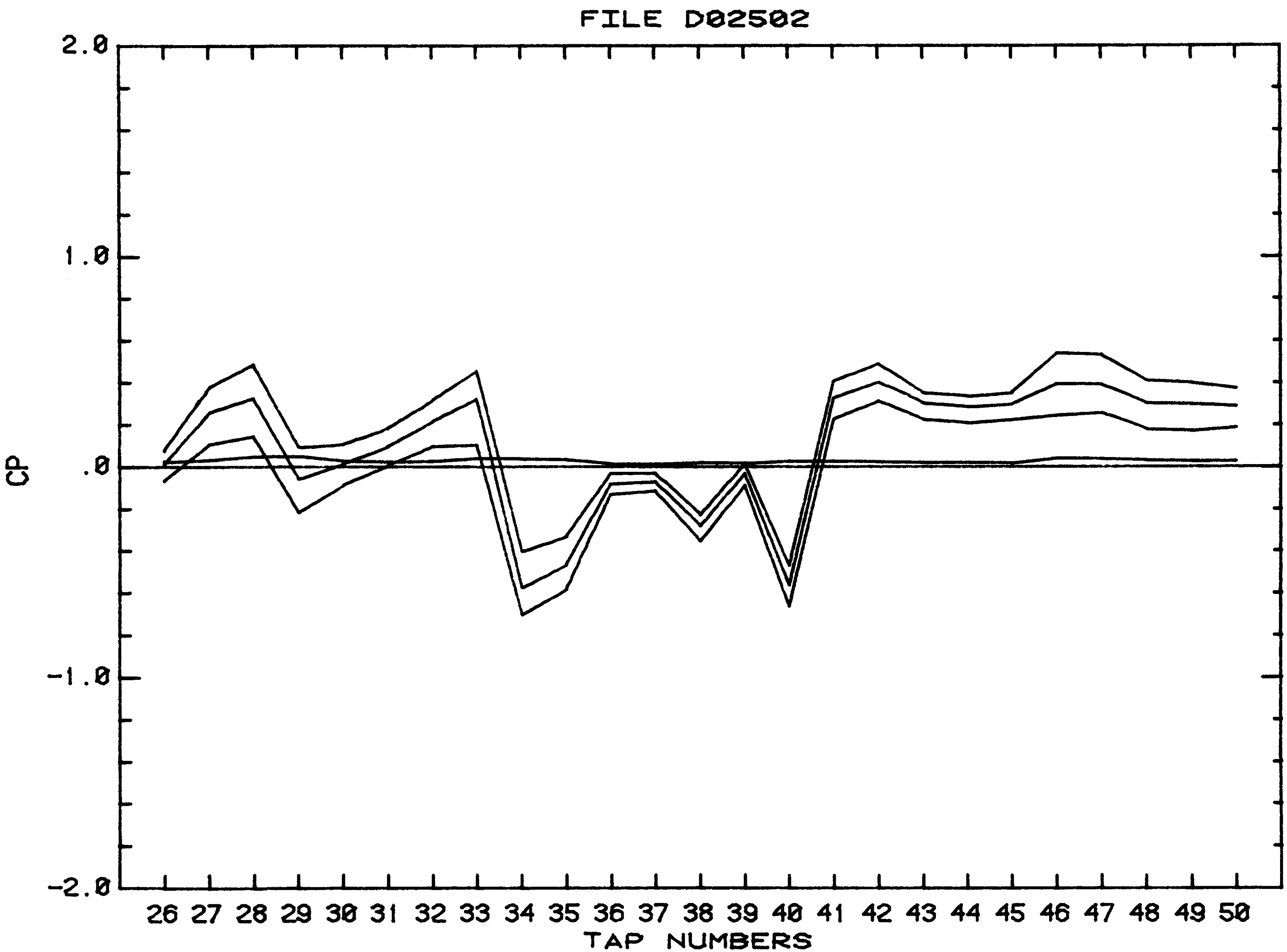
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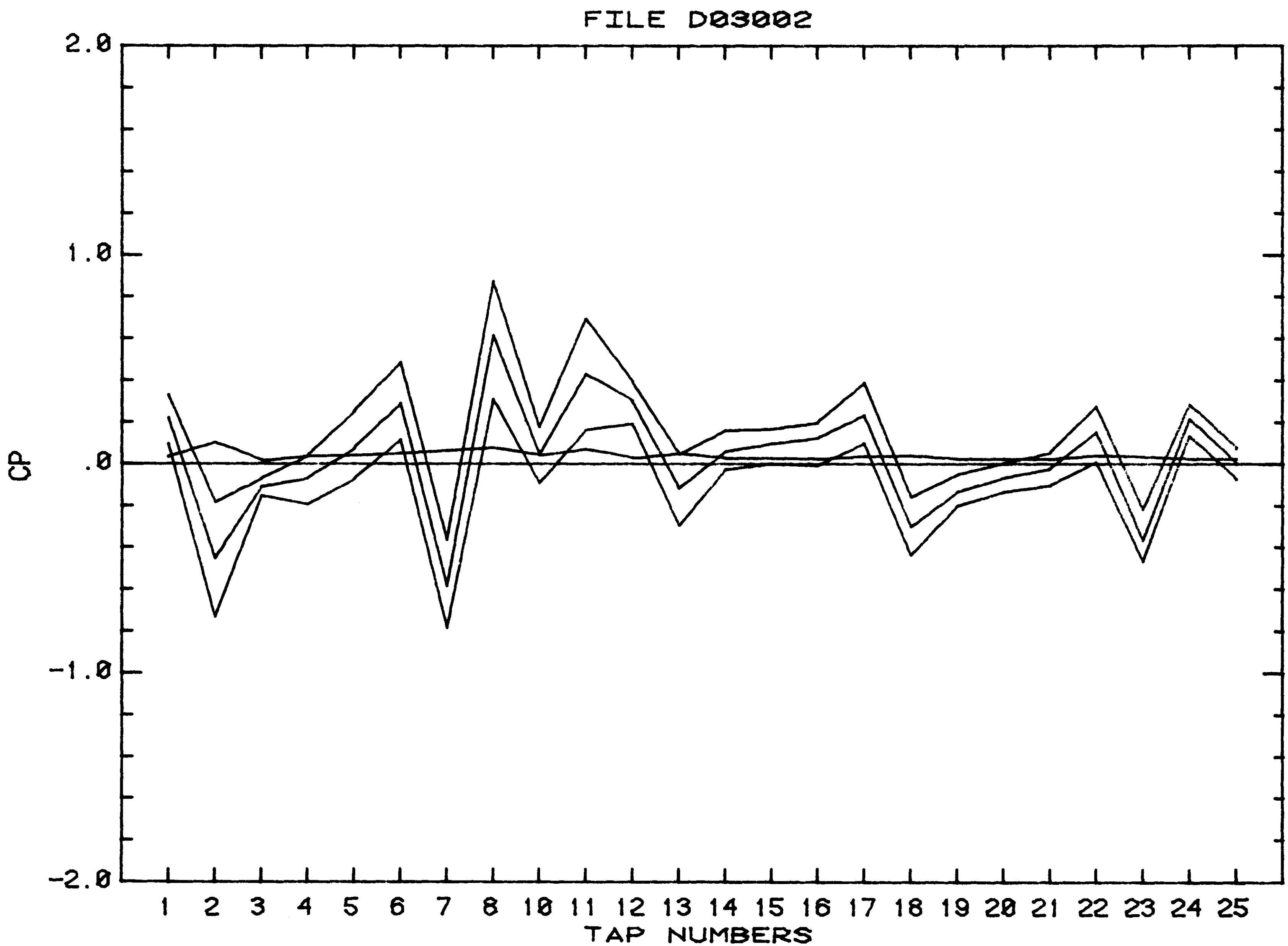
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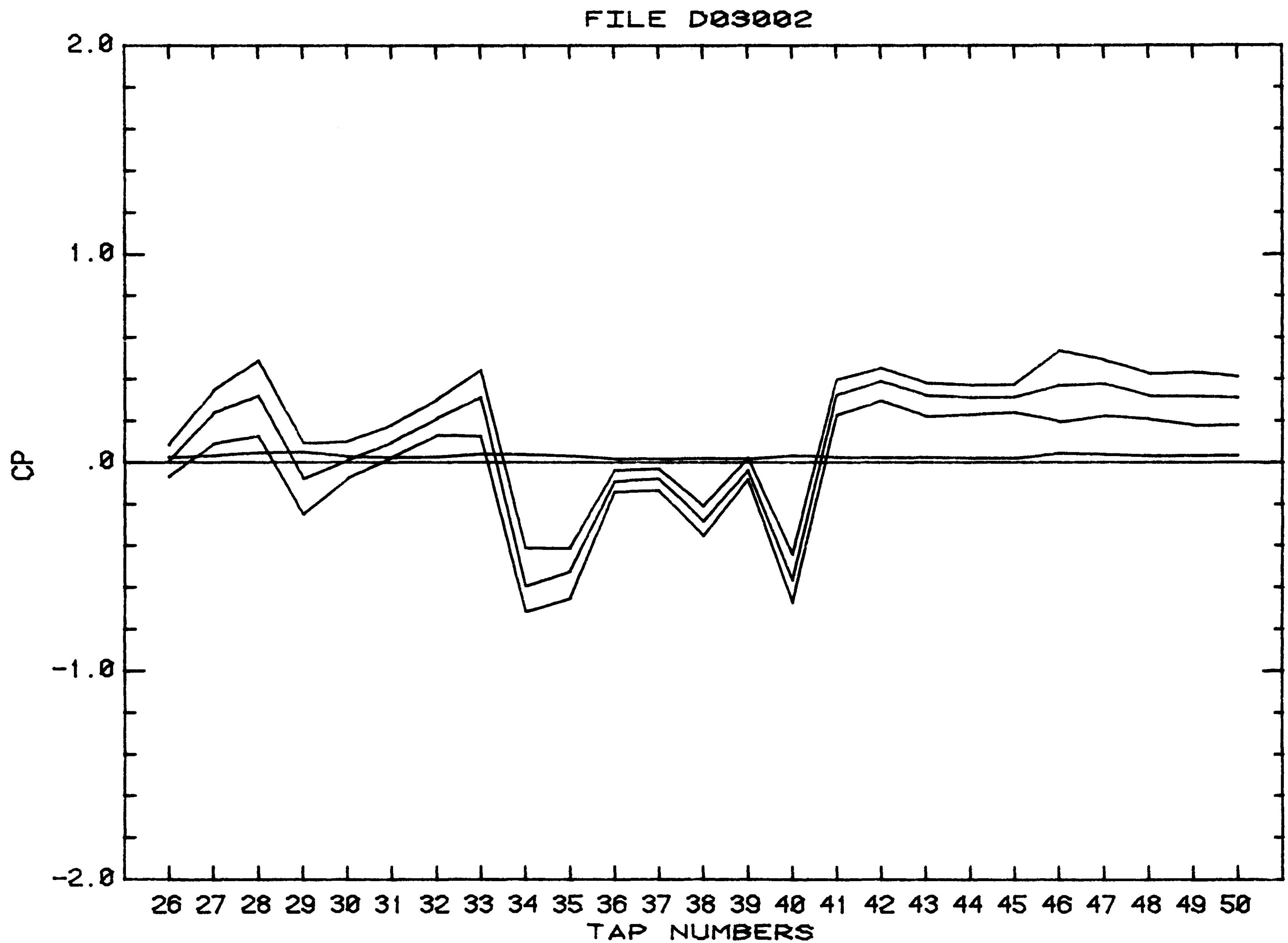
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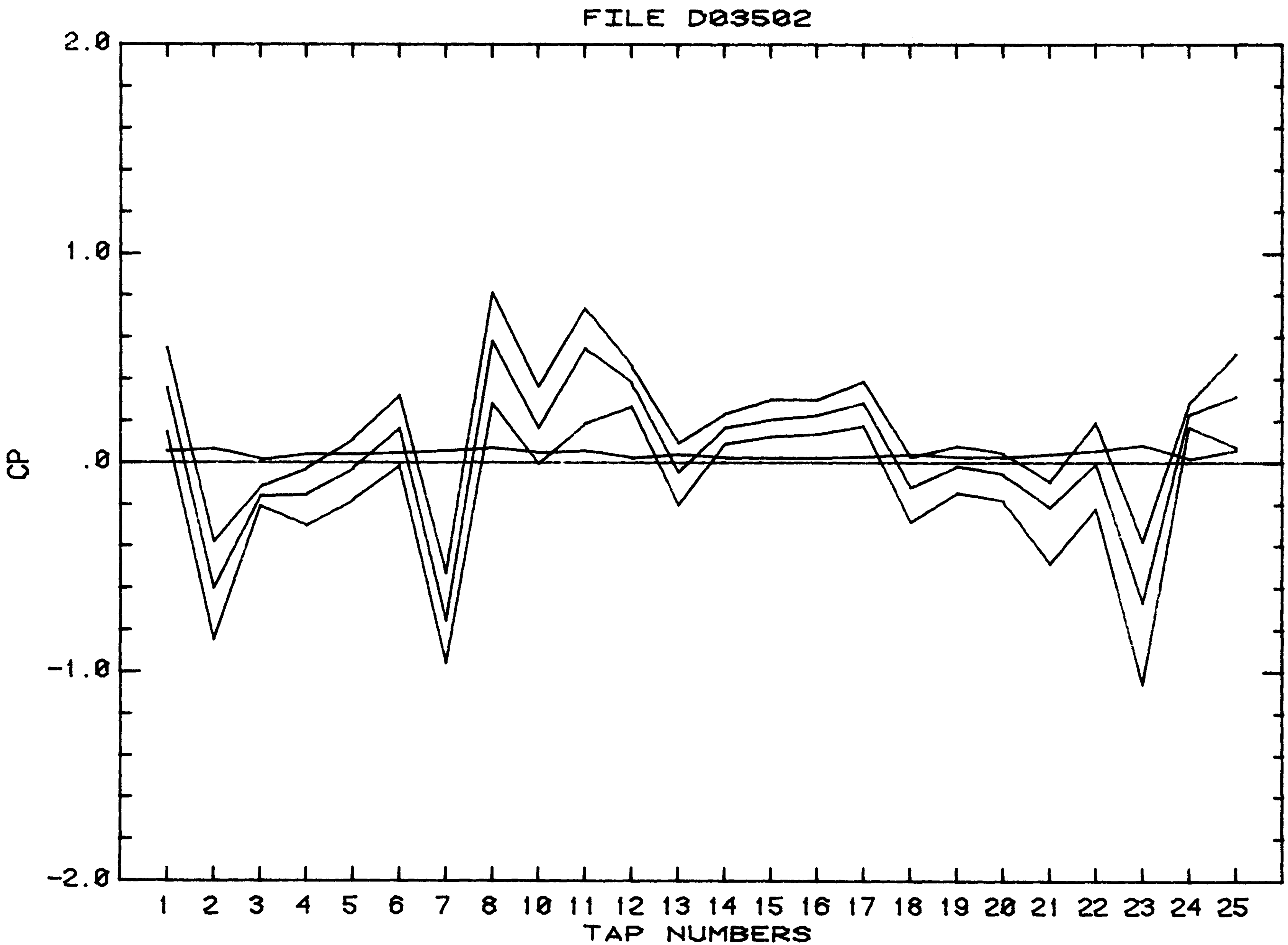
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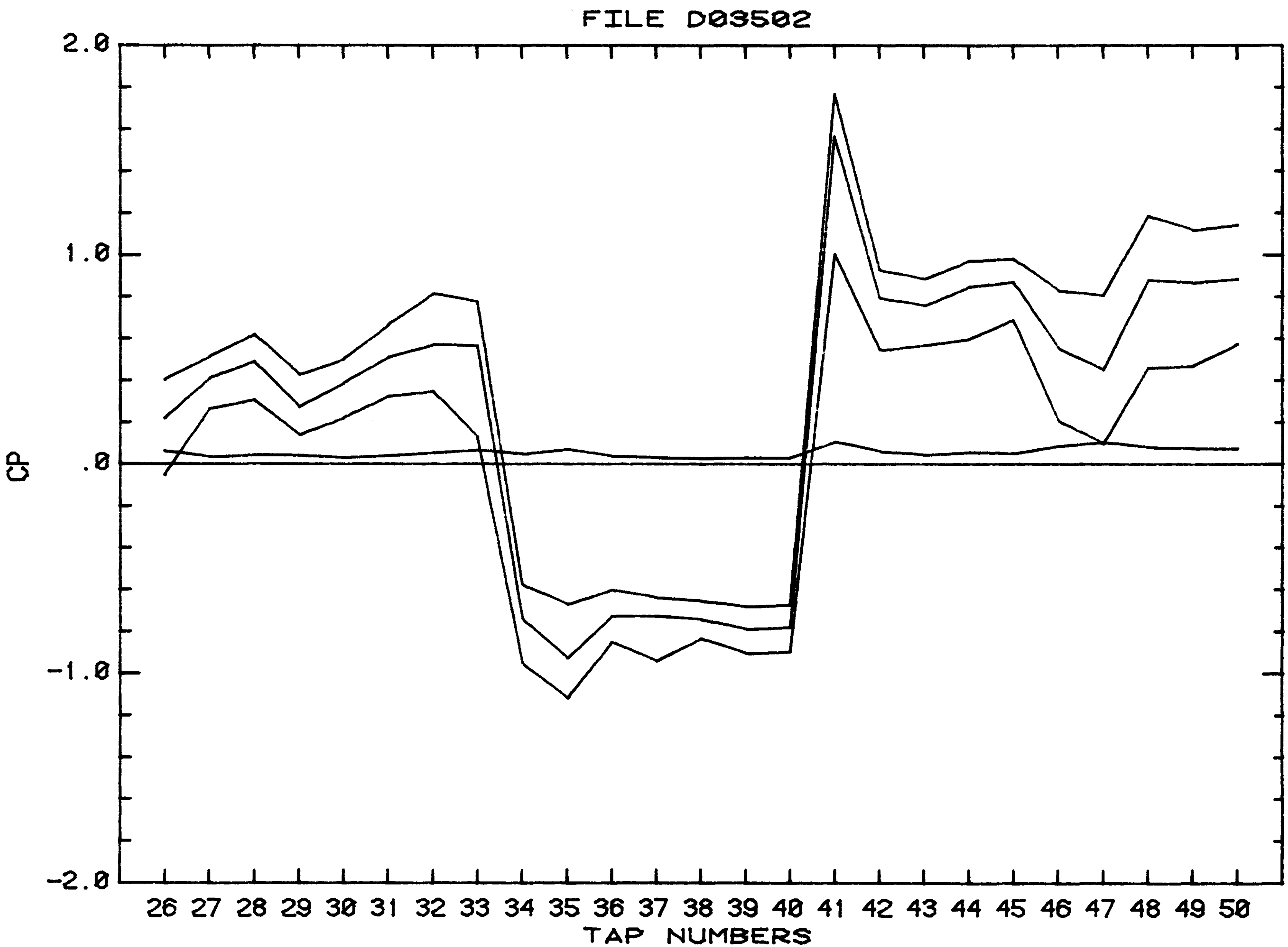
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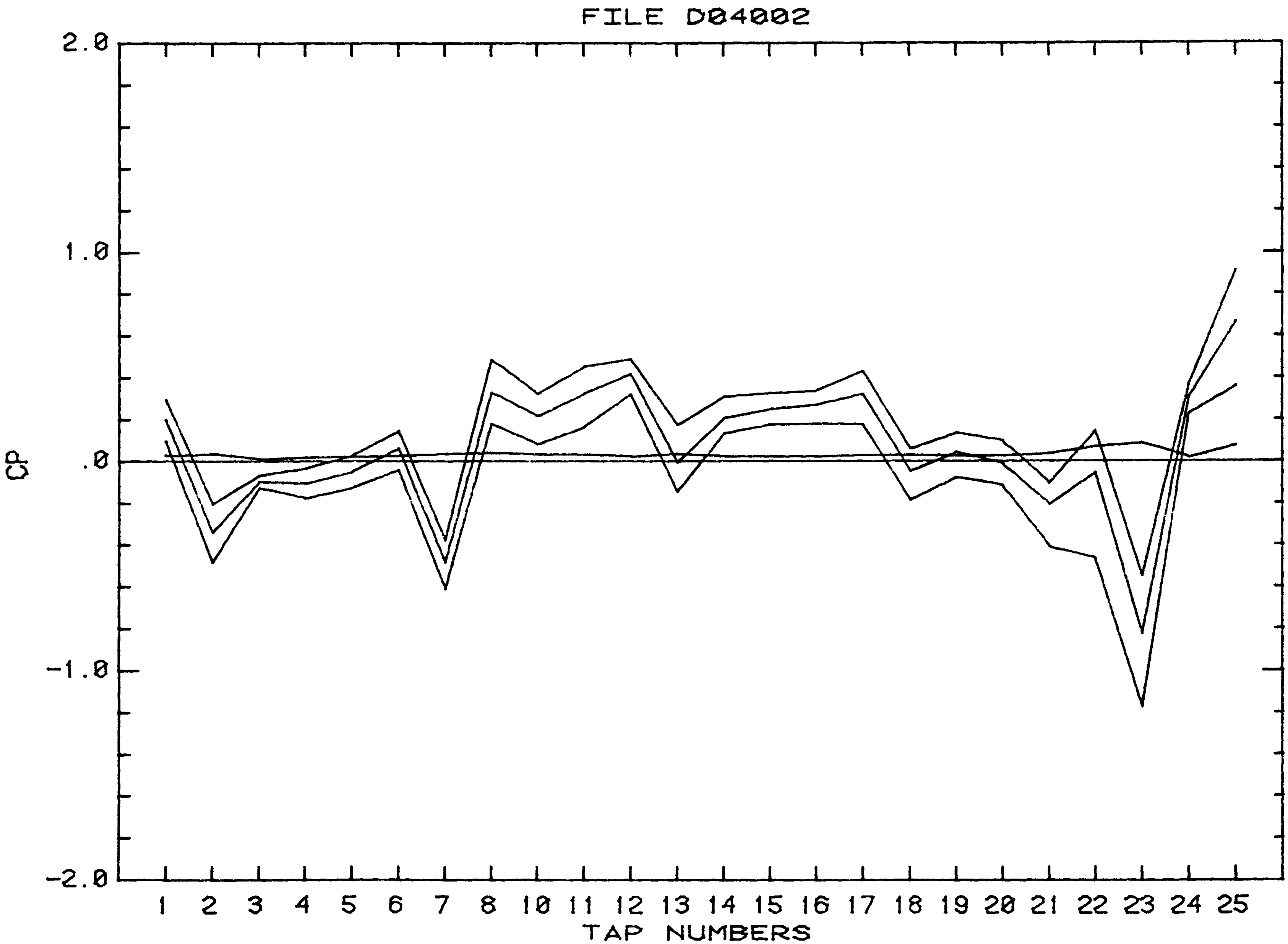
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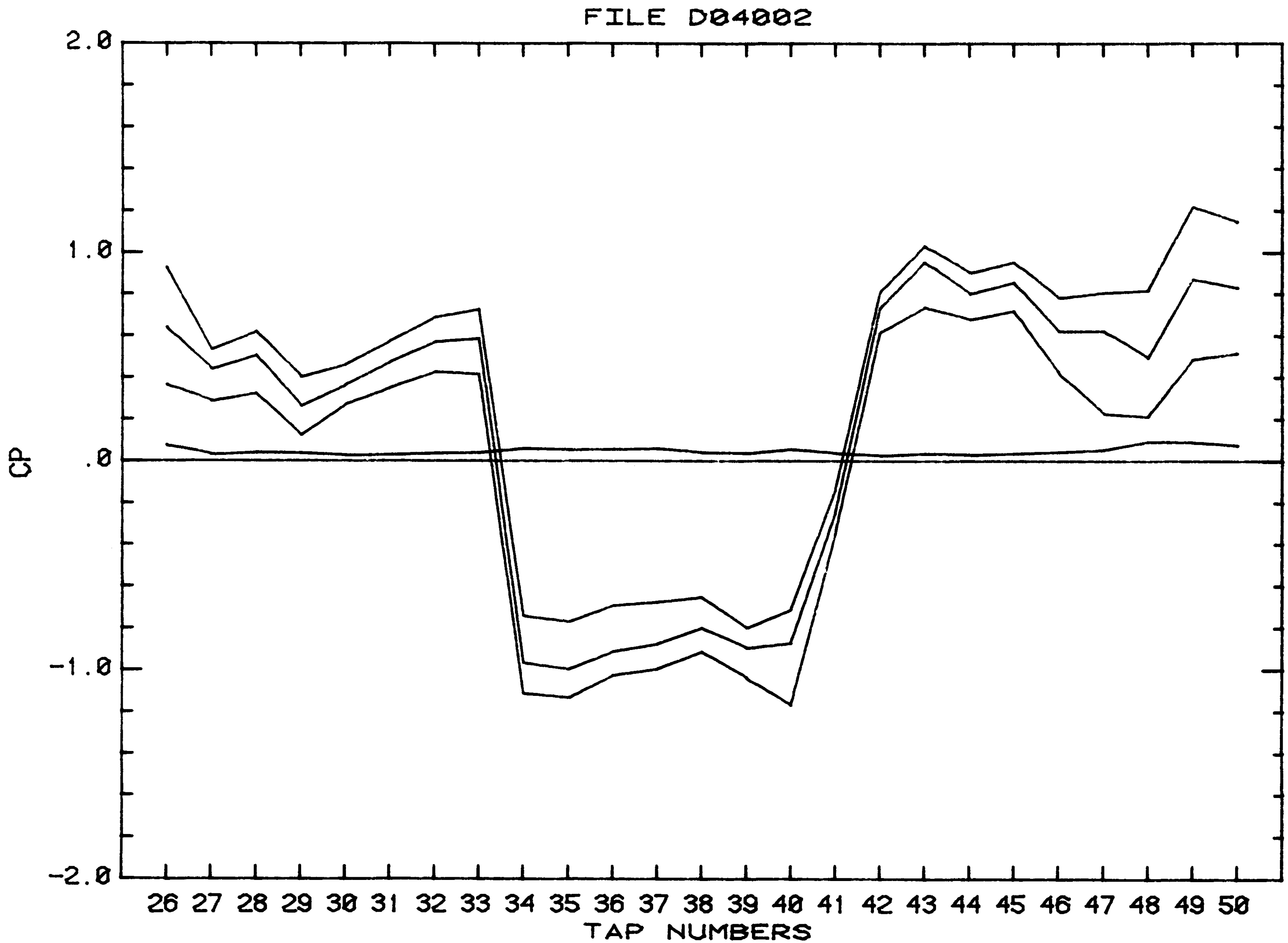
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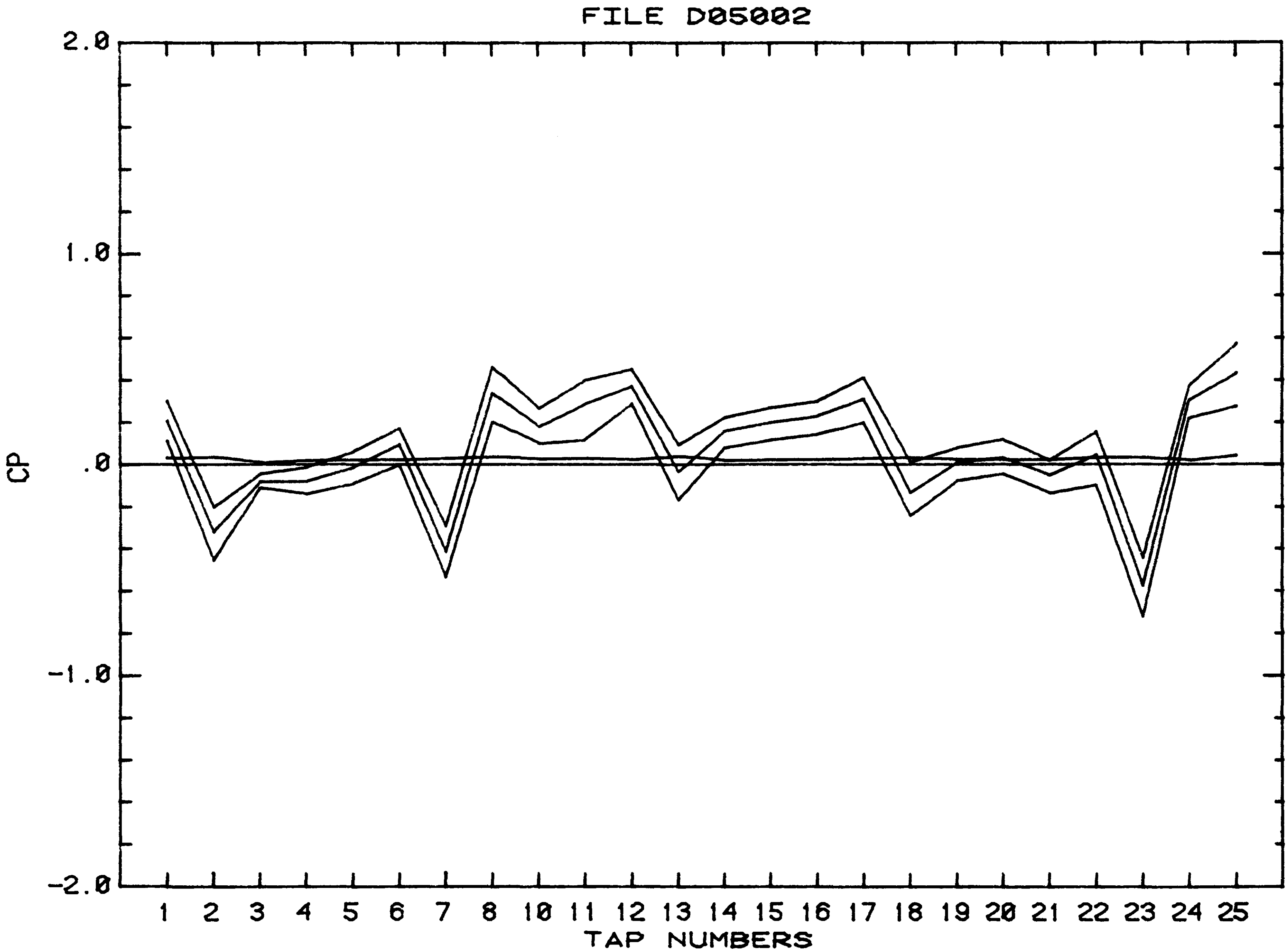
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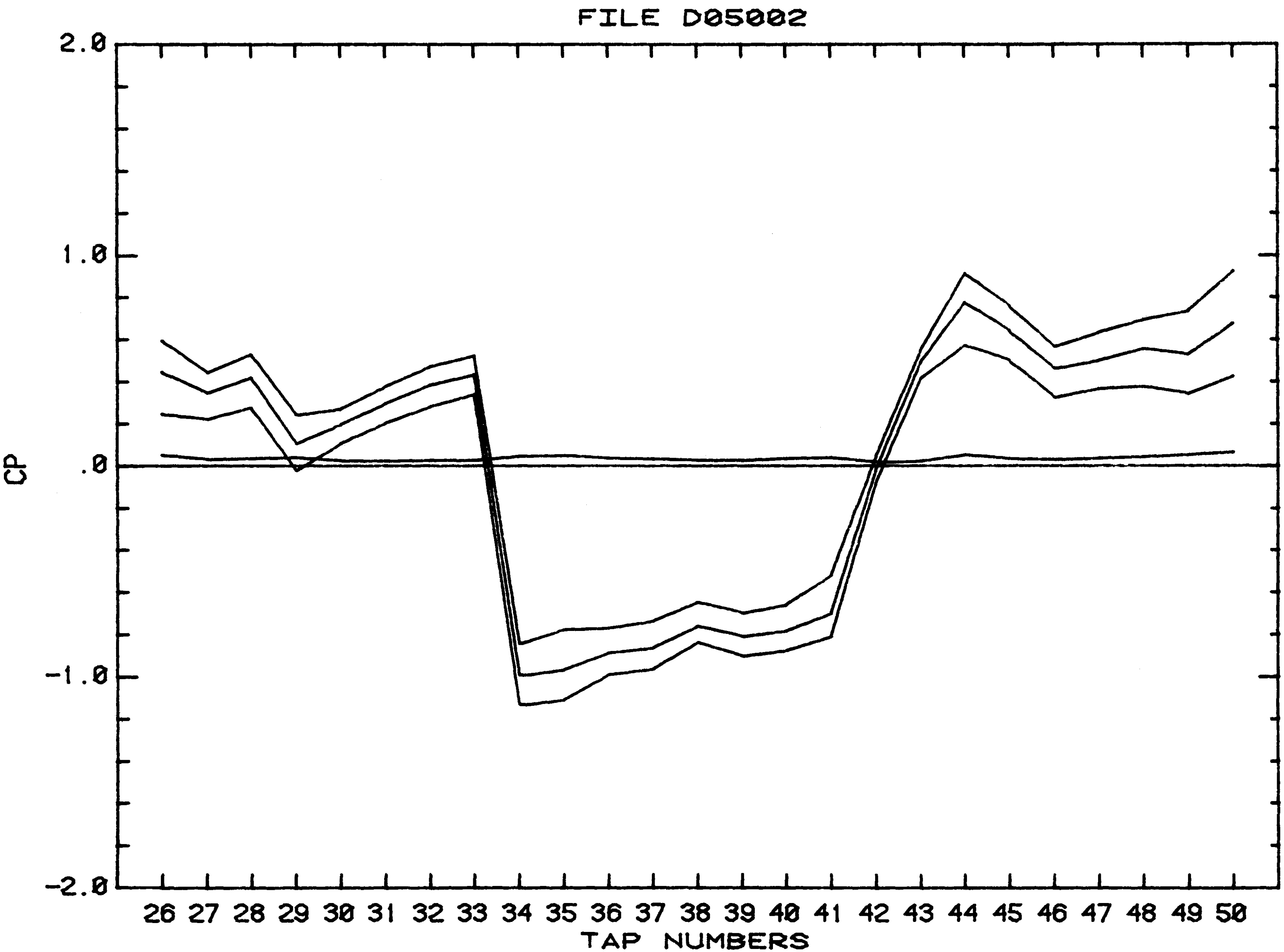
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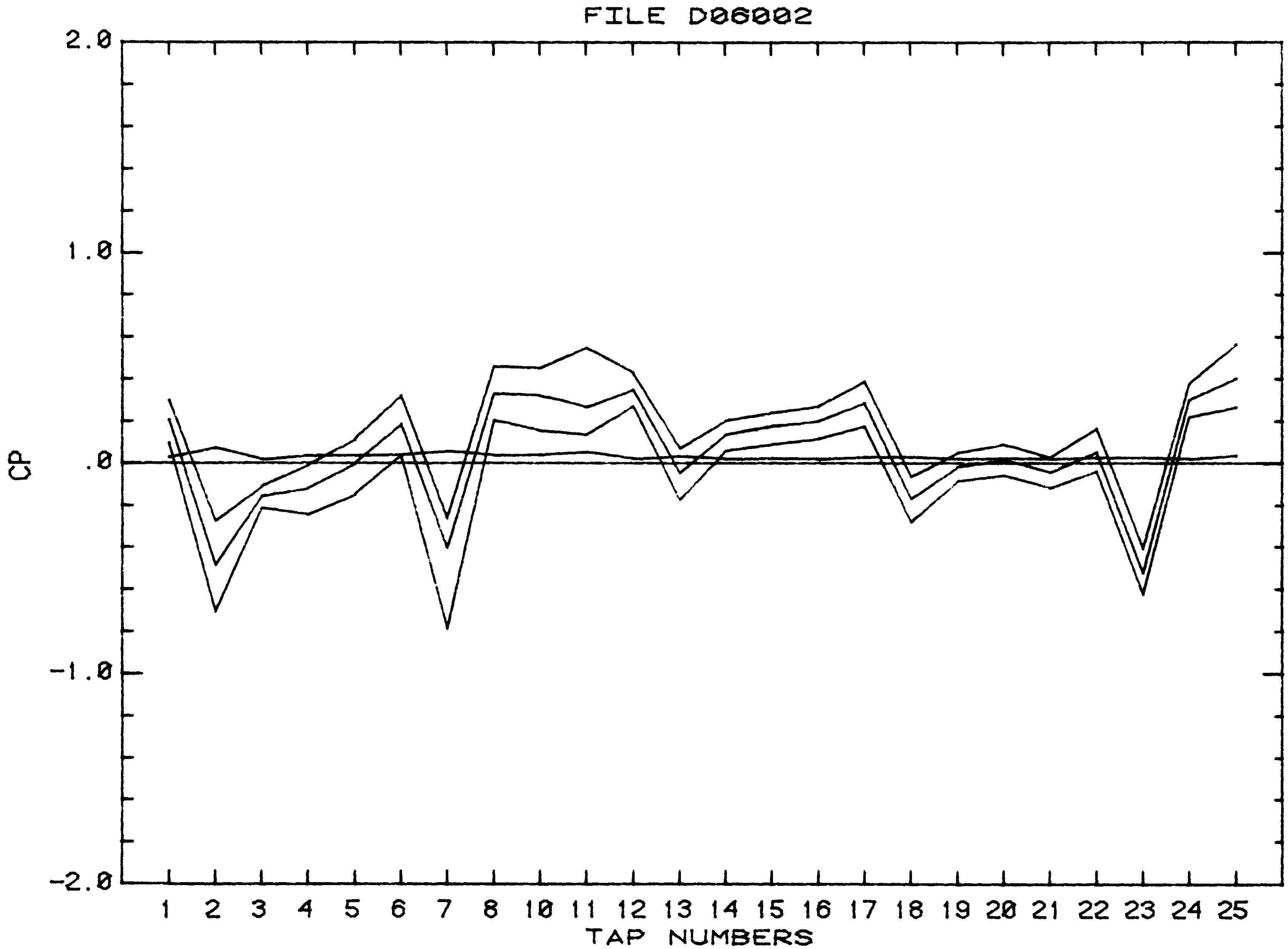
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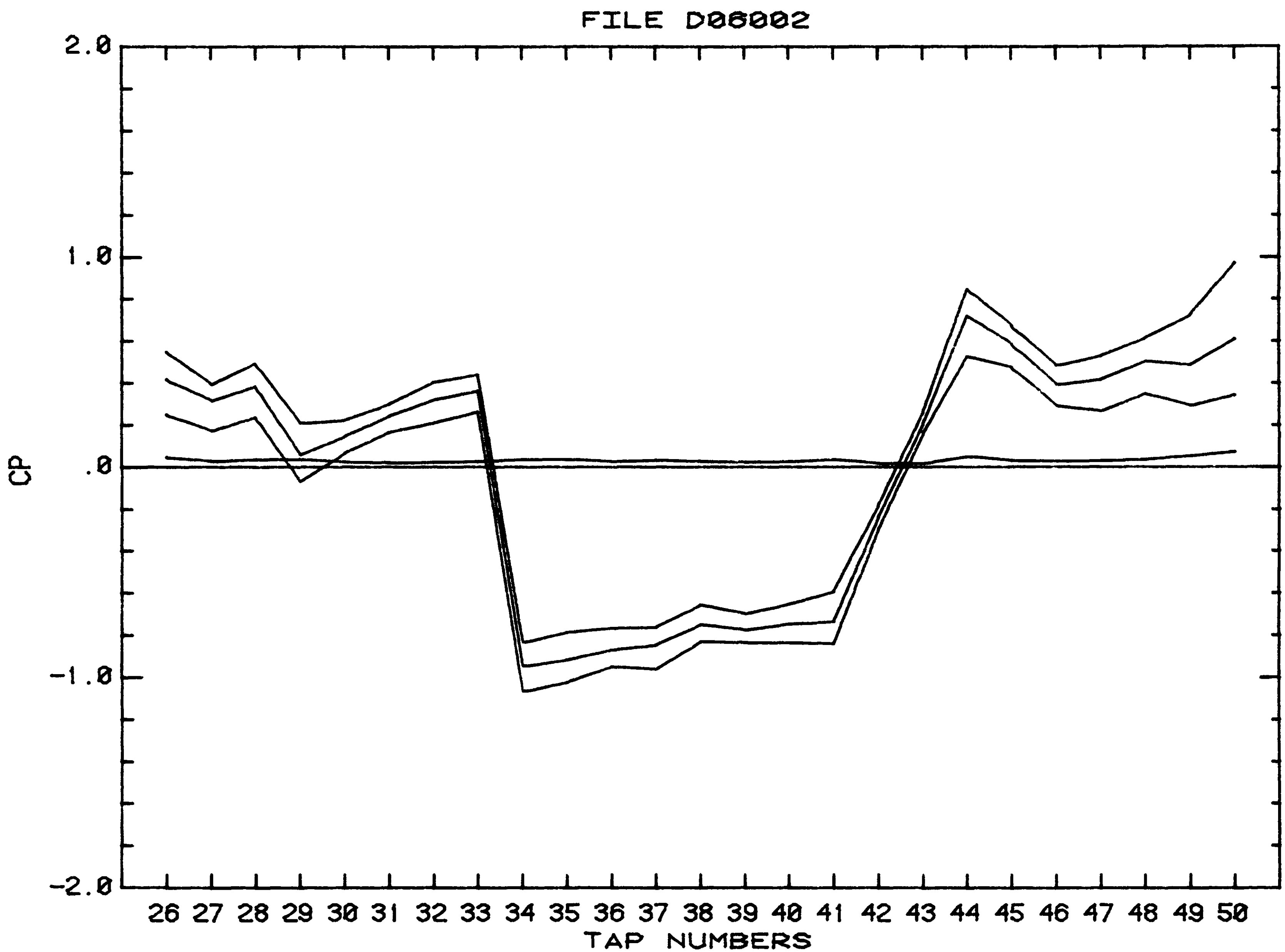
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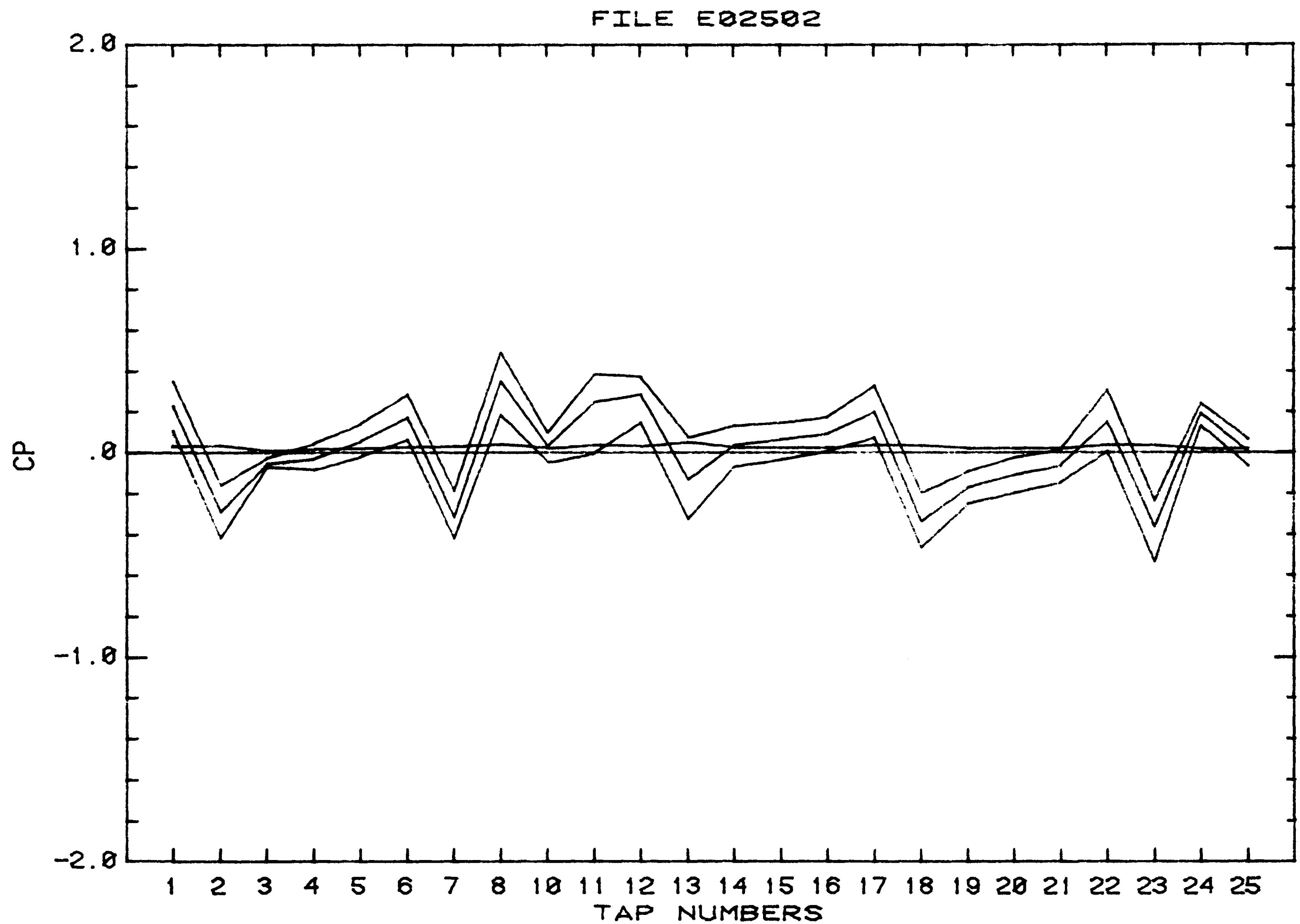

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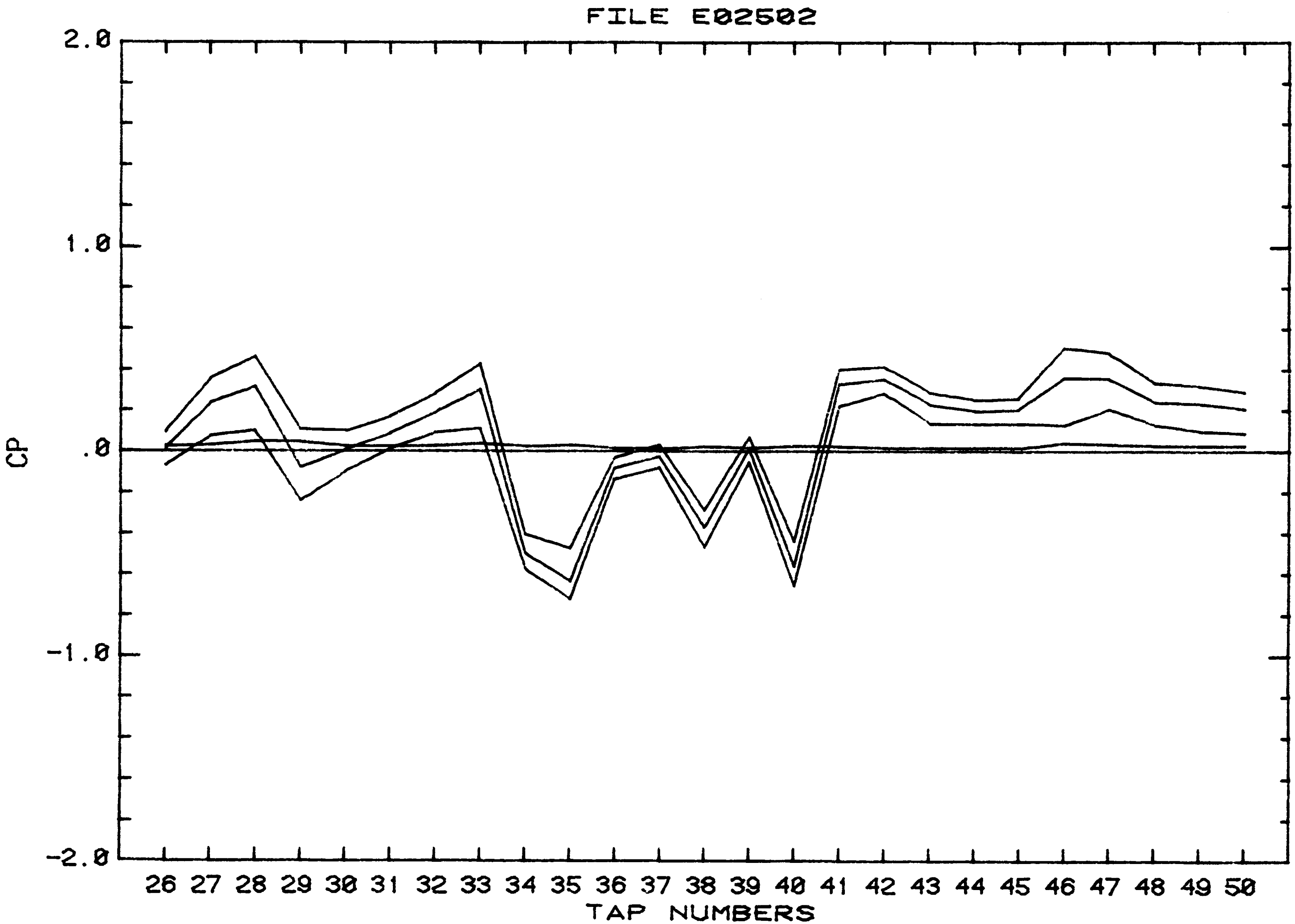
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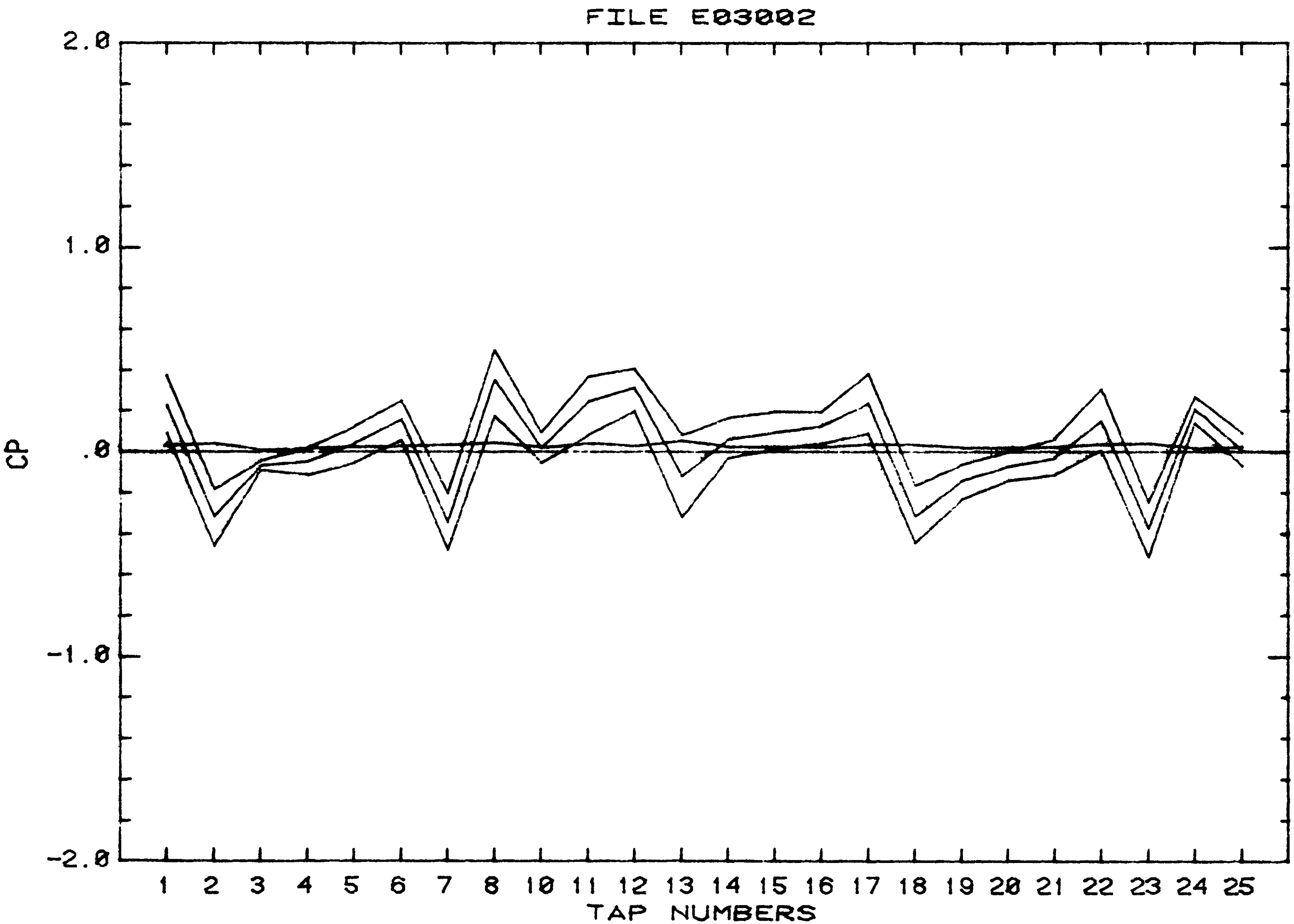
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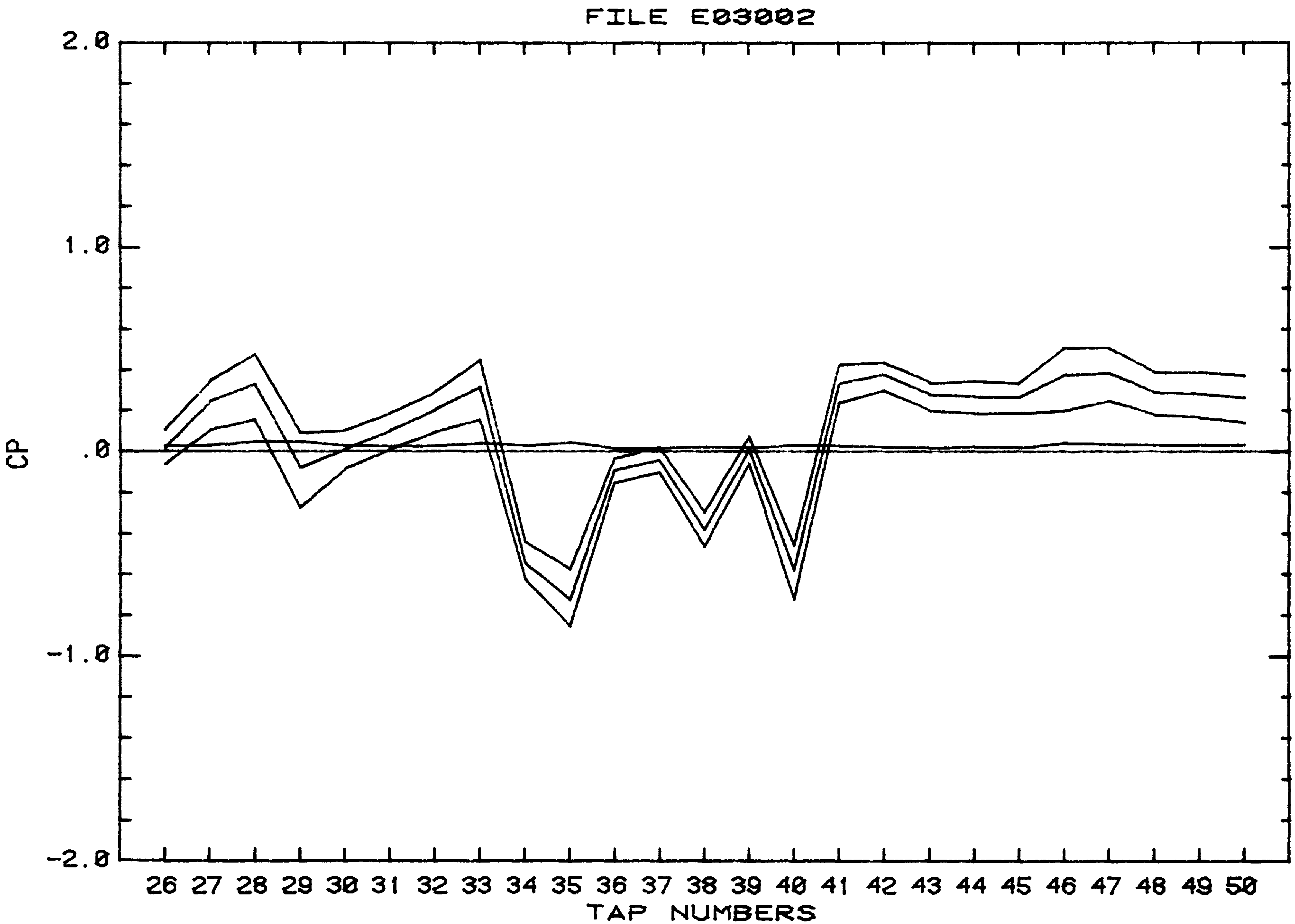
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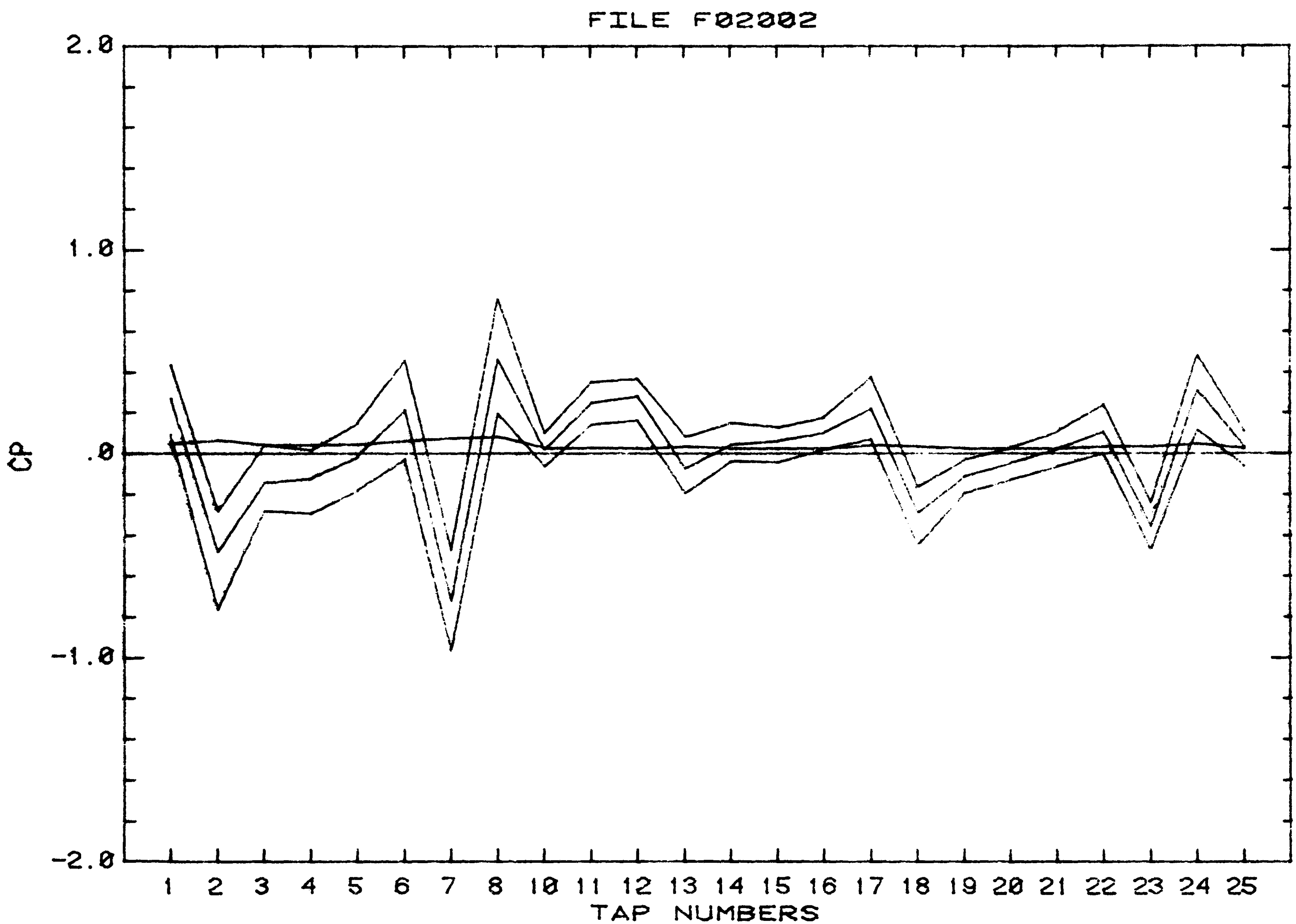
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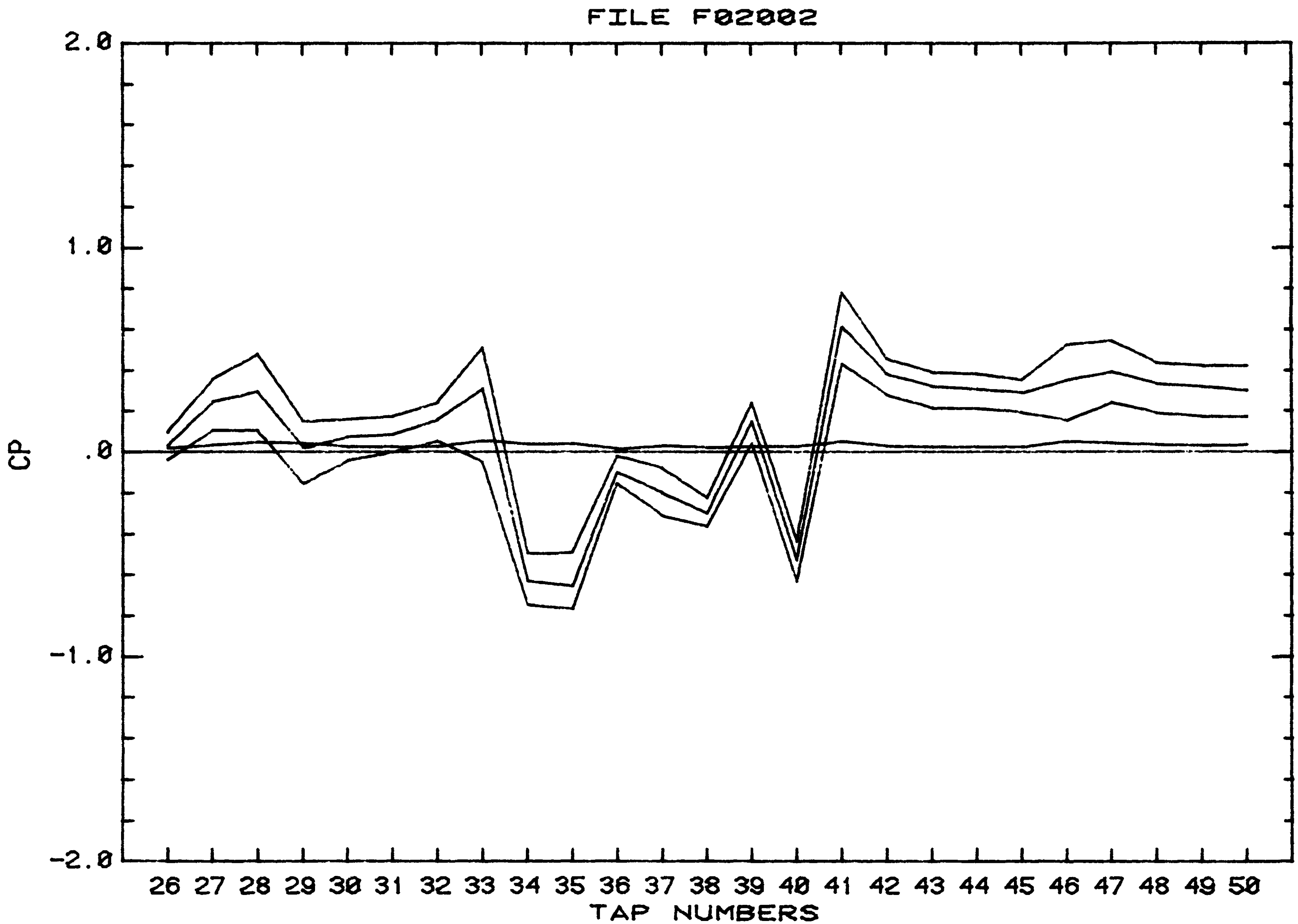
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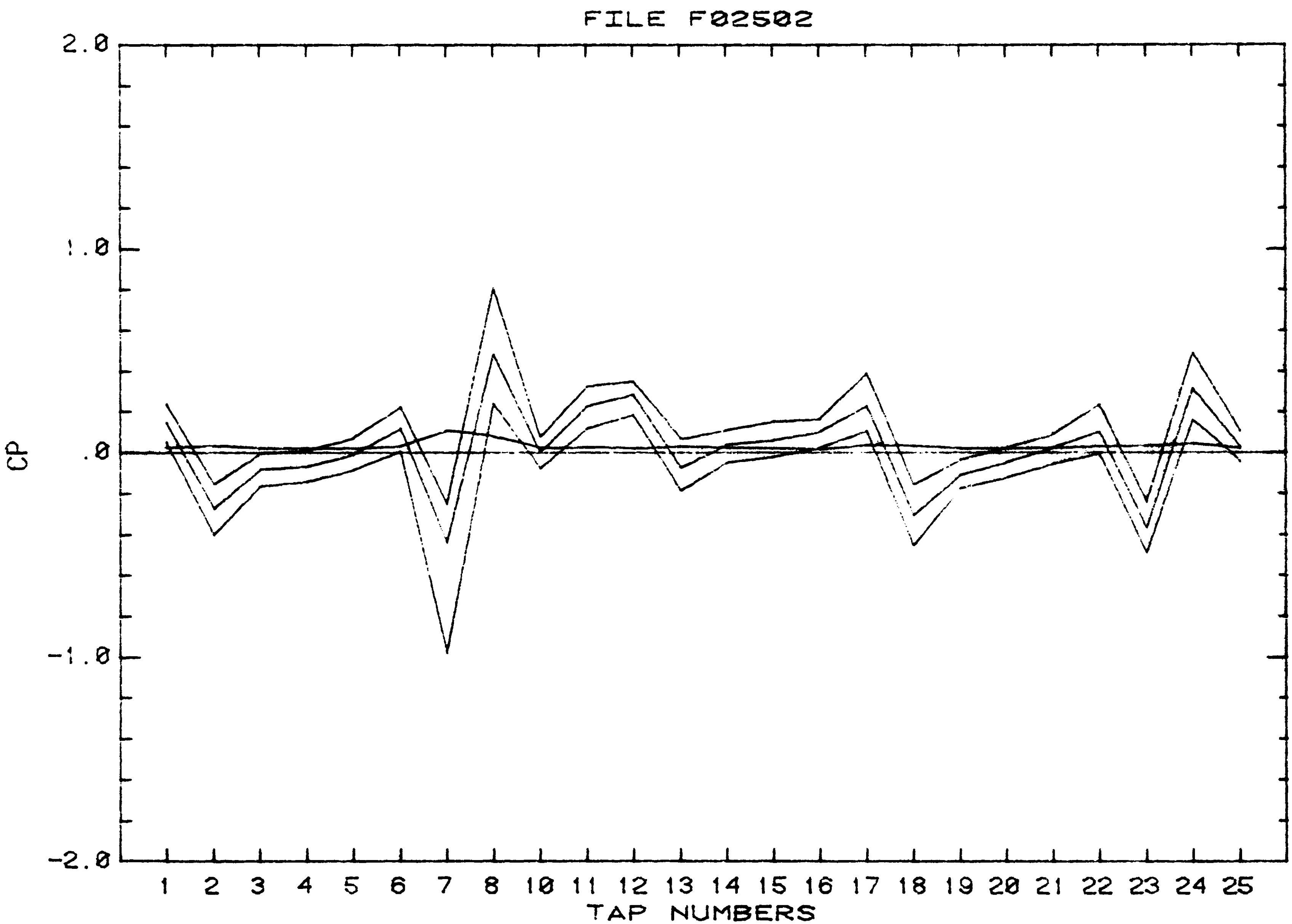
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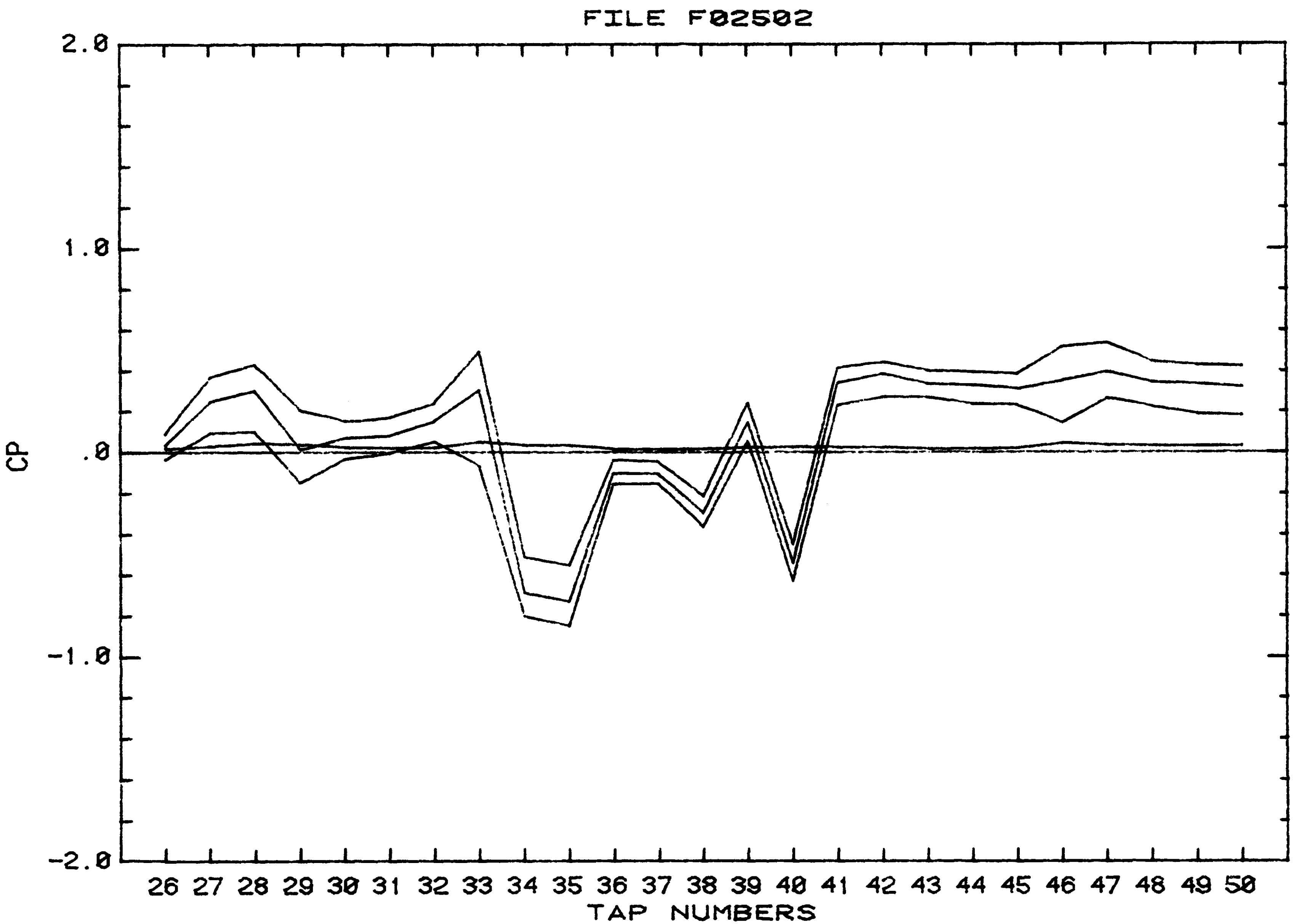
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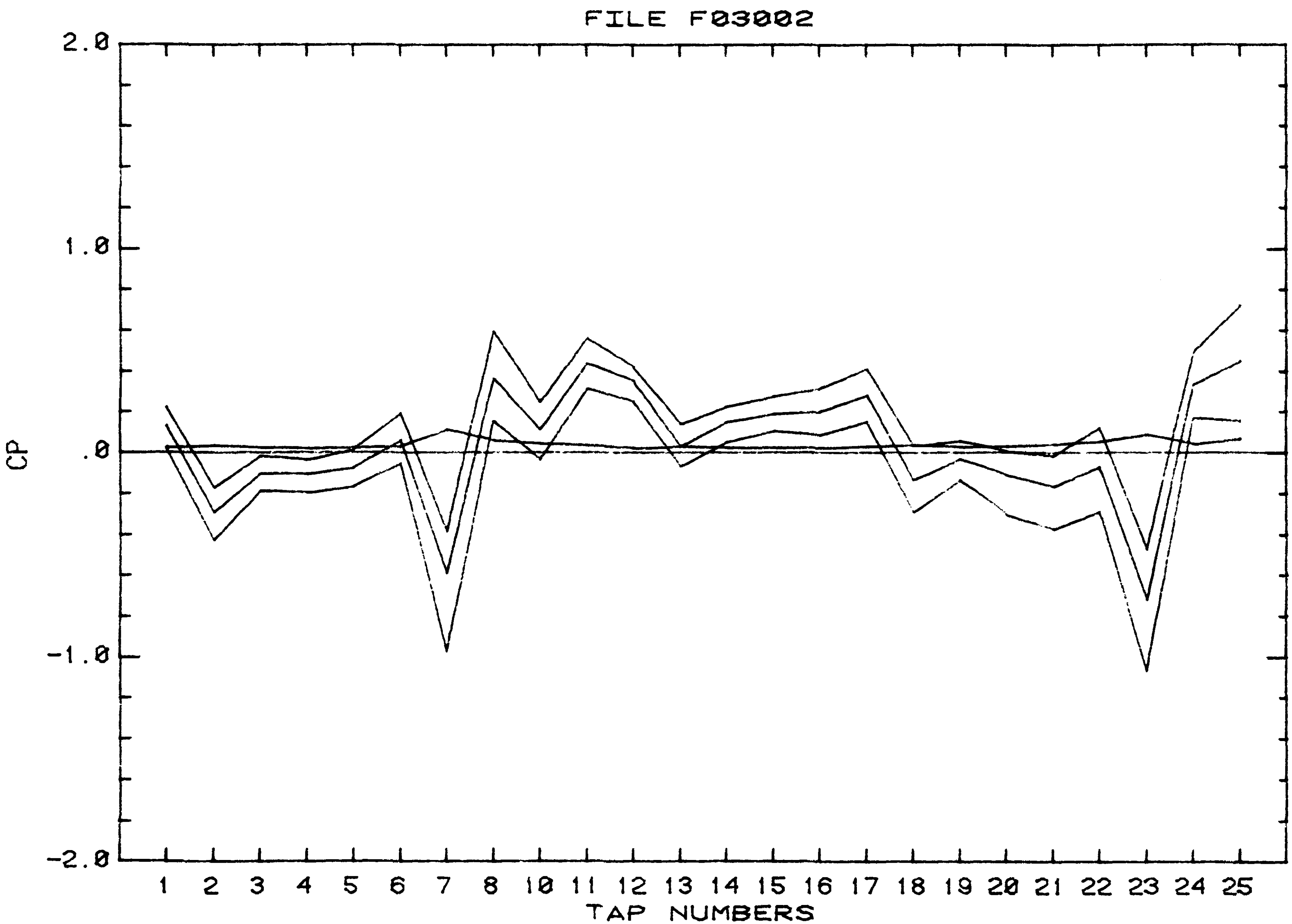
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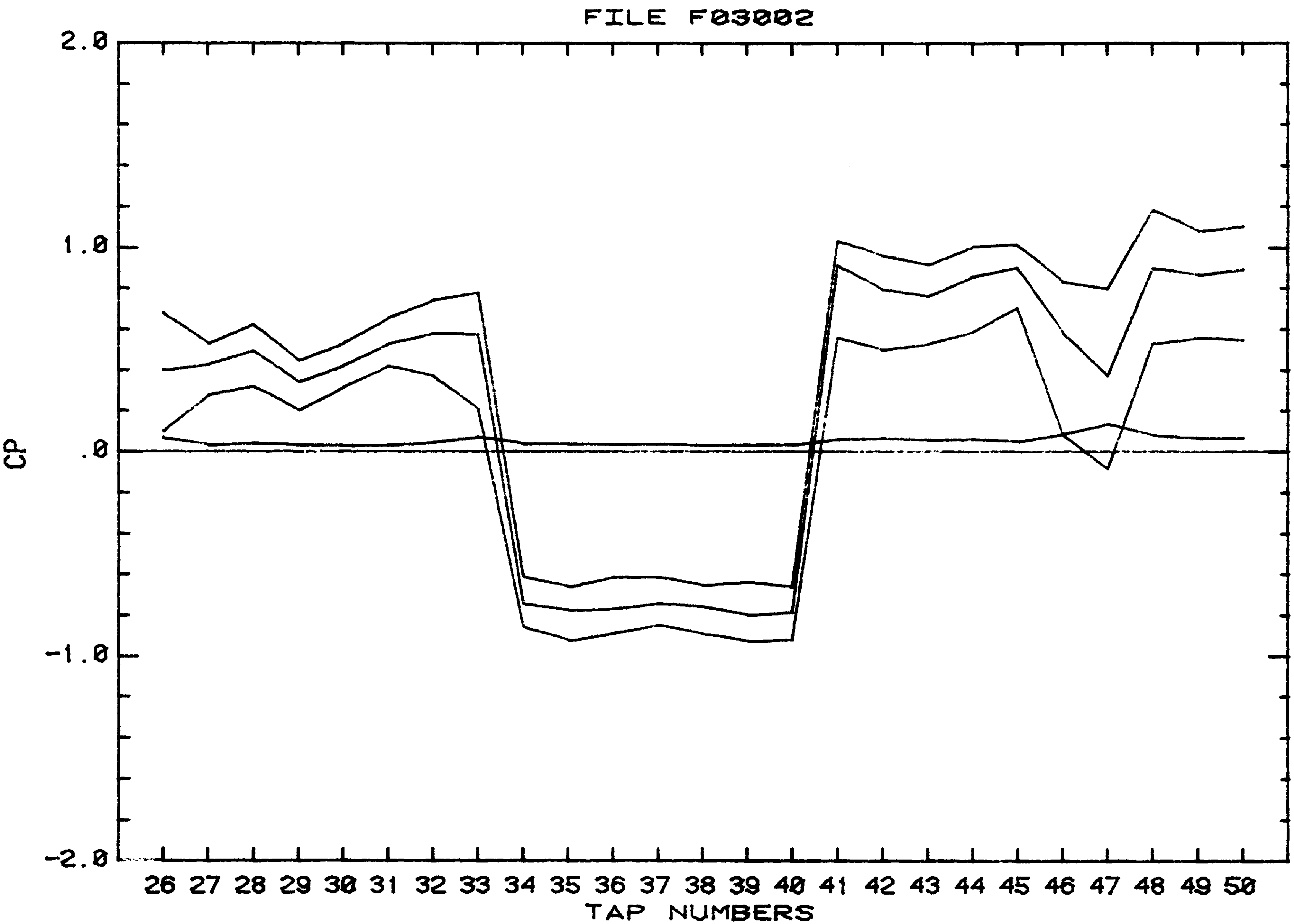
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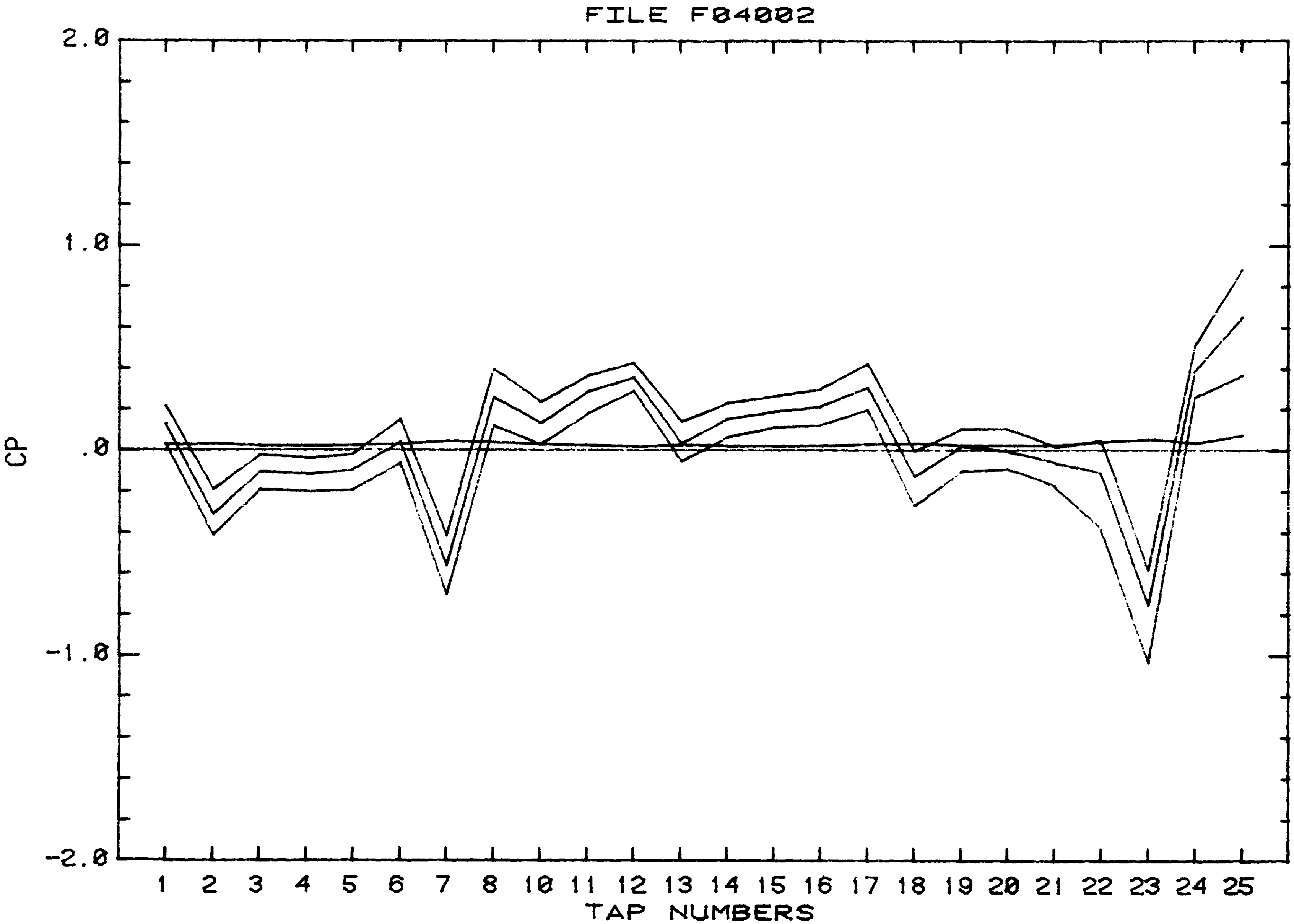

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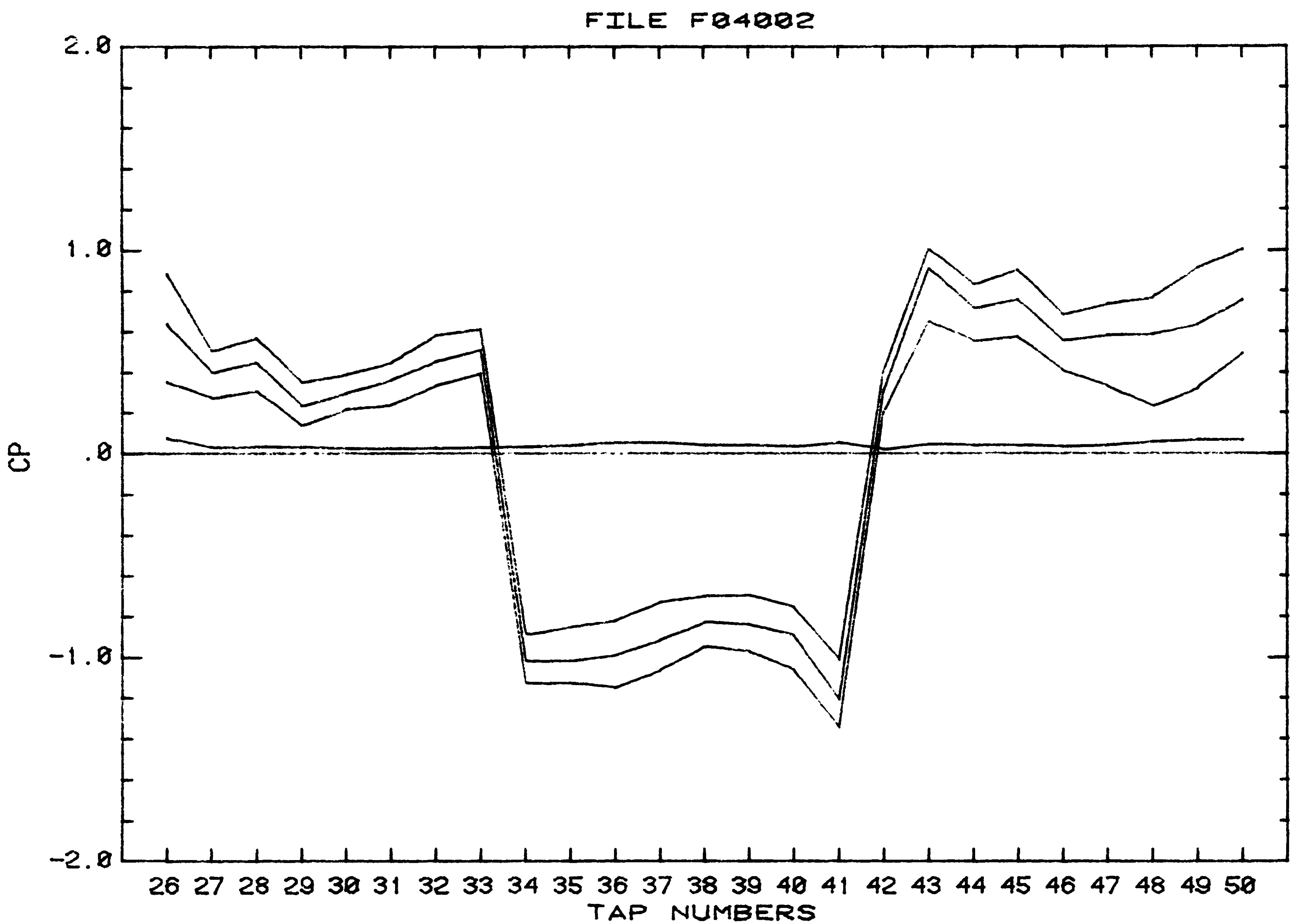
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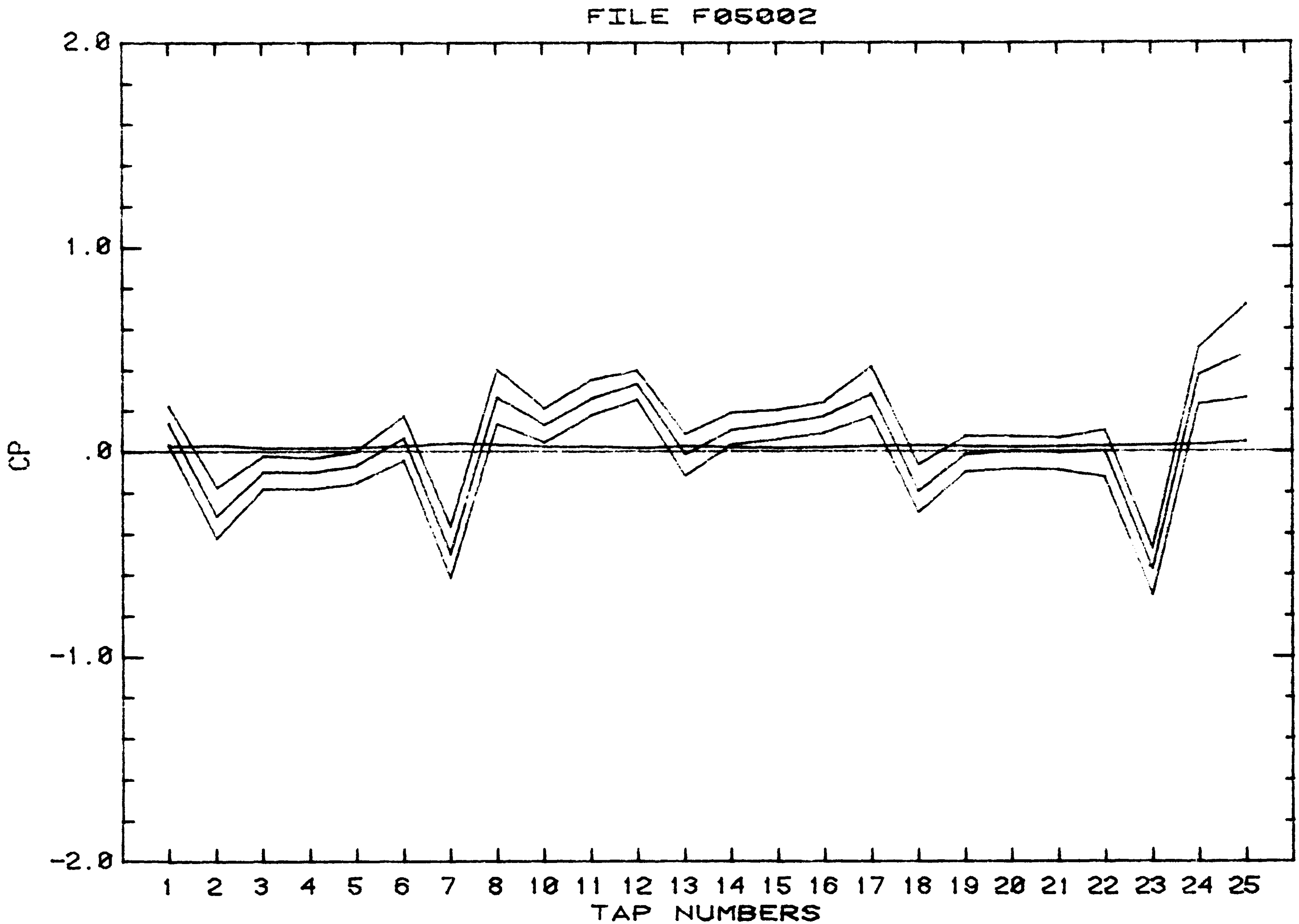
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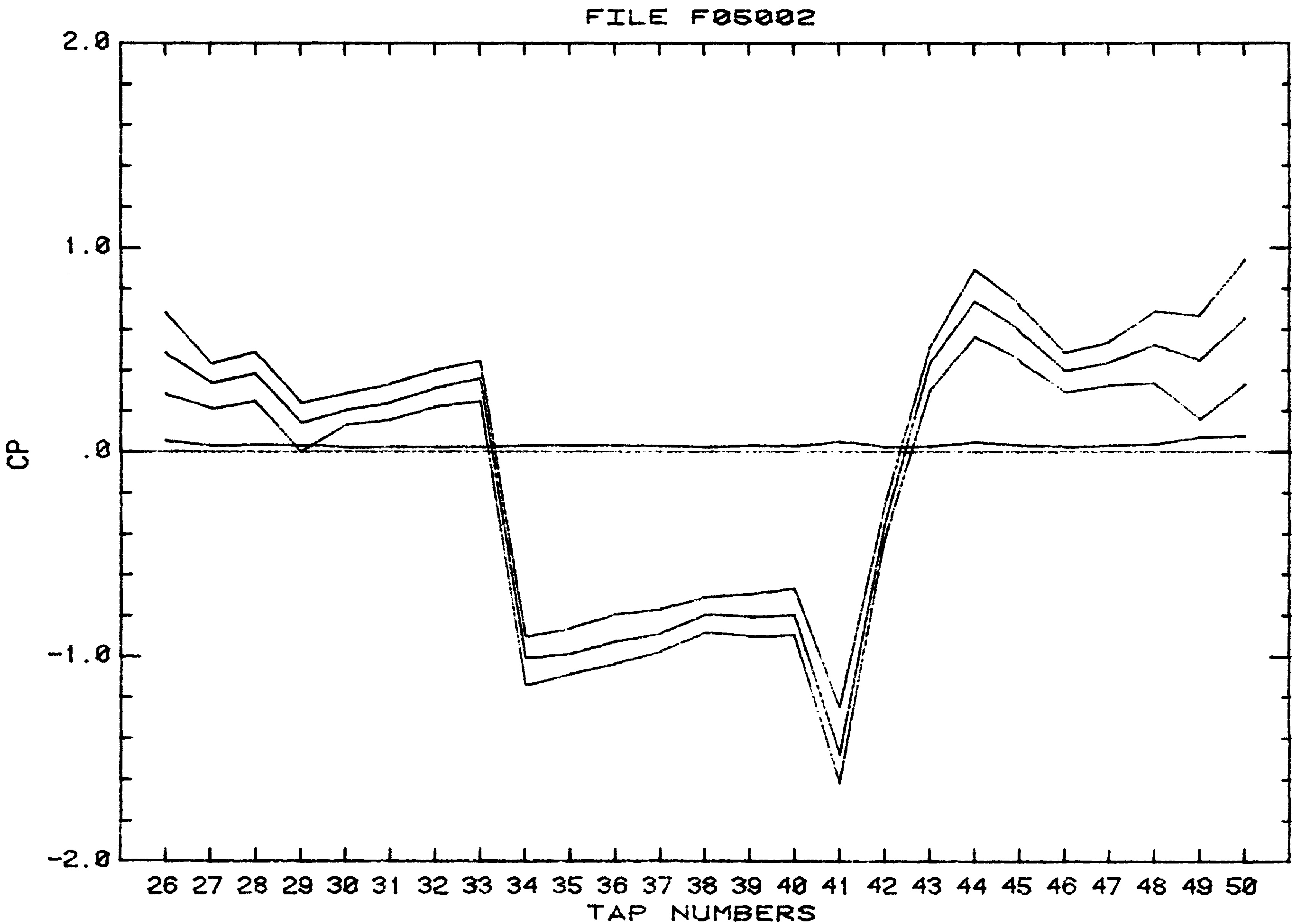
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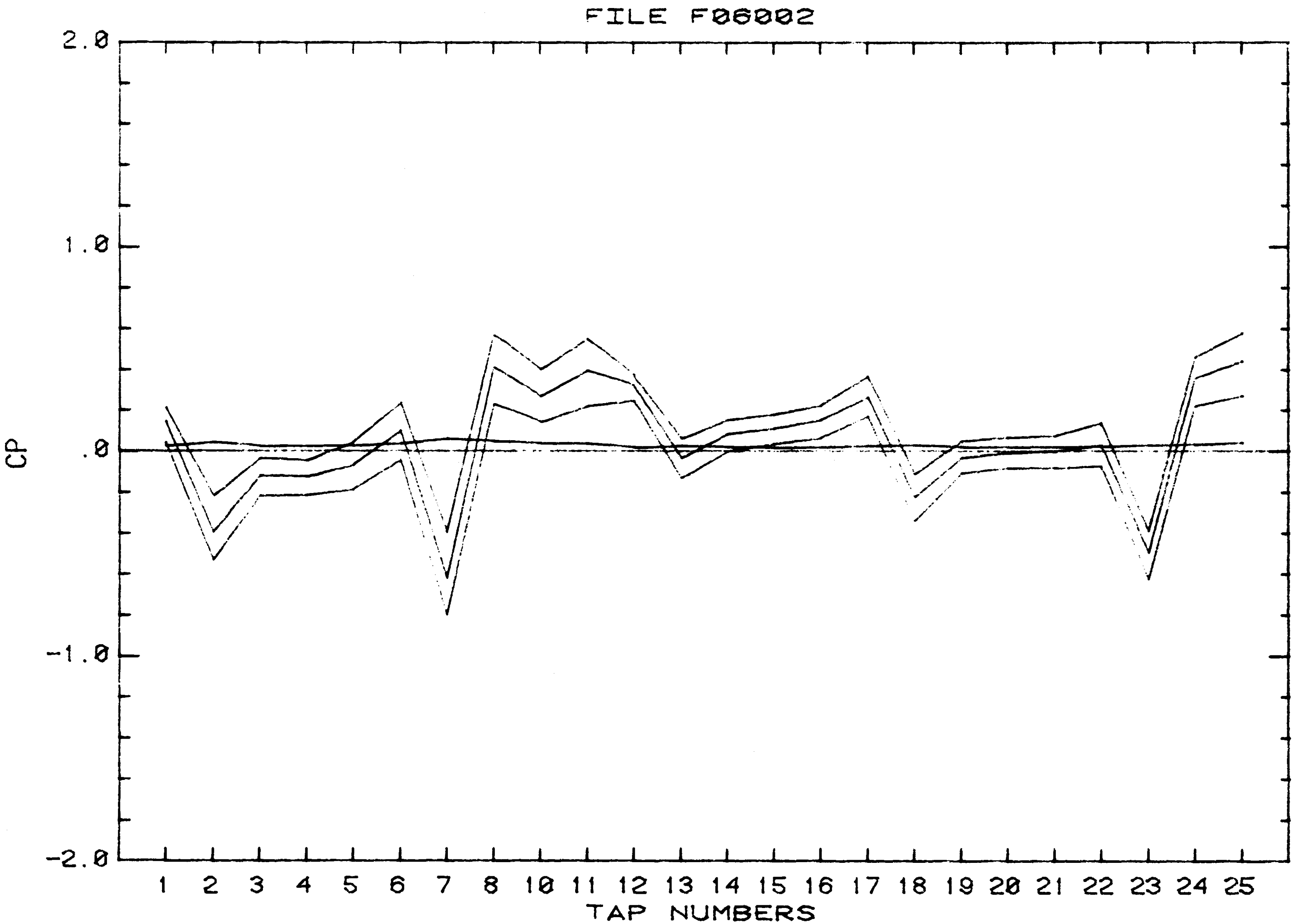
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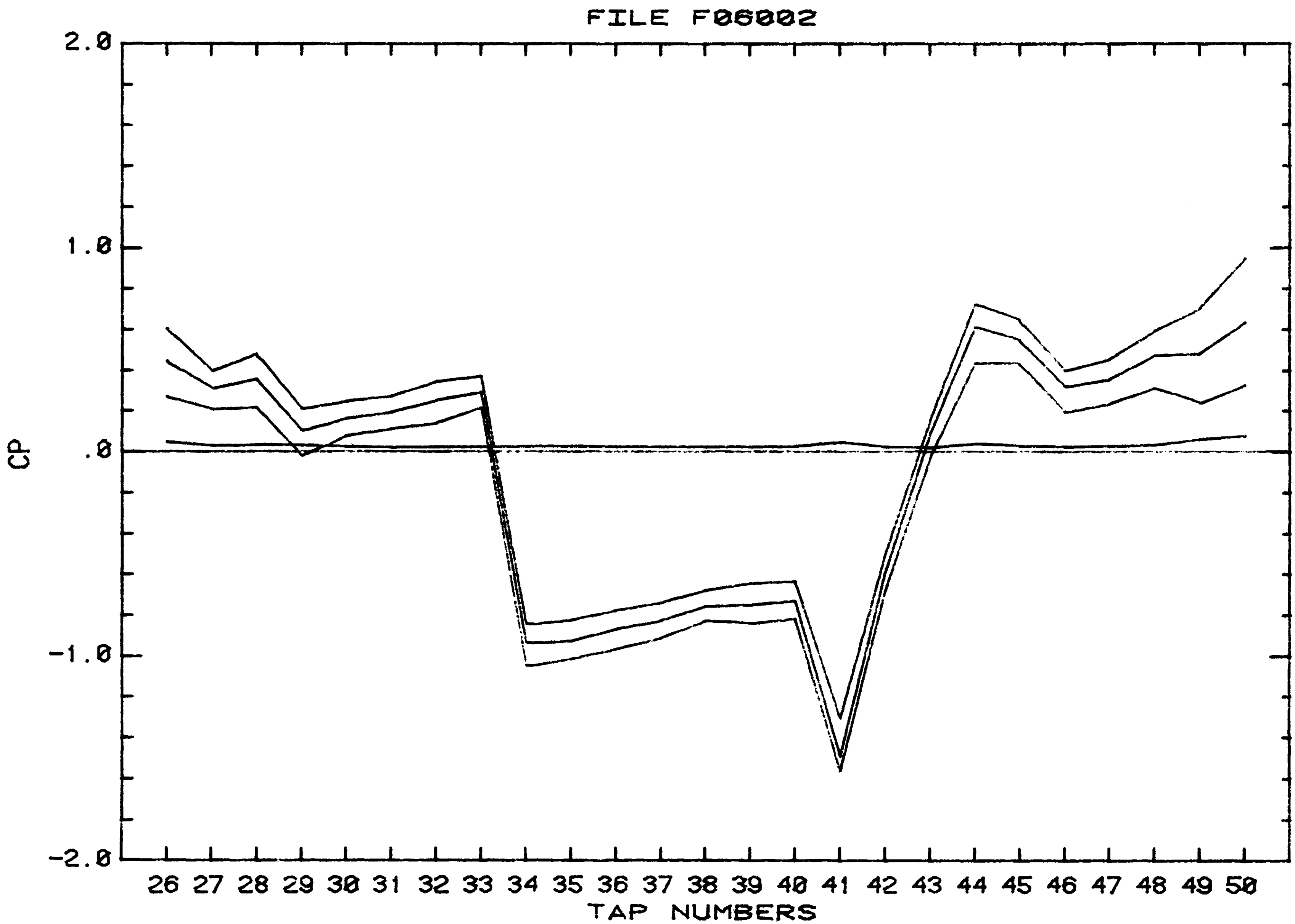
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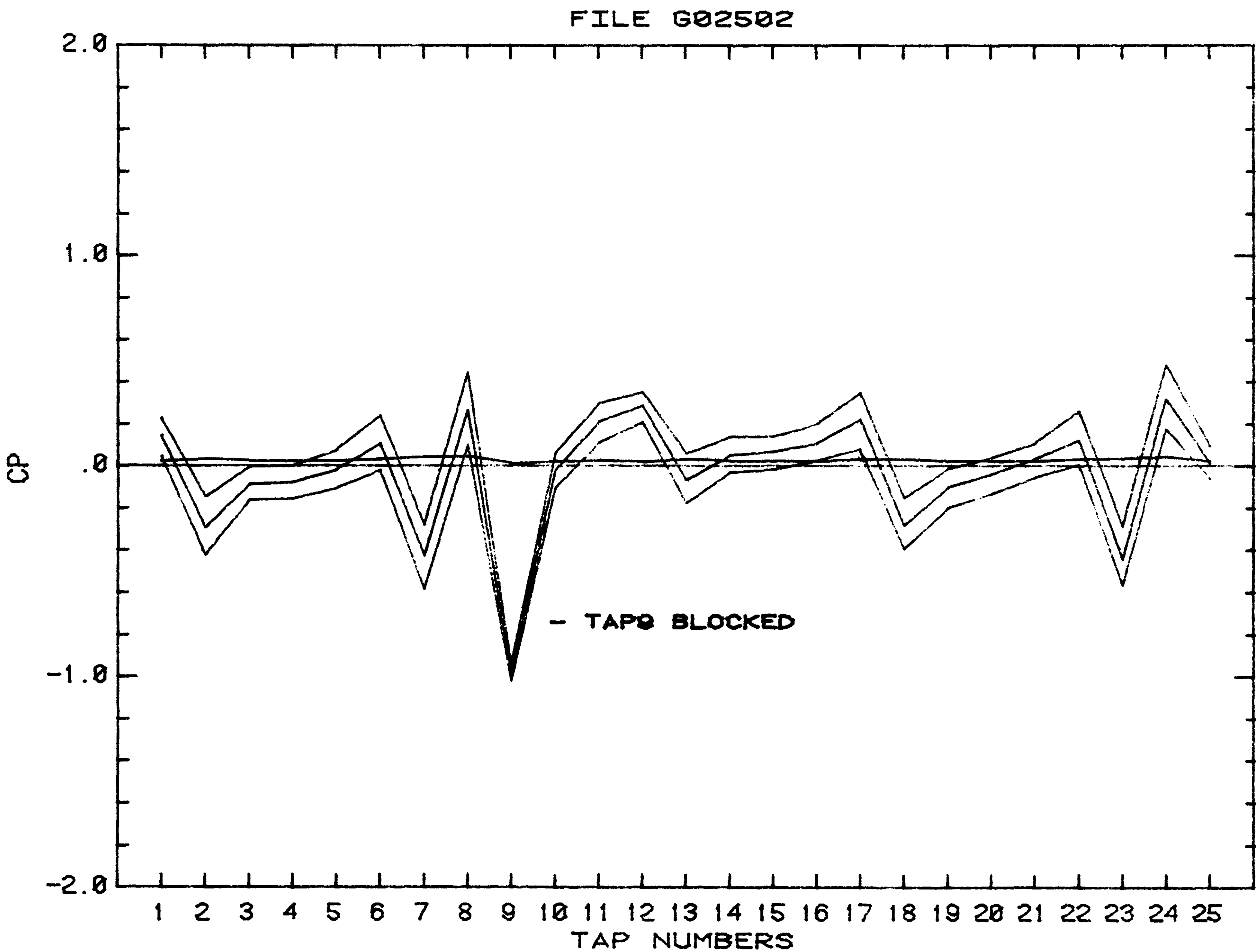
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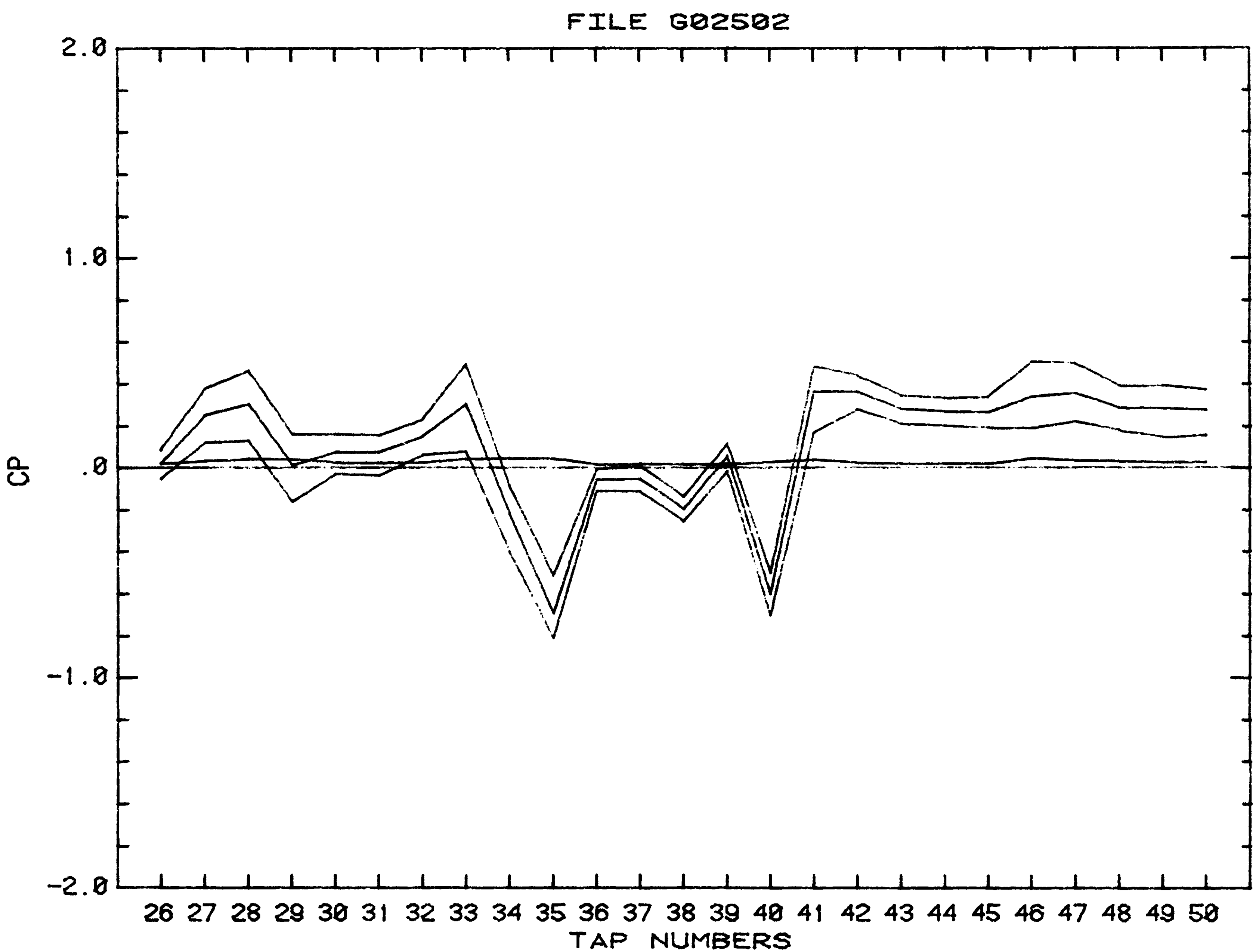
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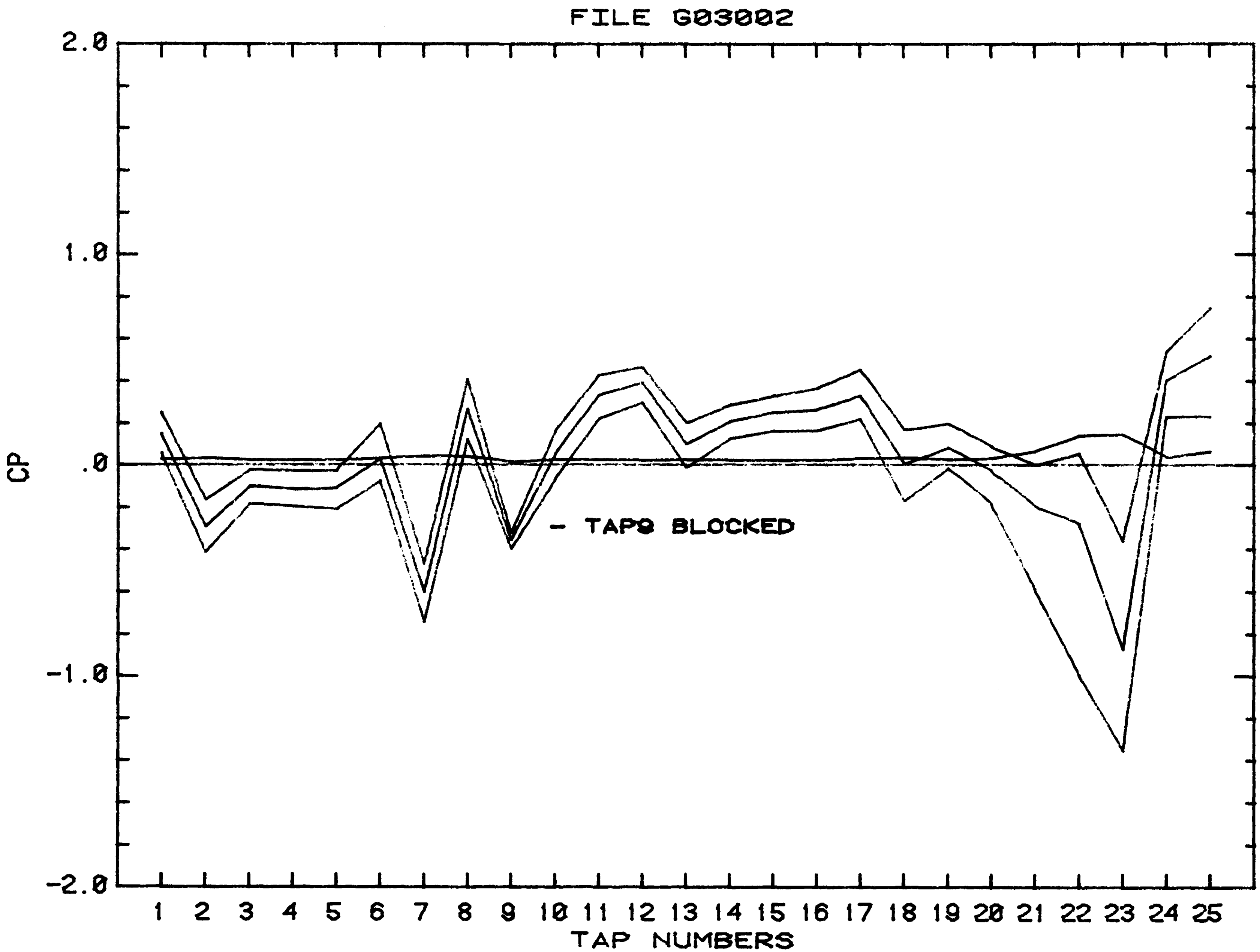
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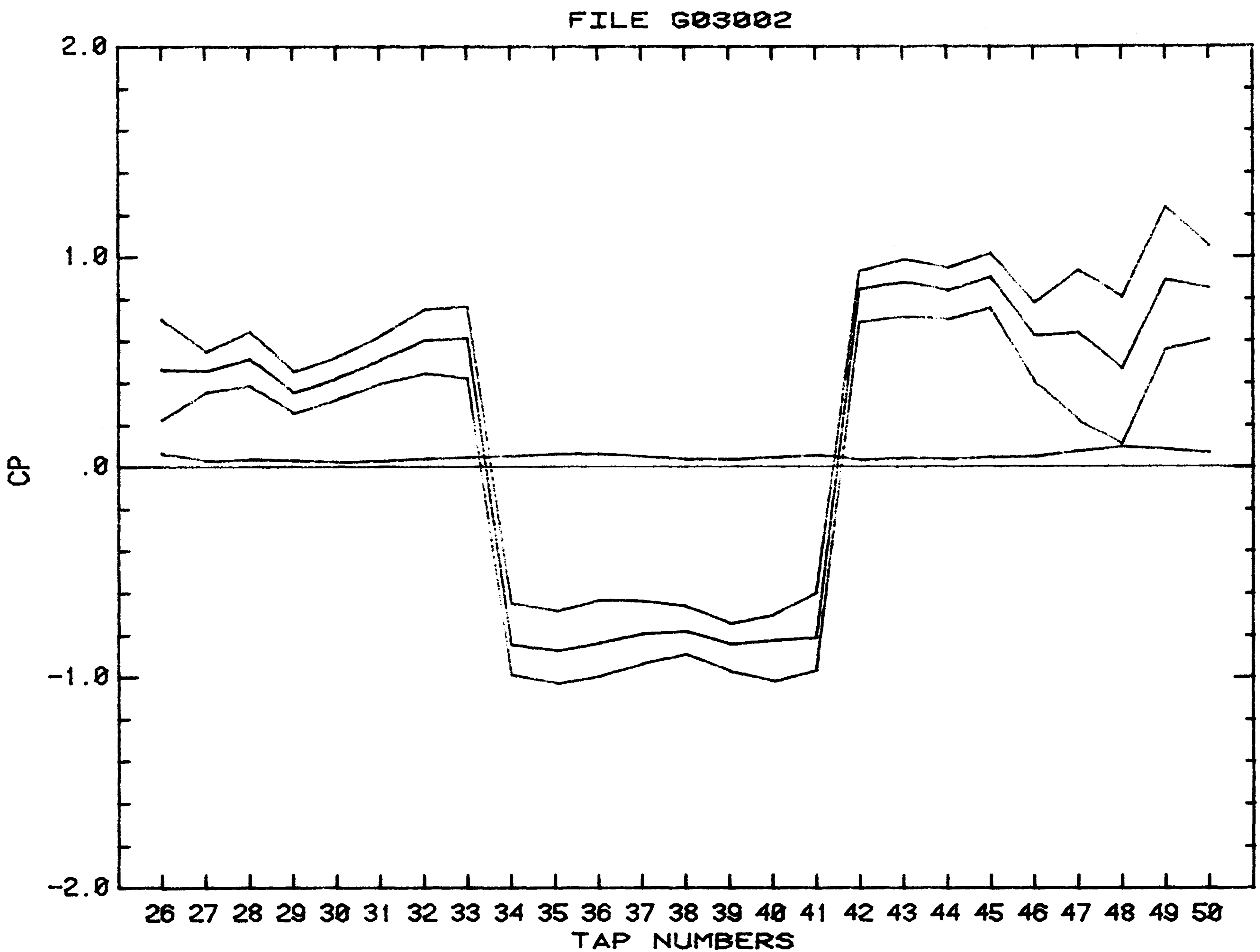
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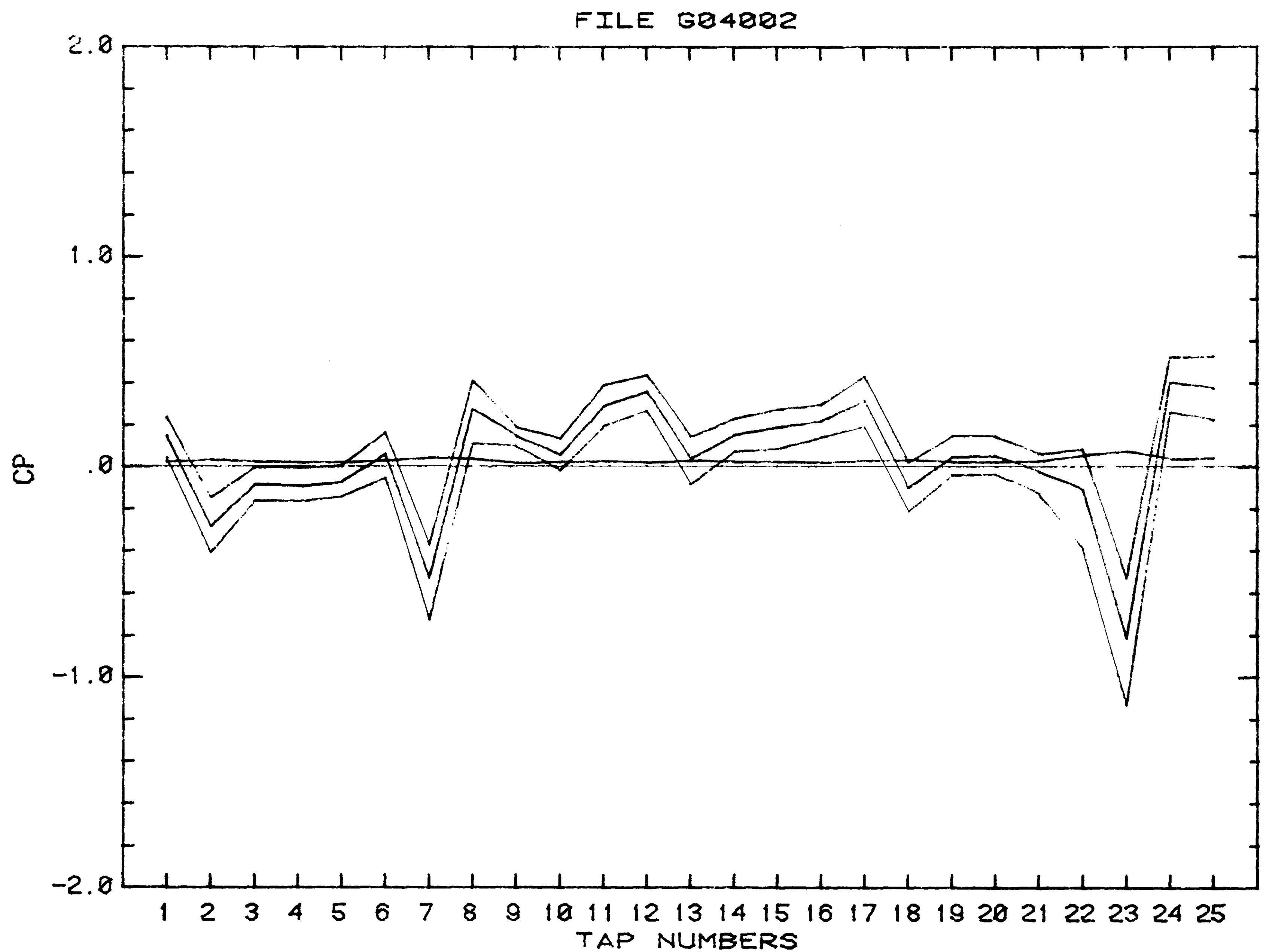
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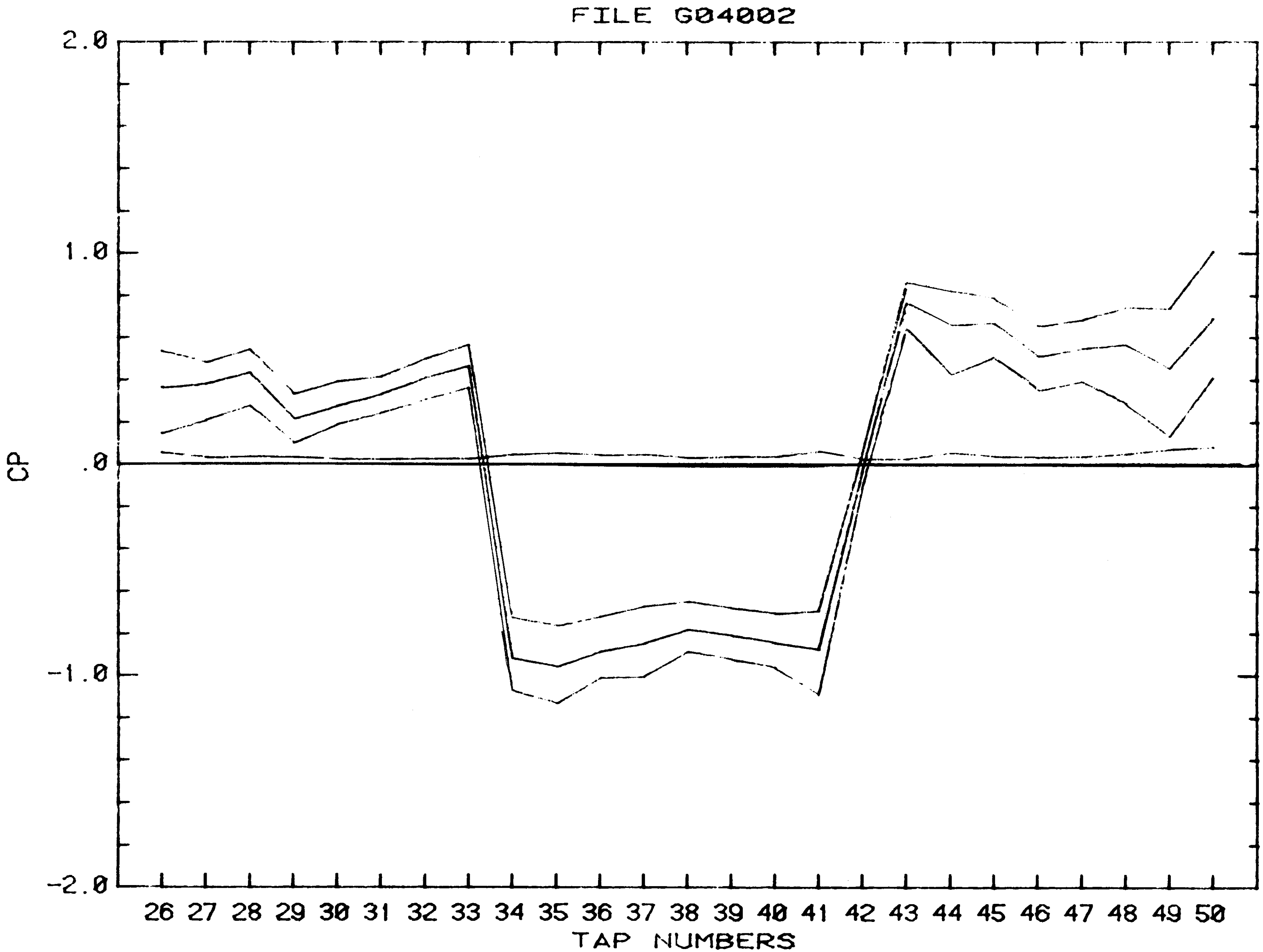
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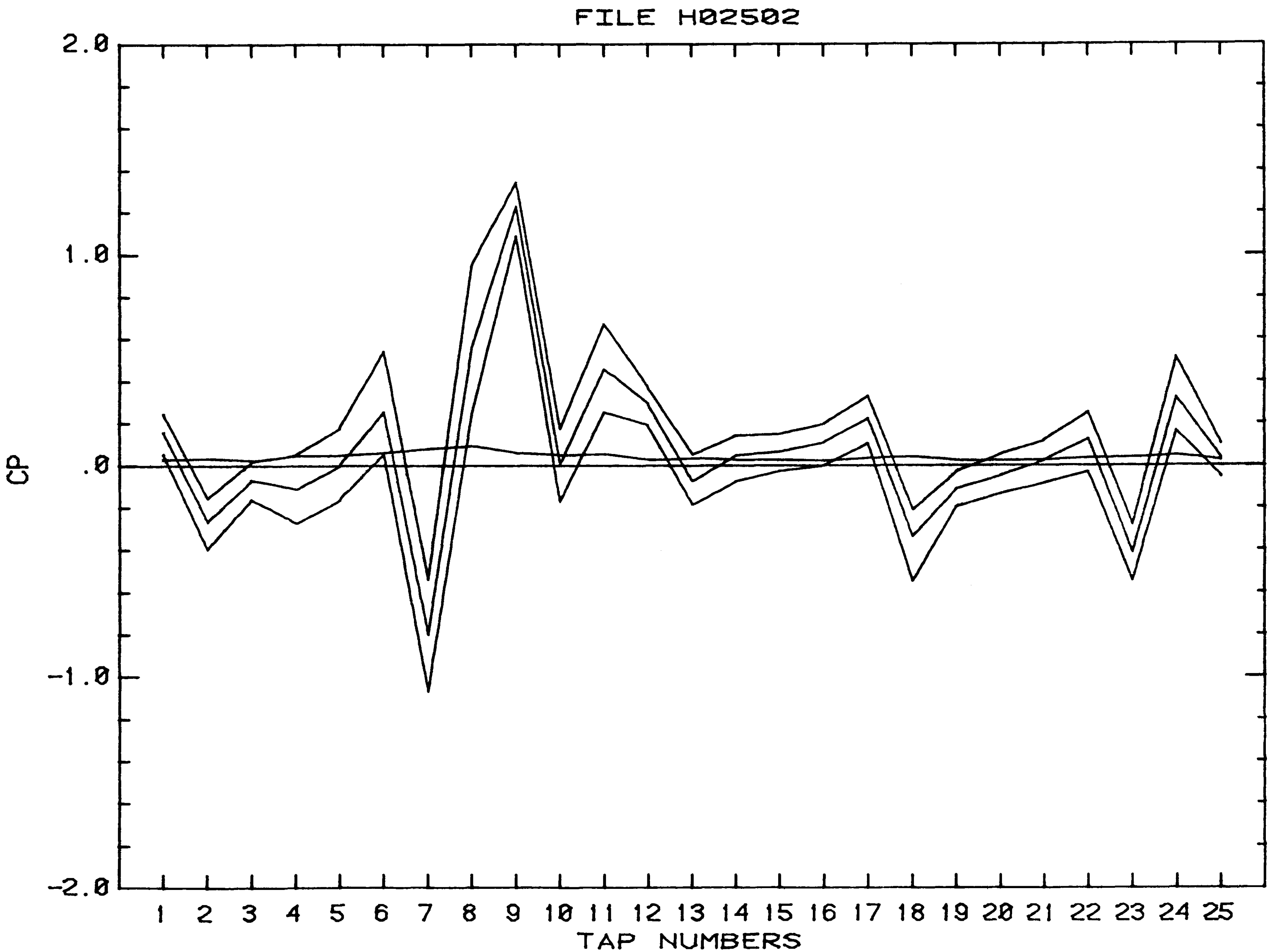
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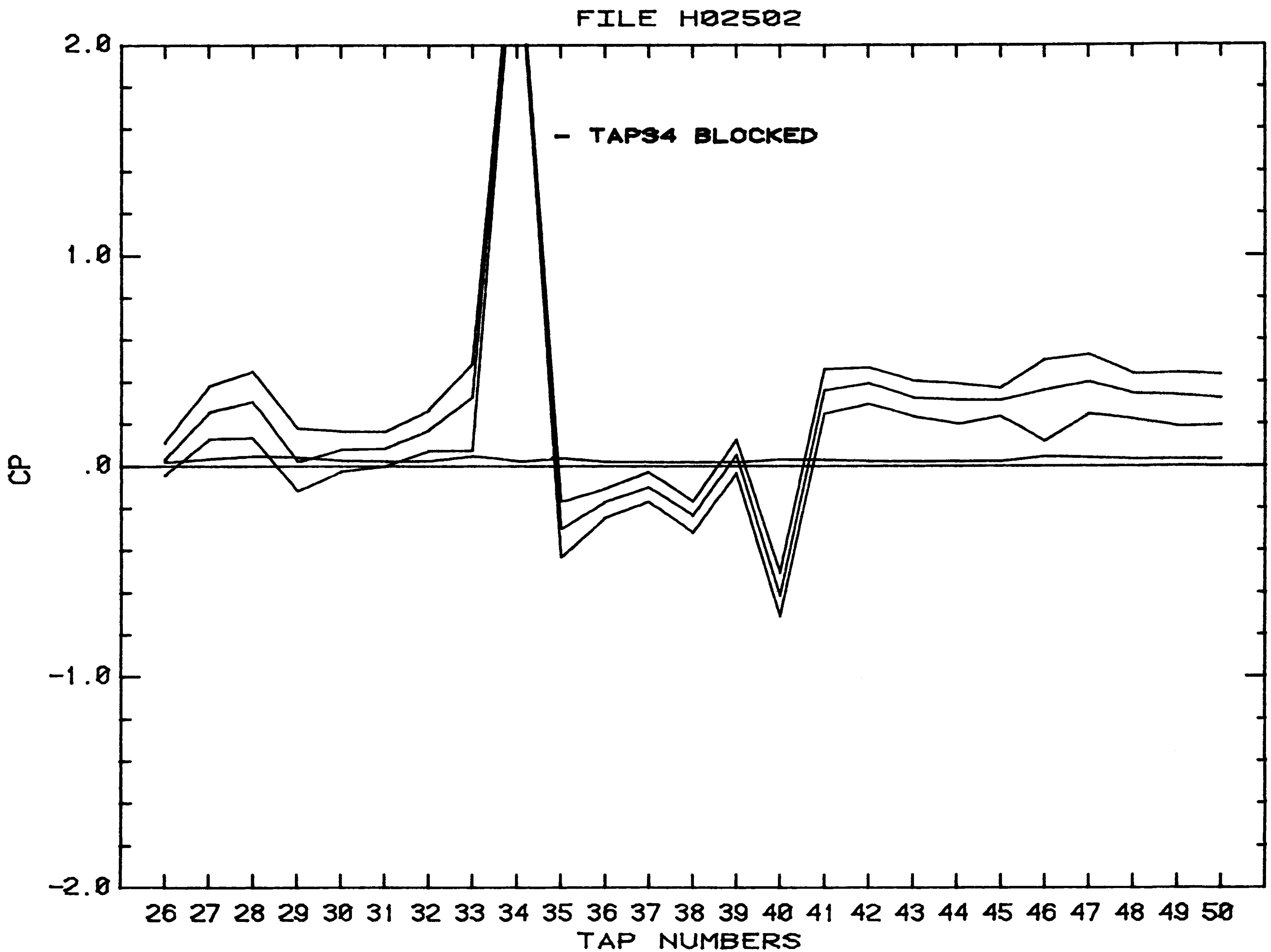
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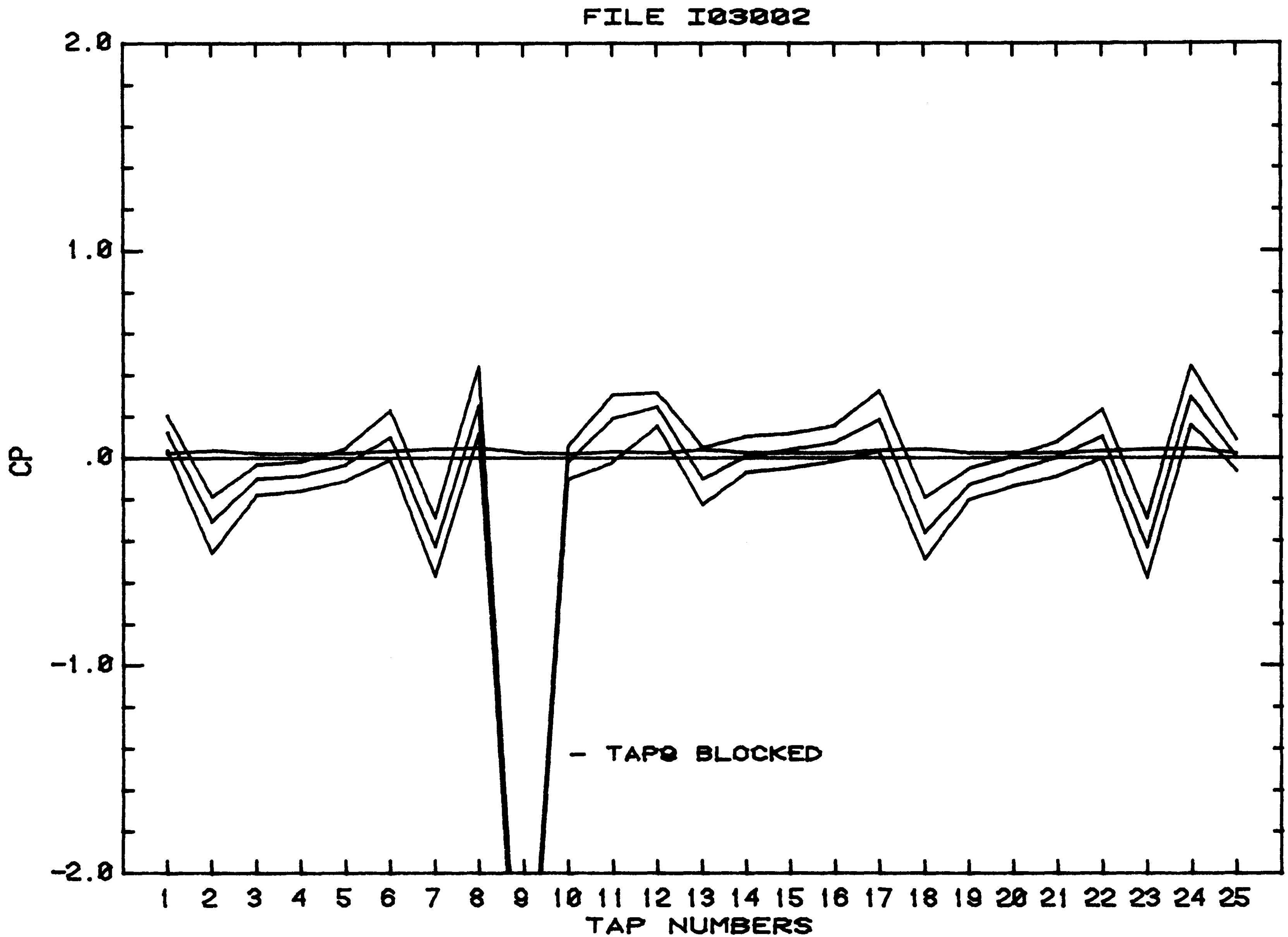
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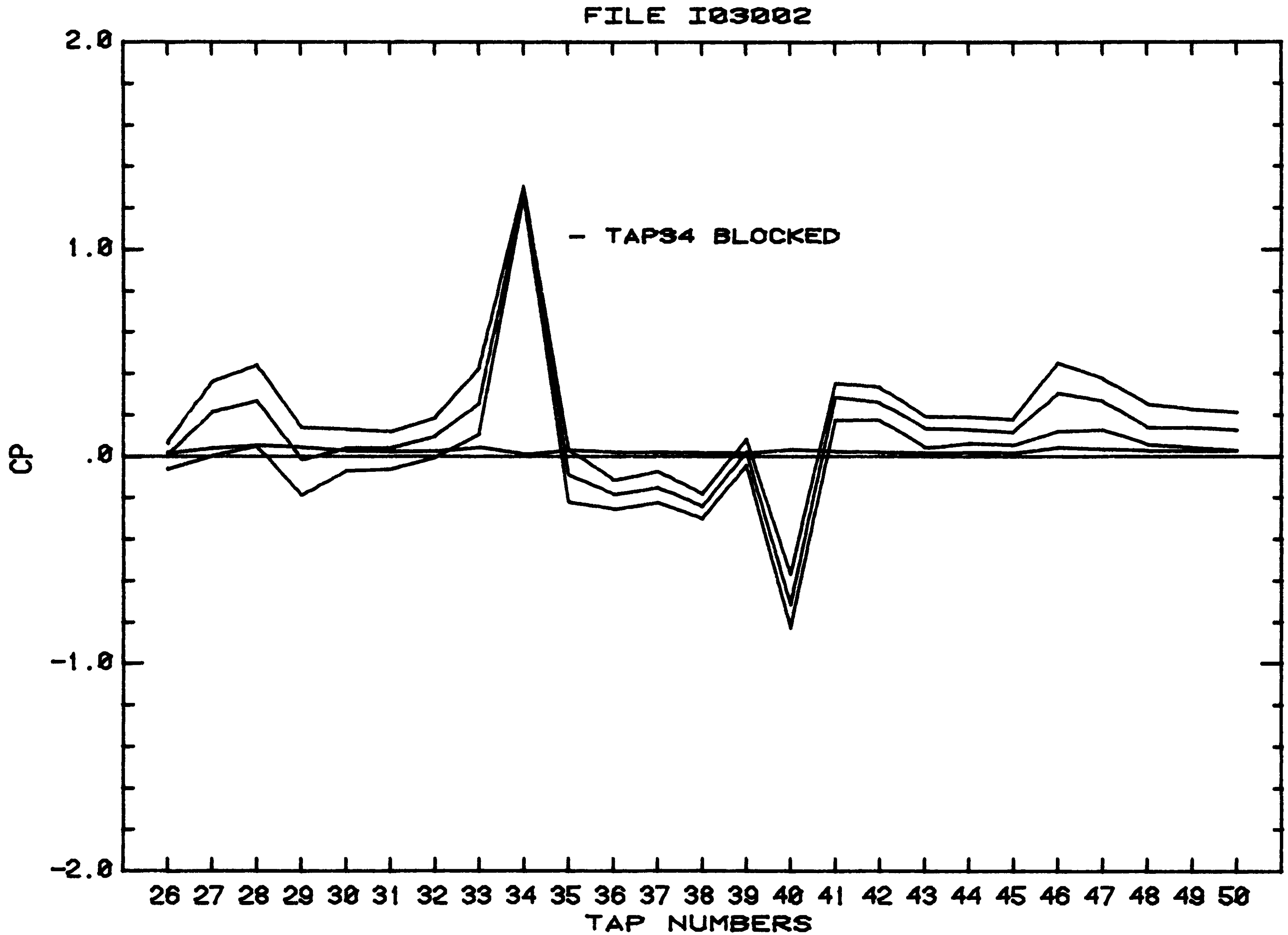
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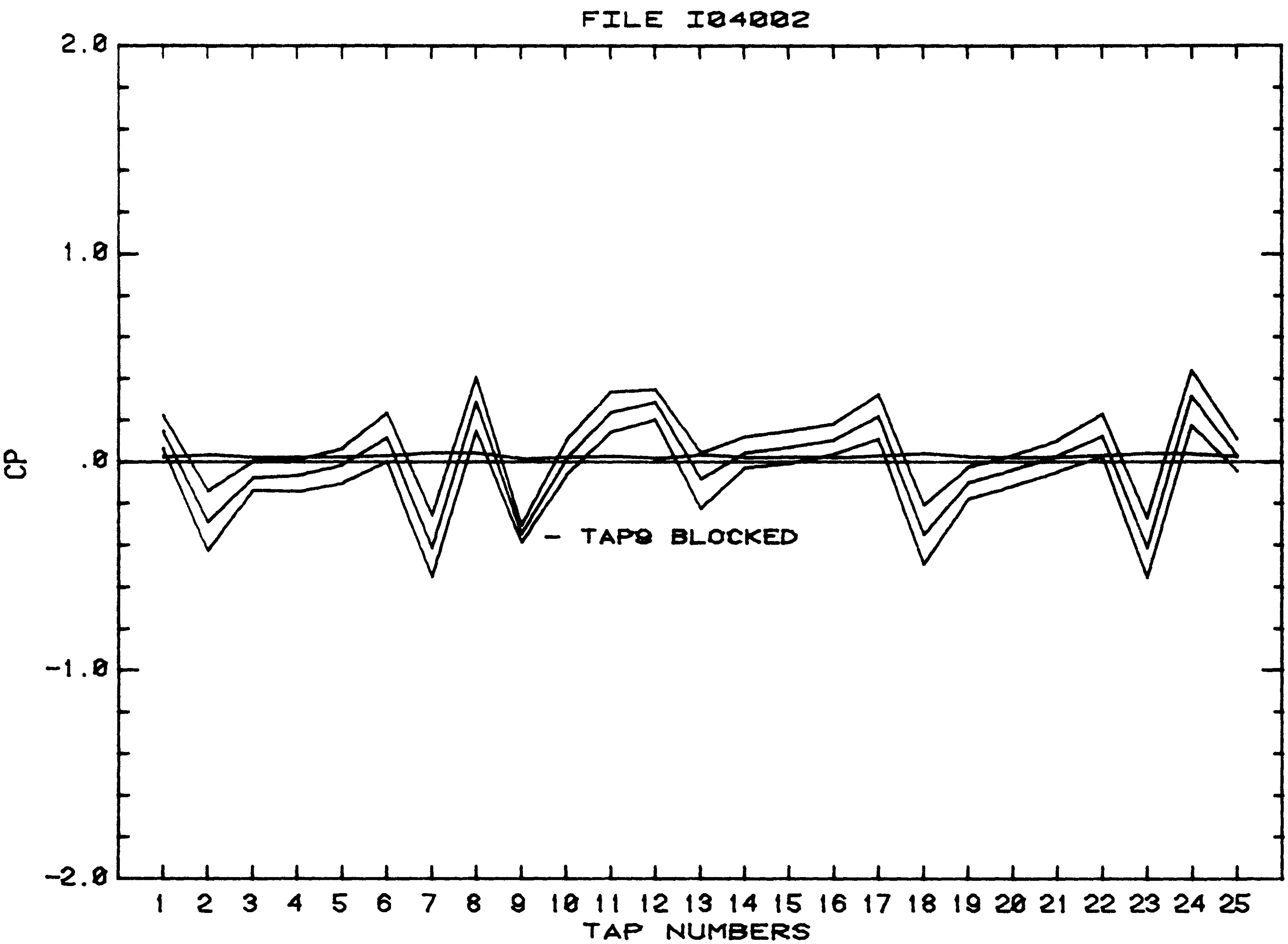
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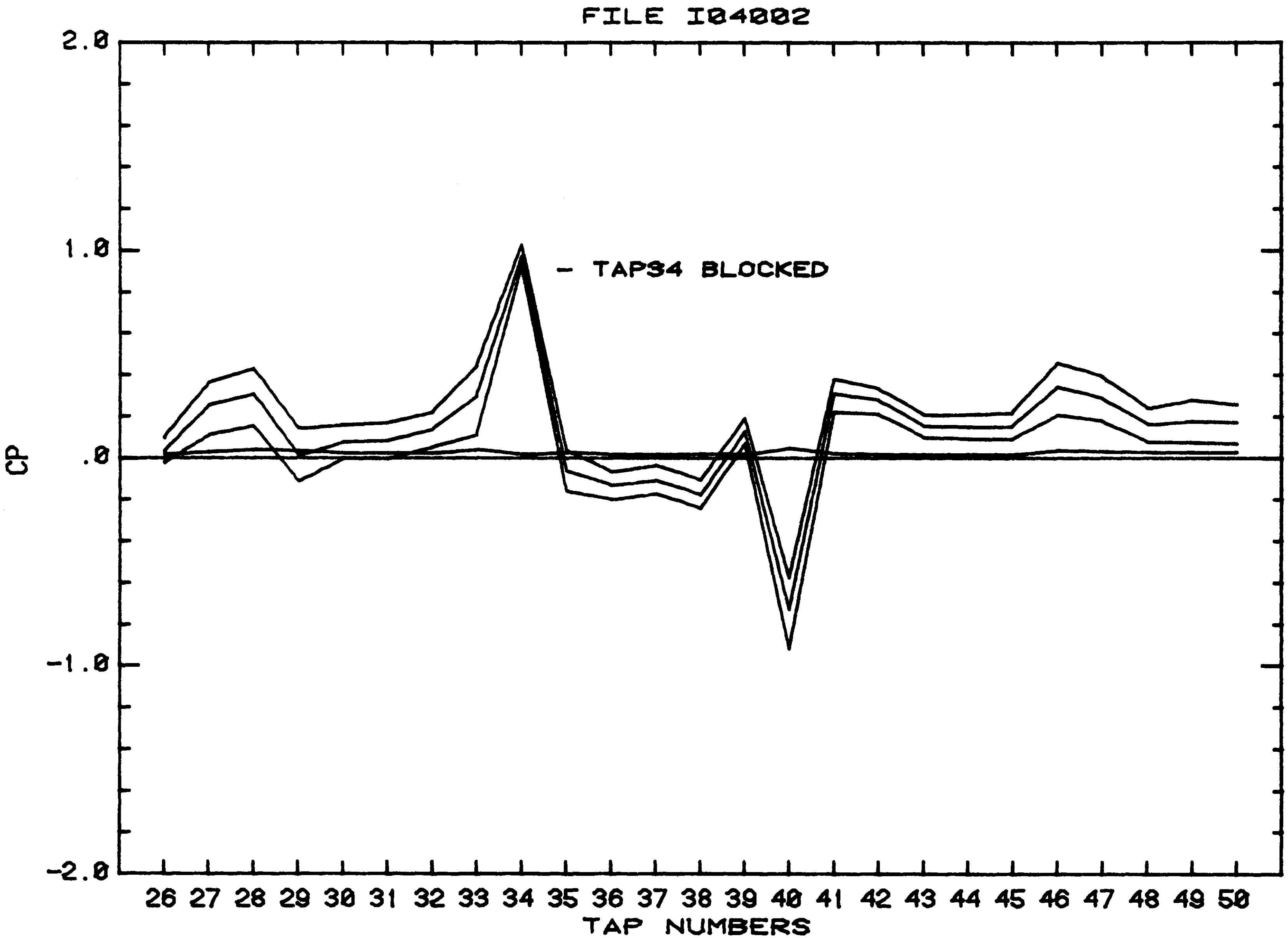

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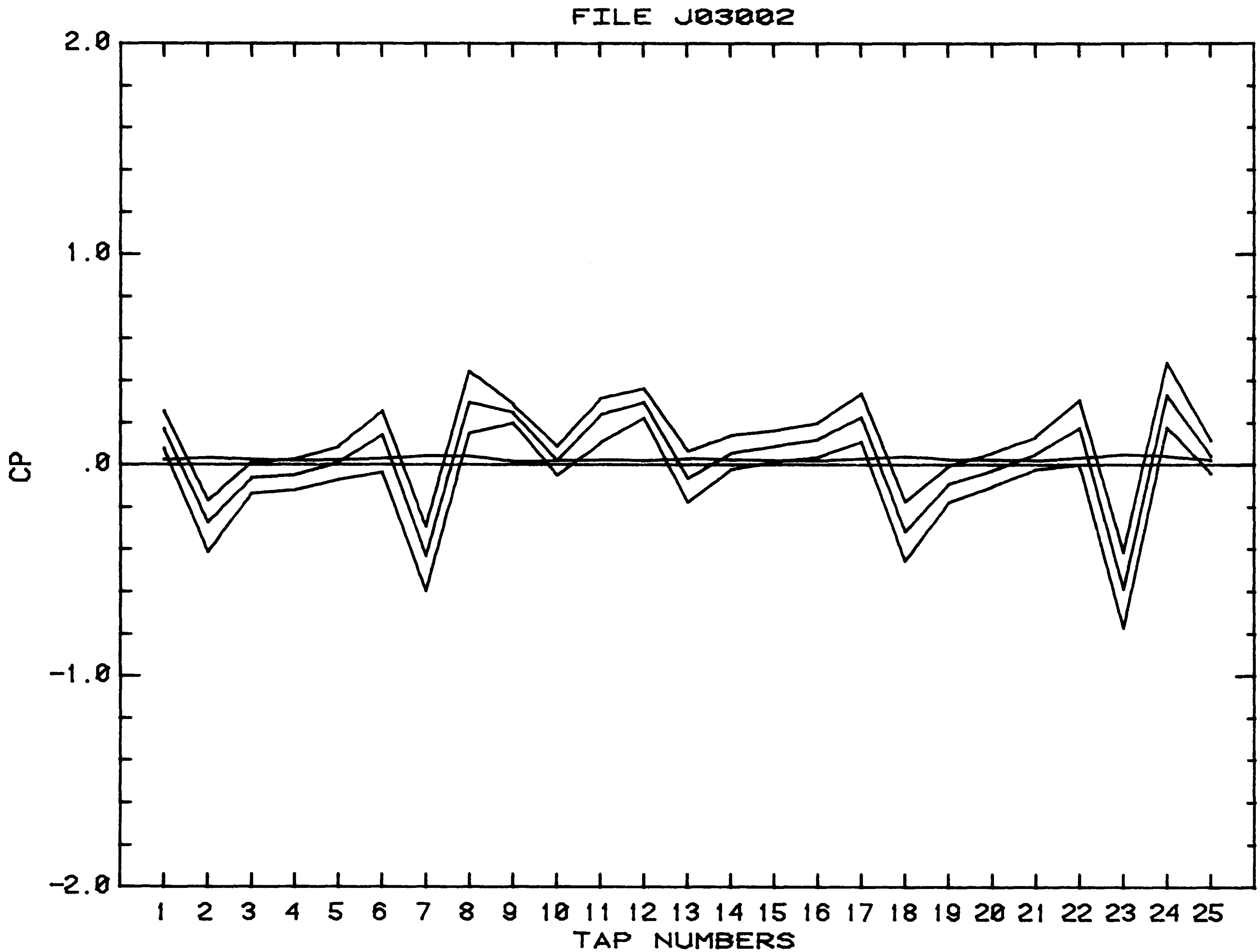

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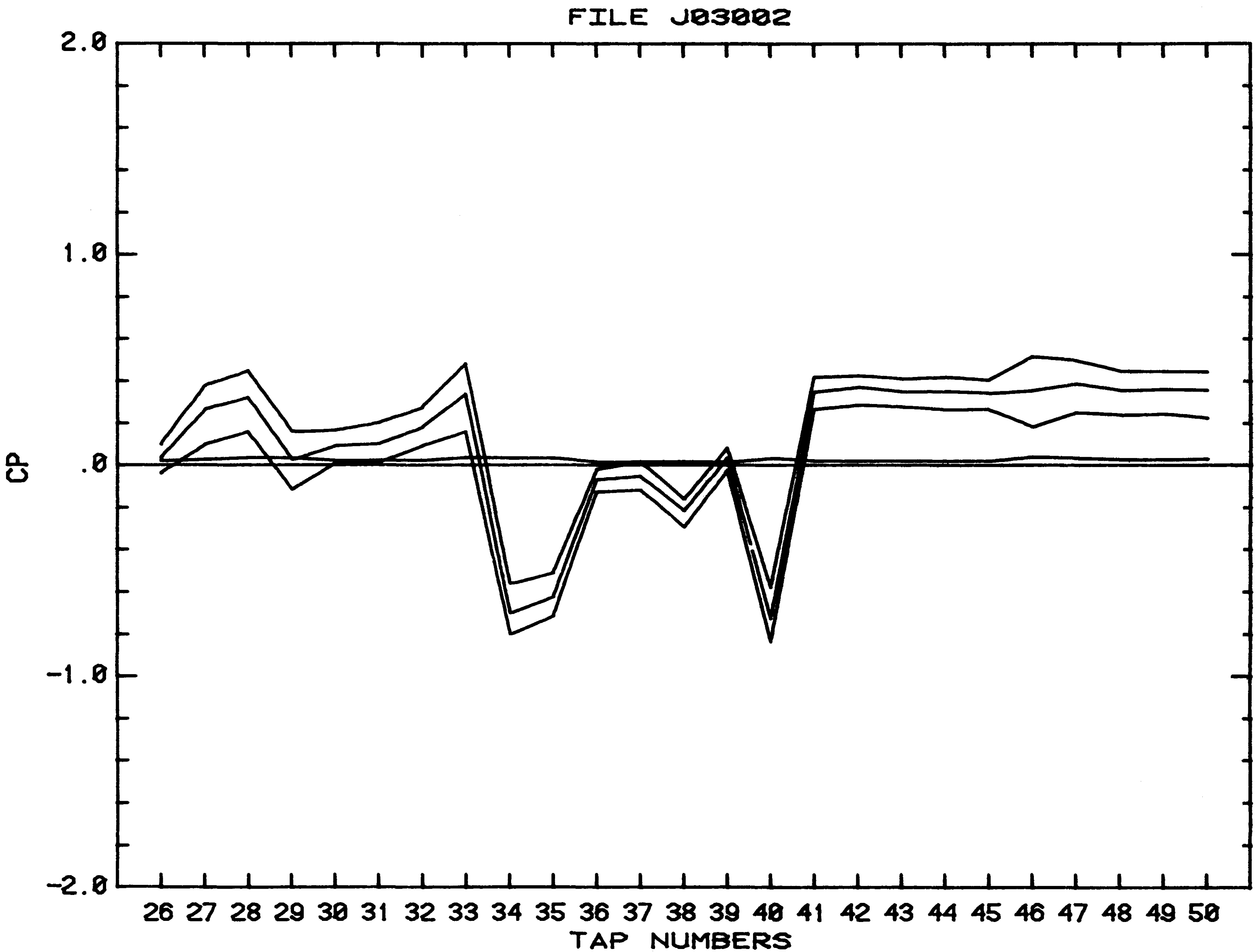
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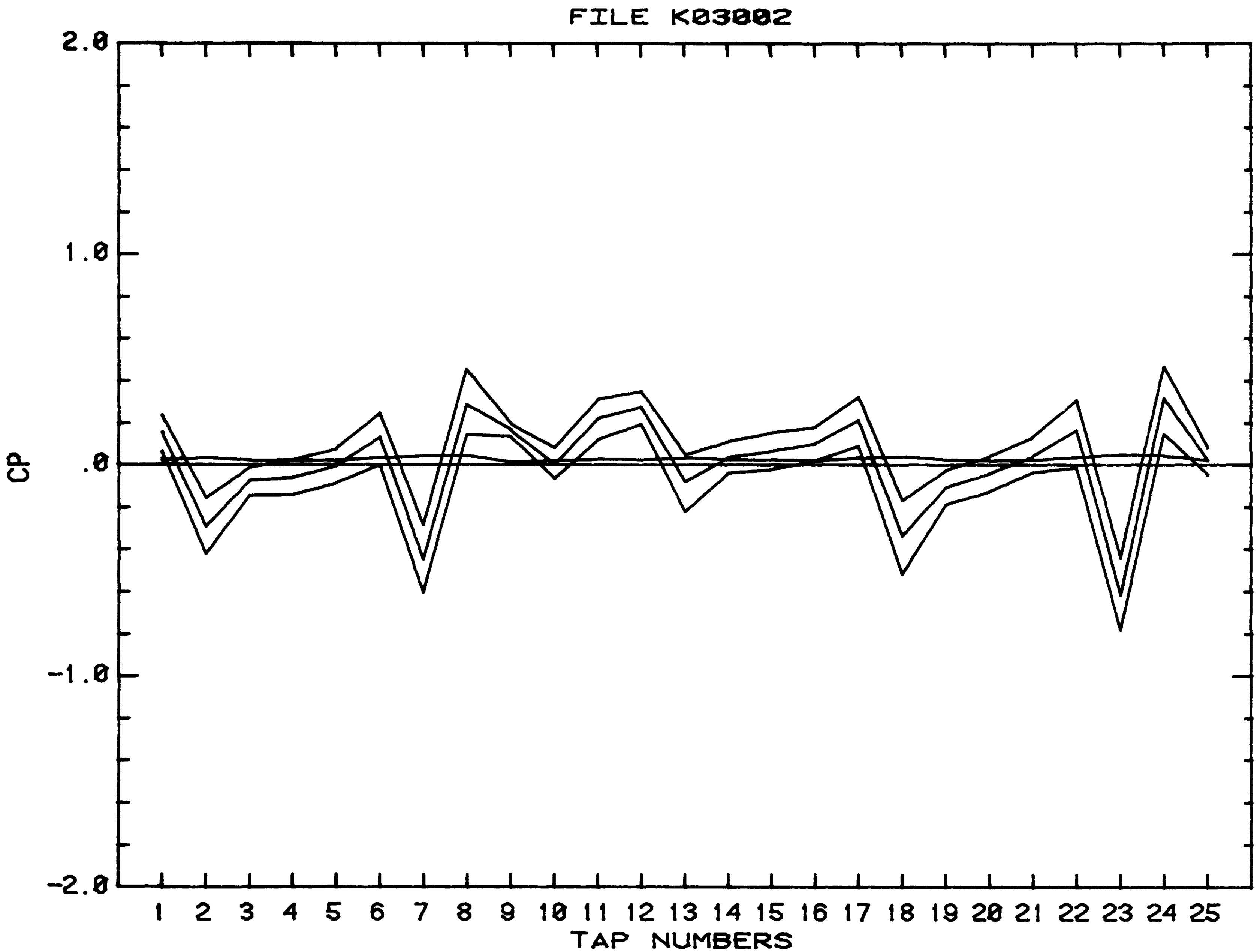
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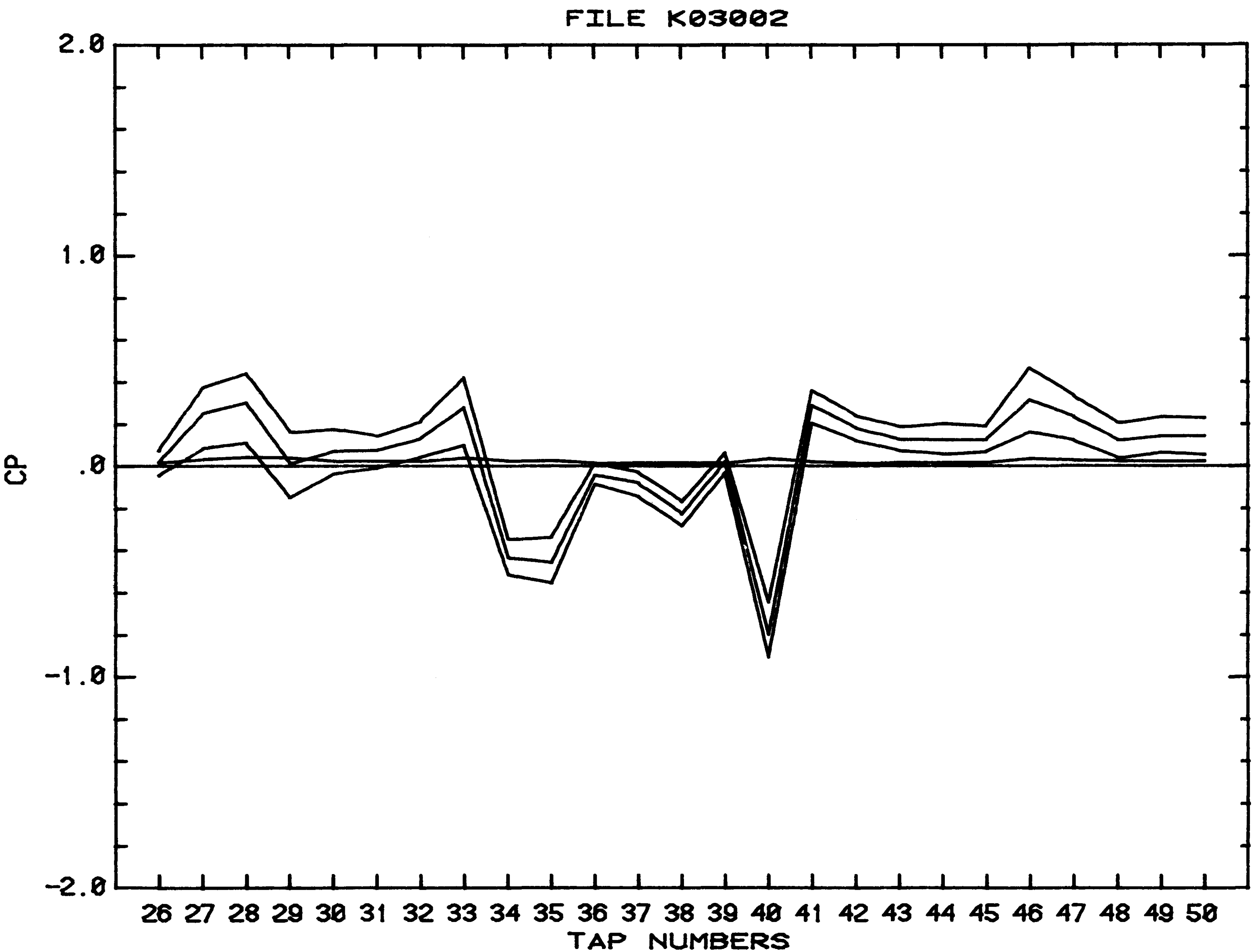
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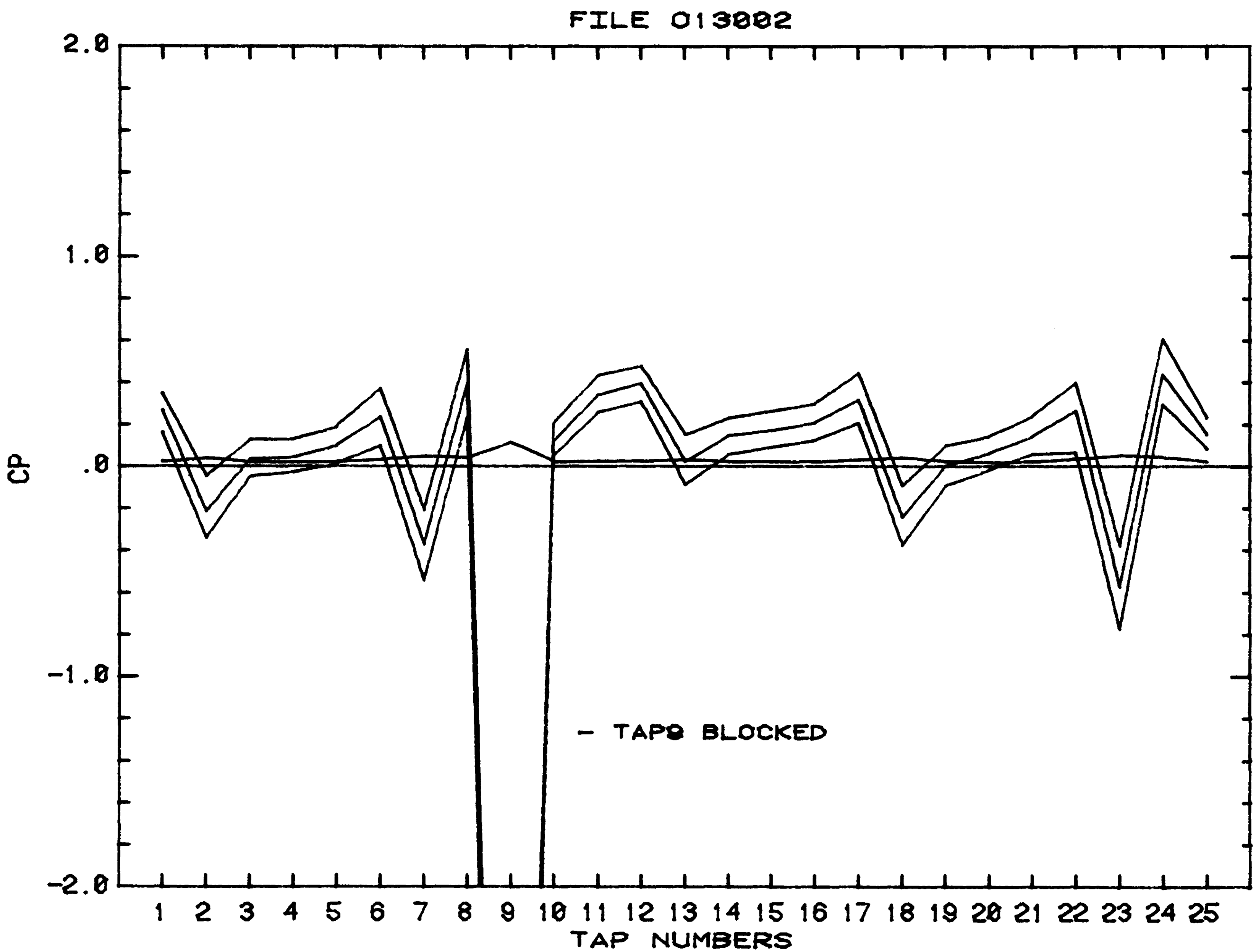

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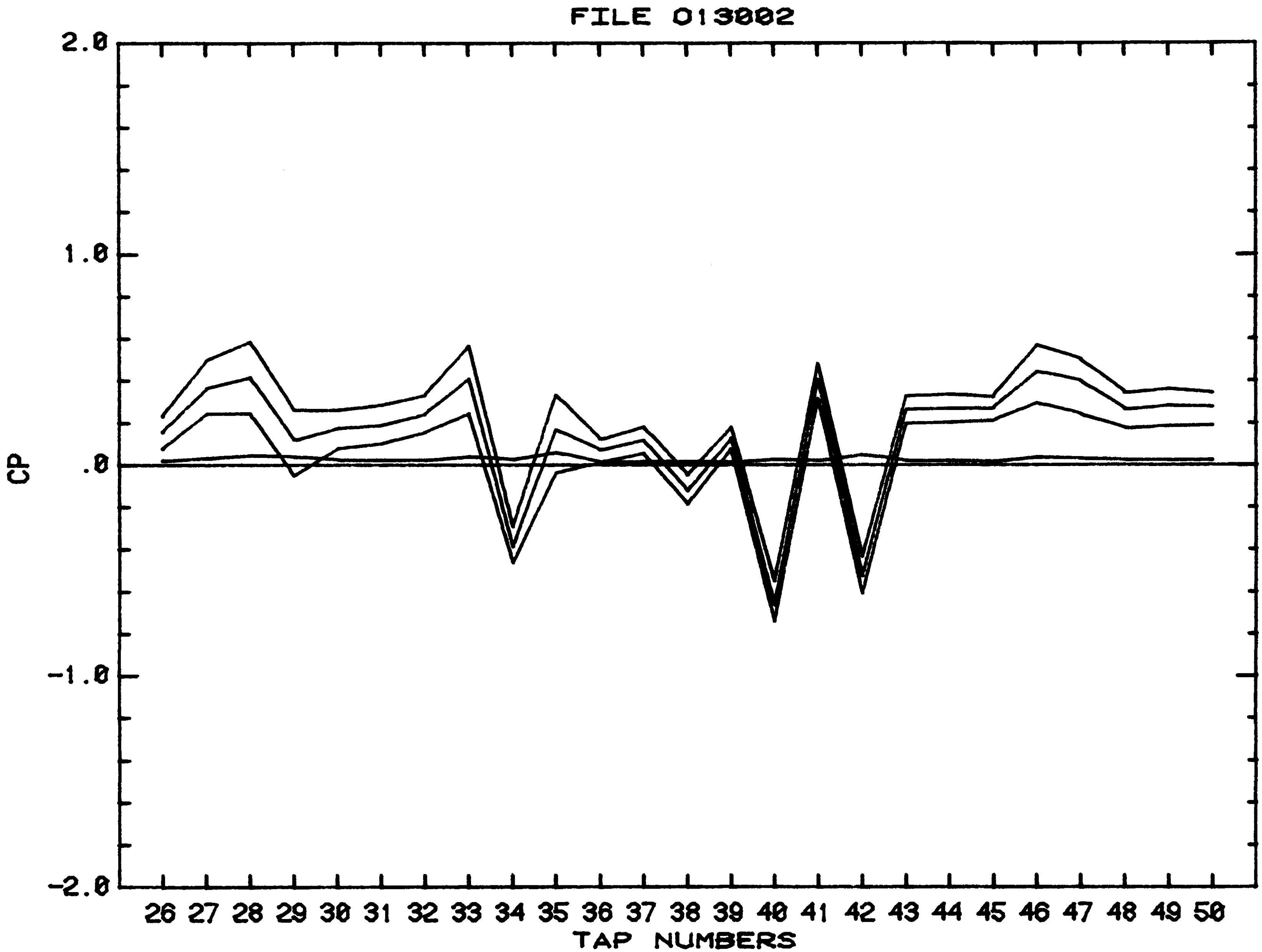
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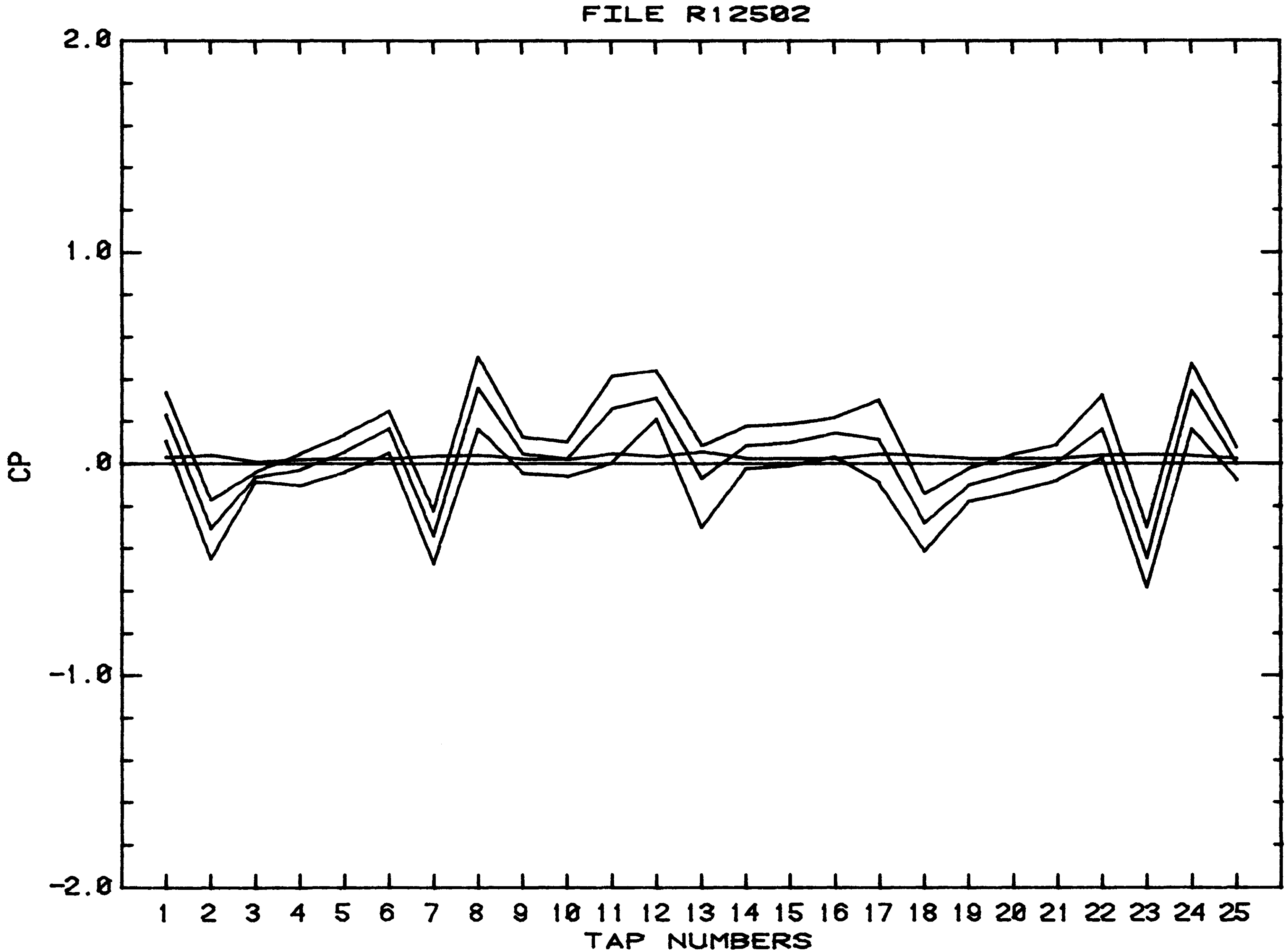
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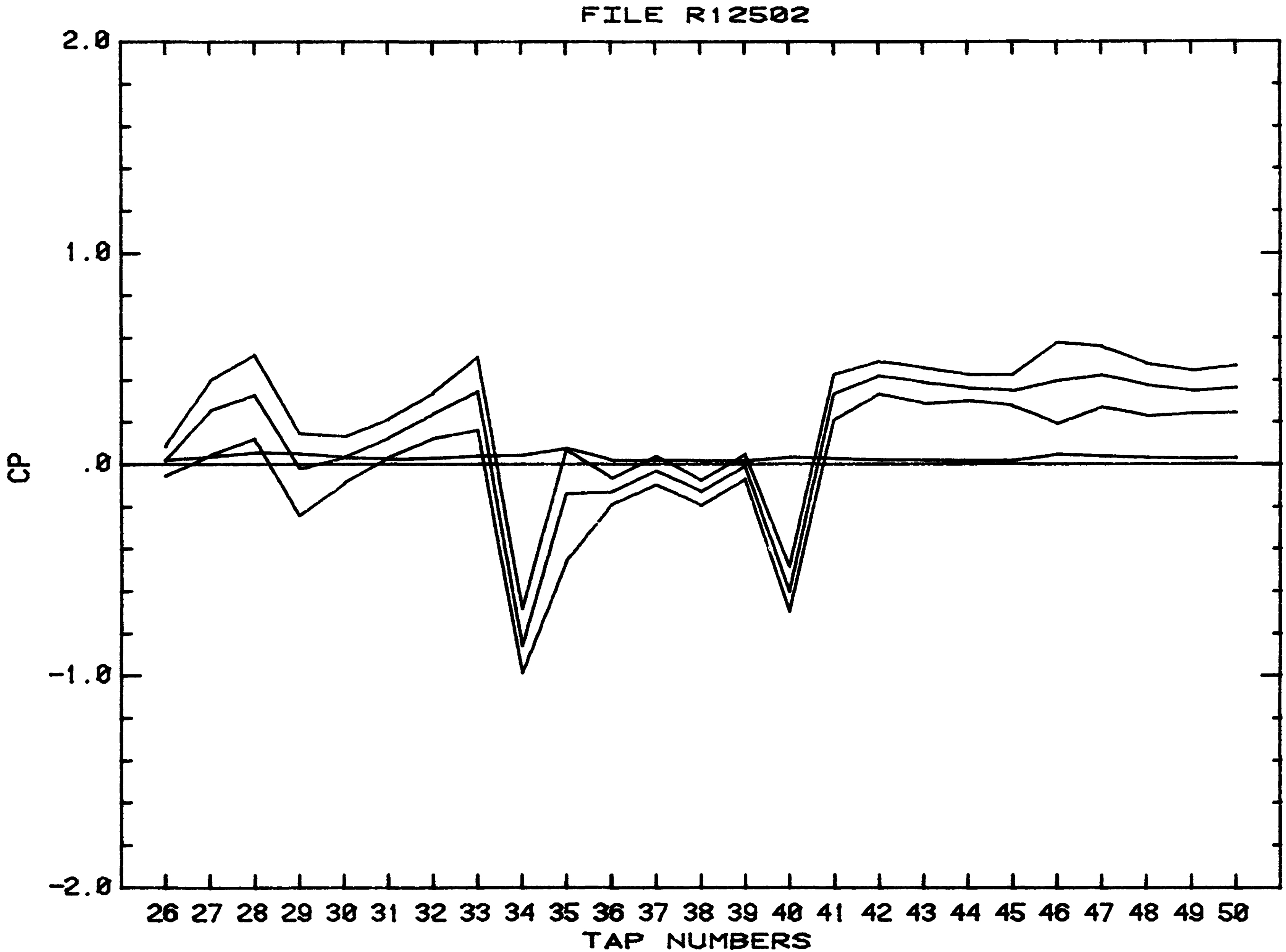
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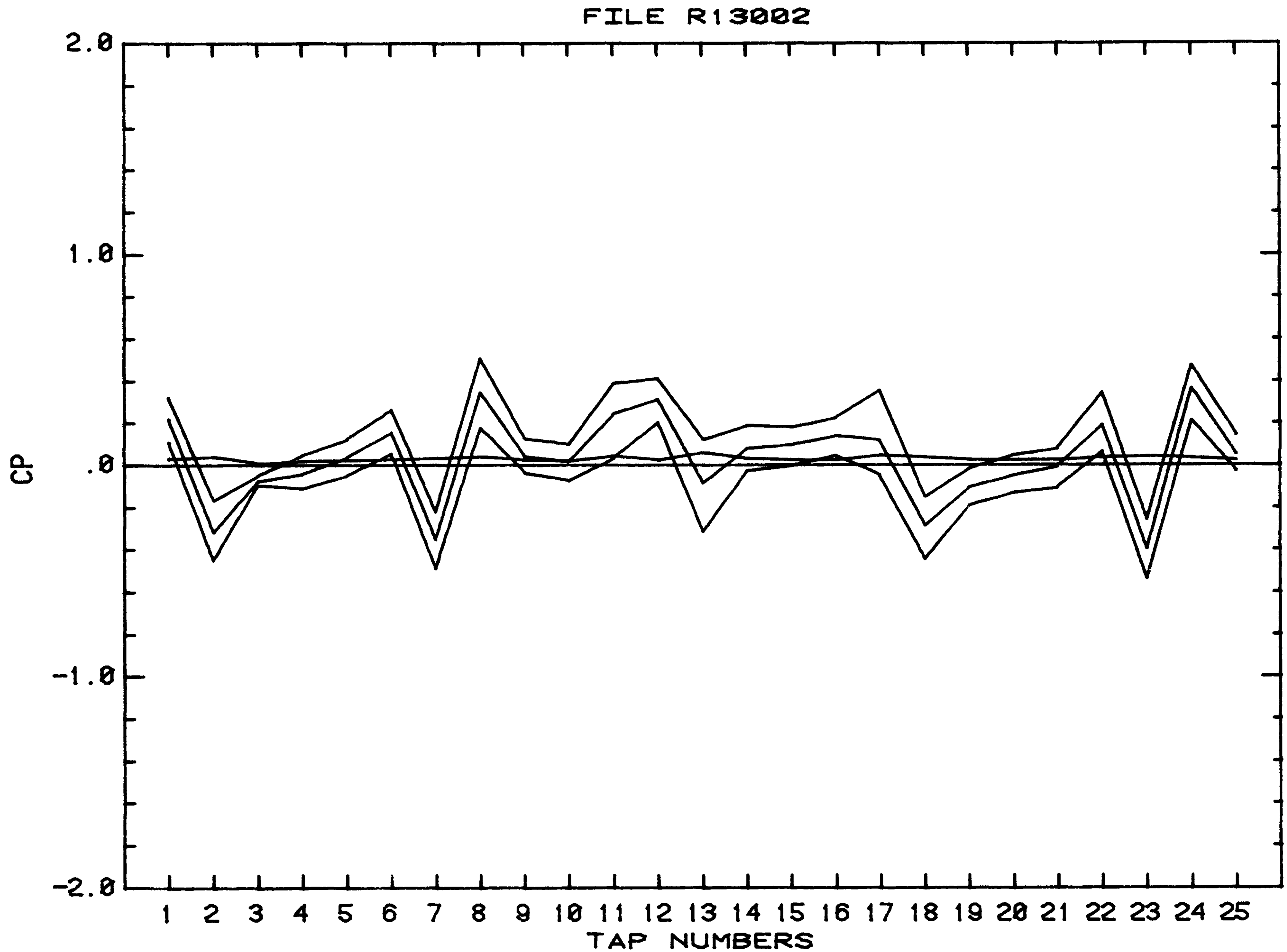

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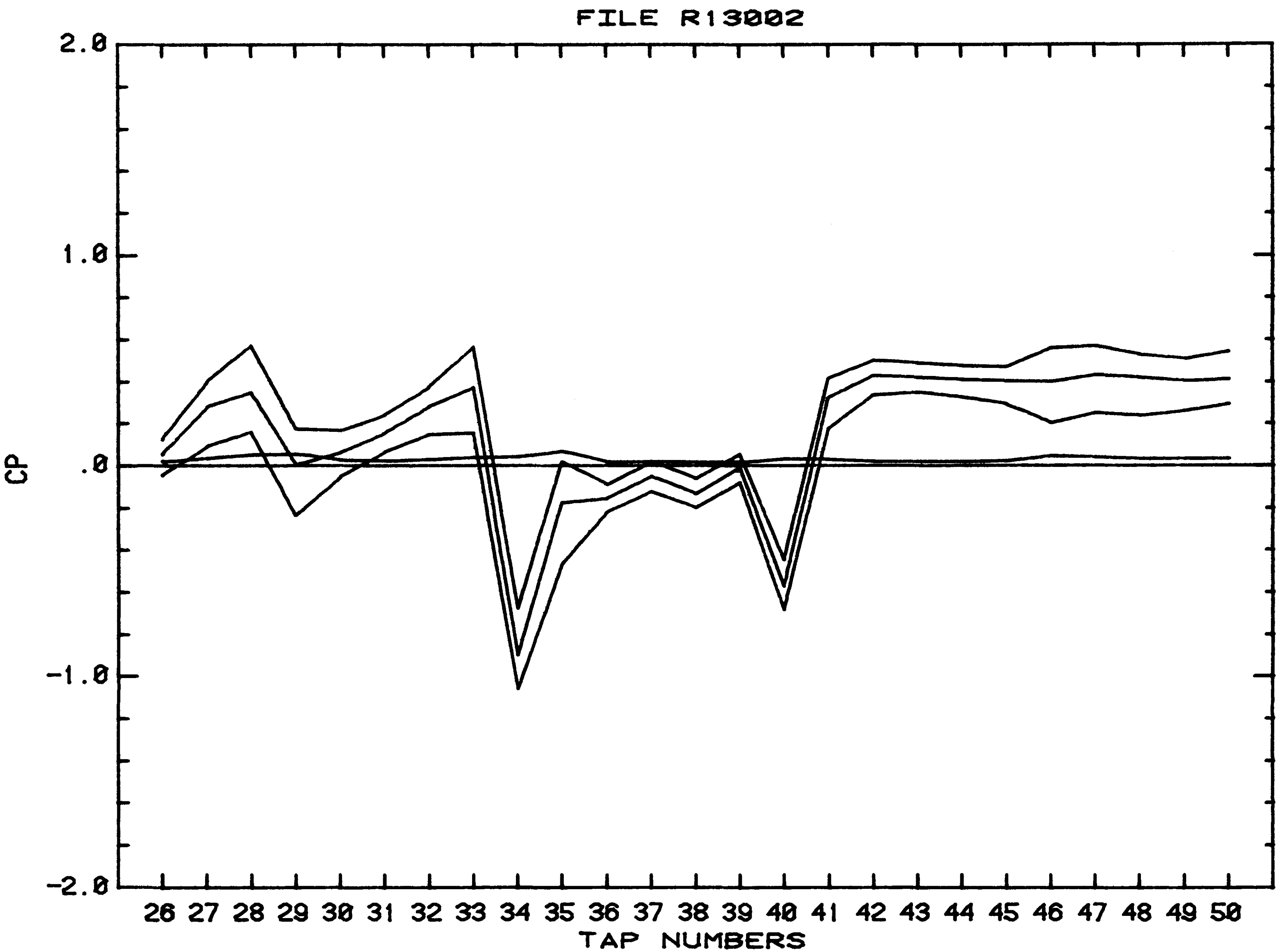
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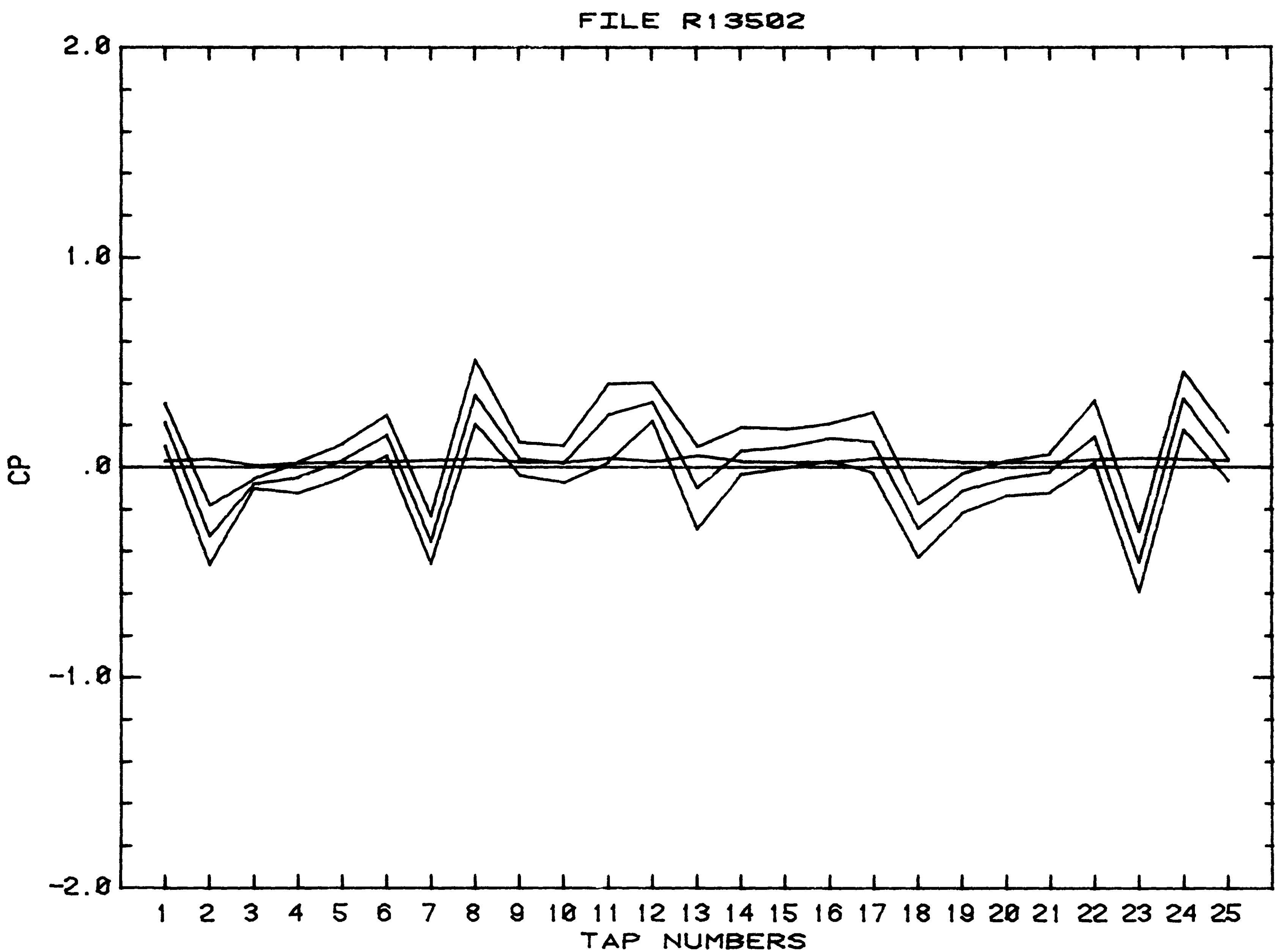
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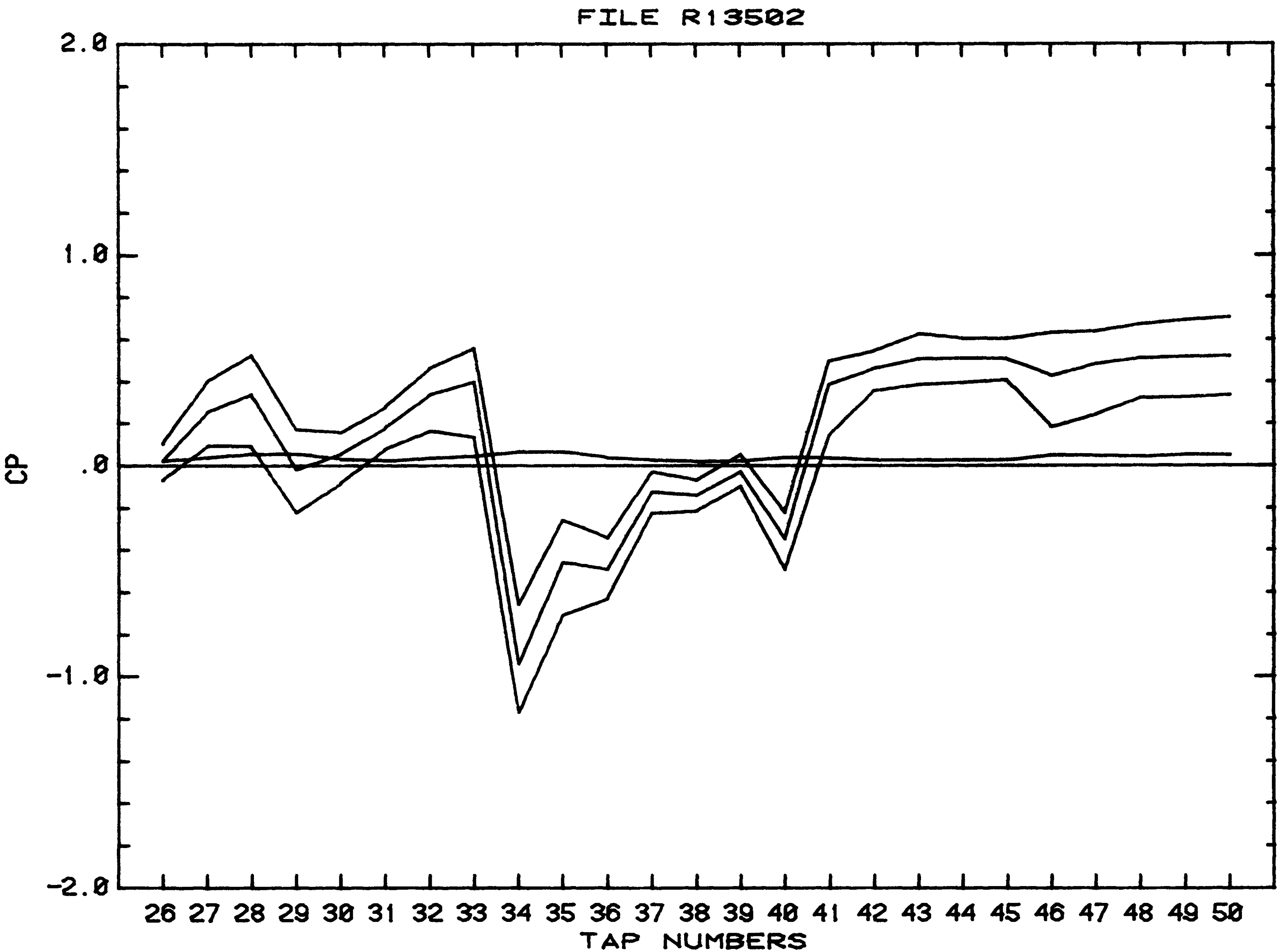
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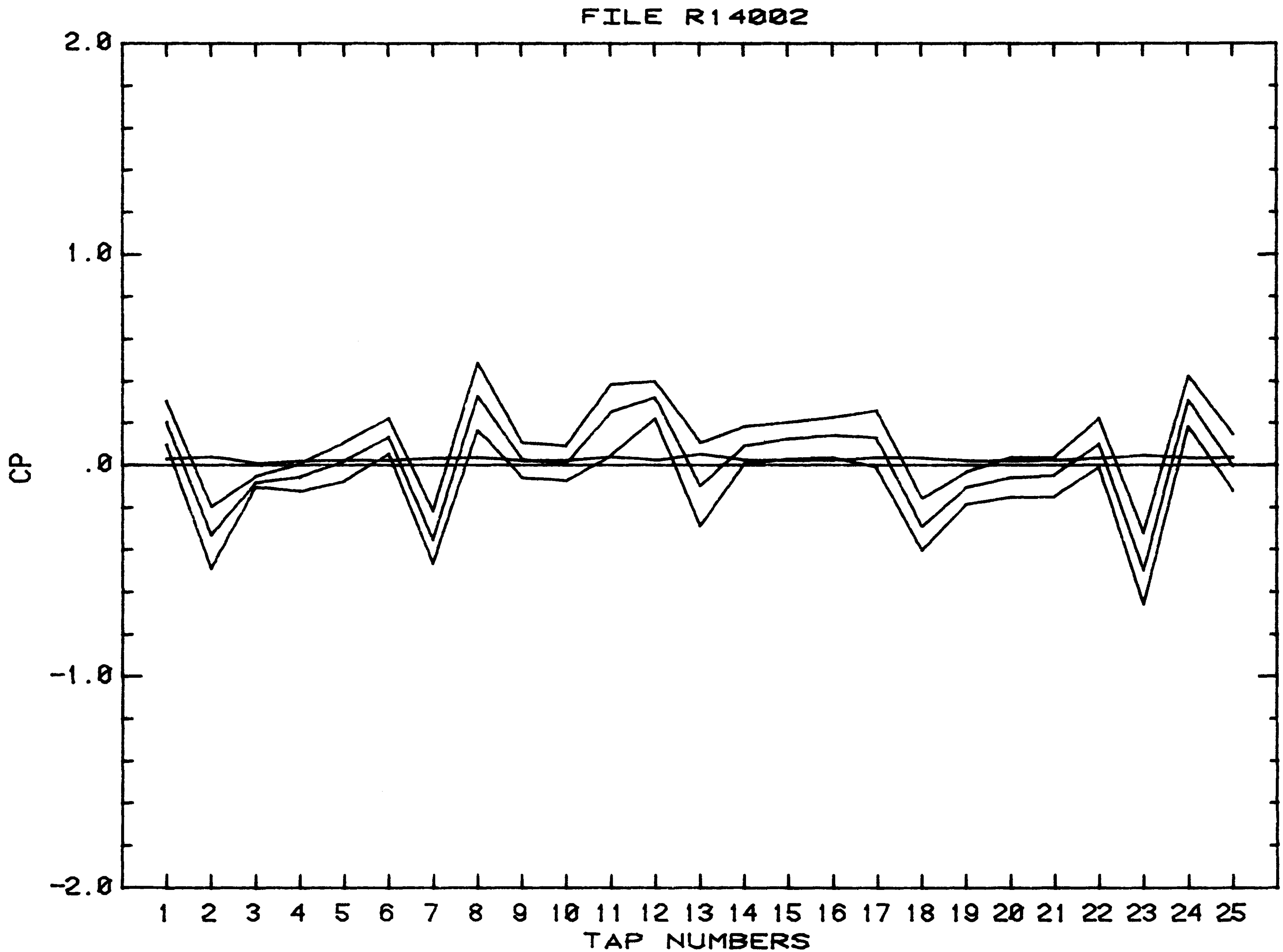
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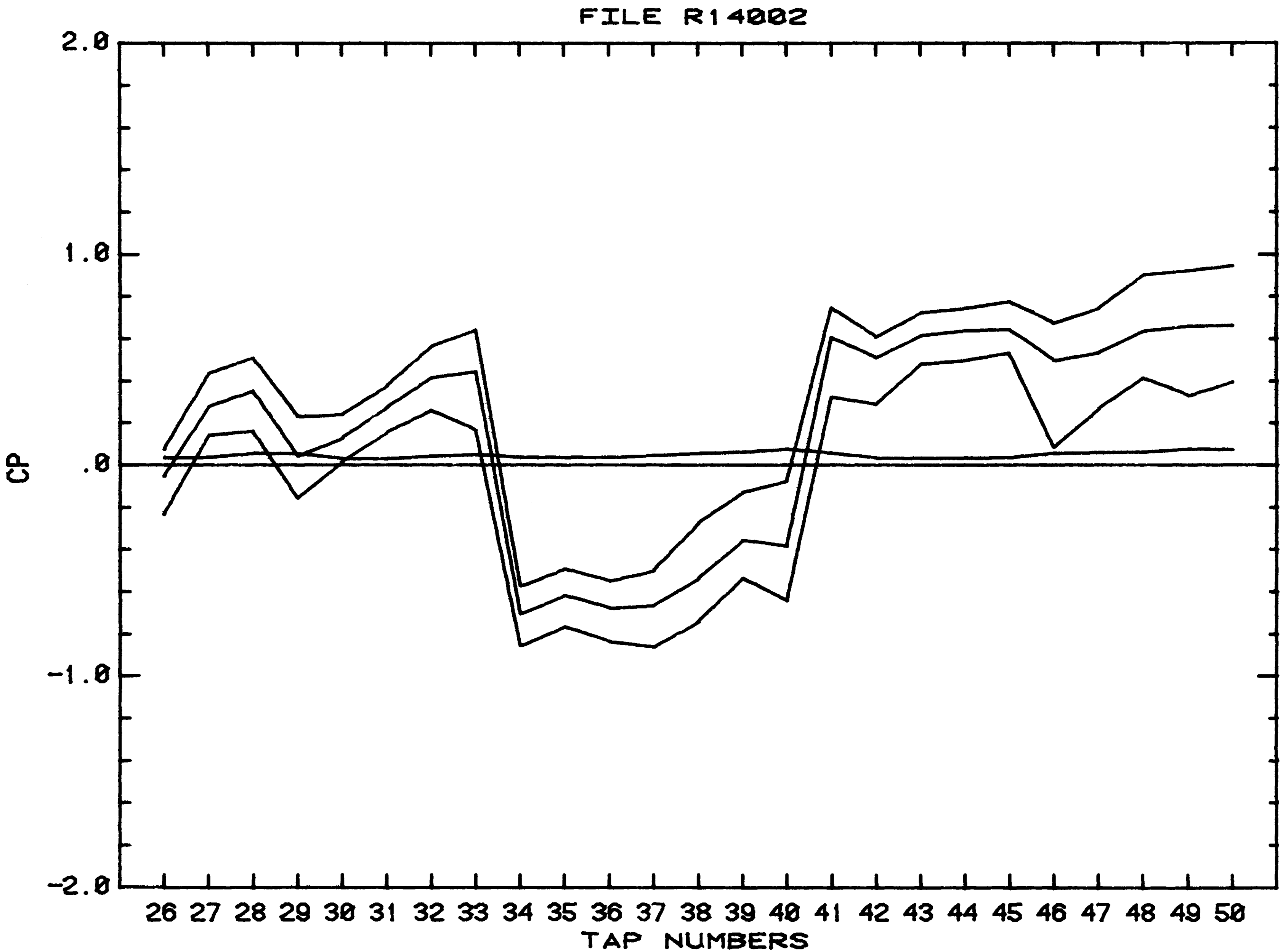
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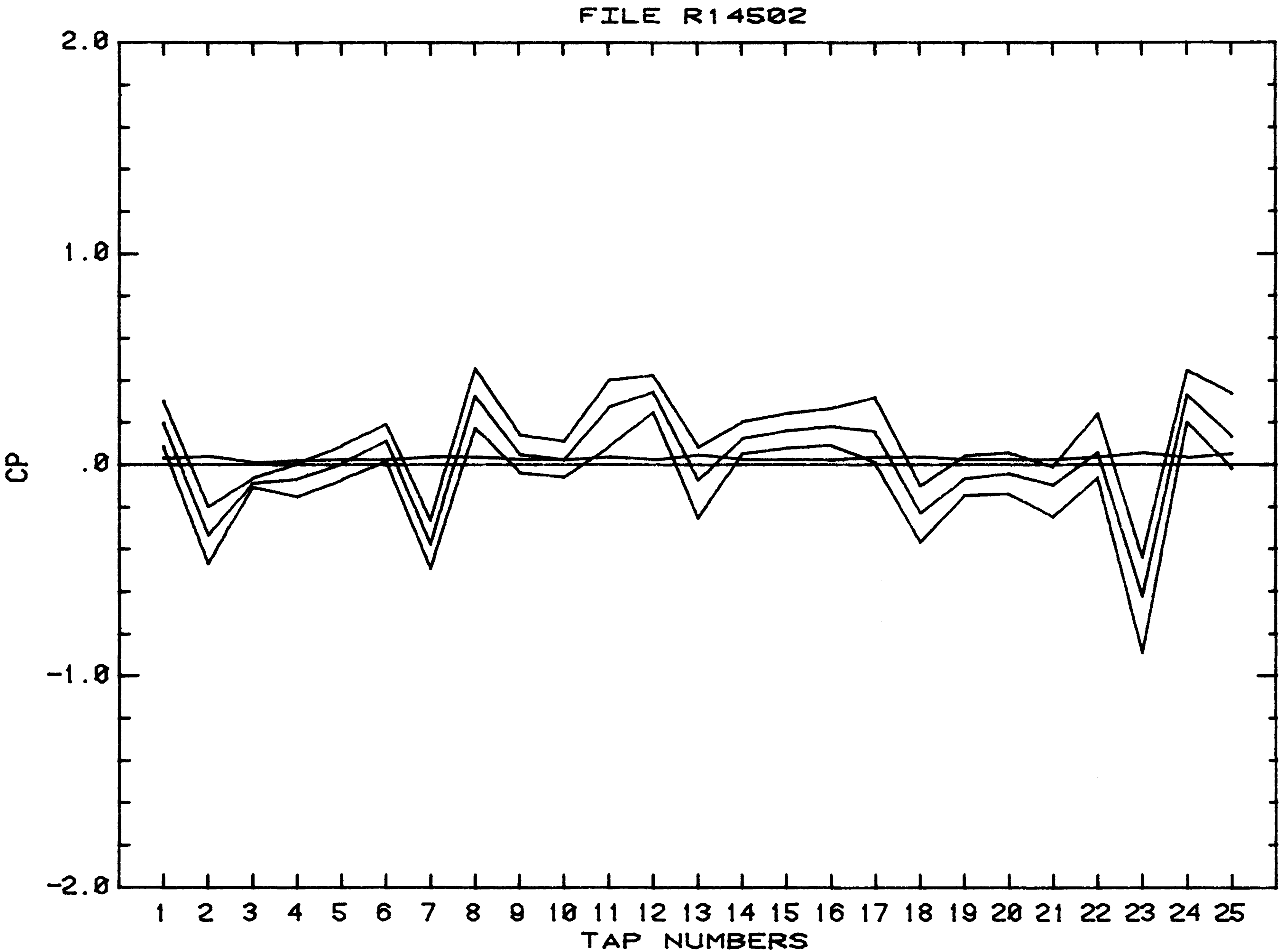
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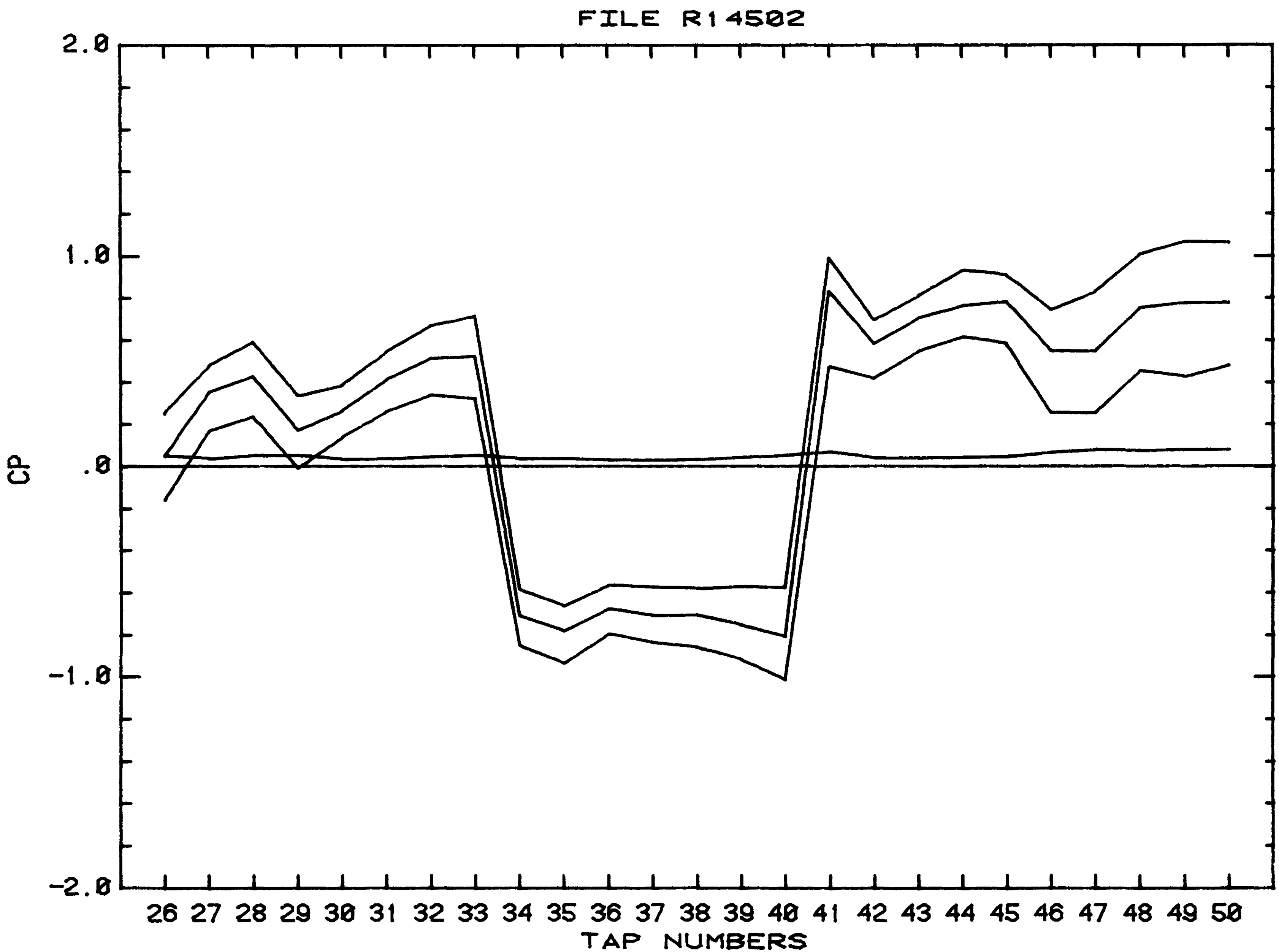

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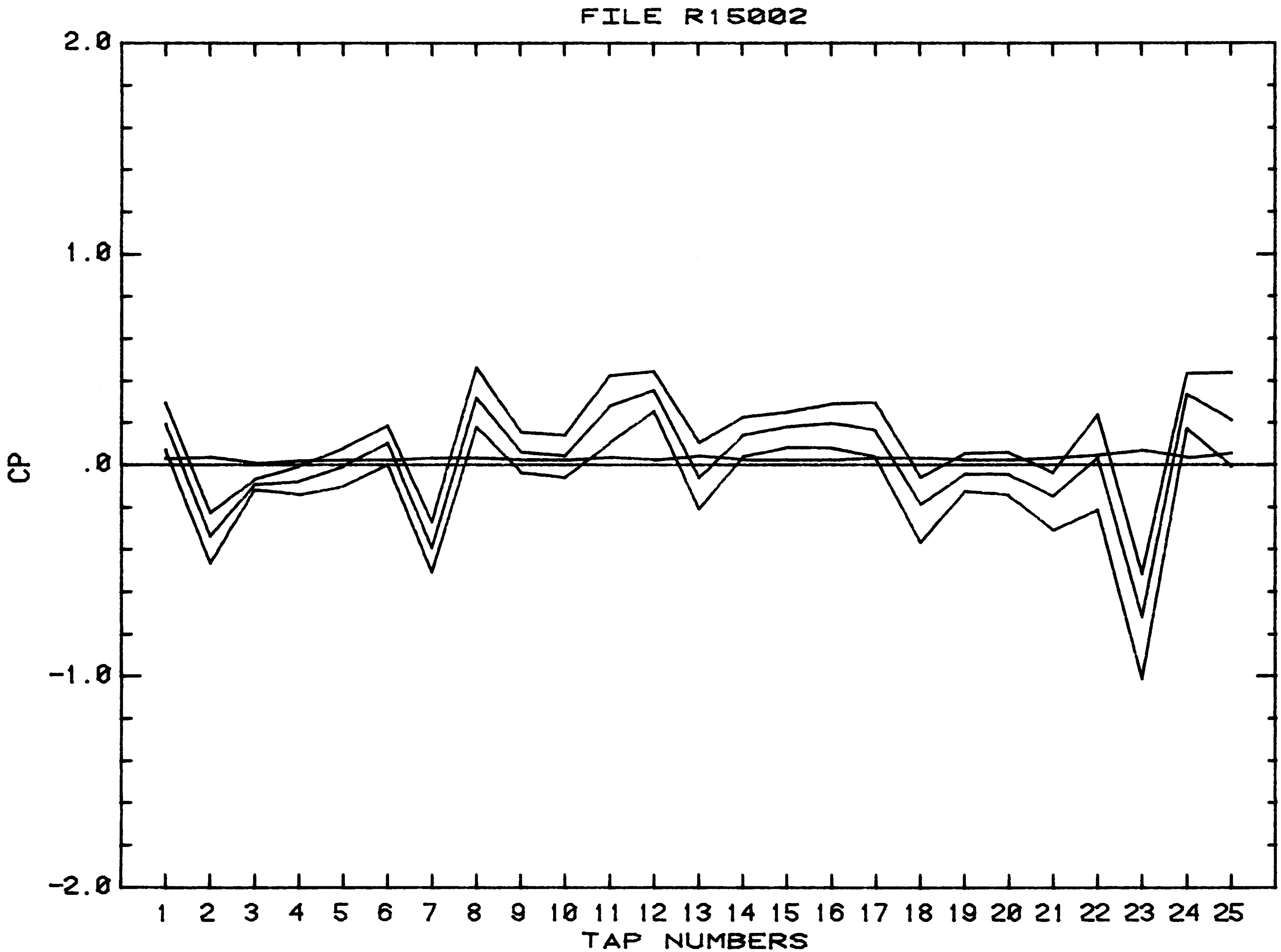
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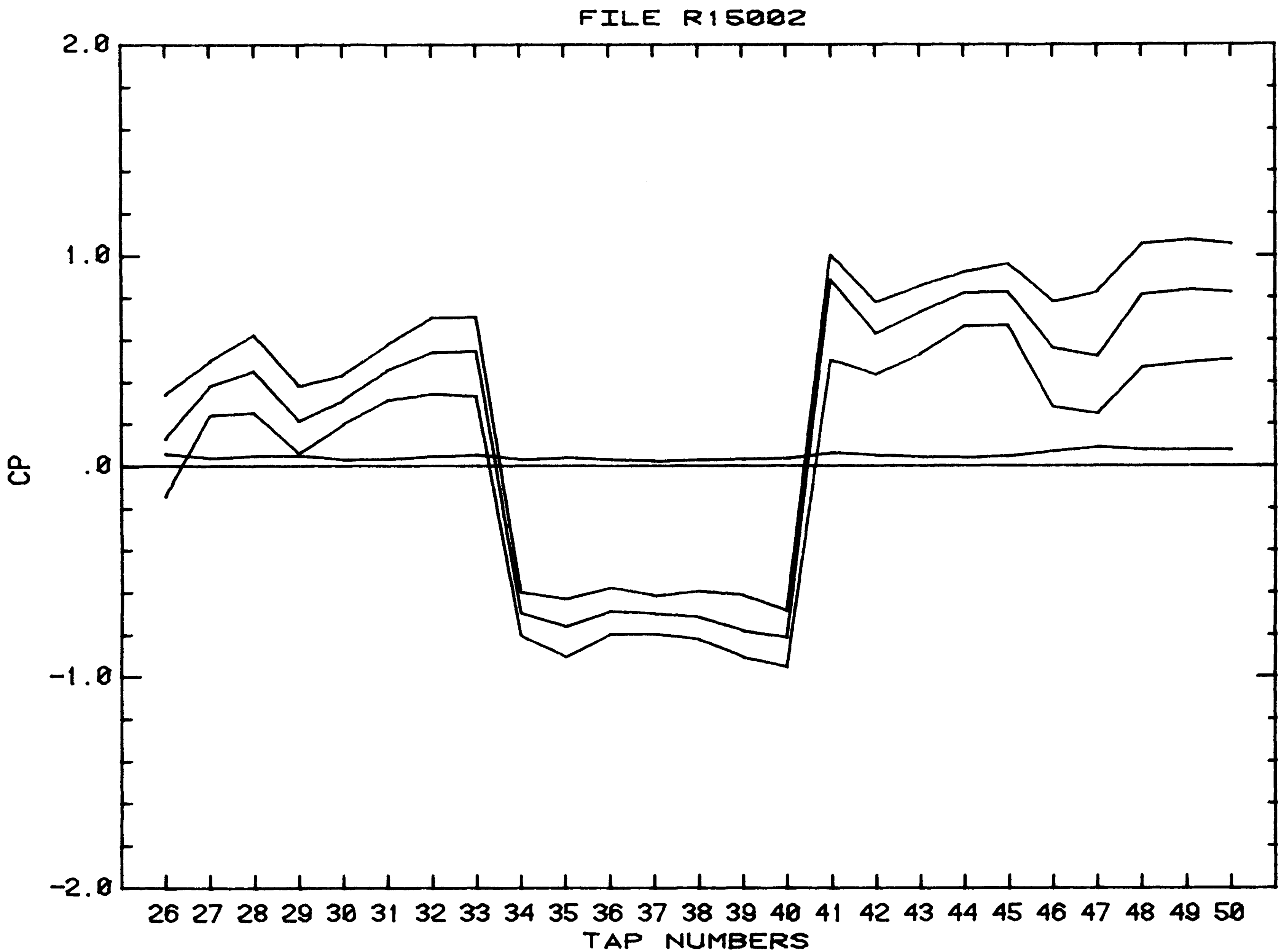
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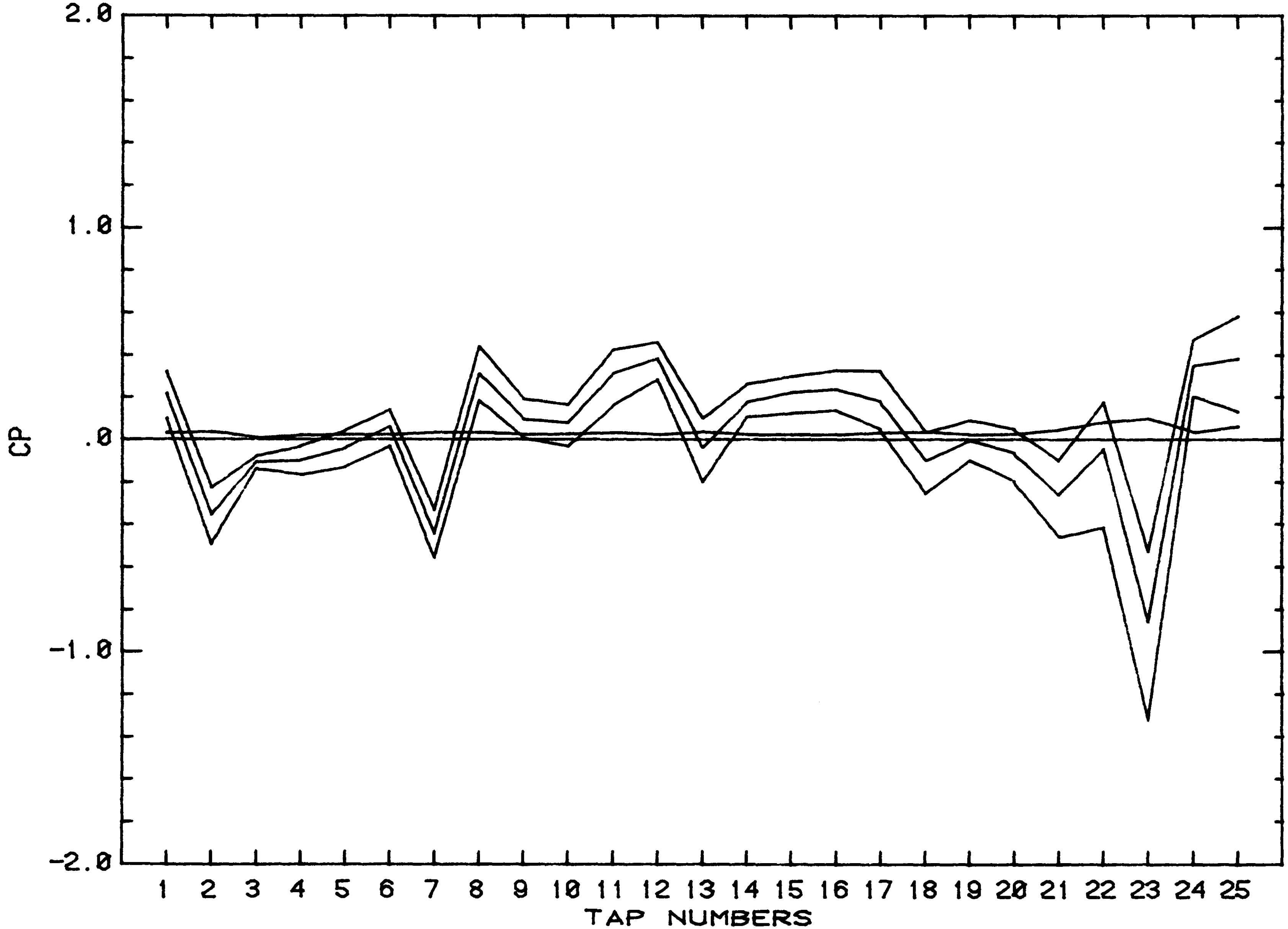

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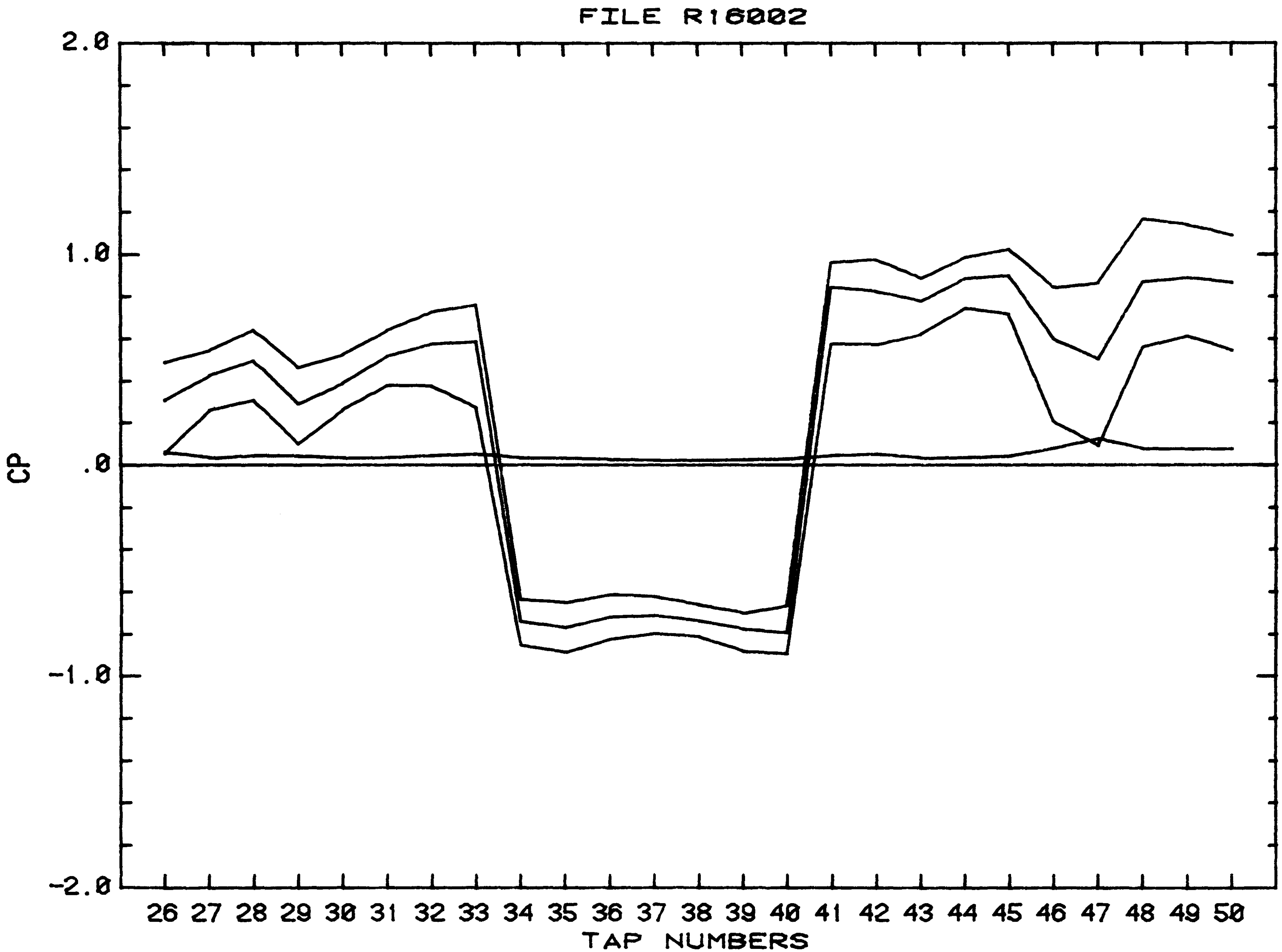
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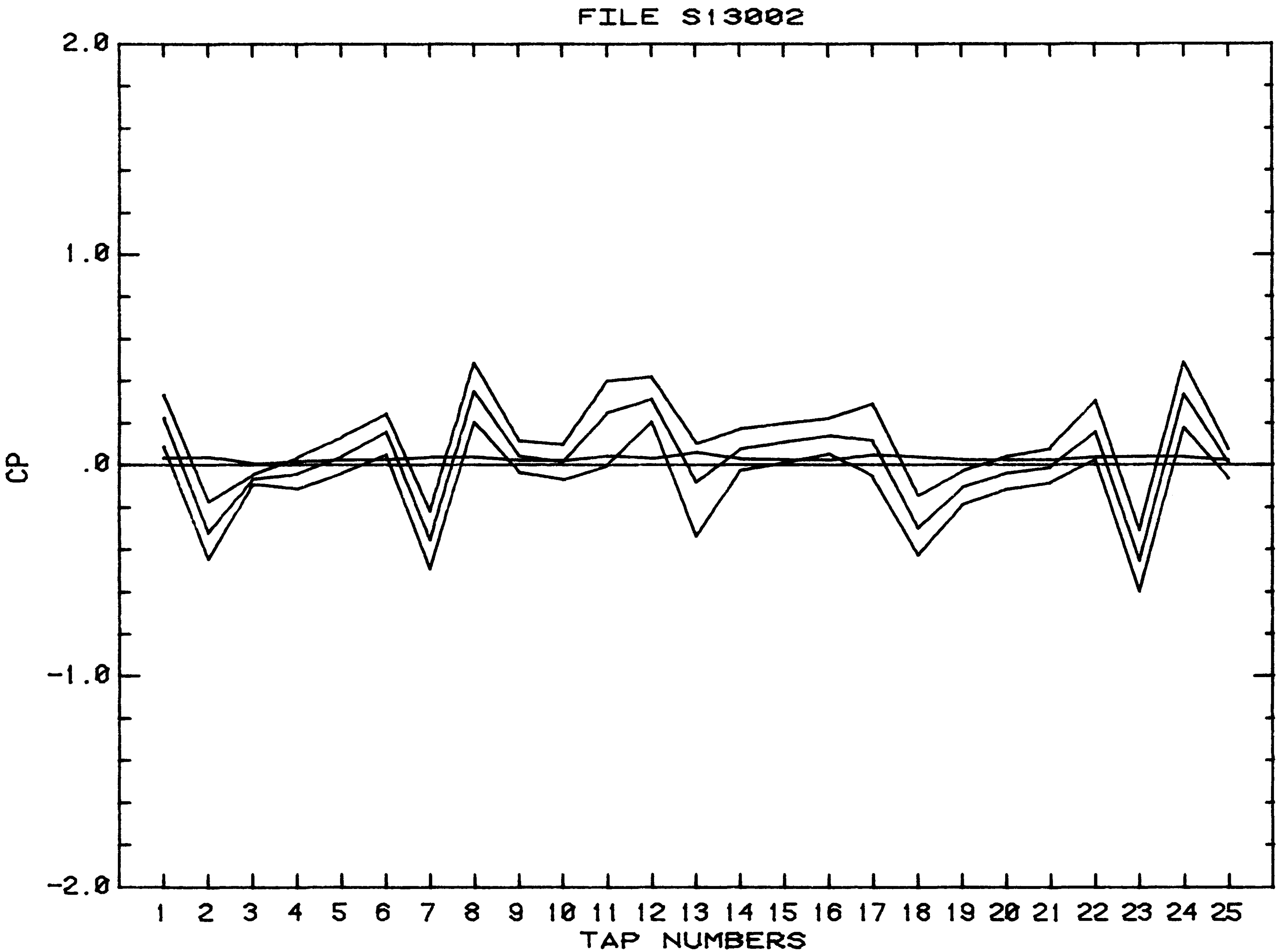

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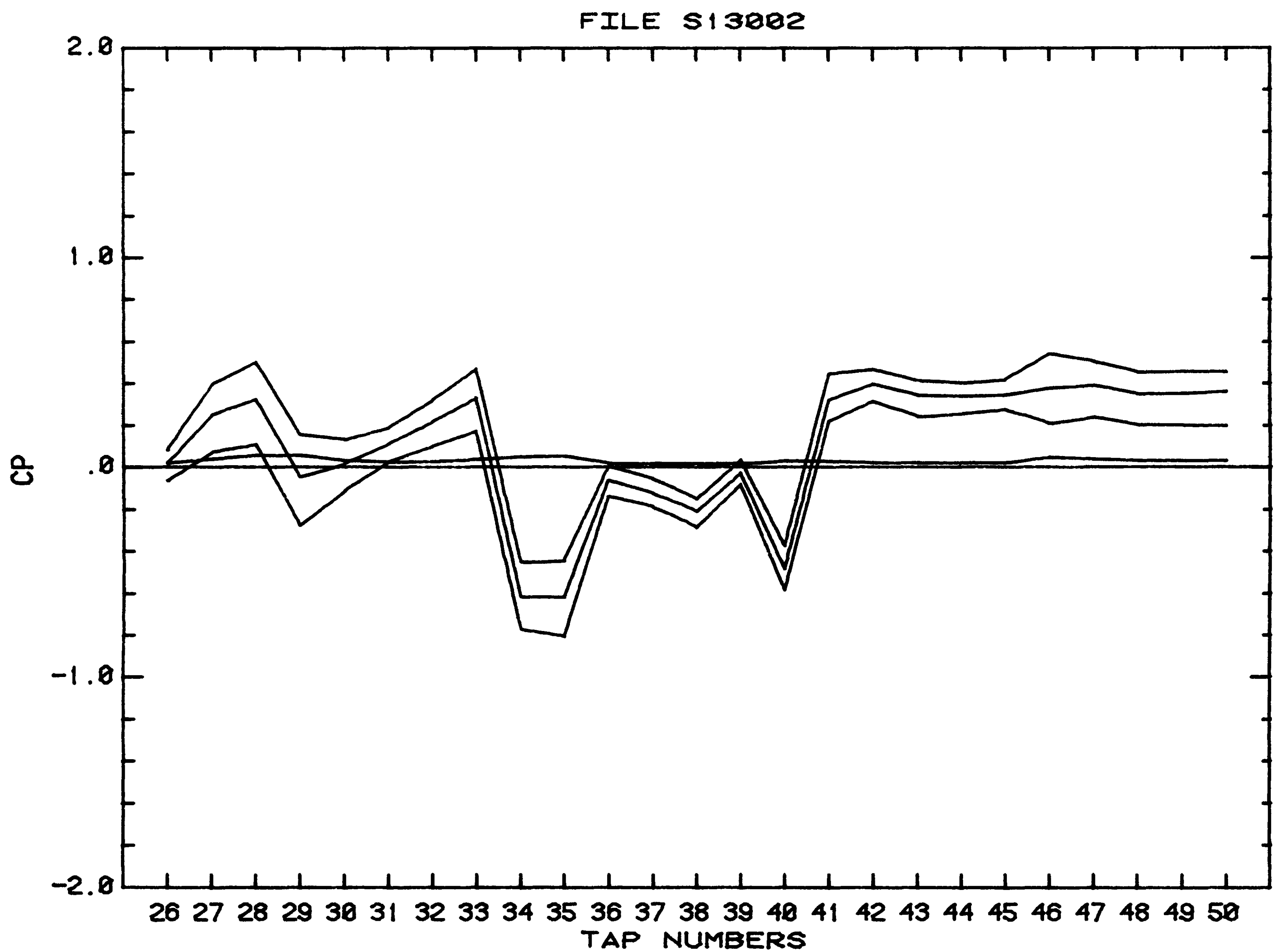
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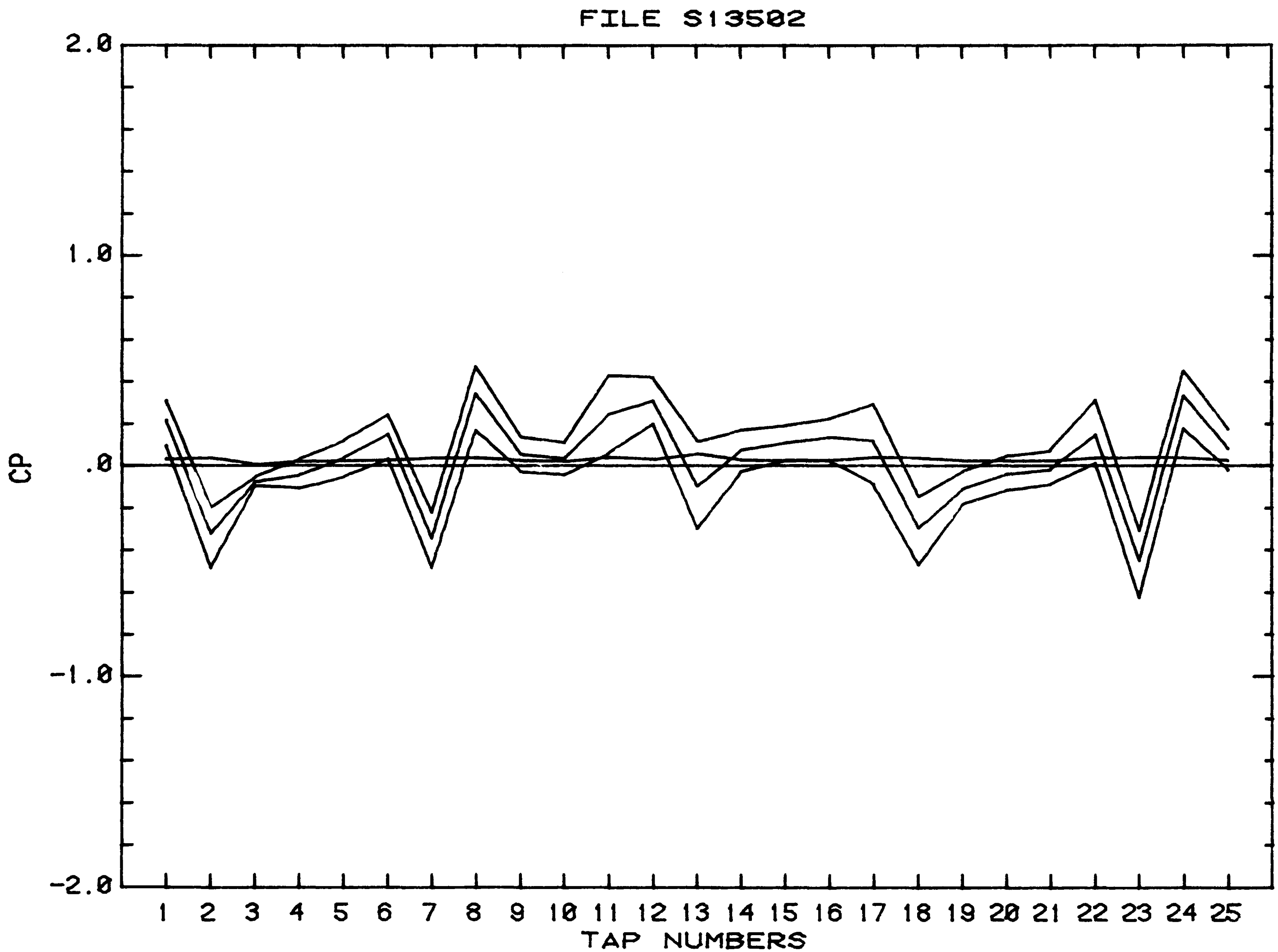
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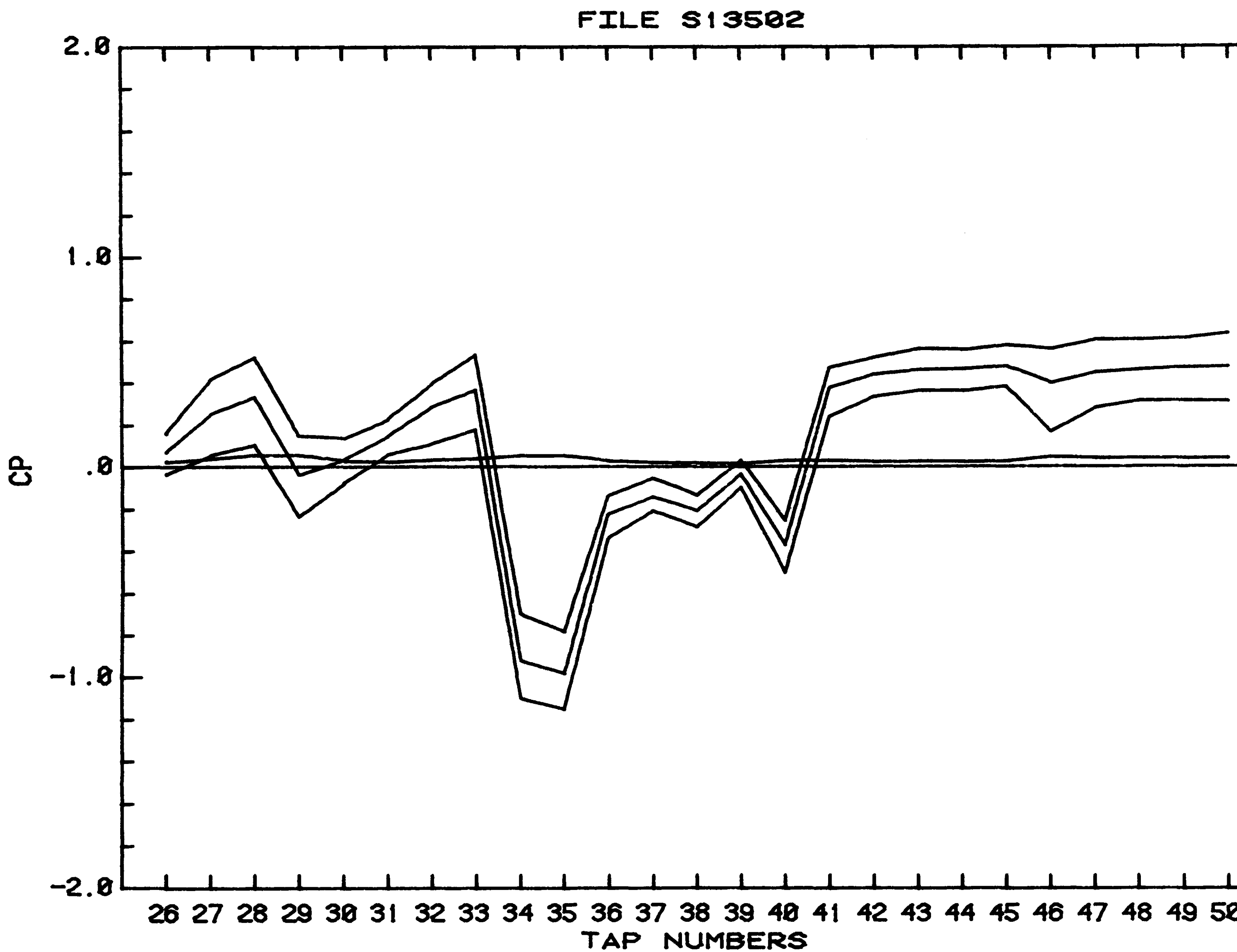
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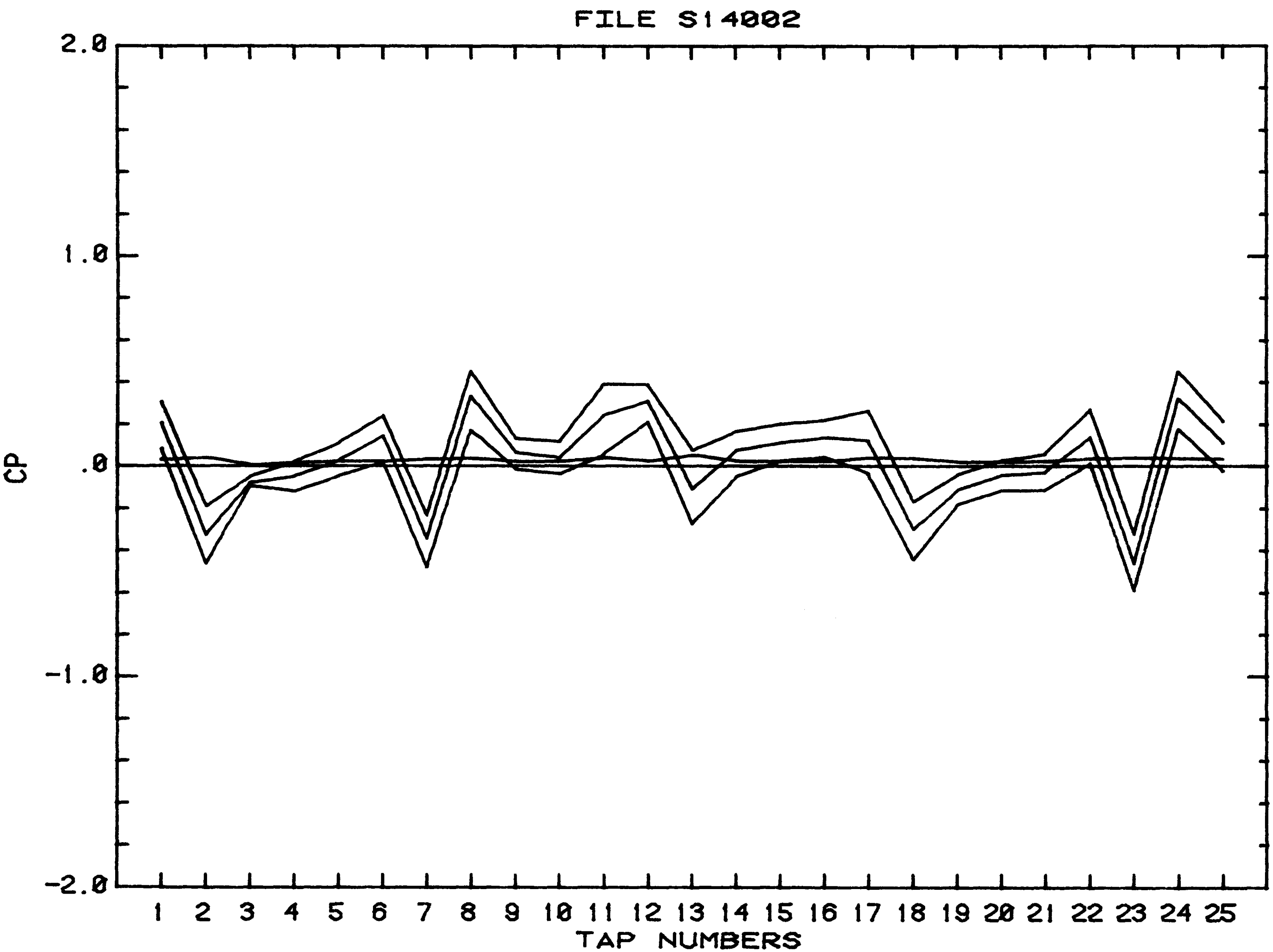
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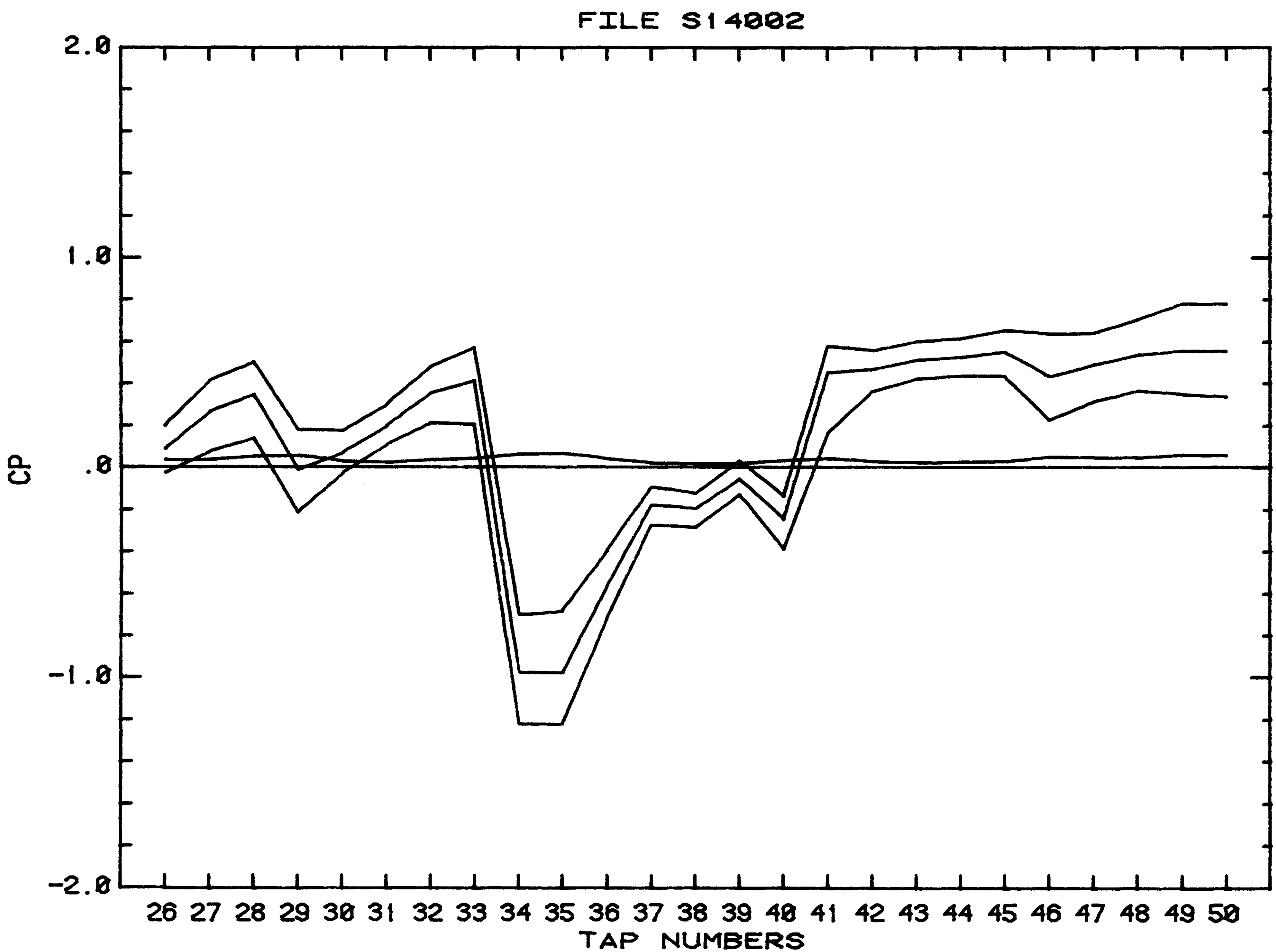
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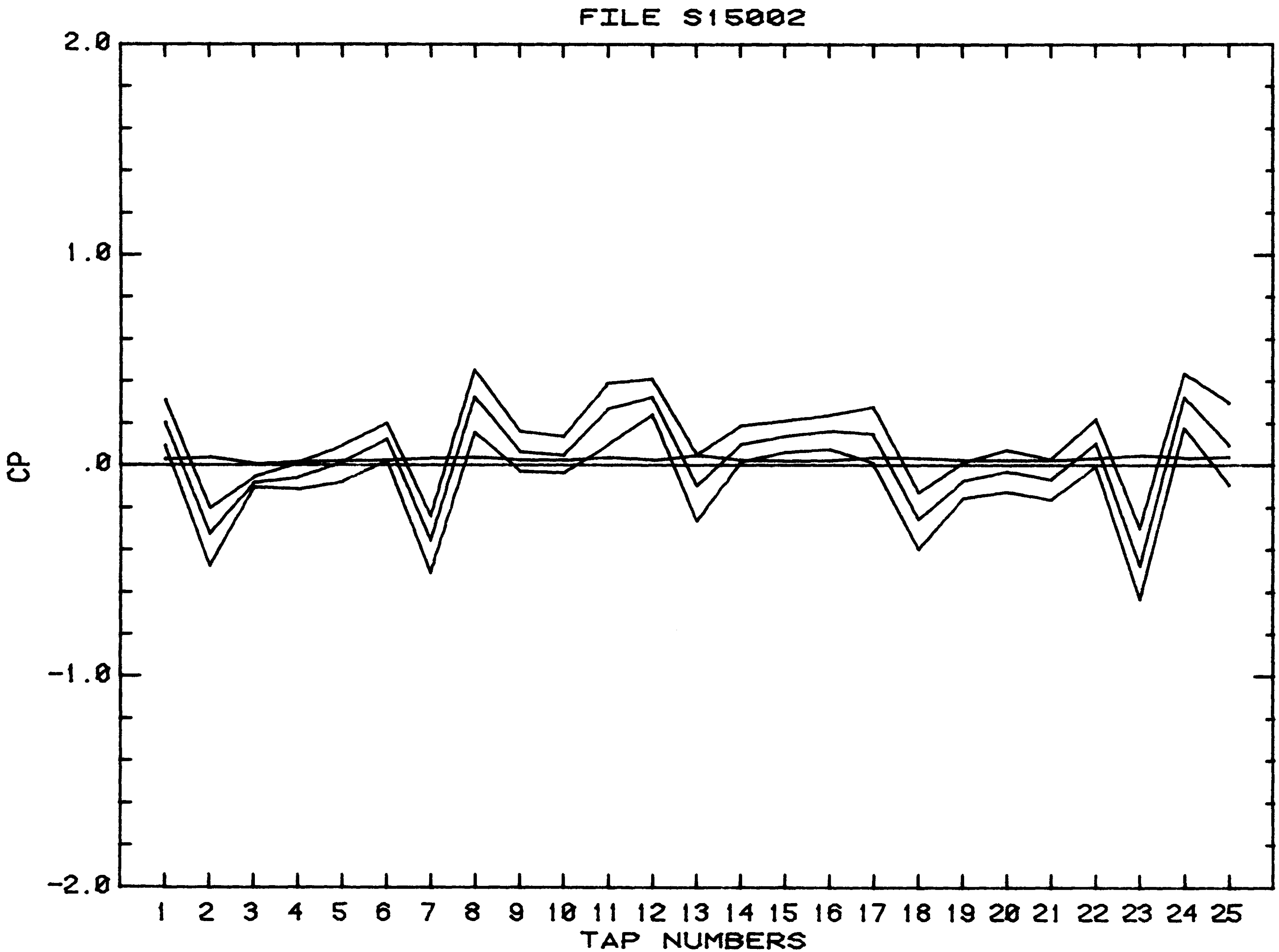
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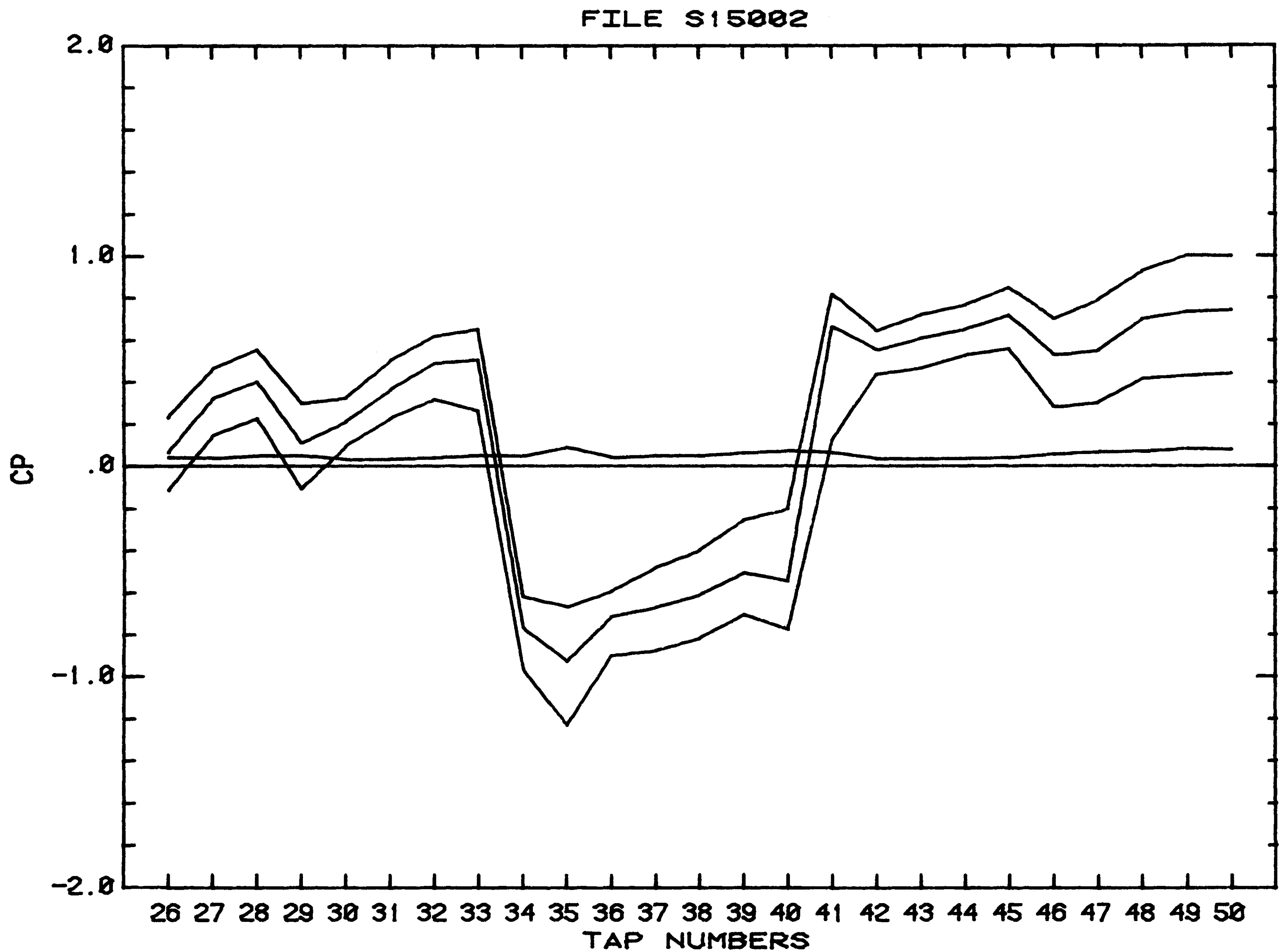
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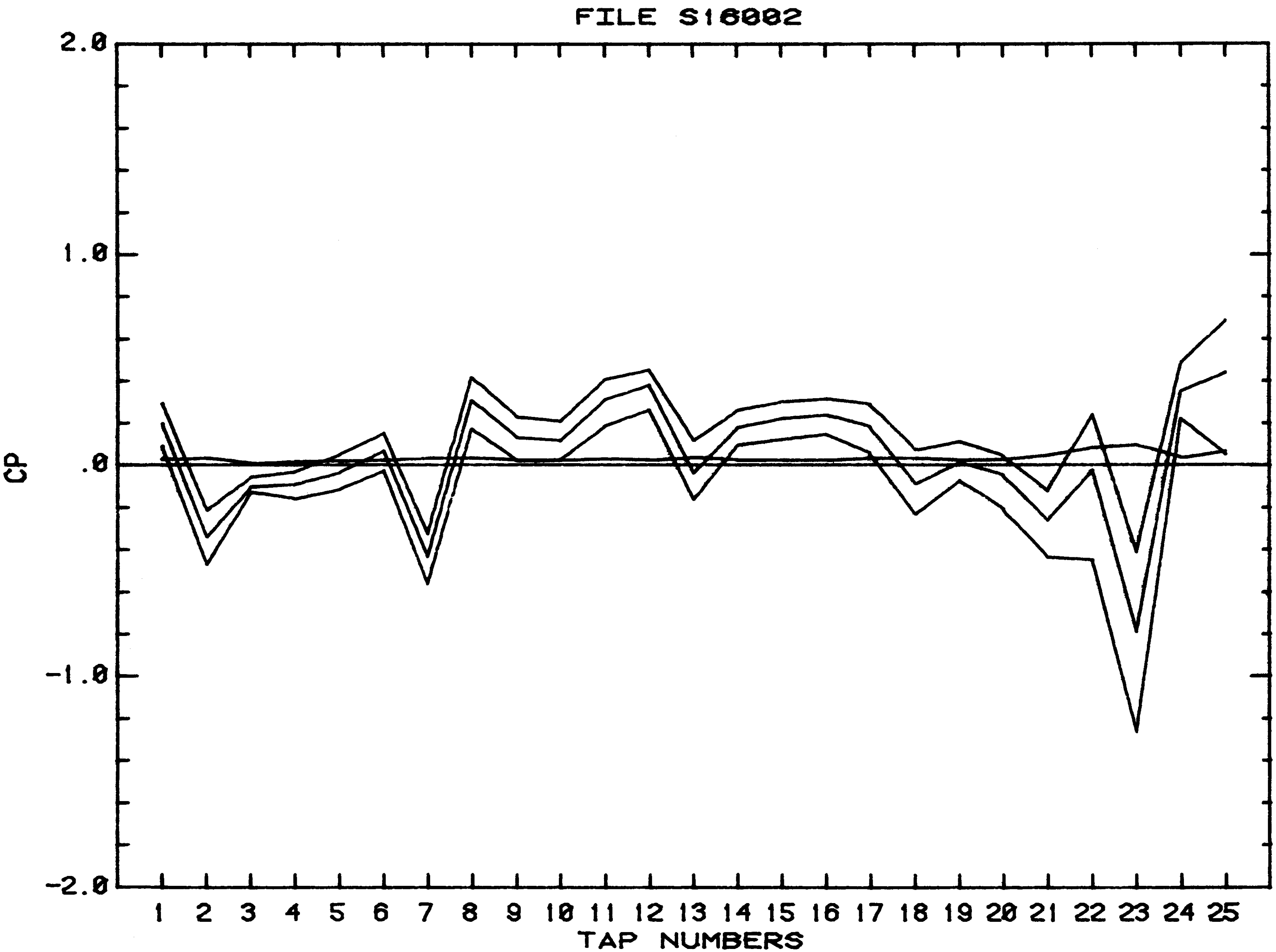
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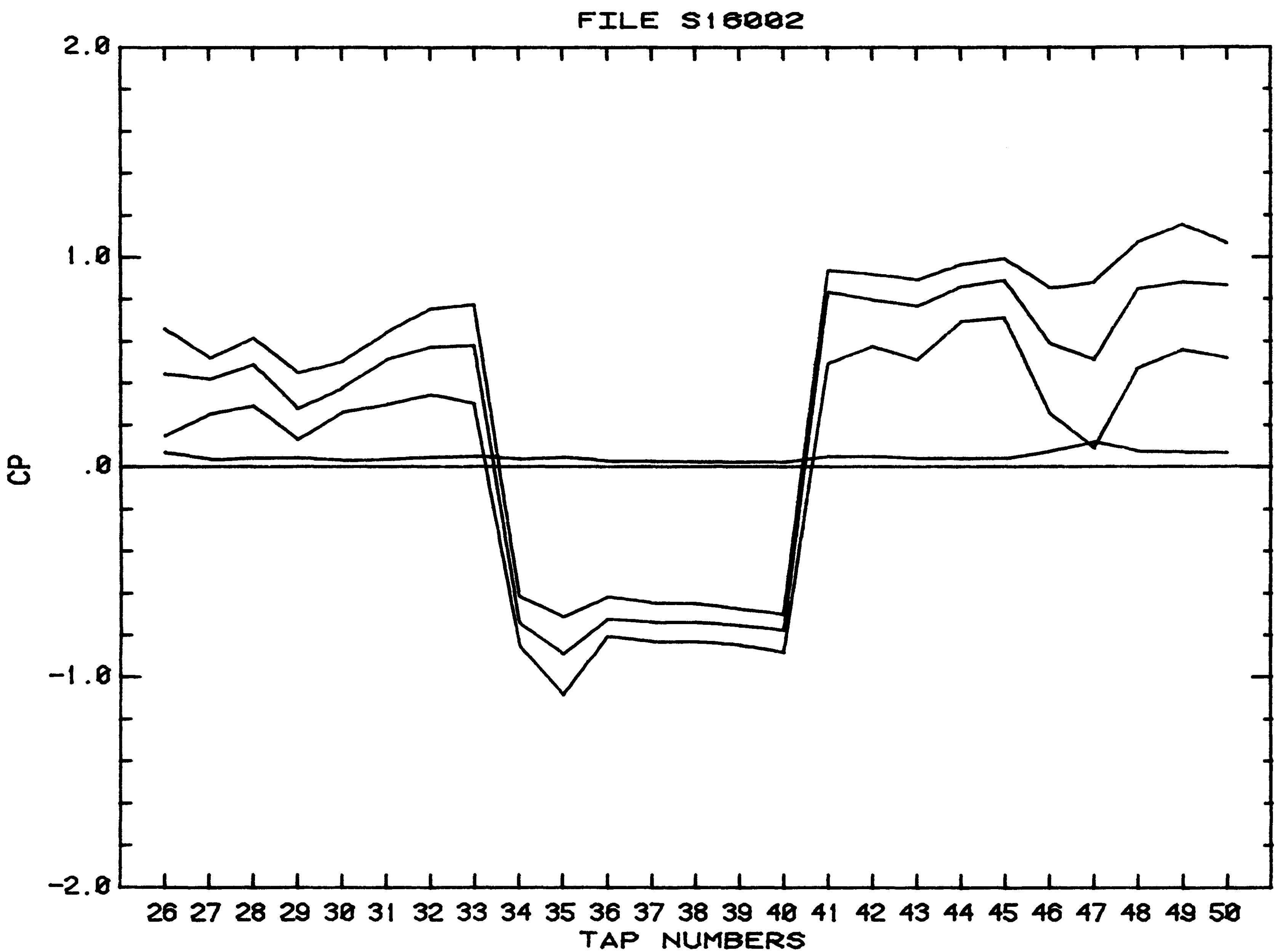
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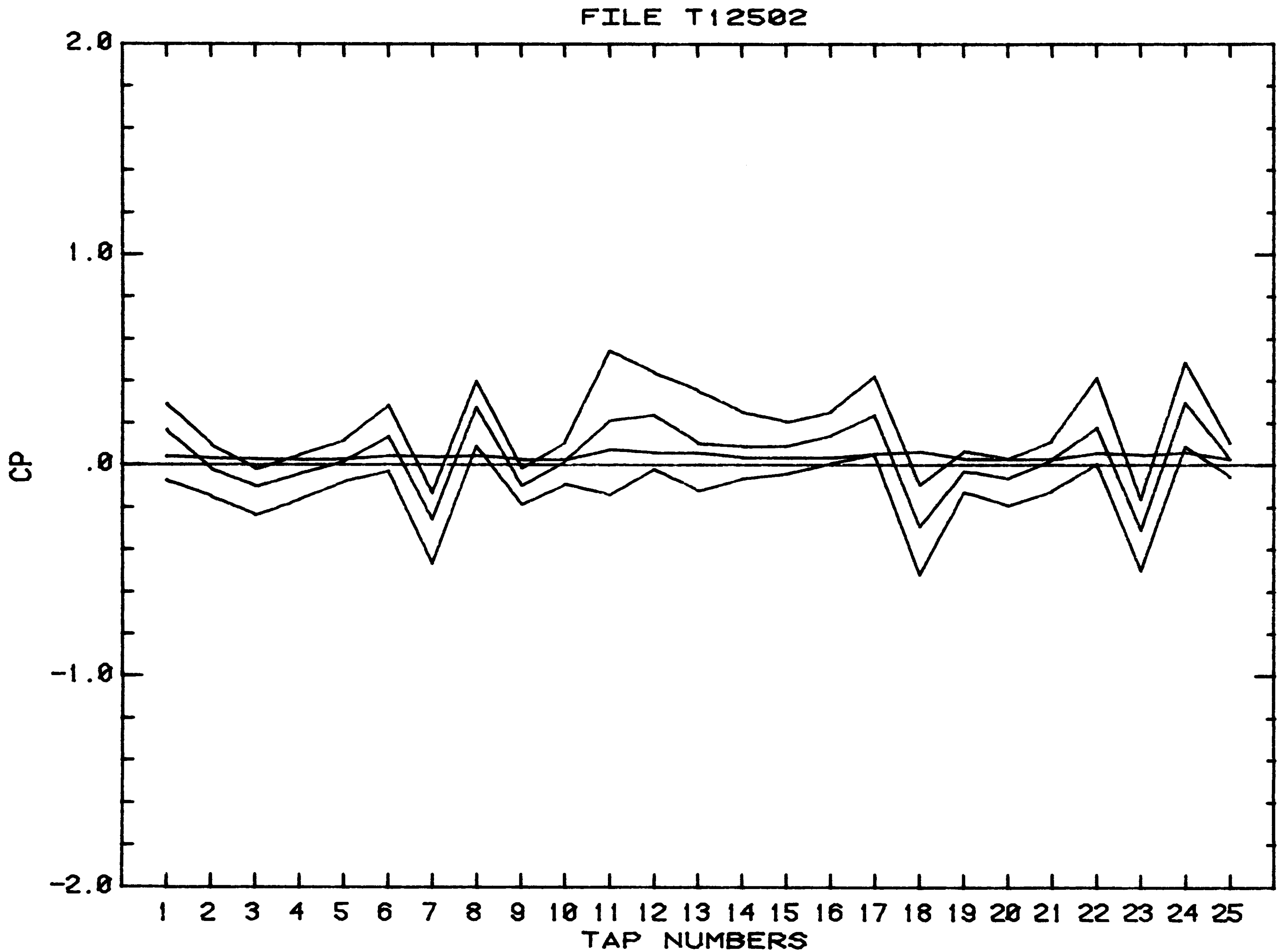

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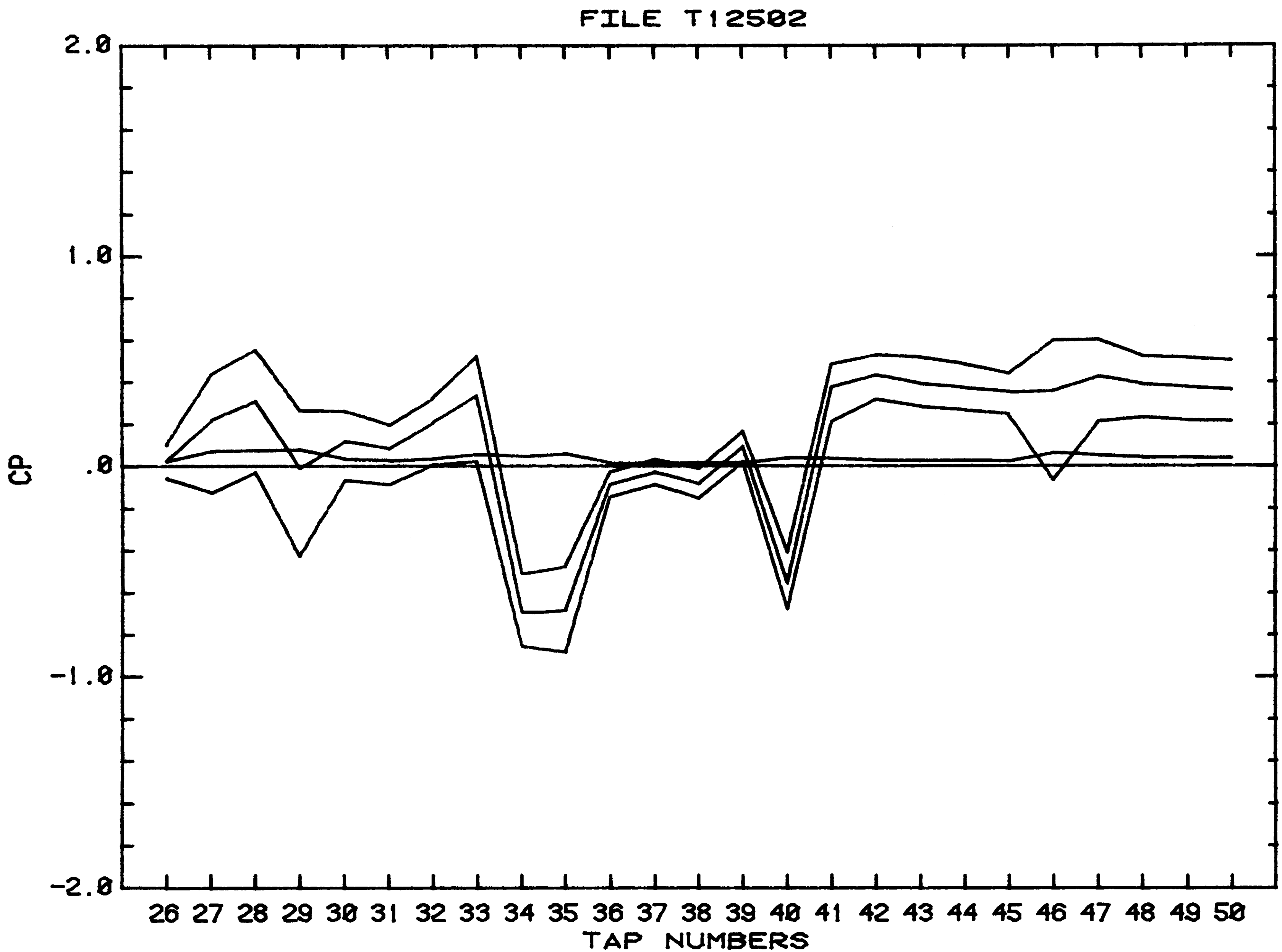
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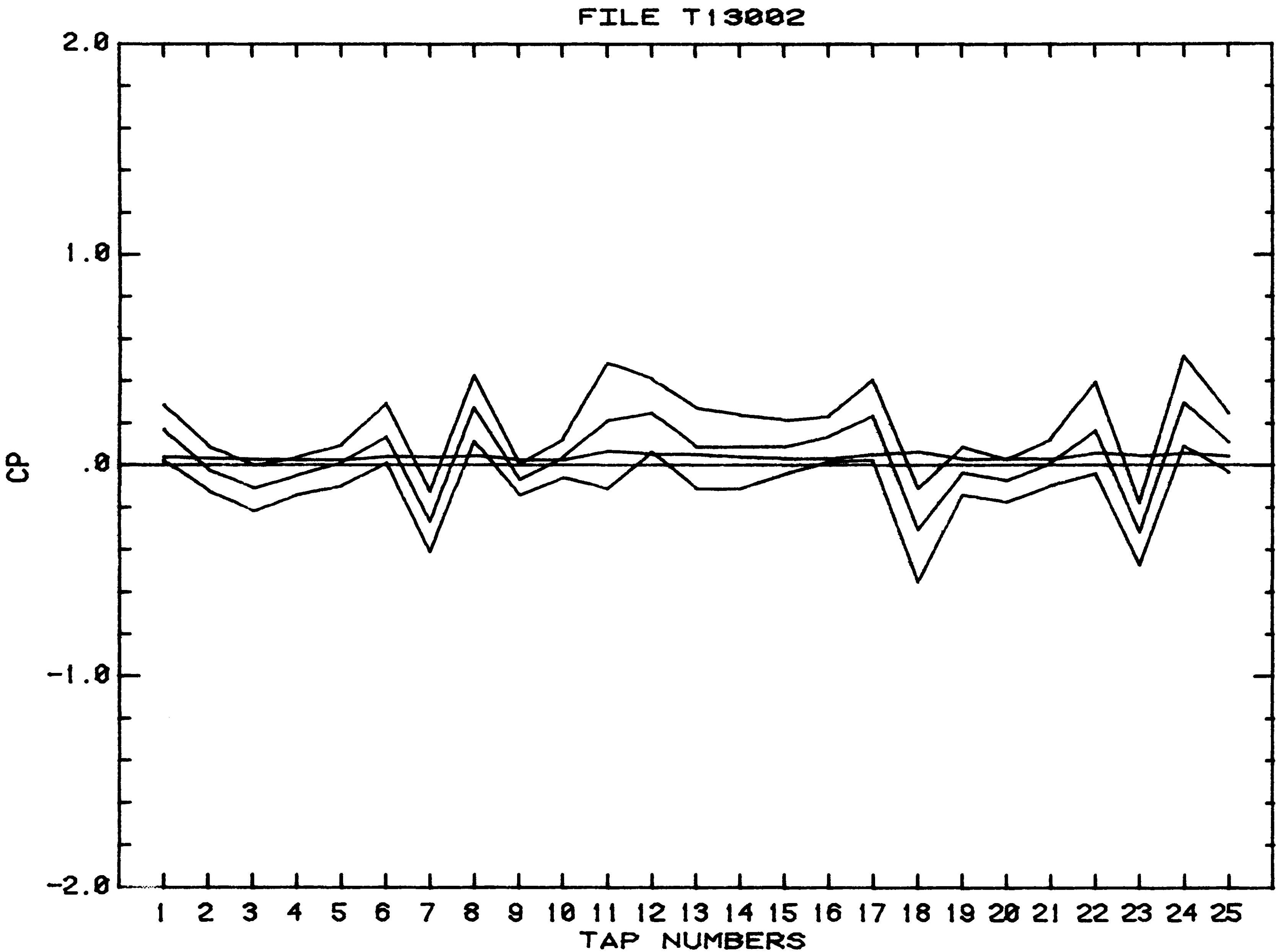
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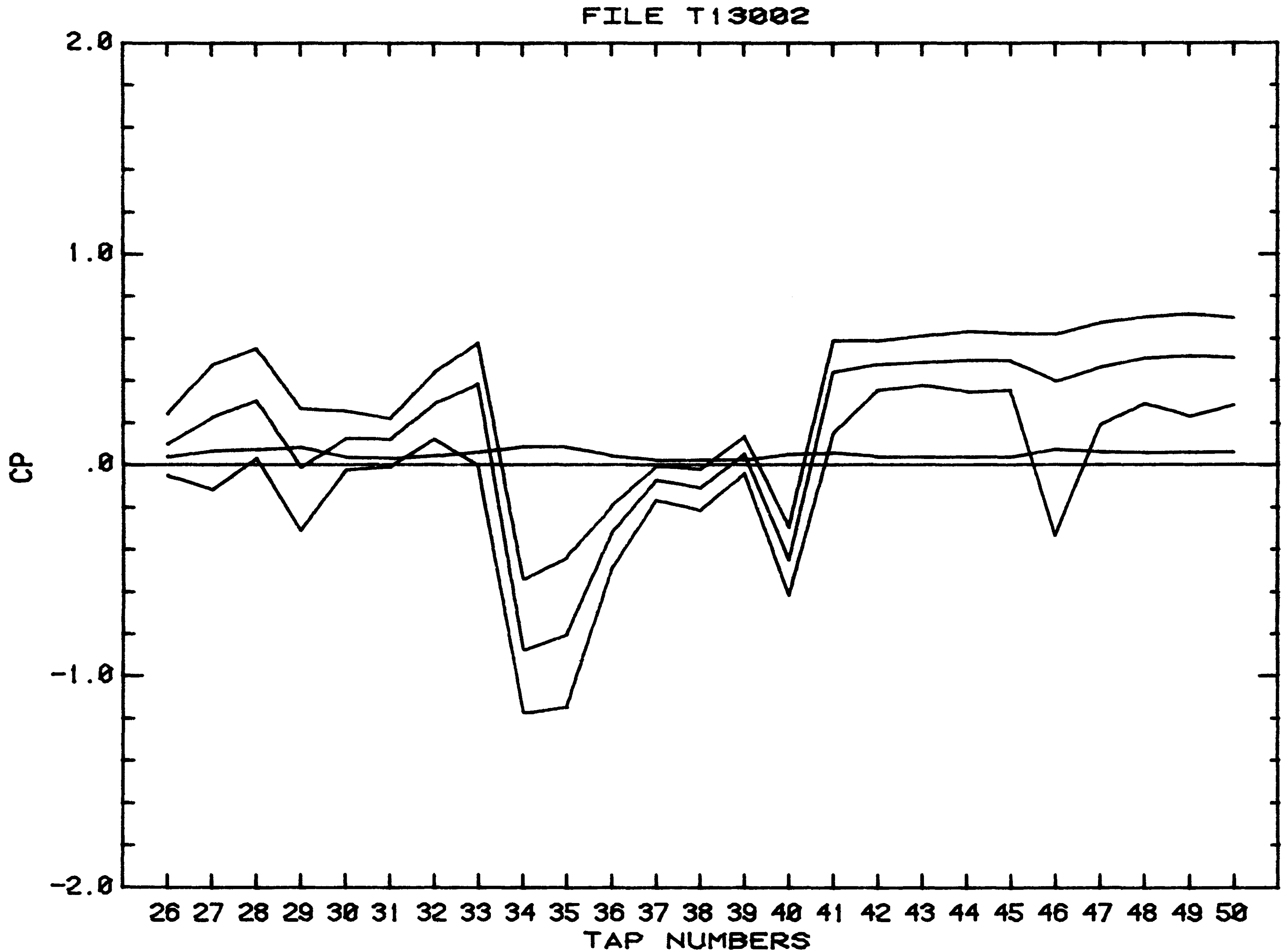
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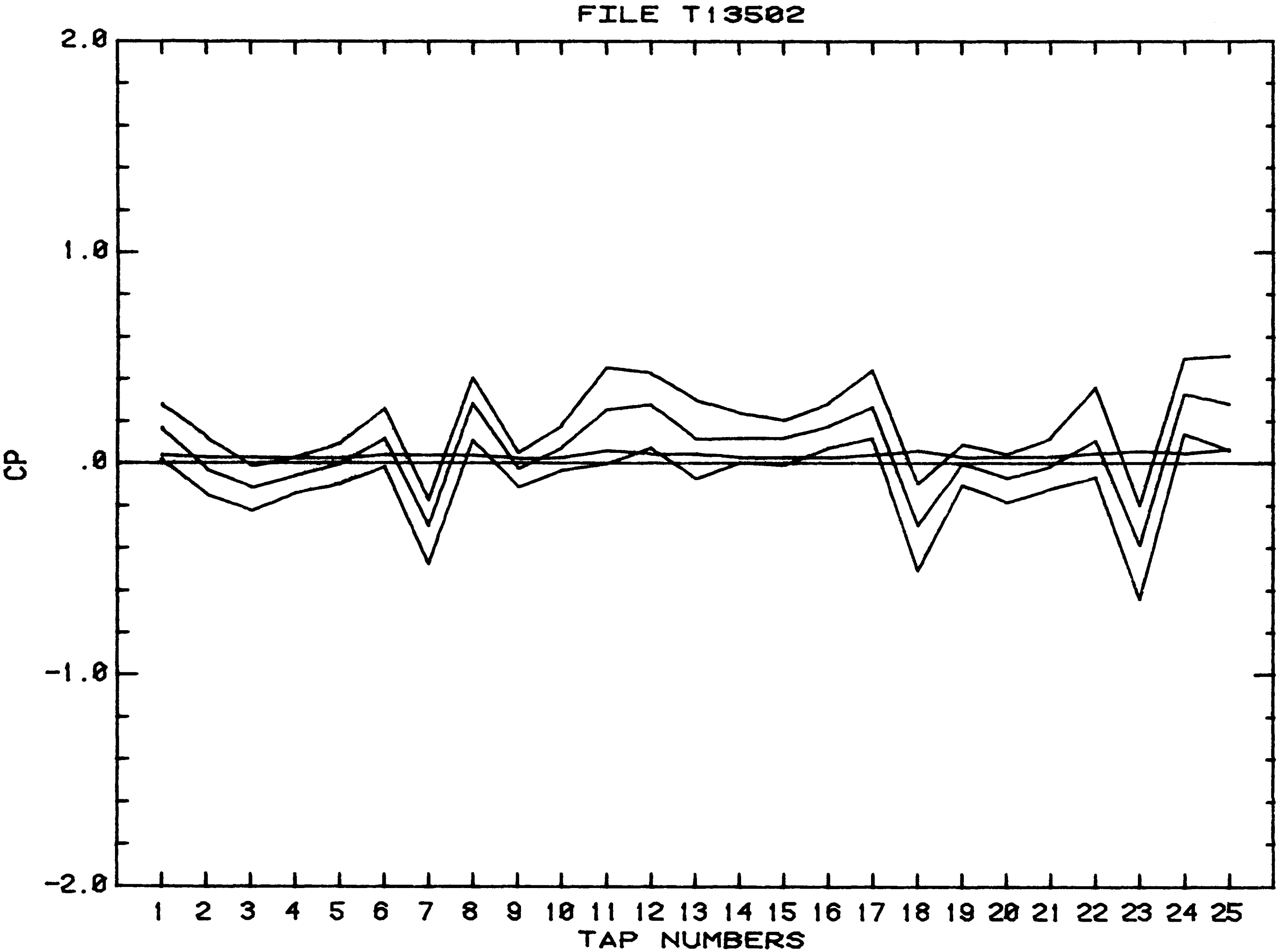
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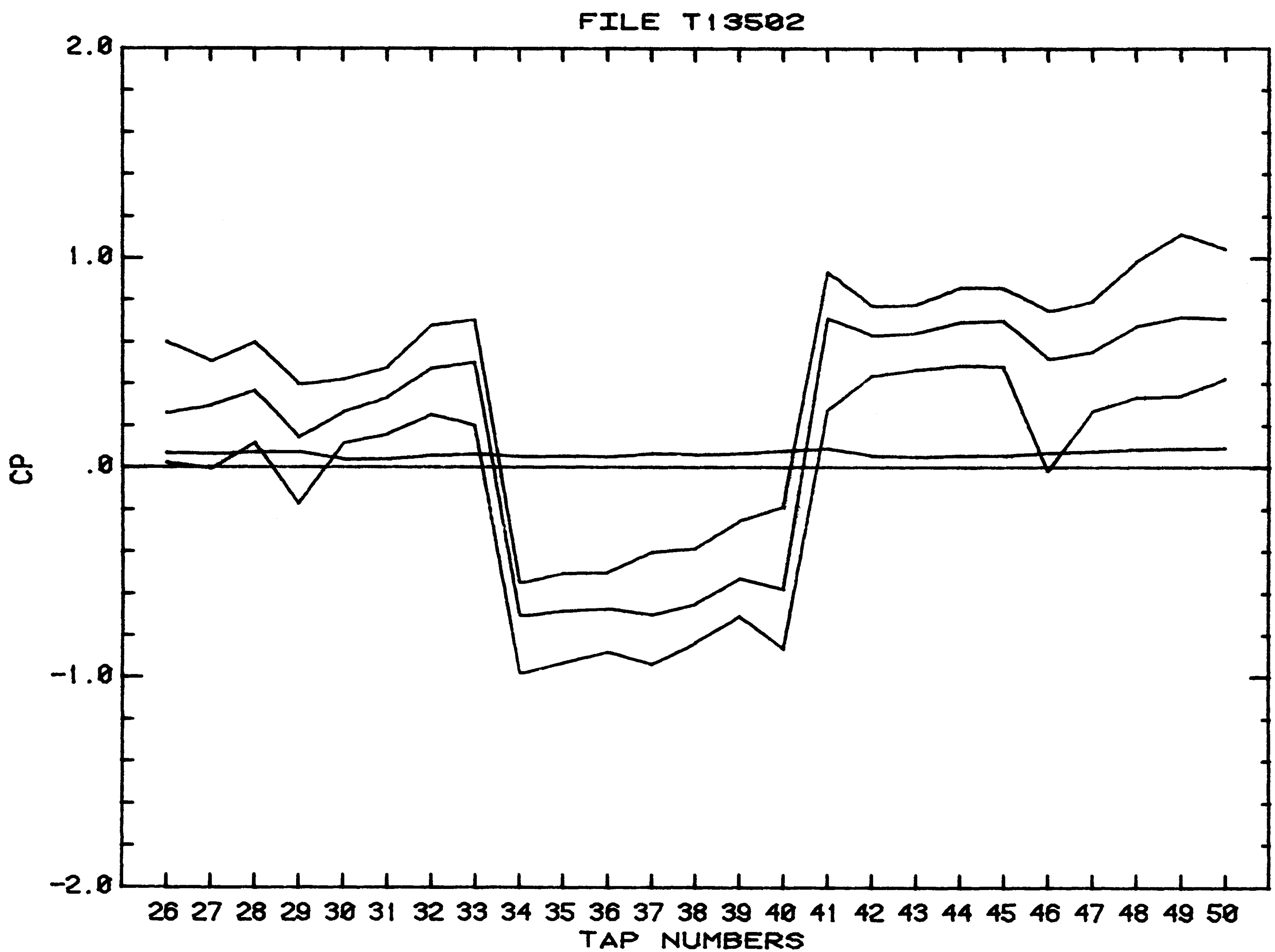
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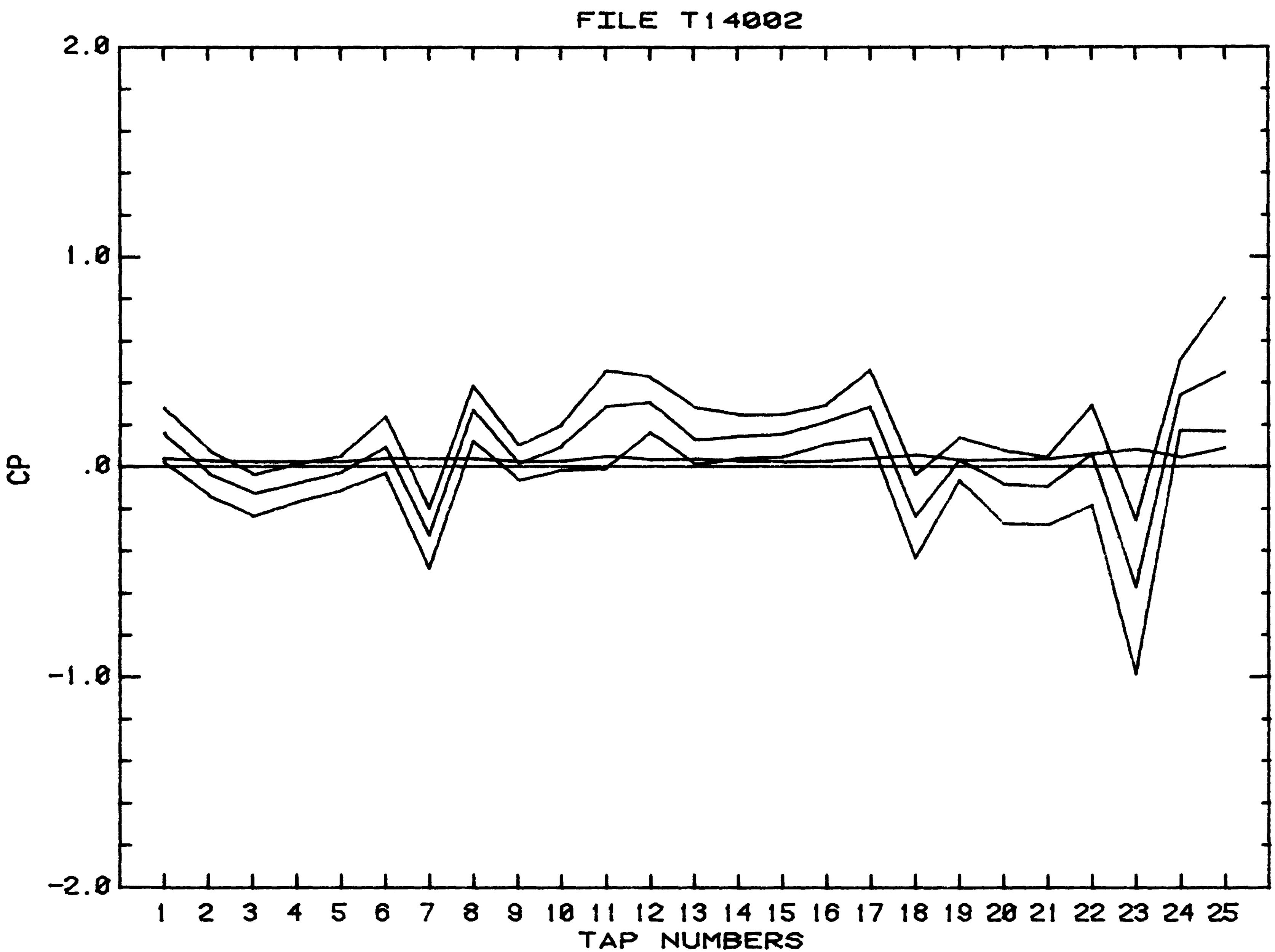
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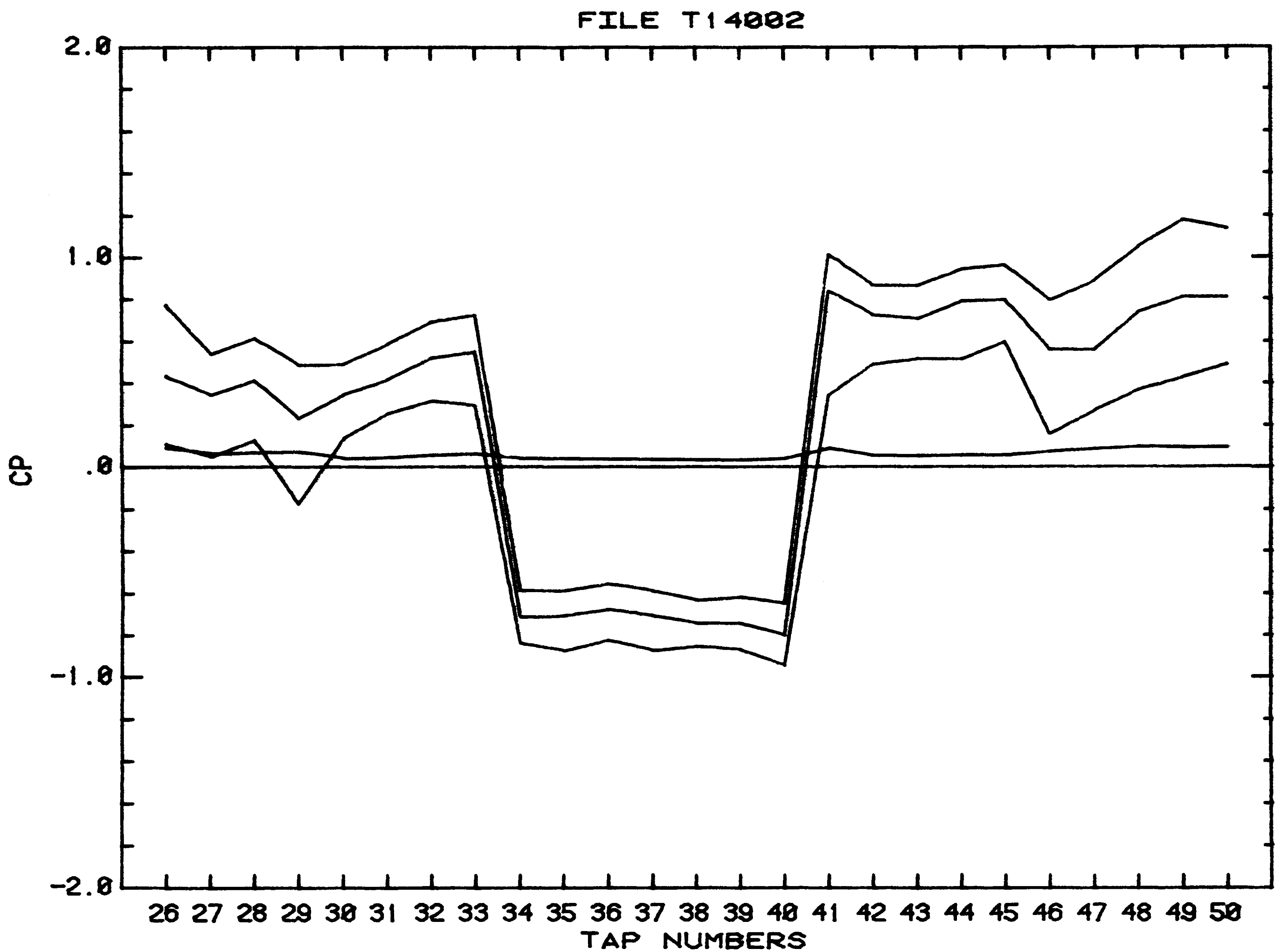
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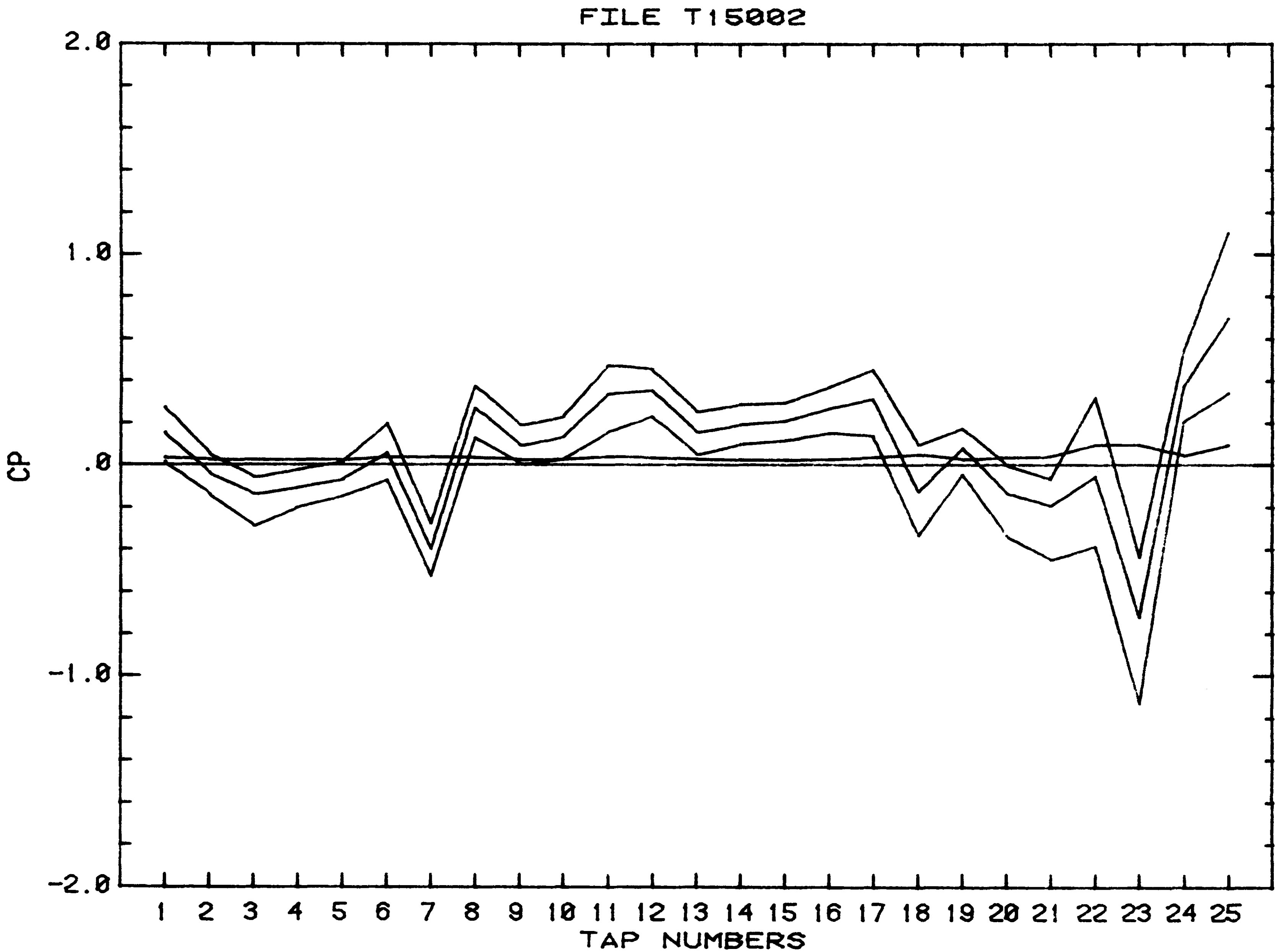
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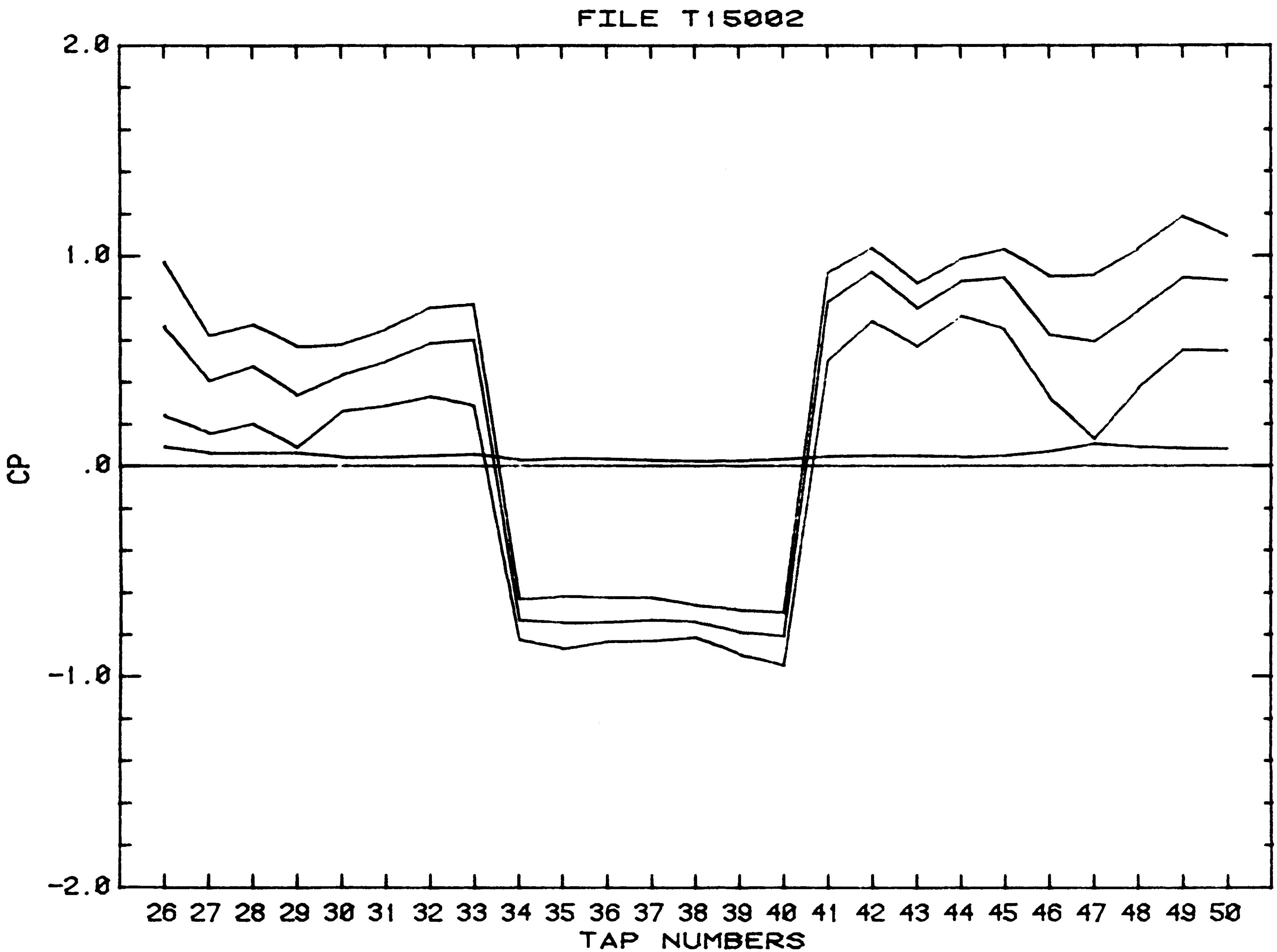
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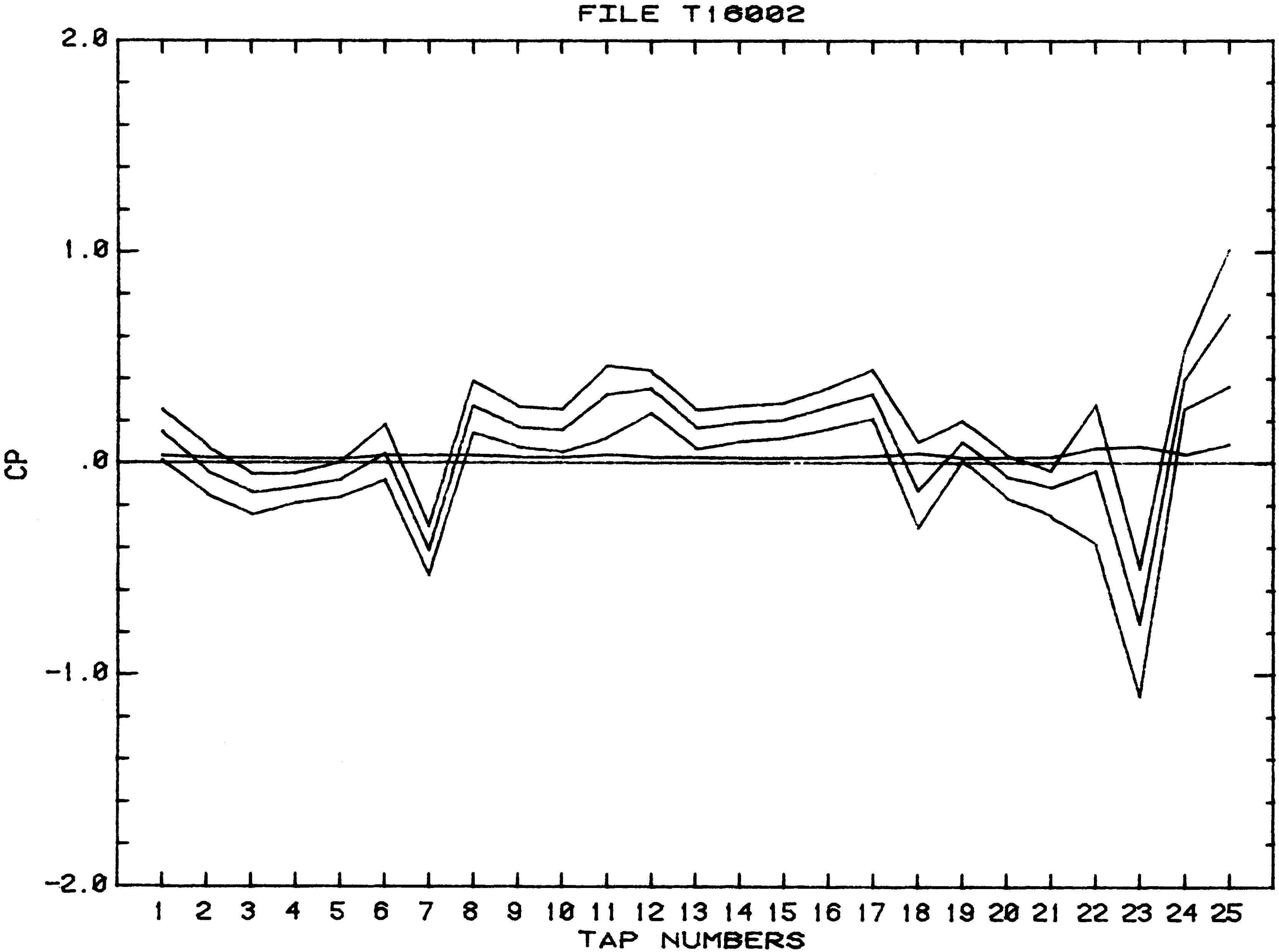
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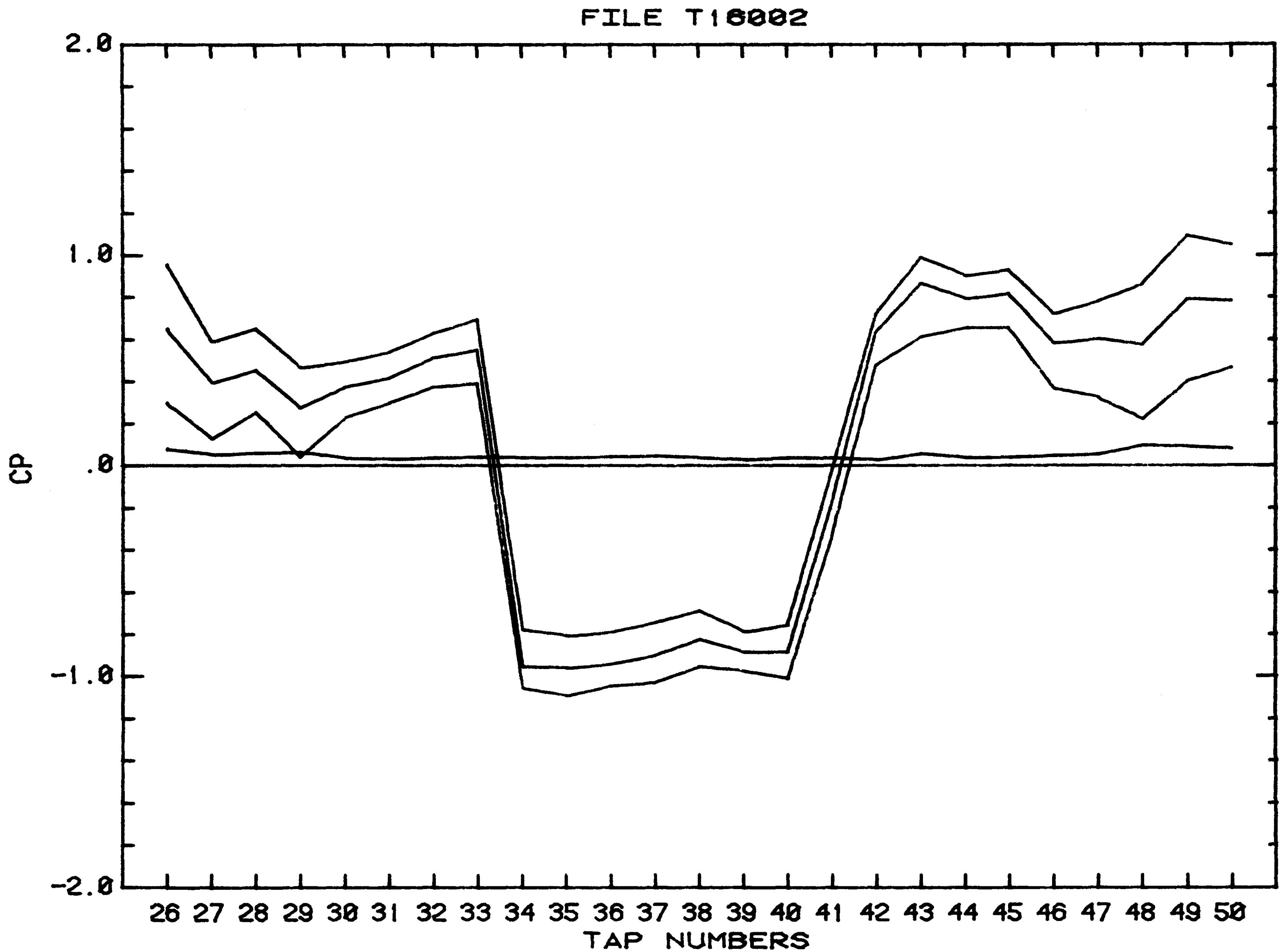
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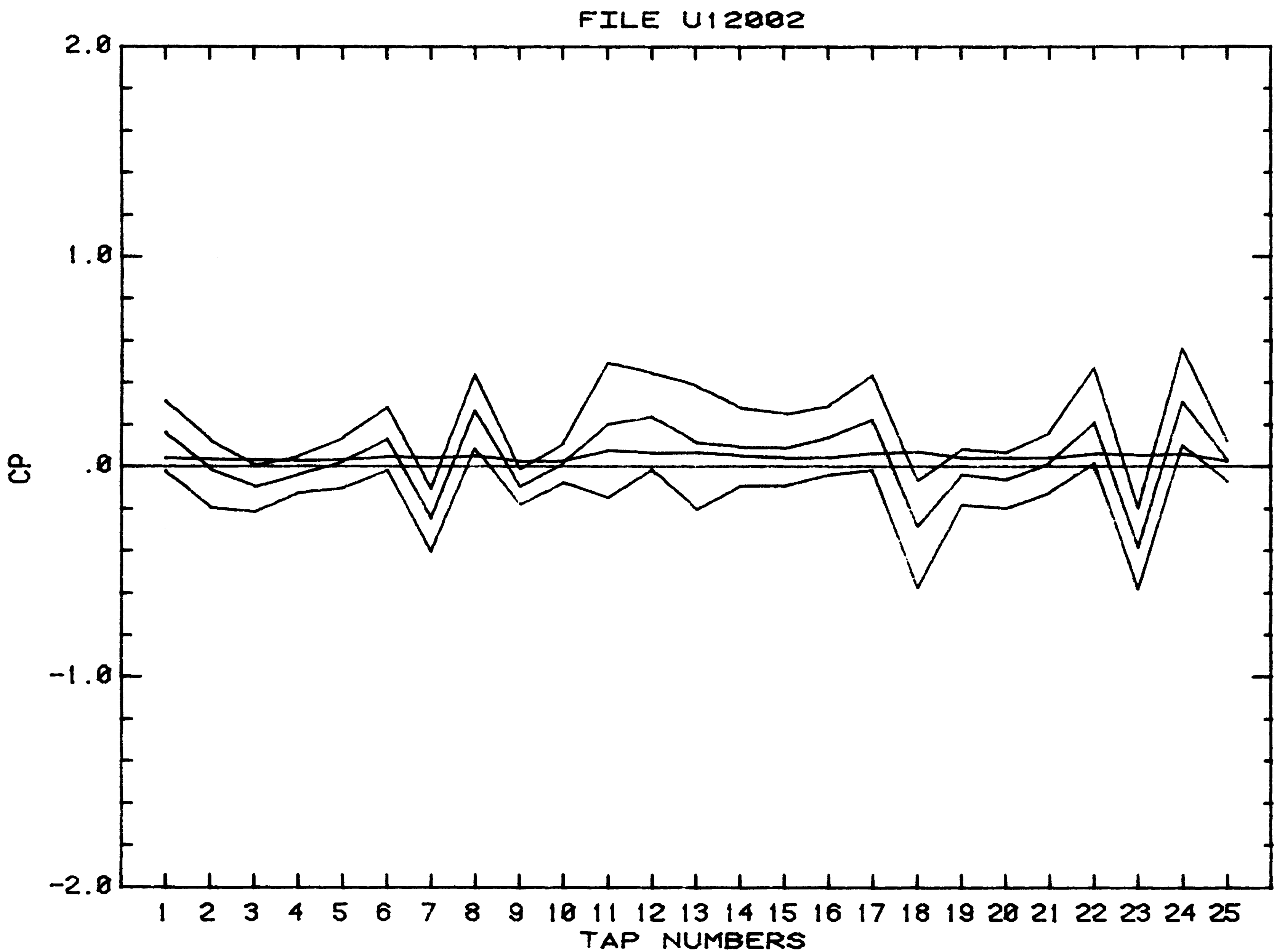
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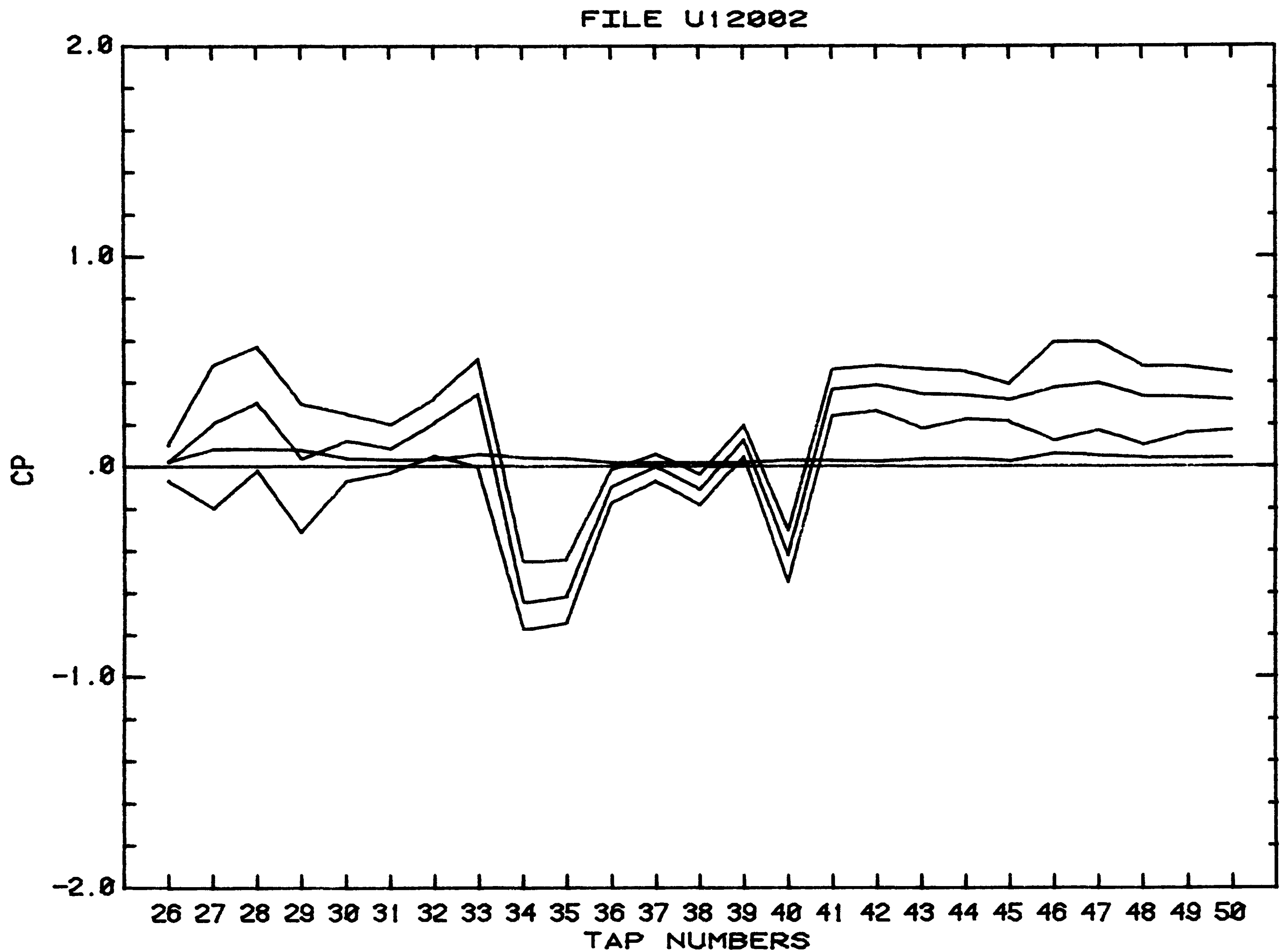
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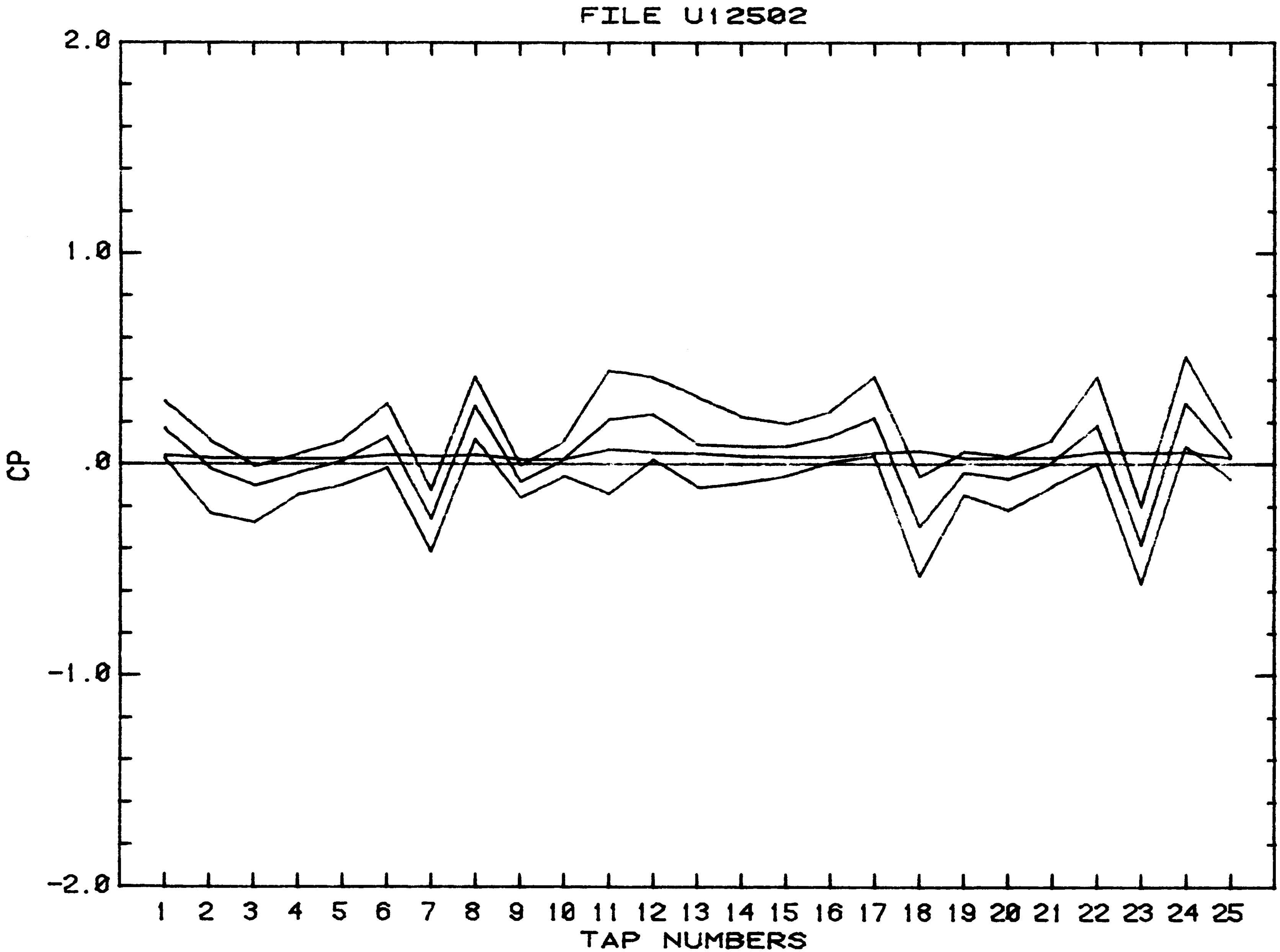
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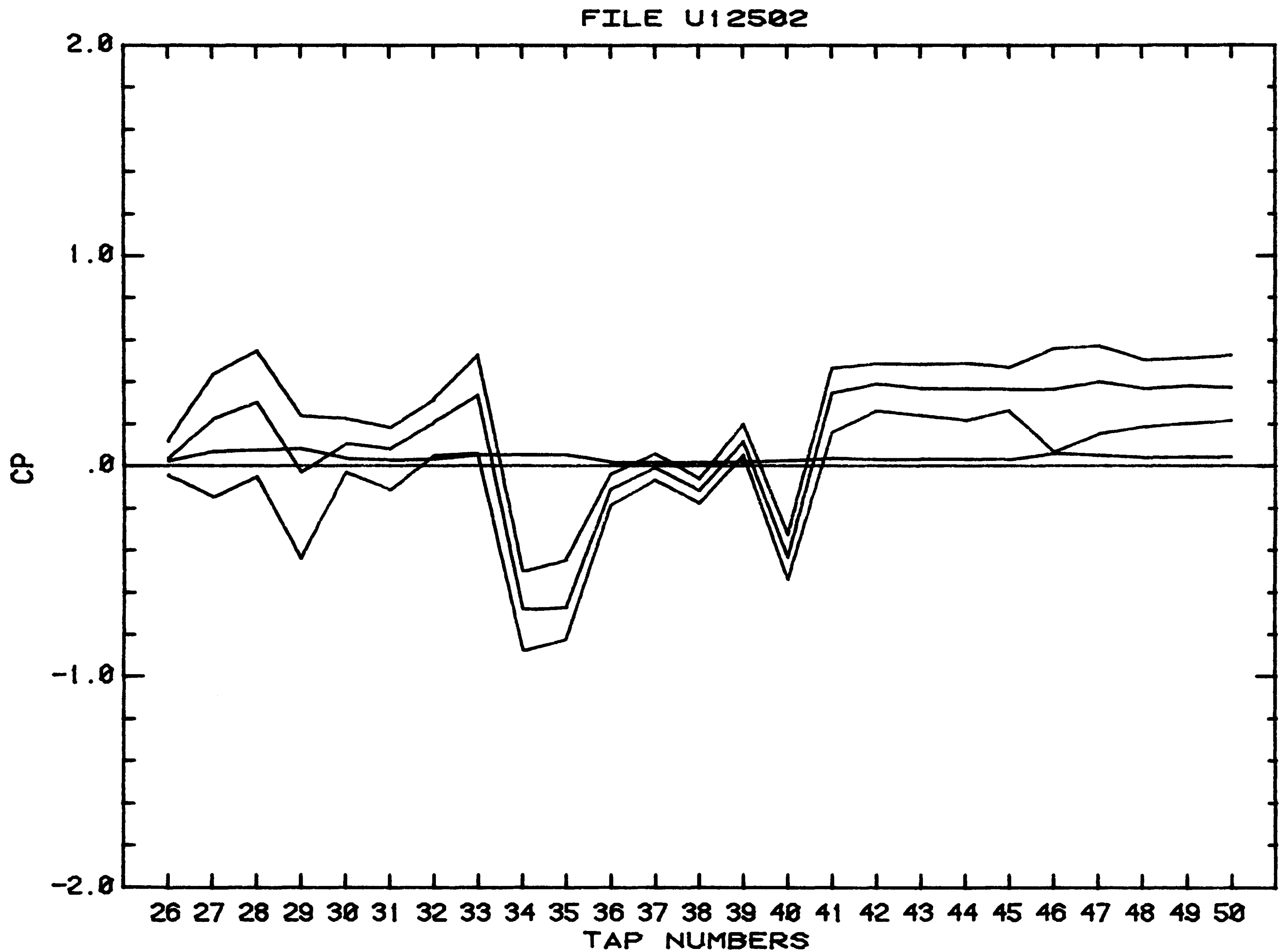
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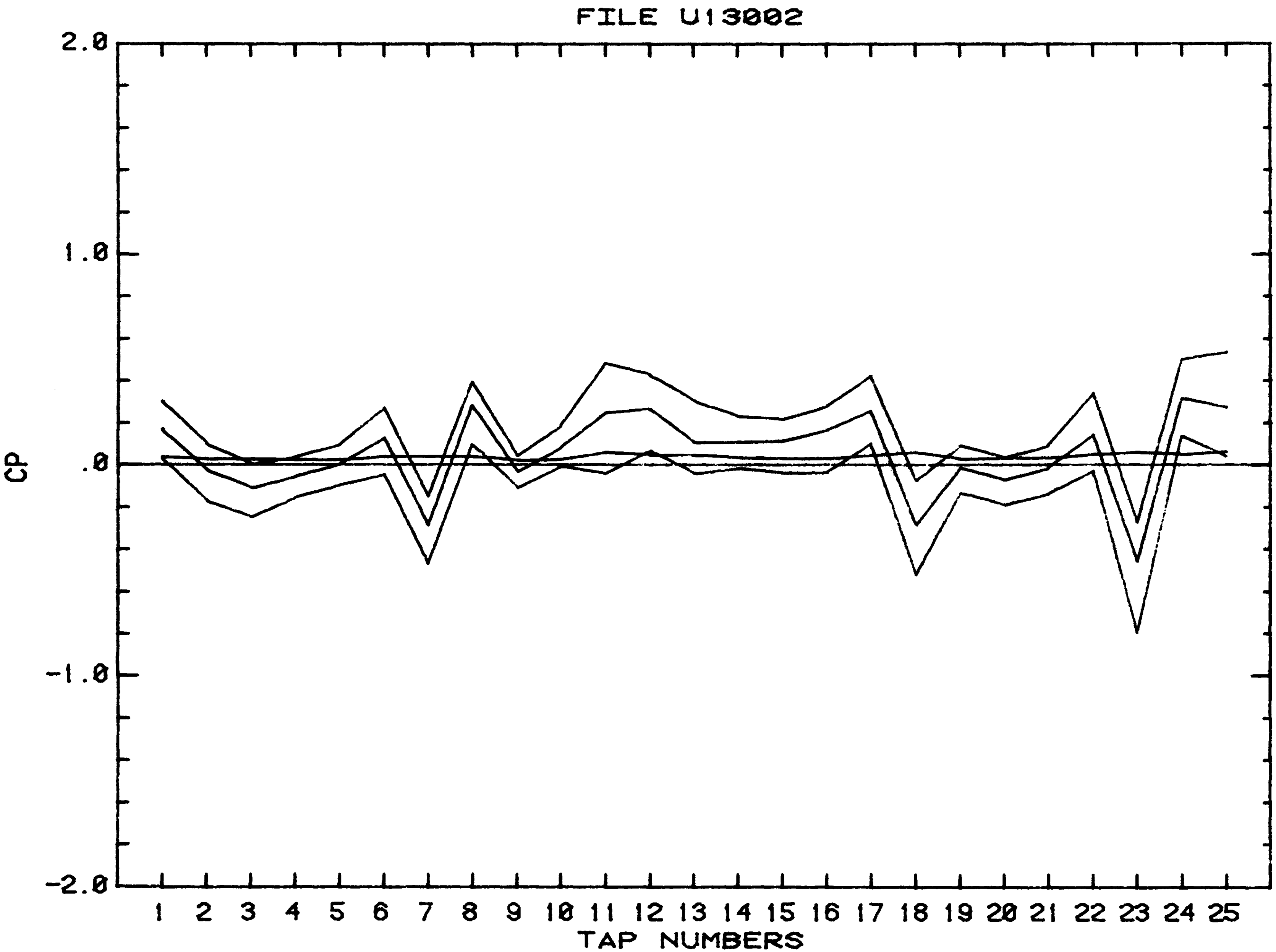

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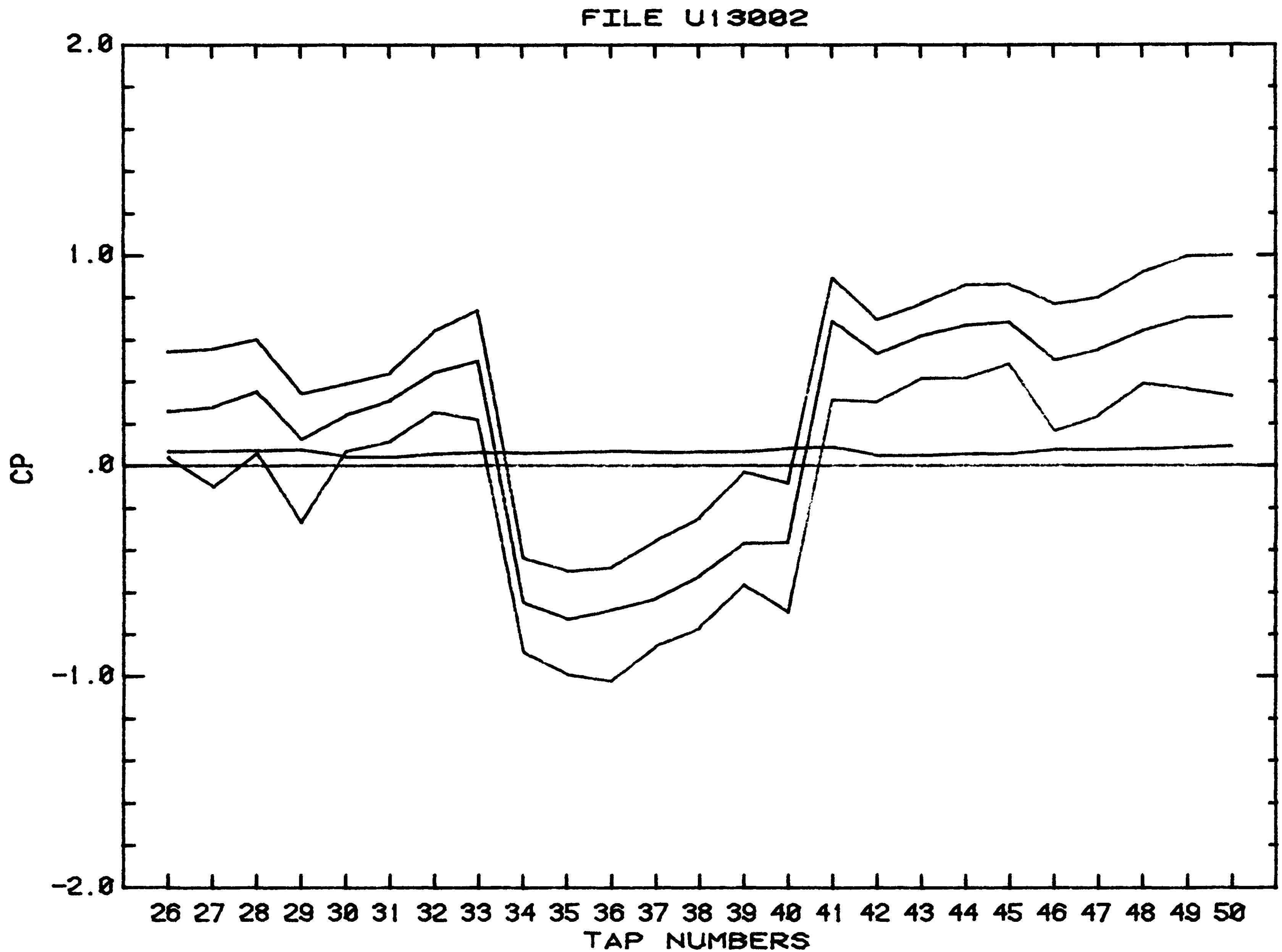
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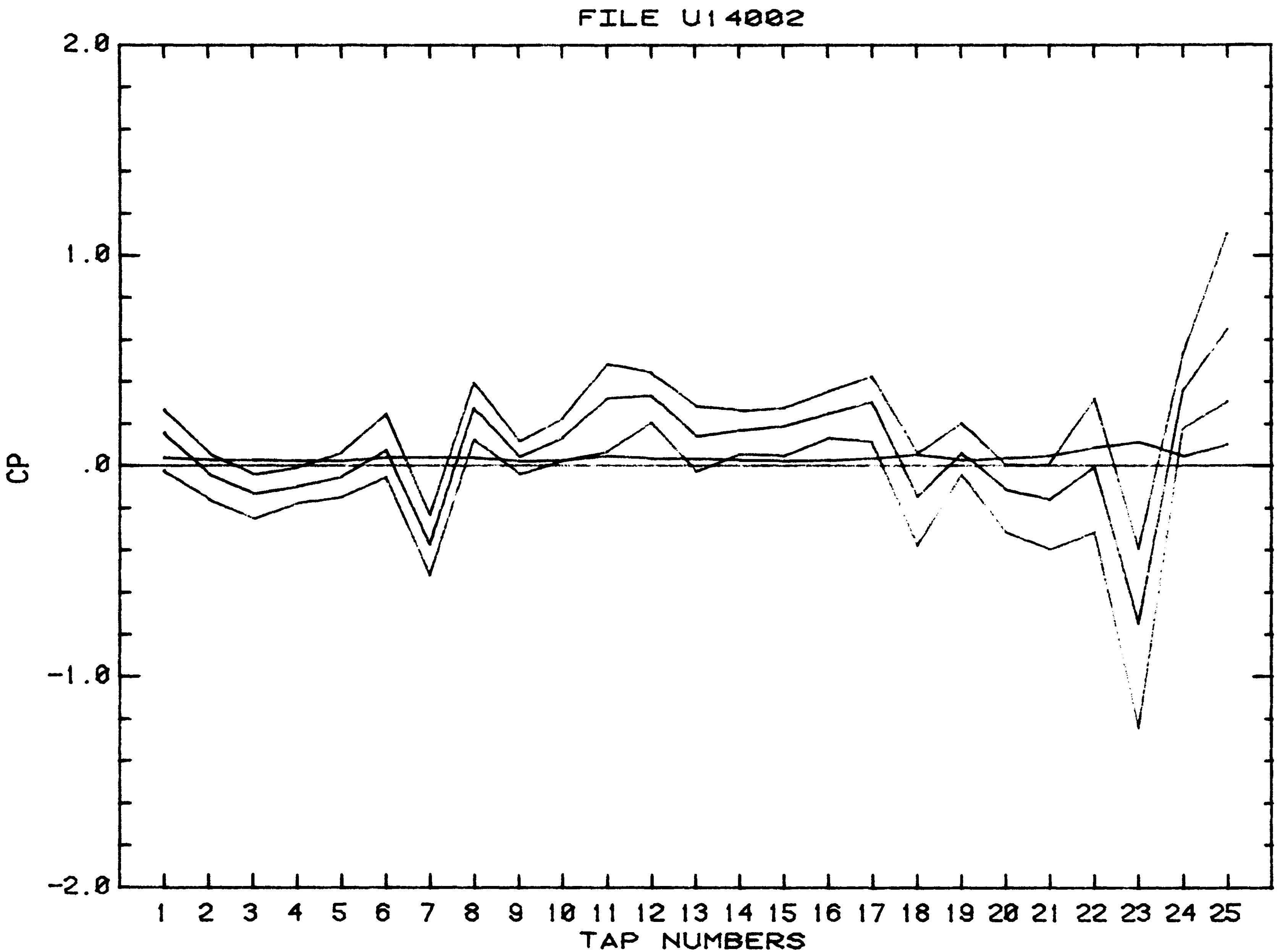
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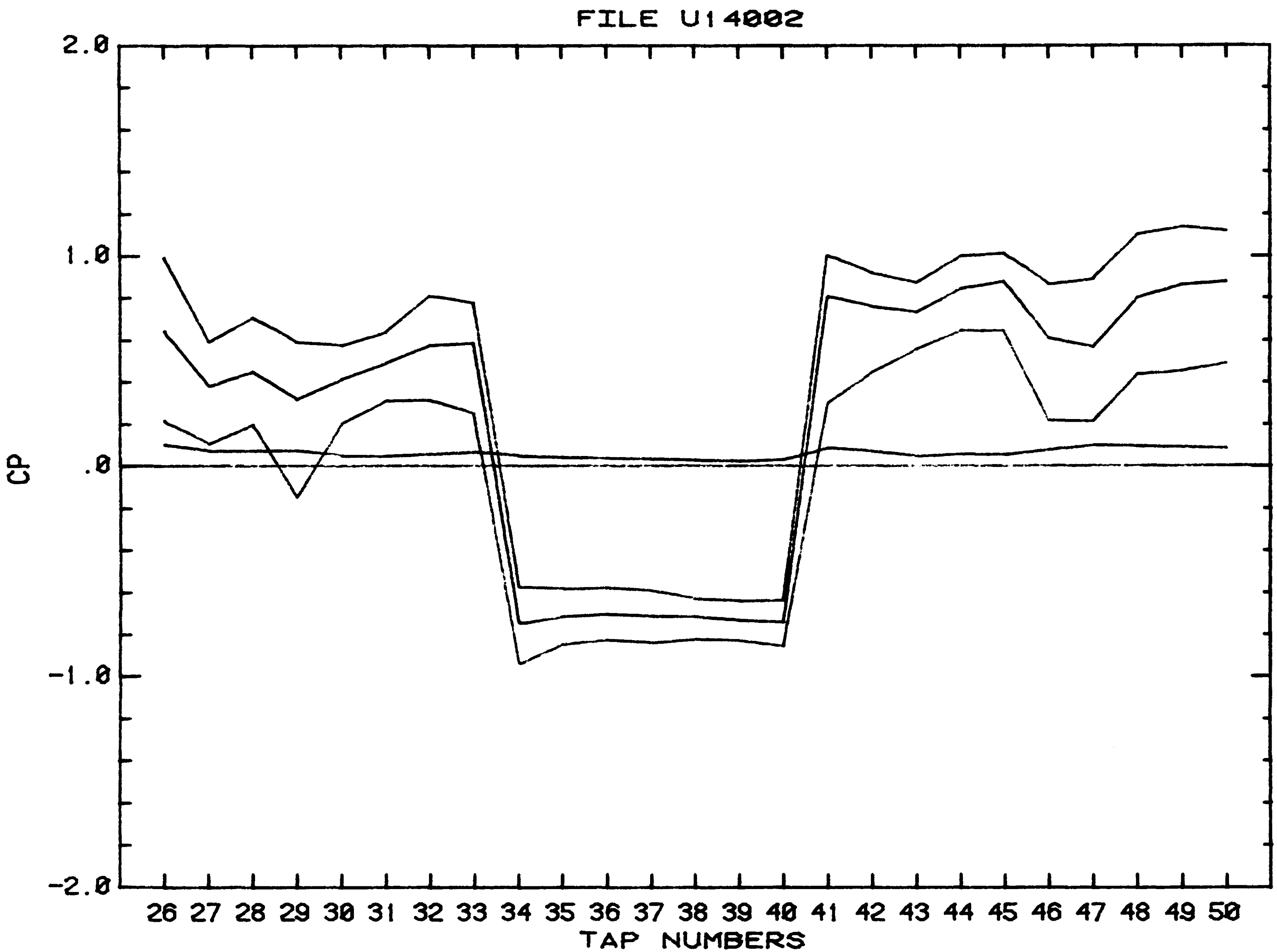
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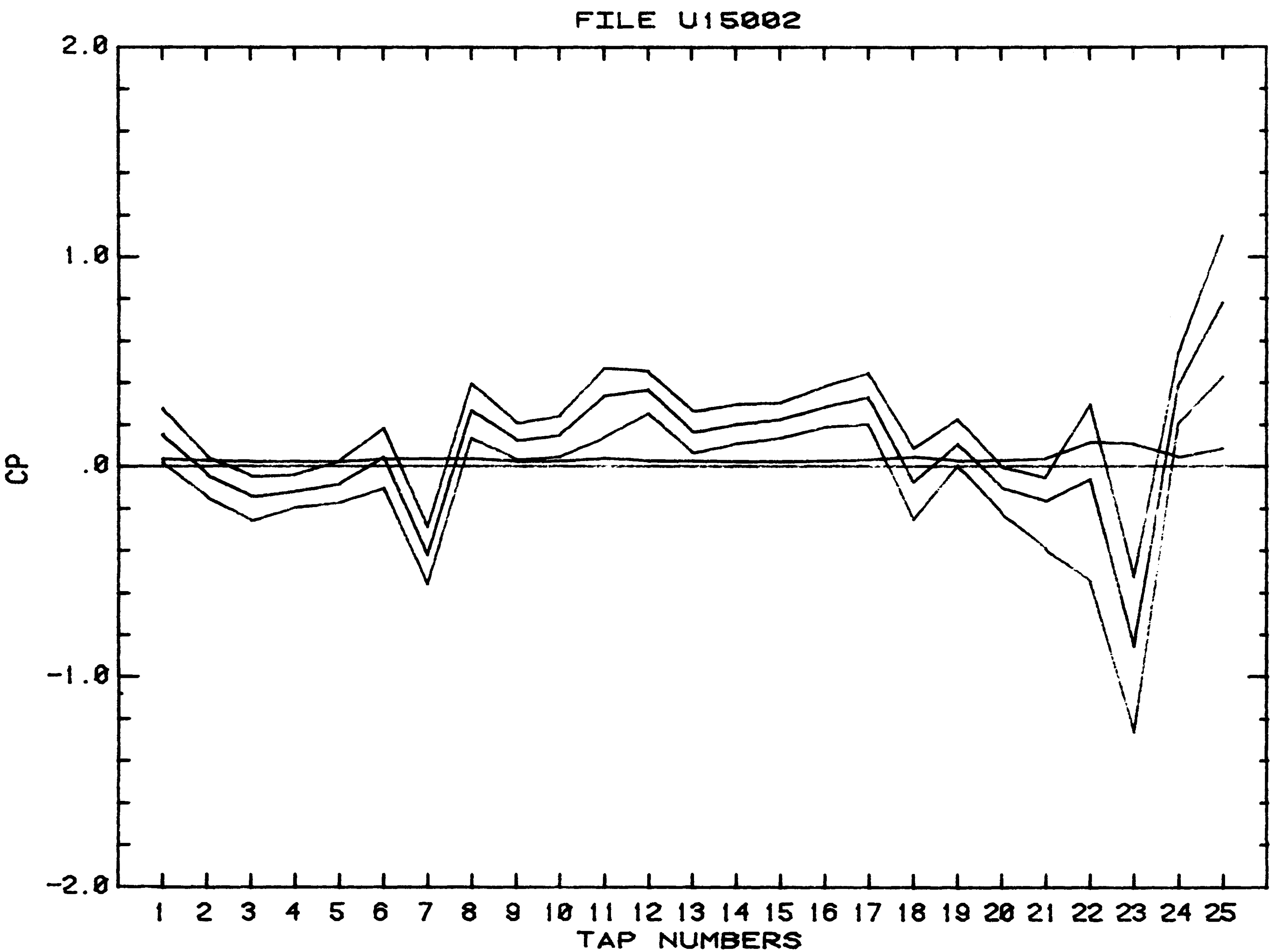
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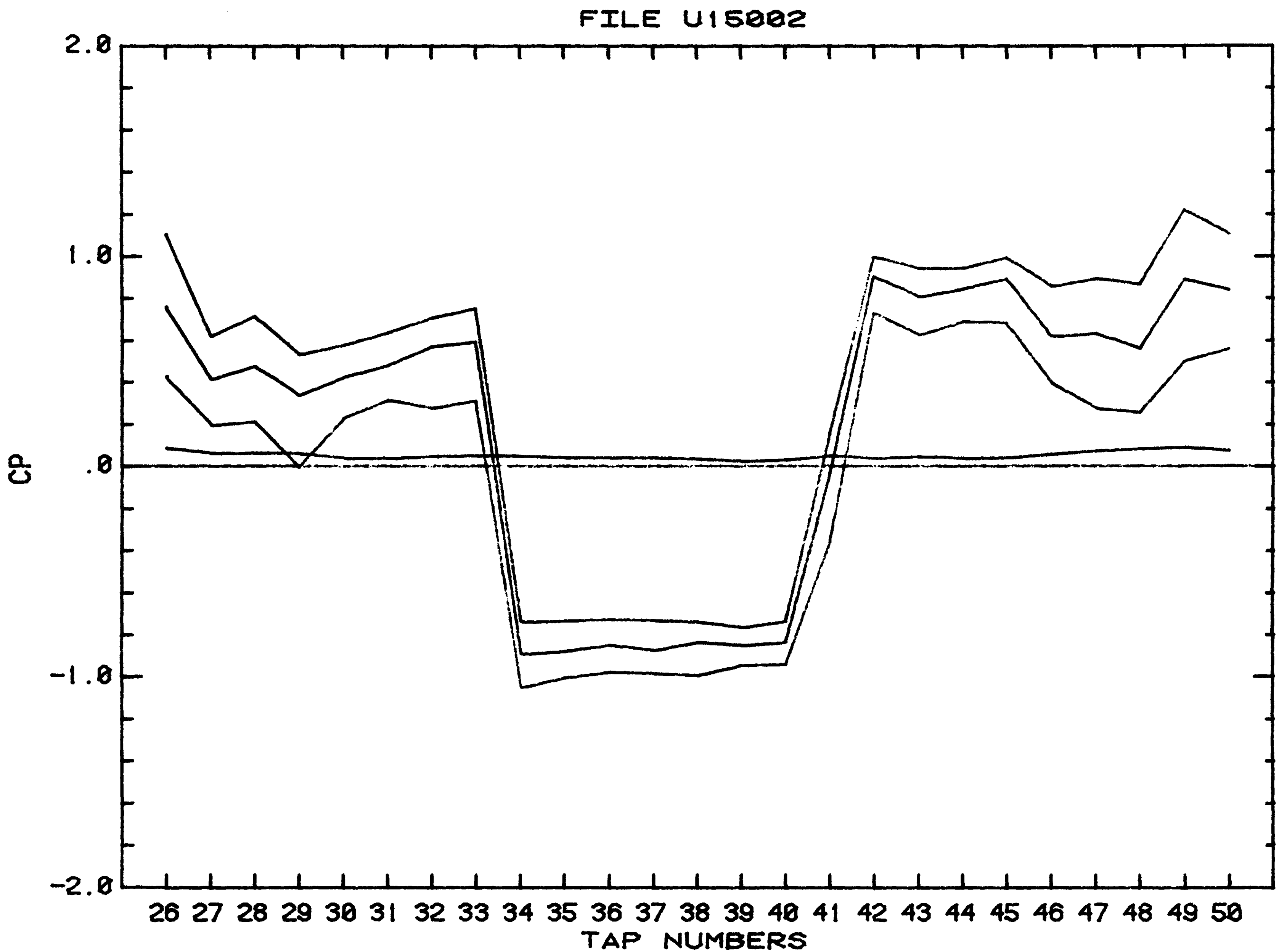
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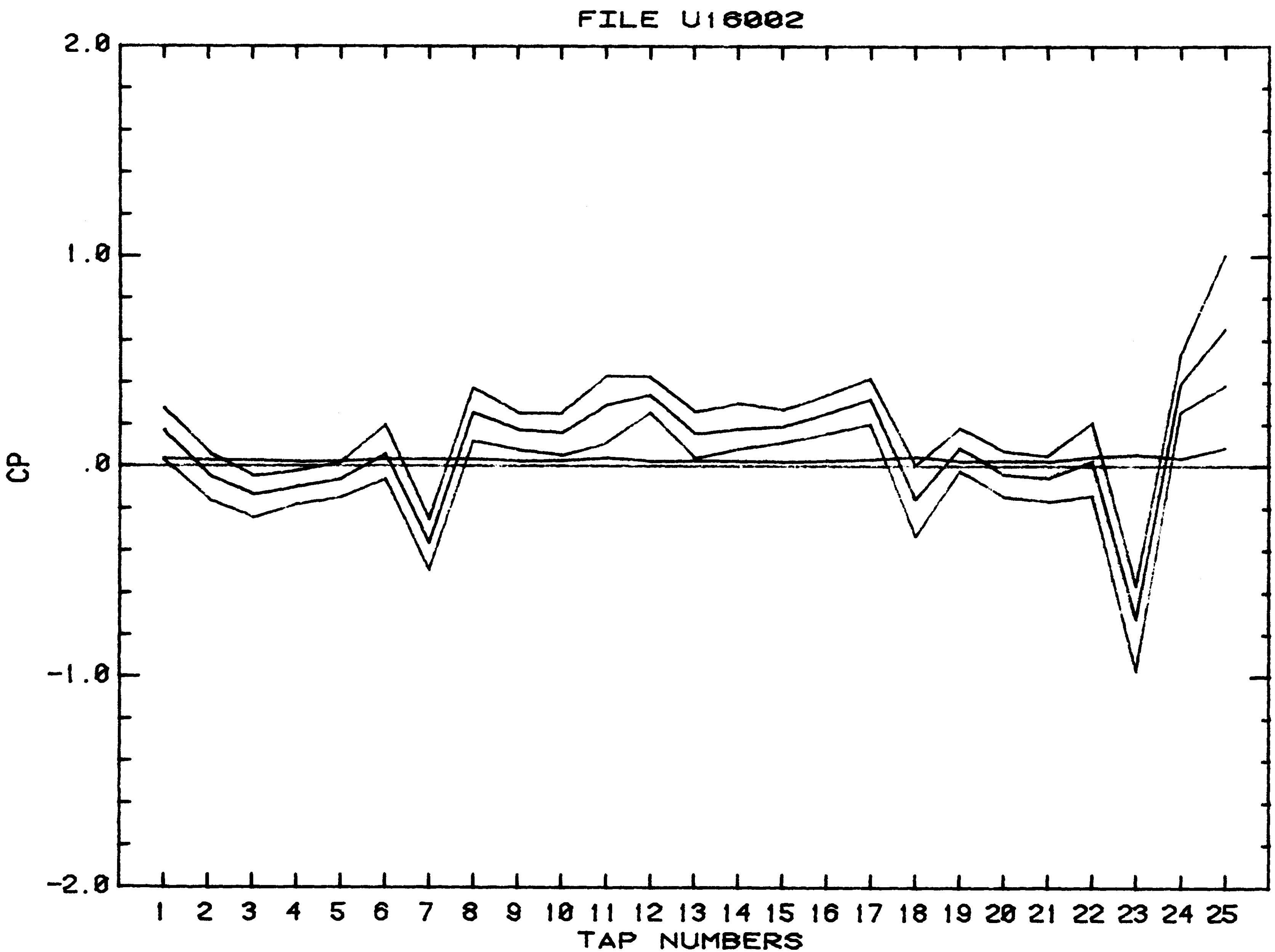

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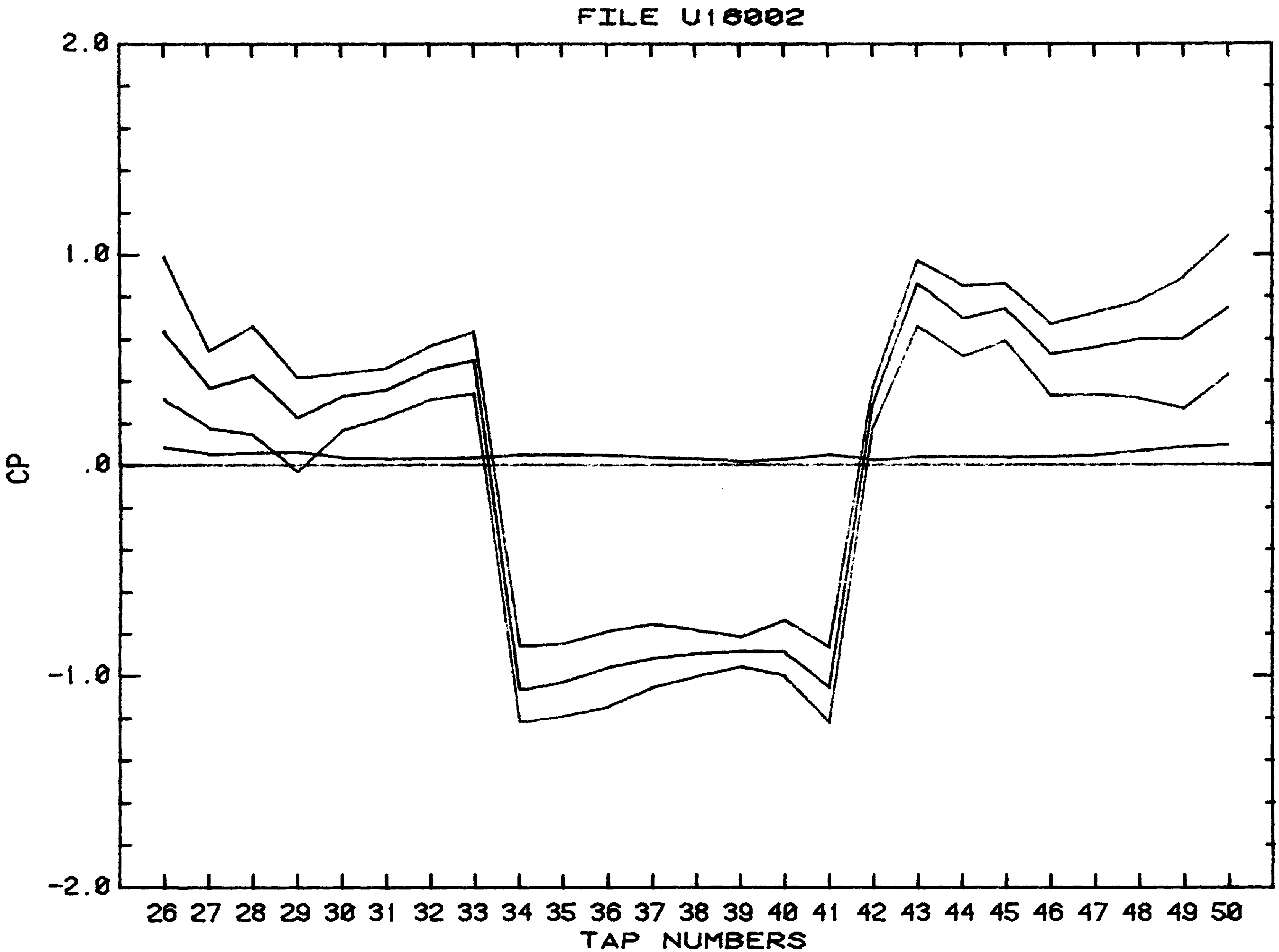
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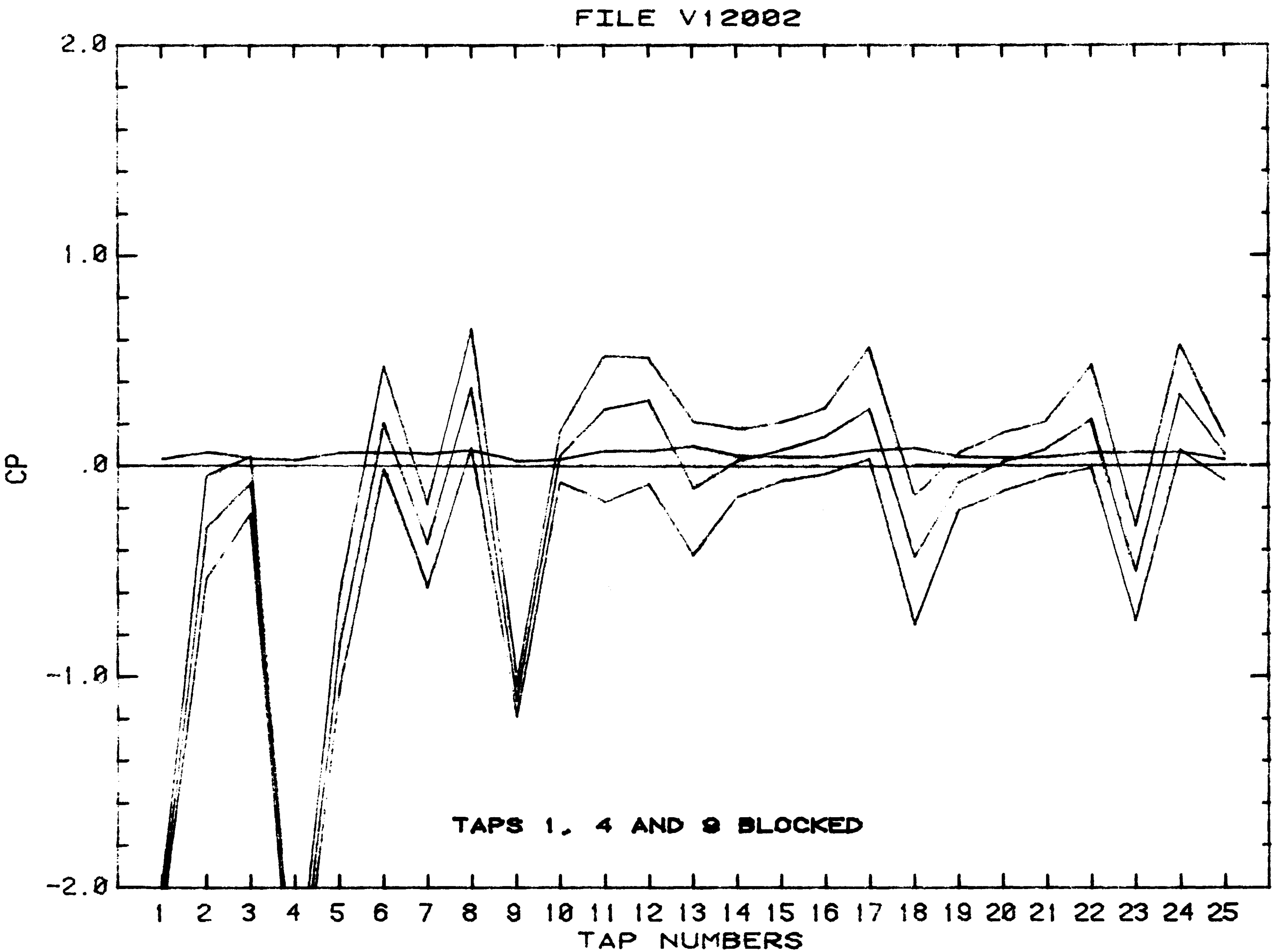
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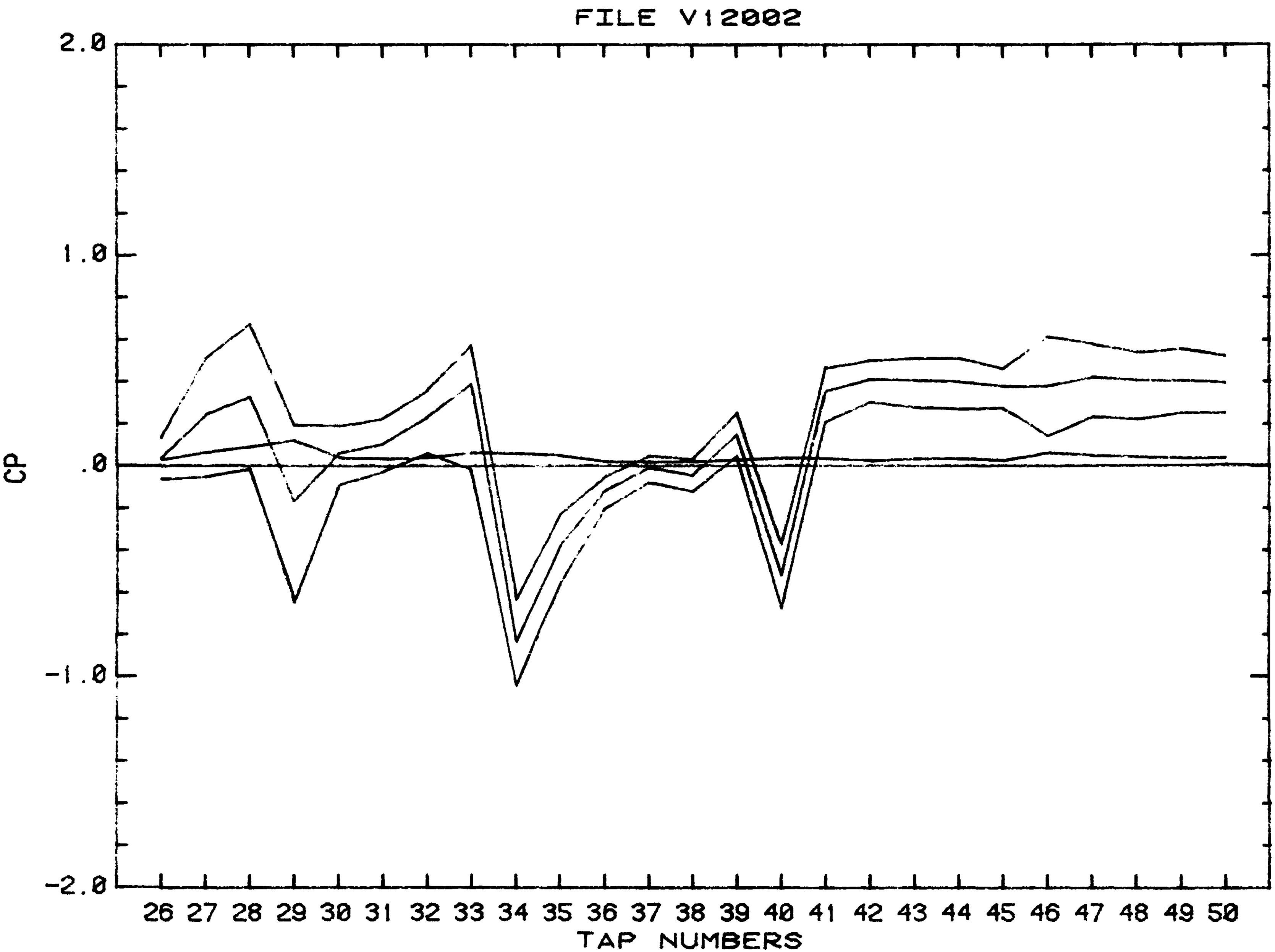
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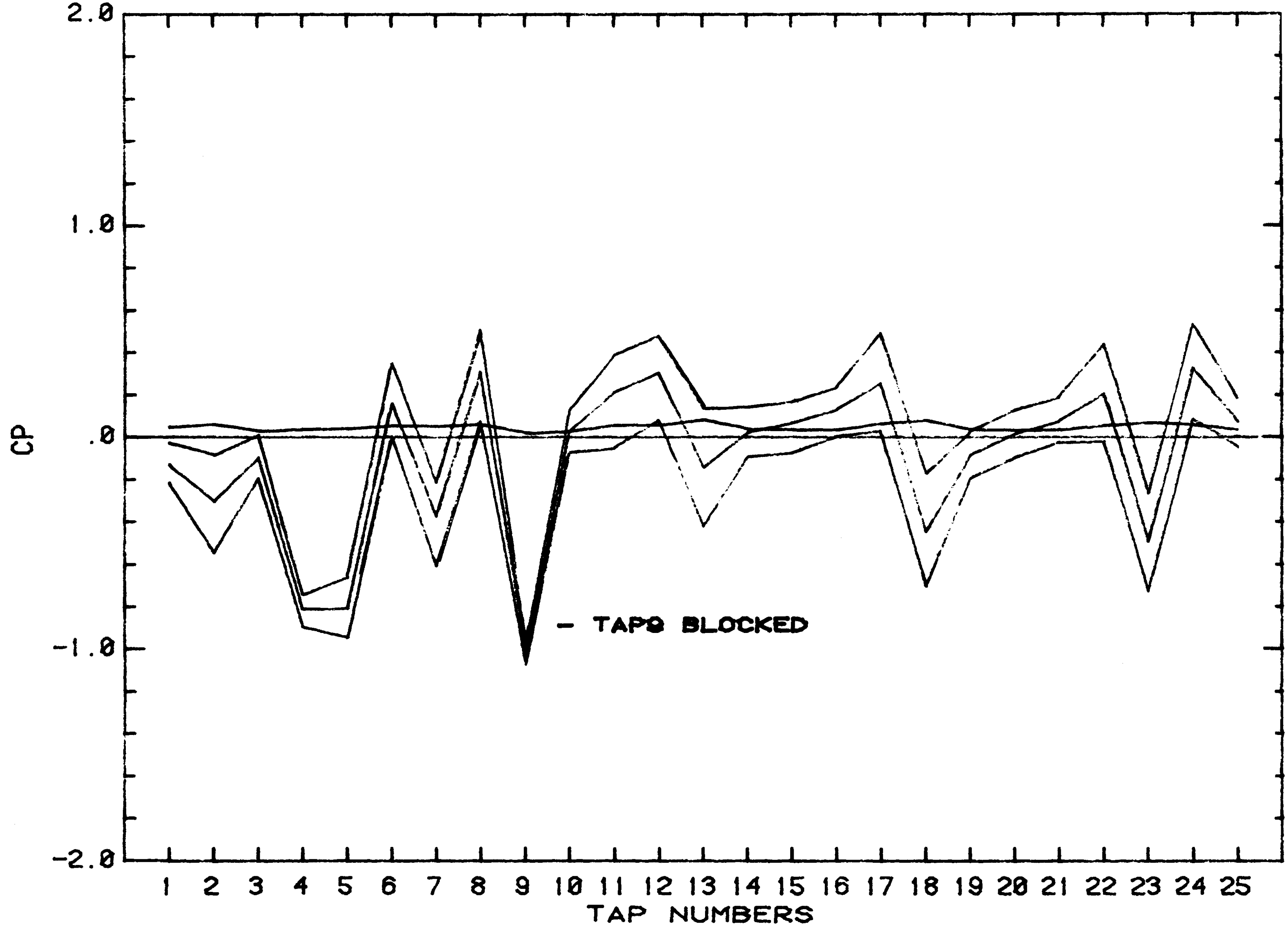
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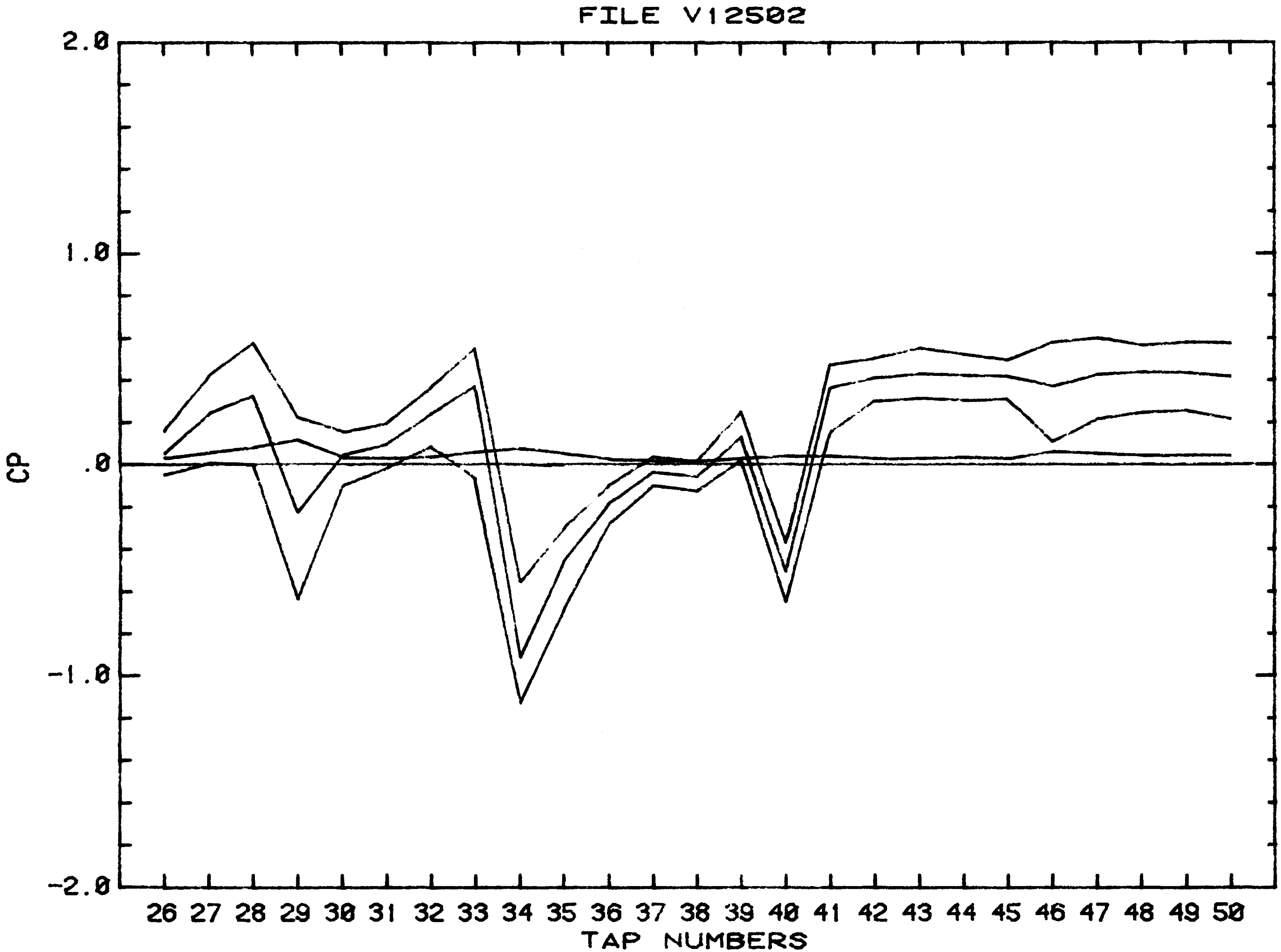

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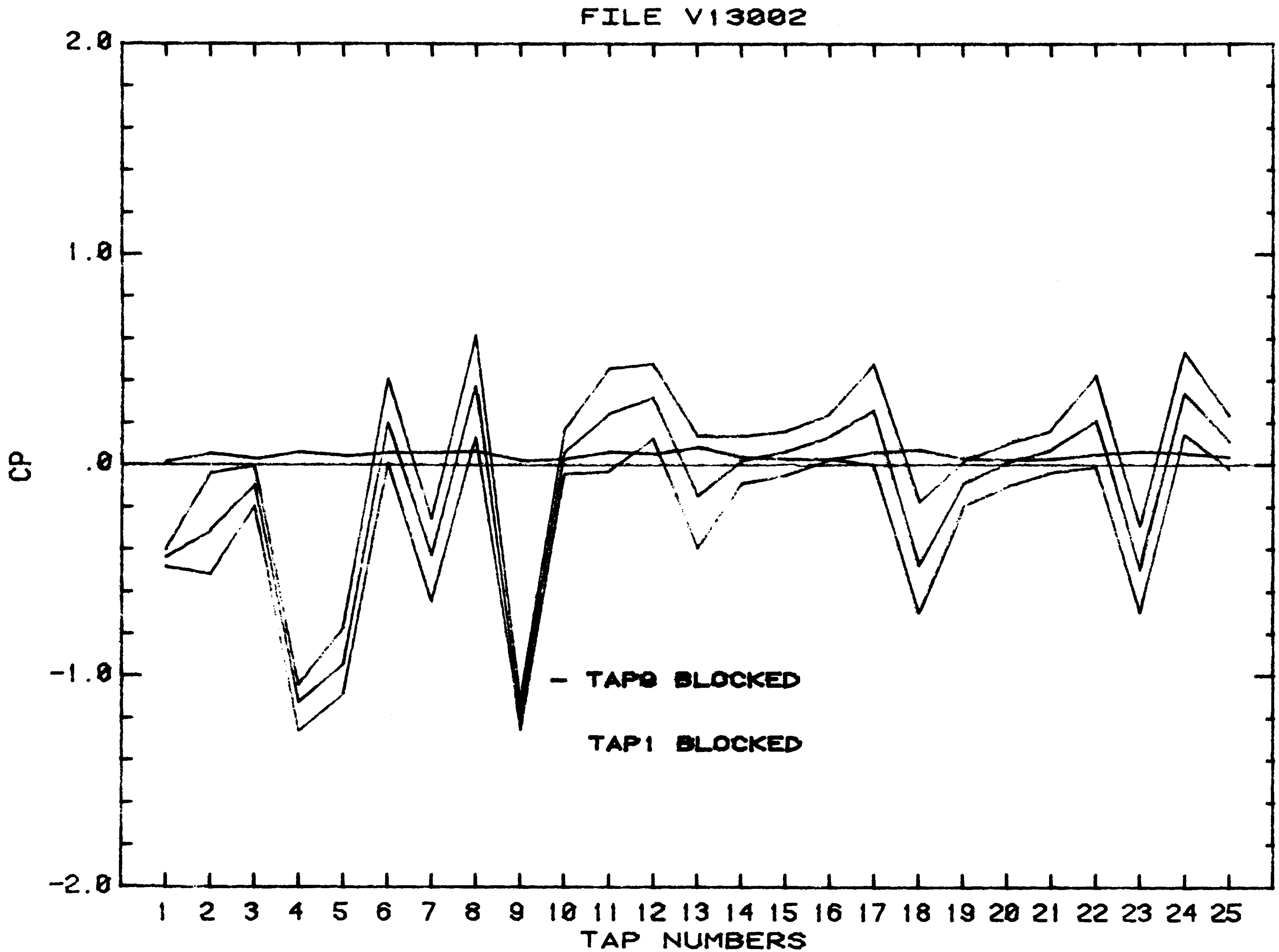
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TAP NUMBERS
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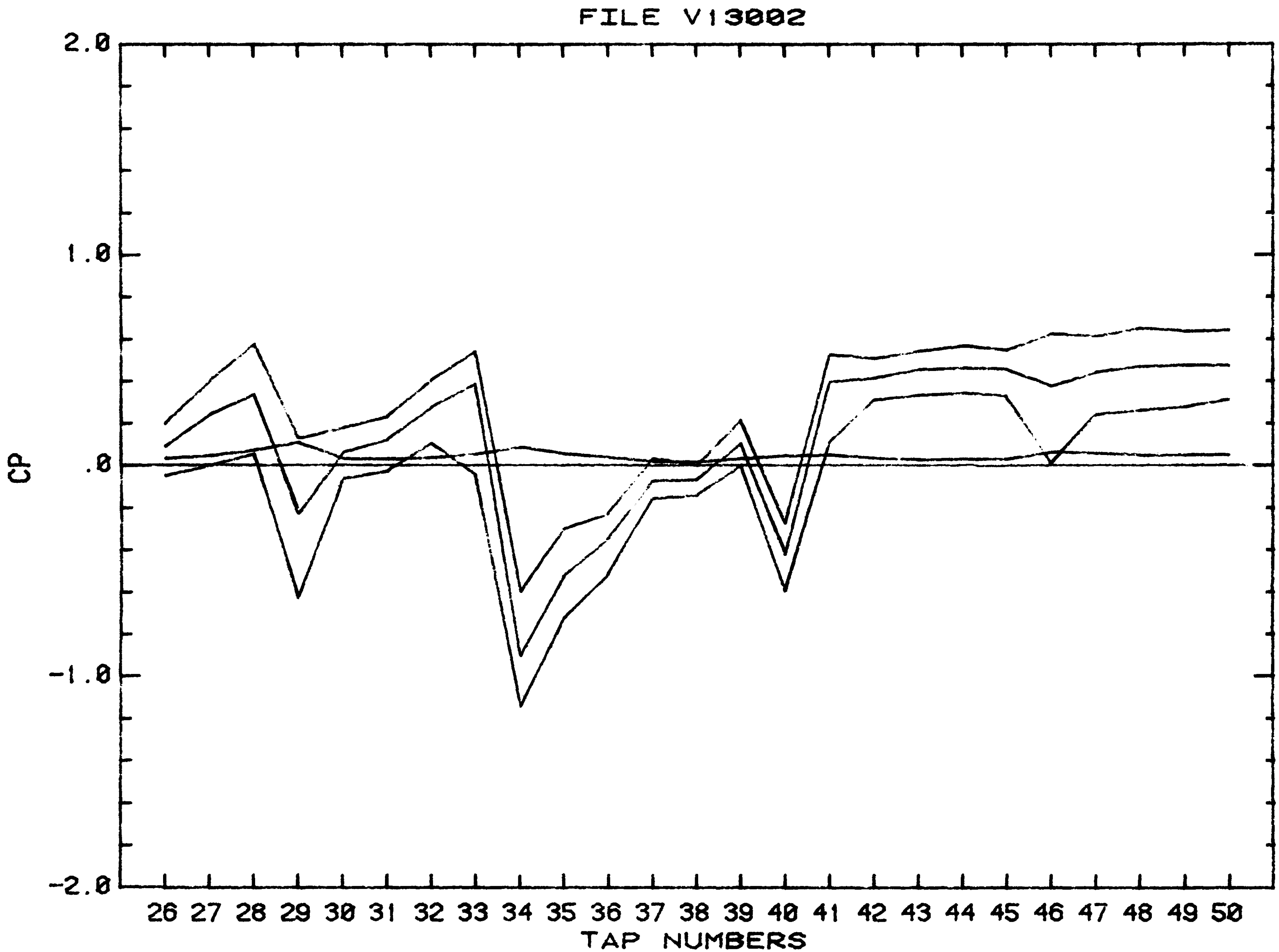
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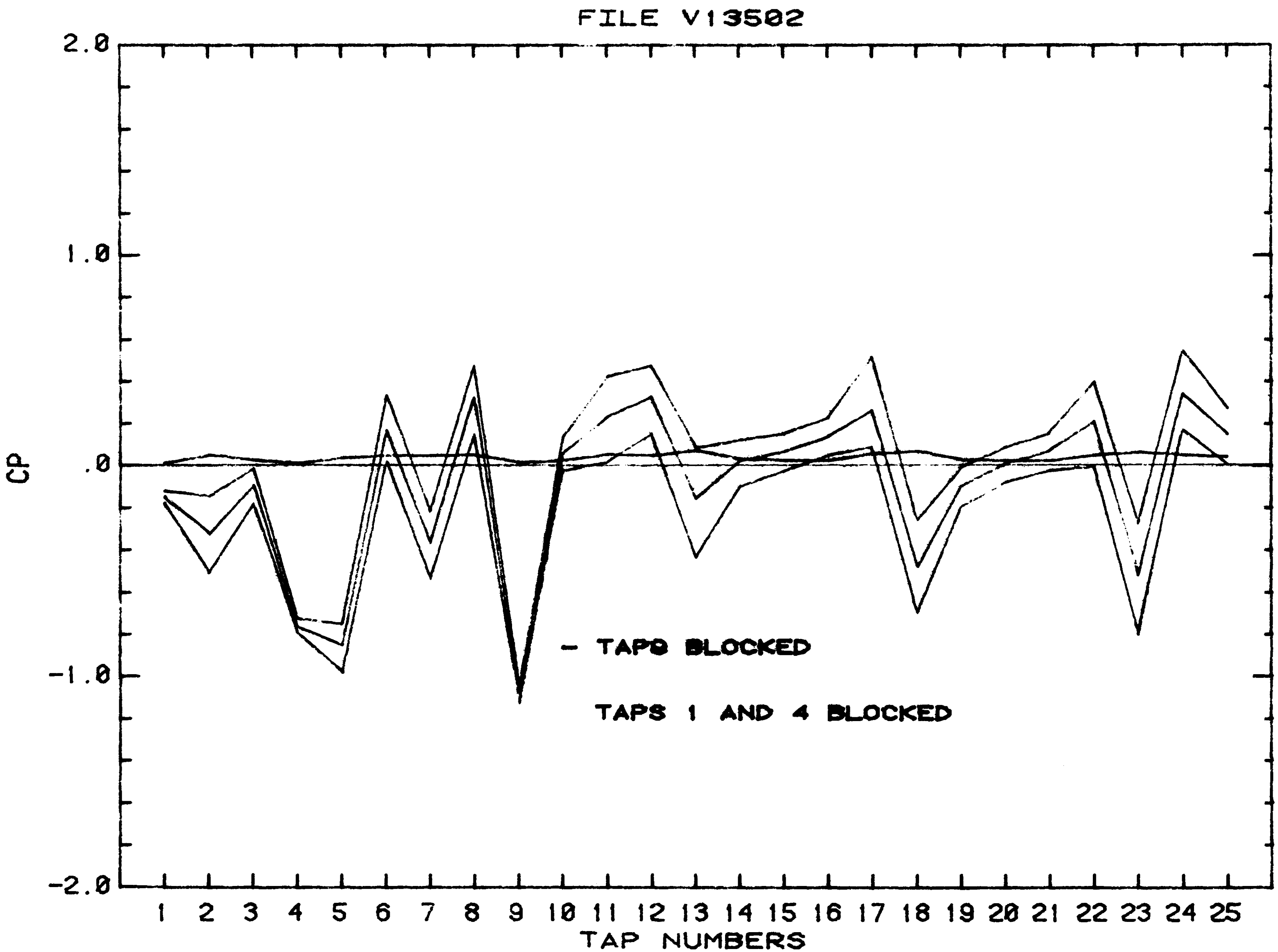
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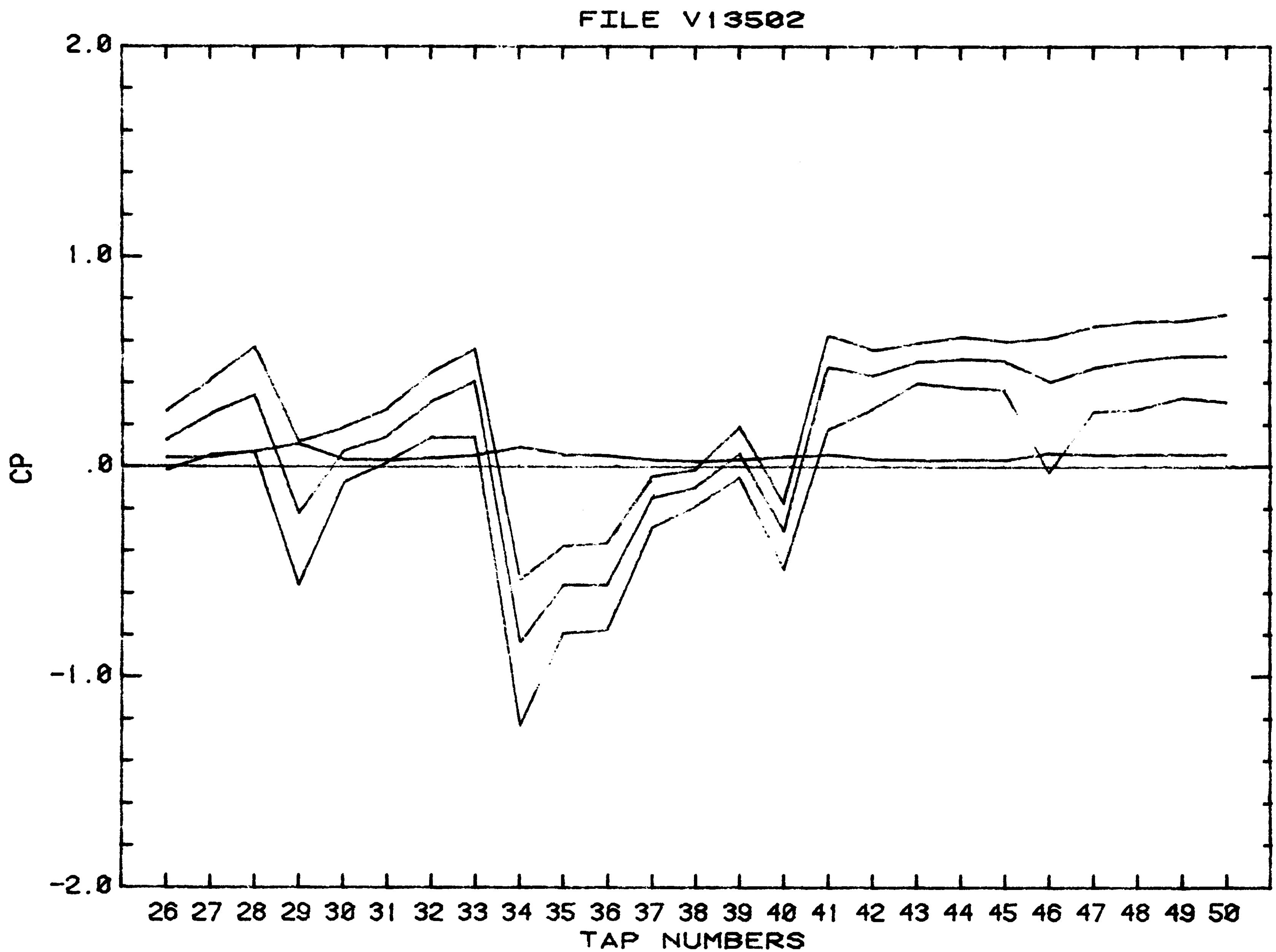
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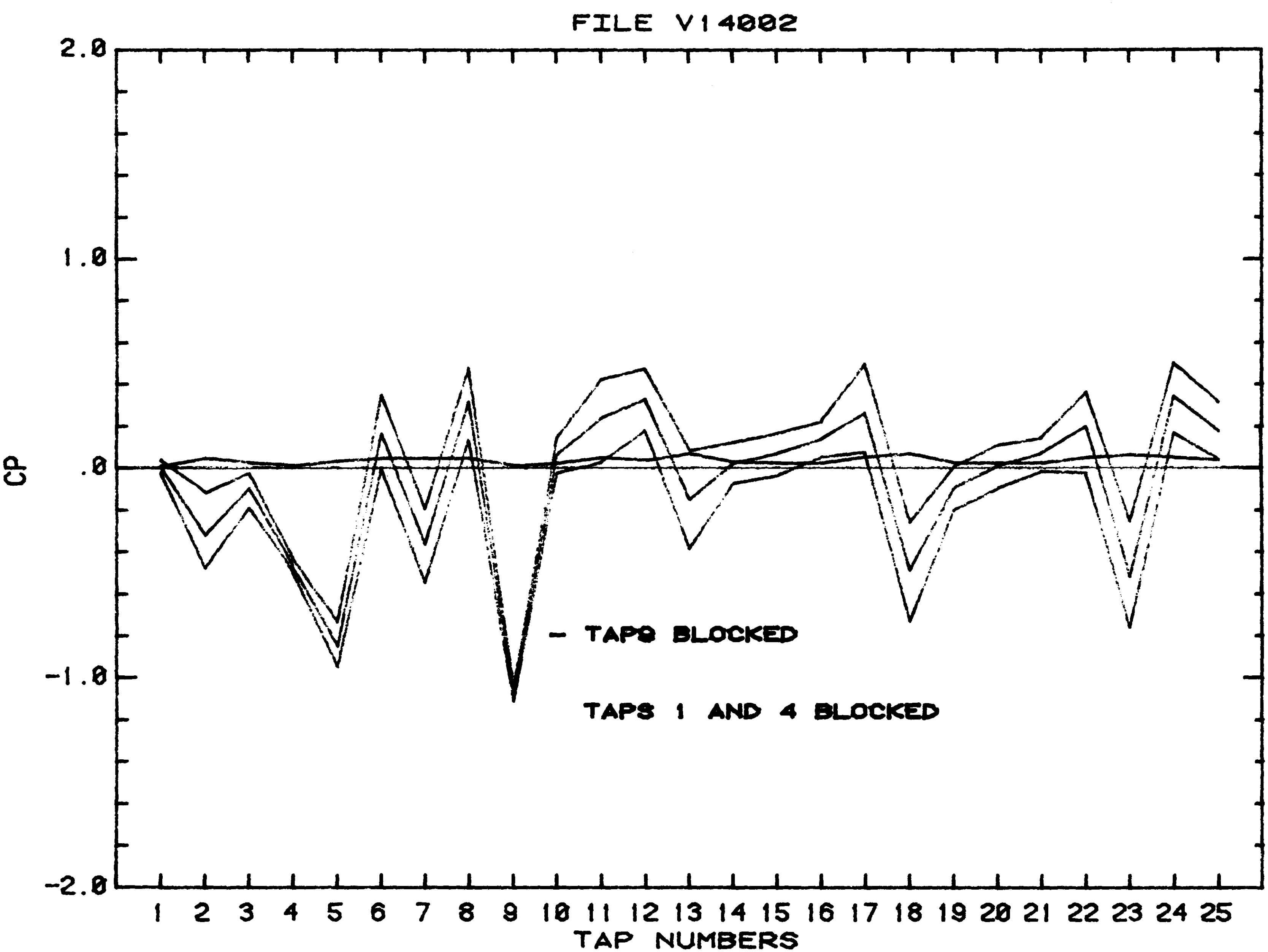
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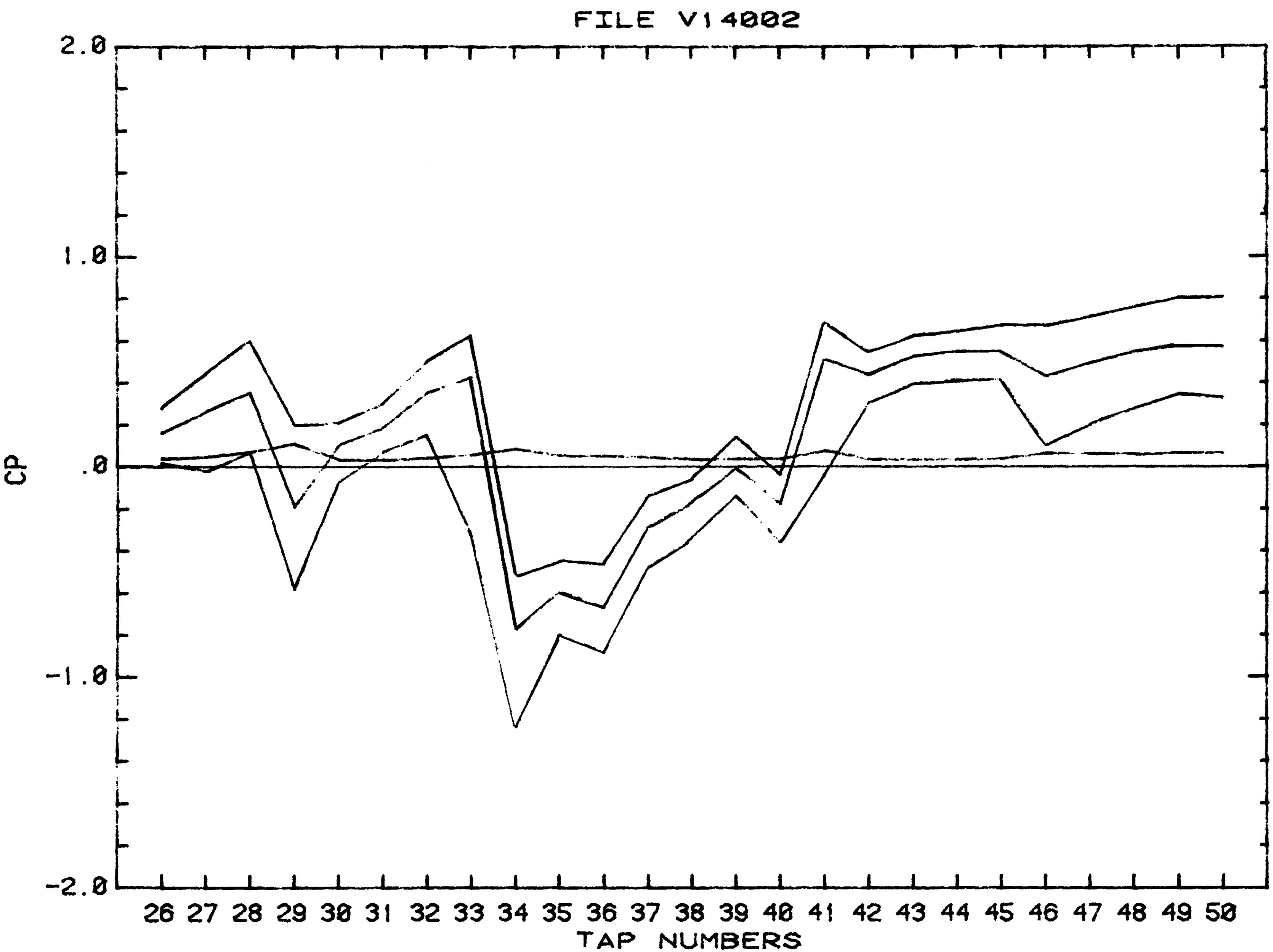

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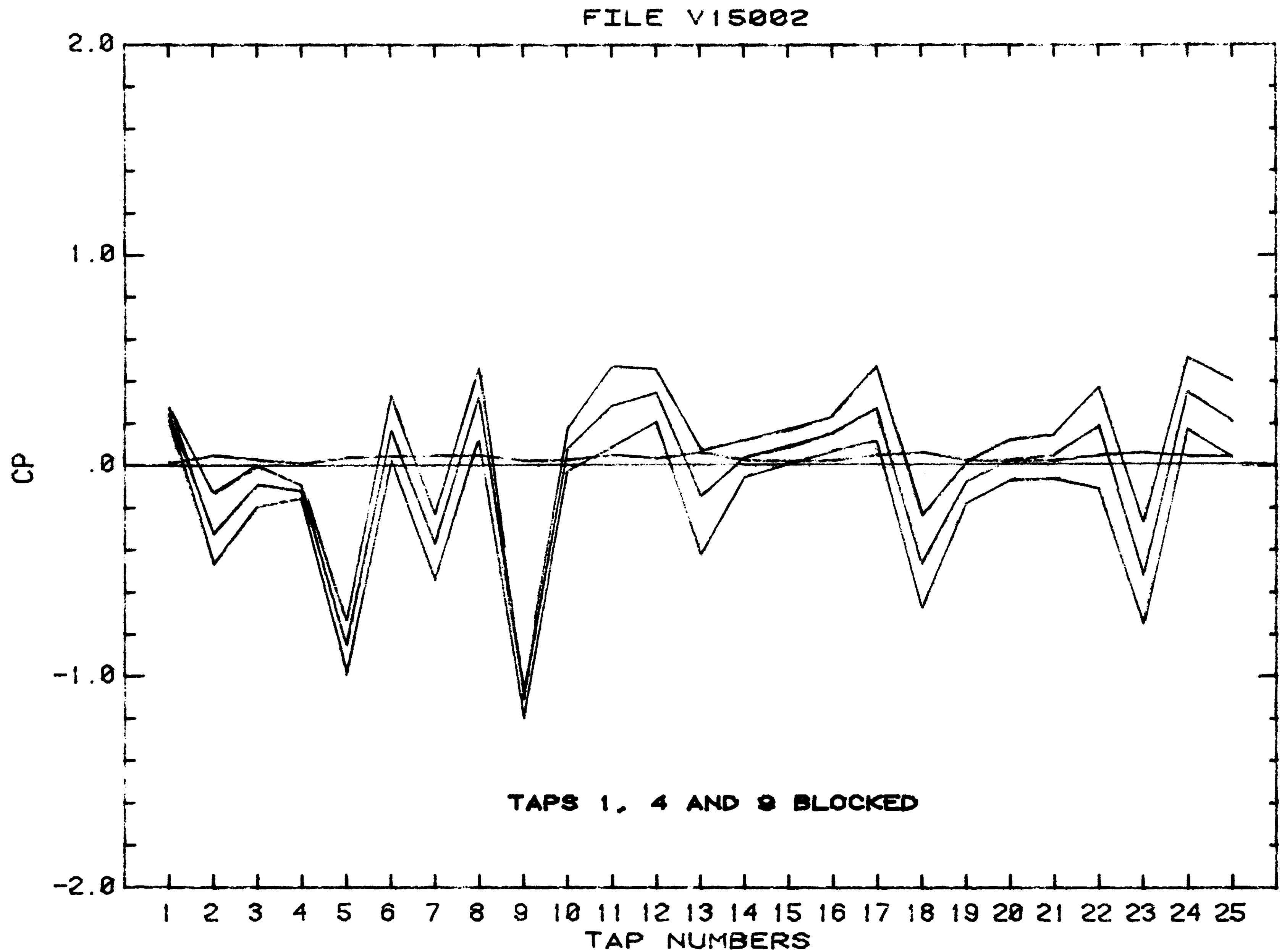

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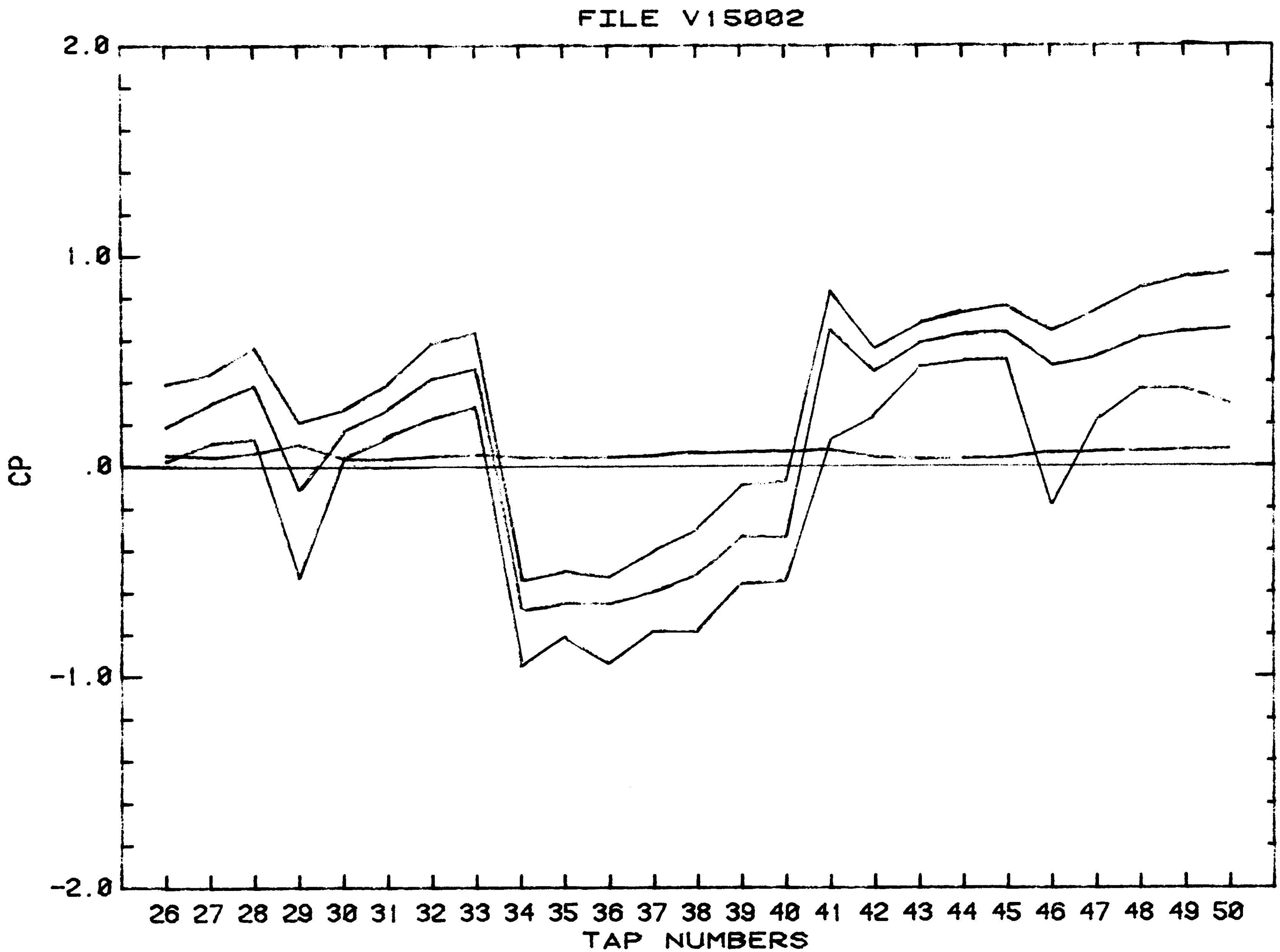
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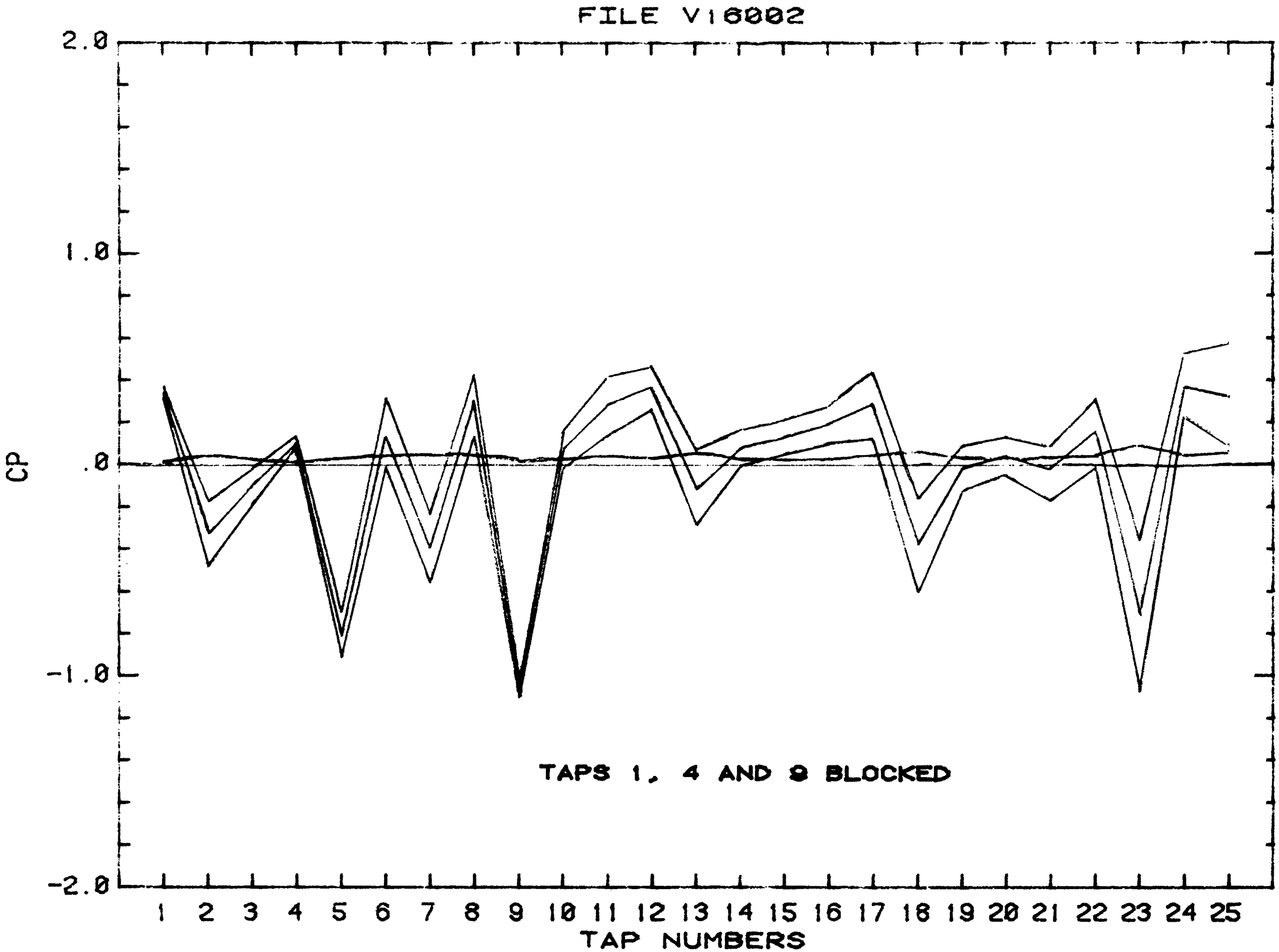
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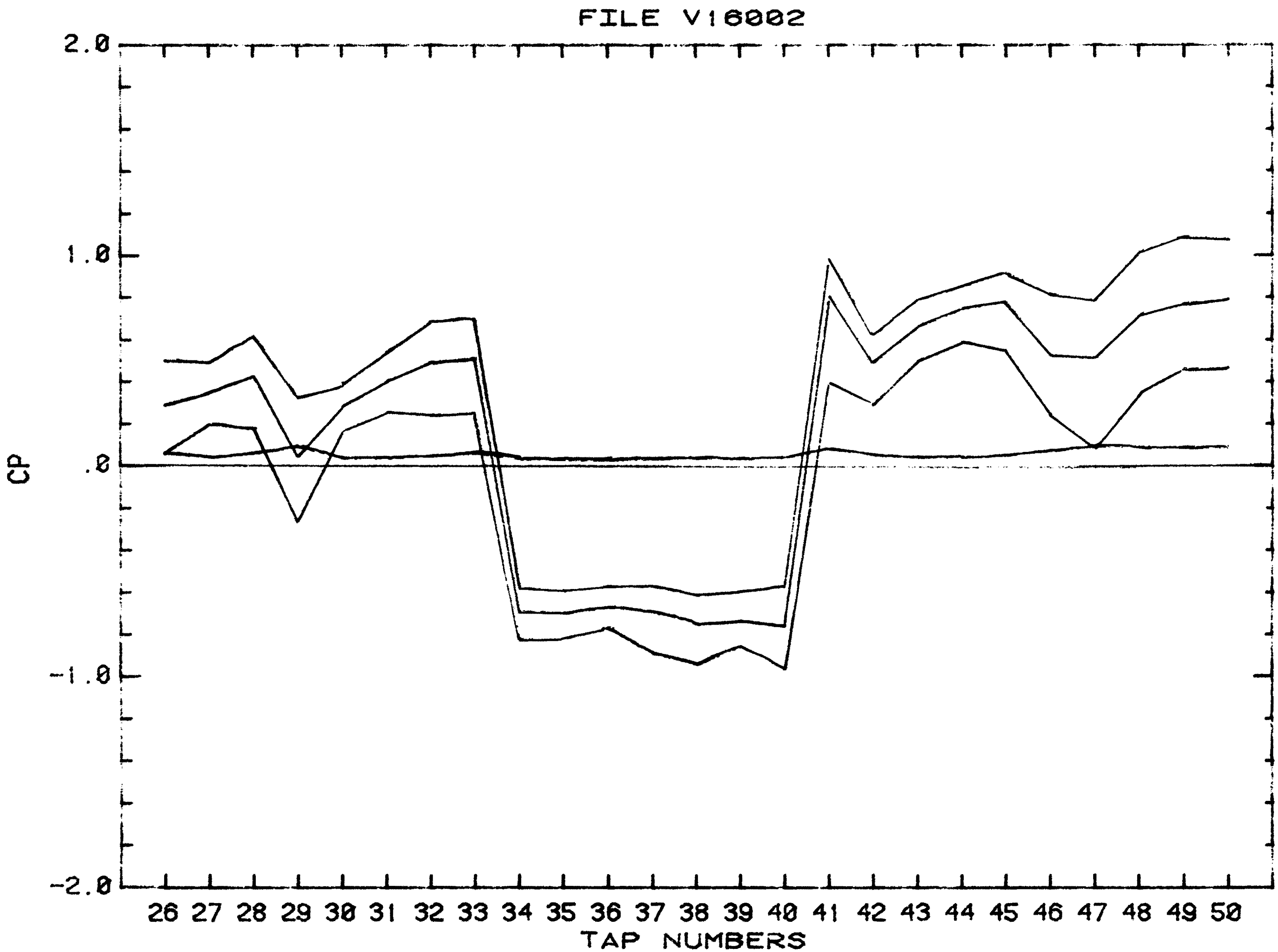
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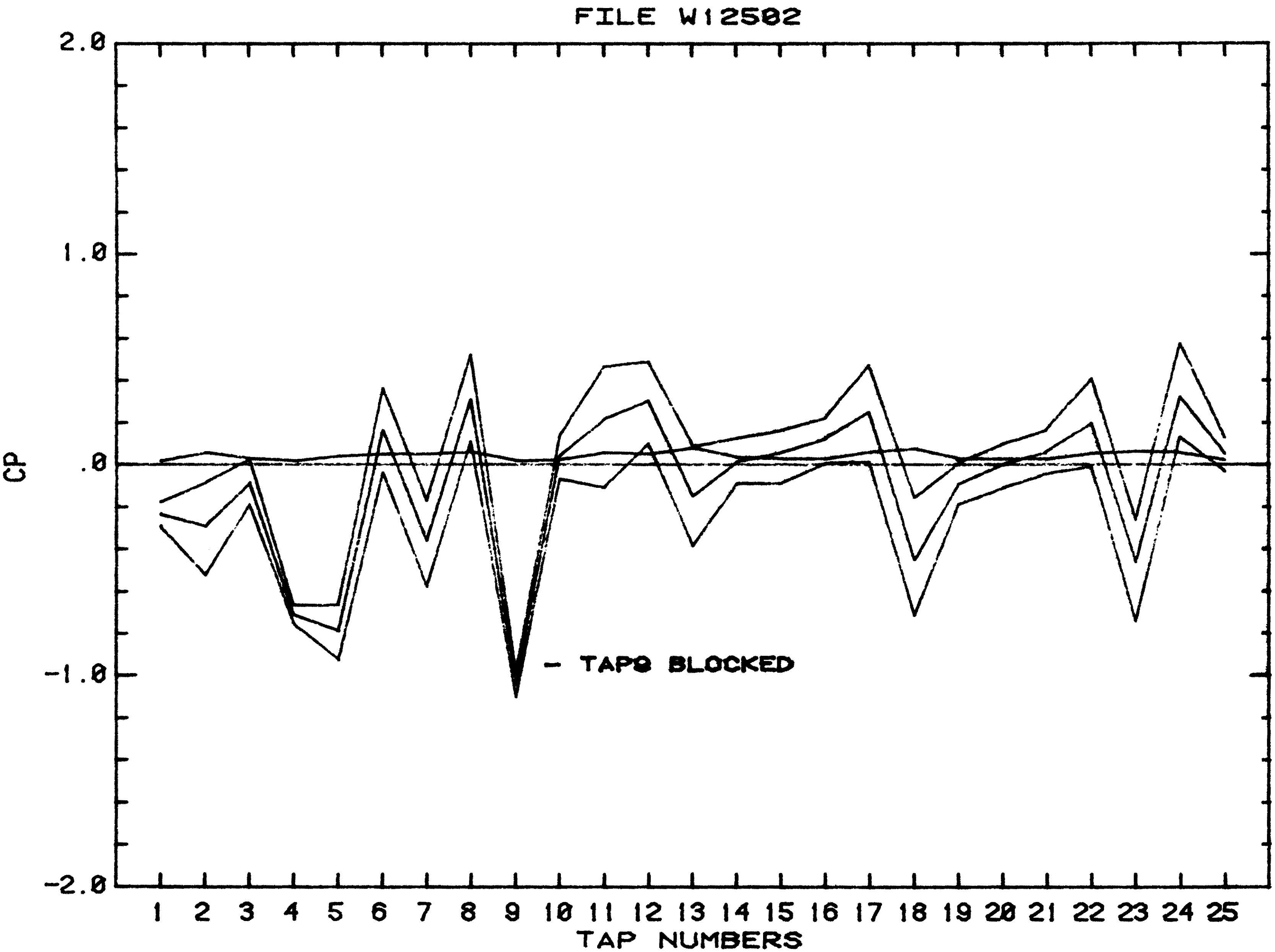
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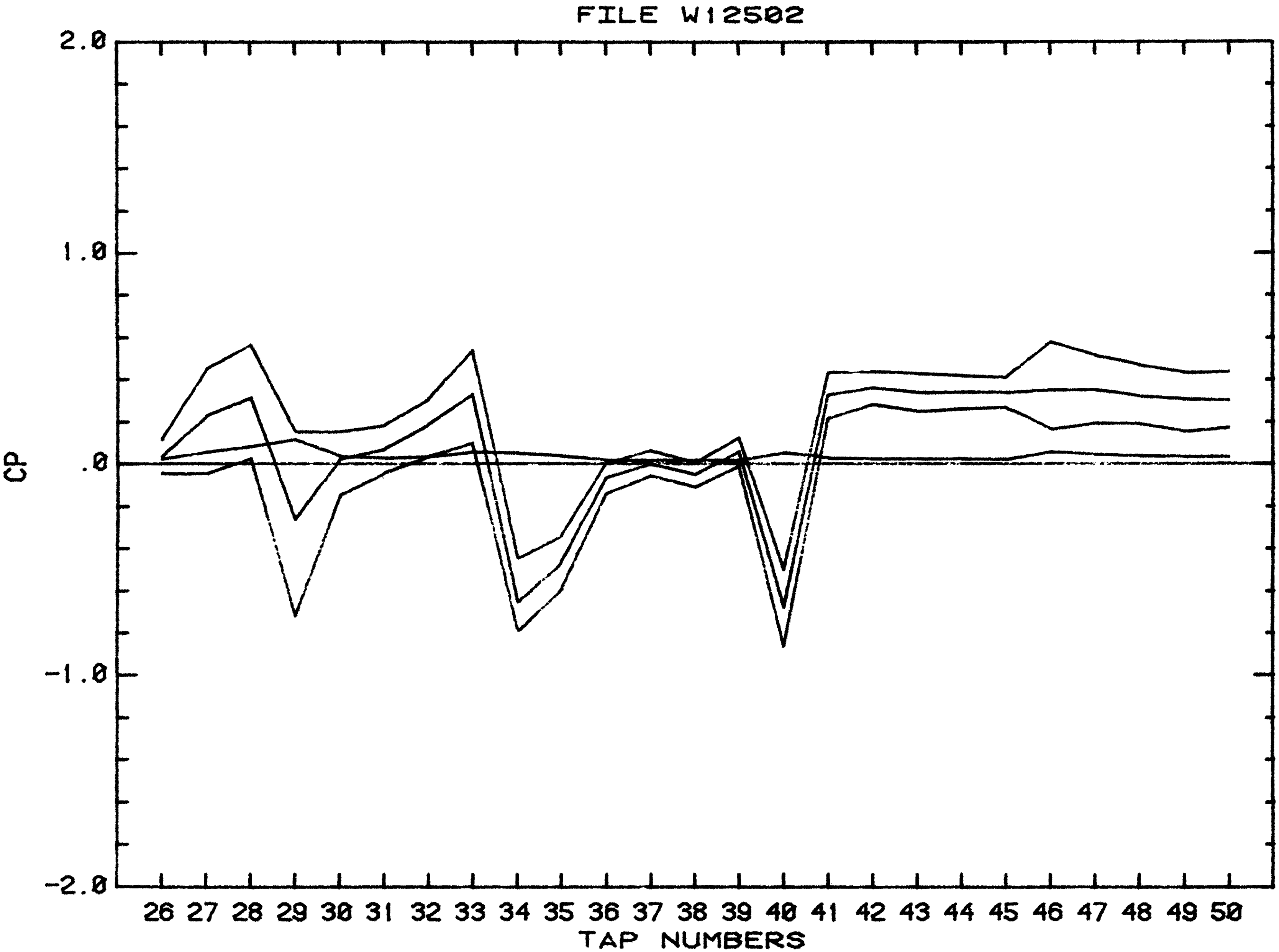

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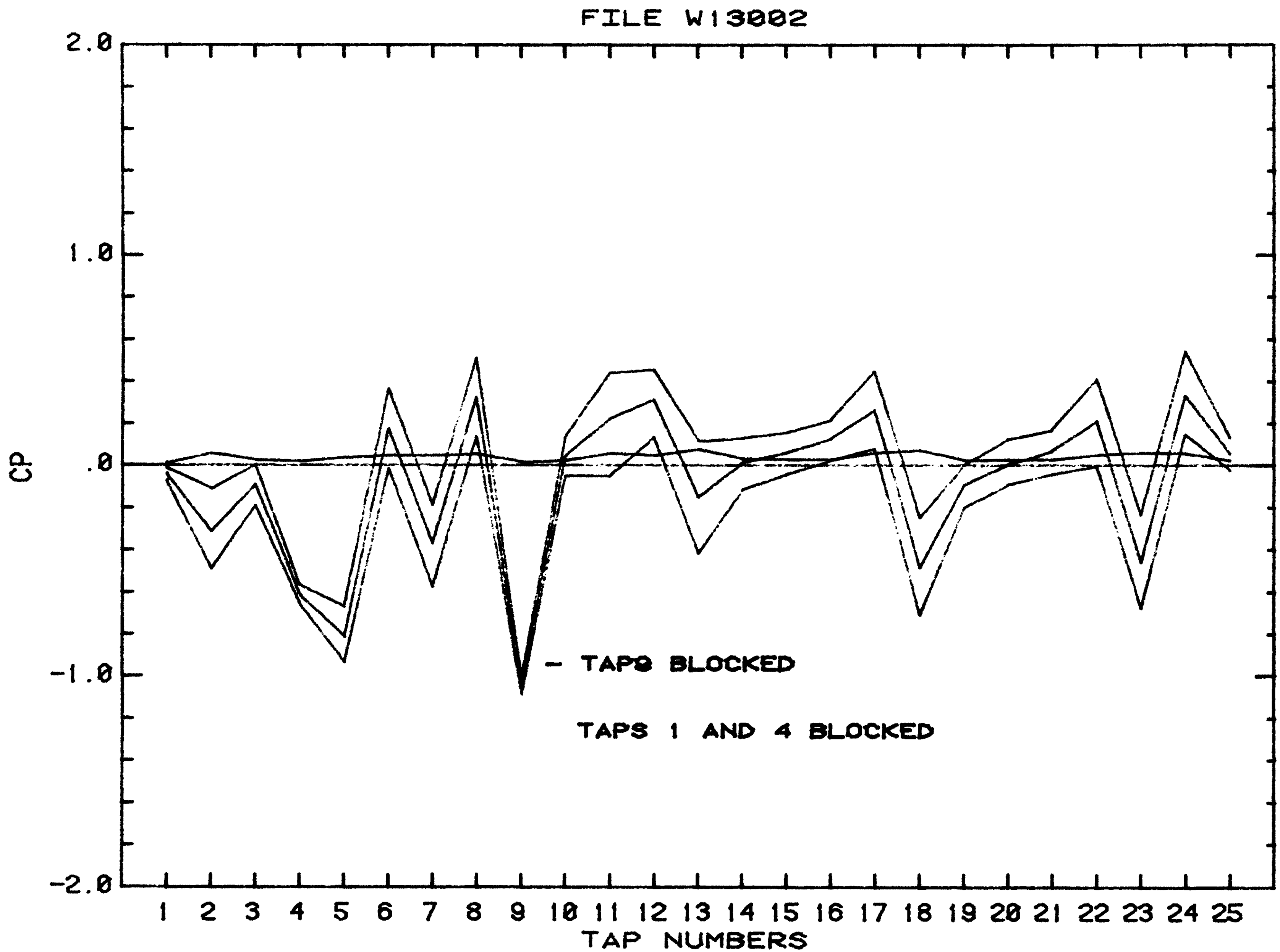
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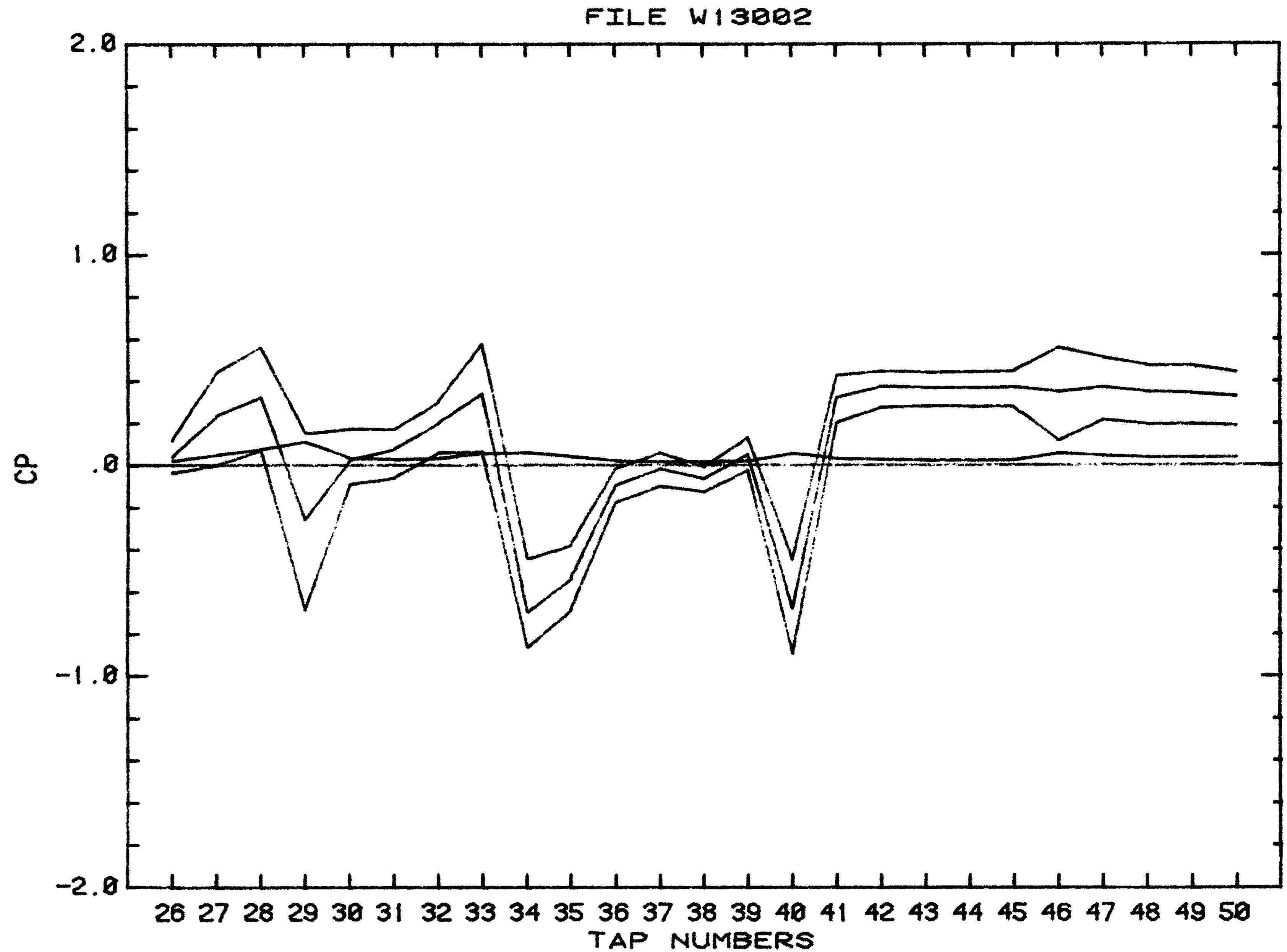
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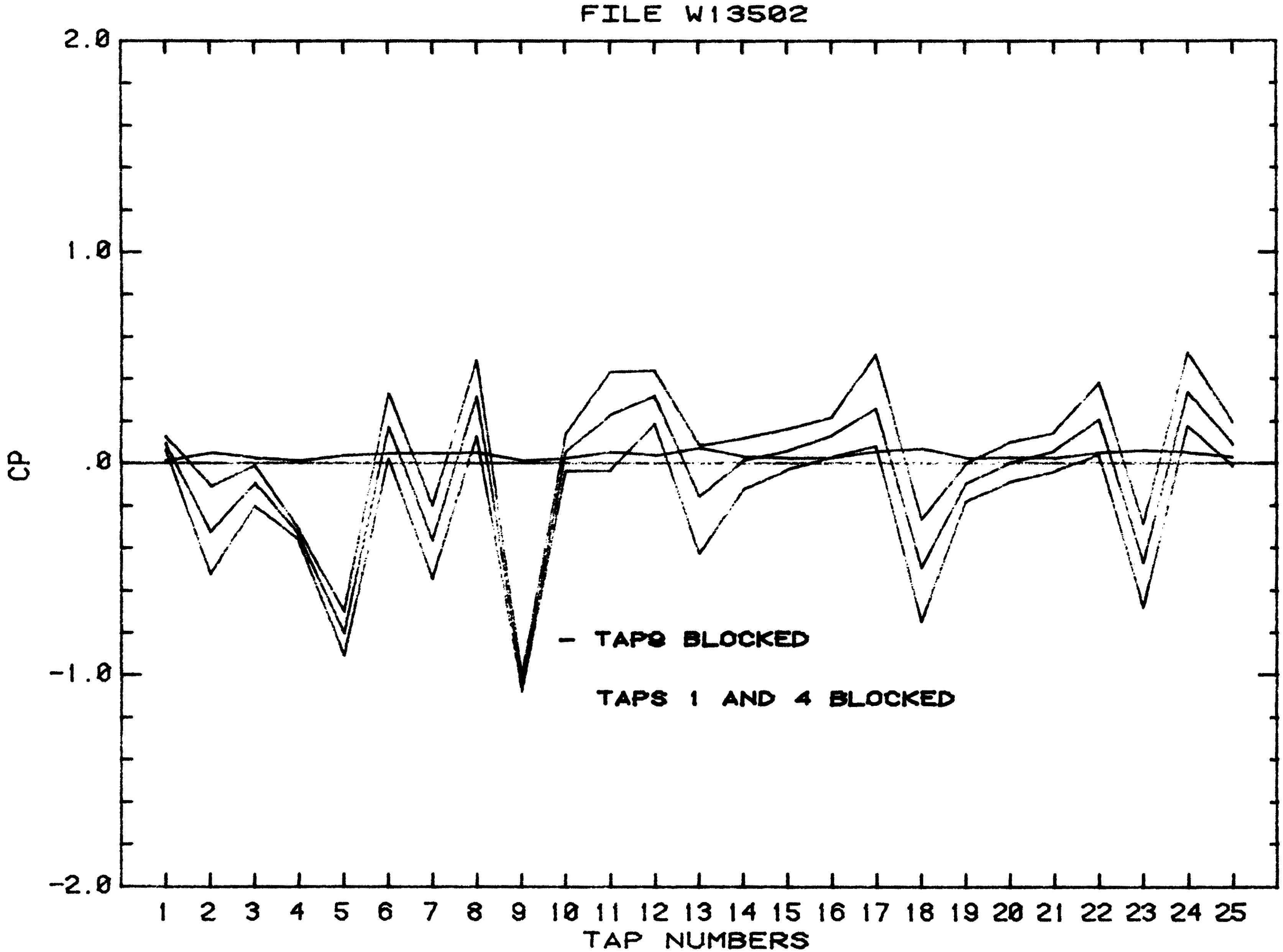

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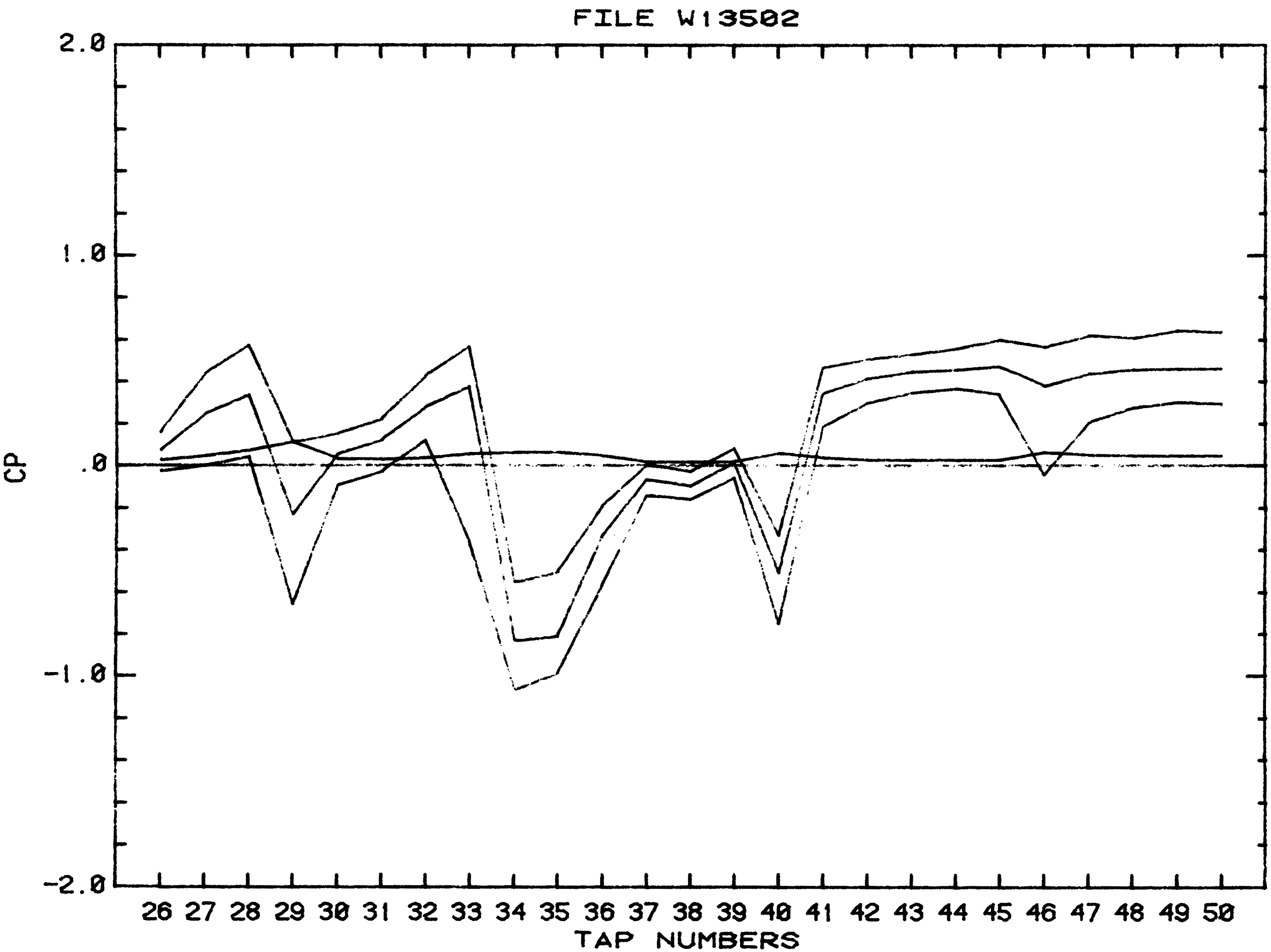
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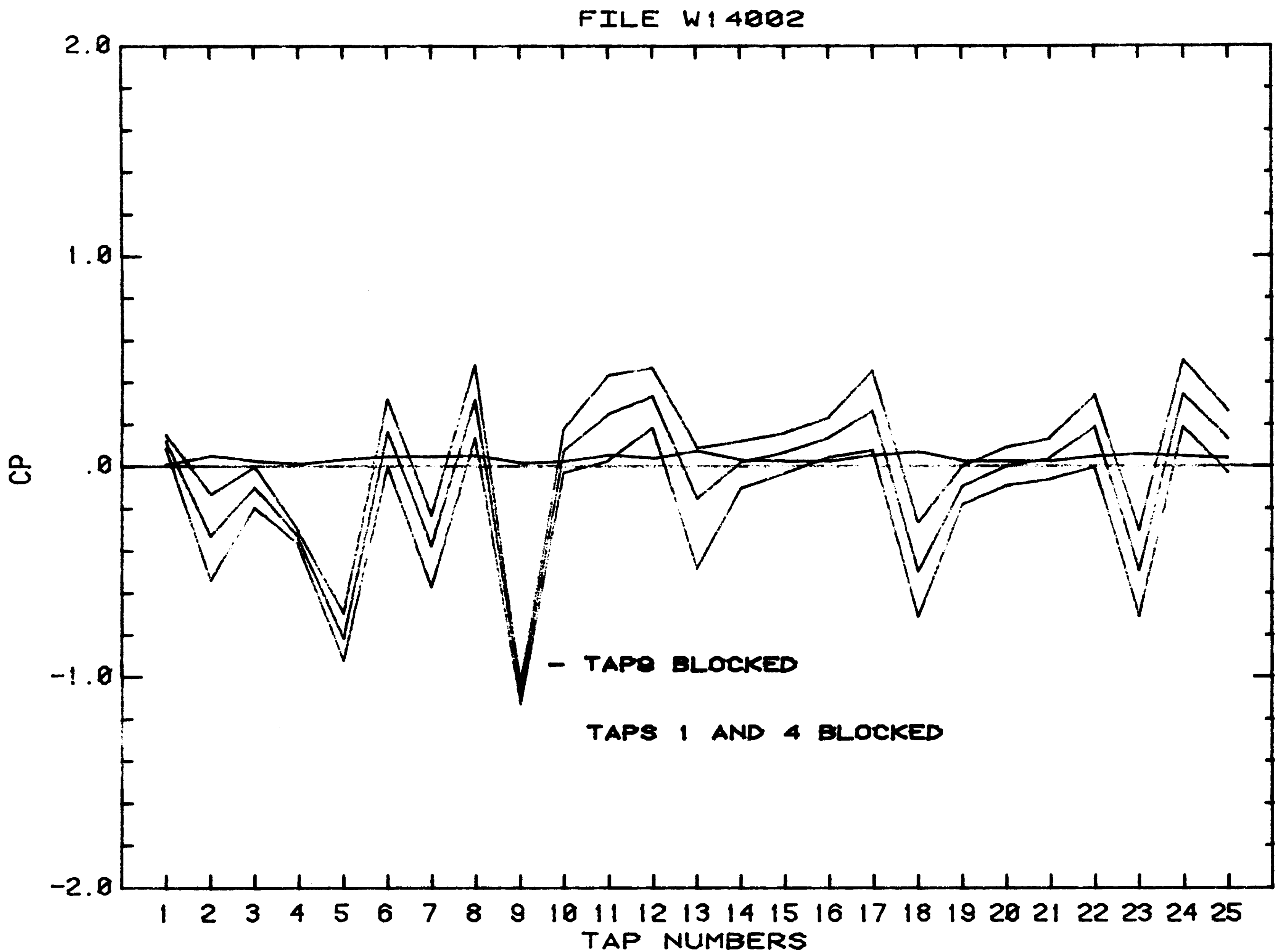
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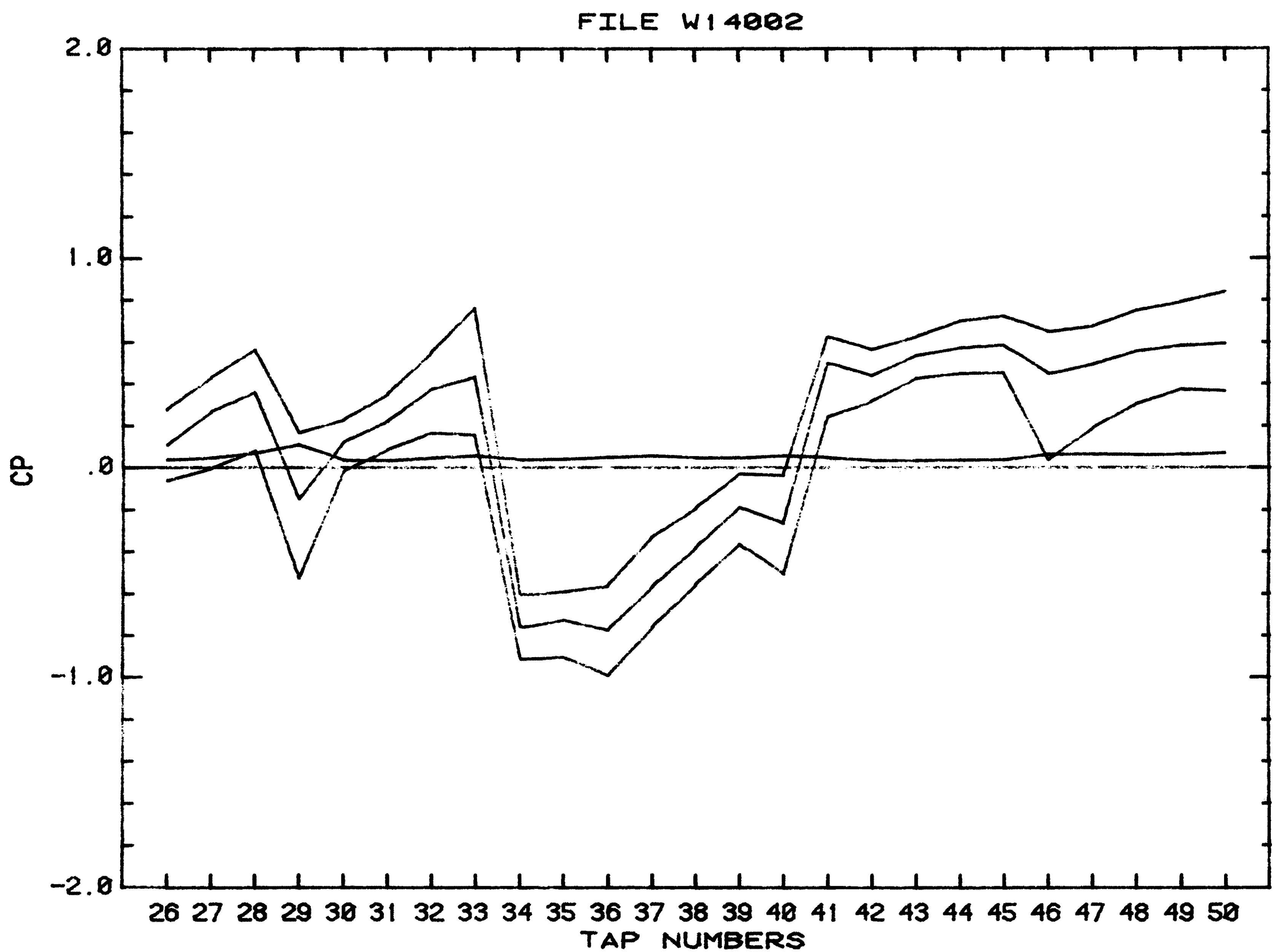
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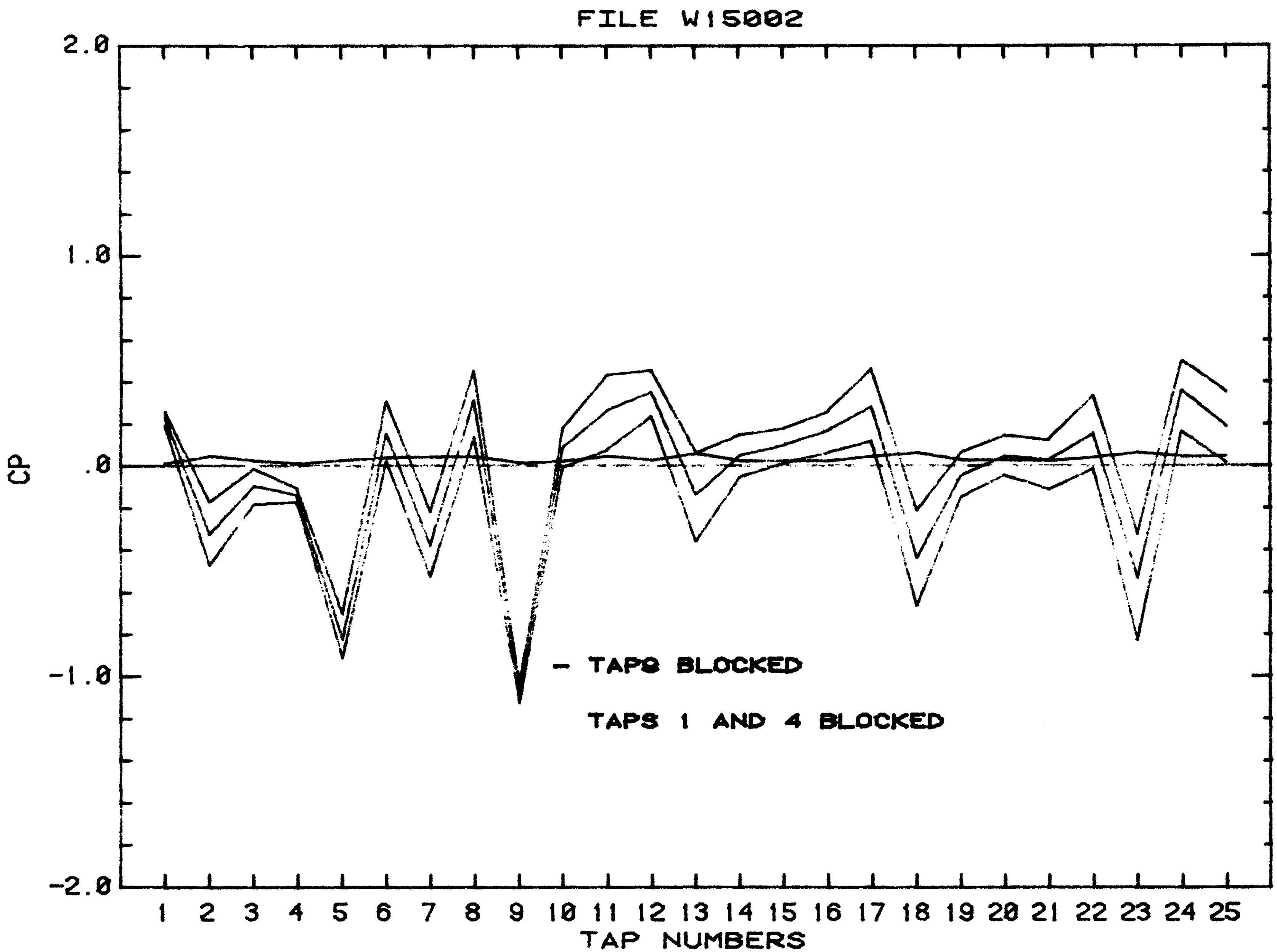

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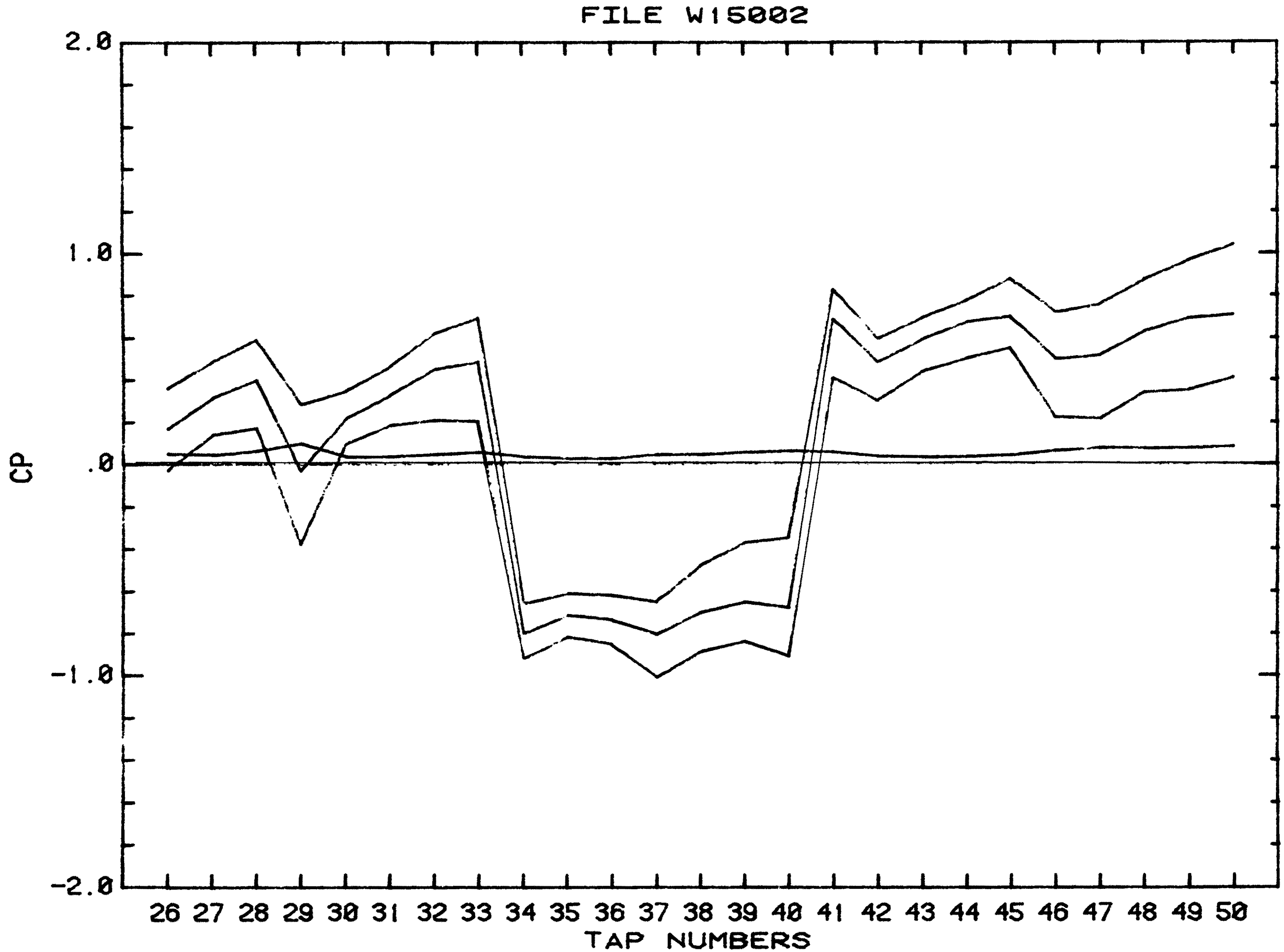
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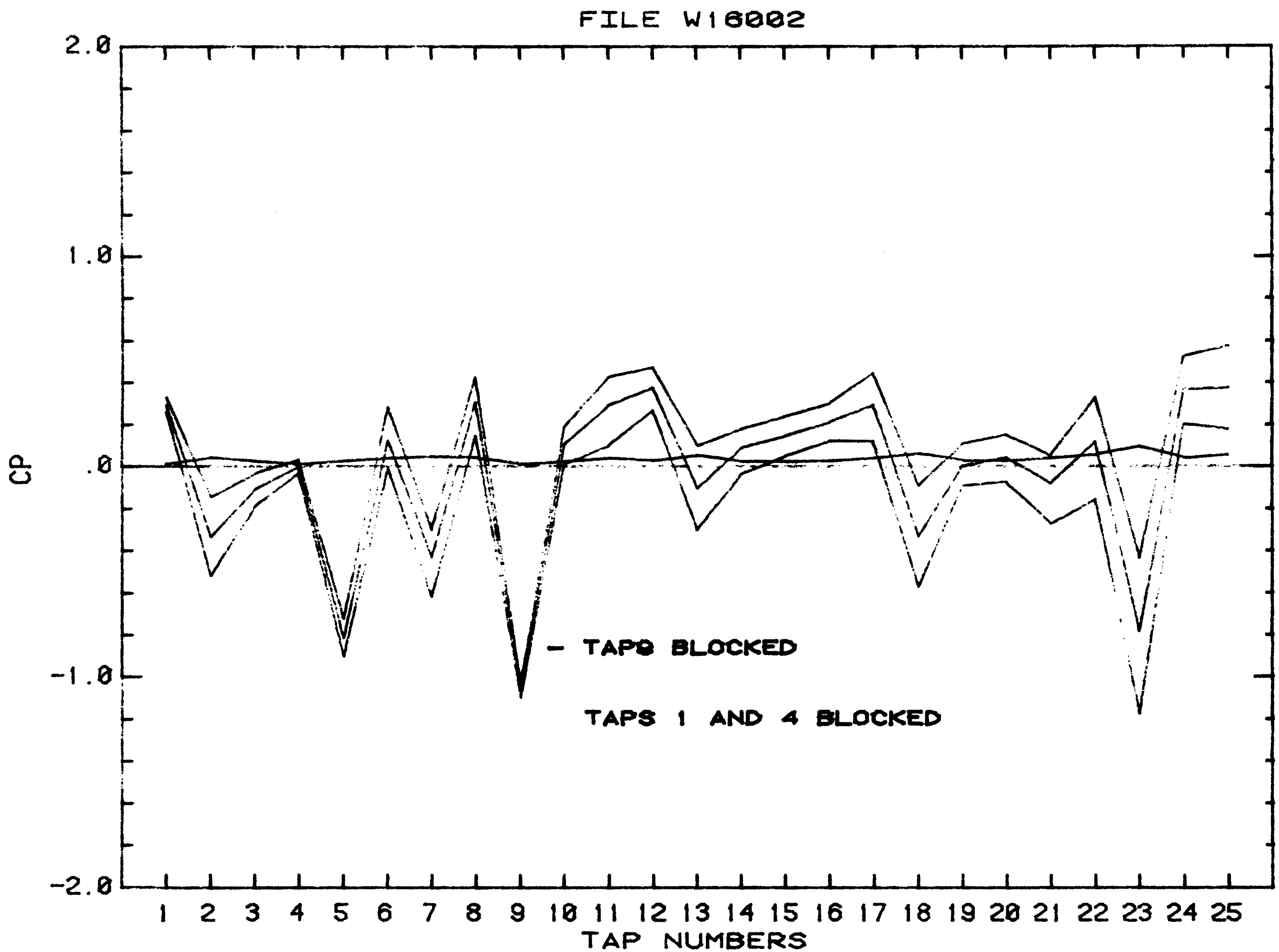

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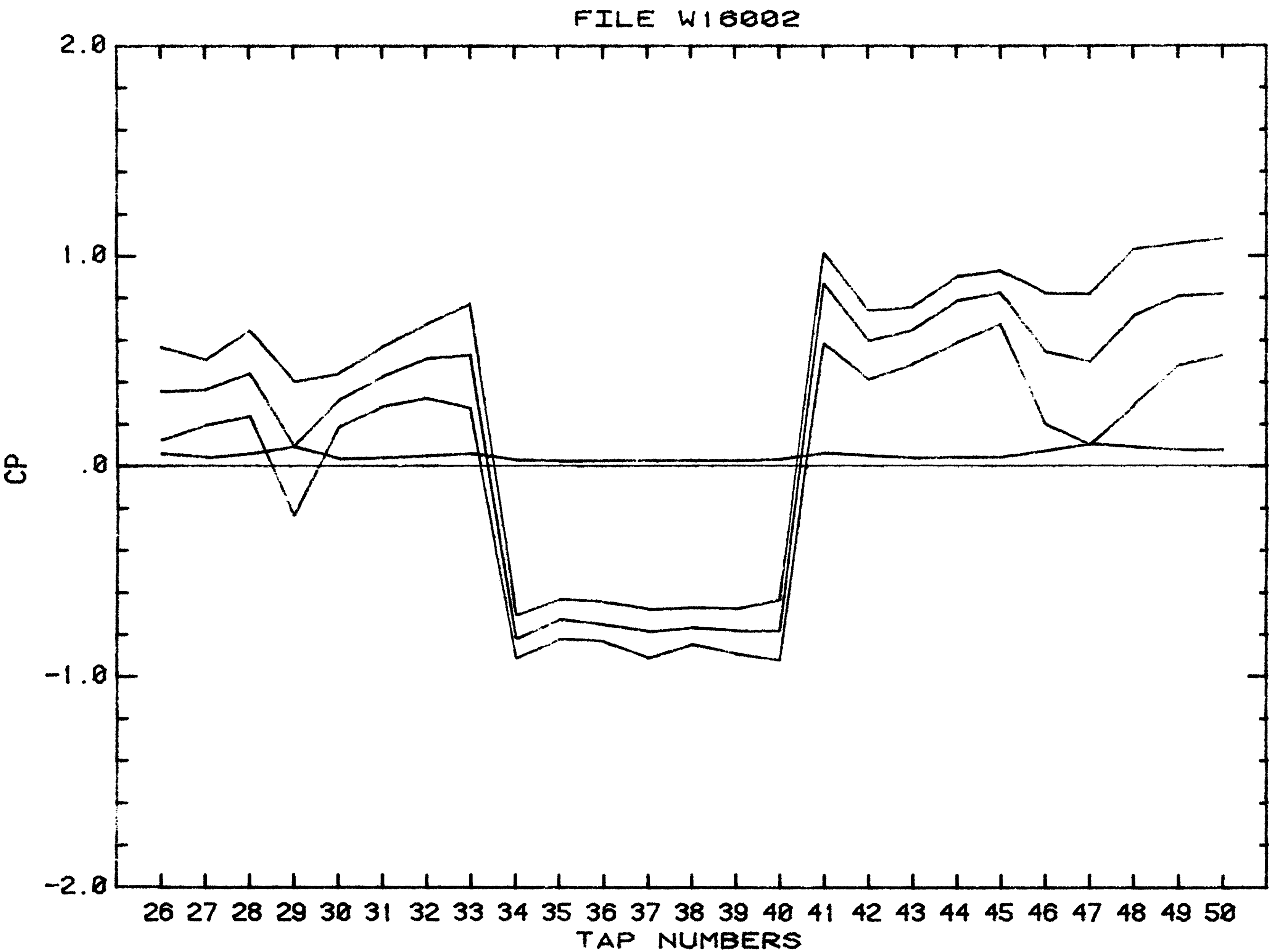
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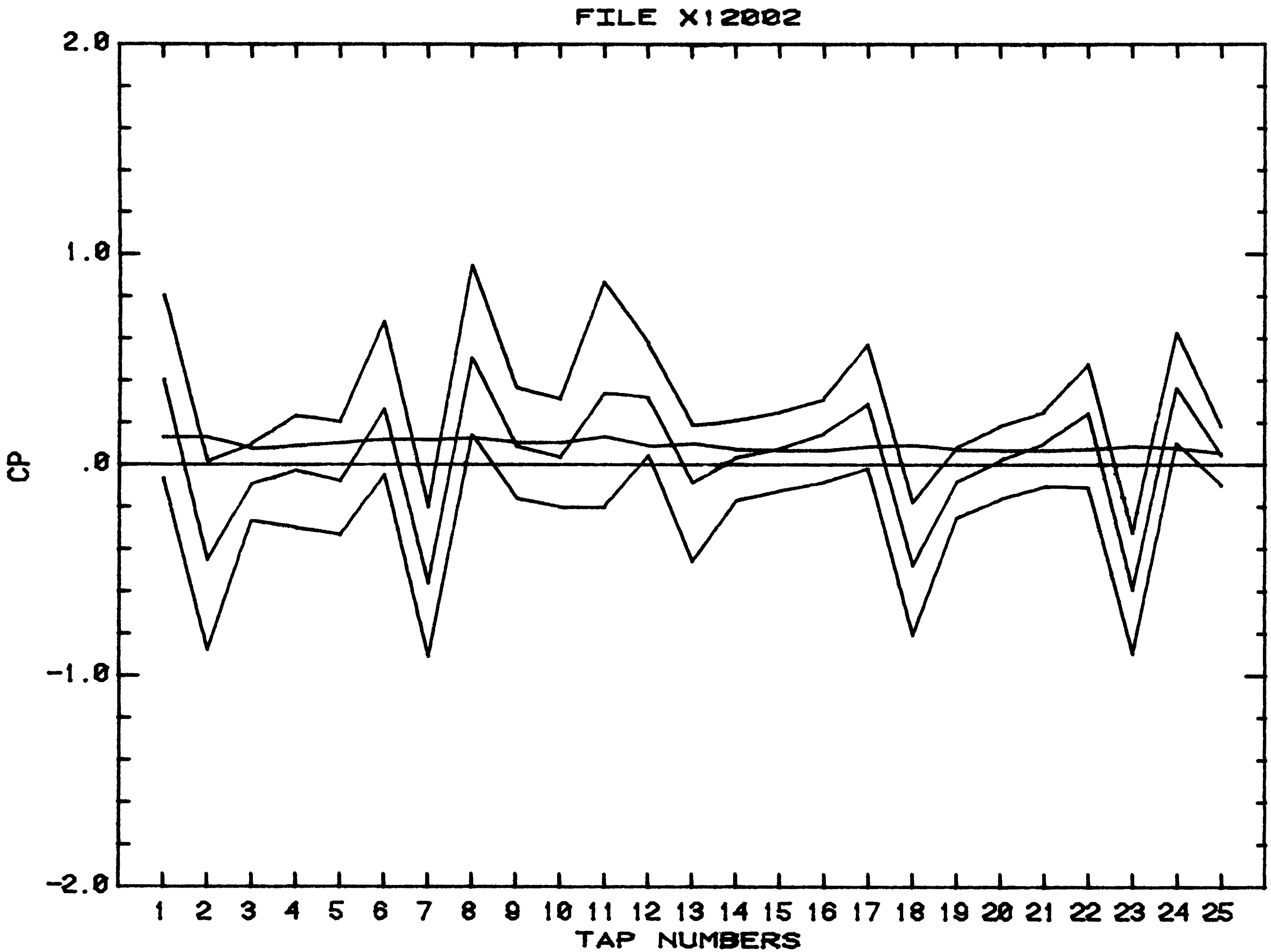
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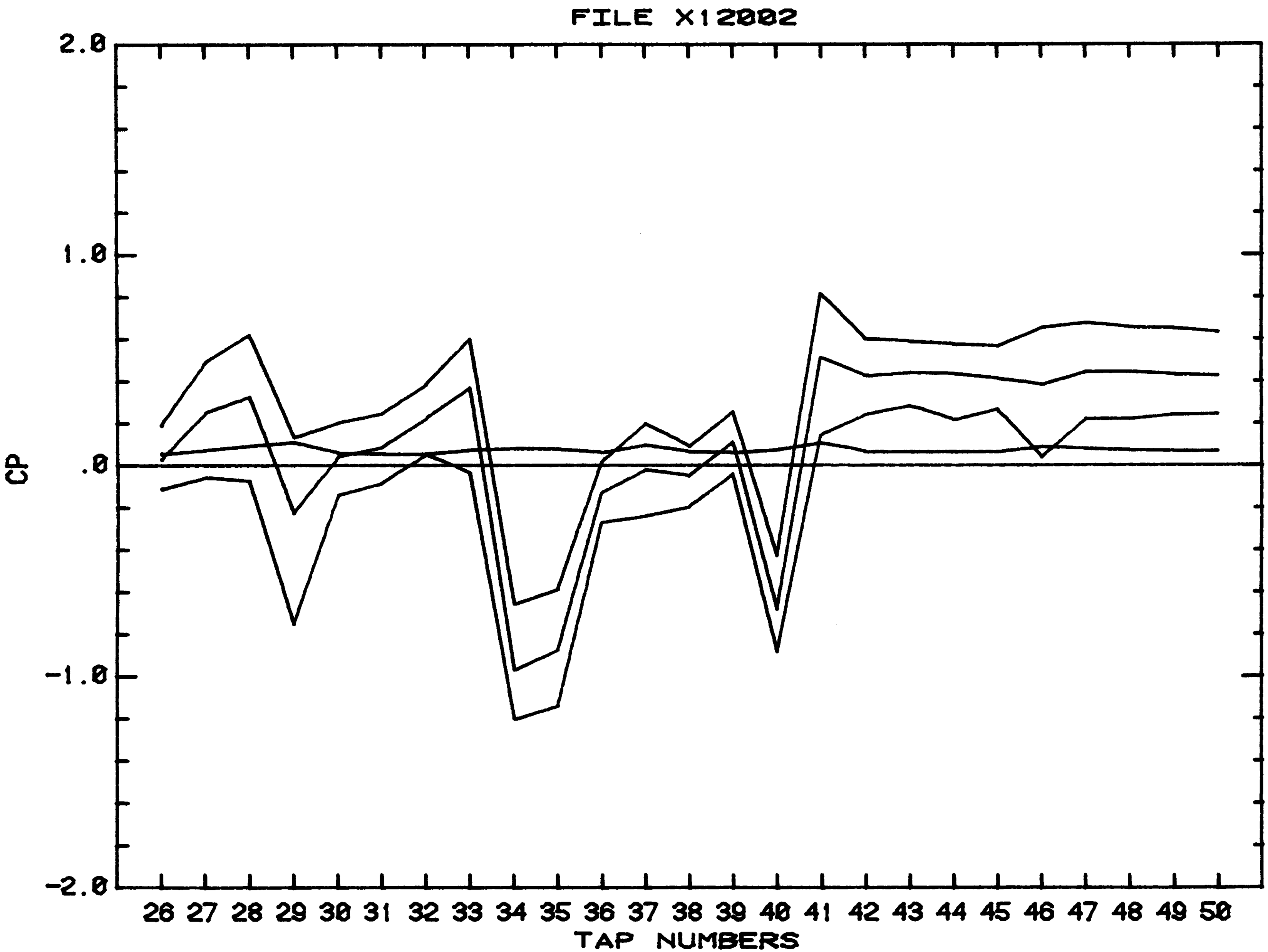
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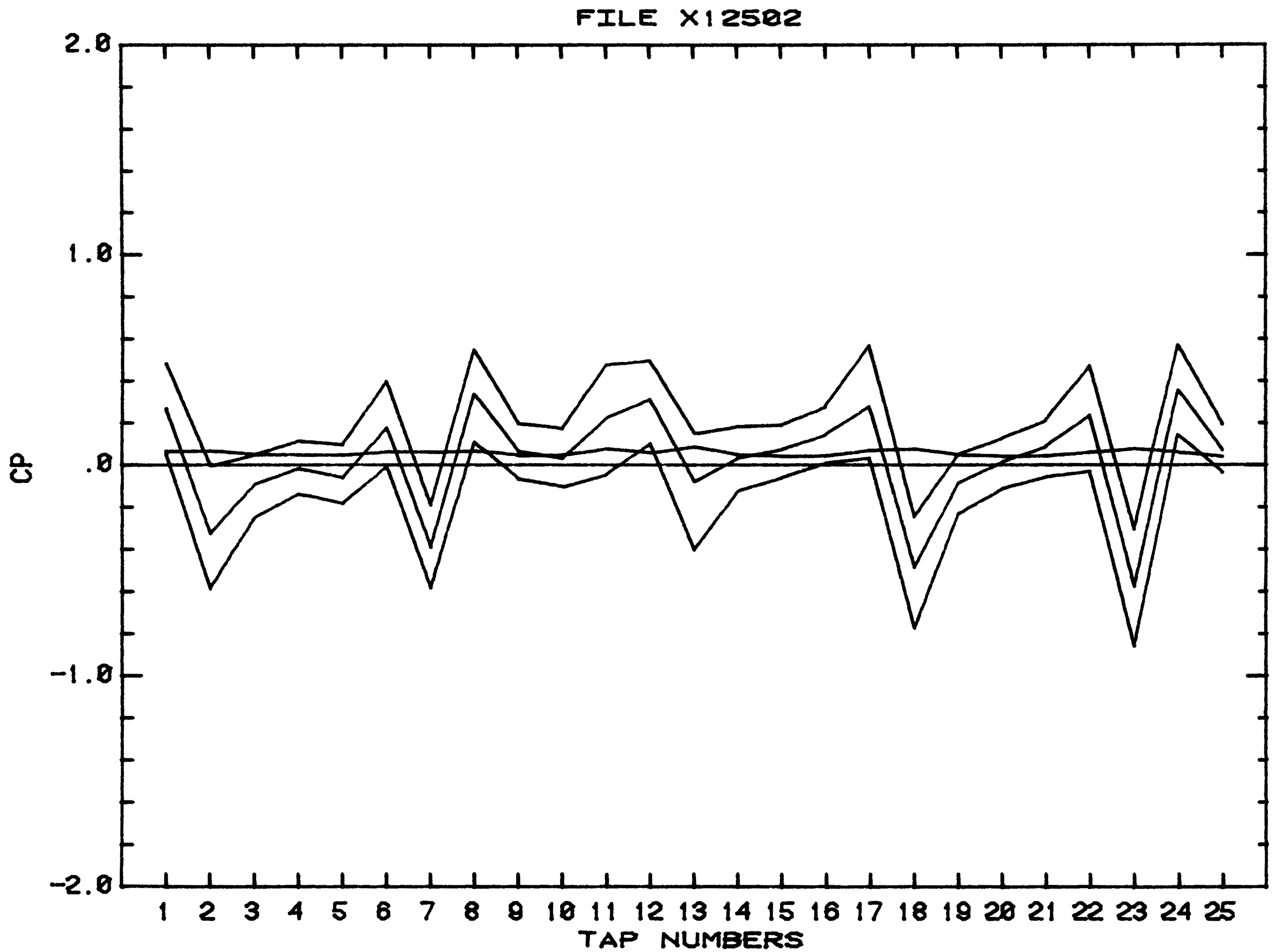
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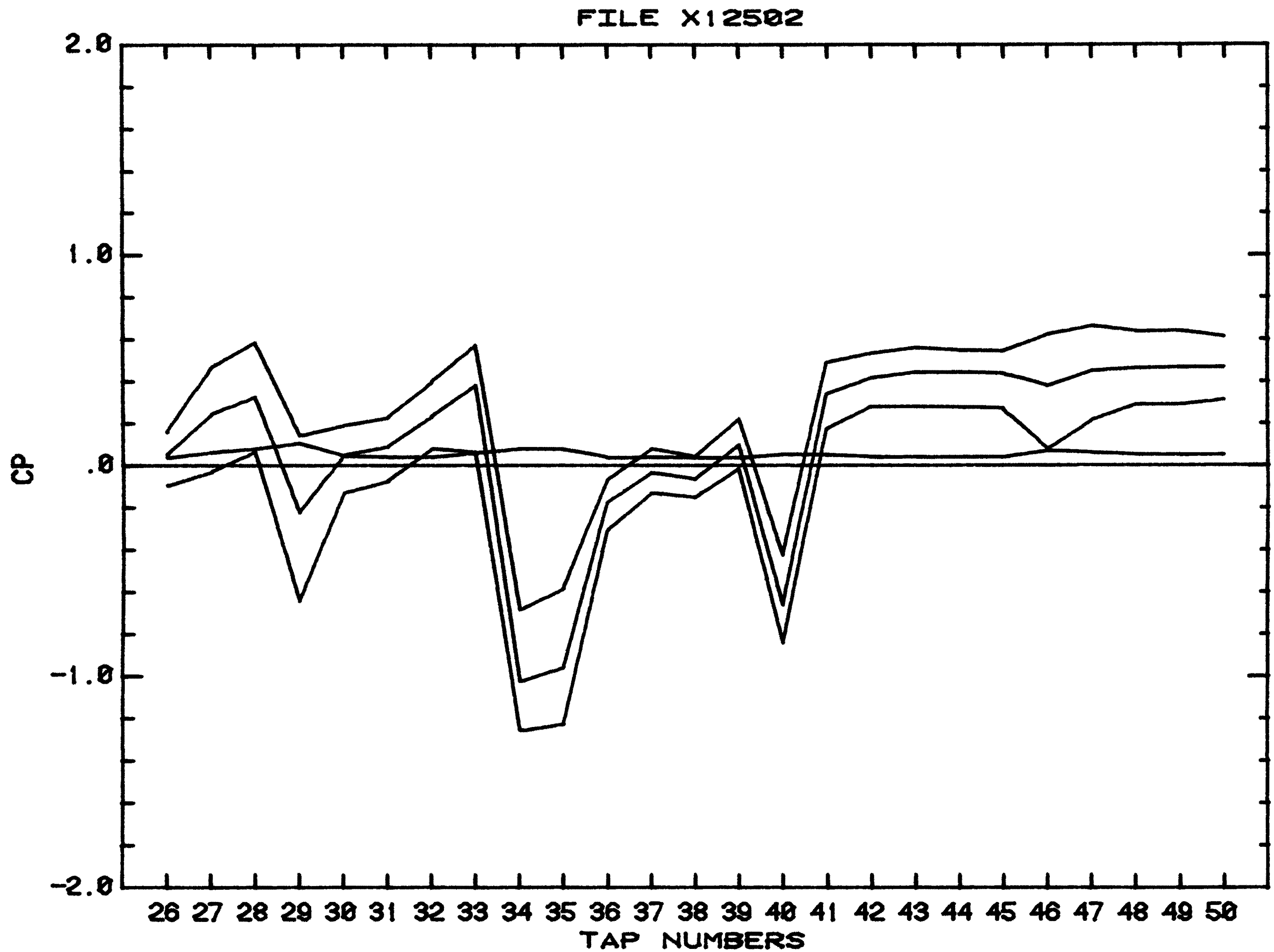

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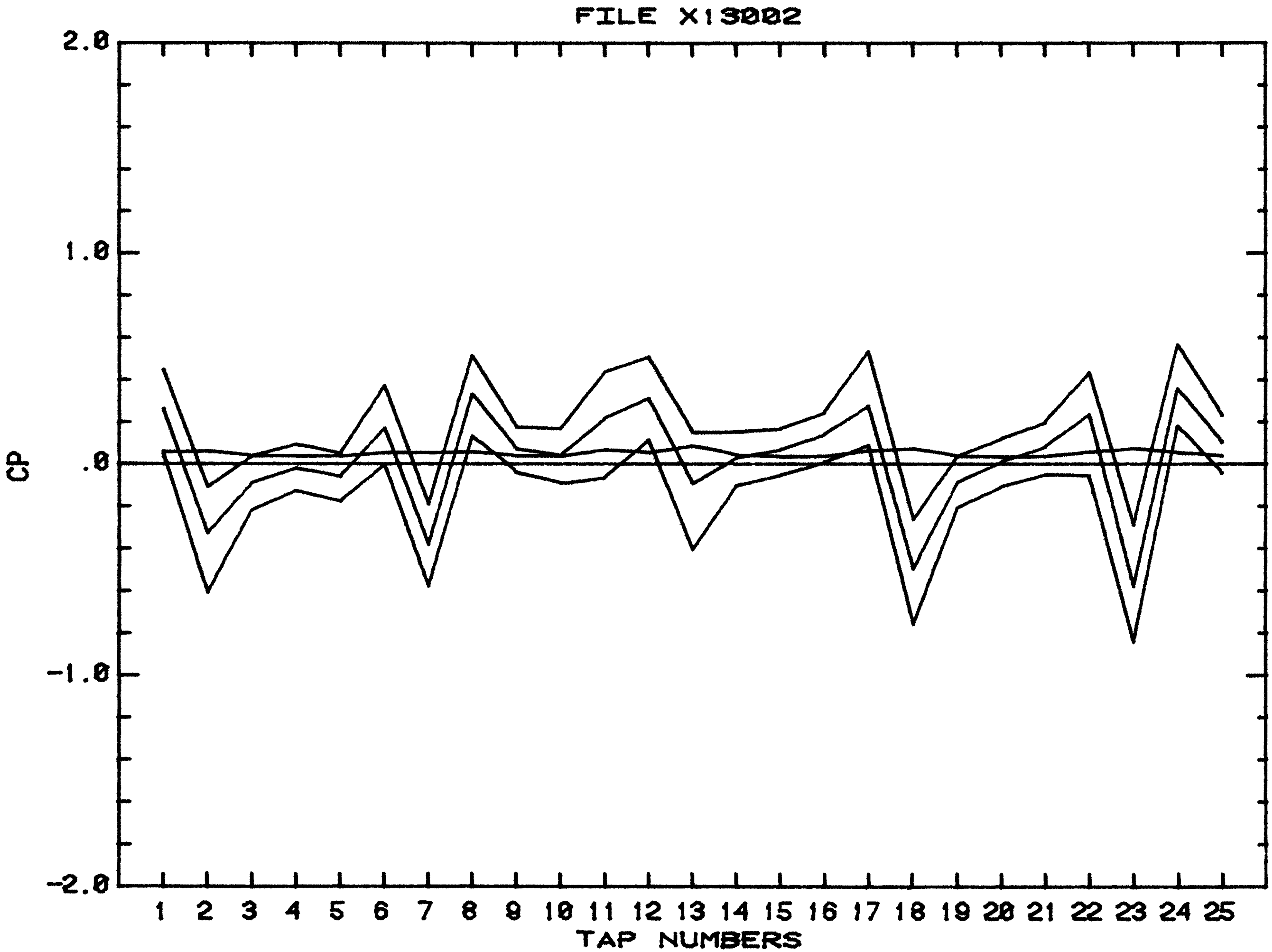
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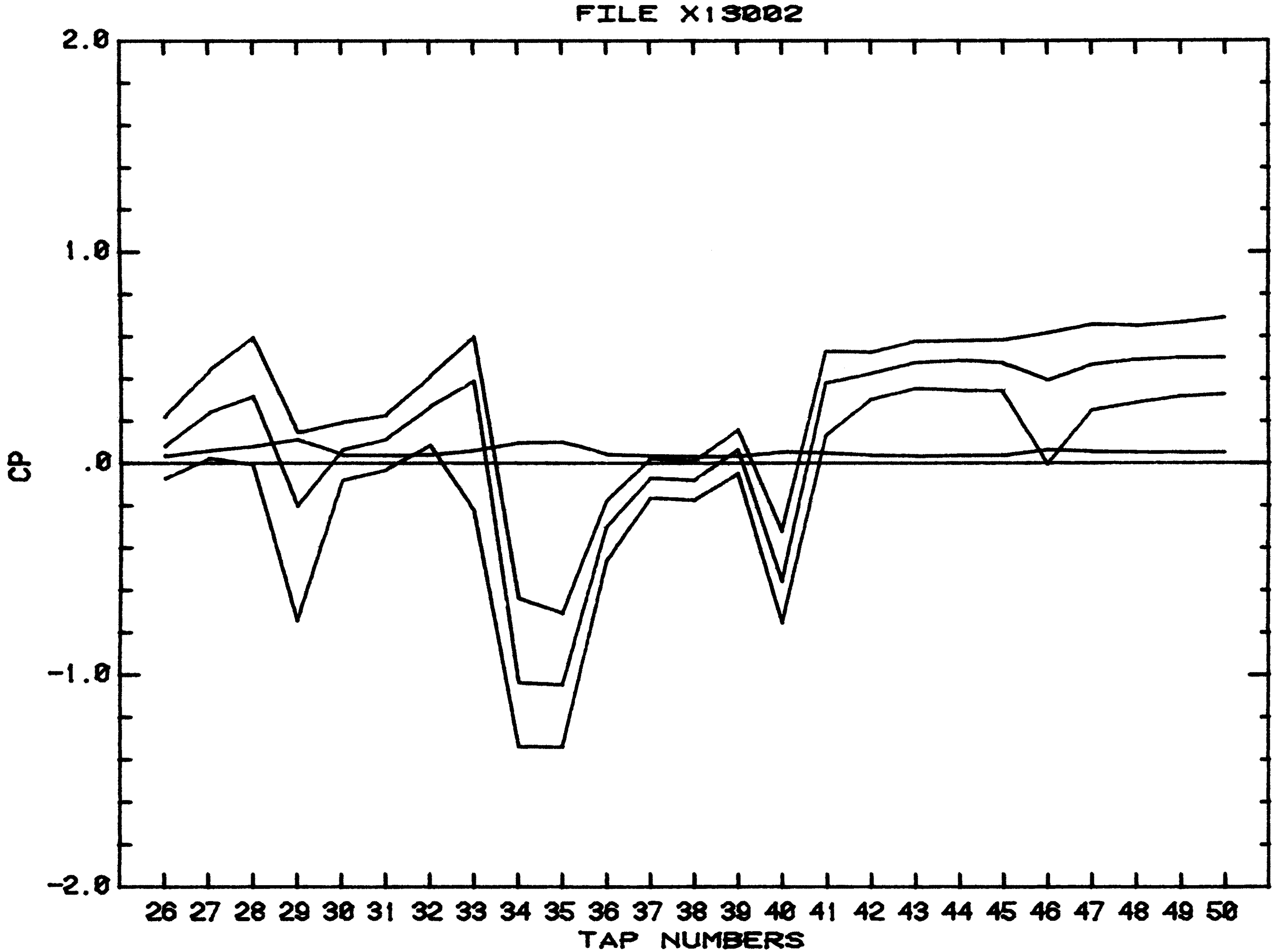
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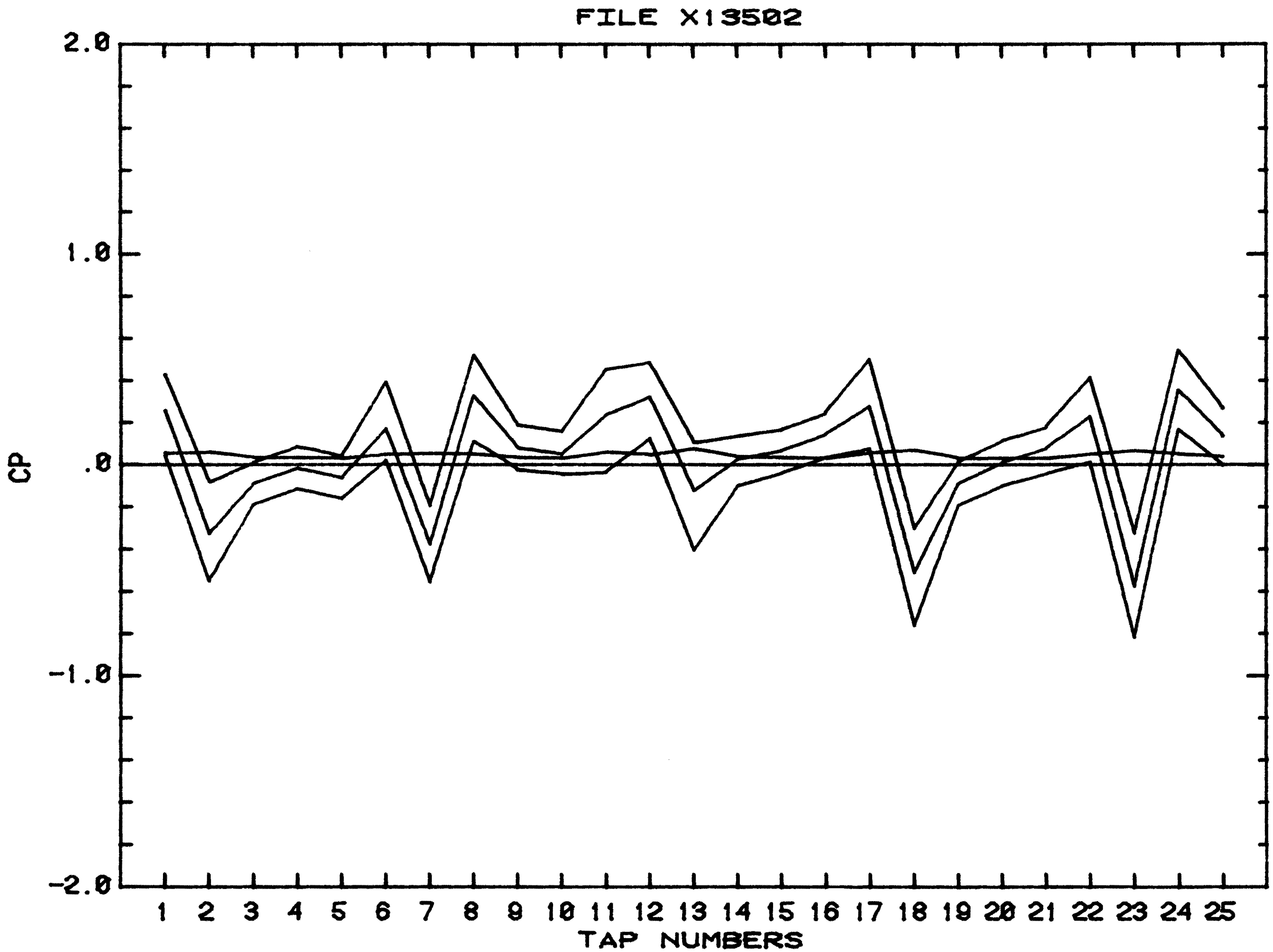
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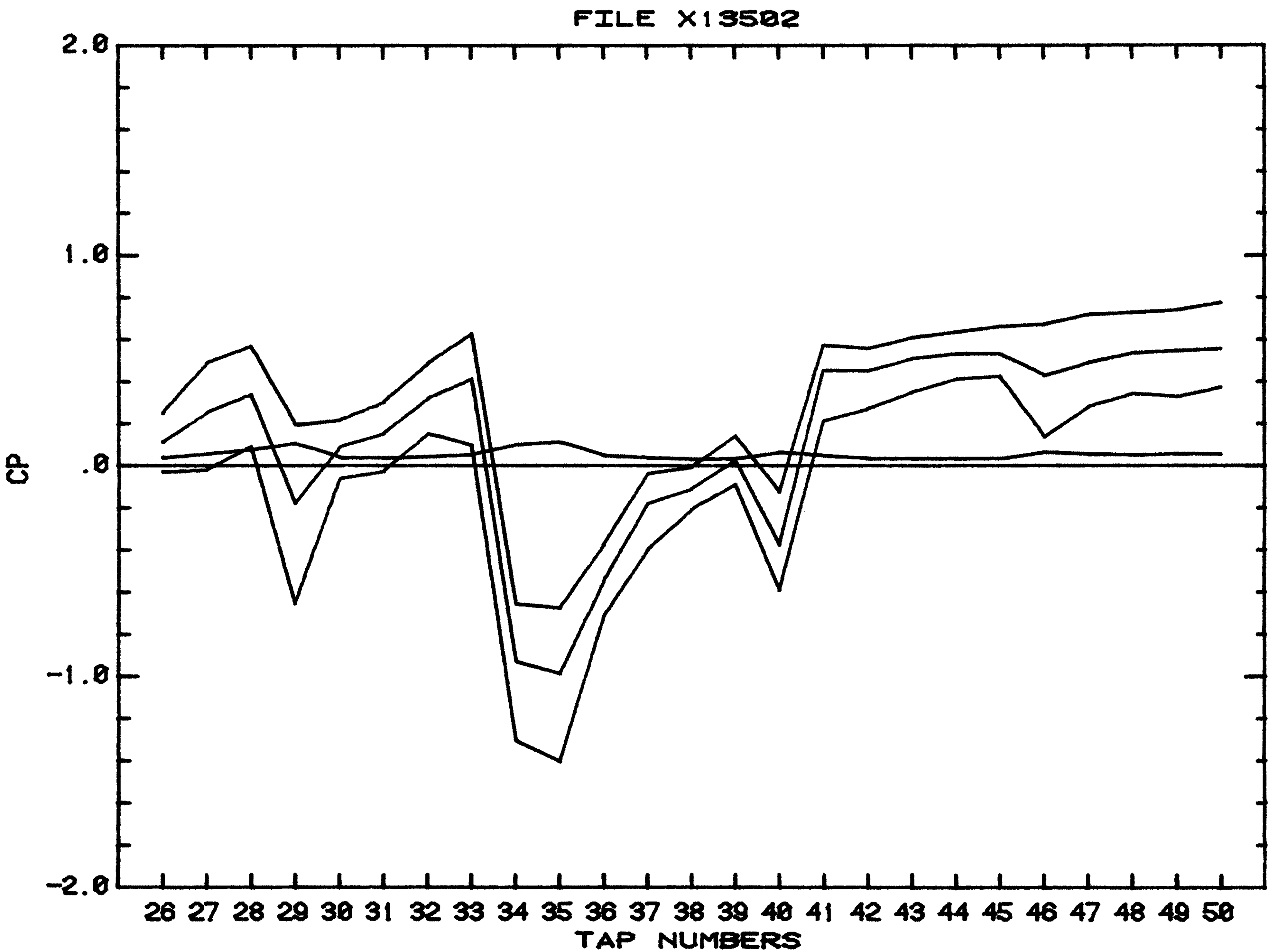
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TAP NUMBERS