AD-A062 639 BOEING VERTOL CO PHILADELPHIA PA F/G 1/3
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFI--ETC(U)
SEP 78 P F SHERIDAN DAAJ02-77-C-0020
UNCLASSIFIED USARTL-TR-78-23G-V-7A NL

1 OF 3
ADA
062639

USARTL-TR-78-23G

INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION

VOLUME VII-A - Frequency Analyses of Wake Split-Film Data, Buildup to Baseline

Philip F. Sheridan

Boeing Vertol Company
P.O. Box 16858
Philadelphia, Pa. 19142

September 1978

Final Report for Period March 1977 - February 1978

Prepared for

APPLIED TECHNOLOGY LABORATORY
U. S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES (AVRADCOM)
Fort Eustis, Va. 23604

APPLIED TECHNOLOGY LABORATORY POSITION STATEMENT

In 1975 a wind tunnel test program was conducted in the Boeing-Vertol 20-foot V/STOL Wind Tunnel on a 1/5th-scale UTTAS model to investigate and find solutions for several aerodynamic problems encountered during the UTTAS flight-testing. Specifically, these tests focused upon (a) the structure of the hub/rotor wake in the vicinity of the empennage, (b) the formulation of the ground vortex and its relation to hub loads and fuselage loads during transition, and (c) the occurrence of vibratory air pressures from the blade passing over the fuselage. Only portions of the above-mentioned wind tunnel test data were reduced and analyzed in addressing the flight-test problems of the UTTAS aircraft.

Under Contract DAAJ02-77-C-0020, Boeing-Vertol completed analyses on the data to understand more completely the aerodynamic interactions that are involved and to formulate instructions for the guidance of designers in these respects. The results of these studies are applicable to all existing and future single-rotor/tail rotor helicopters. The data have been segregated according to aerodynamic interactions and associated phenomena/problem areas. From this body of knowledge, a generalized set of design guidelines meaningful to the single-rotor helicopter design concept formulation were developed and are included in these reports.

Mr. Robert P. Smith of the Aeronautical Technology Division, Aeromechanics Technical Area, served as project engineer for this effort.

E - AD62590
F - AD62117

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: USARTL-TR-78-23G-V-7A
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION, Volume VII-A Frequency Analyses of Wake Split-Film Data, [redacted] Buildup to Baseline.
E - AD62640

5. TYPE OF REPORT & PERIOD COVERED: FINAL REPORT, 15 Mar 1977 - 13 Feb 1978
6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): Philip F. Sheridan

8. CONTRACT OR GRANT NUMBER(s): DAAJ02-77-C-0020

9. PERFORMING ORGANIZATION NAME AND ADDRESS:
Boeing Vertol Company
P.O. Box 16858
Philadelphia, Pa. 19142

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 62209A 1L262209AH76 00 189 EK

11. CONTROLLING OFFICE NAME AND ADDRESS:
Applied Technology Laboratory, US Army Research and Technology Laboratories (AVRADCOM)
Fort Eustis, Virginia 23604

12. REPORT DATE: September 1978
13. NUMBER OF PAGES: 210

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): 212p.

15. SECURITY CLASS. (of this report): Unclassified
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

B = AD61861

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Volume VII of an eight-volume report
Volume VII is comprised of seven sub-volumes (A thru G)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Wake	Interaction	Empennage
Flow	Aerodynamic Interaction	Flow Modifier
Frequency	Flow Environment	Powered Model
Spectrum	Configuration	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is the first of seven sub-volumes of Volume VII containing spectrographs of the model helicopter hub/rotor wake as it was modified by various aerodynamic devices. This sub-volume deals with the wake changes as the model is built up to the baseline configuration.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

403 682

D – Open Hubcaps
E – Air Ejectors
F – Air Ejectors With Hubcaps; Wings
G – Fairings and Surface Devices

Volume VIII, Frequency Analyses of Wake Single Film Data
A – Buildup to Baseline
B – Basic Configuration Wake Exploration
C – Hubcaps and Air Ejectors

TABLE OF CONTENTS

INTRODUCTION

Volume VII presents an array of machine plotted graphs of wake angle and velocity versus frequency in the band from 4 to 240 Hz derived from the split film transducers. This encompasses data in the spectrum through 10 times rotor speed which is 1433 RPM or 23.88 Hz.

The graphs showing wake frequency spectra are sequenced in the same order as the Outline of Wake Investigations (Table I). These graphs are dustributed among Volumes VII-A through VII-G by the major categories of Table I in the following arrangement:

Volume	VII-A	- Build-up to Baseline
Volume	VII-B	- Basic Configuration
Volume	VII-C	- Effect of Hub Caps Sections 1 & 2
Volume	VII-D	- Effect of Hub Caps Sections 3 & 4
Volume	VII-E	- Effect of Hub Caps Section 5 and Effect of Air Ejectors
Volume	VII-F	- Air Ejectors with Open Hub Caps and Effect of Wings and Misc. Section 1
Volume	VII-G	- Effect of Wings and Misc. Sections 2 & 3

The Table I outline and other material is included for reference and as context to the work of each sub-volume. Table 2, the List of Test Runs, arranges the runs in numerical order and gives pertinent text parameters.

The Index of Rake Positions, Table 3, lists the hot film transducer rake positions in the model coordinate system for each run and its test points. The main feature of Table 3 is the indexing of the test point number to the model water line station and butt line as it varied from run to run. The table groups the runs as they shared the indexing correspondence of point with position. It is emphasized that the runs in a group do not necessarily all share the same number of test points but they do have same correspondence within their respective ranges of test points.

The orientation of the rake is shown pictorially in Figures 1 through 6 for the various test runs. Figure 7 presents a scaled drawing of the model with reference to the three-axis coordinate system.

TABLE 1

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code	Run No.	Base-line
Build-up to Baseline			
1. Nacelles removed	$K_{13}+H_1-N$	149	150
2. Blades off, rotating hub	$K_{13}-M+H_{1.0}$	160	156
3. " " , non-rotating hub	$K_{13}-M+H_{1.0}$	158	156
4. " " , hub off	$K_{13}-M-H_{1.0}$	159	156
Basic Configuration			
1. Wake Explorations near Empennage			
(a) 15" Long. + traverse at T/R C.L.	K_{11}	111	---
(b) 9" Vert. + " above T/R "	"	112	---
(c) 2" " " in vortex	"	113	---
(d) 8" " " (continue 112)	"	114	---
(e) 13" " " behind stab.	"	115	---
(f) Lateral traverse, left stab. (One T.P. only)	"	116	---
(g) Same continued	"	117	---
(h) Same continued (One T.P. only)	"	118	---
(i) Lateral traverse right stab.	"	119	---
(j) T/R effect on wake	$K_{11}+T_2^0$	121	115
2. Climb/Descent Studies			
(a) Climb 900 FPM	K_{11}	135	---
(b) Descent 800 FPM	"	136	---
Effect Of Hub Caps			
1. Solid Caps on Canister			
(a) 7.6" diam. 2.17" ht. soft Pitch Arms	$K_{11}-H_{1.0}+H_{1.2}$	137	136
(b) 7.6" diam. 2.17" ht. stiff Pitch Arms	$K_{13}+H_{1.2}$	153	156
(b) 7.6" diam. 2.45" ht. flt. test config.	$K_{13}+H_{1.2.1}+I_1+E_{1.0}$	207	188

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
Effect of Hub Caps (Continued)			
2. Solid Caps Raised Above Canister			
(a) 7.6" diam. 2.45" ht. 70" depth, .55 gap	$H_{1.2.2}+I_1+E_{1.0}$	208	188
(b) 10.0" diam. 3.25" ht. 1.55" depth, .50" gap	$H_{1.8.1}+I_1+E_{1.0}$	189	188
(c) 10.0" diam. 4.125" ht. 2.05" depth, .875" gap	$H_{1.8.2}+I_1+E_{1.0}$	190	188
(d) Repeat of 189	" " "	210	188
3. Open Caps Without Underbody			
(a) 10.0" diam. 1.25" gap,blades	$H_{1.0.2}+I_1+E_{1.0}$	193	188/166
(b) " " " gap, no blades	$H_{1.0.1}-M$	166	158
(c) " " 2.05" gap,blades	$H_{1.14.1}+I_1+E_{1.0}$	211	188
(d) " " 1.75" gap, no blades	$H_{1.0.1}-M$	165	158
(e) " " 1.87" gap,blades	$H_{1.0.3}+I_1+E_{1.0}$	191	188
(f) 16" diam. 2.00" gap,blades	$H_{1.7.1}$	168	156/167
(g) " " " gap, no blades	$H_{1.7.1}-M$	167	158
(h) " " 4.00" gap,blades	$H_{1.7.2}$	169	156
4. Open Caps with Underbody			
(a) 7.6" diam. 1.25" gap	$H_{1.11.1}+I_2+E_{1.0}$	194	188
(b) " " " "	$H_{1.11.1}+I_2+E_{4.0}$	198	188
(c) " " " " center post	$H_{1.11.2}+I_2$	202	194
(d) 10.0" diam. .5" gap, no blades	$H_{1.5.1}-M$	164	158
(e) " " 1.25" gap, no blades	$H_{1.5.2}-M$	161	158
(f) " " 2.0" gap, no blades	$H_{1.5.4}-M$	163	158
(g) " " 4.0" gap, no blades	$H_{1.5.3}-M$	162	158
(h) " " 1.25" gap	$H_{1.5.2}$	154	156/161

*Basic Code is K13.

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
5. Miscellaneous Hub Covers			
(a) Hub fairing 16" diam.	$H_{1.3}$	151	150
(b) Wham-O-Frisbee 10" diam.	$H_{1.9.0}+E_{1.2}$	182	181
(c) Fab. glass Frisbee 16" diam.	$H_{1.9.1}+E_{1.2}$	183	181
Effect of Air Ejectors			
1. Basic system no blowing	$H_{1.0}+E_{1.0}$	172	156
2. " " 40 psi	" "	173	156/172
3. " " 150 psi	" "	174	156/172
4. Wide chord shroud 40 psi	$H_{1.0}+E_{2.5.1}$	175	156/173
5. Wide " " 150 psi	" "	176	156/174
6. W/C shroud w. lip 40 psi	$H_{1.0}+E_{3.5.2}$	184	156/173
7. Same Contoured Parallel 150 psi	$H_{1.0}+E_{3.5.4}$	187	156/174
8. Bifurcated duct 0 psi	$H_{1.0}+E_{5.0}$	203	156
9. " " 40 psi	" "	204	156/203
10. " " 150 psi	" "	205	156/203
Air Ejectors with Open Hub Caps with Underbodies			
1. 7.6" diam. 1.25" gap, 0 psi	$H_{1.11.1}+I_2+E_{1.0}$	194	188/172
2. " " " " 20 psi	" " "	195	188
3. " " " " 40 psi	" " "	196	188/173
4. " " " " 150 psi	" " "	197	188/174
5. " " " " 0 psi	$H_{1.11.1}+I_2+E_{4.0}$	198	188/194
6. " " " " 40 psi	" " "	199	188/196
7. " " " " 150 psi	" " "	200	188/196
8. Same with center post	$H_{1.11.2}+I_2+E_{4.6}$	201	188/200
9. 10.0" diam. 2.0" gap wide ch'd. shroud (150 psi)	$H_{1.5.4}+E_{2.5.1}$	177	156/176
Effect of Wings and Misc.			
1. Wings			
(a) Nacelle-mounted stub wing	$H_{1.0}+W_{1.0}+E_{1.1}$	178	181
(b) Single slotted flapped wing	$H_{1.0}+W_{3.0}+E_{1.0}$	180	181
(c) Dougle slotted flapped wing	$H_{1.0}+W_{2.0}+E_{1.0}$	179	181
(d) Boom-mounted stub wing	$H_{1.0}+W_{4.0}$	186	156

*Basic Code is K13.

TABLE 1 (CONTINUED)

OUTLINE OF WAKE INVESTIGATIONS

Description	Configuration Code*	Run No.	Base-line
2. Crown Fairings			
(a) Flat top behind shaft	$K_{11}+D_1$	140	138
(b) Round top behind shaft	$K_{11}+D_2$	141	138
(c) Extended flat top fairing	H_1+D_4	170	156
(d) Flat top + 16" cap, 4" gap	$H_{1.7.2}+D_4$	171	170
(e) Forward fairing/nacelle fairing	$P_{1.0}$	152	156
3. Surface Devices			
(a) Vortex generators	$K_{11}+VG_{2.1}$	139	138
(b) Guidevane between nacelles	$K_{11}+FV_1$	142	138
(c) Longitudinal strakes	$H_{1.5.3}+S_4$	155	156
(d) 14% porosity spoiler	$K_{11}+X_1$	143	138

*Basic Code is K13 unless noted otherwise.

TABLE 2. **LIST OF TEST RUNS**
BASIC INVESTIGATIONS OF THE HUB WAKE

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
111	K_{11}/15" Long. wake traverse at TR center line	80	1433/0	8	6.0	-2.0	∞	Off
112	" /9" Vert. wake traverse above TR center line	"	"	"	"	"	"	"
113	" /2" Vert traverse through MR vortex	"	"	"	"	"	"	"
114	" /8" Vert. traverse below TR center line	"	"	"	"	"	"	"
115	" /13" Vert. traverse behind stabilizer	"	"	"	"	"	"	"
116	" /Lateral traverse - left stabilizer	"	"	"	"	"	"	"
117	" /116 continued	"	"	"	"	"	"	"
118	" /116 continued	"	"	"	"	"	"	"
119	" /Lateral traverse - right stabilizer	"	"	"	"	"	"	"
121	$K_{11}+T_2$/Effect of tail rotor flow on wake	"	1433/ 4500	"	"	"	"	On
135	K_{11}/Wake in 900 fpm climb	"	"	"	-6.0	-4.5	"	Off
136	" /Wake in 800 fpm descent	"	"	"	6.0	-2.0	"	"

TABLE 2(CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
137	K_{11}-$H_{1.0}$+$H_{1.2}$/Effect of 7.6 inch diam. solid hub cap	80	1433/0	8	6	-3.8	∞	Off
138	K_{11}/Repeat of base run	"	"	"	"	"	"	"
139	K_{11}+$VG_{2.1}$/Effect of vortex generators on aft crown	"	"	"	"	"	"	"
140	K_{11}+D_1/Flat-topped "doghouse" fairing on aft crown	"	"	"	"	"	"	"
141	K_{11}+D_2/Rounded-top fairing	"	"	"	"	"	"	"
142	K_{11}+FV_1/Deflection vane on crown between nacelles	"	"	"	"	"	"	"
143	K_{11}+X_1/Variable porosity spoiler	"	"	"	"	"	"	"
149	K_{13}+H_1-N_1/Effect of nacelles off also add stiff pitch arms (K_{13})	60	1075/0	4.5	"	"	"	"
150	K_{13}+H_1/60 knot baseline	"	"	"	"	"	"	"
151	K_{13}+$H_{1.3}$/16 inch diam. helmet fairing	"	"	"	"	"	"	"
152	K_{13}+$P_{1.0}$/Pylon and intake fairings	80	1433/0	8	"	"	"	"
153	K_{13}+$H_{1.2}$/Repeat 137 with K_{13} pitch arms	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					$\alpha°$	$\psi°$	h/d	
154	$K_{13}+H_{1.5.2}$/10" open hub cap, 7" underbody, 1.25"gap	80	1433/0	8	6	-3.8	∞	Off
155	$K_{13}+H_{1.5.2}+S_4$/Same as 154 except strakes on aft crown	"	"	"	"	"	"	"
156	$K_{13}+H_{1.0}$/Baseline with K_{13},i.e., stiff pitch arms	"	"	"	"	"	"	"
158	$K_{13}-M+H_{1.0}$/Wake studies with blades off, hub not rotating	"	0/0	"	"	"	"	"
159	$K_{13}-M-H_{1.0}$/Wake studies with hub off	"	"	"	"	"	"	"
160	$K_{13}-M+H_{1.0}$/Same as 158 except hub is rotating	"	1433/0	"	"	"	"	"
161	$K_{13}-M+H_{1.5.2}$/Repeat of 154 without blades	"	0/0	"	"	"	"	"
162	$K_{13}-M+H_{1.5.3}$/Same as 161 except 4" gap	"	"	"	"	"	"	"
163	$K_{13}-M+H_{1.5.4}$/Same as 161 except 2" gap	"	"	"	"	"	"	"
164	$K_{13}-M+H_{1.5.1}$/Same as 161 except 0.5" gap	"	"	"	"	"	"	"
165	$K_{13}-M+H_{1.0.1}$/ 10" open hub cap,no underbody,same cap vert.position as Run 154	"	"	"	"	"	"	"
166	$K_{13}-M+H_{1.0.2}$/Same as 165 with cap lowered by 0.5"	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
167	K_{13}-M+$H_{1.7.1}$/16" open cap, no underbody, 2" gap	80	0/0	8	6	-3.8	∞	Off
168	K_{13}+$H_{1.7.1}$/Blades on, same cap config. as 167	"	1433/0	"	"	"	"	"
169	K_{13}+$H_{1.7.2}$/16" open cap, no underbody, 4" gap	"	"	"	"	"	"	"
170	K_{13}+$H_{1.0}$+$D_{4.0}$/Extended flat top fairing on aft crown	"	"	"	"	"	"	"
171	K_{13}+$H_{1.7.2}$+$D_{4.0}$/Same fairing as 170, same cap as 169	"	"	"	"	"	"	"
172	K_{13}+$H_{1.0}$+$E_{1.0}$(0psi)/Basic air ejector zero blowing baseline	"	"	"	"	"	"	"
173	K_{13}+$H_{1.0}$+$E_{1.0}$(40 psi)/Same as 172 with 40 psi supply	"	"	"	"	"	"	"
174	K_{13}+$H_{1.0}$+$E_{1.0}$(150 psi)/Same as 172 with 150 psi supply	"	"	"	"	"	"	"
175	K_{13}+$H_{1.0}$+$E_{2.5.1}$(40 psi)/Ejector with wide chord shroud at 40 psi	"	"	"	"	"	"	"
176	K_{13}+$H_{1.0}$+$E_{2.5.1}$(150 psi)/Same as 174 with 150 psi supply	"	"	"	"	"	"	"
177	K_{13}+$H_{1.5.4}$+$E_{2.5.1}$(150 psi)/Same as 176 with 10" cap like 163	"	"	"	"	"	"	"
178	K_{13}+$H_{1.0}$+$W_{1.0}$+$E_{1.1}$(0 psi)/Nacelle mounted wing	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
179	$K_{13}+H_{1.0}+W_{2.0}+E_{1.0}$ (0 psi)/Double slotted flapped wing	80	1433/0	8	6	-3.8	∞	Off
180	$K_{13}+H_{1.0}+W_{3.0}+E_{1.0}$ (0 psi)/Single slotted flapped wing	"	"	"	"	"	"	"
181	$K_{13}+H_{1.0}+E_{1.2}$ (0 psi)/Baseline with ejector tube moved aft	"	"	"	"	"	"	"
182	$K_{13}+H_{1.9.0}+E_{1.2}$ (0 psi)/Standard 10" frisbee	"	"	"	"	"	"	"
183	$K_{13}+H_{1.9.1}+E_{1.2}$ (0 psi)/16" fabricated frisbee	"	"	"	"	"	"	"
184	$K_{13}+H_{1.0}+E_{3.5.2}$ (40 psi)/Wide chord with lip at 40 psi	"	"	"	"	"	"	"
185	$K_{13}+H_{1.0}+E_{3.5.2}$ (150 psi)/Same as 184 with 150 psi air	"	"	"	"	"	"	"
186	$K_{13}+H_{1.0}+W_{4.0}$/Boom mounted stub wing	"	"	"	"	"	"	"
187	$K_{13}+H_{1.0}+E_{3.5.4}$ (150 psi)/Like 185 with modified shroud	"	"	"	"	"	"	"
188	$K_{13}+H_{1.0}+I_1+E_{1.0}$ (0 psi)/Baseline with I_1 instr. ring	"	"	"	"	"	"	"
189	$K_{13}+H_{1.8.1}+I_1+E_{1.0}$ (0 psi)/Solid cap, 10" diam. 3.25" height	"	"	"	"	"	"	"
190	$K_{13}+H_{1.8.2}+I_1+E_{1.0}$ (0 psi)/Same as 190 except + 4.12" height	"	"	"	"	"	"	"

TABLE 2 (CONTINUED) **LIST OF TEST RUNS**

EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
191	$K_{13}+H_{1.0.2}+I_1+E_{1.0}$ (0 psi)/10" cap, no underbody, 1.87" gap	80	1433/0	8	6	-3.8	∞	Off
193	$K_{13}+H_{1.0.2}+I_1+E_{1.0}$ (0 psi)/10" cap, no underbody, 1.25" gap	"	"	"	"	"	"	"
194	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(0 psi)/7.6" cap, underbody, 1.25" gap	"	"	"	"	"	"	"
195	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(20 psi)/Same as 194 with 20 psi air	"	"	"	"	"	"	"
196	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(40 psi)/Same as 194 with 40 psi air	"	"	"	"	"	"	"
197	$K_{13}+H_{1.11.1}+I_2+E_{1.0}$(150 psi)/Same as 194 with 150 psi air	"	"	"	"	"	"	"
198	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (0 psi)/Same as 194 except blowing tube 2" aft	"	"	"	"	"	"	"
199	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (40 psi)/Same as 198 with 40 psi air	"	"	"	"	"	"	"
200	$K_{13}+H_{1.11.1}+I_2+E_{4.0}$ (150 psi)/Same as 198 with 150 psi air	"	"	"	"	"	"	"
201	$K_{13}+H_{1.11.2}+I_2+E_{4.0}$ (150 psi)/Same as 200 except center support cap	"	"	"	"	"	"	"
202	$K_{13}+H_{1.11.2}+I_2$/Baseline with I_2 and no blowing tube	"	"	"	"	"	"	"
203	$K_{13}+H_{1.0}+E_{5.0}$(0 psi)/Bifurcated air duct baseline	"	"	"	"	"	"	"

TABLE 2(CONTINUED) **LIST OF TEST RUNS**
EVALUATION OF WAKE-ALTERING DEVICES

RUN NO.	CONFIGURATION/CONDITION	V_{TUN} KNOTS	RPM MR/TR	DISK LDG. psf	MODEL ANGLES		MR HT.	TAIL ROTOR
					α°	ψ°	h/d	
204	$K_{13}+H_{1.0}+E_{5.0}$ (150 psi)/Bifurcated duct with 150 psi air	80	1433/0	8	6	-3.8	∞	Off
205	$K_{13}+H_{1.0}+E_{5.0}$ (40 psi)/Same as 204 with 40 psi air	"	"	"	"	"	"	"
207	$K_{13}+H_{1.2.1}+I_1+E_{1.0}$ (0 psi)/7.6" solid cap, no gap	"	"	"	"	"	"	"
208	$K_{13}+H_{1.2.2}+I_1+E_{1.0}$ (0 psi)/Same as 207 except 0.55" gap	"	"	"	"	"	"	"
210	$K_{13}+H_{1.15.1}+I_1+E_{1.0}$ (0 psi)/Repeat of 189	"	"	"	"	"	"	"
211	$K_{13}+H_{1.14.1}+I_1+E_{1.0}$ (0 psi)/Like 189 and 210 except cap is open	"	"	"	"	"	"	"

TABLE 3

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
111	20	53.5	103.1	-7.25	1
	21	"	"	"	
	22	"	105.0	"	
	24	"	107.0	"	
	26	"	109.0	"	
	28	"	111.0	"	
	30	"	112.9	"	
	32	"	114.9	"	
	34	"	116.9	"	
	36	"	118.9	"	
112	2	48.9	107.3	-7.25	1
	4	50.8	"	"	
	6	52.7	103.3	"	
	8	54.5	"	"	
	10	56.2	"	"	
	12	57.2	"	"	
113	2	51.7	103.3	-3.25	1
	4	52.3	"	"	
	6	52.8	"	"	
	8	53.3	"	"	
	10	53.9	"	"	
	11	53.3	"	"	
114	2	44.5	103.0	-3.25	1
	4	46.4	"	"	
	6	48.2	"	"	
	8	50.0	"	"	
	10	51.9	"	"	
115	3	52.9	124.7	-3.25	1
	4	52.0	"	"	
	6	50.0	"	"	
	9	48.0	"	"	
	10	46.0	"	"	
	12	44.1	"	"	
	14	42.1	"	"	
	16	53.0	"	"	
	18	54.0	"	"	
	20	55.0	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
116	7	36.9	100.5	-17.5	1
117	2	37.6	100.5	-16.0	1
	4	"	"	-14.0	
	6	37.3	99.6	-12.0	
	8	"	"	-10.0	
	10	"	"	- 8.0	
118	2	37.6	100.5	- 6.0	1
119	2	37.3	99.6	+ 6.0	1
	5	"	"	8	
	8	"	"	10	
	9	"	"	"	
	14	"	"	14	
	16	"	"	16	
	20	51.5	102.5	17.5	
	25	52.3	101.7	-17.5	
121	3	62.9	129.0	+ 5.7	2
	4	53.5	"	"	
	6	50.1	"	"	
	8	46.0	"	"	
	10	42.1	"	"	
135	2	56.9	106.3	- 5.7	3
	4	54.5	"	"	
	6	52.5	"	"	
	8	50.5	"	"	
	10	48.5	"	"	
	12	46.5	"	"	
	14	44.5	"	"	
136	2	56.5	104.0	- 8.0	4
	4	54.5	"	"	
	6	52.5	"	"	
	8	50.6	"	"	
	10	48.5	"	"	
	12	46.5	"	"	
	14	44.5	"	"	
	17	37.1	"	"	
	18	39.0	"	"	
	19	41.0	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
137	3	38.7	98.4	- 8.0	5
	5	39.9	"	"	
	7	42.0	100.5	"	
	9	44.0	"	"	
	11	46.0	103.6	"	
	13	48.0	"	"	
	15	50.0	"	"	
	17	52.0	"	"	
	19	54.0	"	"	
138-41, 143	2	38.8	98.4	- 8.0	5
	3	40.0	"	"	
	4	42.0	100.5	"	
	5	44.0	"	"	
	6	46.0	103.6	"	
	7	48.0	"	"	
	8	50.0	"	"	
	9	52.0	"	"	
	10	54.0	"	"	
142	7	37.8	98.4	- 8.0	5
	8	"	"	"	
	9	40.2	"	"	
	10	42.0	100.5	"	
	11	44.0	"	"	
	12	46.0	103.6	"	
	13	48.0	"	"	
	14	50.0	"	"	
	15	52.0	"	"	
	16	54.0	"	"	
	17	56.8	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
149-151	2	38.8	98.5	- 8.0	5
	3	40.0	"	"	
	4	42.0	100.6	"	
	5	44.0	"	"	
	6	46.0	103.5	"	
	7	48.0	"	"	
	8	50.0	"	"	
	9	52.0	"	"	
	10	54.0	"	"	
152-6, 158 161-4, 166 167, 169-71 175, 177-9 180,182,184 186-8, 190 191,193,194 196,198,201 204,207,208 211	2 3 4 5 6 7 8 9	42.9 44.9 46.9 48.9 50.9 52.9 54.9 56.9	97.9 " 100.6 " 104.6 " " "	0.0 " " " " " " "	6
159	1	54.9	104.6	0.0	6
	2	52.9	"	"	
	3	50.7	"	"	
	4	48.6	100.6	"	
	5	46.7	"	"	
160,203	5	42.9	97.9	0.0	6
	6	44.9	"	"	
	7	46.9	100.6	"	
	8	48.9	"	"	
	9	50.9	104.6	"	
	10	52.9	"	"	
	11	54.9	"	"	
165	3	44.9	97.9	0.0	6
	4	42.9	"	"	
	5	46.9	100.6	"	
	6	48.9	"	"	
	7	50.9	104.6	"	
	8	52.9	"	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
168, 183	4	42.9	97.9	0.0	6
	5	44.9	"	"	
	6	46.9	100.6	"	
	7	48.9	"	"	
	8	50.9	104.6	"	
	9	52.9	"	"	
	10	54.9	"	"	
172	3	42.9	97.9	0.0	6
	4	44.9	"	"	
	6	44.9	"	"	
	7	46.9	100.6	"	
	8	48.9	"	"	
	9	50.9	104.6	"	
	10	52.9	"	"	
	11	54.9	"	"	
173,174,176	1	42.9	97.9	0.0	6
185,195,197	2	44.9	"	"	
199,200,205	3	46.9	100.6	"	
210	4	48.9	"	"	
	5	50.9	104.6	"	
	6	52.9	"	"	
	7	54.9	"	"	
181	2	42.9	97.9	0.0	6
	3	44.9	"	"	
	4	46.9	100.6	"	
	5	48.9	"	"	
	6	50.9	104.6	"	
	7	52.9	"	"	
	9	54.9	"	"	
	10	"	"	"	
	11	"	"	"	
	12	"	"	"	
	13	42.9	97.9	"	

TABLE 3 (CONTINUED)

INDEX TO RAKE POSITIONS

RUN NUMBER	TEST POINT	WATER LINE	MODEL STATION	BUTT LINE	LOCATION FIGURE
189	29	42.9	97.9	0.0	6
	30	44.9	"	"	
	31	46.9	100.6	"	
	32	48.9	"	"	
	33	"	"	"	
	34	50.9	104.6	"	
	35	"	"	"	
	36	48.9	100.6	"	
	37	50.9	104.6	"	
	38	52.9	"	"	
	39	54.9	"	"	
202	3	43.4	97.9	0.0	6
	4	44.9	"	"	
	5	46.9	100.6	"	
	6	48.9	"	"	
	7	50.9	104.6	"	

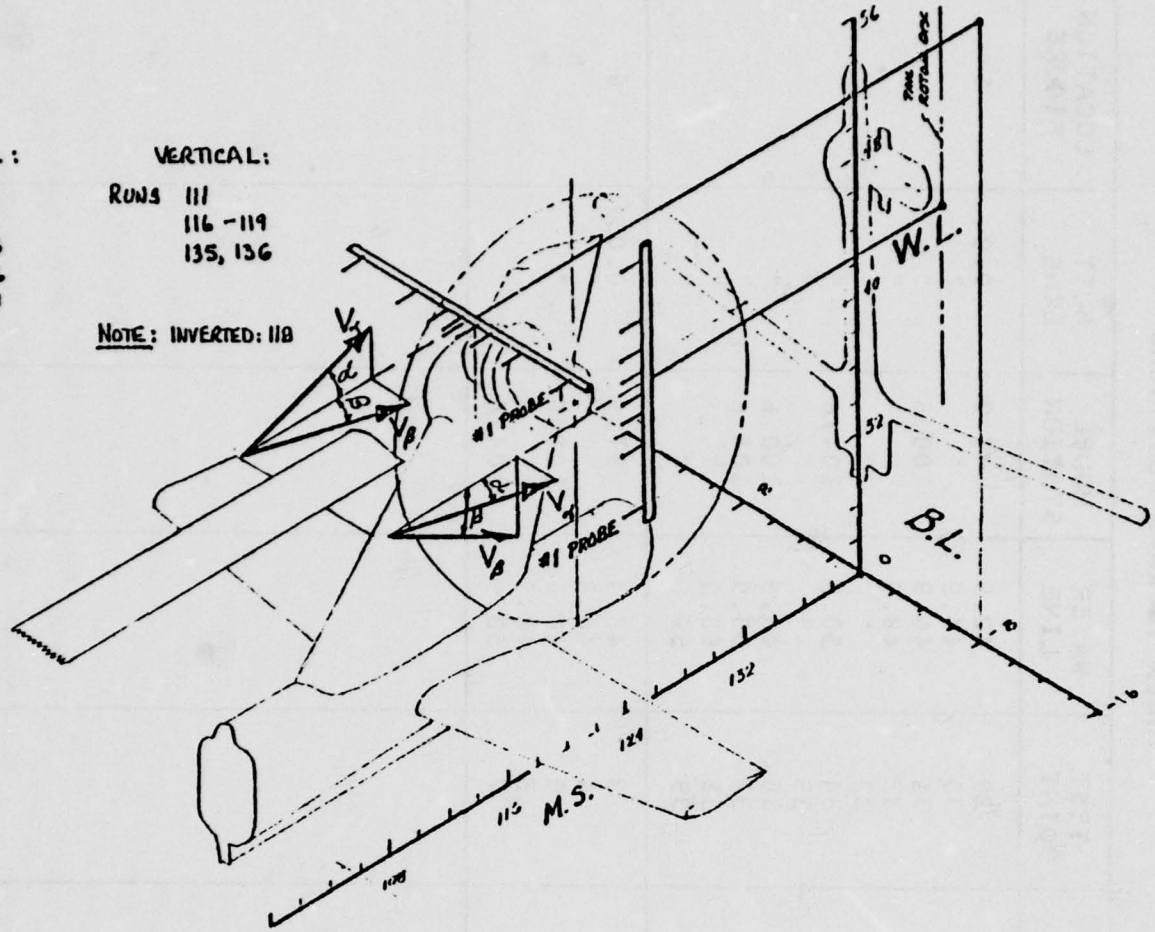


FIGURE 1 - RAKE ORIENTATION DIAGRAM

RUN 121

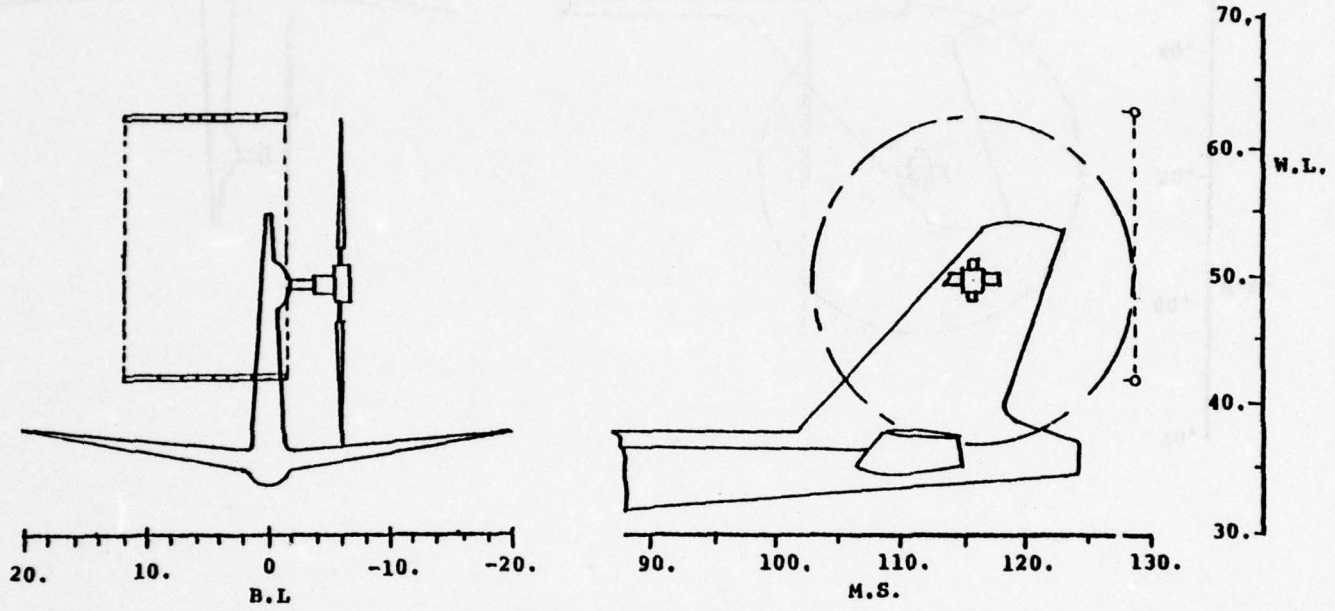


FIGURE 2 -HOT FILM RAKE LOCATIONS

RUN 135

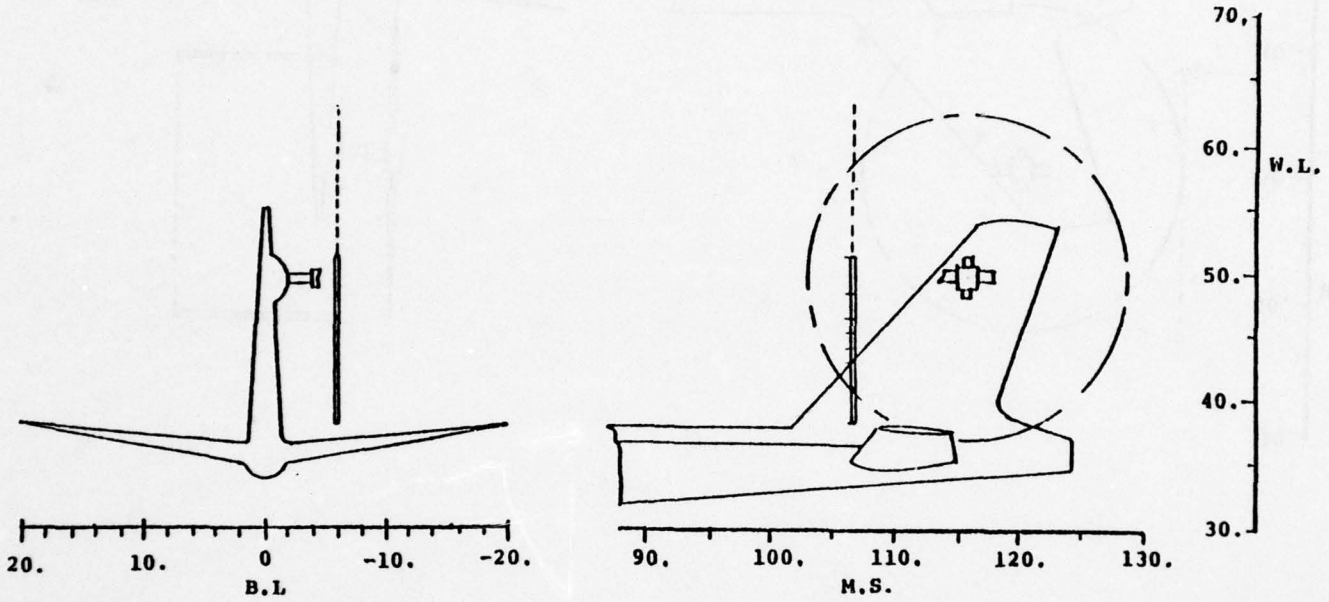


FIGURE 3 -HOT FILM RAKE LOCATIONS

RUN 136

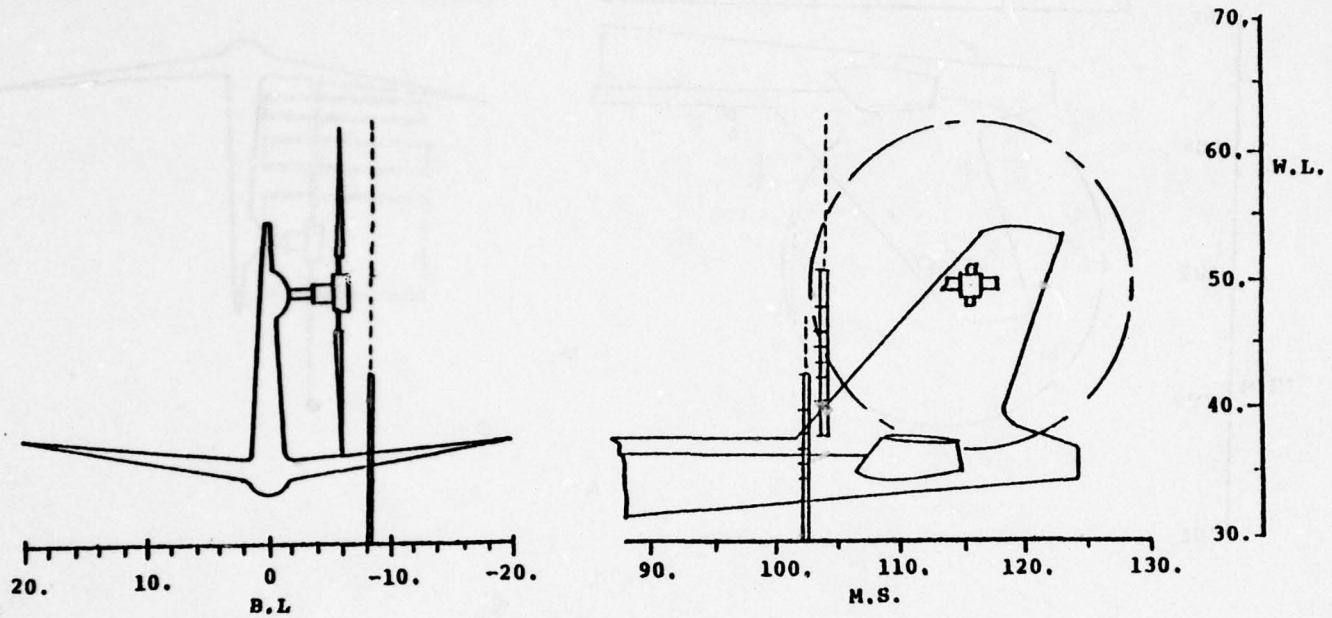


FIGURE 4 -HOT FILM RAKE LOCATIONS

RUN 137, 138, 139, 140, 141, 142,
143, 148, 149, 150, 151

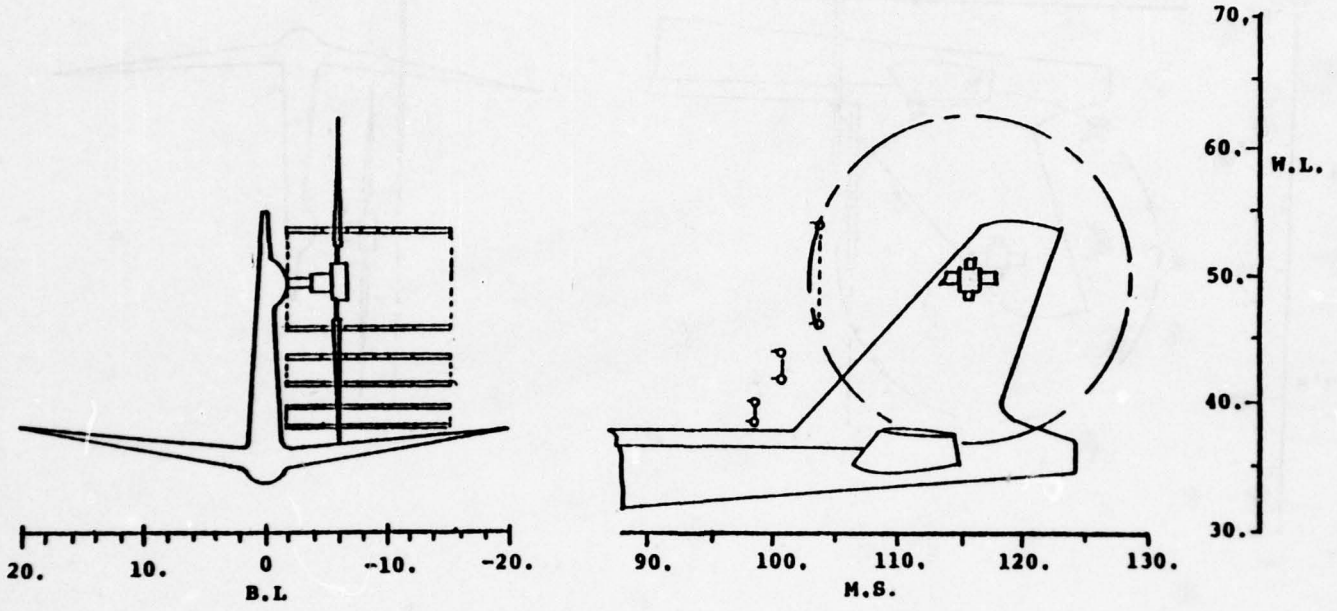


FIGURE 5 -HOT FILM RAKE LOCATIONS

RUN 152-156, 158-211

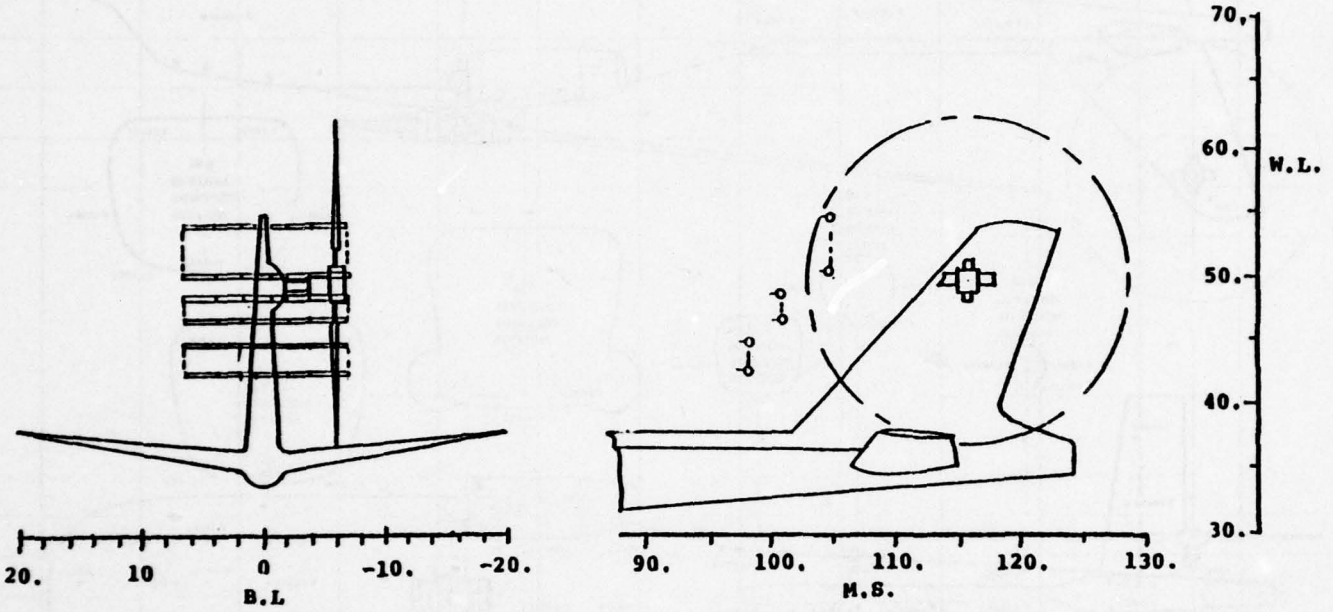


FIGURE 6 -HOT FILM RAKE LOCATIONS

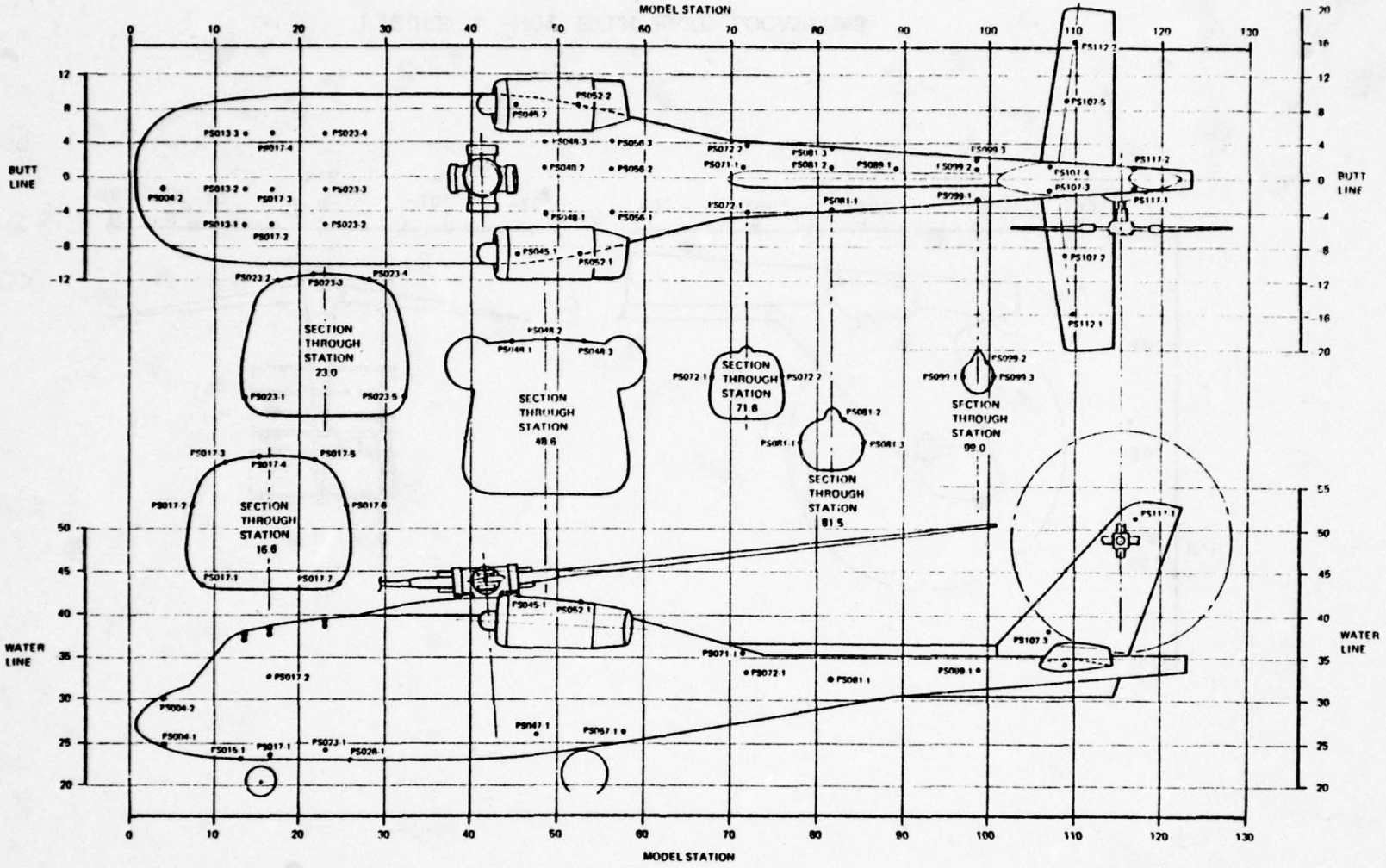
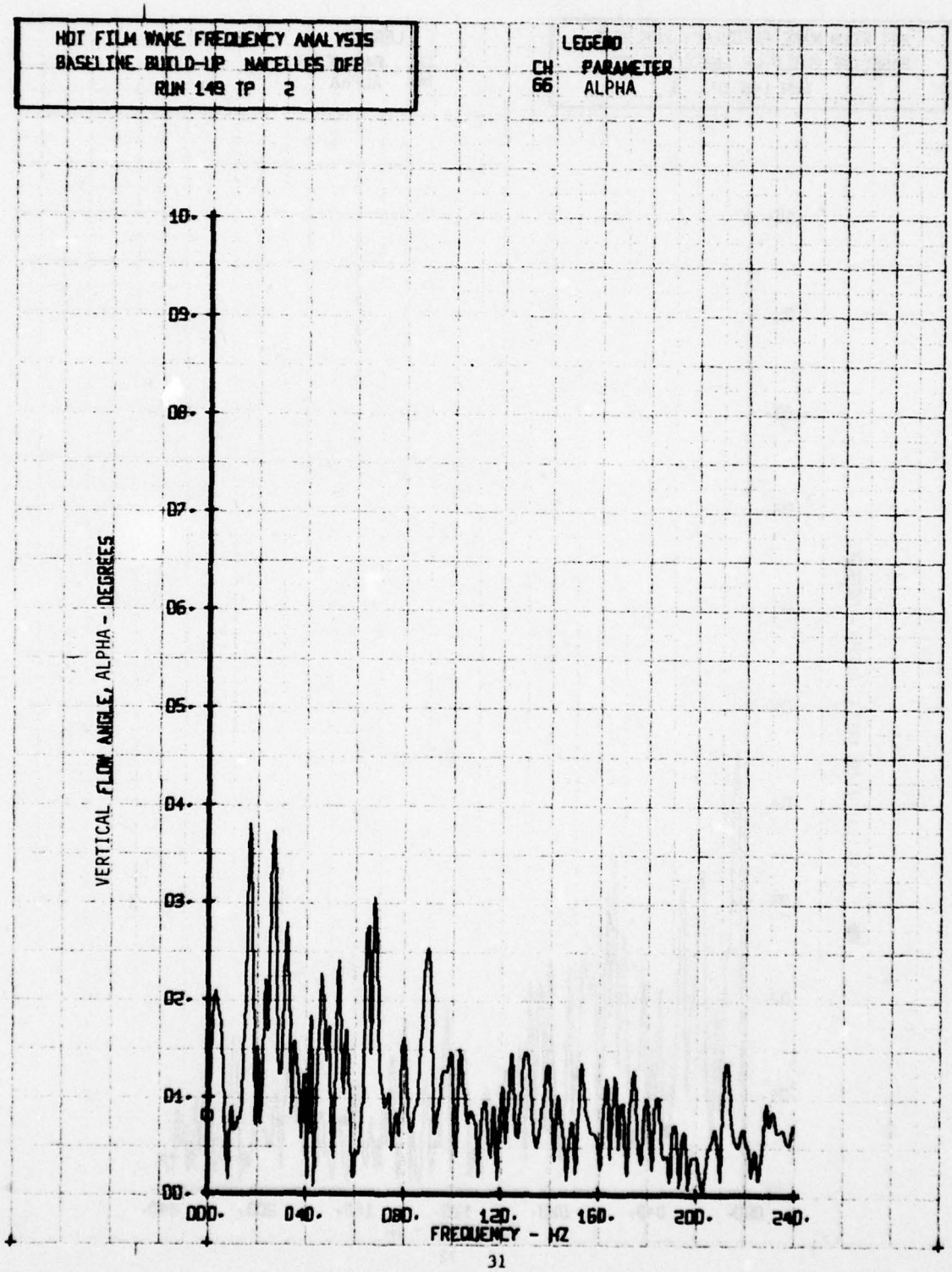
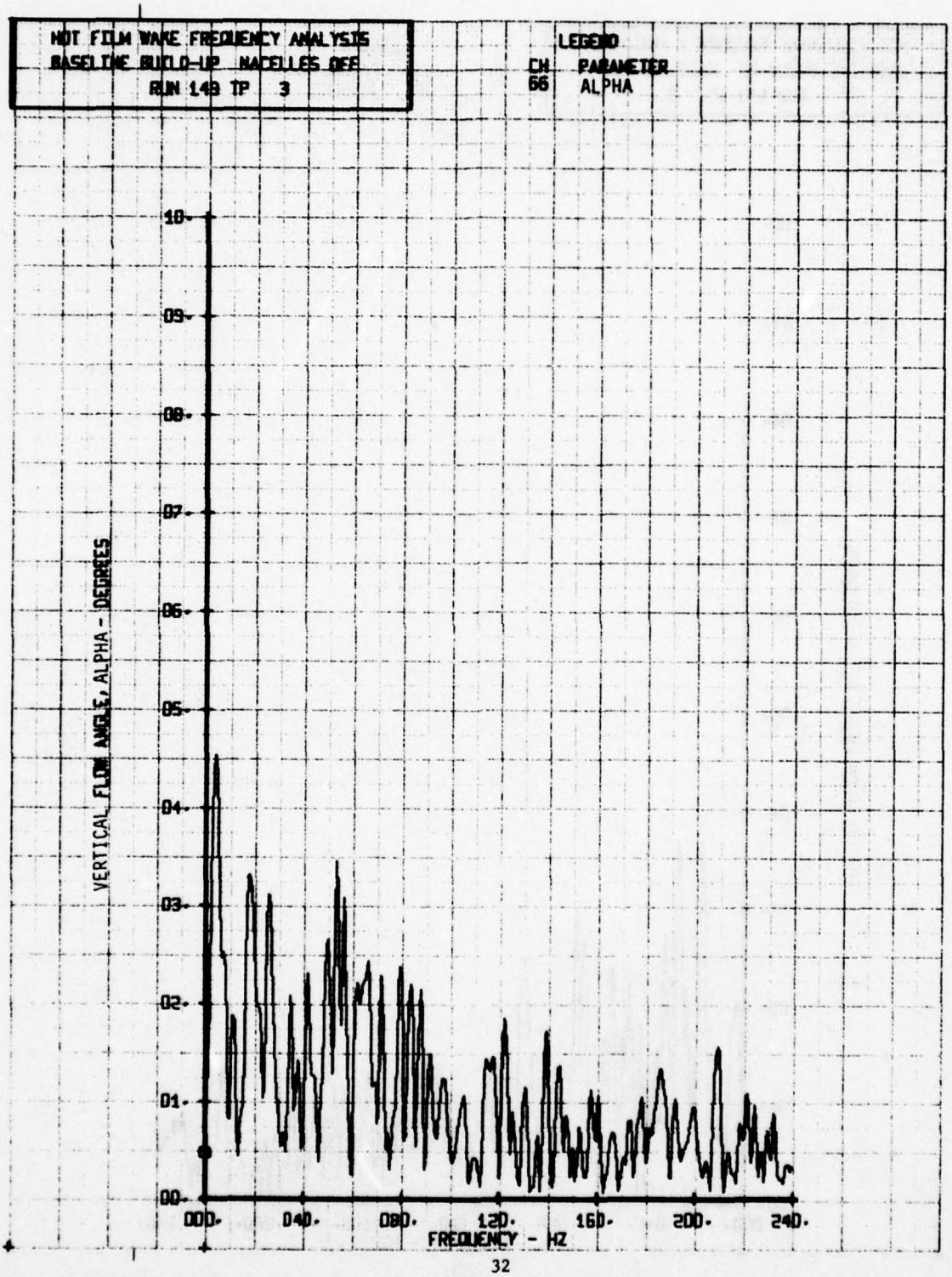
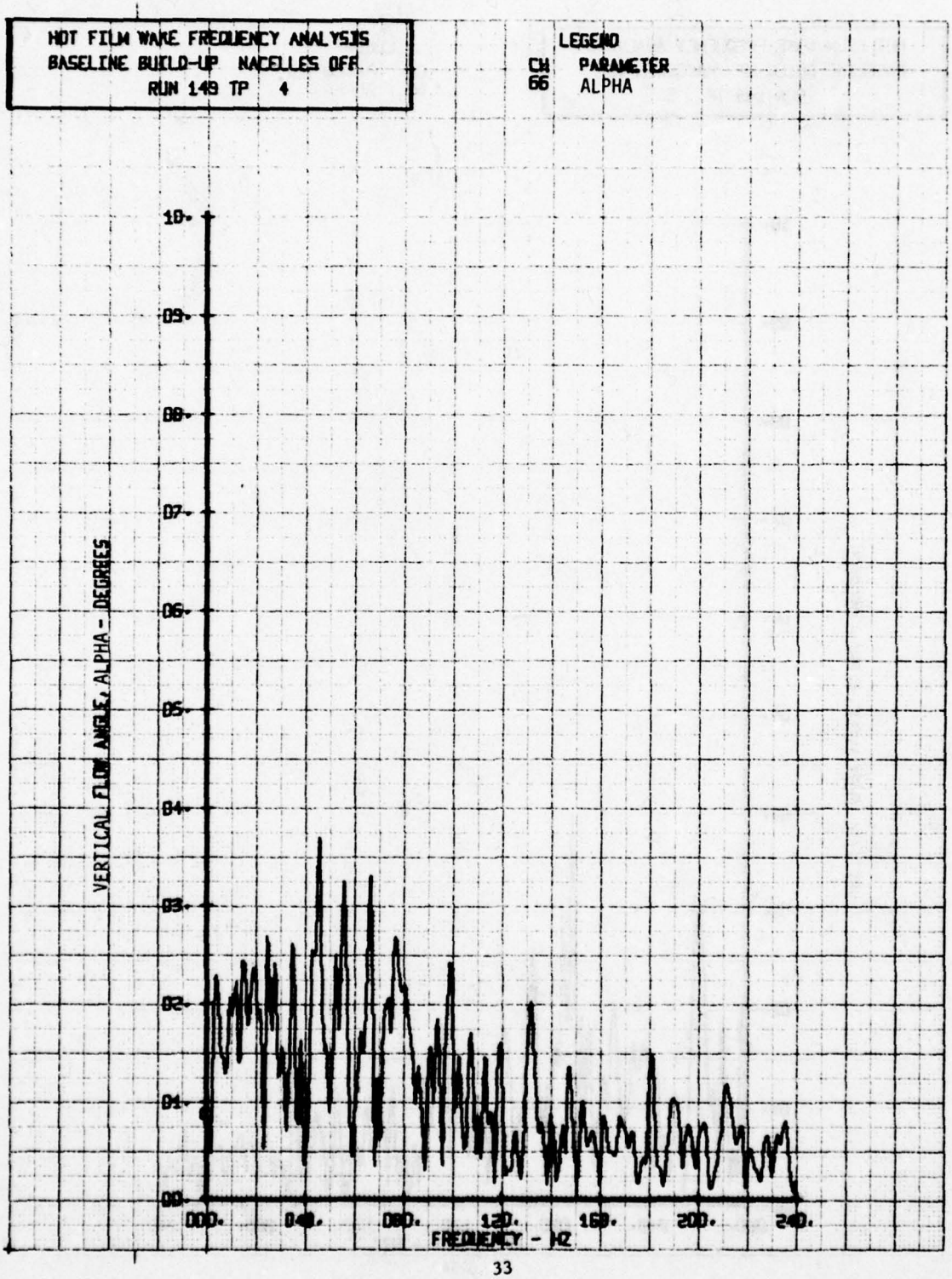
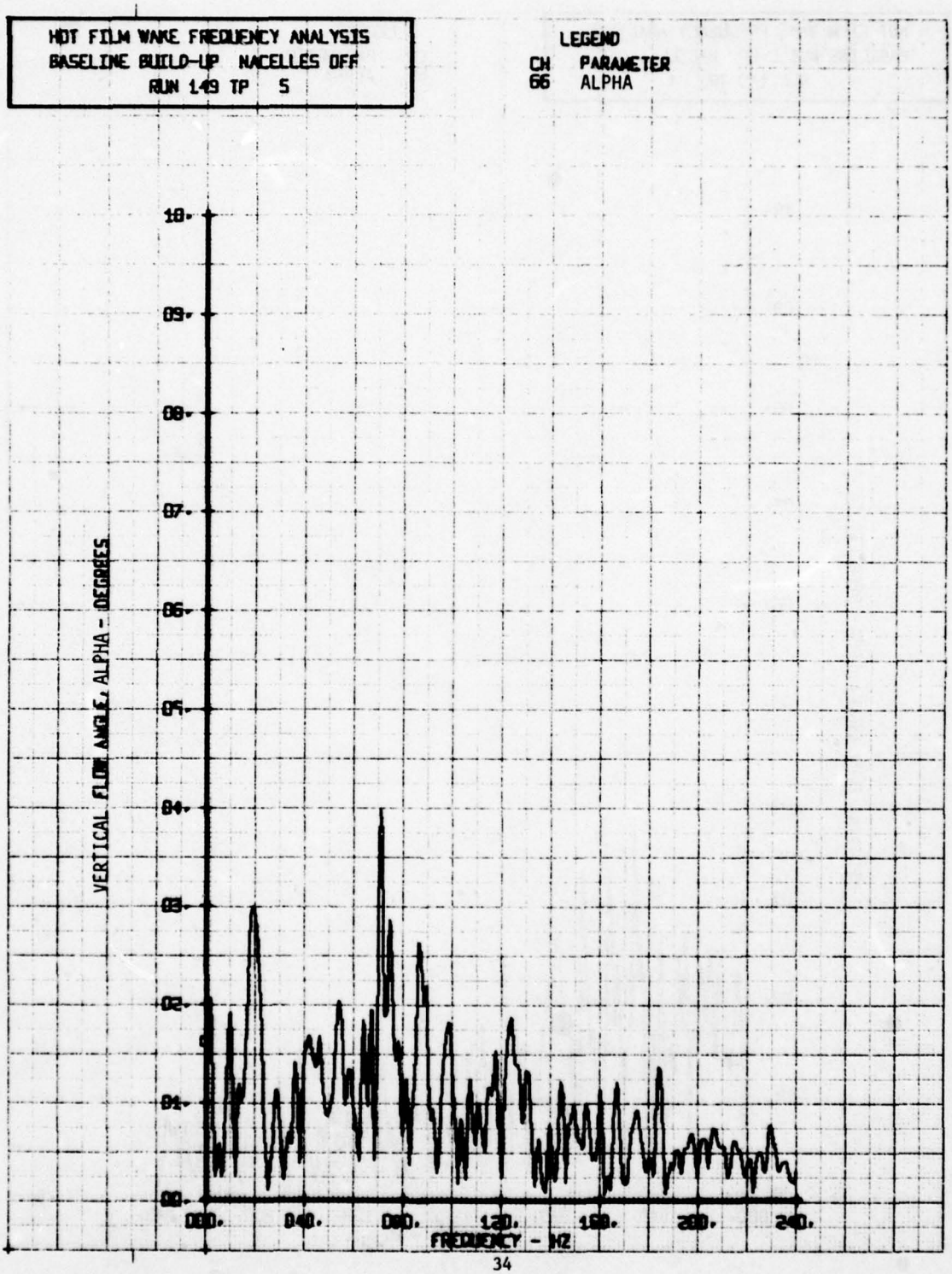


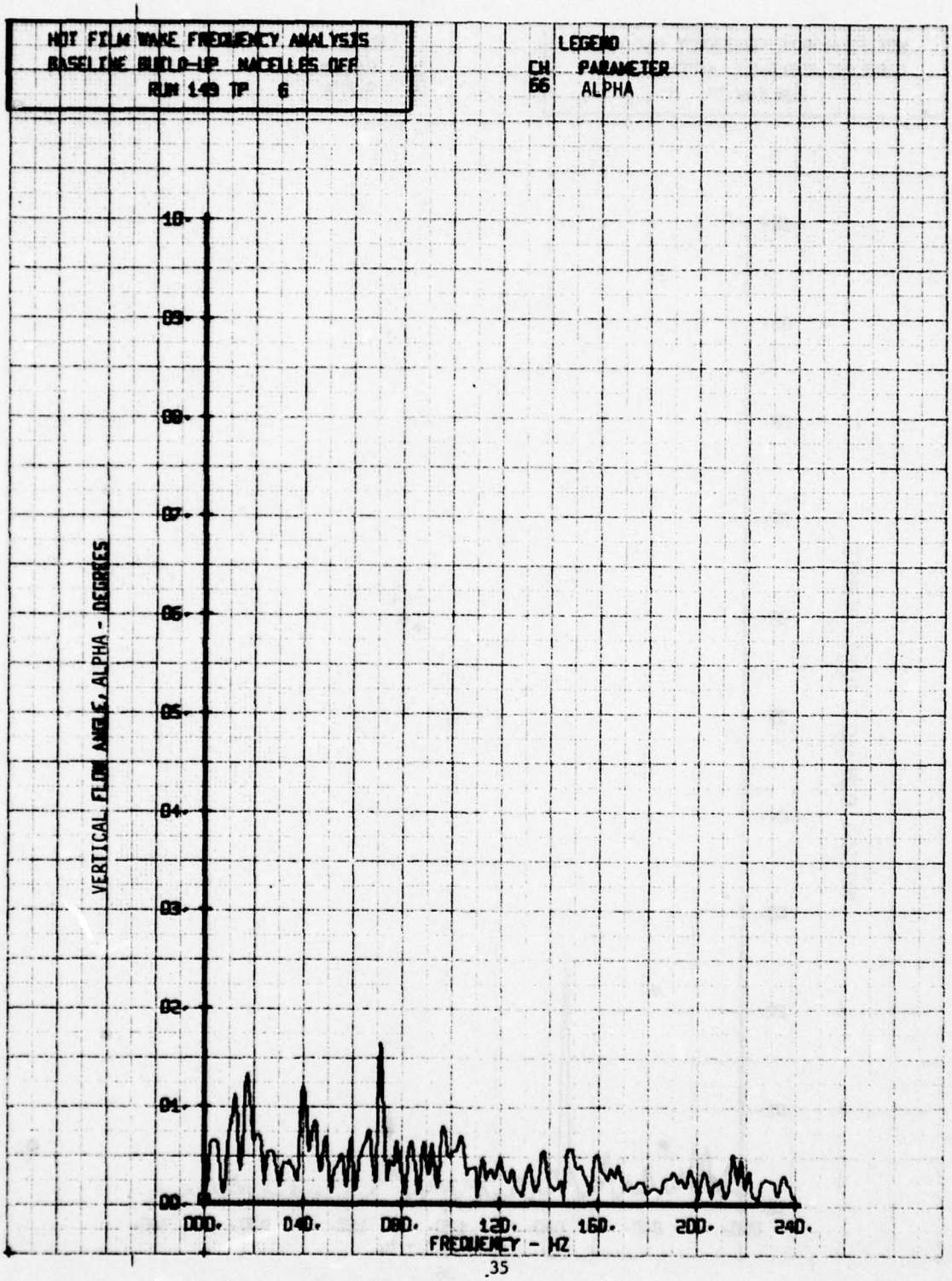
FIGURE 7 -1/4.85 SCALE MODEL GEOMETRY AND SURFACE PRESSURE TRANSDUCER LOCATIONS

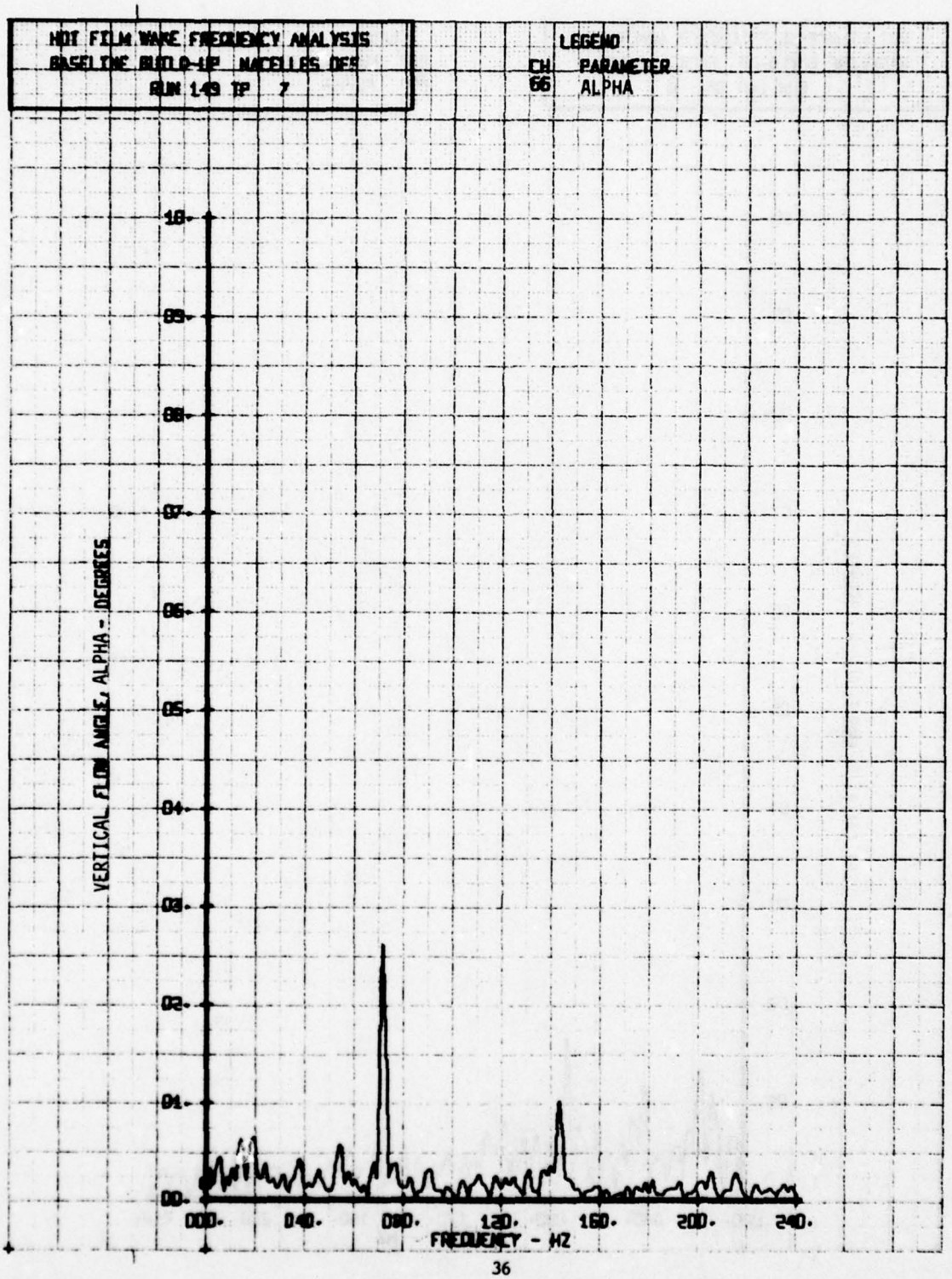

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 148 TP 2
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

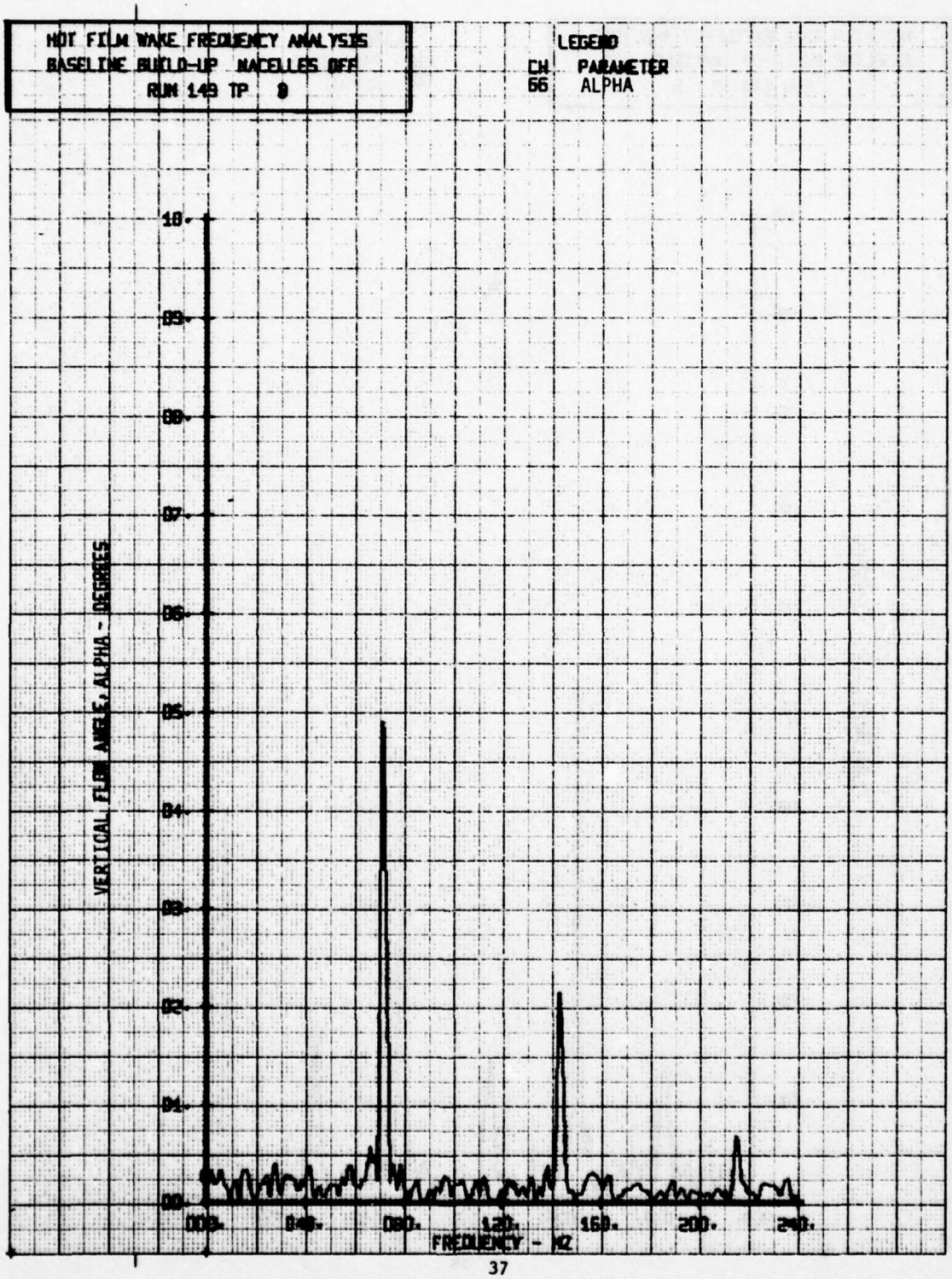

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

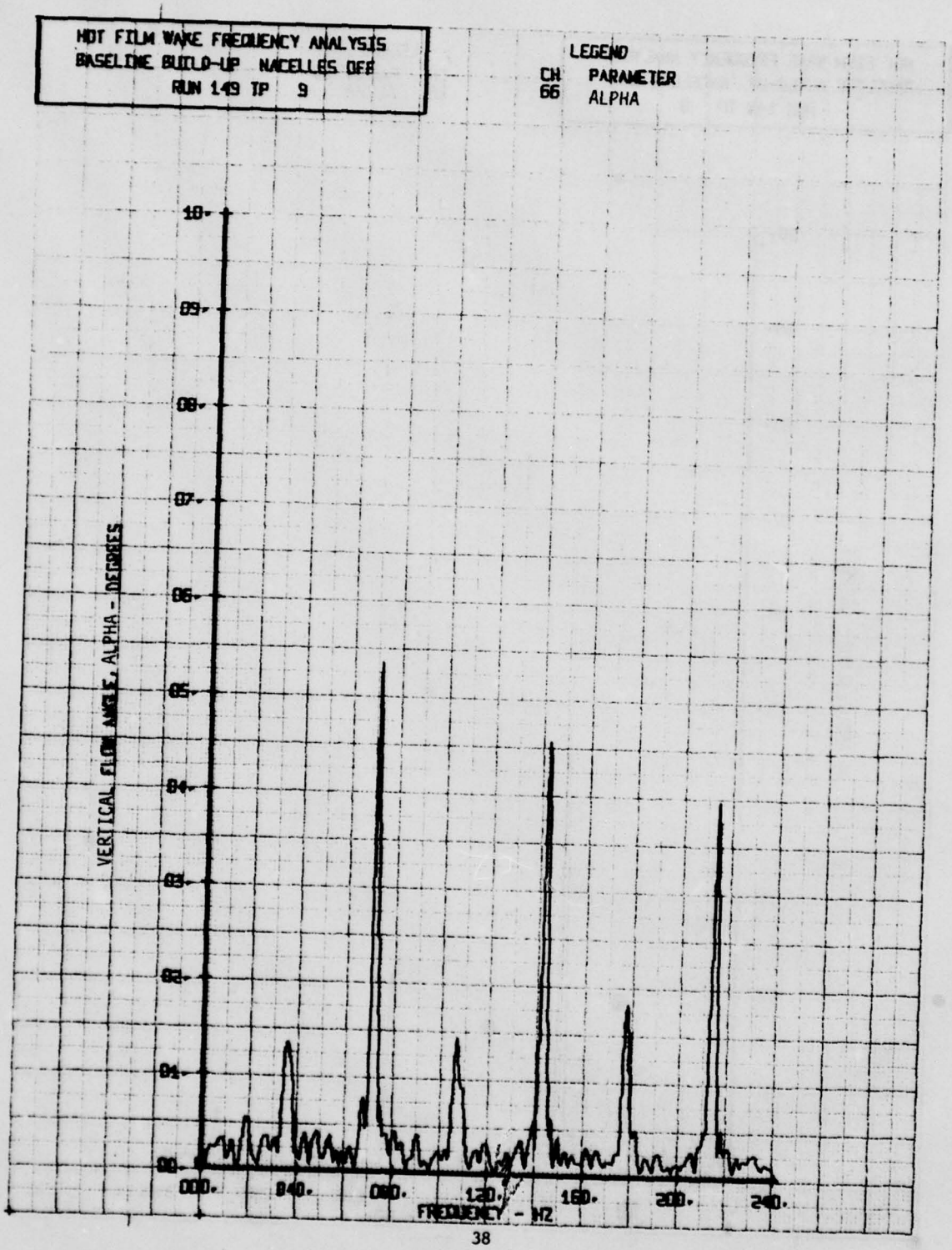

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

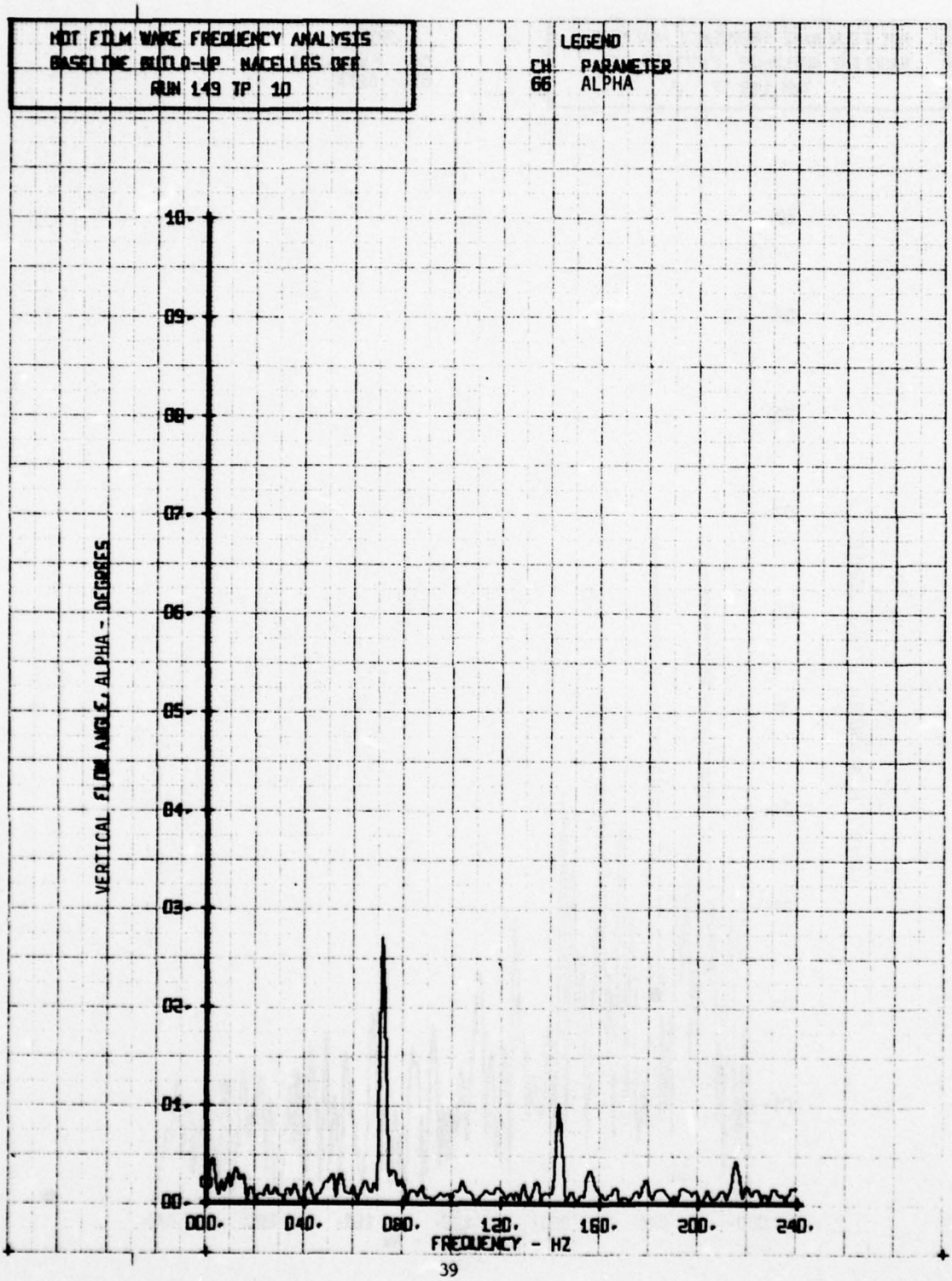

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

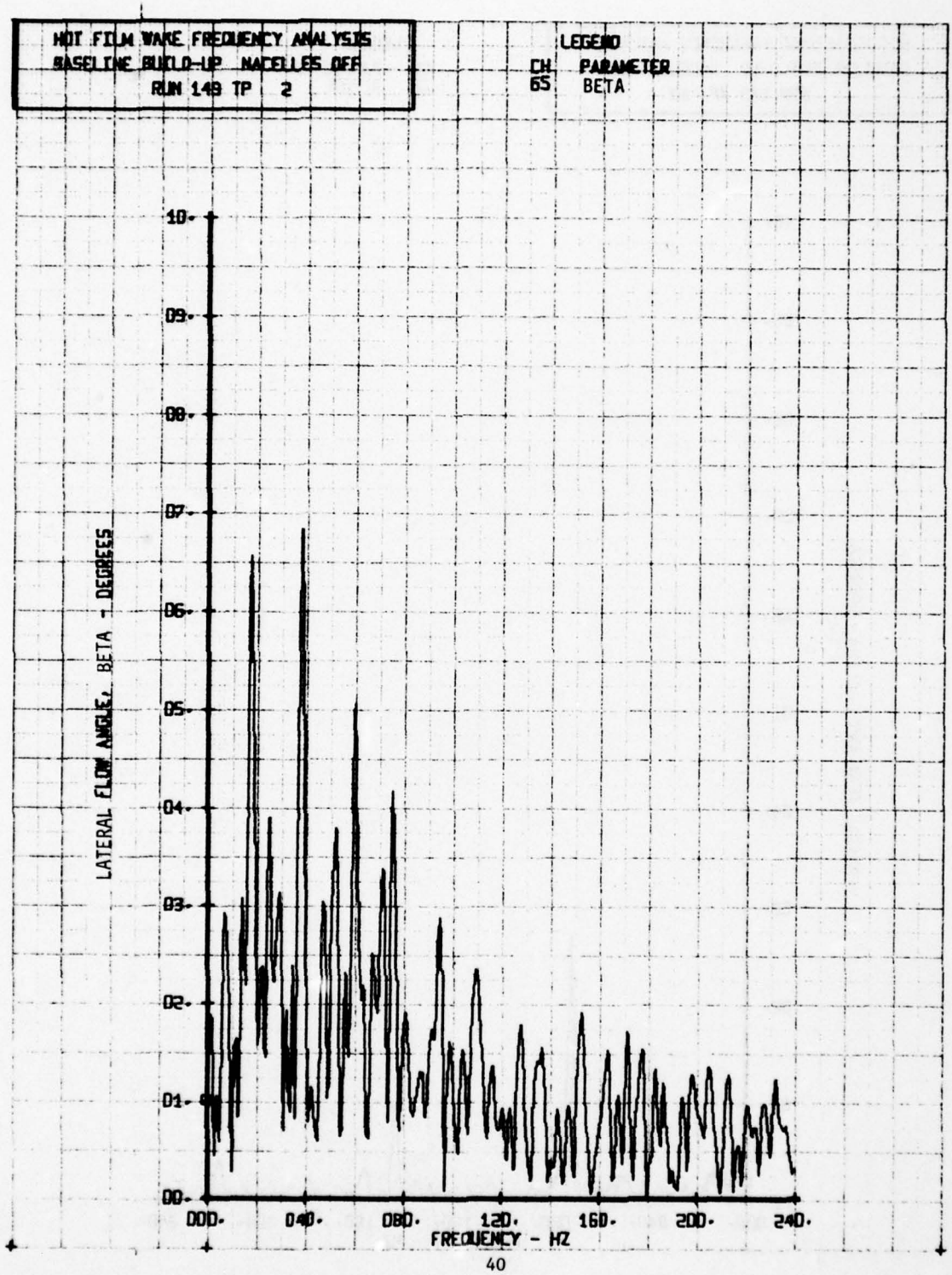

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 6
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

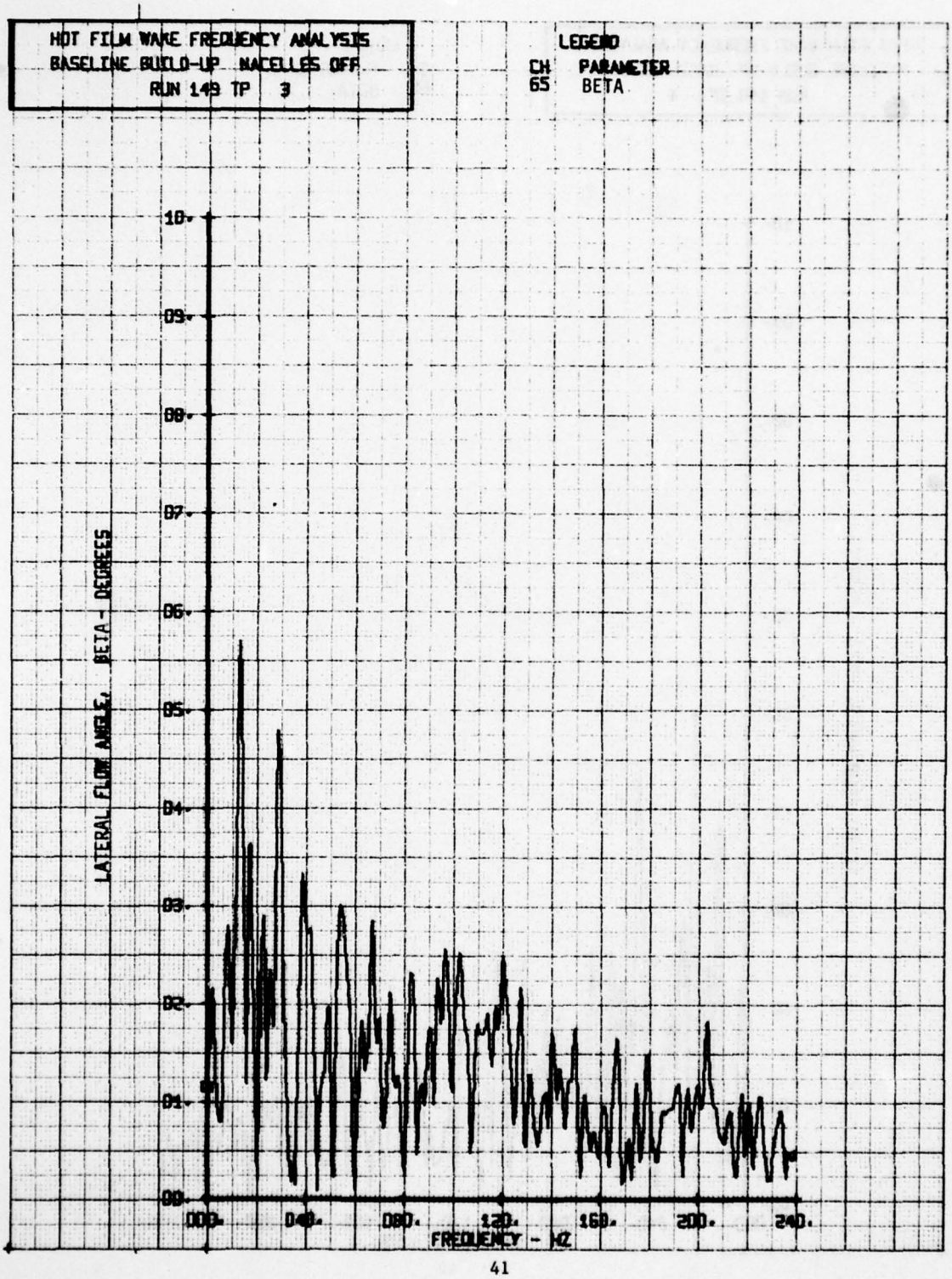

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 7
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

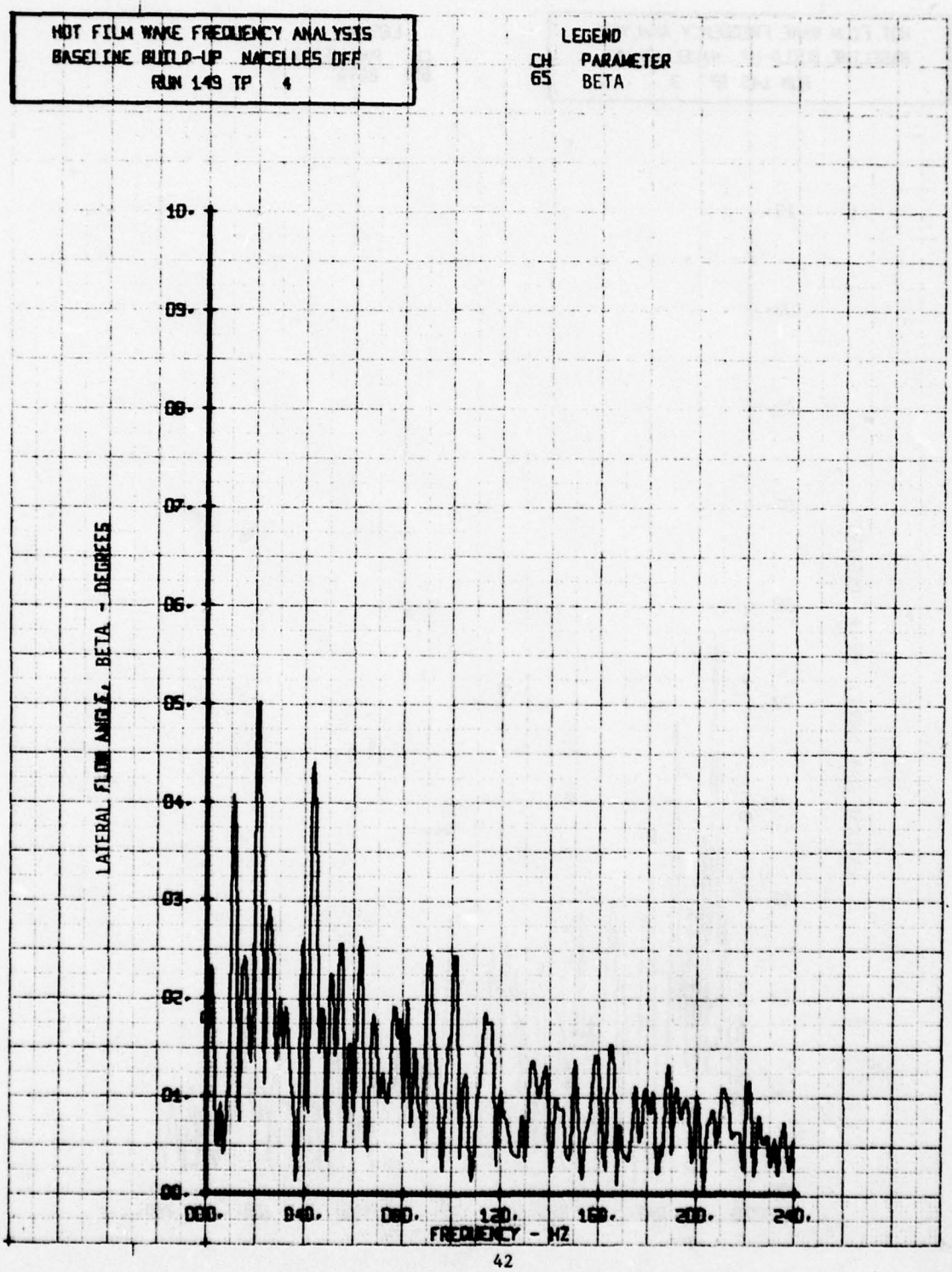

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
FREQUENCY - HZ

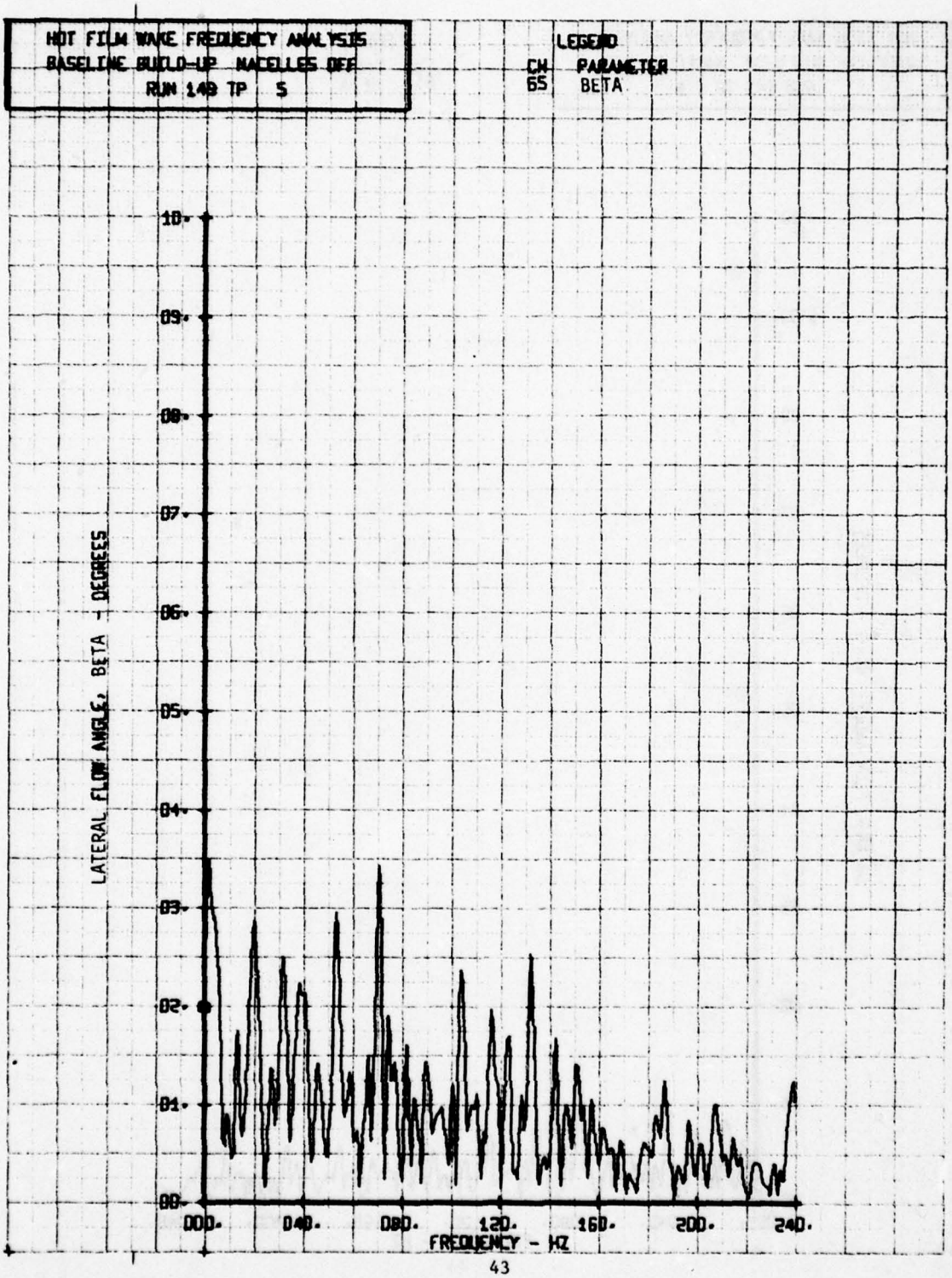

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

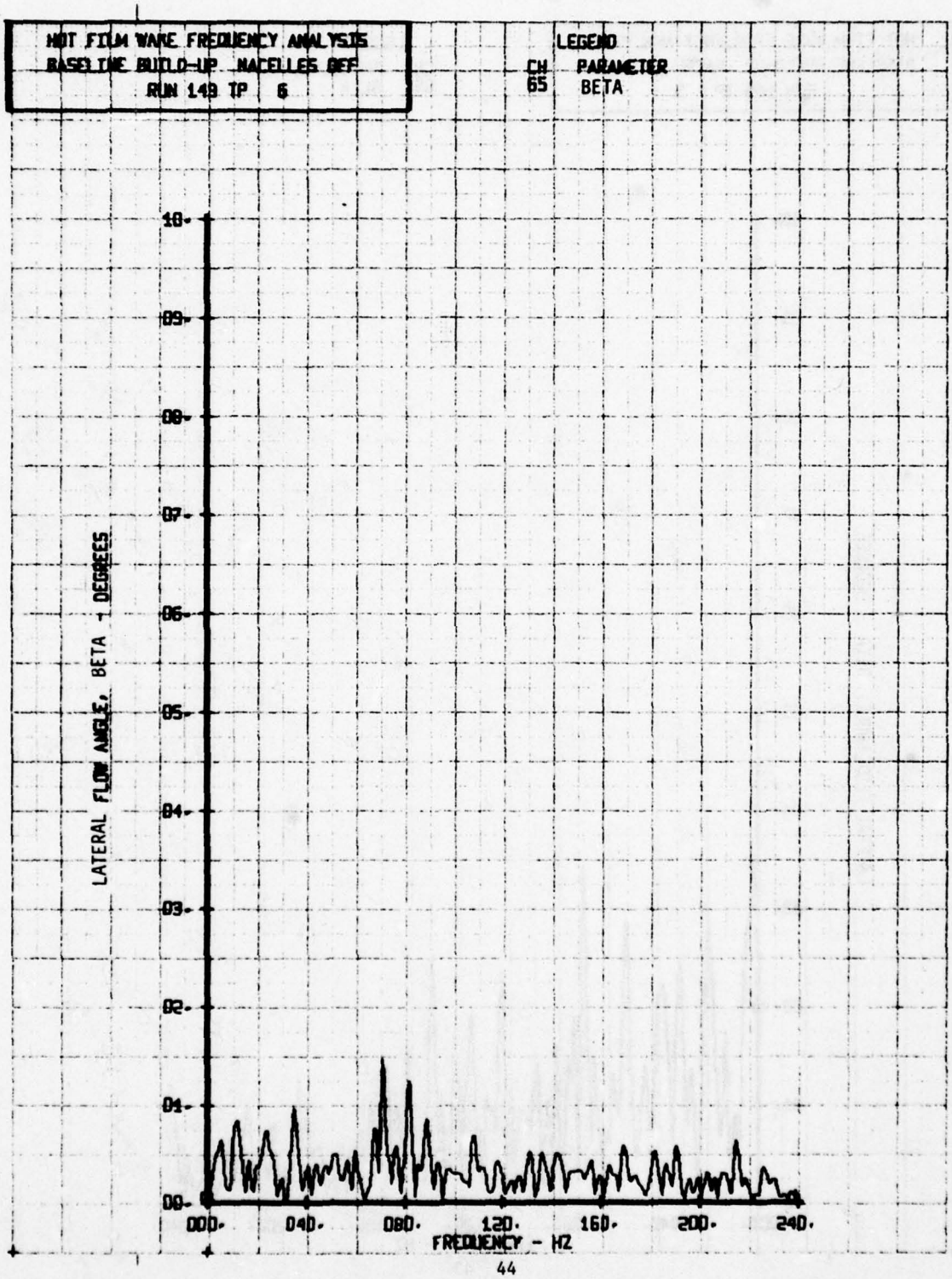

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 10
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

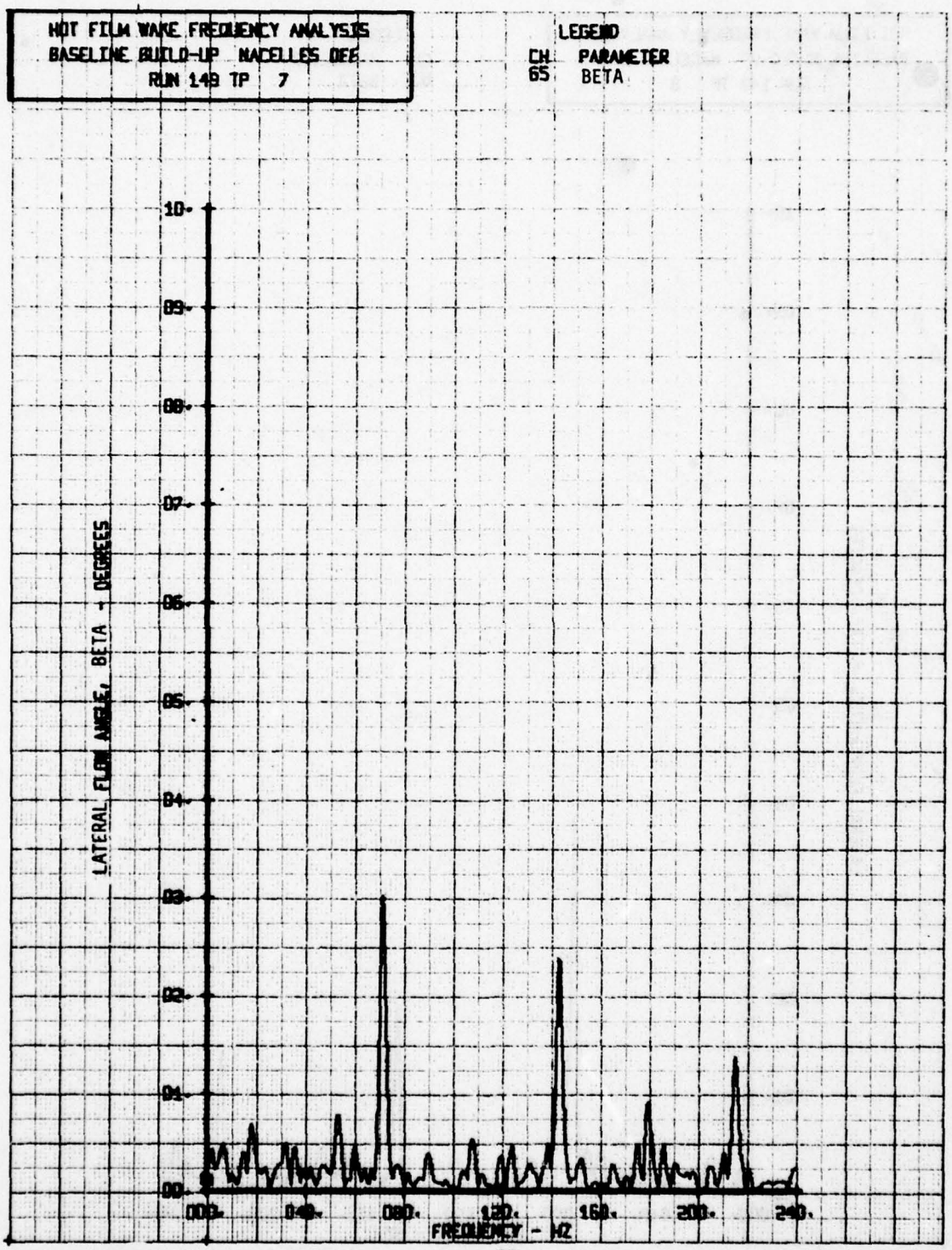

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 148 TP 2
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

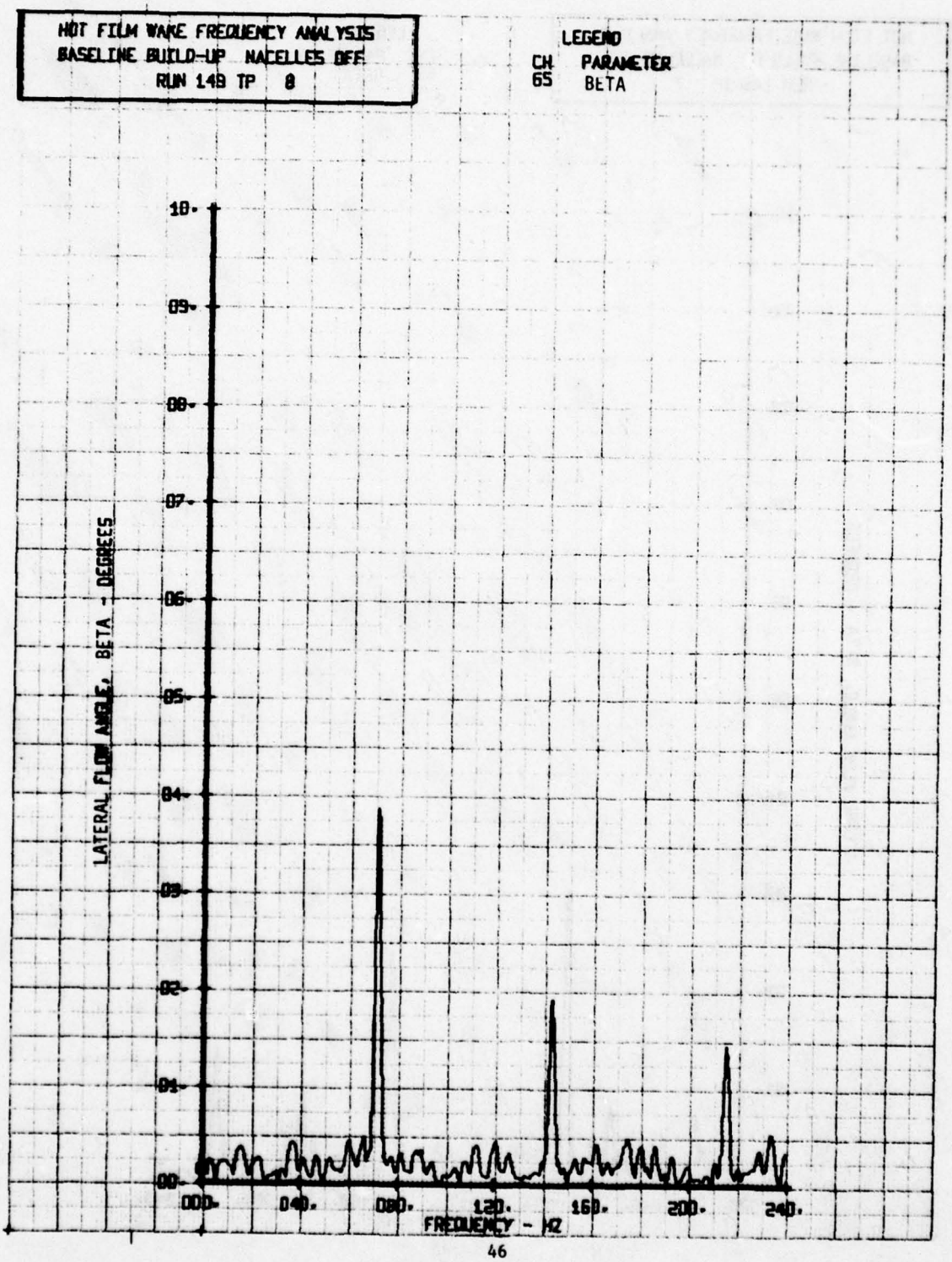

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

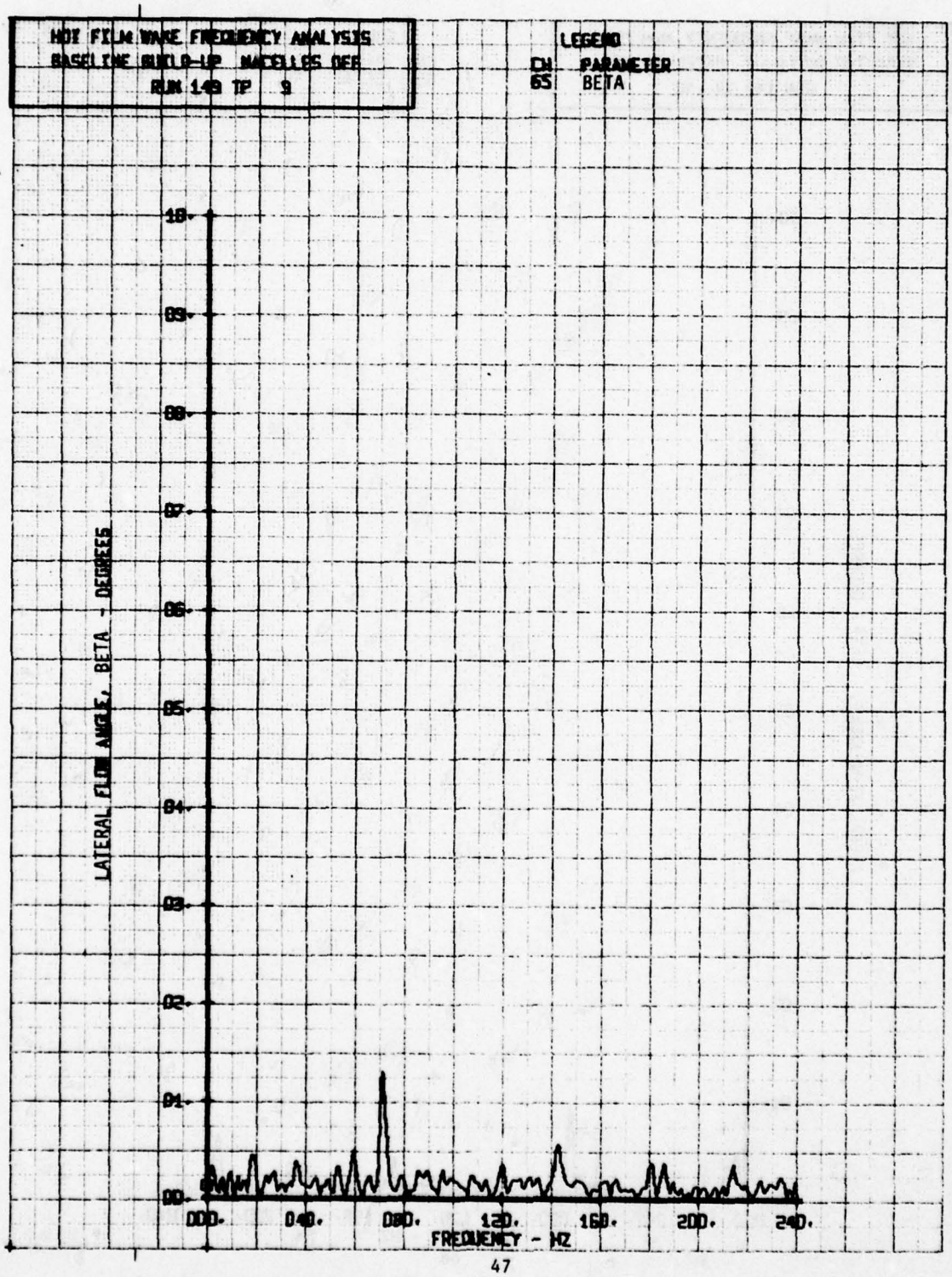

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 4
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

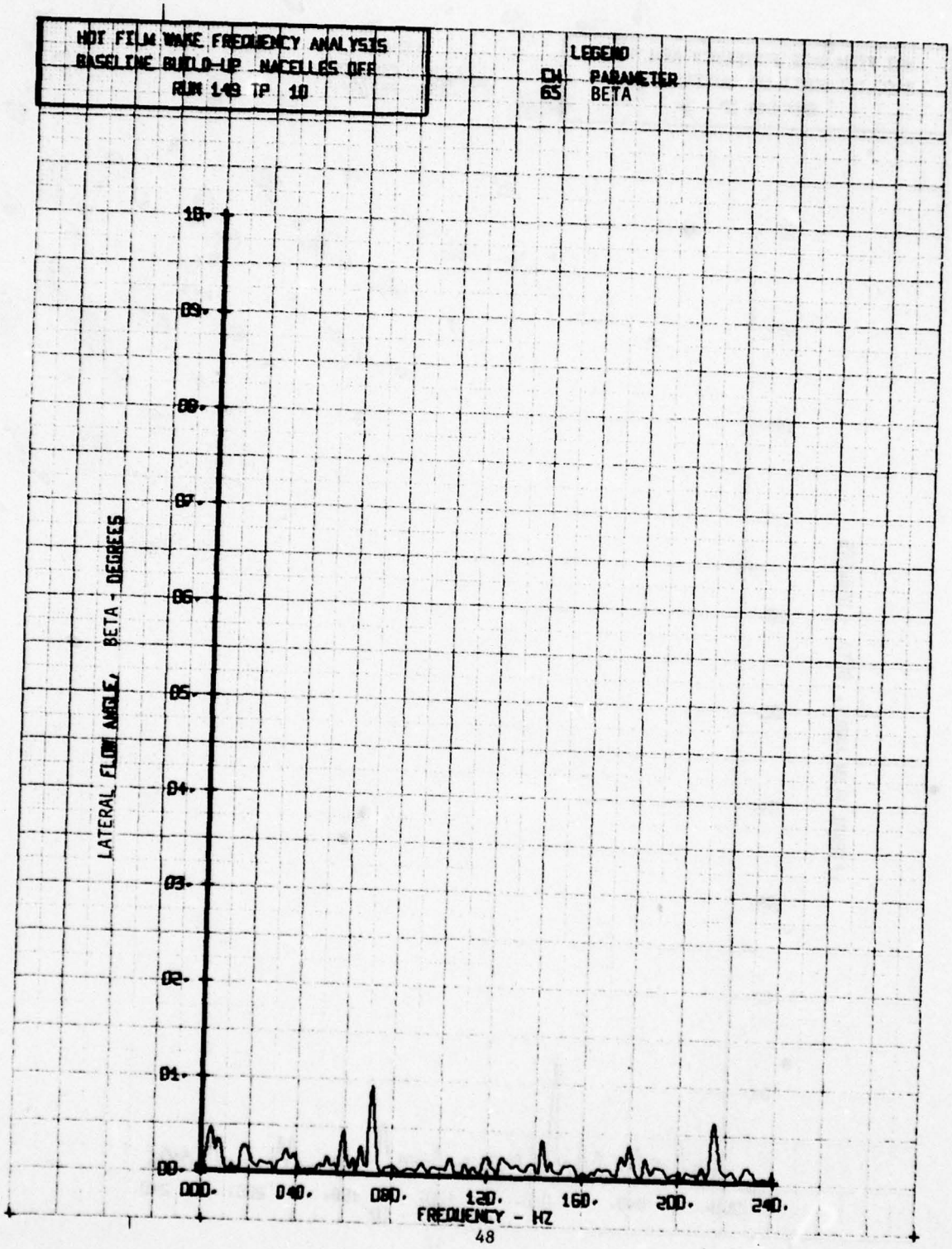

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

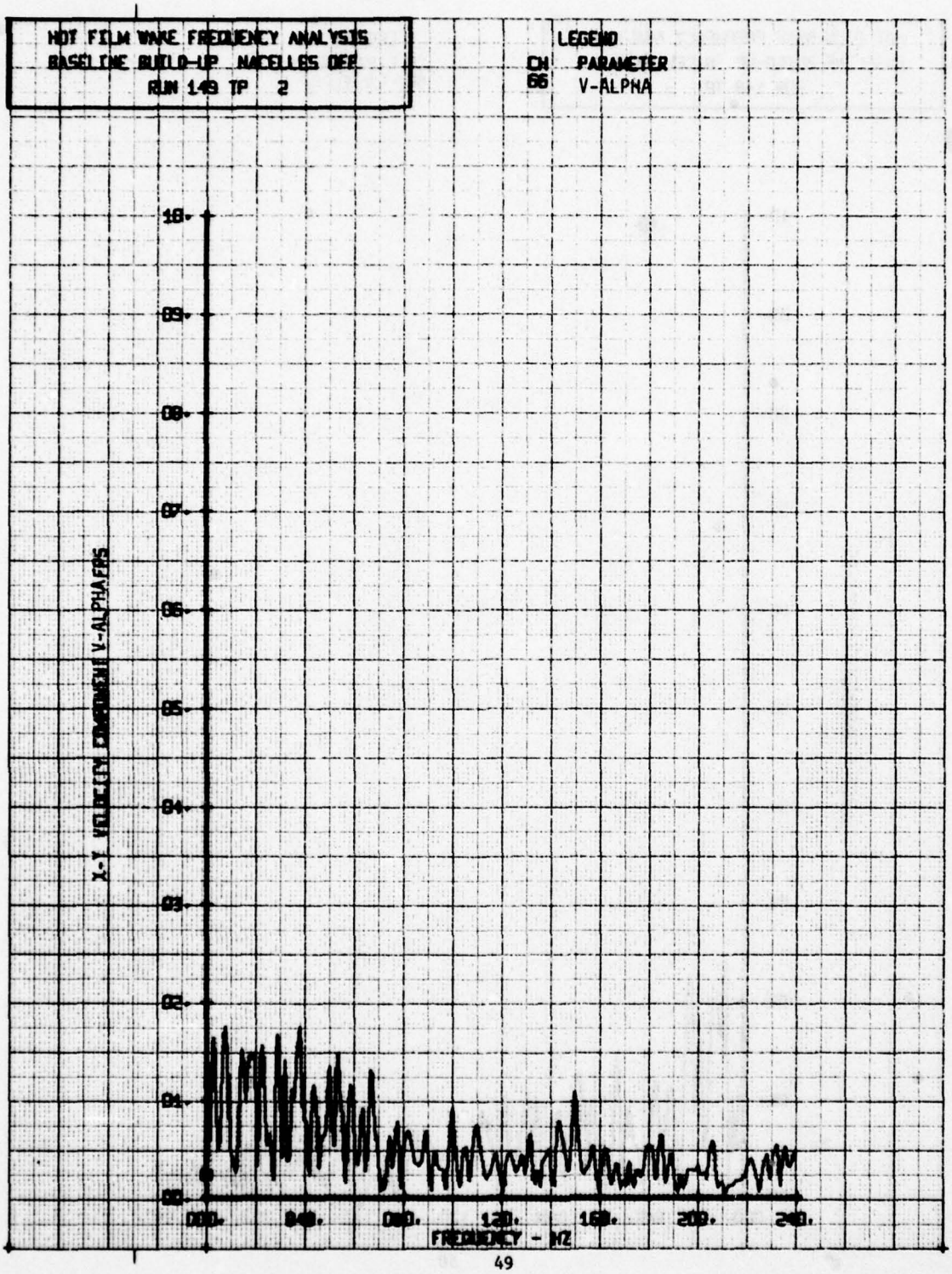

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 6
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

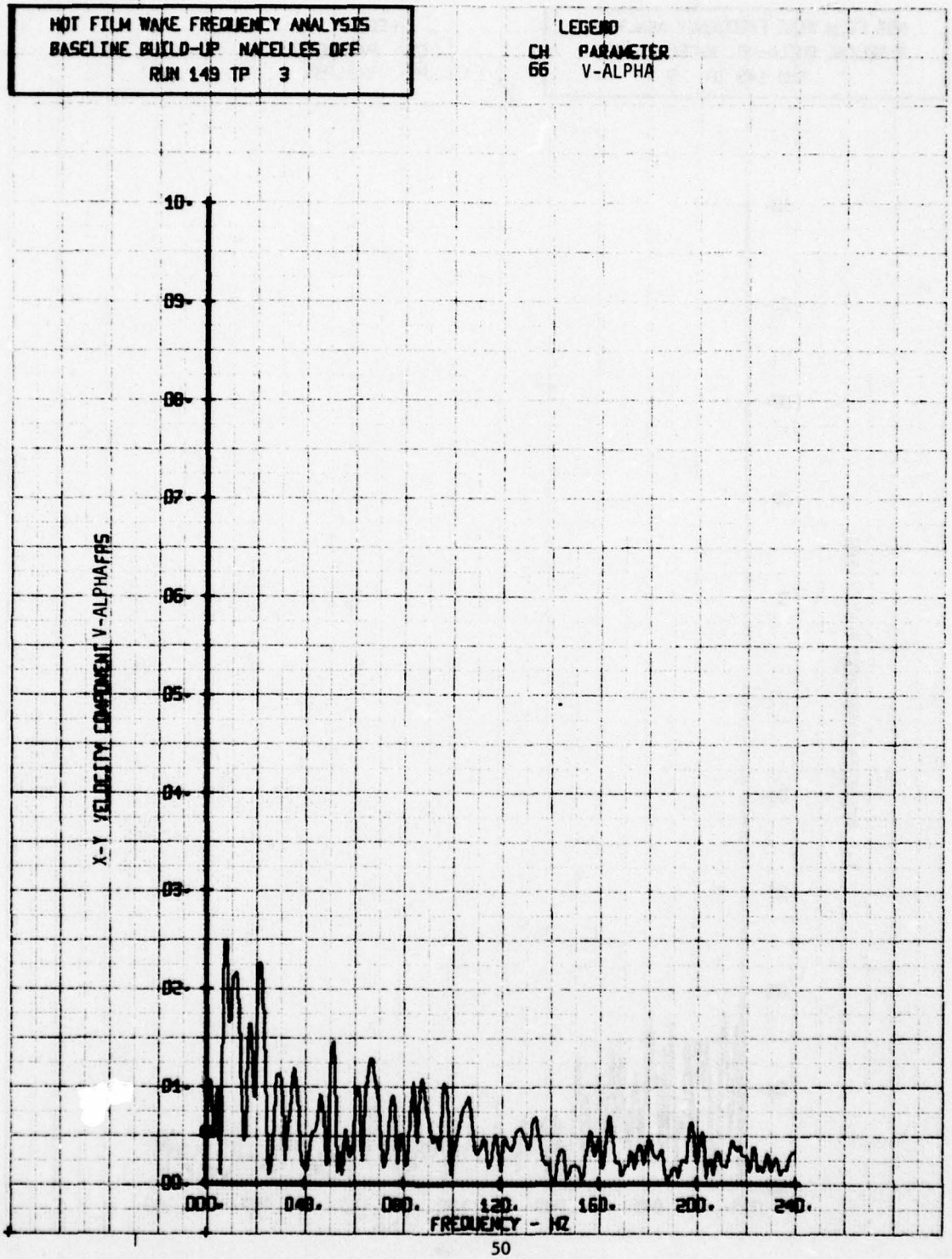

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 7
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA + DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

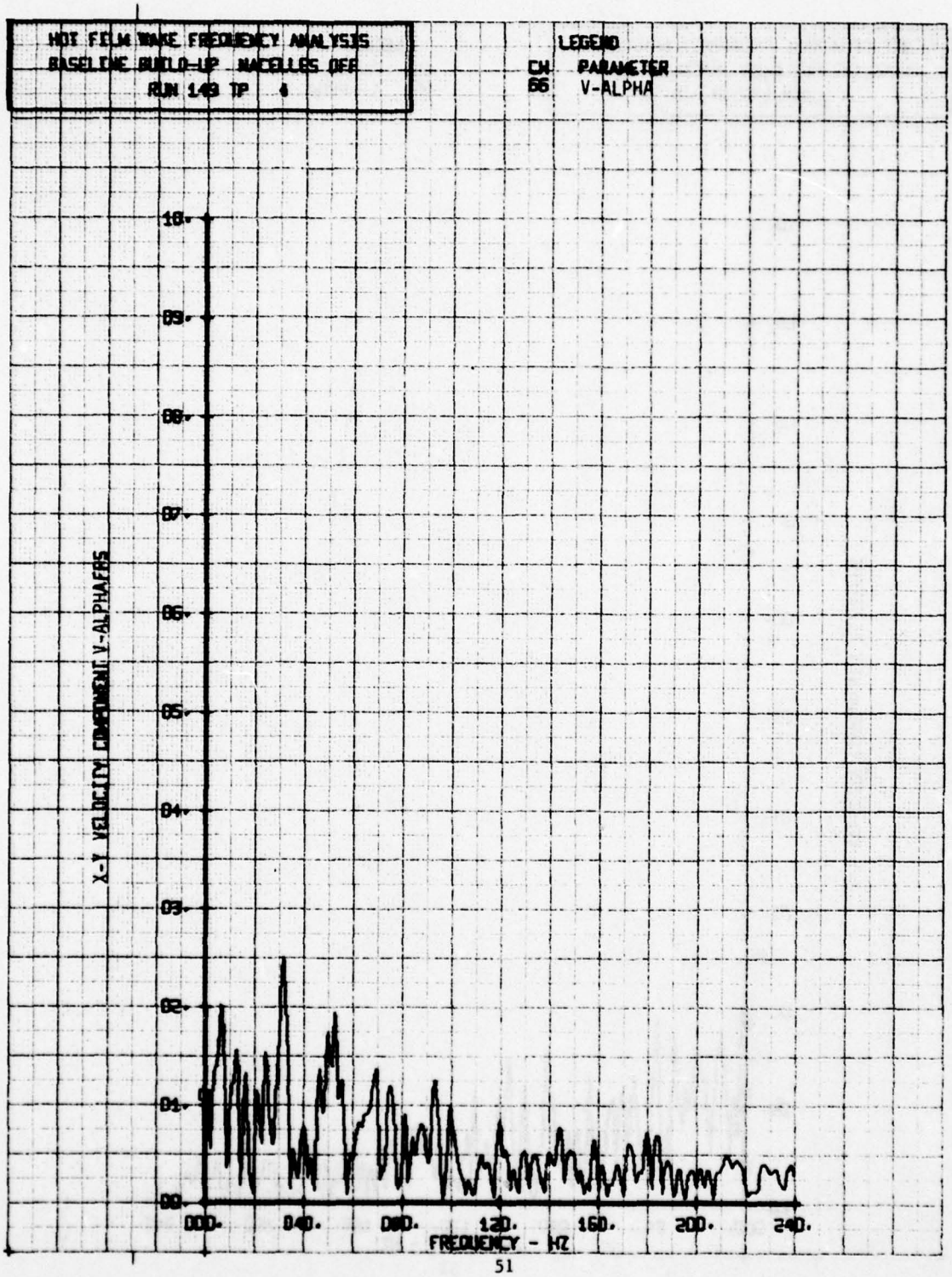

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

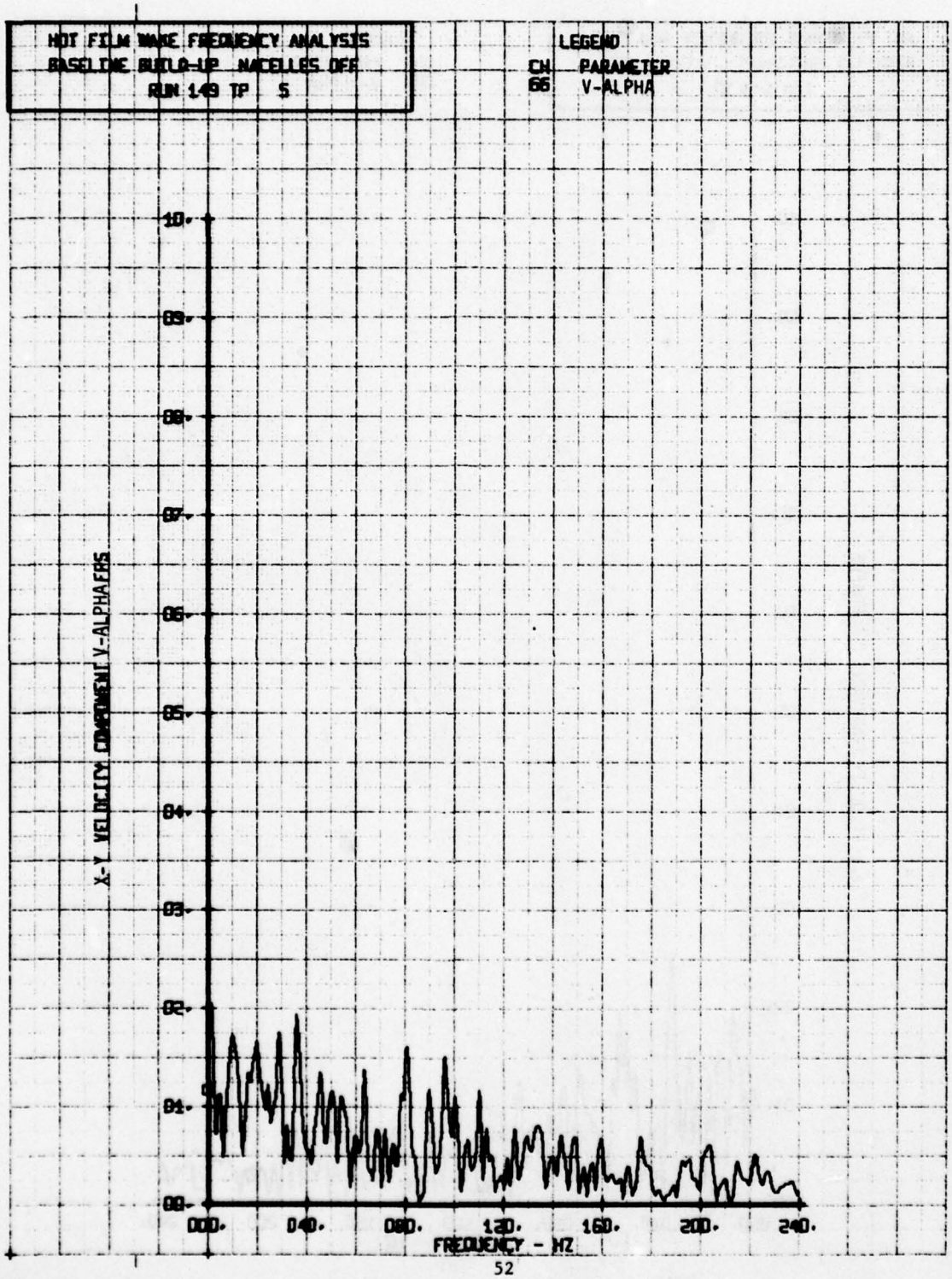

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
FREQUENCY - HZ
000.
040.
080.
120.
160.
200.
240.

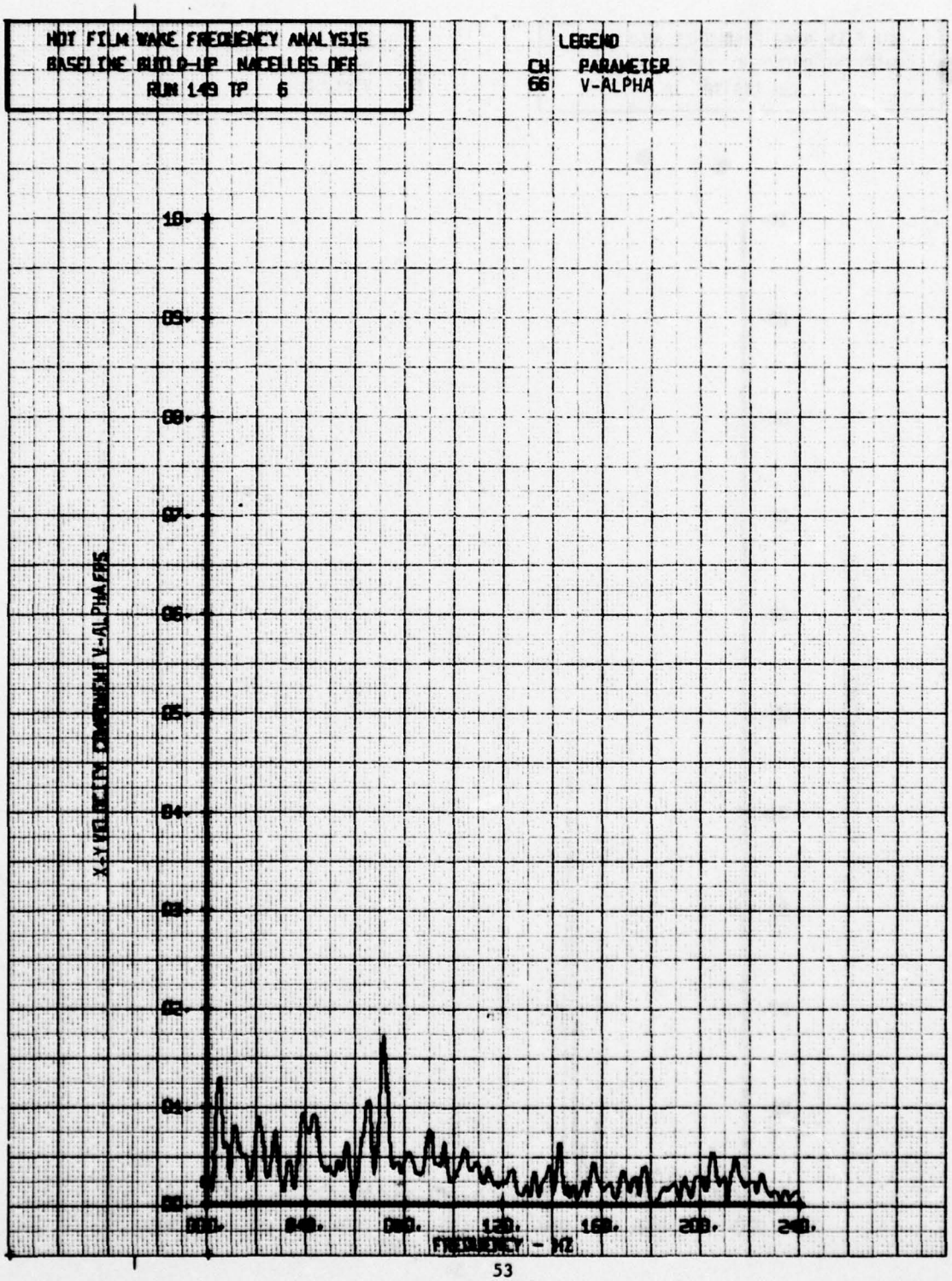

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 10
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

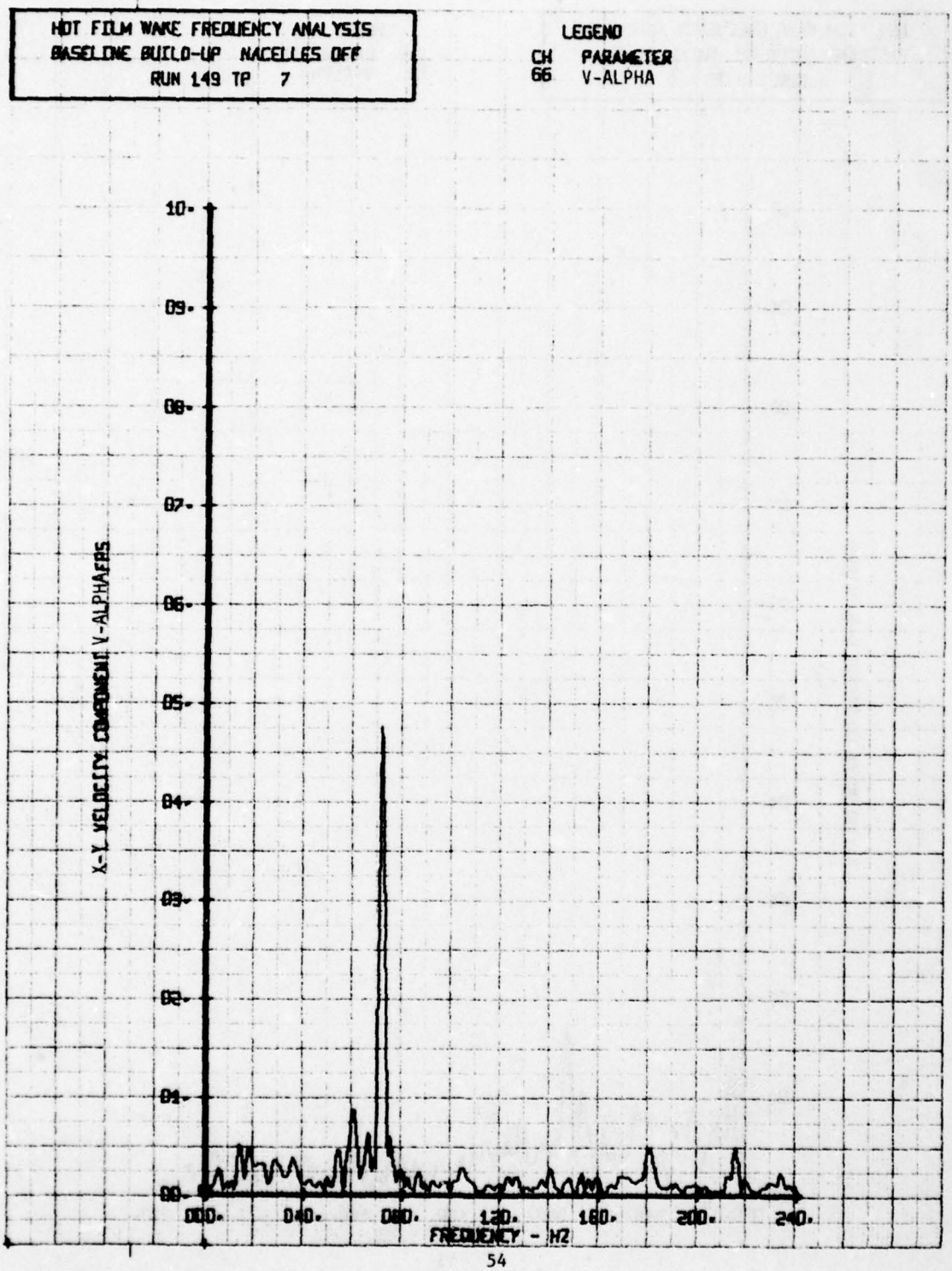

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 2
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VOLTAGE COMPONENT V-ALPHA/EPS
FREQUENCY - HZ

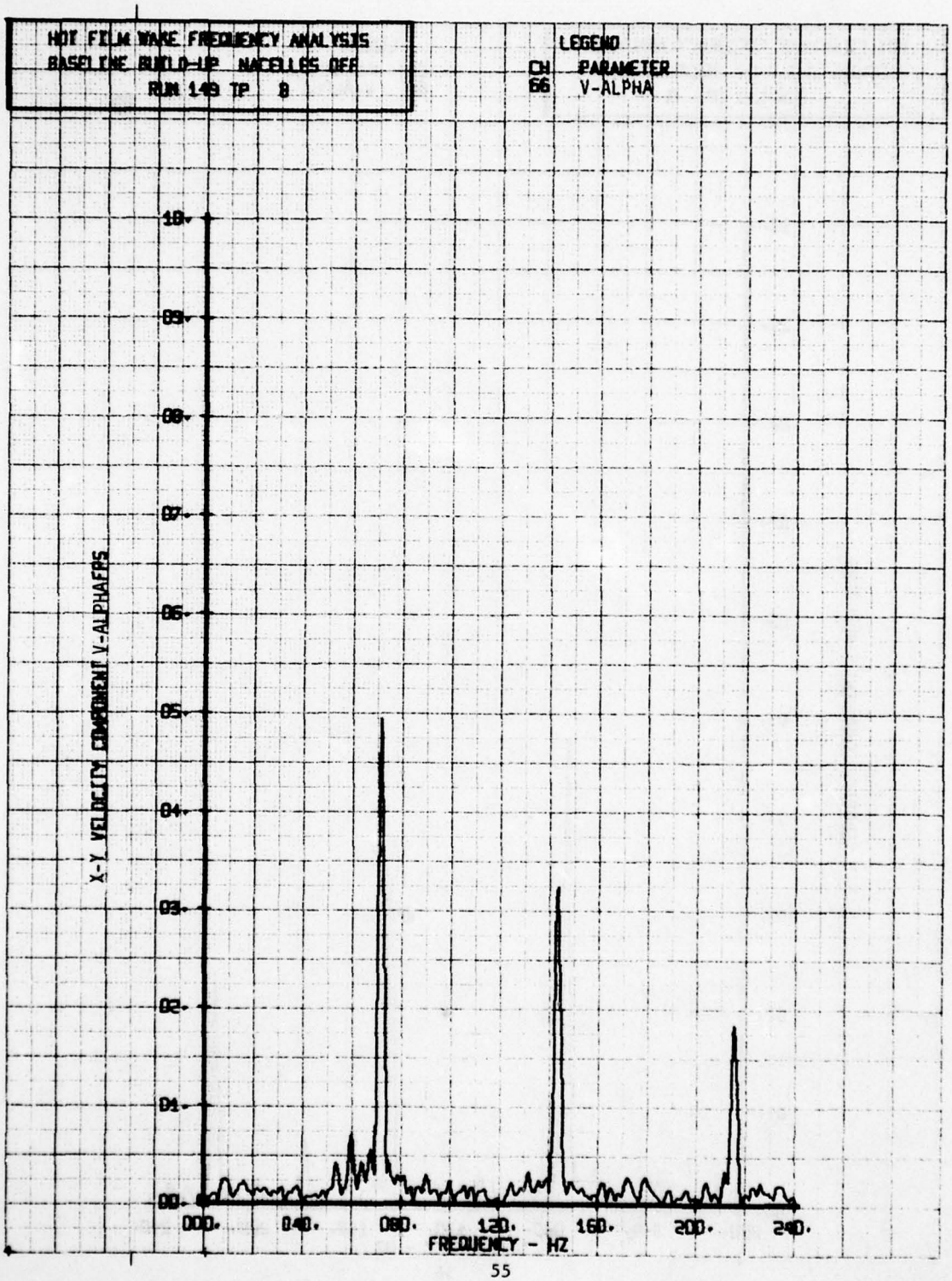

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

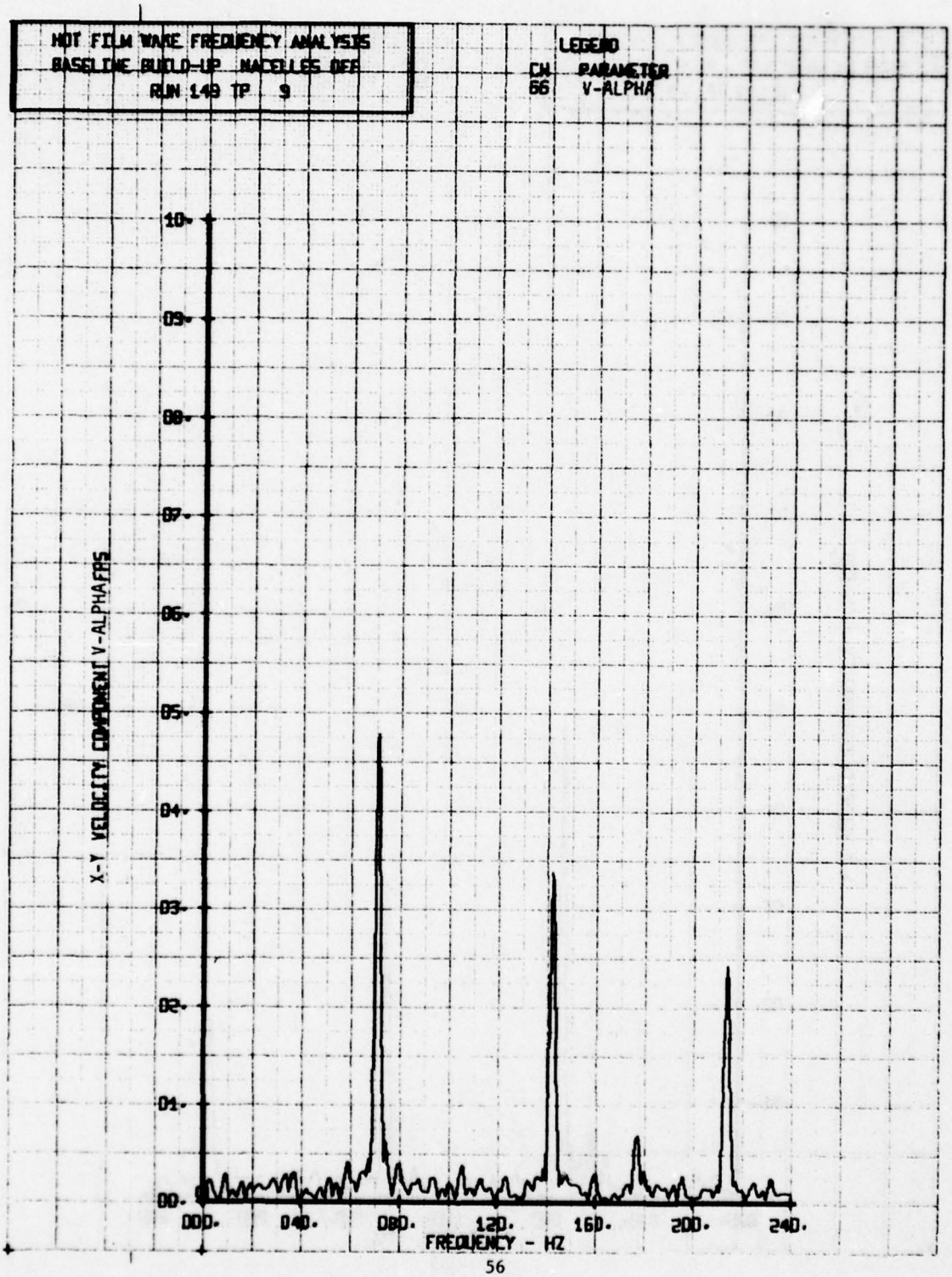

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 143 TP 4
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

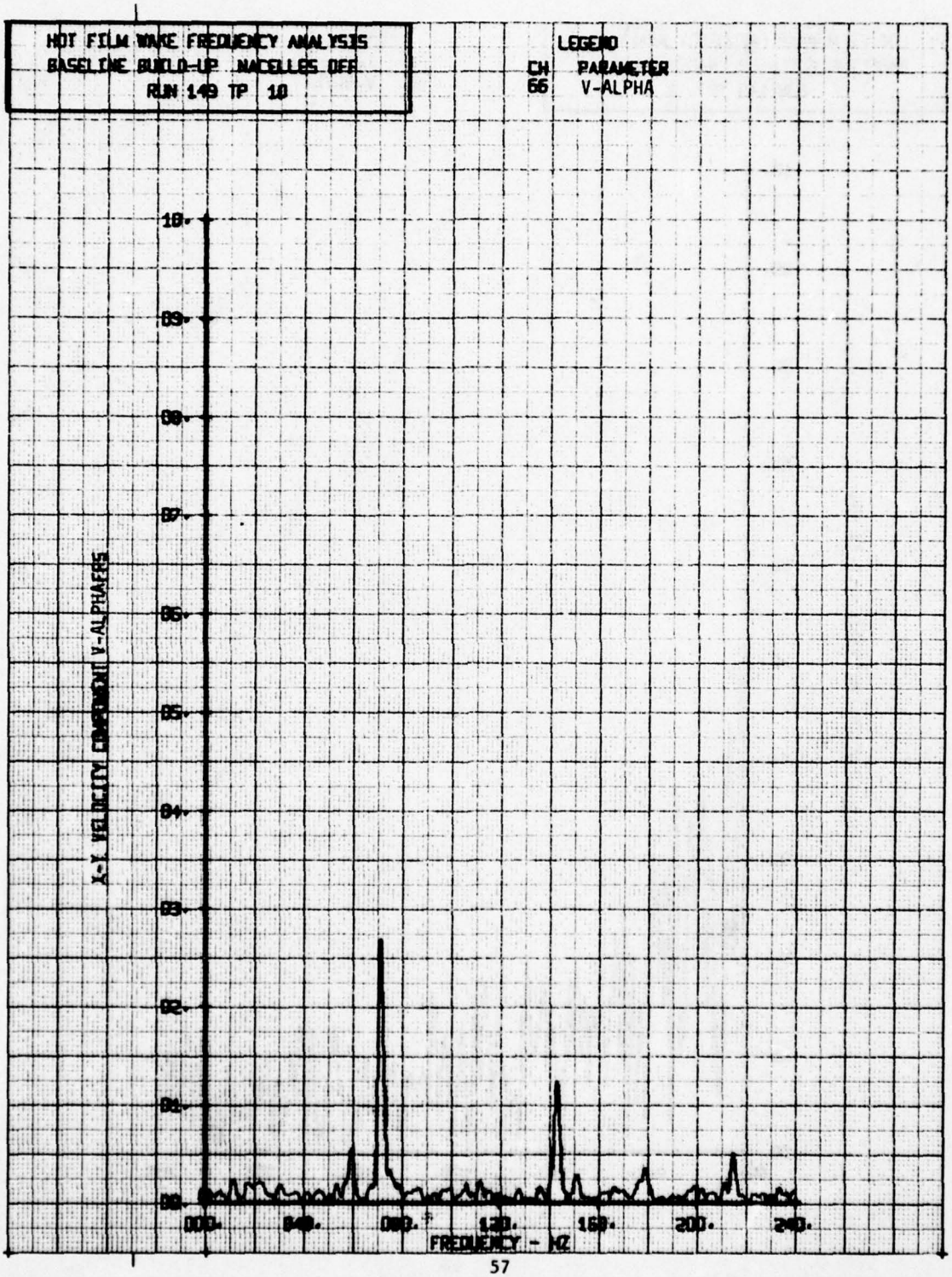

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

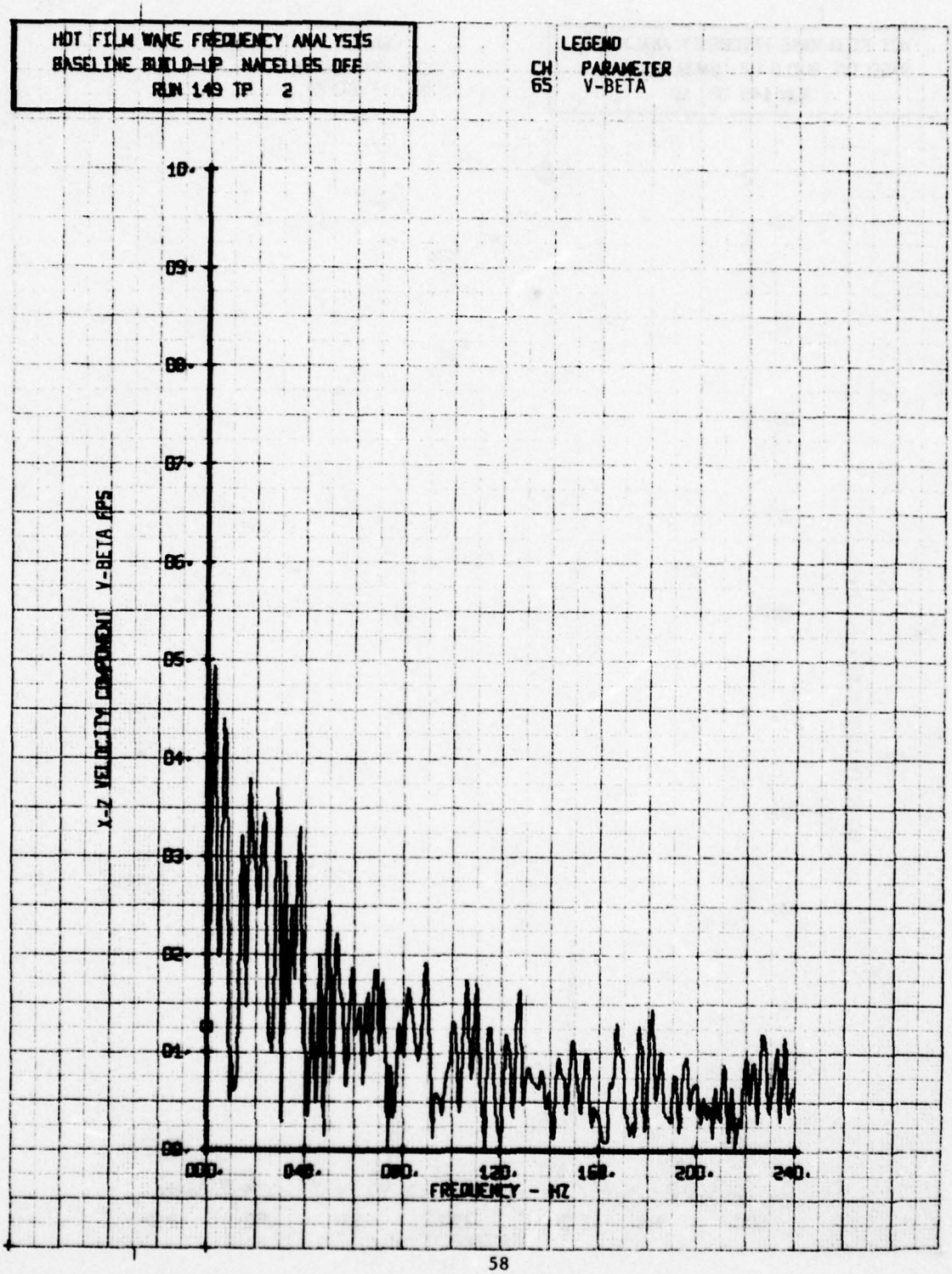

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES DER
RUN 149 TP 6
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/RS
FREQUENCY - HZ

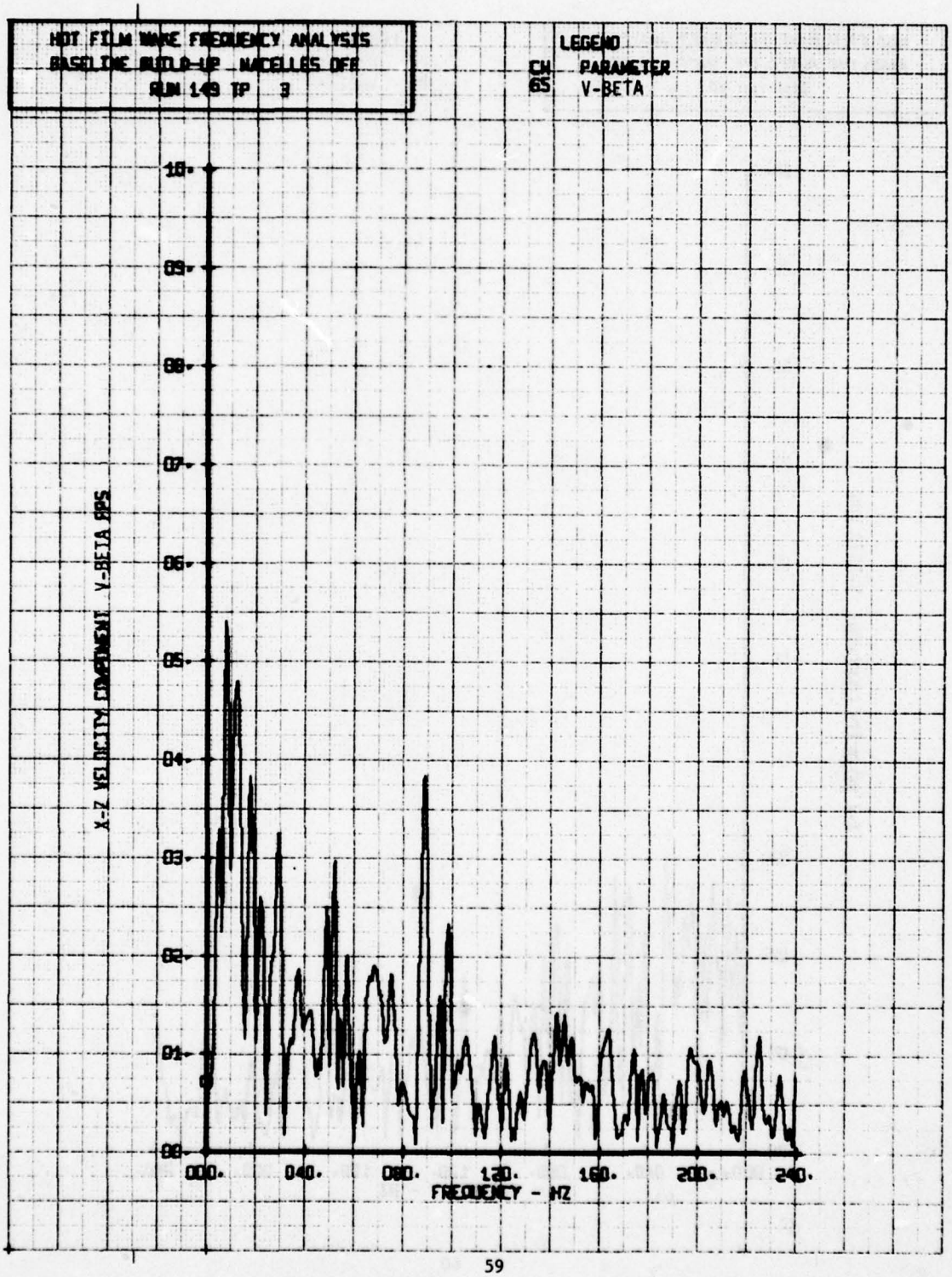

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 7
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHAFBS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

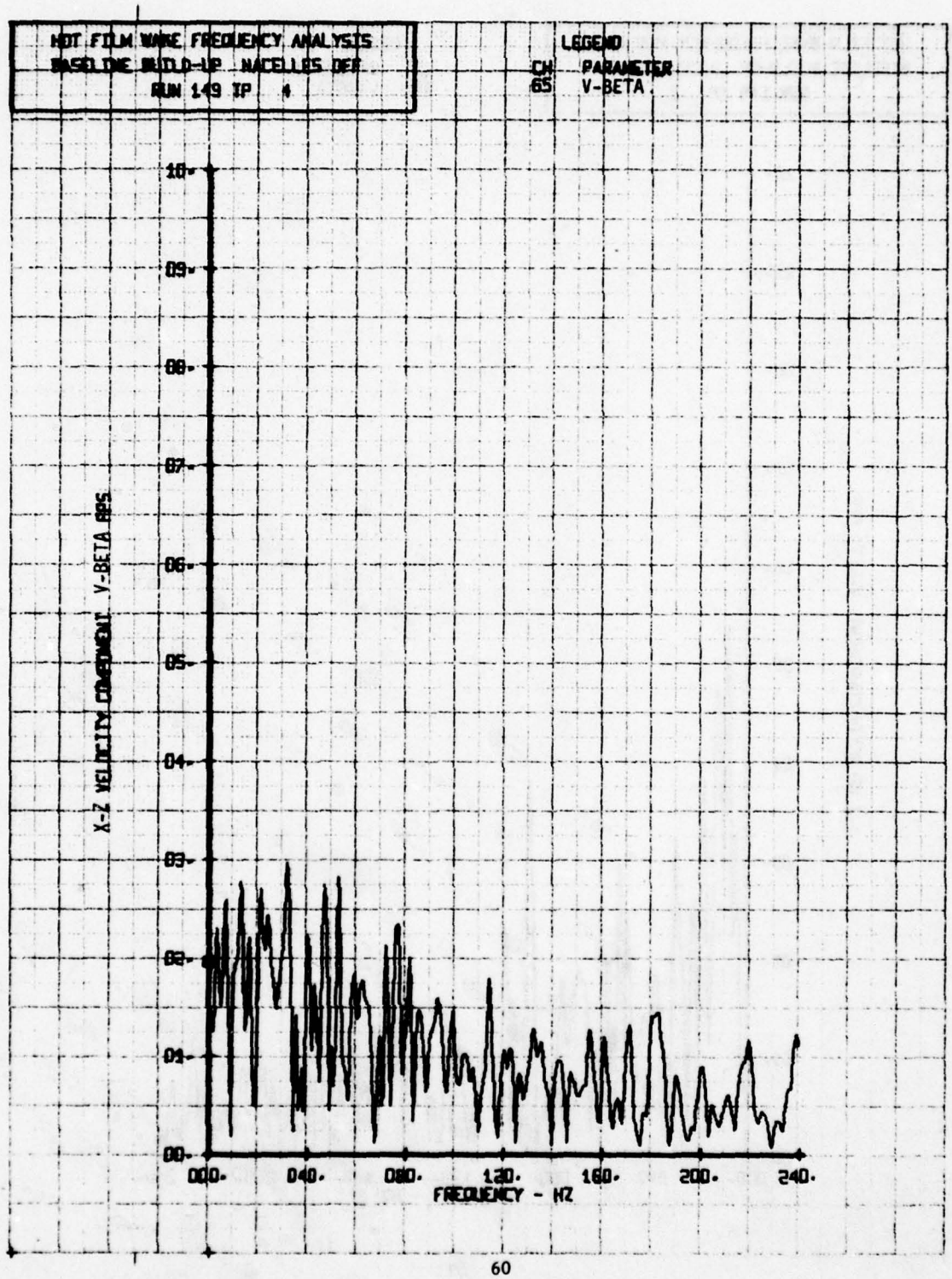

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

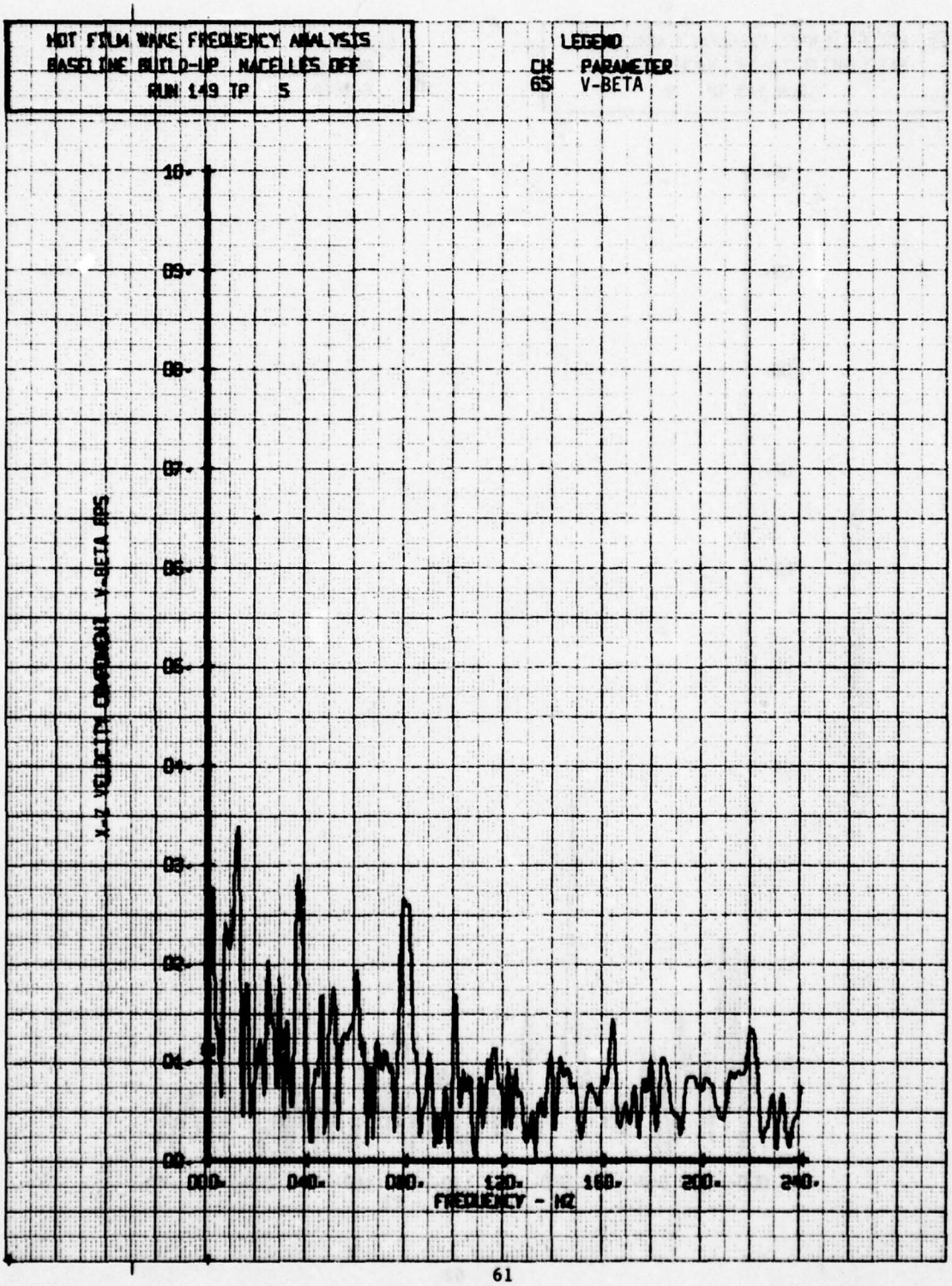

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

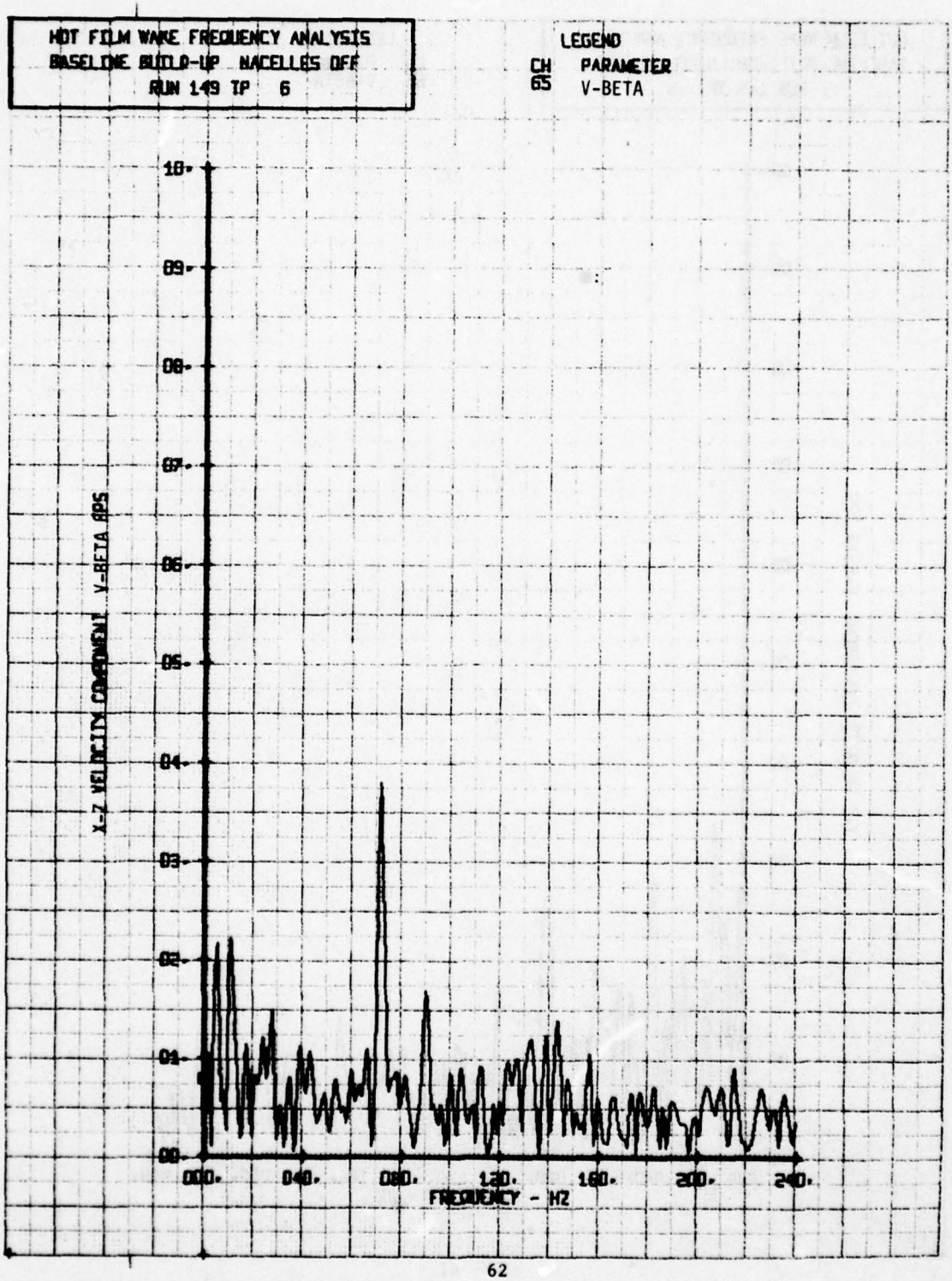

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 18
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFFS
FREQUENCY - HZ

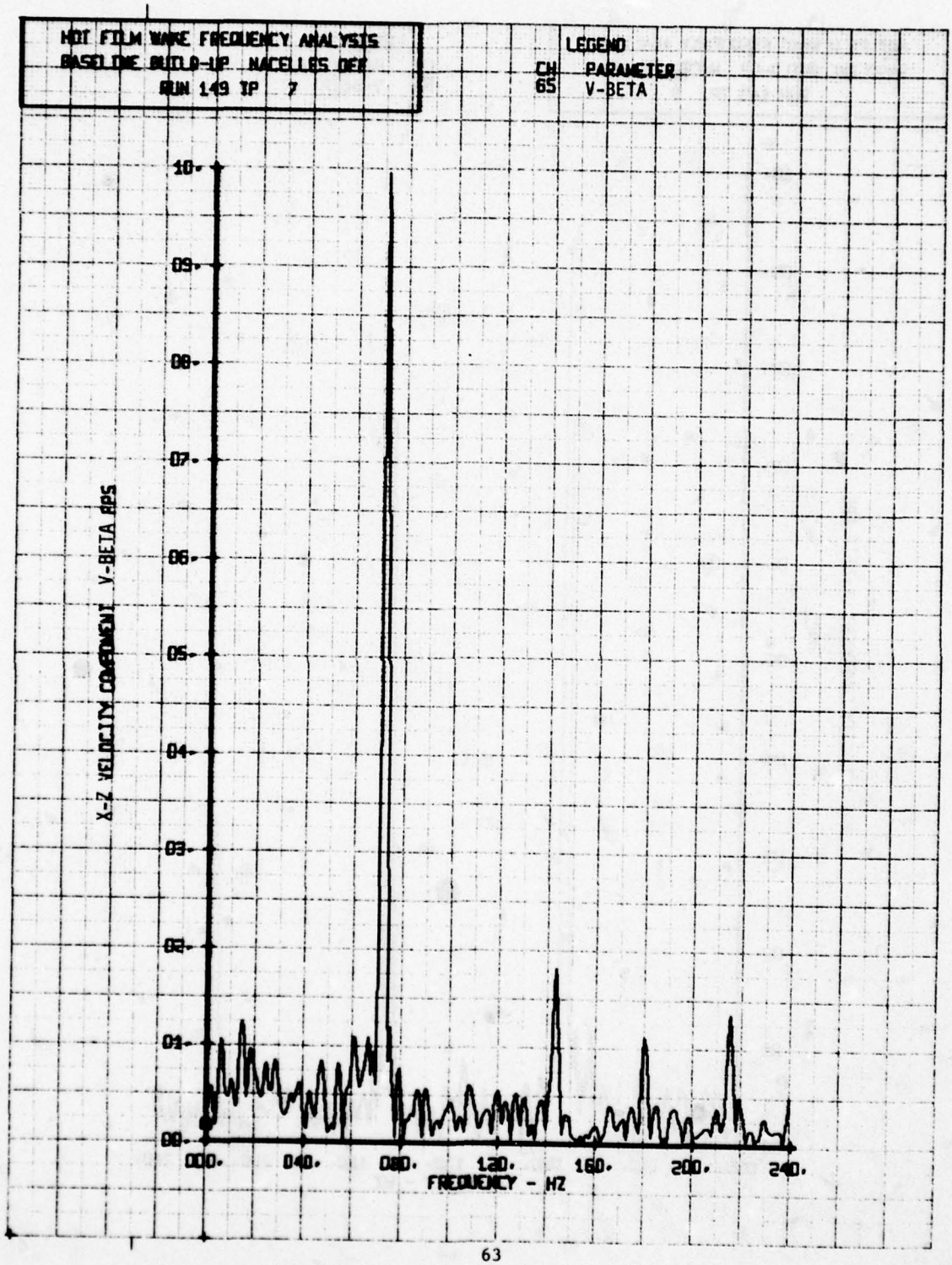

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 2
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

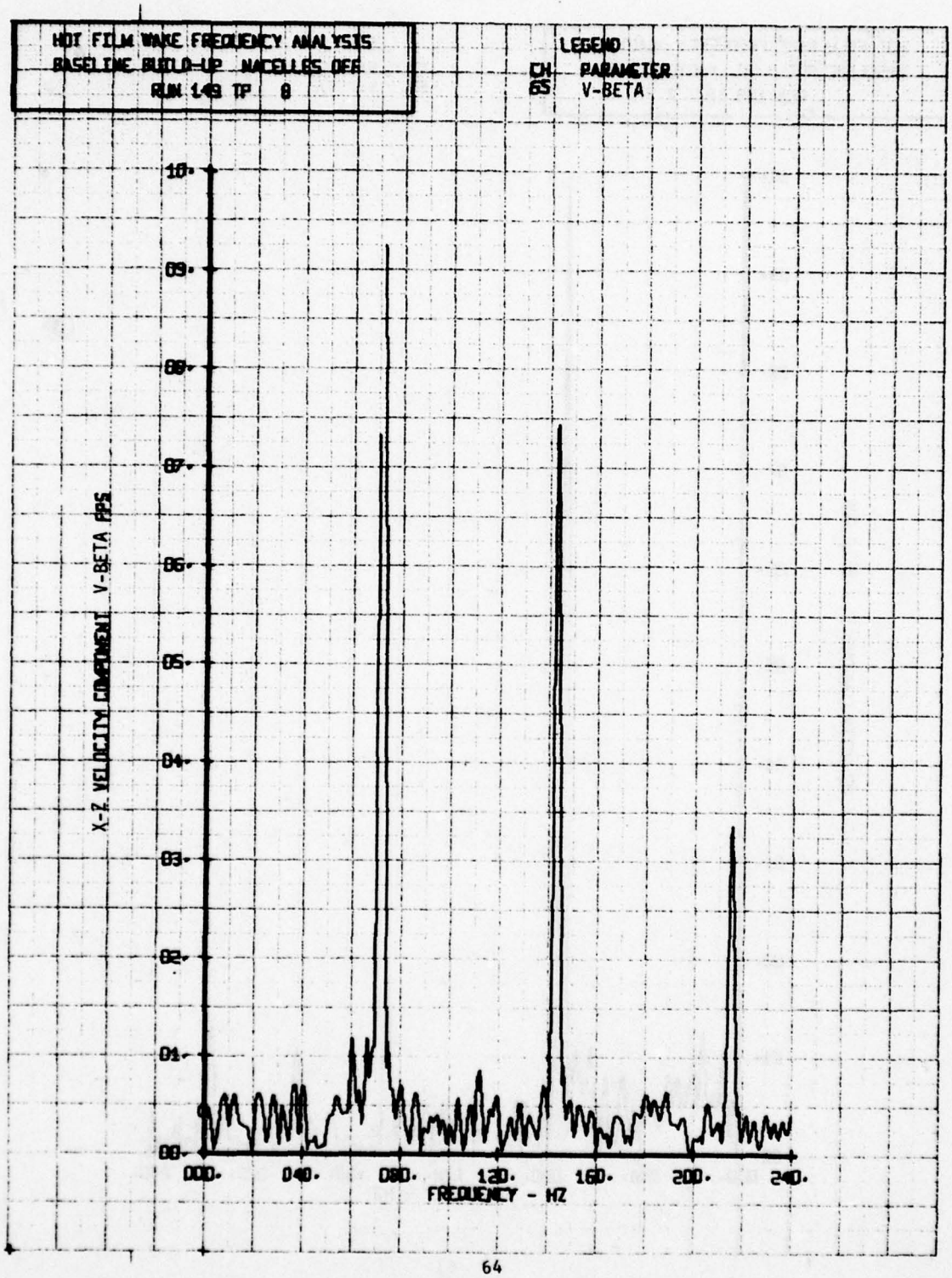

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 3
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

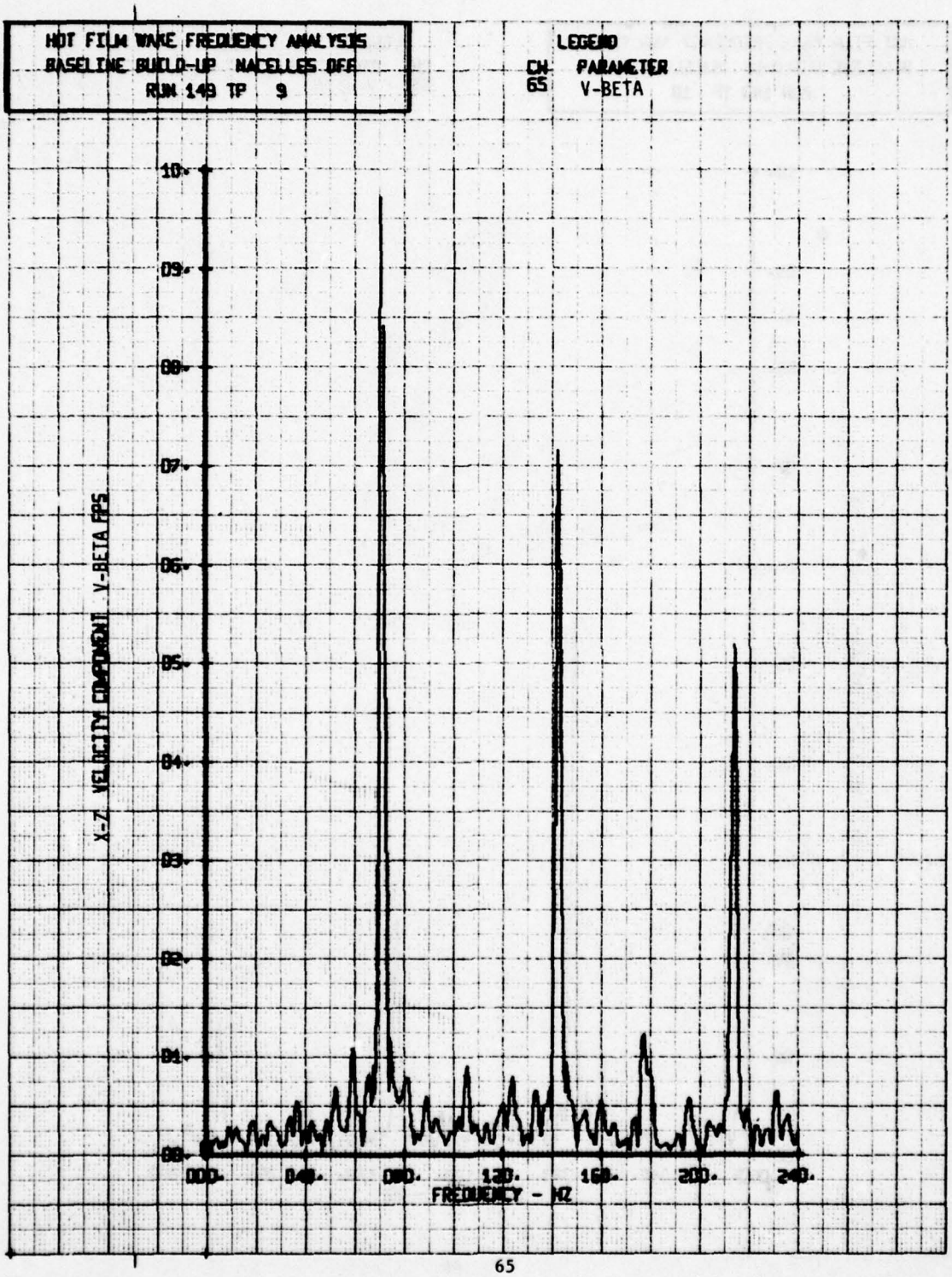

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES DEF
RUN 149 TP 4
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

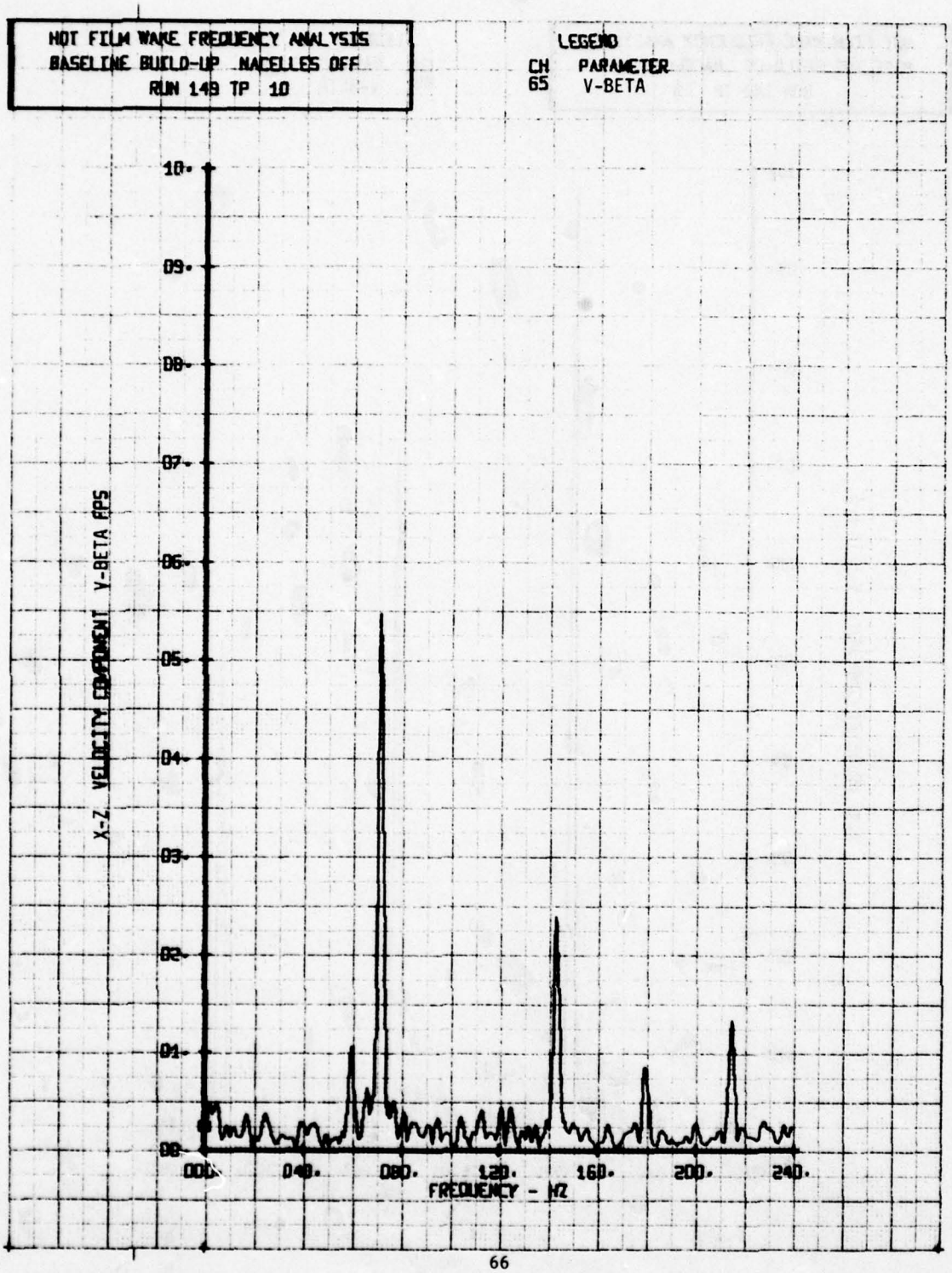

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 5
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
V-BETA RMS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

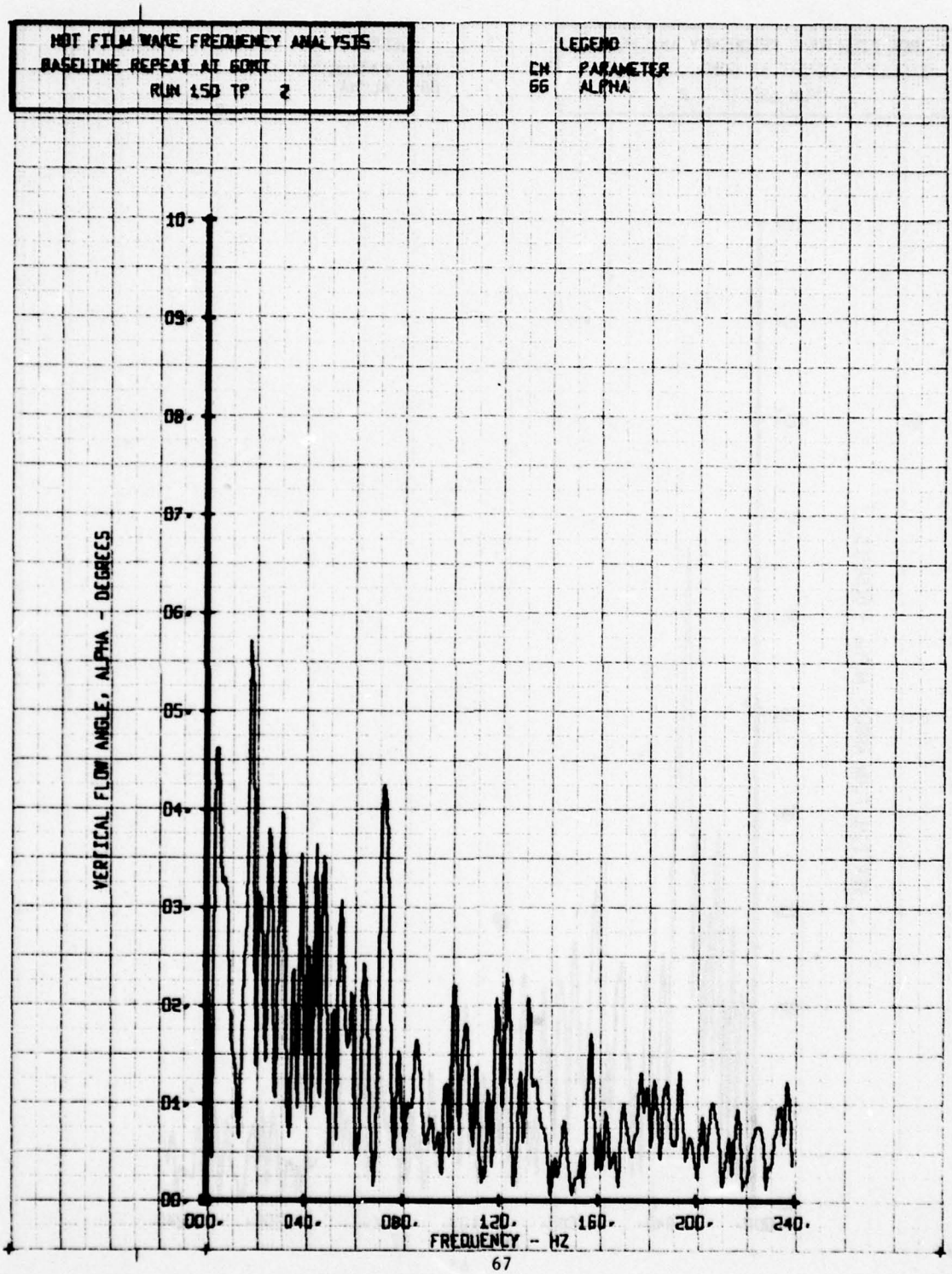

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 6
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

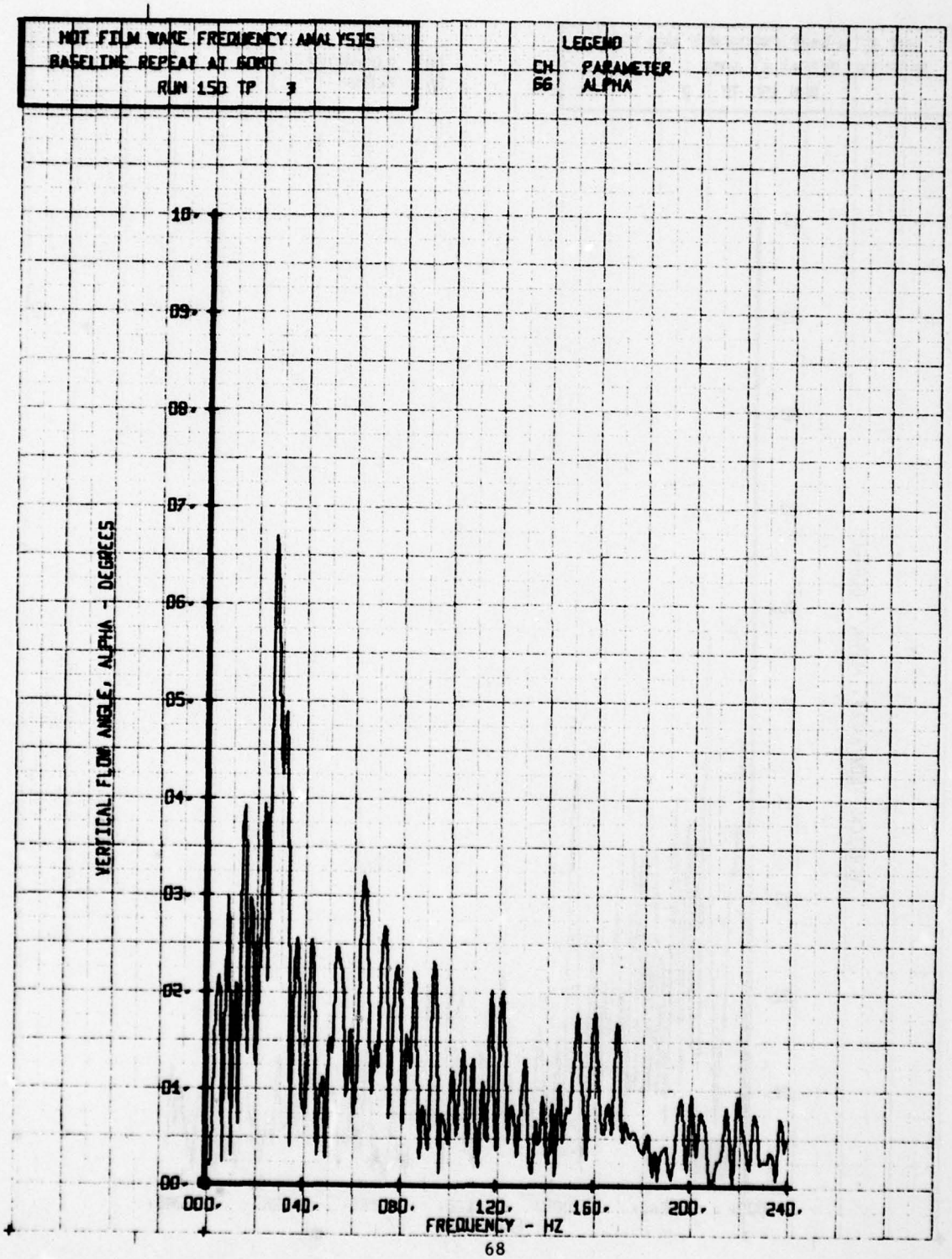

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES DEP
RUN 149 TP 7
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

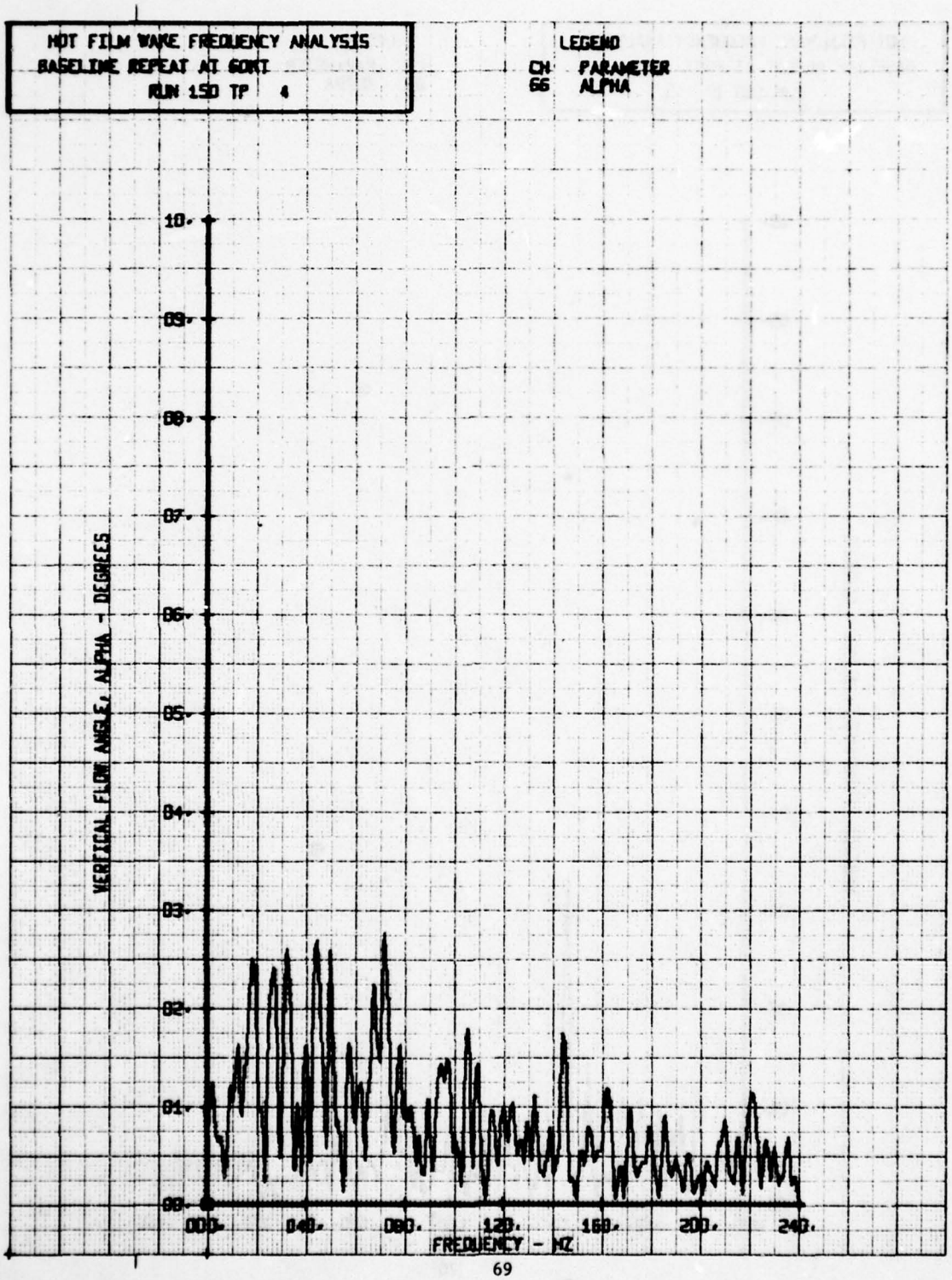

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 8
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

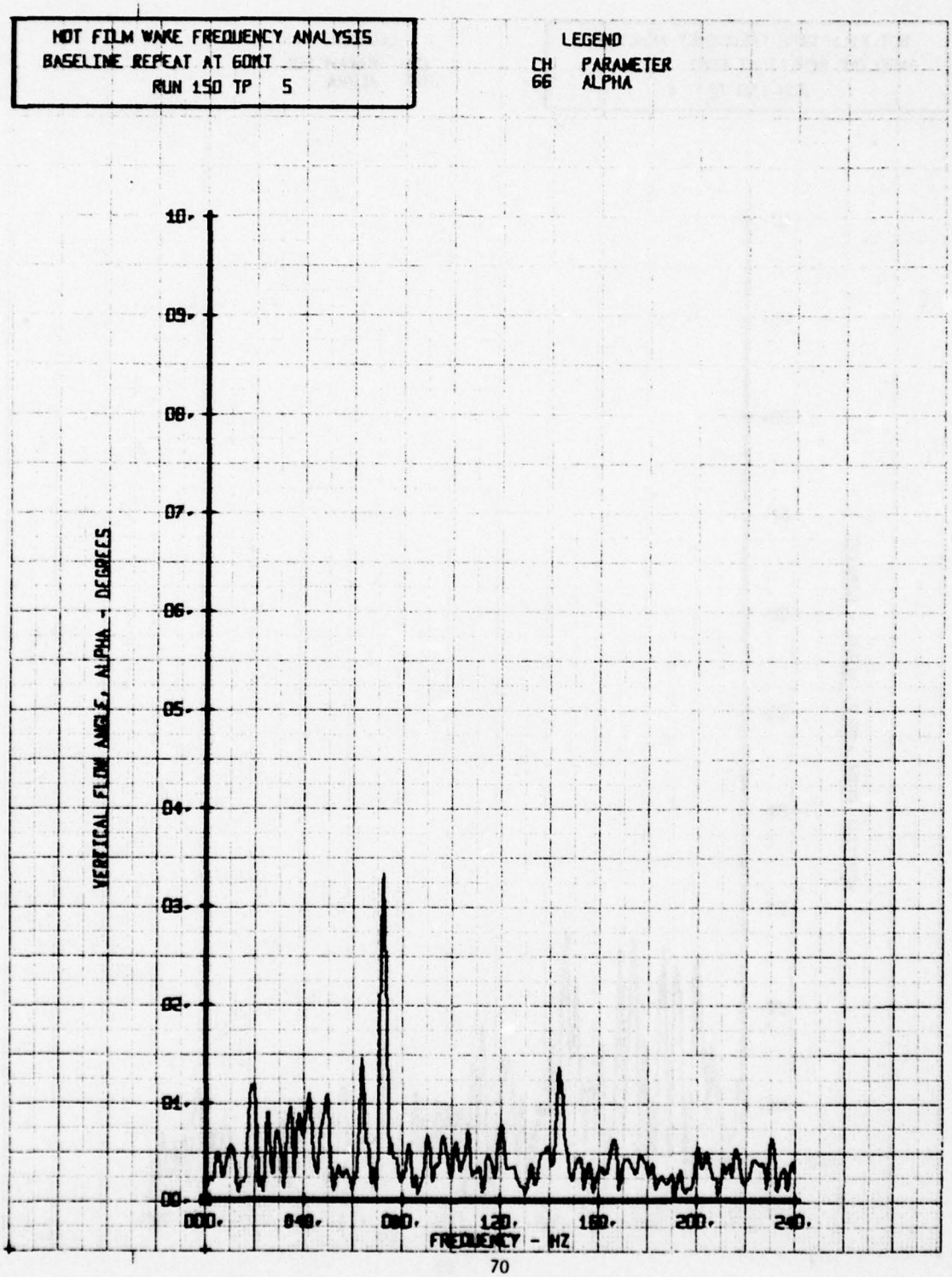

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 9
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

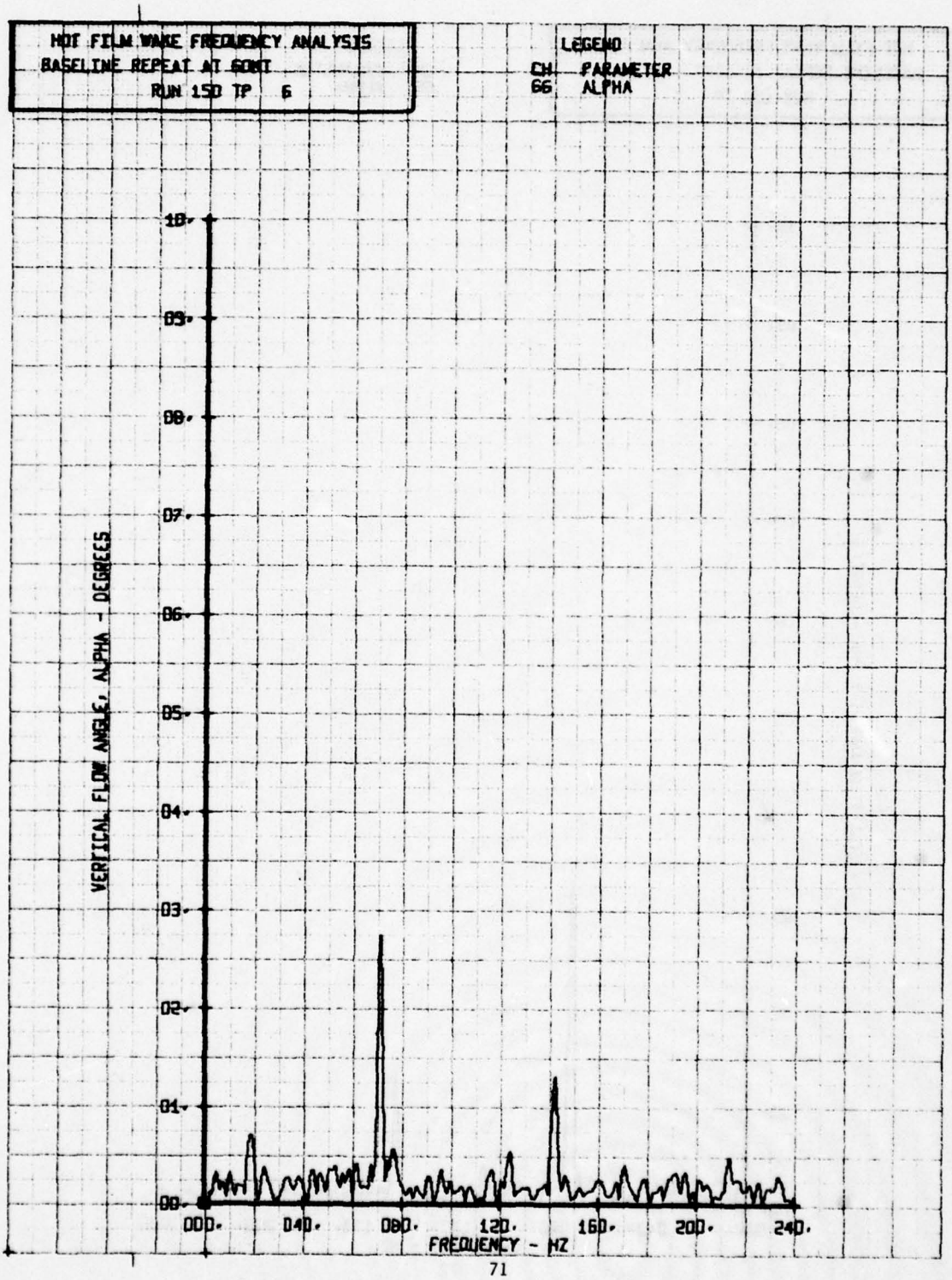

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BUILD-UP NACELLES OFF
RUN 149 TP 10
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

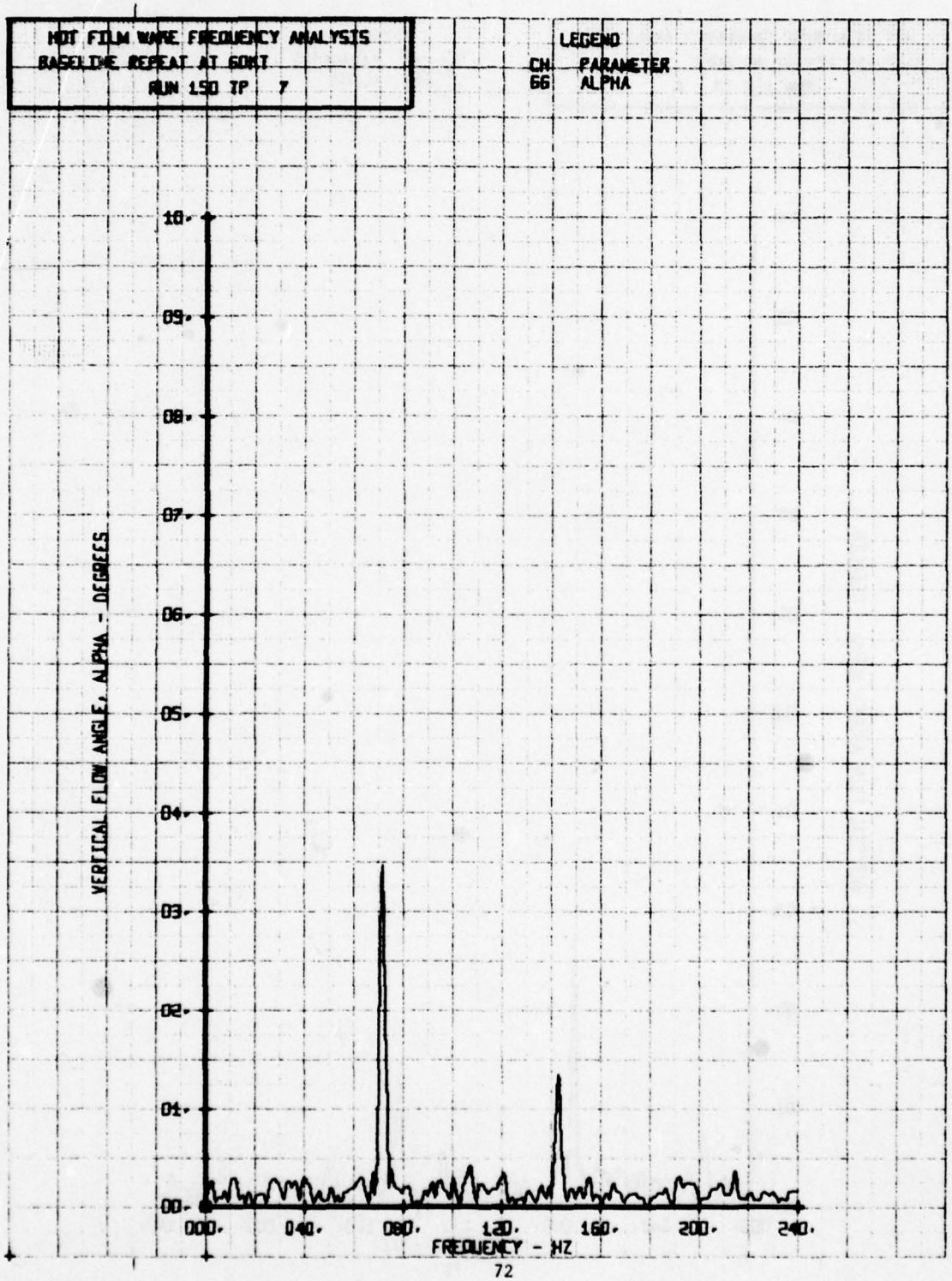

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 2
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

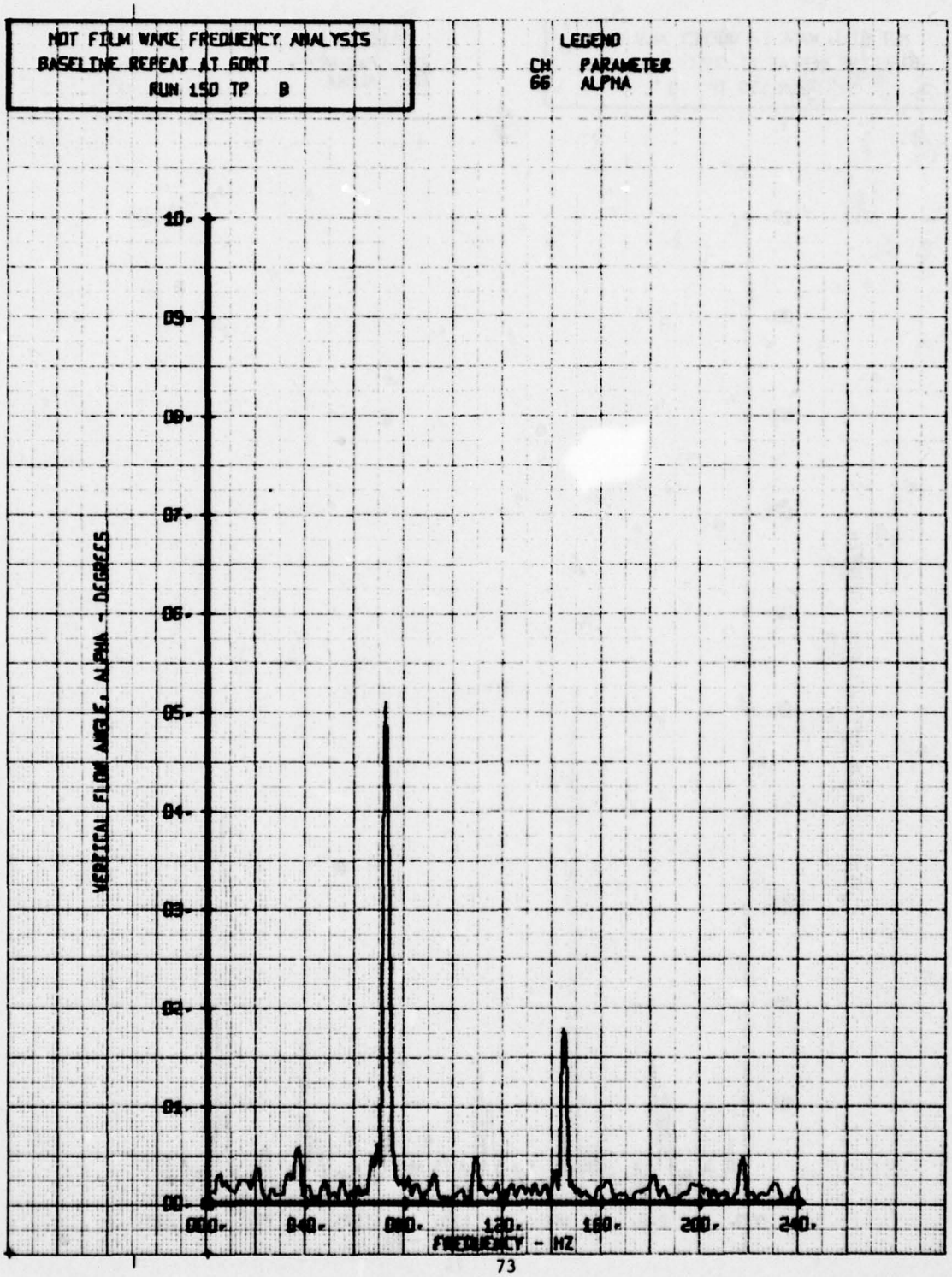

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 3
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

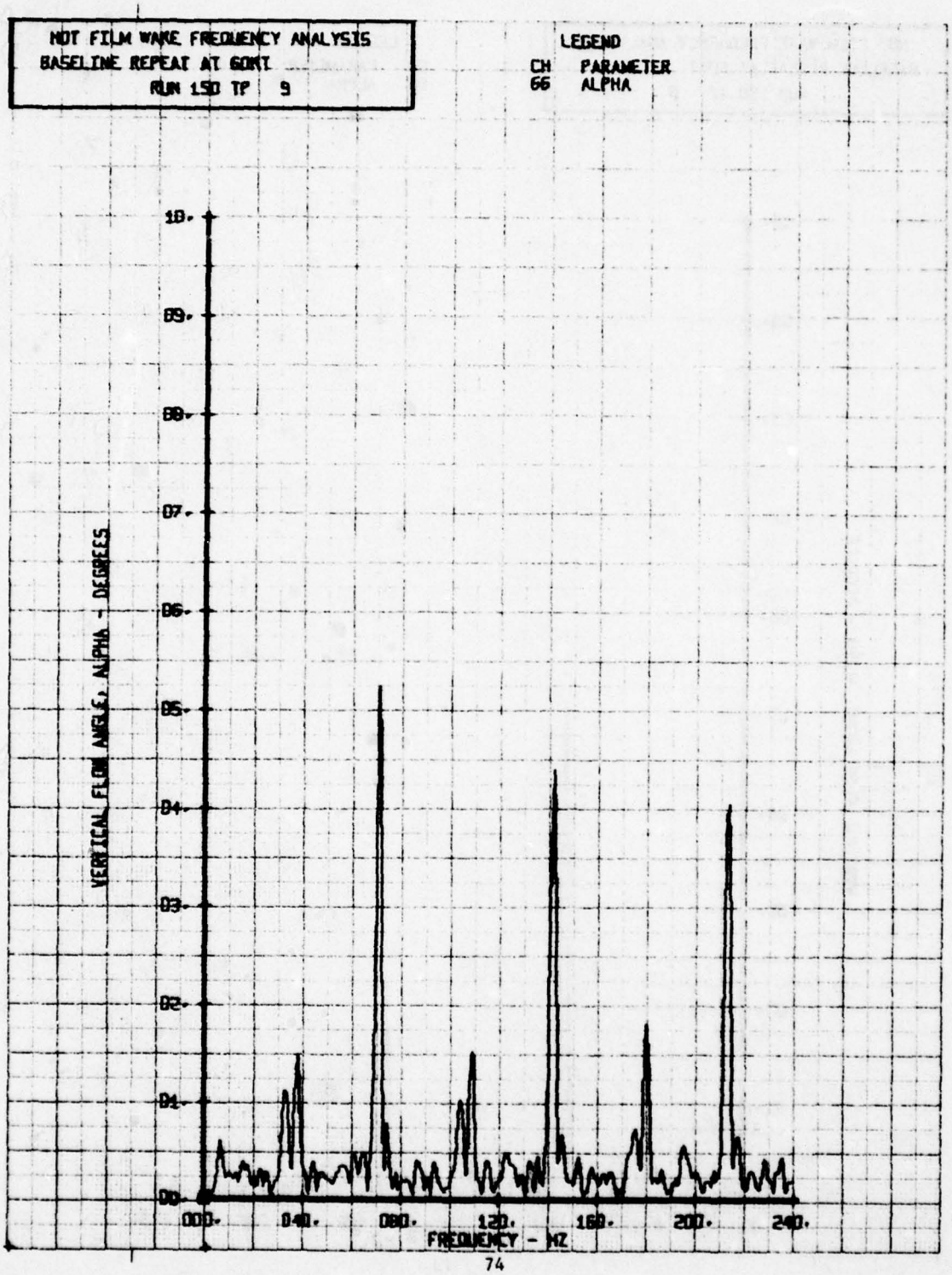

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 4
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

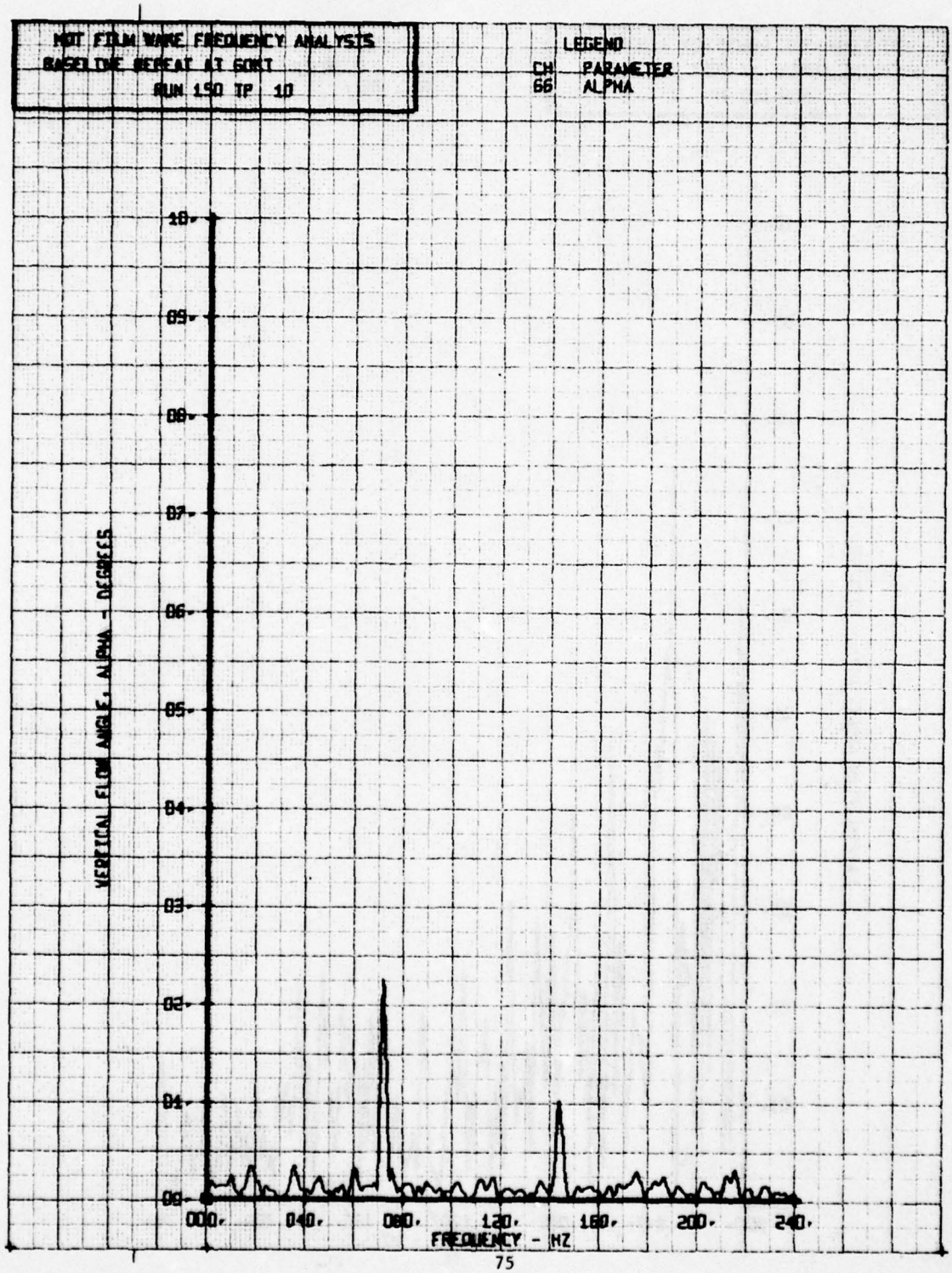

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 5
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

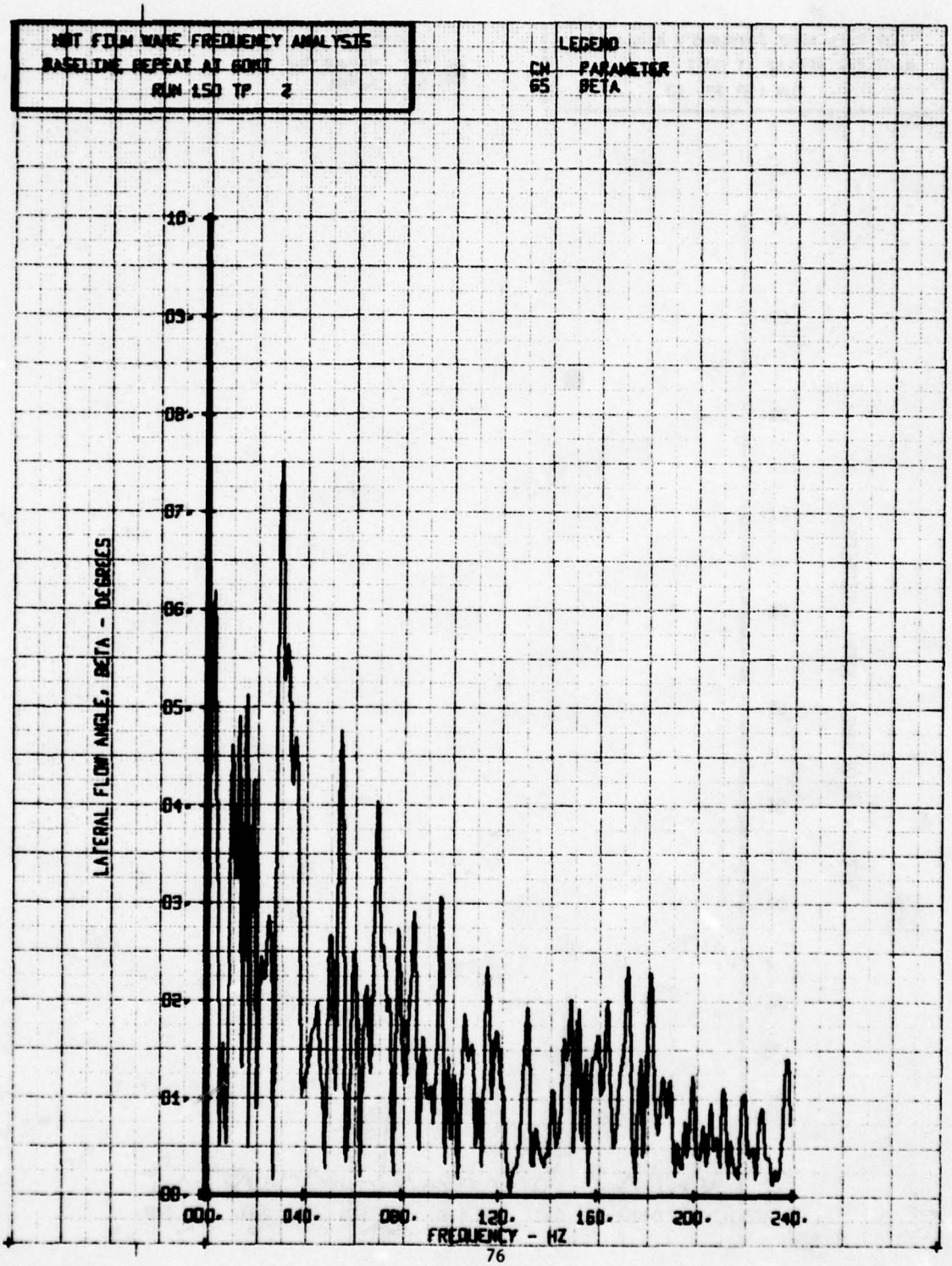

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

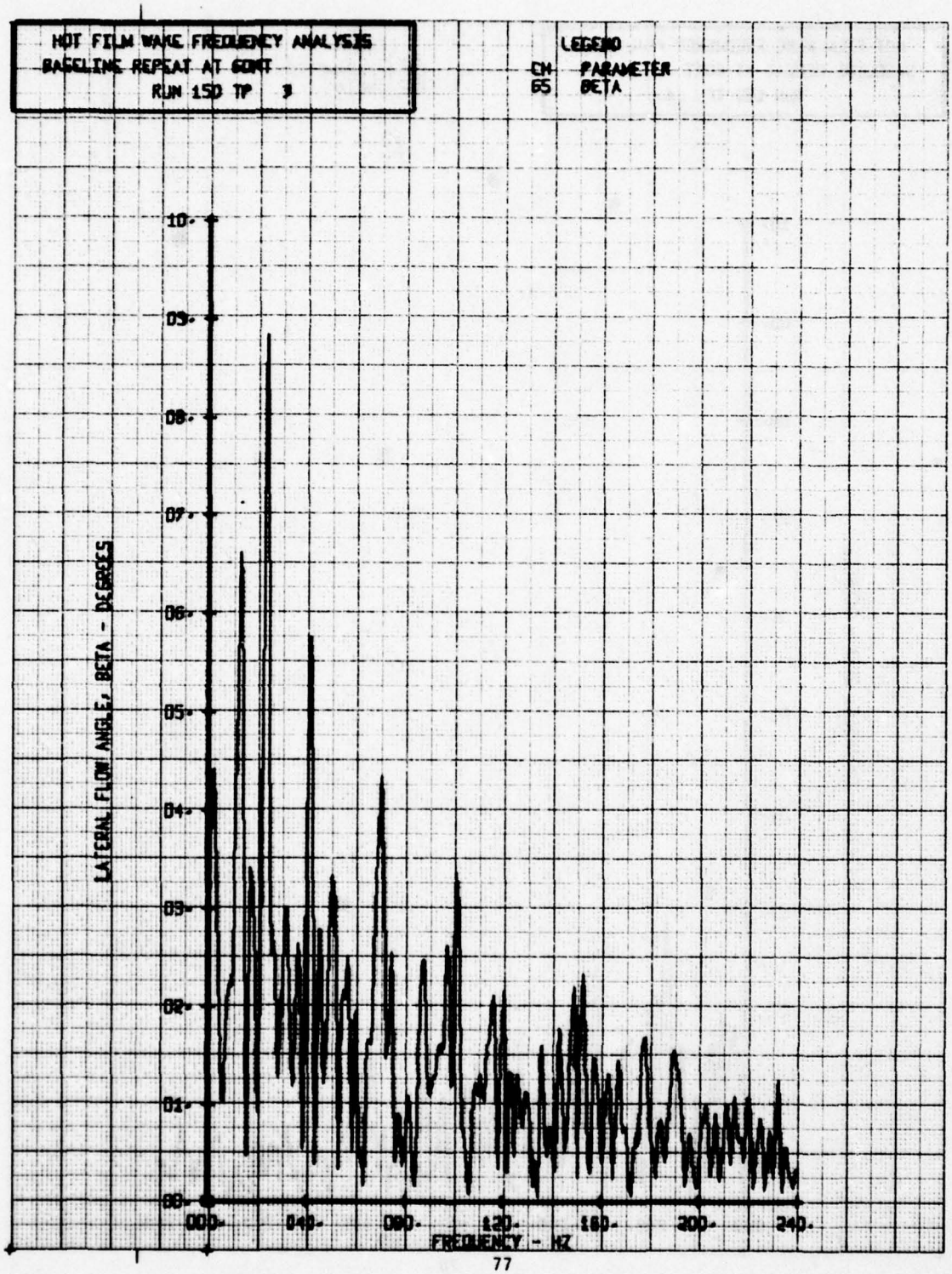

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 7
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

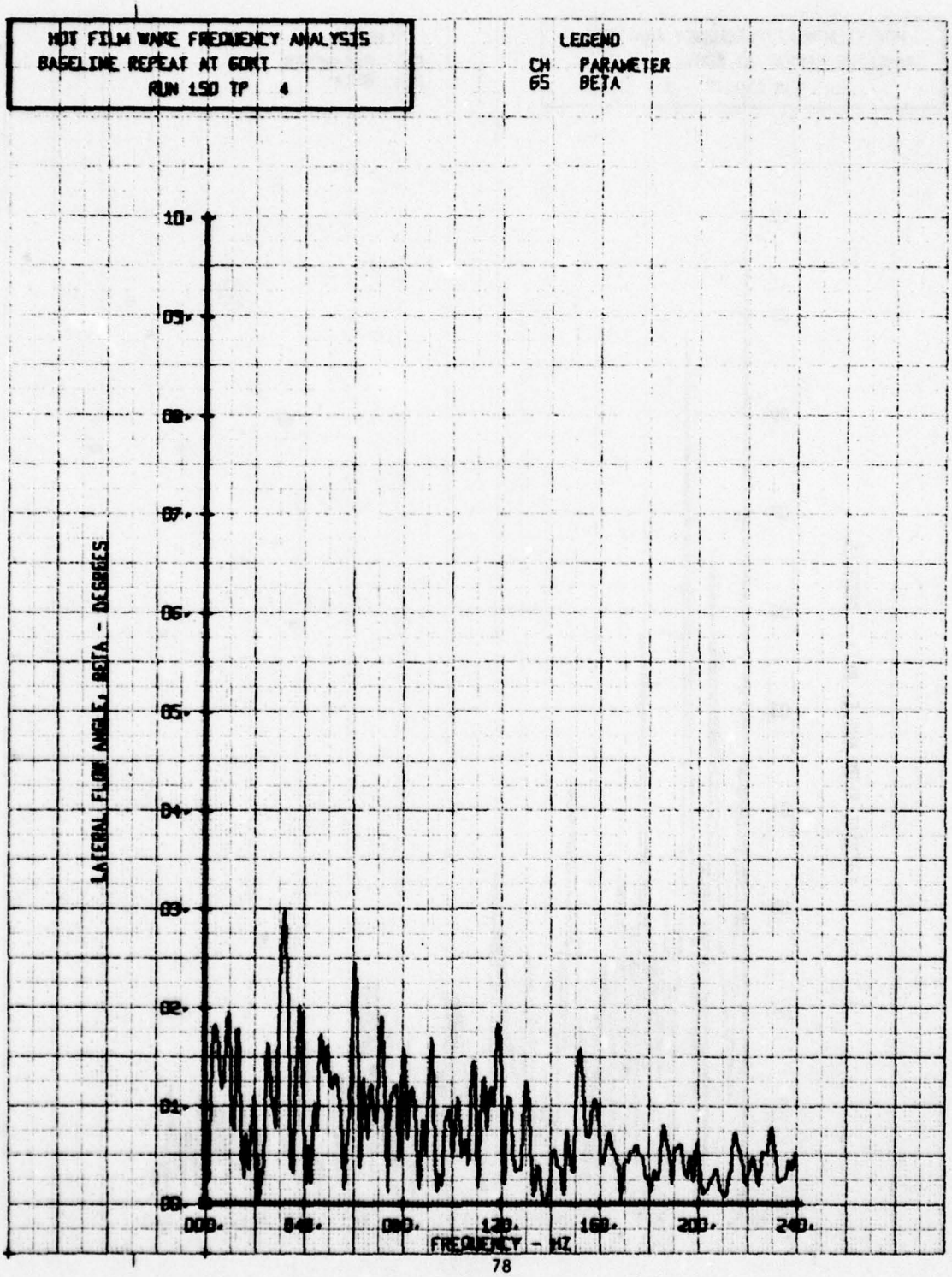

MDT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP B
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

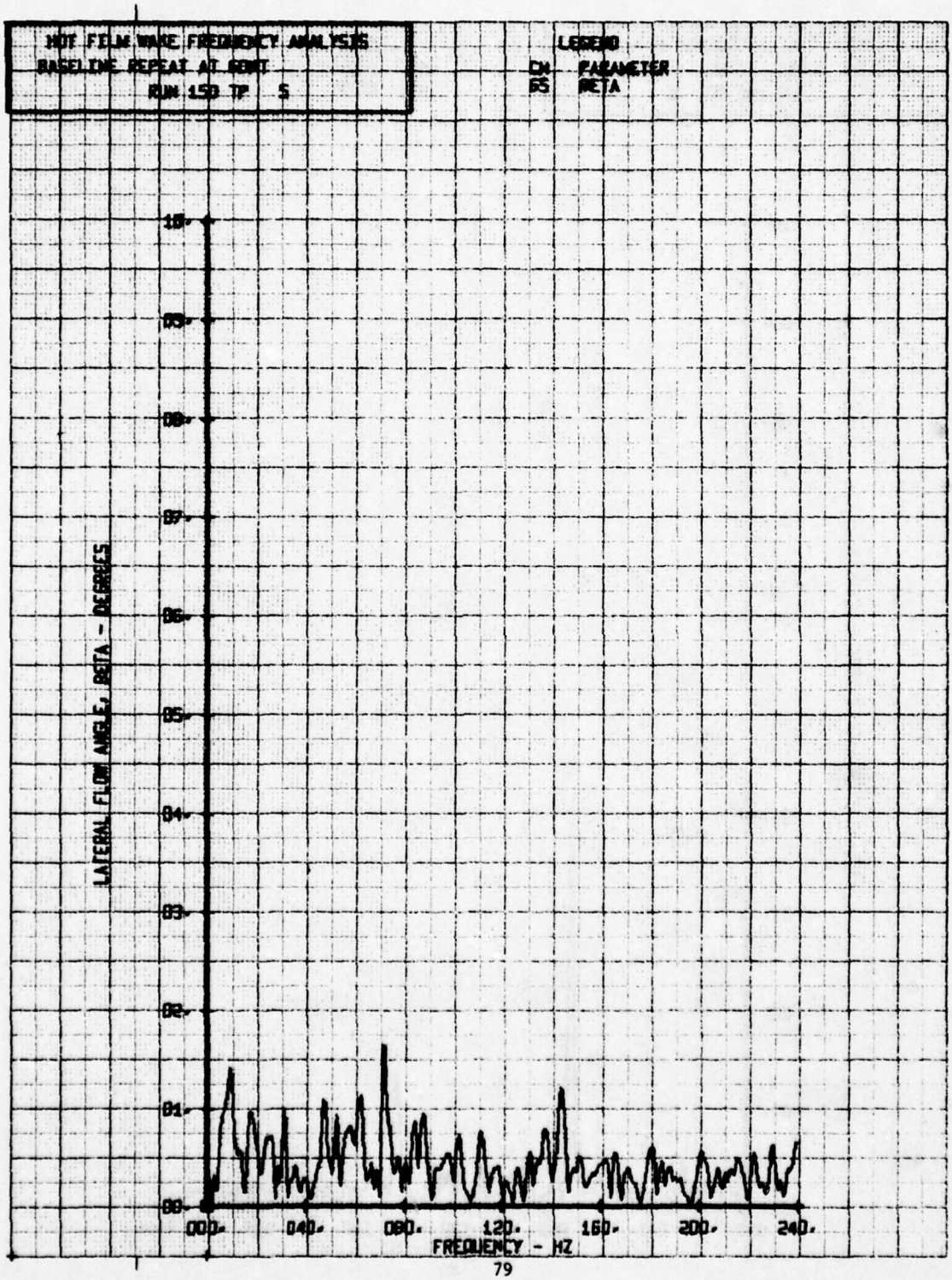

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

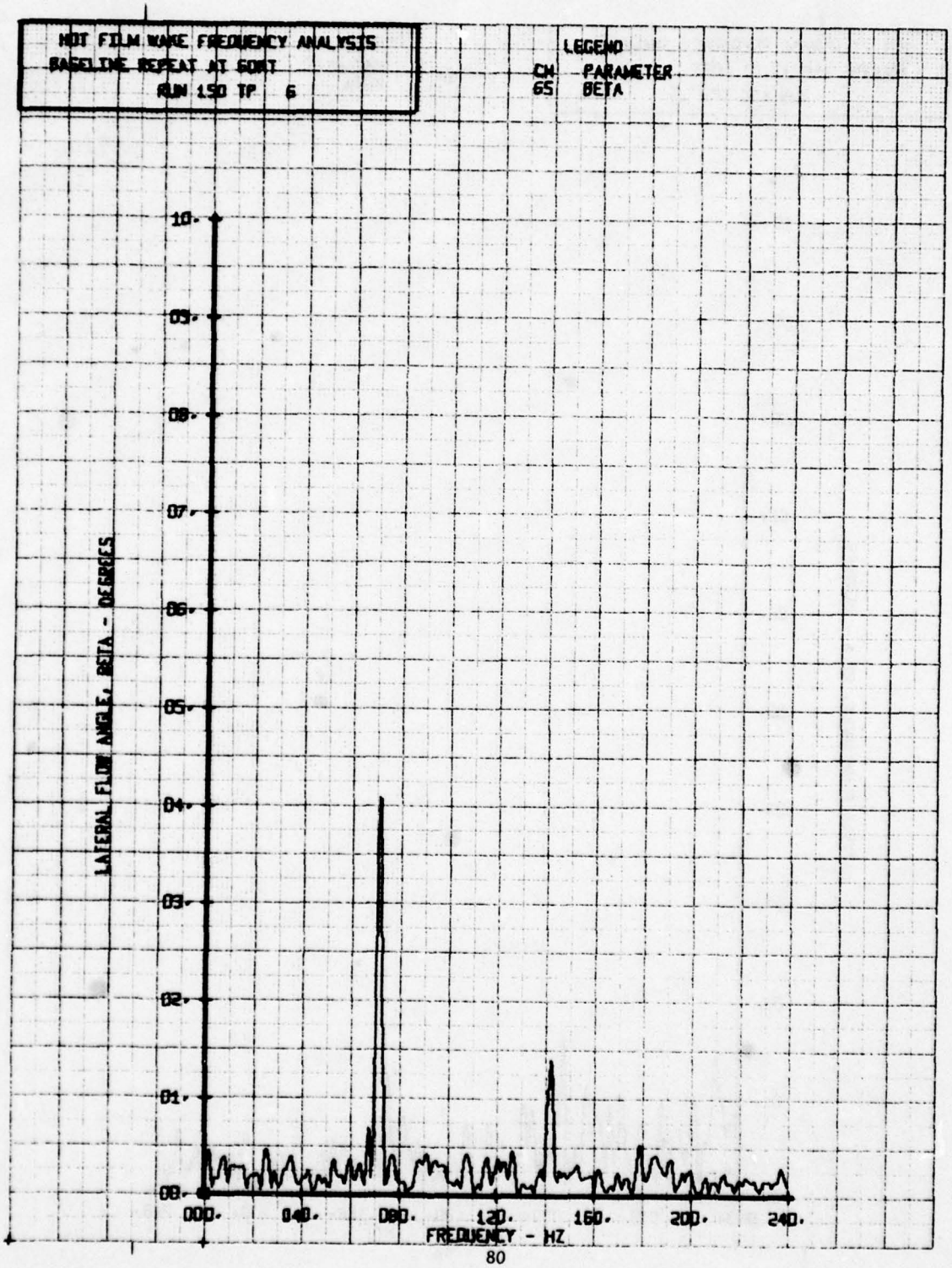

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 10
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

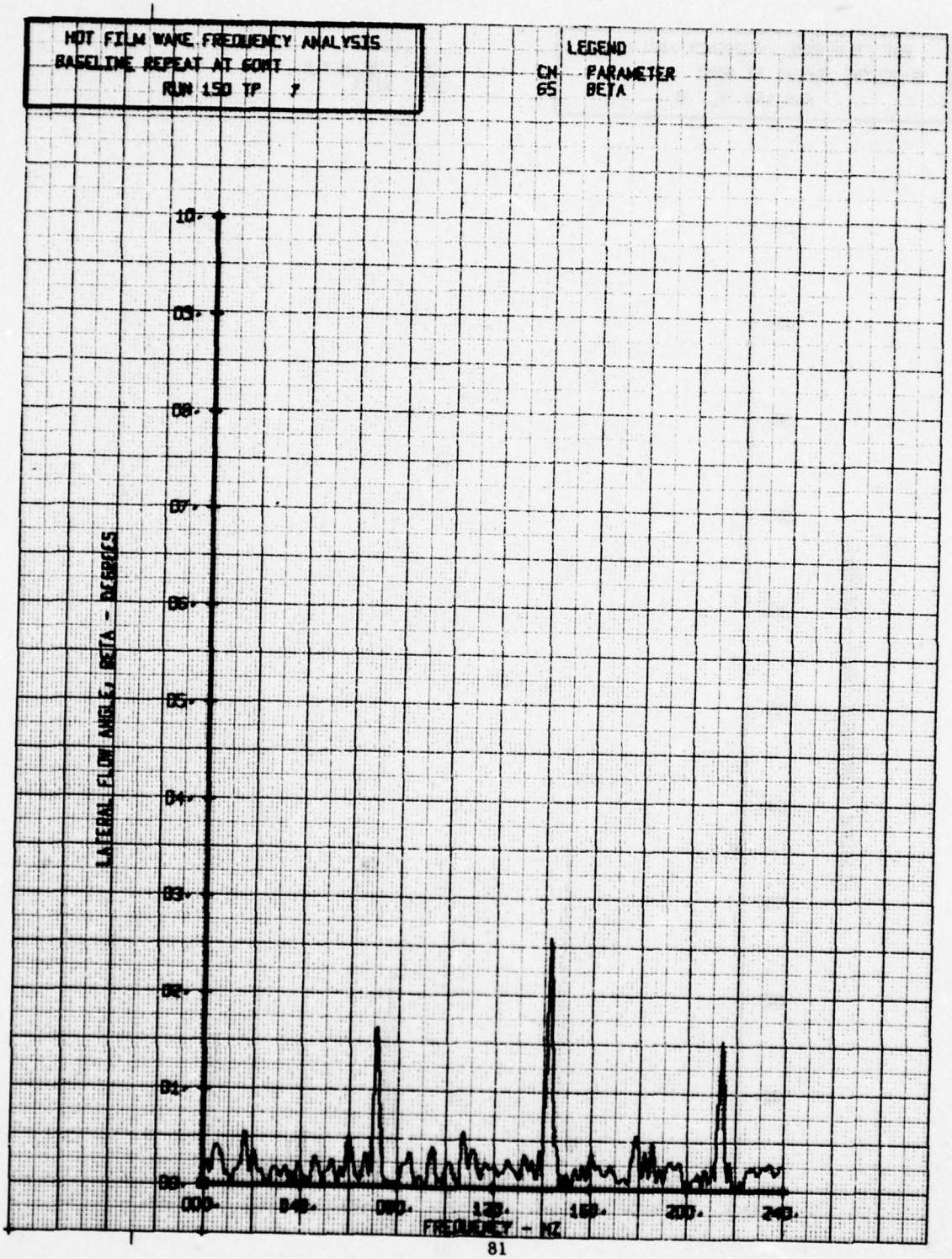

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 80KT
RUN 150 TP 2
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

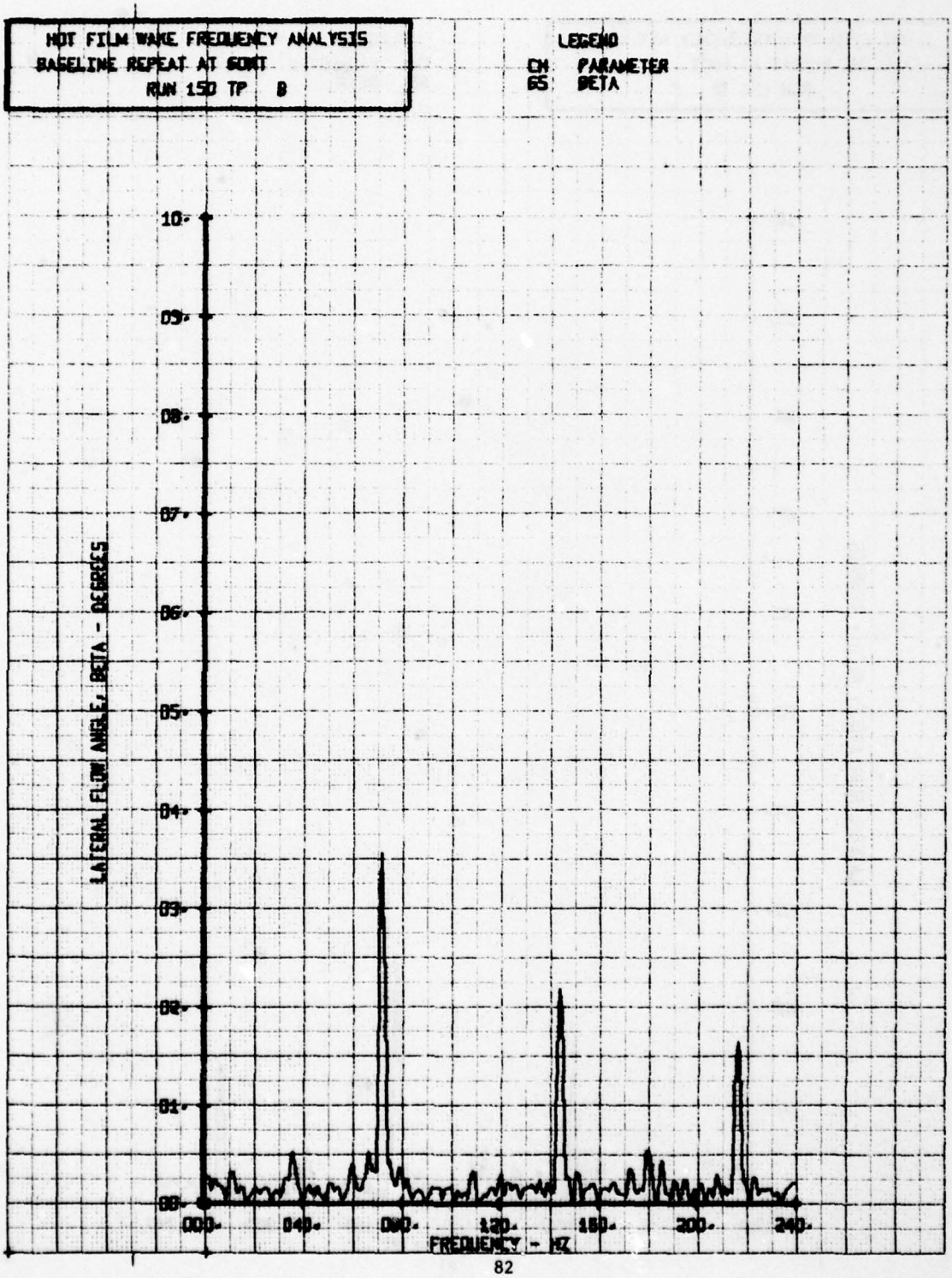

HOT FILM WAKE FREQUENCY ANALYSIS
BAFFLING REPEAT AT 60KT
RUN 150 TP 3
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

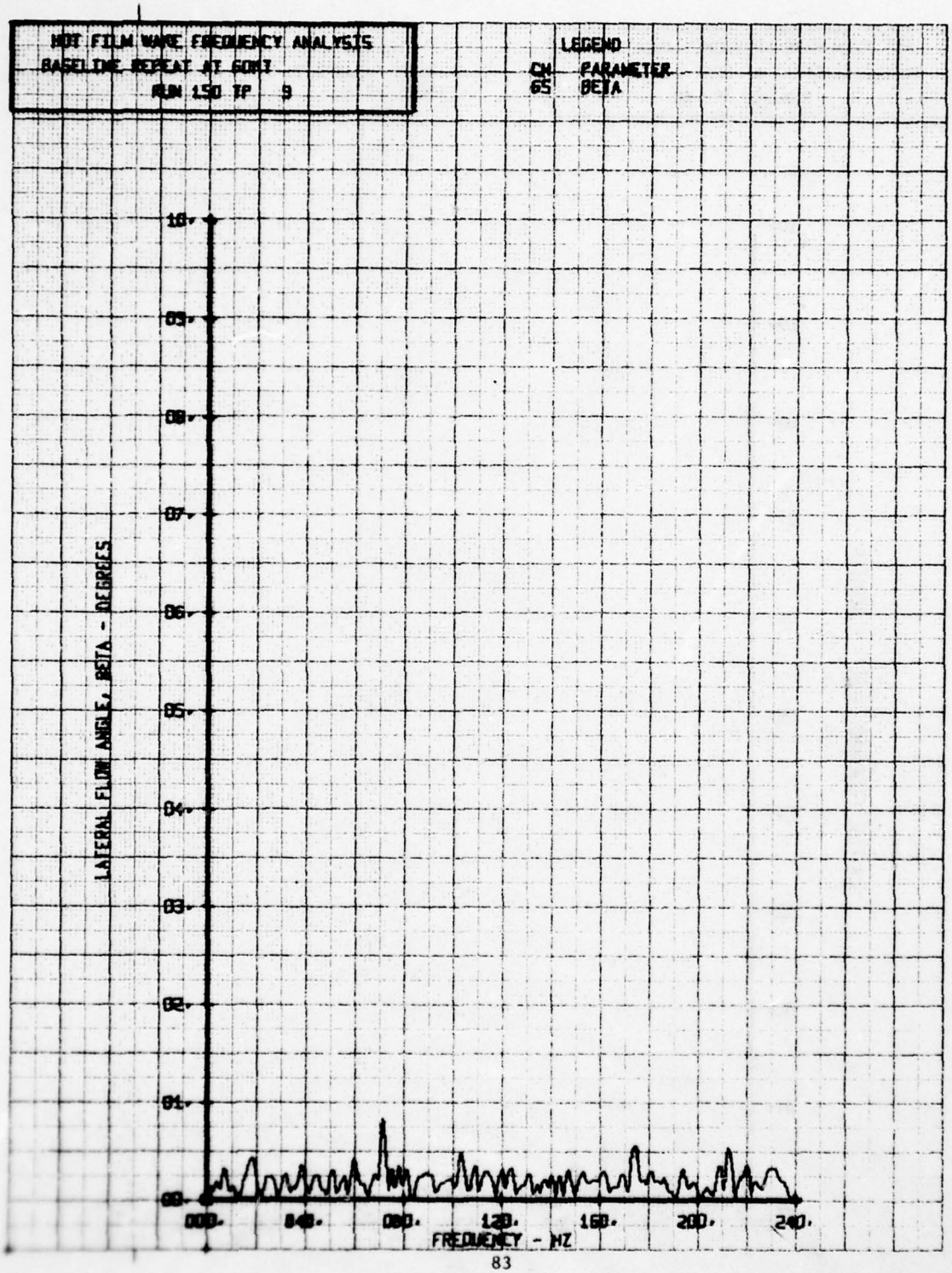

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT GOAT
RUN 150 TP 4
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

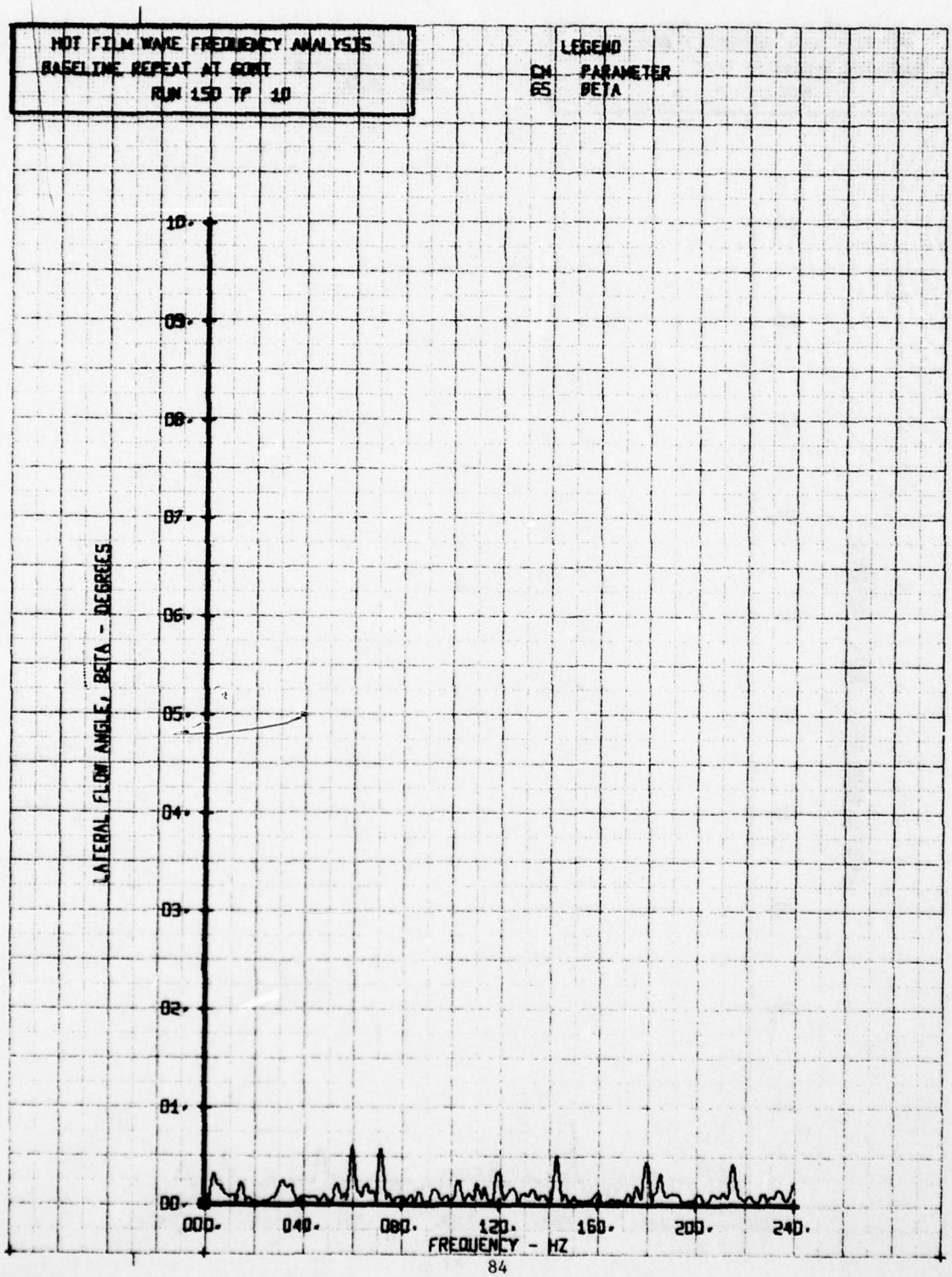

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT RBMT
RUN 150 TP 5
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
05.
00.
97.
96.
95.
94.
93.
92.
91.
90.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

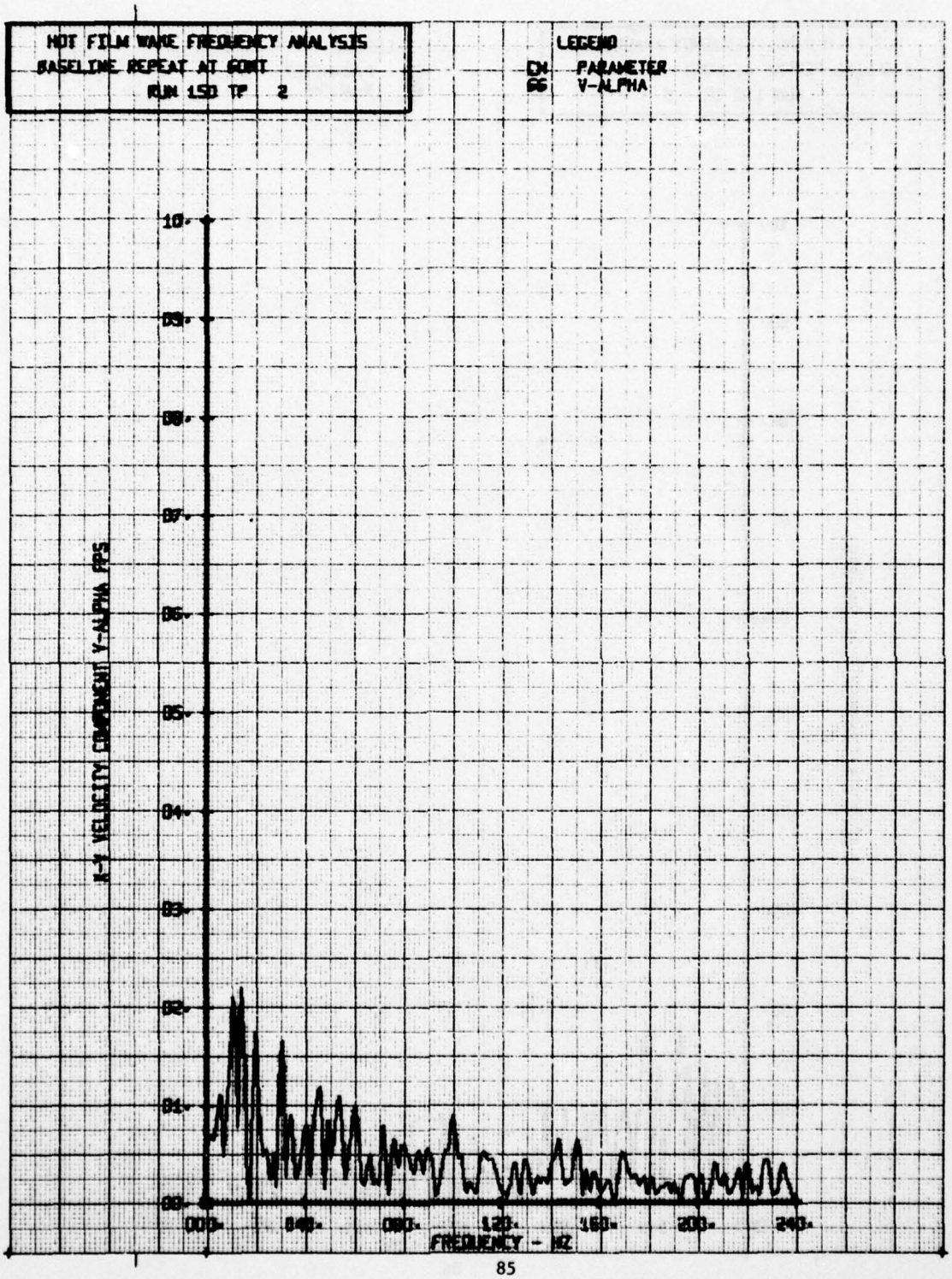

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

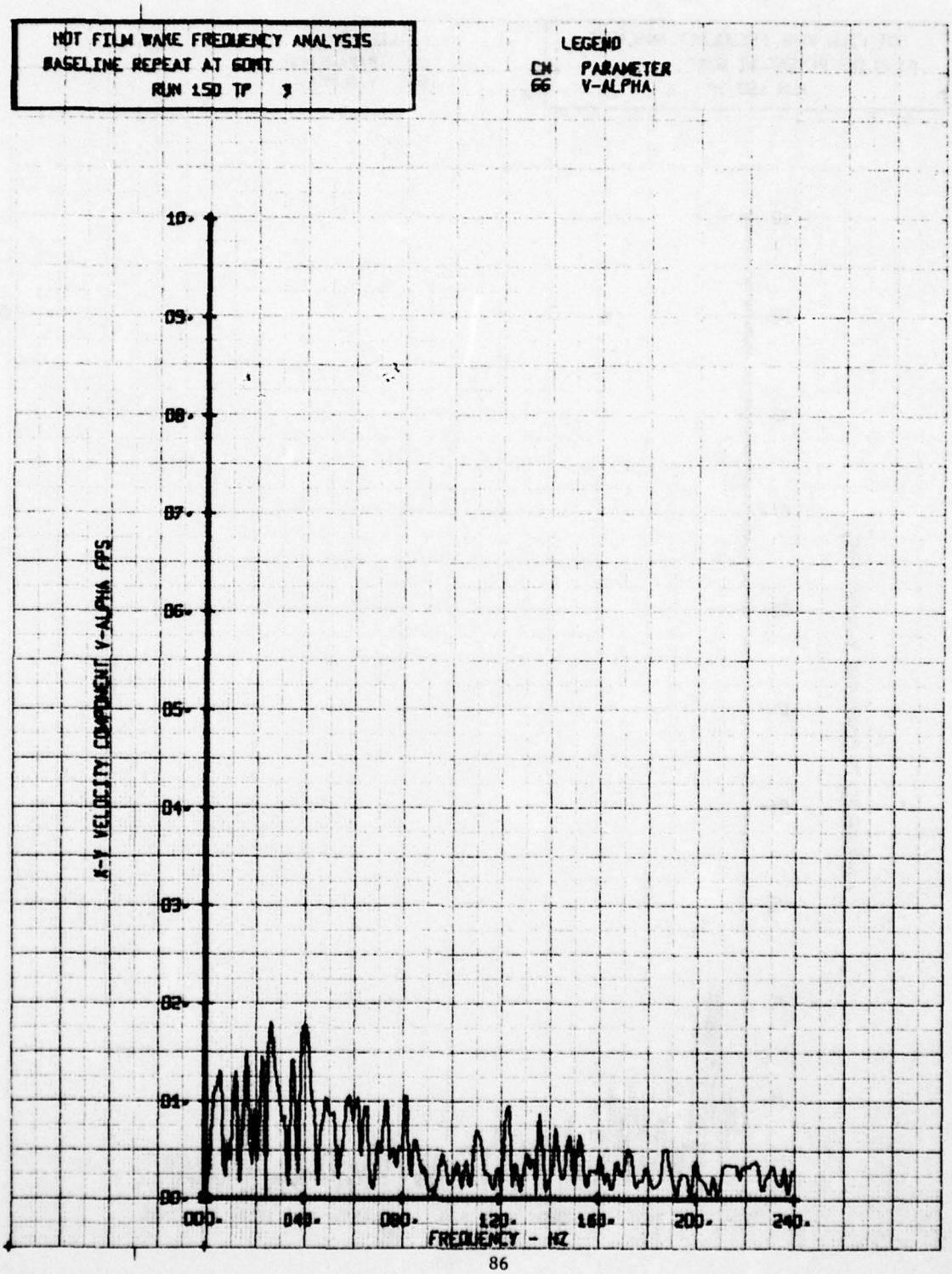

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT GOHT
RUN 150 TP 7
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
FREQUENCY - HZ

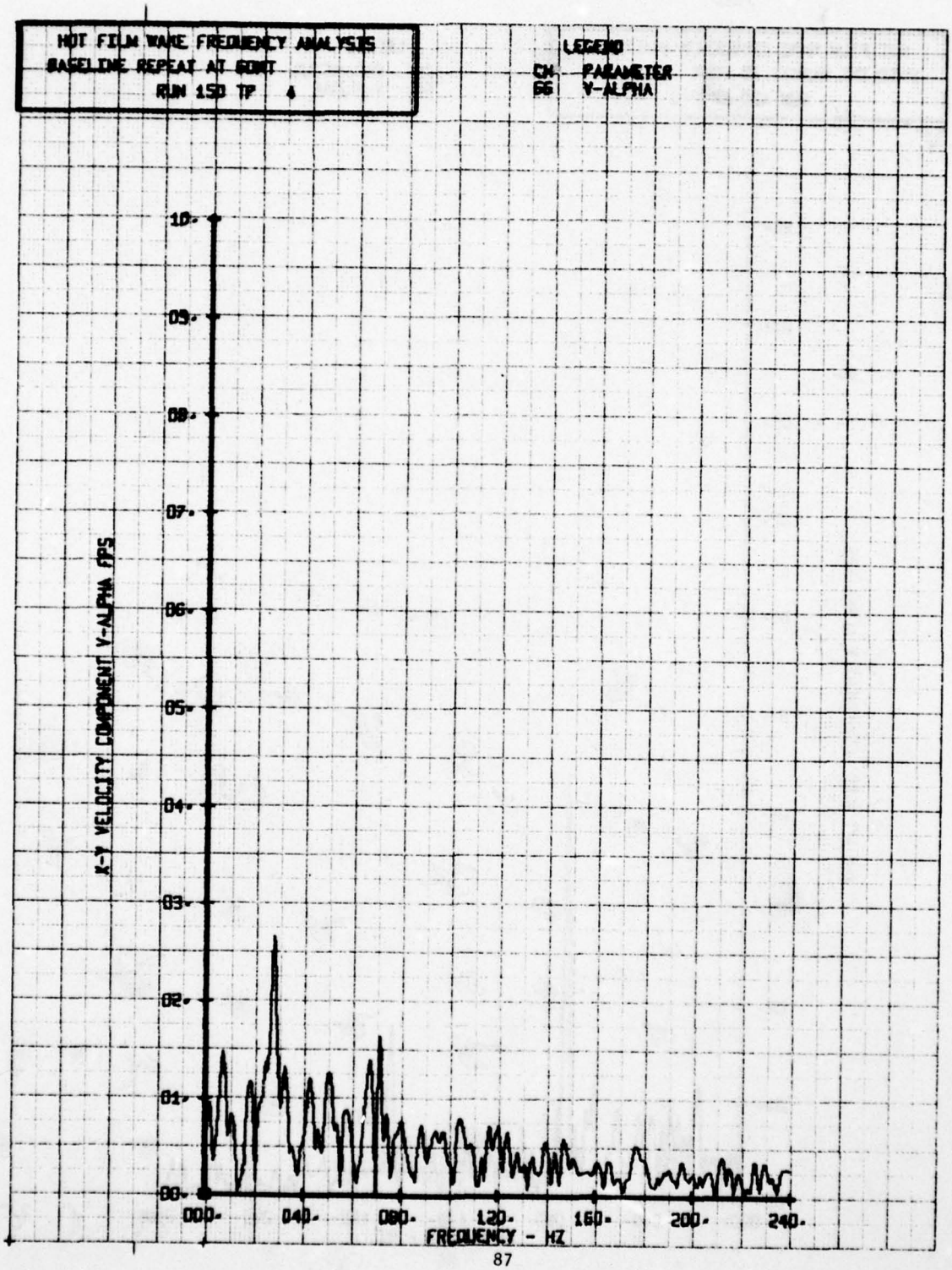

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 8
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

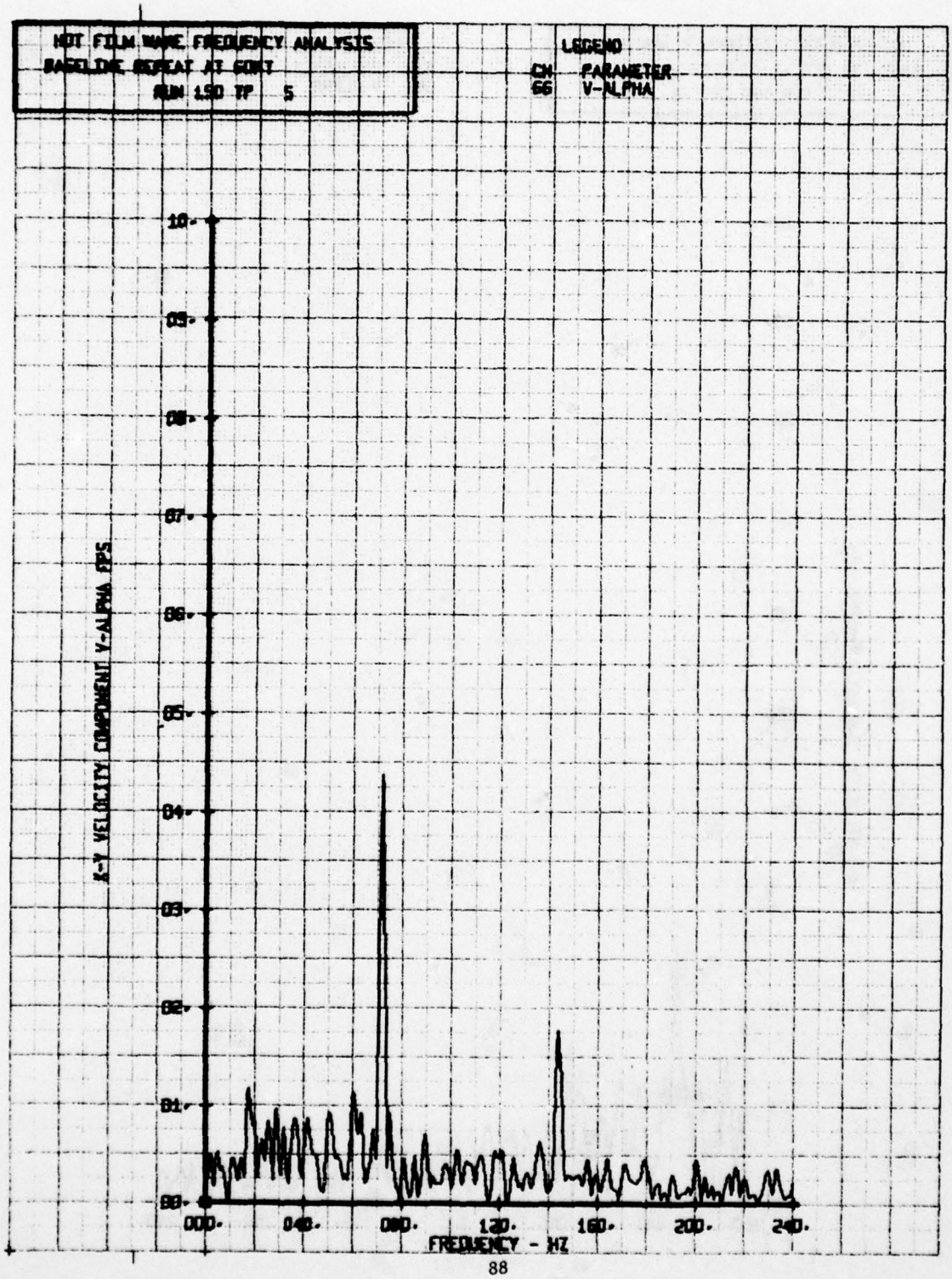

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

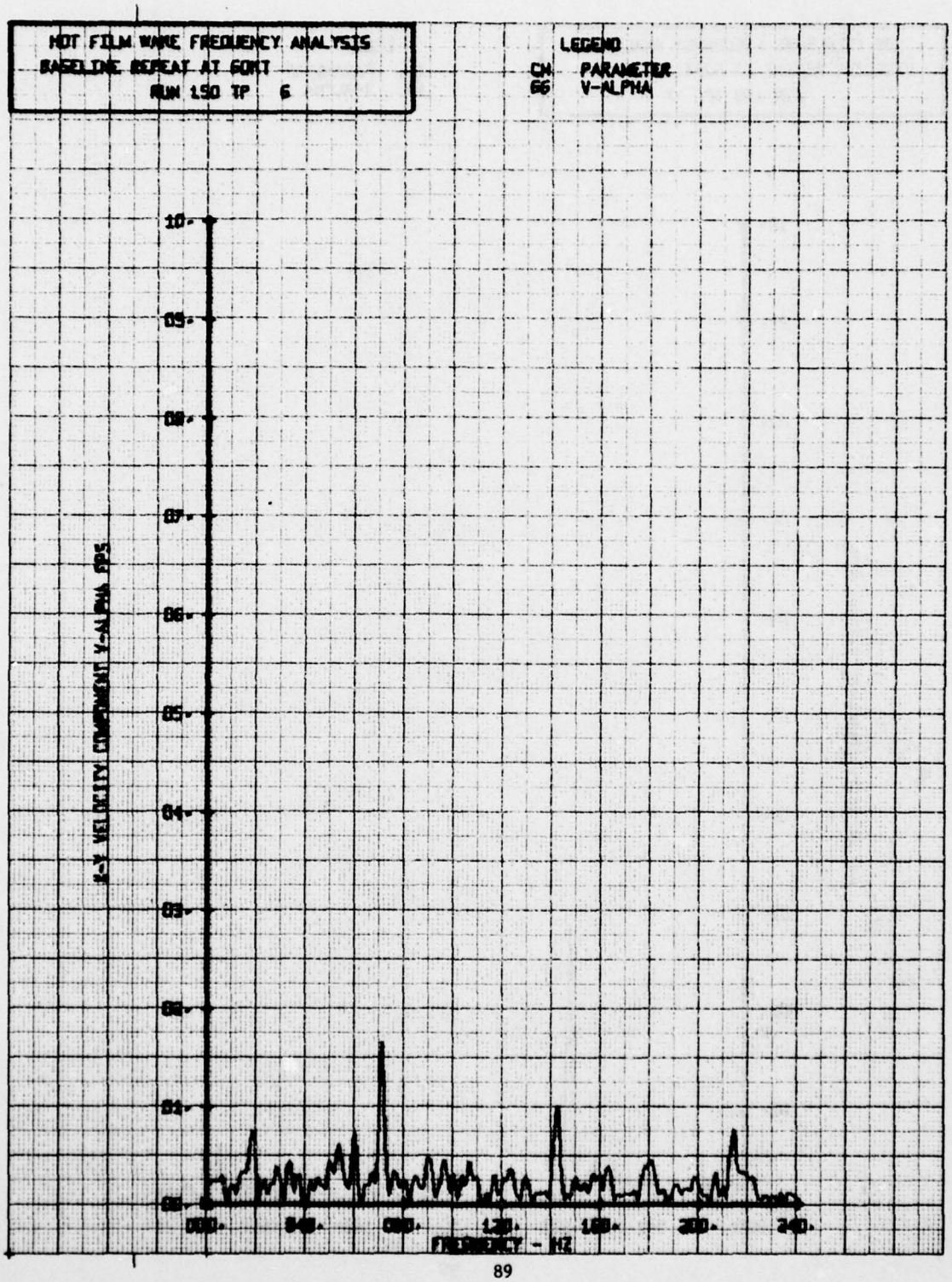

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT GORT
RUN 150 TP 10
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

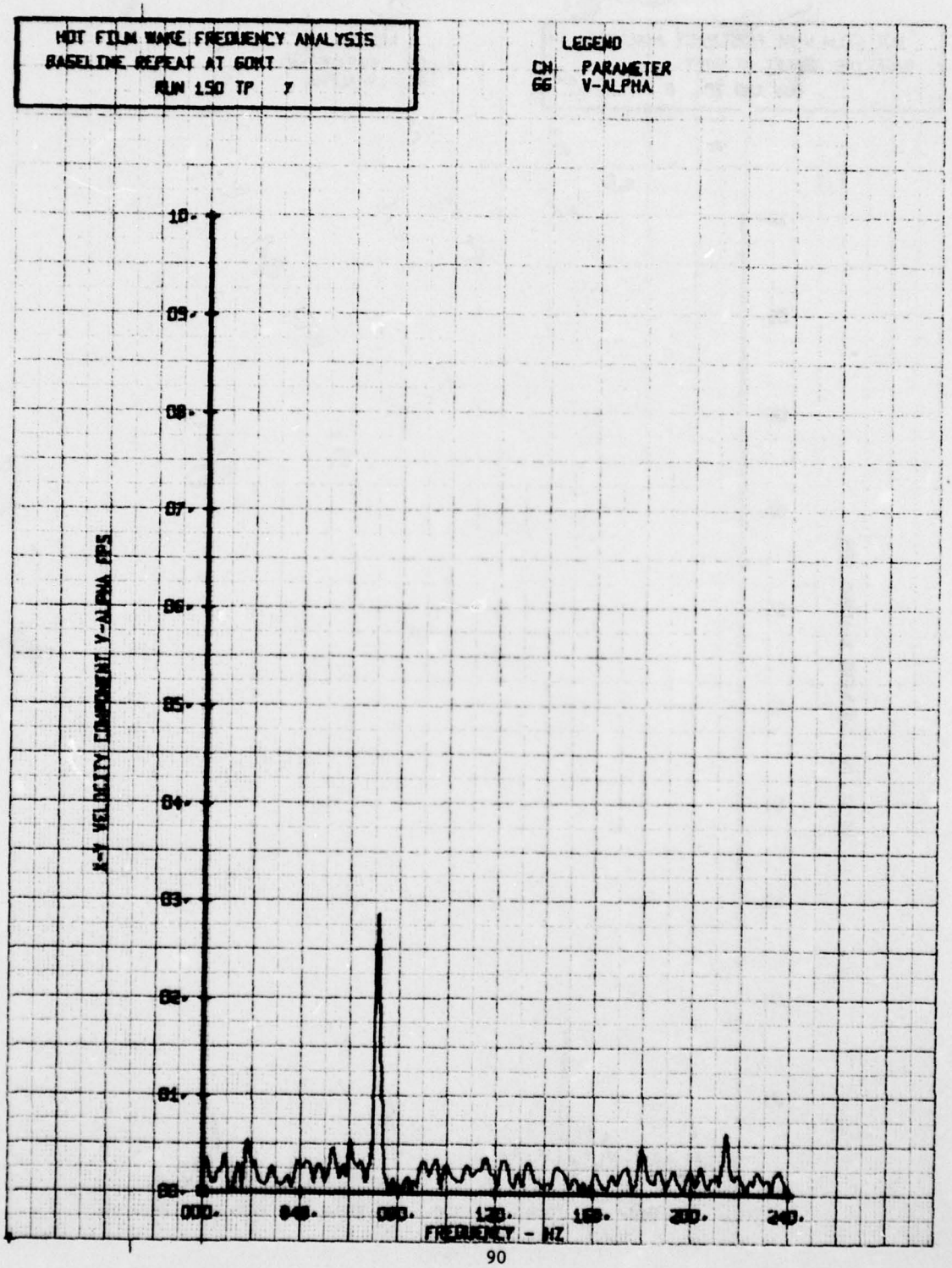

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT GONT
RUN 150 TP 2
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

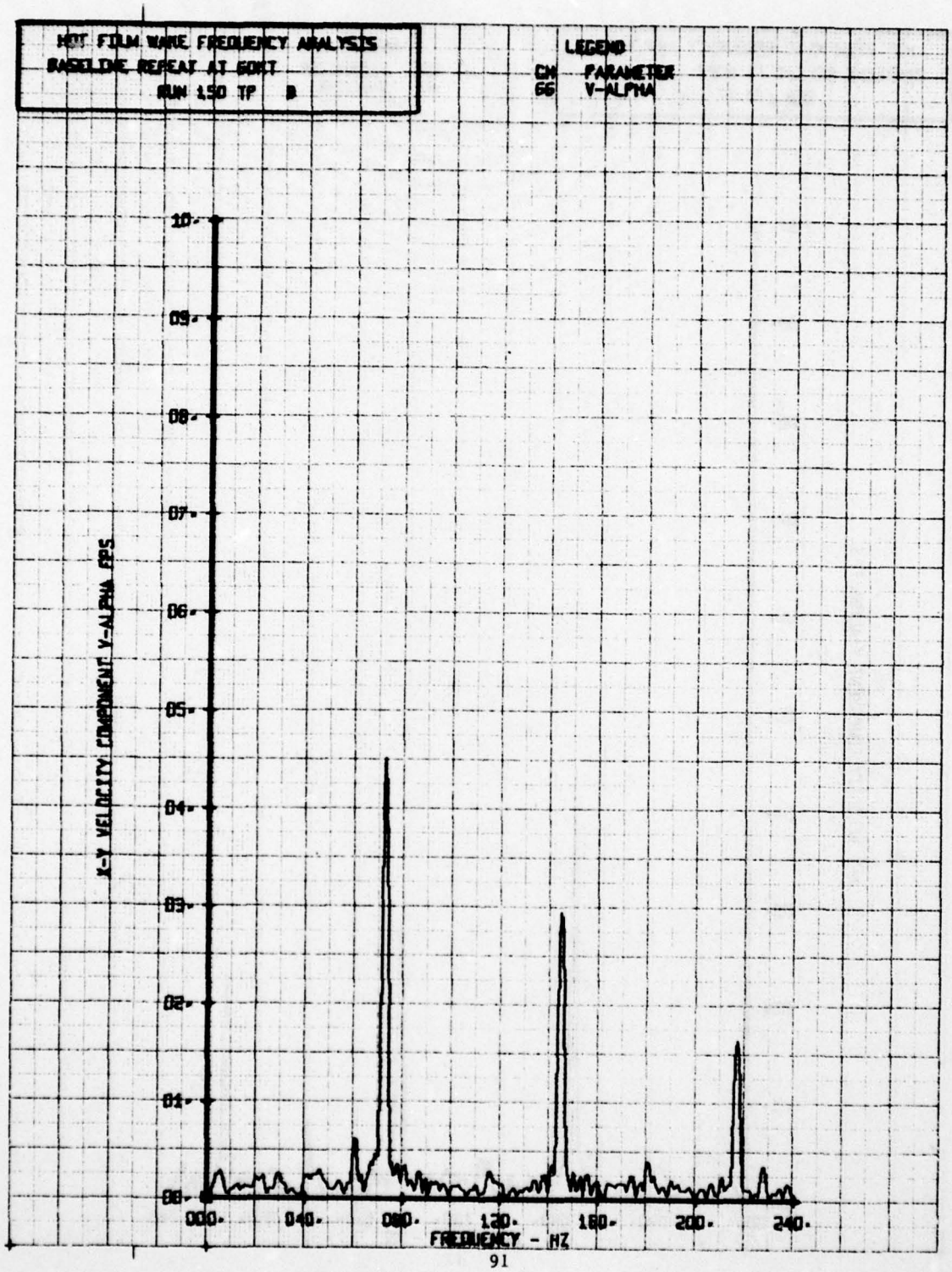

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60HT
RUN 150 TP 3
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

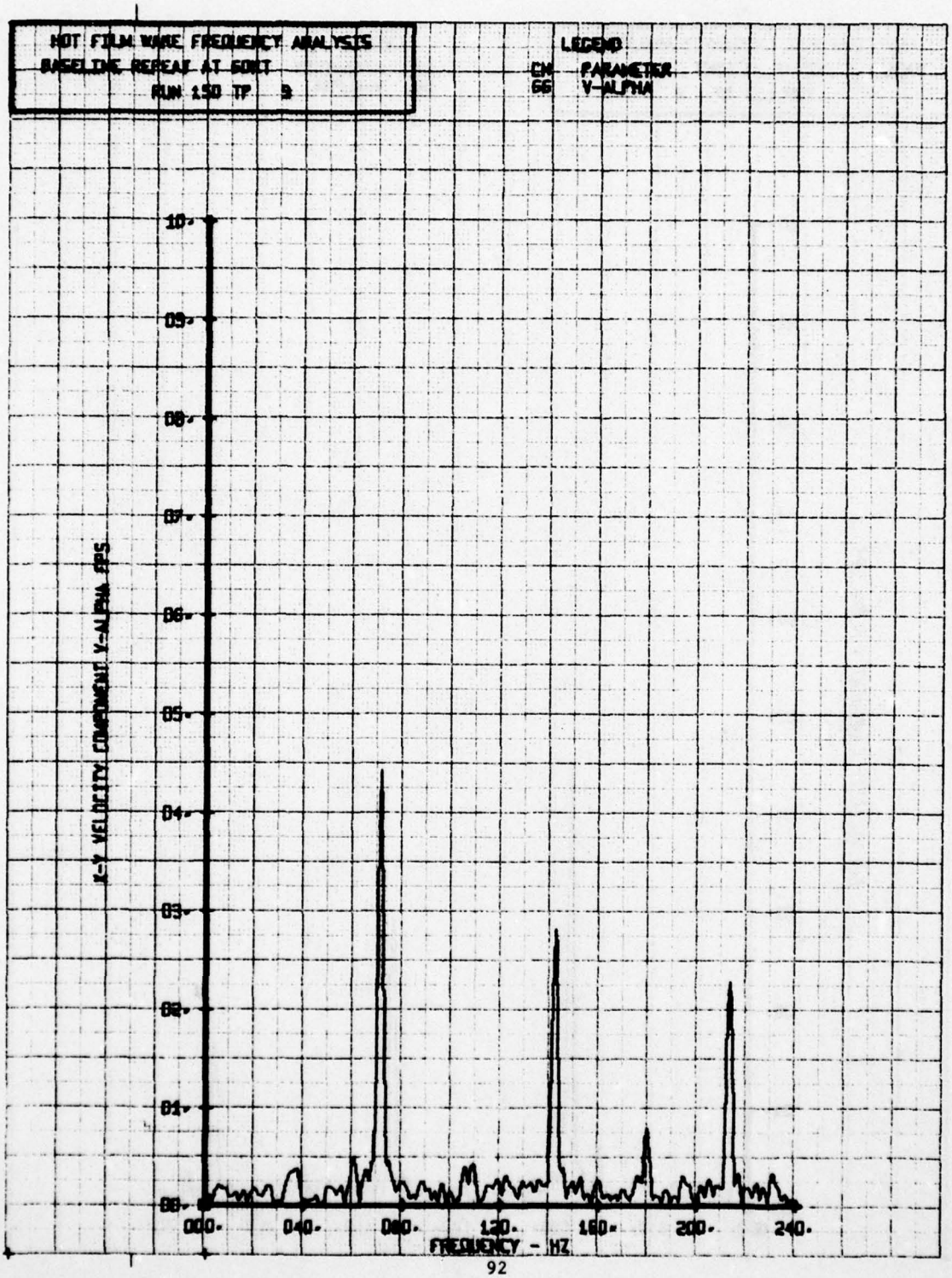

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 4
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

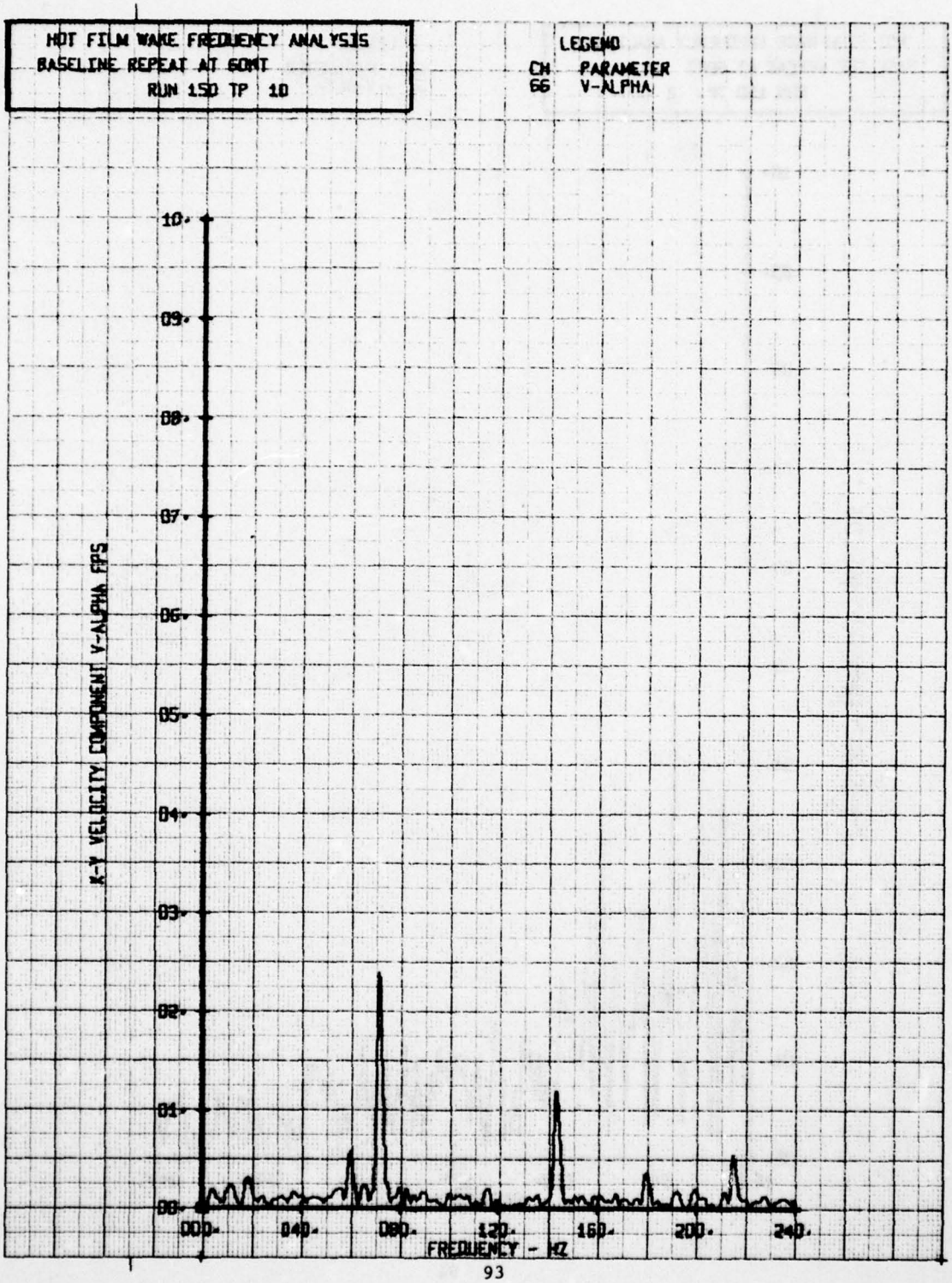

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 5
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

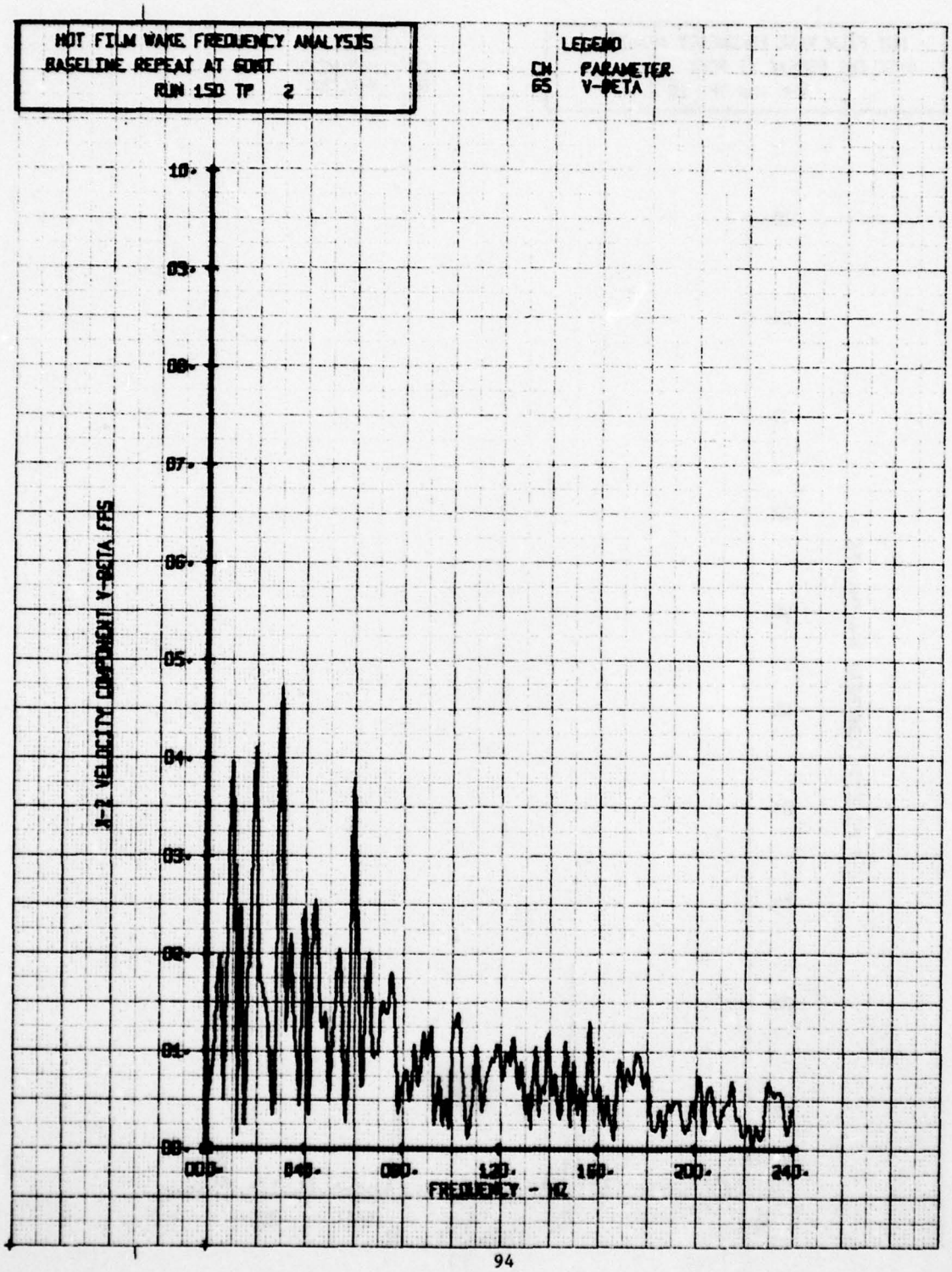

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

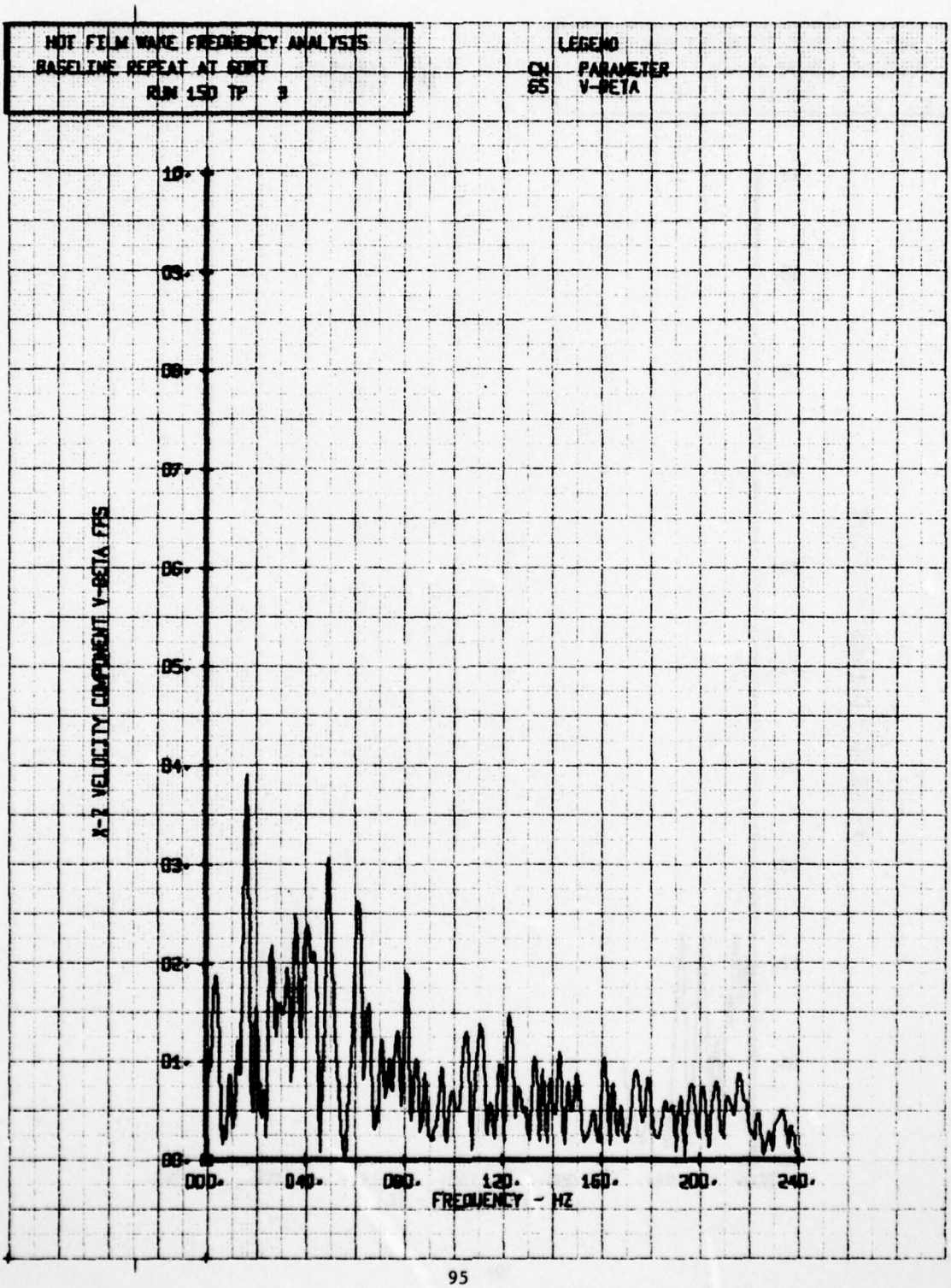

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 7
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

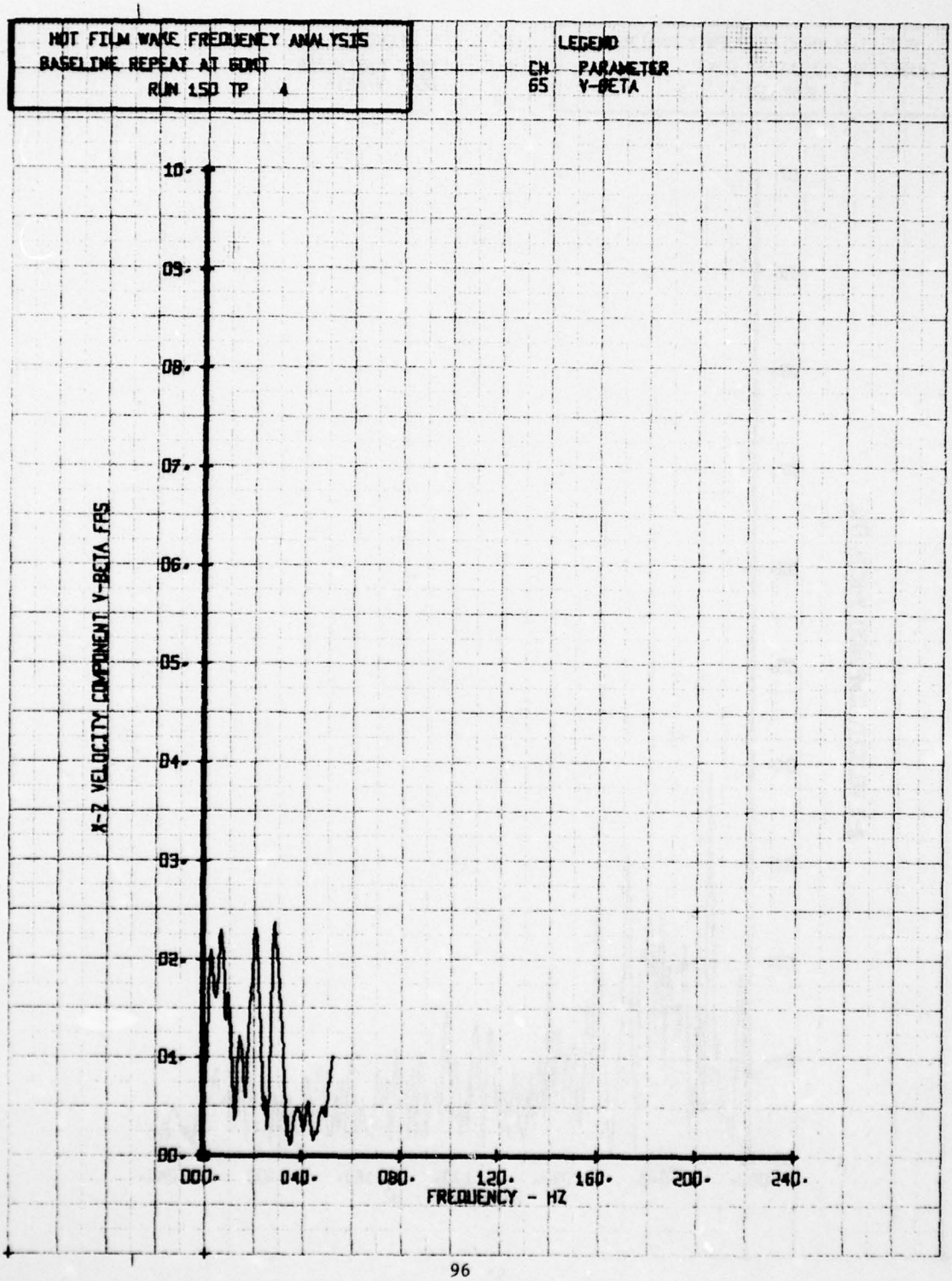

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP B
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60MT
RUN 150 TP 10
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

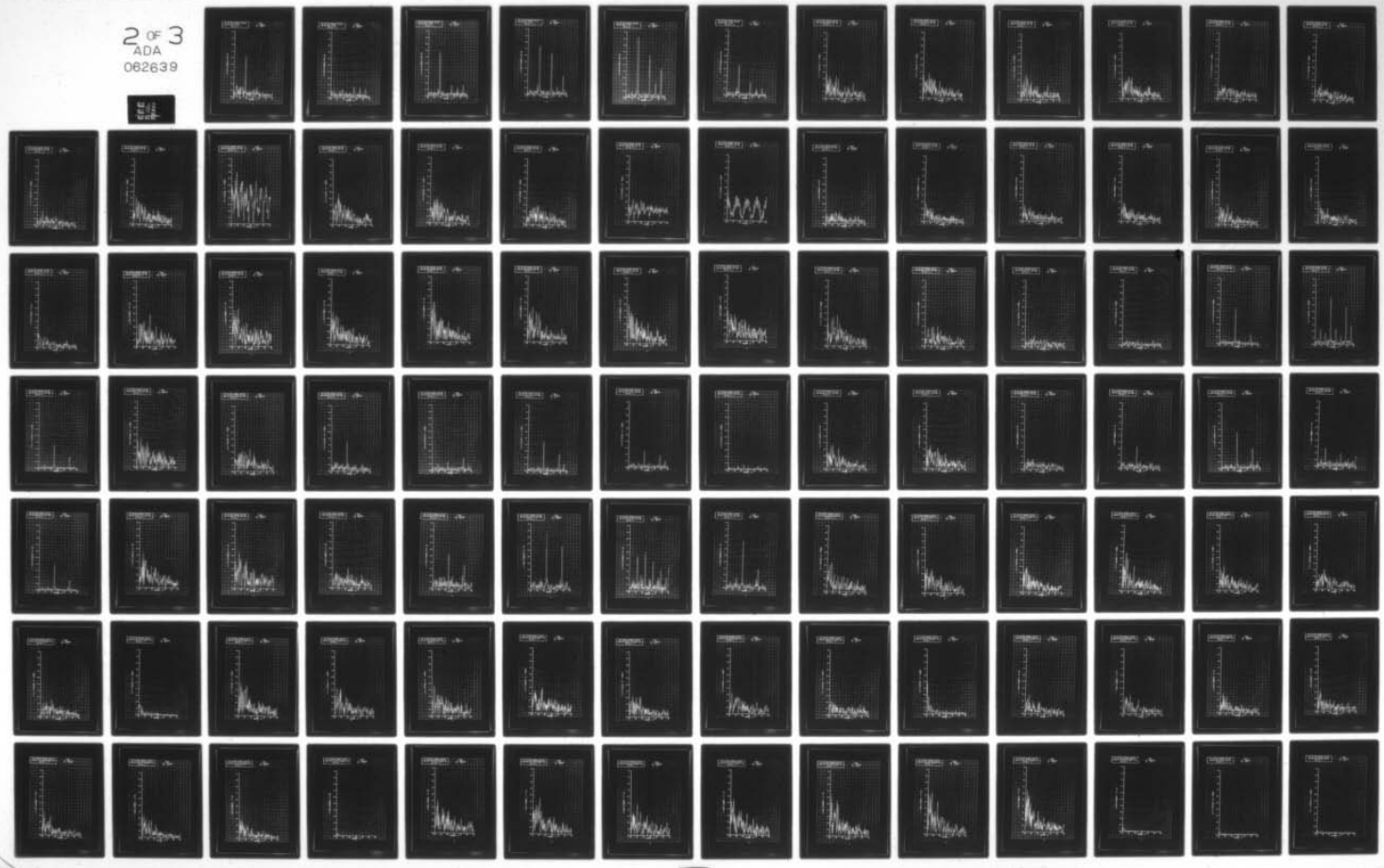

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 2
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-2 VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

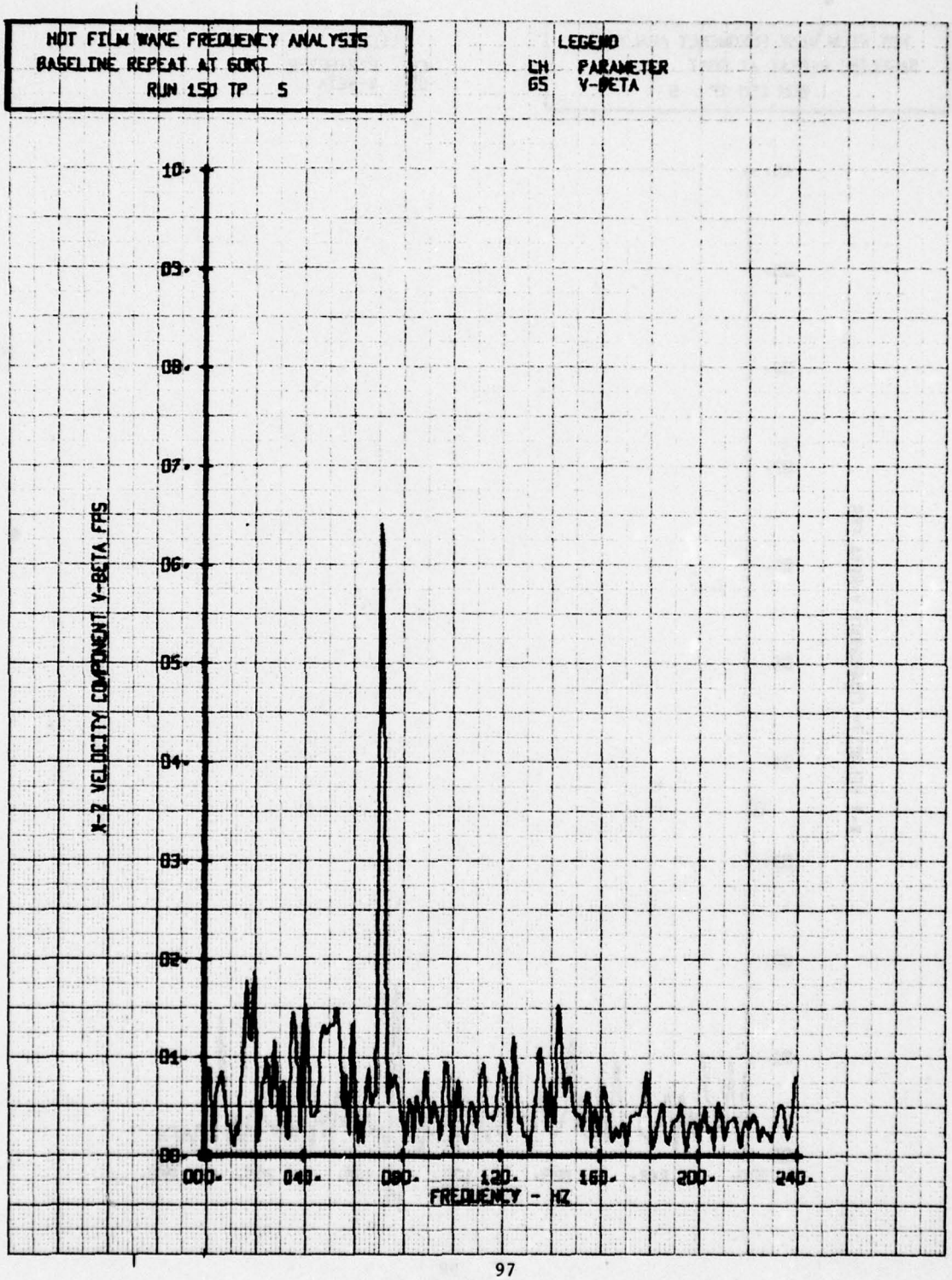

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 3
LEGEND
CN PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

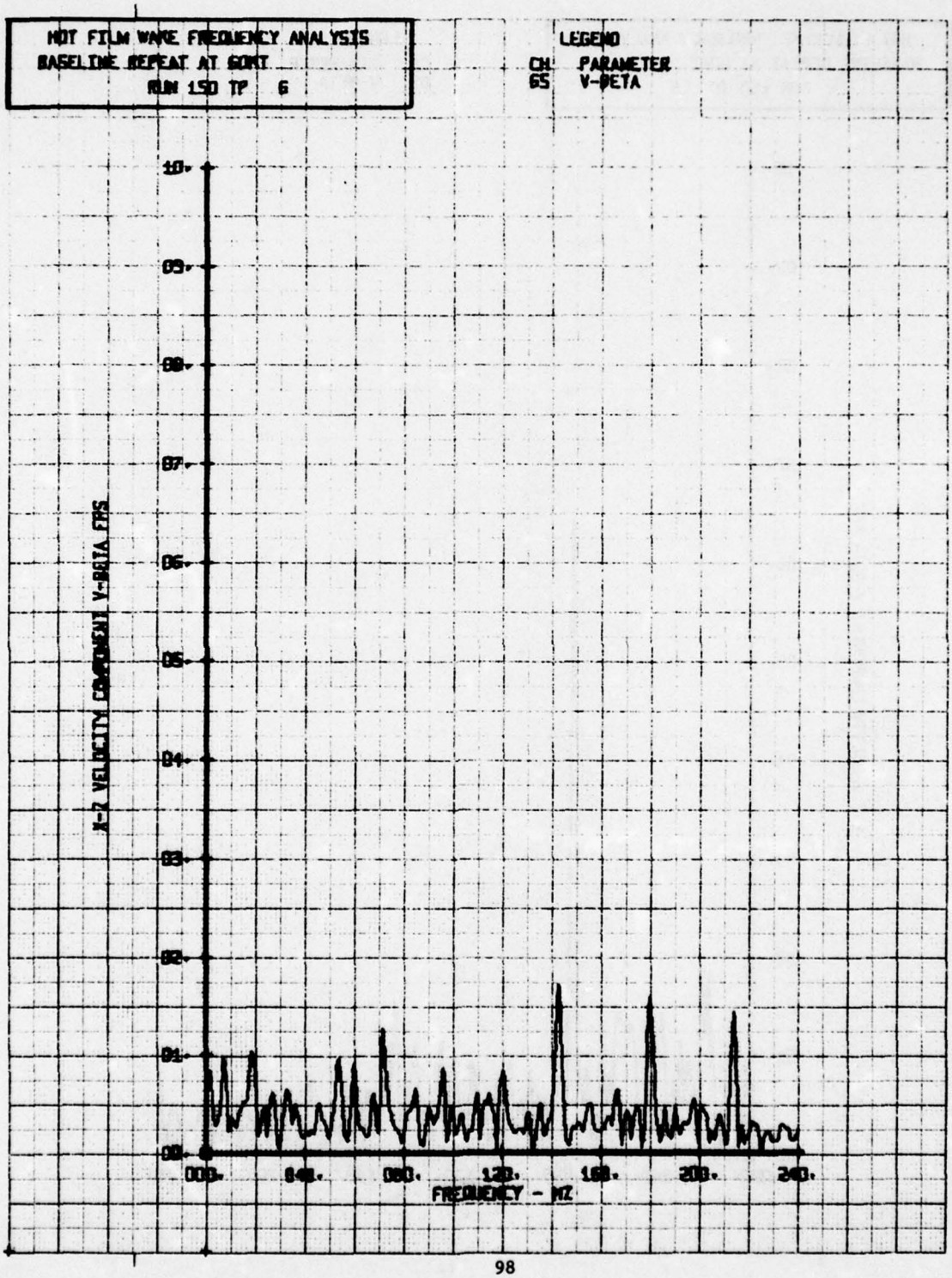

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 4
LEGEND
CH PARAMETER
65 V-BETA
X-2 VELOCITY COMPONENT V-BETA FRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

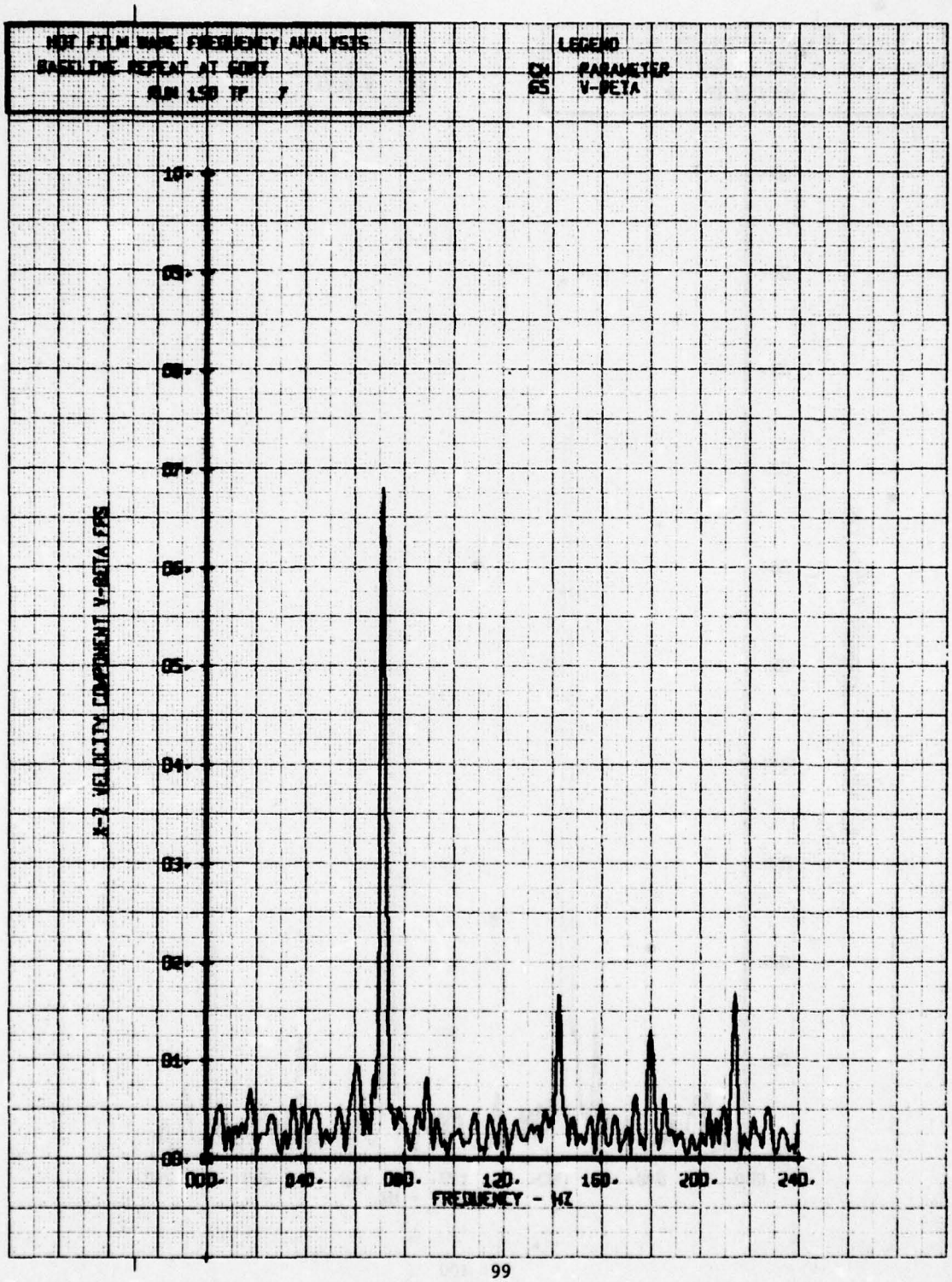
AD-A062 639 BOEING VERTOL CO PHILADELPHIA PA F/G 1/3
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFI--ETC(U)
SEP 78 P F SHERIDAN DAAJ02-77-C-0020
UNCLASSIFIED USARTL-TR-78-23G-V-7A NL

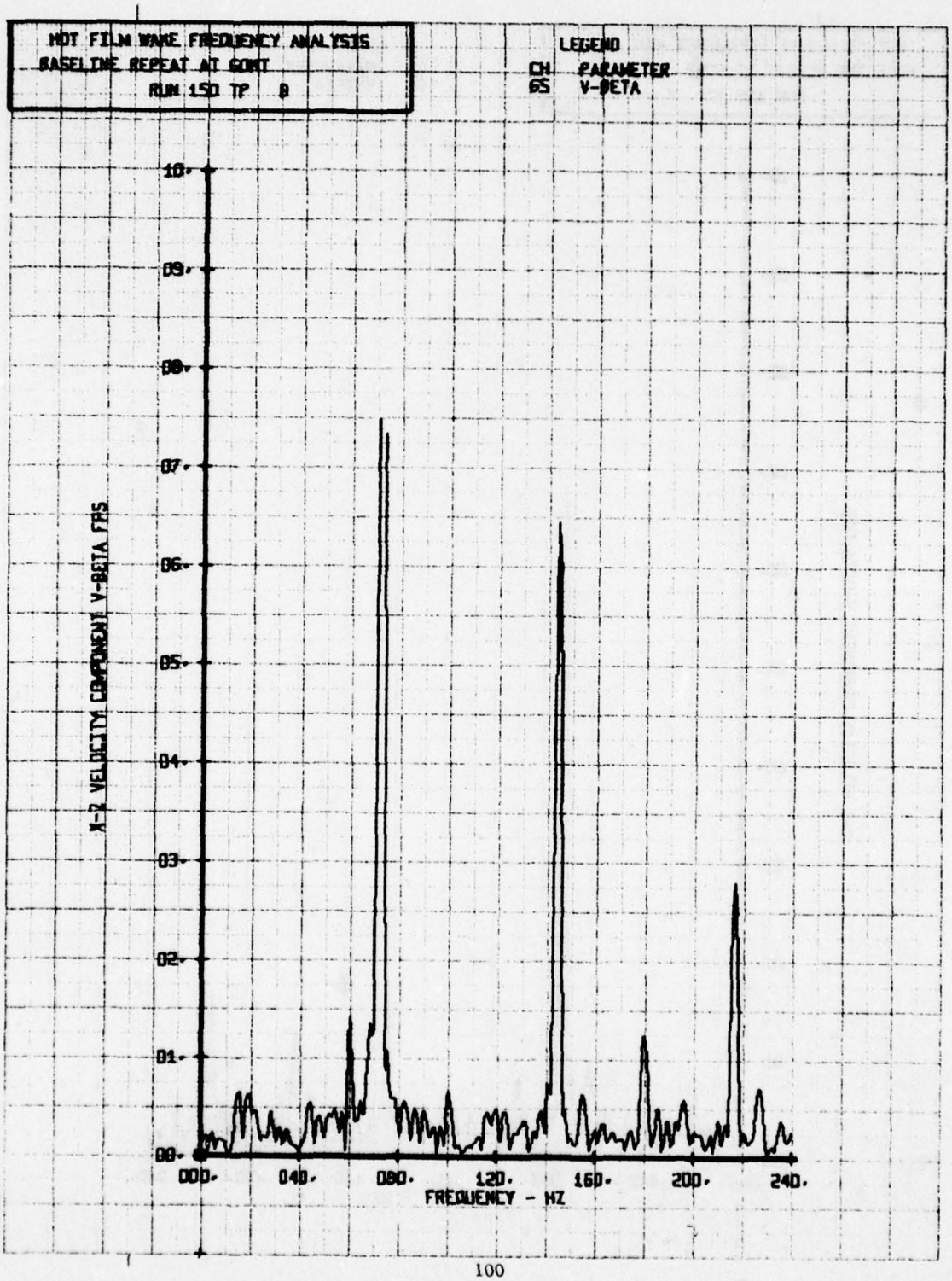
2 OF 3
ADA
062639

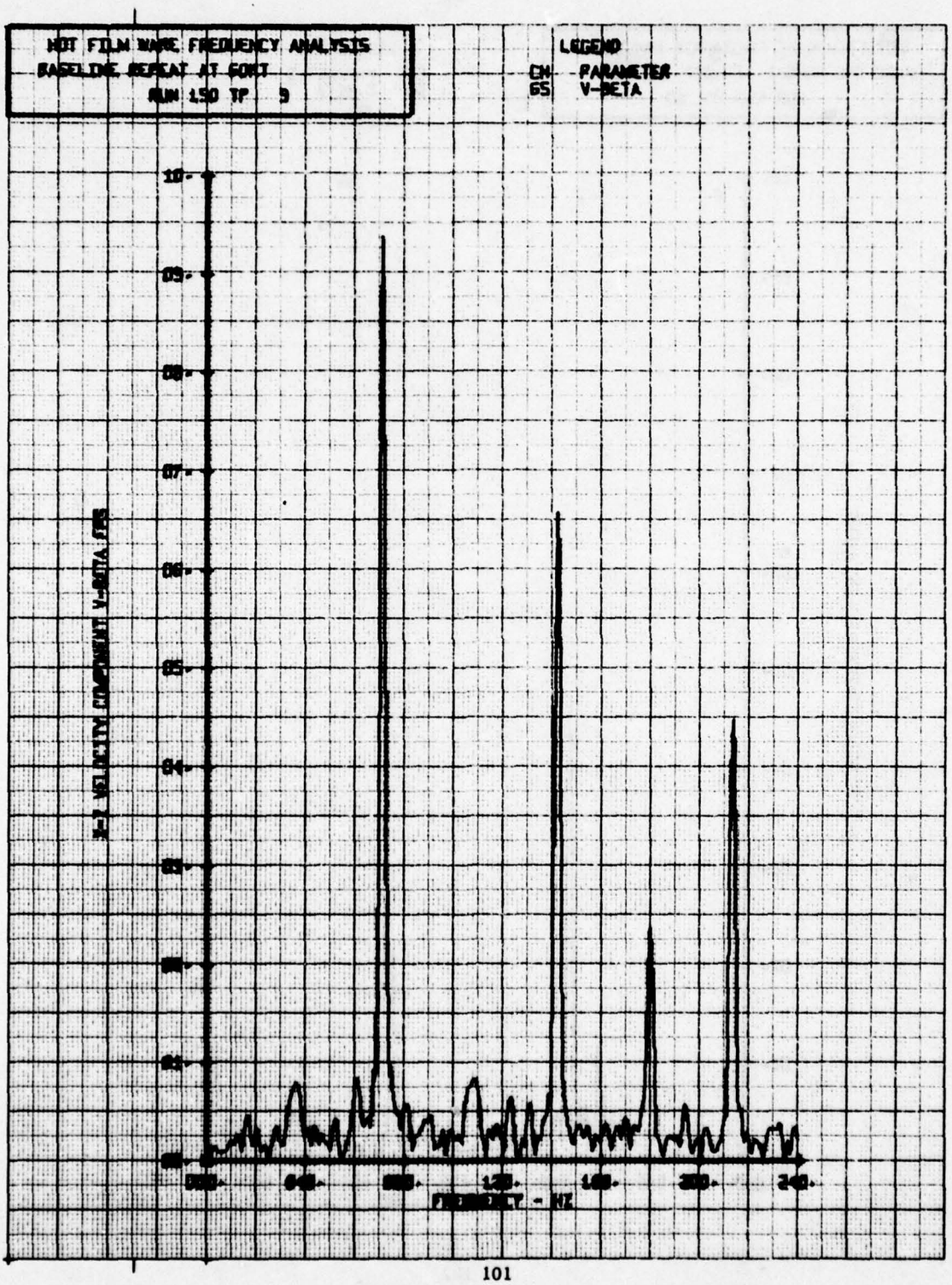


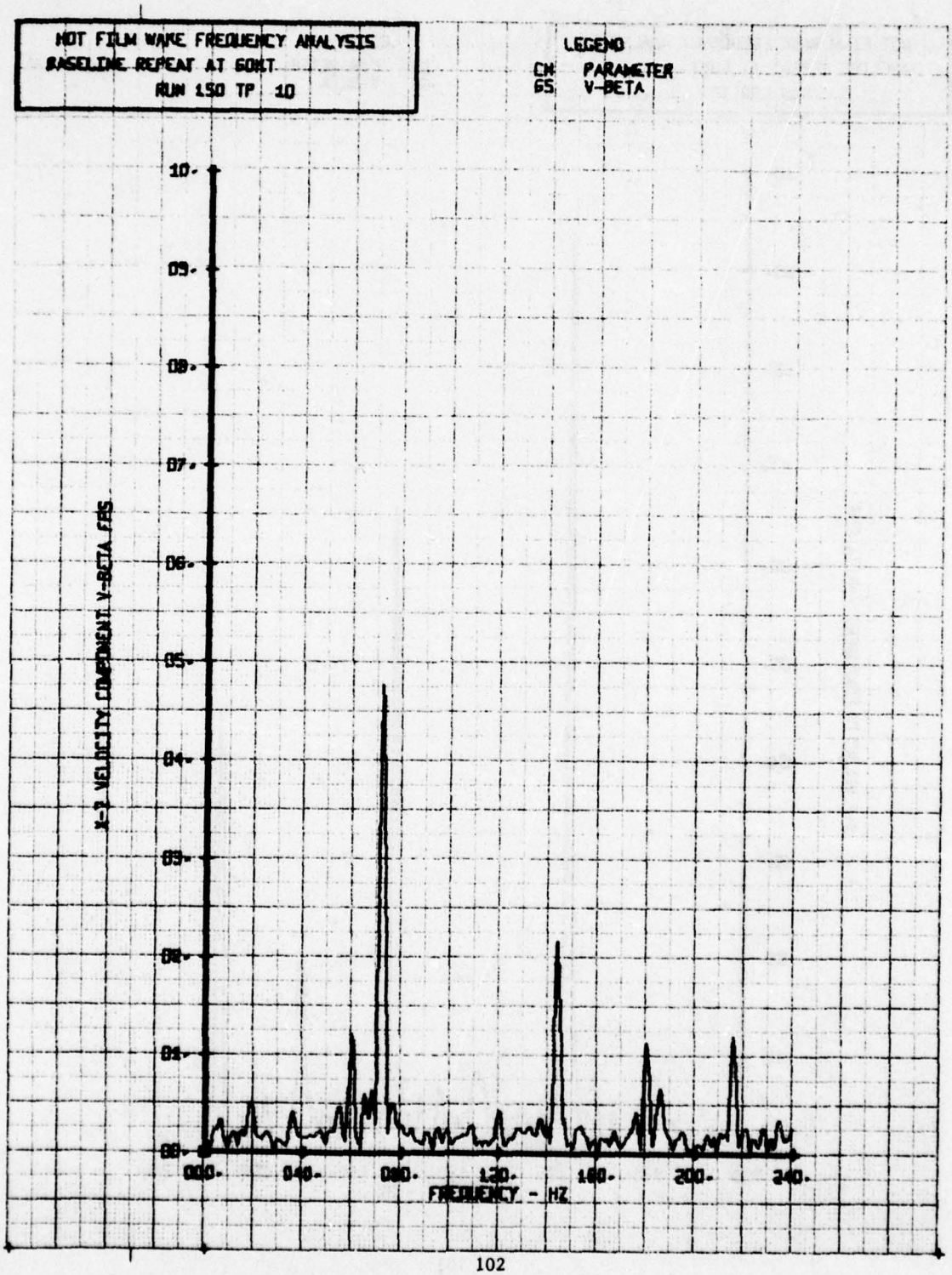

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 5
LEGEND
CH PARAMETER
G5 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

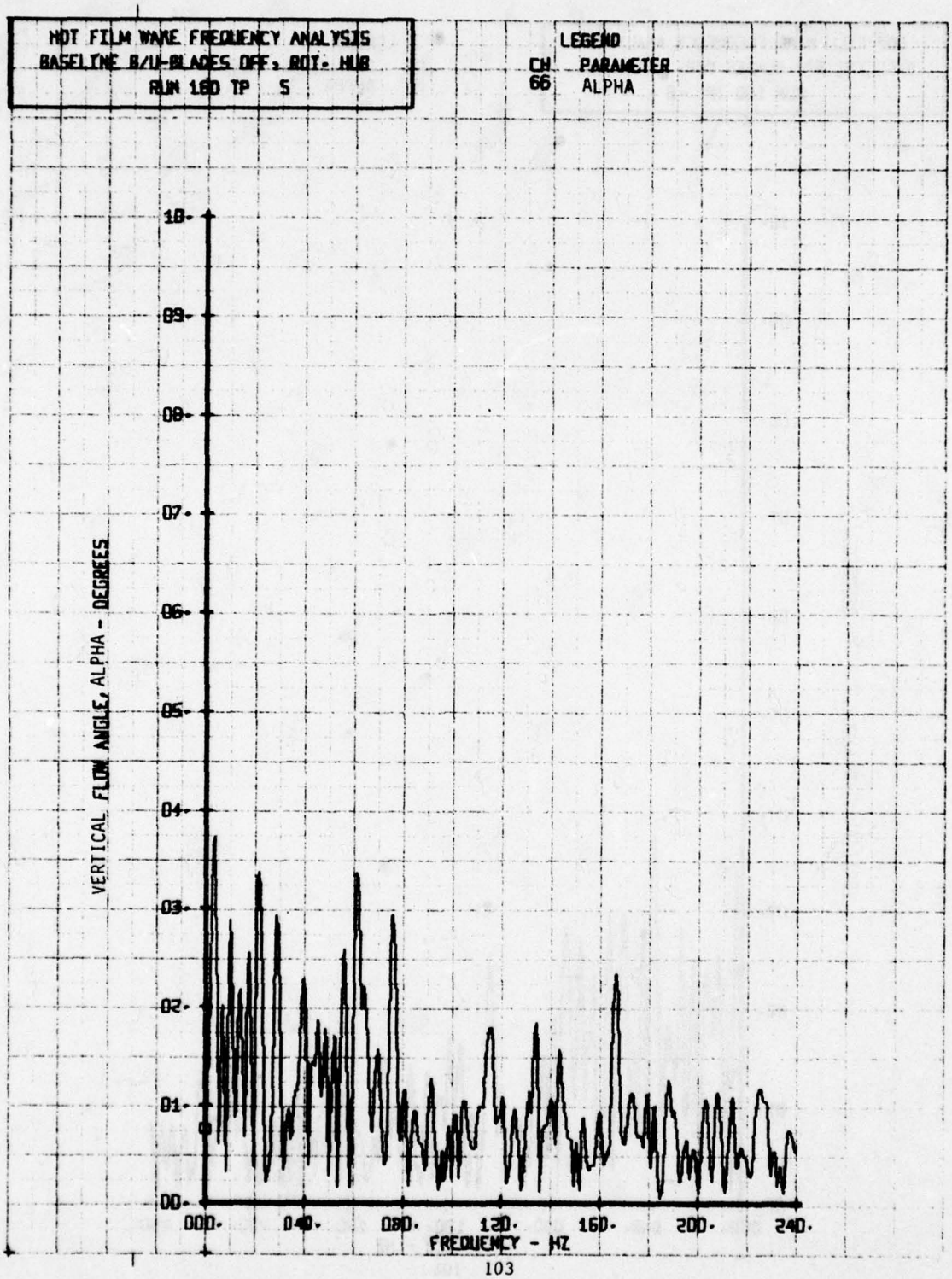

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 6
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

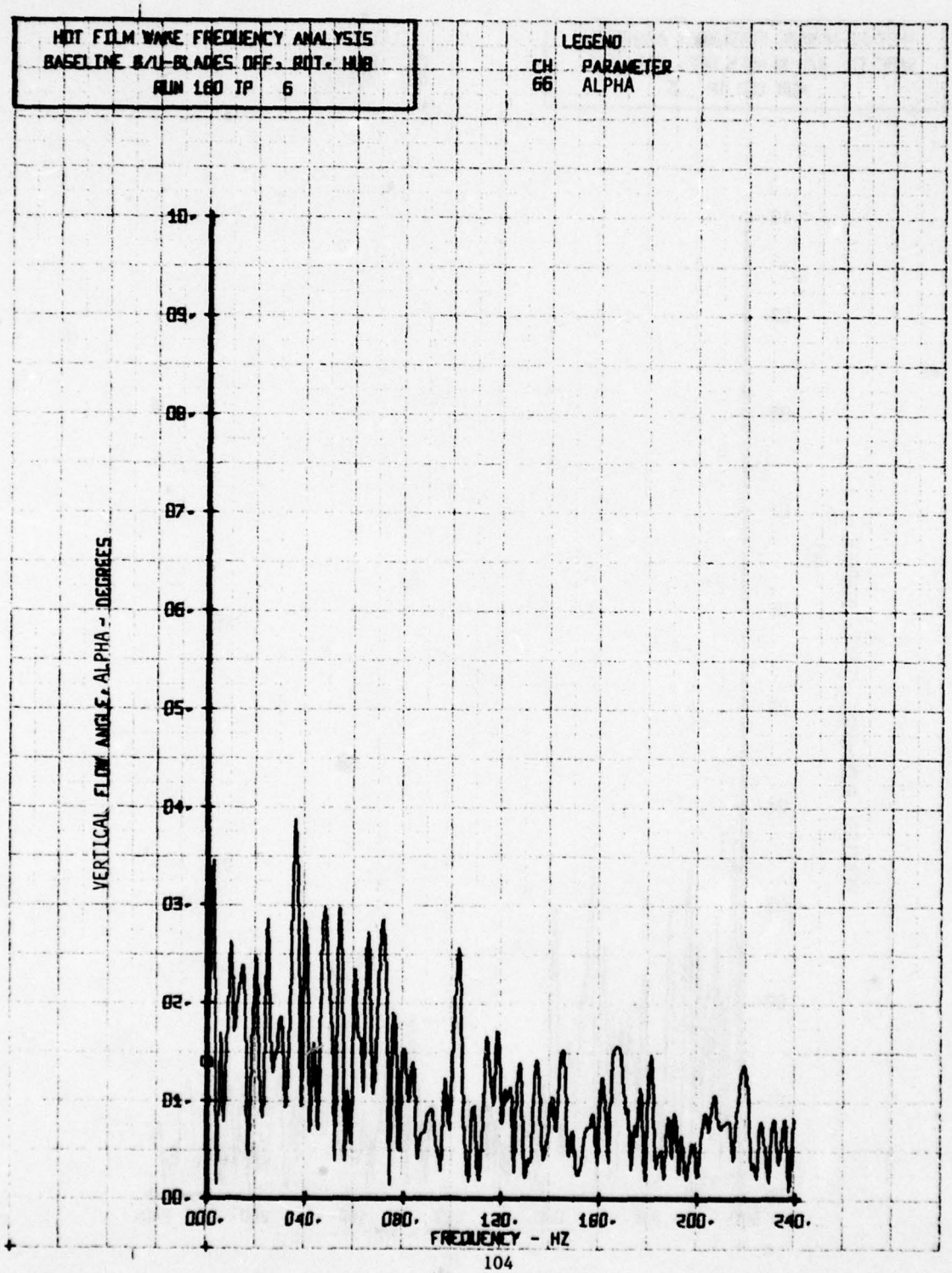

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TF 7
LEGEND
CH PARAMETER
05 V-BETA
X-2 VELOCITY COMPONENT V-BETA 05
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

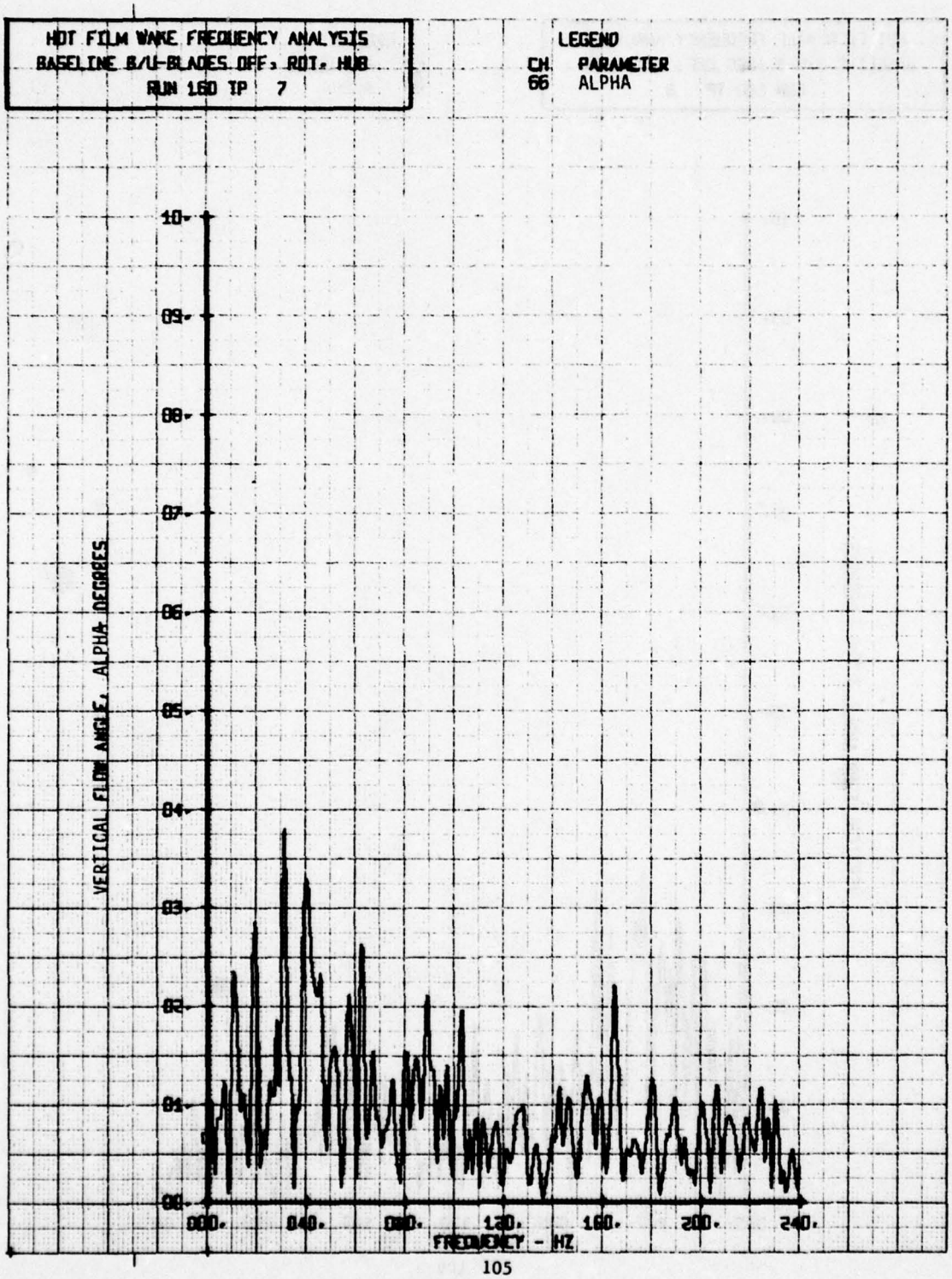

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT CORT
RUN 150 TP 8
LEGEND
CH PARAMETER
GS V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-2 VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

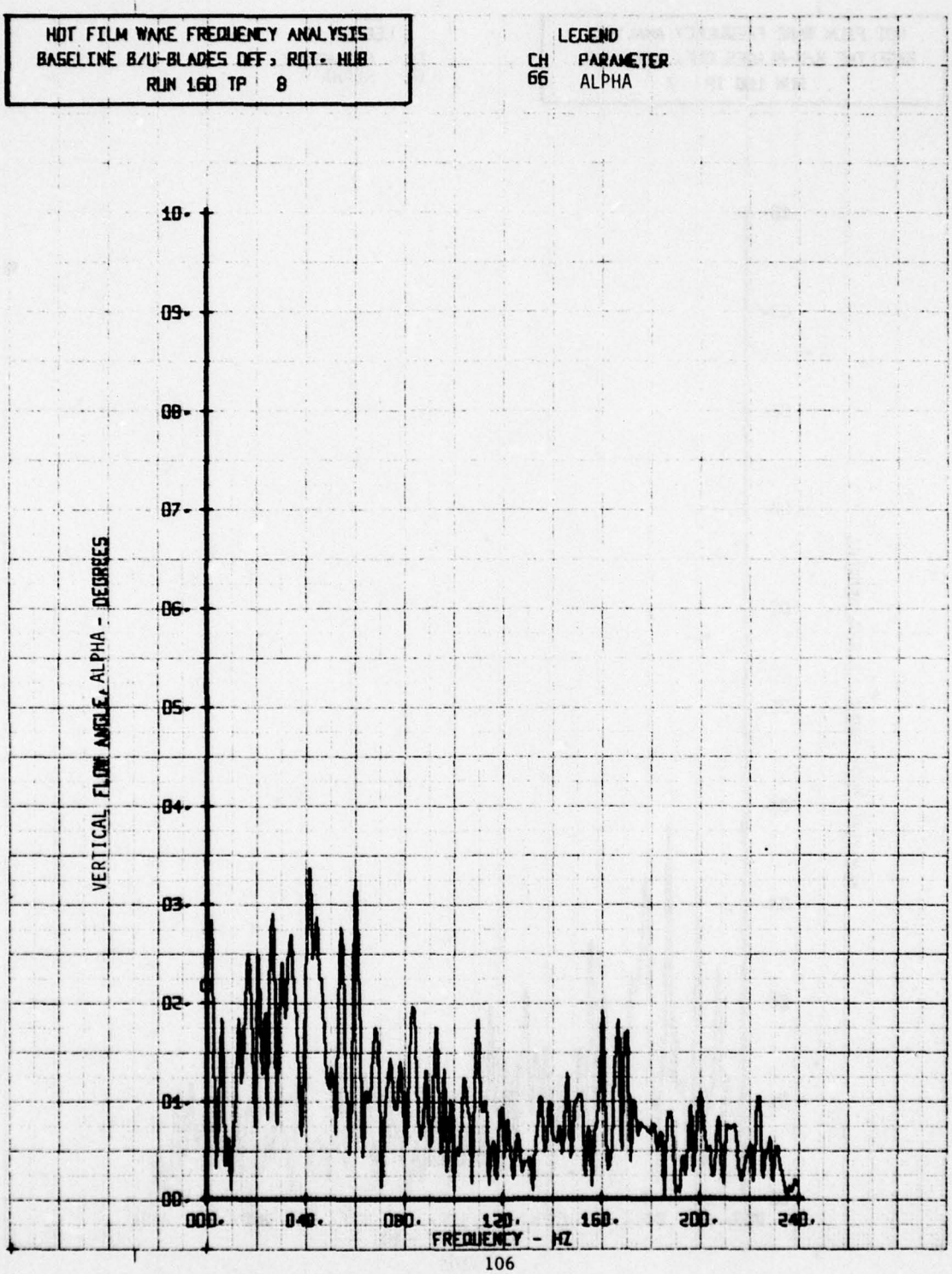

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 9
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
RMS VELOCITY COMPONENT V-BETA FPS
FREQUENCY - HZ

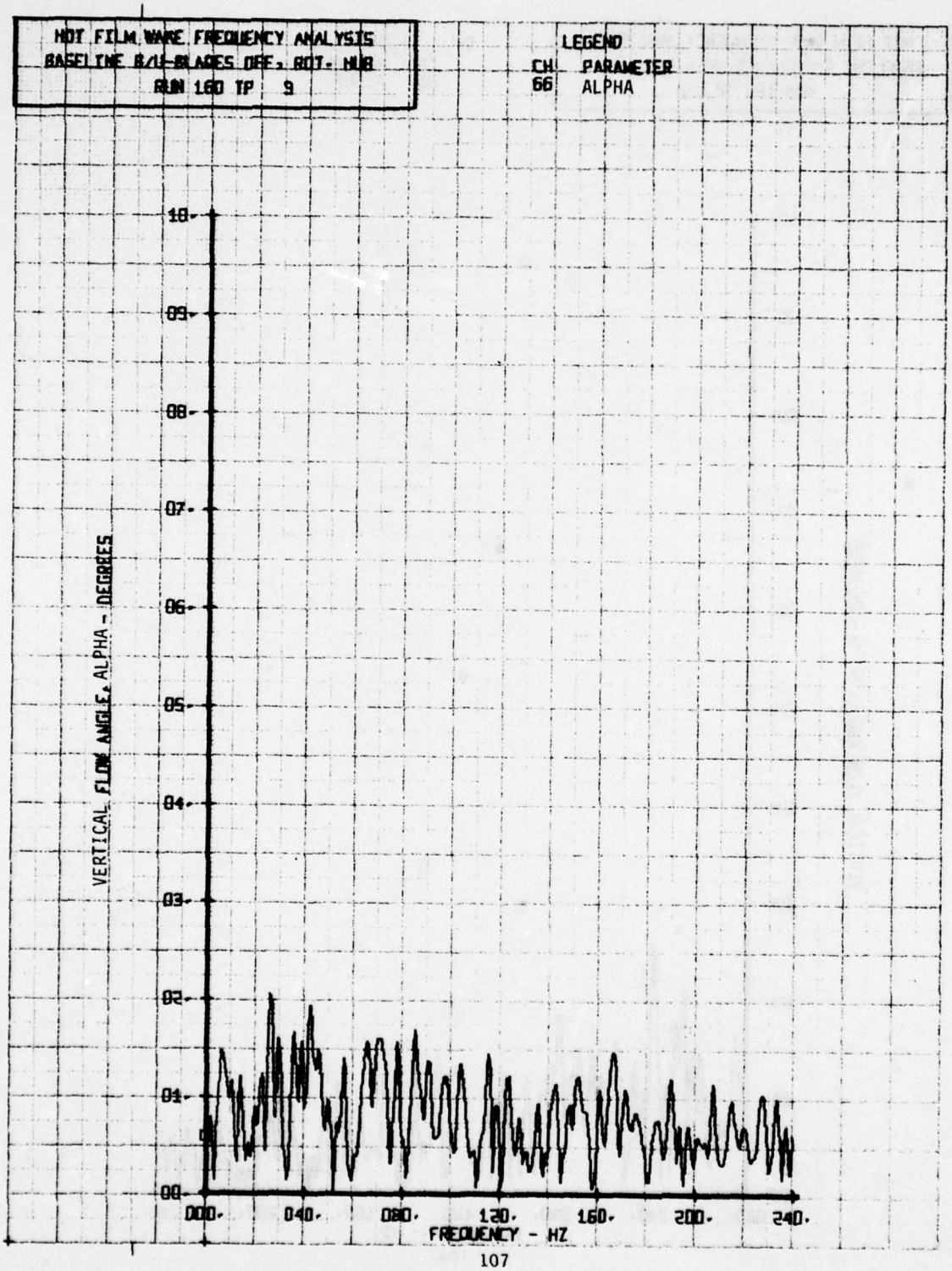

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE REPEAT AT 60KT
RUN 150 TP 10
LEGEND
CH PARAMETER
65 V-BETA
X-2 VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

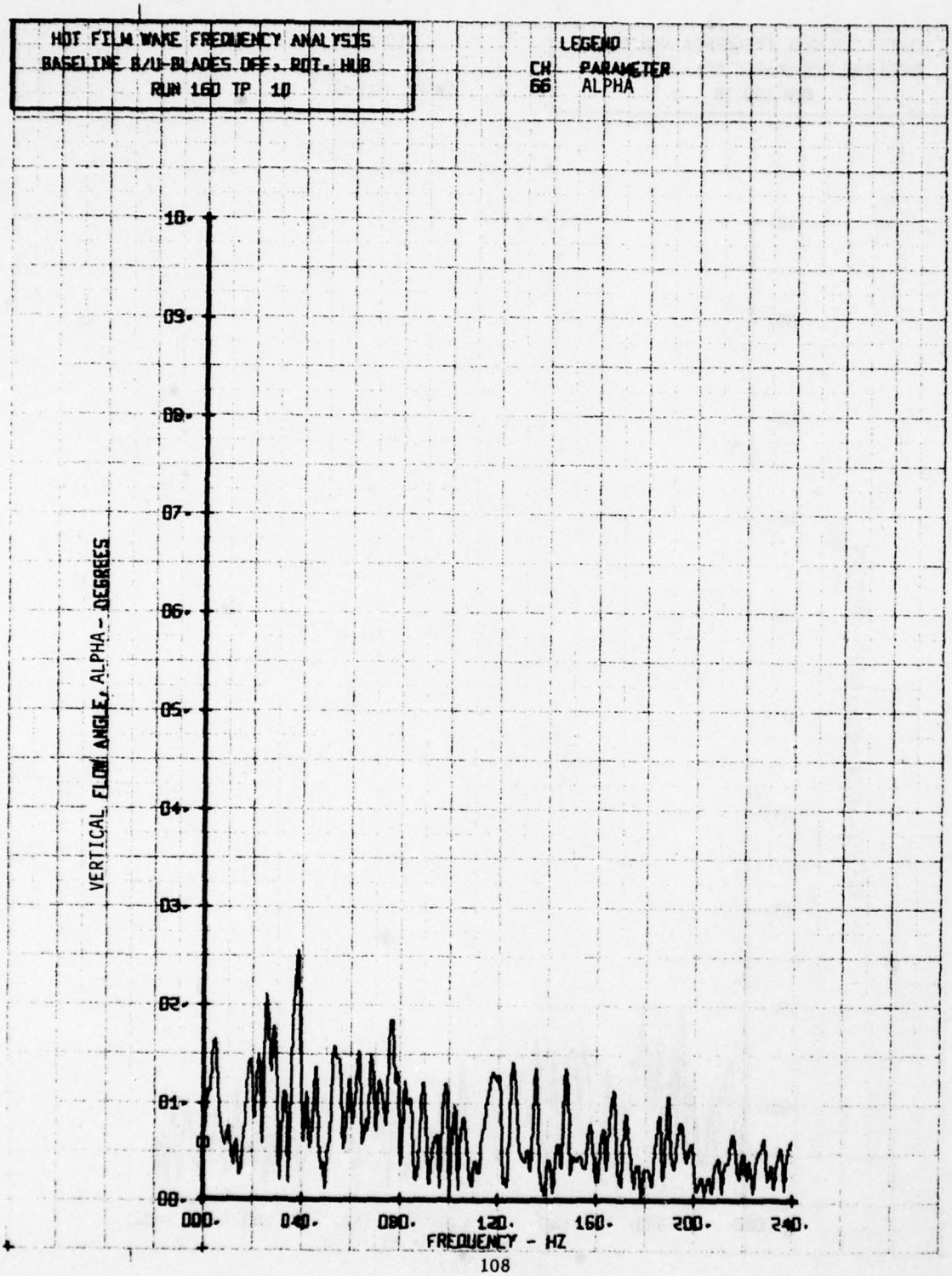

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 5
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

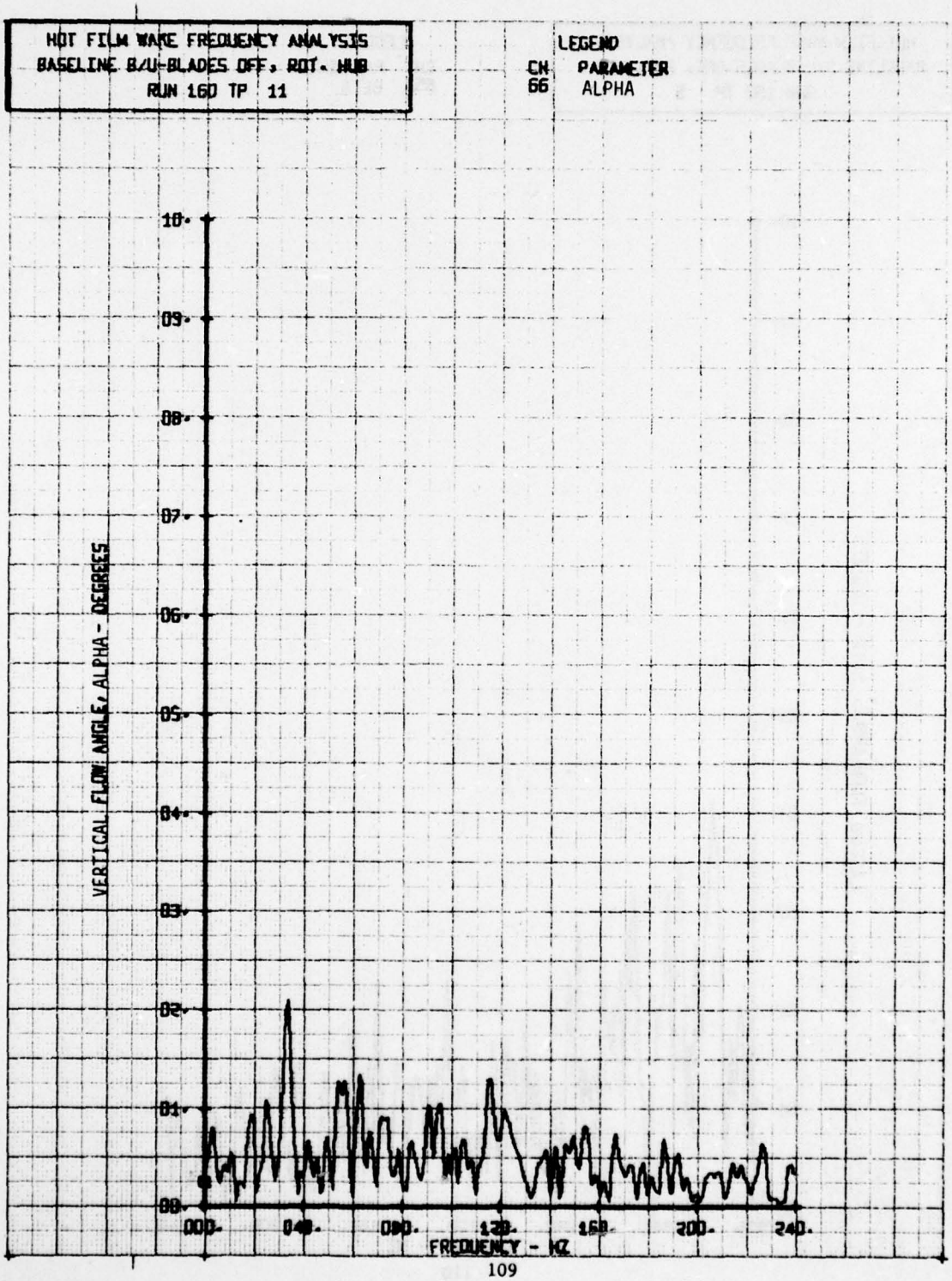

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 180 TP 6
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

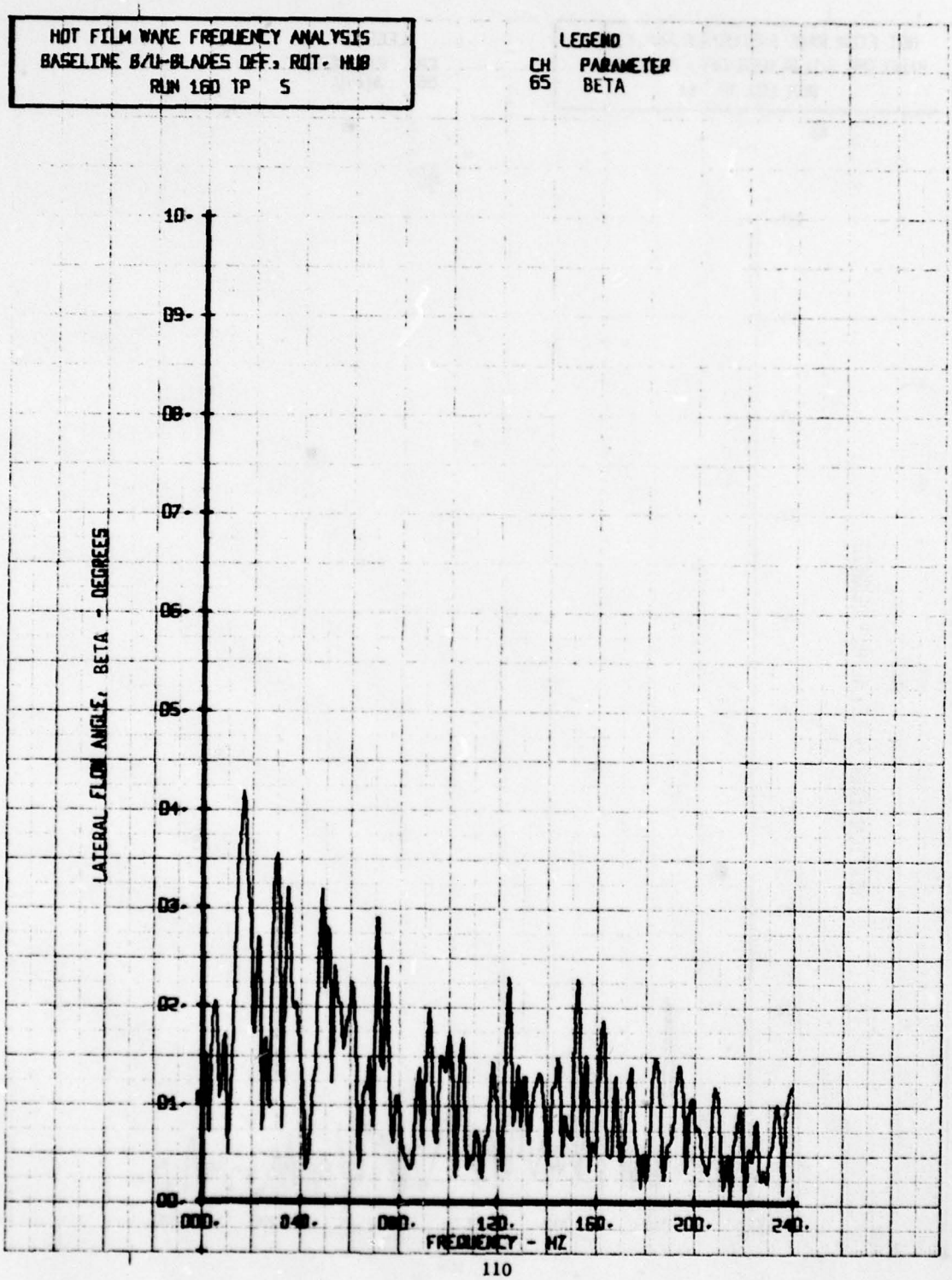

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 7
LEGEND
CH. PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA, DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

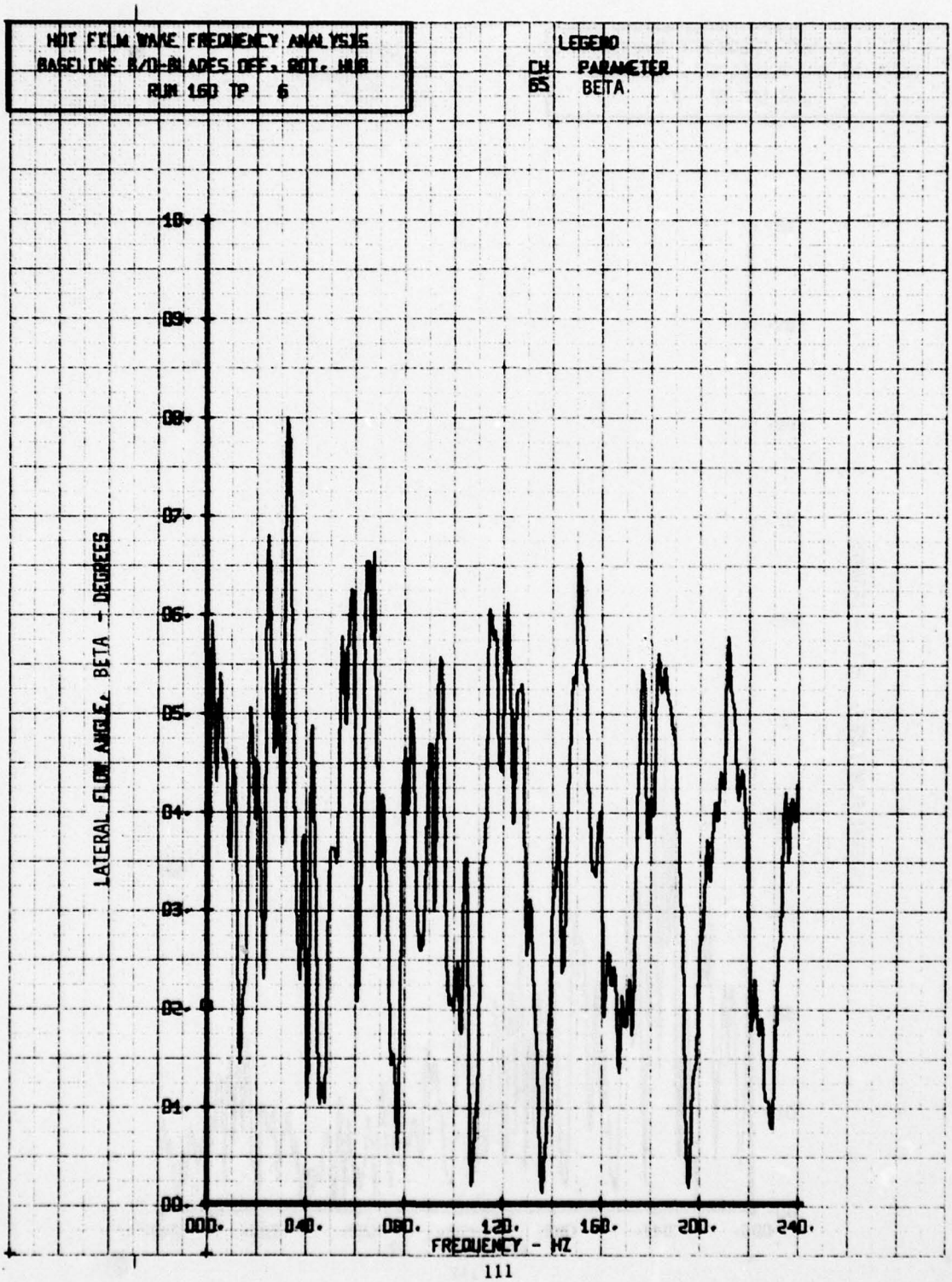

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 8
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

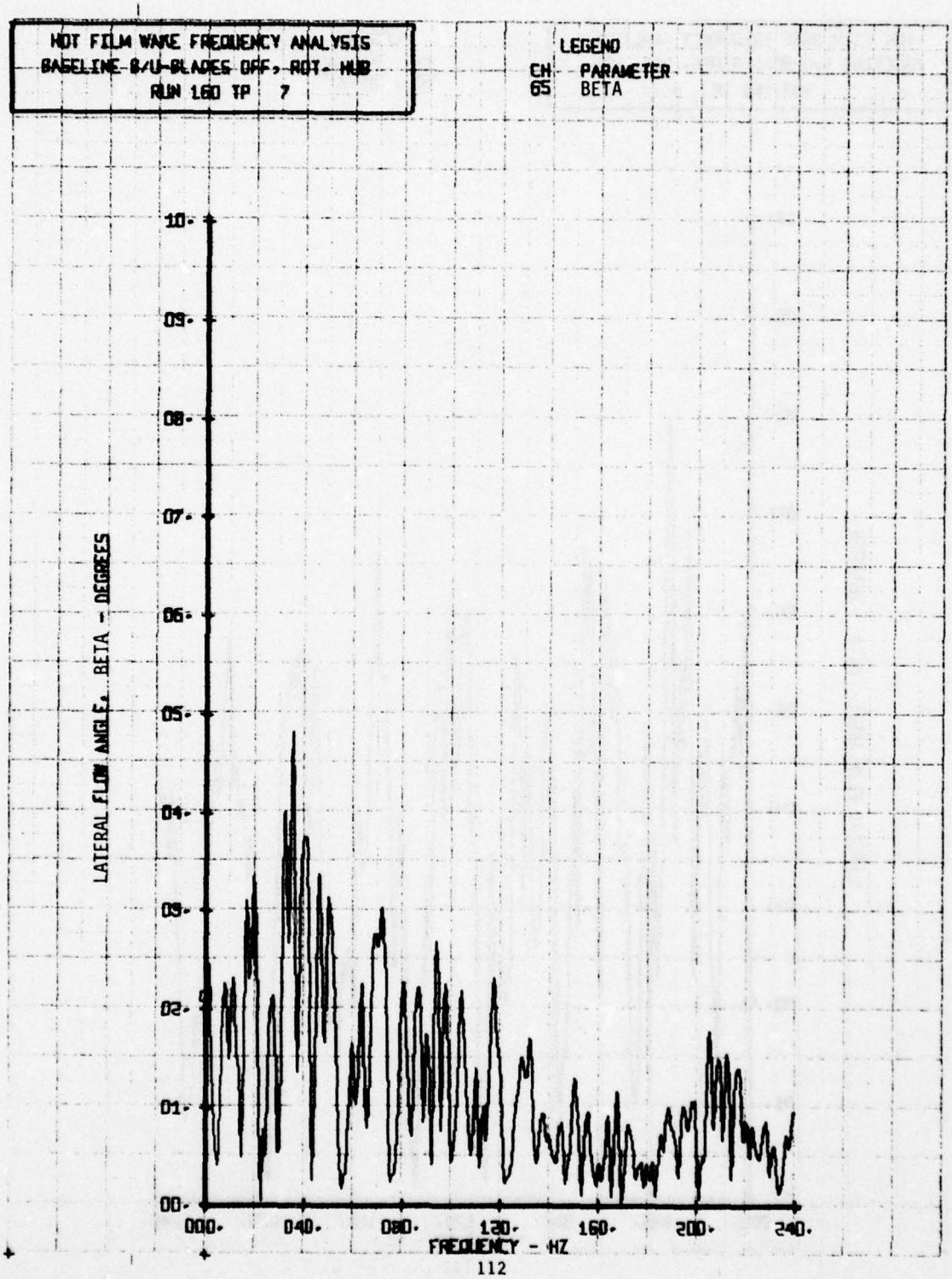

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/L-BLADES OFF, ROT. HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

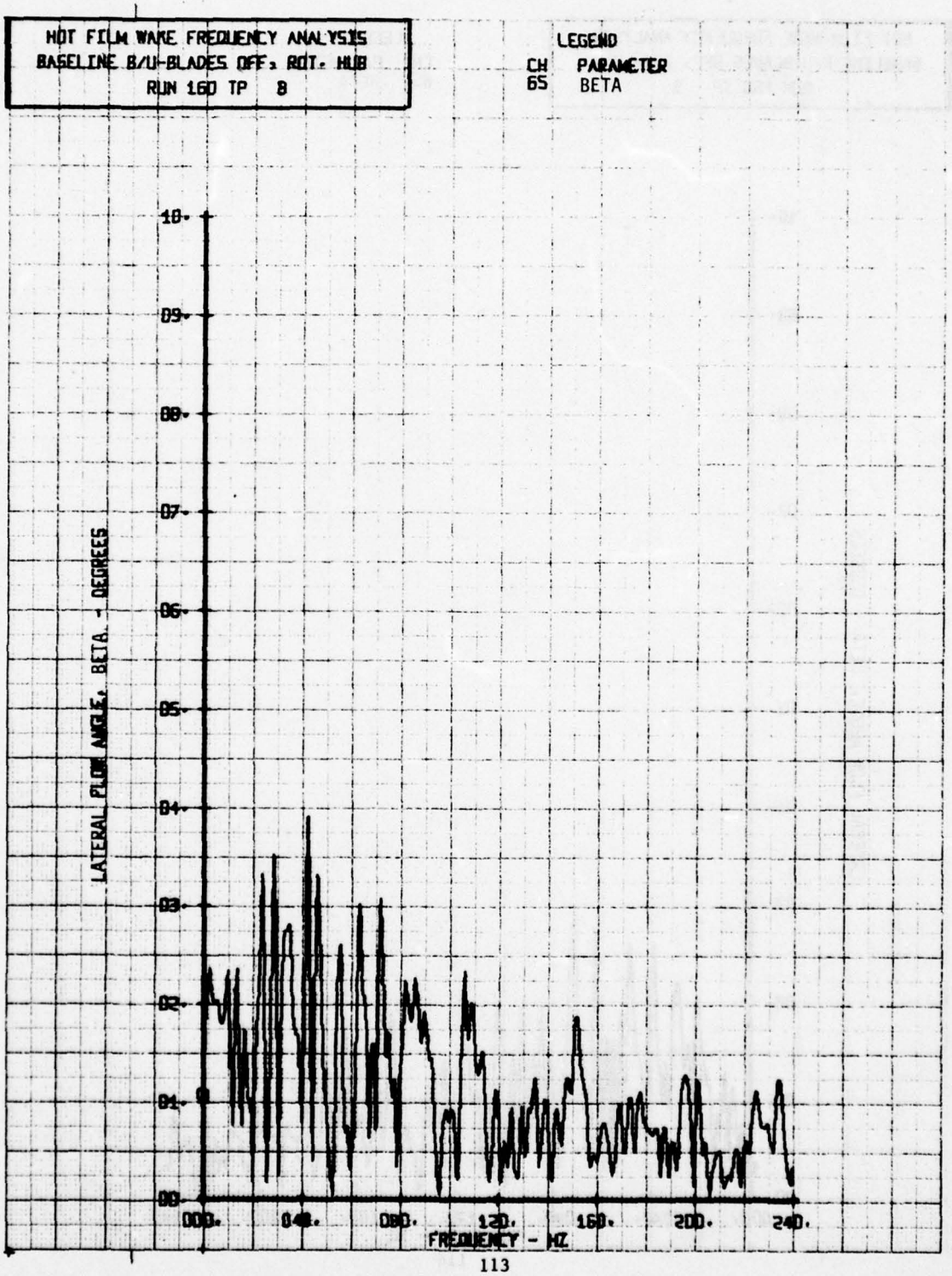

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES DEF. ROT. HUB
RUN 160 TP 10
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

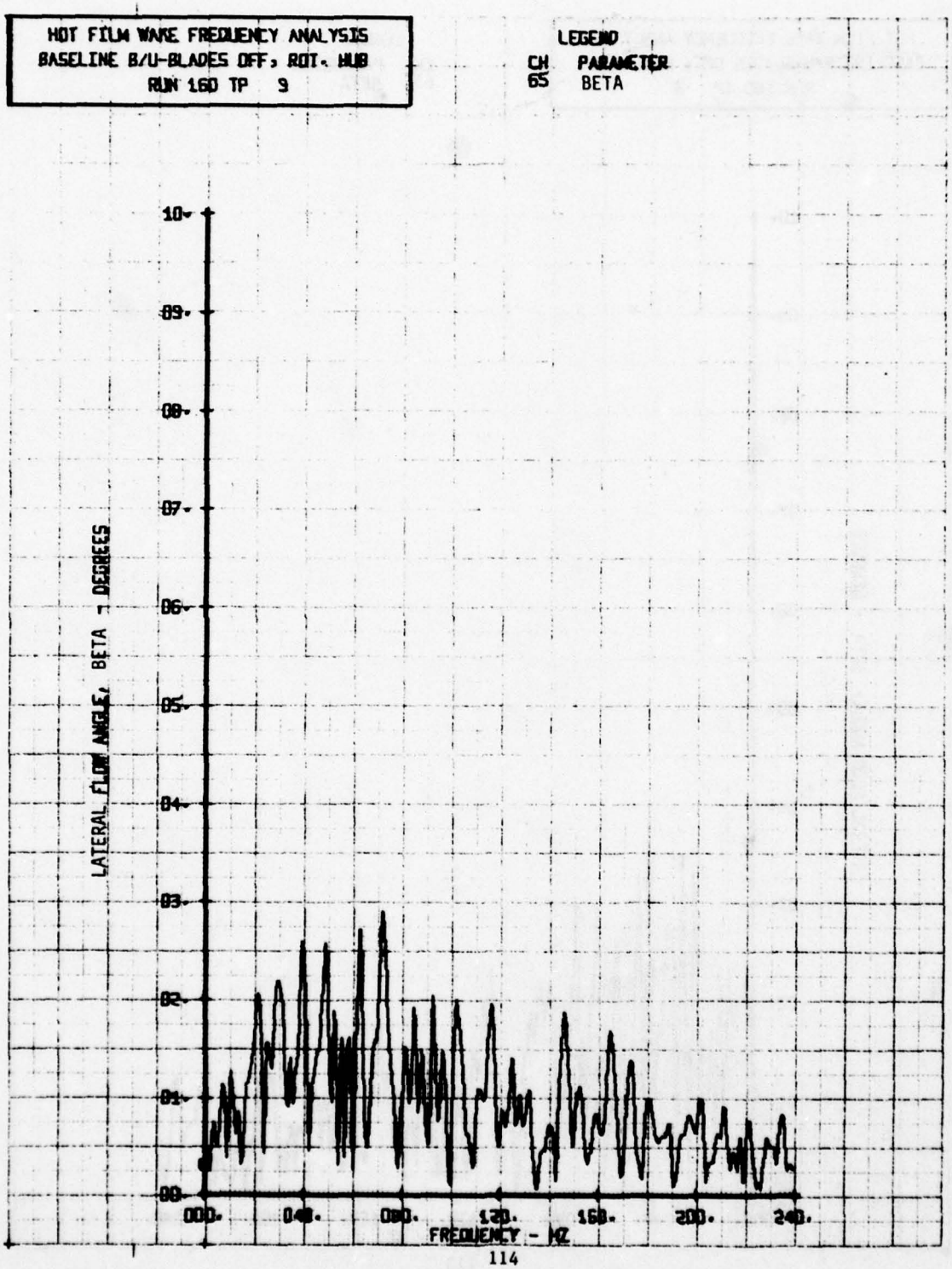

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - KZ

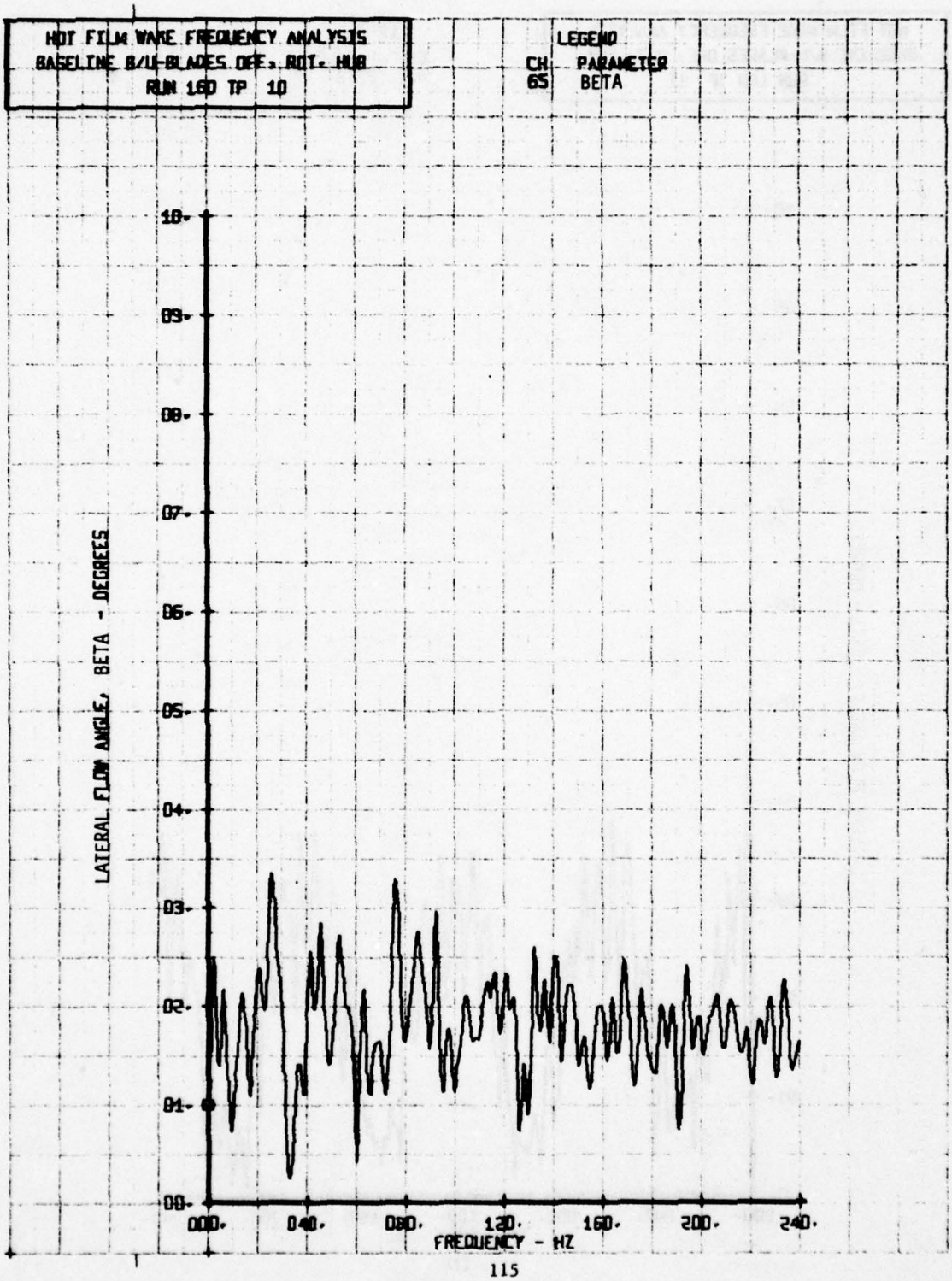

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT- HUB
RUN 160 TP 5
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10-
09-
08-
07-
06-
05-
04-
03-
02-
01-
00-
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

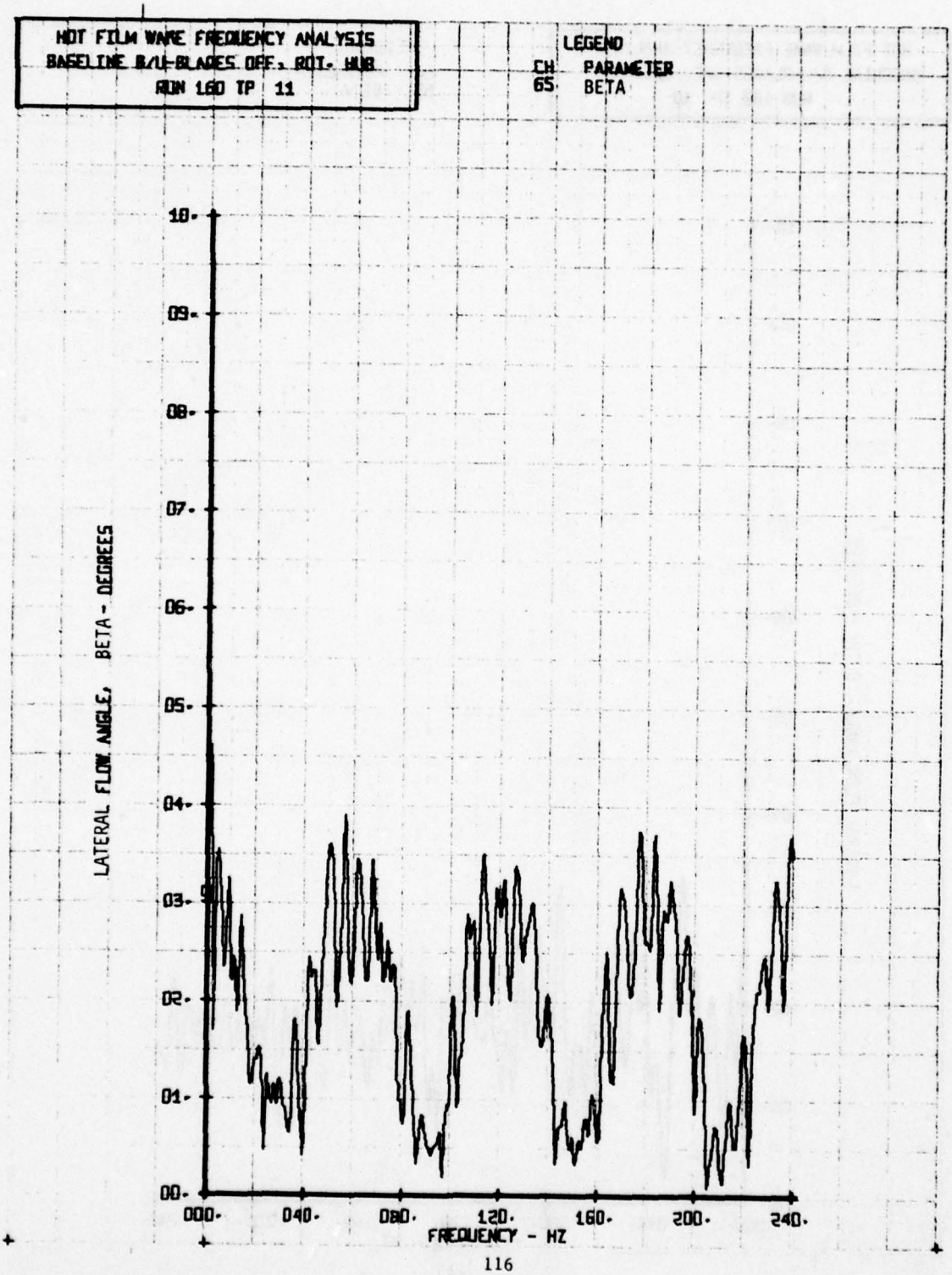

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/D-BLADES OFF, ROT. HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

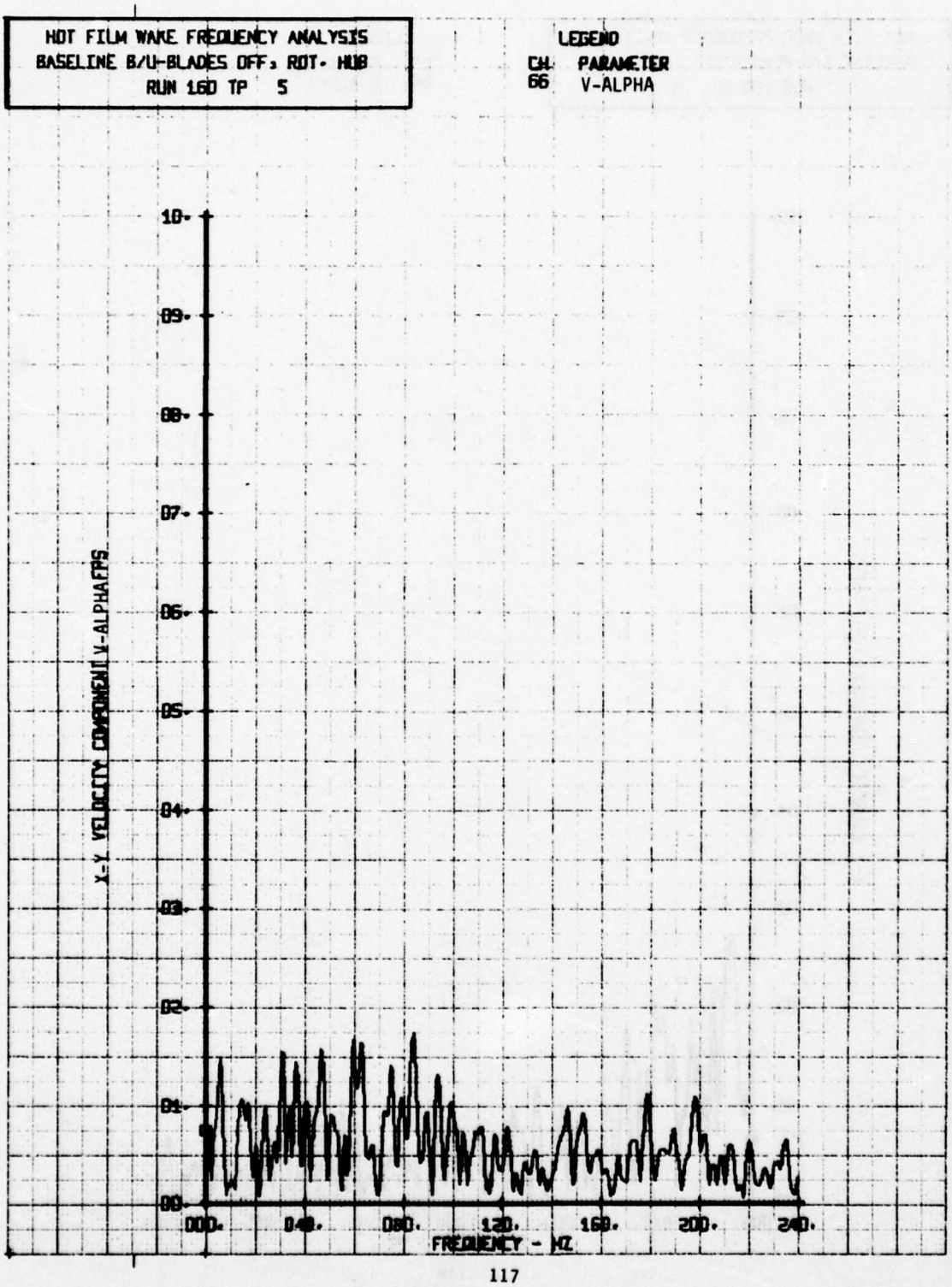

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT- HUB
RUN 160 TP 7
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

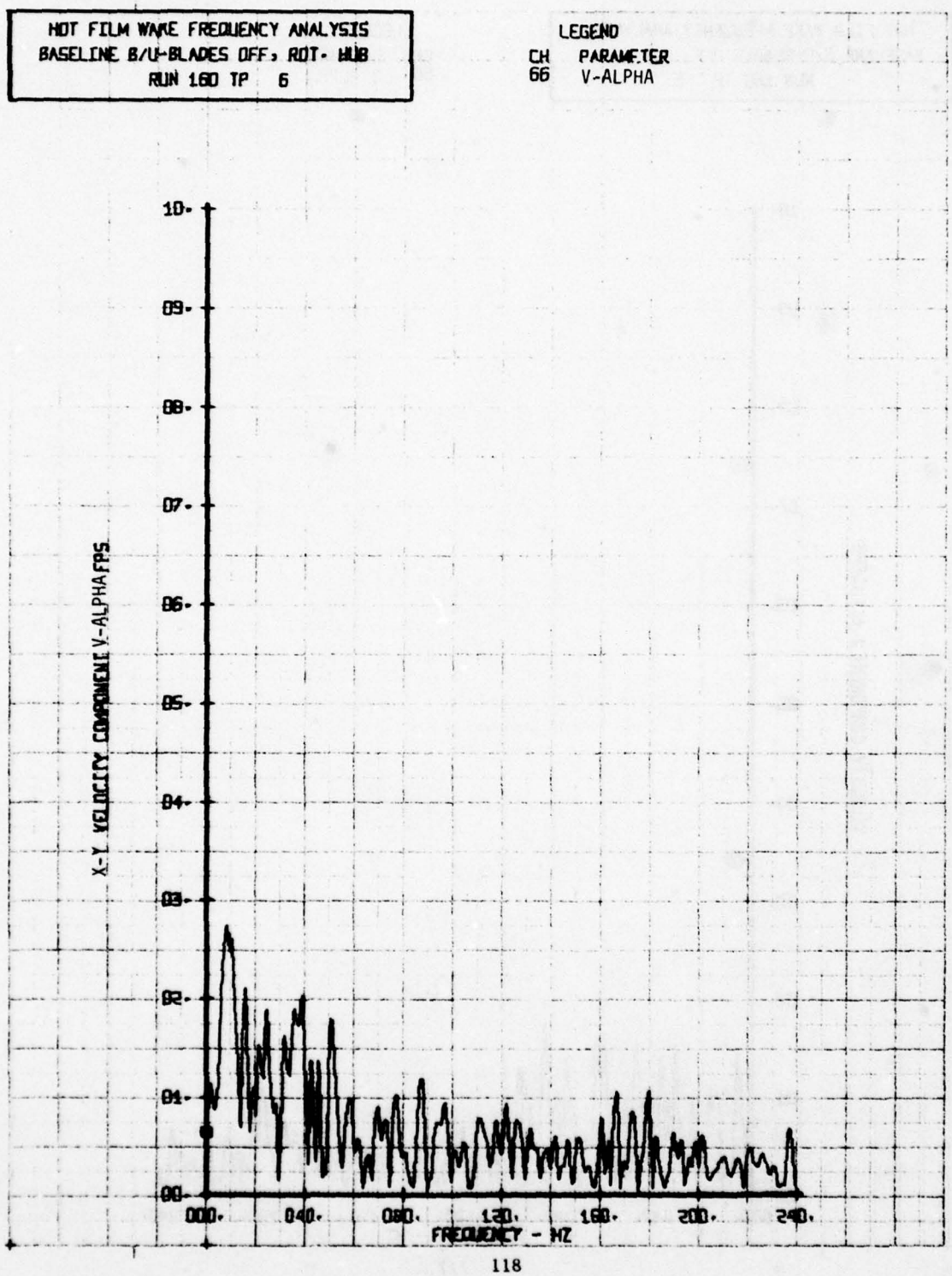

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 8
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

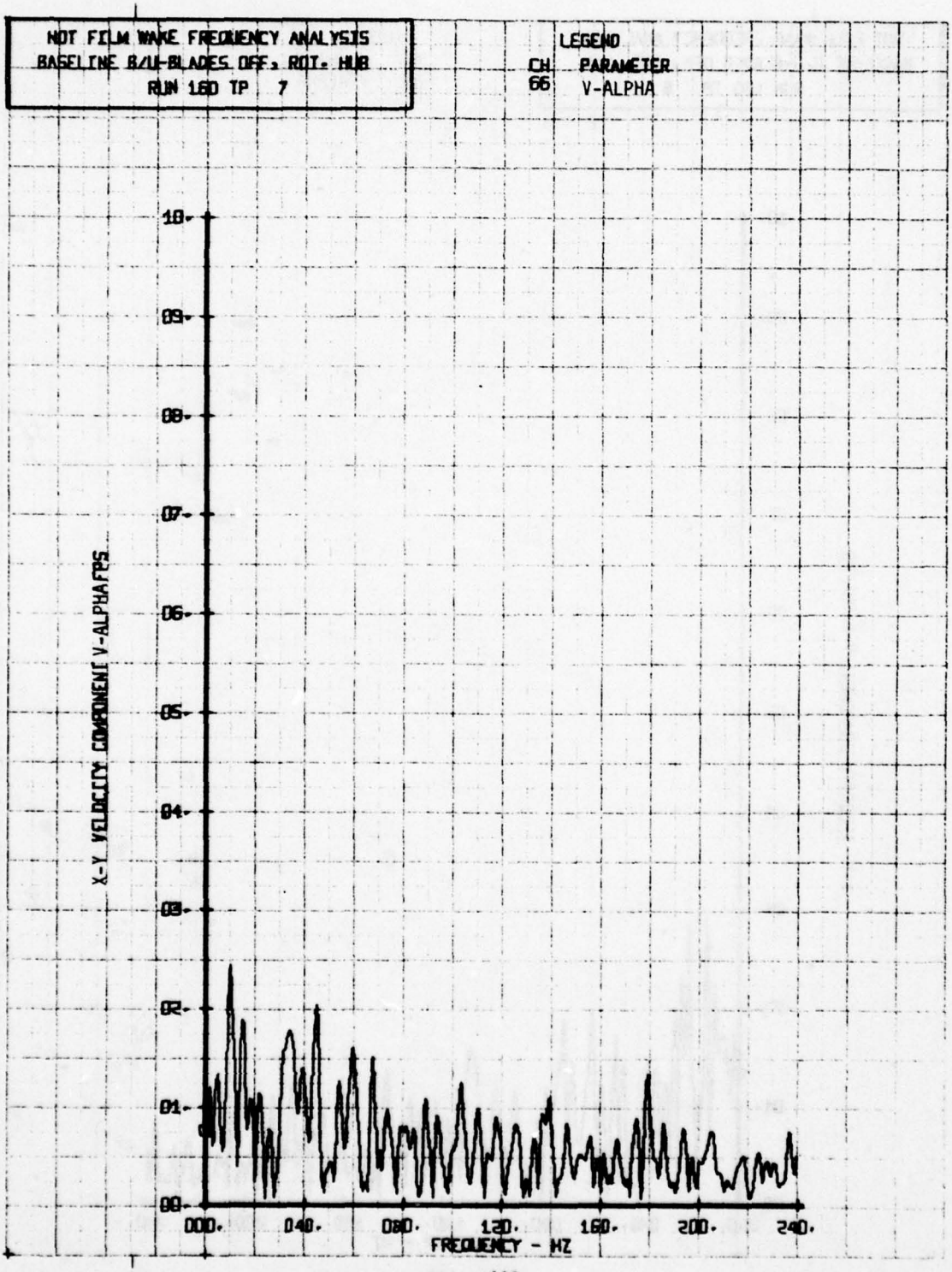

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - KZ

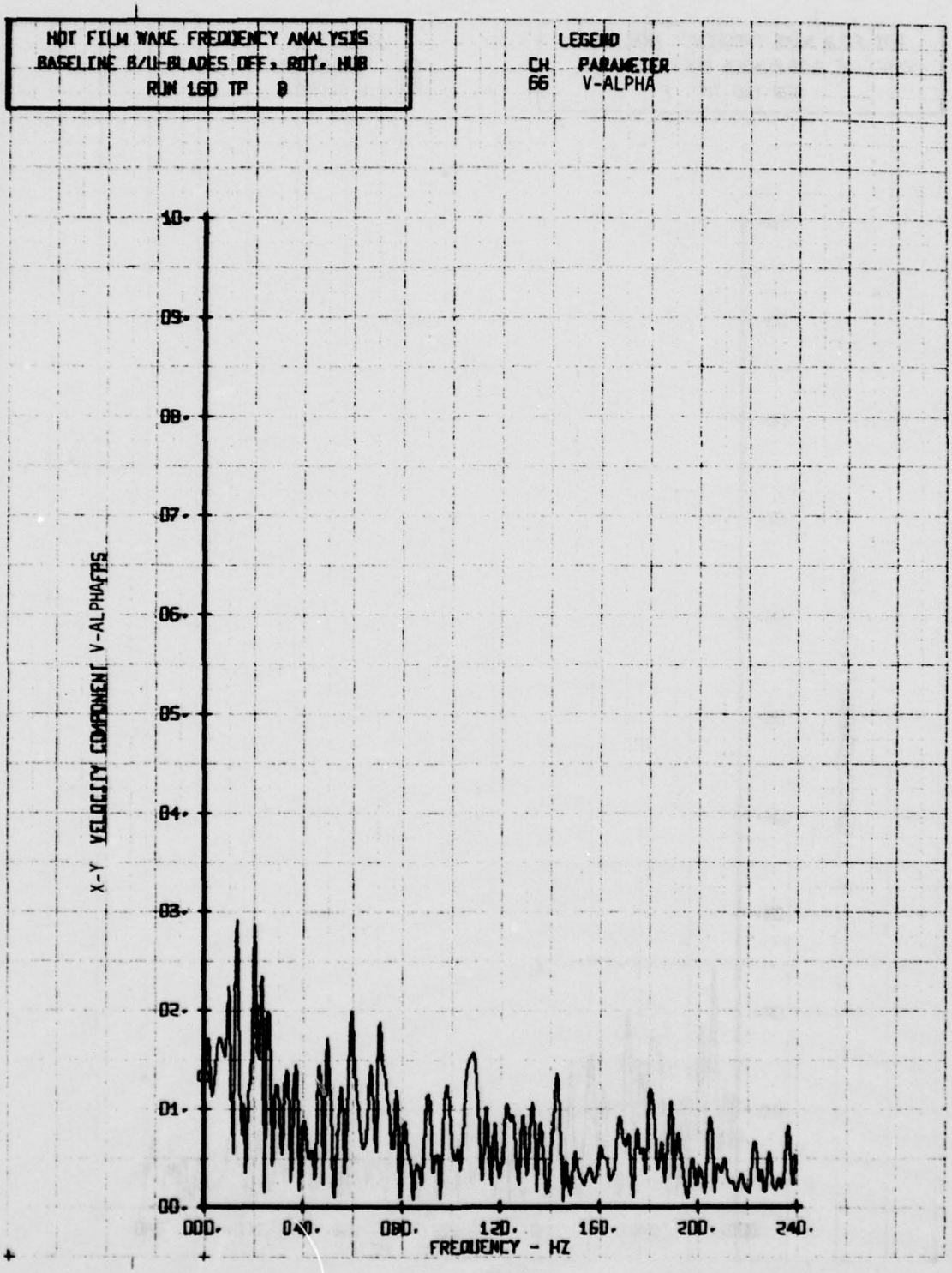

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 10
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

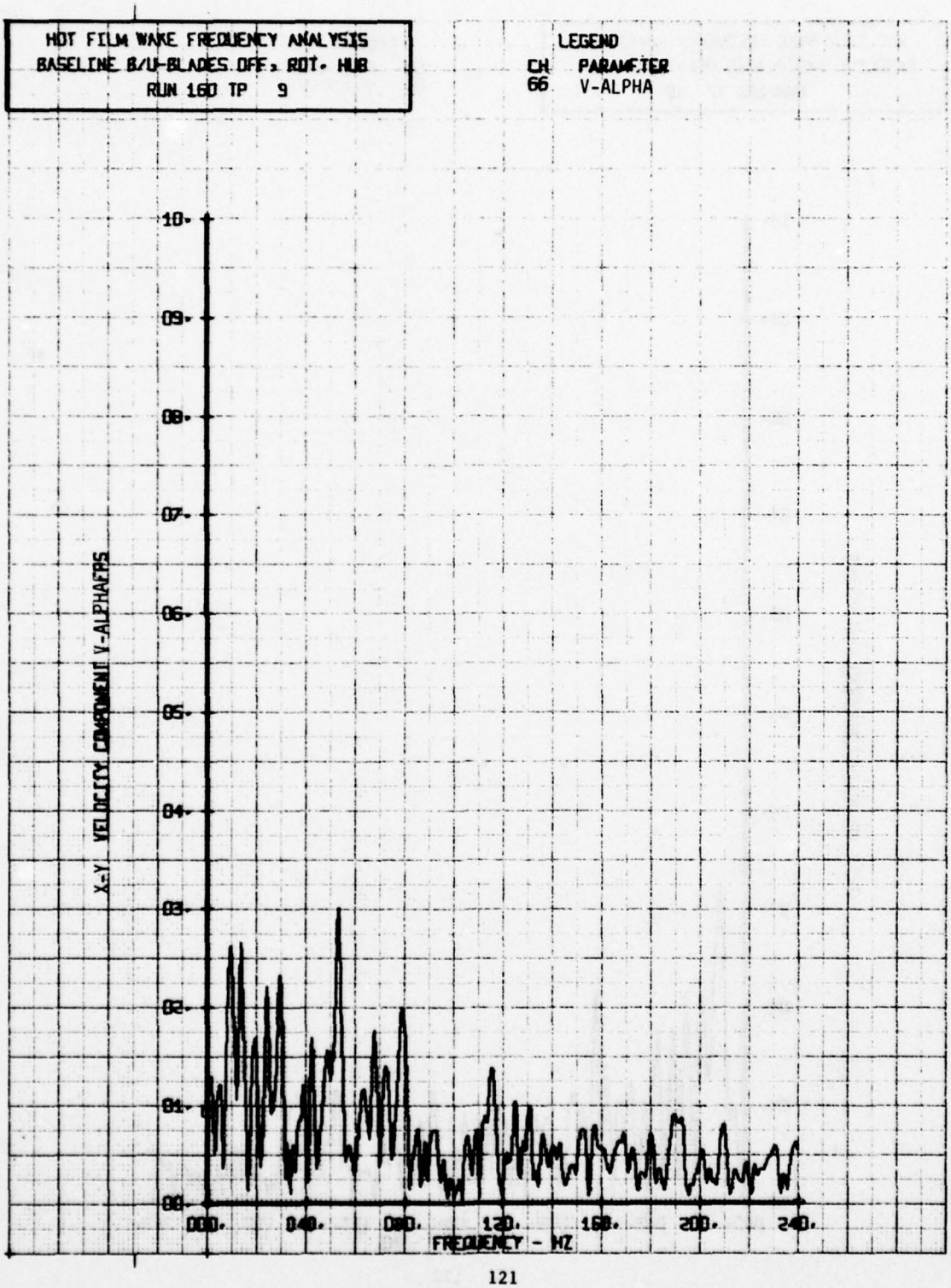

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

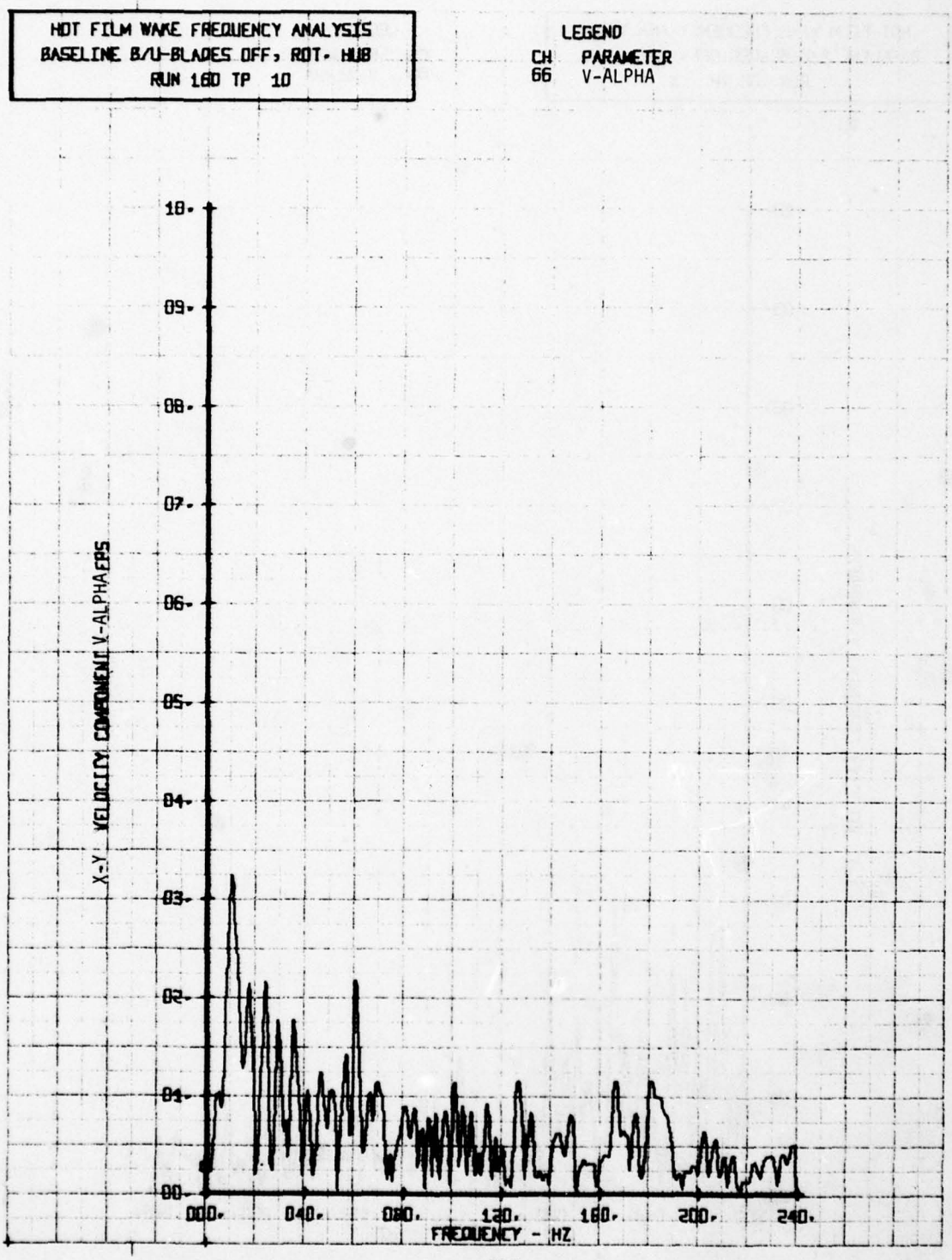

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 5
LEGEND
CH. PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

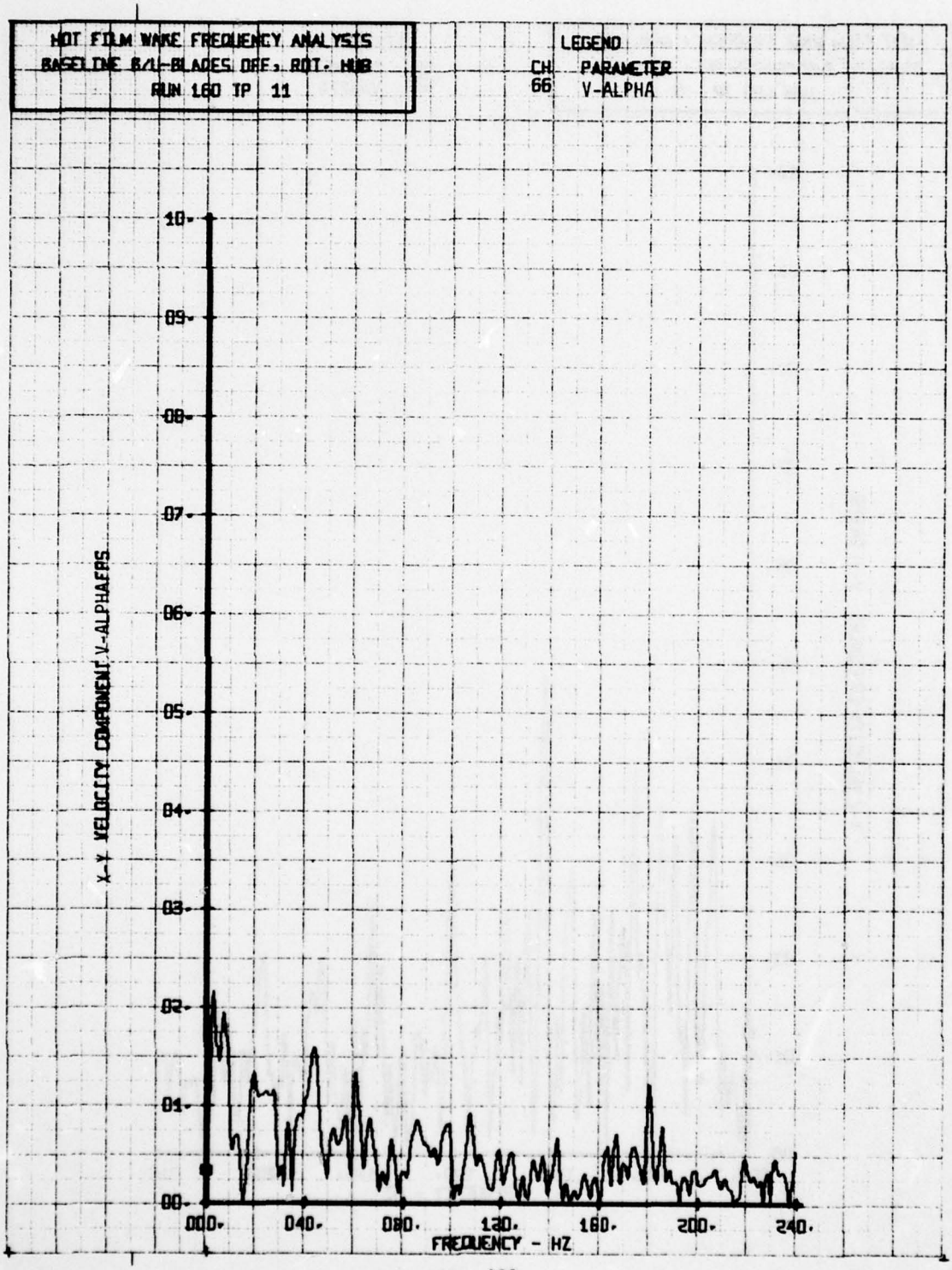

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

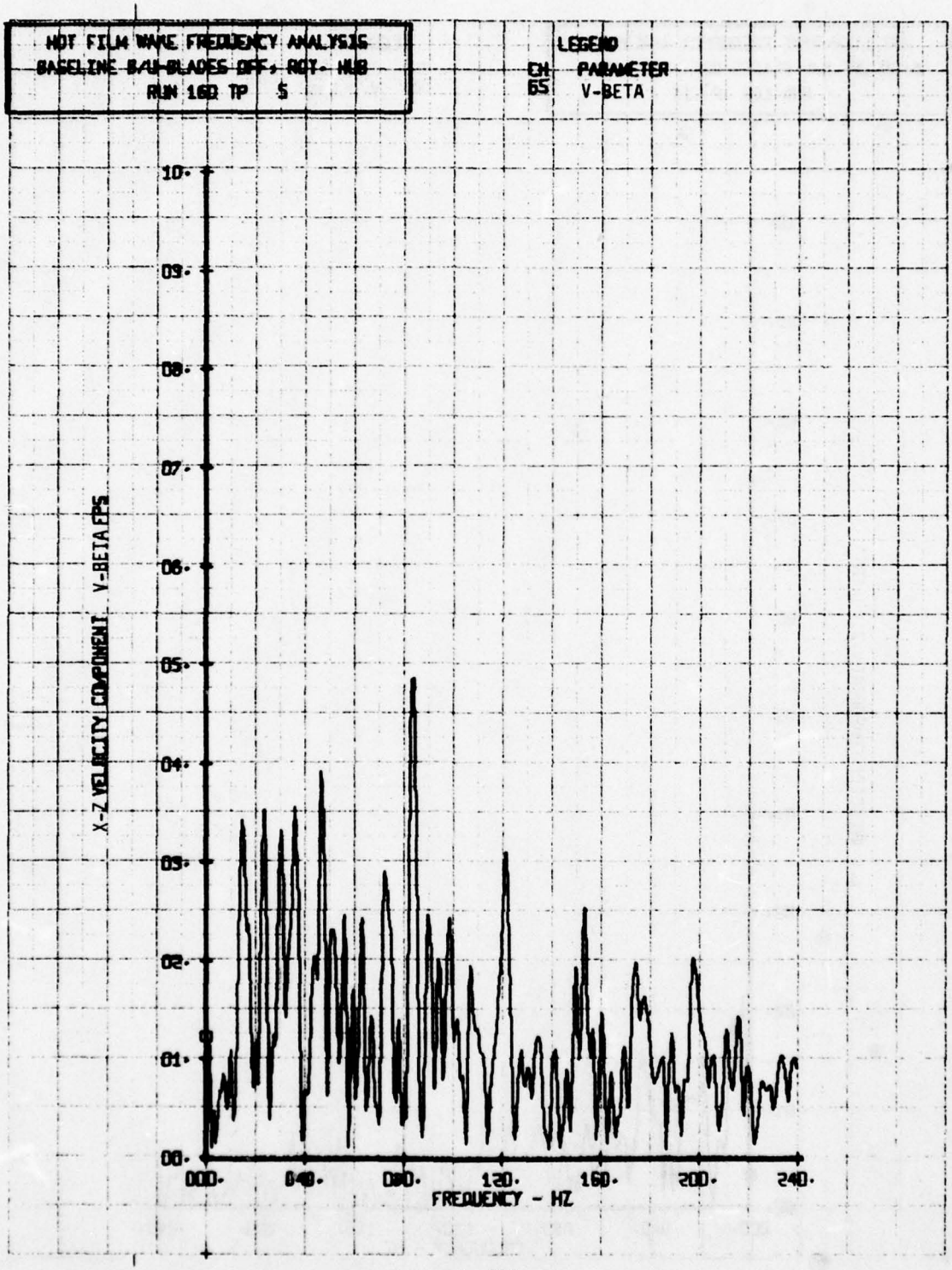

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 7
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

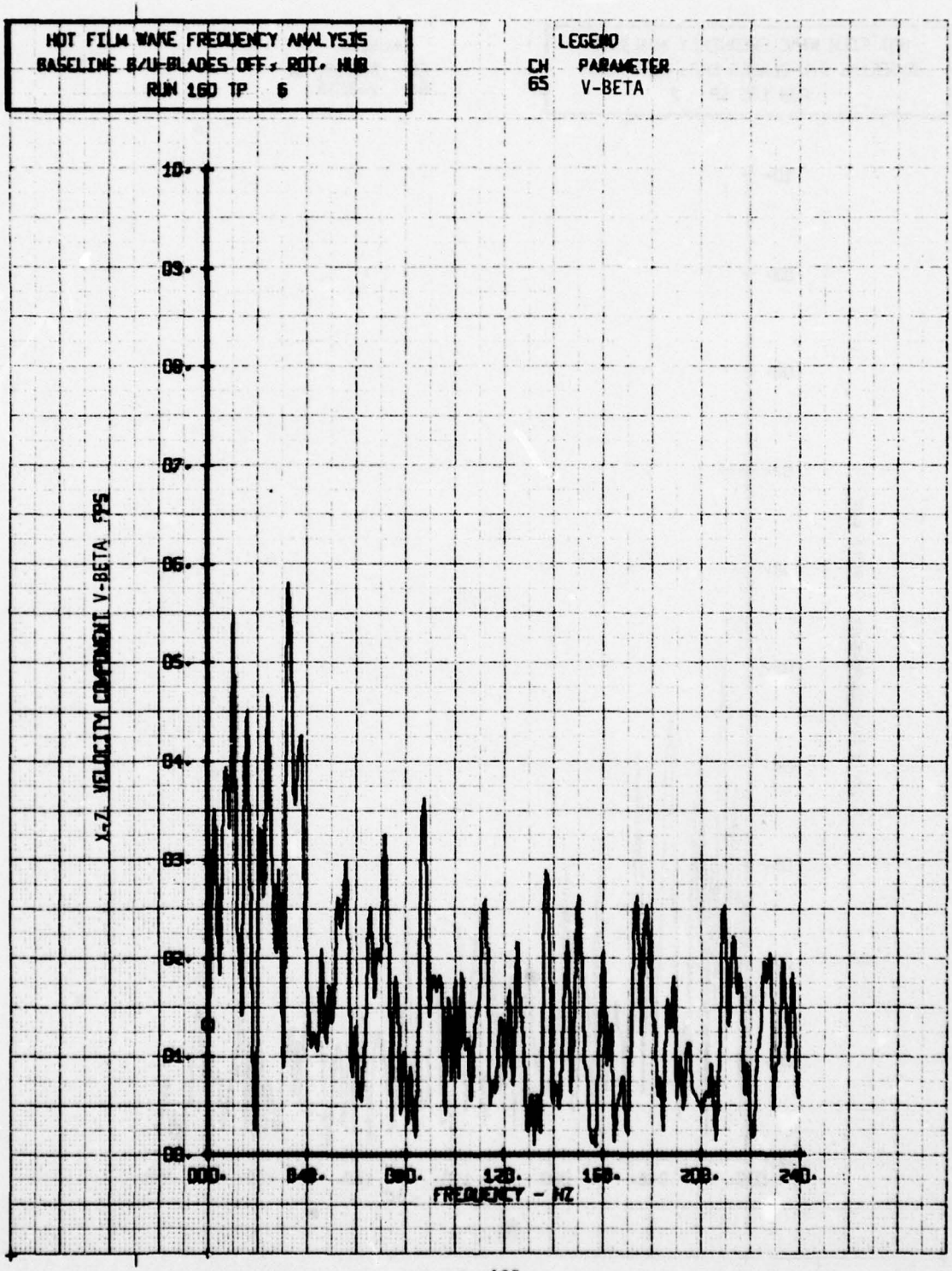

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, BOT. HUB
RUN 160 TP 8
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

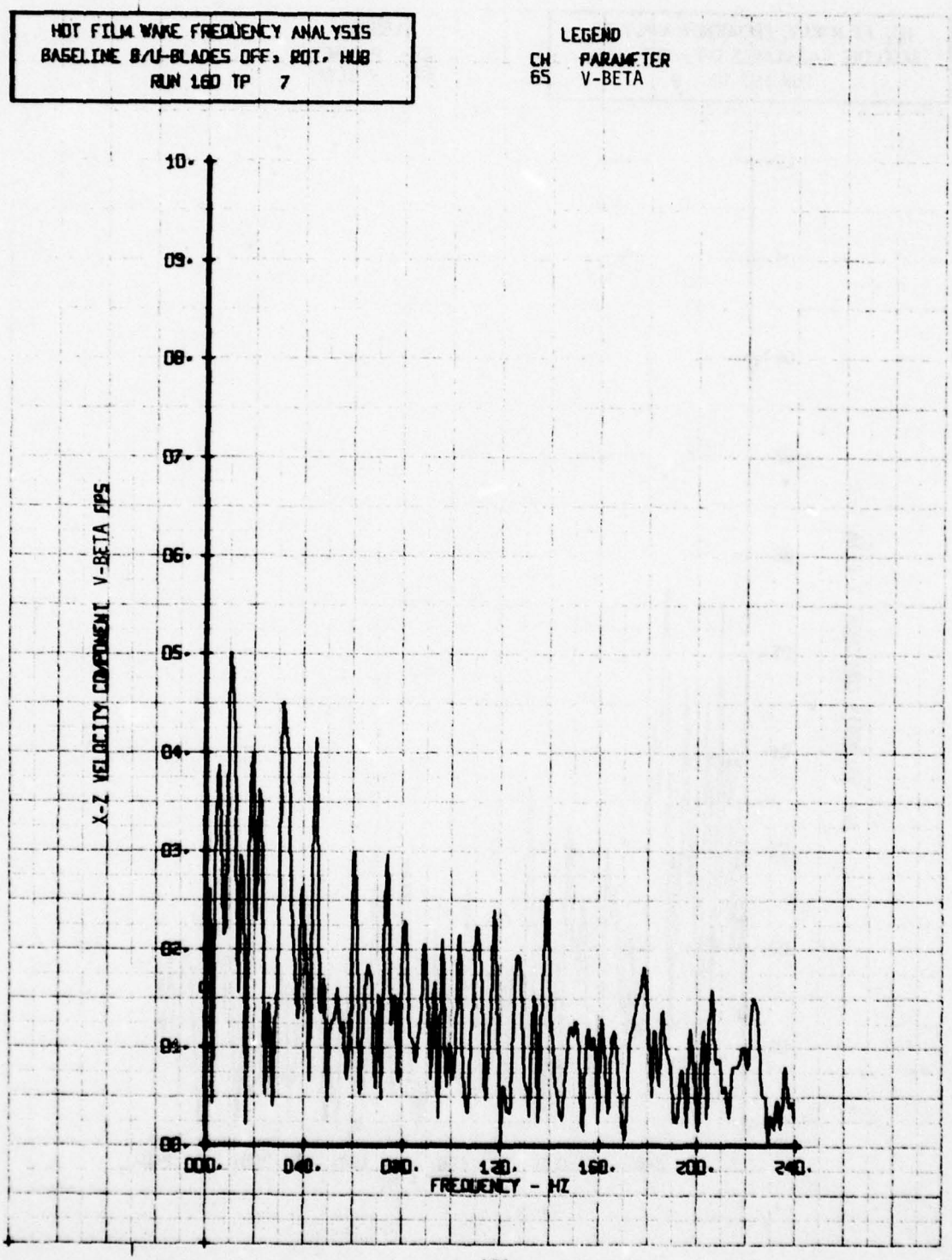

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAERS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

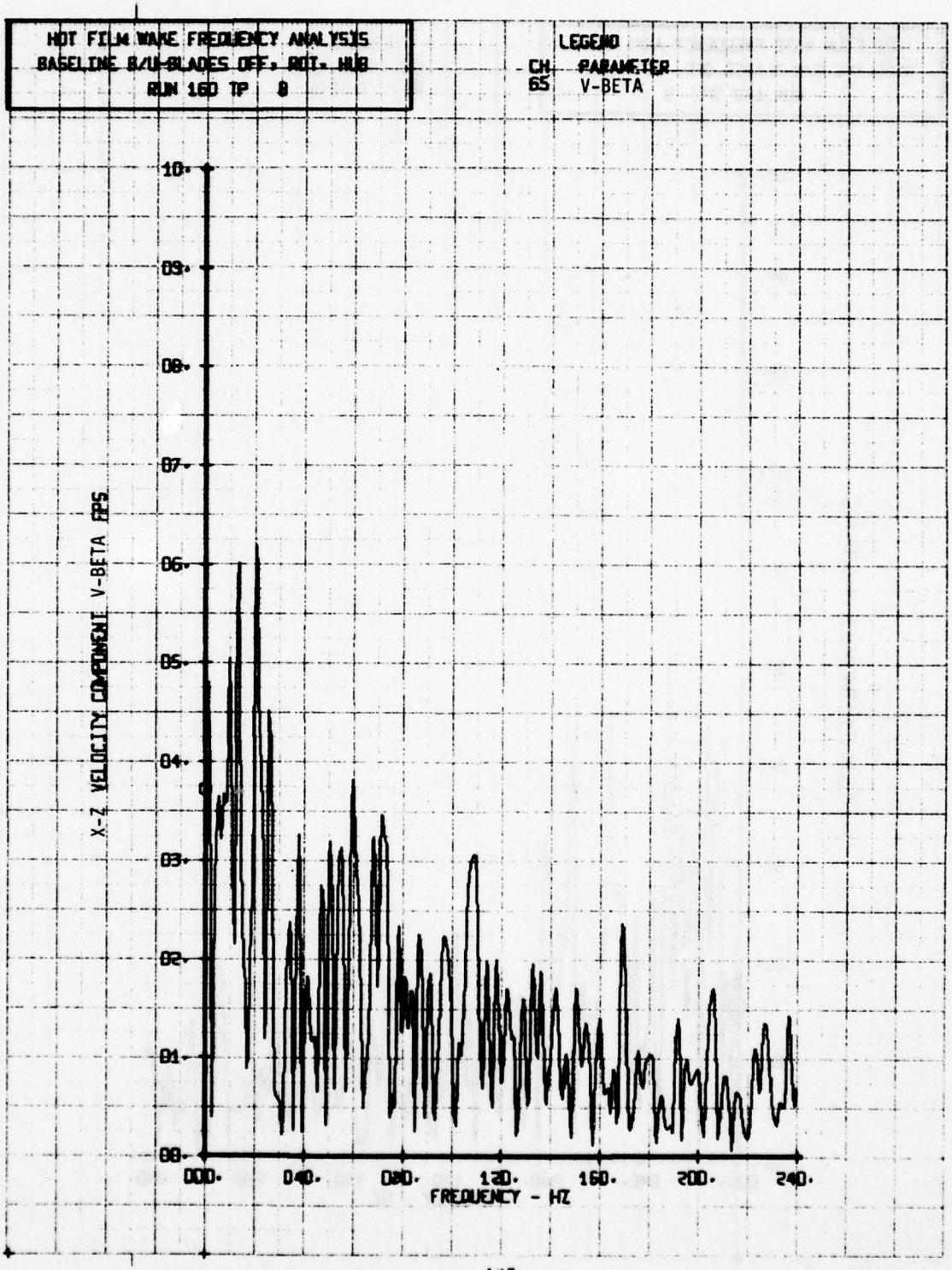

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 180 TP 10
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA EPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

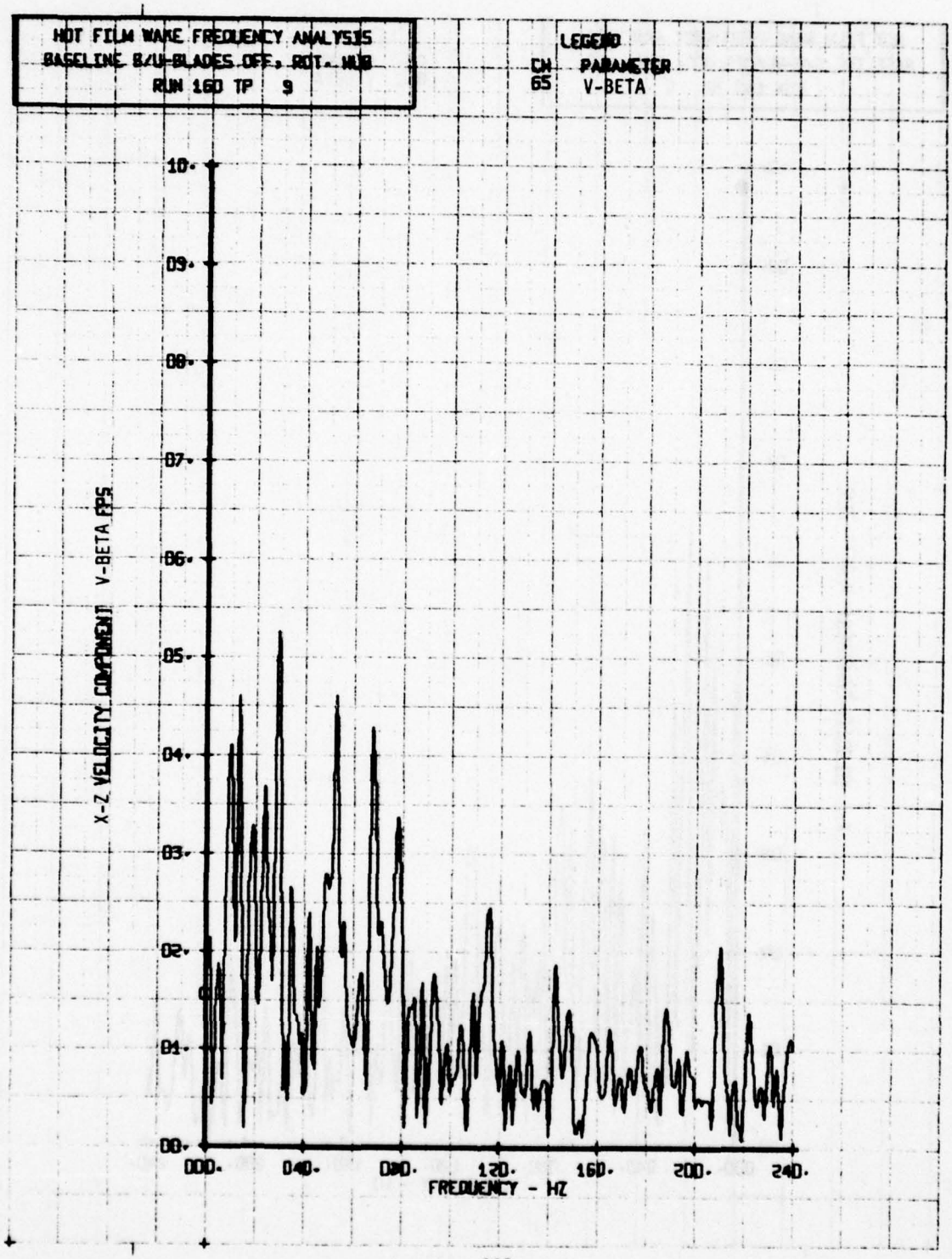

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 8/1-BLADES DEF. ROT. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

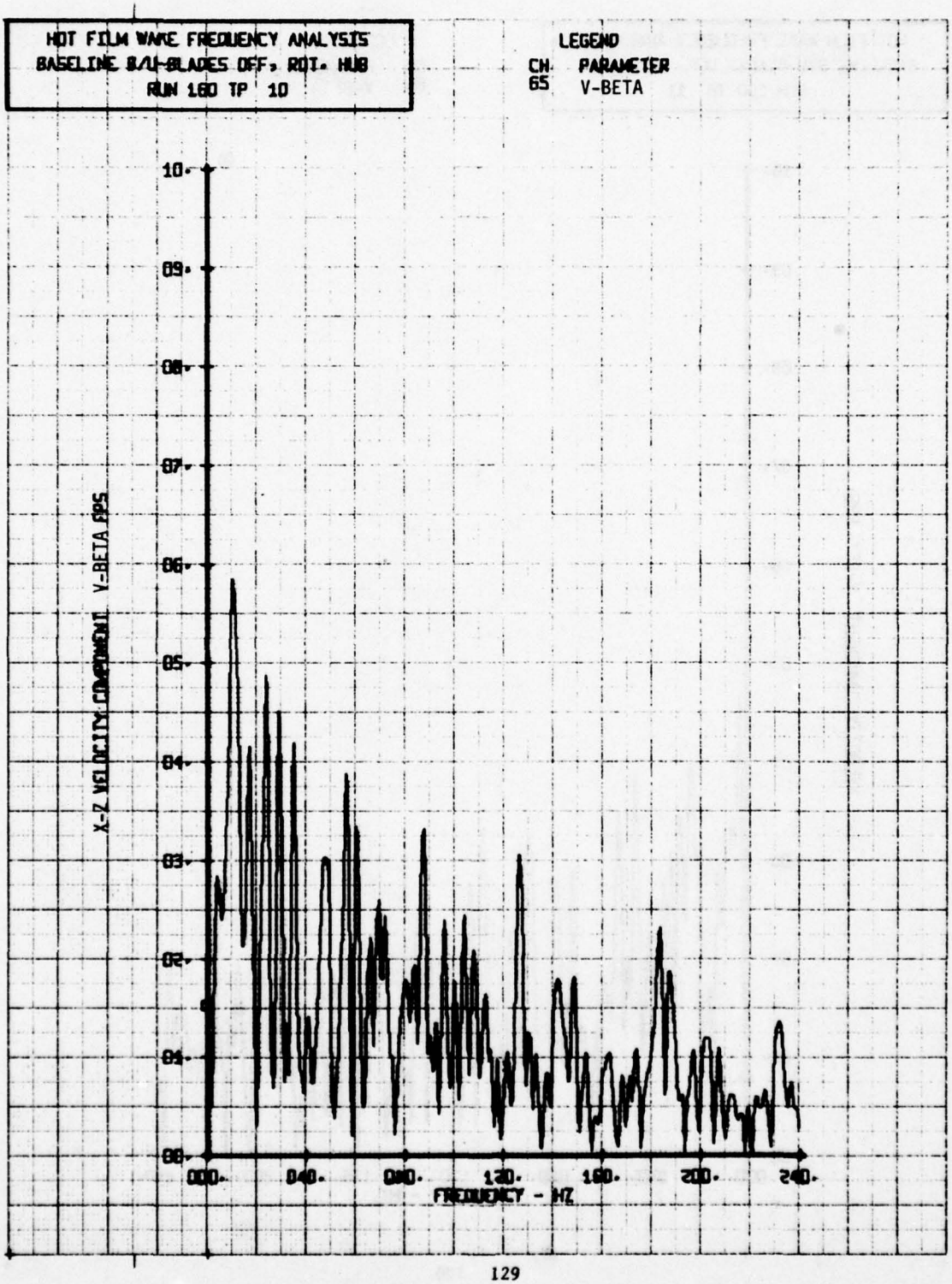

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/H-BLADES OFF, ROT. HUB
RUN 160 TP 5
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

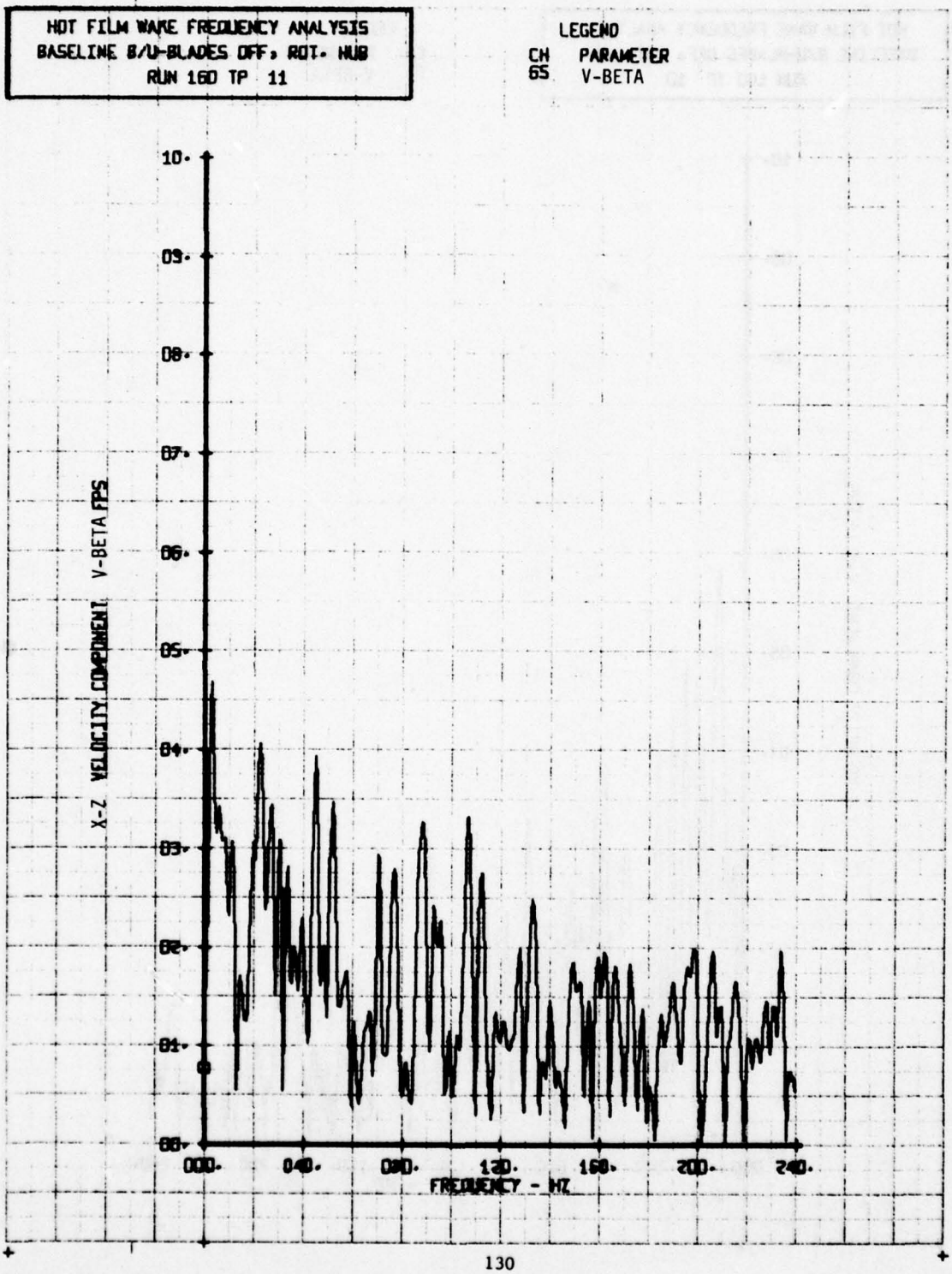

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 6
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

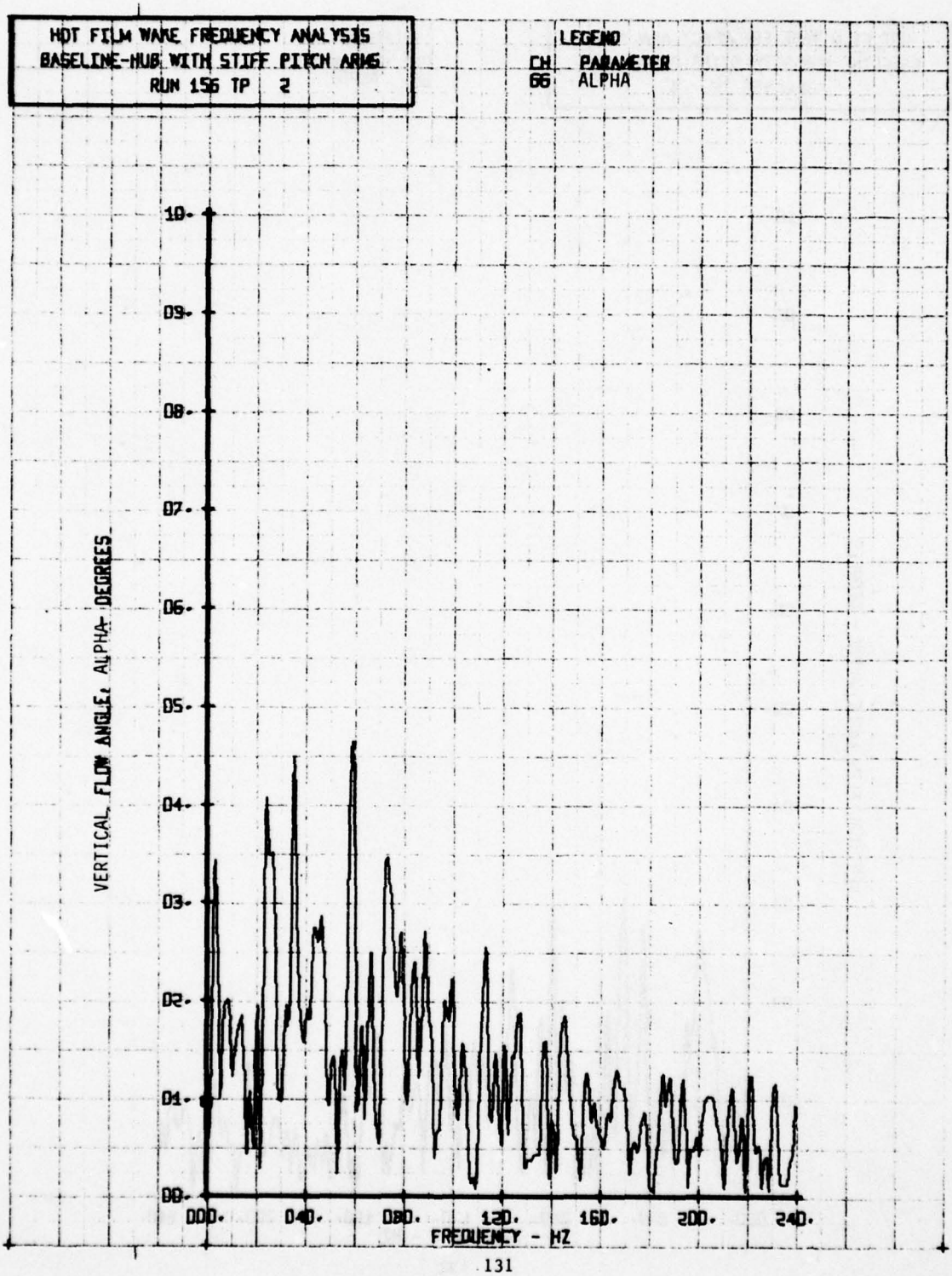

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 7
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

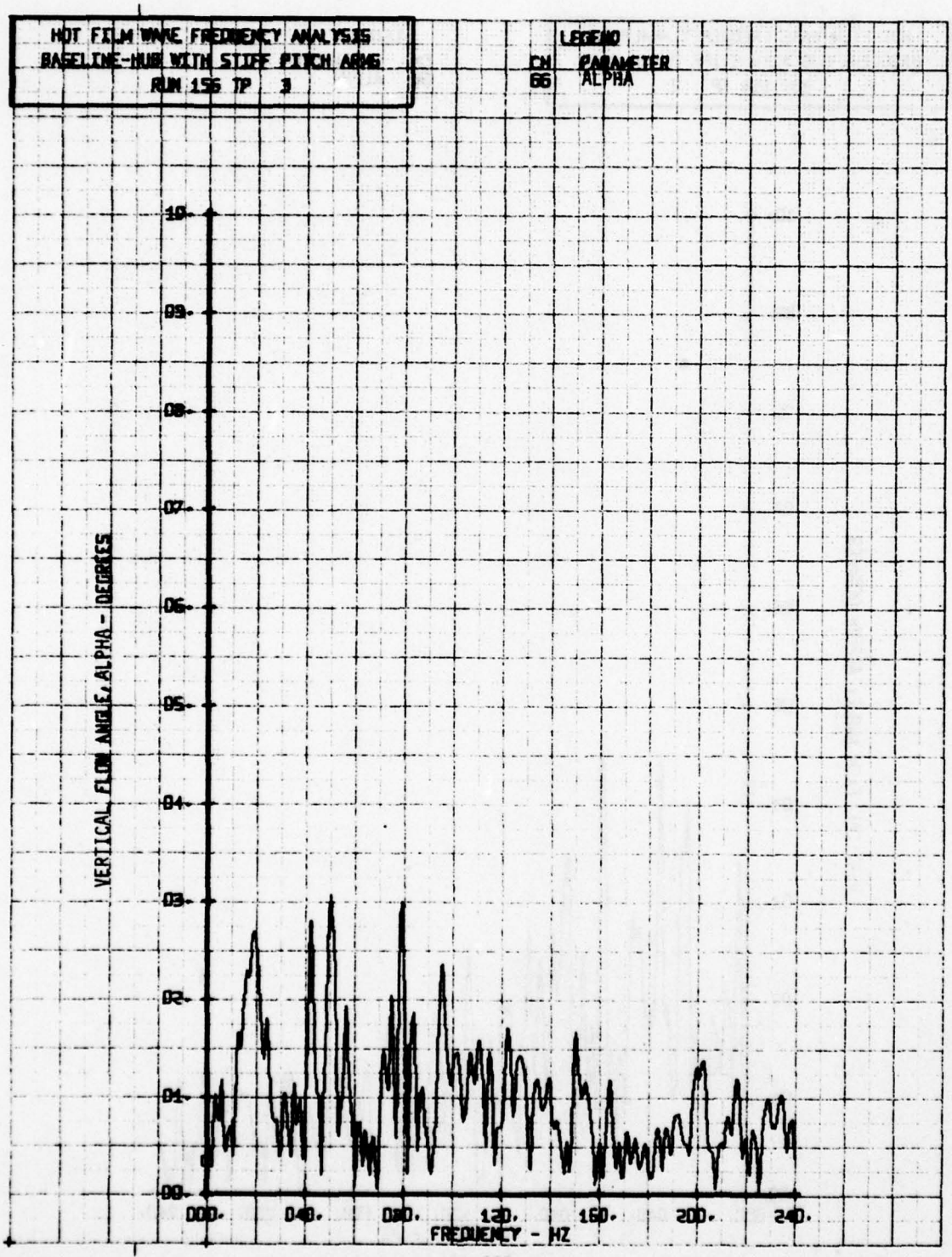

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 8
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

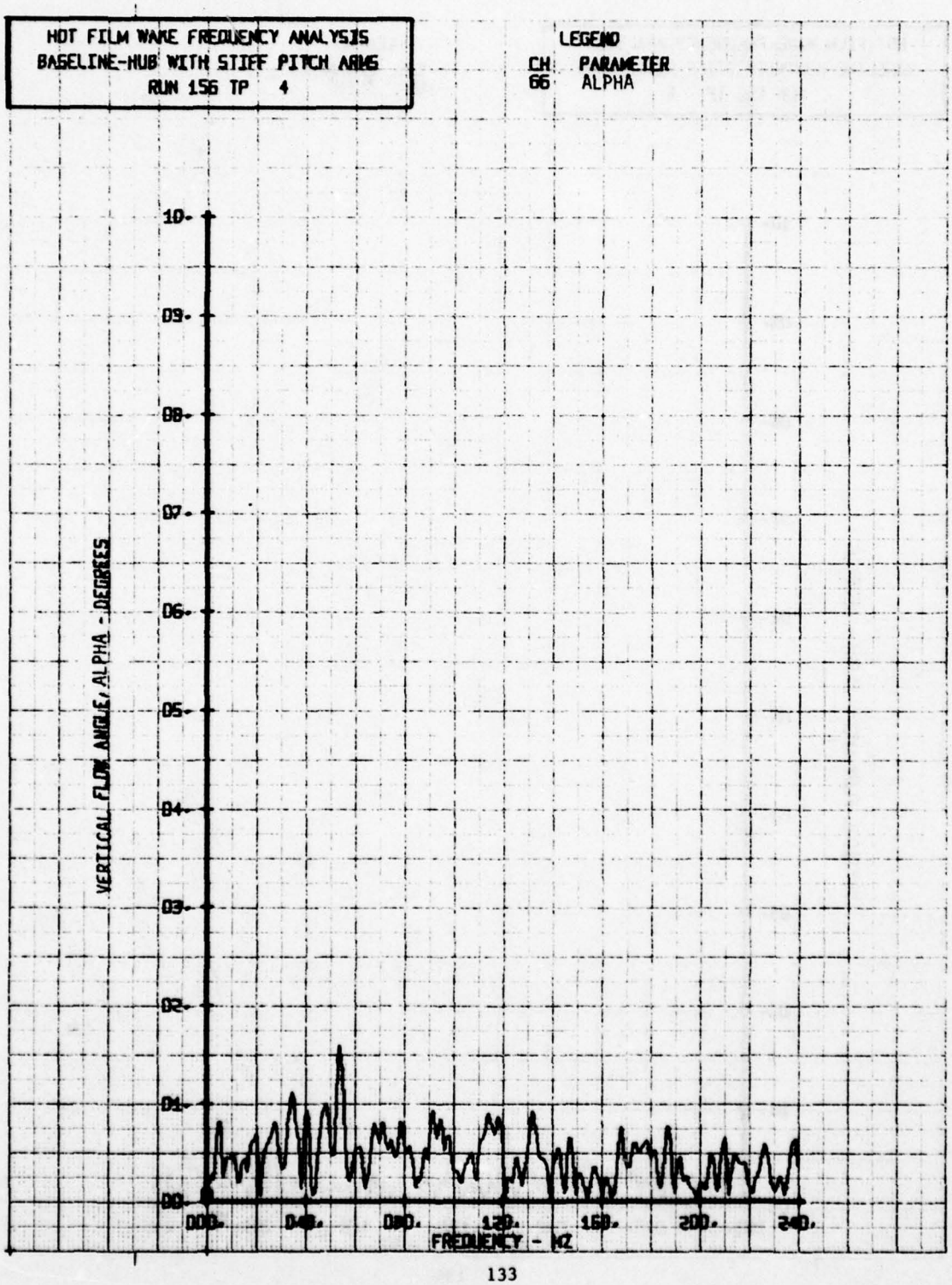

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 9
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

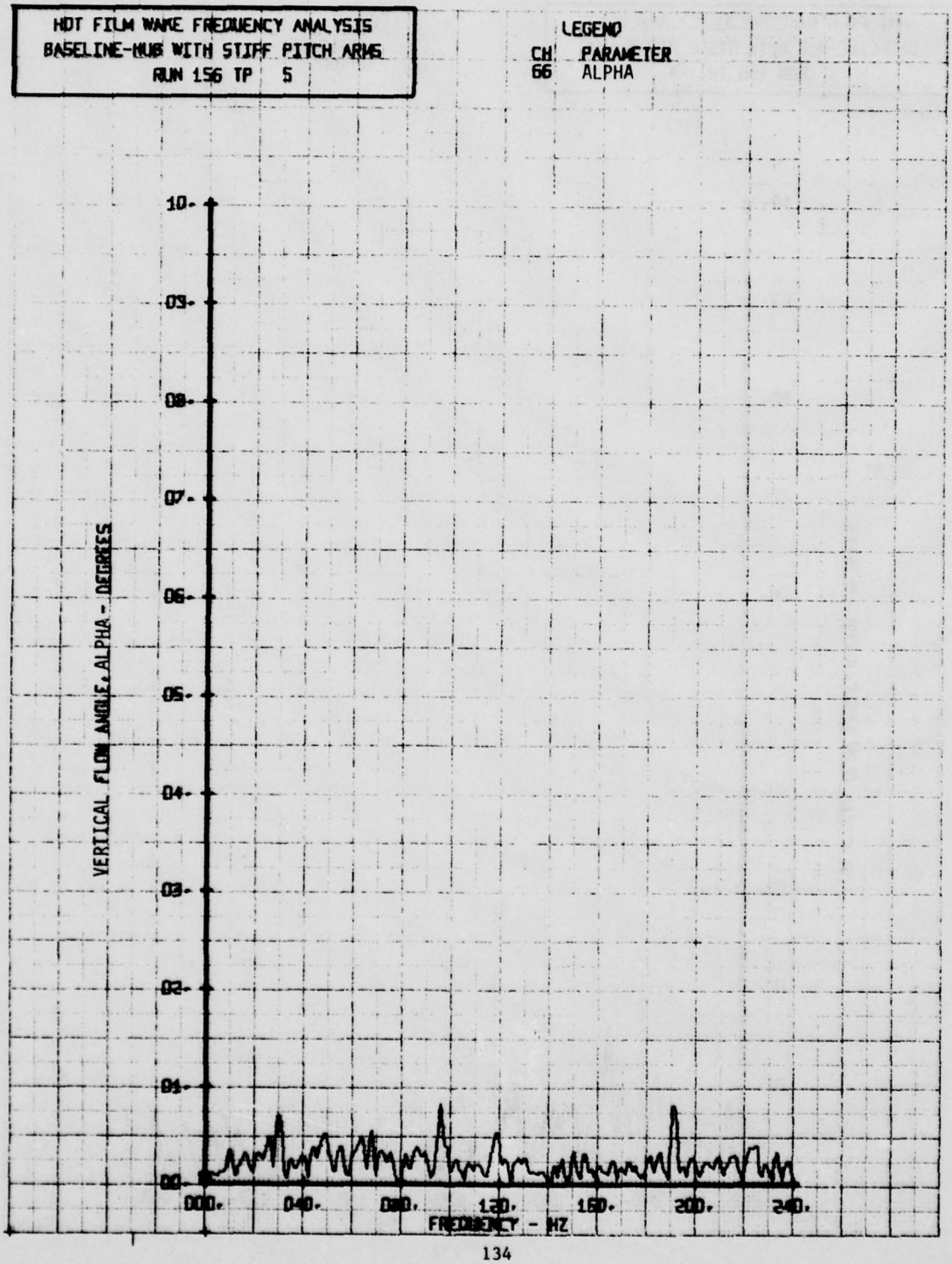

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/L-BLADES OFF, ROT. HUB
RUN 160 TP 10
LEGEND
CH. PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

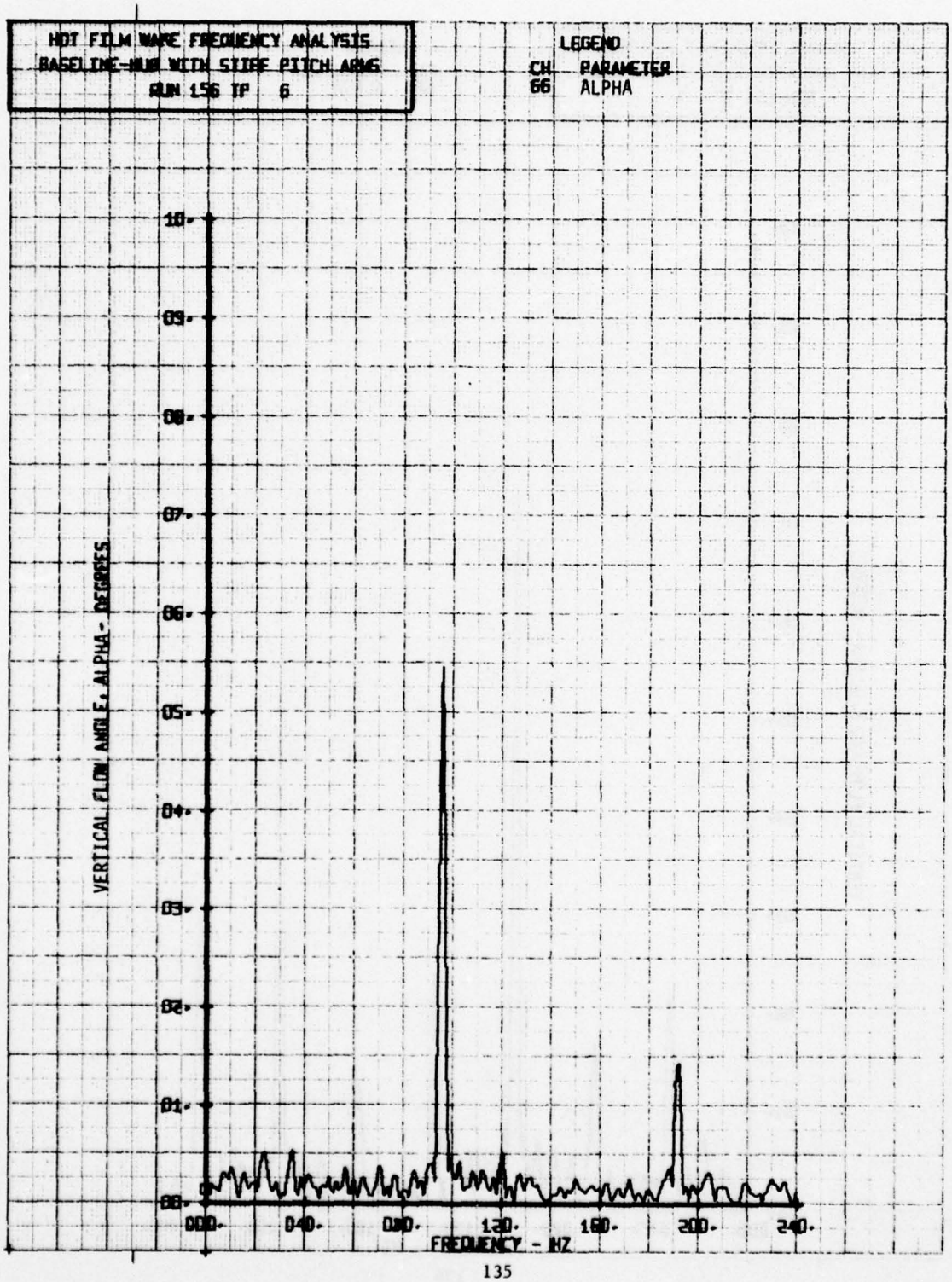

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, ROT. HUB
RUN 160 TP 11
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

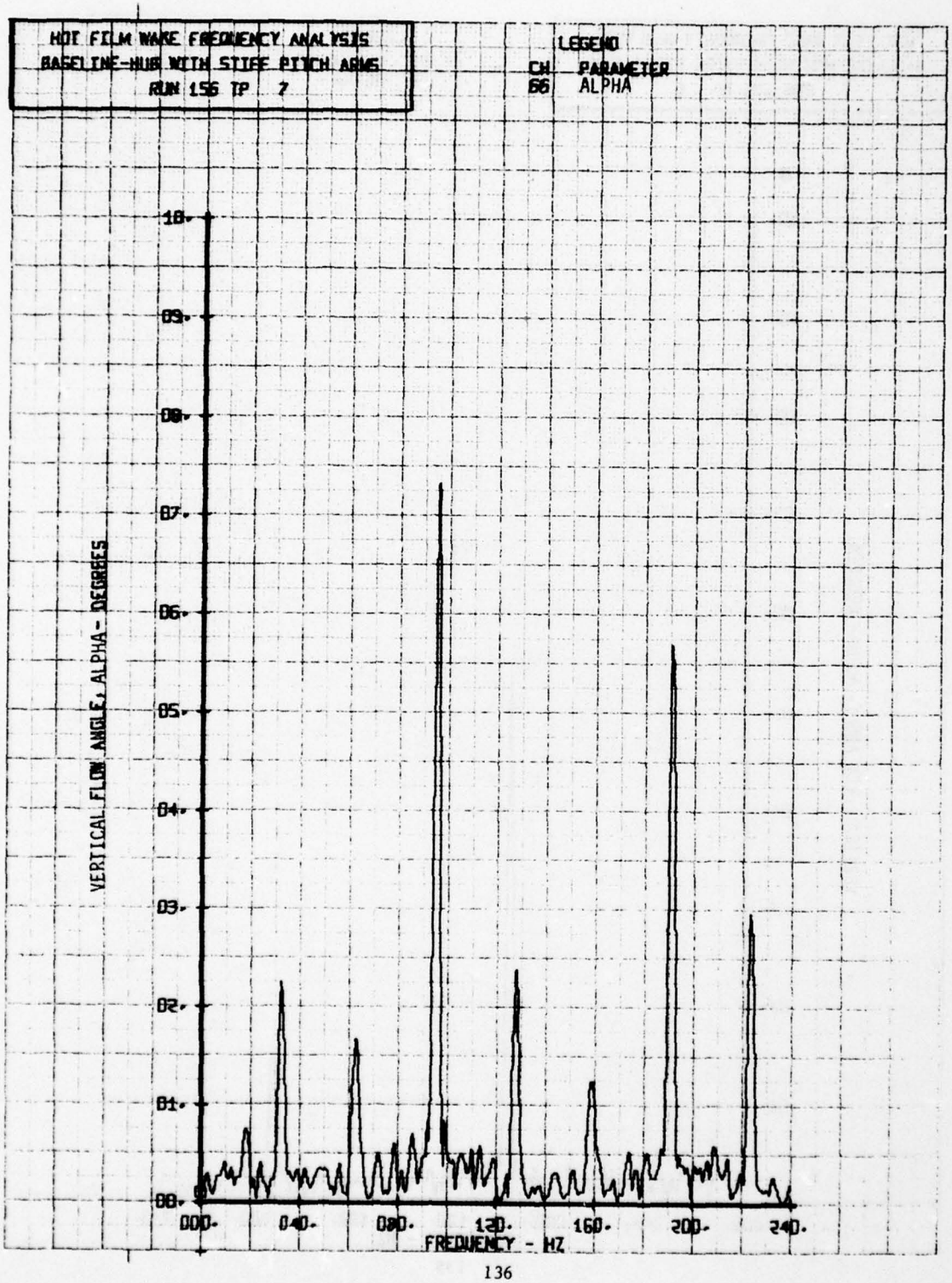

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA- DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

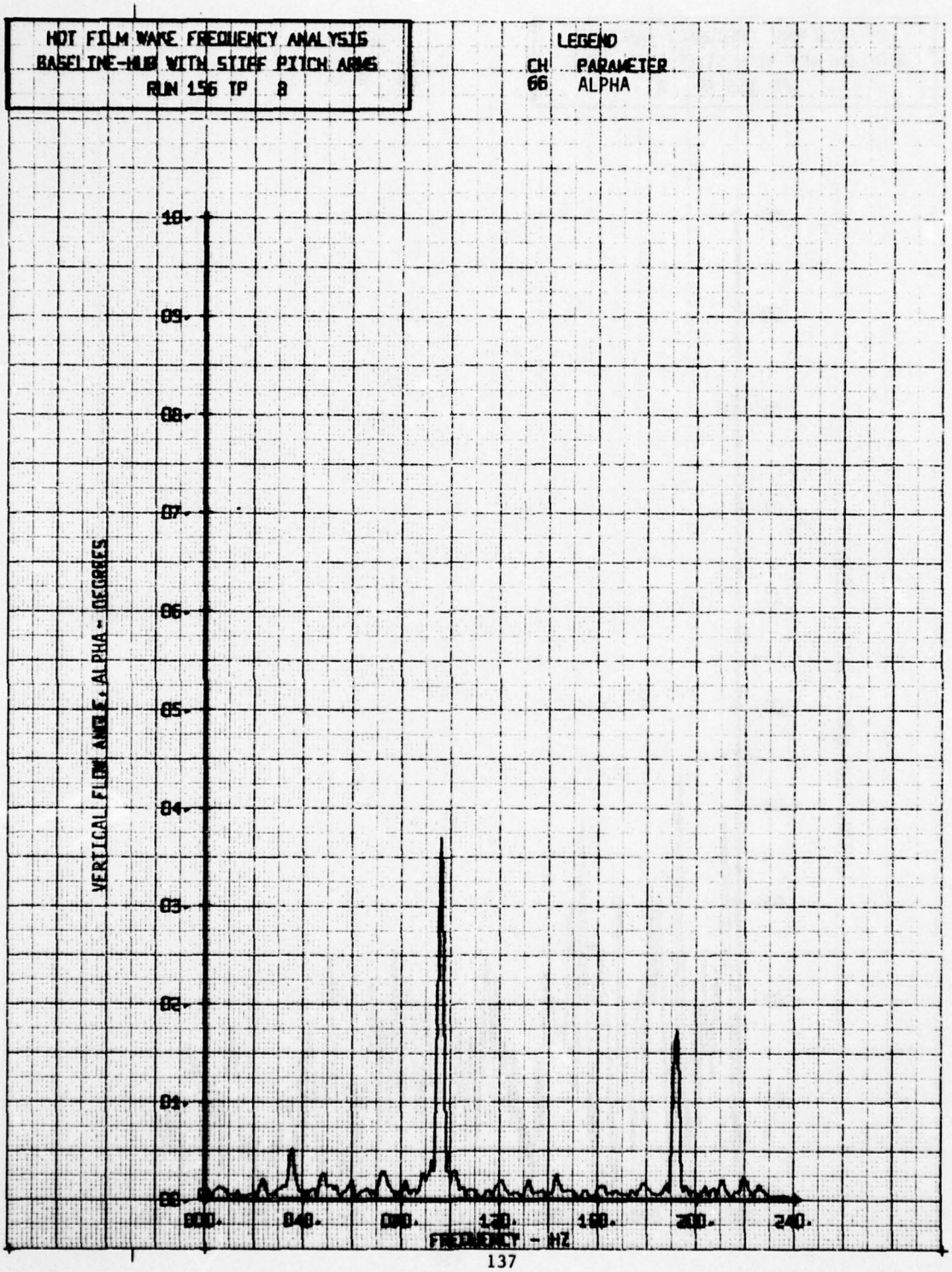

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 3
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE,ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

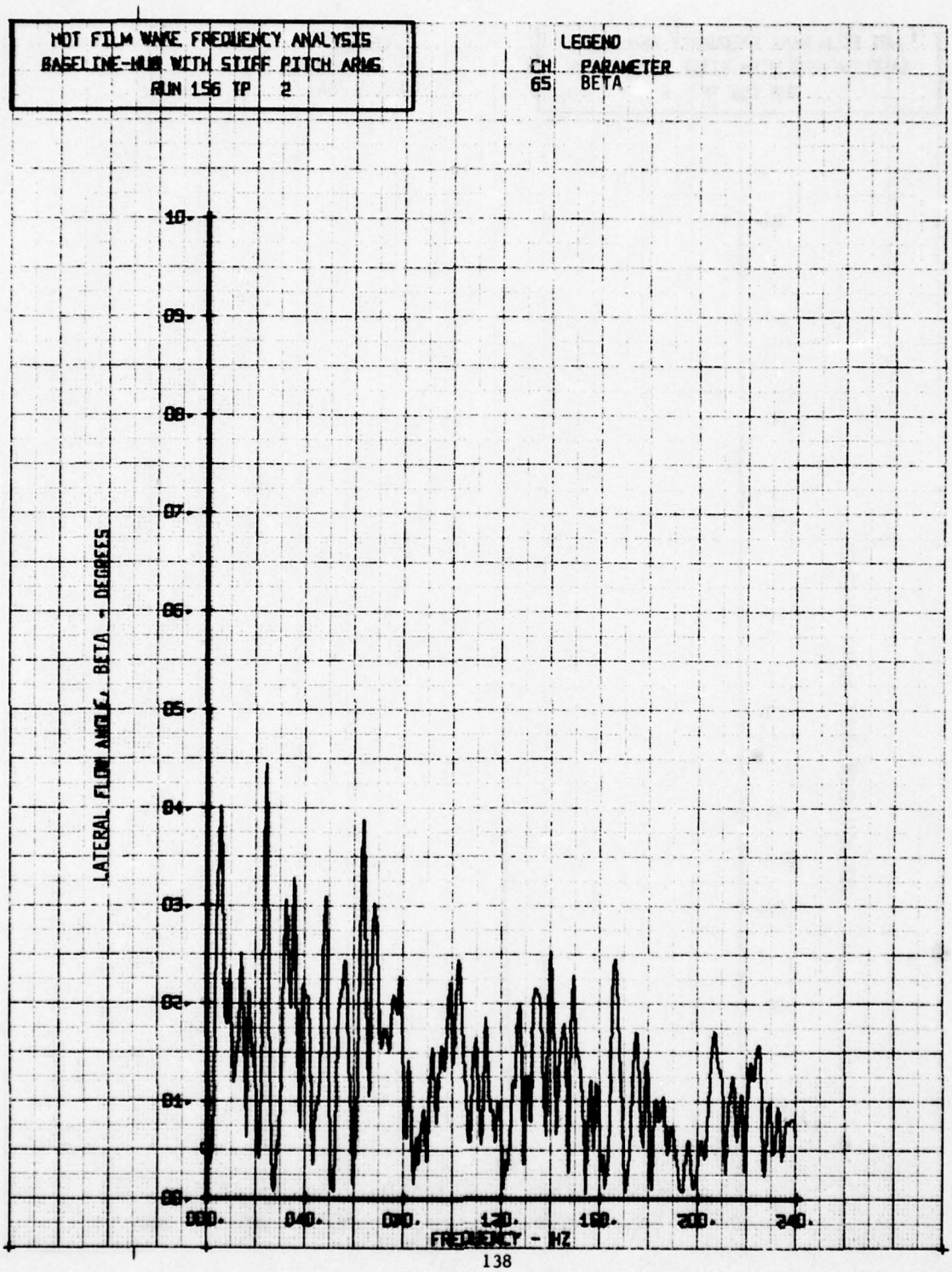

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 4
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

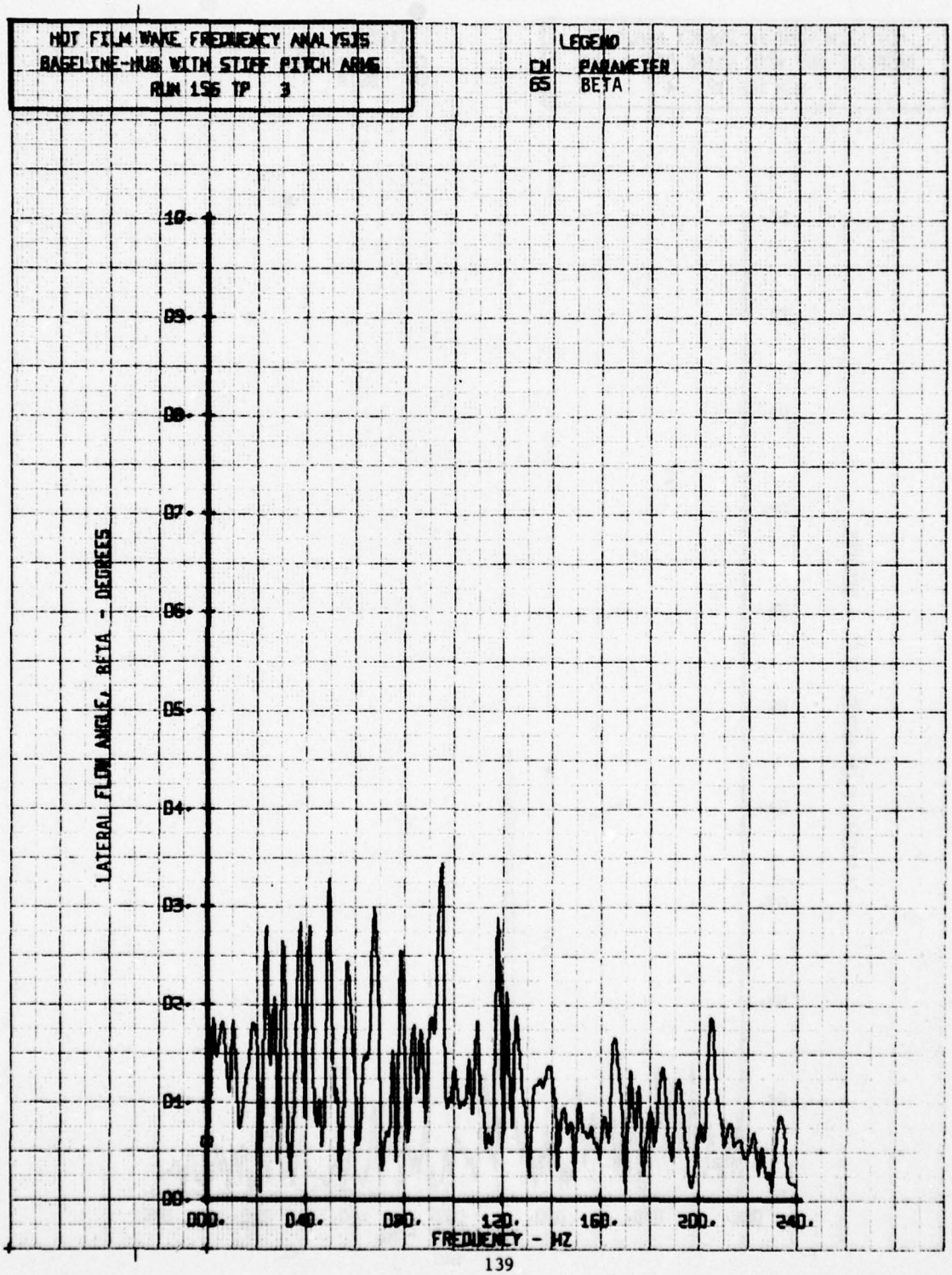

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE,ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

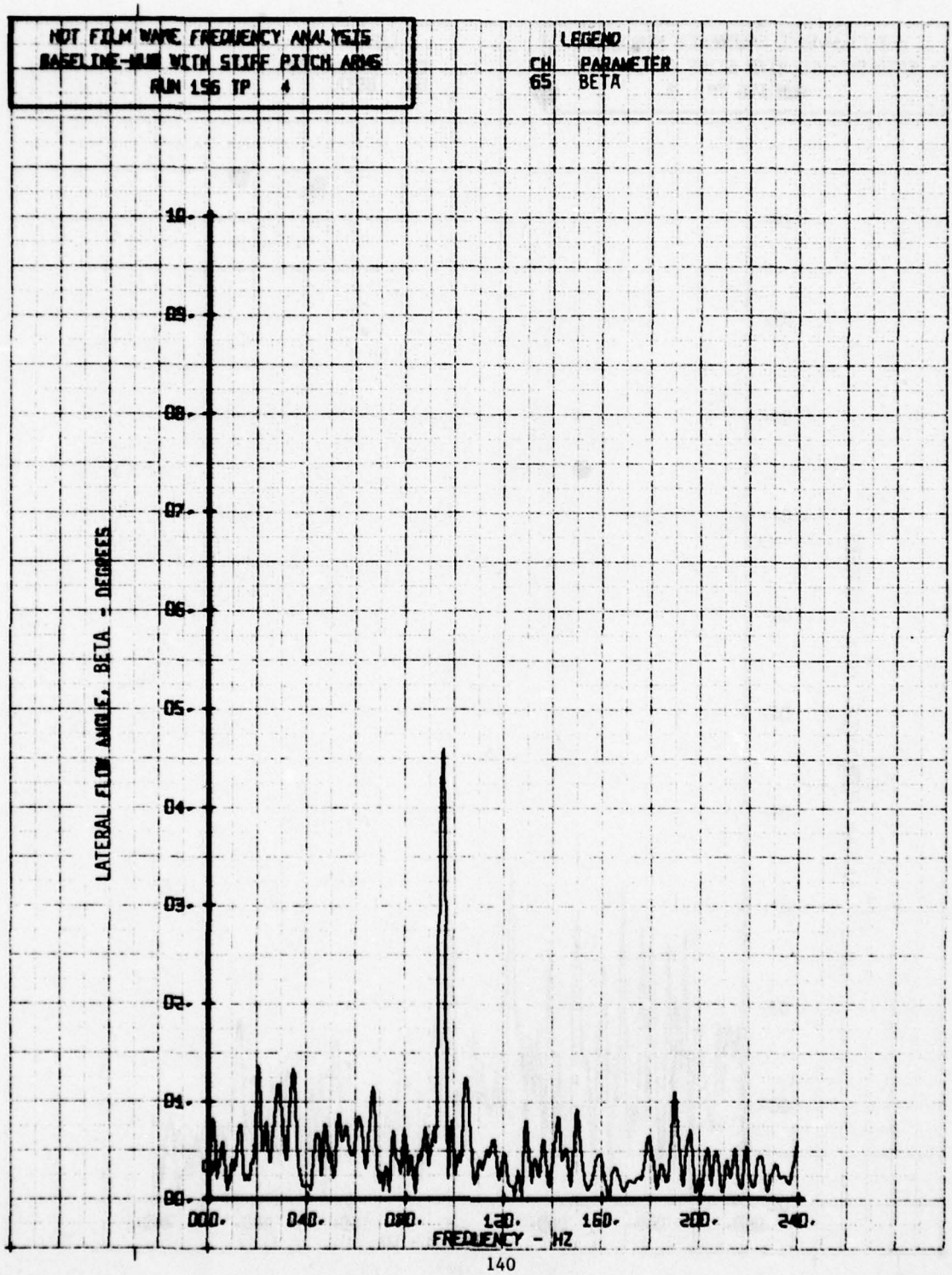

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 6
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

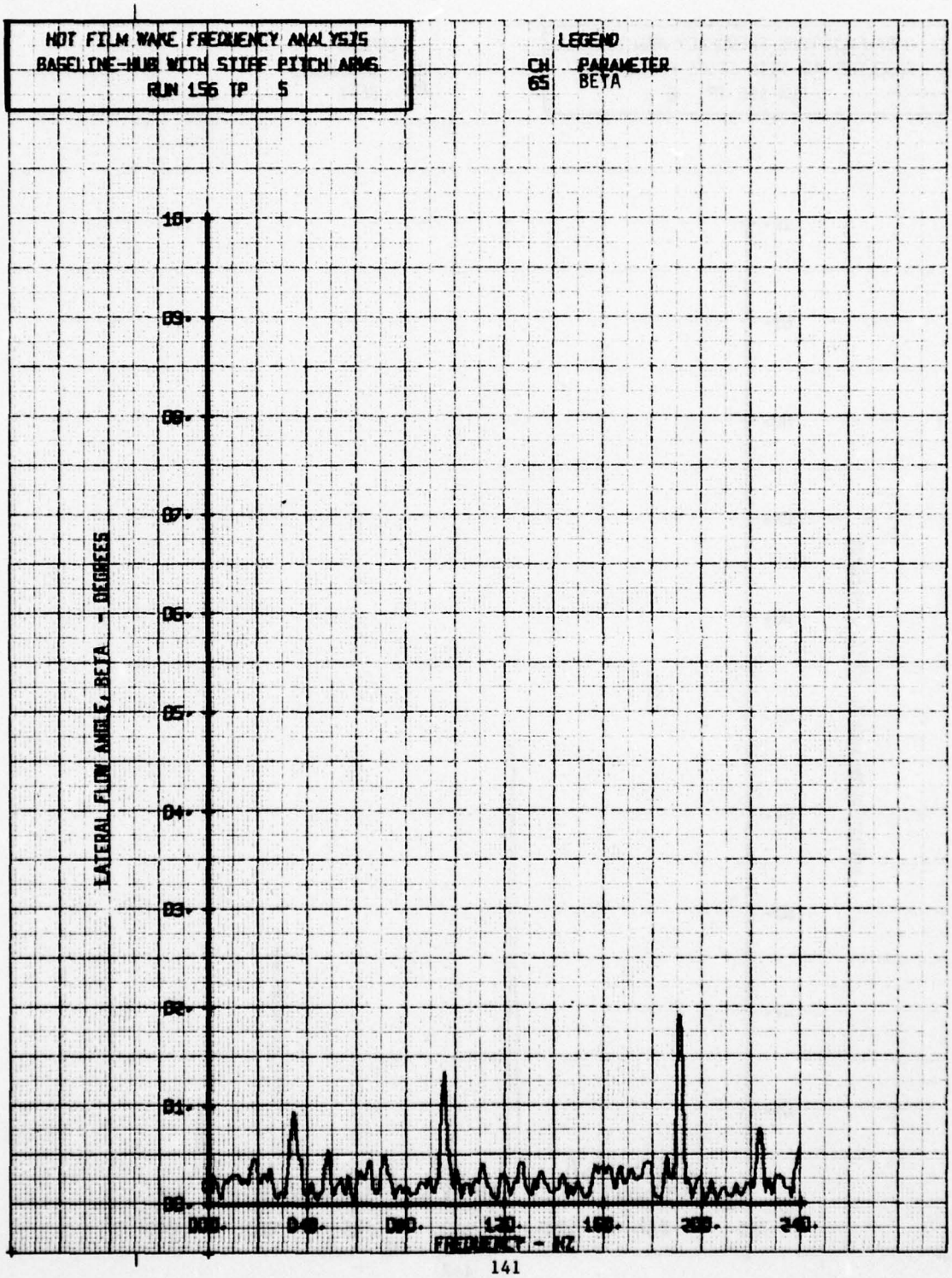

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 7
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

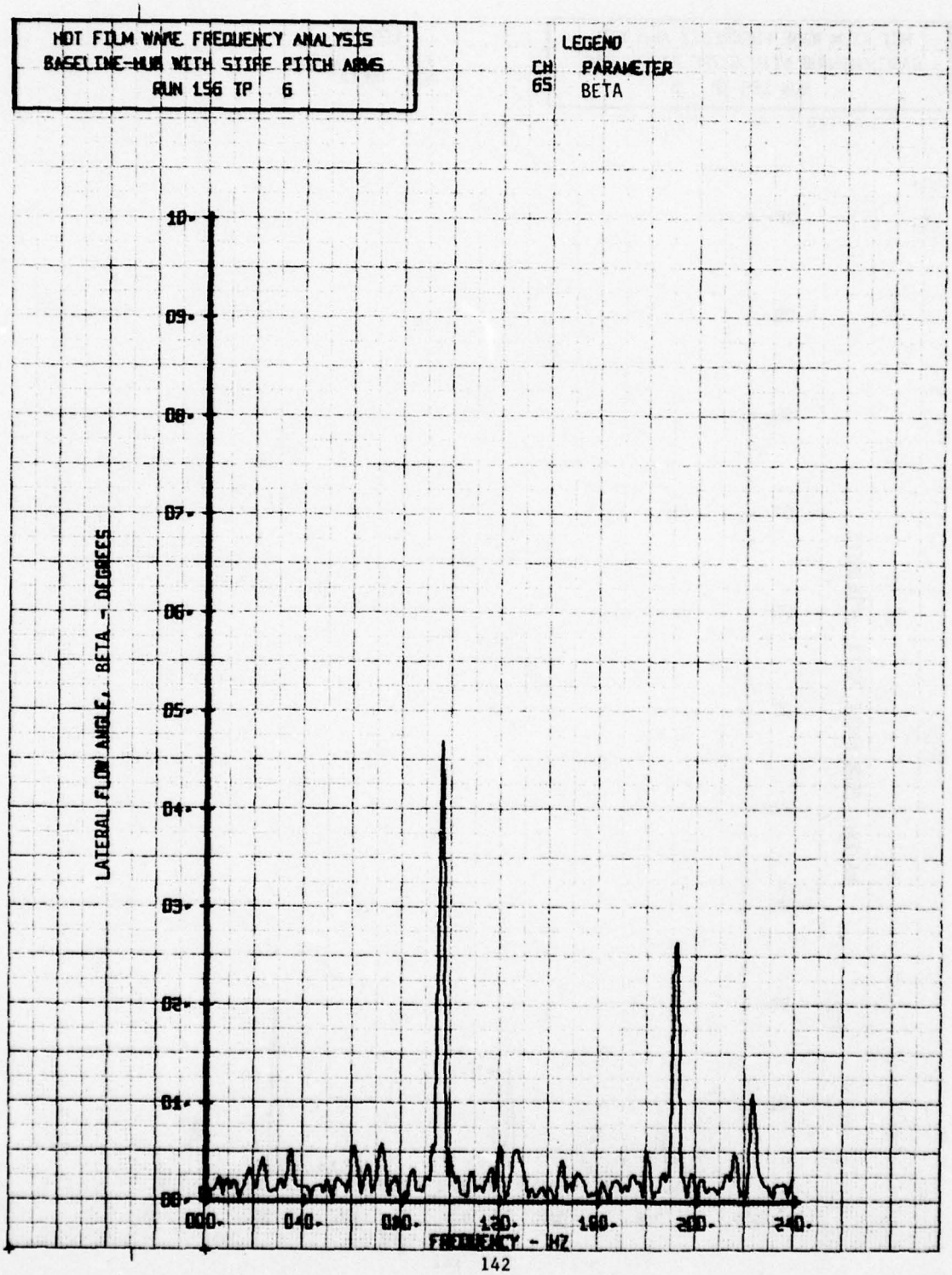

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 8
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
080.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

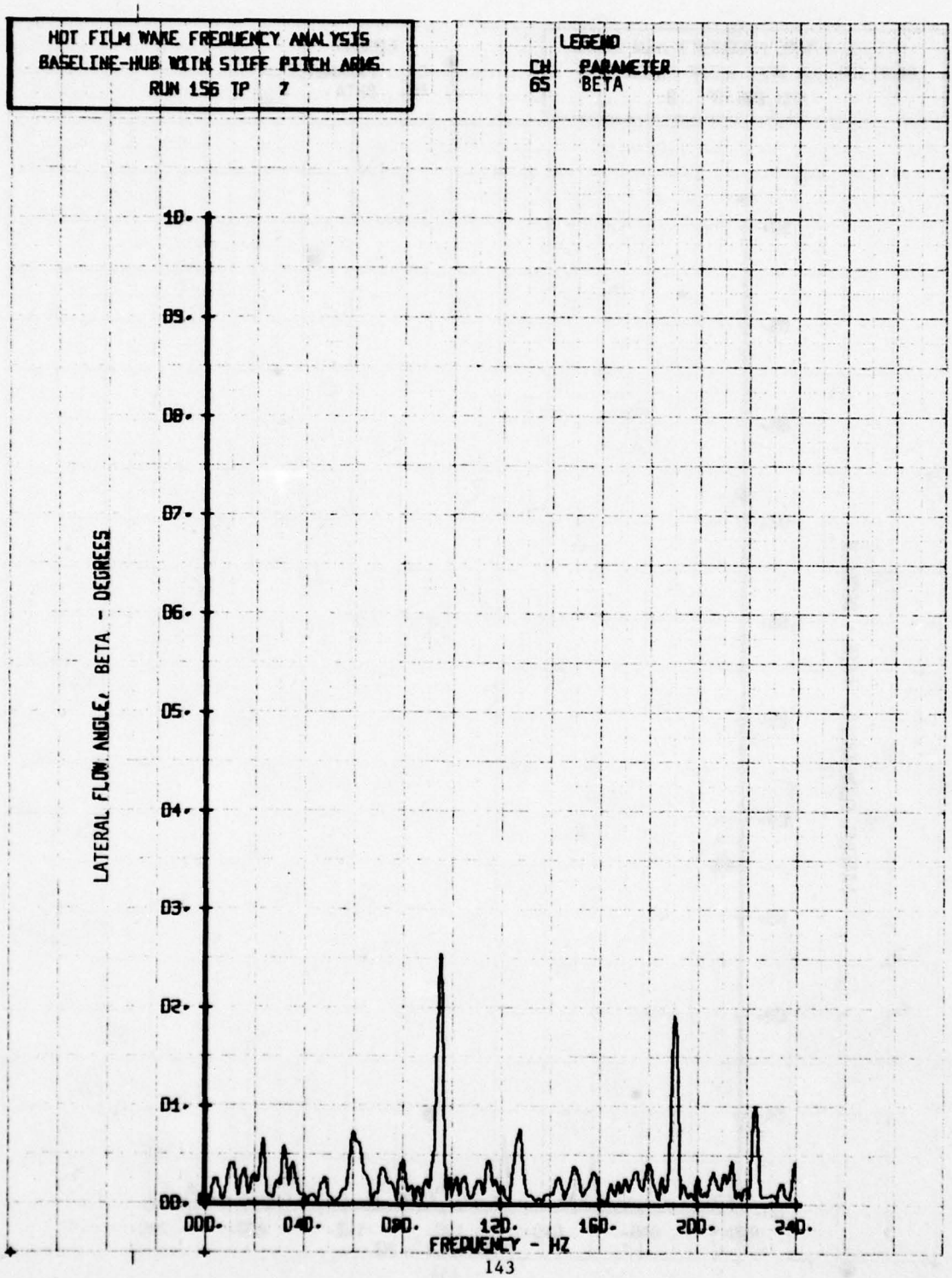

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

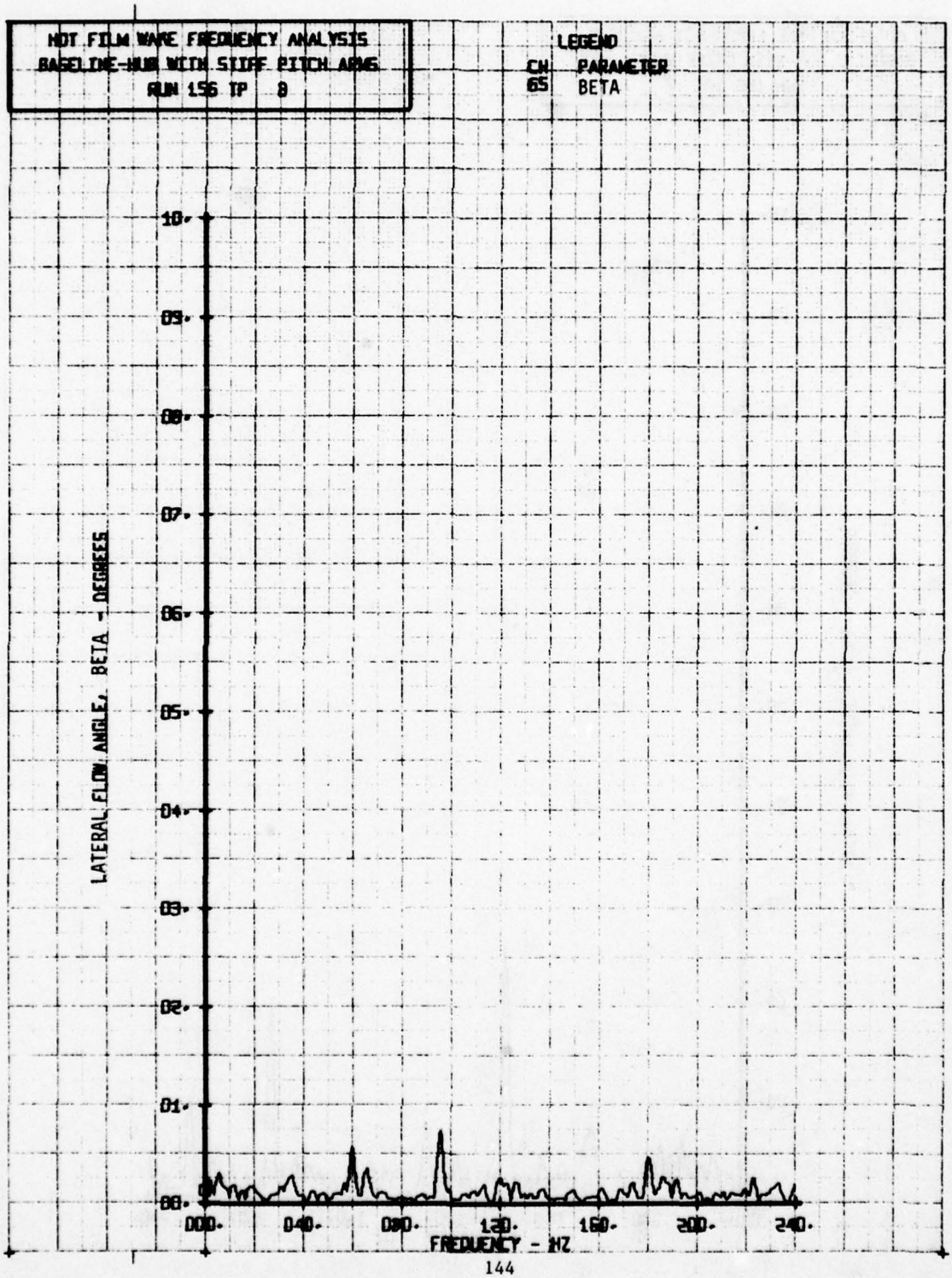

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 3
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

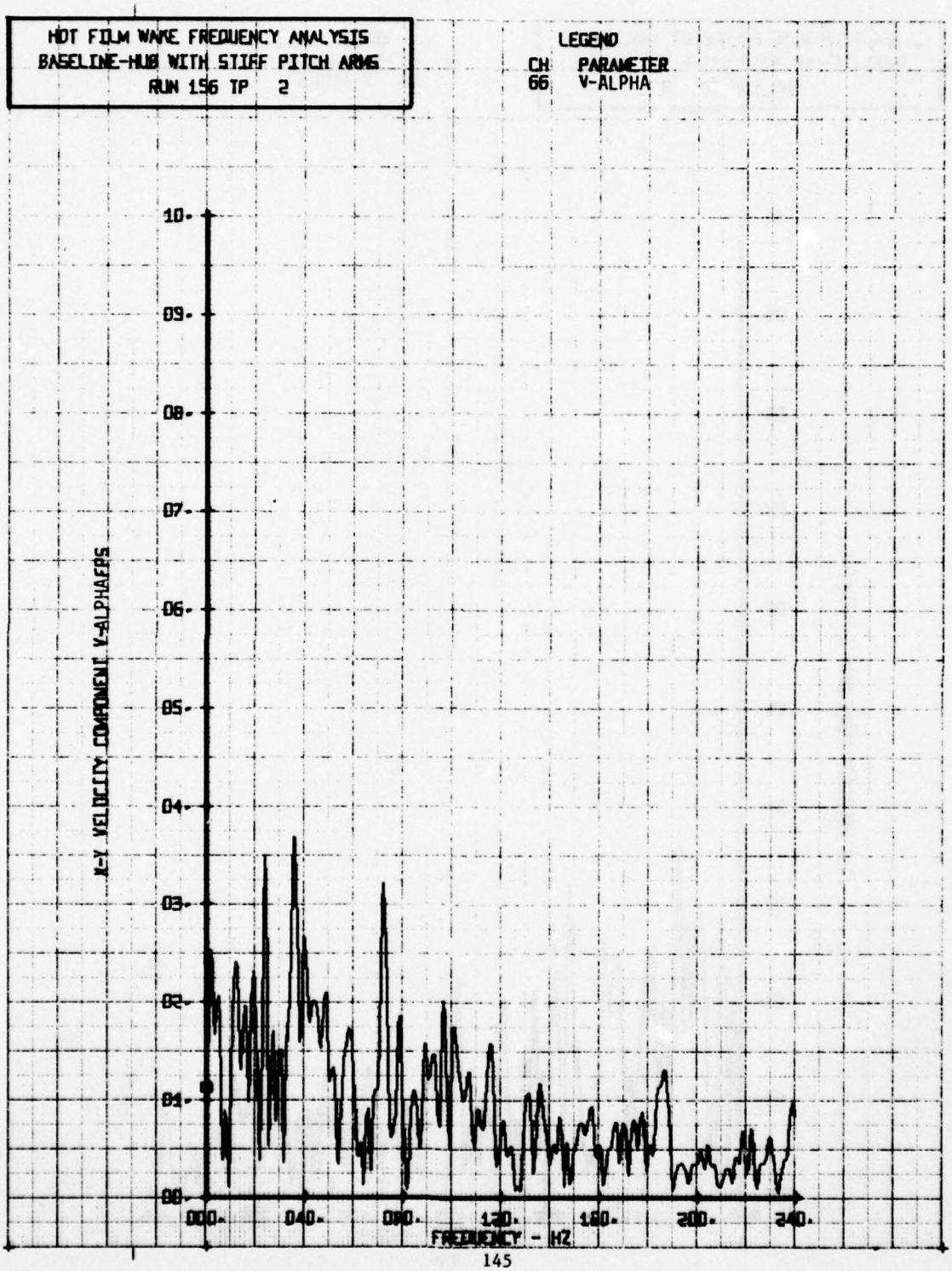

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 4
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

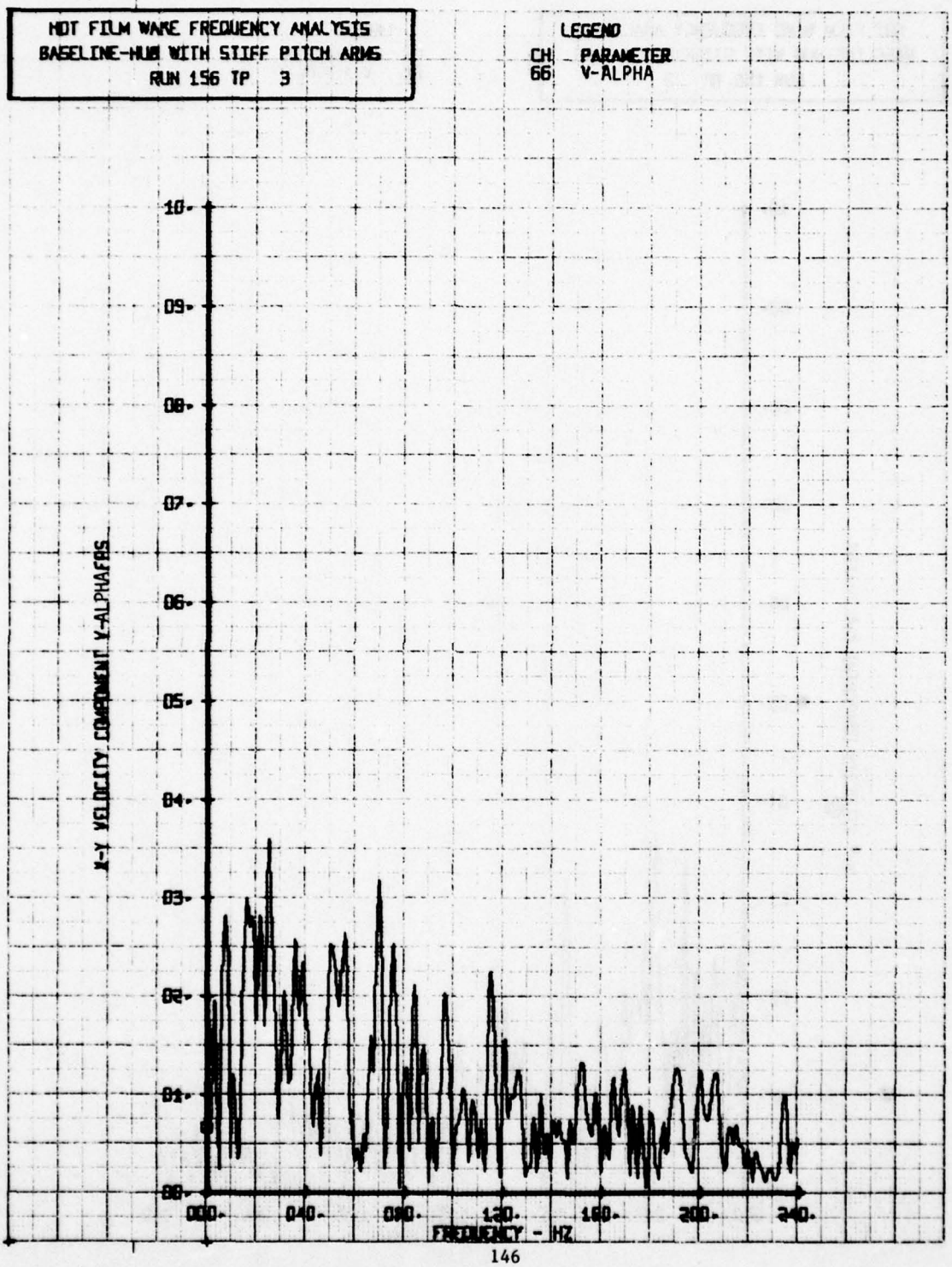

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
65 BETA
10
09
08
07
06
05
04
03
02
01
00
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

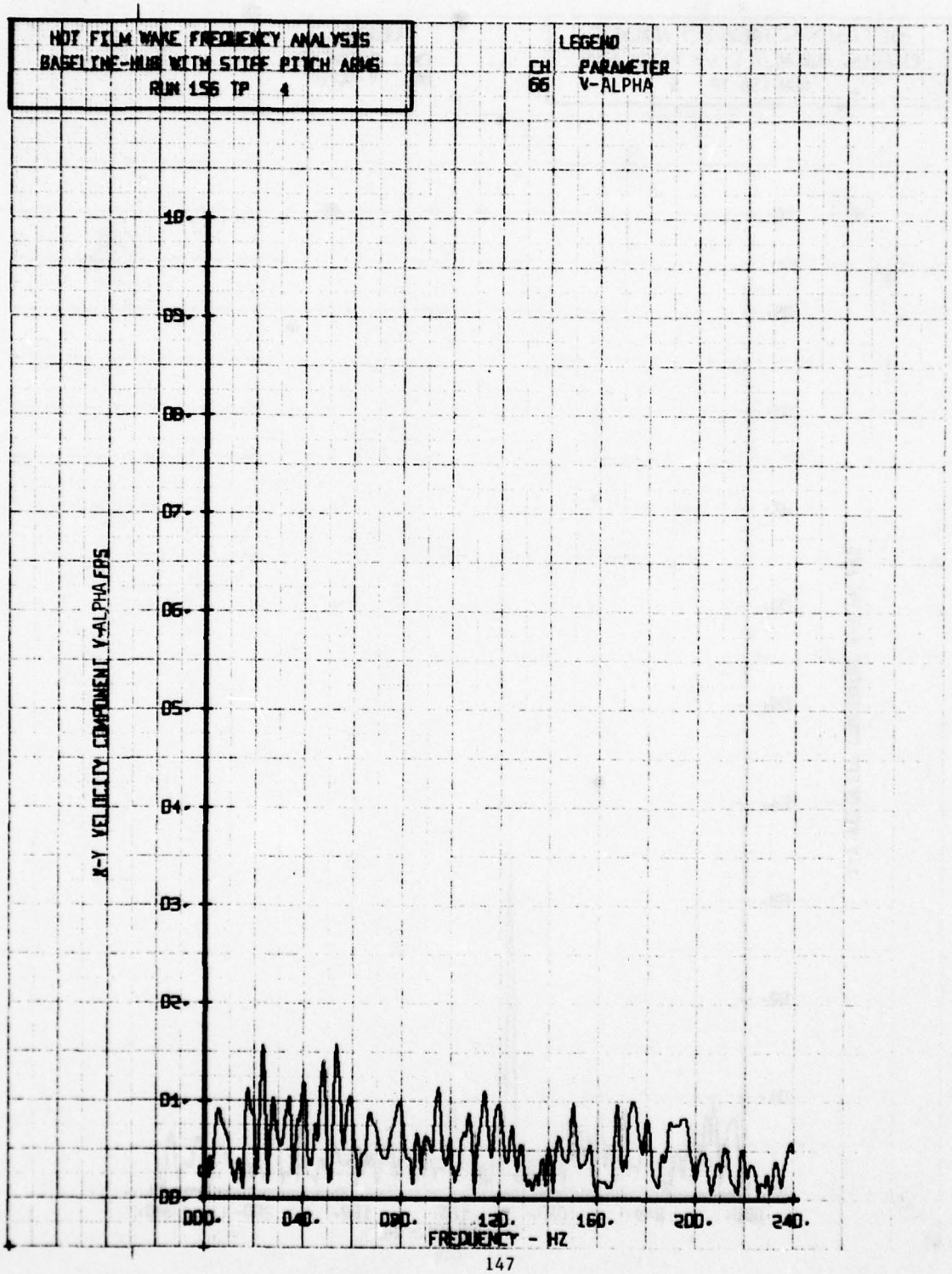

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 6
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

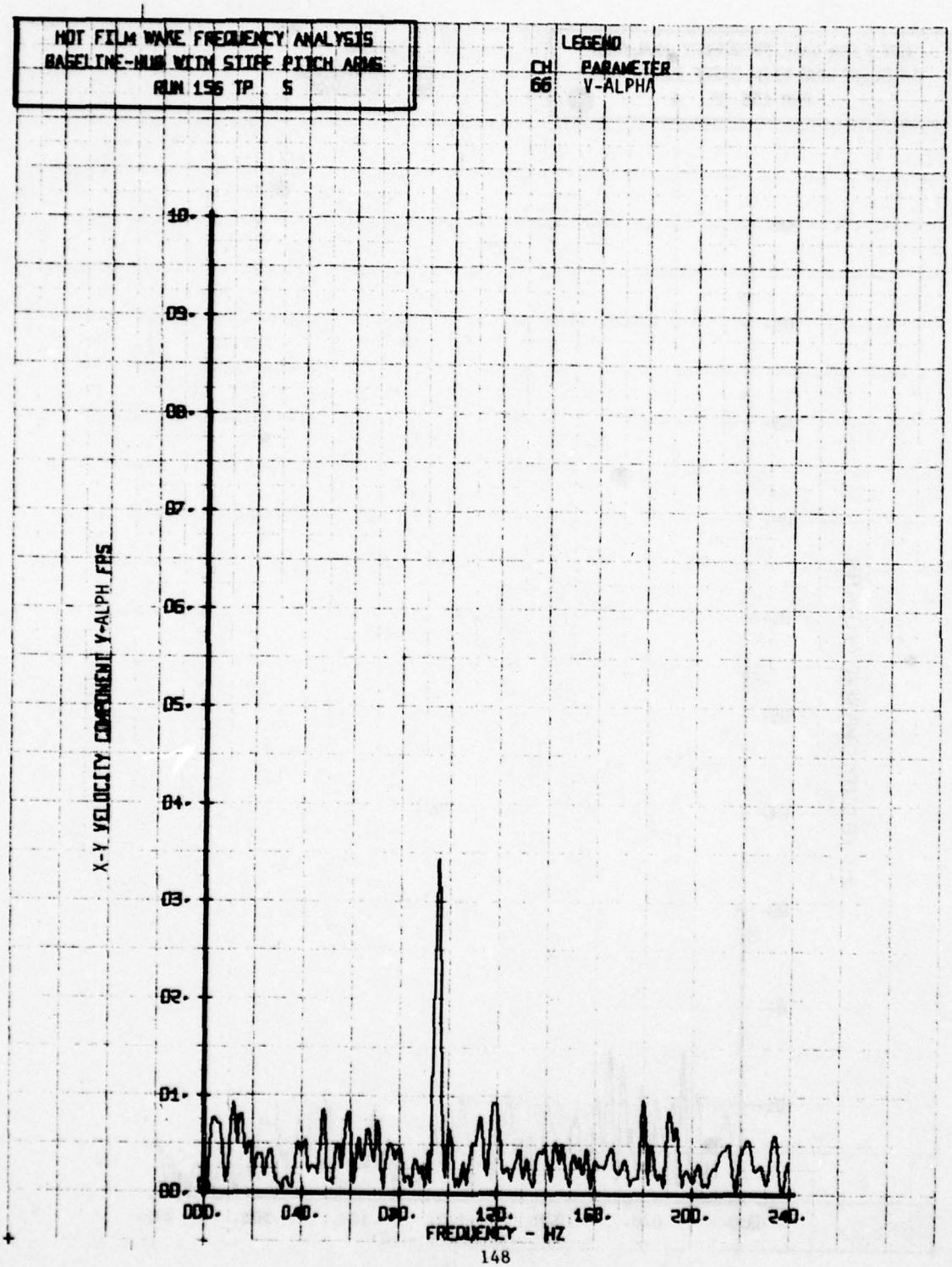

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 7
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

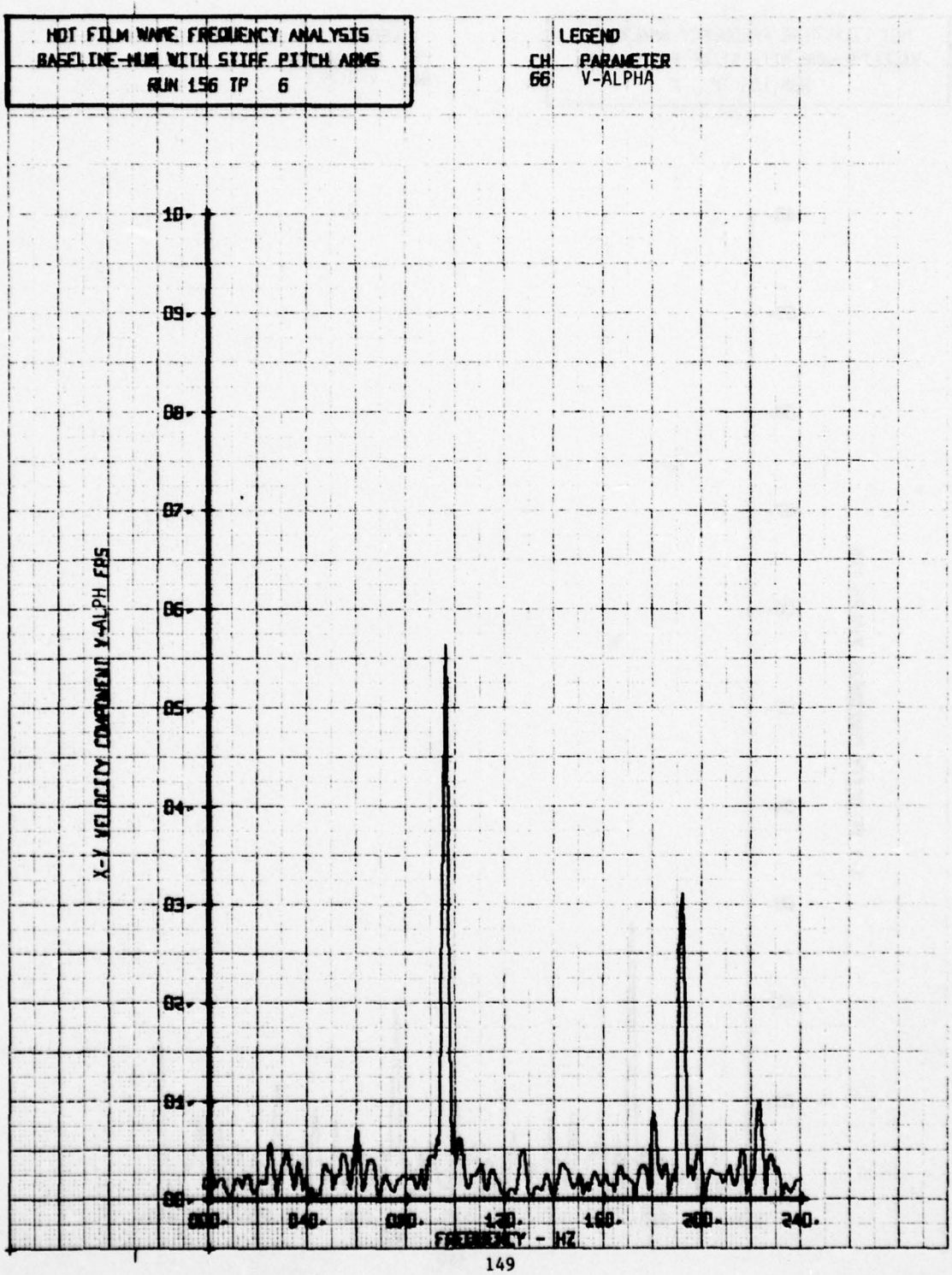

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 8
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

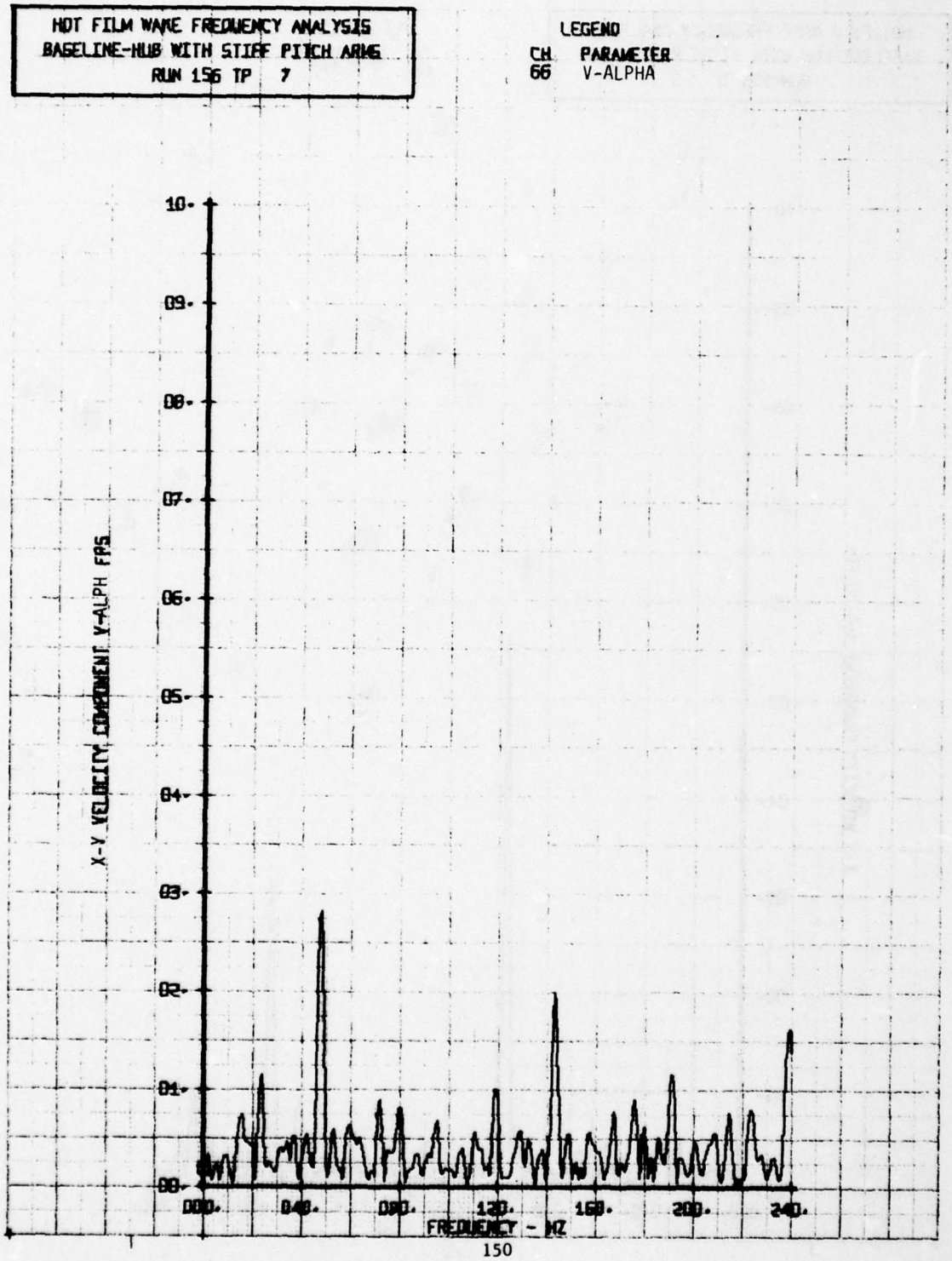

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ
X-Y VELOCITY COMPONENT V-ALPHAFPS

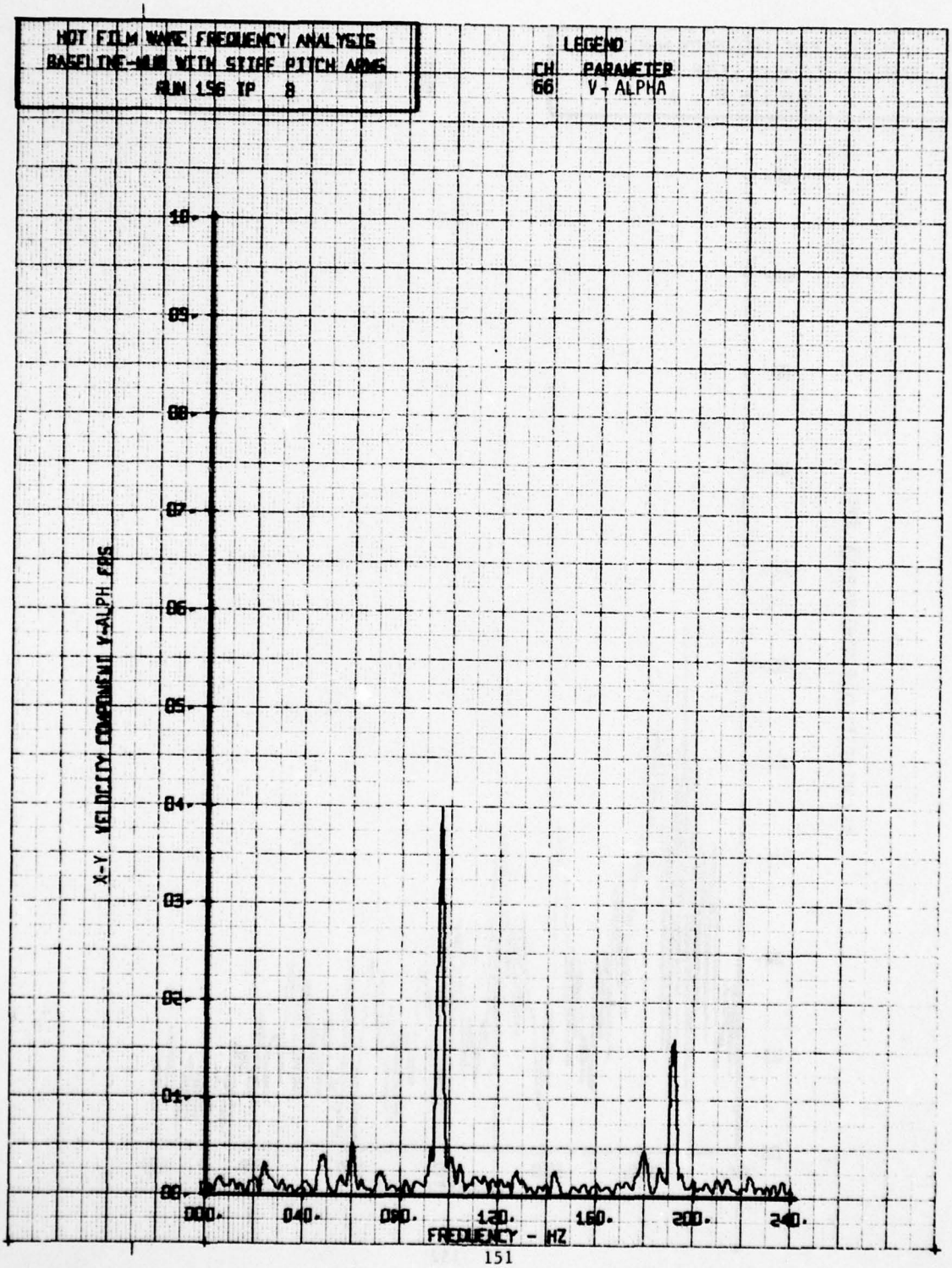

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 3
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT V-ALPHAFBS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

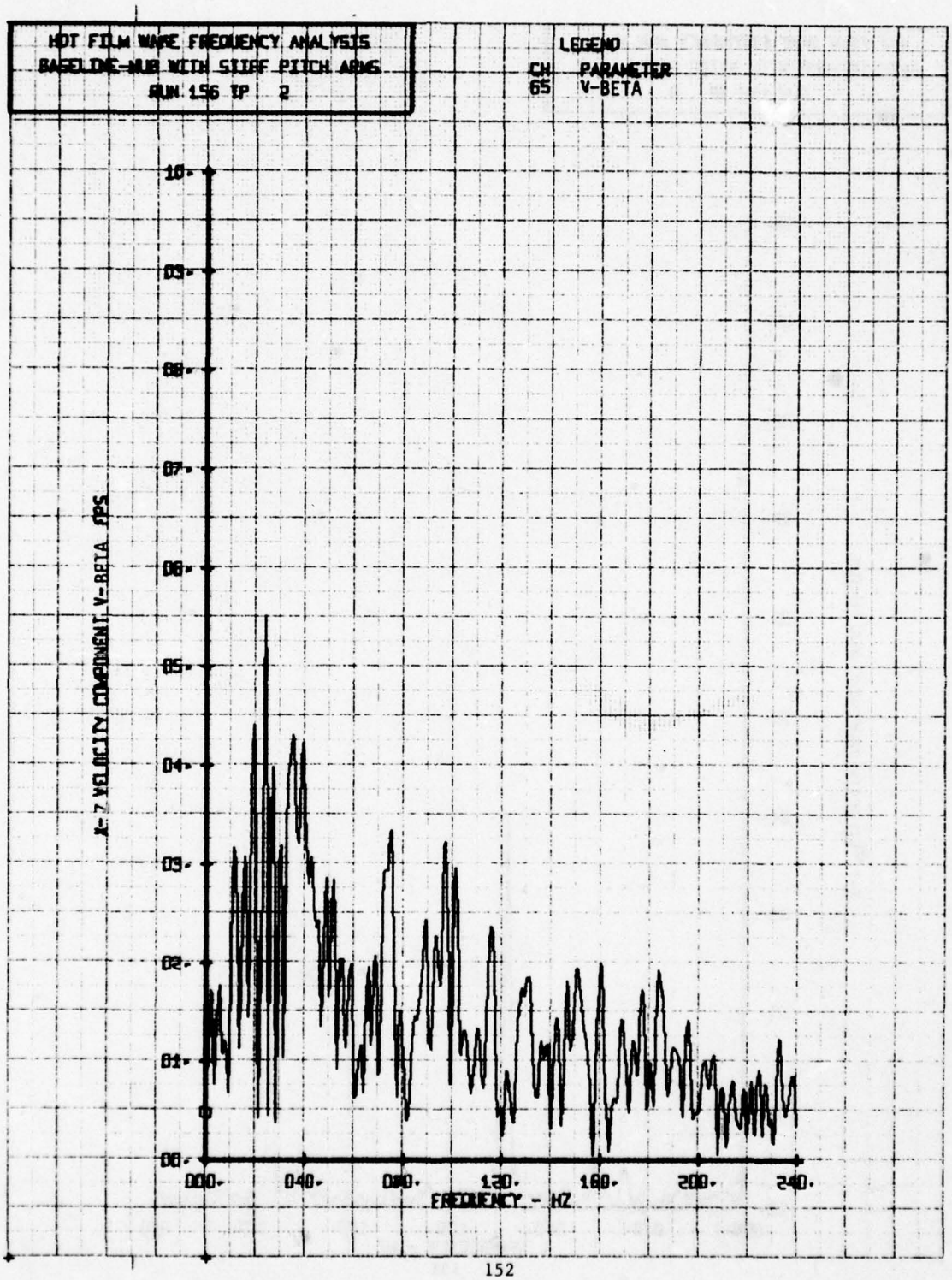

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 4
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA FBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

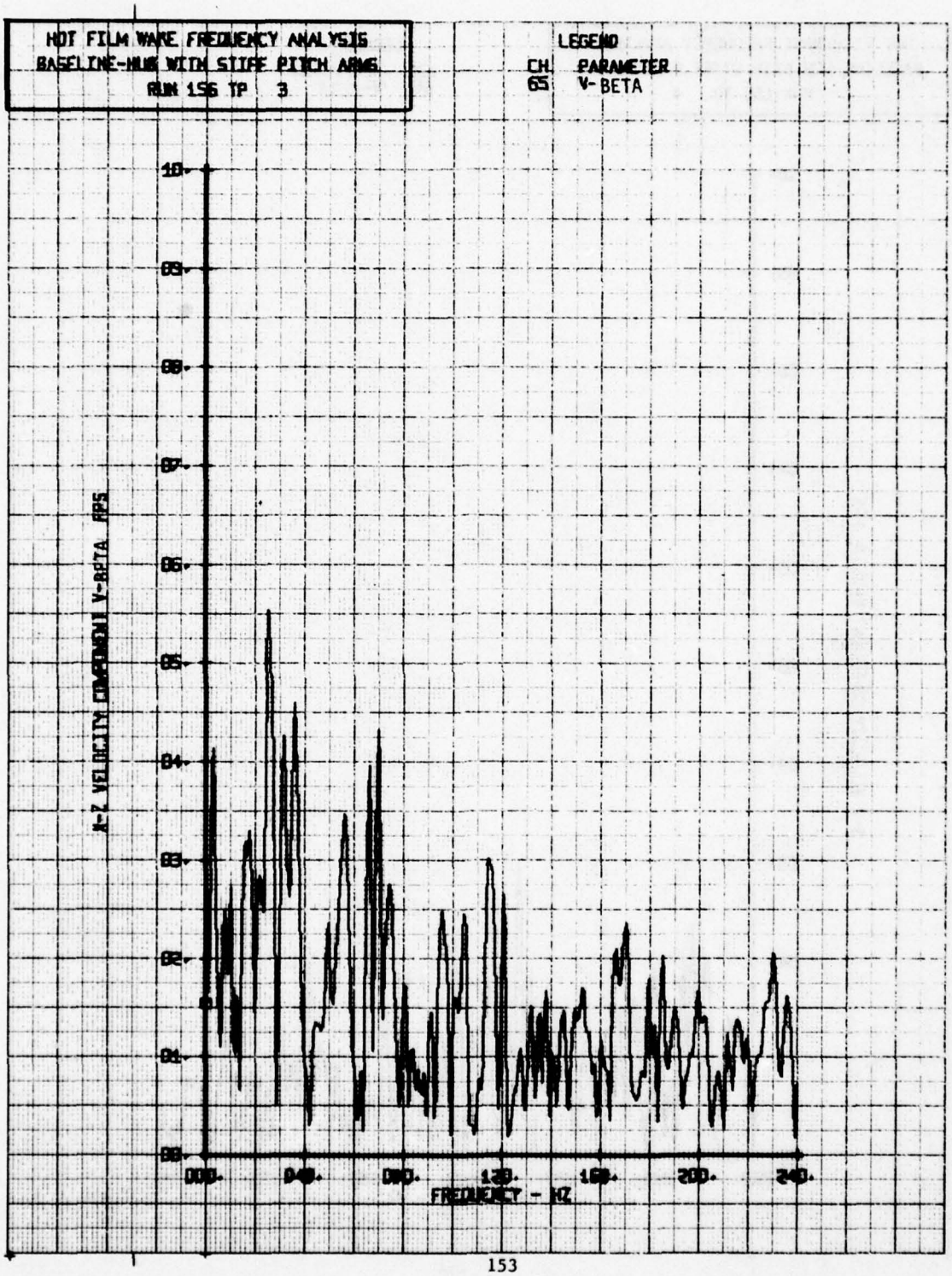

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPH_FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

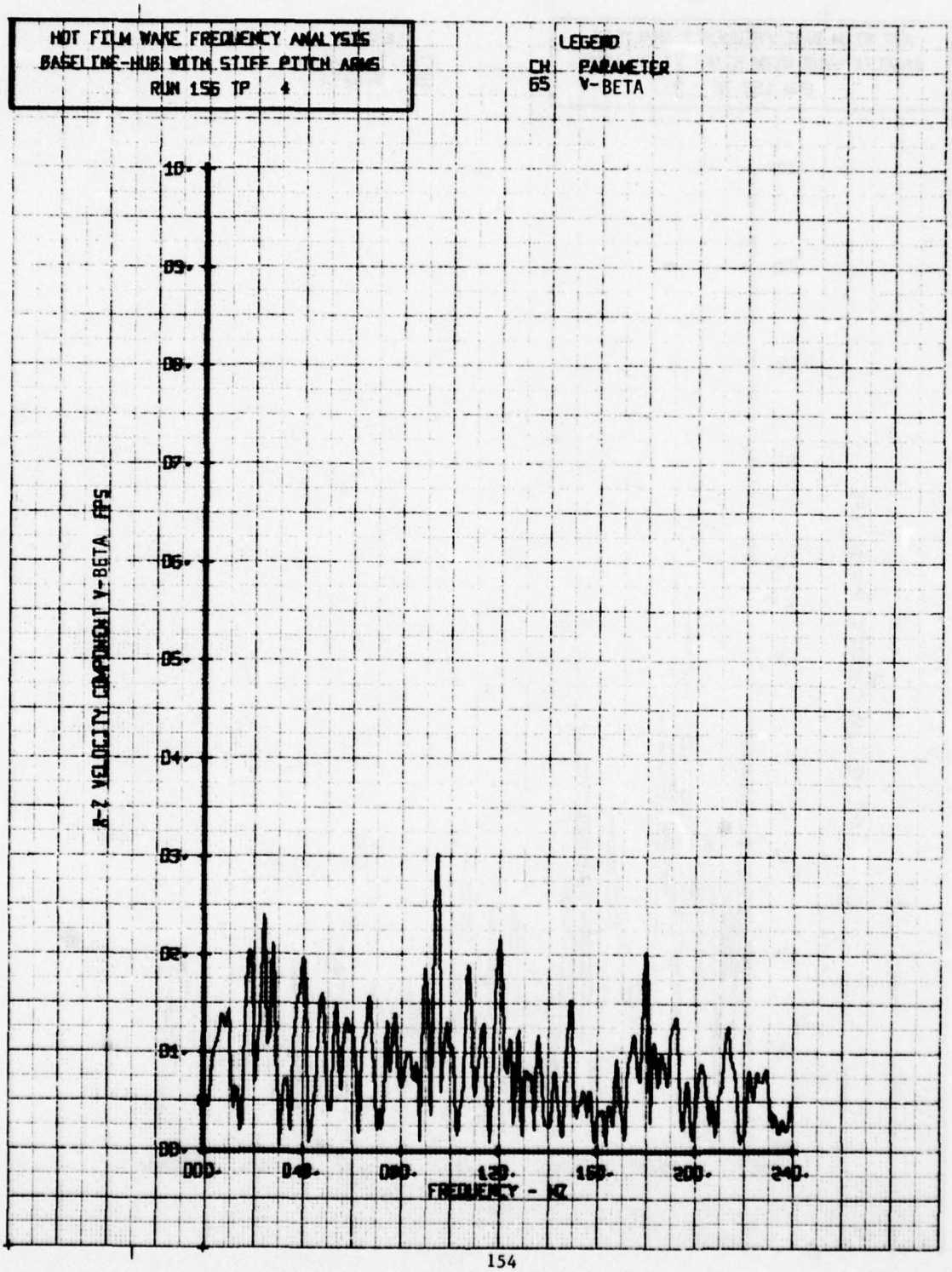

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 6
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPH FBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

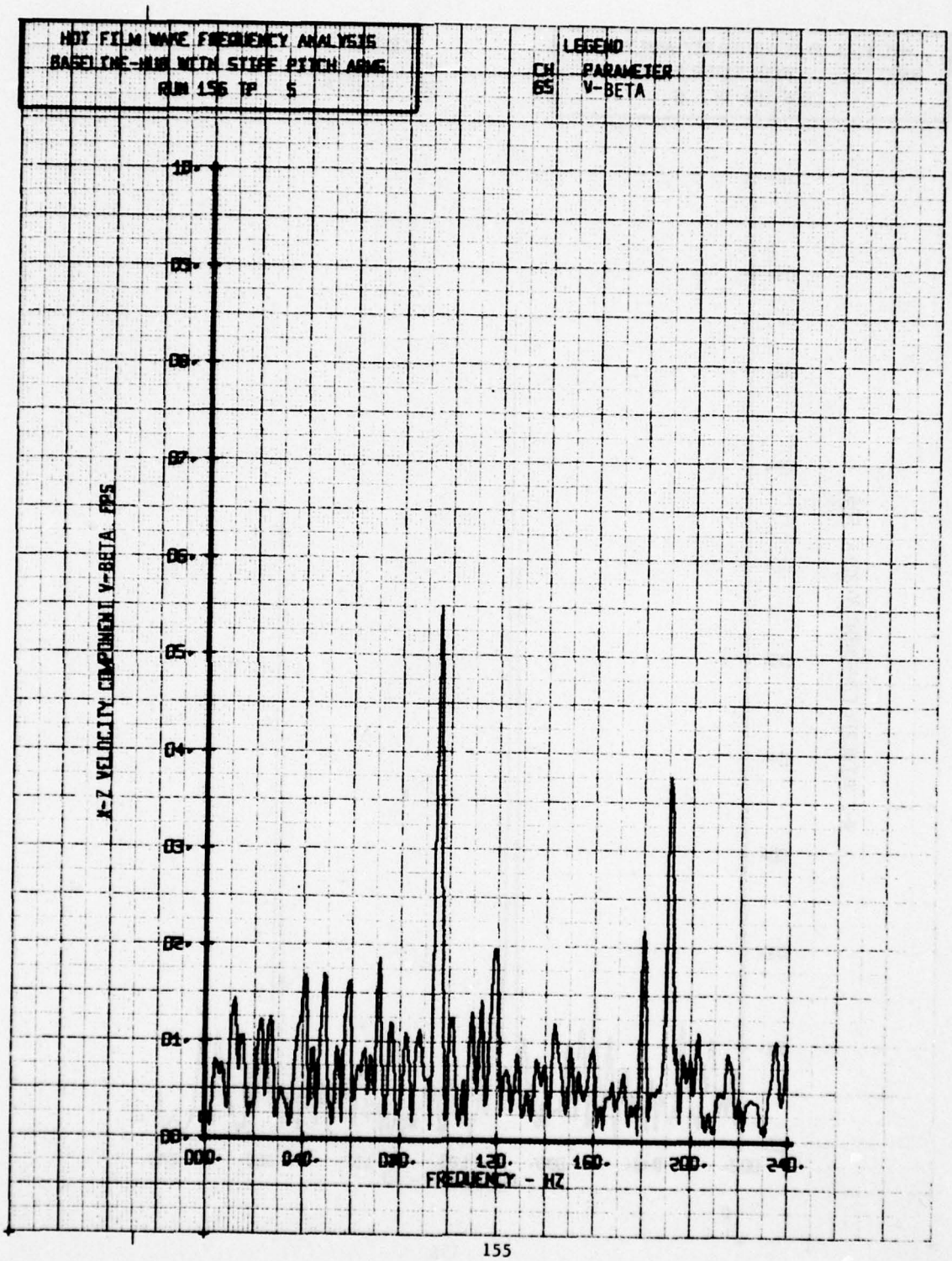

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 7
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPH FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

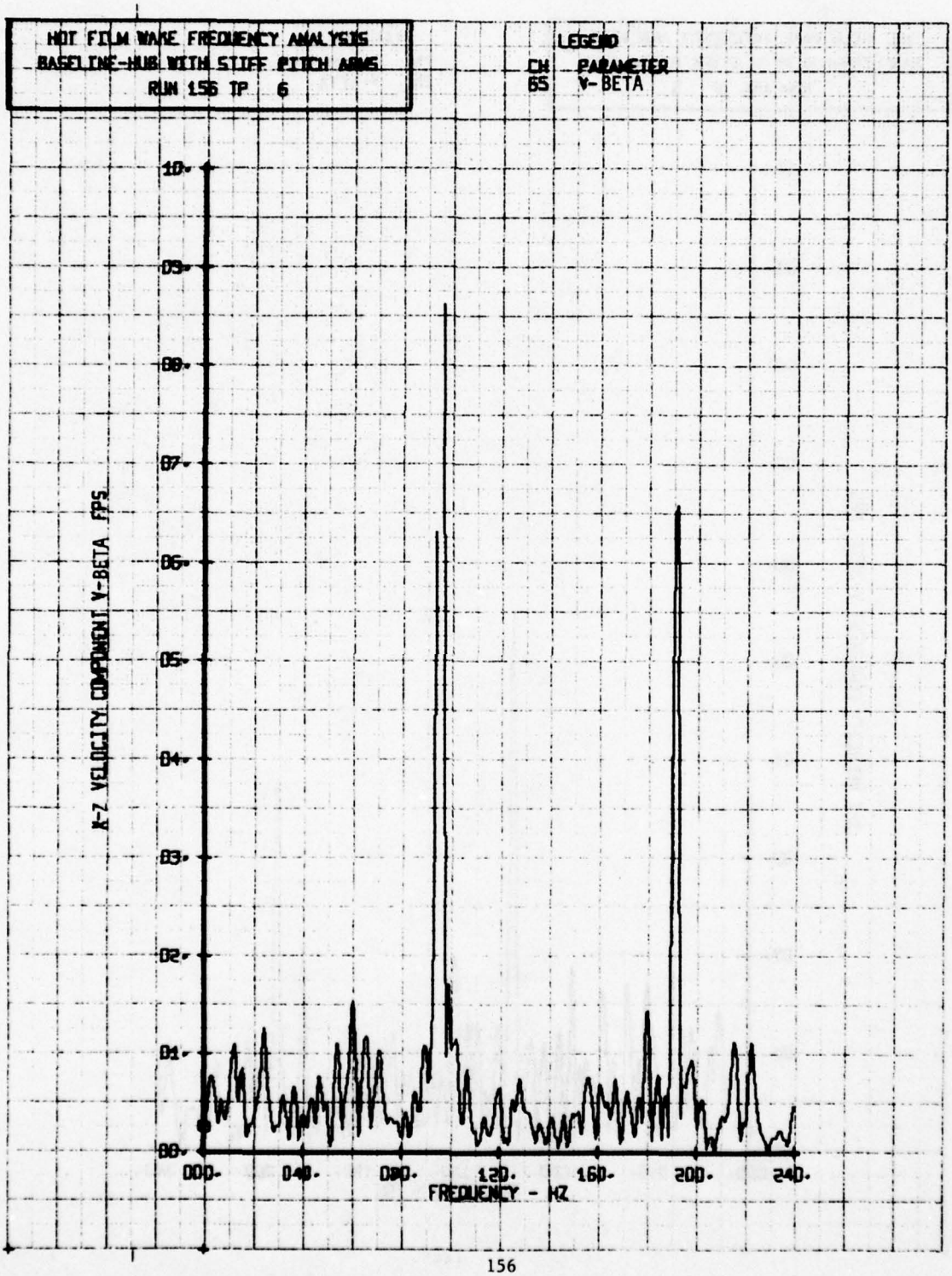

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 8
LEGEND
CH PARAMETER
66 V+ ALPHA
X-Y: VELOCITY COMPONENT V-ALPH FBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

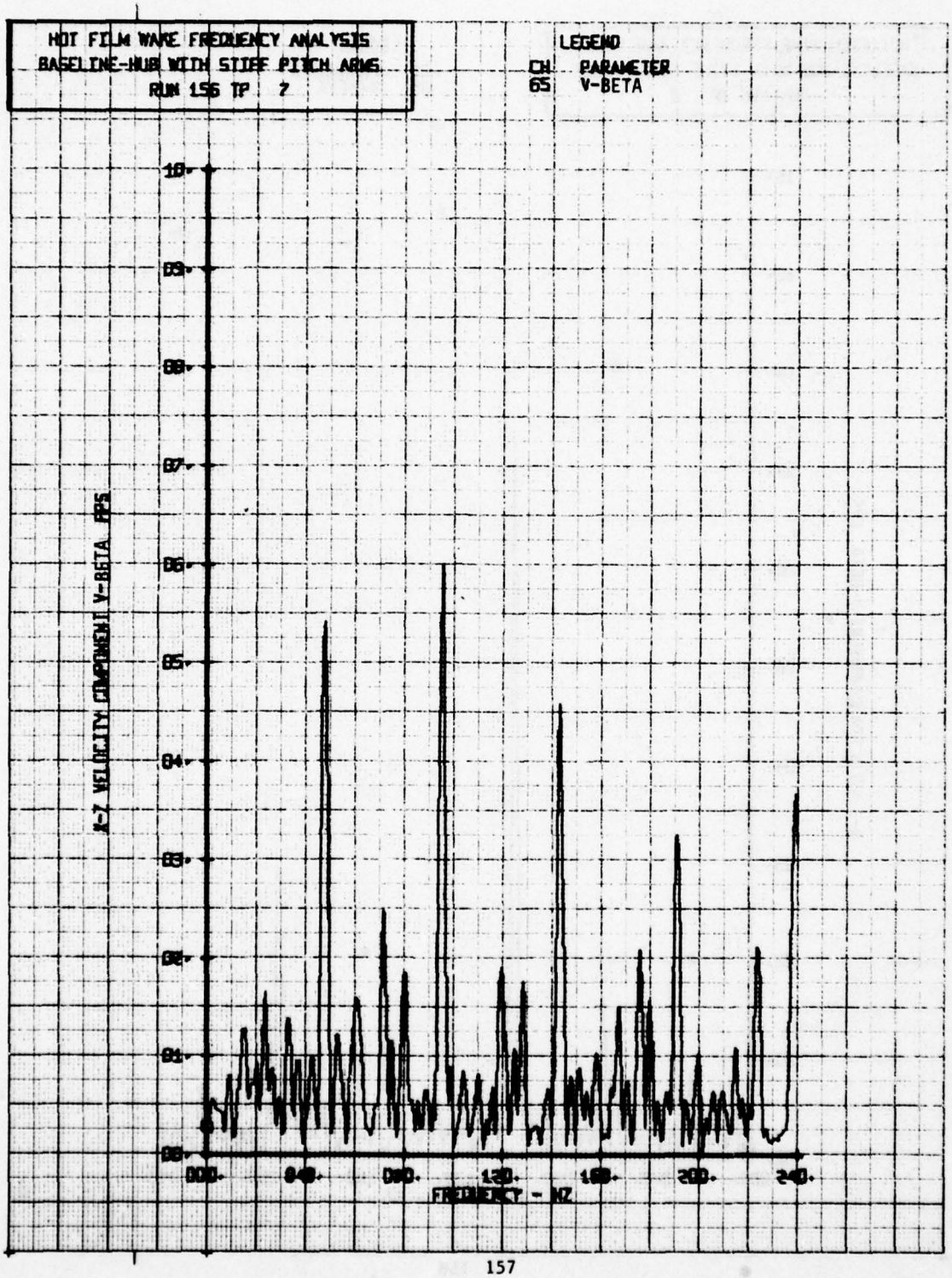

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 2
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ
K-Z VELOCITY COMPONENT V-BETA FPS

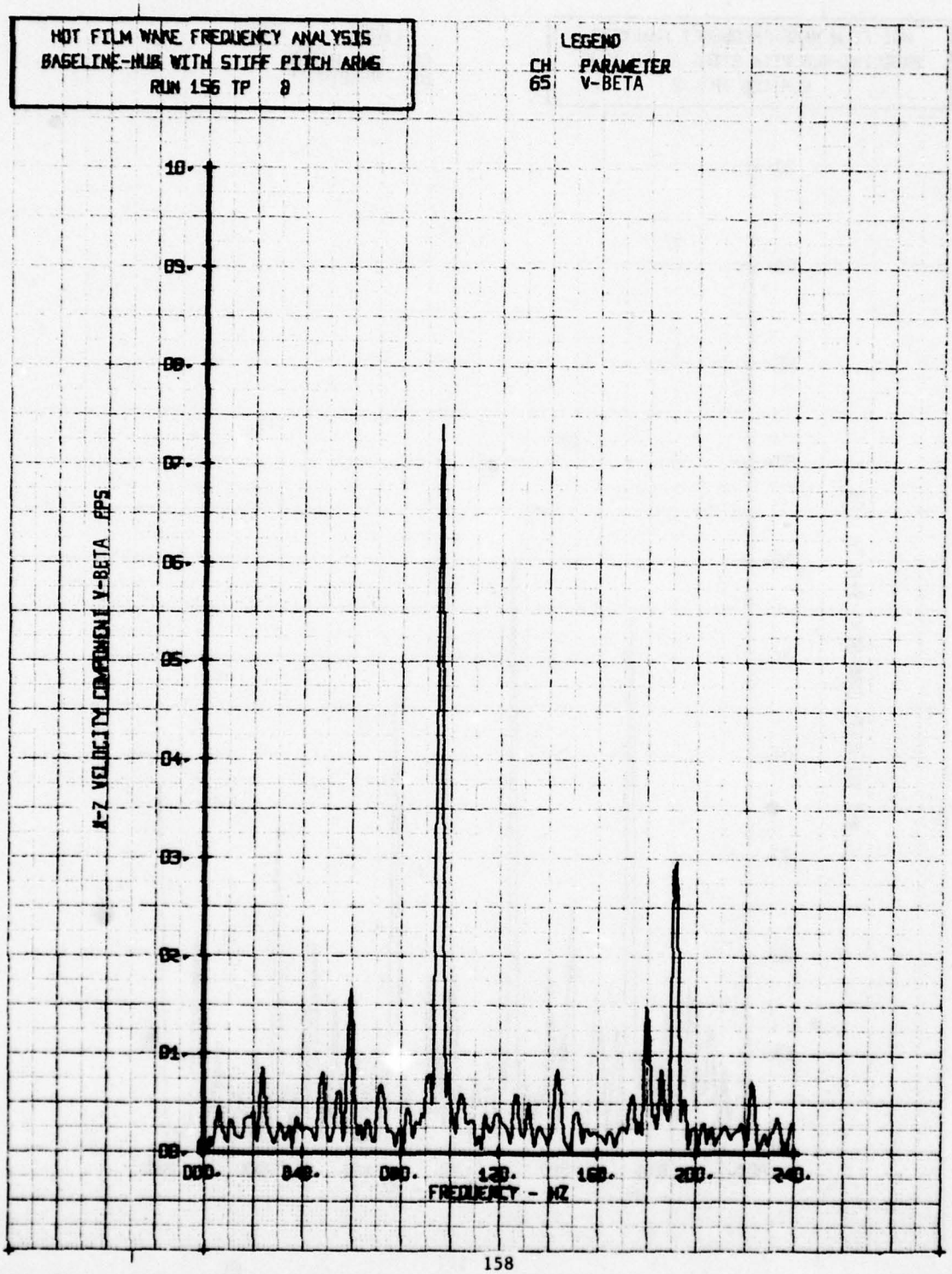

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 3
LEGEND
CH PARAMETER
65 V-BETA
A-Z VELOCITY COMPONENT V-BETA FPS
FREQUENCY - HZ

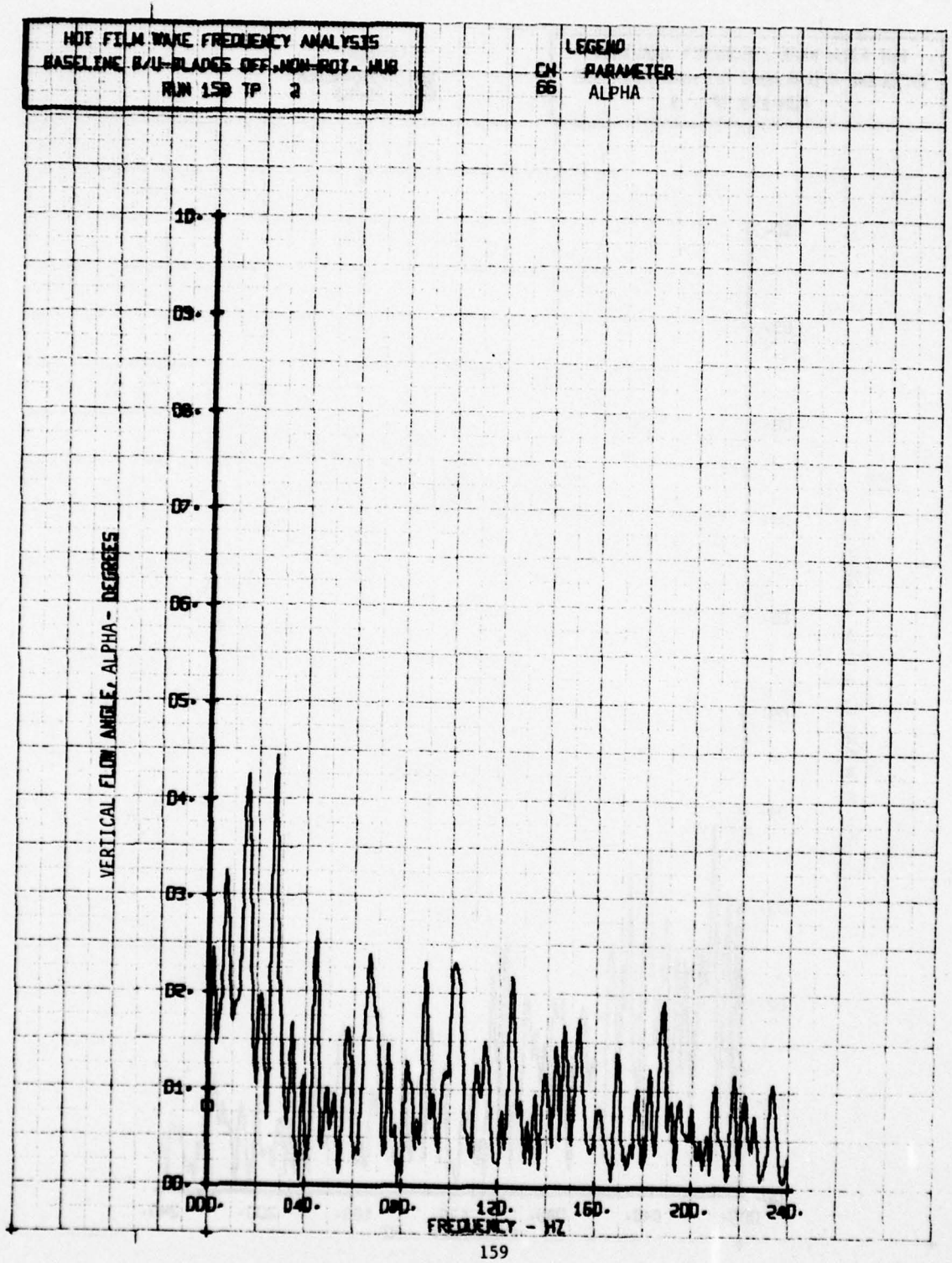

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 4
LEGEND
CH PARAMETER
65 V-BETA
A-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

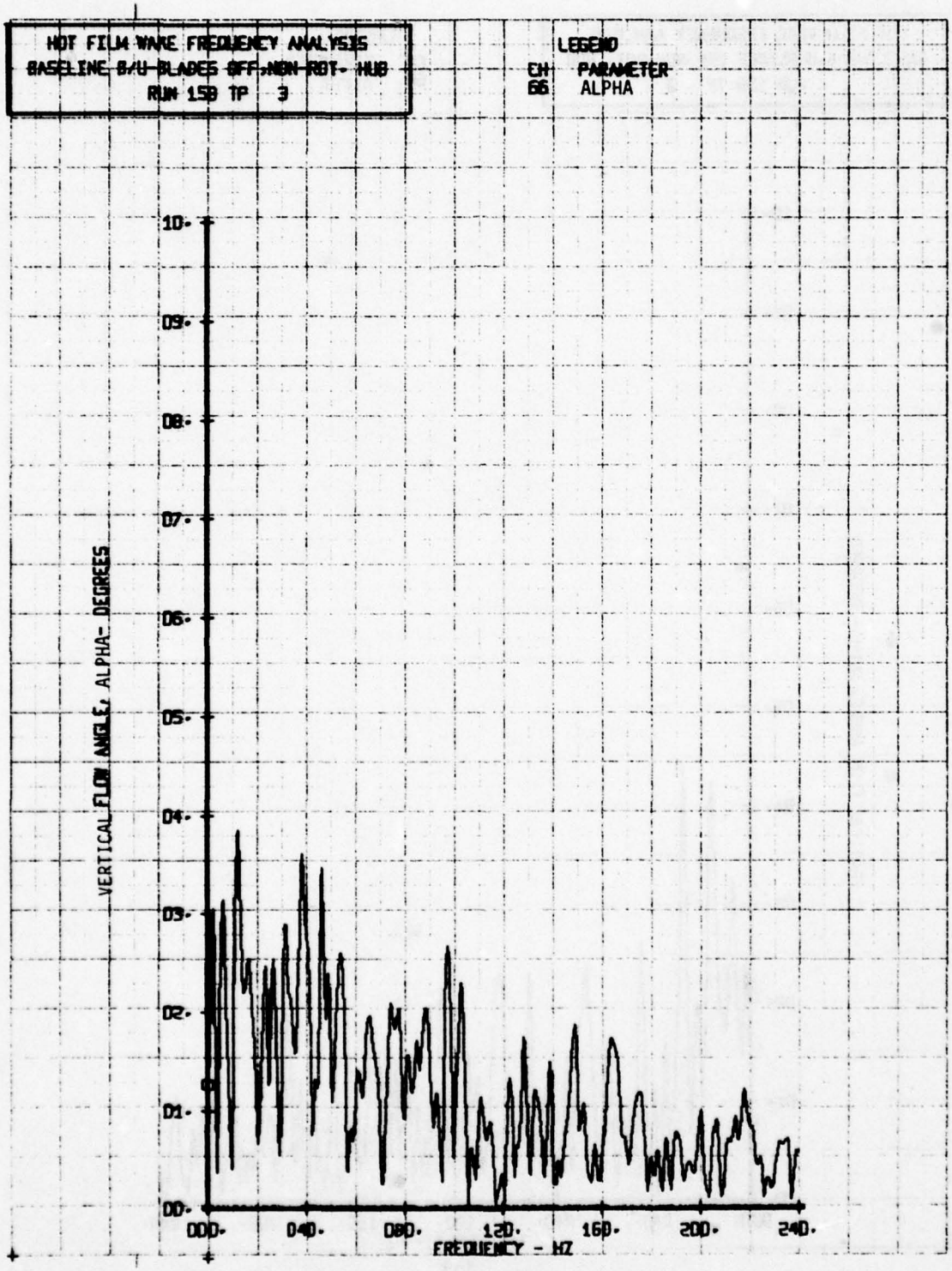

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 5
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
FREQUENCY - HZ
000.
040.
080.
120.
160.
200.
240.

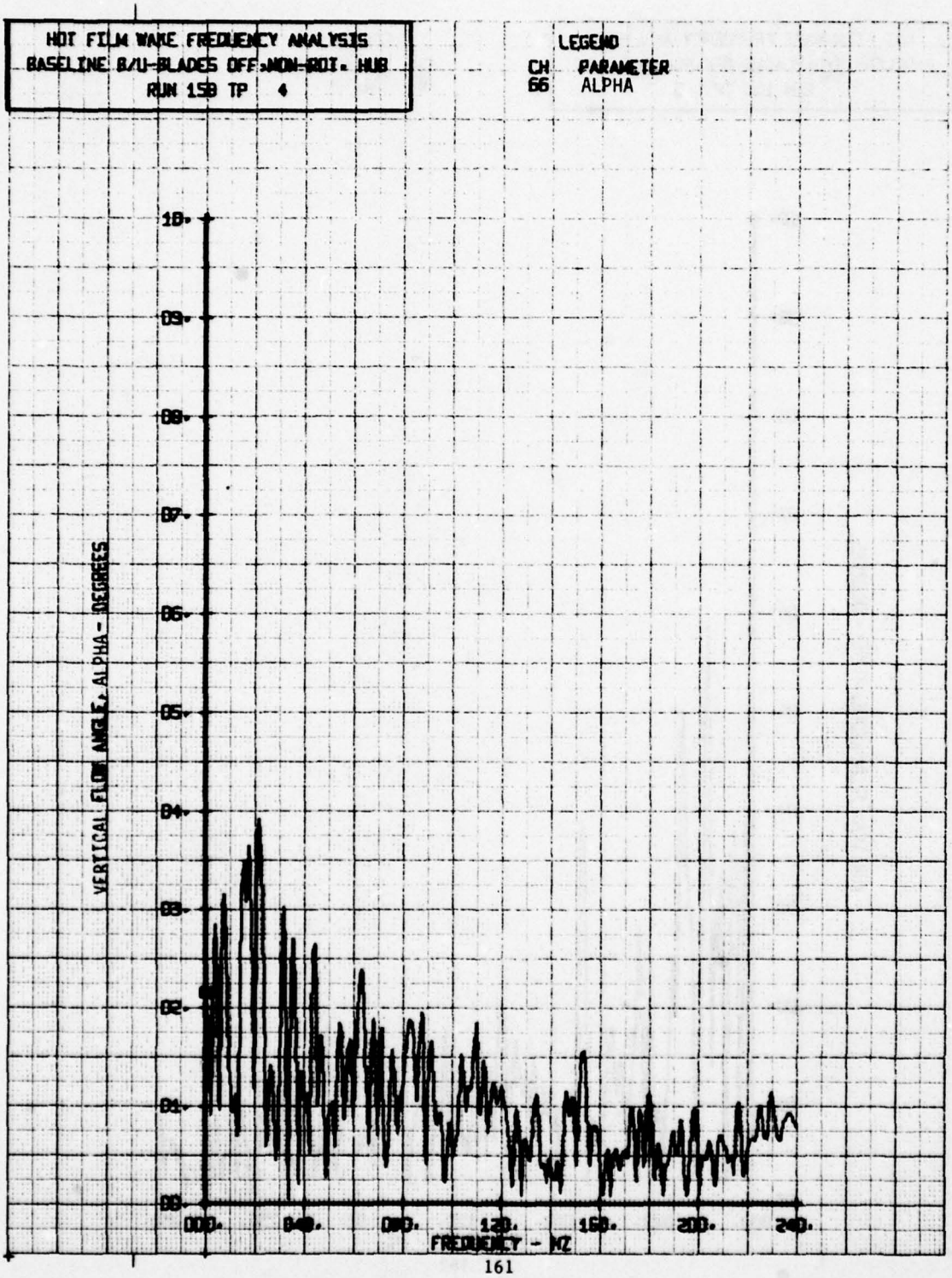

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 155 TP 6
LEGEND
CH PARAMETER
65 V-BETA
10-
09-
08-
07-
06-
05-
04-
03-
02-
01-
00-
000-
040-
080-
120-
160-
200-
240-
FREQUENCY - HZ

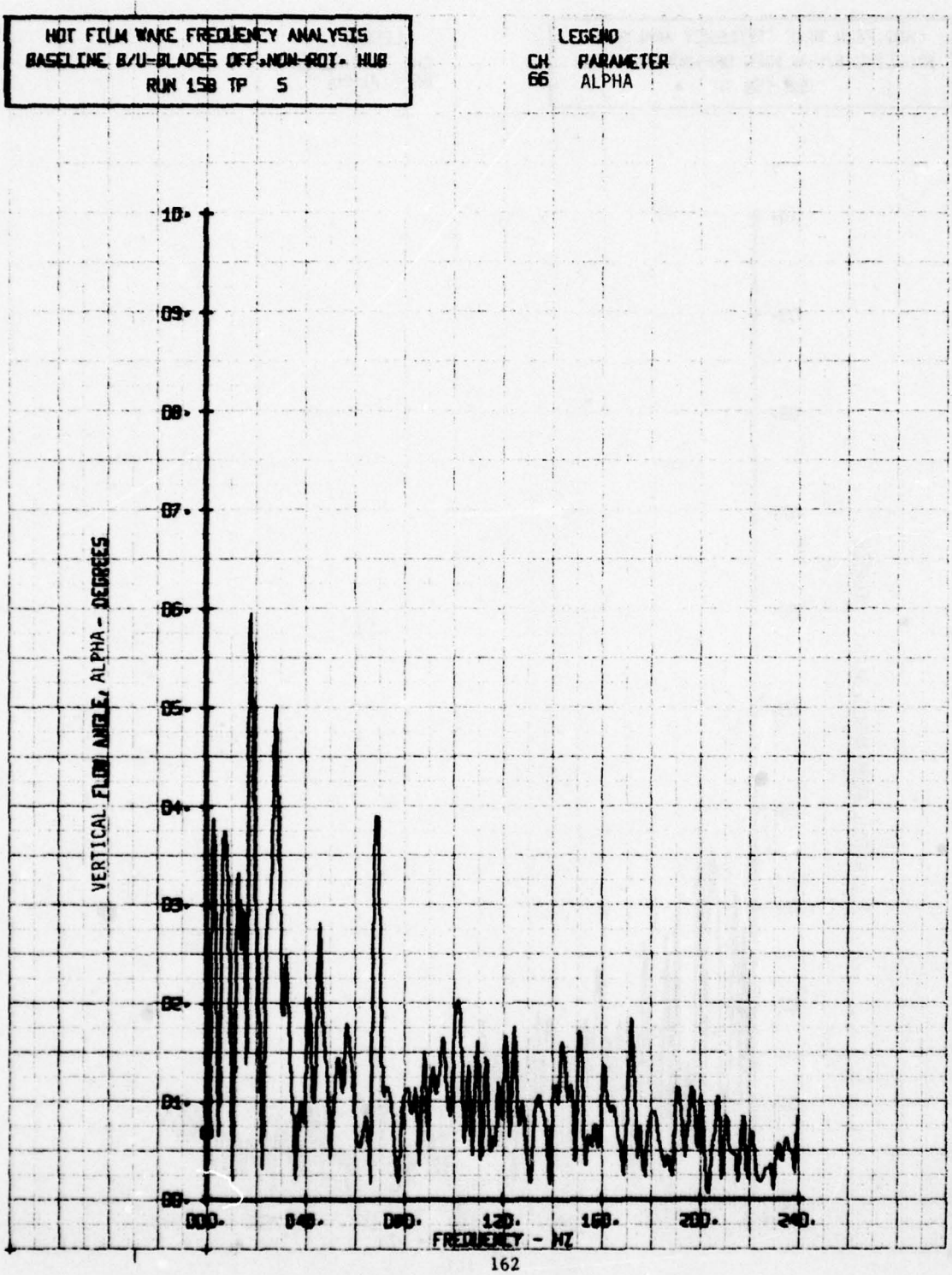

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 7
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

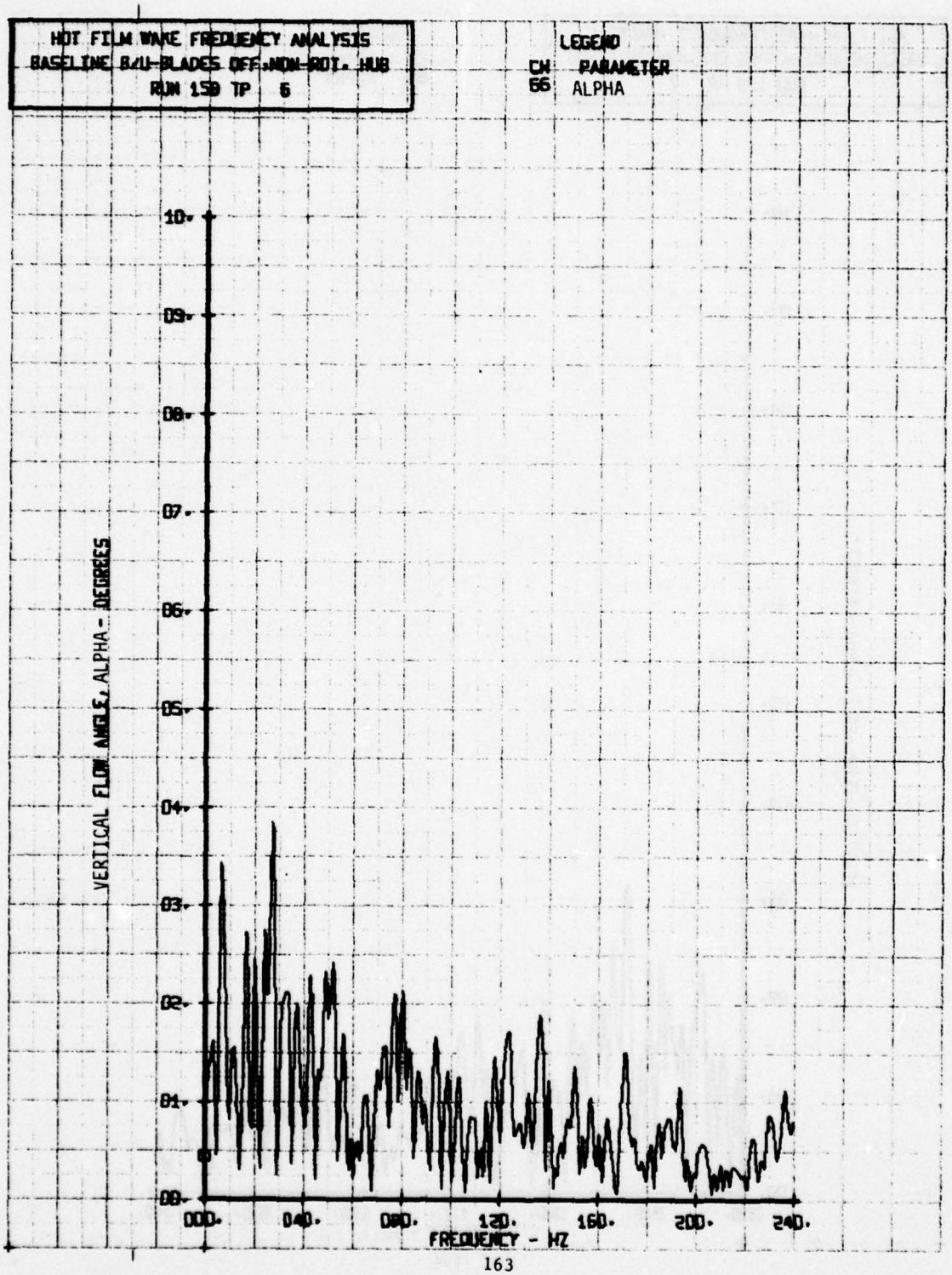

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE-HUB WITH STIFF PITCH ARMS
RUN 156 TP 8
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

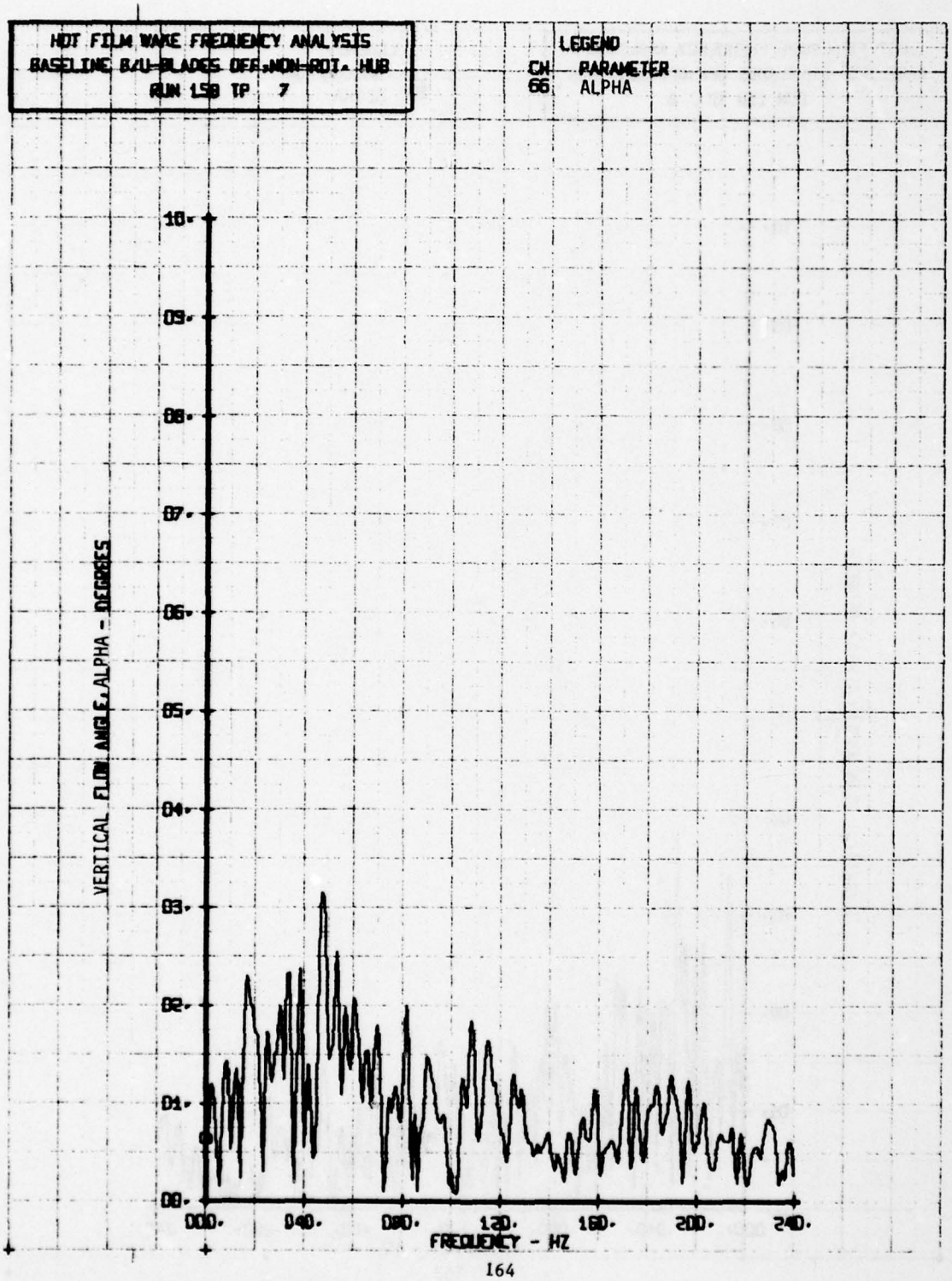

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 2
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

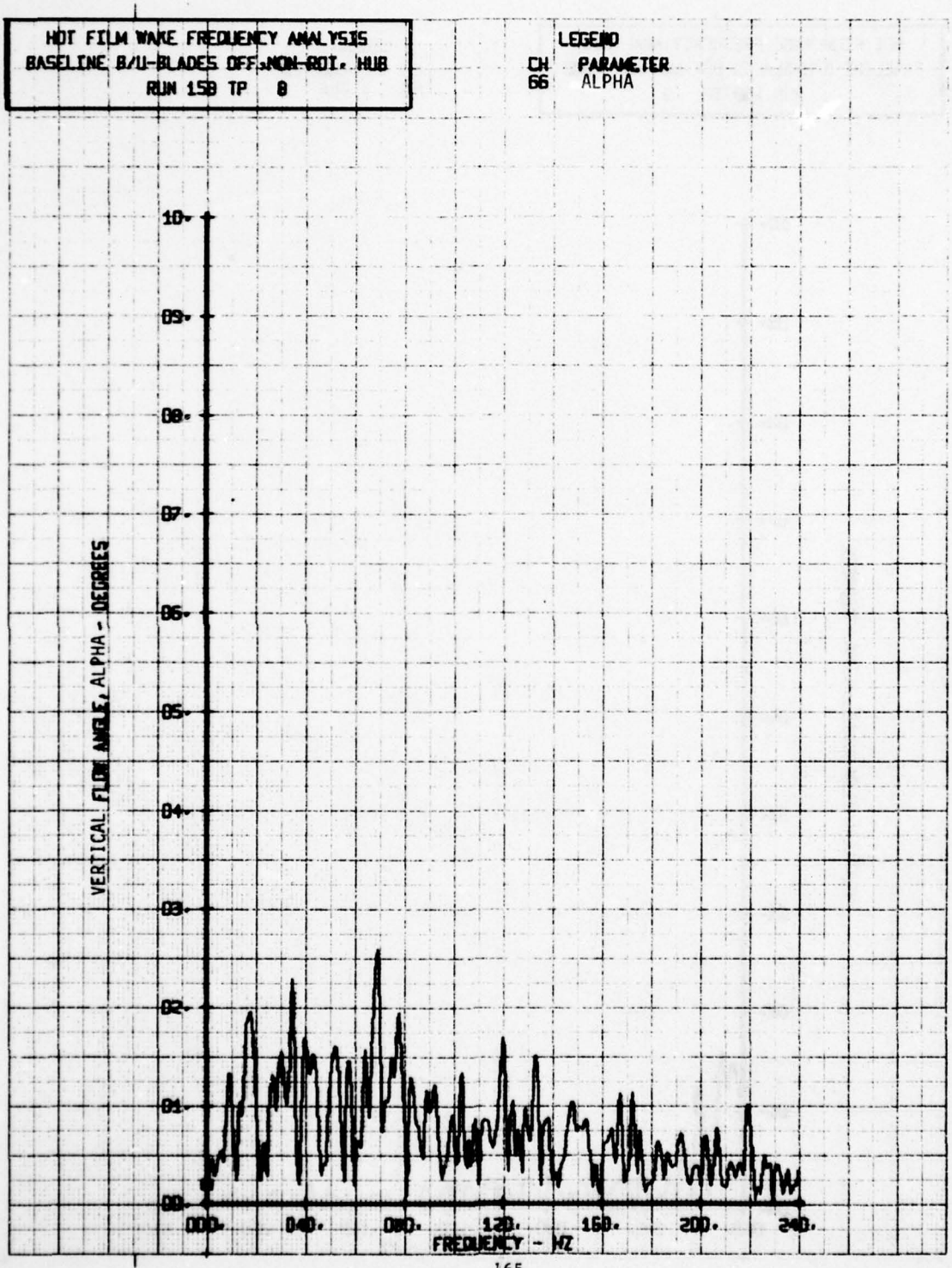

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U BLADES OFF,NON-ROT. HUB
RUN 158 TP 3
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA- DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 159 TP 4
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE, ALPHA - DEGREES
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF.NON-ROT. HUB
RUN 158 TP 5
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

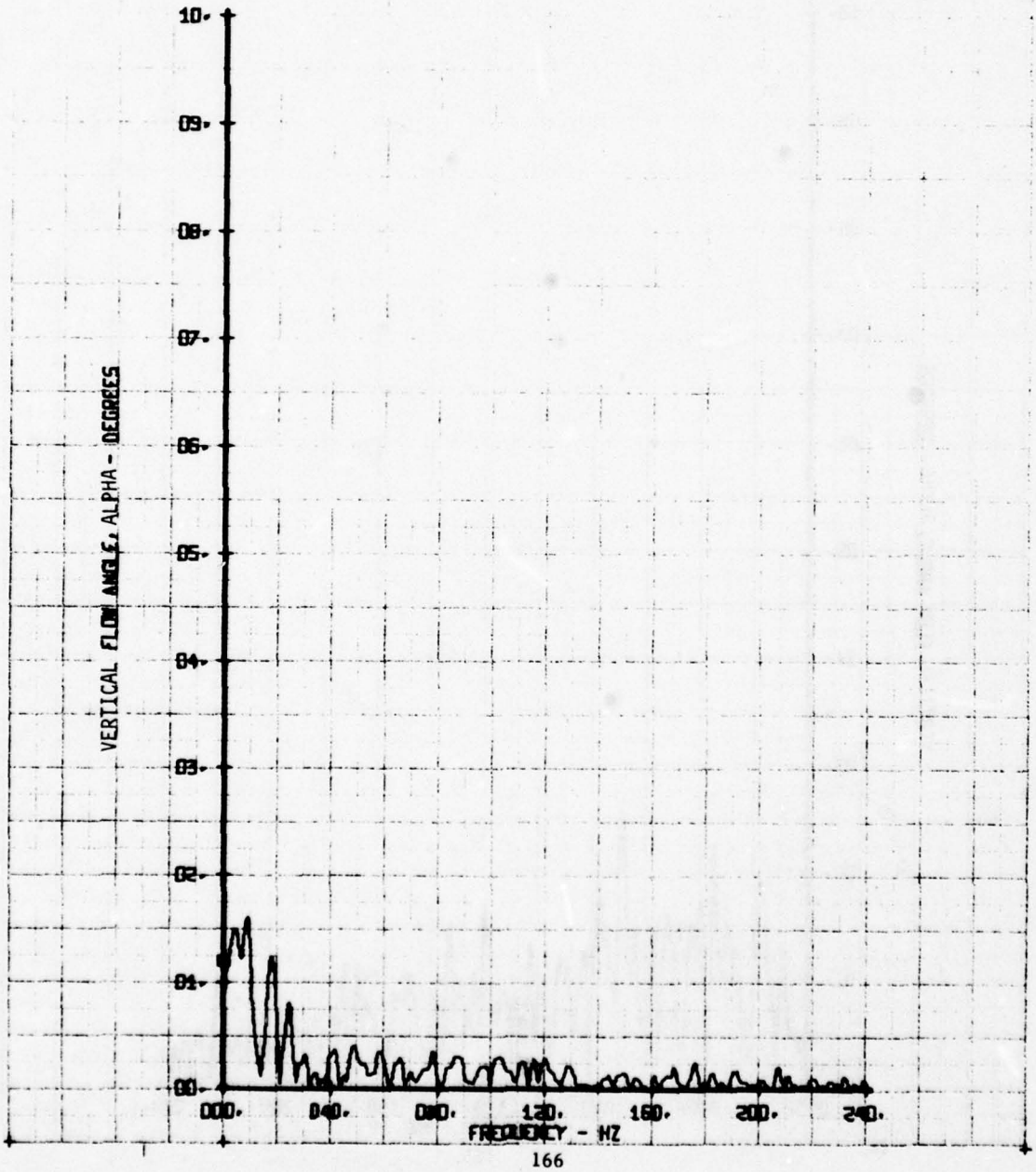

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF.NON-ROT. HUB
RUN 159 TP 6
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

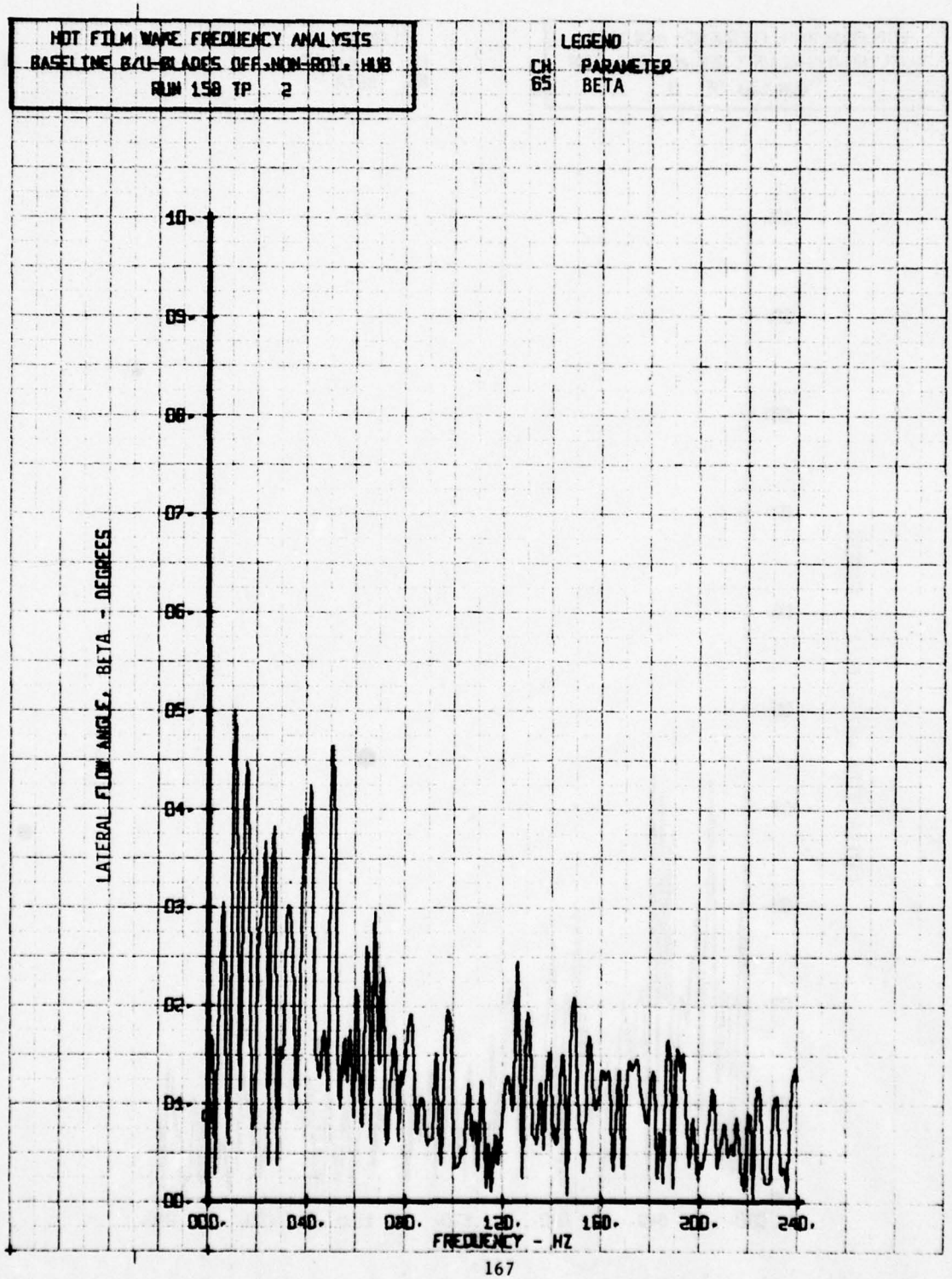

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U BLADES OFF,NON-ROT. HUB
RUN 158 TP 7
LEGEND
CH PARAMETER
66 ALPHA
VERTICAL FLOW ANGLE,ALPHA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

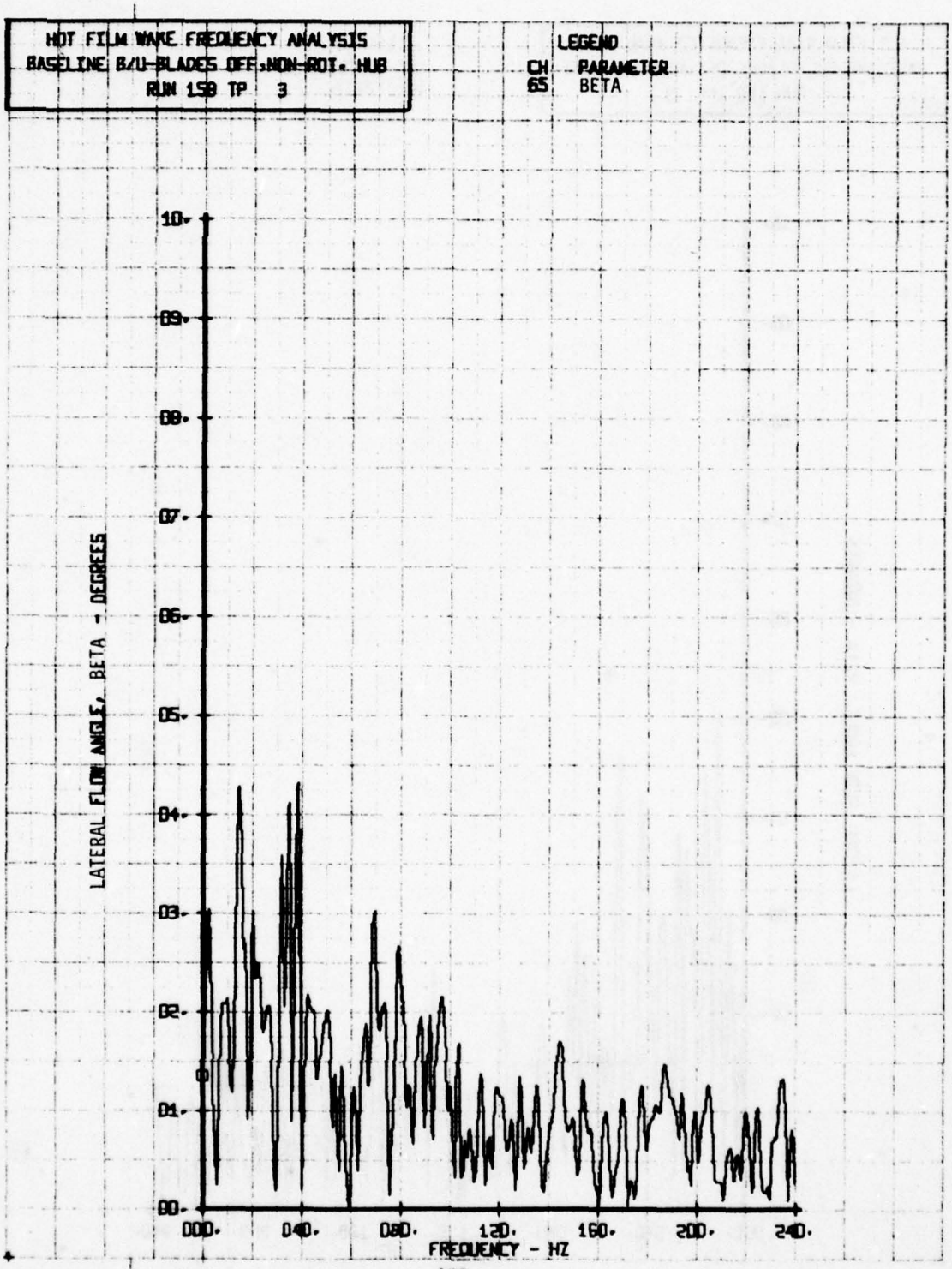

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 8
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

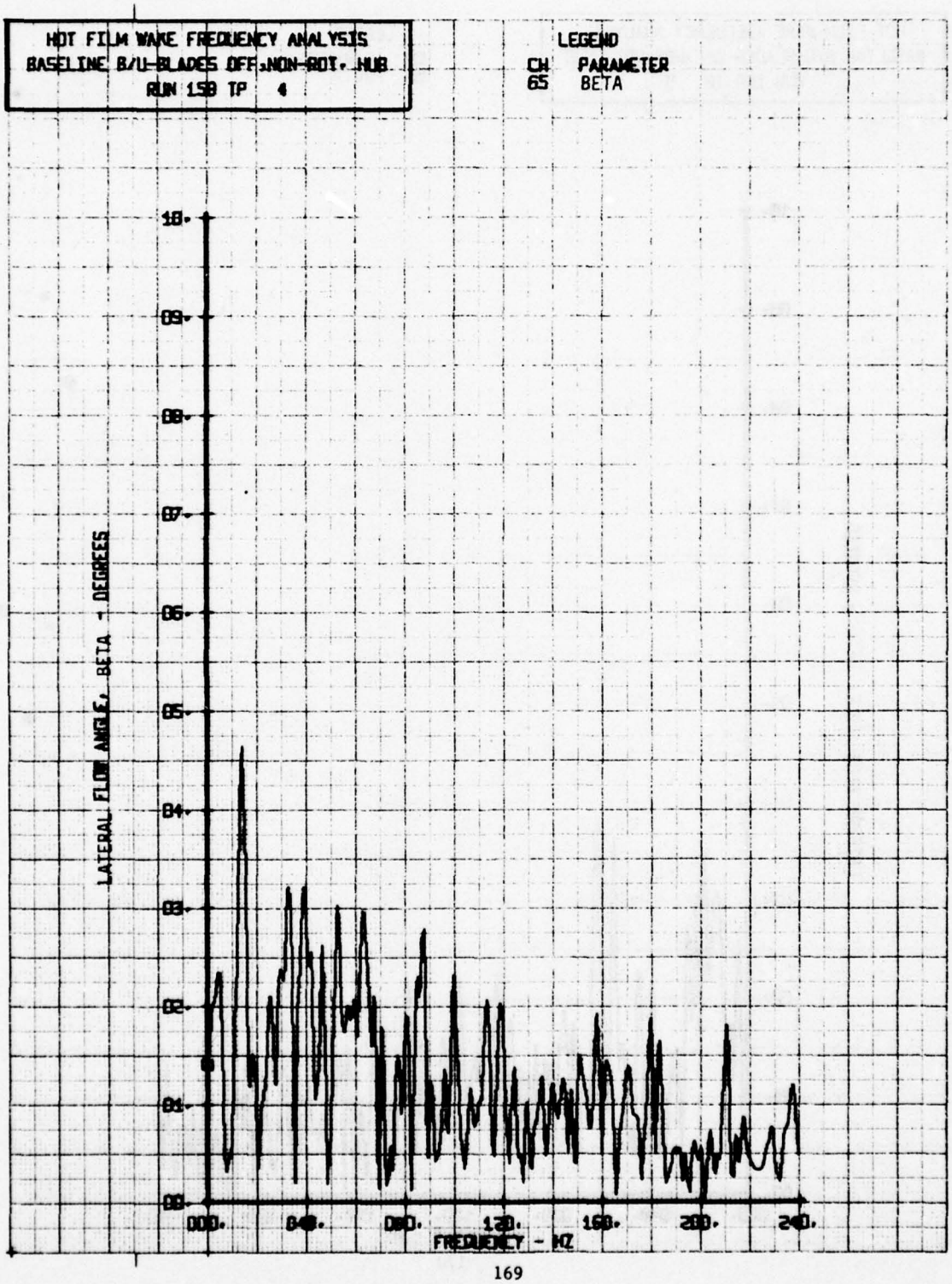
HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 150 TP 9

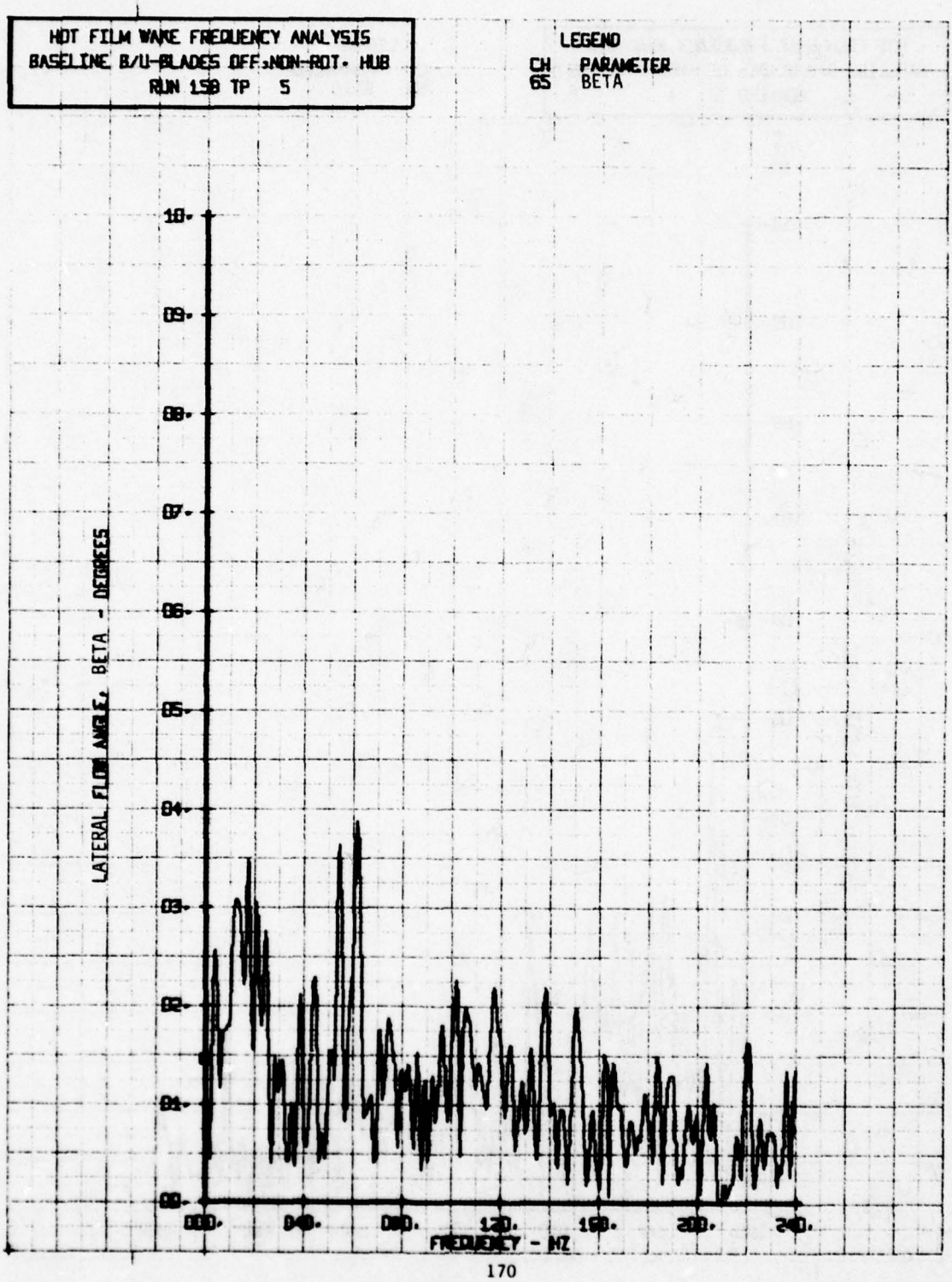
LEGEND
CH PARAMETER
66 ALPHA

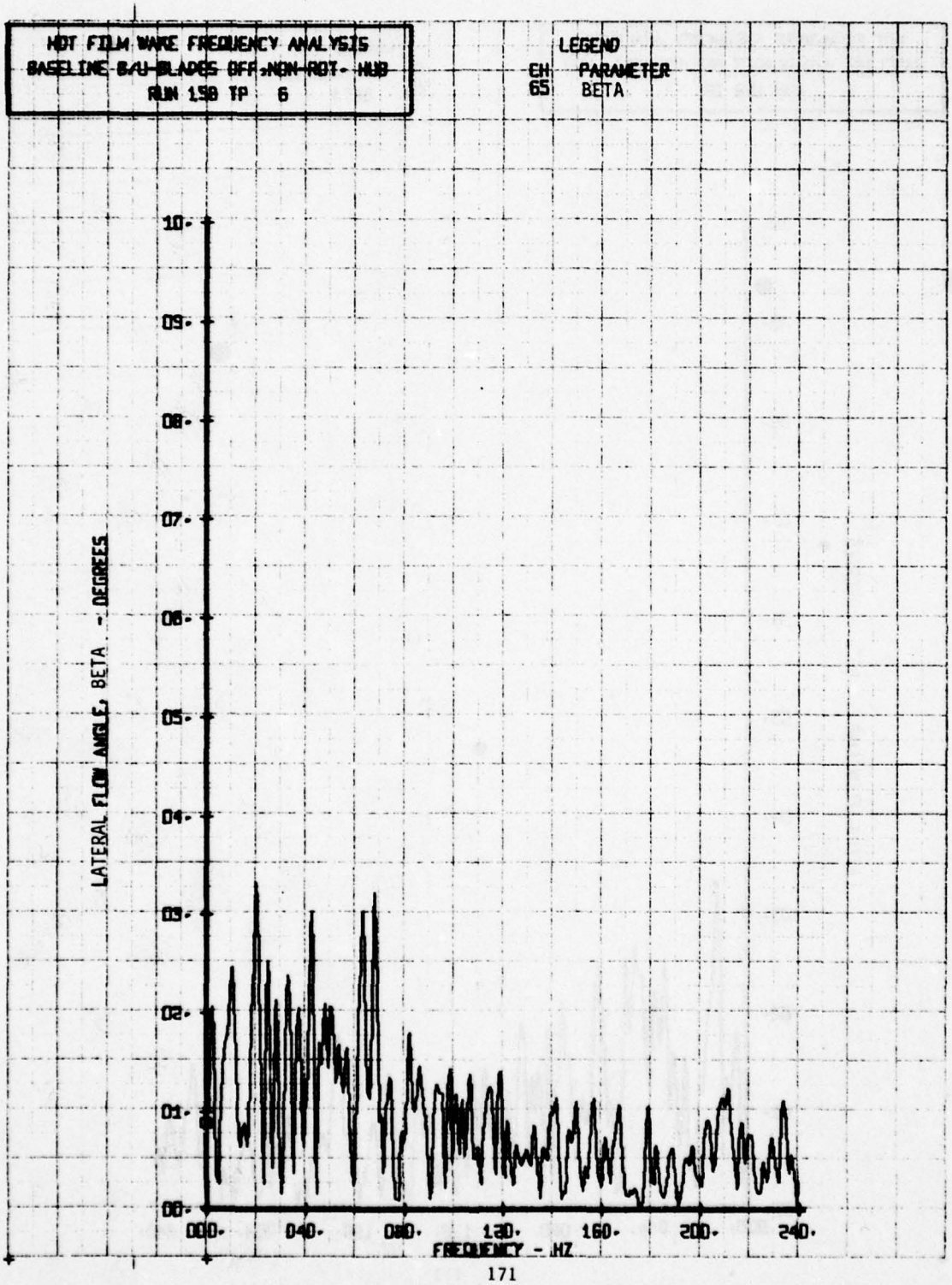


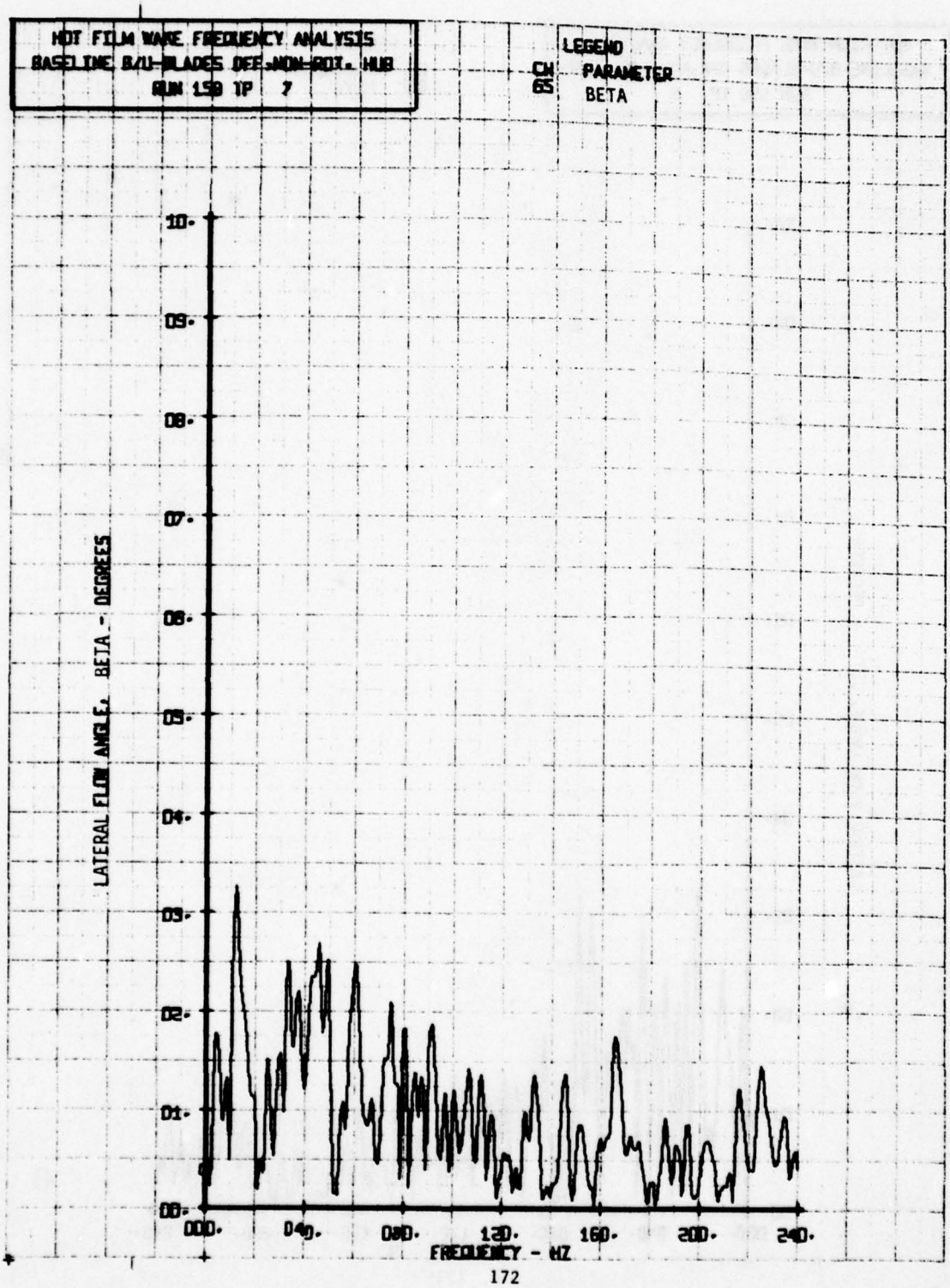

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF-NON-ROT. HUB
RUN 158 TP 2
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

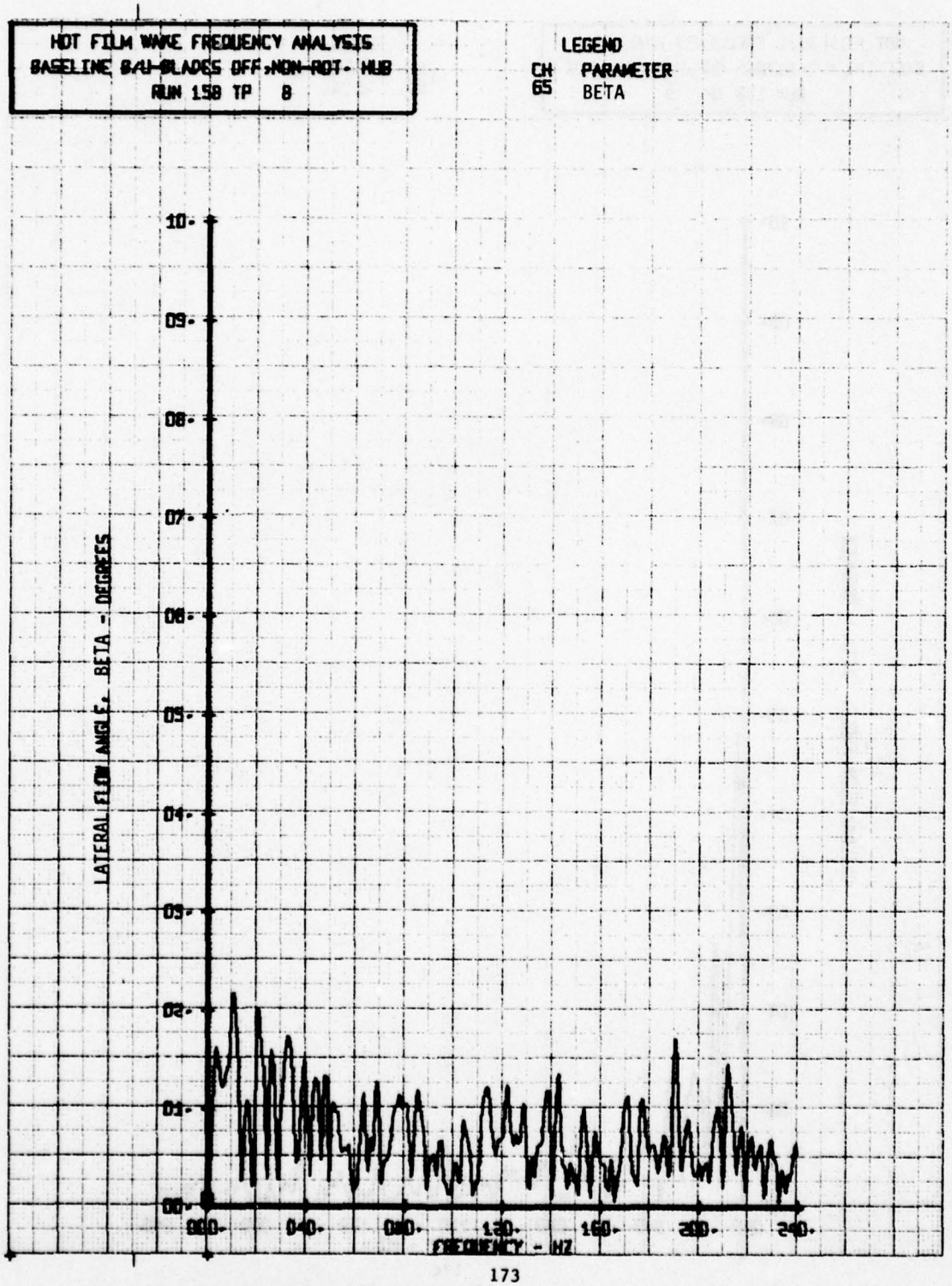

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 3
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

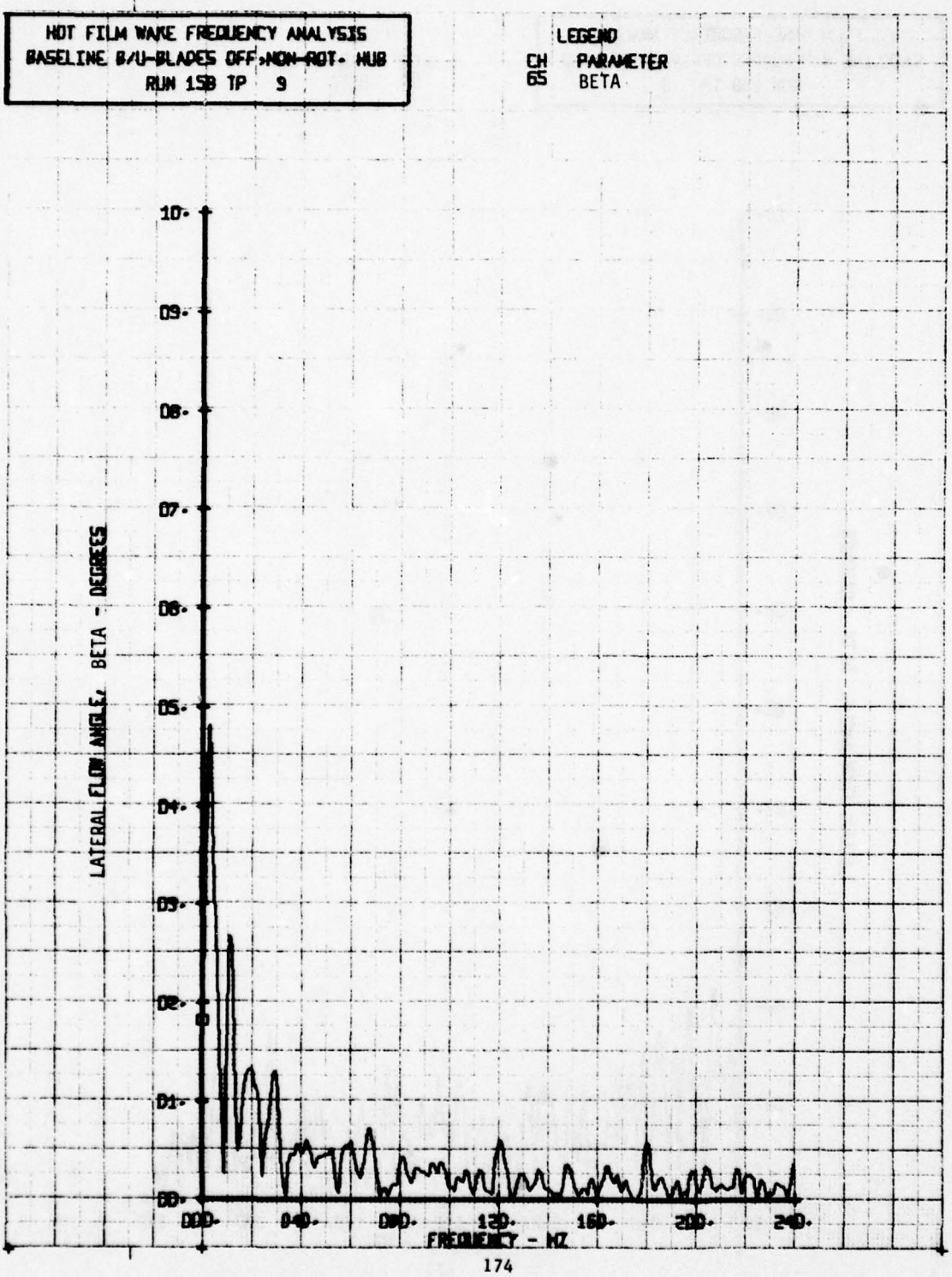

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 4
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
FREQUENCY - HZ

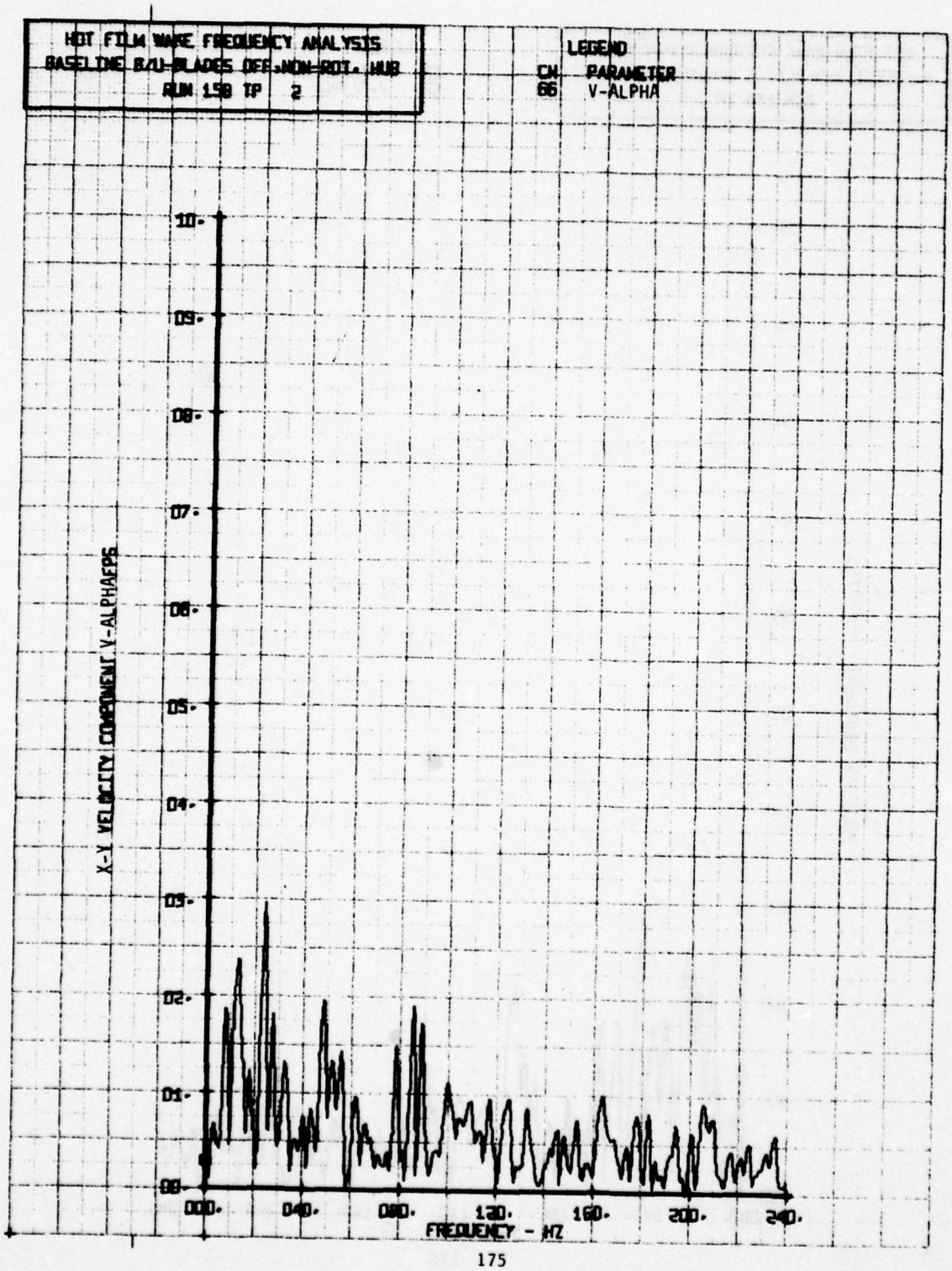

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 5
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

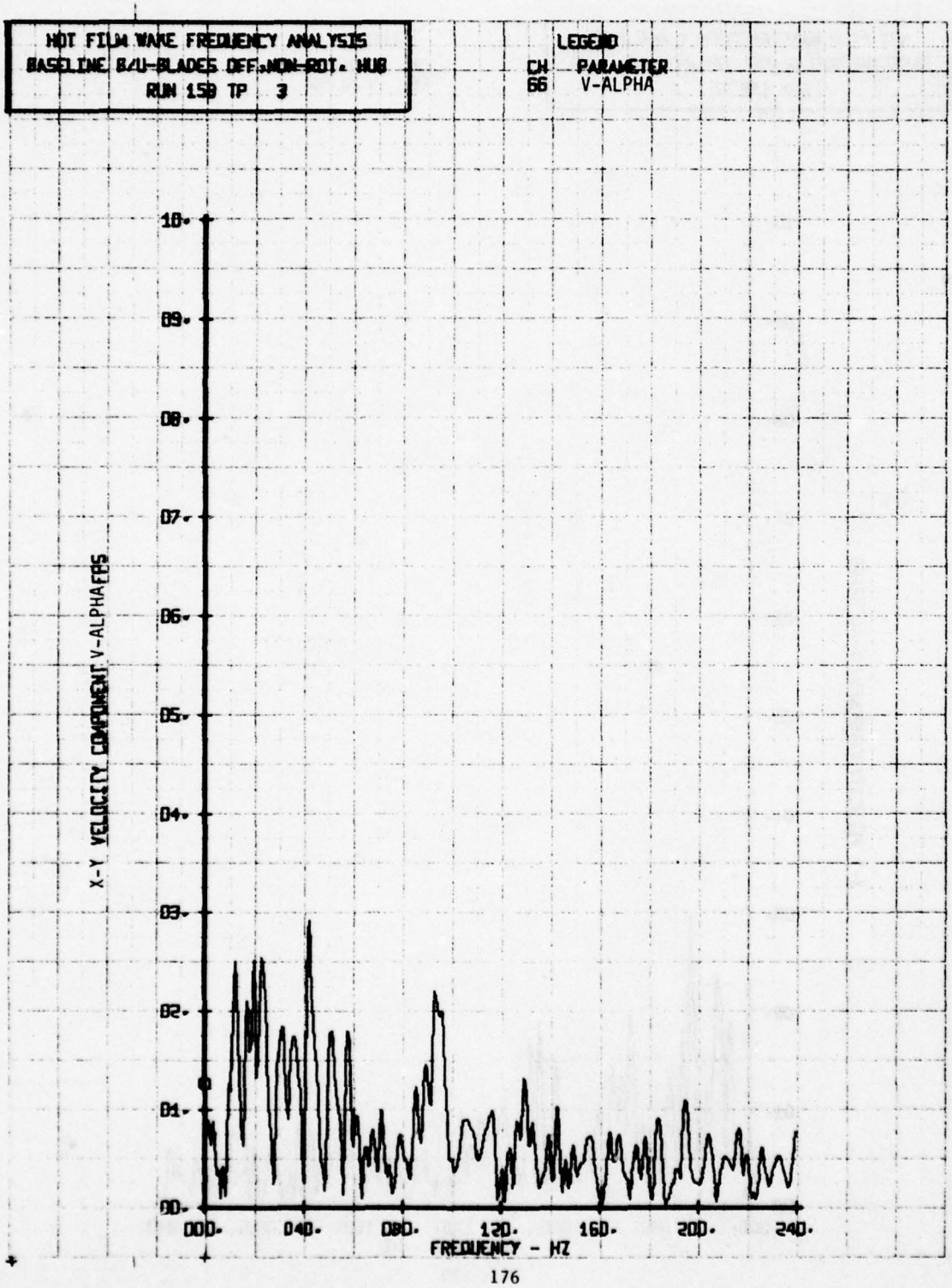

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT- HUB
RUN 158 TP 6
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

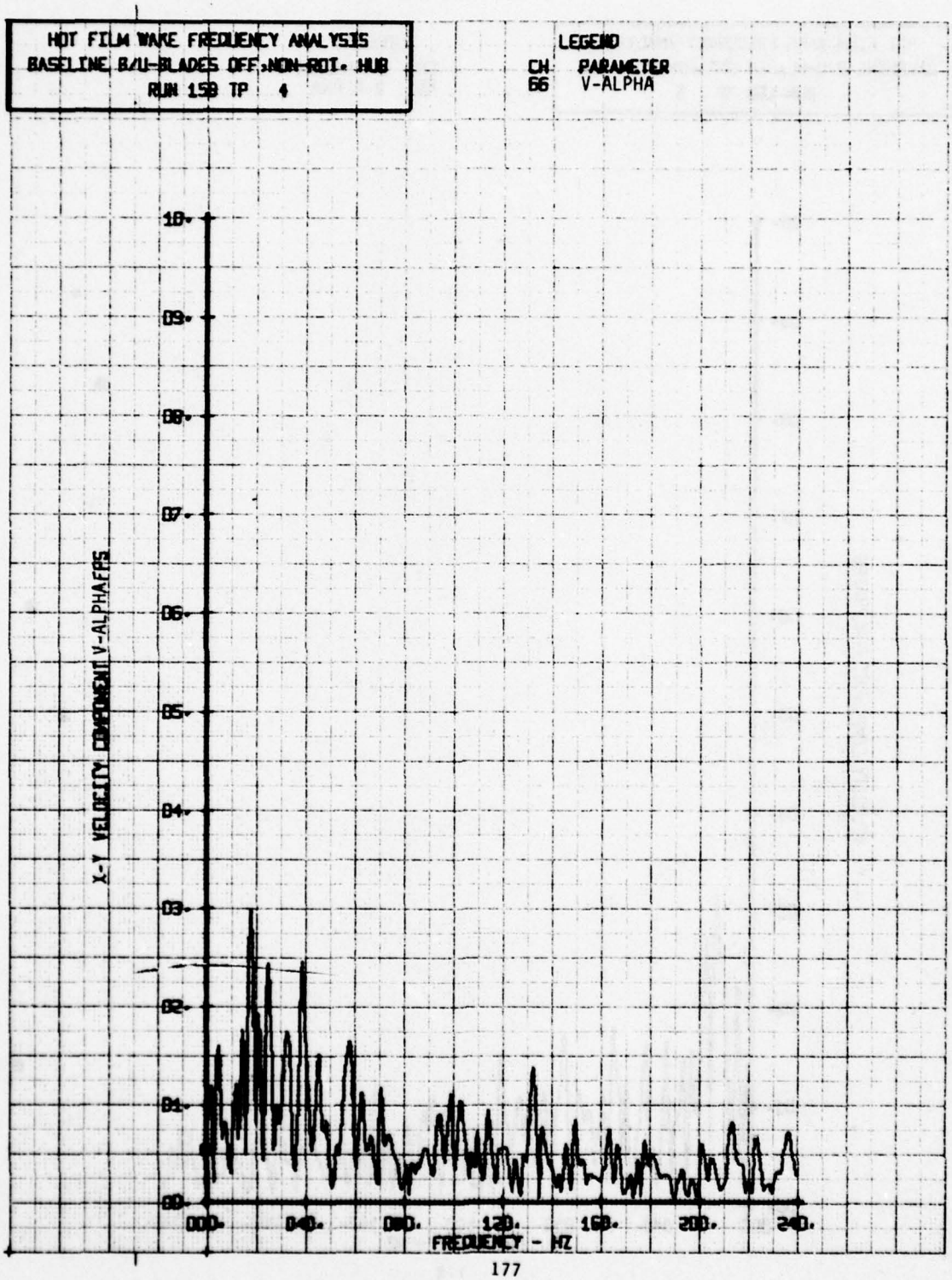

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES DEF.NON-ROT. HUB
RUN 159 TP 7
LEGEND
CH 65 PARAMETER
BETA
LATERAL FLOW ANGLE, BETA -, DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

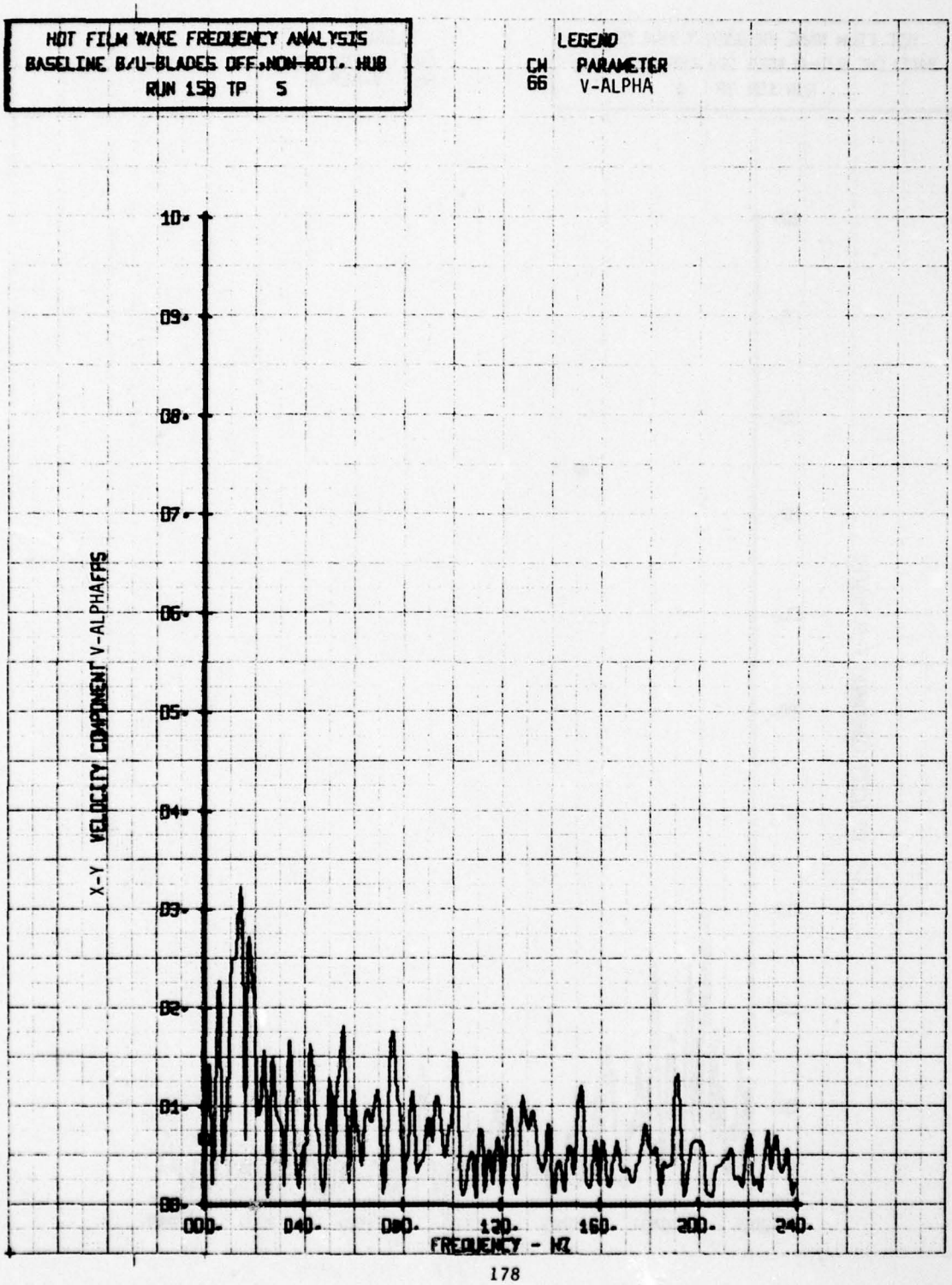

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 159 TP 8
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

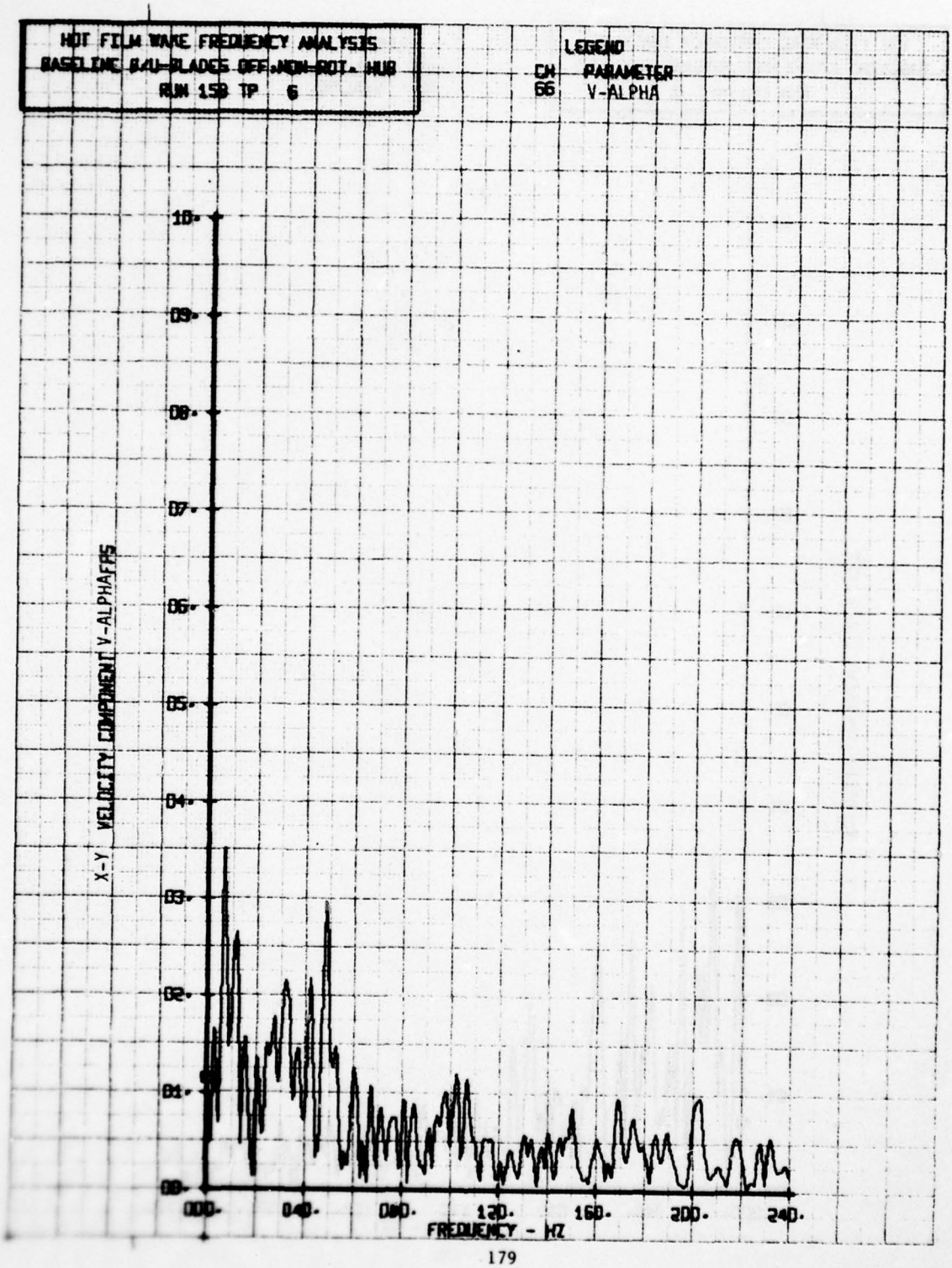

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 9
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

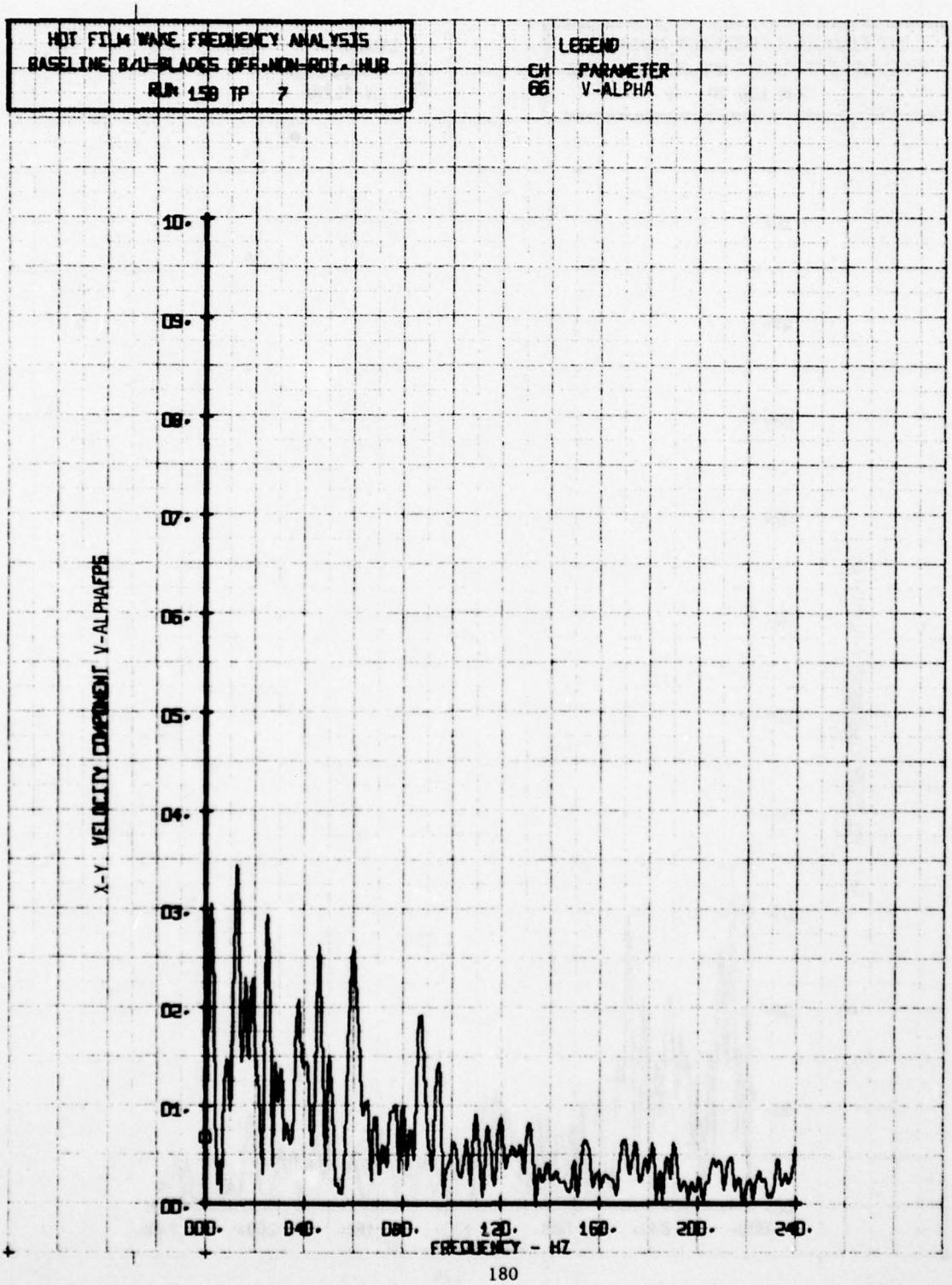

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES DEF.NON-ROT. HUB
RUN 158 TP 2
LEGEND
CH. PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAEPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

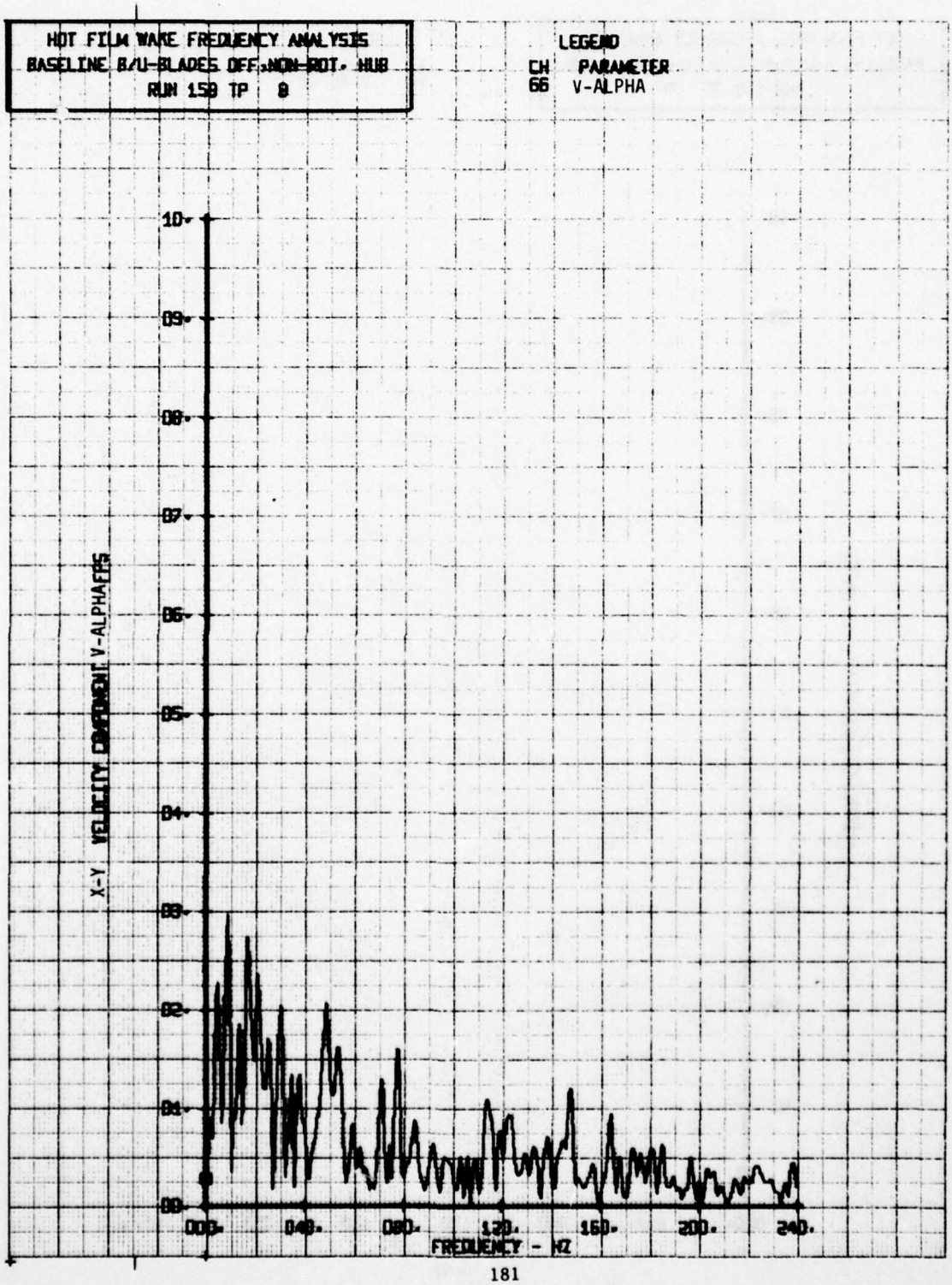

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 159 TP 3
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/FRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

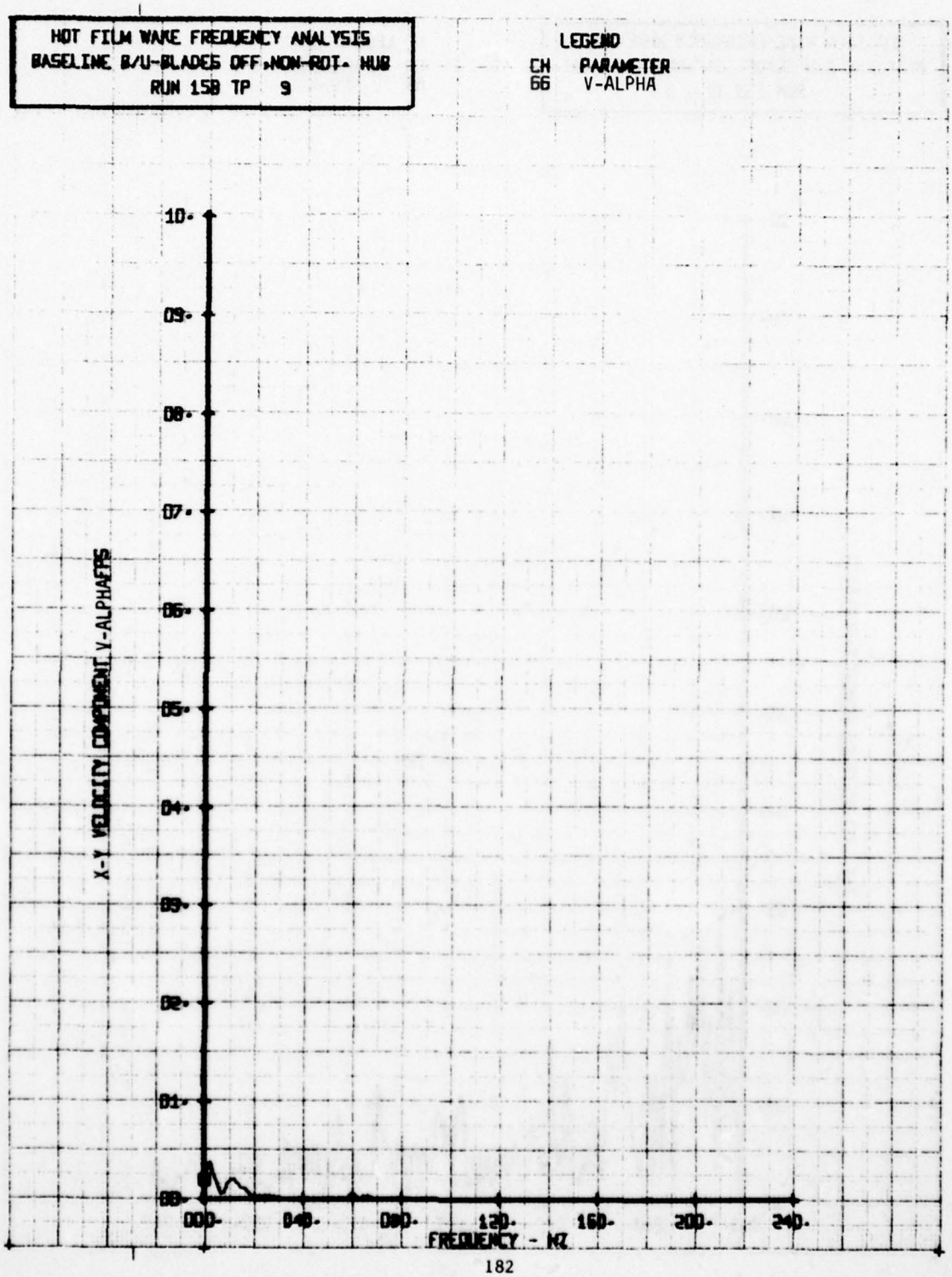

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 4
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

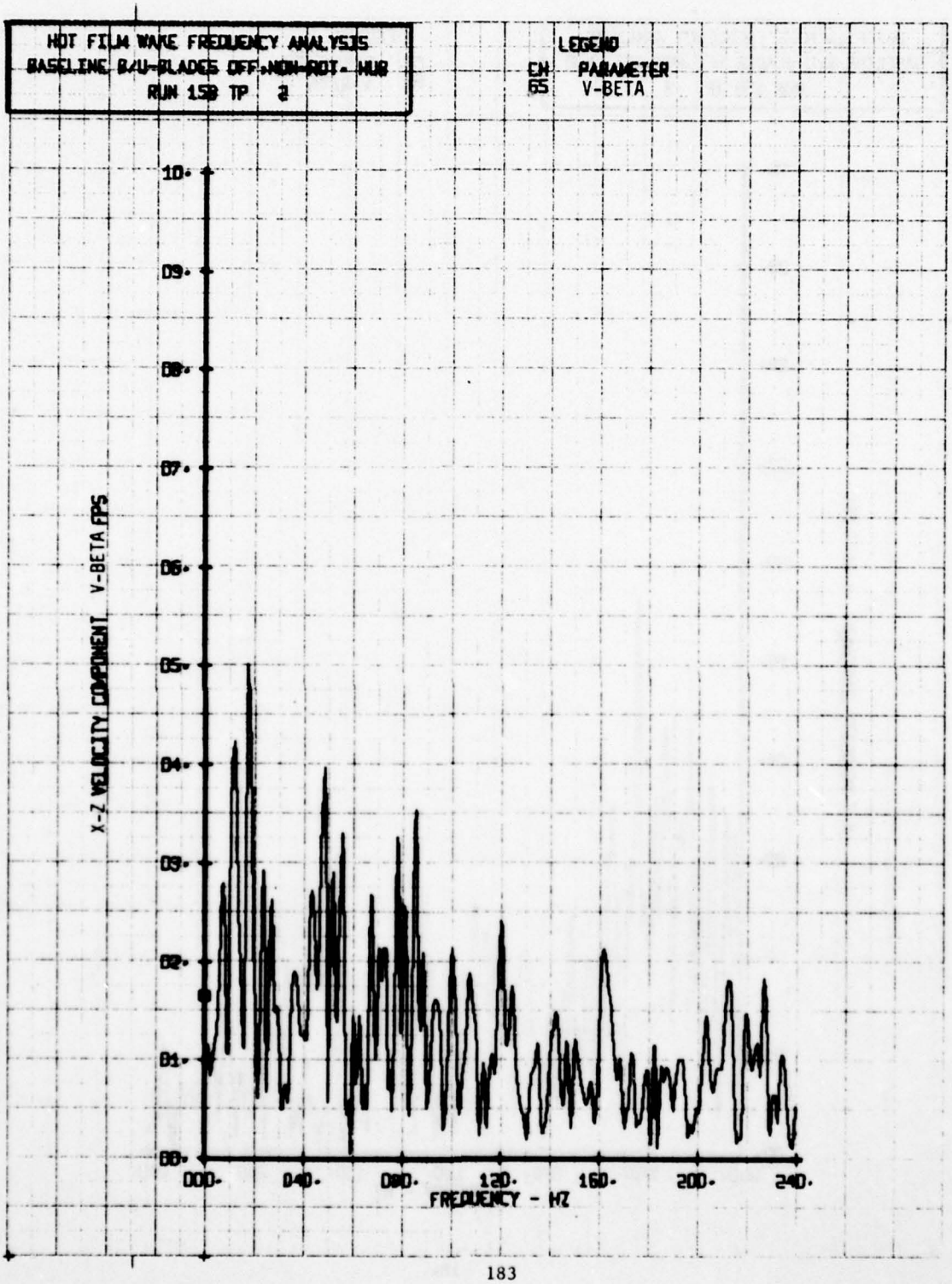

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 5
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

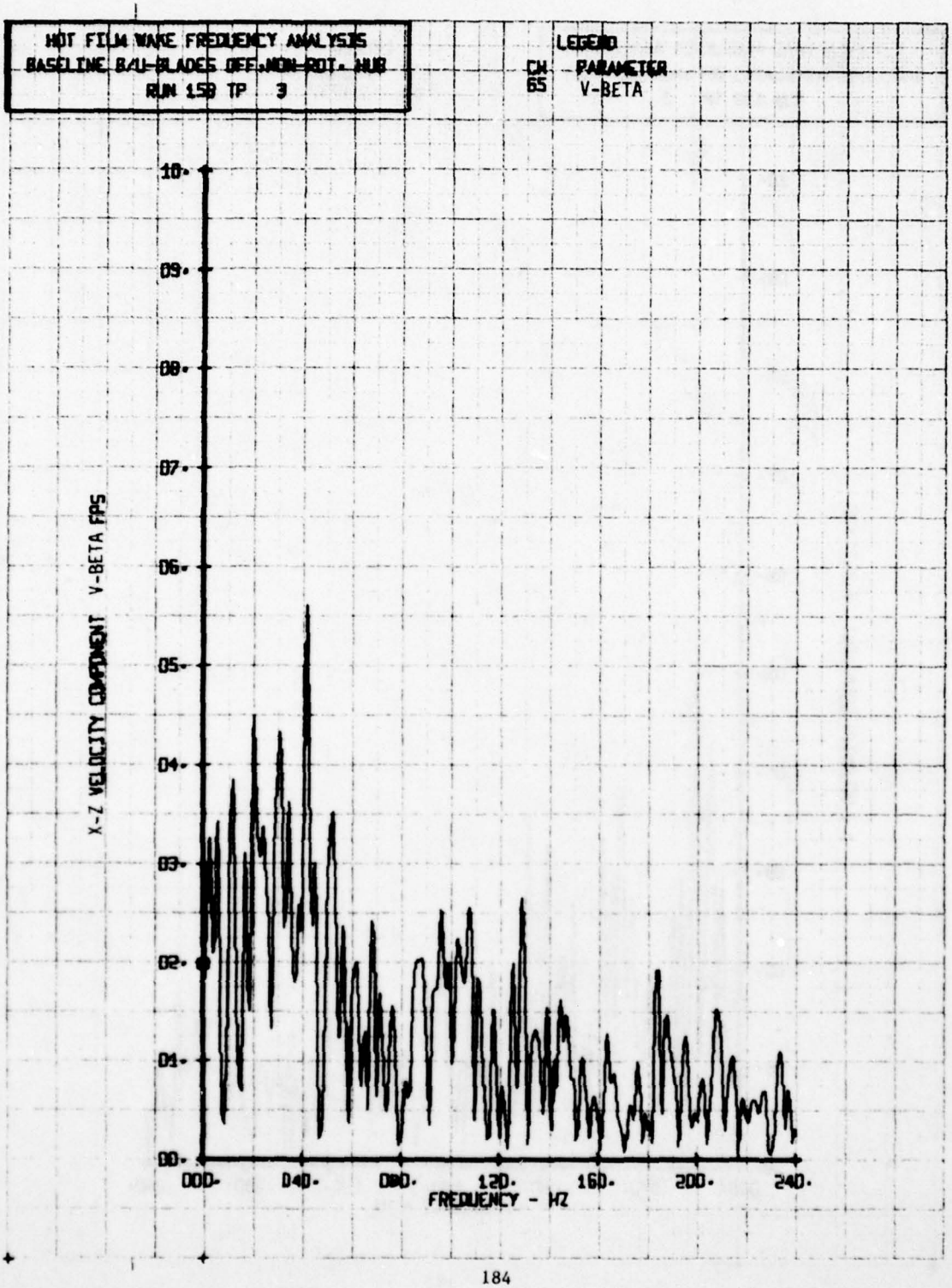

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE 64U-BLADES OFF-NON-ROT. HUB
RUN 158 TP 6
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

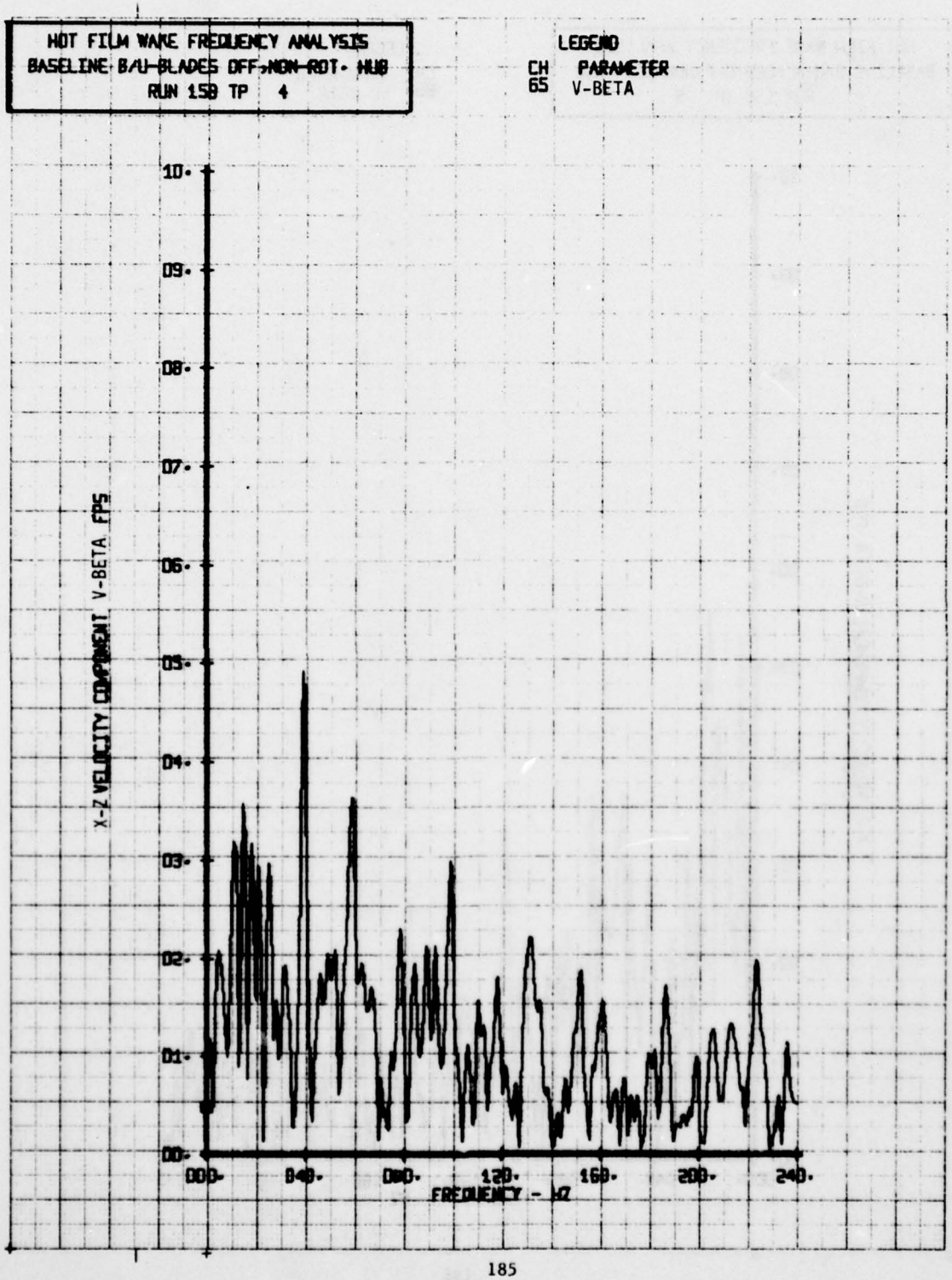

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF.NON-ROT. HUB
RUN 158 TP 7
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

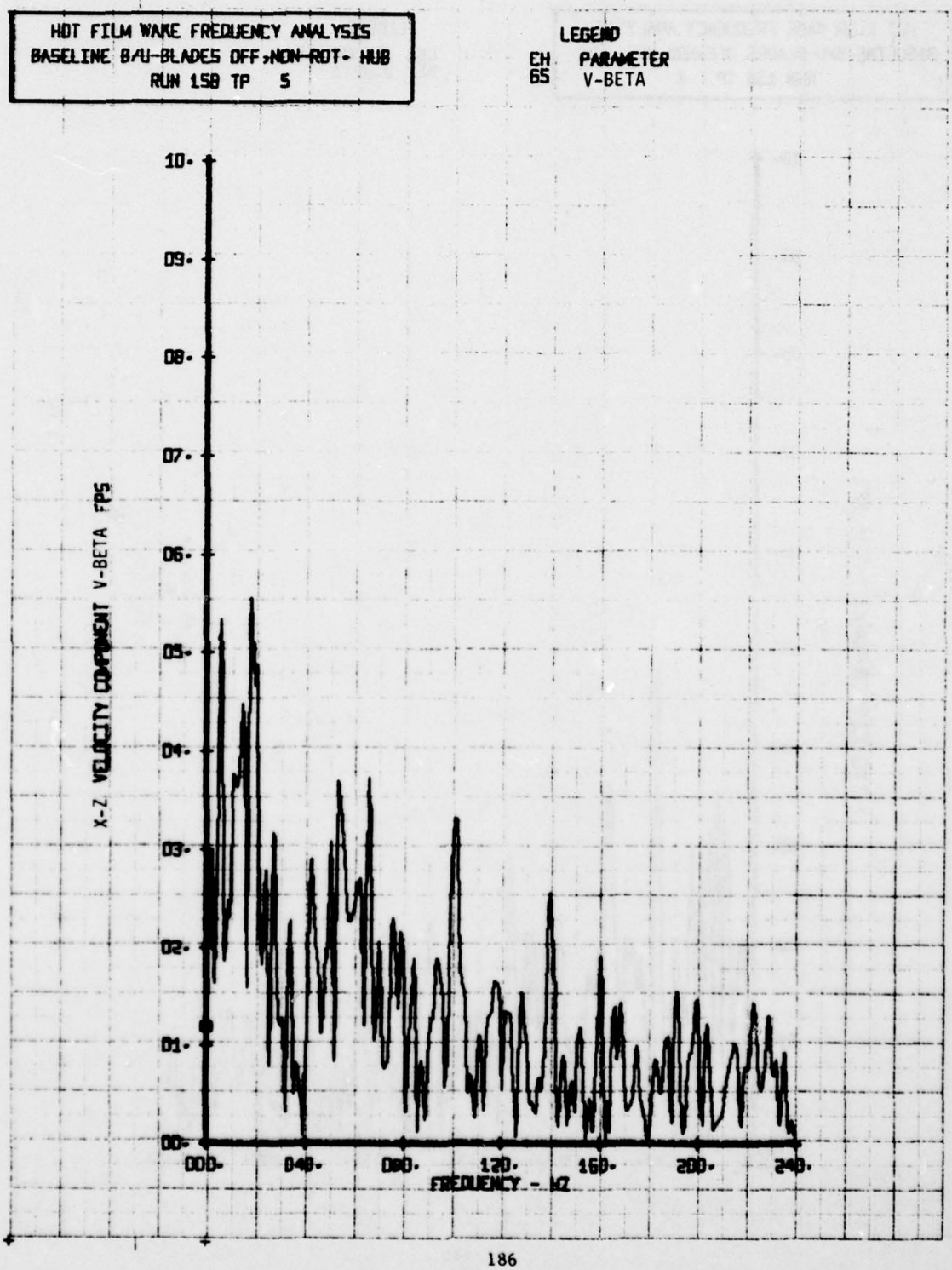

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 159 TP 8
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

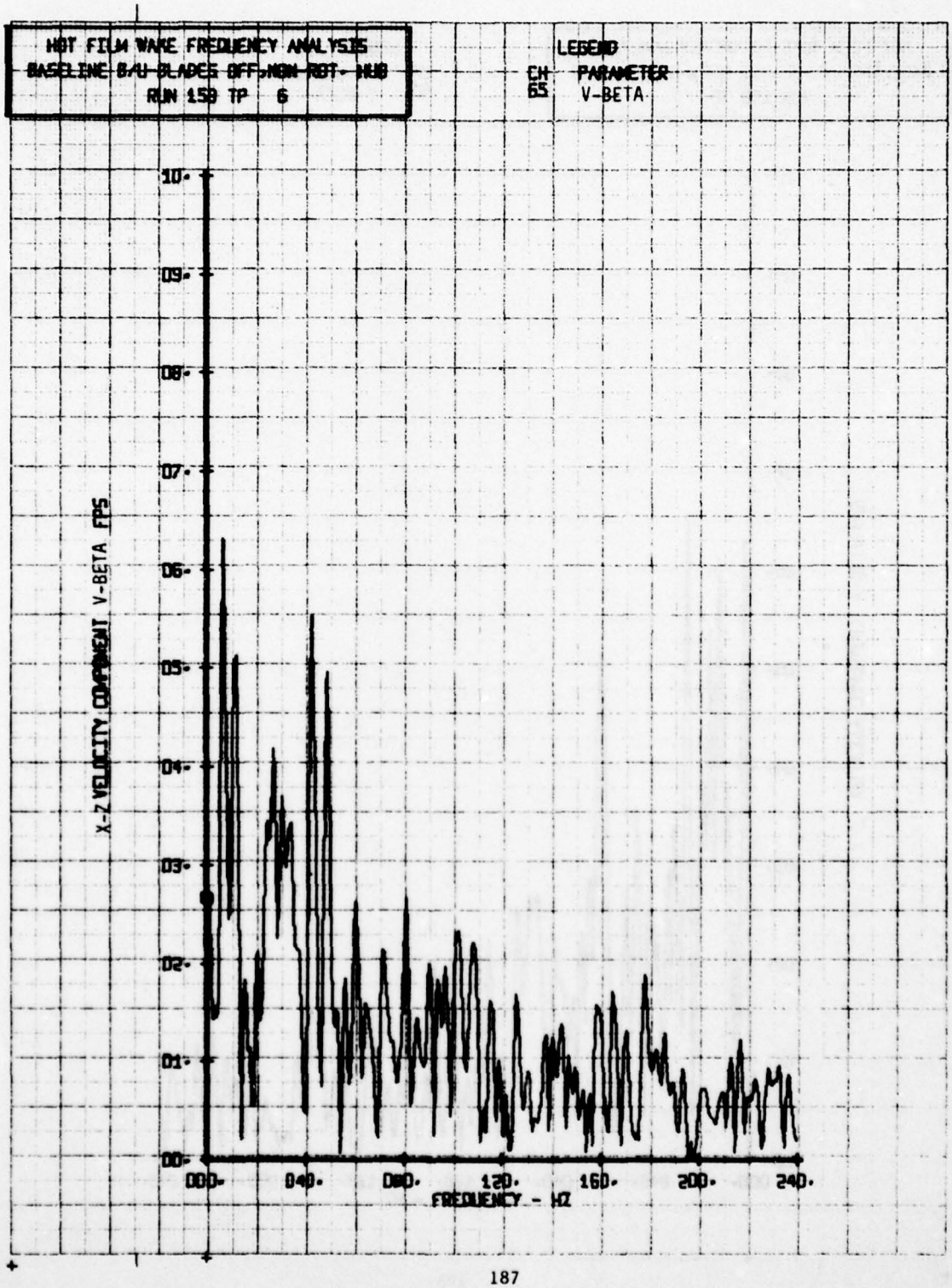

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 9
LEGEND
CH PARAMETER
66 V-ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Y VELOCITY COMPONENT Y-ALPHAFPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

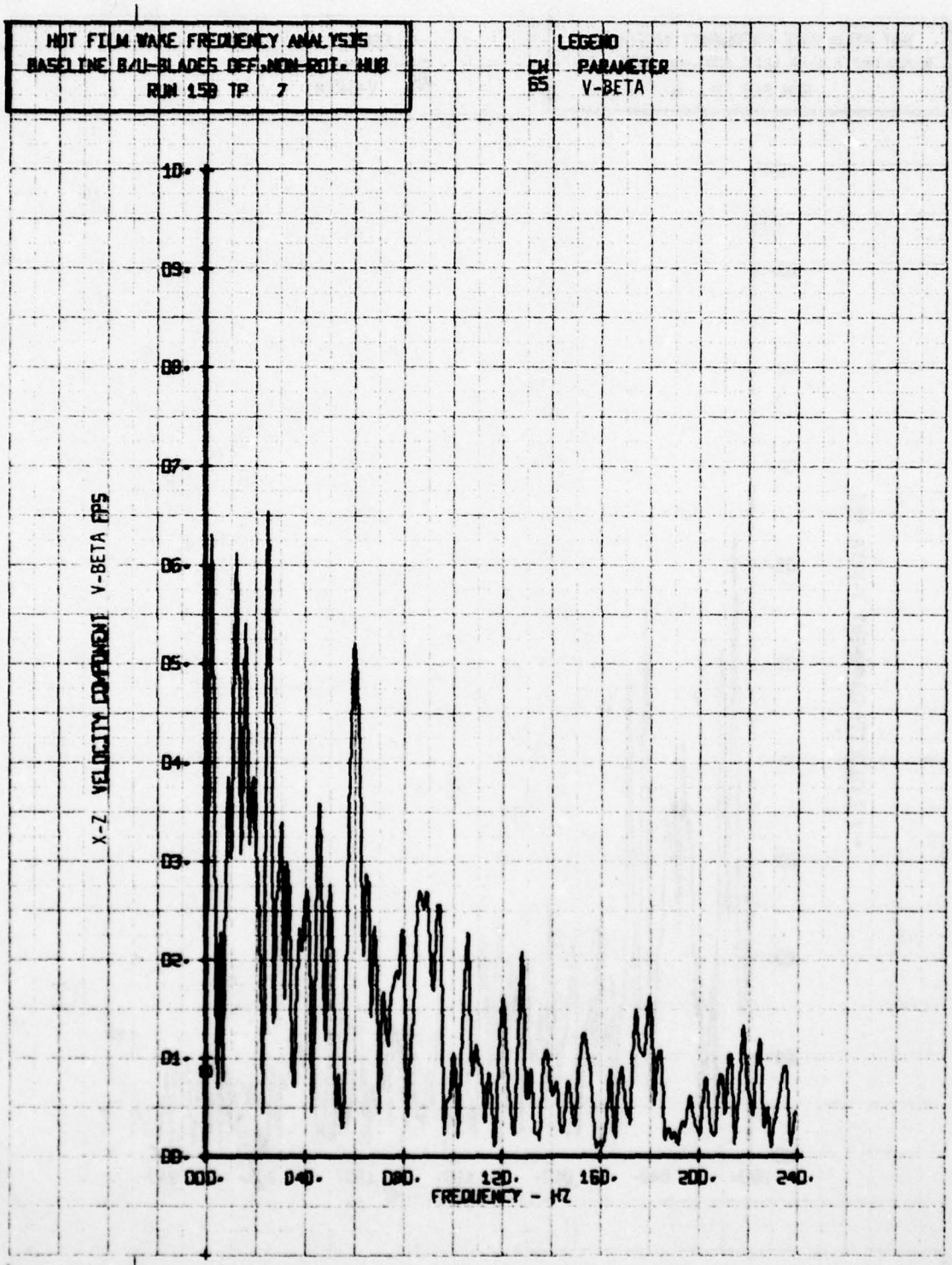

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF-NON-ROT- HUB
RUN 158 TP 2
LEGEND
EN PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

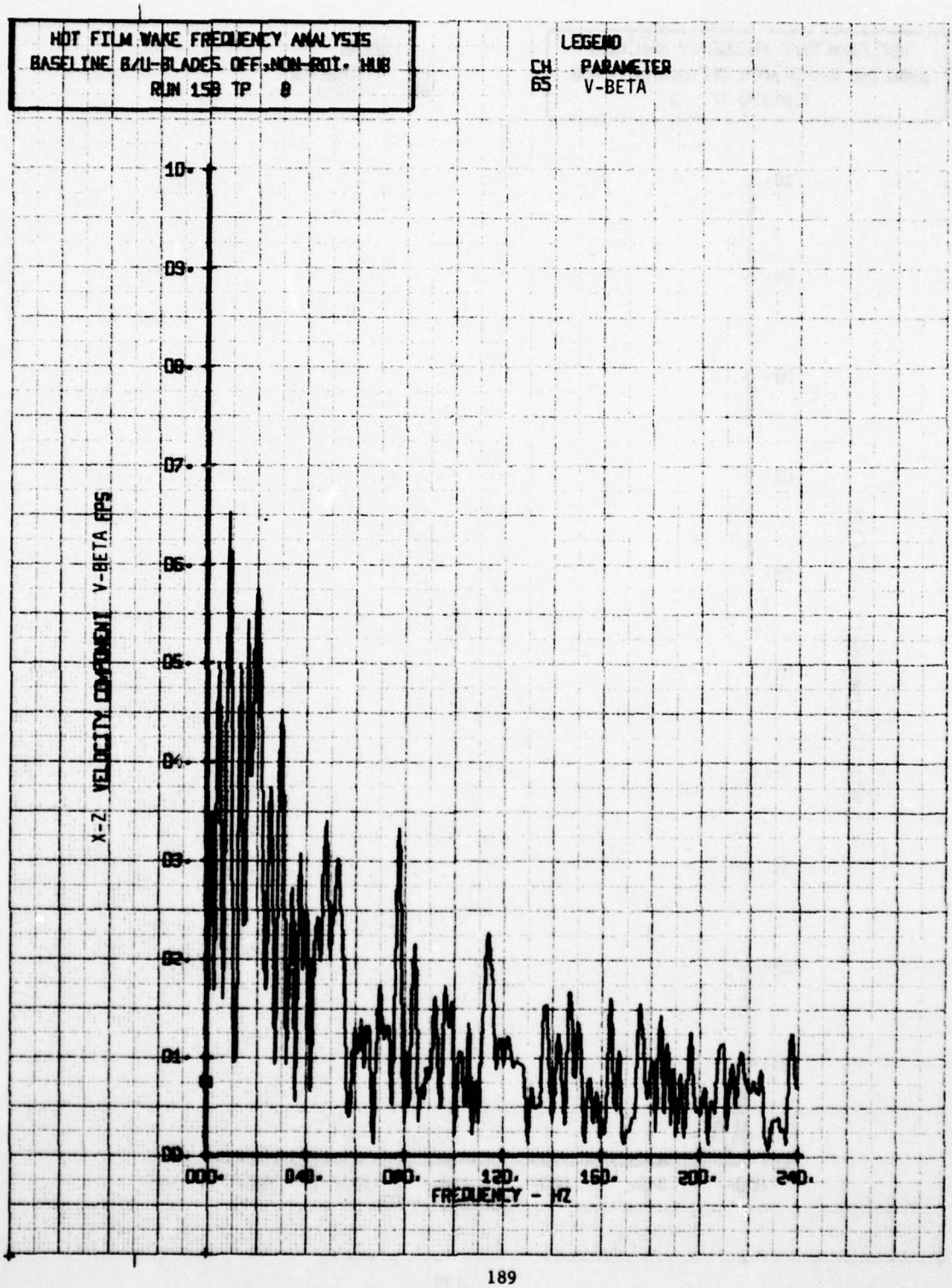

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 3
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

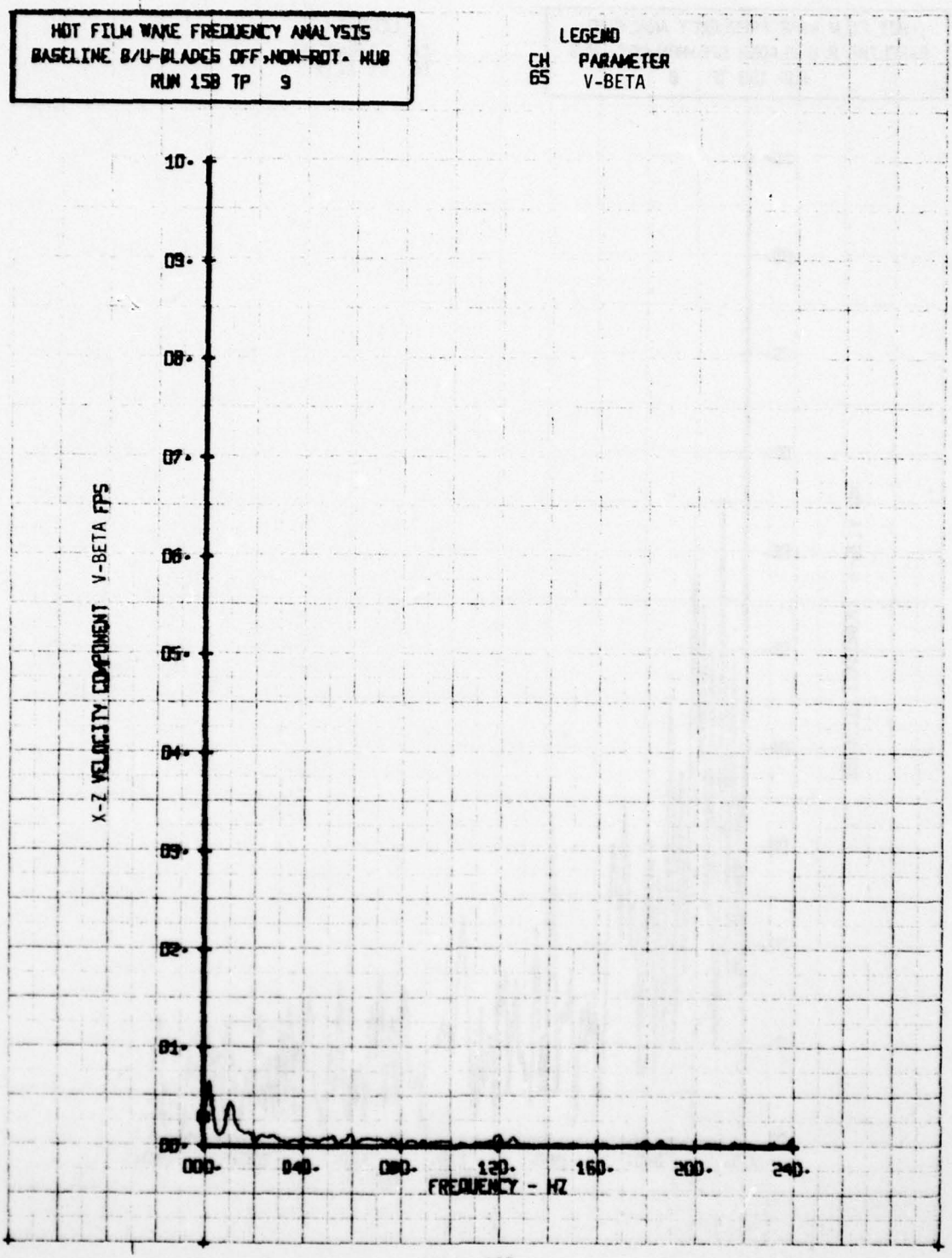

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF-NON-ROT. HUB
RUN 158 TP 4
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

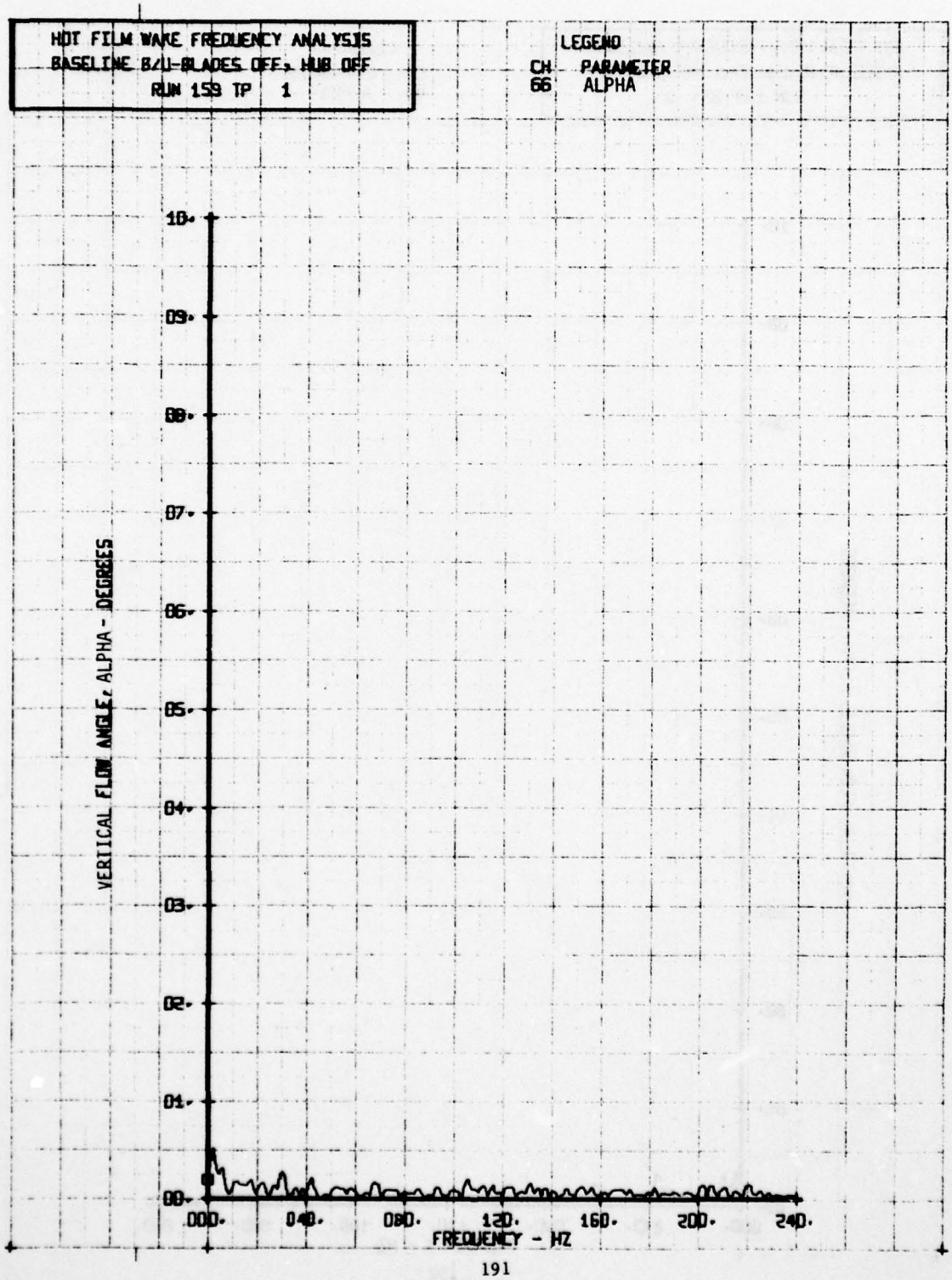

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 5
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

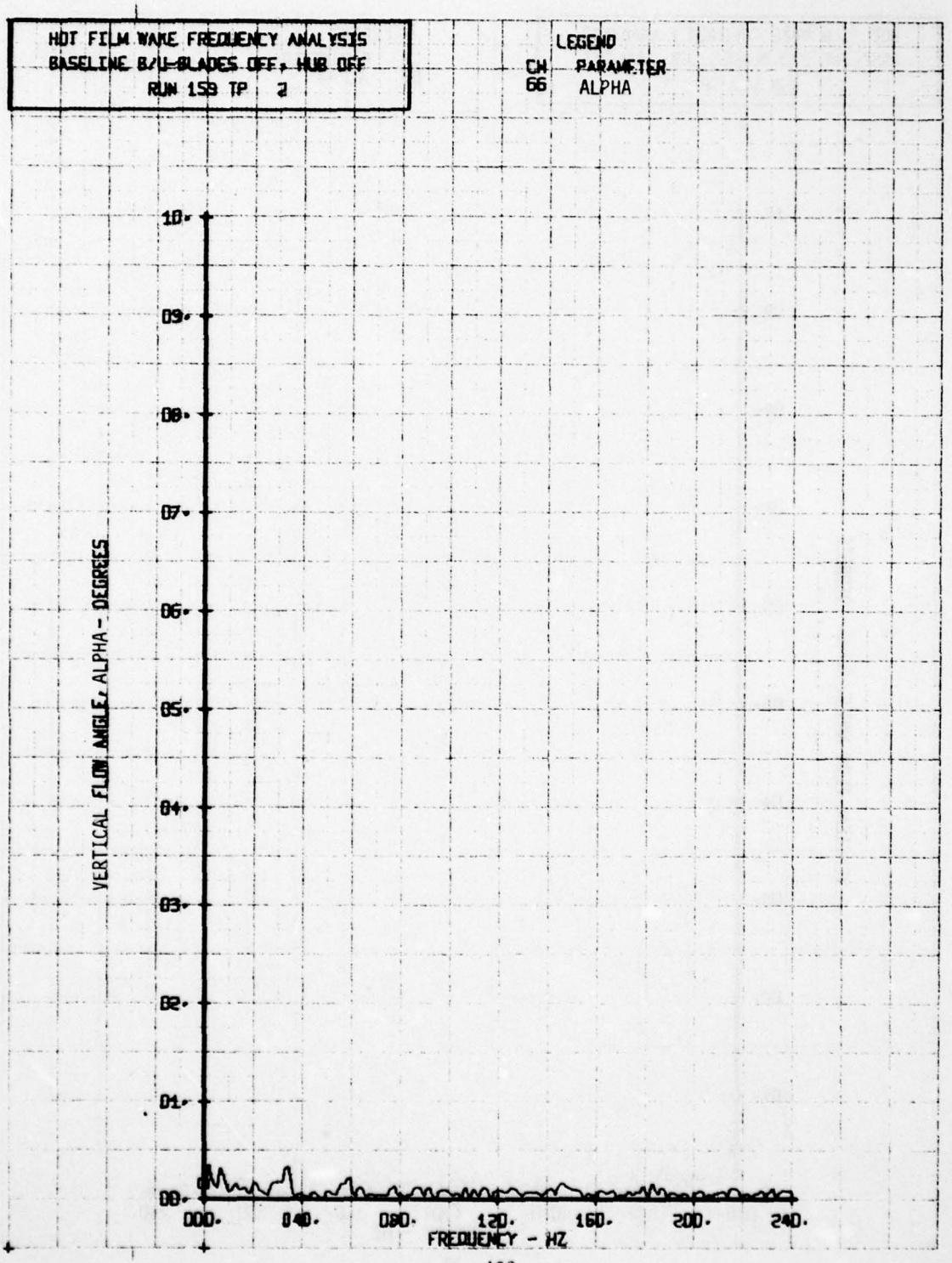

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U BLADES OFF-NON-ROT- HUB
RUN 158 TP 6
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B4U-BLADES DEF.NON-ROT. HUB
RUN 159 TP 7
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 8
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

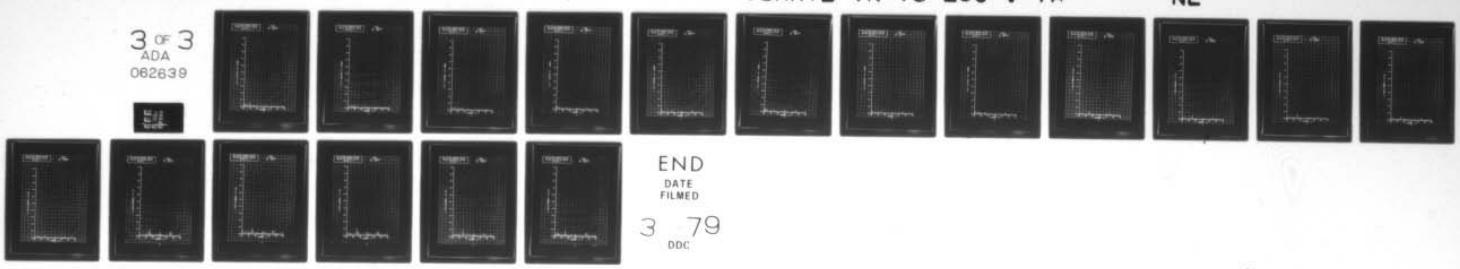

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF,NON-ROT. HUB
RUN 158 TP 9
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 153 TP 1
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 153 TP 2
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

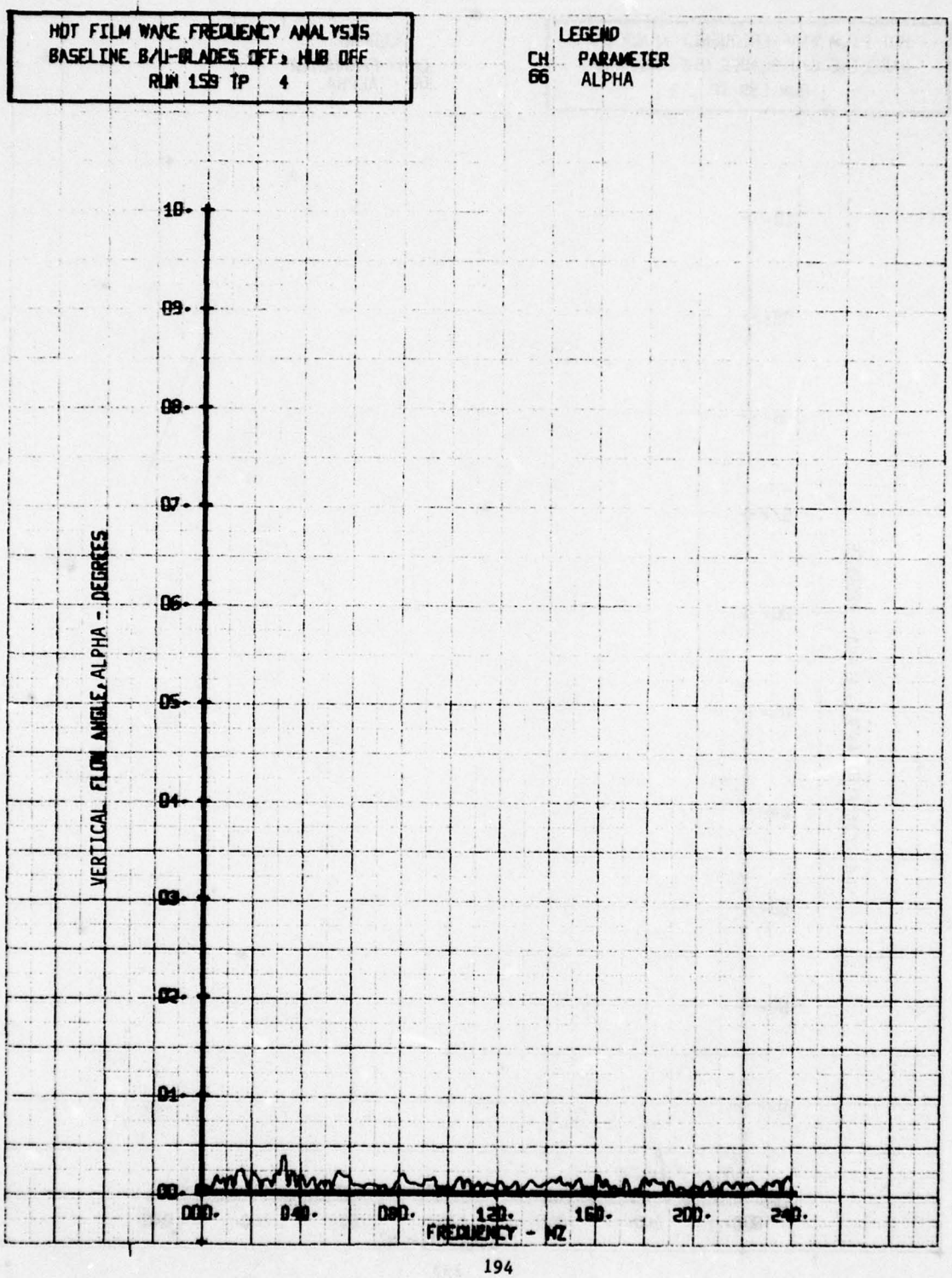
AD-A062 639 BOEING VERTOL CO PHILADELPHIA PA F/G 1/3
INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFI--ETC(U)
SEP 78 P F SHERIDAN DAAJ02-77-C-0020
UNCLASSIFIED USARTL-TR-78-23G-V-7A NL

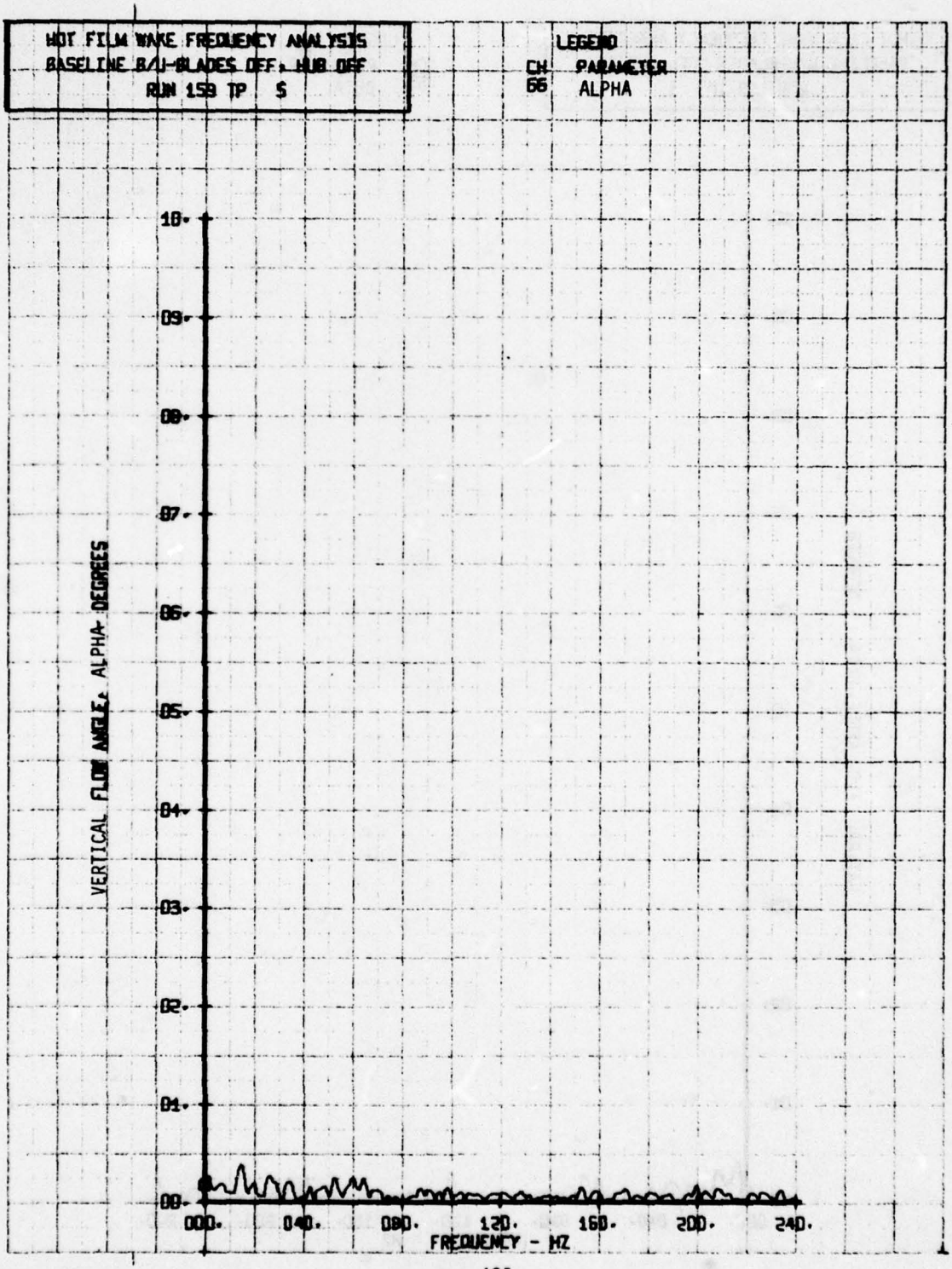
3 OF 3
ADA
062639

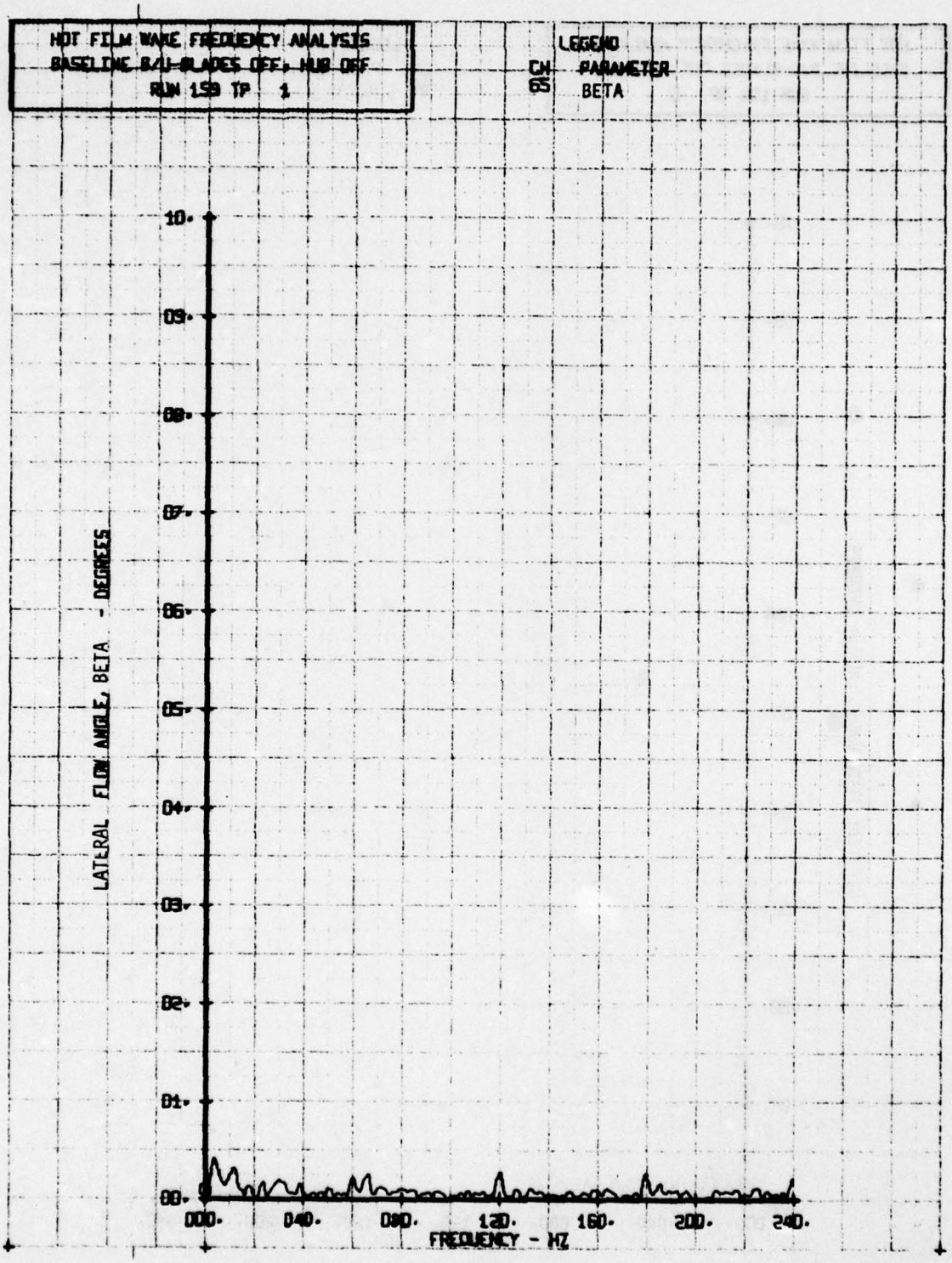


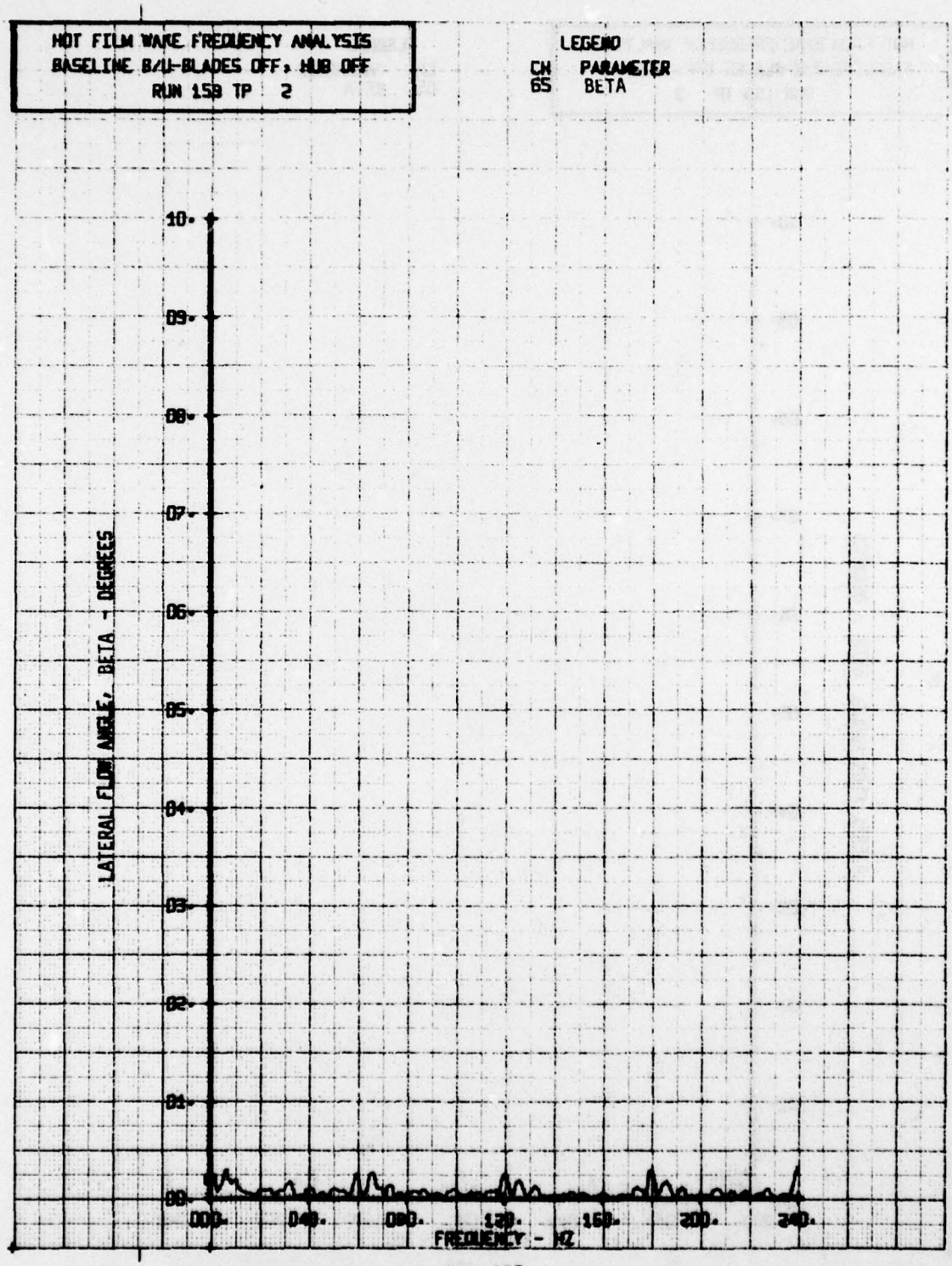
END
DATE
FILMED
3 79
DDC

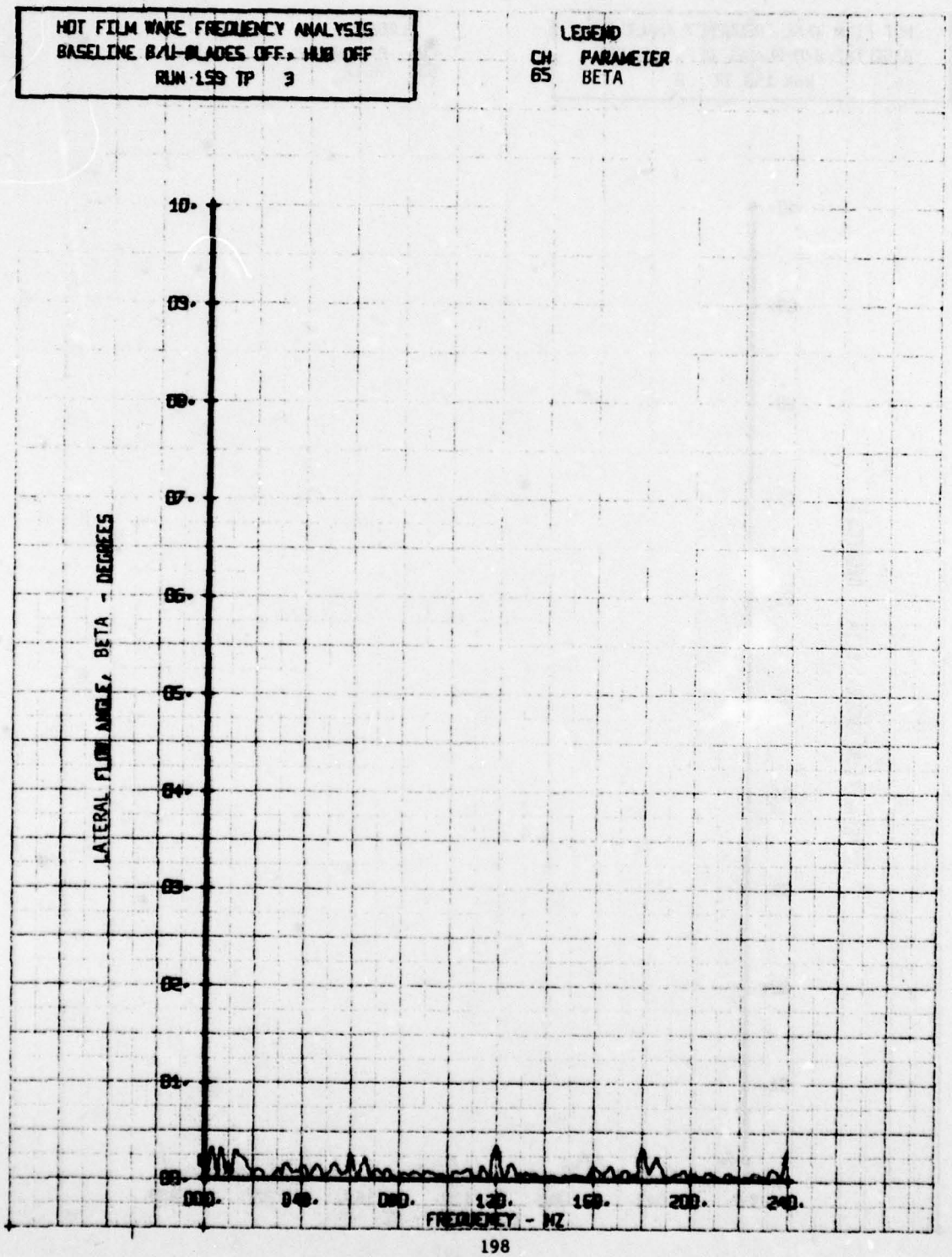

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 3
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

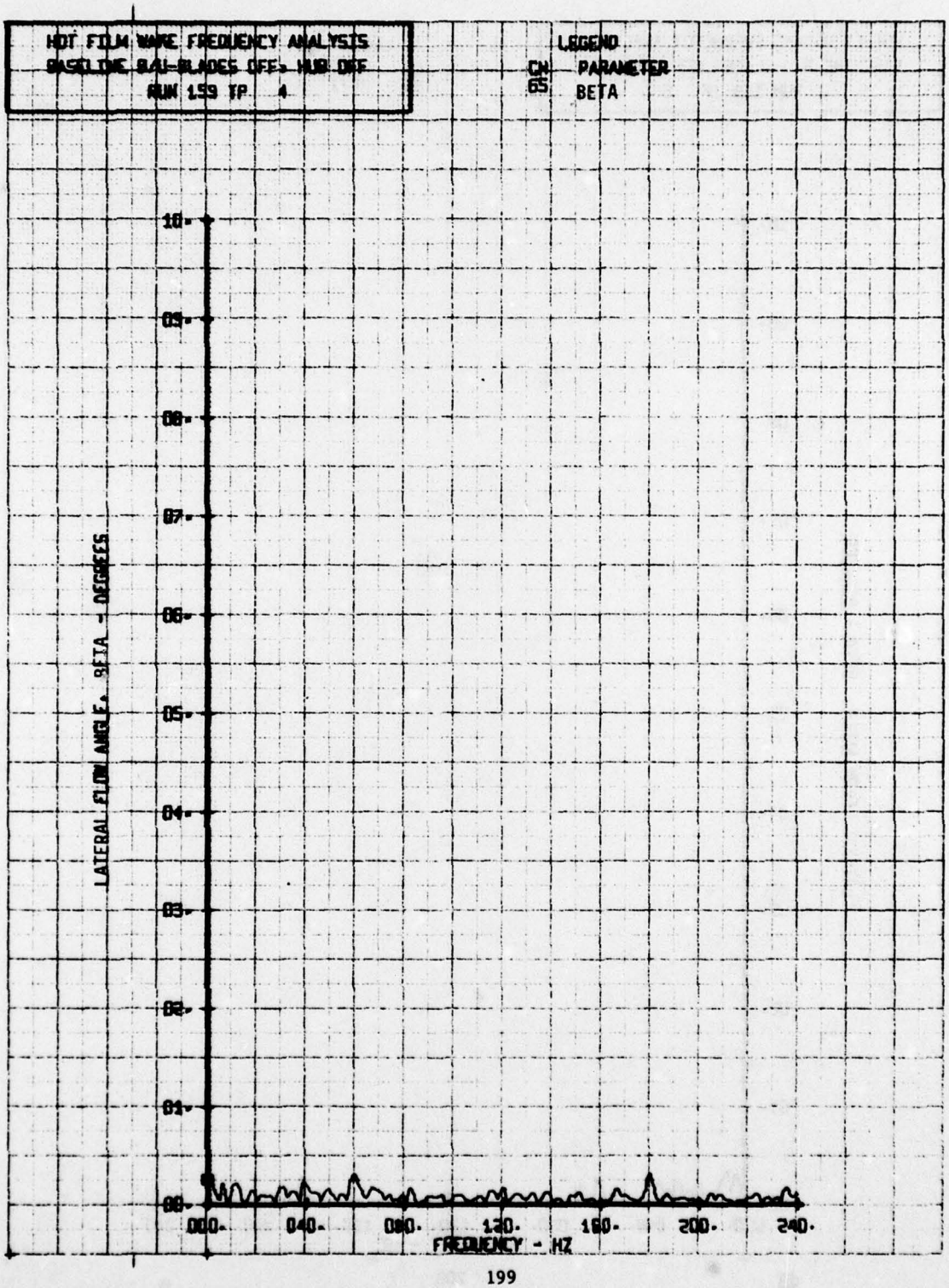

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 4
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE,ALPHA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

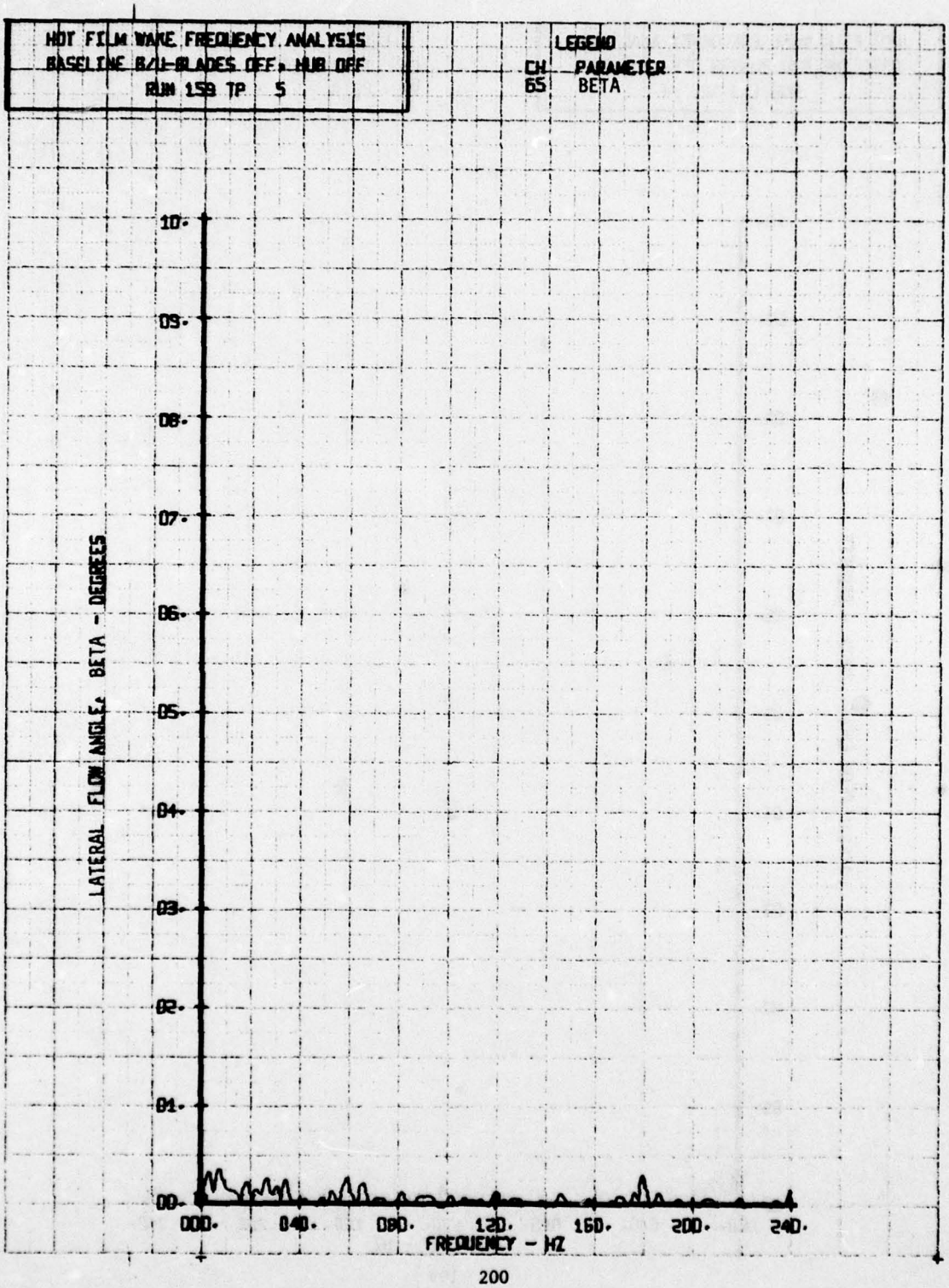

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 5
LEGEND
CH PARAMETER
66 ALPHA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
VERTICAL FLOW ANGLE, ALPHA, DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

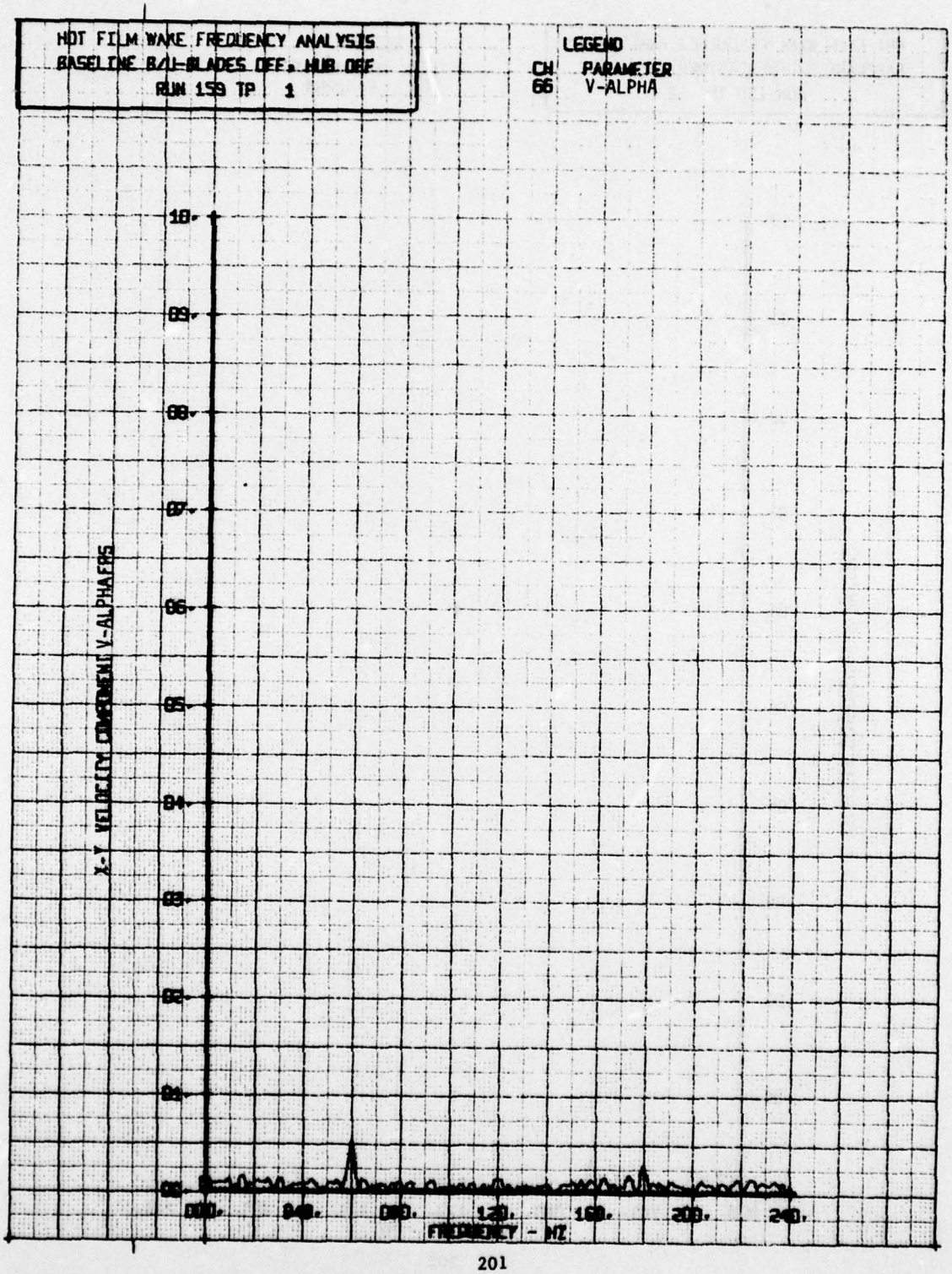

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 1
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

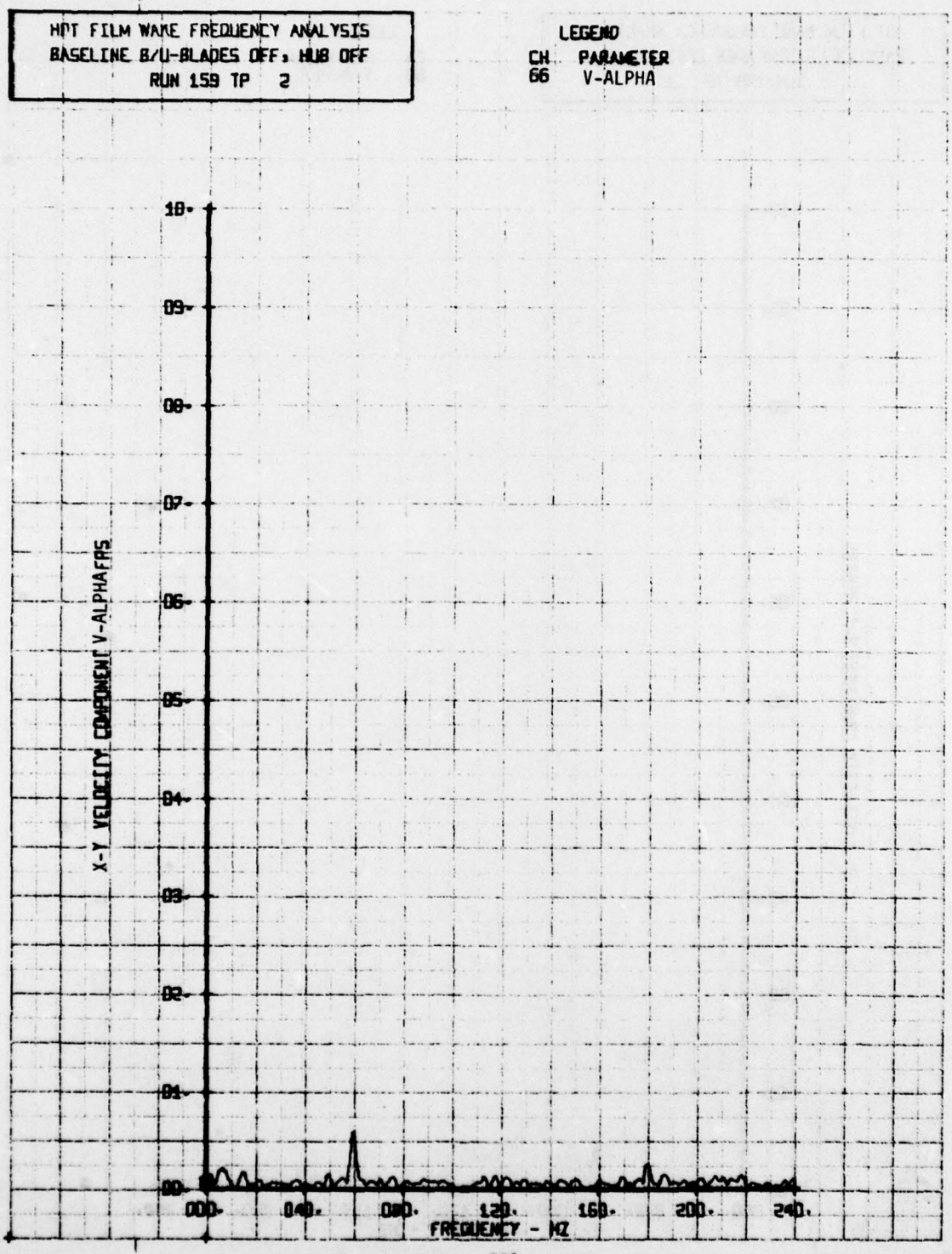

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 2
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

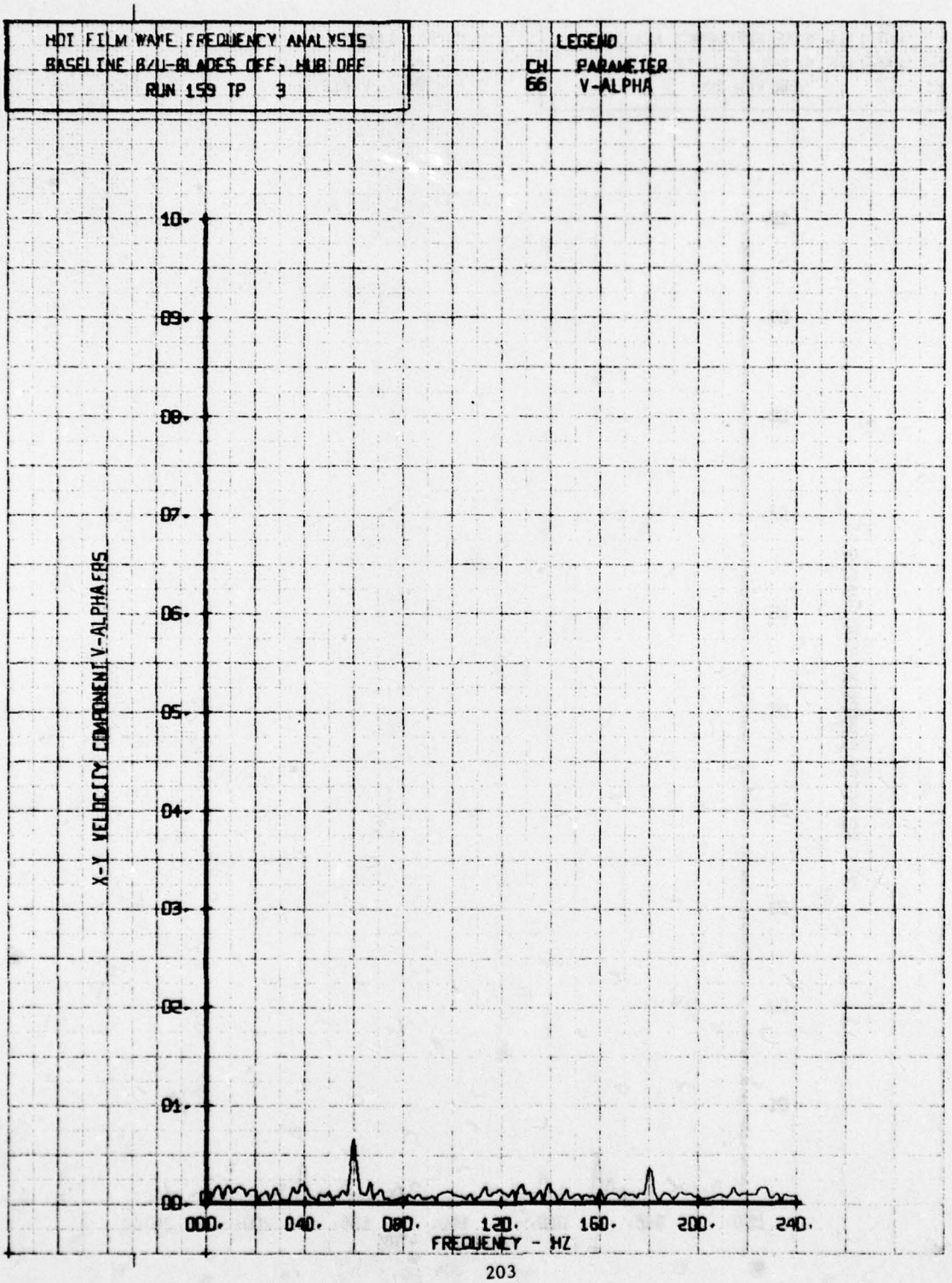

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 3
LEGEND
CH PARAMETER
65 BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

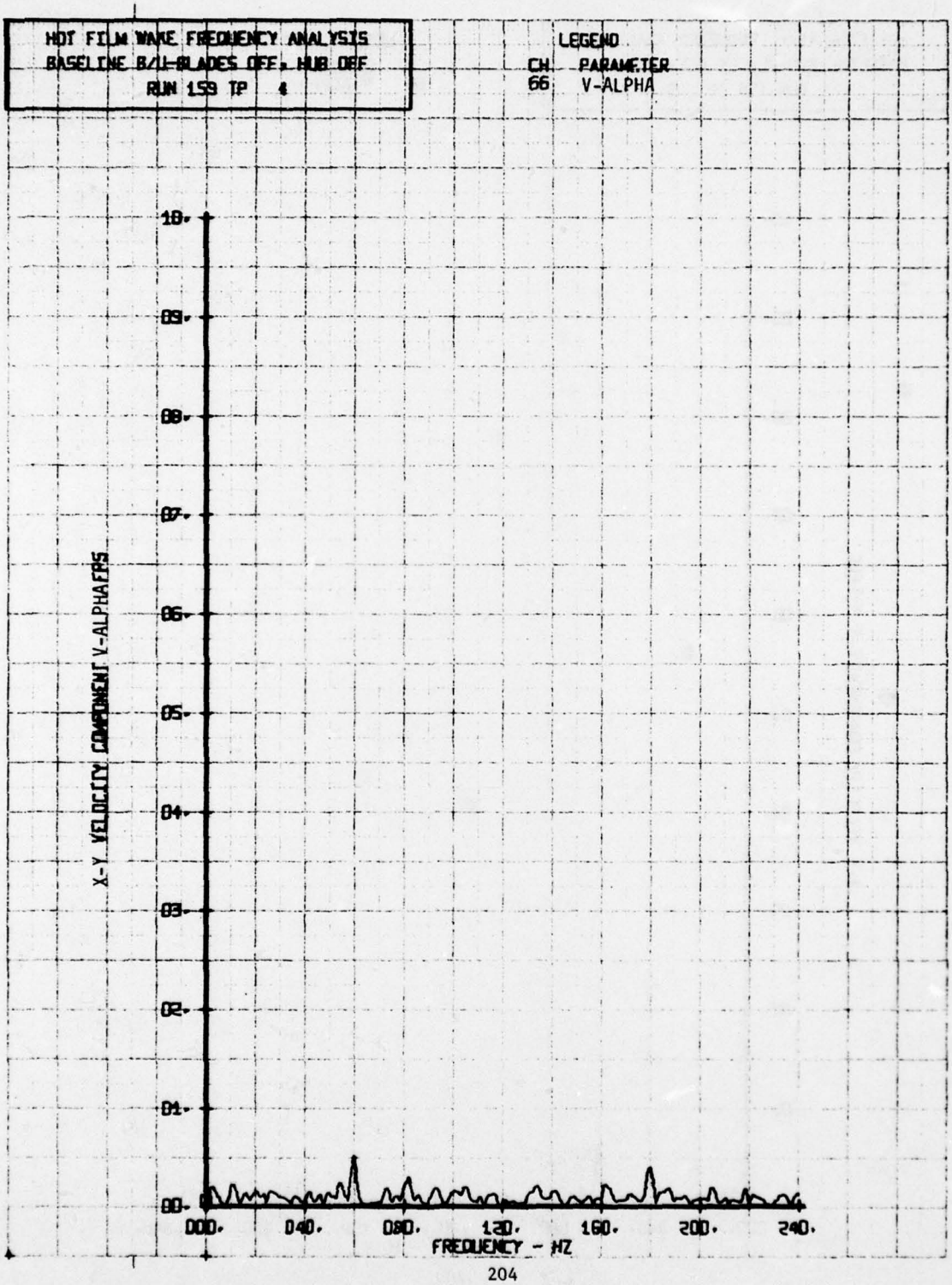

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE, BAI-BLADES OFF, HUB OFF
RUN 159 TP 4
LEGEND
CH 65 PARAMETER
BETA
LATERAL FLOW ANGLE, BETA - DEGREES
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

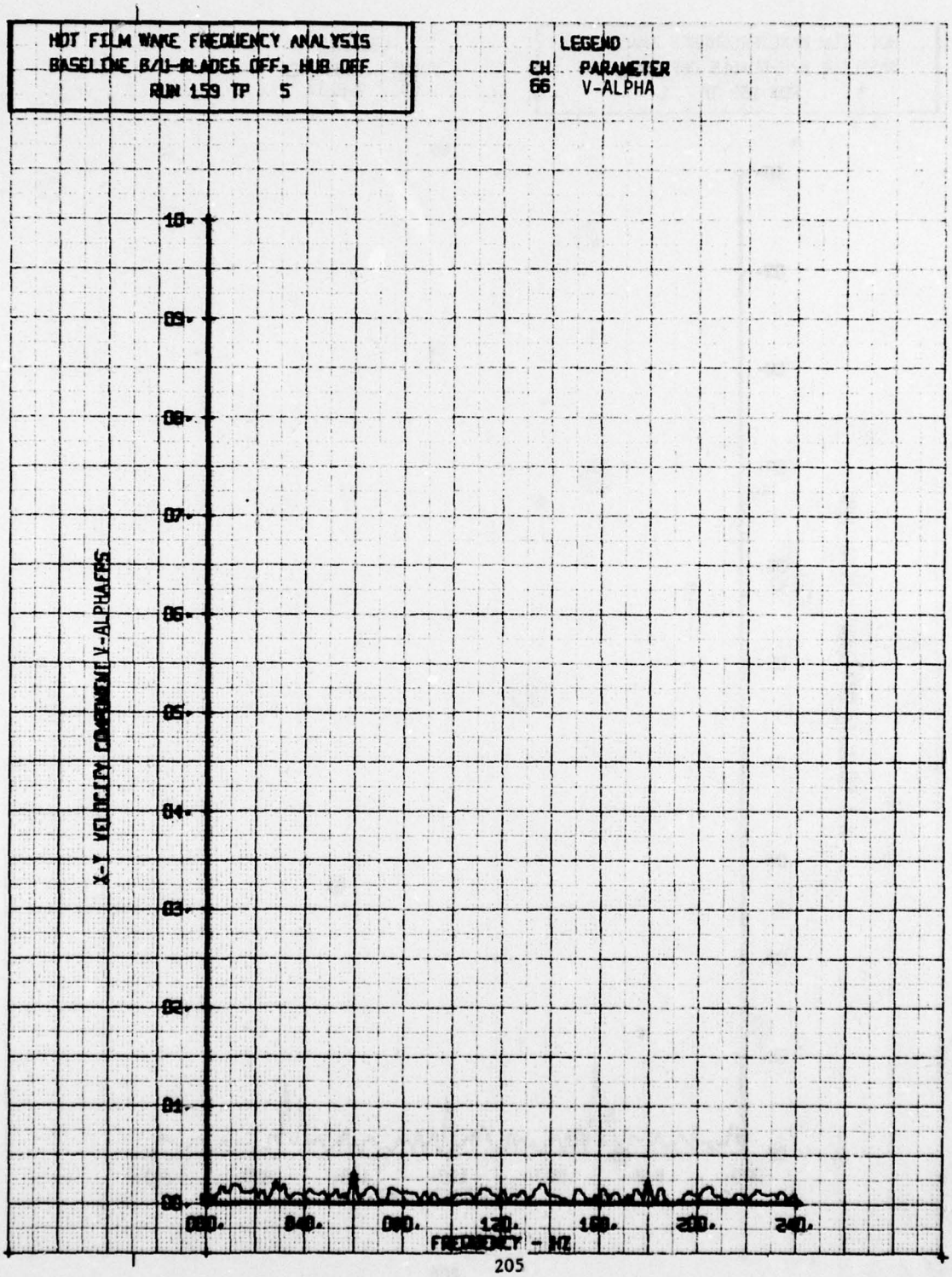

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/I-BLADES OFF, HUB OFF
RUN 159 TP 5
LEGEND
CH PARAMETER
65 BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
LATERAL FLOW ANGLE, BETA - DEGREES
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

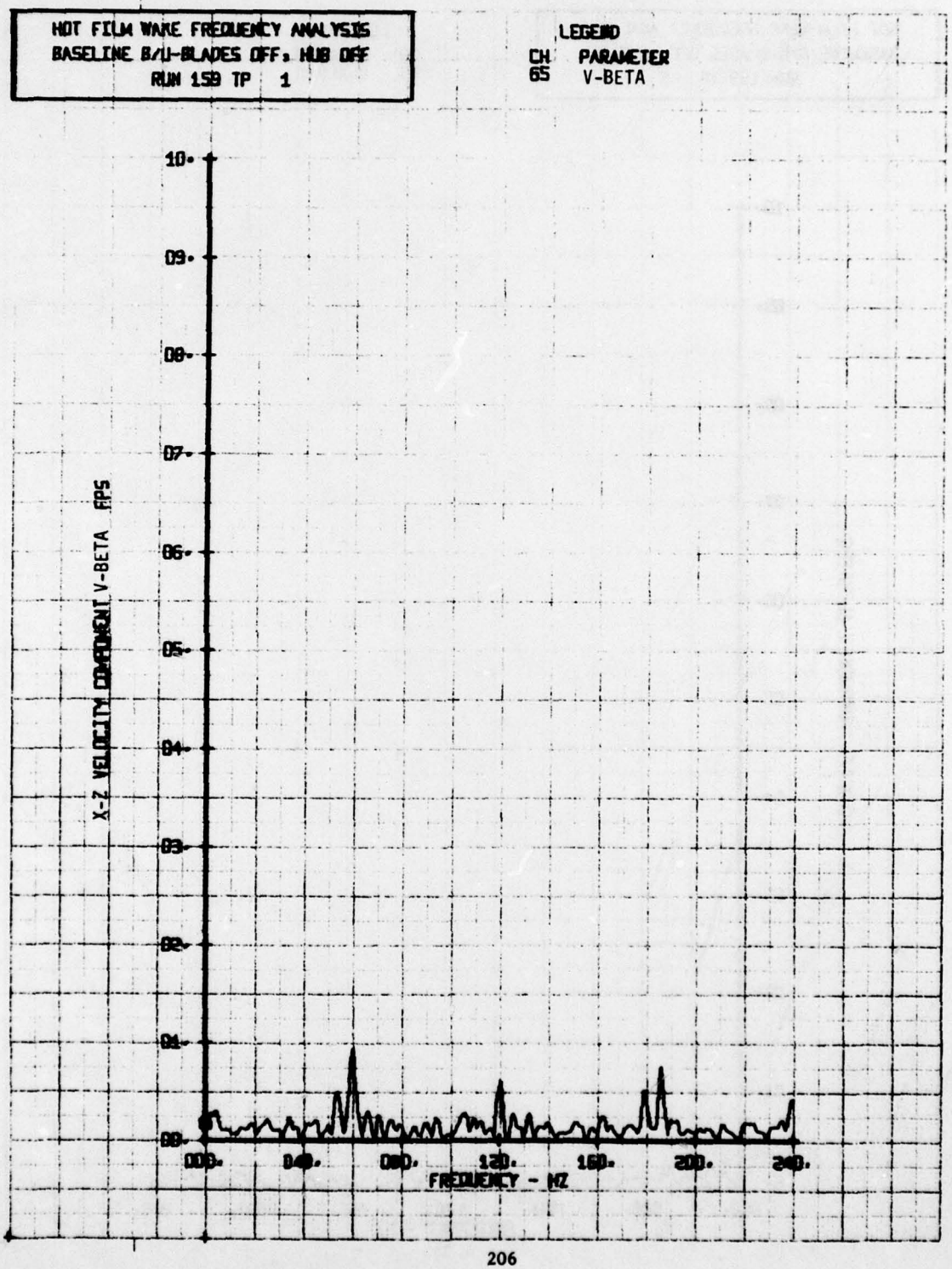

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 1
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

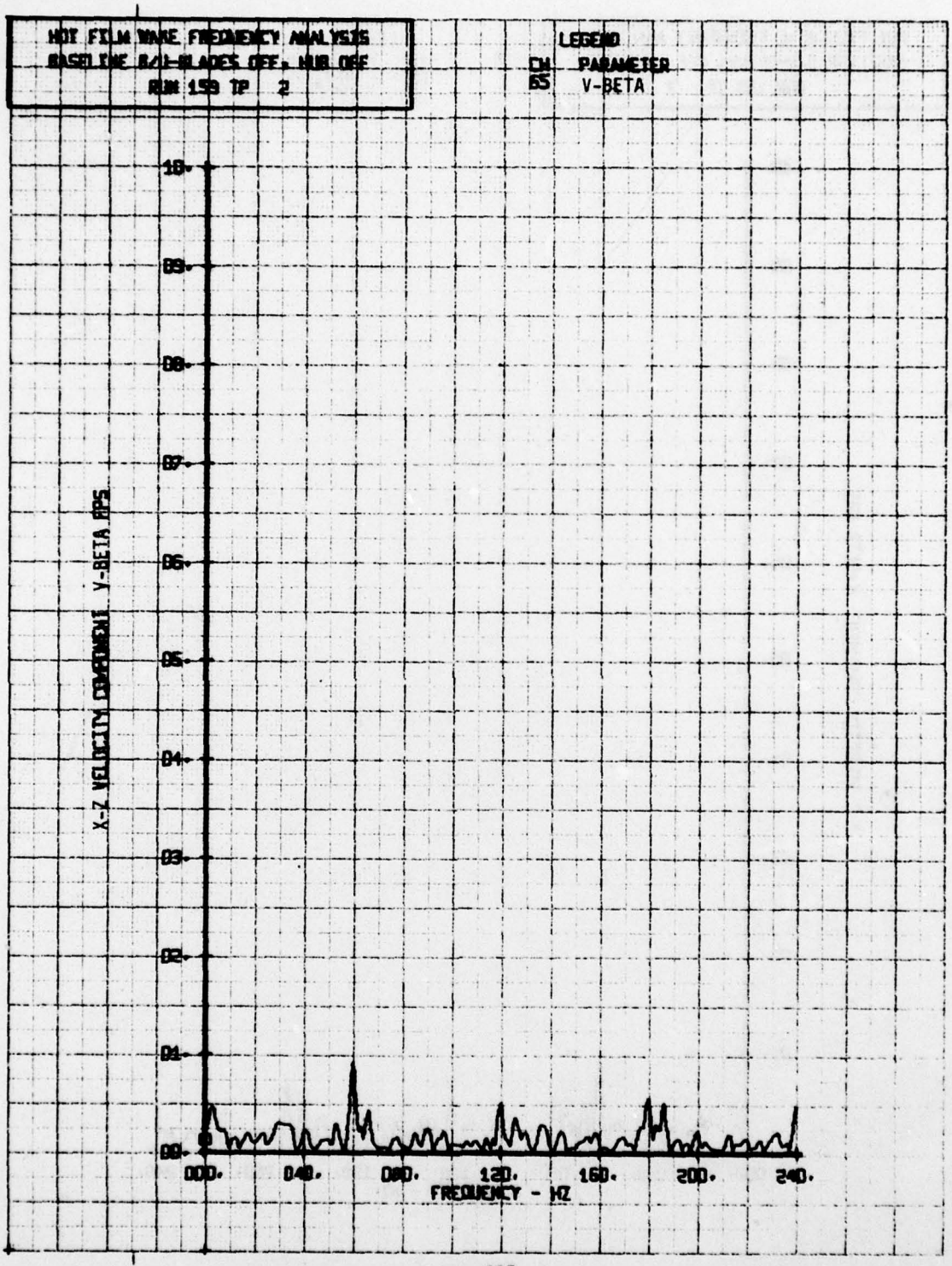

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 2
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

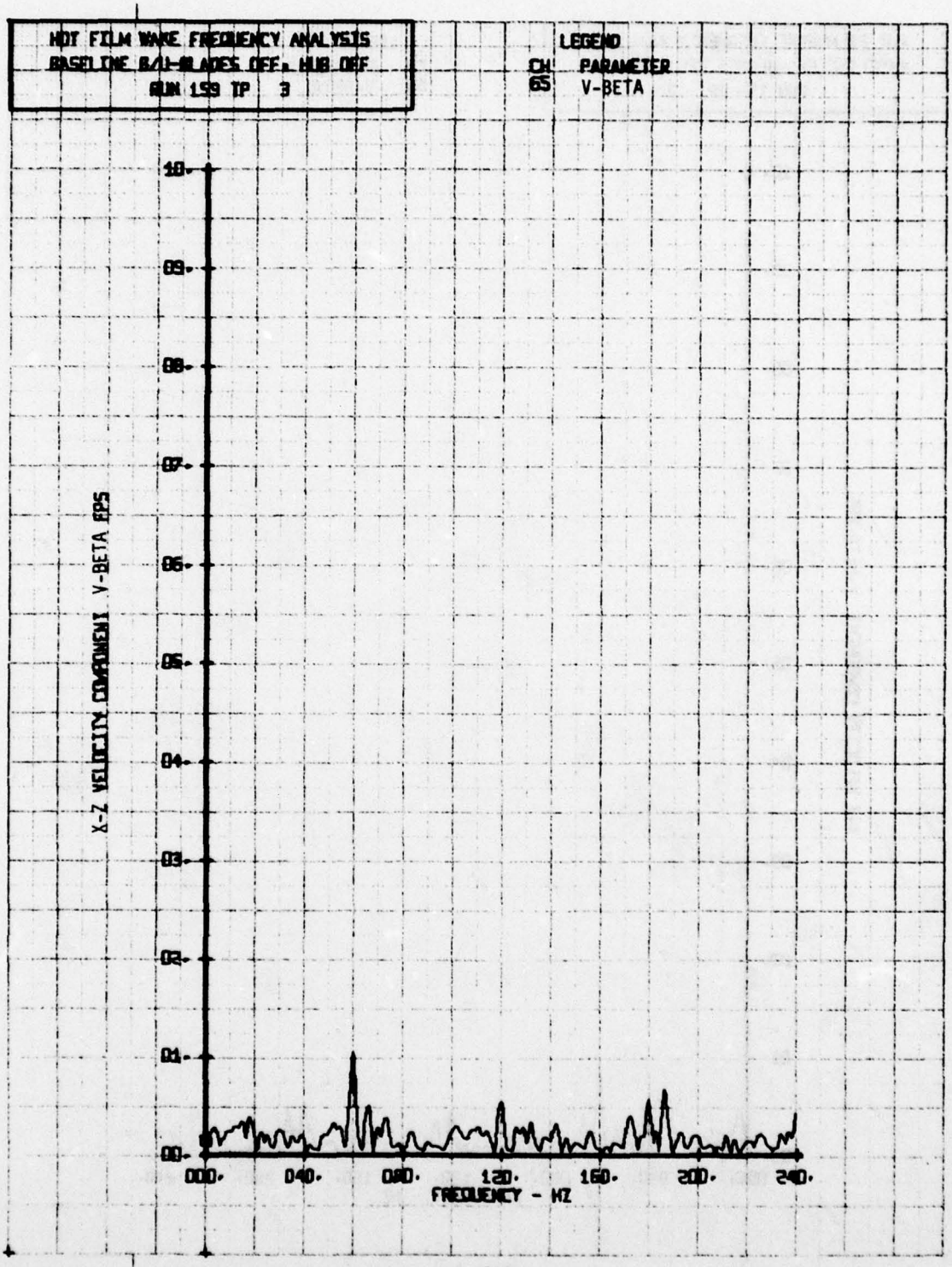

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 3
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA FBS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

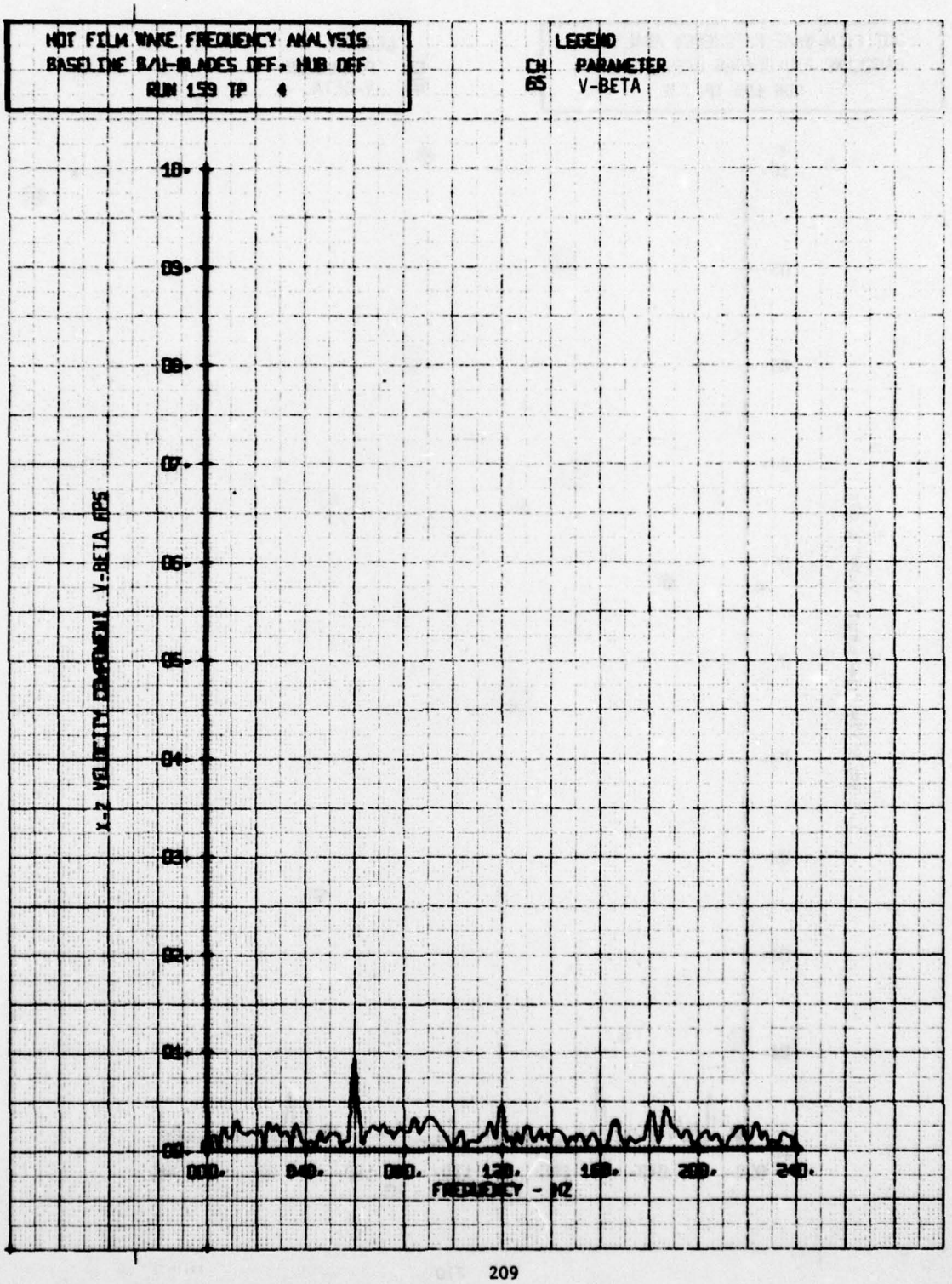

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 4
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHAFRS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

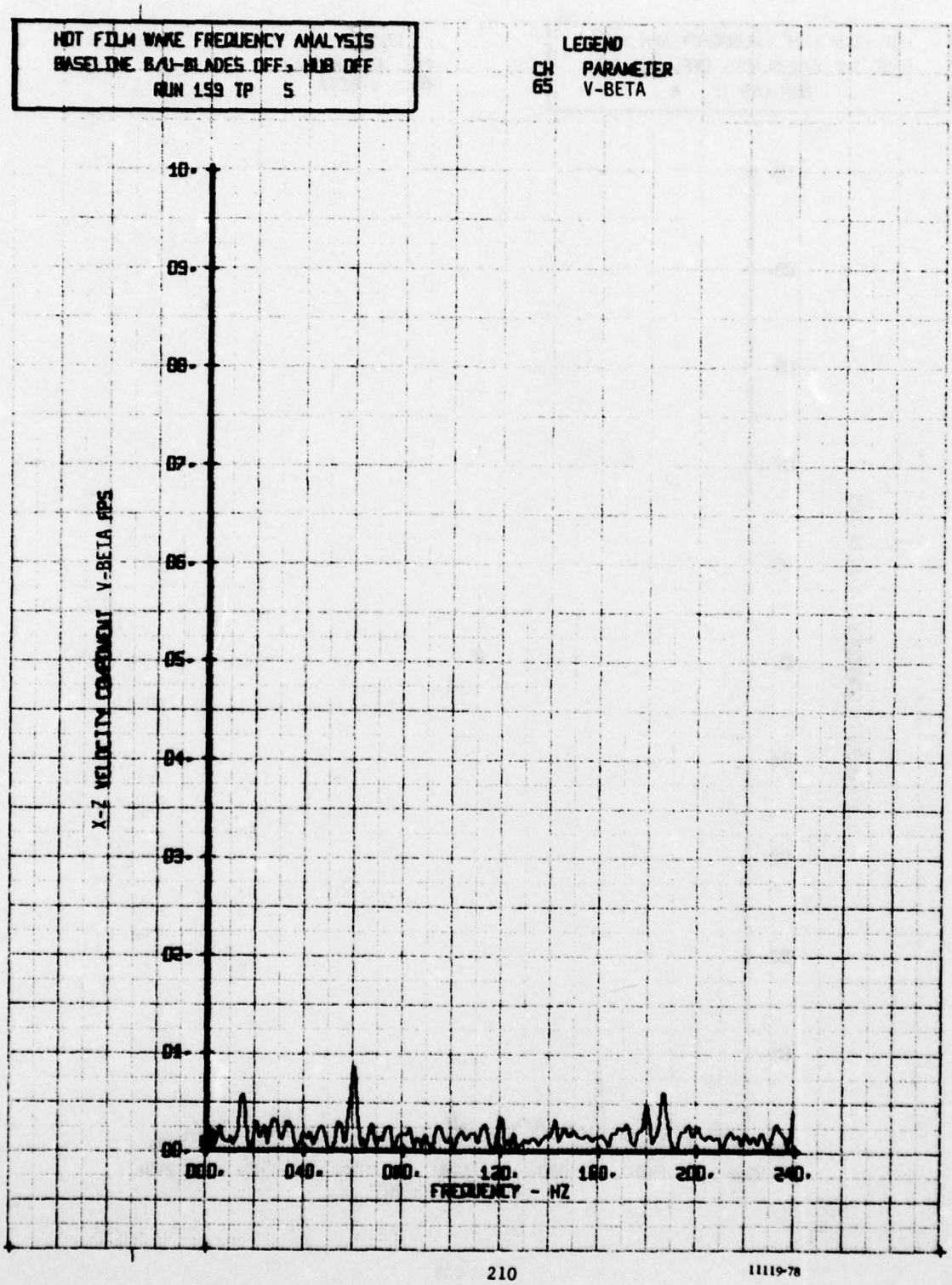

HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/1-BLADES OFF, HUB OFF
RUN 159 TP 5
LEGEND
CH PARAMETER
66 V-ALPHA
X-Y VELOCITY COMPONENT V-ALPHA/RMS
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 1
LEGEND
CH PARAMETER
65 V-BETA
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
X-Z VELOCITY COMPONENT V-BETA FPS
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE R/I-BLADES OFF, HUB OFF
RUN 159 TP 2
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RMS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES OFF, HUB OFF
RUN 159 TP 3
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA FPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE B/U-BLADES DEF. HUB DEF
RUN 159 TP 4
LEGEND
CH PARAMETER
05 V-BETA
X-Z VELOCITY COMPONENT V-BETA 005
FREQUENCY - HZ


HOT FILM WAKE FREQUENCY ANALYSIS
BASELINE BAU-BLADES OFF, HUB OFF
RUN 159 TP 5
LEGEND
CH PARAMETER
65 V-BETA
X-Z VELOCITY COMPONENT V-BETA RPS
10.
09.
08.
07.
06.
05.
04.
03.
02.
01.
00.
000.
040.
080.
120.
160.
200.
240.
FREQUENCY - HZ

11119-78