

**A WIND TUNNEL INVESTIGATION OF JETS
EXHAUSTING INTO A CROSSFLOW**

Volume III

Additional Data for Two-Jet Configurations

*L. B. FRICKE
P. T. WOOLER
H. ZIEGLER*

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FOREWORD

This report presents the results of one of the efforts expended in performance of Contract F33615-69-C-1602, "V/STOL Aircraft Aerodynamic Prediction Methods Investigation", Project No. 698BT. The work was performed by the Northrop Corporation, Aircraft Division. Sponsored by the Air Force Flight Dynamics Laboratory, Air Force Systems Command, the overall program started in May 1969 and is scheduled to be completed in December 1971. Dr. Peter T. Wooler is the Principal Investigator for the Northrop Corporation. Mr. Robert Nicholson is the Project Engineer for the Air Force.

This report, consisting of four volumes, contains the data generated during low speed wind tunnel testing of a four-foot diameter circular plate model with up to three jets exhausting into a crossflow. The test model, instrumentation, test procedure, and reduction and accuracy of the test data are discussed in Volume I. A summary and discussion of the test results are also presented in Volume I. The present volume contains additional data pertaining to the two-jet configurations. Volumes II and IV contain additional data pertaining to the one- and three-jet configurations, respectively.

This technical report has been reviewed and is approved.



C. B. WESTBROOK

Chief, Control Criteria Branch
Flight Control Division
Air Force Flight Dynamics Laboratory

ABSTRACT

A low speed wind tunnel test of a four-foot diameter circular plate model with up to three exhausting jets was conducted to determine surface static pressure distributions, jet paths, and jet decay characteristics in the presence of a crossflow. Data were obtained for the one-jet configuration with the jet exiting at a number of angles to the plate and at various velocity ratios and sideslip angles. Two-jet arrangements were tested with the jets exiting normal to the plate for three different spacings between the two jets and at a number of velocity ratios and sideslip angles. Three-jet configuration data were obtained with the jets exiting normal to the plate for a number of velocity ratios and sideslip angles. As a result of this investigation, several conclusions are deduced pertaining to the interaction of multiple jets exhausting into a crossflow.

This report consists of four volumes. The test model, instrumentation, test procedure, and reduction and accuracy of the test data are discussed in Volume I. A summary and discussion of the test results are also presented in Volume I. The present volume contains additional data pertaining to the two-jet configurations. Volumes II and IV contain additional data pertaining to the one- and three-jet configurations, respectively.

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LIST OF SYMBOLS

BETA or β	Angle of Sideslip, Degrees, (See Fig. 1, Vol. I)
C_p	Pressure Coefficient, $C_p = (p-p_\infty)/q$
C_{p_t}	Total Pressure Coefficient, $C_{p_t} = \frac{(p_t - p_{t_\infty})}{(p_{t_0} - p_{t_\infty})}$
DELTA J or δ_j	Jet Deflection Angle, Degrees, (See Fig. 2, Vol. I)
M	Mach Number
p	Surface Static Pressure, PSF
p_∞	Freestream Static Pressure, PSF
p_a	Atmospheric Pressure, PSF
p_t	Total Pressure, PSF
p_{t_∞}	Freestream Total Pressure, PSF
p_{t_0}	Jet Exit Total Pressure, PSF
Q or q	Freestream Dynamic Pressure, $Q = 1/2\rho U^2$, PSF
Q_j or Q_j	Jet Dynamic Pressure, $Q_j = 1/2\rho_j U_{j_0}^2$, PSF
r/d_0	Ratio of Radial Distance to Jet Diameter
U	Freestream Velocity, FPS
U_{j_0}	Jet Exit Velocity, FPS
U/U_j or U/U_j	Effective Velocity Ratio, $U/U_j = \sqrt{Q/Q_j}$
x	Chordwise Coordinate, Inches, (See Fig. 1, Vol. I)
y	Spanwise Coordinate, Inches, (See Fig. 1, Vol. I)
ρ	Freestream Air Density, Slugs/ft. ³
ρ_j	Jet Exit Air Density, Slugs/ft. ³

SECTION I

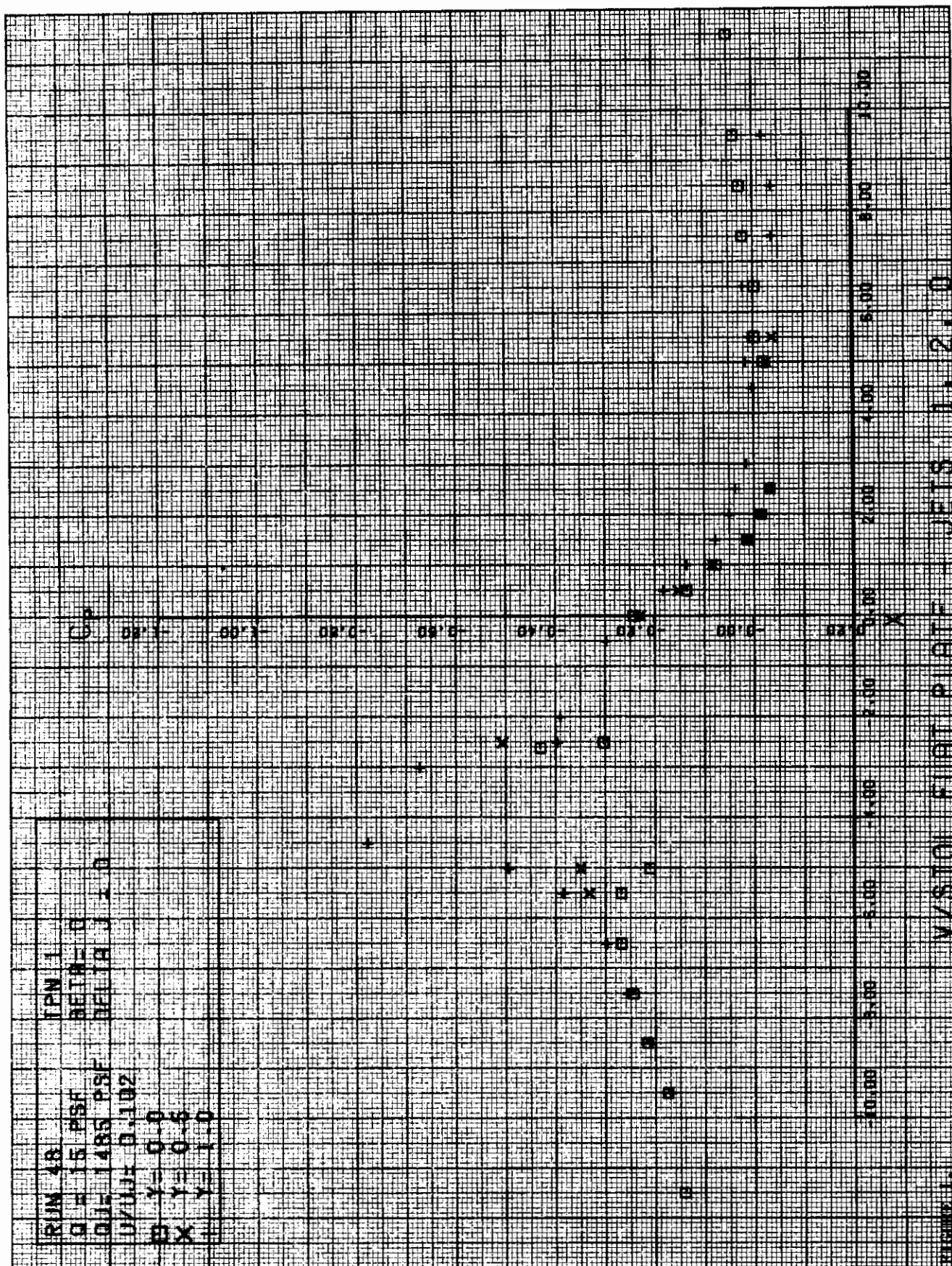
INTRODUCTION

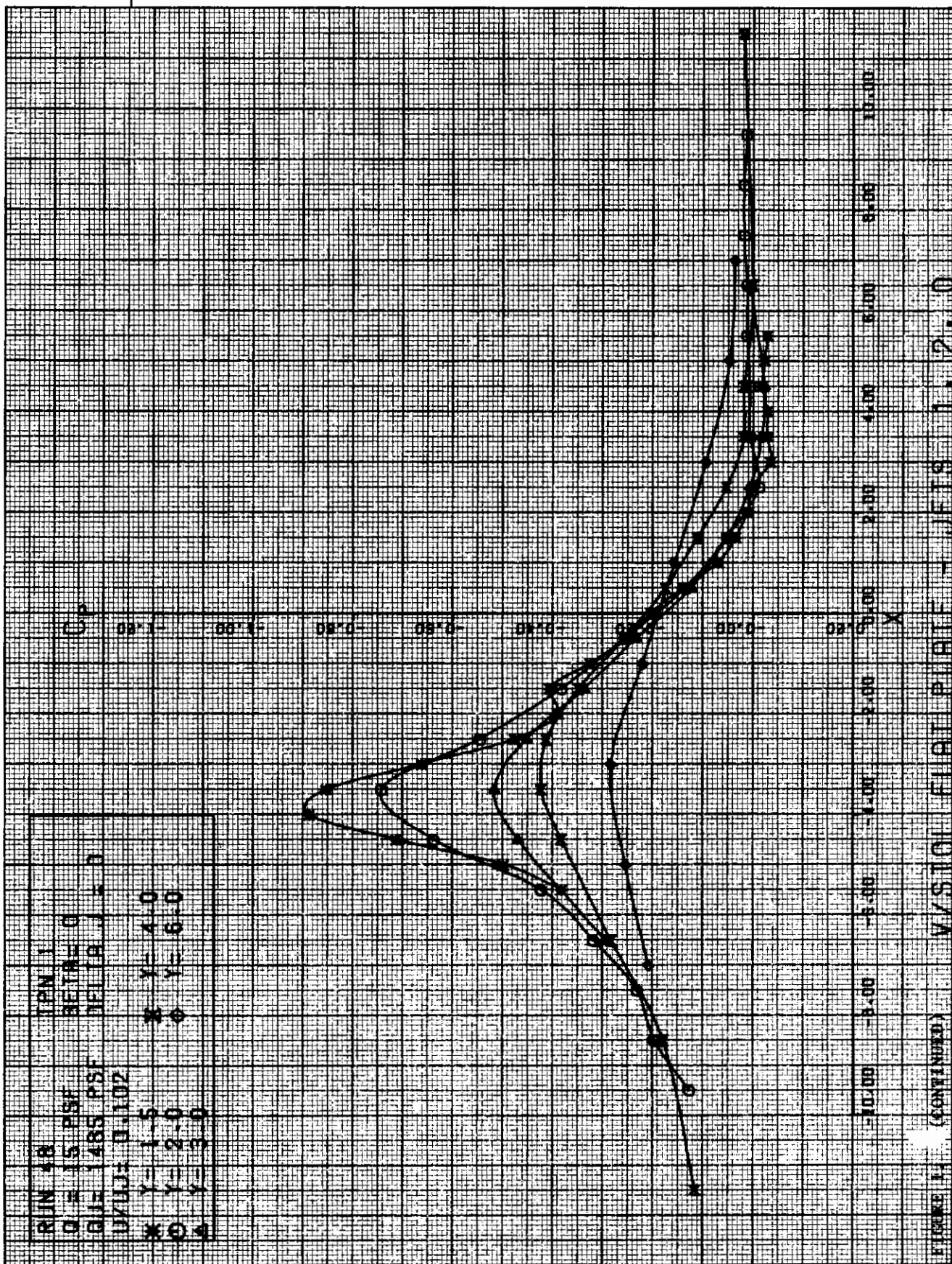
The objectives of this investigation were to generate surface static pressure data, jet decay characteristics, and jet centerline information for one-, two-, and three-jet configurations exhausting into a crossflow. The details of the test model, instrumentation, test procedure, and reduction and accuracy of the test data have been presented in Volume I. A summary and discussion of the test results, together with some significant conclusions, have also been presented in Volume I.

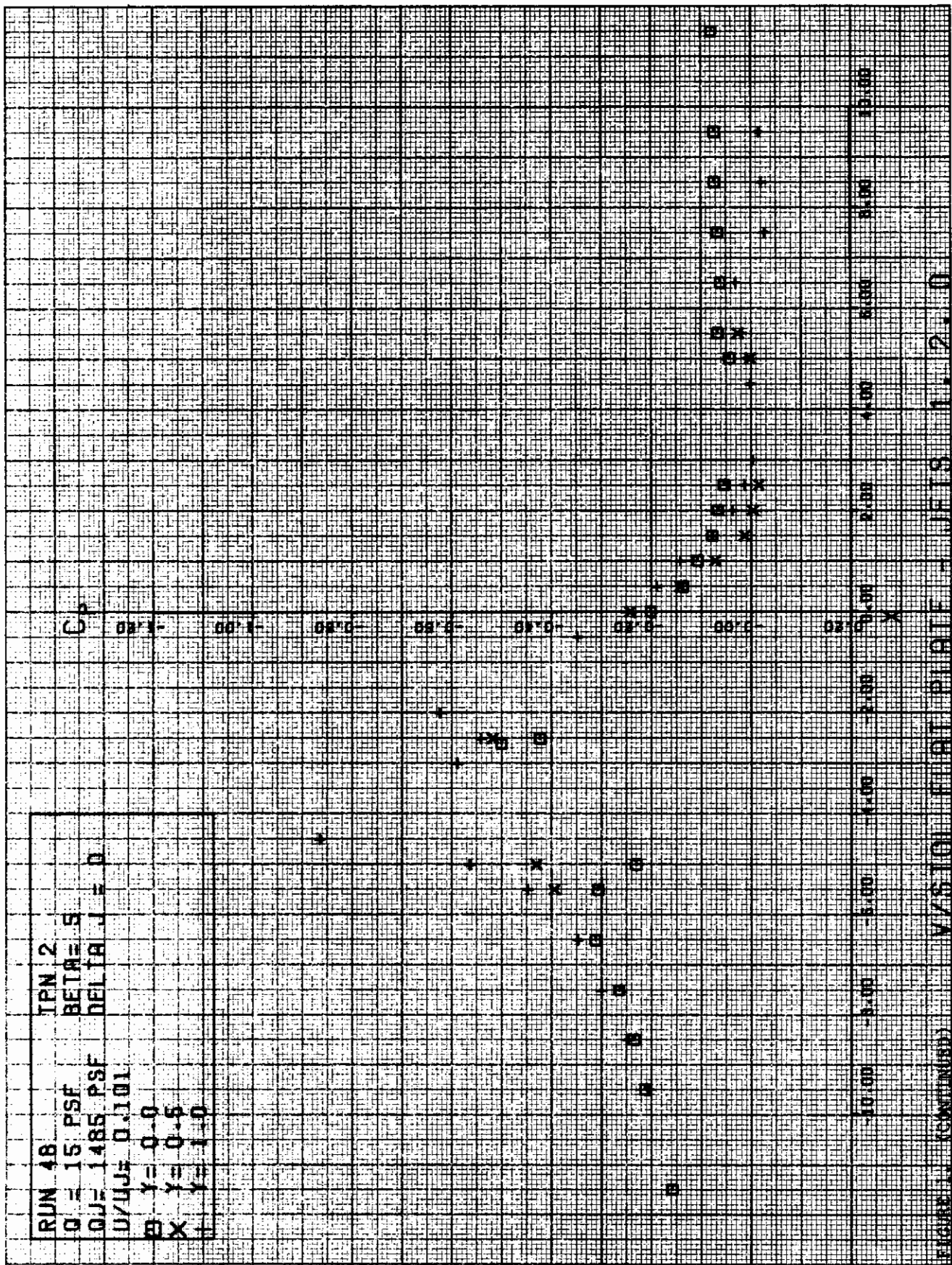
This volume contains additional surface static pressure data for the two-jet configurations. Data are presented for configurations with:

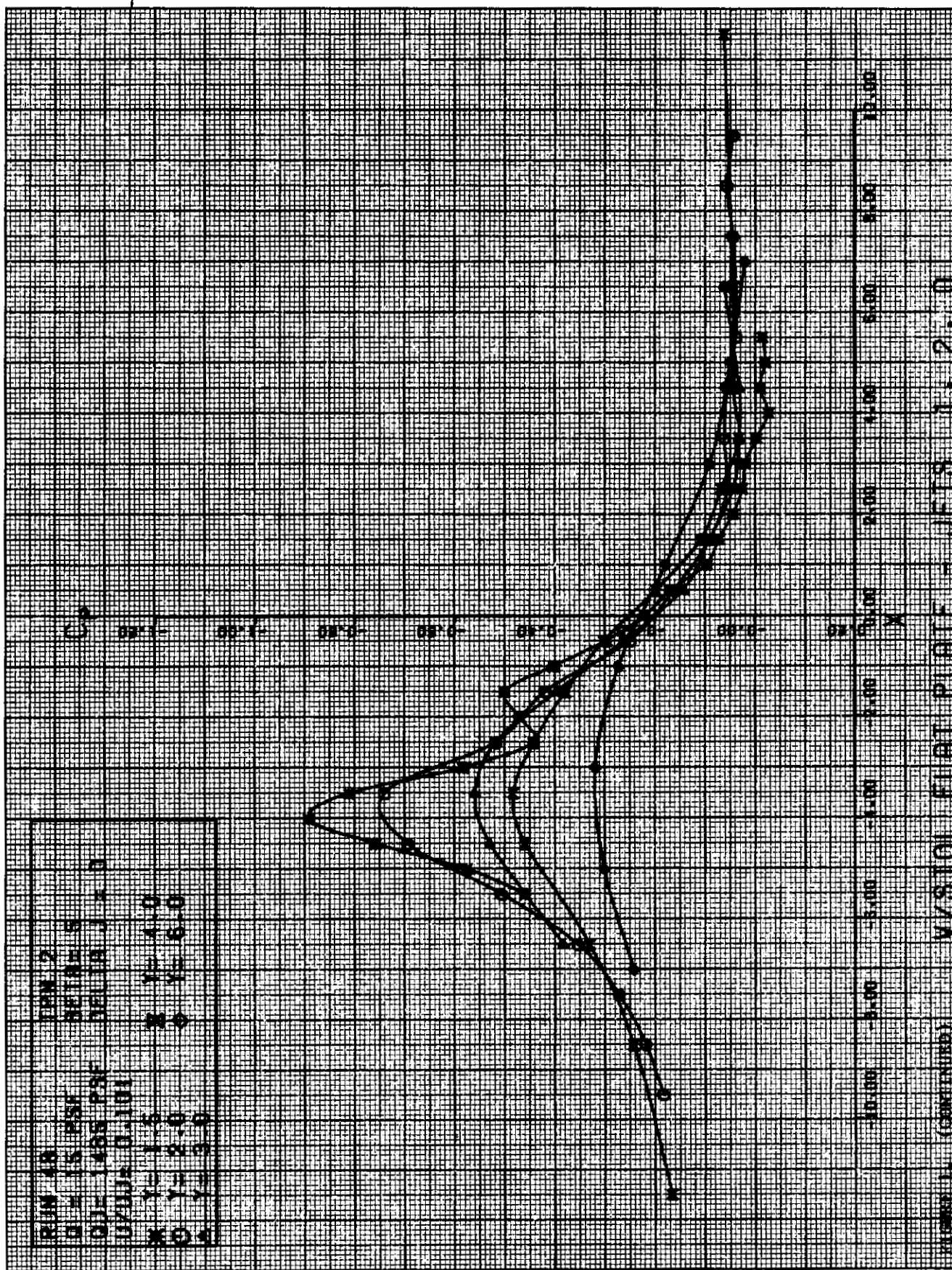
1. Jets 1, 2 operating at velocity ratios of 0.10, 0.15, 0.20, 0.25, and 0.30 for various sideslip angles.
2. Jets 2, 3 operating at velocity ratios of 0.10, 0.15, and 0.25 for various sideslip angles.
3. Jets 1, 3 operating at velocity ratios of 0.10, 0.15, 0.20, 0.25, and 0.30 for various sideslip angles.

Data for a velocity ratio of 0.125, for each of the two-jet configurations listed above, are presented in Volume I for various sideslip angles. Data for Jets 2, 3 at velocity ratios of 0.20 and 0.30 as well as data for Jets 1,2 and 1,3 with differential velocity ratios are also presented in Volume I.









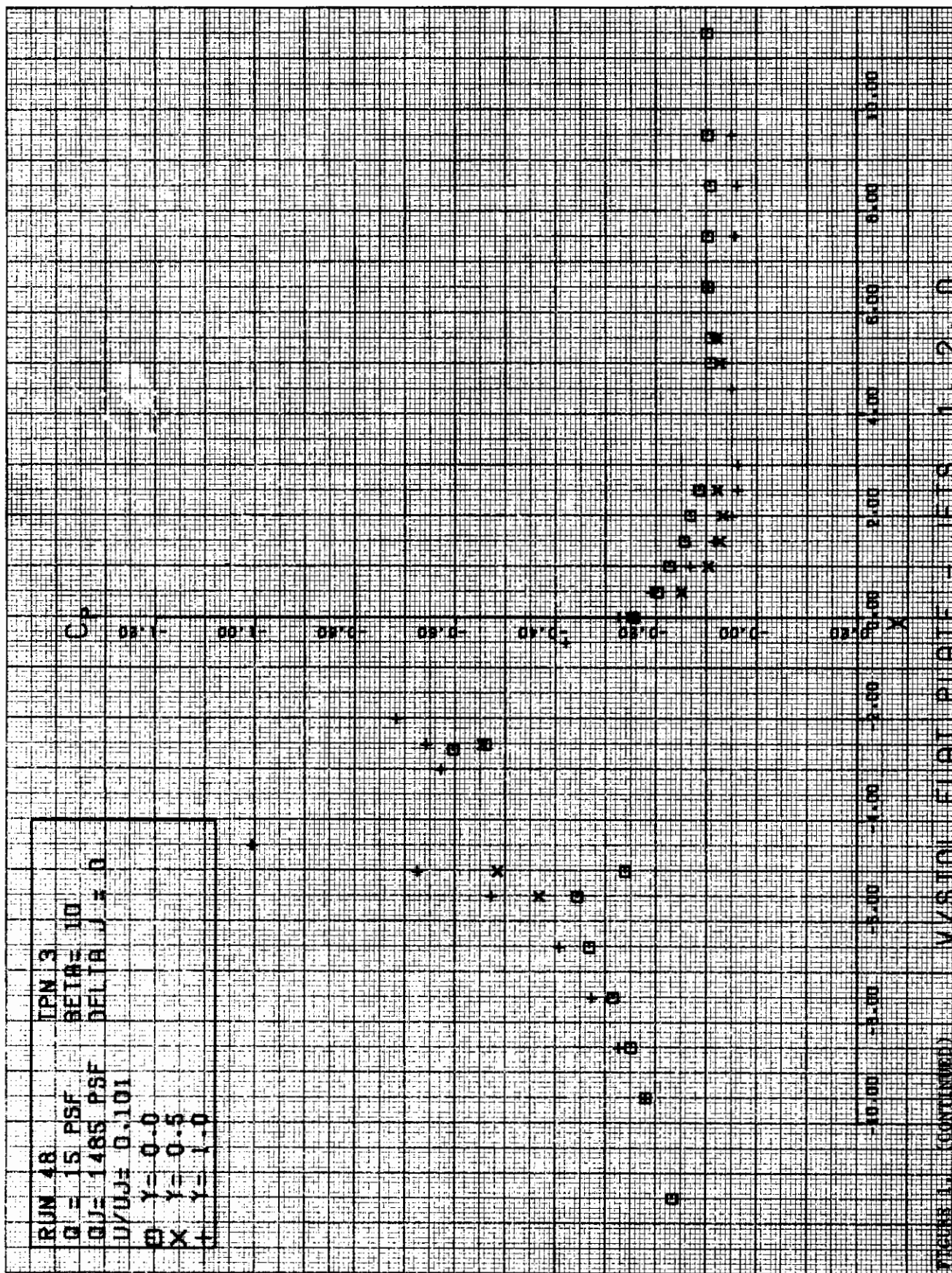
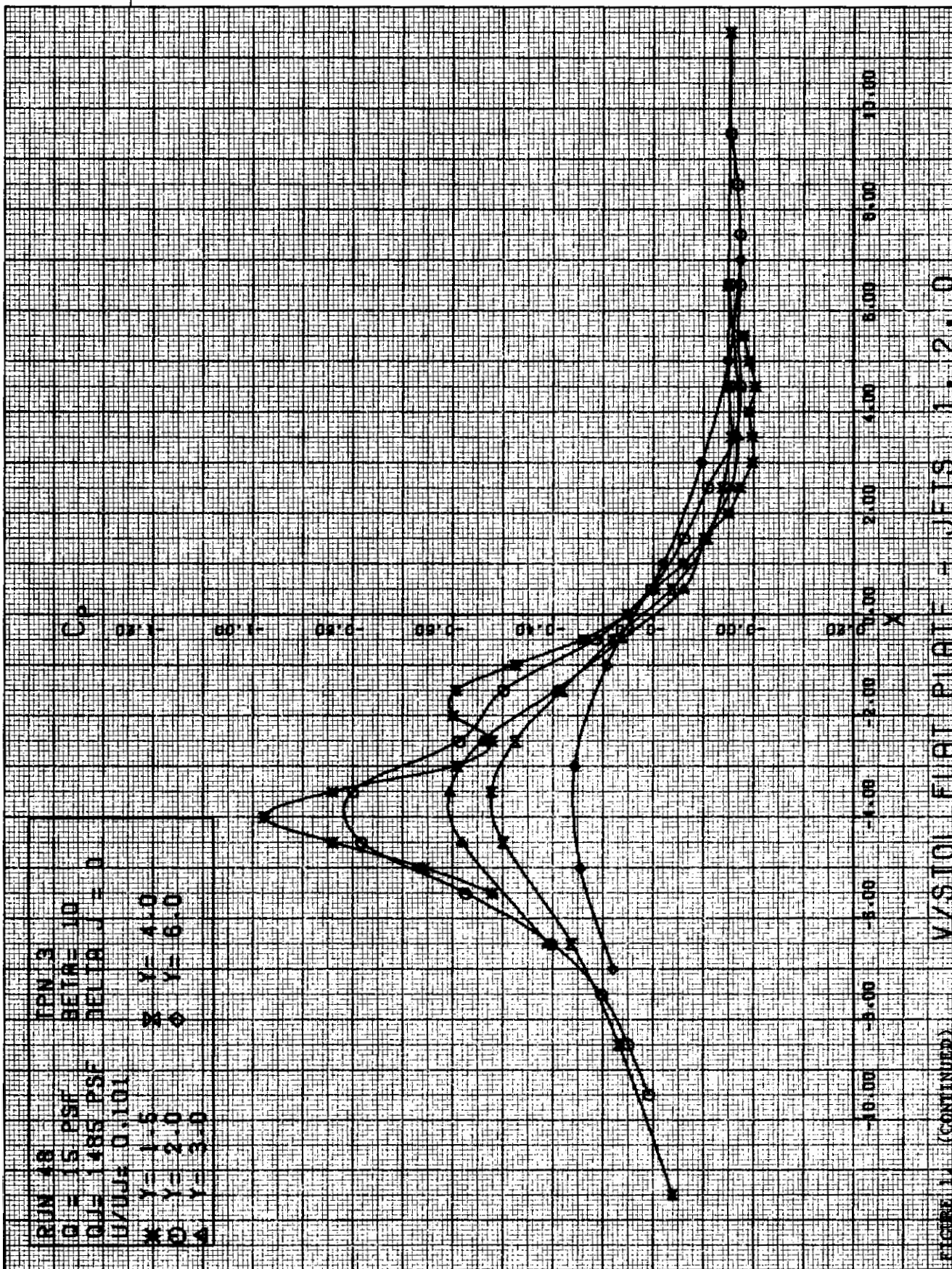
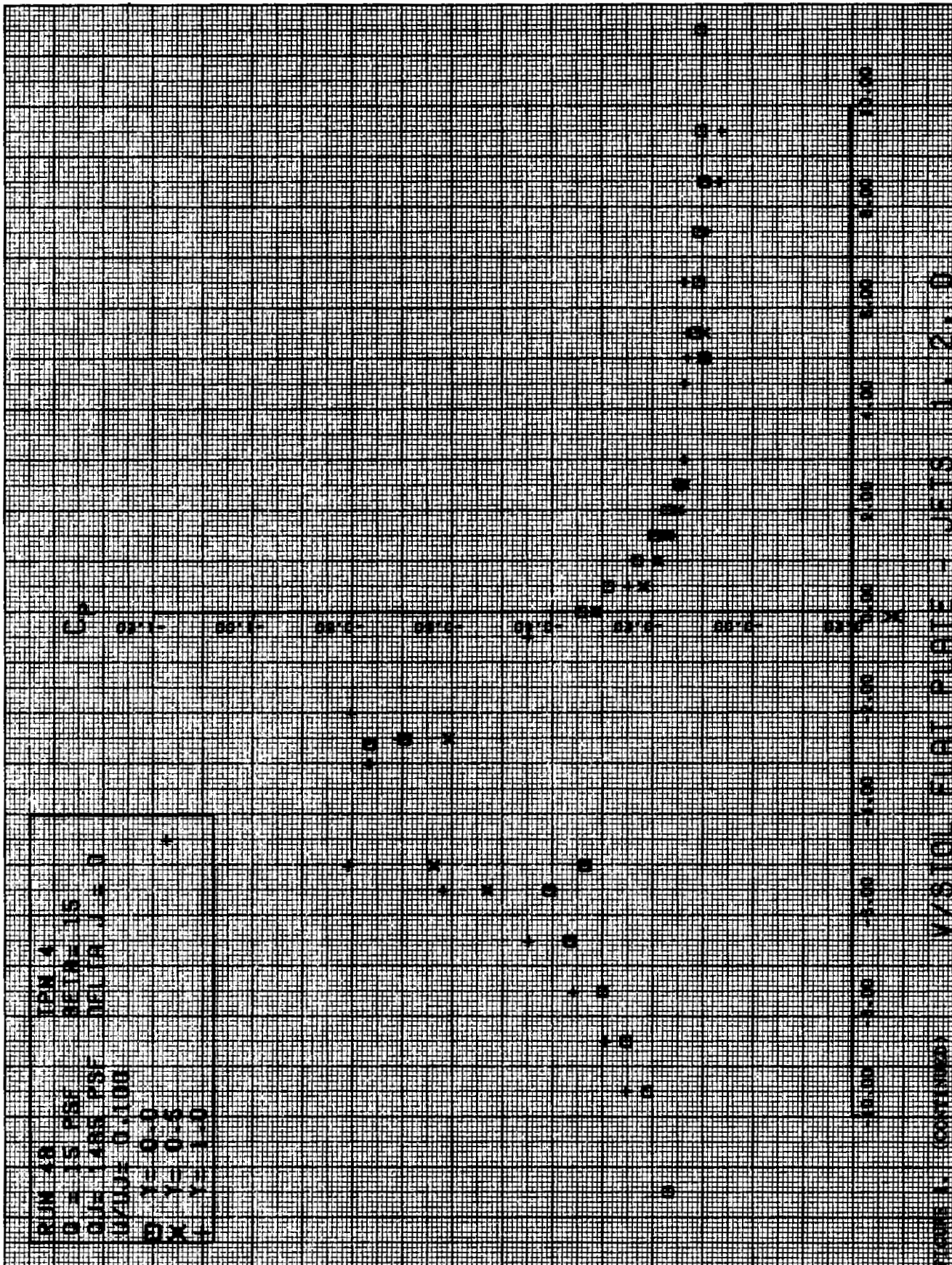
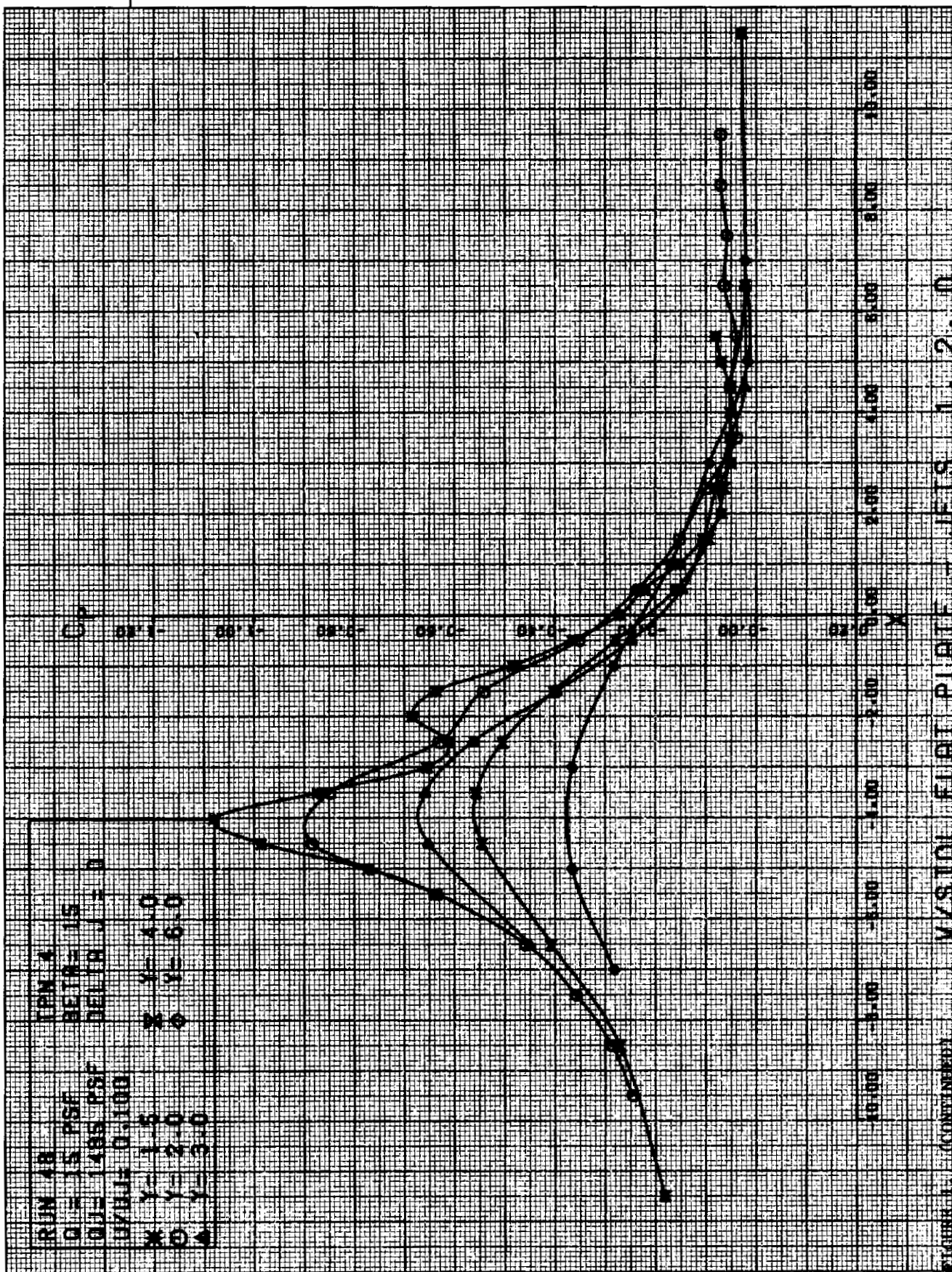
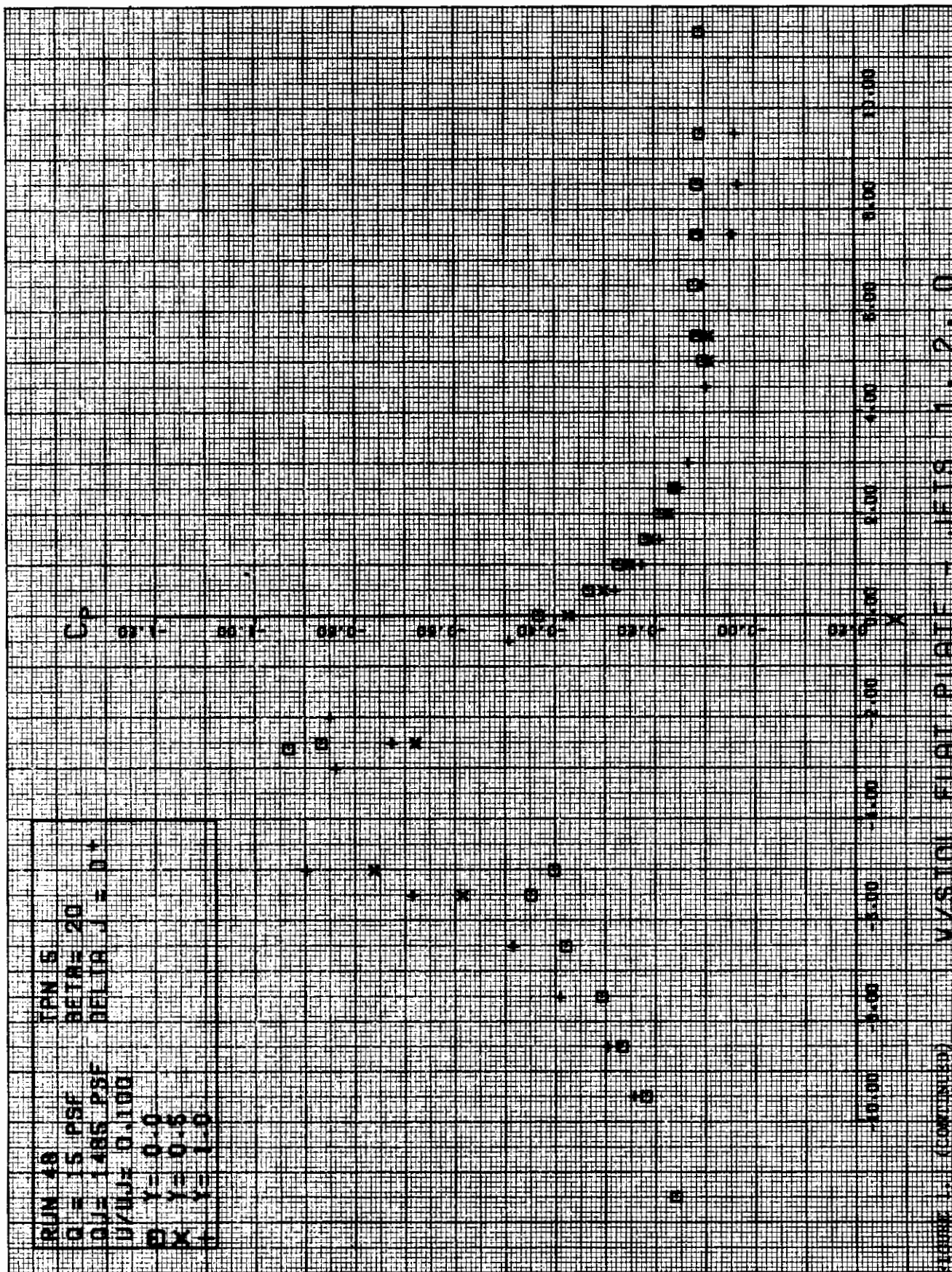


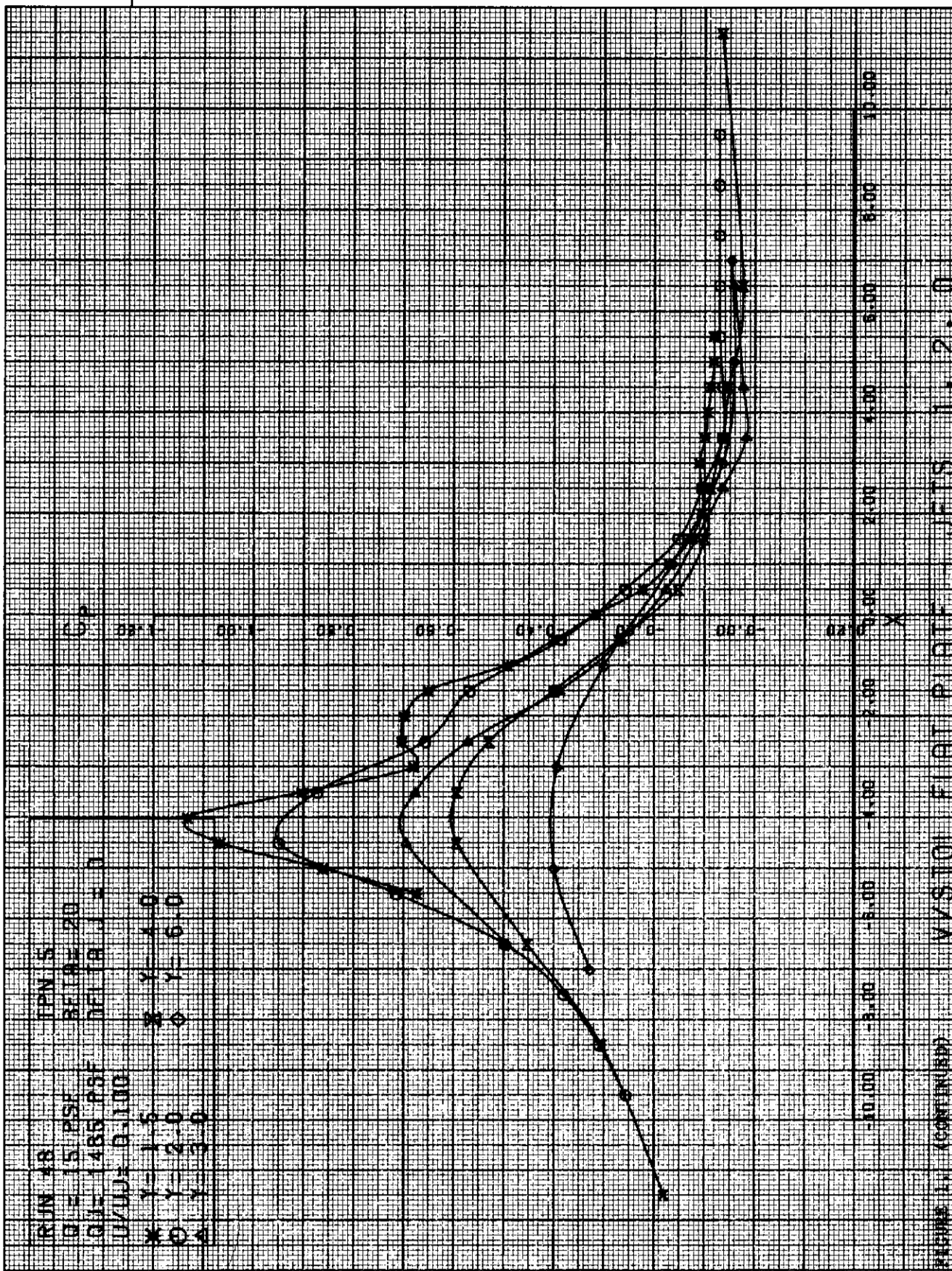
FIGURE 1. (CONTINUED) V/STOL FLIGHT PLATE - JETS 1.2.0

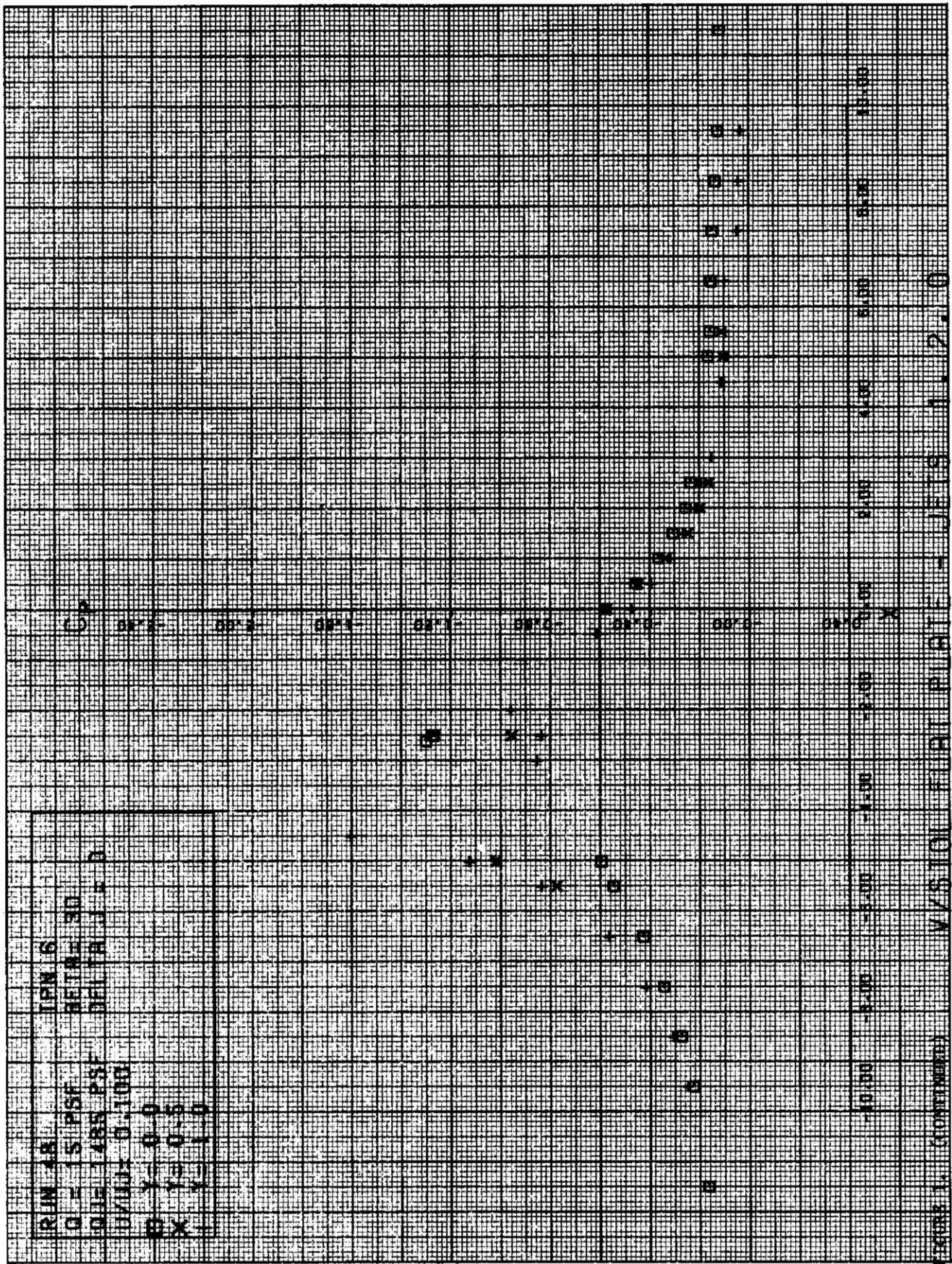


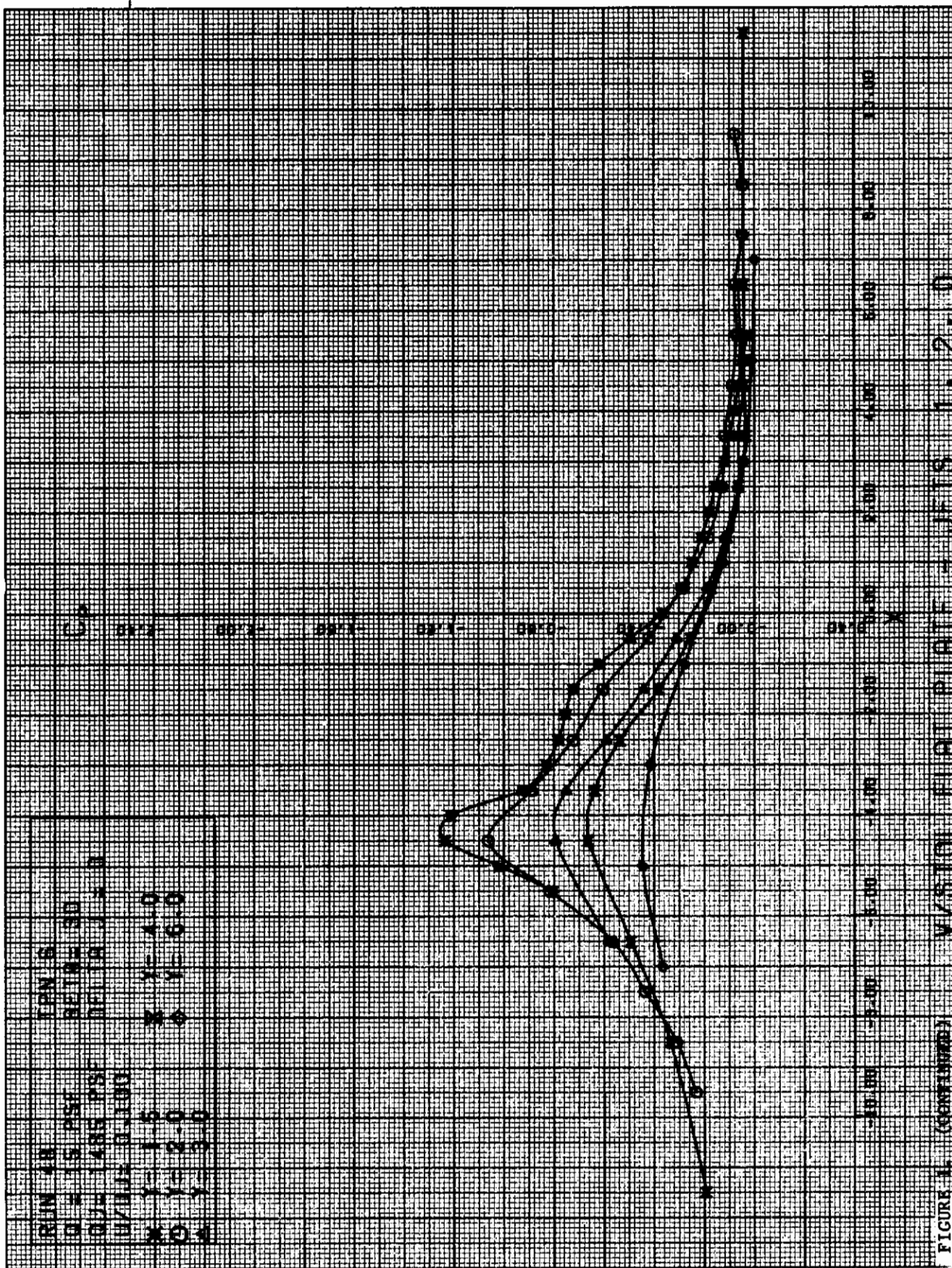


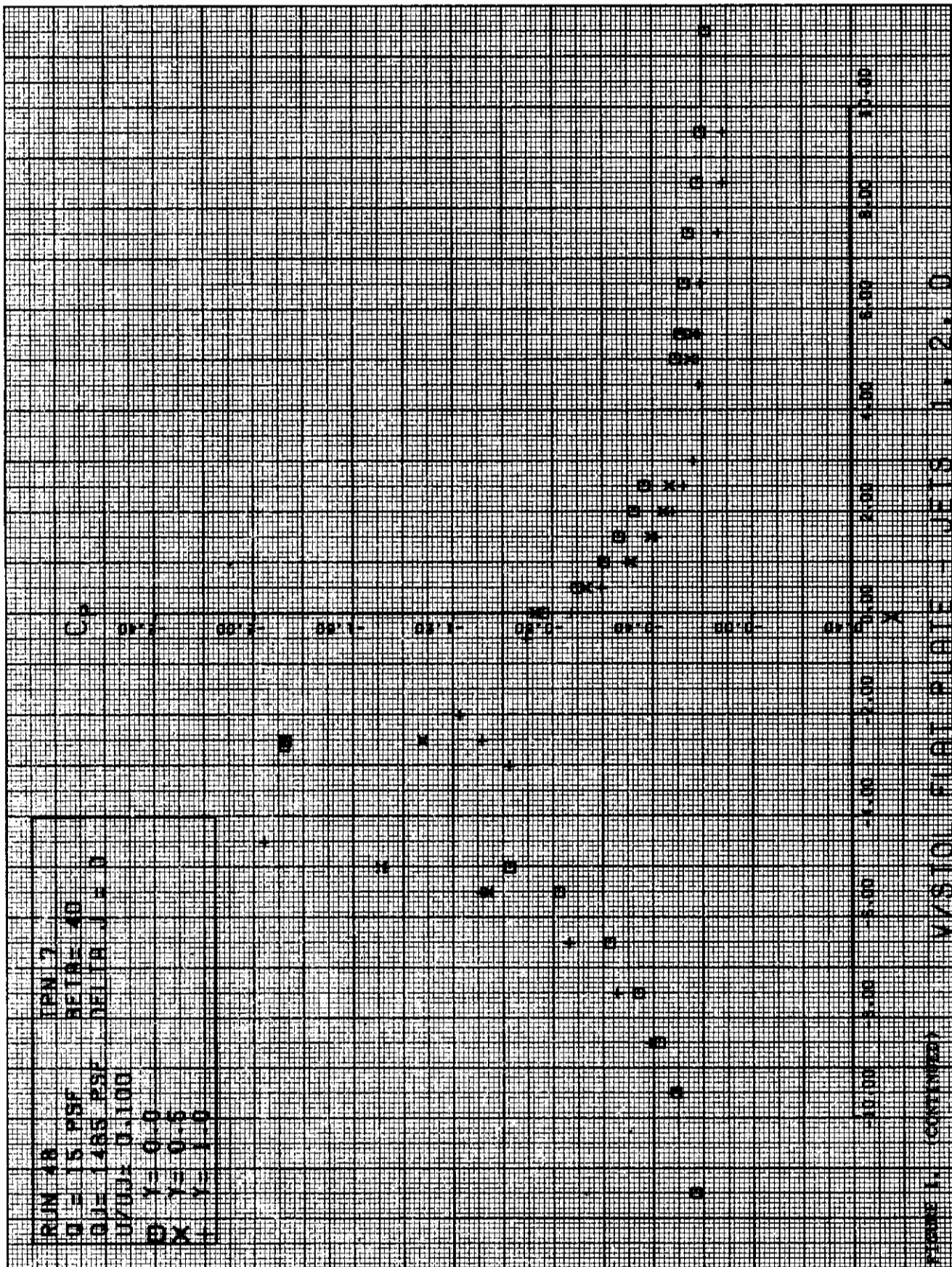


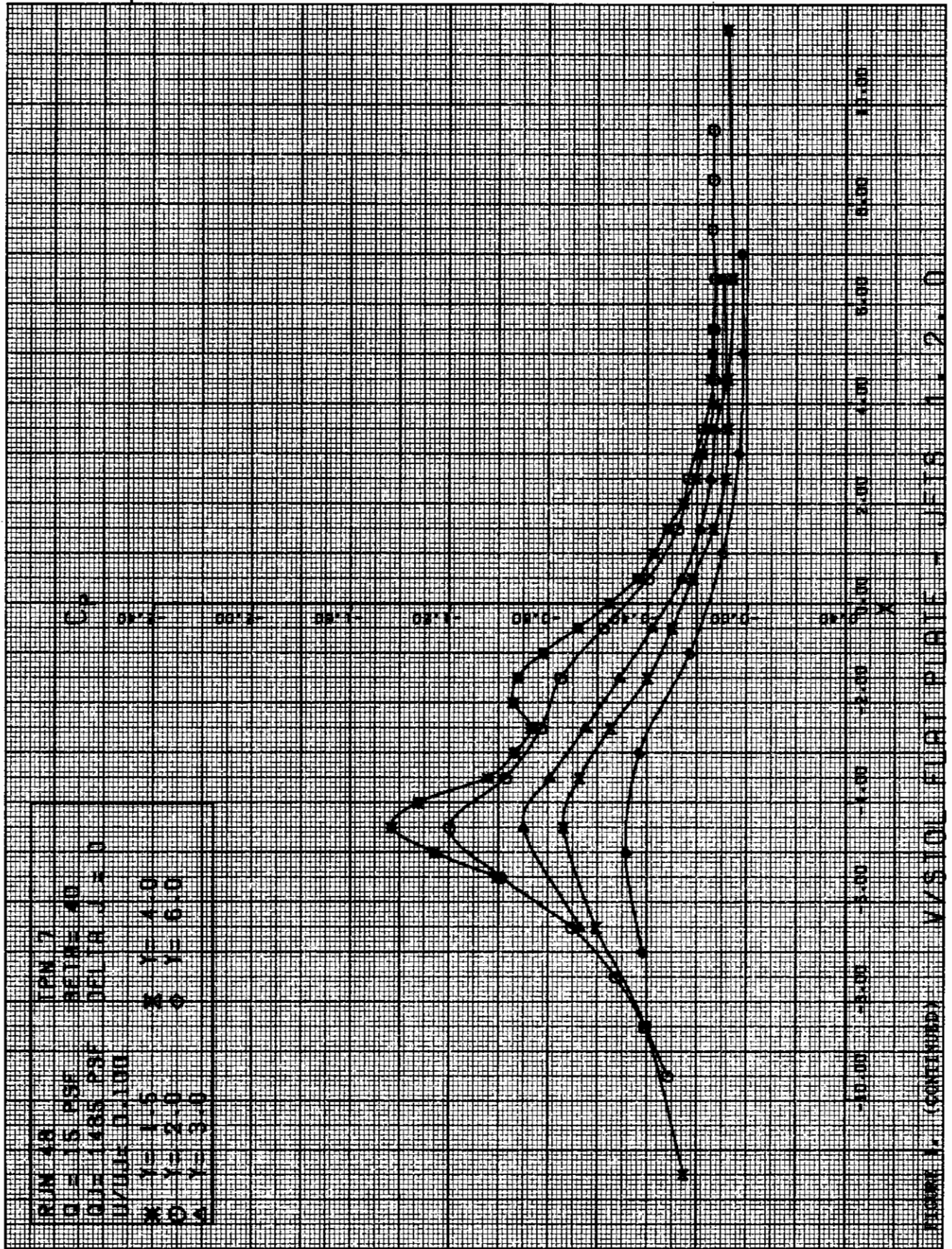


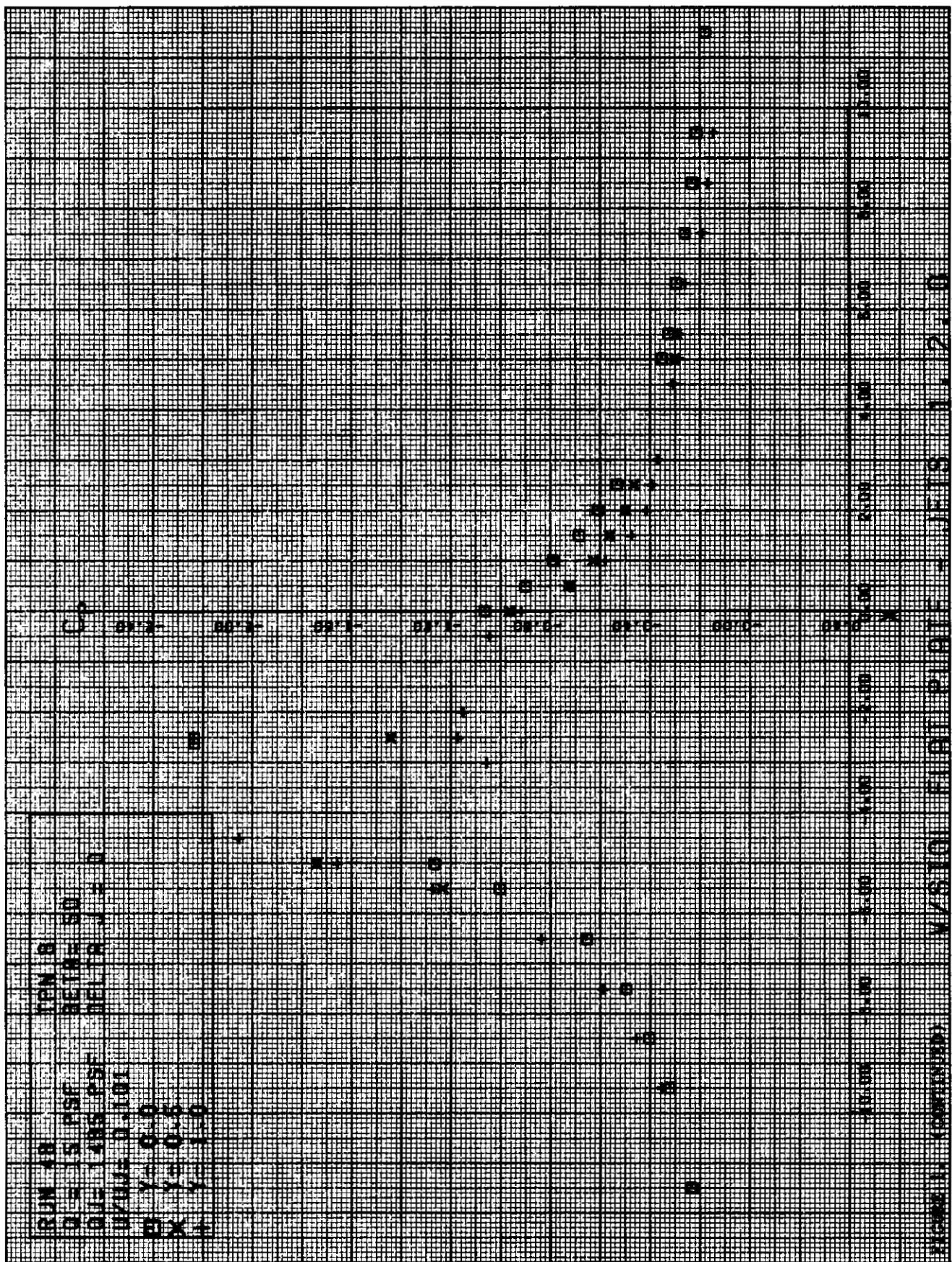


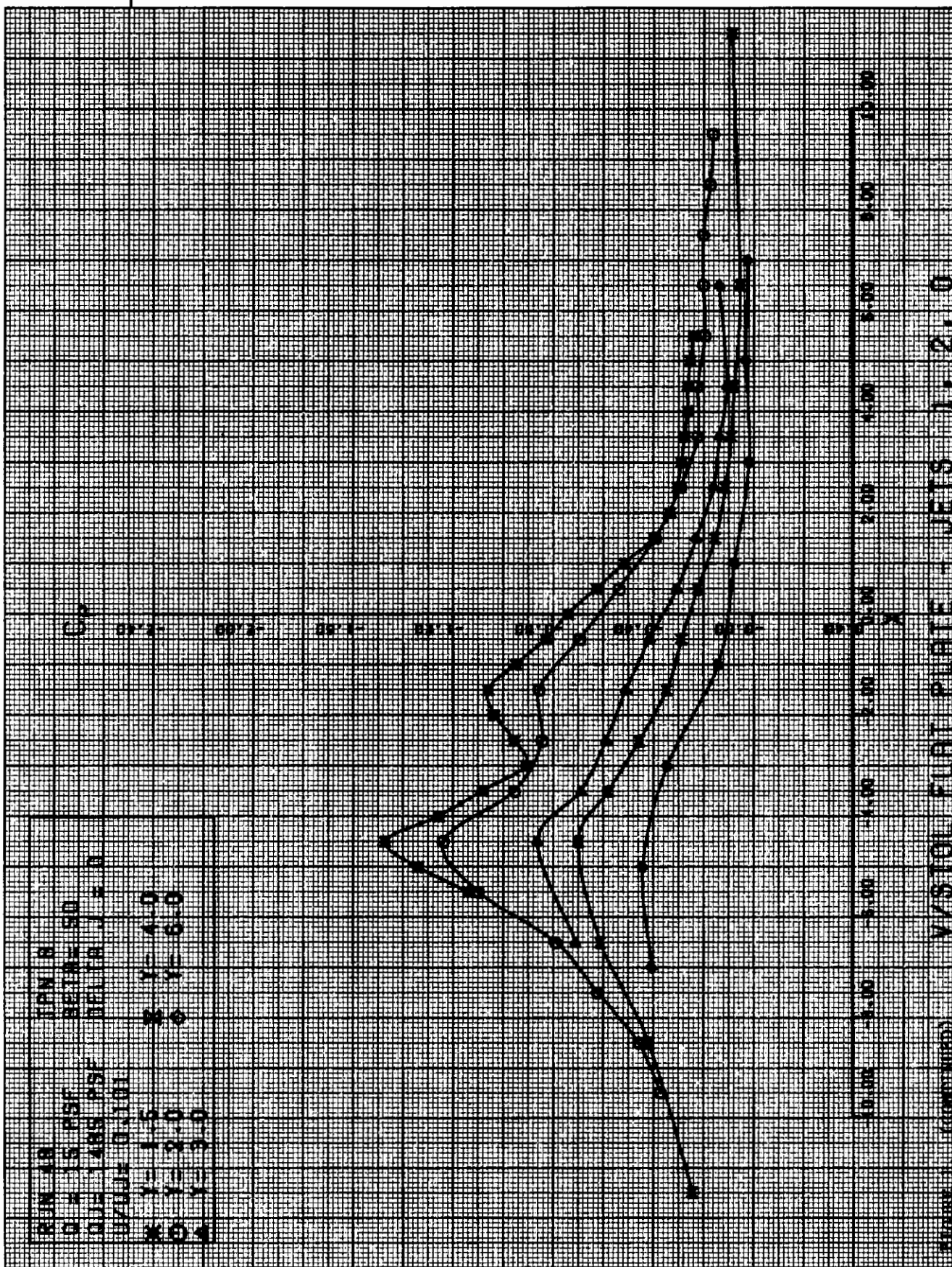


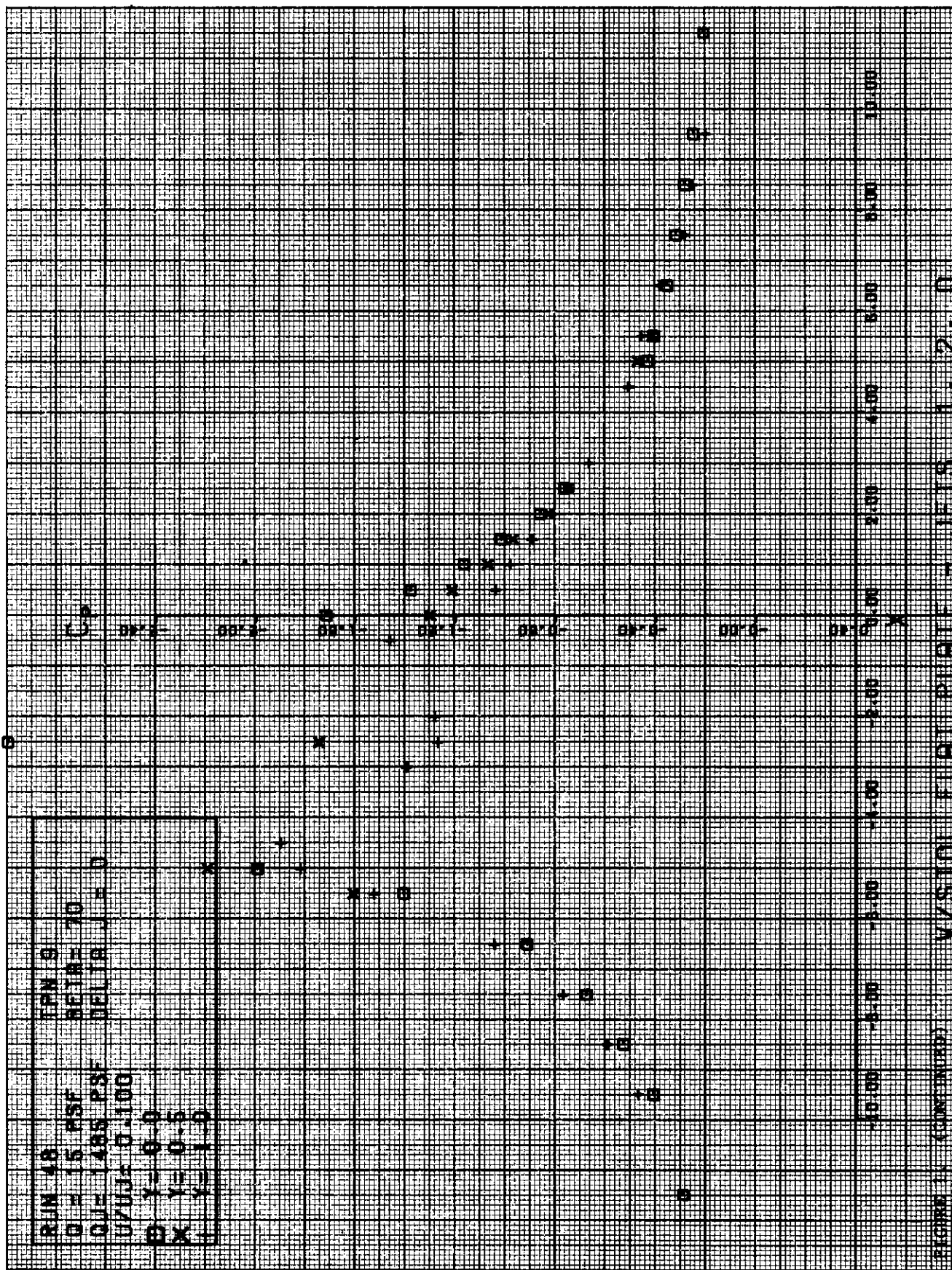


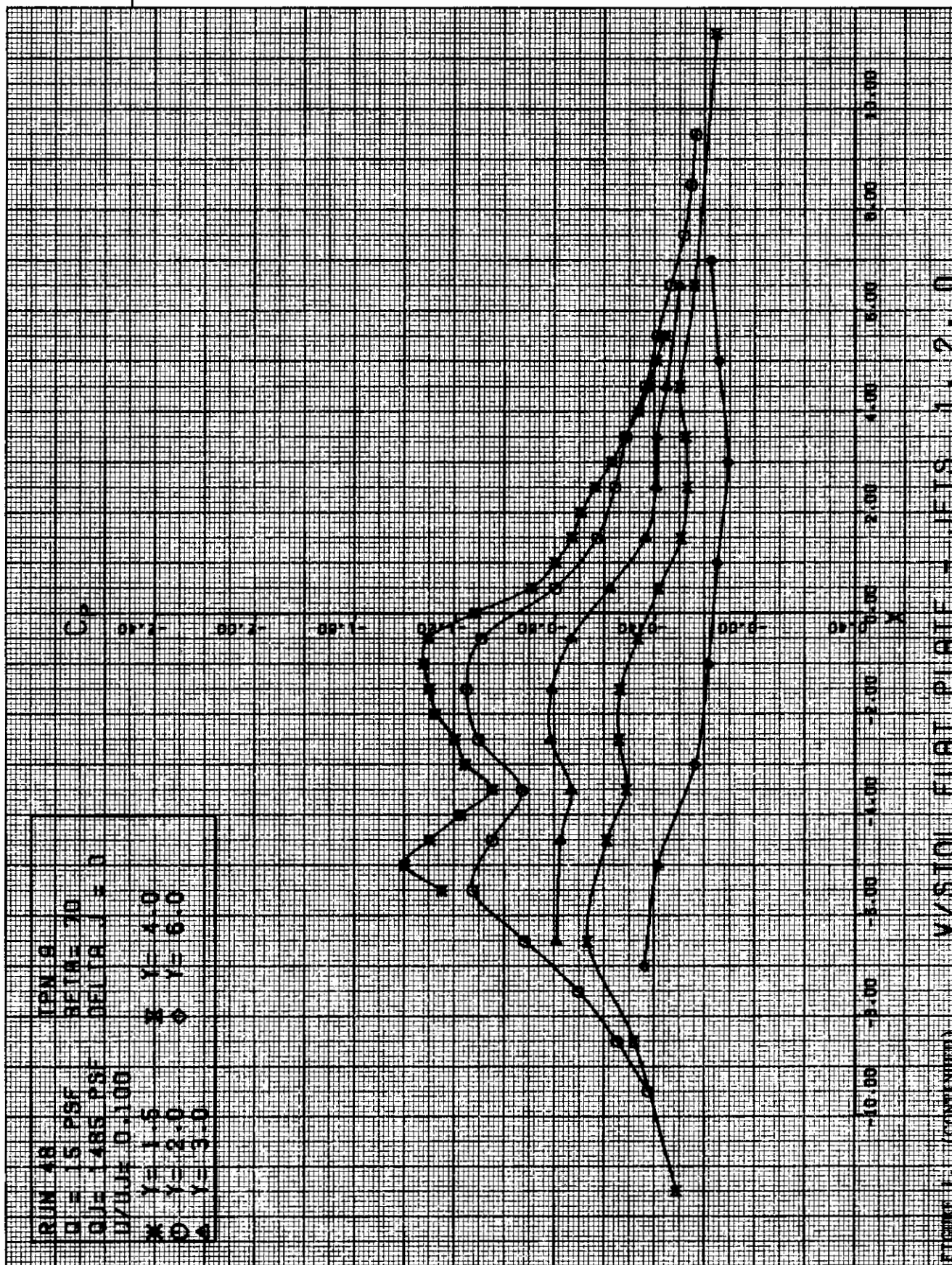


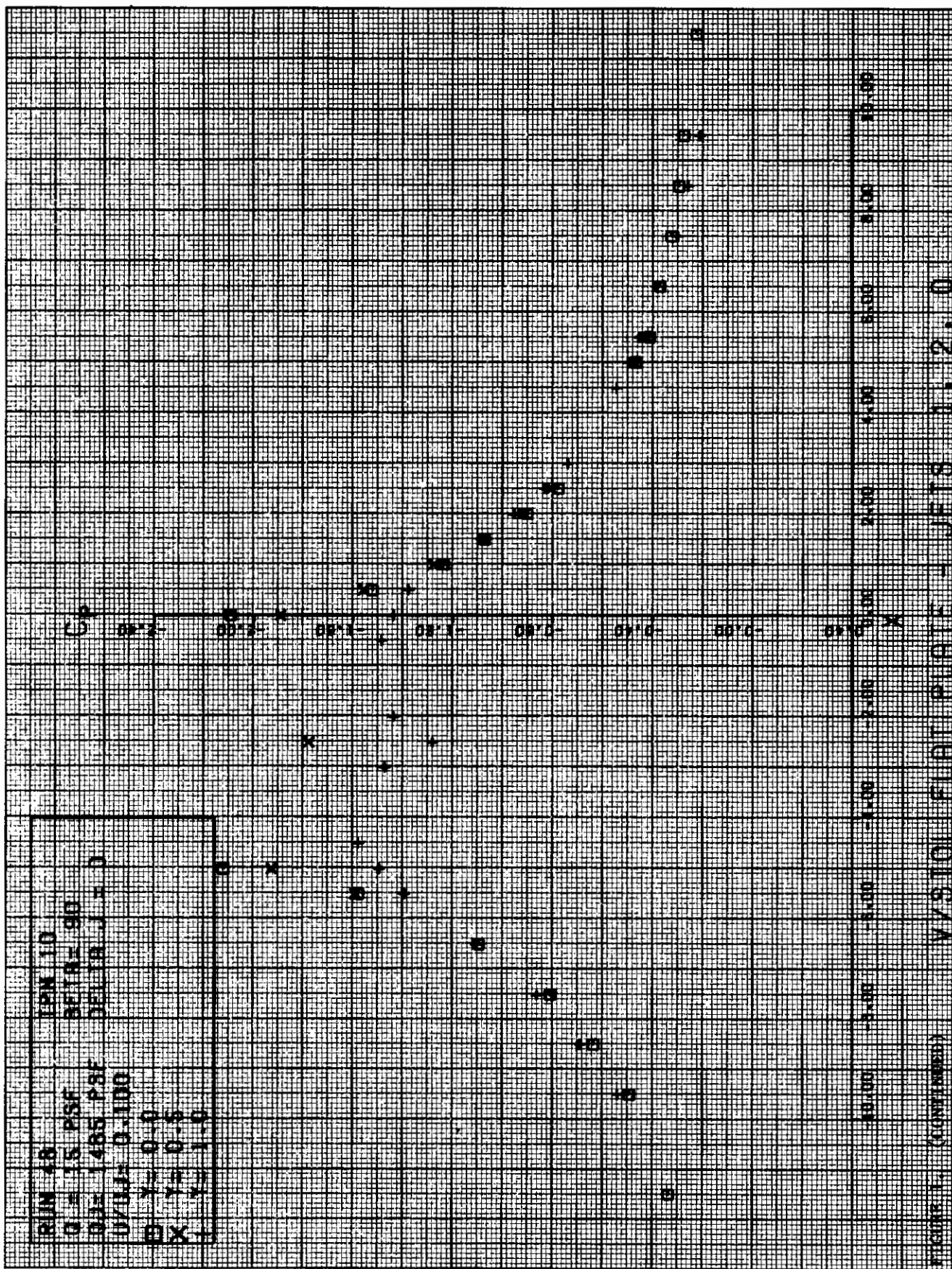


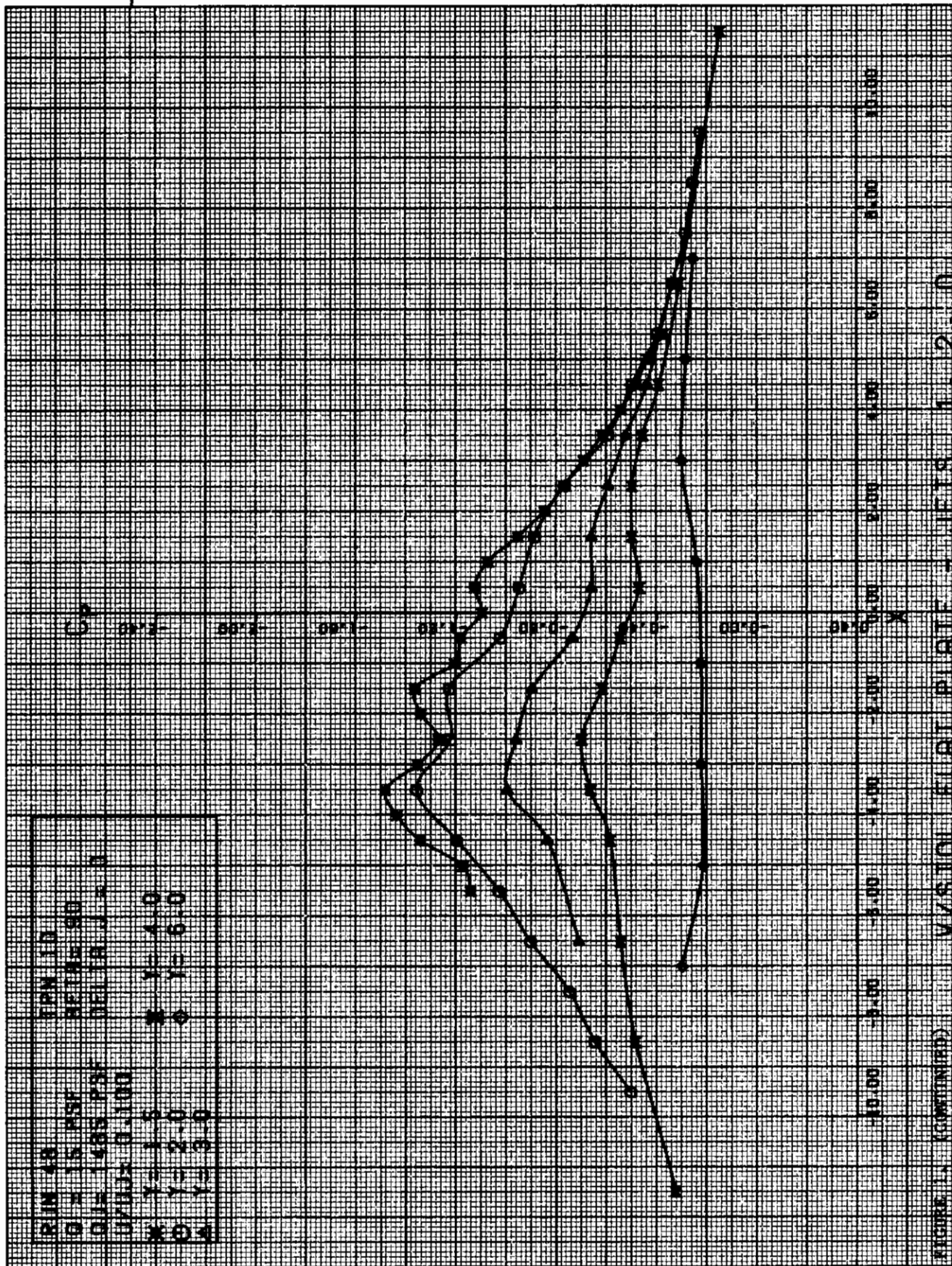






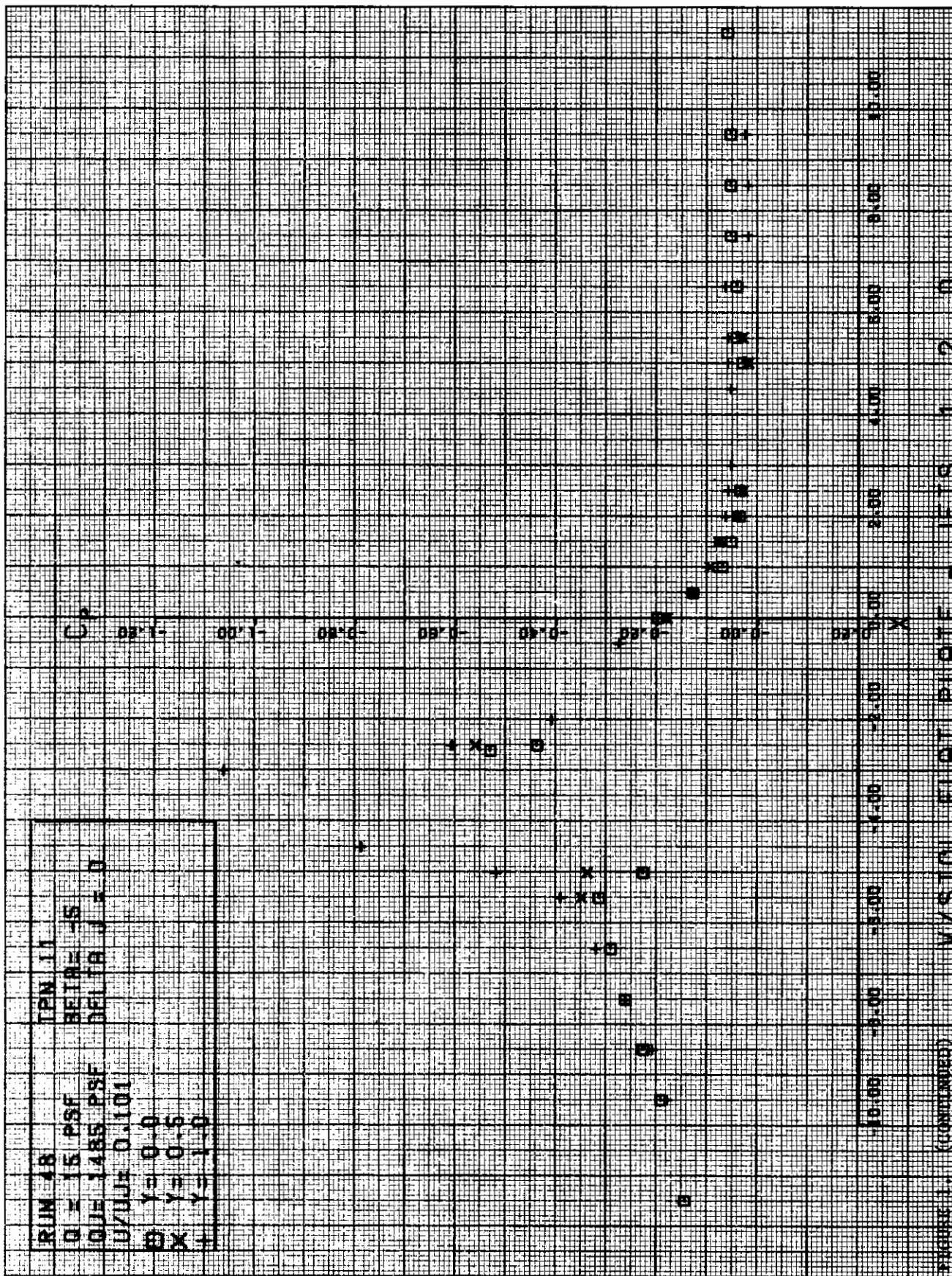


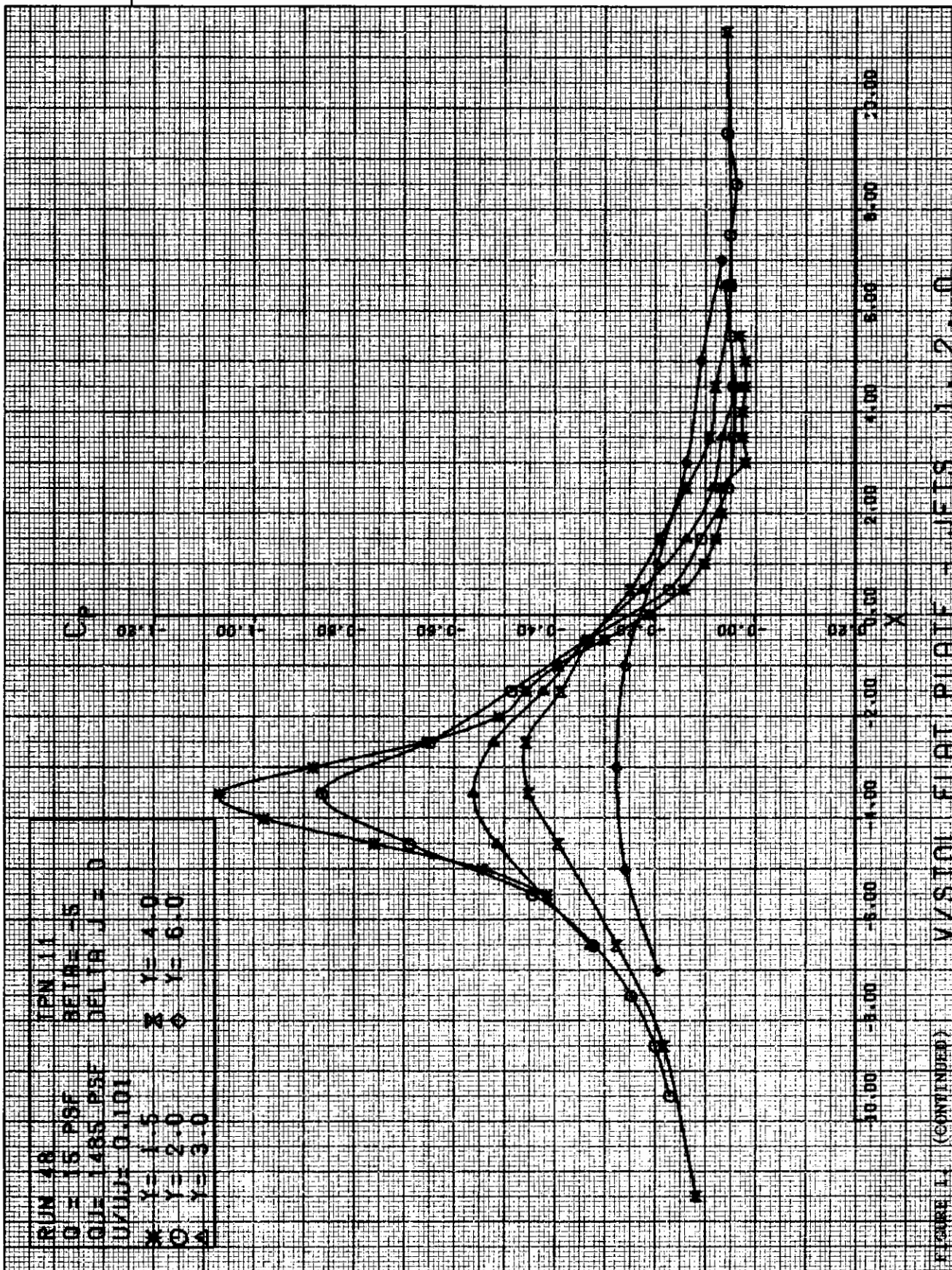


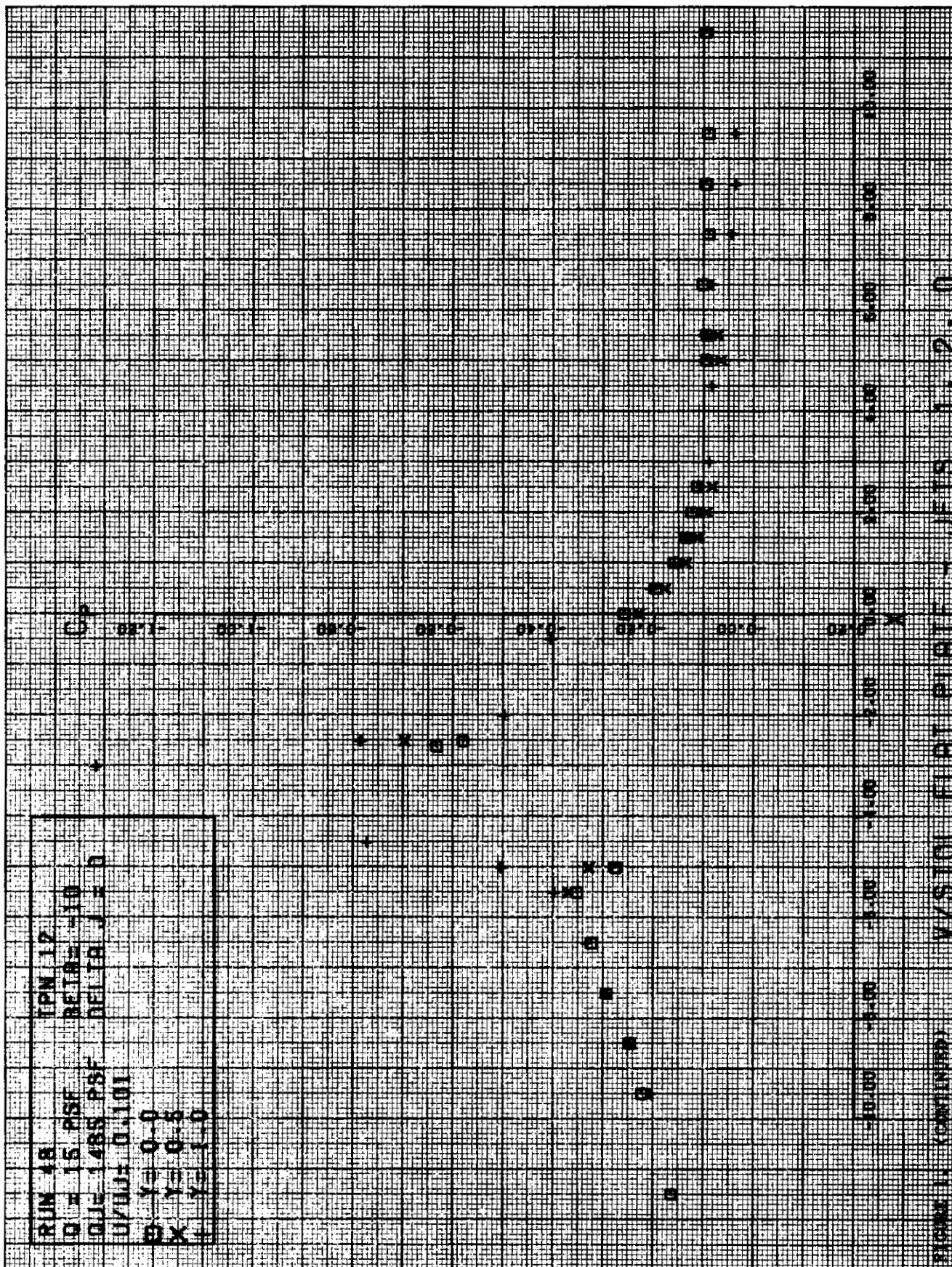


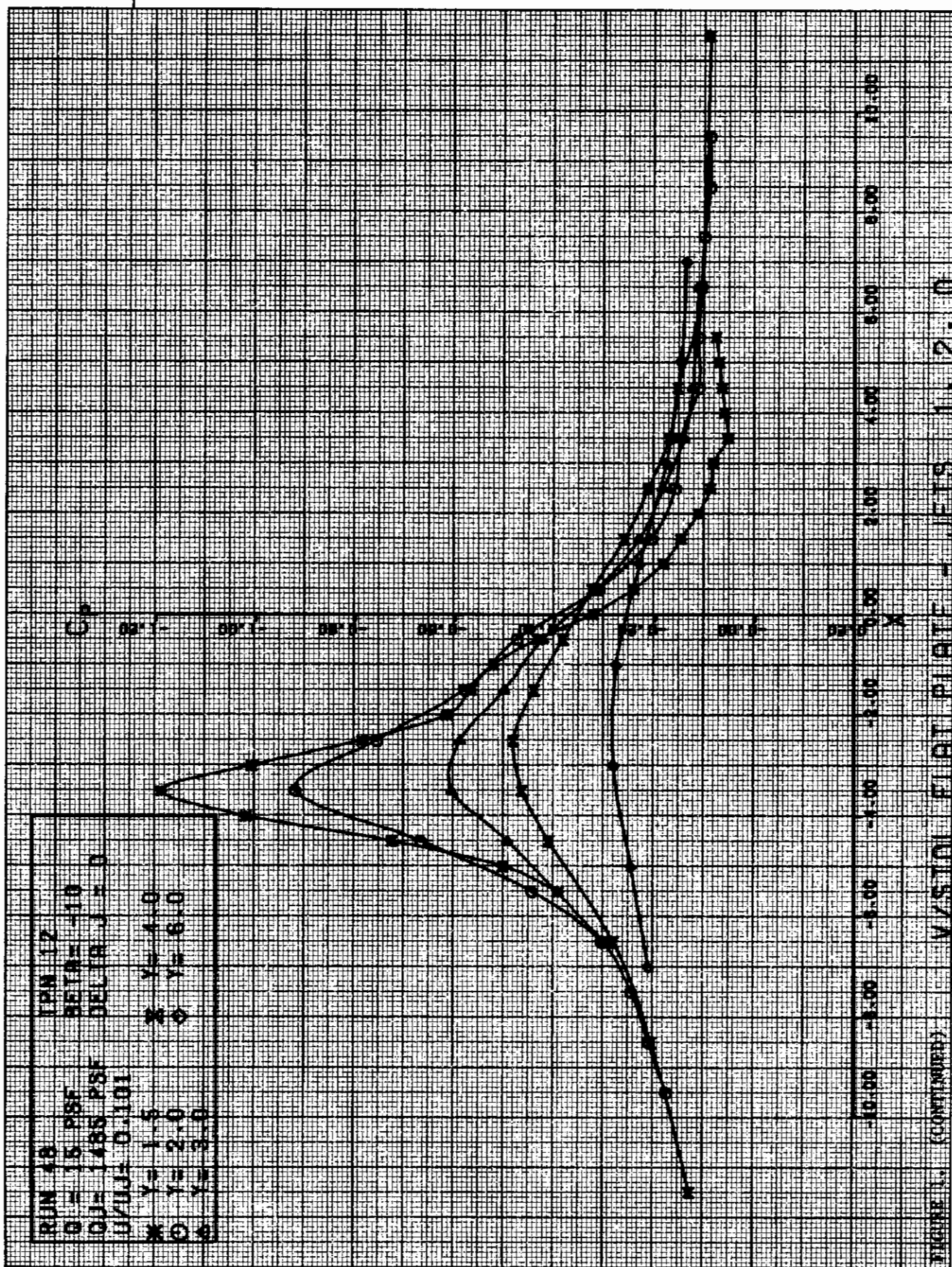
RUN 10
 Q 1 15 PSR
 Q 12 1485 PSF
 UYVLOX 0.1100
 X Y=1.5
 Y Z=2.0
 W 13.0-0

FIGURE 1. (CONTINUED) VISION FLAR PLATE - JETIS 11.2.0









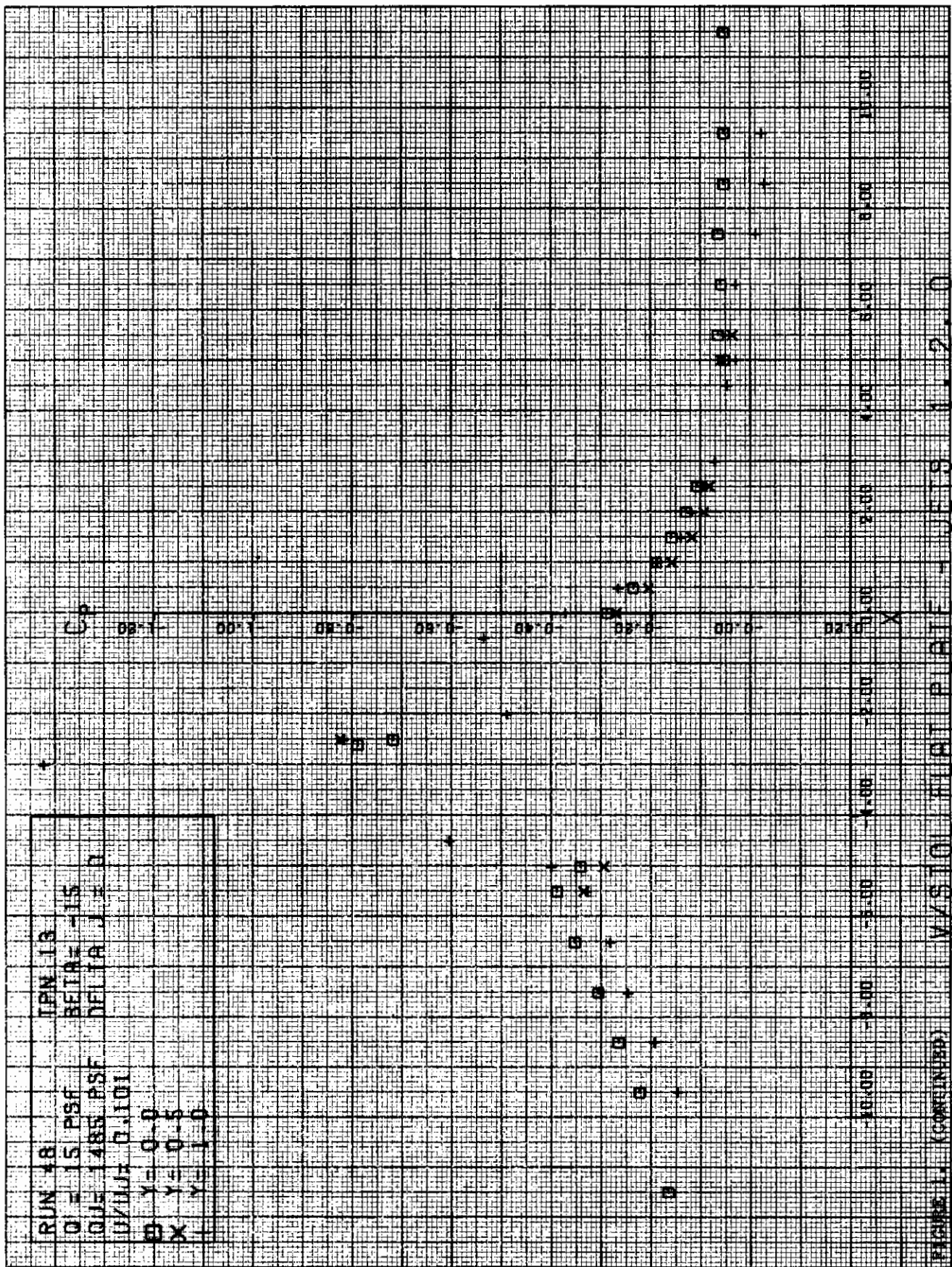
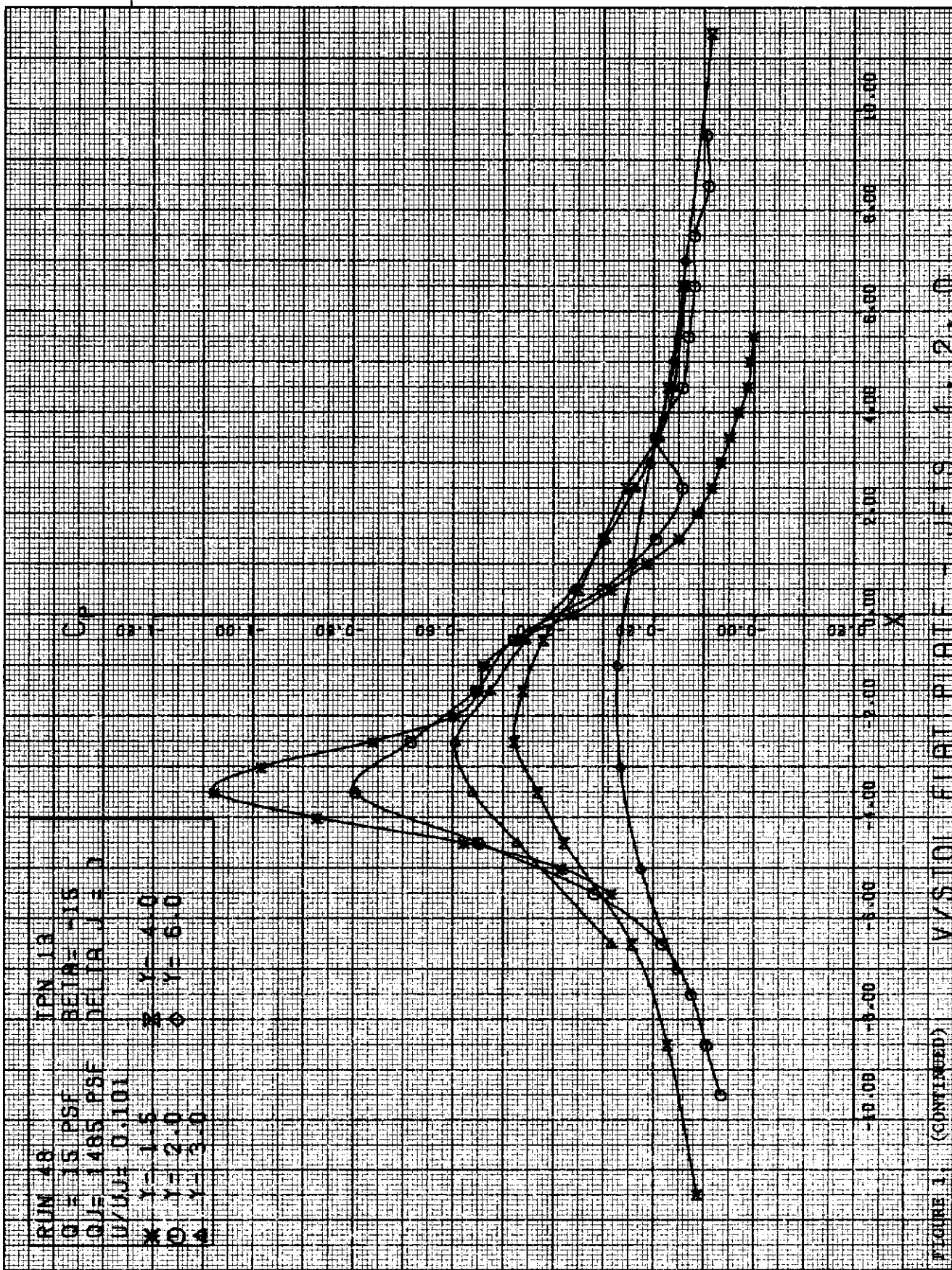
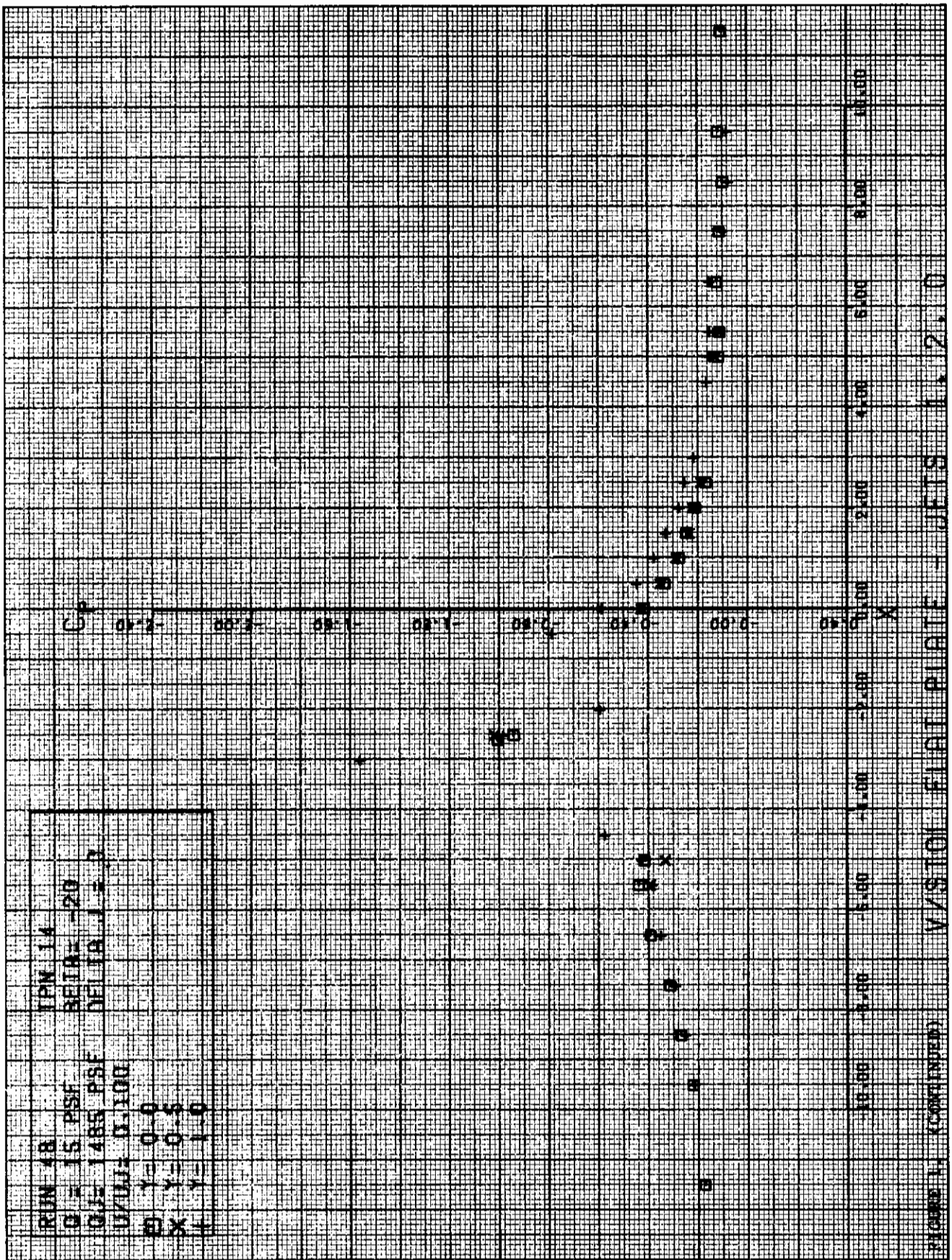
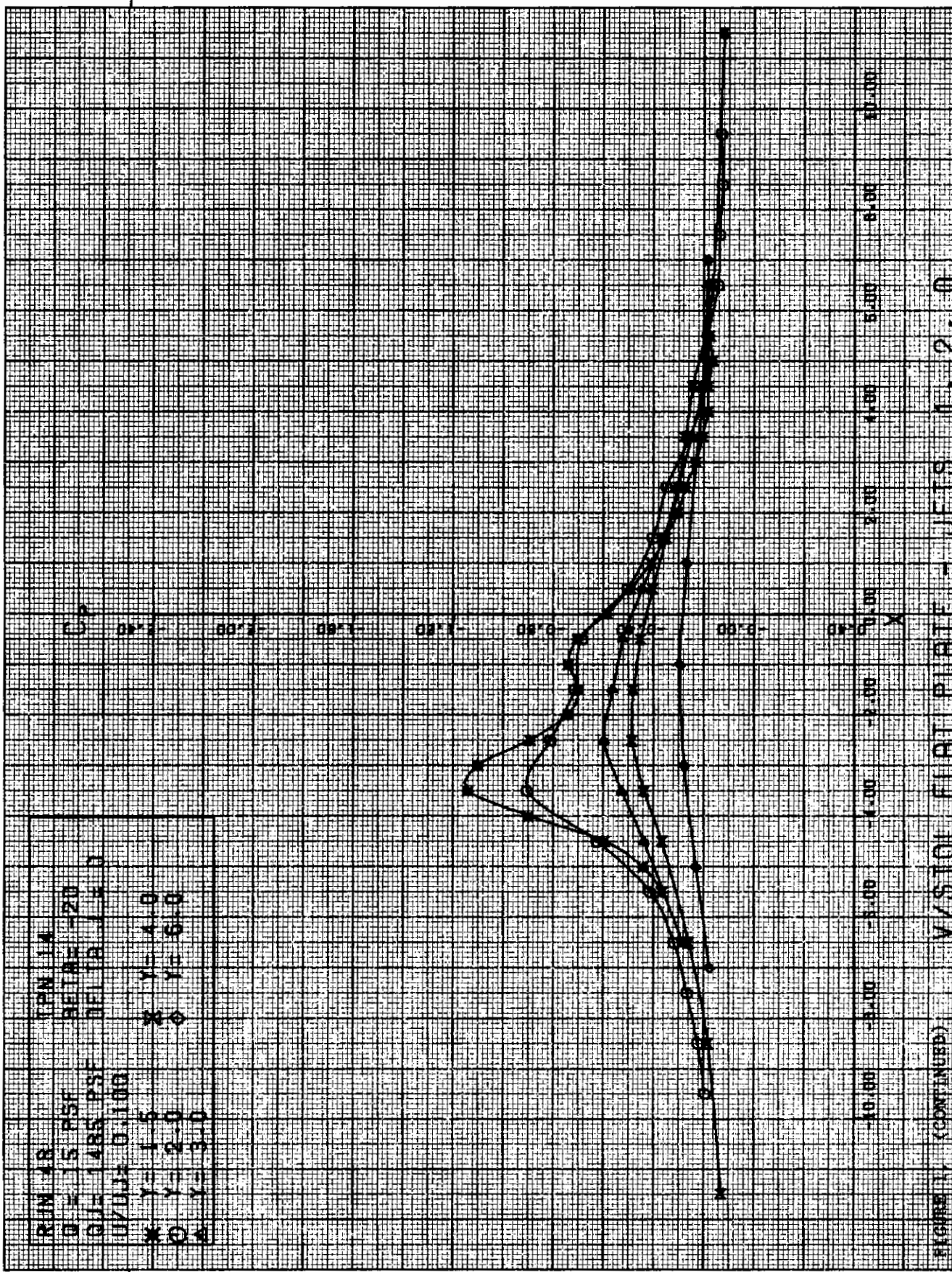


FIGURE 1. (CONTINUED) VAS101 FLIGHT PROFILE - JET 9 11 2.0







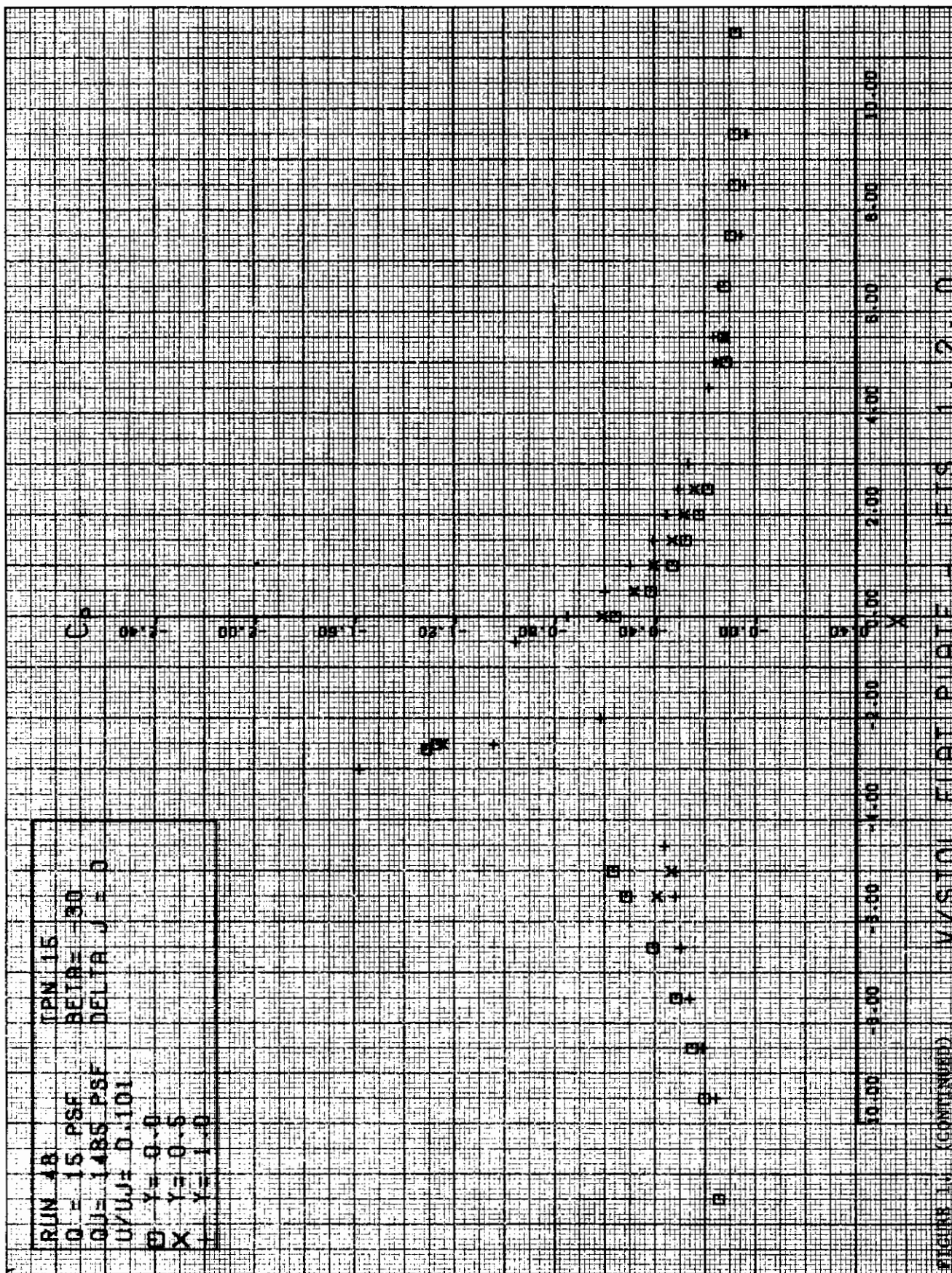


FIGURE 14 (CONTINUED)

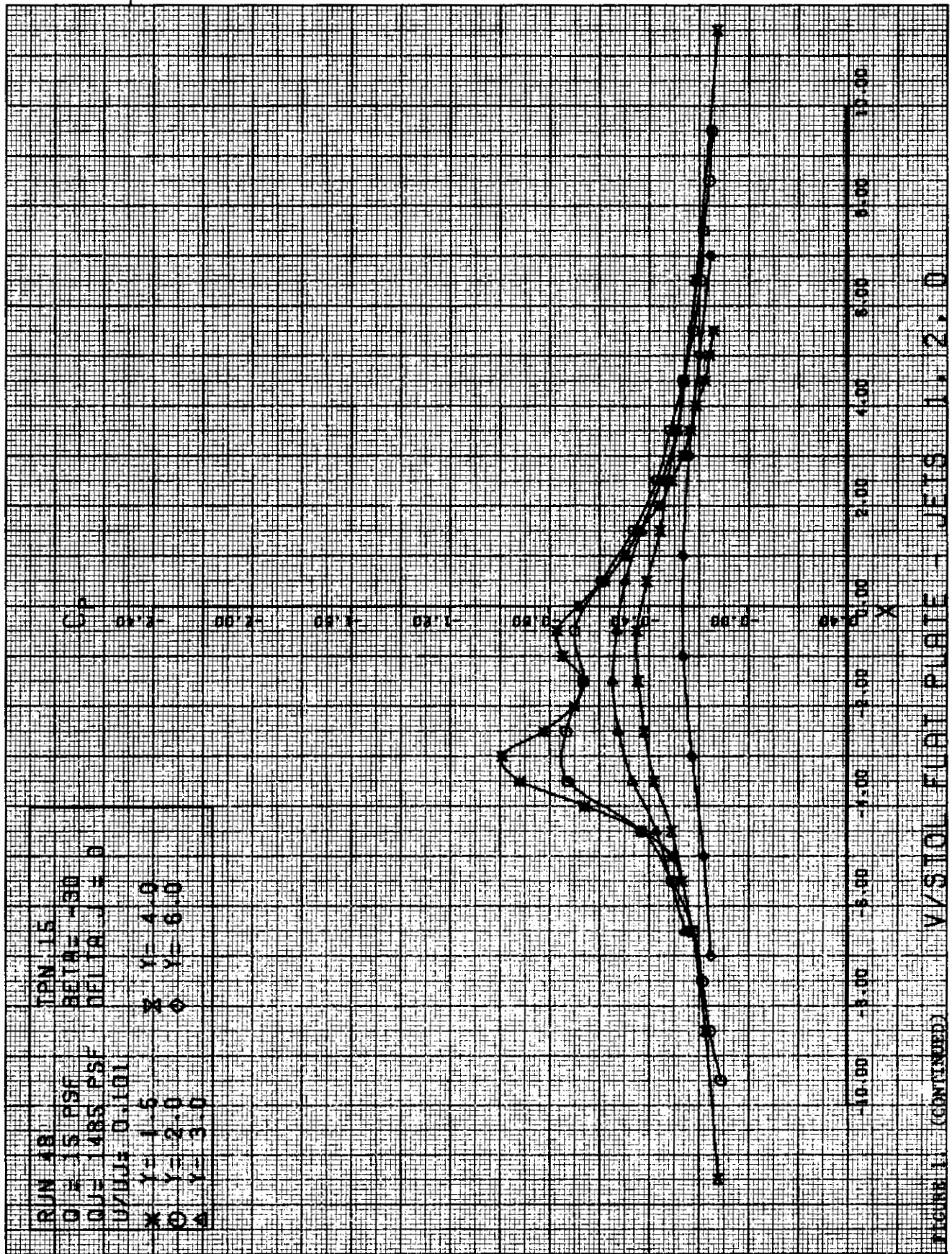
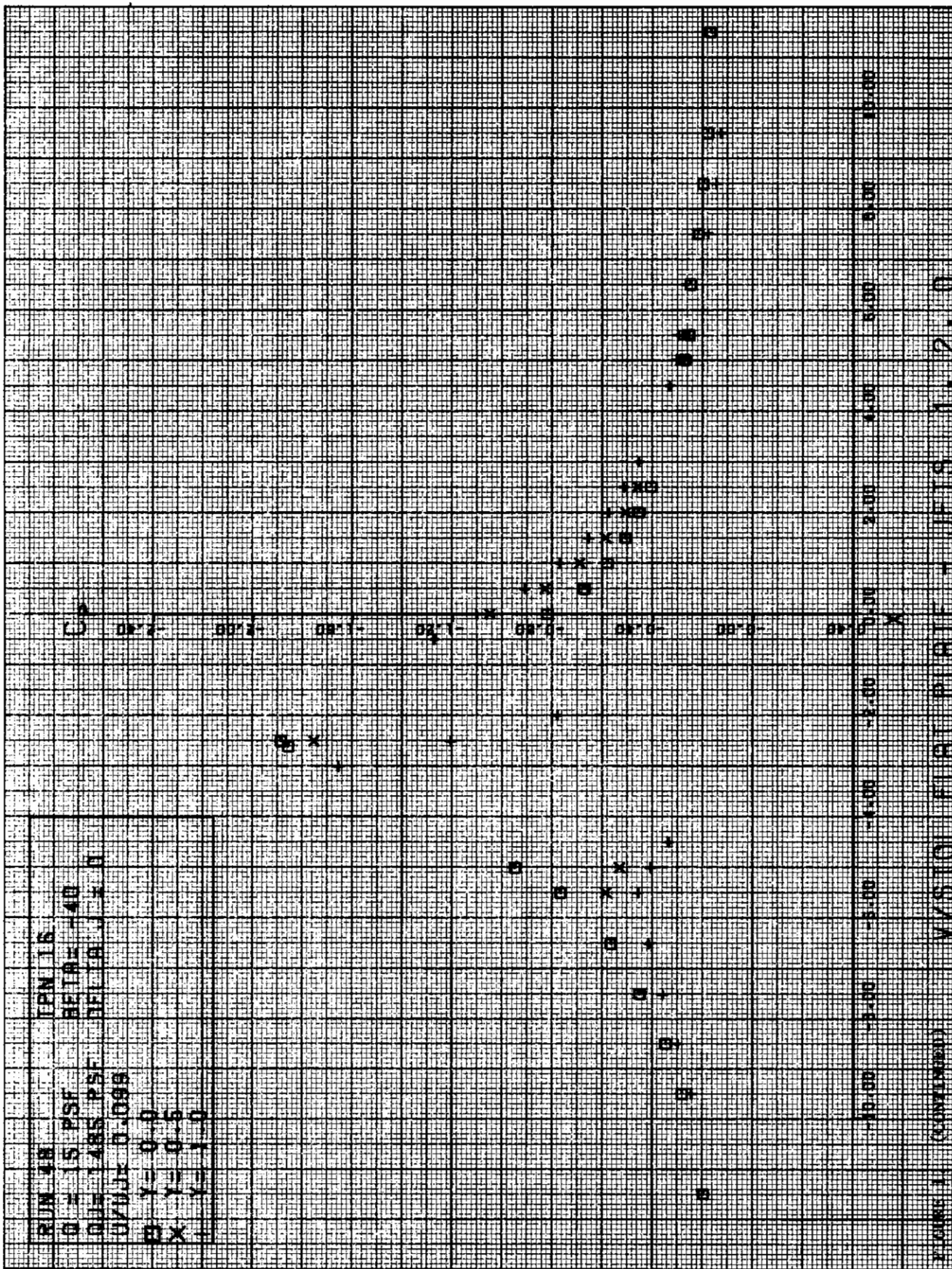
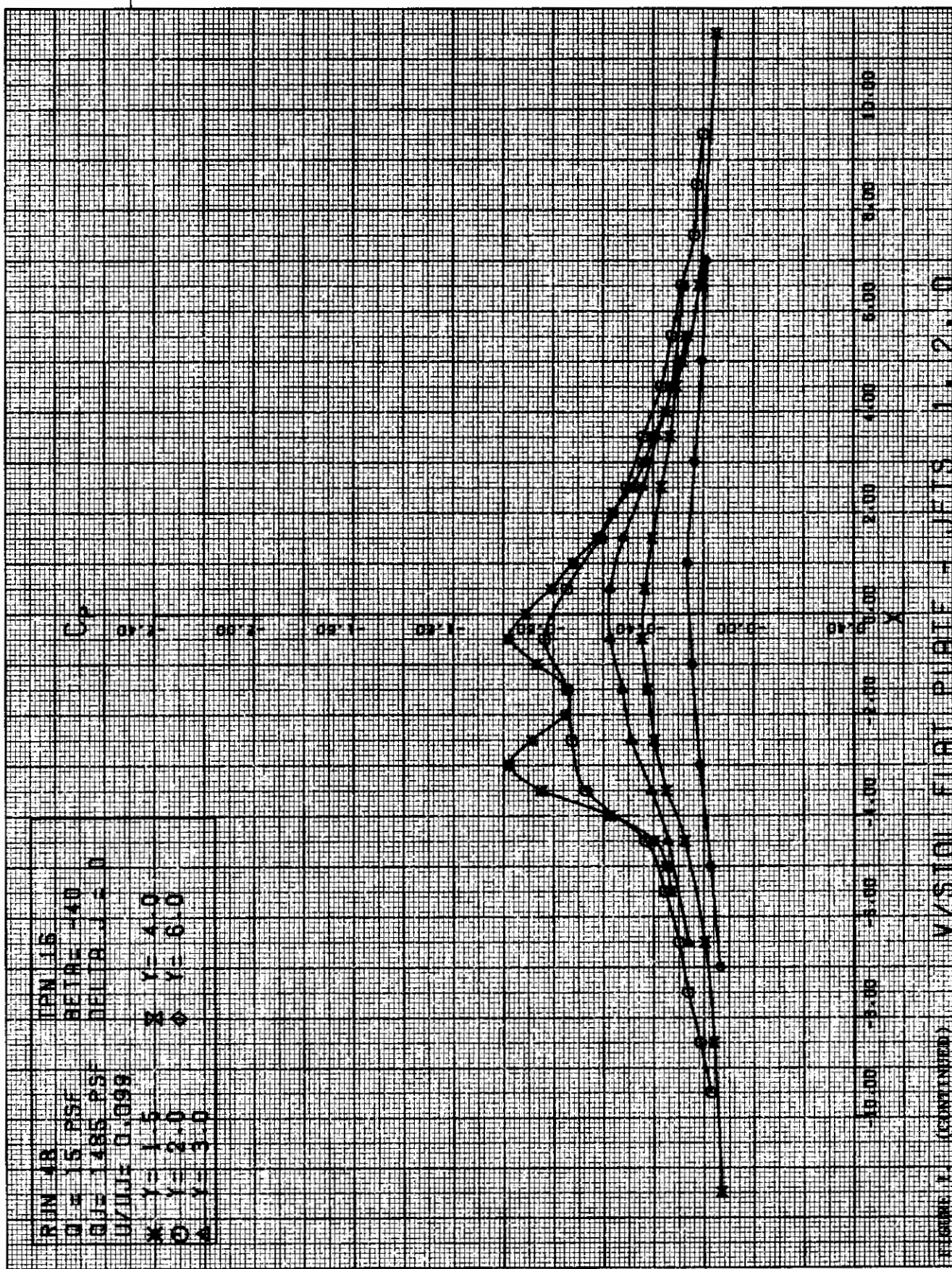


FIGURE 1 (CONTINUED) V-109 FLAT PLATE - JETS 1, 2, 3





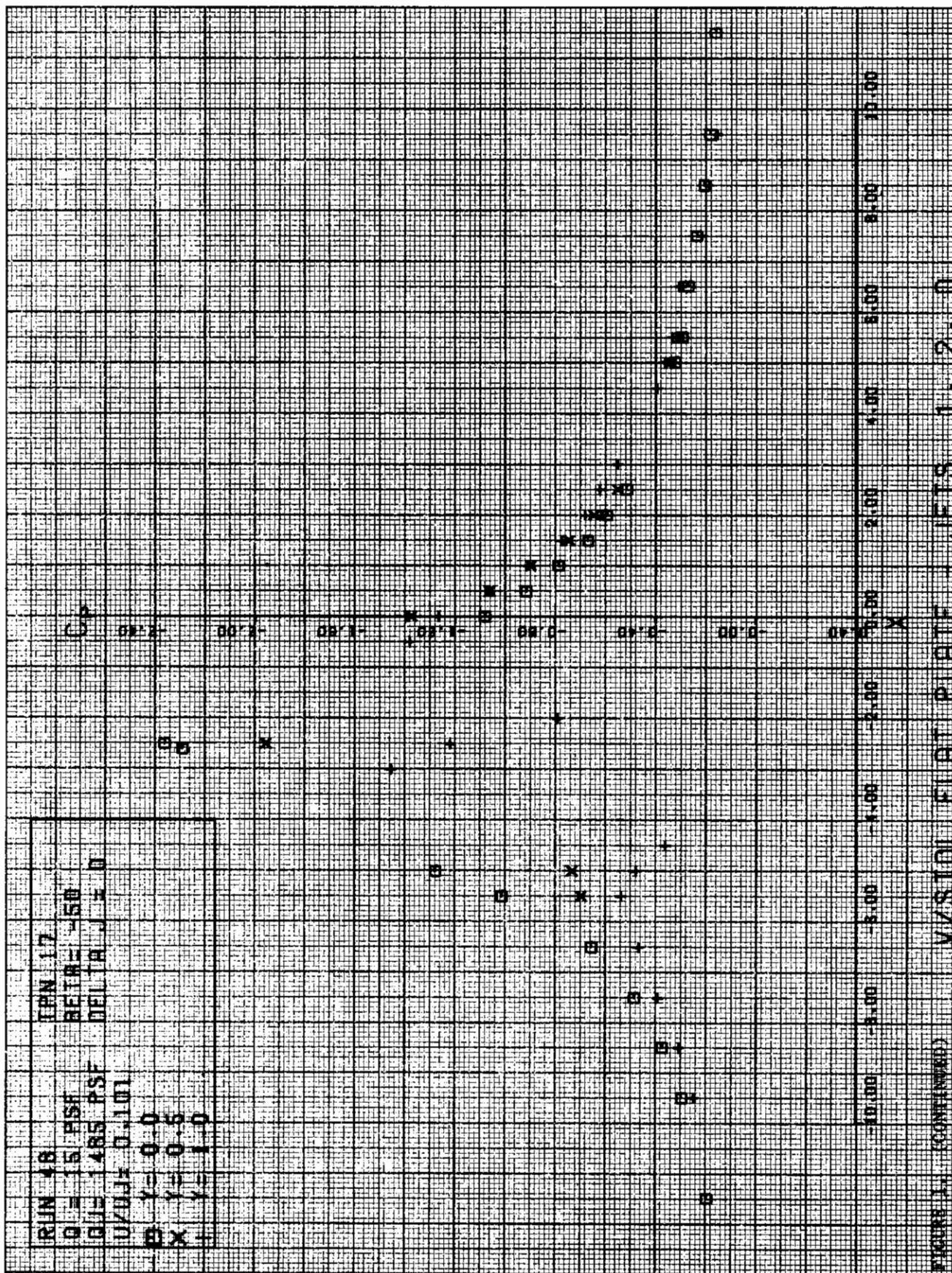


FIGURE 1. (CONTINUED)

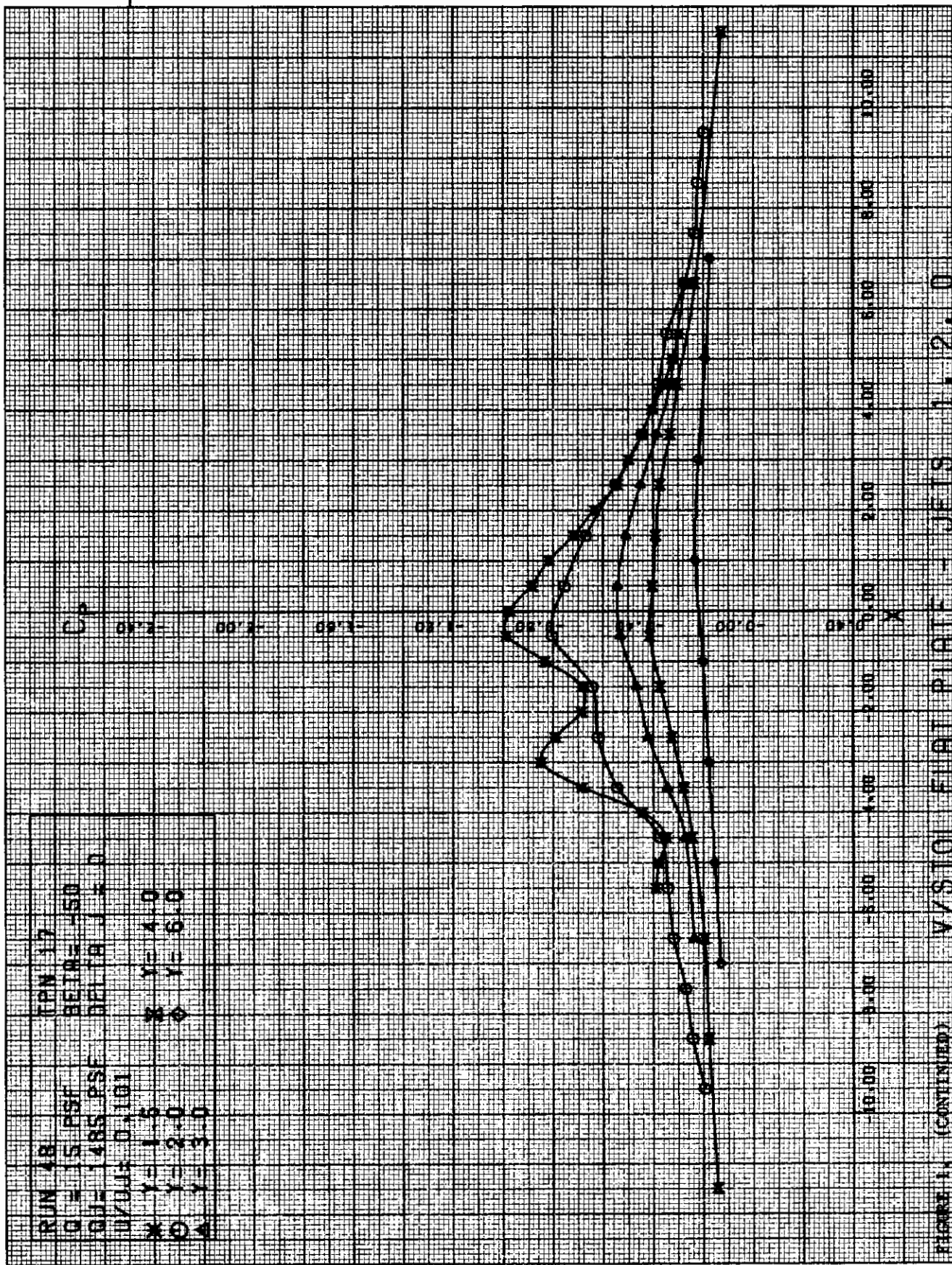
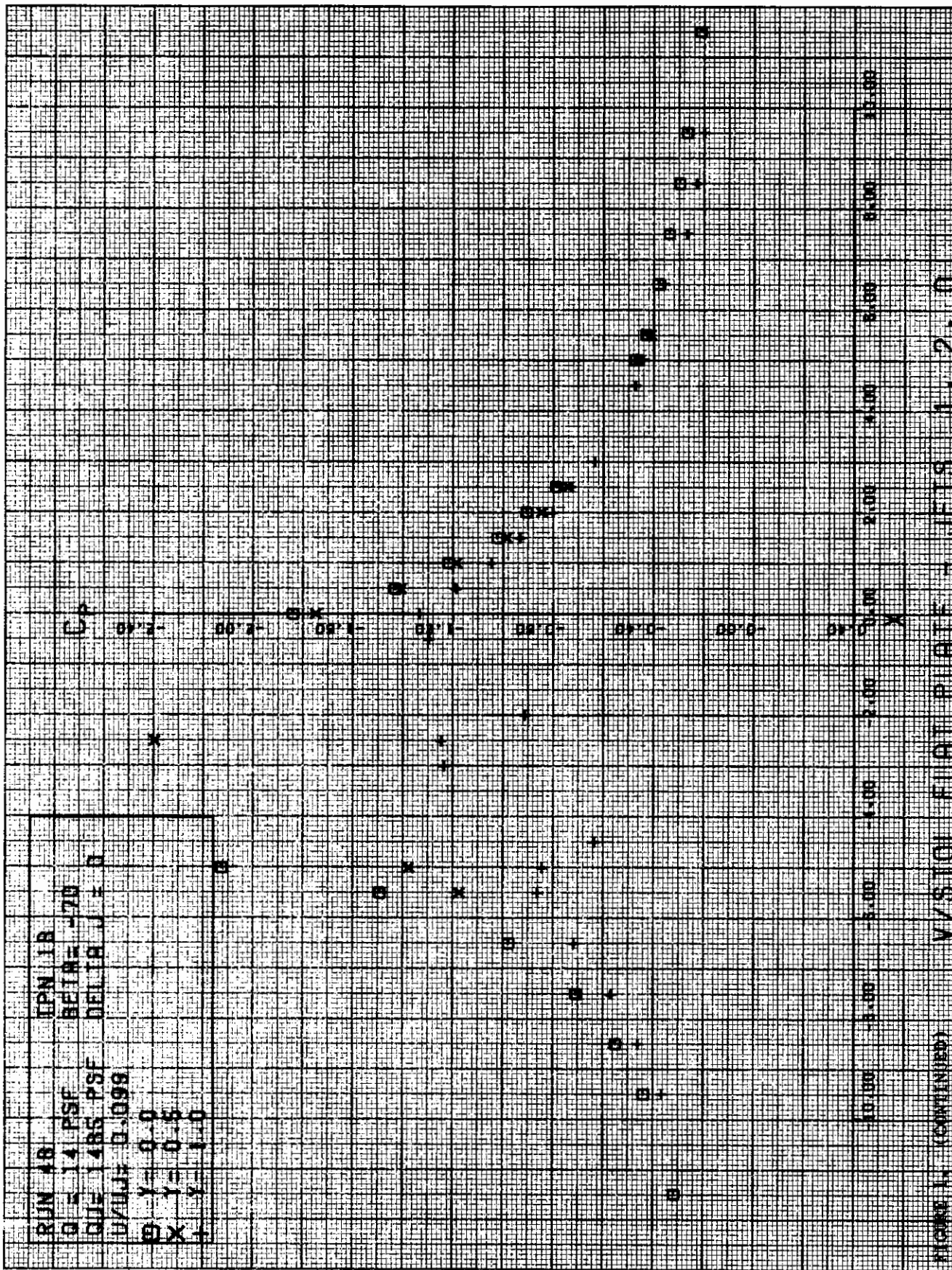
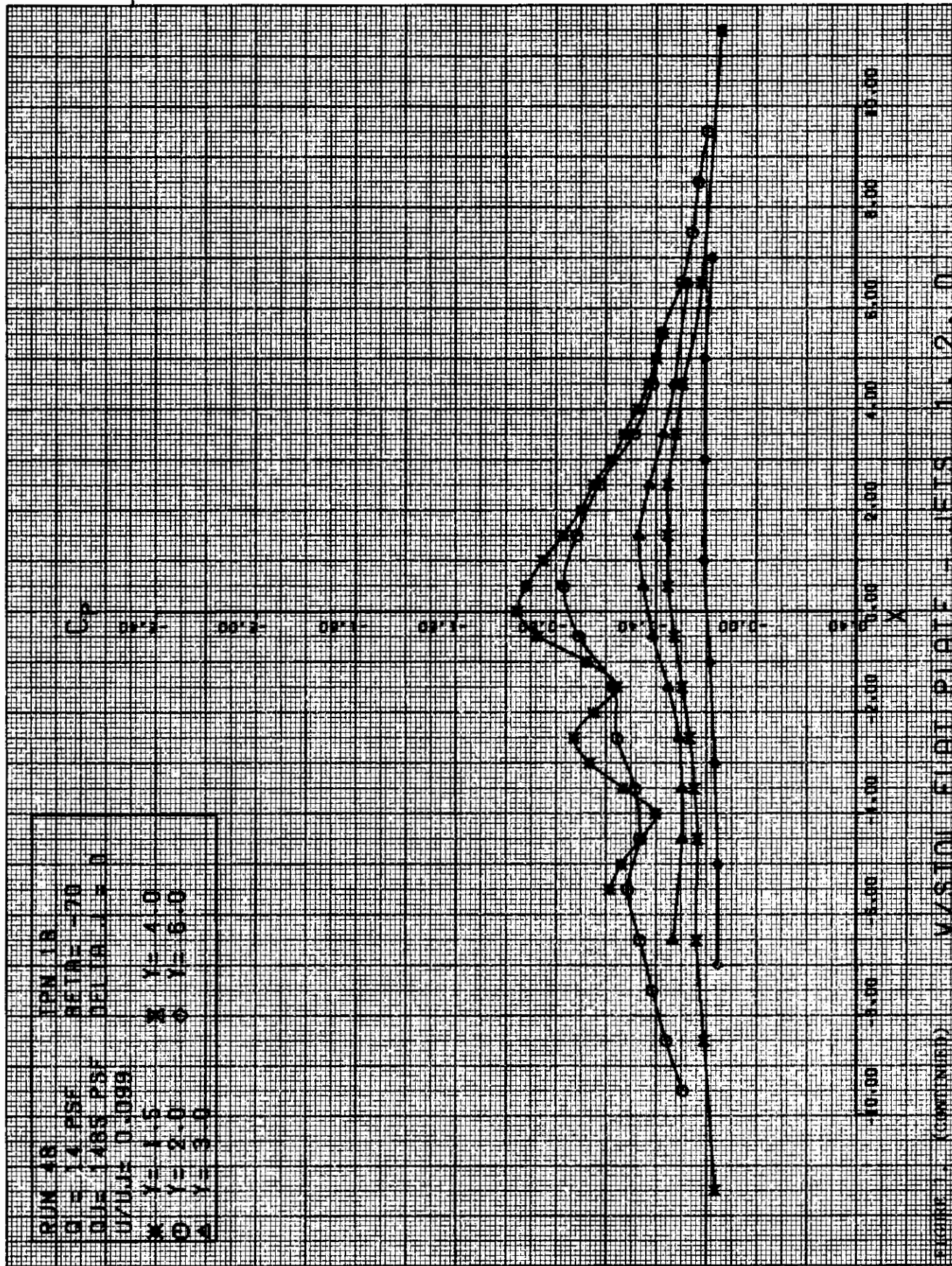
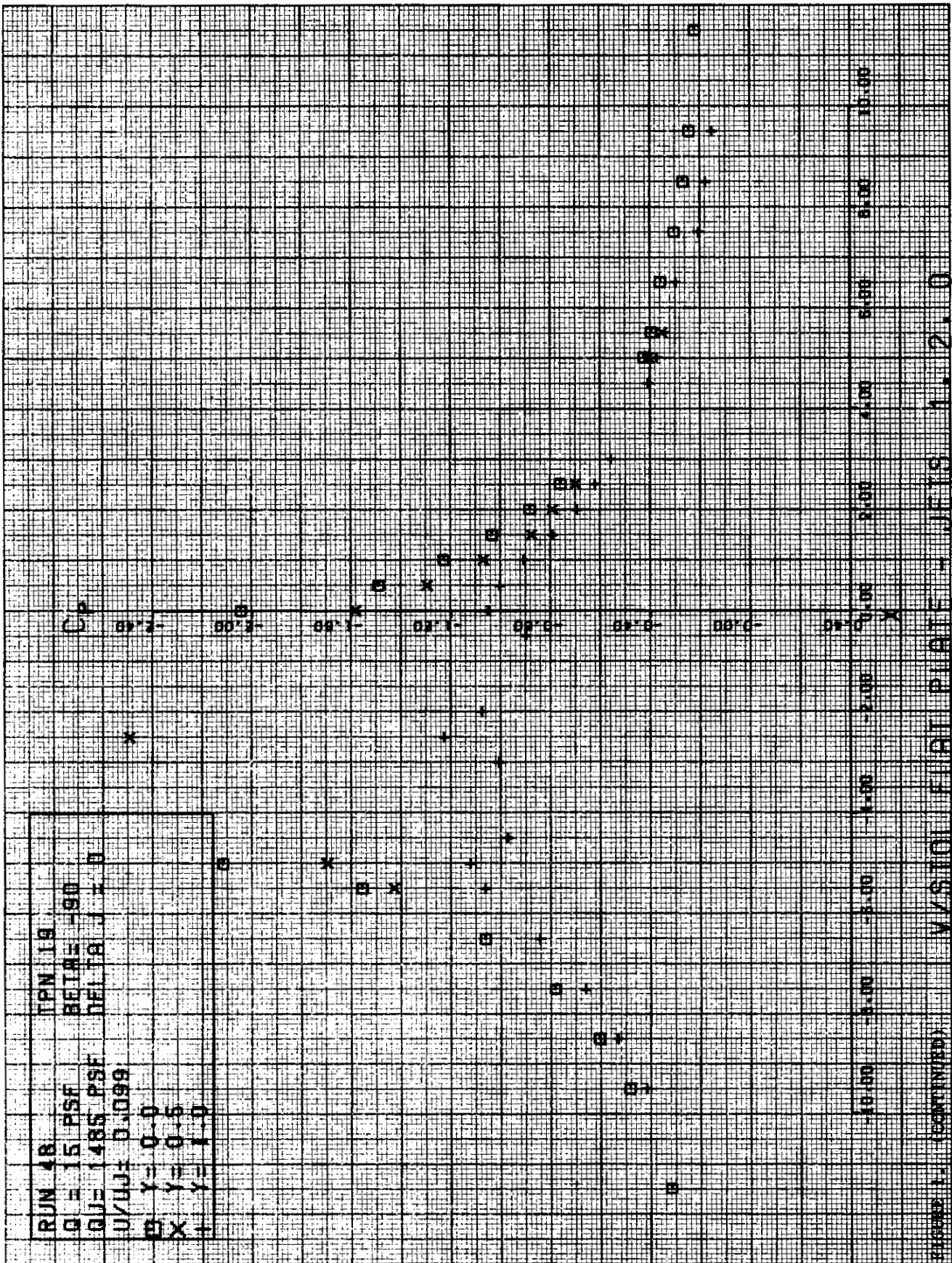


FIGURE 1. (CONTINUED) VISION FLAT PLATE - JETS 11.2.0







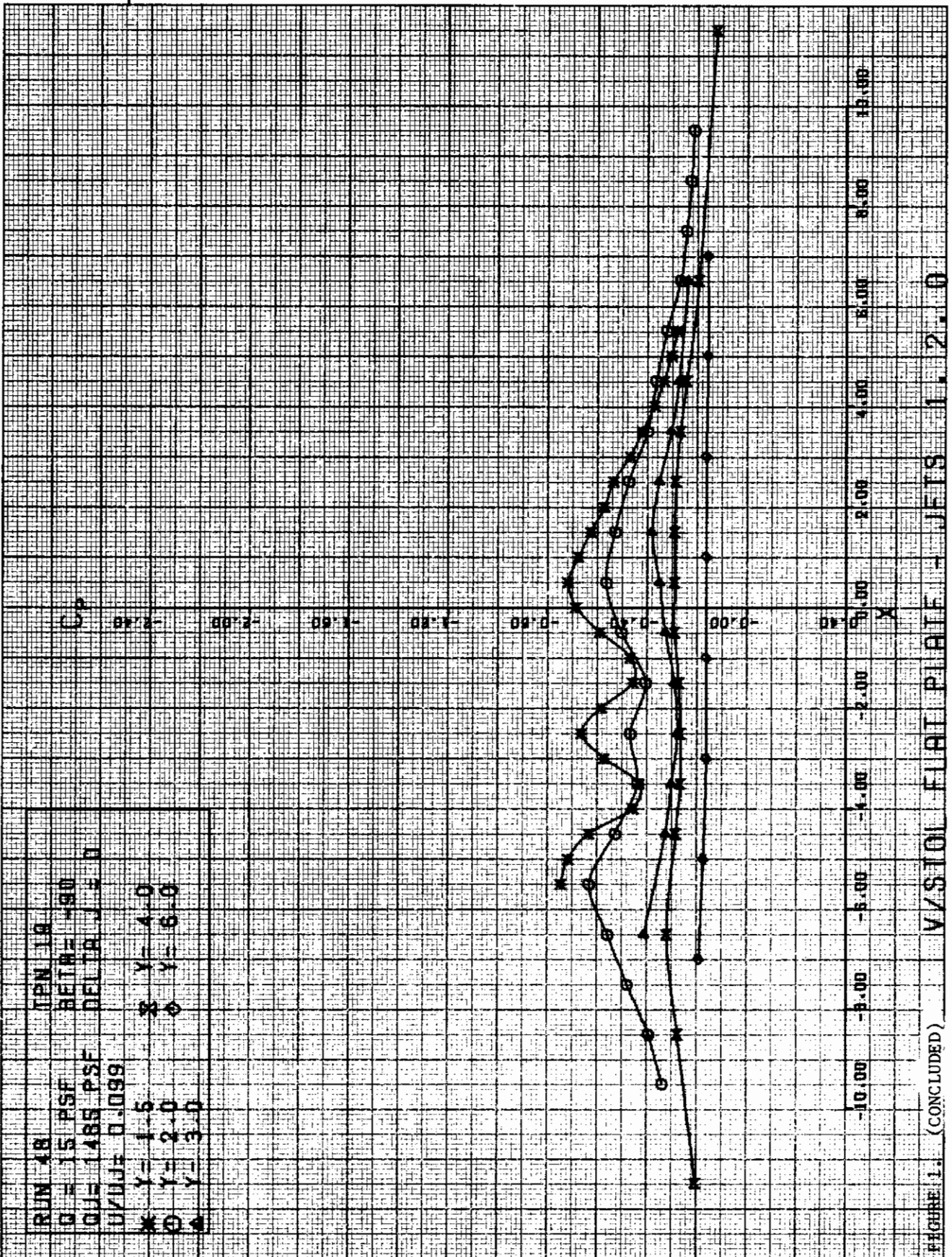
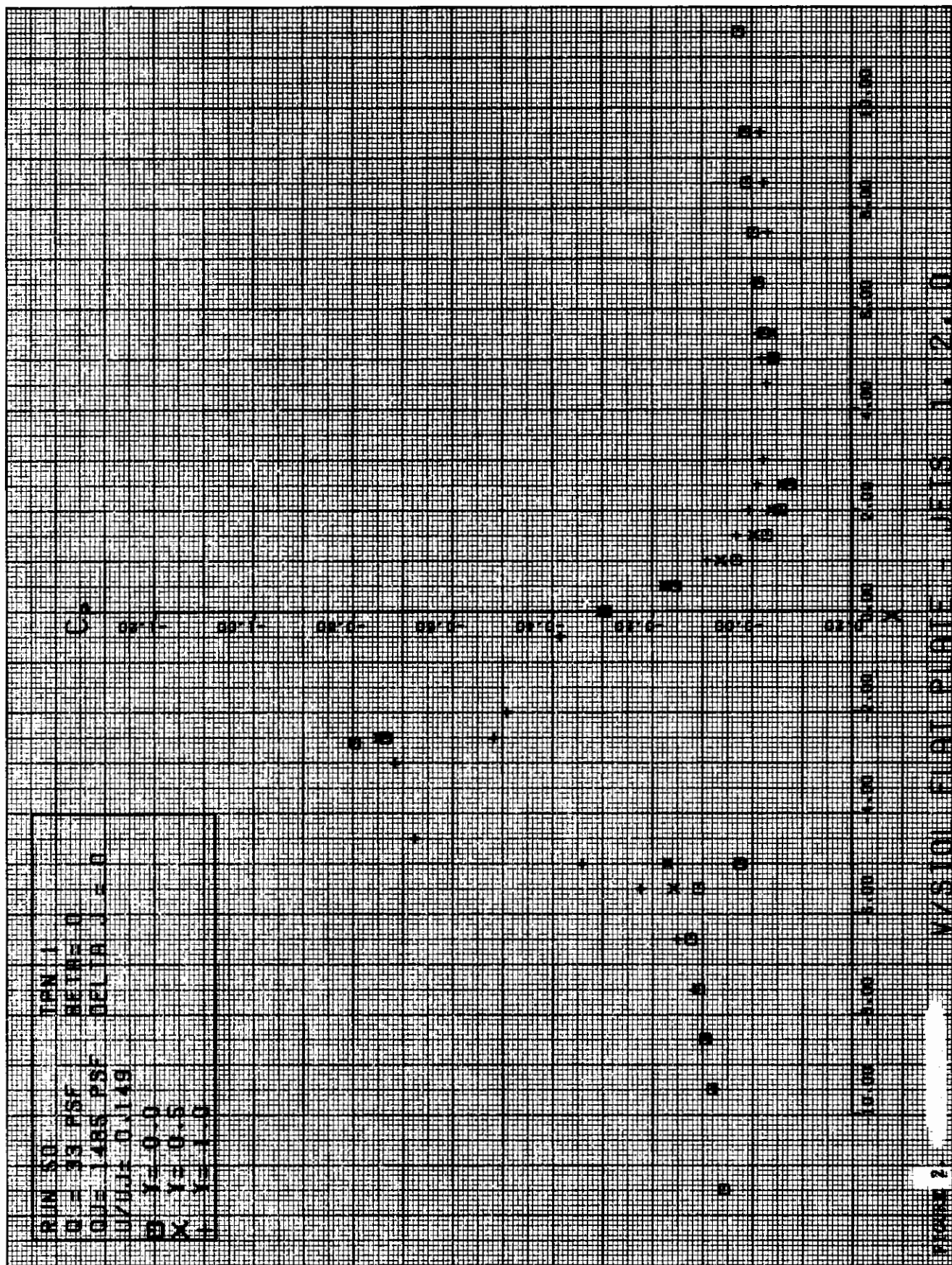
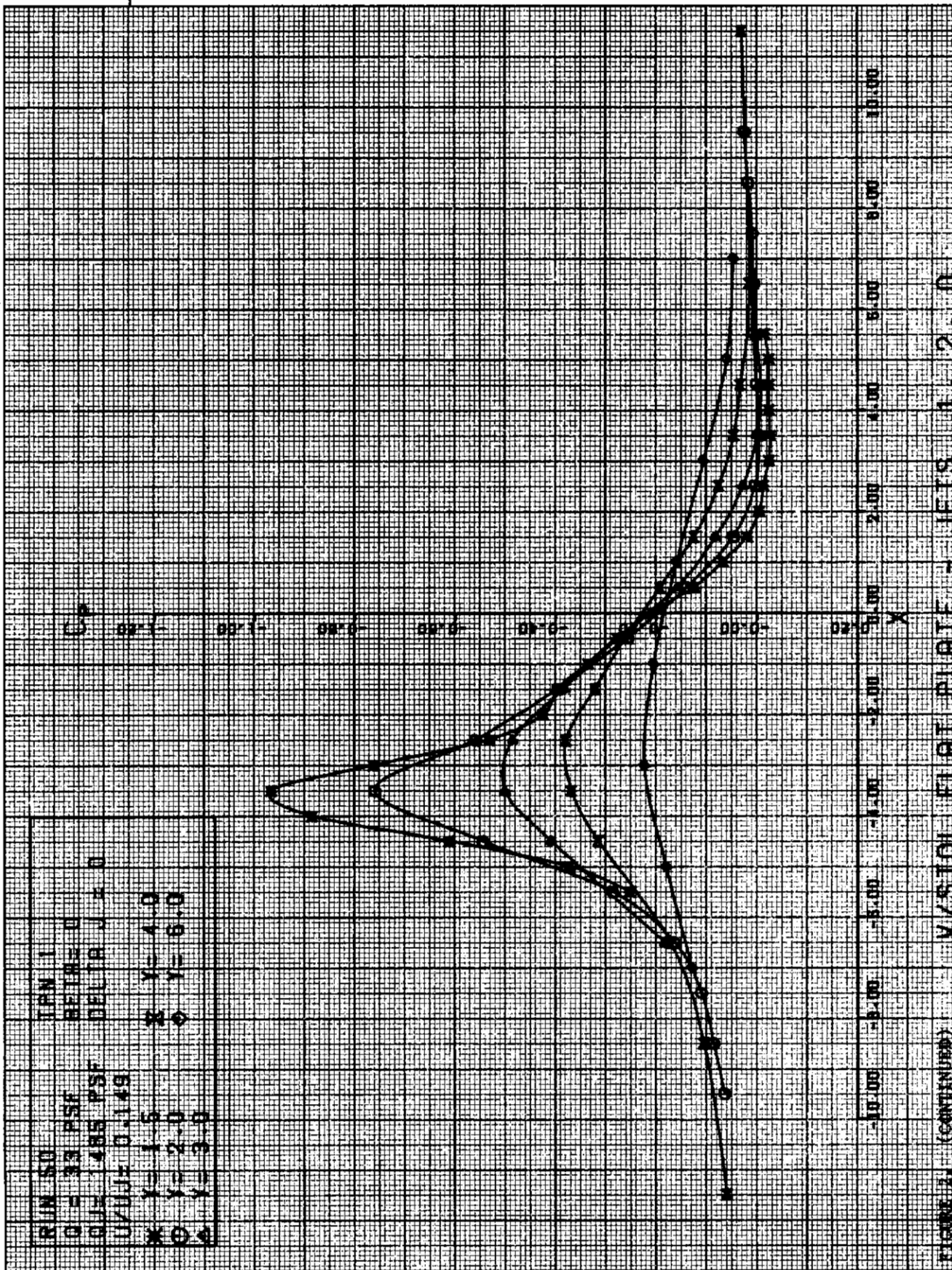


FIGURE 1. (CONCLUDED)





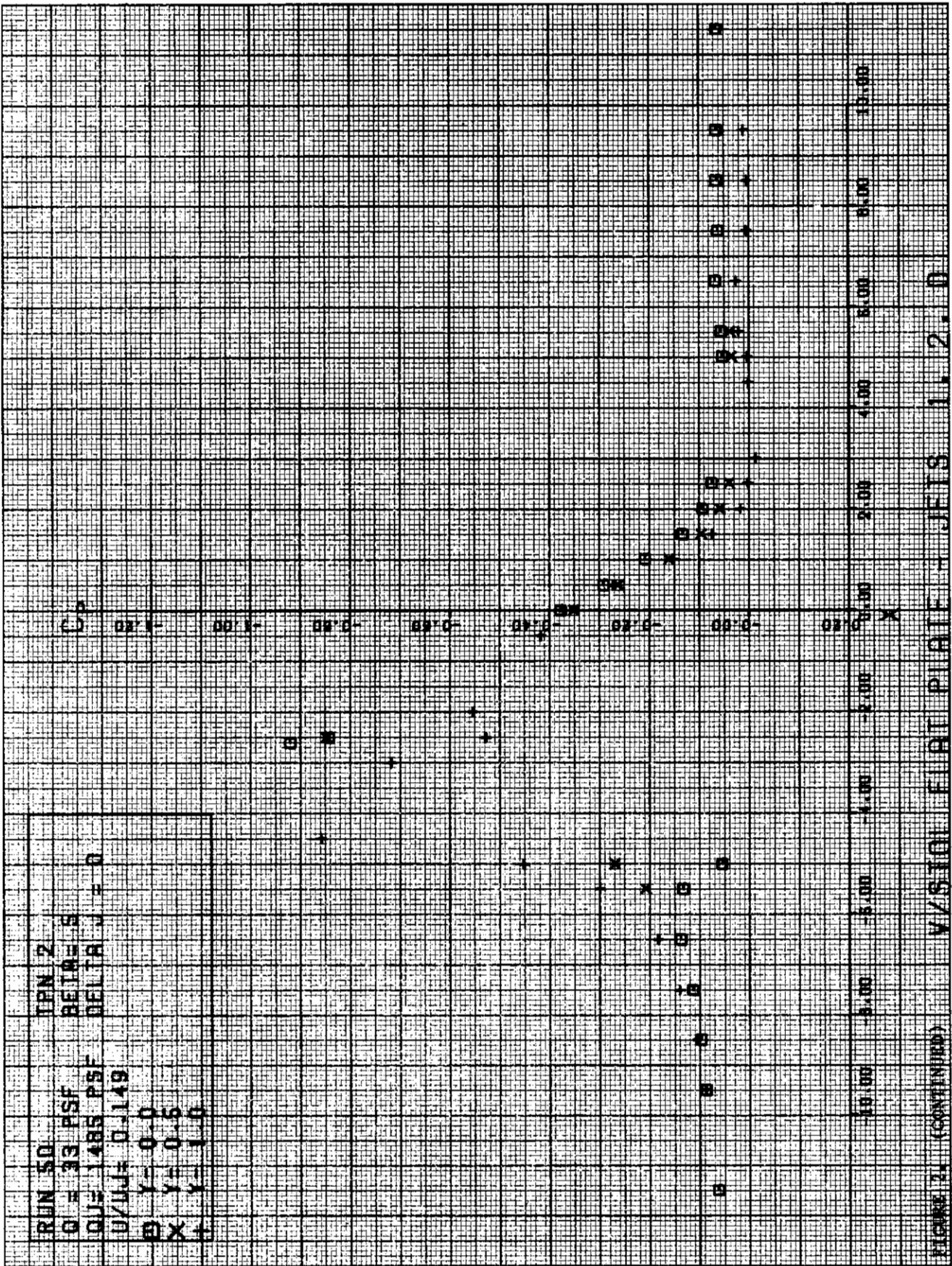


FIGURE 2. (CONTINUED) V/SJOL FLAT PLATE - JETS 1. 2. D

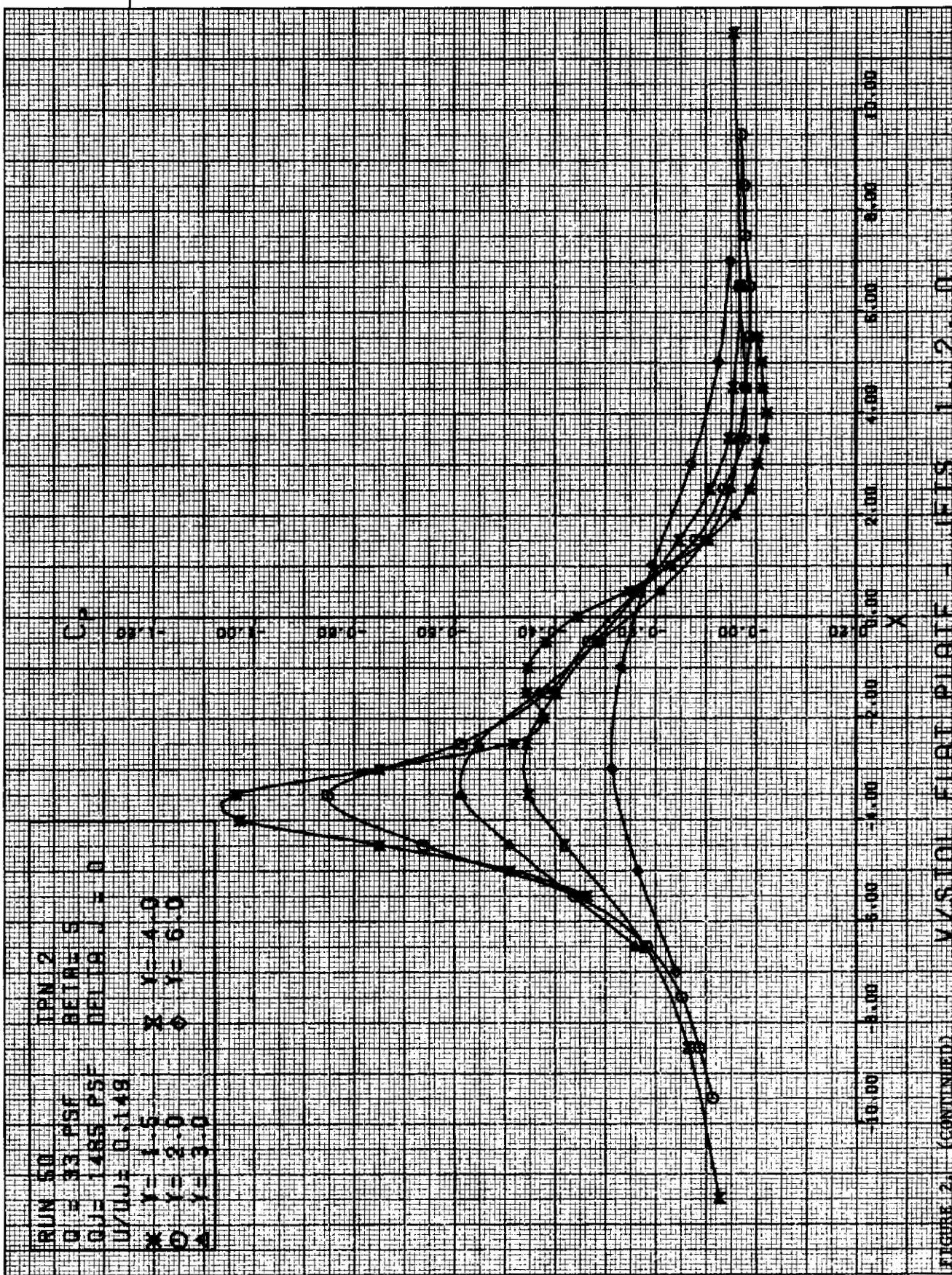


FIGURE 2. (CONTINUED)

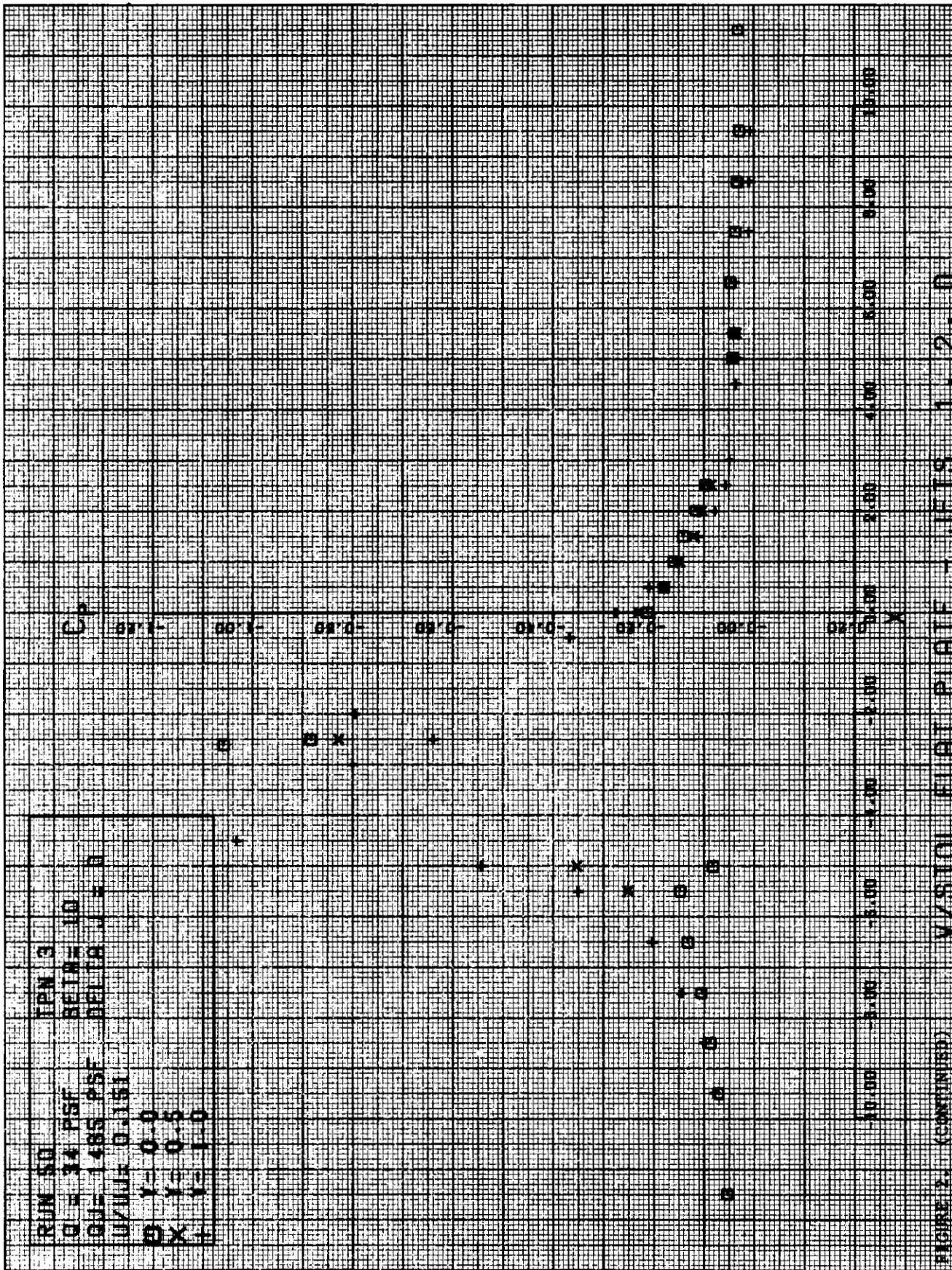
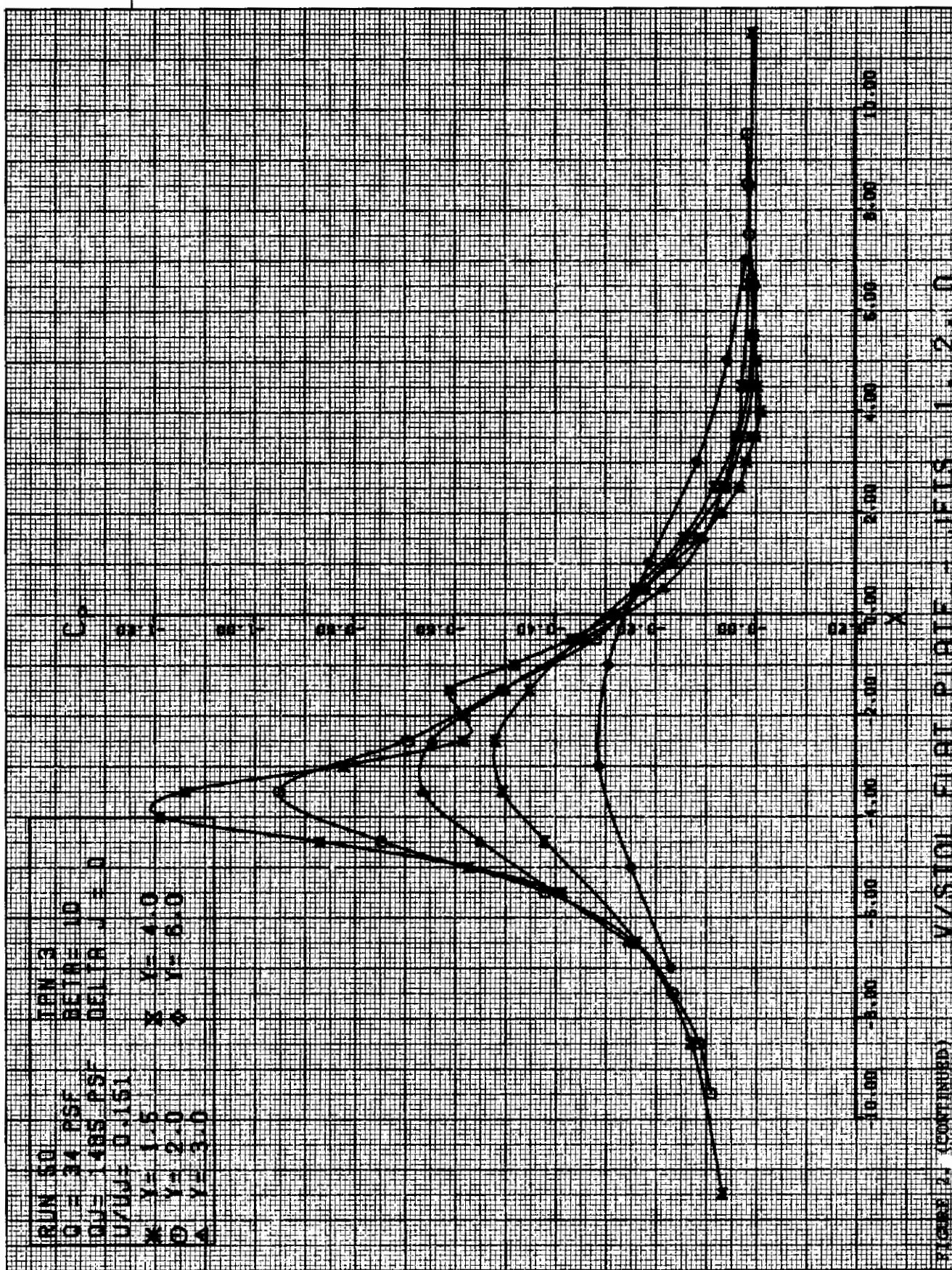
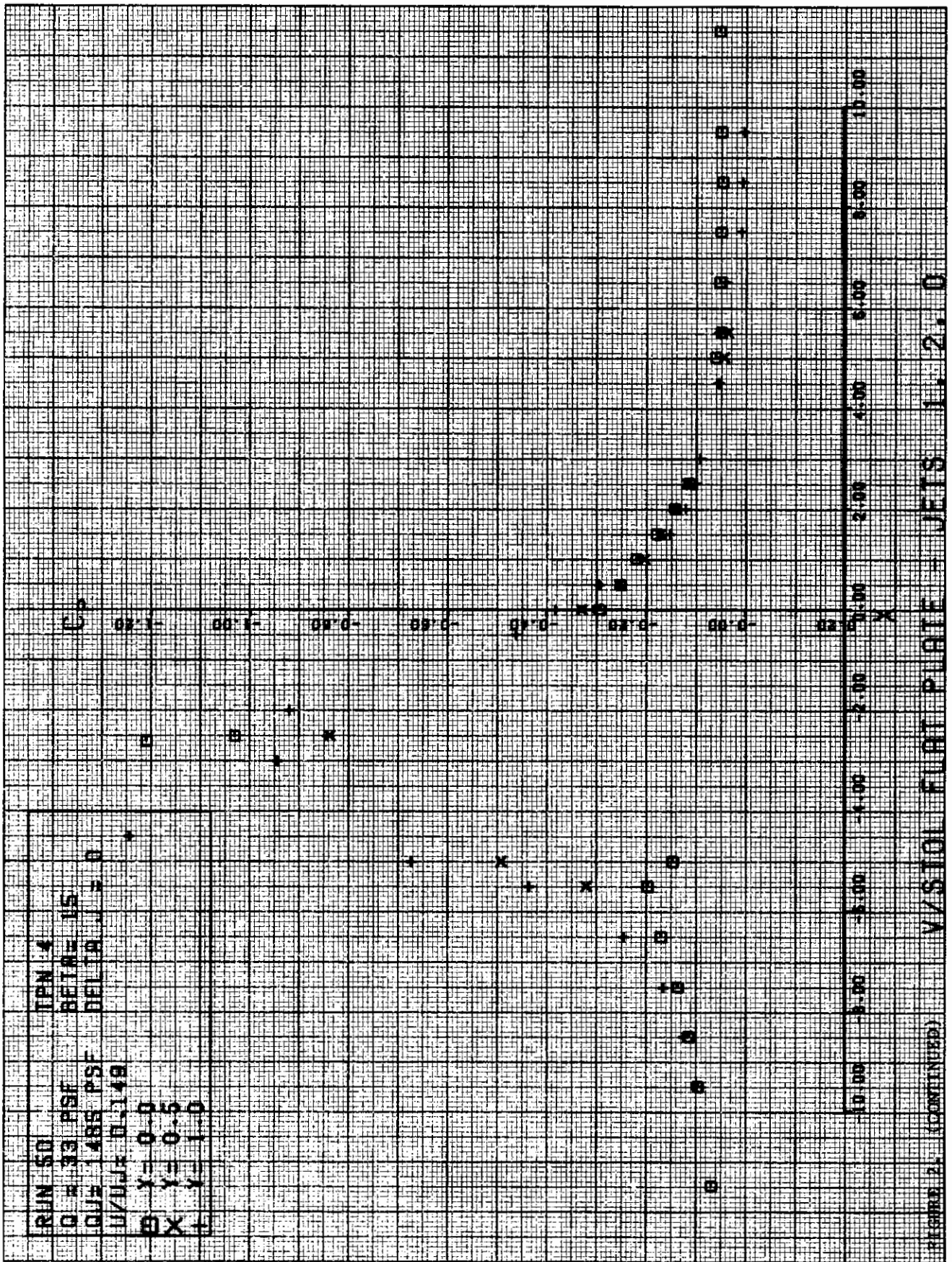
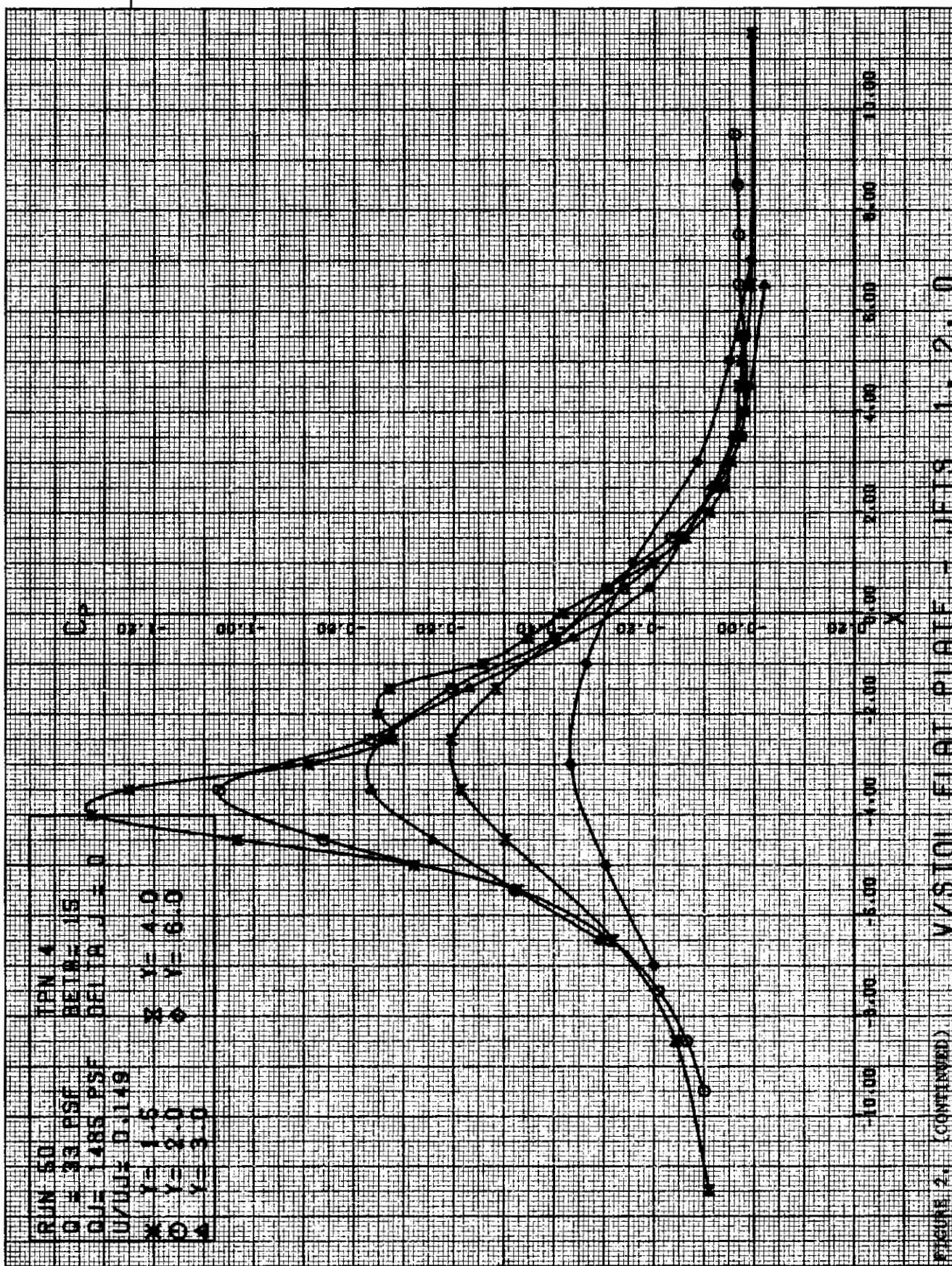


FIGURE 2. (CONTINUED)







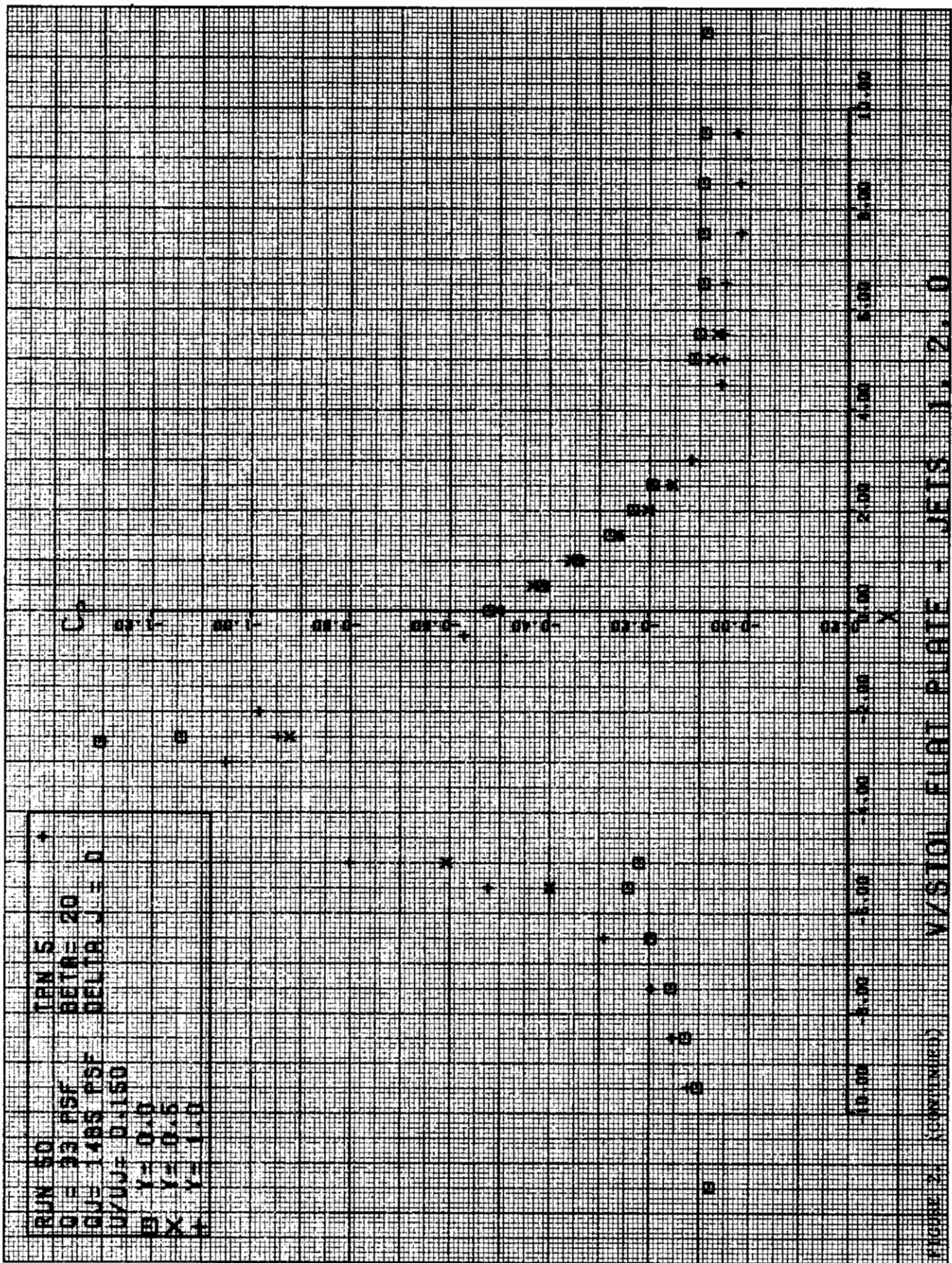
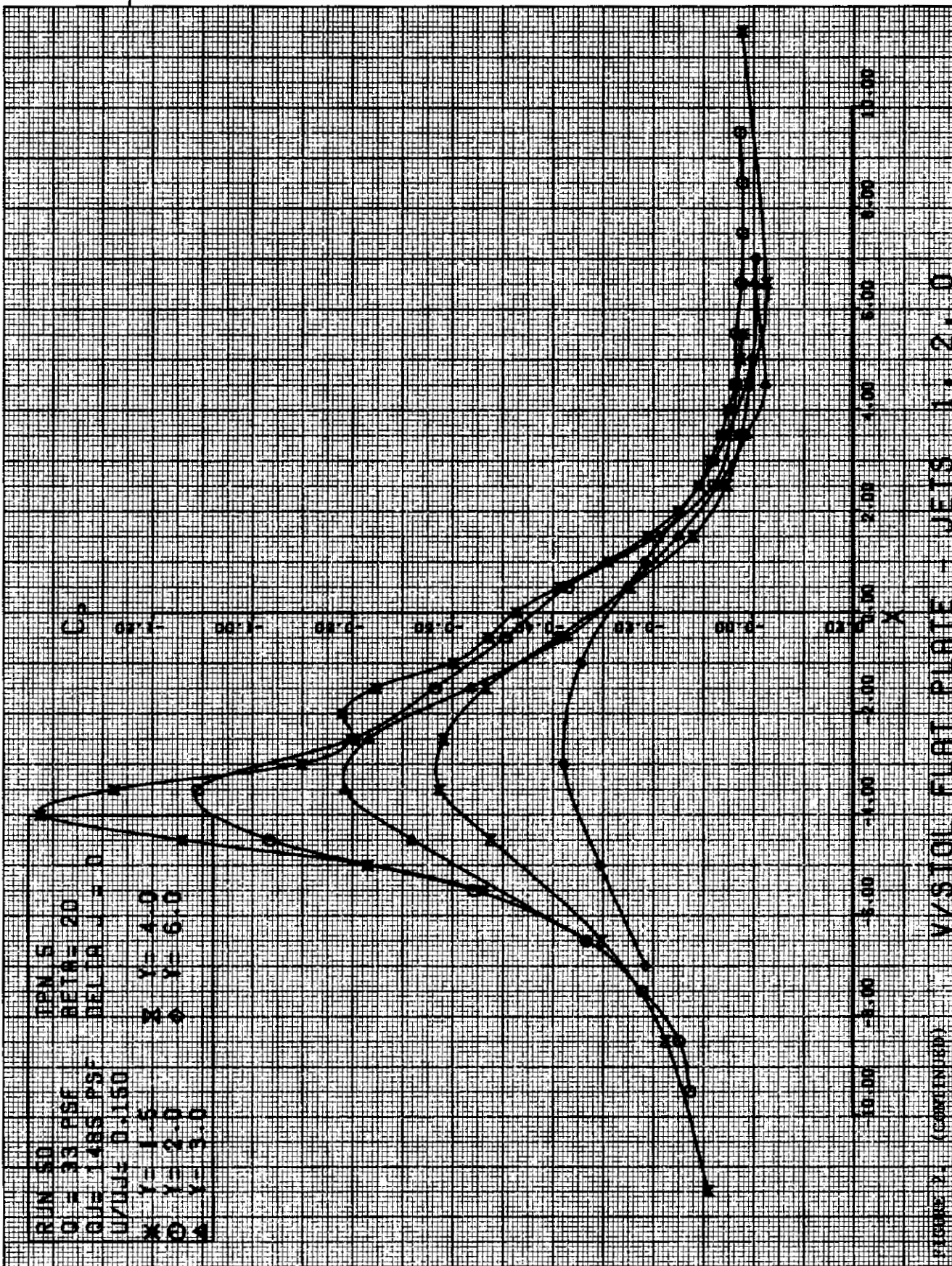
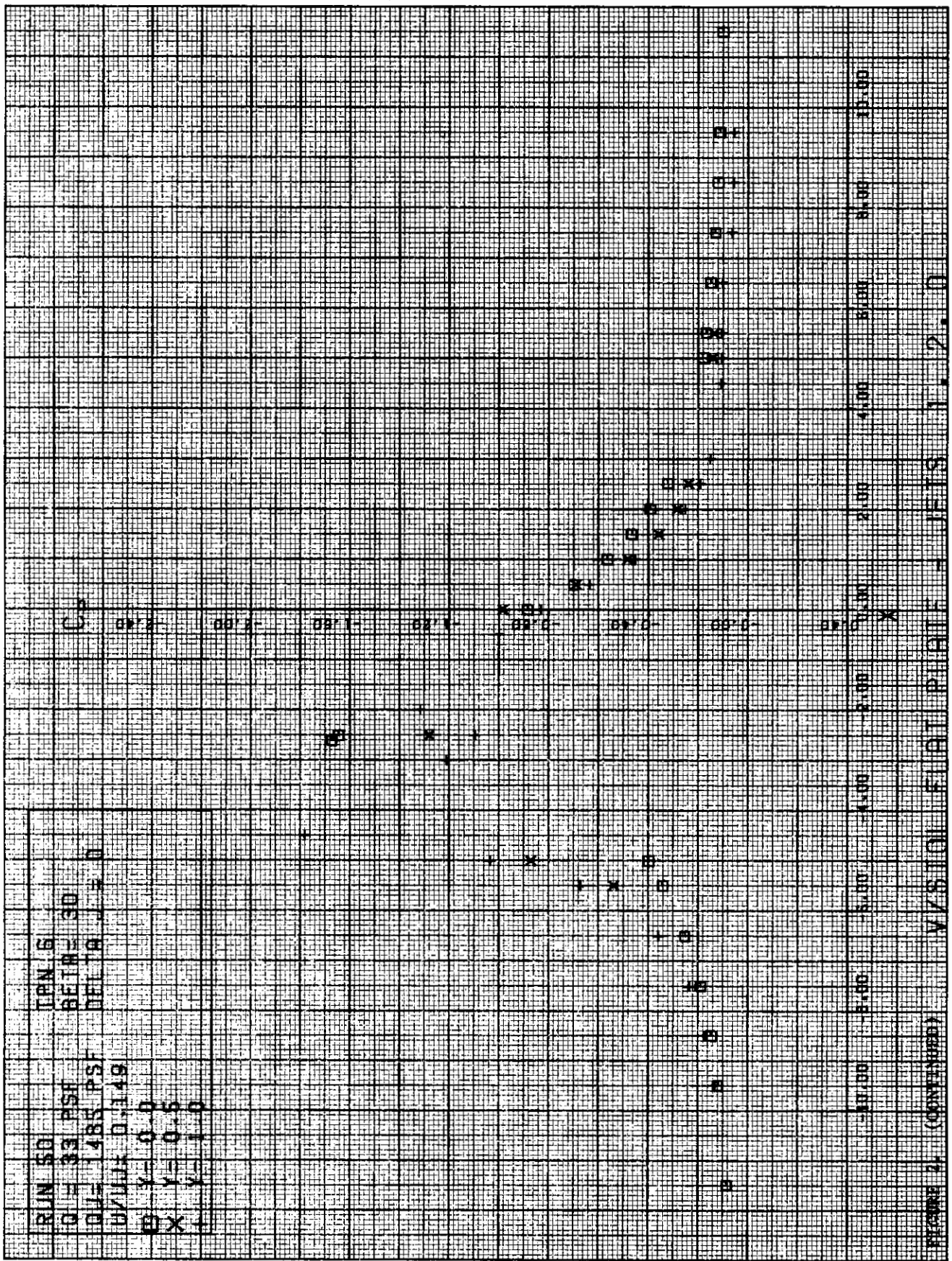
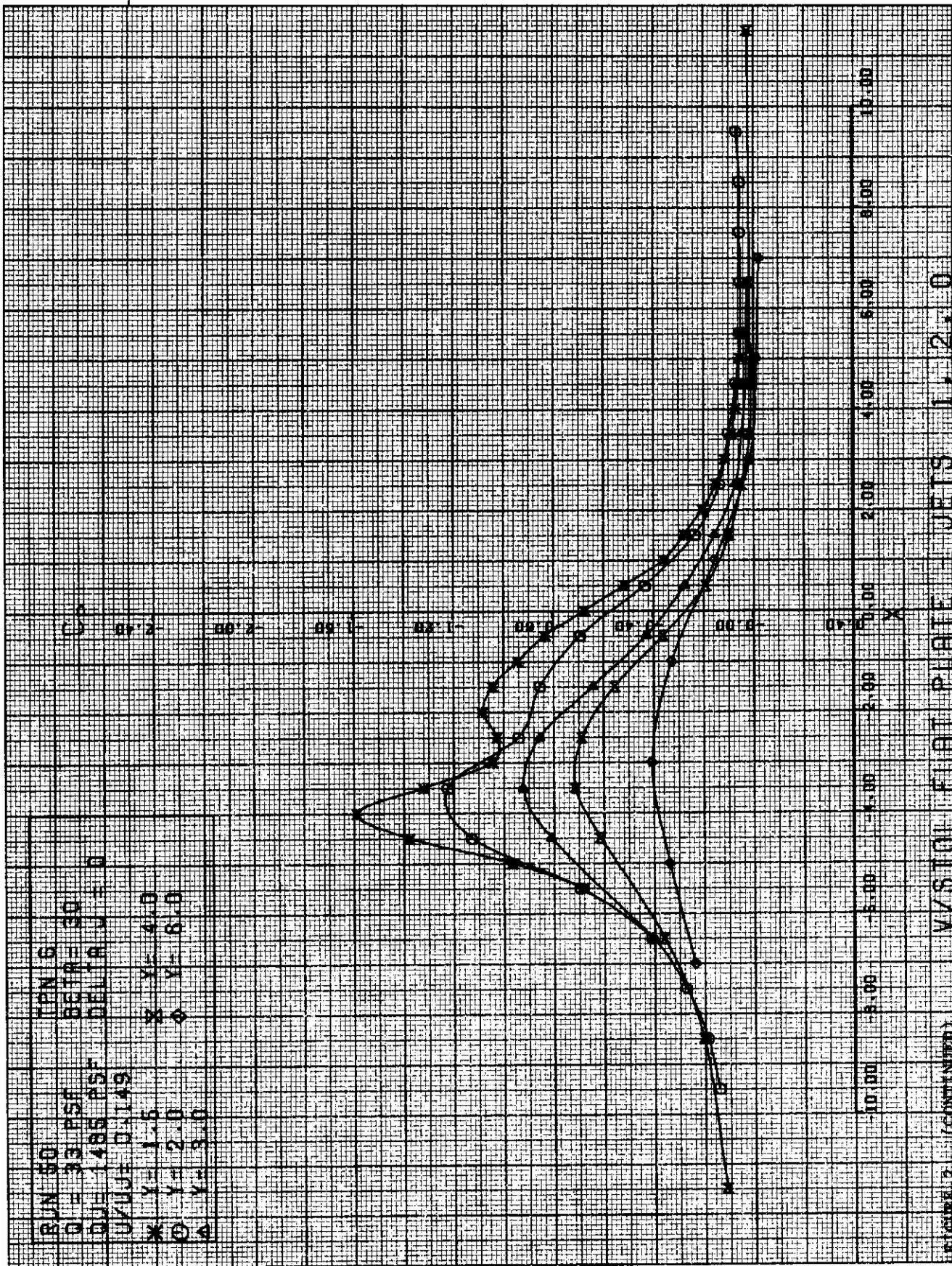
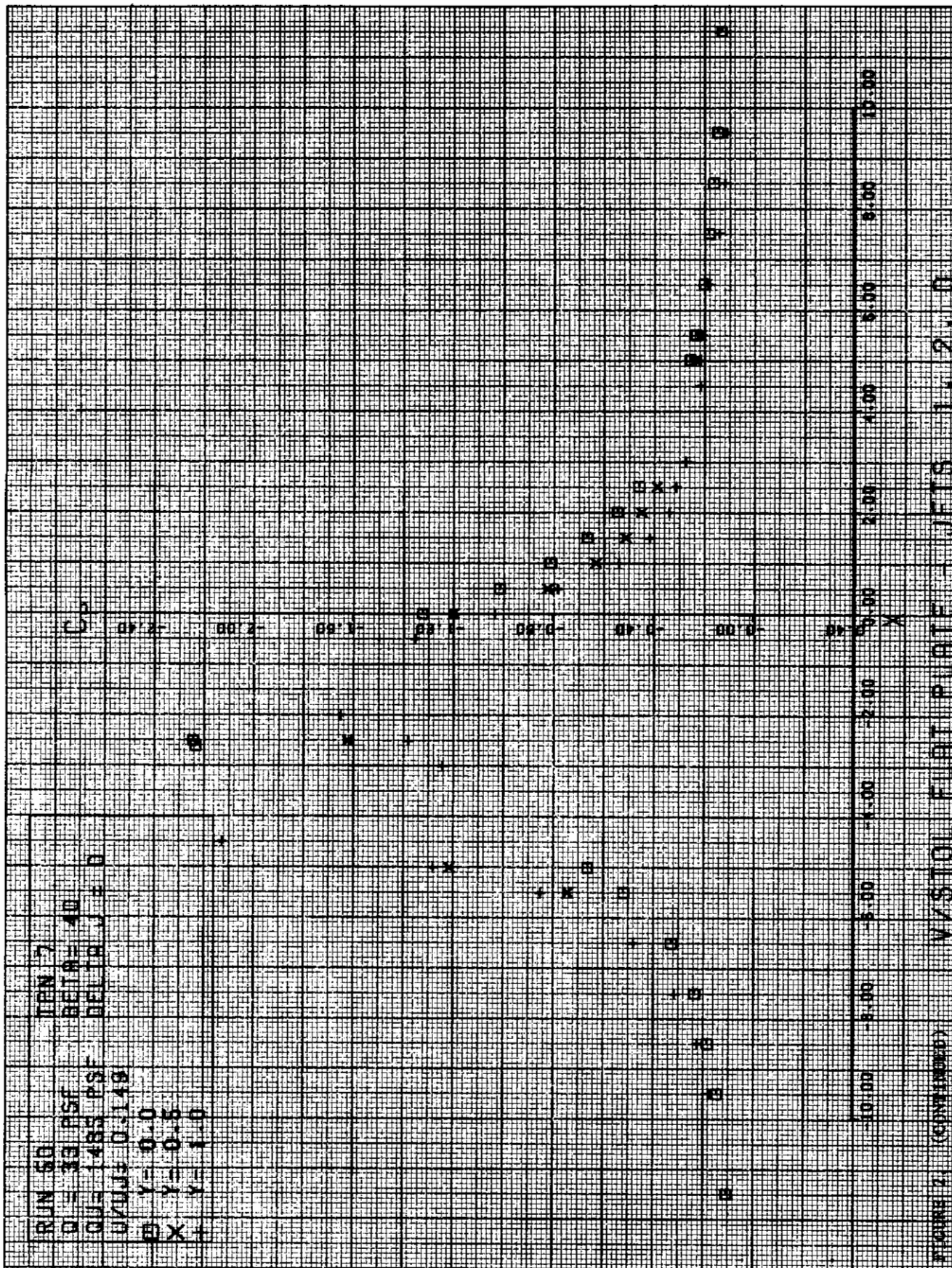


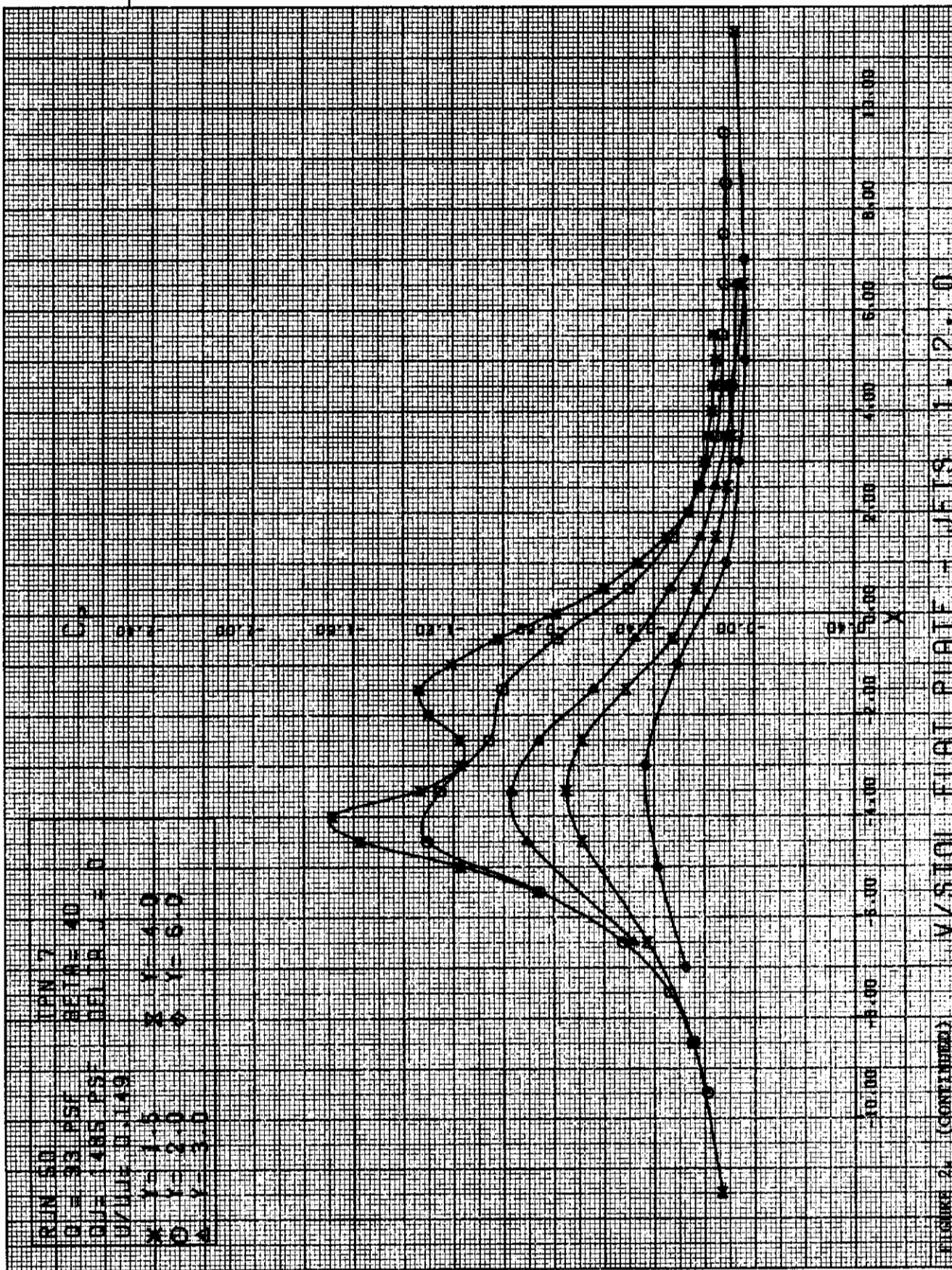
FIGURE 24 (CONTINUED) VISTOL FLAT PLATE - JETS 1, 2, 0











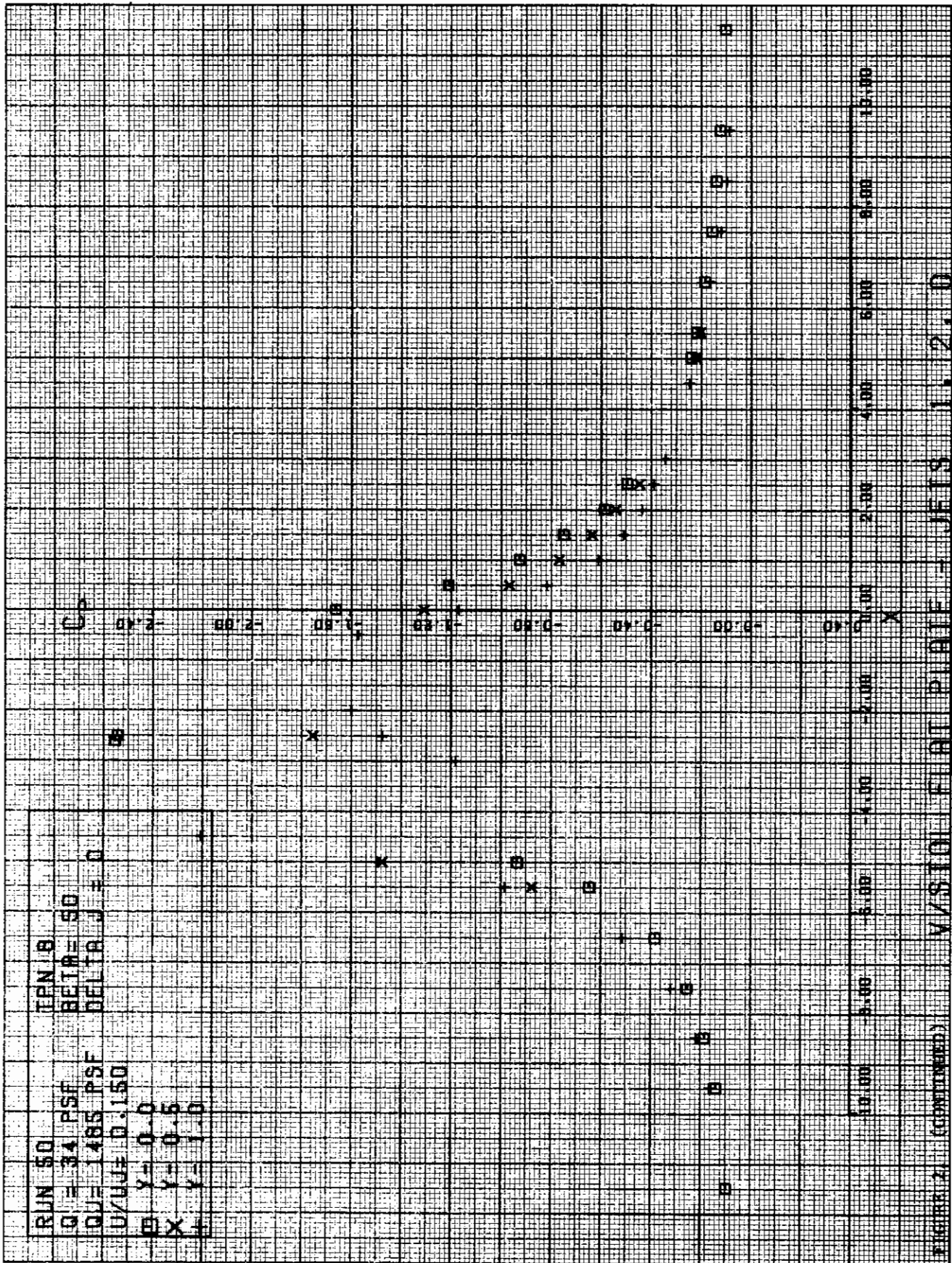
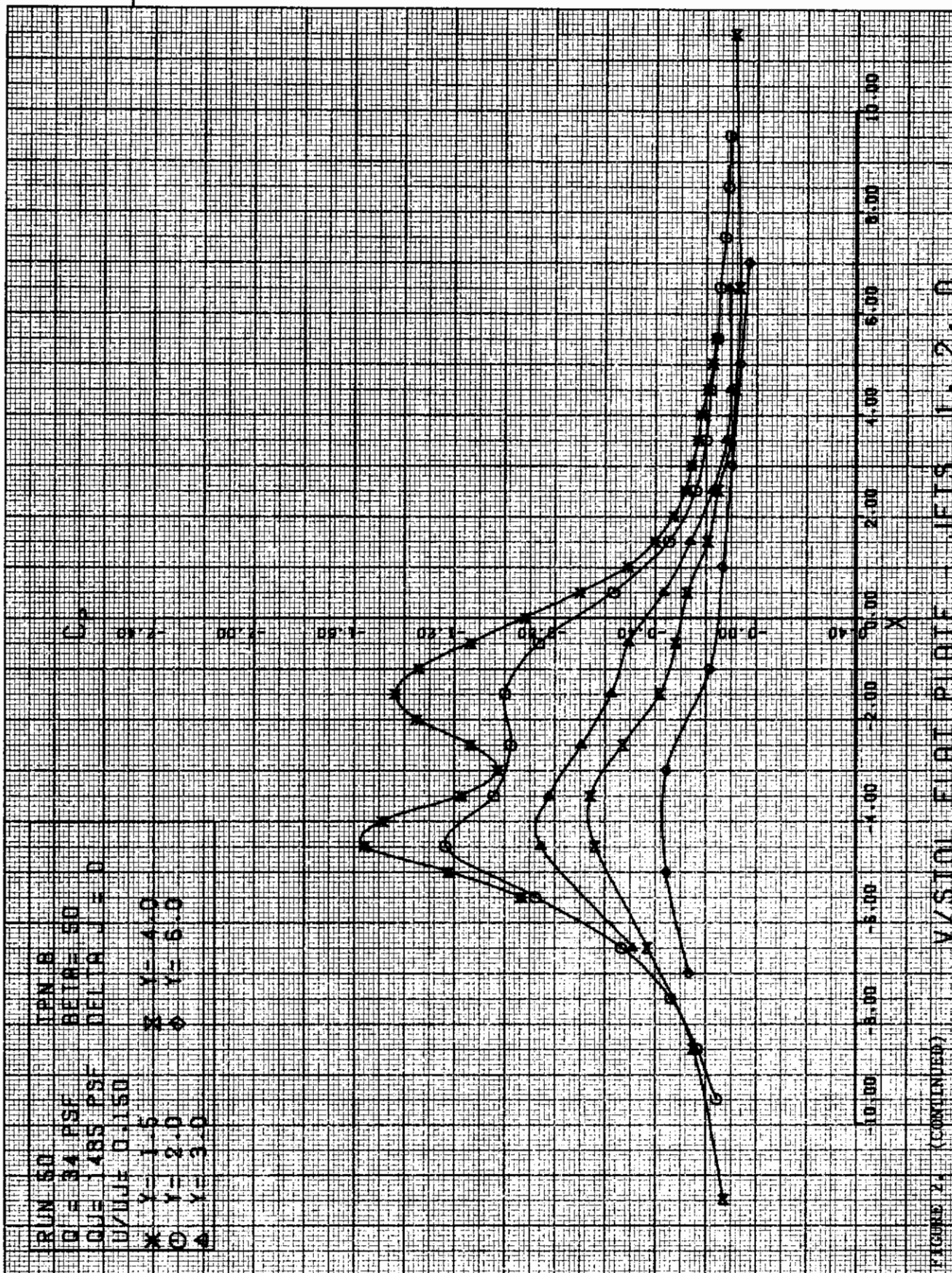
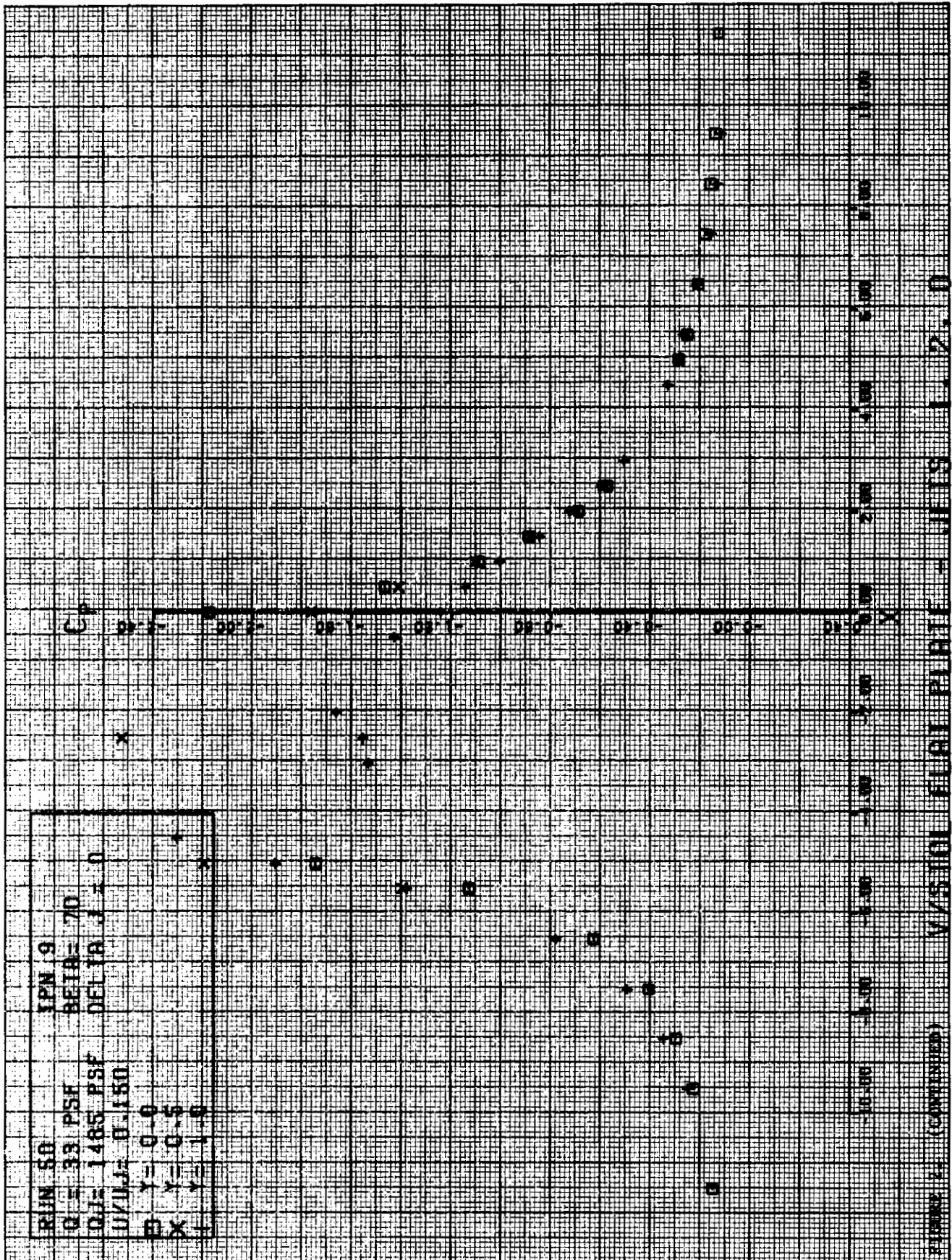
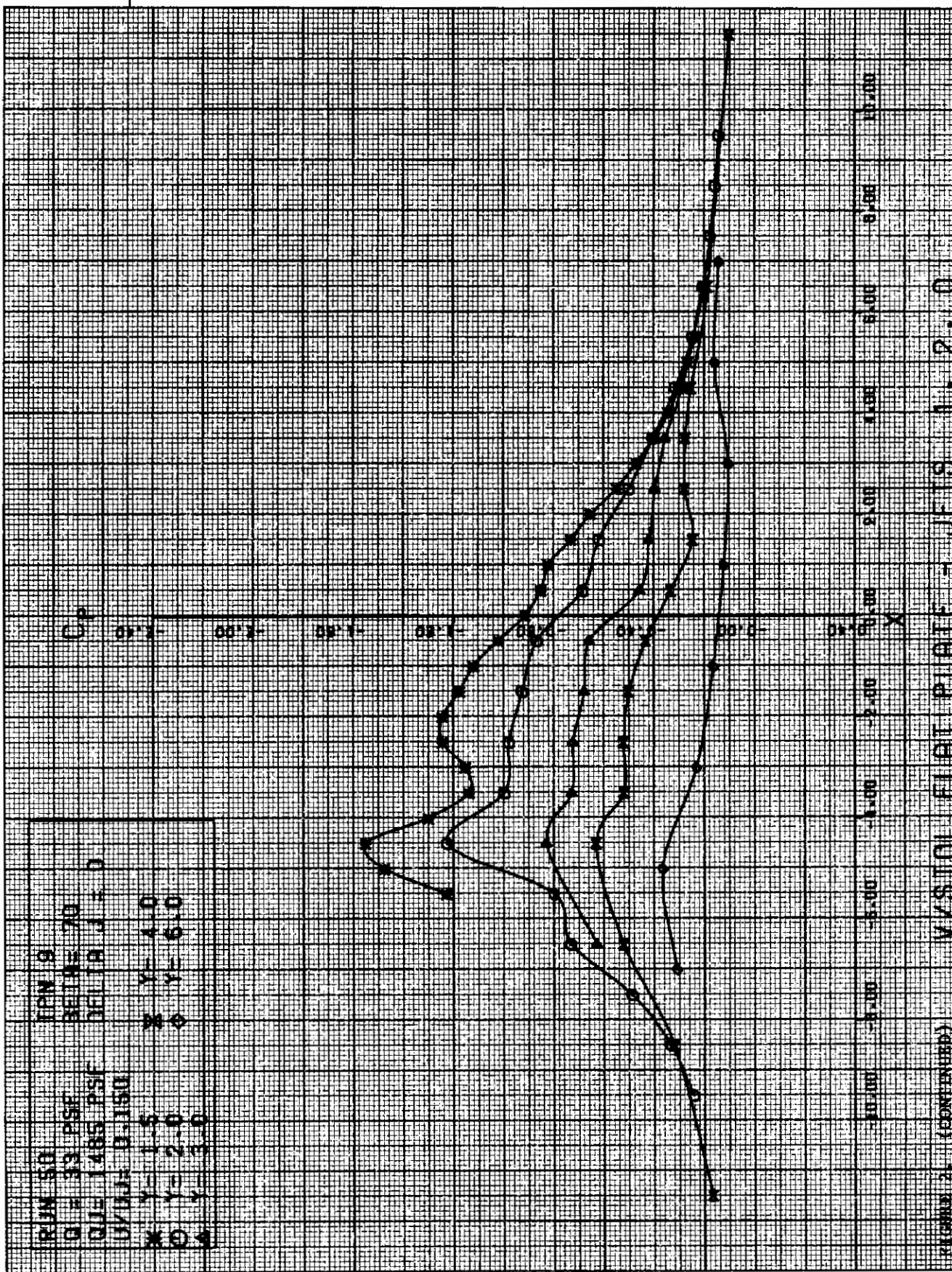


FIGURE 2 (CONTINUED) VISION FLAT PUFF - JETS 1, 2, D







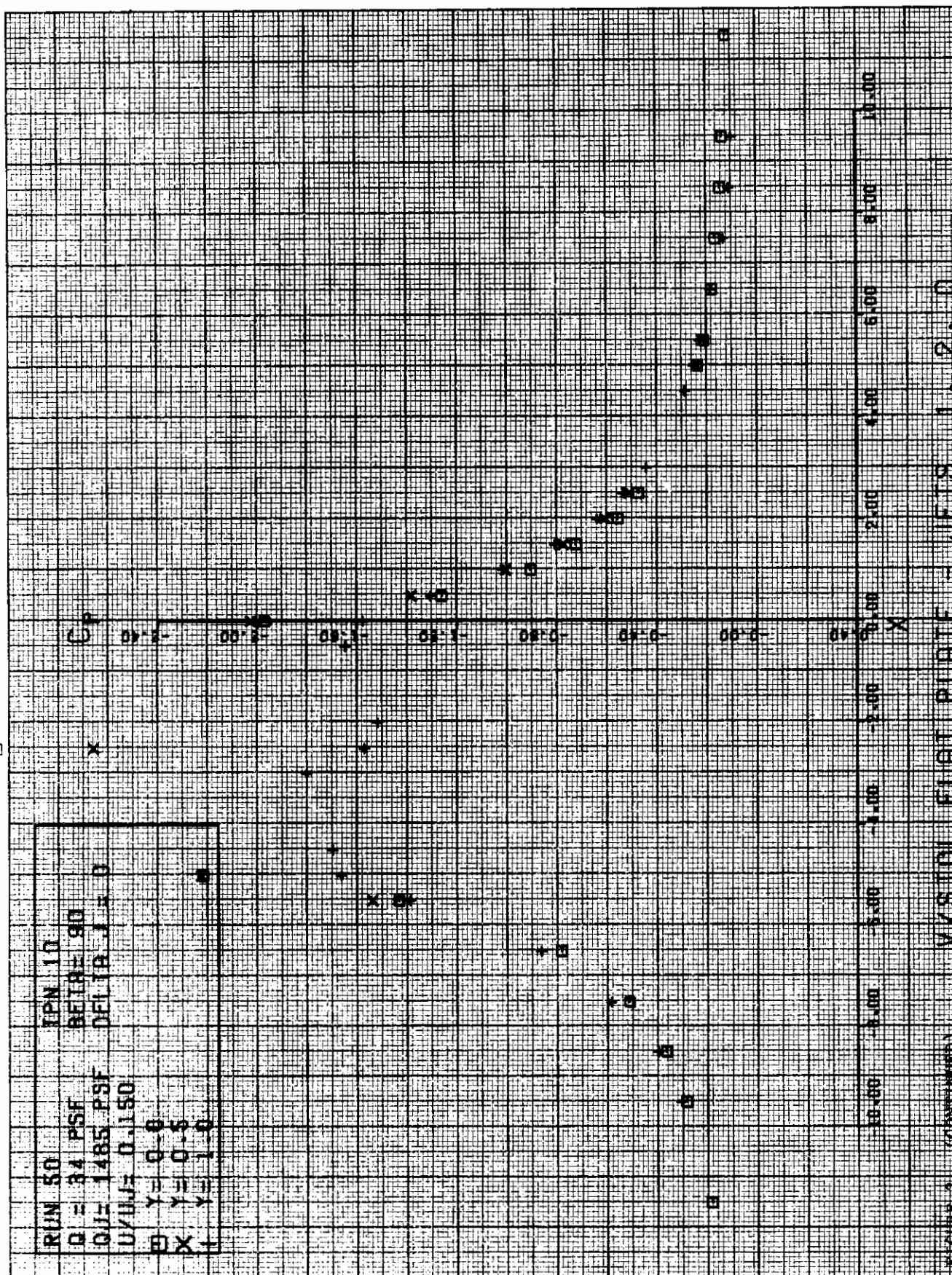


FIGURE 2. (CONTINUED) VISTOL FLAT PLATE - JET S 1, 2, 0

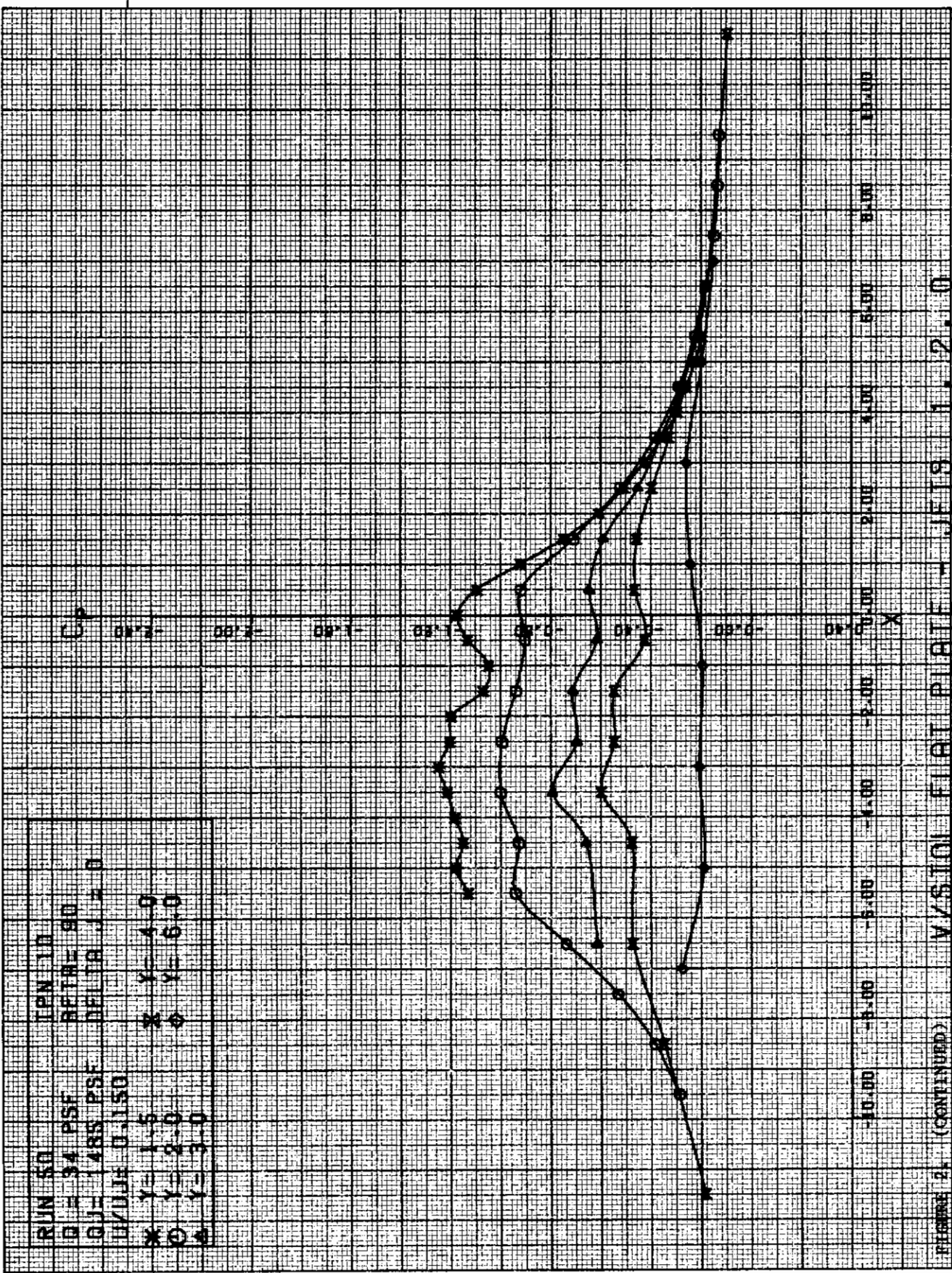
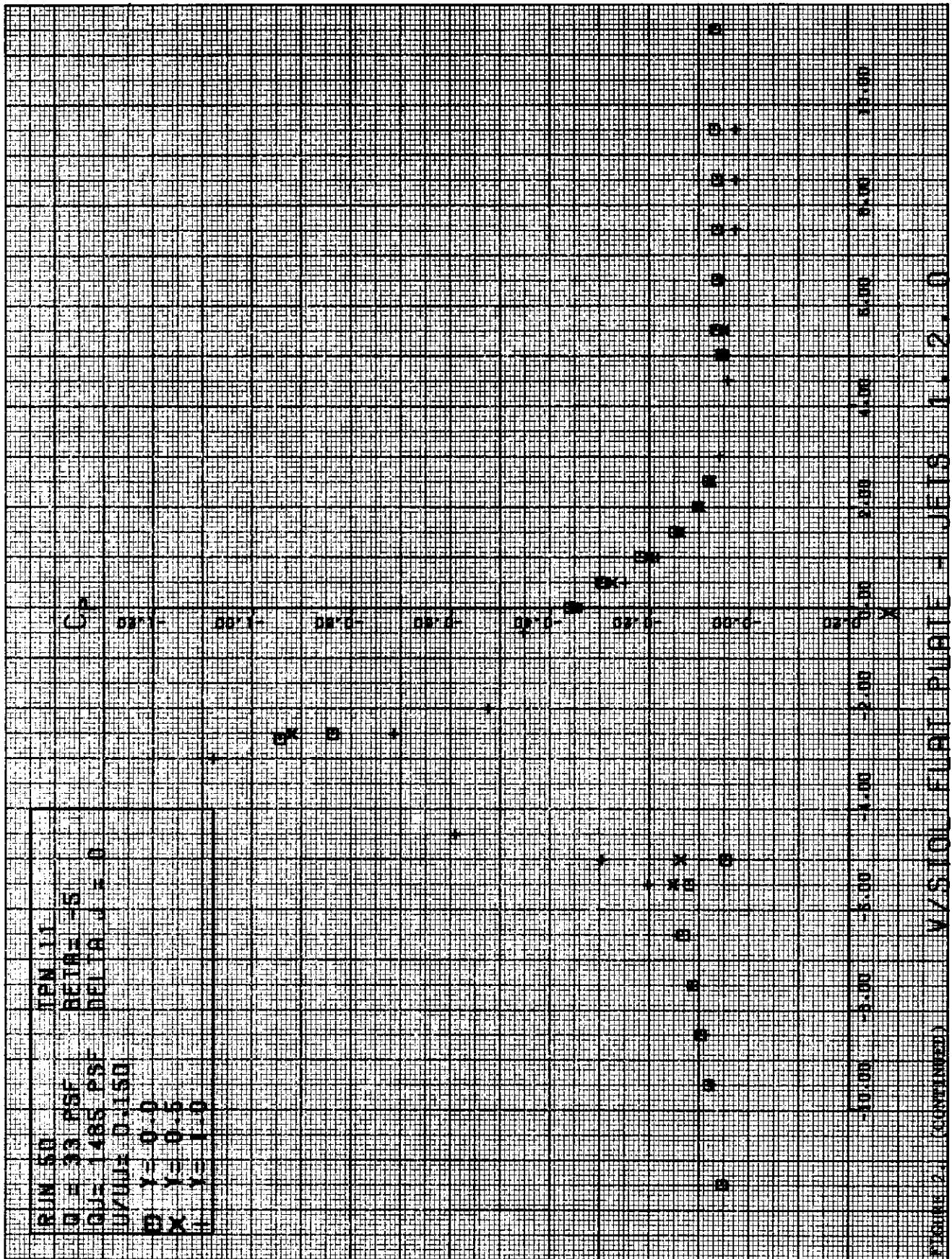
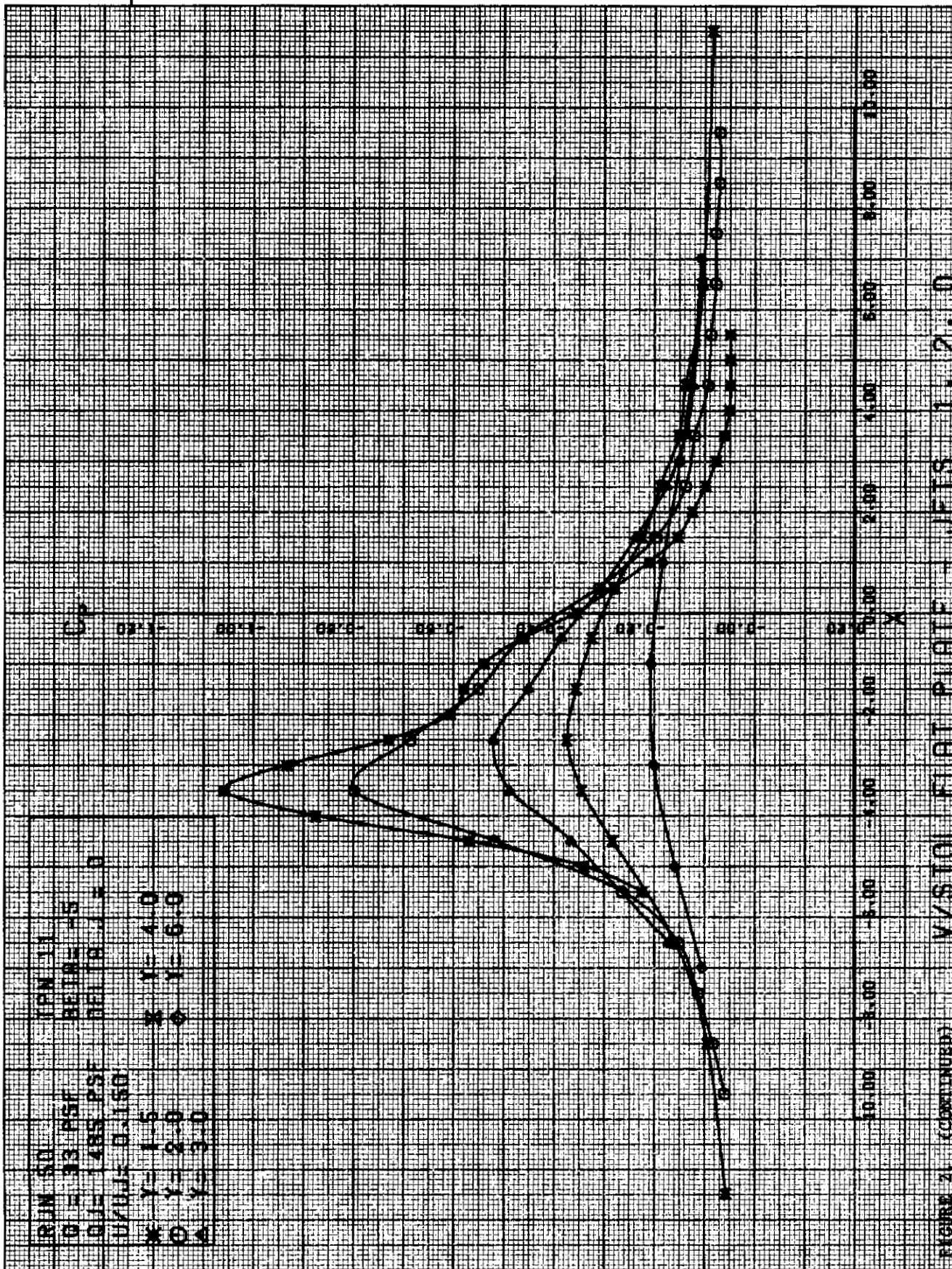


FIGURE 2, (CONTINUED)





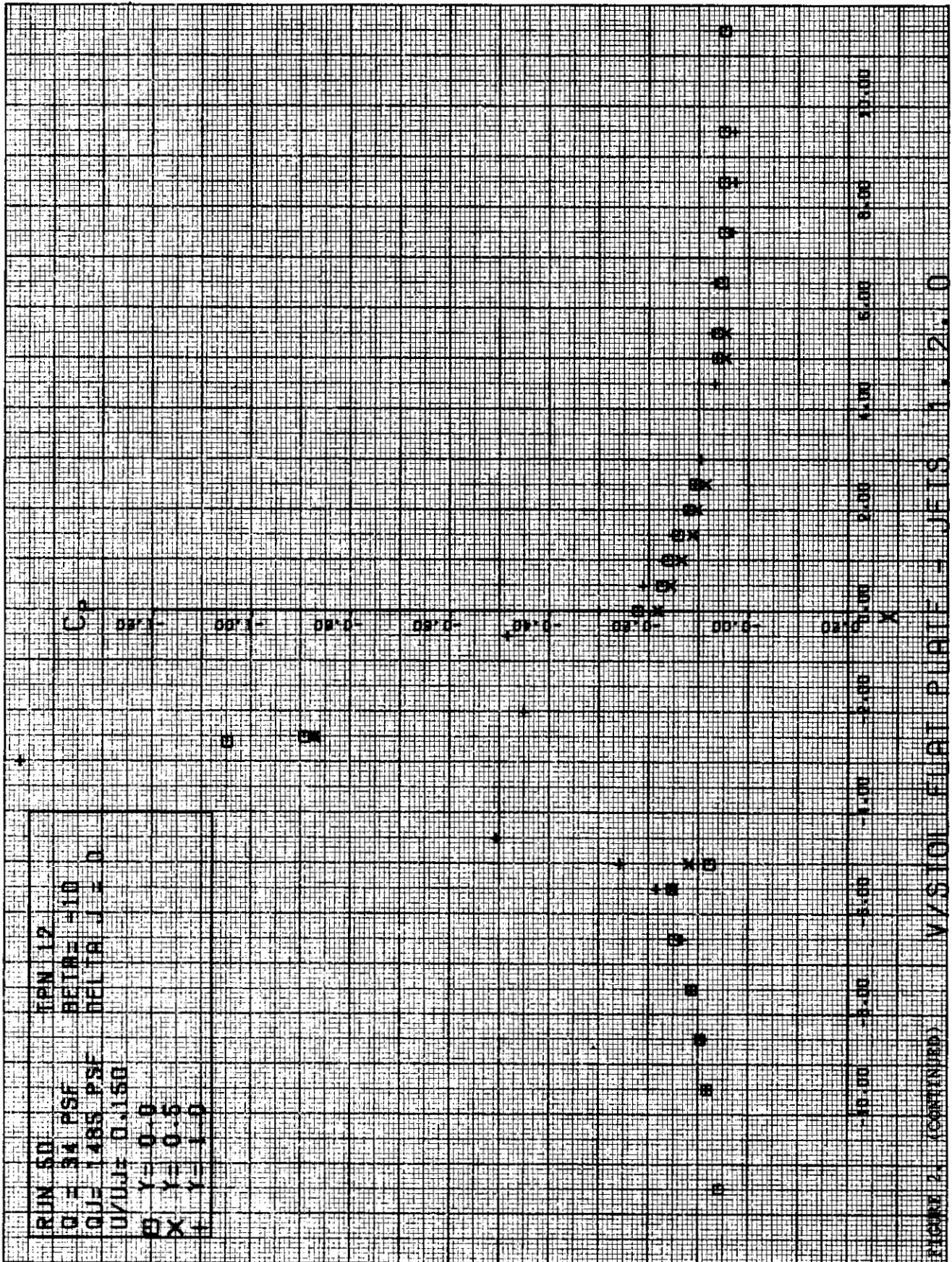
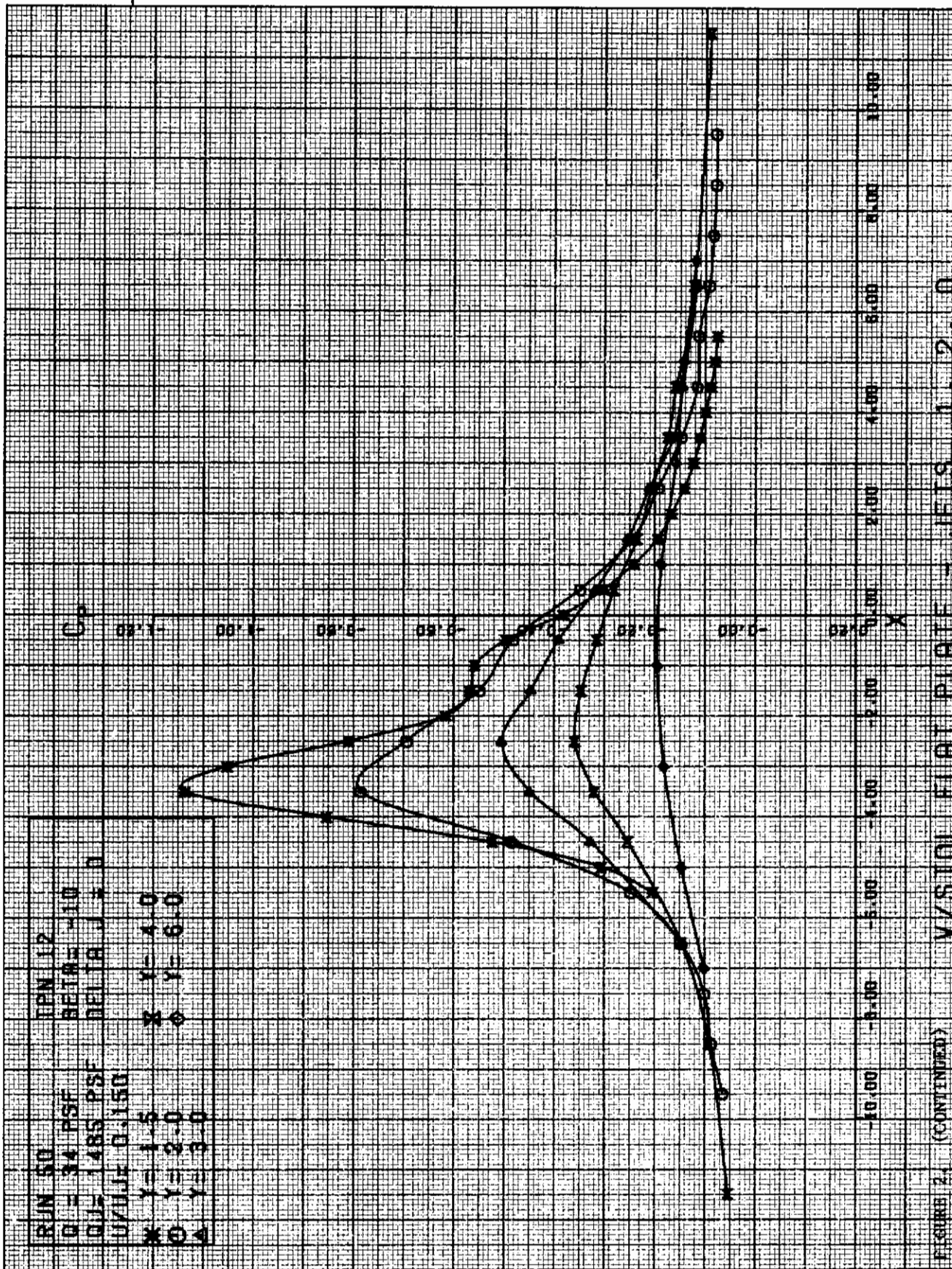


FIGURE 1. (CONTINUED) V/S FOR FLAT PLATE - JETS 1.2, 0



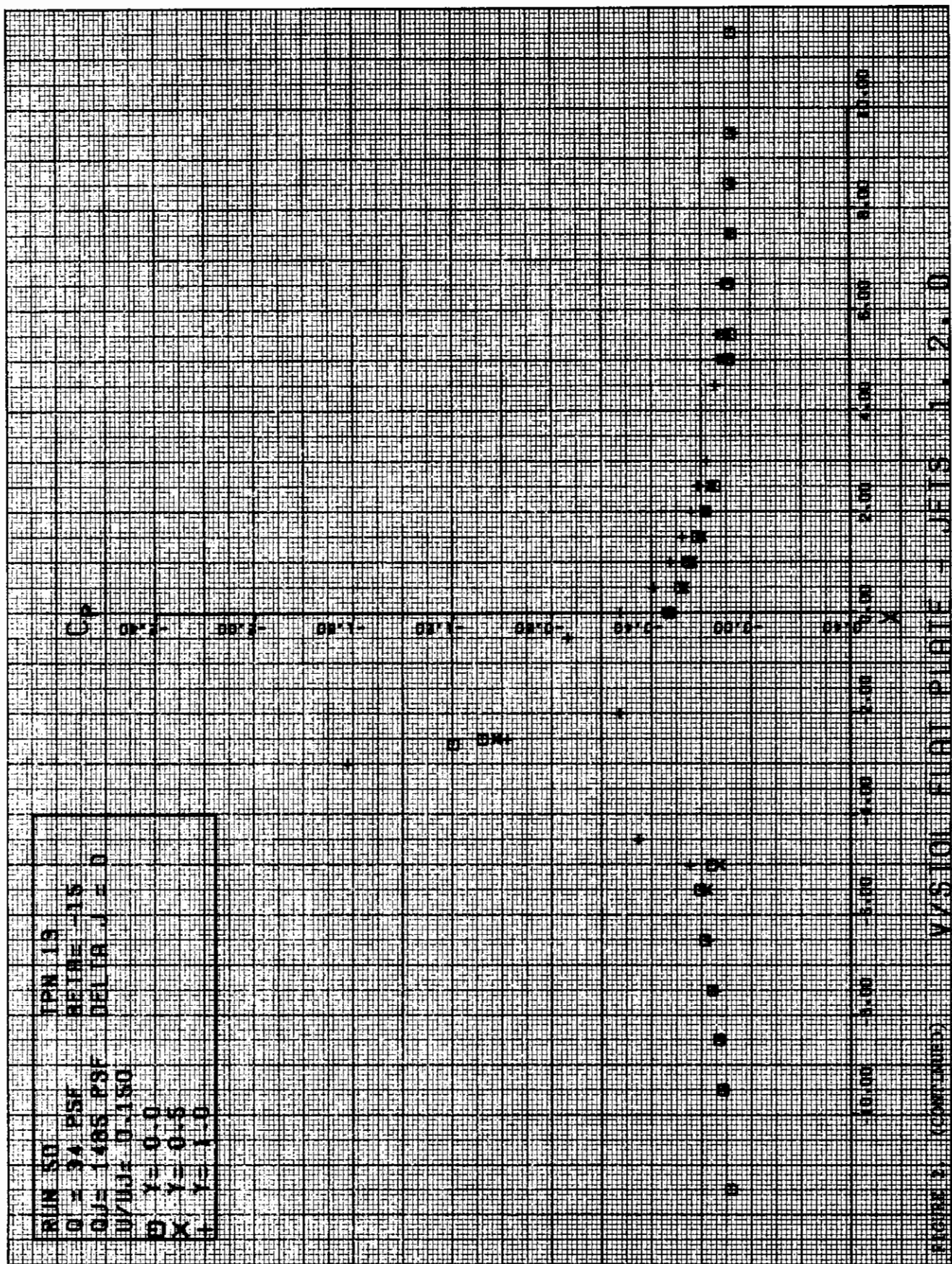
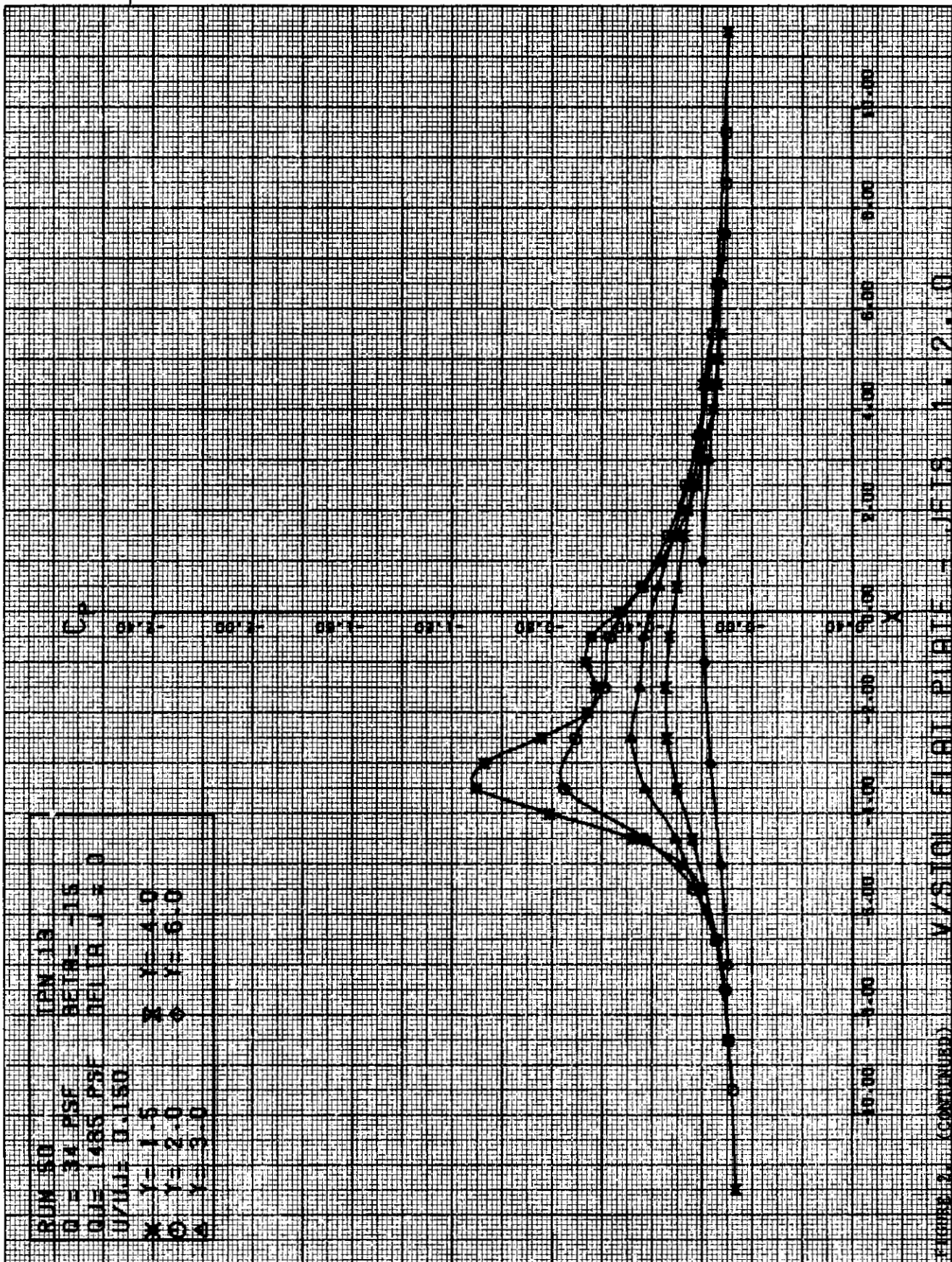
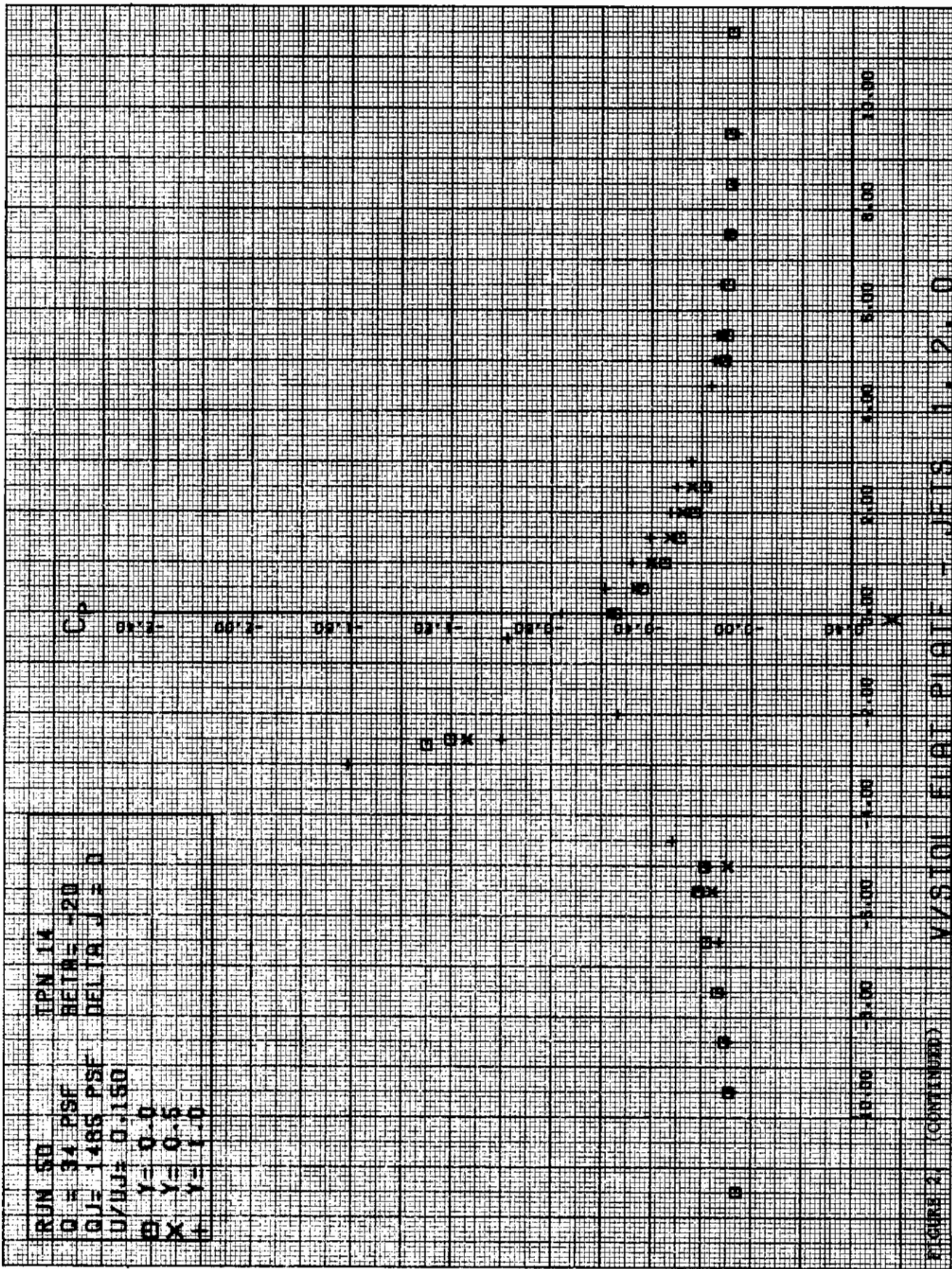


FIGURE 3 (CONTINUED) VISIOL FUOT PLATE - JETS 11-21-0





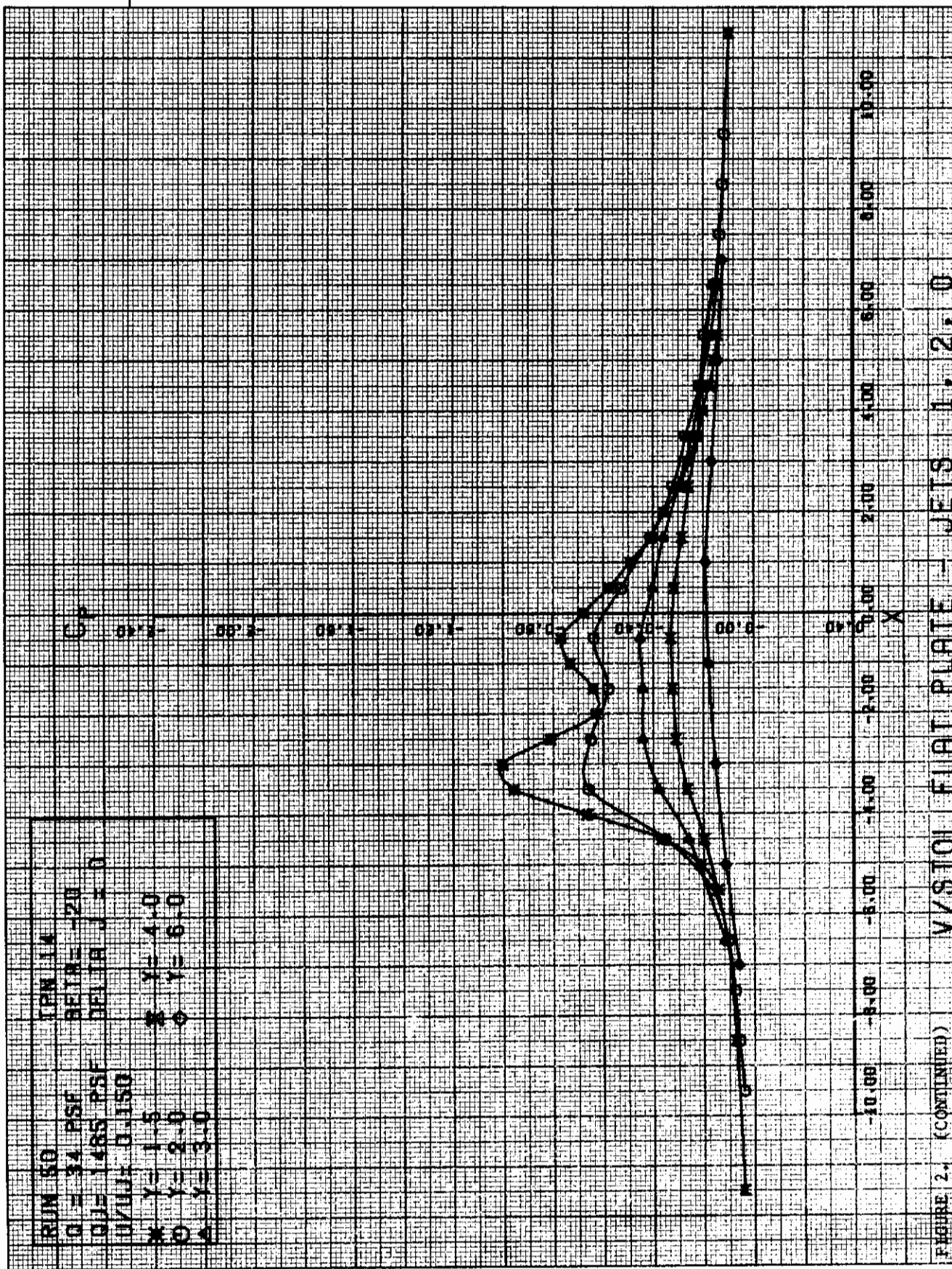
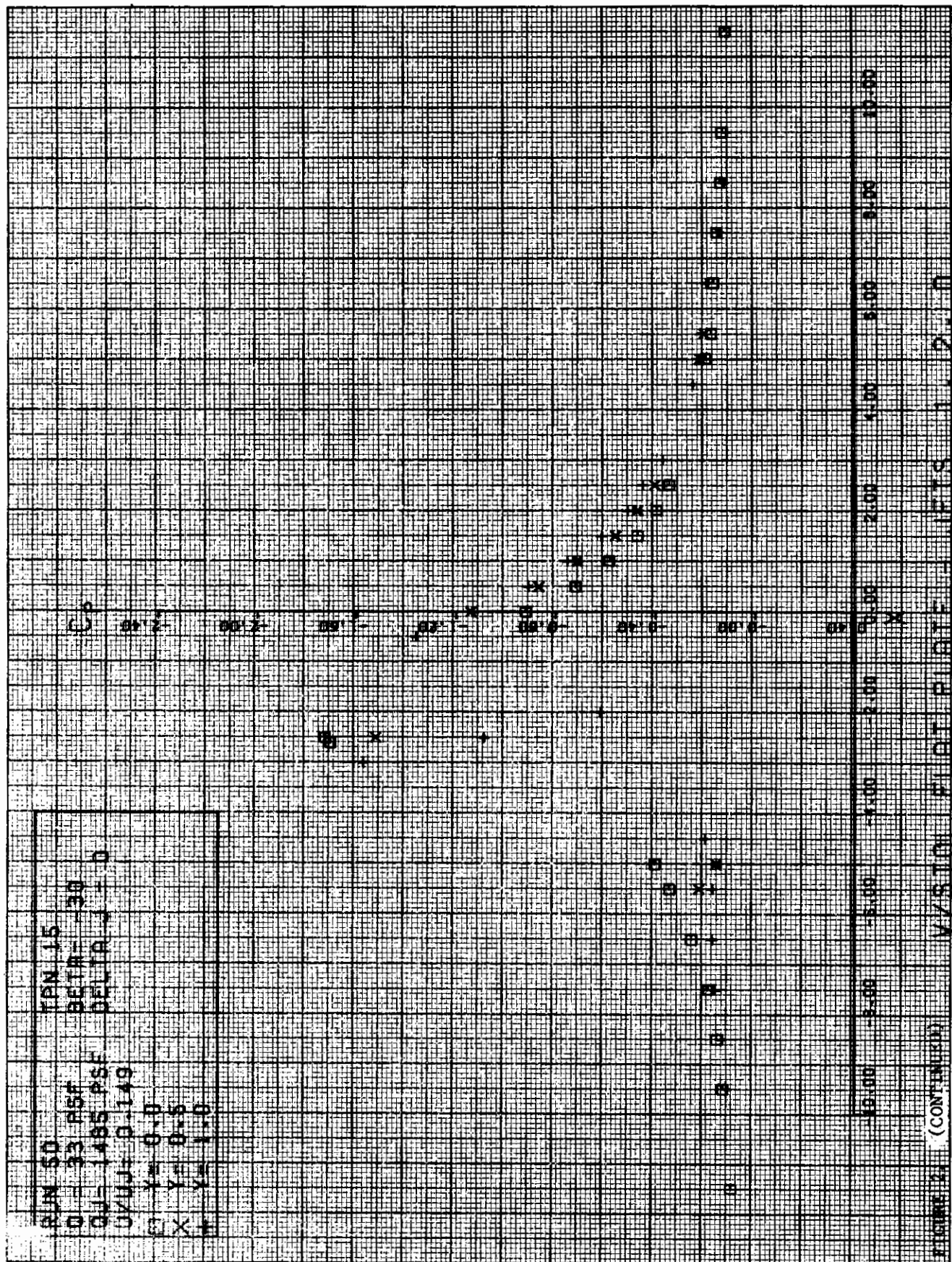
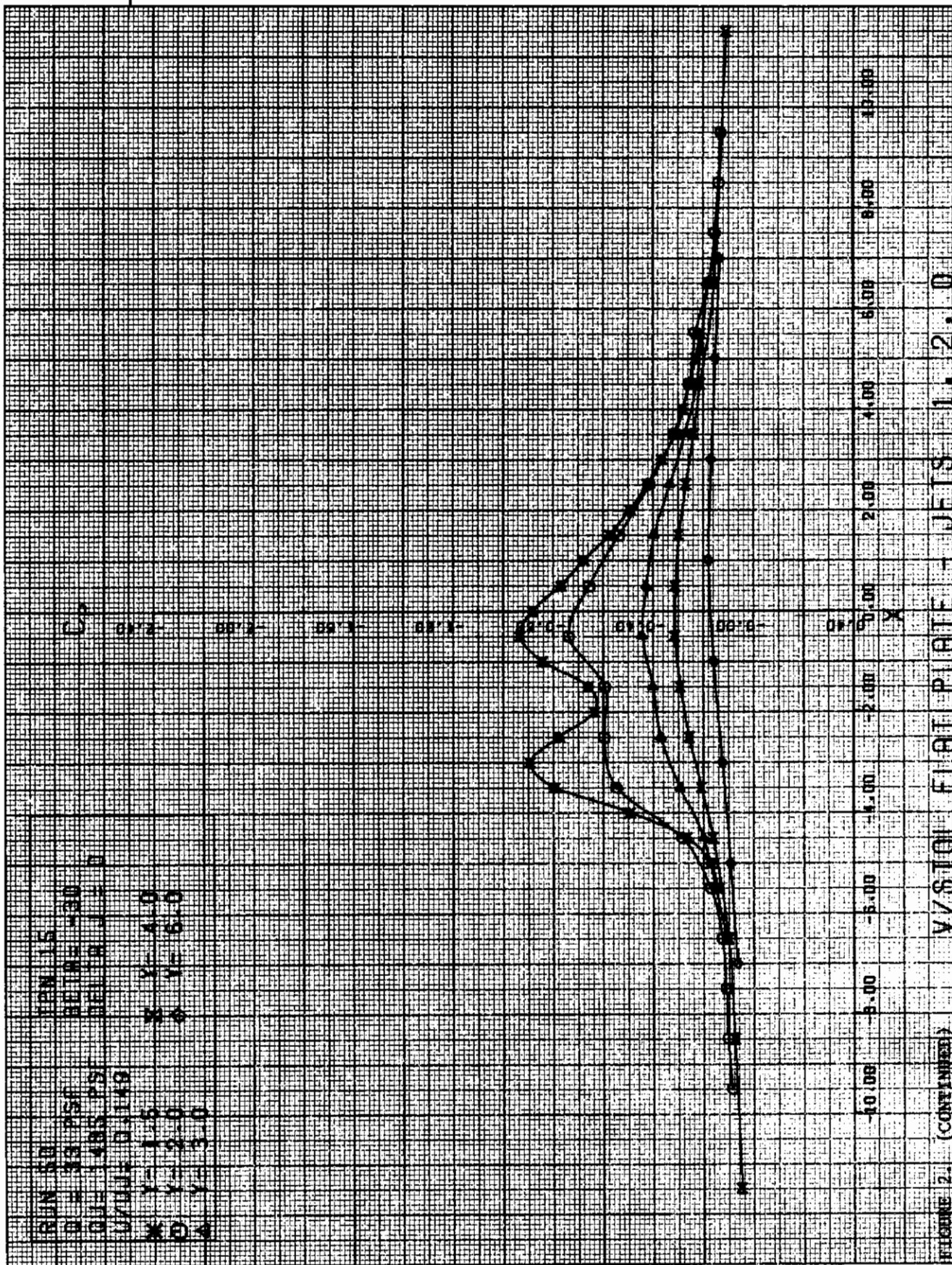


FIGURE 2. (CONTINUED) V/STOL FLAT PLATE - JETS 1, 2, 0





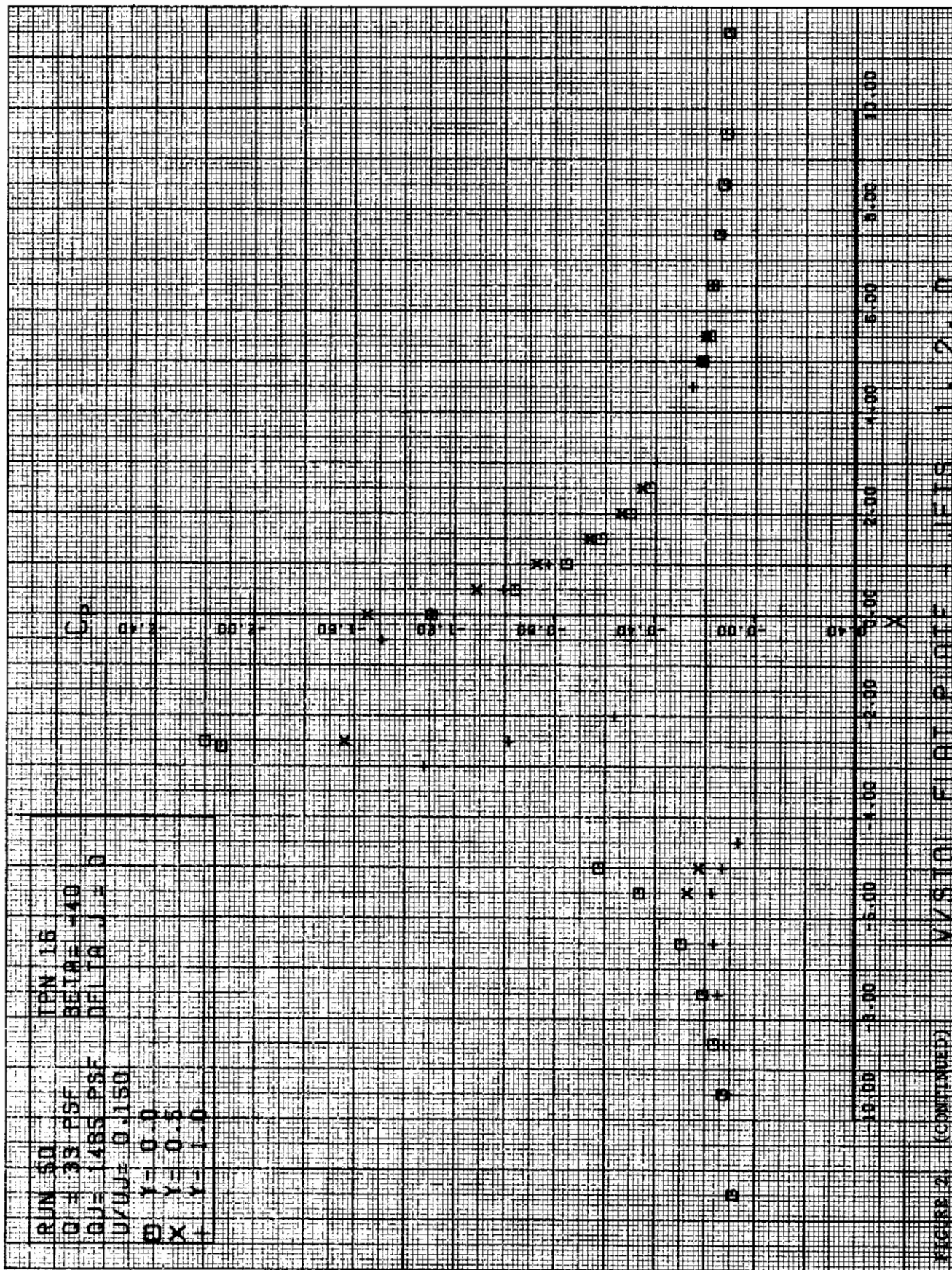
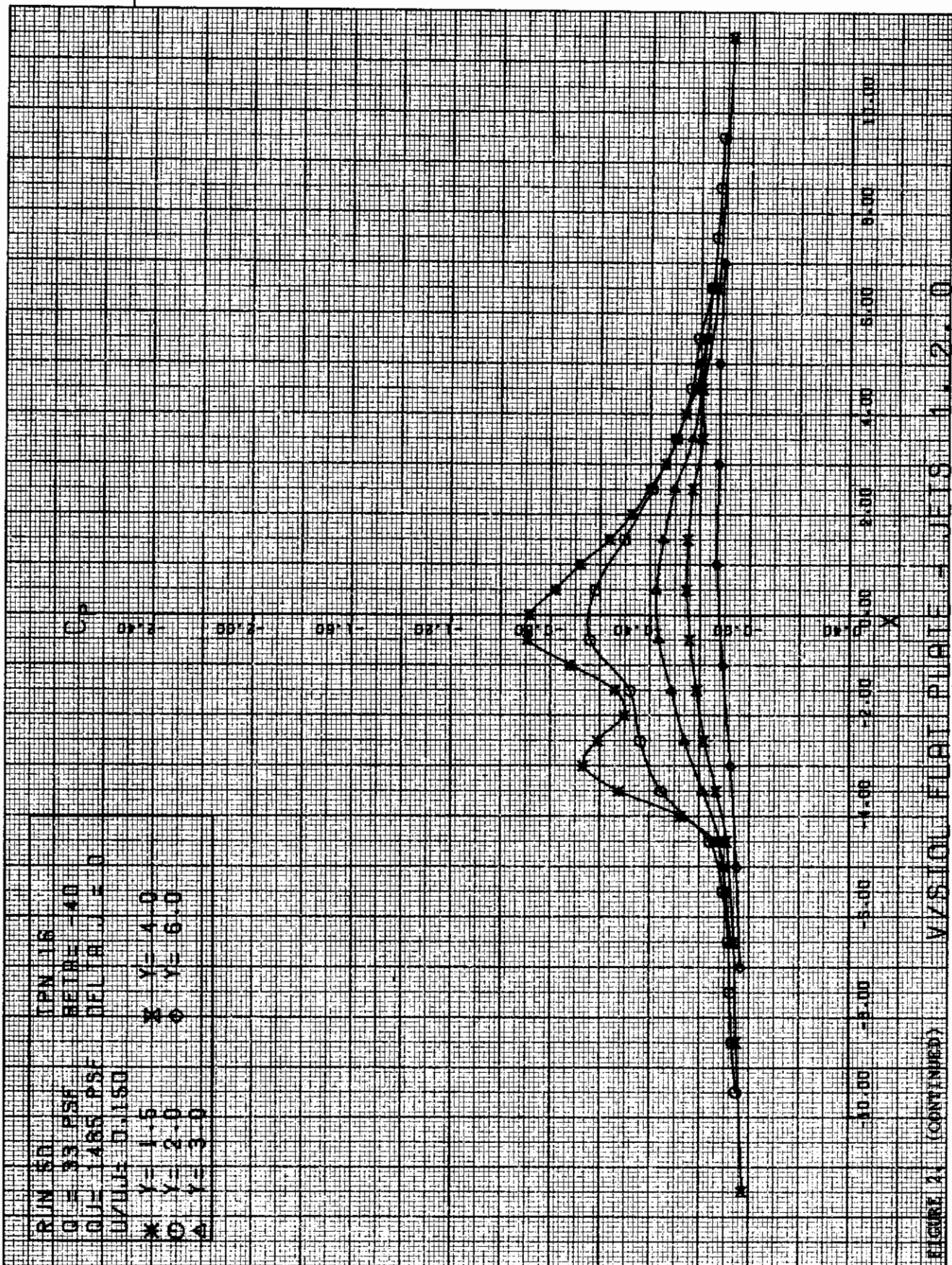
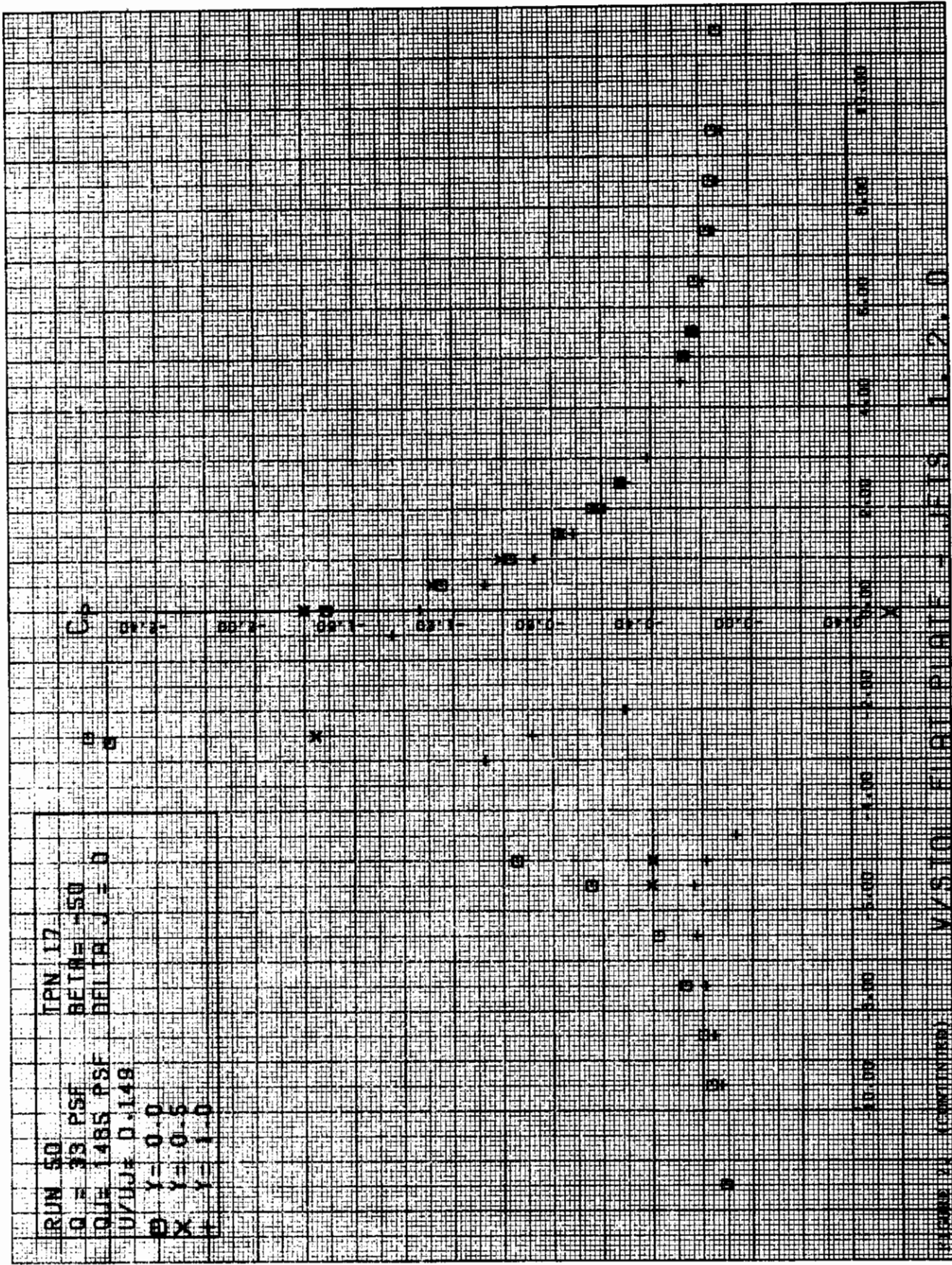


FIGURE 2. (CONTINUED) VJ570L FLAT PLATE JETS 1, 2, 0



Contrails



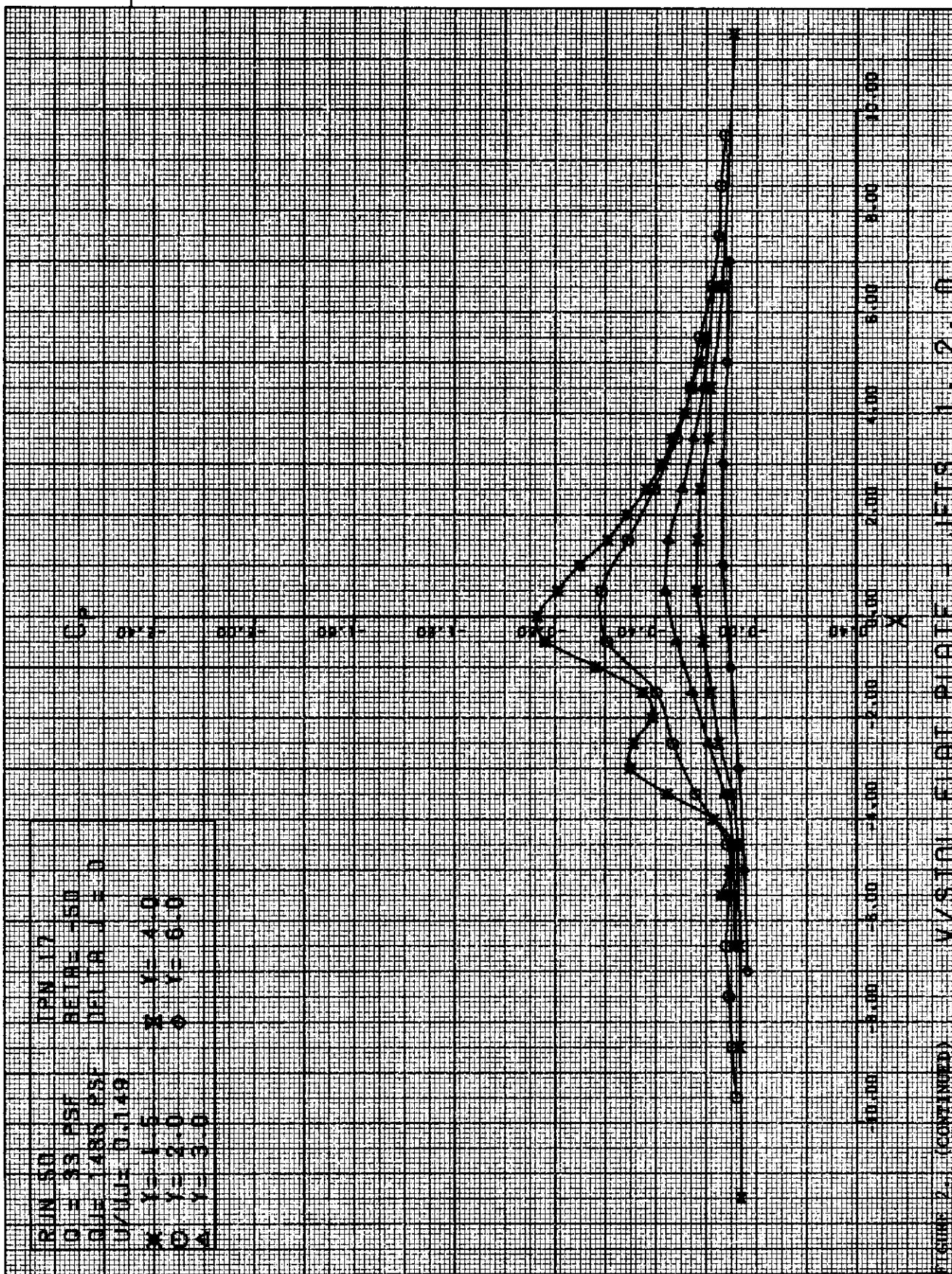
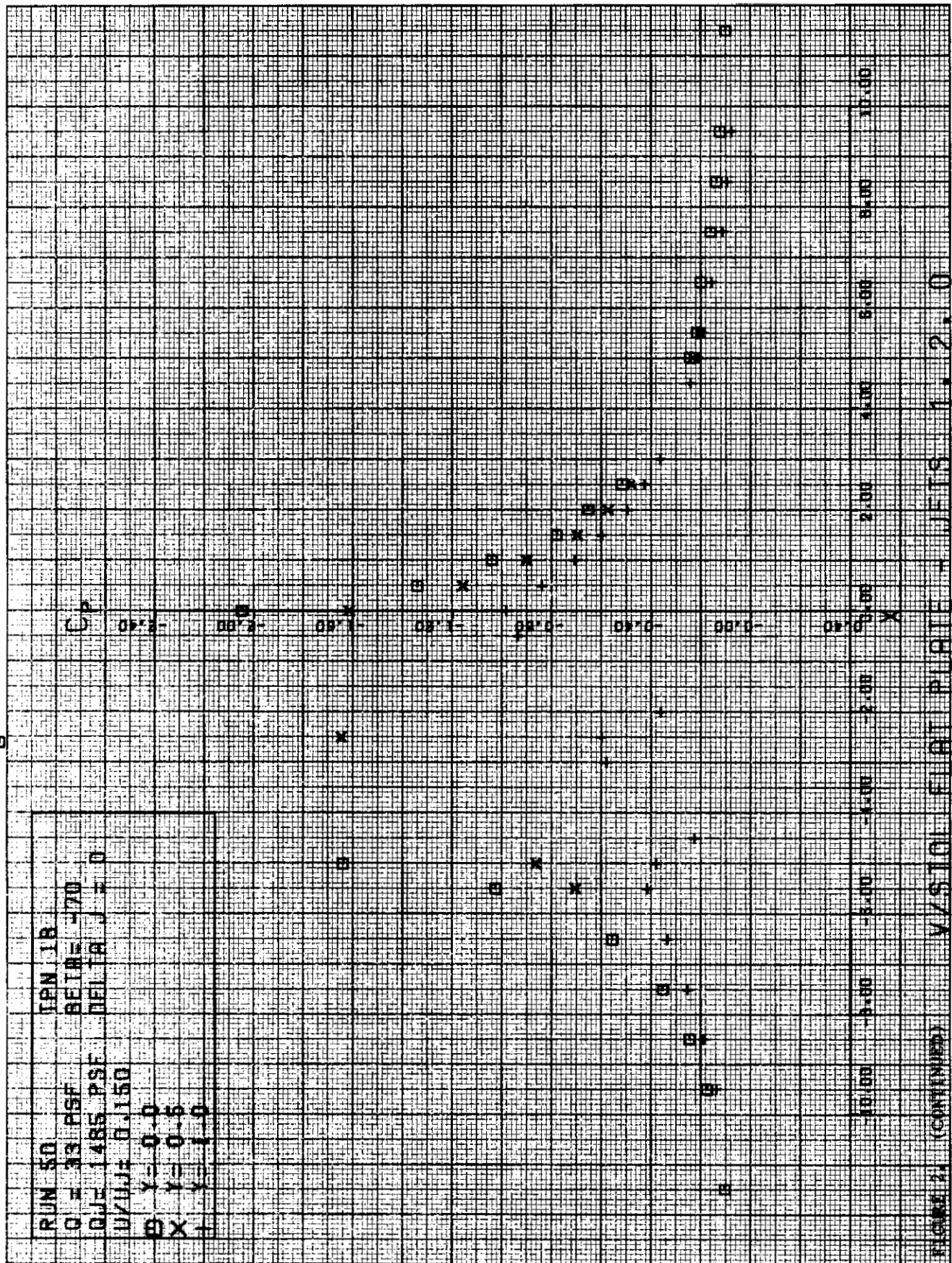
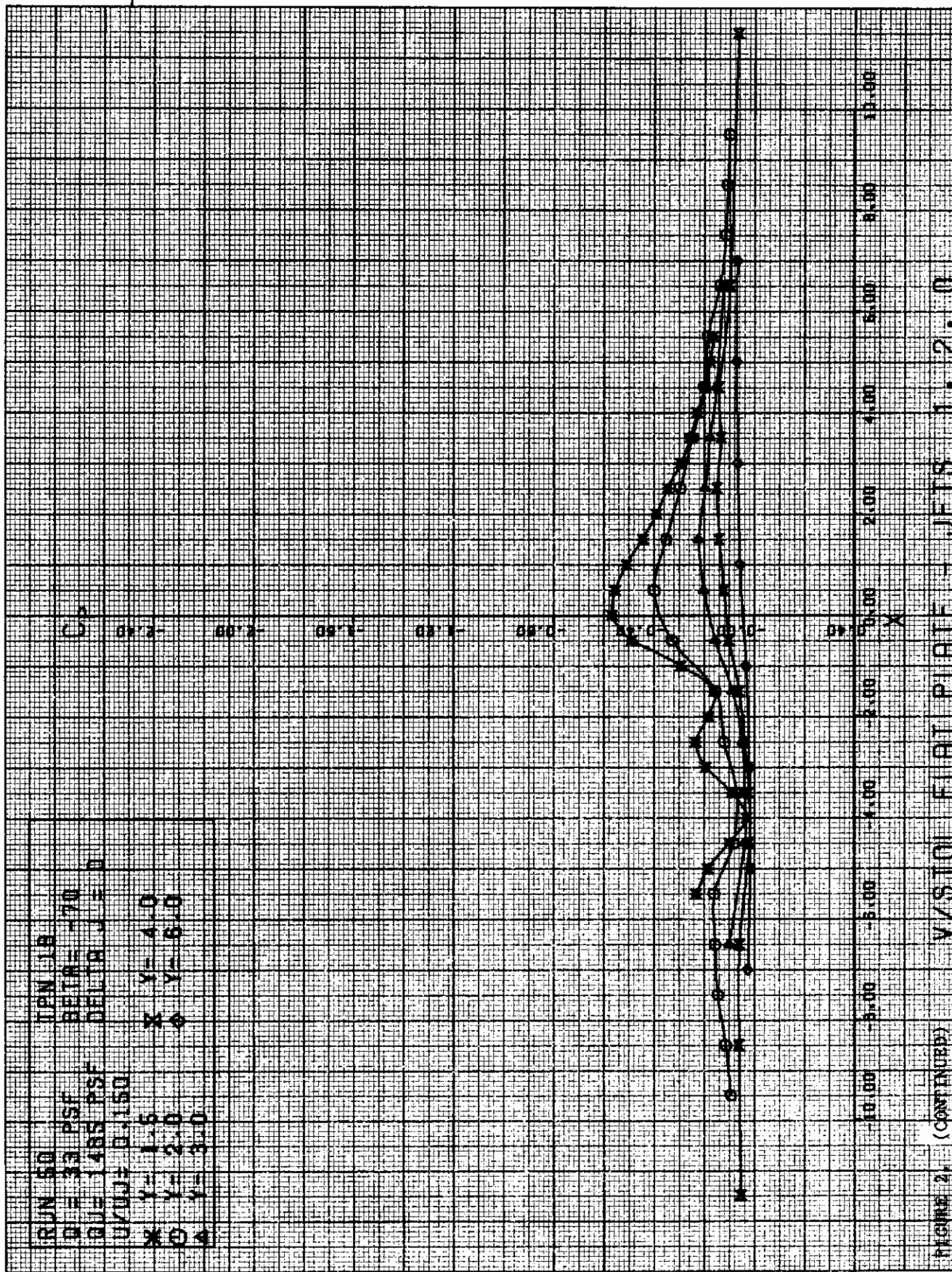


FIGURE 2 (CONTINUED)





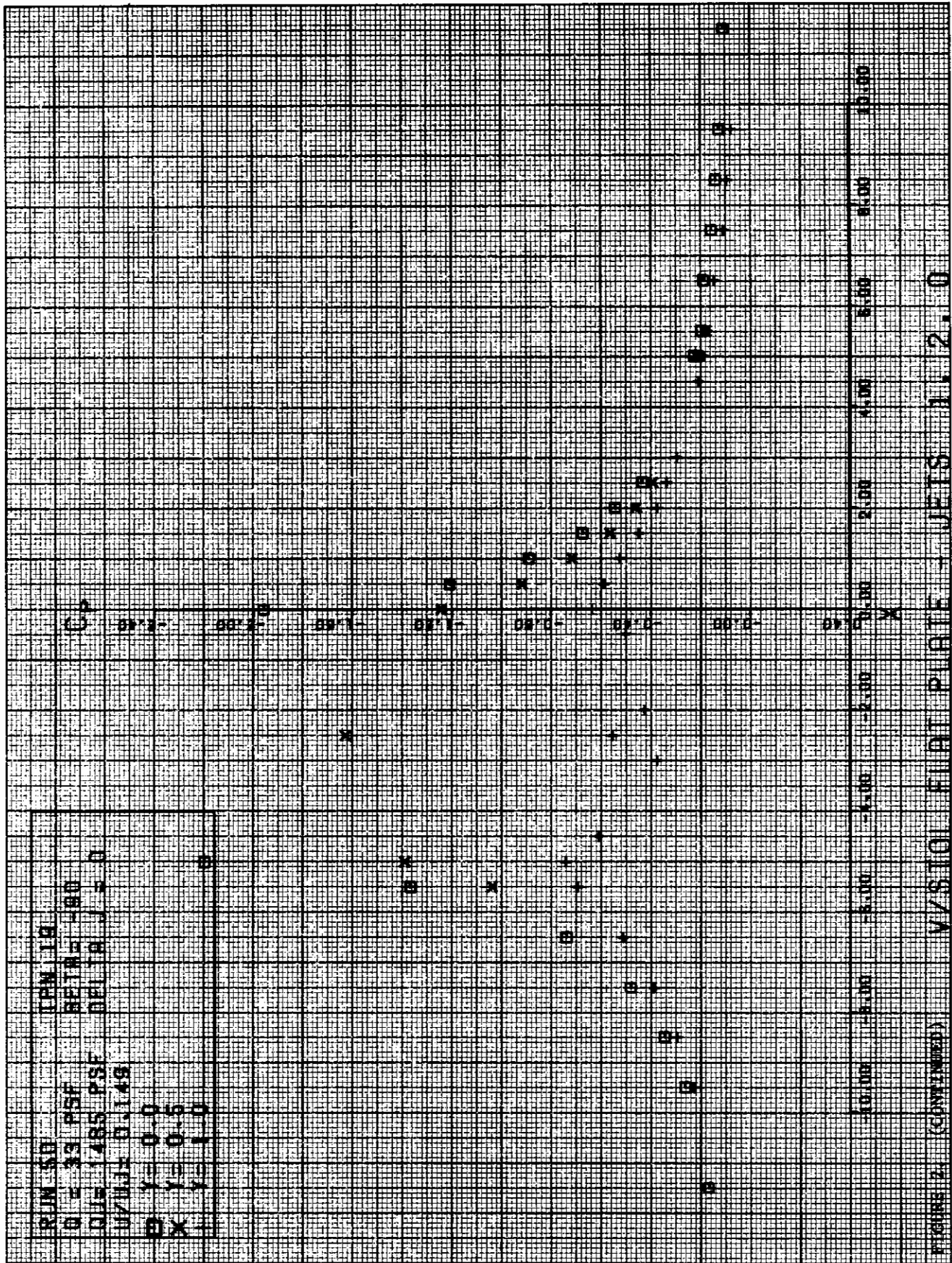


FIGURE 2. (CONTINUED) V/S101 FLIGHT PLATE - JETS 11.2.0

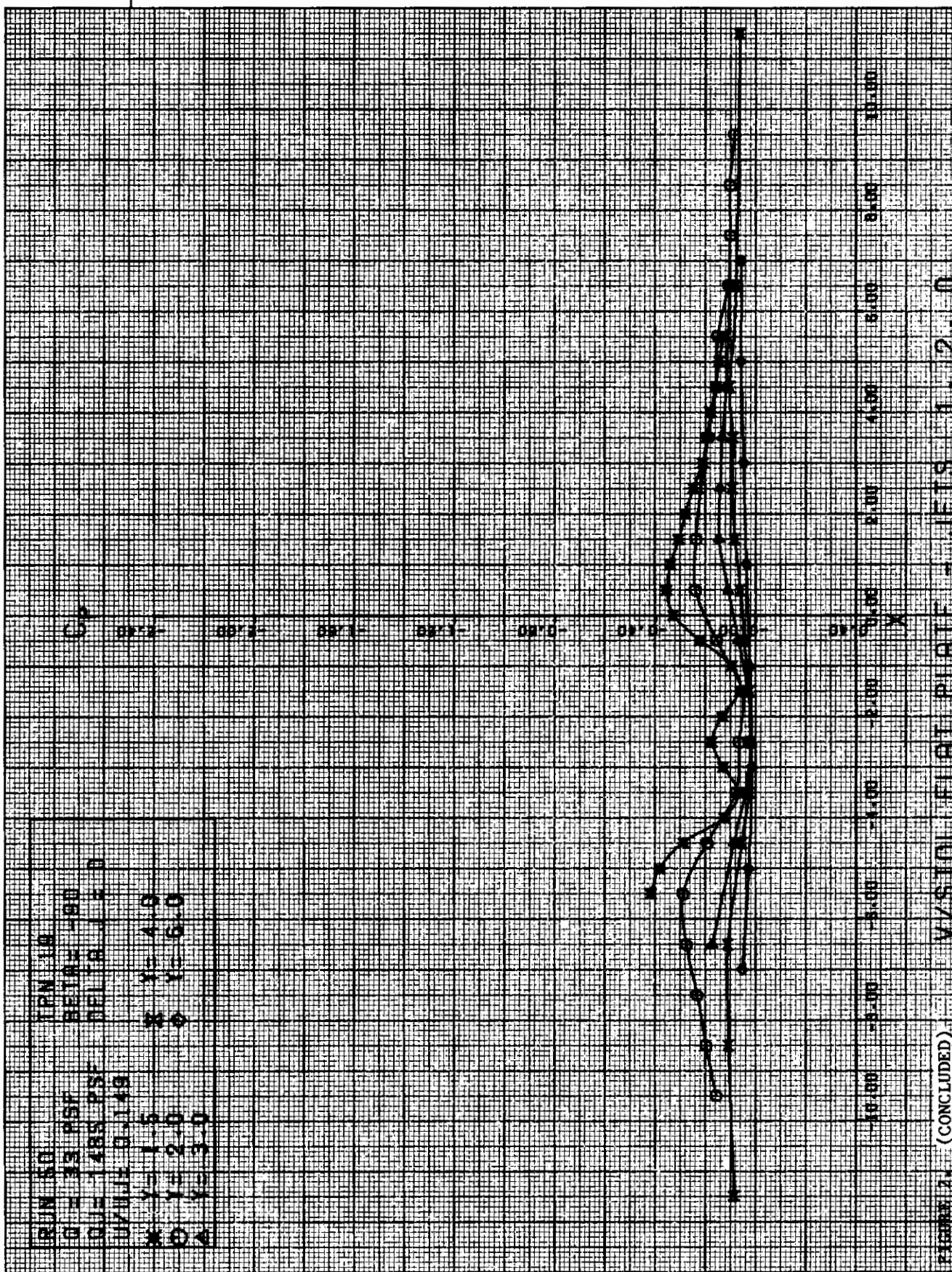
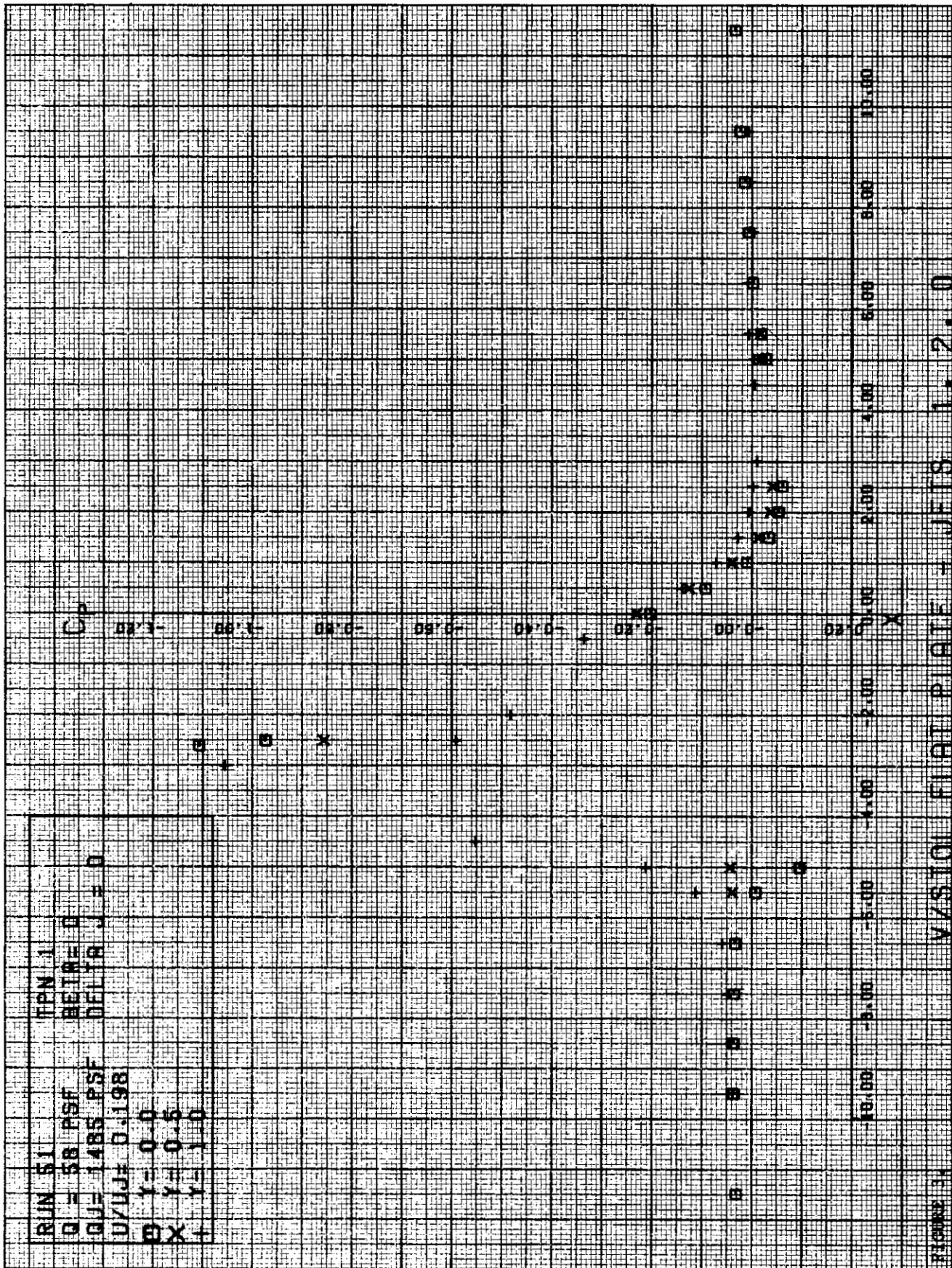


FIGURE 7. (CONCLUDED)



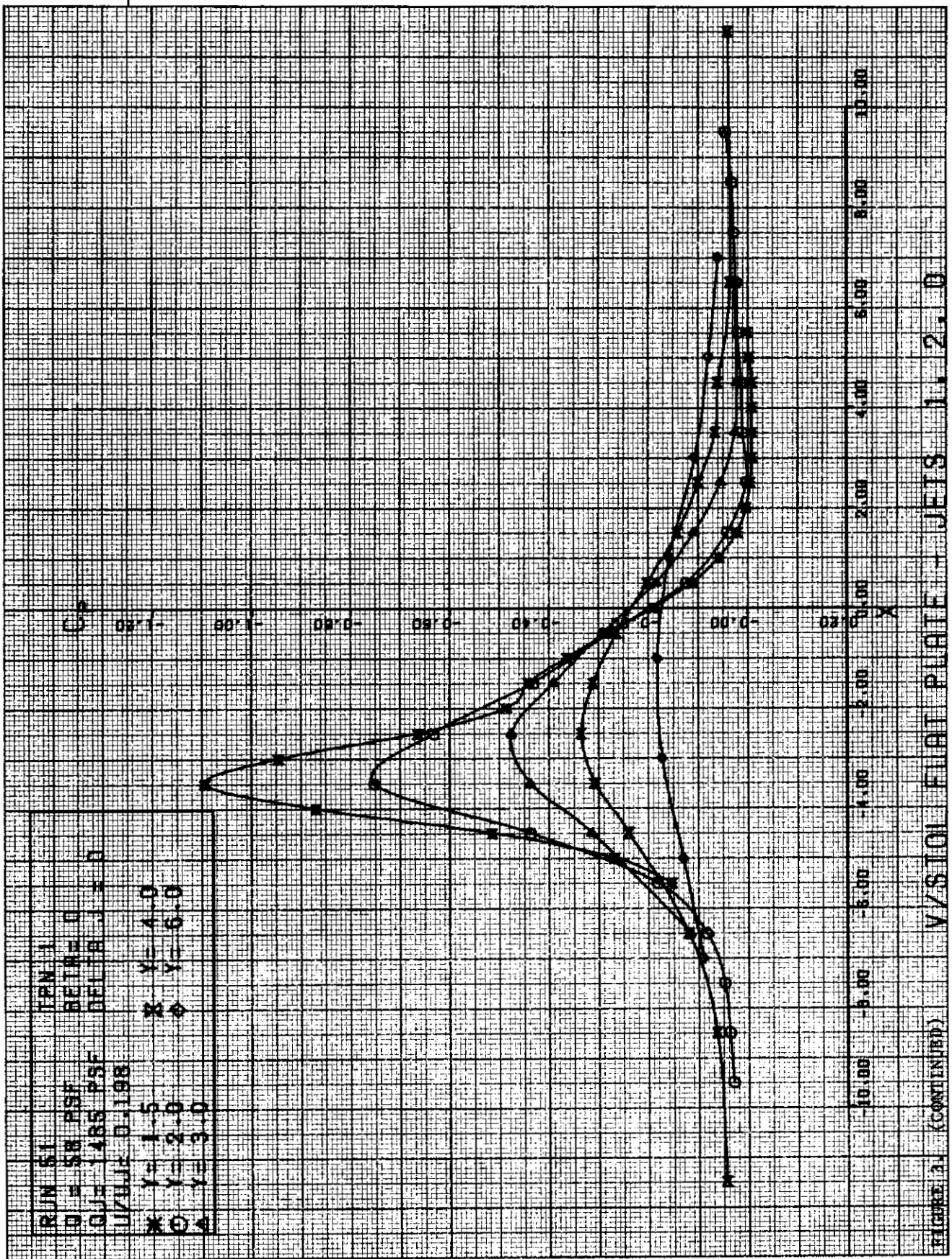
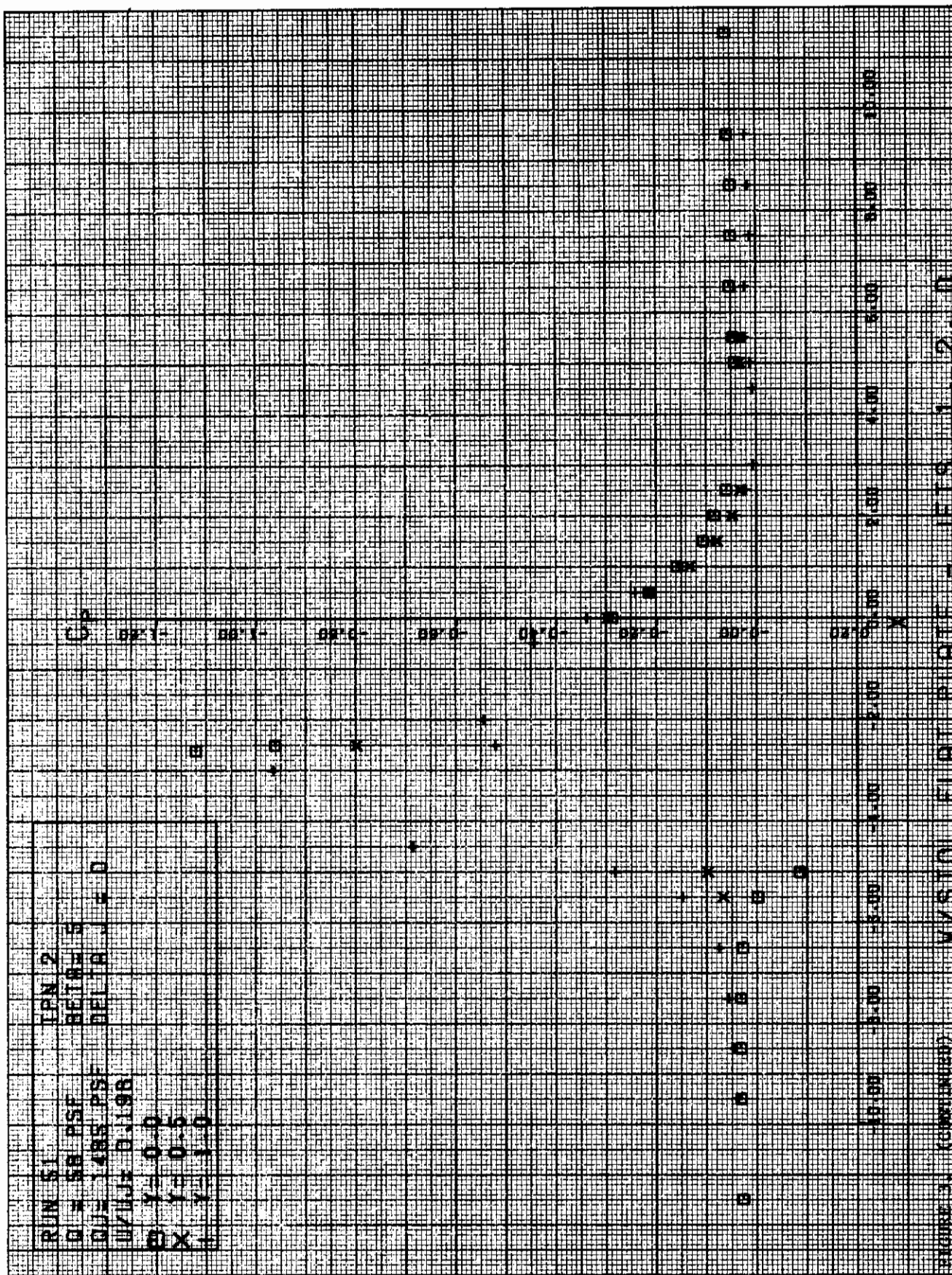
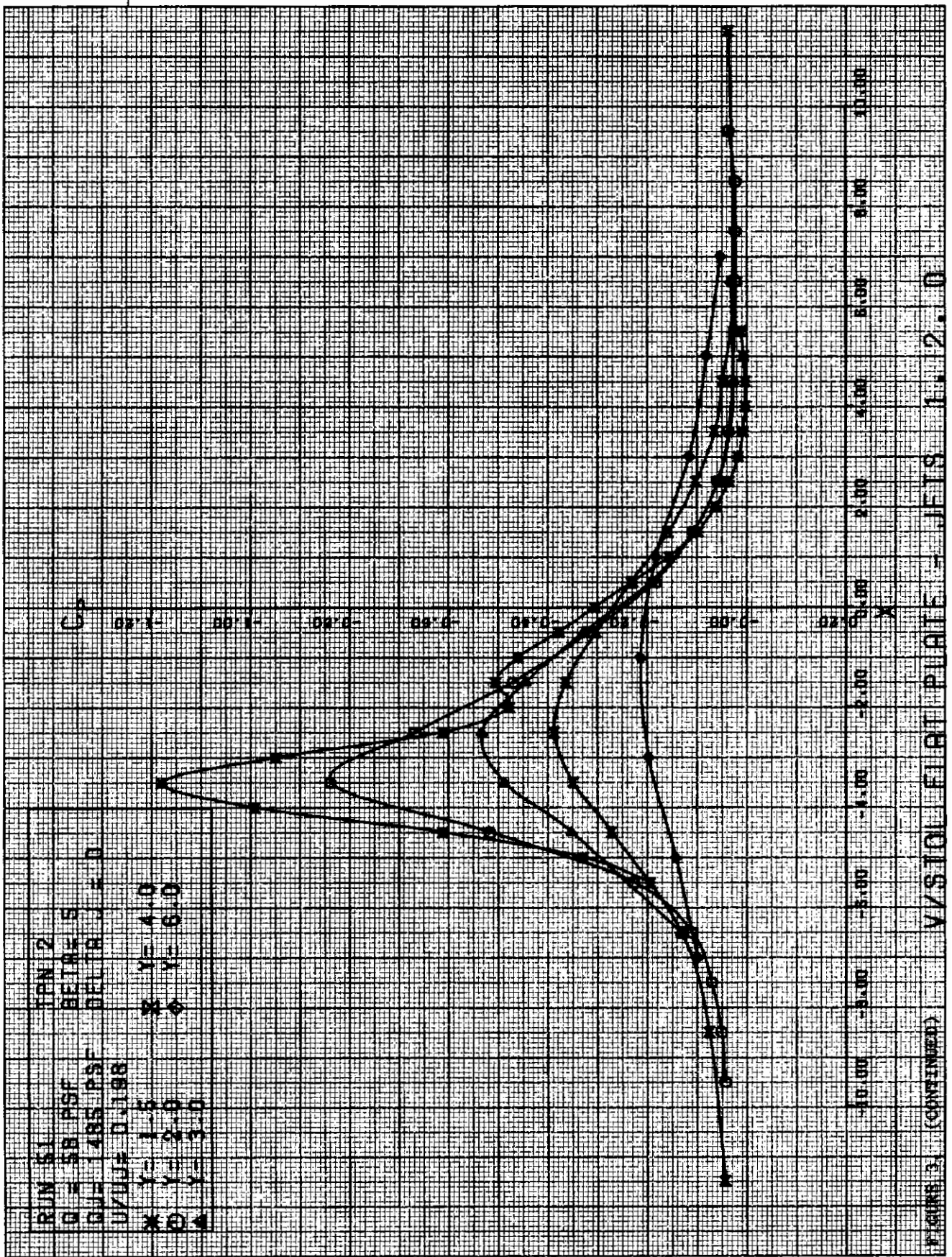
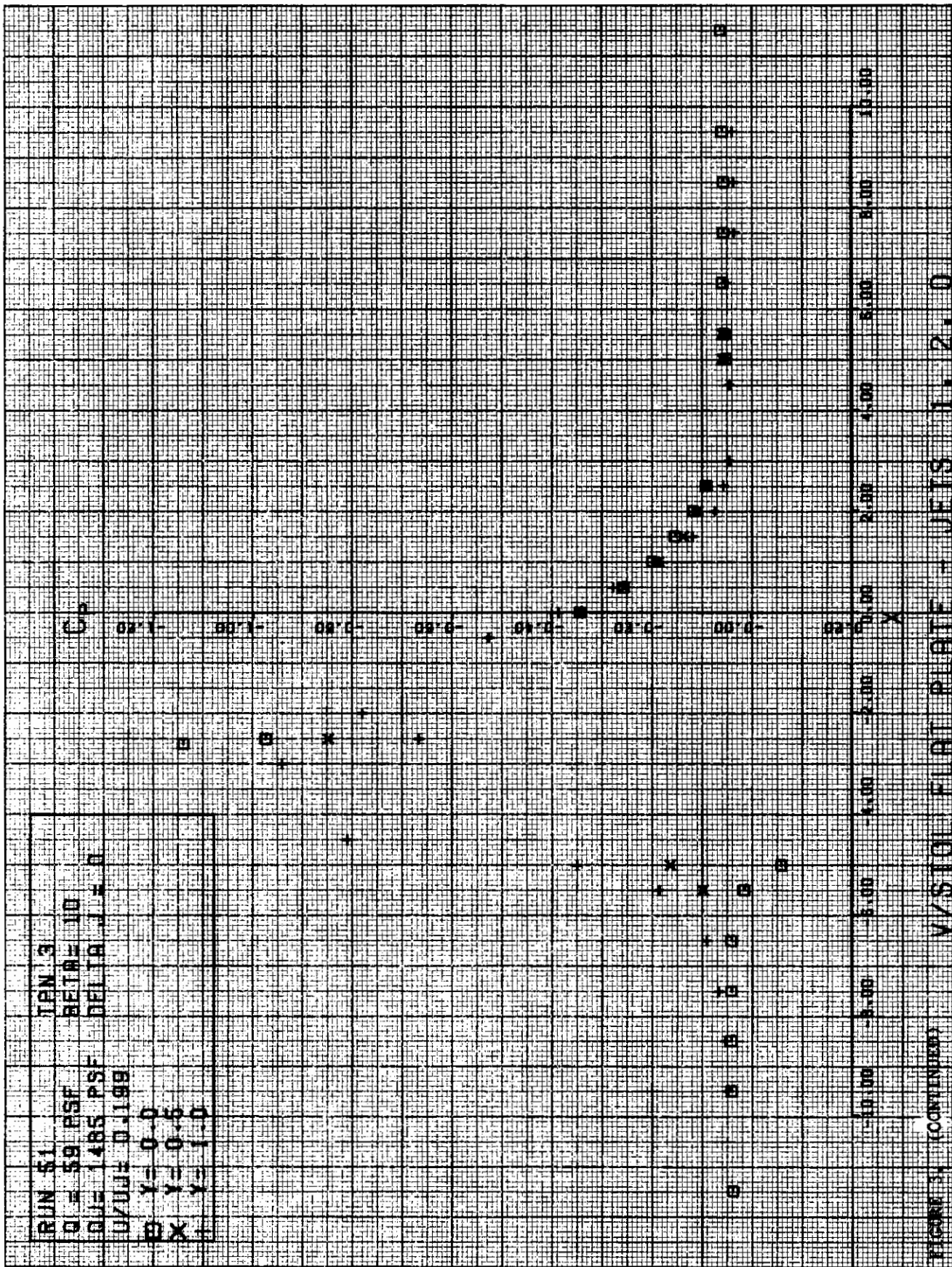
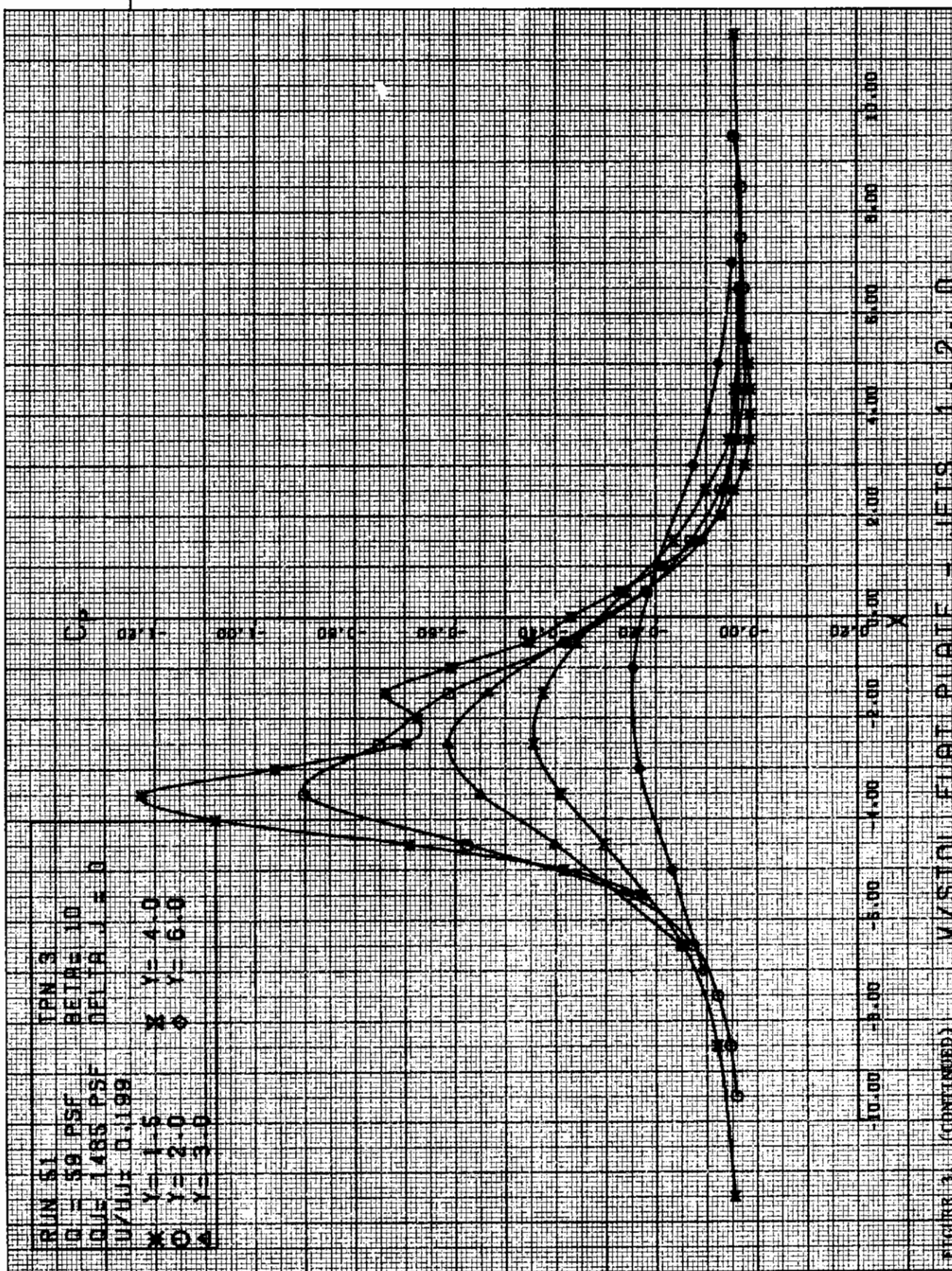


FIGURE 2. (CONTINUED) V/S TO FLAT PLATE - JETS 1, 2, 3, 4









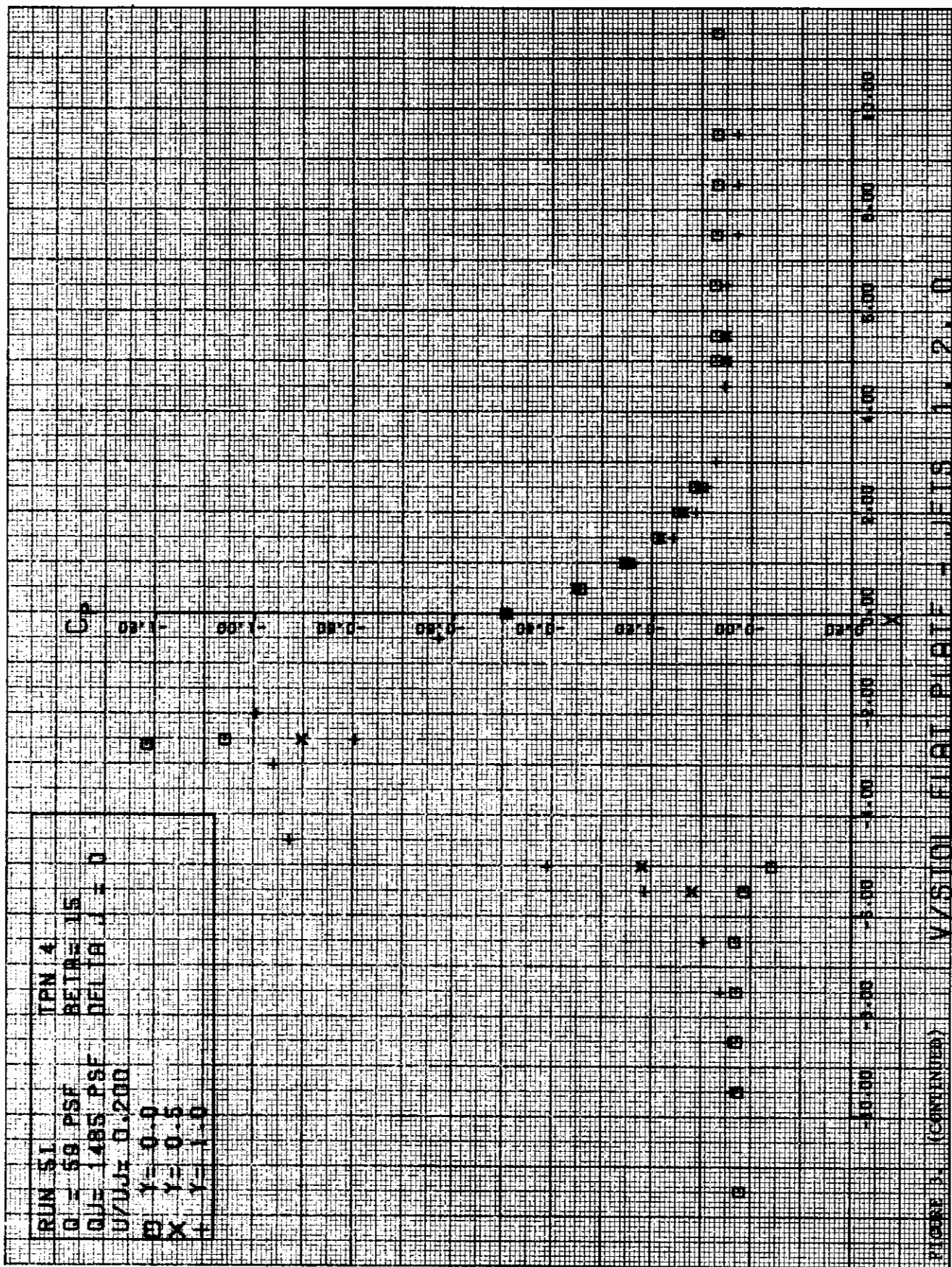
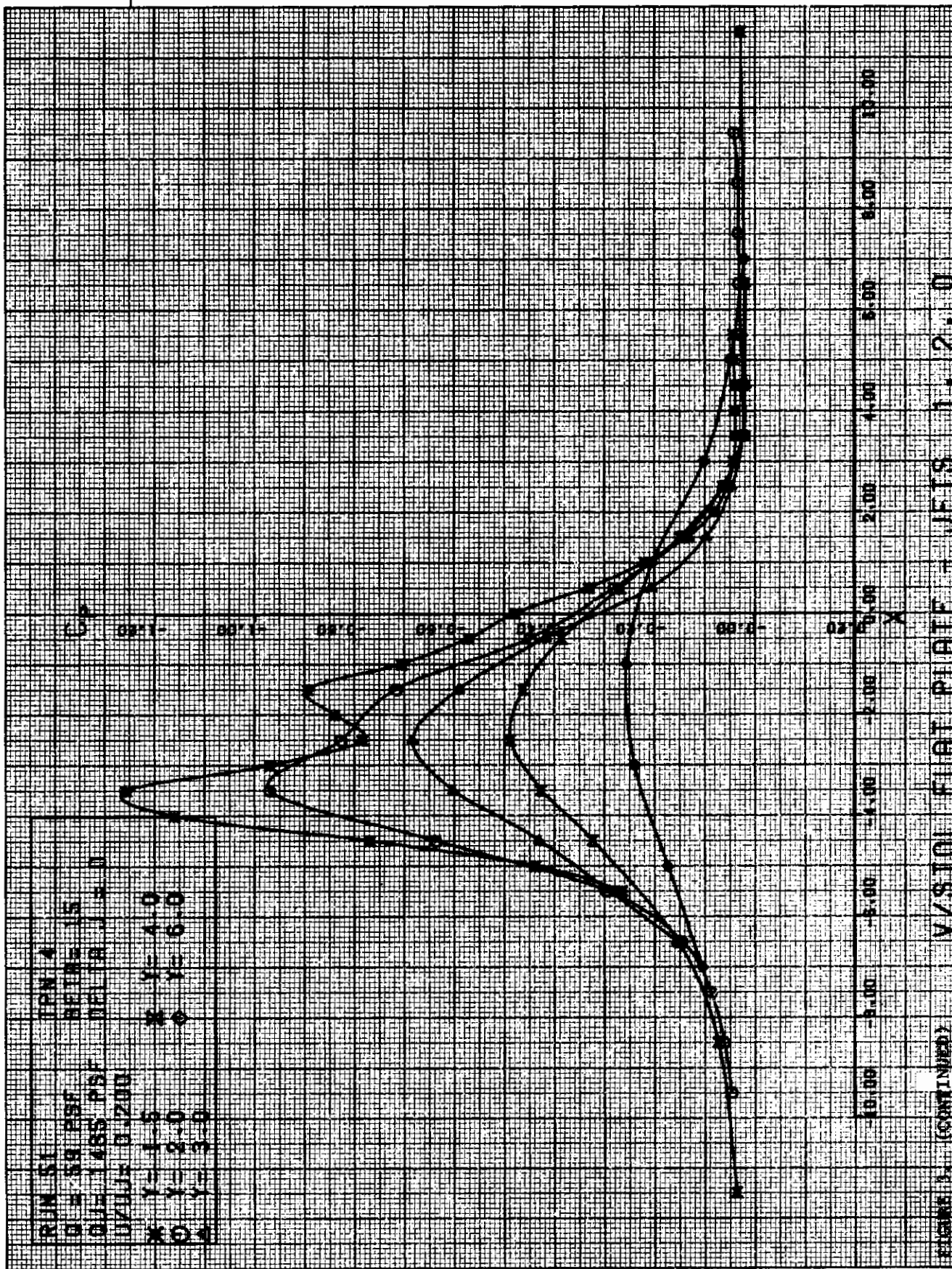
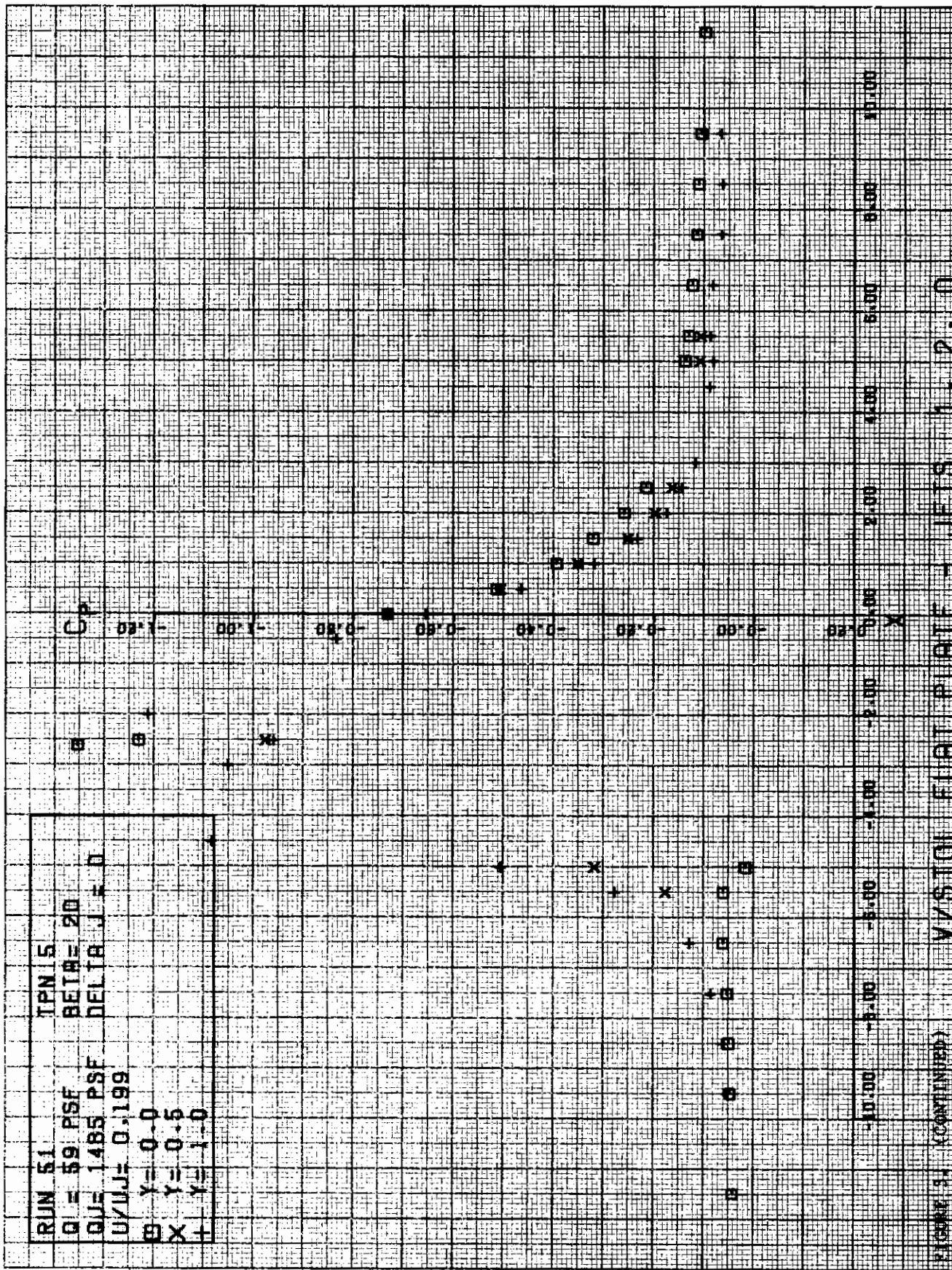
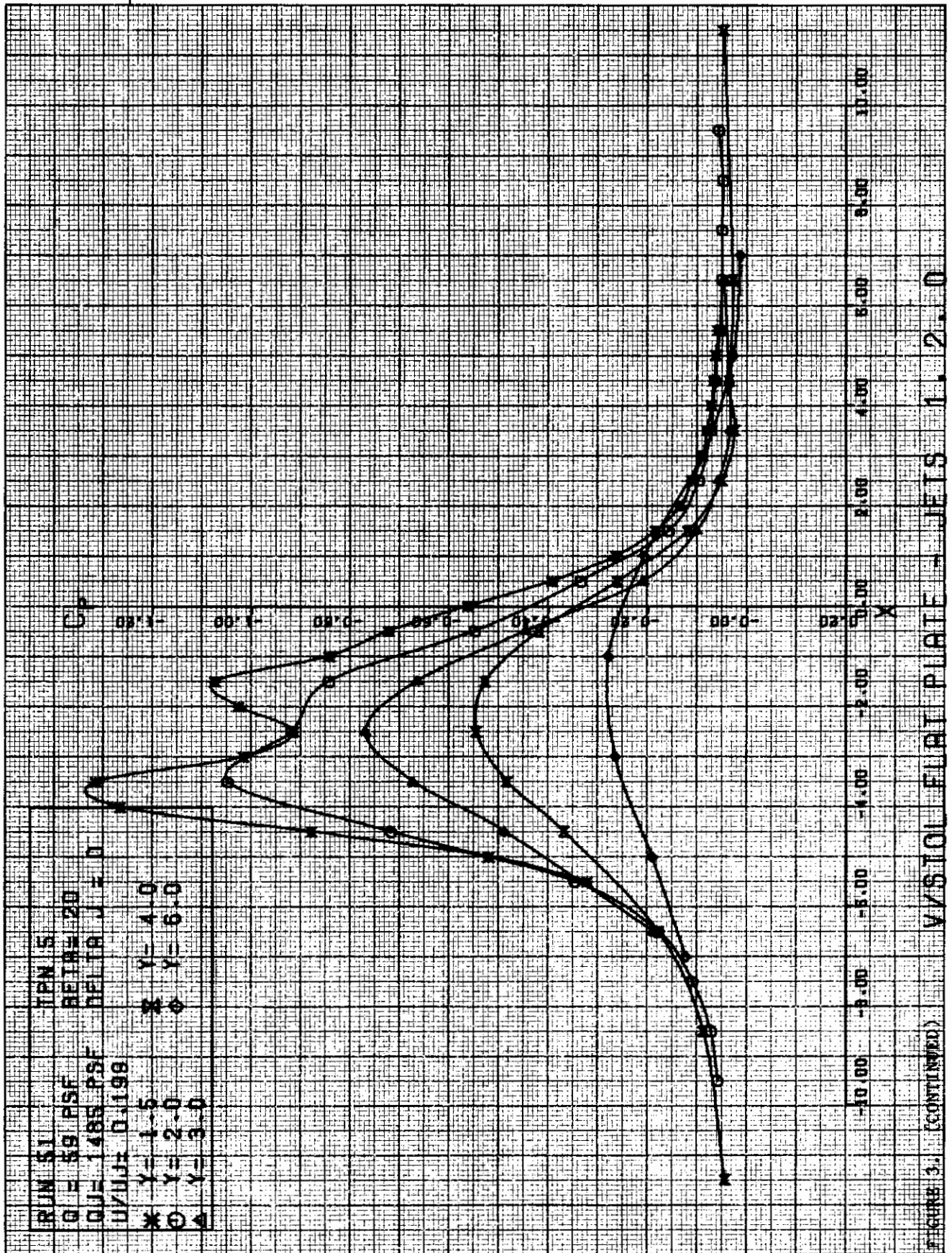


FIGURE 3. (CONTINUED)







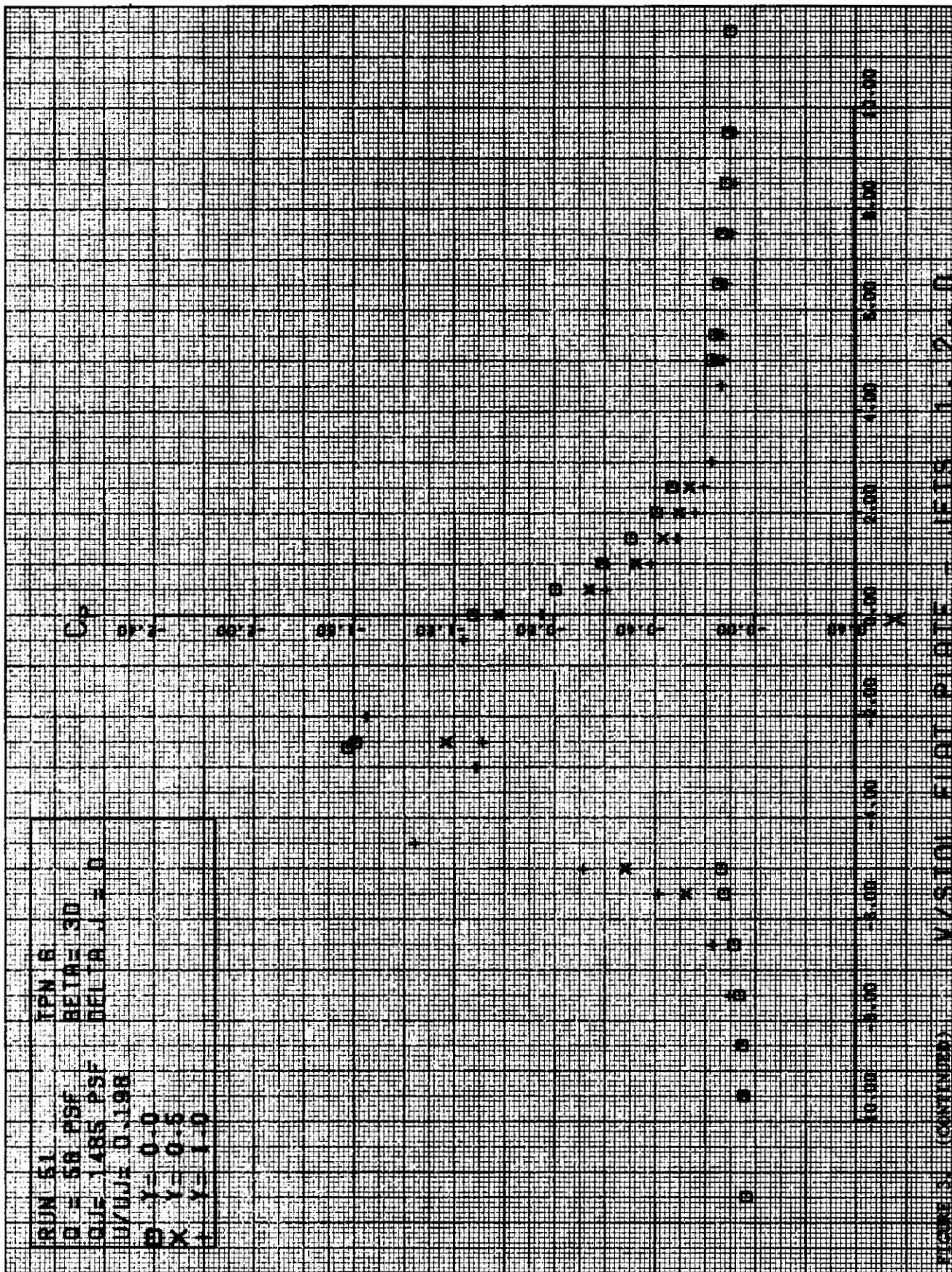


FIGURE 51 (CONTINUED) V/STOL FLIGHT PROFILE - JETS 1, 2, D

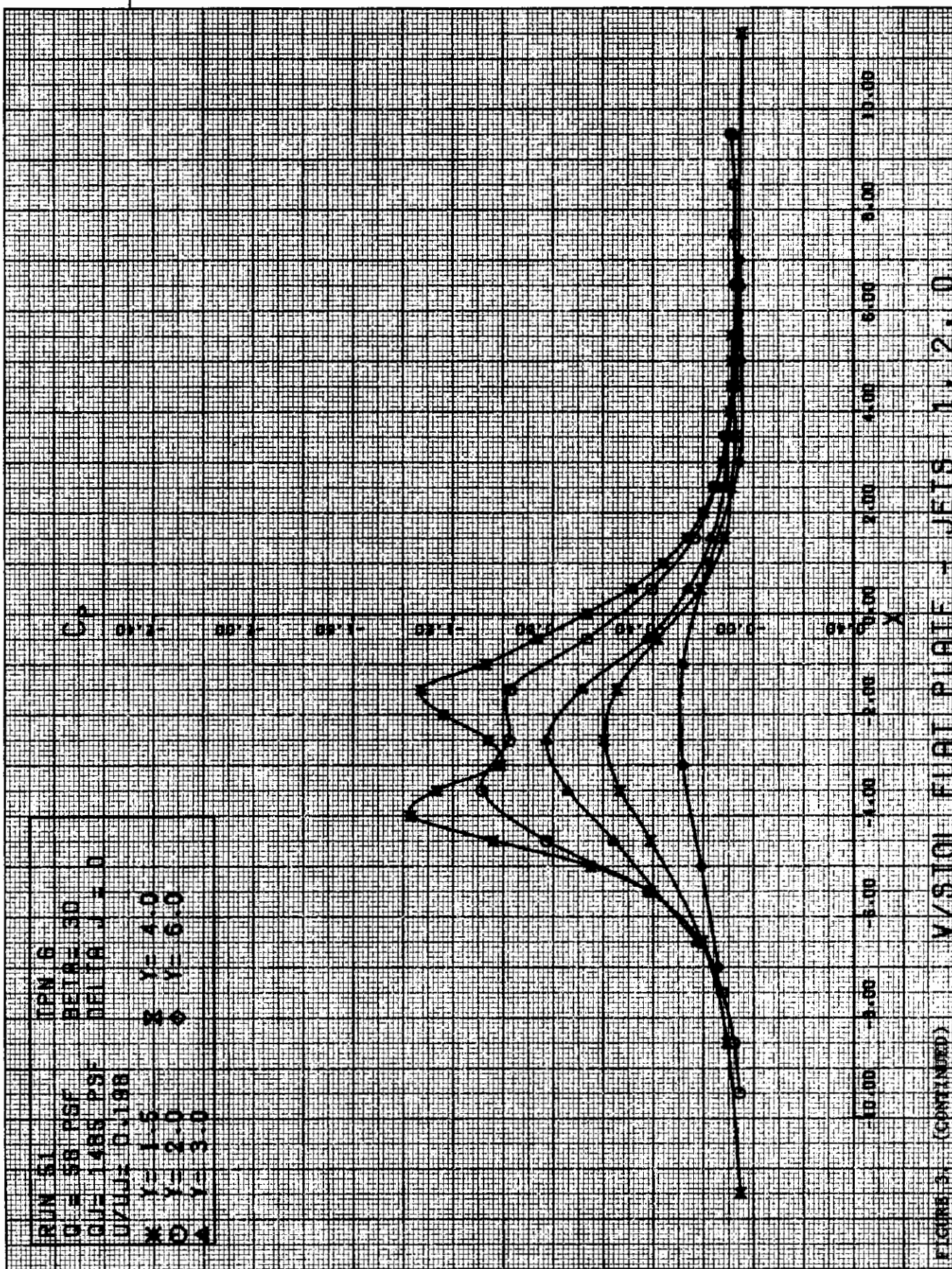
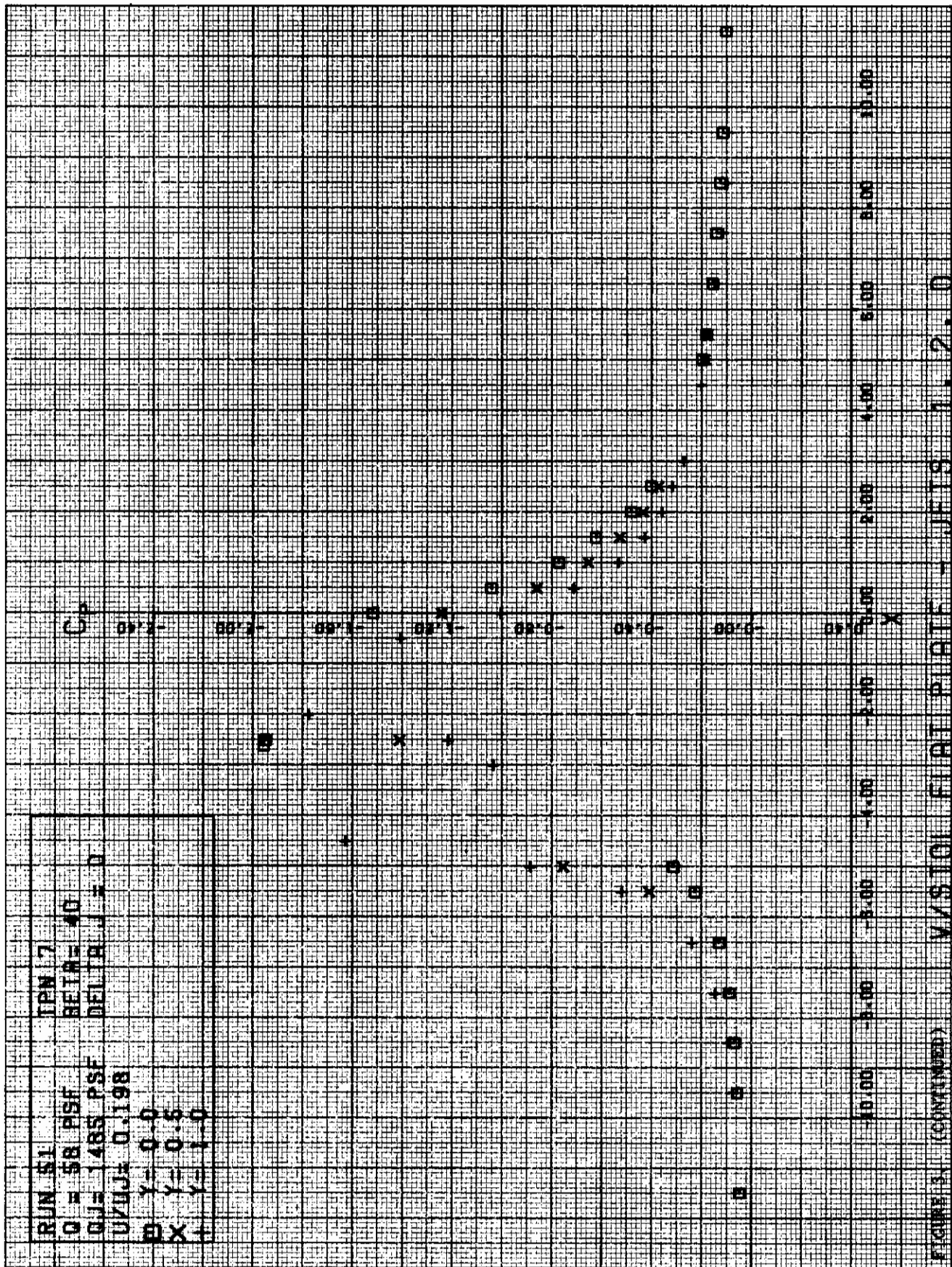


FIGURE 3. (CONTINUED) V/SIGN FLAT PLATE - JETS 1, 2, 0



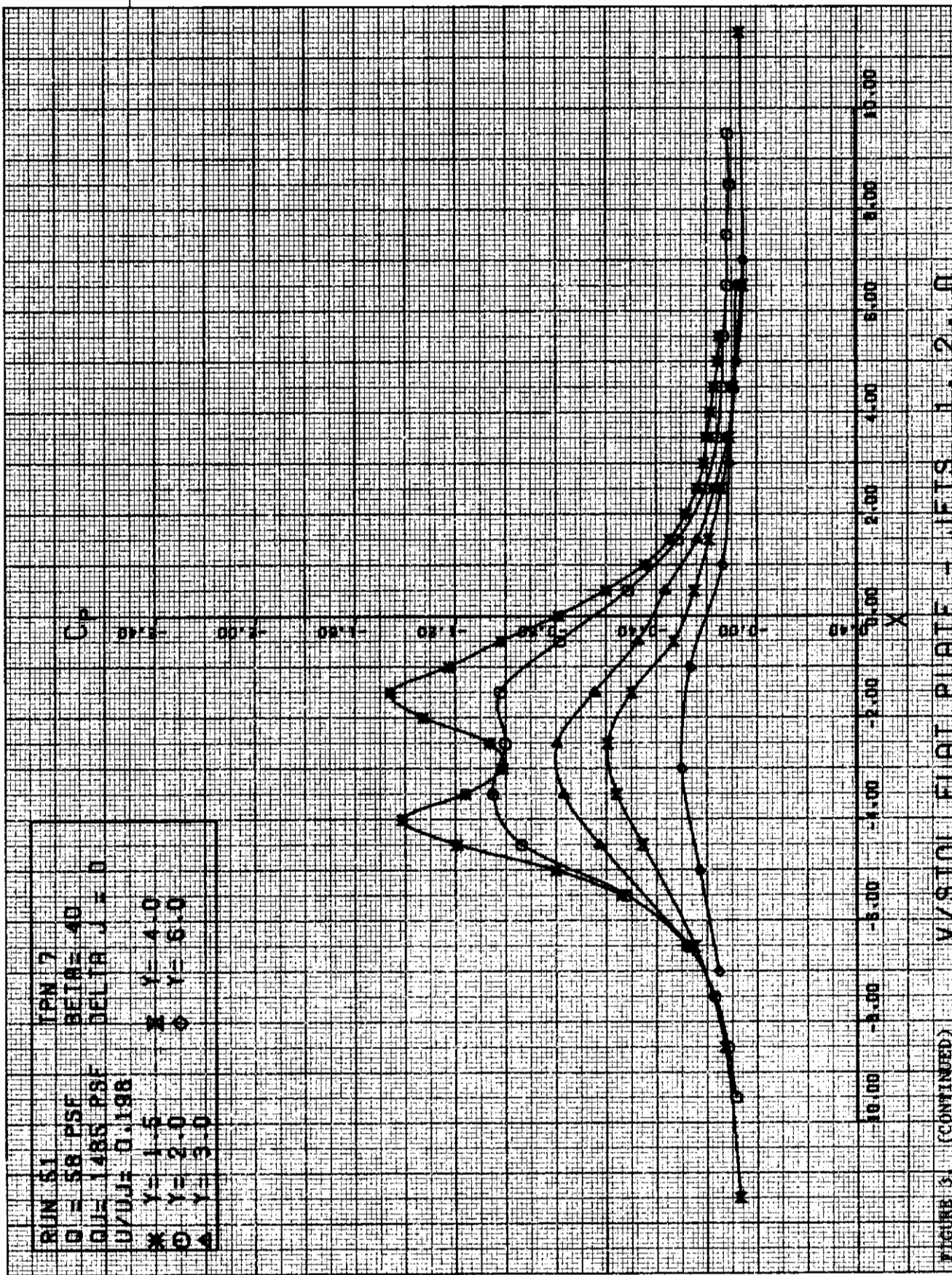


FIGURE 3 (CONTINUED) W/STOOL FLAT PLATE - JETS 1, 2, 0

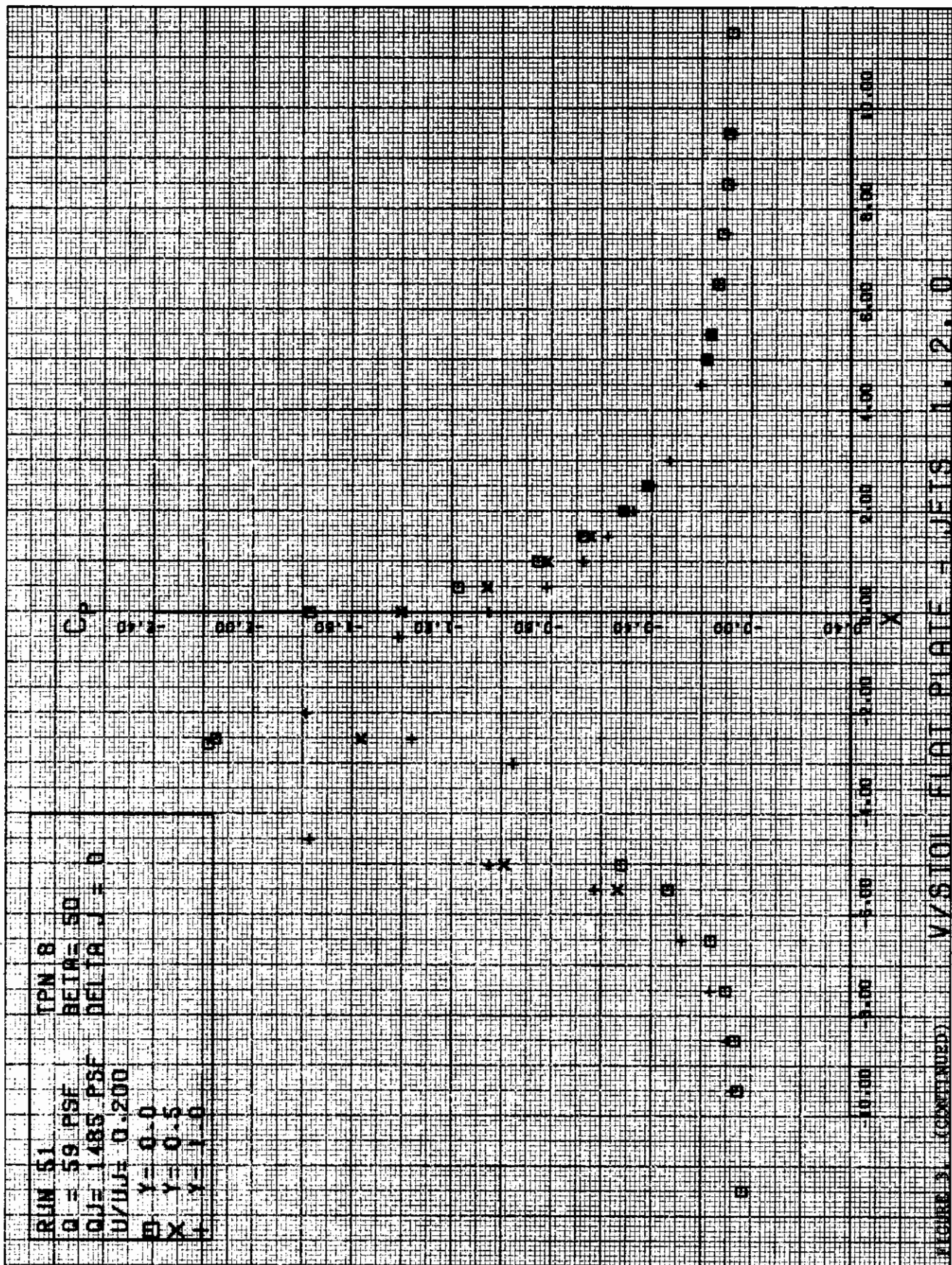
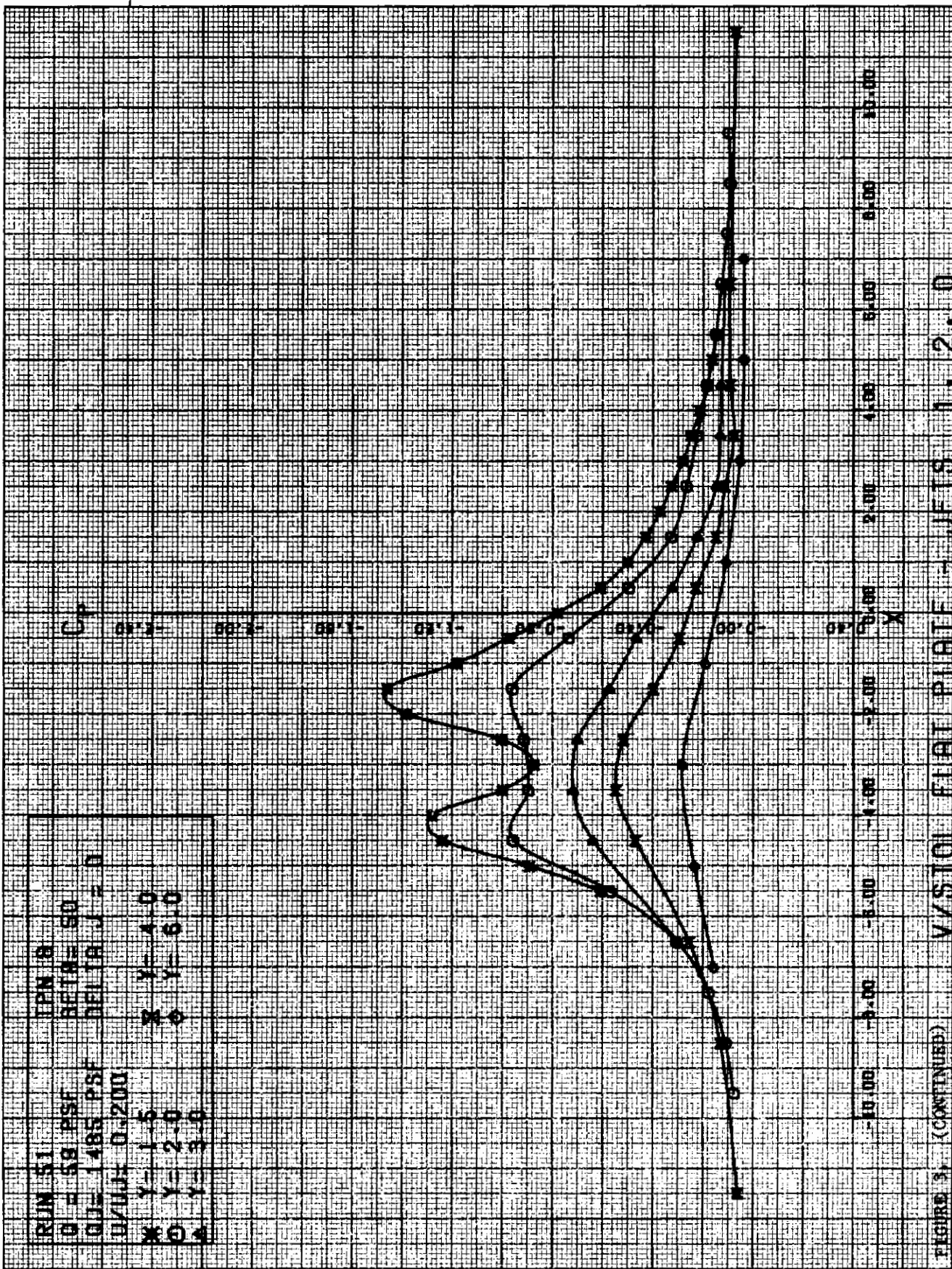
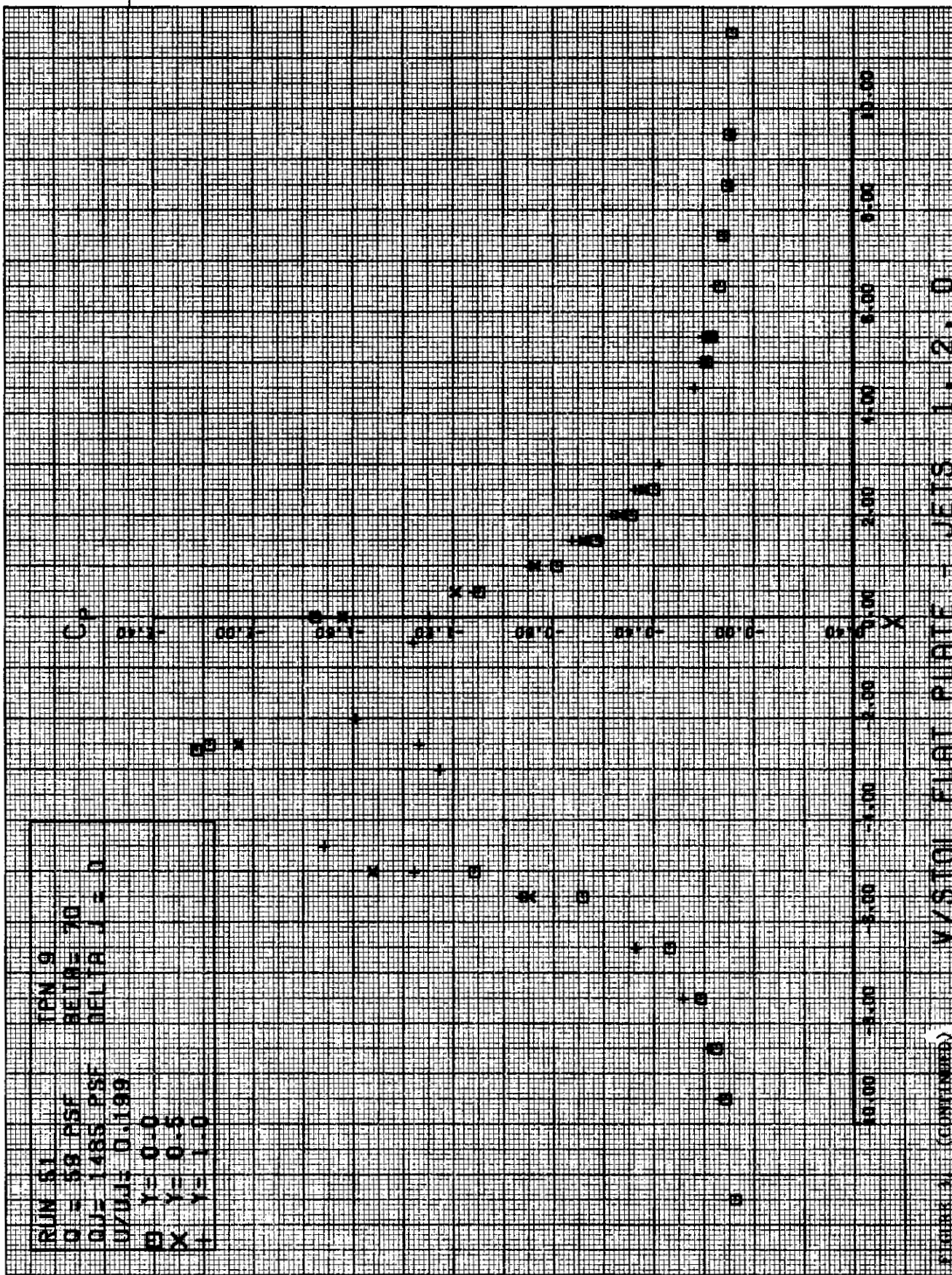


FIGURE 3 (CONTINUED)





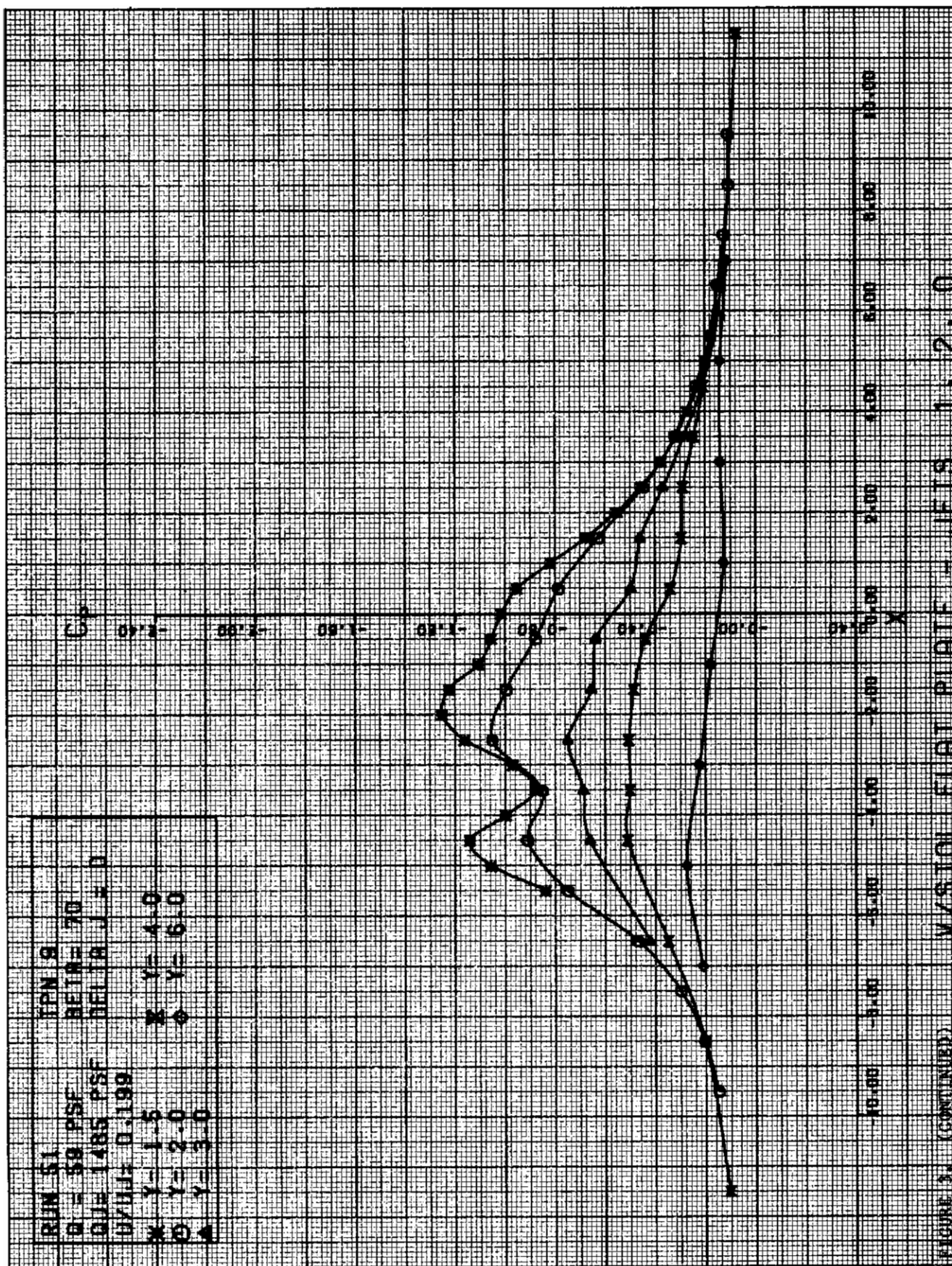
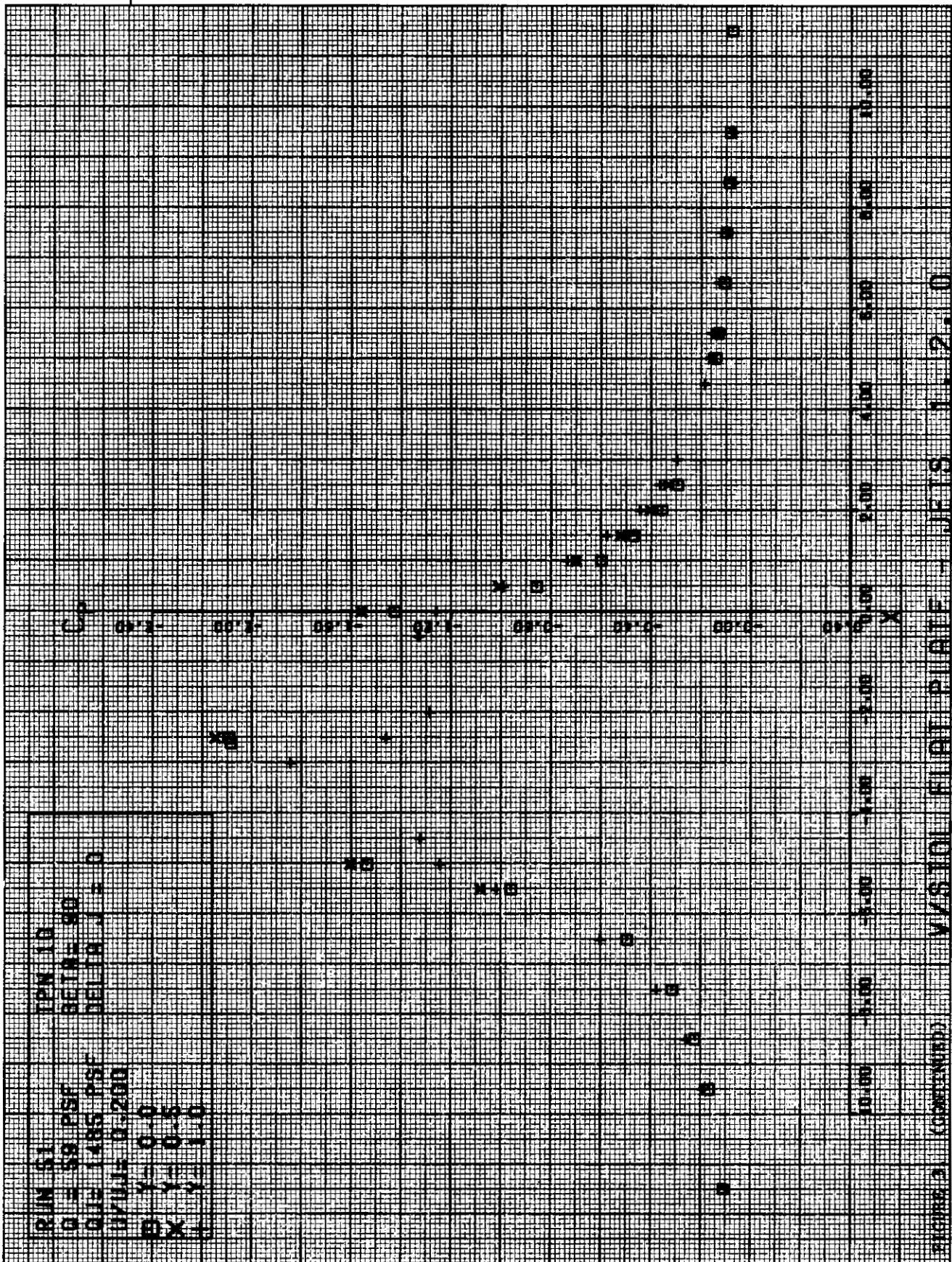
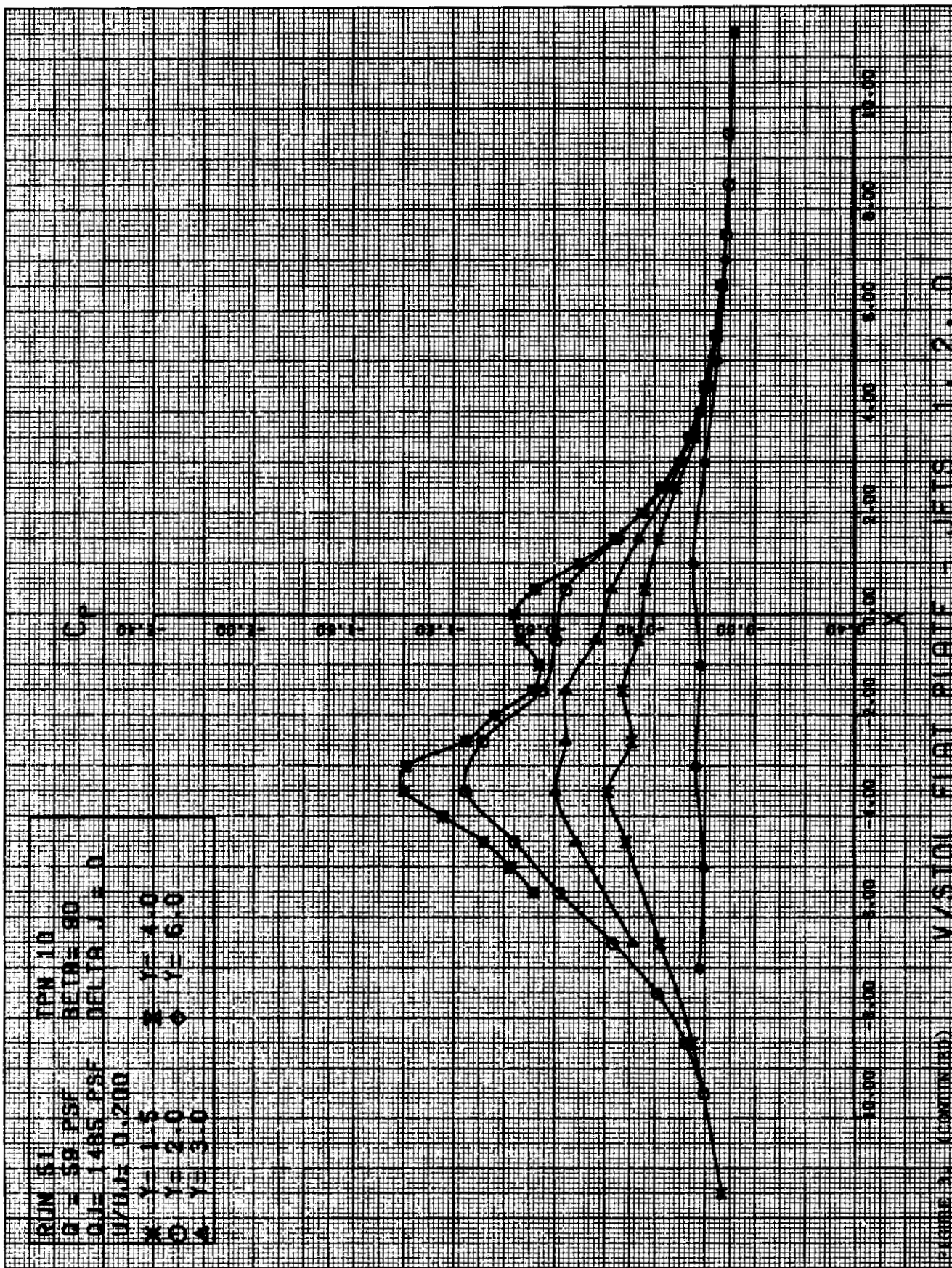


FIGURE 3. (CONTINUED) V/STOL FLAT PLATE - JETS 1, 2, 0





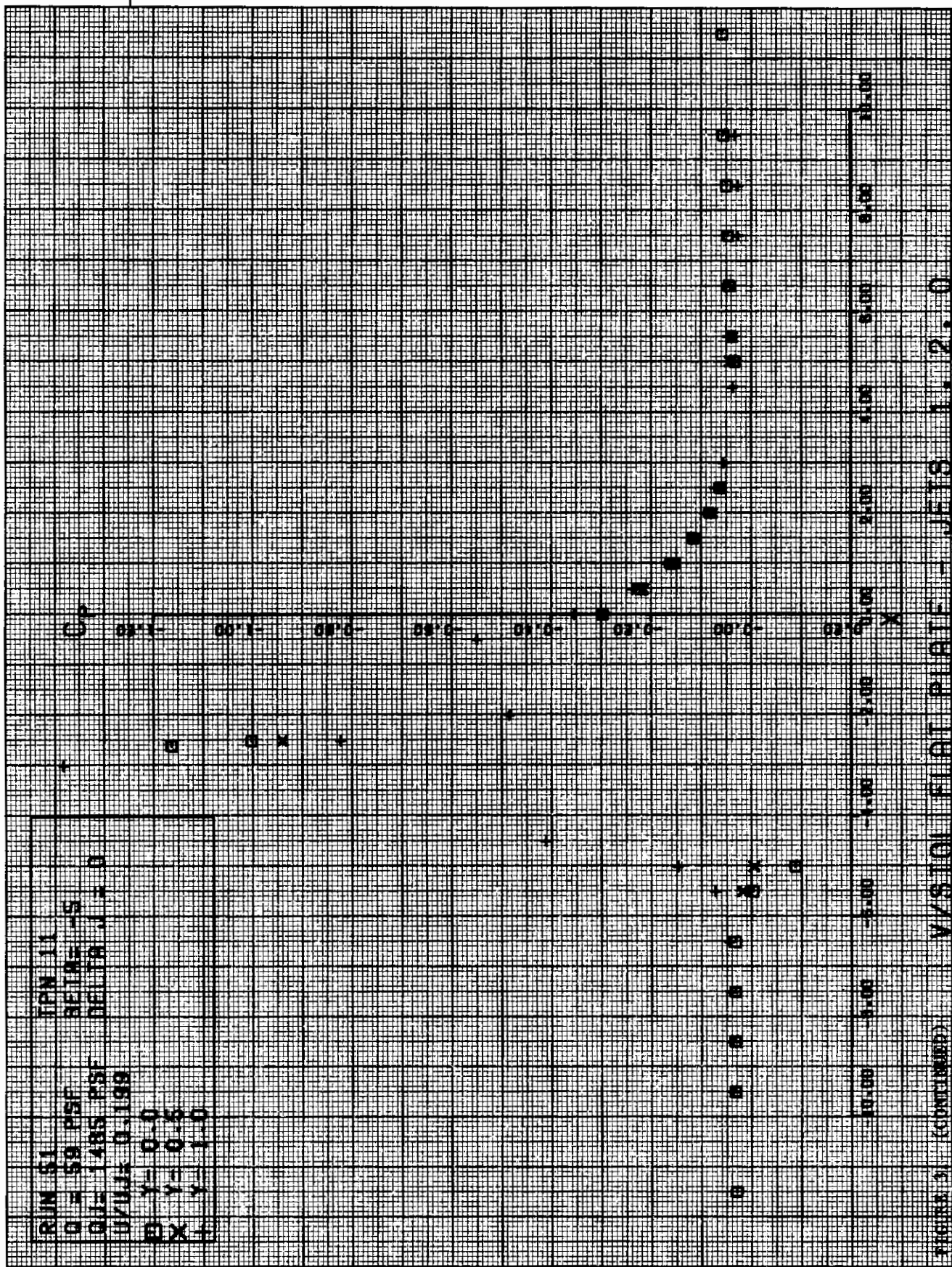
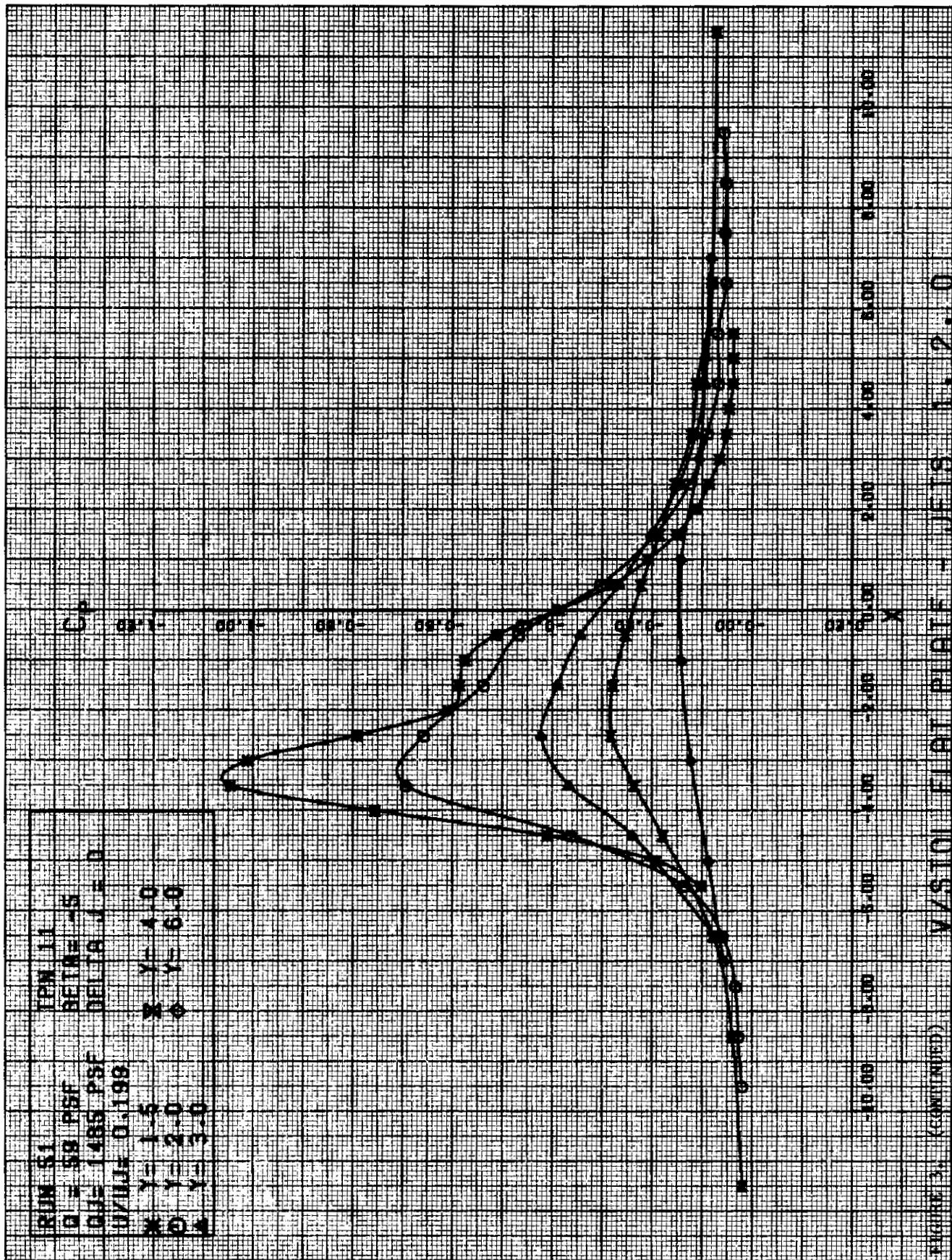
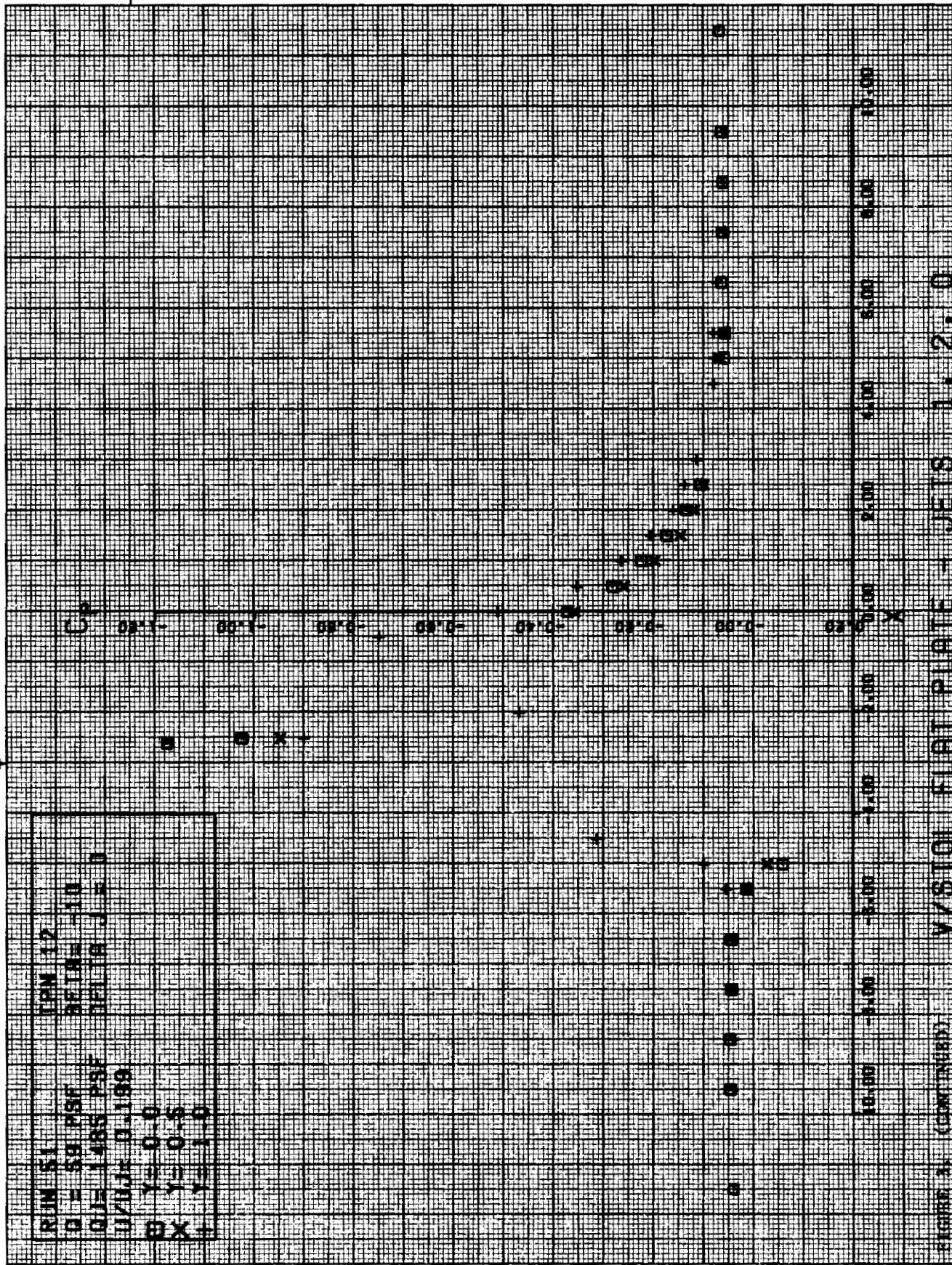


FIGURE 3) (CONTINUED) V/STOL FLAT PLATE - JETS 1, 2, 0





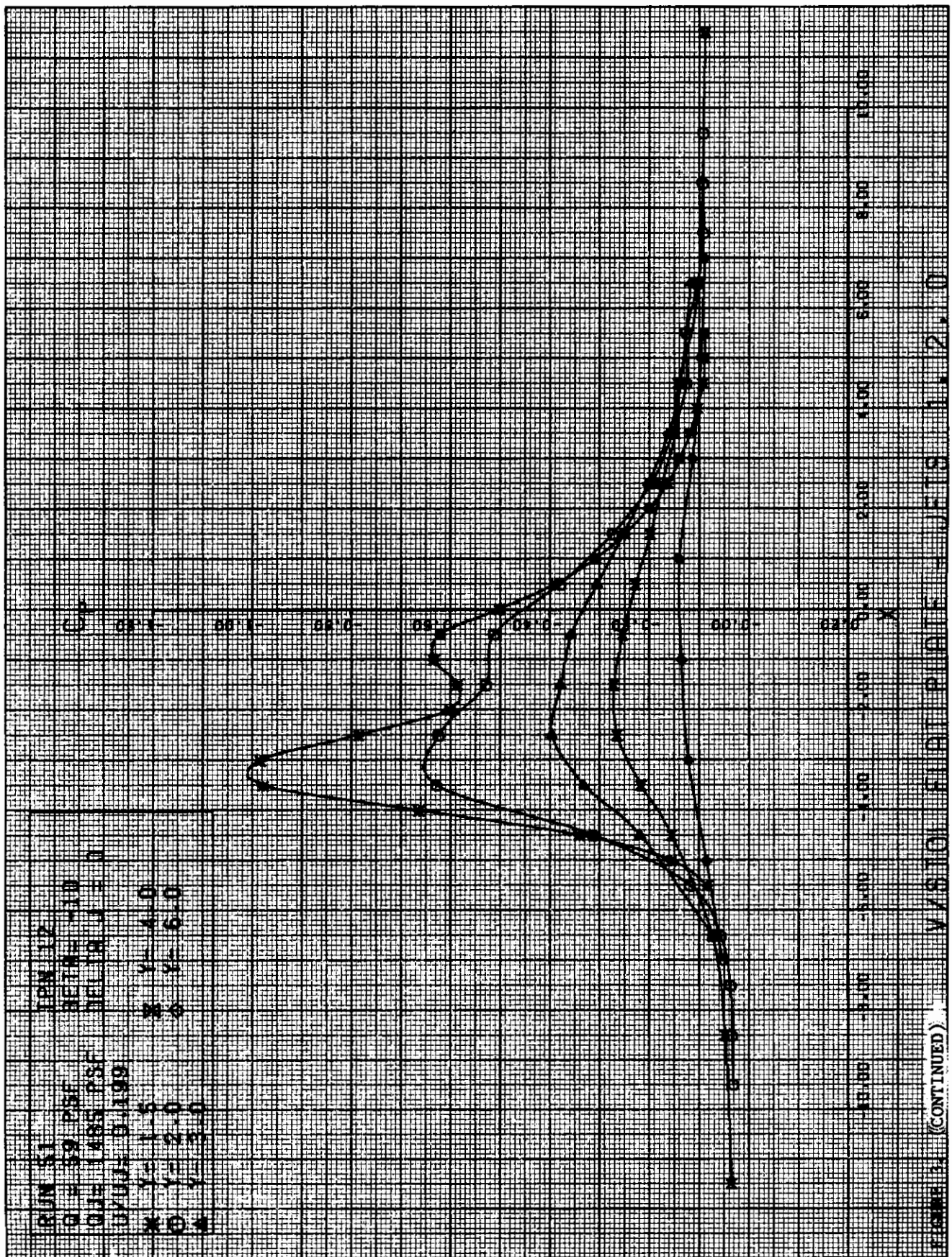


FIGURE 14 (CONTINUED) VISION FLAT PLATE JETS 11, 21, 0

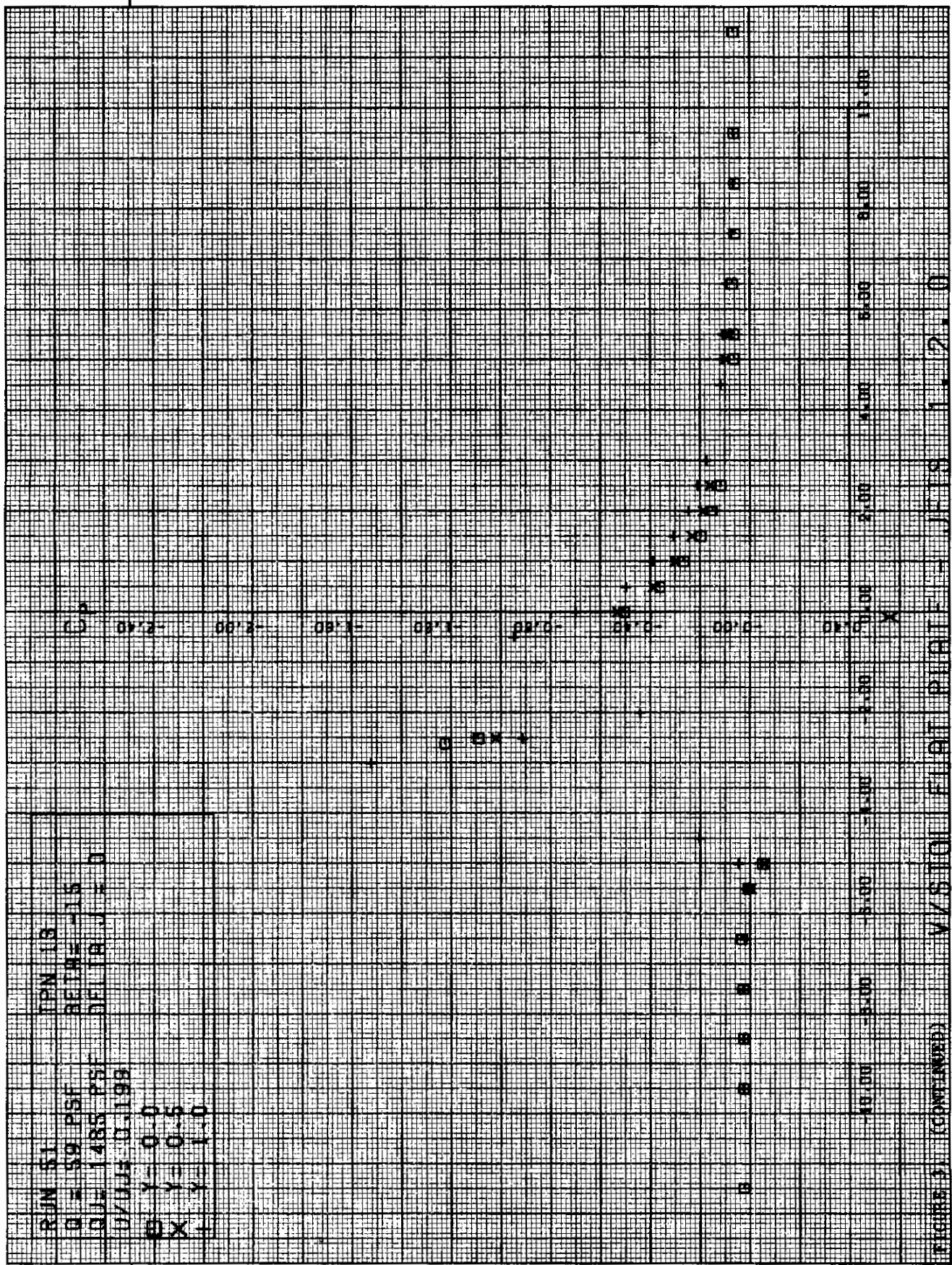
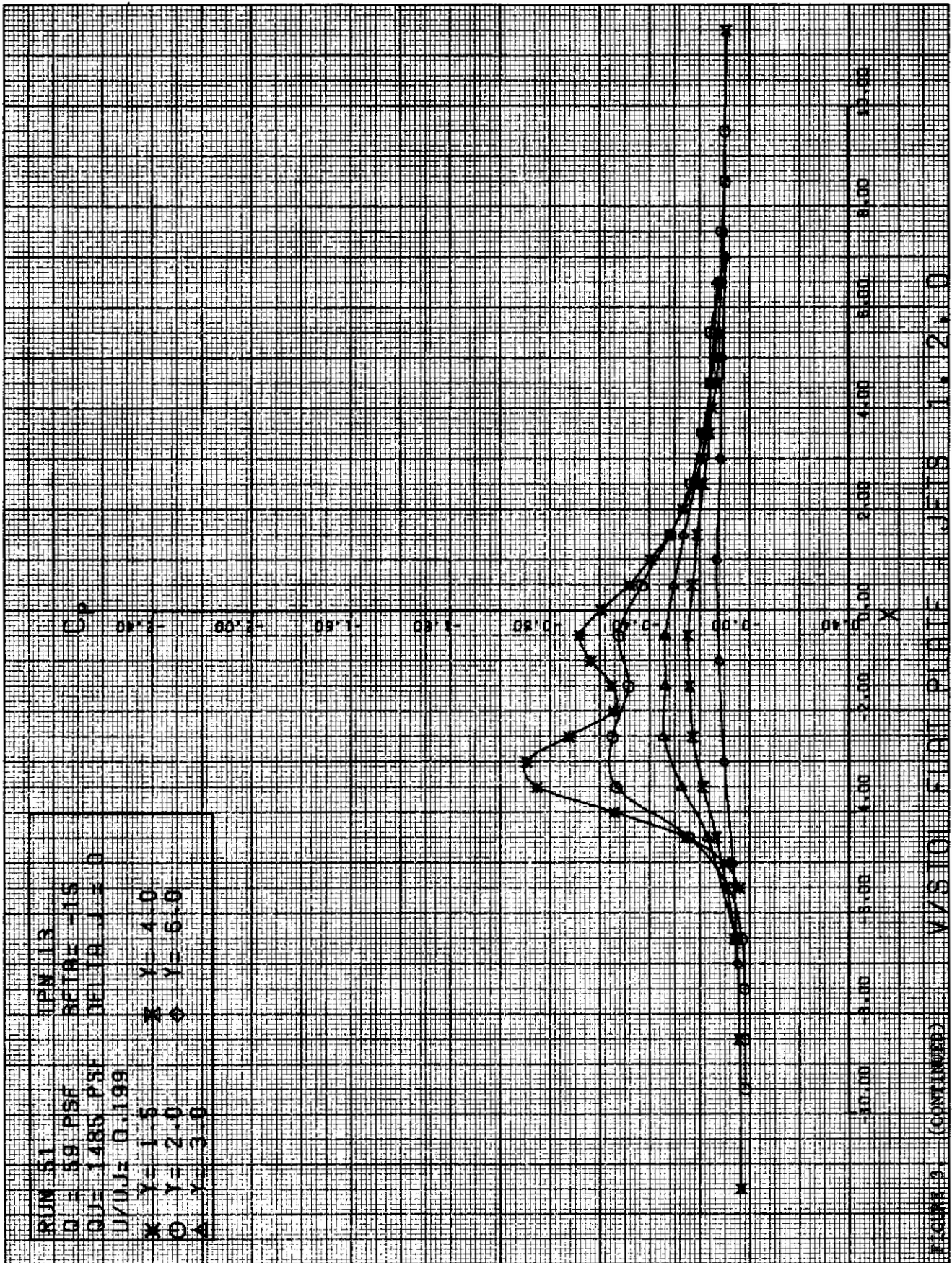
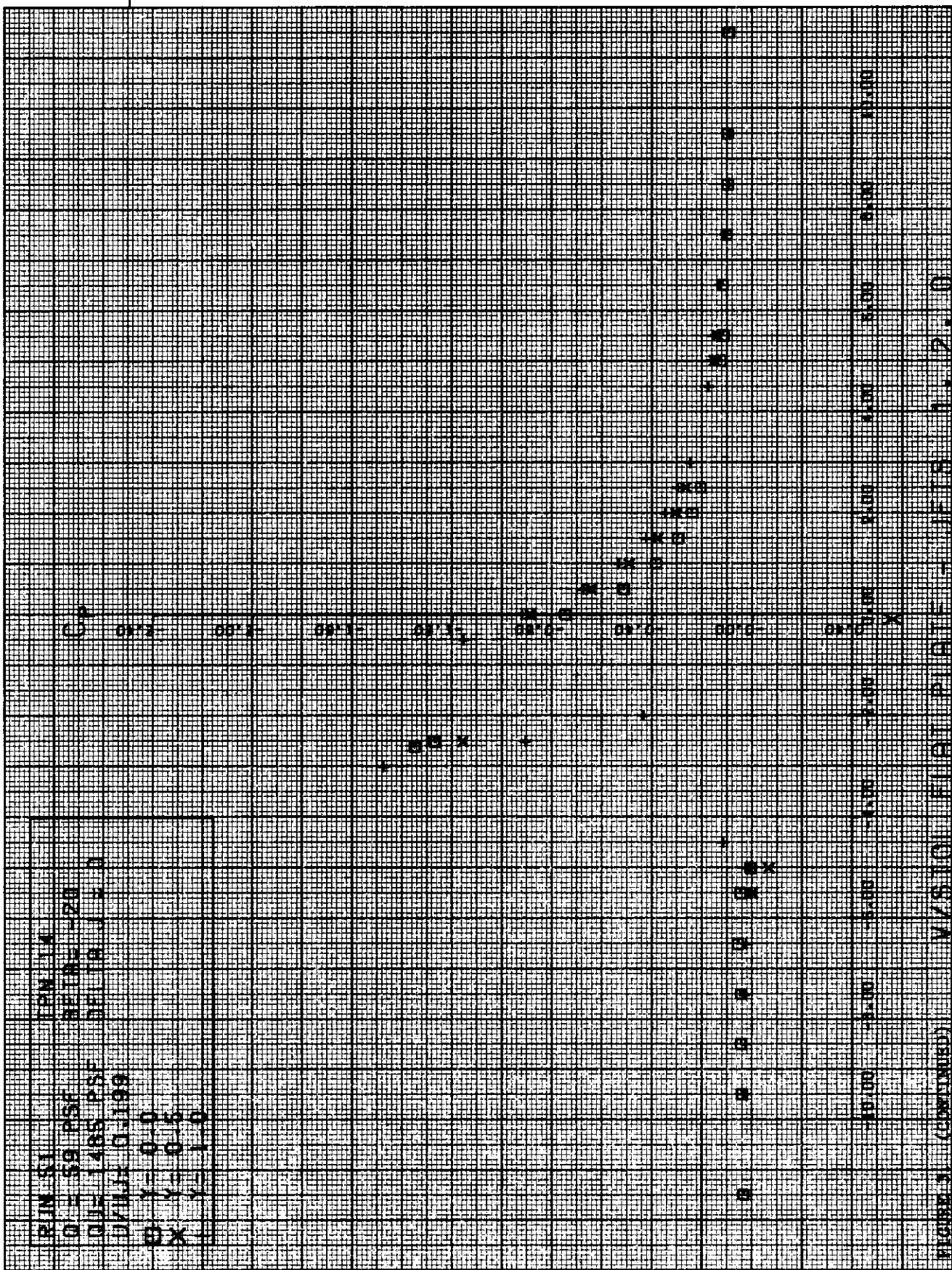
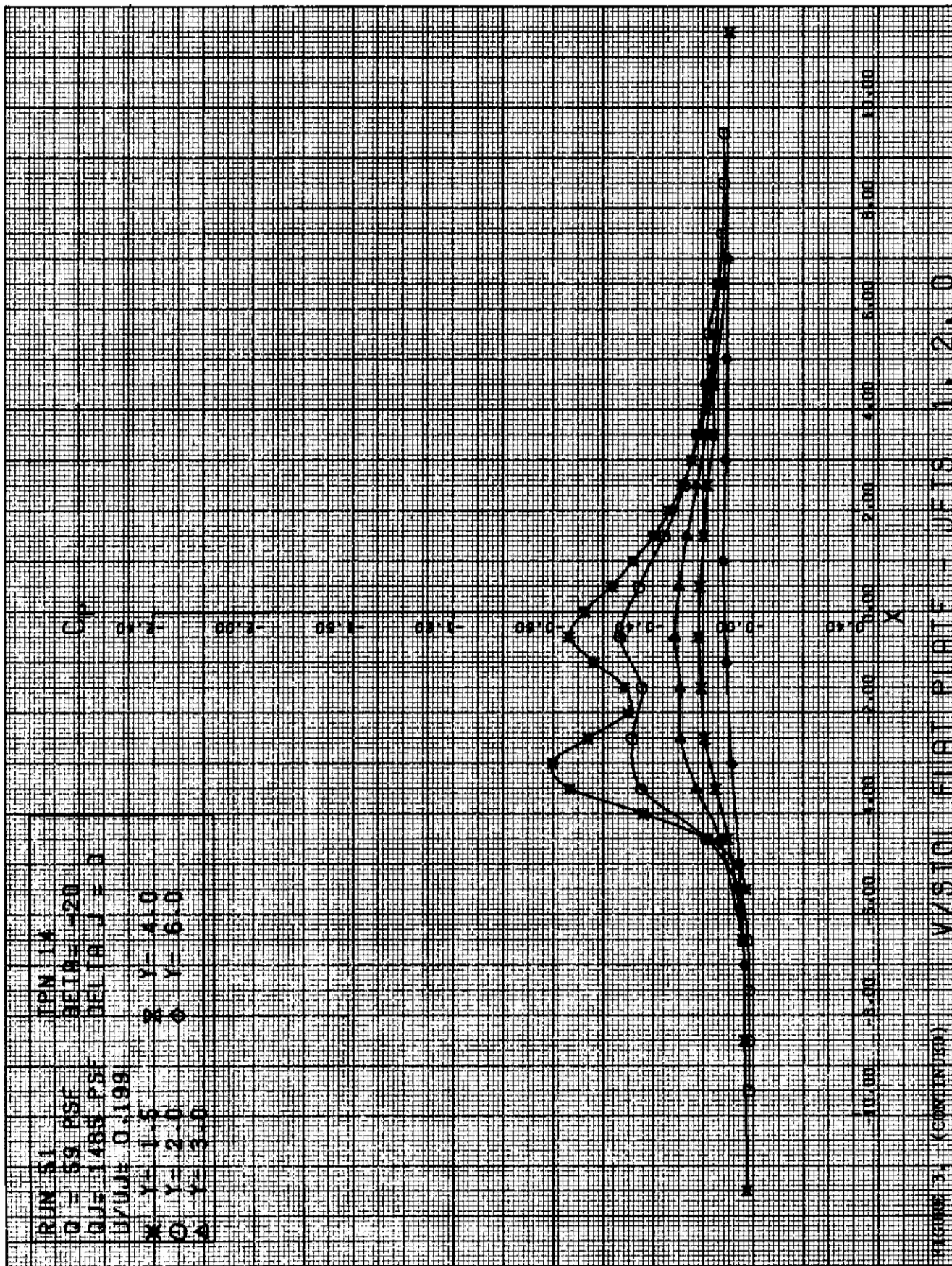
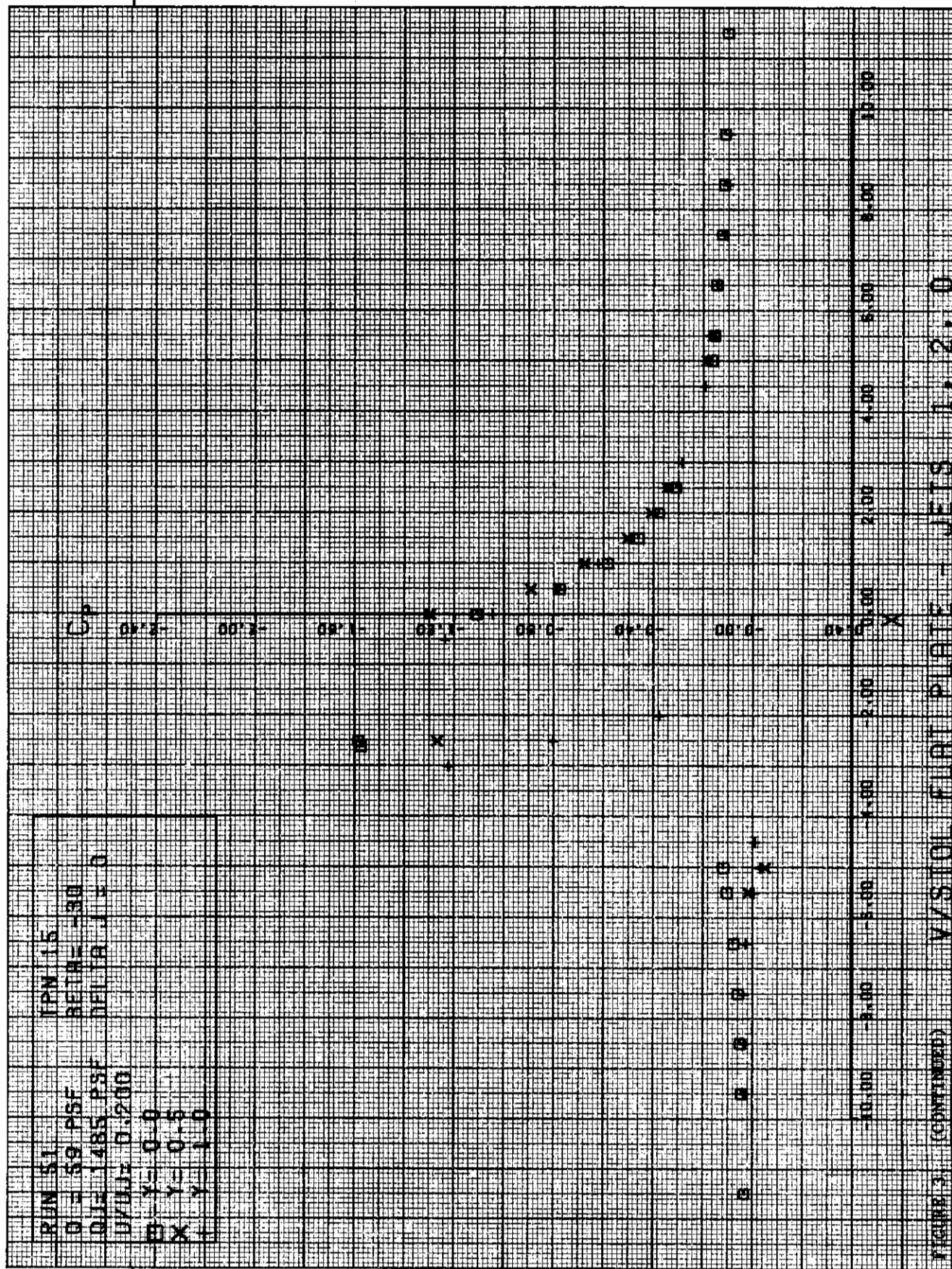


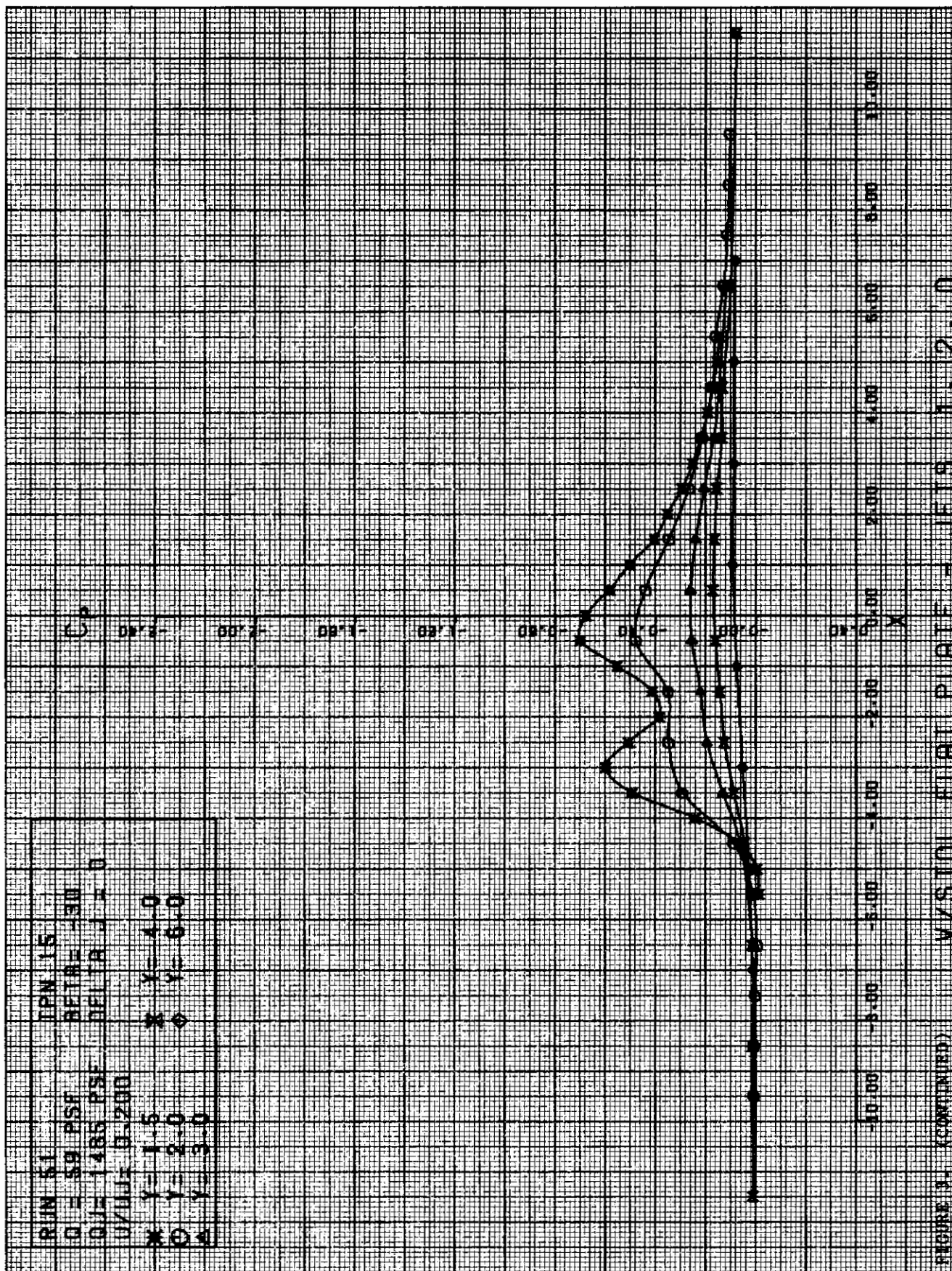
FIGURE 31 (CONTINUED) V/STOL FLAT PLATE JETS 1.2.0

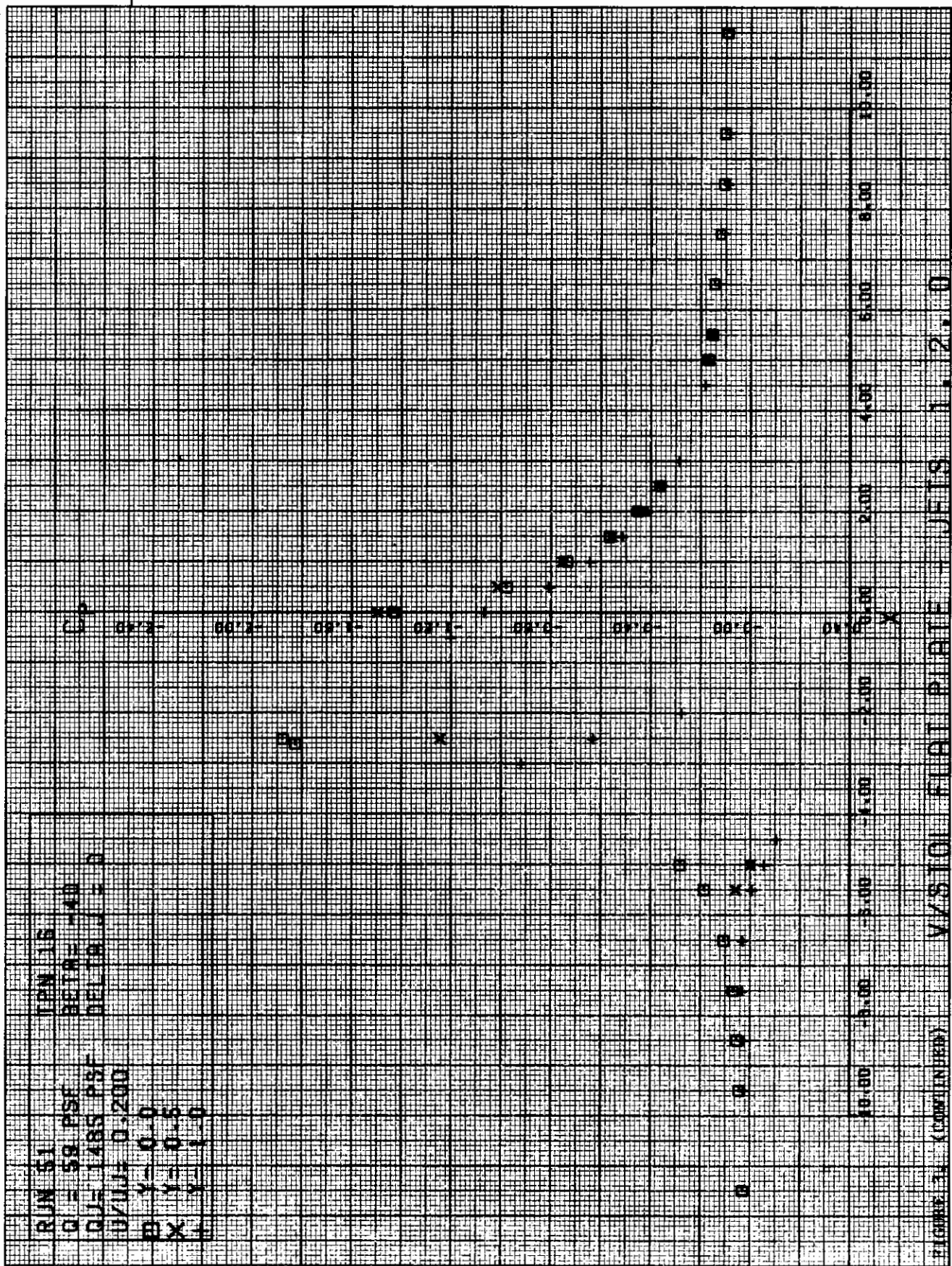


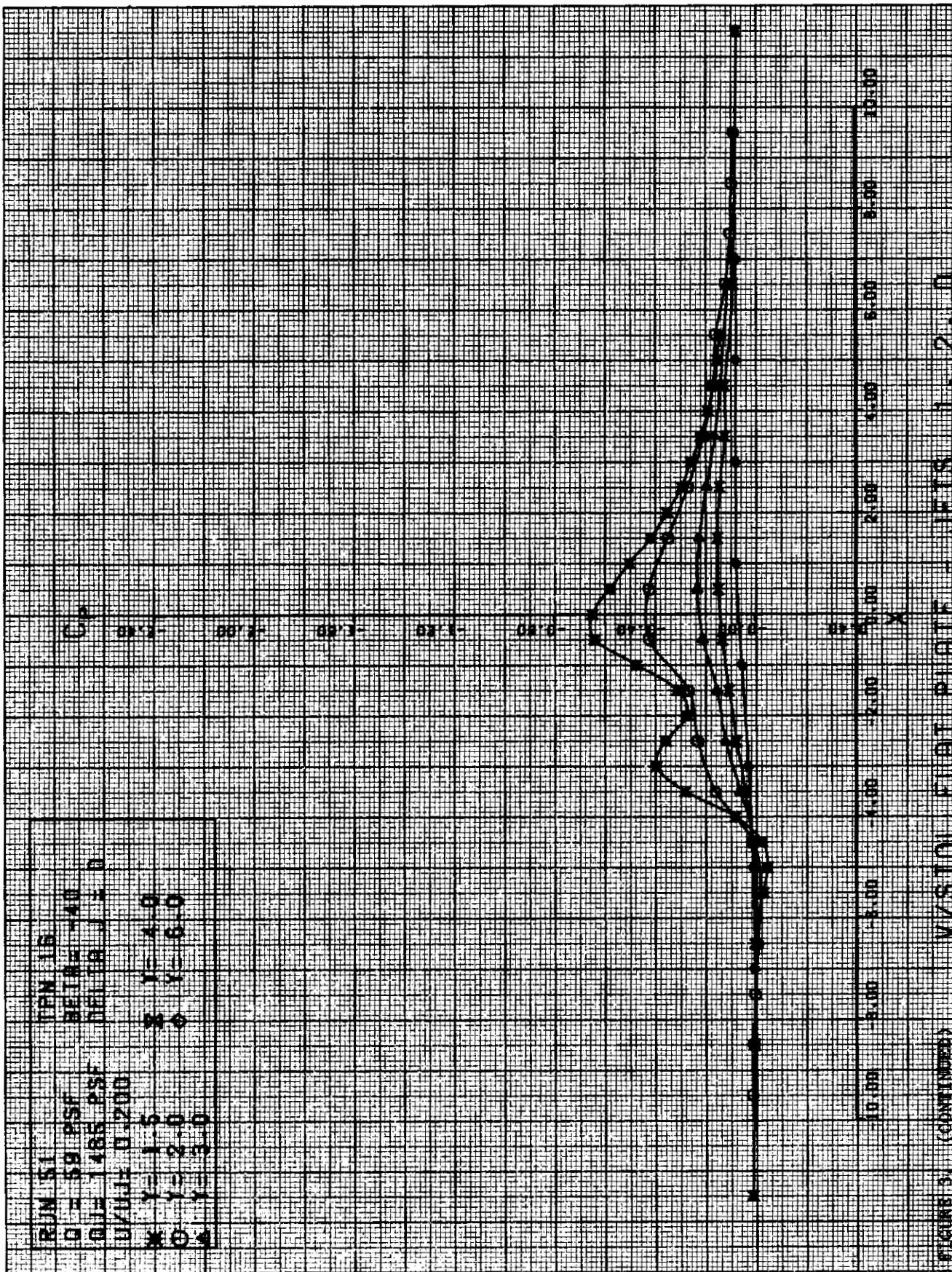












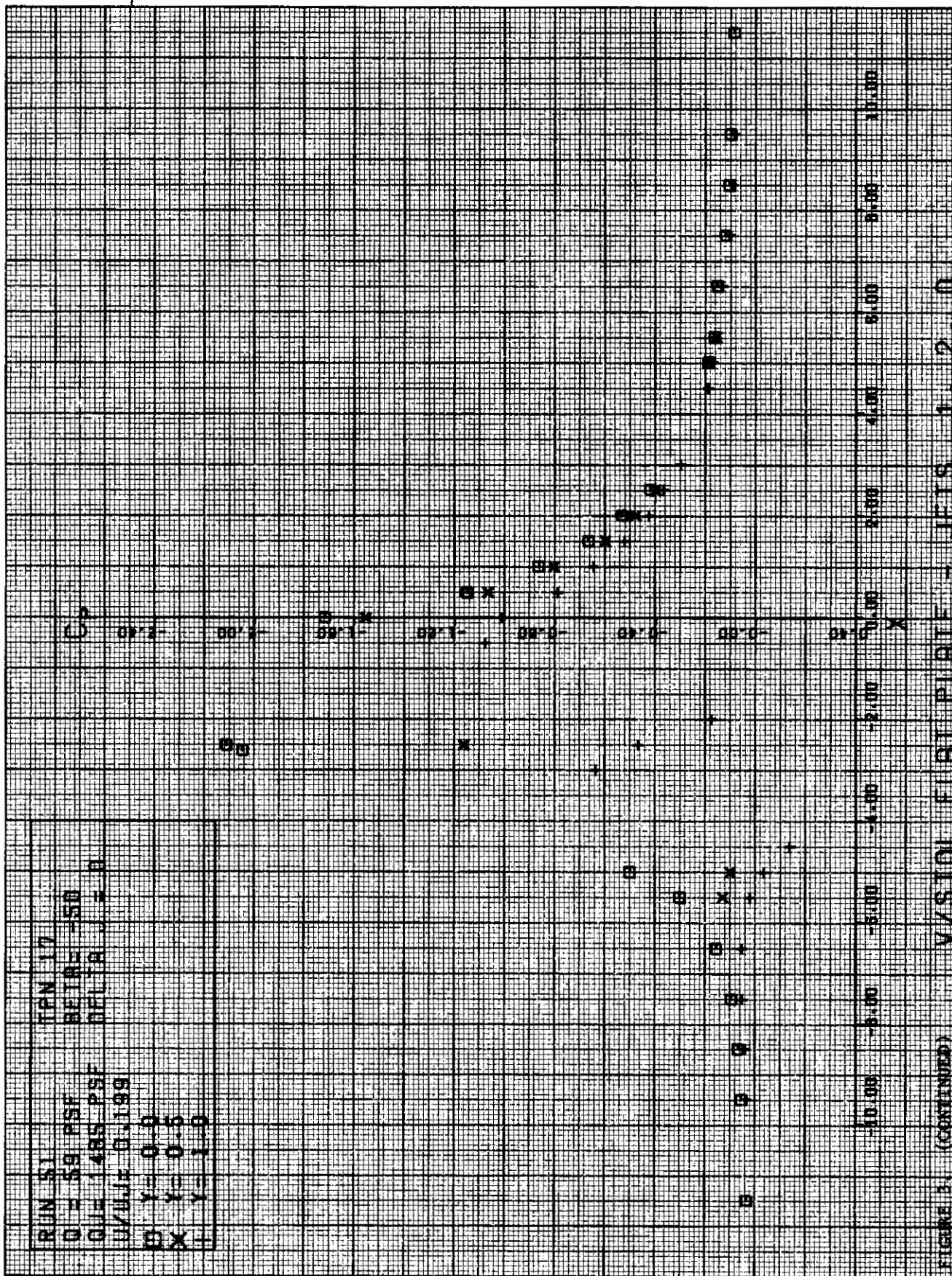
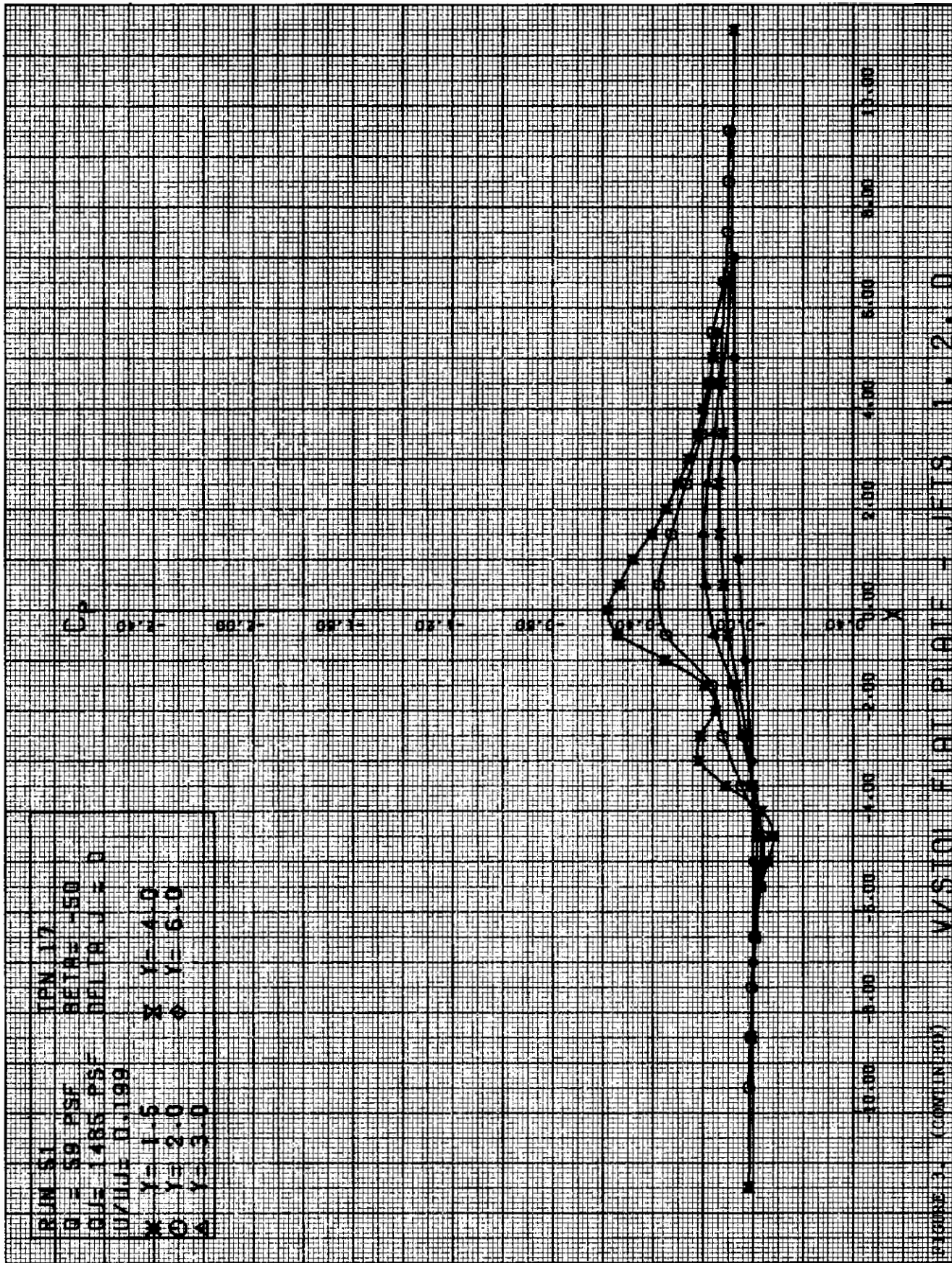
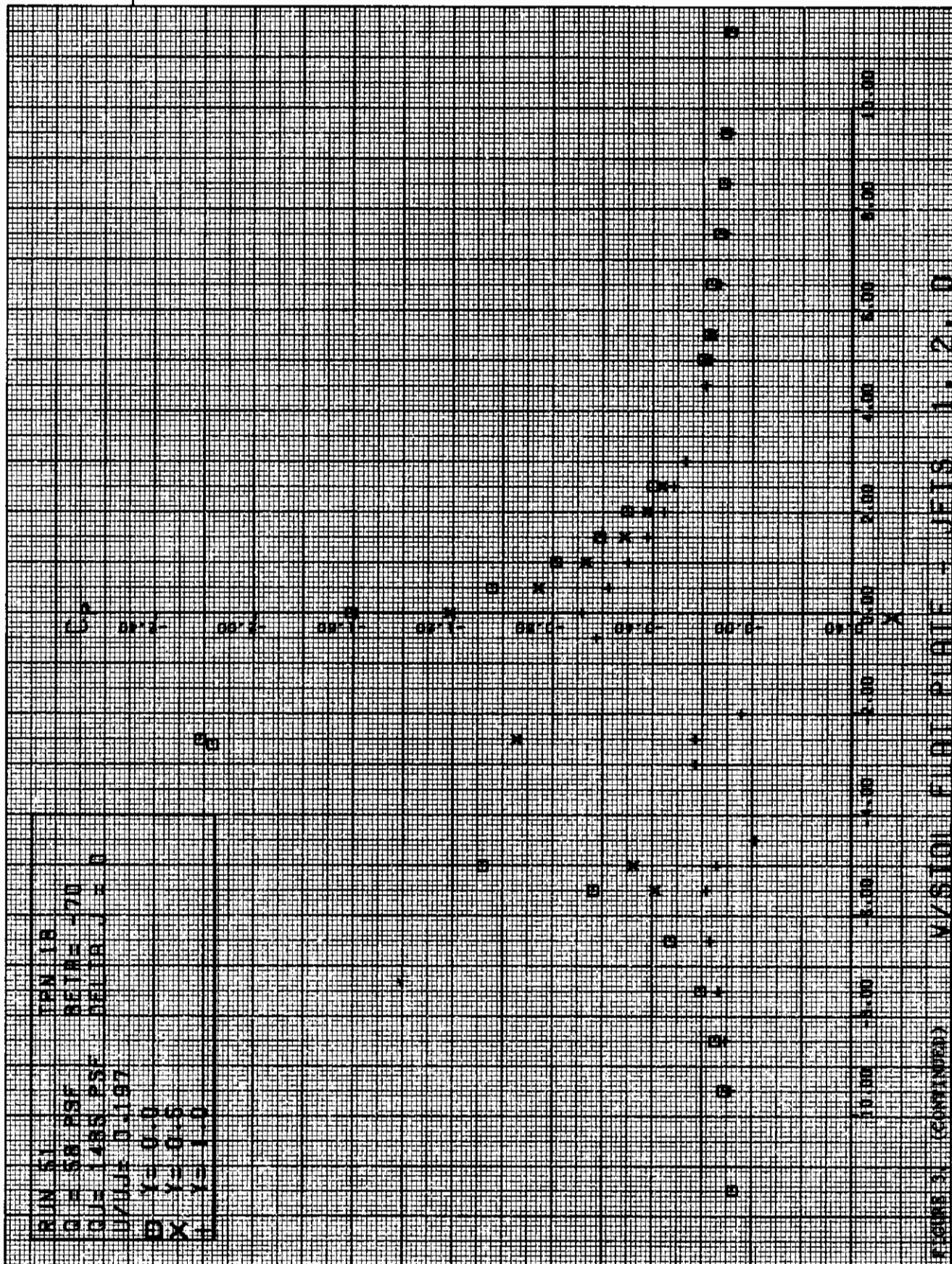
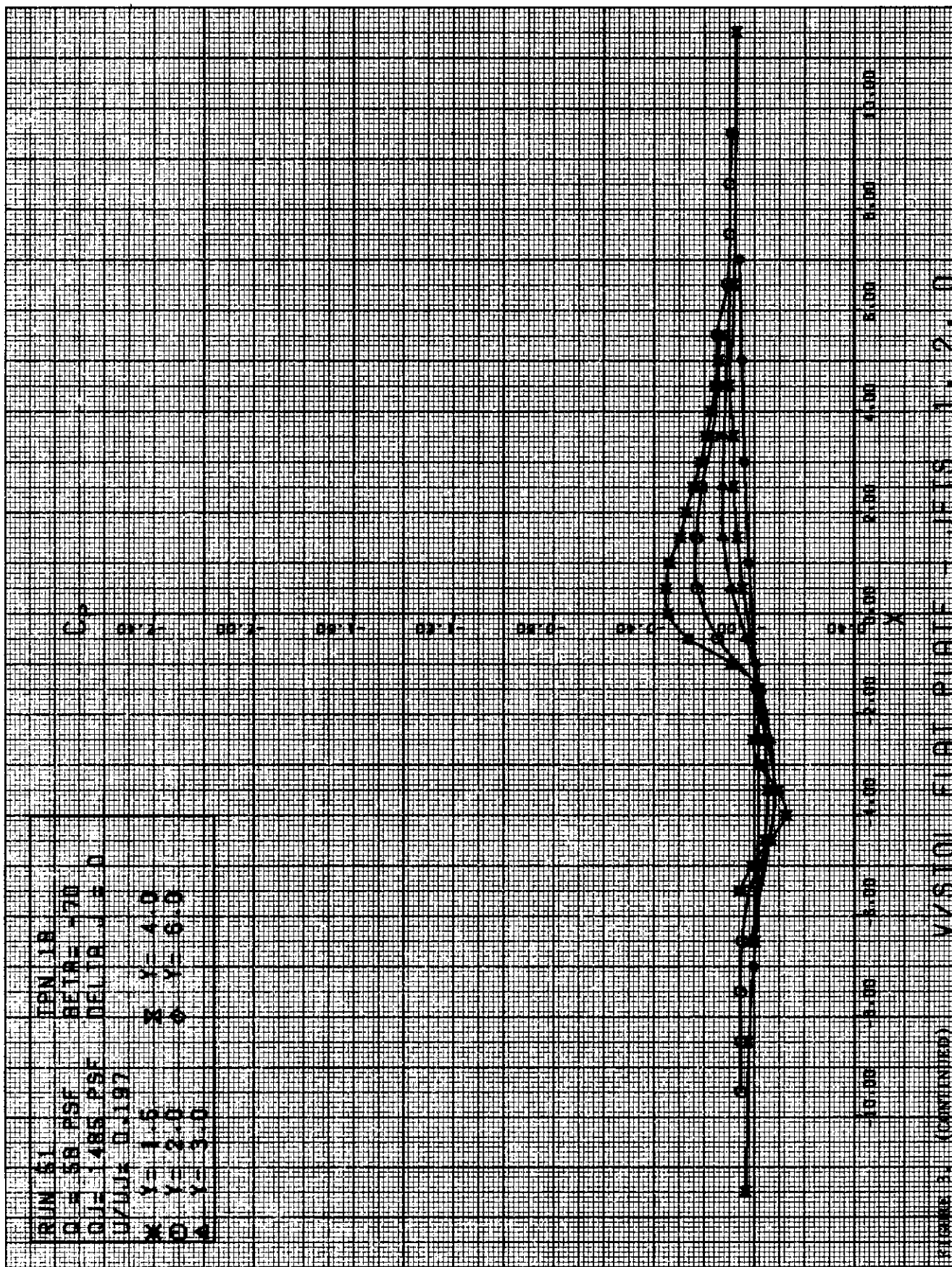
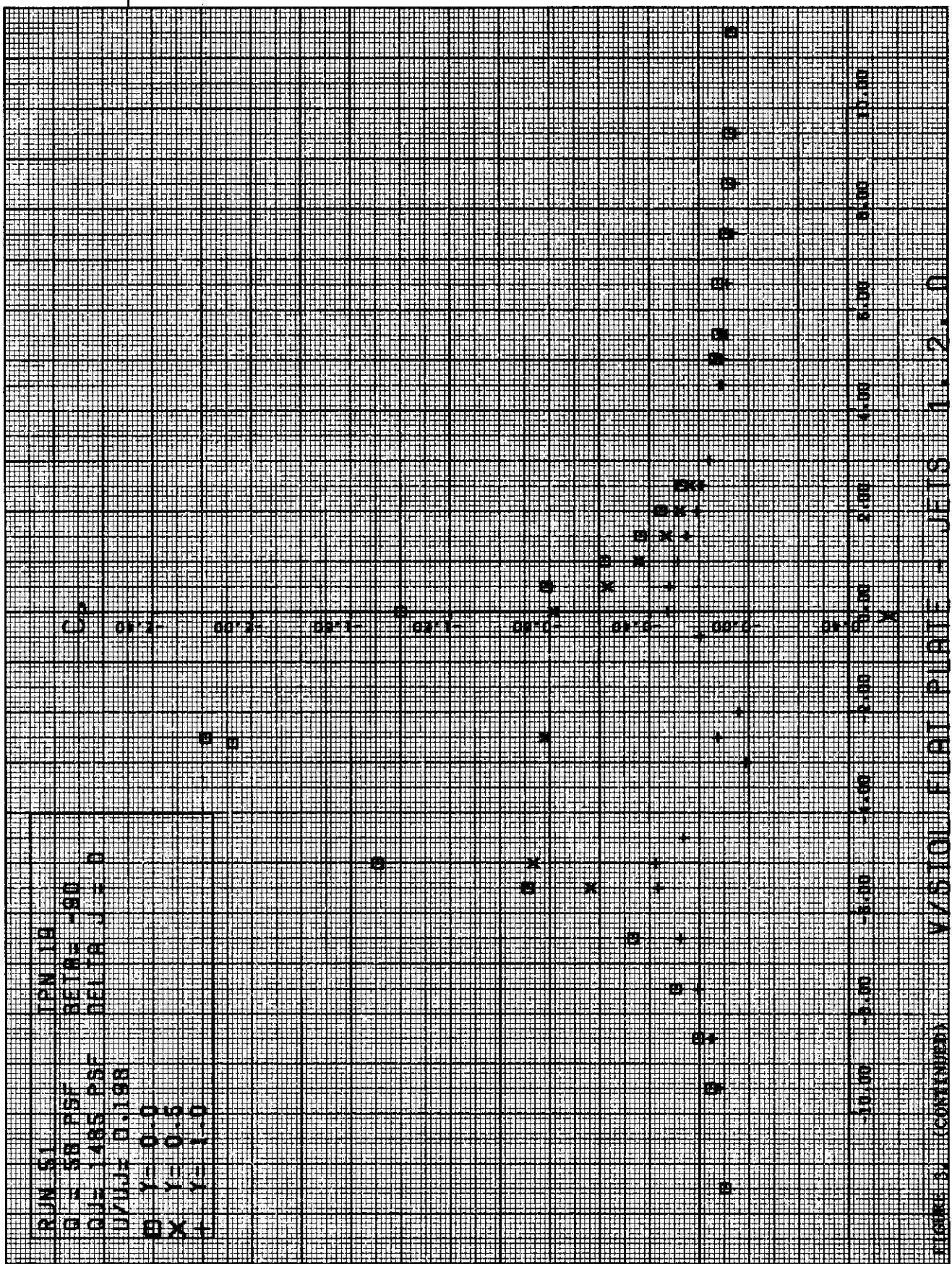


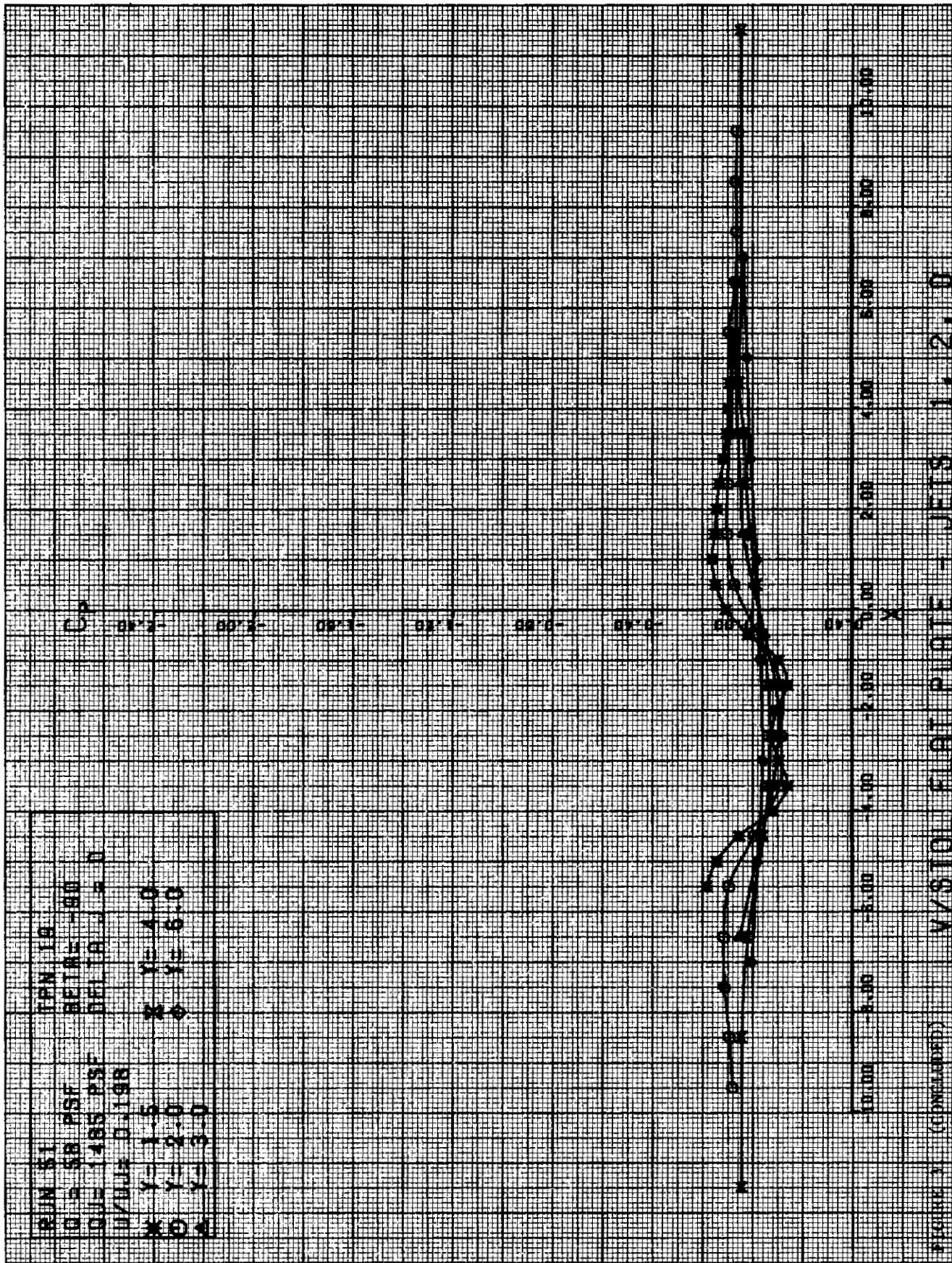
FIGURE 1 (CONTINUED) V/S101 FEET PLATE - JFIS 1.2.0

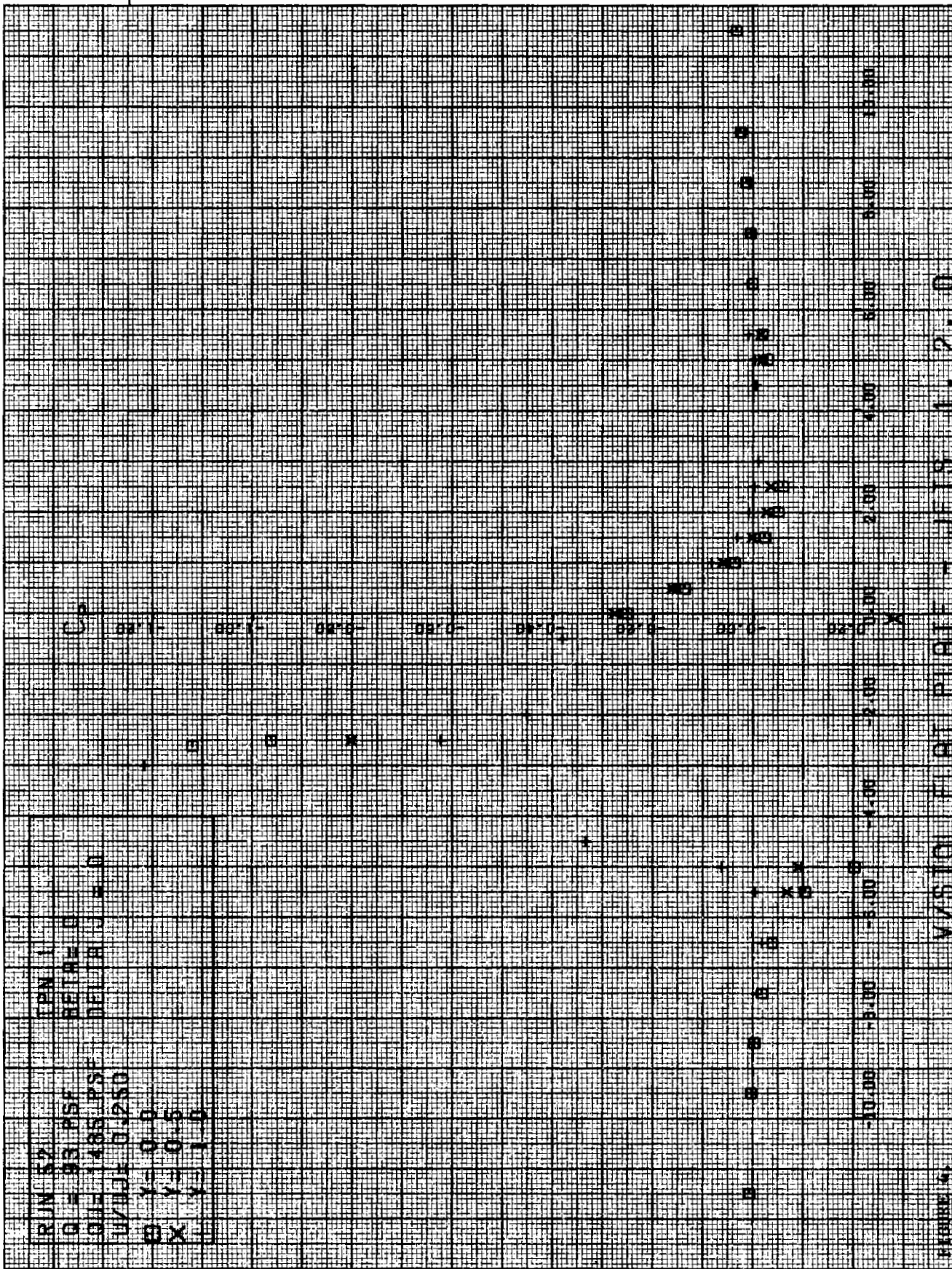


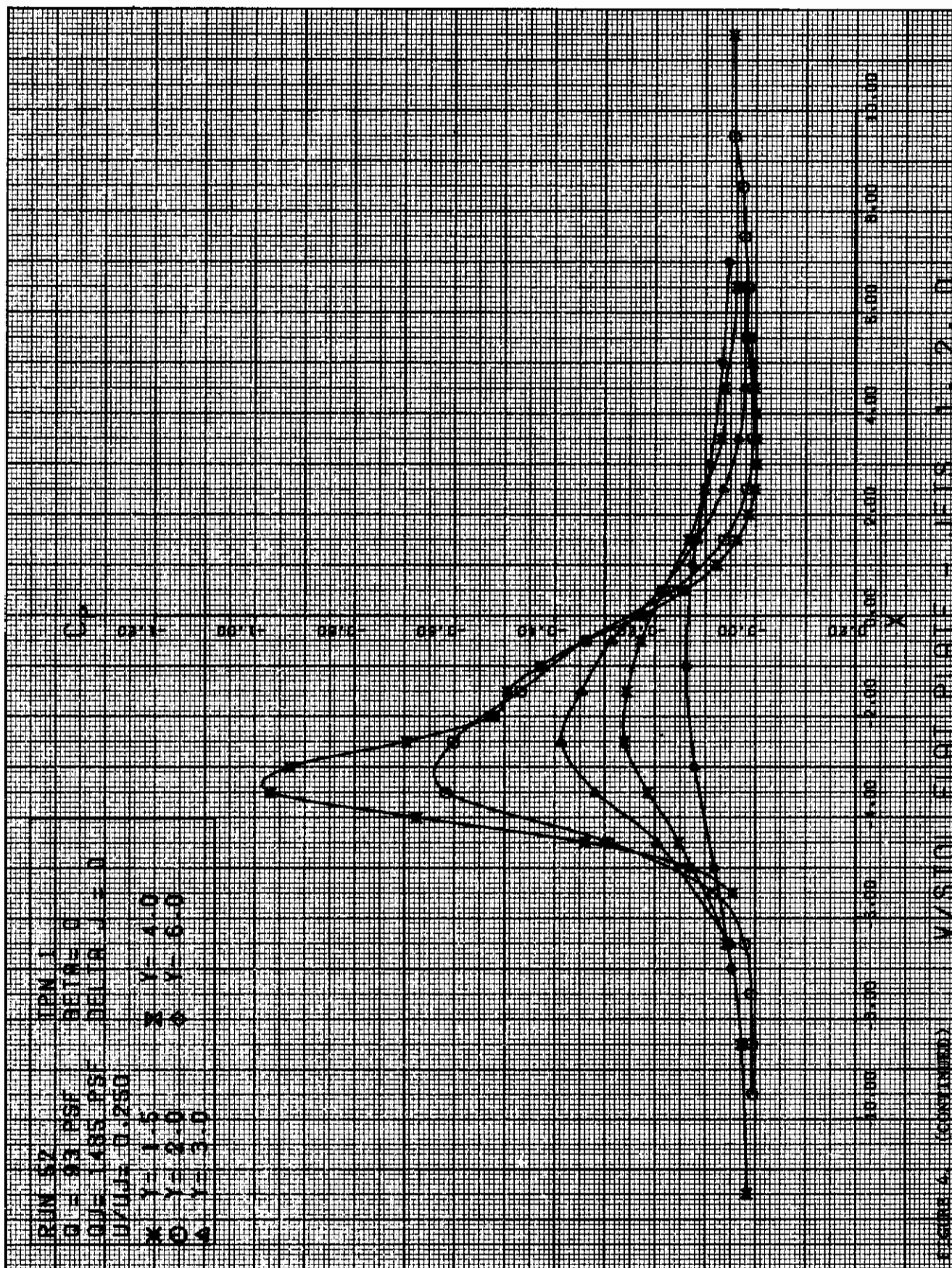


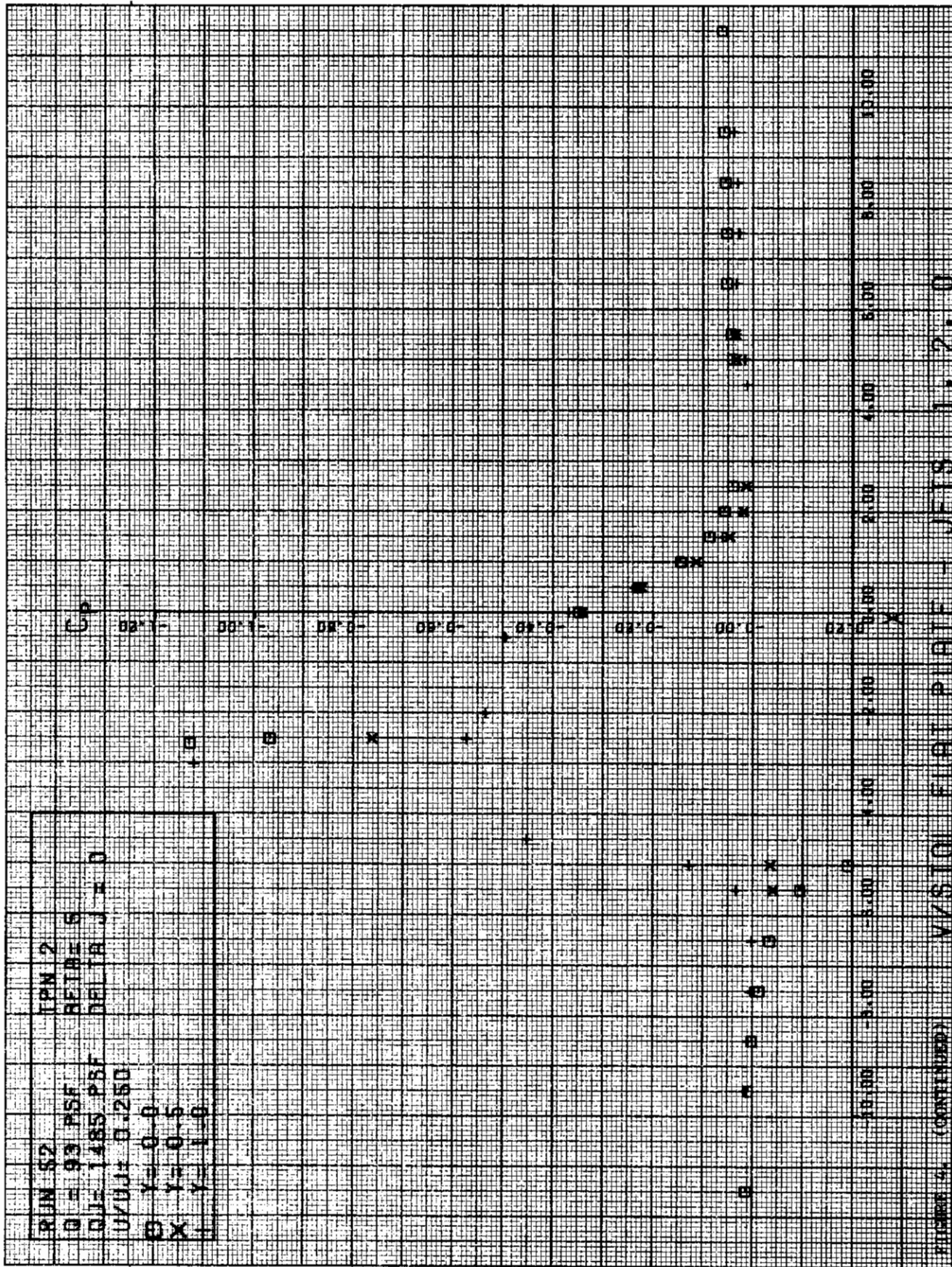


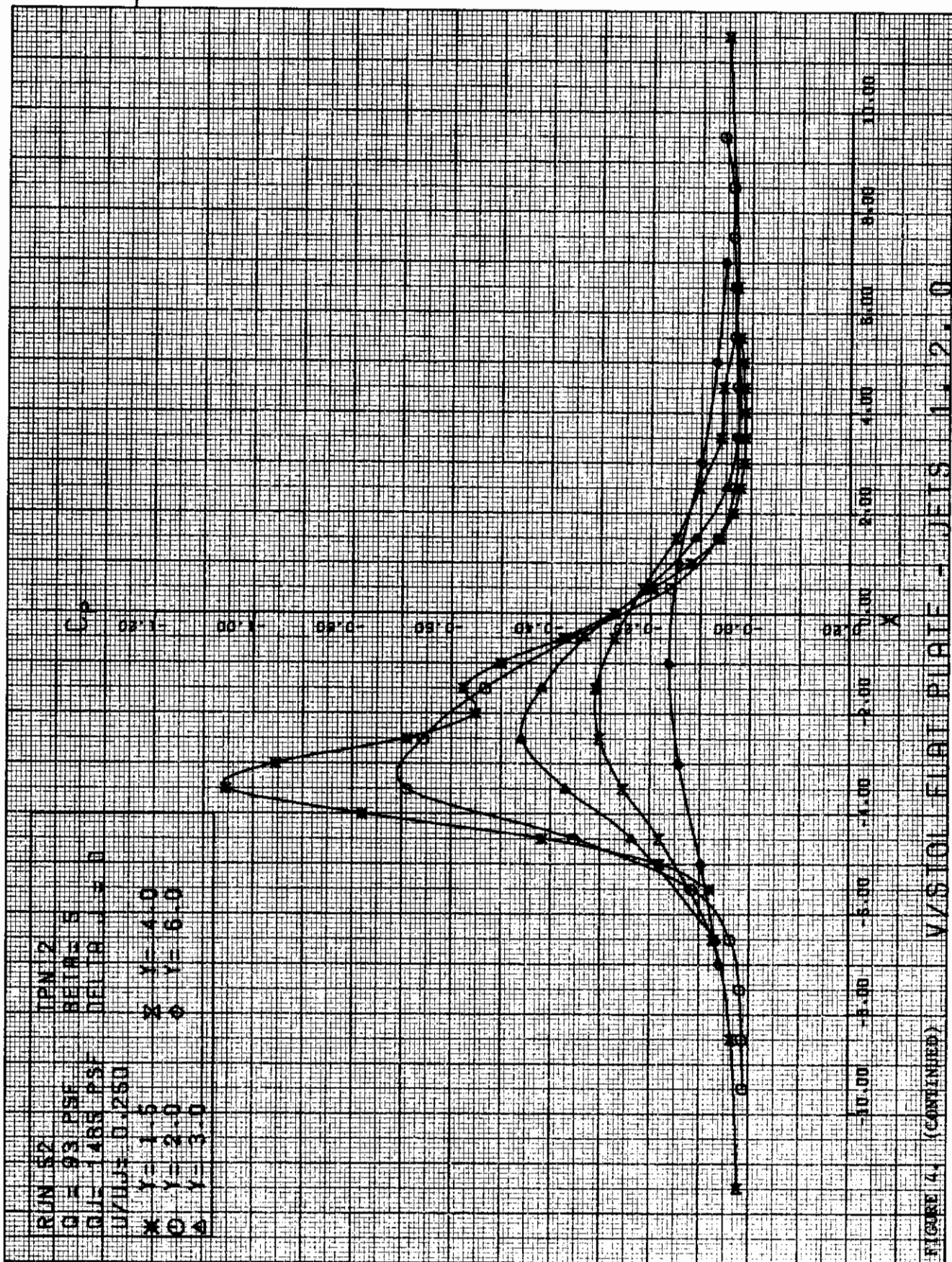


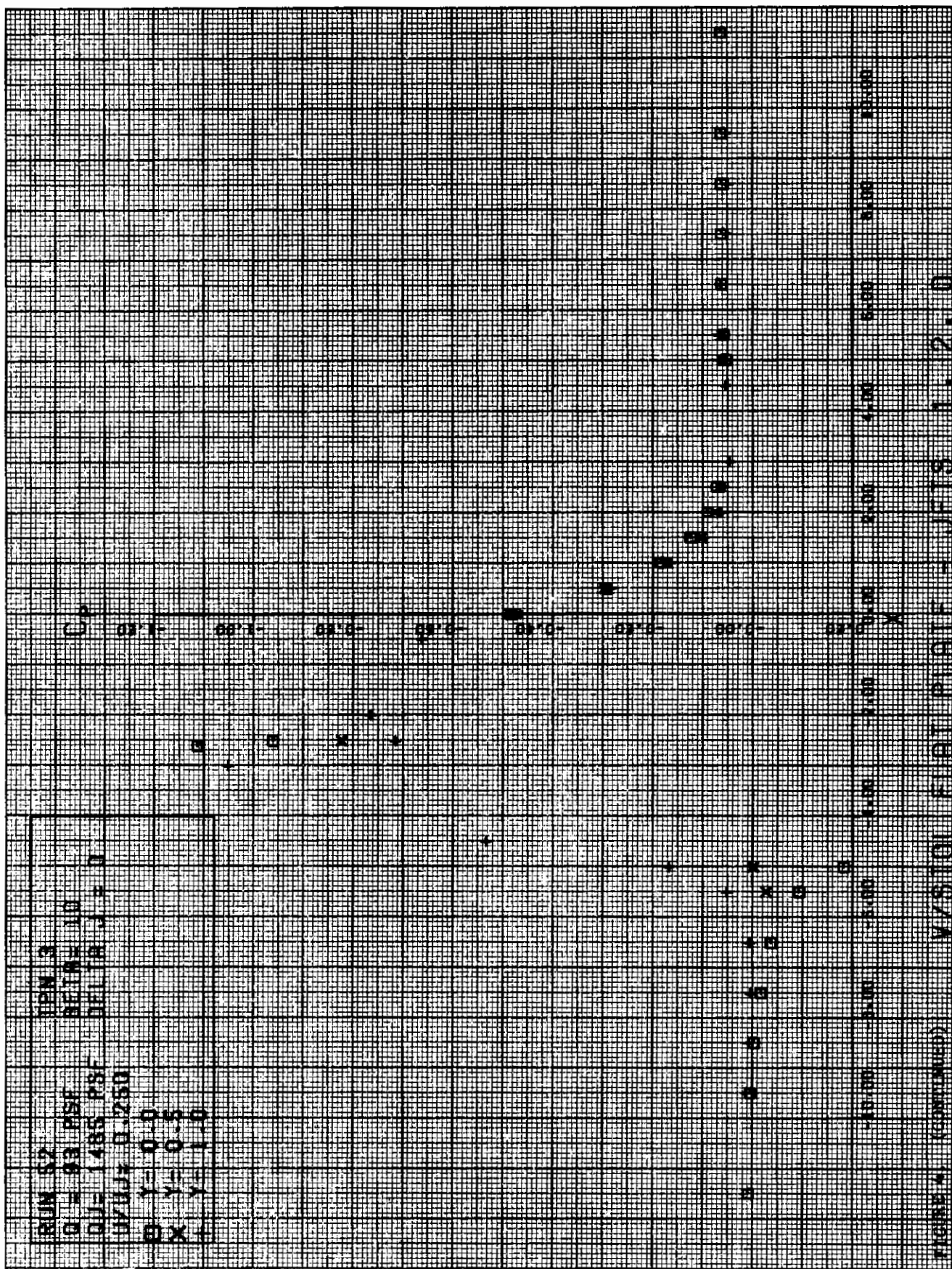


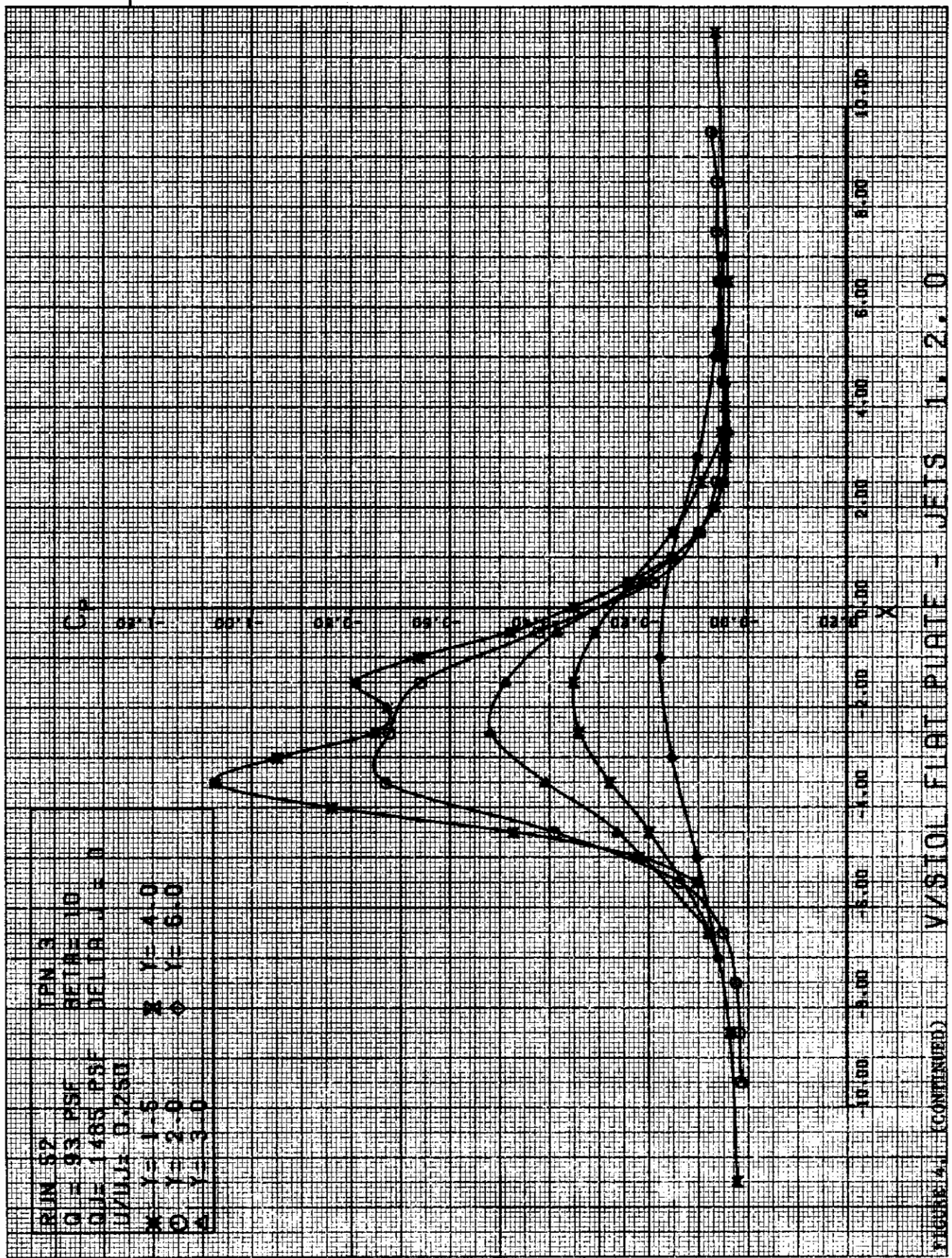


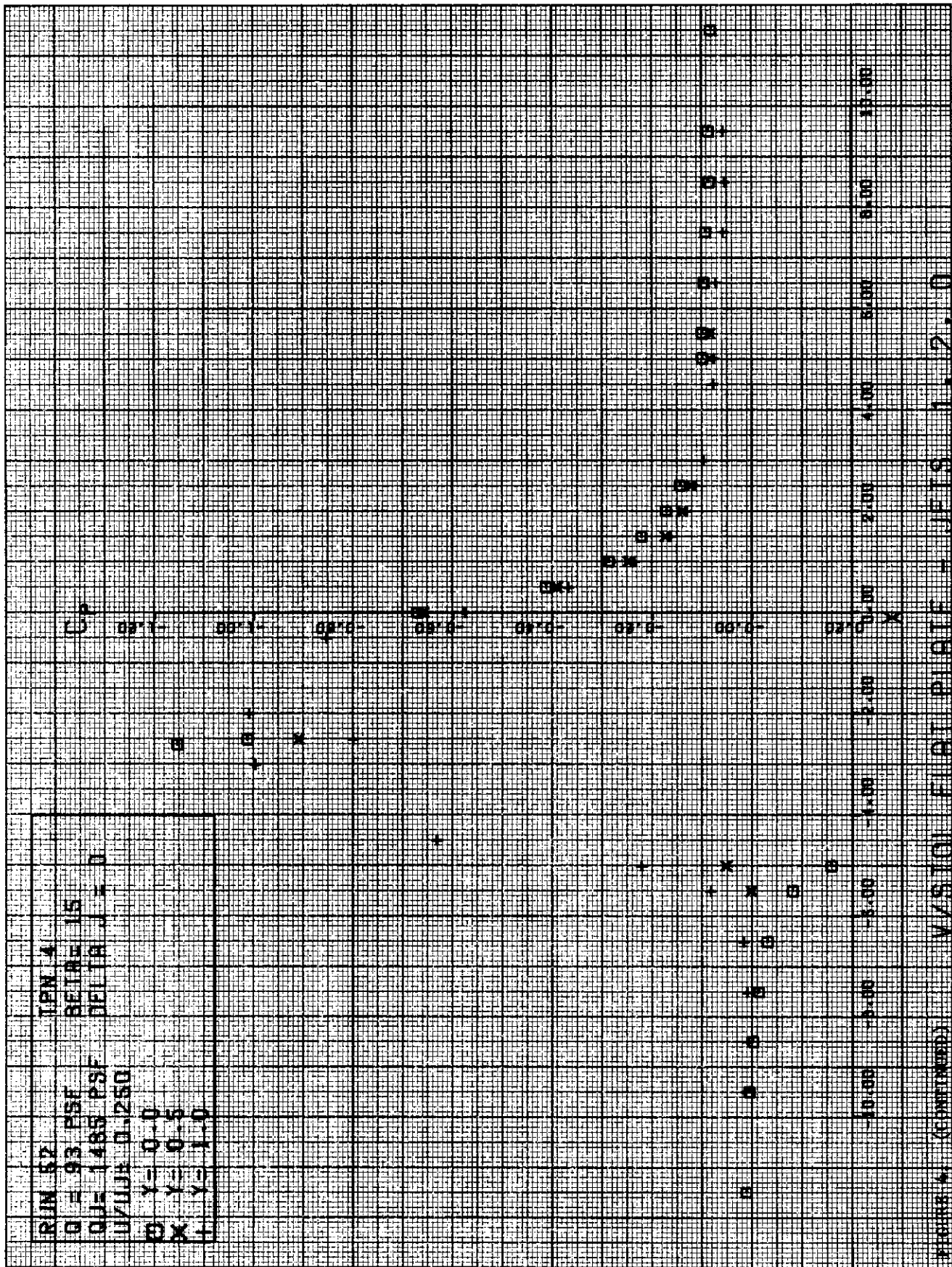












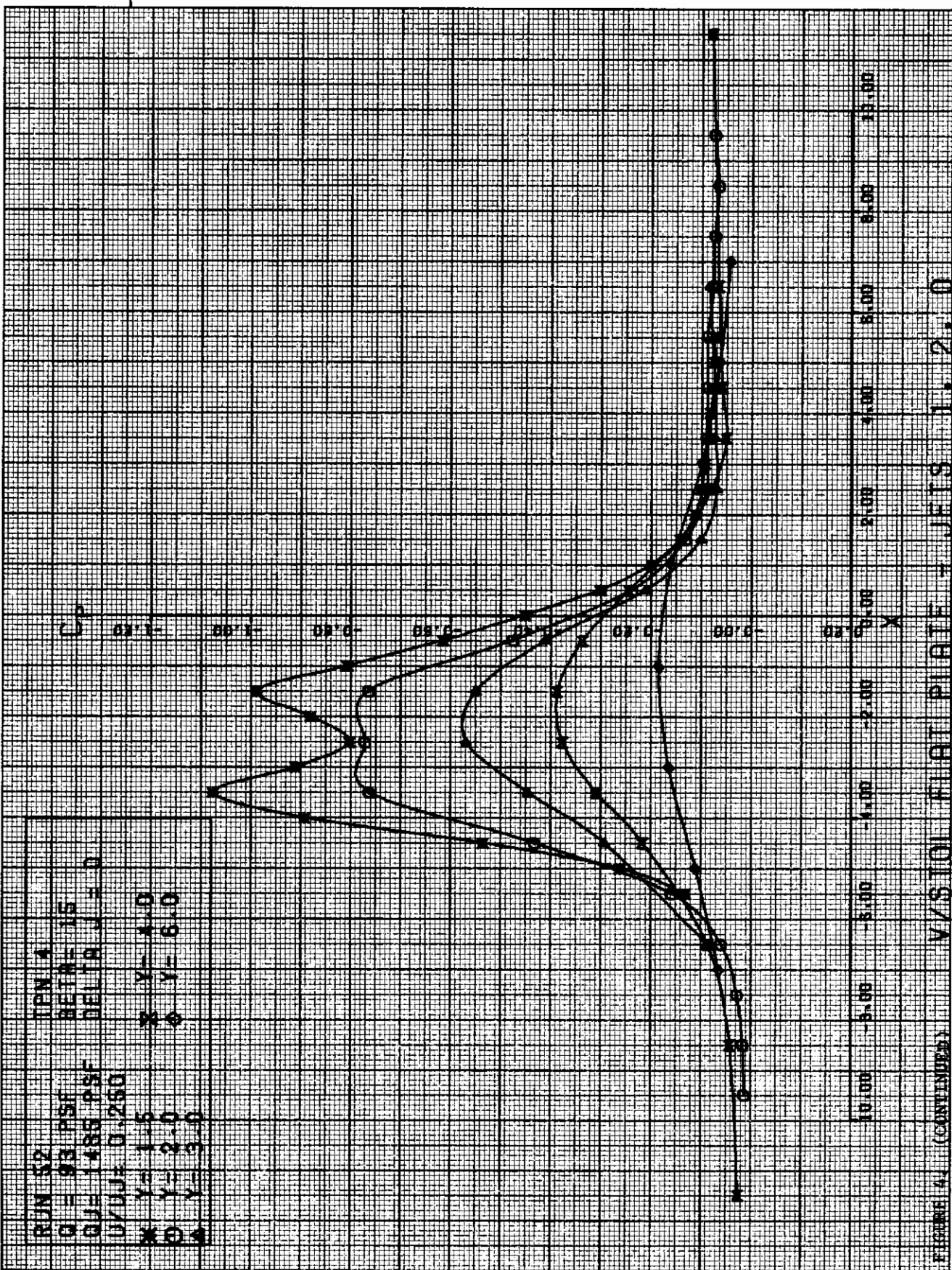


FIGURE 4. (CONTINUED)

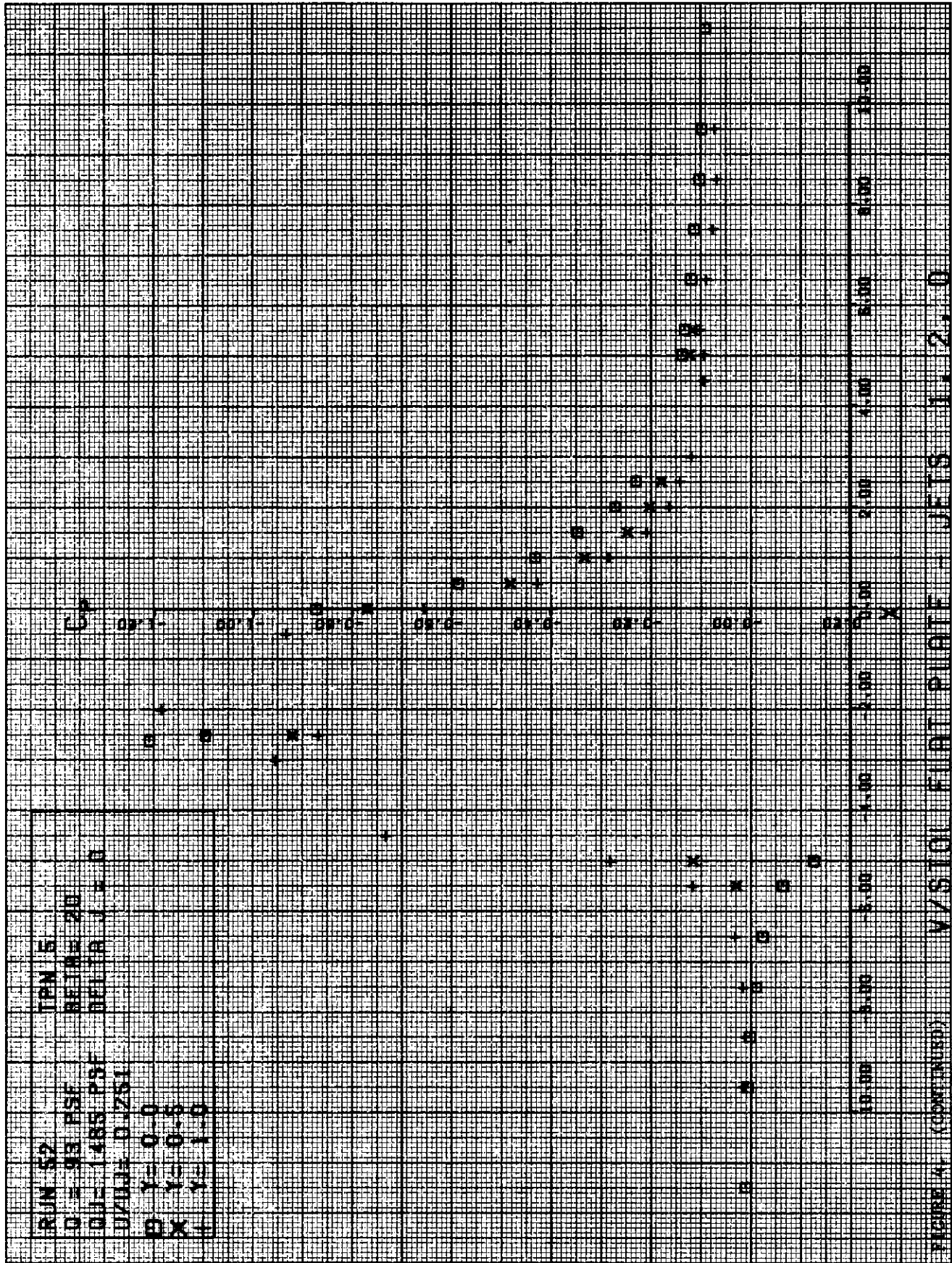
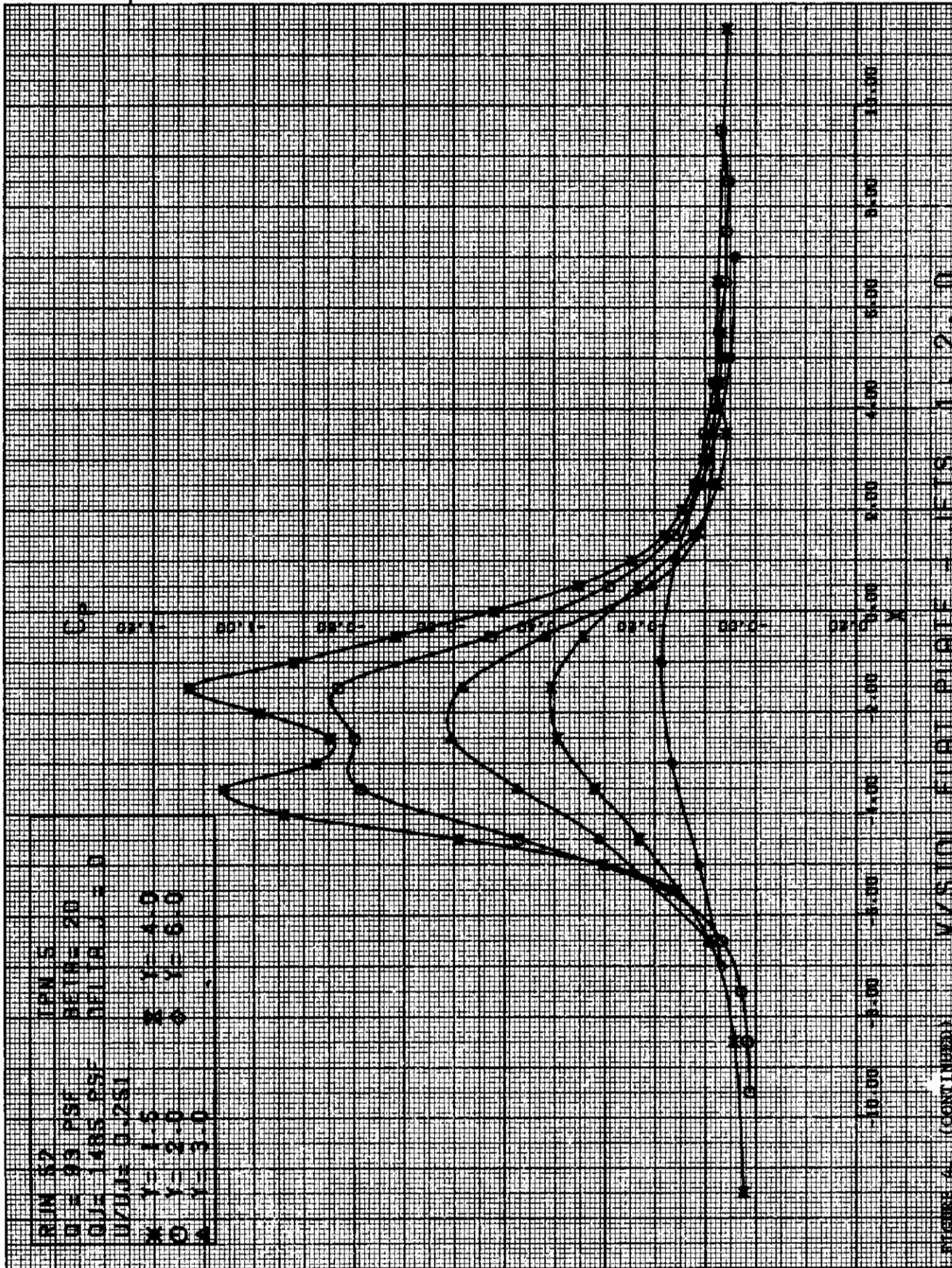


FIGURE 4 (CONTINUED) VISTOL FLAT PLATE JETS U. 2. 0



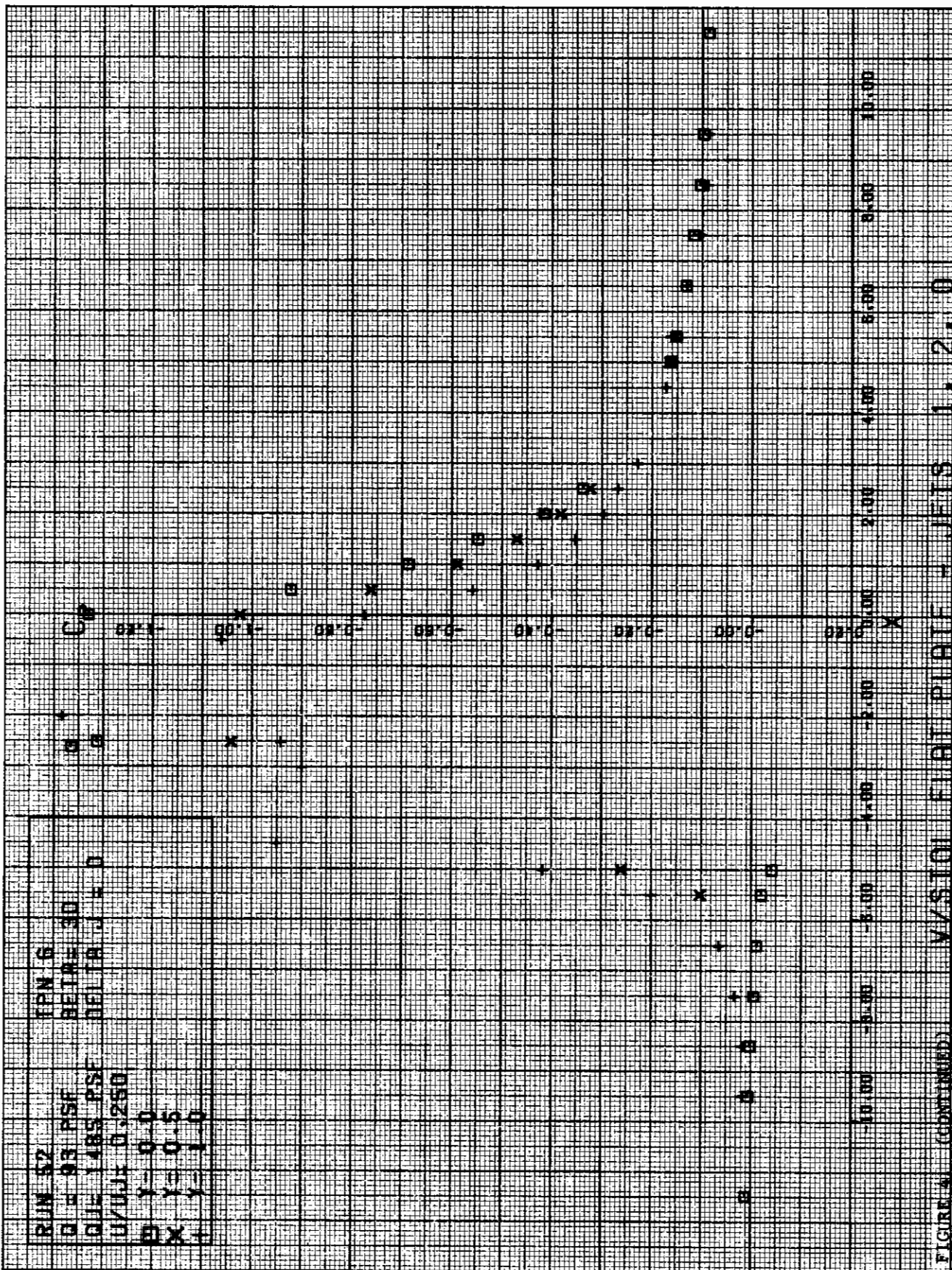
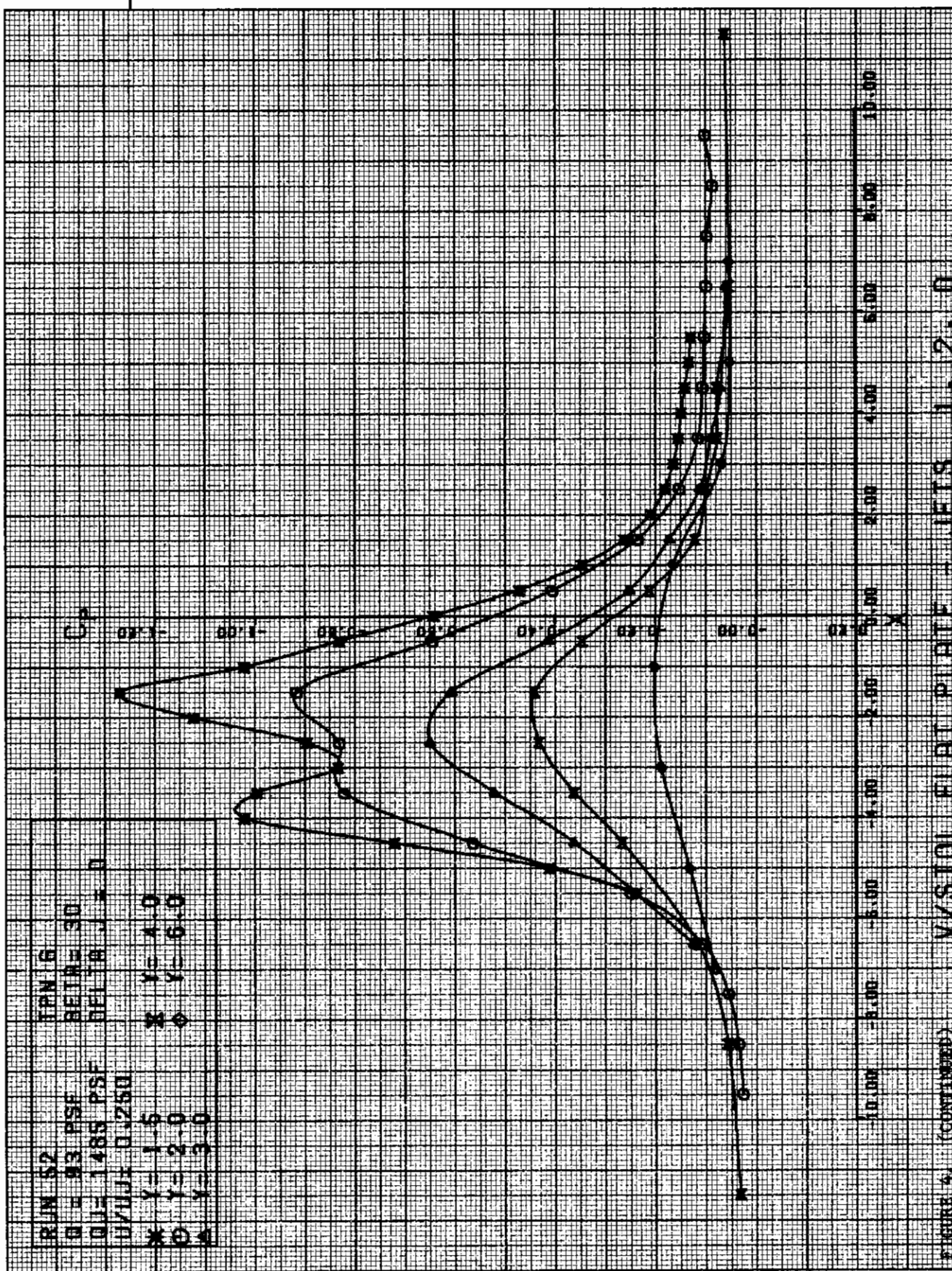
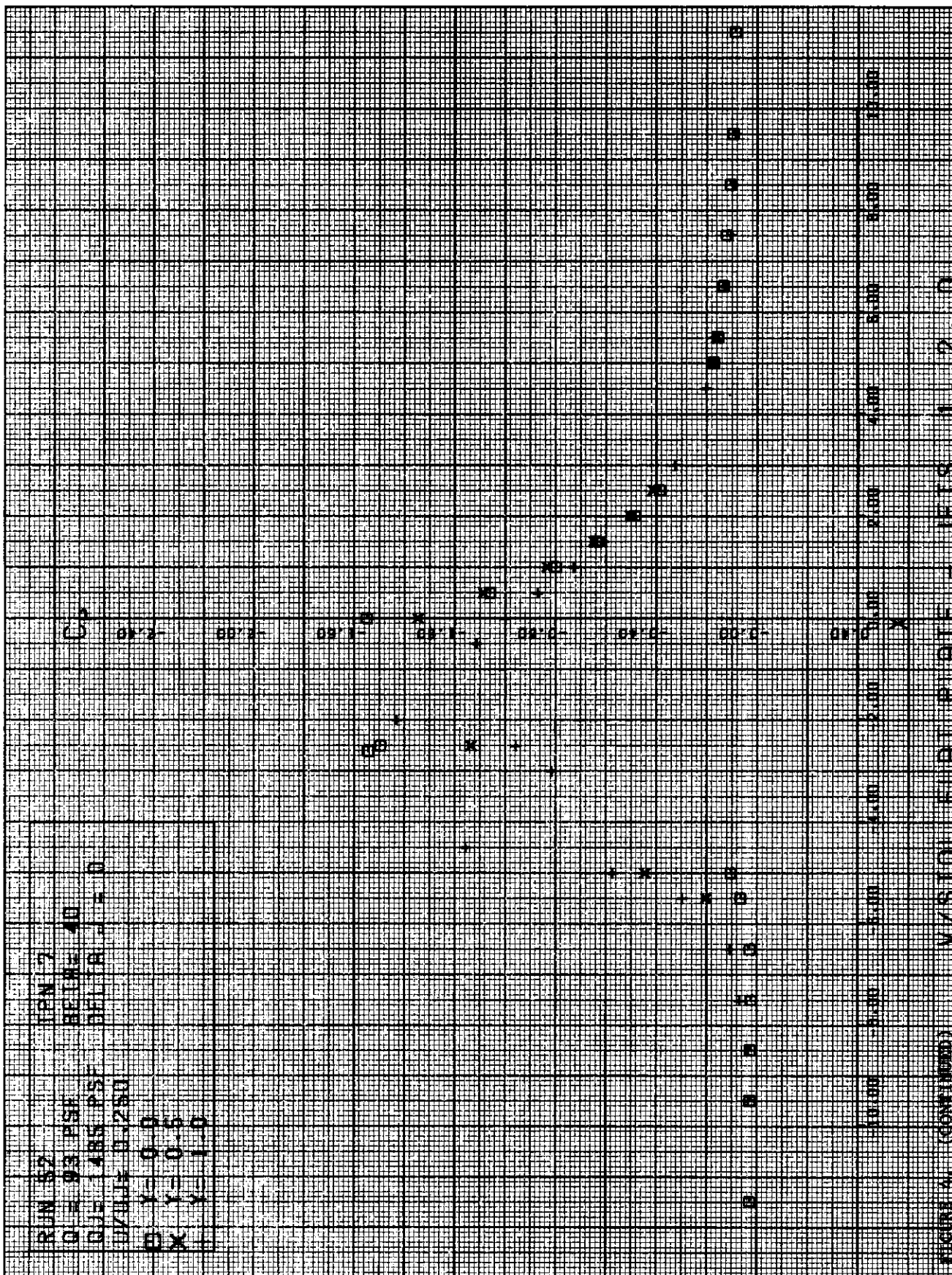
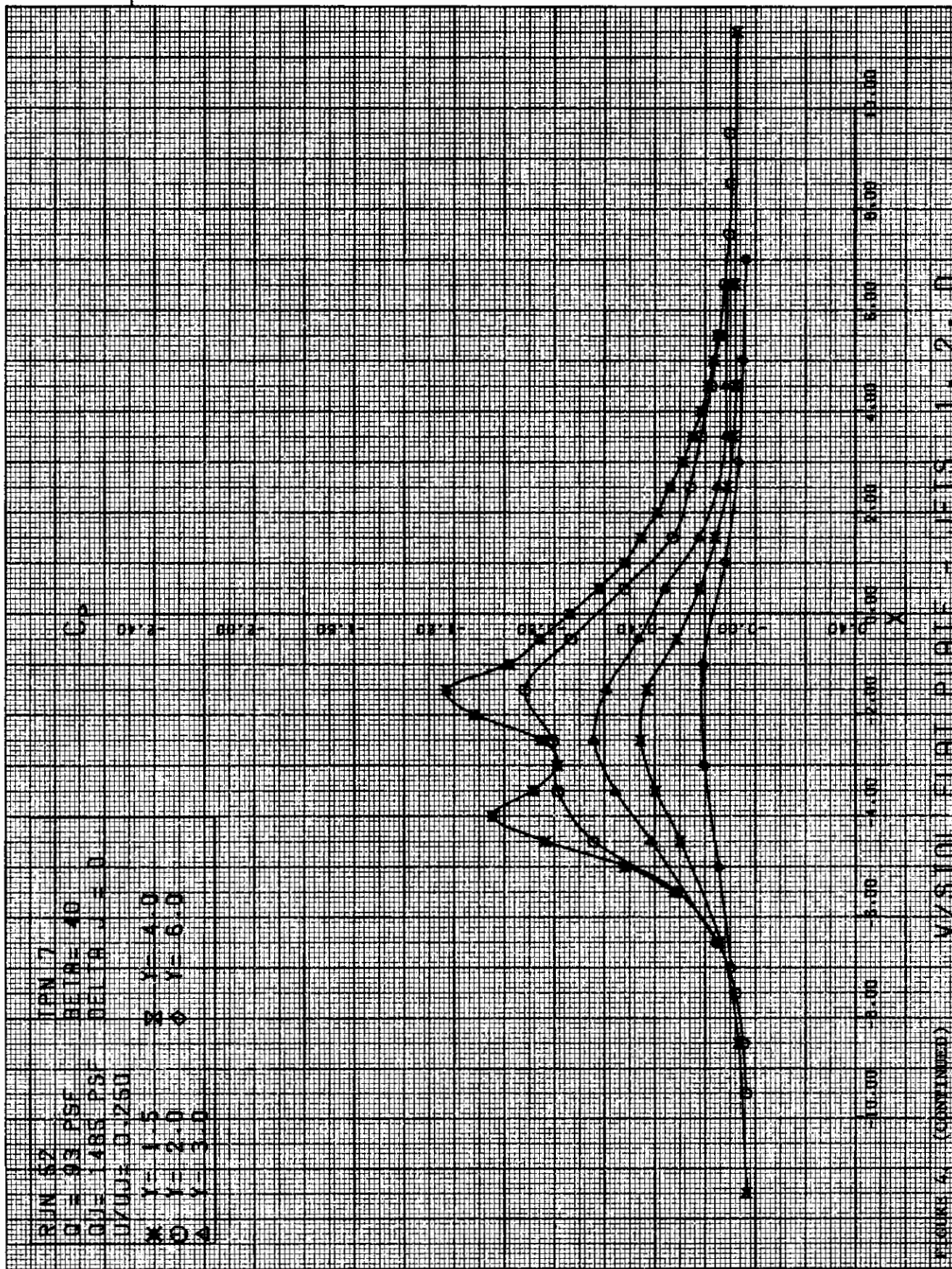
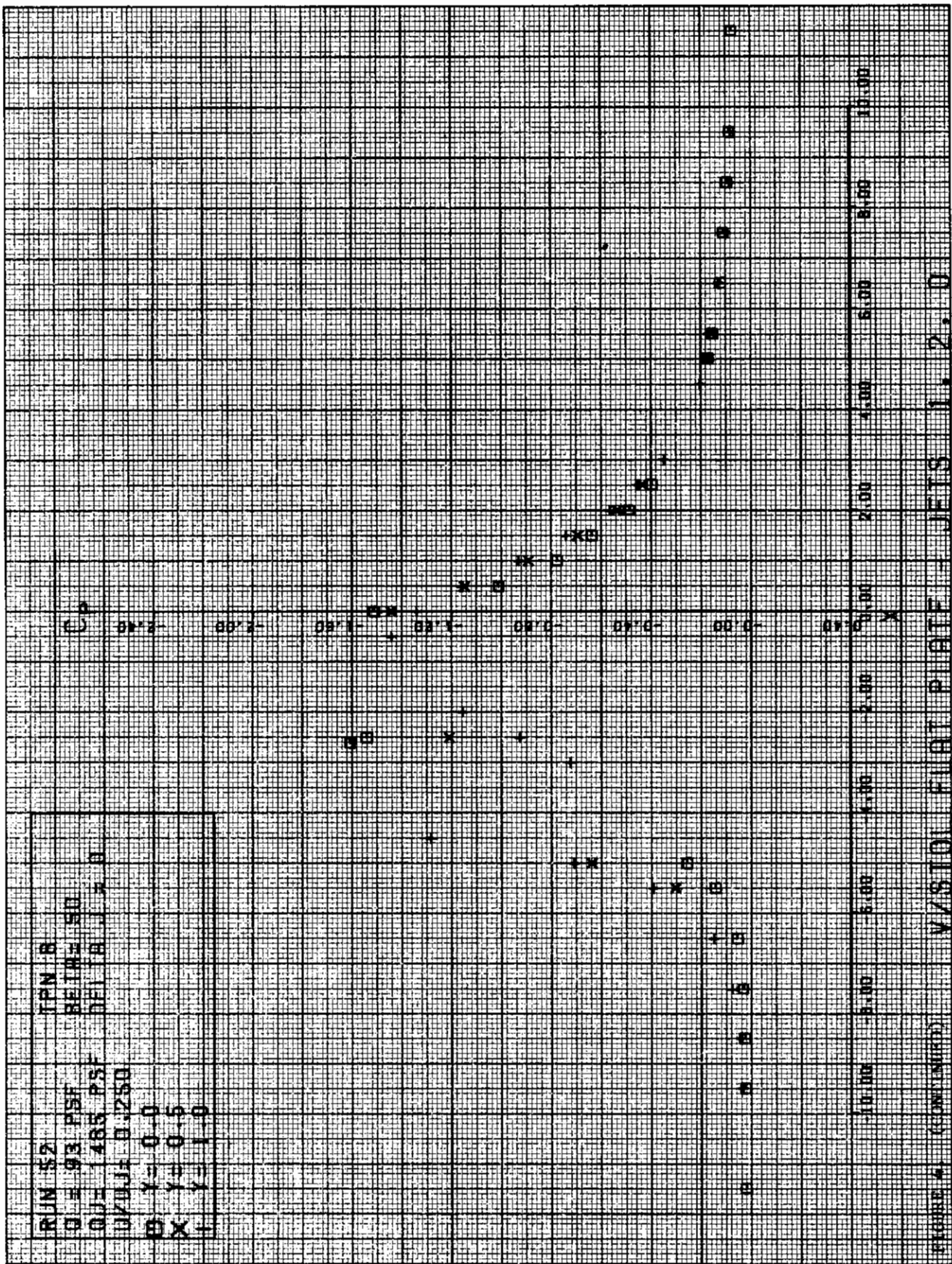


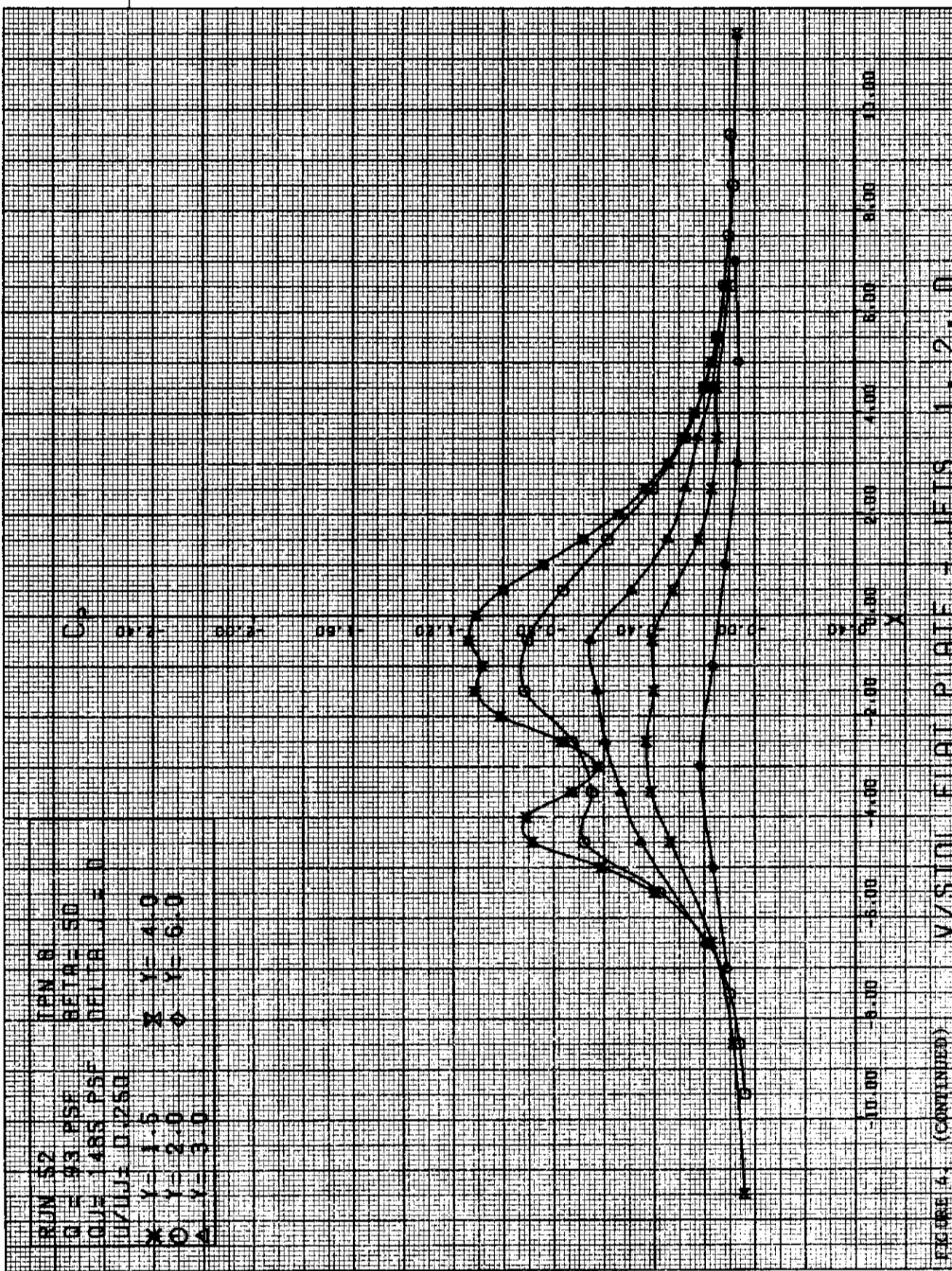
FIGURE 4 (CONTINUED)

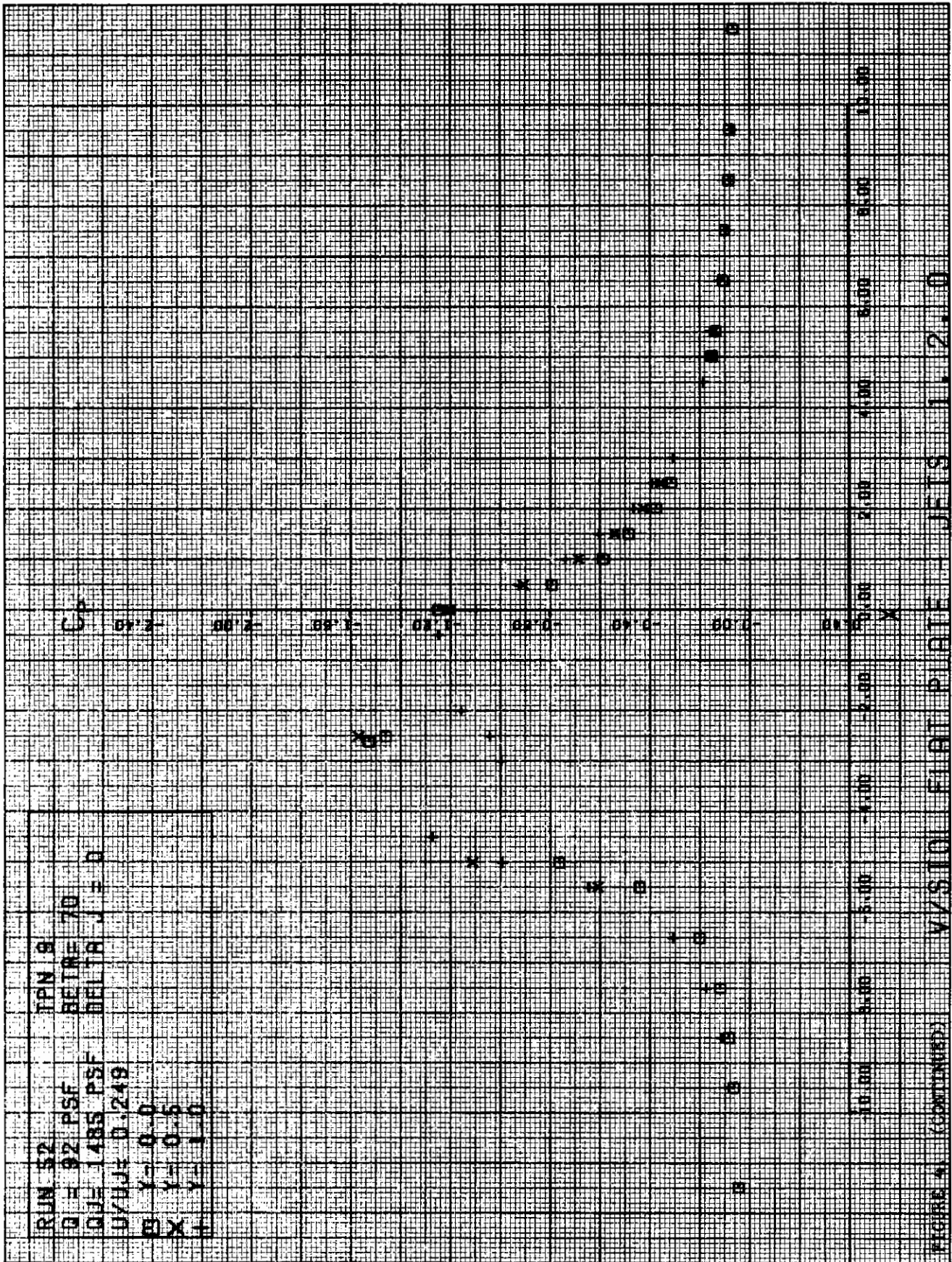


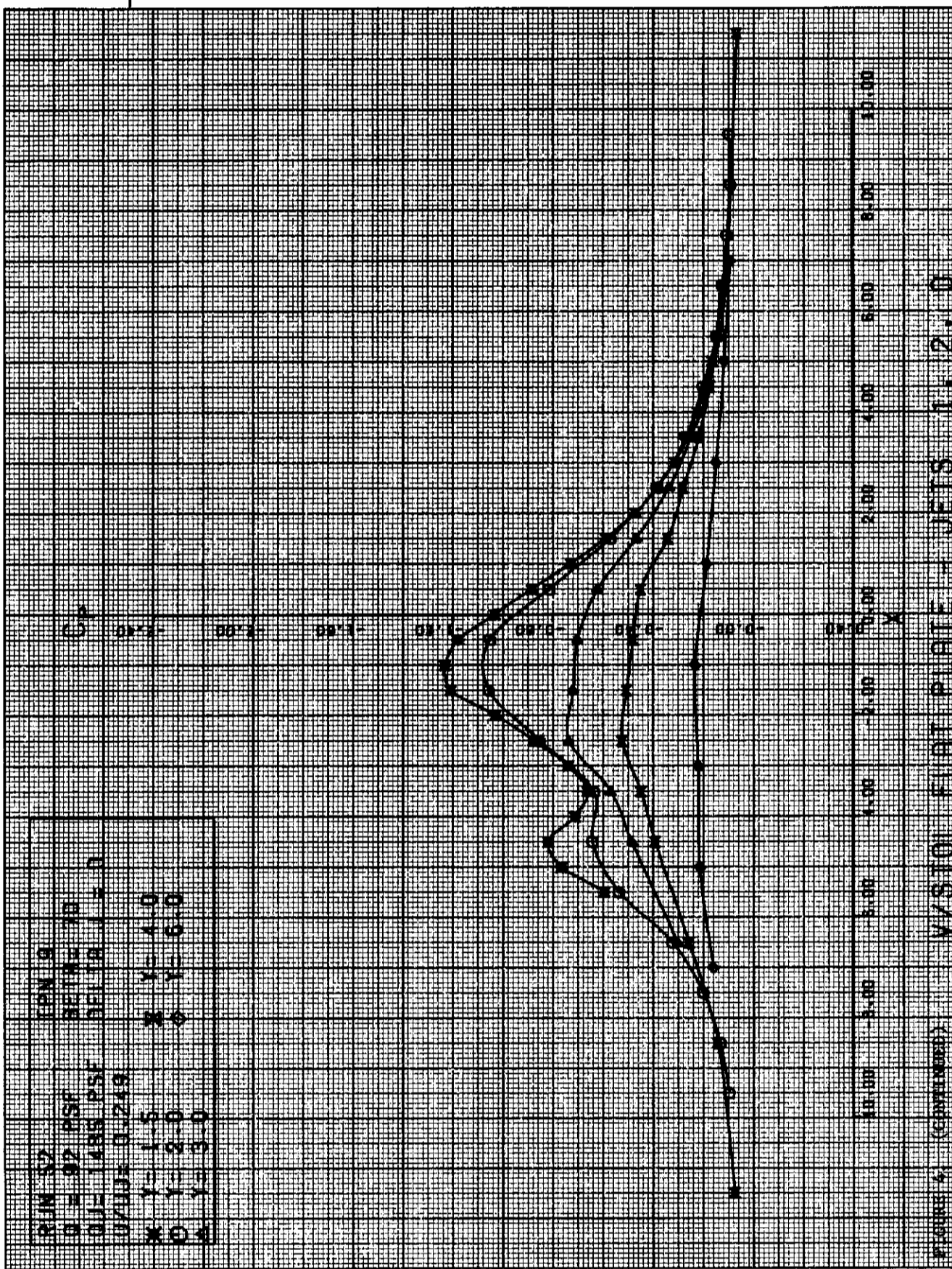


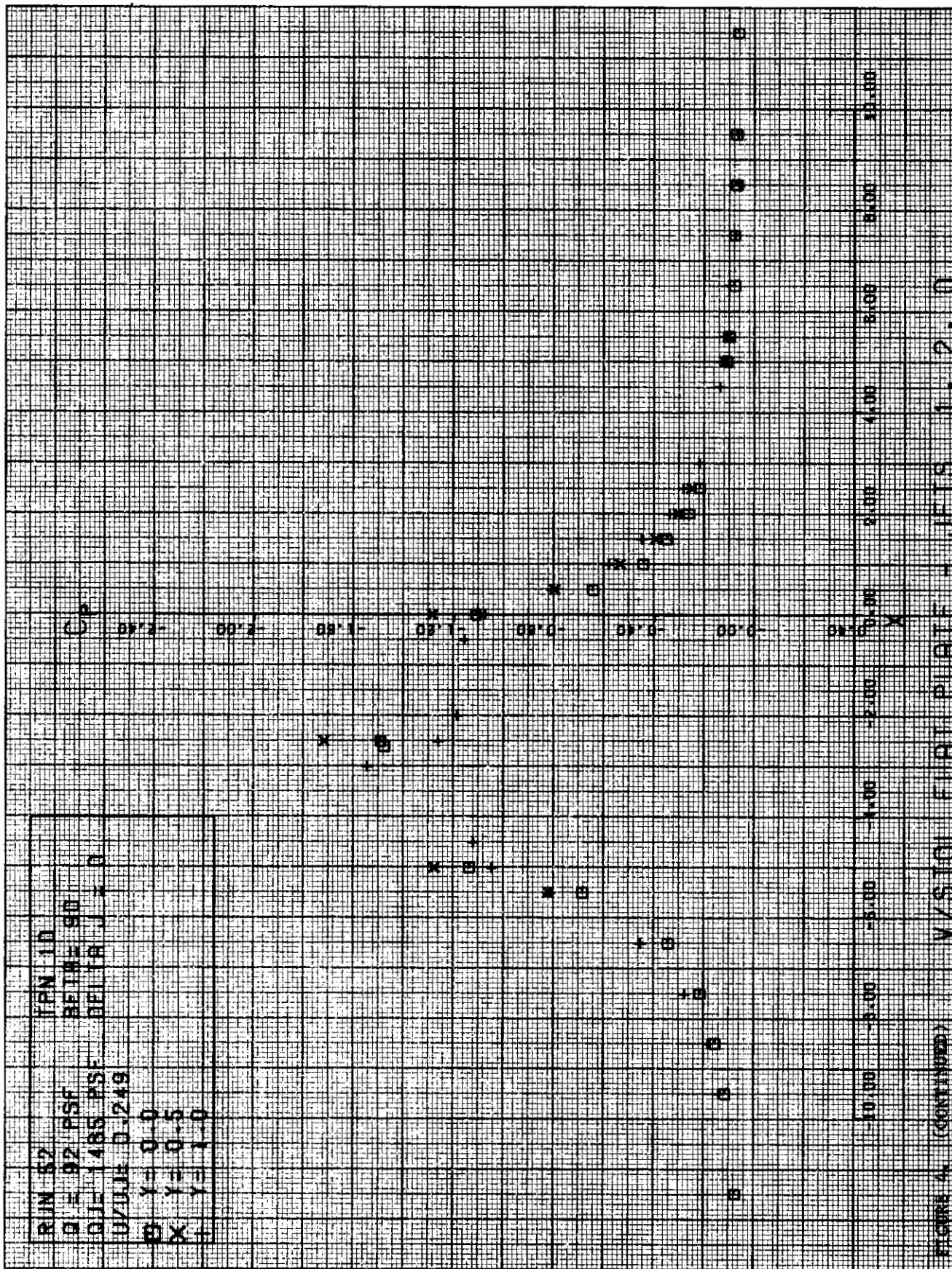












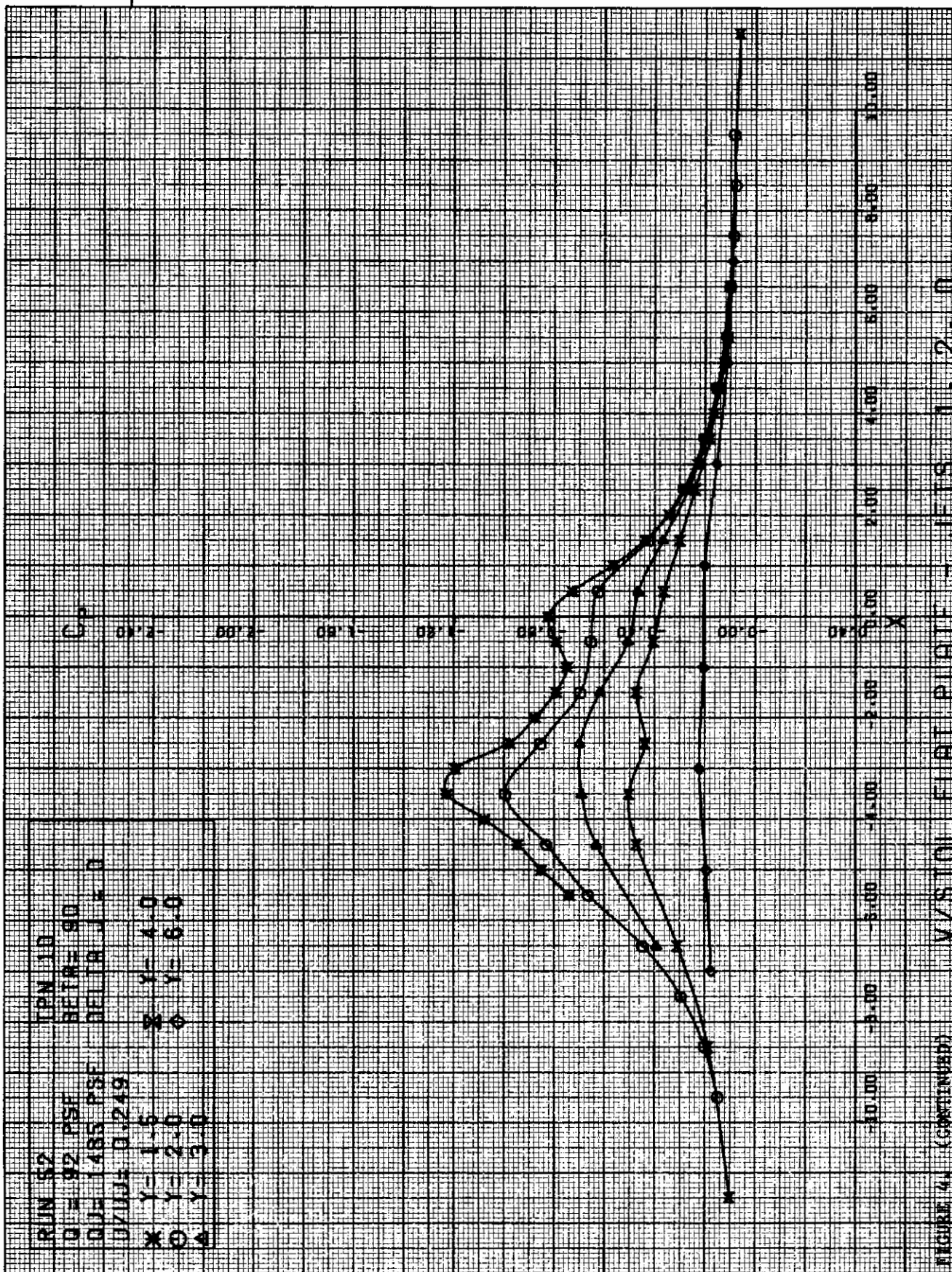
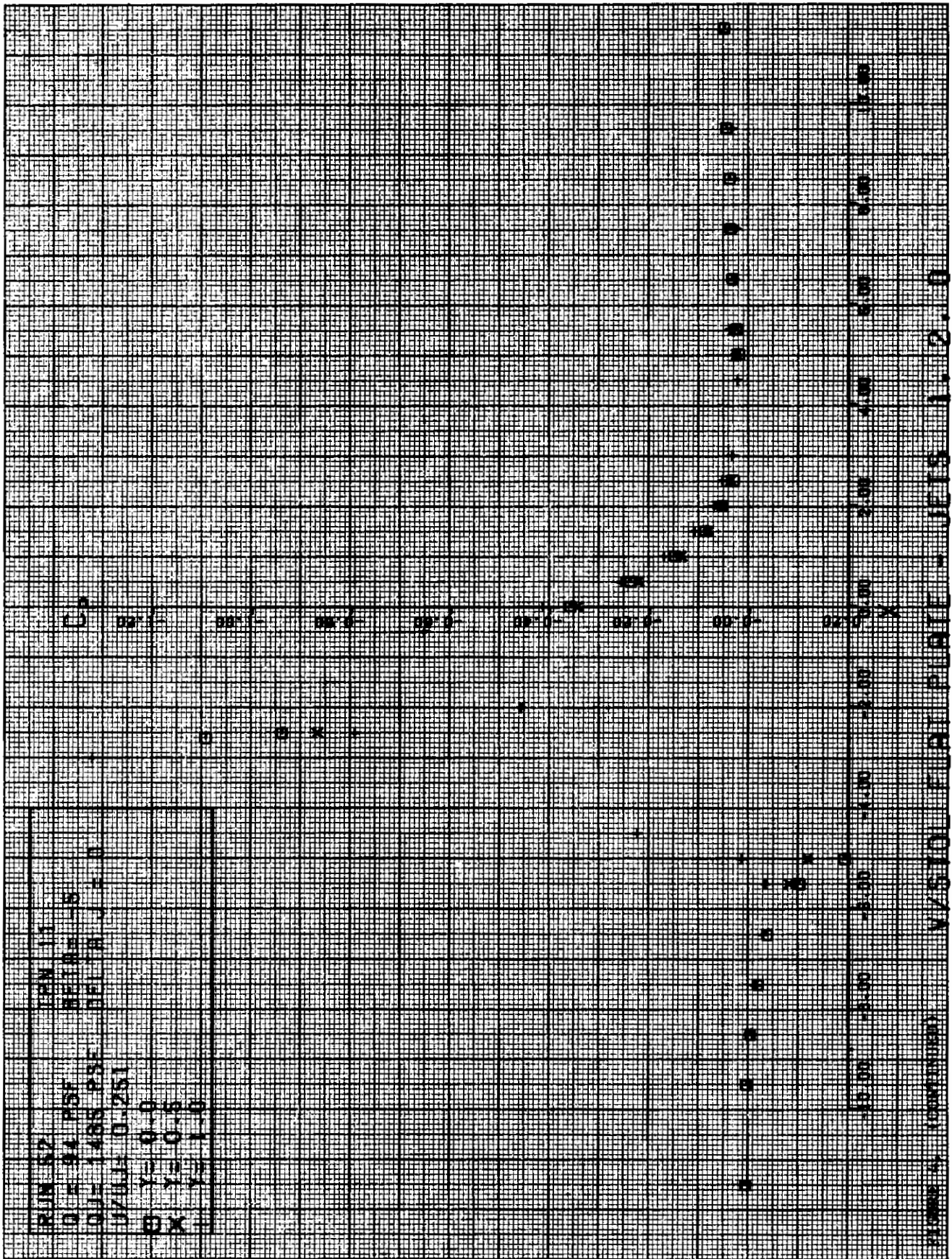
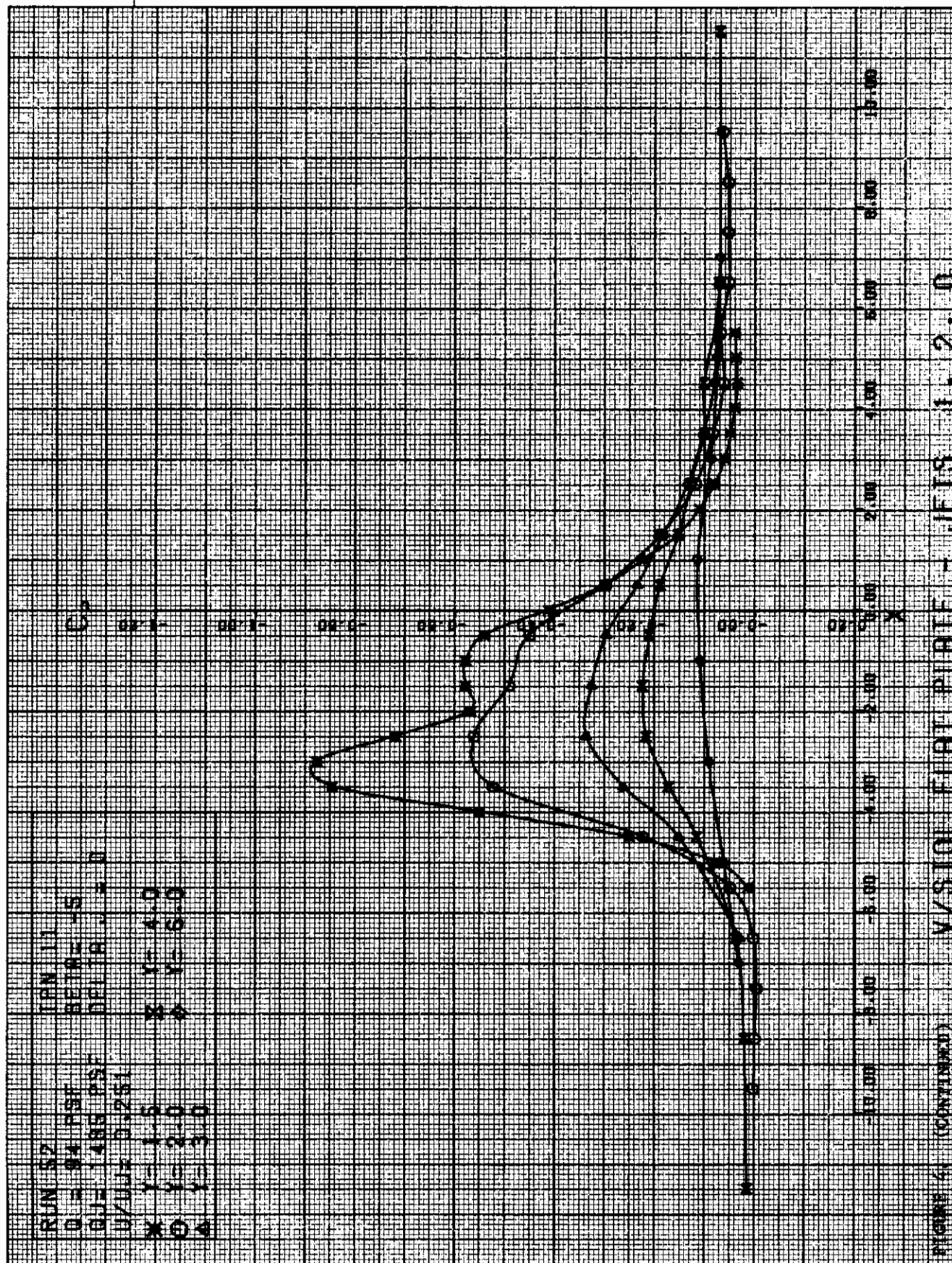
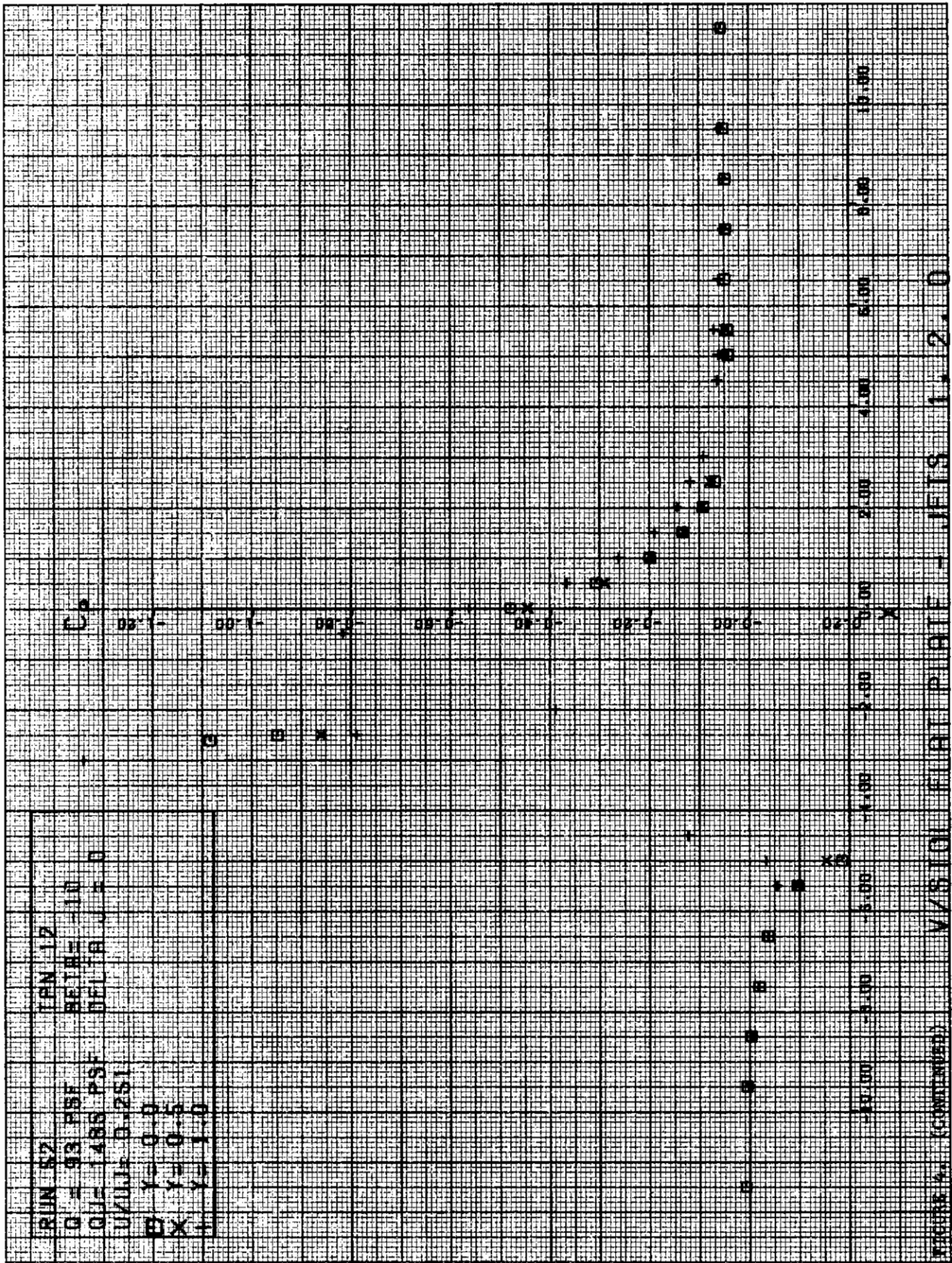
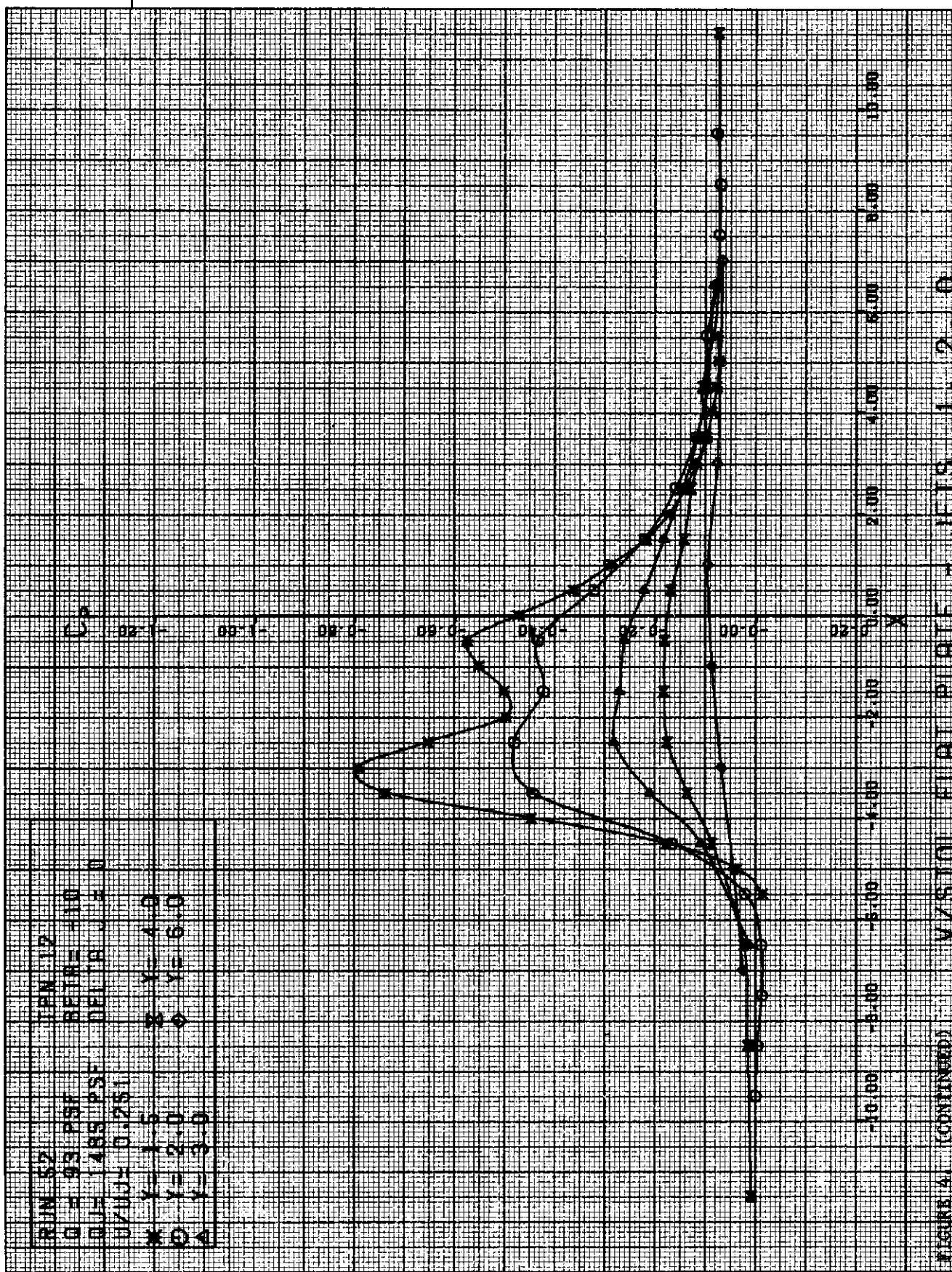


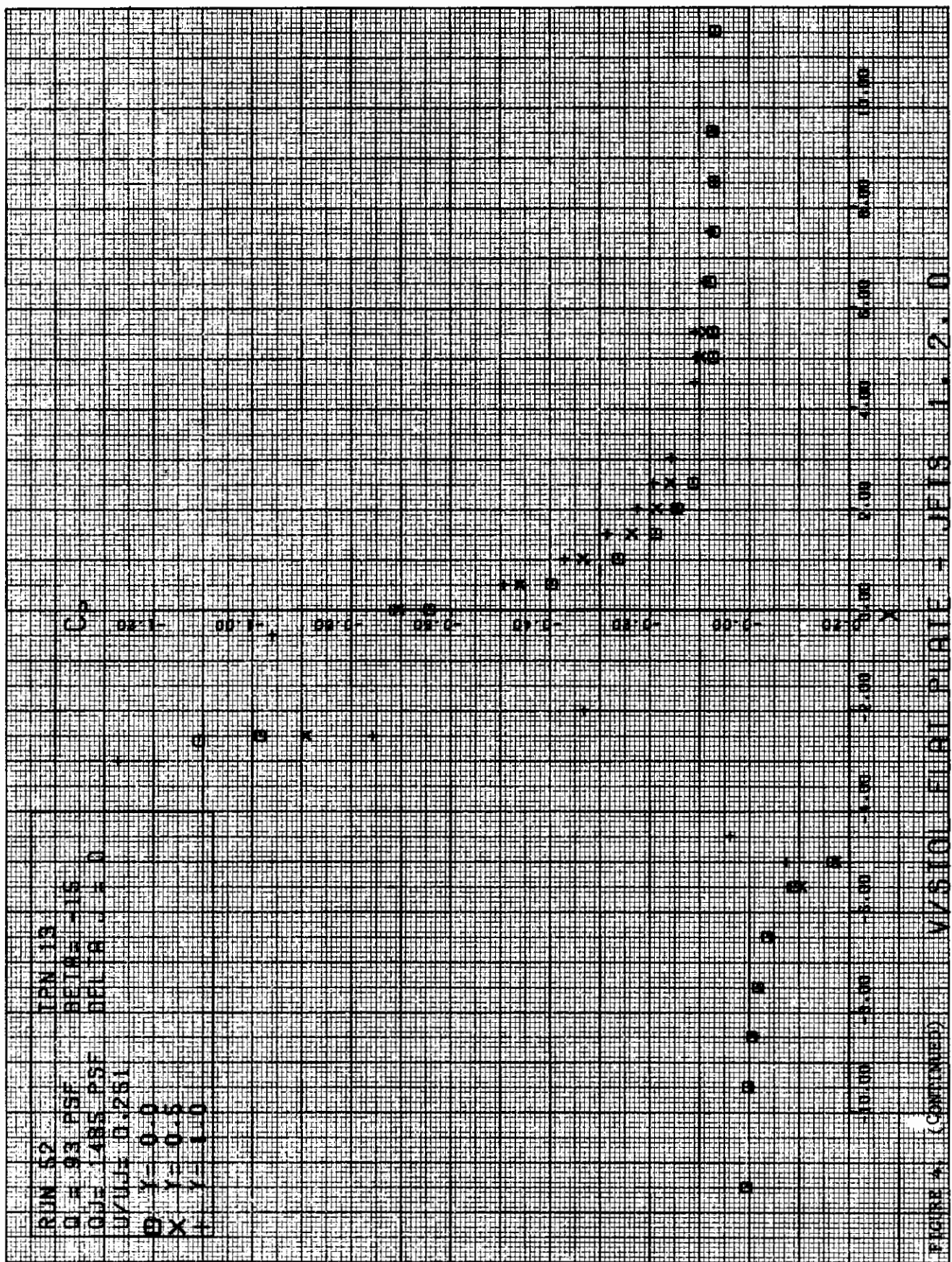
FIGURE 4. (CONTINUED) W/STON FLAT PLATE - JETS 1, 2, 0

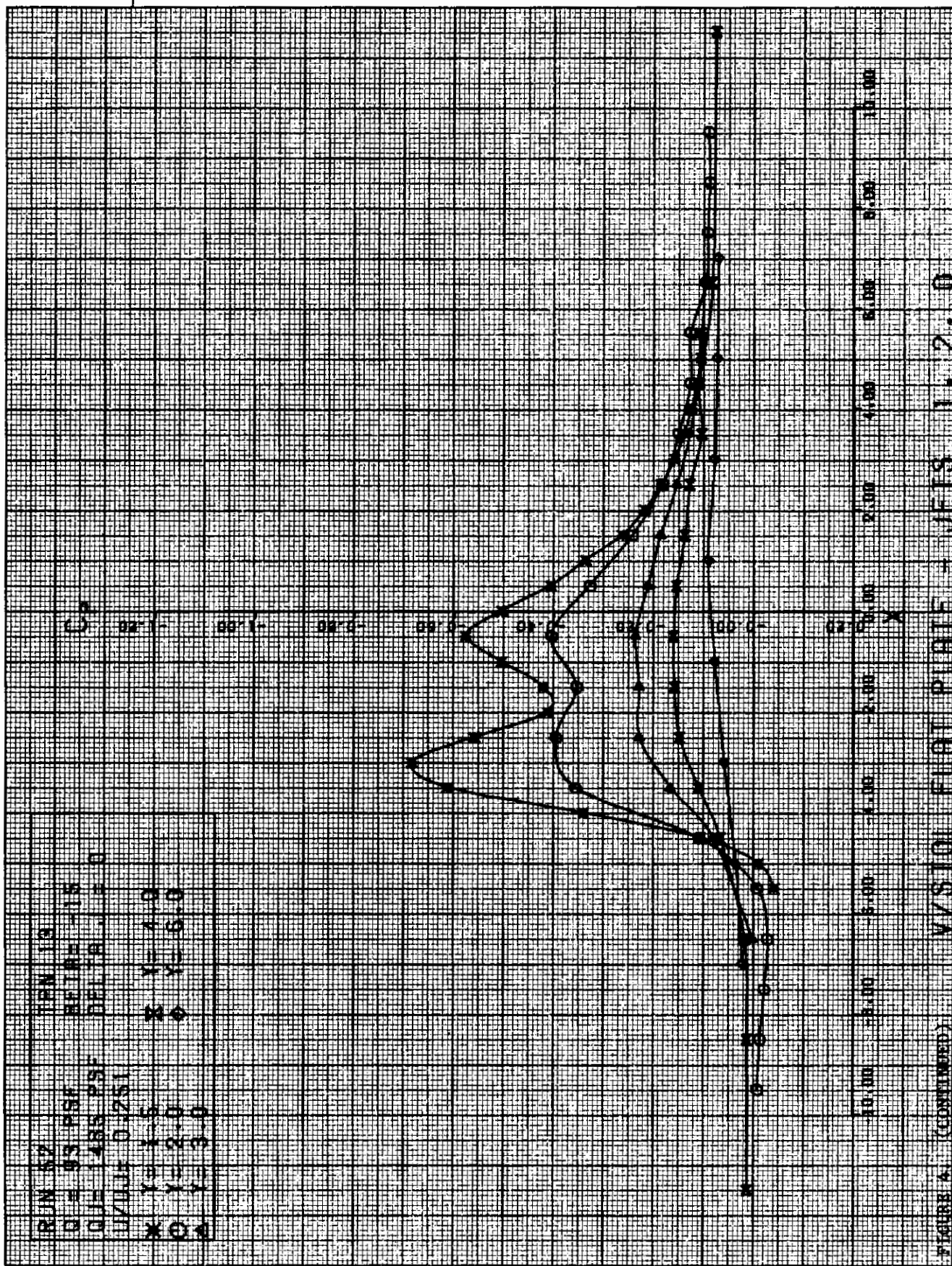


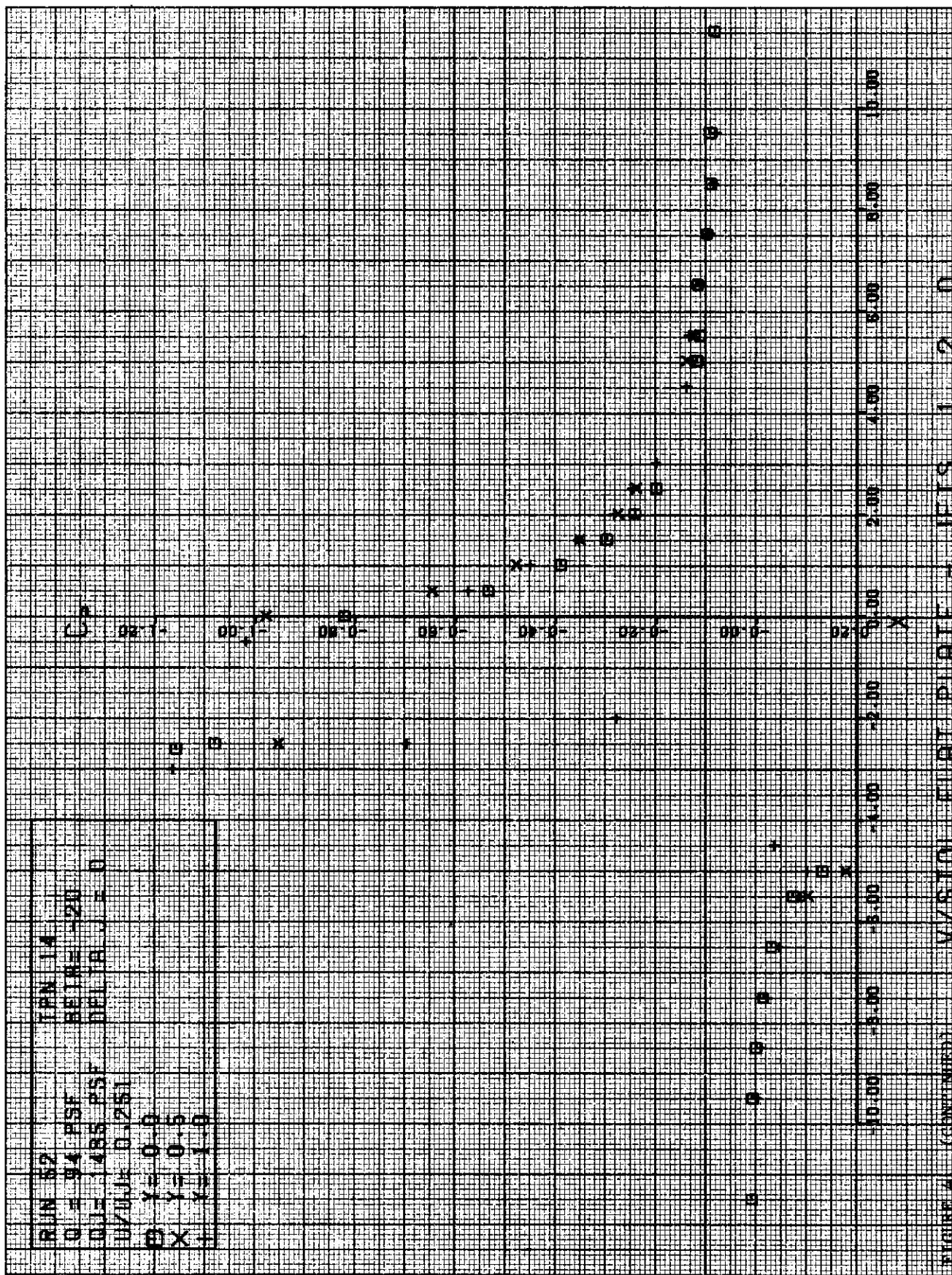












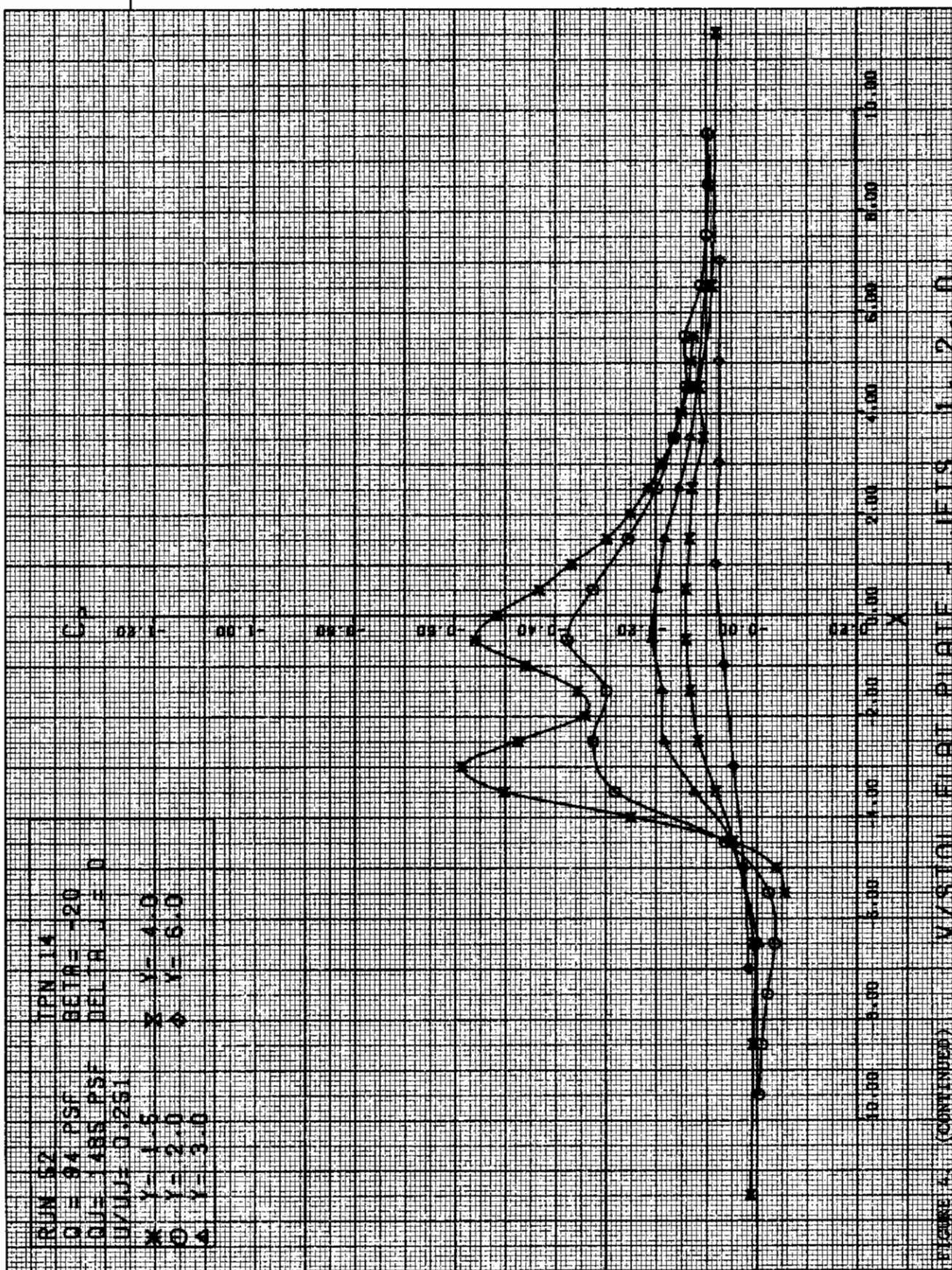
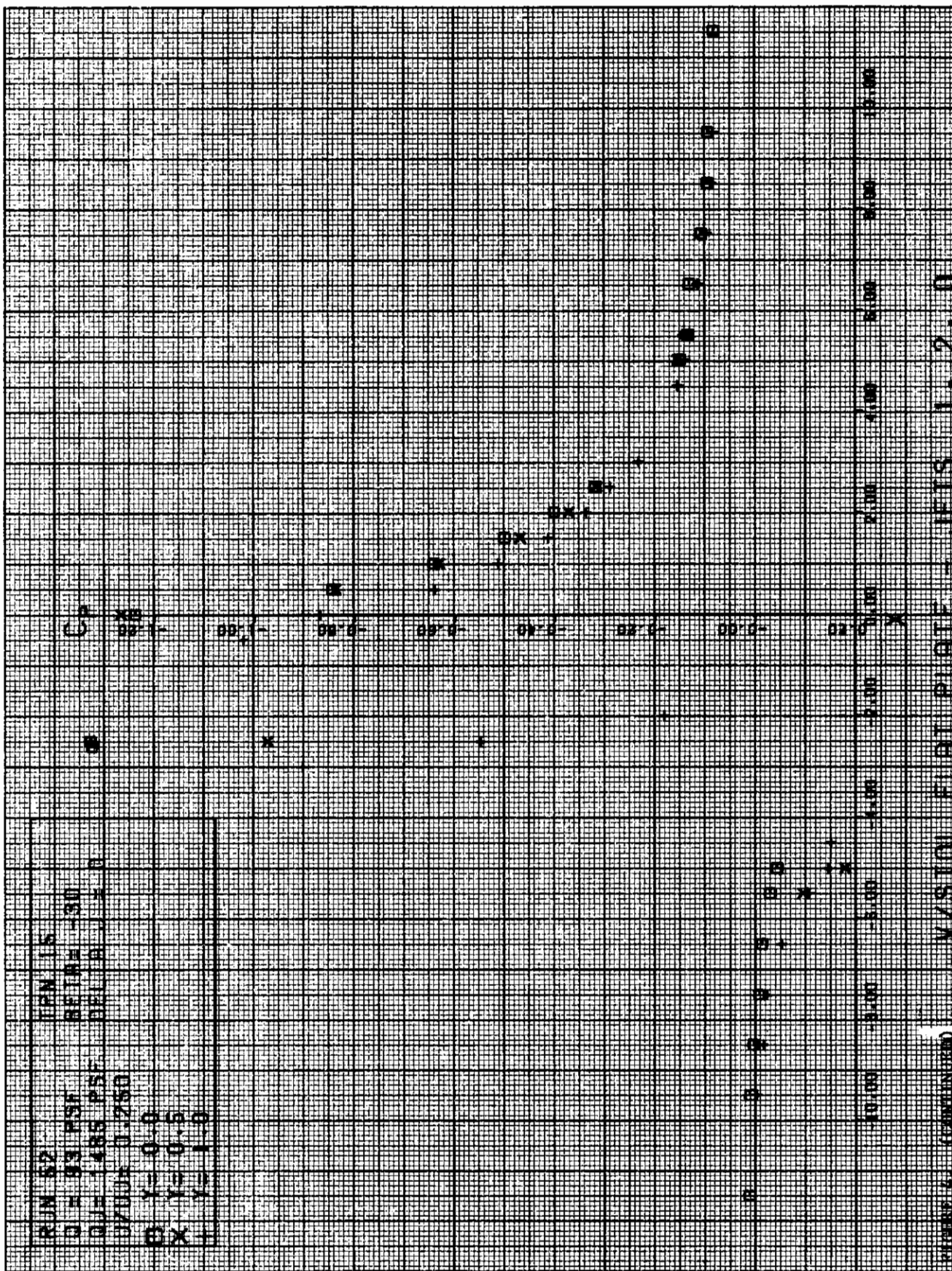
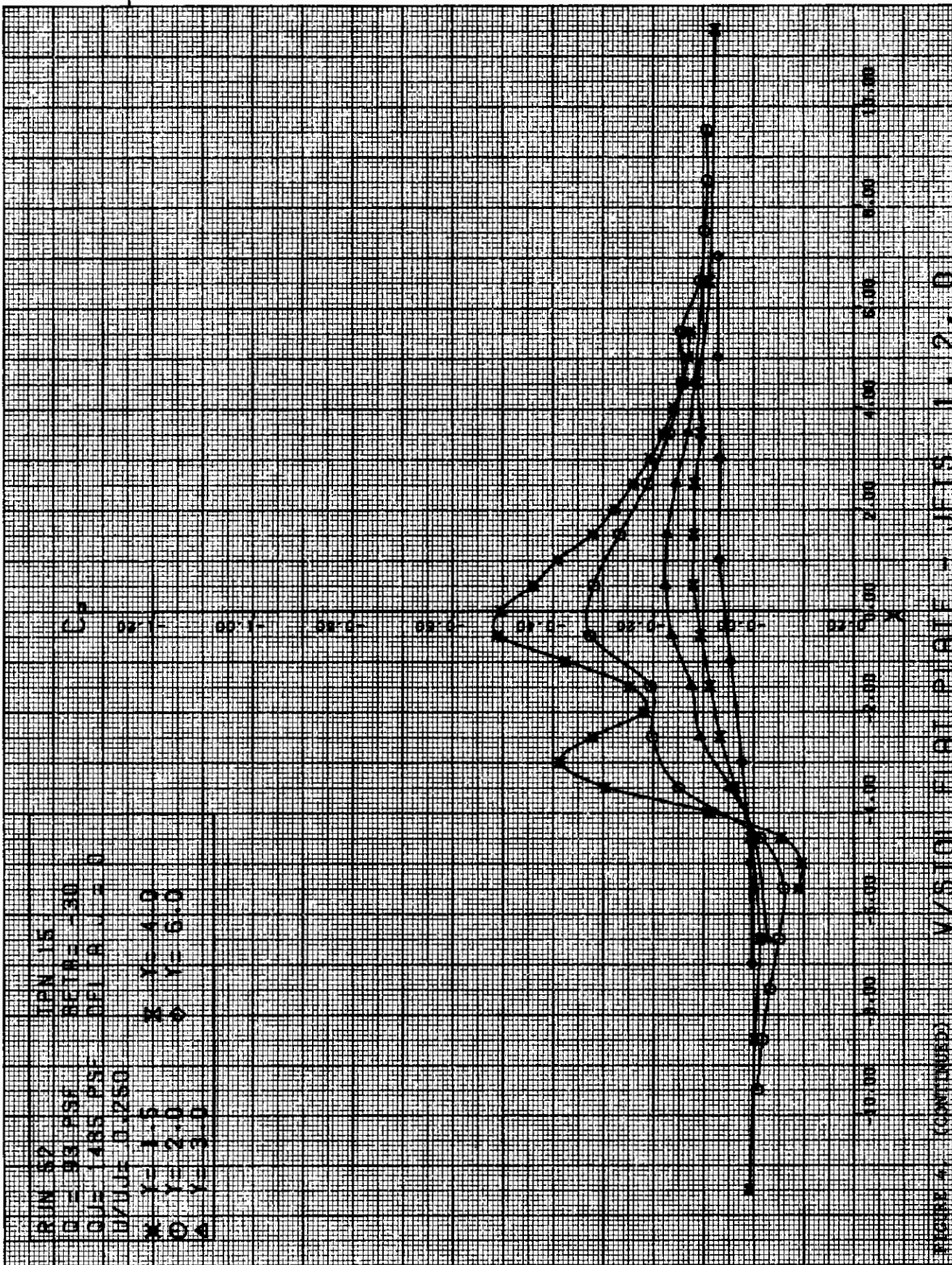


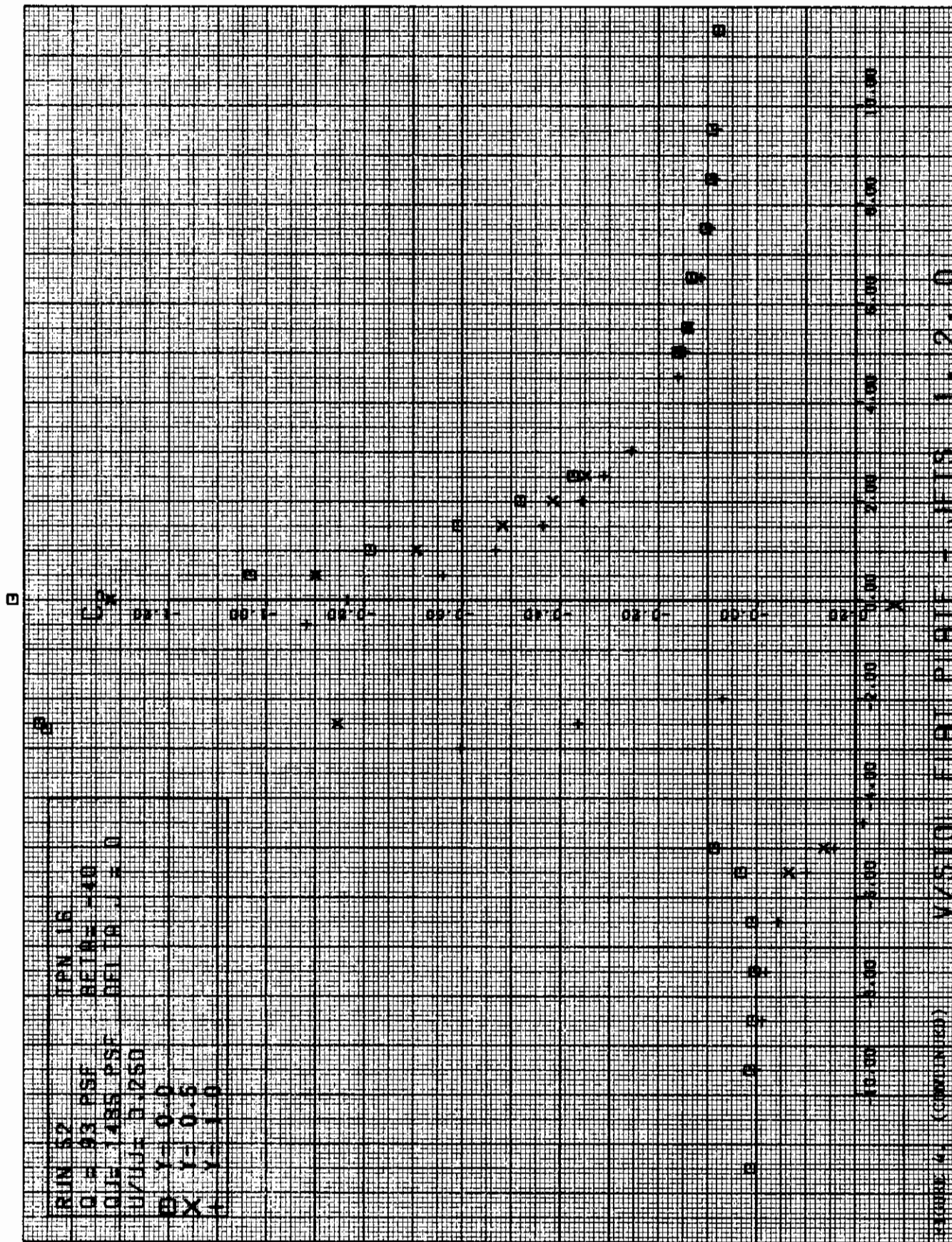
FIGURE 4. (CONTINUED) V/S101 FLAT PLATE - JF18 1, 2, D





RUN 52 IPN 15
 Q = 93 PSF BETR = 30
 Q15 = 485 PSF DEL R = 0
 D/DUE 0.250
 W Y = 1.5 X = 4.0
 Q Y = 2.0 X = 6.0
 A Y = 3.0 X = 3.0

FIGURE 6. (CONTINUED) V/S101 FLAT PLATE - JETS 1. 2. 0



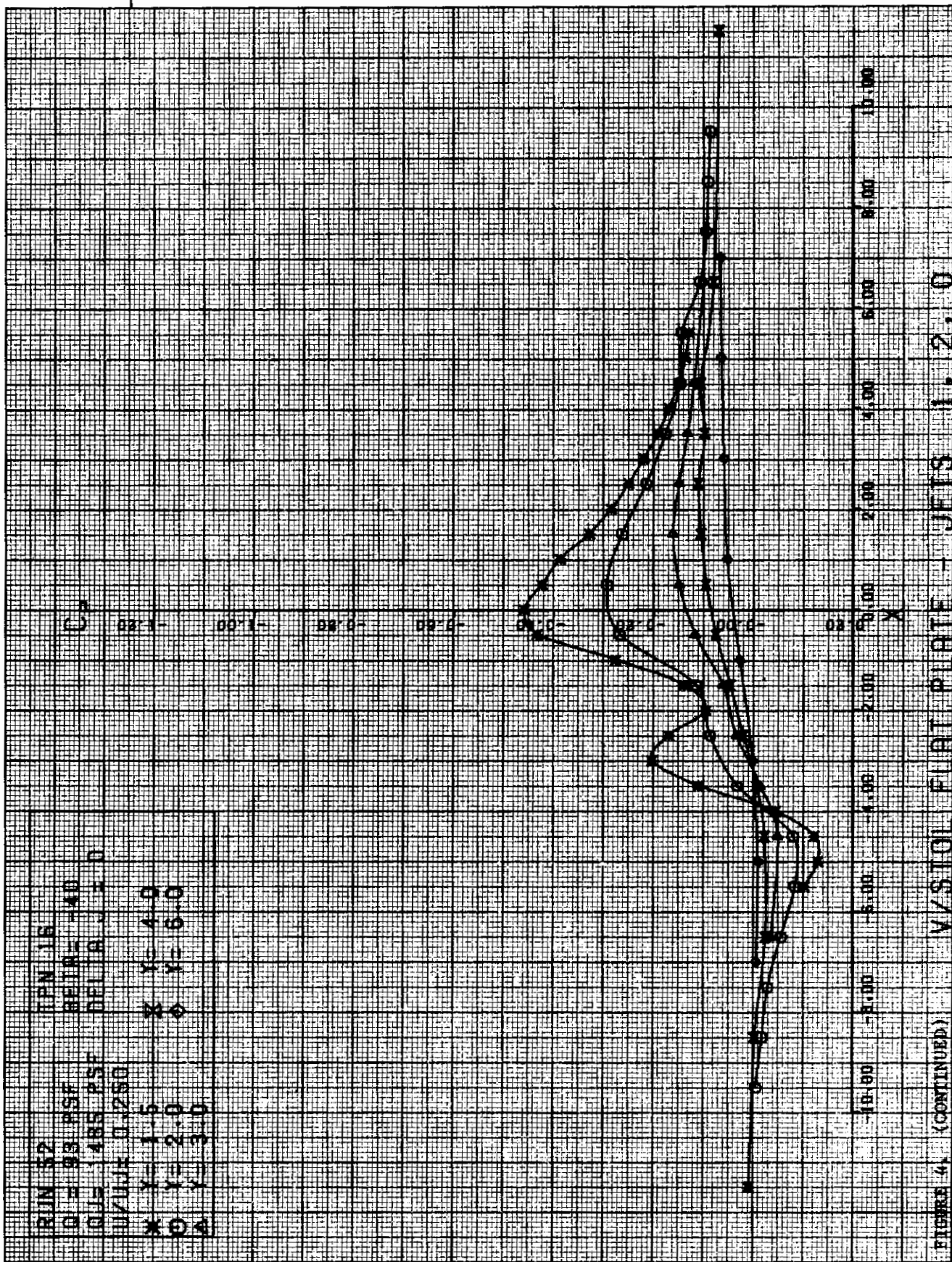
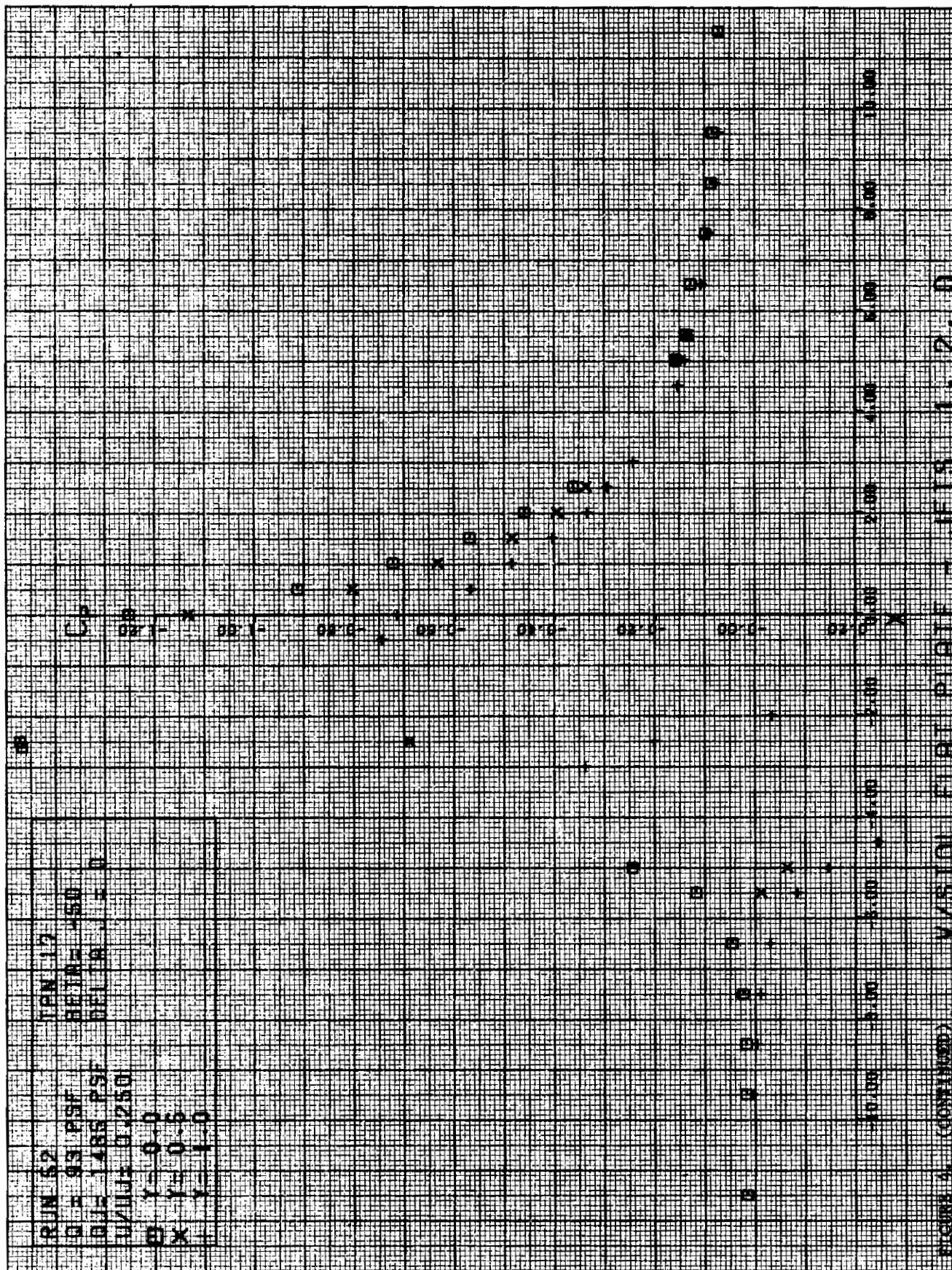
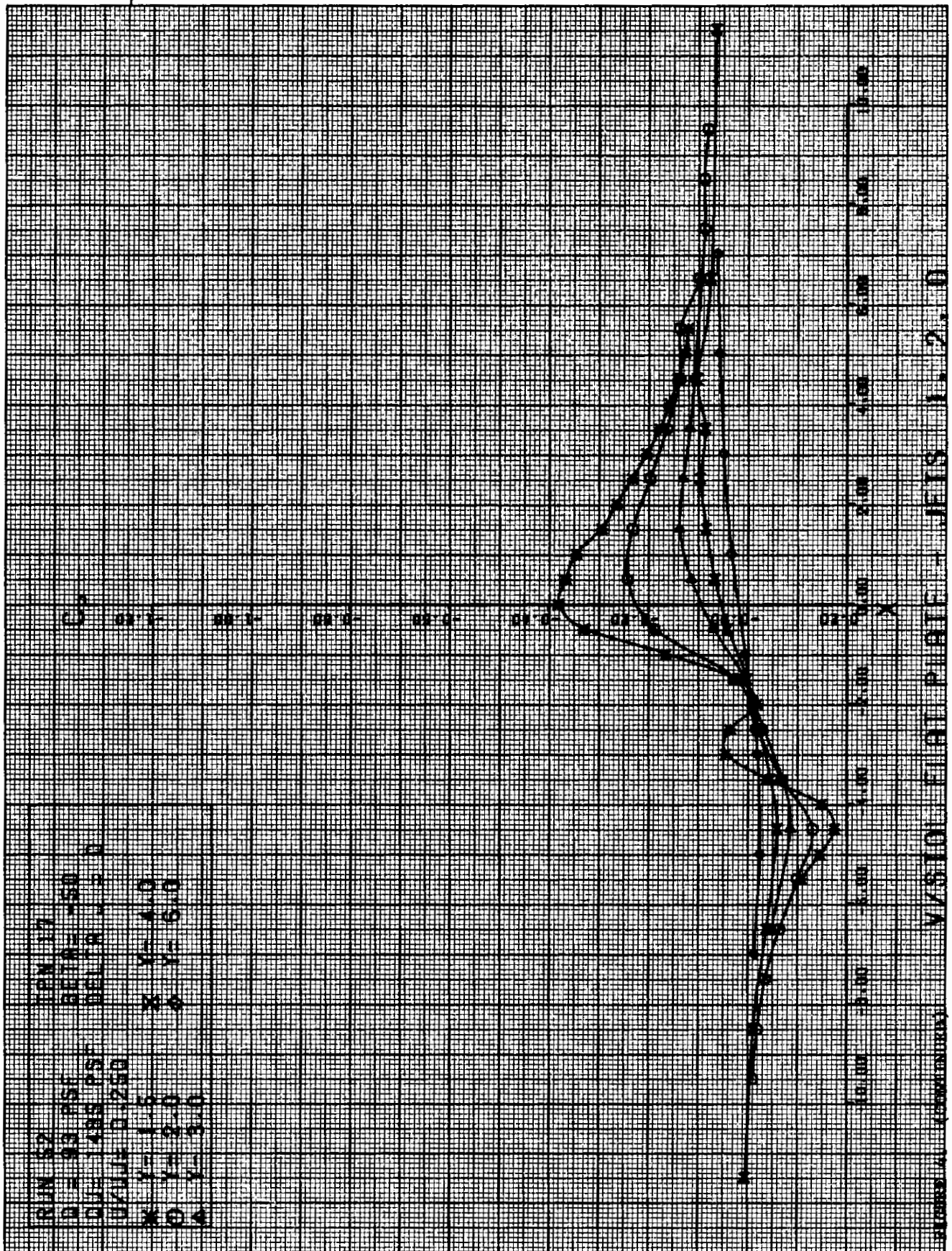
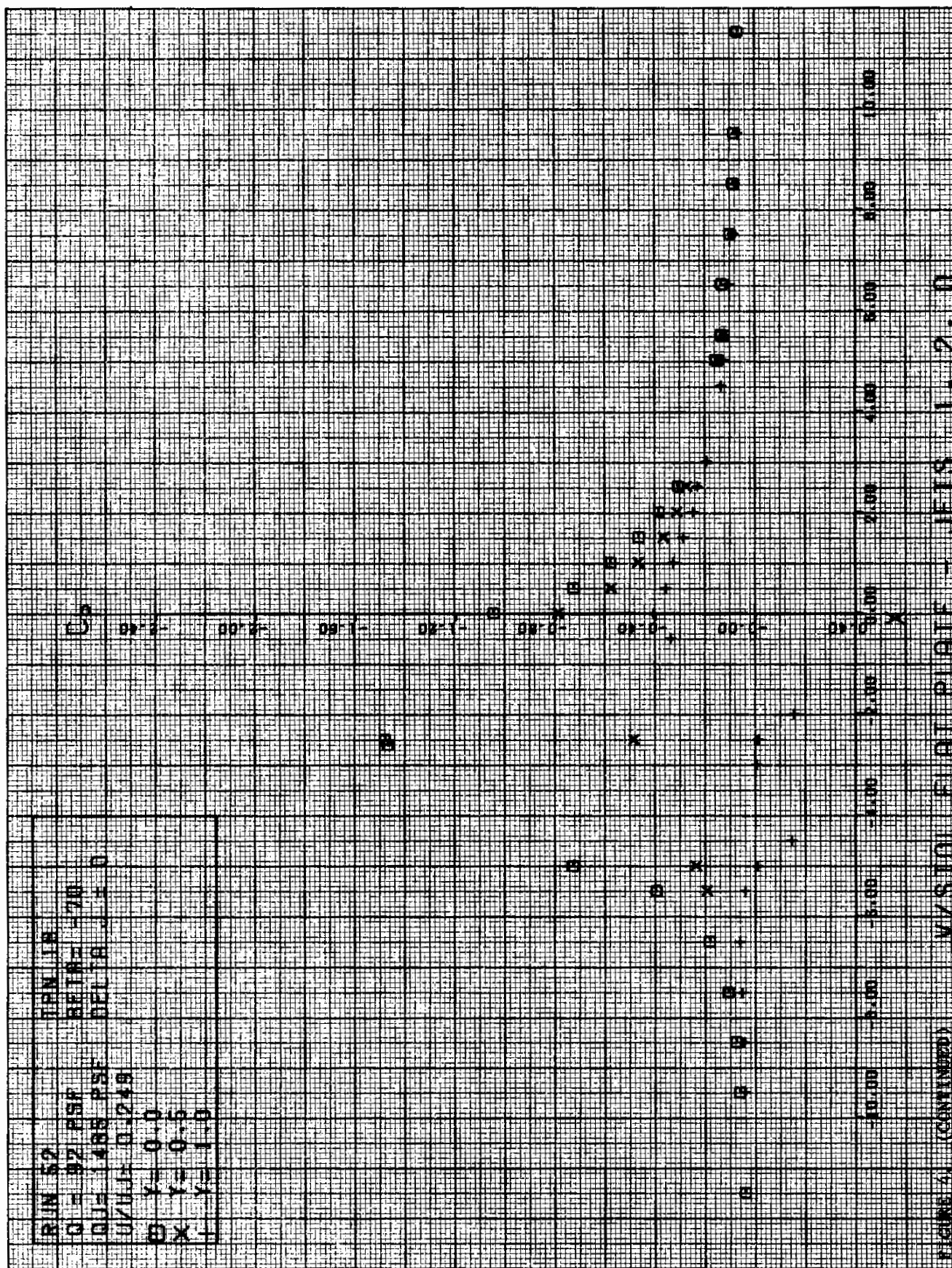
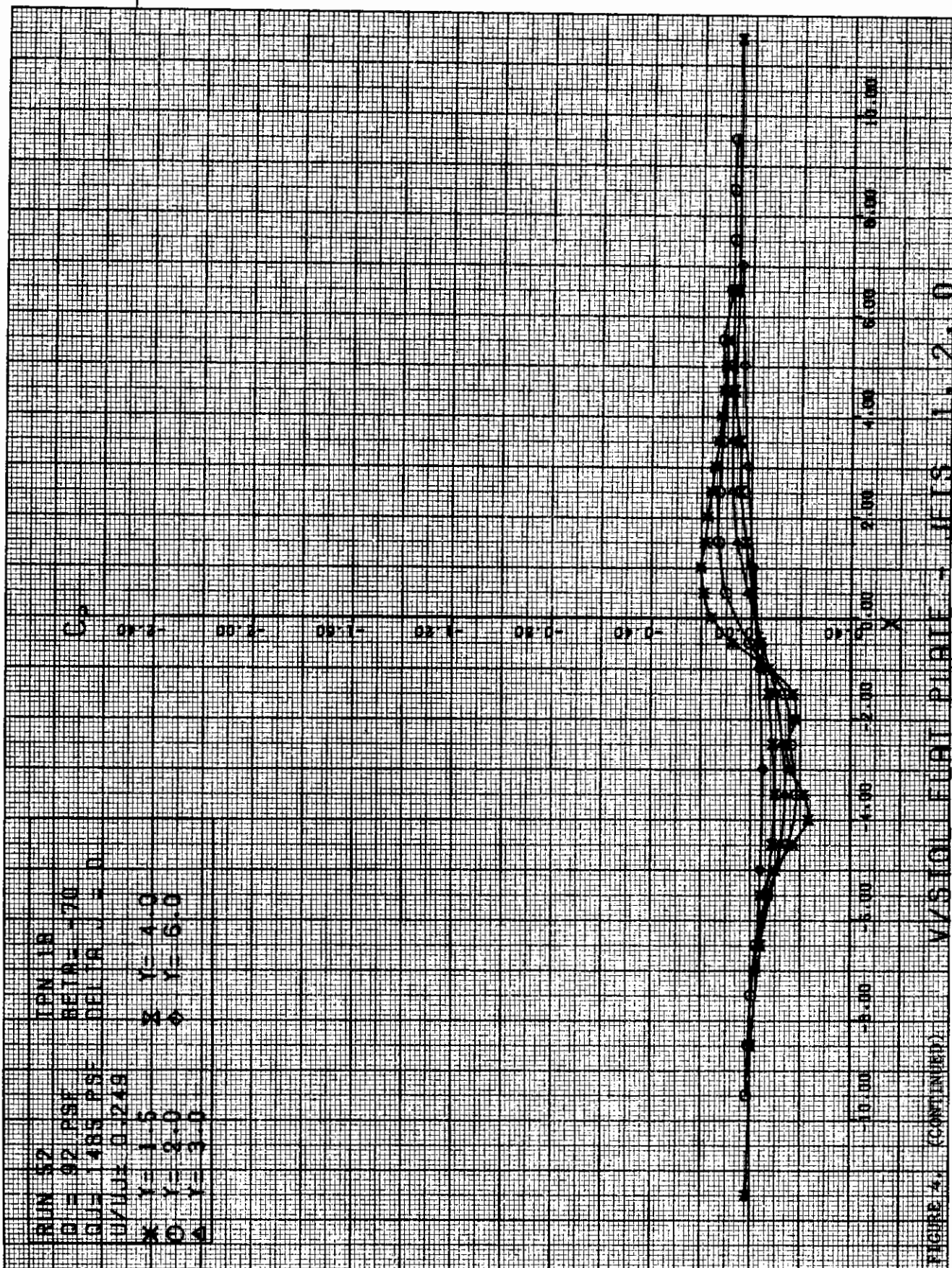


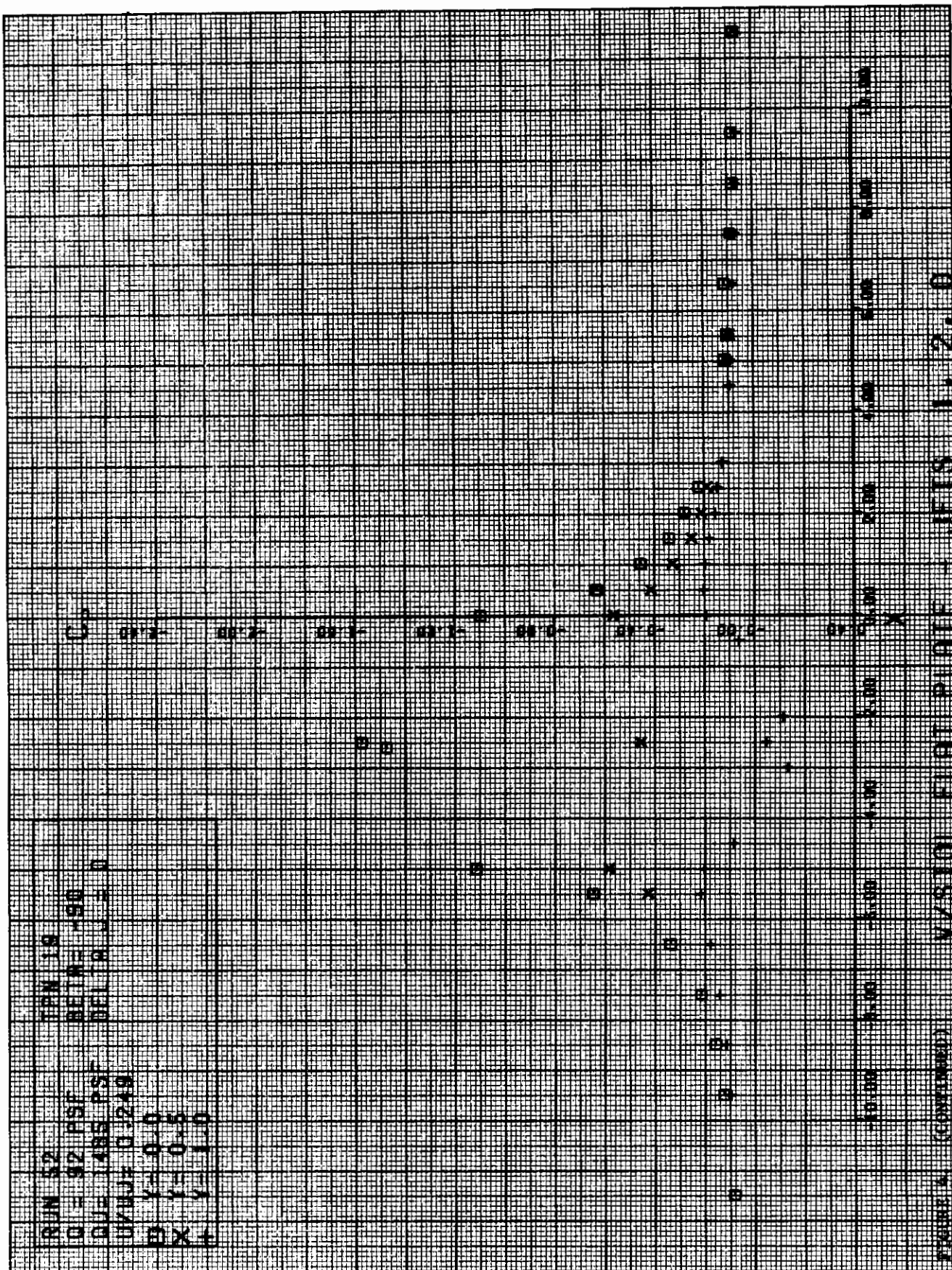
FIGURE 4. (CONTINUED) V/STOIL FLAT PLATE - JETS 1, 2, 3, 0

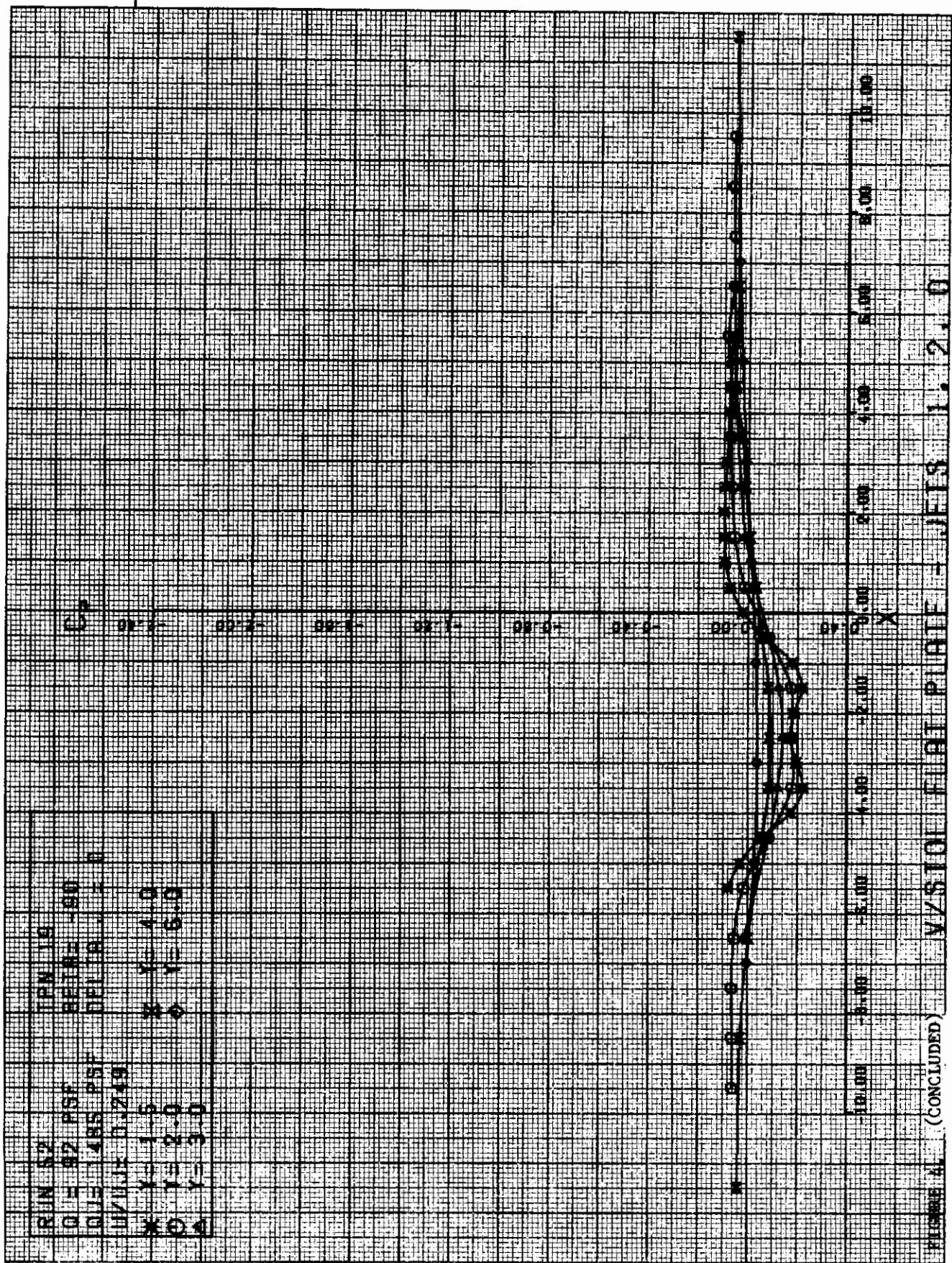


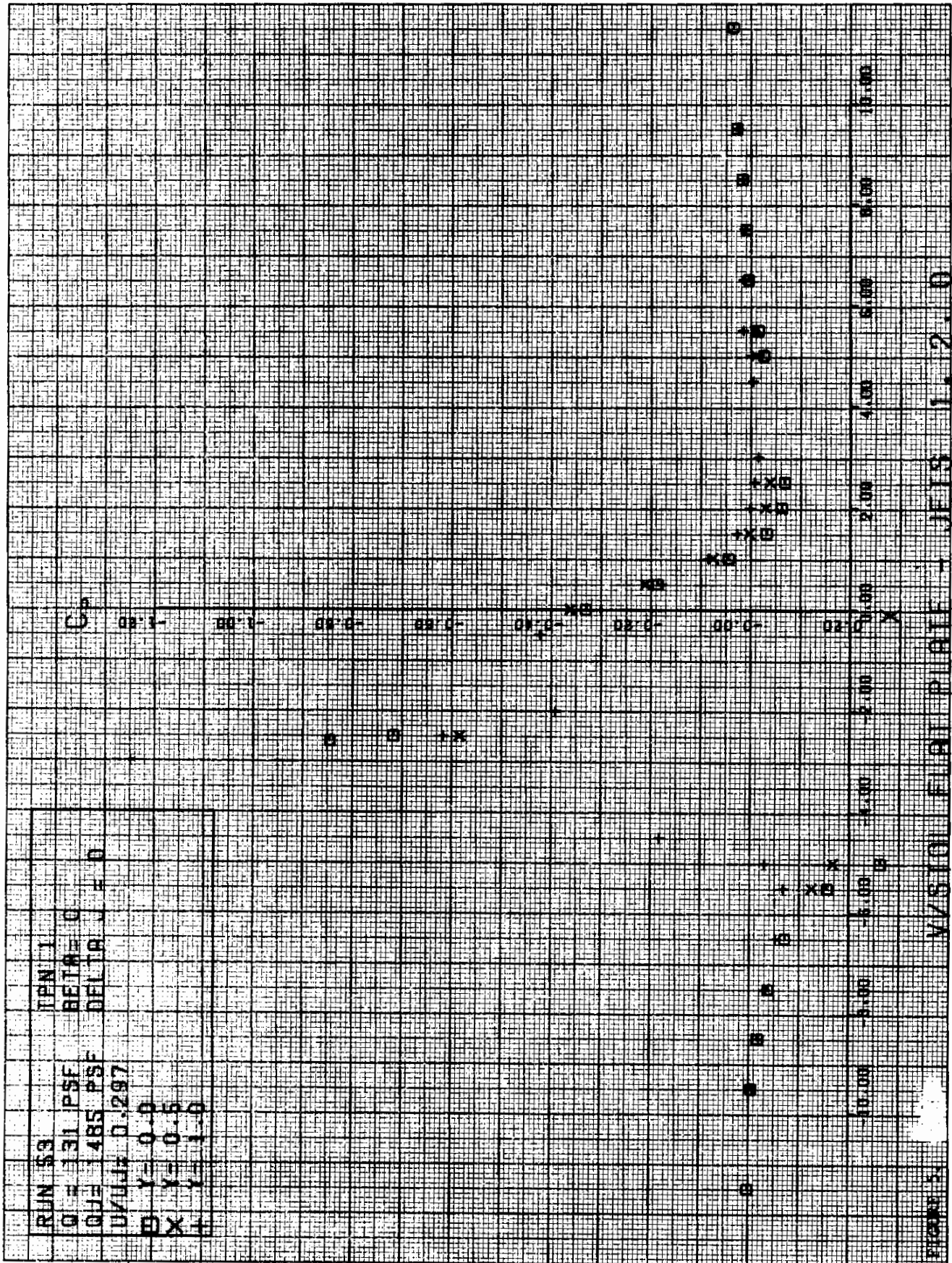


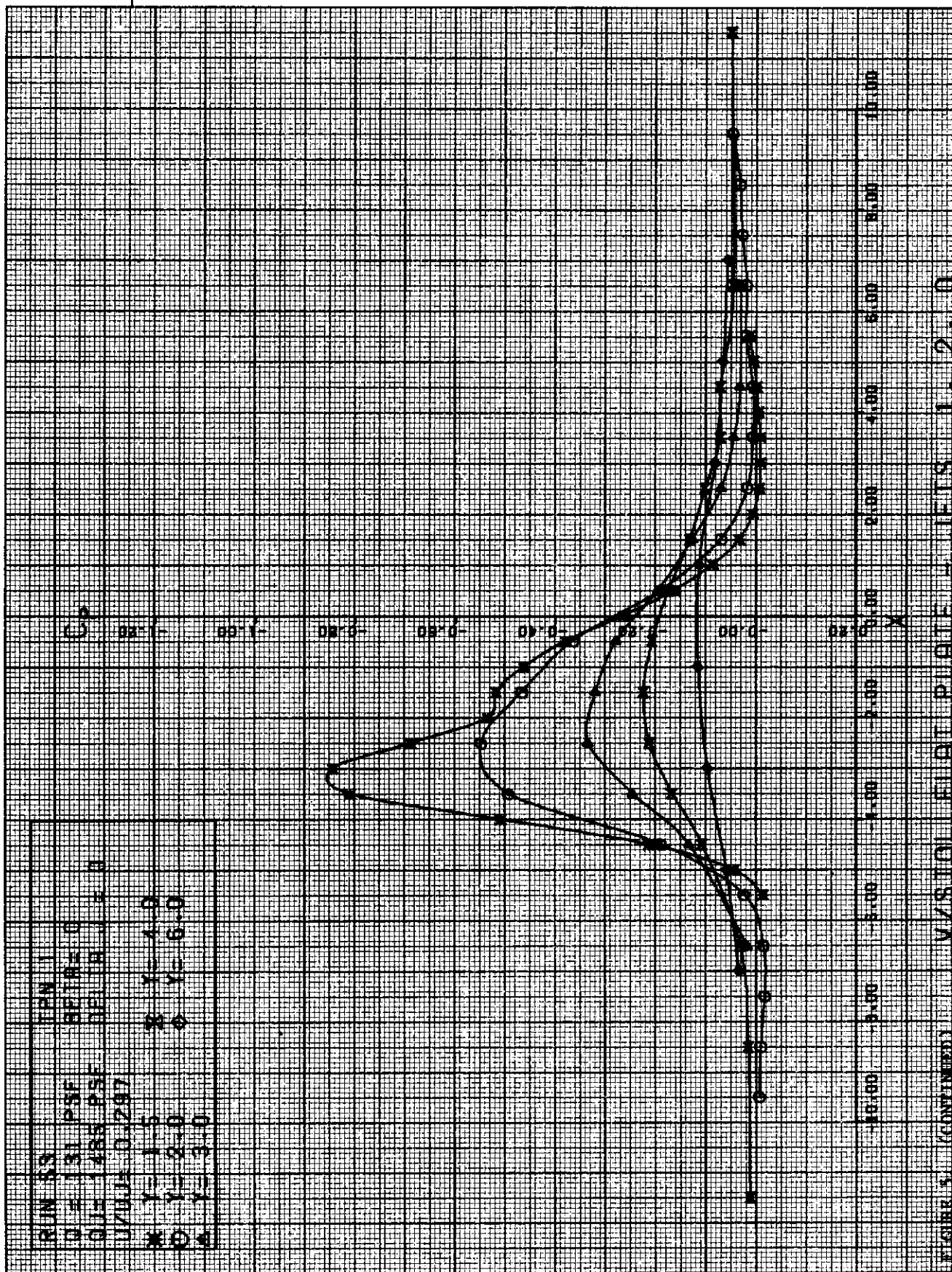


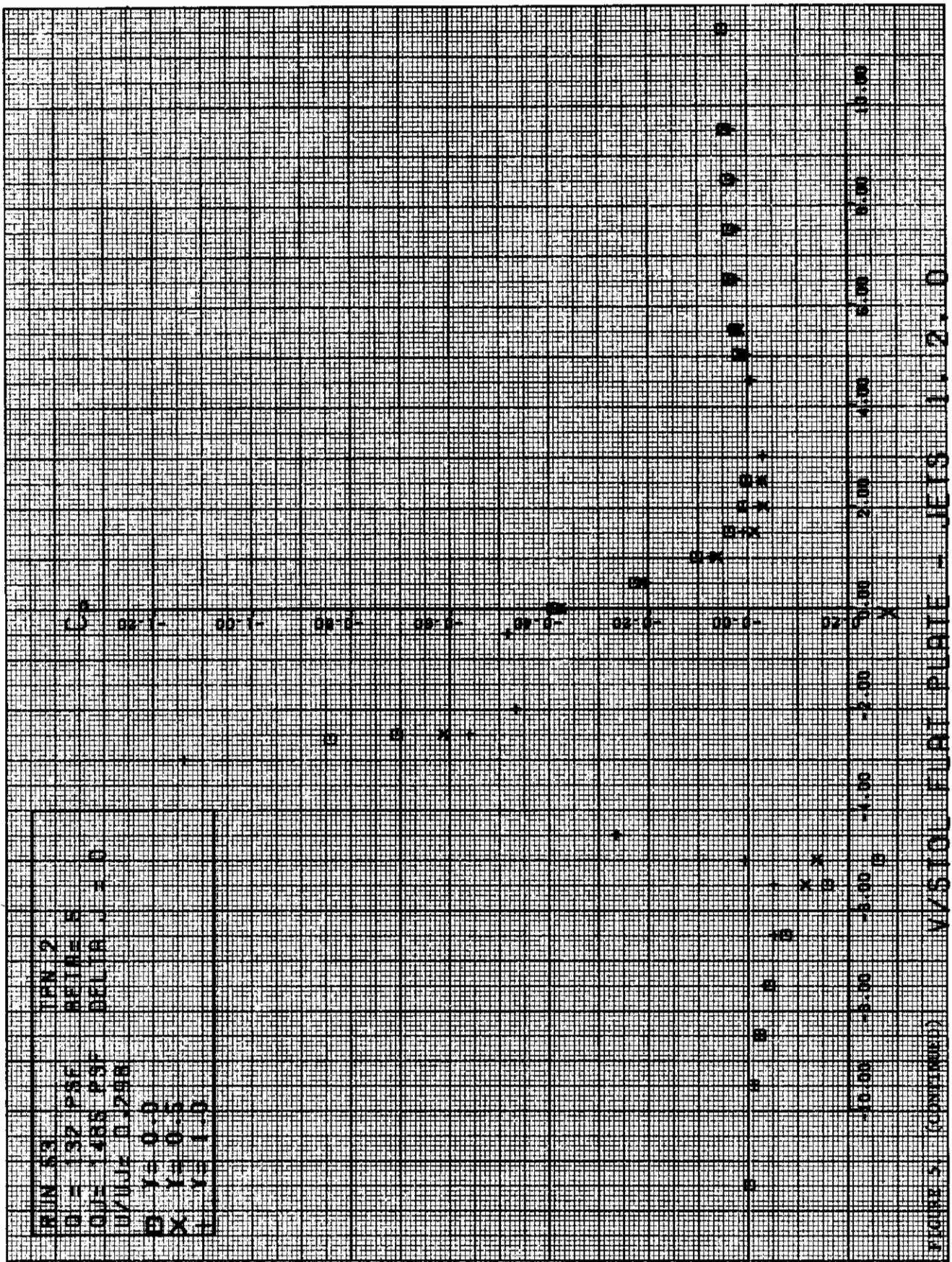


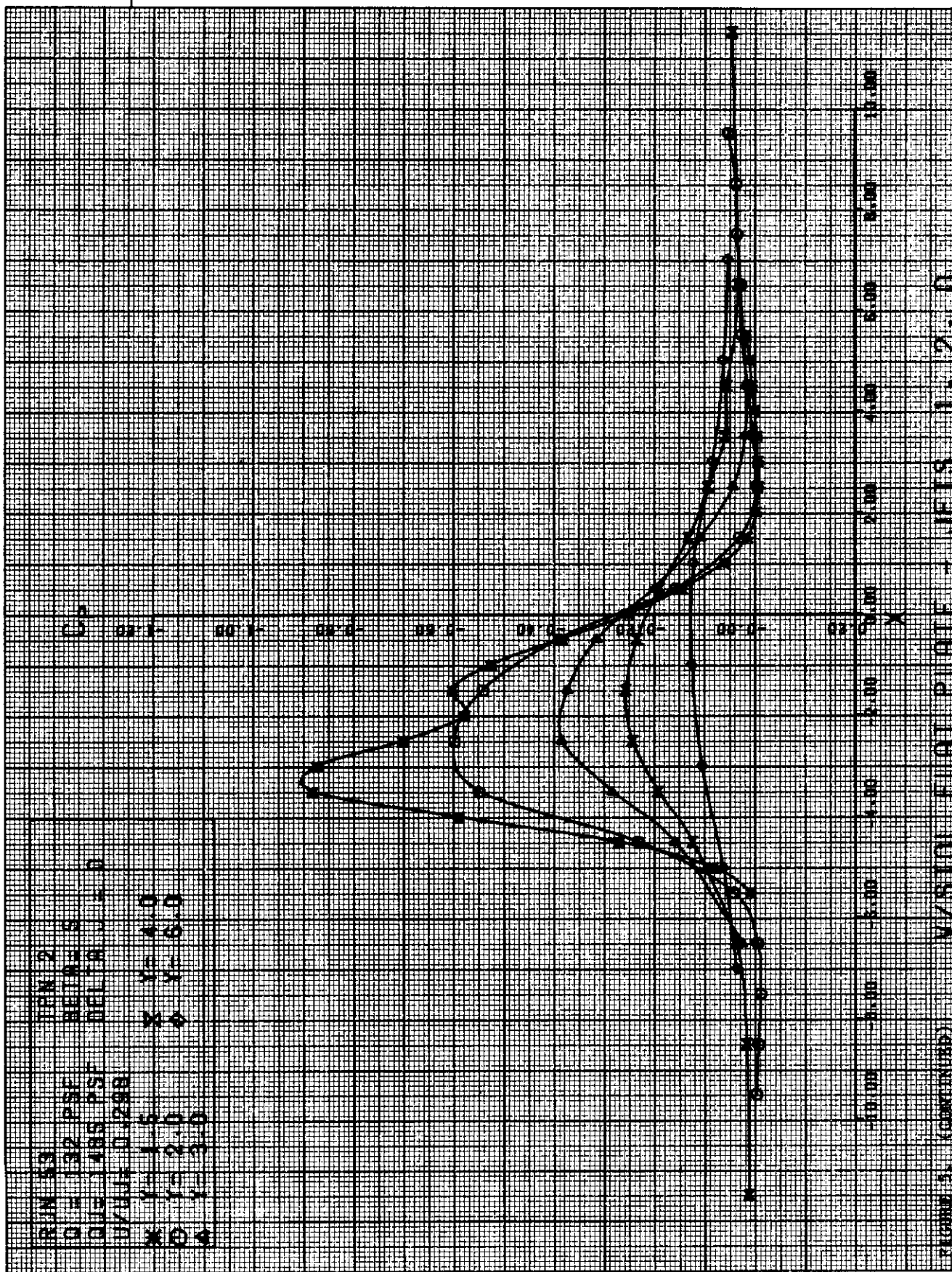












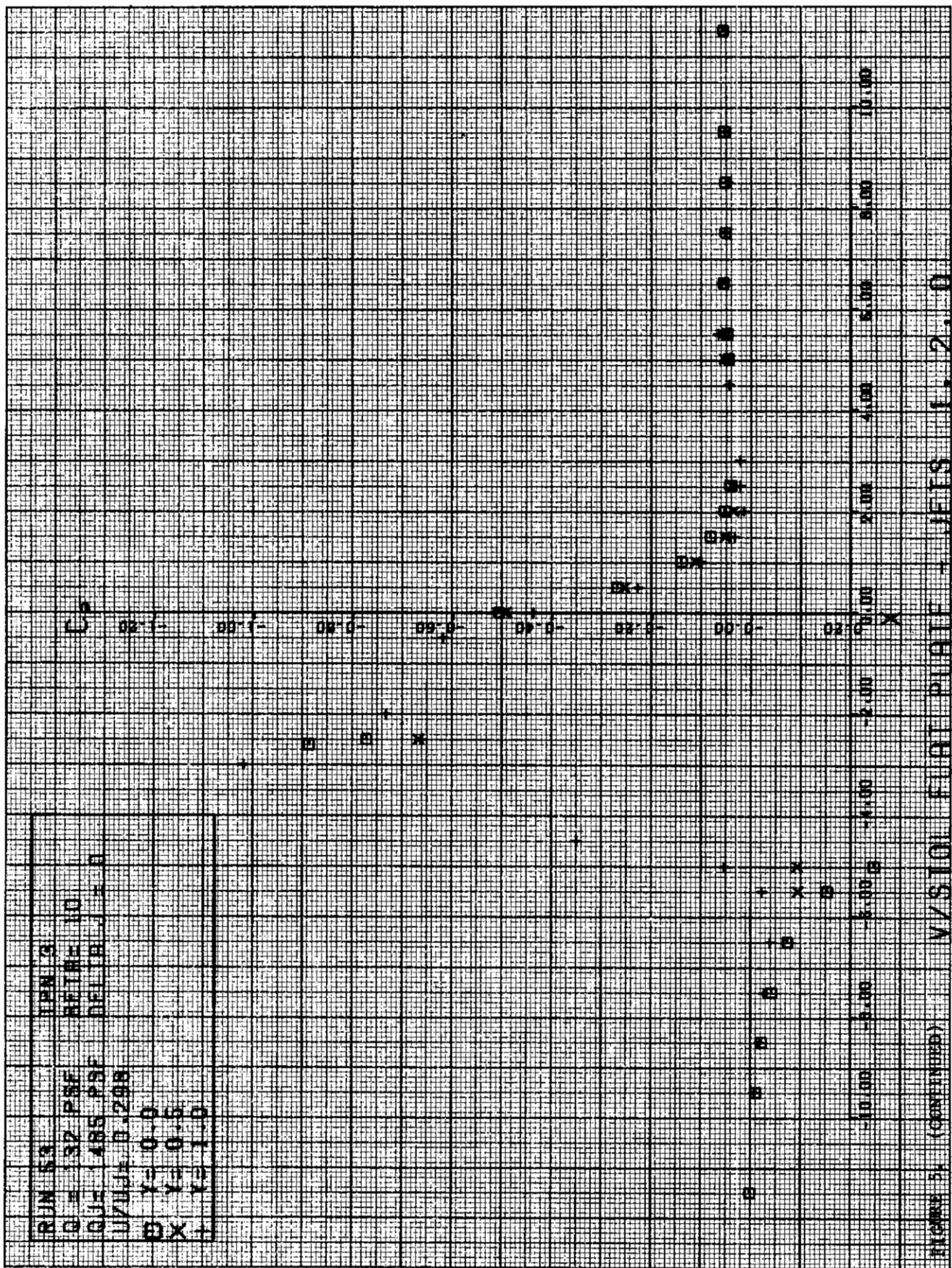


FIGURE 5. (CONTINUED) V/STOL FLAT PLATE - JETS L. 2. 0

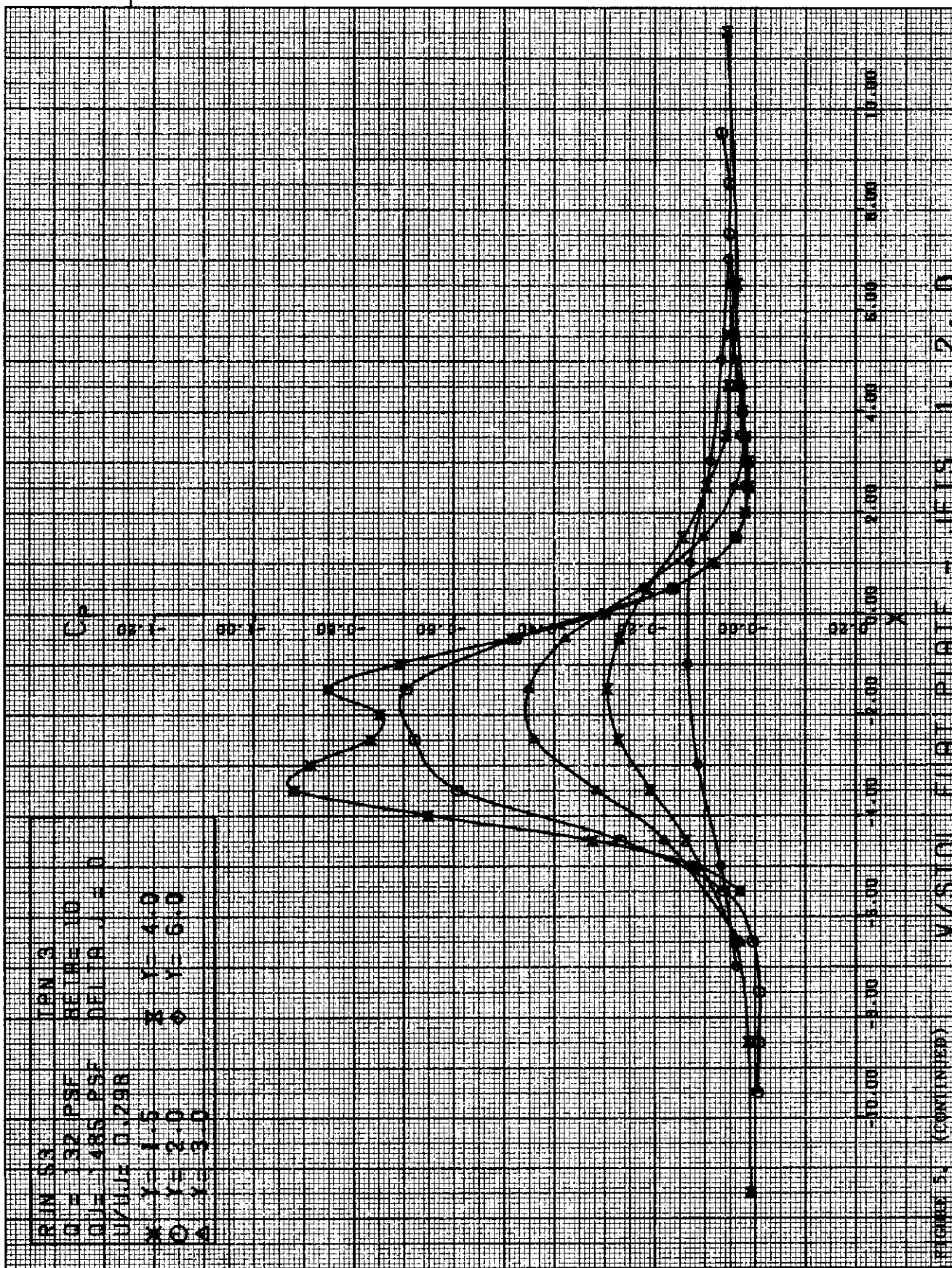
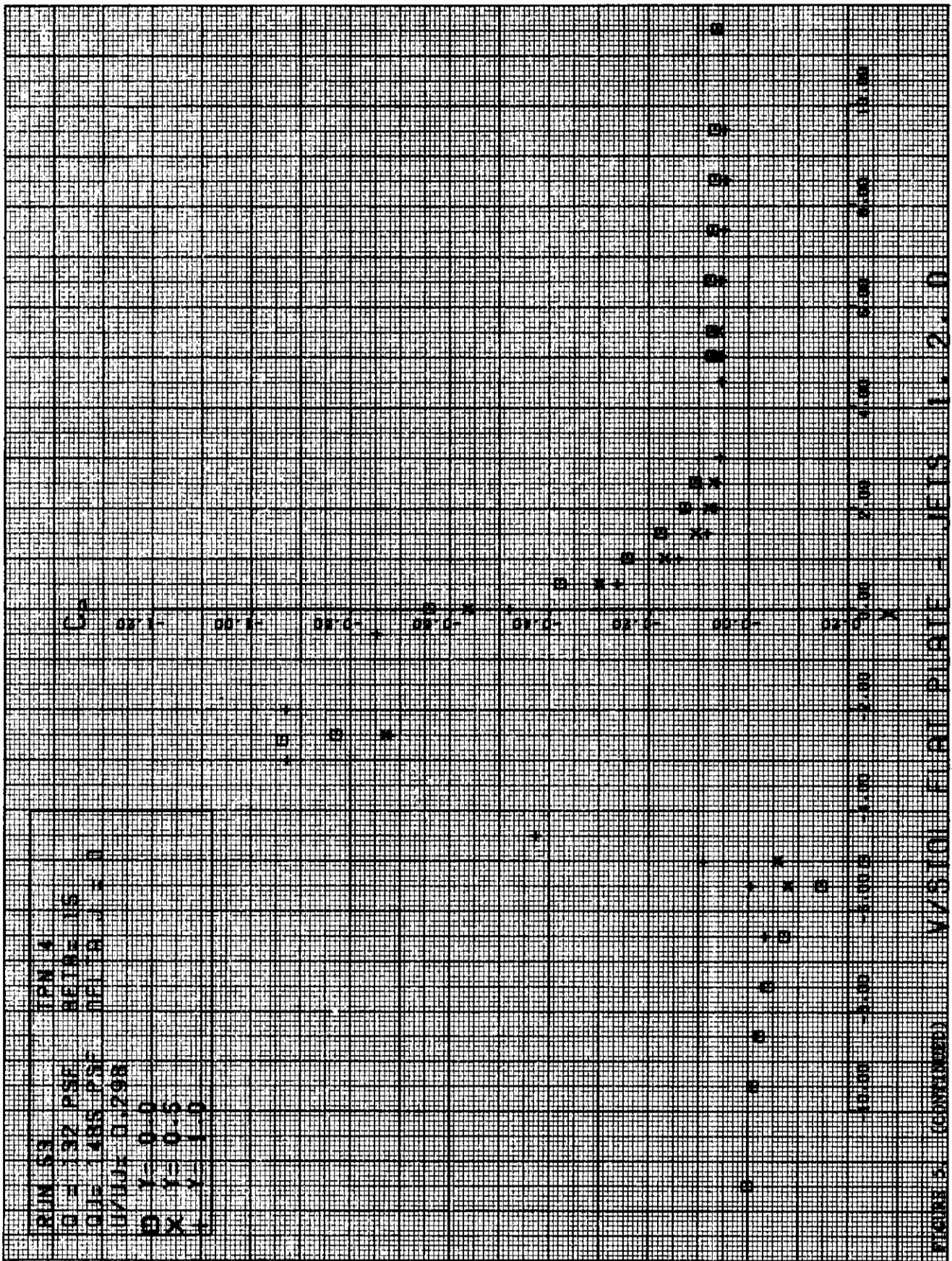


FIGURE 5. (CONTINUED) VISUAL FLARE PROFILE - JETS 11.2.0



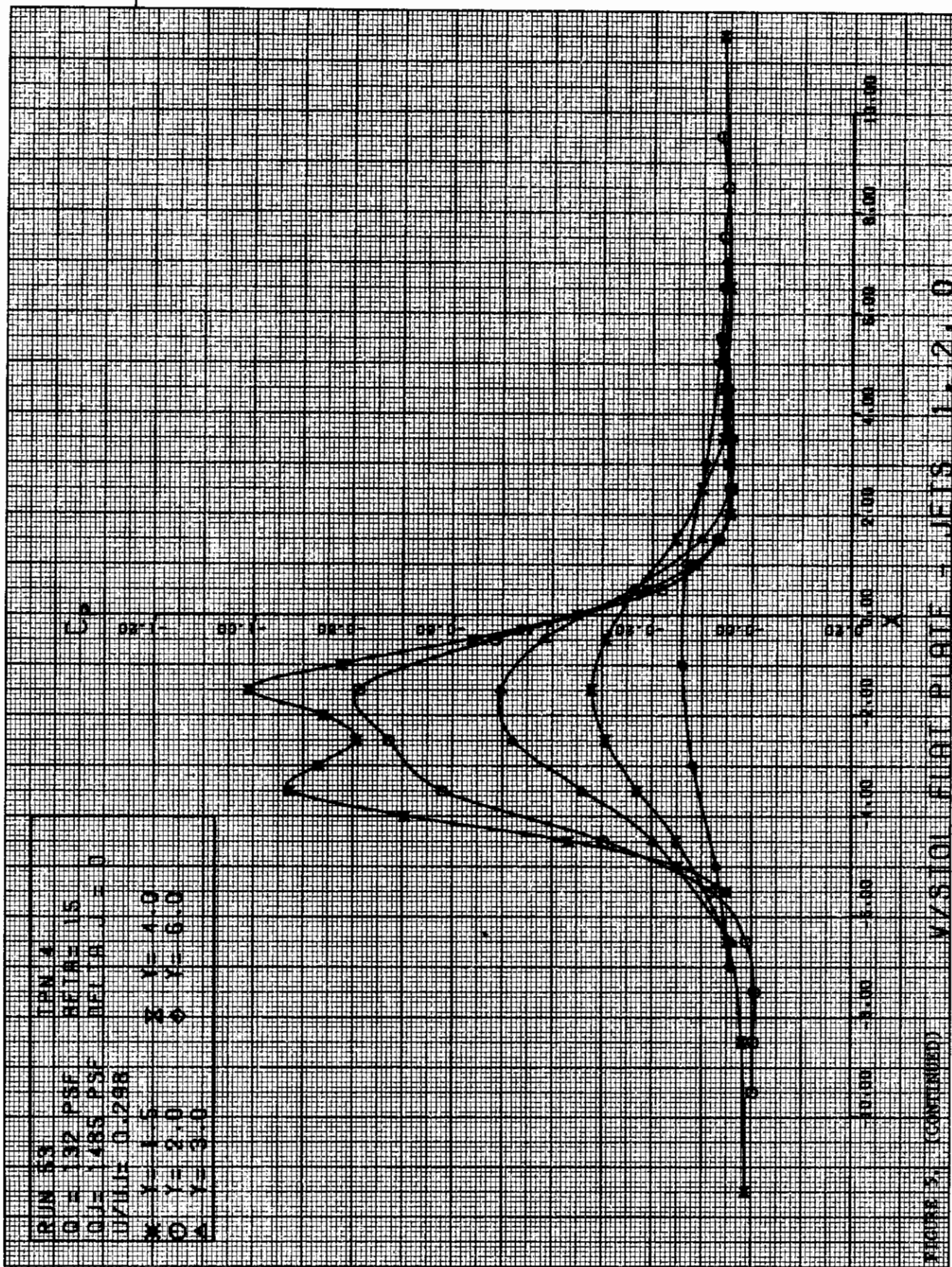


FIGURE 5. (CONTINUED) W/STOL FLIGHT PLATE - JETS 11,270

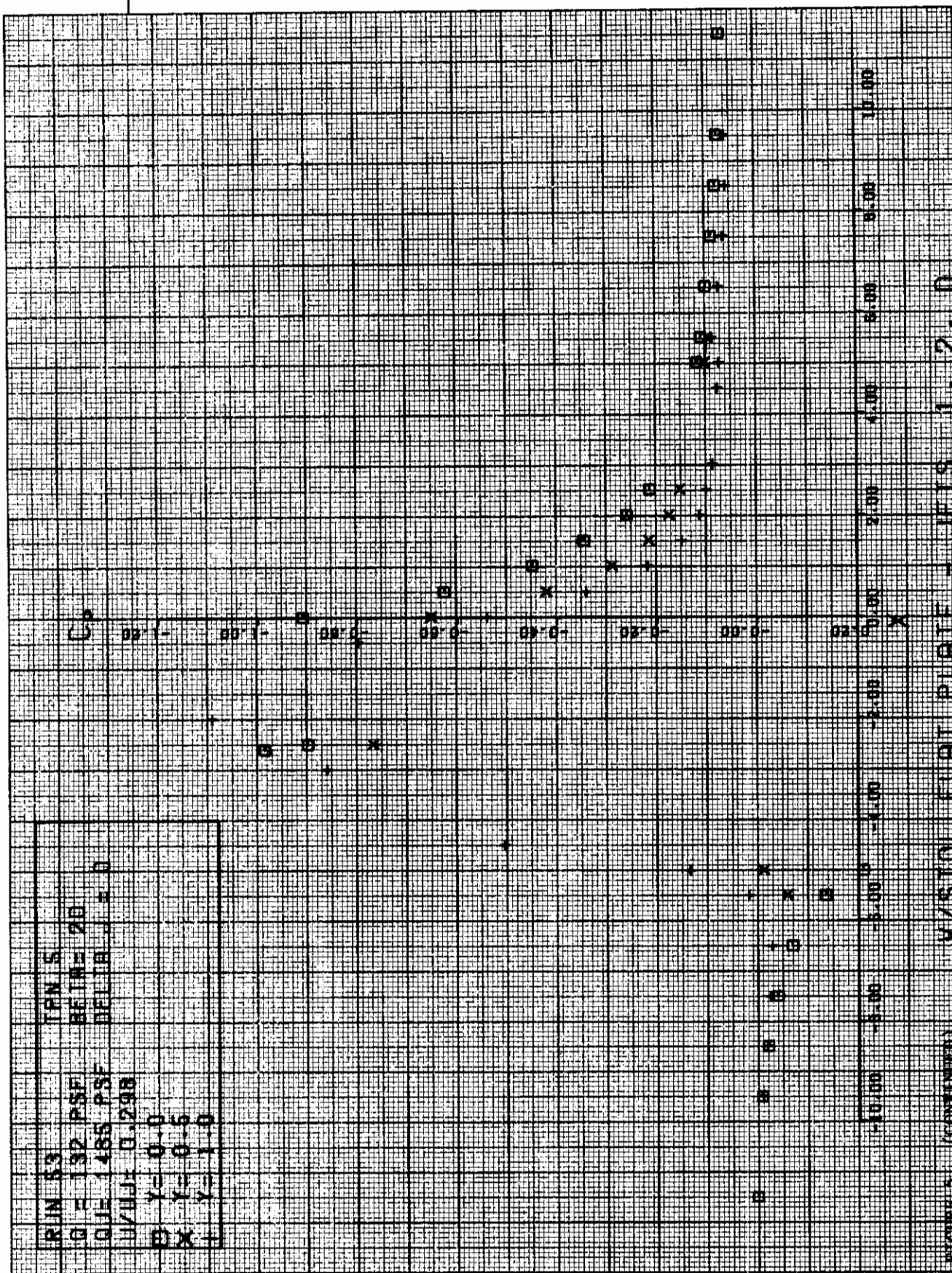


FIGURE 5. (CONTINUED) V/STOL FLAT PURVE - JETS 1.2.0

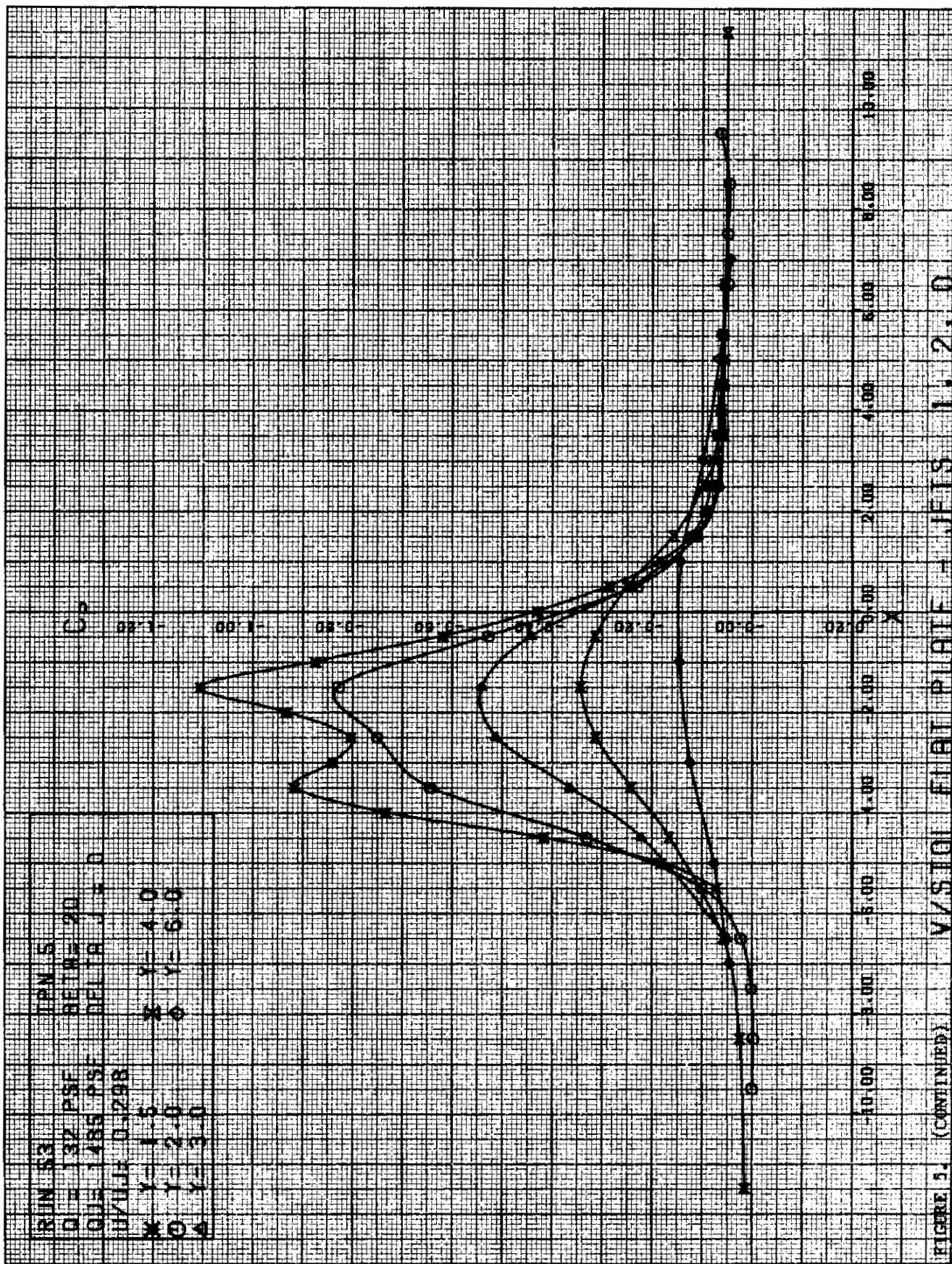
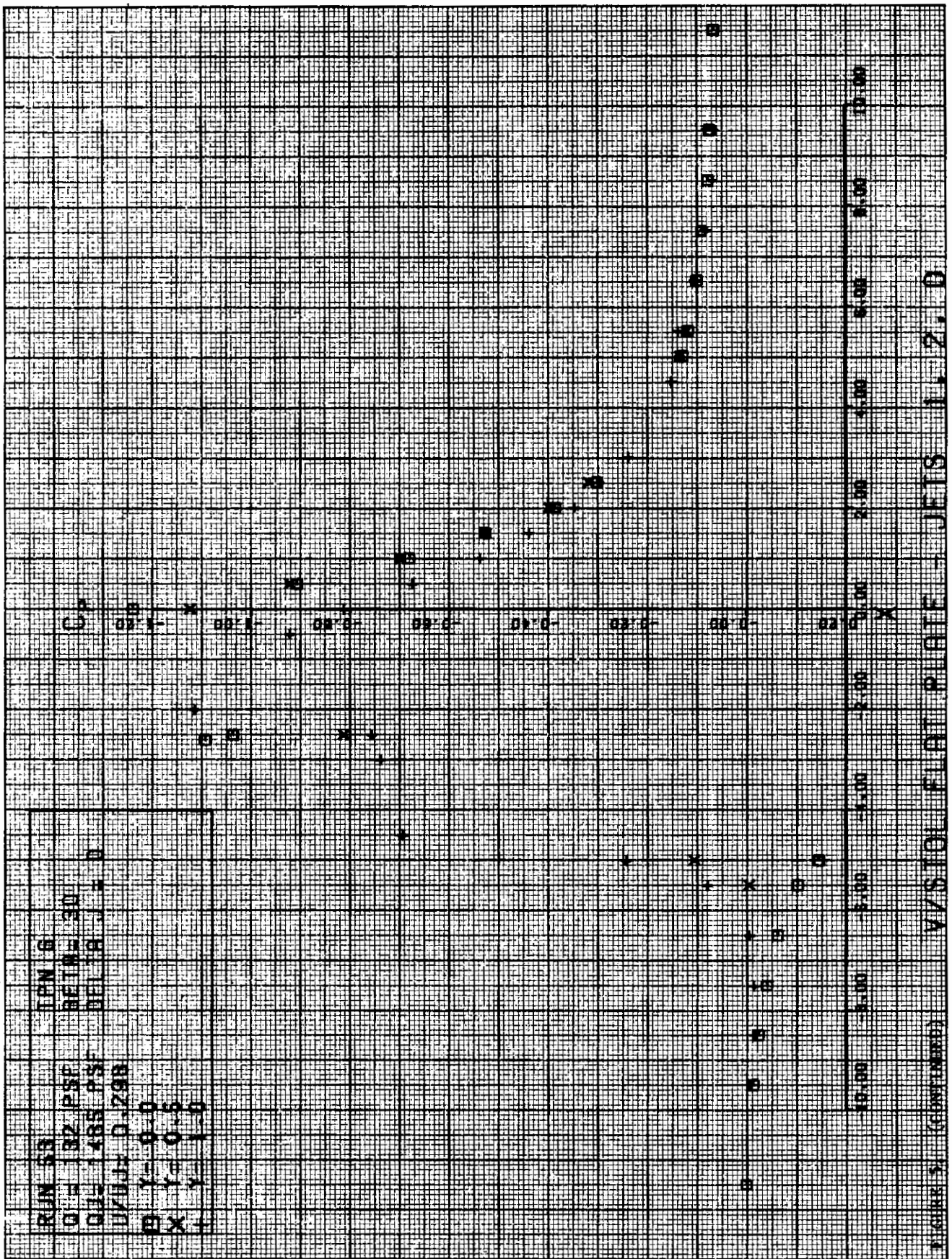


FIGURE 3. (CONTINUED) V/STOL FLAT PLATE JETTS W 2.0



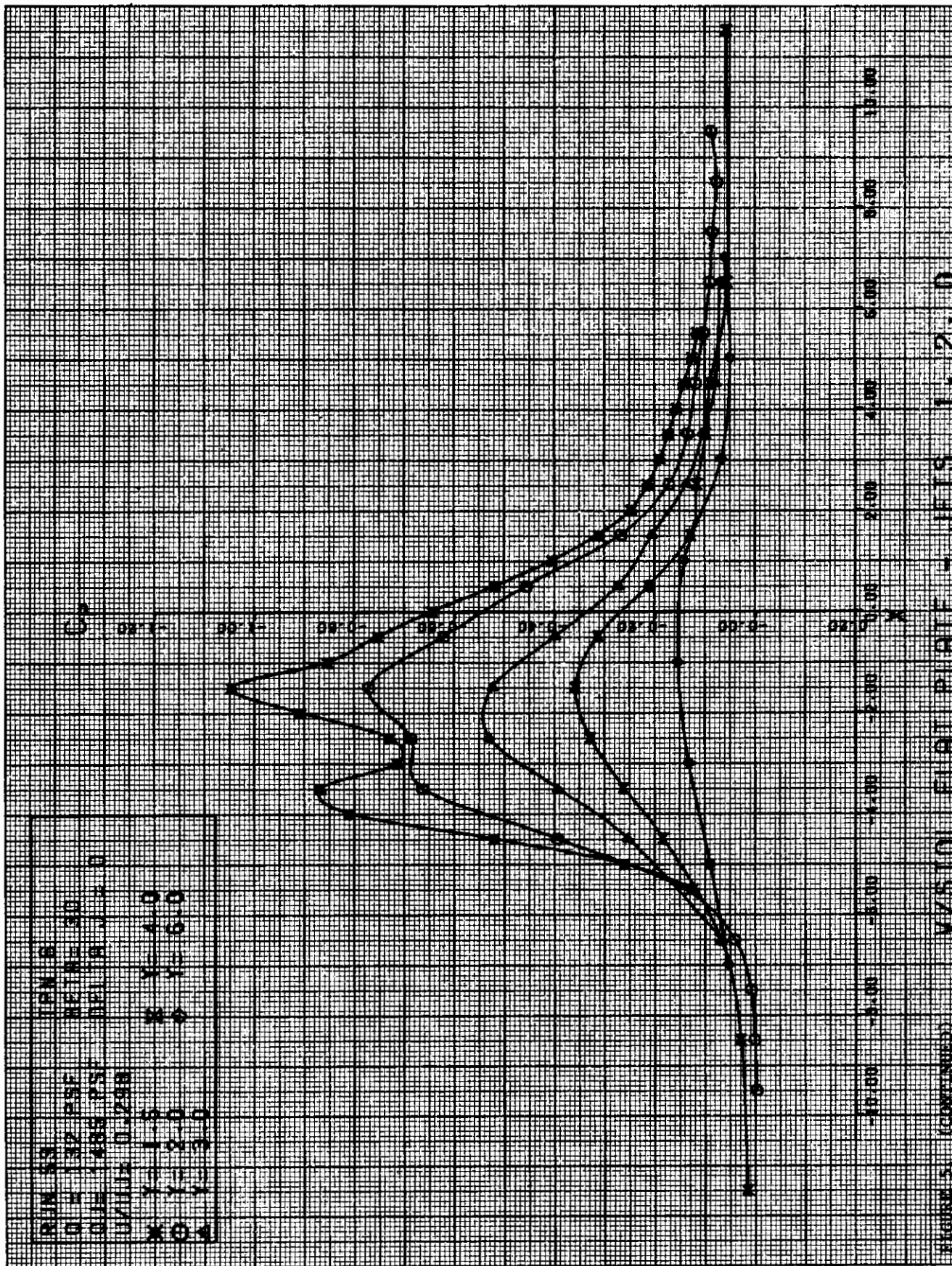


FIGURE 51. (CONTINUED) VVS101 FLIGHT PROFILE - JETIS 1. 2. 3. D

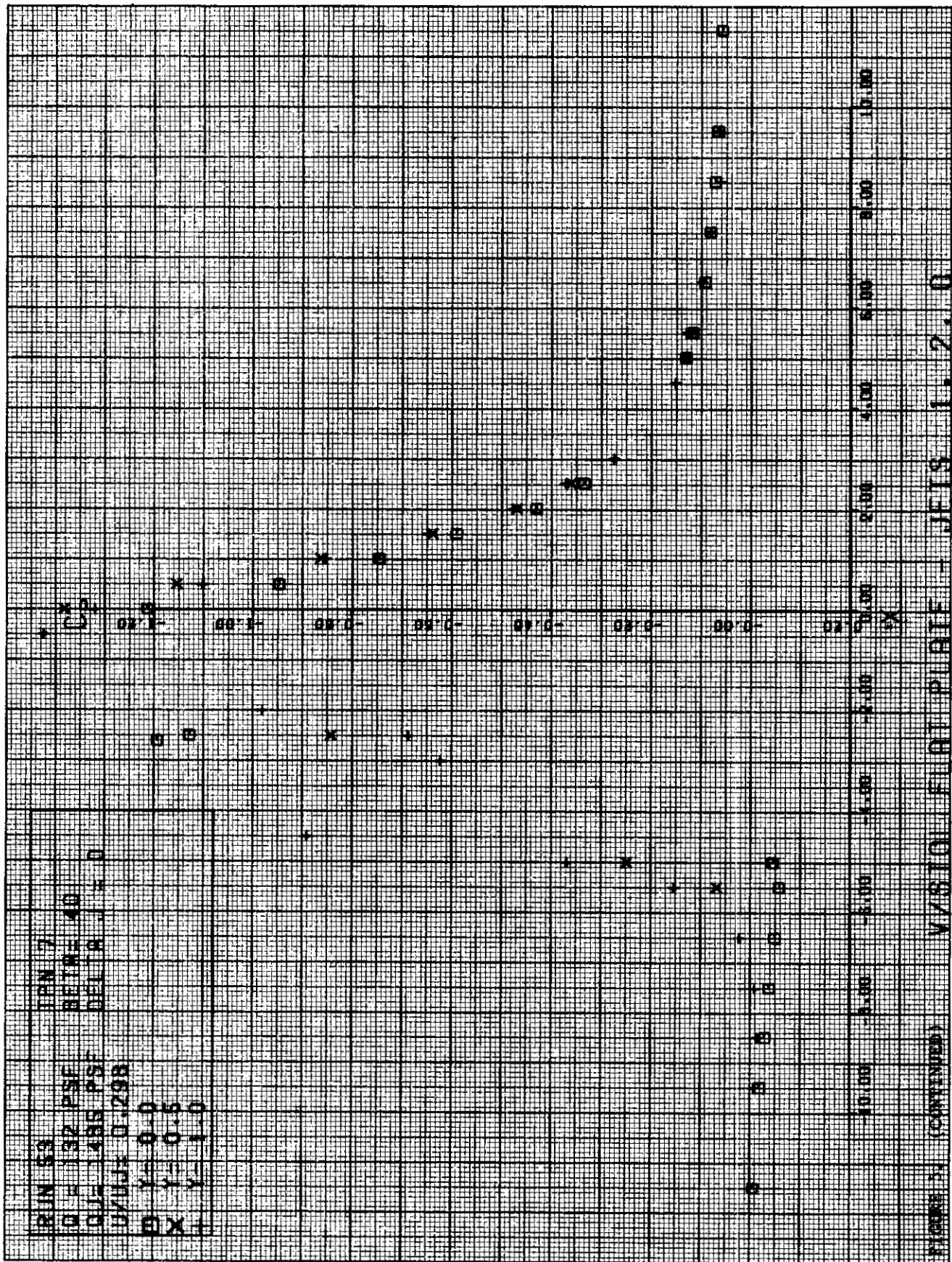
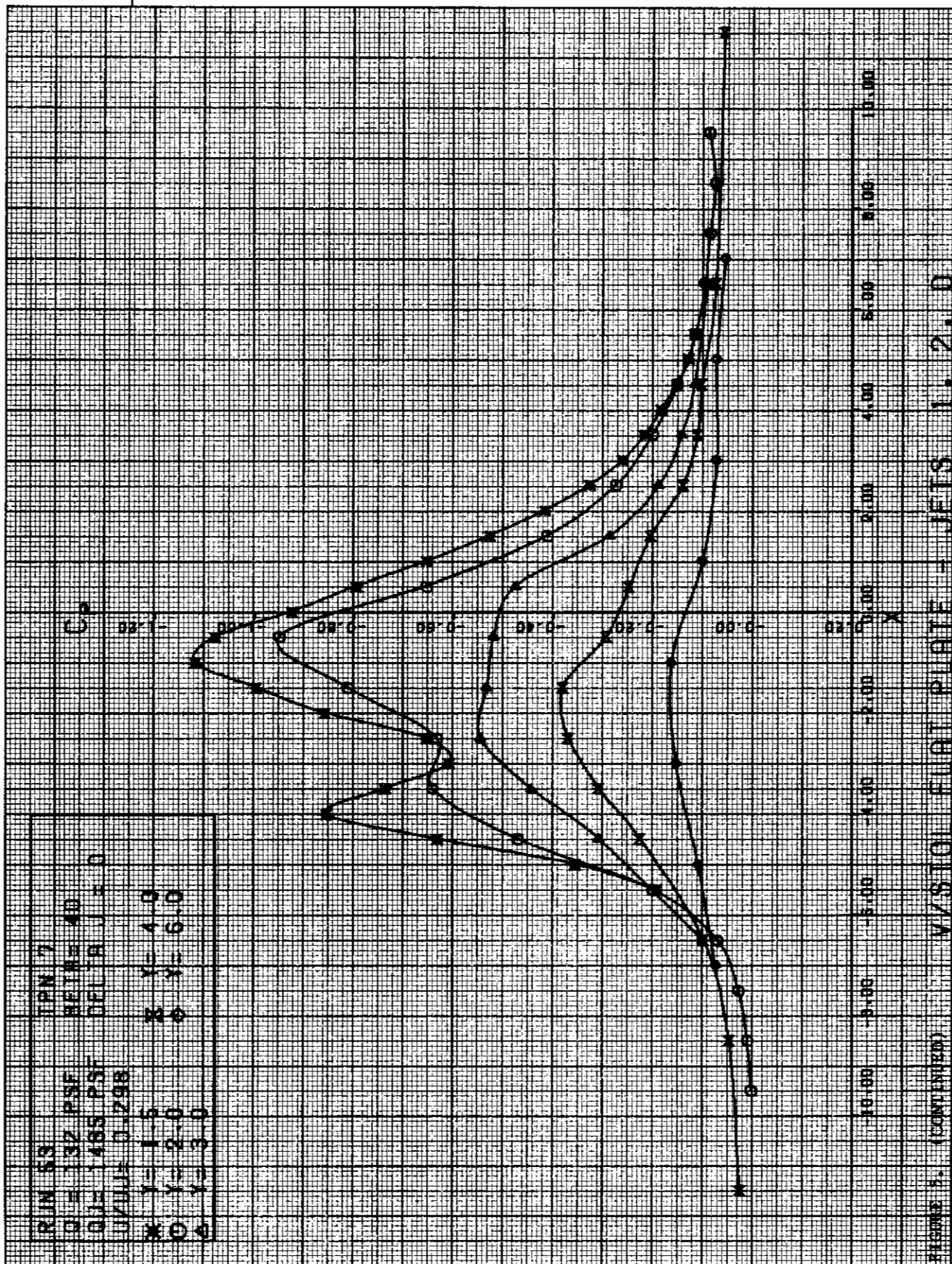
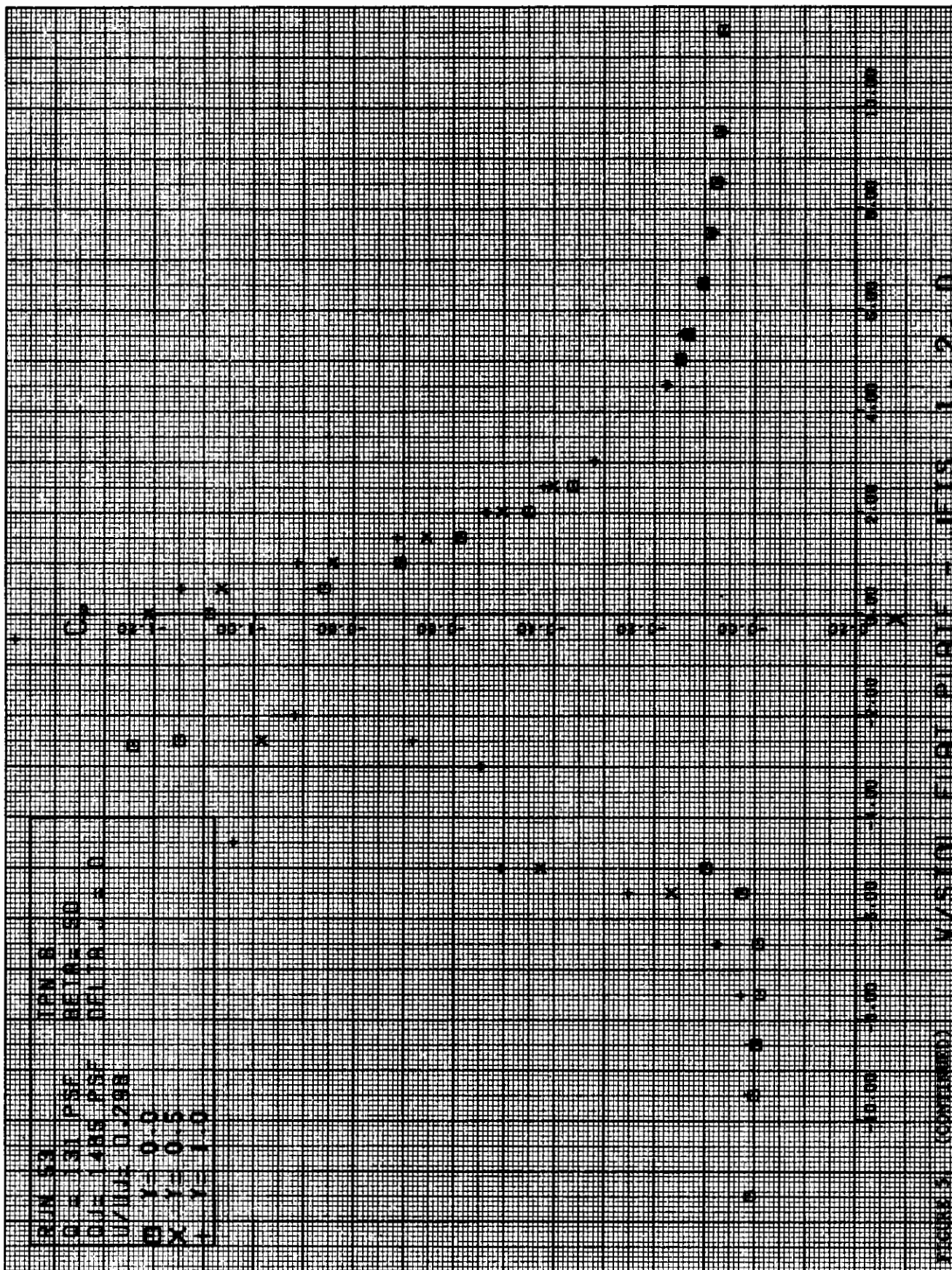


FIGURE 5 (CONTINUED) VISTOL FLAT PLATE - JFIS 11.2.0





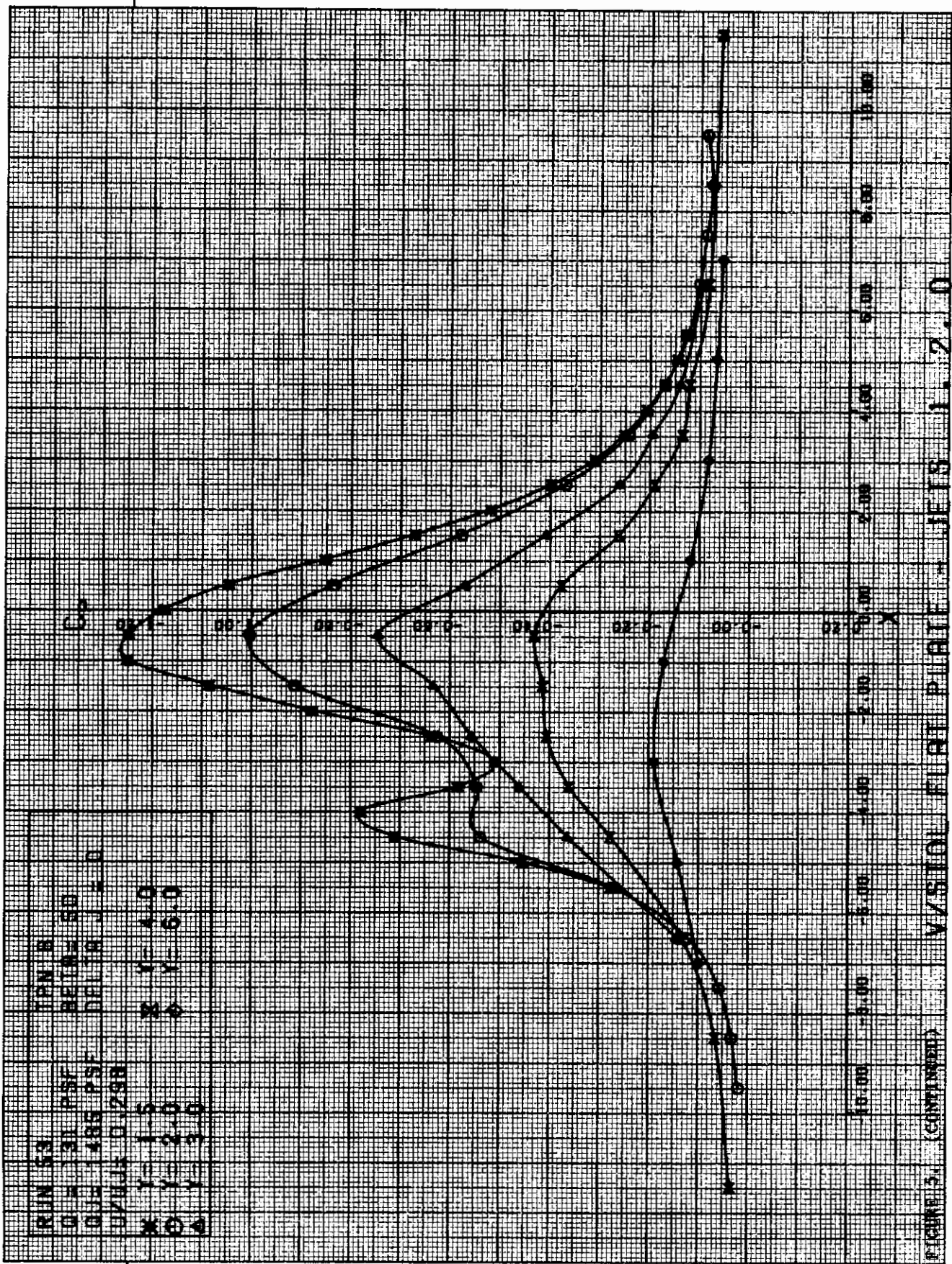


FIGURE 54 (CONTINUED) VISUAL FLIGHT PLATE - JETS - 11-22-0

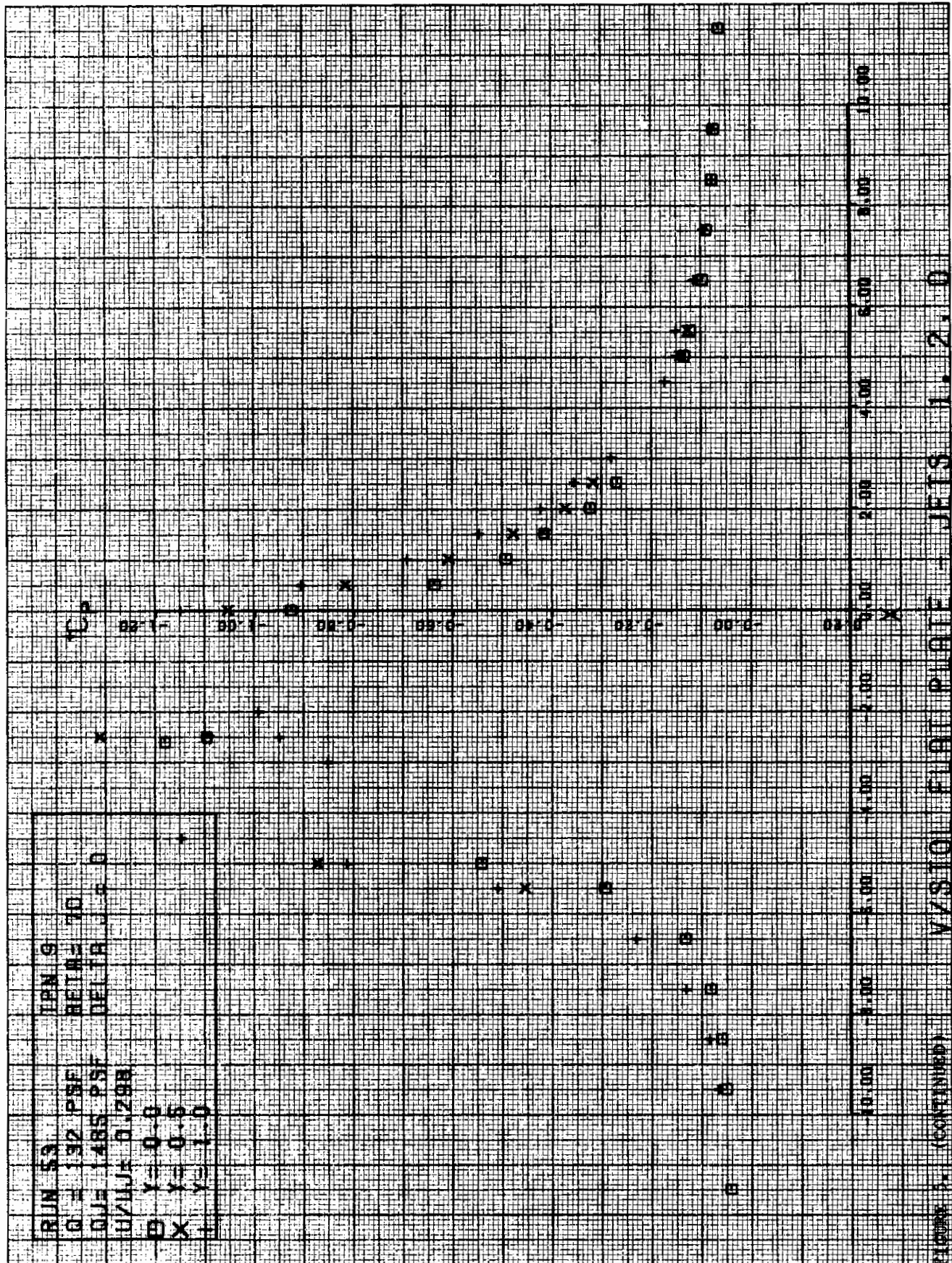
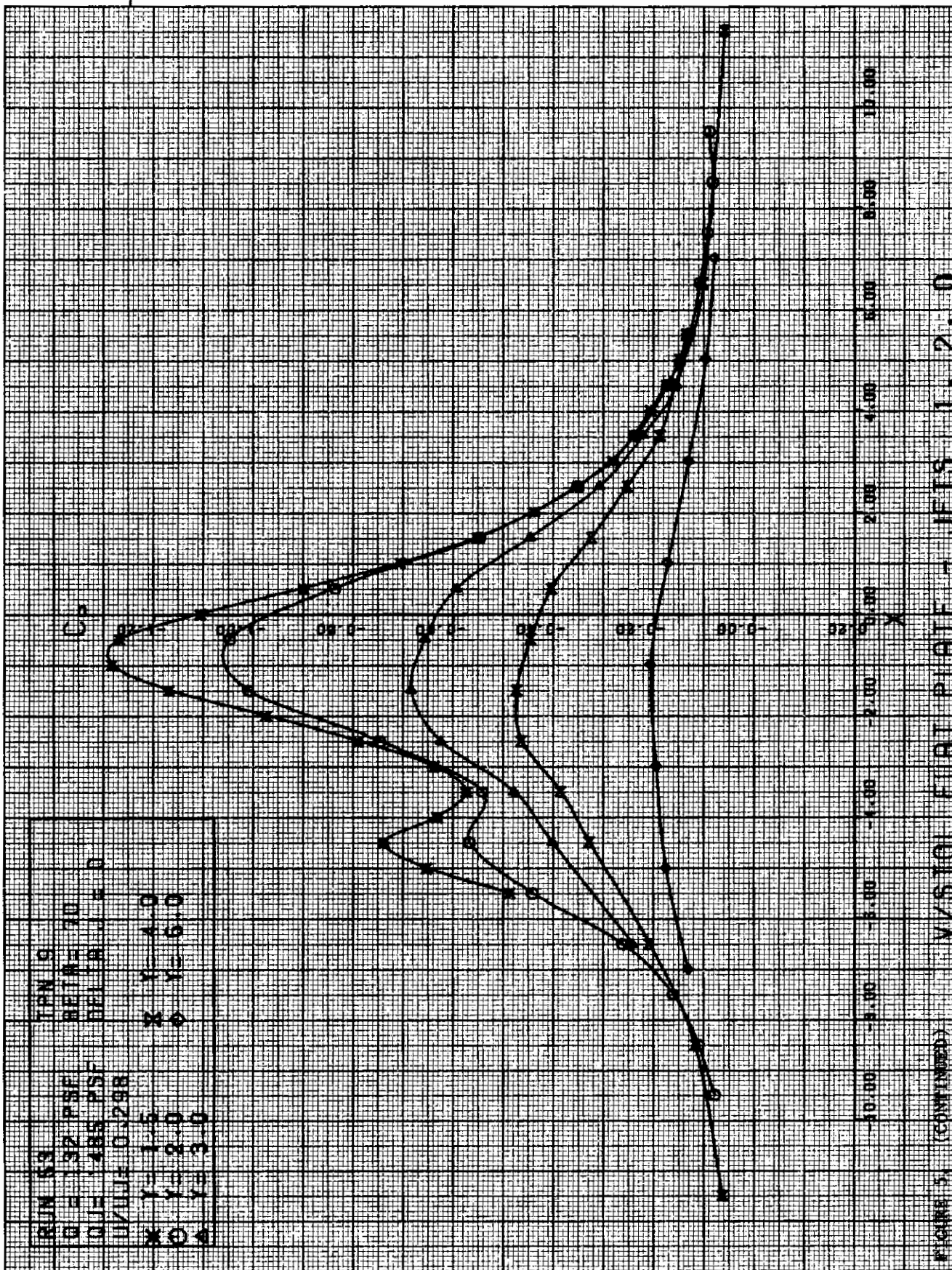
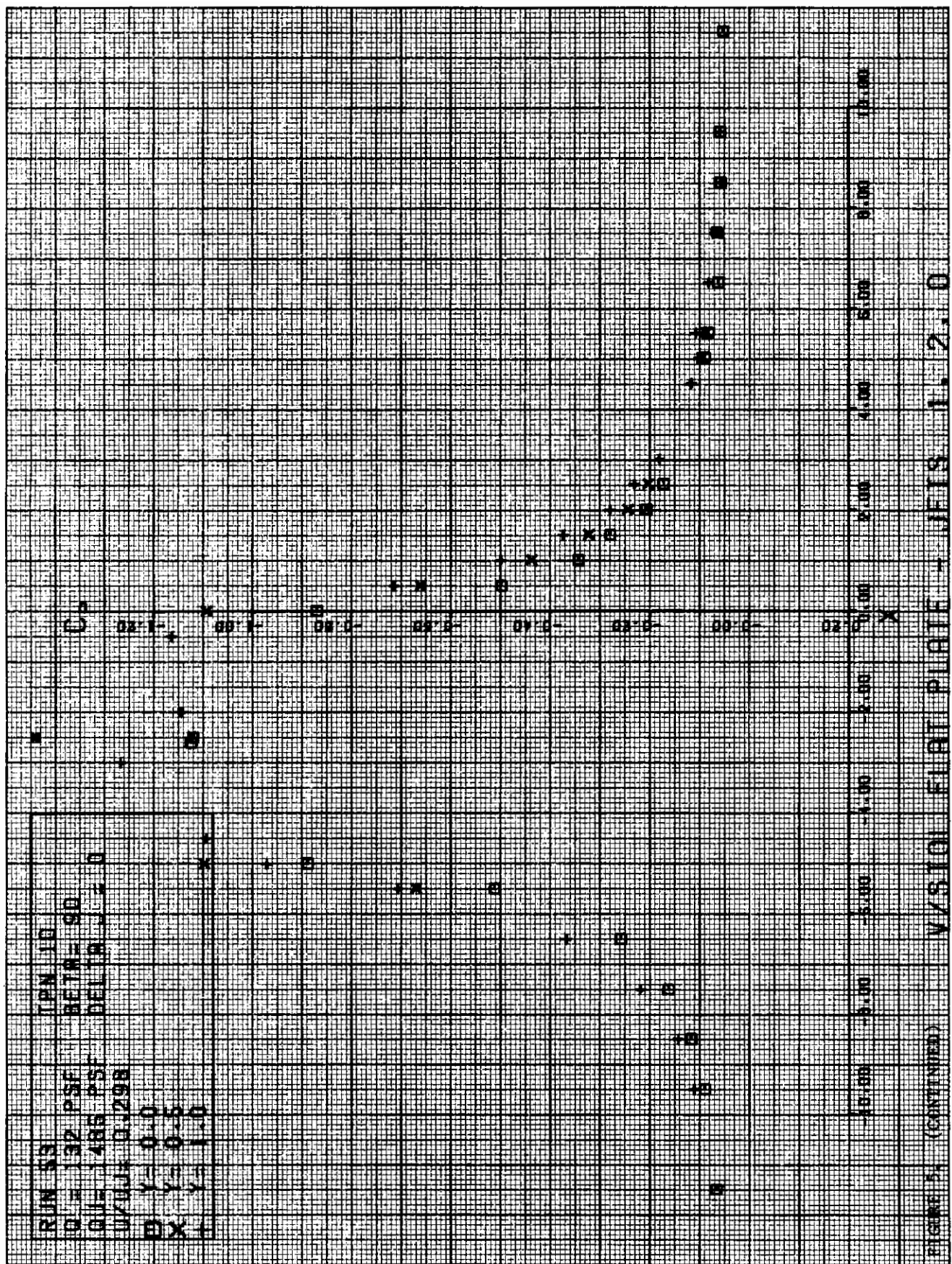
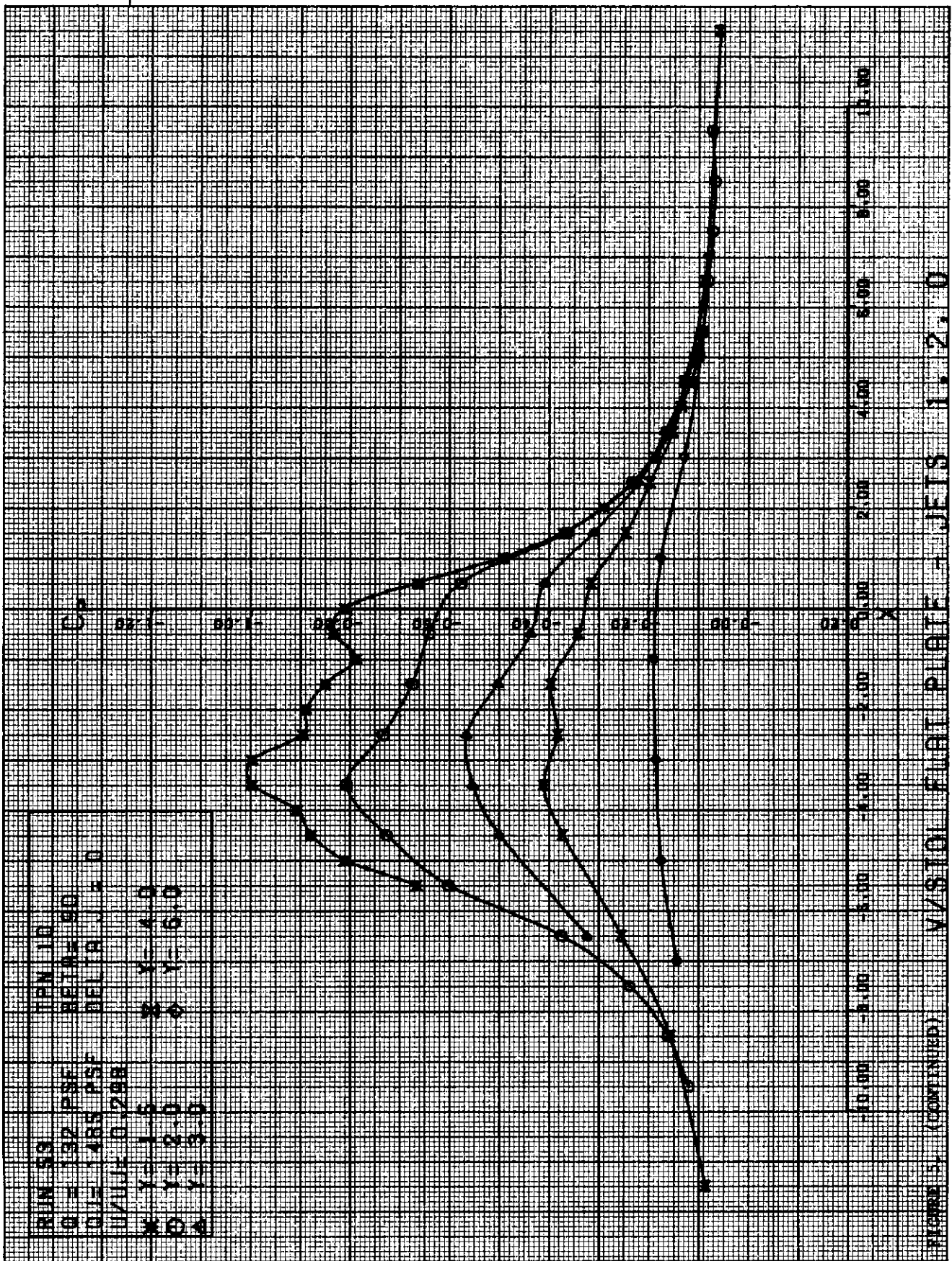
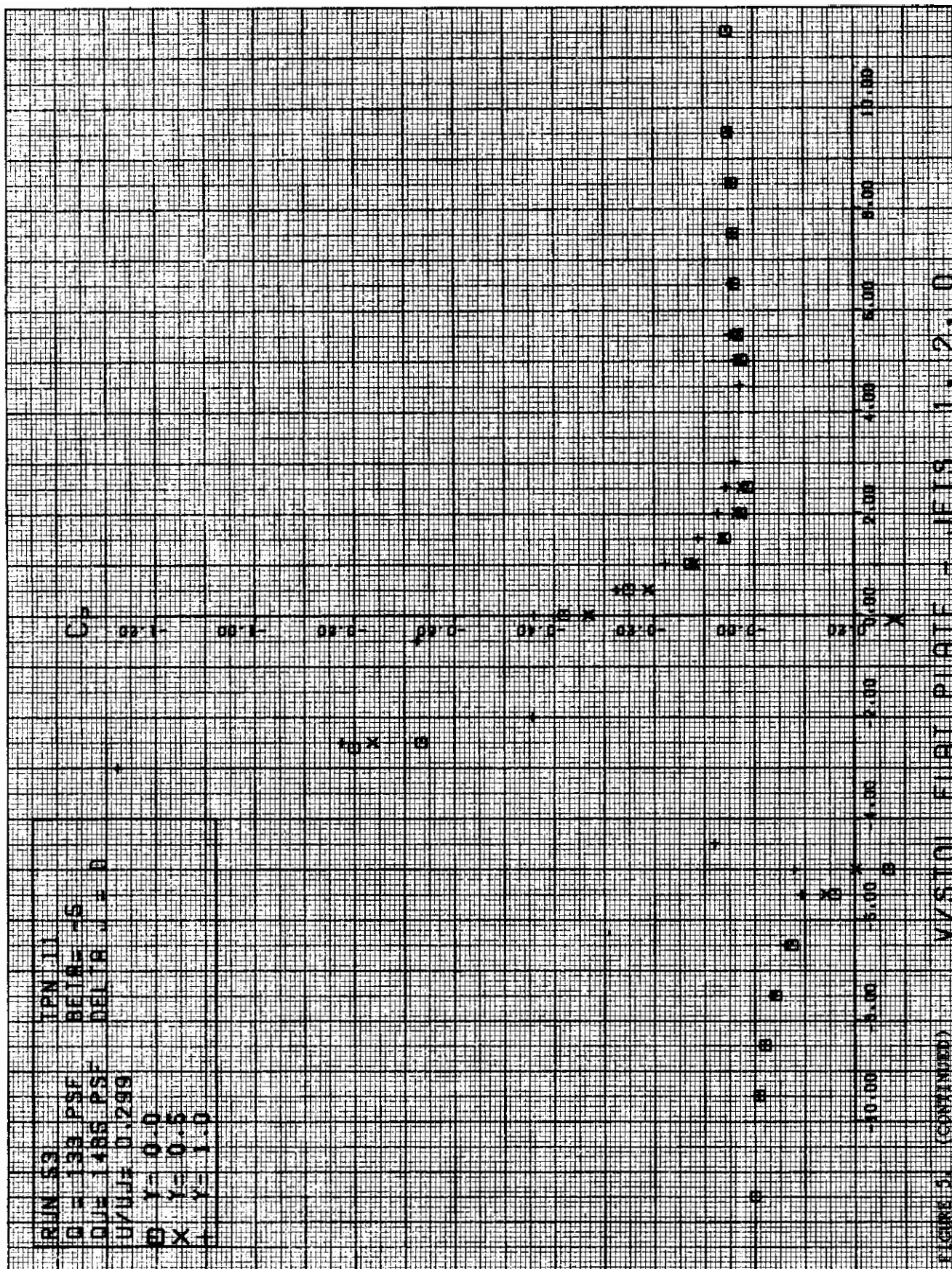


FIGURE 3. (CONTINUED) V-101 FLAT PLATE - JETS 1, 2, 3









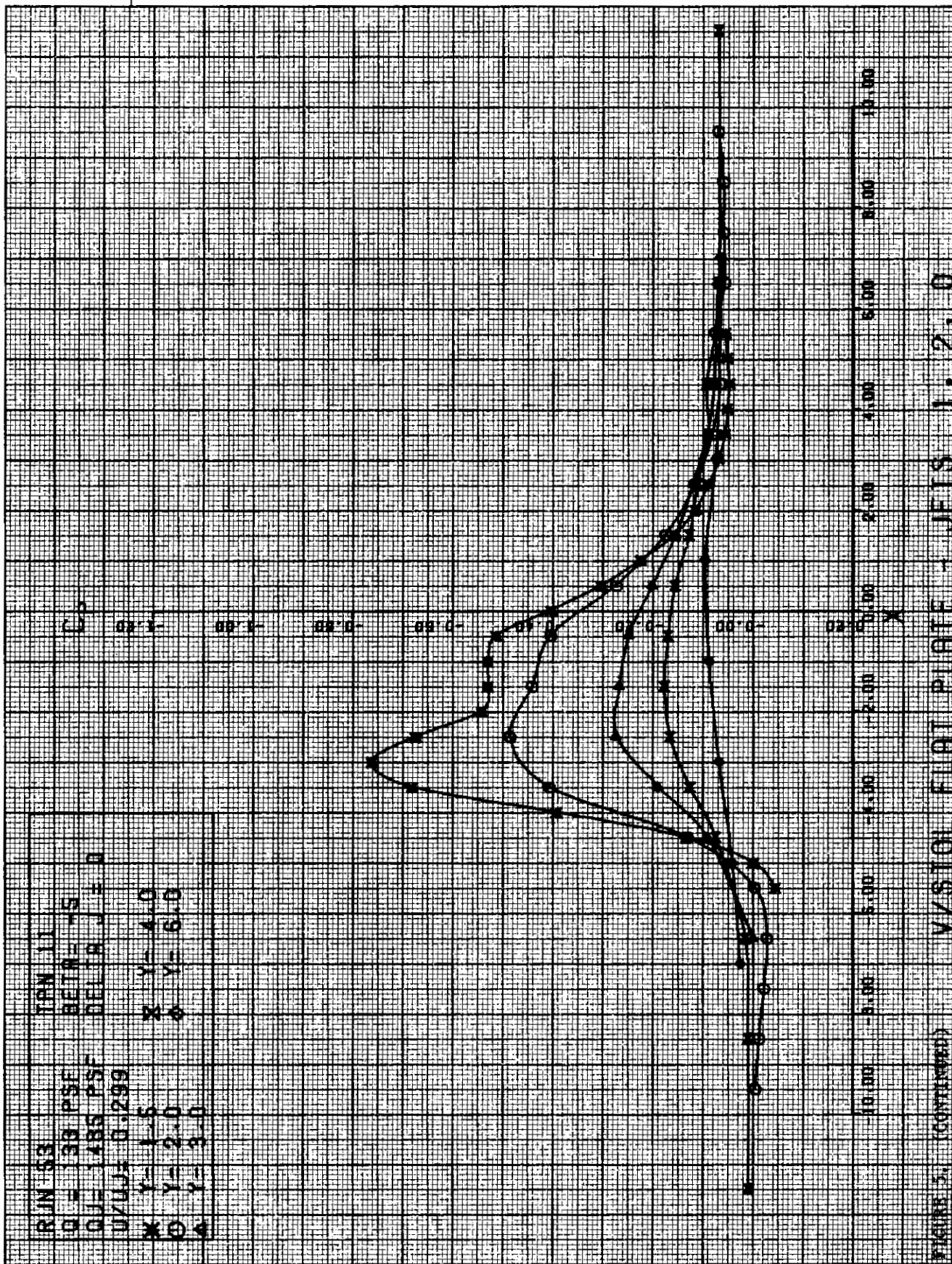
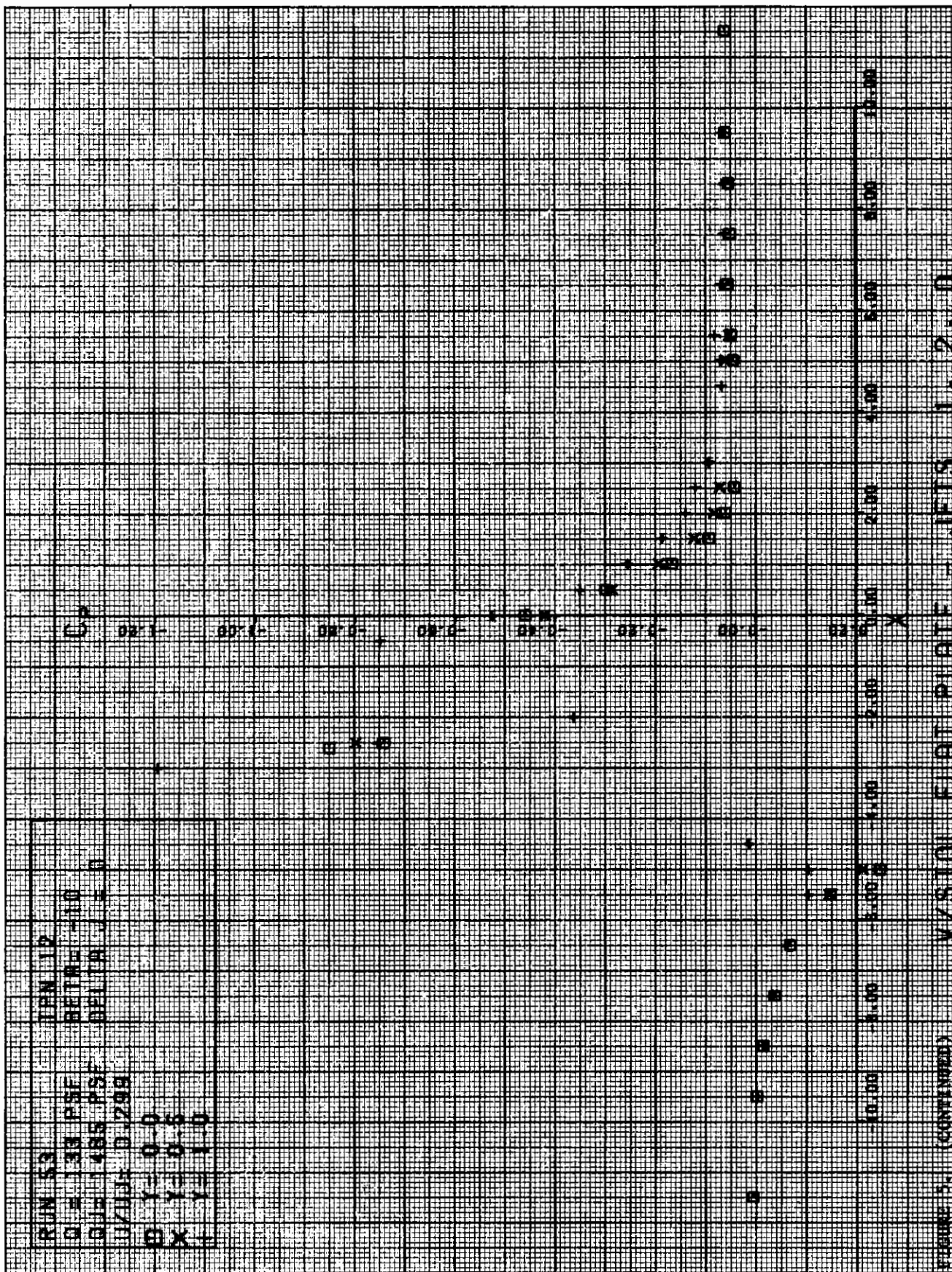
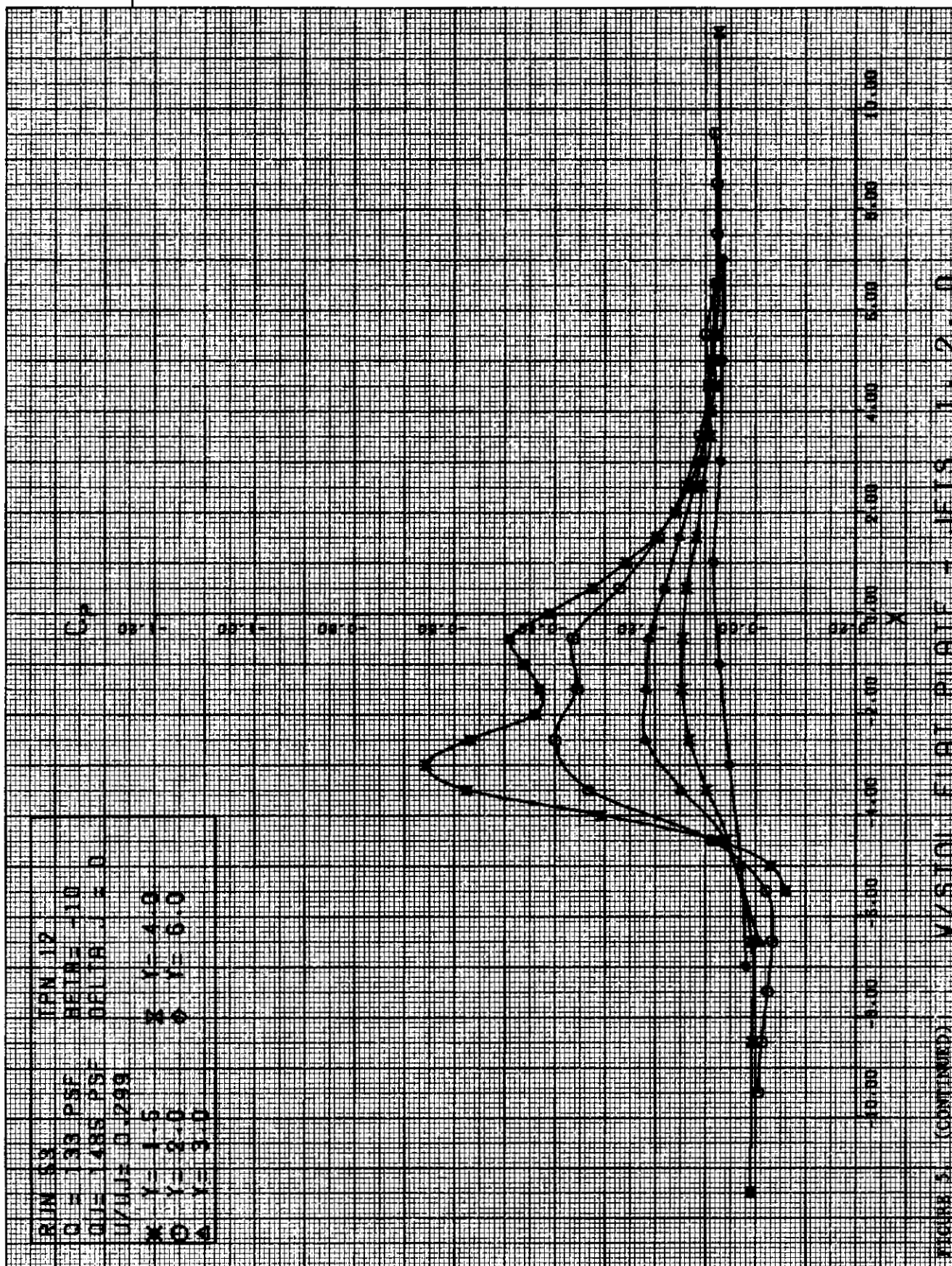
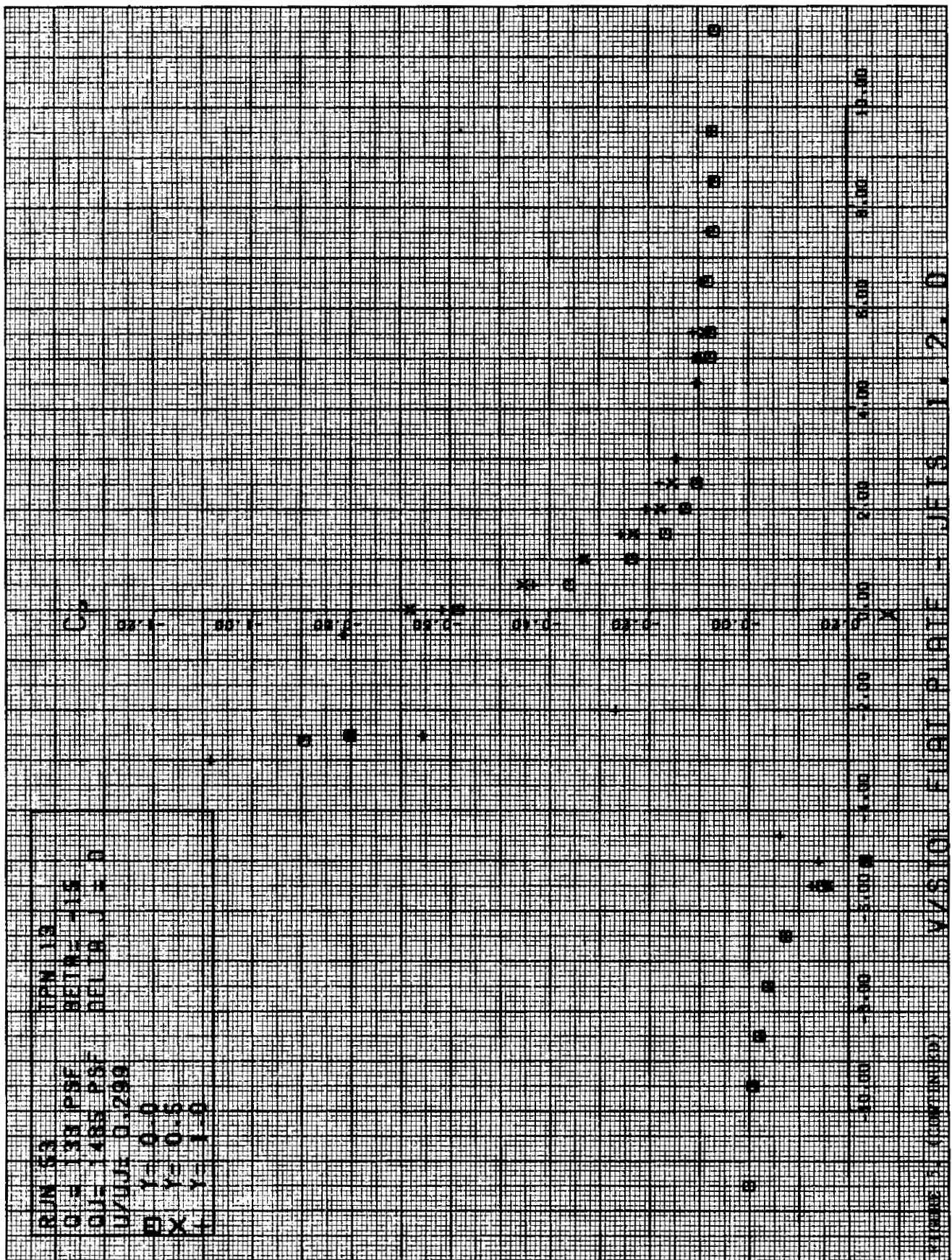


FIGURE 5. (CONTINUED) VISION FLAT PLATE - JETS 1, 2, 0





Contrails



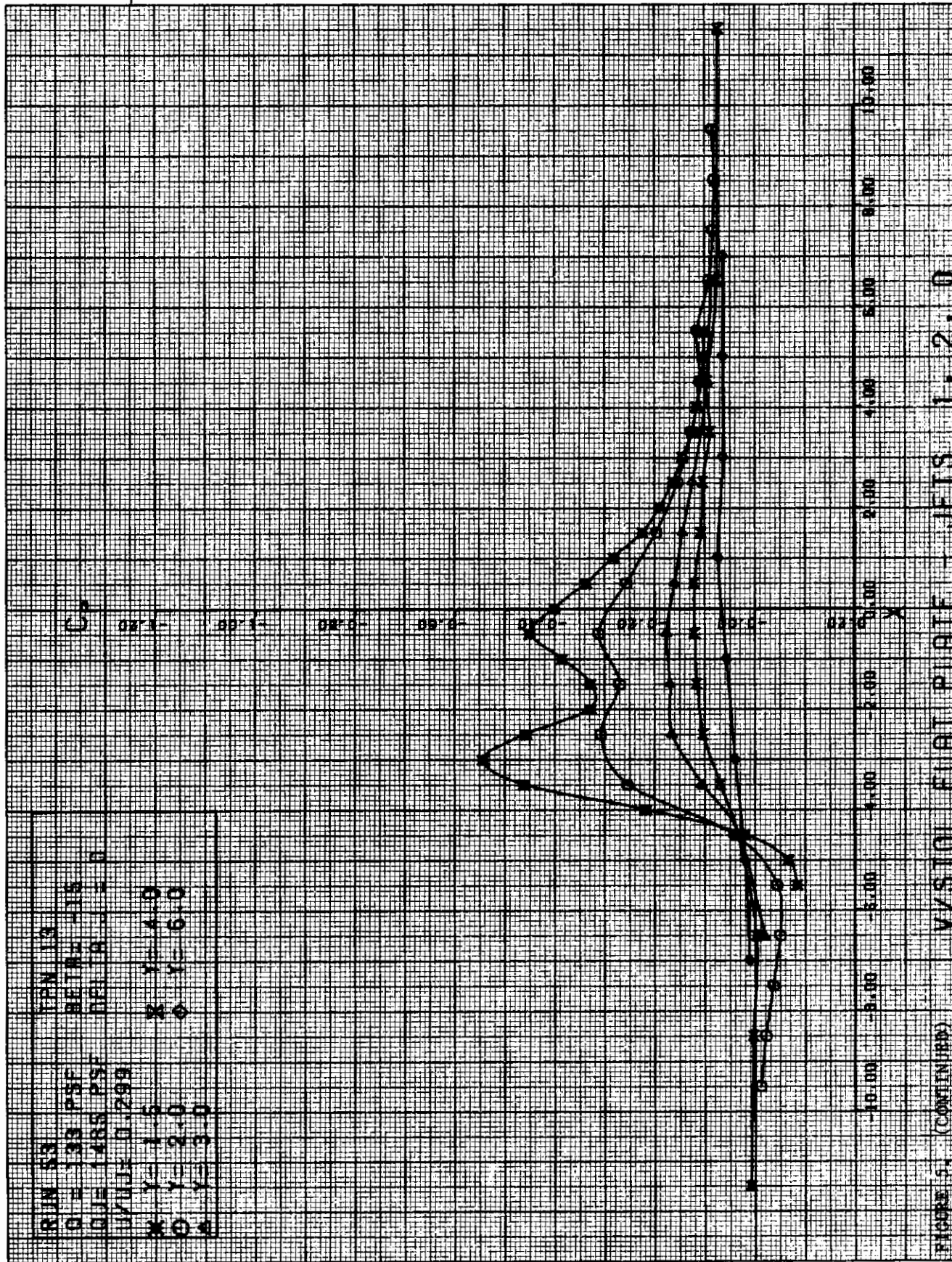
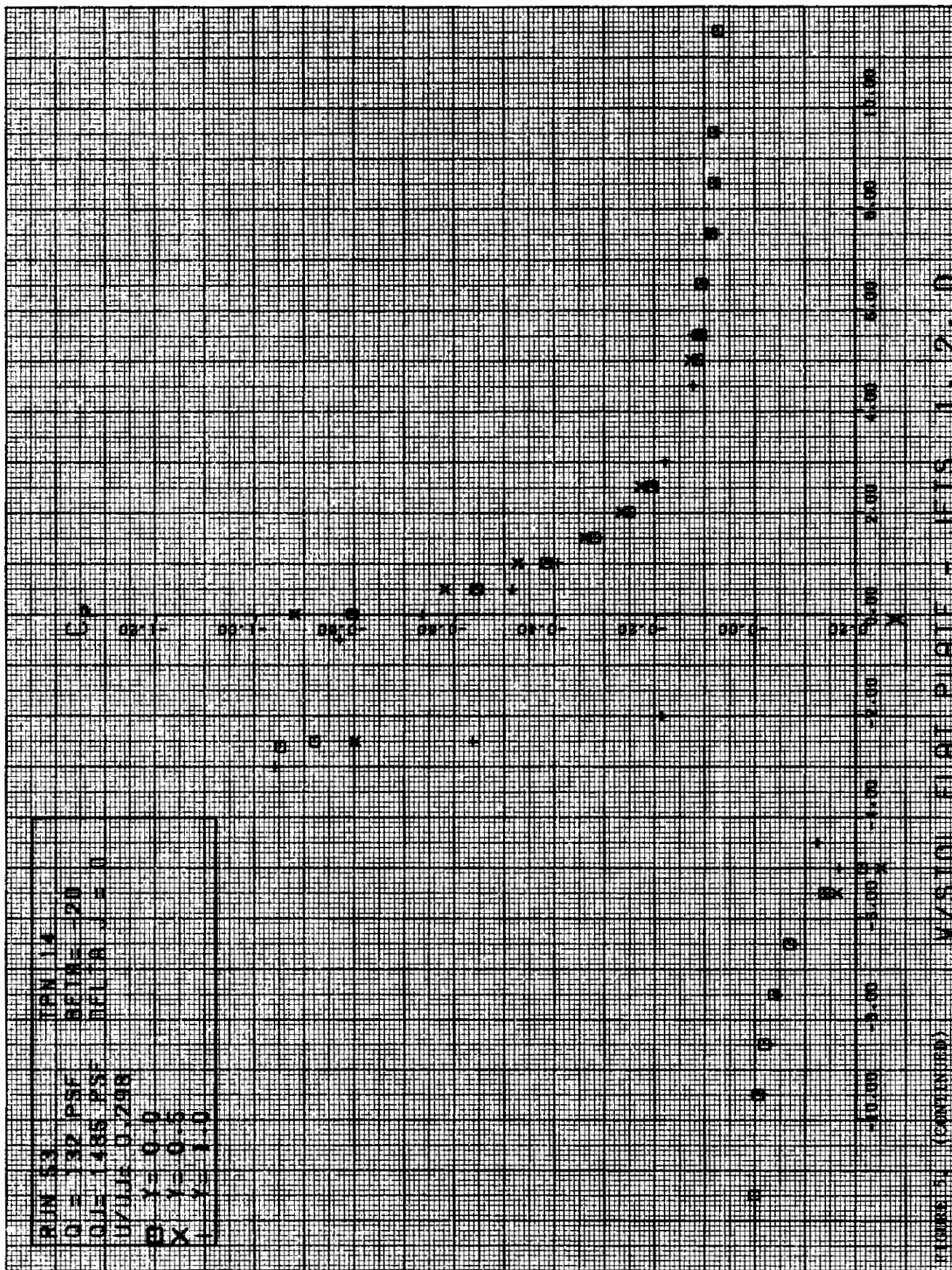
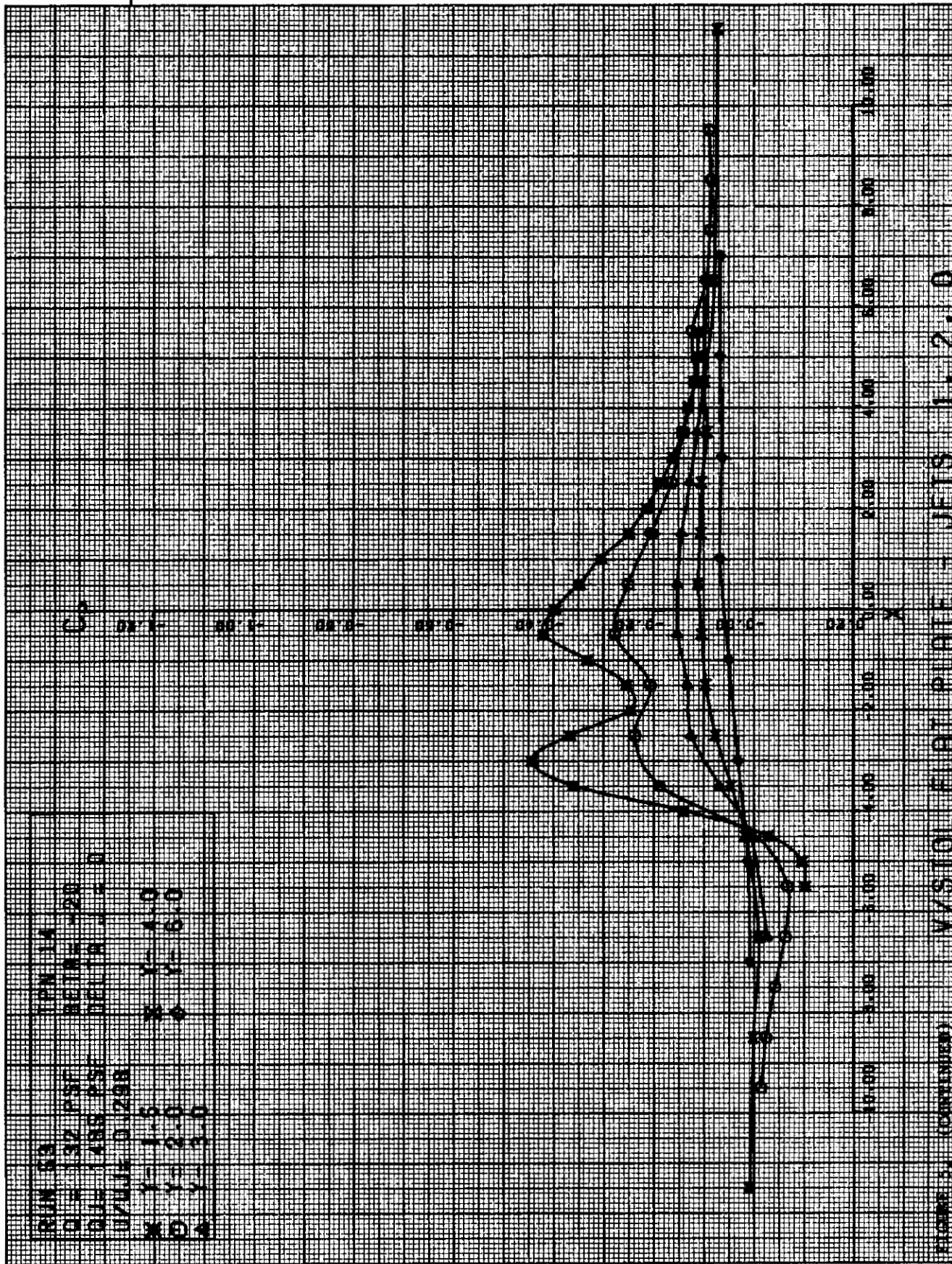


FIGURE 5 (CONTINUED) VELOCITY FLAT PLATE JETS 1, 2, 3





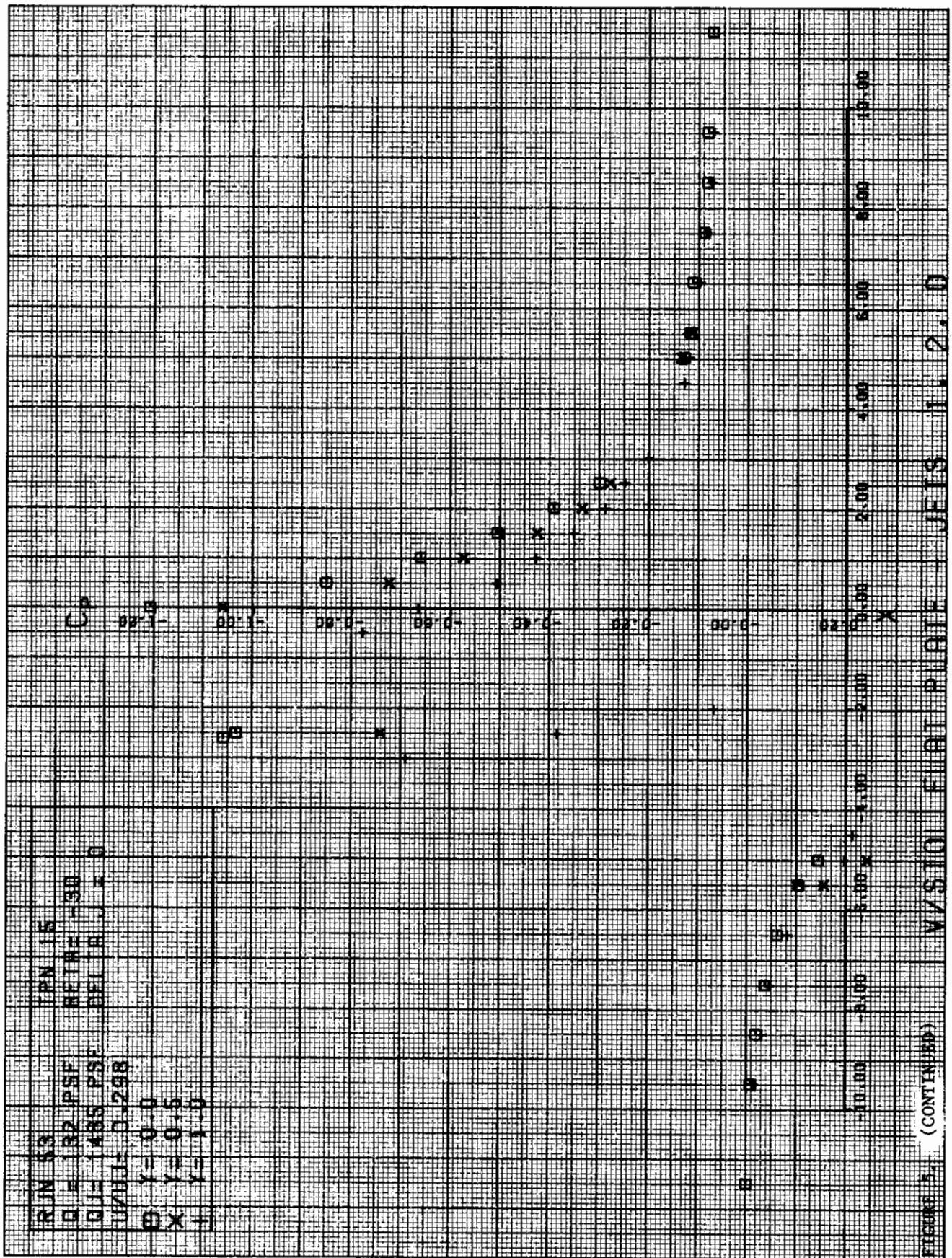
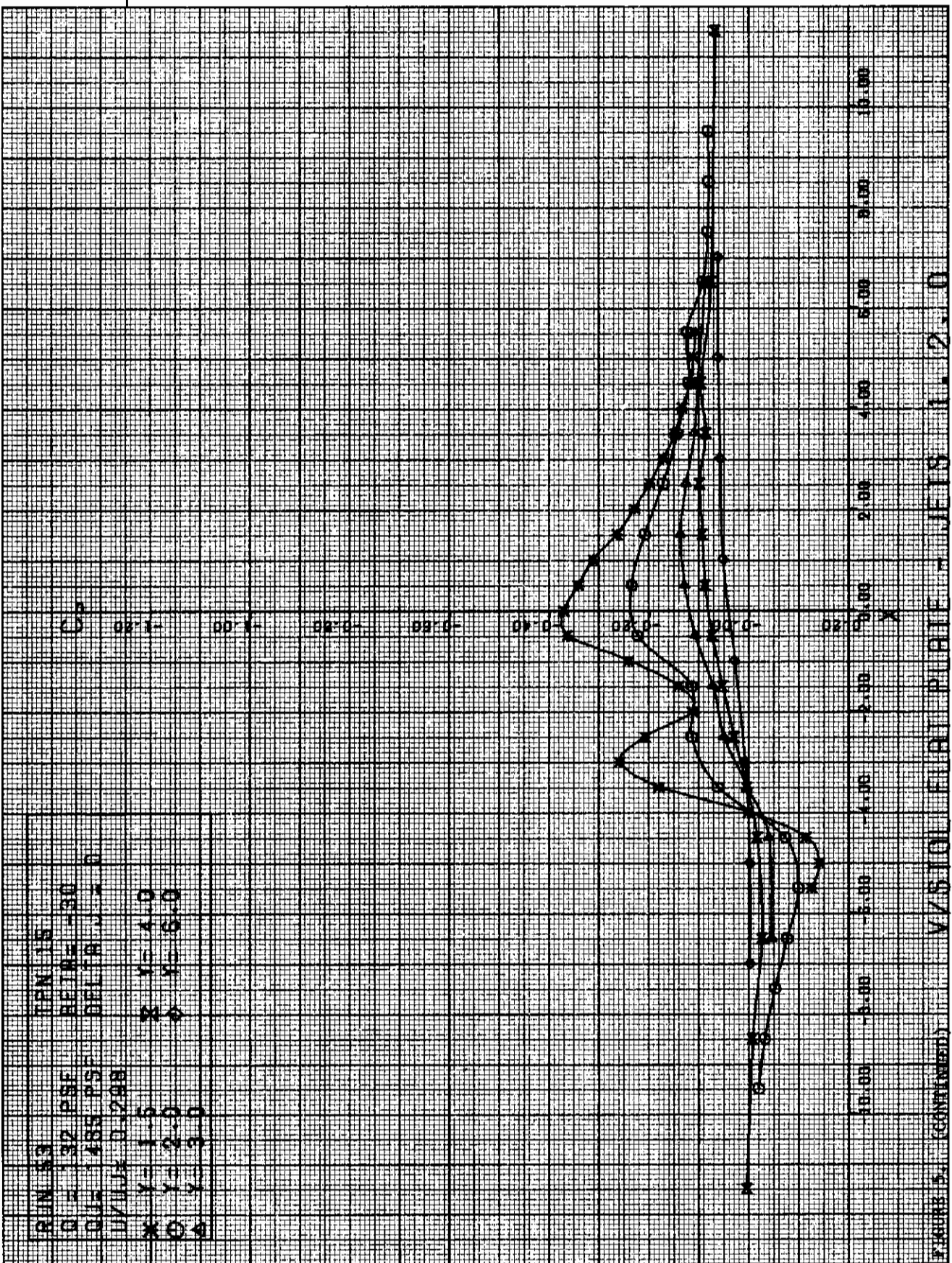


FIGURE 2 (CONTINUED)



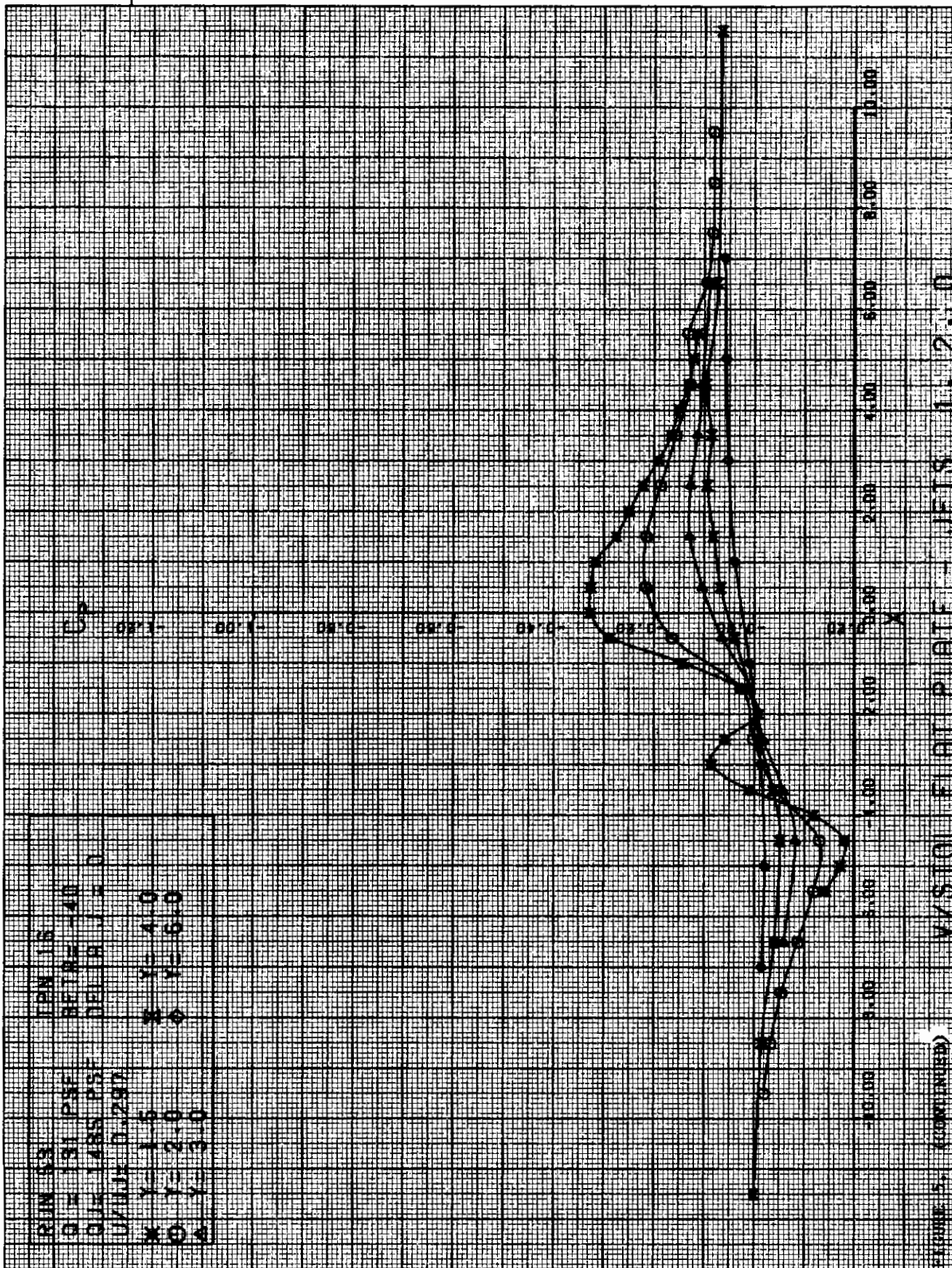
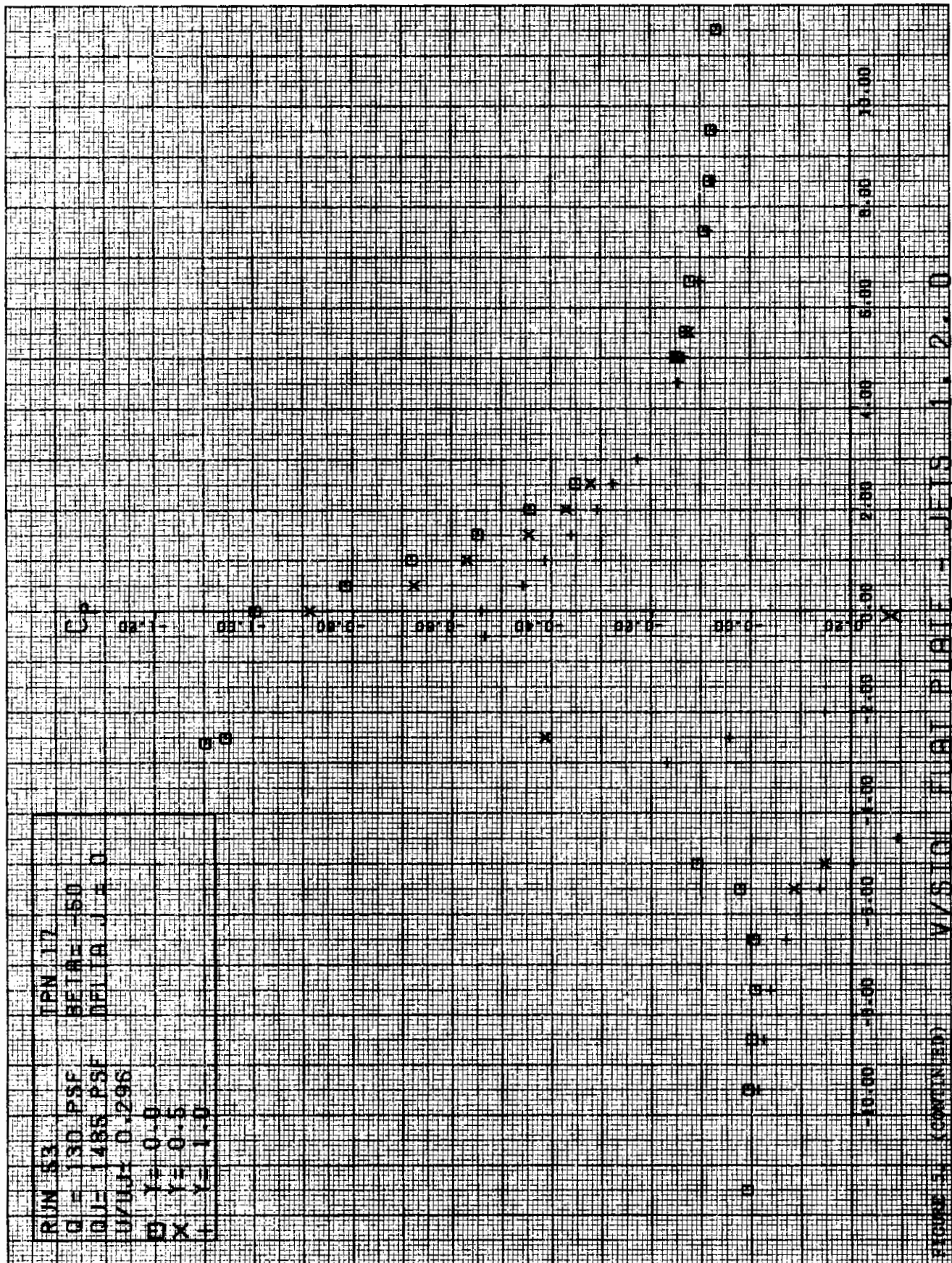
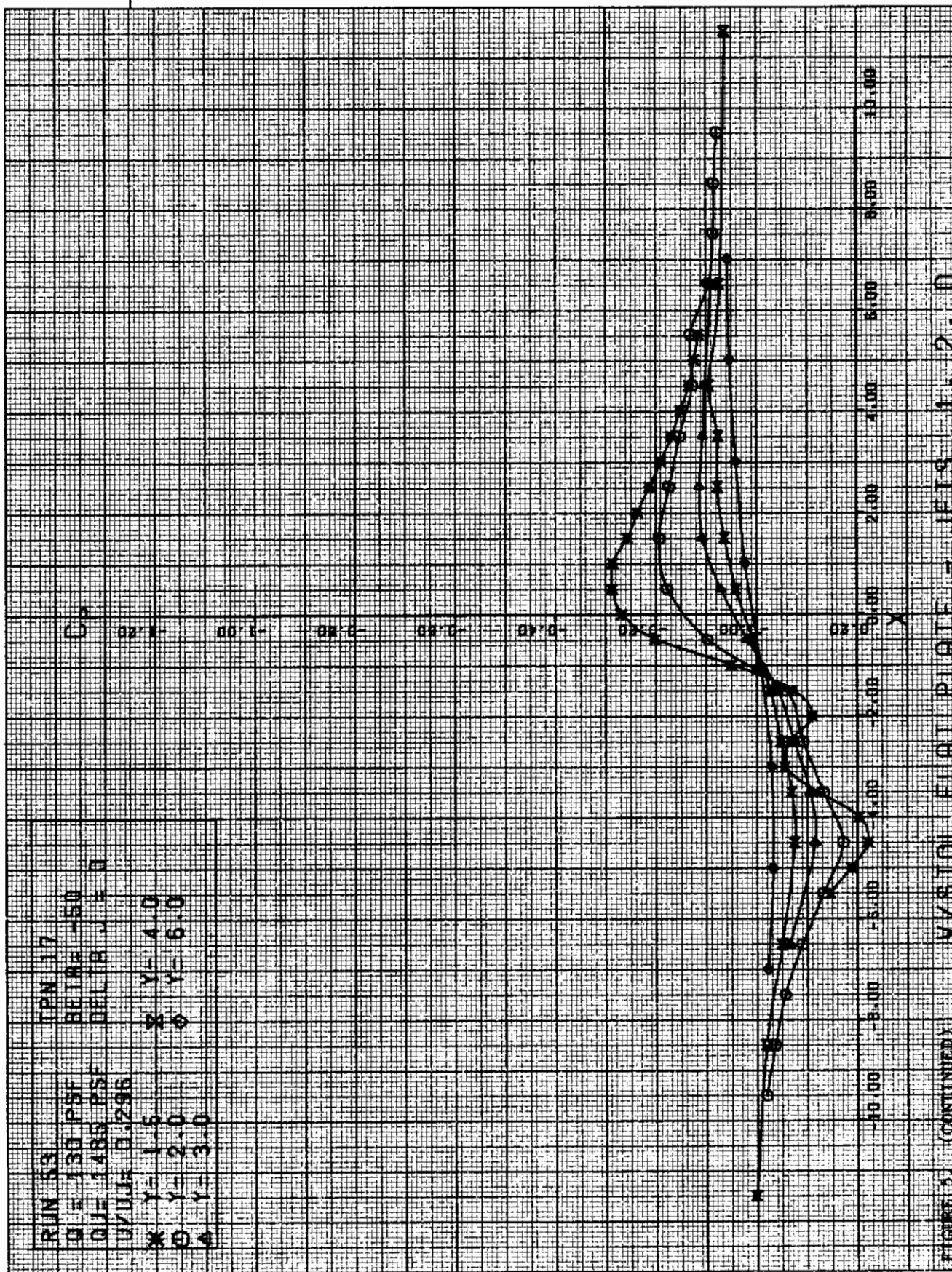
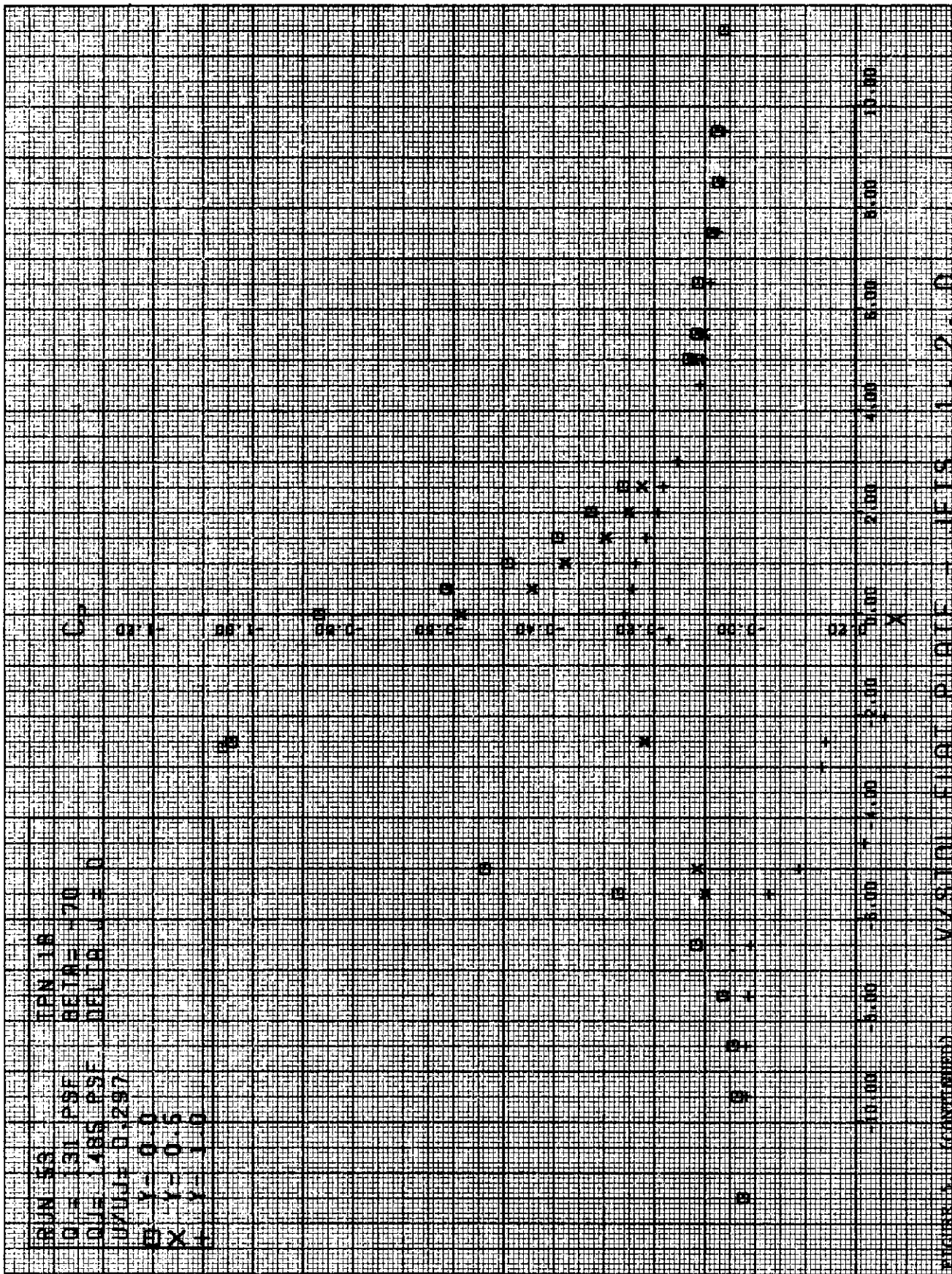
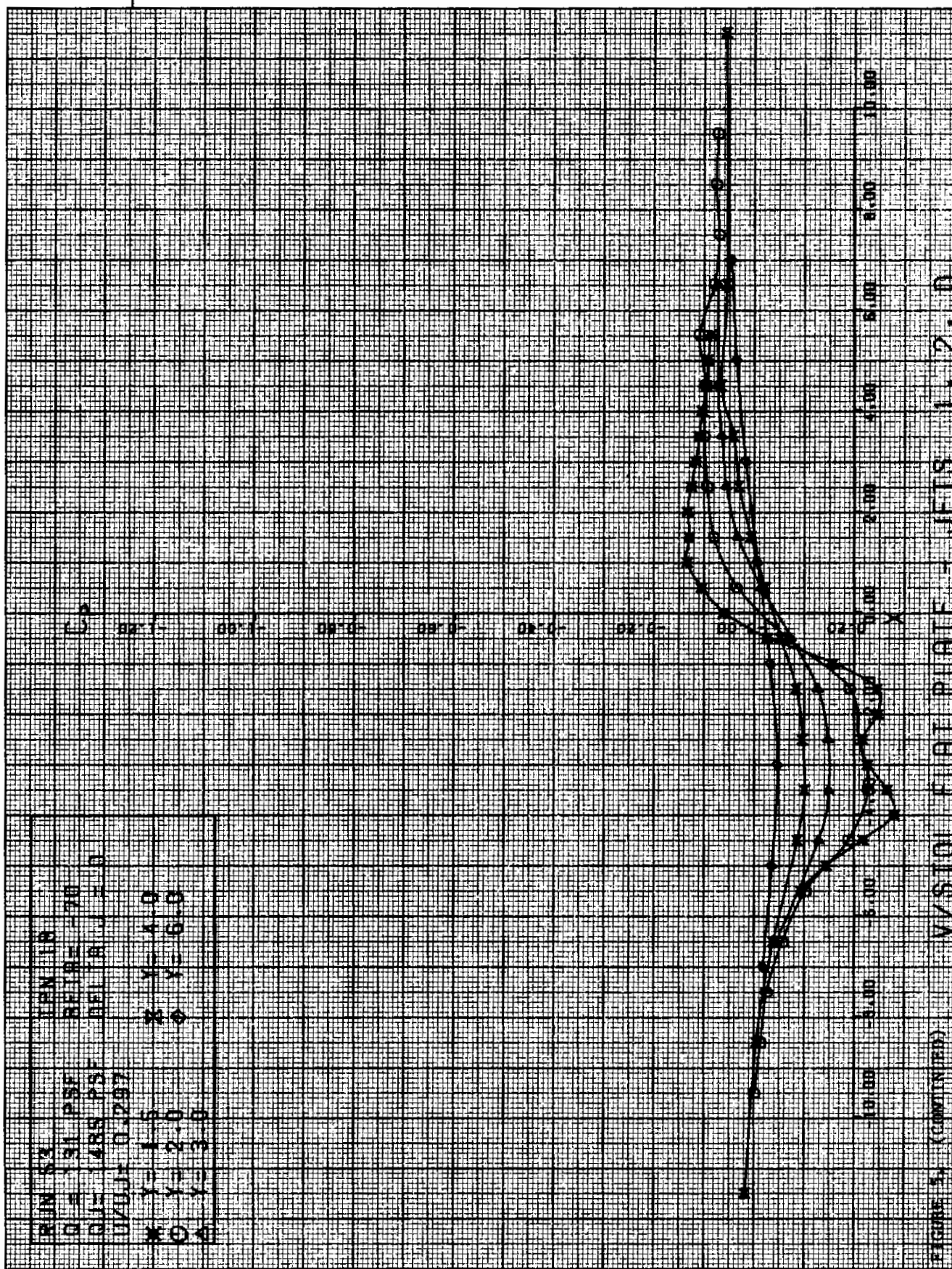


FIGURE 5 (CONTINUED) W5700L FLAT PLATE JET, REF MZ = 40, UPFLW = 0.290









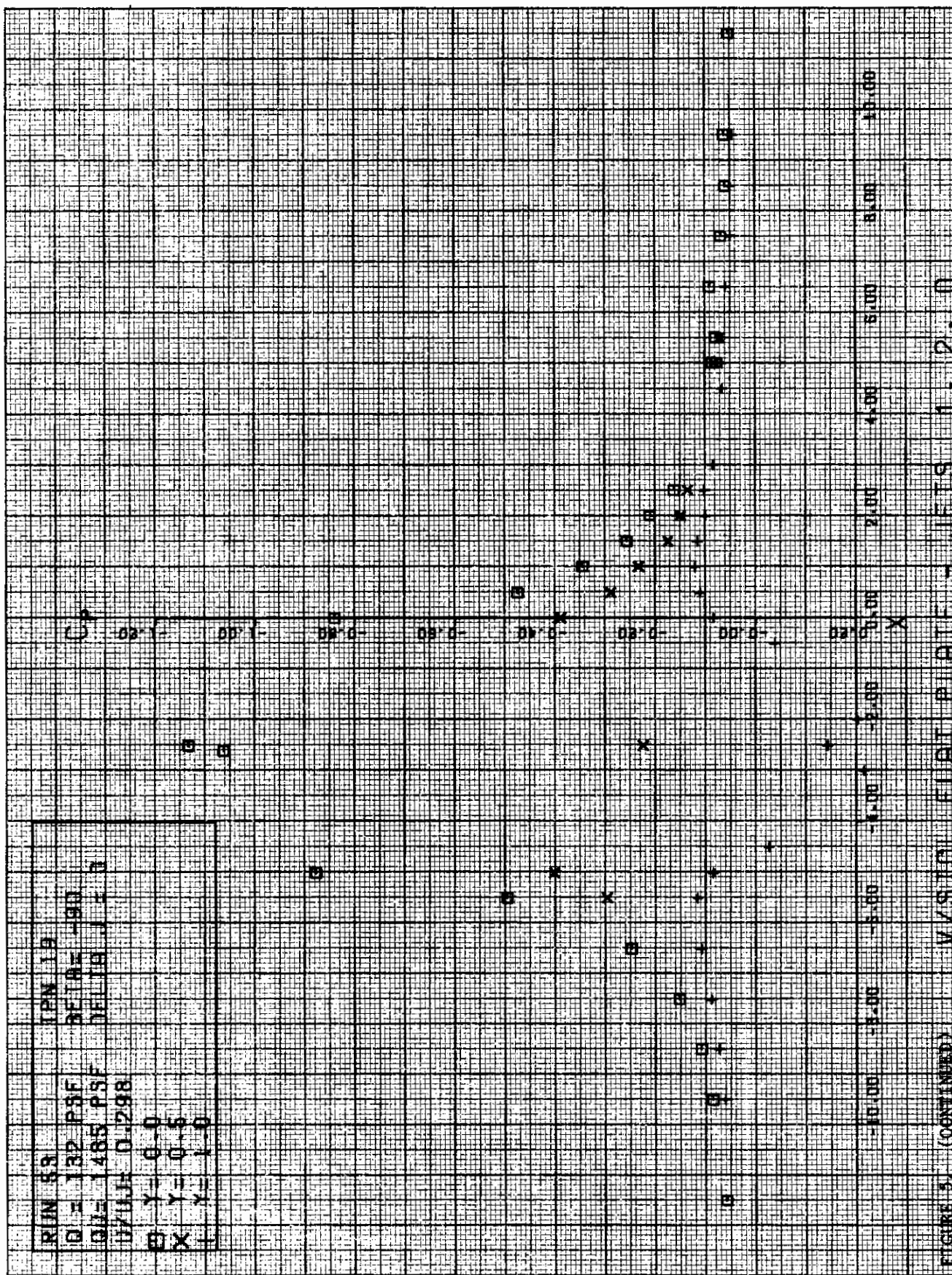
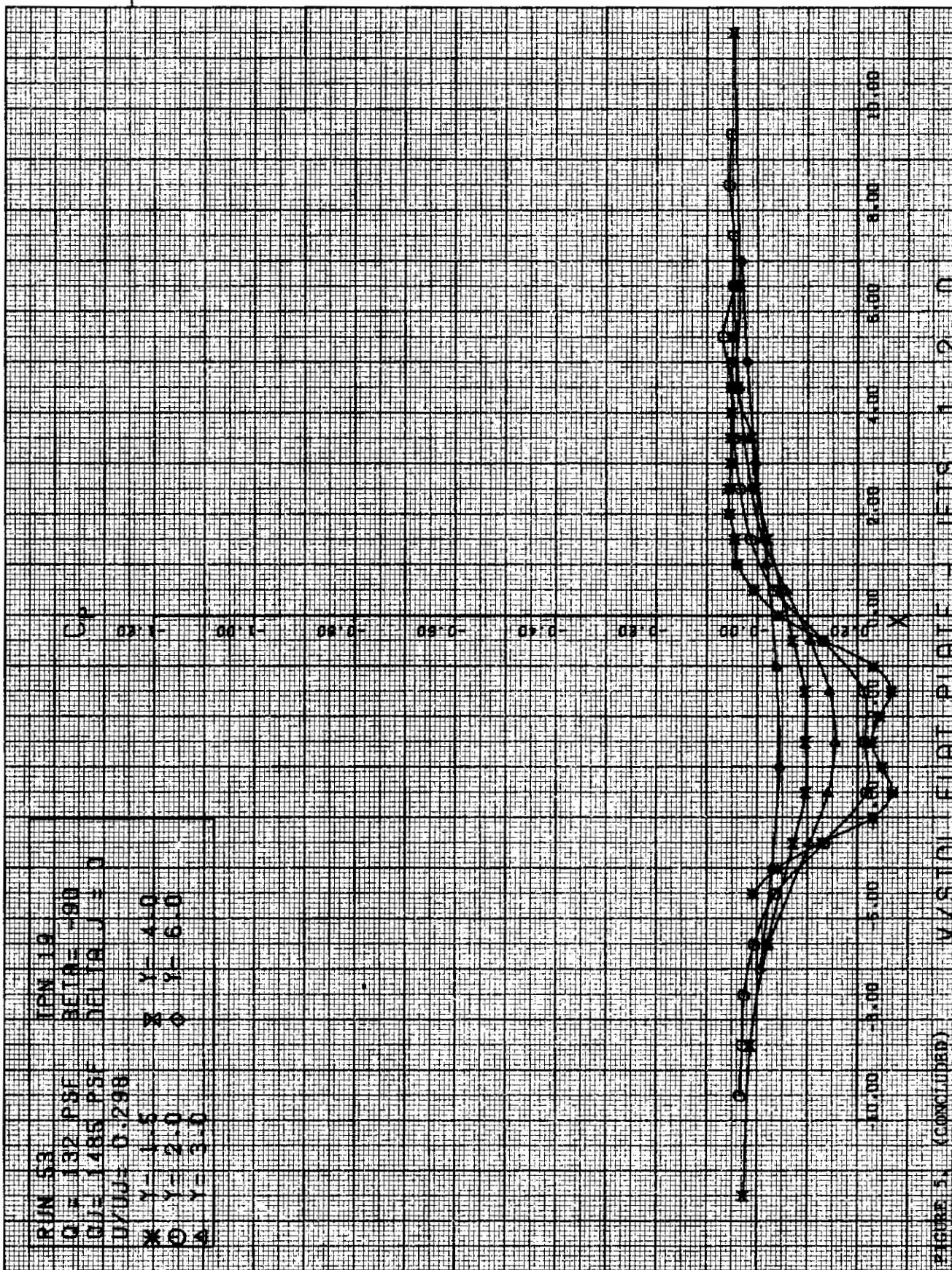
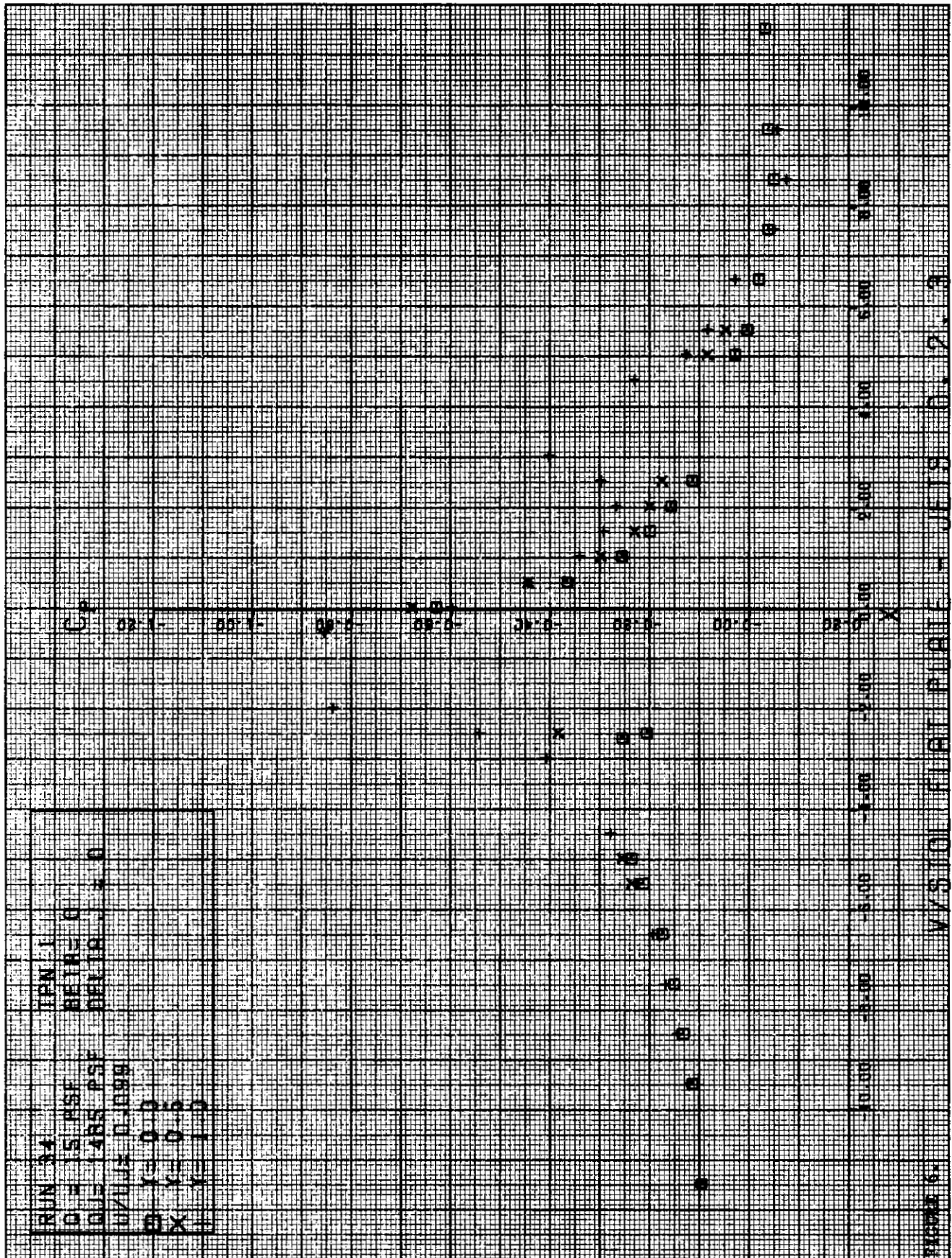
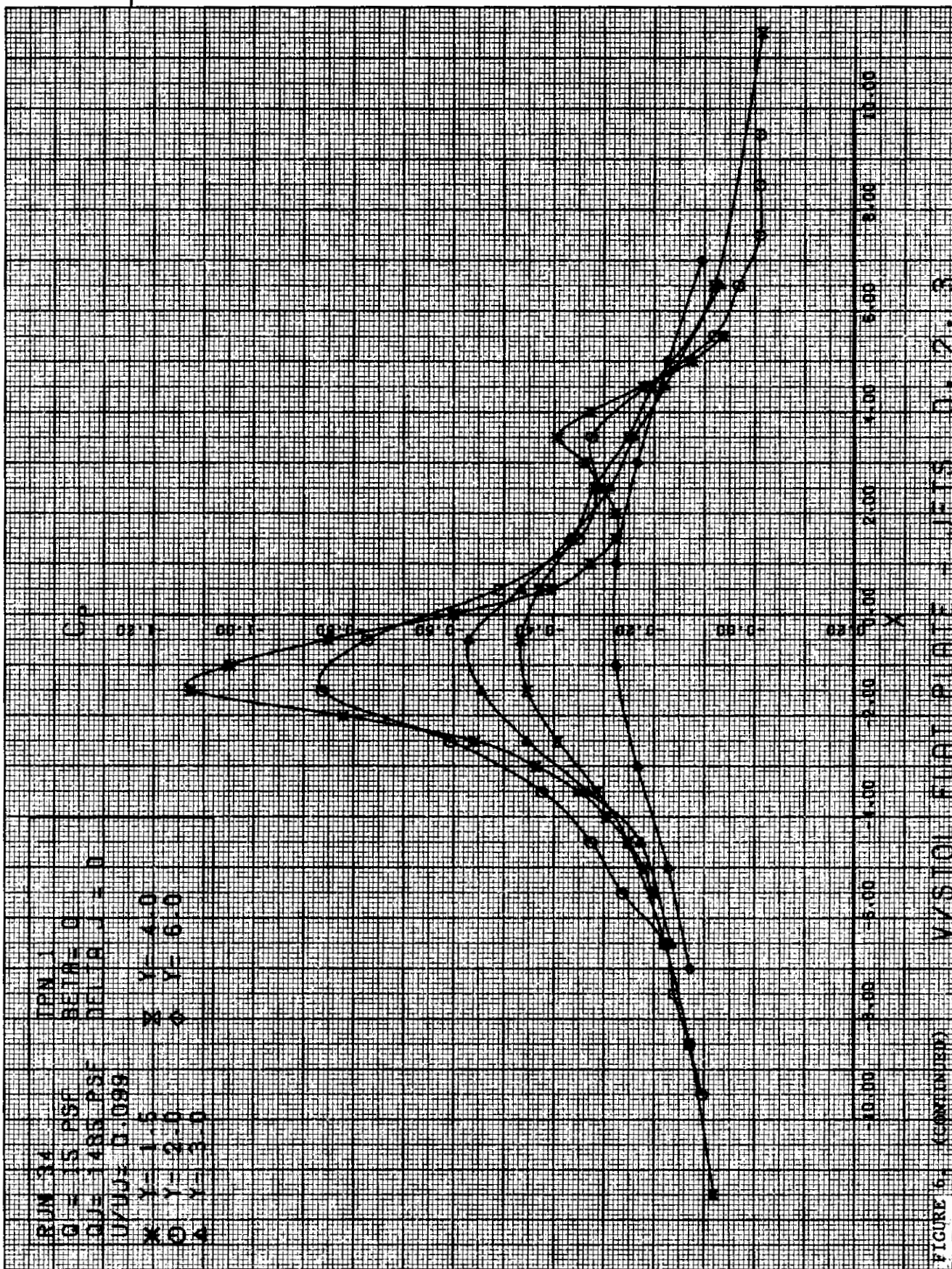
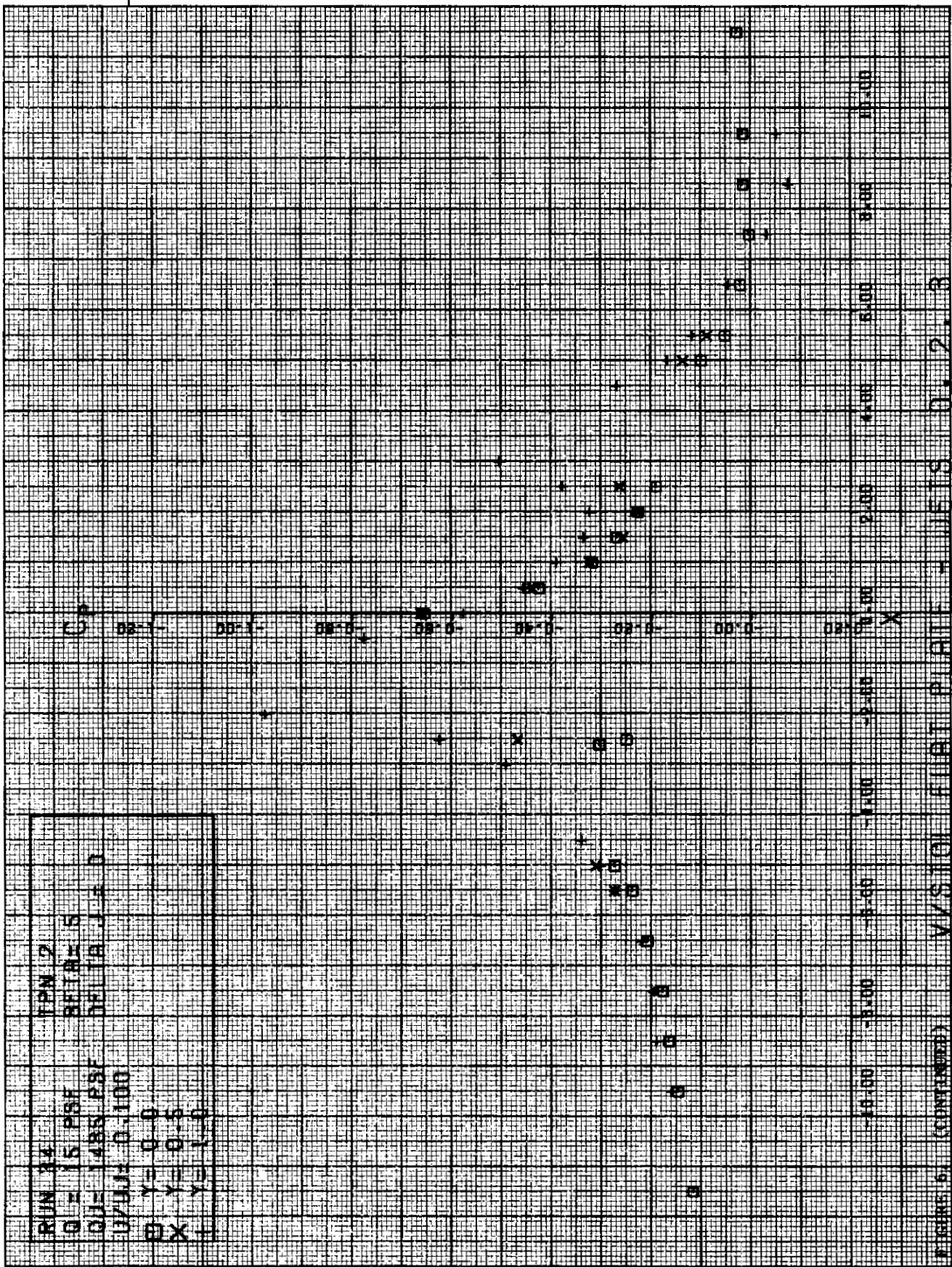


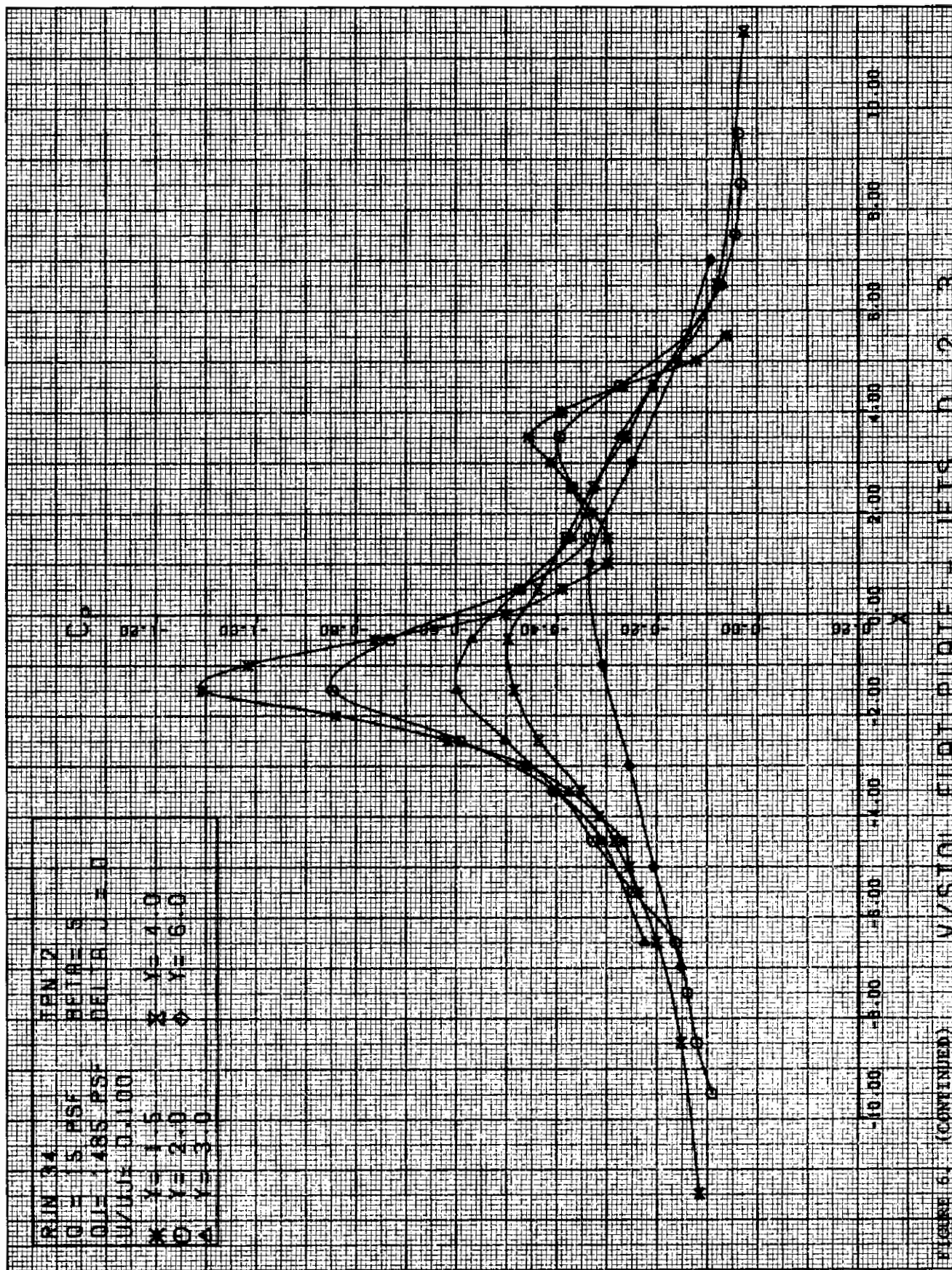
FIGURE 3. (CONTINUED) V/100 FLAT PLATE - JETS 1.2.0











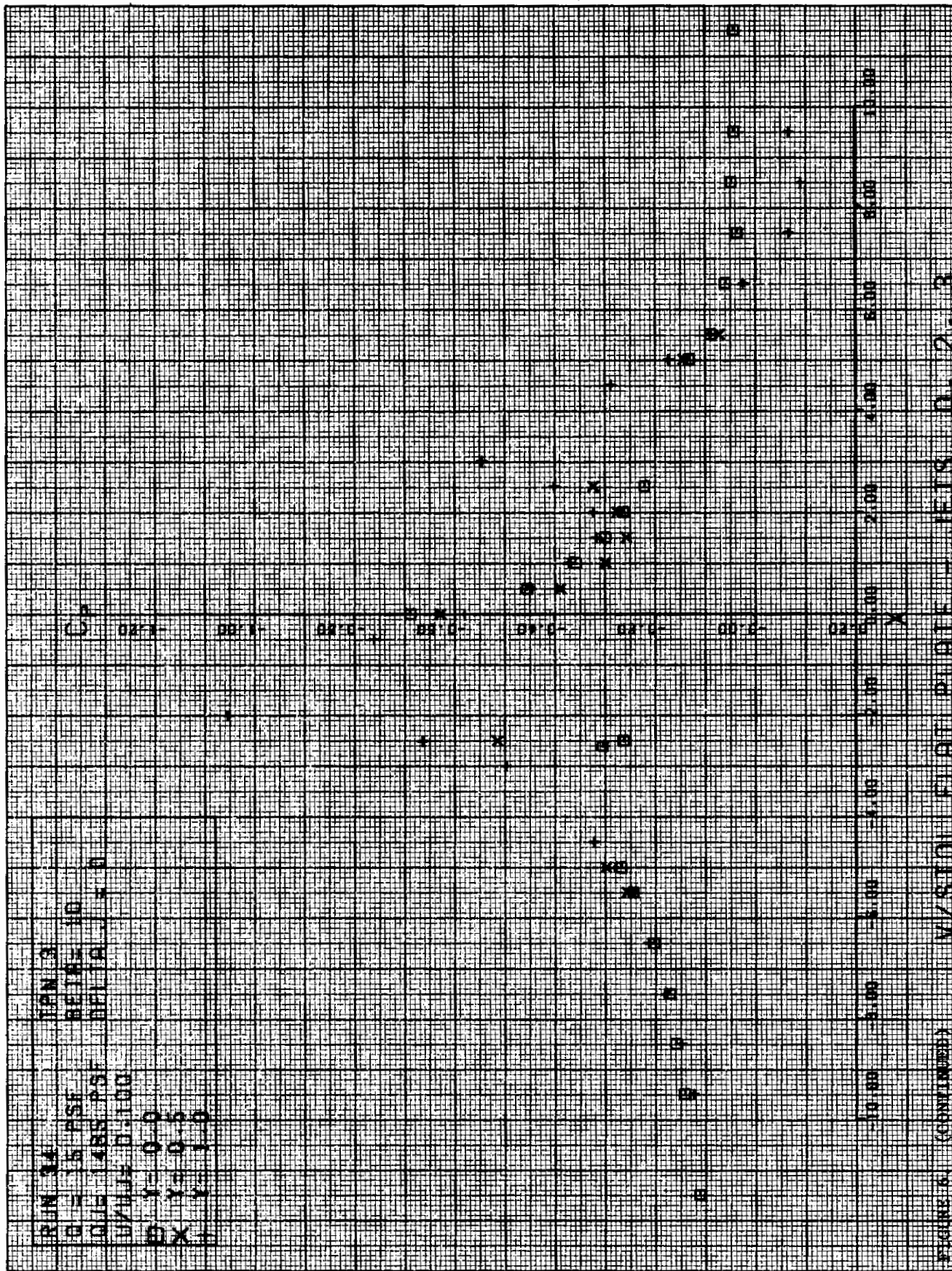
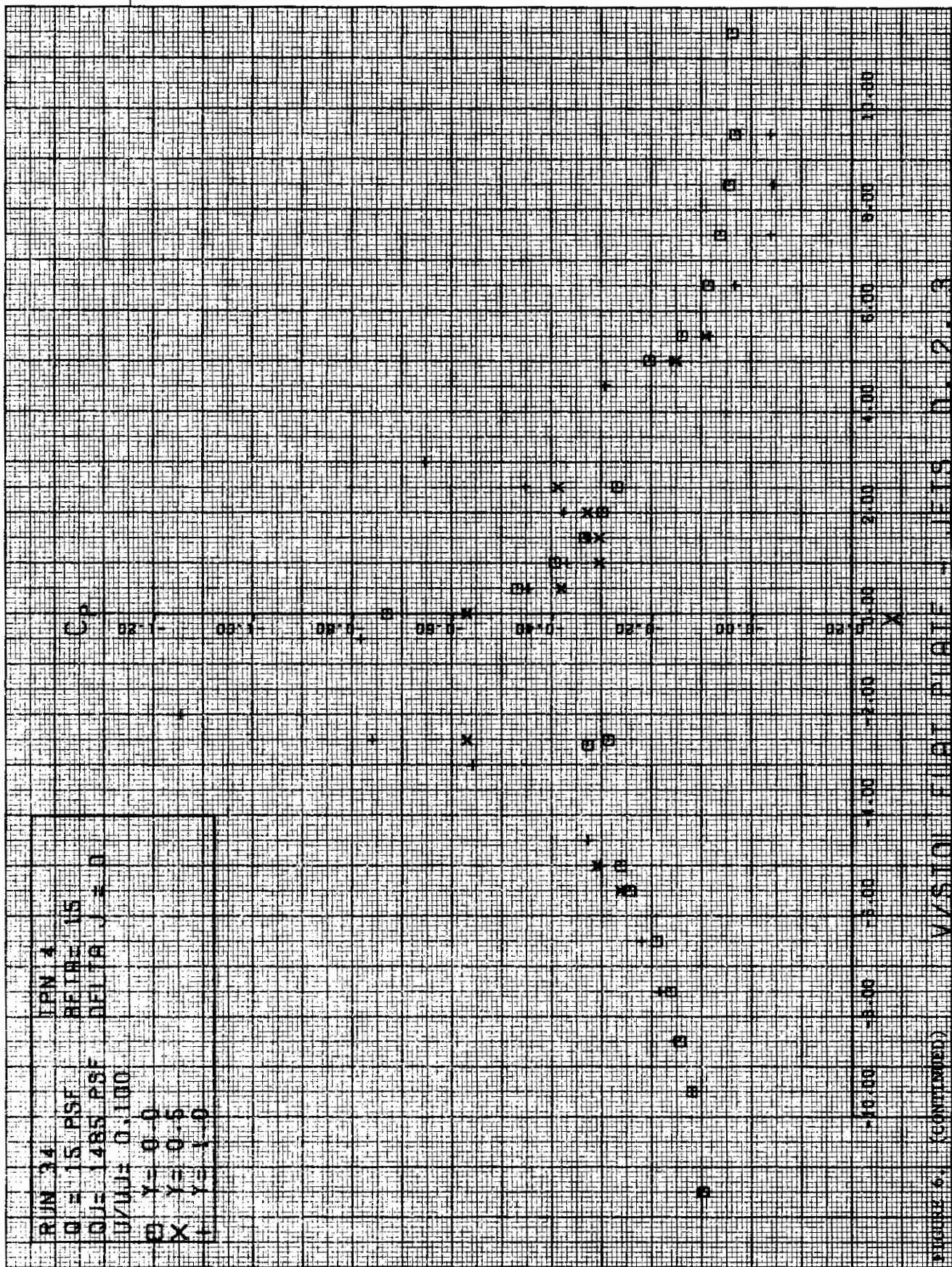
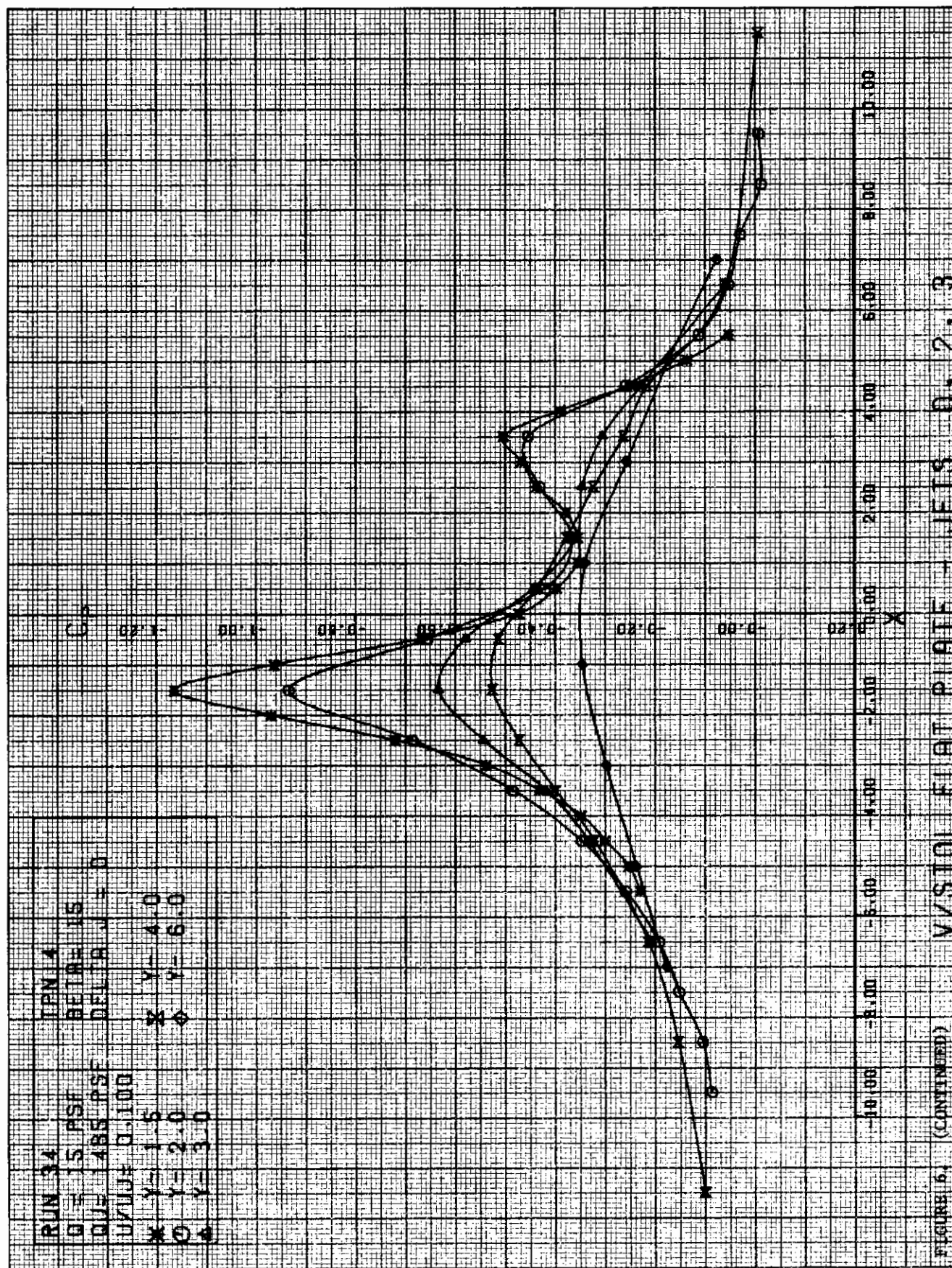


FIGURE 6. (CONTINUED) V/S 101 FLAT PROFILE - JETS D. 2. 3





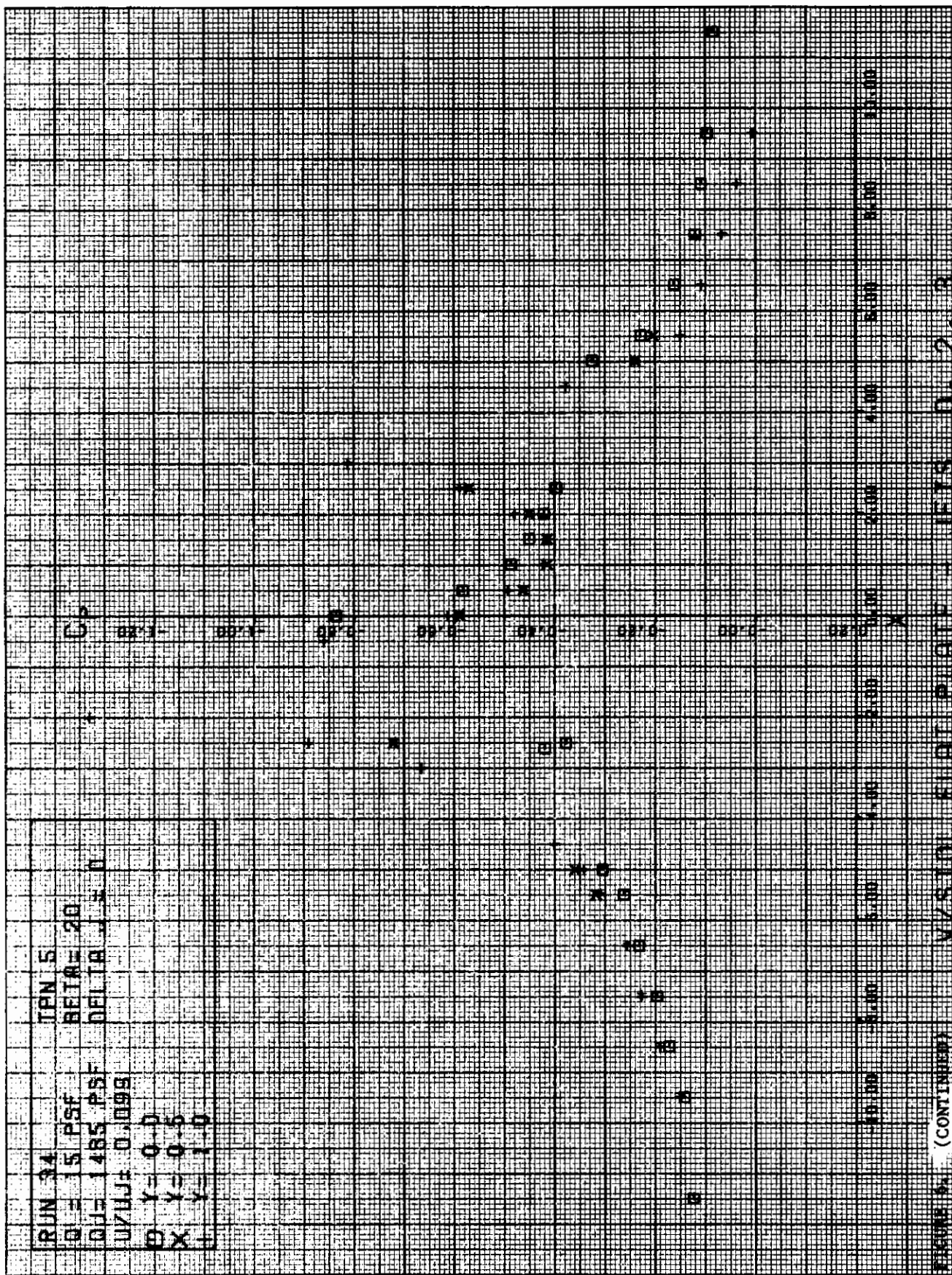
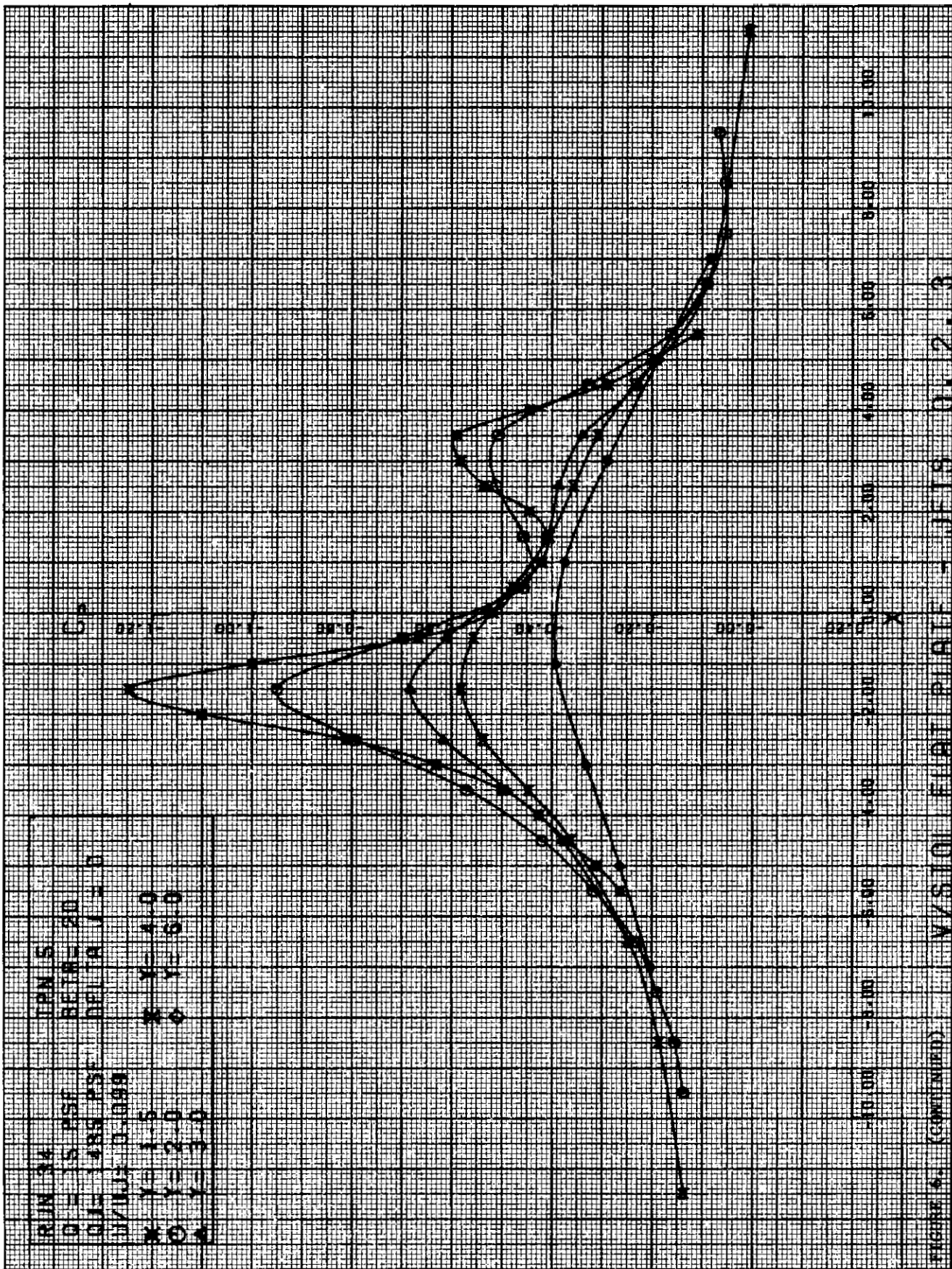
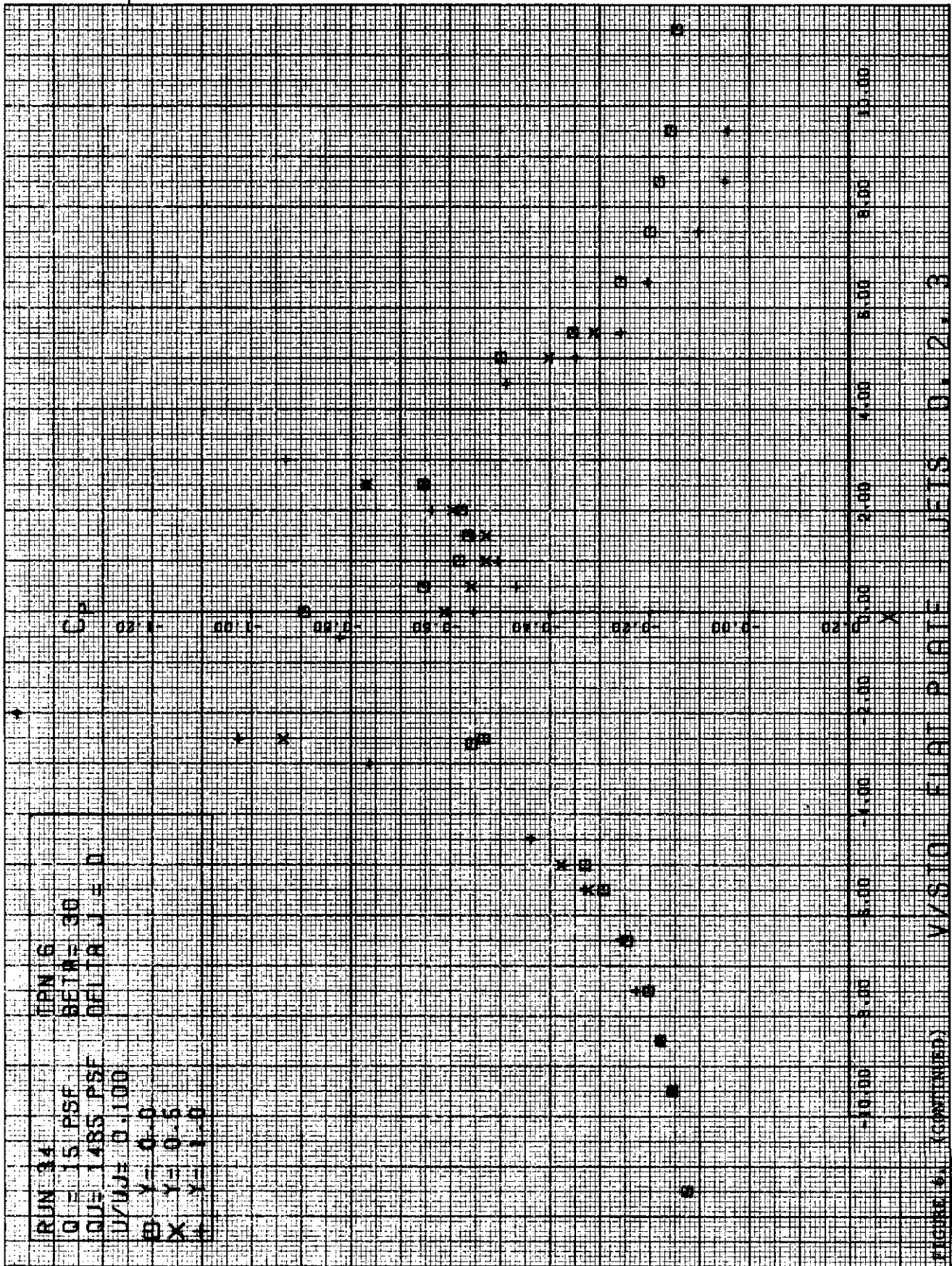
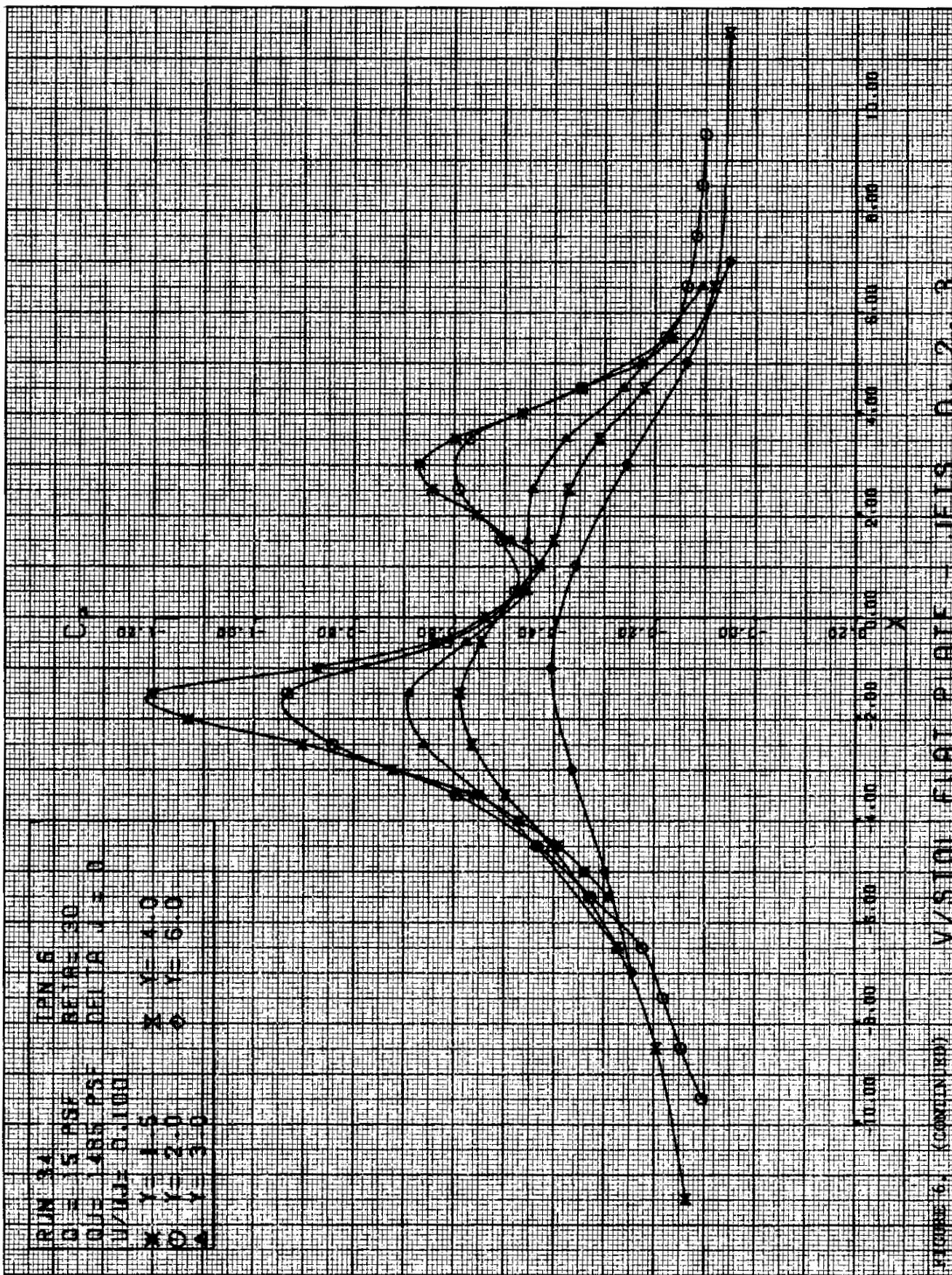


FIGURE 5. (CONTINUED)







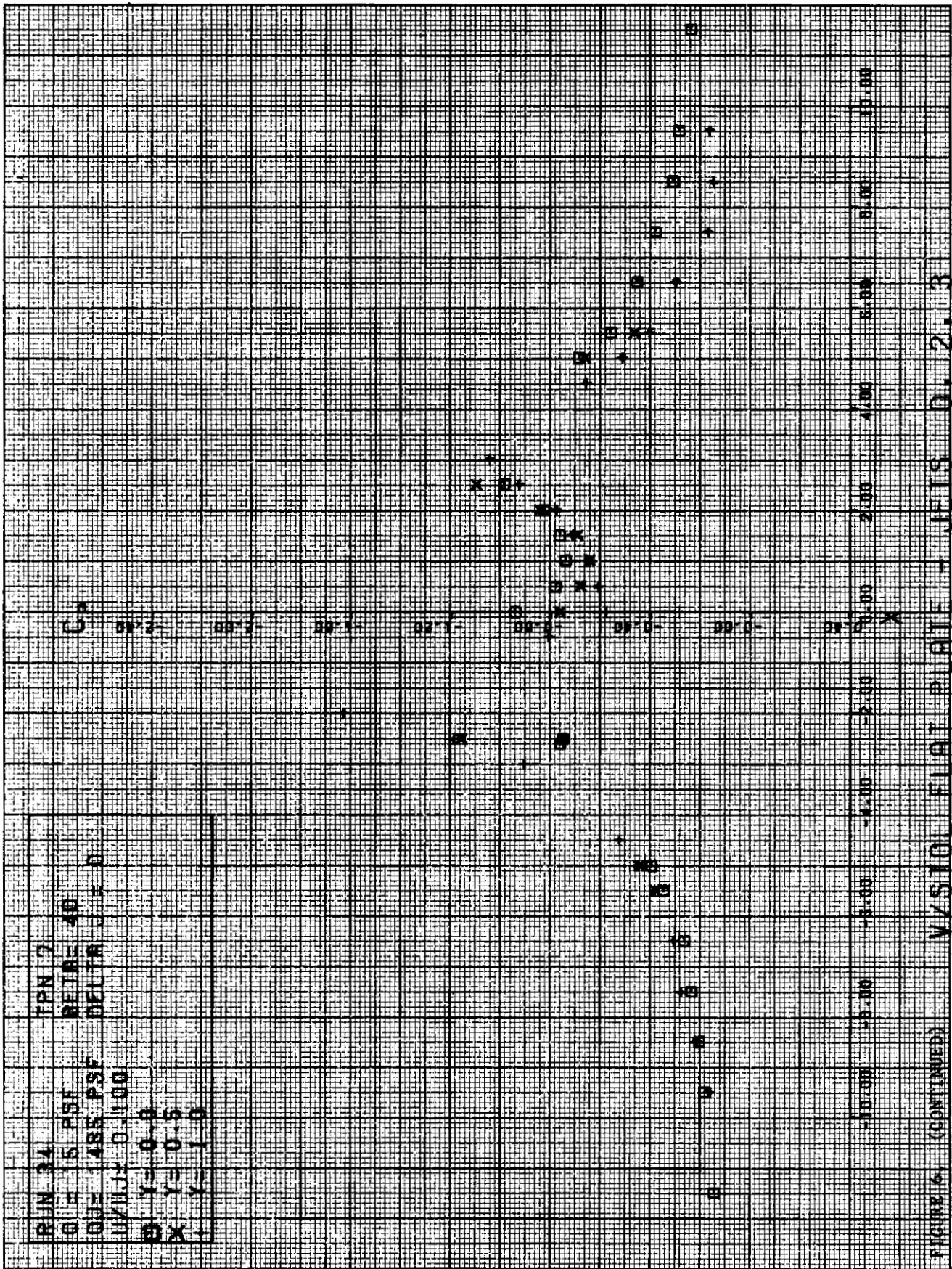
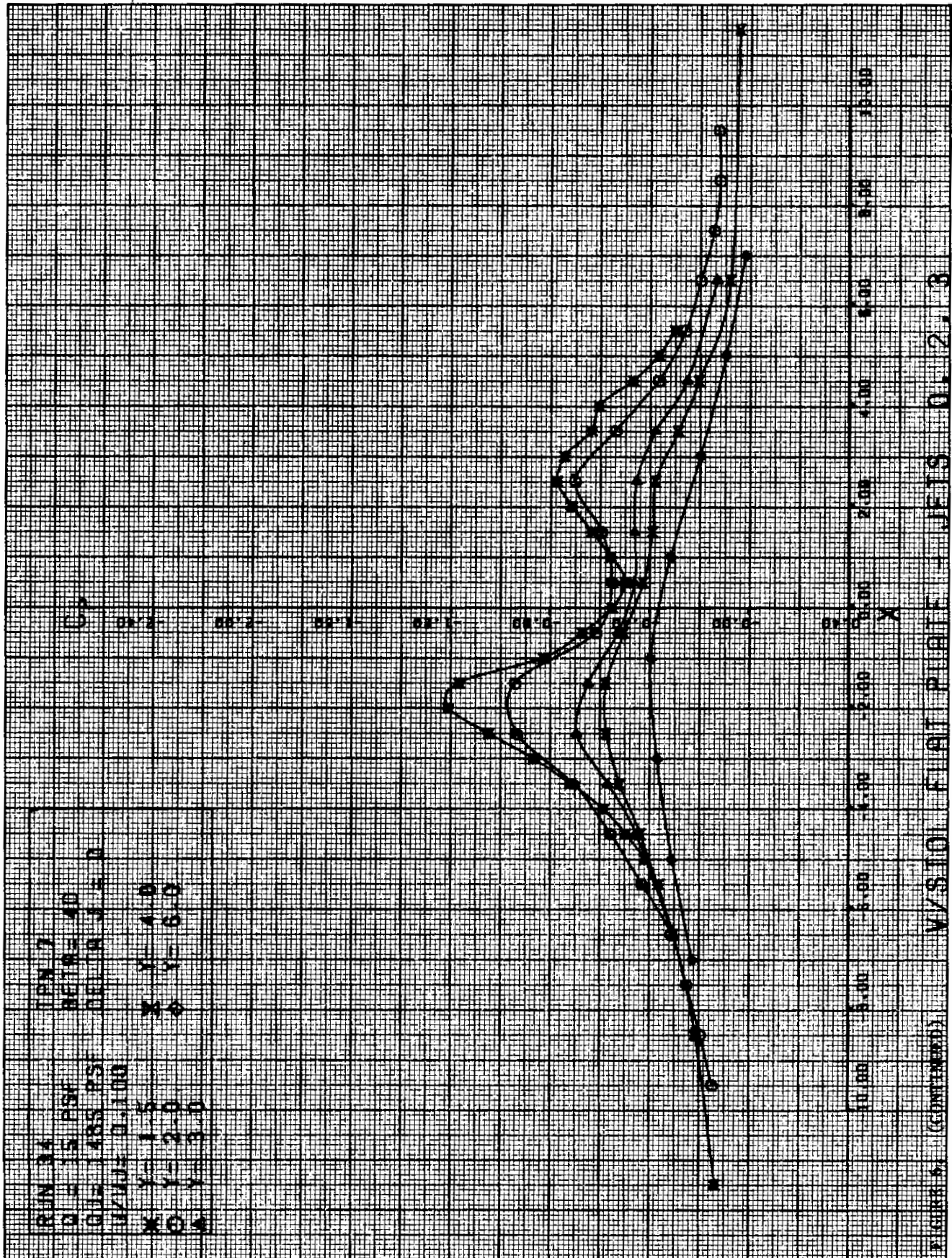
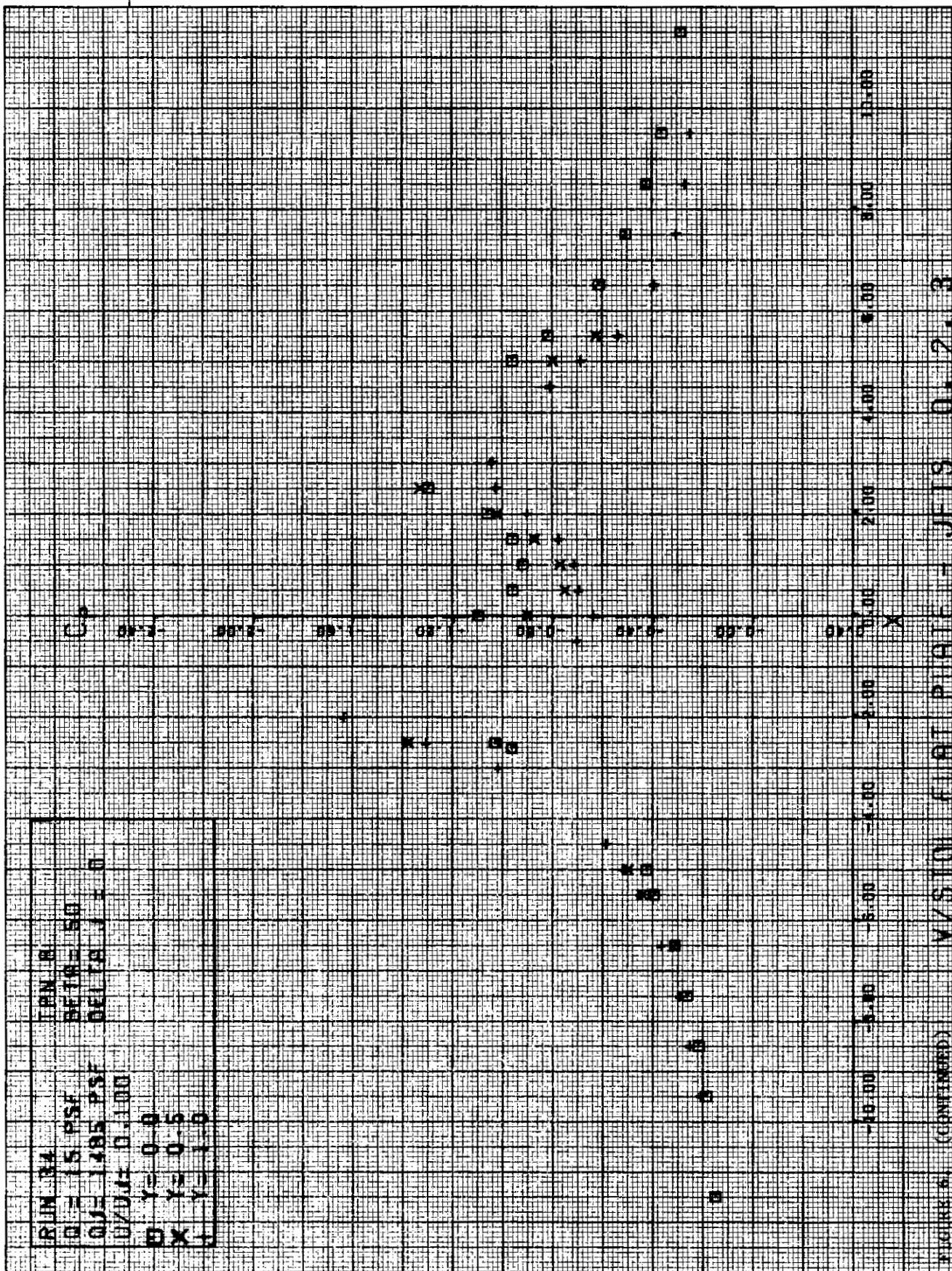


FIGURE 6 (CONTINUED) V5100 FLAT PLATE - JETS 0.2.3





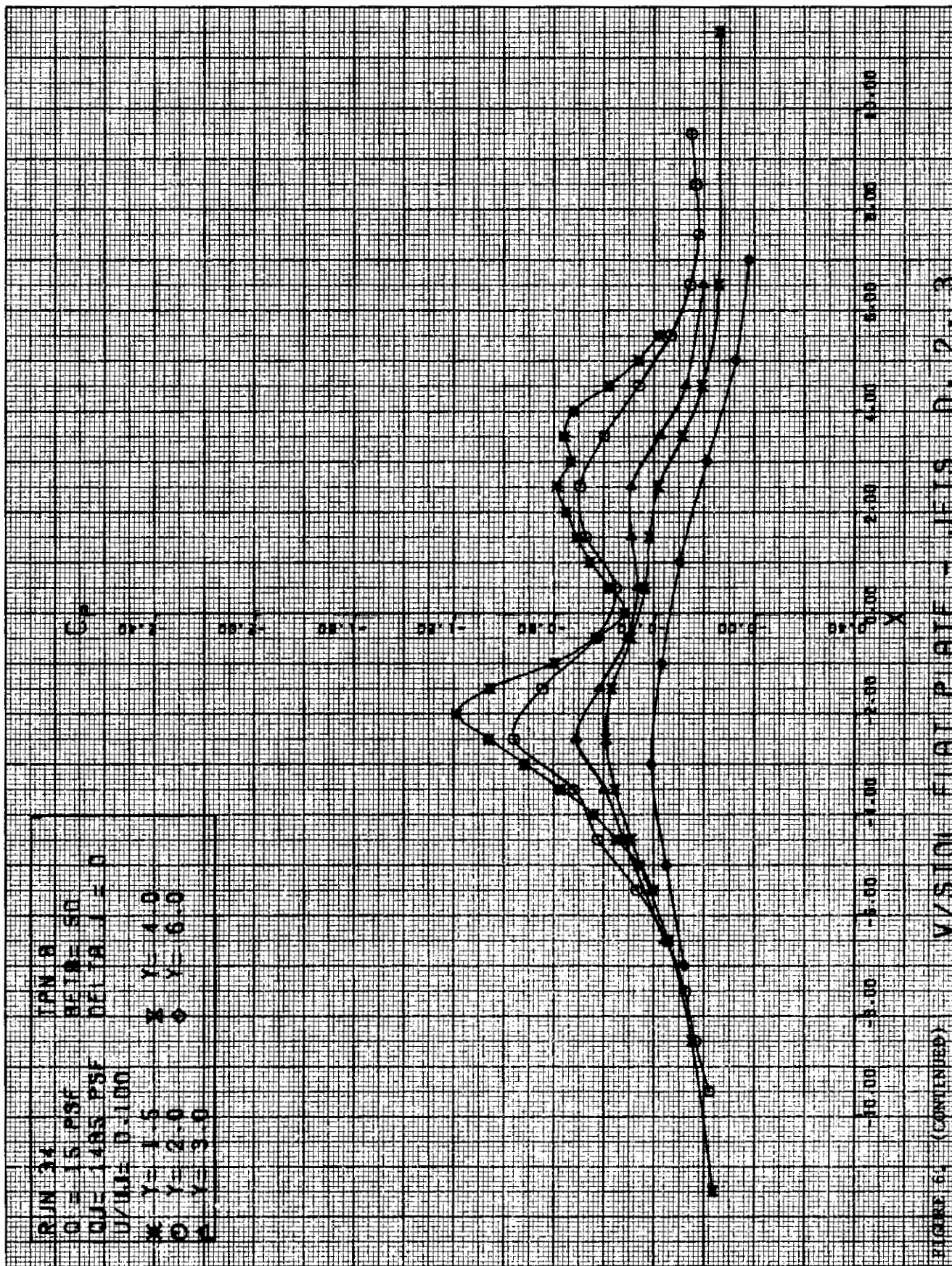


FIGURE 6. (CONTINUED) V/5100 FLAT PLATE - JETS 0.2-3

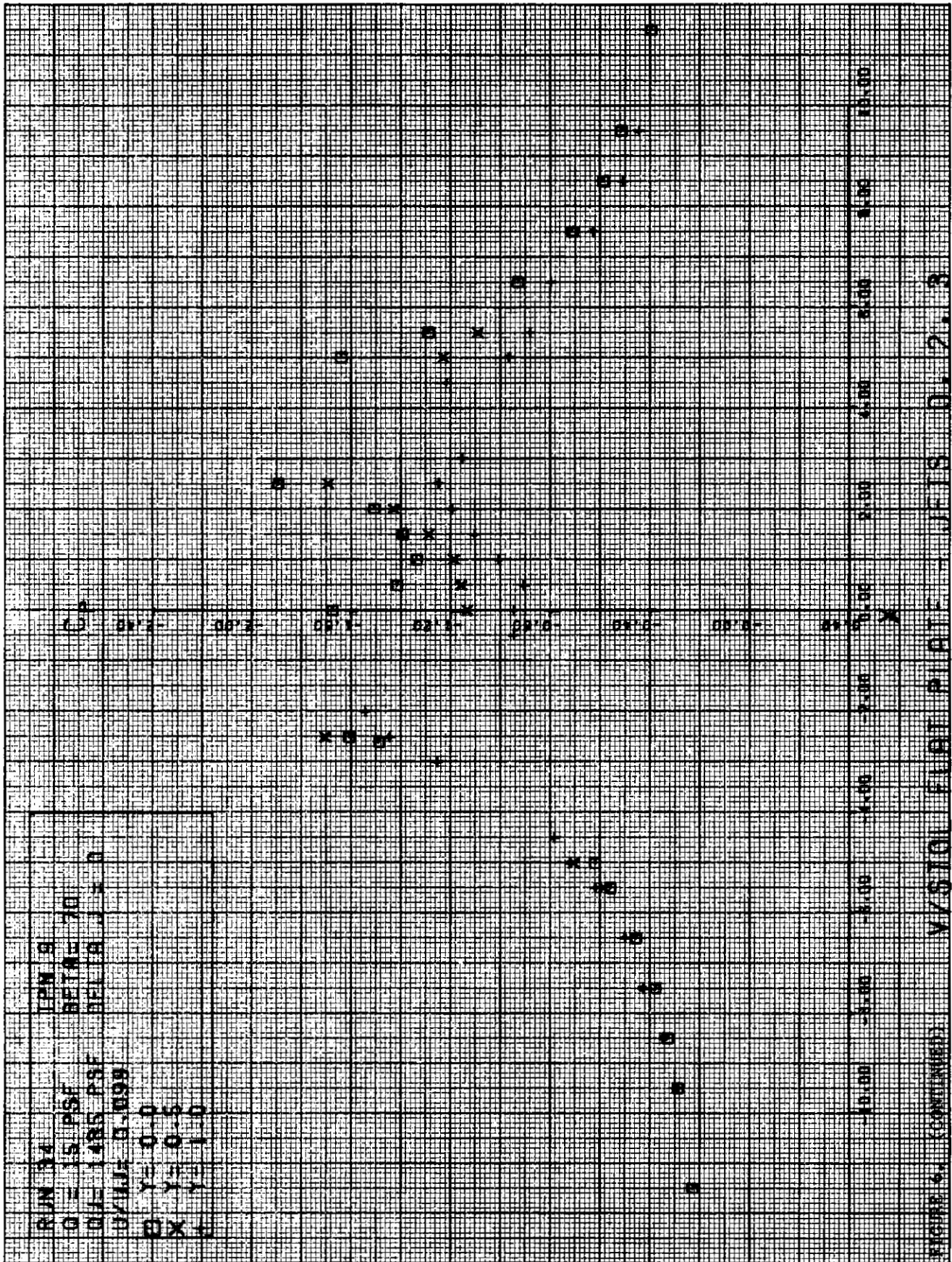
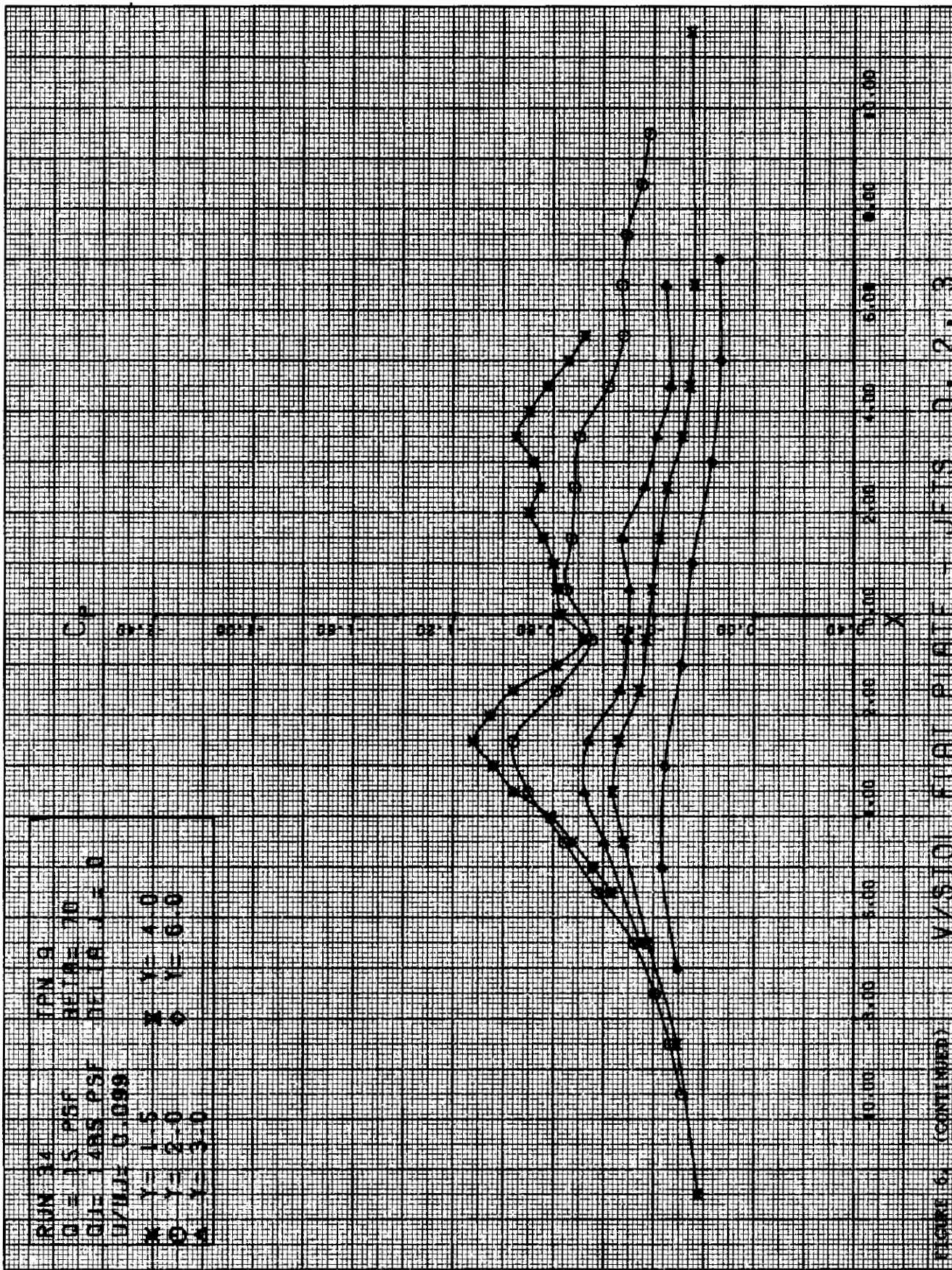
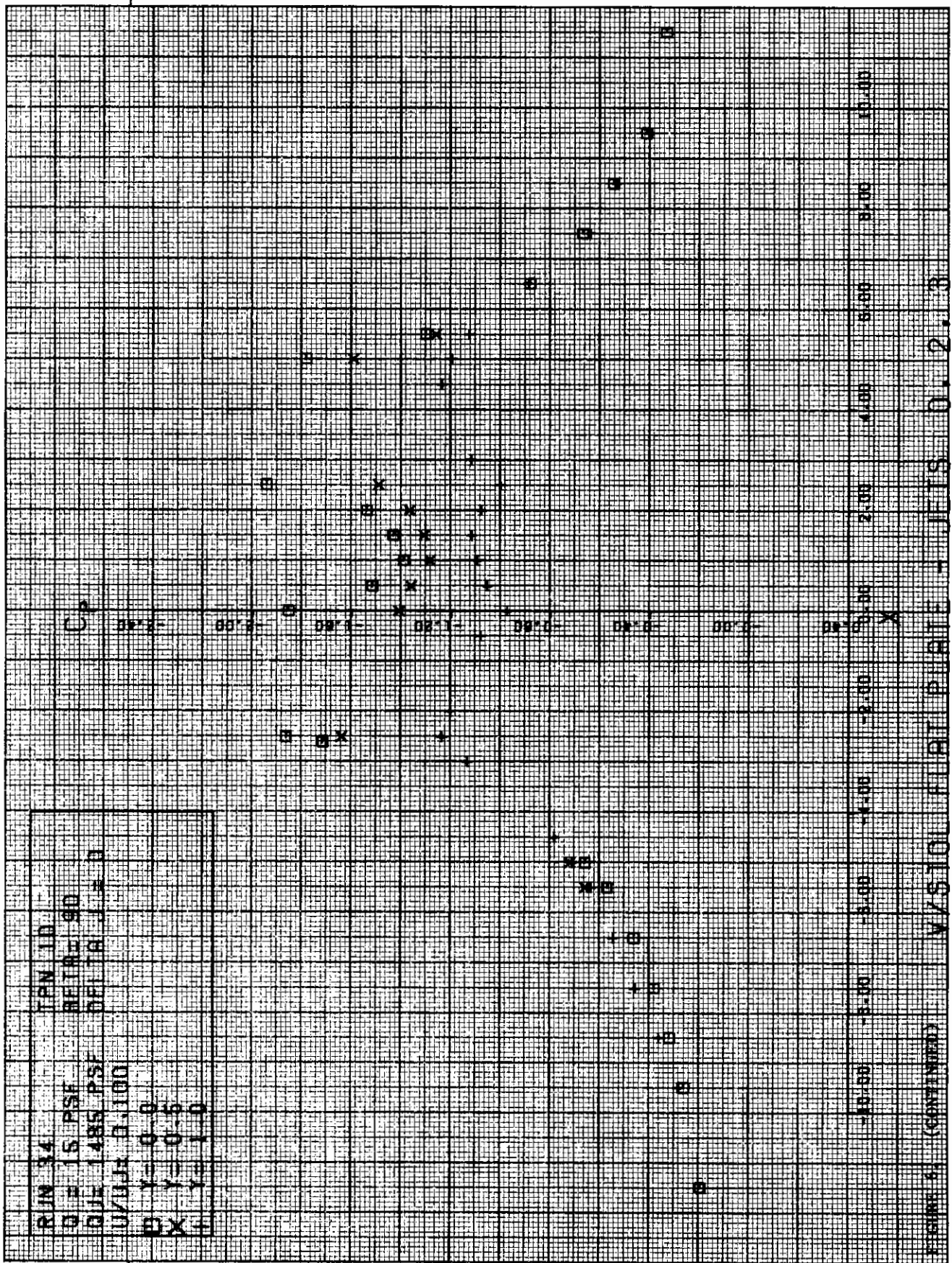
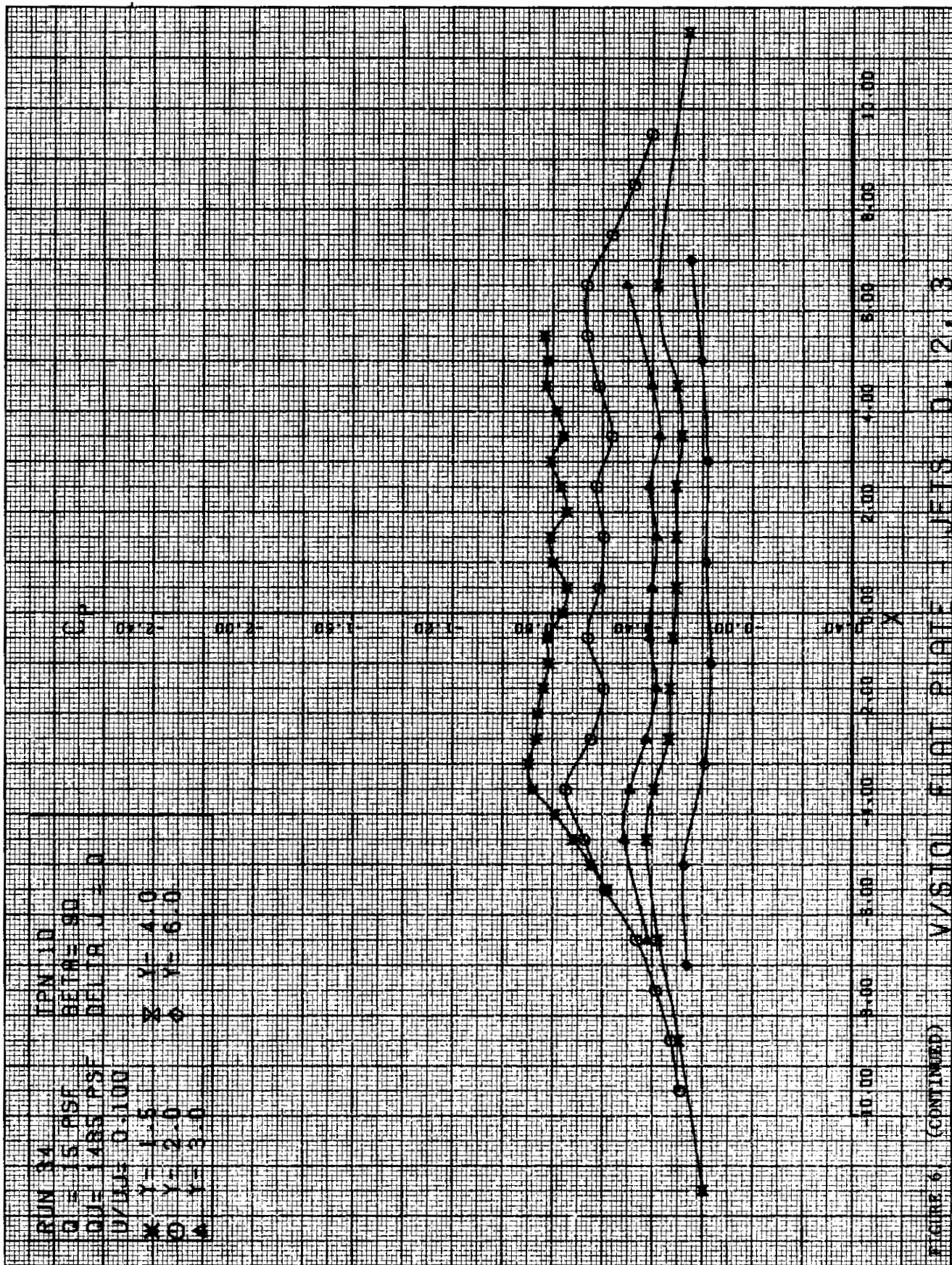


FIGURE 6. (CONTINUED) V/STOL FLAT PLATE J/FIS 0.2. 3







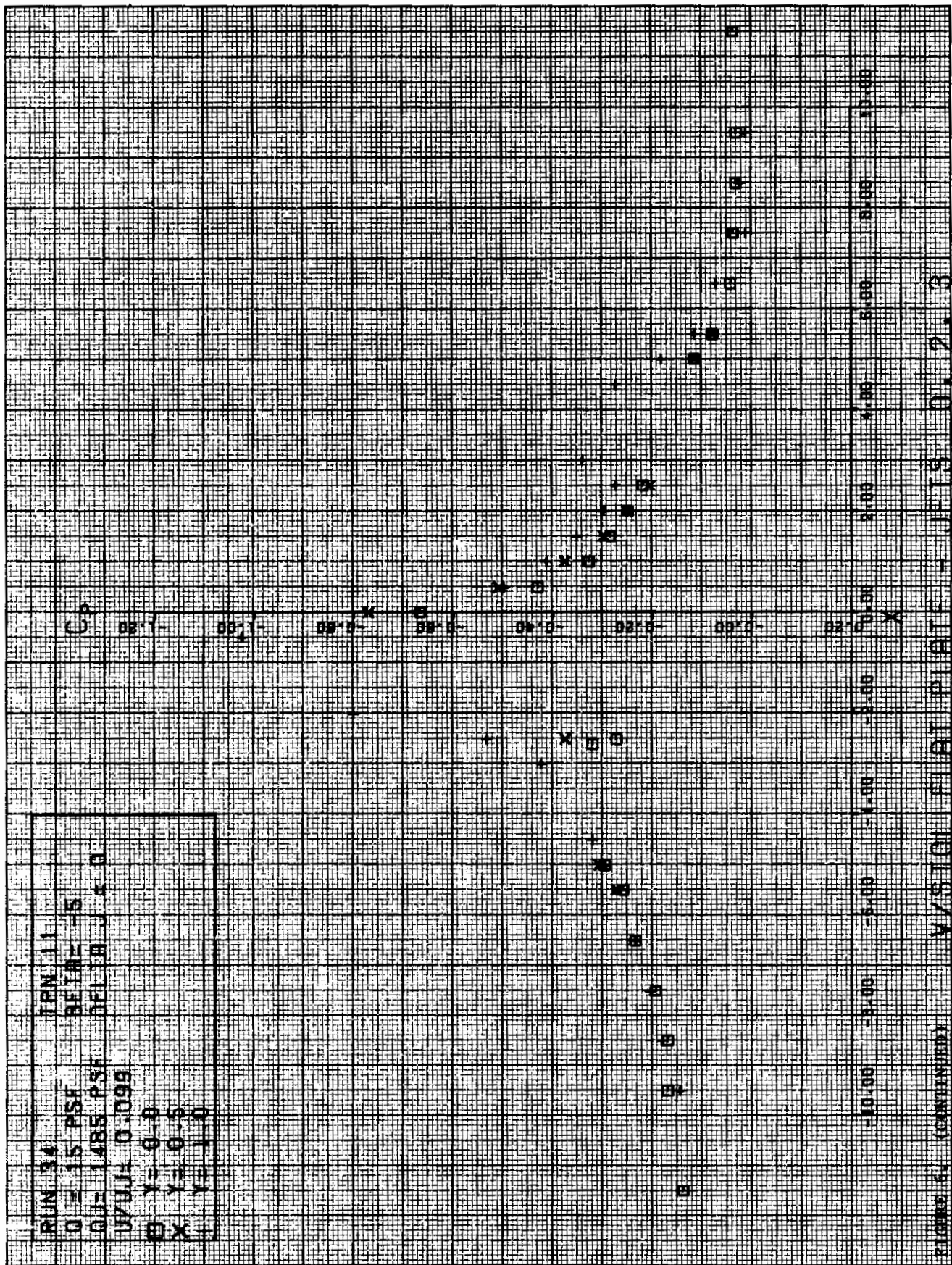
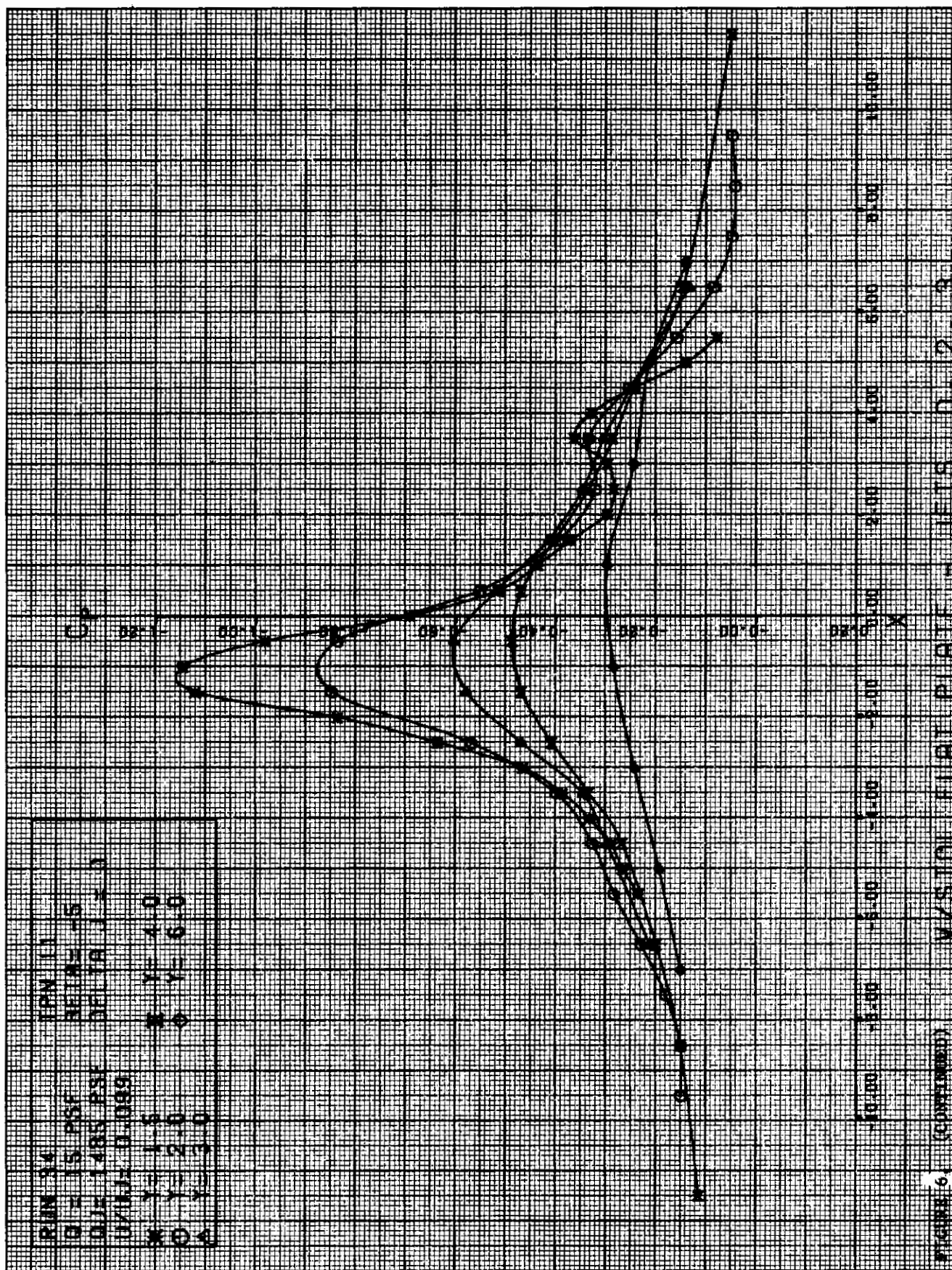


Figure 64 (CONTINUED) VISION FLAT PLATE - JETIS 0.2.3



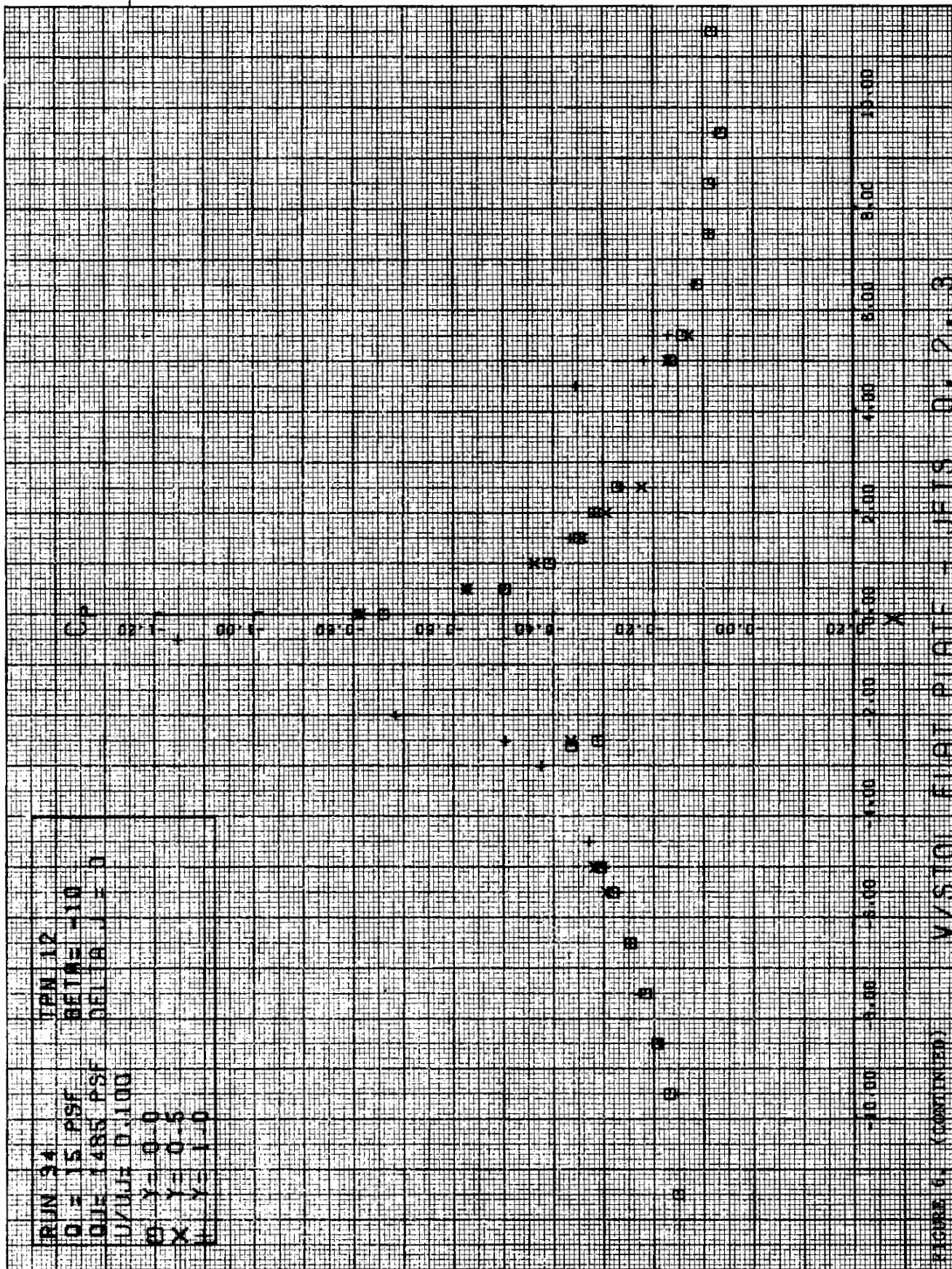
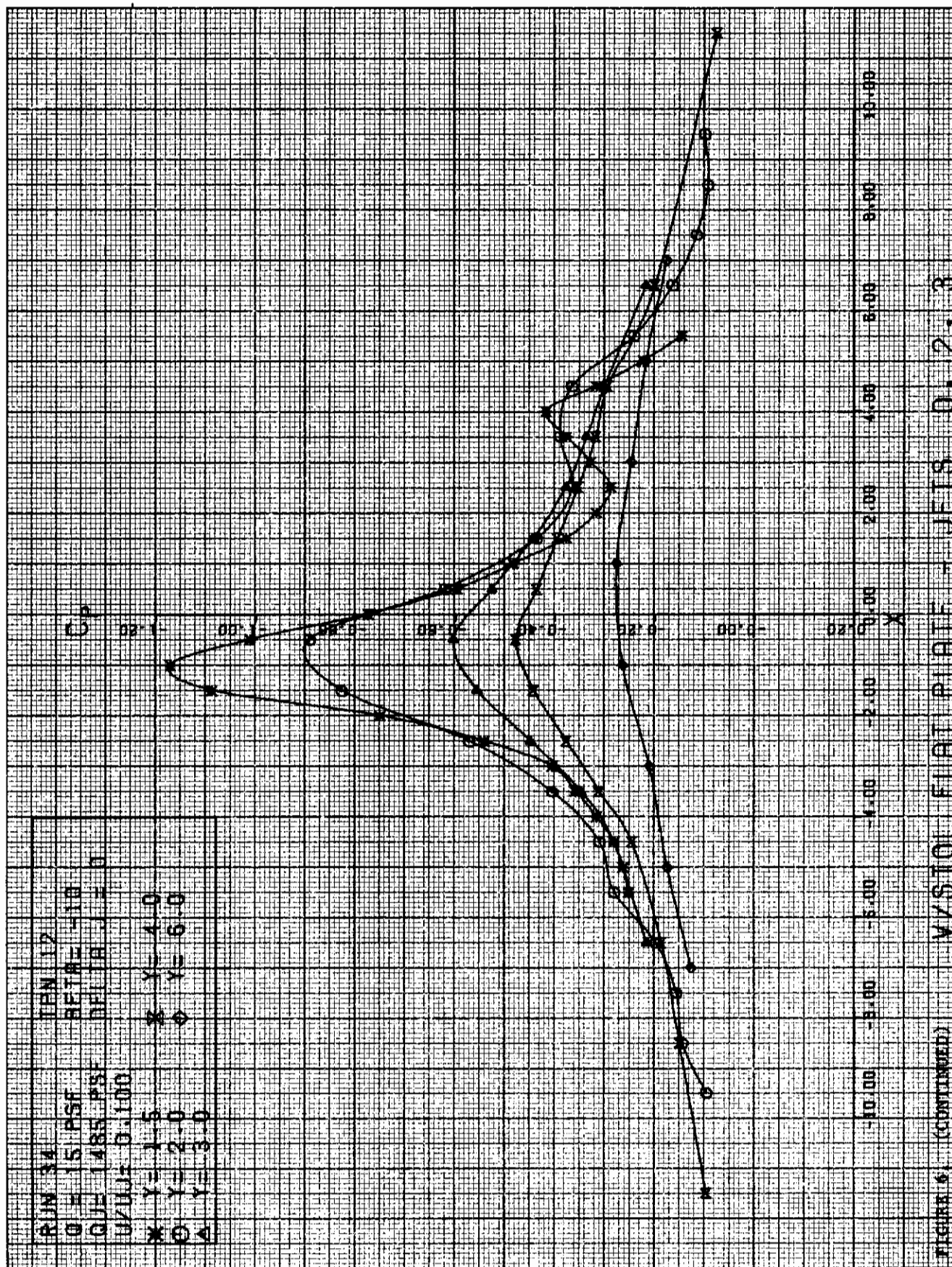


FIGURE 6. (CONTINUED) V/STOL FLAT PLATE - JETS 0.2.3



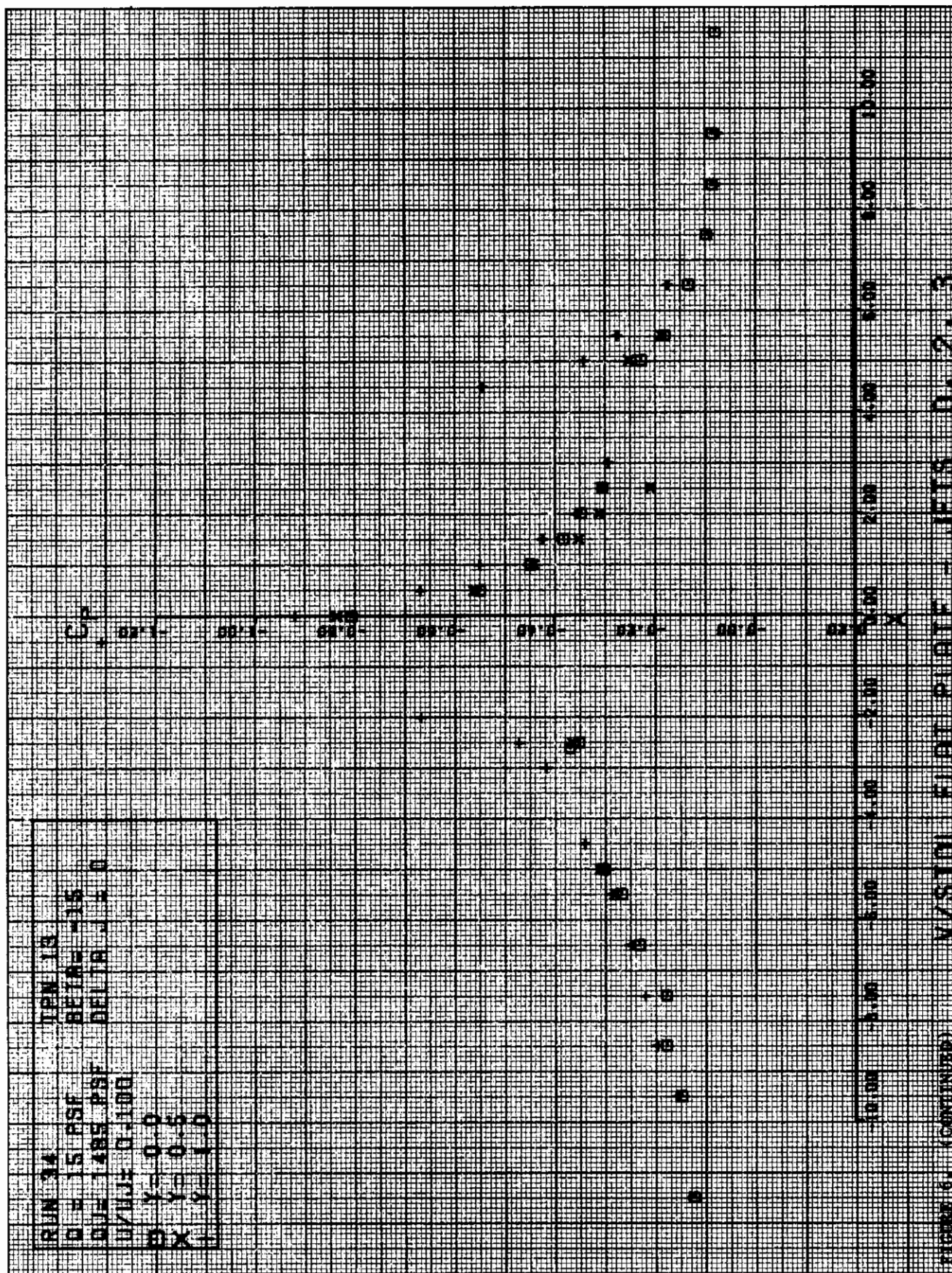


FIGURE 6. (CONTINUED) V/STOL FLIGHT PROFILE - JETS D. 2. 3

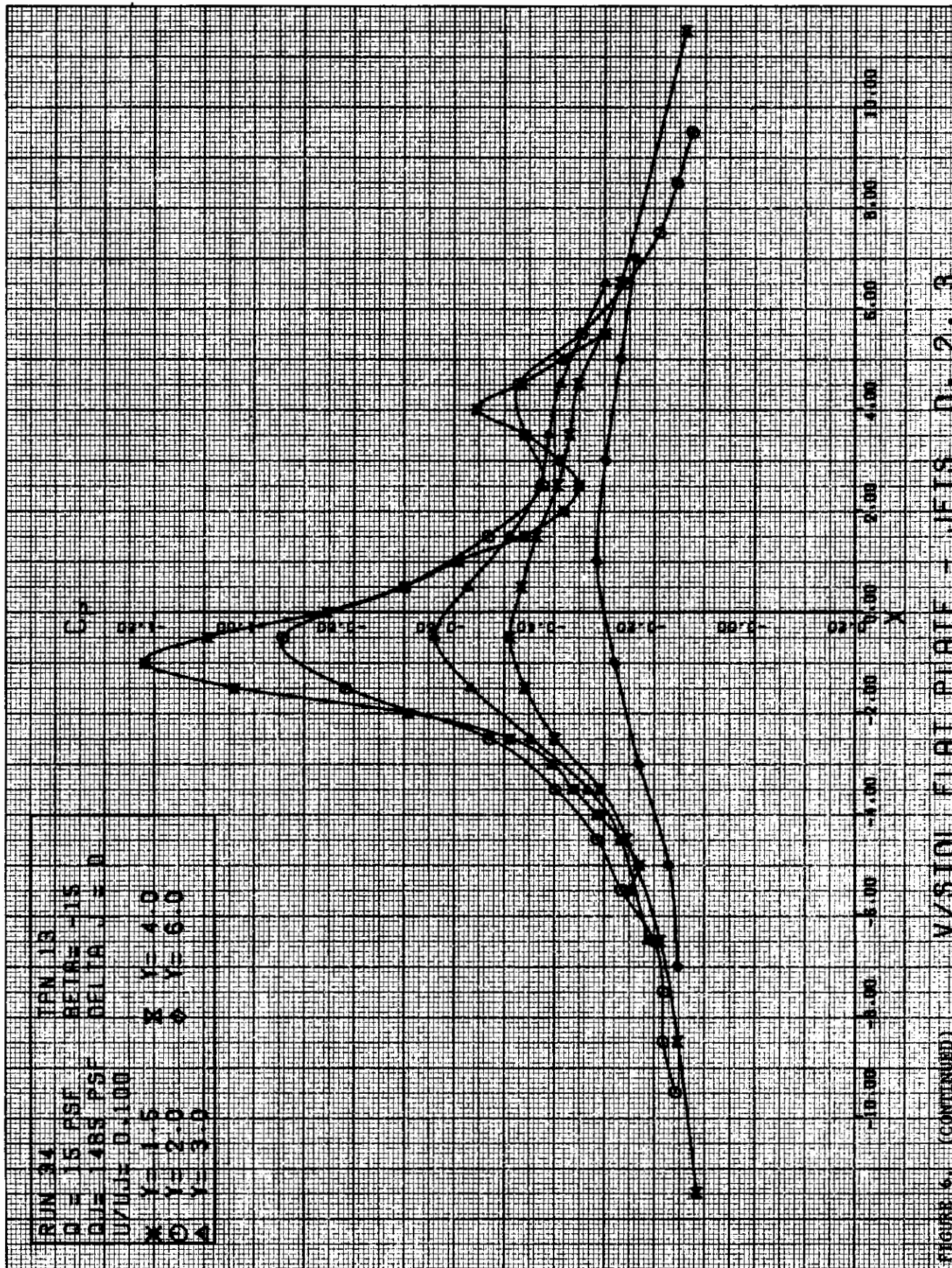
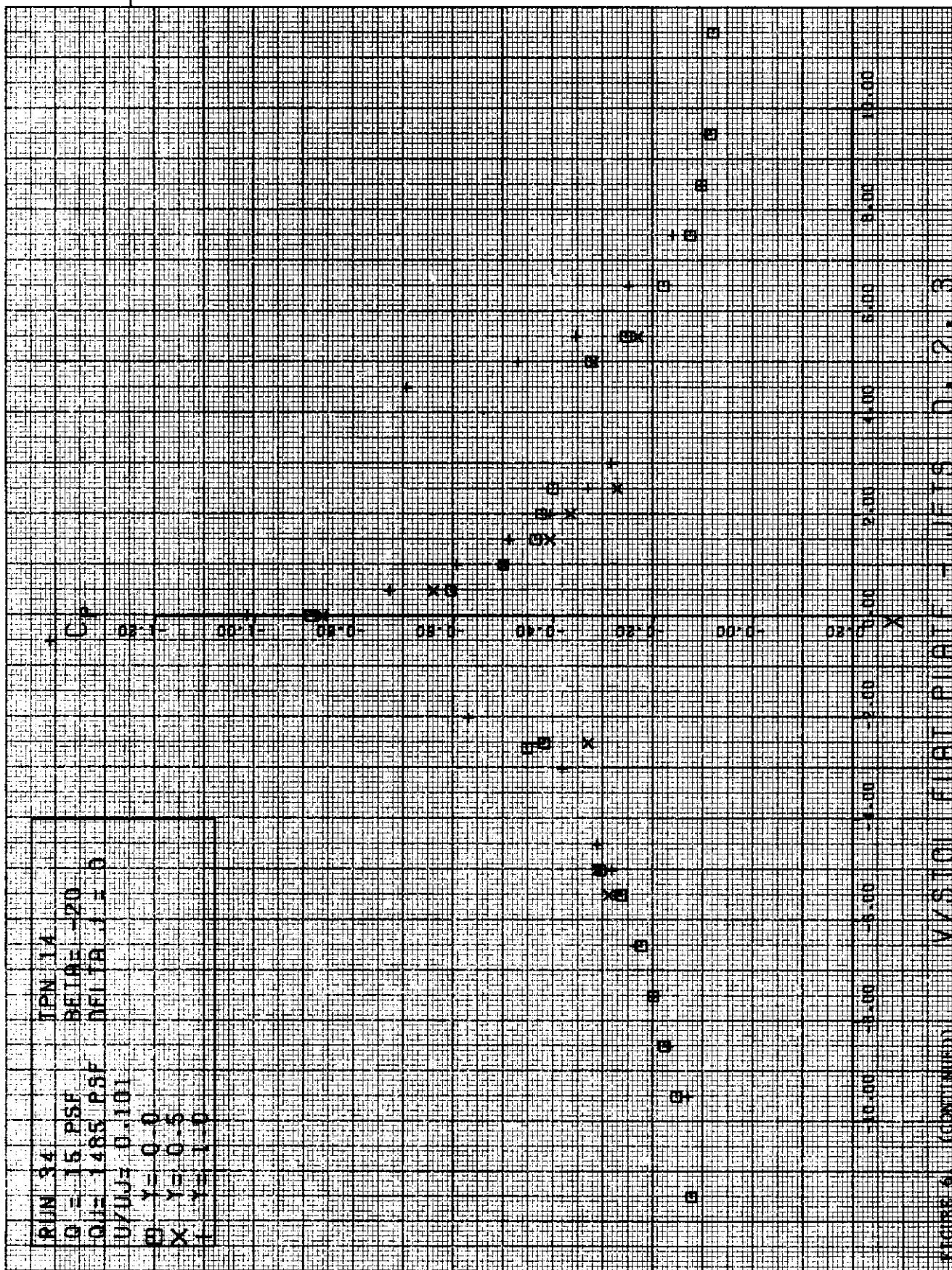
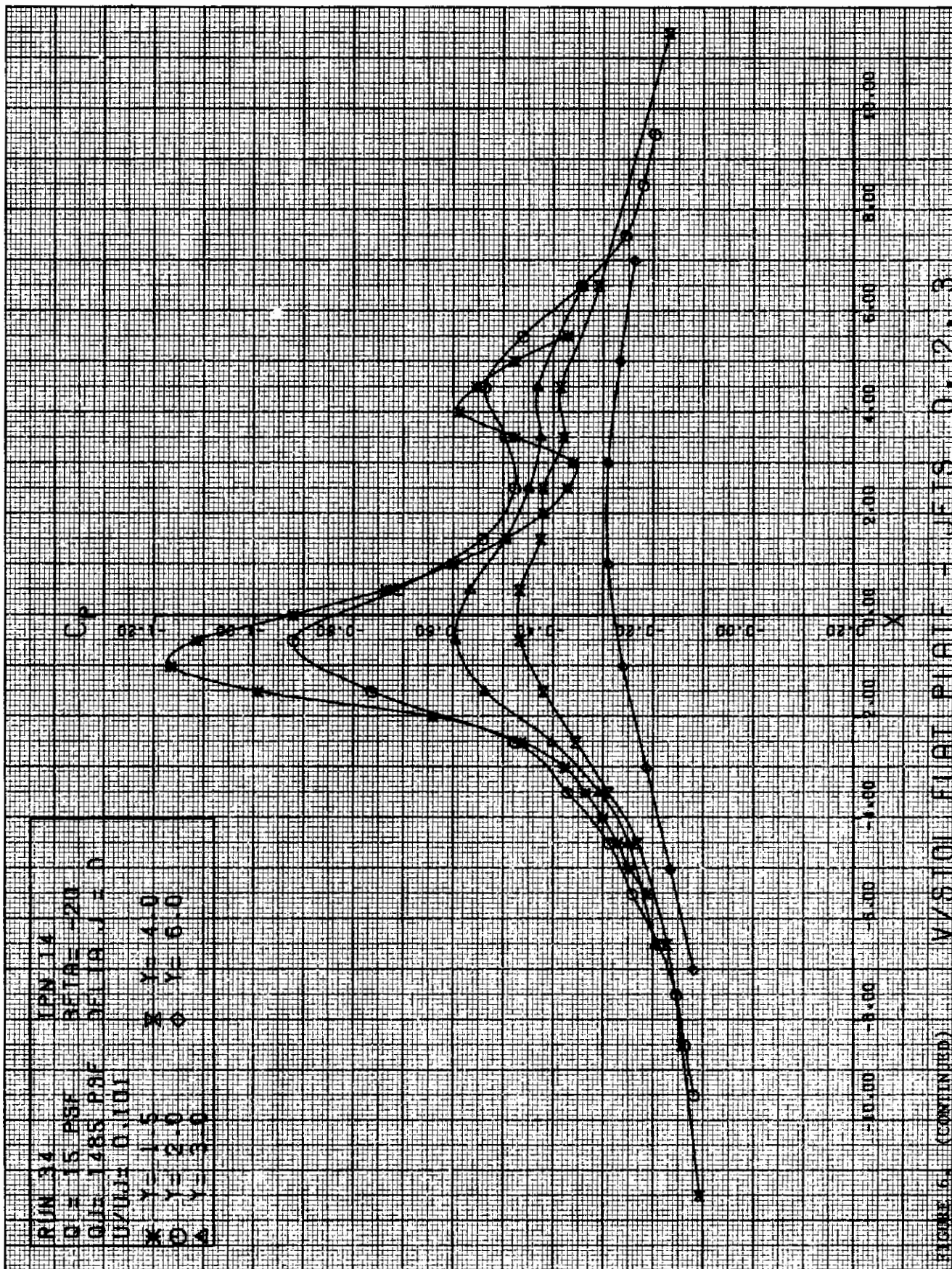
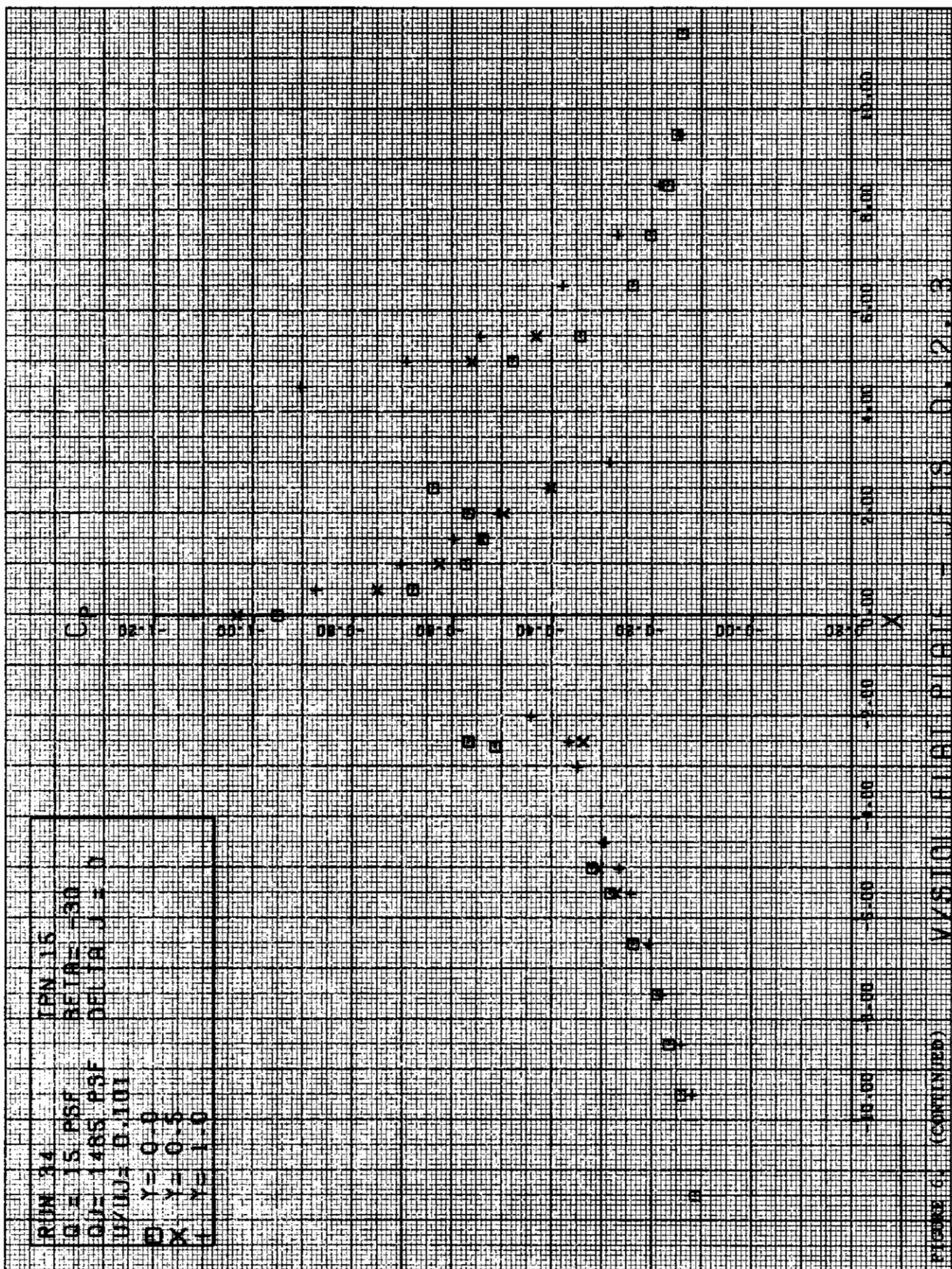
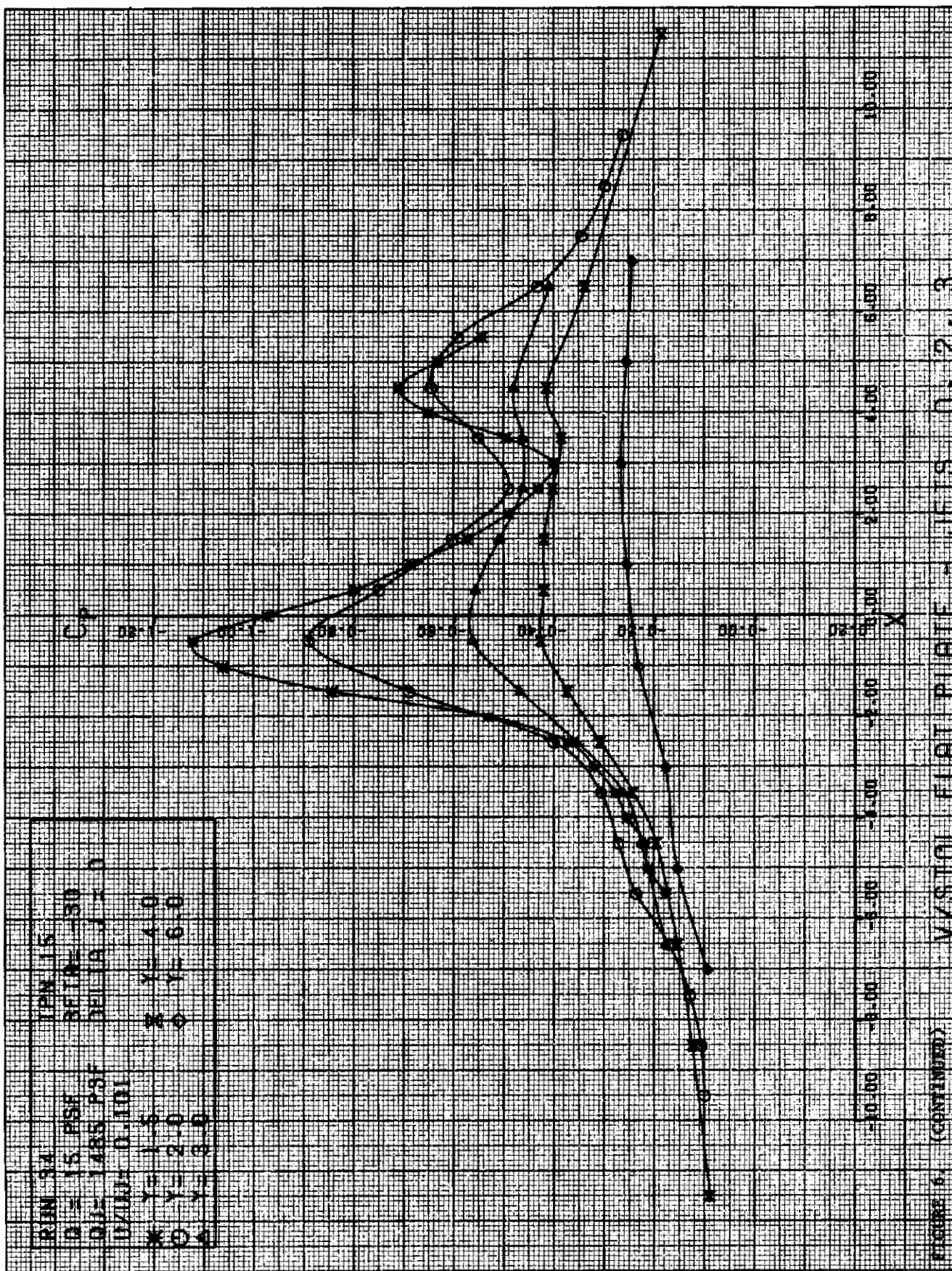


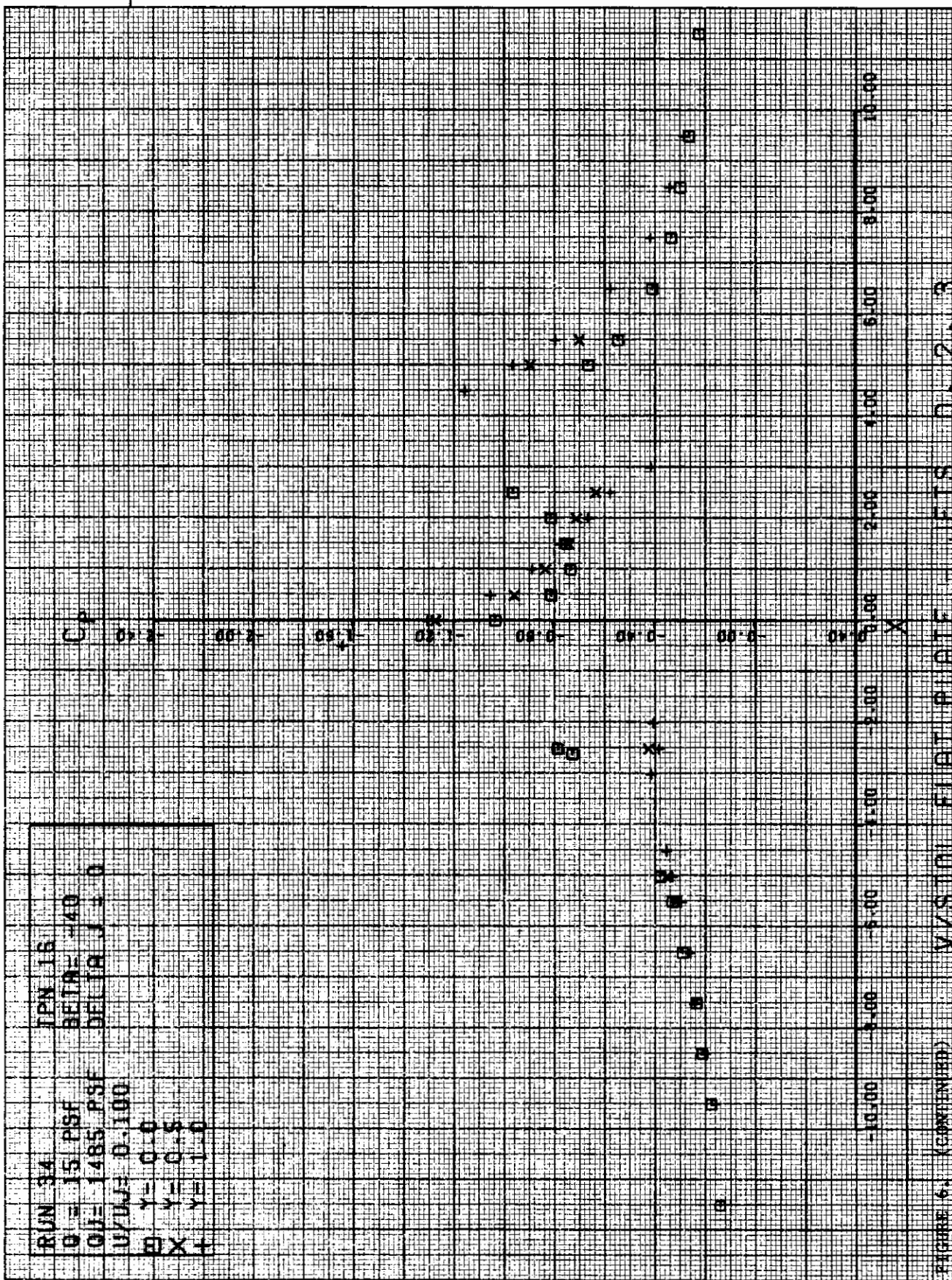
FIGURE 6. (CONTINUED) V/SION FLAT PROFILE - JETS 0. 2. 3

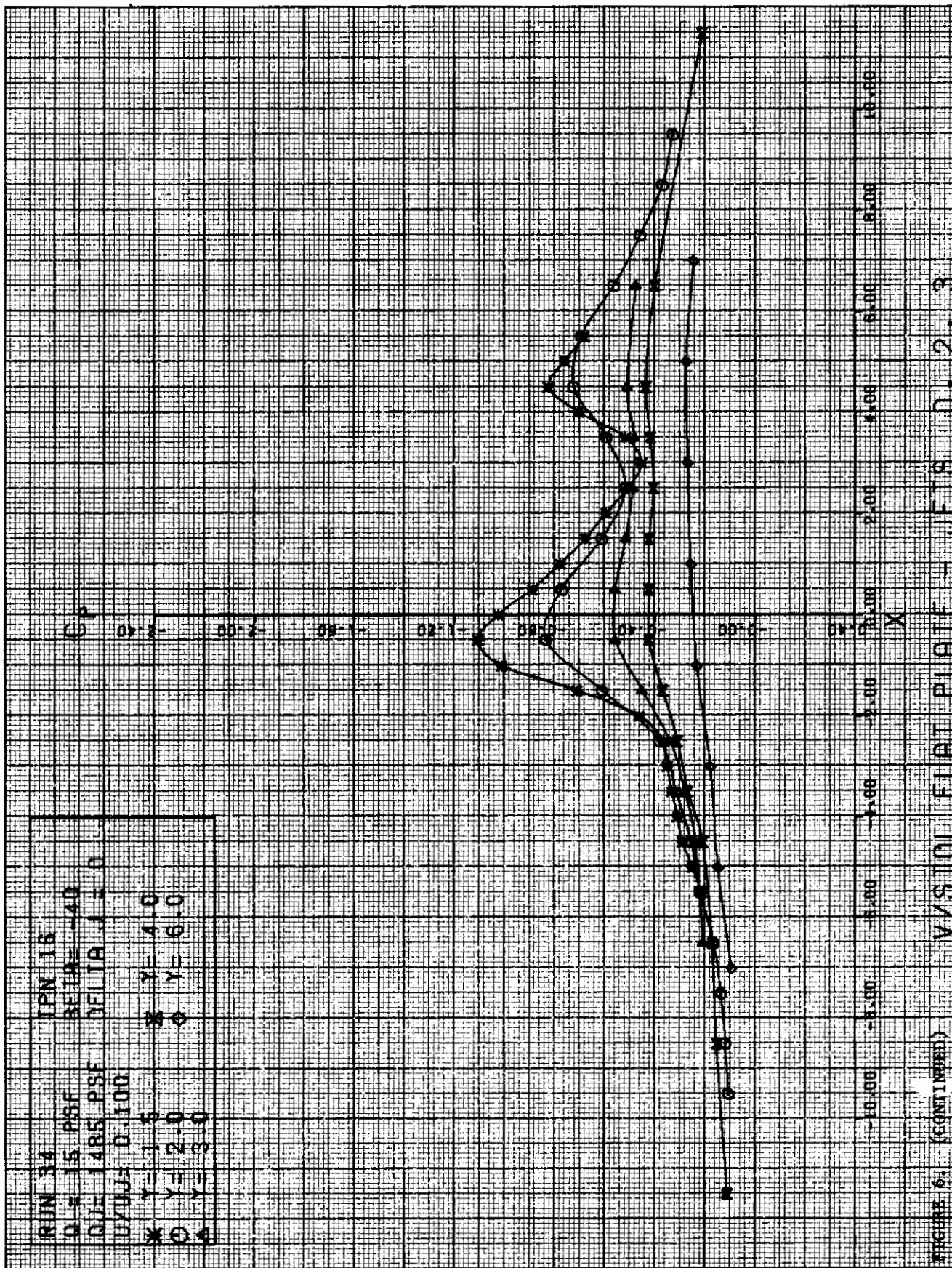


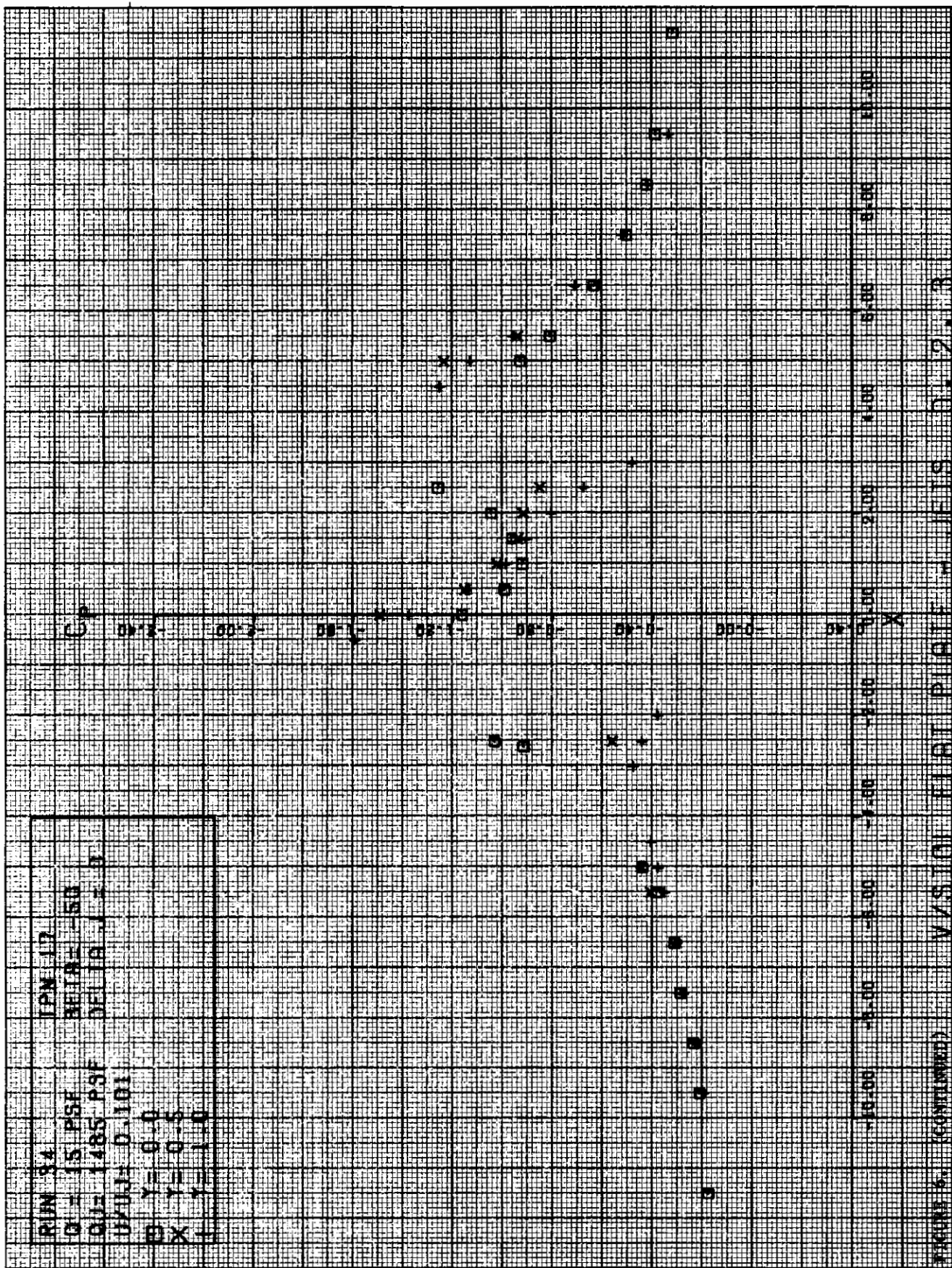


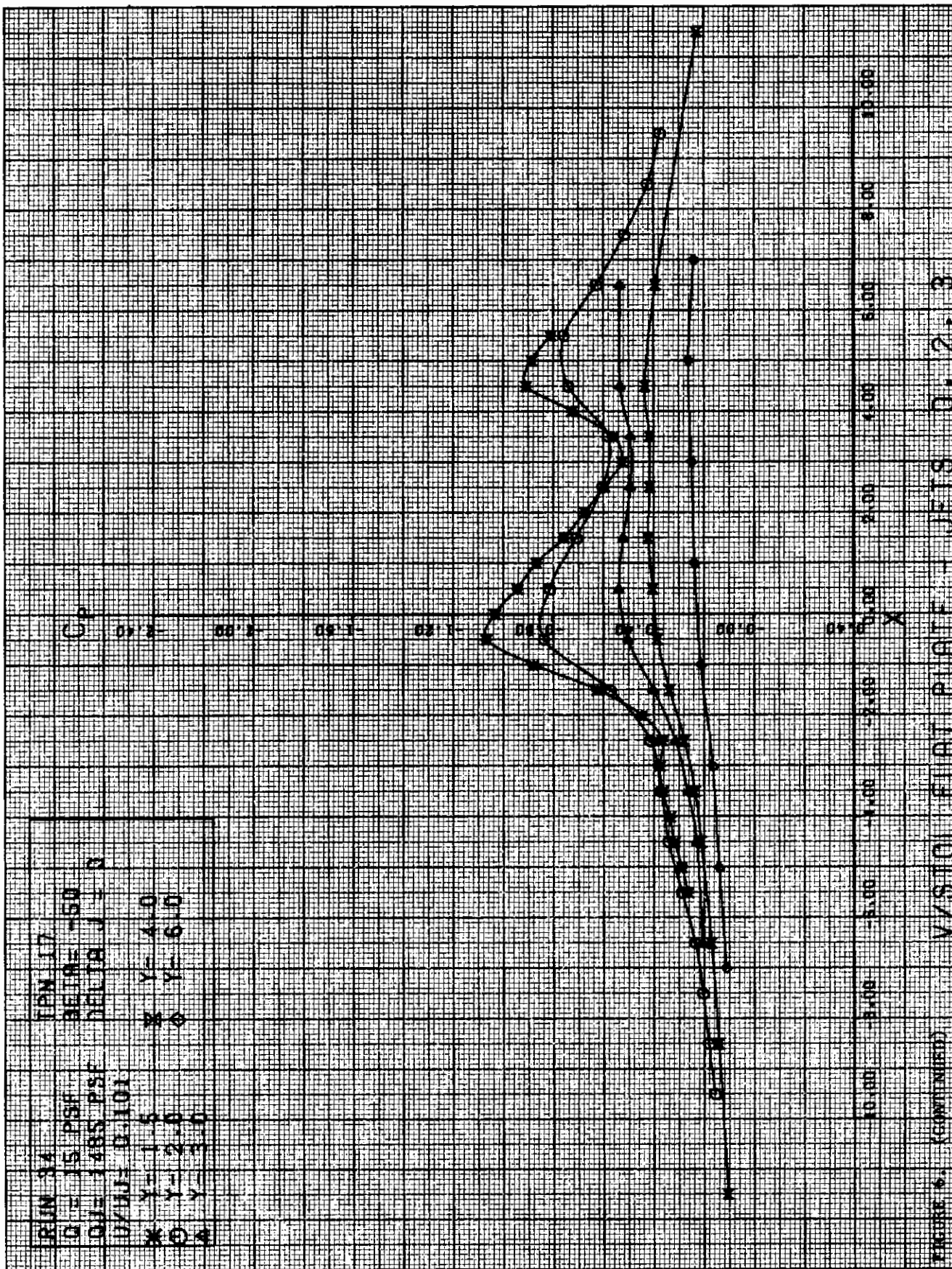


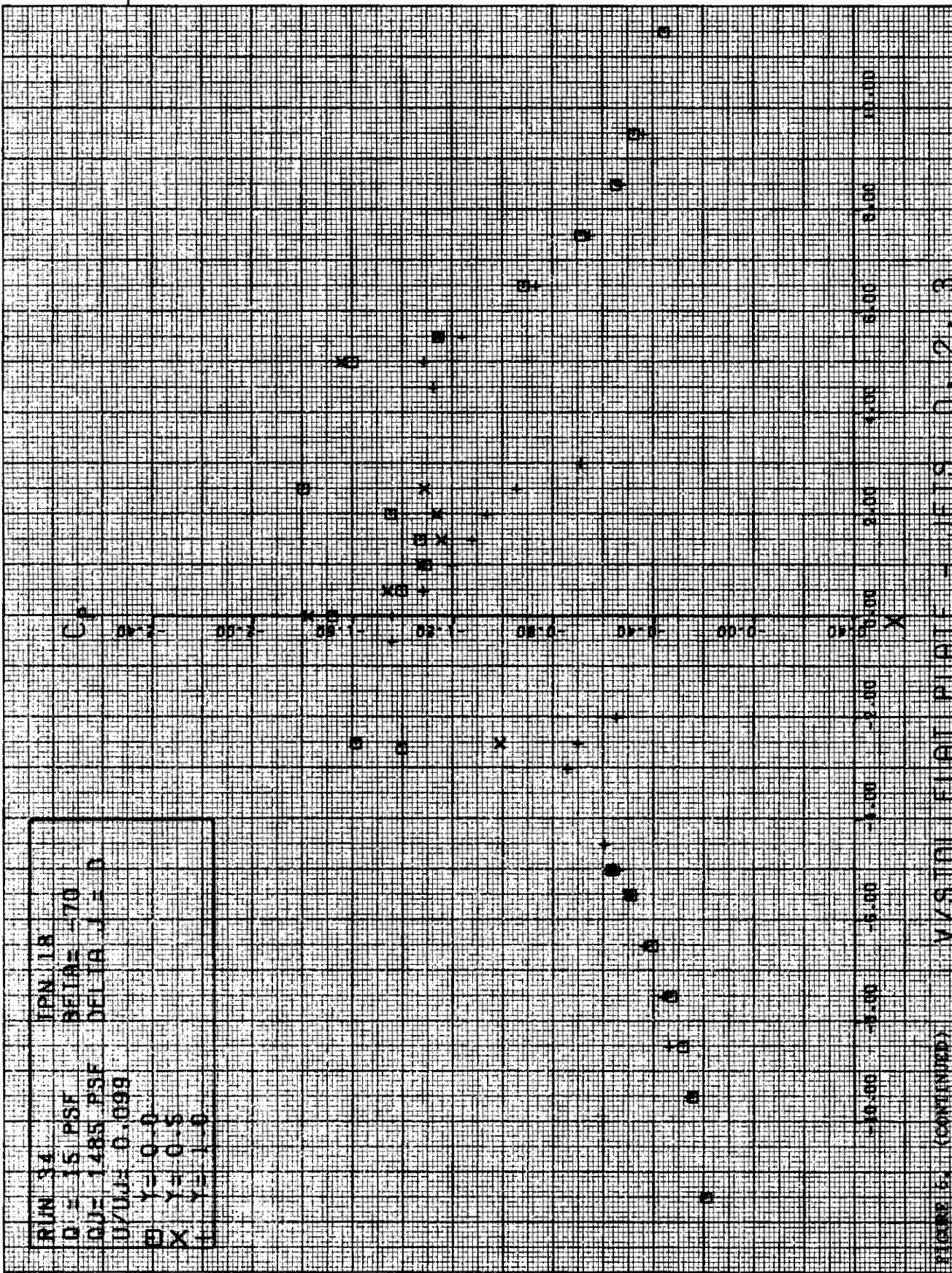


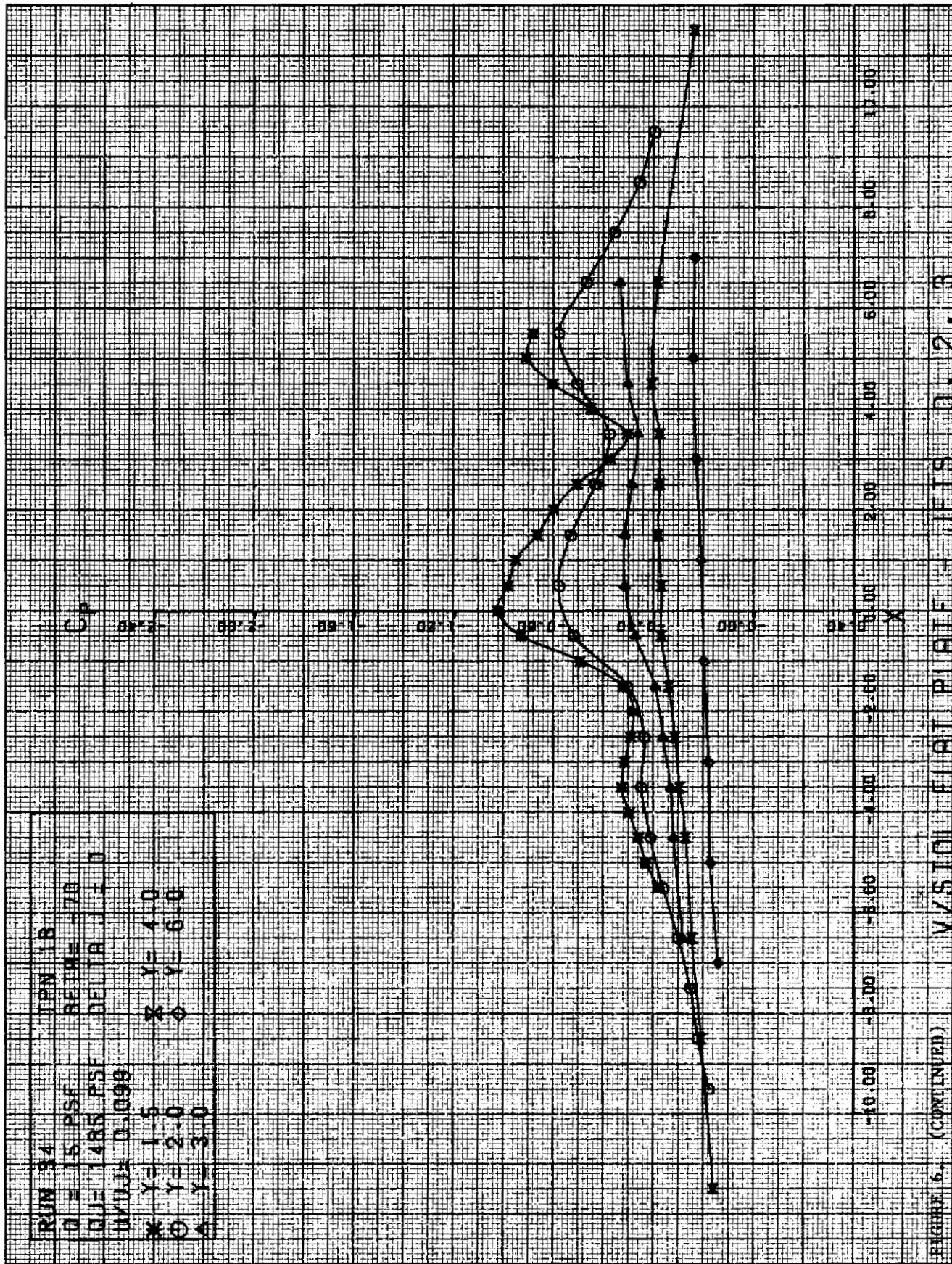


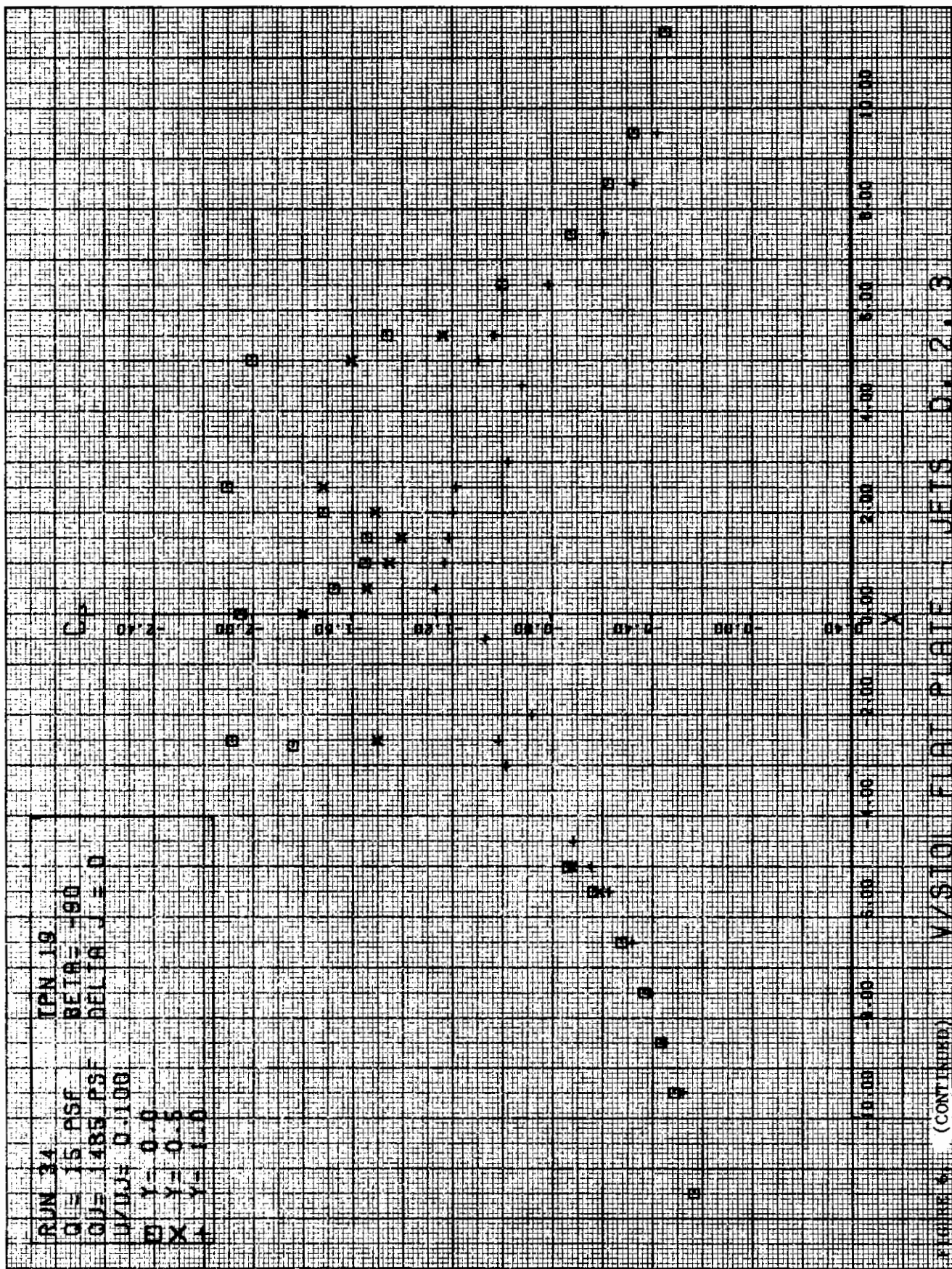


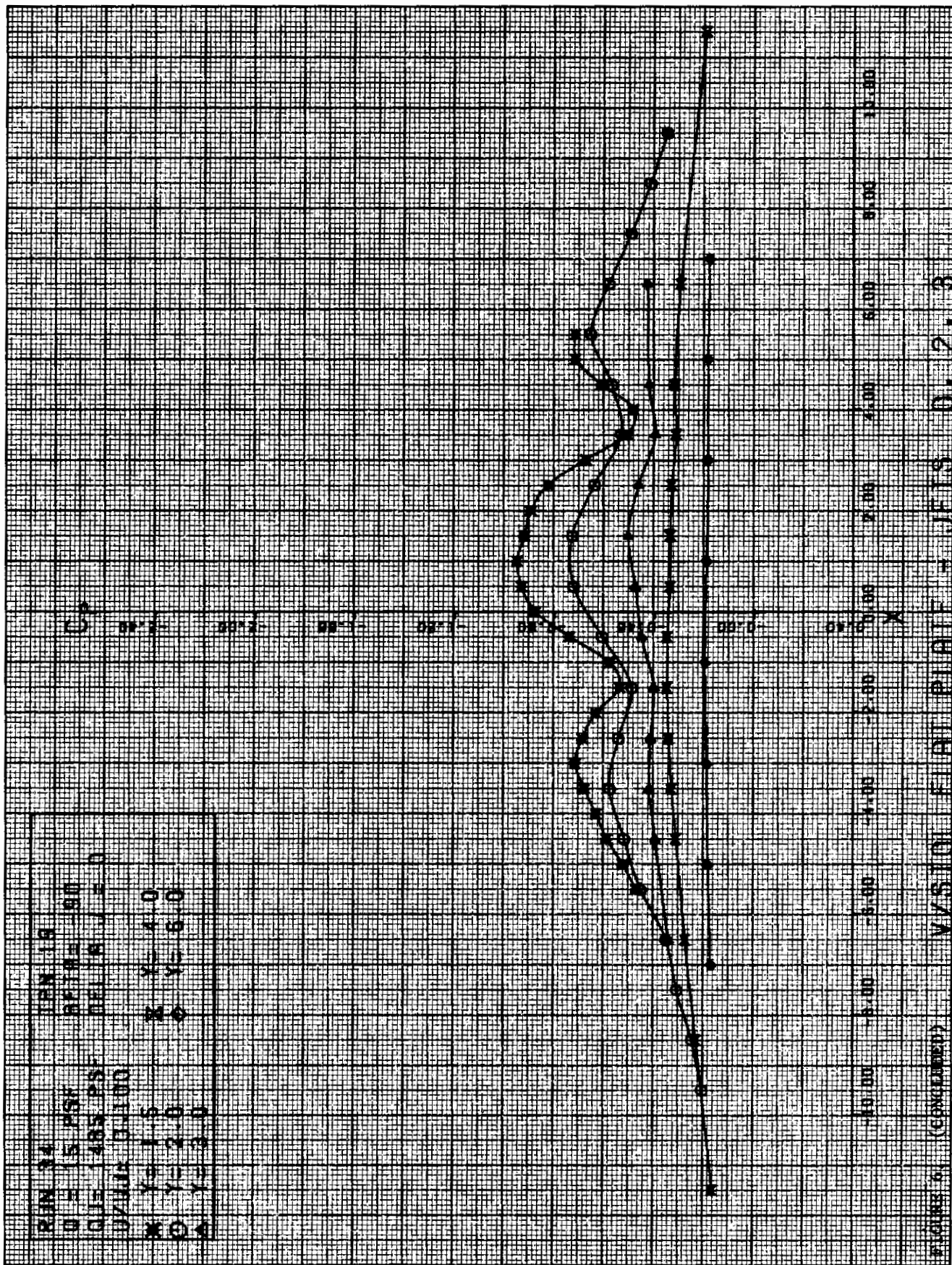












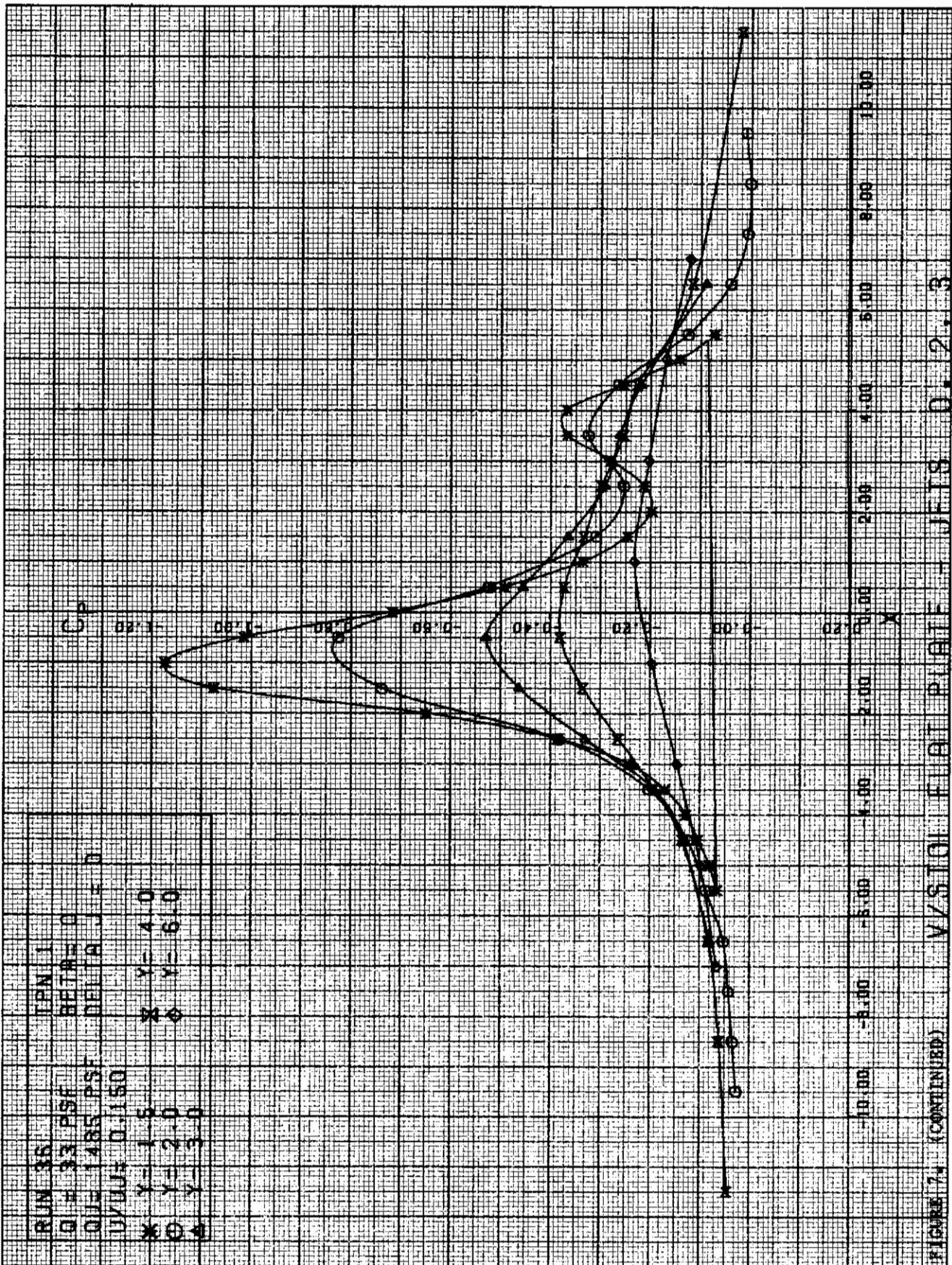
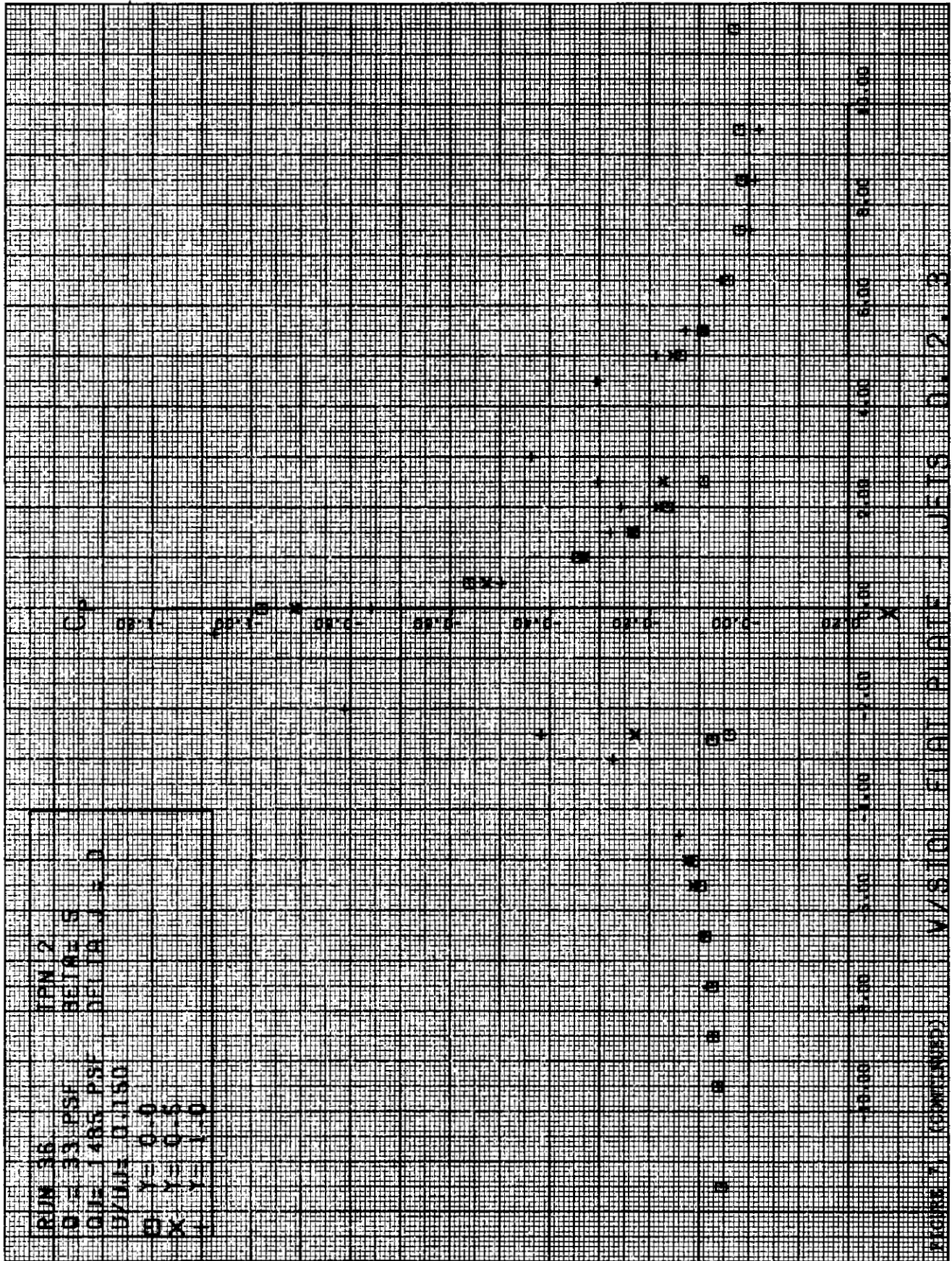
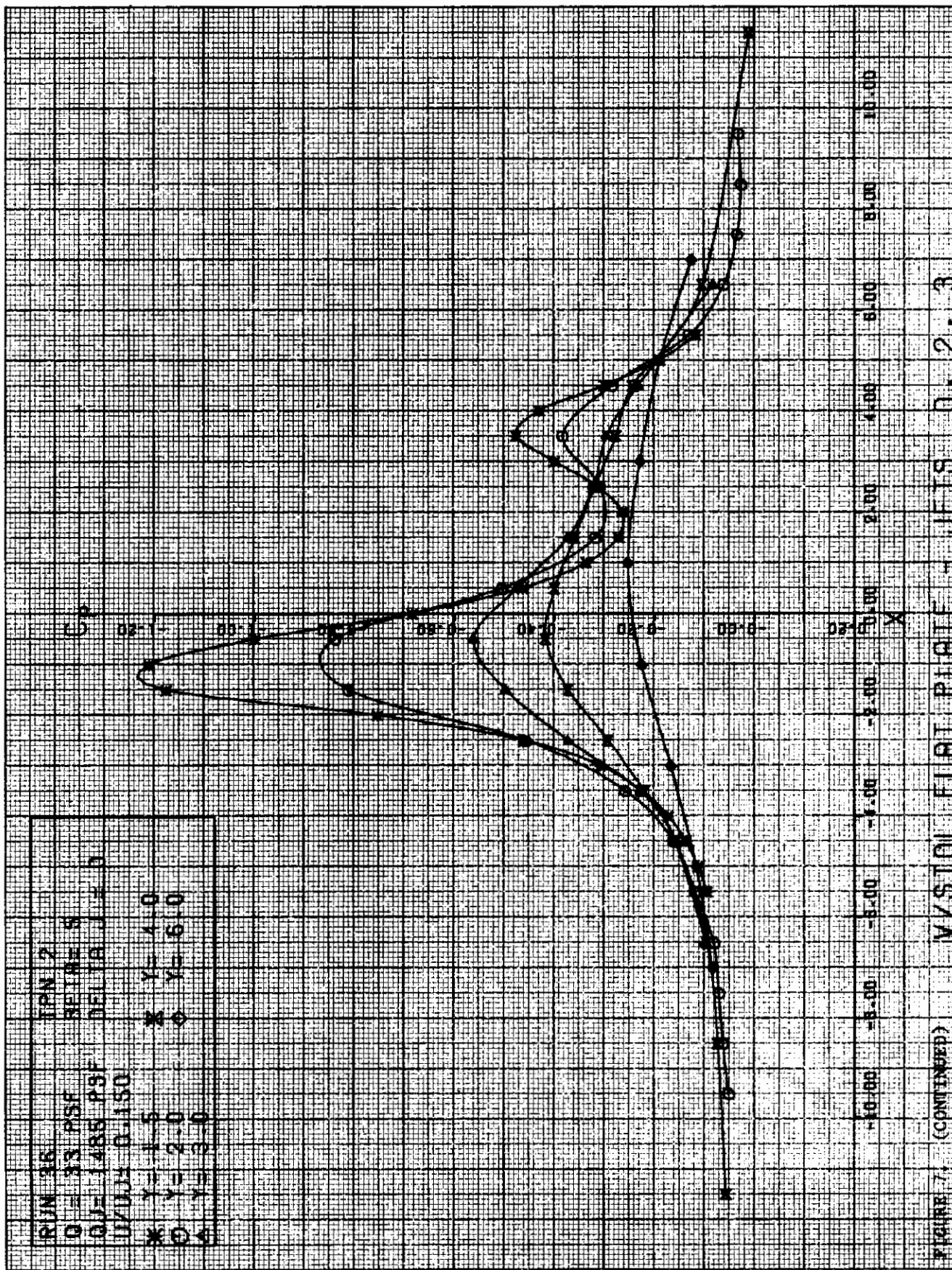
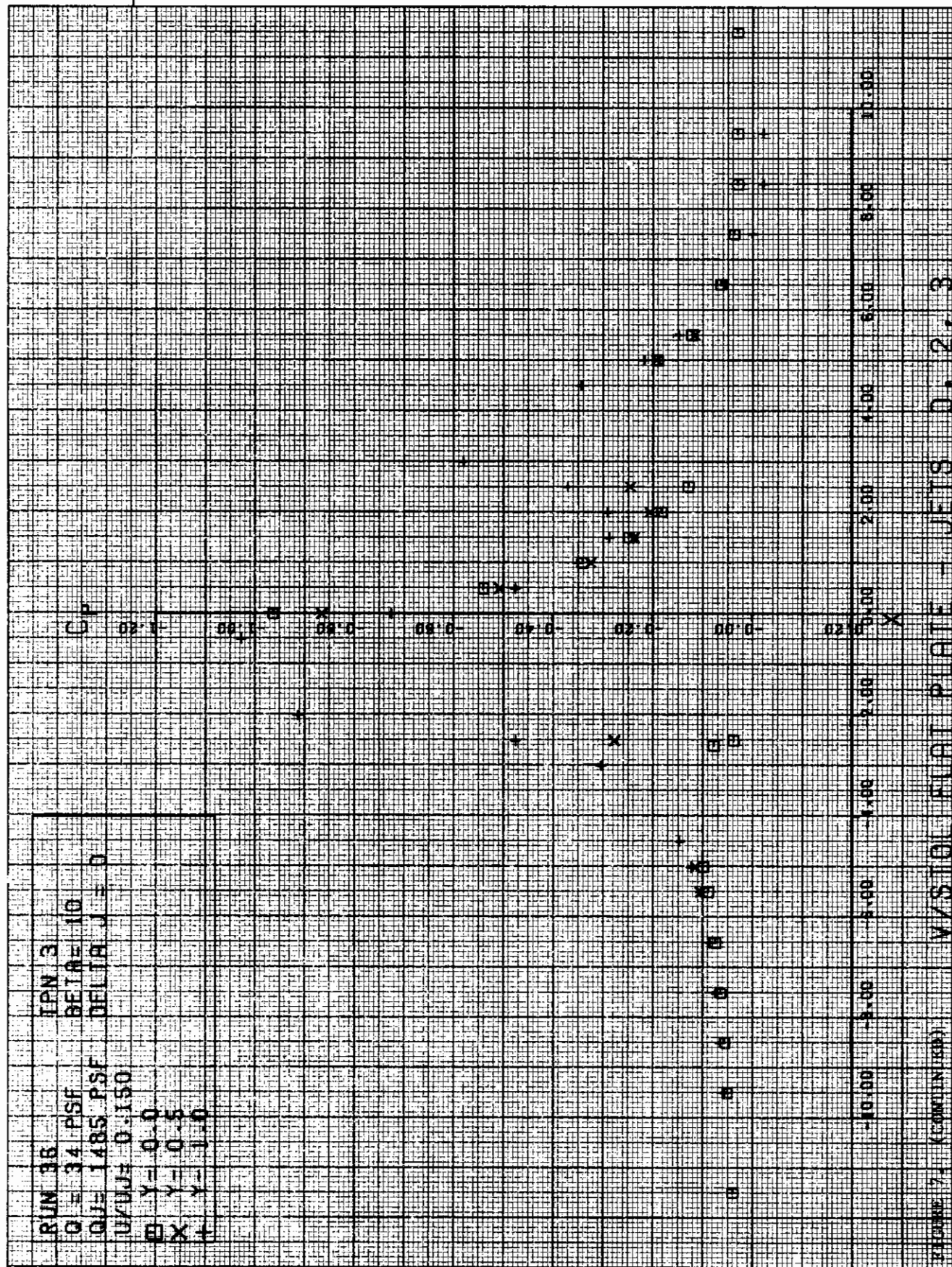


FIGURE 17. (CONTINUED) V-STOIL FLAT PLATE - JETS 0.2, 3







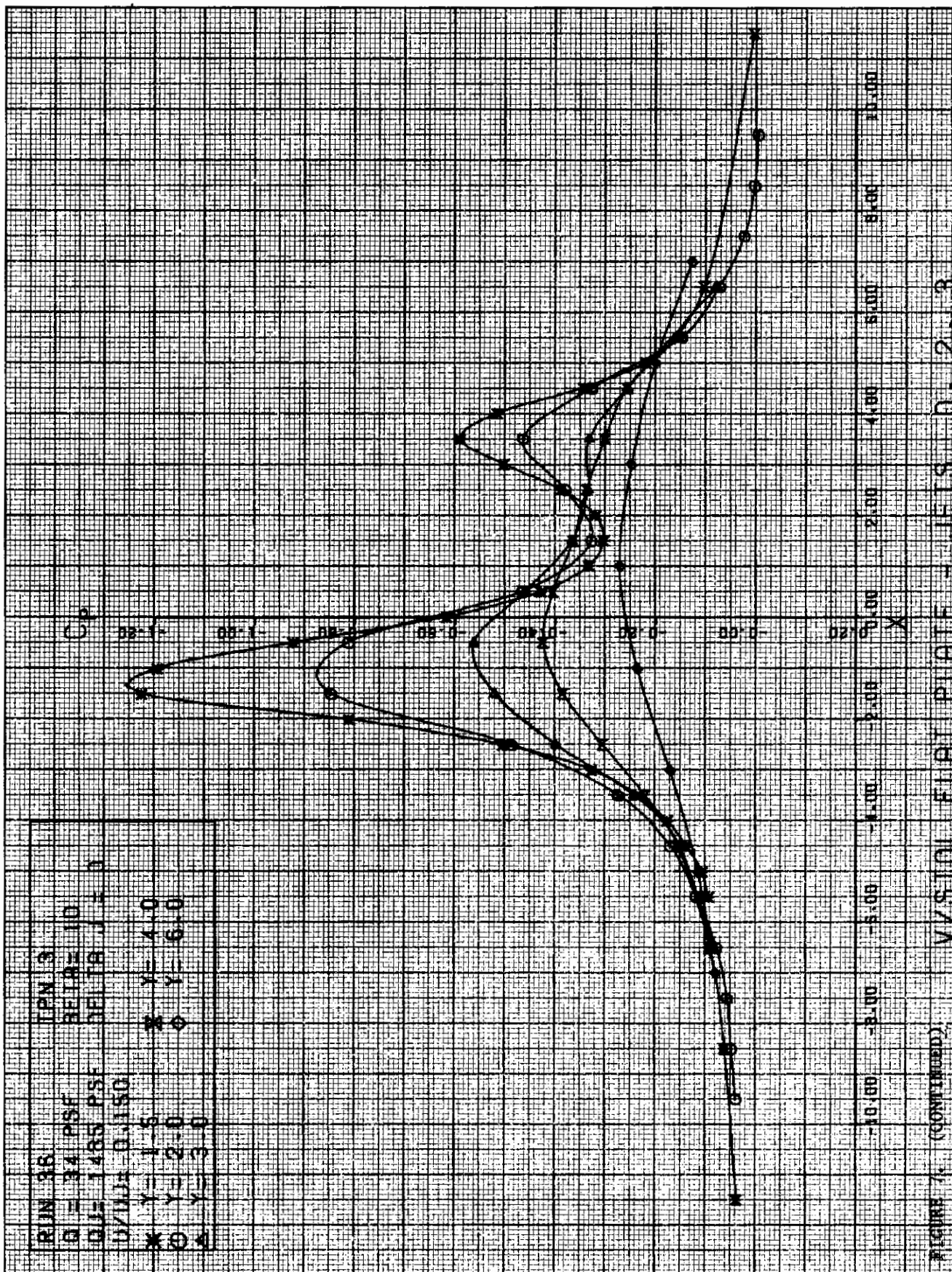
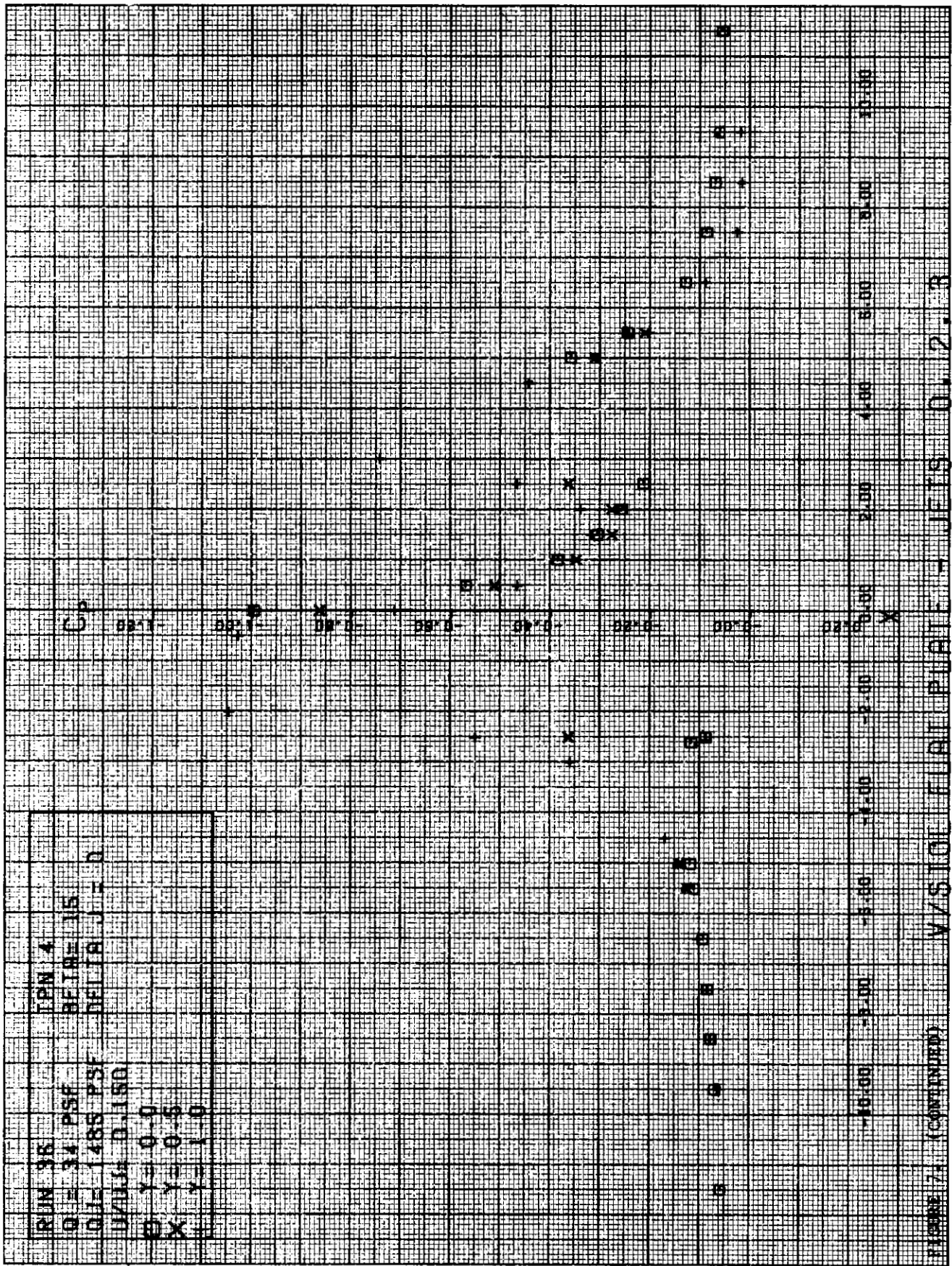
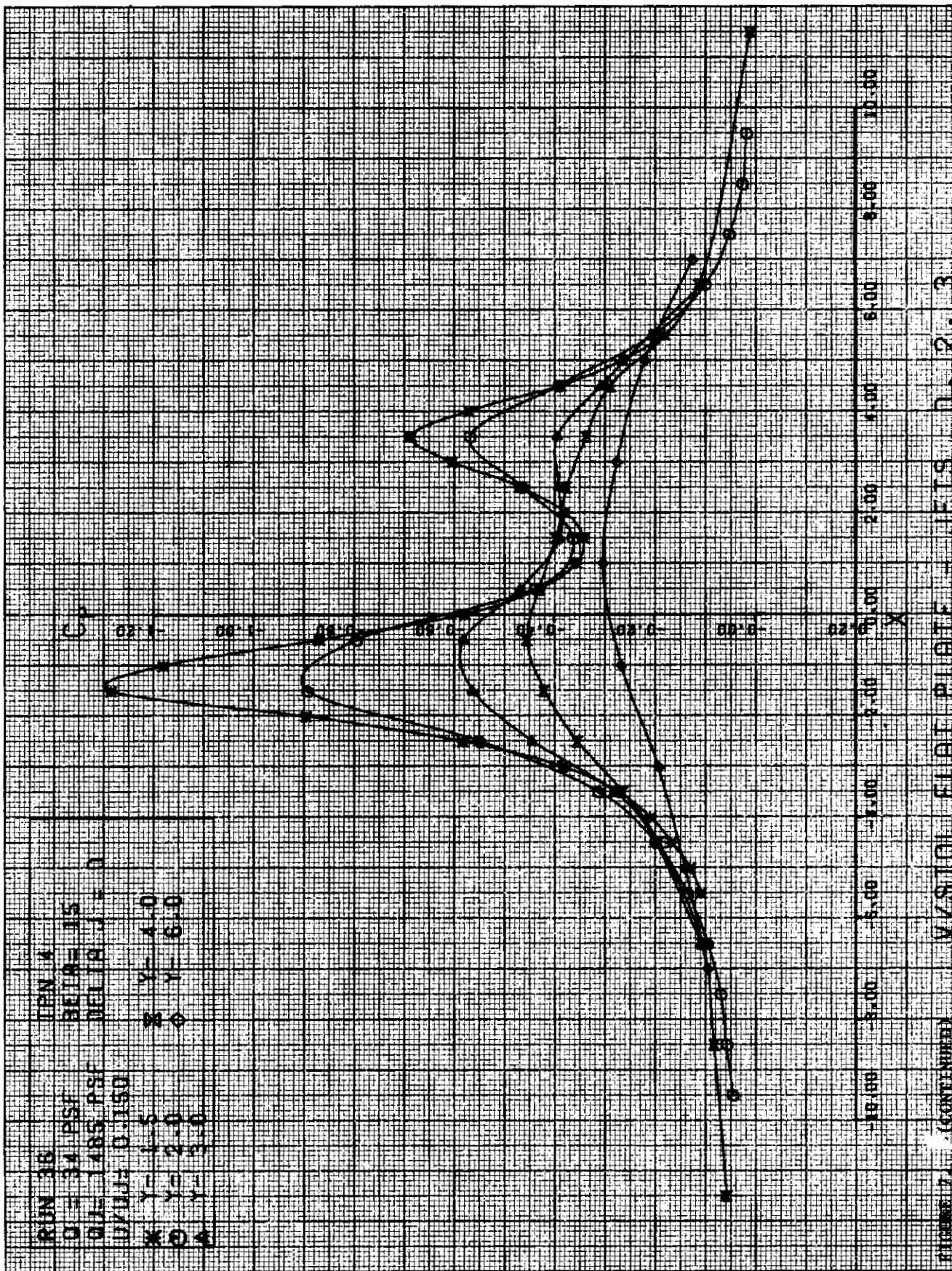
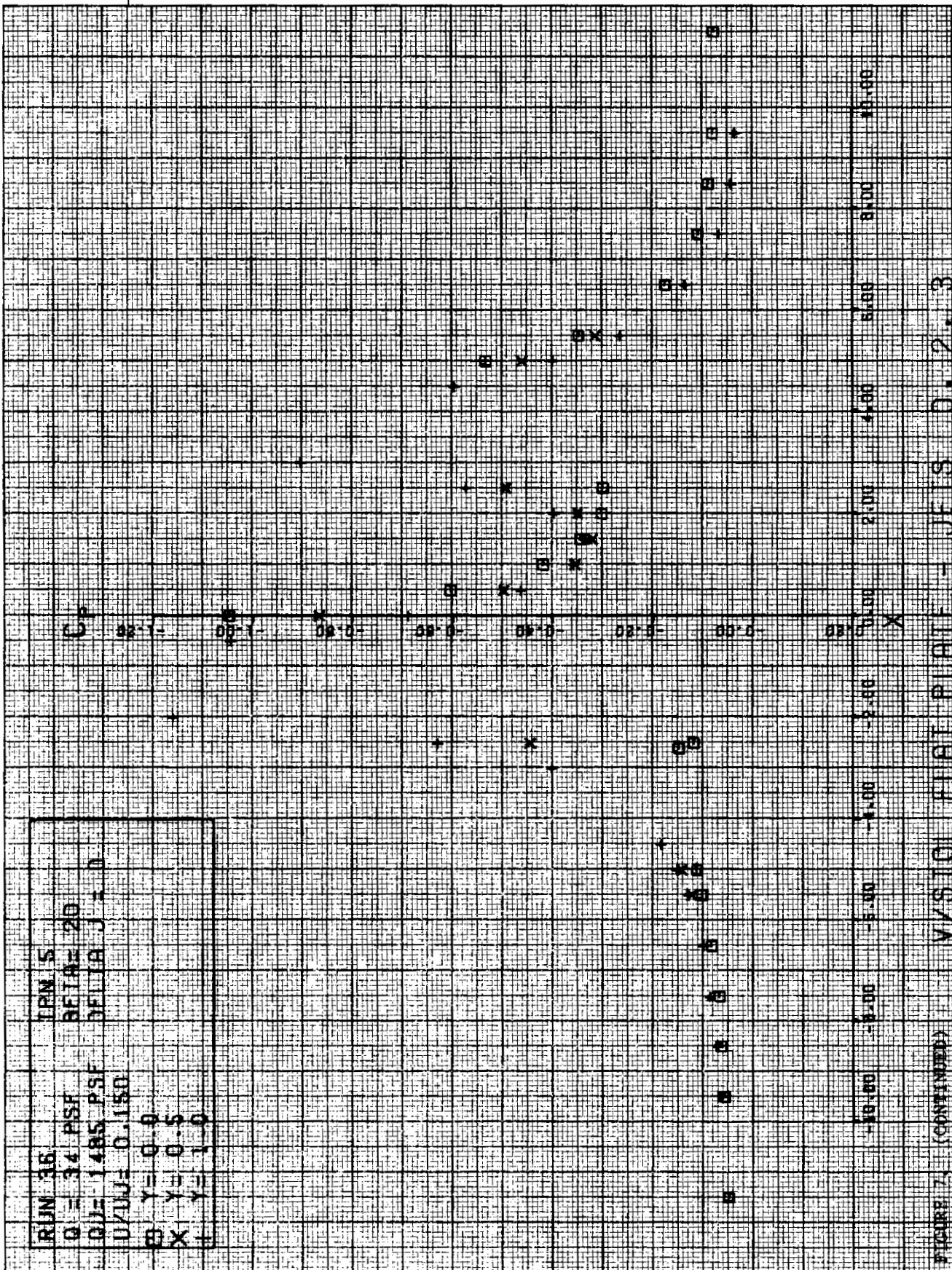
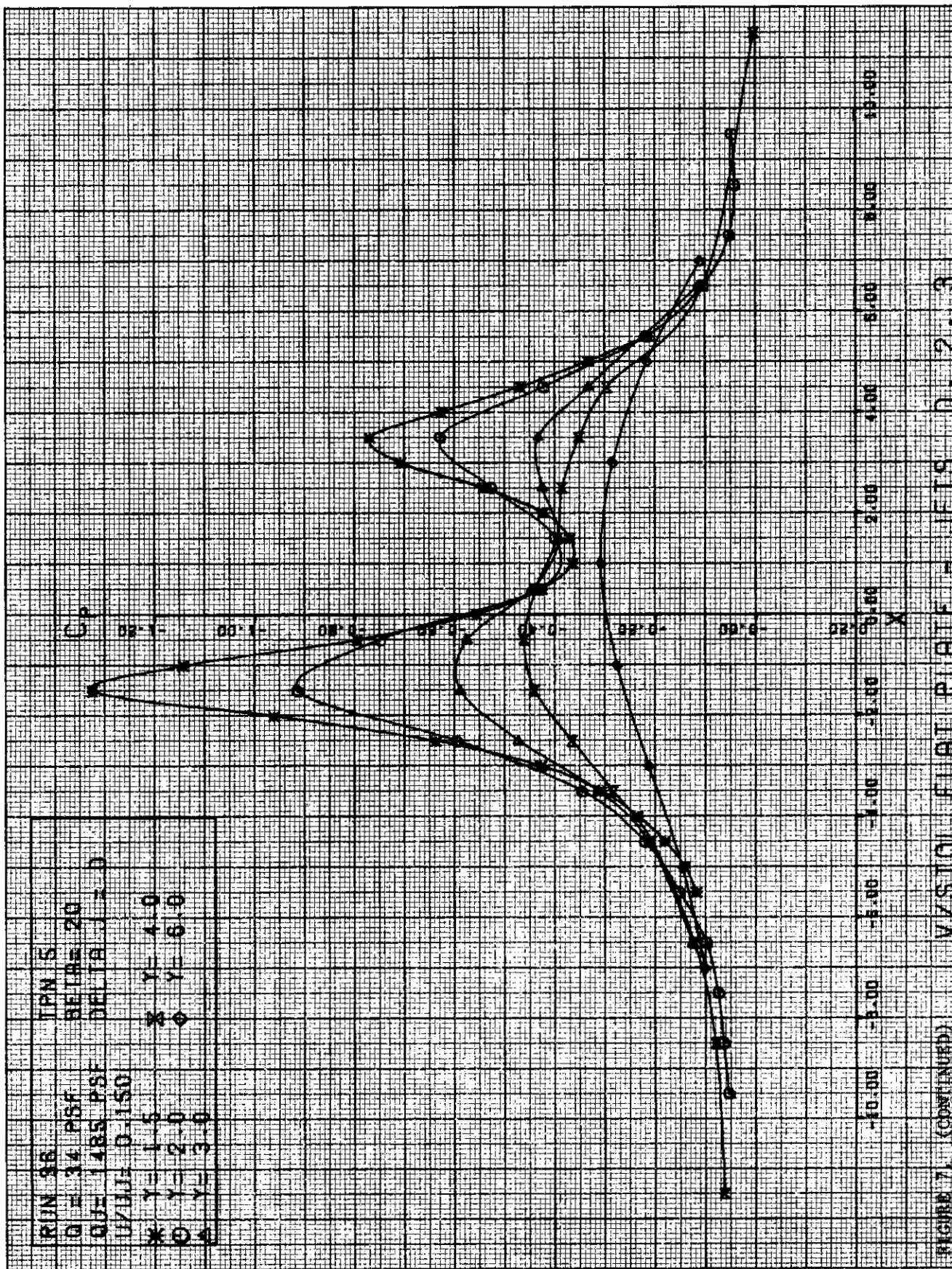


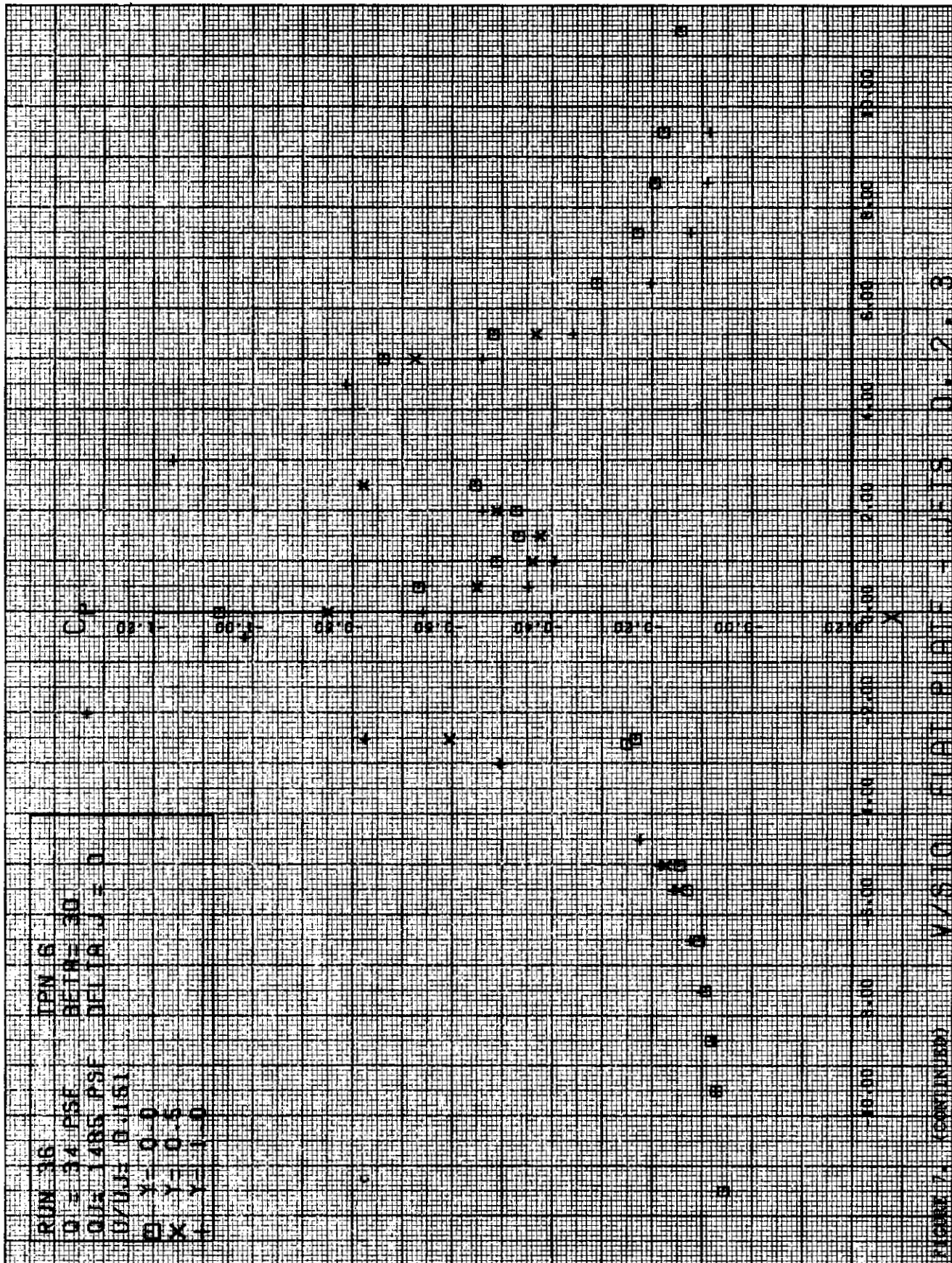
FIGURE 7. (CONTINUED) VV5101 FIGHTER PLANE - JETS 0.2, 3

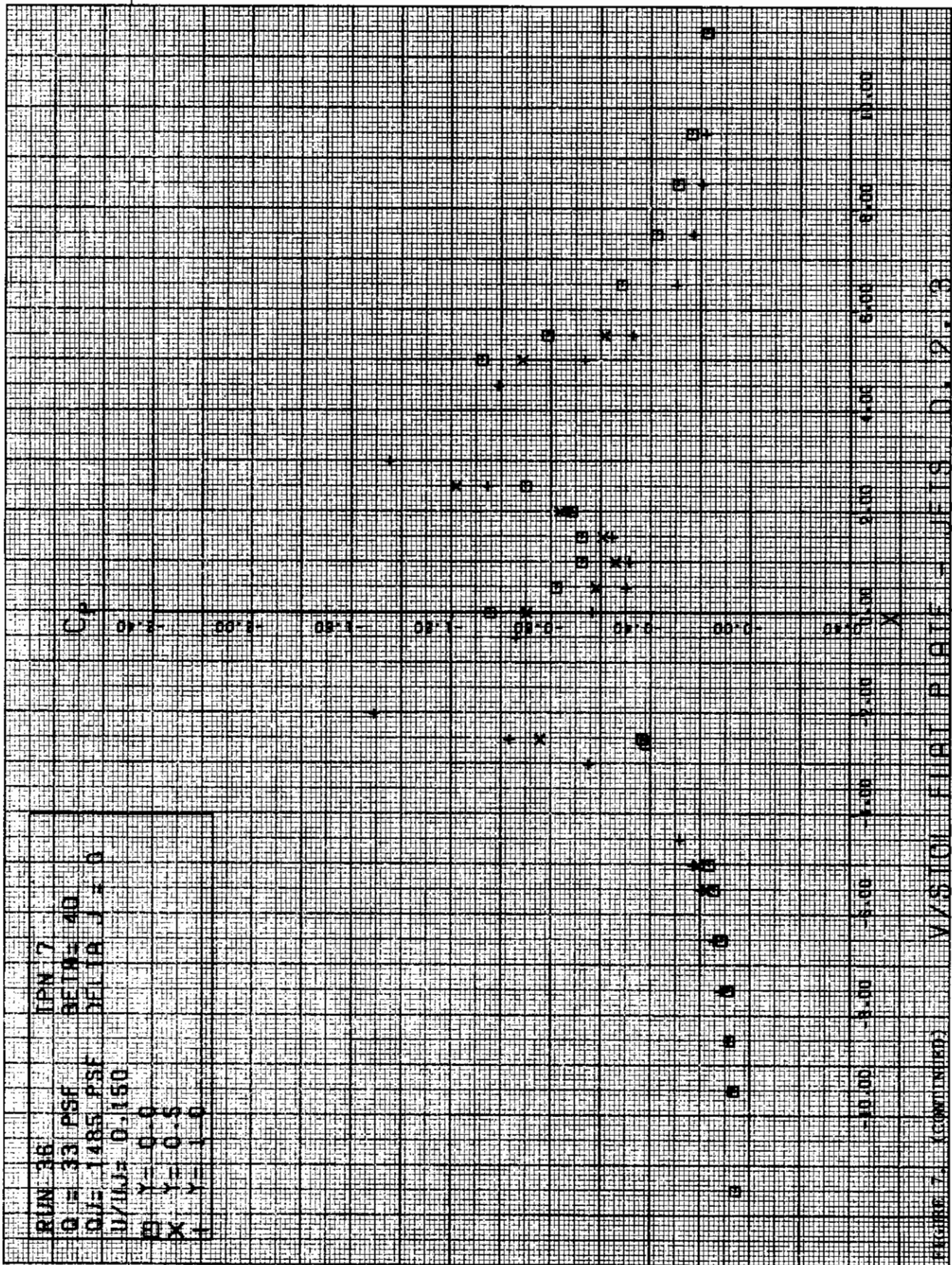


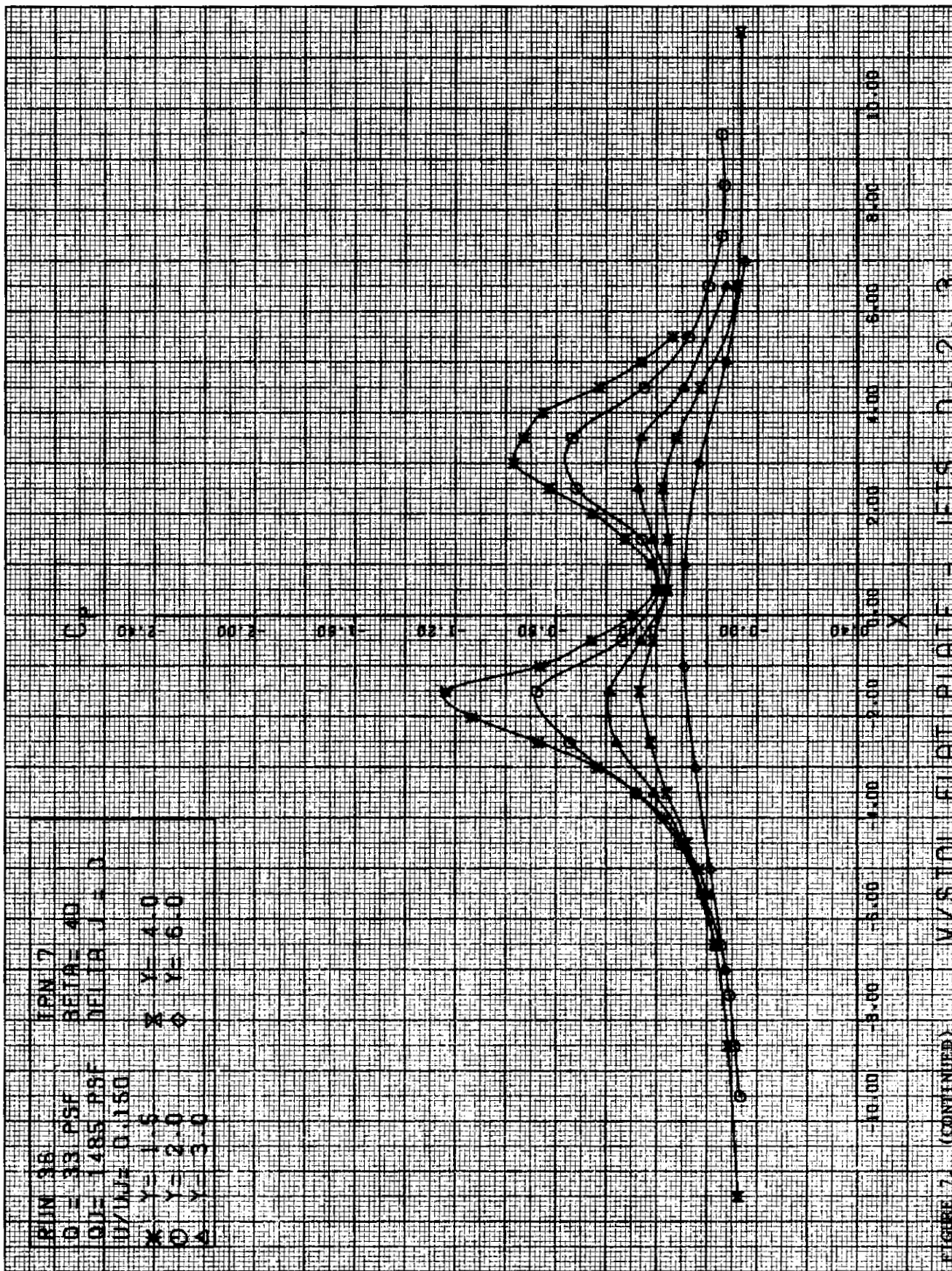


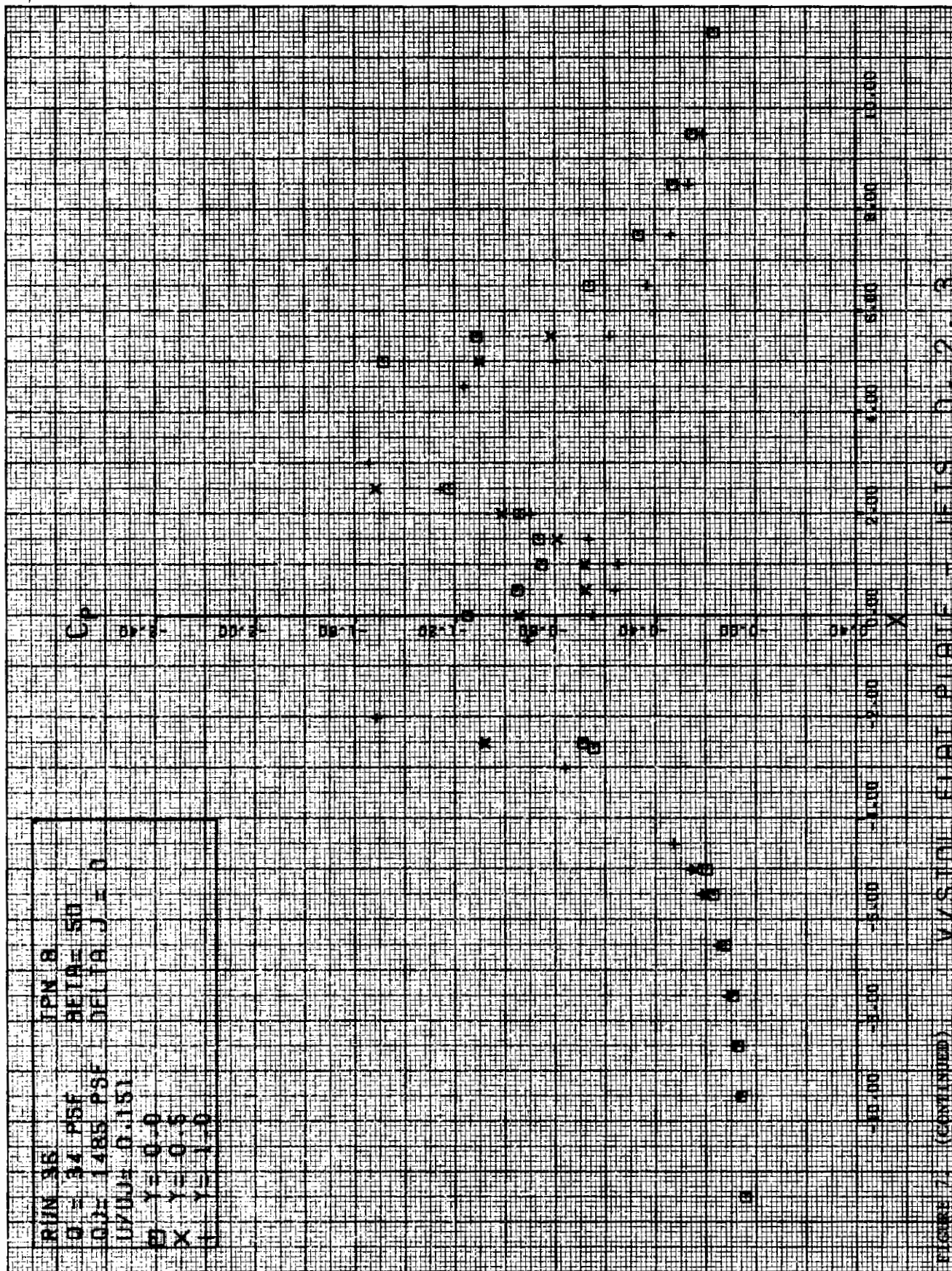


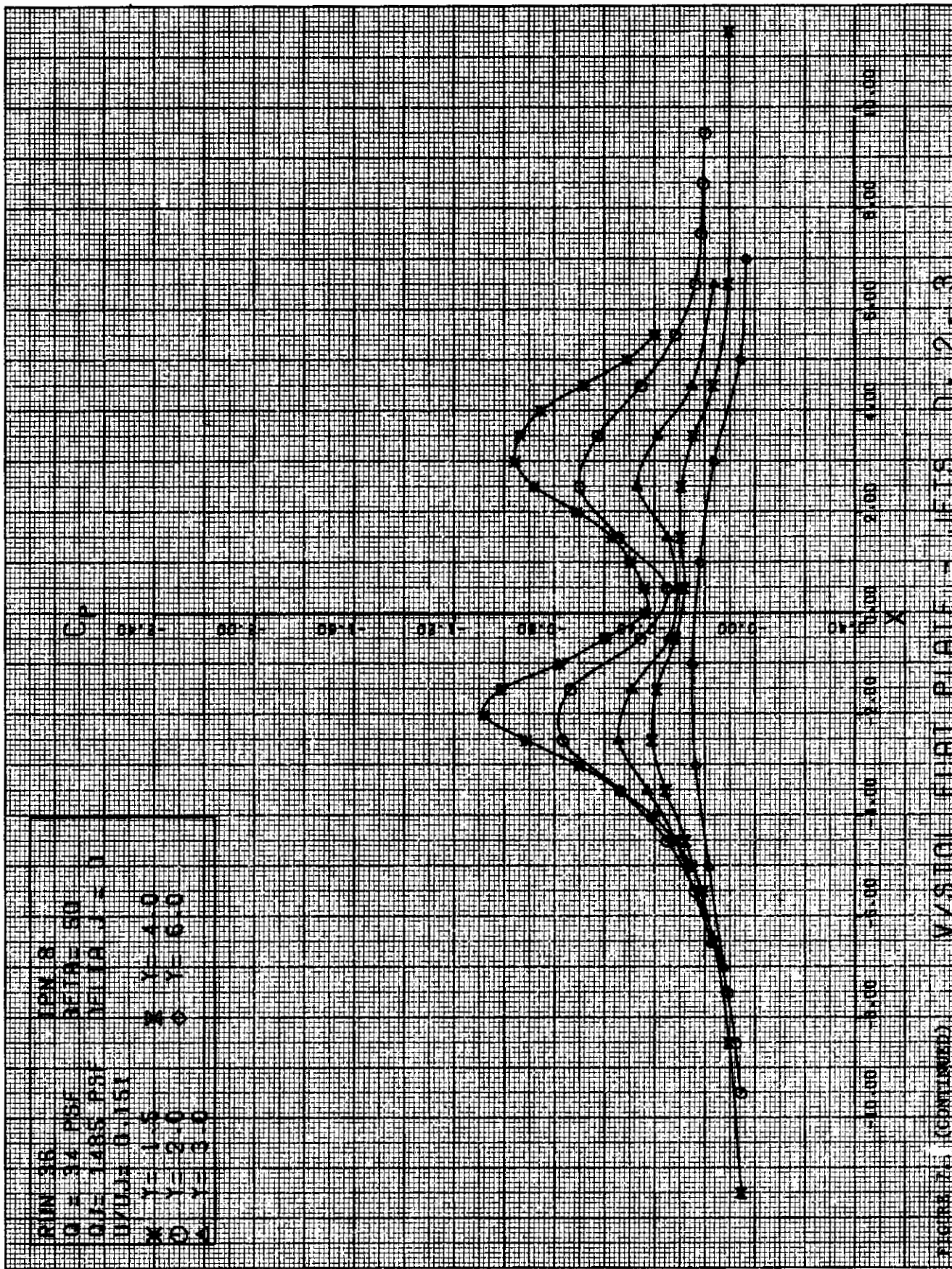


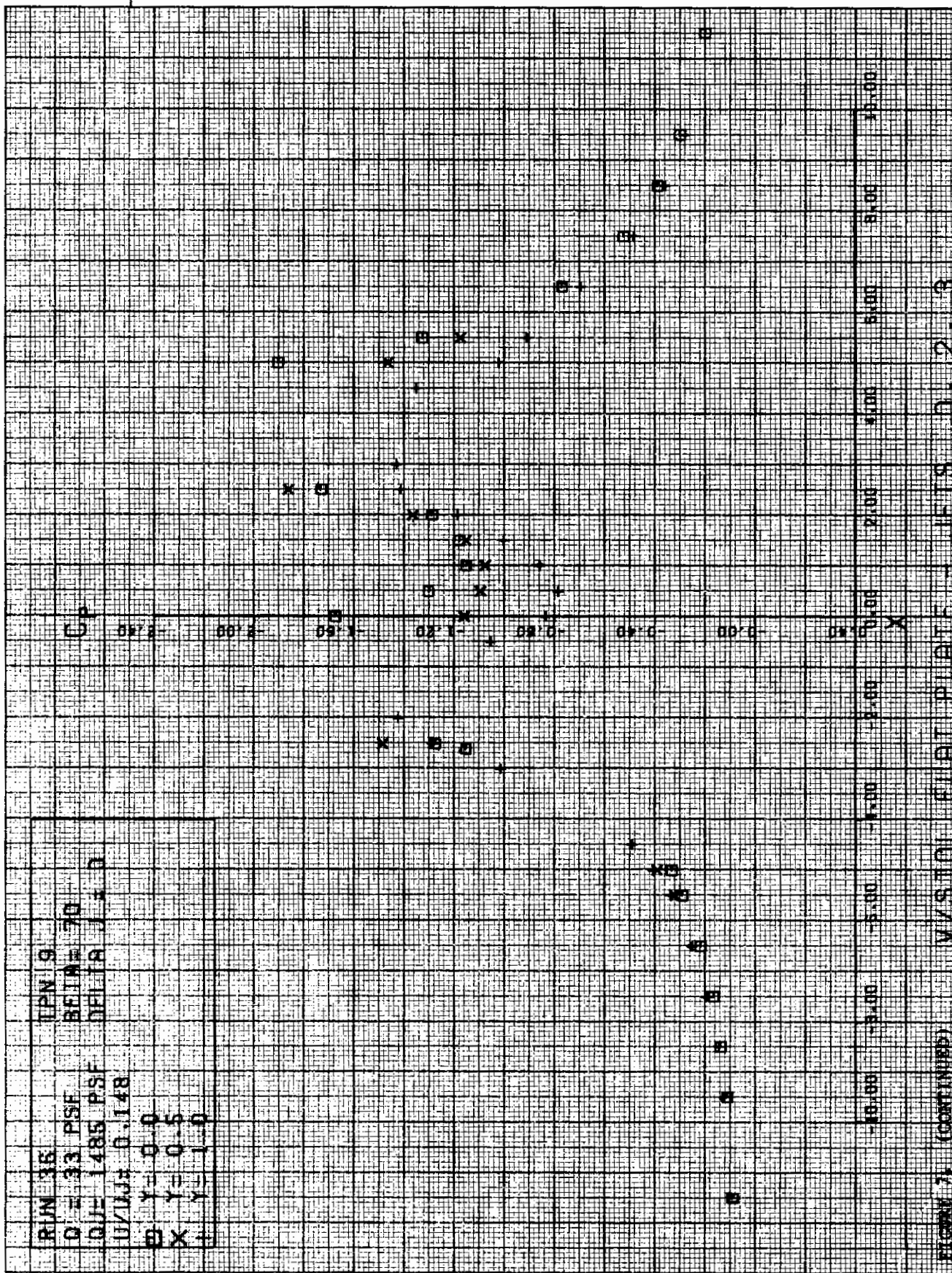


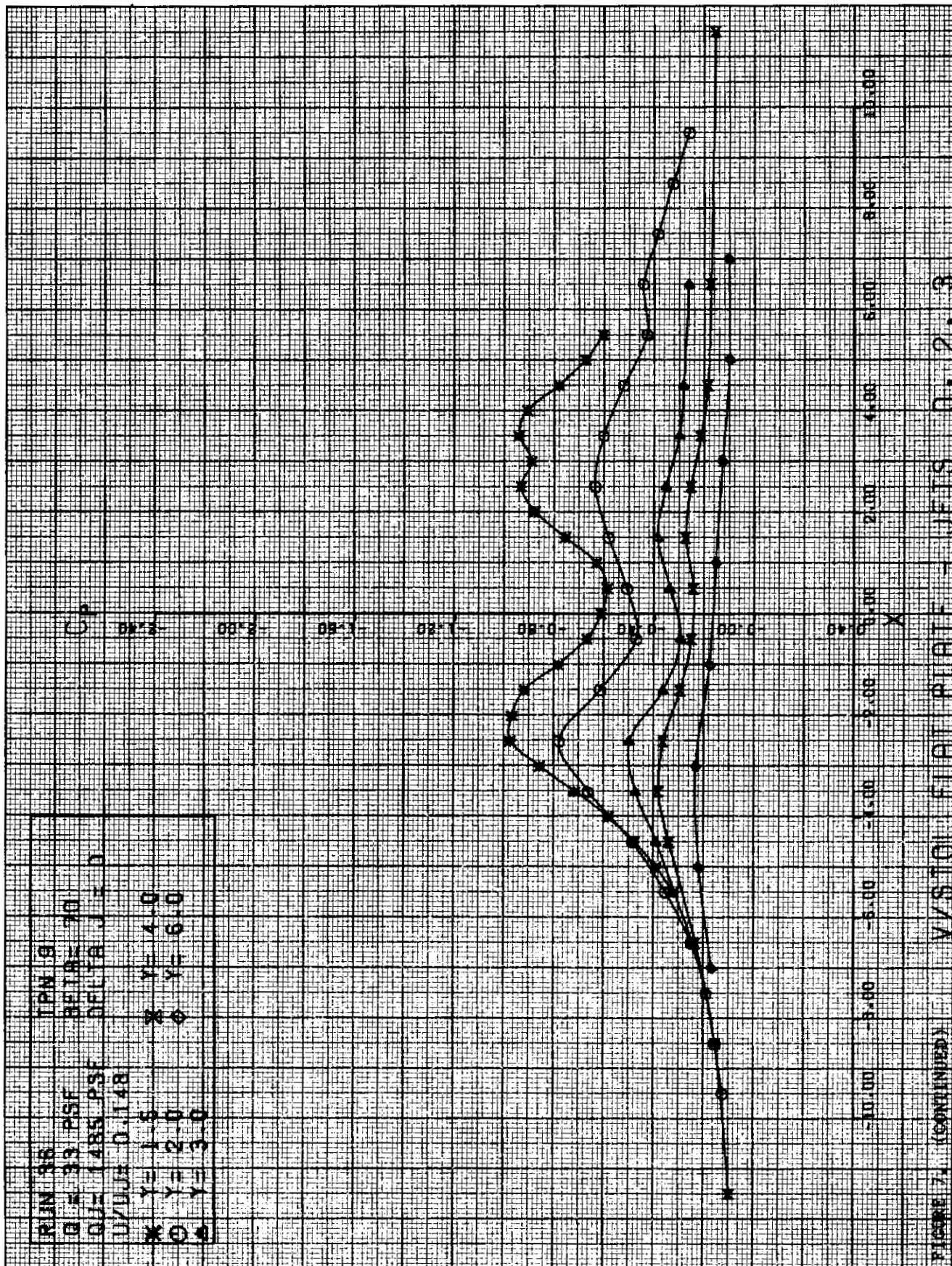


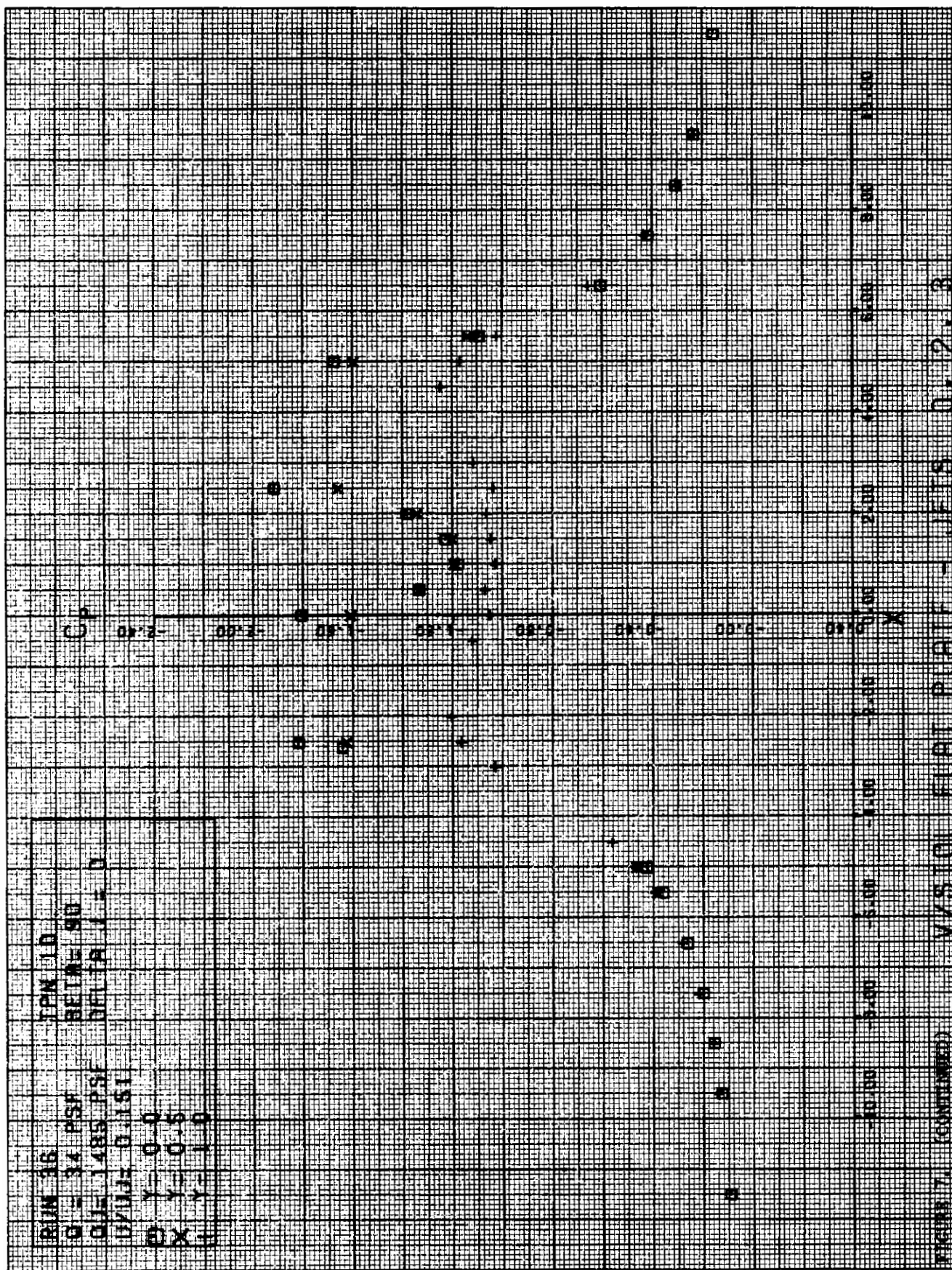


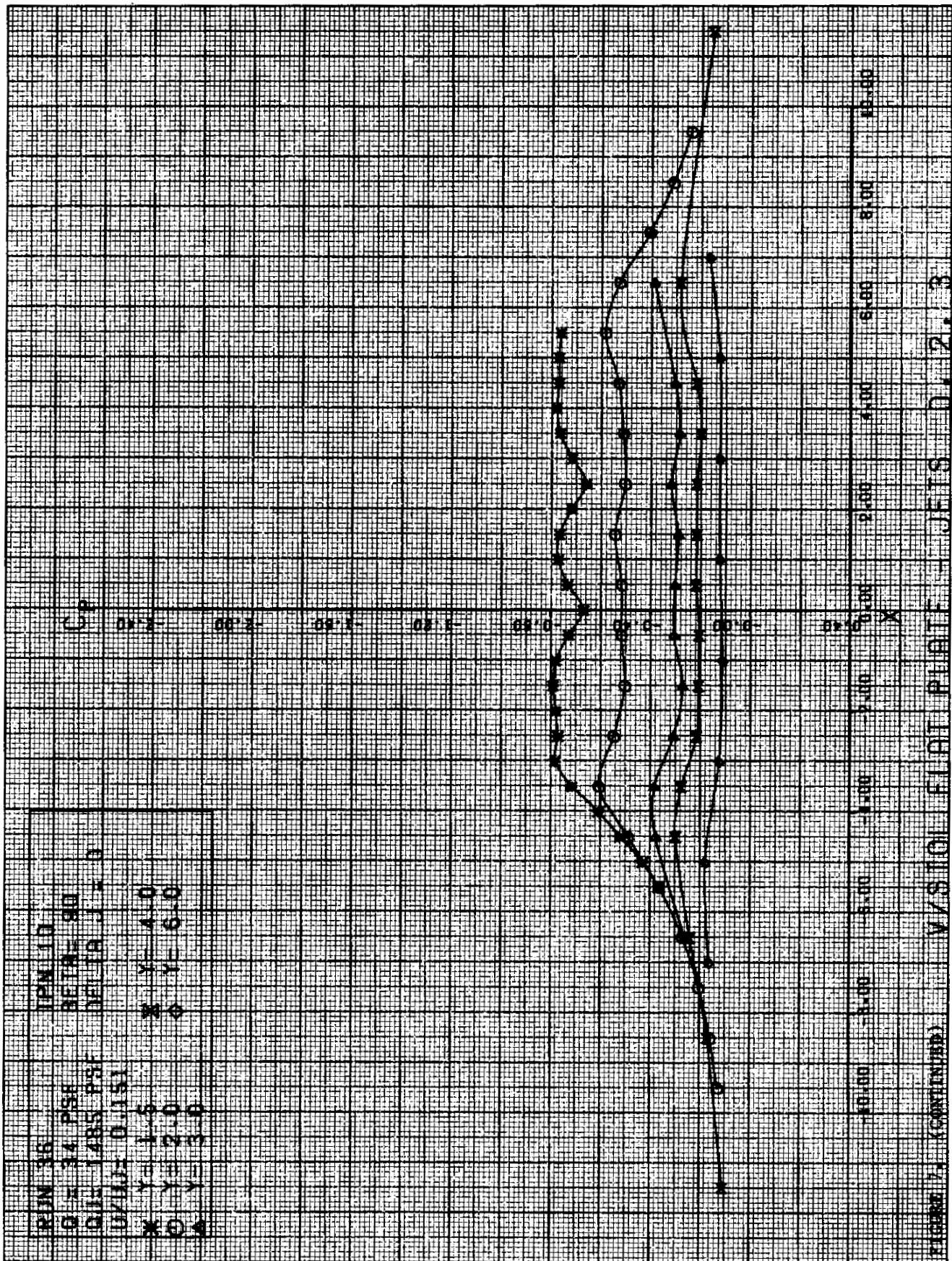


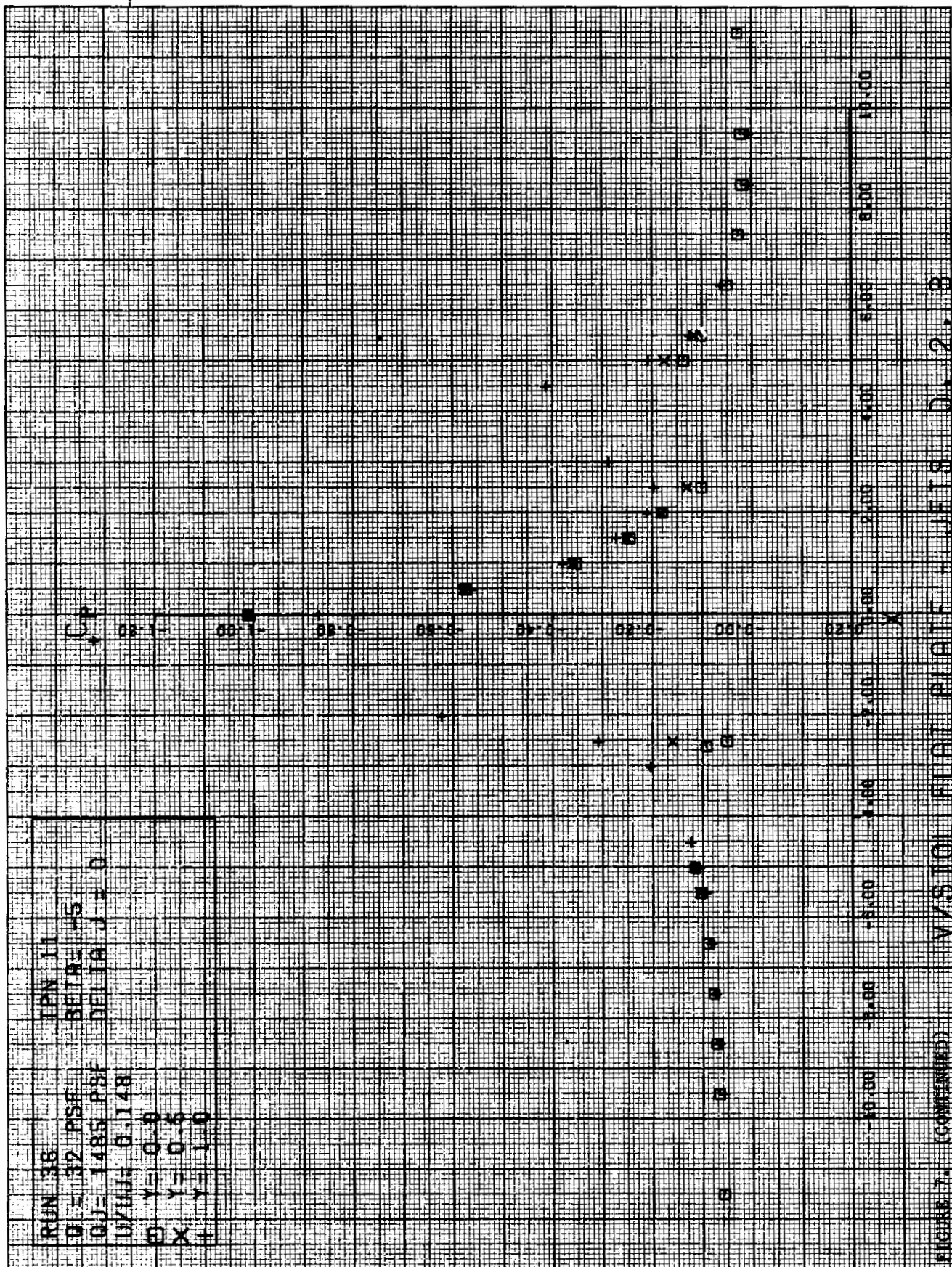


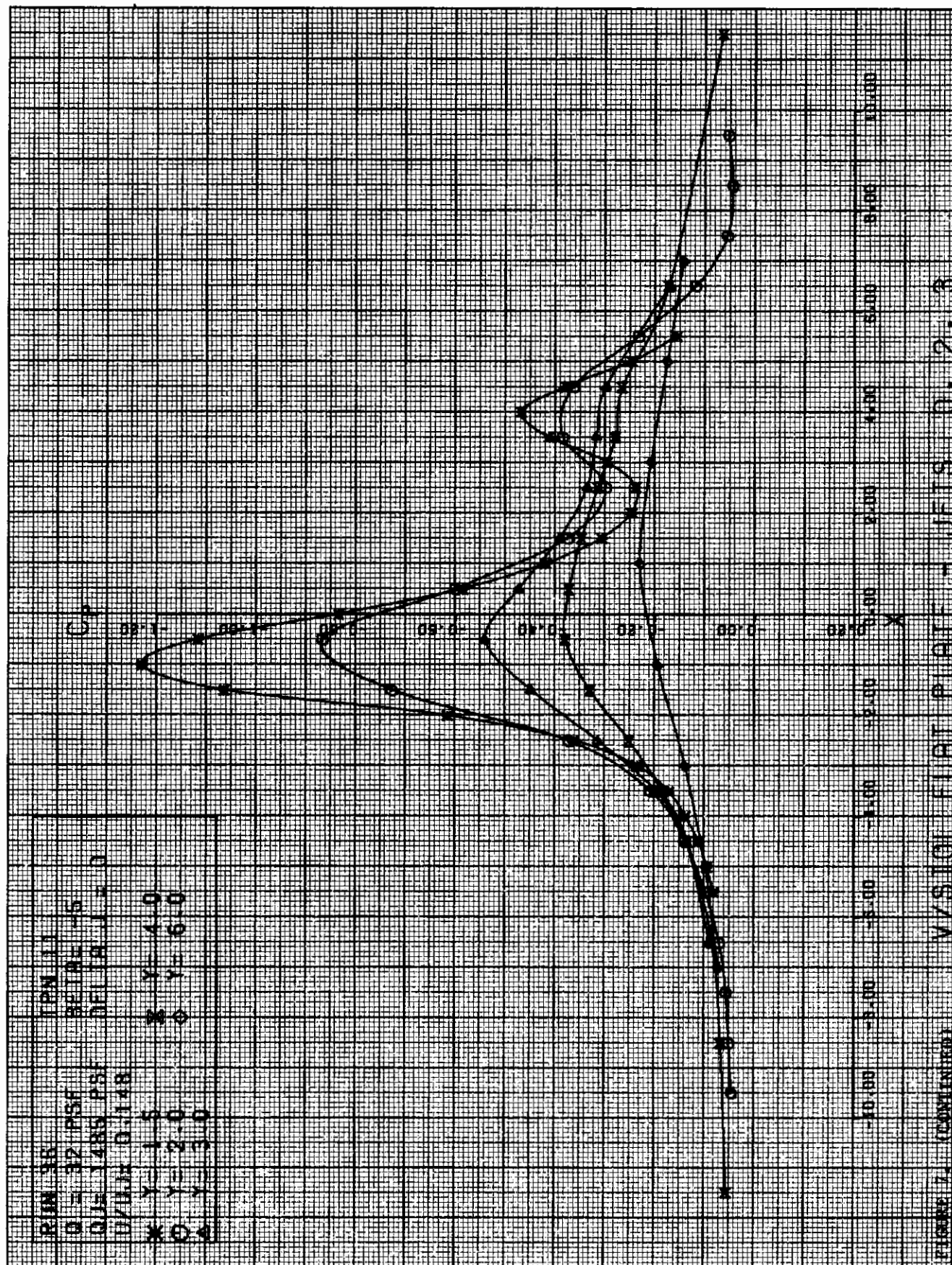


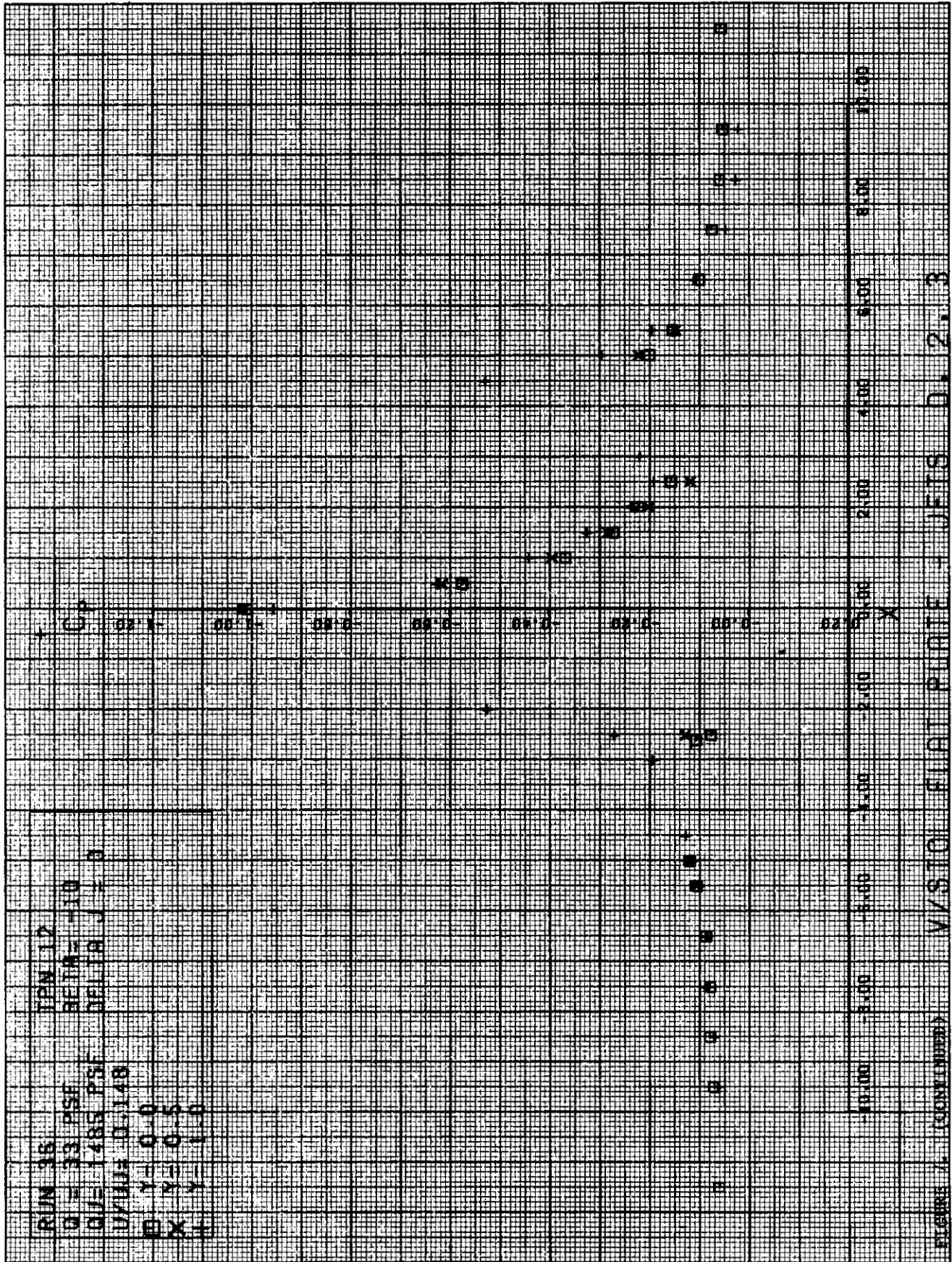


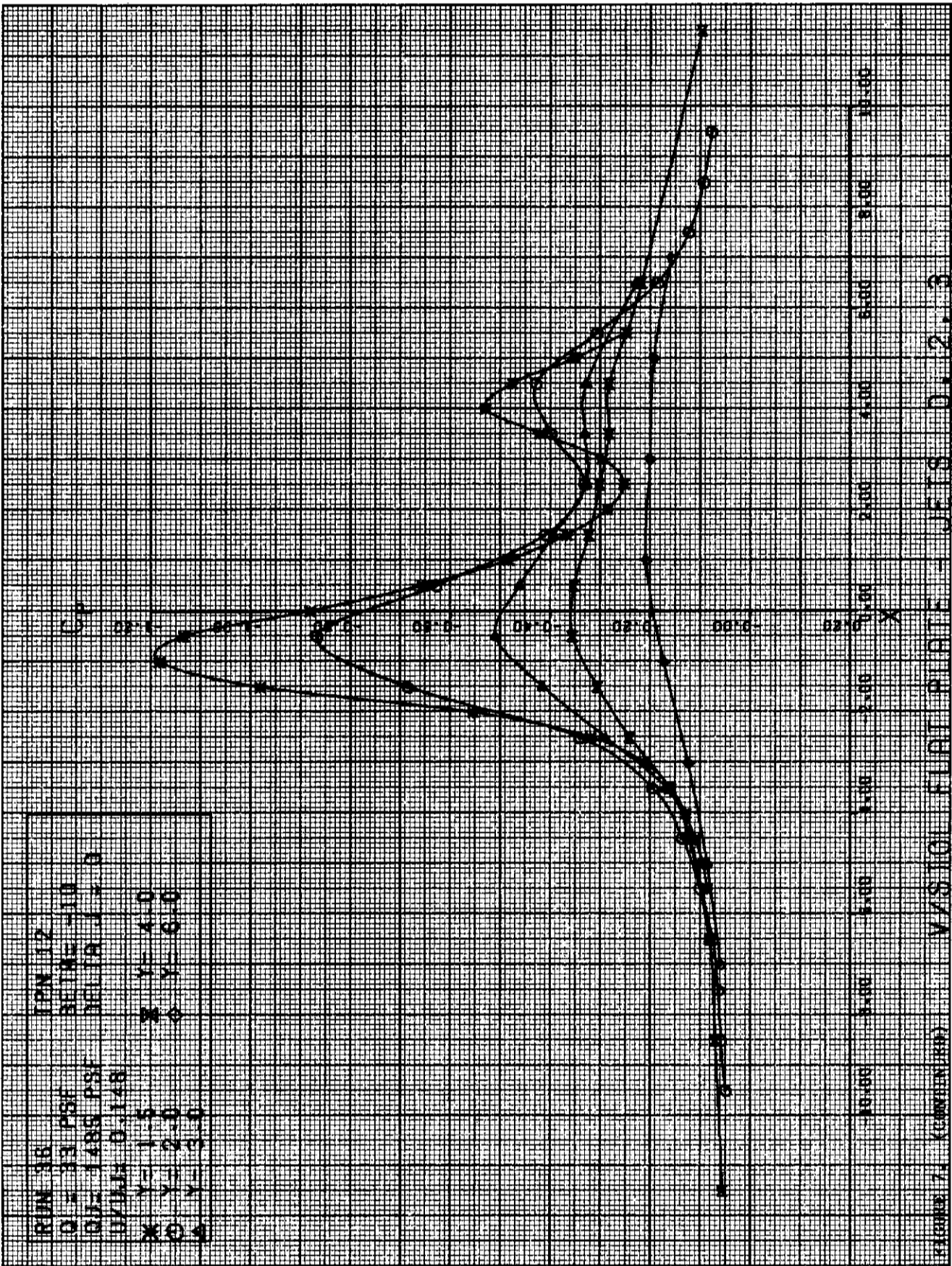


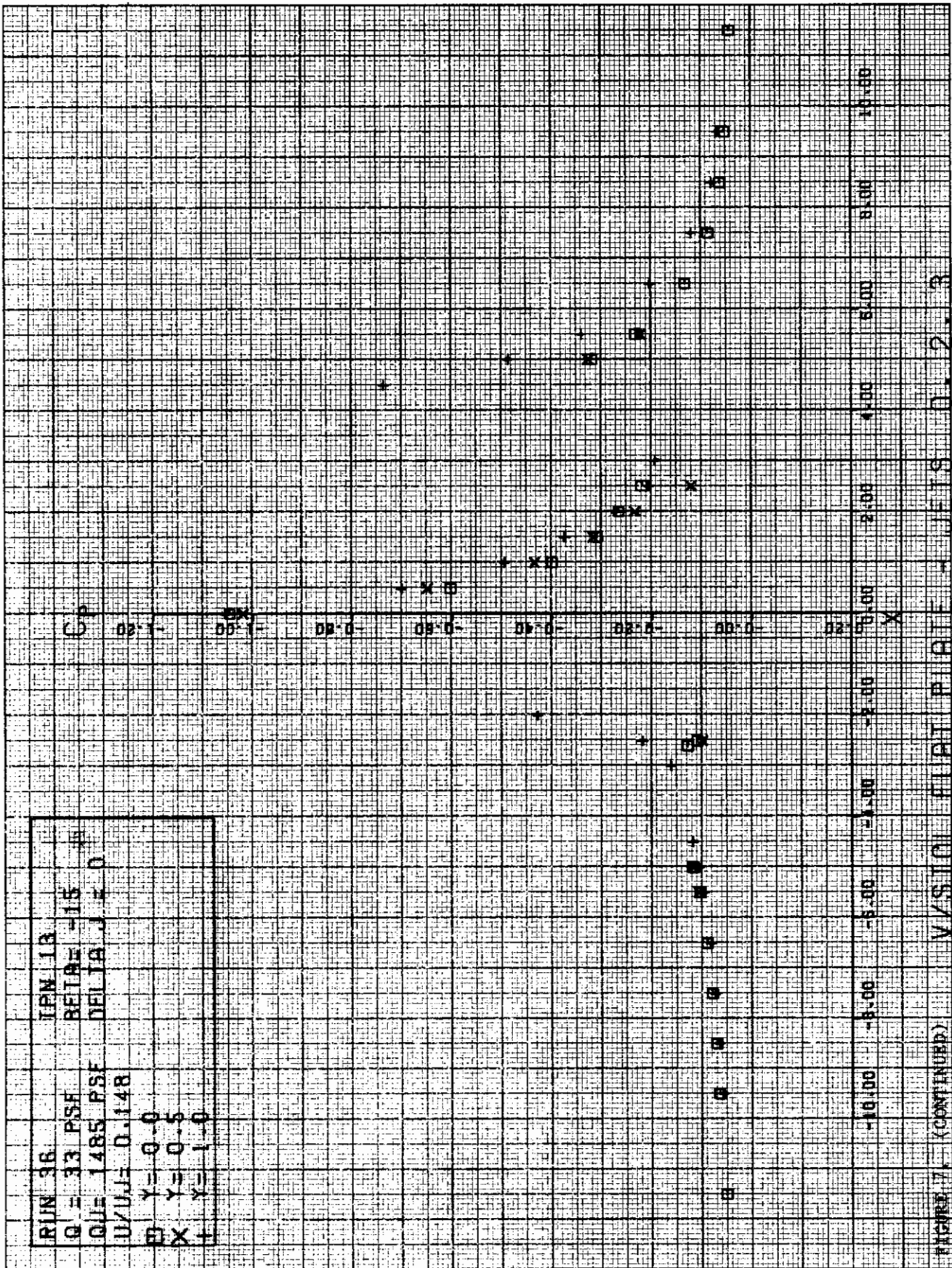












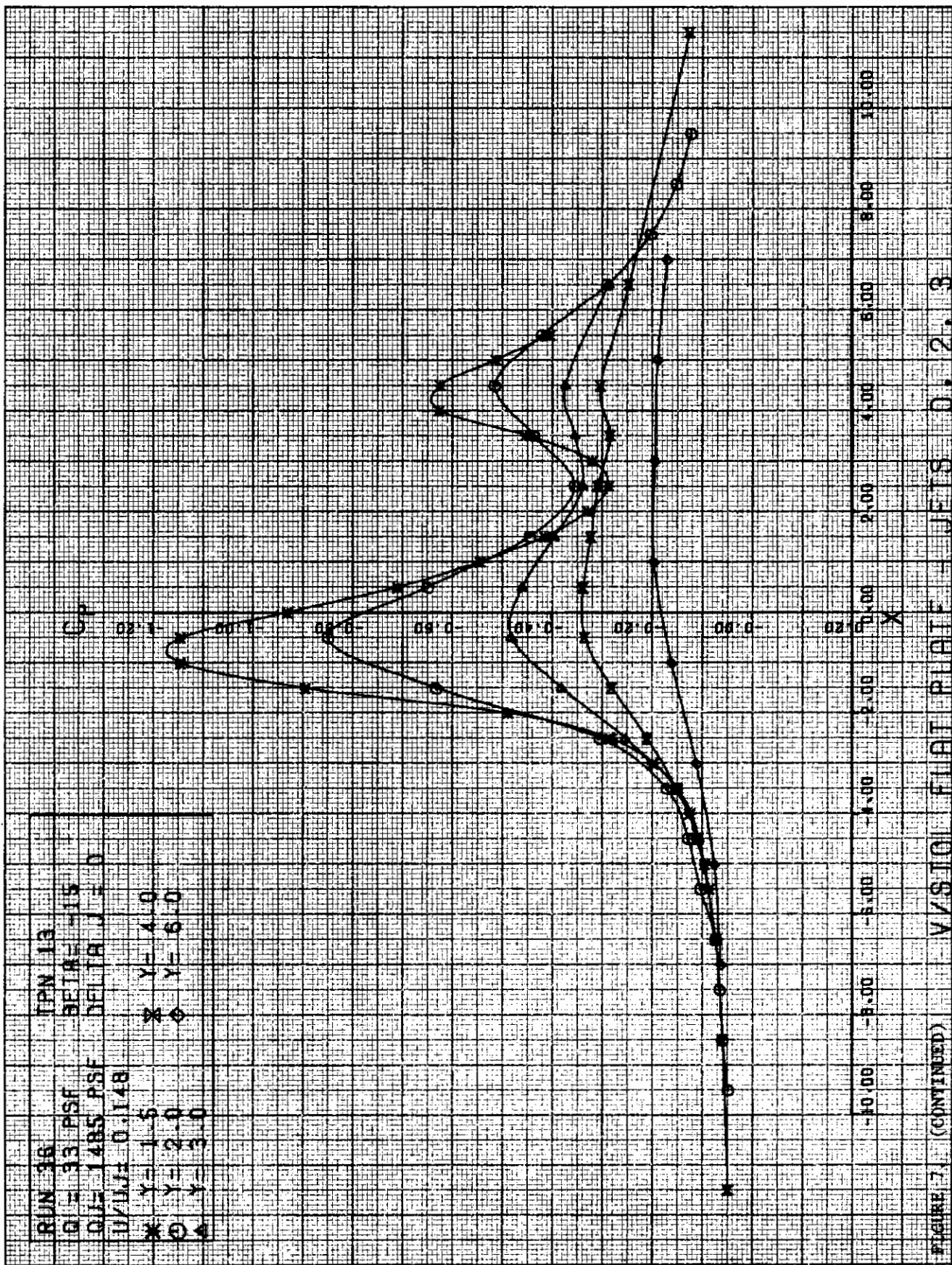
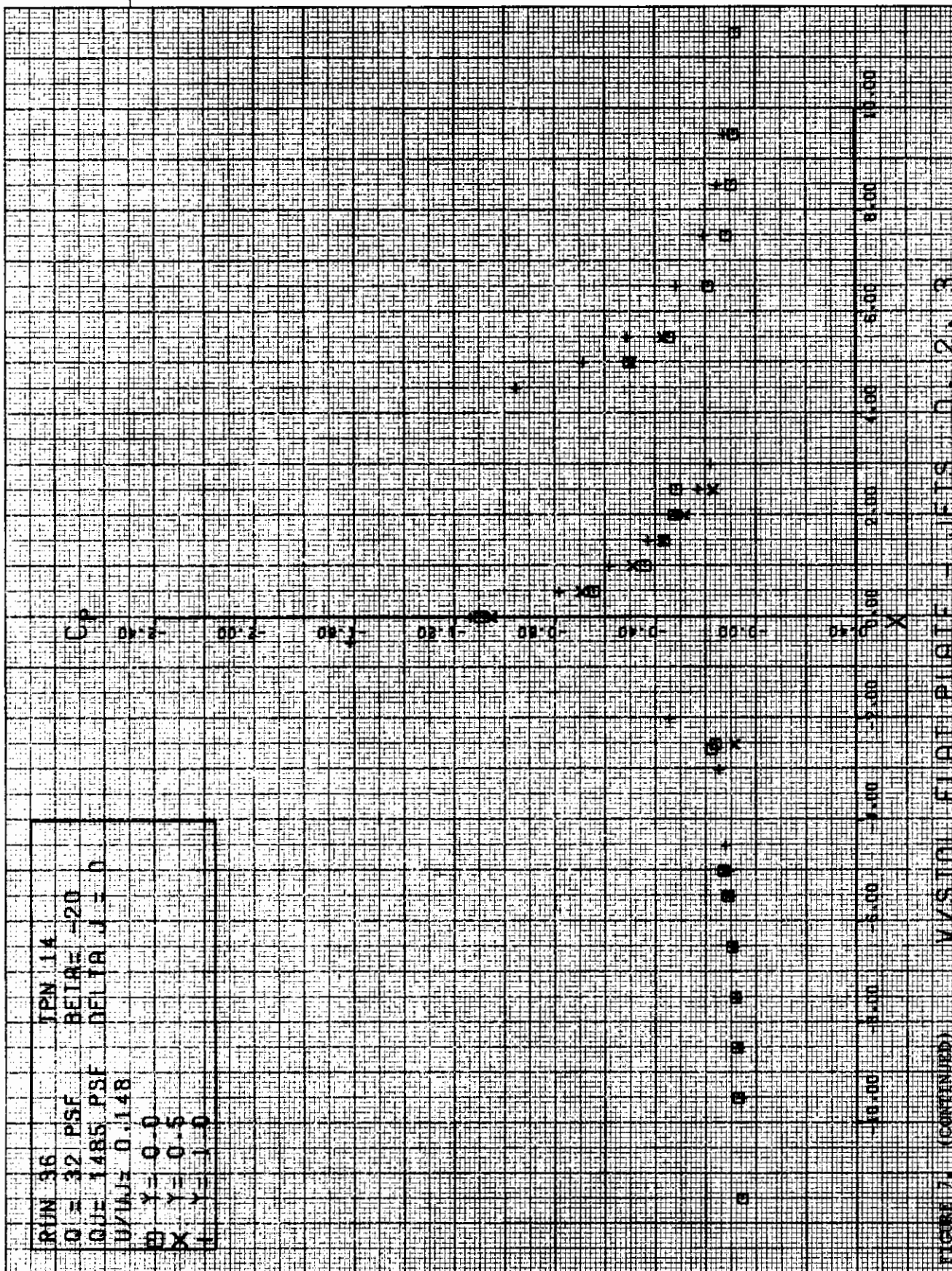


FIGURE 7 (CONTINUED) V/S101 FLAT PLATE - JETS 0, 2, 3



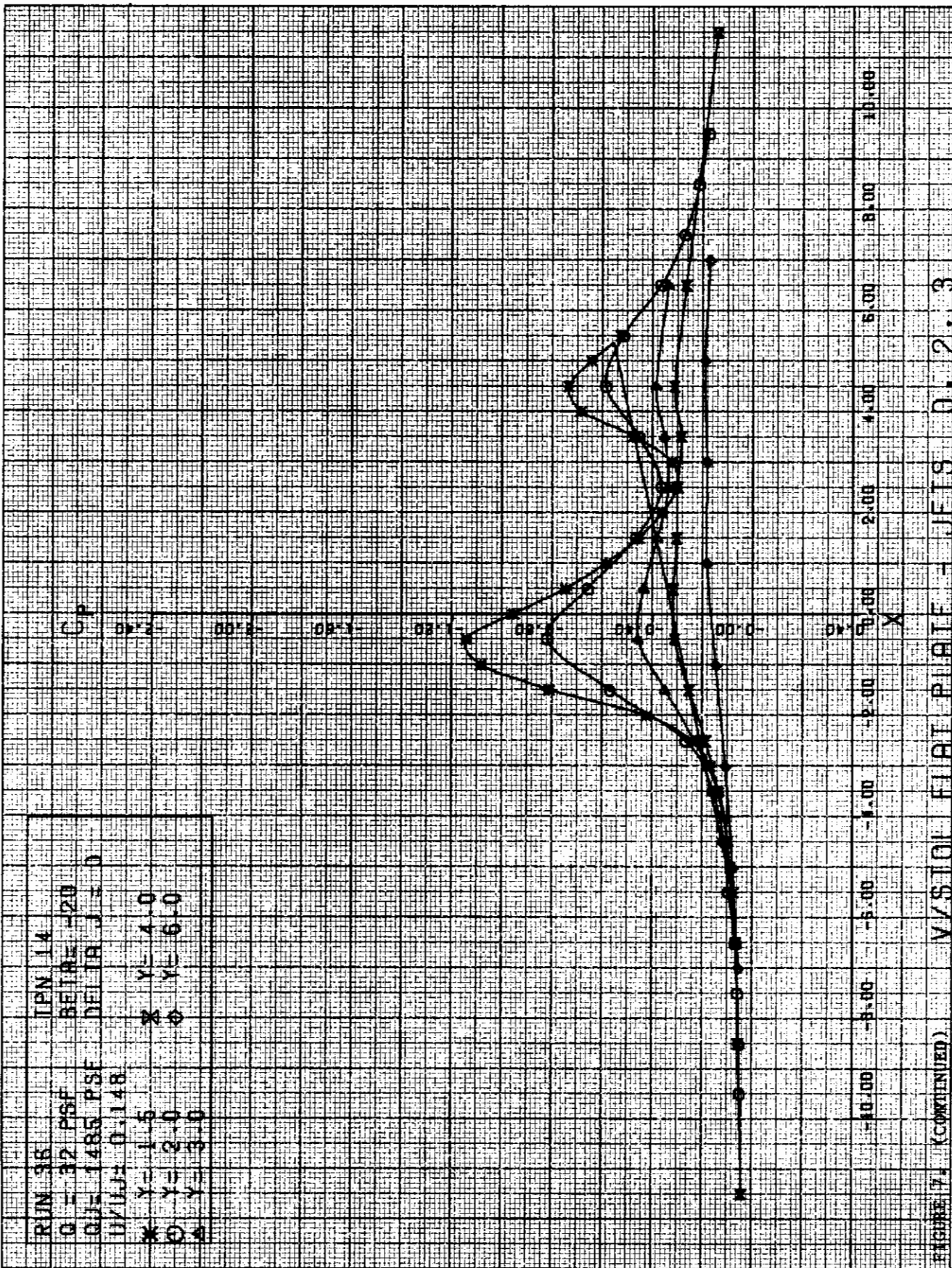
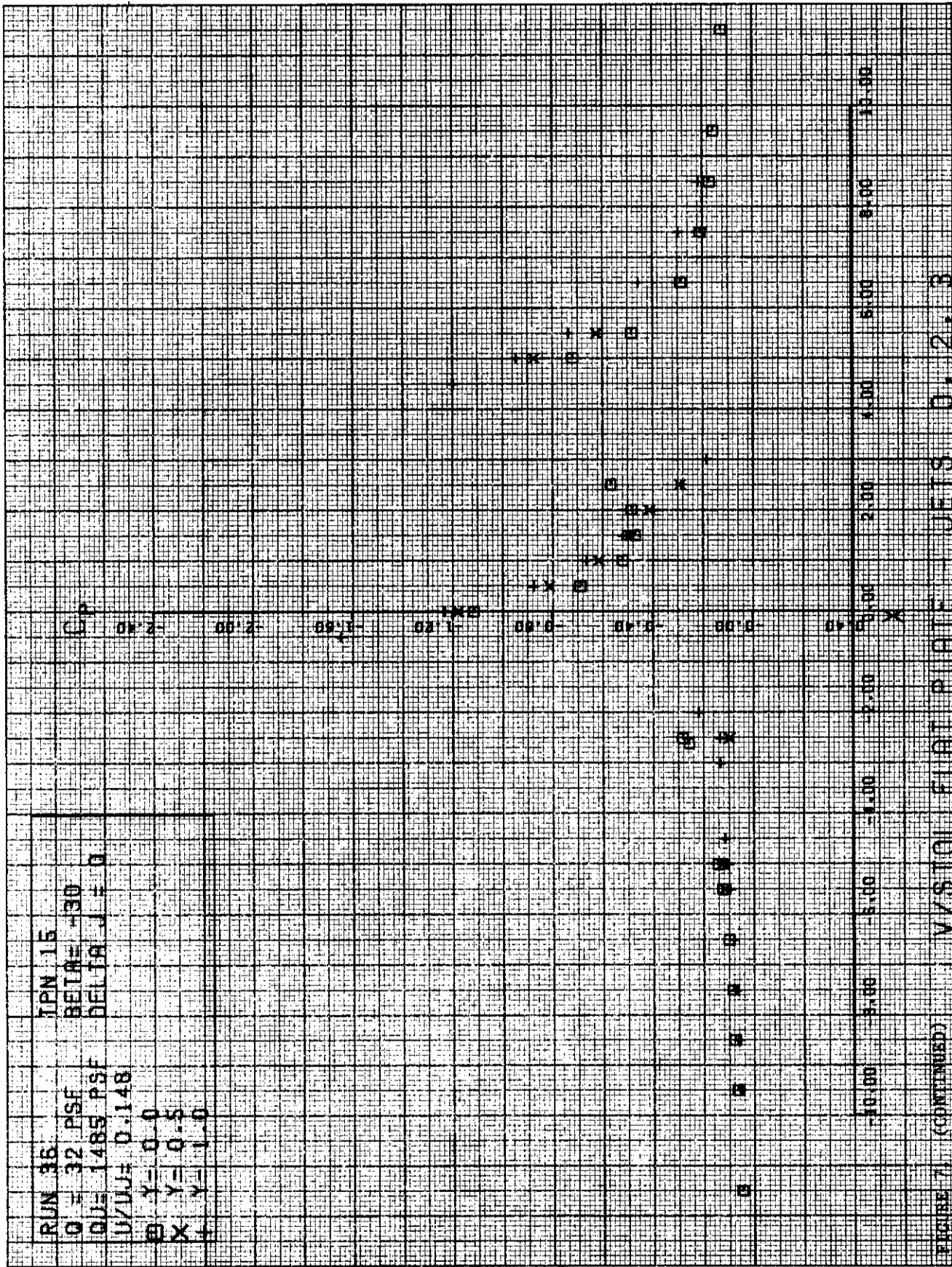
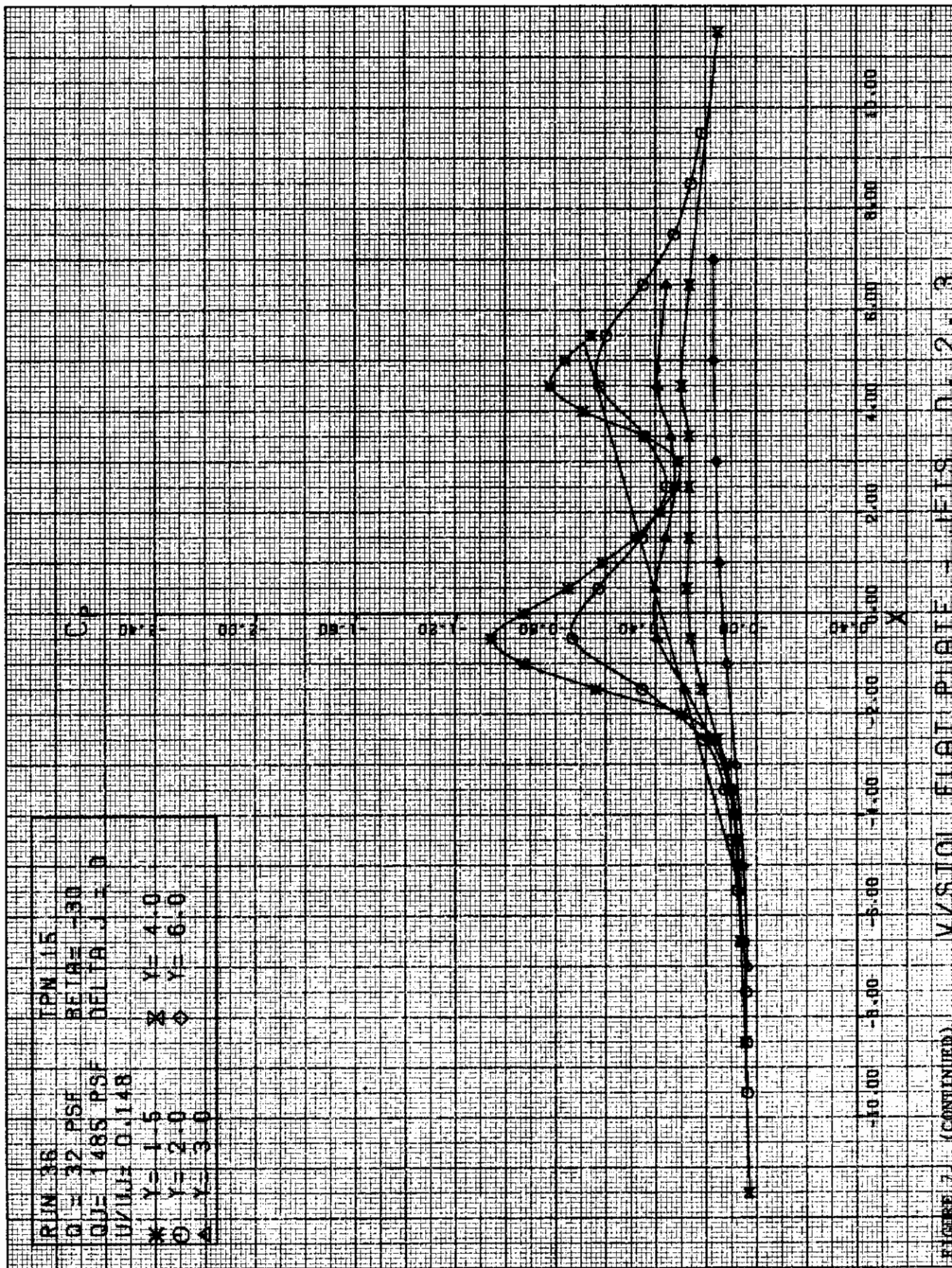
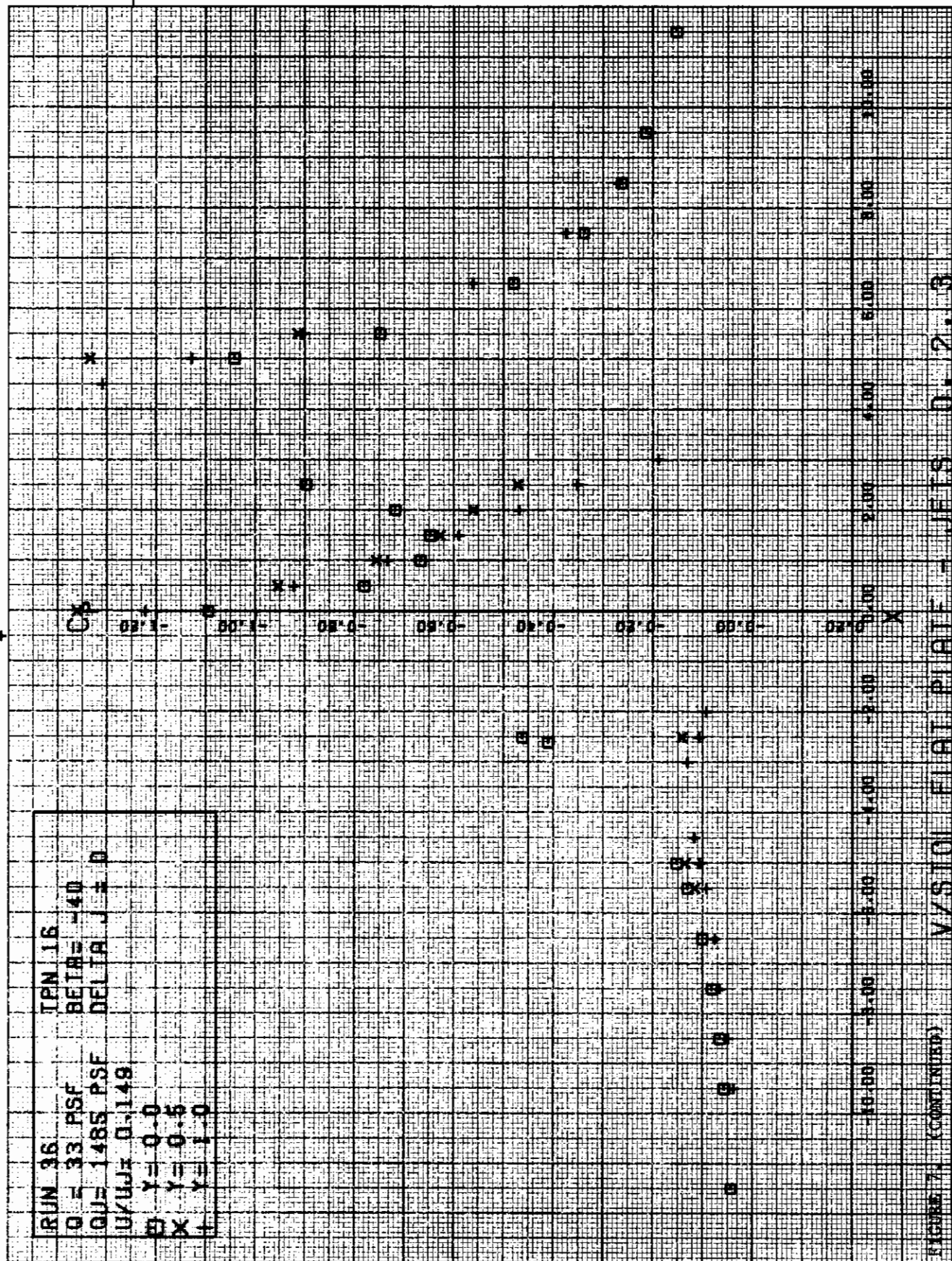
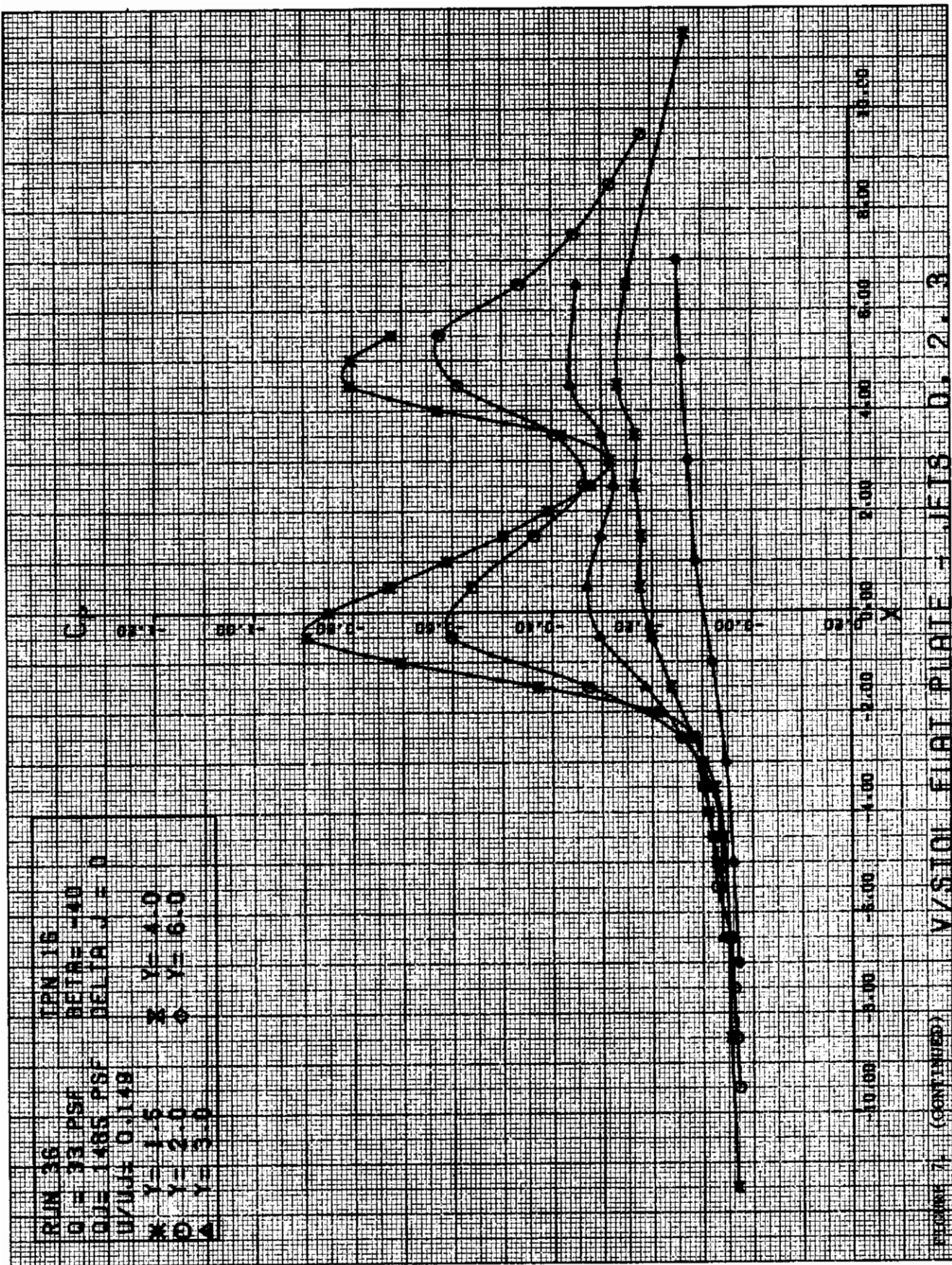


FIGURE 7. (CONTINUED) V/STOL FIAT PLATE - JETS 0.2.3









x

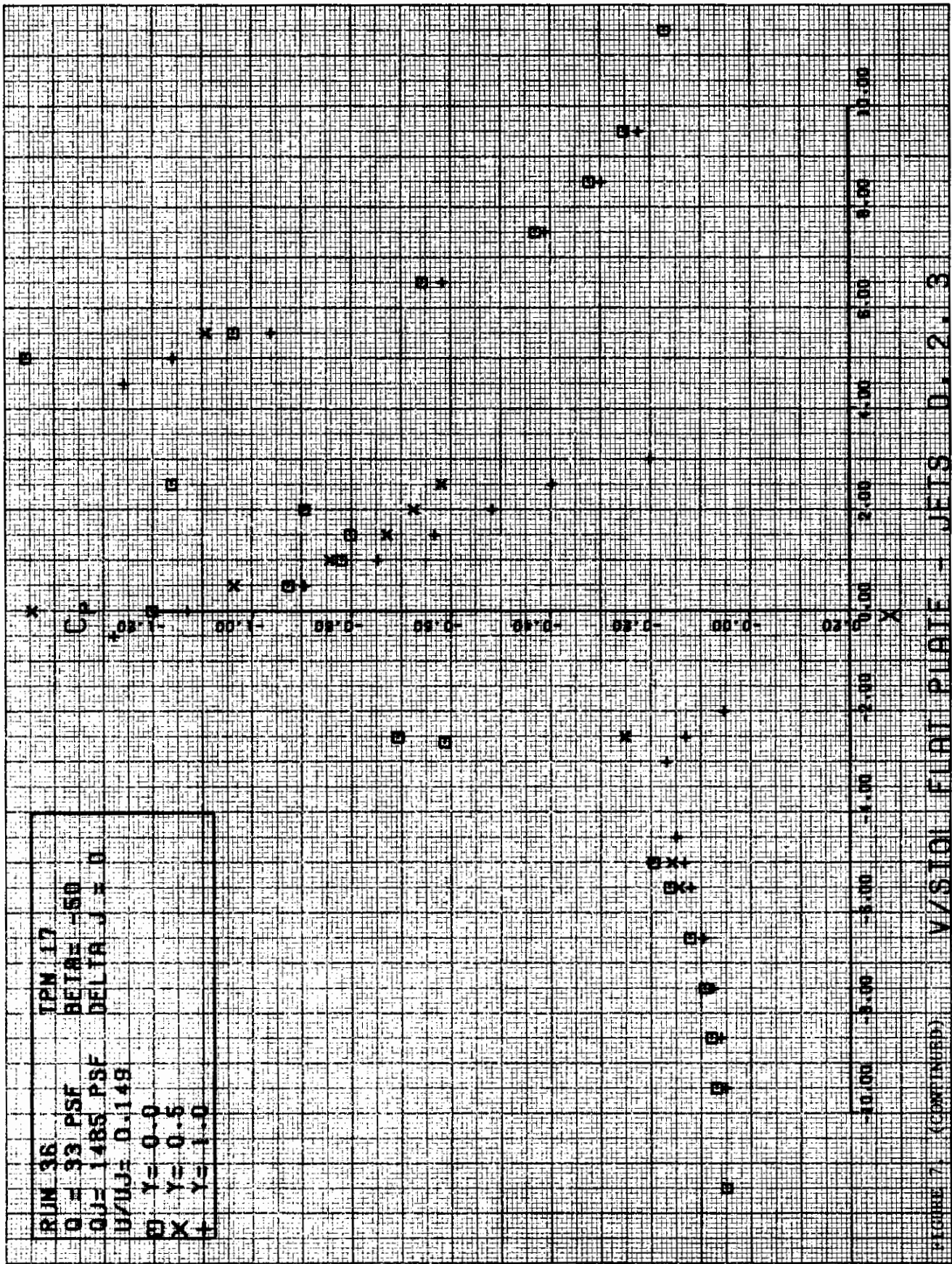
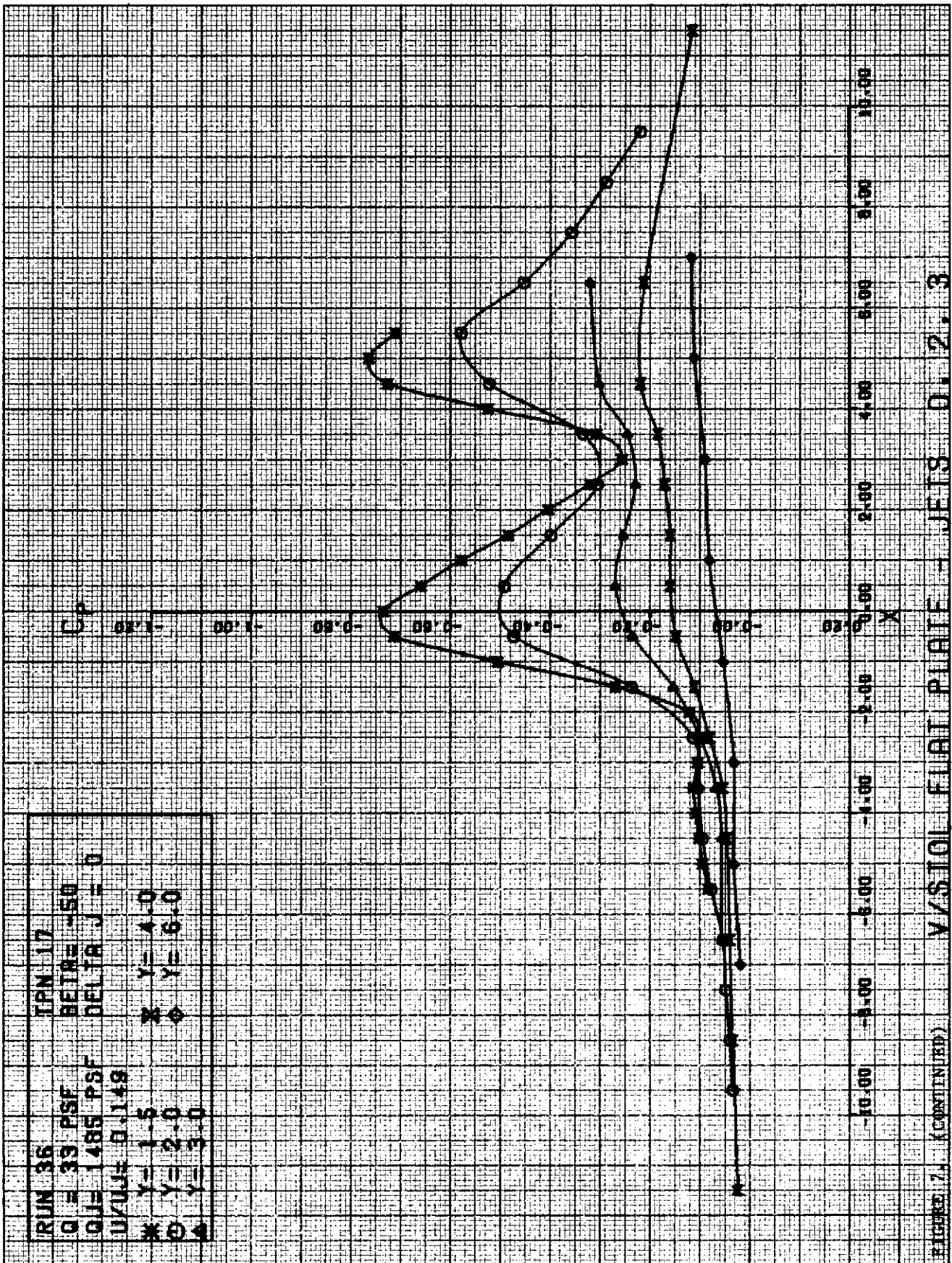
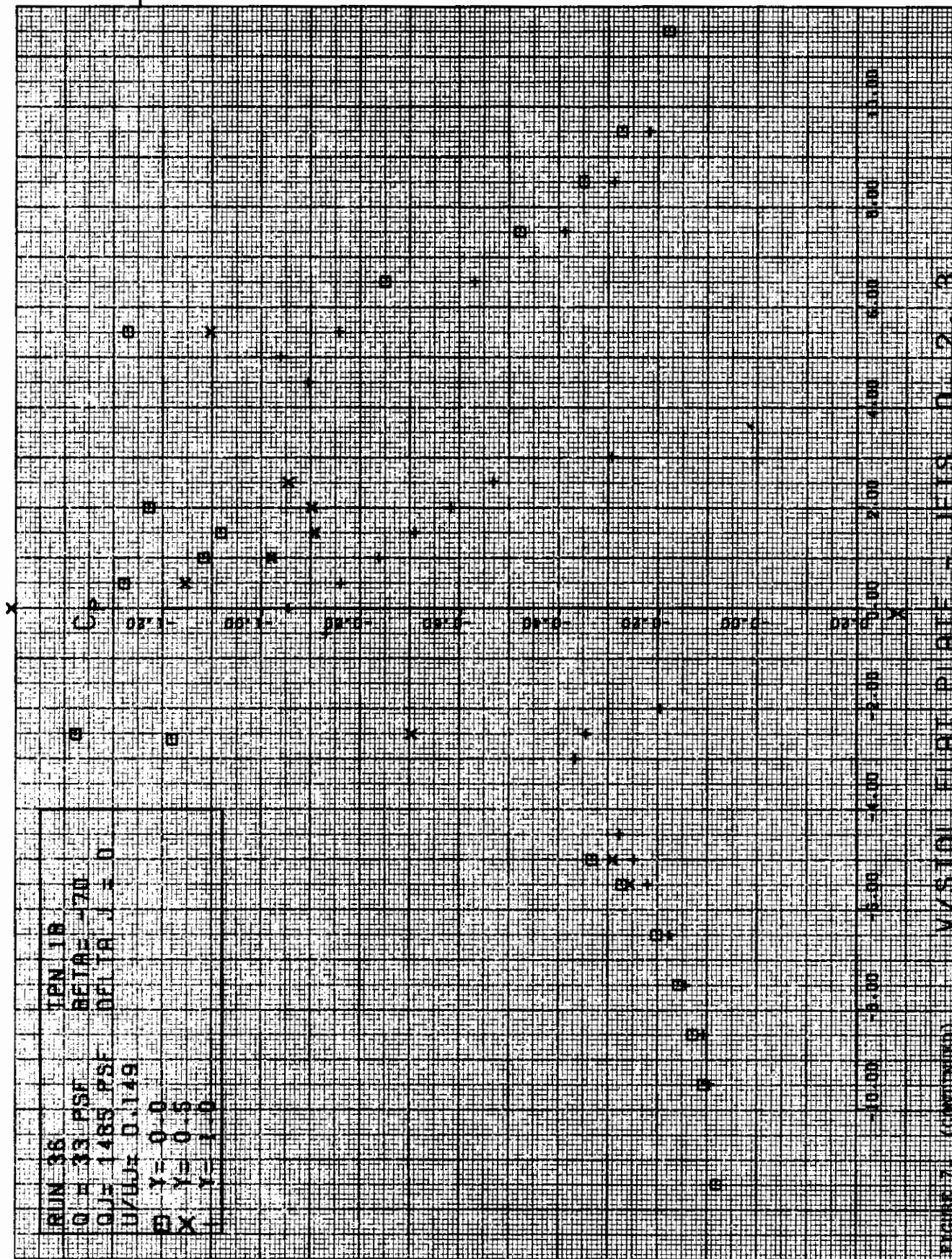
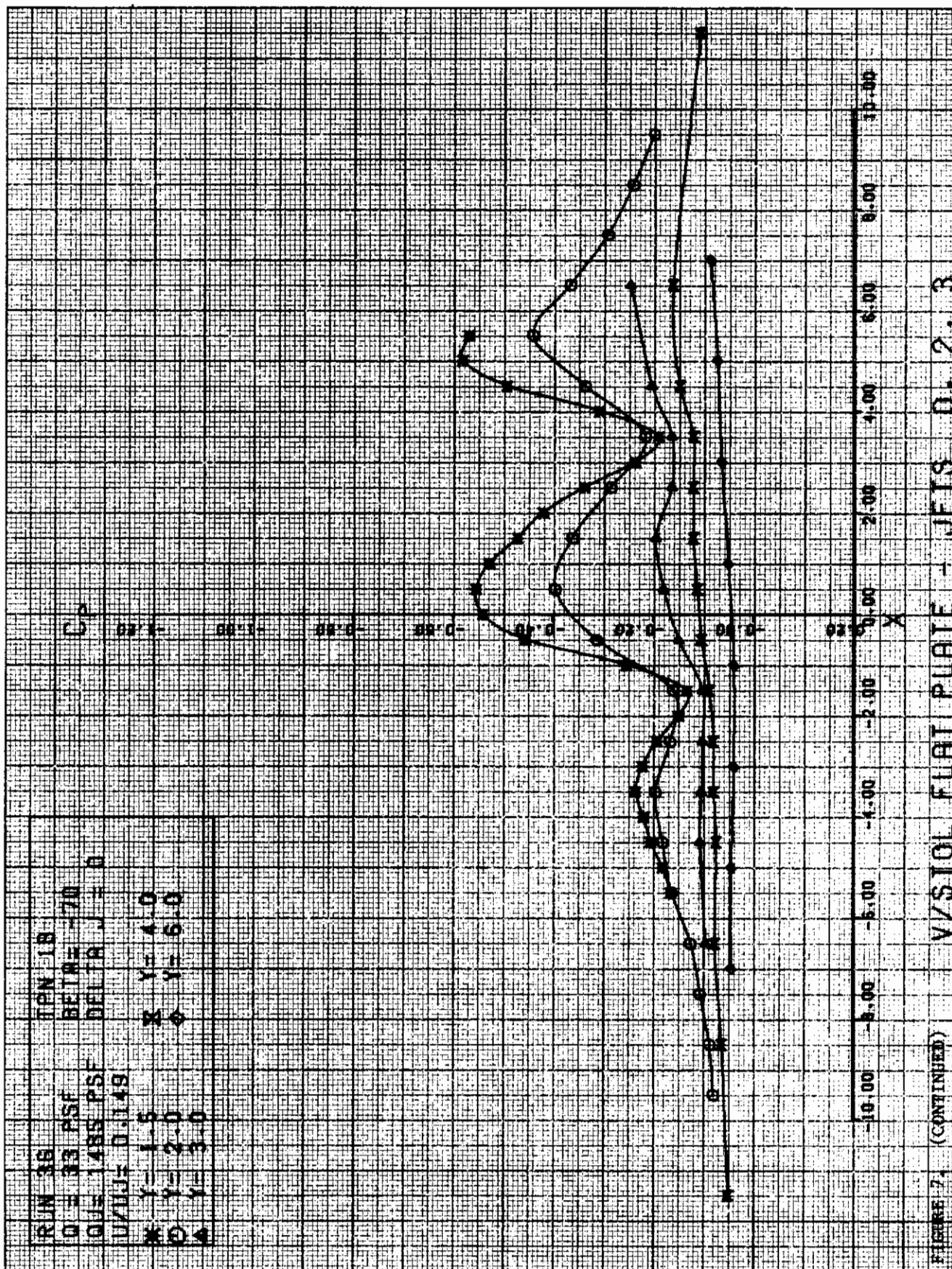


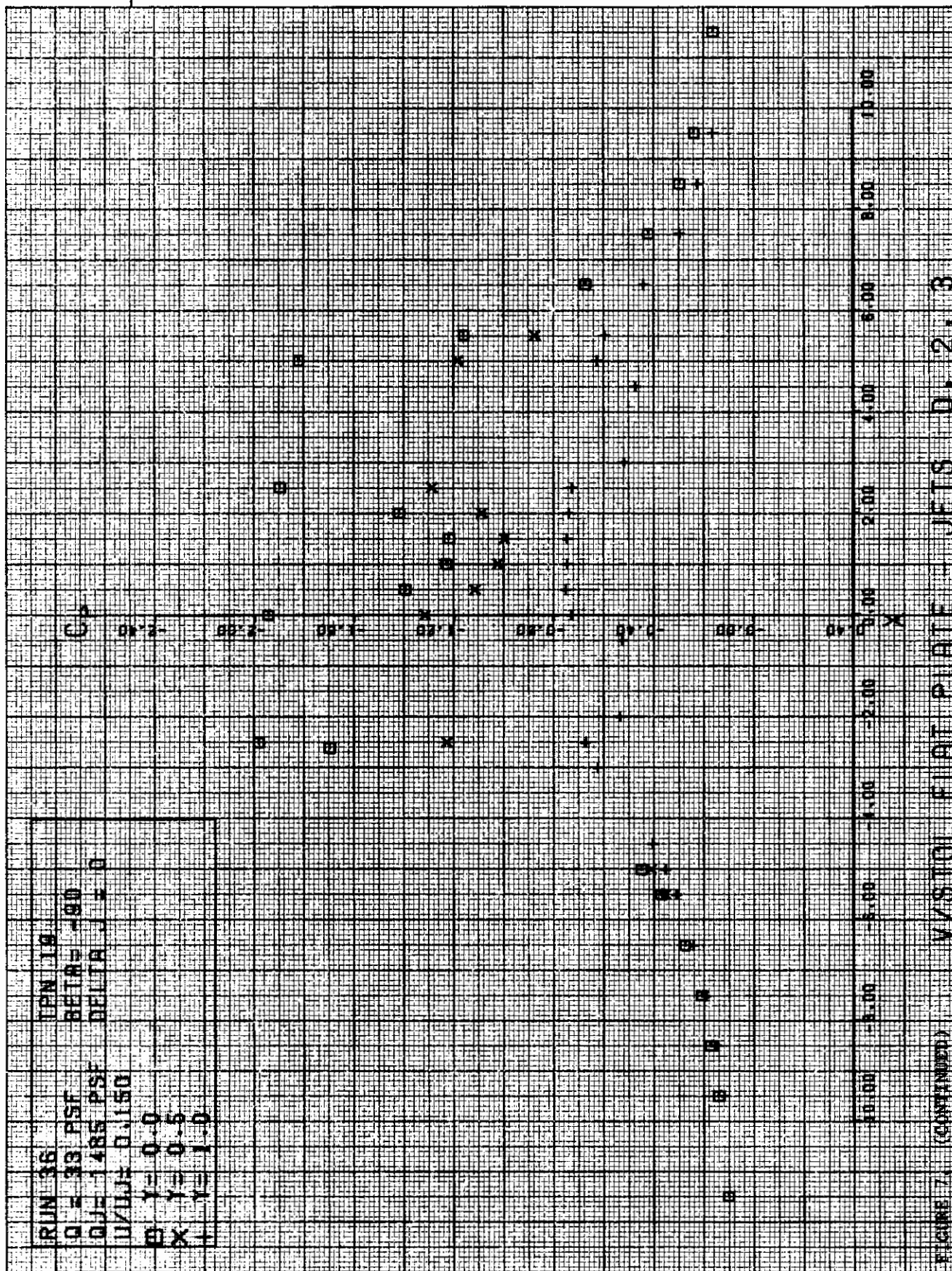
FIGURE 7 (CONTINUED) V/SIOL FLAT PLATE - JETS D. 2. 3



B
X







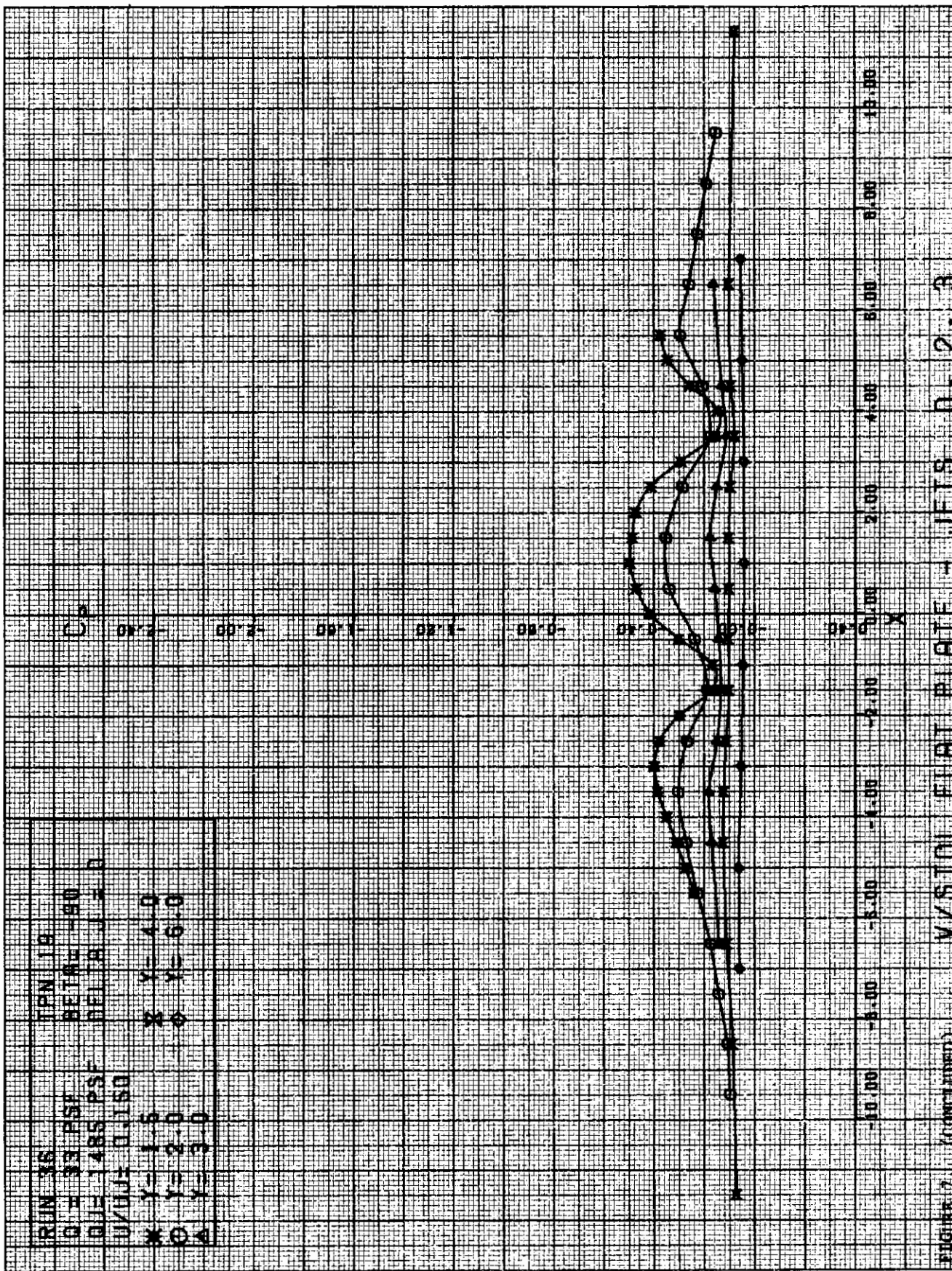
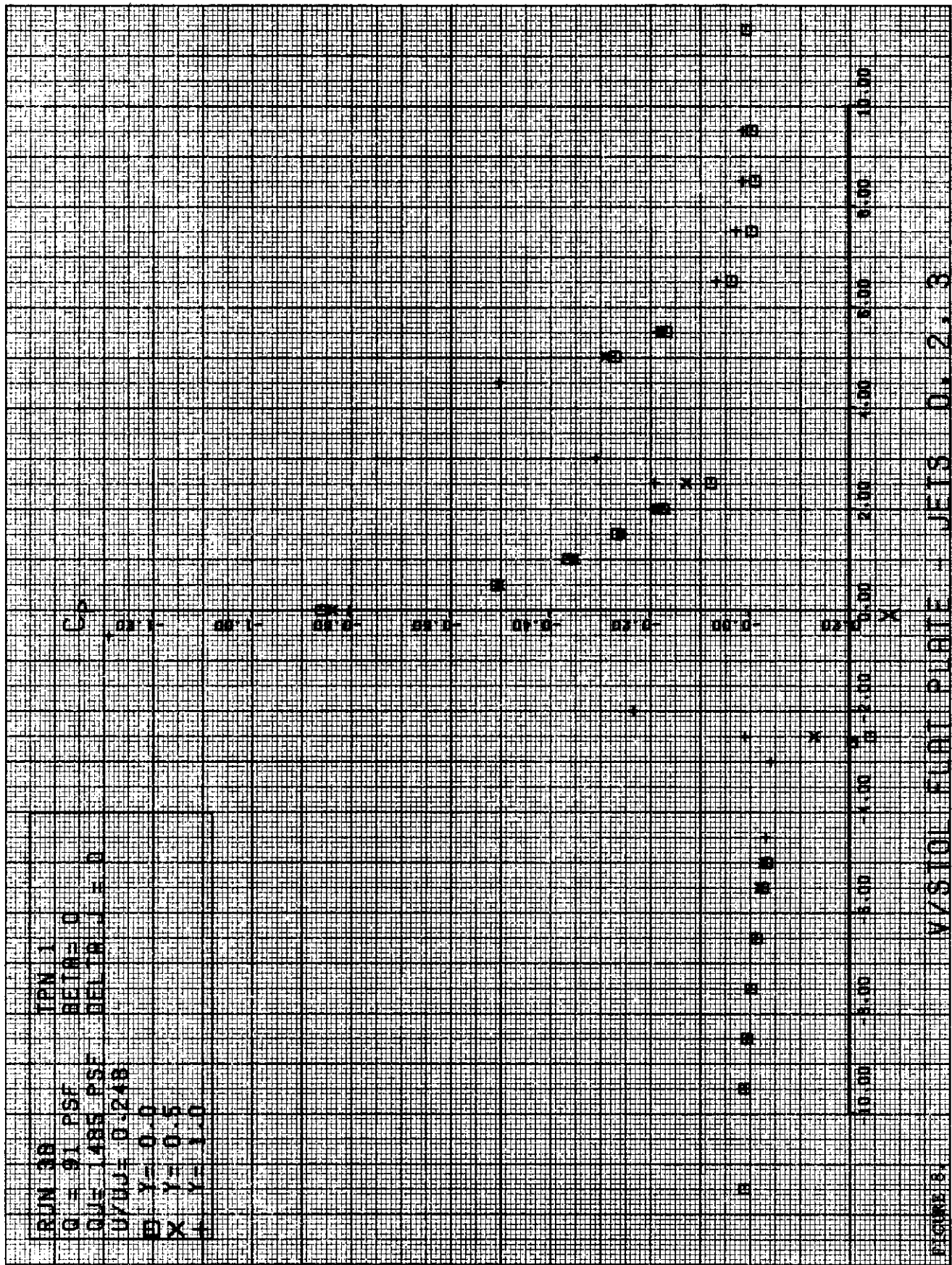


FIGURE 7. (continued) V/S 101 FLAT PLATE - JETS 0.2, 3



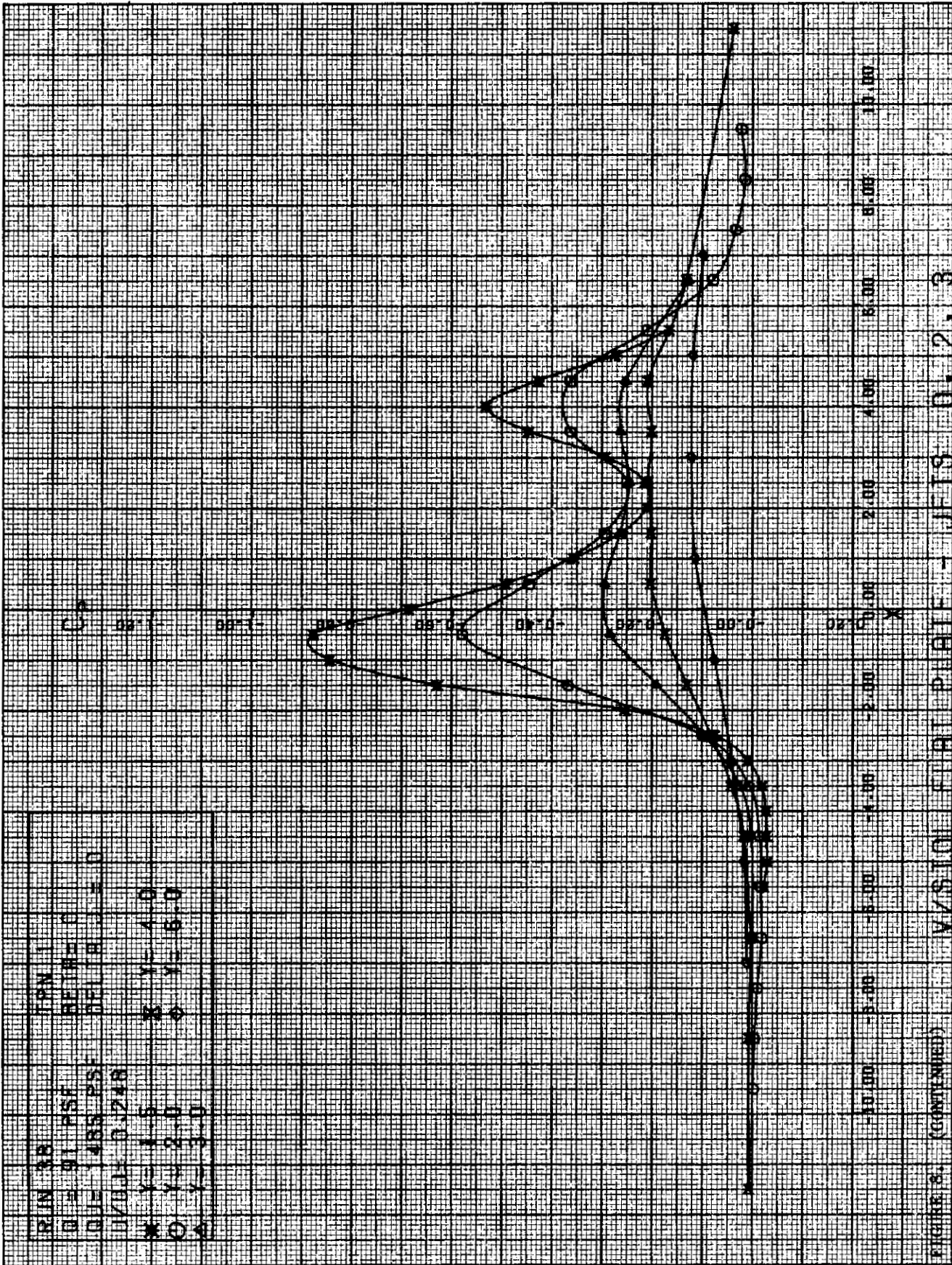


FIGURE 8. (CONTINUED) WINDS IN FLIGHT PUBLISHED JULY 2, 1953

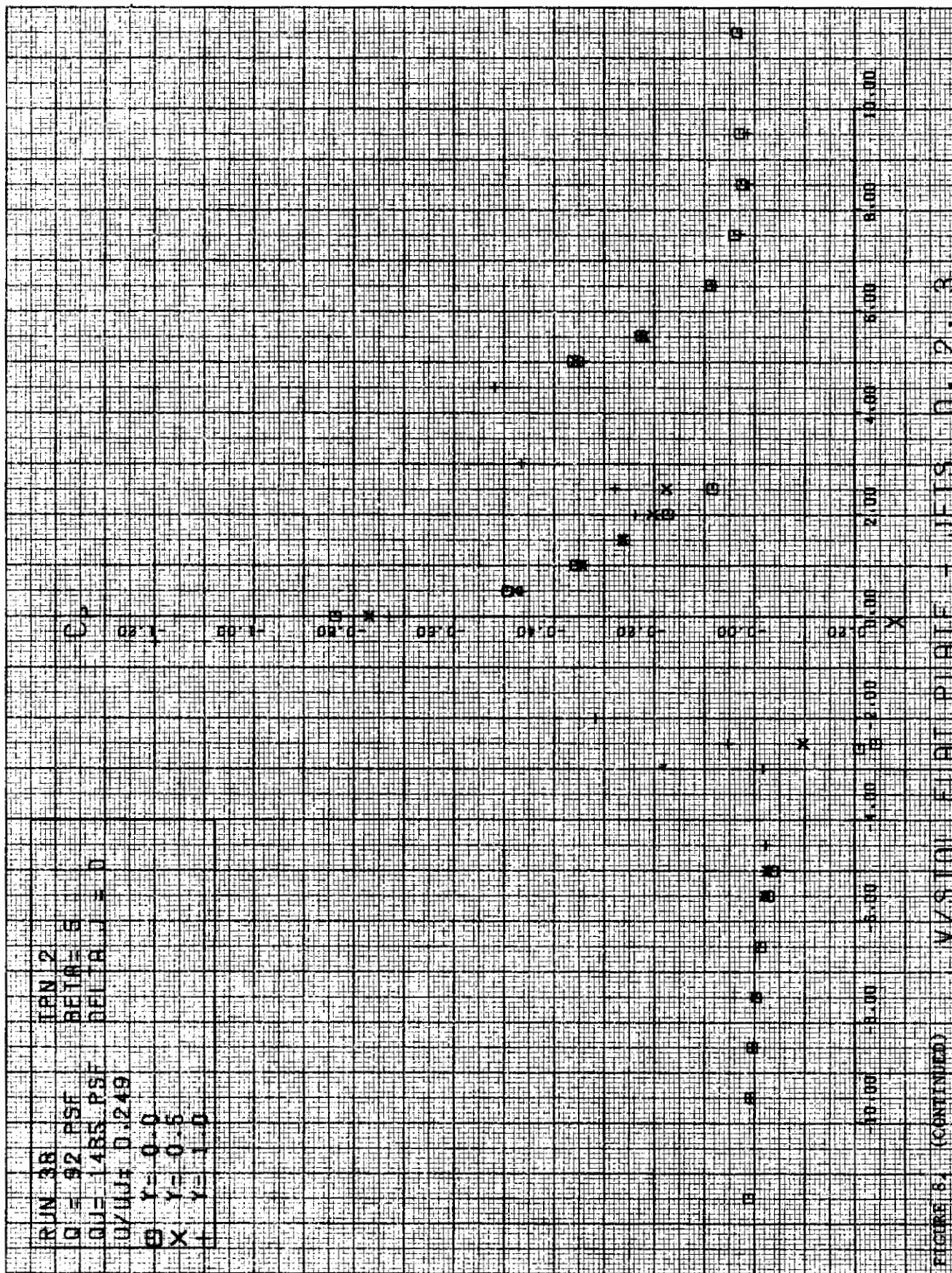
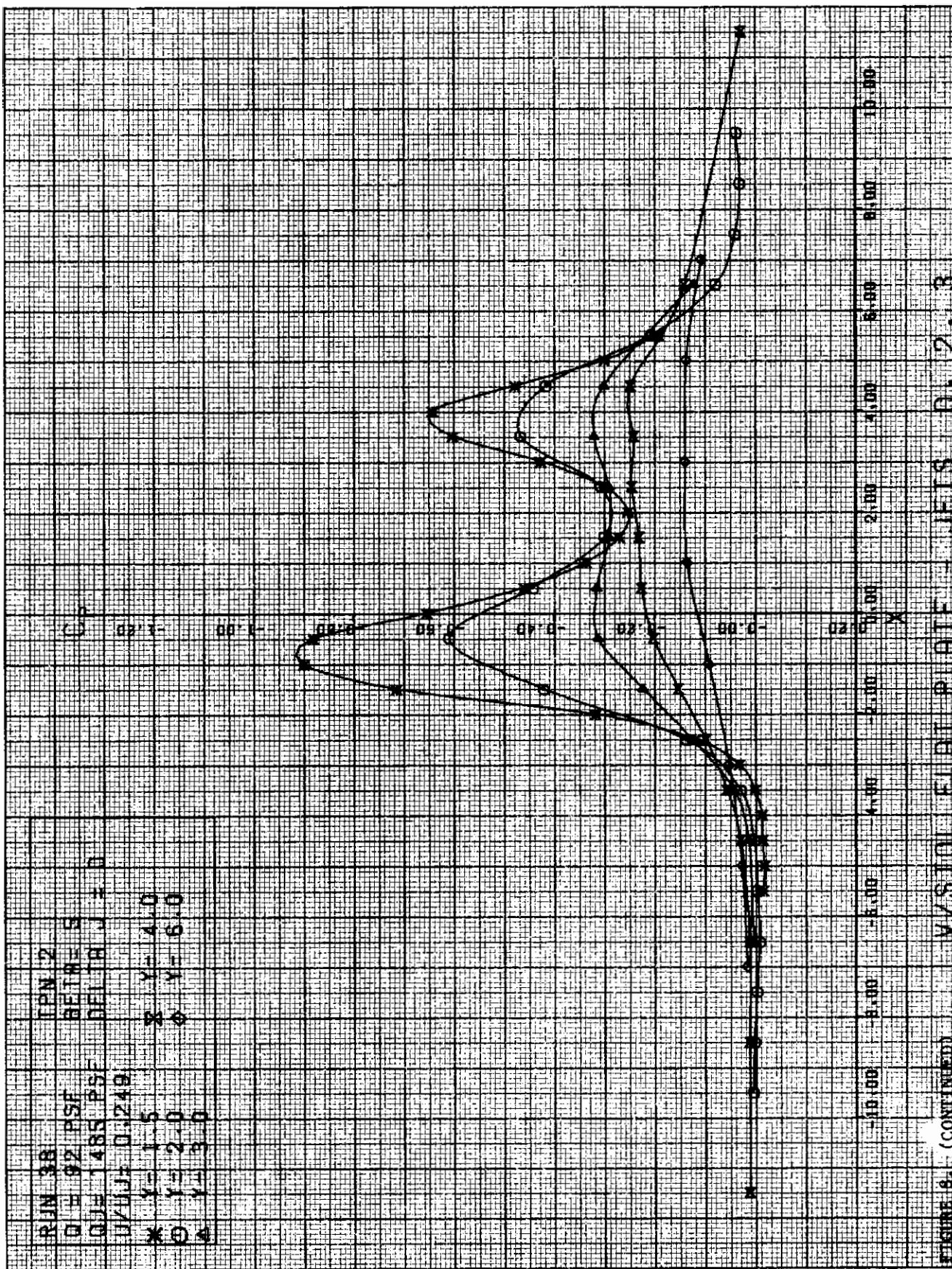
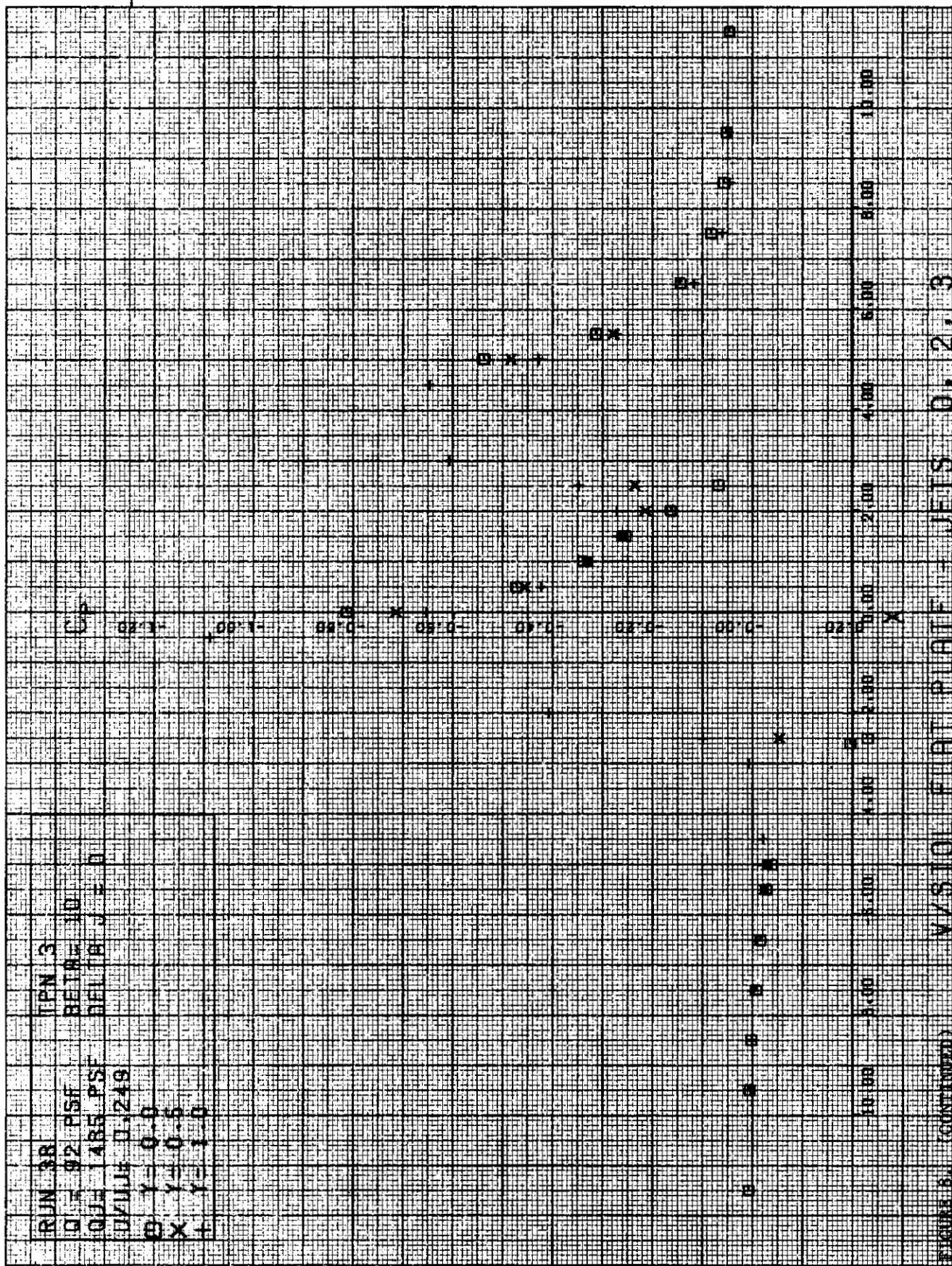


FIGURE 8-4 (CONTINUED) VISION FLAT PAPER - UJIS 0.2, 3





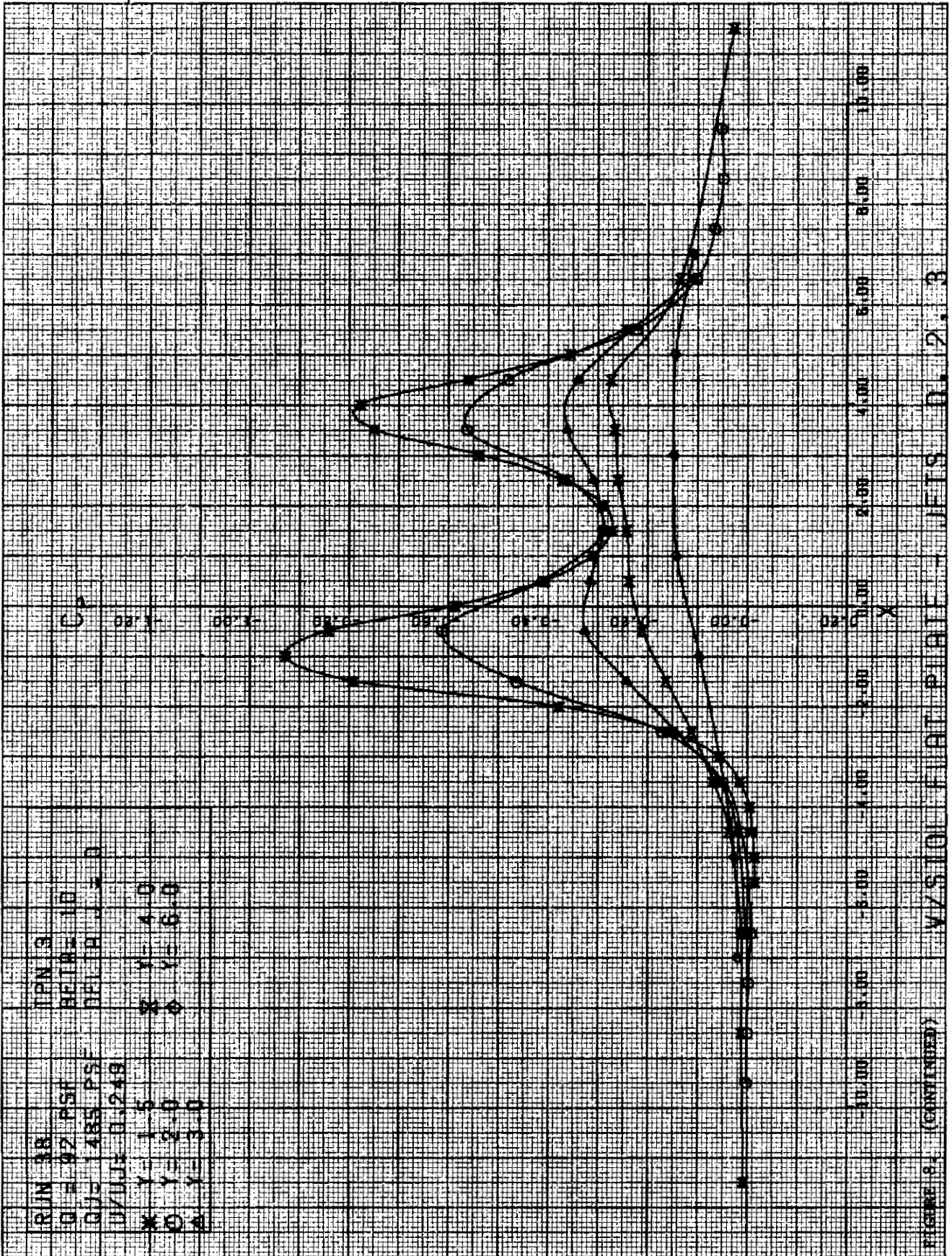
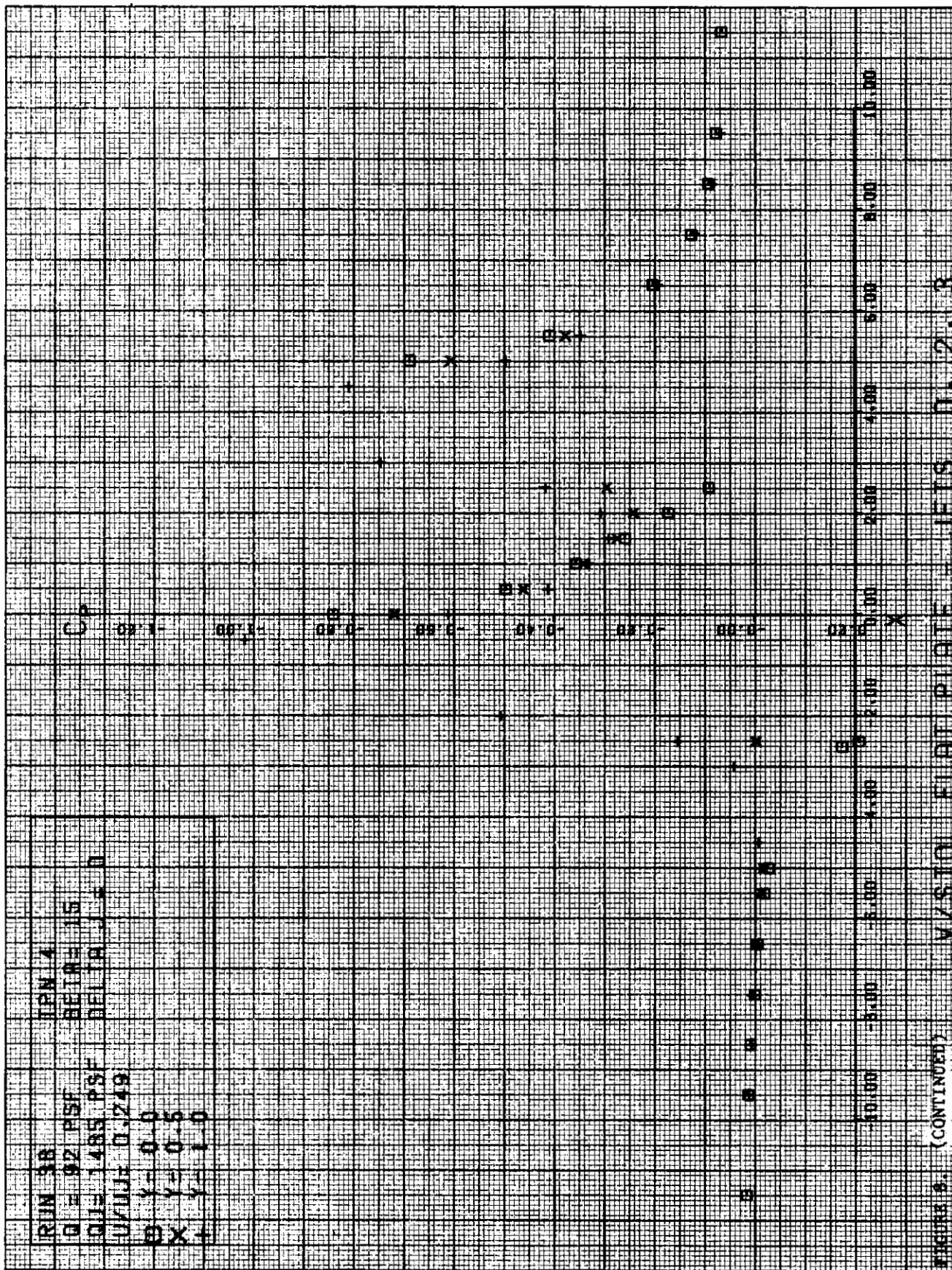
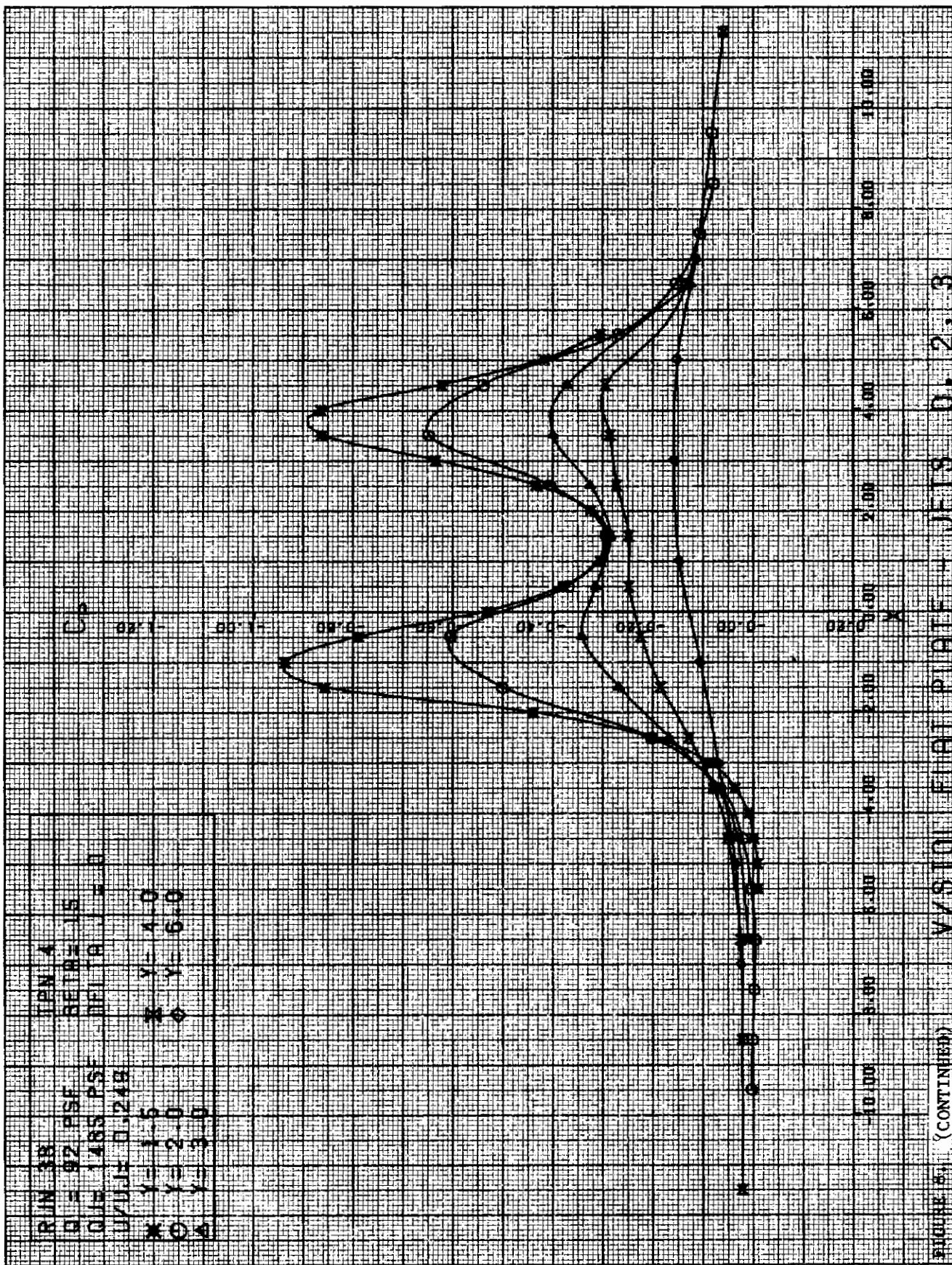


FIGURE 9. (CONTINUED) V/S 101. FLAT PLATE. JETS. D. 2.3





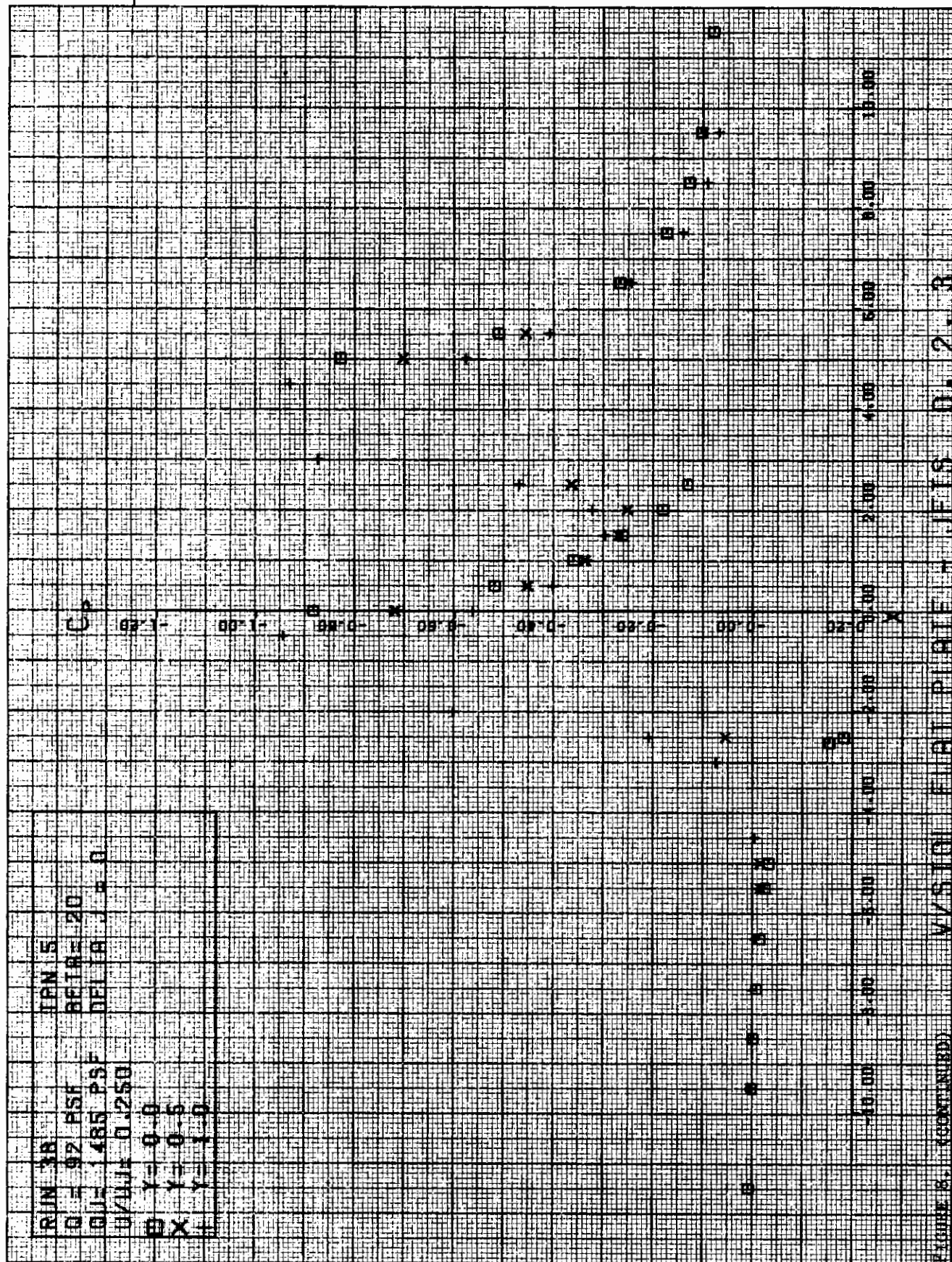
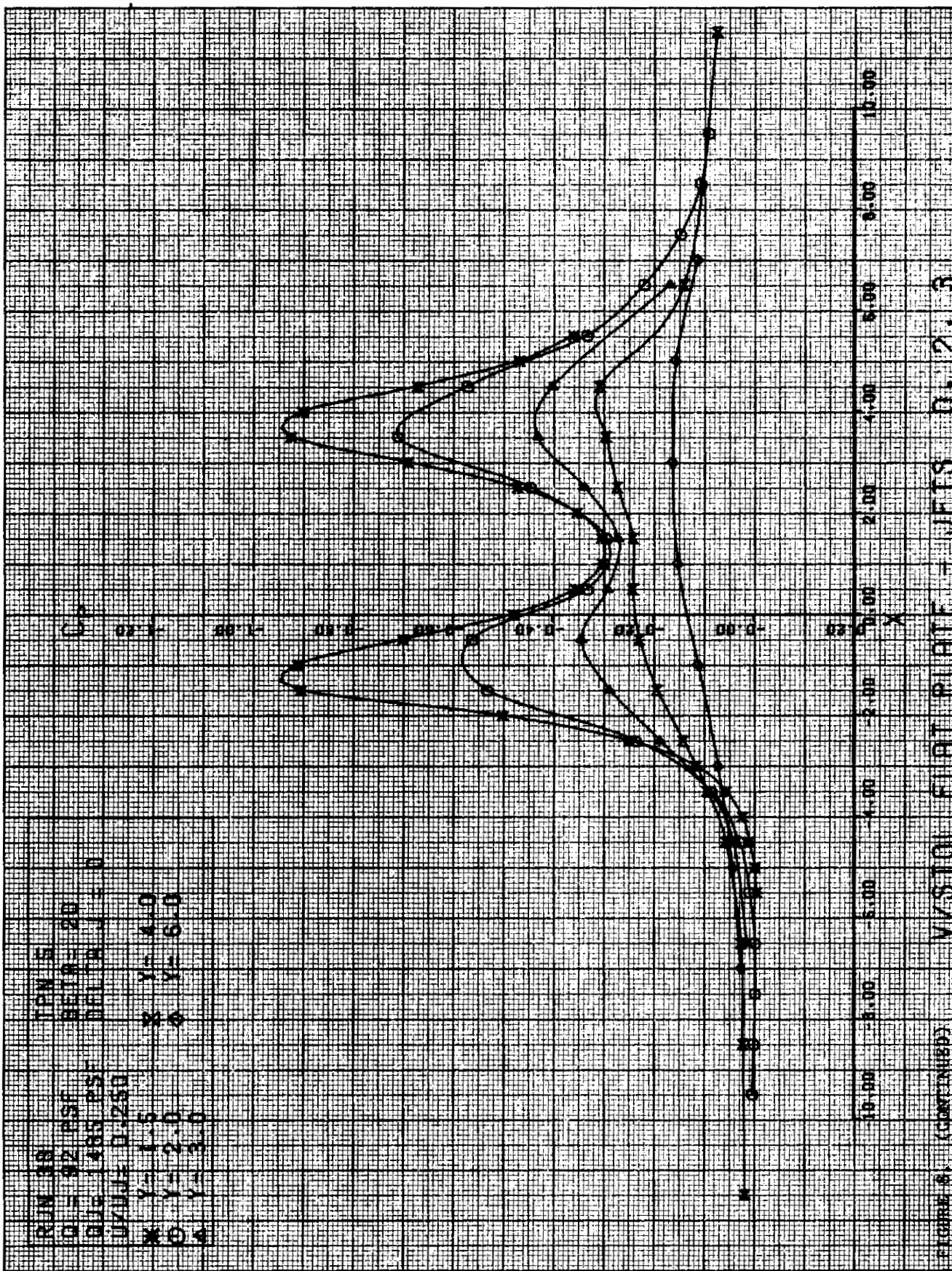
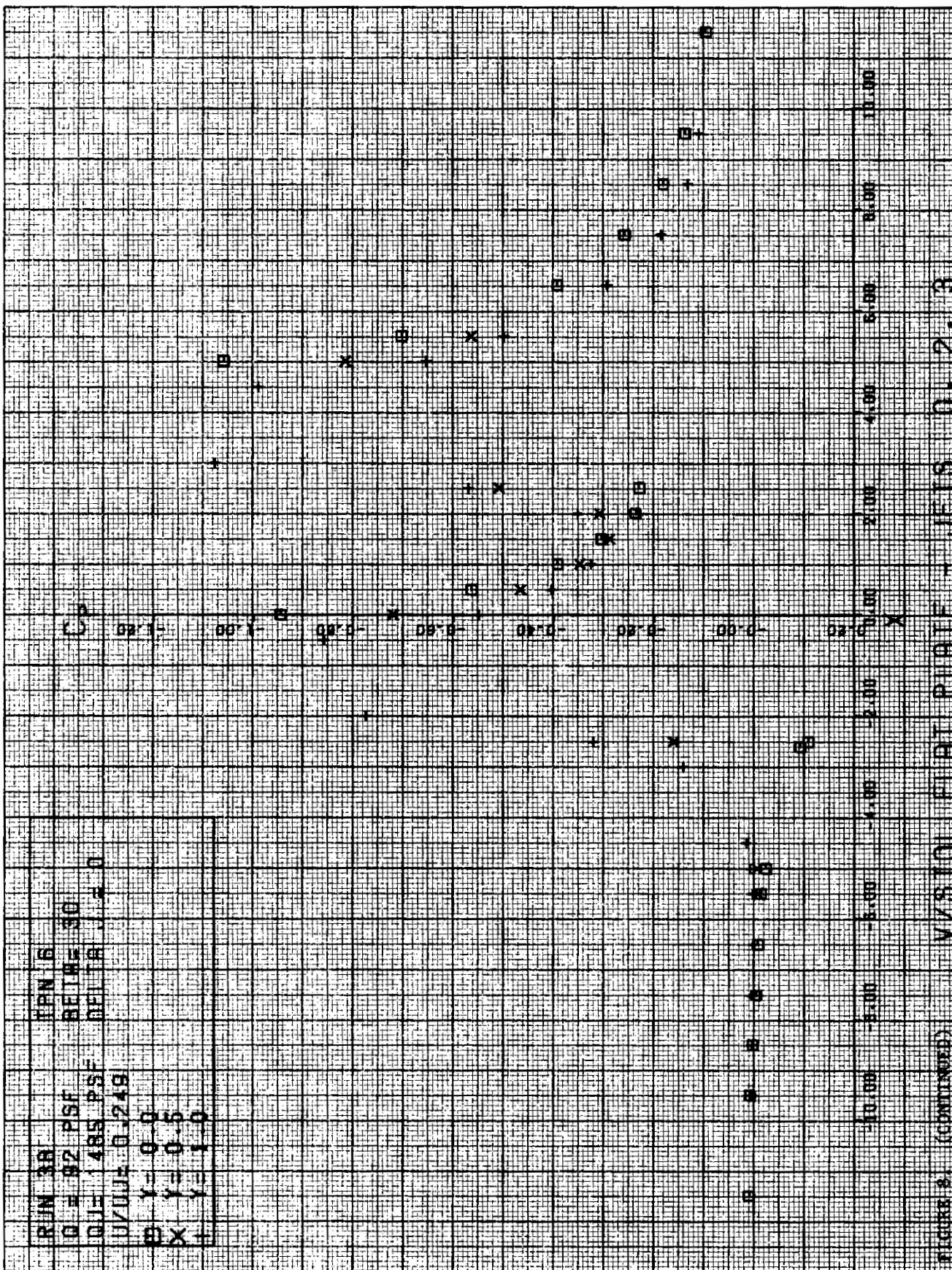
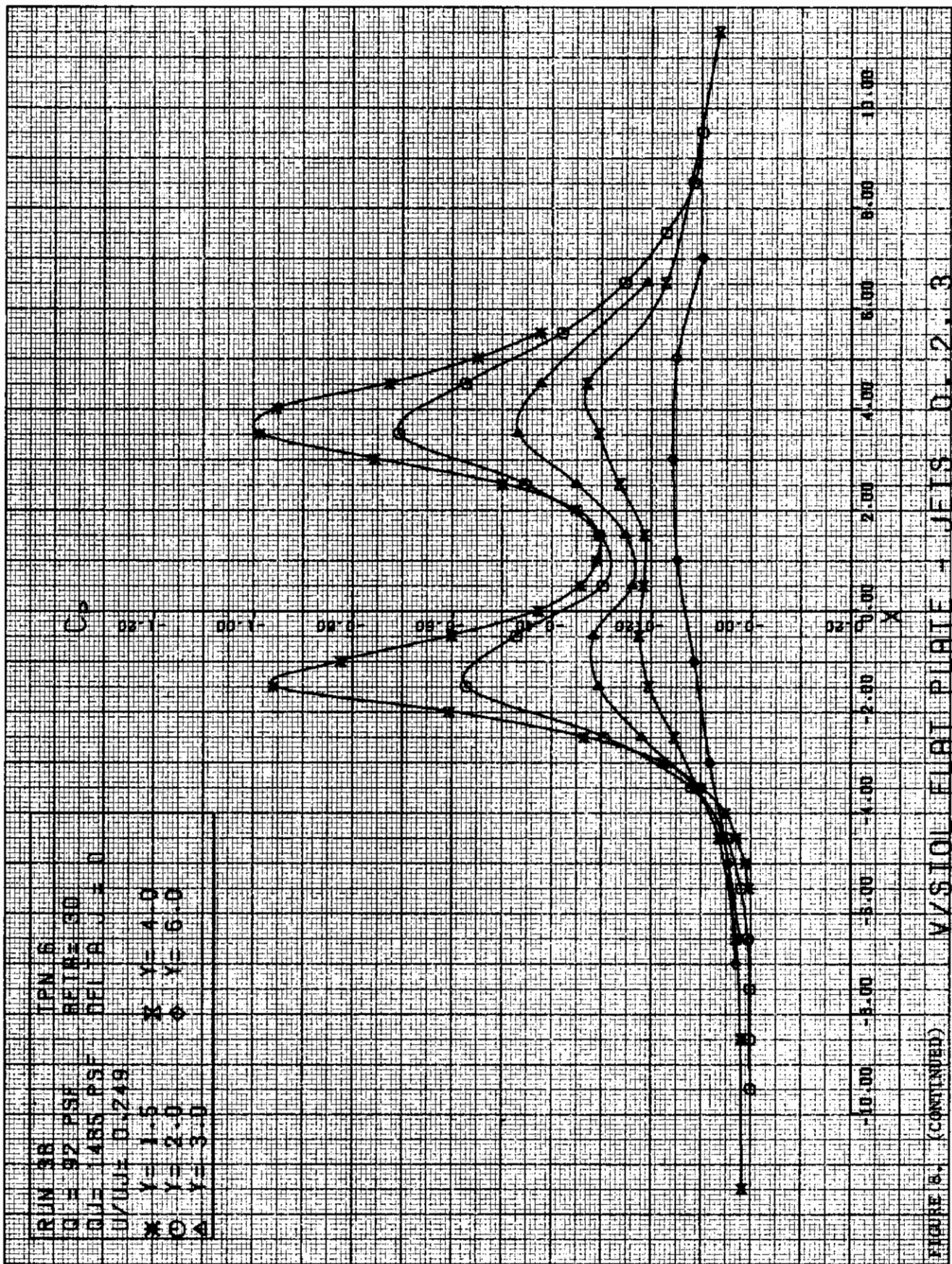


FIGURE 8. (CONTINUED) V/S 101 FLAT PLATE - JETS D. 2.3







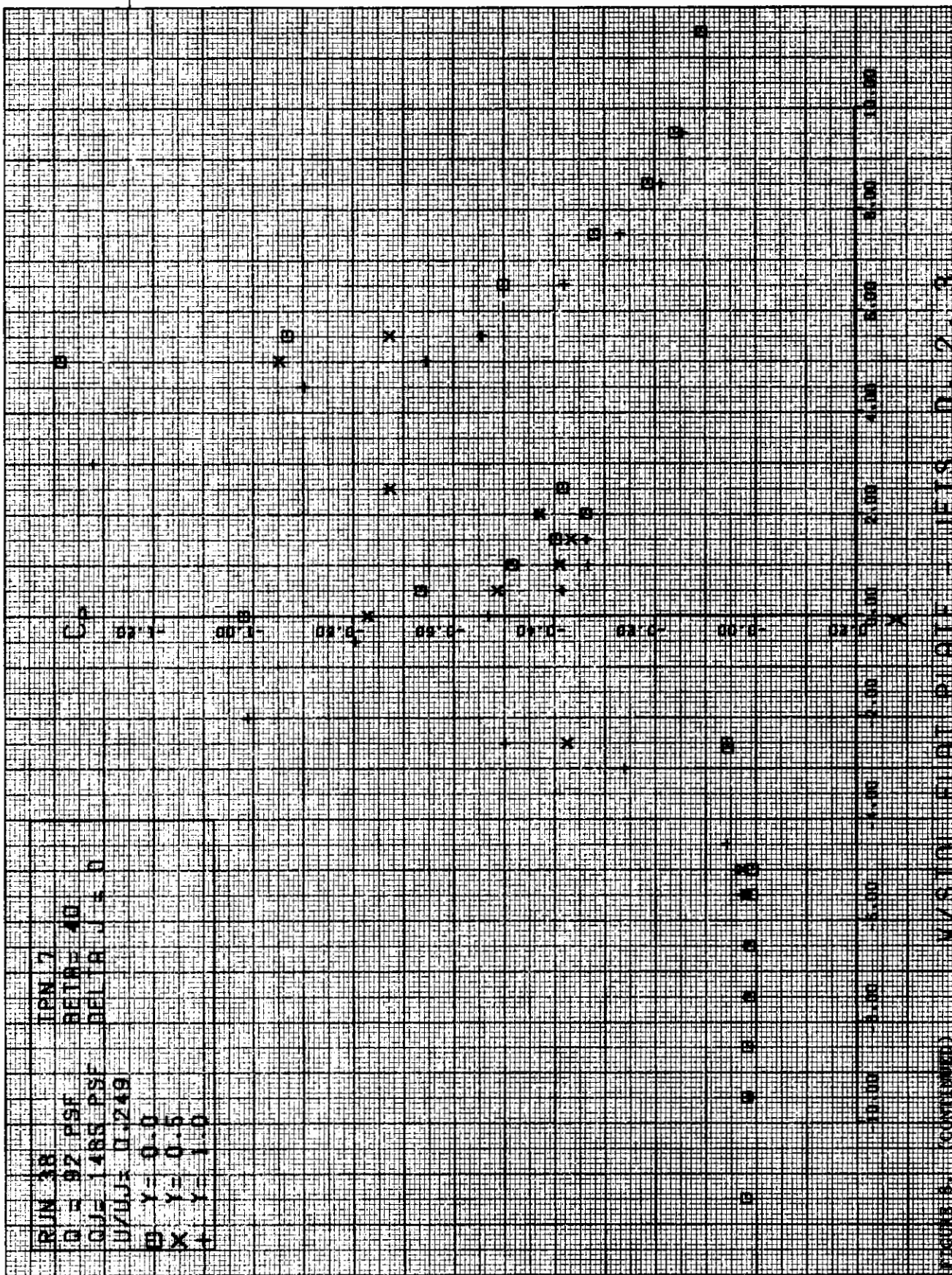
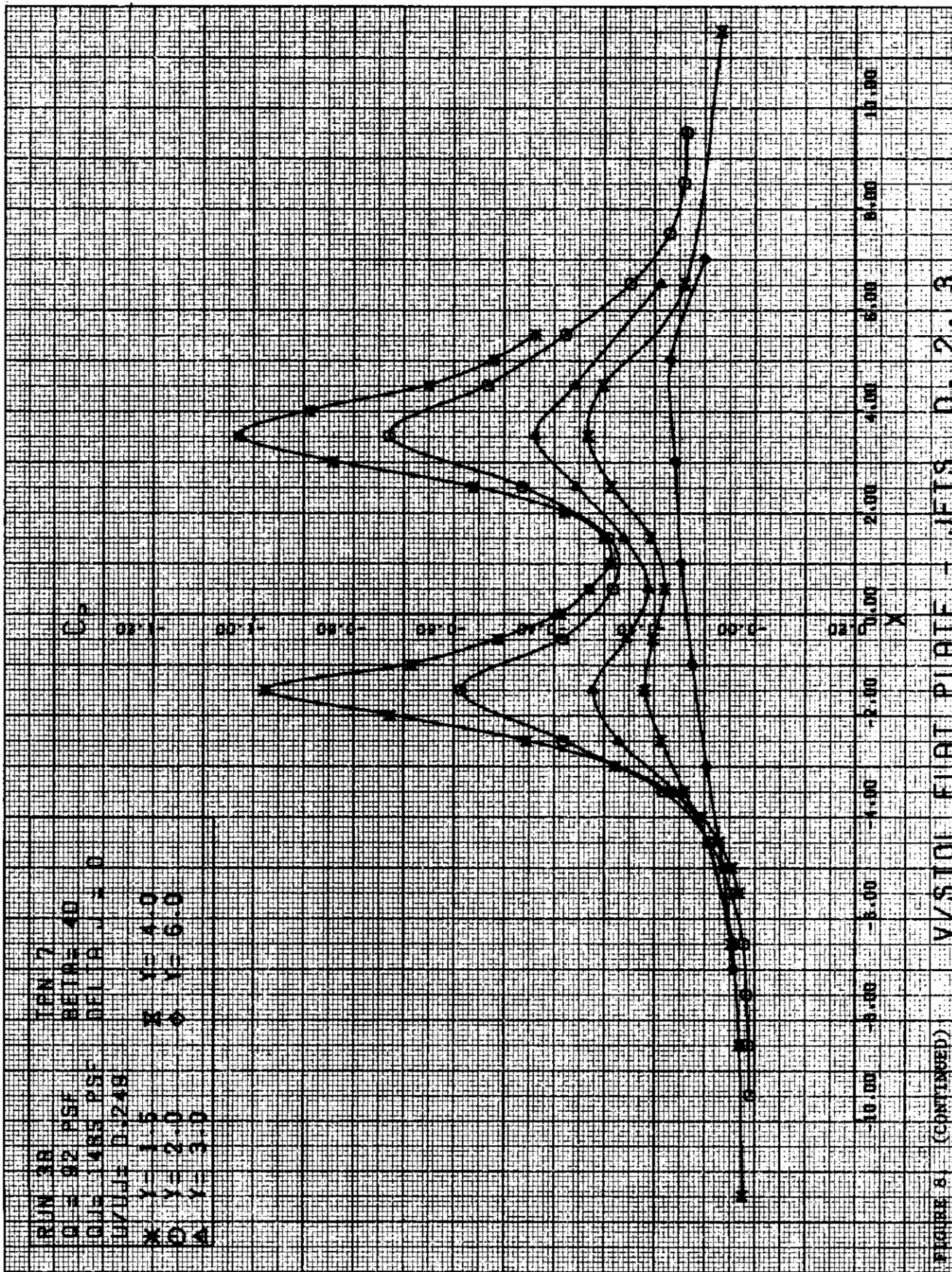
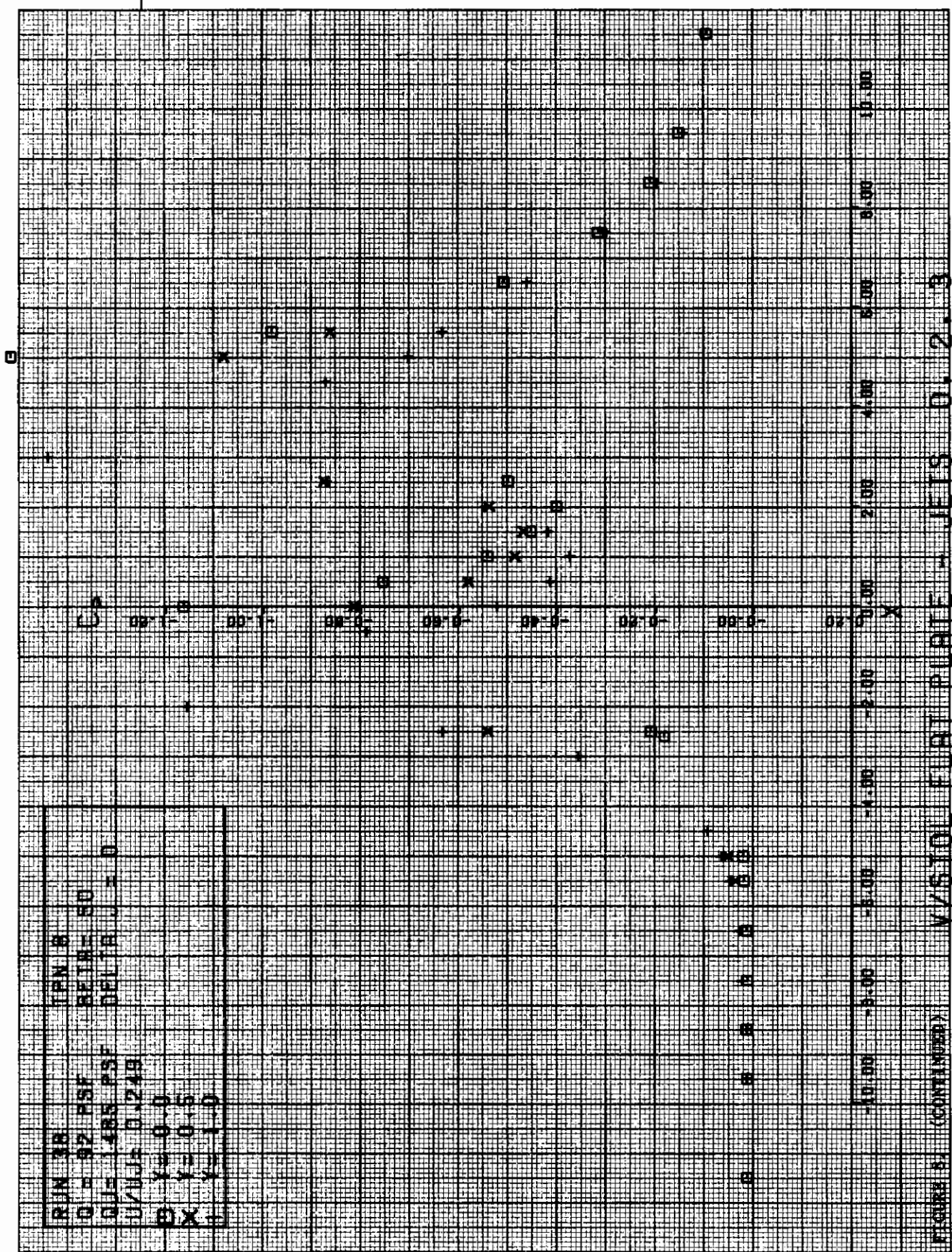


FIGURE 5. (CONTINUED) V/S TO FLIGHT PROFILE - JETS D. 2. 3





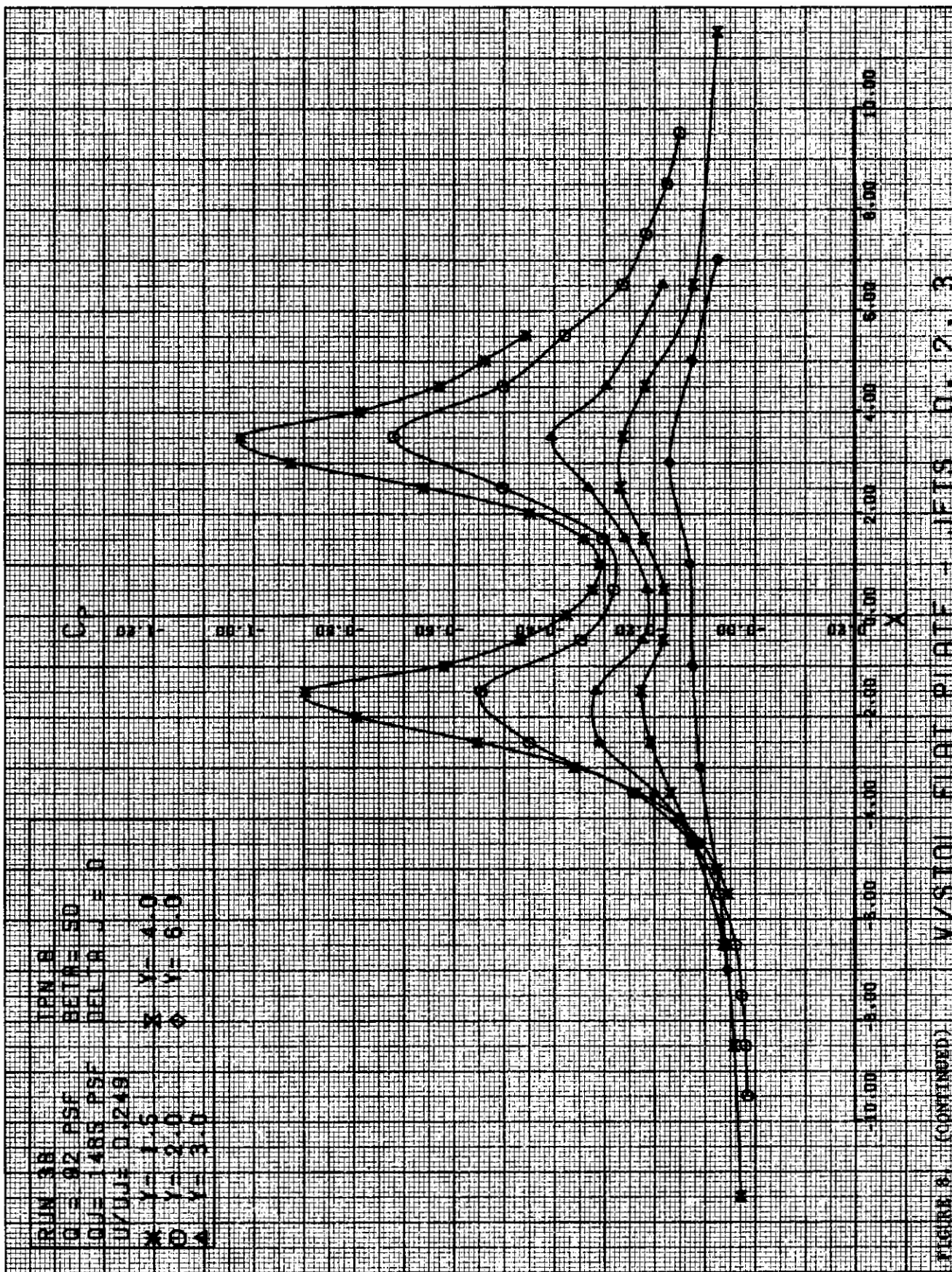
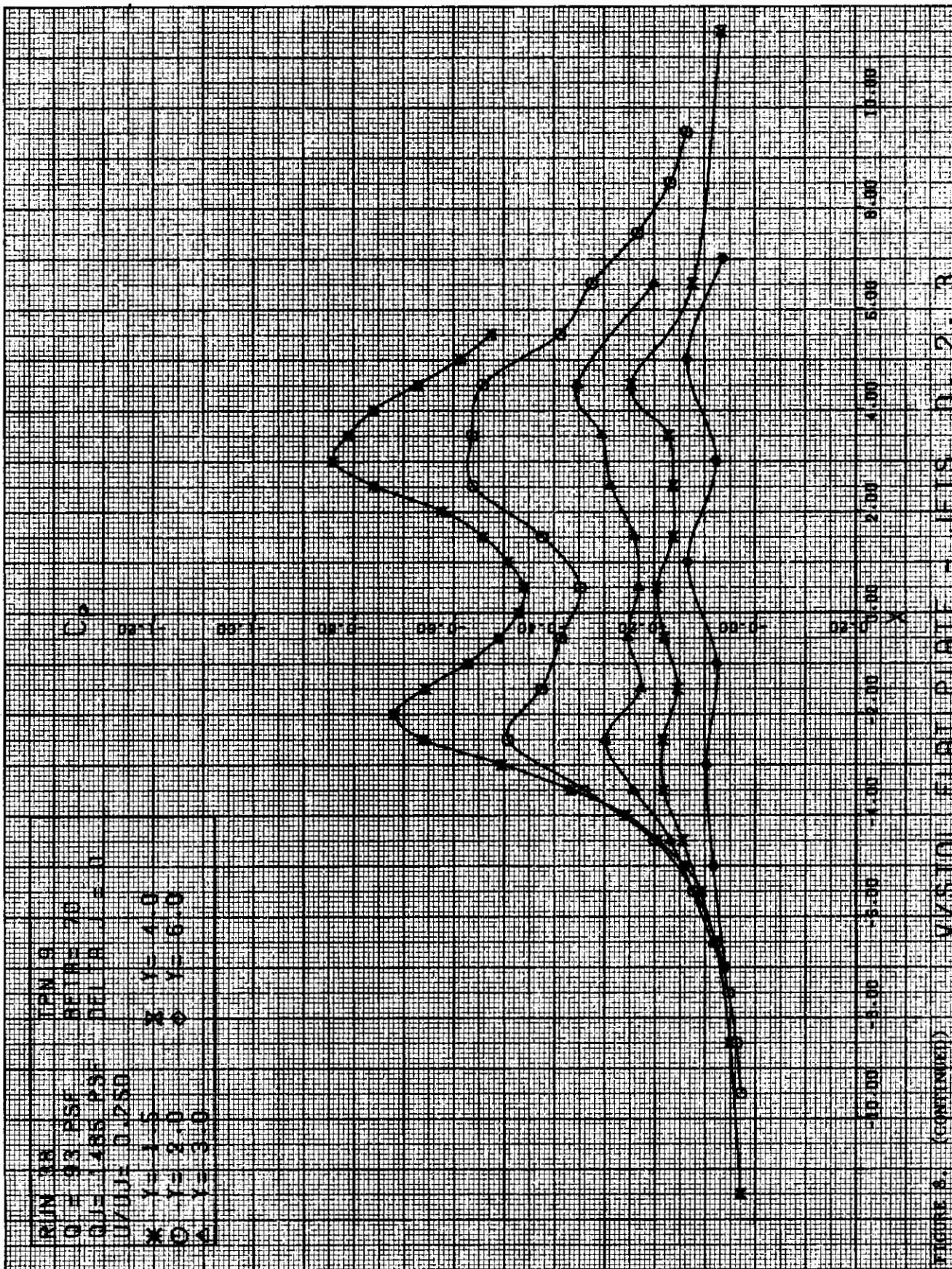
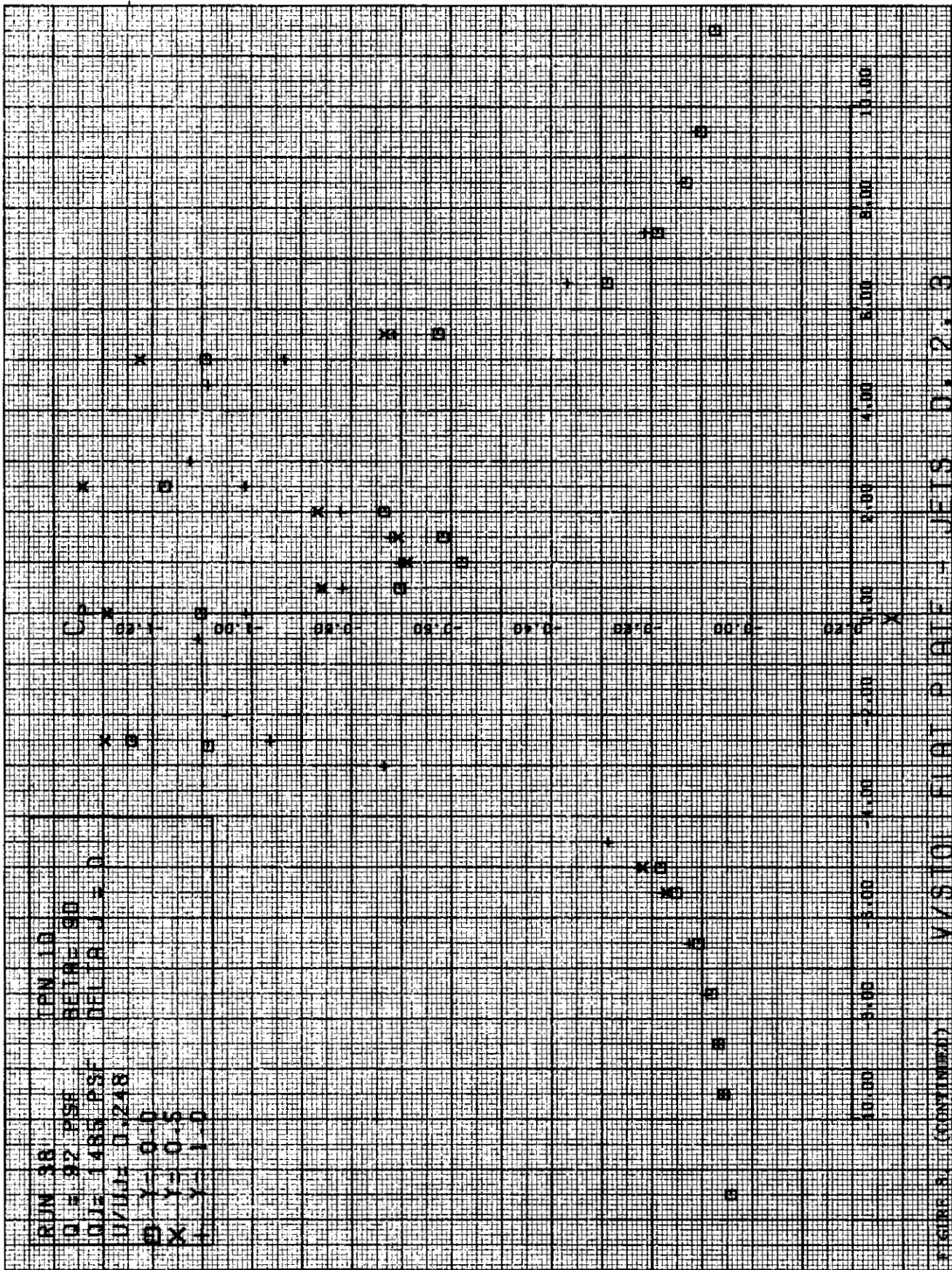
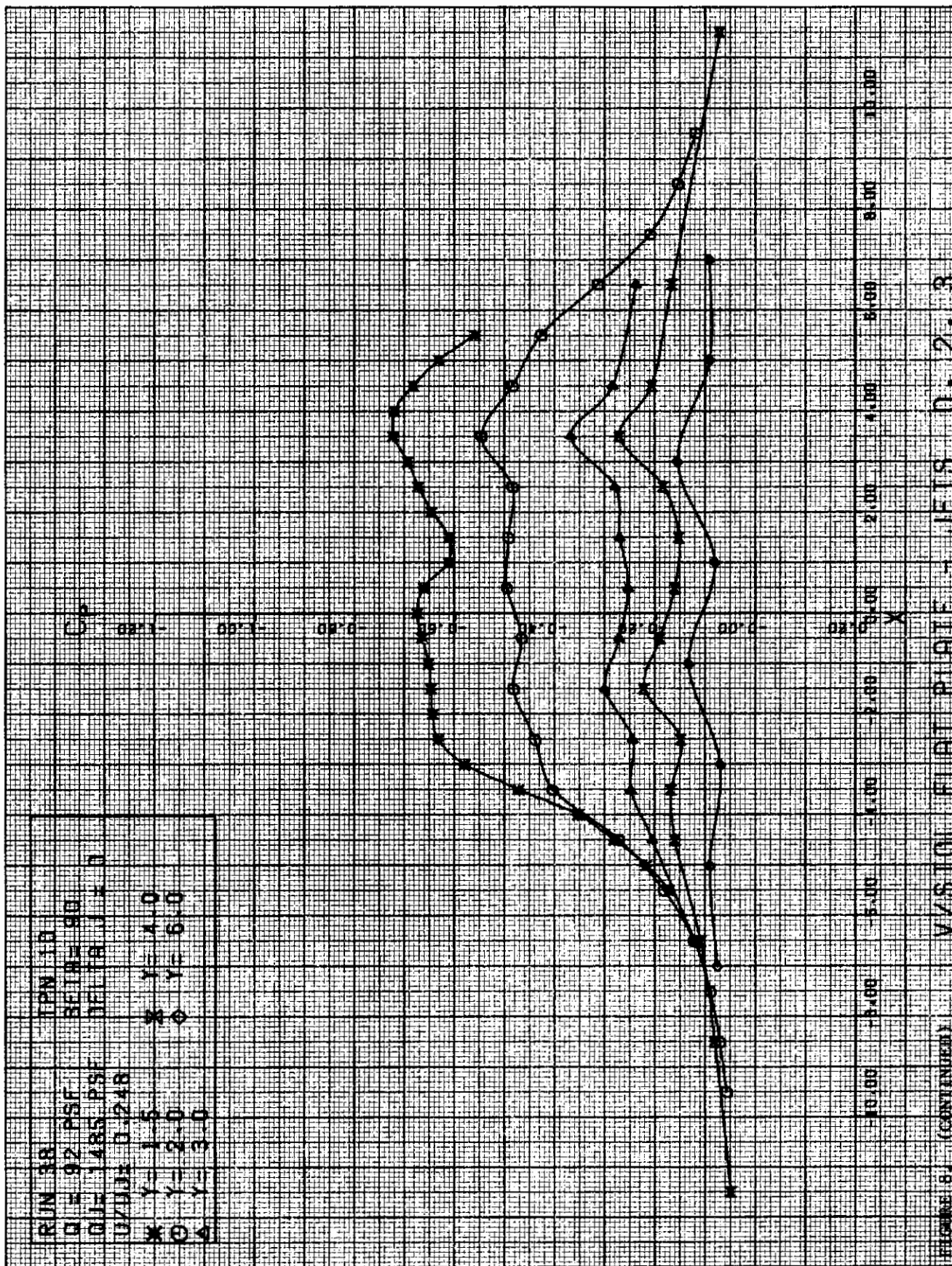
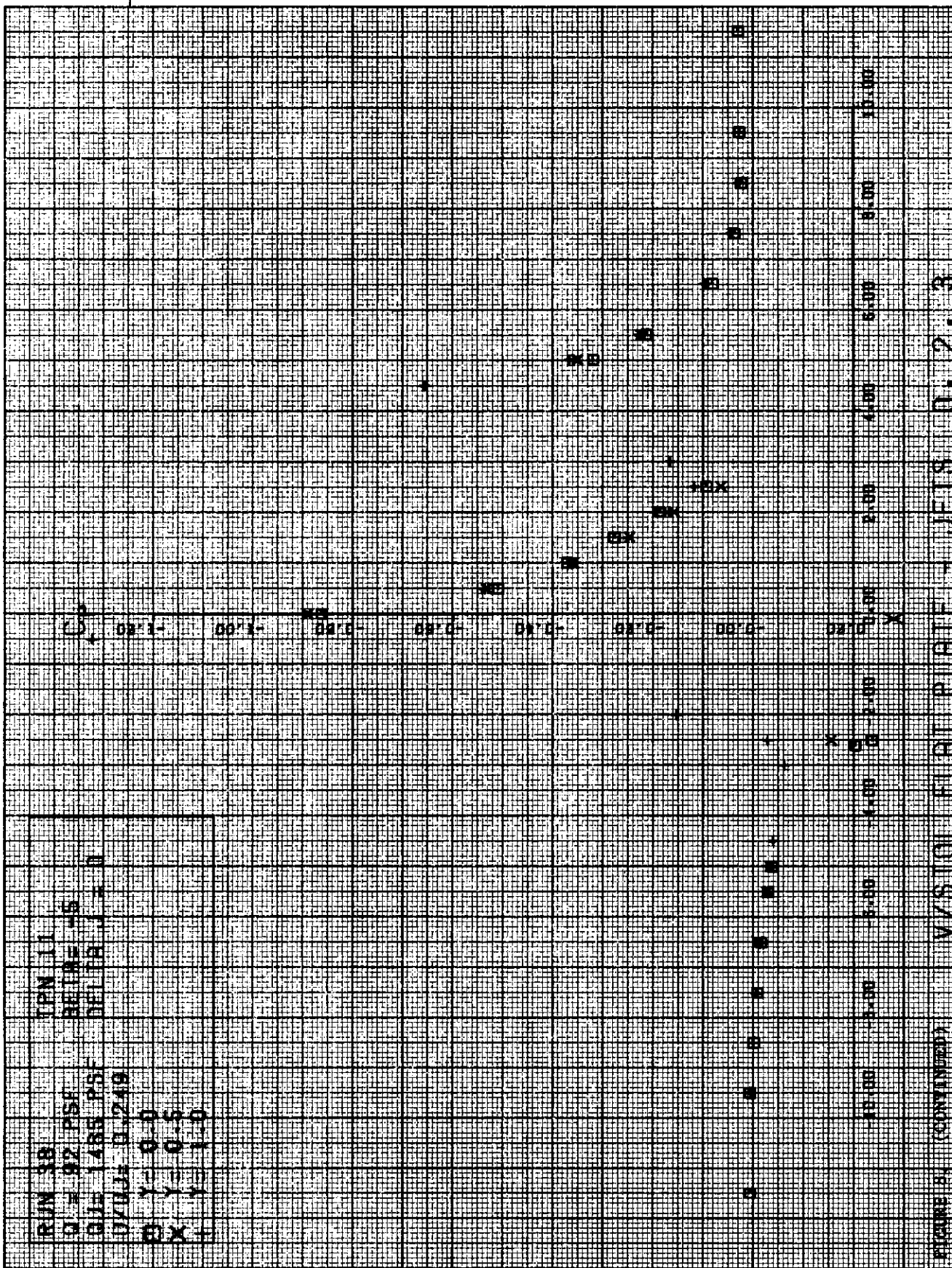


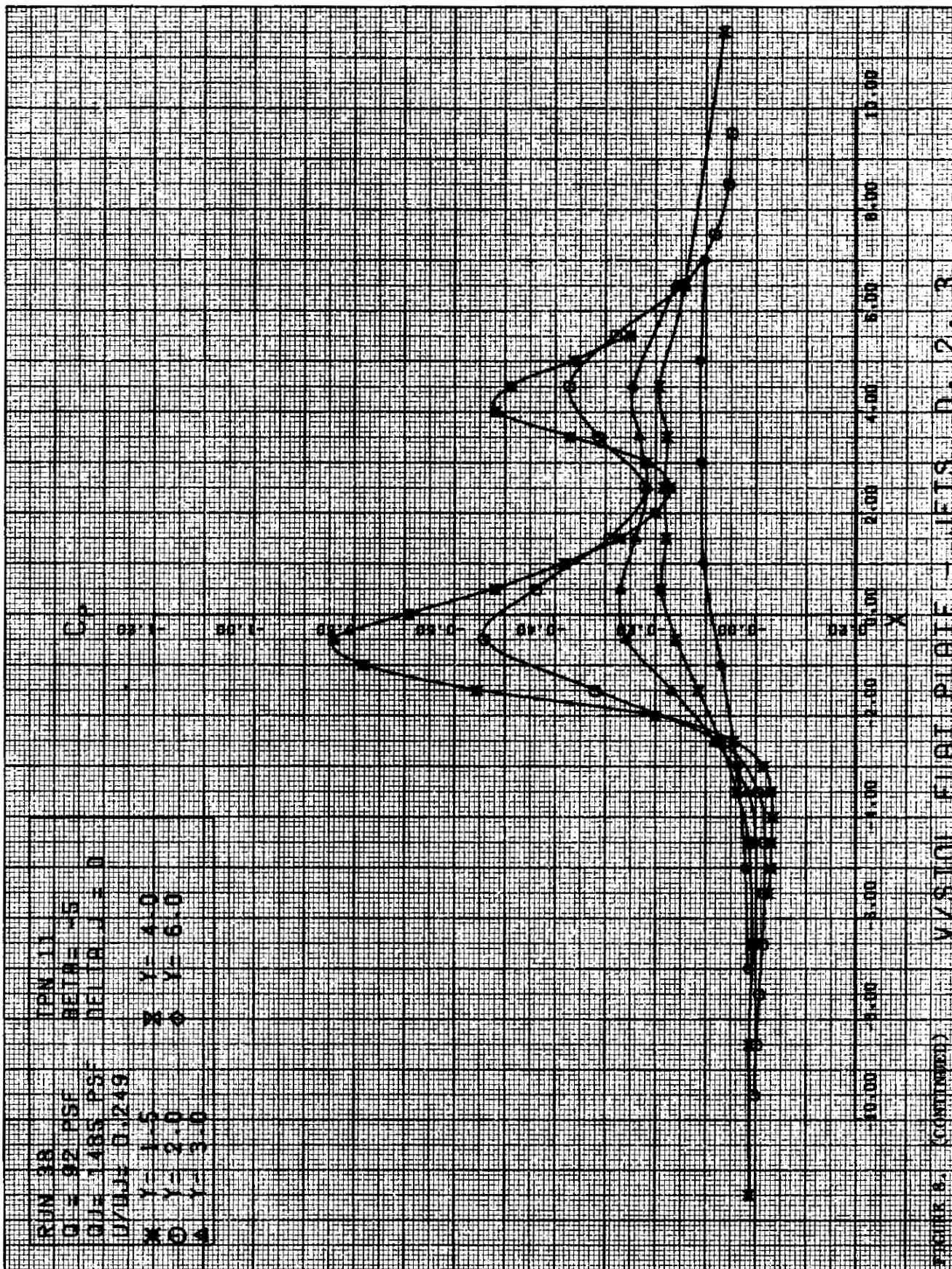
FIGURE 8 (CONTINUED) W/STOL FLAT PLATE - JETS 0.2, 3











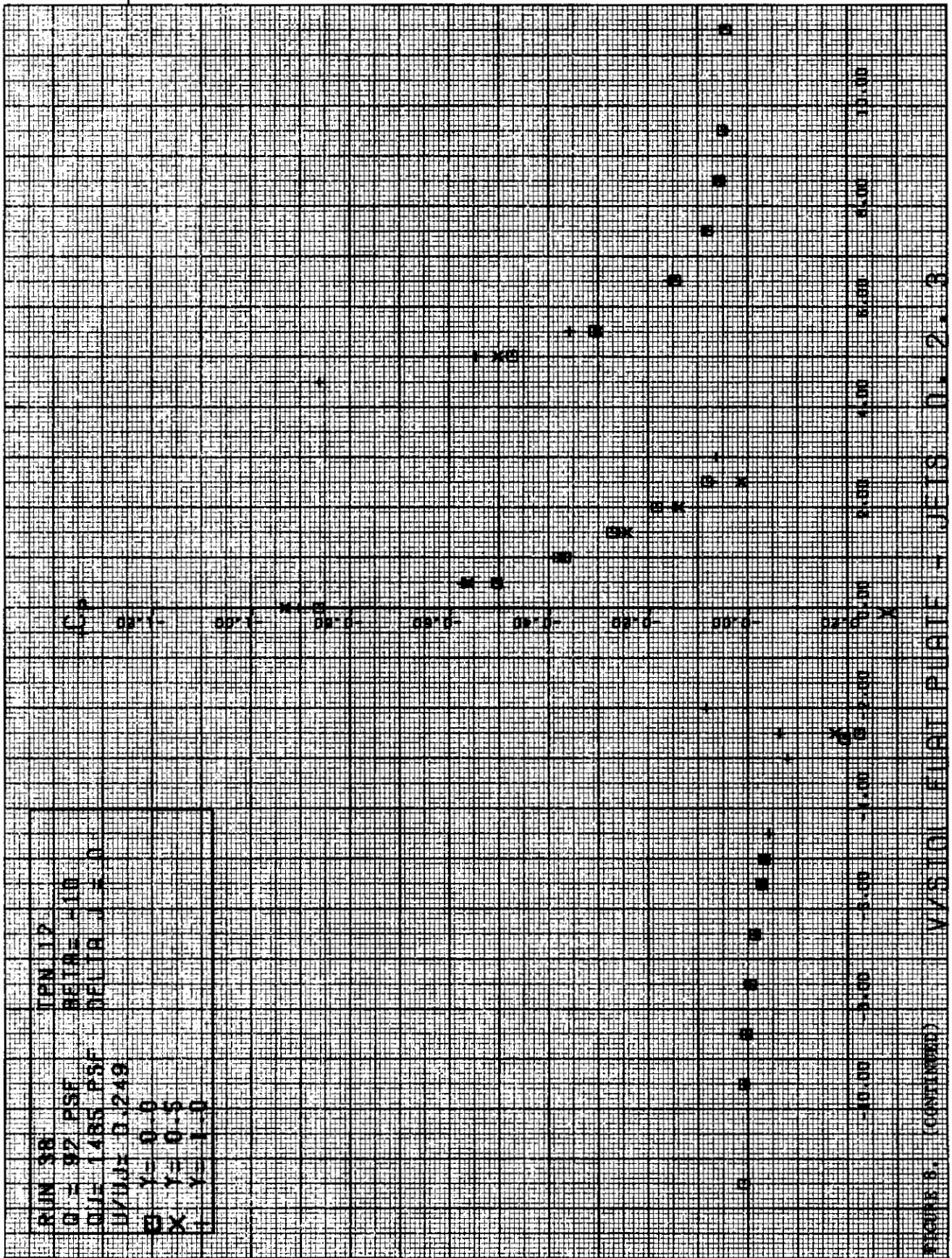
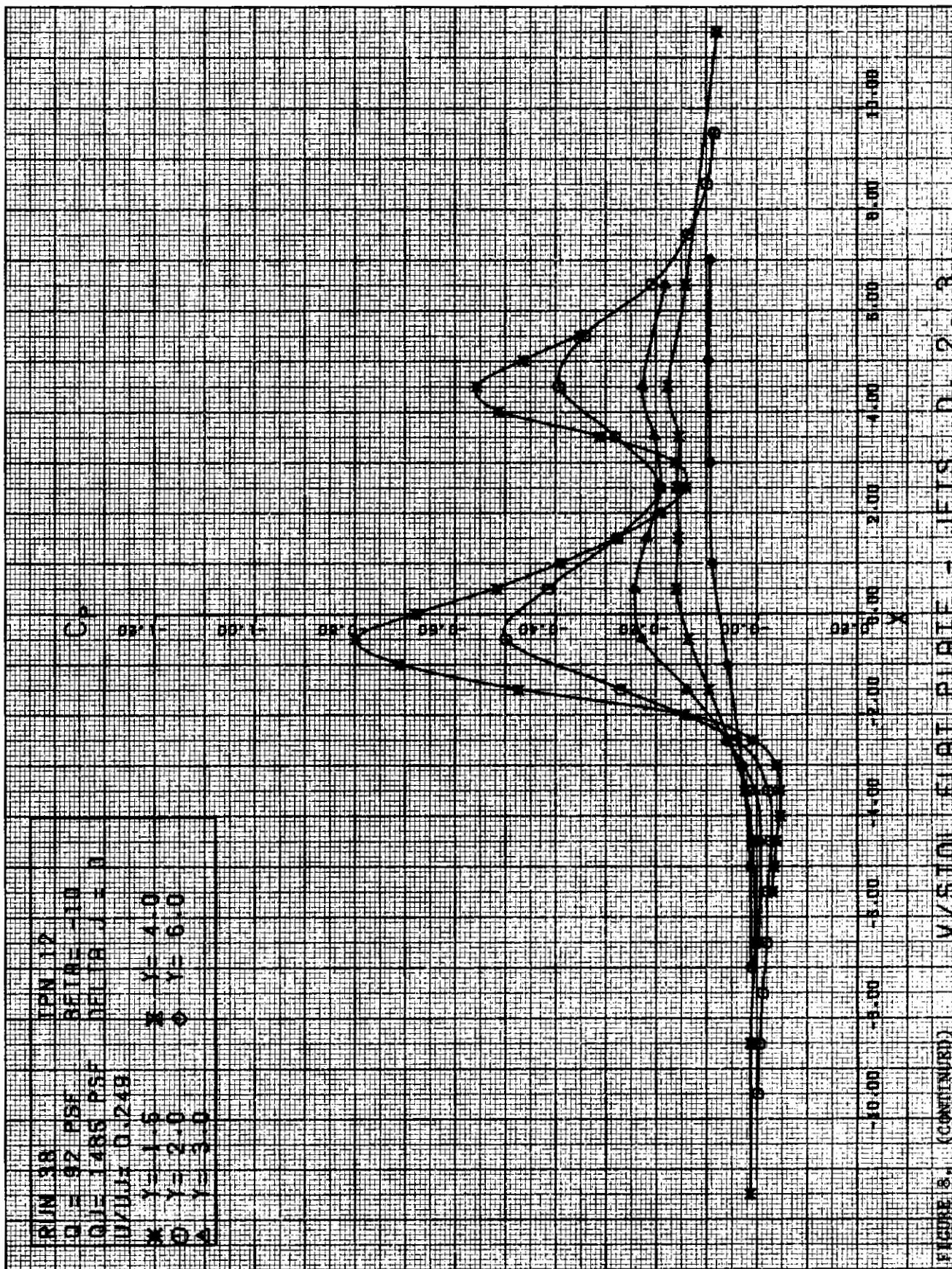
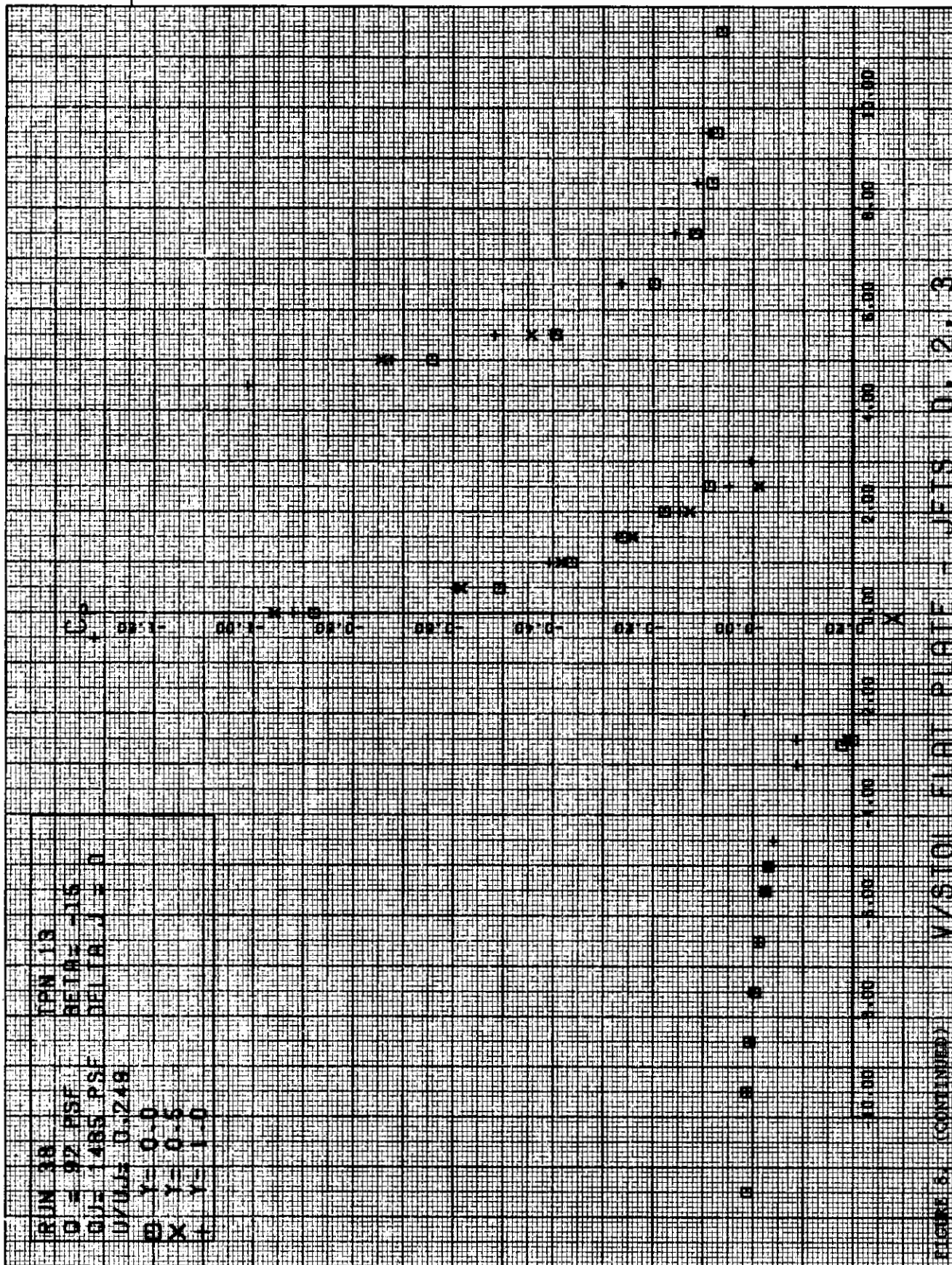
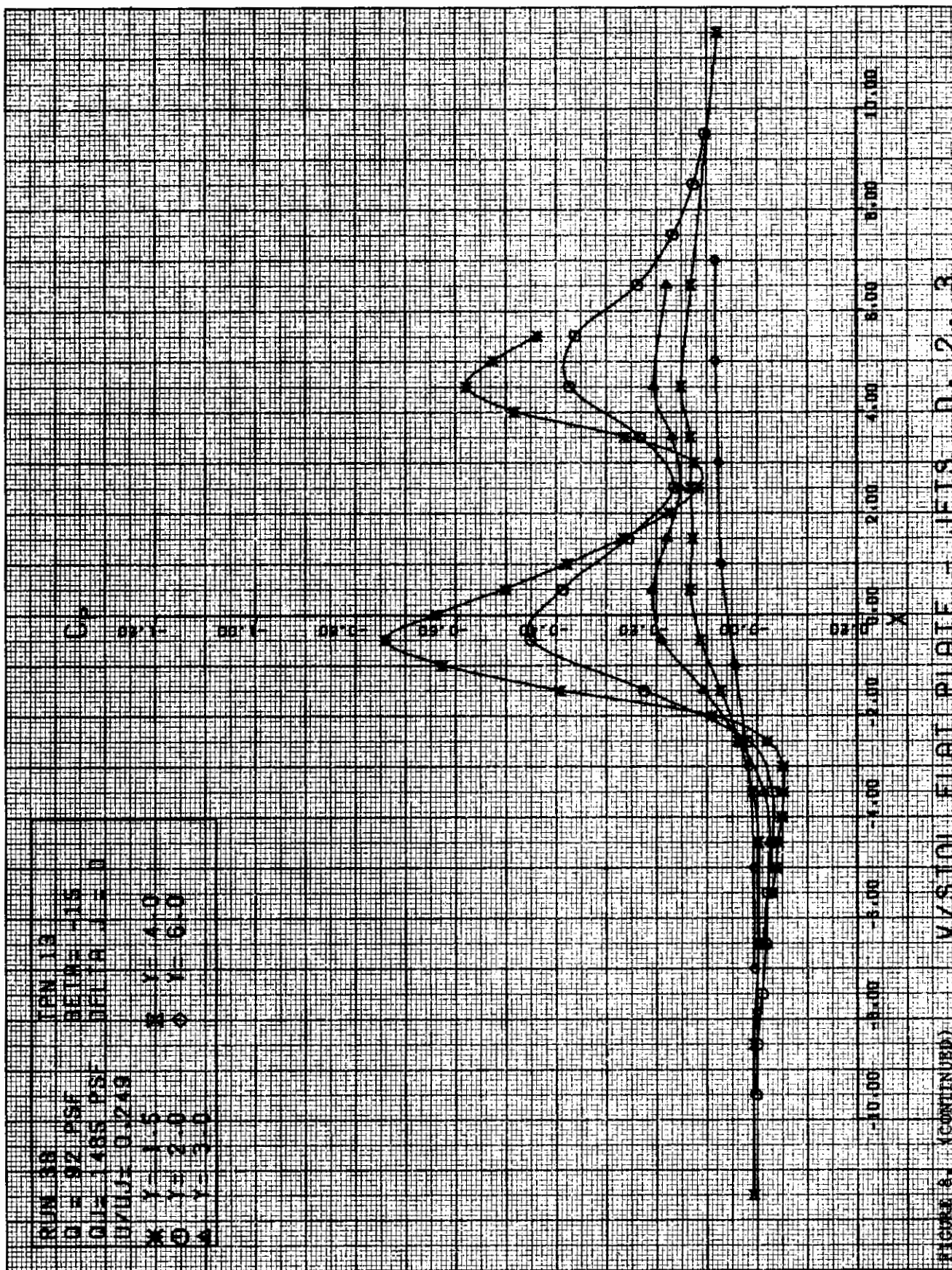
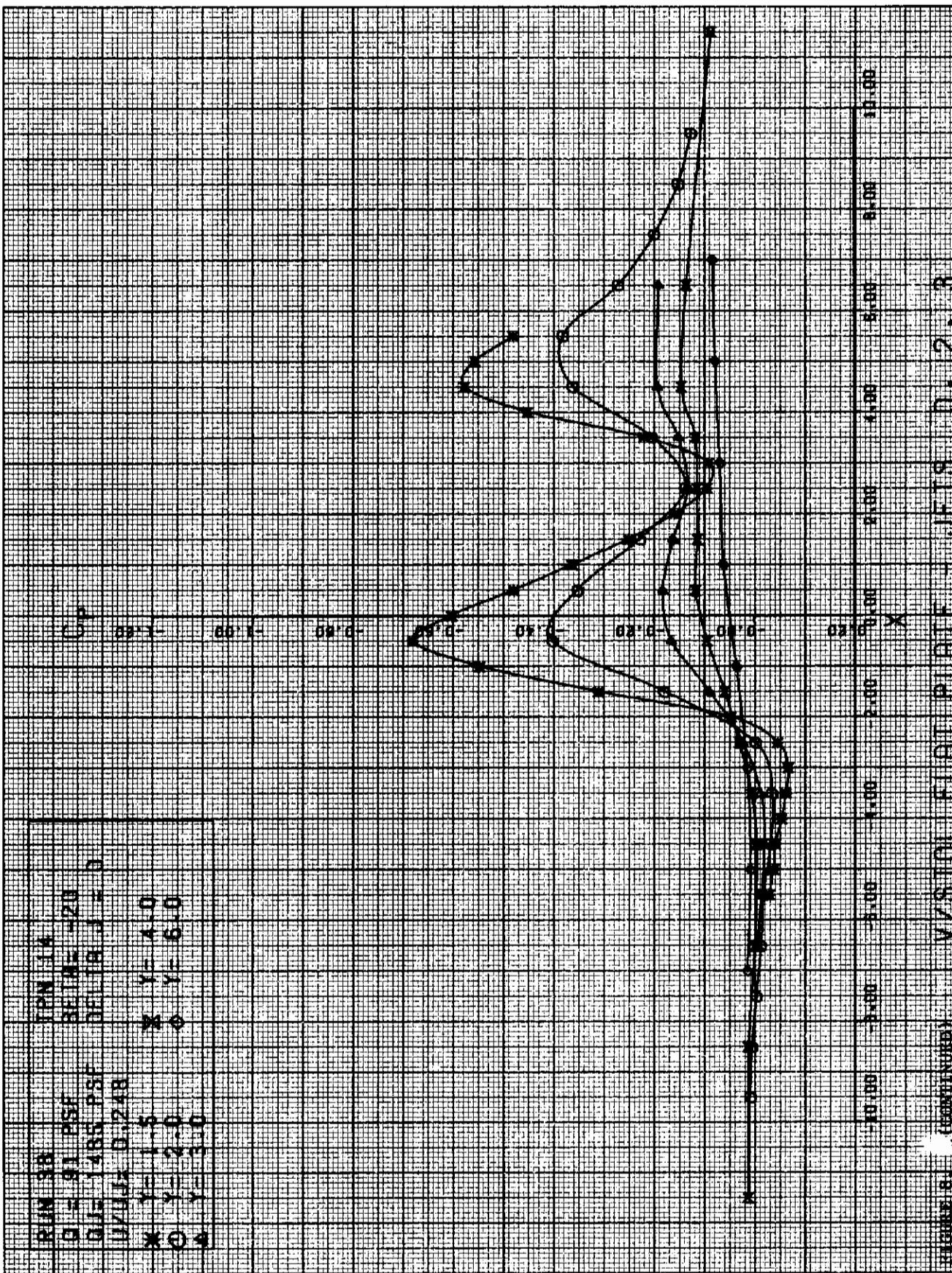


FIGURE 6. (CONTINUED) VISION FLIGHT PLATE - JETIS D. 2. 3









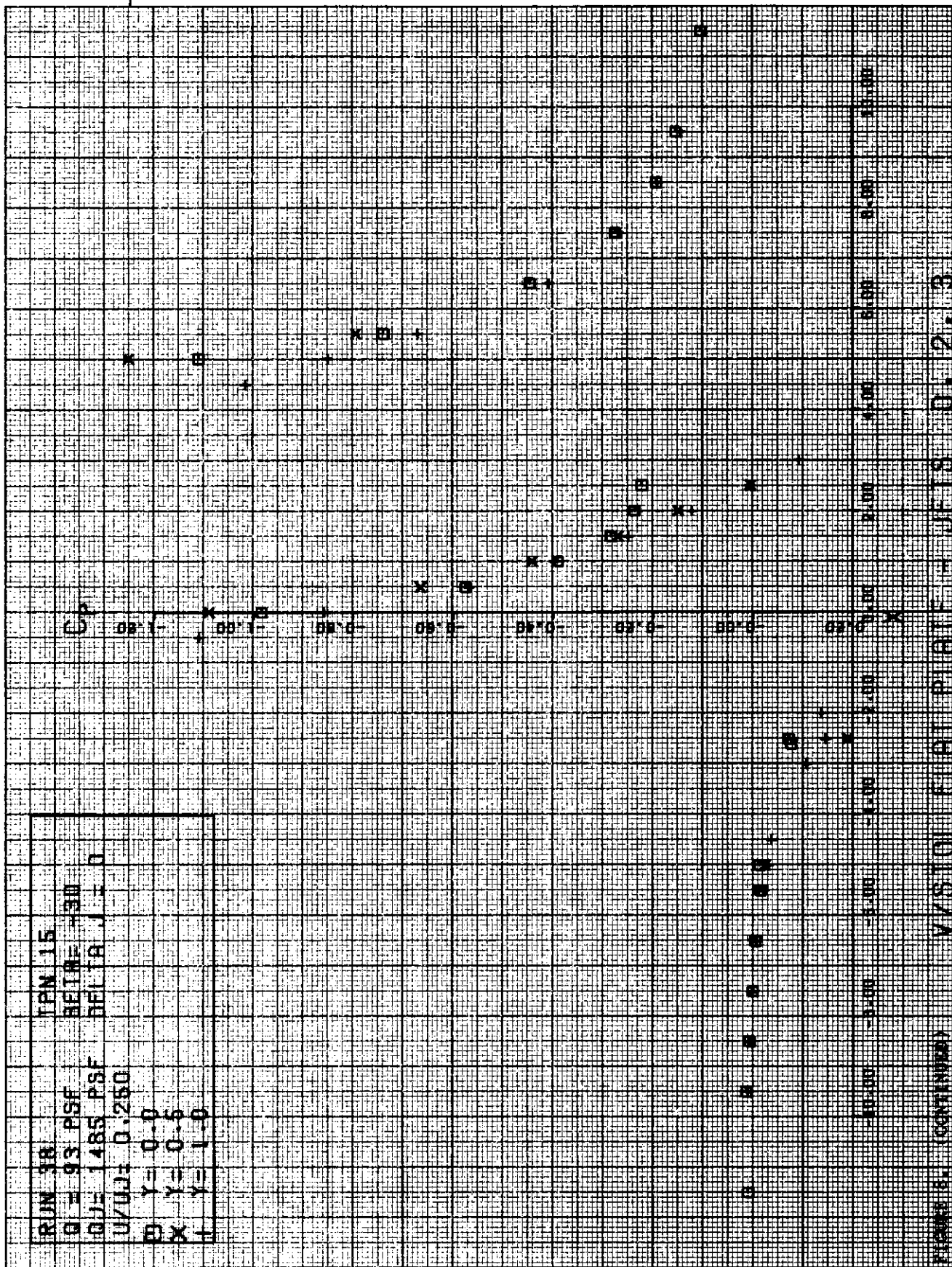
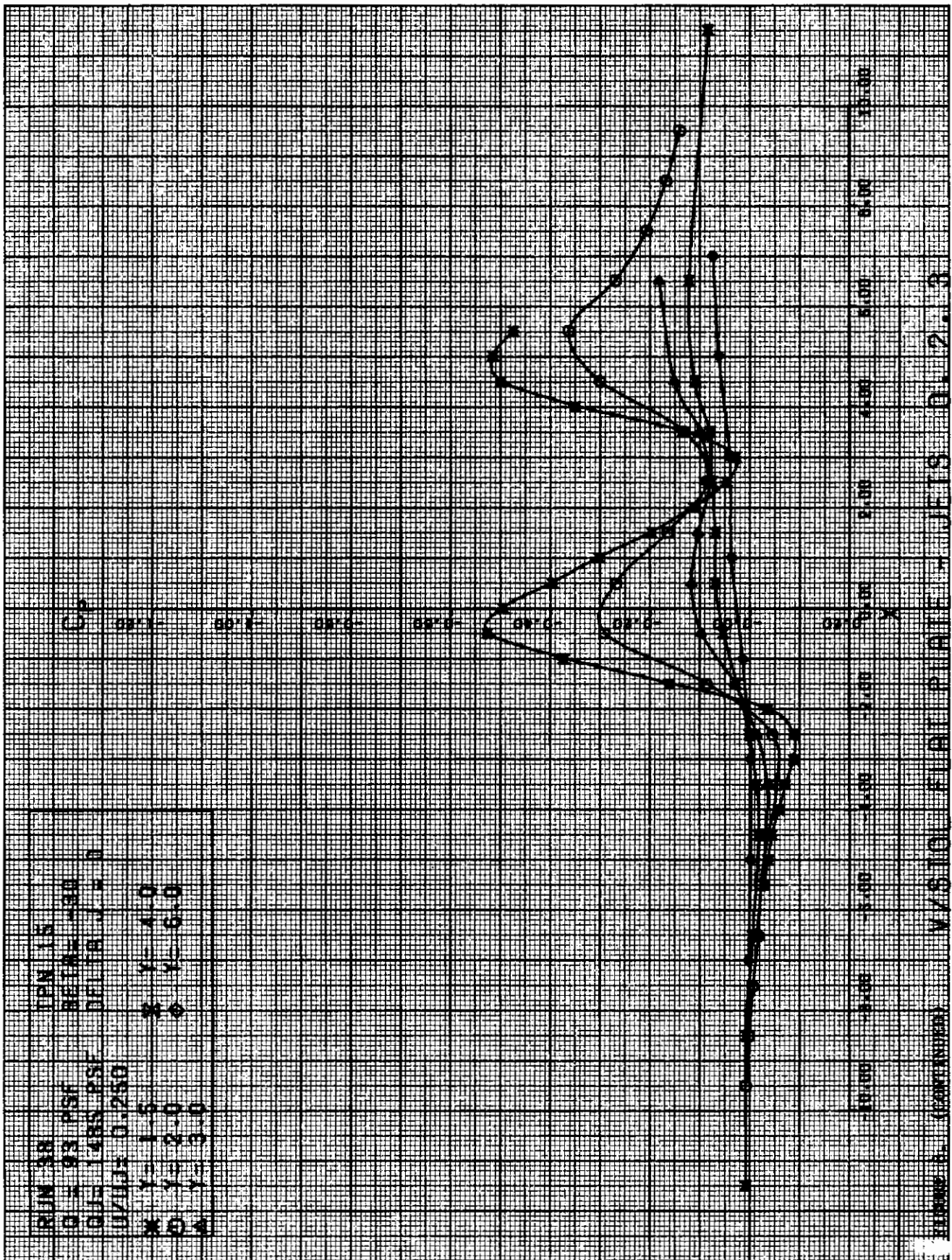


FIGURE 5. (CONTINUED) VISION FIRST PHASE - JETS 0.2.3



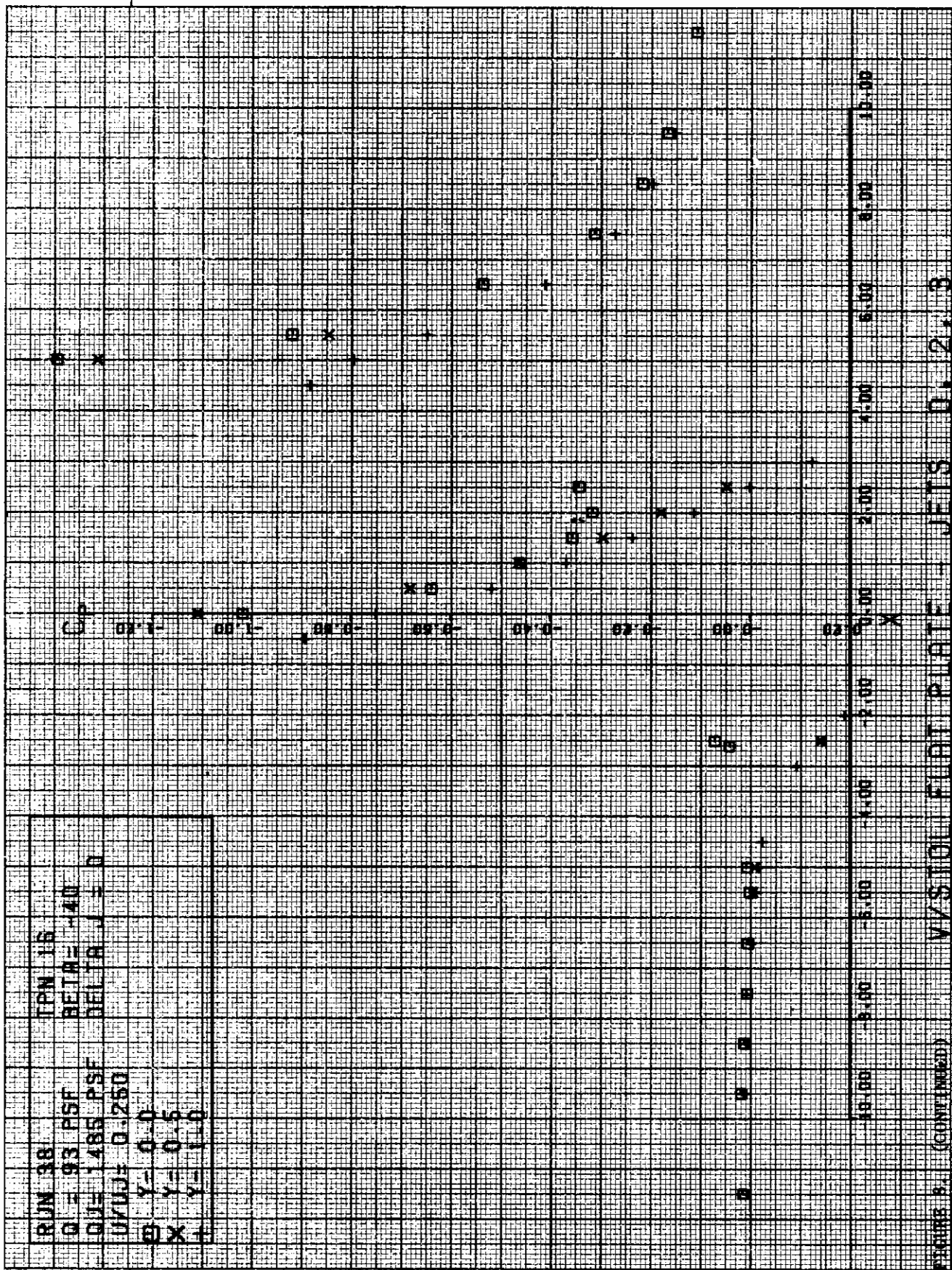


FIGURE 8. (CONTINUED) VYSTIOL FLAT PLATE - JETS 0. 2. 3

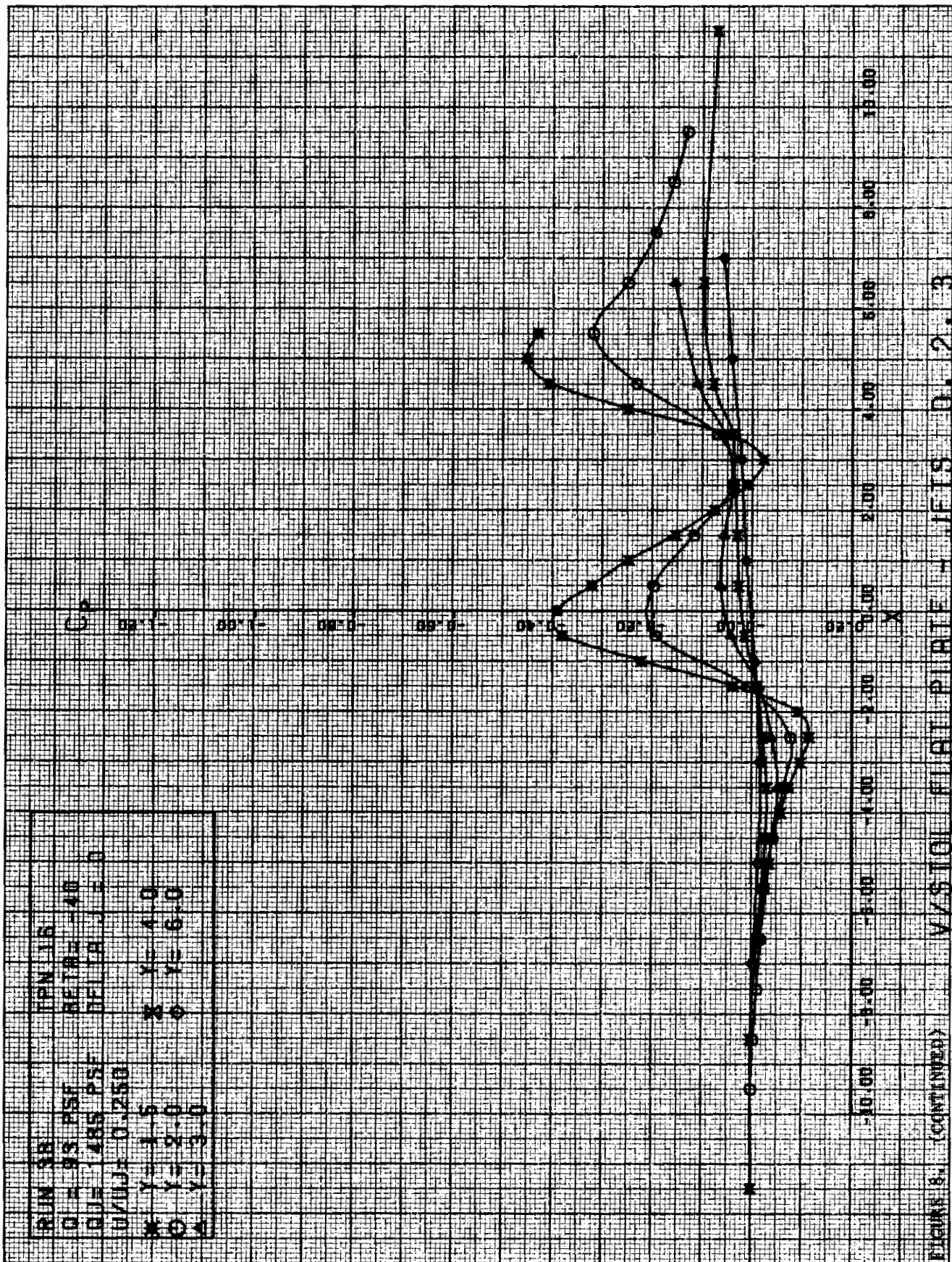
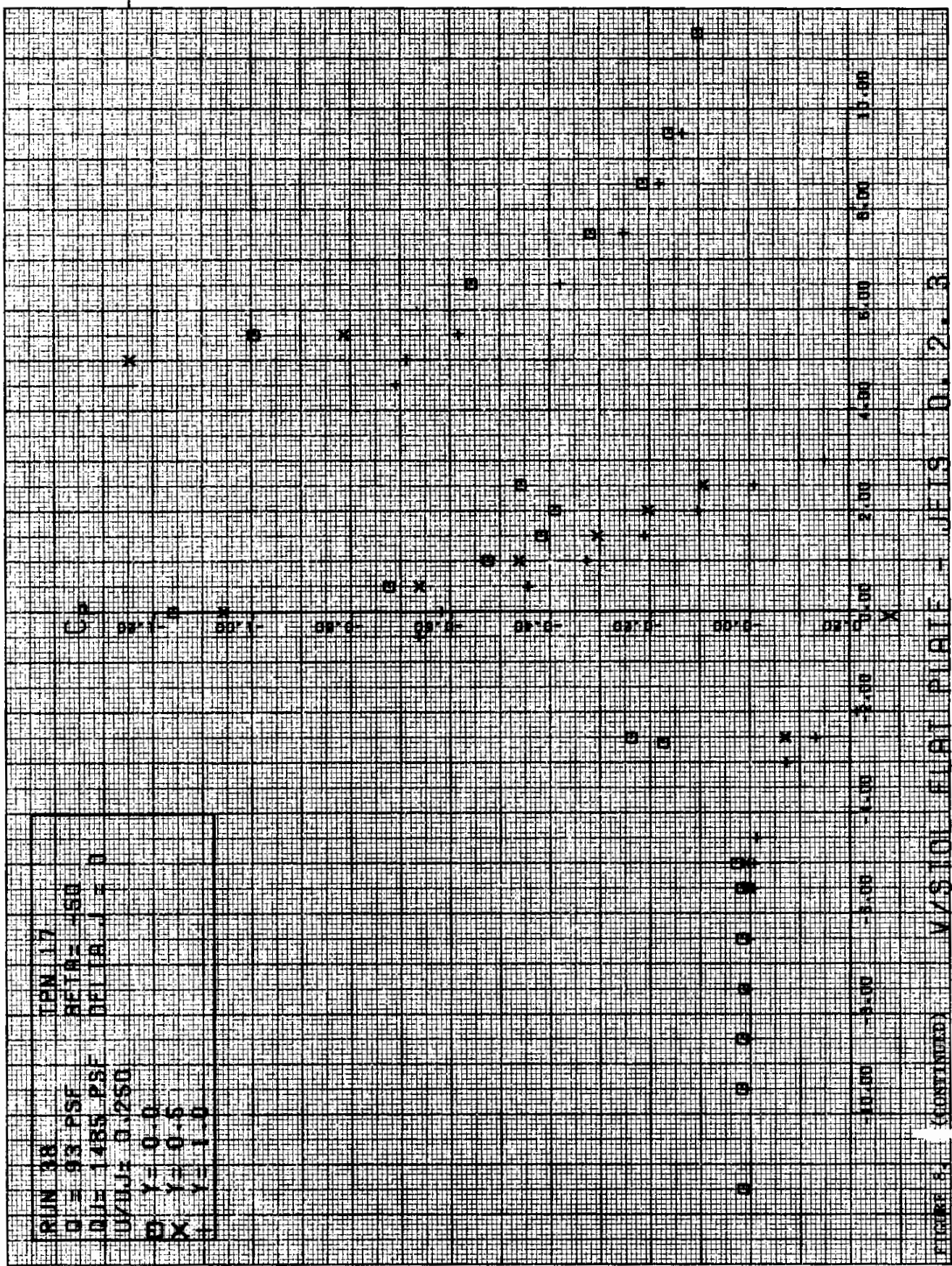
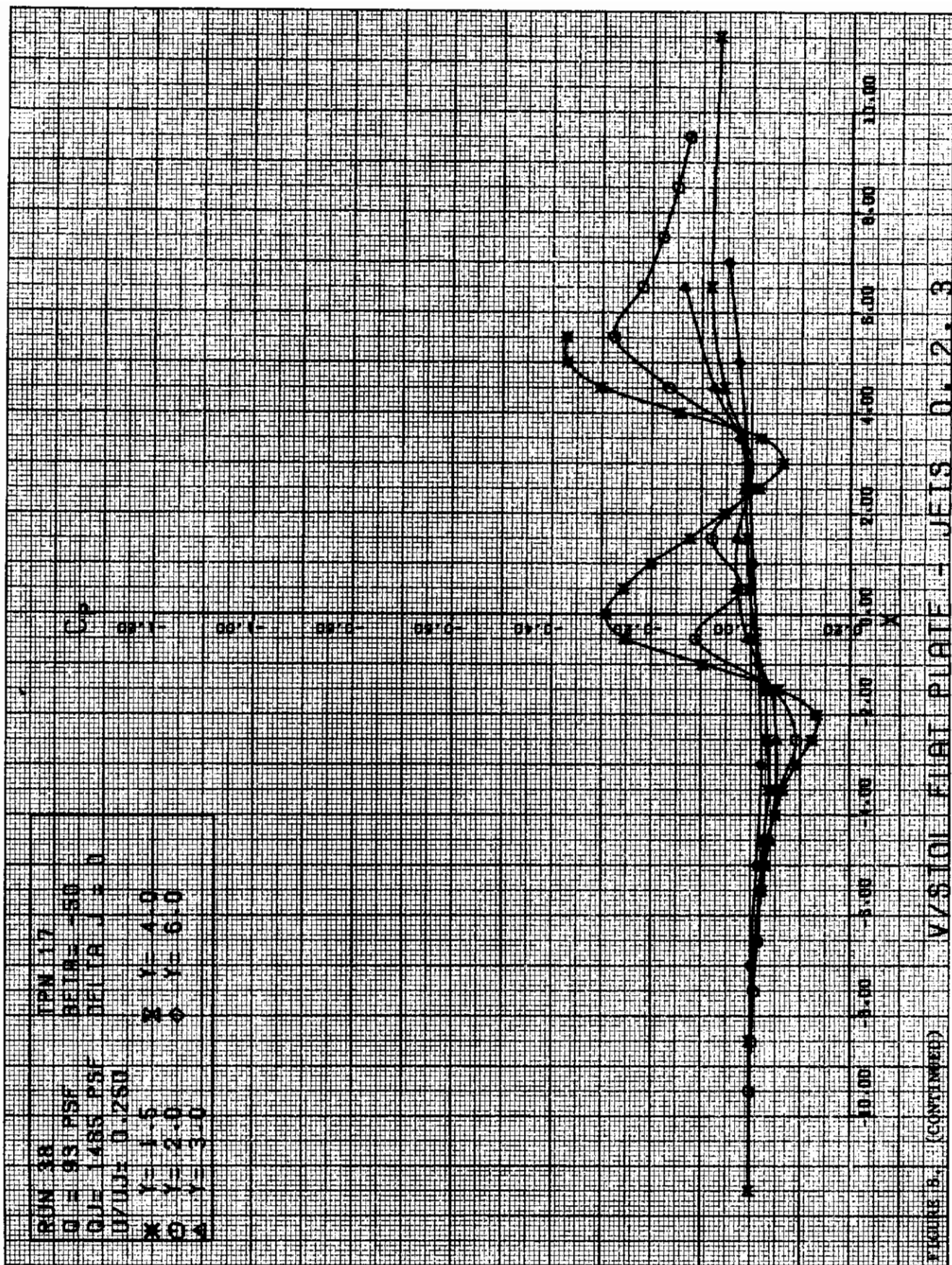
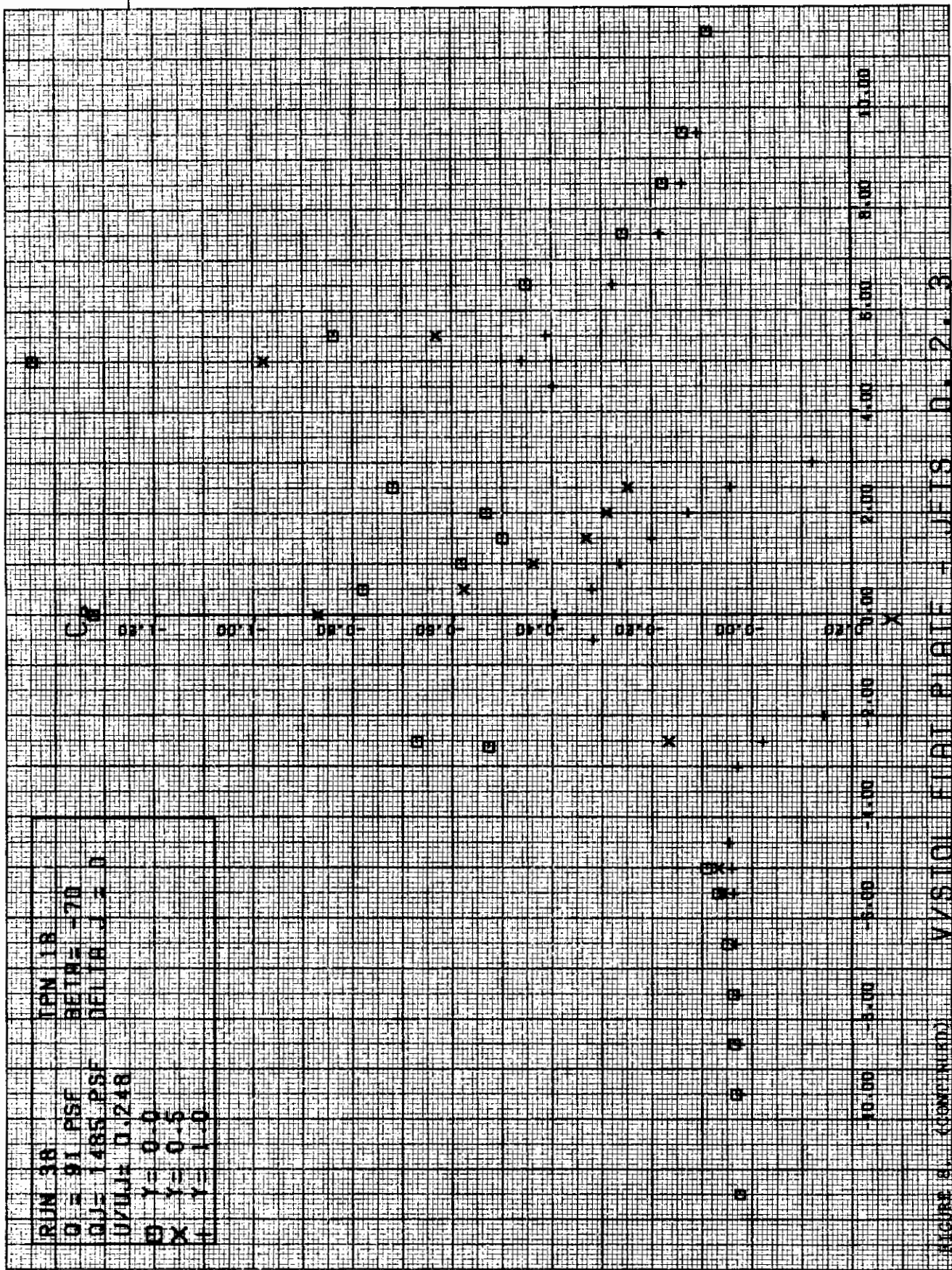


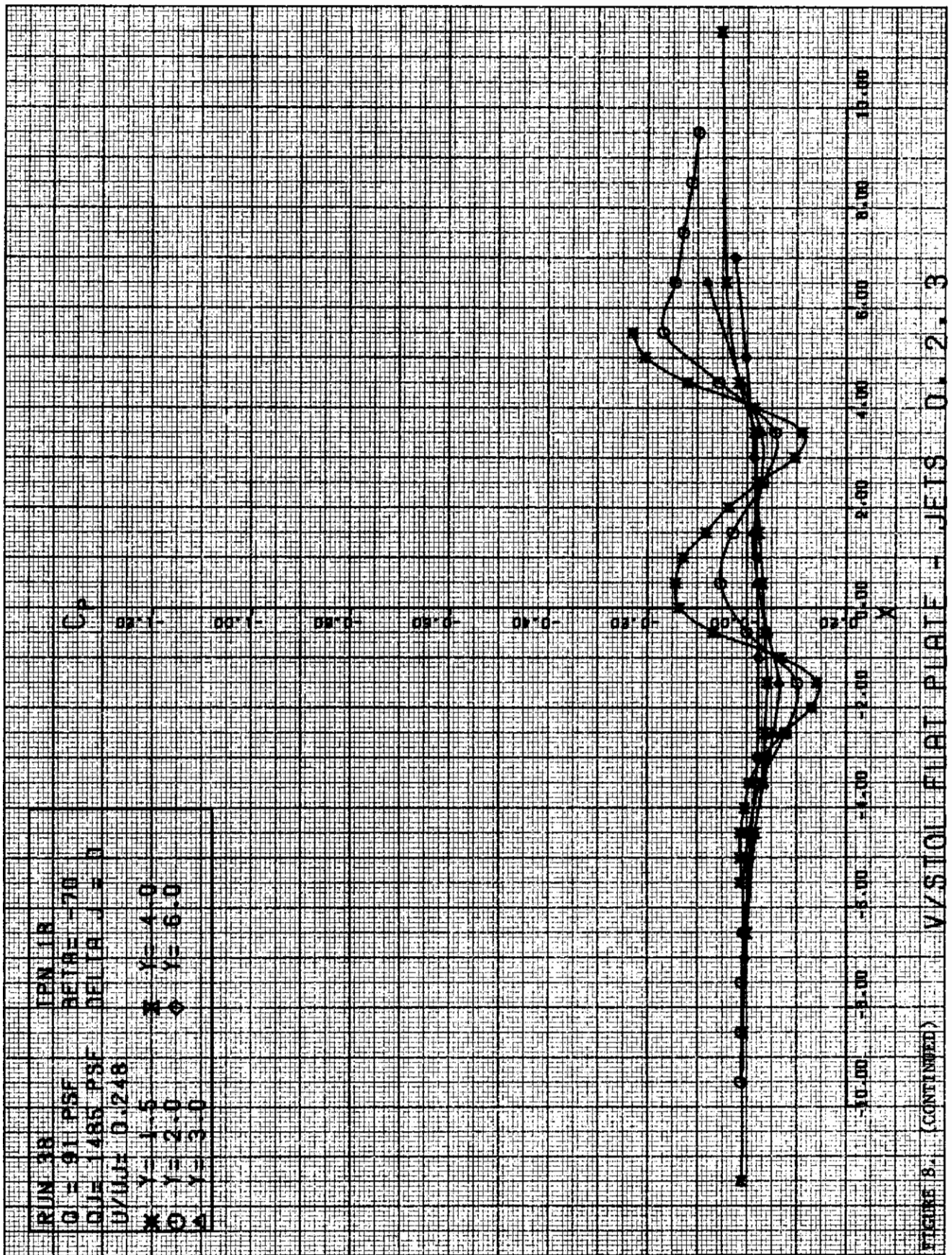
FIGURE 8. (CONTINUED) V/S TOL FLAT PIRTE - JETS 0. 2. 3

9









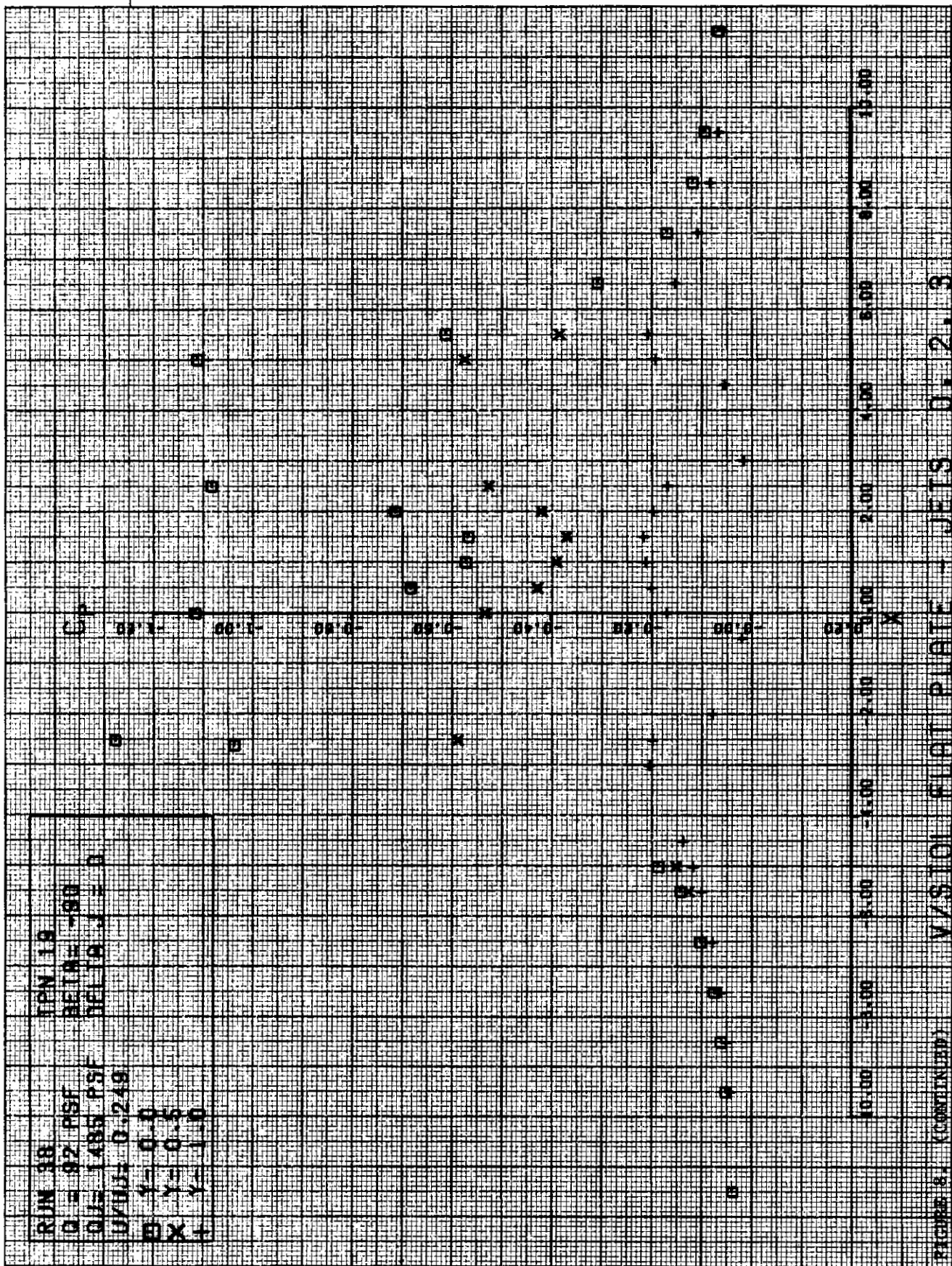
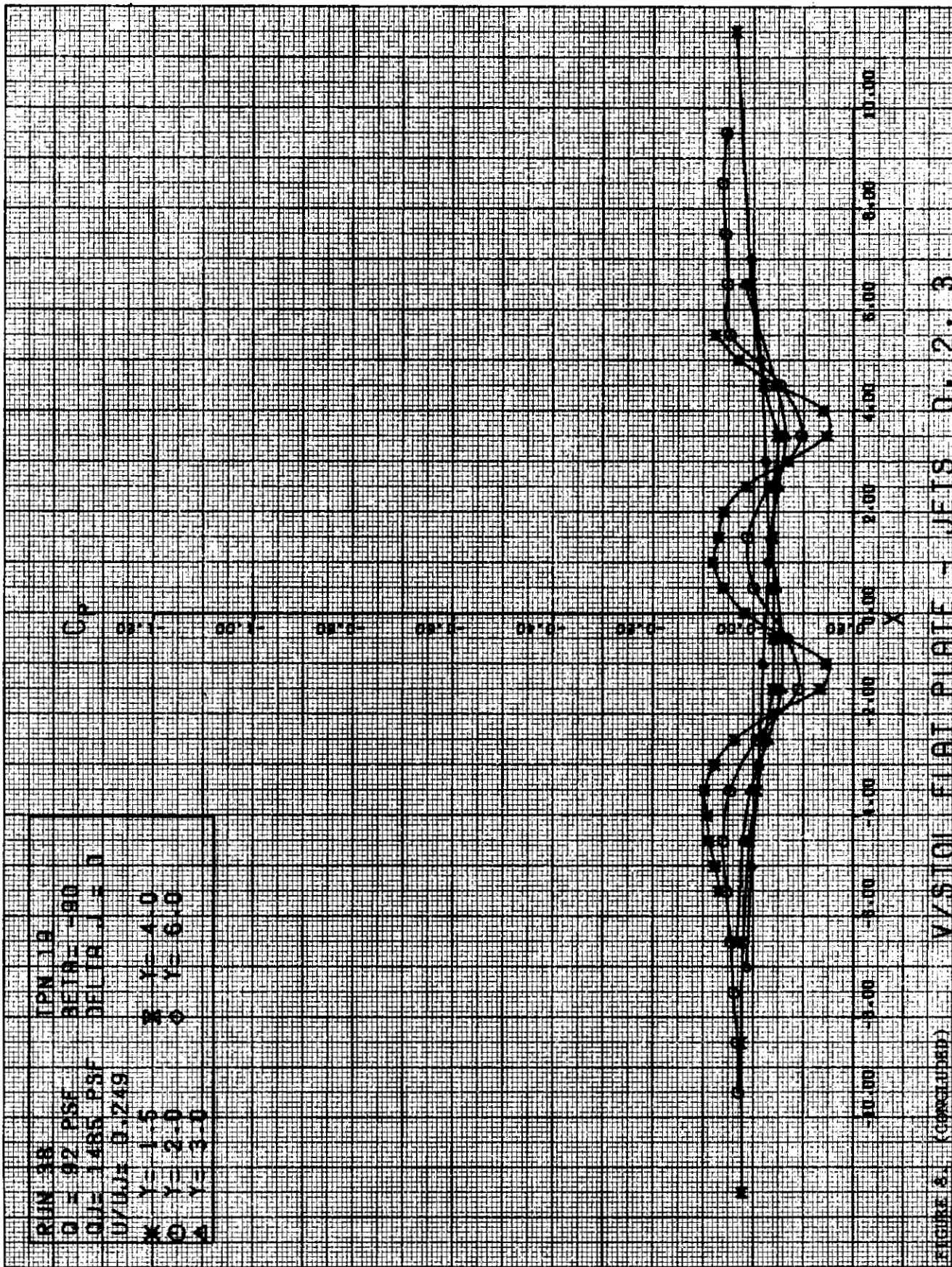
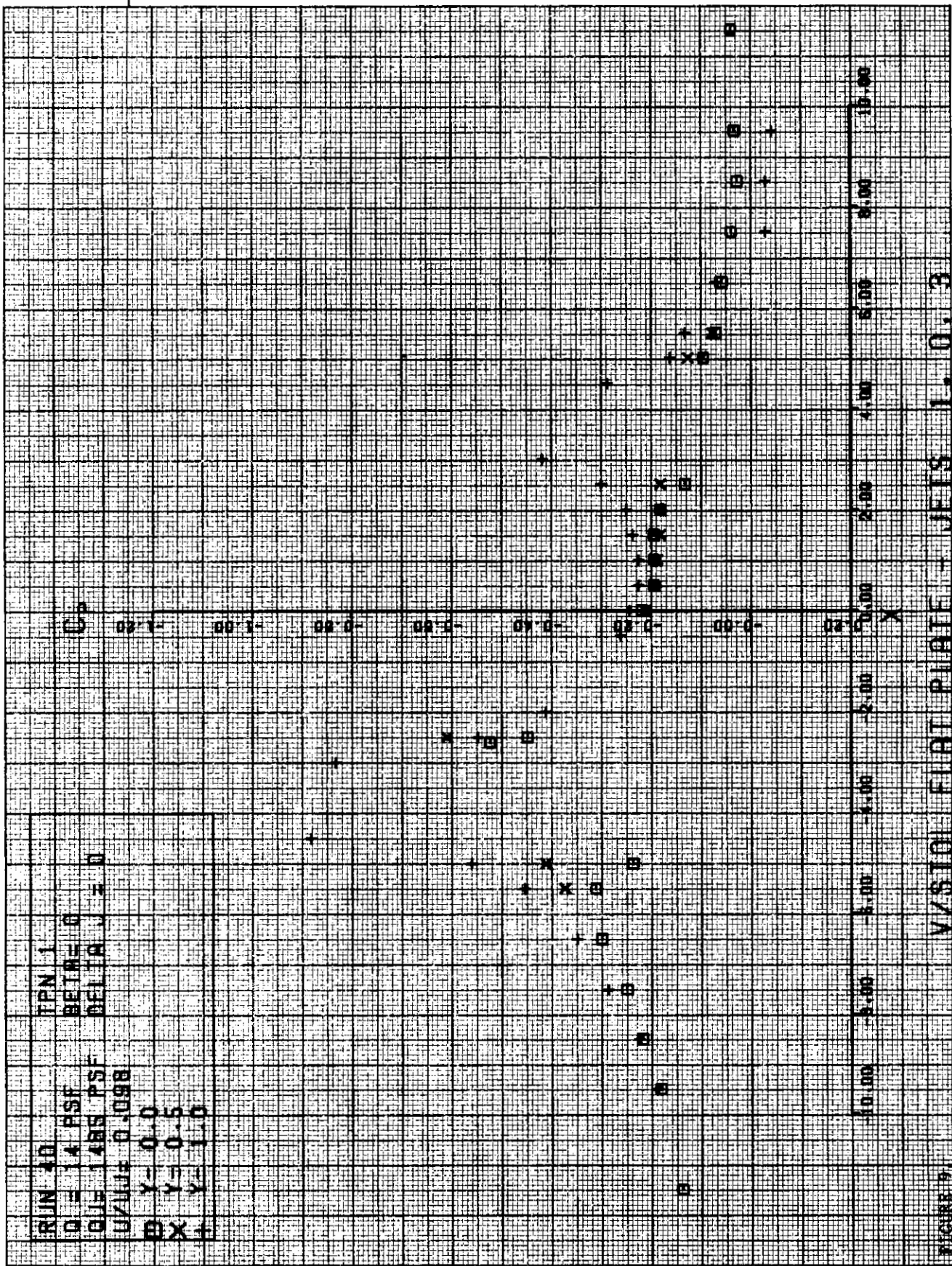
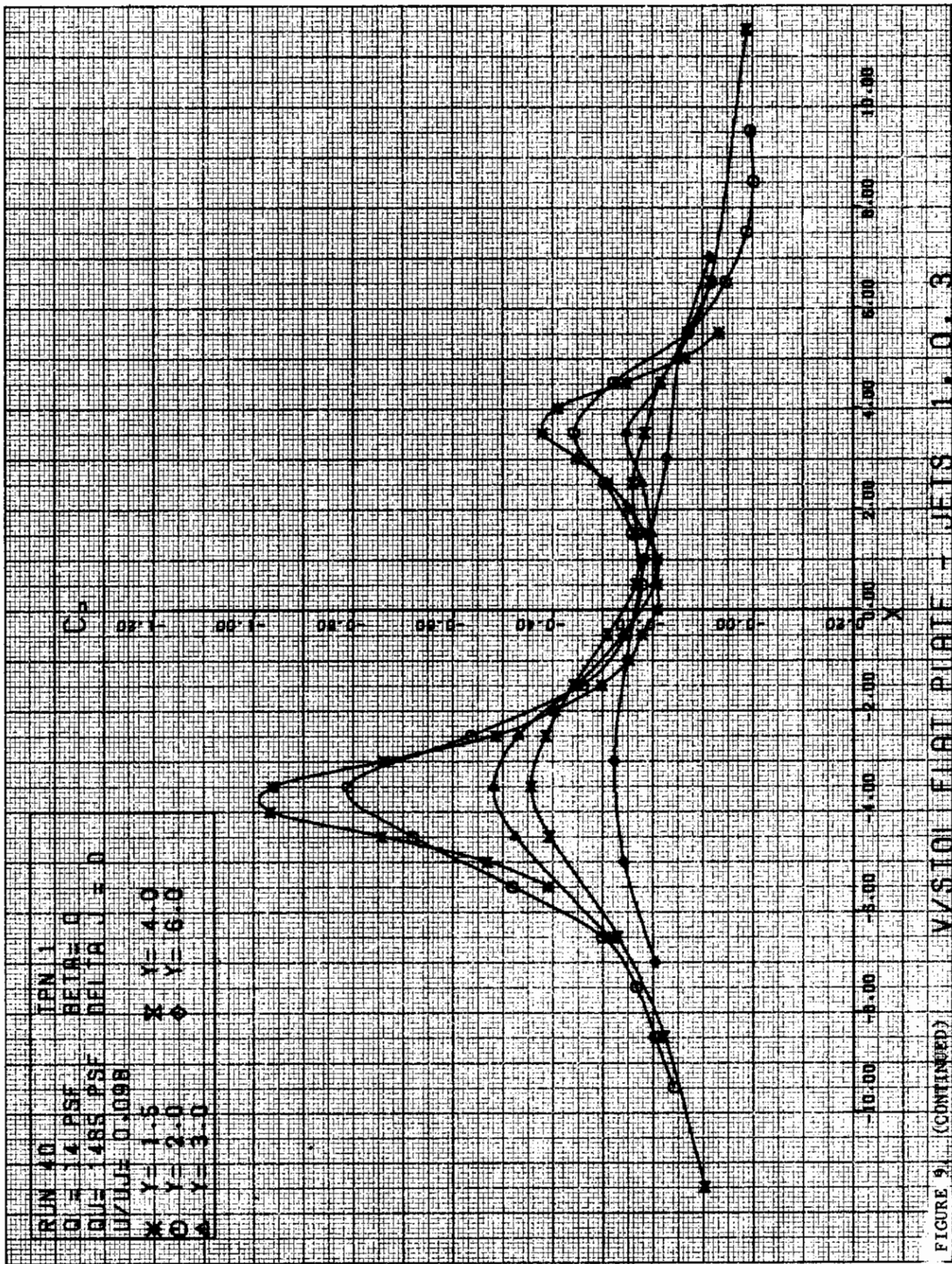
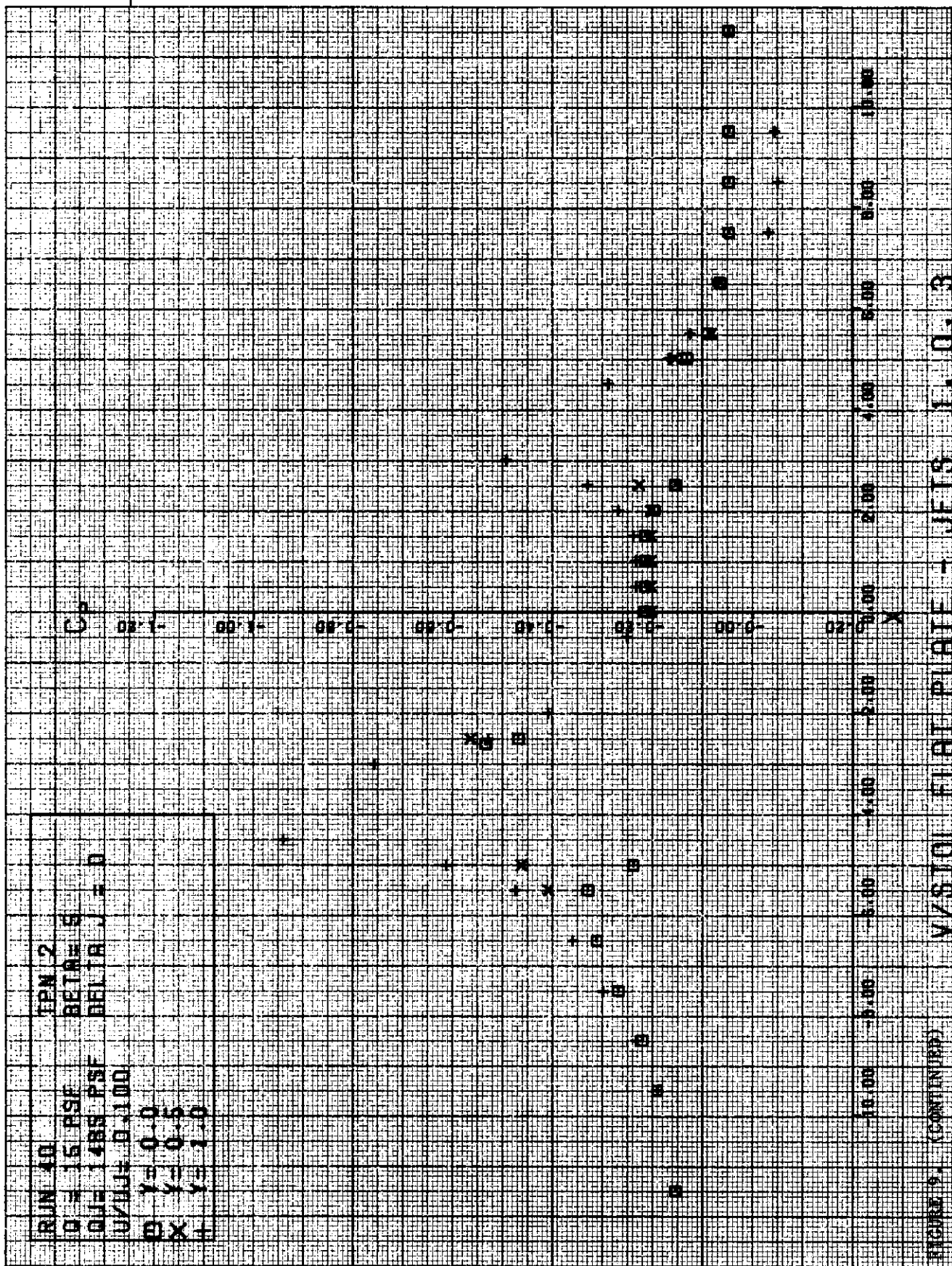


FIGURE 8. (CONTINUED) V/STOI FLAT PLATE - JETS 0.2.3









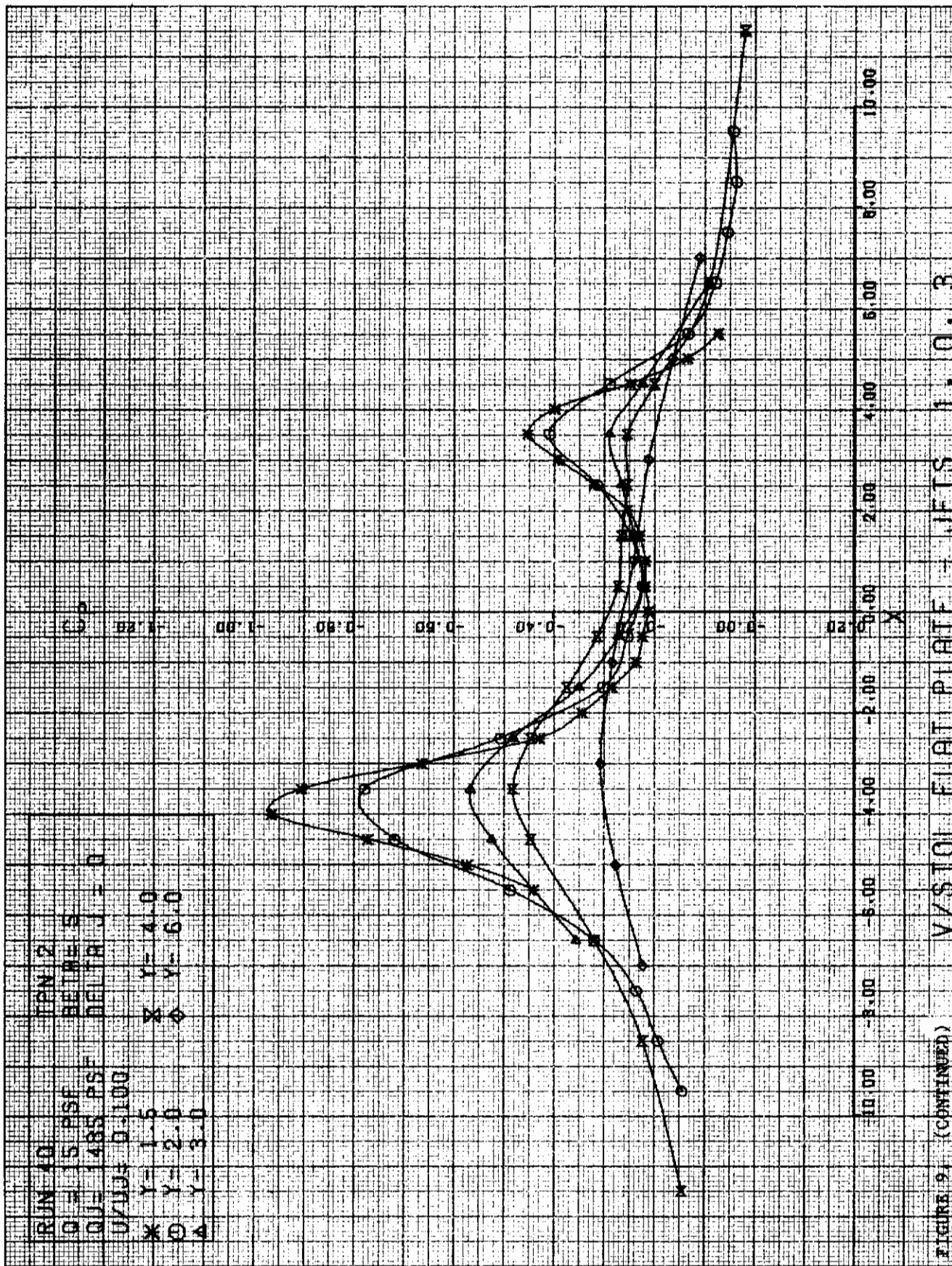
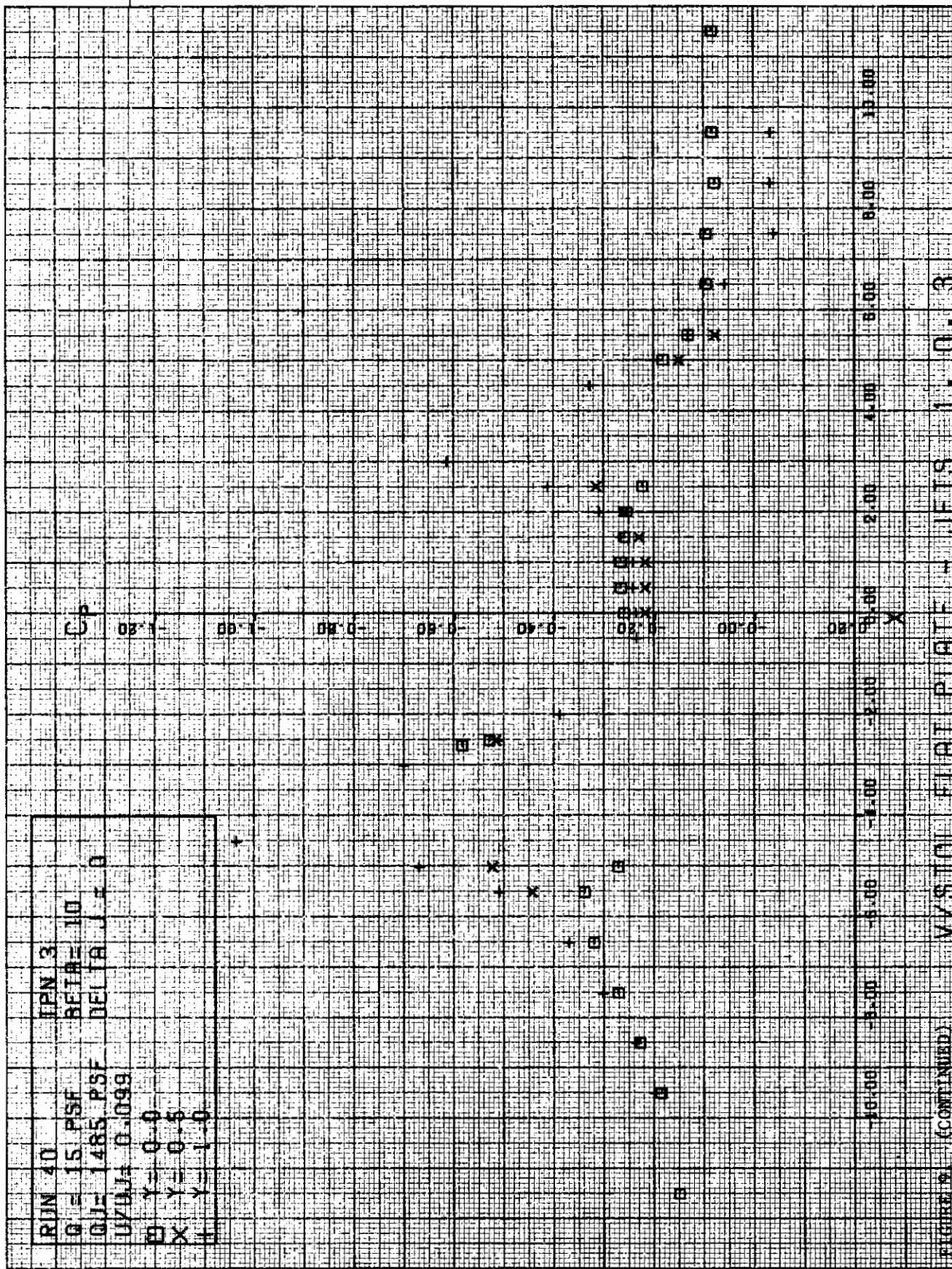


FIGURE 9 (CONTINUED) VYSIOL FLAT PLATE - JETS 1, 0, 3



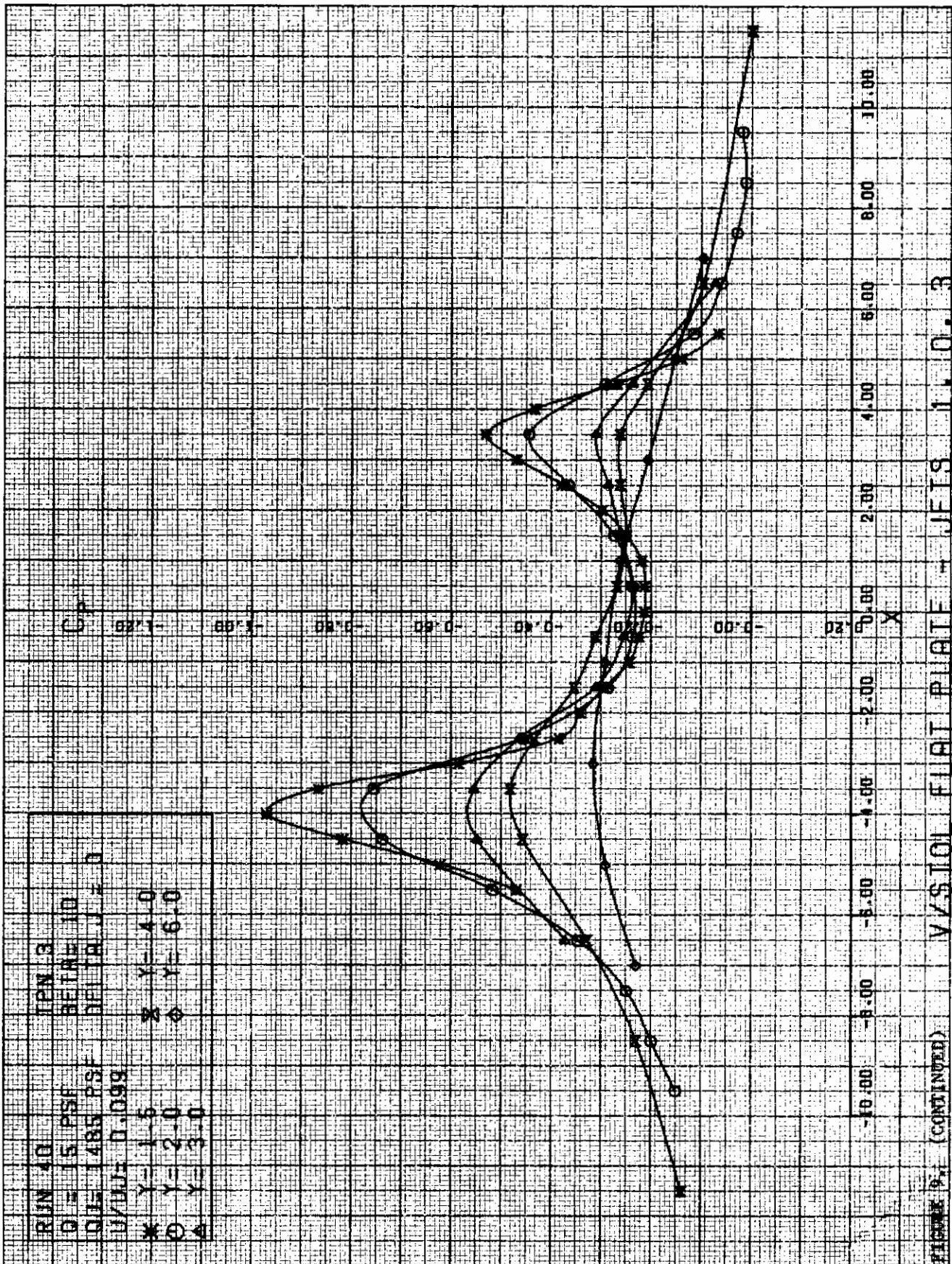


FIGURE 9. (CONTINUED) V/SION FLAT PLATE - JETS 1.0.3

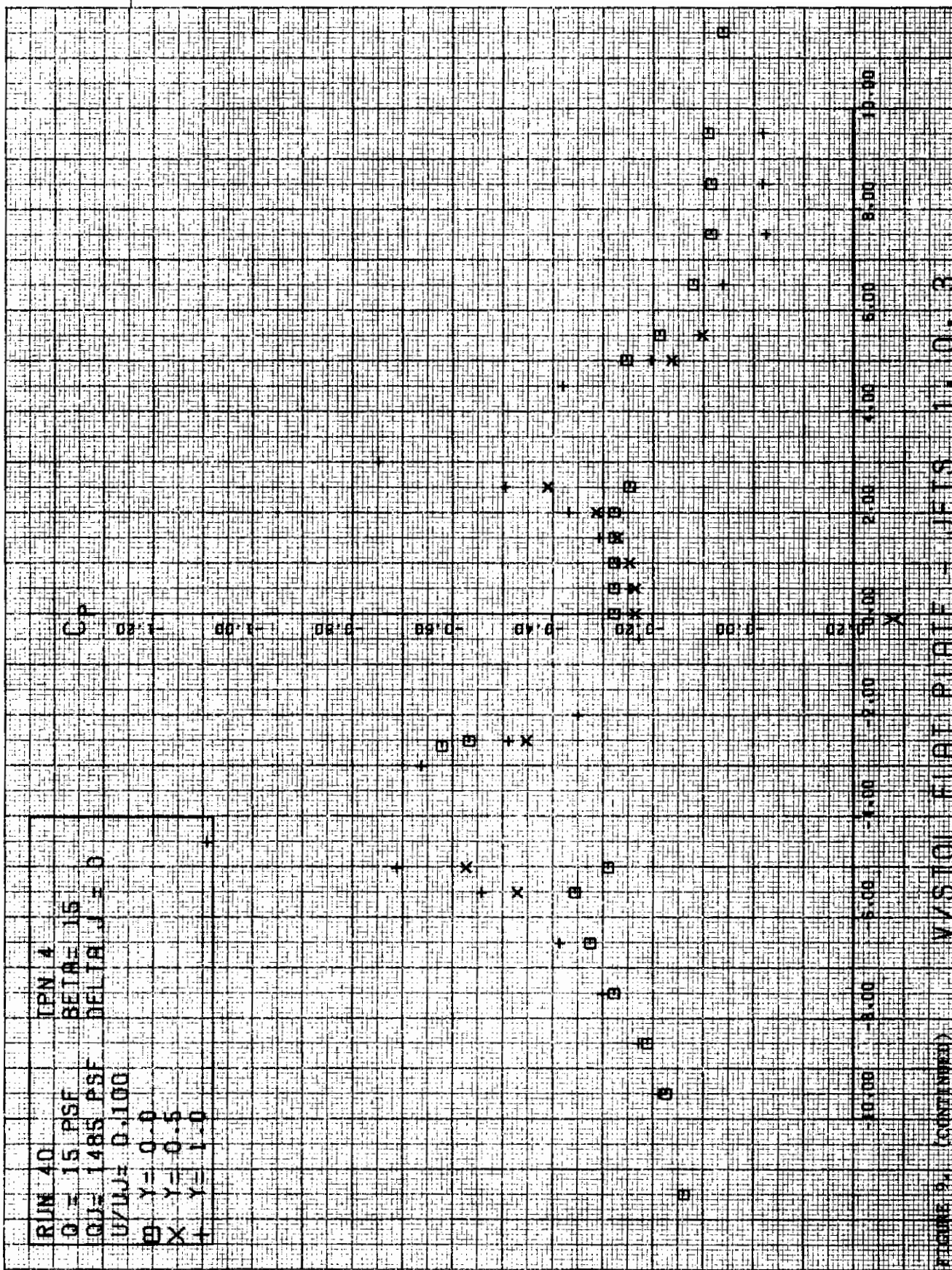
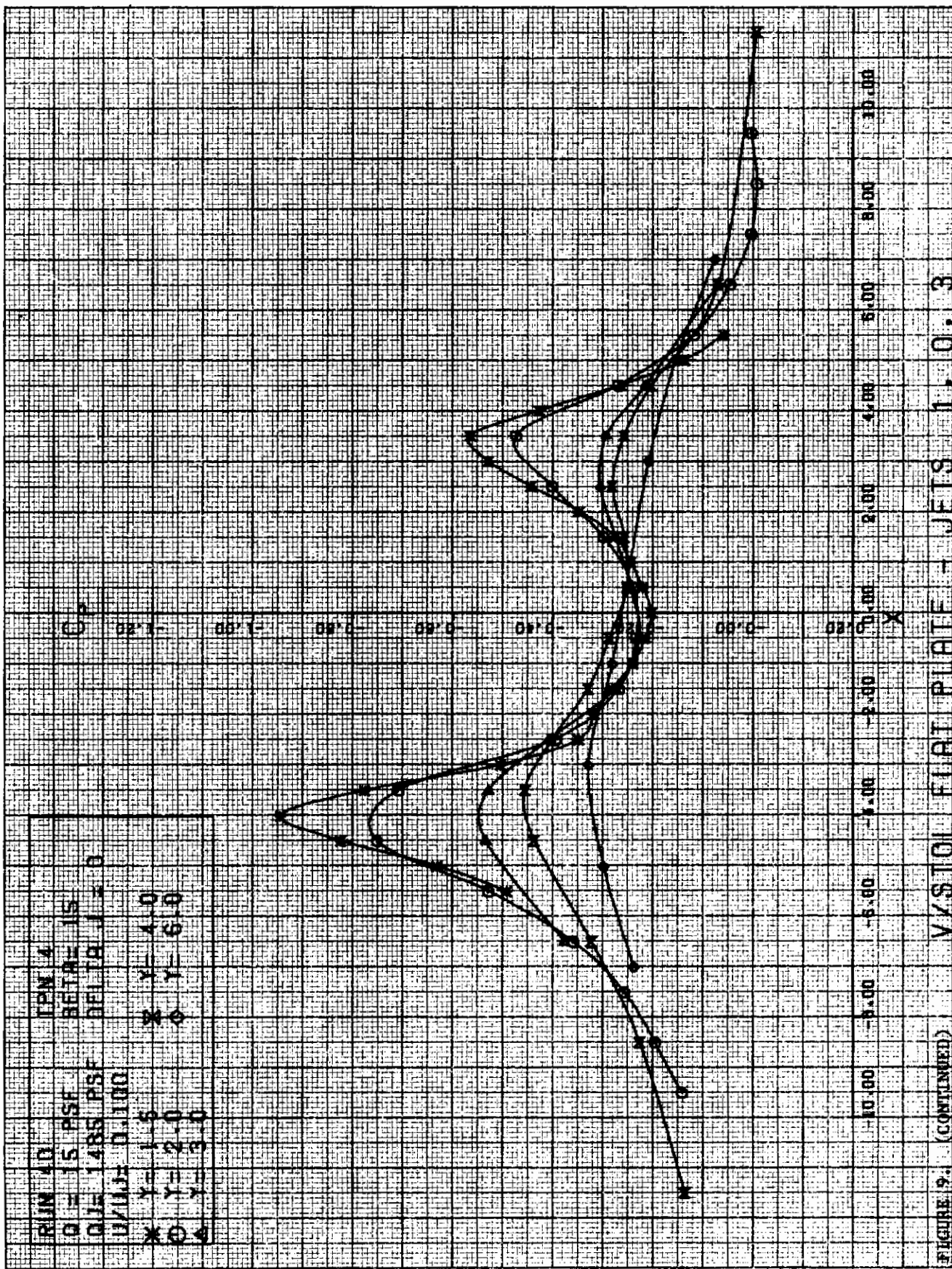


FIGURE 9. (CONTINUED)



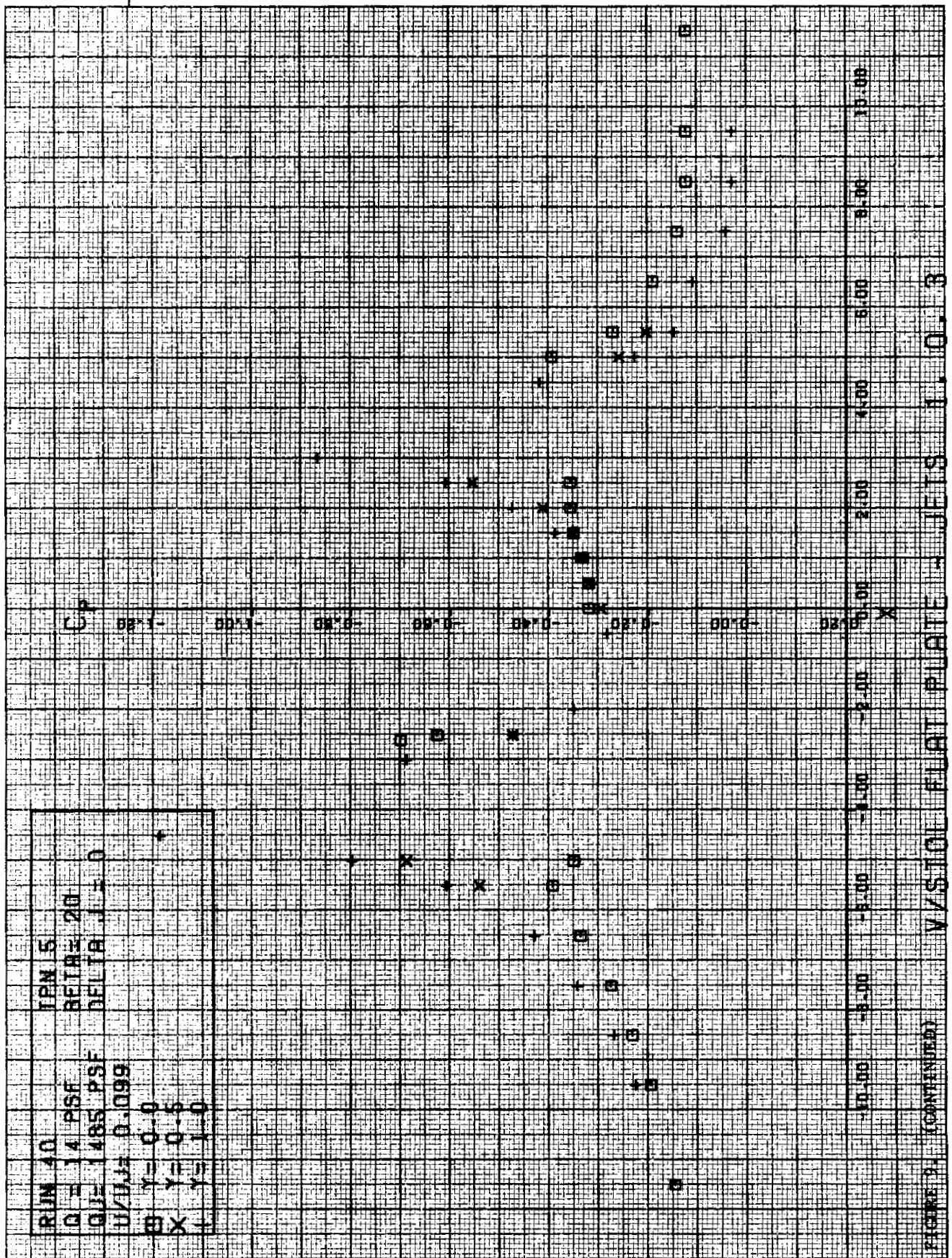


FIGURE 9. (CONTINUED) V/STOL FLAT PLATE - JETS 1.0.3

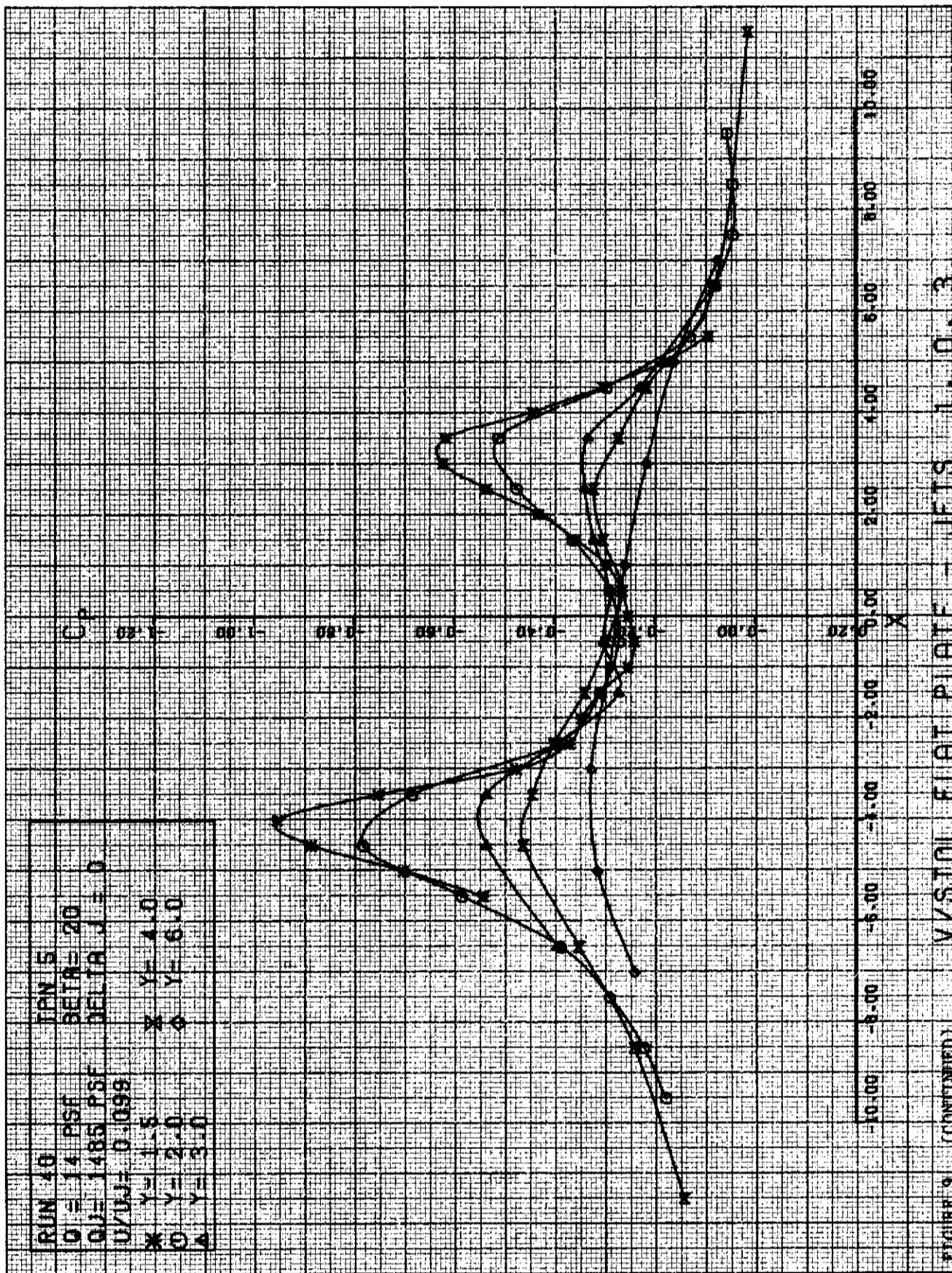


FIGURE 9 (CONTINUED) V/STOIL FLAT PLATE - JETS 1, 0, 3

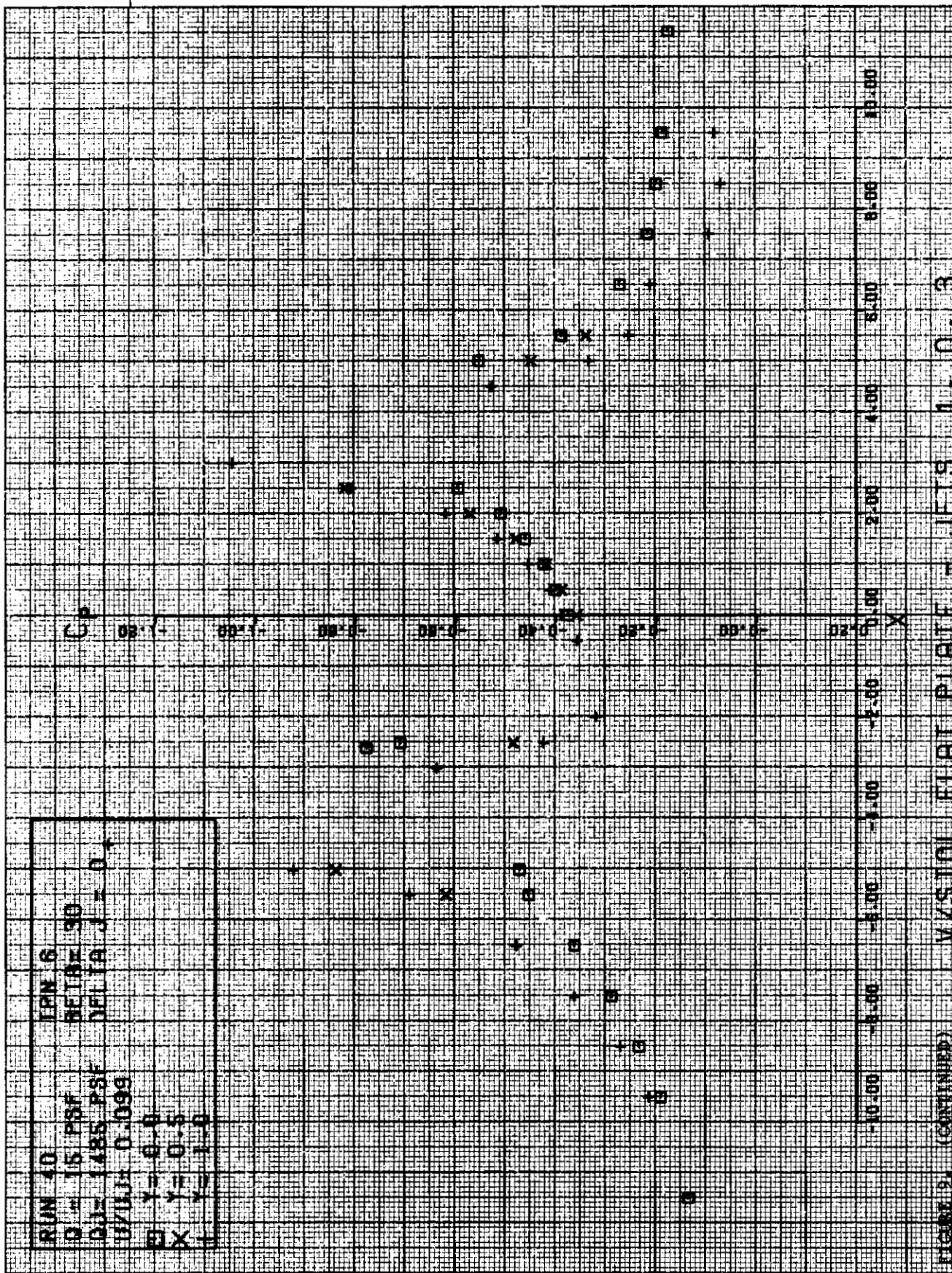


FIGURE 9. (CONTINUED)

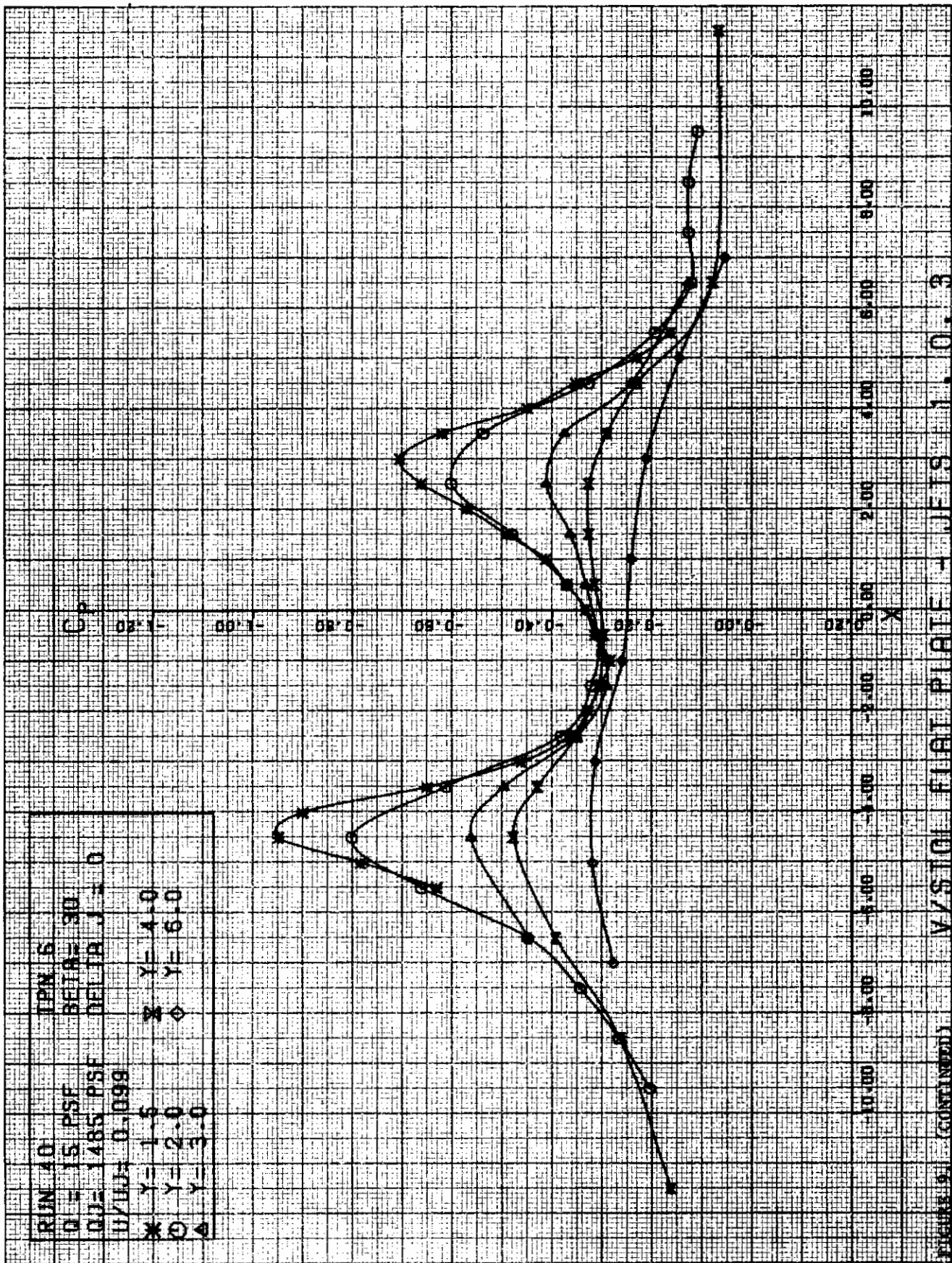
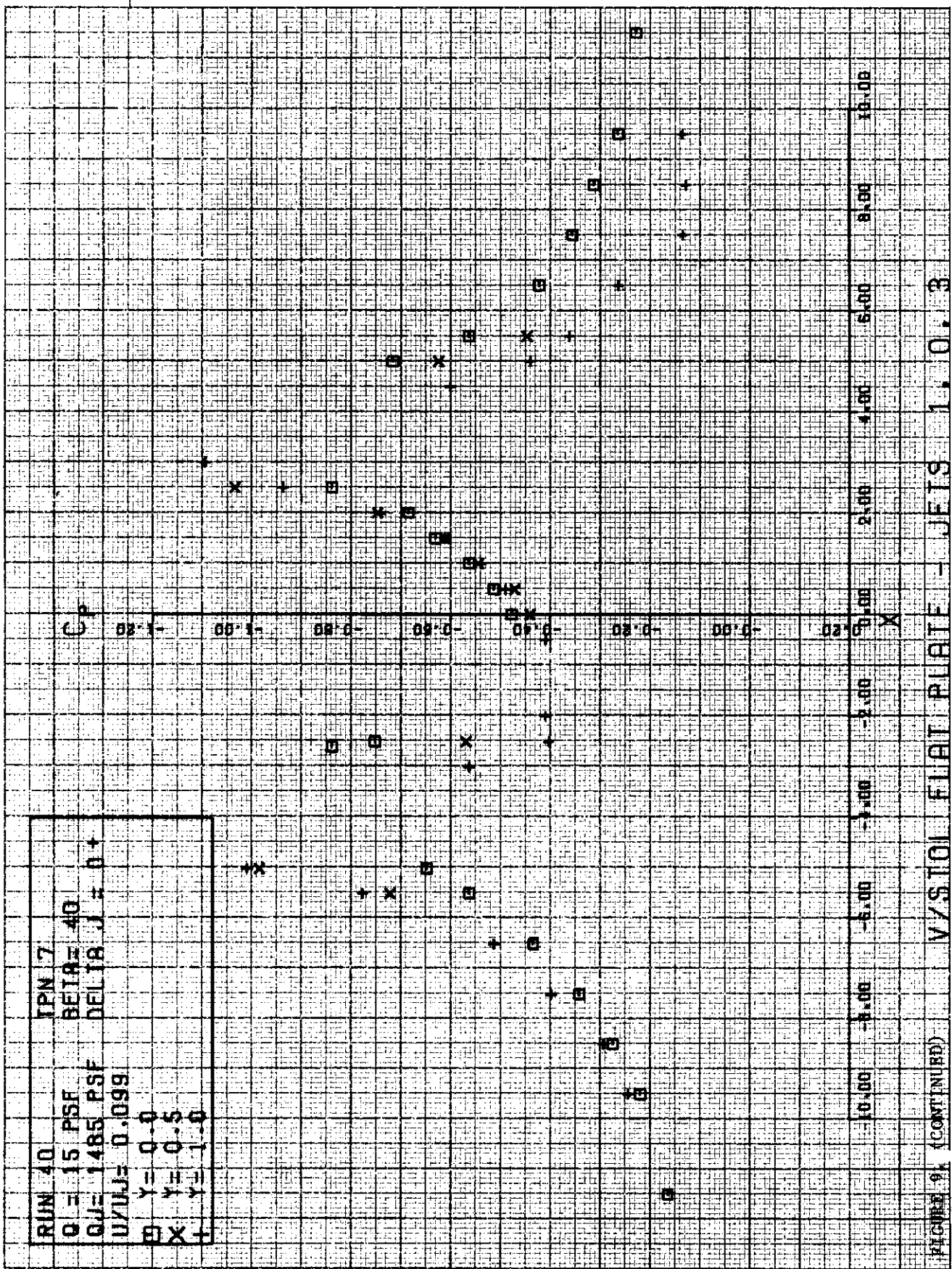
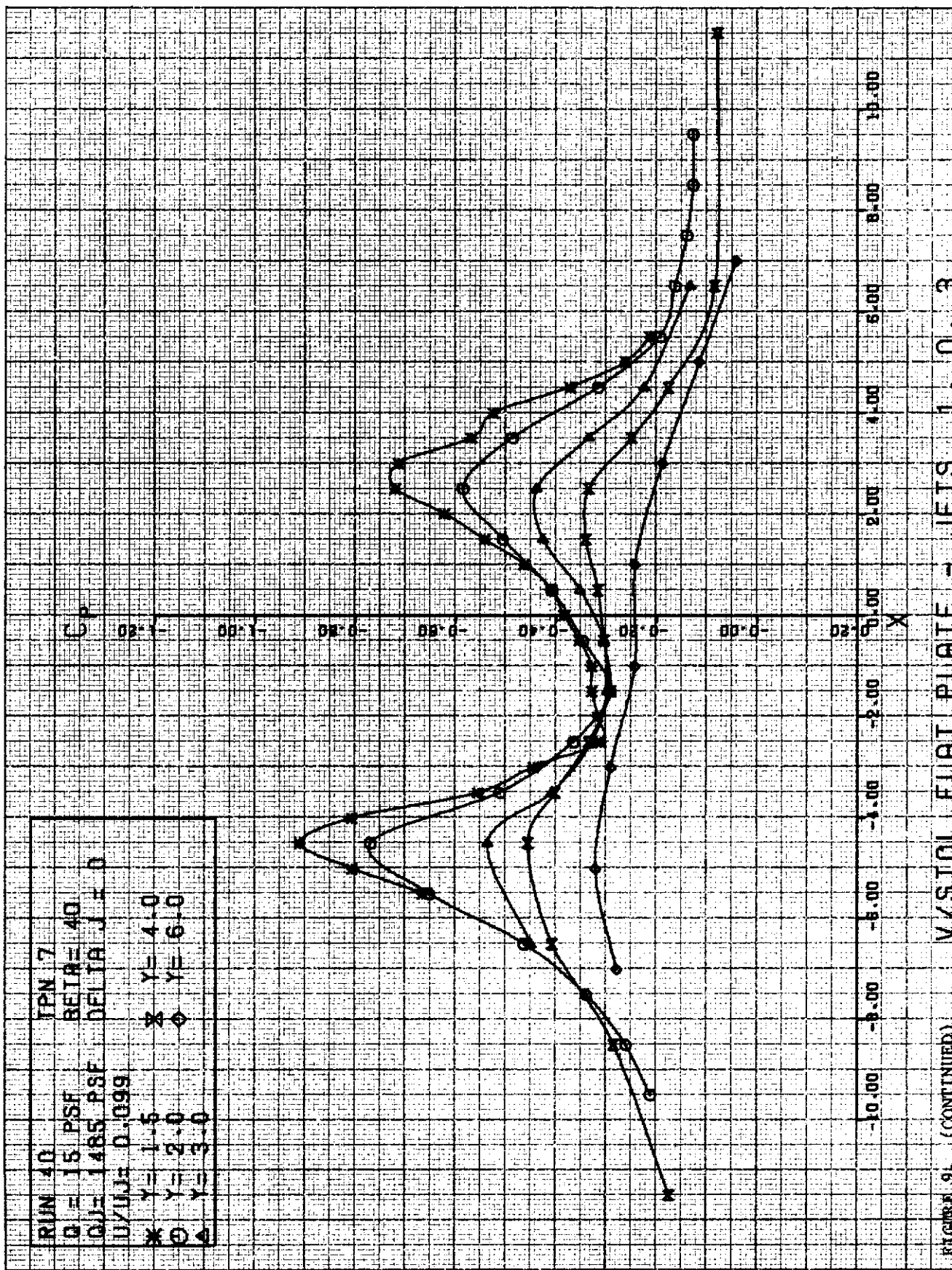
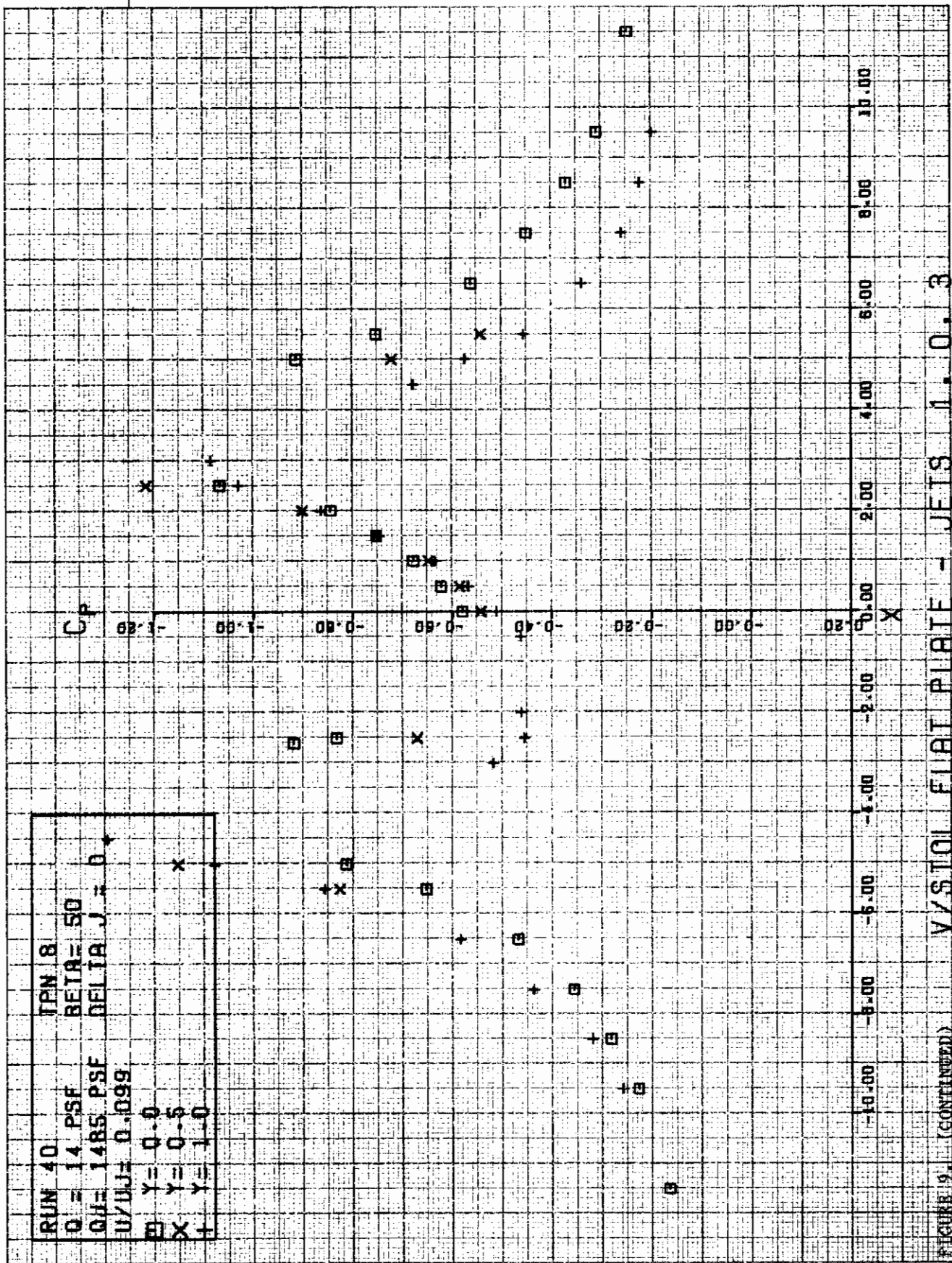


FIGURE 9. (CONTINUED) V/STOL FLAT PLATE - JETS 1.0. 3







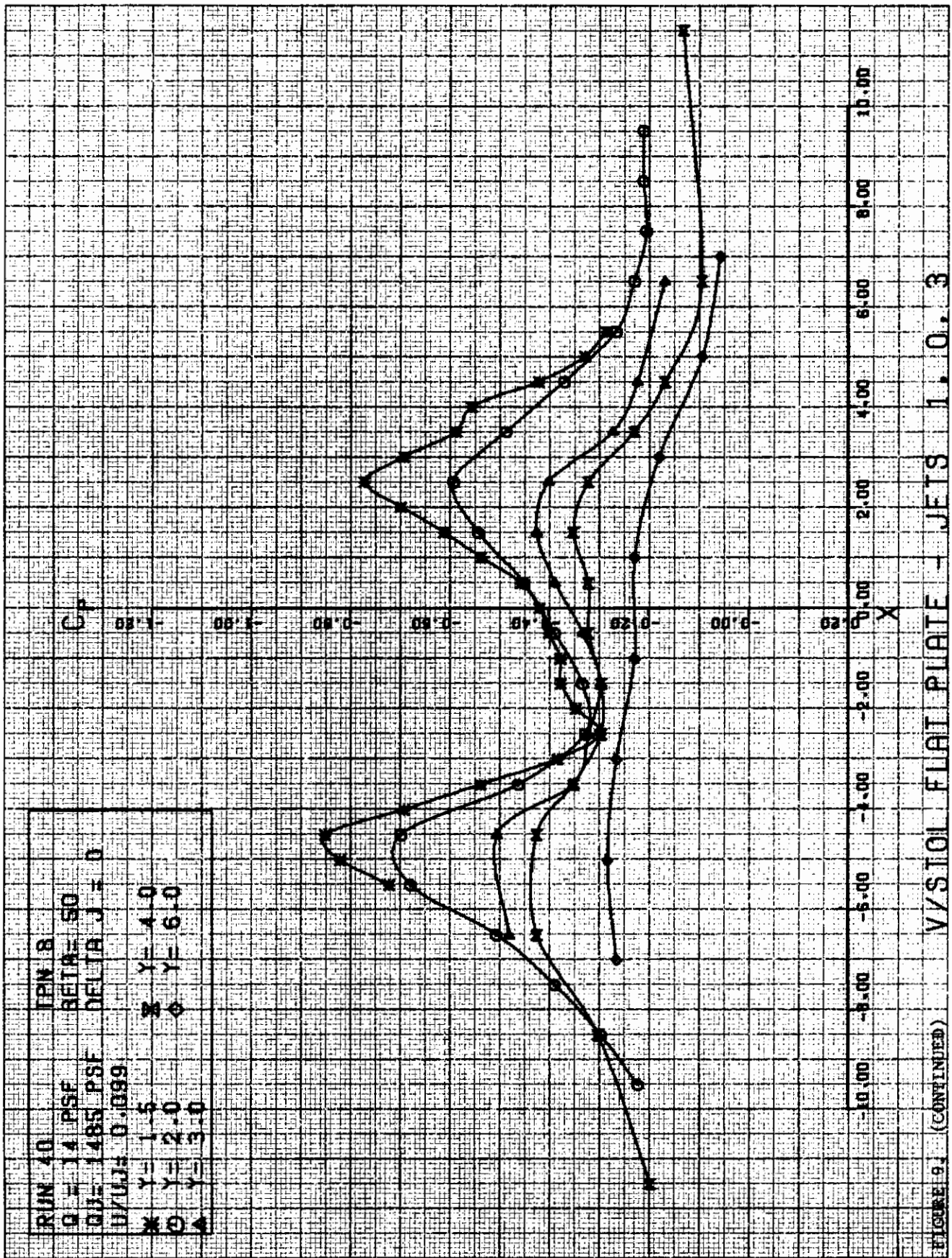


FIGURE 9. (CONTINUED) WYSTOL FLAT PLATE - JETS 1, 0, 3

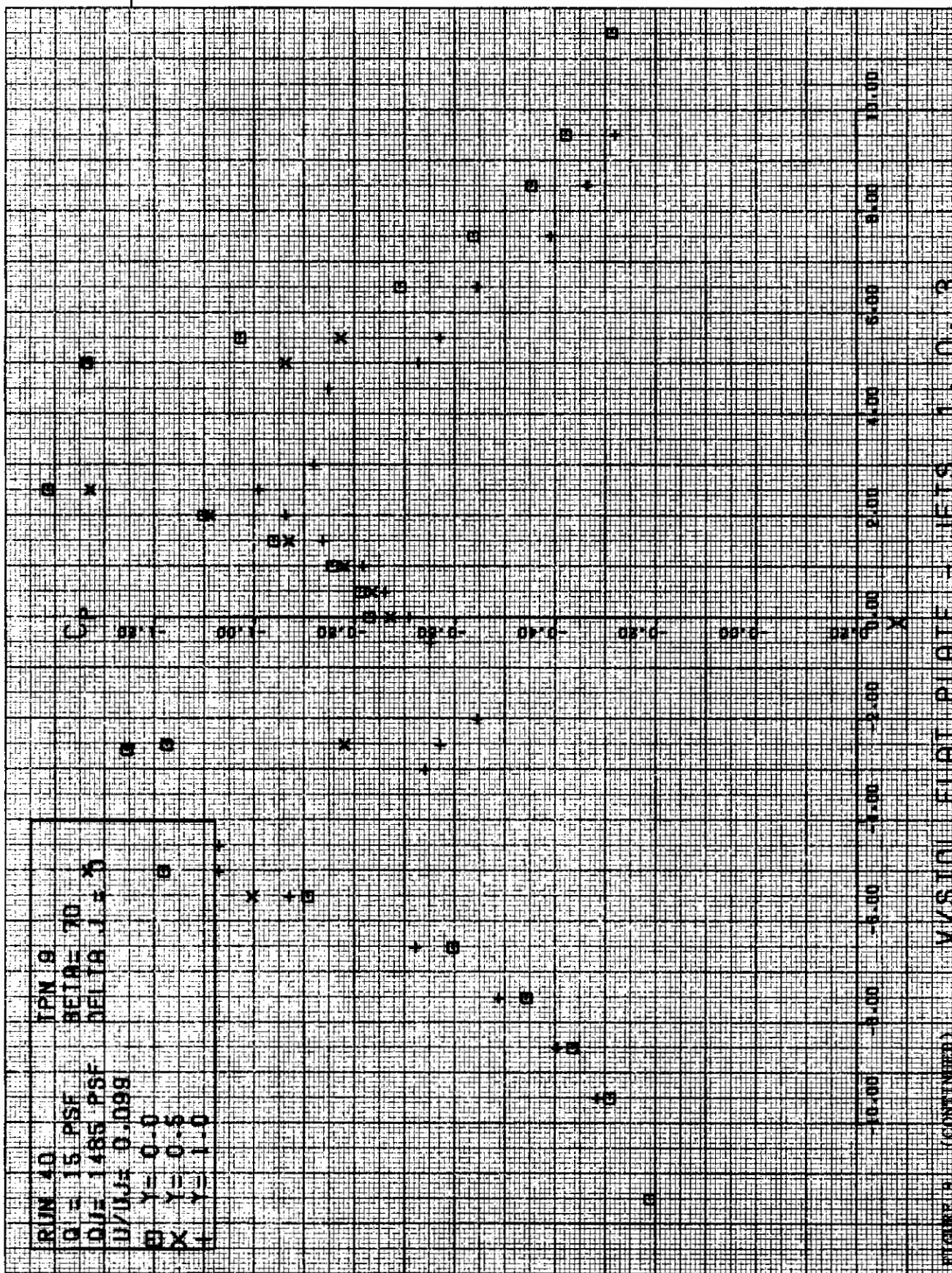
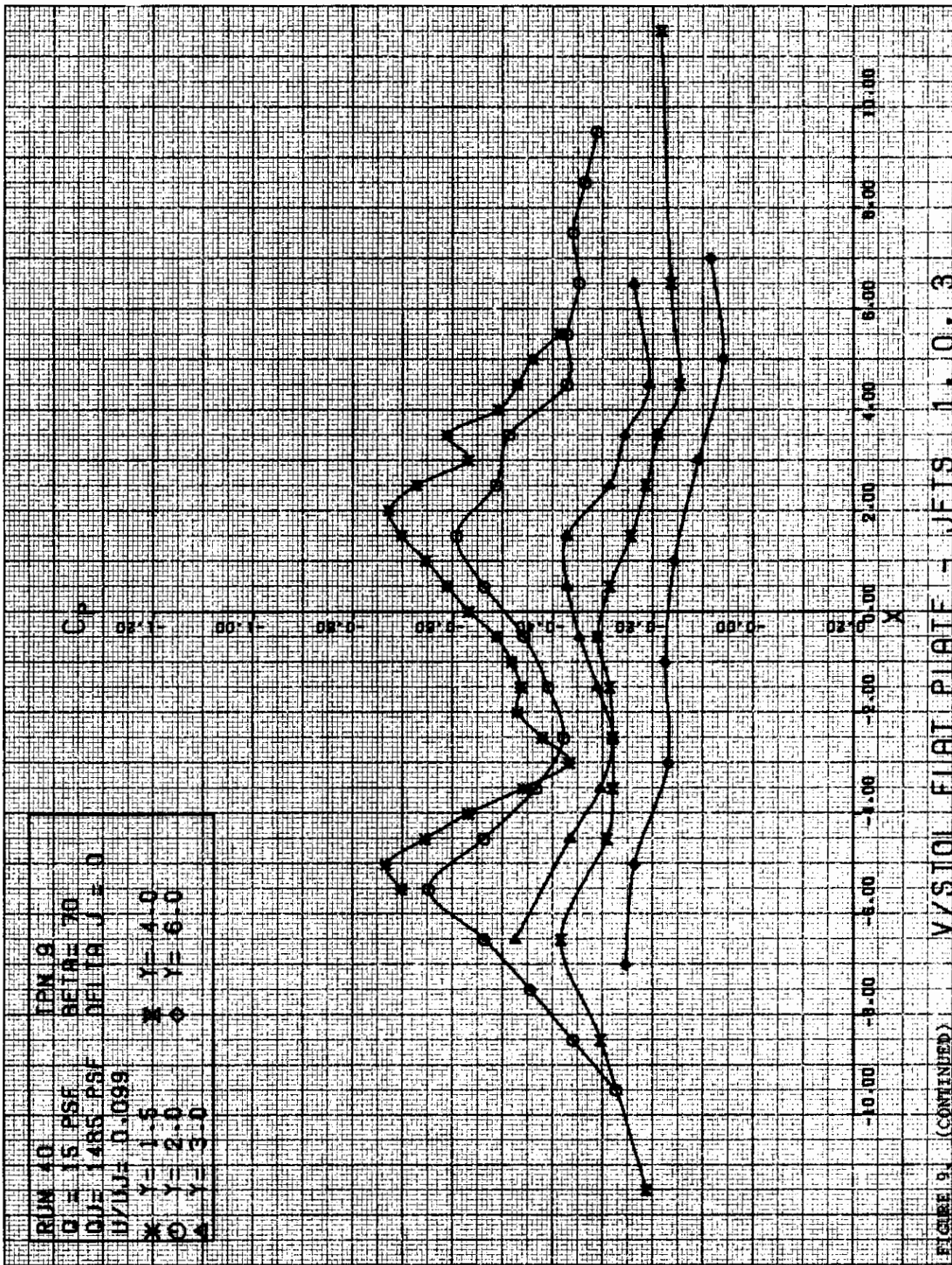
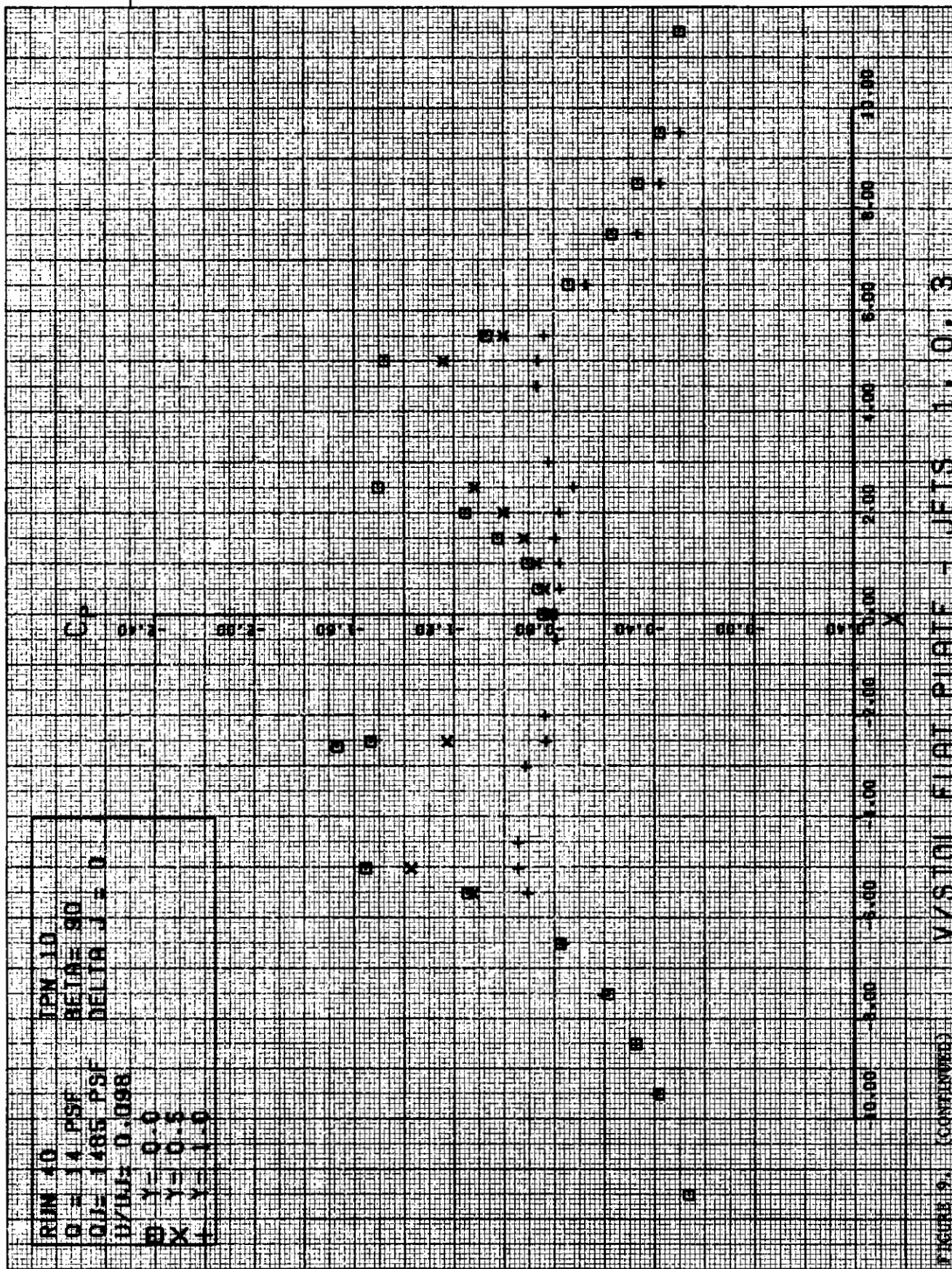
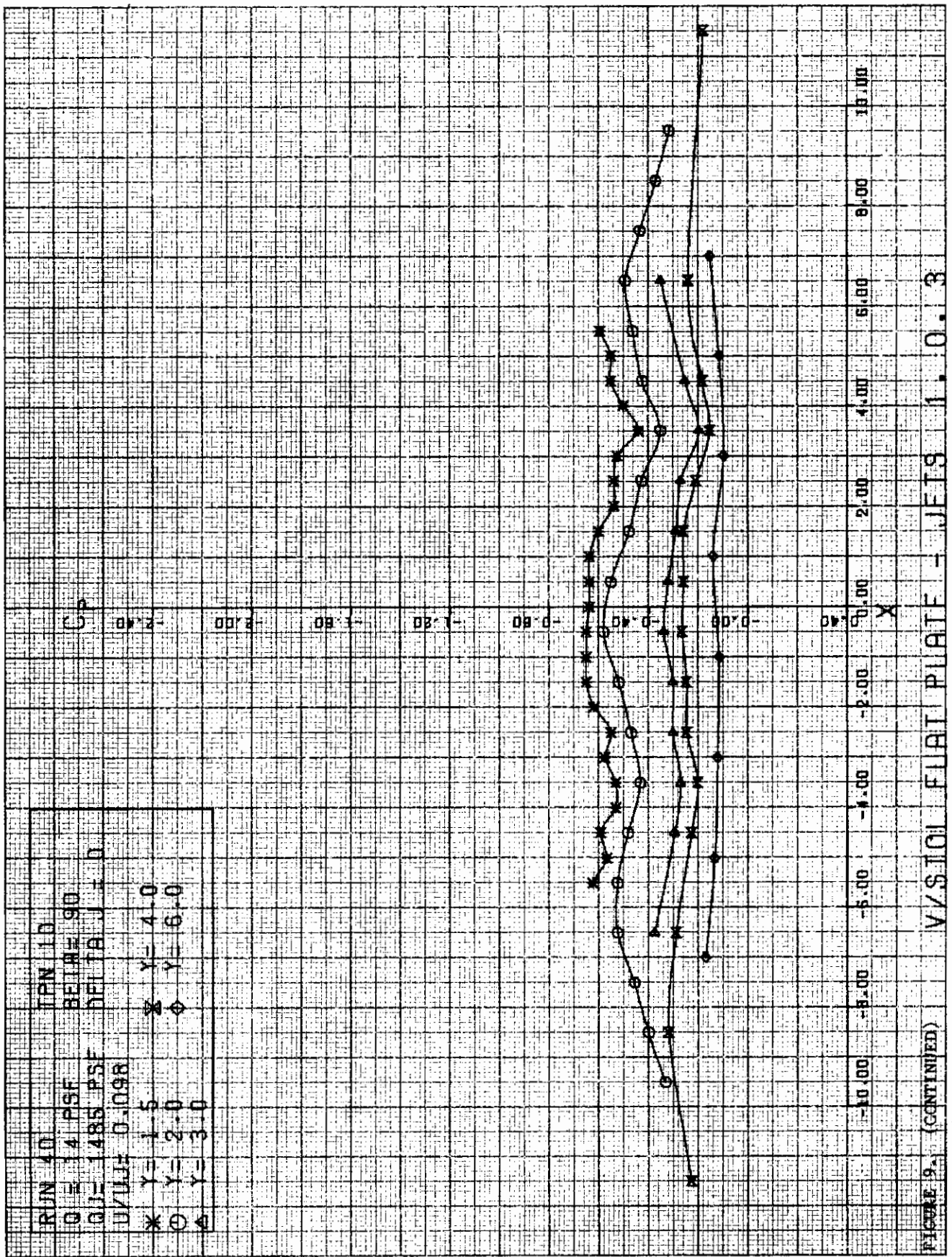


FIGURE B. (CONTINUED) V/|U| vs Y/|U| - JETS 1, 0, 3







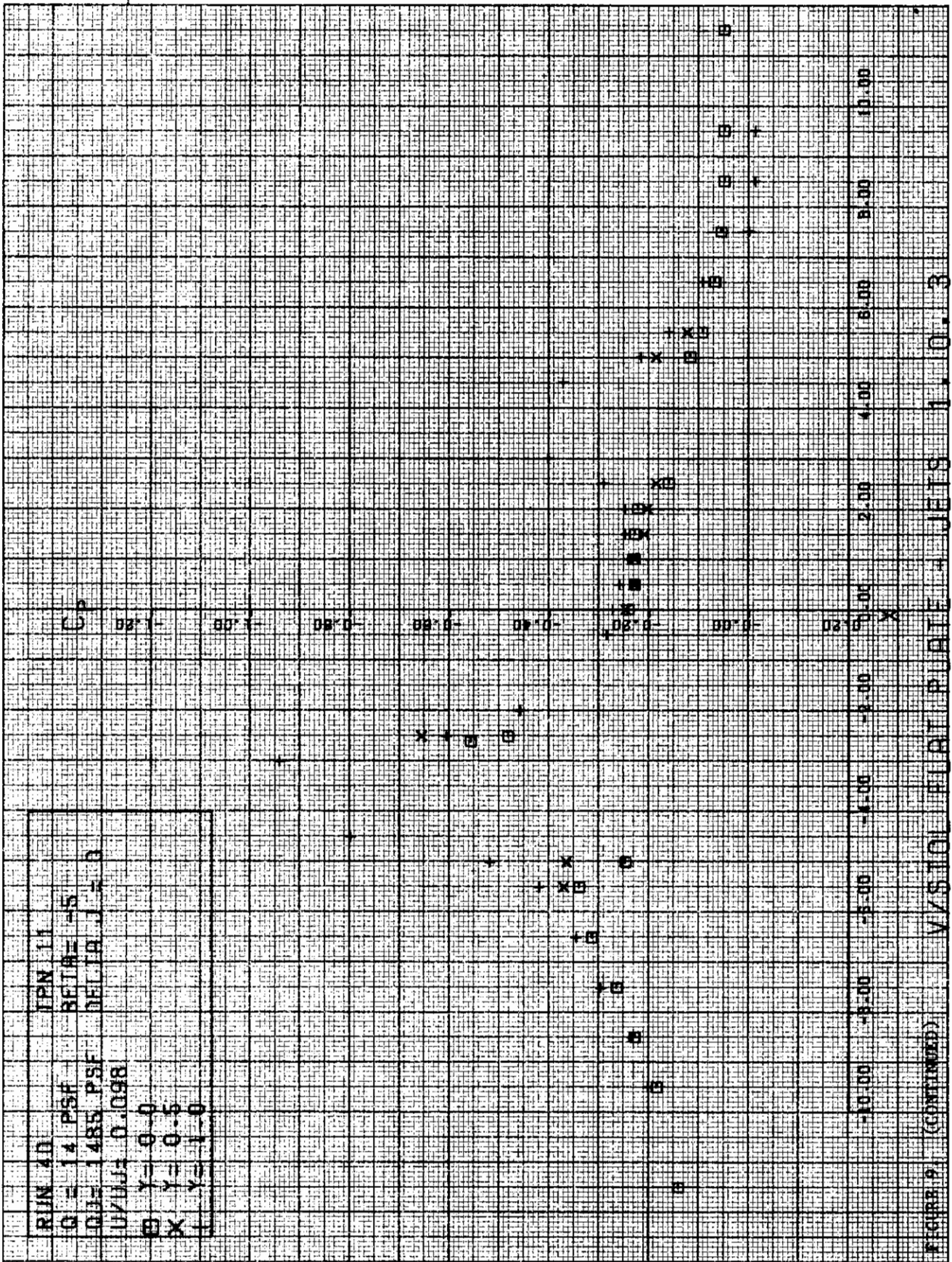
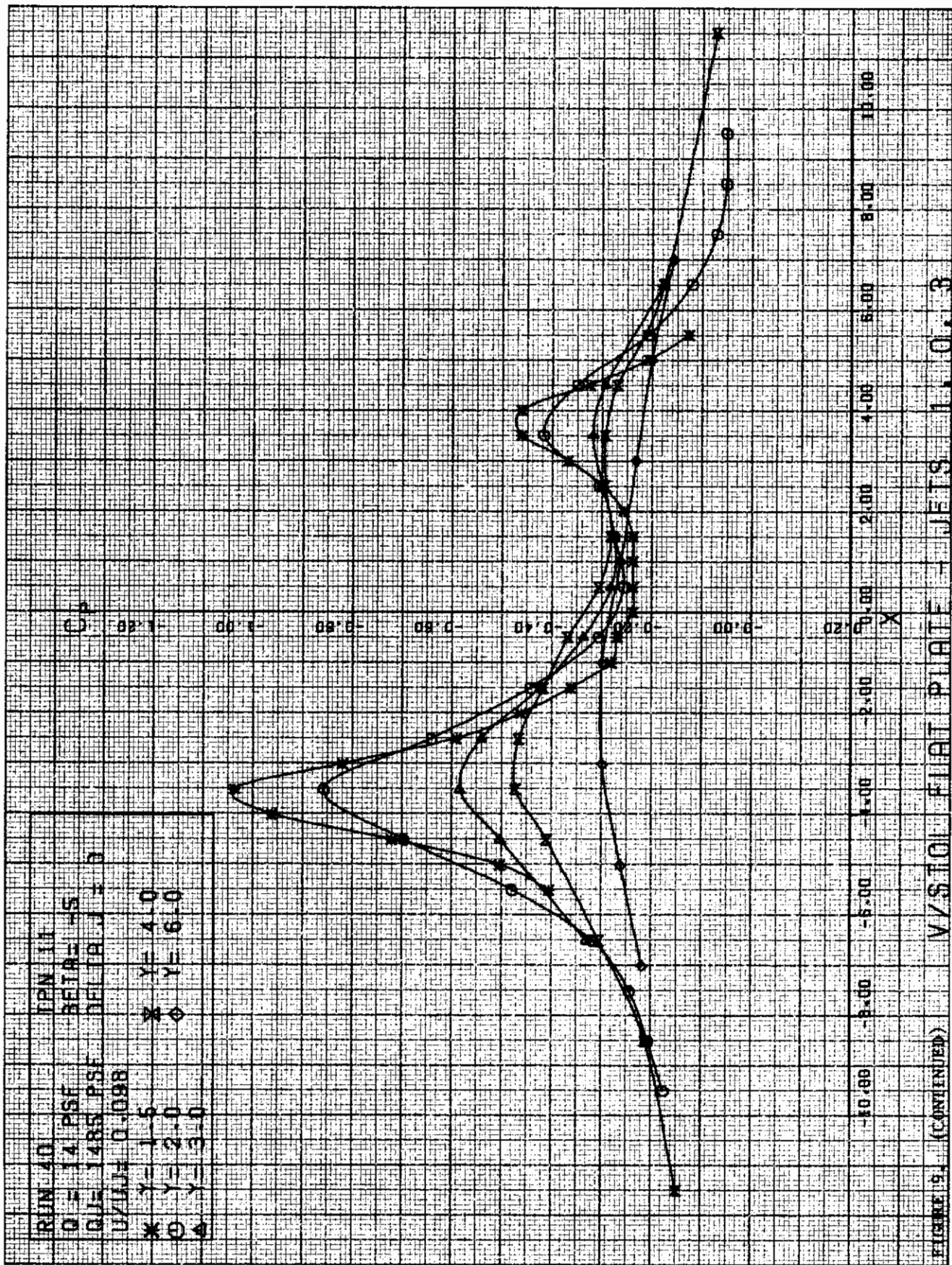
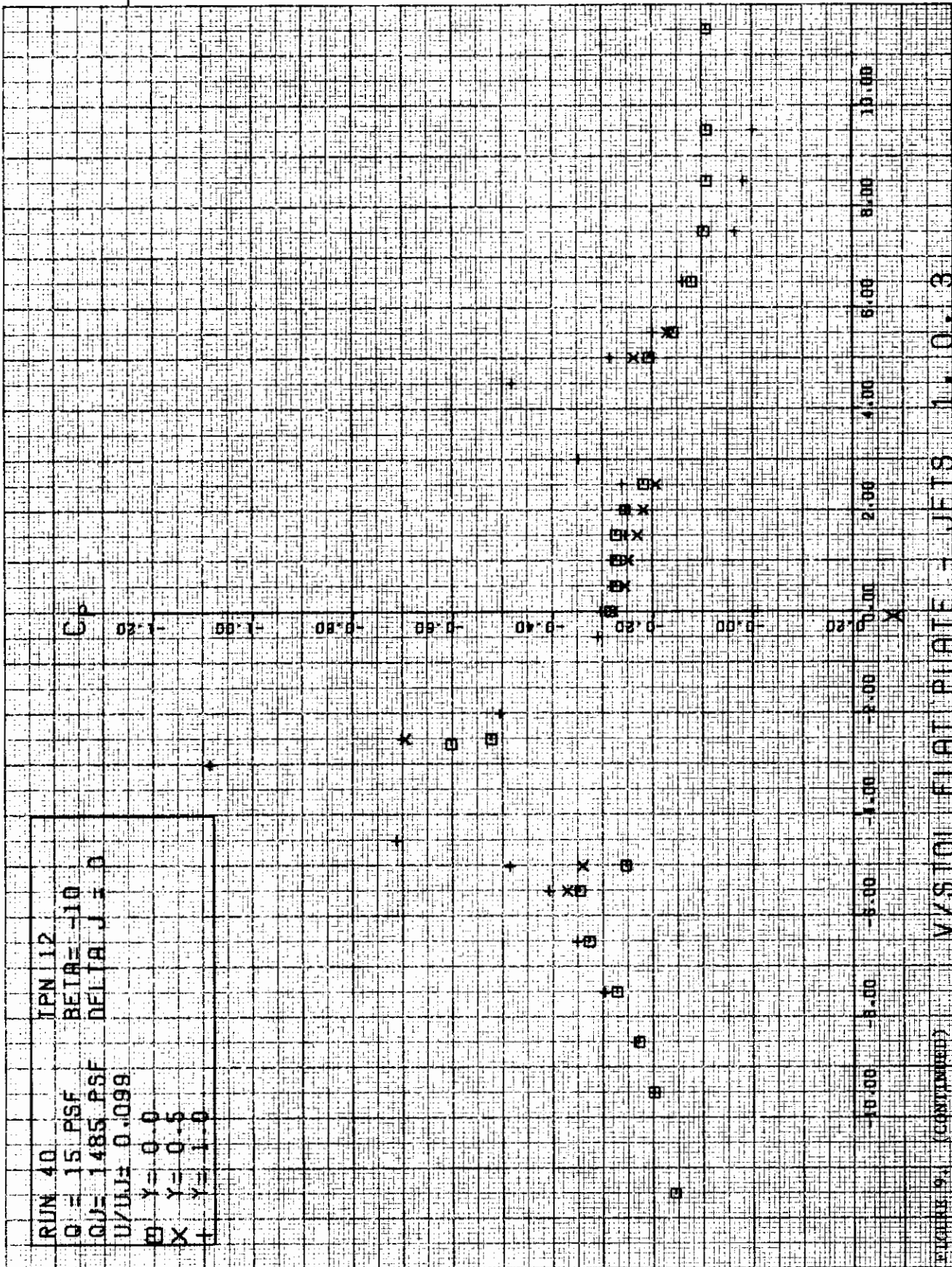
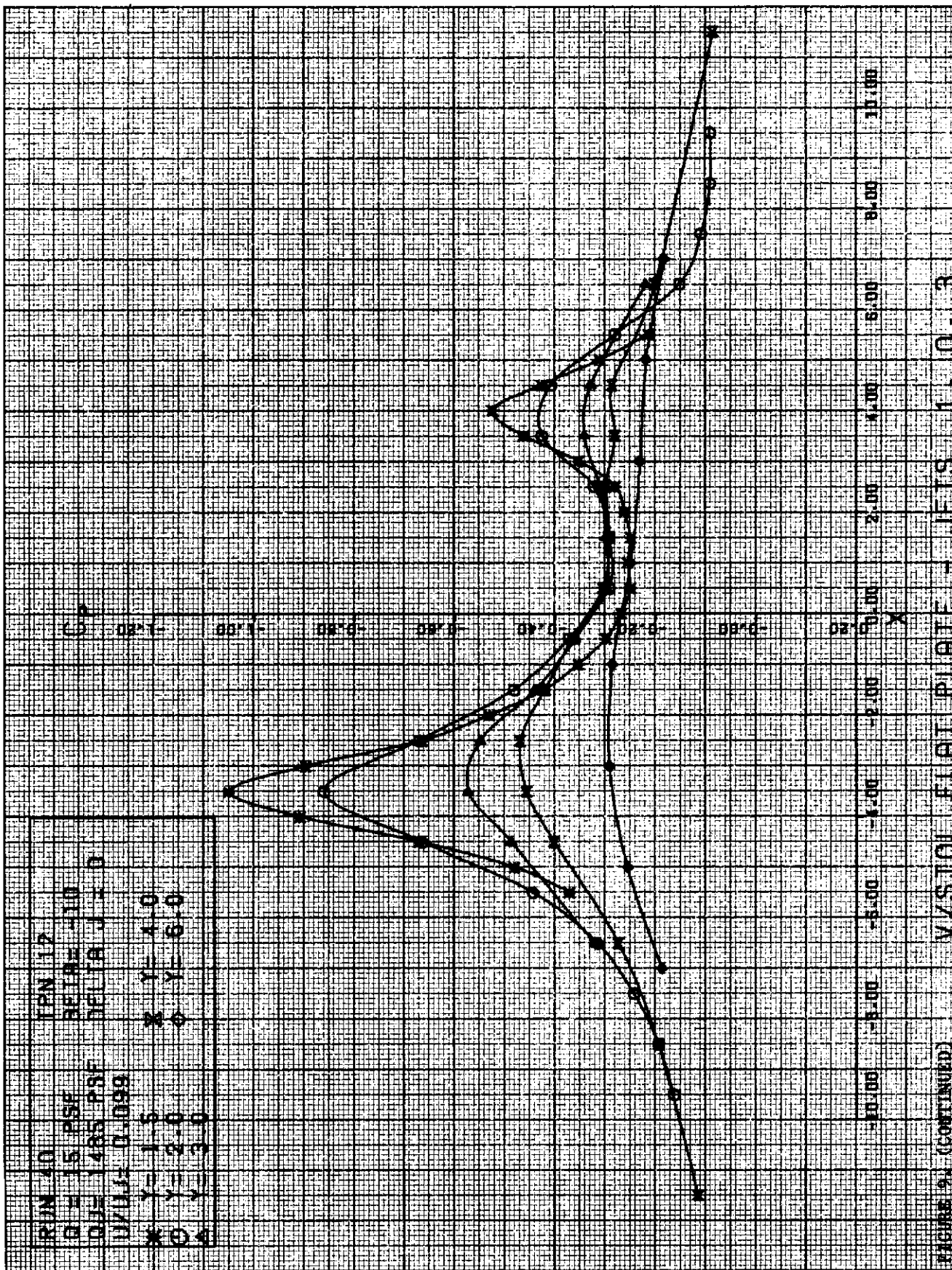
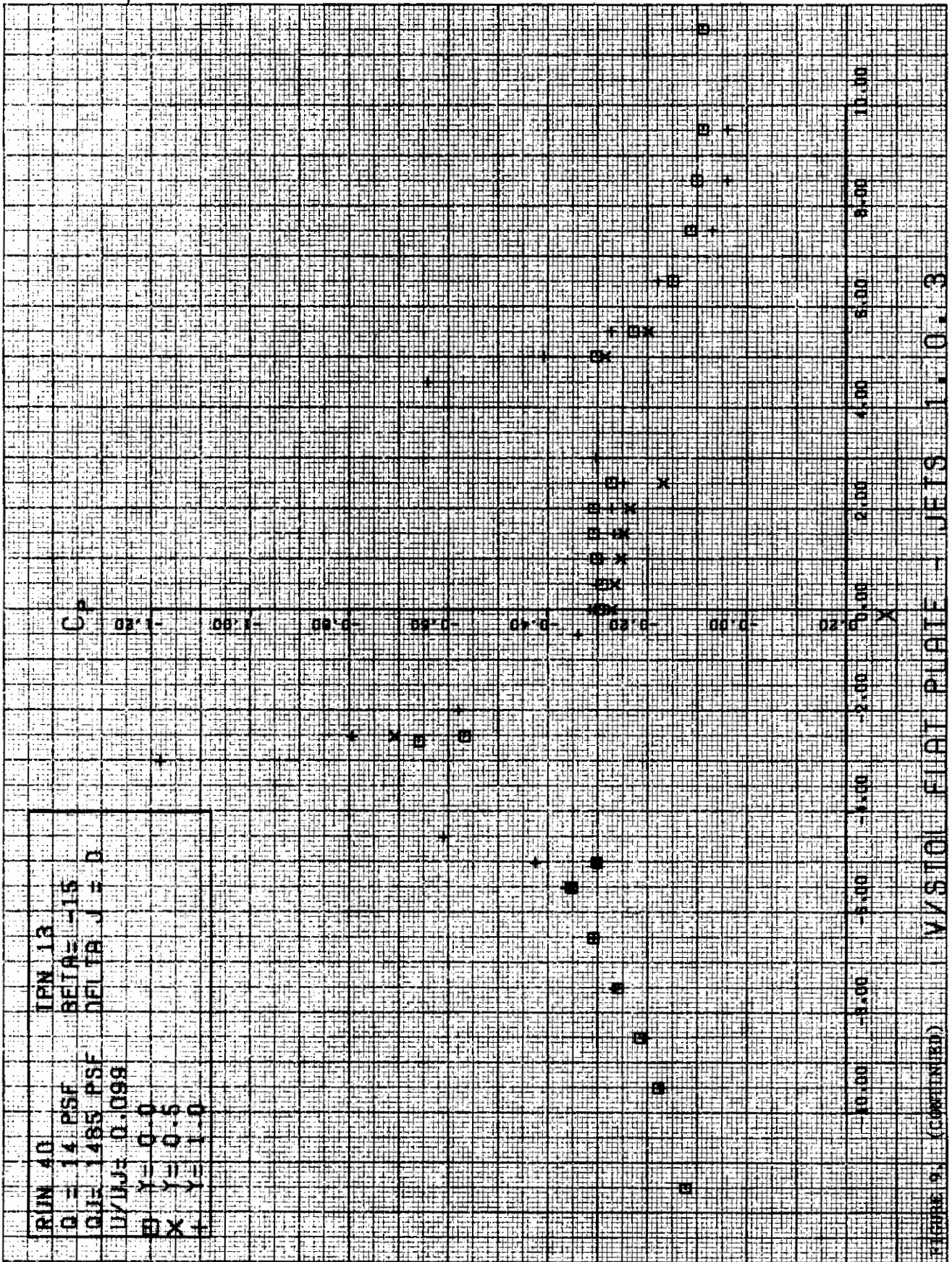


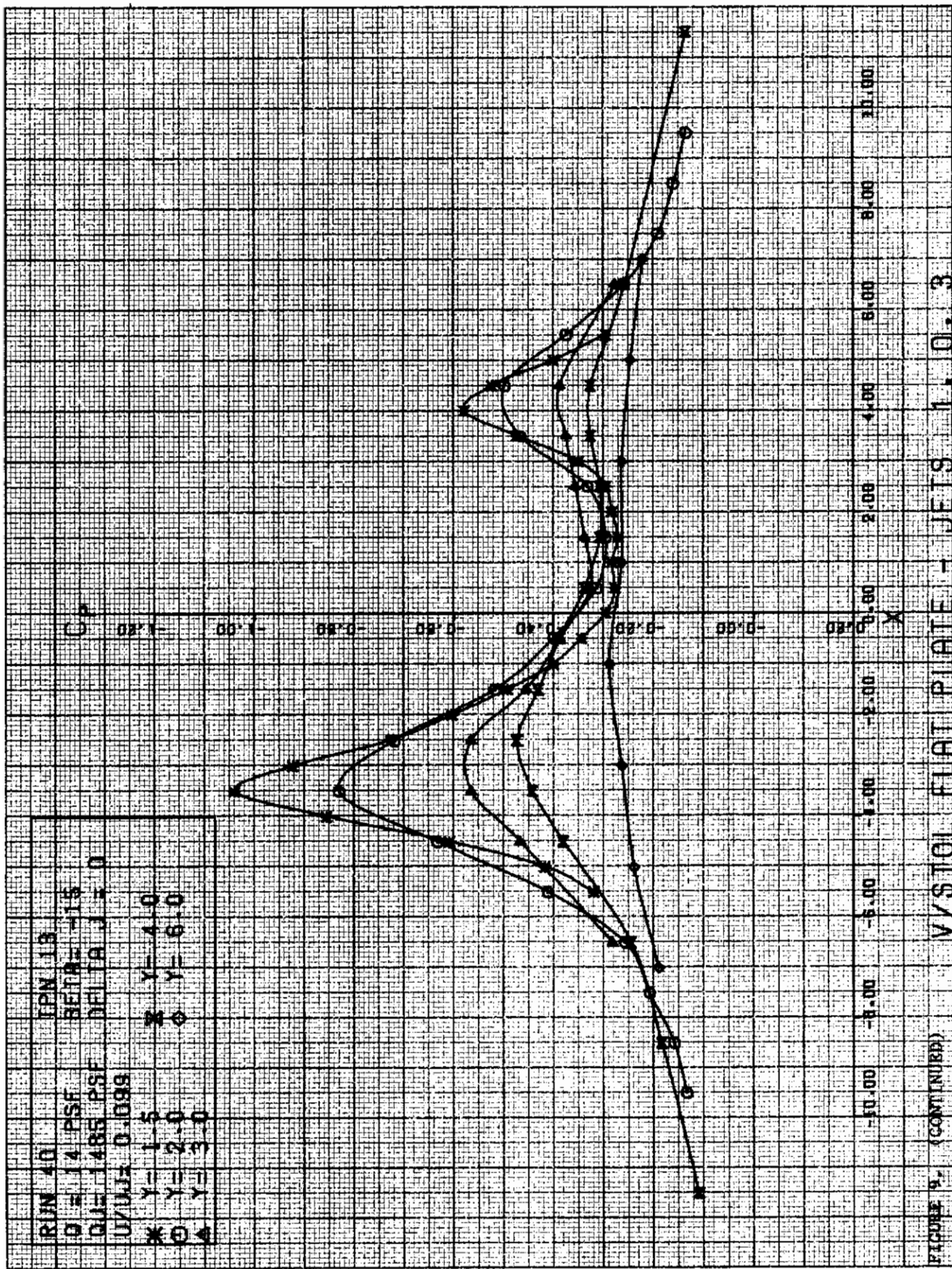
FIGURE 9. (CONTINUED) V/STOL FLIGHT PROFILE - JETS 1, 0, 3

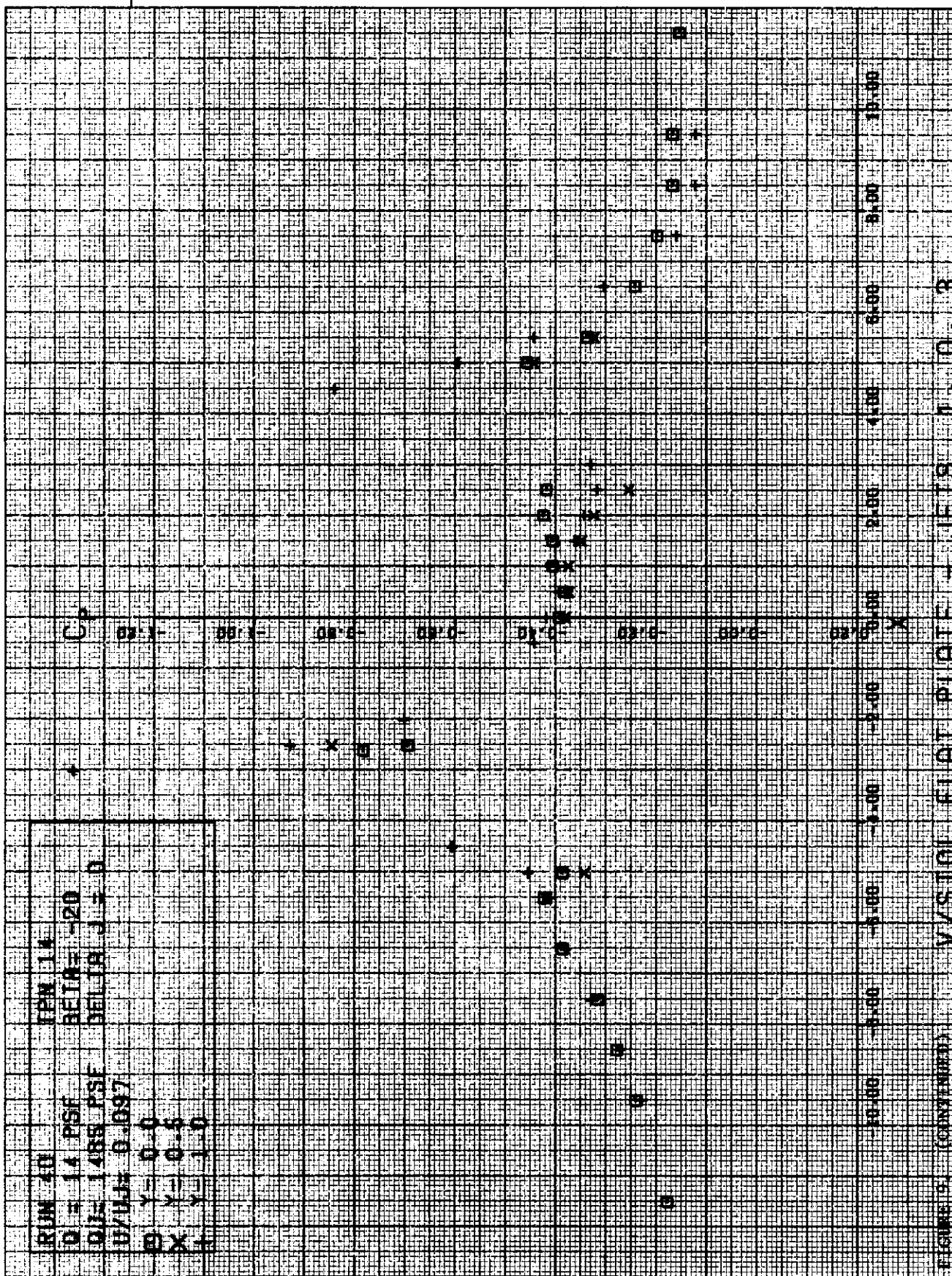


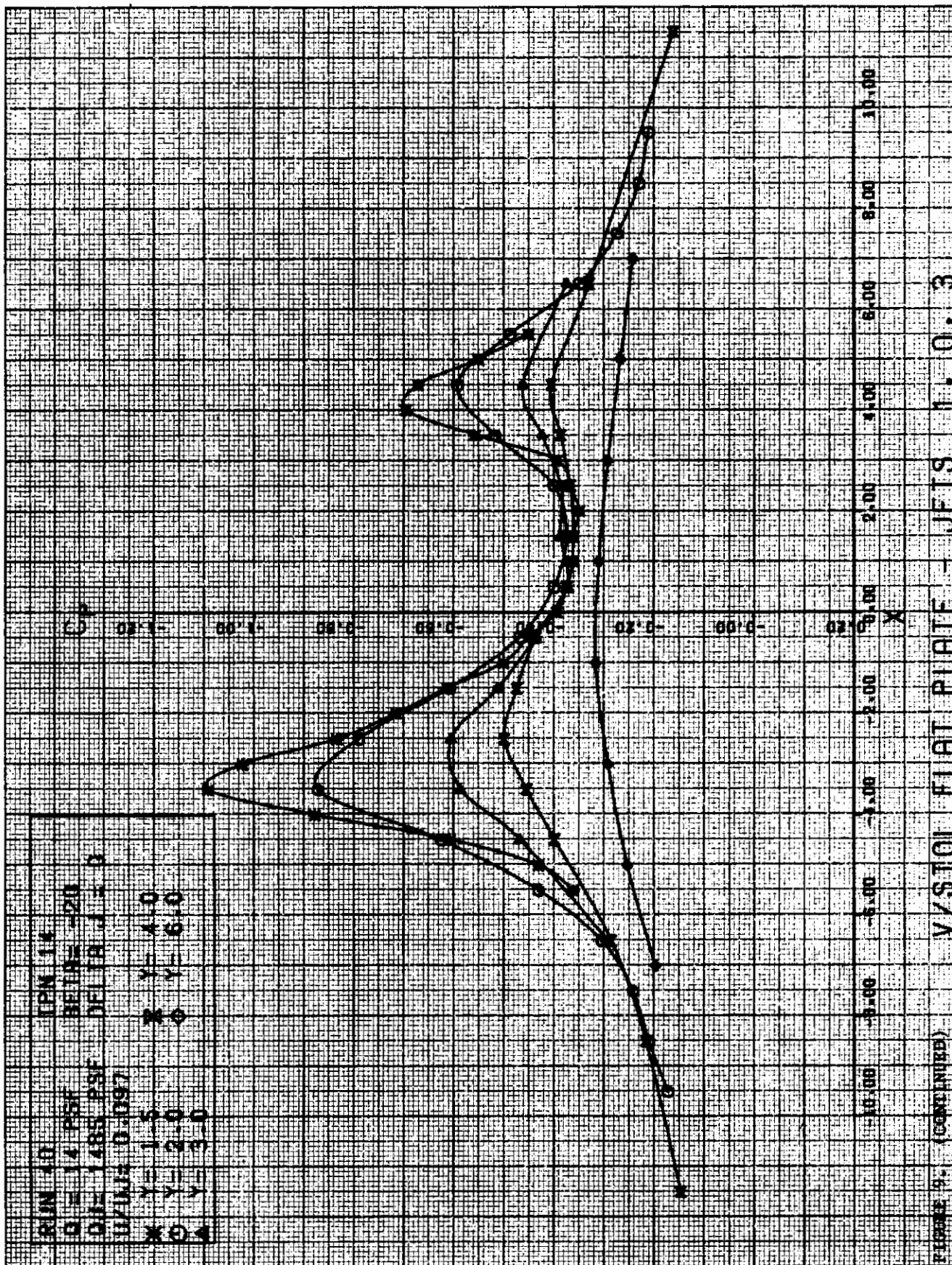


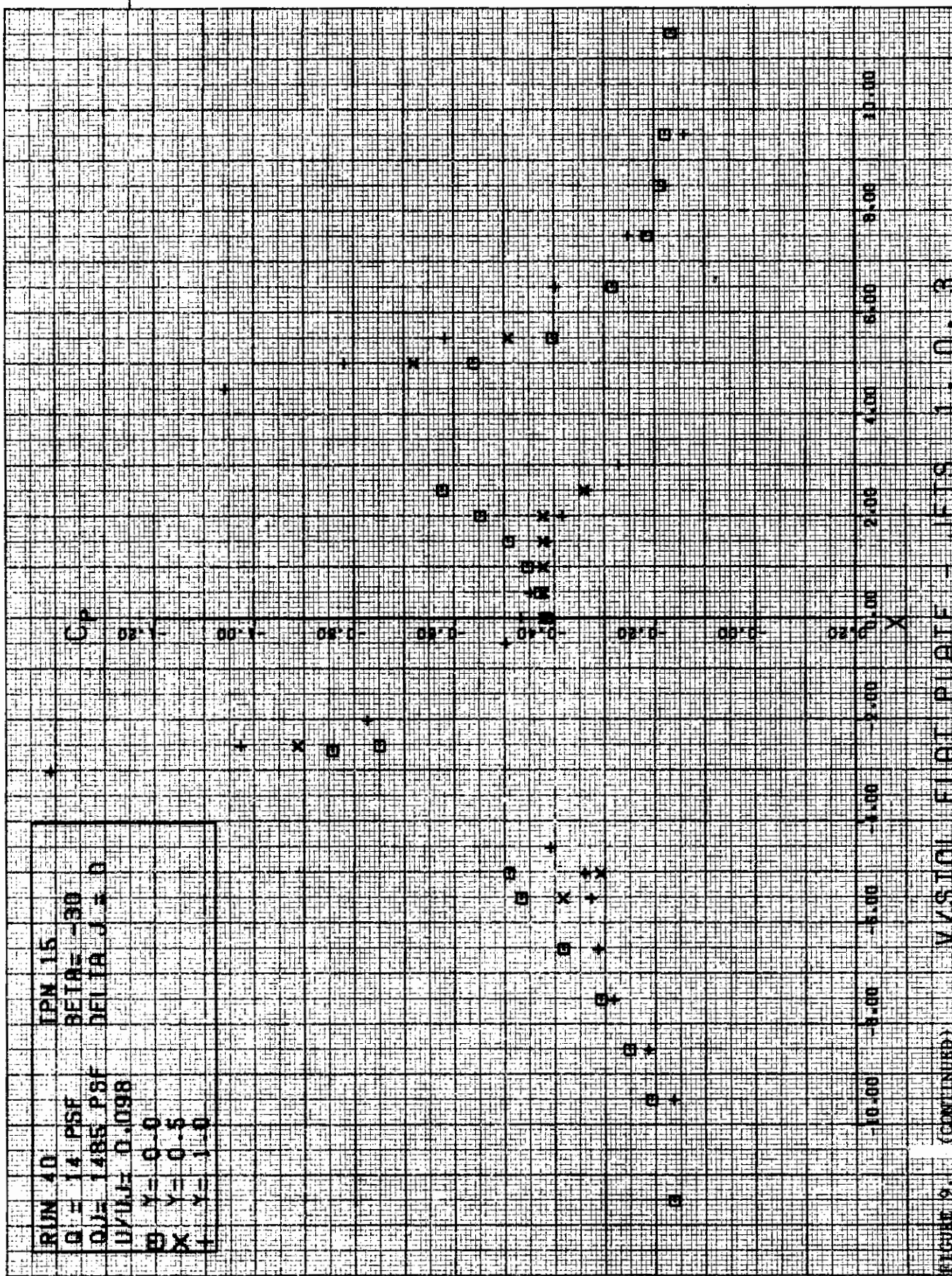


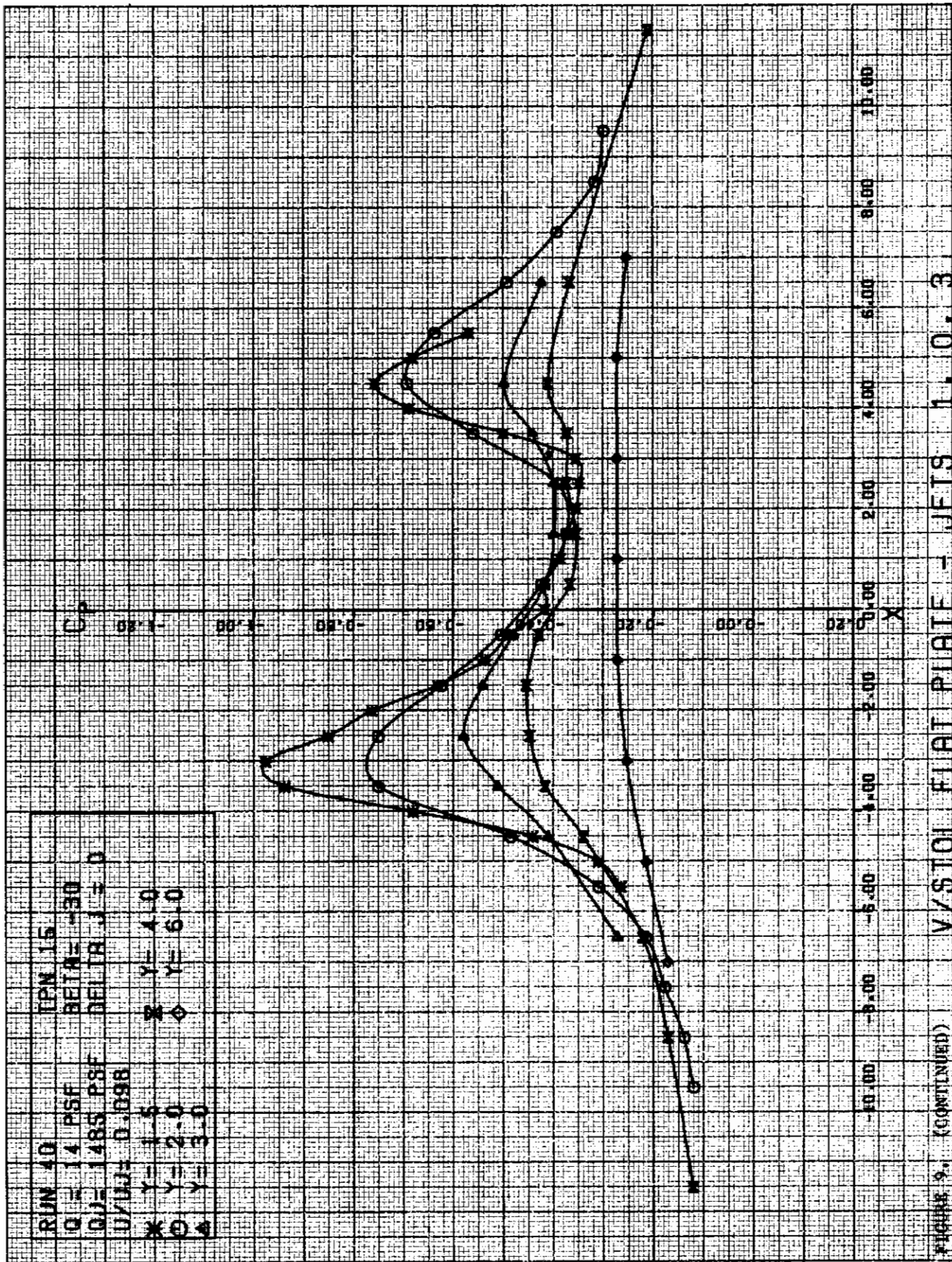


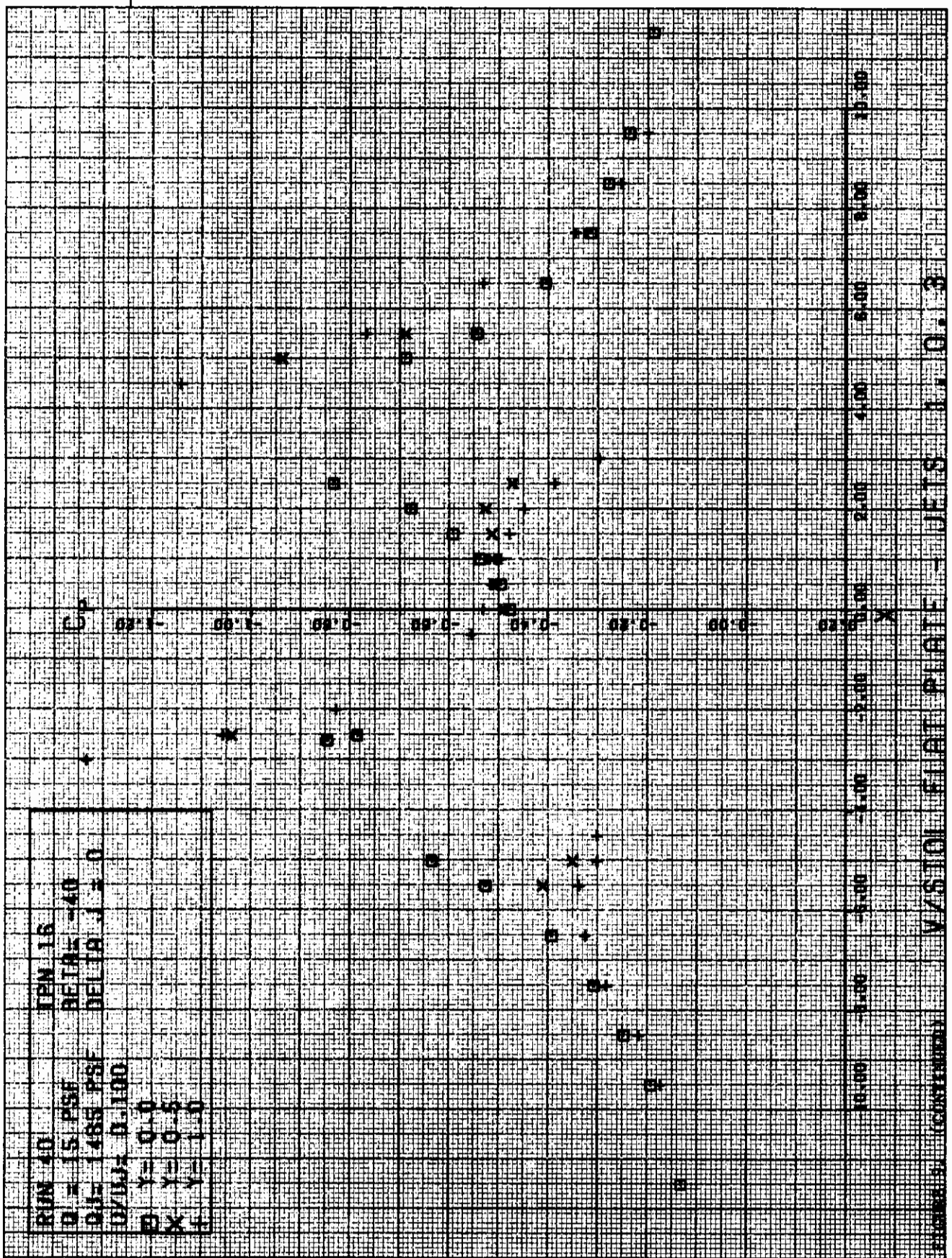


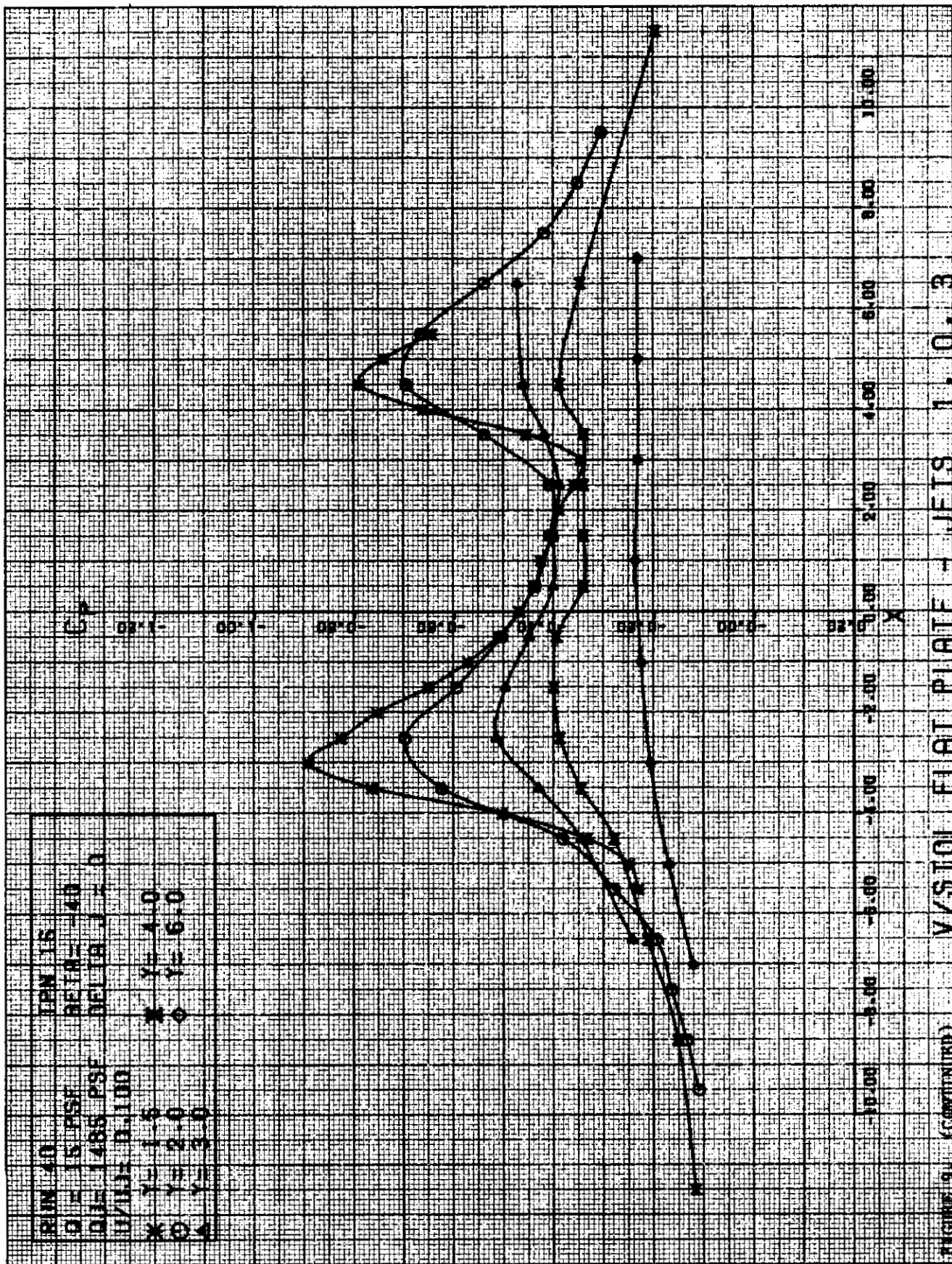


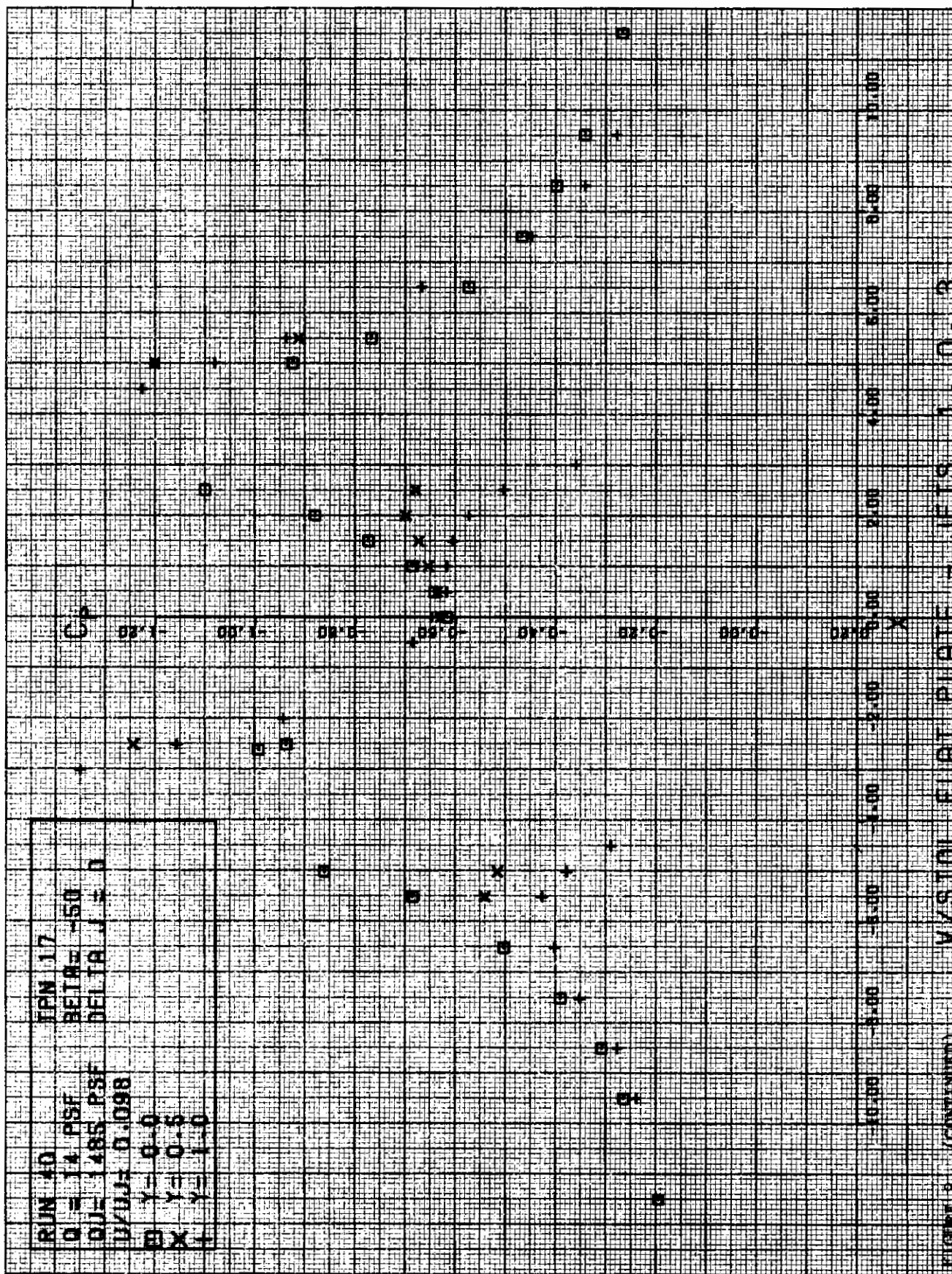


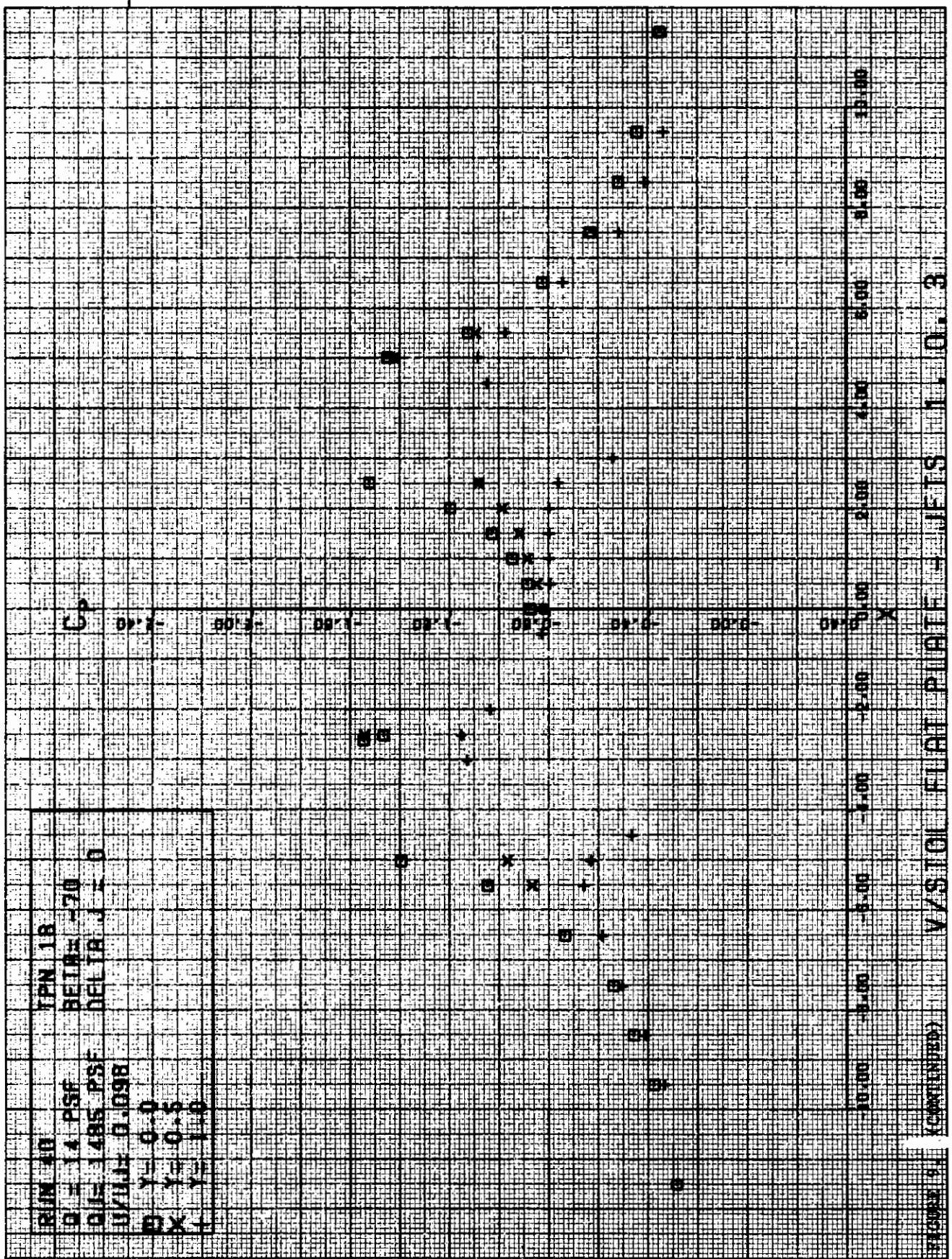


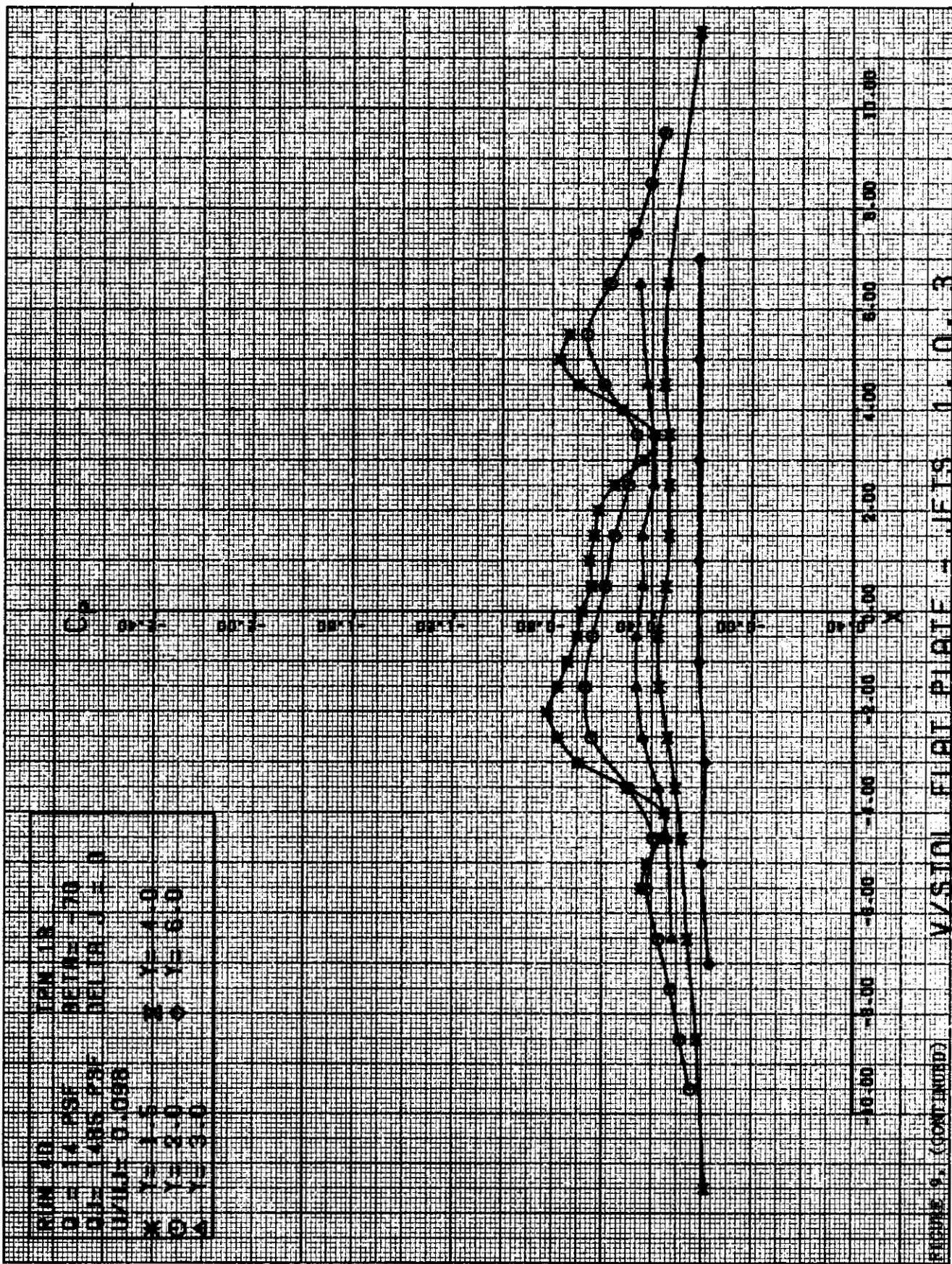












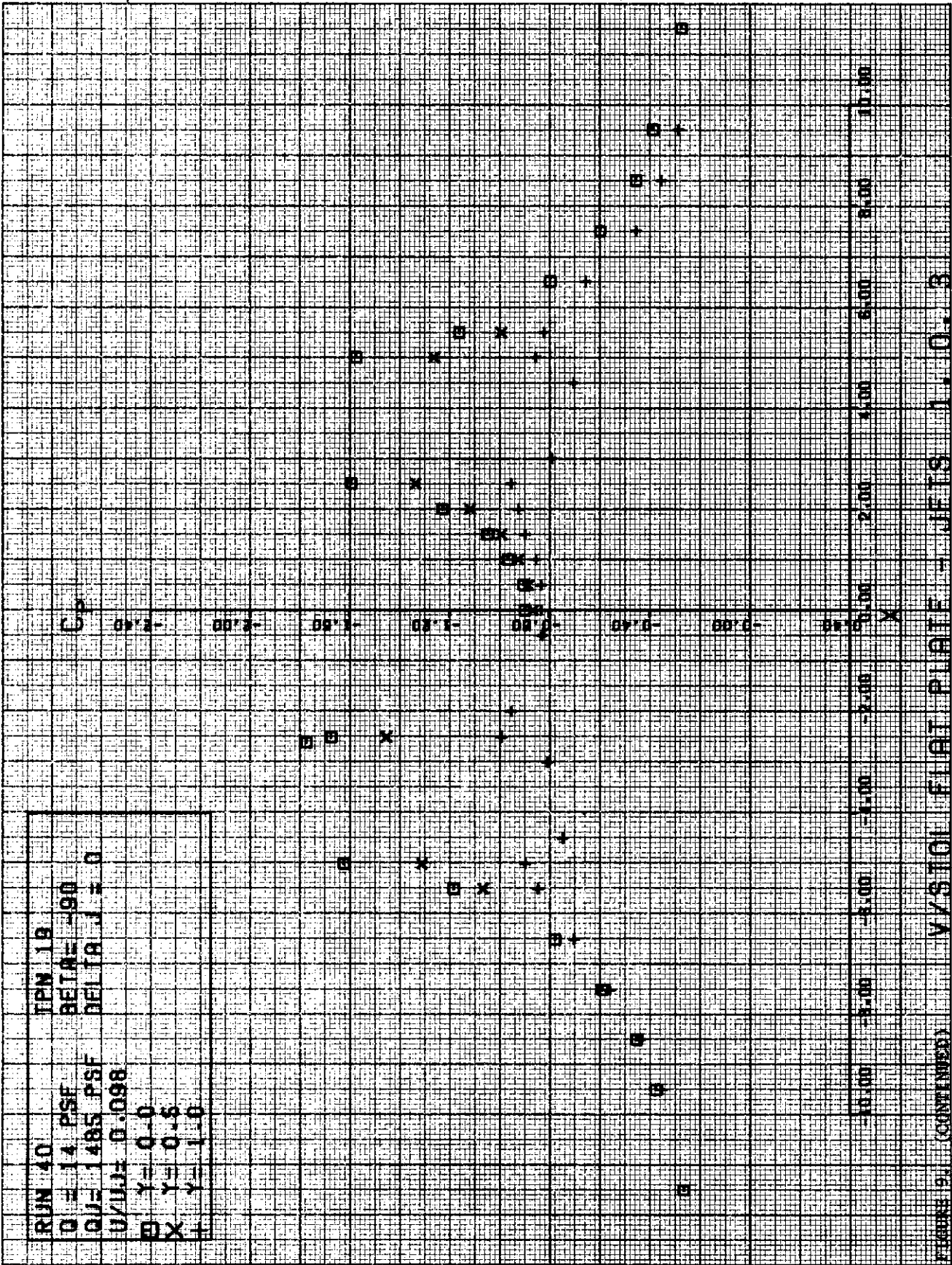


FIGURE 21 (CONTINUED)

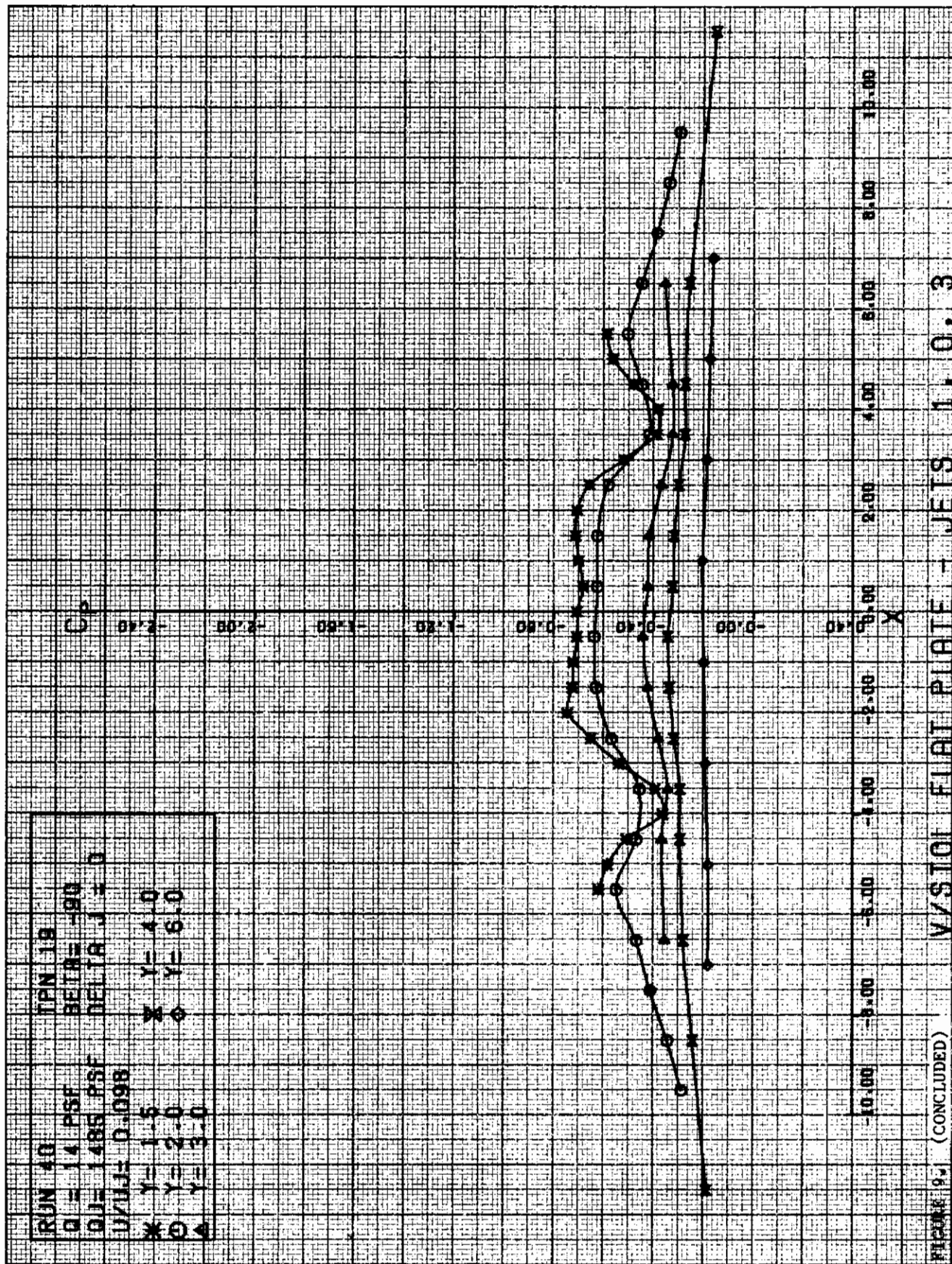
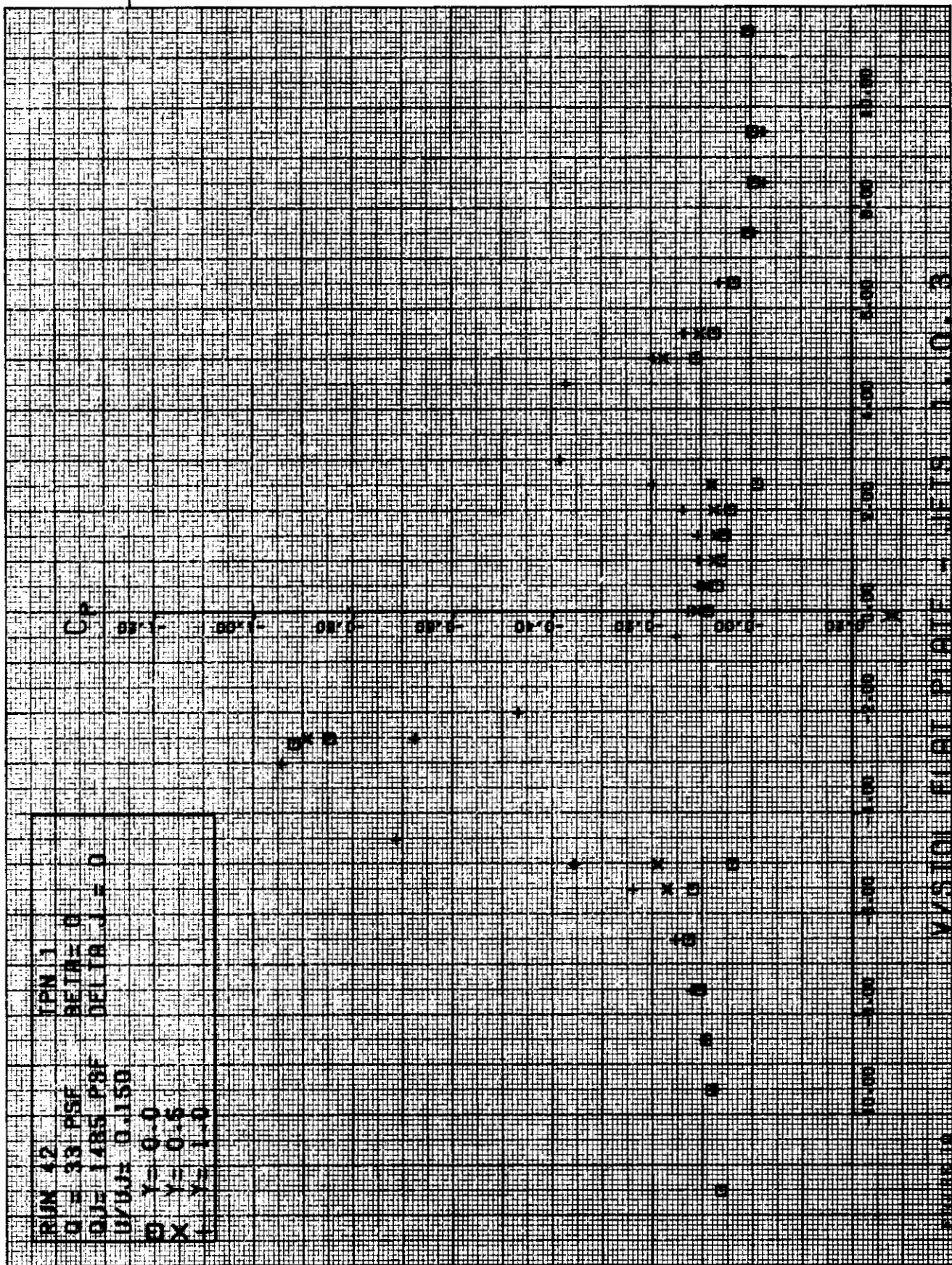
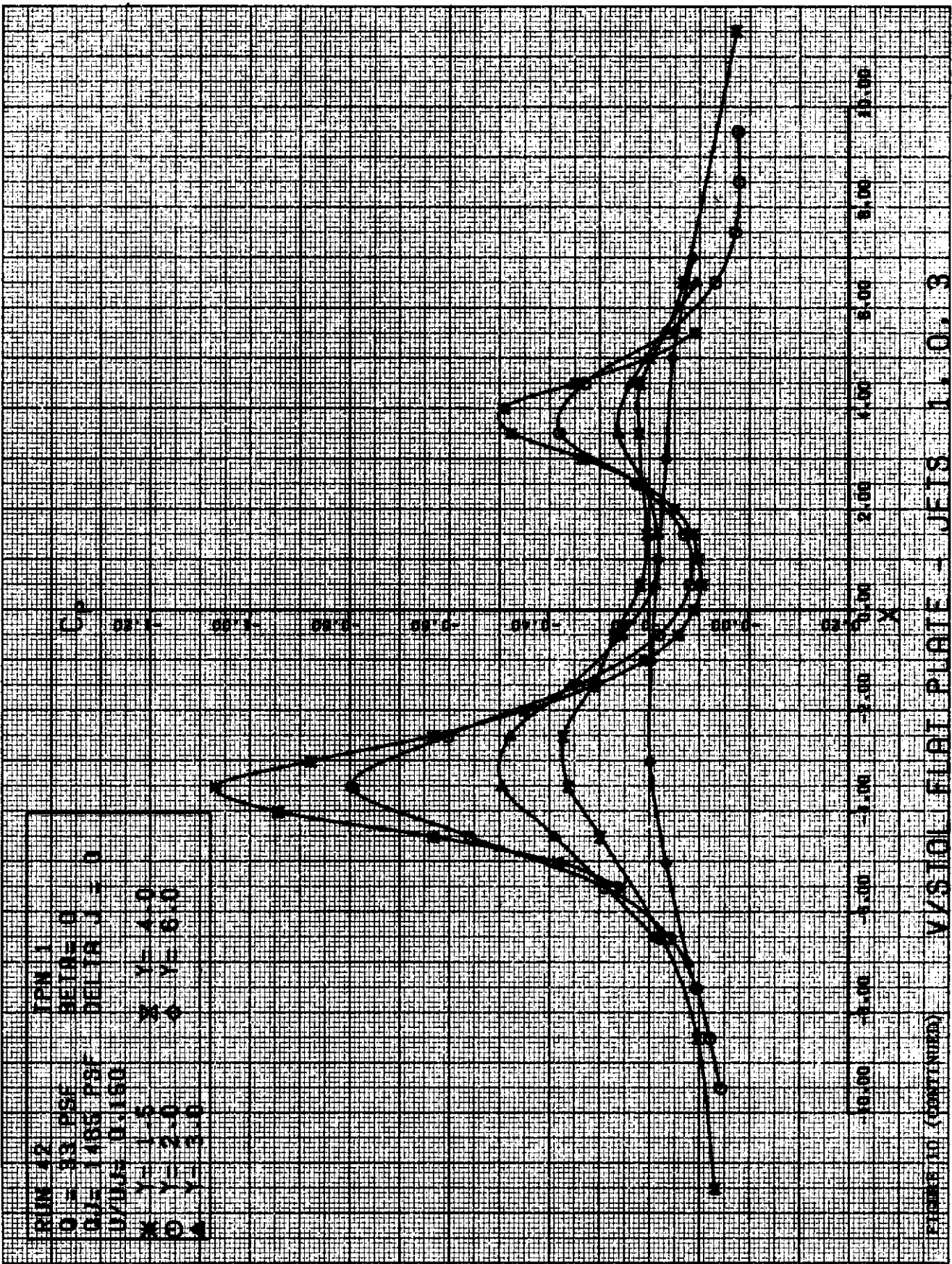
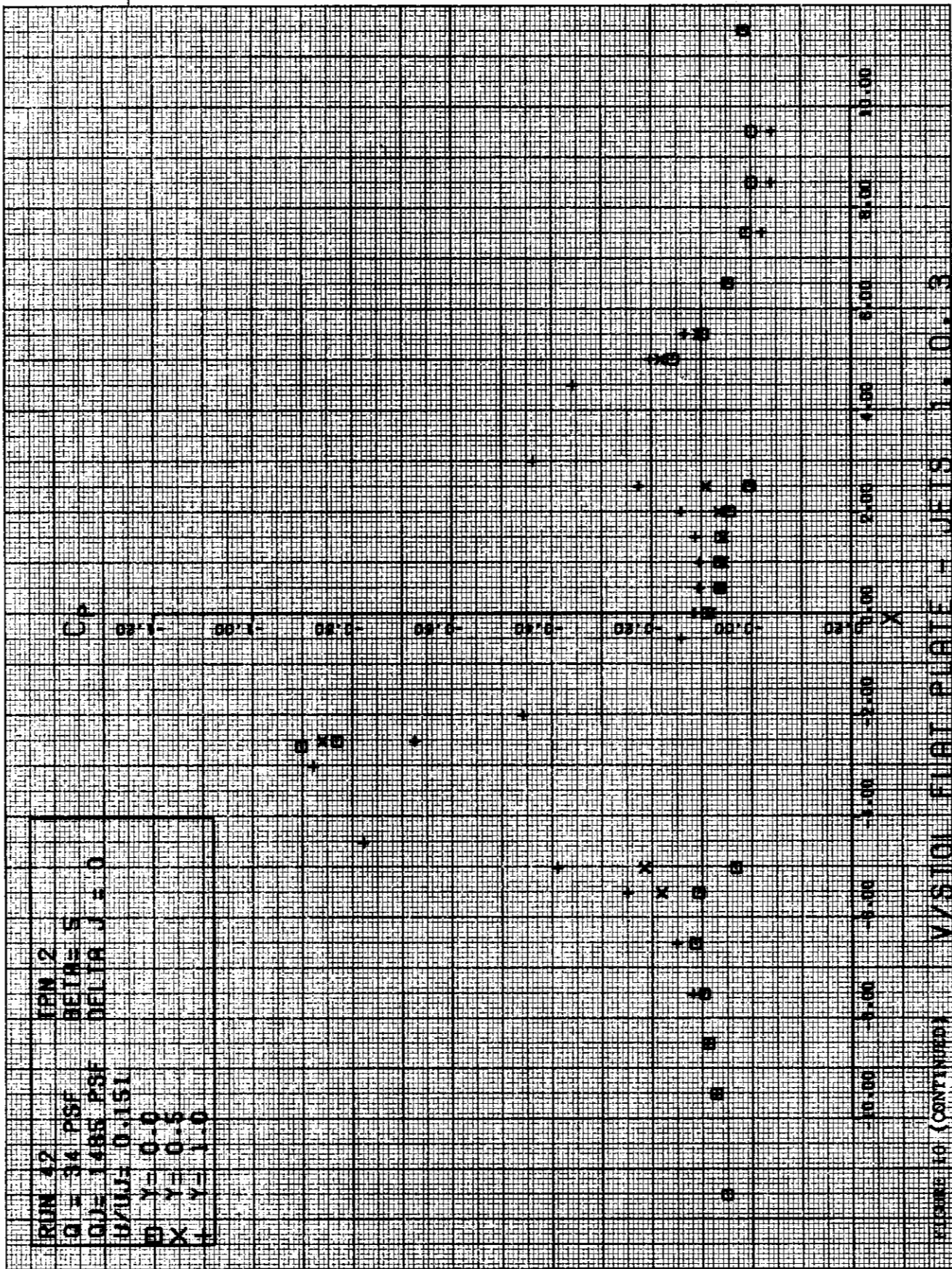


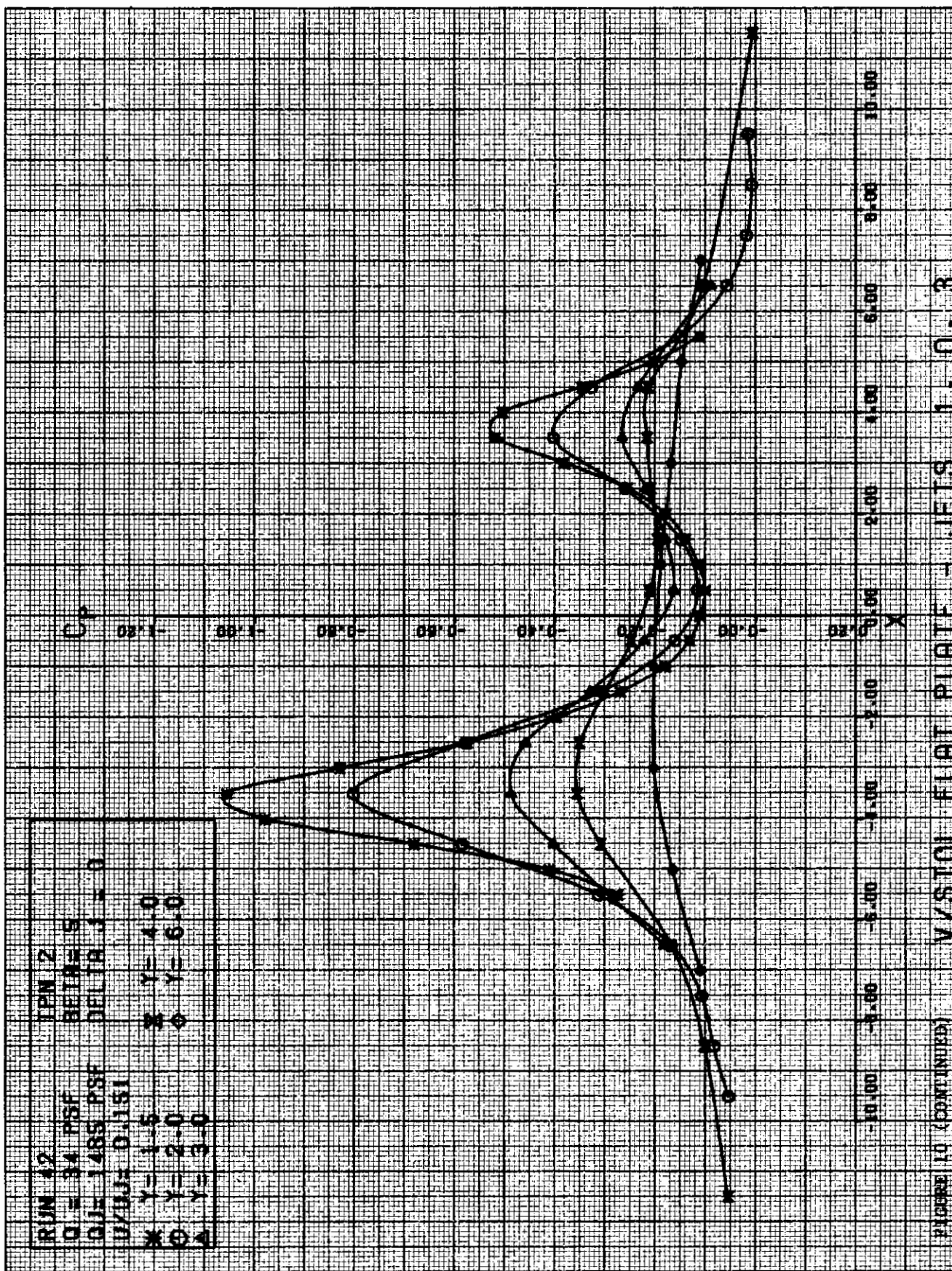
FIGURE 9. (CONCLUDED)

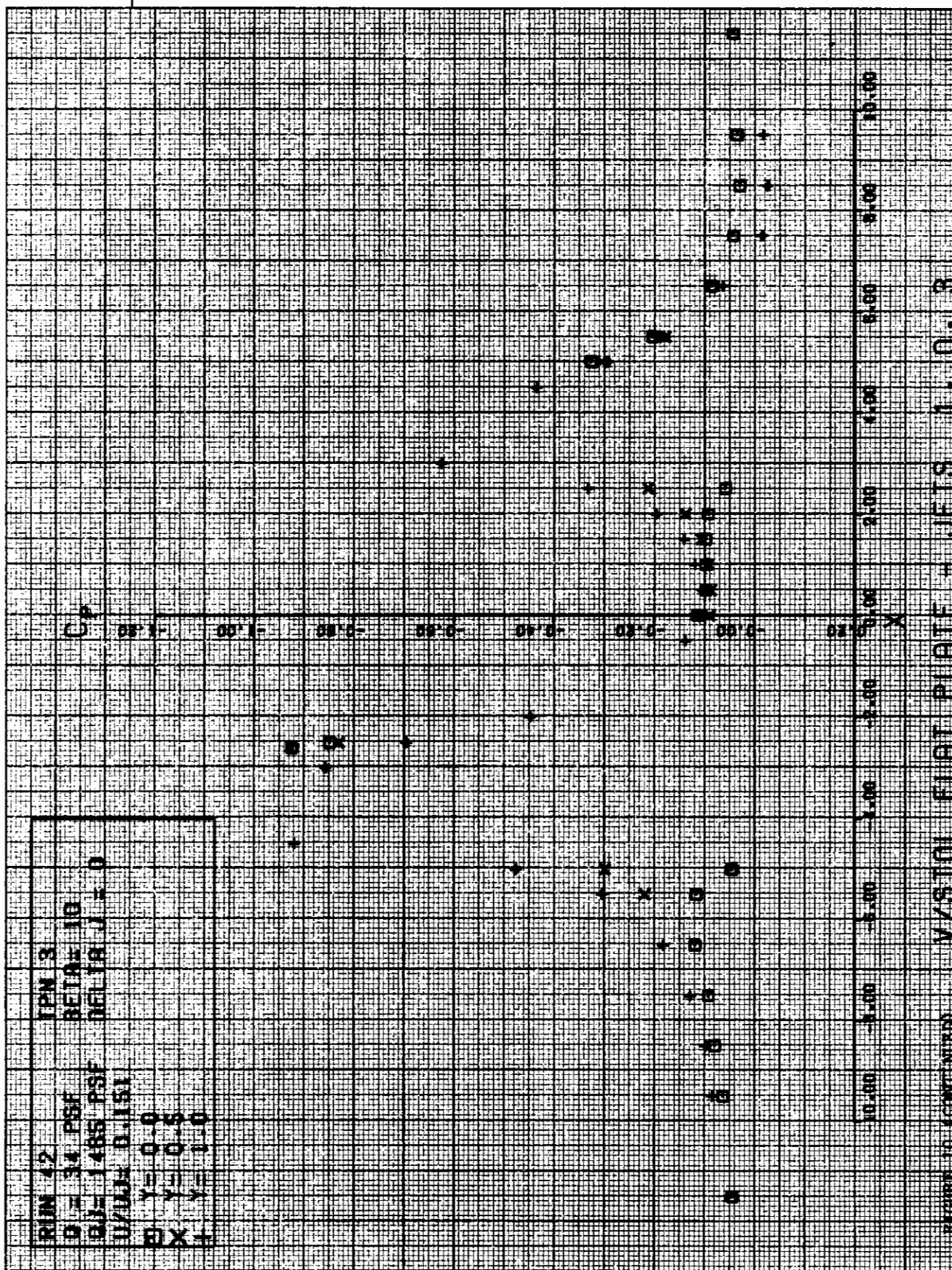


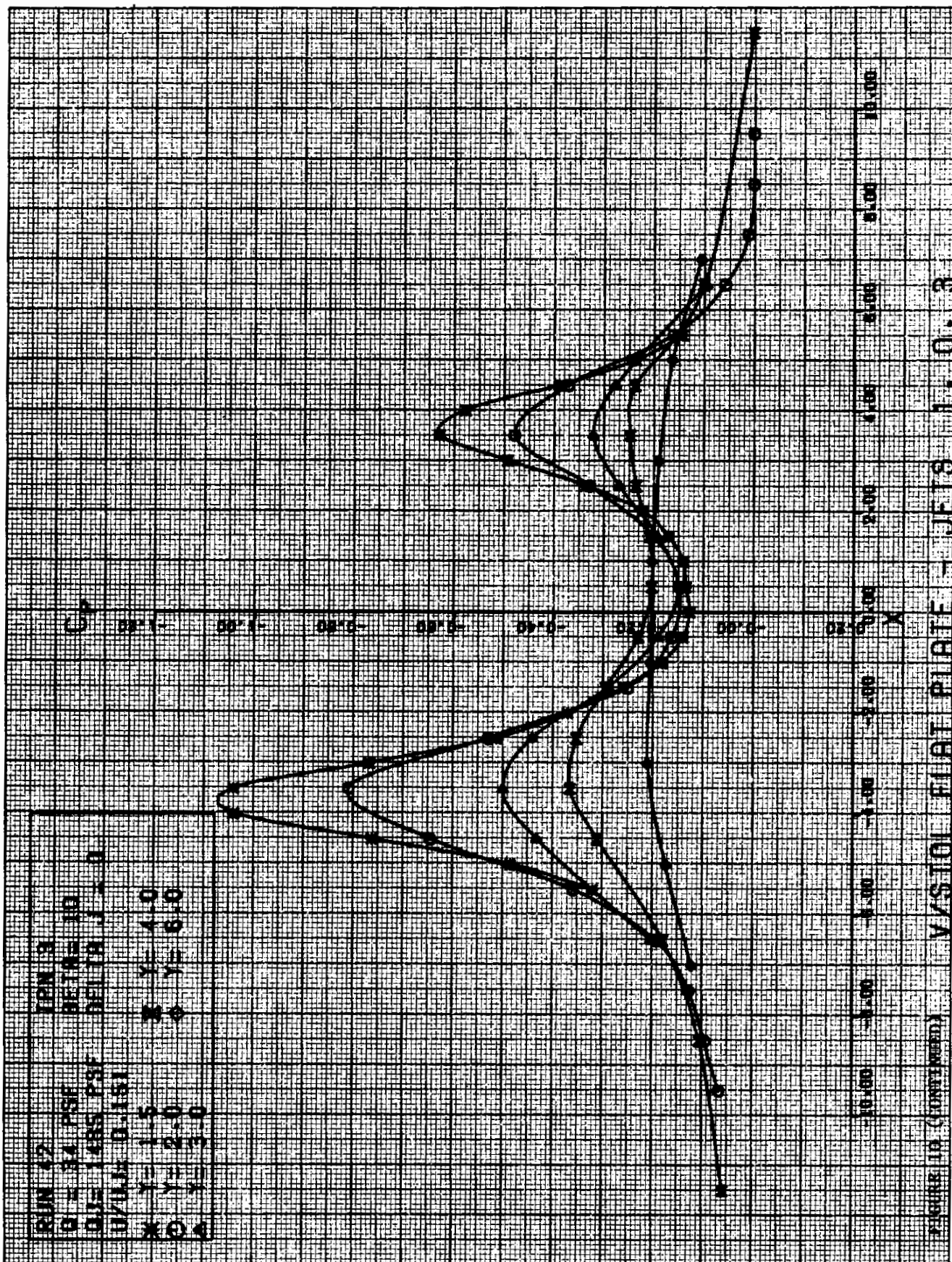


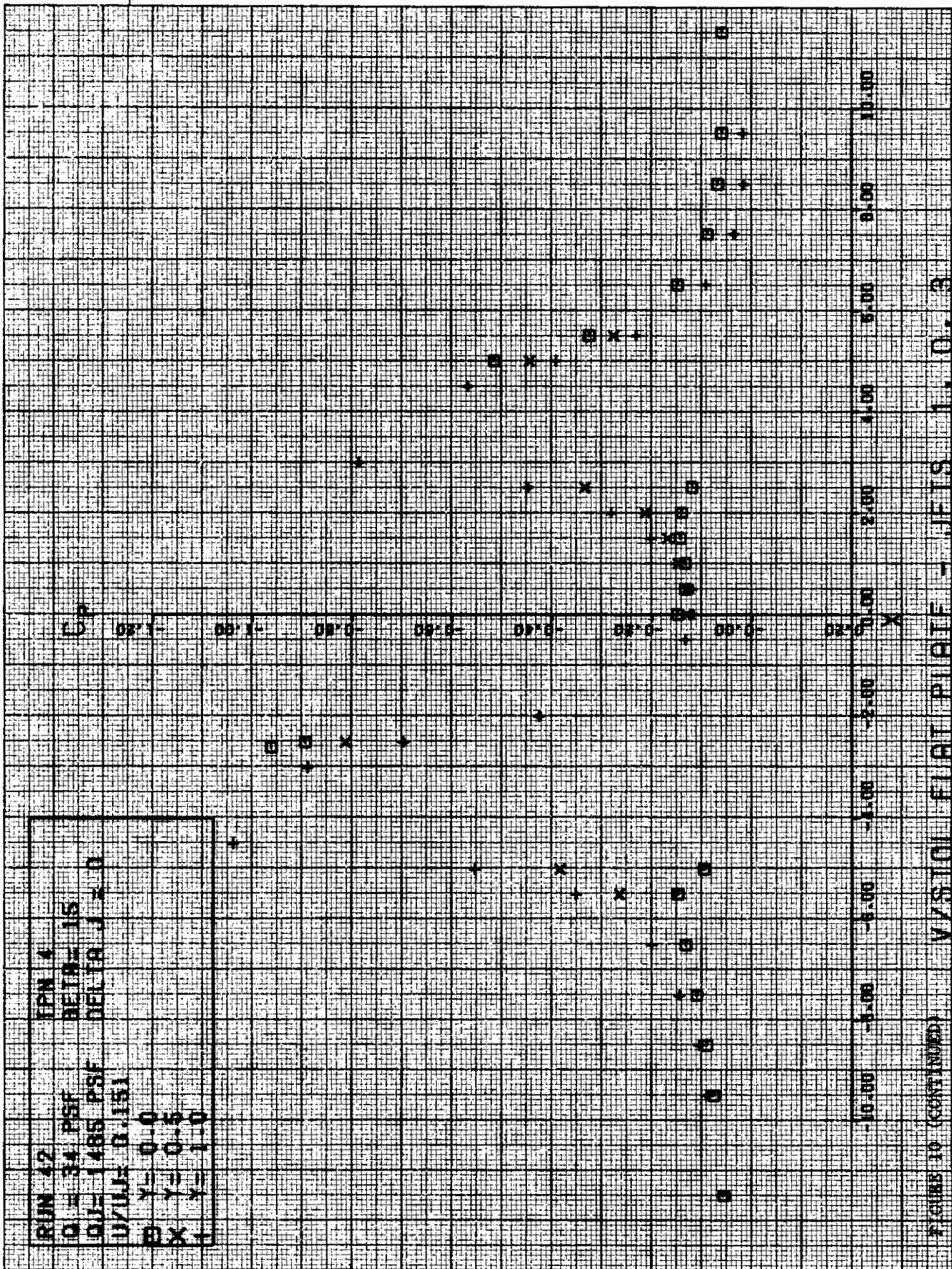


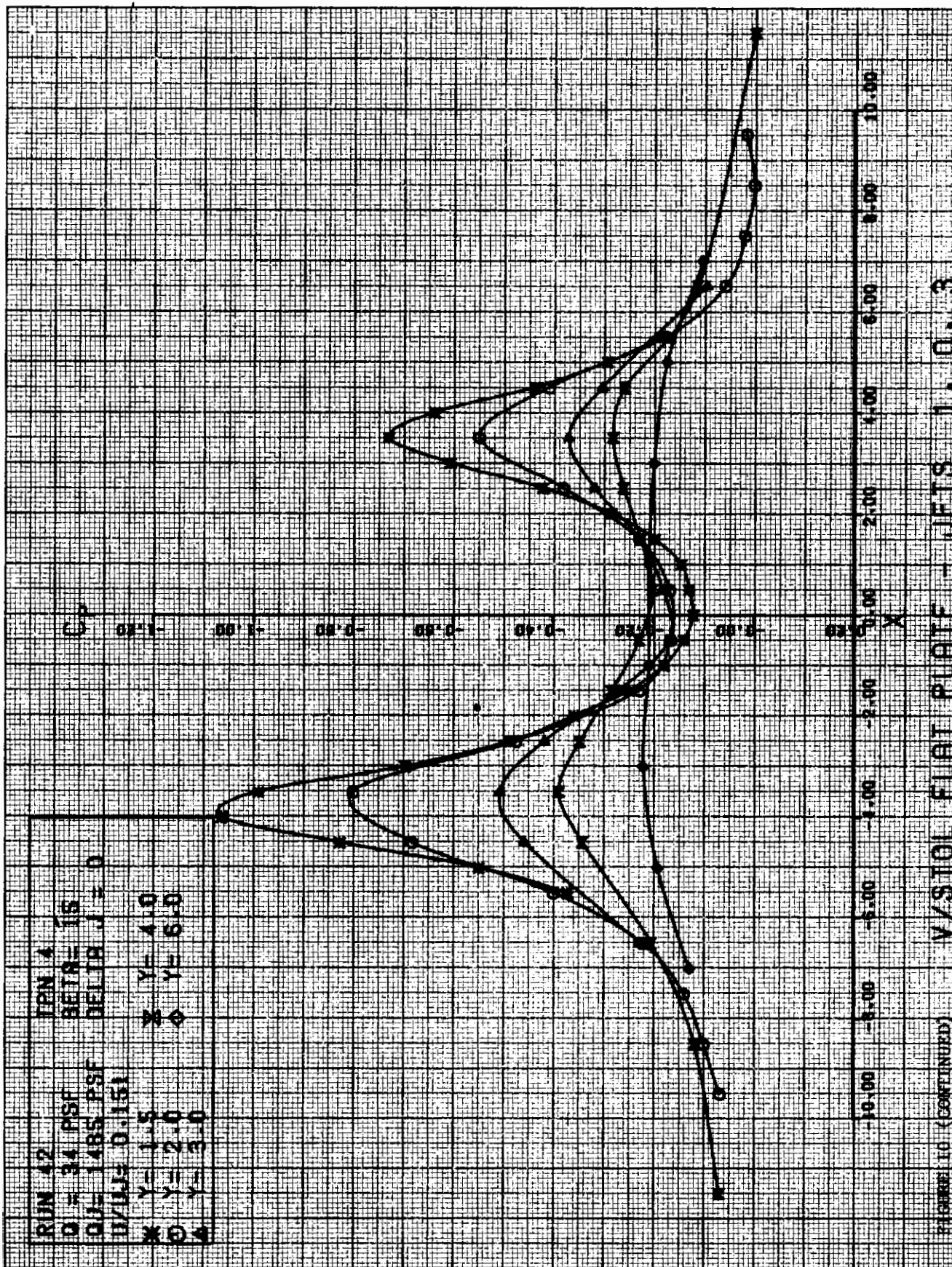
VISTOL FIAT PLATE - JETS 1.0.3
 (CONTINUED)

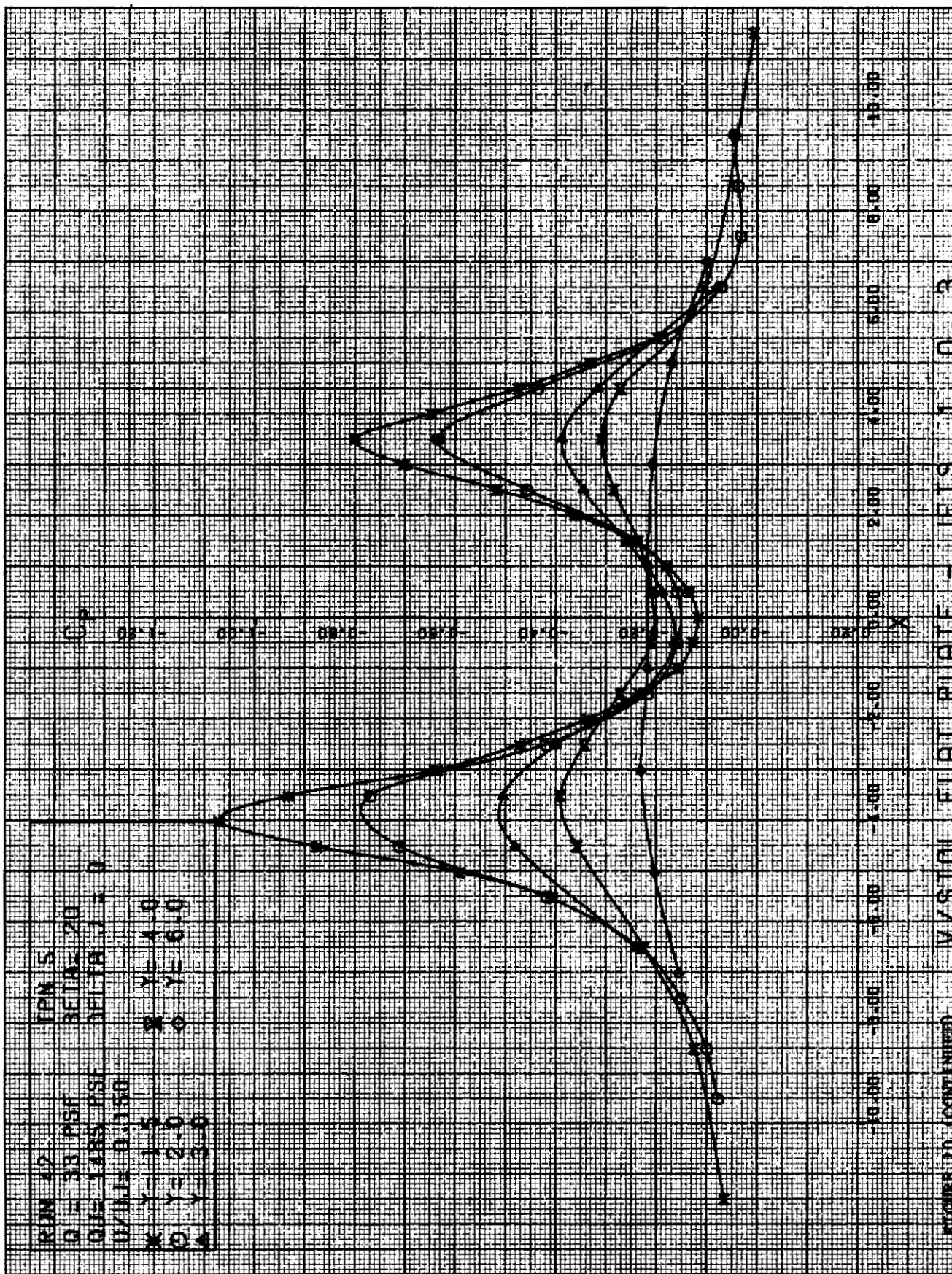


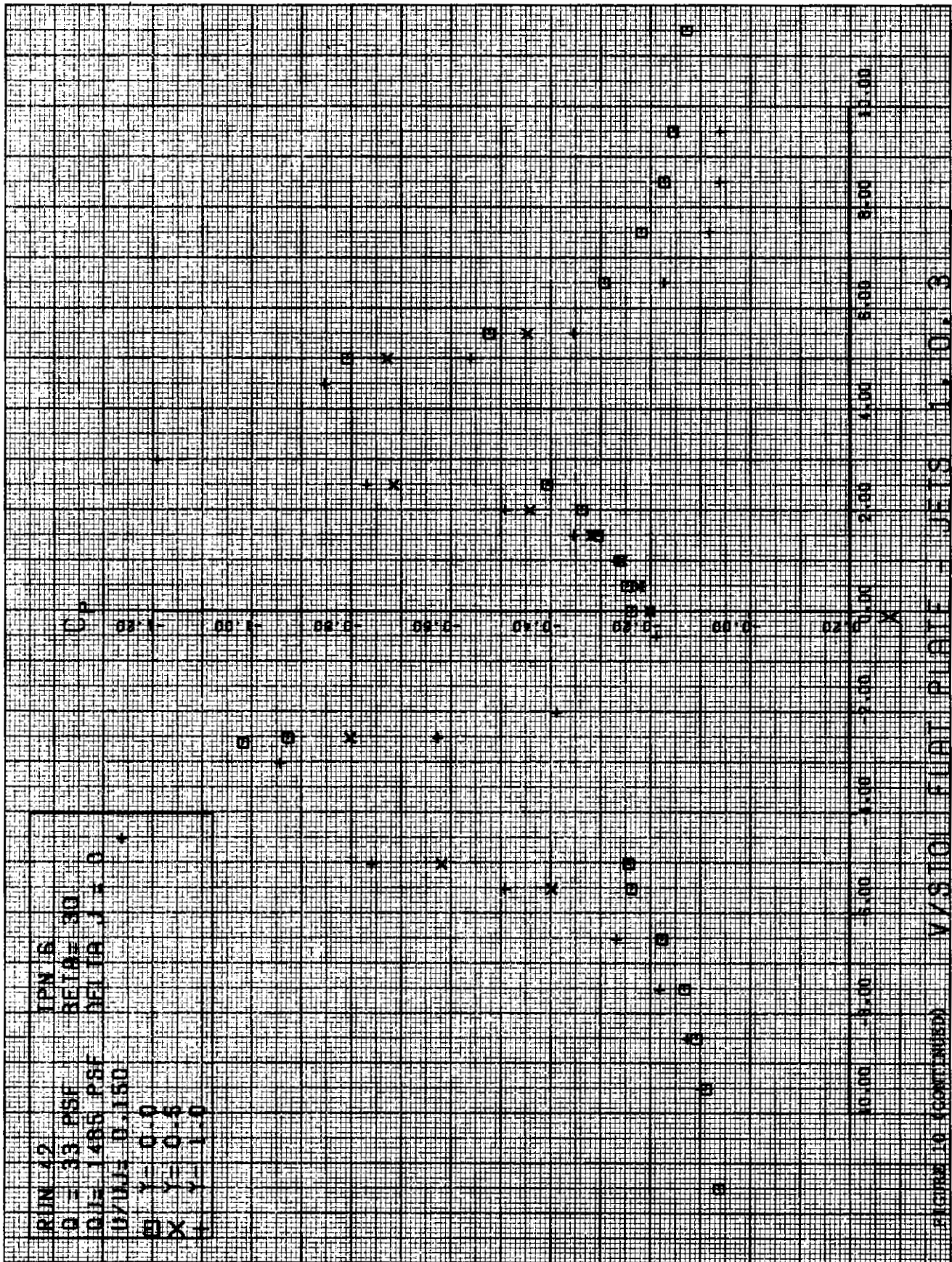


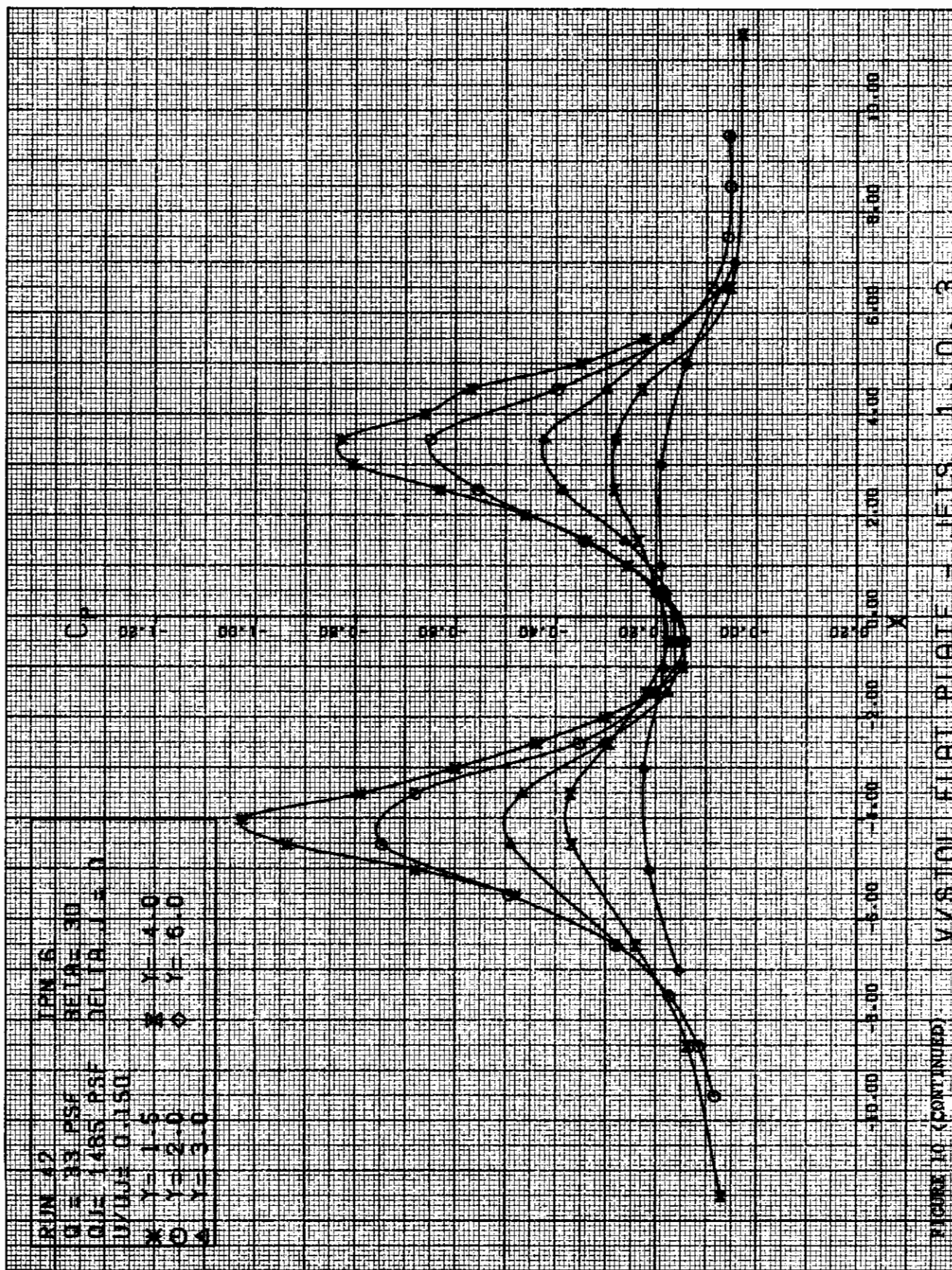












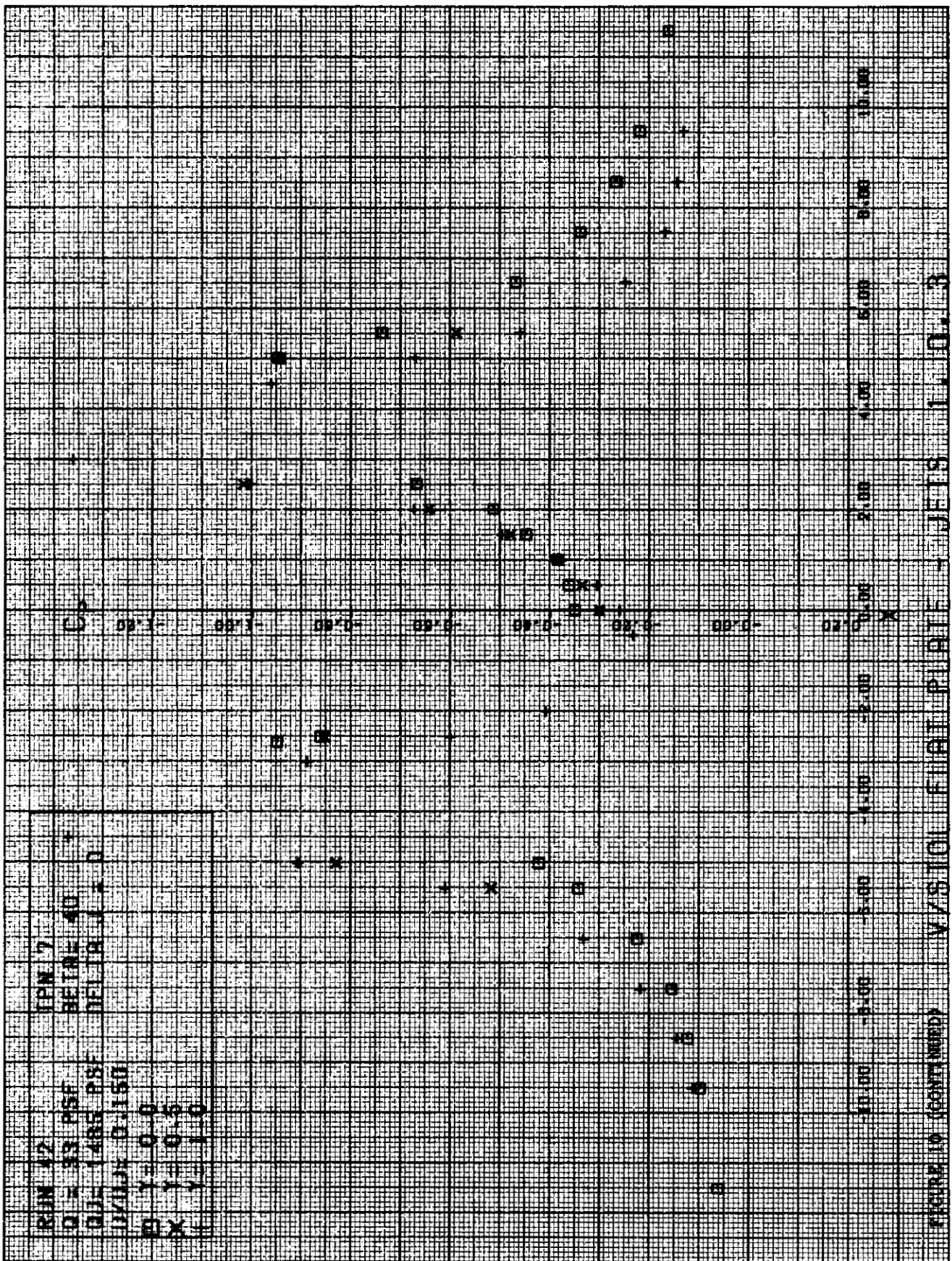
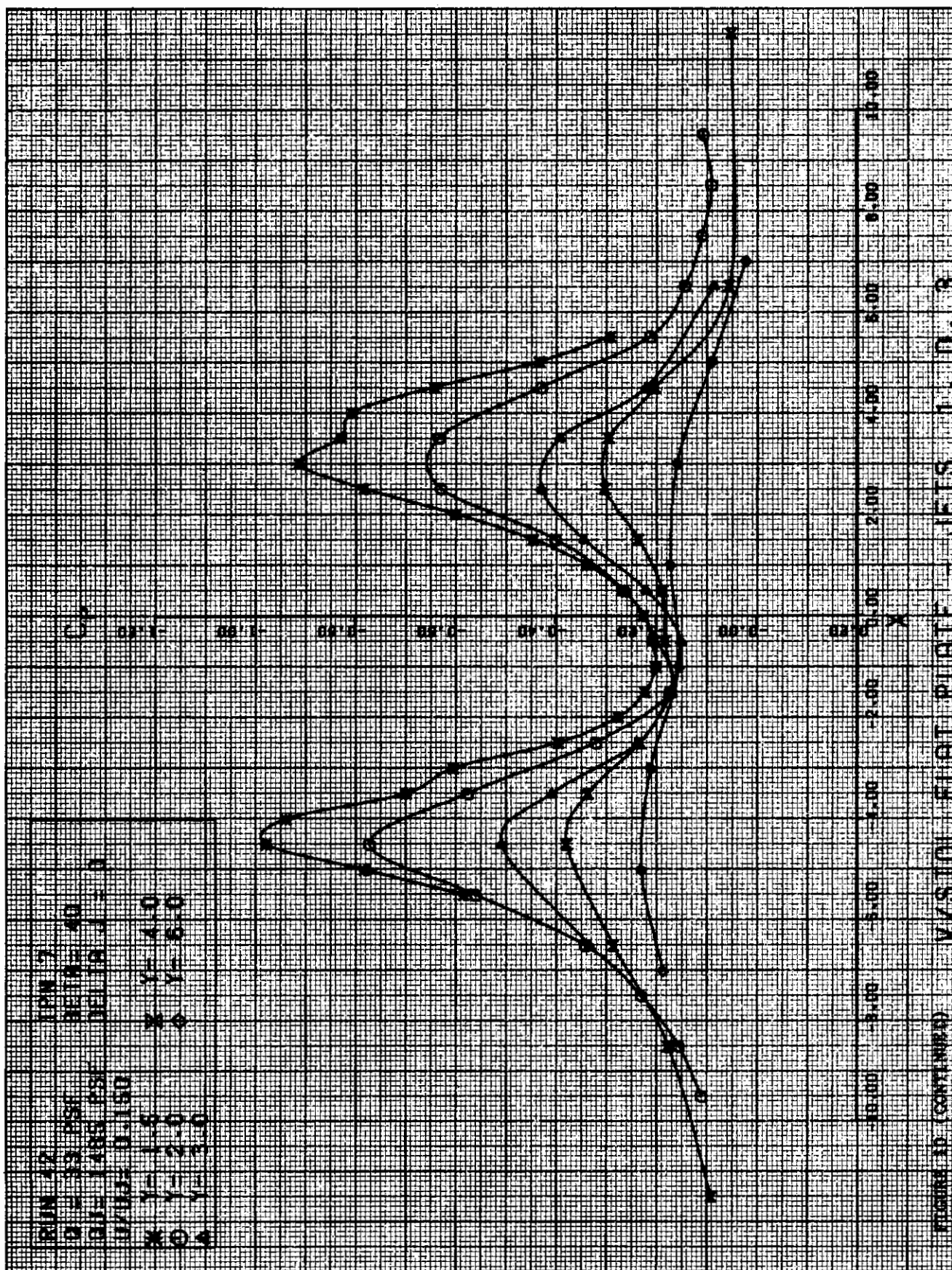
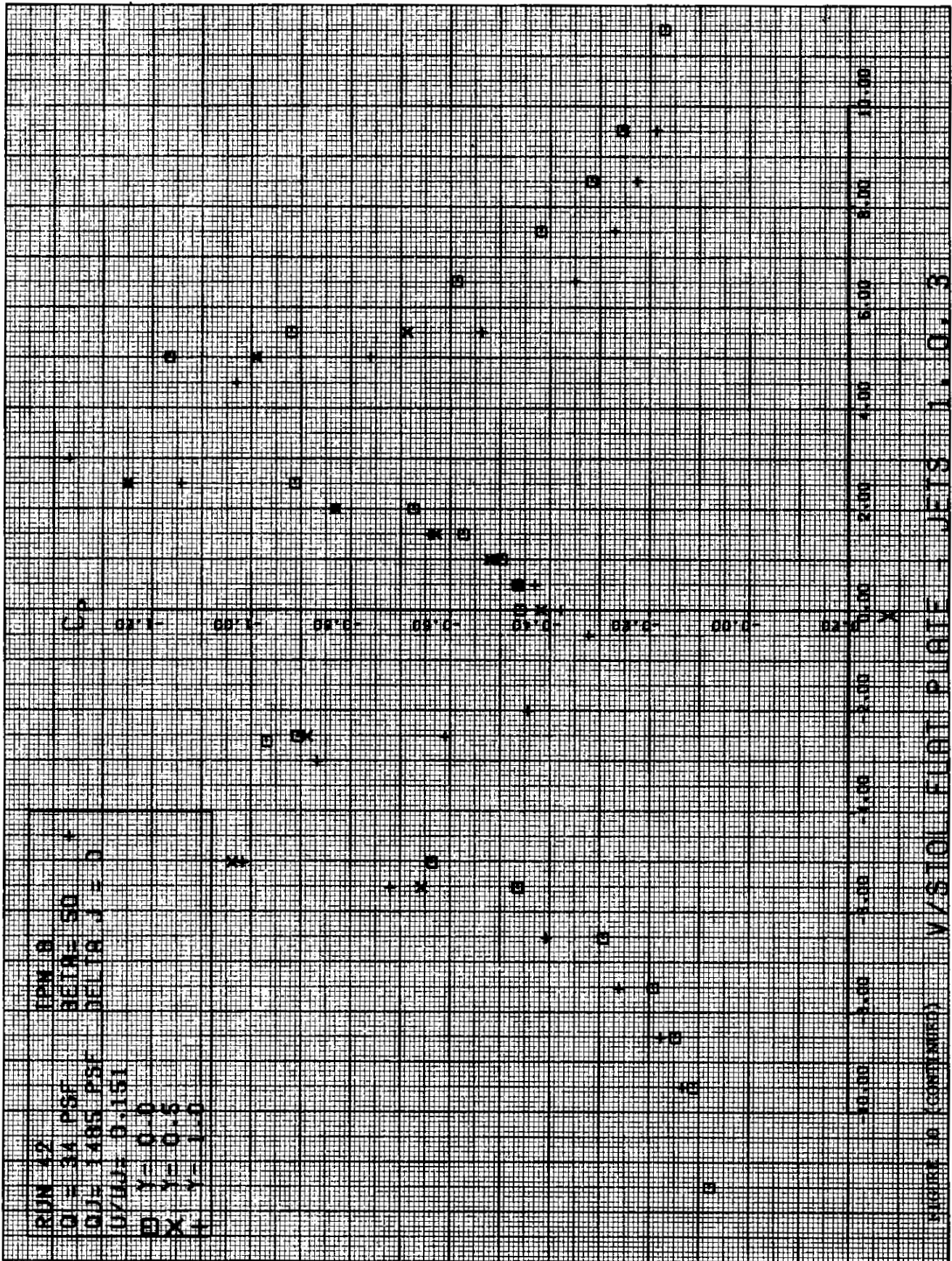
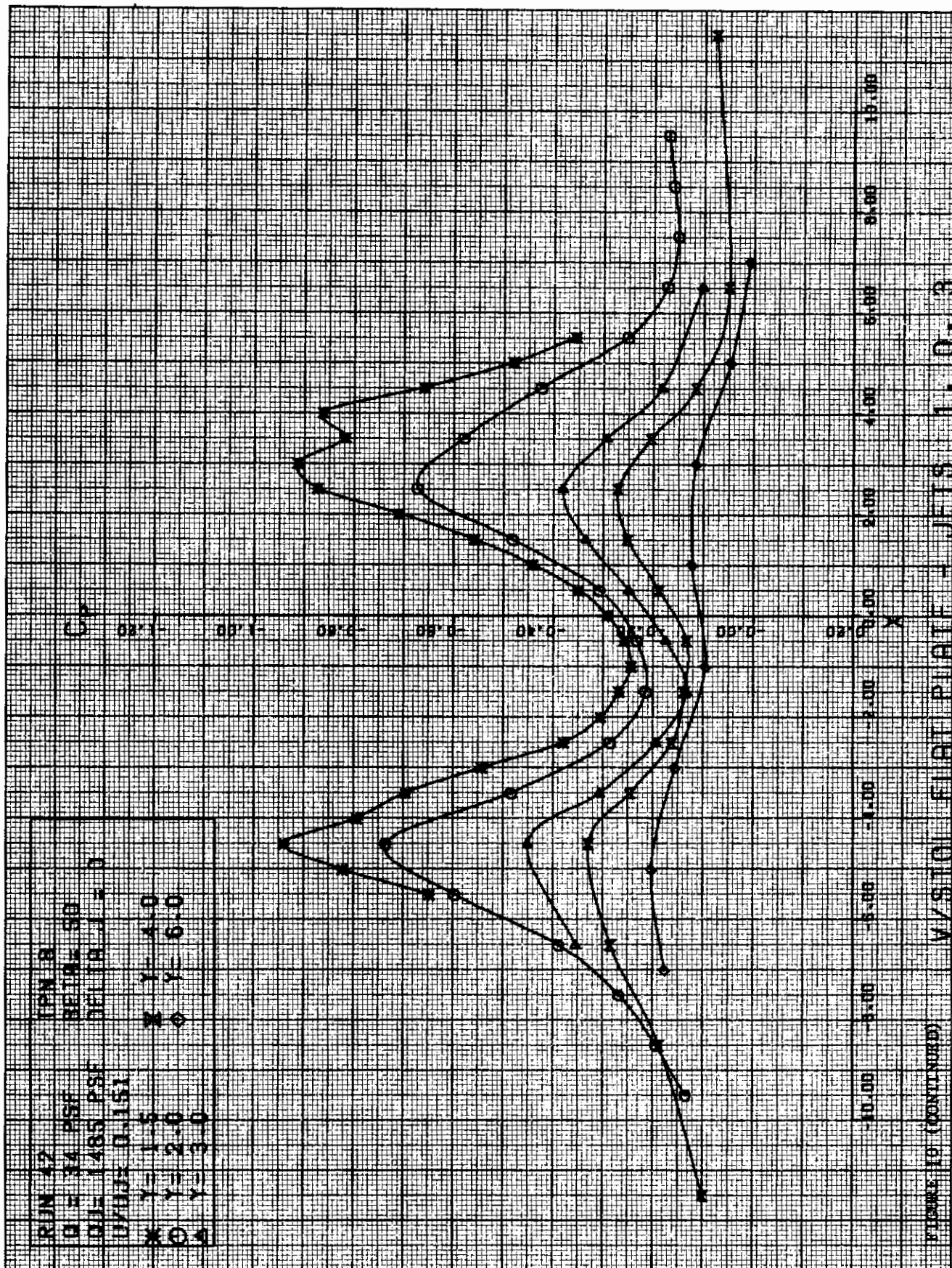
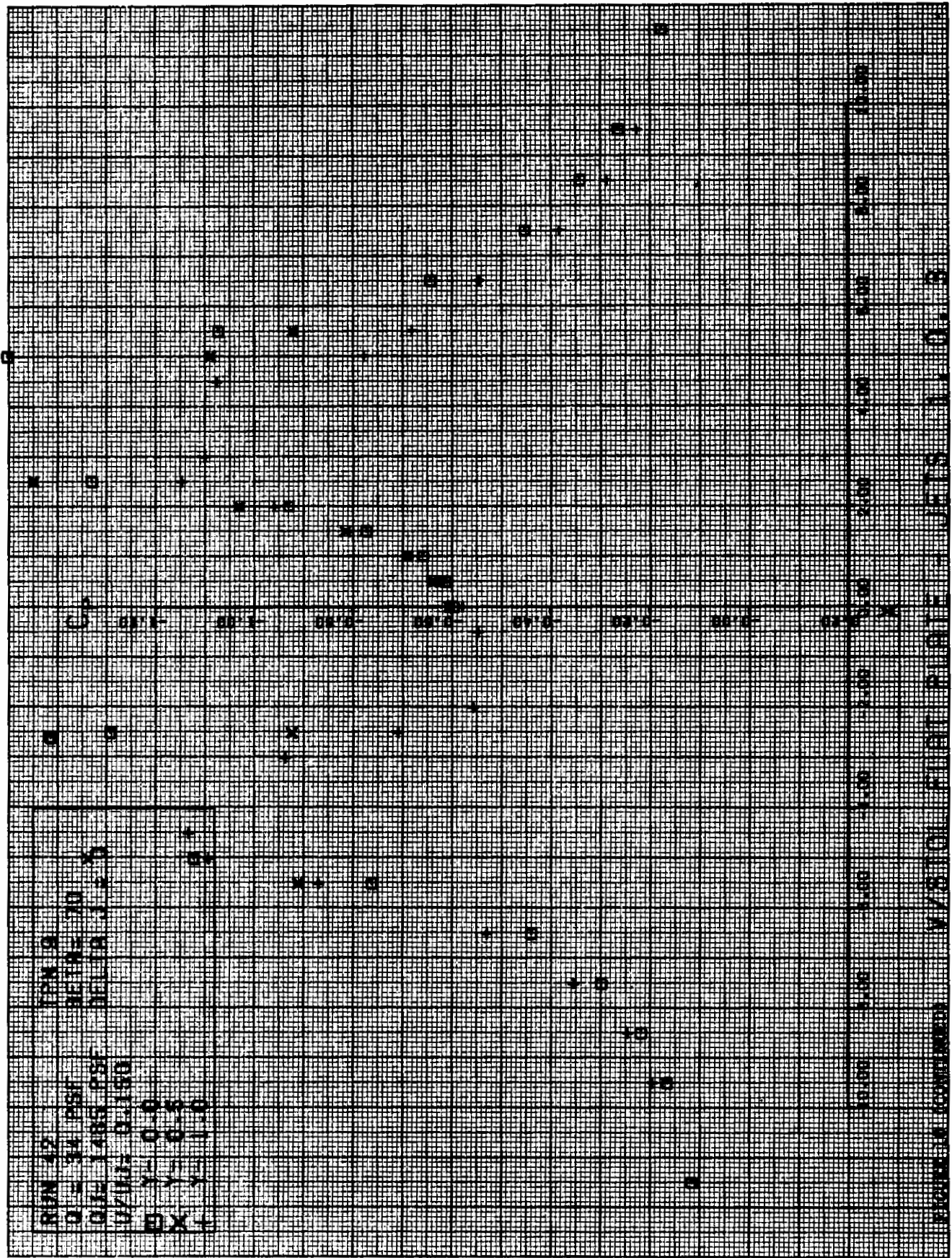


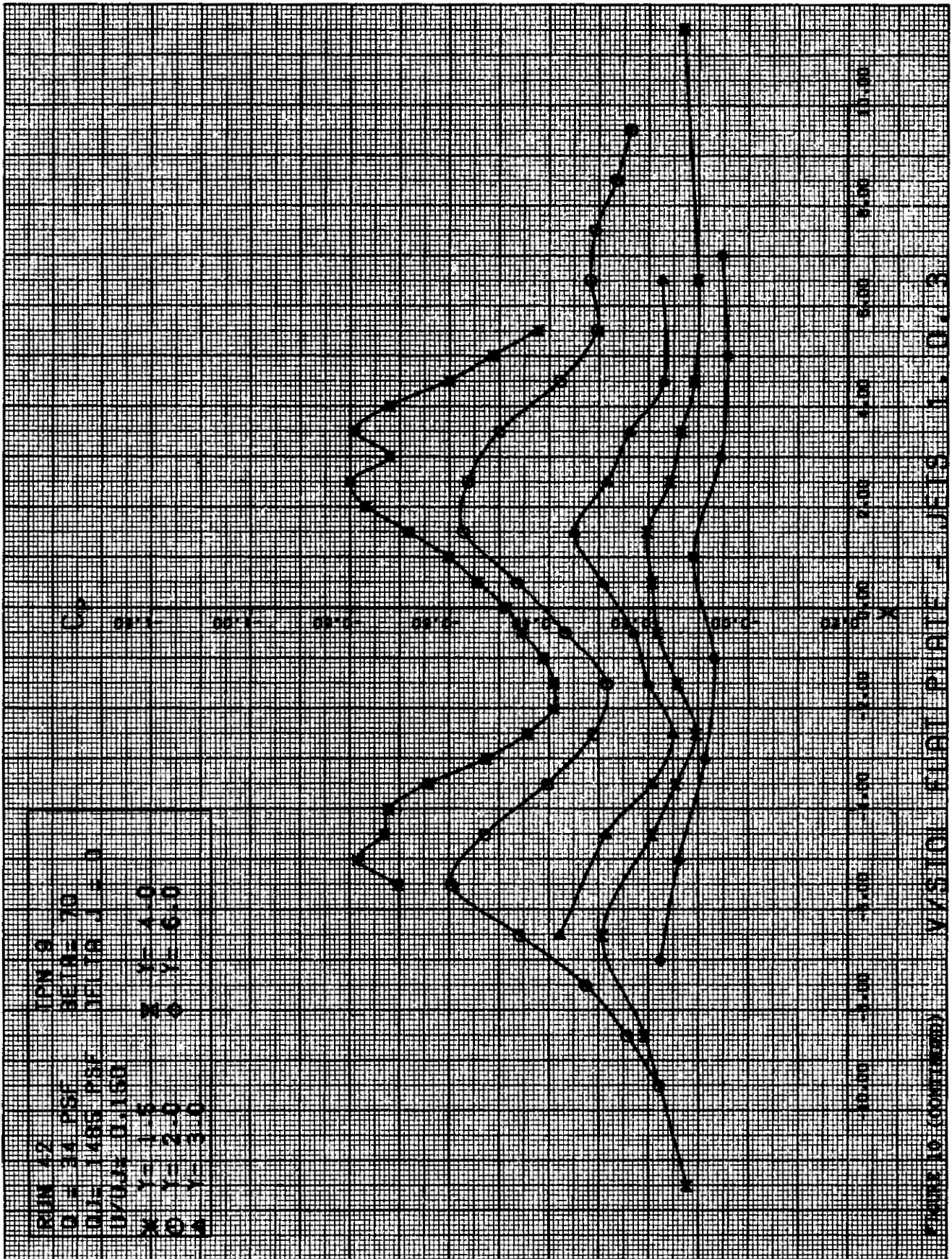
FIGURE 10 (CONTINUED) VYSTOL FLIGHT PROFILE - JETIS 1110.0.3











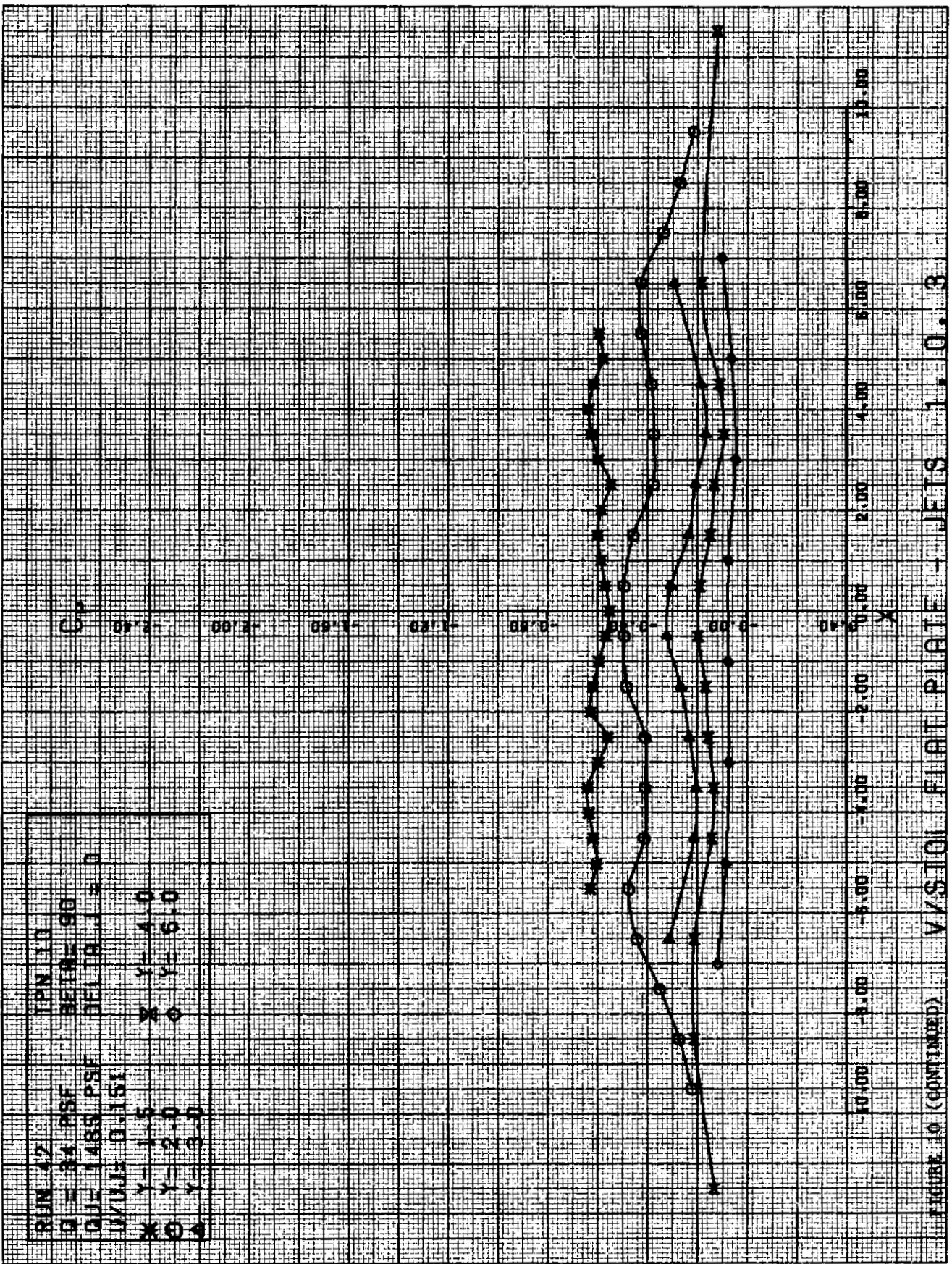
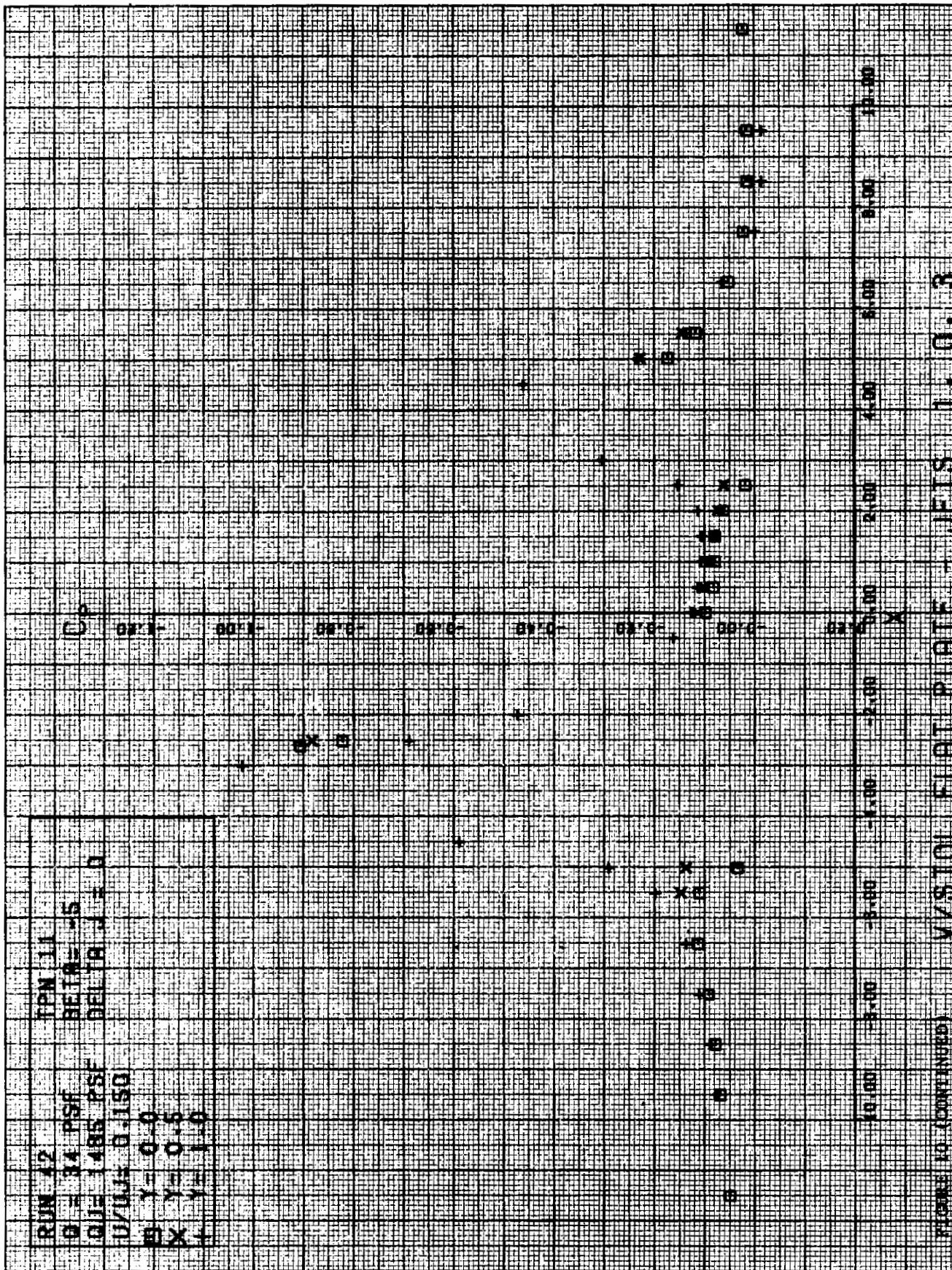


FIGURE 10 (CONTINUED) V/S101 FLAT PLATE - JETS 1, 0, 3

Contrails



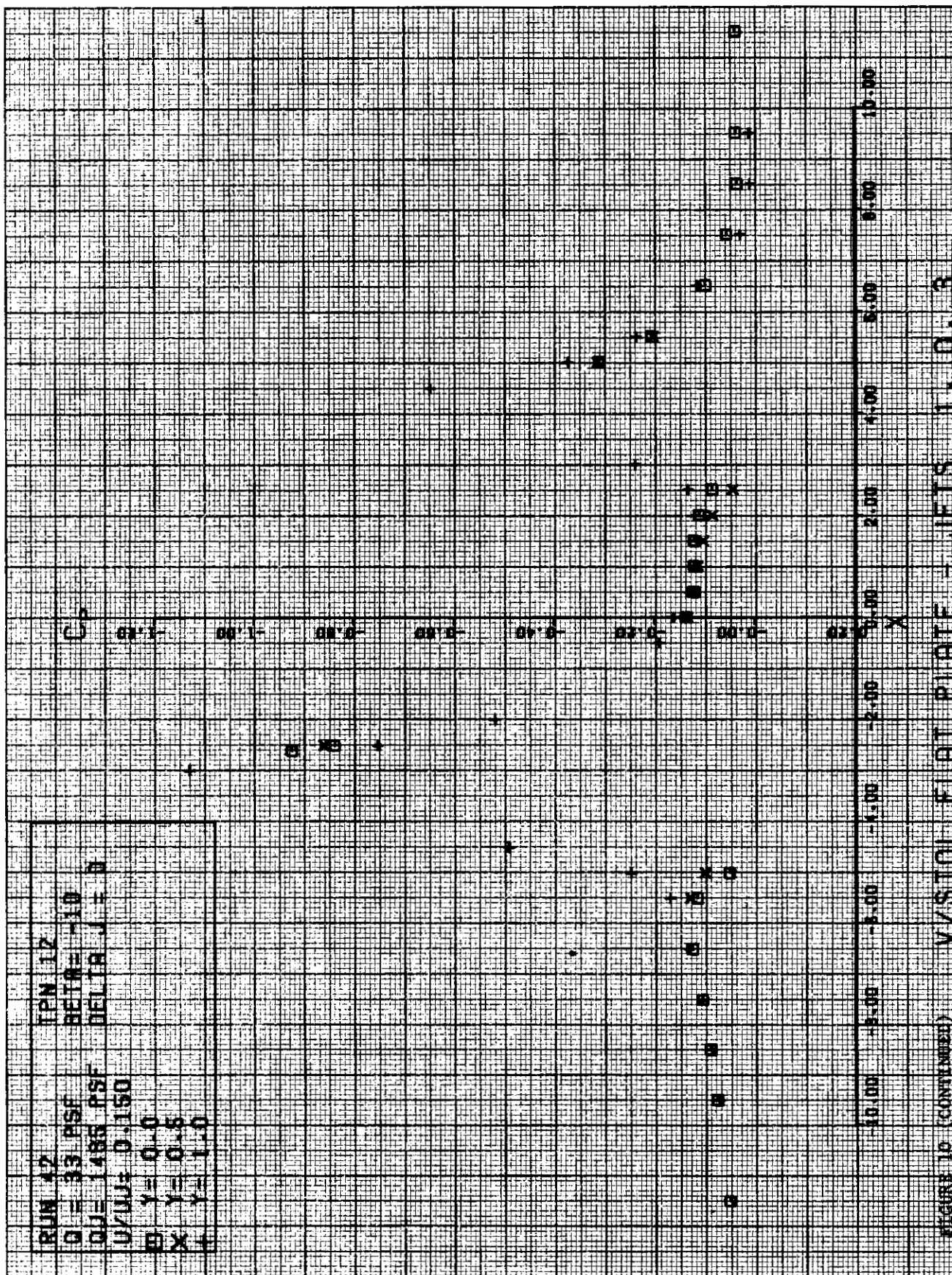
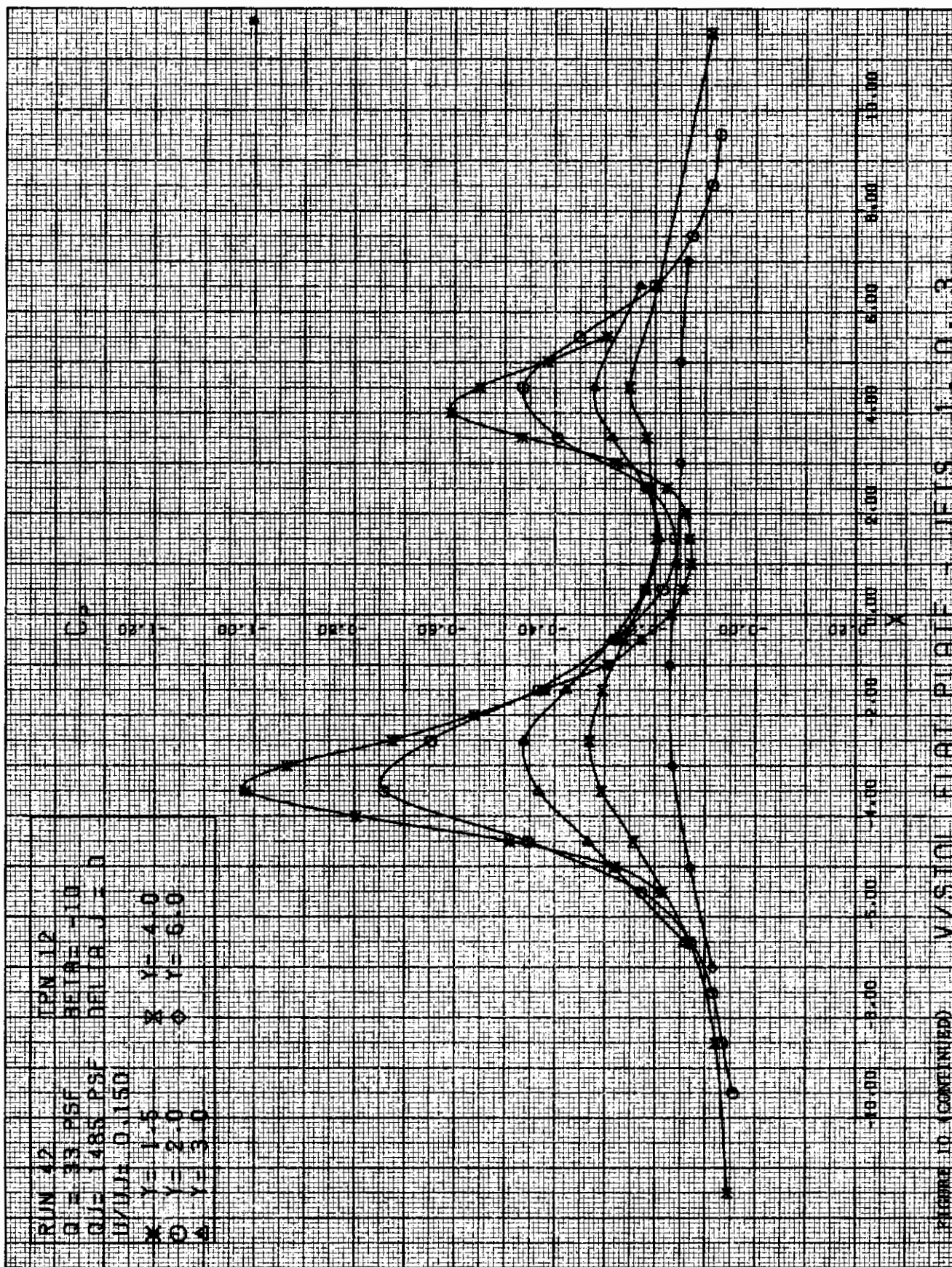


FIGURE 10 (CONTINUED) V/STOL FLAT PLATE - JETS 1, 0, 3



Contrails

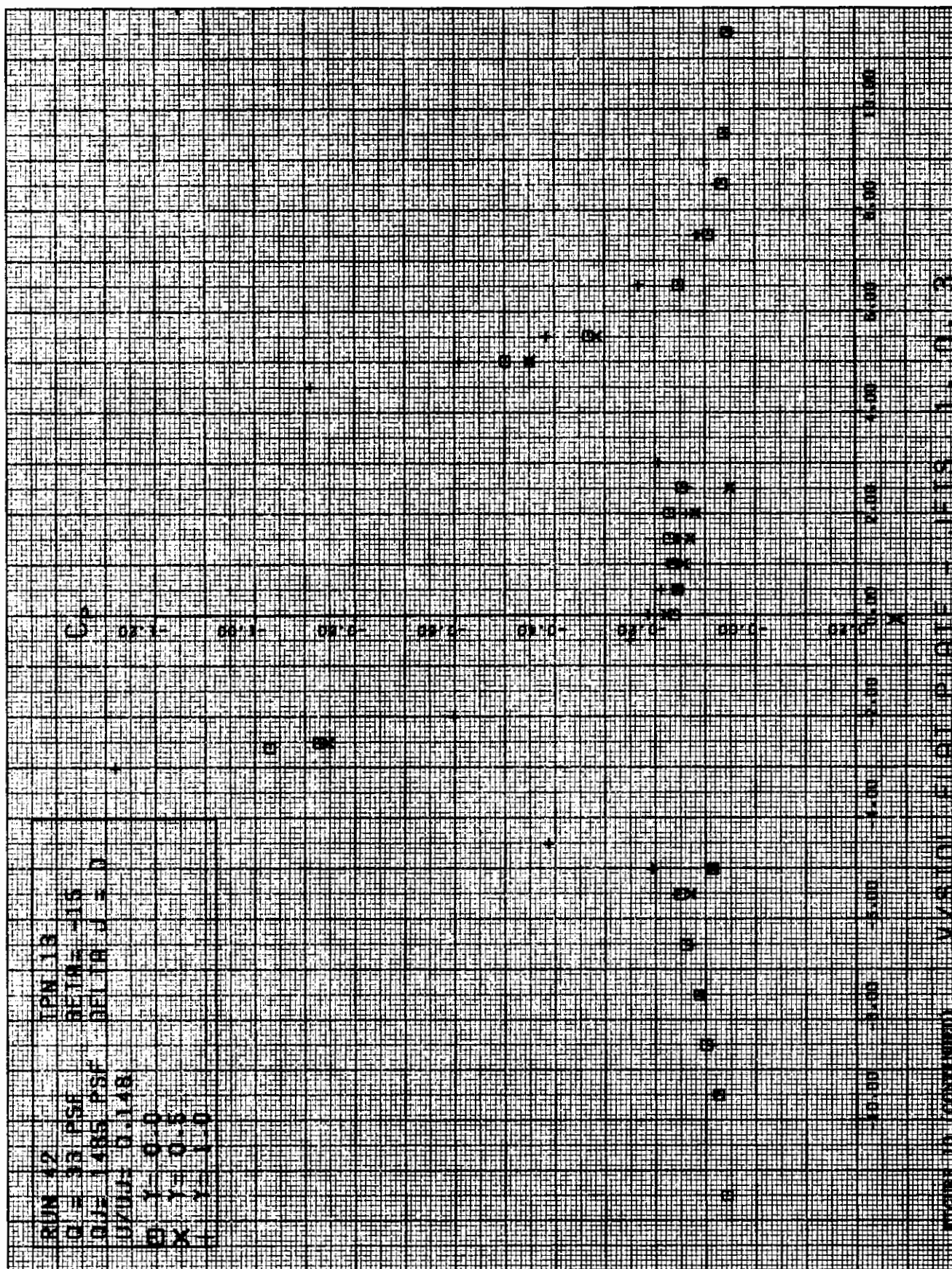
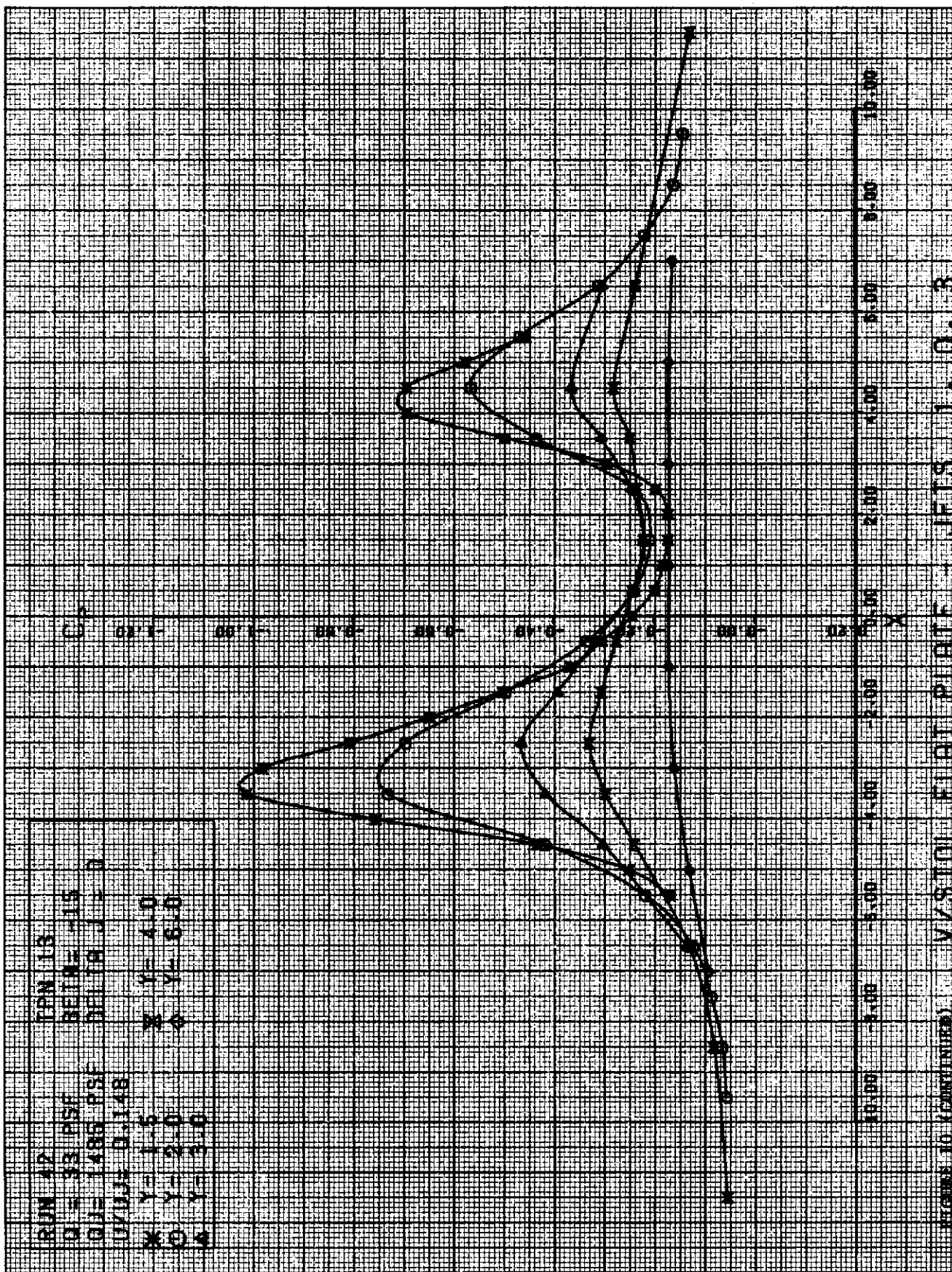
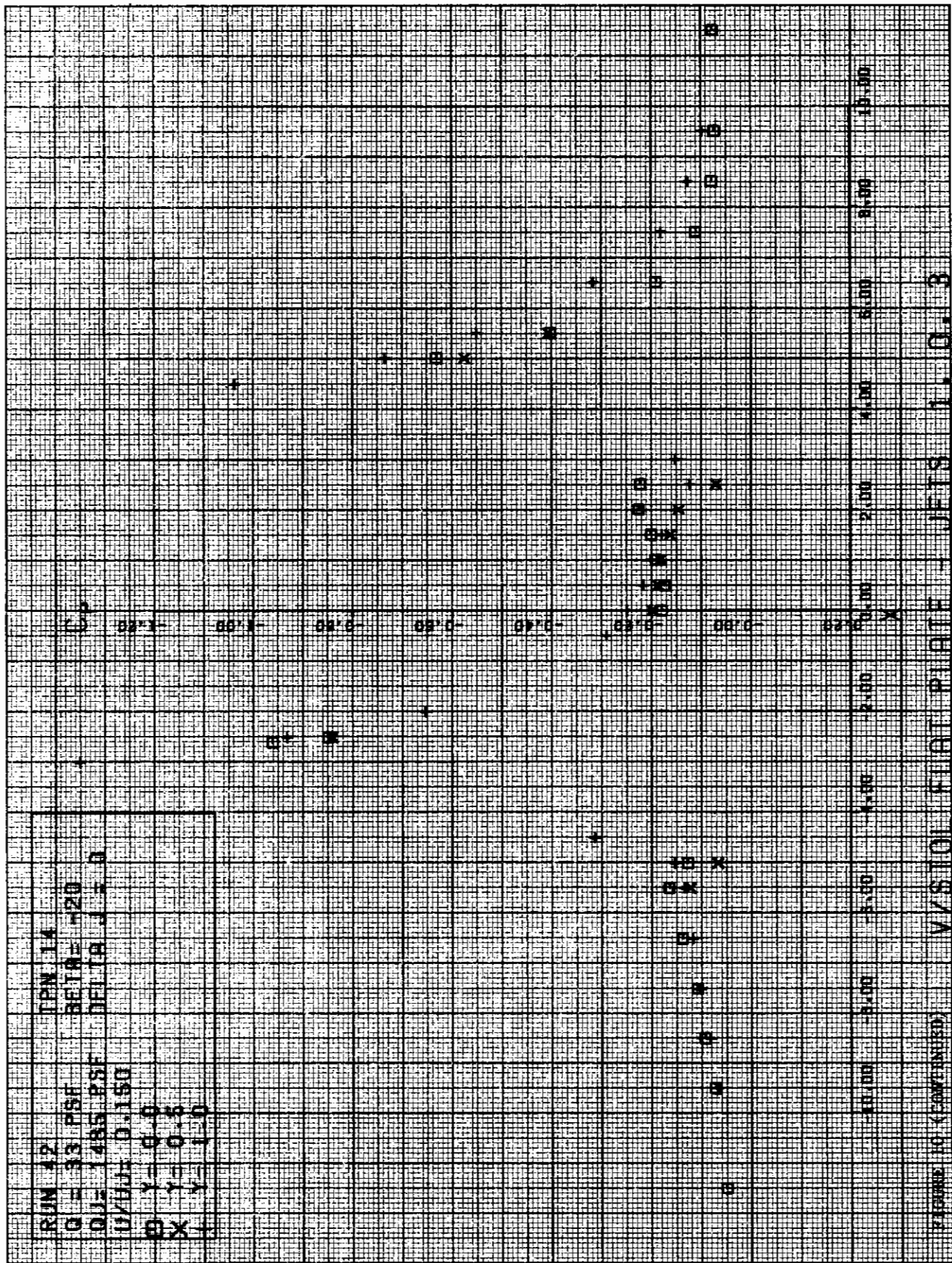


FIGURE 16 (CONTINUED) VVS101 FLIGHT PROFILE - JETES 11-01-3





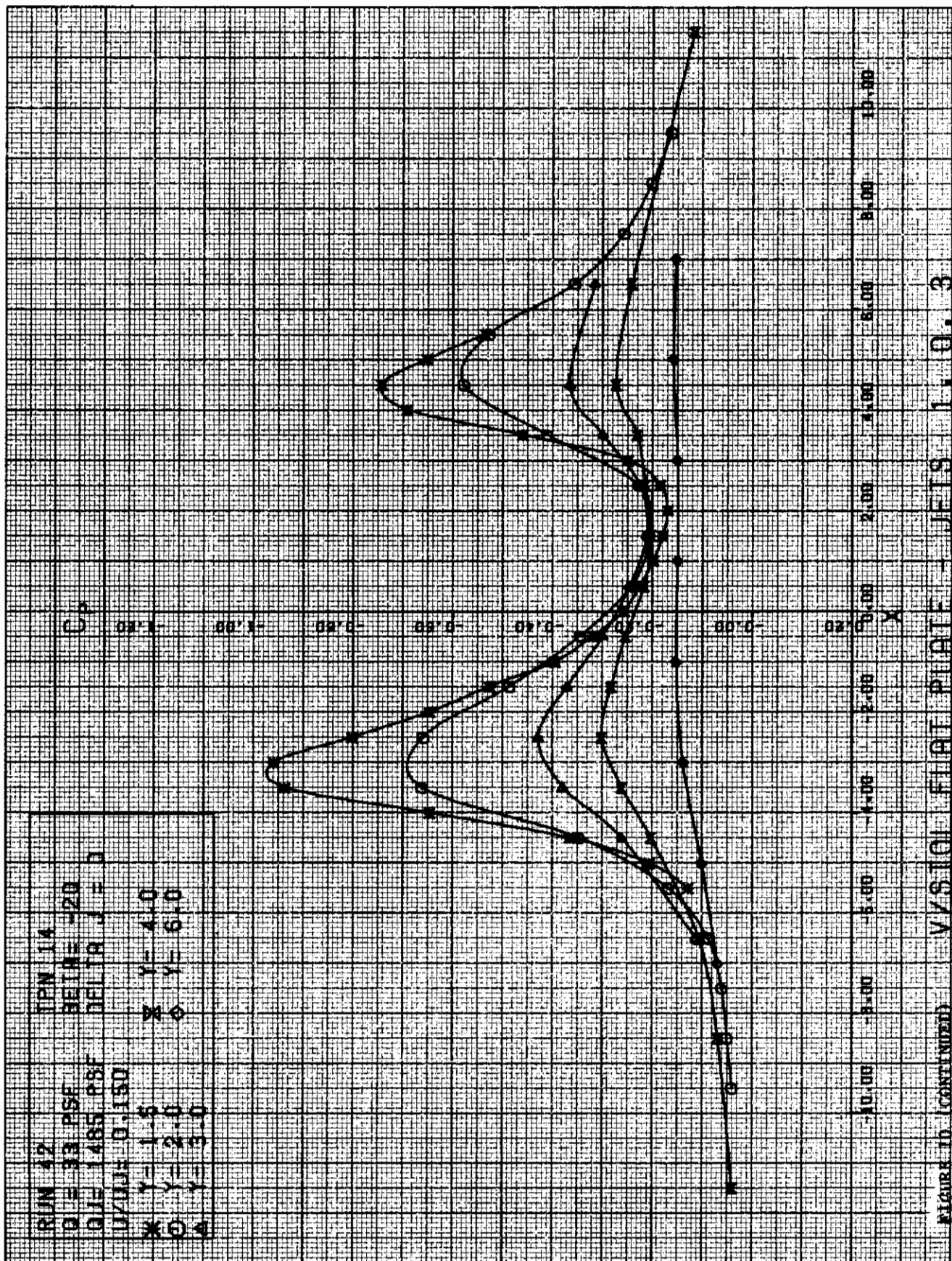
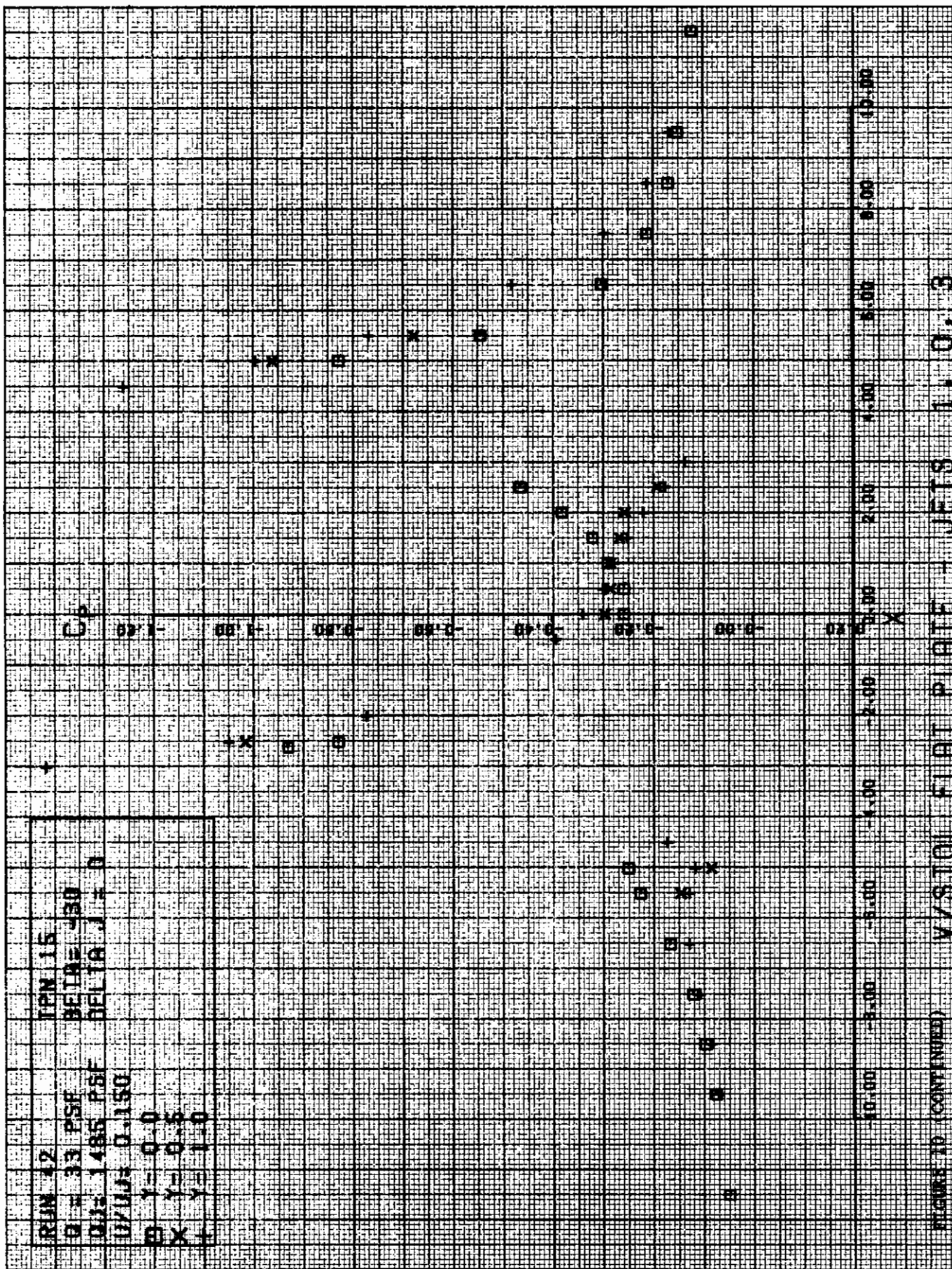
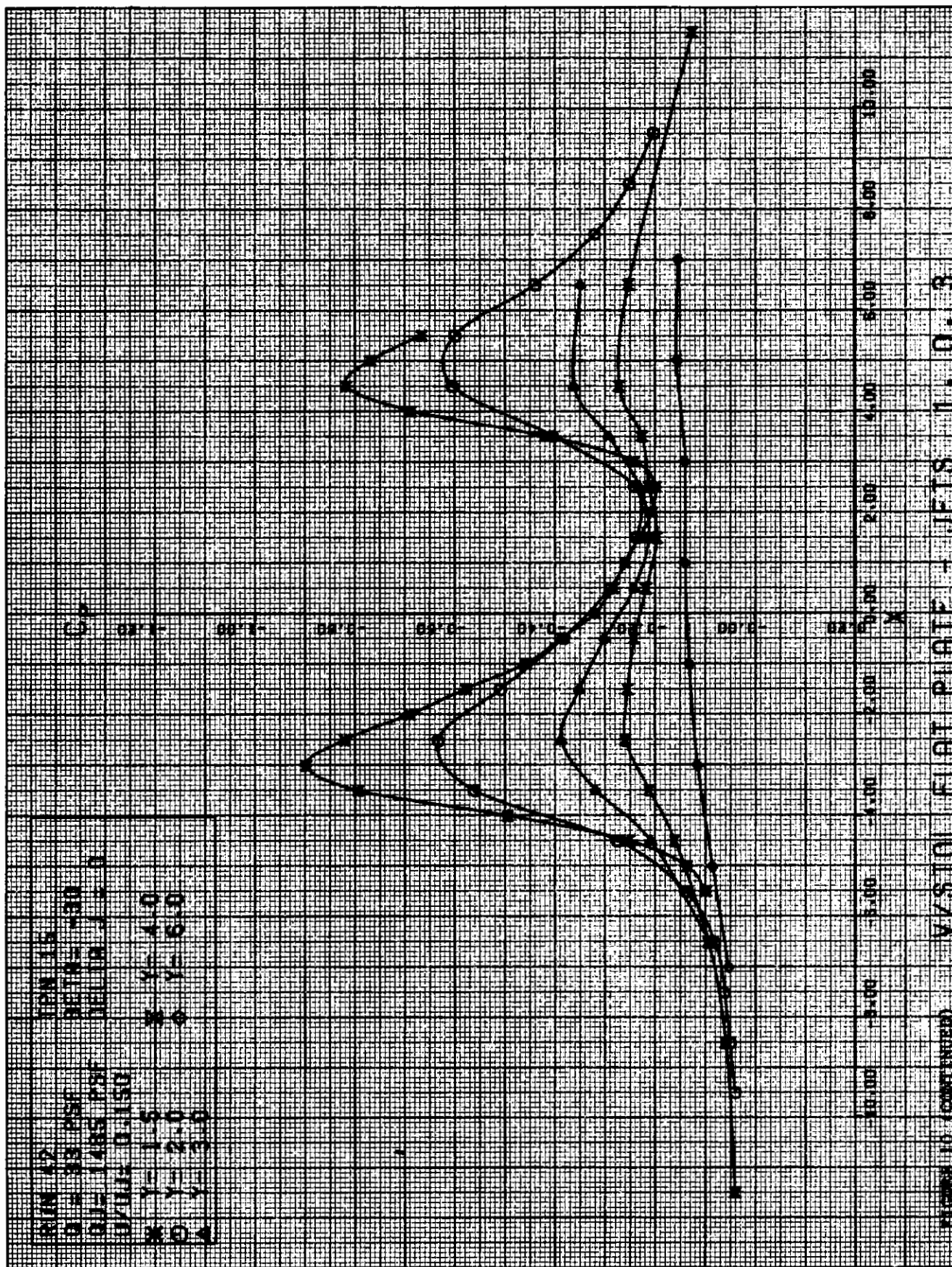


FIGURE 10 (CONTINUED) V/STOL FLAT PLATE - JETS 1, 0, 3

Contrails





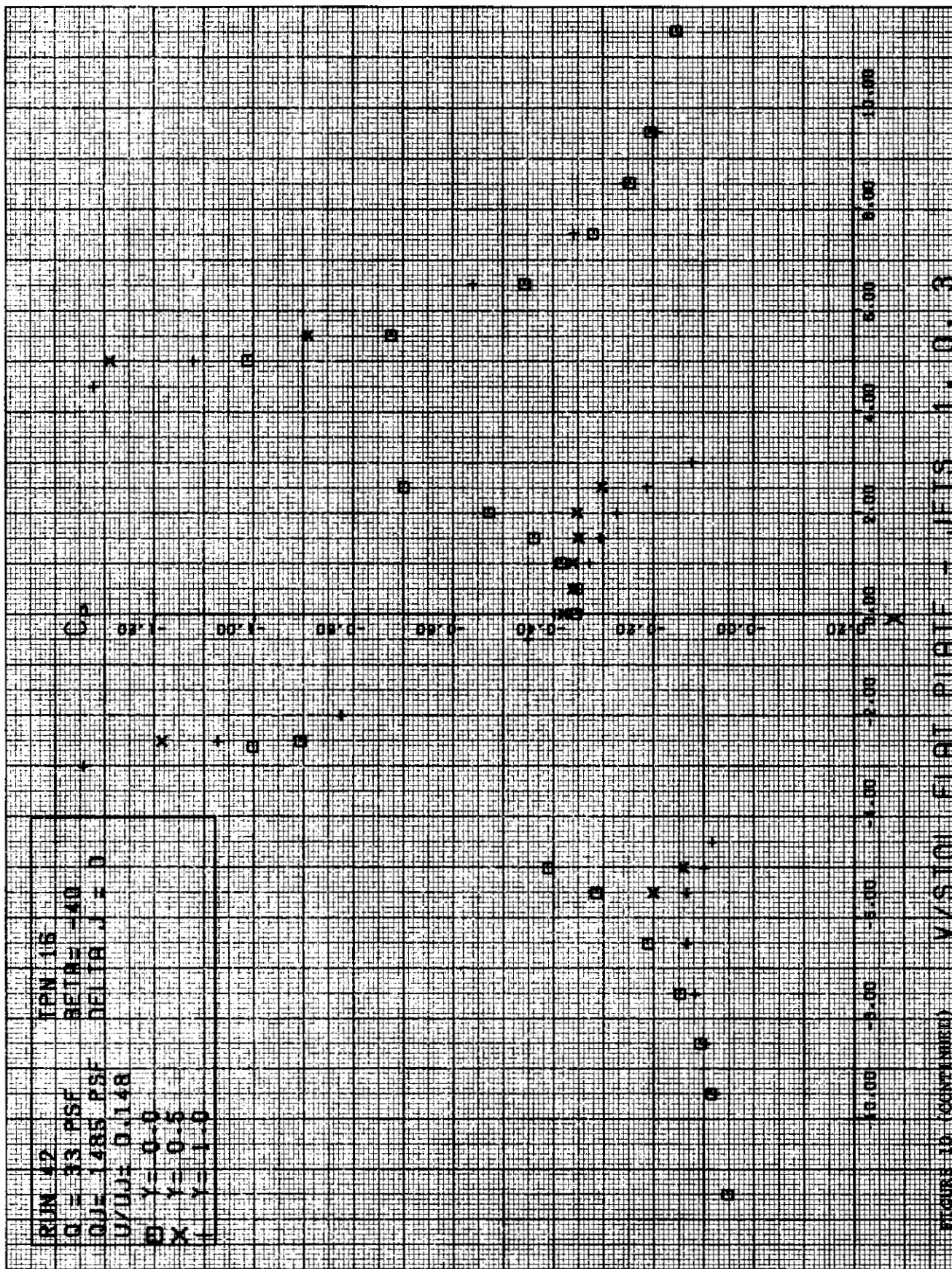
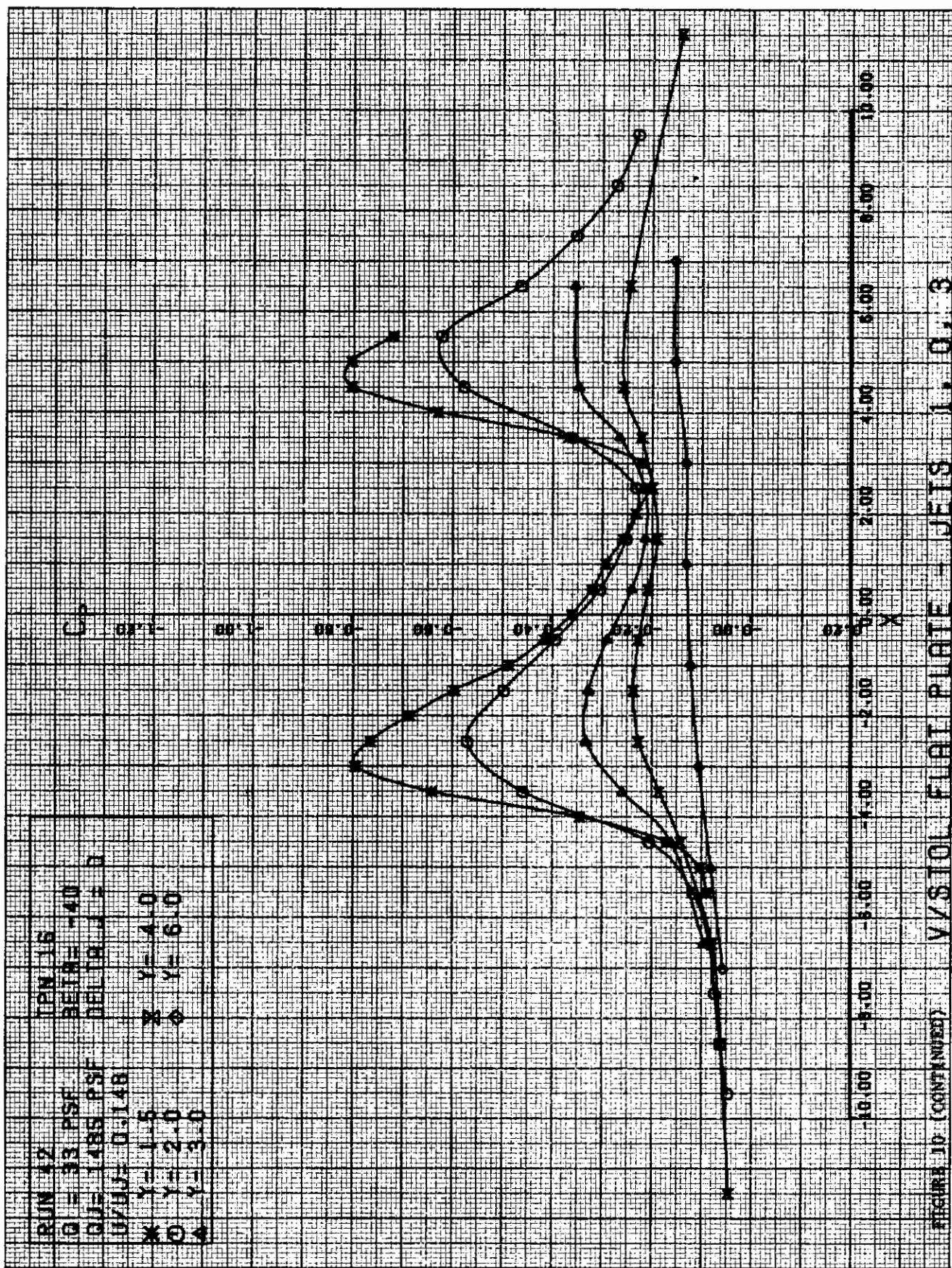
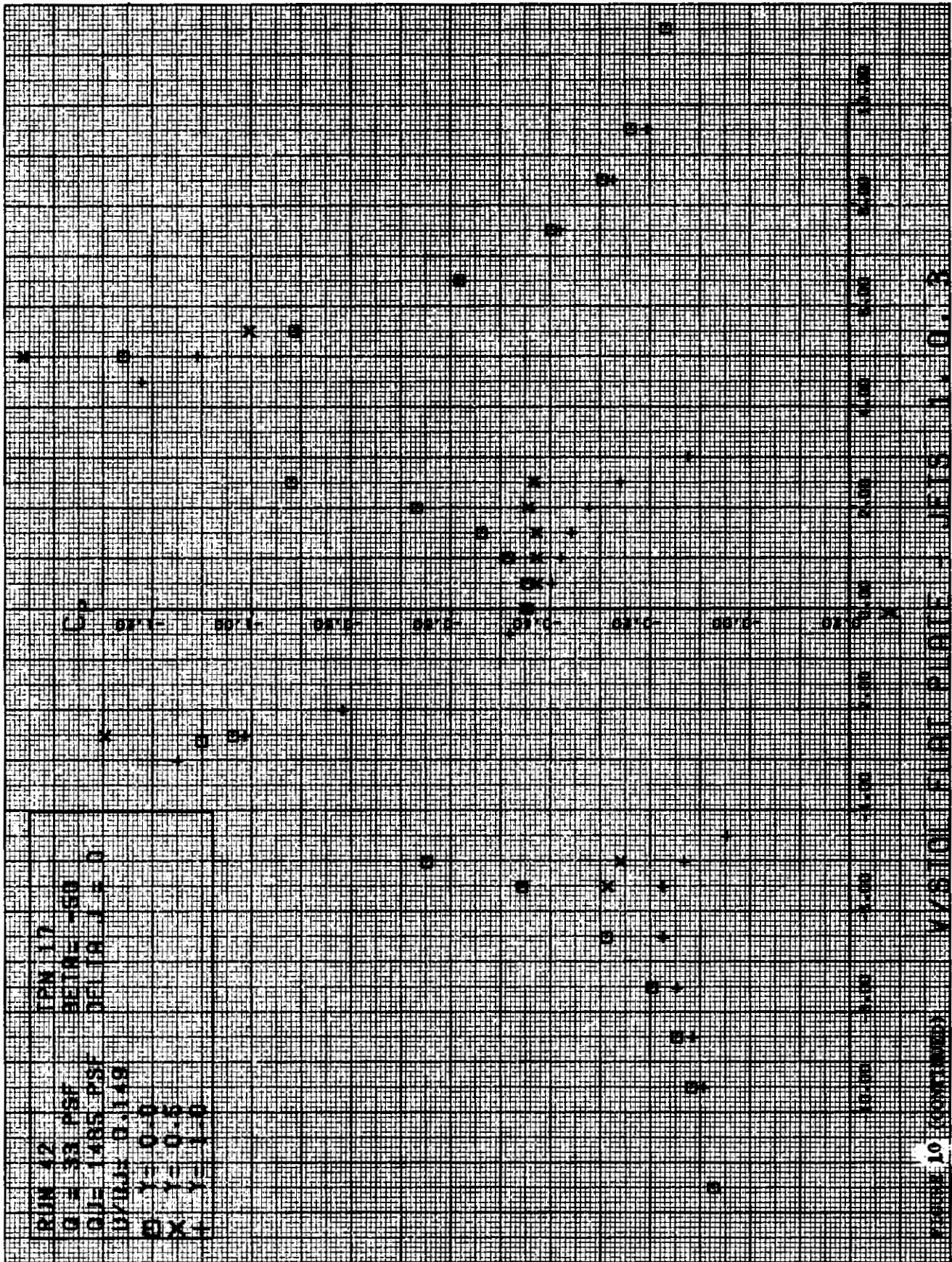
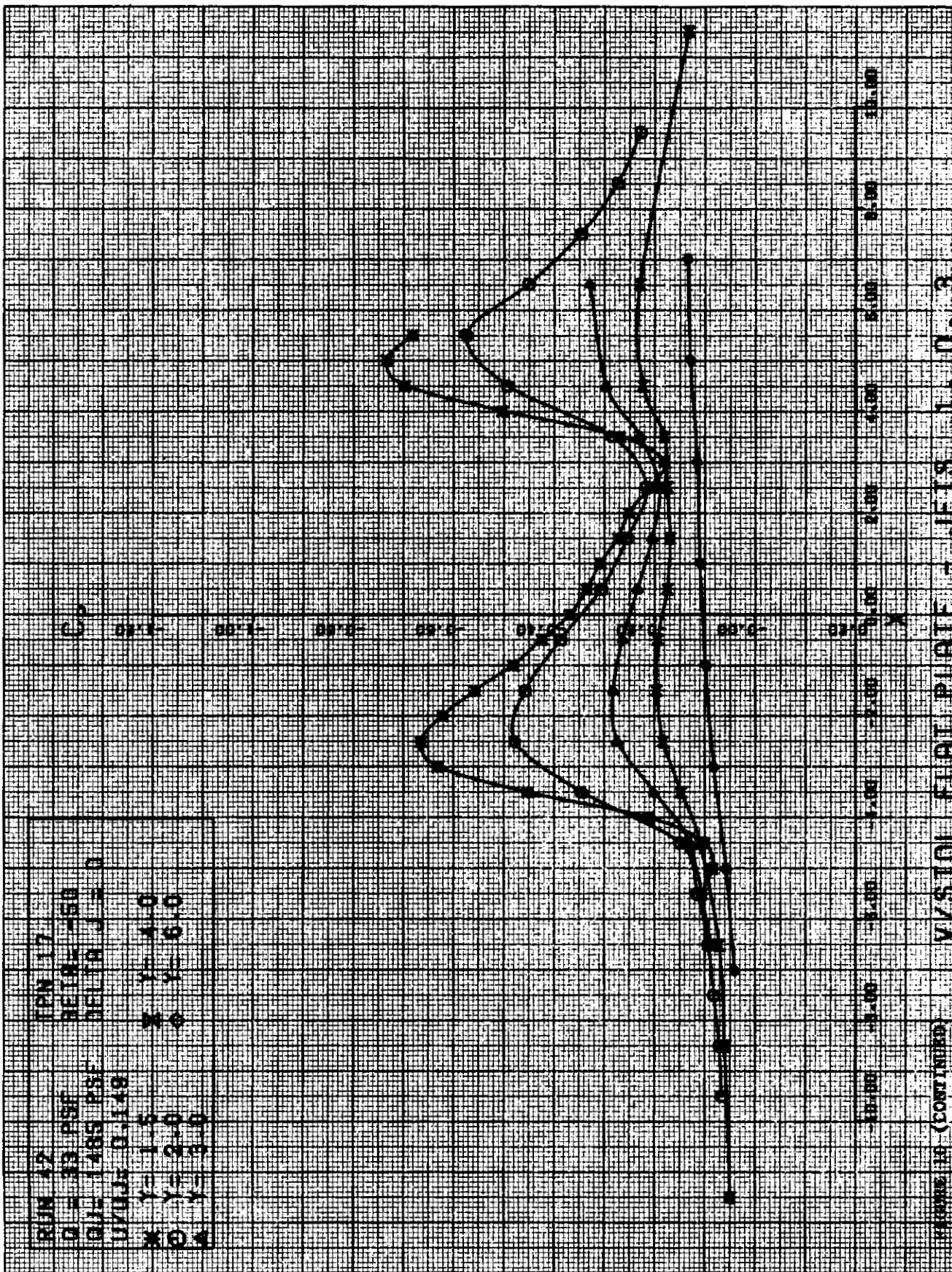
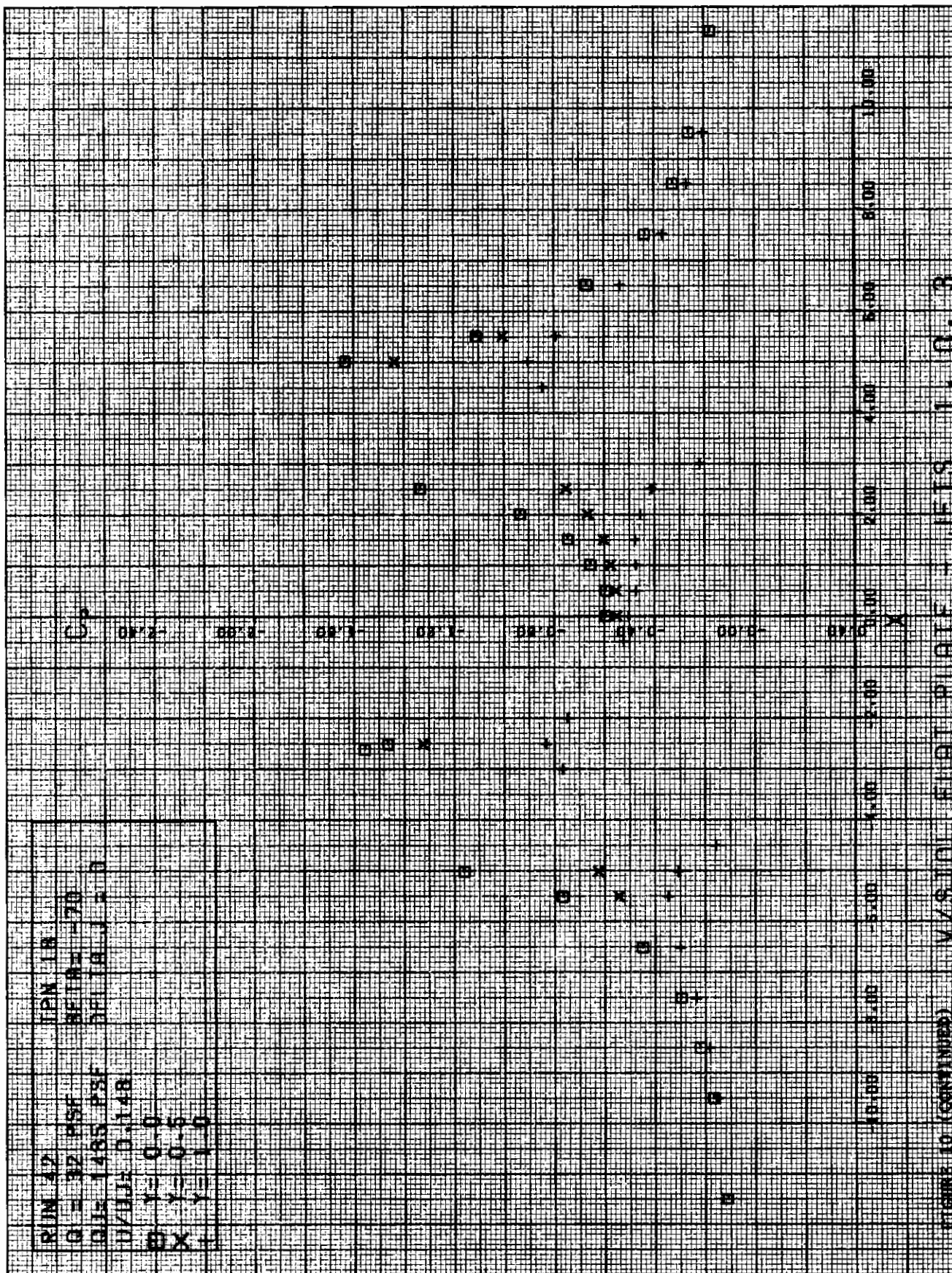


FIGURE 10 (CONTINUED) VJ5000 FLIGHT PROFILE - JETS 1.0.3









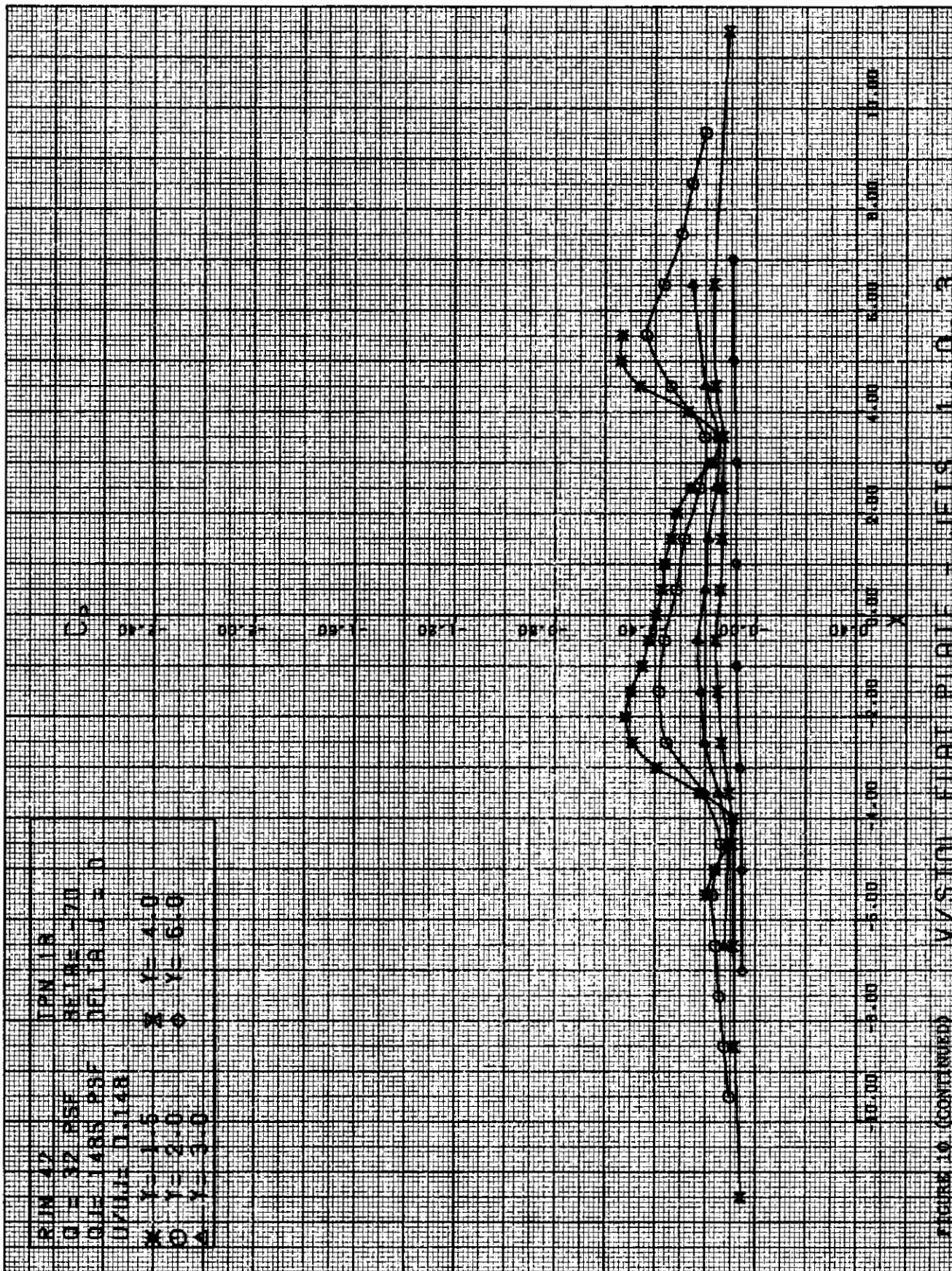
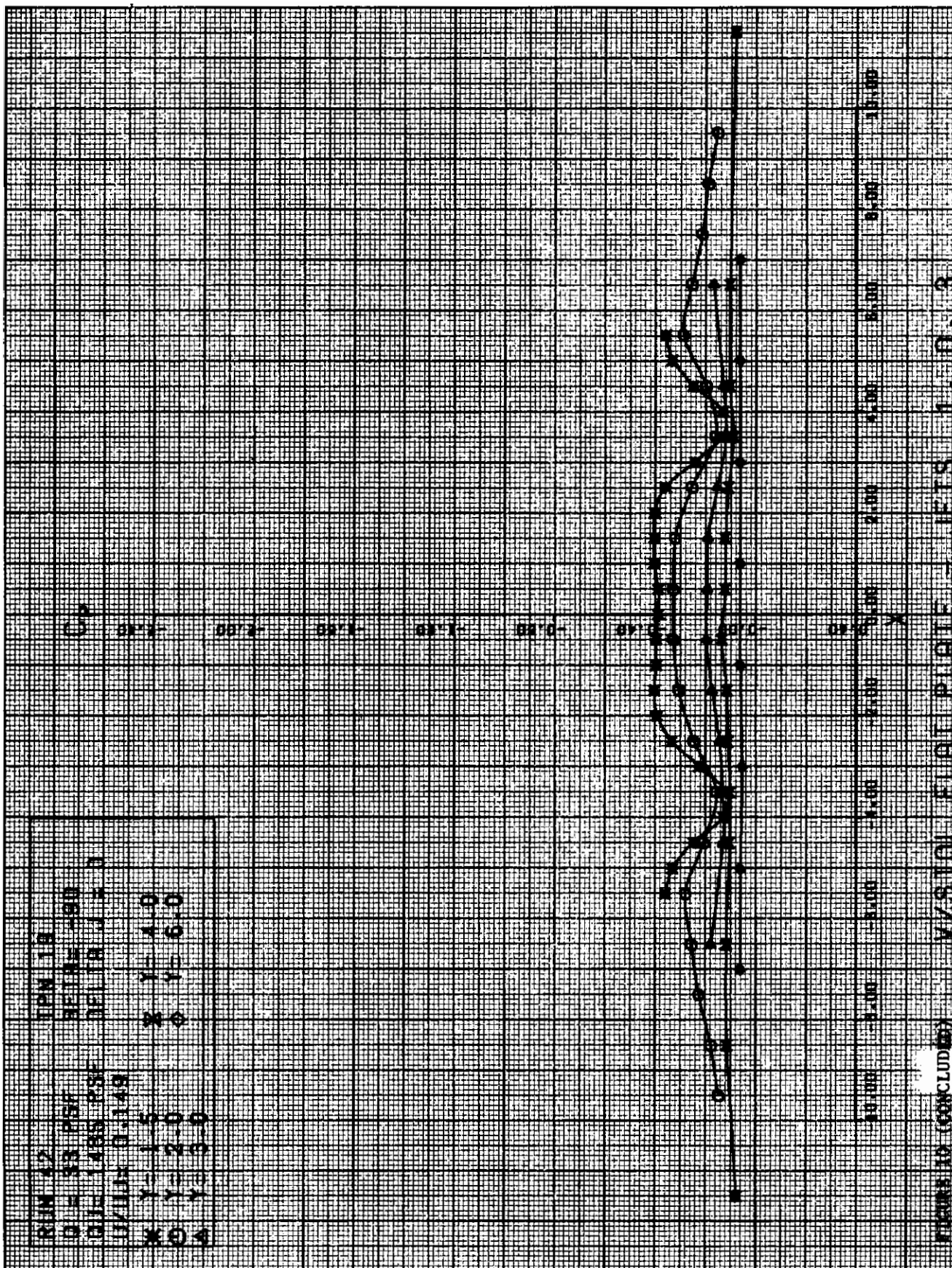
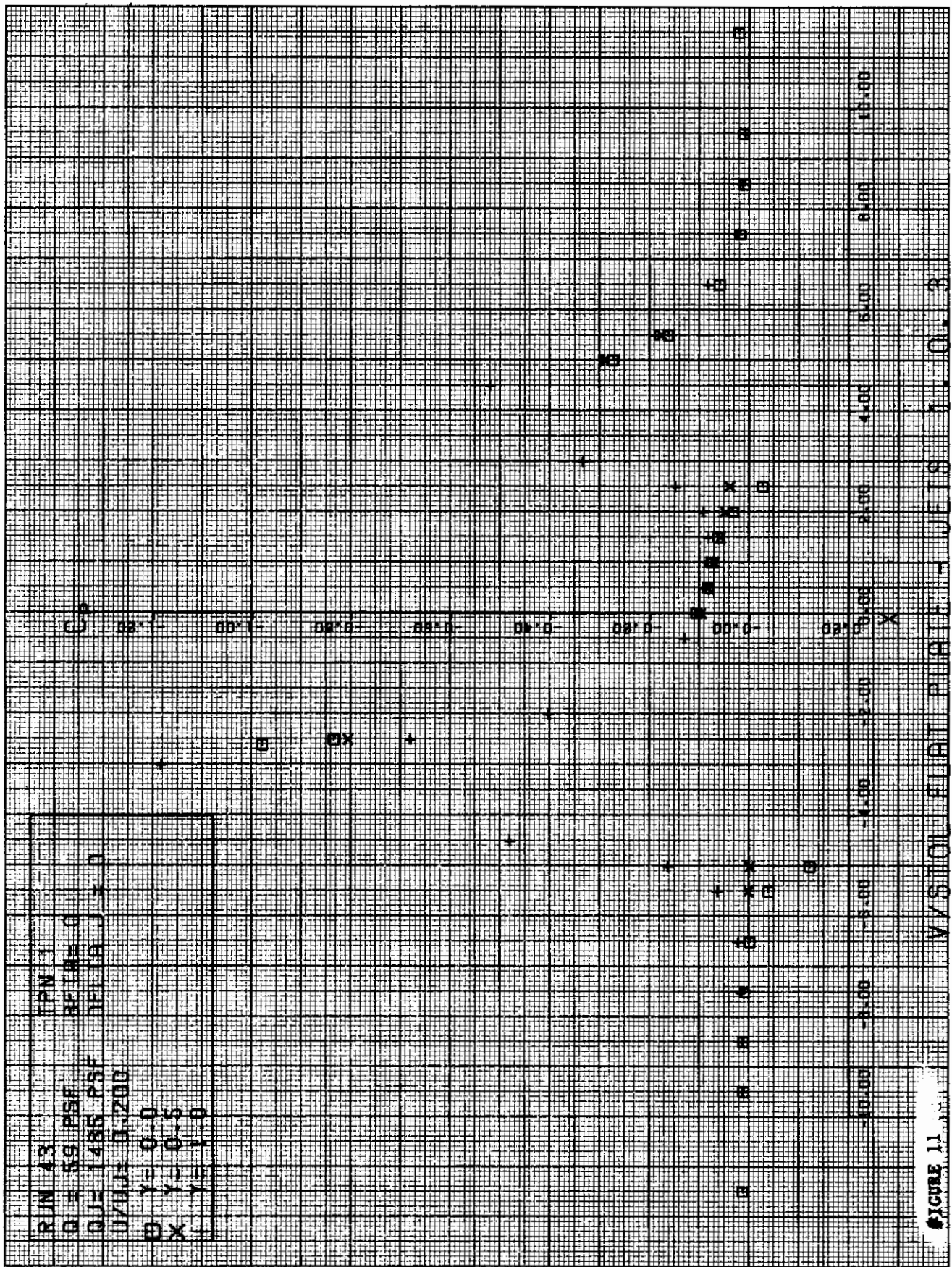
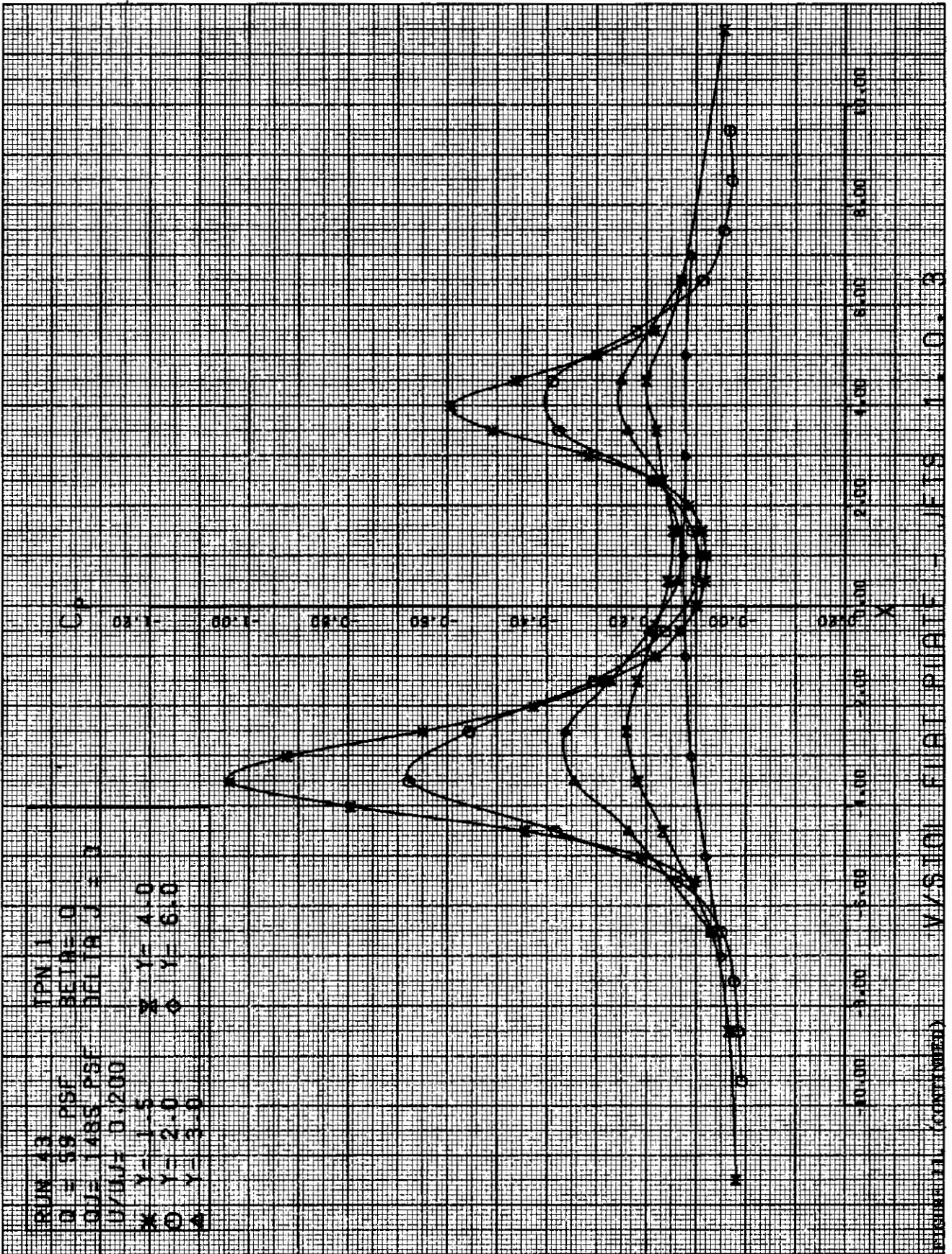
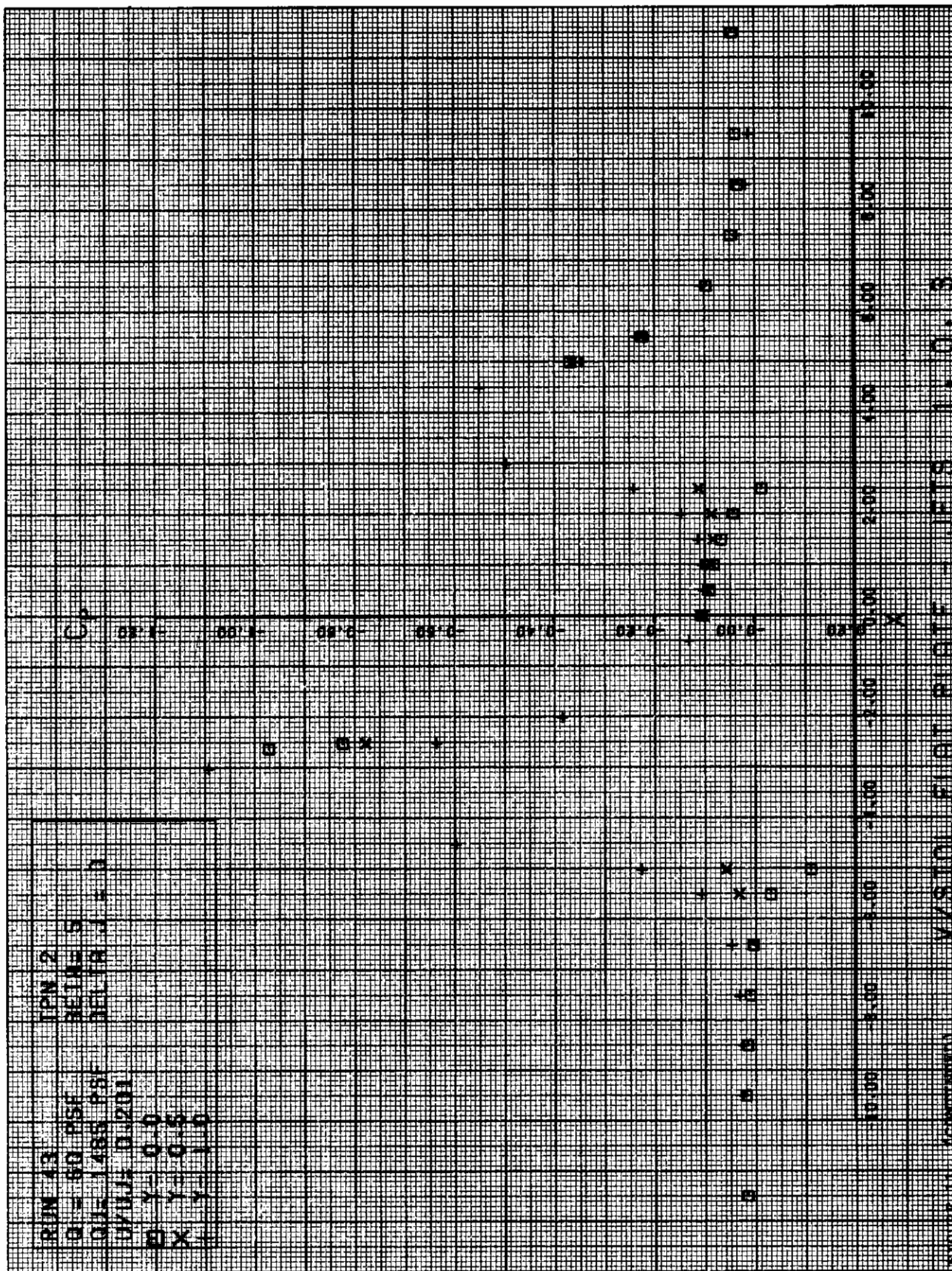


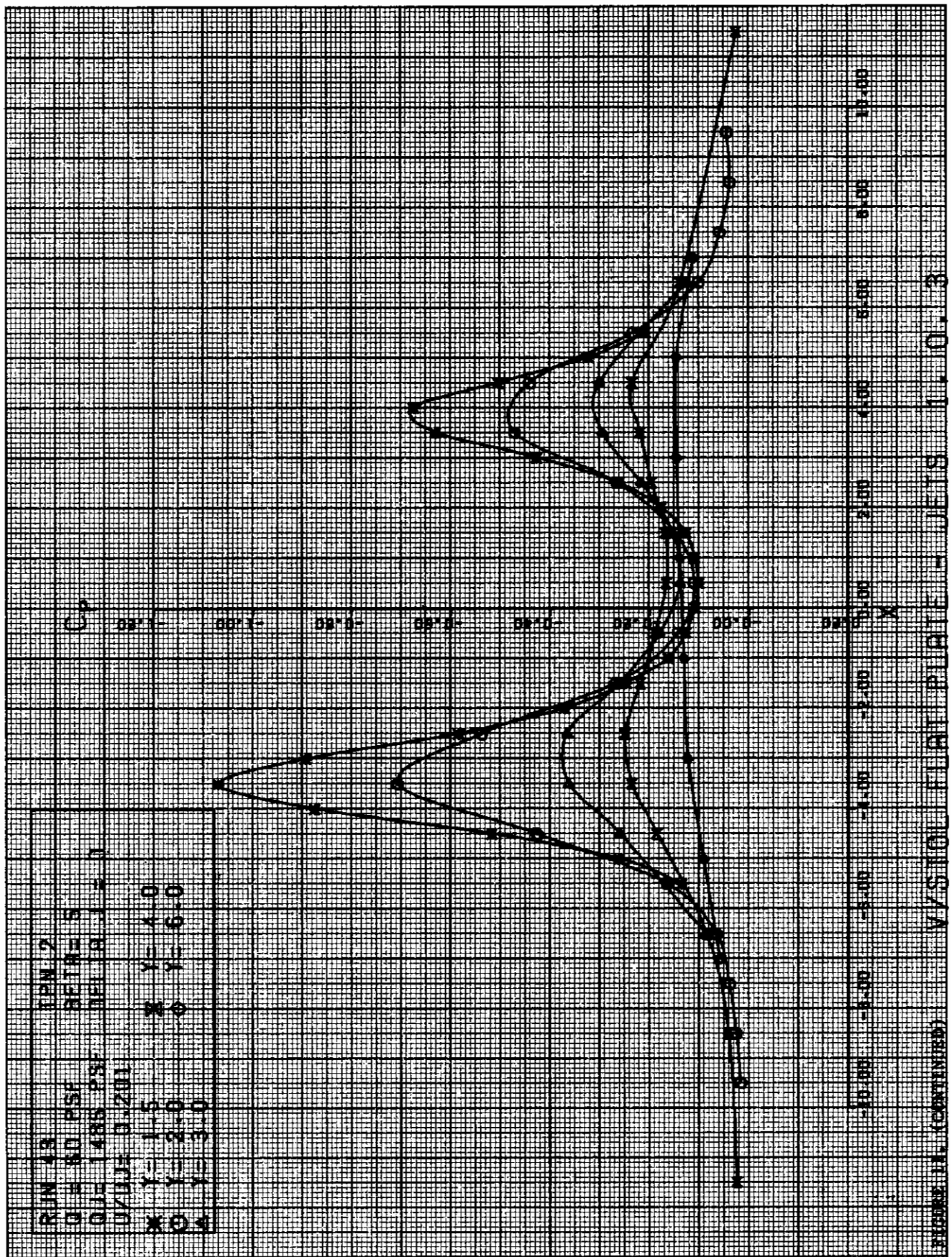
FIGURE 10 (CONTINUED) V-1001 FIGHTER PLANE - JETS 1, 0, 3

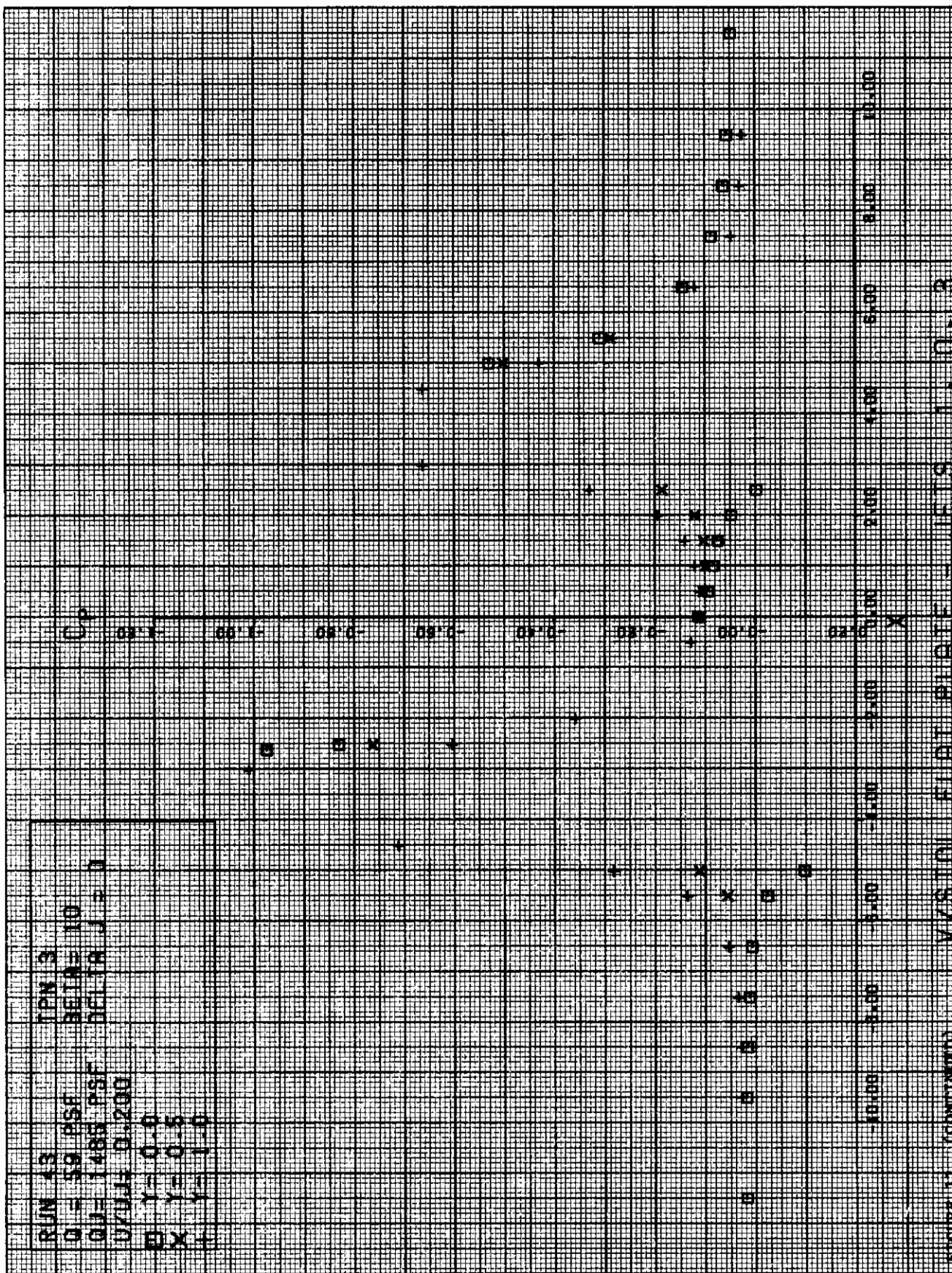


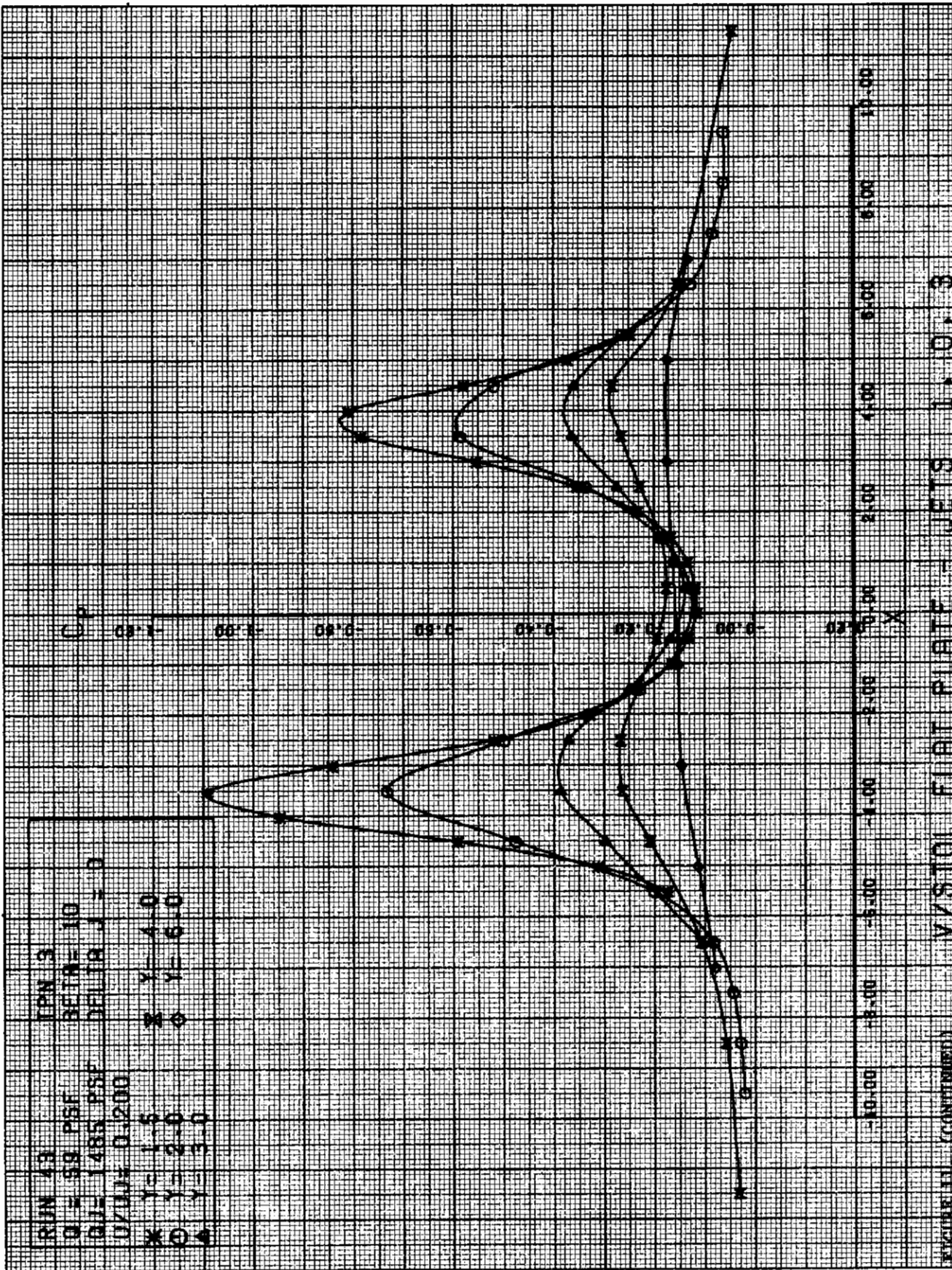


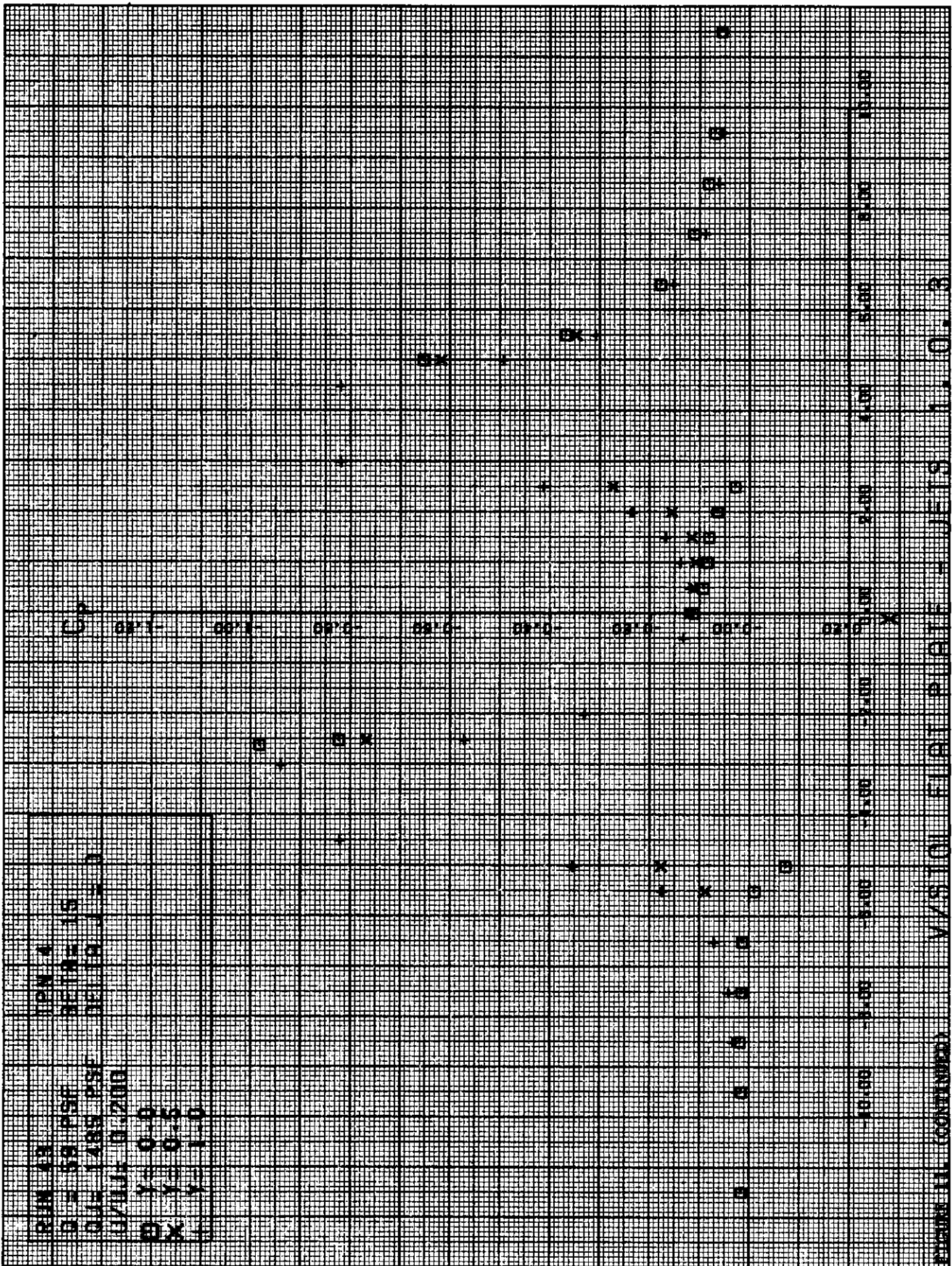


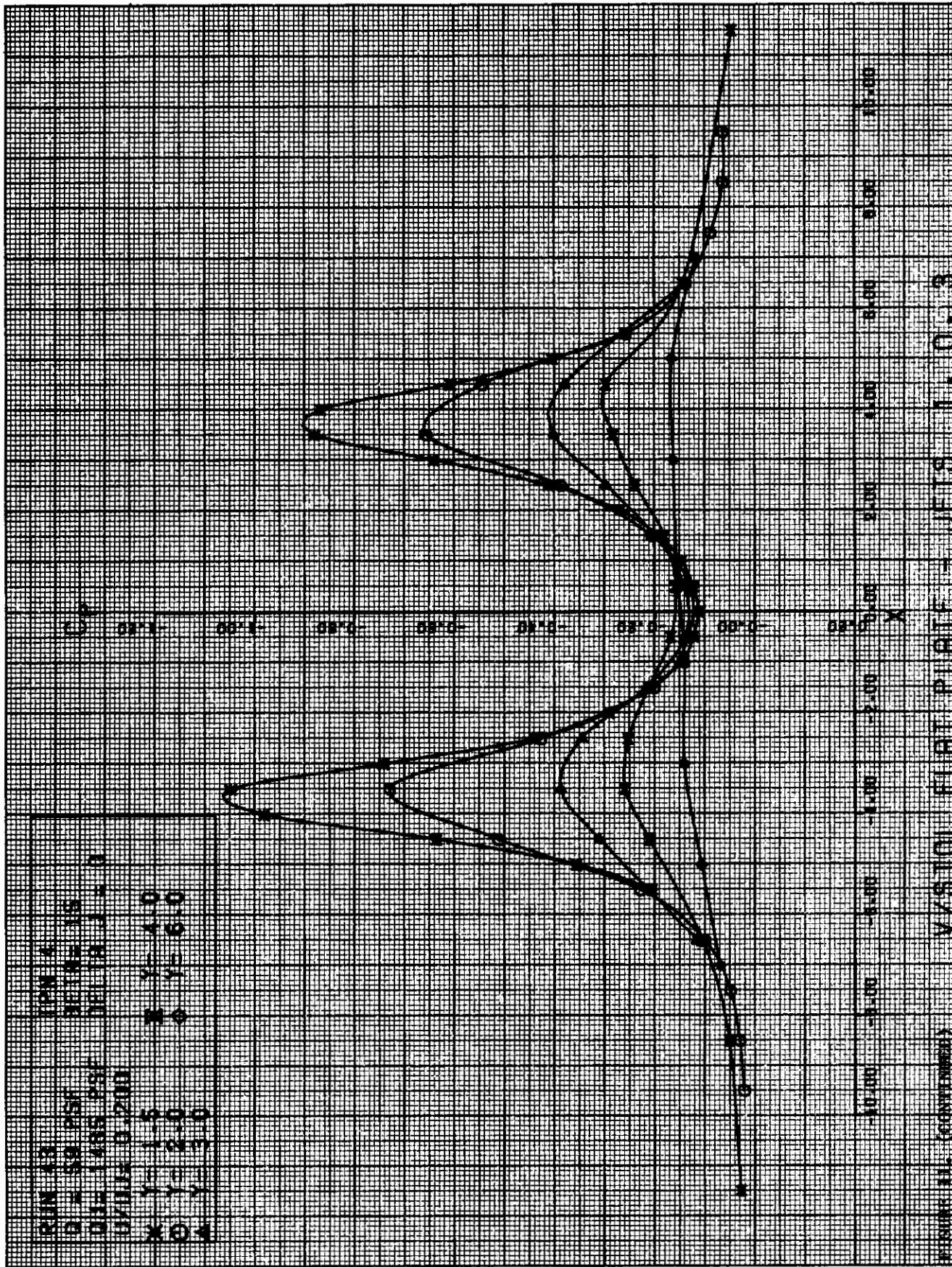


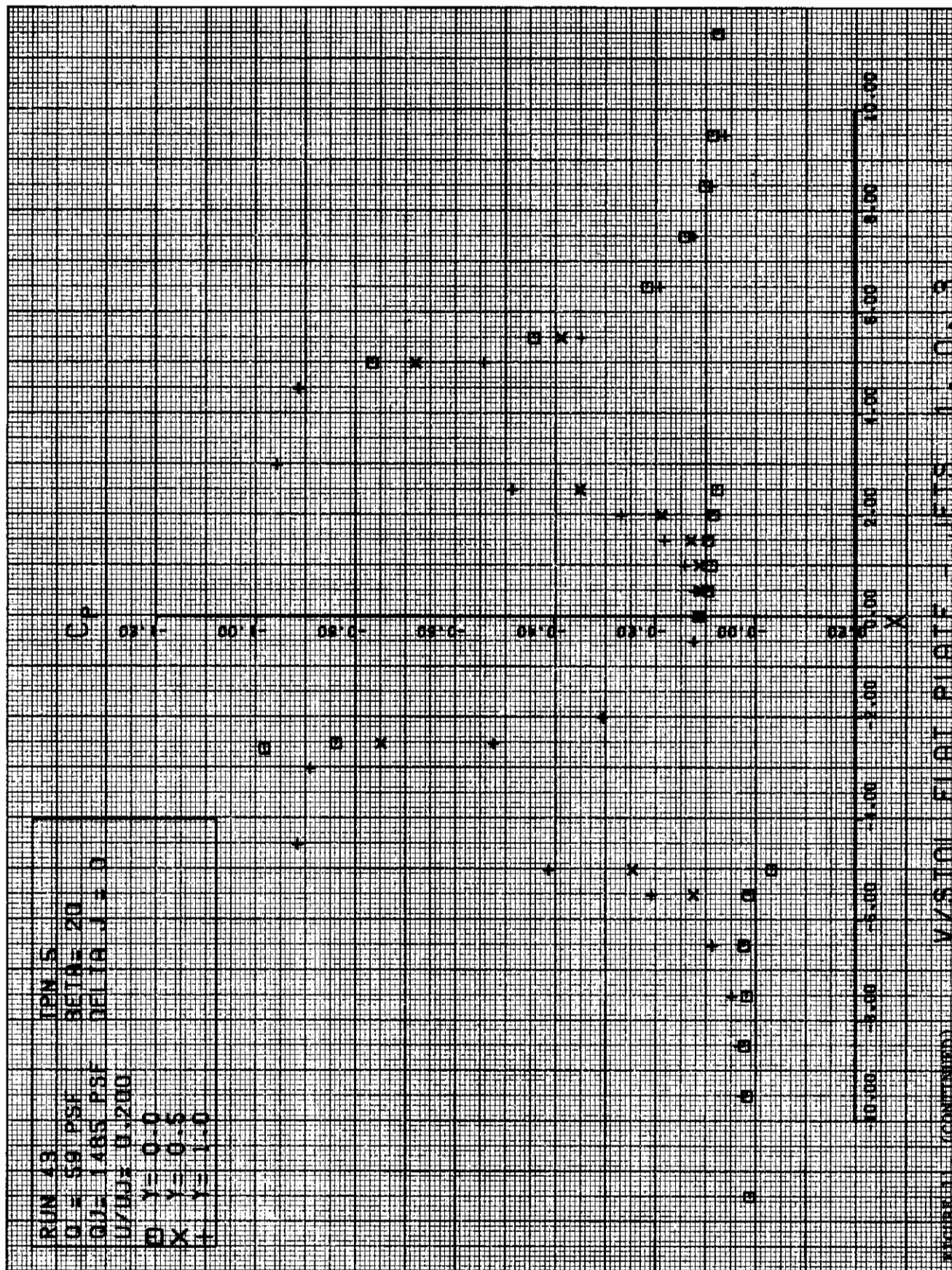












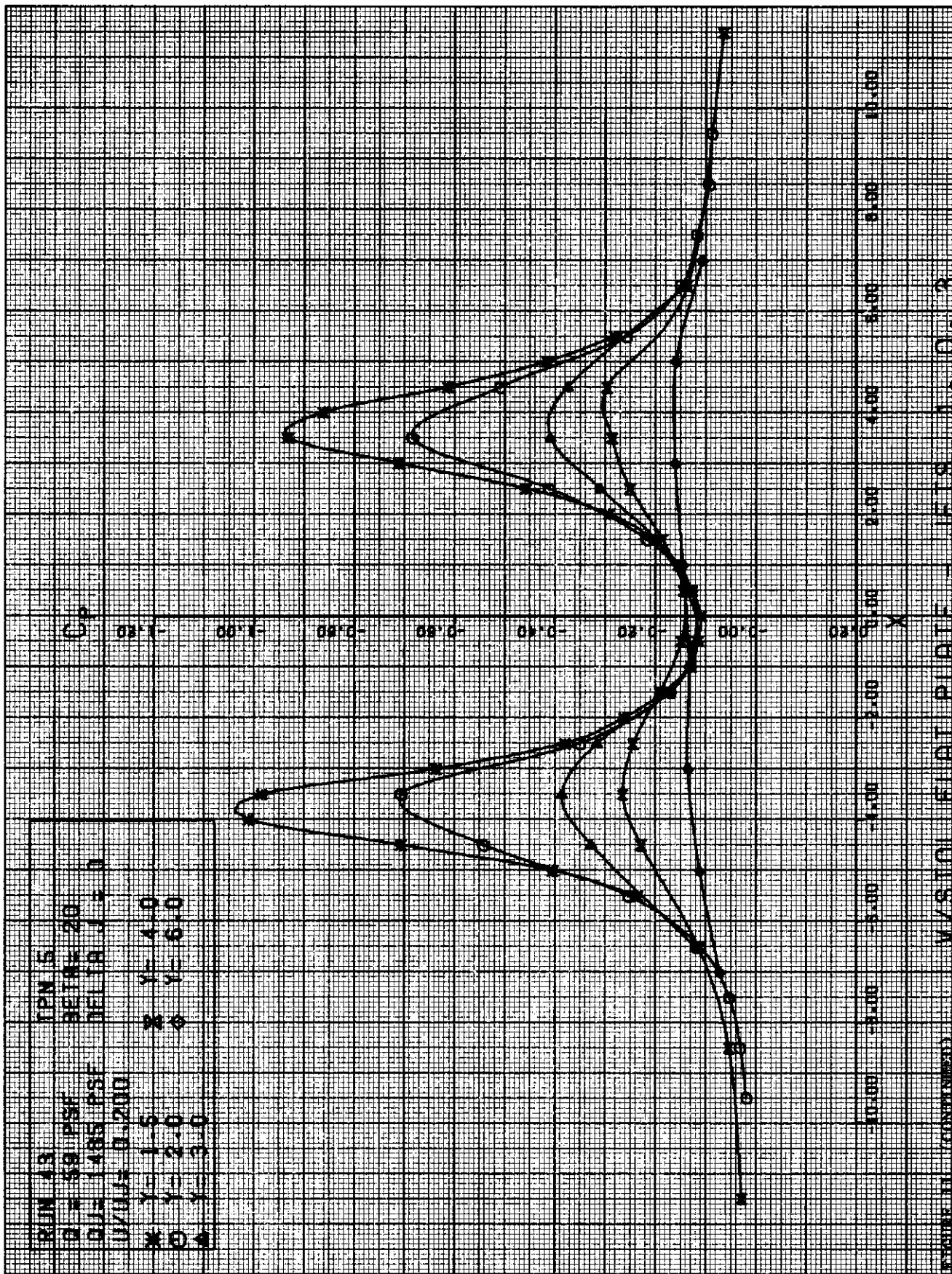
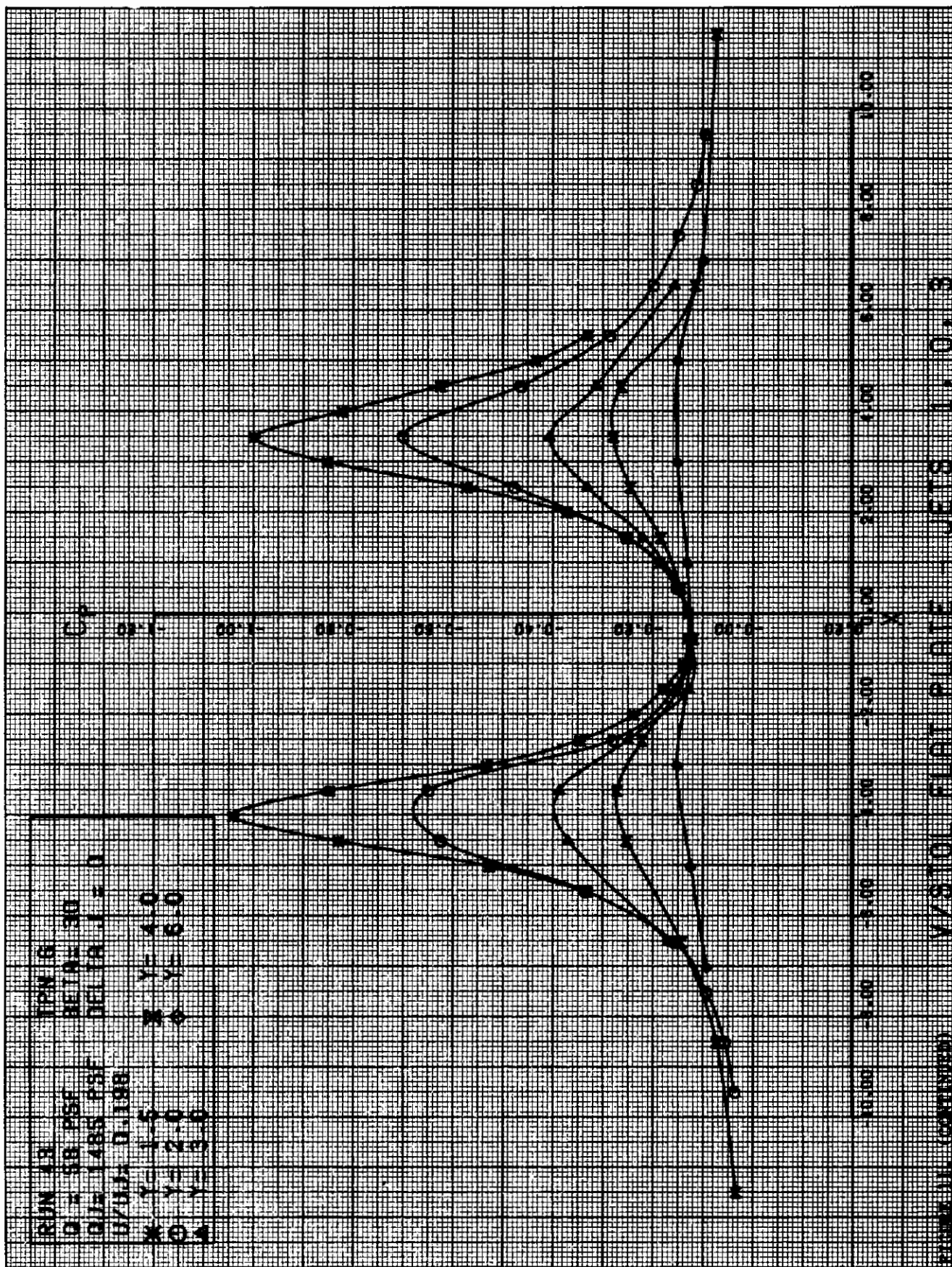
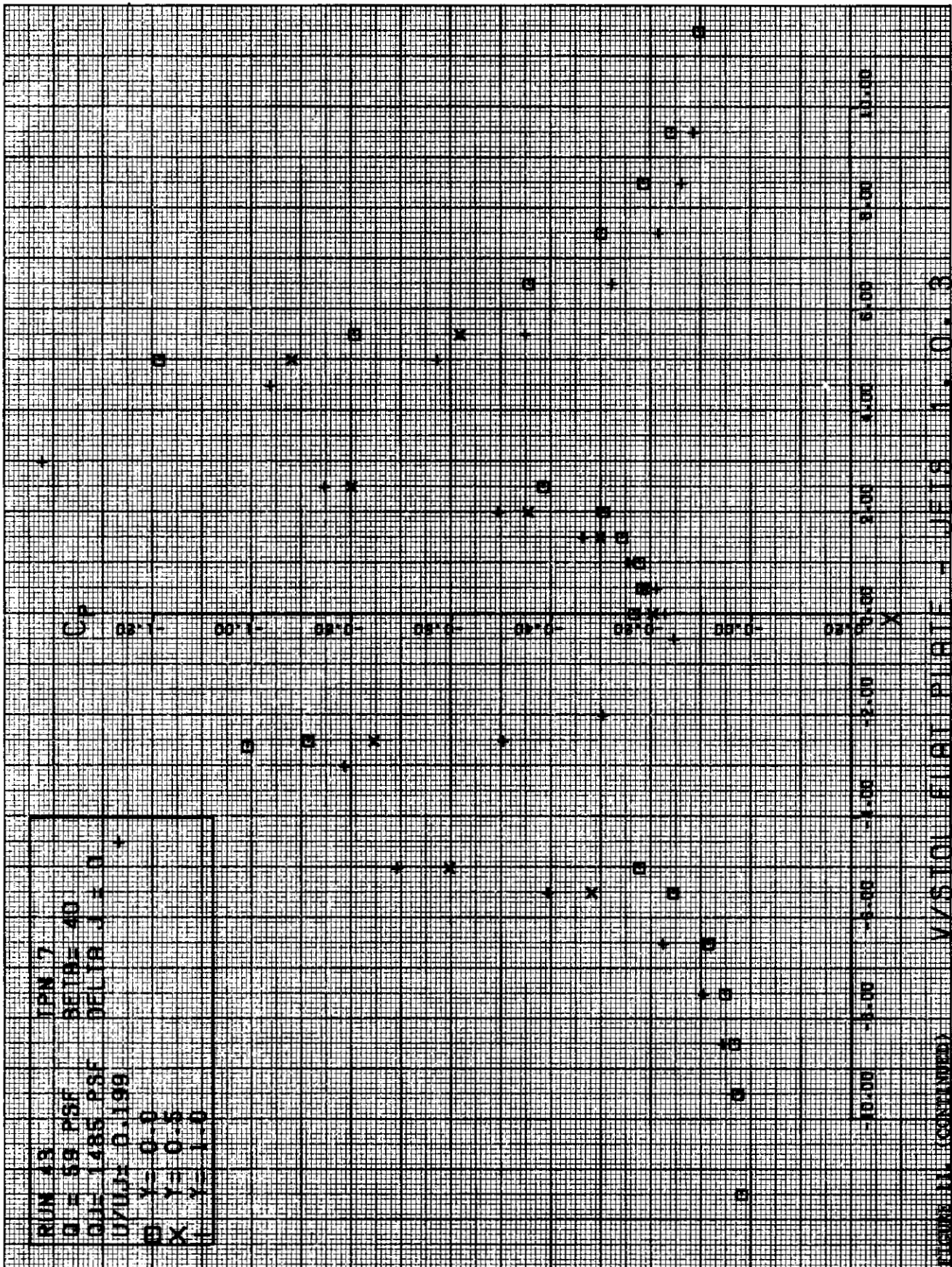


FIGURE 11 (CONTINUED) W/S101 FUAT PLATE - JETS 1, 0, 2





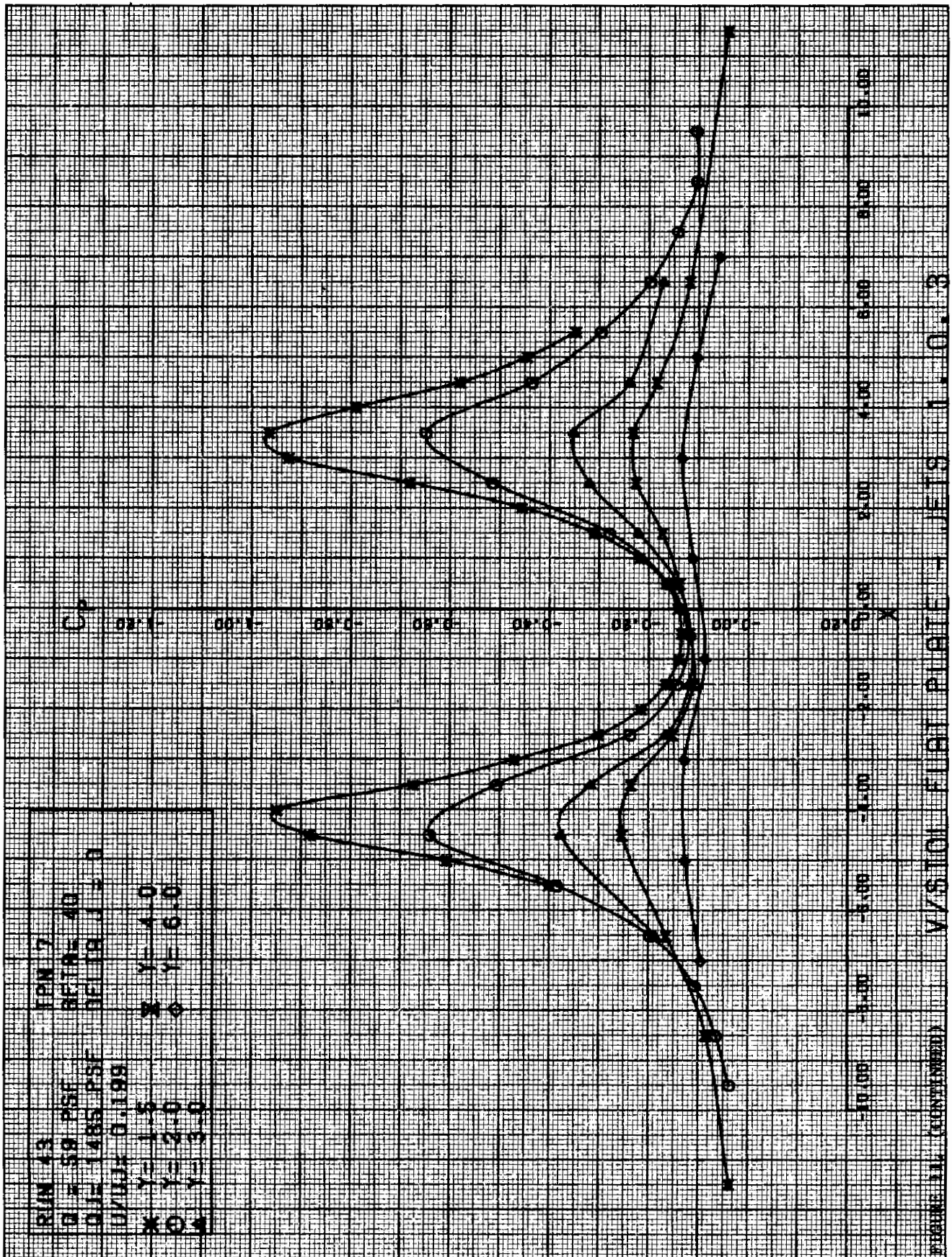
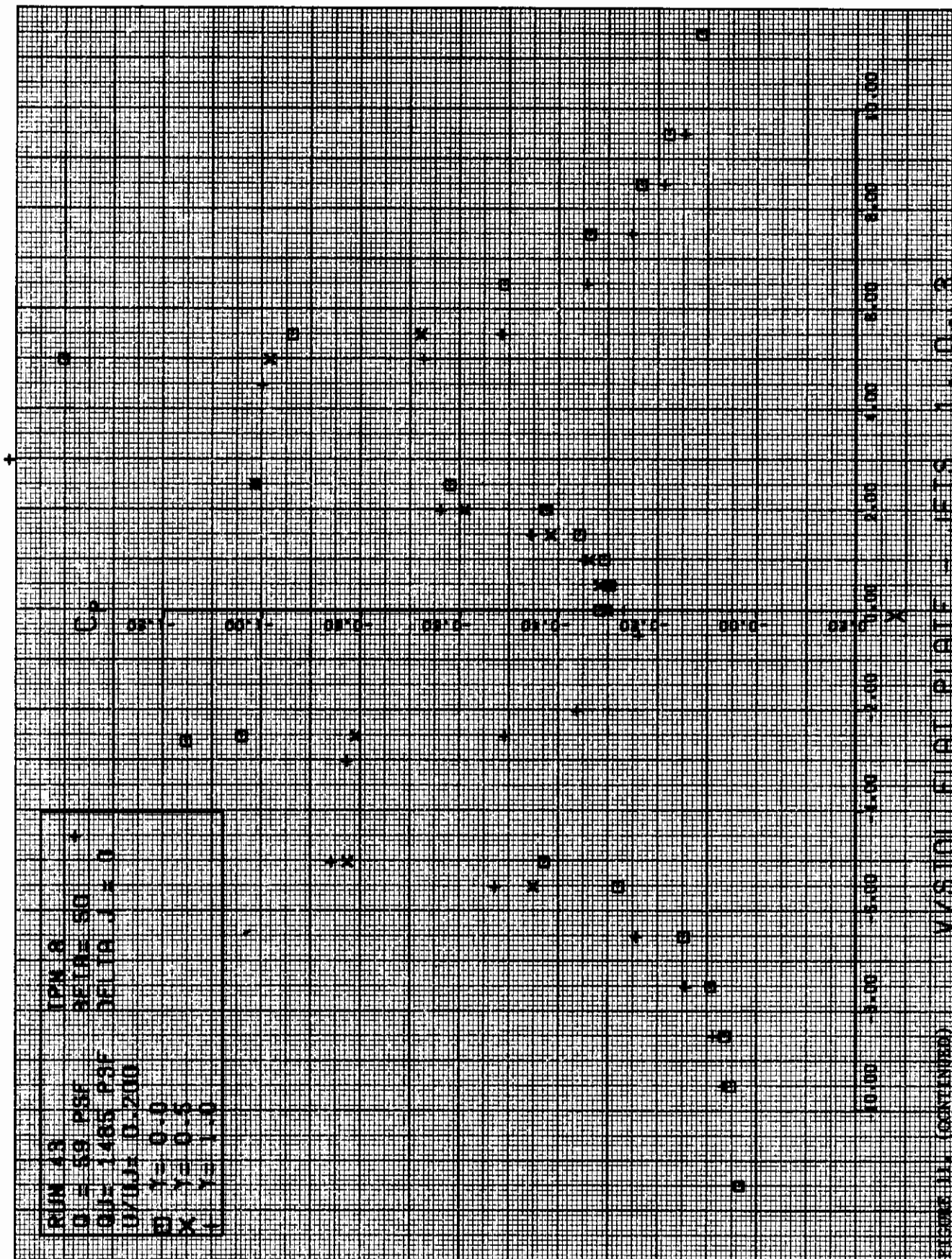
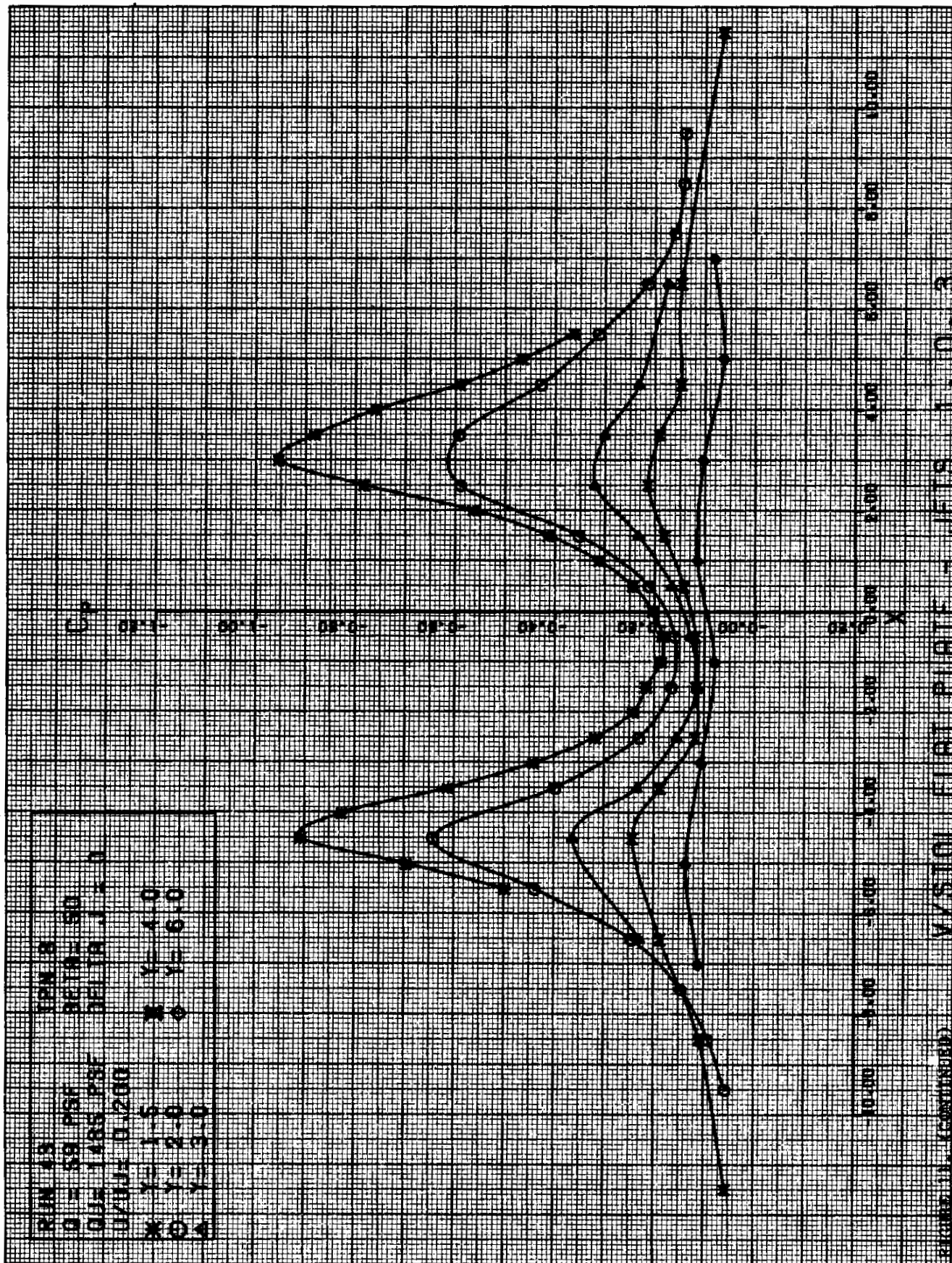
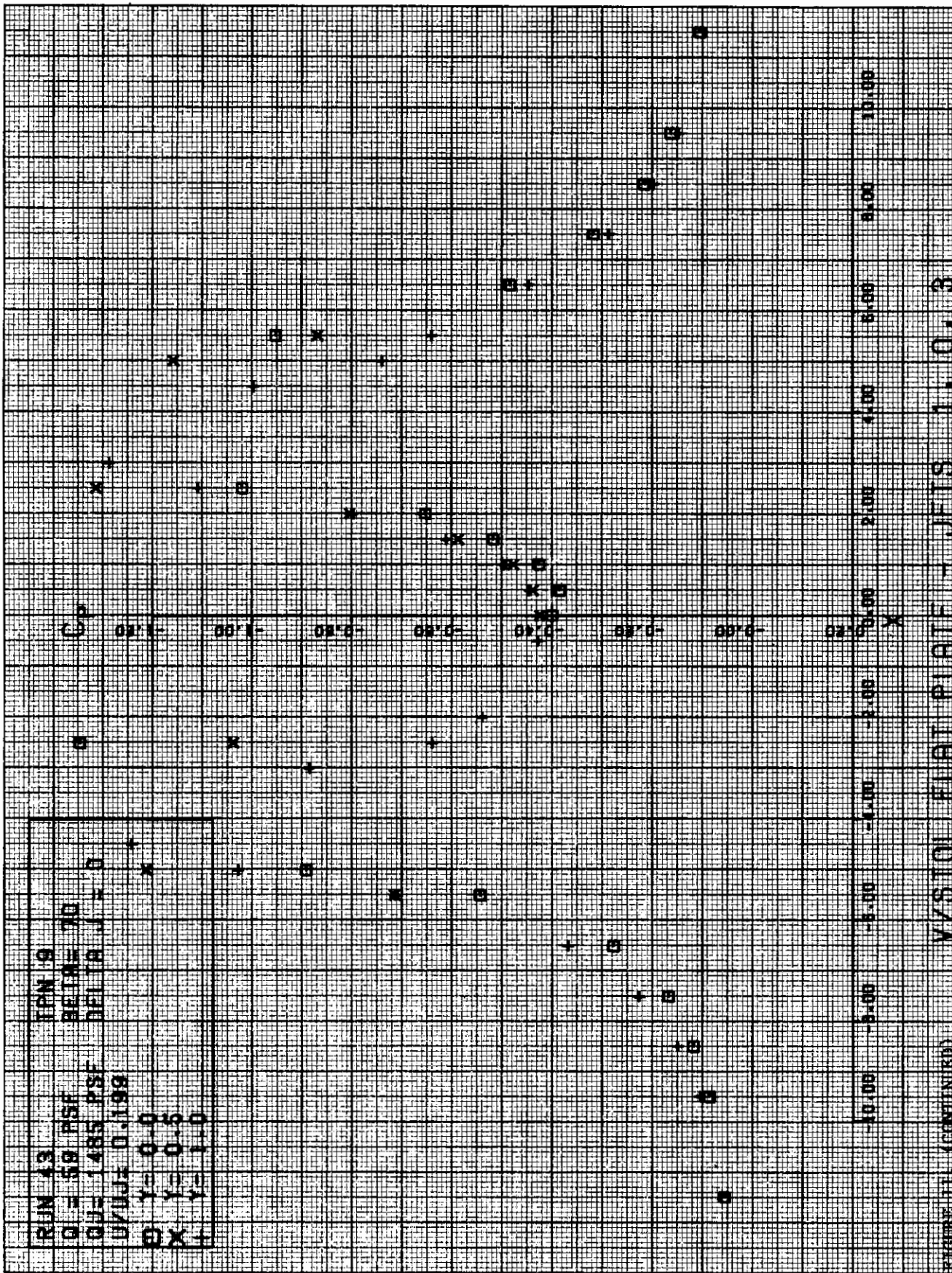
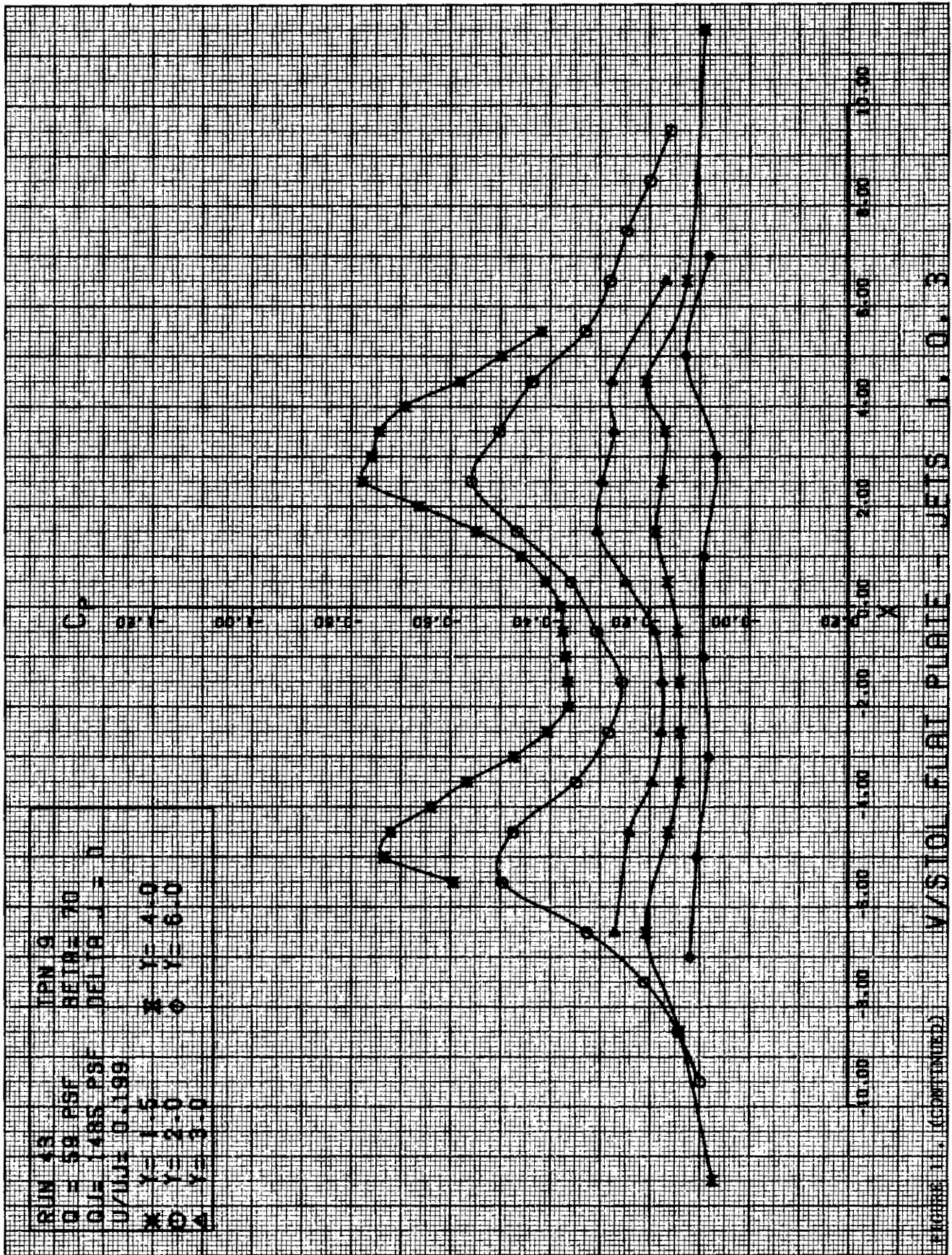


FIGURE 11. (CONTINUED) VISION FLIGHT PROFILE - JETS 1.0.3

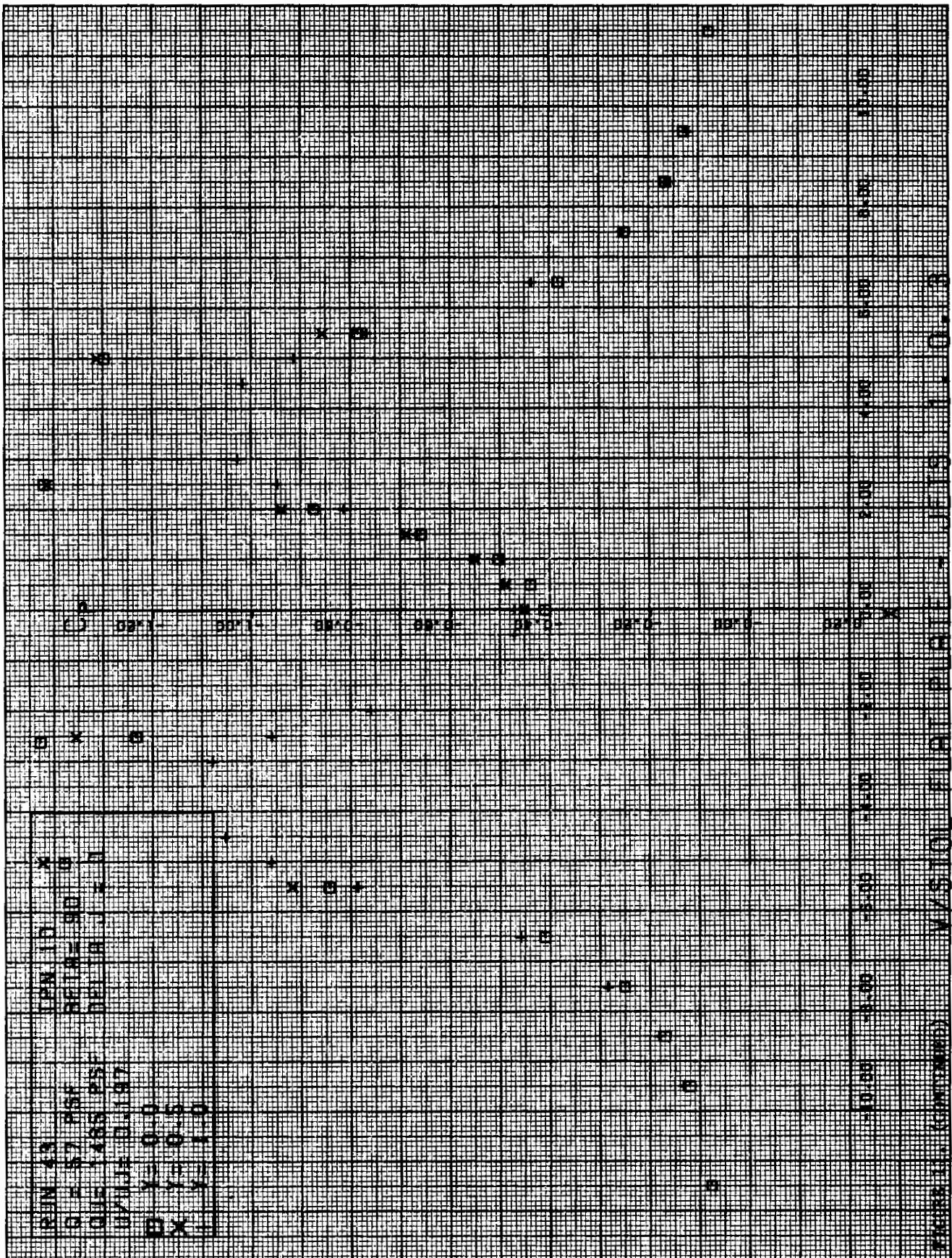








Contrails



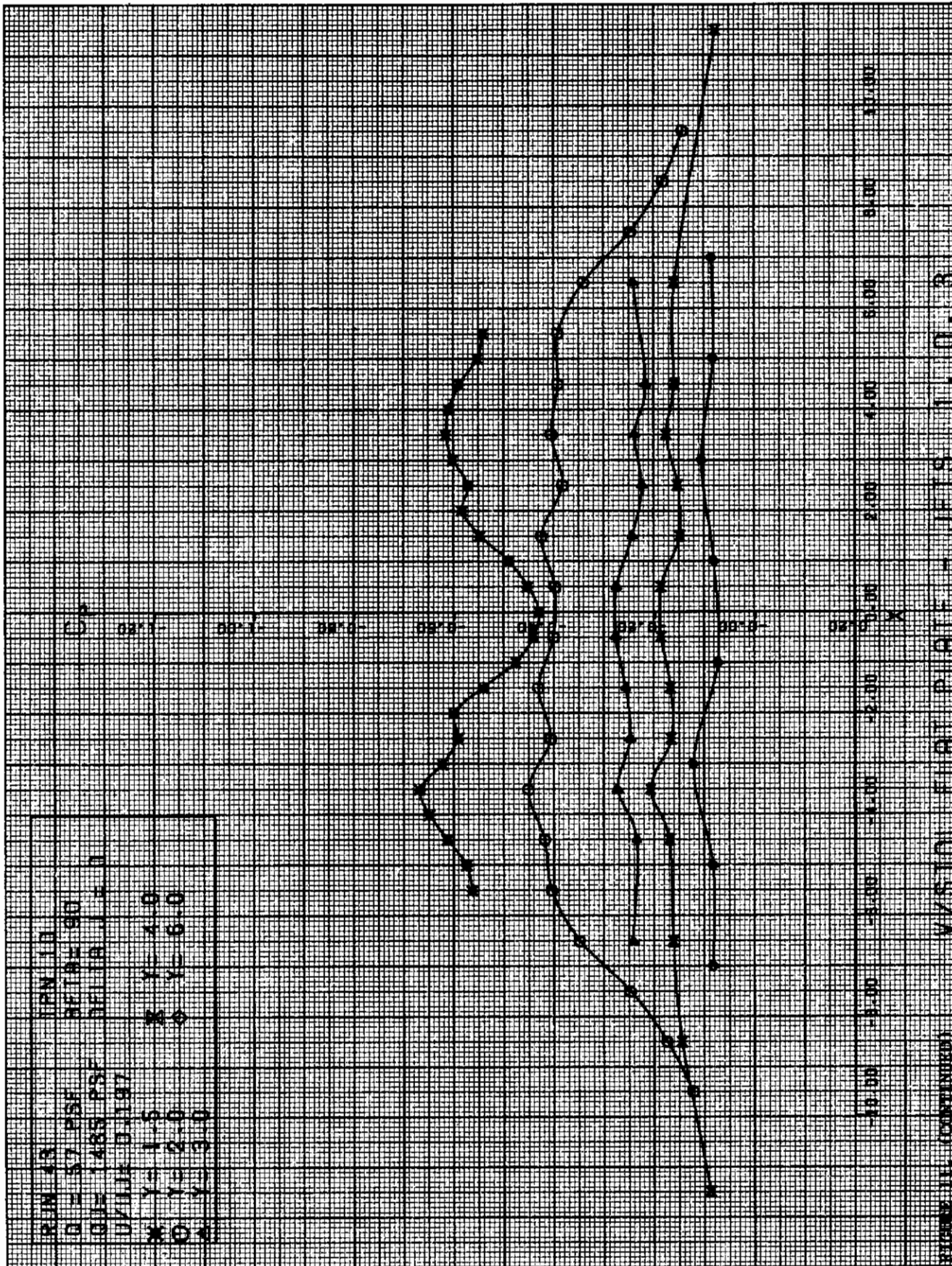
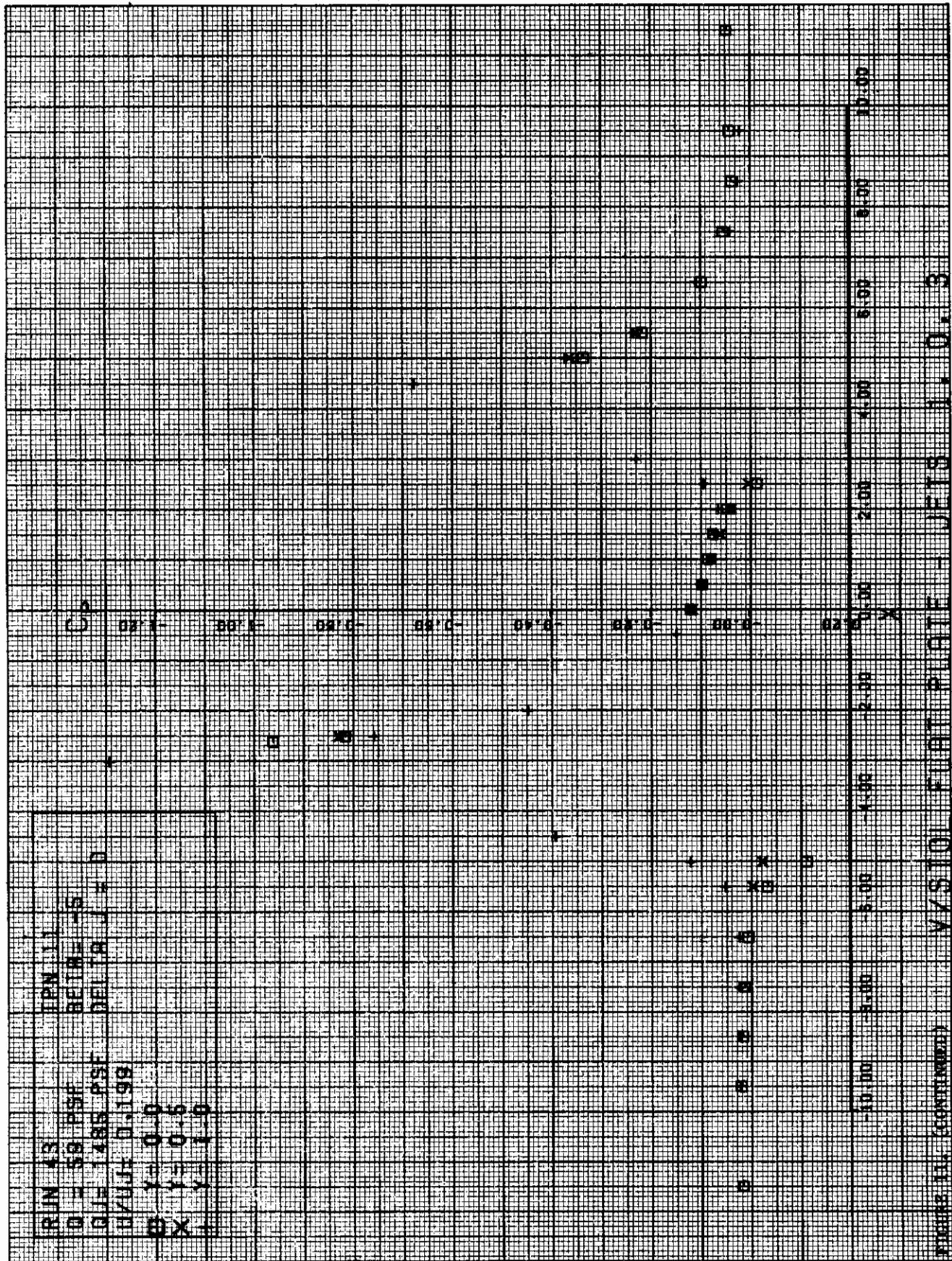
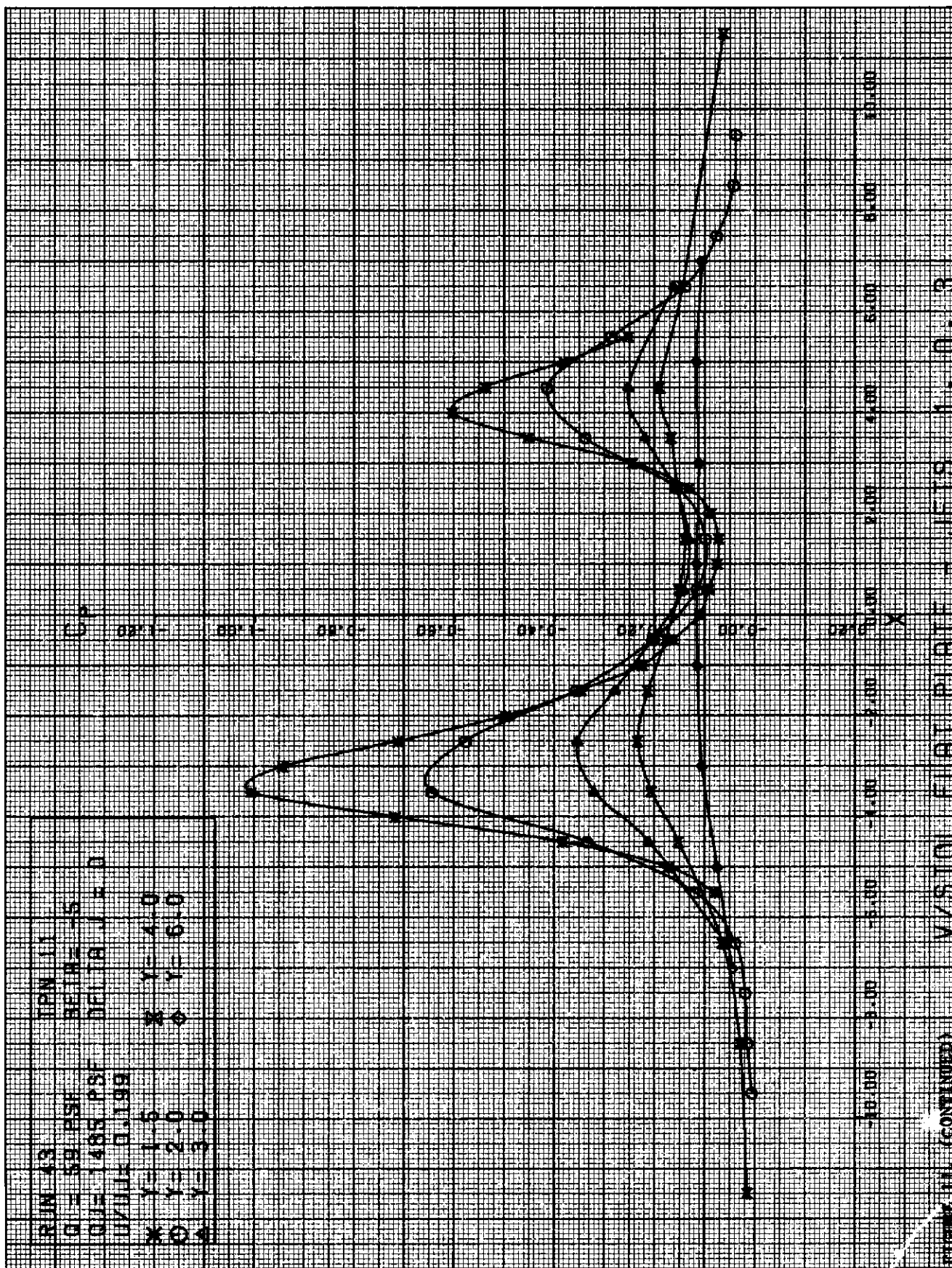
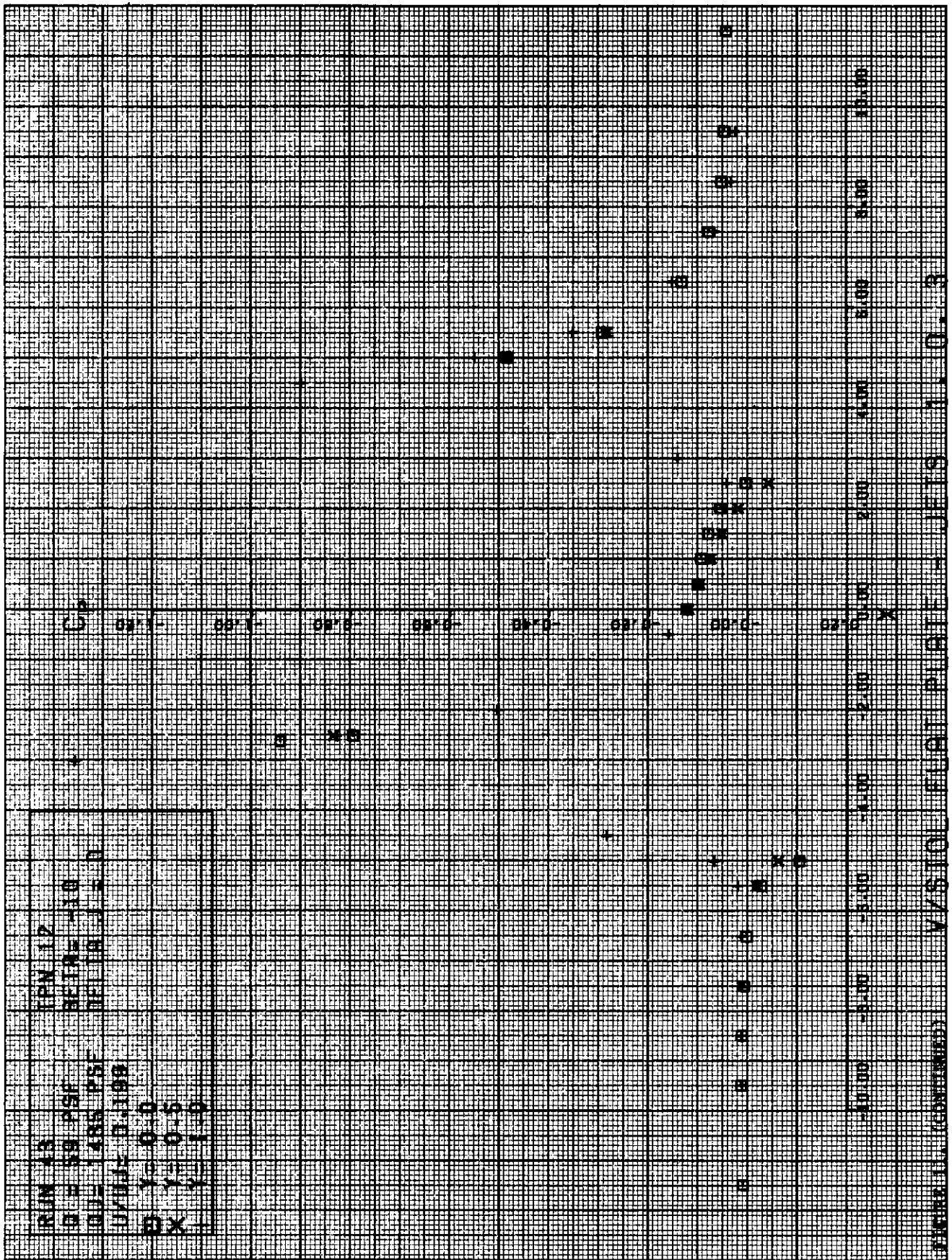


FIGURE 11. (CONTINUED) VISUAL FLAT PLATE - U/FIS 11.0.3







RUN 15
EPN 17
DLE 59 PSE
DUE 285 PSE
UWAL 0.108
D 15 0.0
X 15 0.5
15 1.0

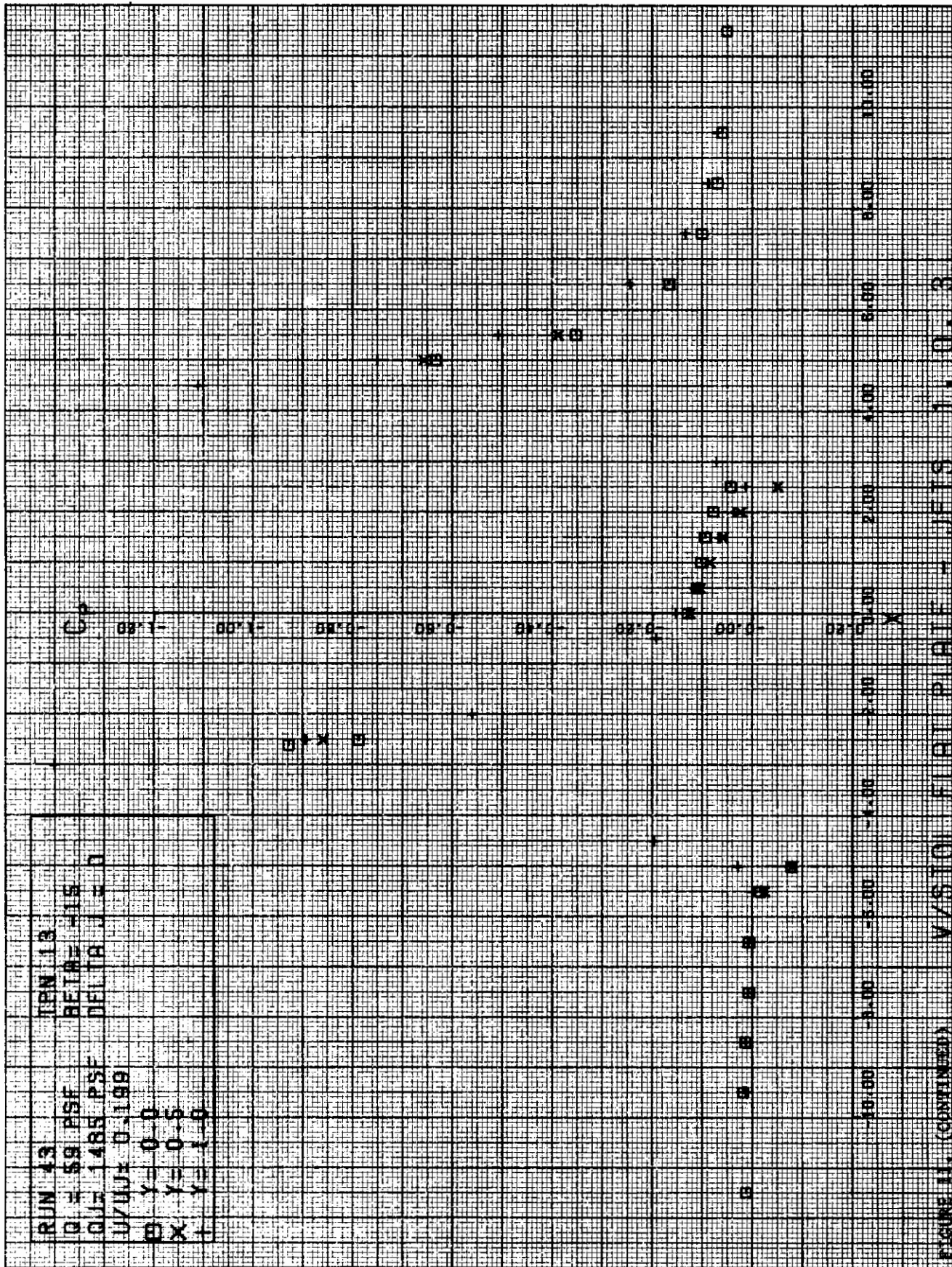
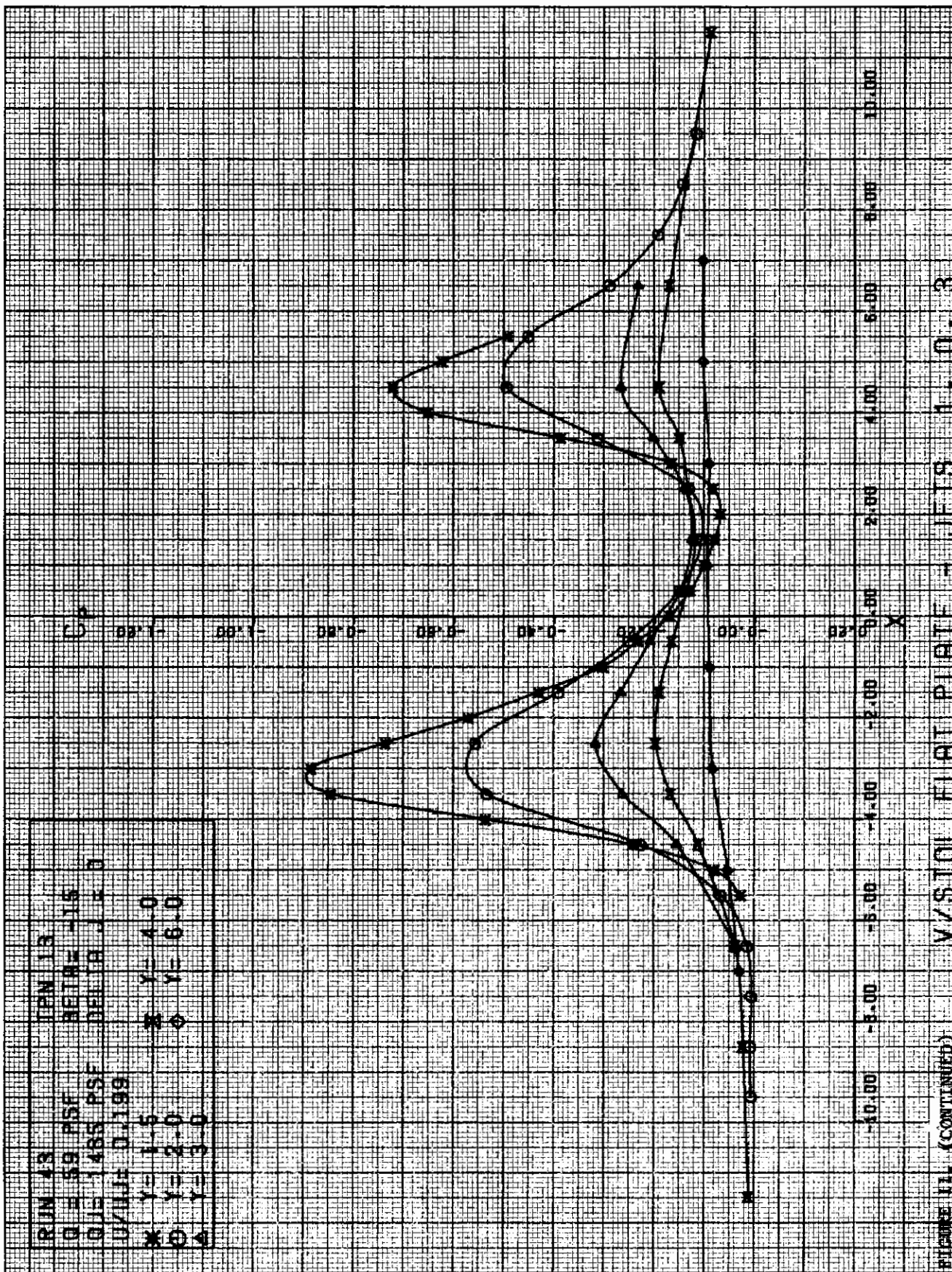
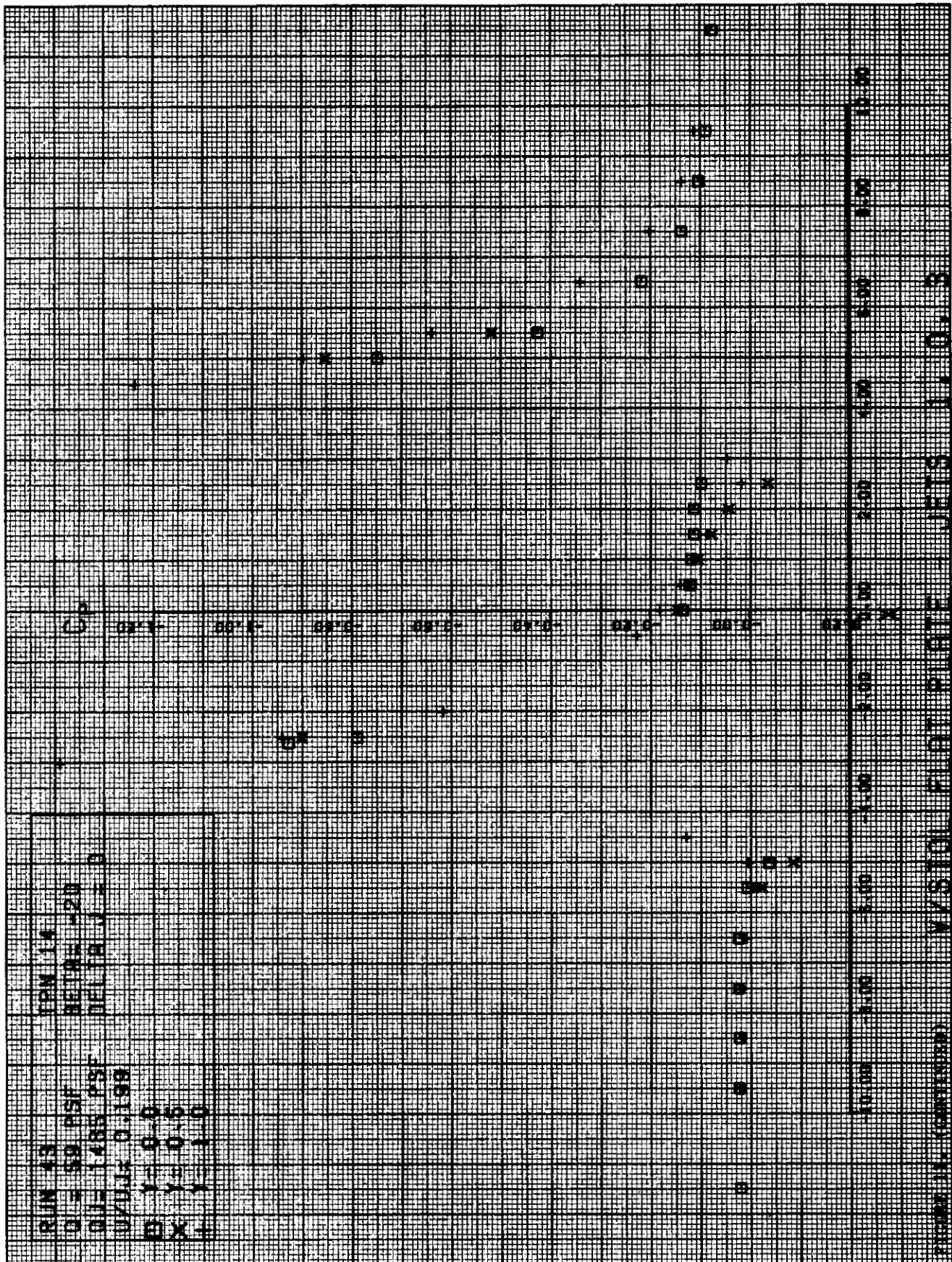
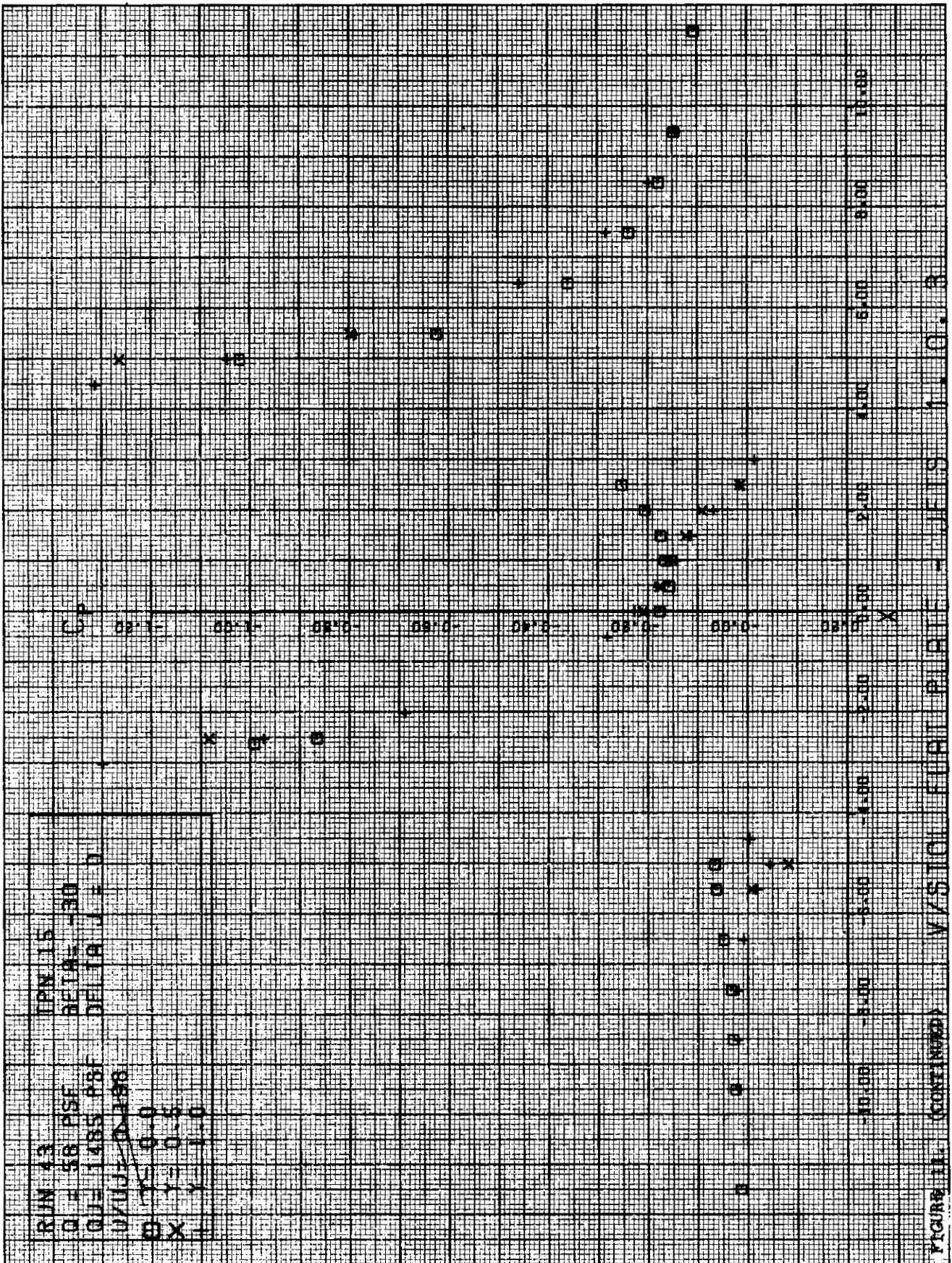


FIGURE 11. (CONTINUED) V/S 101 FLIGHT PLATE - 11.0.3







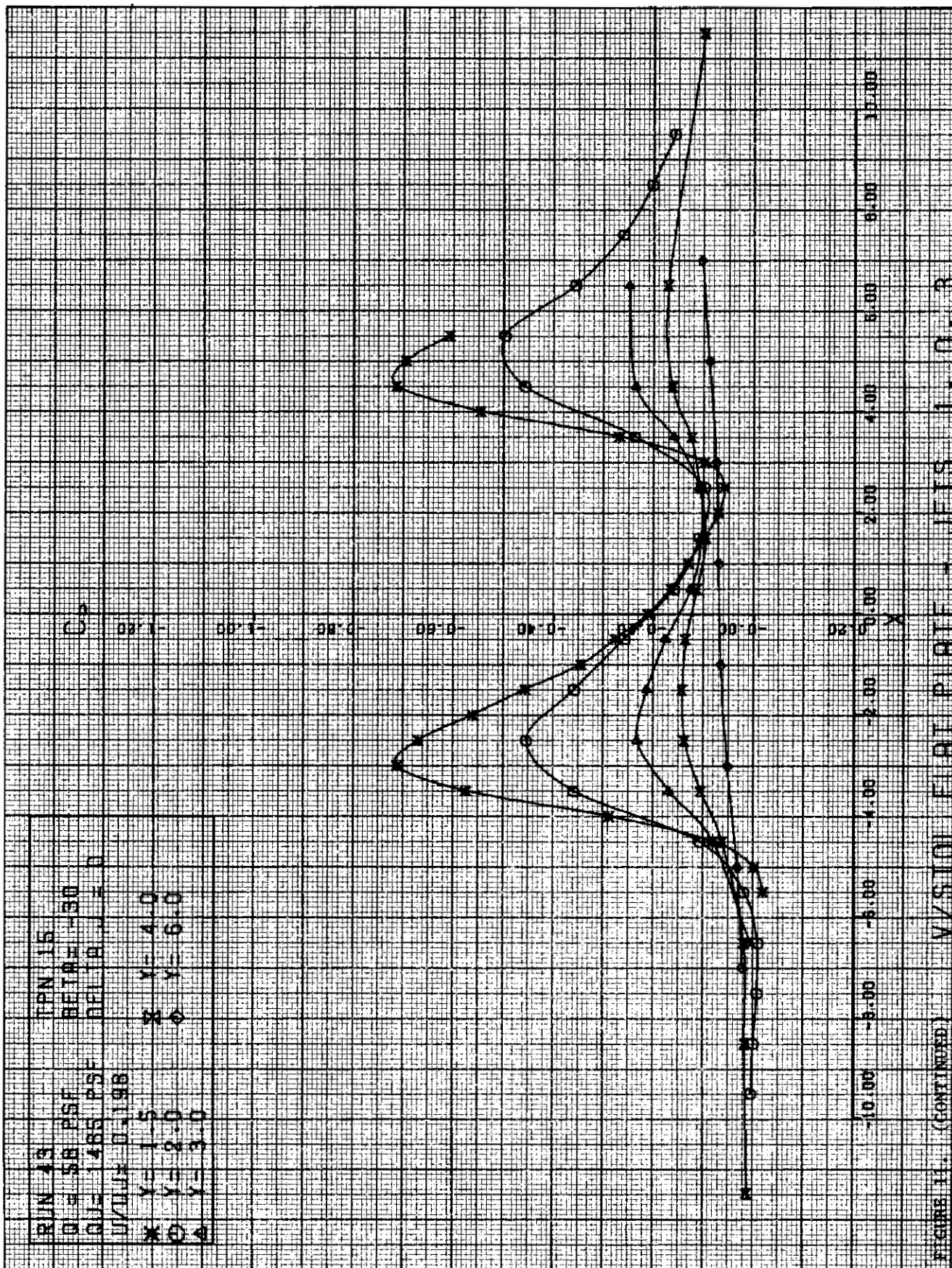


FIGURE 1. (CONTINUED) W/STOL FLAT PLANE - JETS 1.0.3

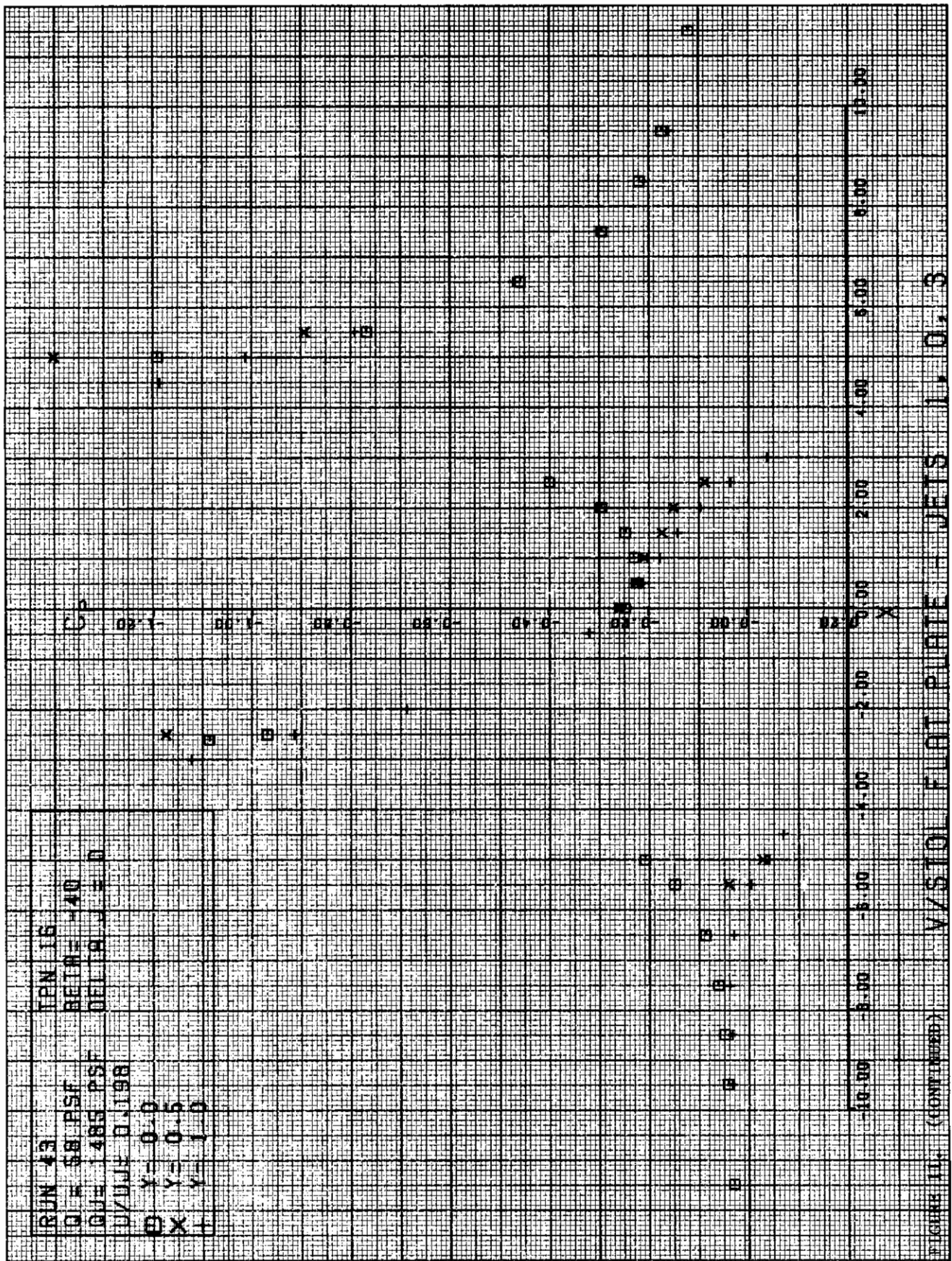
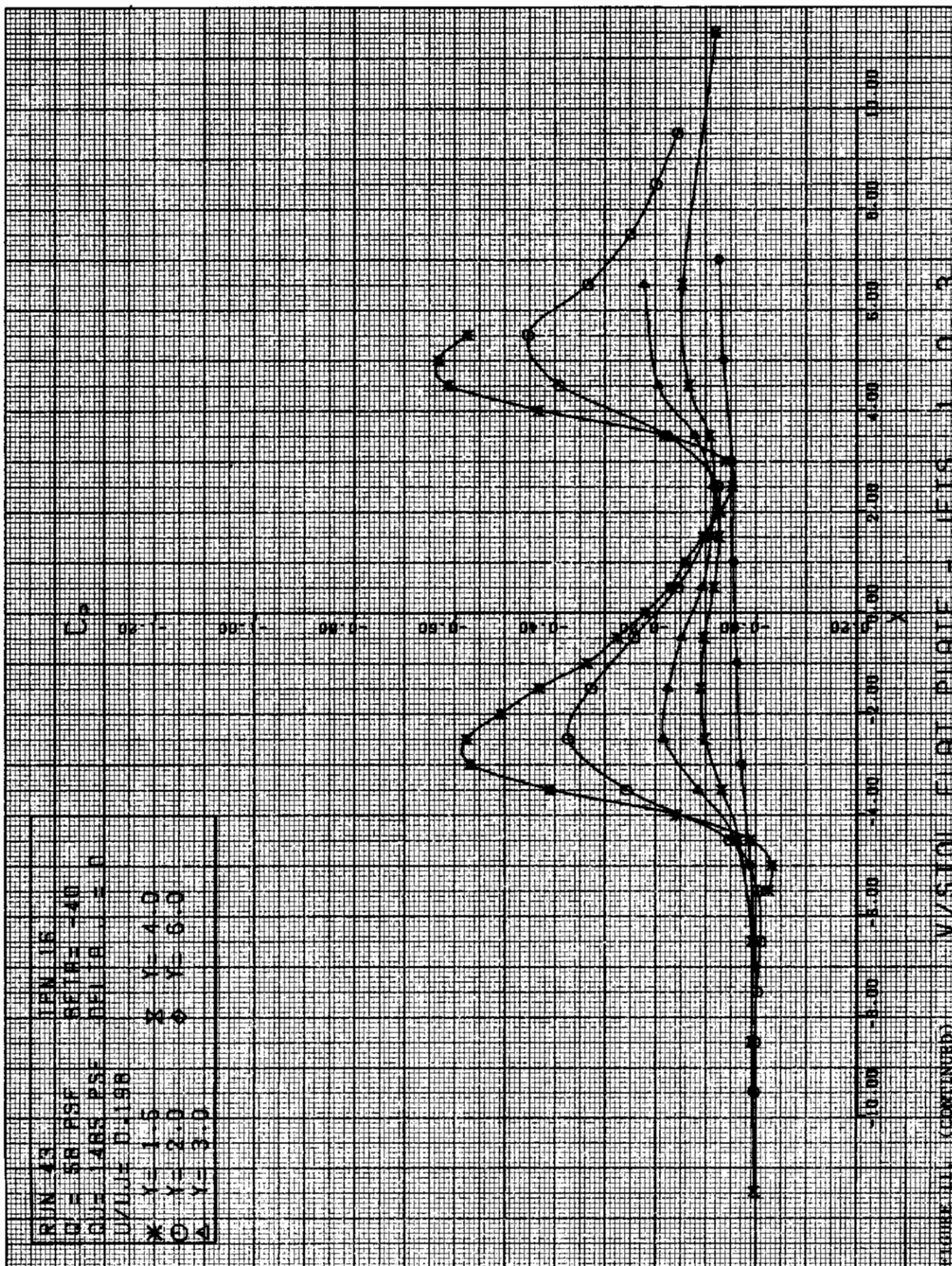
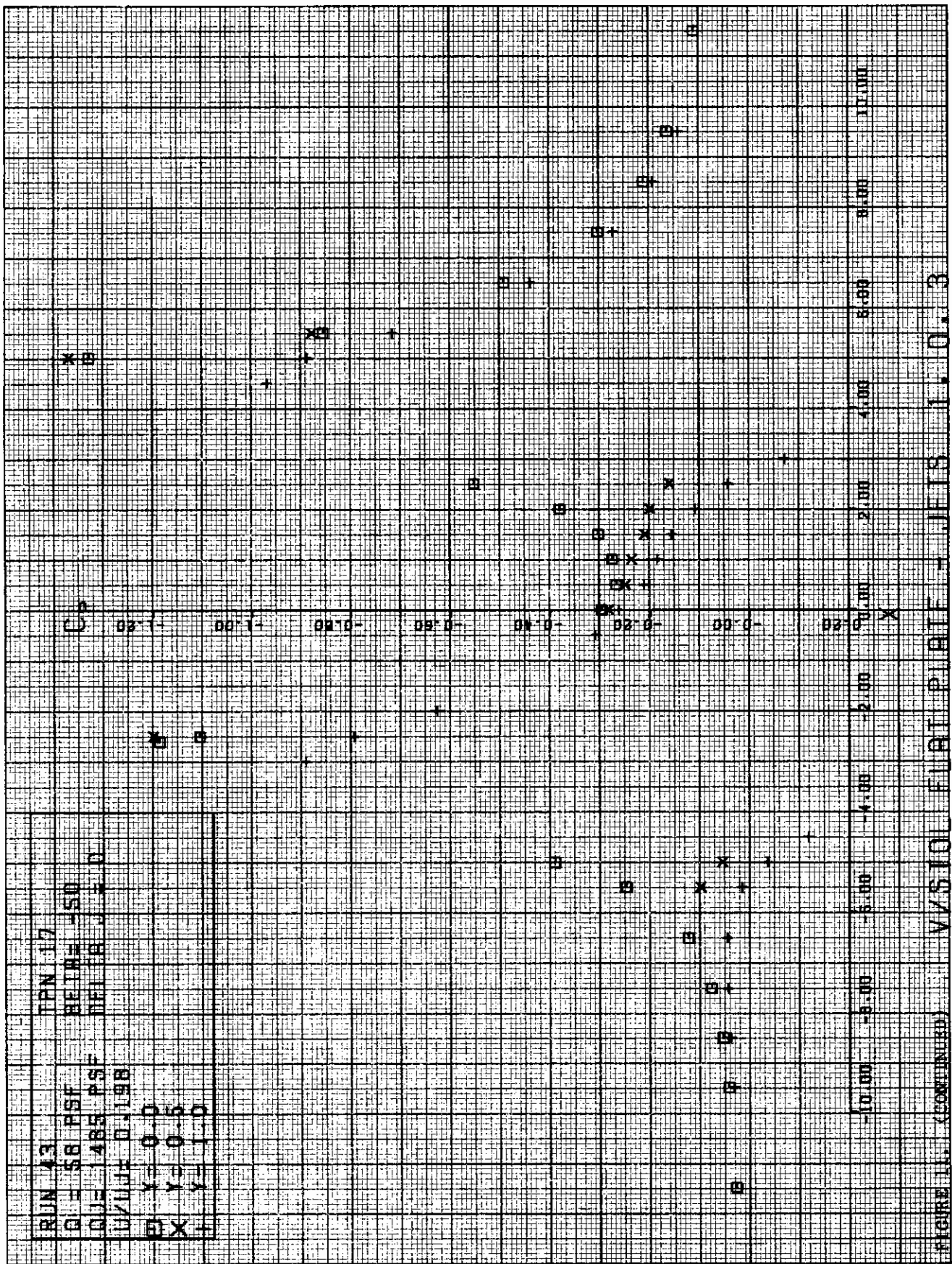
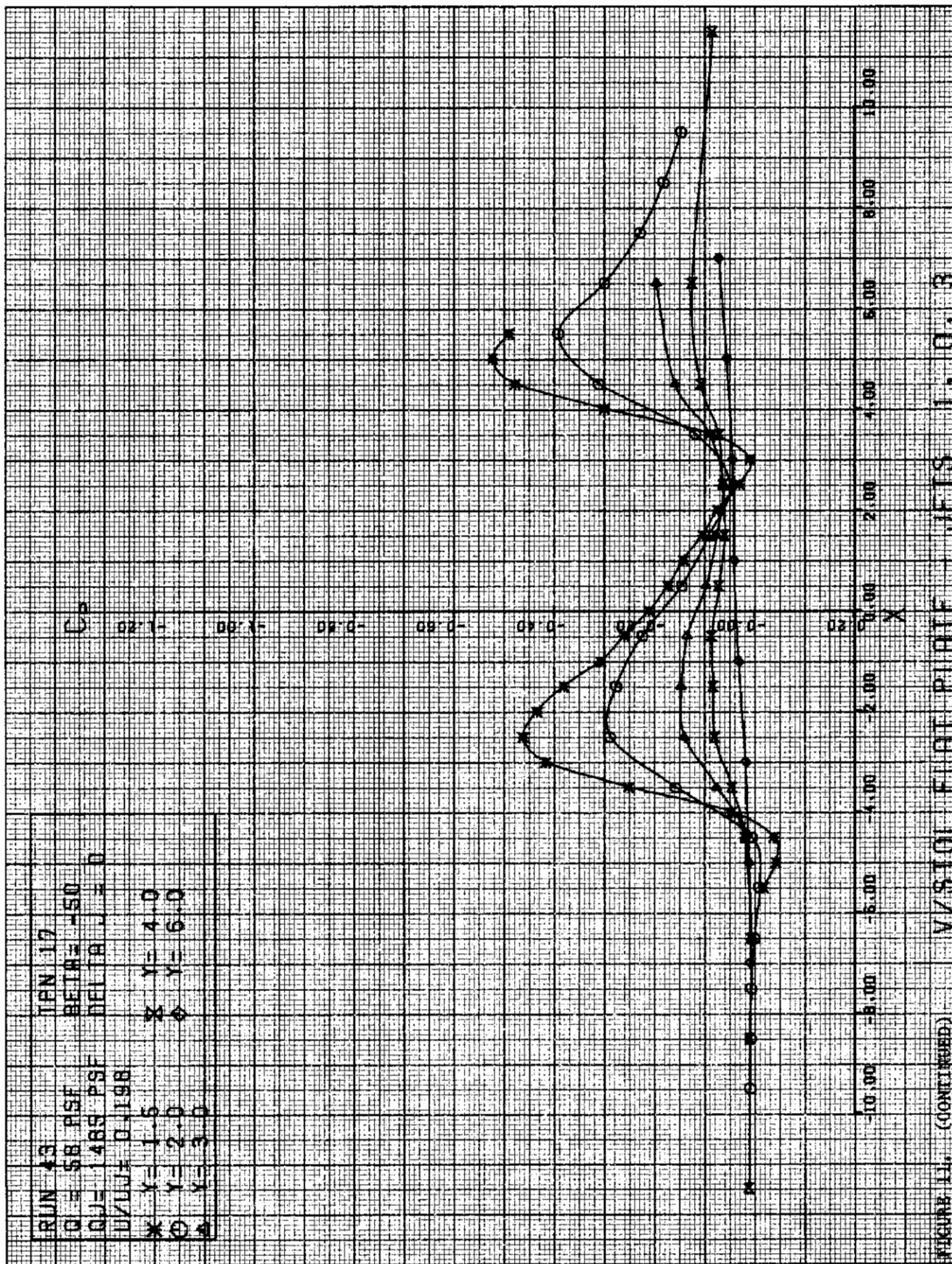
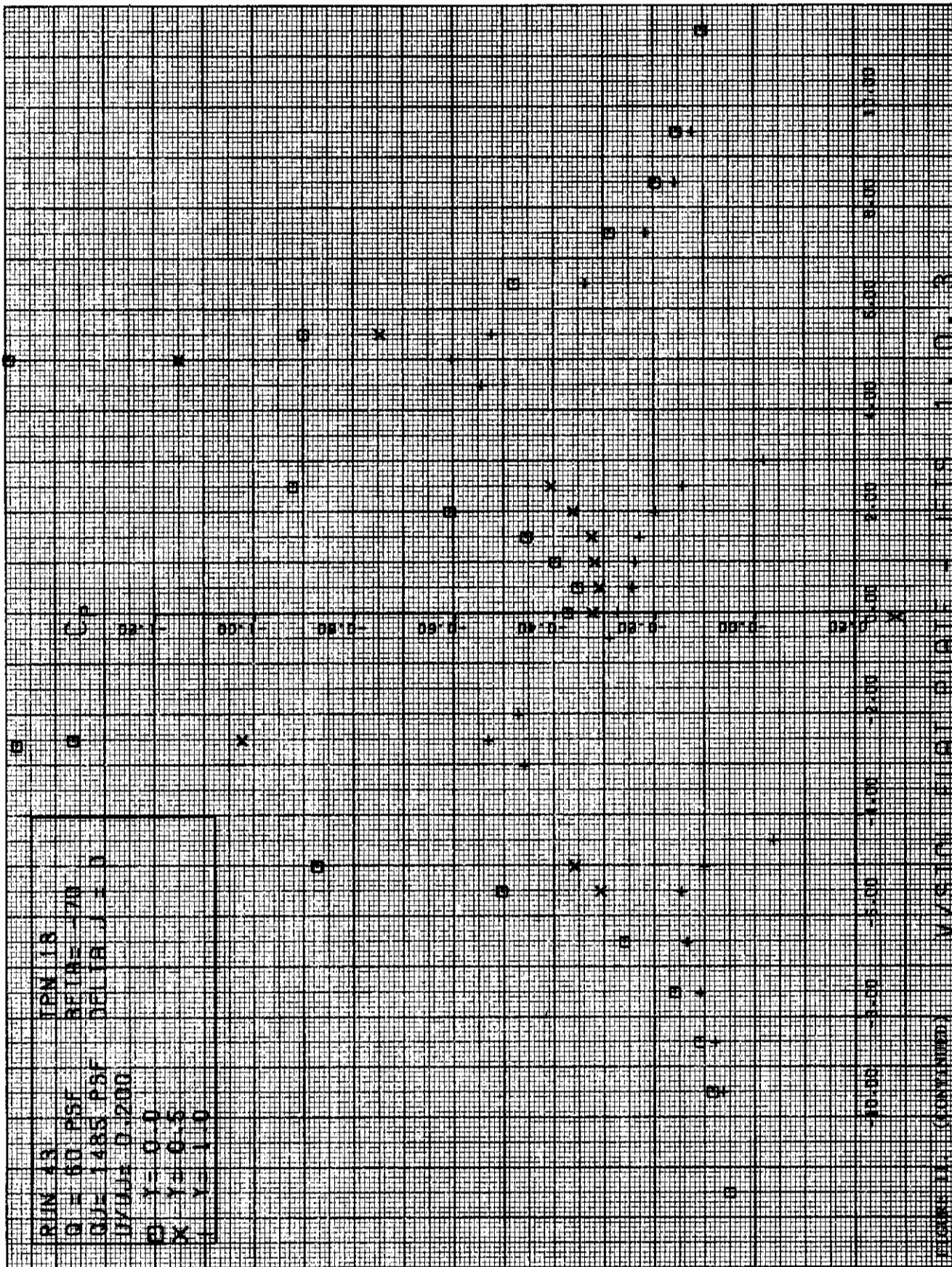


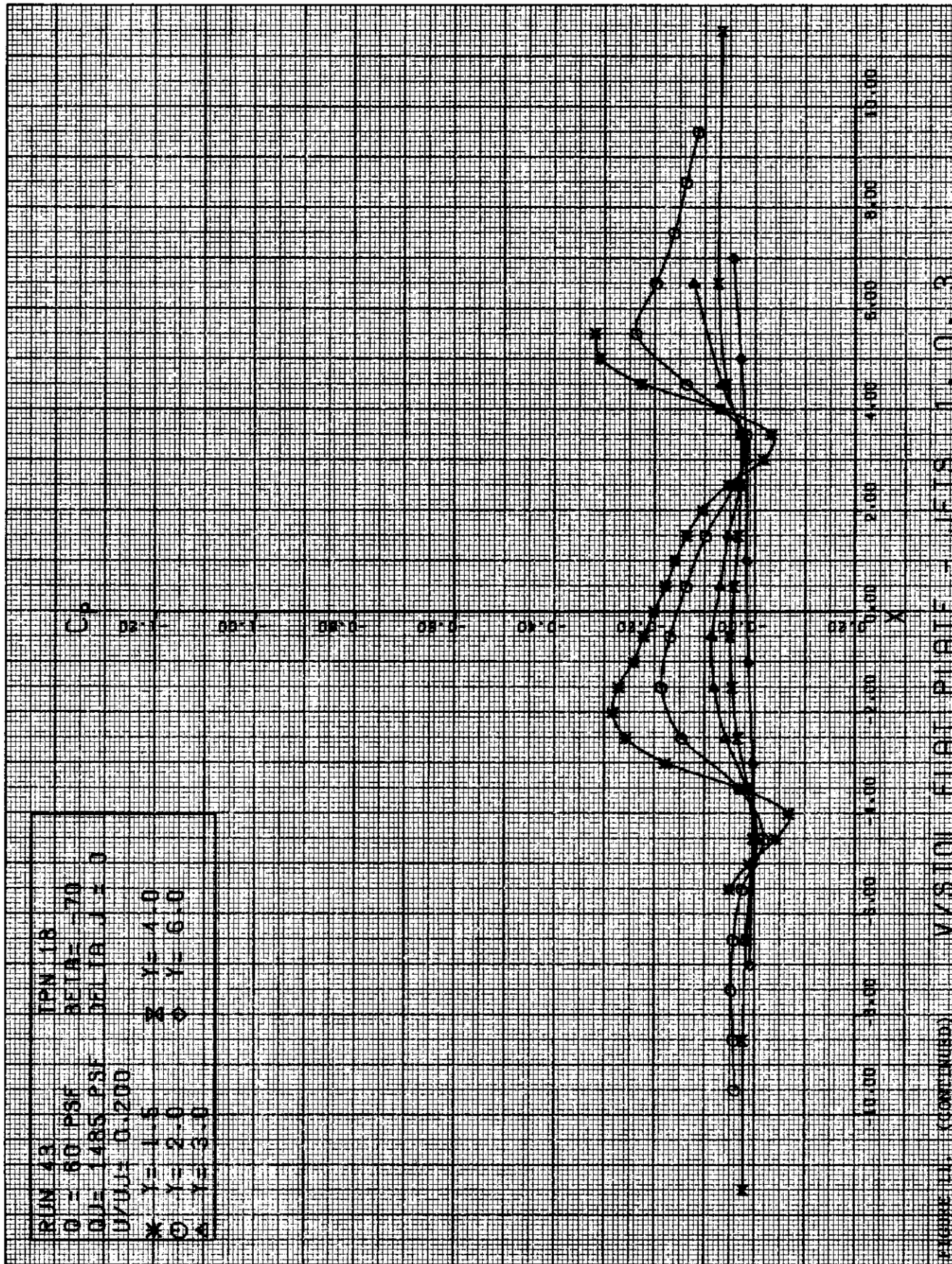
FIGURE III. (CONTINUED) V/S101 FLAT PLATE - JETS 1, 0, 3

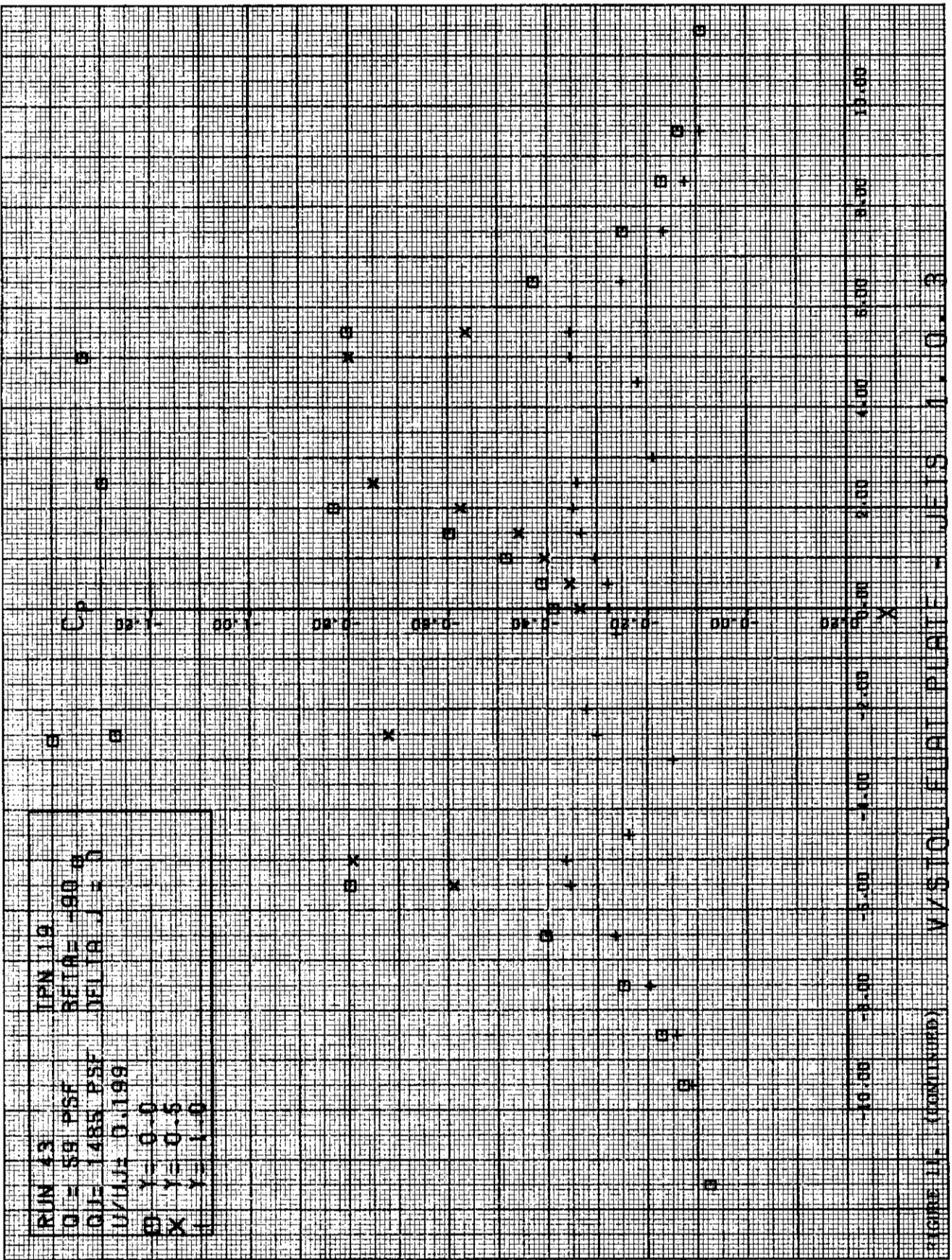












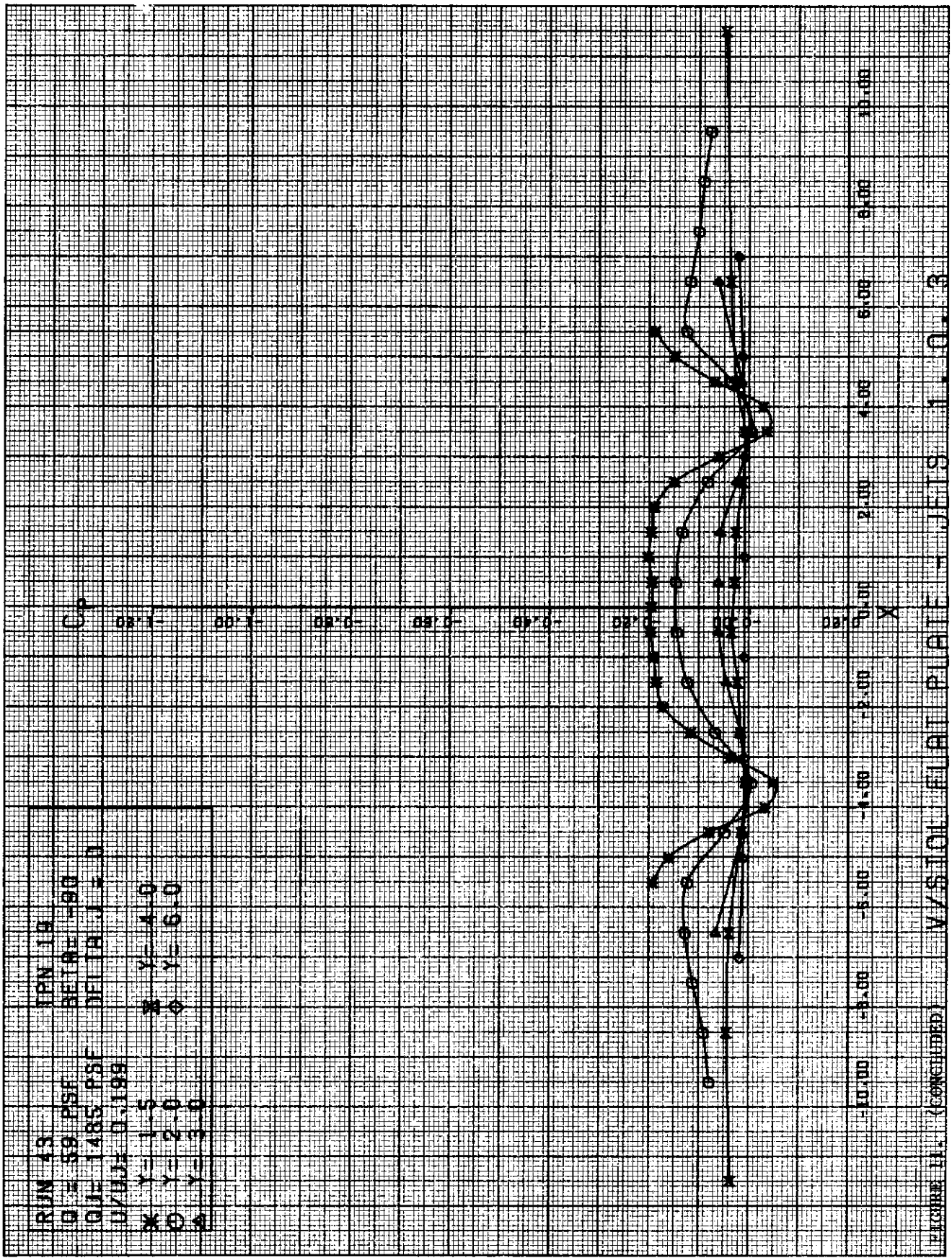
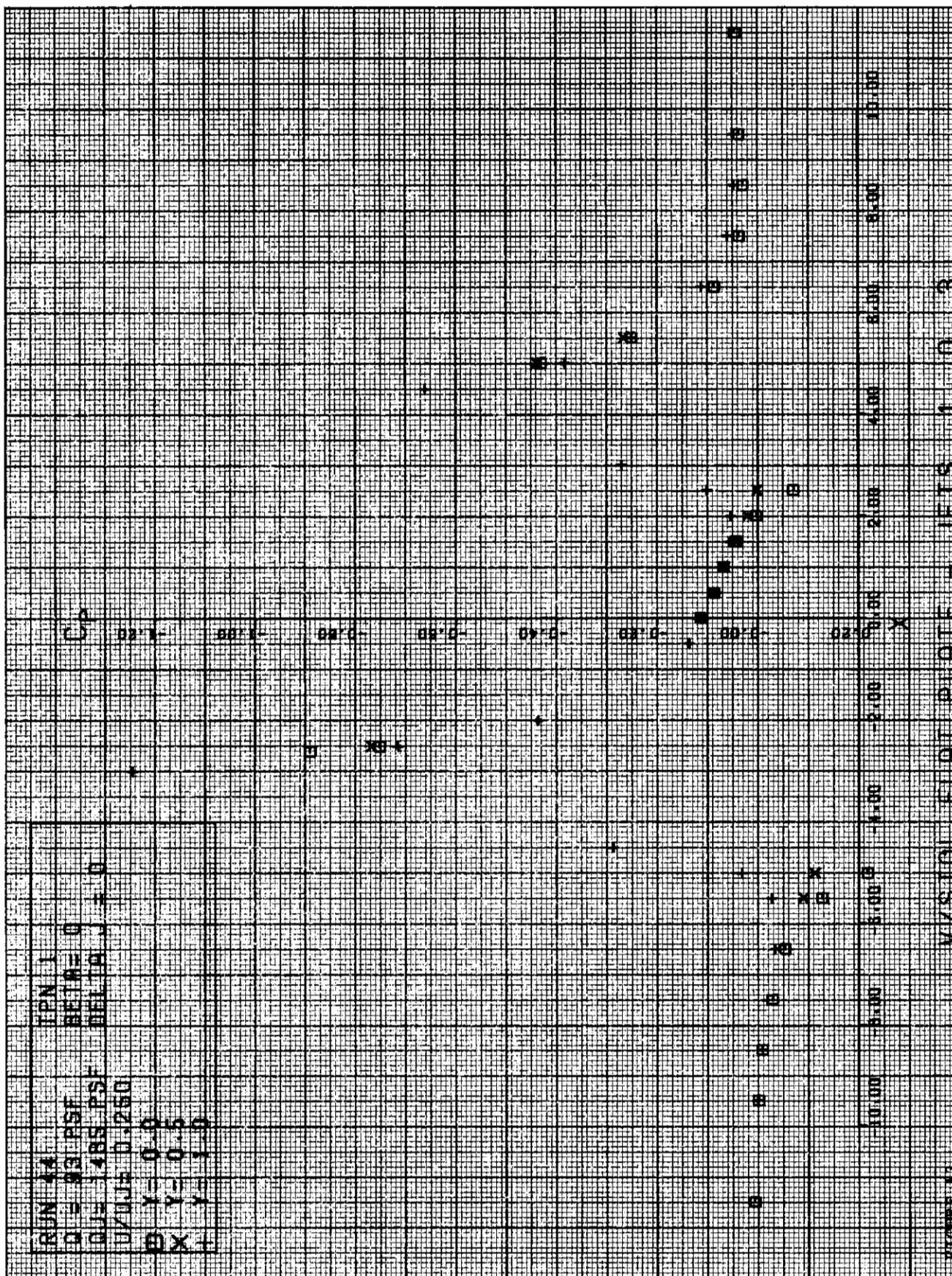
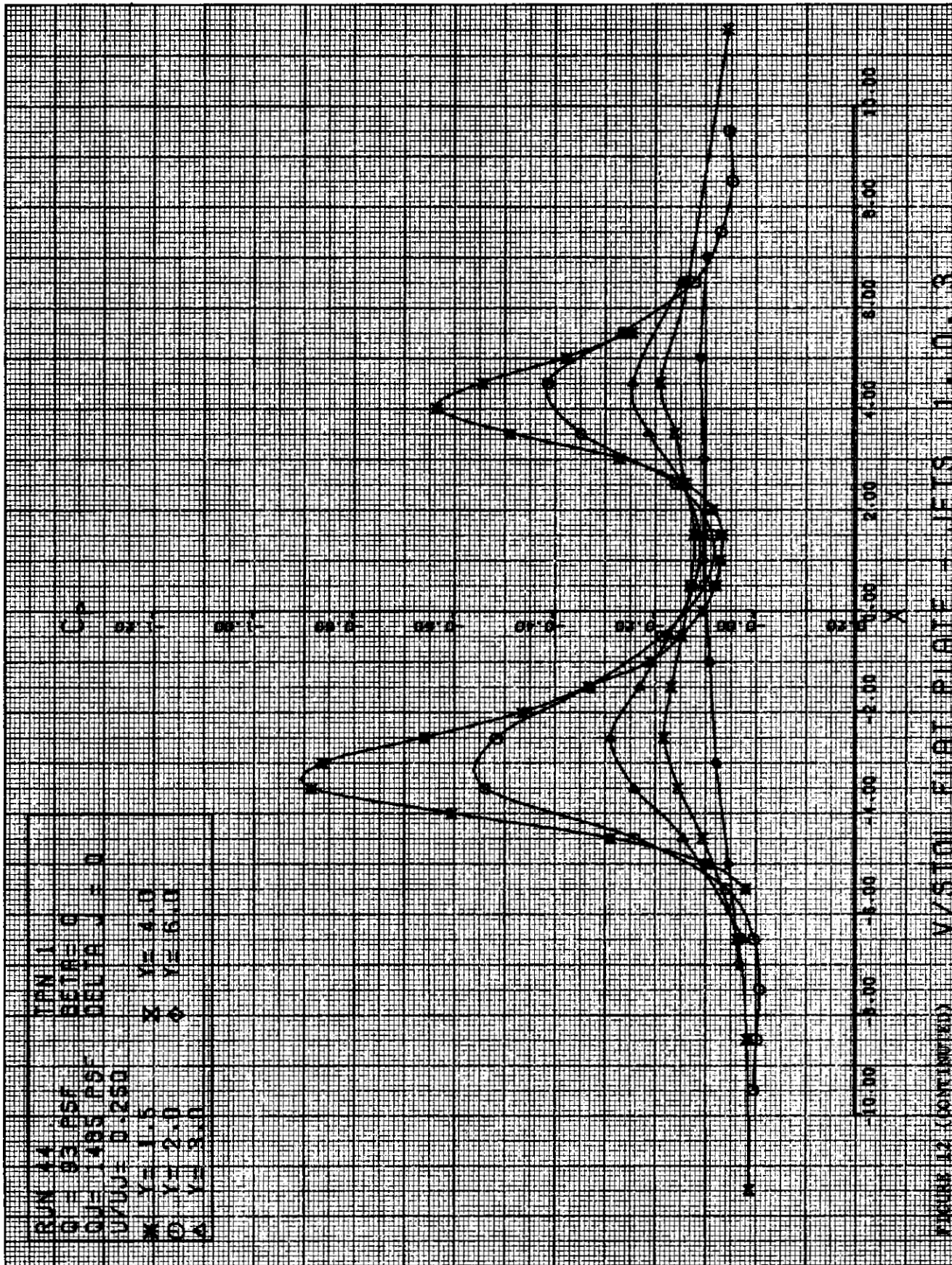
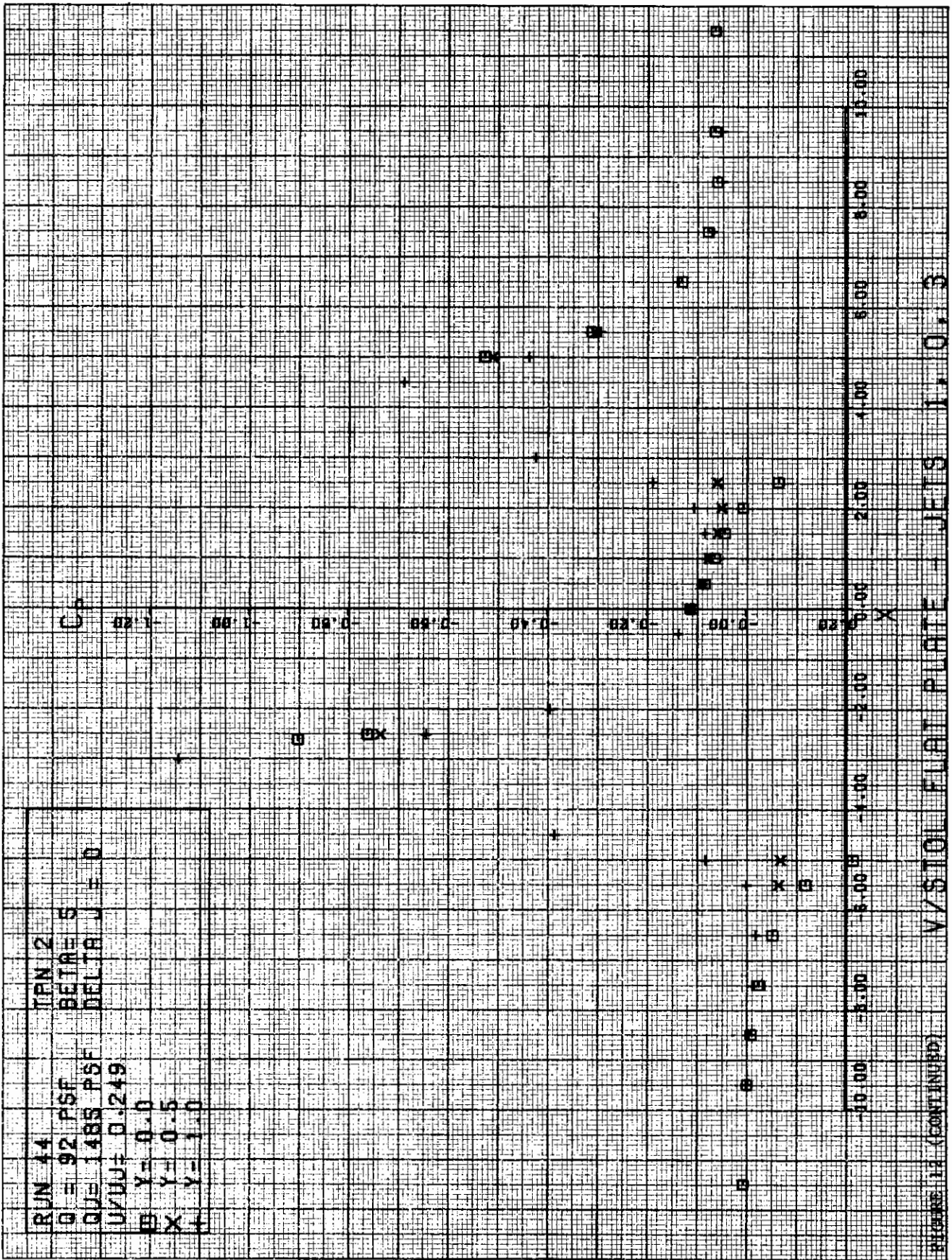


FIGURE 11. (CONCLUDED) VISION FLAT PLATE - JETS 1, 2, 3







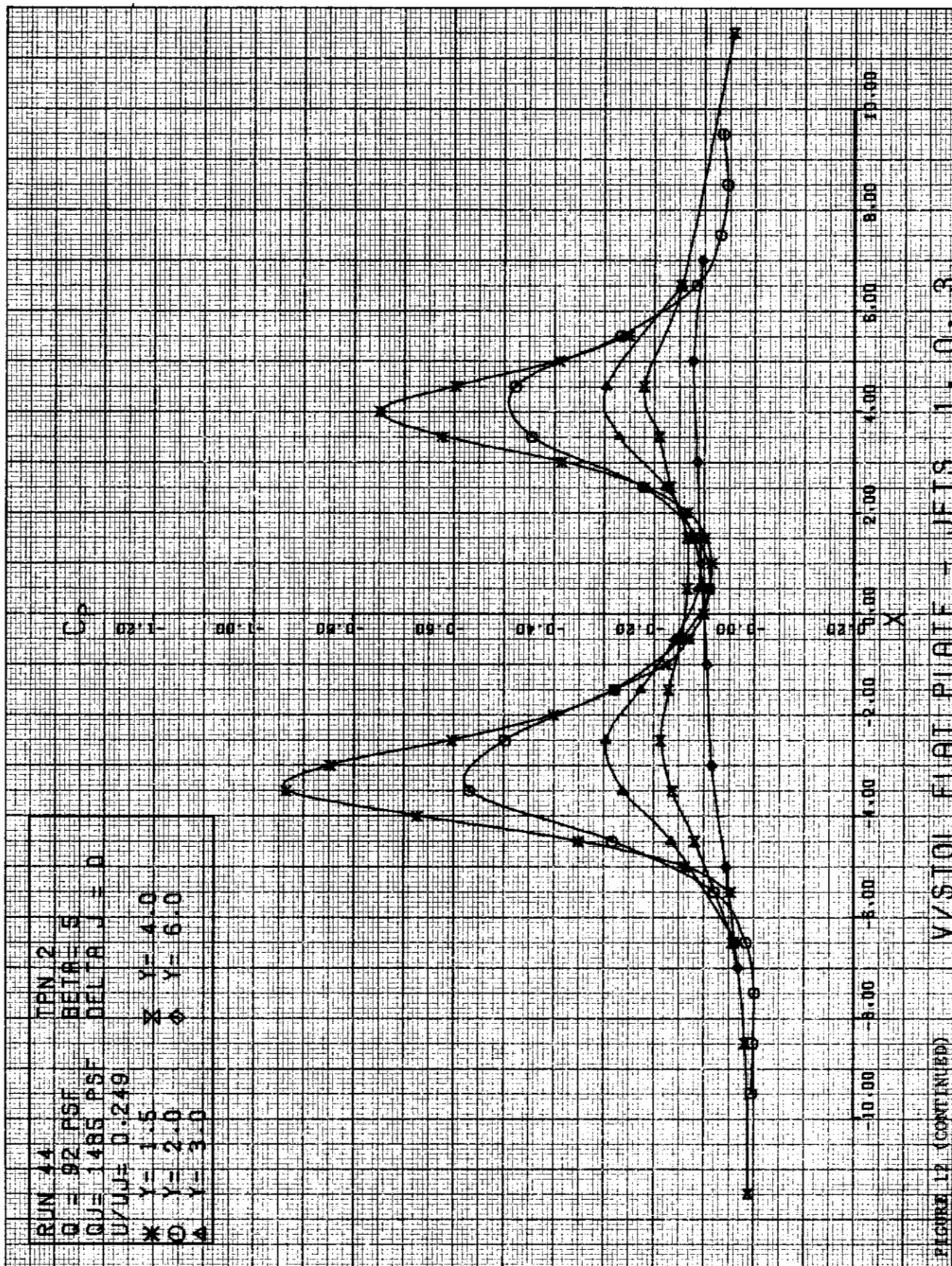
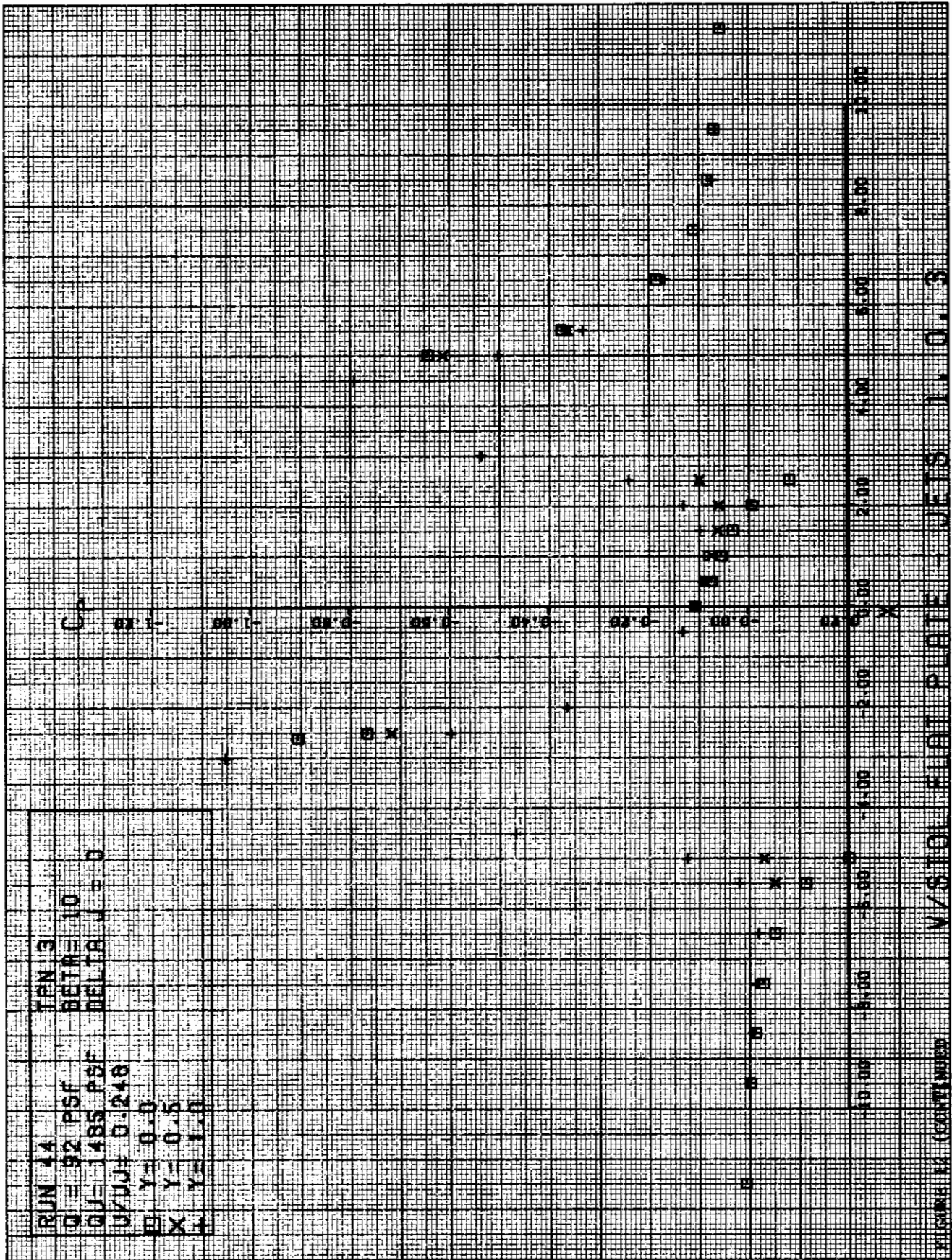
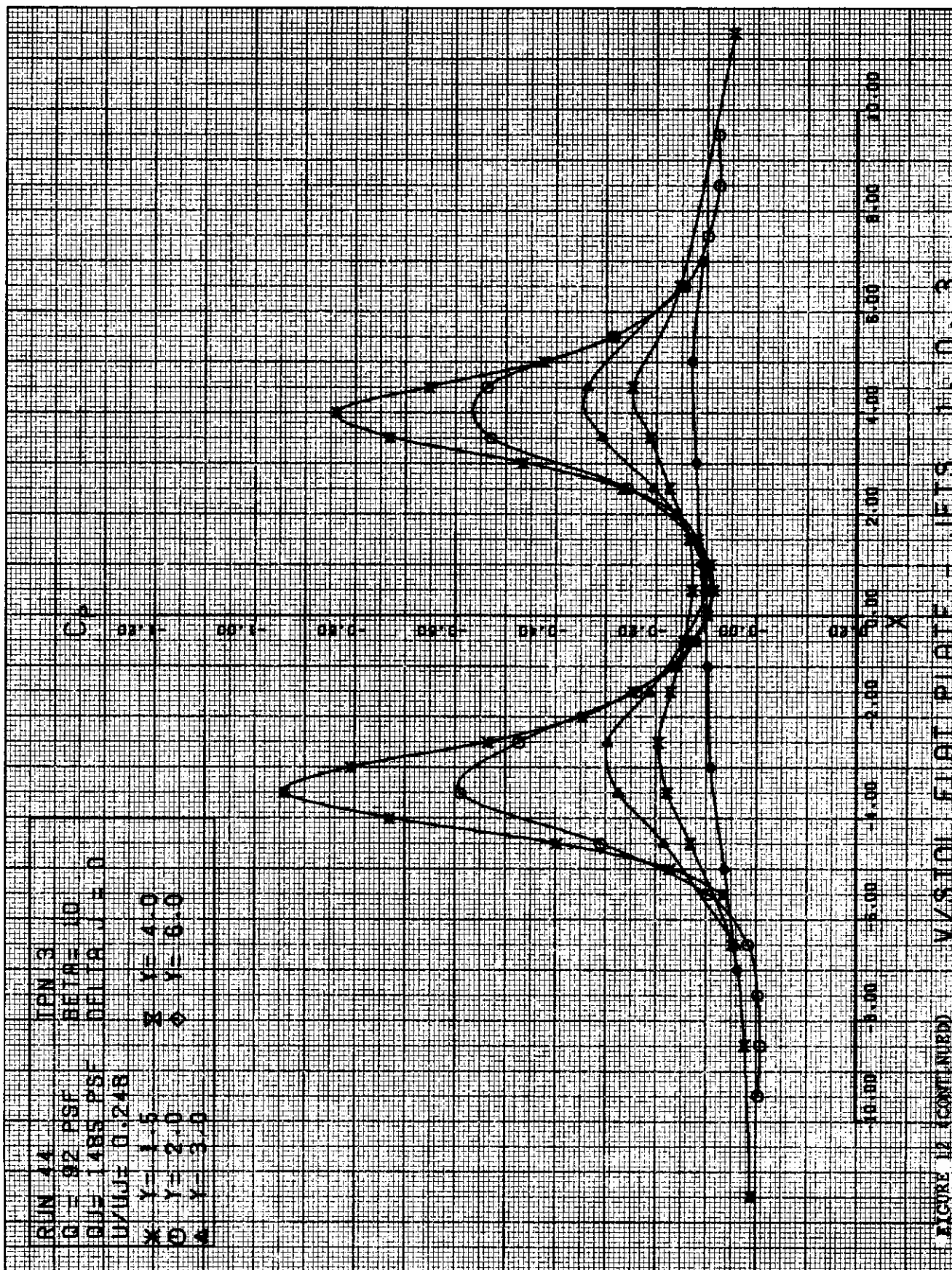


FIGURE 12 (CONTINUED) V/STOL FLAT PLATE - JETS 1, 0, 3





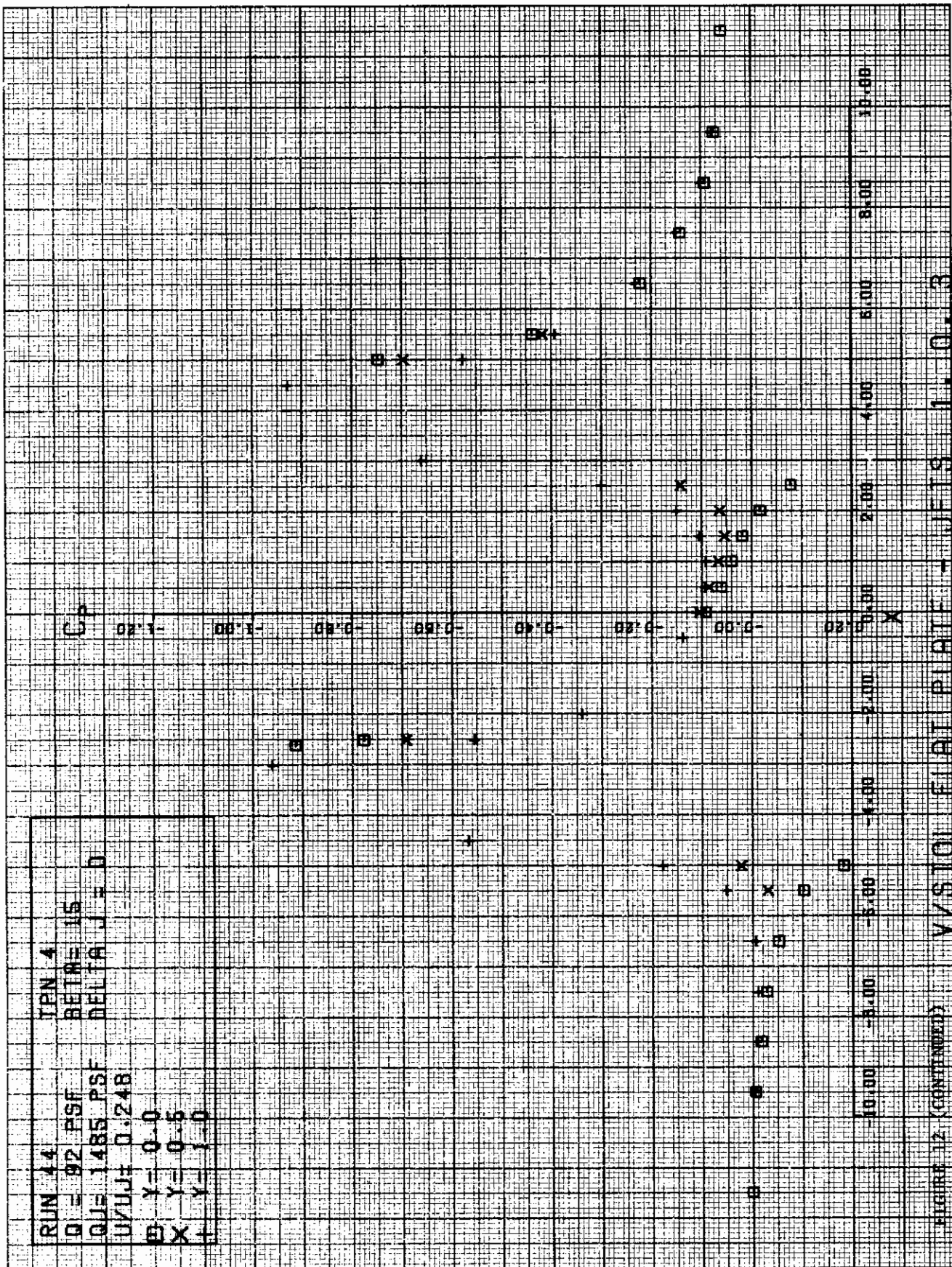
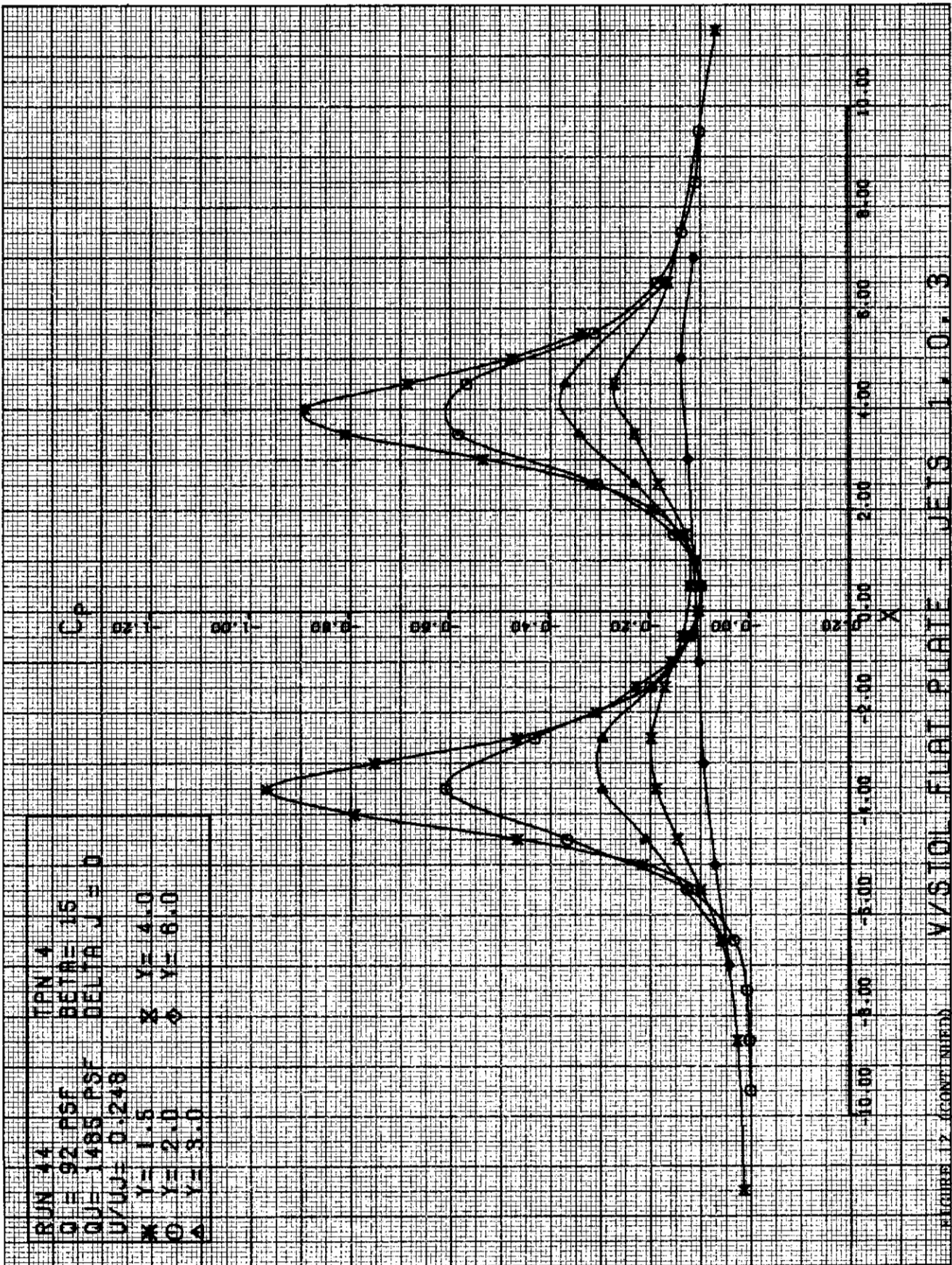
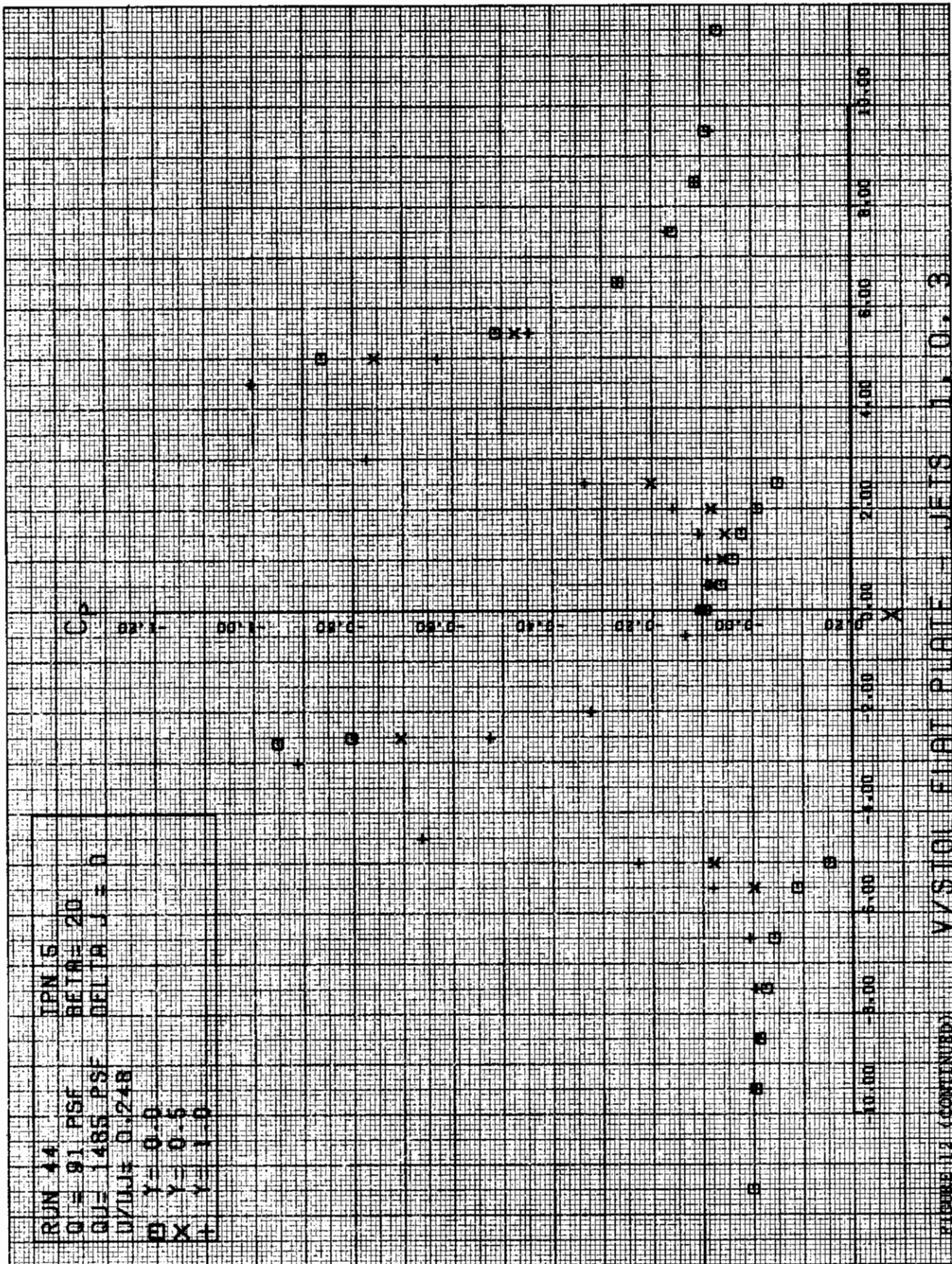
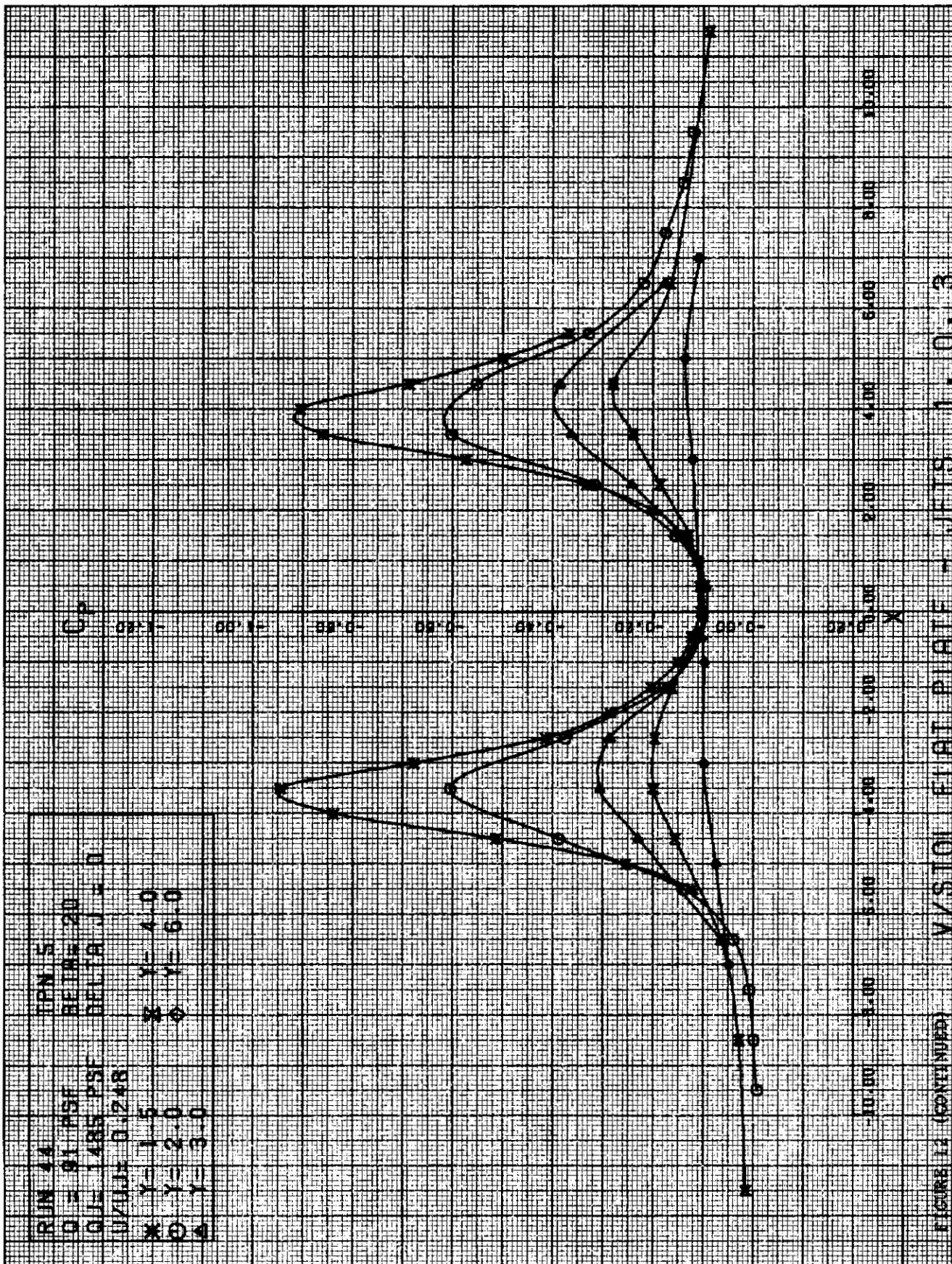


FIGURE 2 (CONTINUED) VISTOL FLAT PLATE - JETS 1-0-3







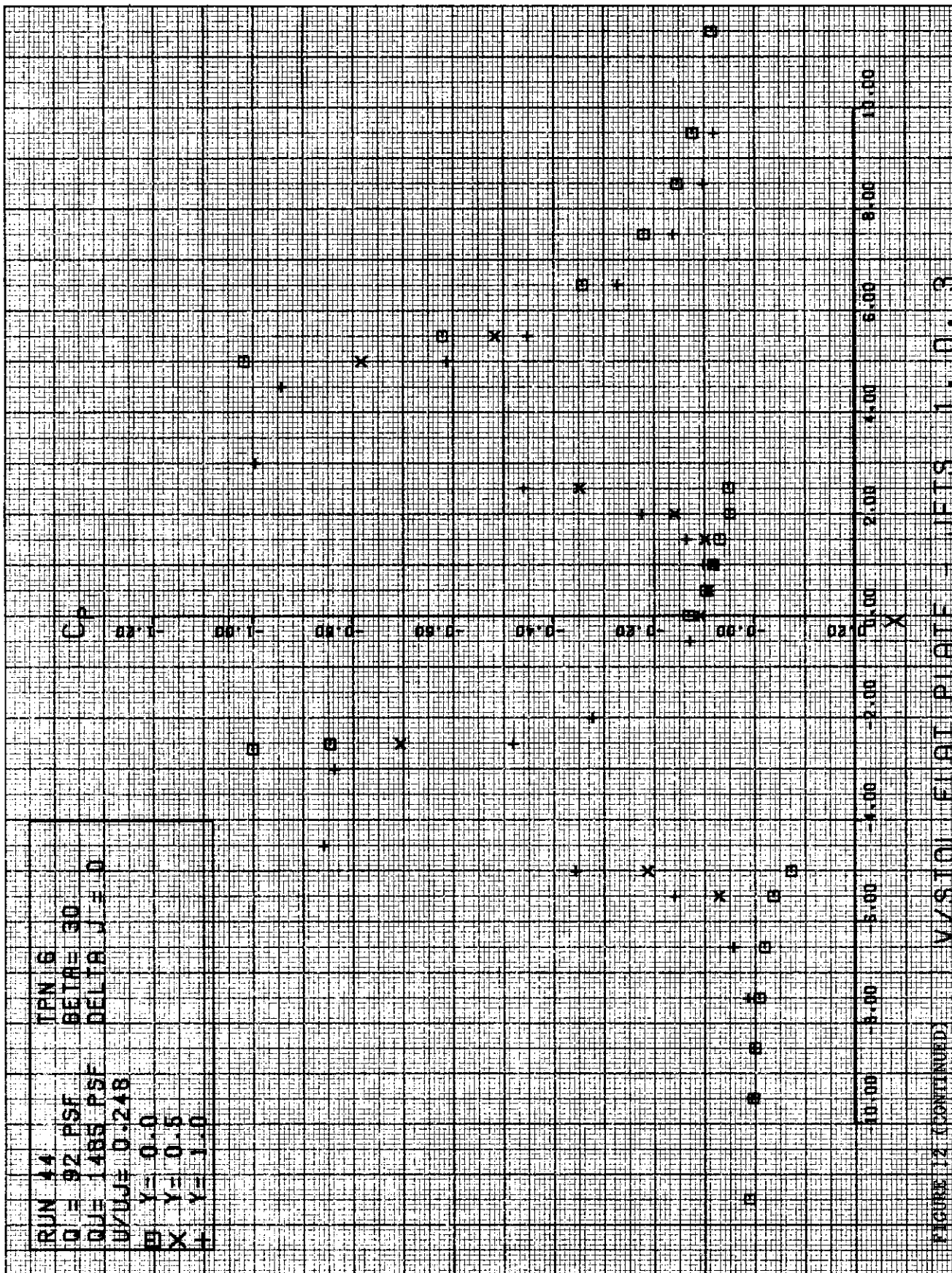


FIGURE 12 (CONTINUED) V/STOL FLAT PLATE - JETS 1, 0, 3

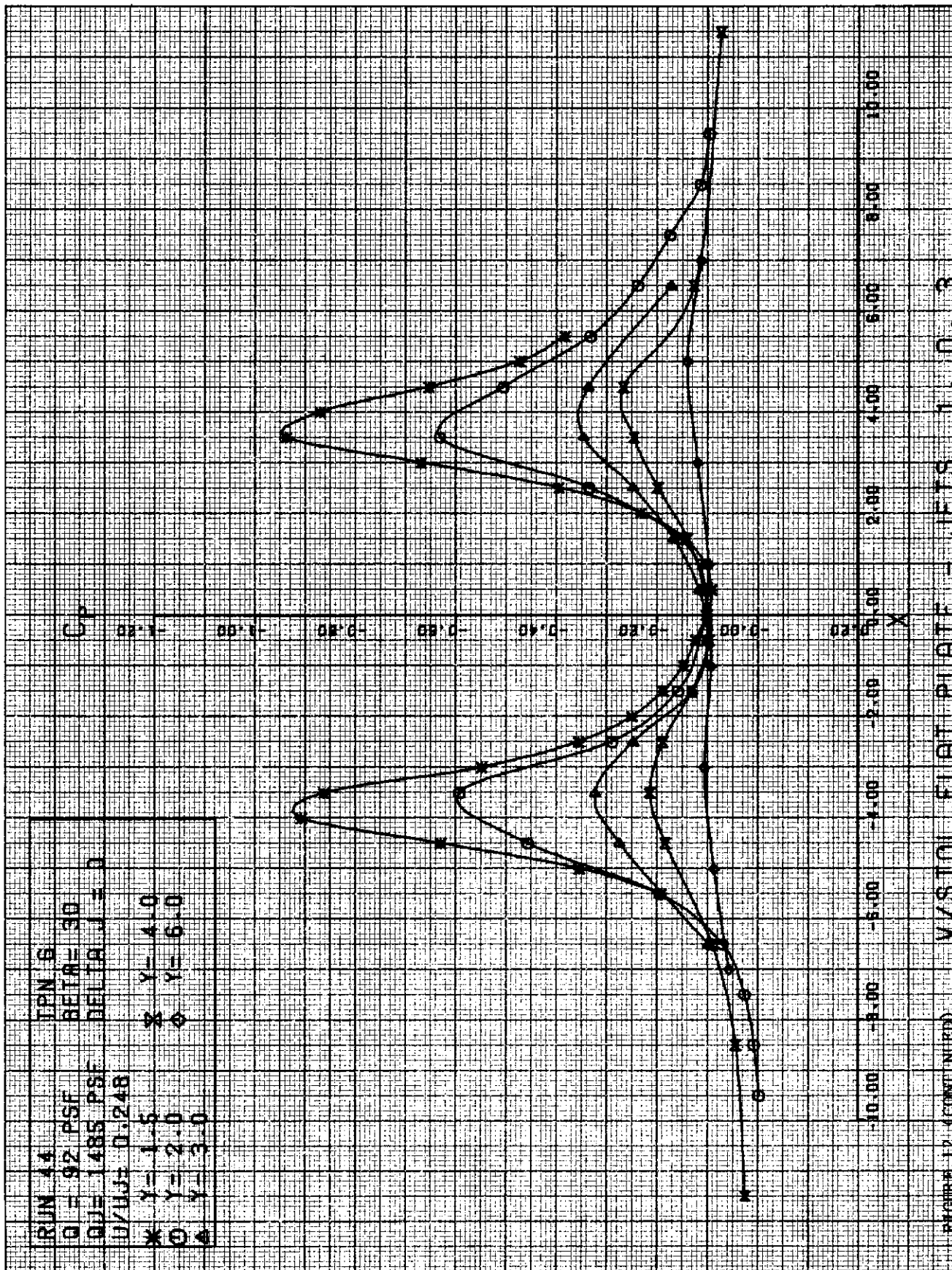
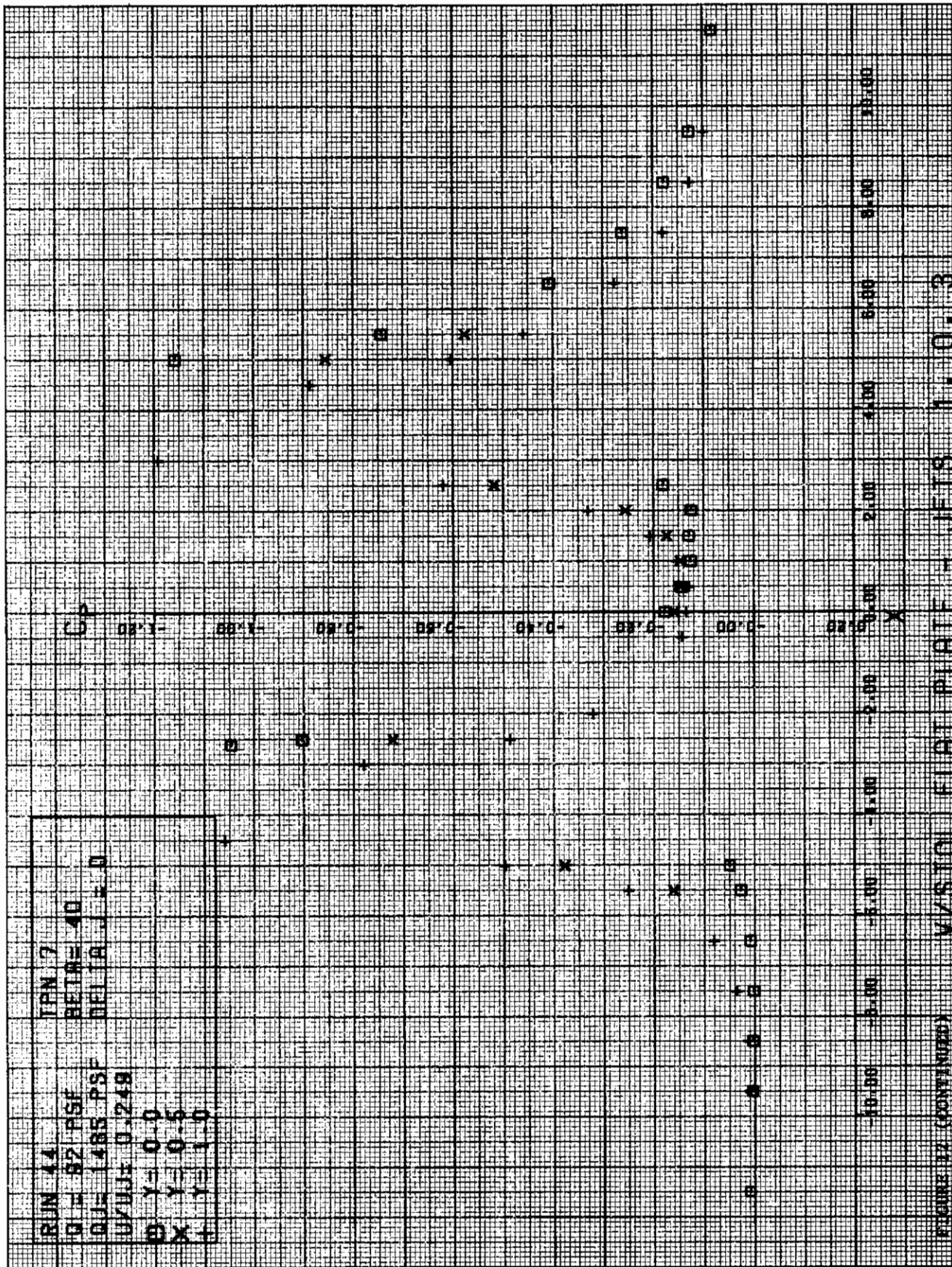
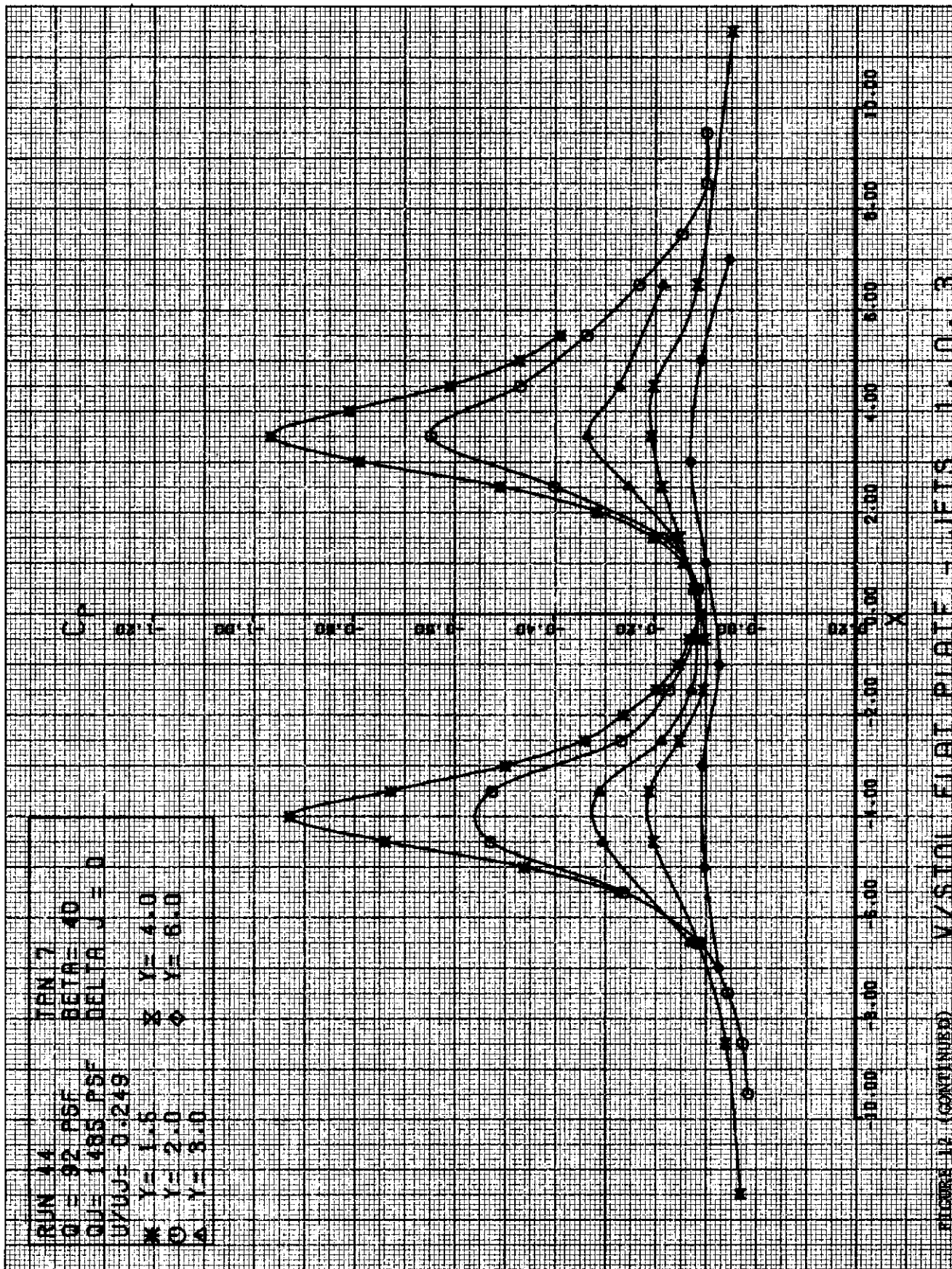
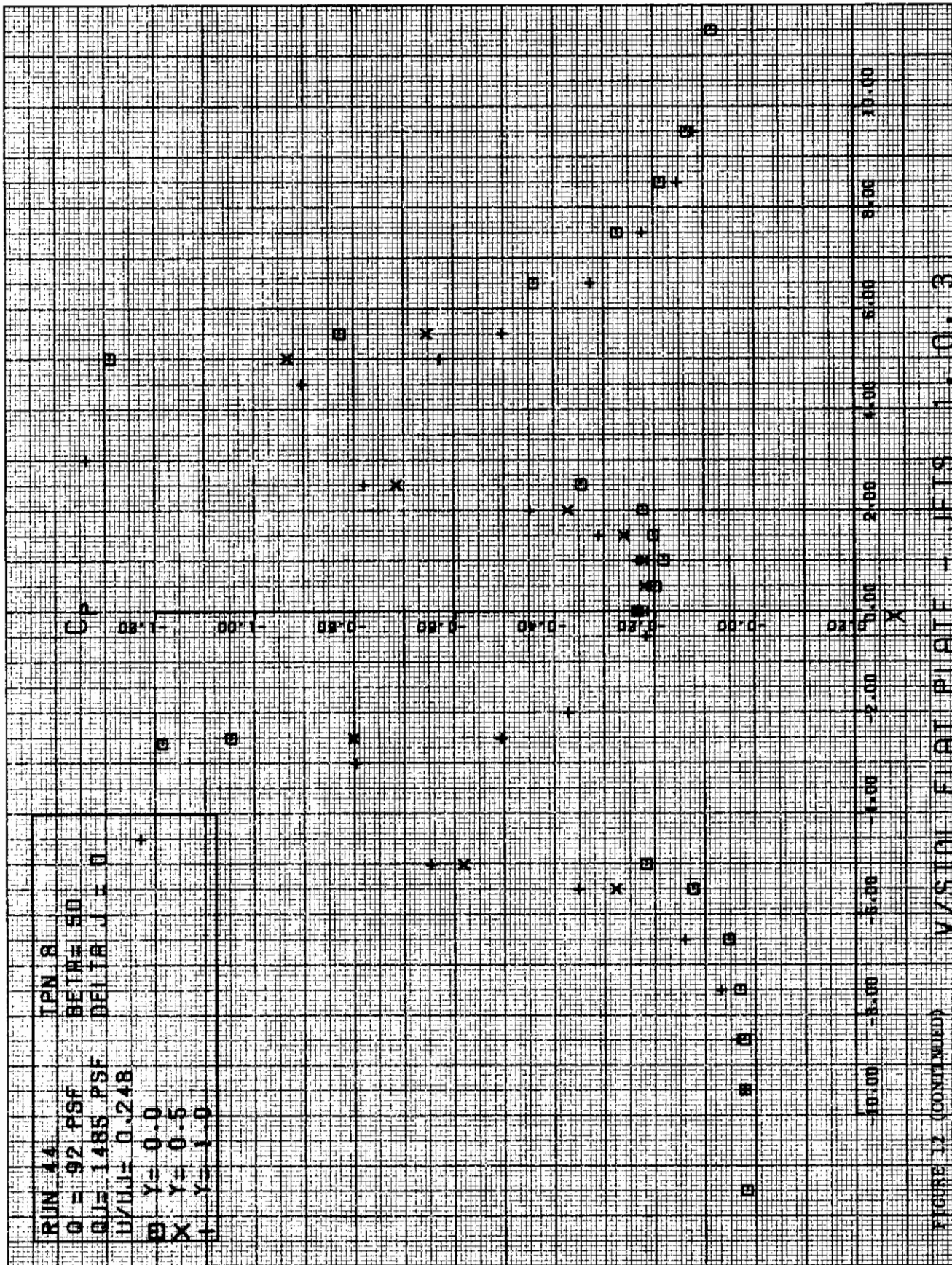


FIGURE 17 (CONTINUED) VISTOL FLAT PLATE - JETS 1, 0, 3







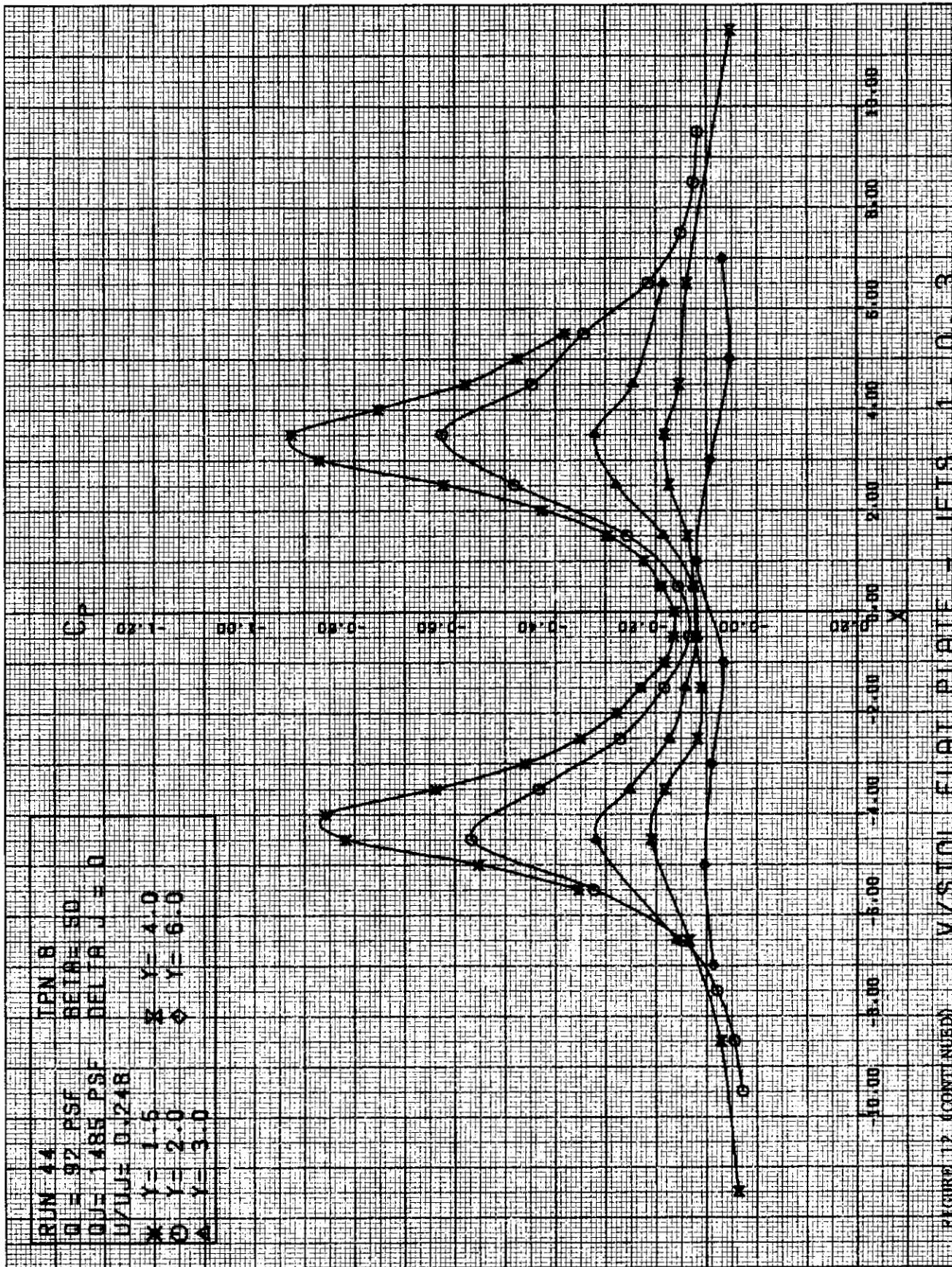
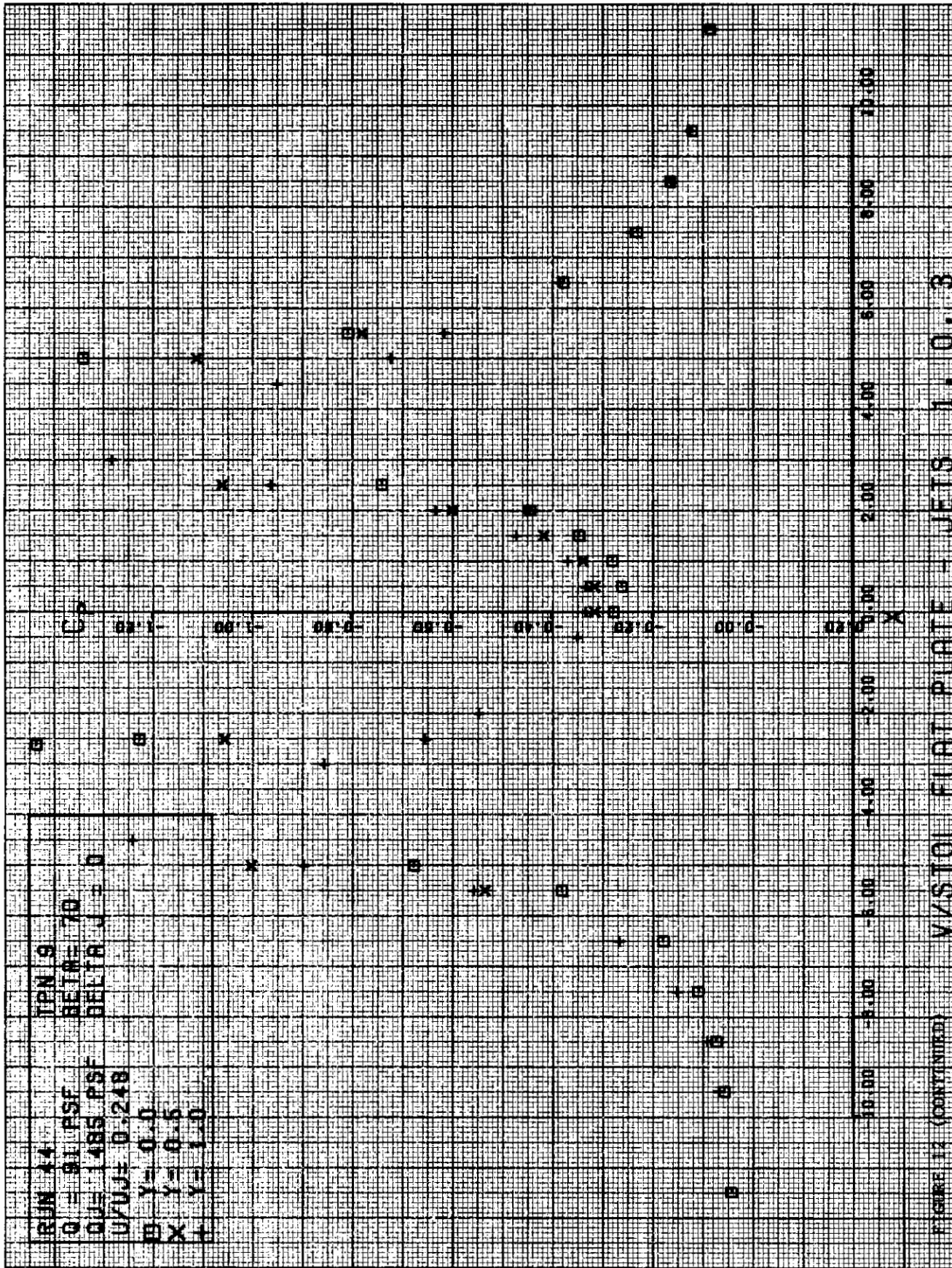
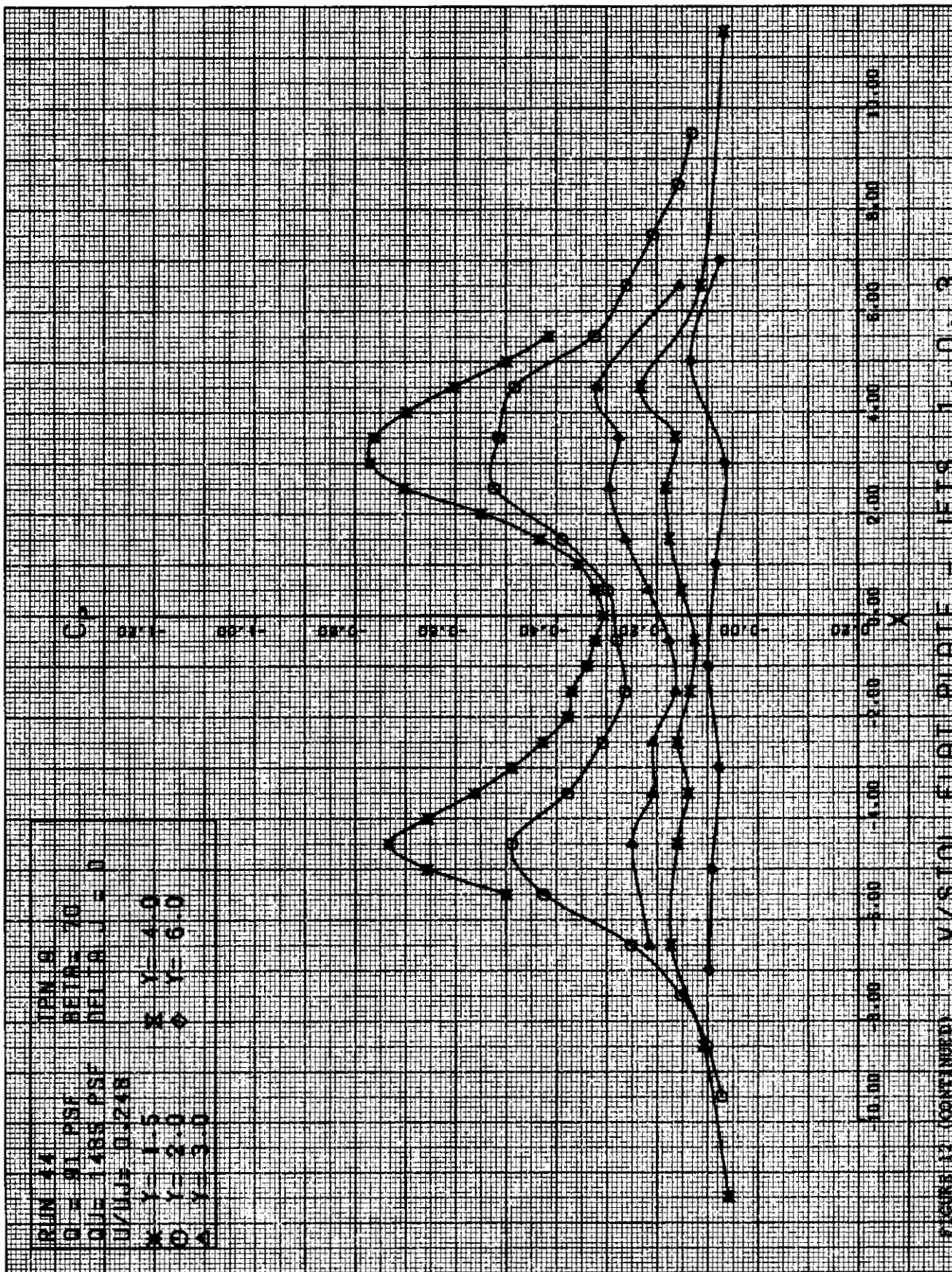


FIGURE 12 (CONTINUED)





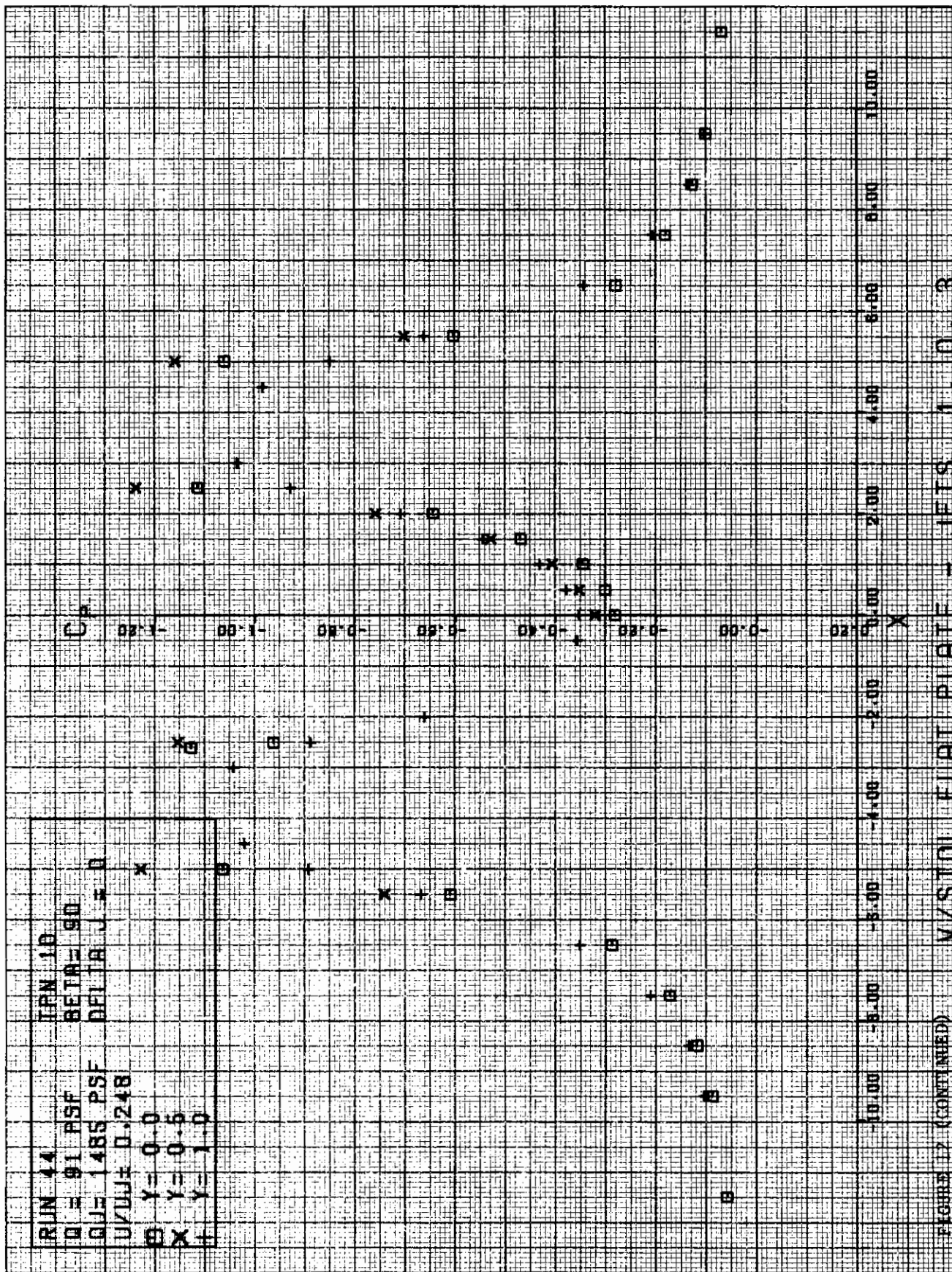


FIGURE 17 (CONTINUED) W/STOL FLAT PLATE - JETS 1.0.3

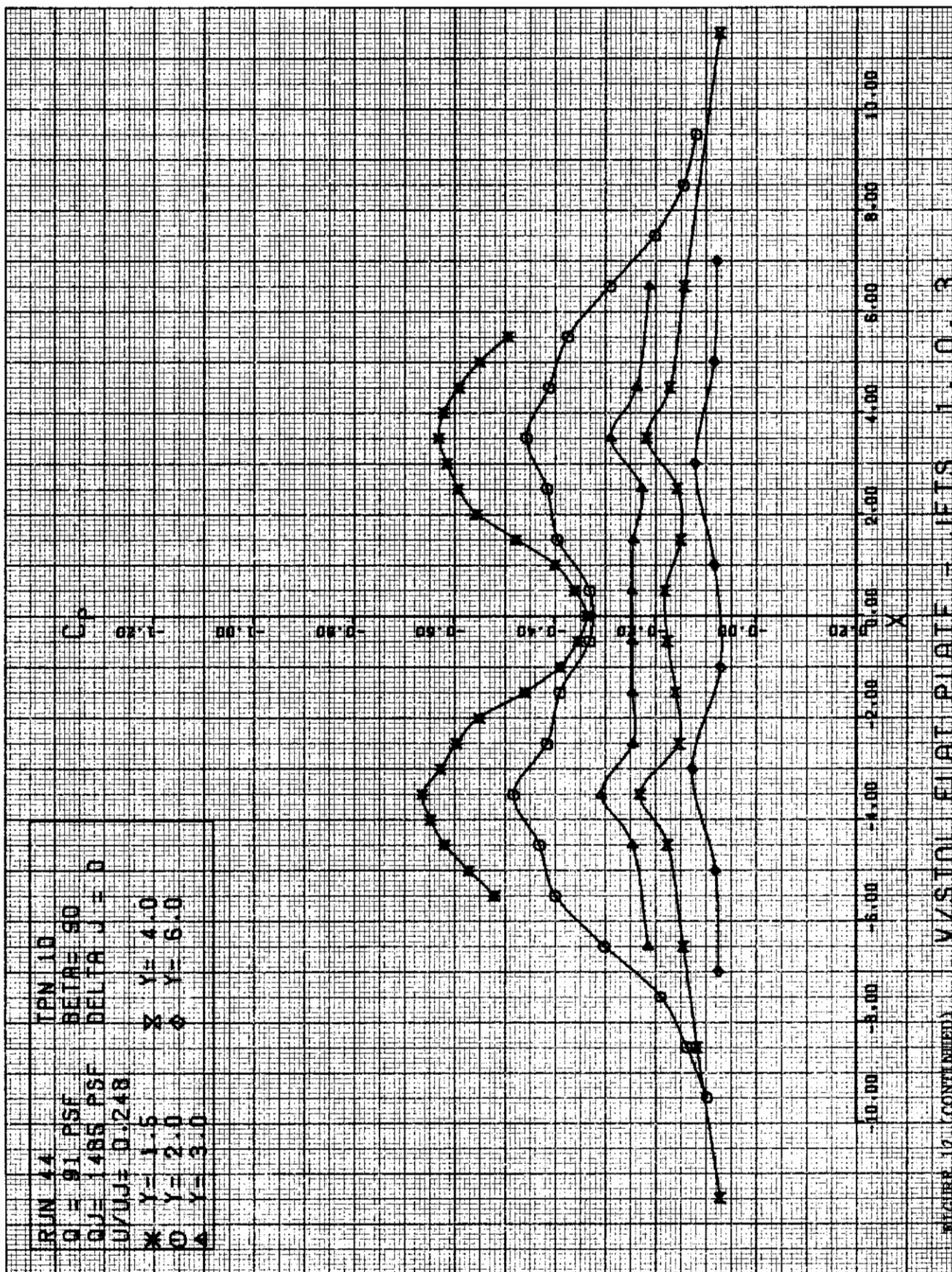
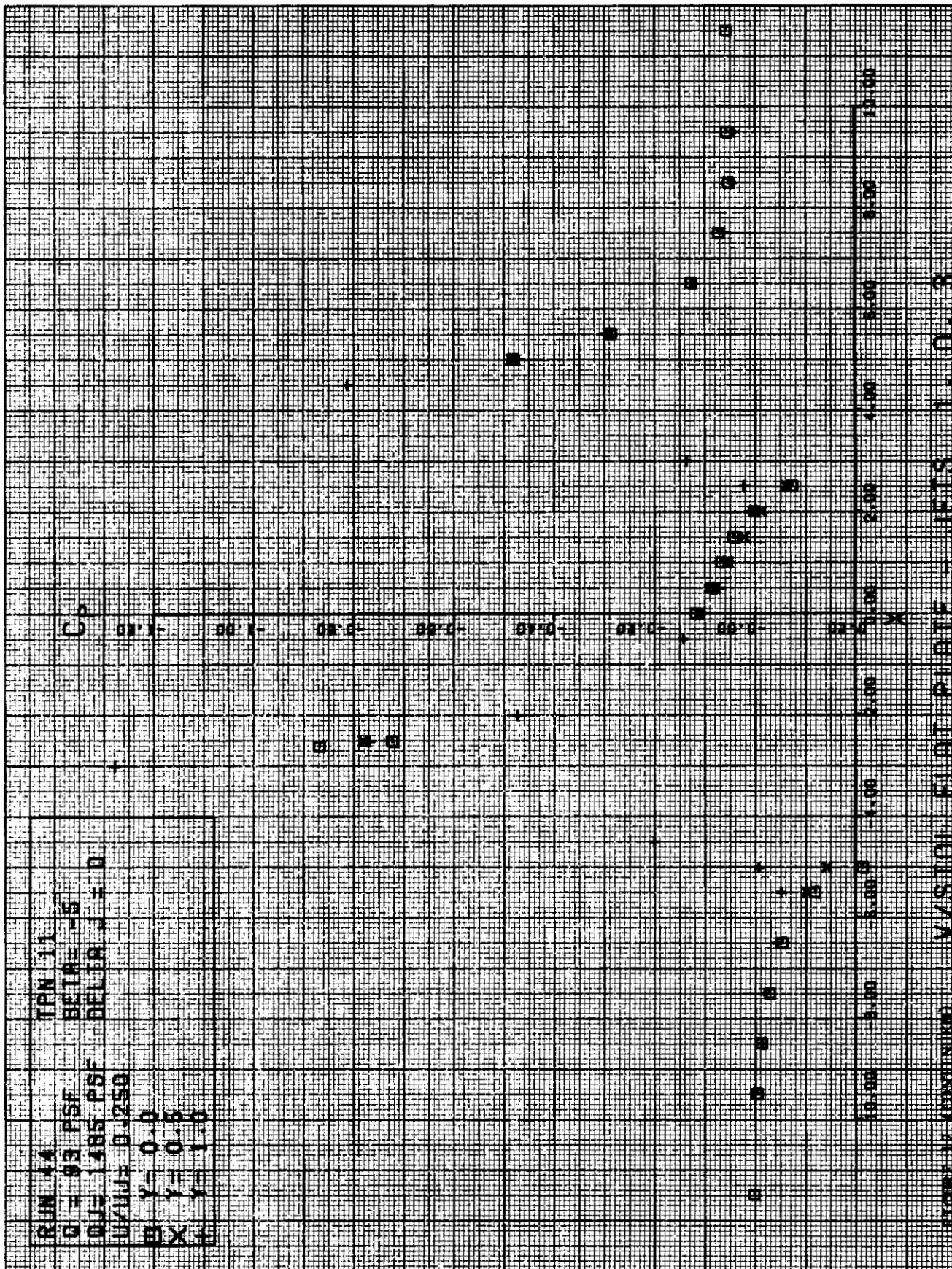
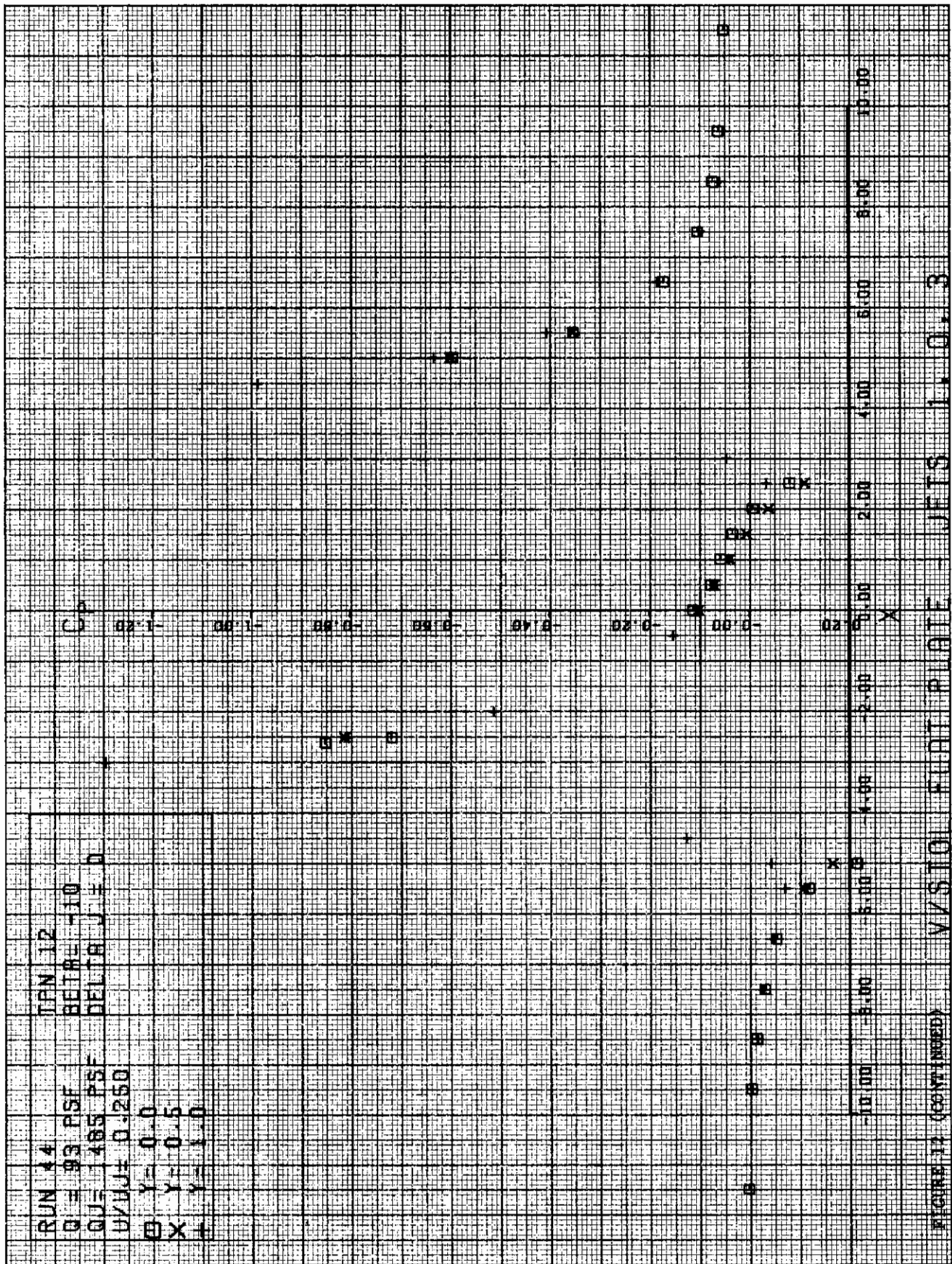


FIGURE 12 (CONTINUED) V/STOL FLAT PLATE - JETS 1.0.3





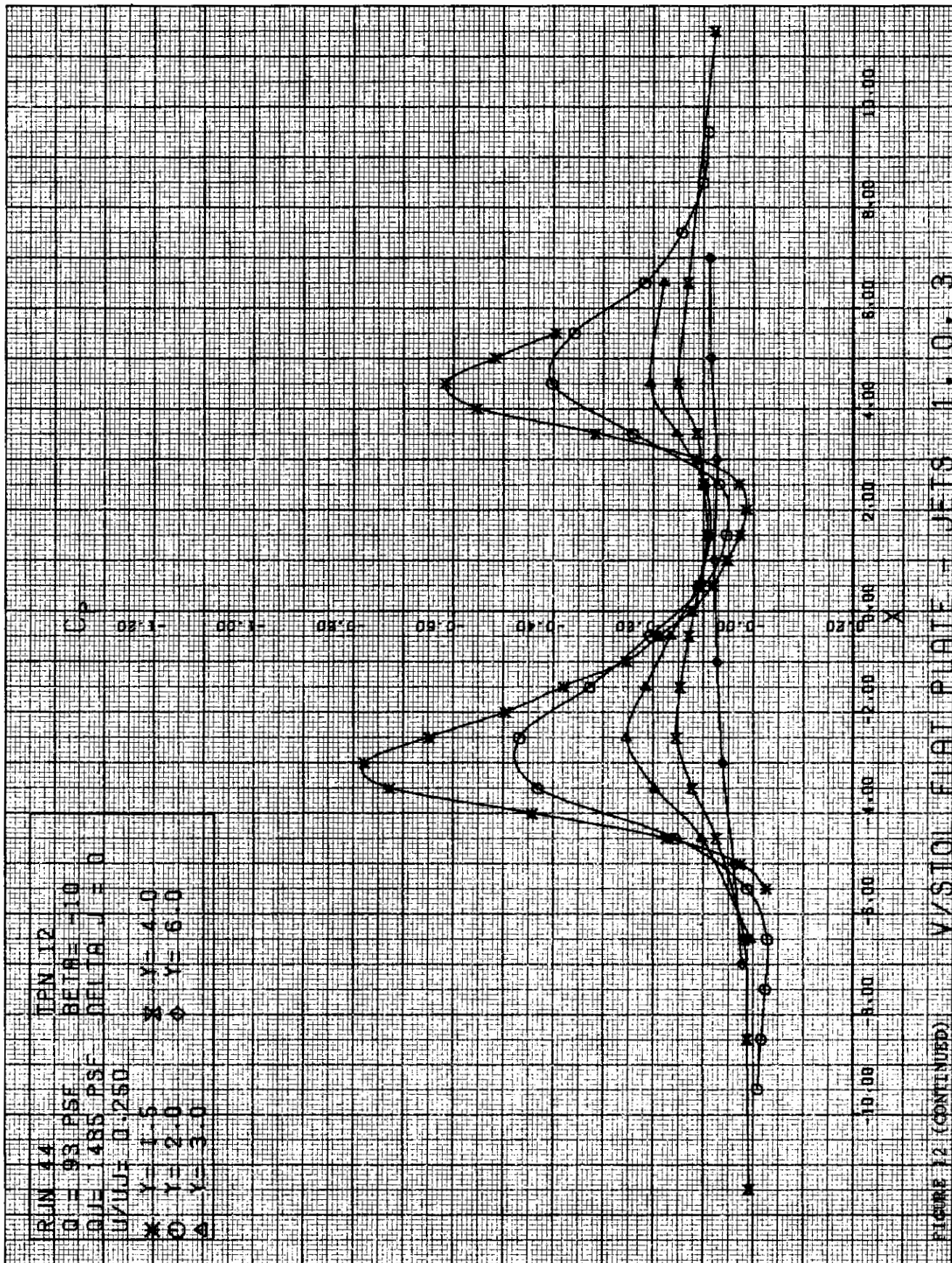
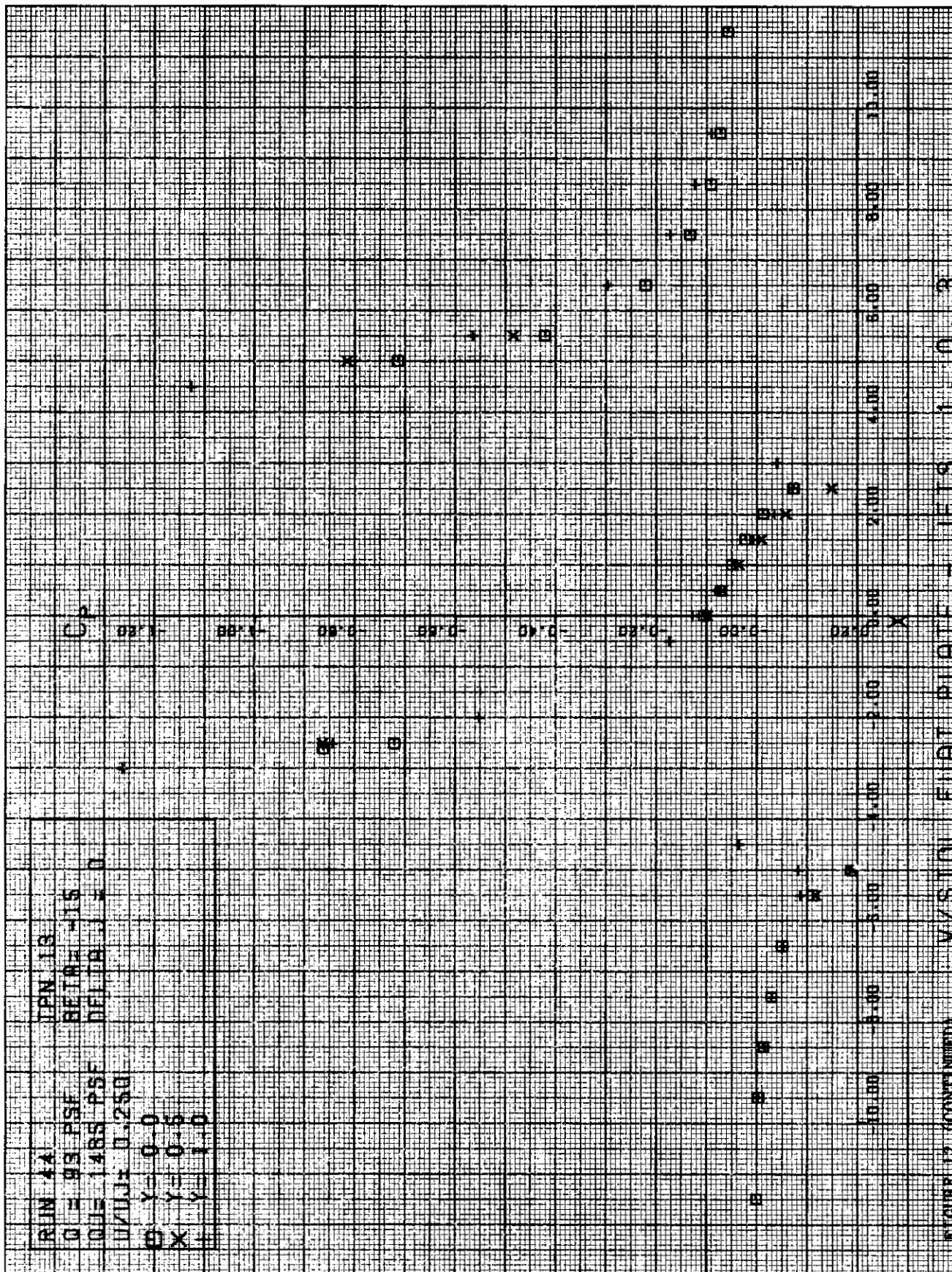
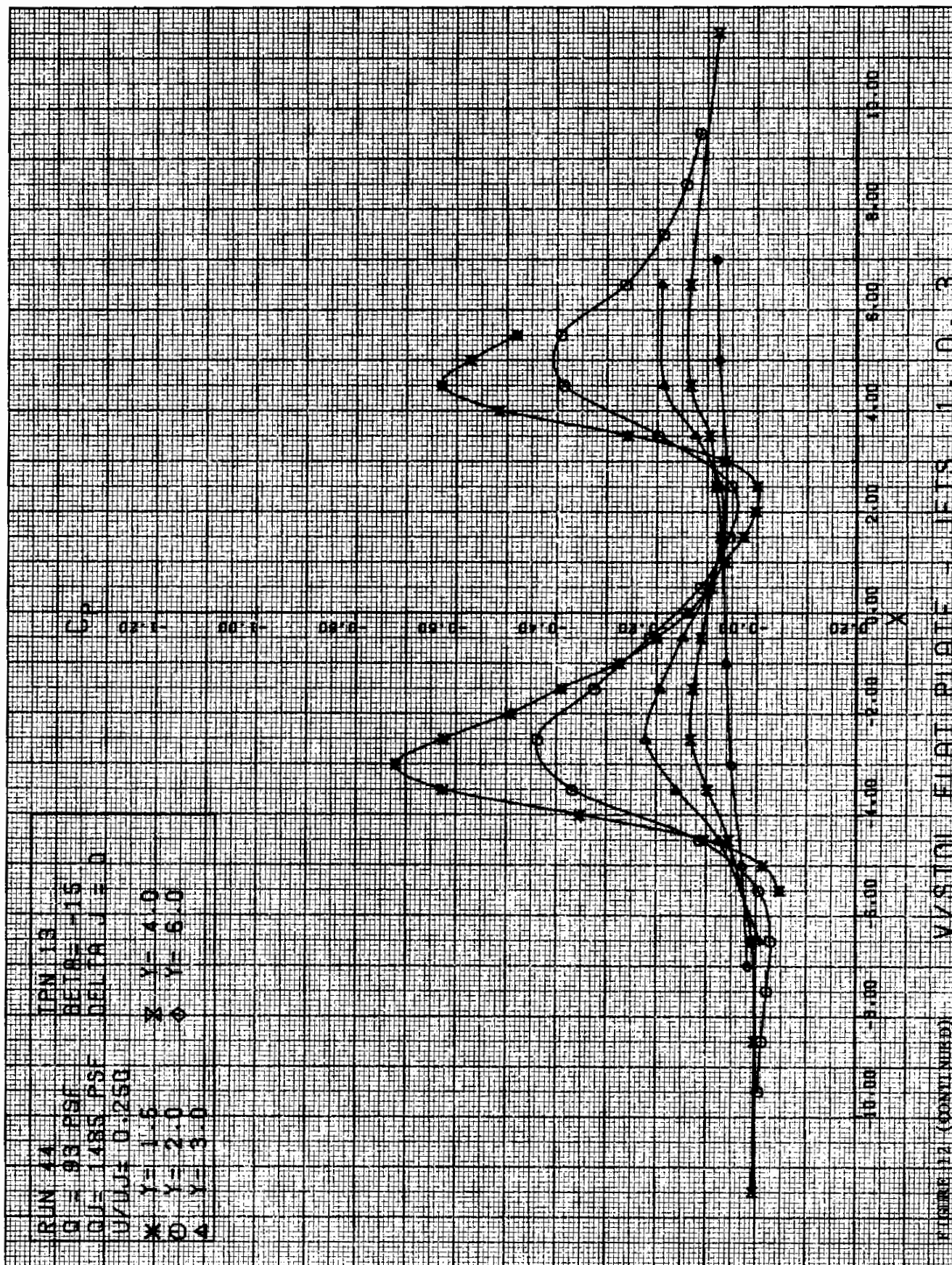
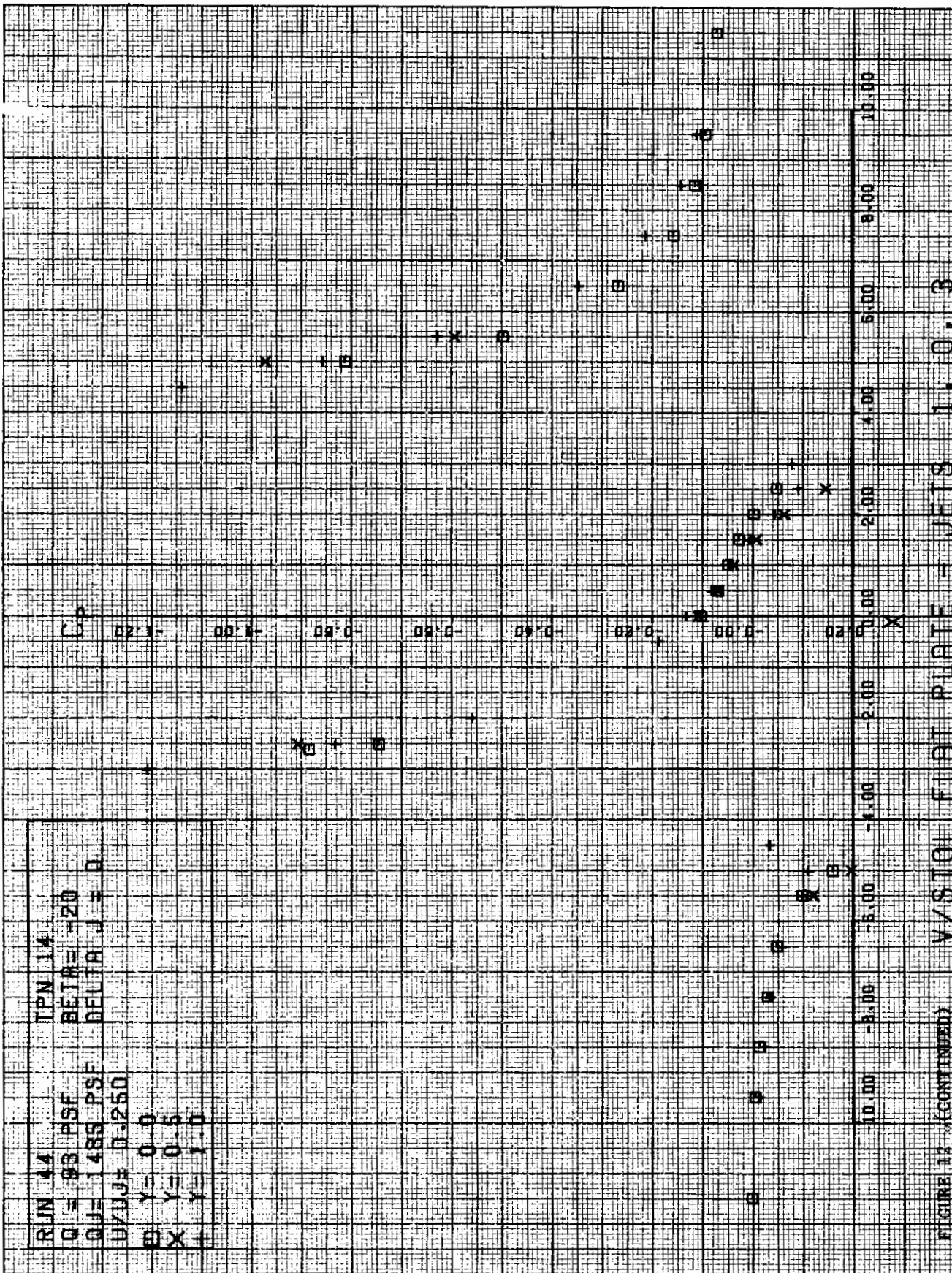
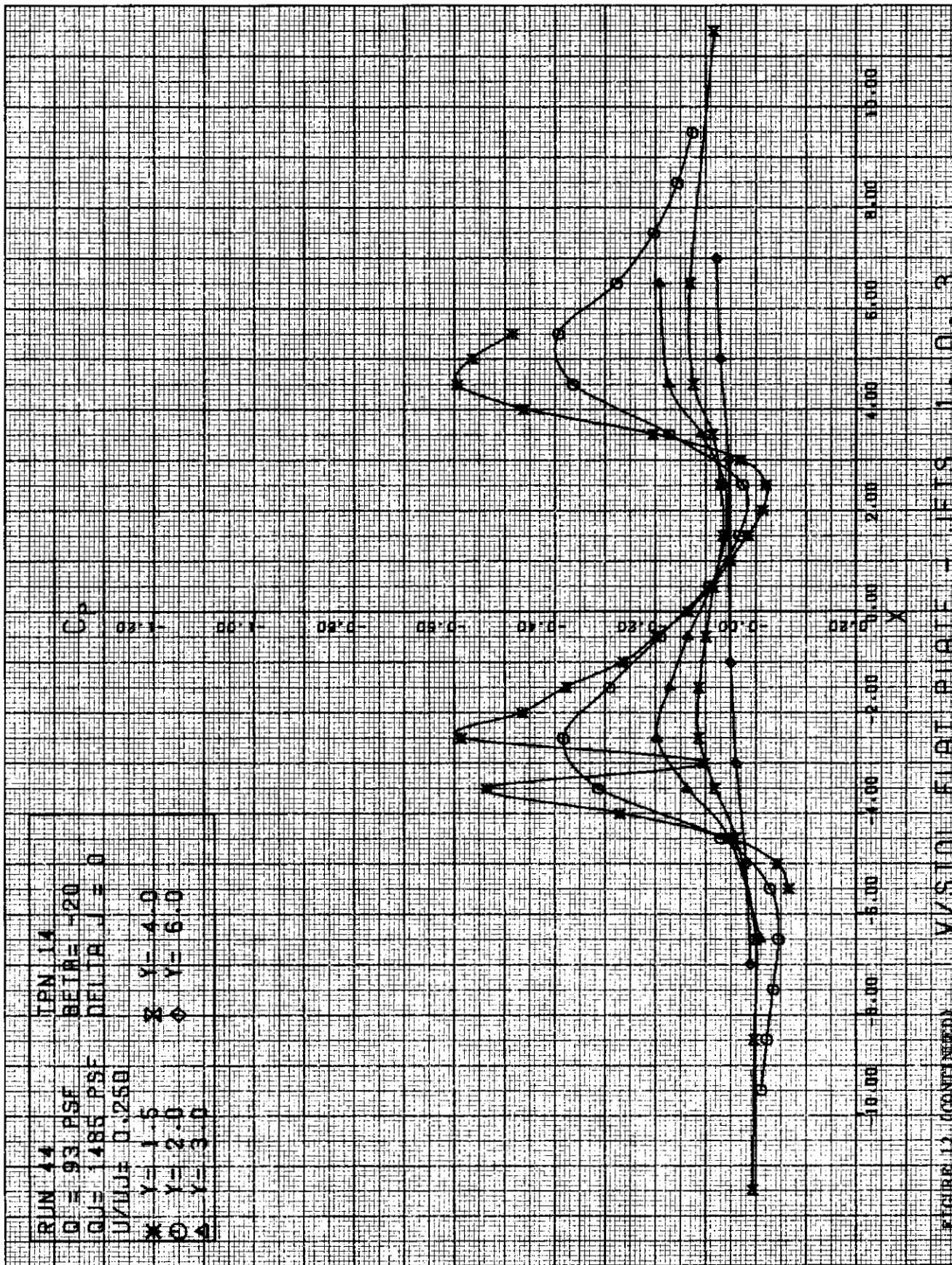


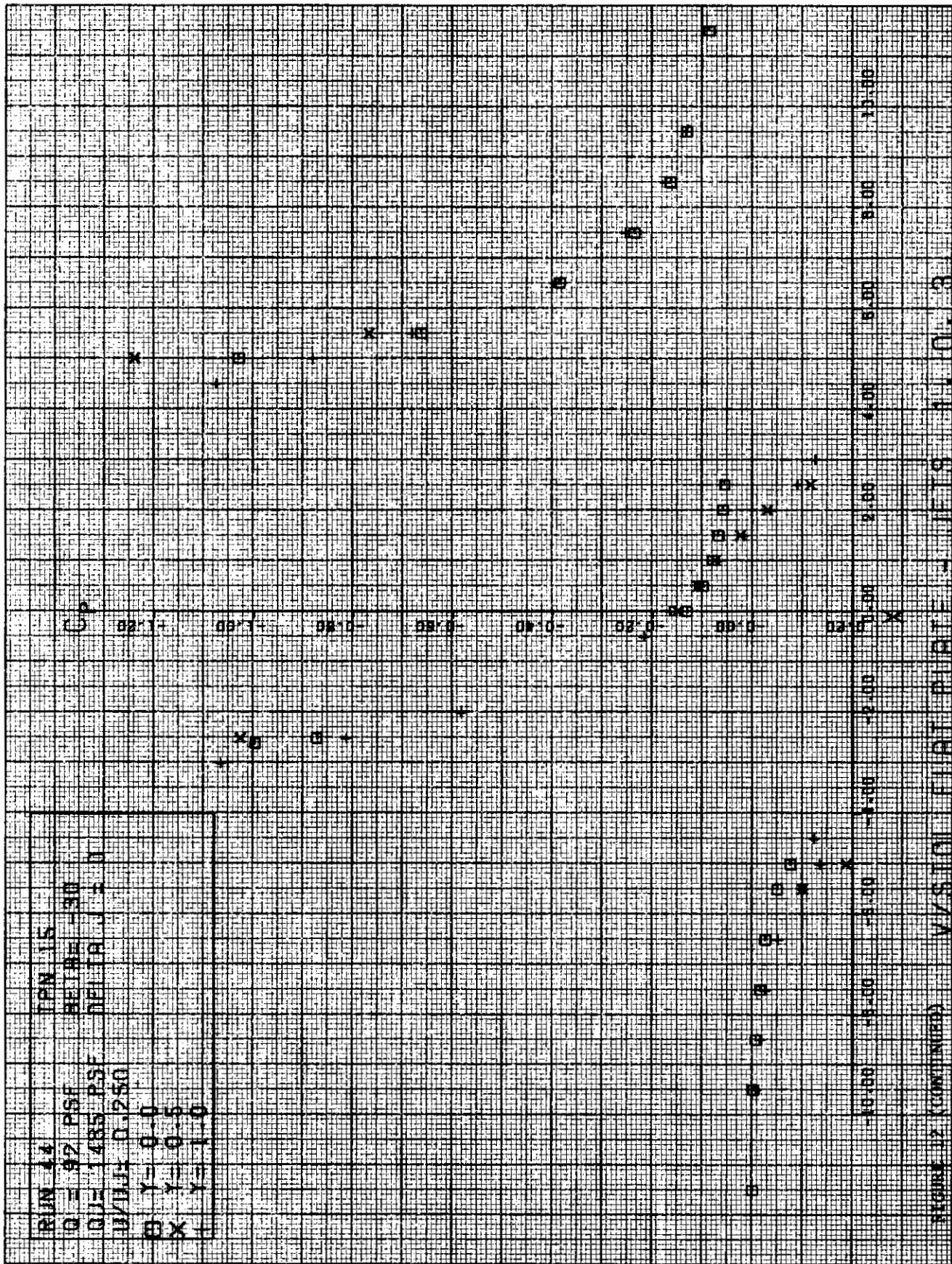
FIGURE 12 (CONTINUED) V-5000 FLAT PLATE - JETS 1, 0, 3

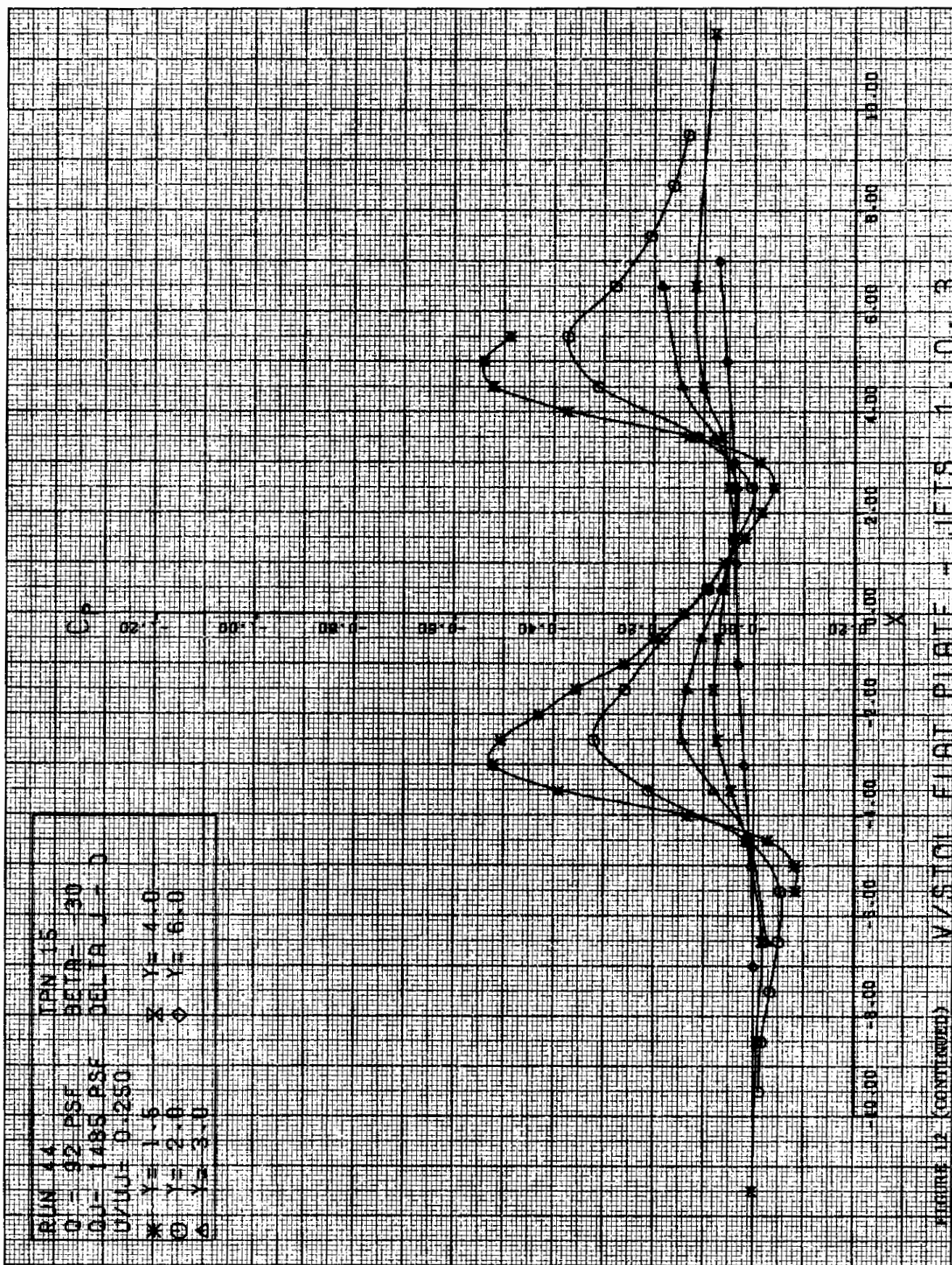


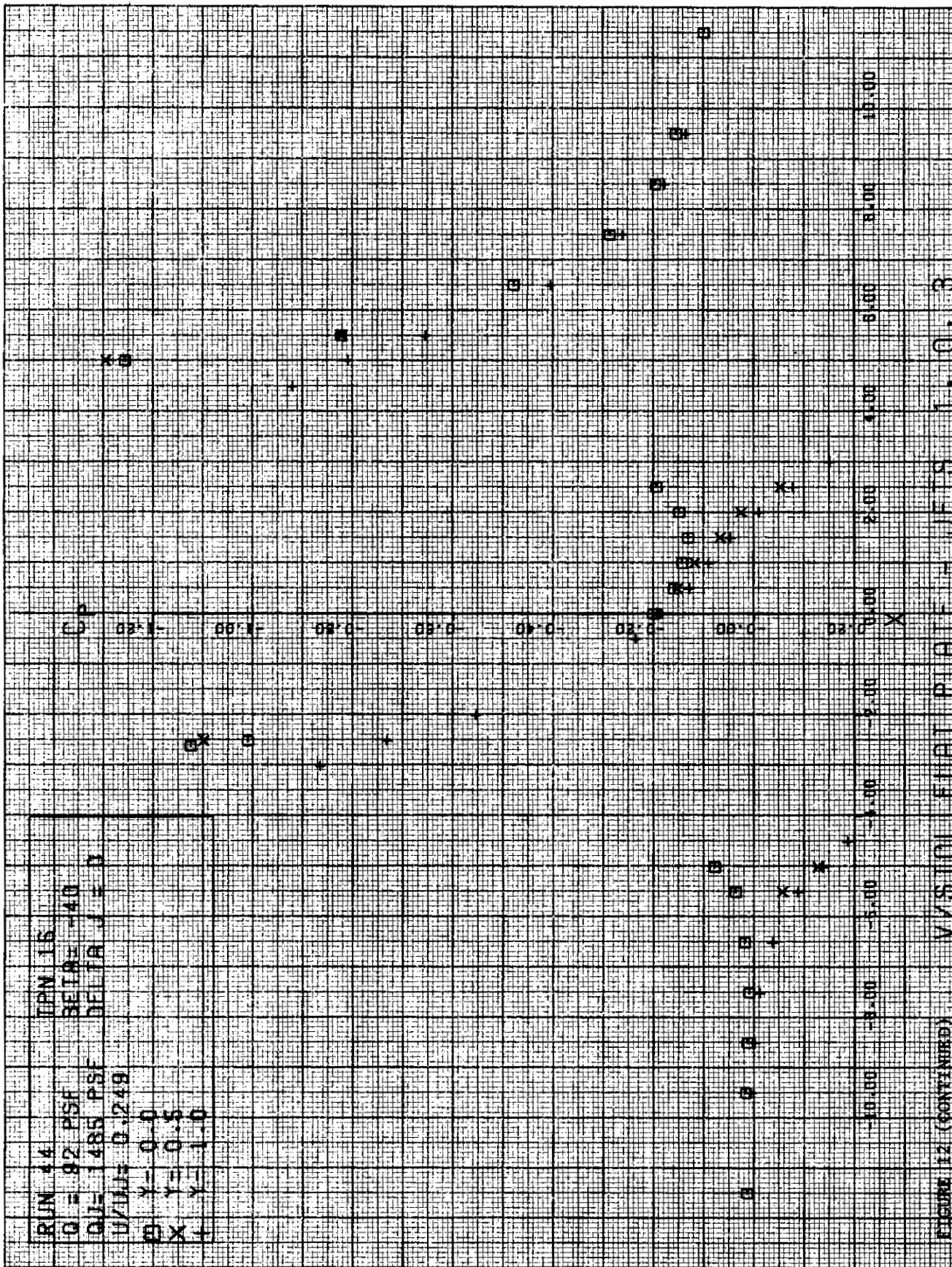


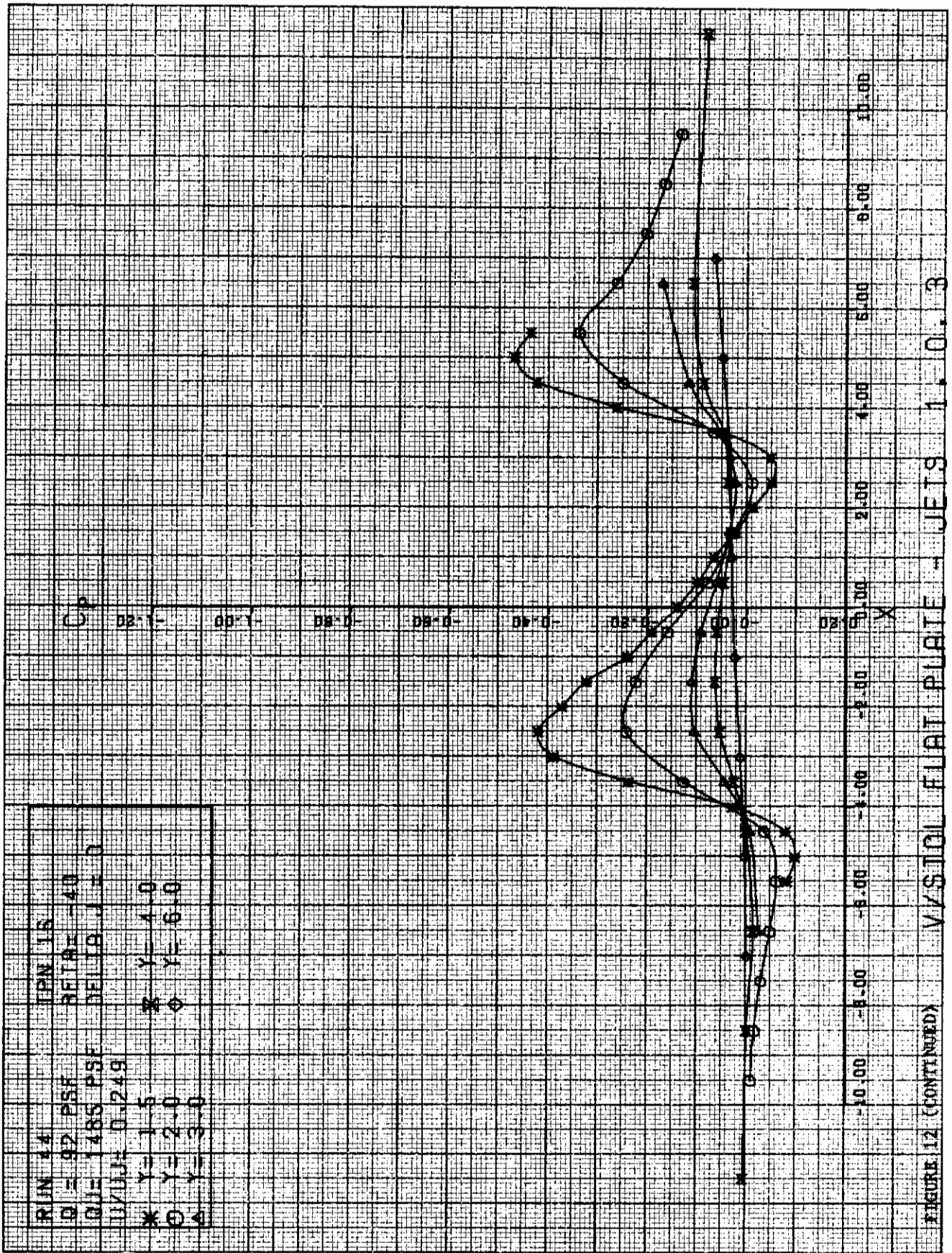












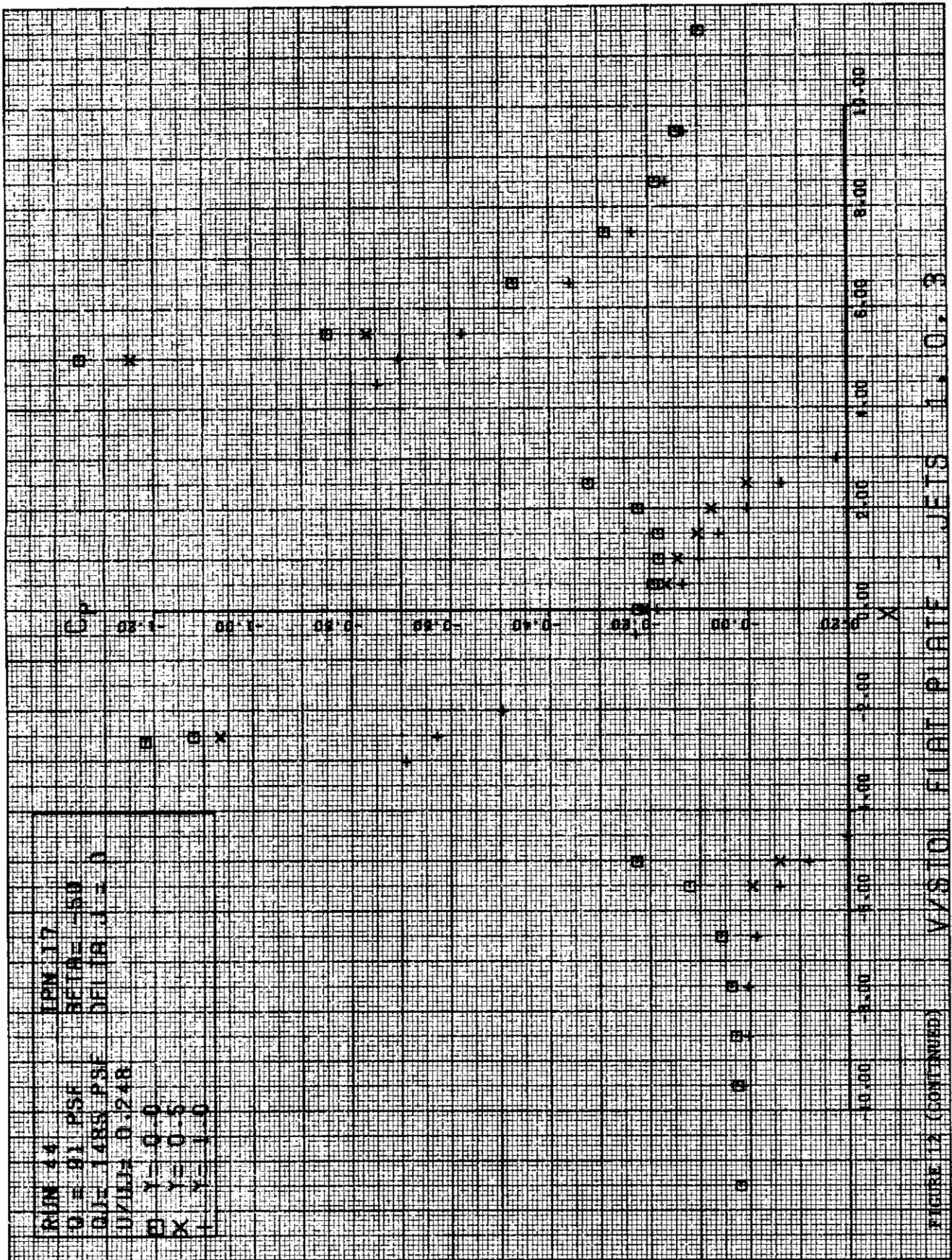
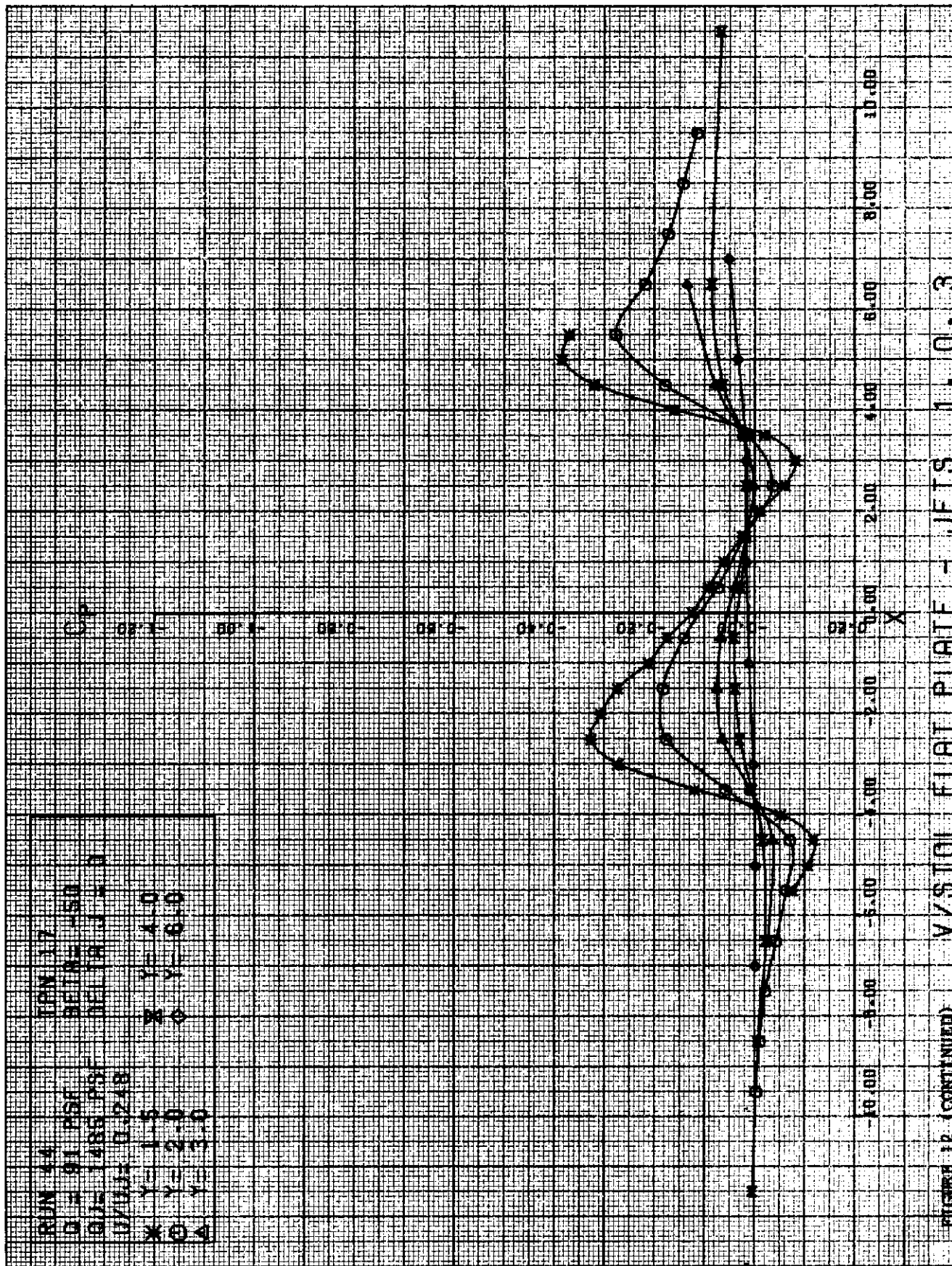
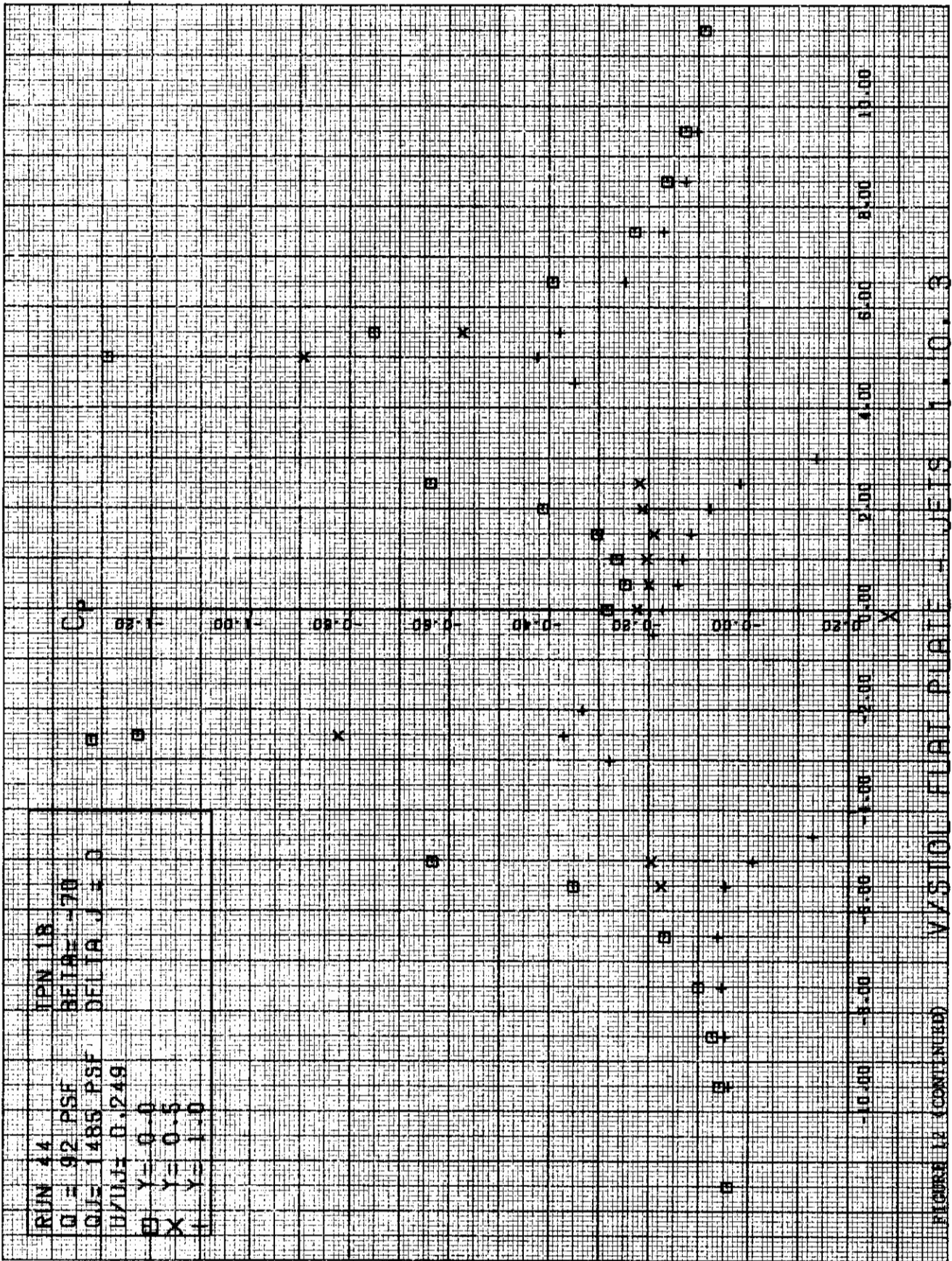


FIGURE 17 (CONTINUED) V/S 101 FLIGHT PLATE - JETS 1, 2, 3





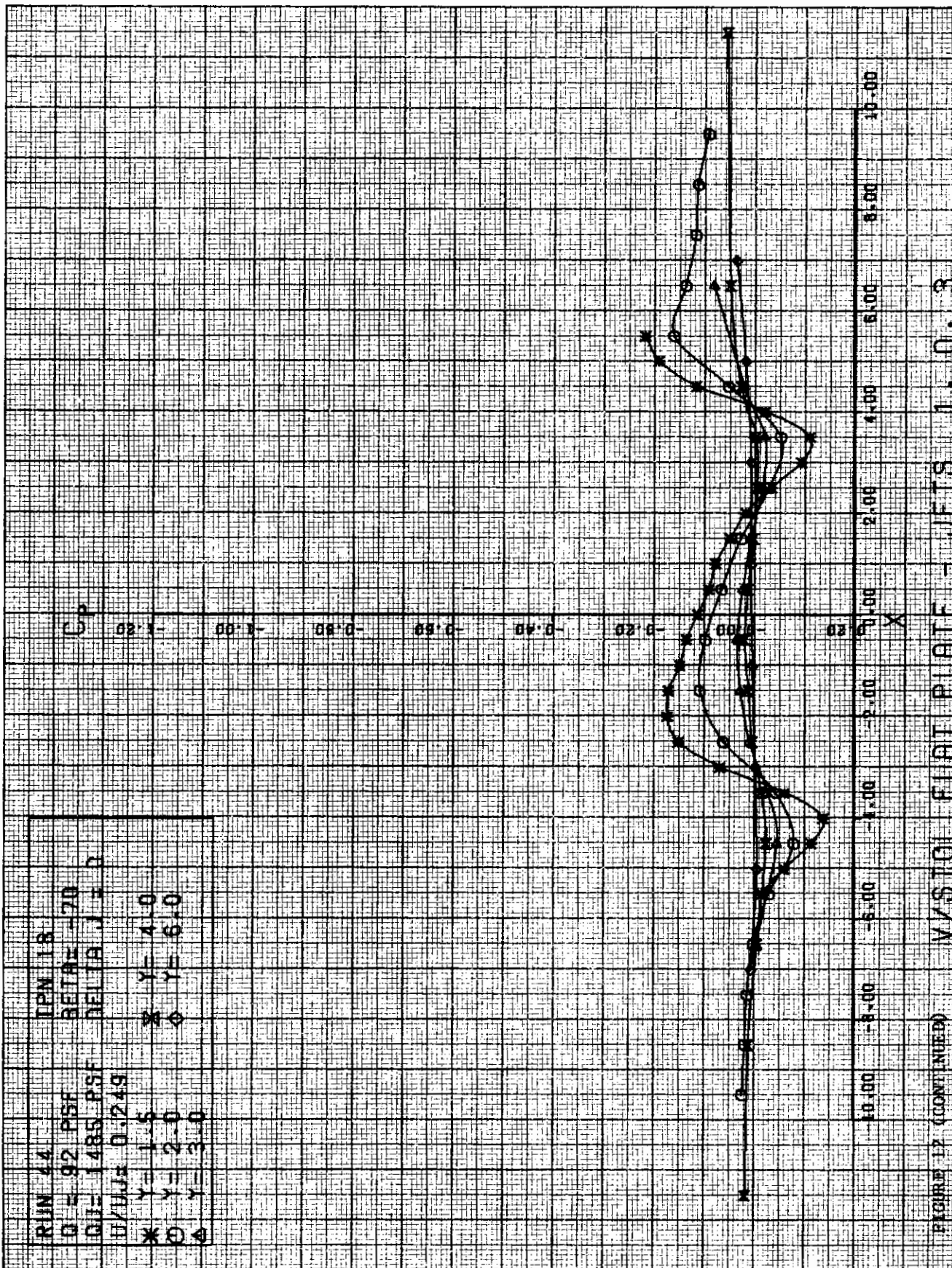
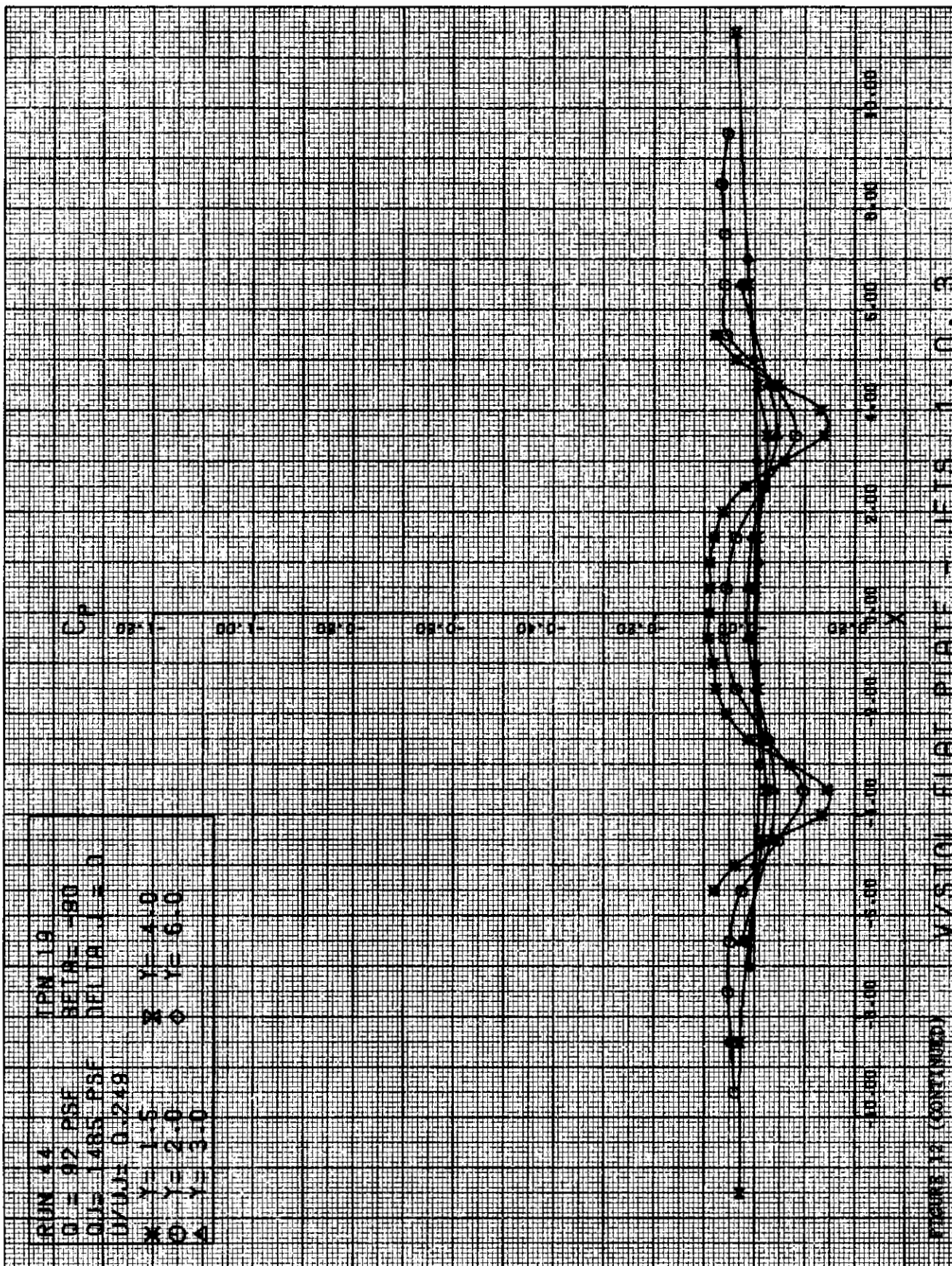
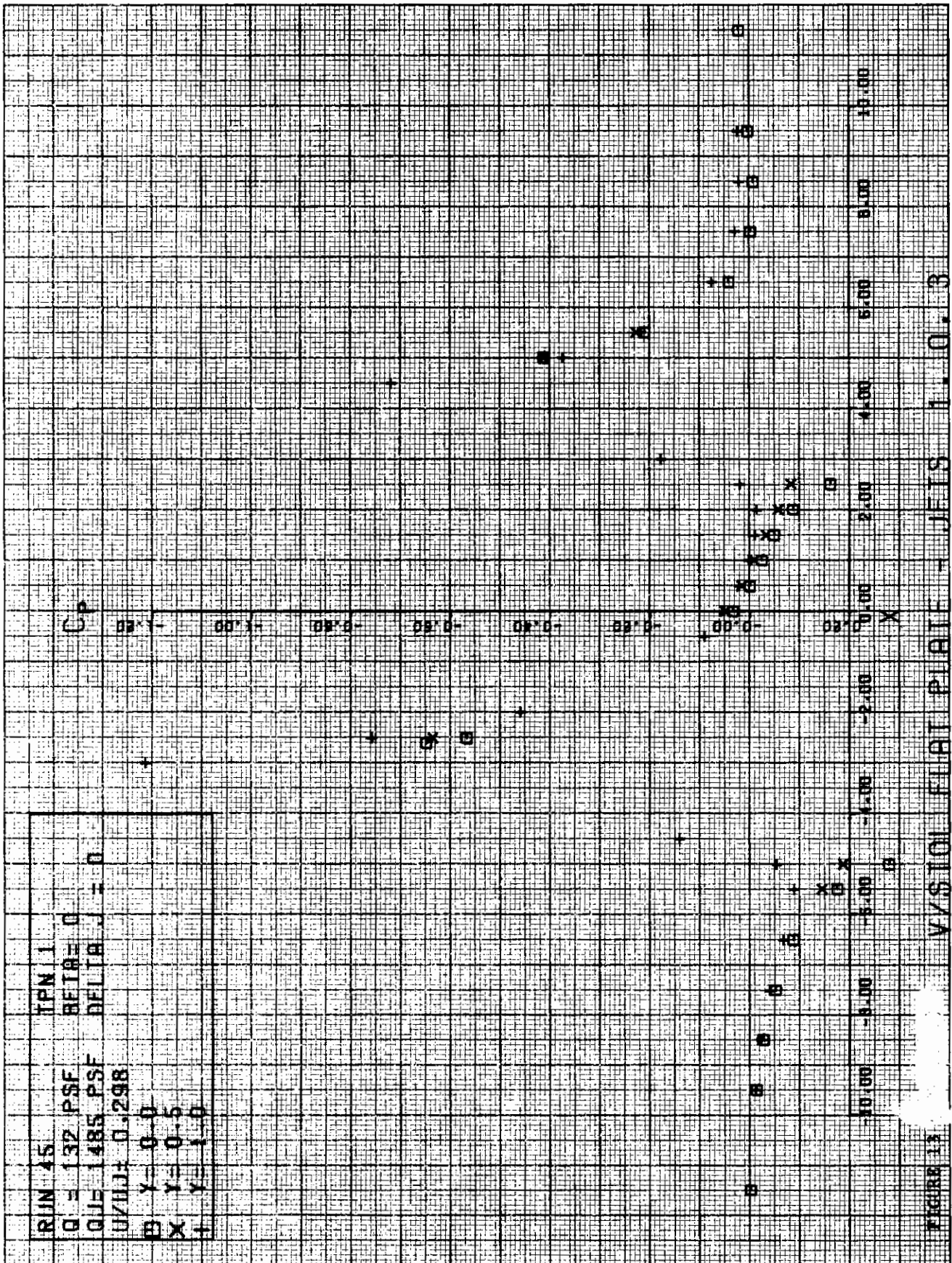


FIGURE 17 (CONTINUED) V/SJOL FLIRT PLATE - JETS 1, 0, 3





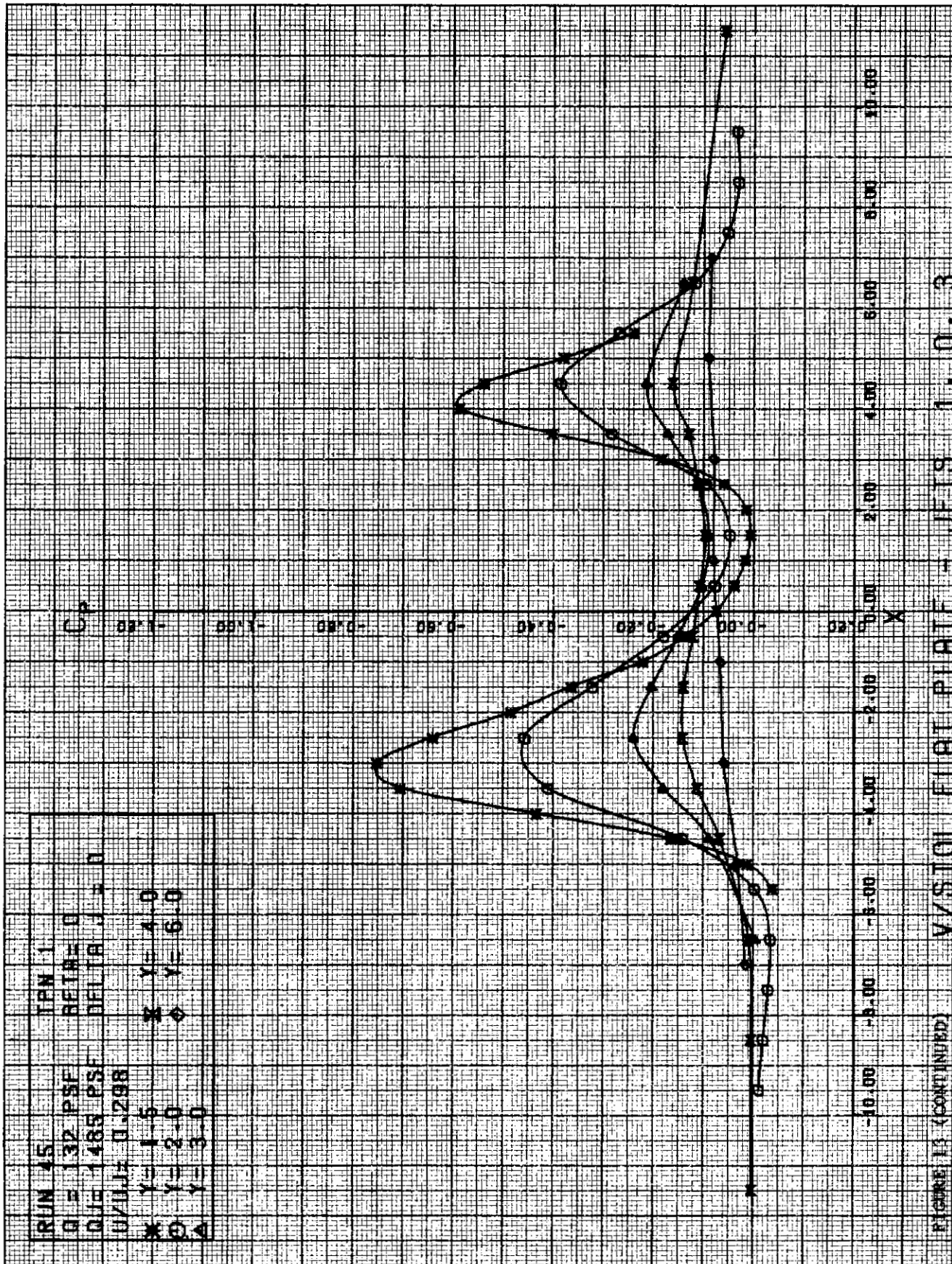
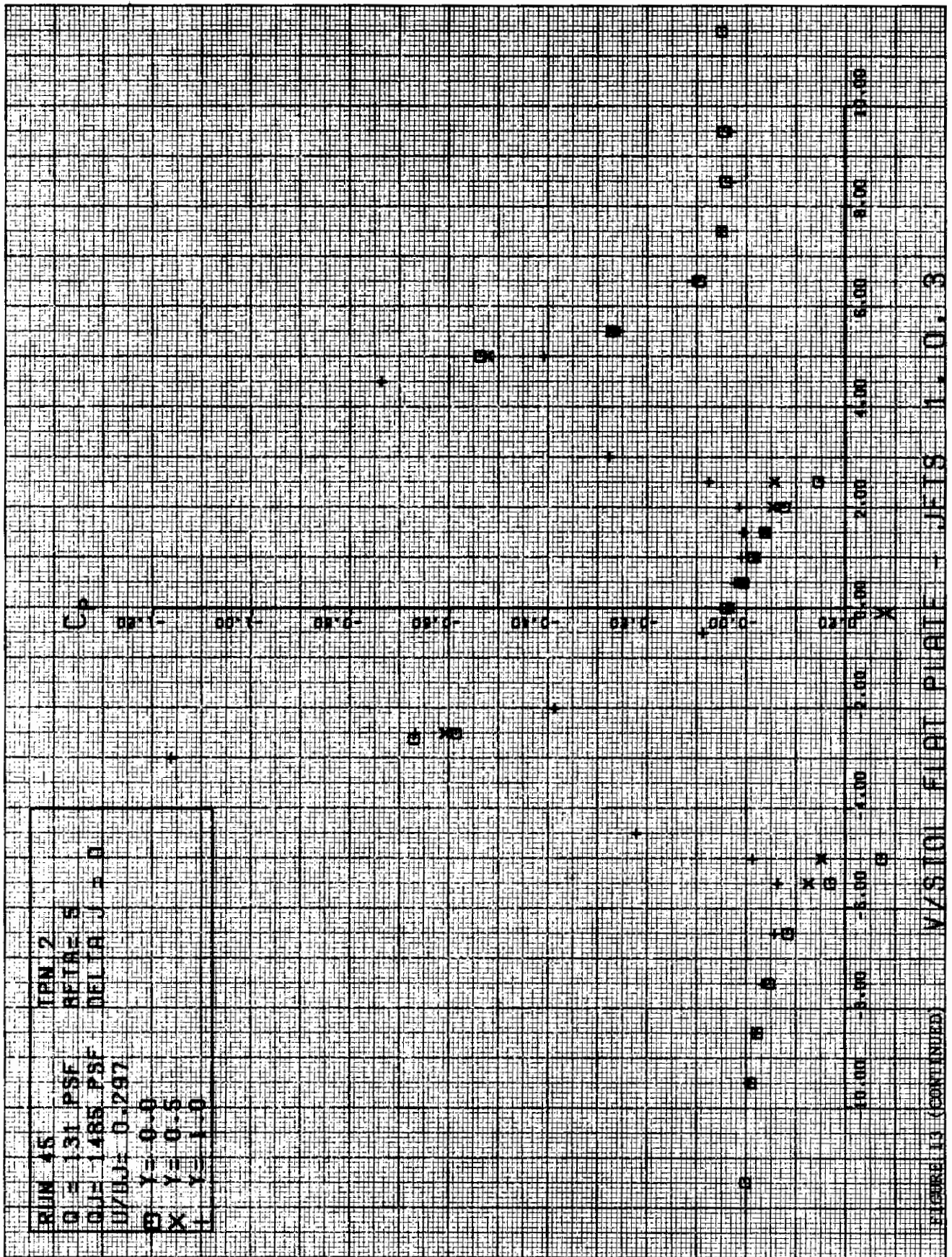


FIGURE 13 (CONTINUED) VISUAL FLIGHT PLATE - IFFIS 11-0-3



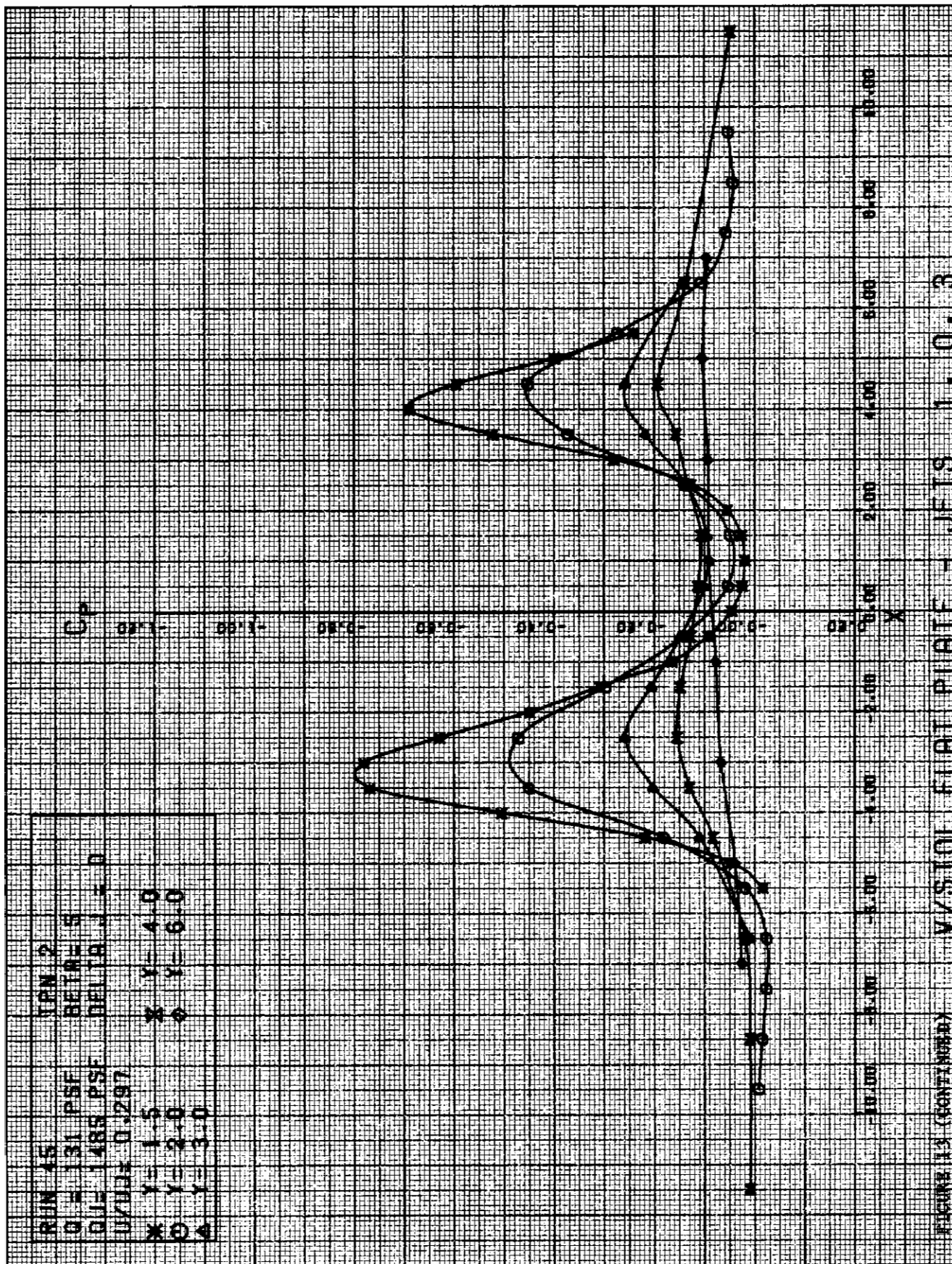


FIGURE 13 (CONTINUED) V/S1011 FLAT PLATE - JETS 1.0-3.3

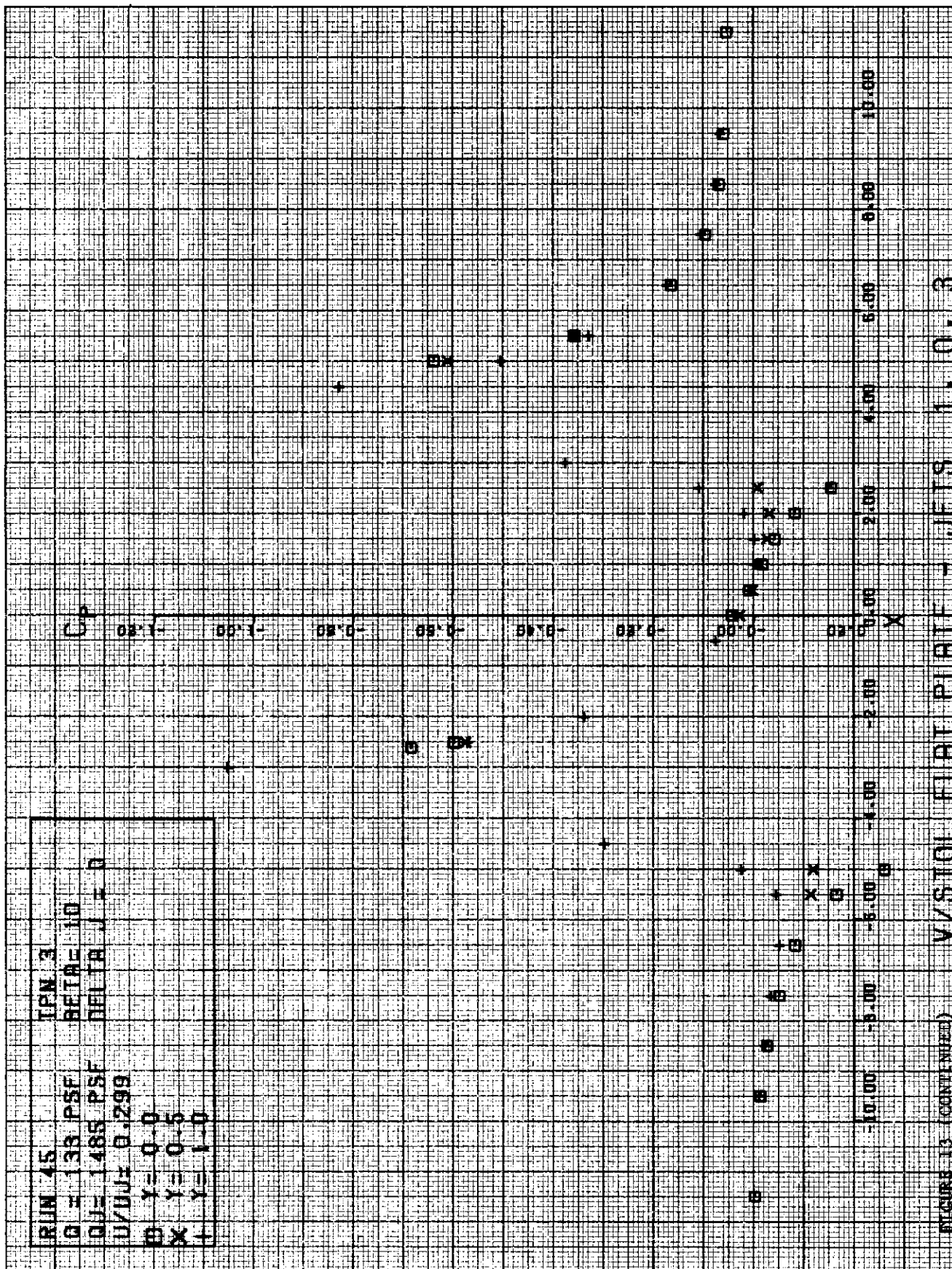


FIGURE 13 (CONTINUED)

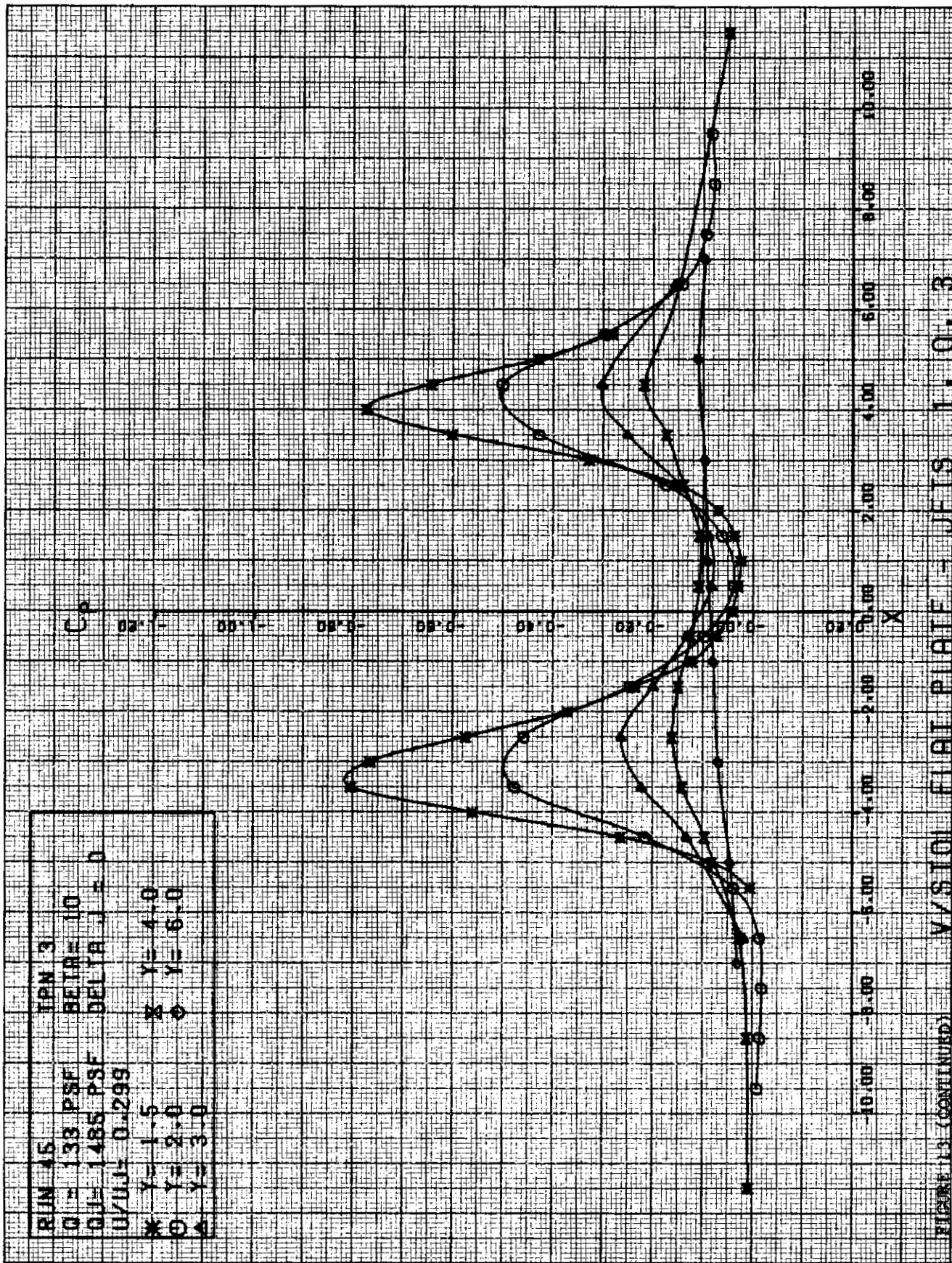
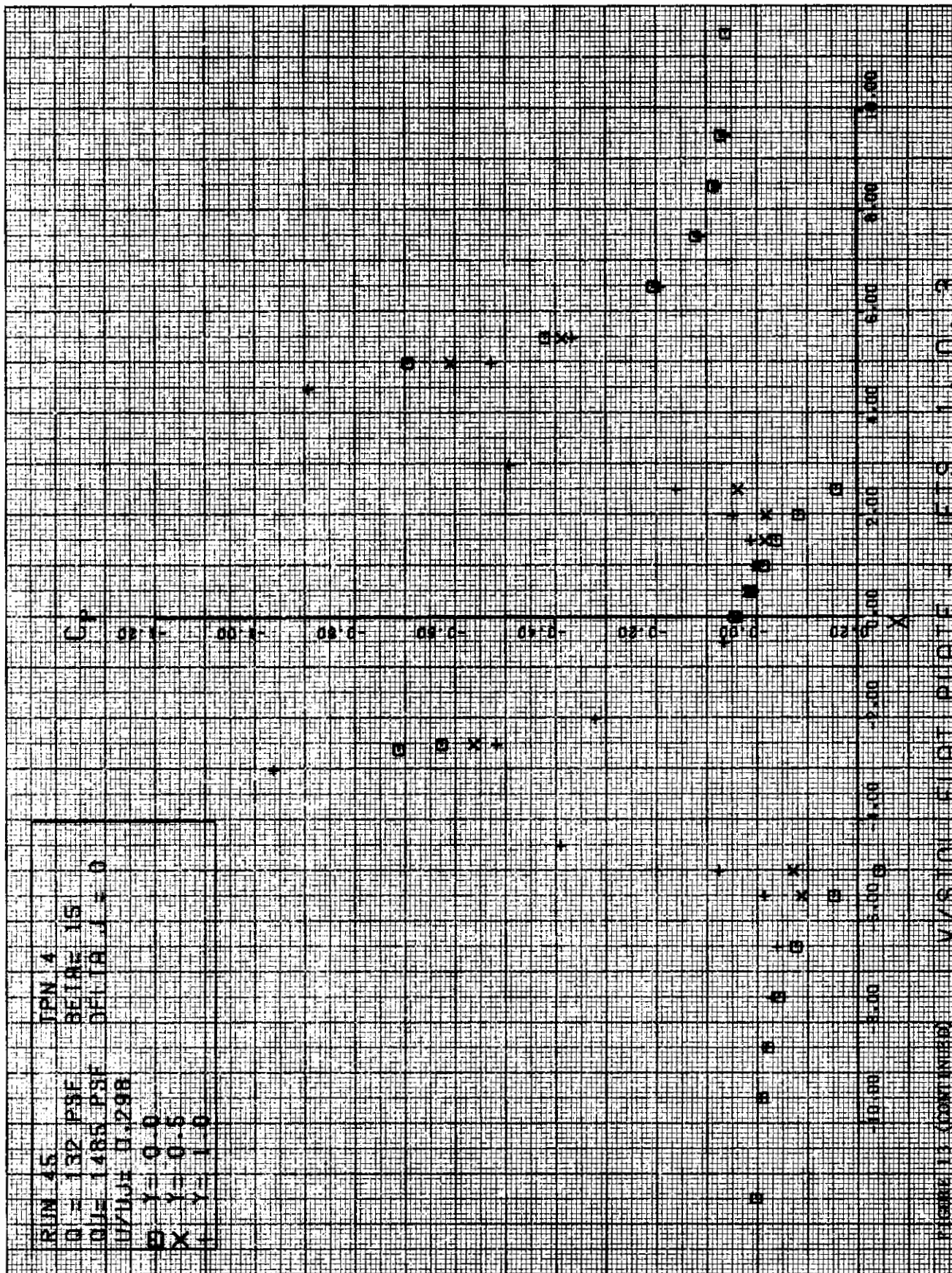
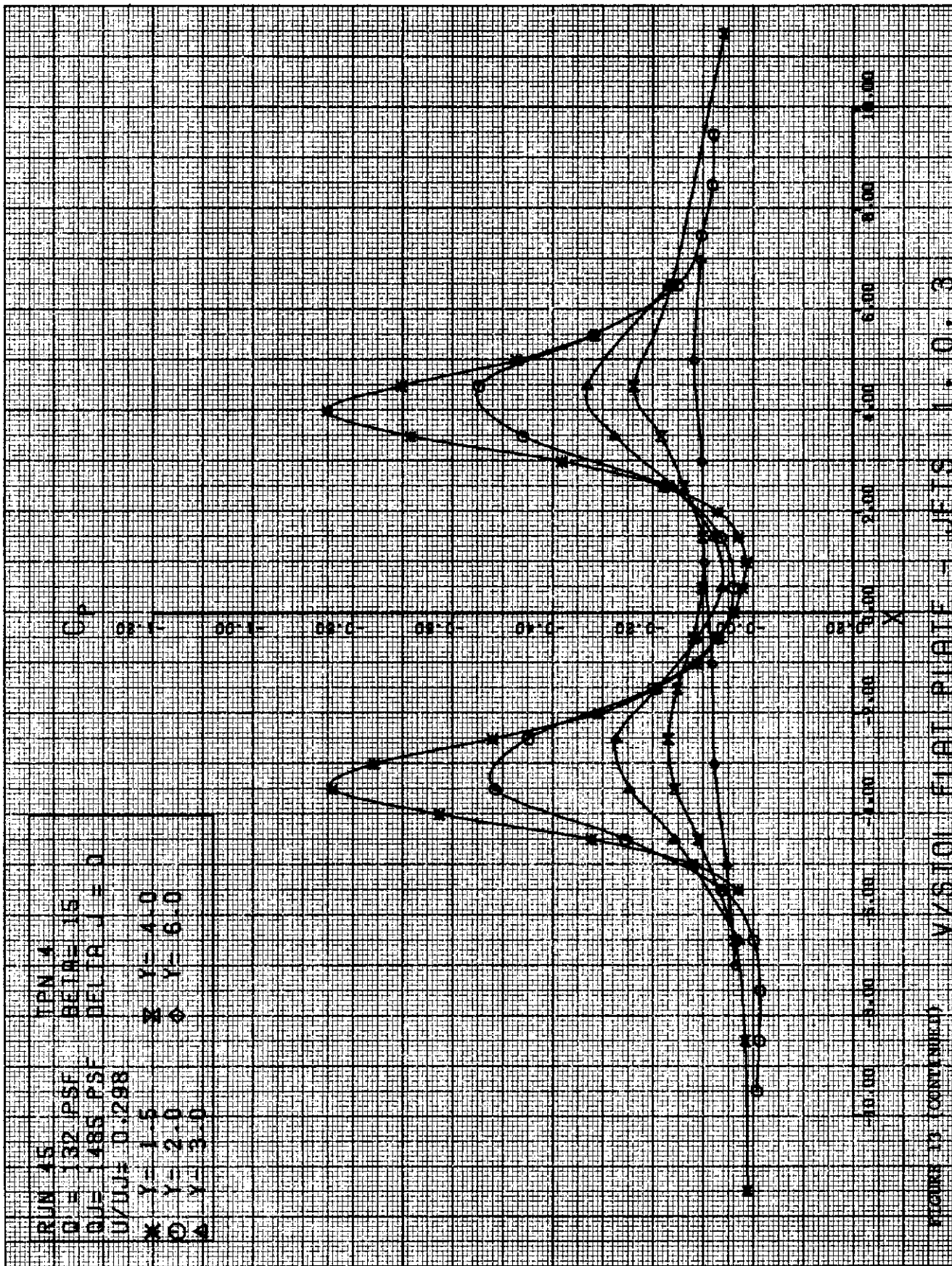


FIGURE 13 (CONTINUED) VISION FILM PLATE - JETS 1, 0, 3





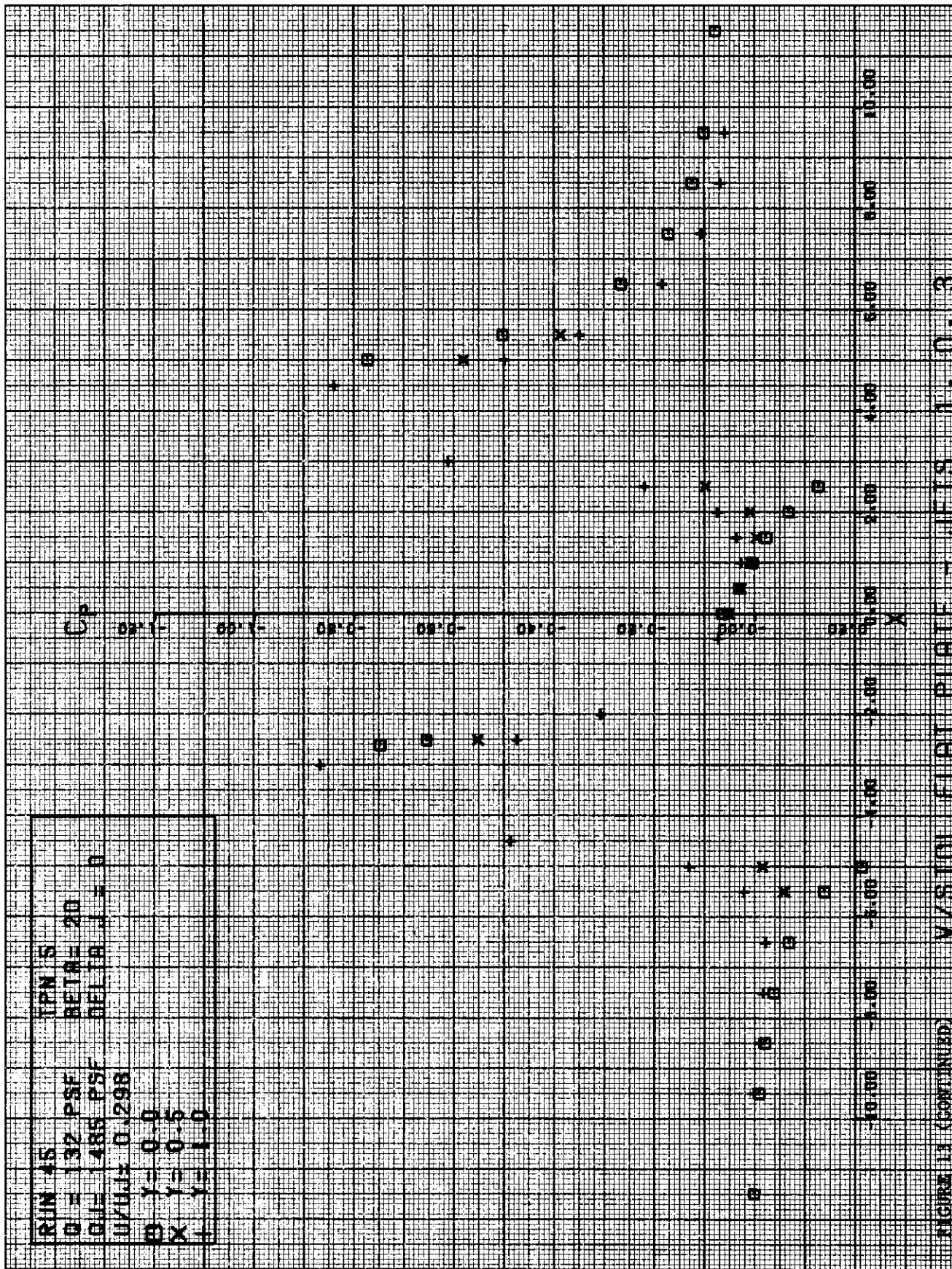
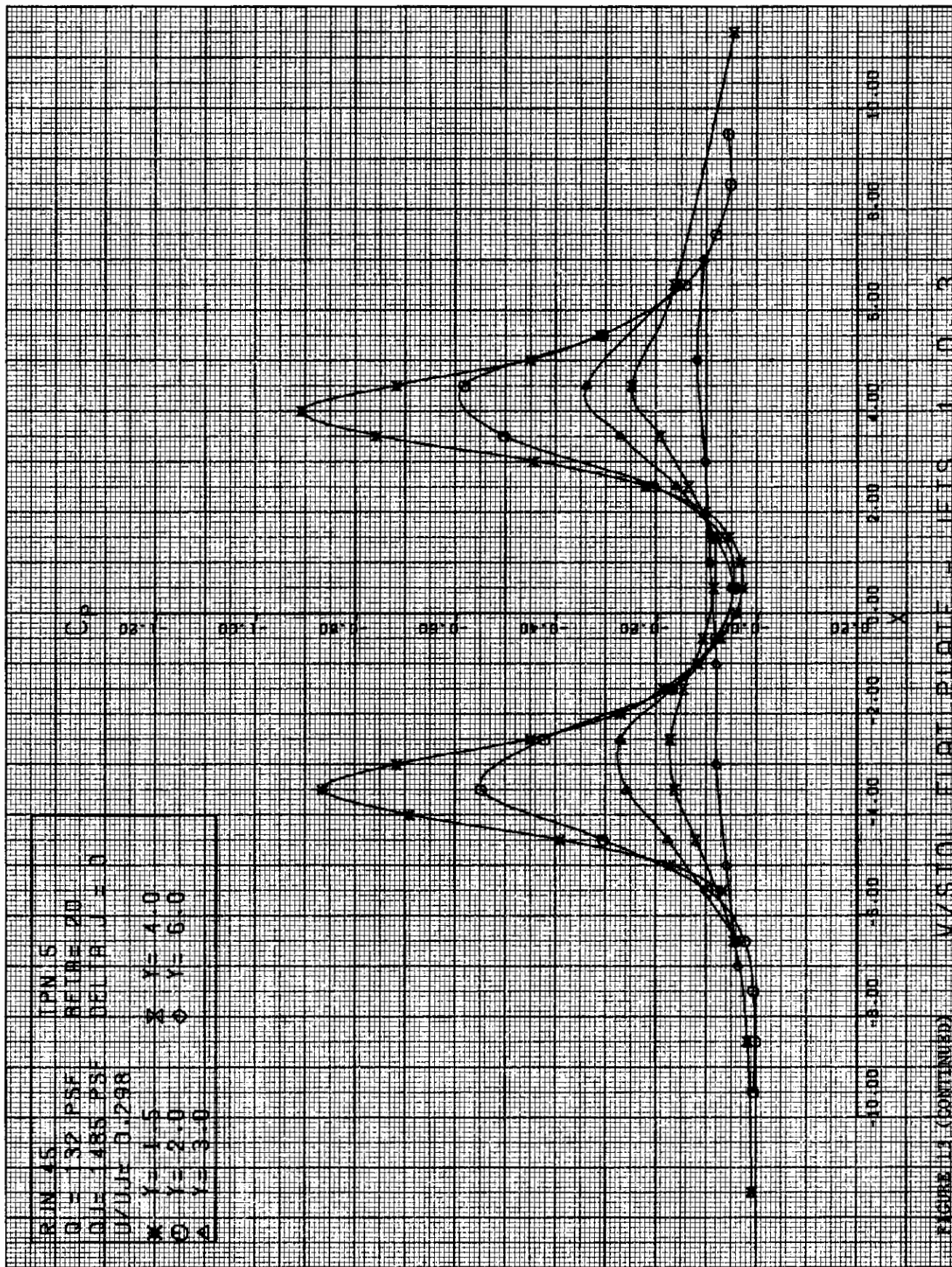


FIGURE 13 (CONTINUED) VISUAL FLIGHT PICTURE - JETS 1, 0, 3



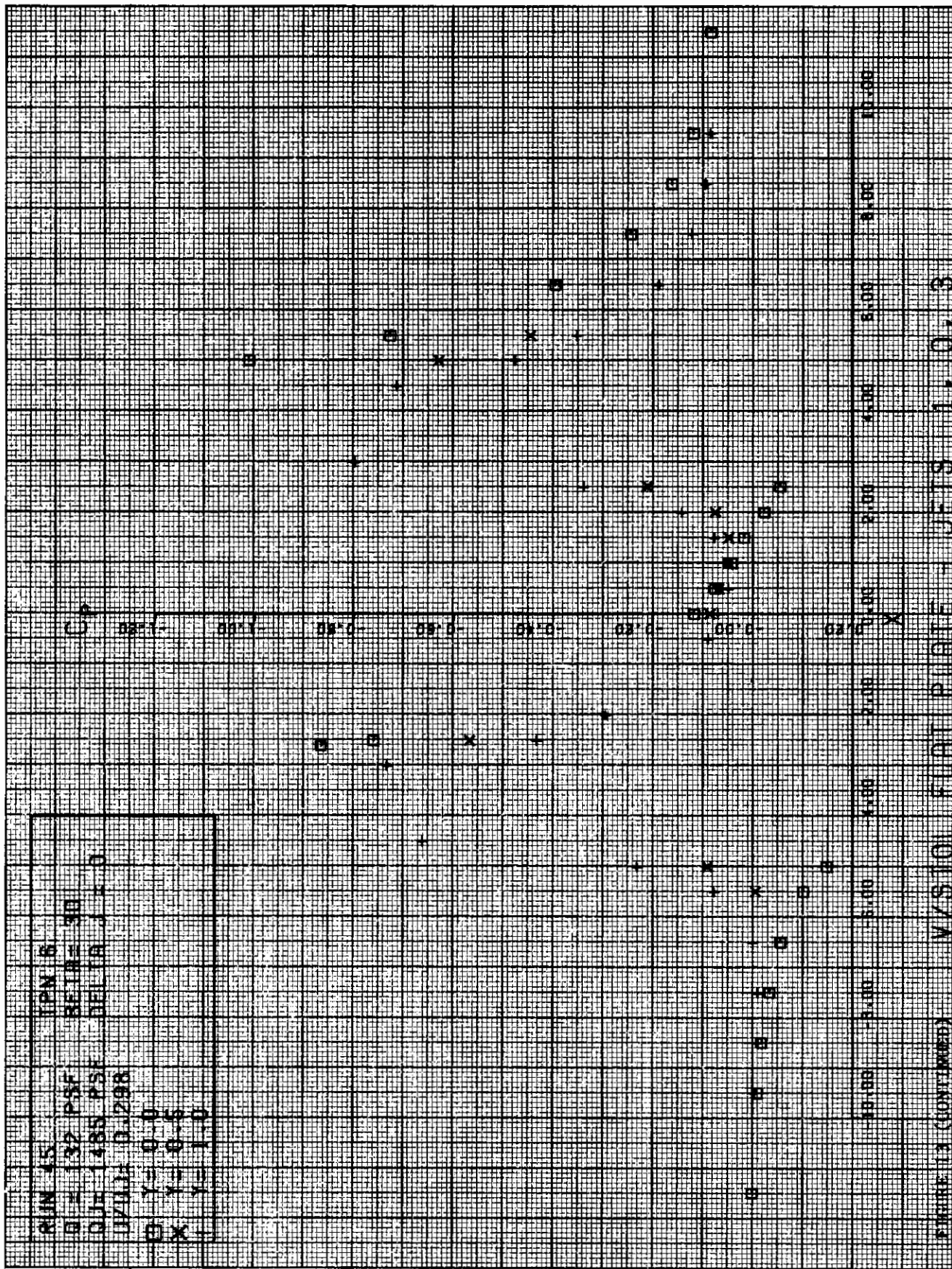
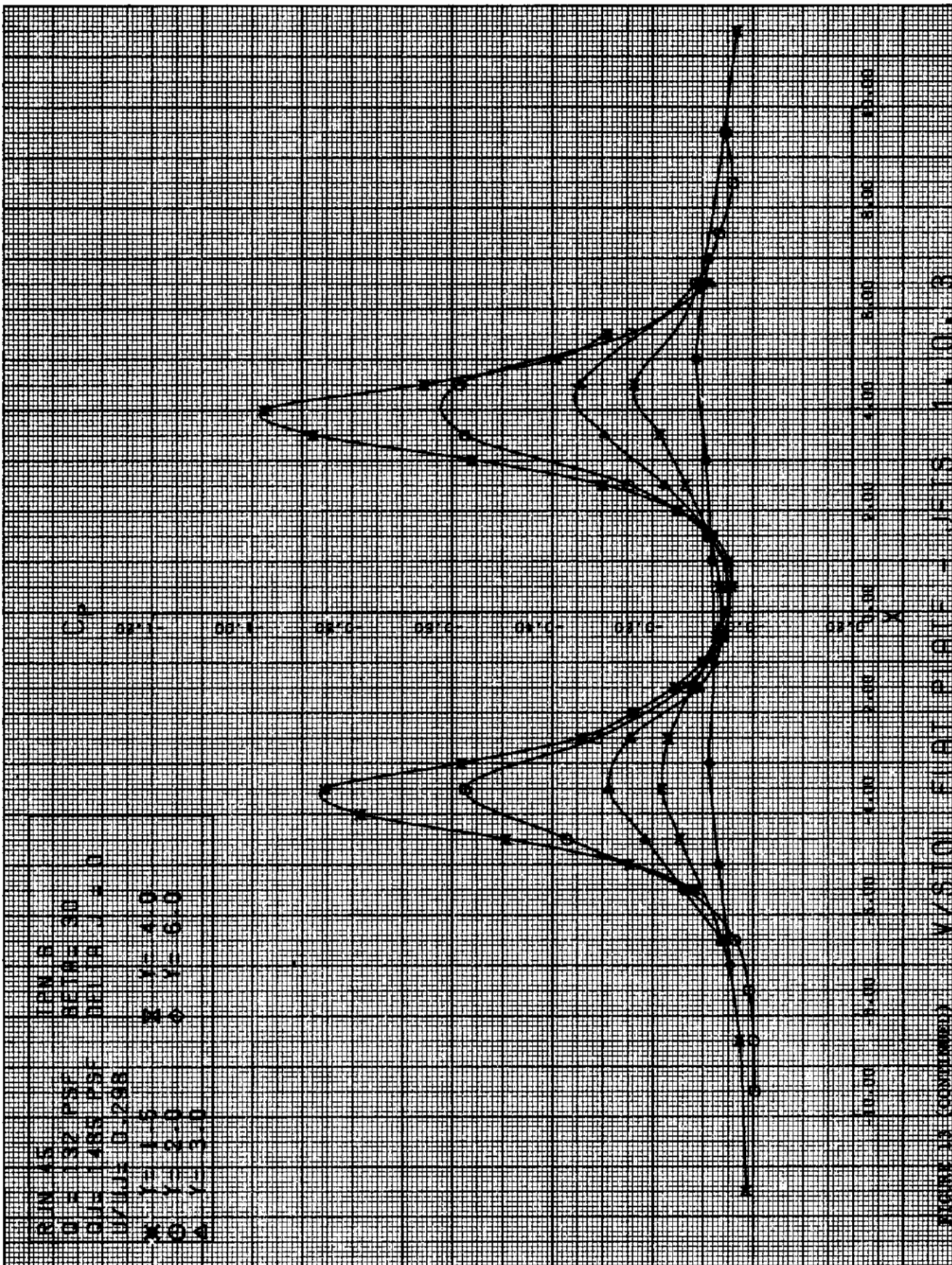
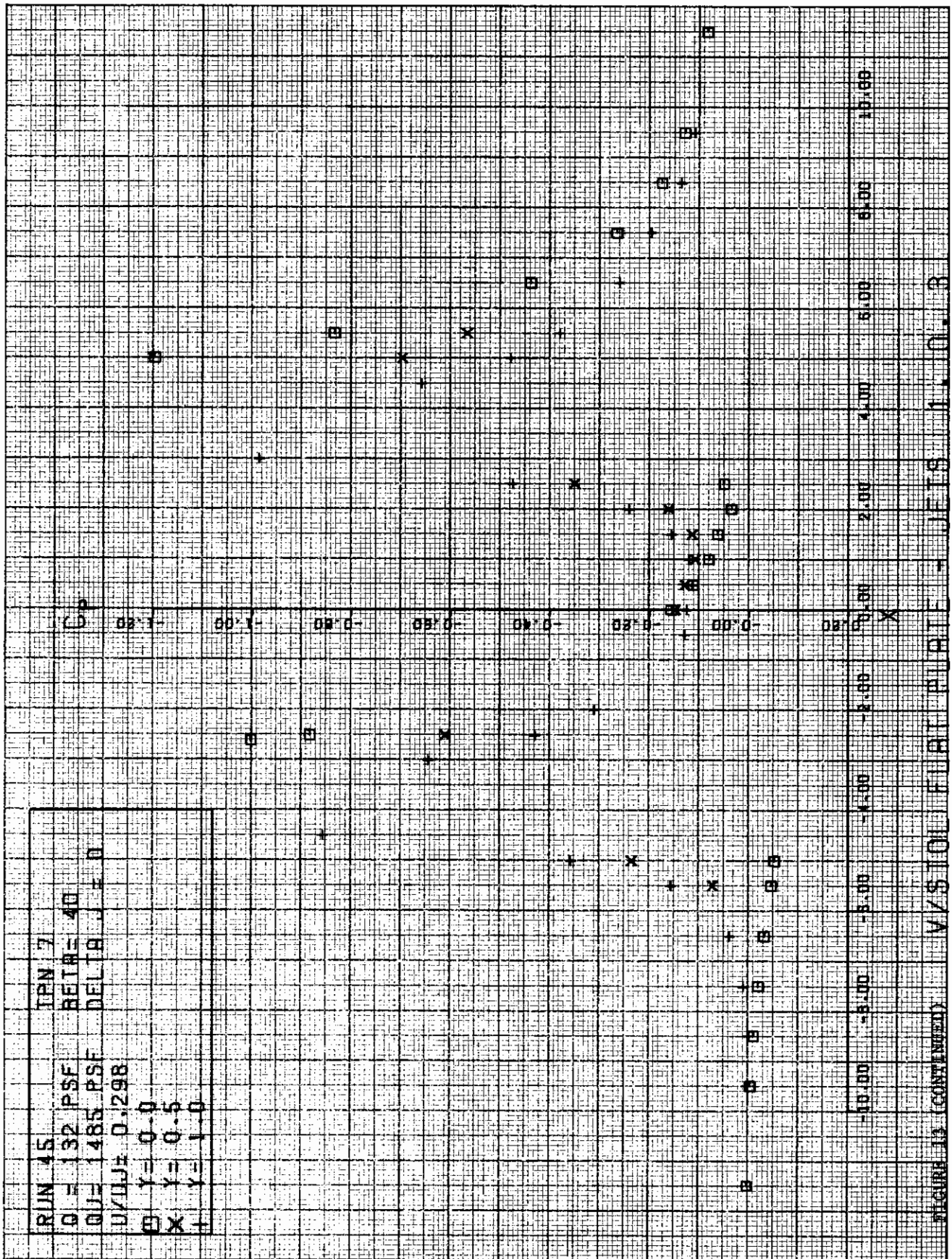


FIGURE 11 (CONTINUED) VISION FLAT PLATE JET'S 11.0.3





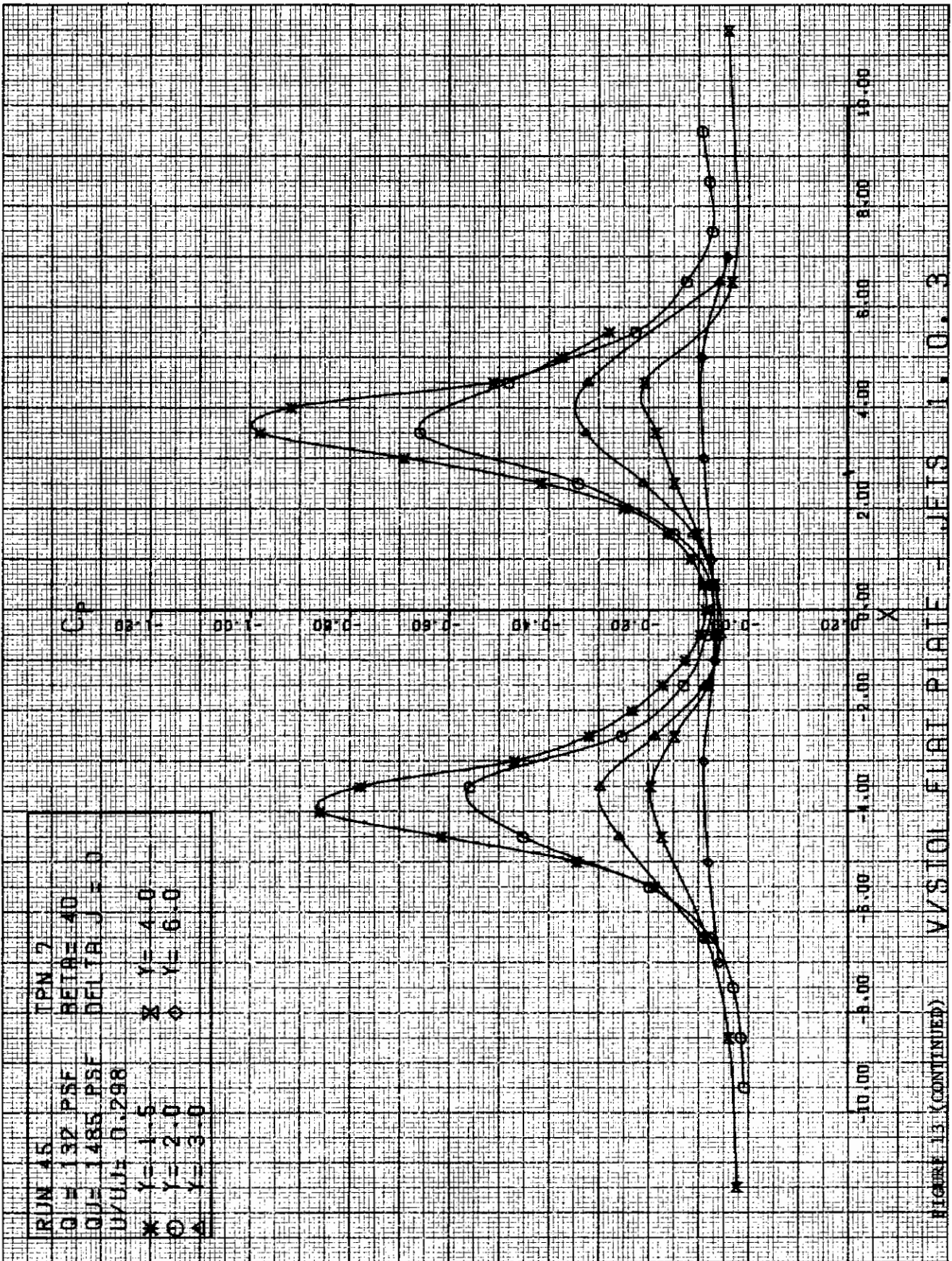
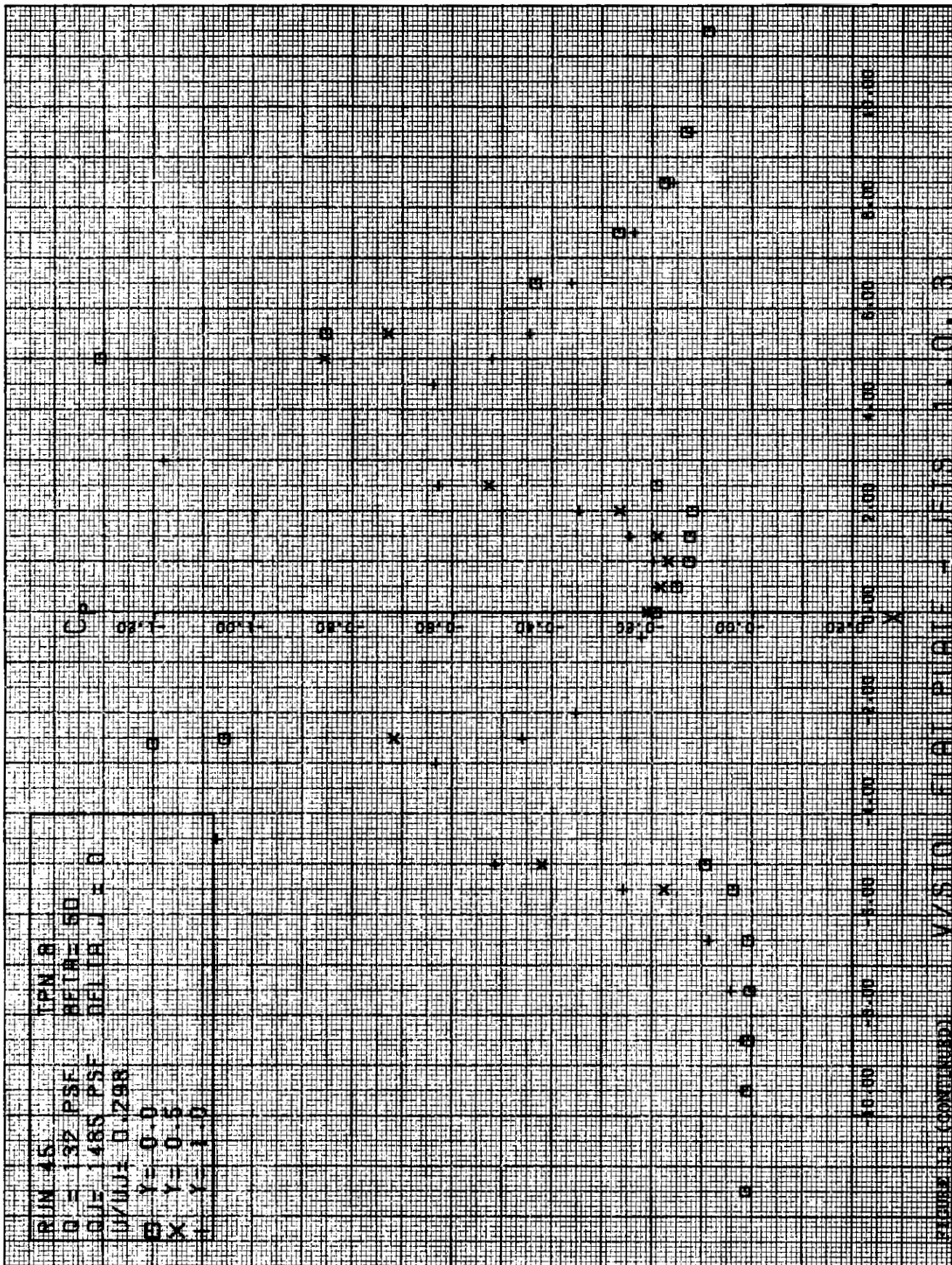
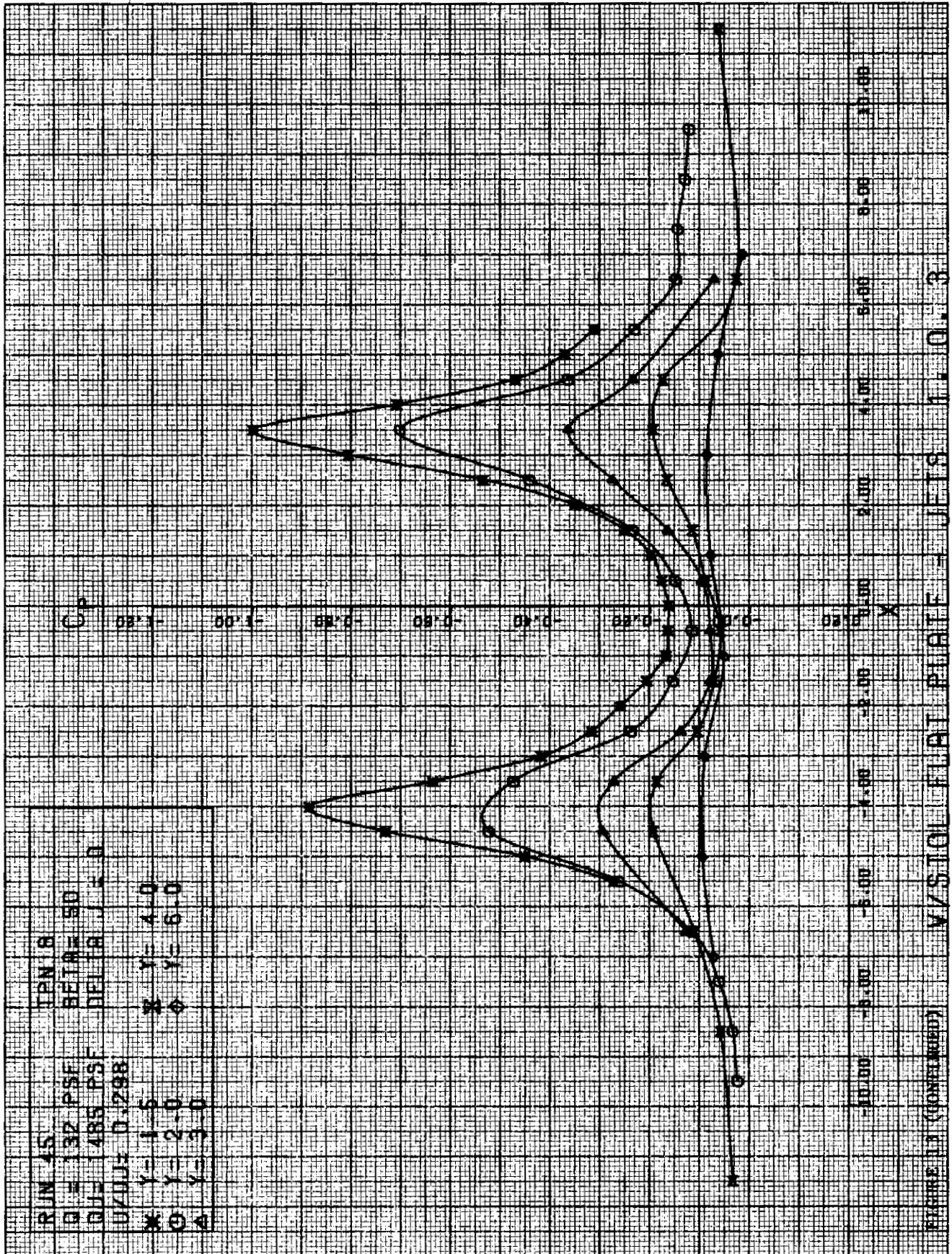
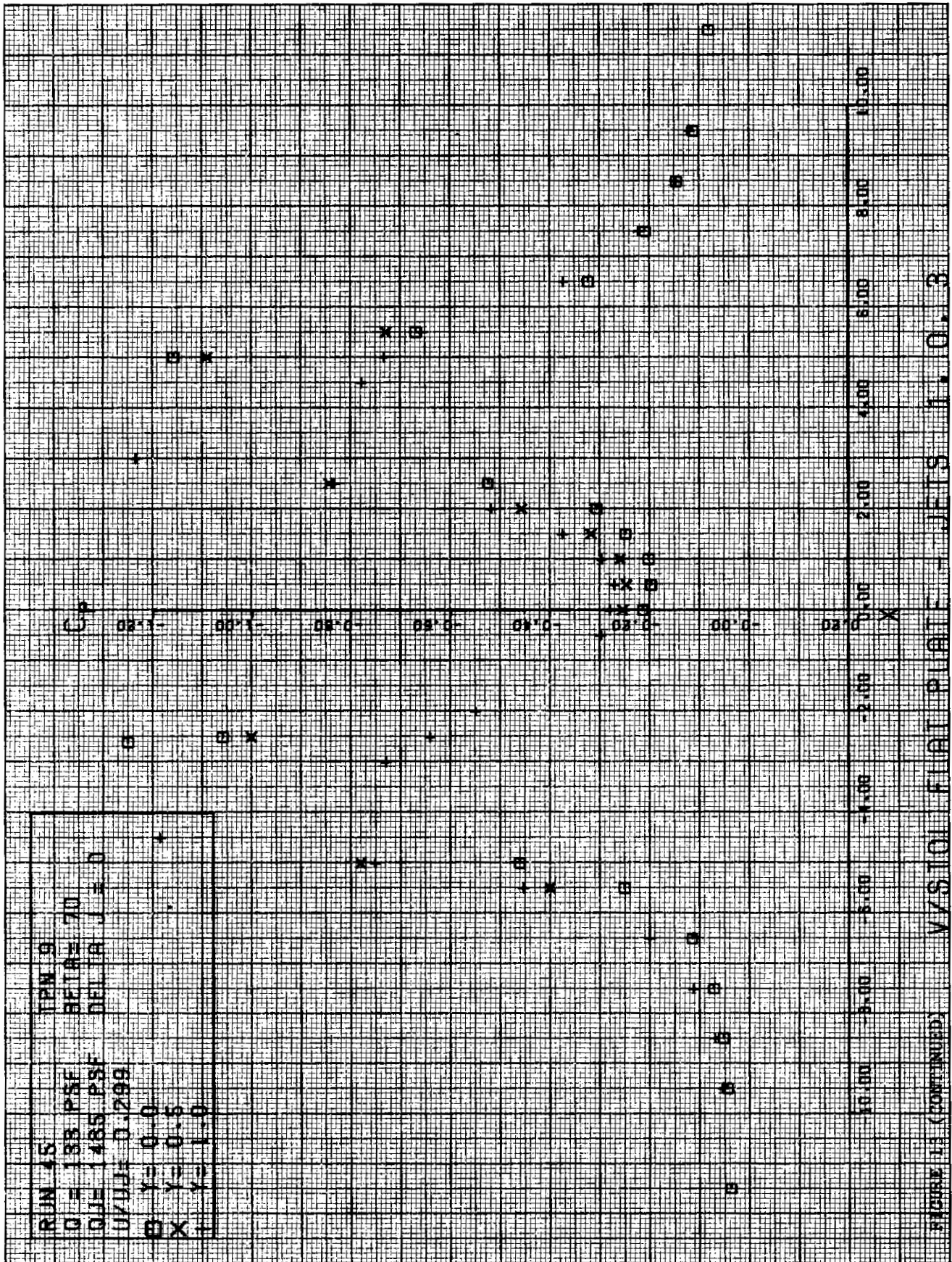


FIGURE 13 (CONTINUED) VISUAL FLIGHT PROFILE - JETS 1, 10, 3







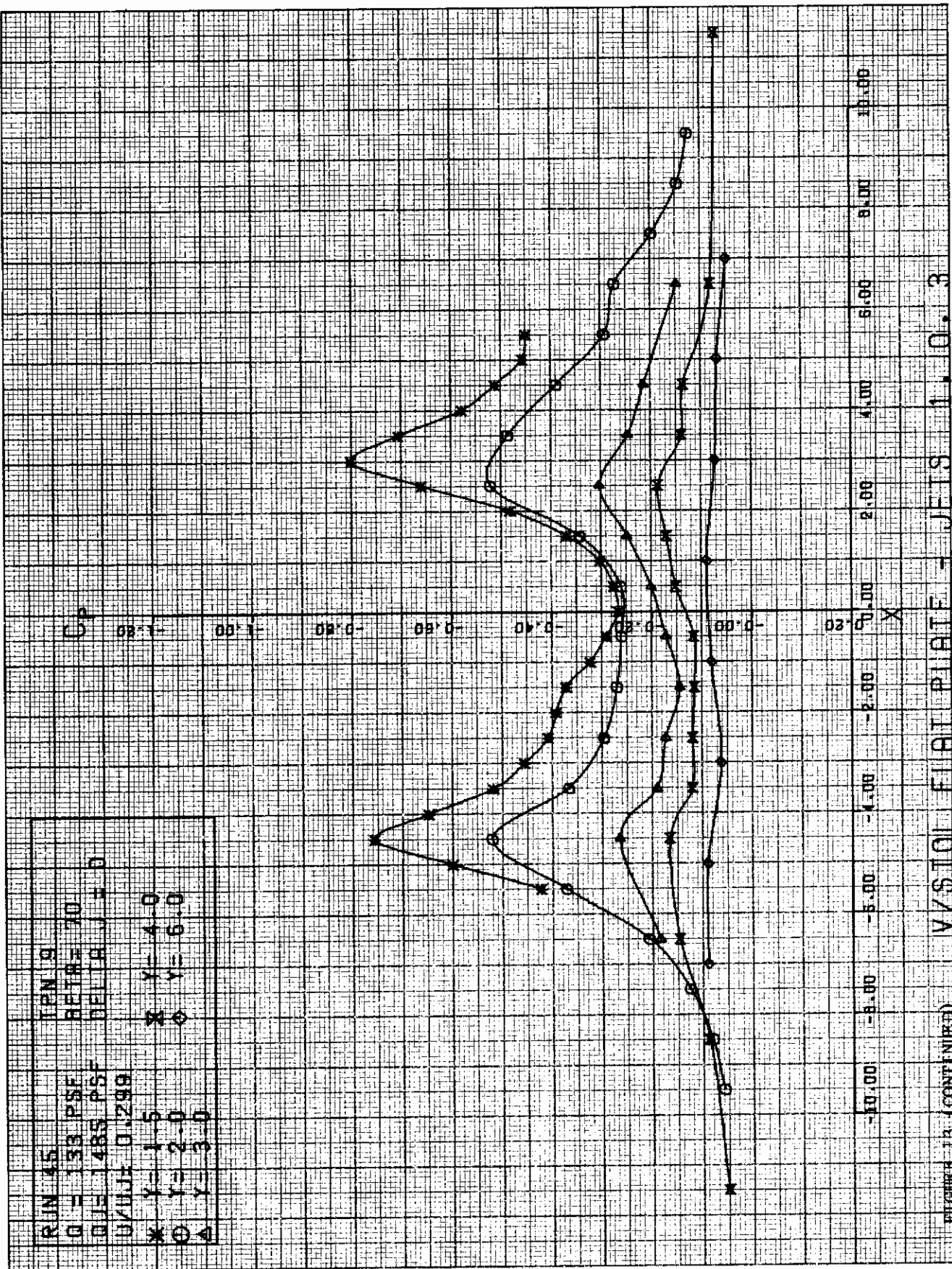


FIGURE 1a. (CONTINUED) VJSTOL FLAT PLATE - JETS 11.0. 3

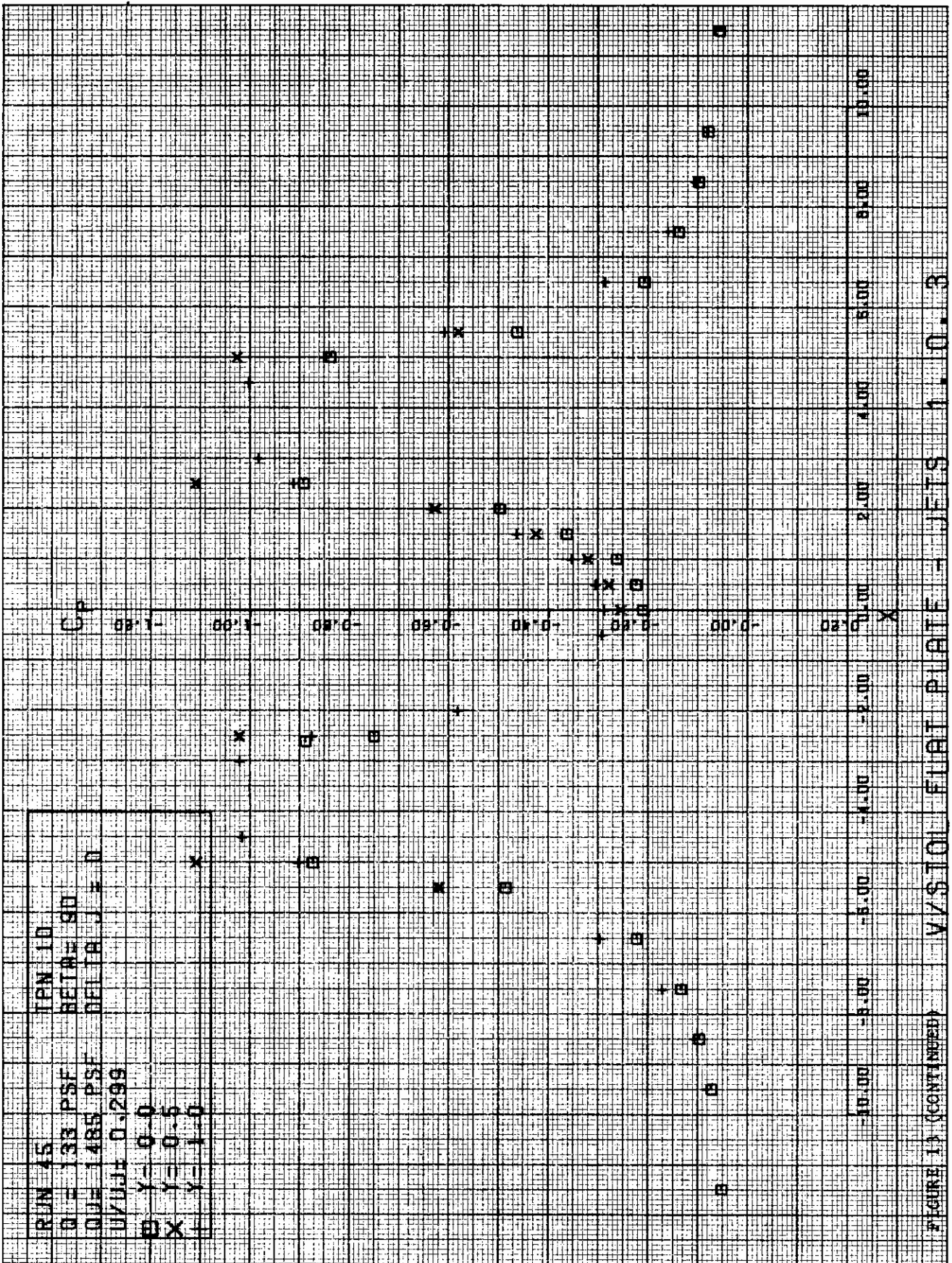


FIGURE 1 (CONTINUED) VISION FLAT PLATE - JETS 1.0.3

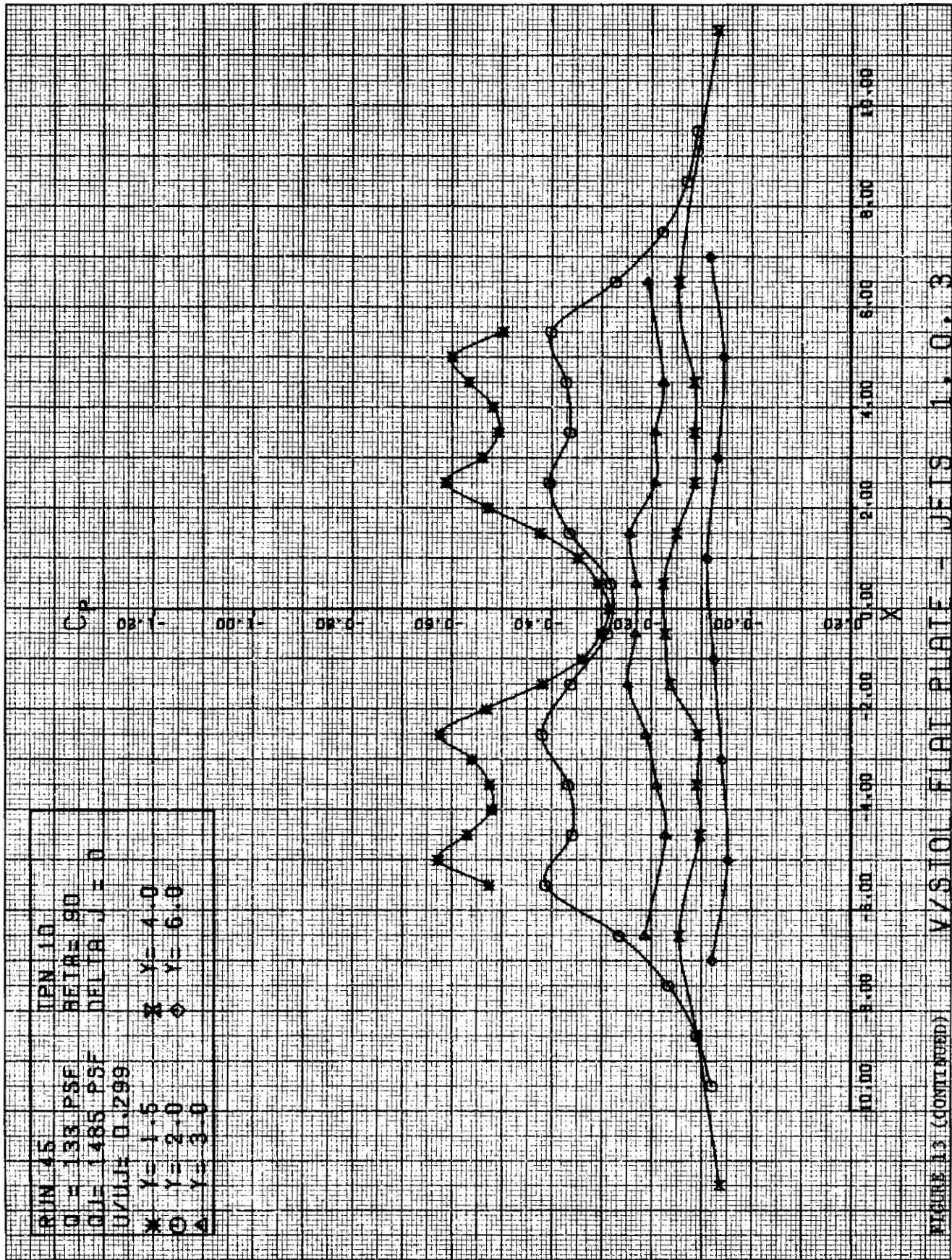
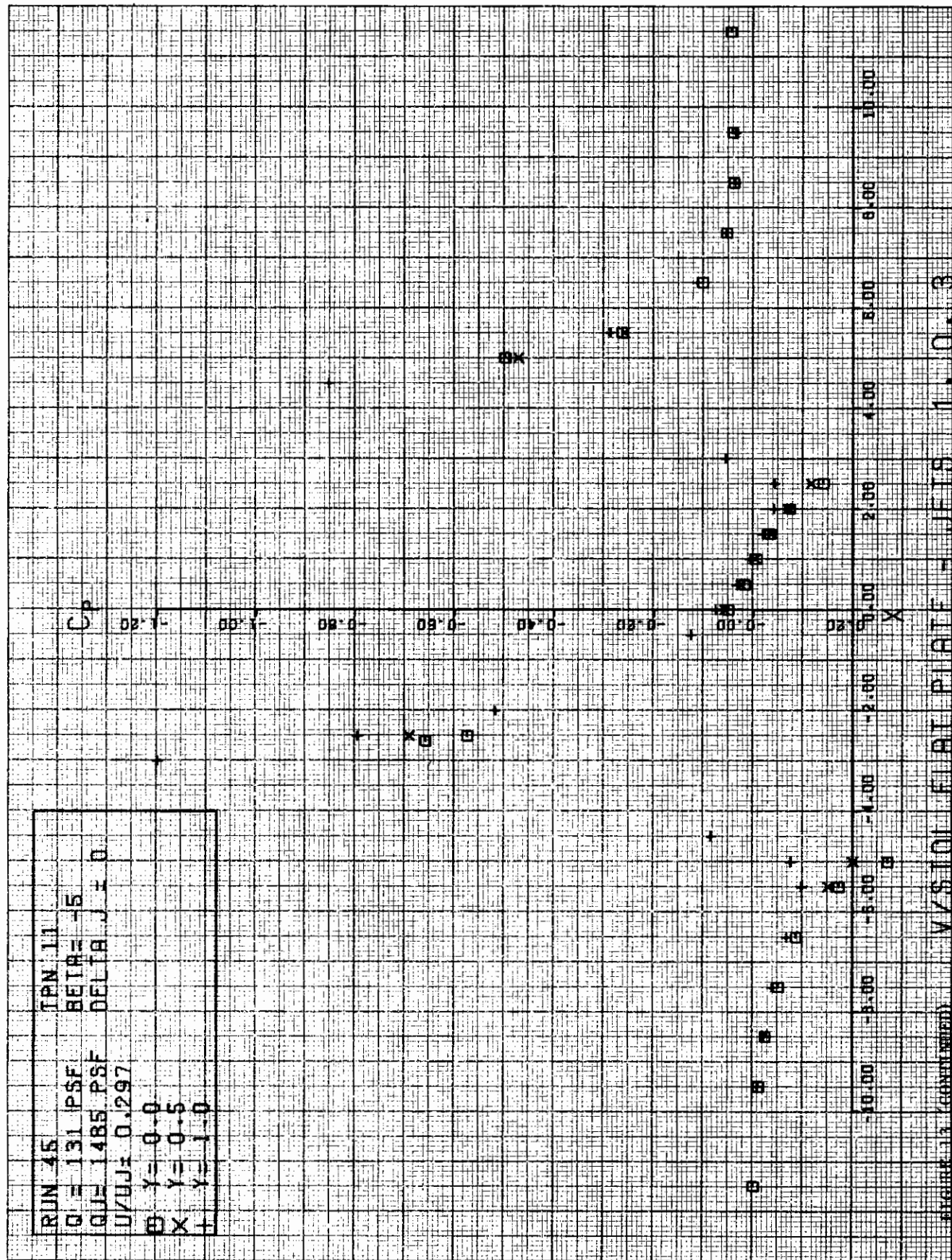


FIGURE 13 (CONTINUED) V-VSTOL FLAT PLATE - JETS 1, 0, 3



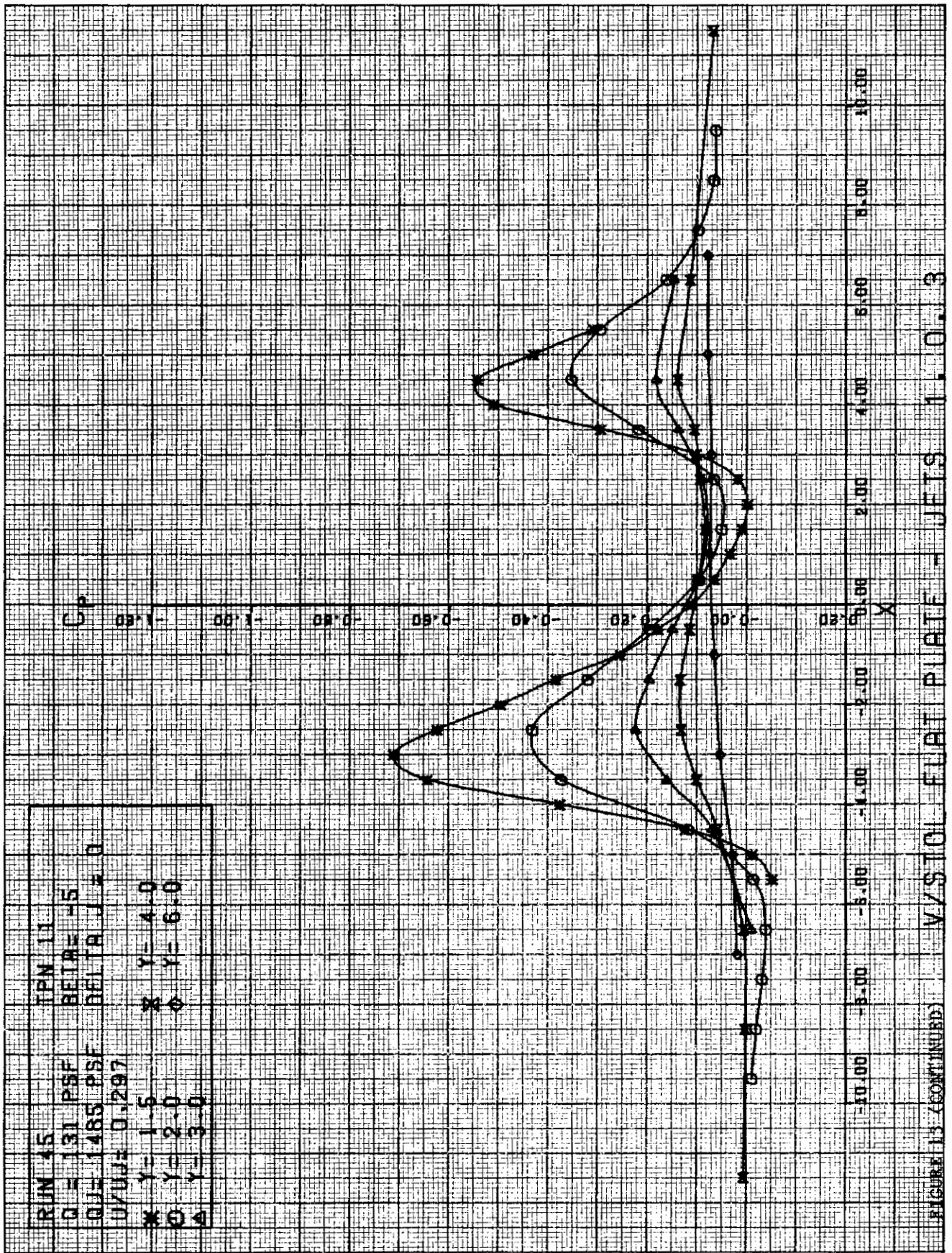


FIGURE 13 (CONTINUED) V/S TOL FLAT PLATE - JETS 1.0, 3

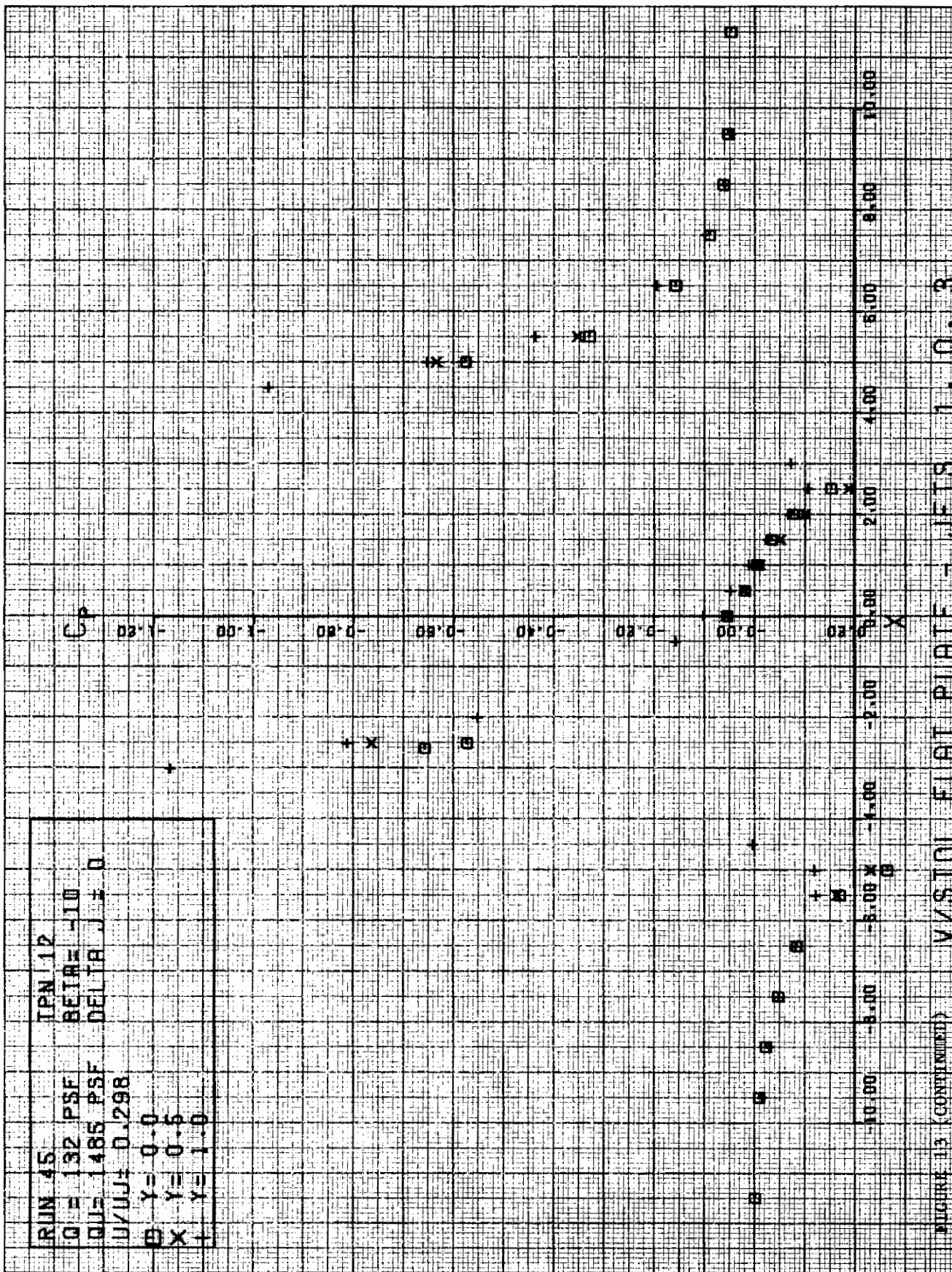


FIGURE 13 (CONTINUED) VISTOL FLAT PLATE - JETS 1.0.3

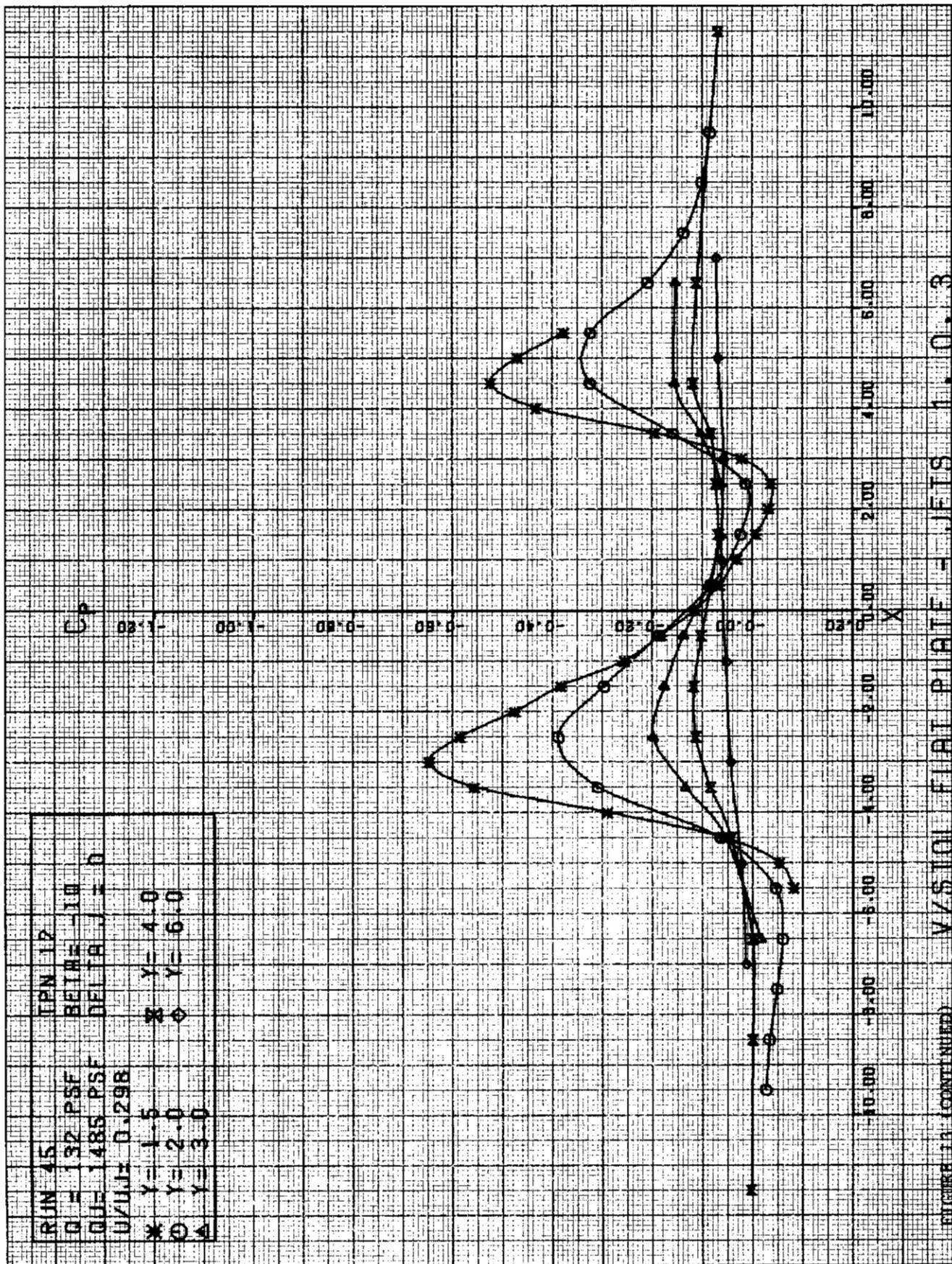
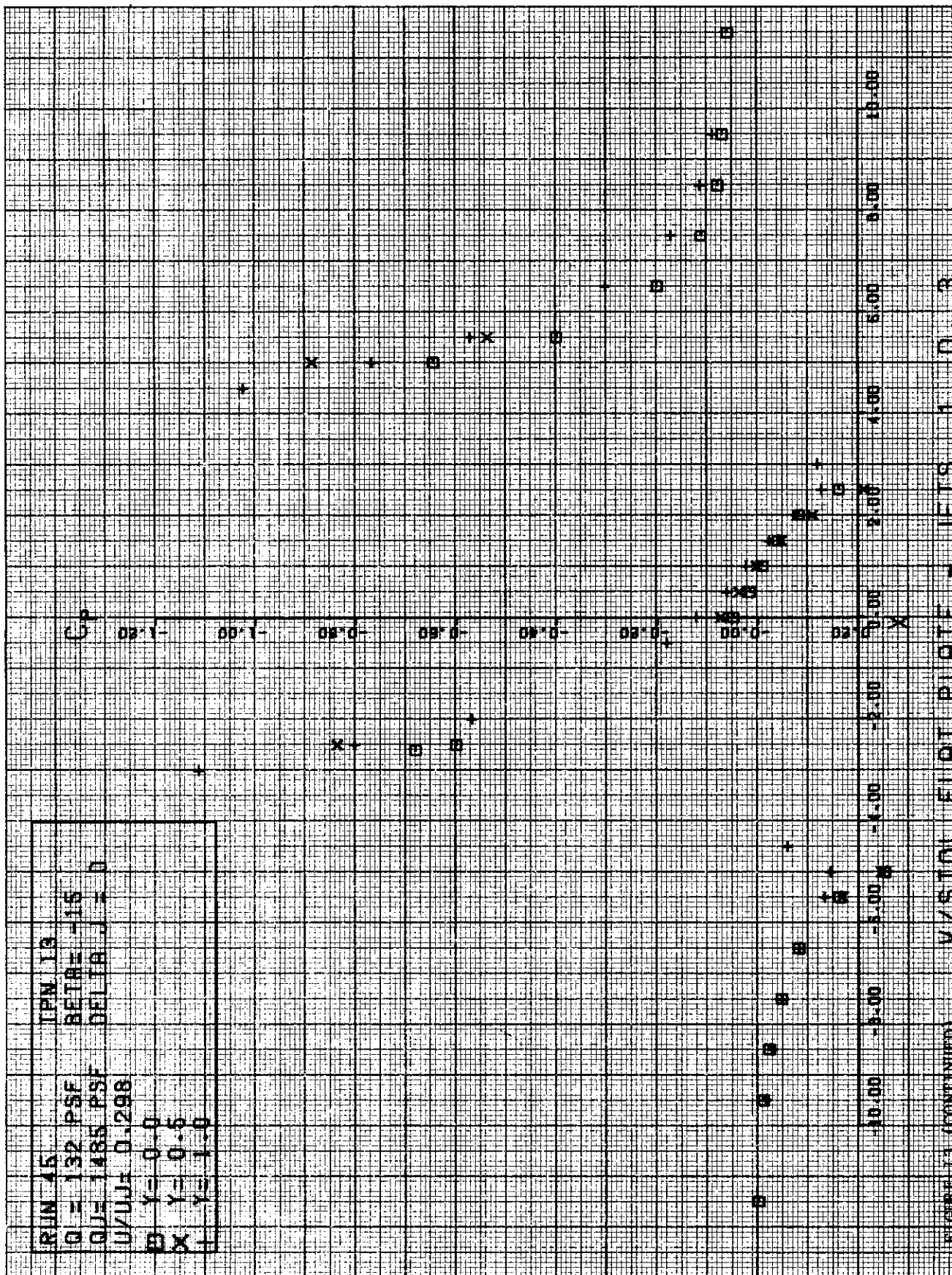
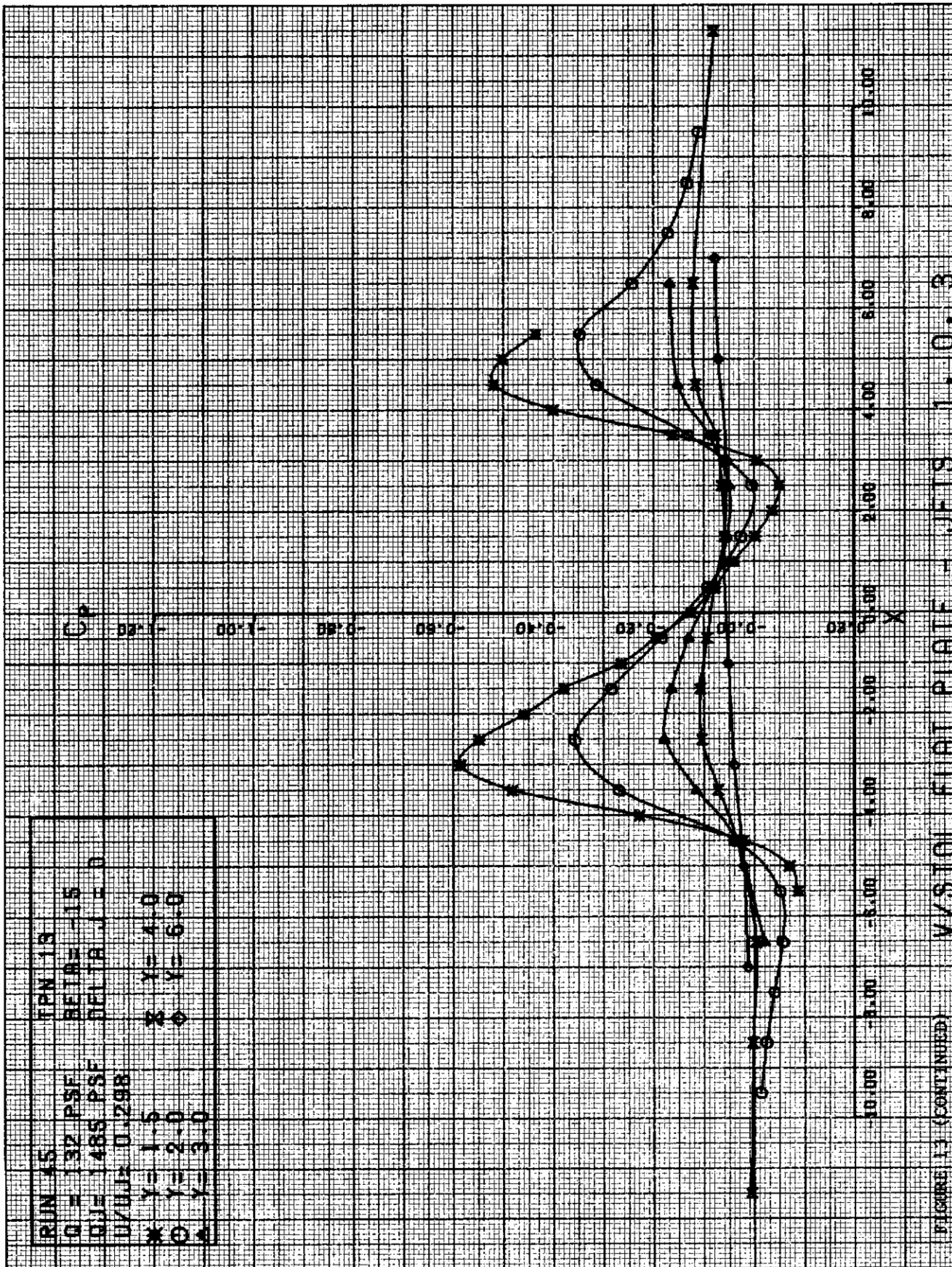
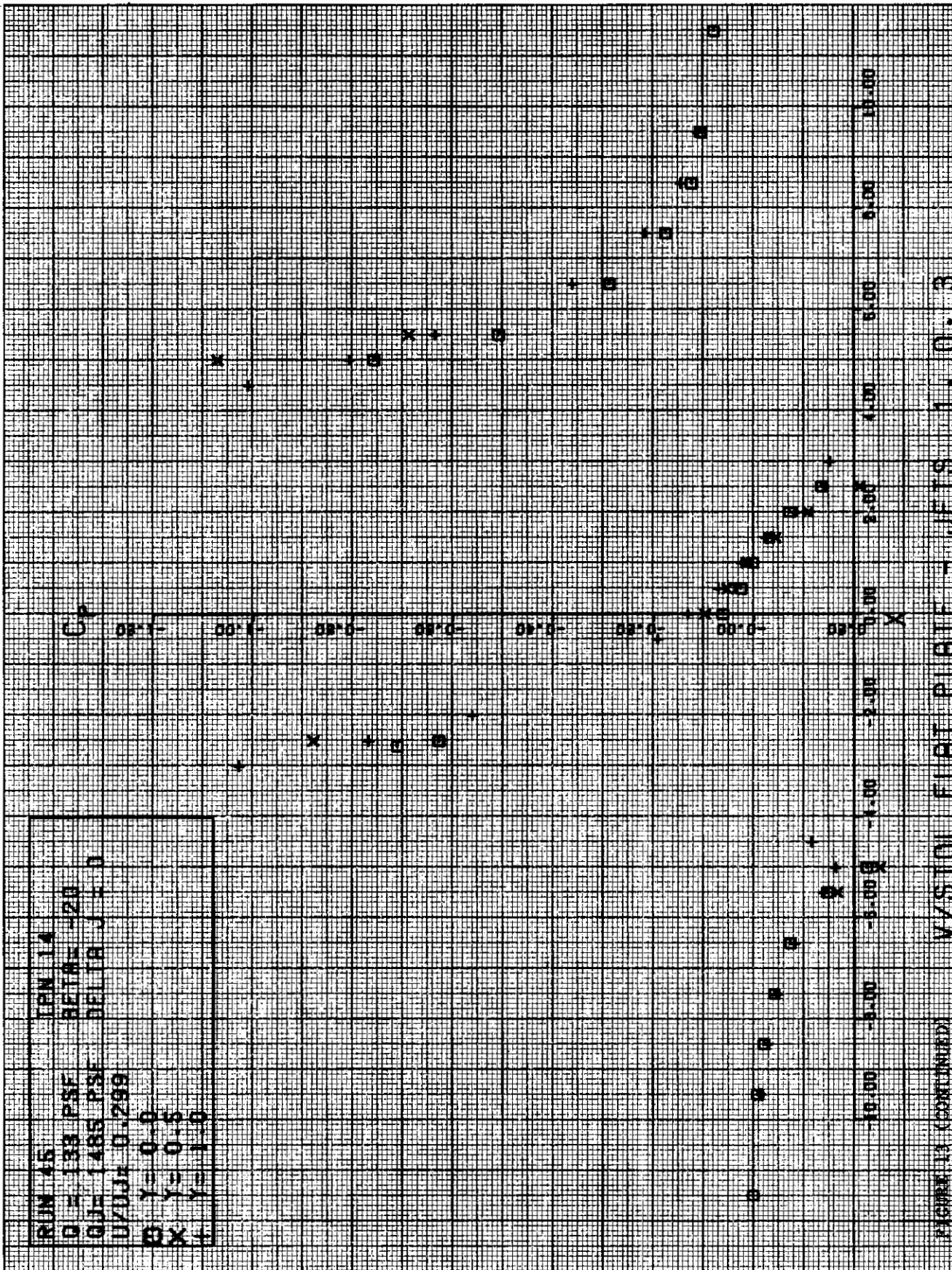
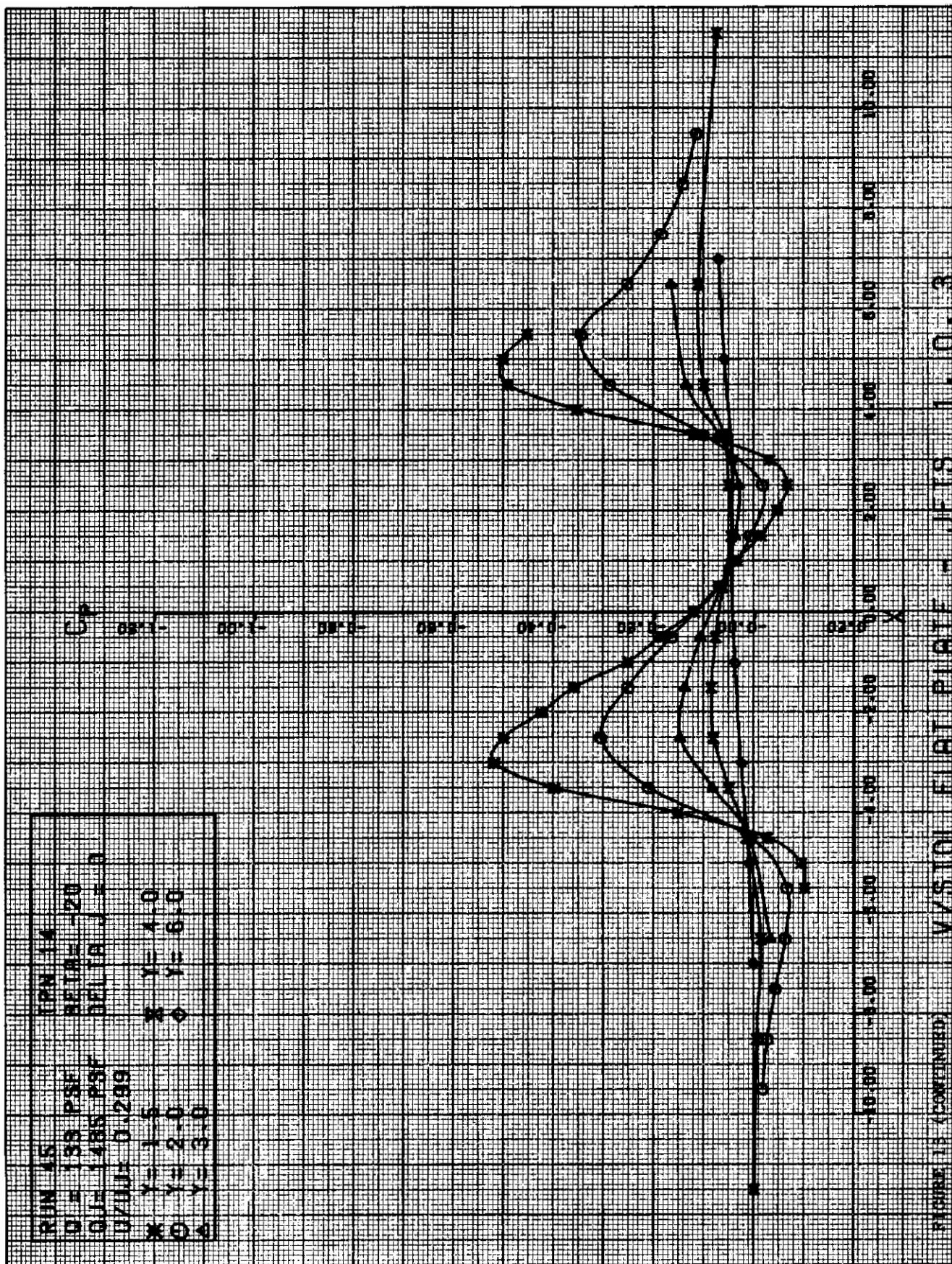


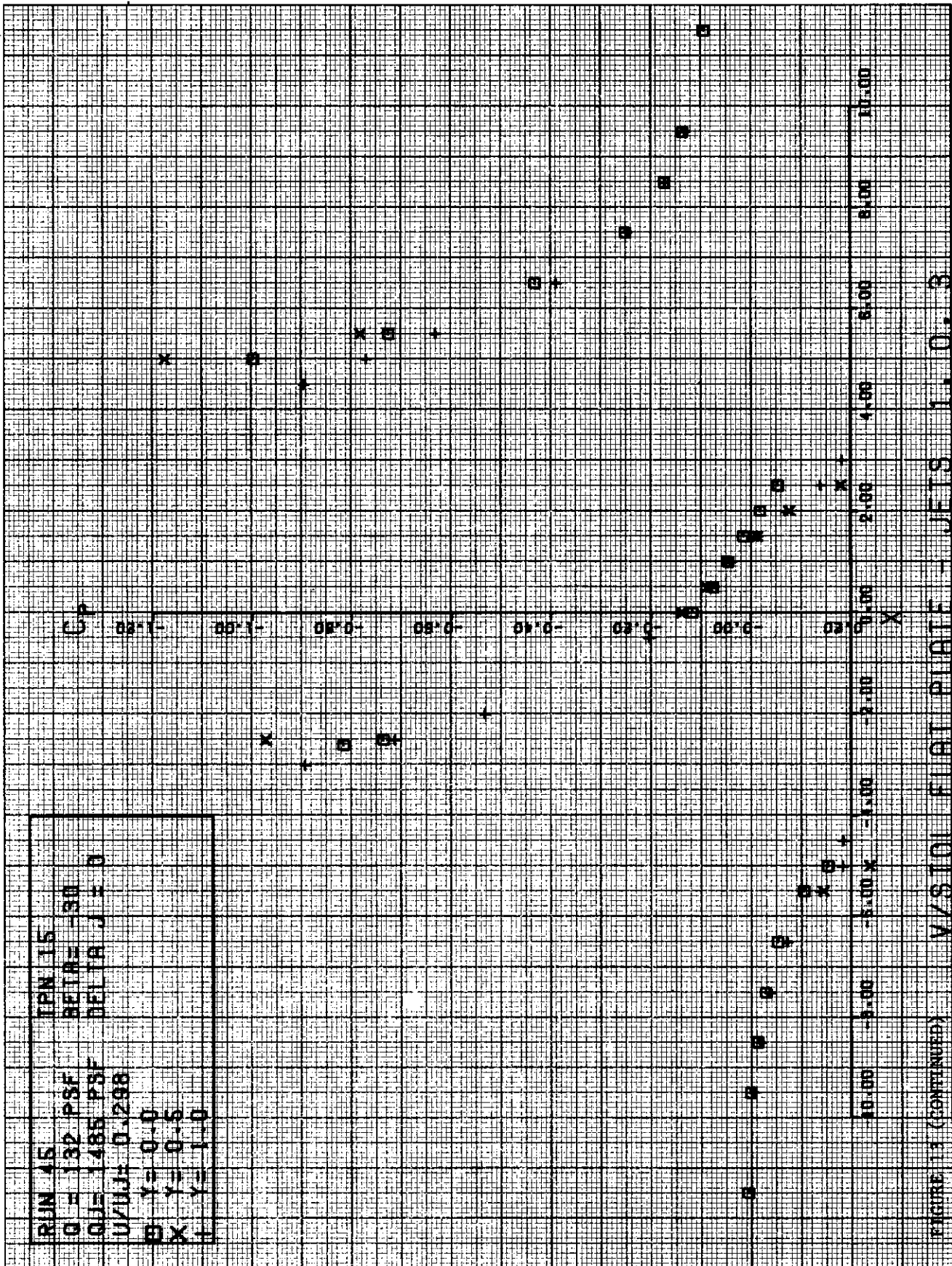
FIGURE 11 (CONTINUED) VISUAL FLAT PLATE - JETS 1, 10, 3

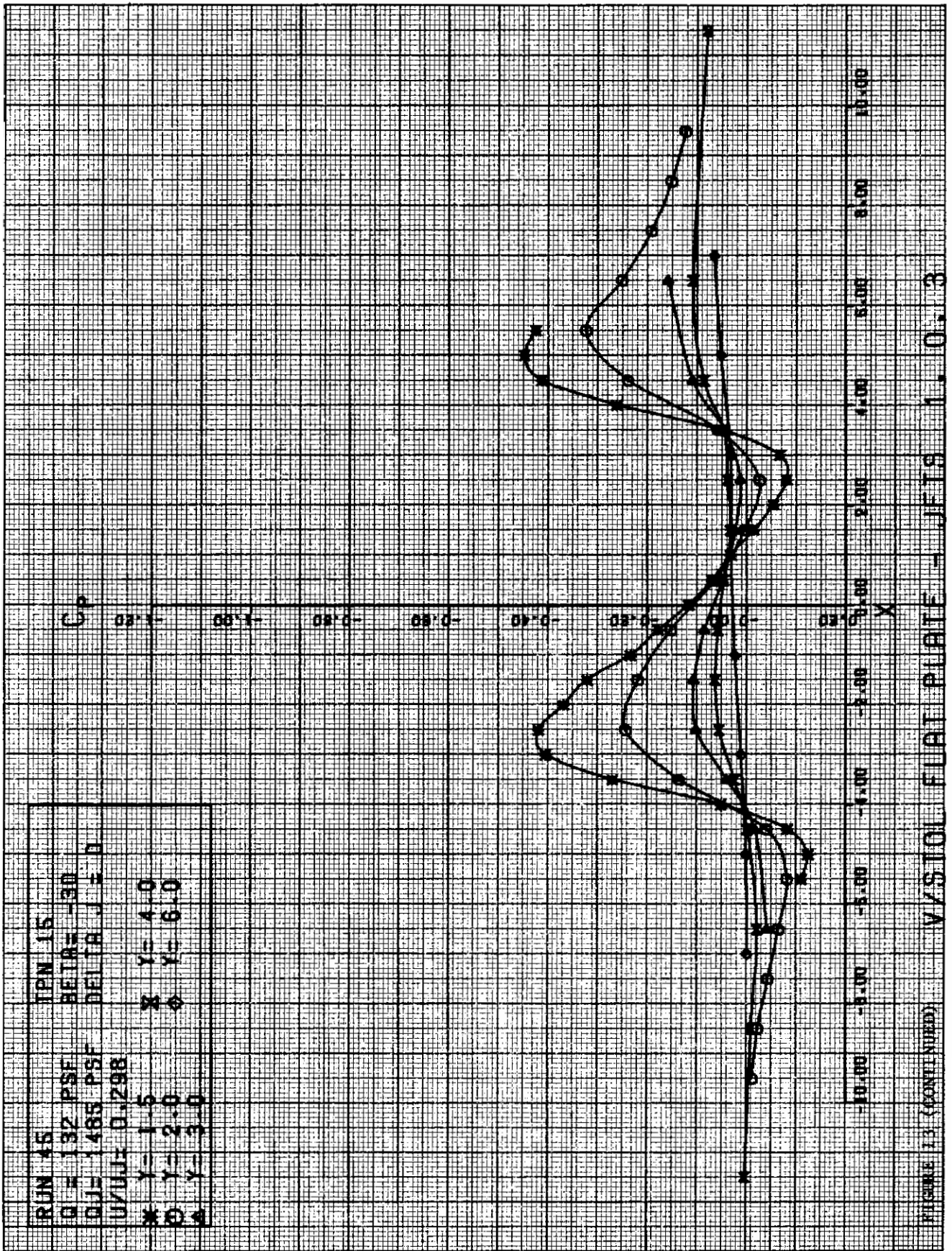


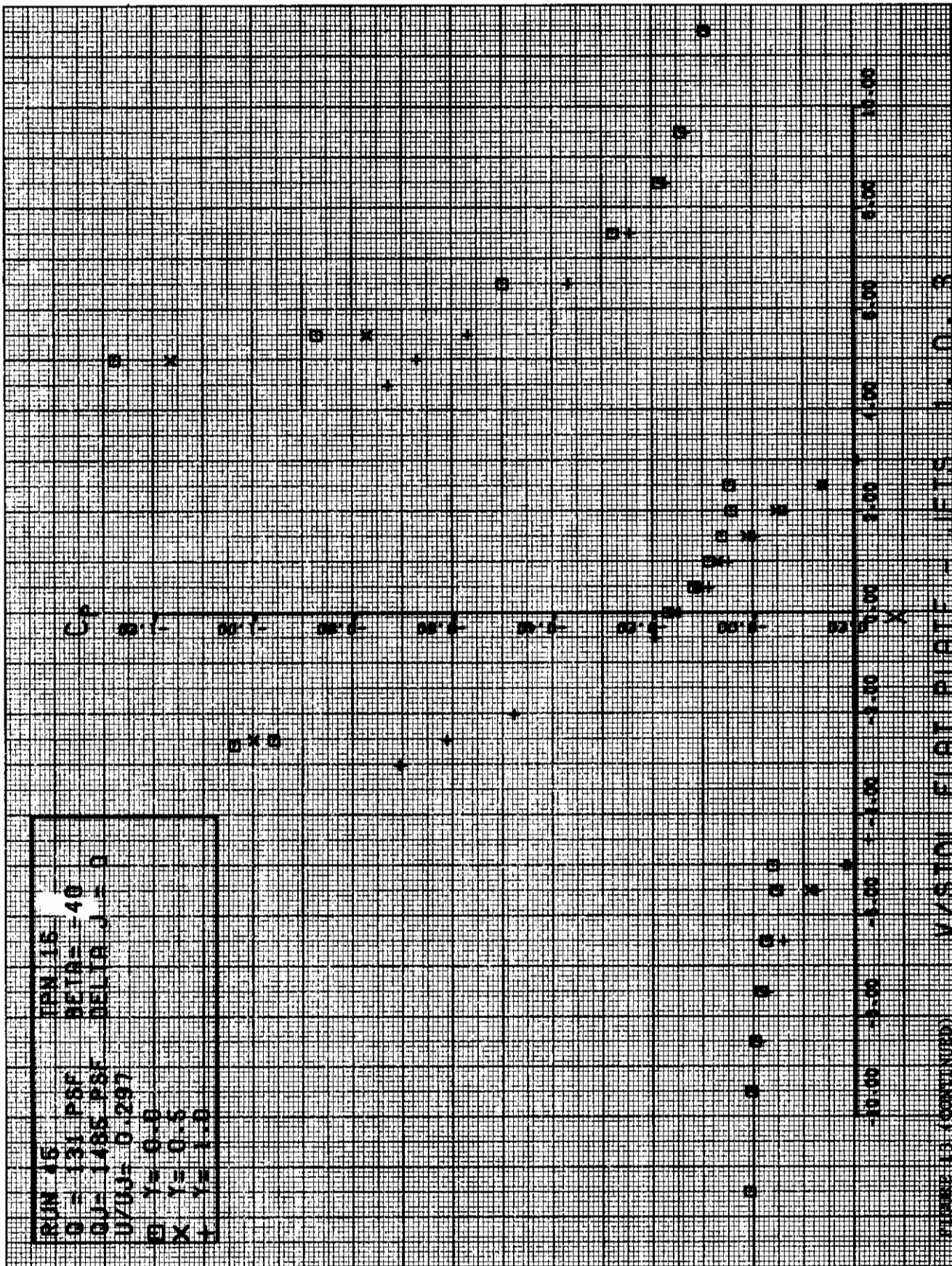


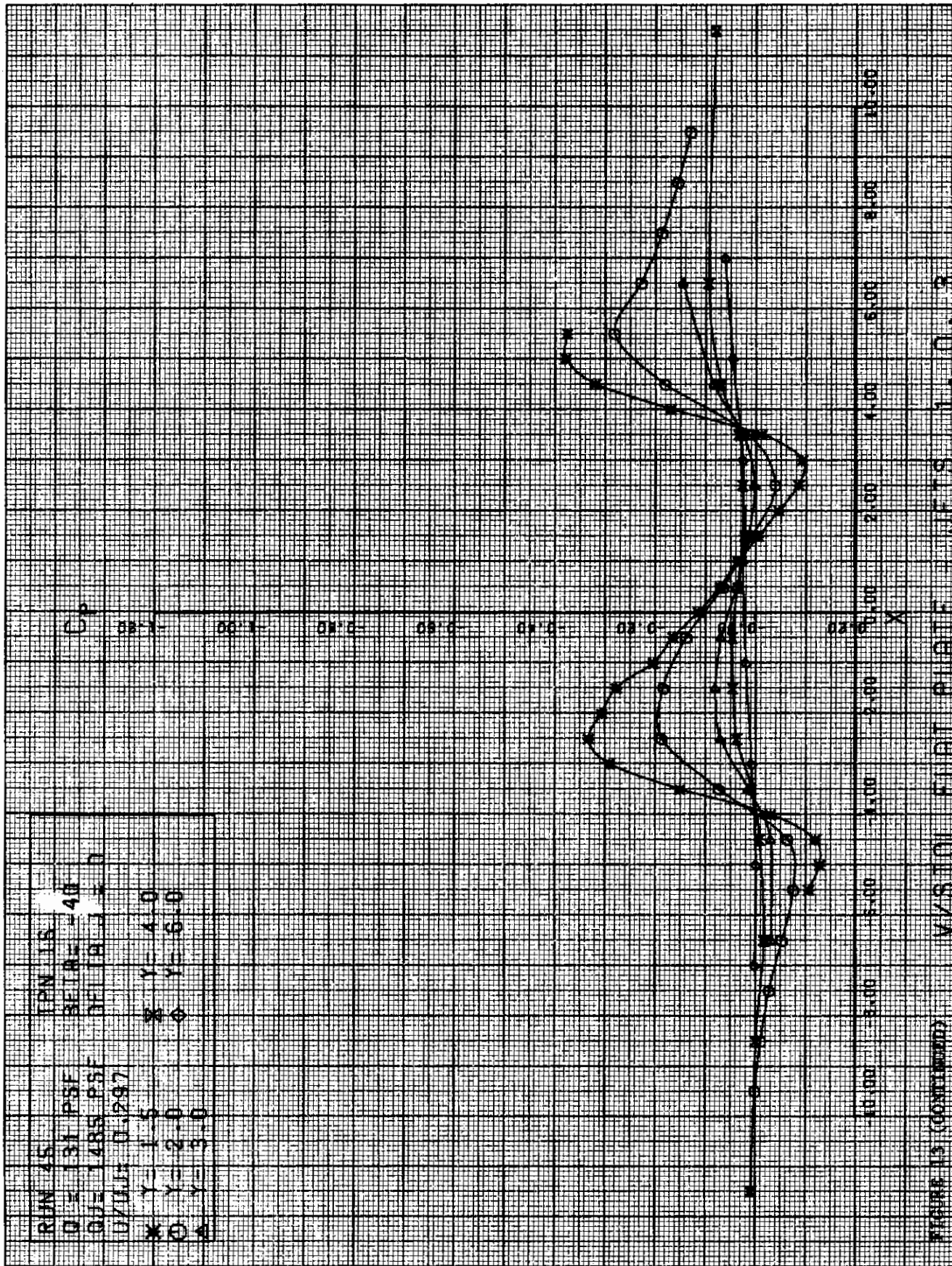












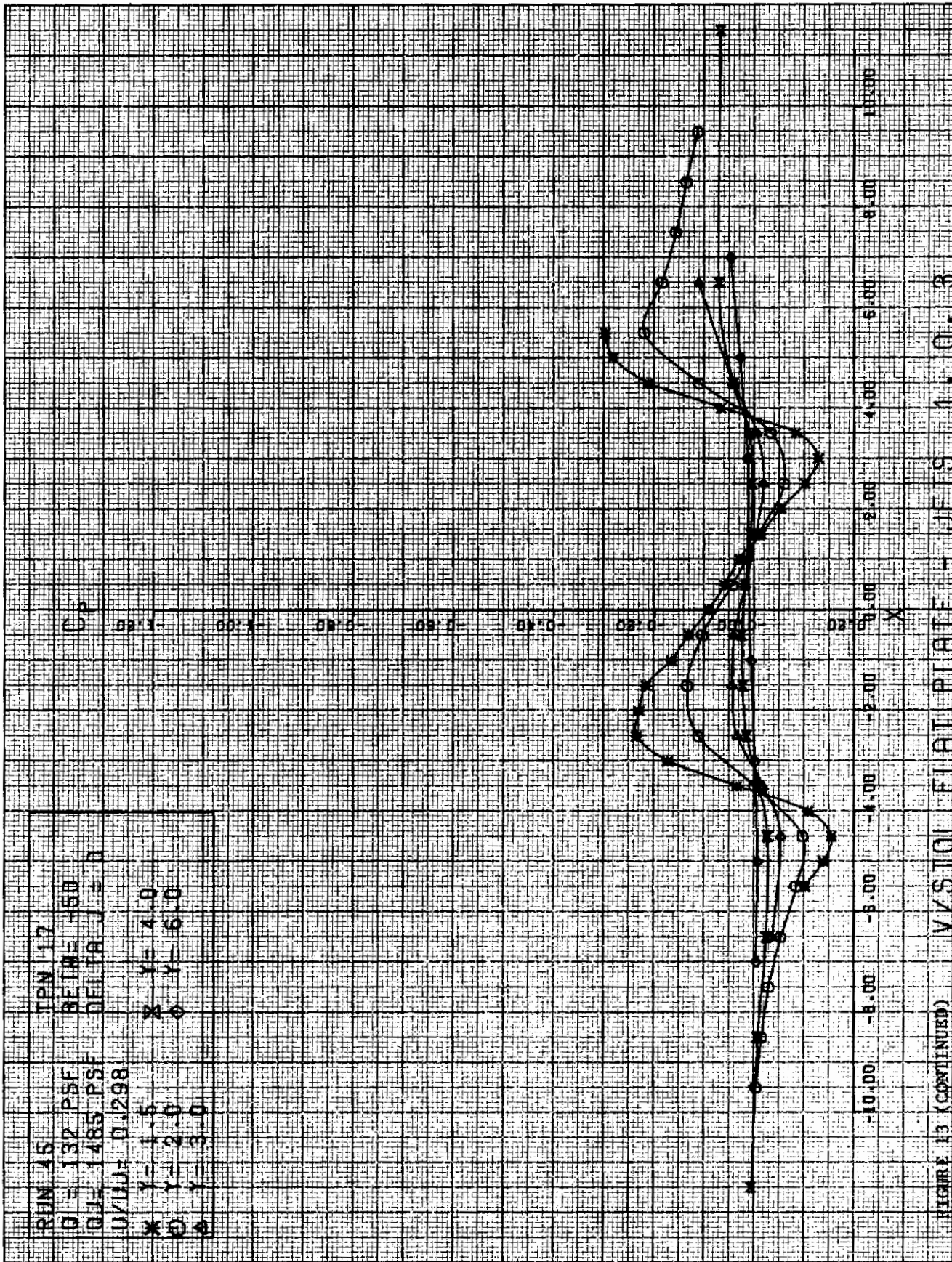
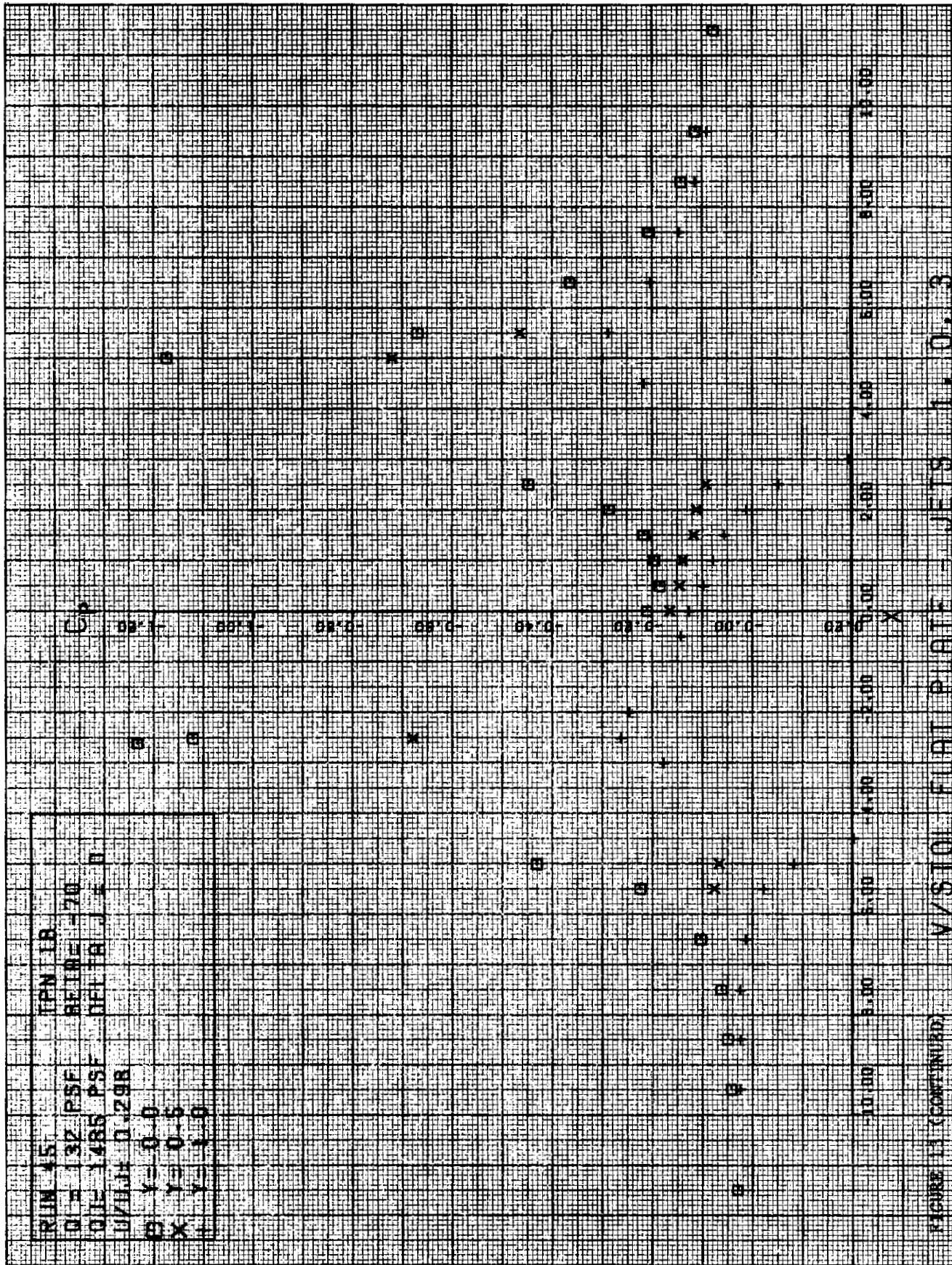


FIGURE 13 (CONTINUED) VISION FLAT PLATE - J519 - 1.0.3



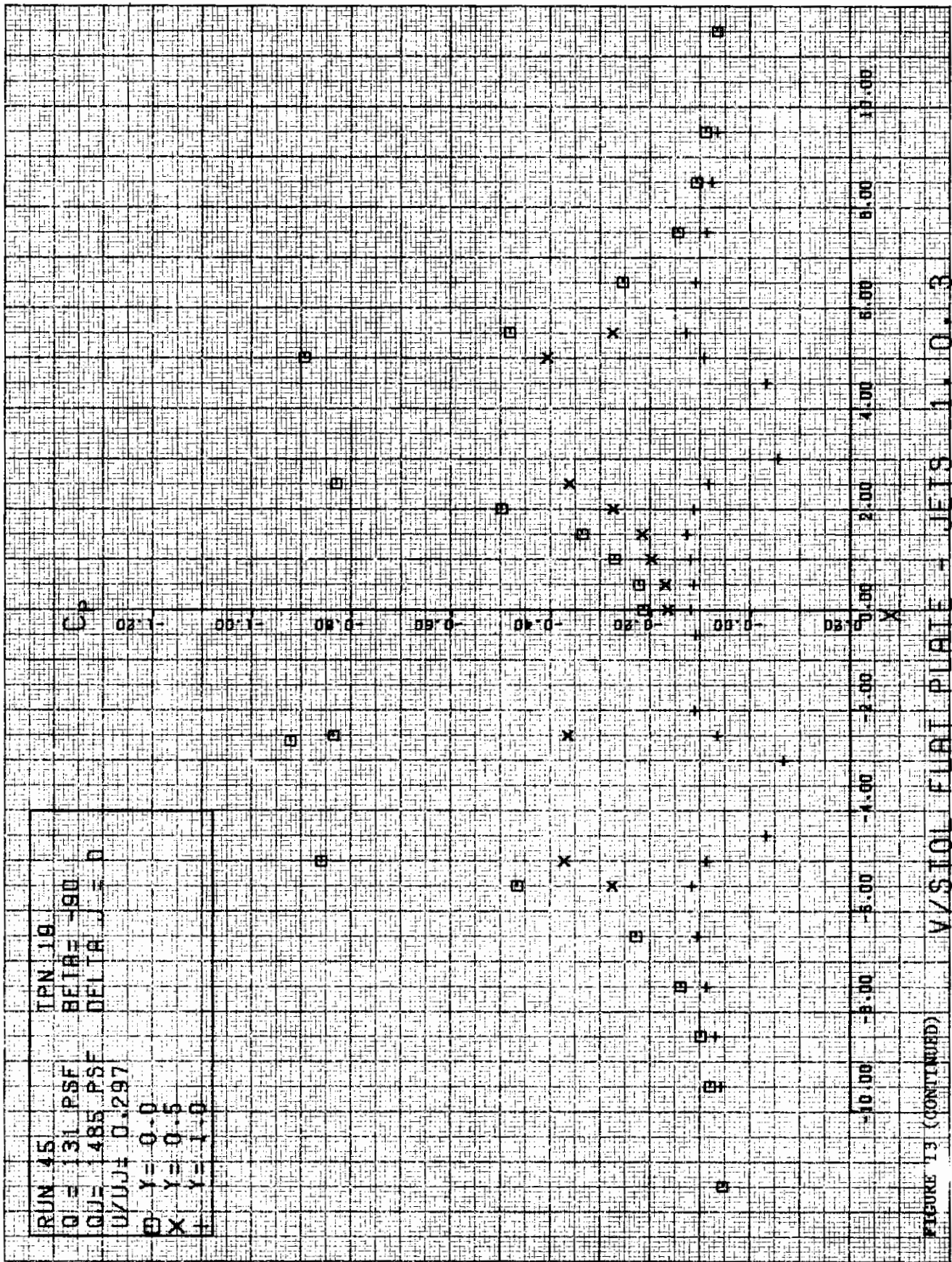


FIGURE 13 (CONTINUED)

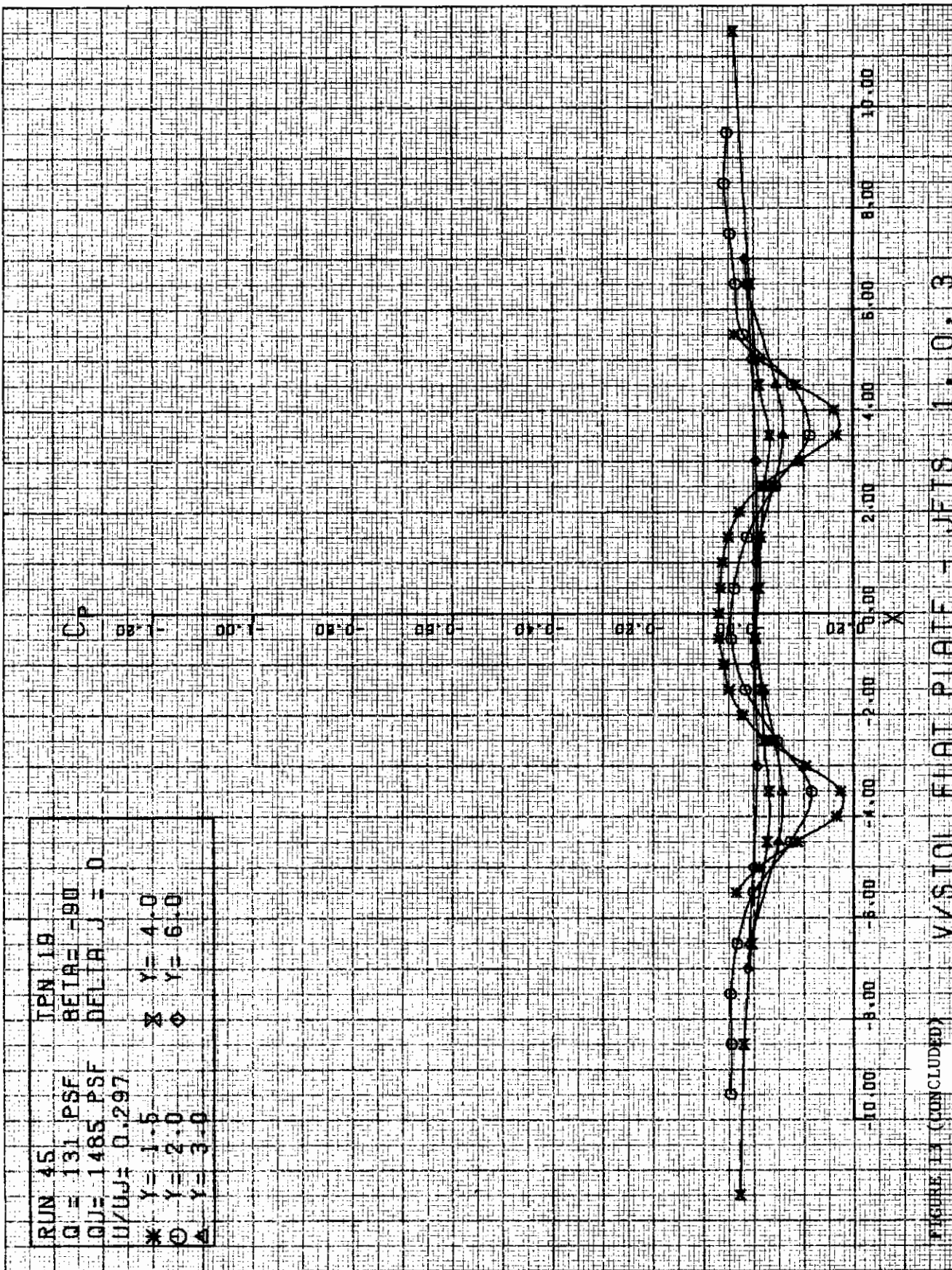


FIGURE 13 (CONCLUDED)

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13. ABSTRACT A low speed wind tunnel test of a four-foot diameter circular plate model with up to three exhausting jets was conducted to determine surface static pressure distributions, jet paths, and jet decay characteristics in the presence of a crossflow. Data were obtained for the one-jet configuration with the jet exiting at a number of angles to the plate and at various velocity ratios and sideslip angles. Two-jet arrangements were tested with the jets exiting normal to the plate for three different spacings between the two jets and at a number of velocity ratios and sideslip angles. Three-jet configuration data were obtained with the jets exiting normal to the plate for a number of velocity ratios and sideslip angles. As a result of this investigation, several conclusions are deduced pertaining to the interaction of multiple jets exhausting into a crossflow. This report consists of four volumes. The test model, instrumentation, test procedure, and reduction and accuracy of the test data are discussed in Volume I. A summary and discussion of the test results are also presented in Volume I. The present volume contains additional data pertaining to the two-jet configurations. Volumes II and IV contain additional data pertaining to the one- and three-jet configurations, respectively.			

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14. KEY WORDS	LINK A		LINK B		LINK C	
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Jet Interference Effects						
Jet Exhaust Flow Fields						

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