(NASA-CR-135239-Vol-1-Sect-3) ACOUSTIC TESTS OF DUCT-BURNING TURBOFAN JET NOISE SIMULATION: COMPREHENSIVE DATA REPORT. VOLUME 1, SECTION 3: DATA PLOTS Final Report (General Electric Co.) 520 p G3/07

N78-28096

Unclas 27186

ACOUSTIC TESTS of DUCT-BURNING TURBOFAN JET NOISE SIMULATION

COMPREHENSIVE DATA REPORT

VOLUME I

SECTION III
DATA PLOTS

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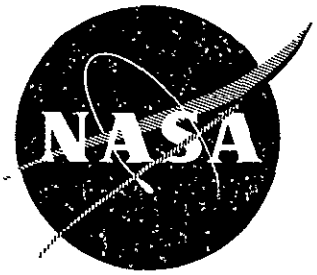
NASA CONTRACT: NAS3-18008



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COMPREHENSIVE DATA REPORT

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Volume I

Volume II

4.0 ACOUSTIC PLOTS

4.1 Acoustic Comparison of Various Nozzle Models at Selected Test Conditions for a Full Size Engine

The data from the full size engine utilizing a scale factor of 8 was plotted for $V_f/V_c \geq 1.5$ at 3 test conditions corresponding to acoustic test matrix points of X 13, X 15, X 25 (where X is the model designation in Section 3.0 (a) of CDR Volume I. These were included in the Final Report, NASA CR 2966, in reduced form. The following plots are in original size for easier detailed analysis. The plots include:

- OASPL directivity
- PNL directivity
- PWL spectra
- SPL spectra at 50°, 90°, 130° and angle corresponding to max. PNL

The solid lines in the OASPL and PNL directivity curves represent a synthesized conical nozzle.

4.2 Acoustic Data Plots for a Full Size Engine Utilizing a Scale Factor of 8

The following plots are presented for a full size engine utilizing a scale factor of 8. GE high frequency atmospheric attenuation factors have been used.

Ground reflection corrections have been applied to the model data prior to scaling.

The spectral data is presented on the basis of 1/3 octave band analysis.

The angular distribution of overall sound pressure levels and perceived noise levels are presented at a microphone location consistent with a FAR36 regulation monitoring location - 2128 ft (648.6 m) sideline and 1110 ft (338.3 m) altitude.

Four types of figures have been used per configuration to present the acoustic data.

The first set of figures shows the effect of velocity and temperature on sound power generation as indicated by sound power level spectra.

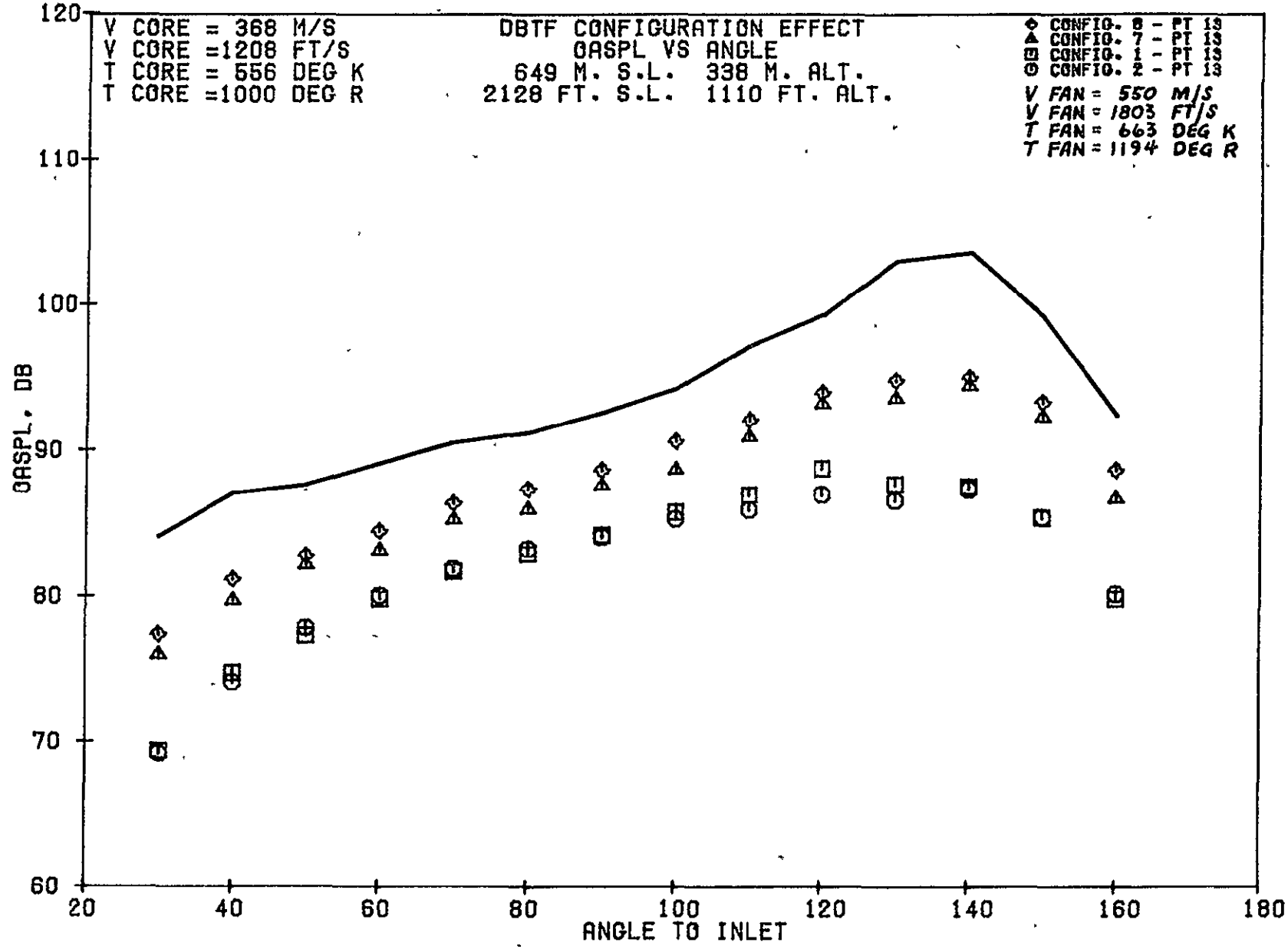
The second set shows the effect of velocity and temperature upon sound generation as indicated by overall sound pressure level sideline directivities

The third set shows the effect of velocity and temperature upon noise generation as indicated by changes in perceived noise level along the sideline.

The fourth set shows the effect of velocity and temperature upon sound propagation as indicated by sound pressure level spectra at 50°, 90°, and 130°.

The plots demonstrate the effect of four basic parameters; fan velocity, core velocity, fan stream temperature and core stream temperature. Some general observations relating to these parameters can be made in terms of the power level spectra. The unsuppressed configurations, (Models 7 and 8), have little variation in their spectra when $V_f/V_c \lesssim 1.0$. The sound power is basically core stream controlled and peaks at low frequencies. When $V_f/V_c > 1.0$, then a second frequency peak occurs at mid frequencies. This is attributed to the high fan radius ratio effects. When the fan stream temperature is increased, sound power levels were reduced, but conversely increases in the core stream temperature leads to small increases in sound power level. The suppressed configurations follow similar trends except that increasing the fan velocity increases the sound power more predominantly in the mid to high frequency regime.

4.1 ACOUSTIC COMPARISON OF VARIOUS NOZZLE MODELS AT SELECTED TEST CONDITIONS FOR A FULL SIZE ENGINE



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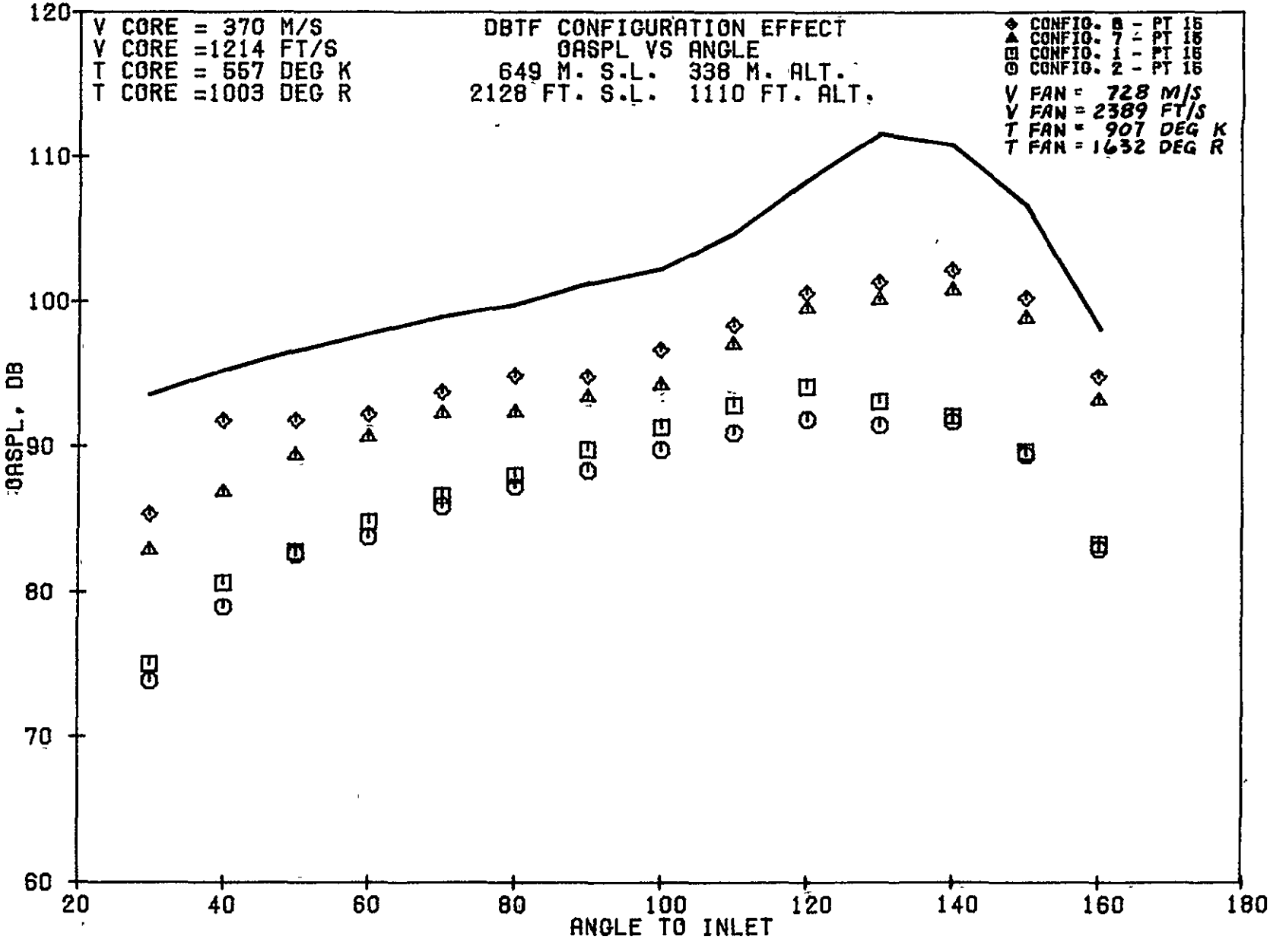

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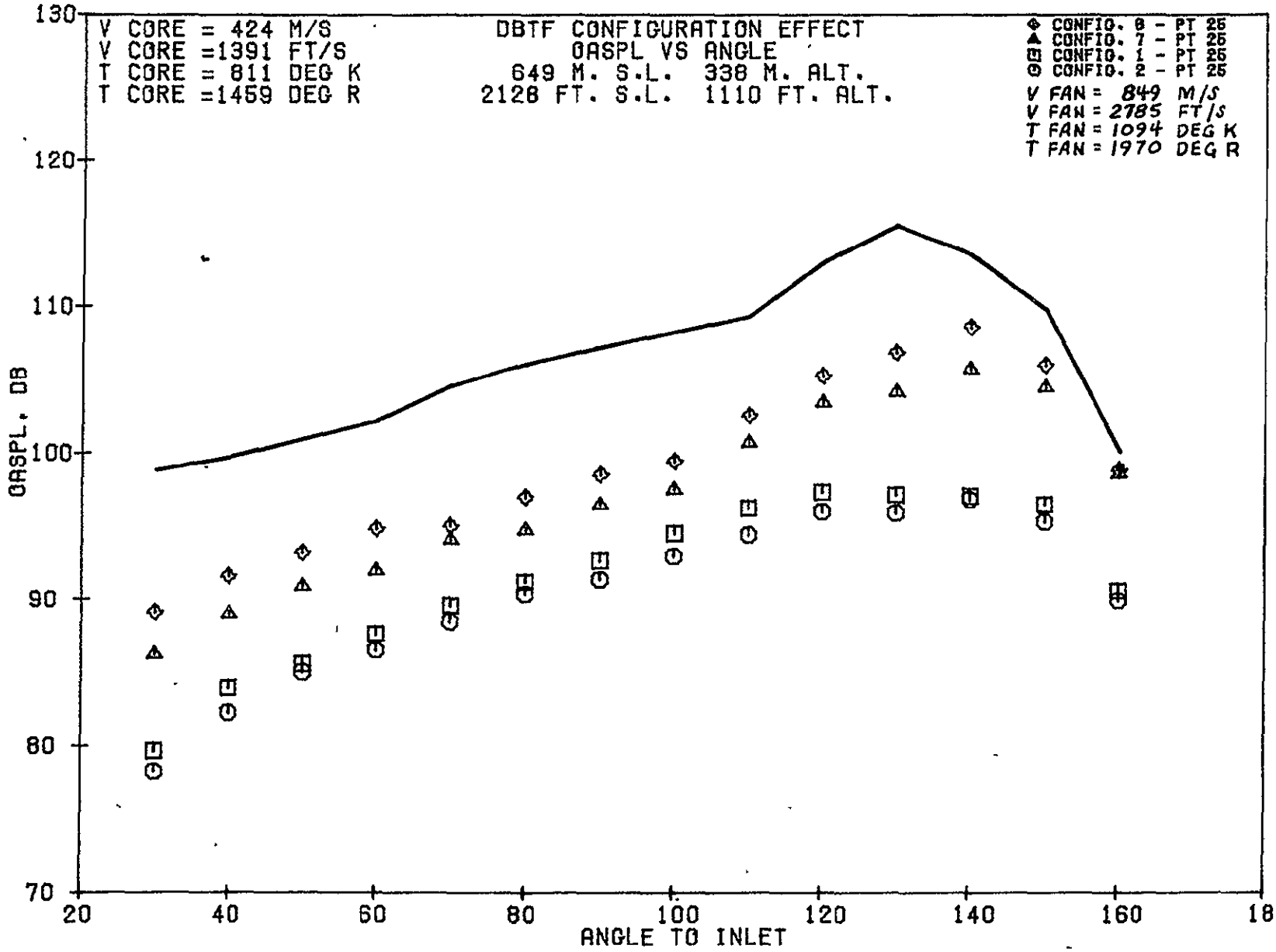

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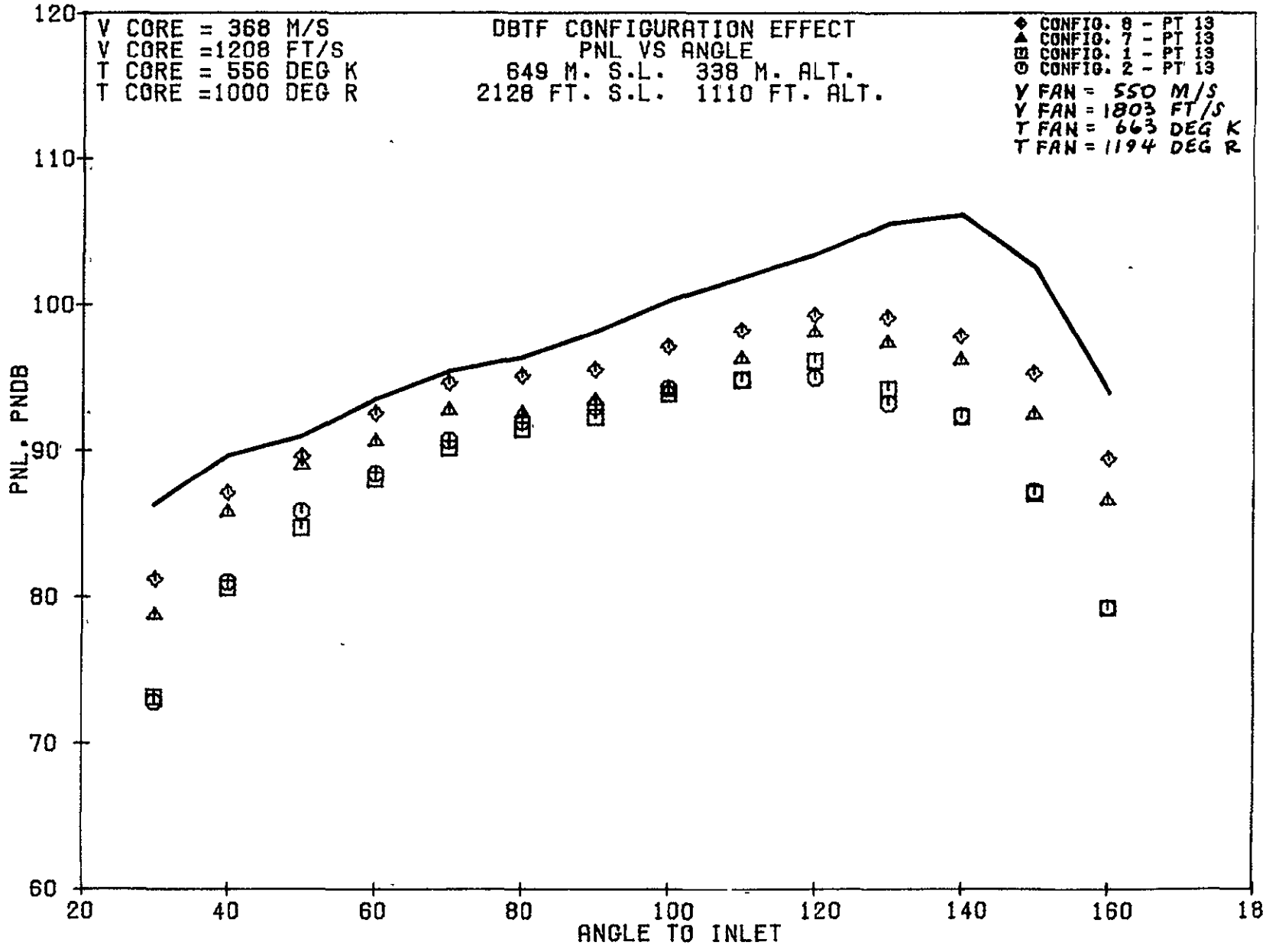

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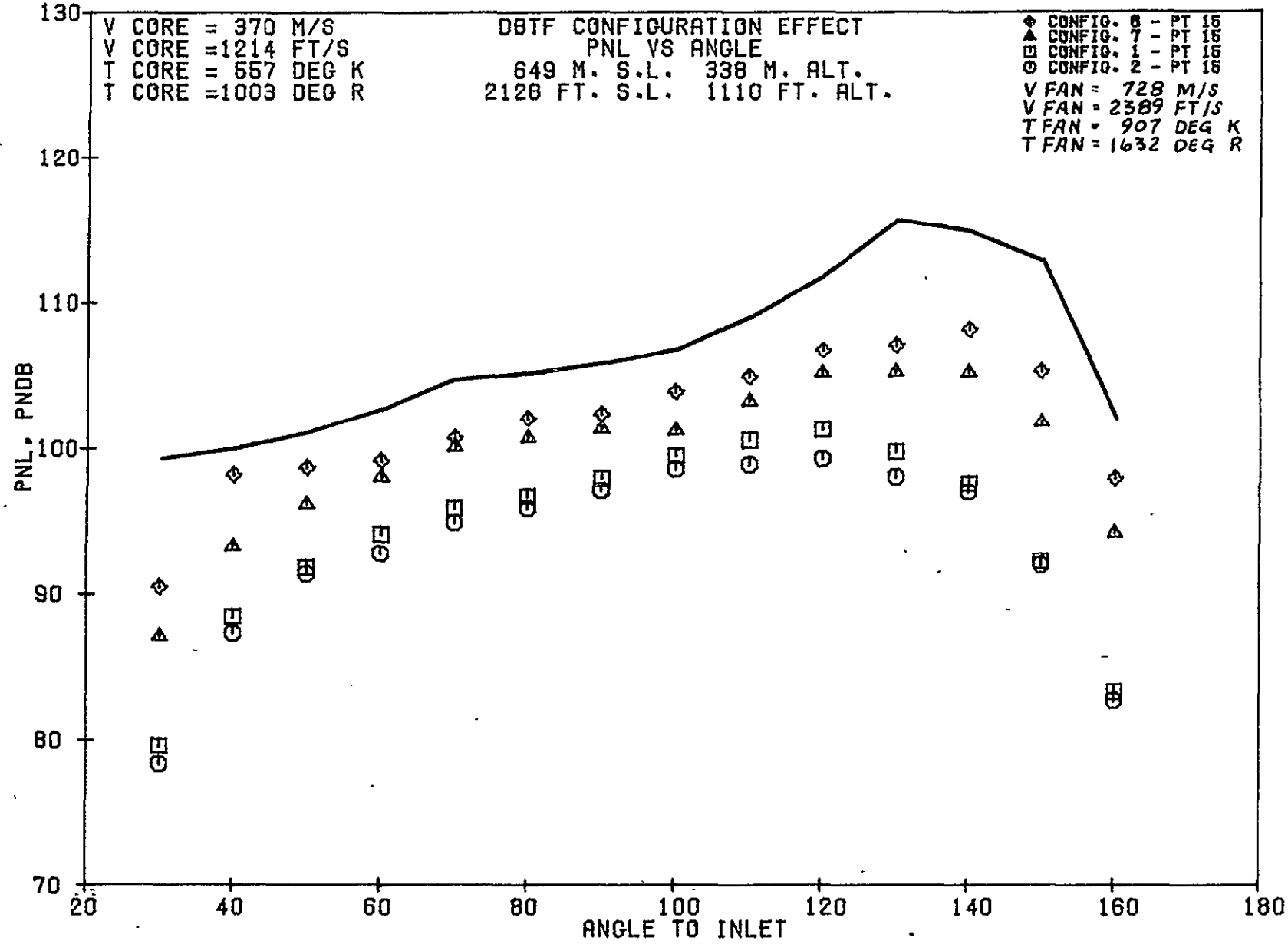

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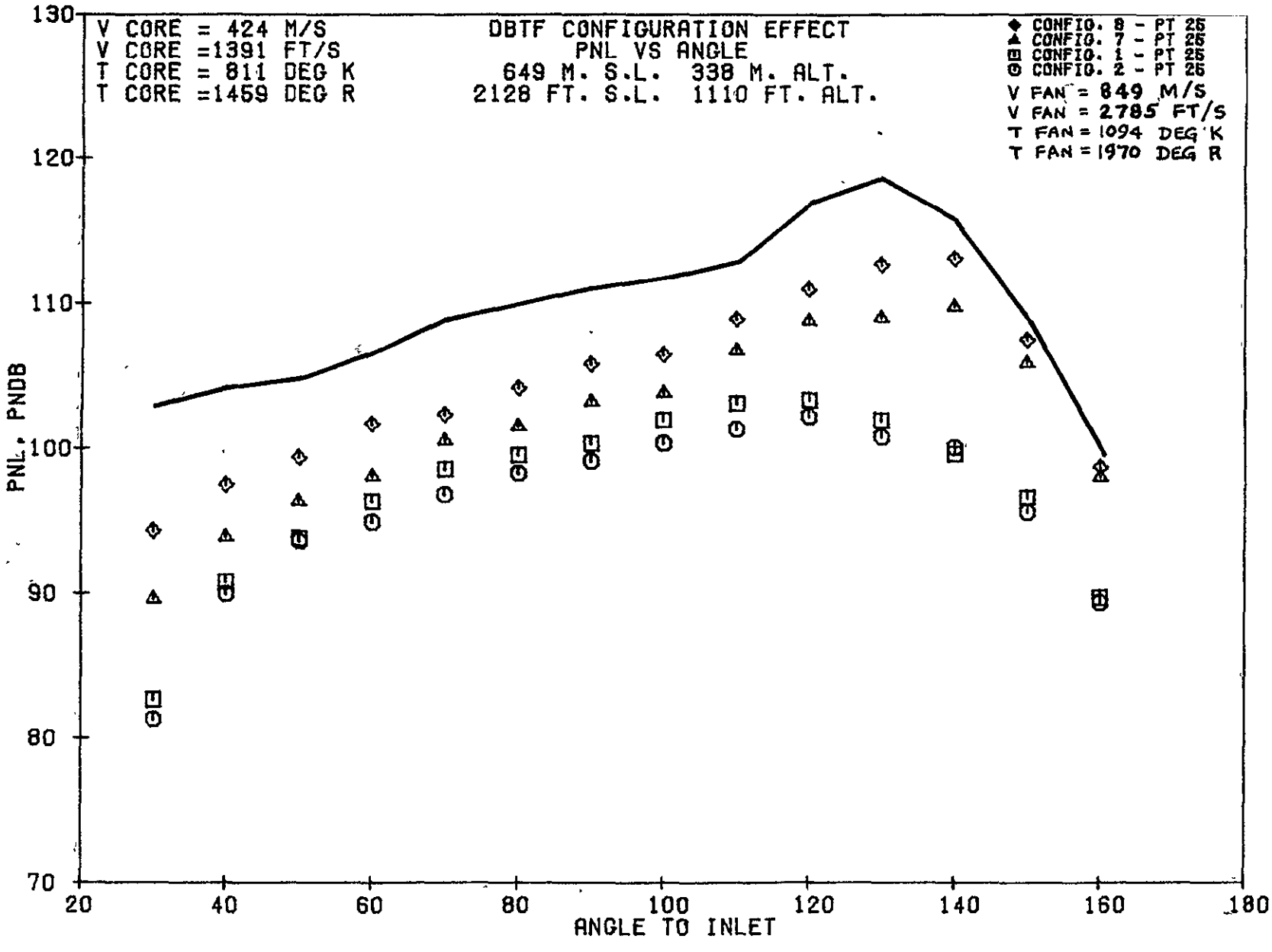

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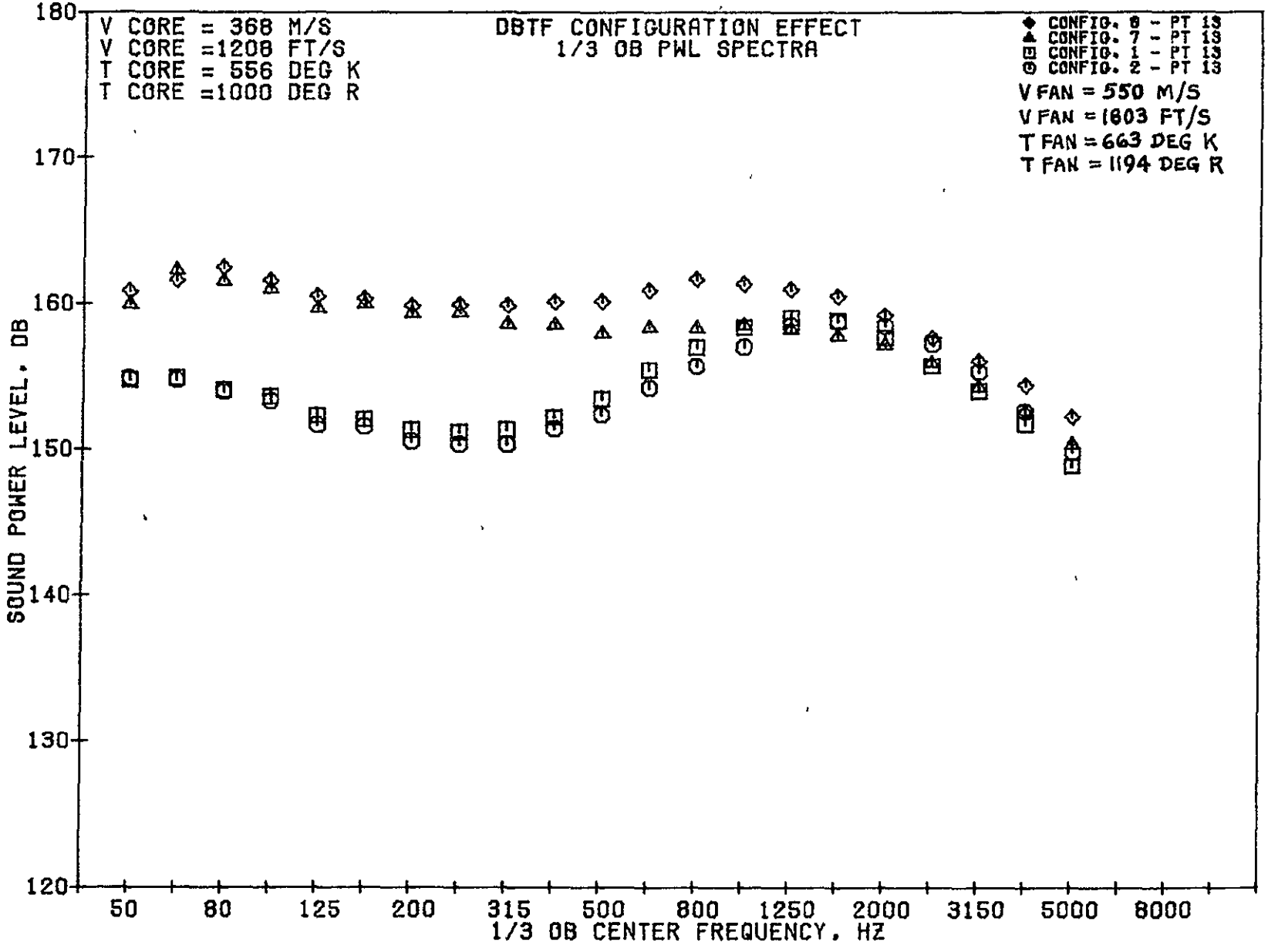

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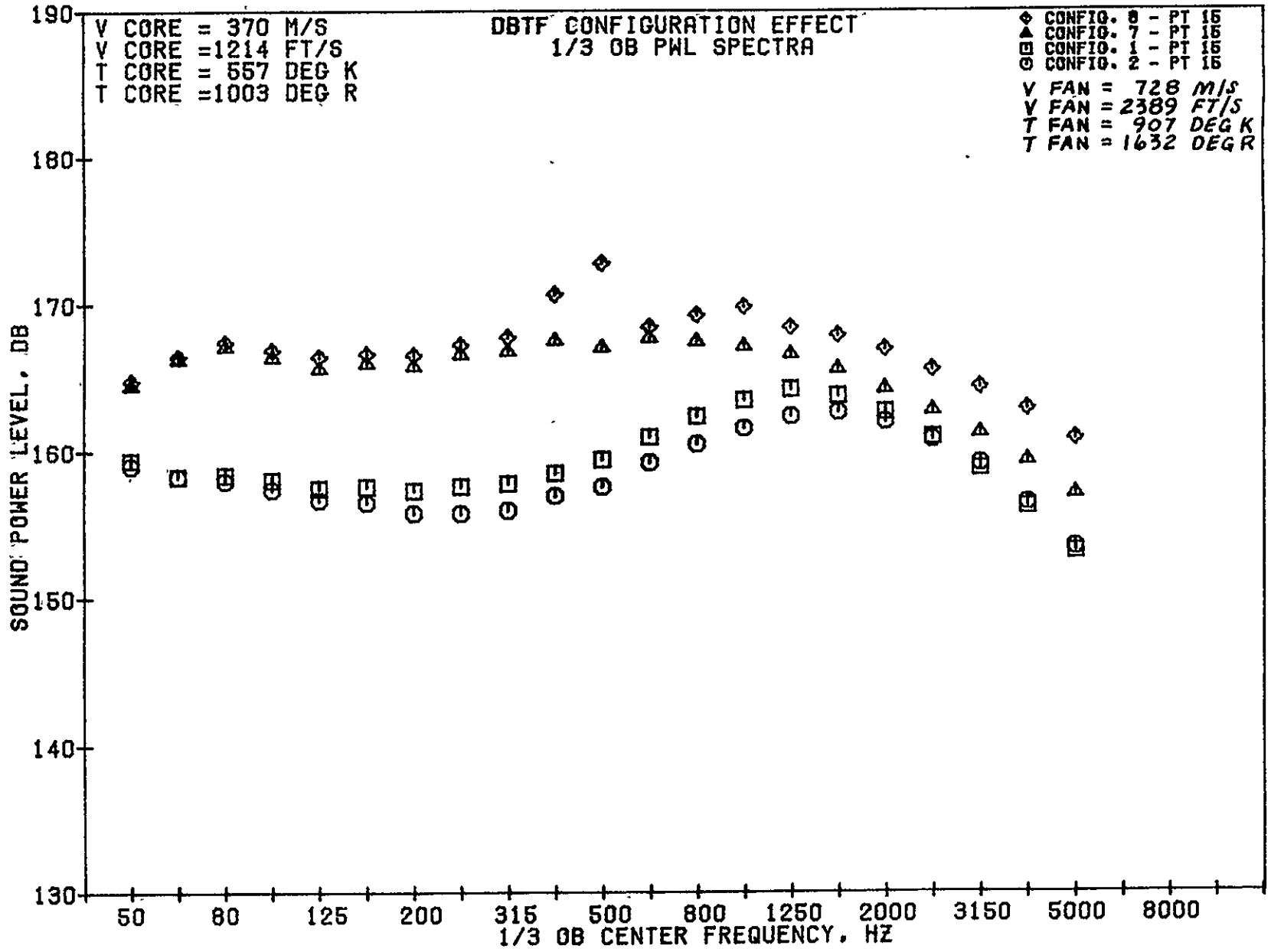

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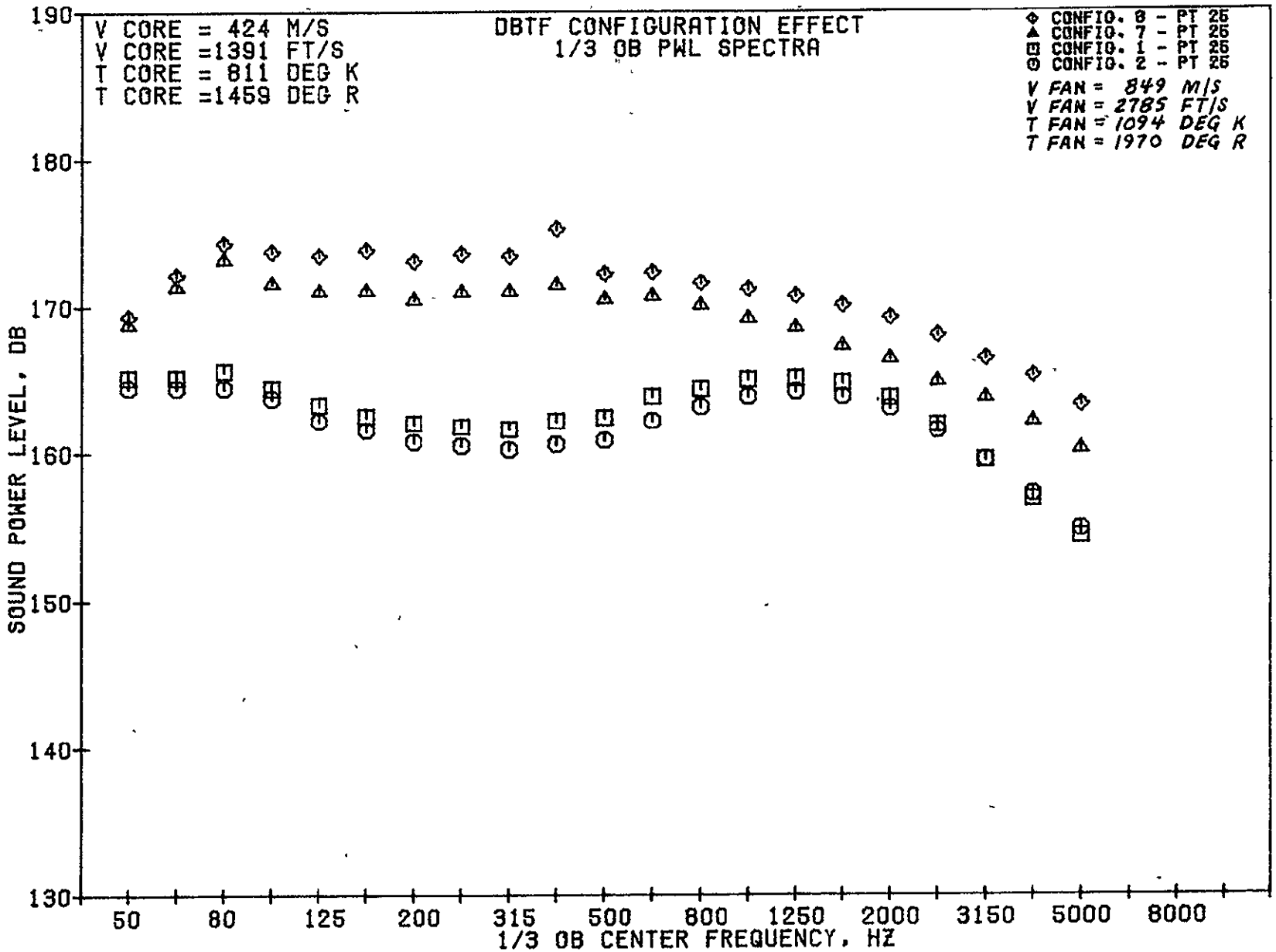

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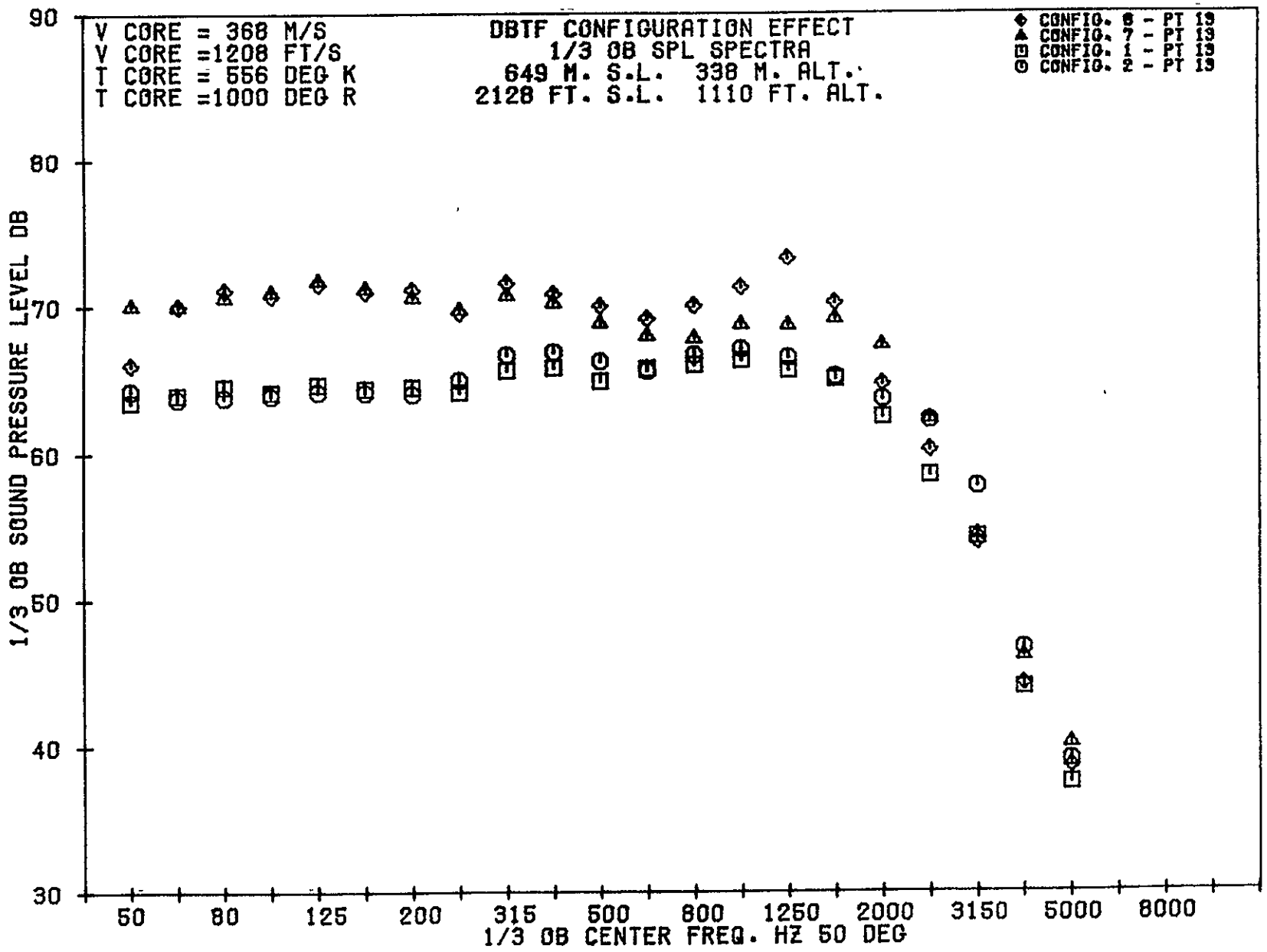
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V CORE =1208 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
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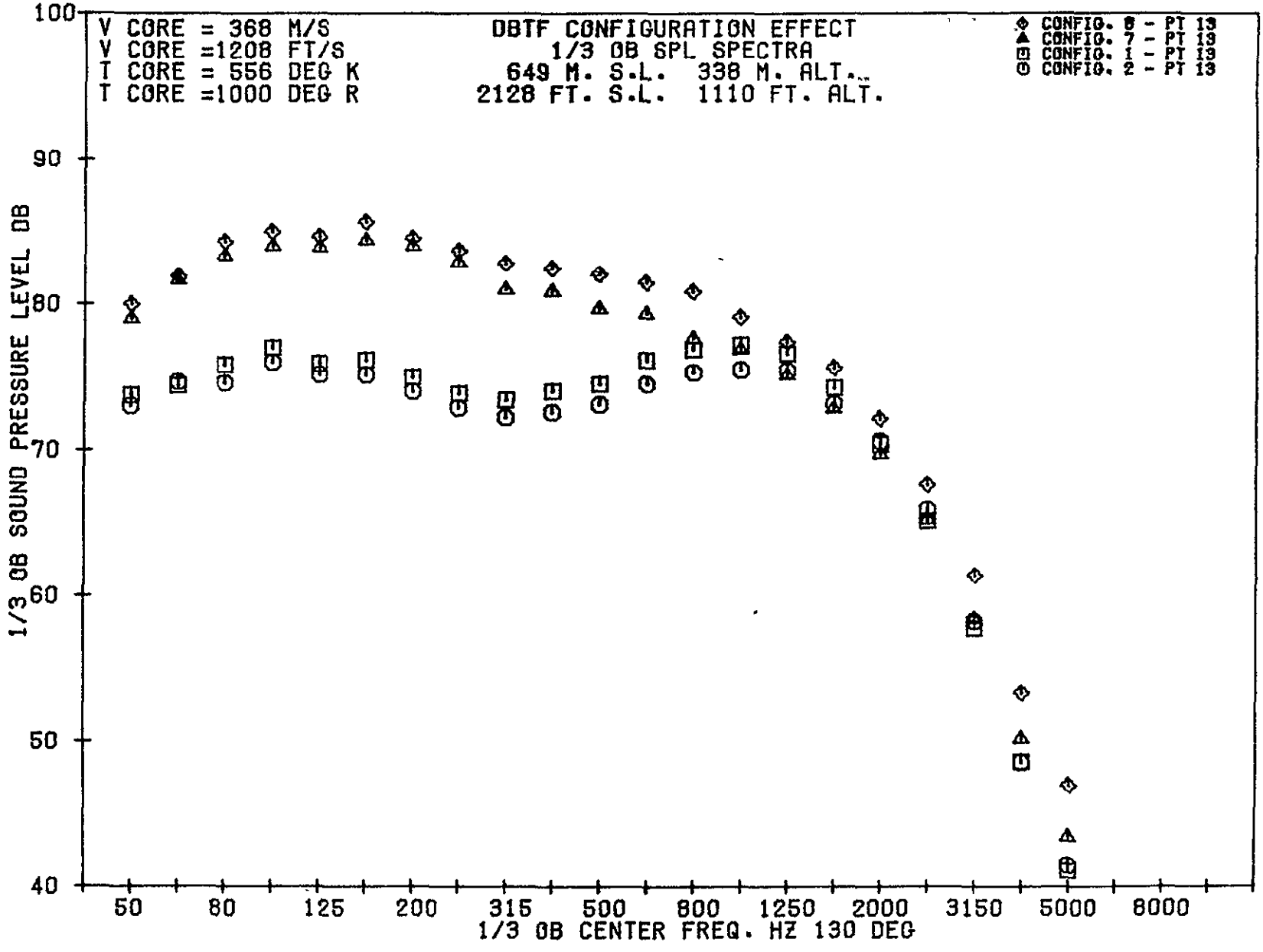
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 6 - PT 19
CONFIG. 7 - PT 19
CONFIG. 1 - PT 19
CONFIG. 2 - PT 19
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG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V CORE =1208 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 6 - PT 13
CONFIG. 7 - PT 13
CONFIG. 1 - PT 13
CONFIG. 2 - PT 13
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
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3150
5000
8000
1/3 OB CENTER FREQ. HZ 130 DEG

1258

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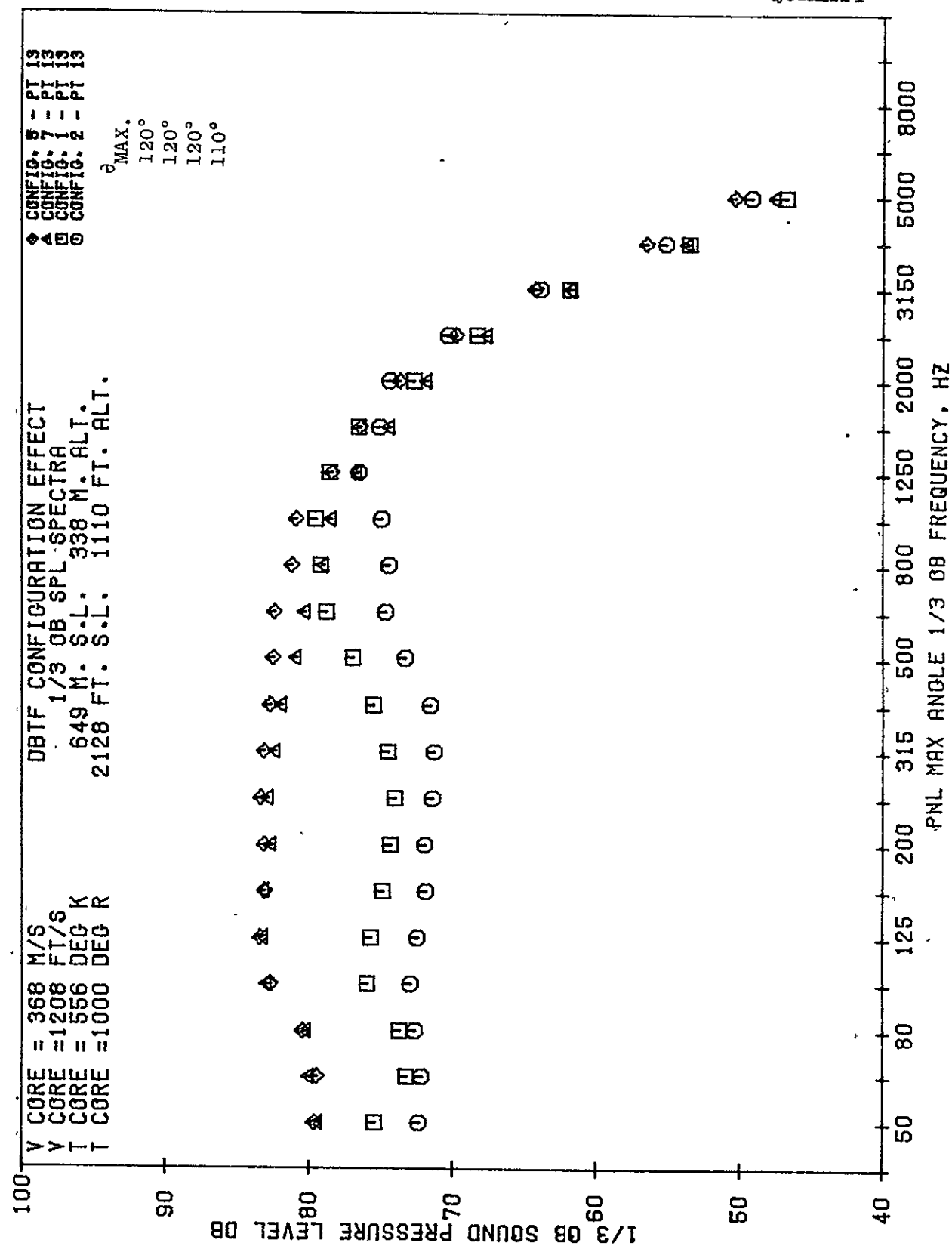

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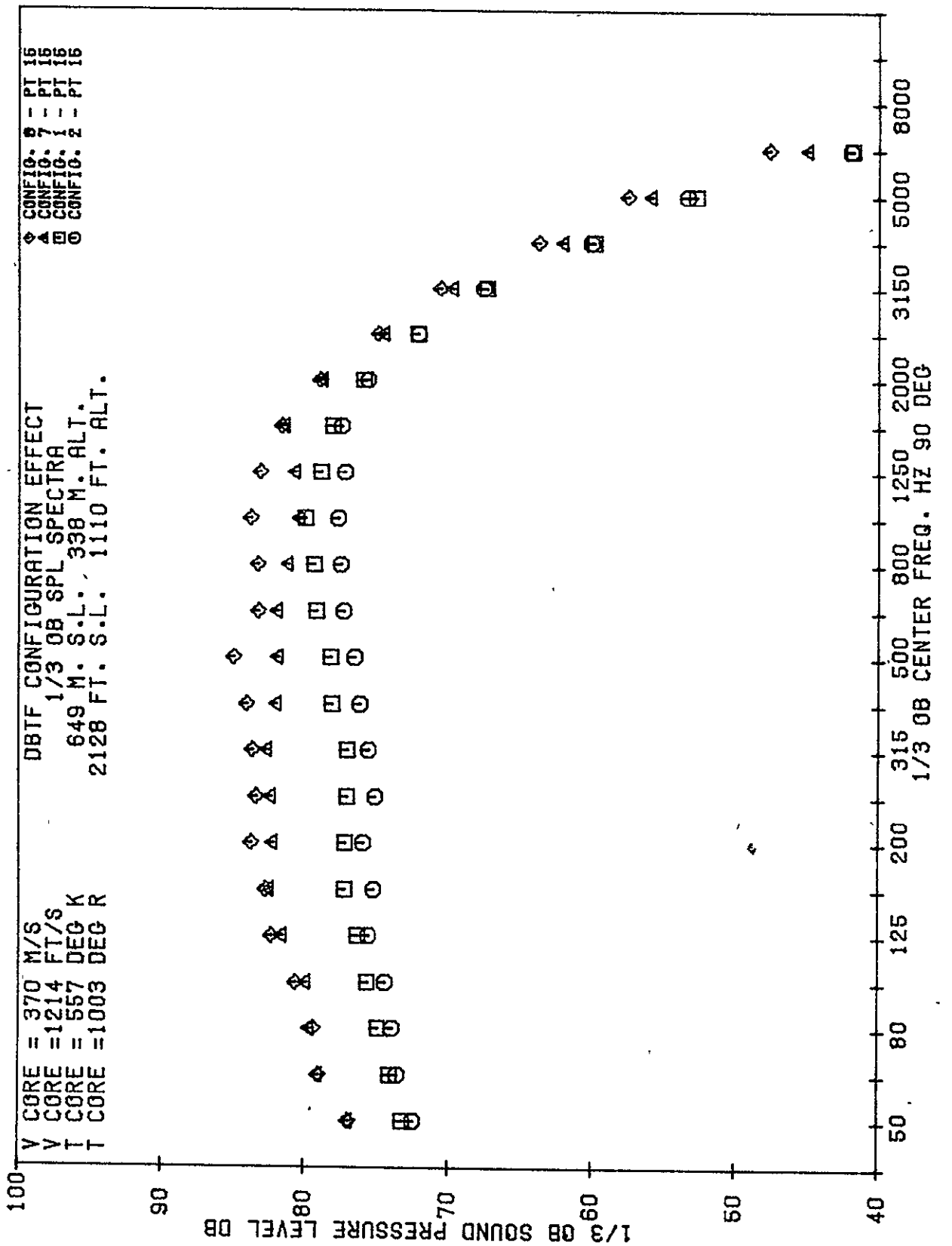
V CORE = 370 M/S
V CORE =1214 FT/S
T CORE = 557 DEG K
T CORE =1003 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 6 - PT 15
CONFIG. 7 - PT 15
CONFIG. 1 - PT 15
CONFIG. 2 - PT 15
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG

1260

4.1.4



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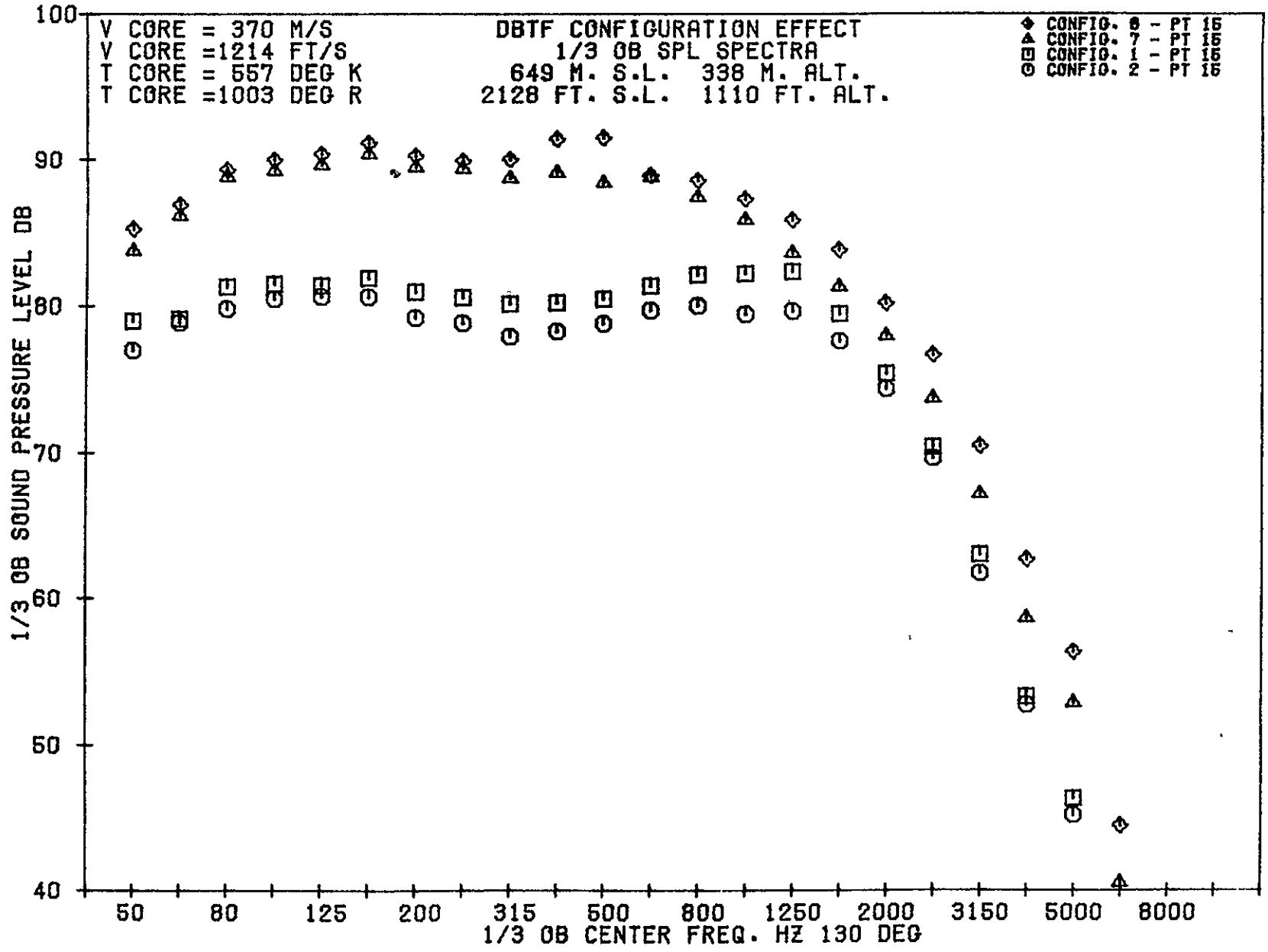
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V CORE =1214 FT/S
T CORE = 557 DEG K
T CORE =1003 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 8 - PT 15
CONFIG. 7 - PT 15
CONFIG. 1 - PT 15
CONFIG. 2 - PT 15
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
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125
200
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500
800
1250
2000
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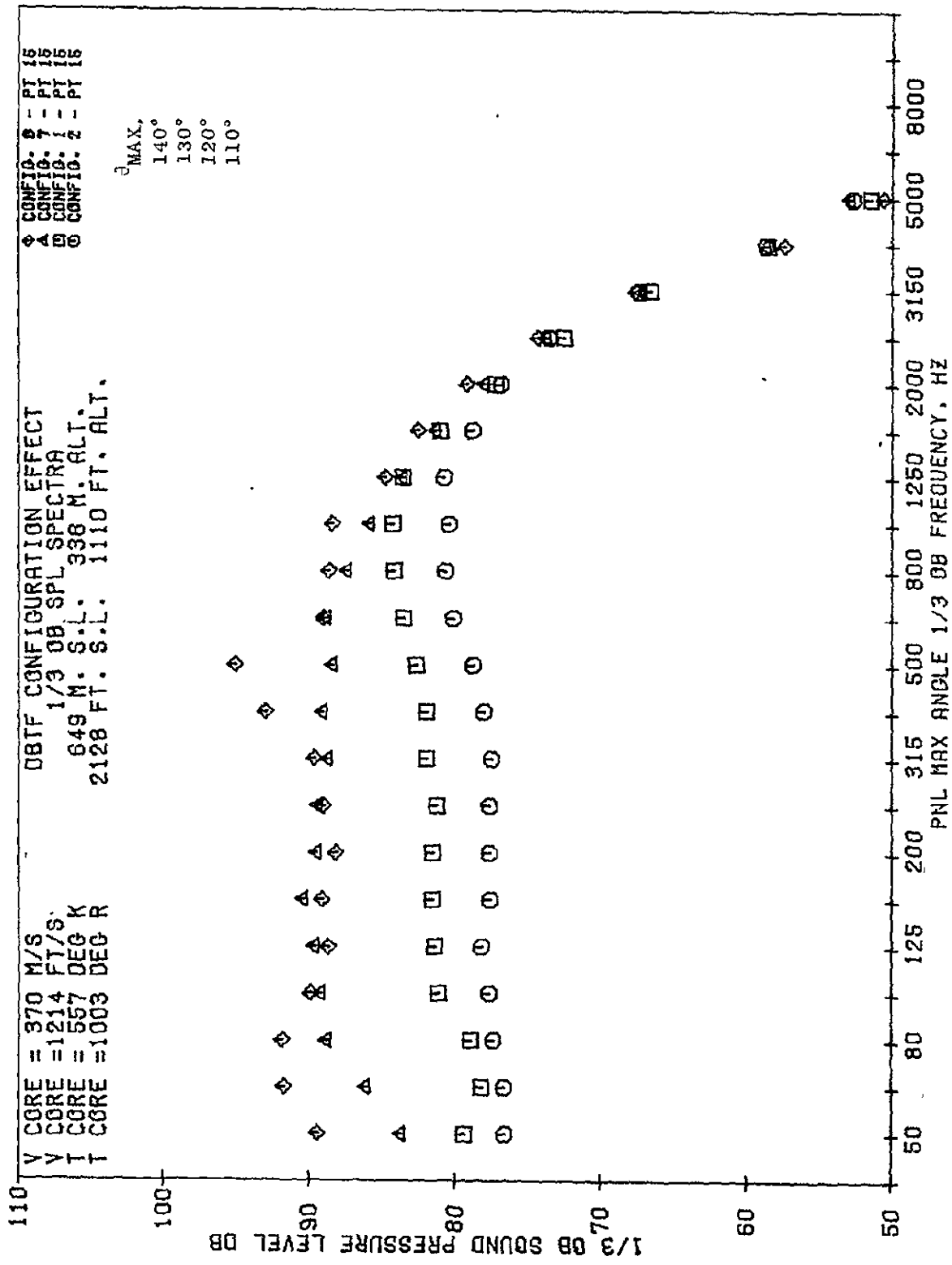
5000
8000
1/3 OB CENTER FREQ. HZ 130 DEG



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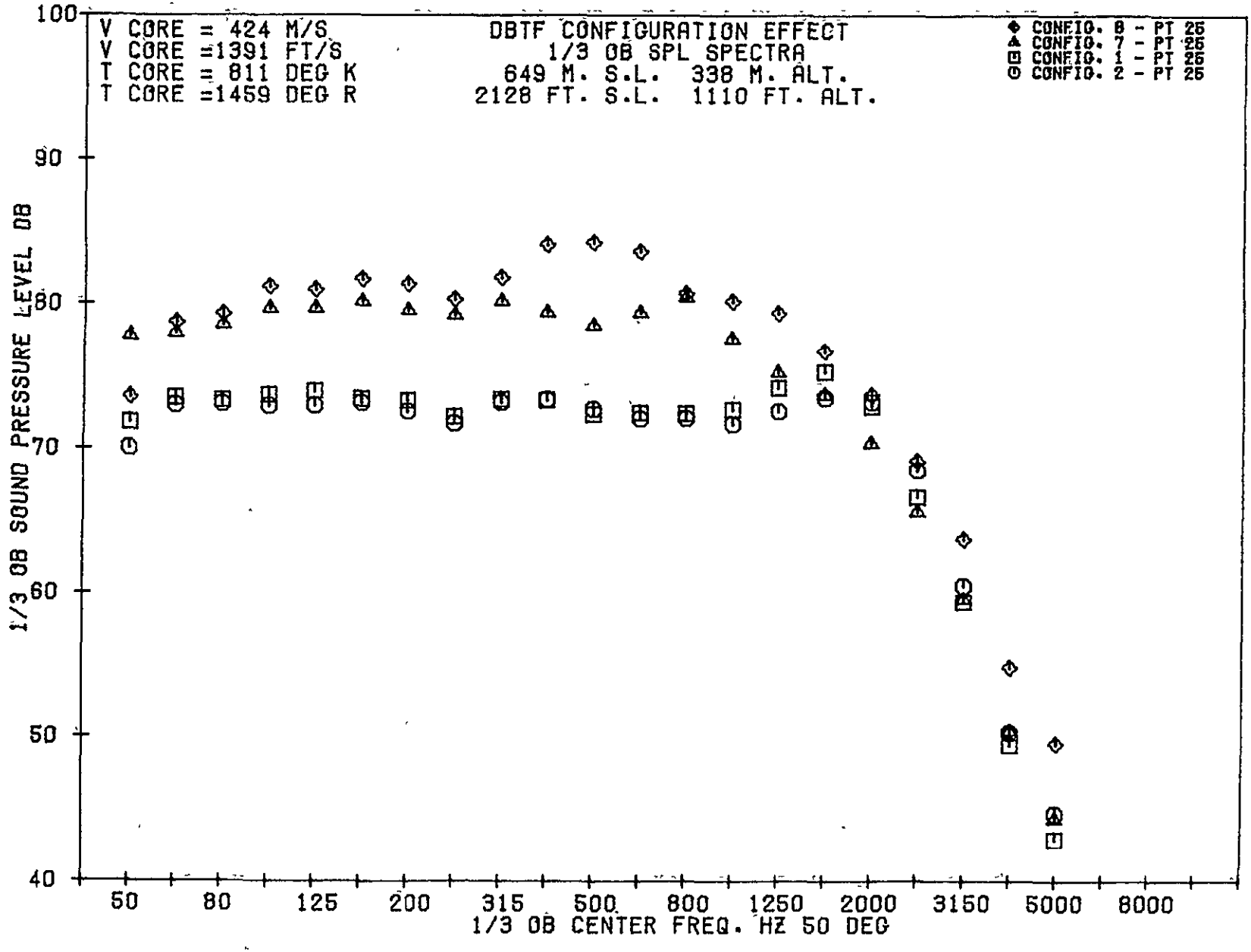
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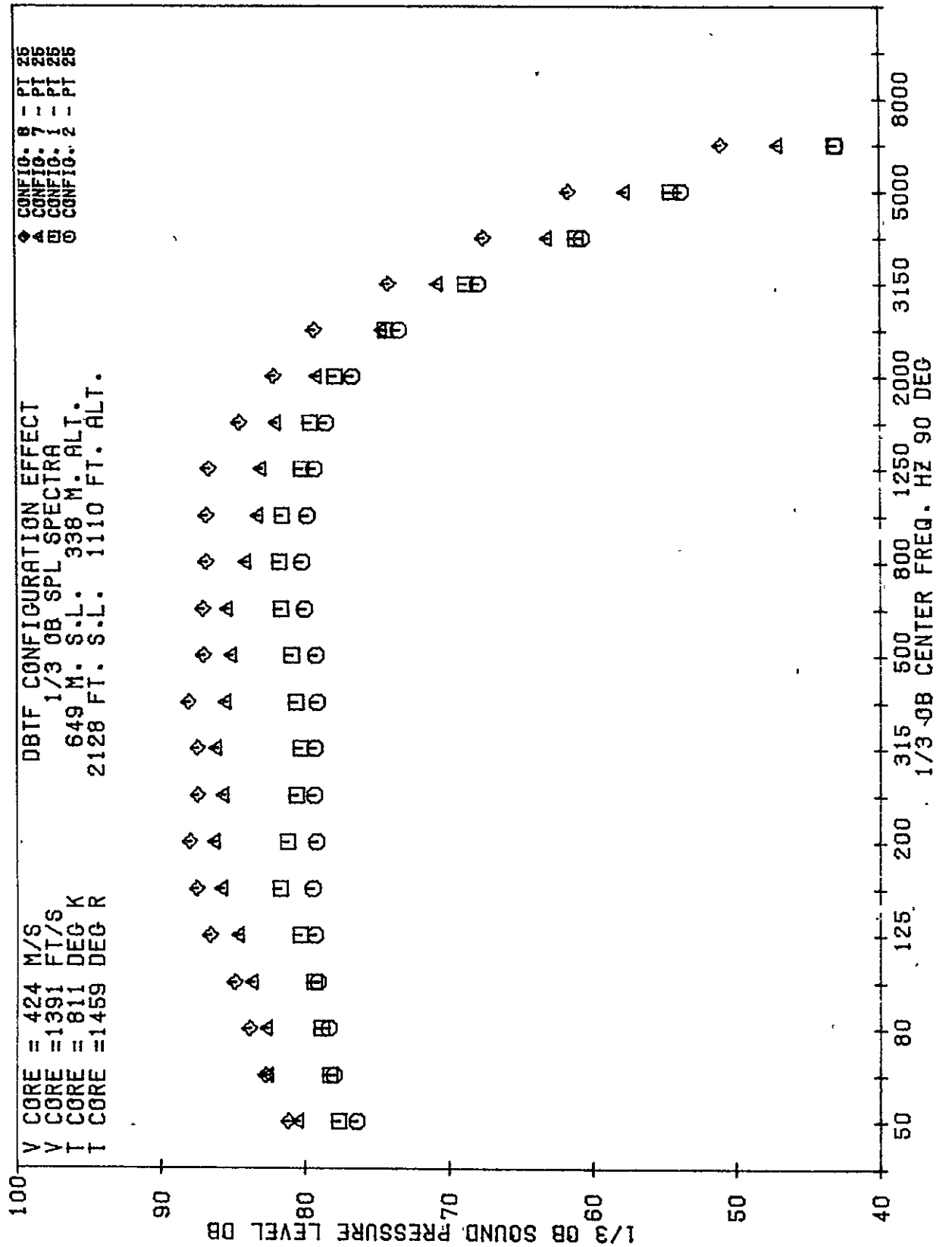
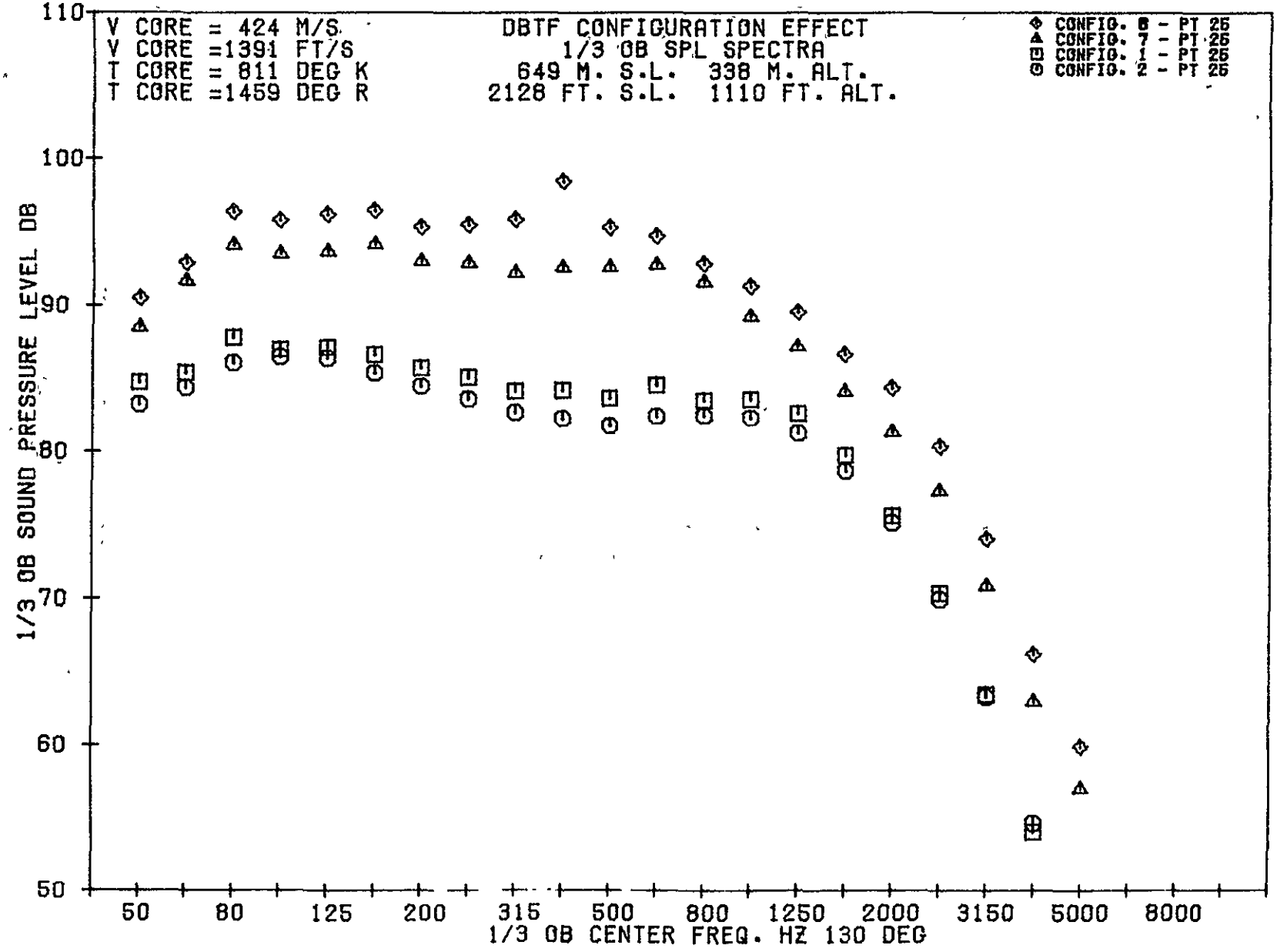
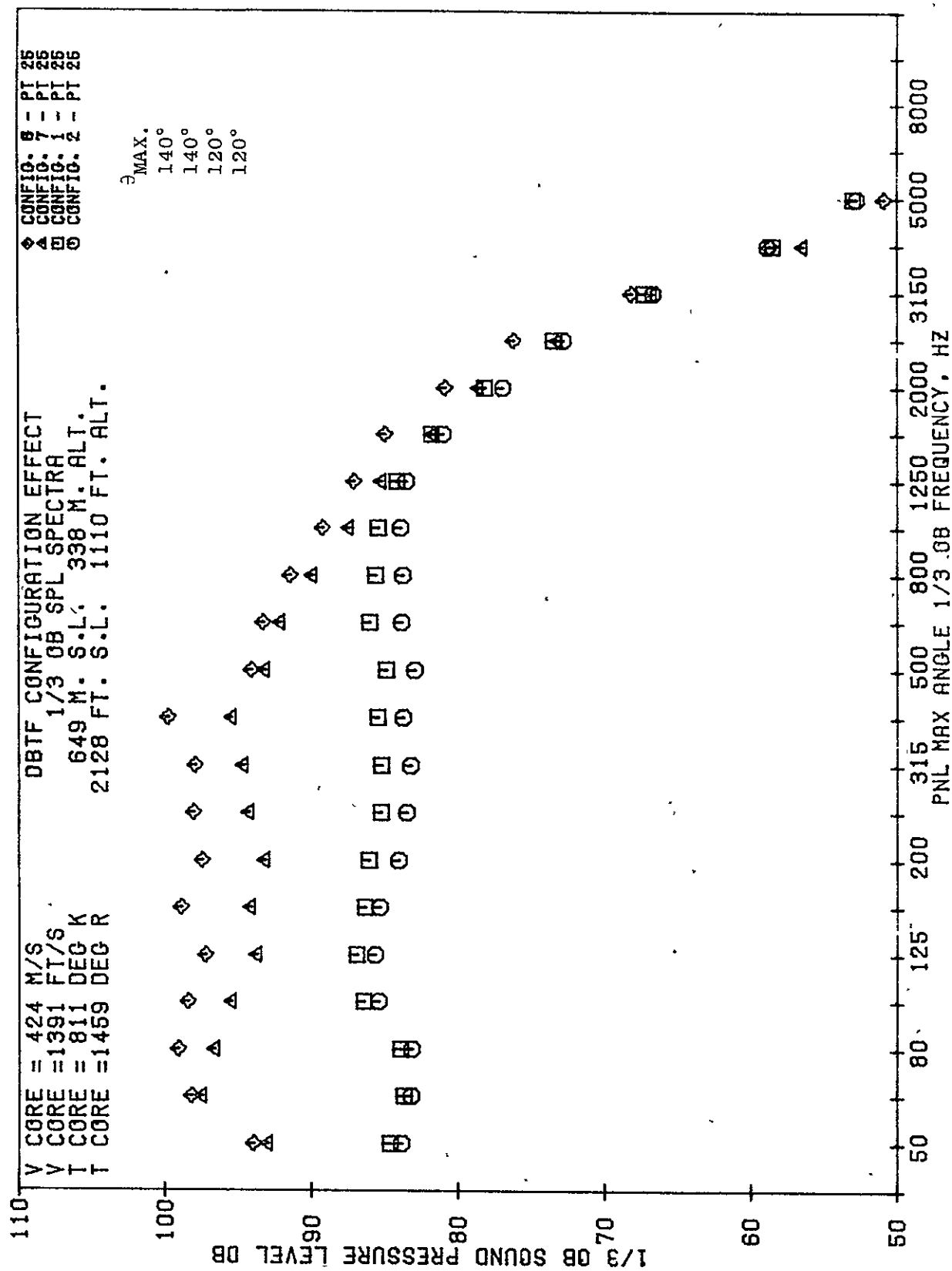
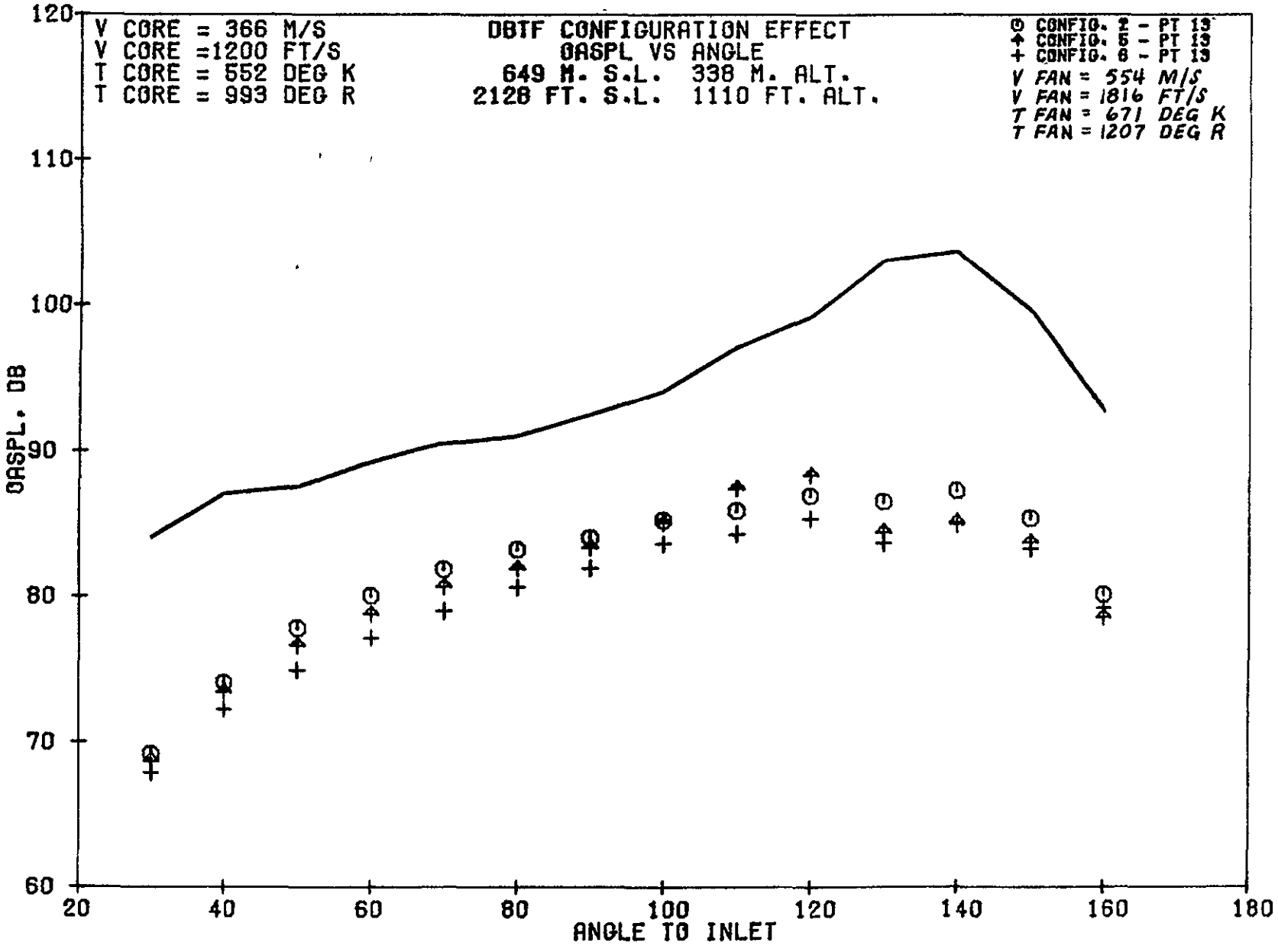
T CORE = 811 DEG K
T CORE =1459 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 8 - PT 25
CONFIG. 7 - PT 25
CONFIG. 1 - PT 25
CONFIG. 2 - PT 25
1/3 OB SOUND PRESSURE LEVEL OB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG




V CORE = 424 M/S
V CORE =1391 FT/S
T CORE = 811 DEG K
T CORE =1459 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 6 - PT 25
CONFIG. 7 - PT 25
CONFIG. 1 - PT 25
CONFIG. 2 - PT 25
1/3 OB SOUND PRESSURE LEVEL DB
110
100
90
80
70
60
50
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 130 DEG

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V CORE =1200 FT/S
T CORE = 552 DEG K
T CORE = 993 DEG R
DBTF CONFIGURATION EFFECT
OASPL VS ANGLE
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 13
CONFIG. 5 - PT 13
CONFIG. 8 - PT 13
V FAN = 554 M/S
V FAN = 1816 FT/S
T FAN = 671 DEG K
T FAN = 1207 DEG R
OASPL, DB
ANGLE TO INLET
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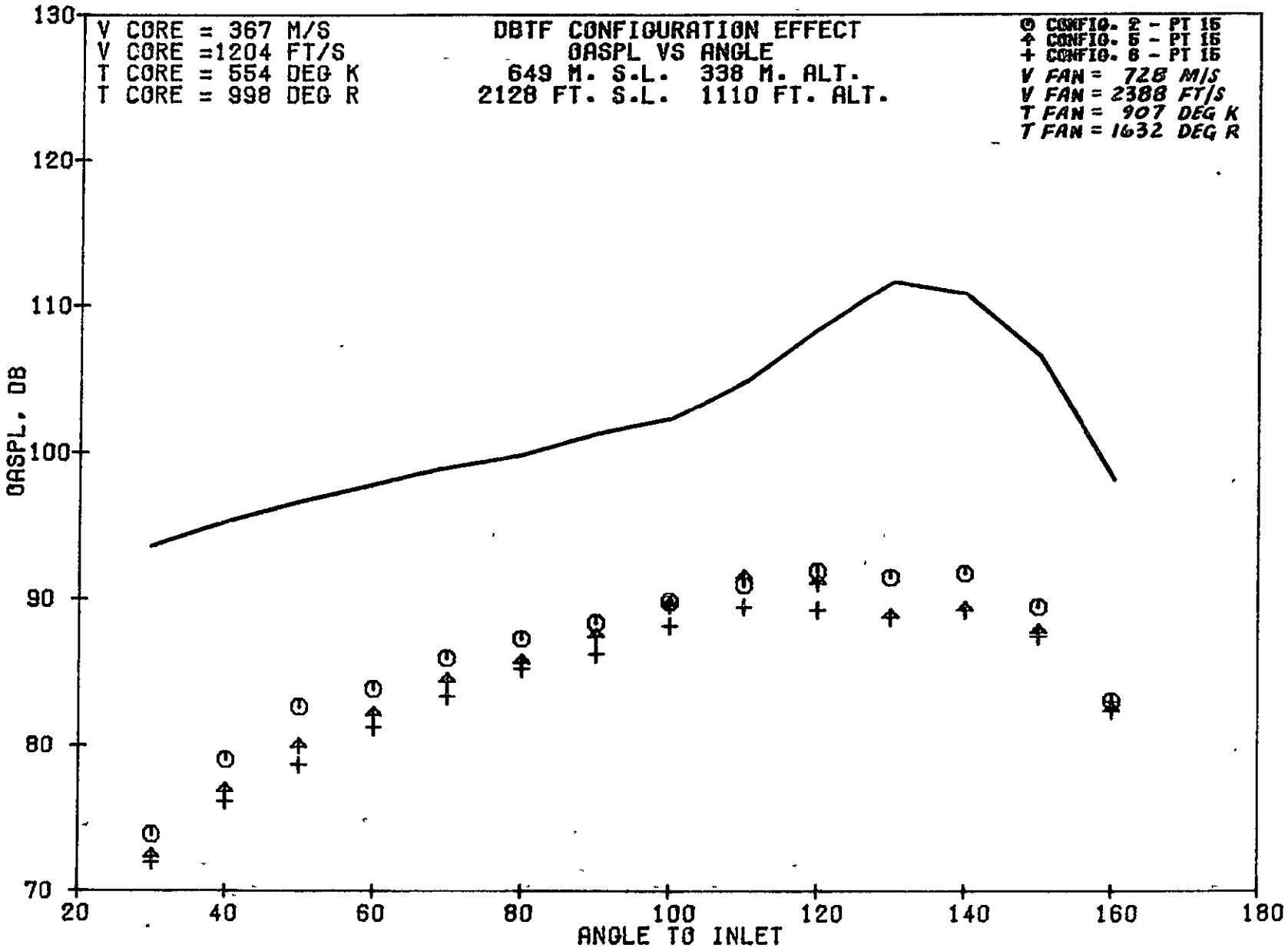
110
100
90
80
70
60
20
40
60
80
100
120
140
160
180



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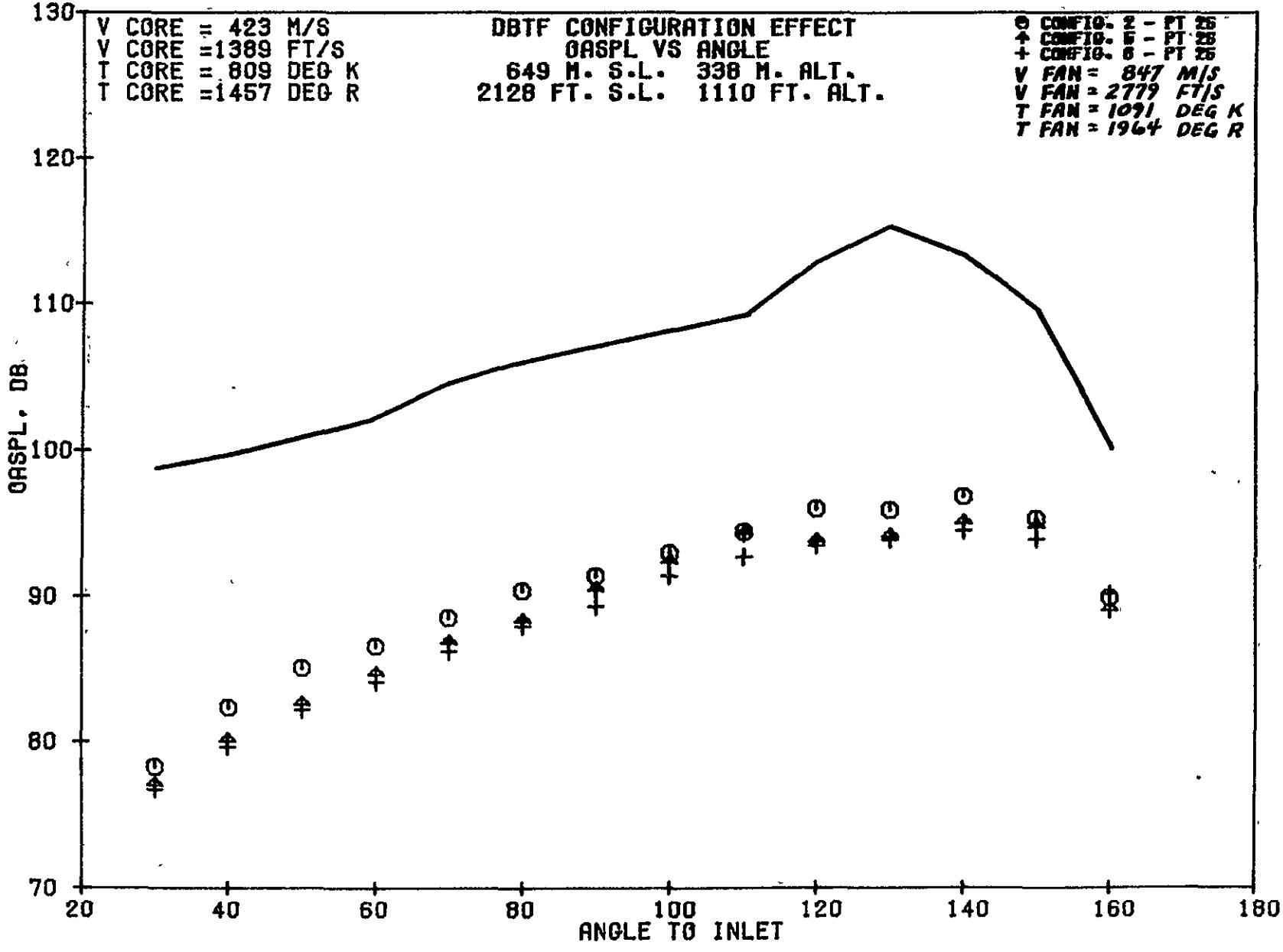
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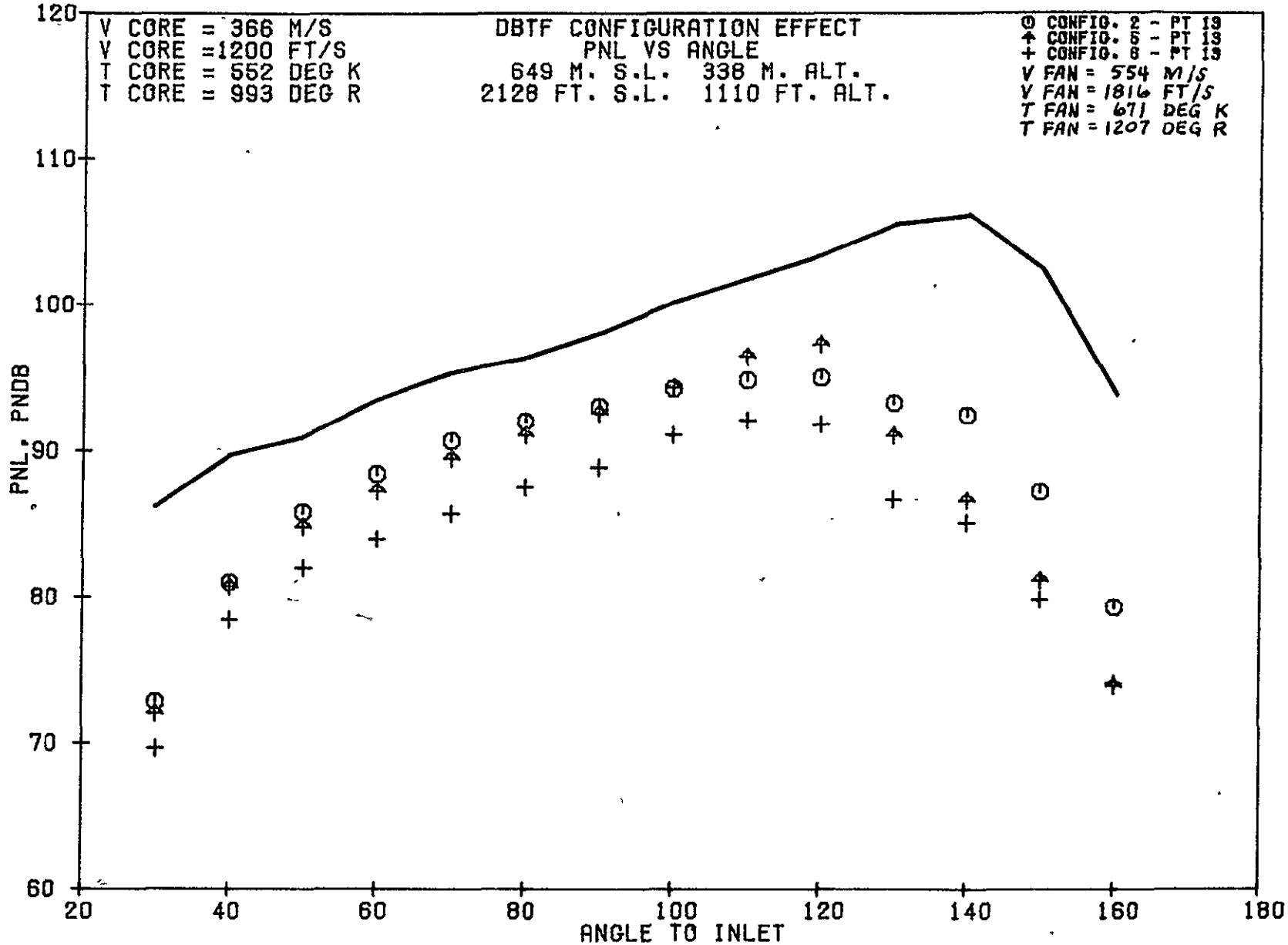
V CORE =1389 FT/S
T CORE = 809 DEG K
T CORE =1457 DEG R
DBTF CONFIGURATION EFFECT
OASPL VS ANGLE
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 25
CONFIG. 5 - PT 25
CONFIG. 6 - PT 25
V FAN = 847 M/S
V FAN = 2779 FT/S
T FAN = 1091 DEG K
T FAN = 1964 DEG R
OASPL, DB
ANGLE TO INLET
130
120
110
100
90
80
70
20
40
60
80
100
120
140
160
180



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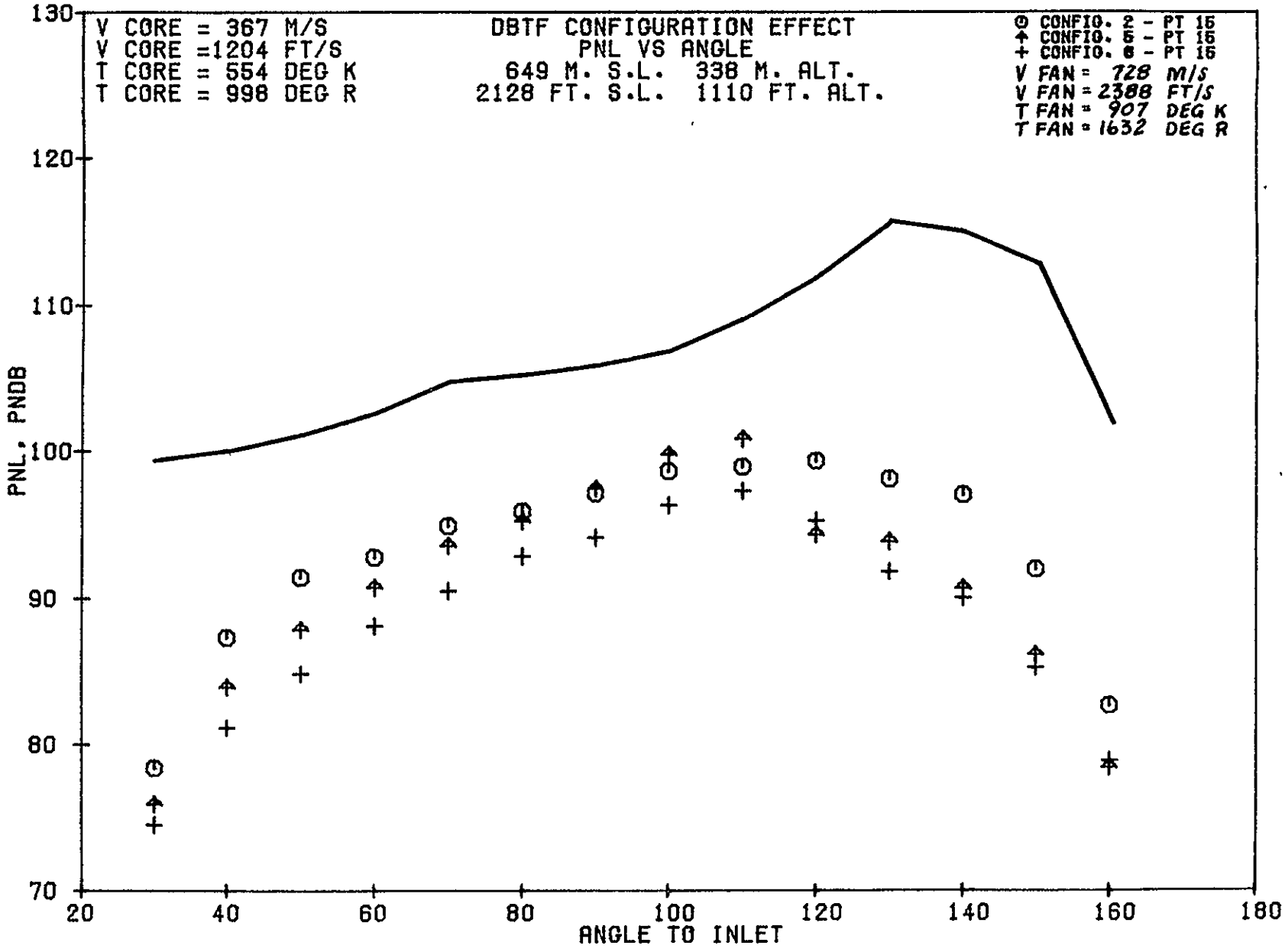

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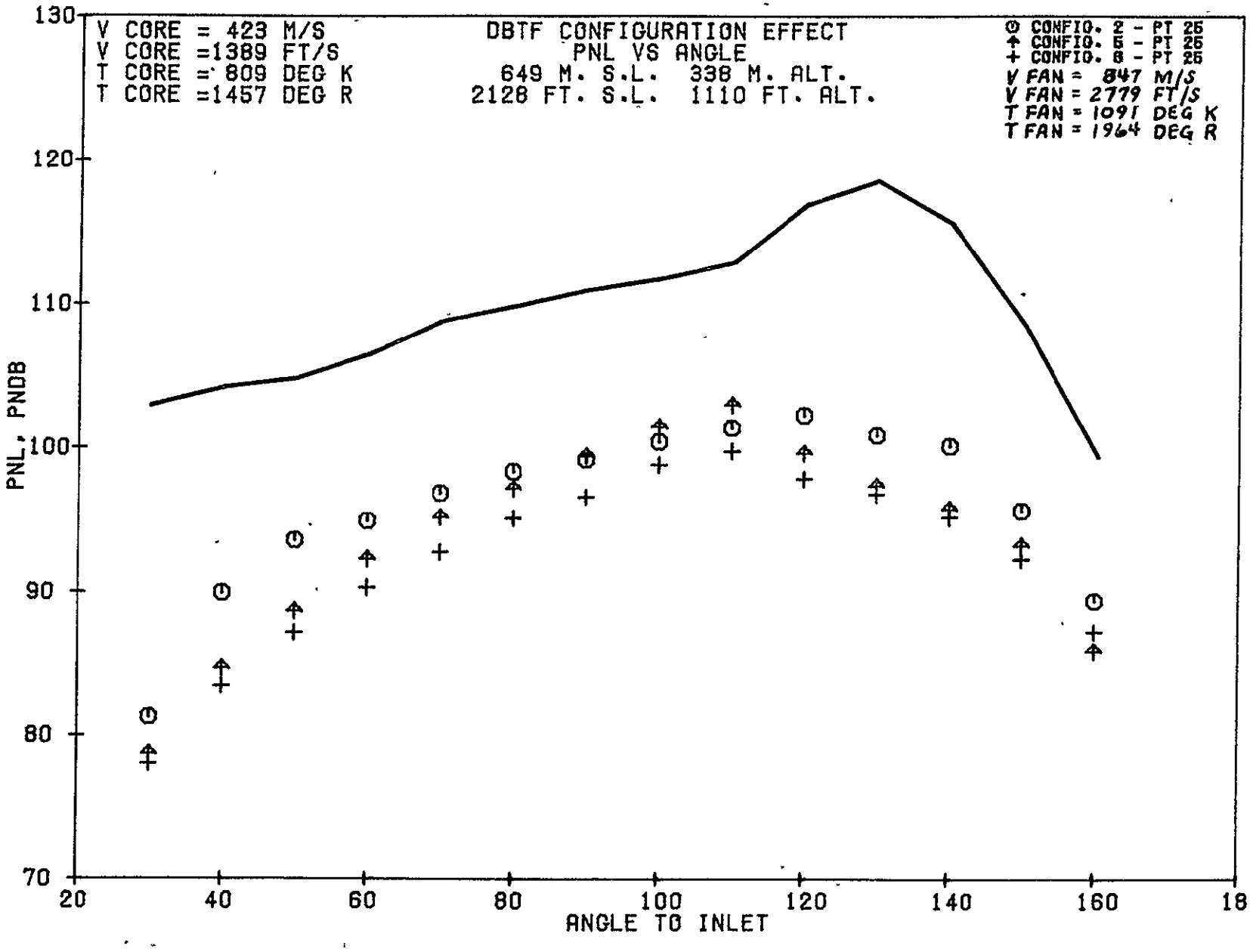

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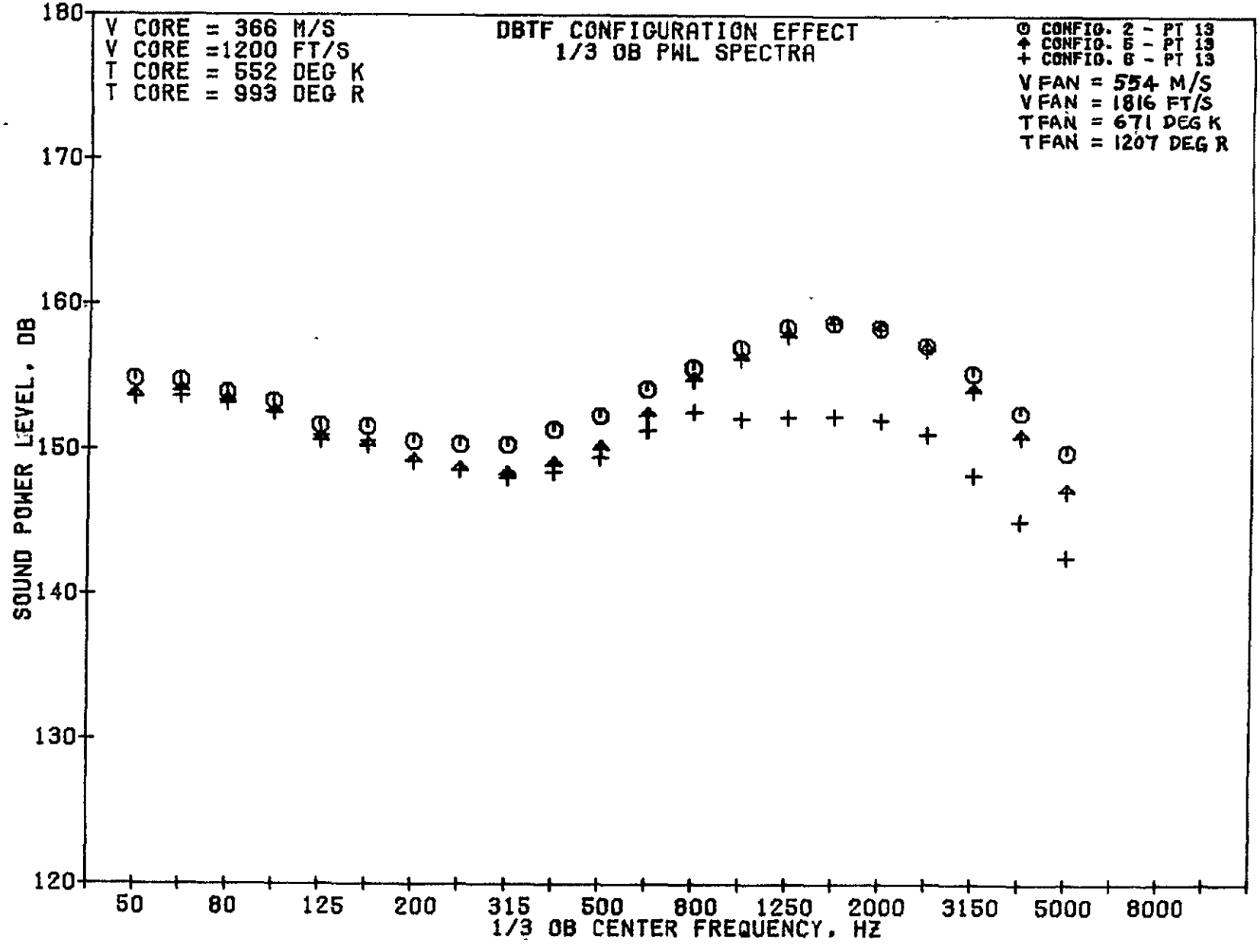

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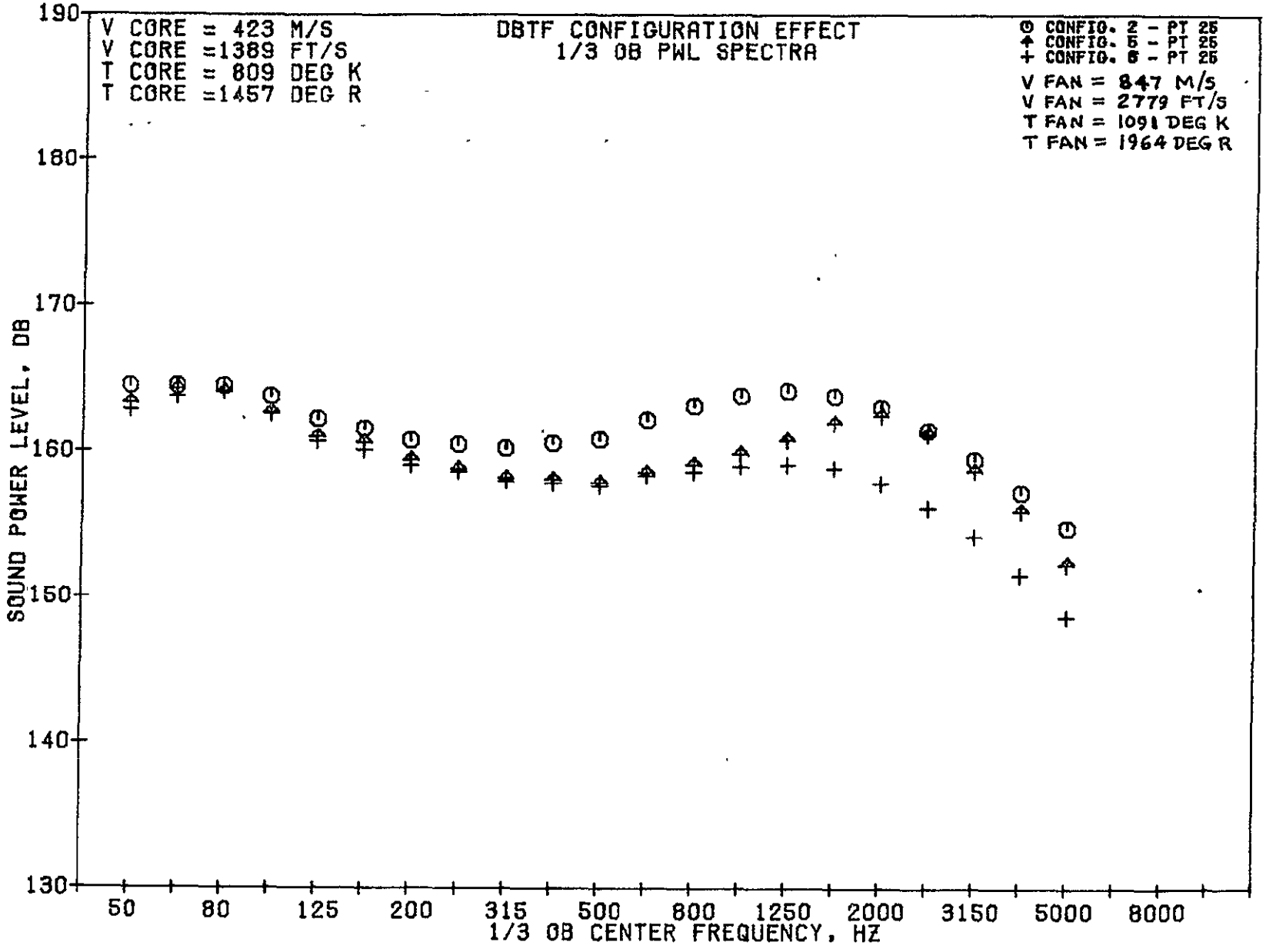

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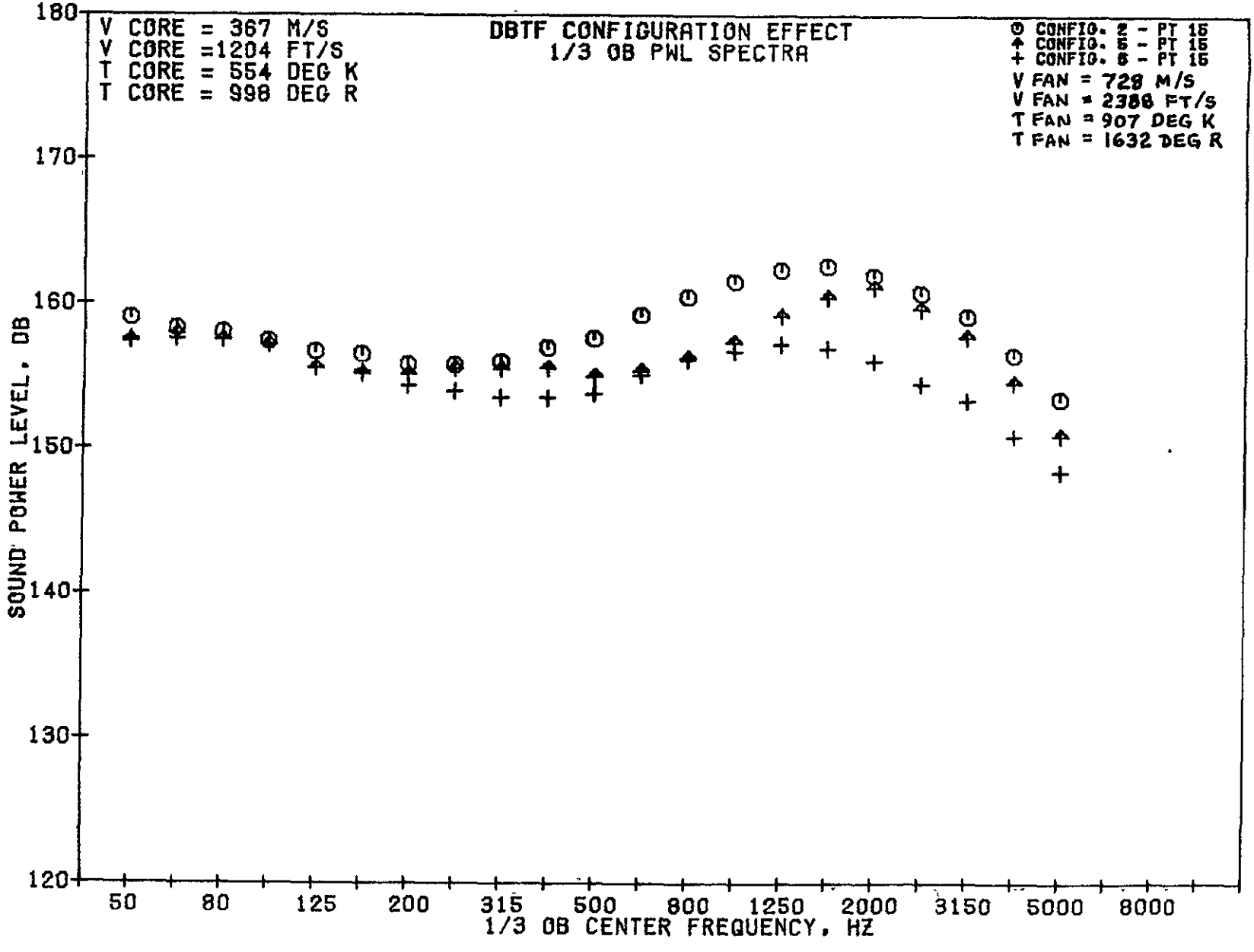

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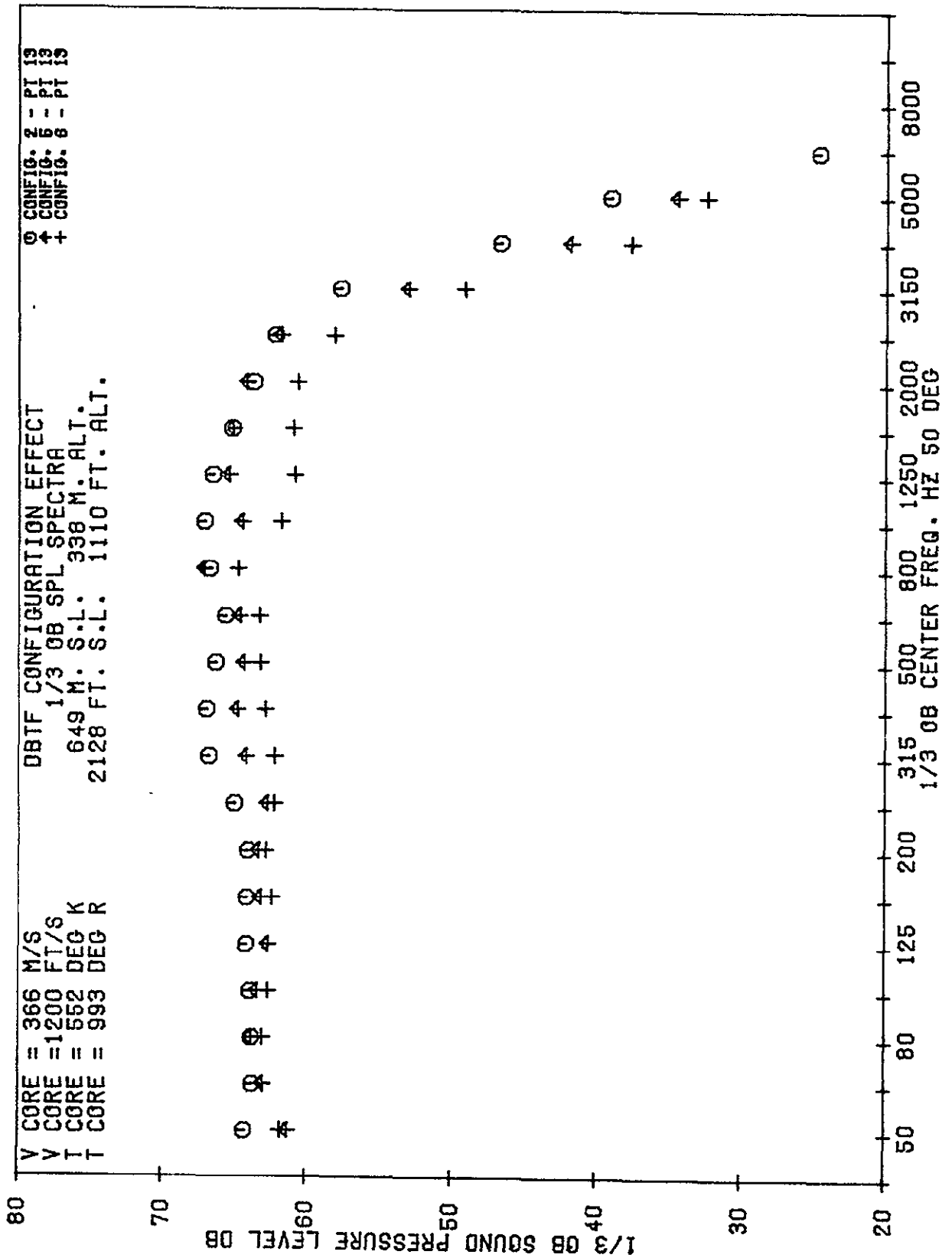

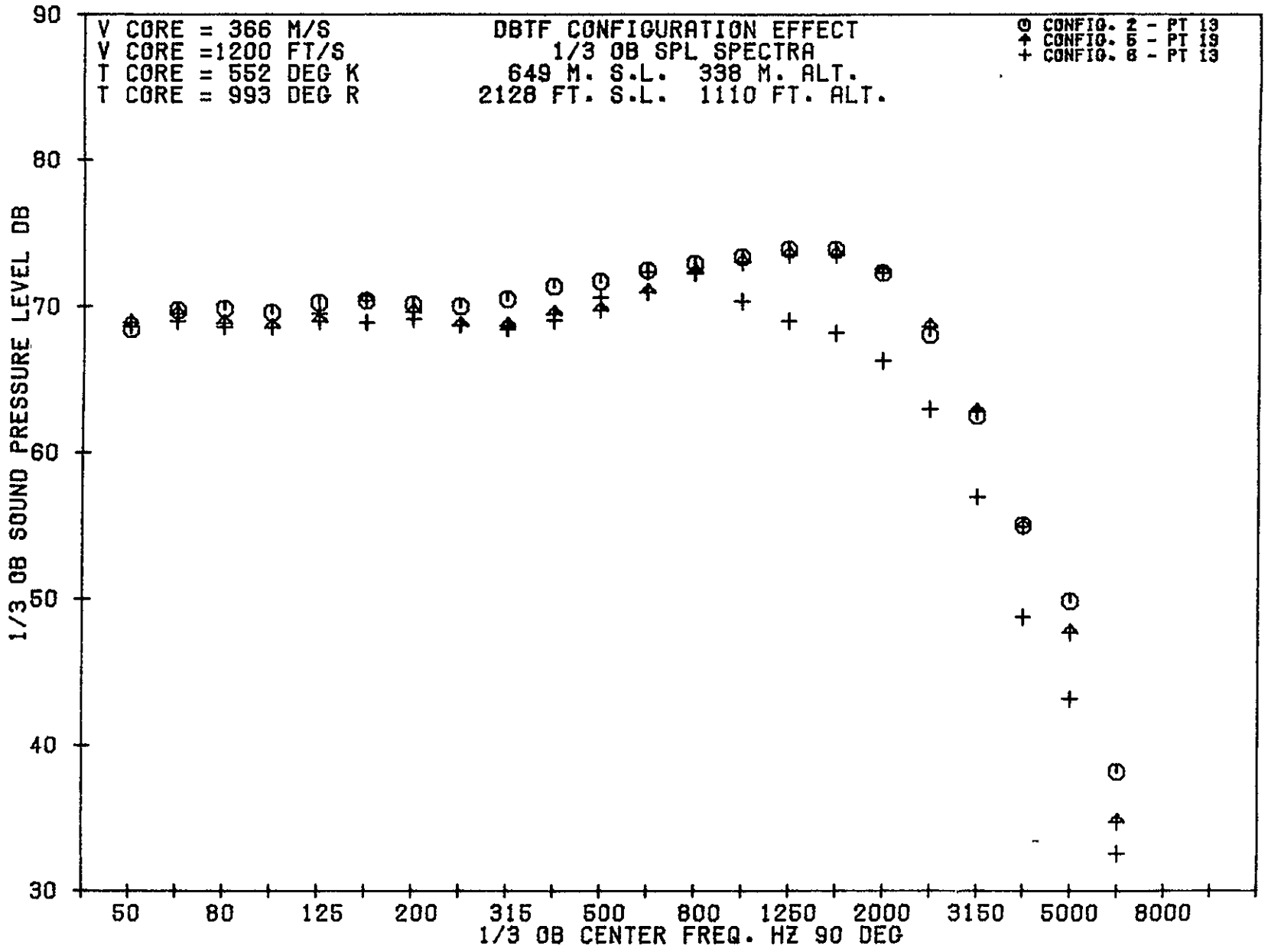
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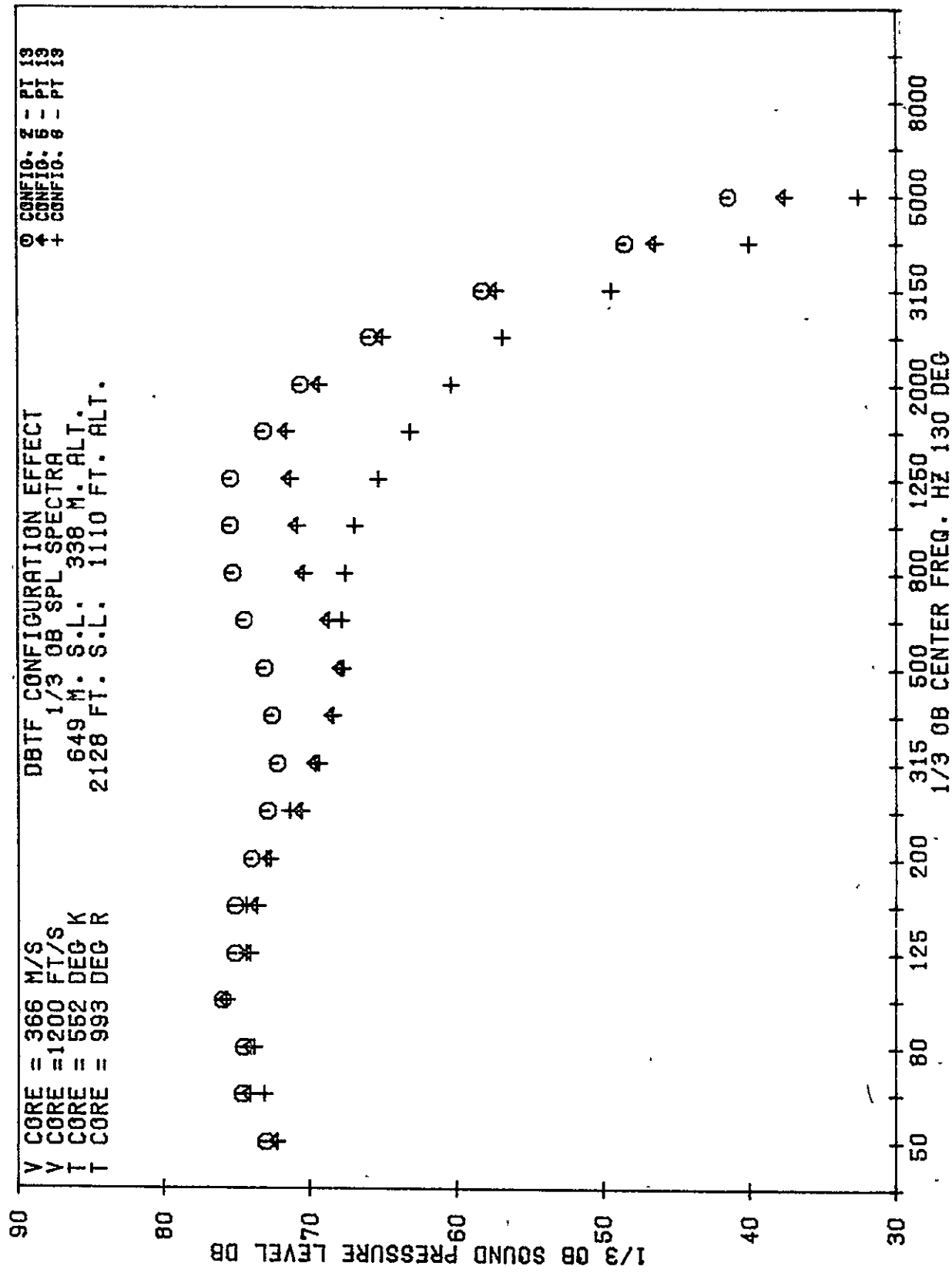
V CORE =1200 FT/S
T CORE = 552 DEG K
T CORE = 993 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 13
CONFIG. 5 - PT 19
CONFIG. 8 - PT 13
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 90 DEG



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V CORE = 366 M/S
V CORE =1200 FT/S
T CORE = 552 DEG K
T CORE = 993 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 13
CONFIG. 5 - PT 13
CONFIG. 8 - PT 13
MAX.
110°
120°
110°
1/3 OB SOUND PRESSURE LEVEL OB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
PNL MAX ANGLE 1/3 OB FREQUENCY, HZ

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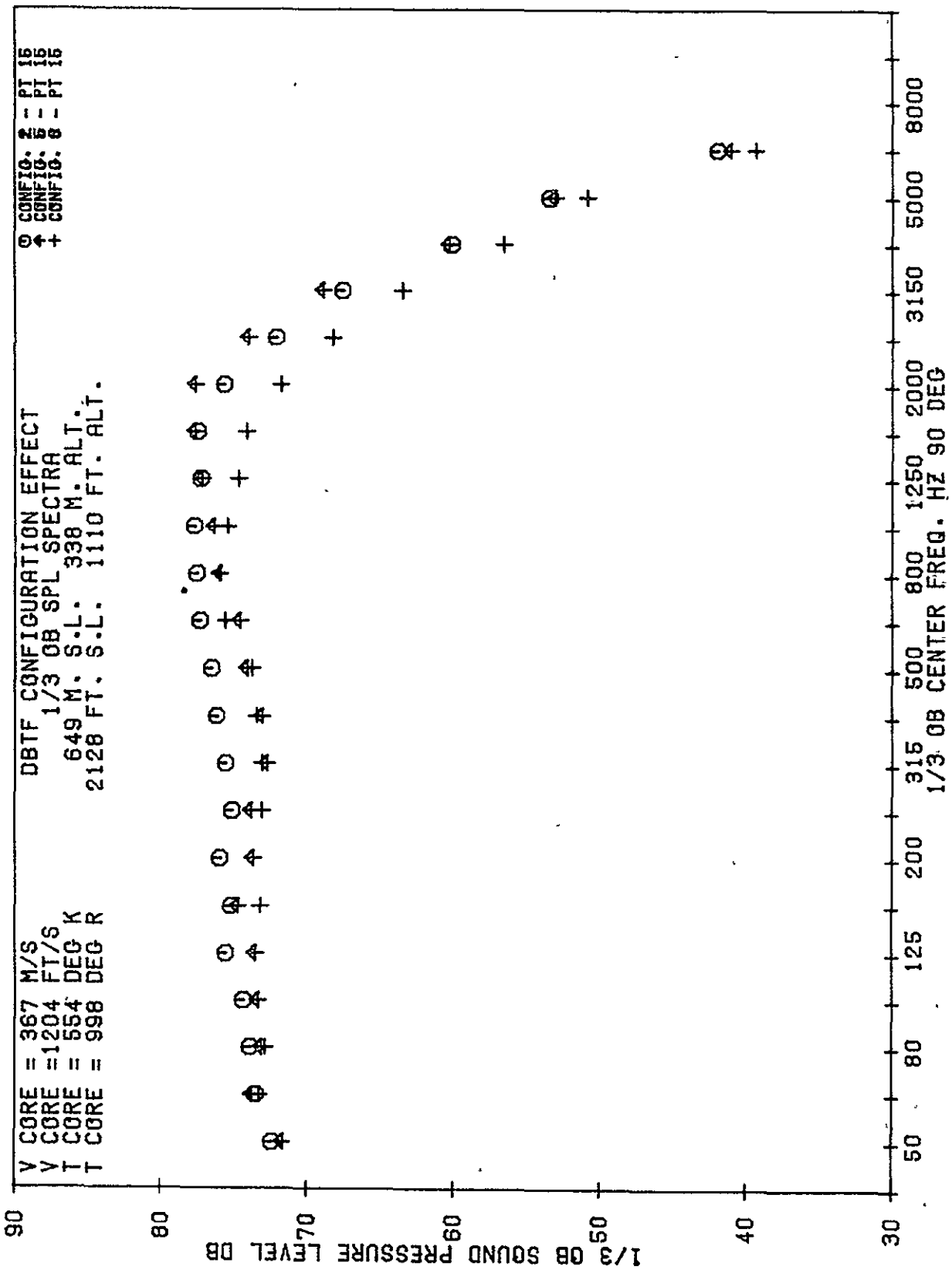
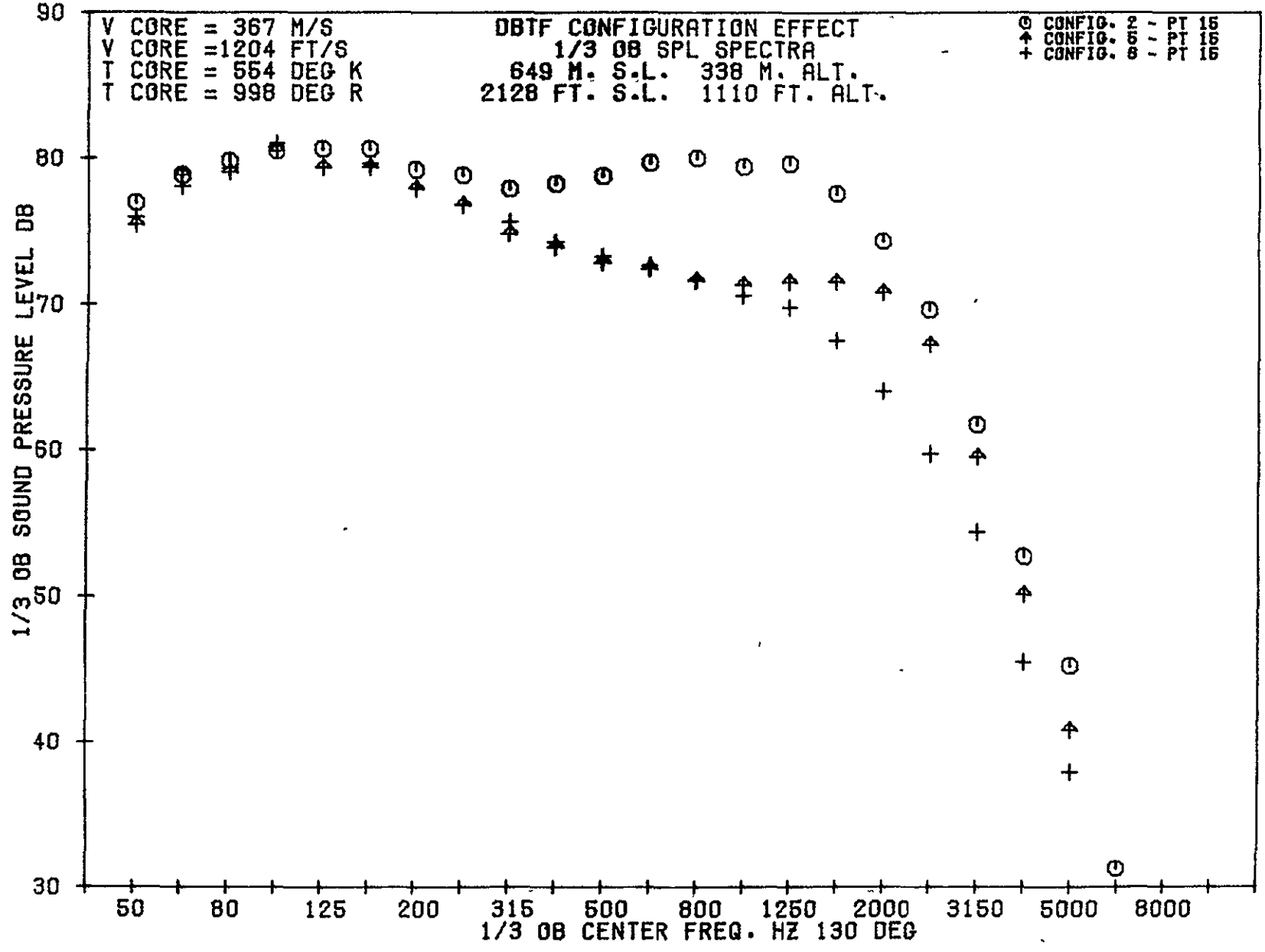
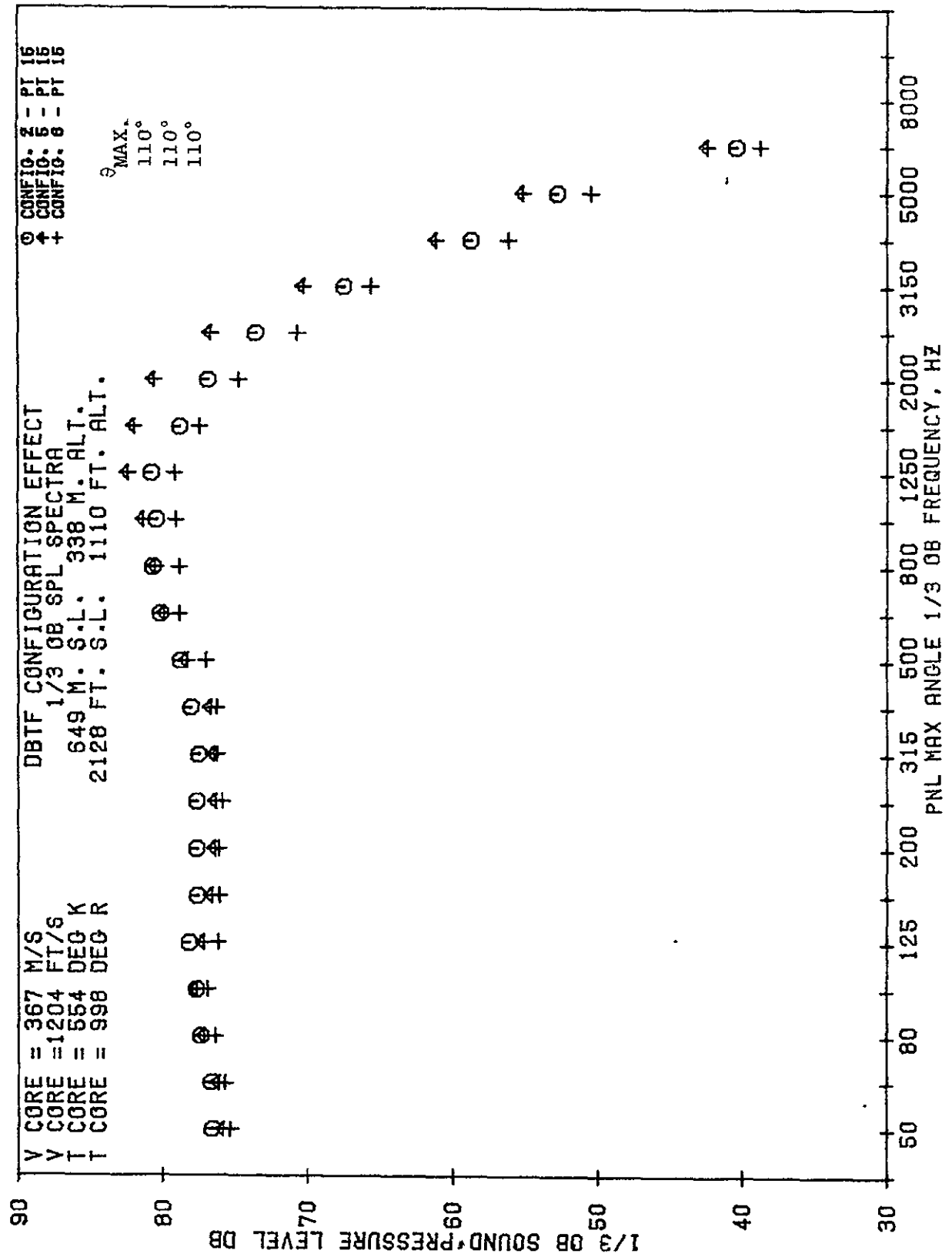
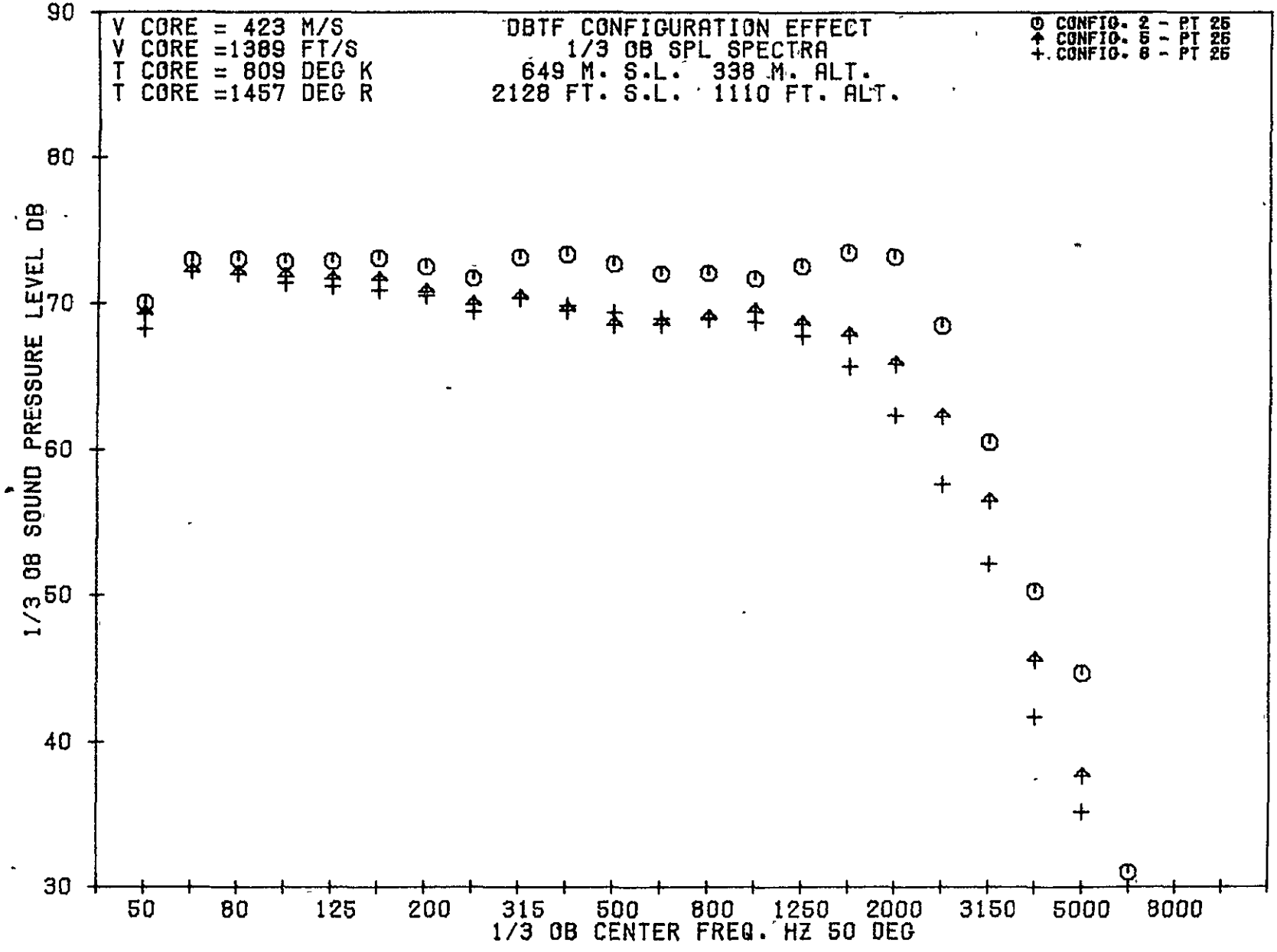
Fig 11




V CORE = 367 M/S
V CORE =1204 FT/S
T CORE = 554 DEG K
T CORE = 998 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 15
CONFIG. 5 - PT 15
CONFIG. 8 - PT 15
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 130 DEG




V CORE = 423 M/S
V CORE =1389 FT/S
T CORE = 809 DEG K
T CORE =1457 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 25
CONFIG. 5 - PT 25
CONFIG. 8 - PT 25
1/3 OB SOUND PRESSURE LEVEL OB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG

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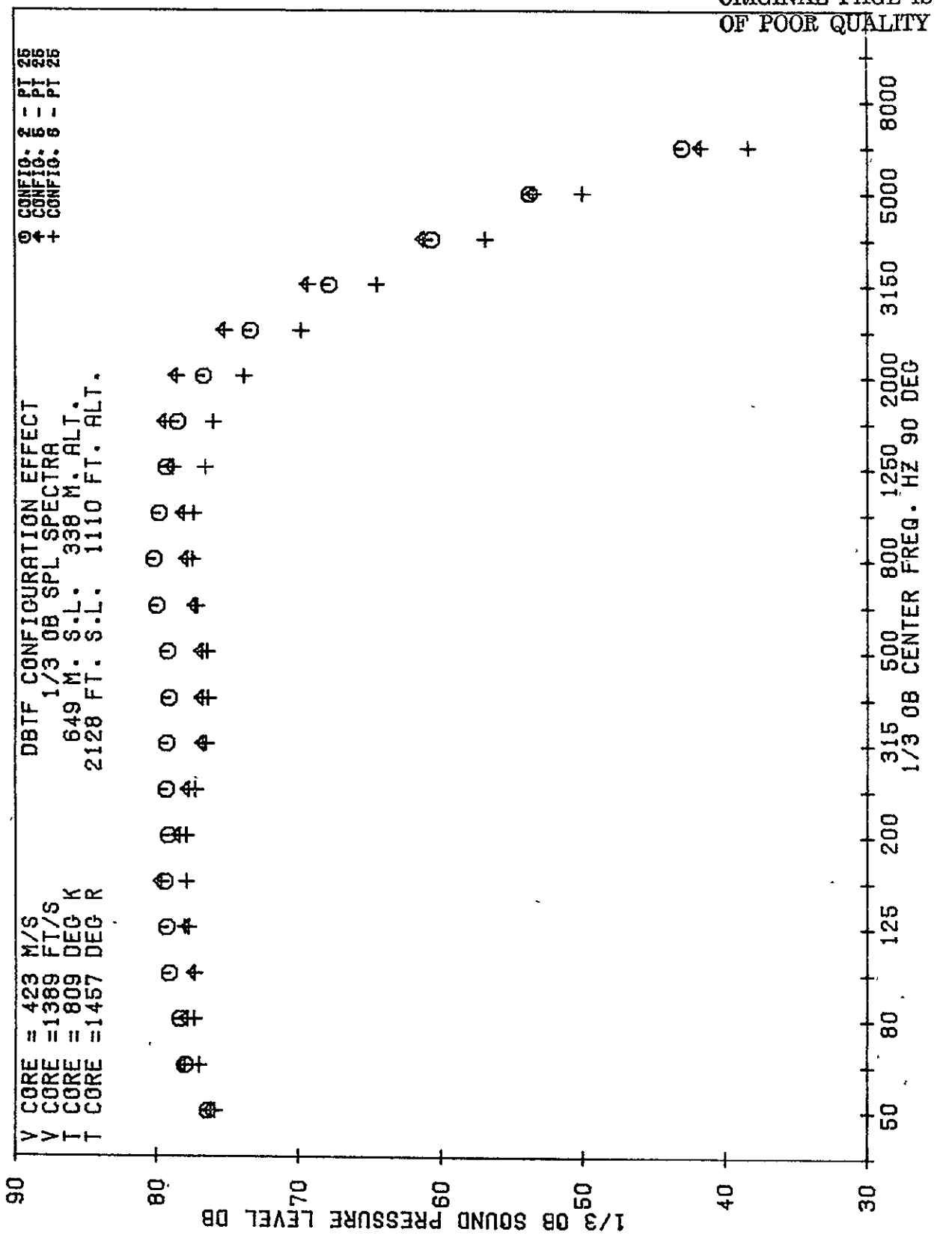
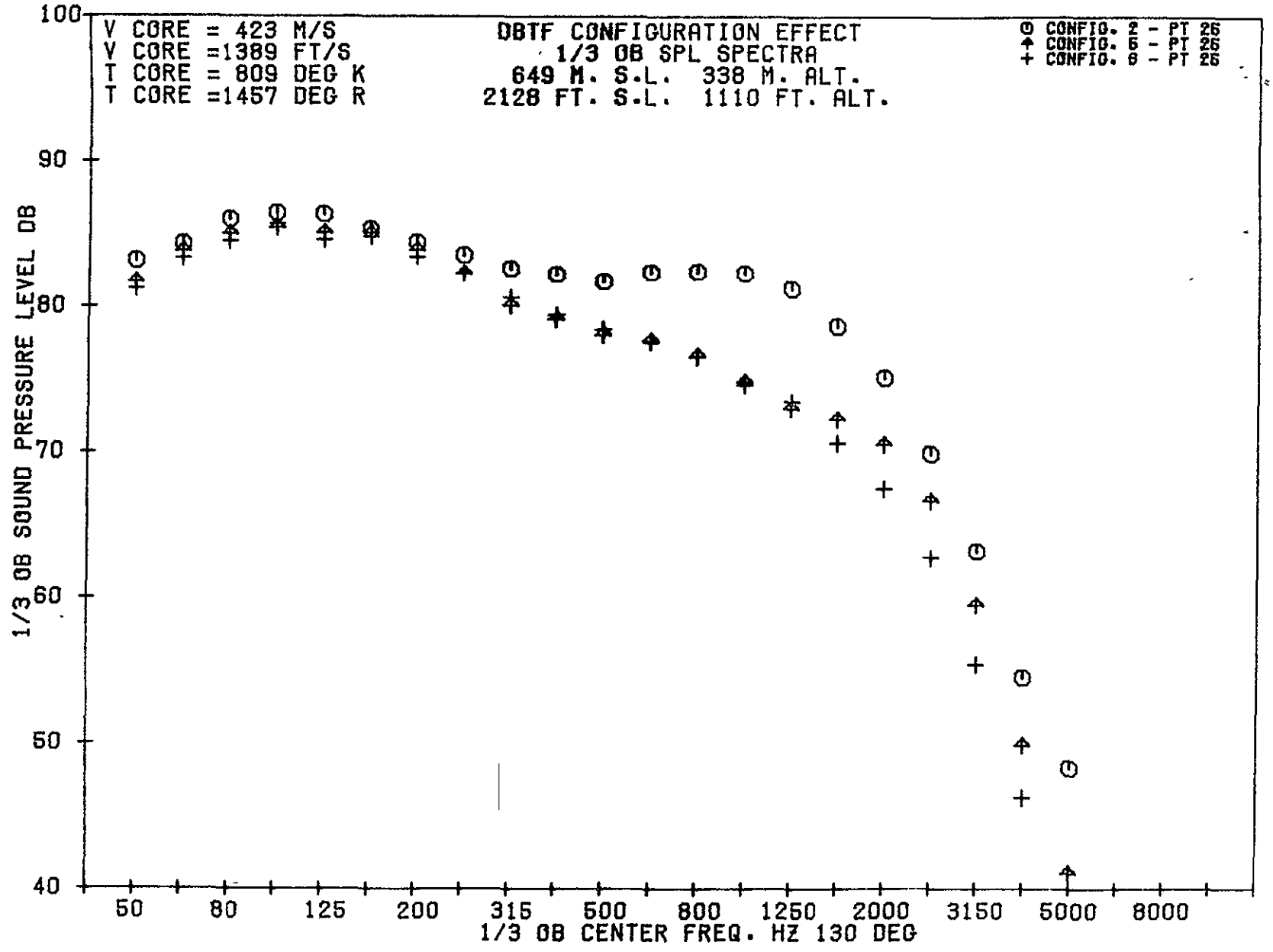
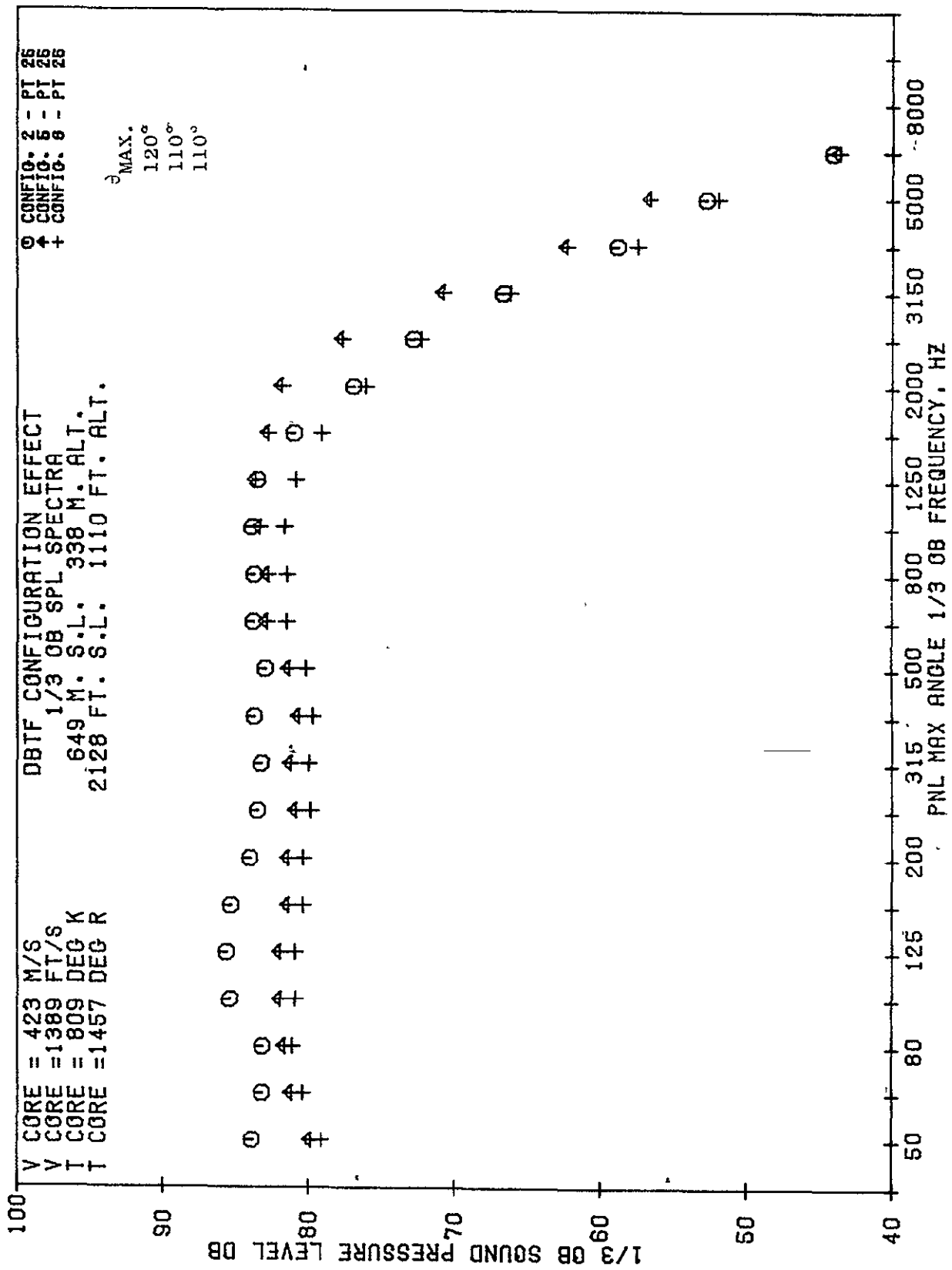



V CORE = 423 M/S
V CORE =1389 FT/S
T CORE = 809 DEG K
T CORE =1457 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 2 - PT 25
CONFIG. 6 - PT 25
CONFIG. 8 - PT 25
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 130 DEG



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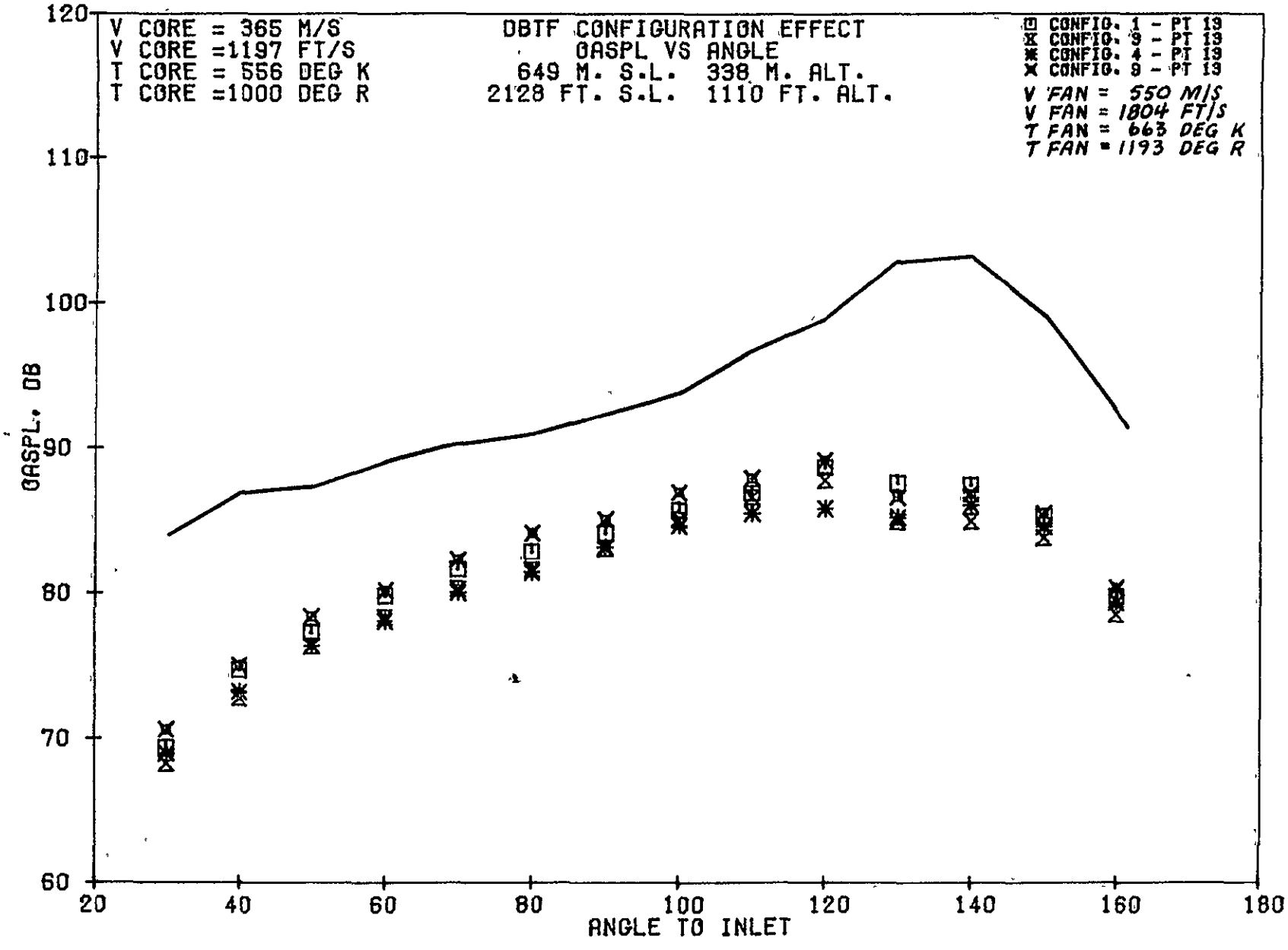
V CORE = 365 M/S
V CORE =1197 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
OBTF CONFIGURATION EFFECT
OASPL VS ANGLE
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 13
CONFIG. 9 - PT 13
CONFIG. 4 - PT 13
CONFIG. 9 - PT 13
V FAN = 550 M/S
V FAN = 1804 FT/S
T FAN = 663 DEG K
T FAN = 1193 DEG R
OASPL, DB
ANGLE TO INLET
120
110
100
90
80
70
60
20
40
60
80
100
120
140
160
180

1288

1289

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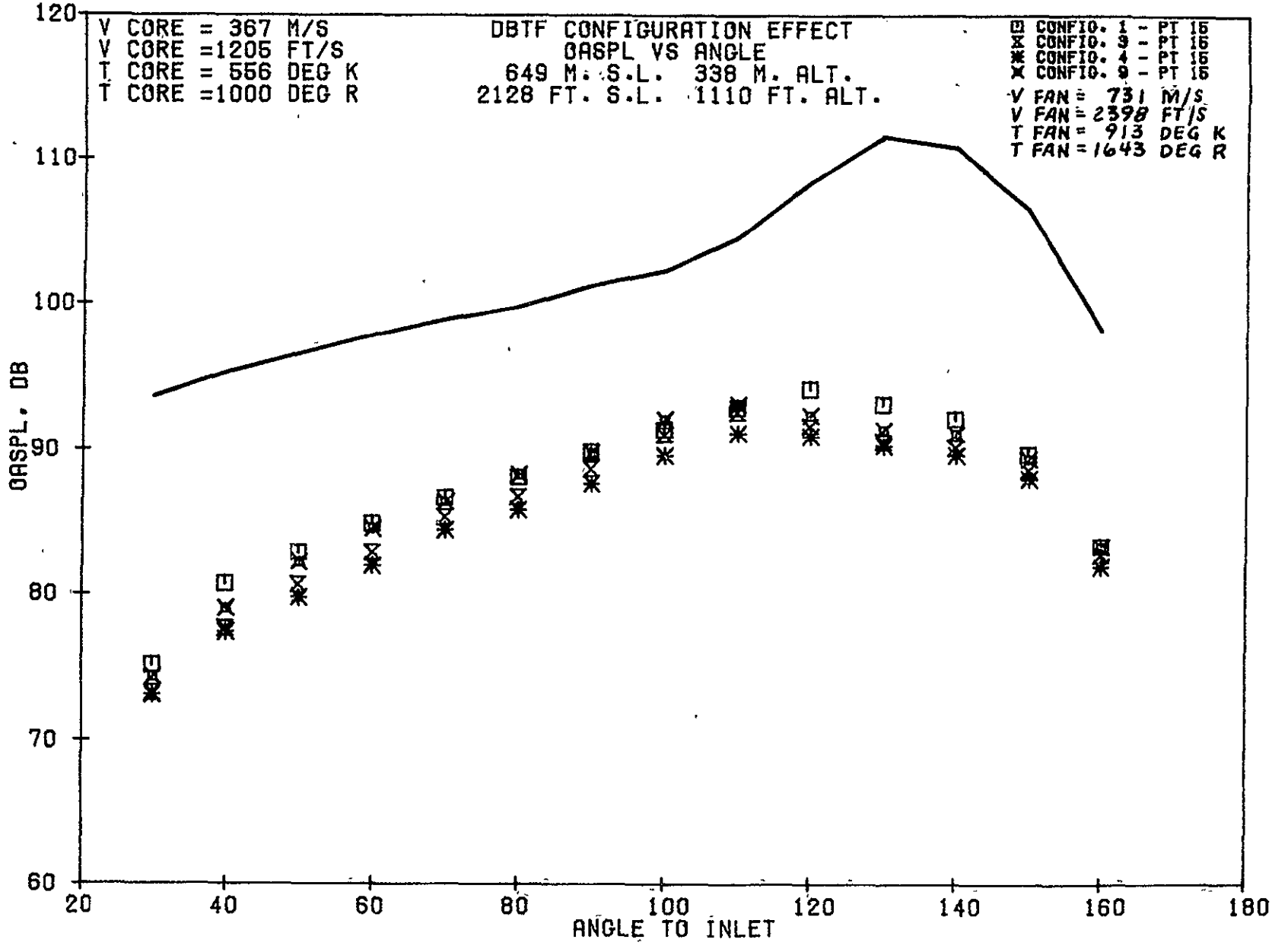

1290

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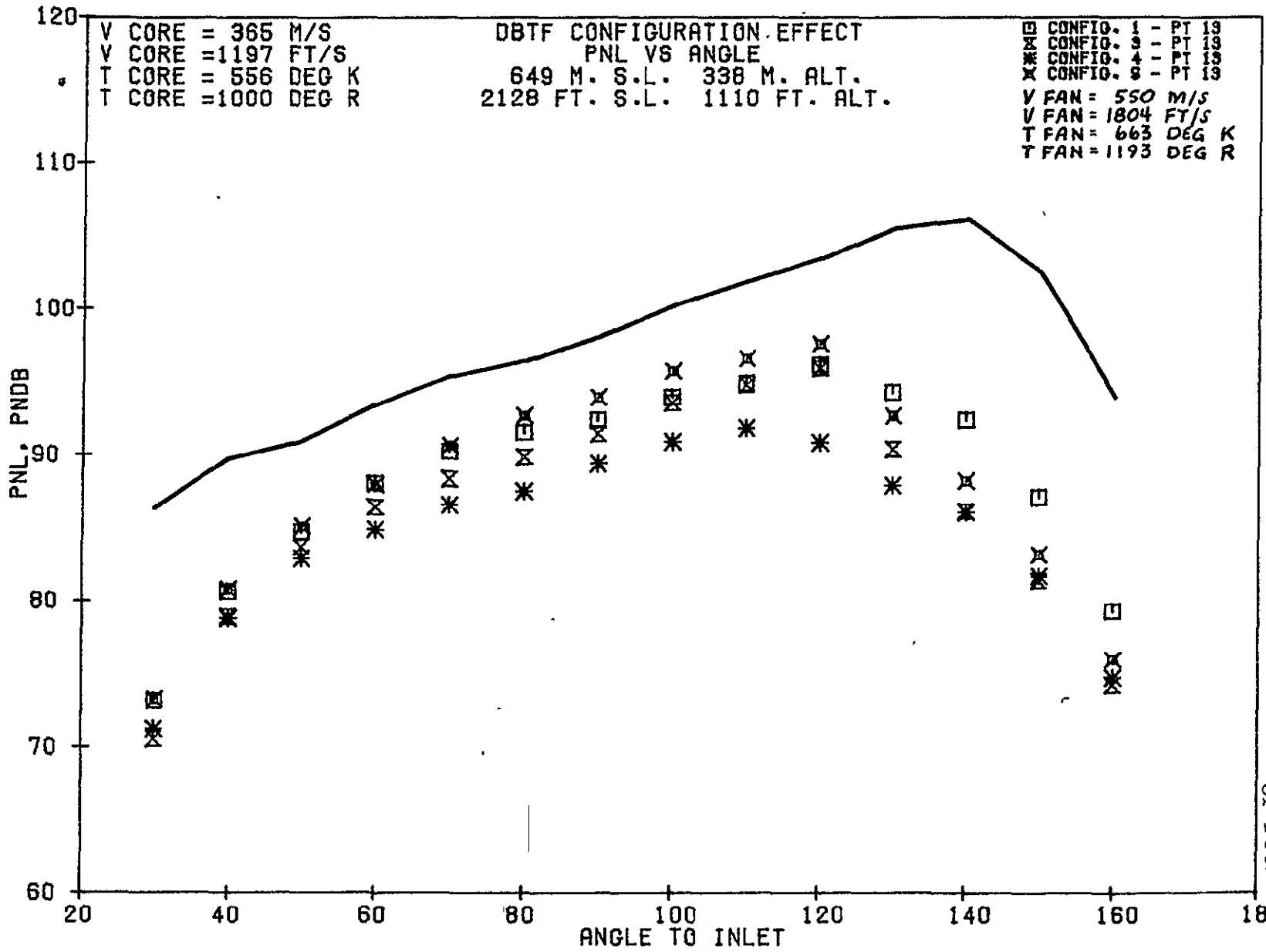

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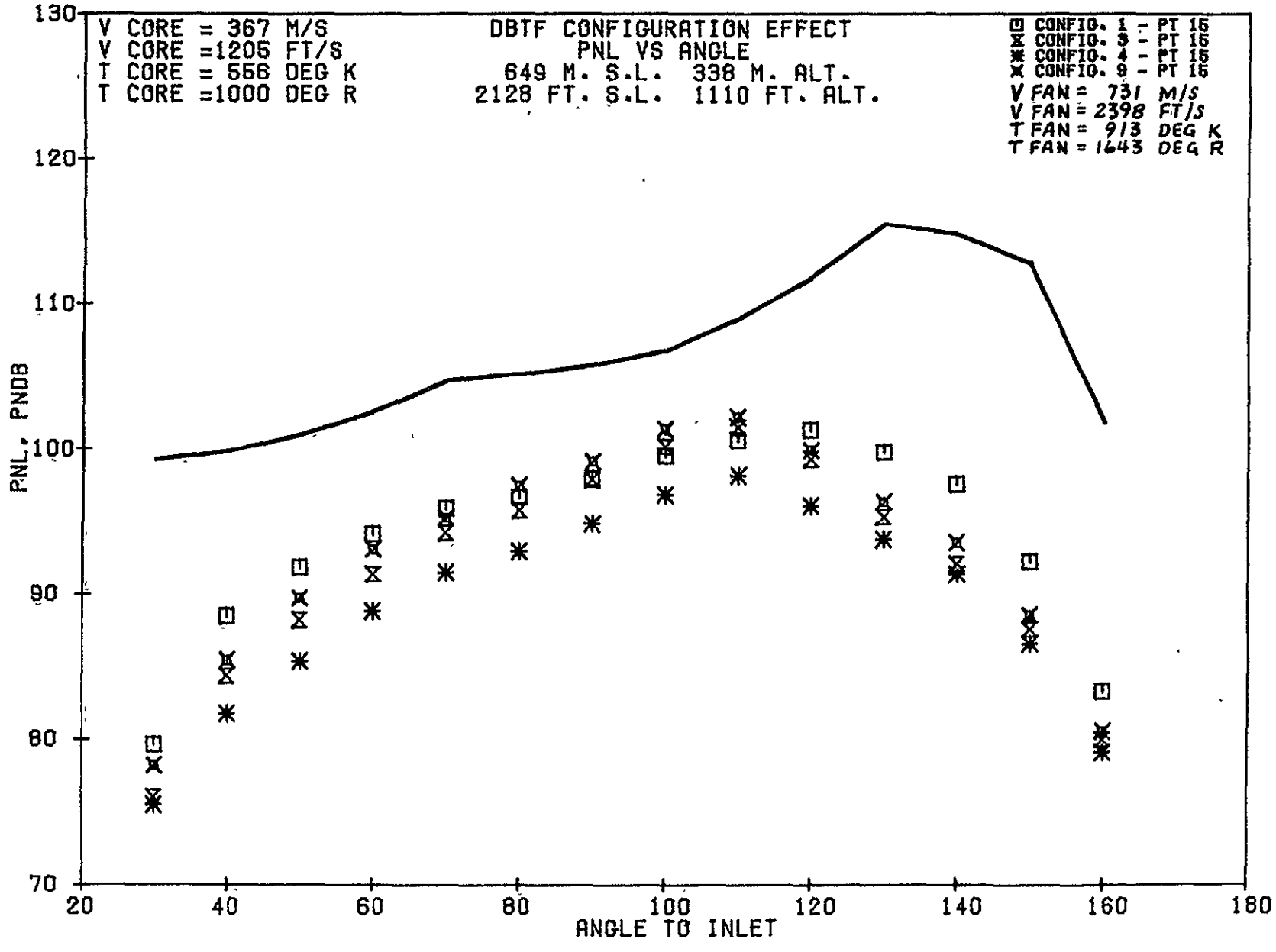
5R552-001

79 BURCH A.



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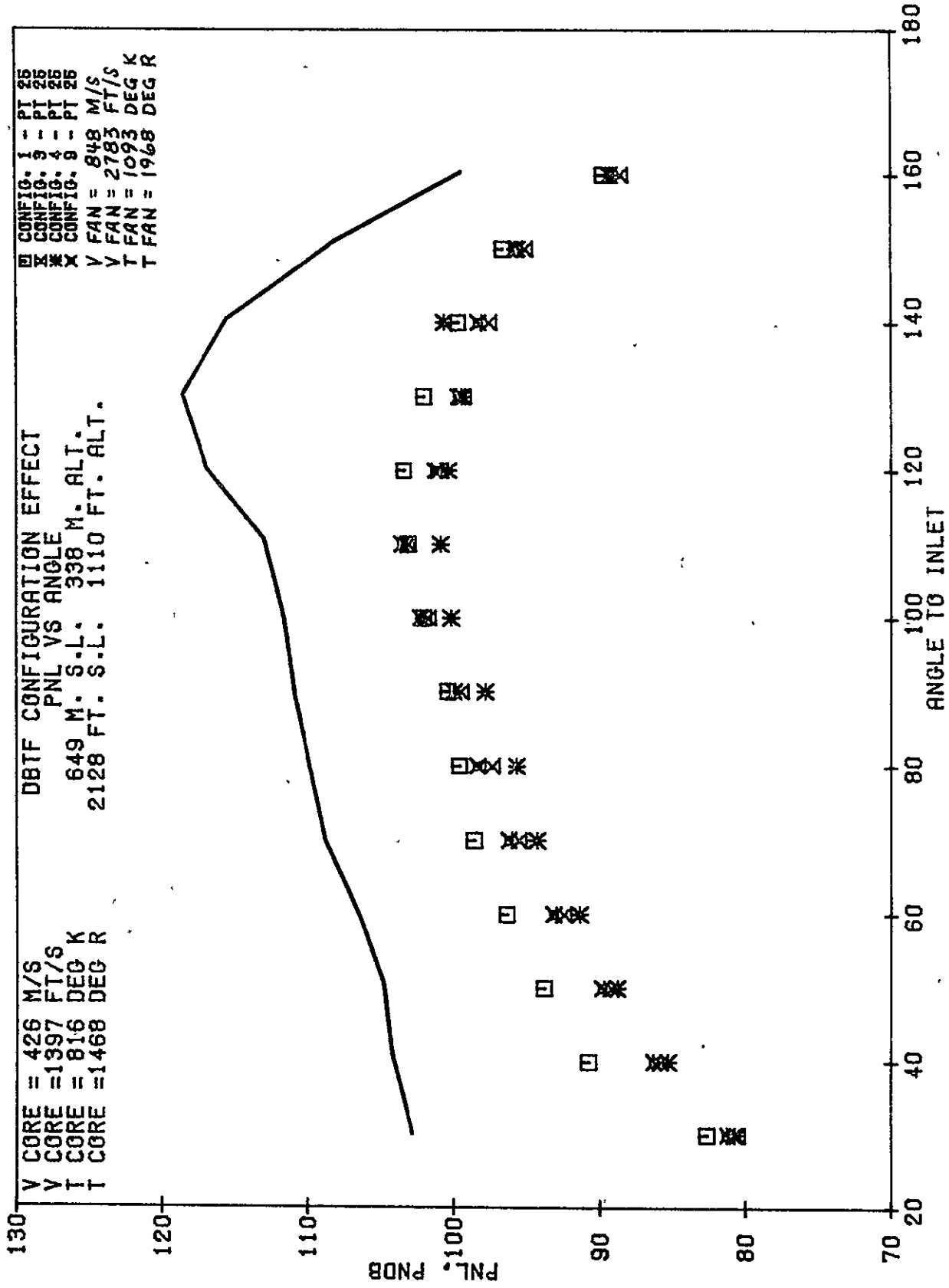
5R552-001

79 BURCH A.



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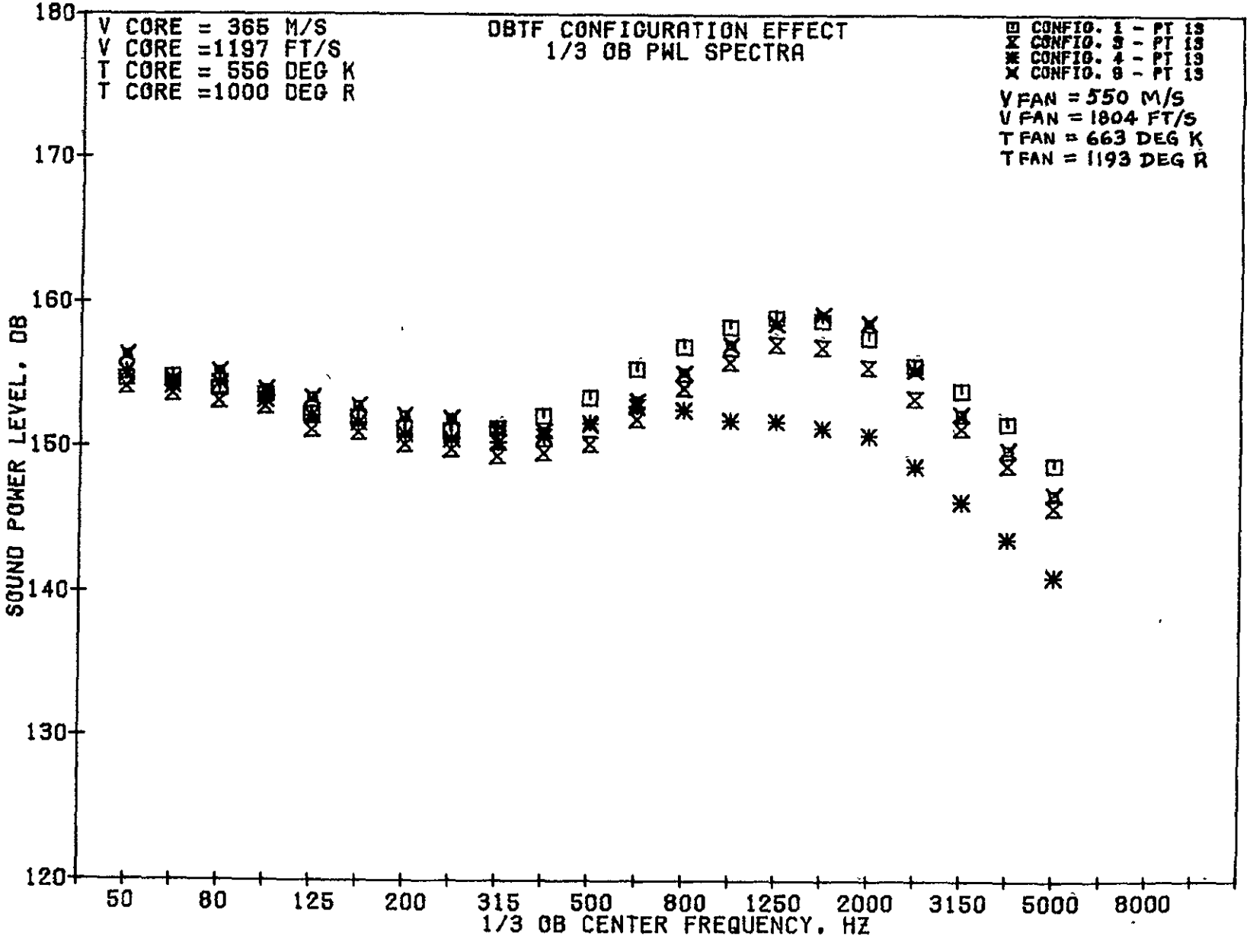

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5R006-001

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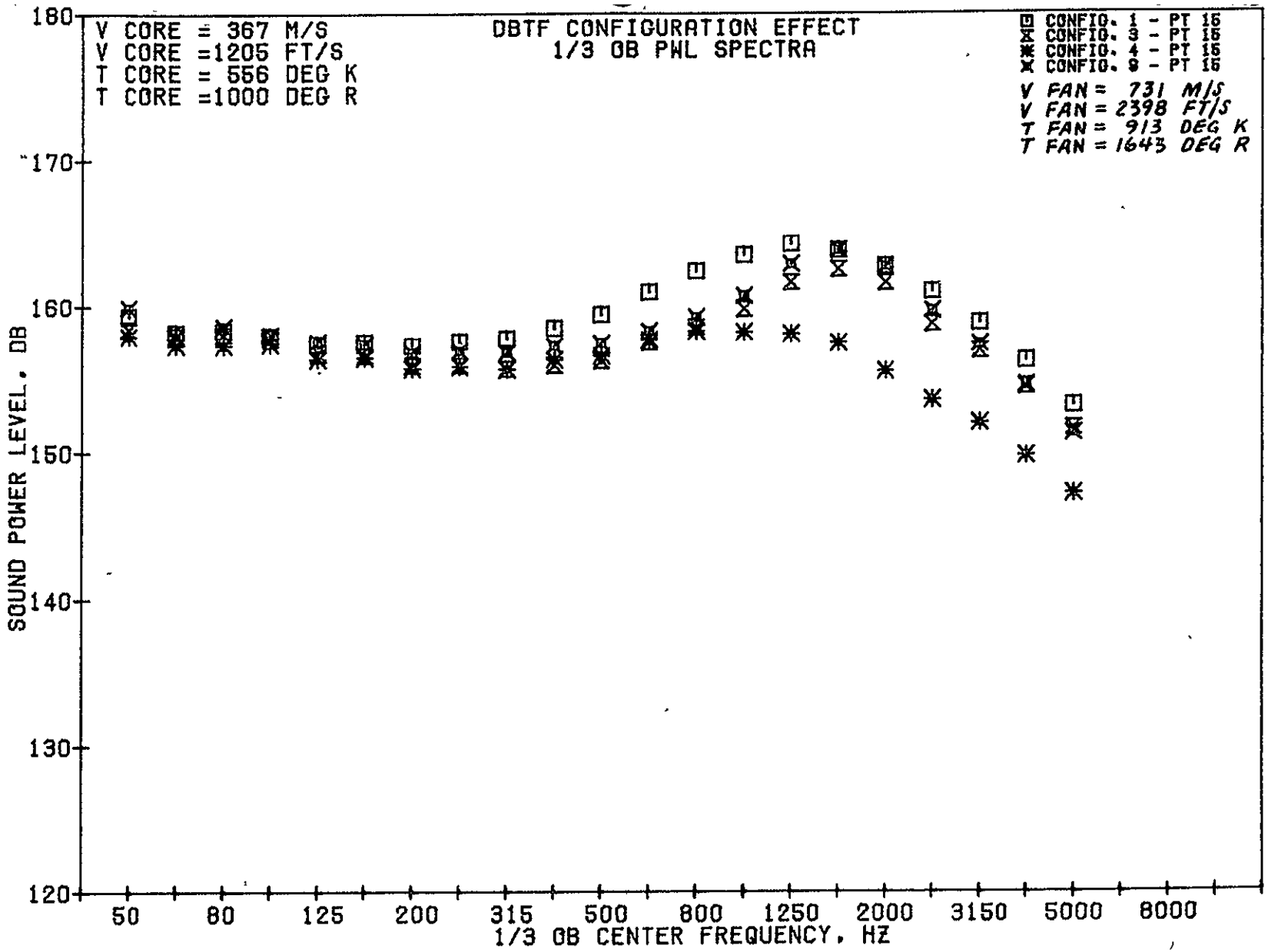

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5R552-001

79 BURCH A.

1295

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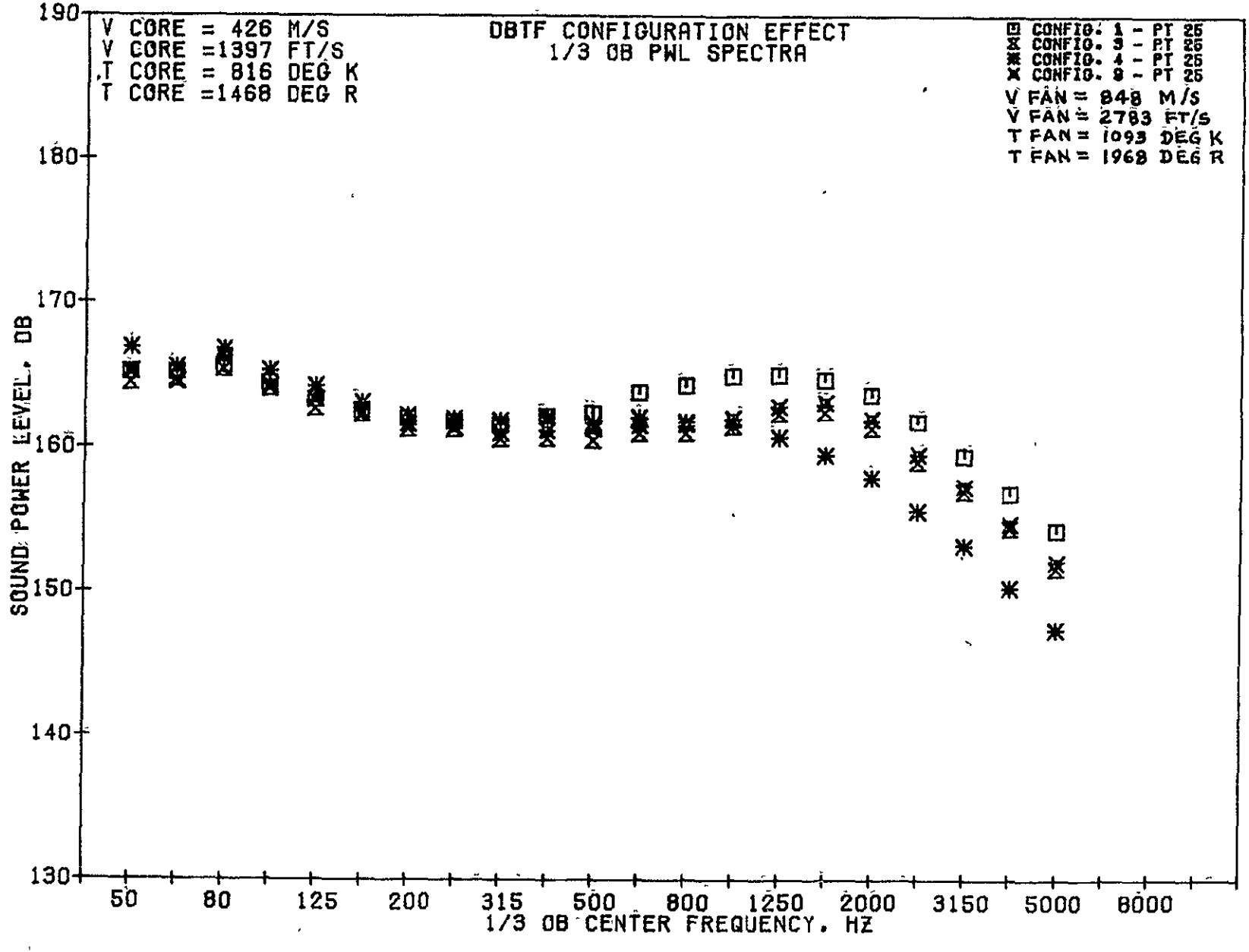

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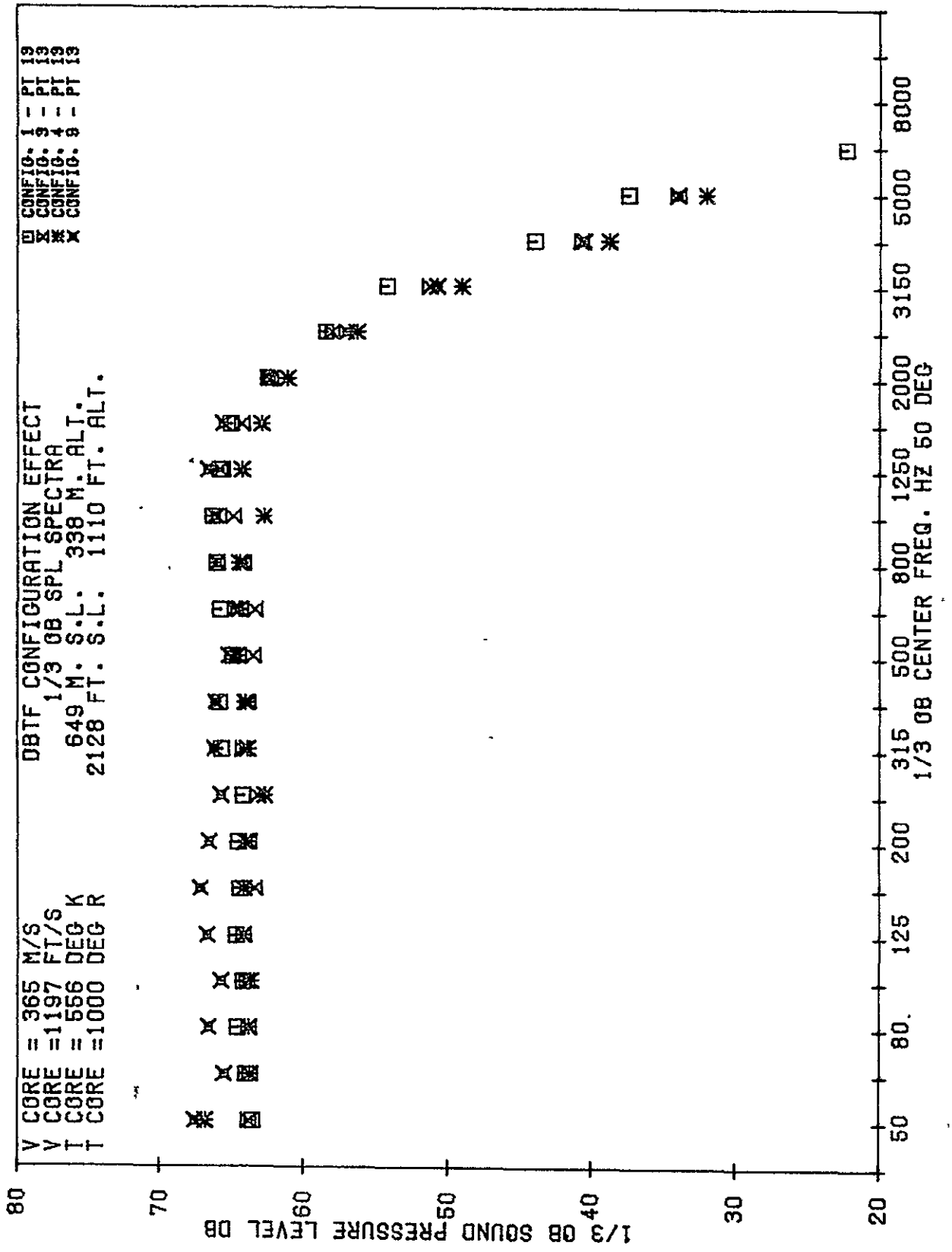
5R006-001

79 BURGH A.

153



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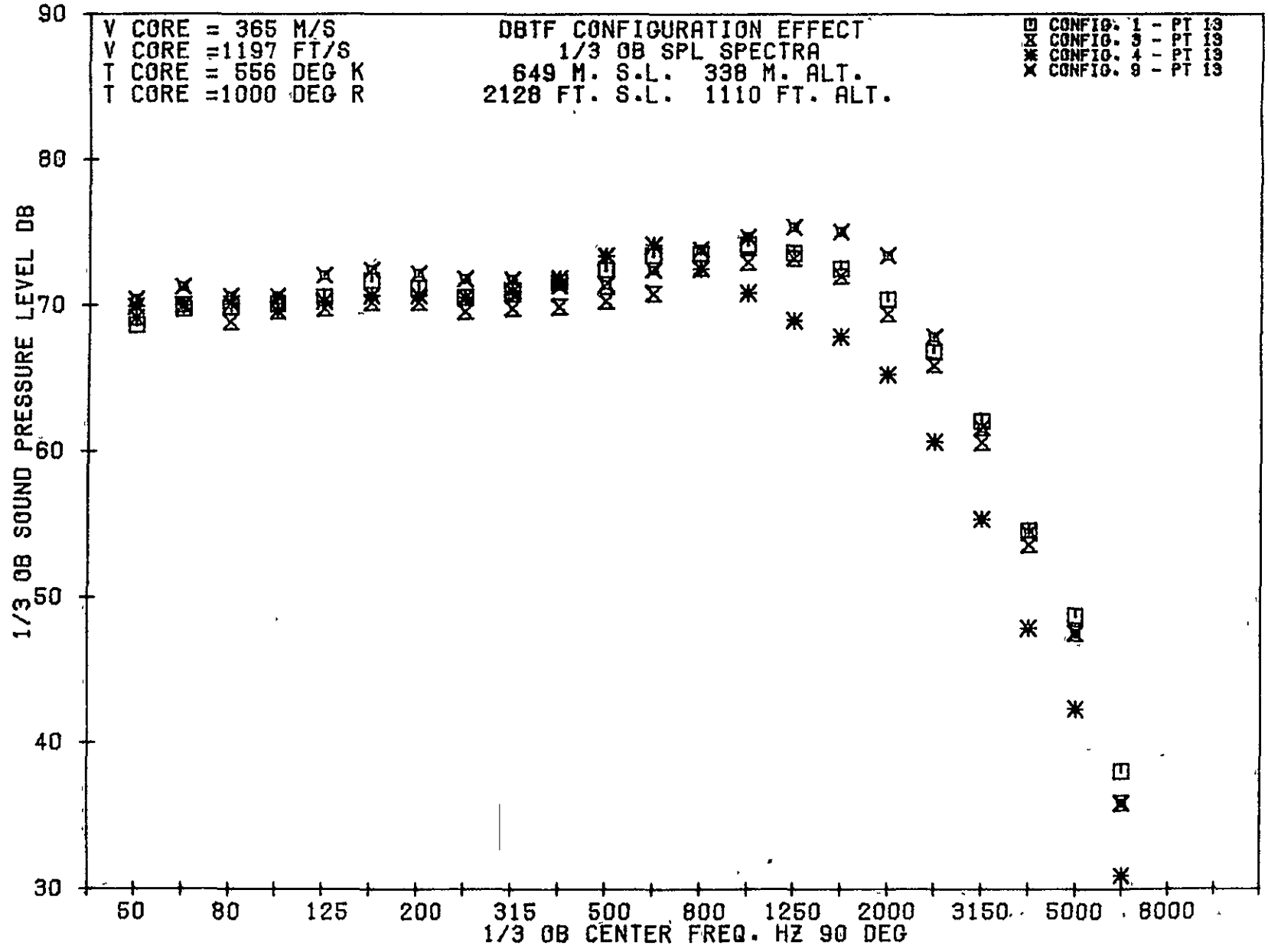
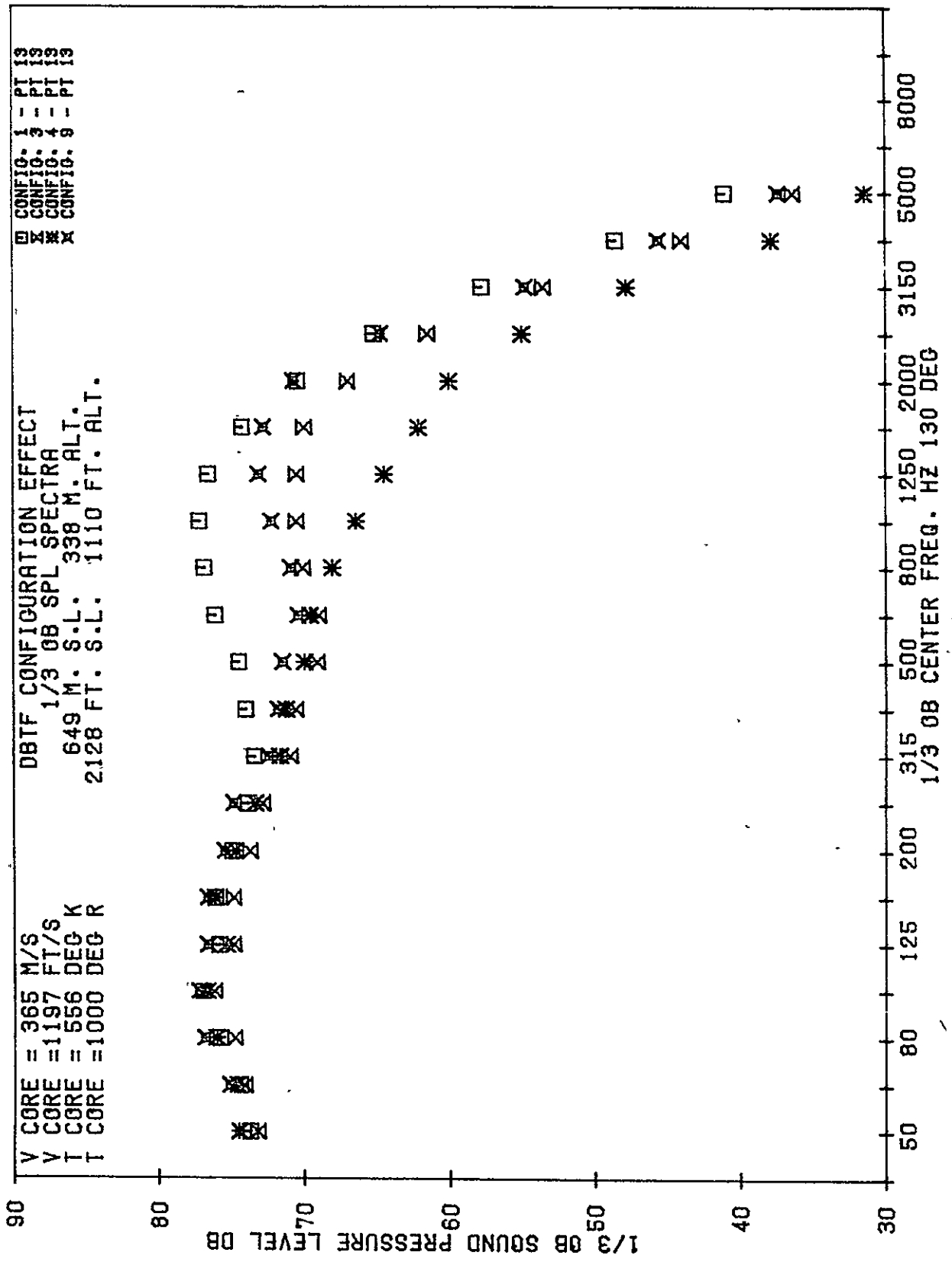
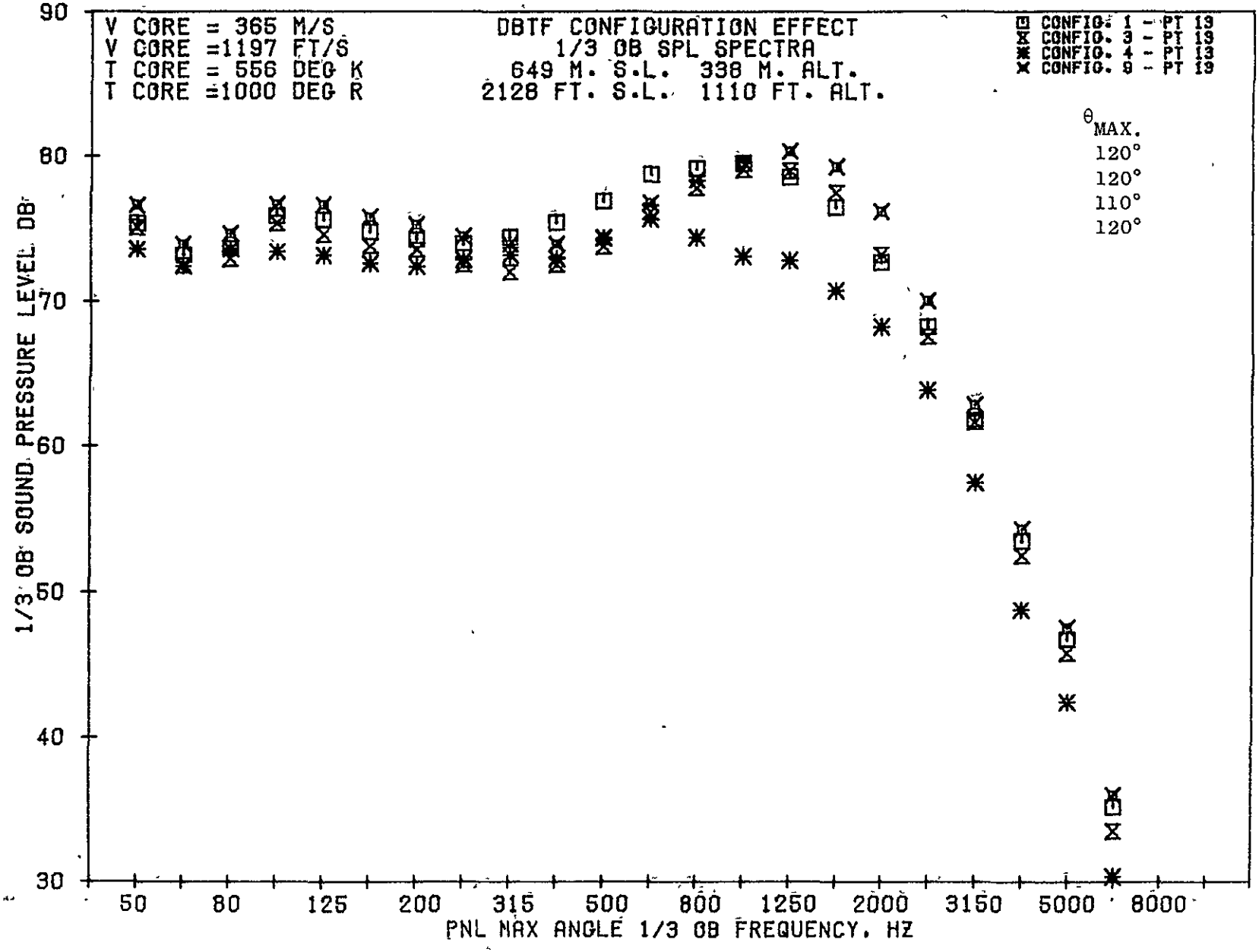

V CORE = 365 M/S
V CORE =1197 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 13
CONFIG. 3 - PT 13
CONFIG. 4 - PT 13
CONFIG. 9 - PT 13
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 90 DEG

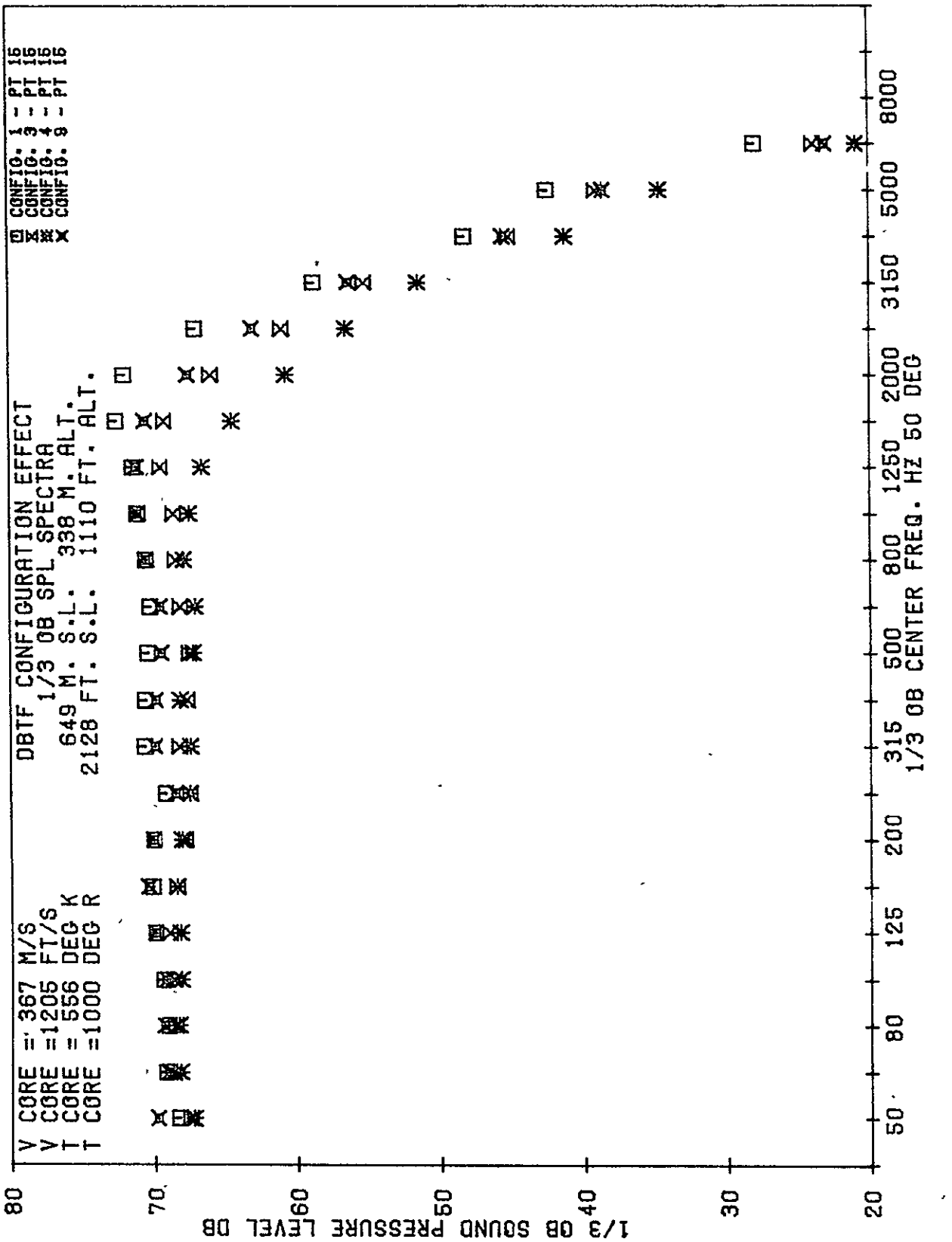
1298

A-35

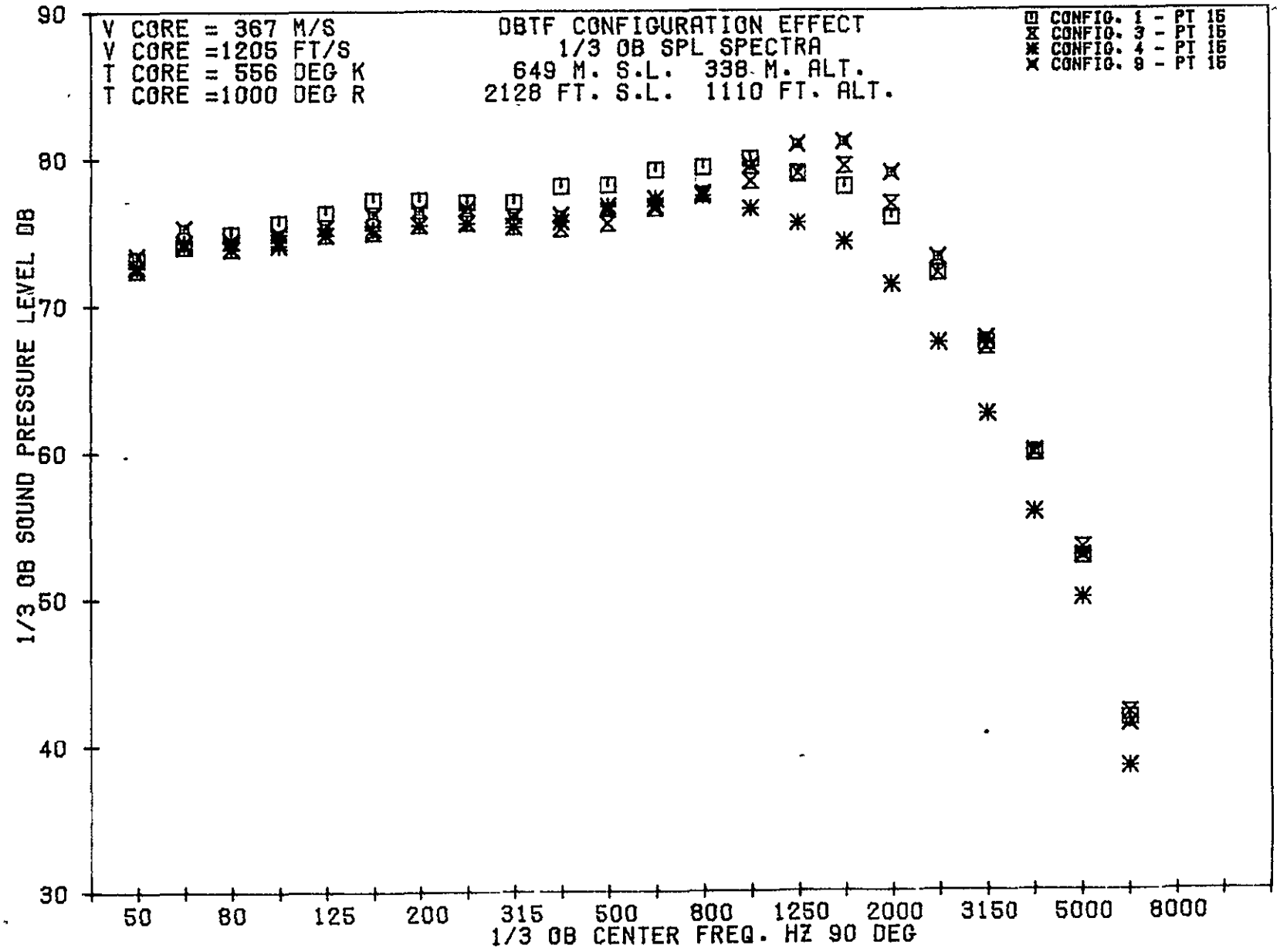


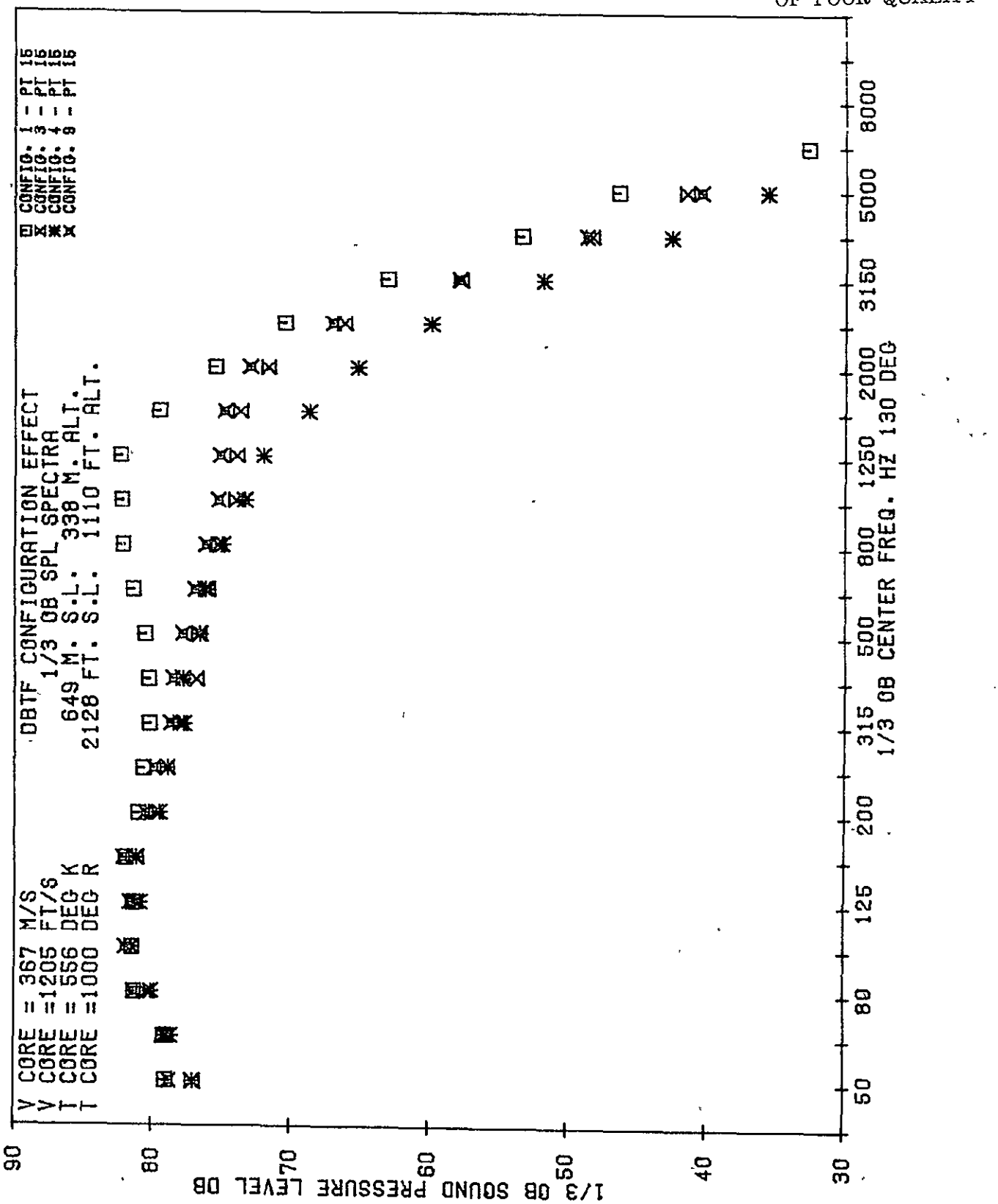

V CORE = 365 M/S
V CORE =1197 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 19
CONFIG. 3 - PT 19
CONFIG. 4 - PT 19
CONFIG. 9 - PT 19
θMAX.
120°
120°
110°
120°
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
PNL MAX ANGLE 1/3 OB FREQUENCY, HZ

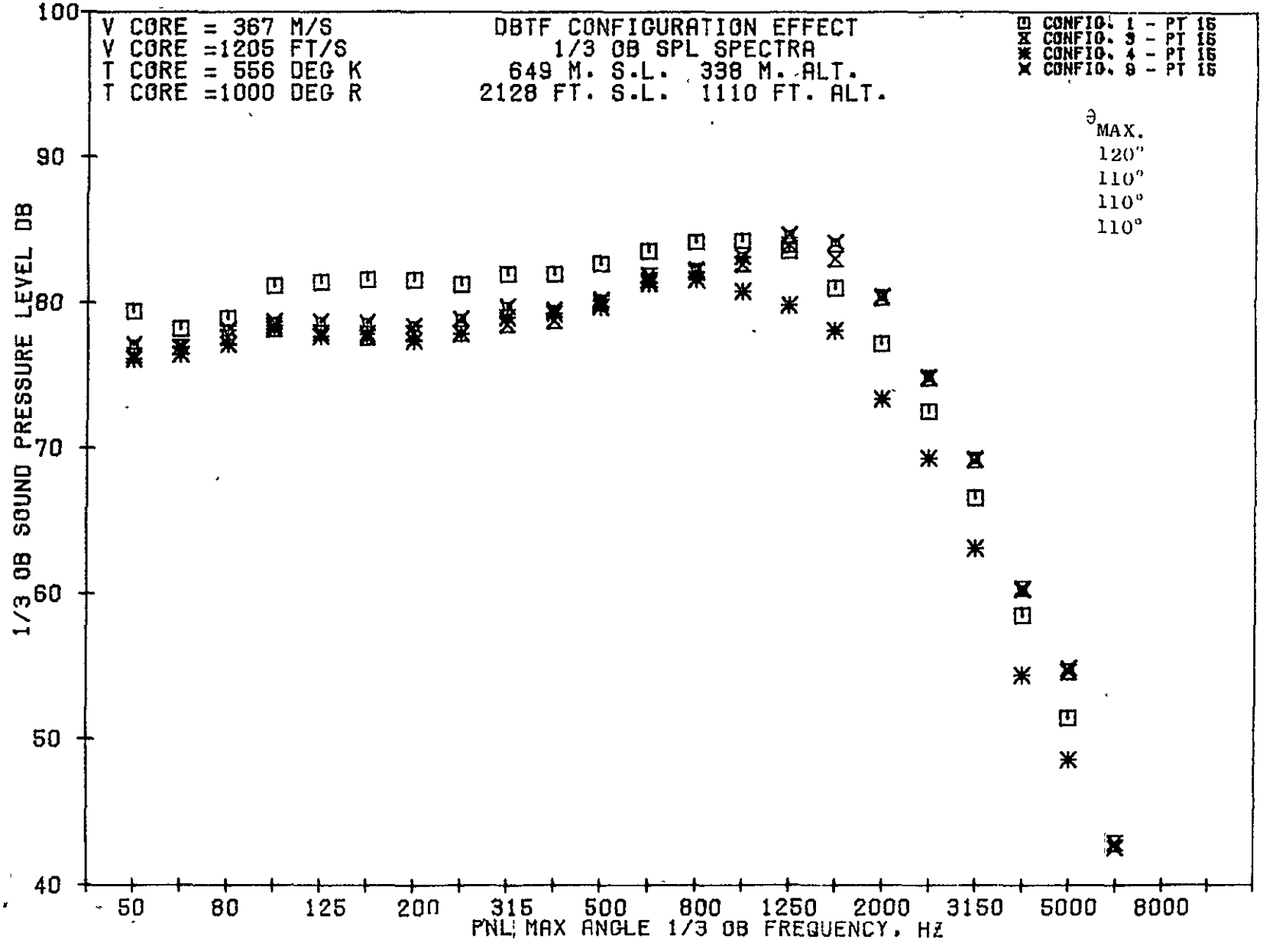
1300


CONFIG. 1 - PT 16
CONFIG. 3 - PT 16
CONFIG. 4 - PT 16
CONFIG. 9 - PT 16
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
V CORE = 367 M/S
V CORE =1205 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
1/3 OB SOUND PRESSURE LEVEL DB
80
70
60
50
40
30
20
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG

4-56

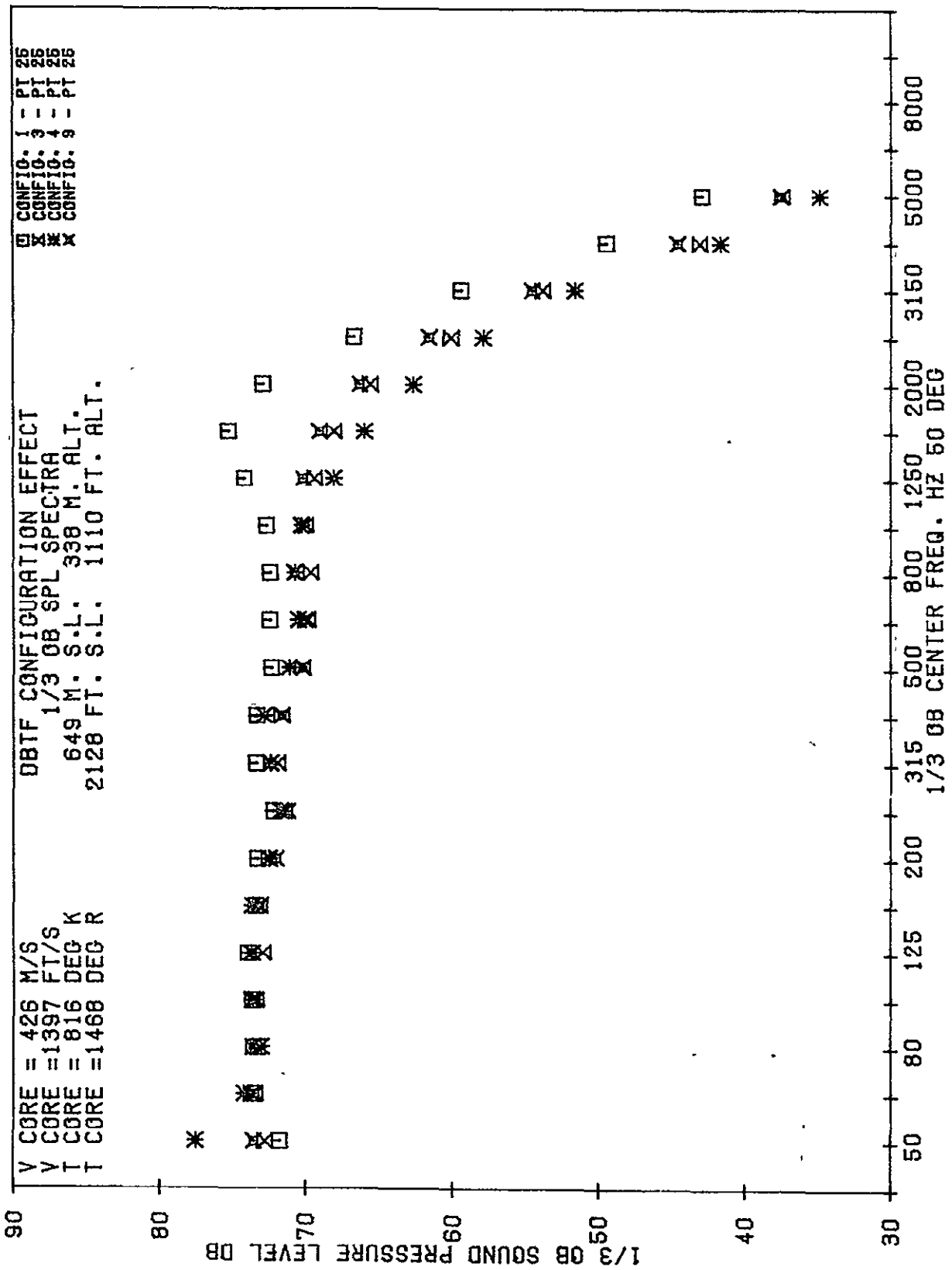

V CORE = 367 M/S
V CORE =1205 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
OBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 15
CONFIG. 3 - PT 15
CONFIG. 4 - PT 15
CONFIG. 9 - PT 15
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 90 DEG



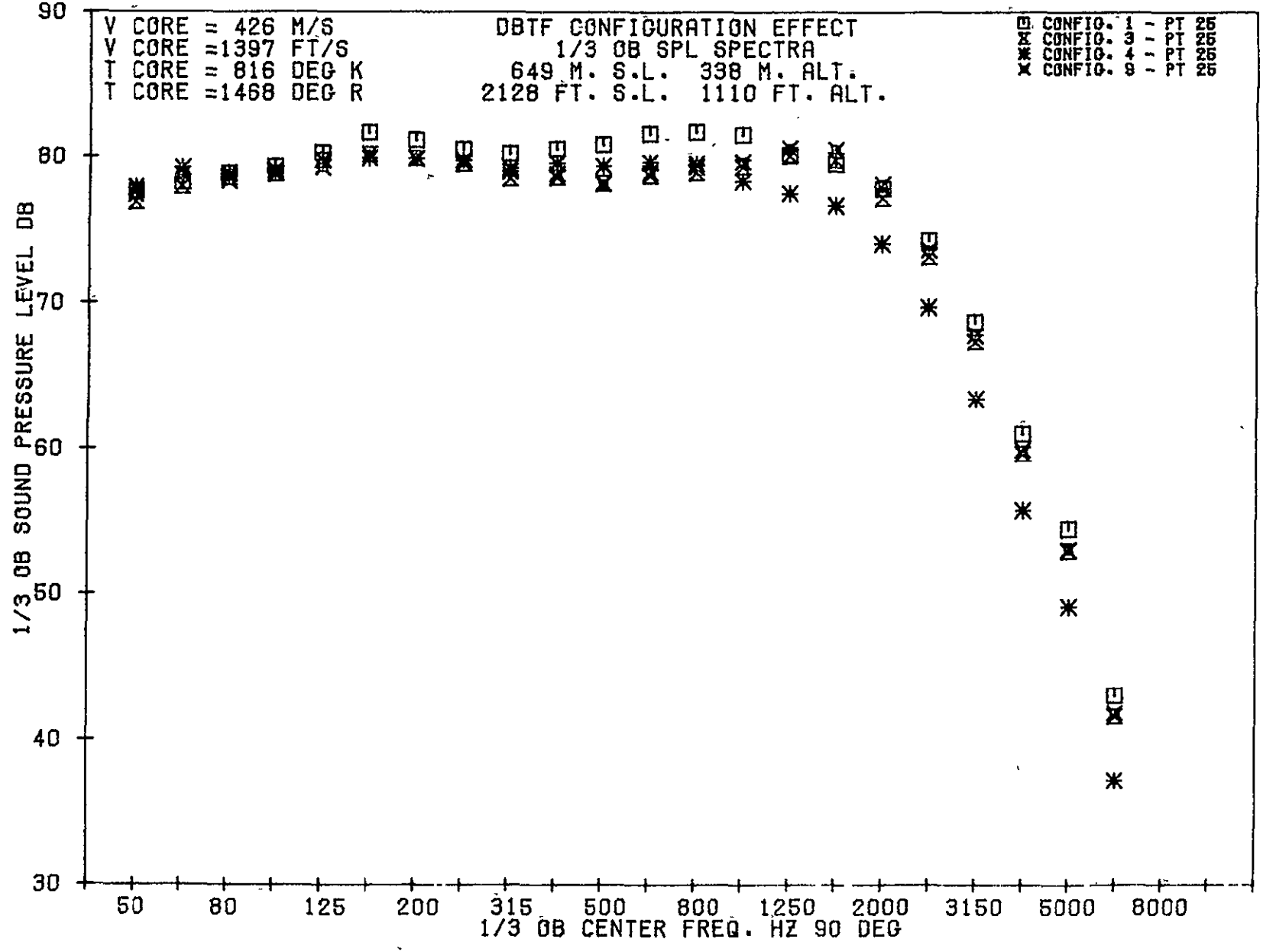

V CORE = 367 M/S
V CORE =1205 FT/S
T CORE = 556 DEG K
T CORE =1000 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 15
CONFIG. 3 - PT 15
CONFIG. 4 - PT 15
CONFIG. 8 - PT 15
∂MAX.
120°
110°
110°
110°
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
PNL MAX ANGLE 1/3 OB FREQUENCY, HZ

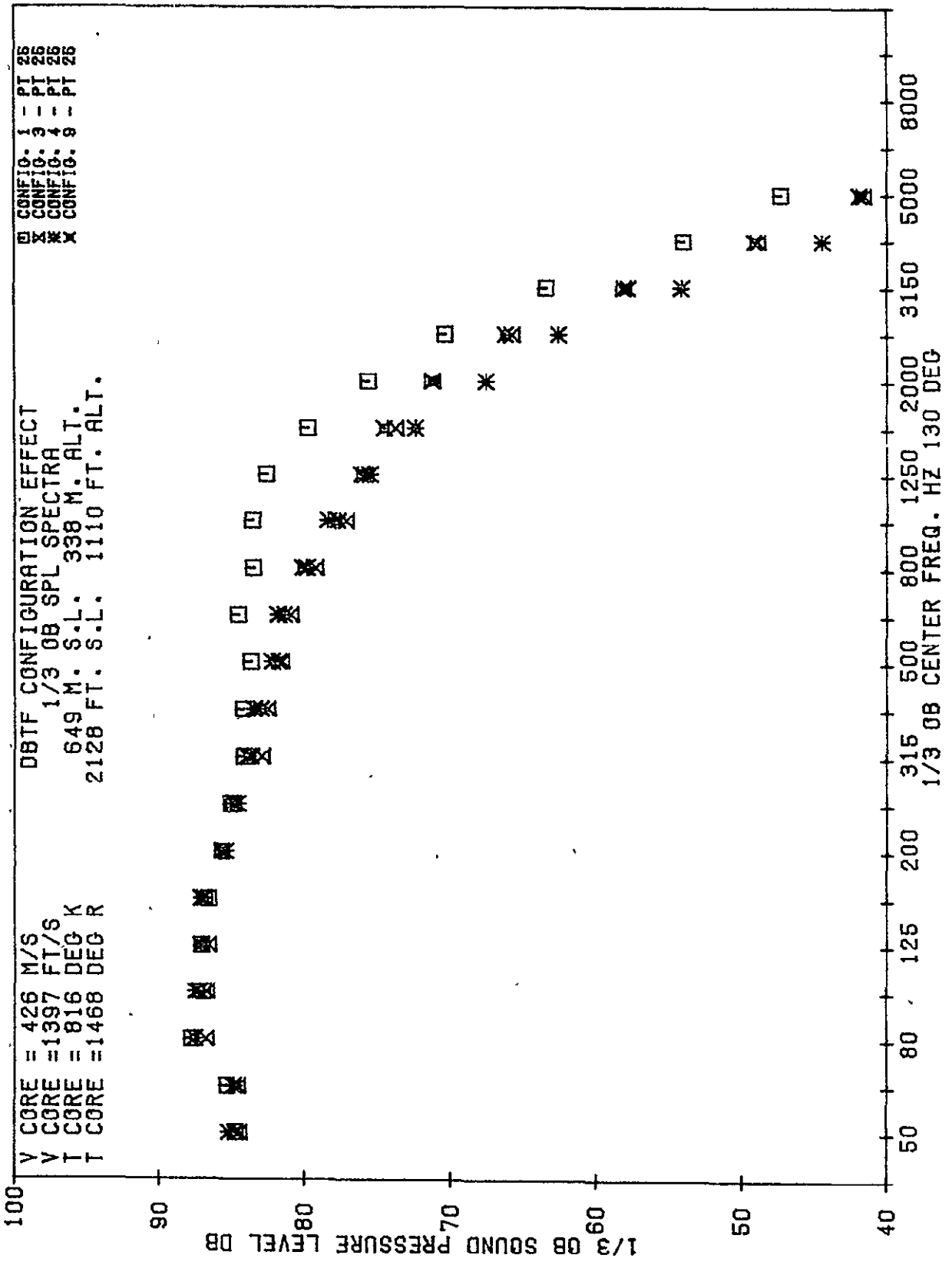
1304

4-121


CONFIG. 1 - PT 25
CONFIG. 3 - PT 25
CONFIG. 4 - PT 25
CONFIG. 9 - PT 25
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
V CORE = 426 M/S
V CORE =1397 FT/S
T CORE = 816 DEG K
T CORE =1468 DEG R
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 50 DEG

46


V CORE = 426 M/S
V CORE =1397 FT/S
T CORE = 816 DEG K
T CORE =1468 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 25
CONFIG. 3 - PT 25
CONFIG. 4 - PT 25
CONFIG. 8 - PT 25
1/3 OB SOUND PRESSURE LEVEL DB
90
80
70
60
50
40
30
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
1/3 OB CENTER FREQ. HZ 90 DEG



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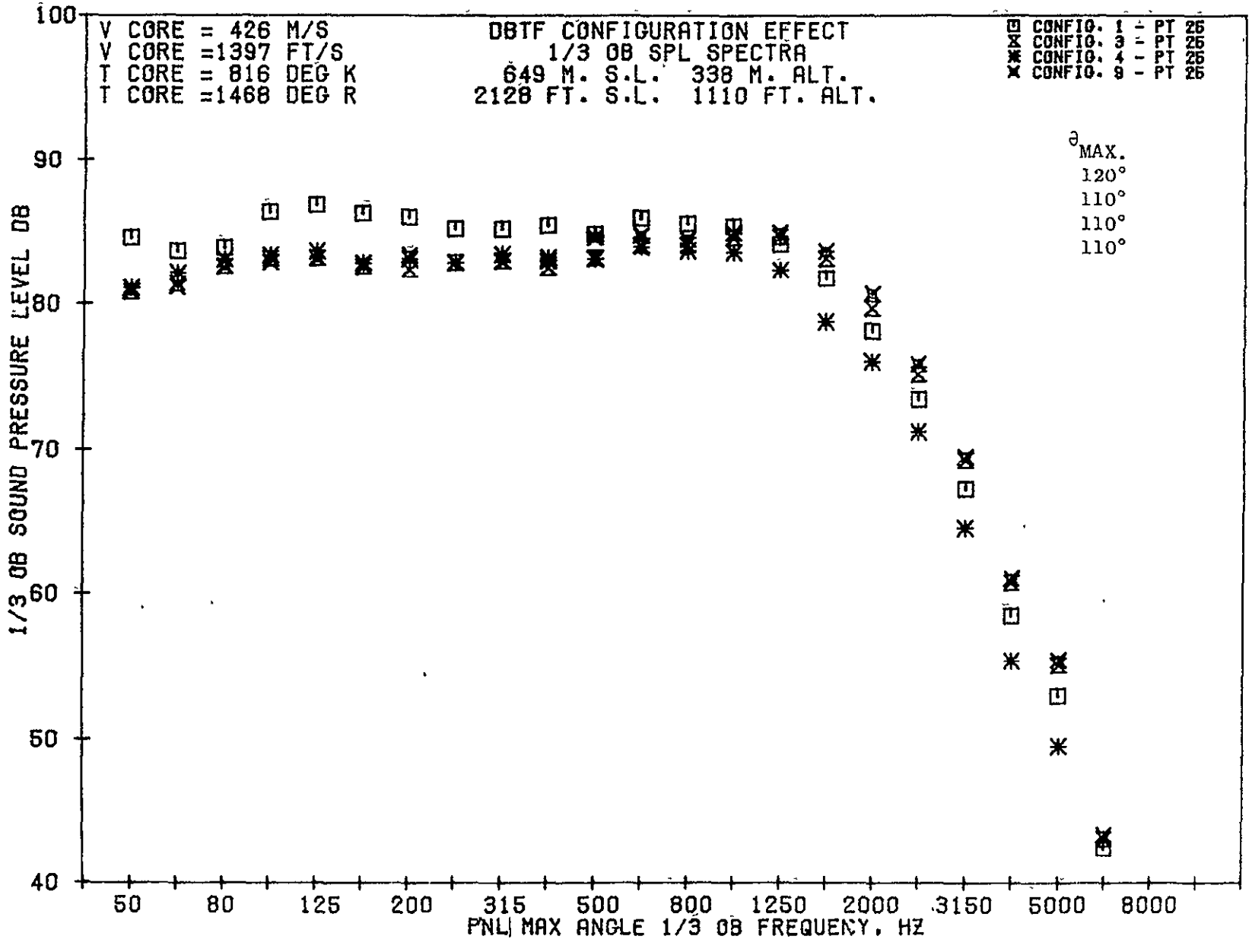
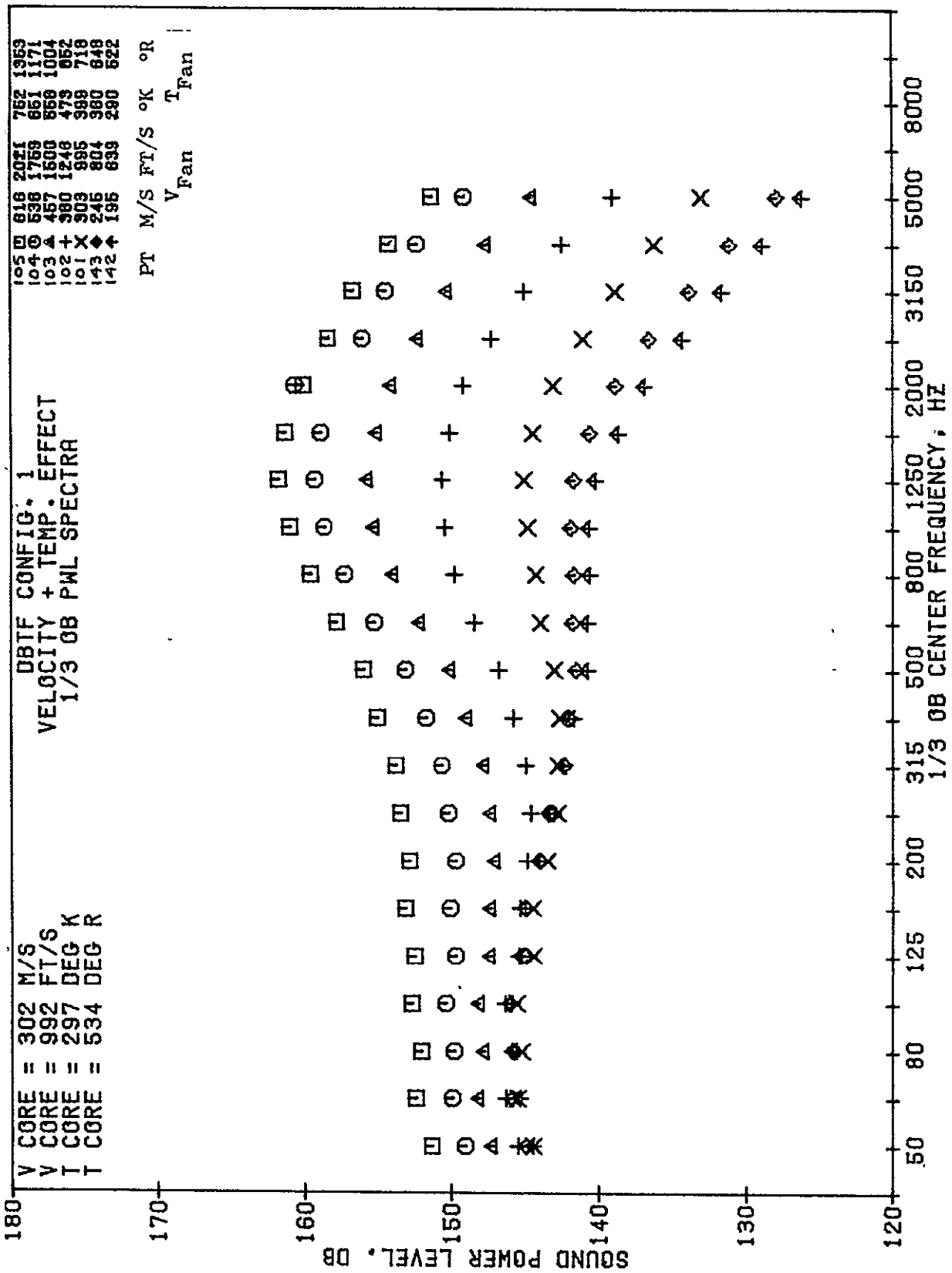
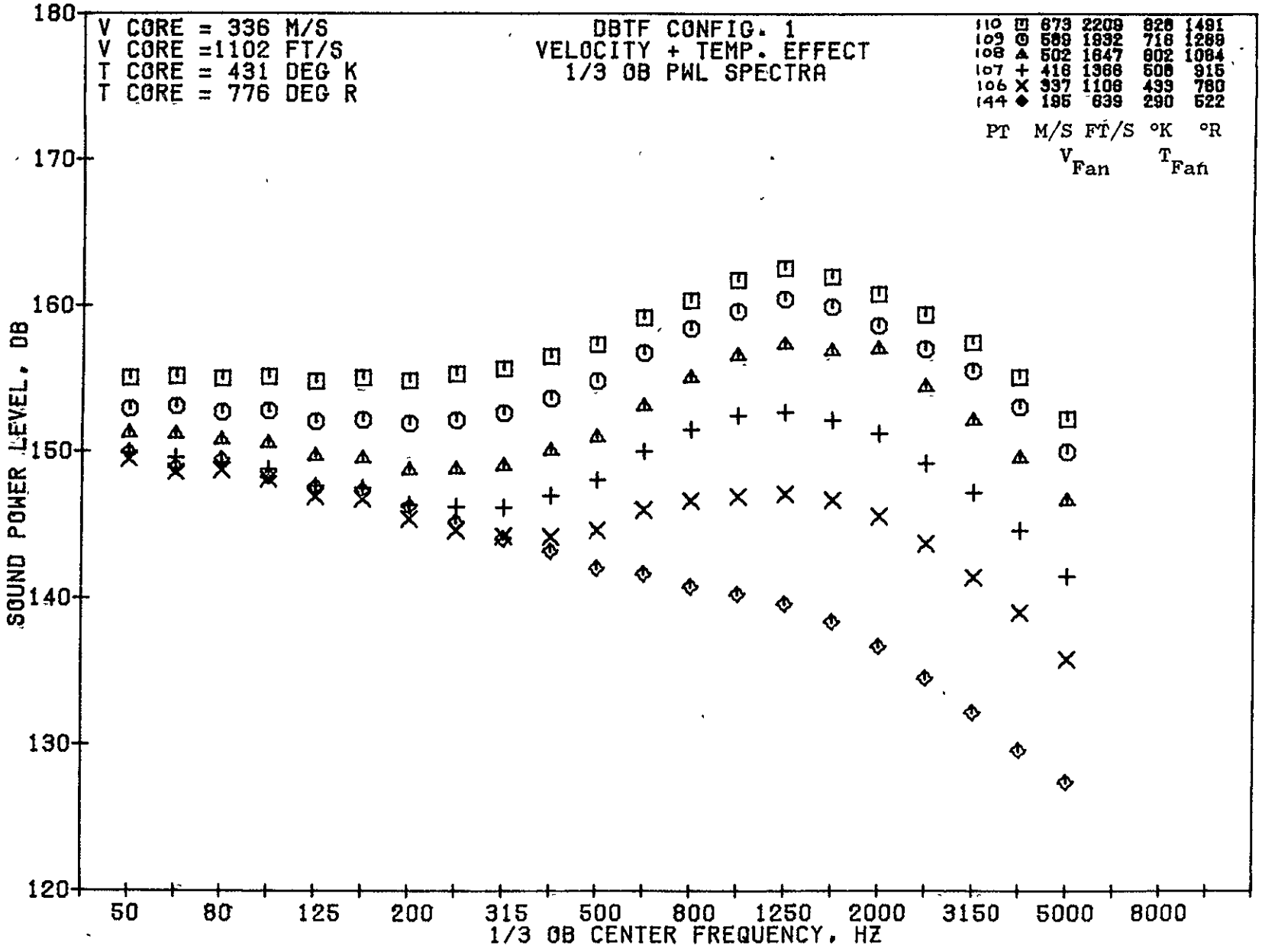

V CORE = 426 M/S
V CORE =1397 FT/S
T CORE = 816 DEG K
T CORE =1468 DEG R
DBTF CONFIGURATION EFFECT
1/3 OB SPL SPECTRA
649 M. S.L. 338 M. ALT.
2128 FT. S.L. 1110 FT. ALT.
CONFIG. 1 - PT 25
CONFIG. 3 - PT 25
CONFIG. 4 - PT 25
CONFIG. 9 - PT 25
θMAX.
120°
110°
110°
110°
1/3 OB SOUND PRESSURE LEVEL DB
100
90
80
70
60
50
40
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
PNL MAX ANGLE 1/3 OB FREQUENCY, HZ

1308

4.2 ACOUSTIC DATA PLOTS FOR A FULL SIZE ENGINE UTILIZING A SCALE FACTOR OF 8





1310

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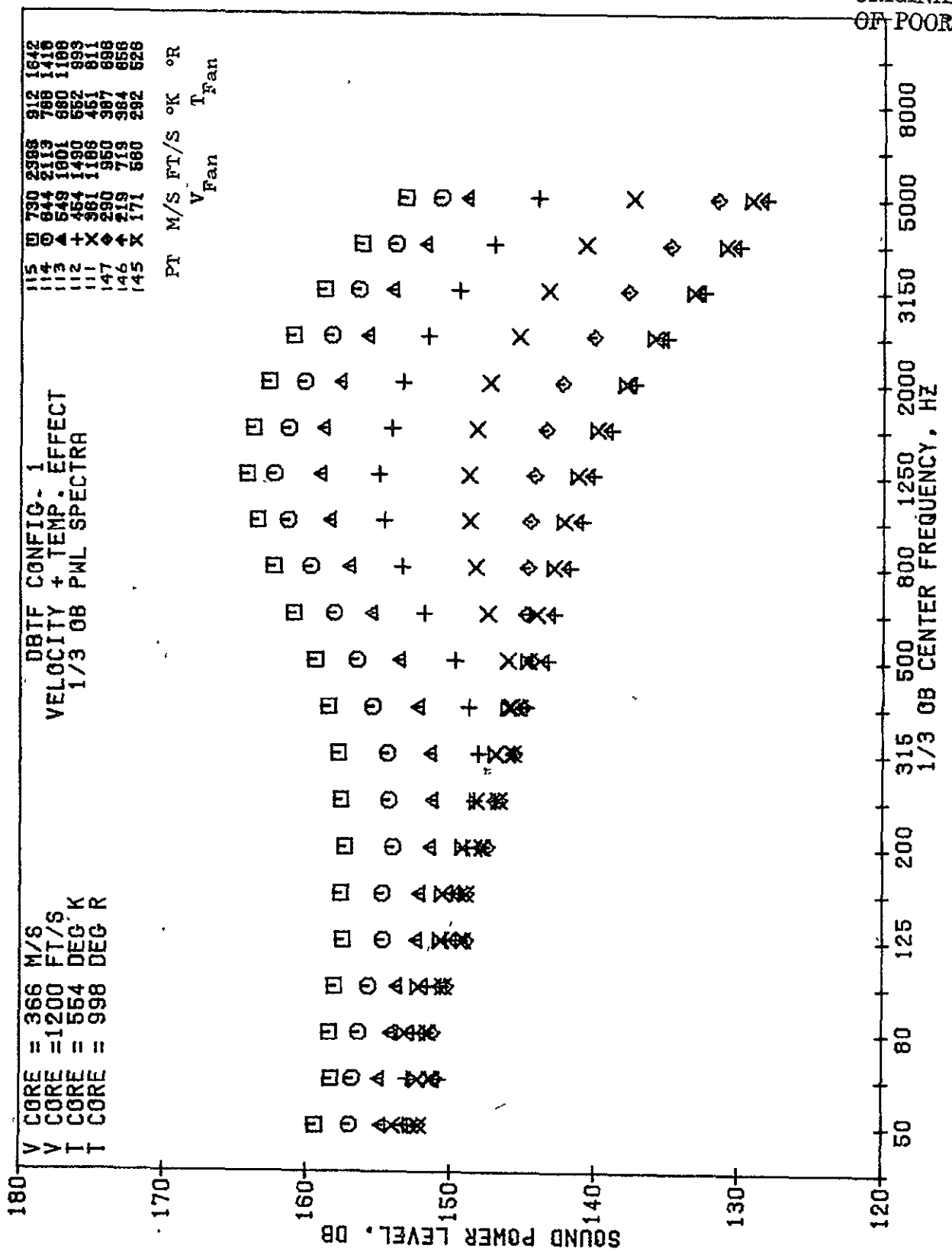

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5R031-001

79 BURCH A.

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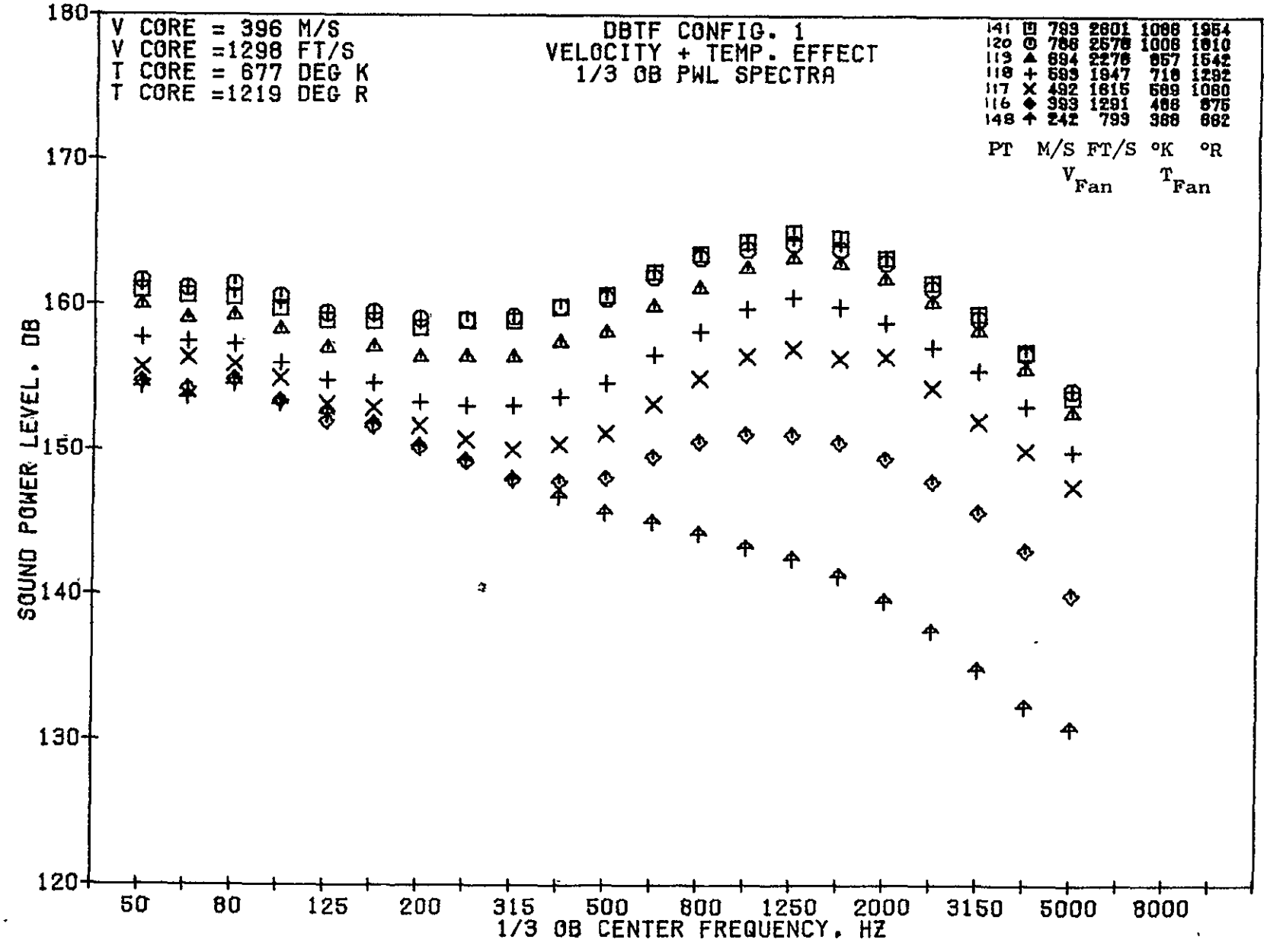

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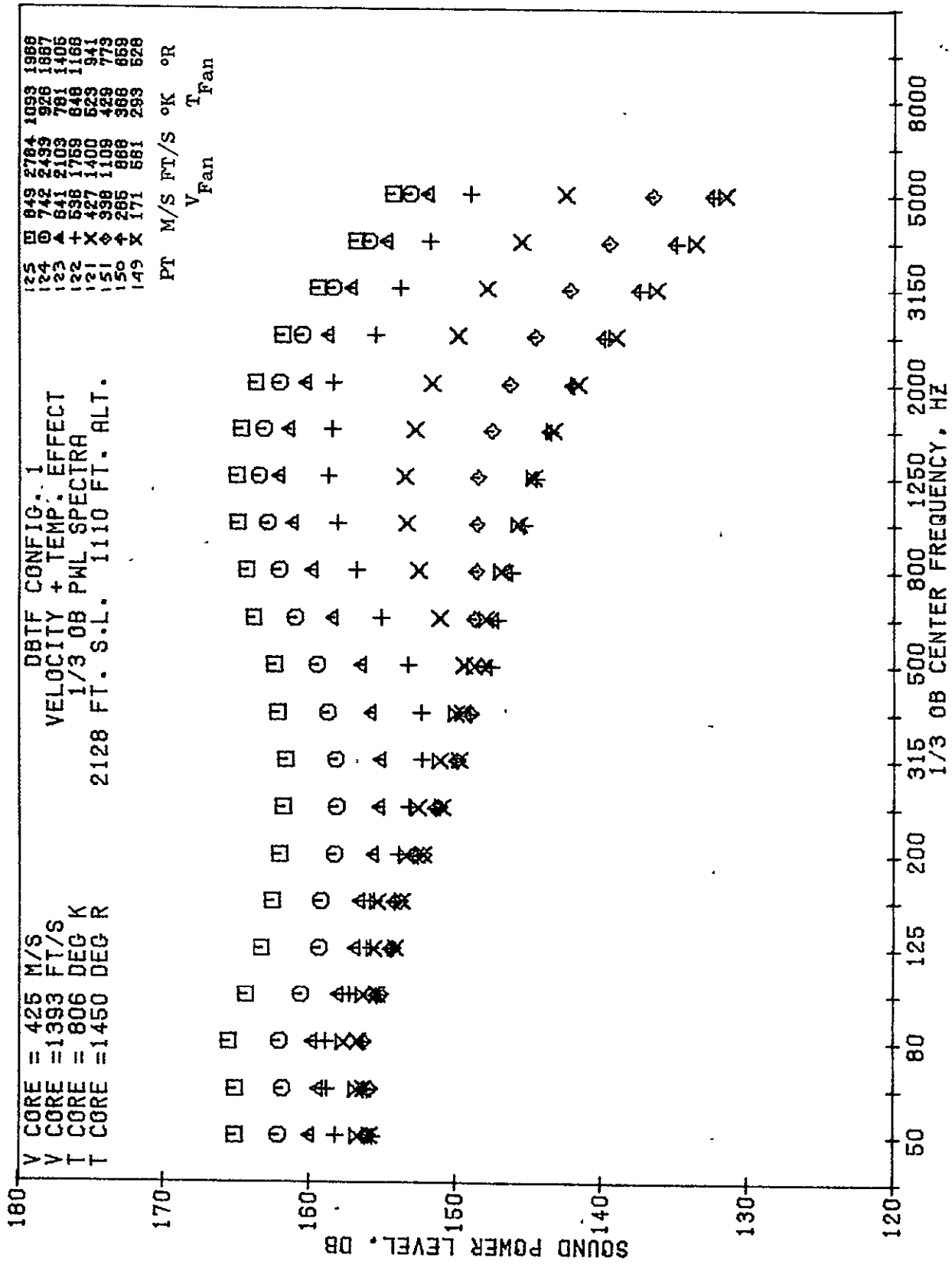
5R031-001



79 BURCH A.

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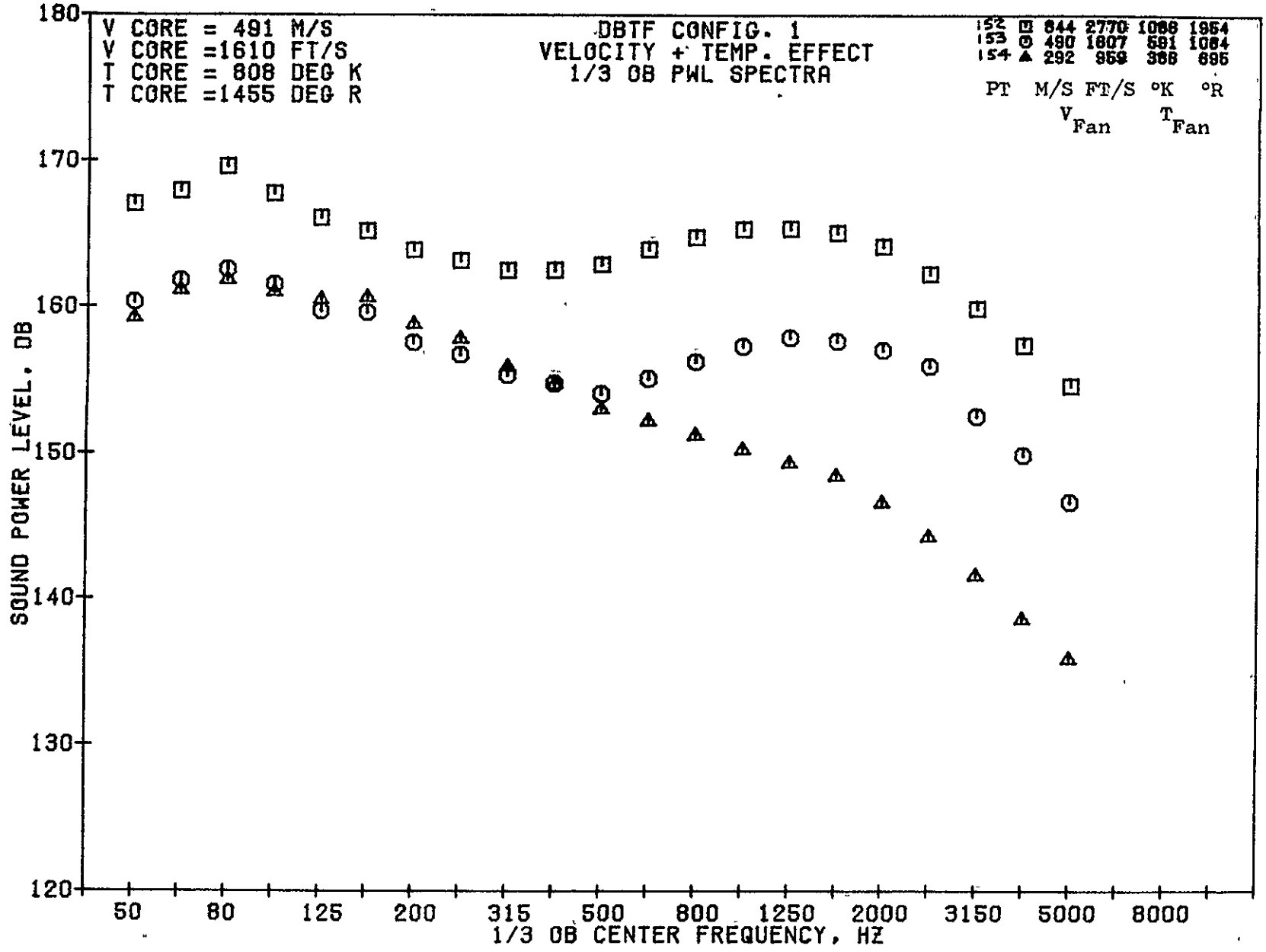
5R266-001

486



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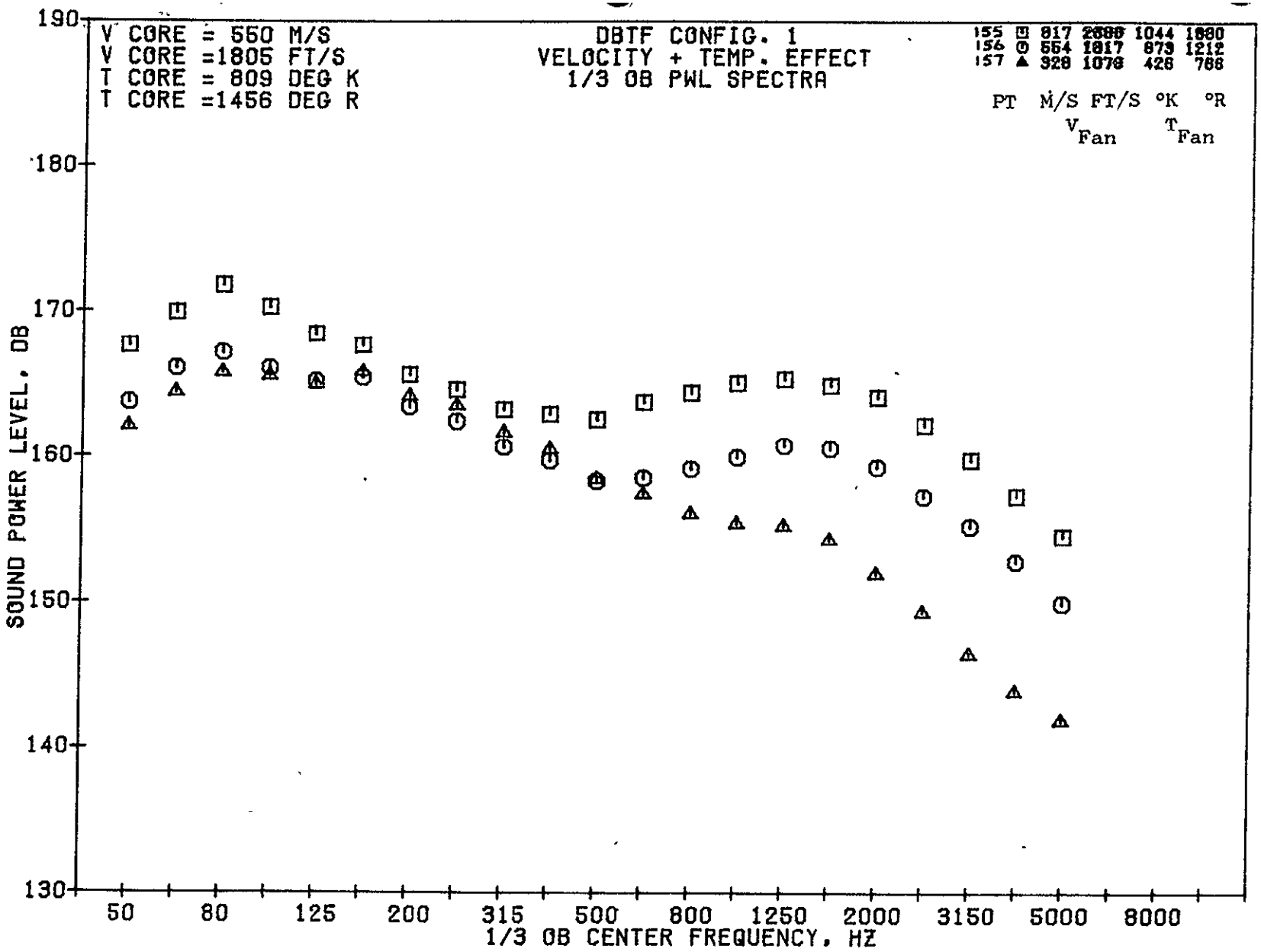
08/13/75
5R031-001



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5R031-001

79 BURCH A.

1315

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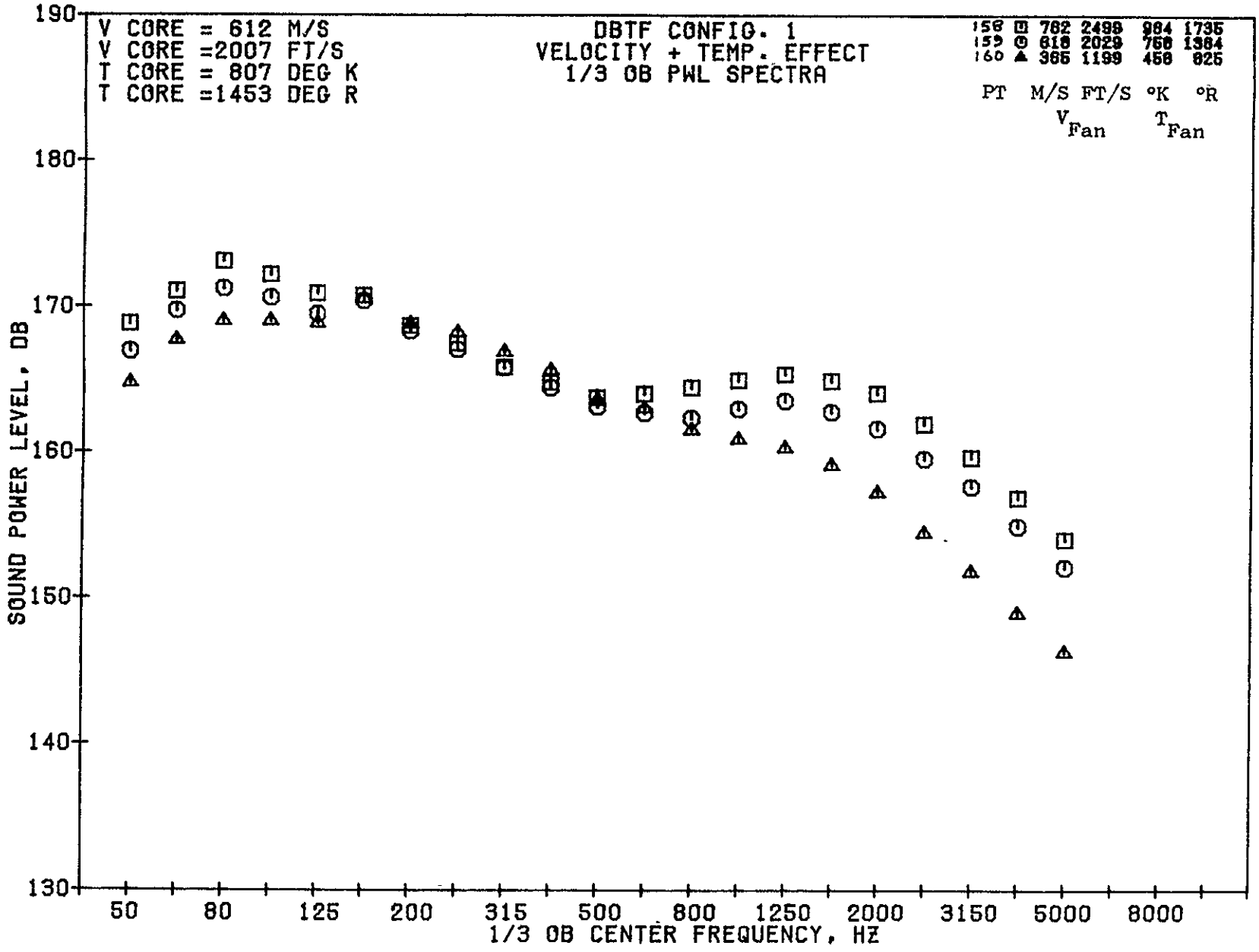

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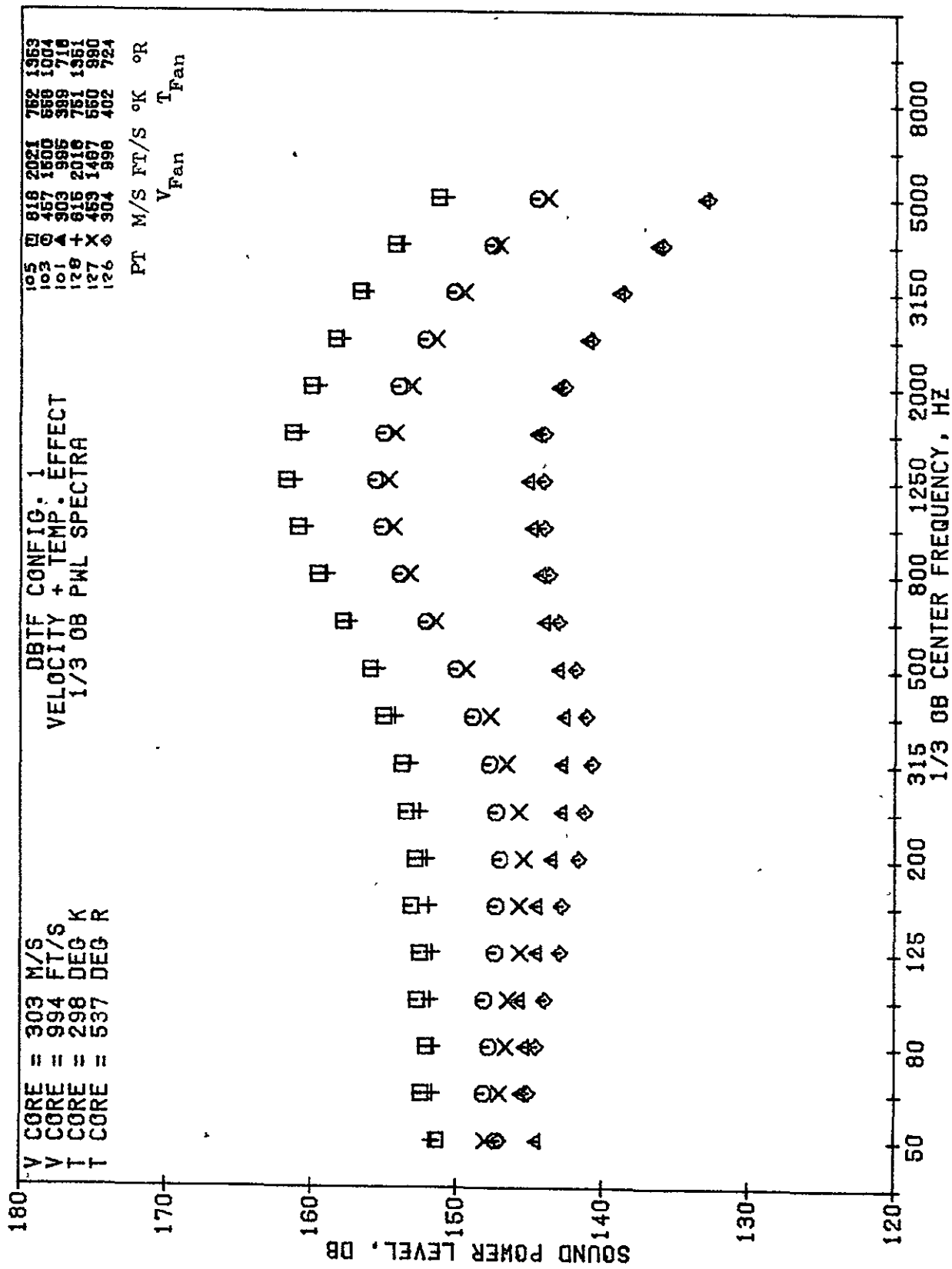
5R031-001



79 BURCH A.

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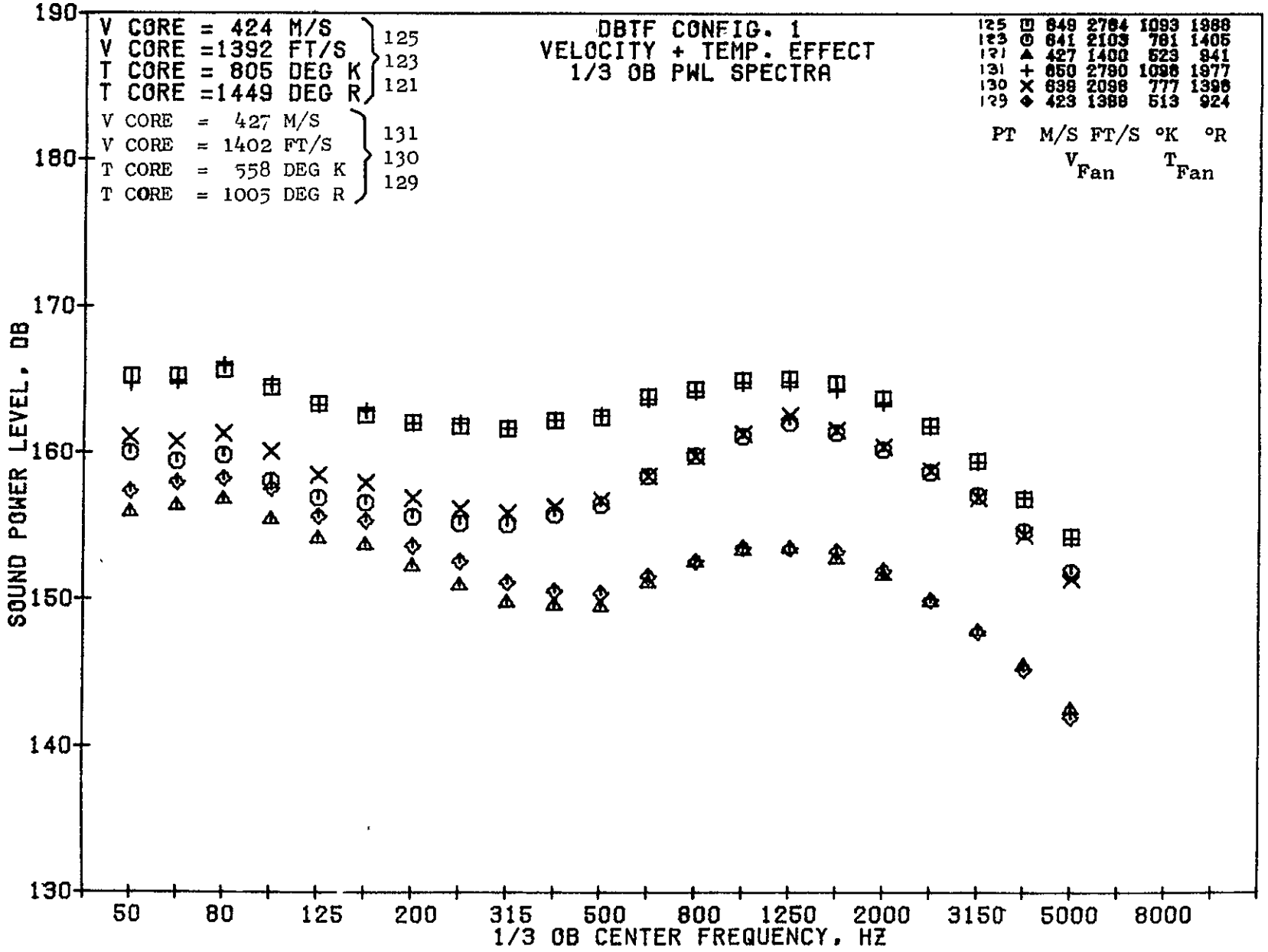
5R031-001

490



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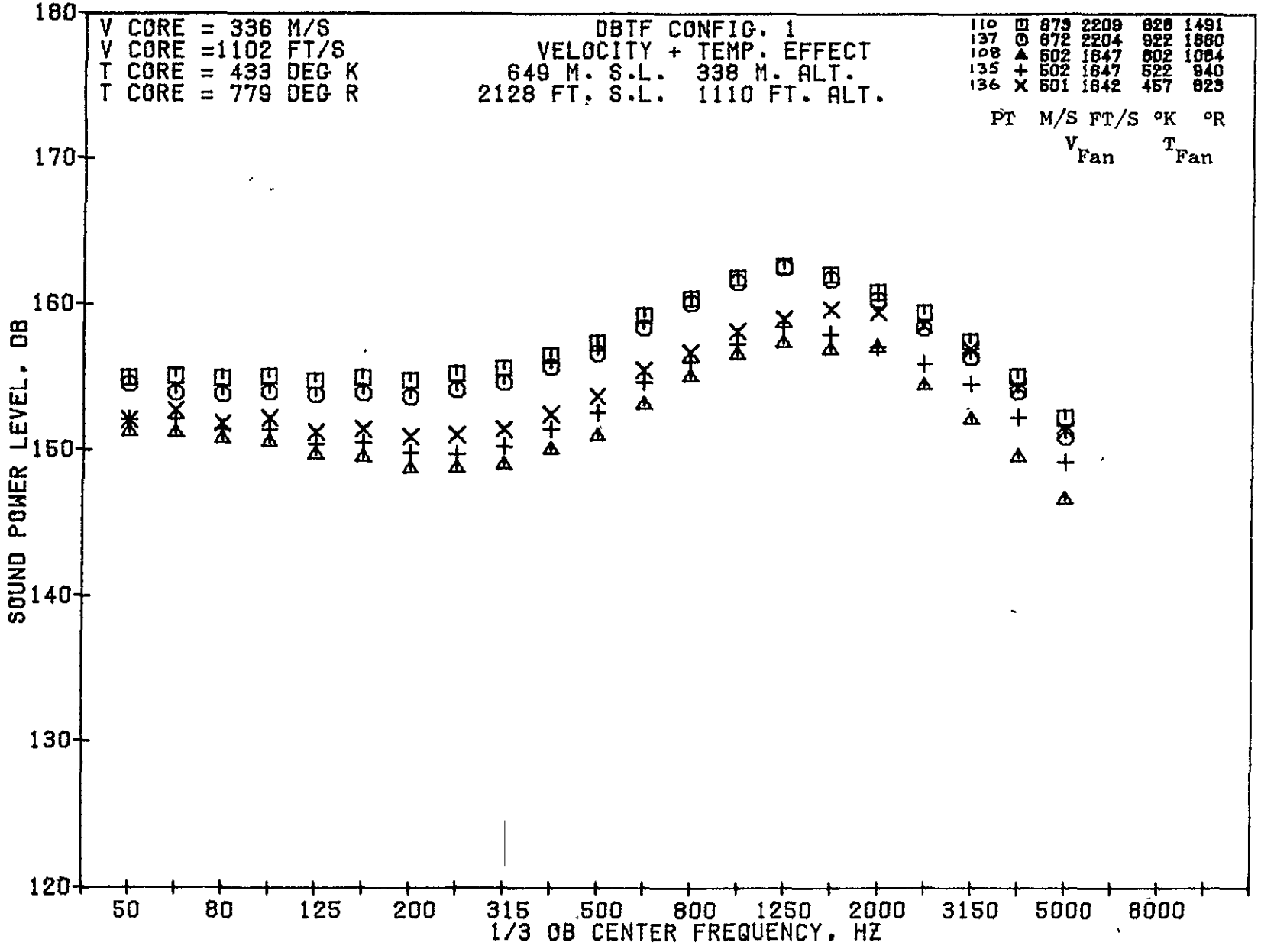
5R031-001

08/13/75
5R031-001

79 BURCH



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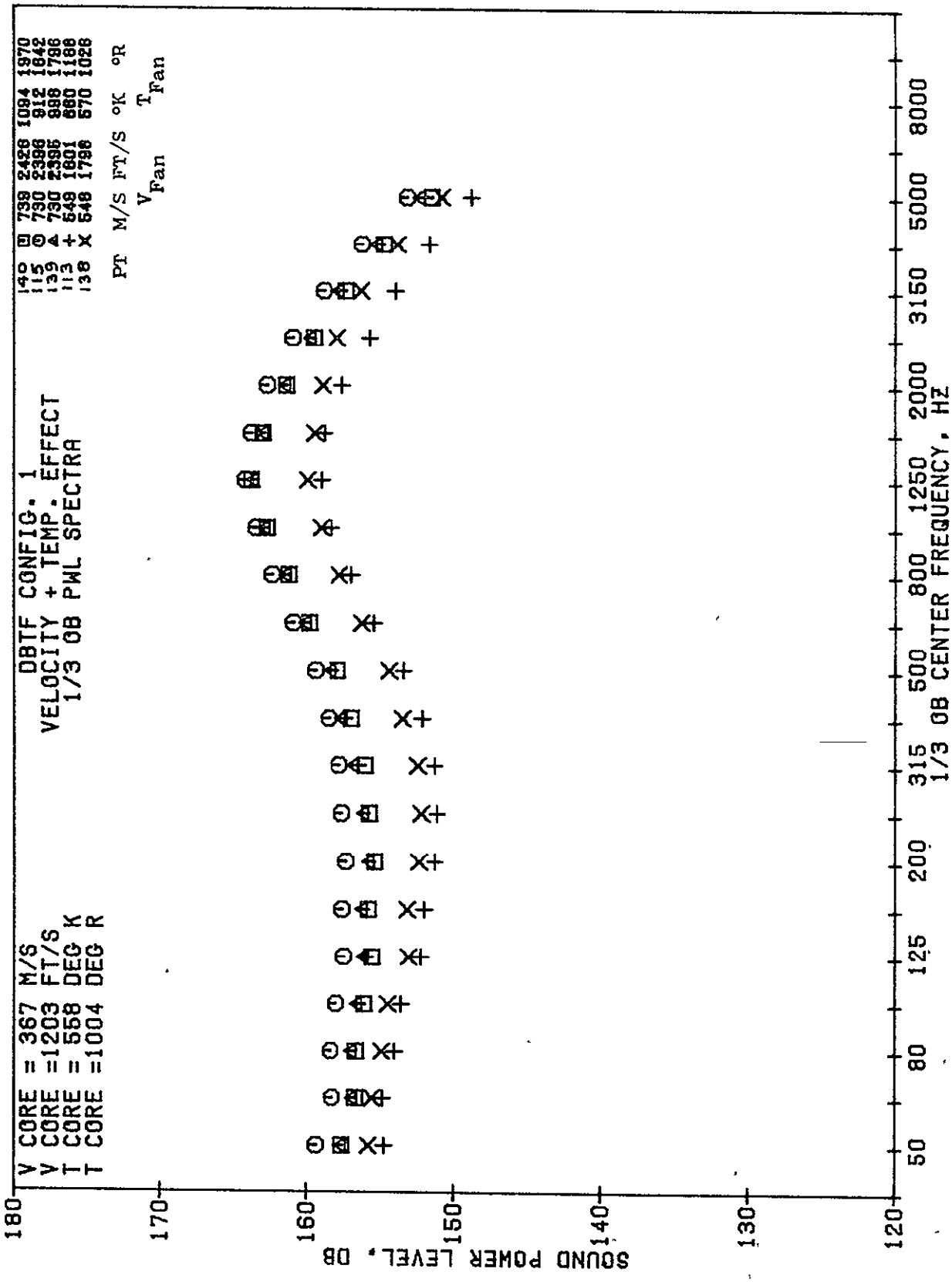

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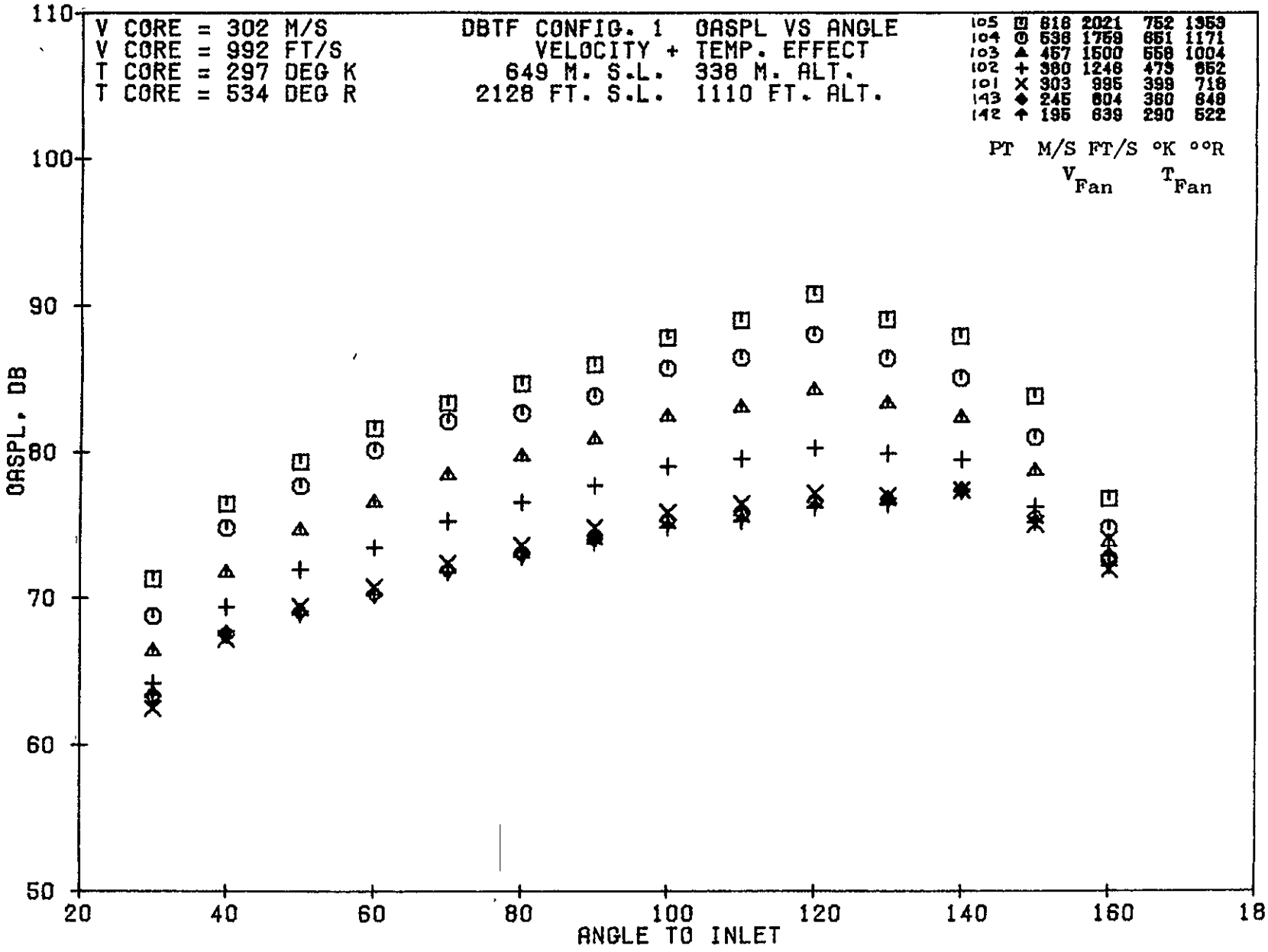

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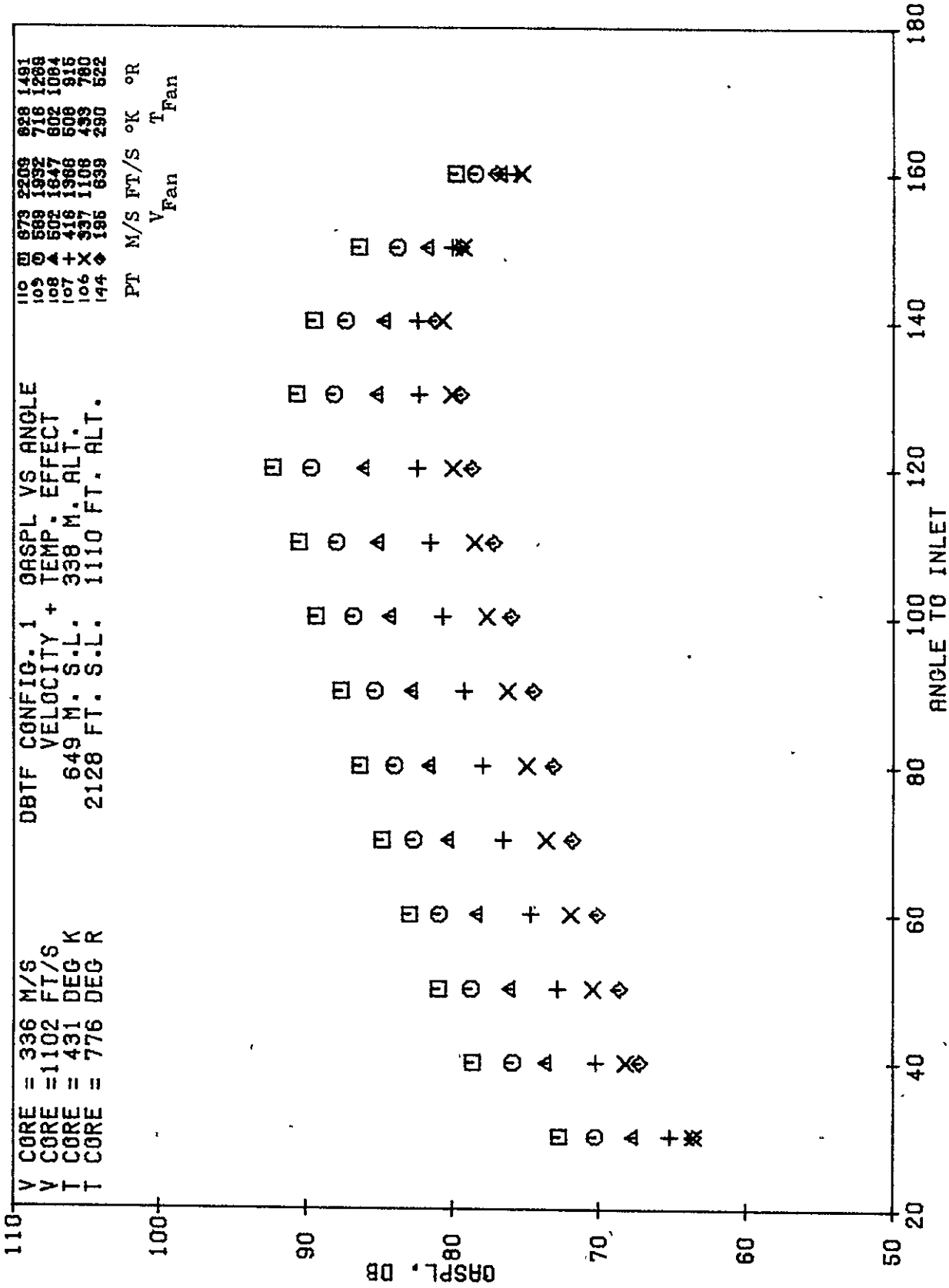

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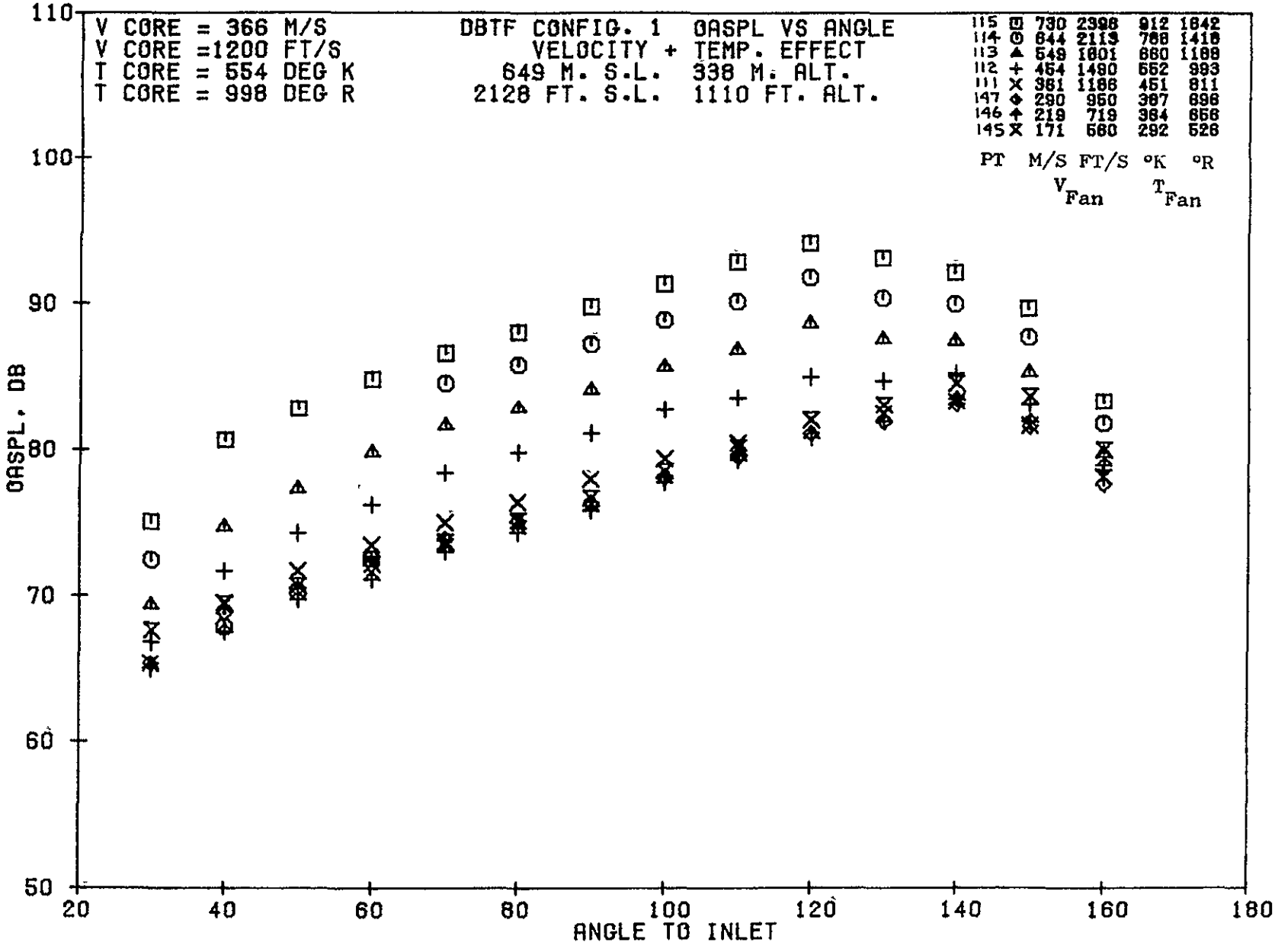

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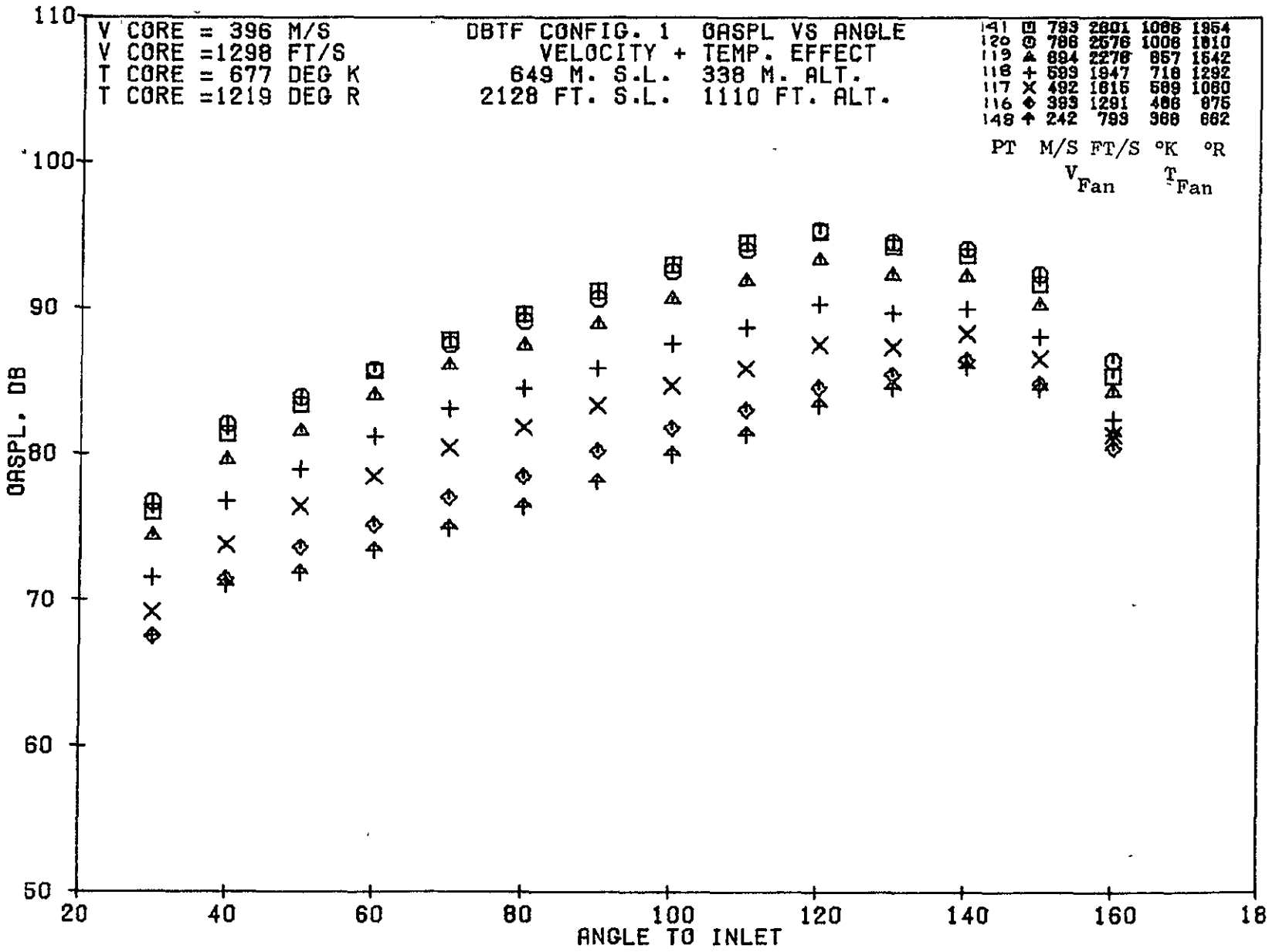

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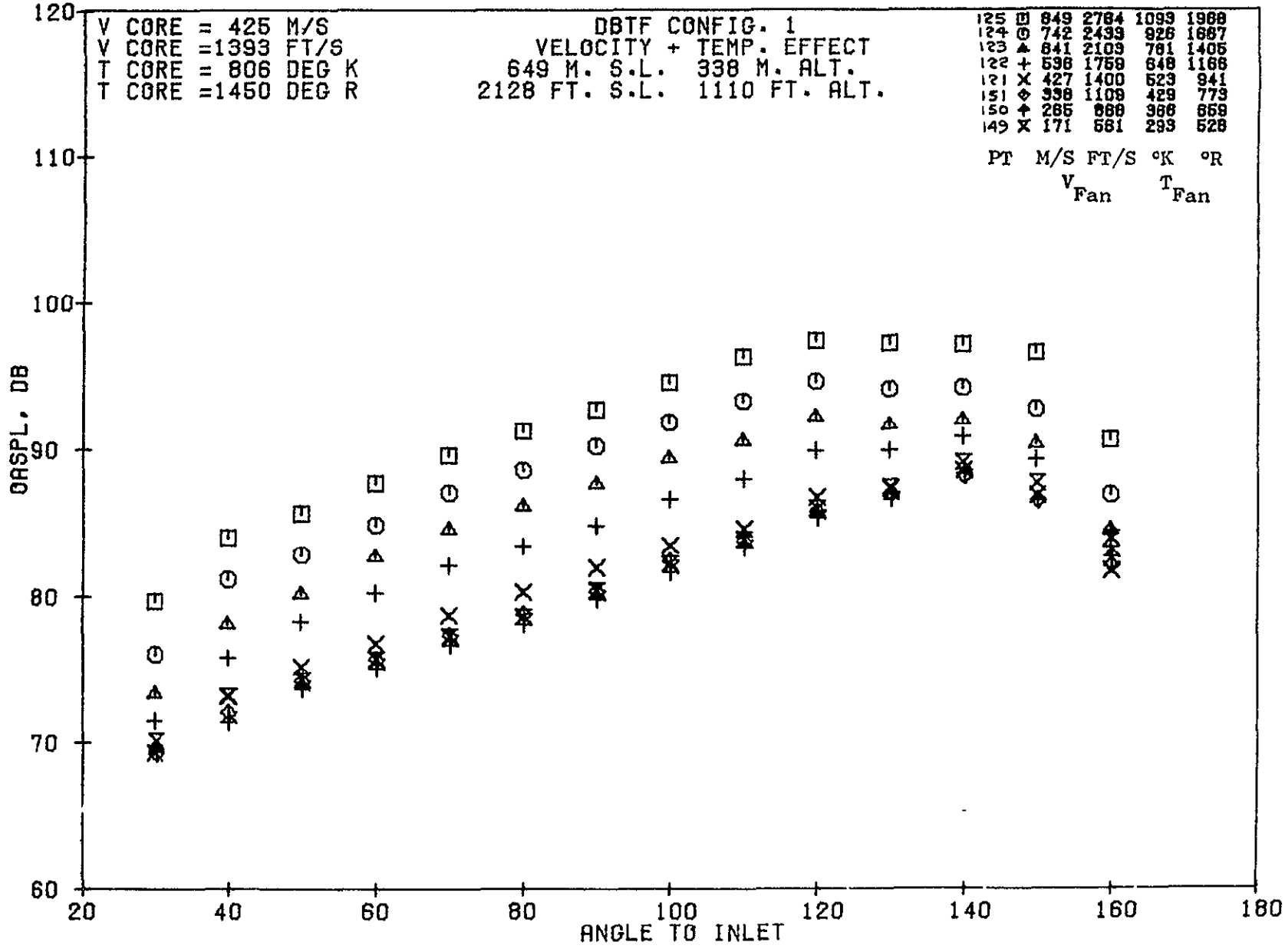

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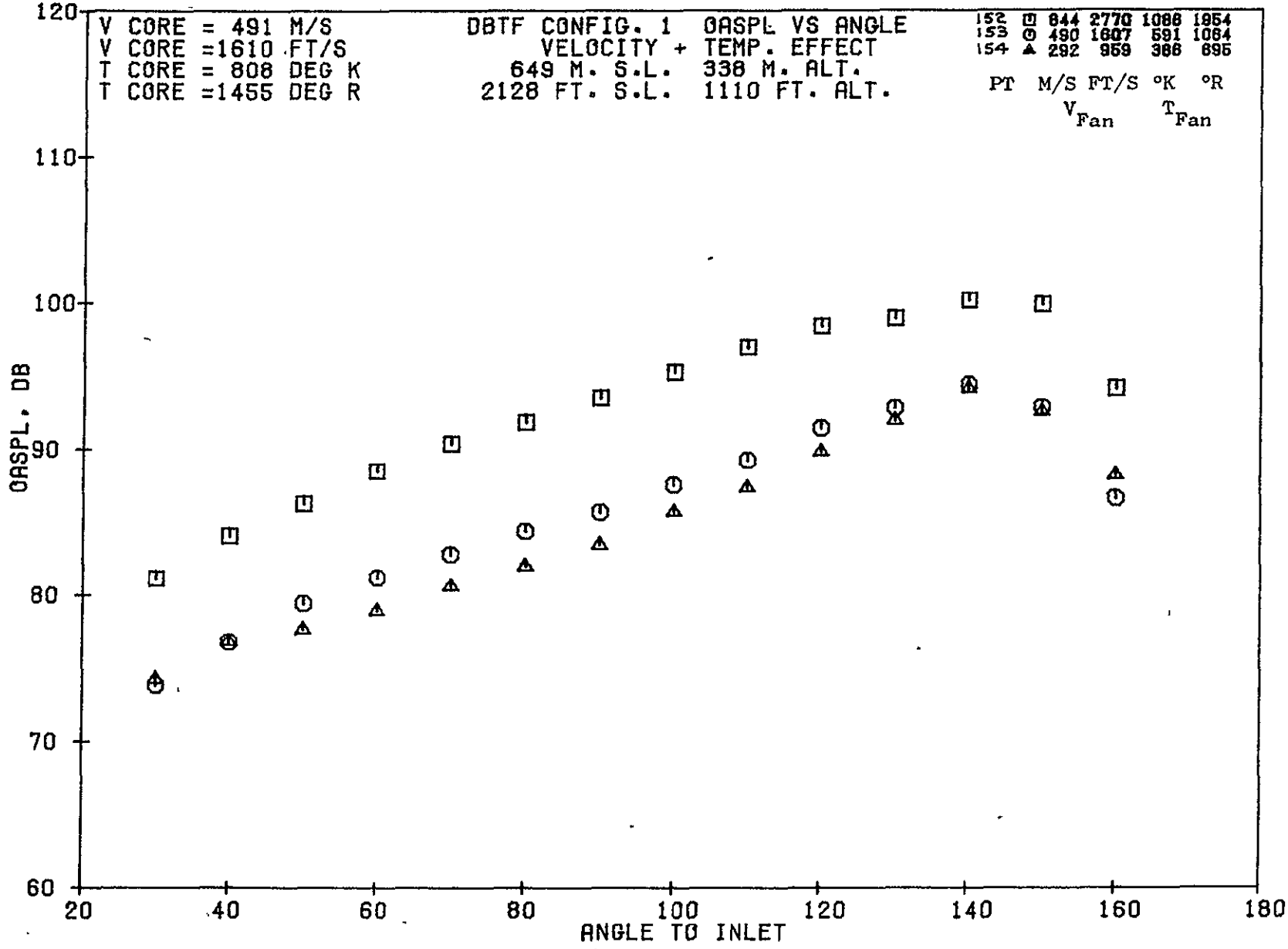

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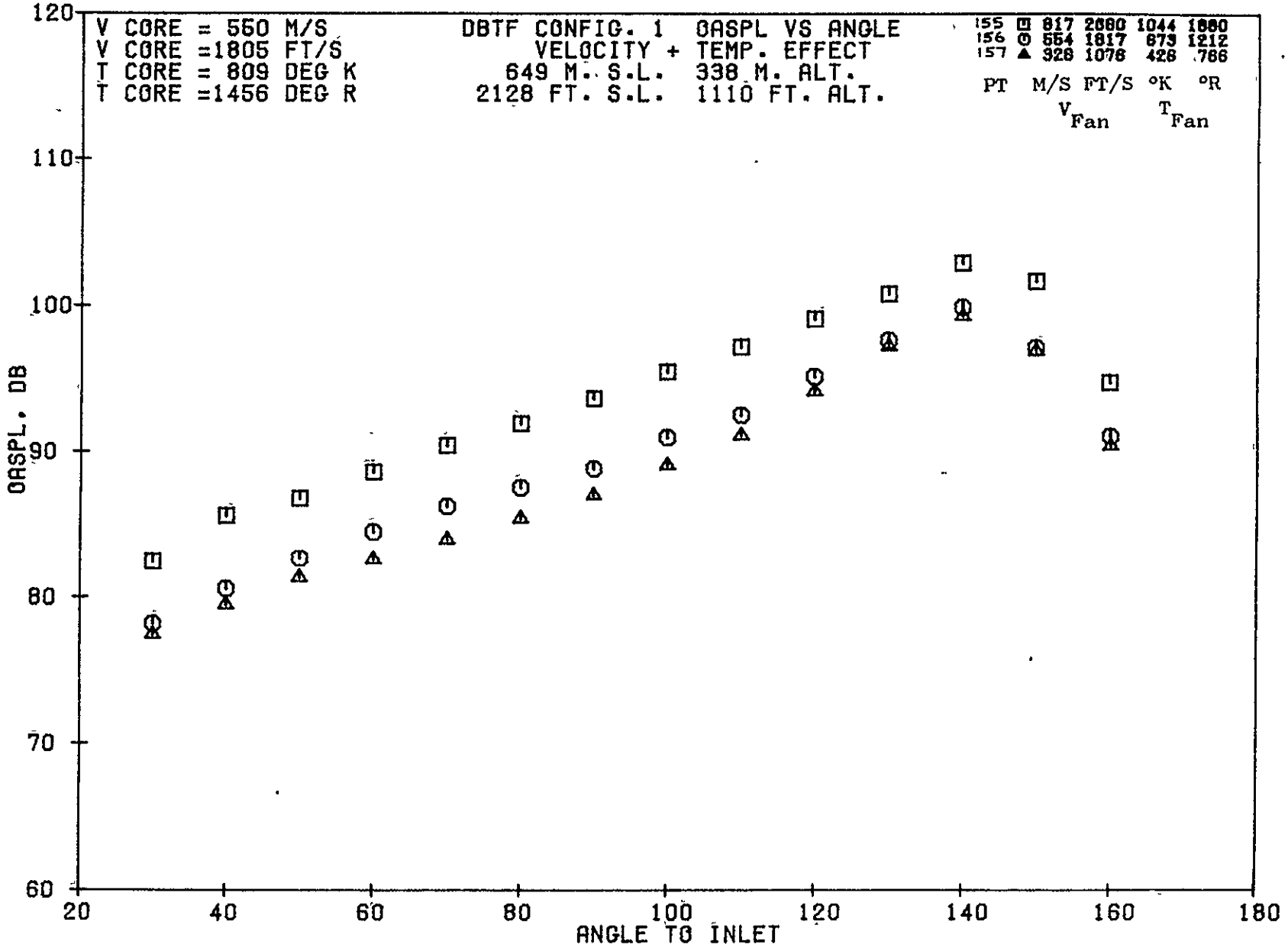

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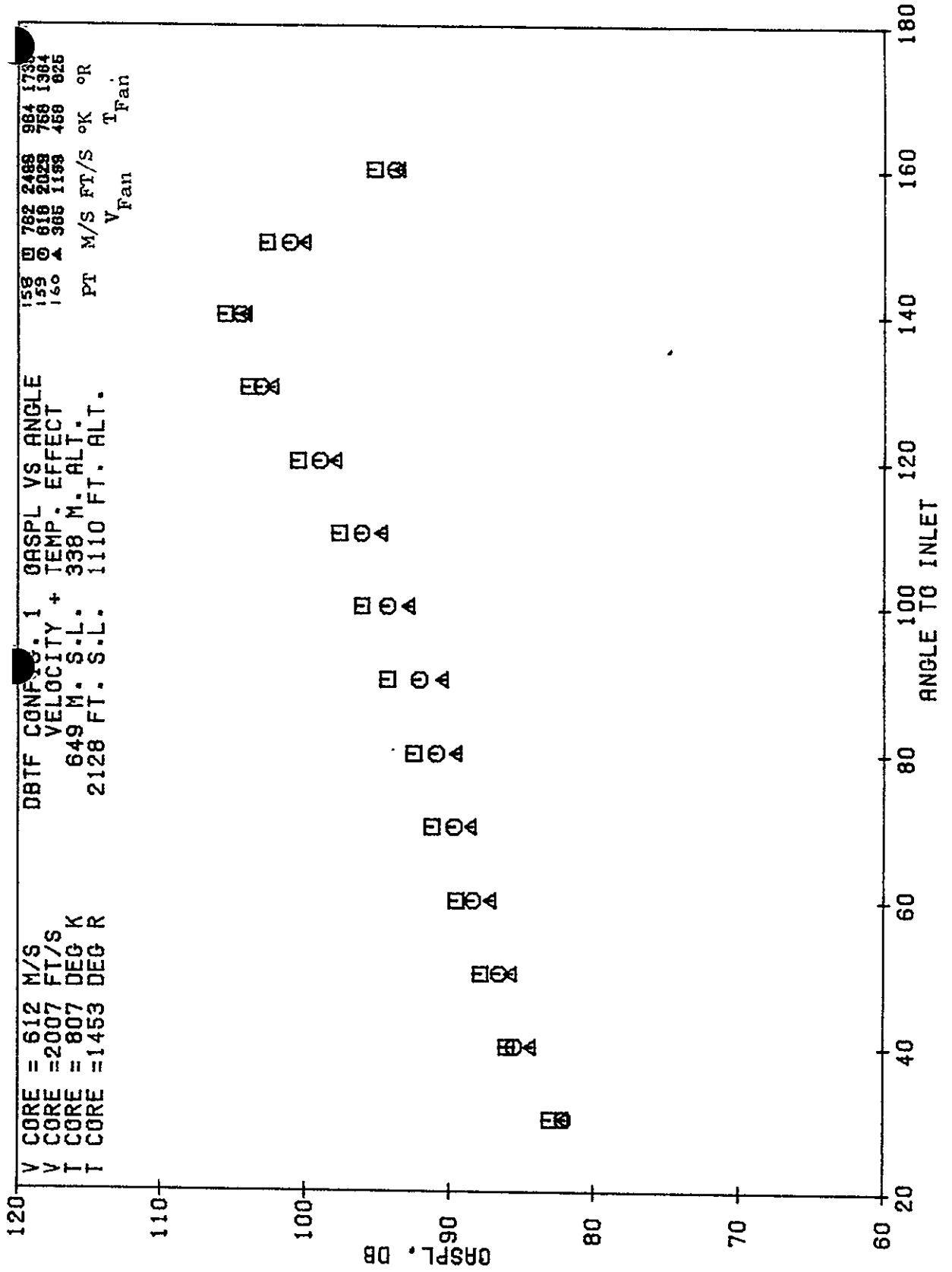

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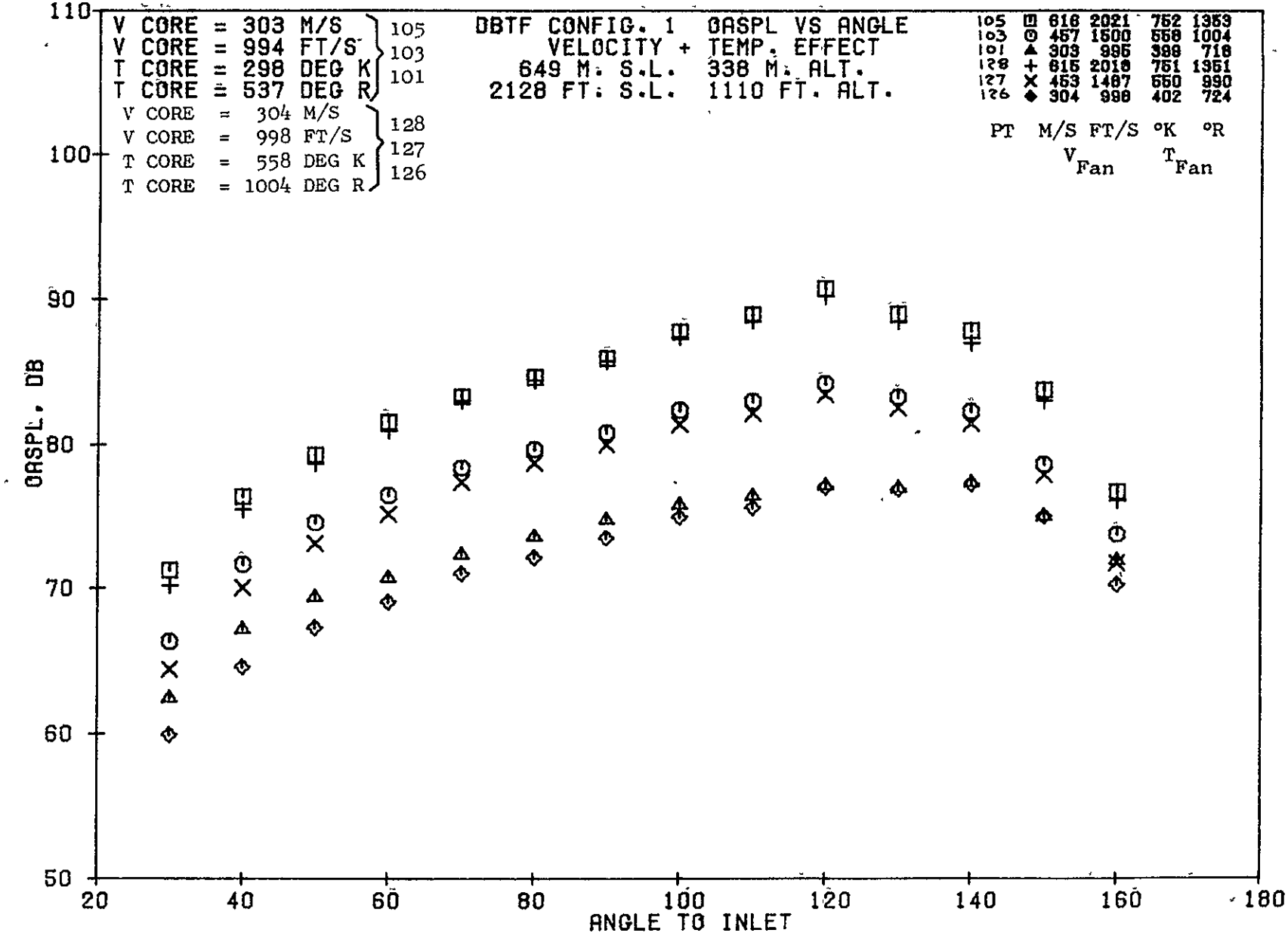

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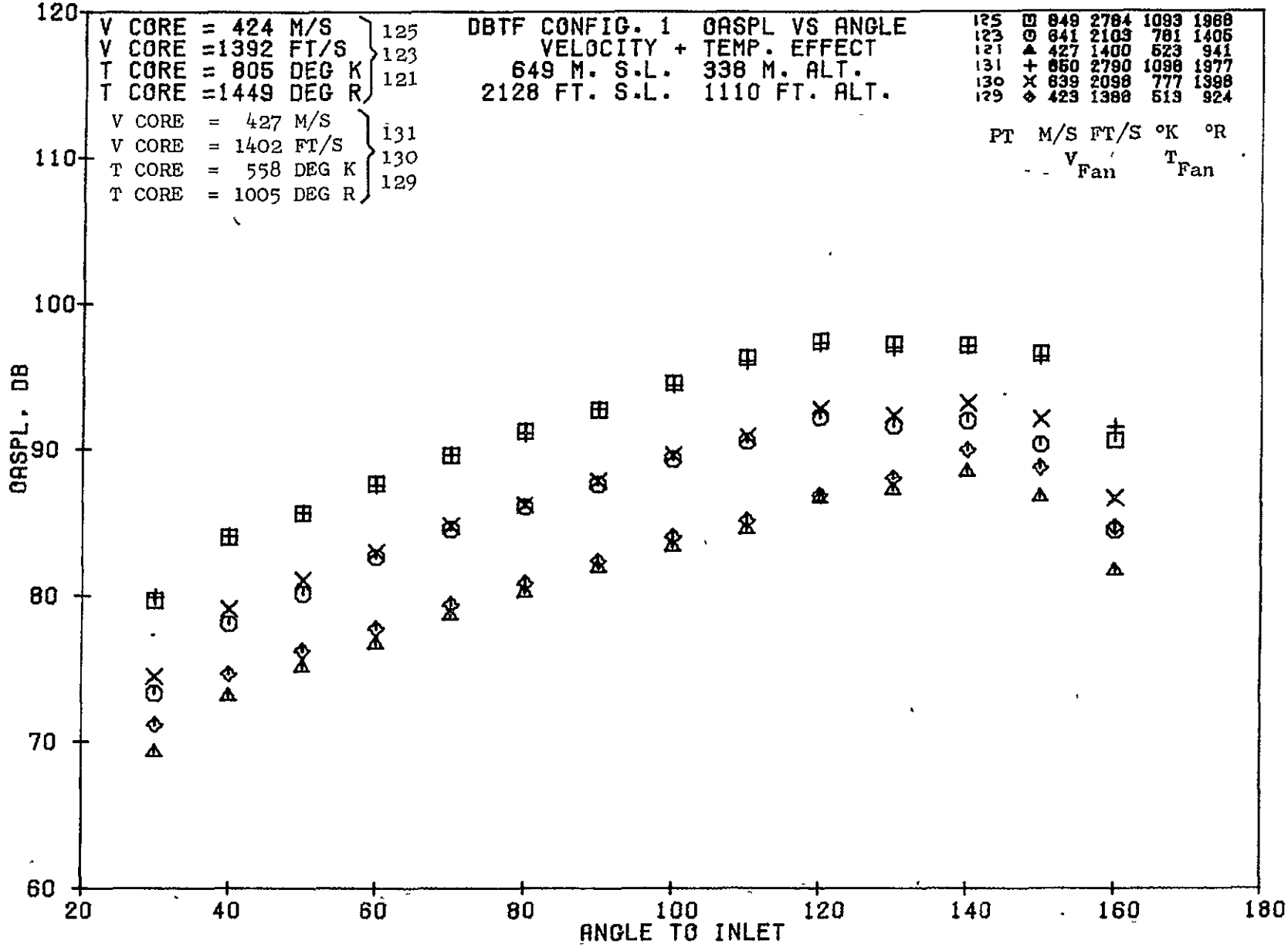

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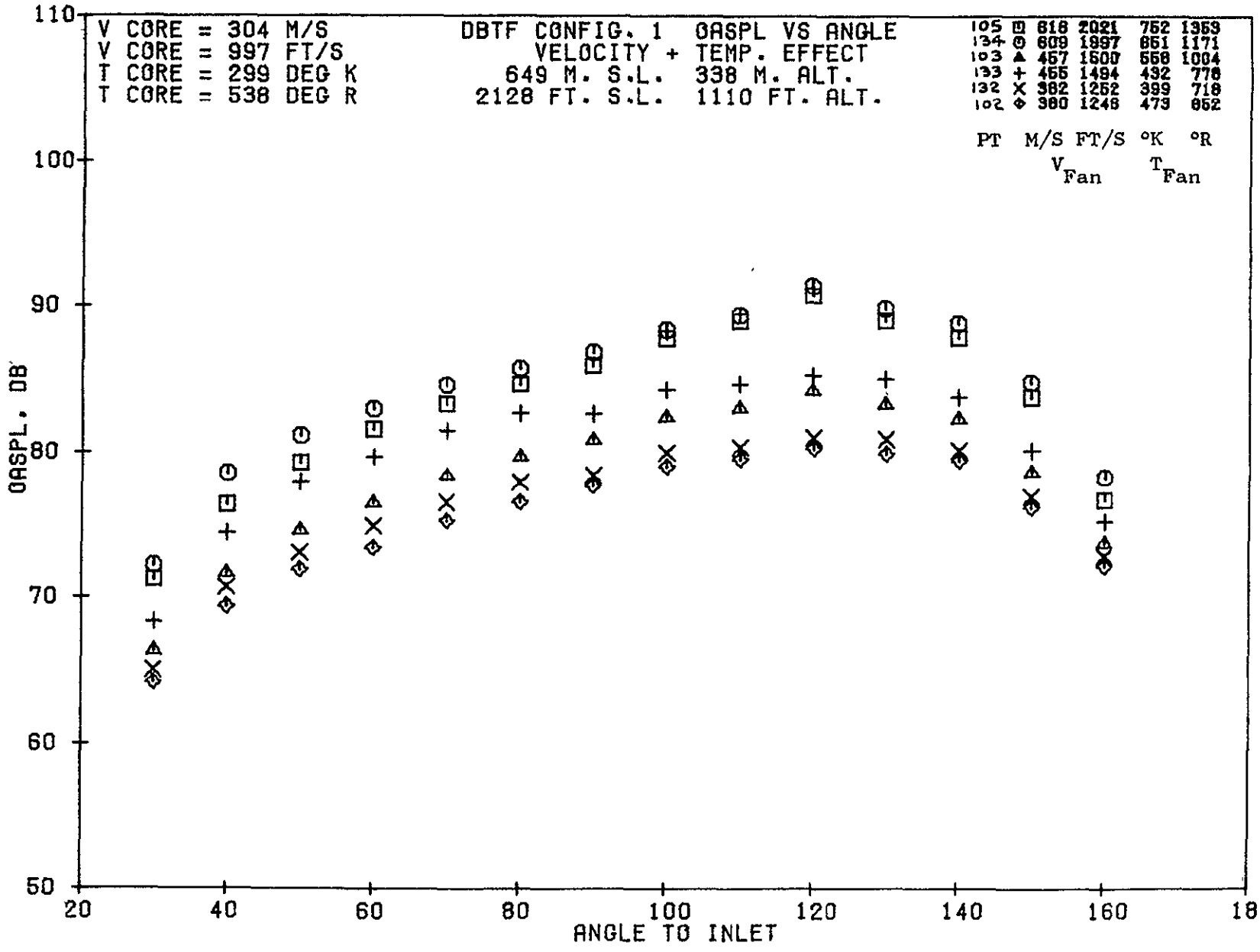

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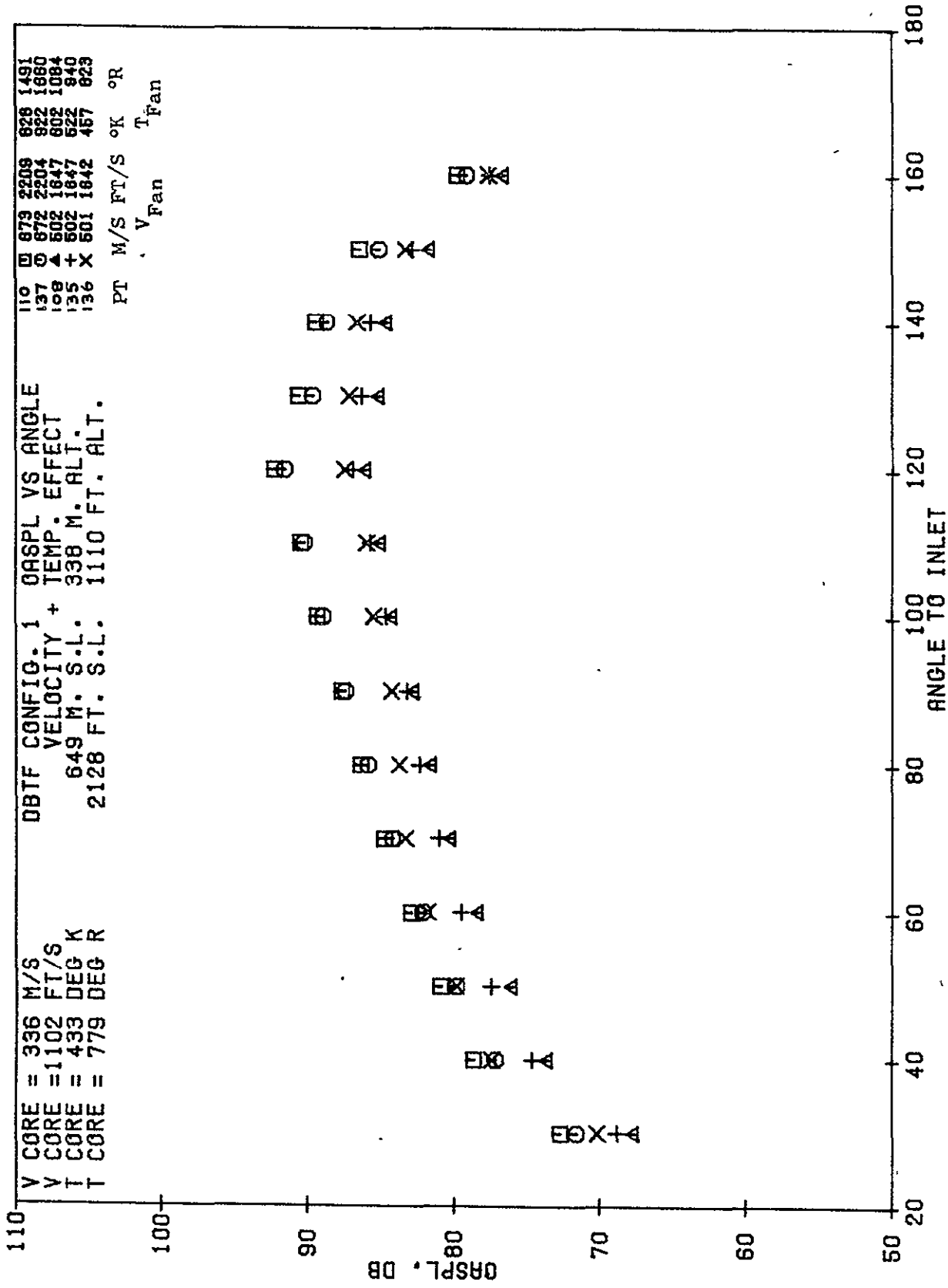

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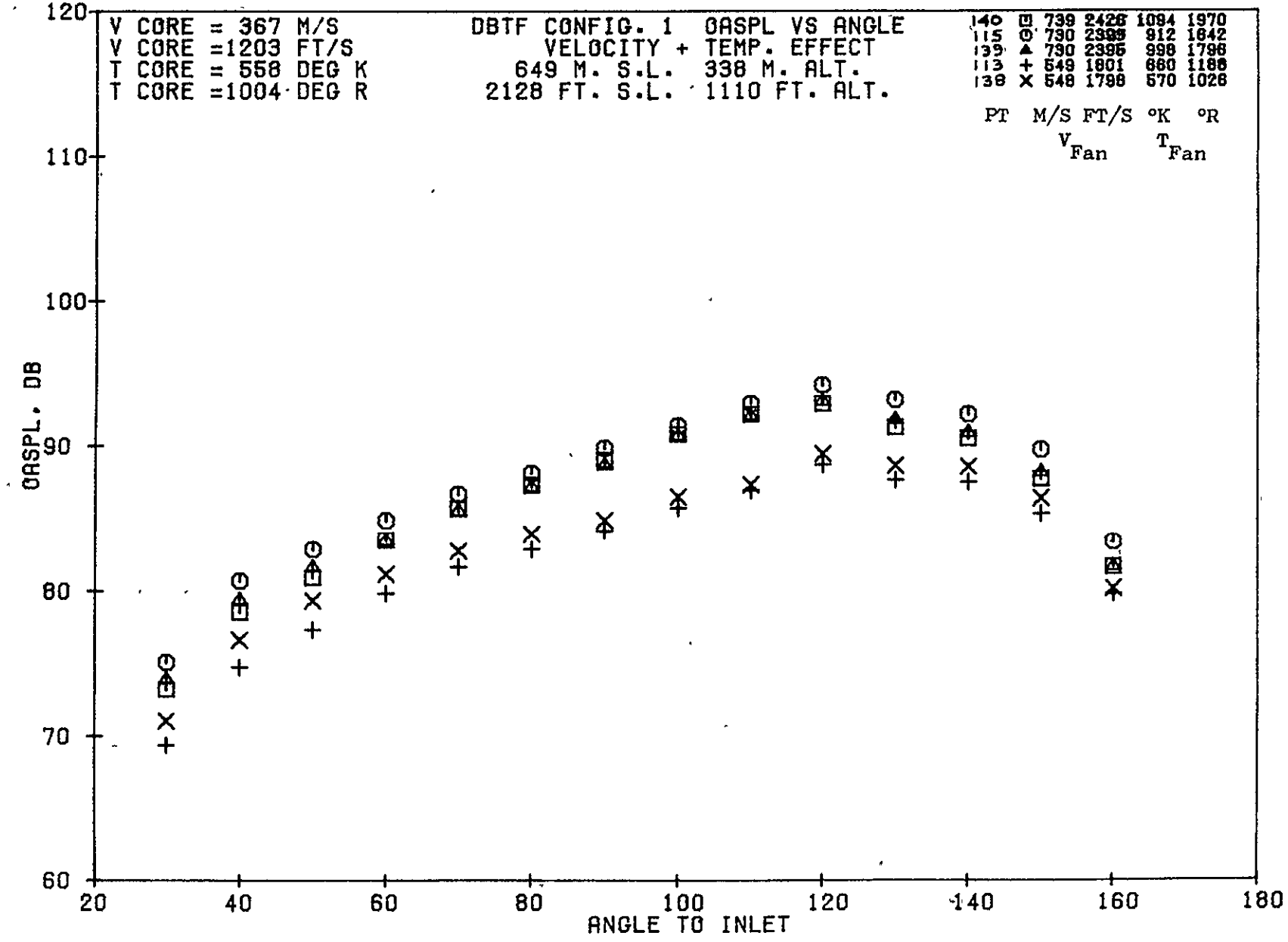

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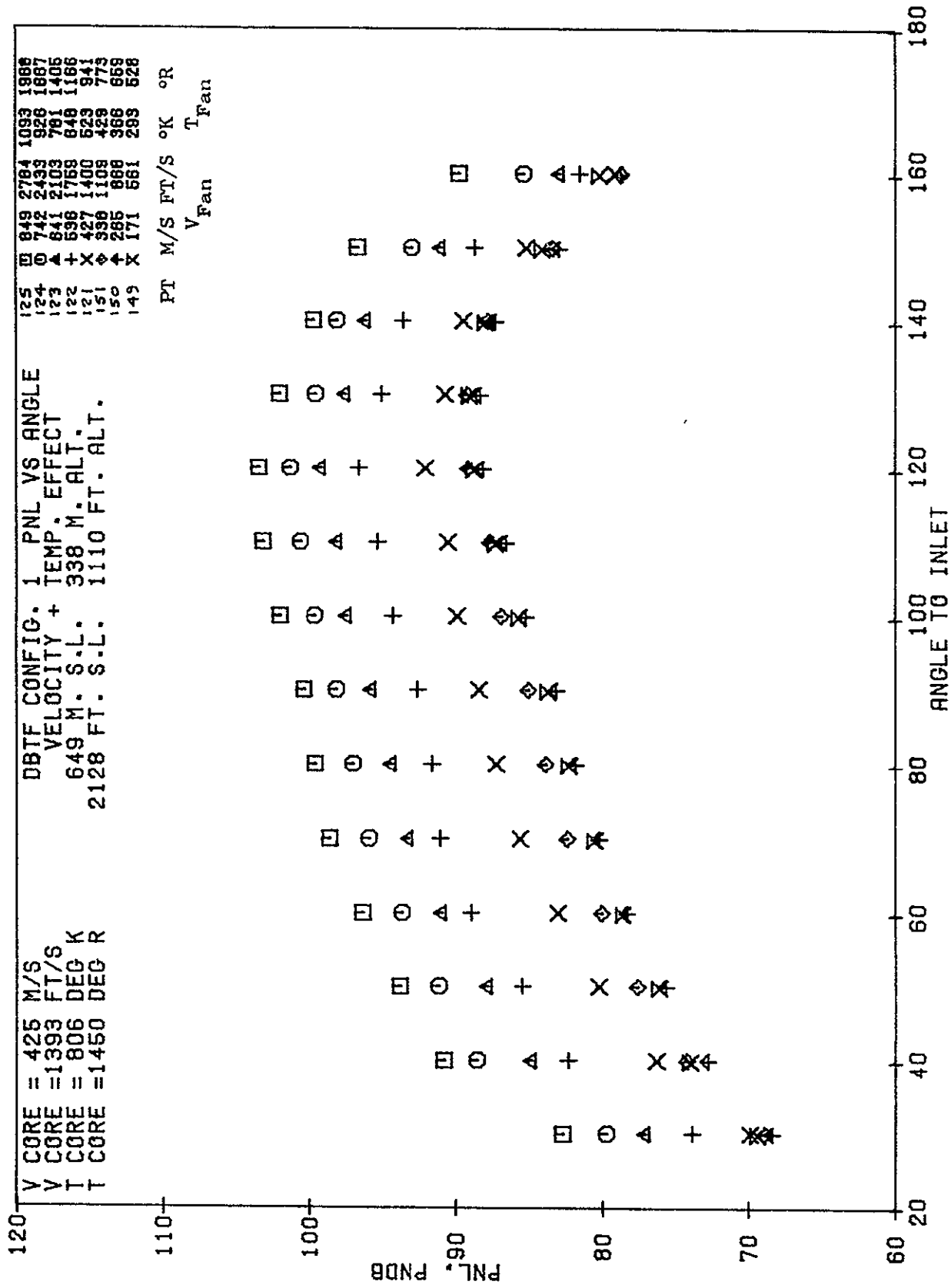

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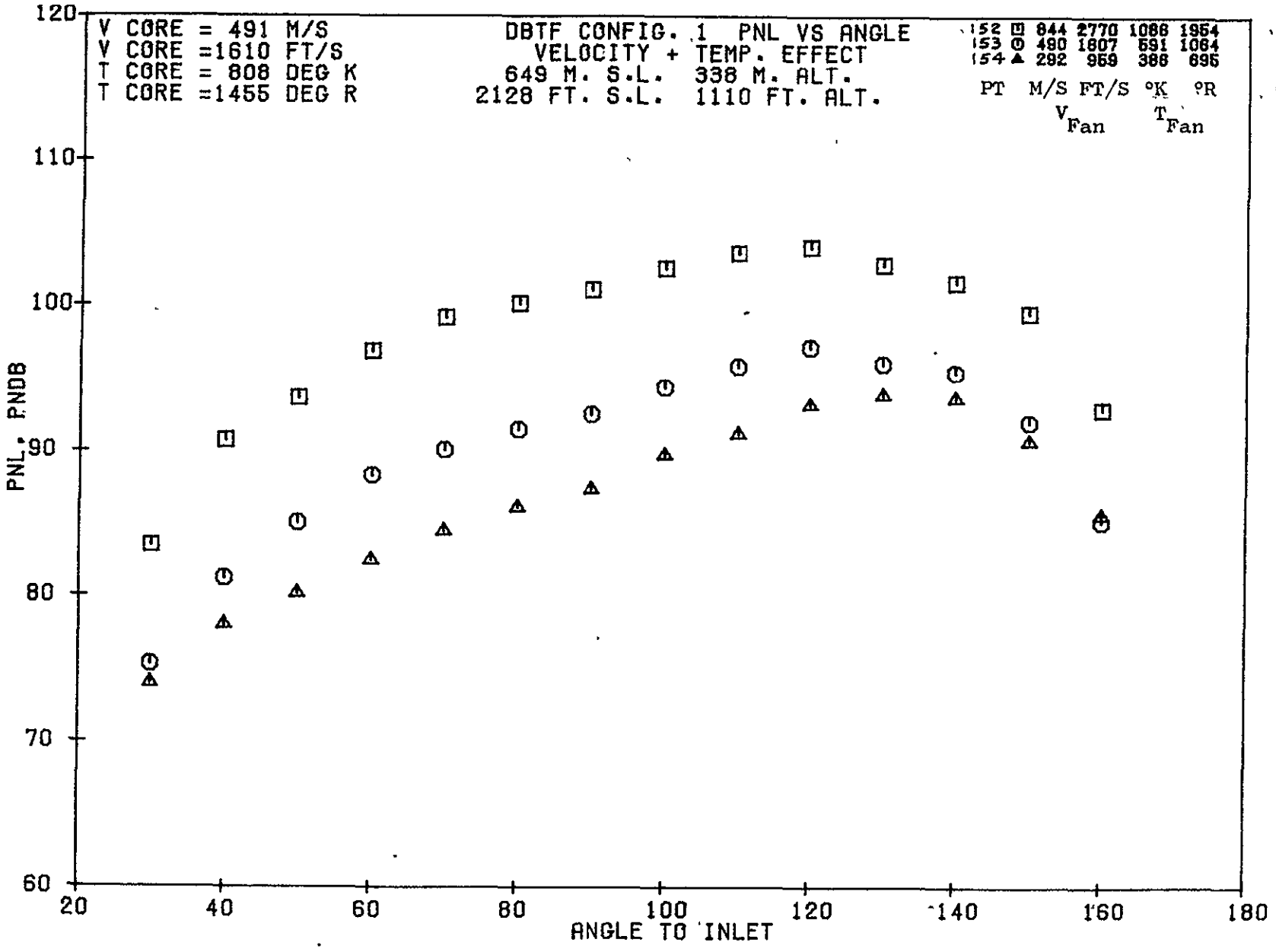

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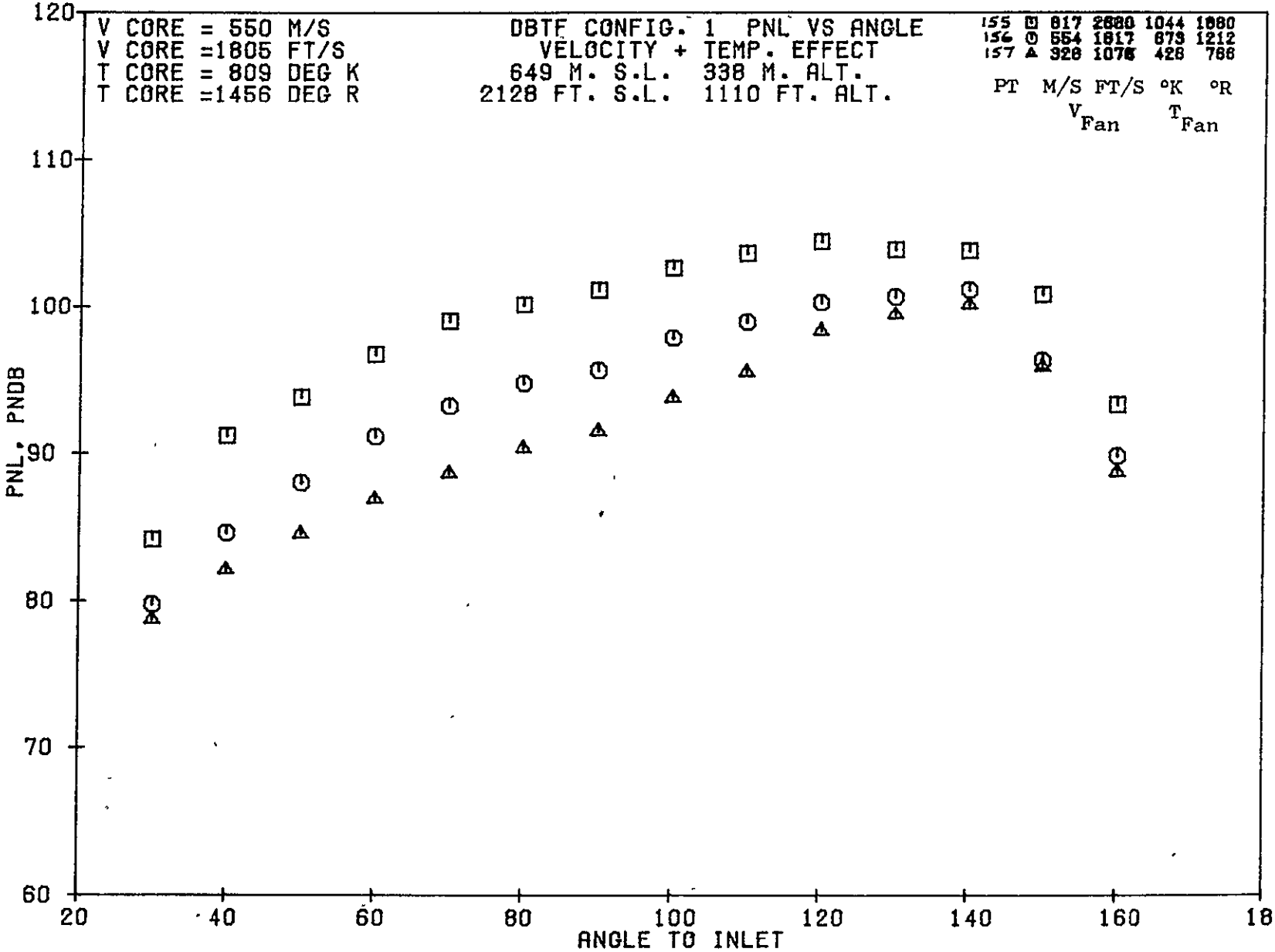

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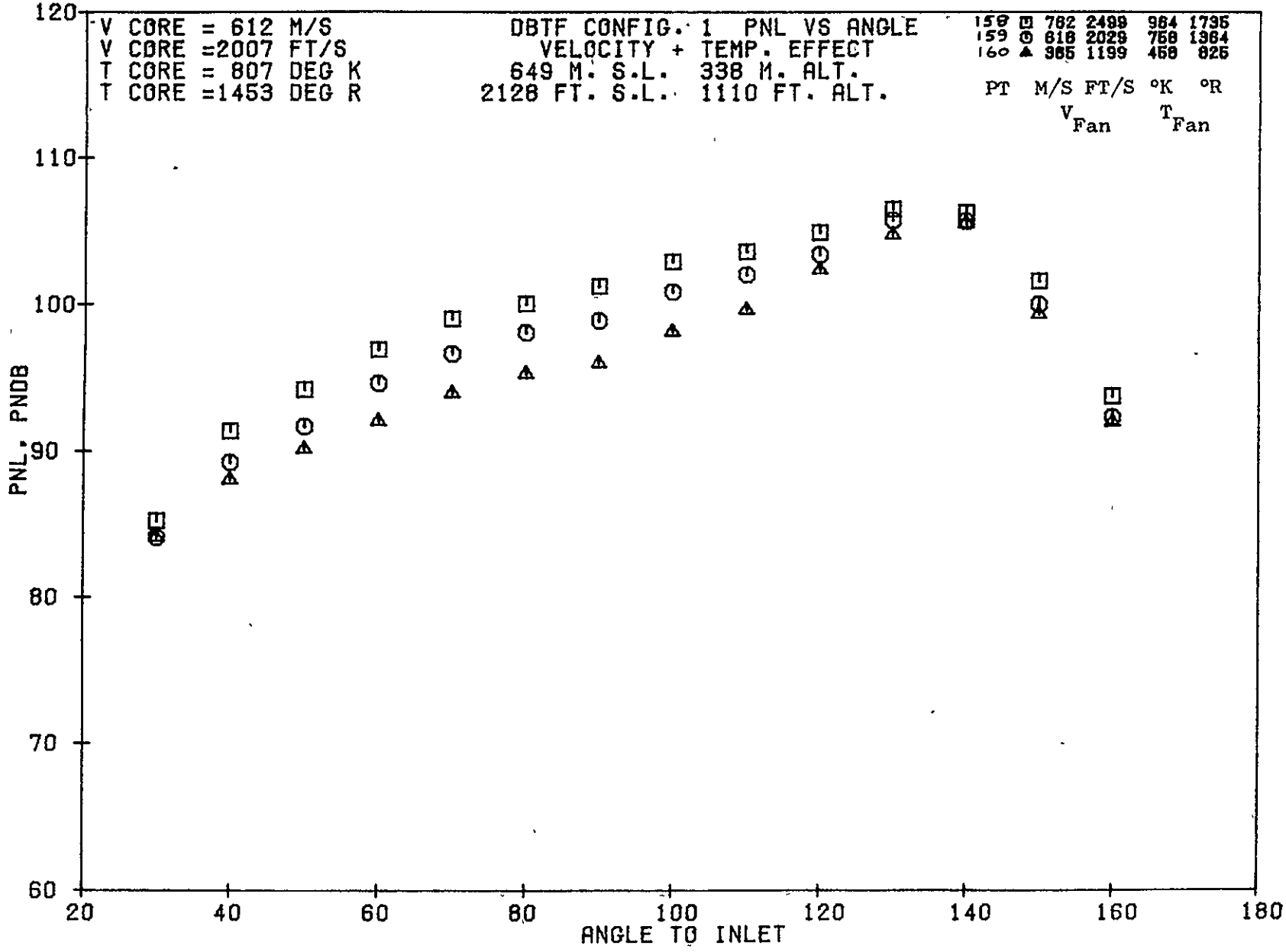

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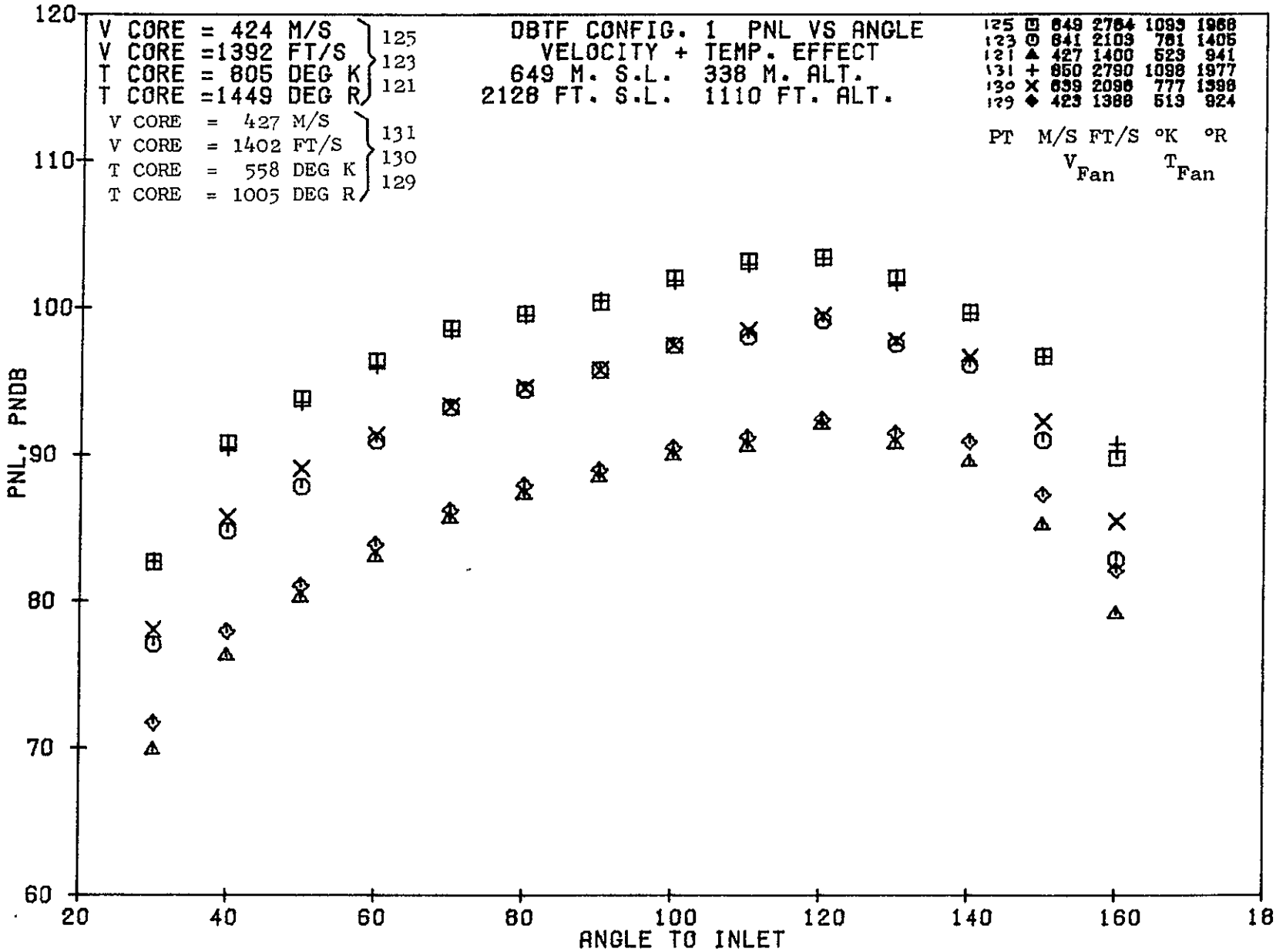

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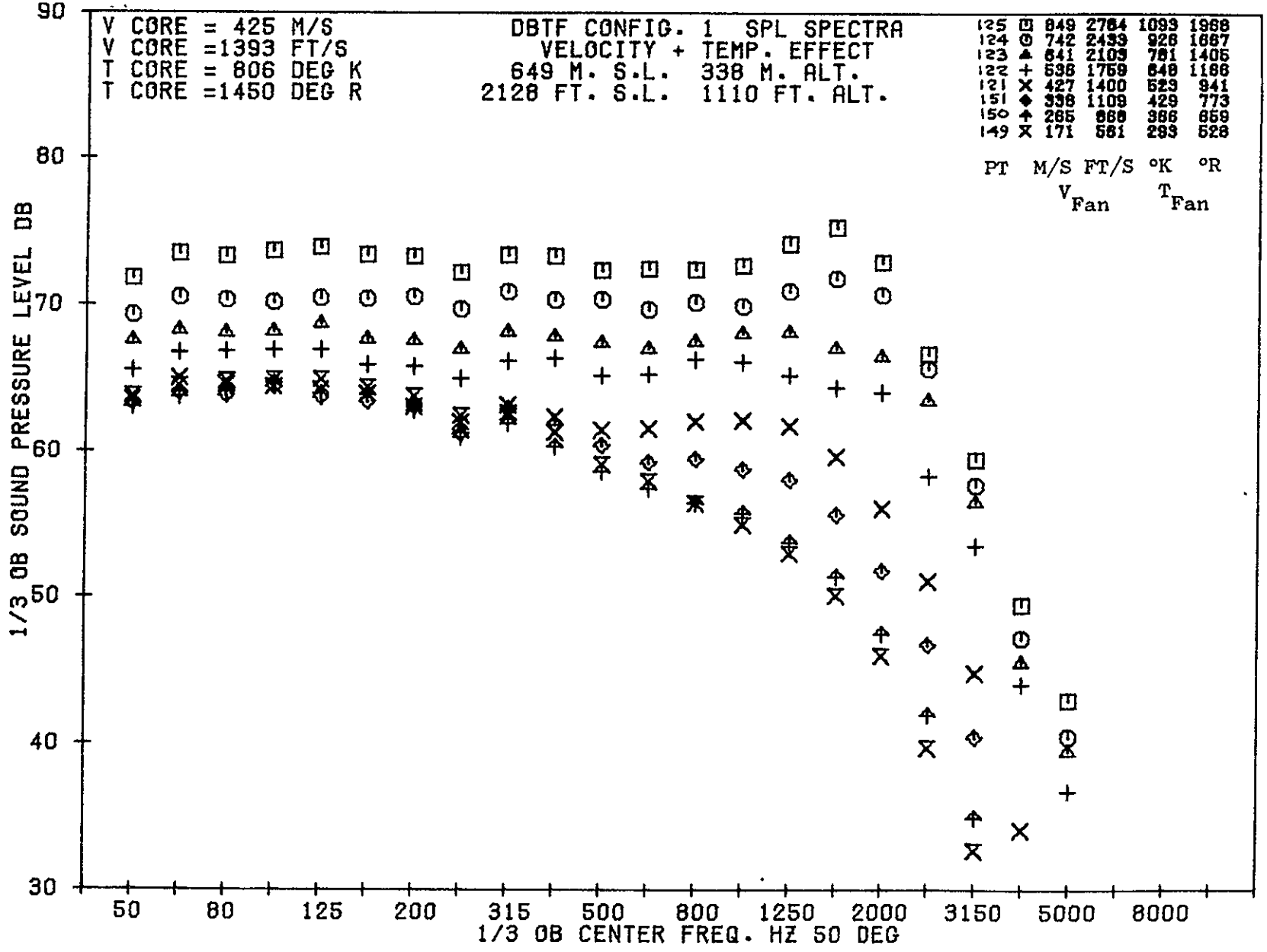

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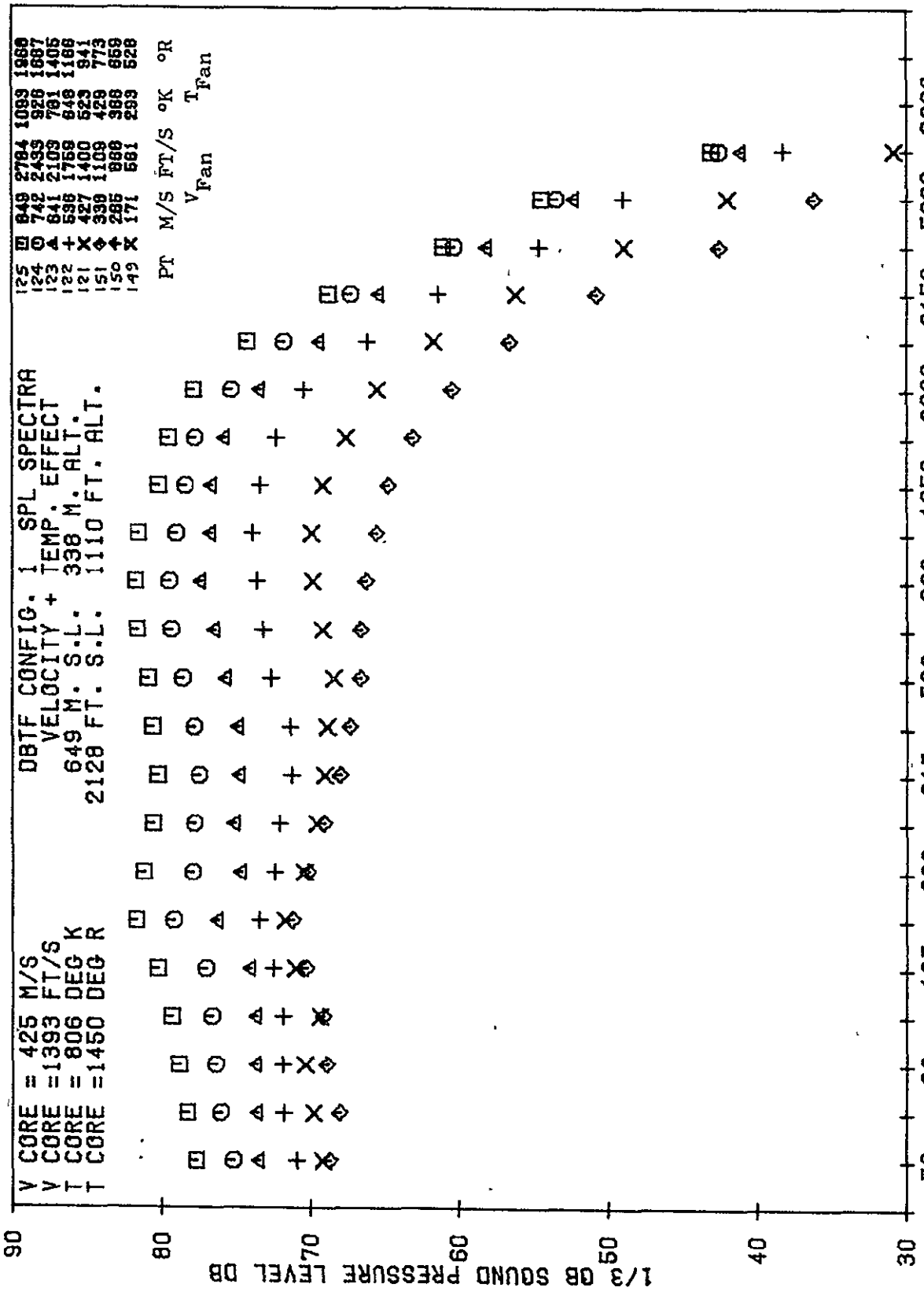

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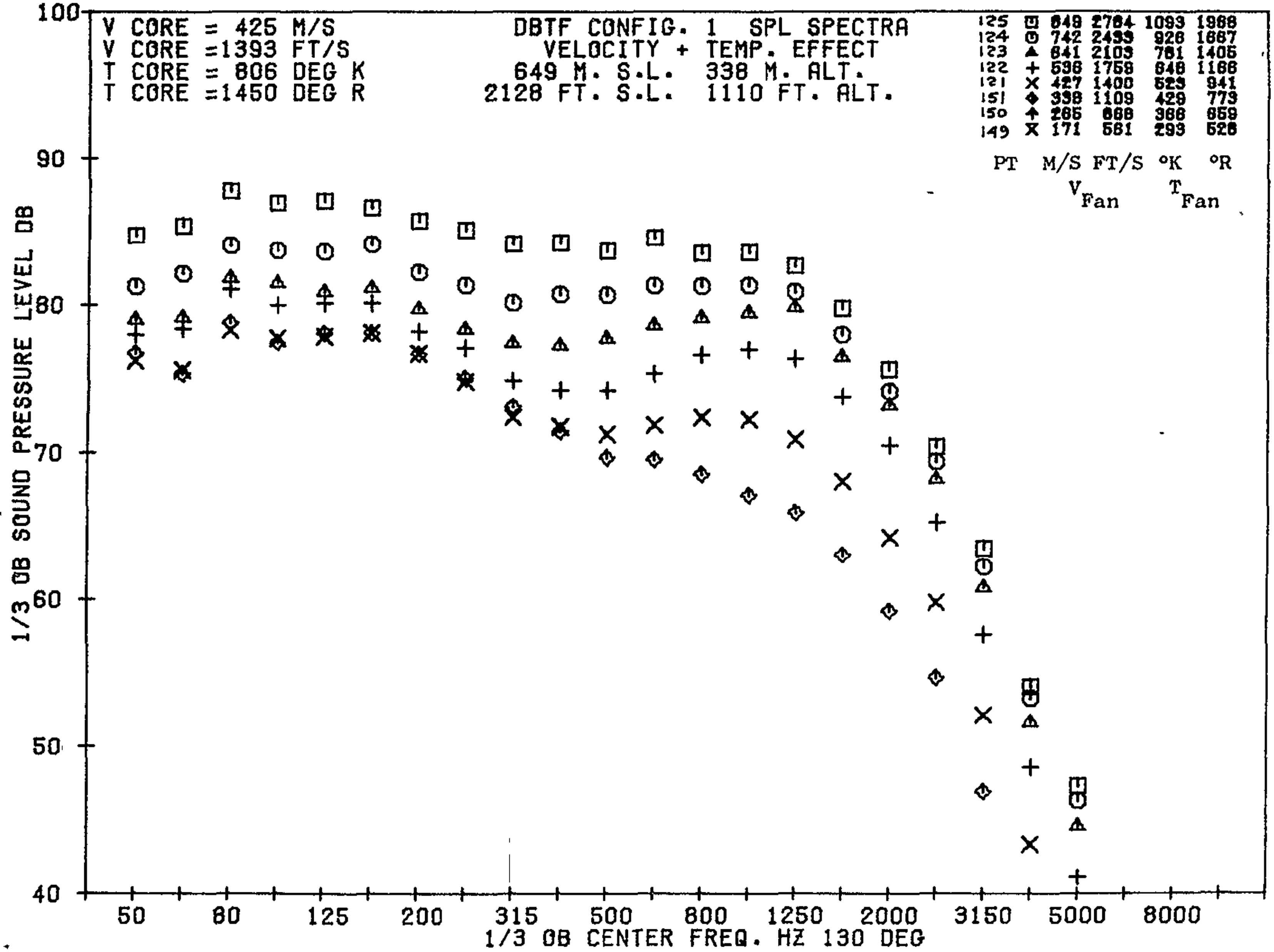

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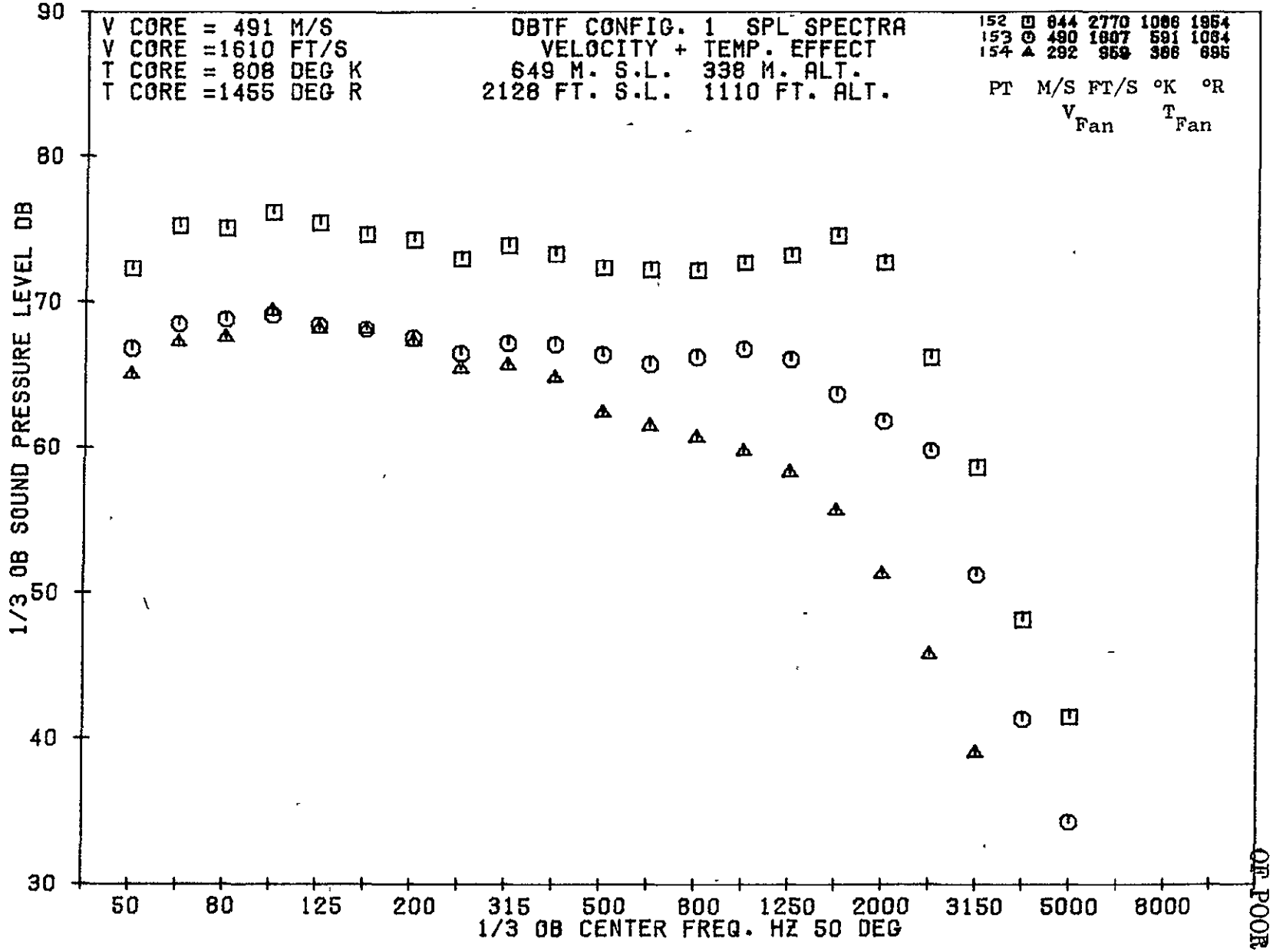

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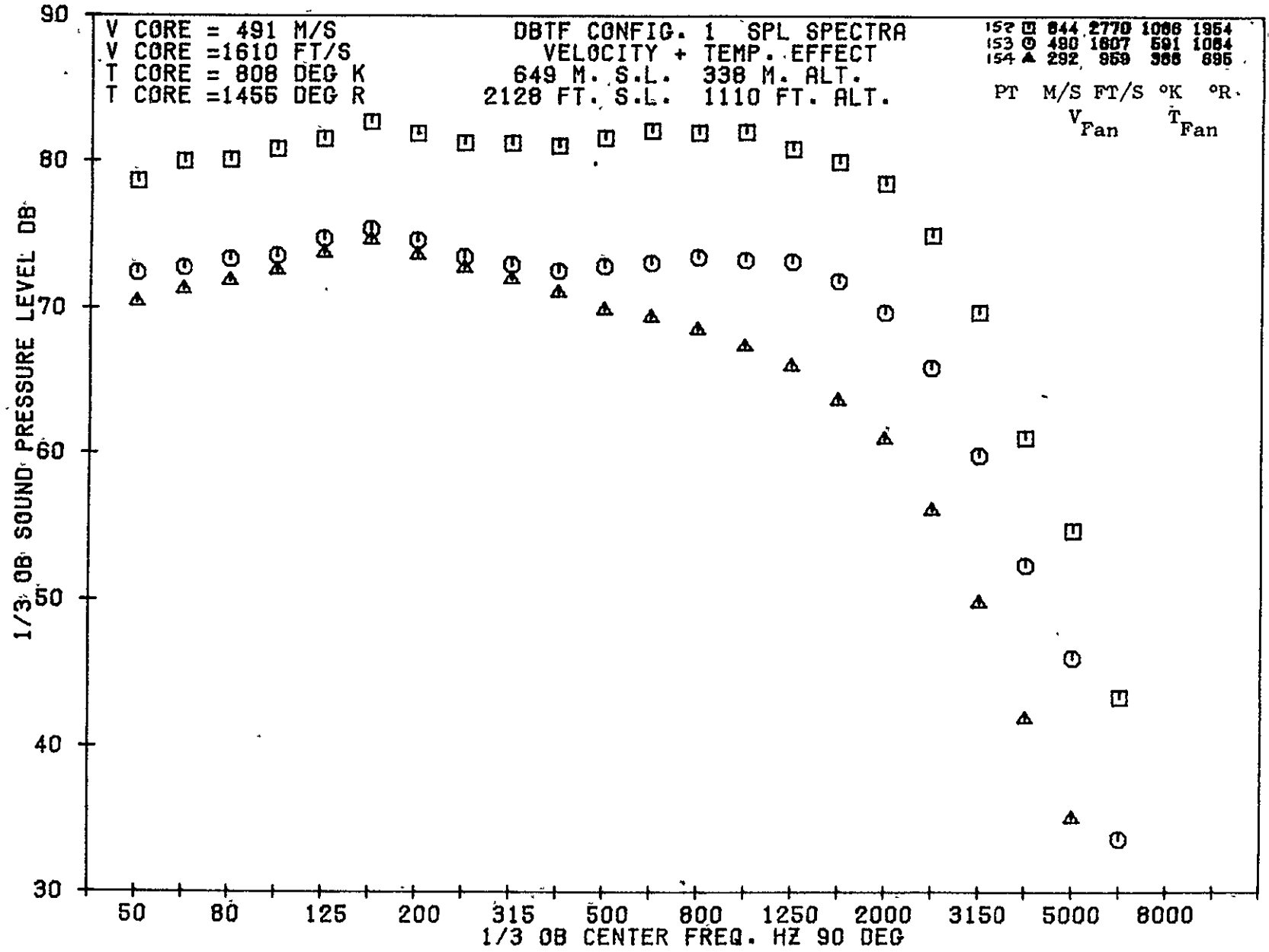

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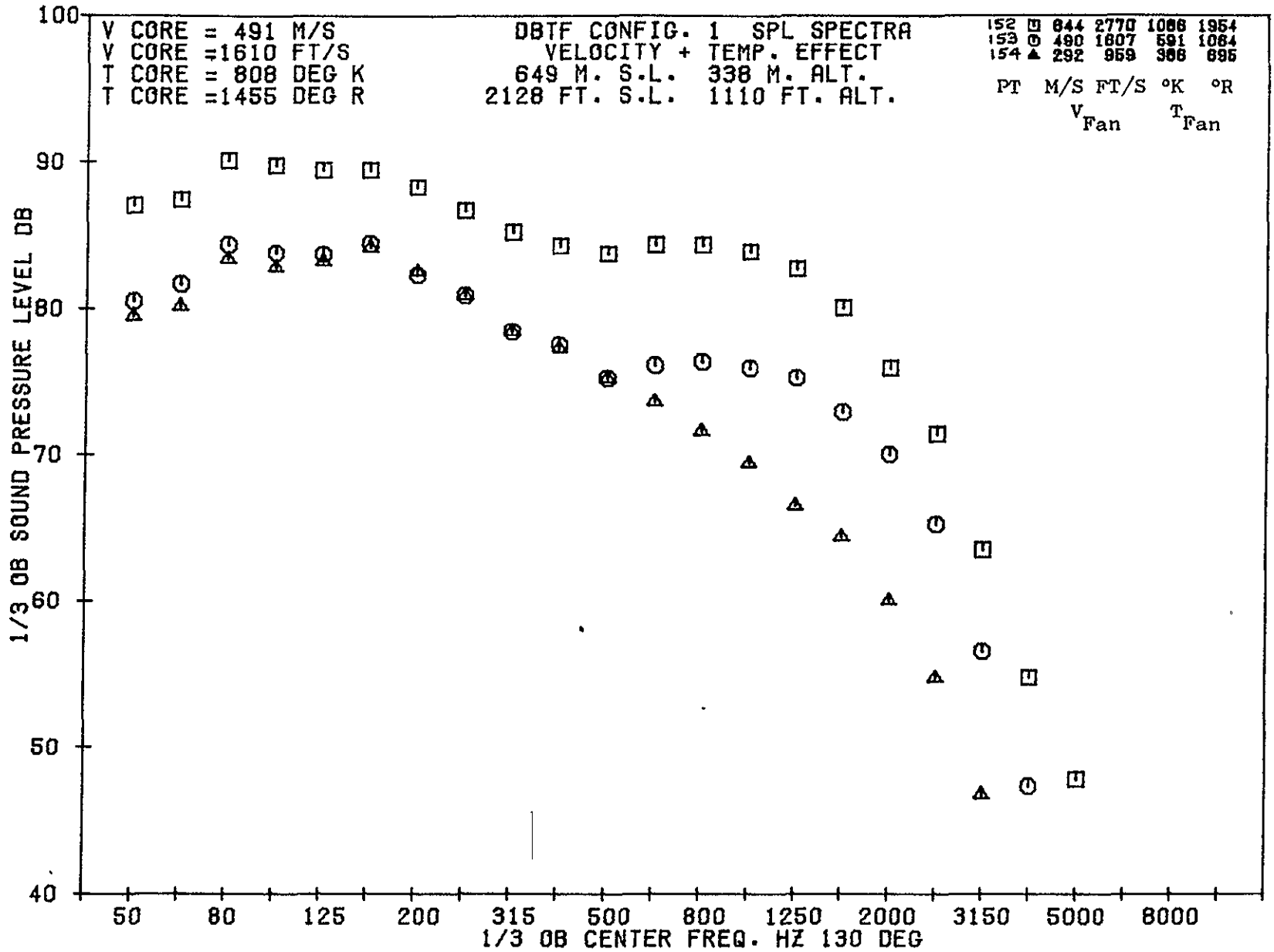

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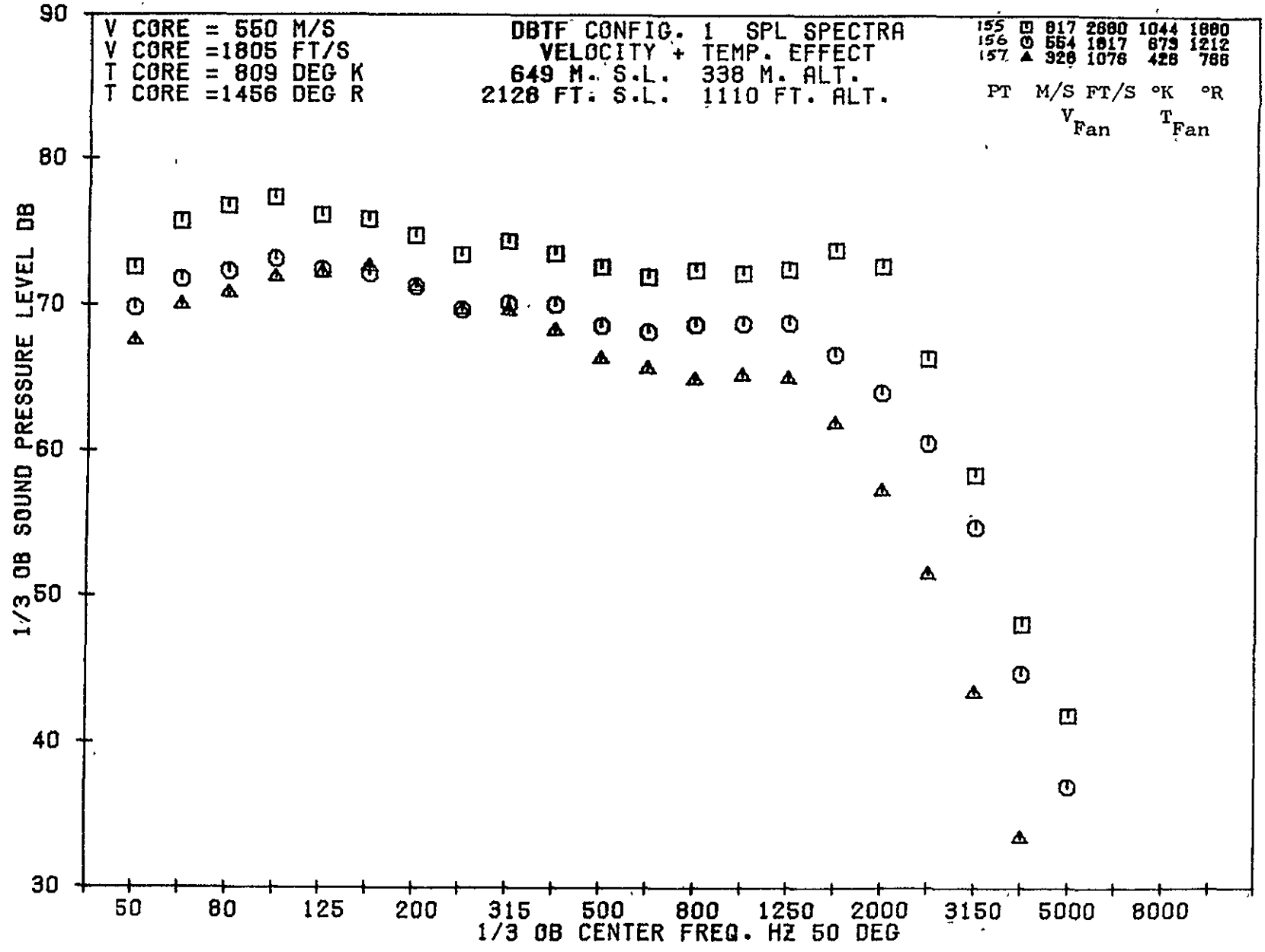

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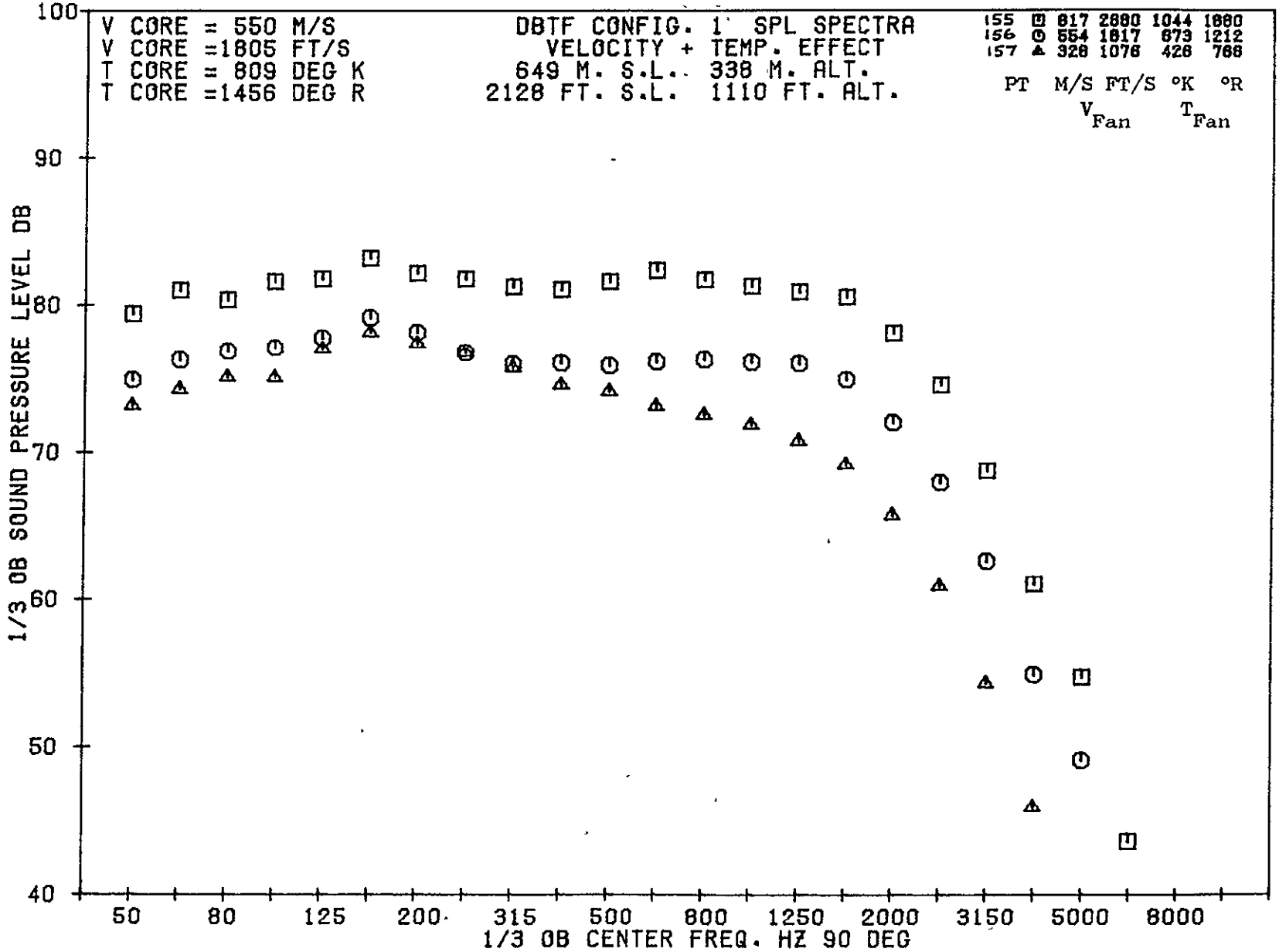

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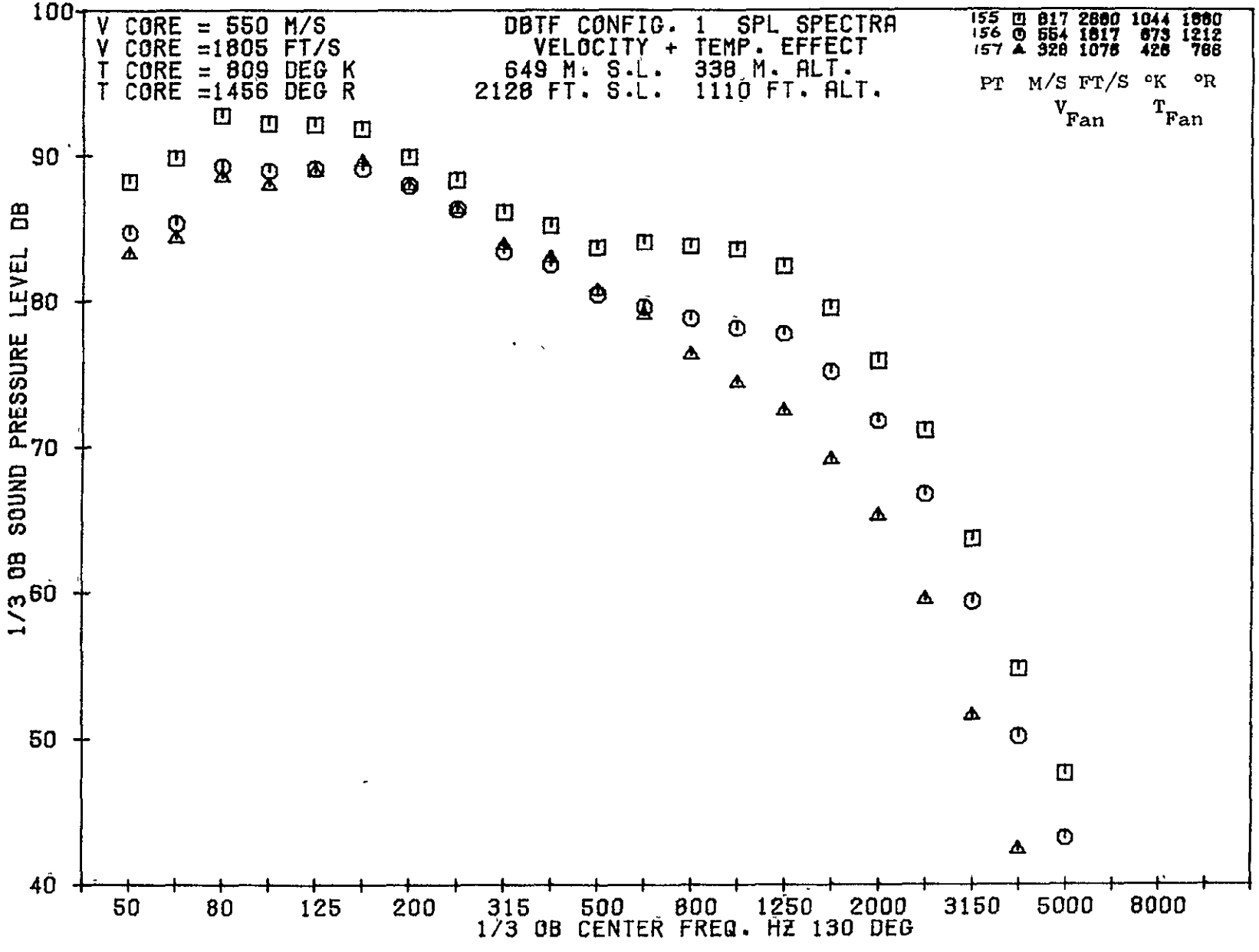

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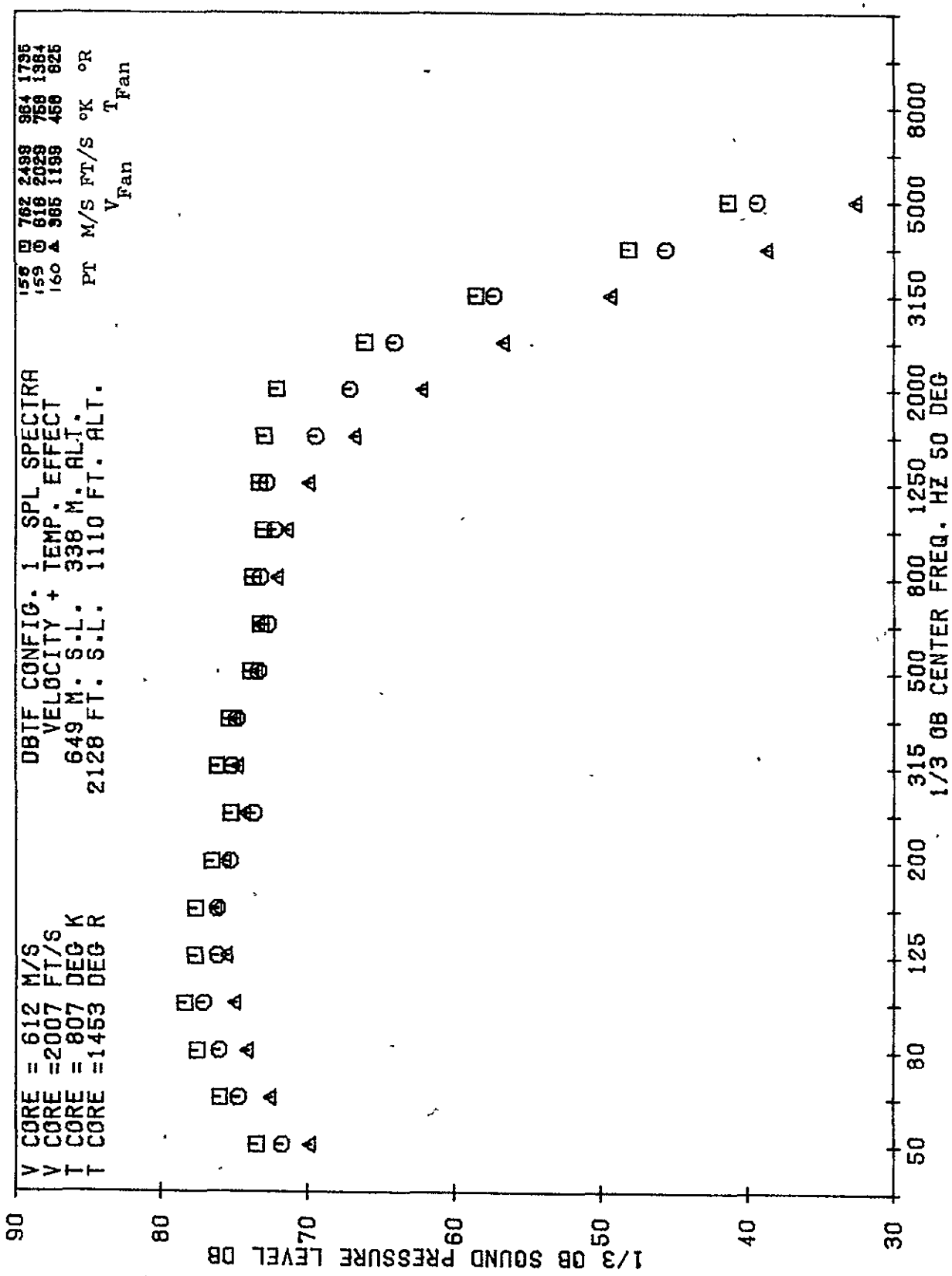

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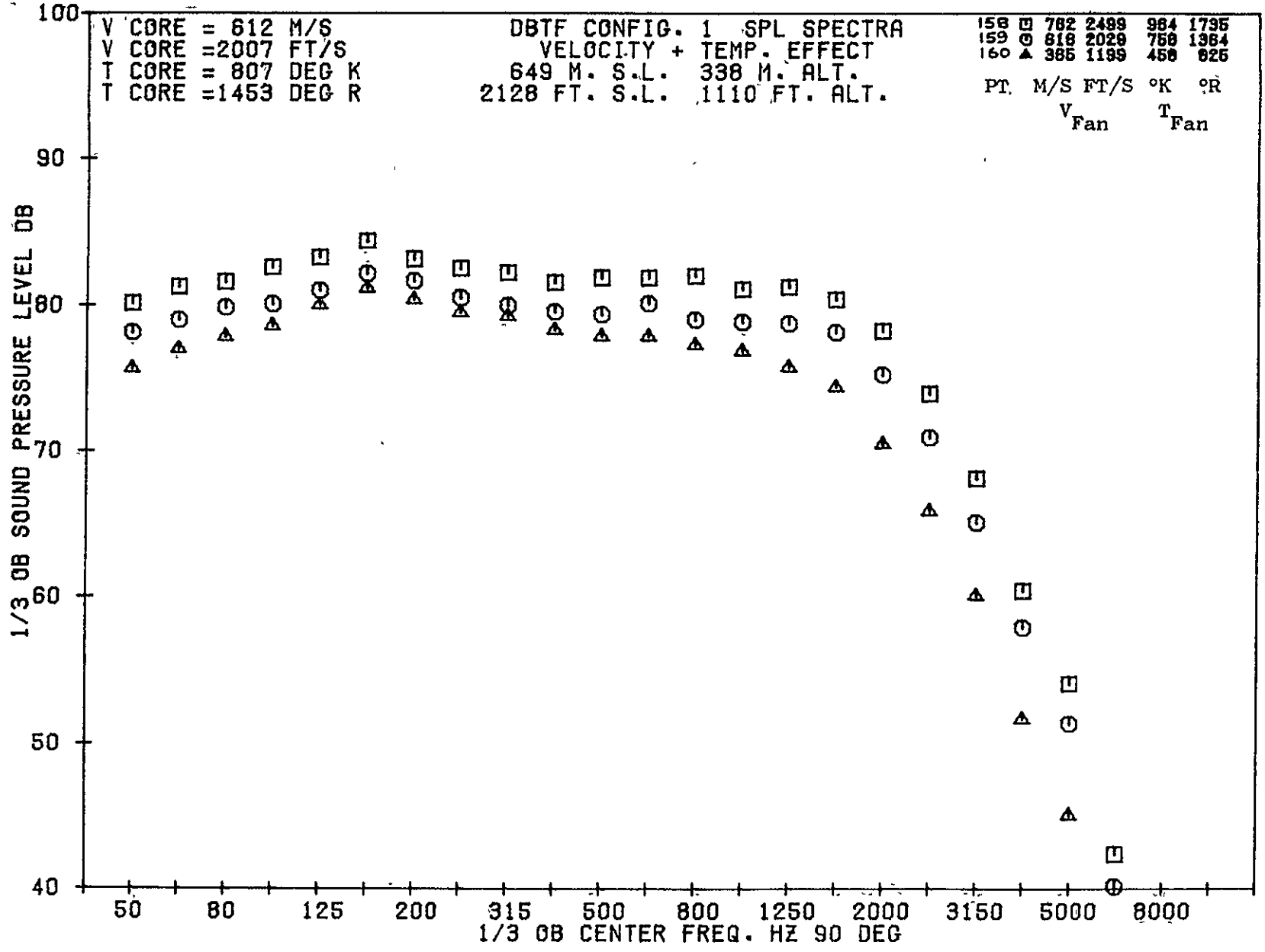

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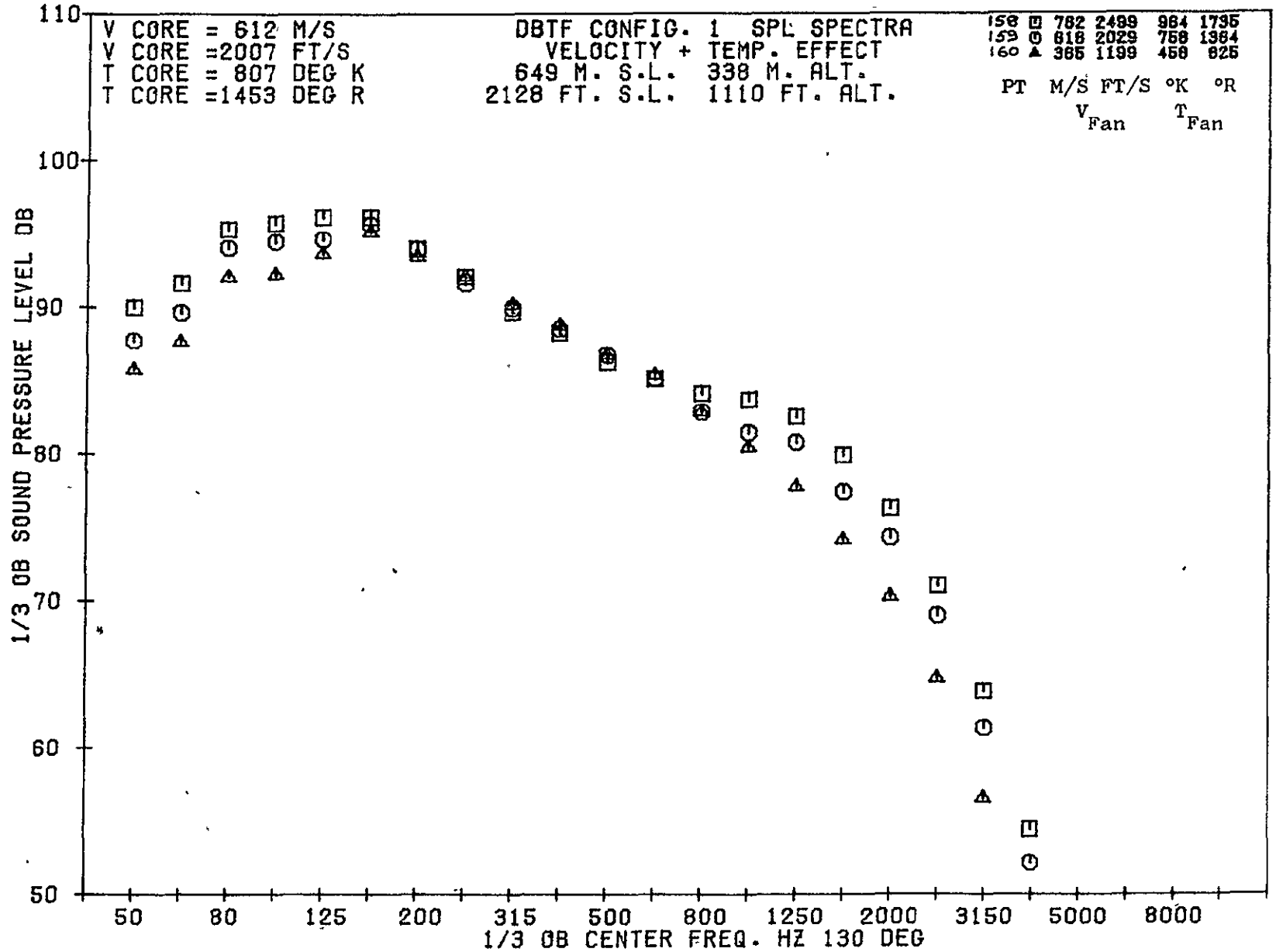

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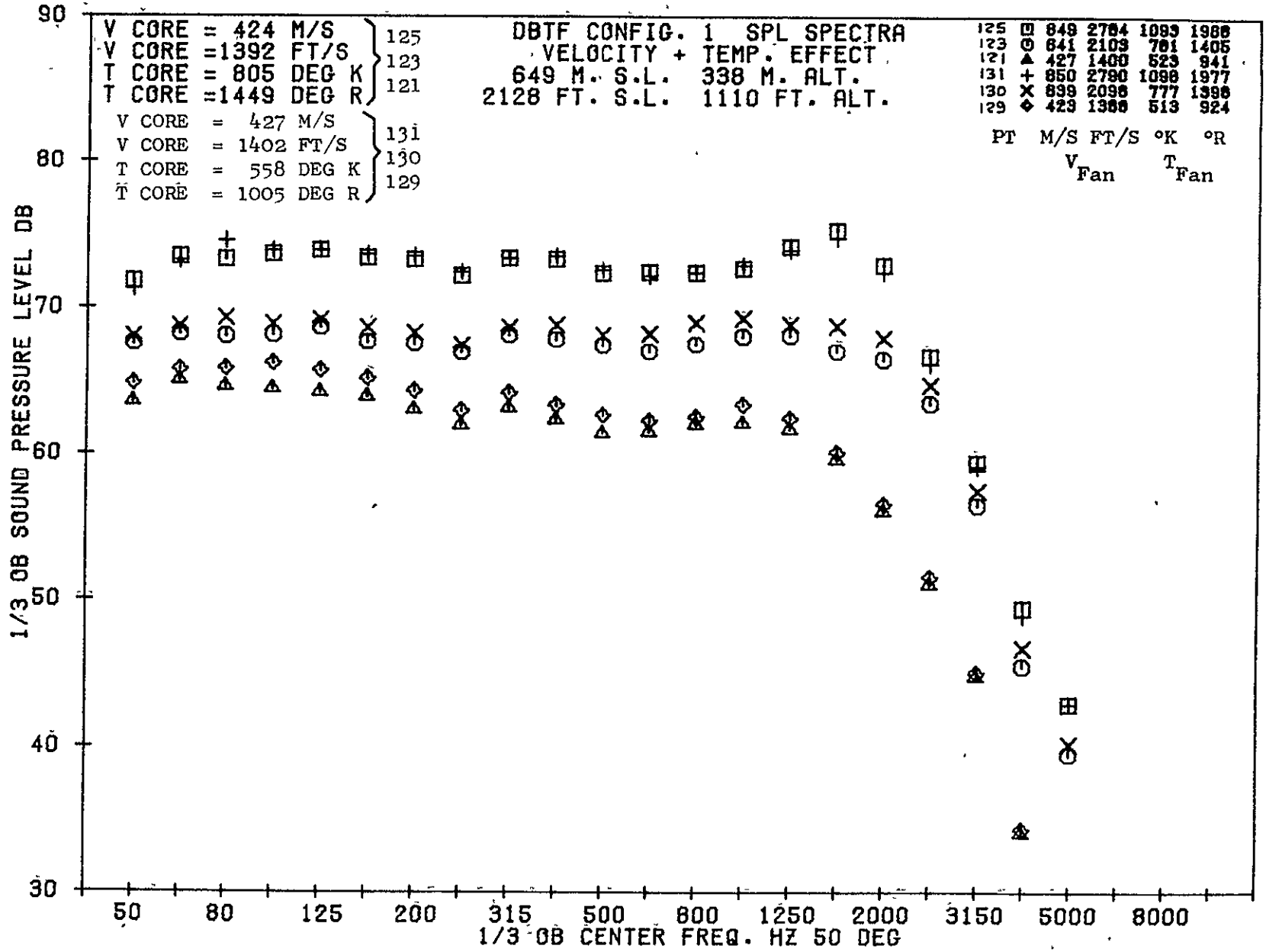

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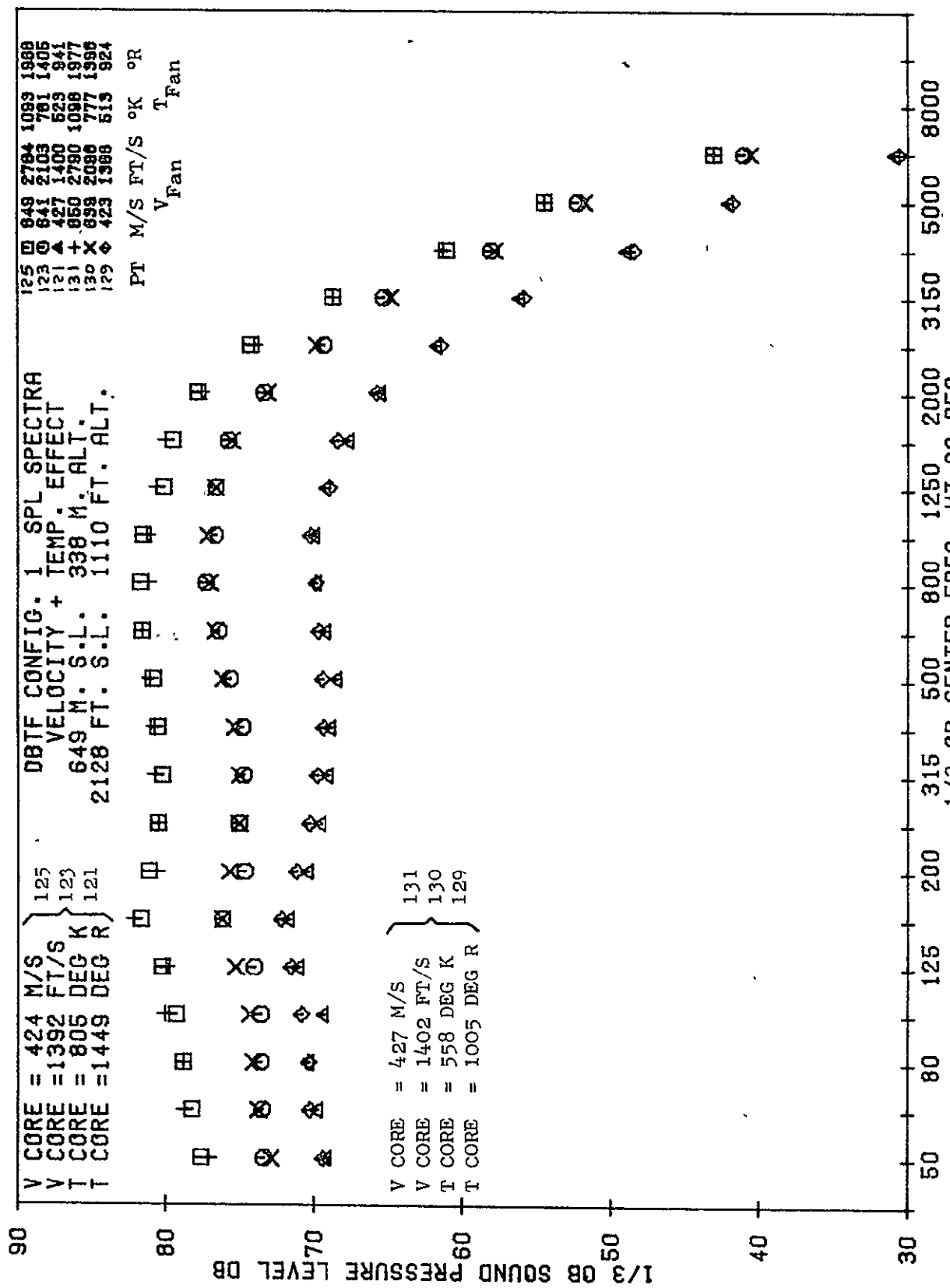

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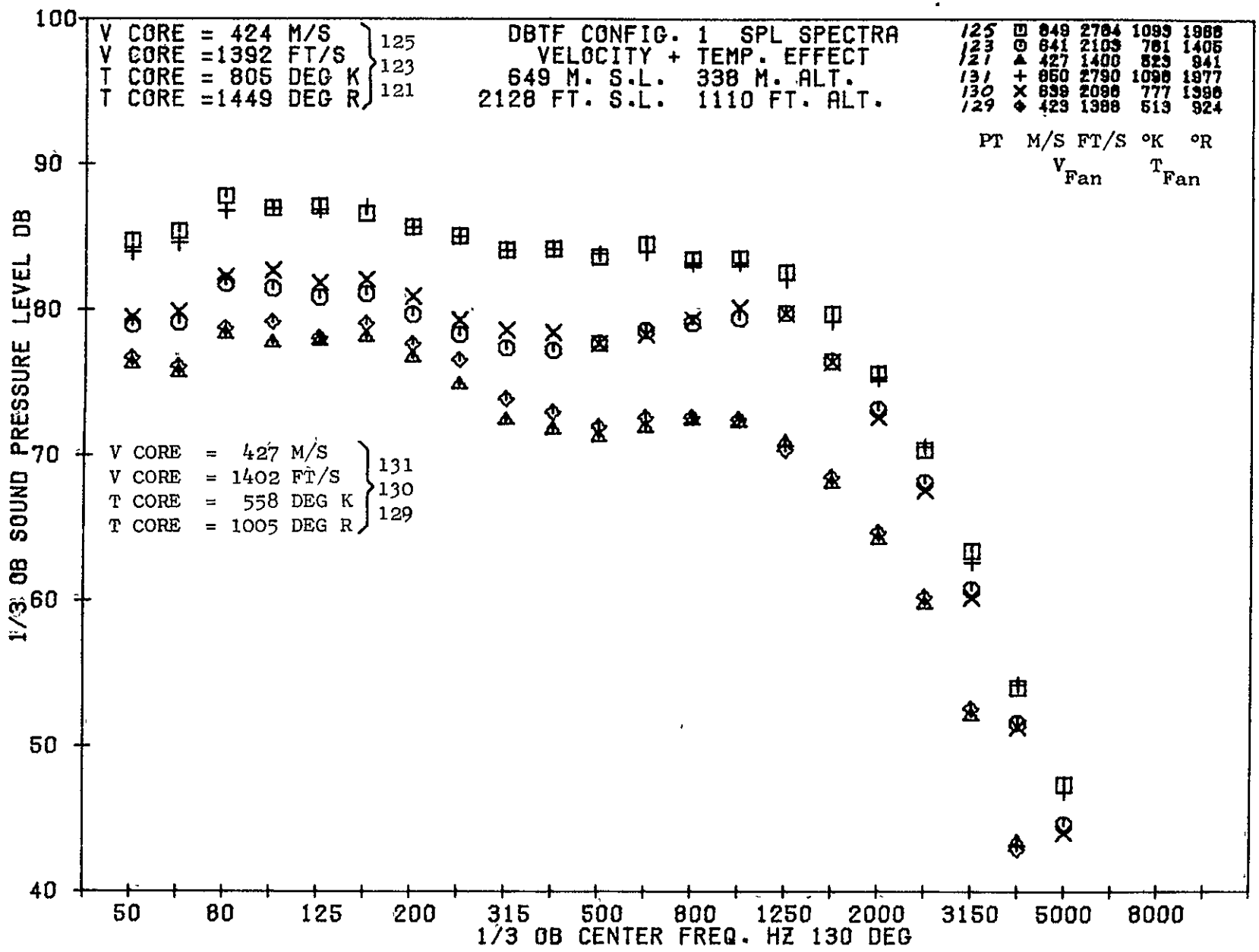

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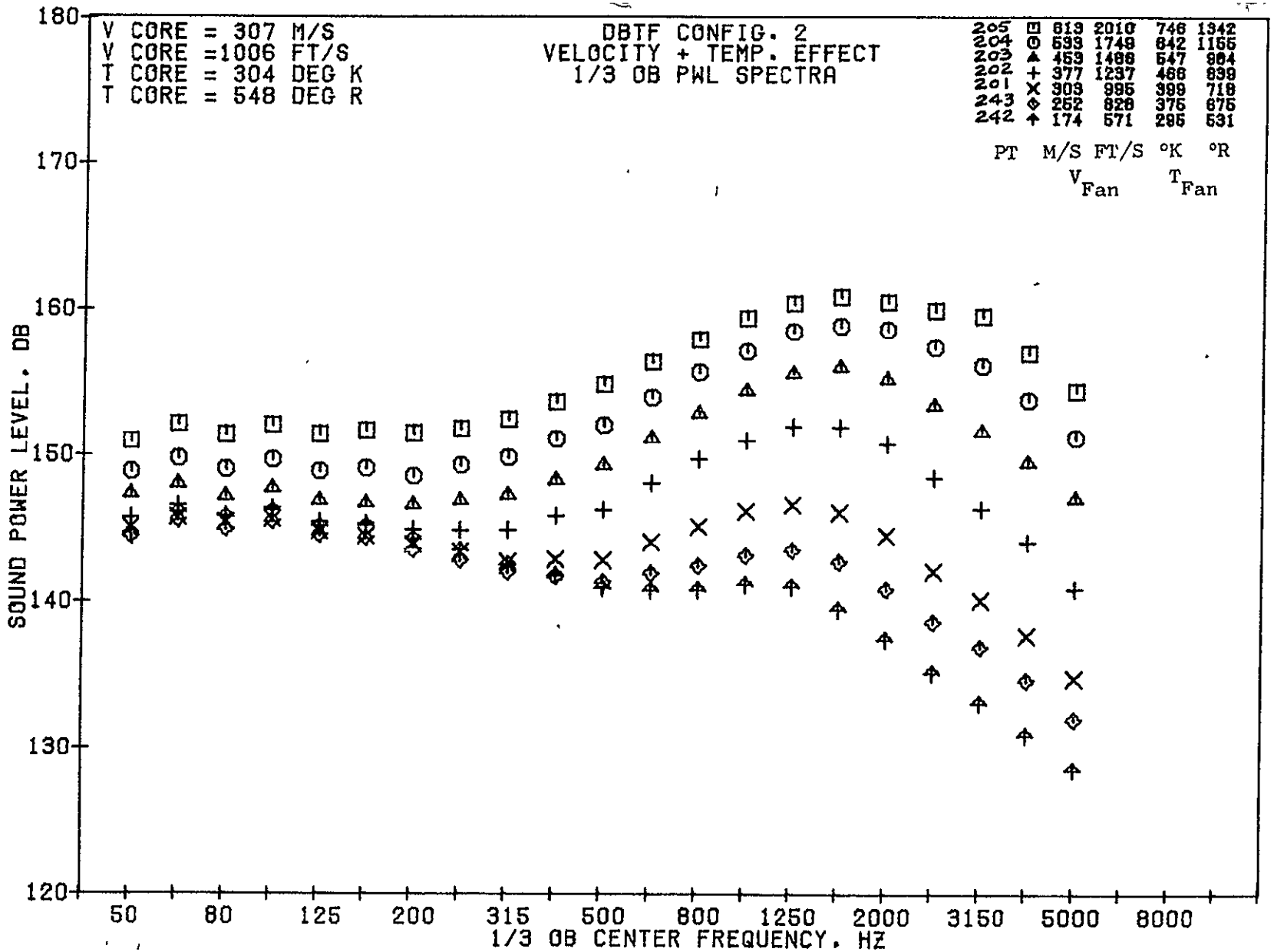

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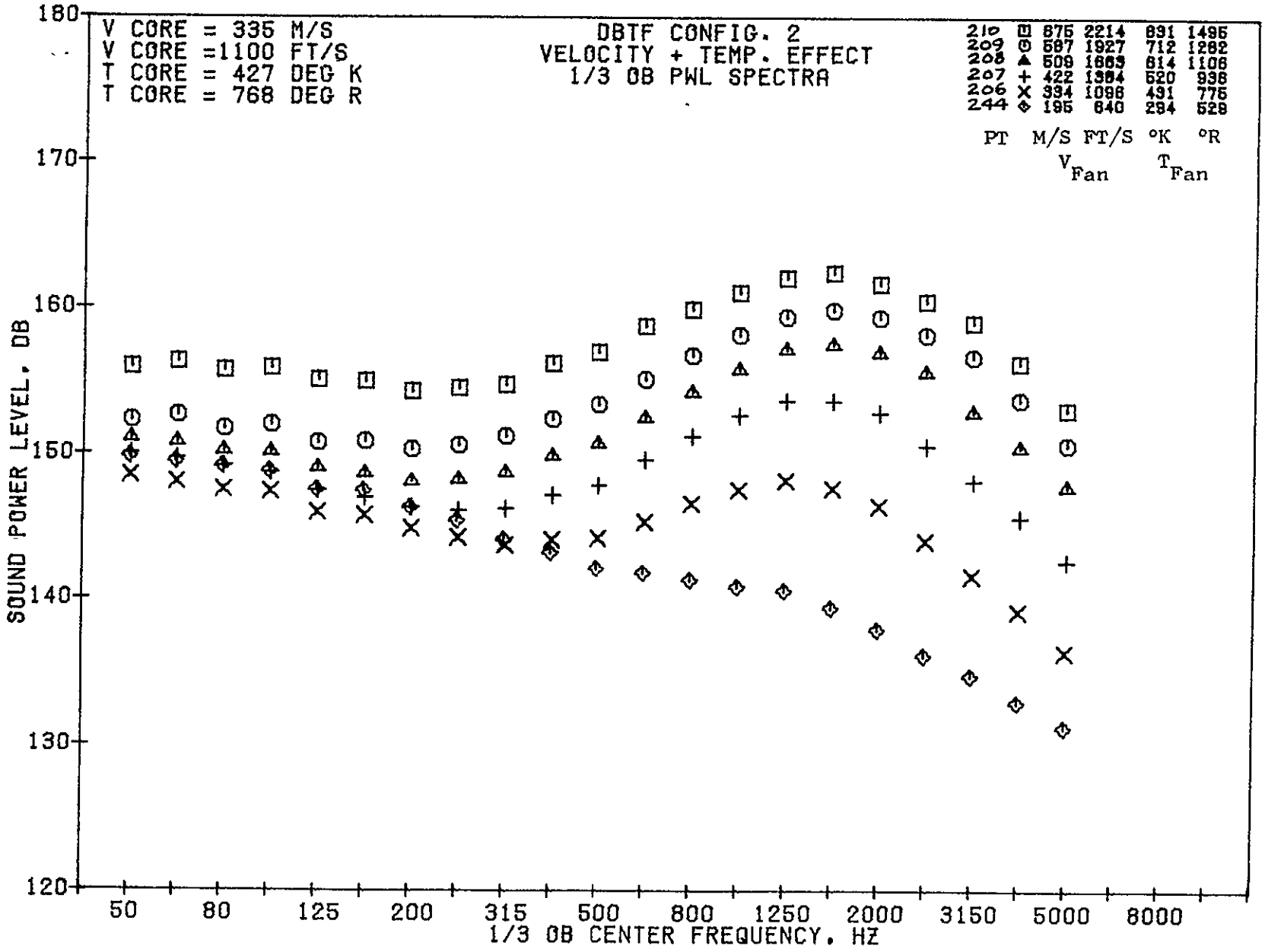

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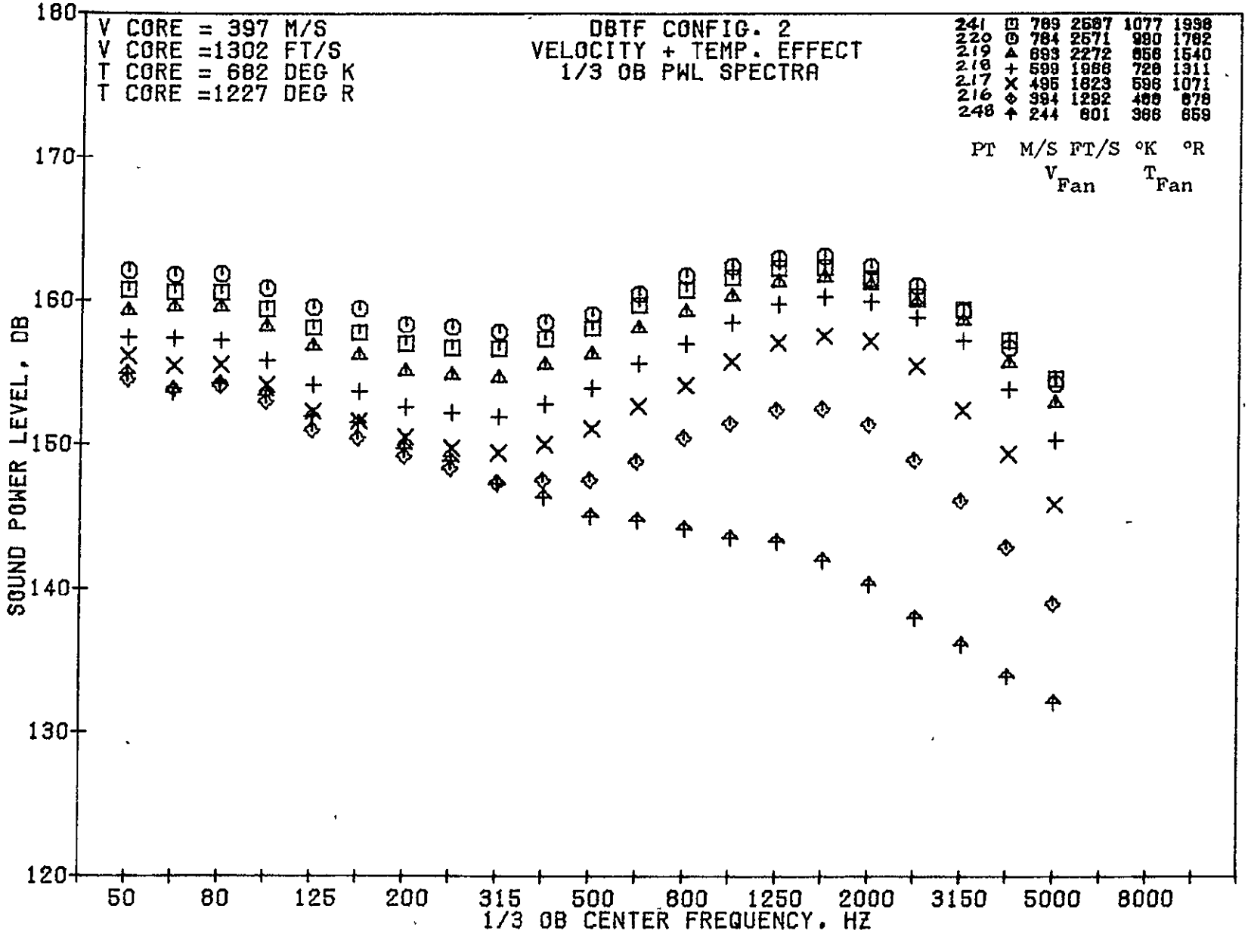

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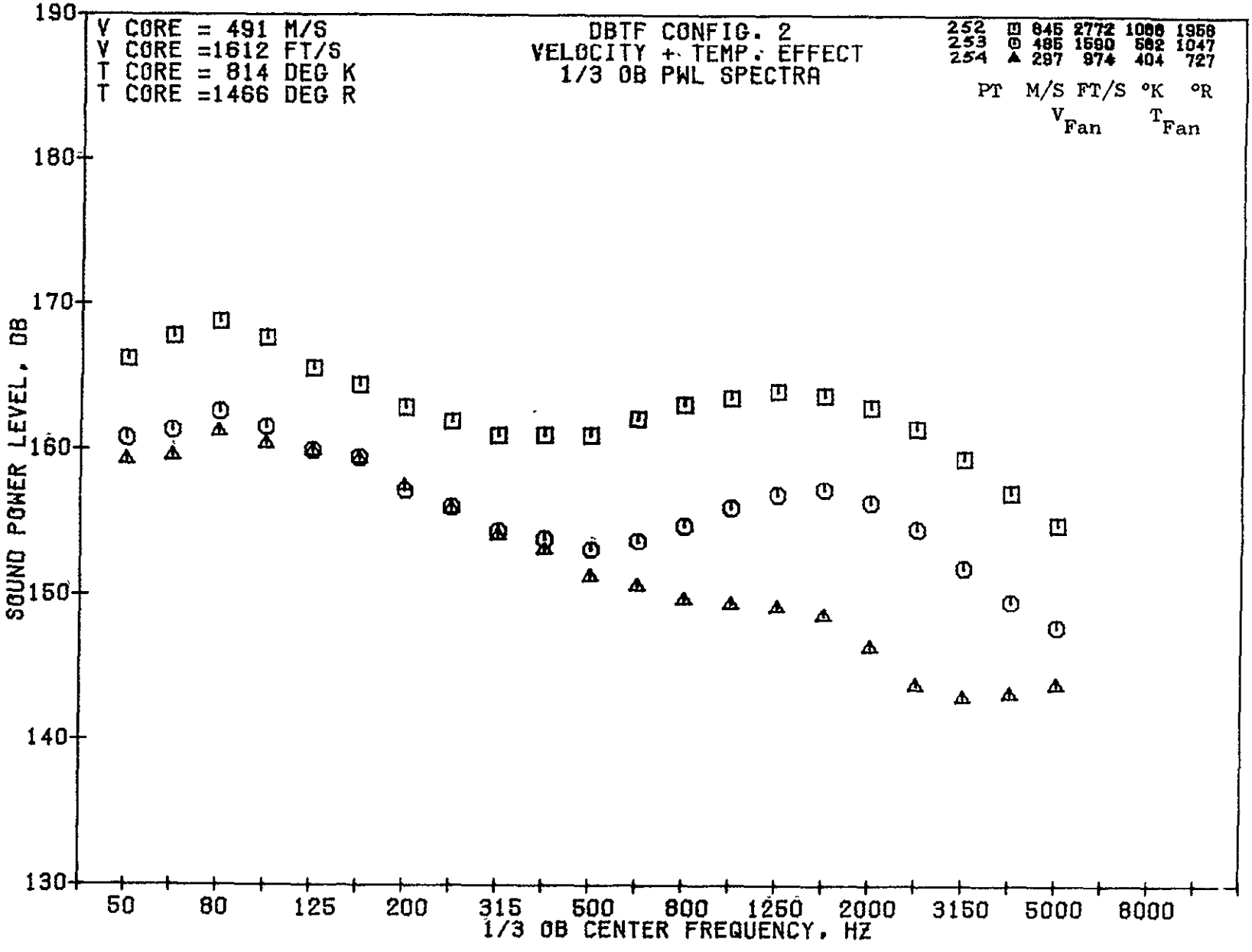

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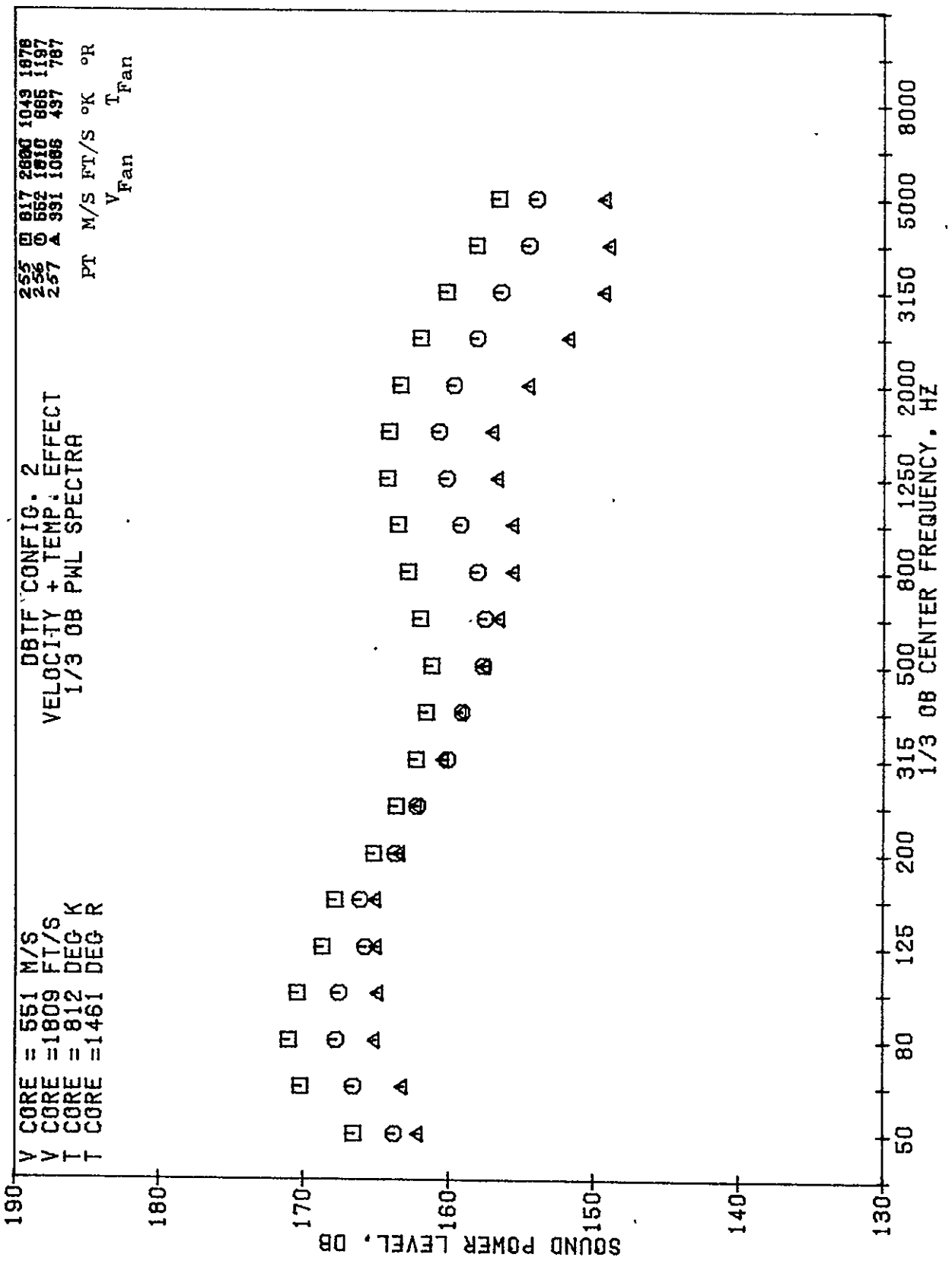

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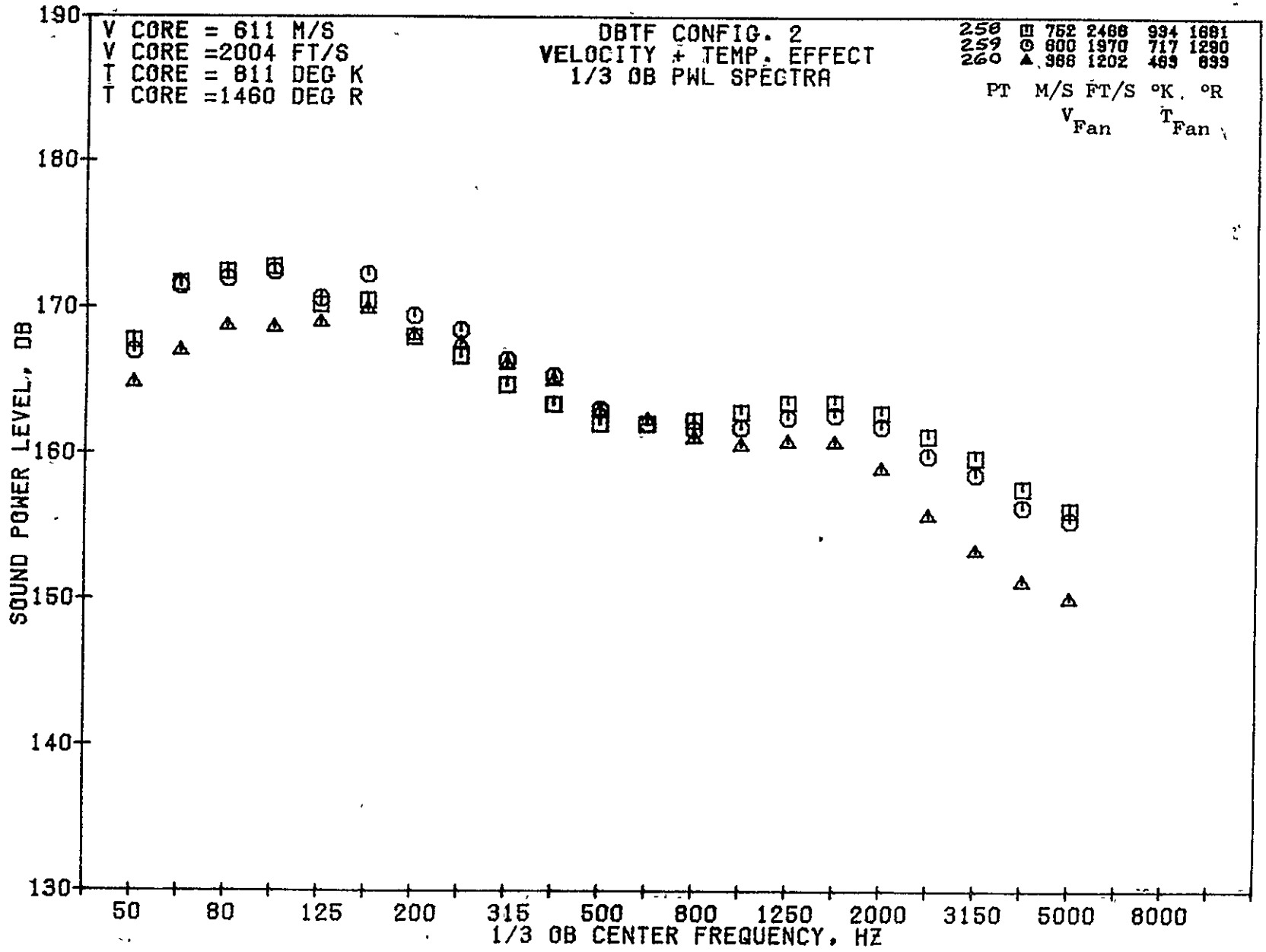

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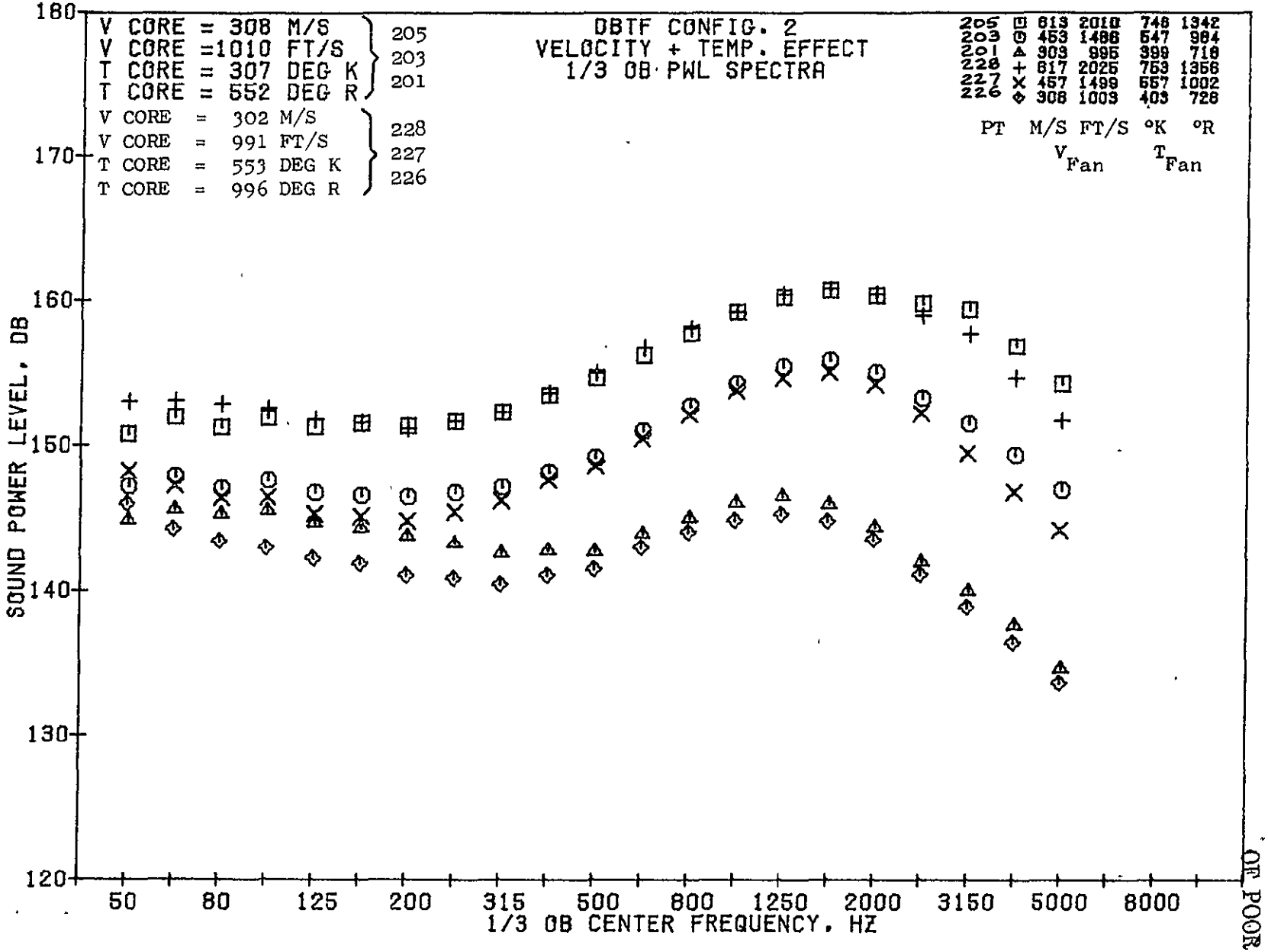

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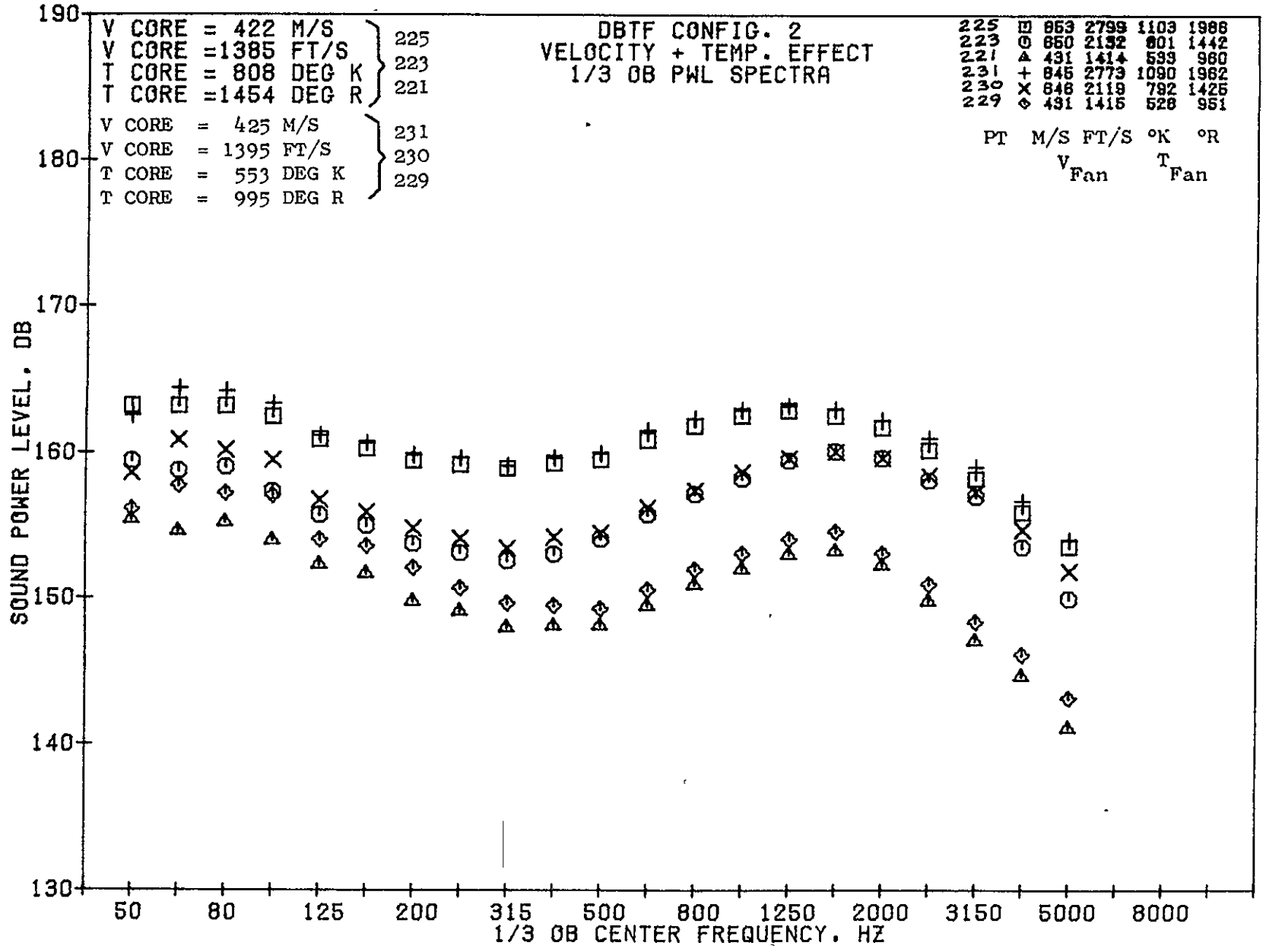

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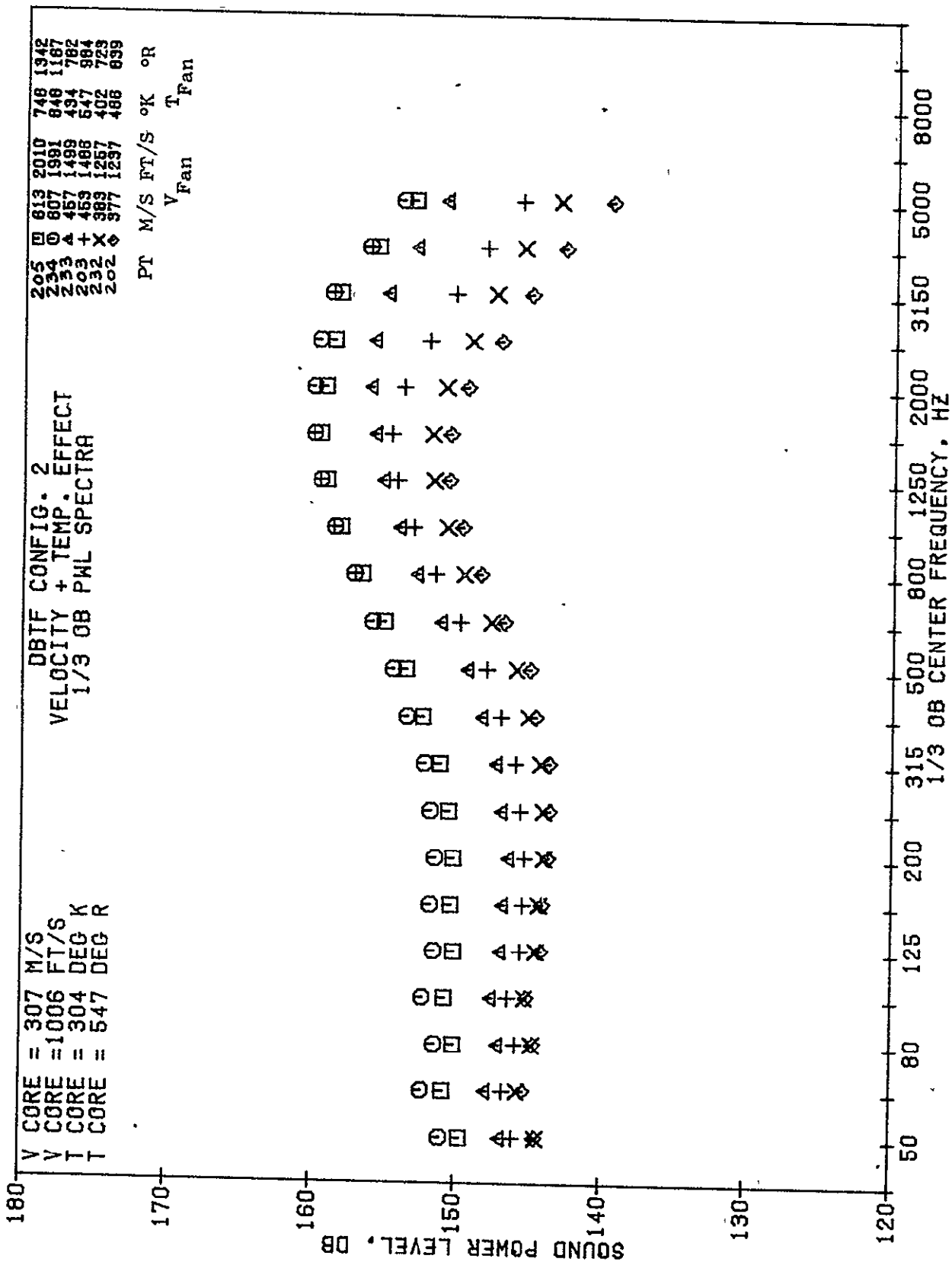

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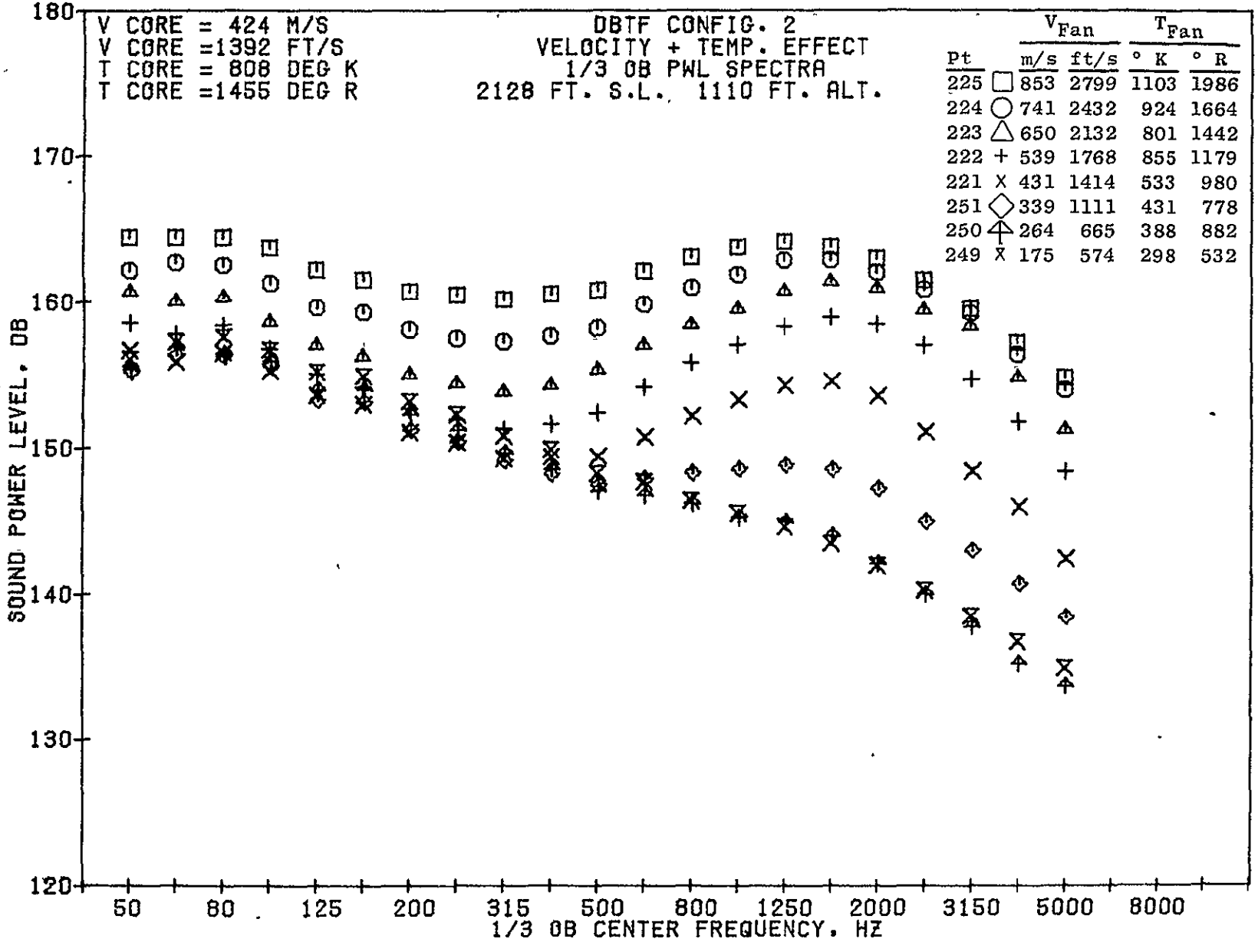

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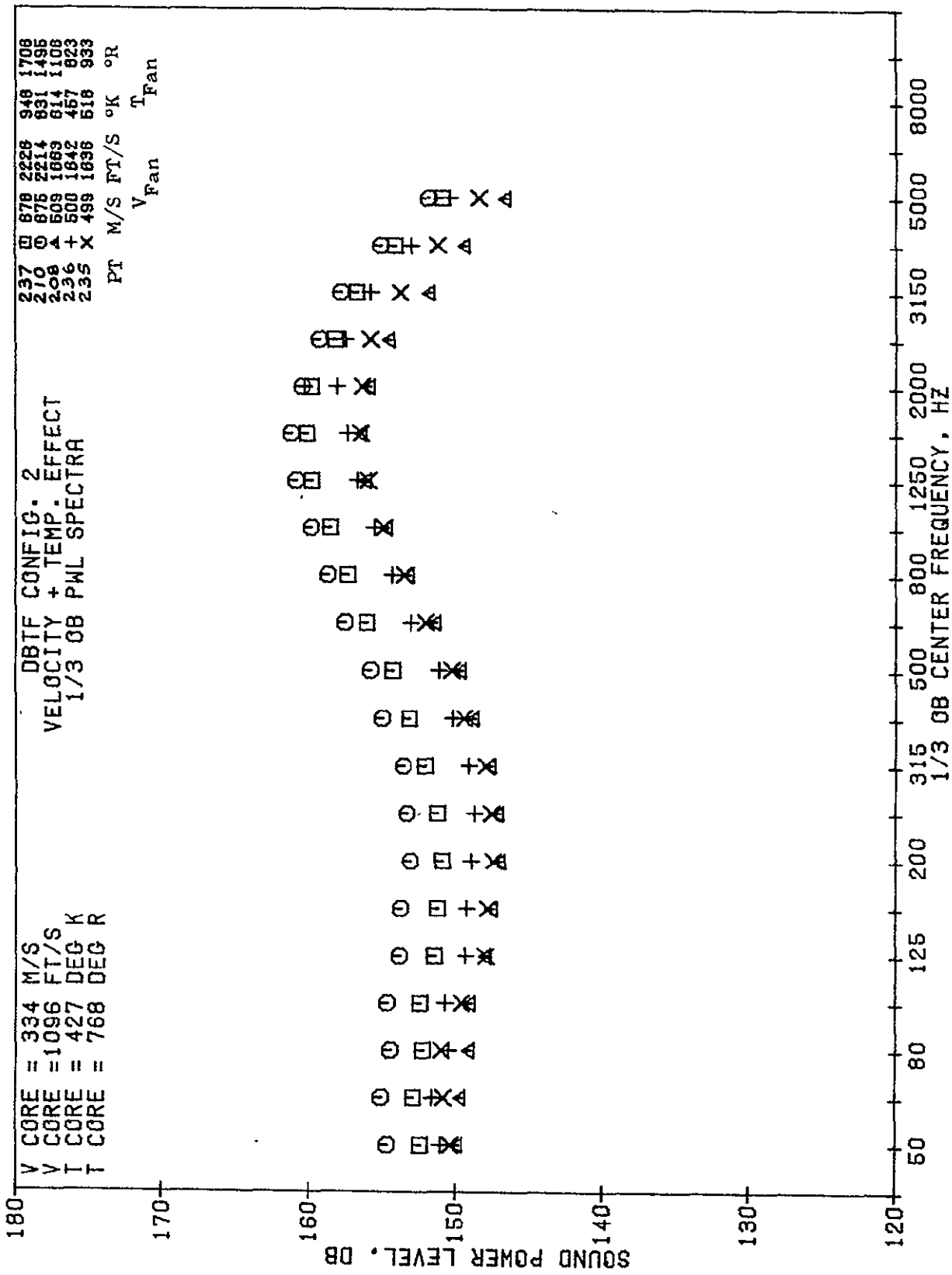

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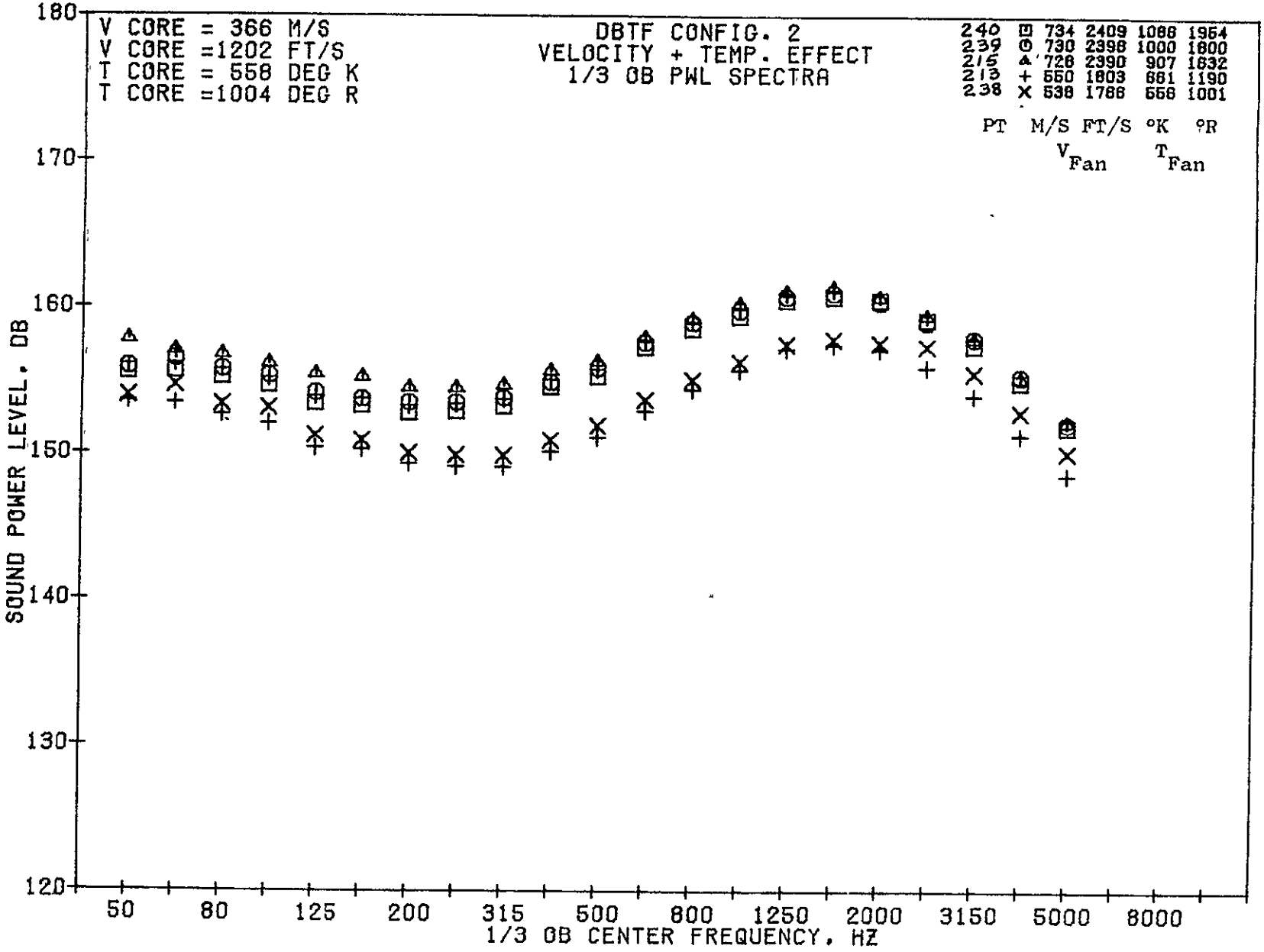

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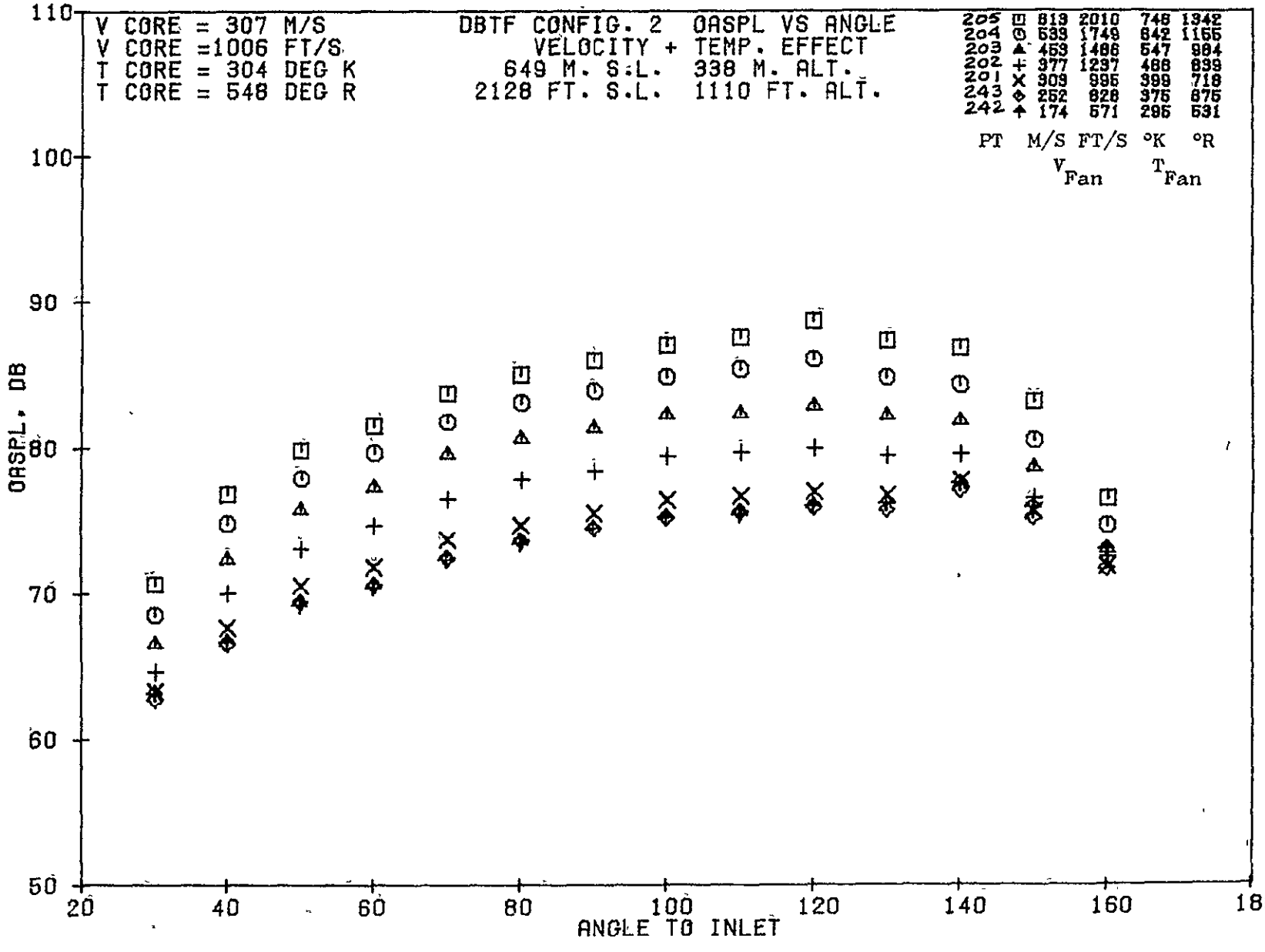

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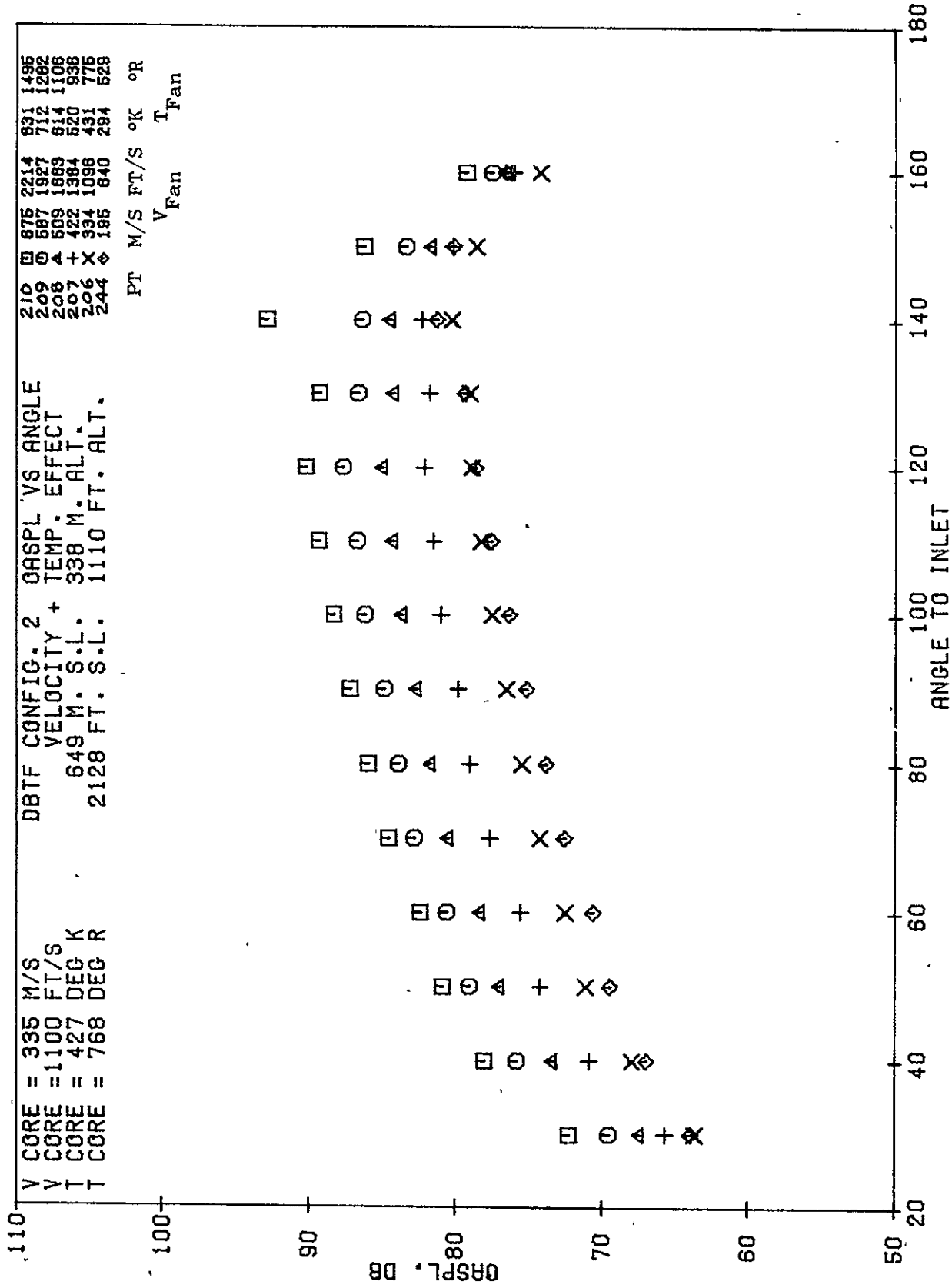

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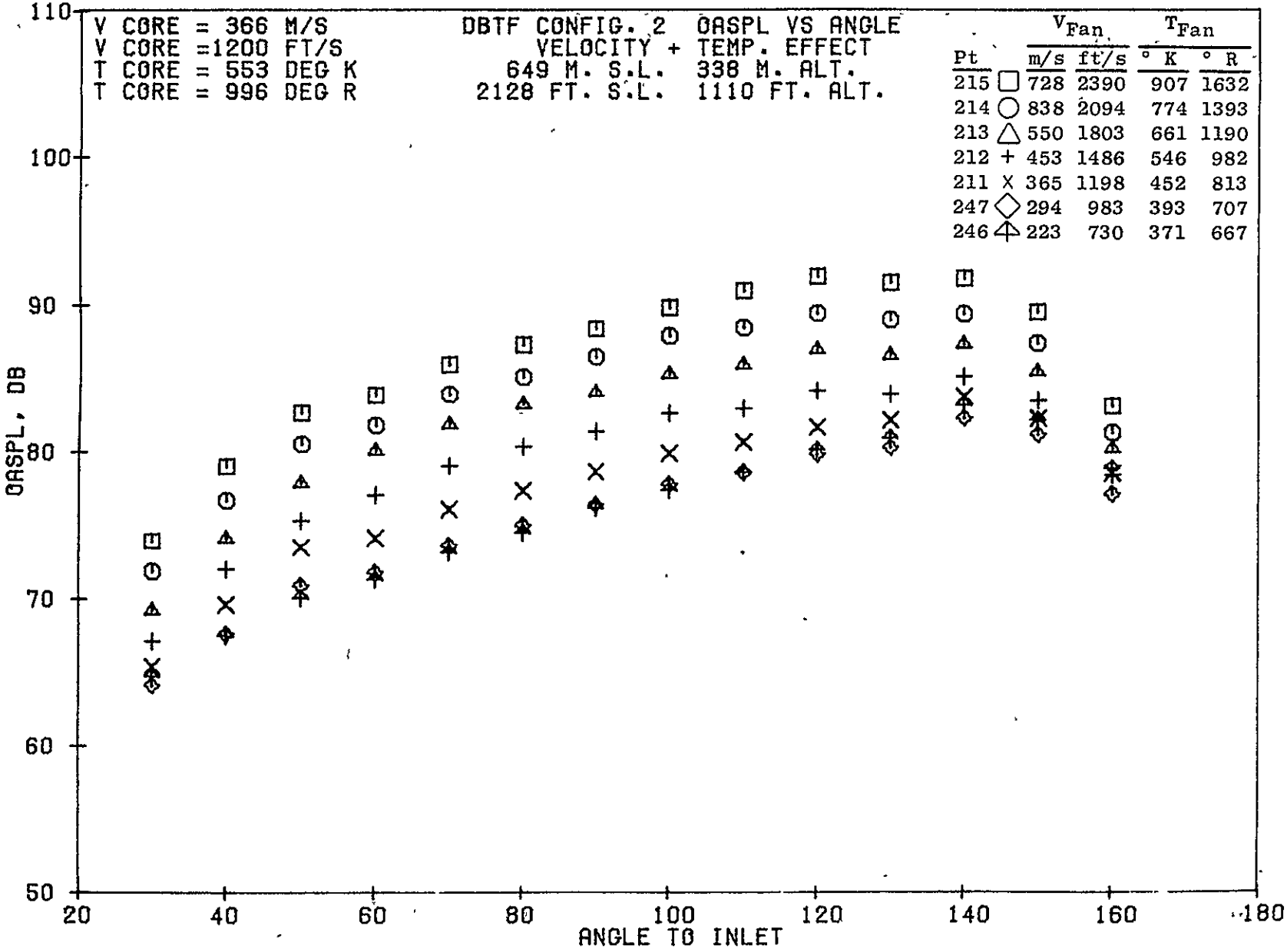

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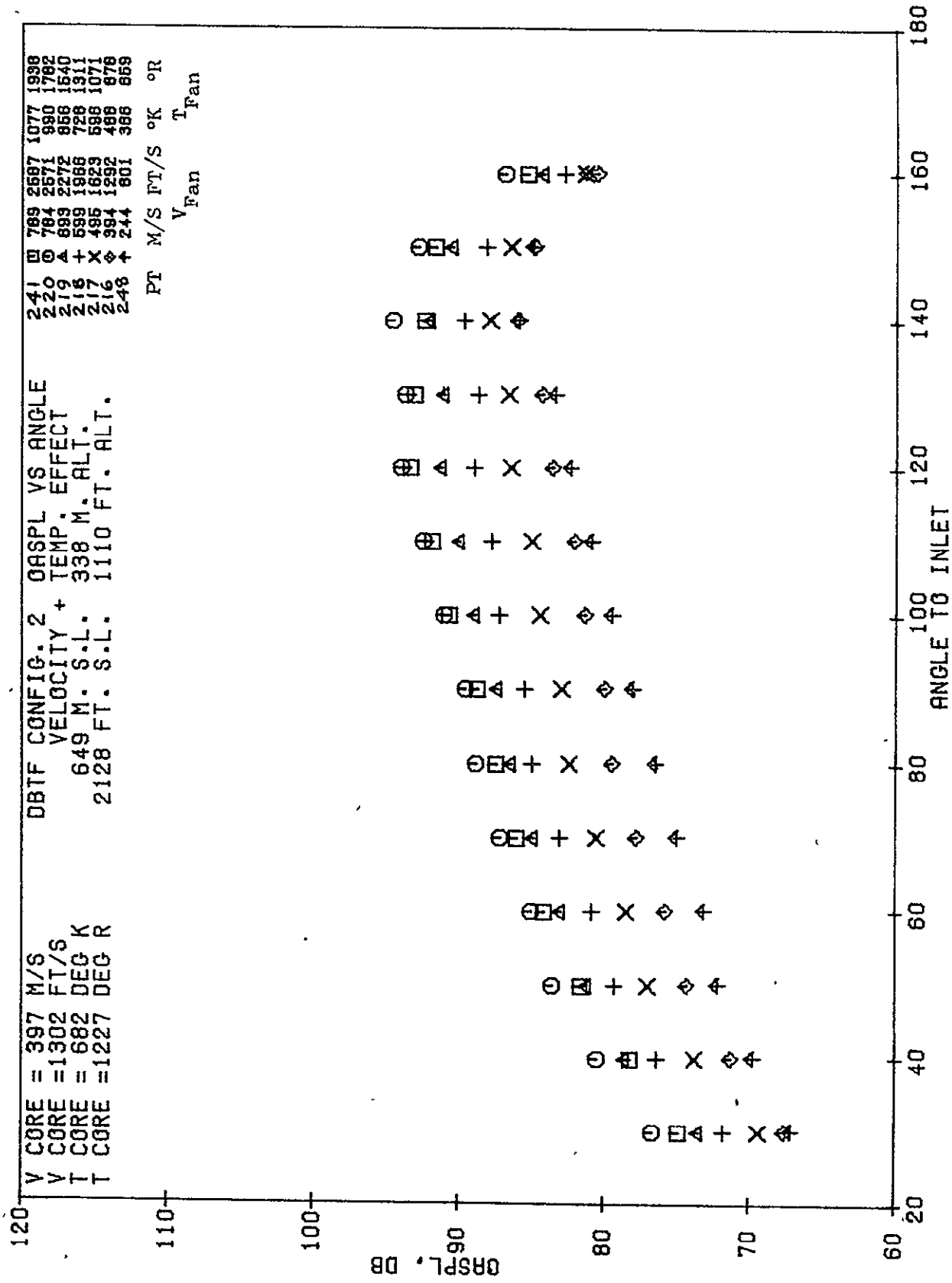

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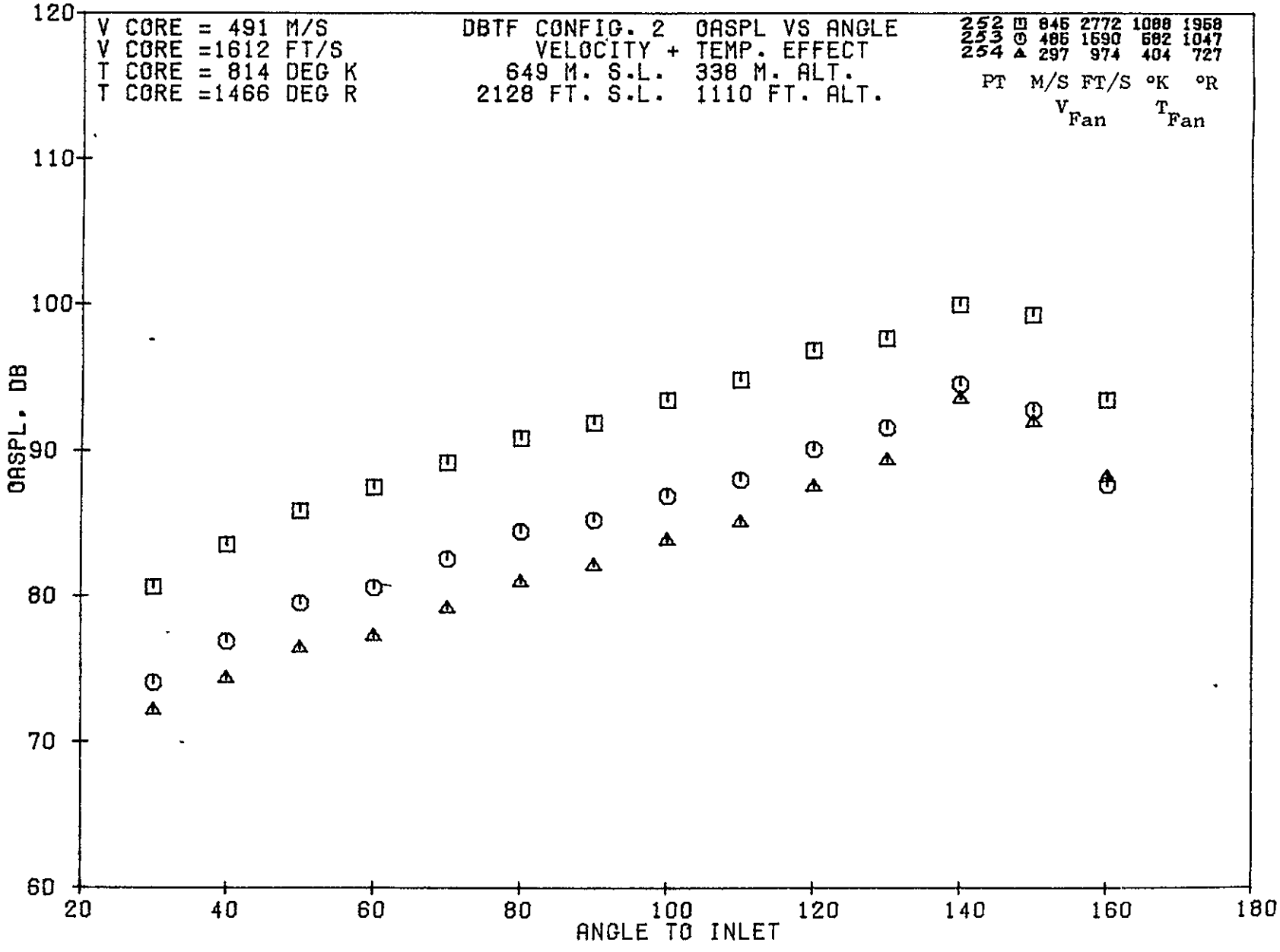

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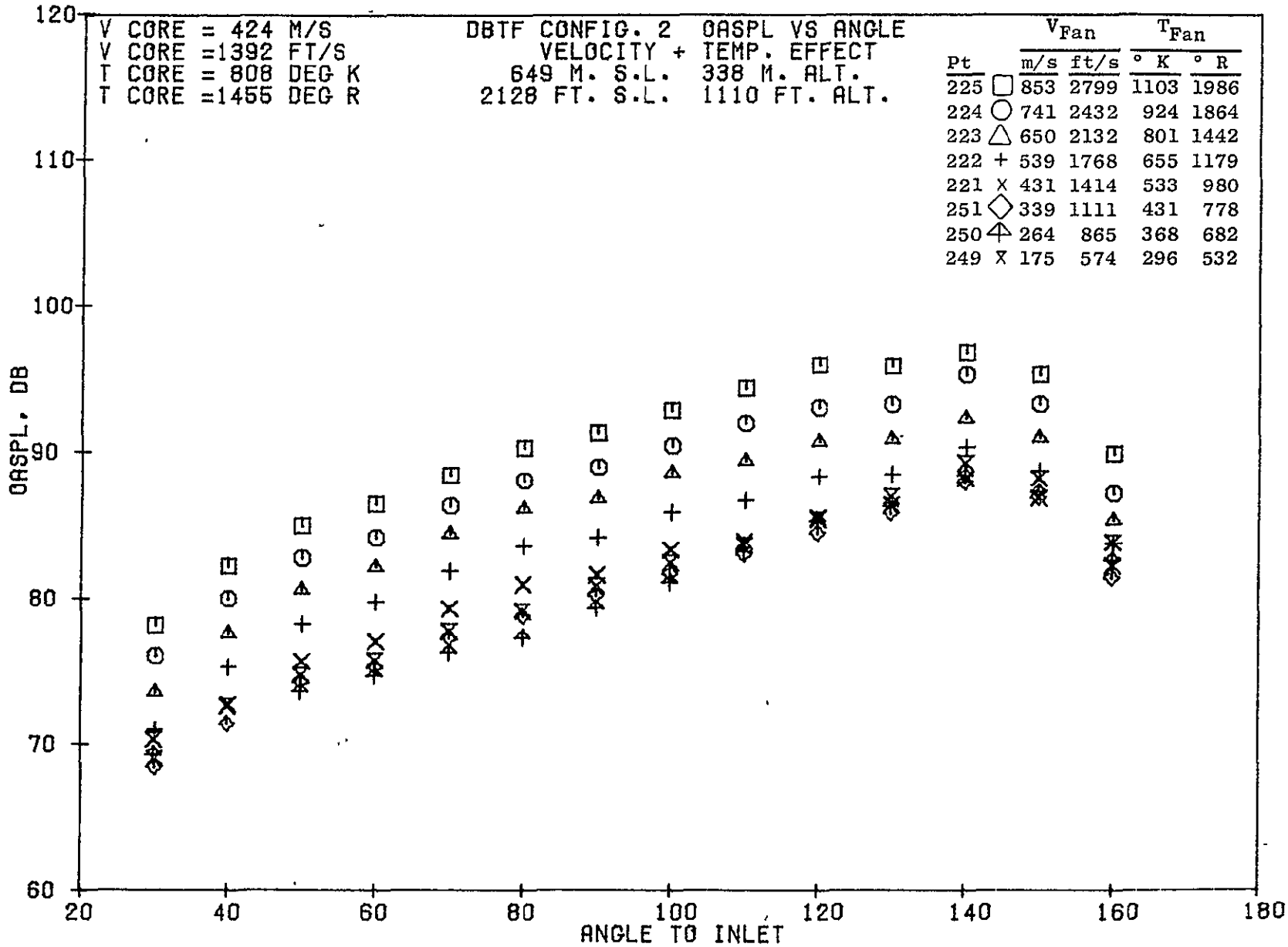

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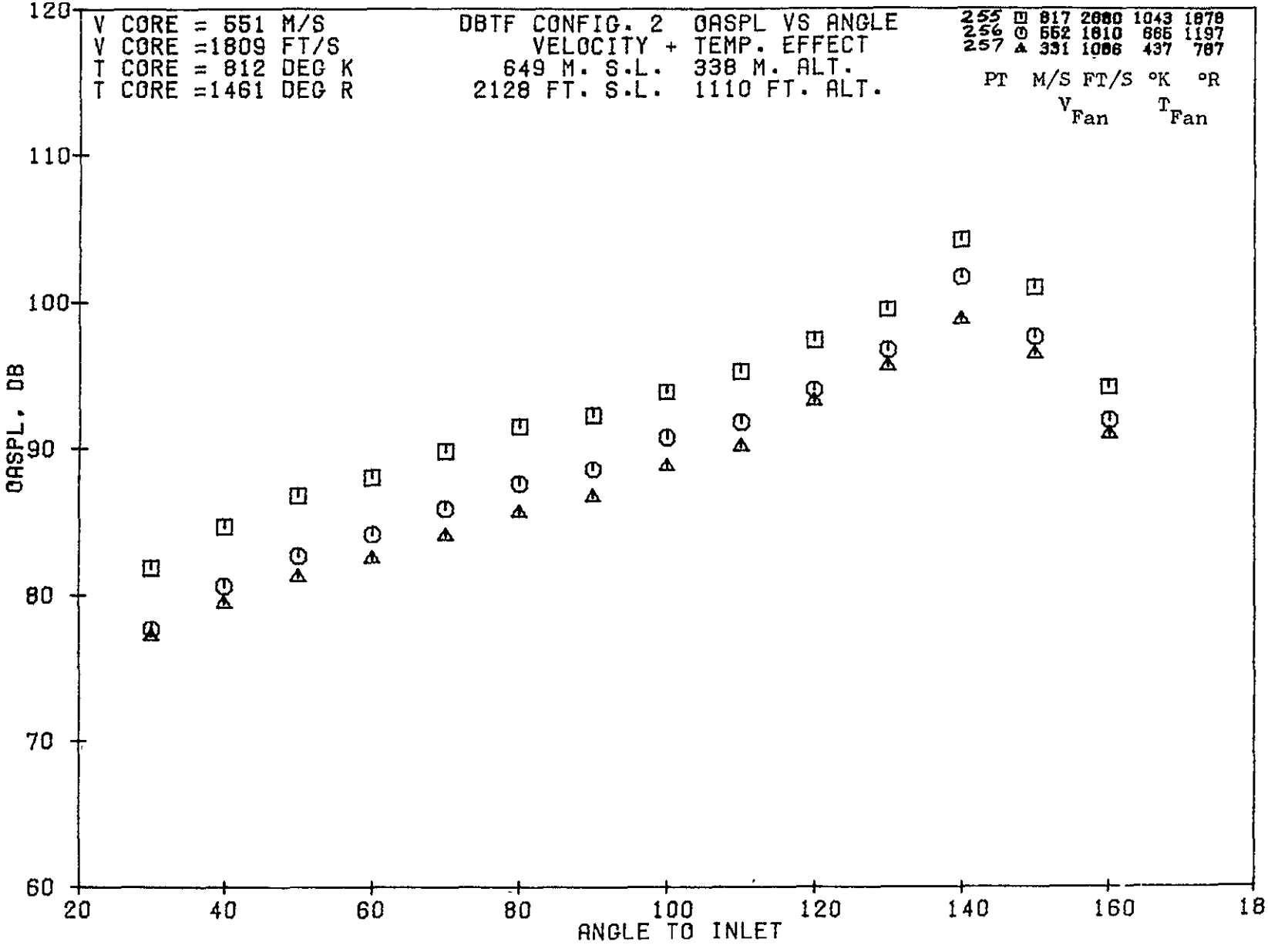
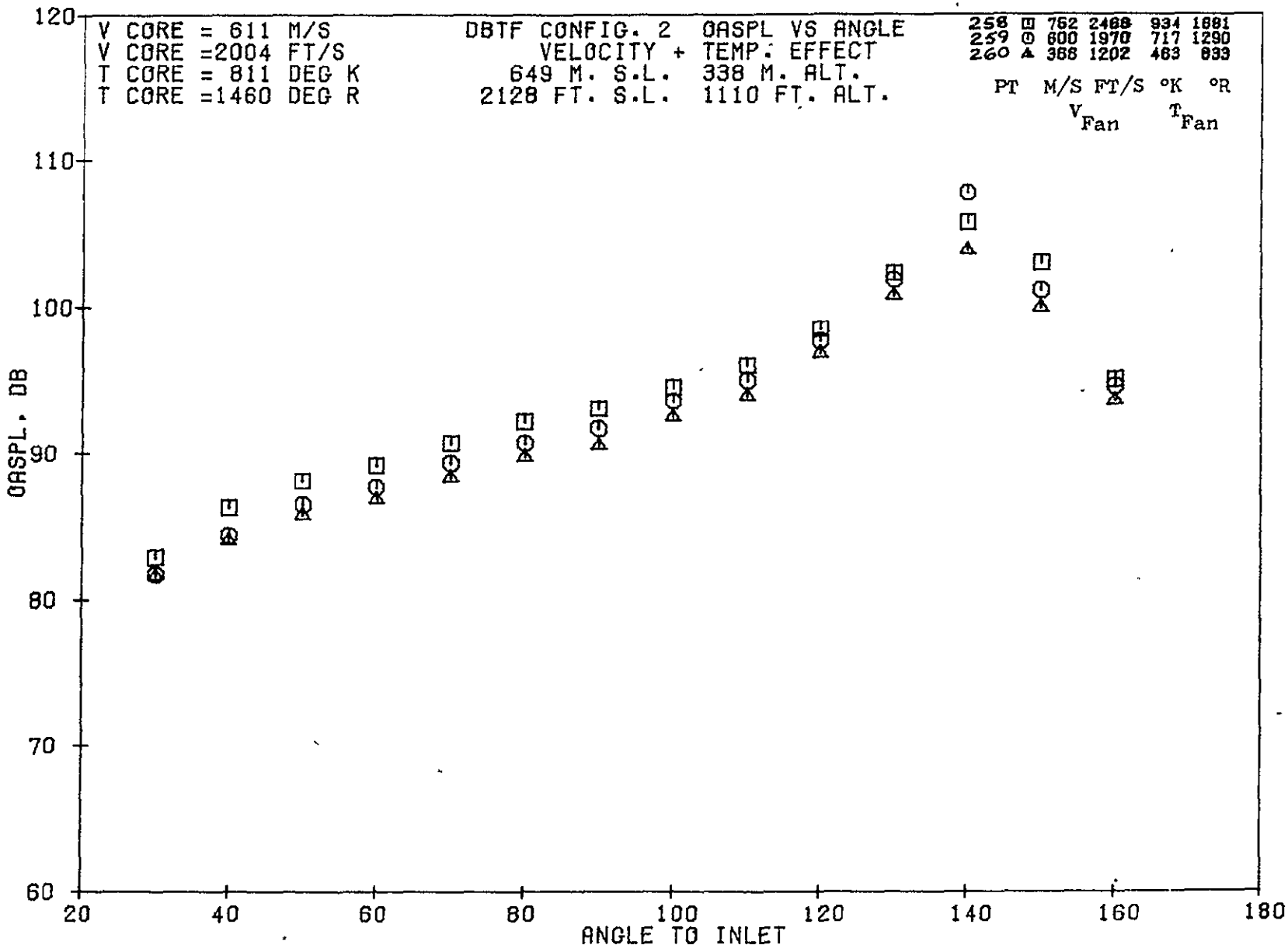
5R266-001

79 BIRCH A.



1374

08/13/75
5R032-001



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08/13/75
5R032-001

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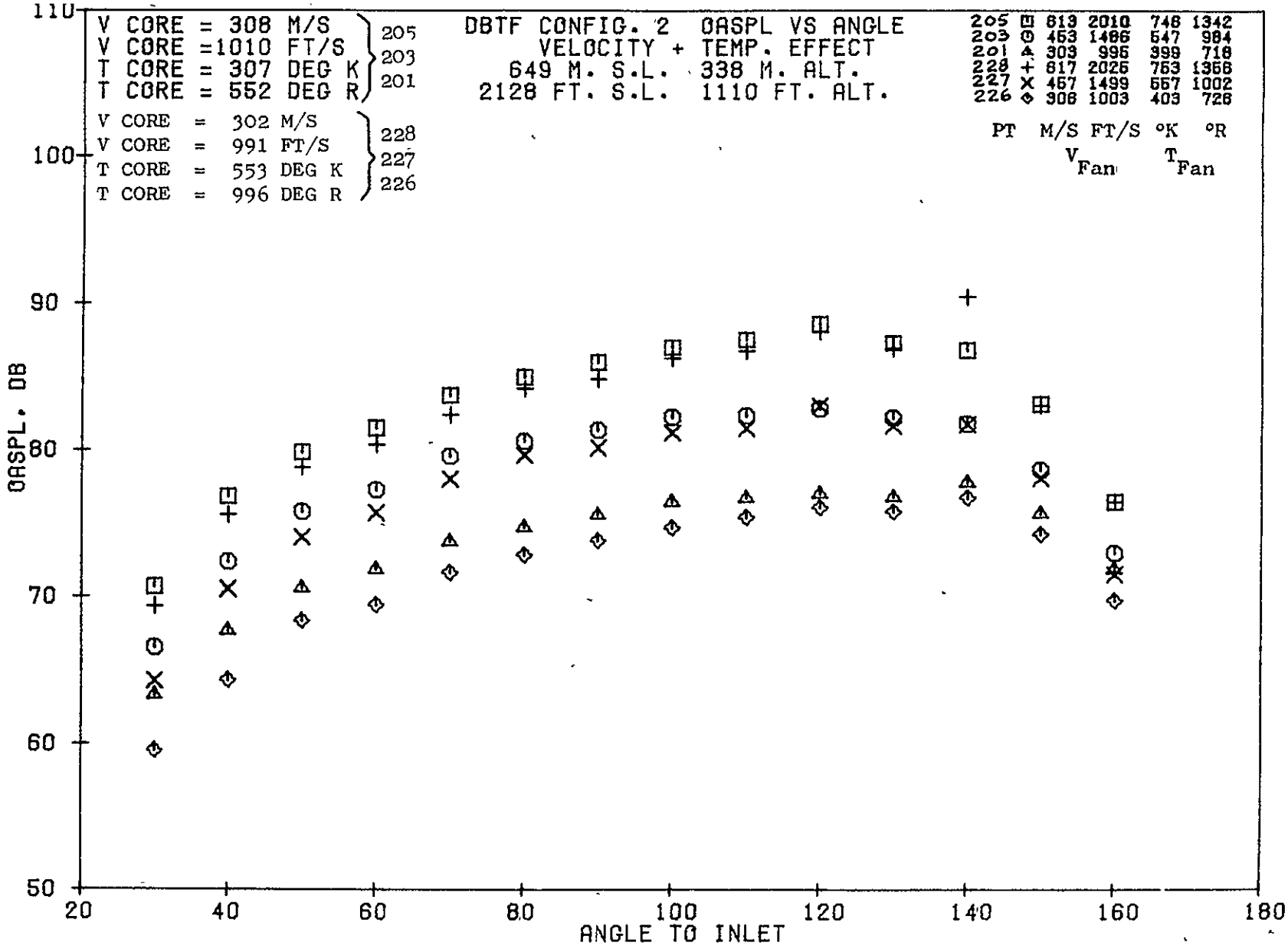

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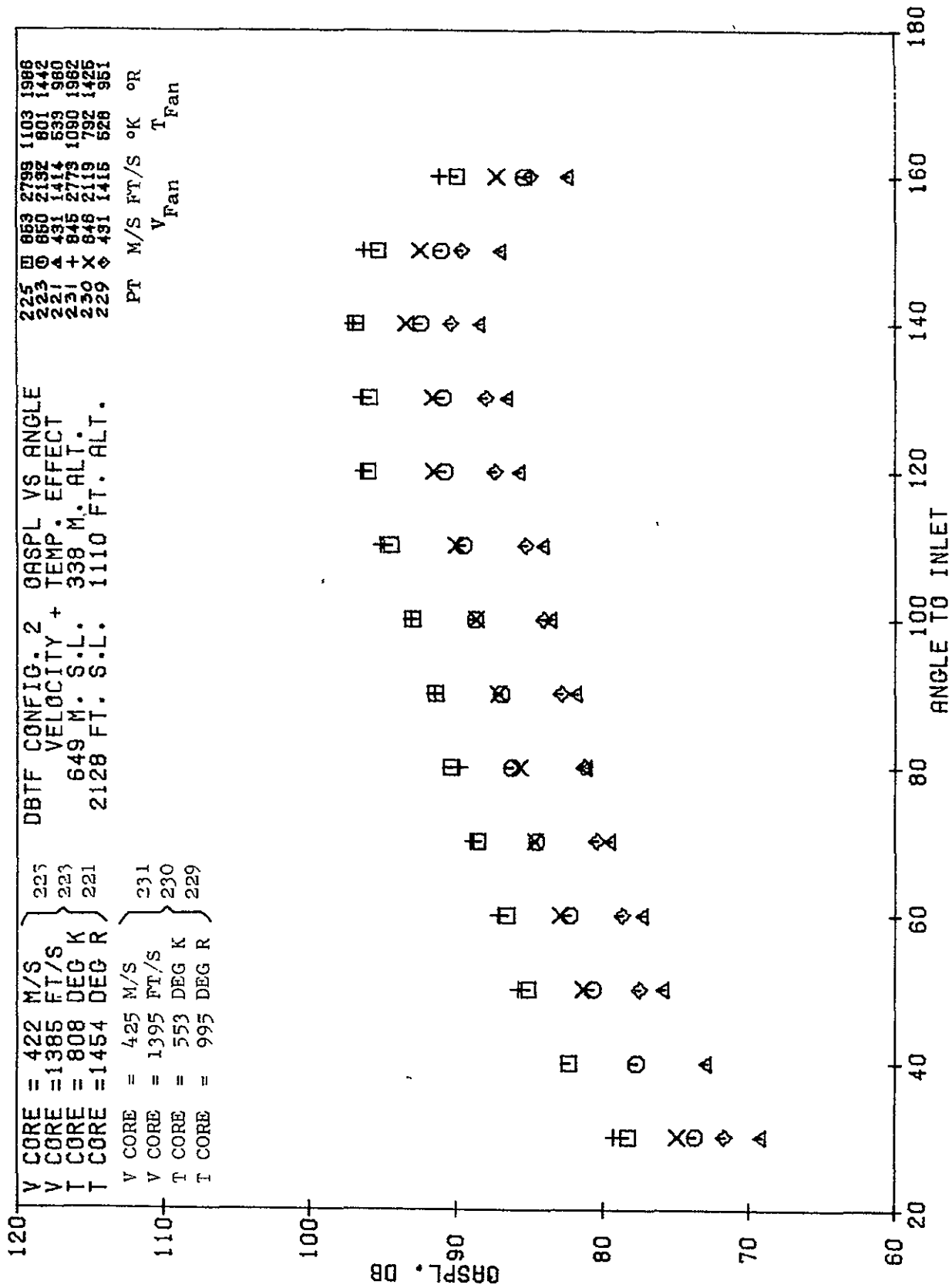
5R032-001



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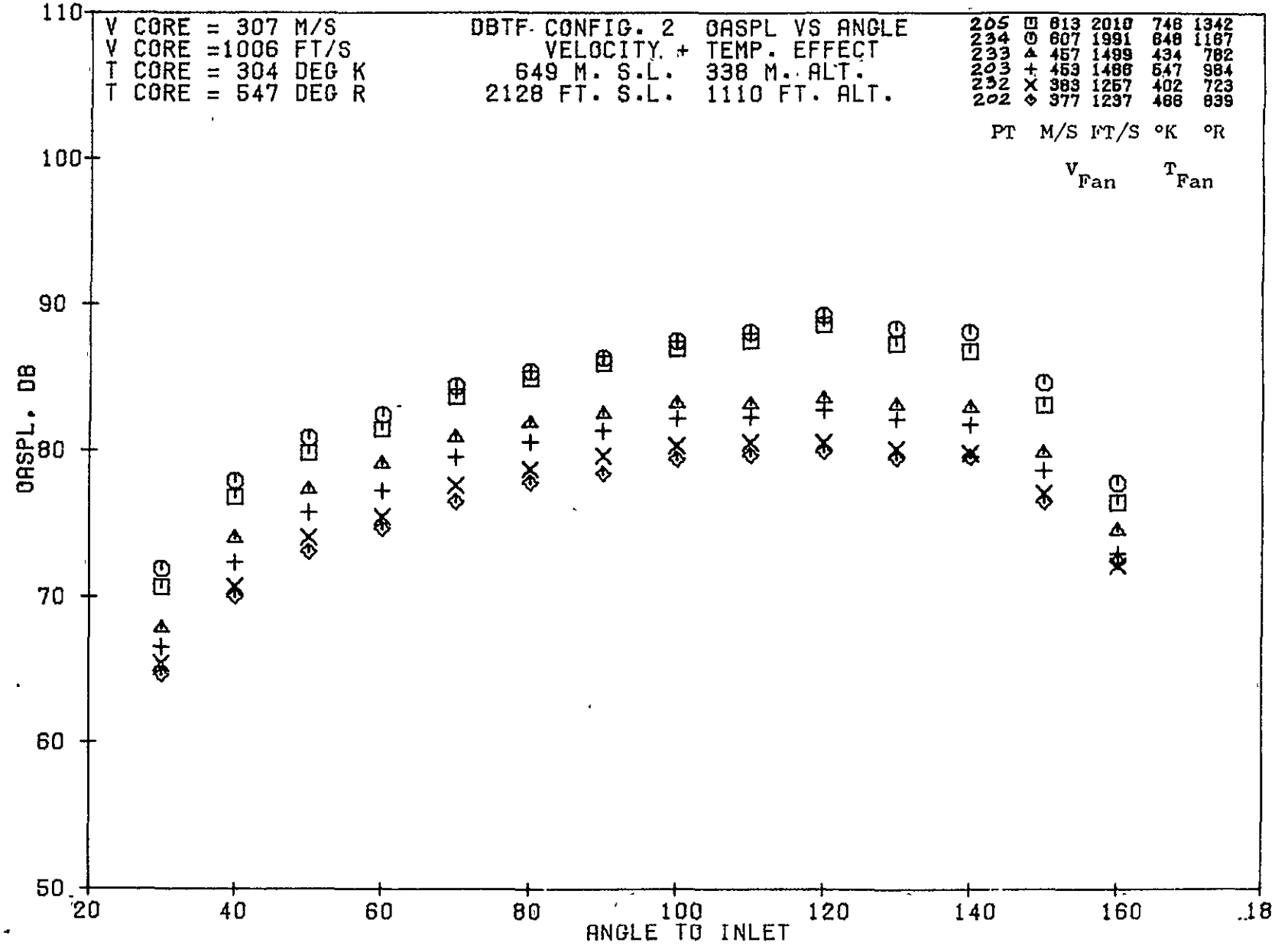

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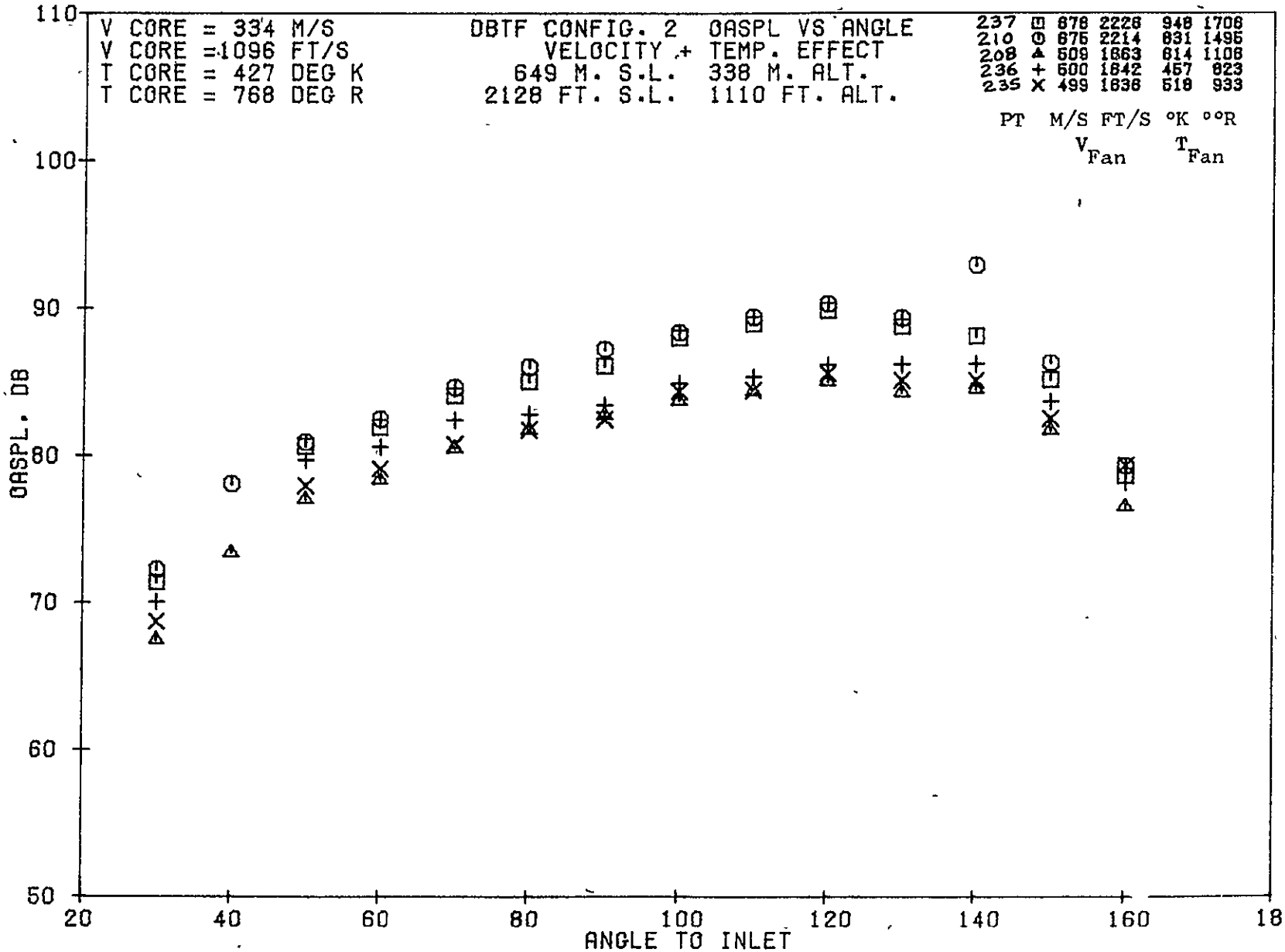
5R032-001



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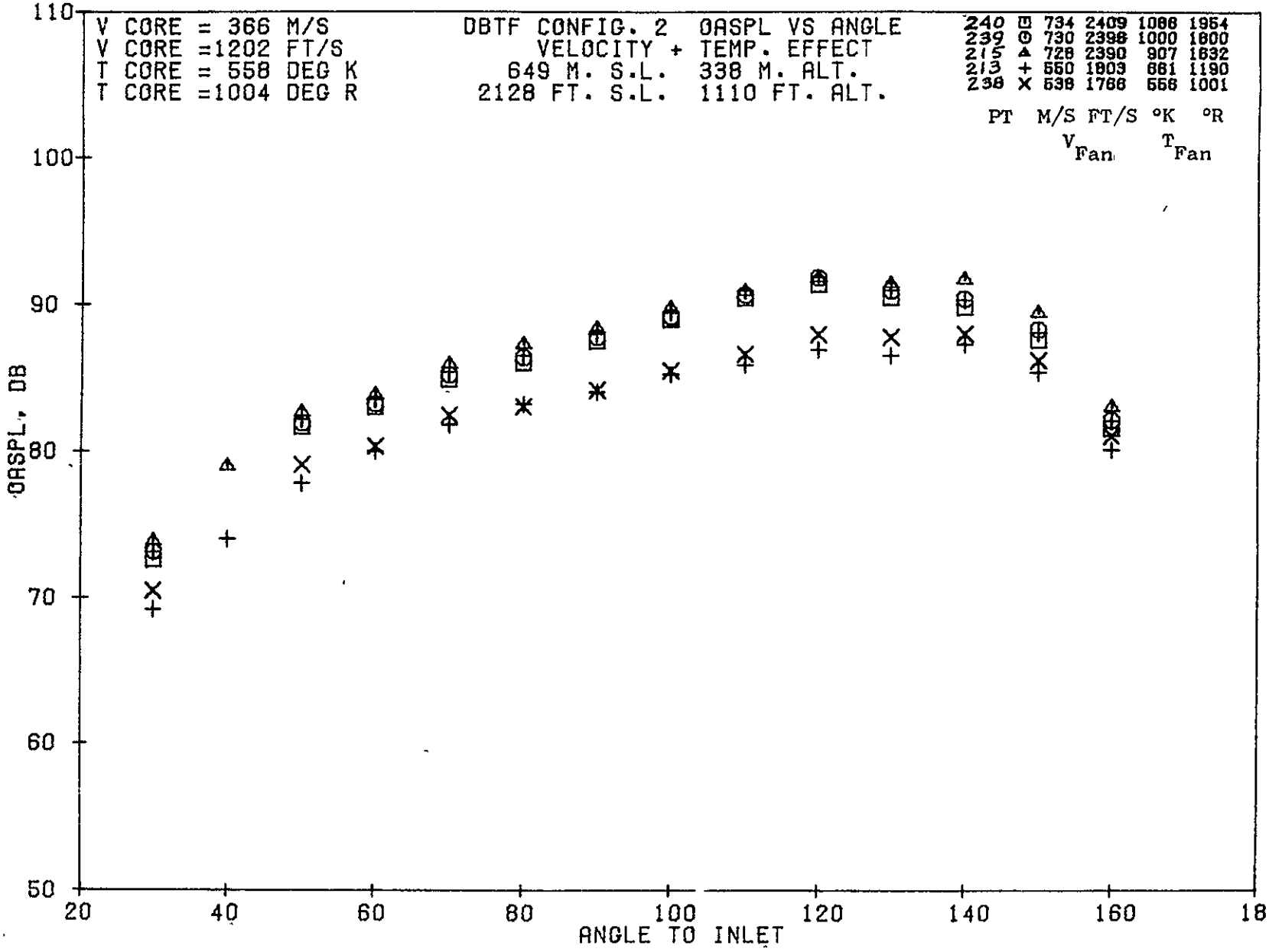

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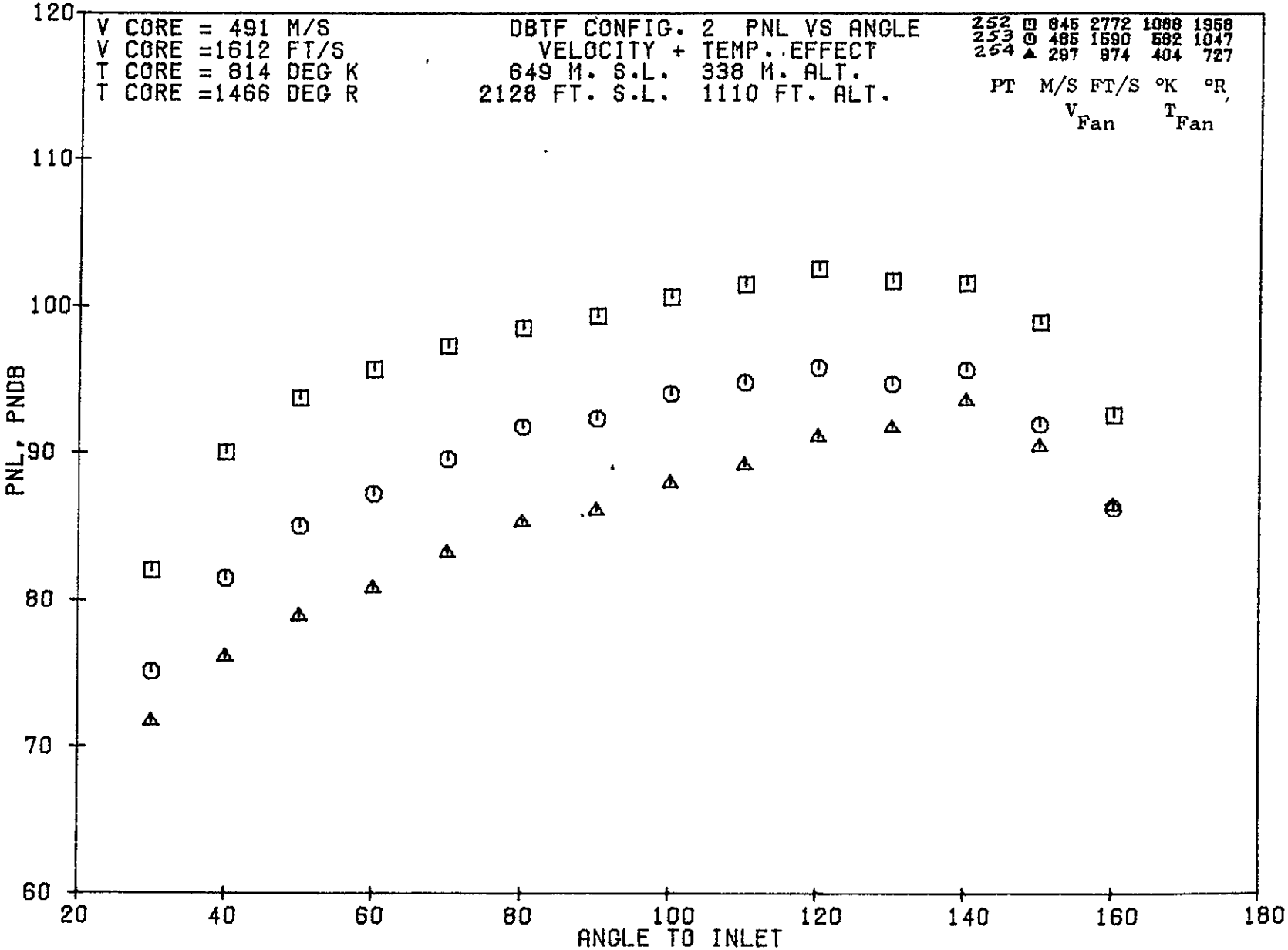

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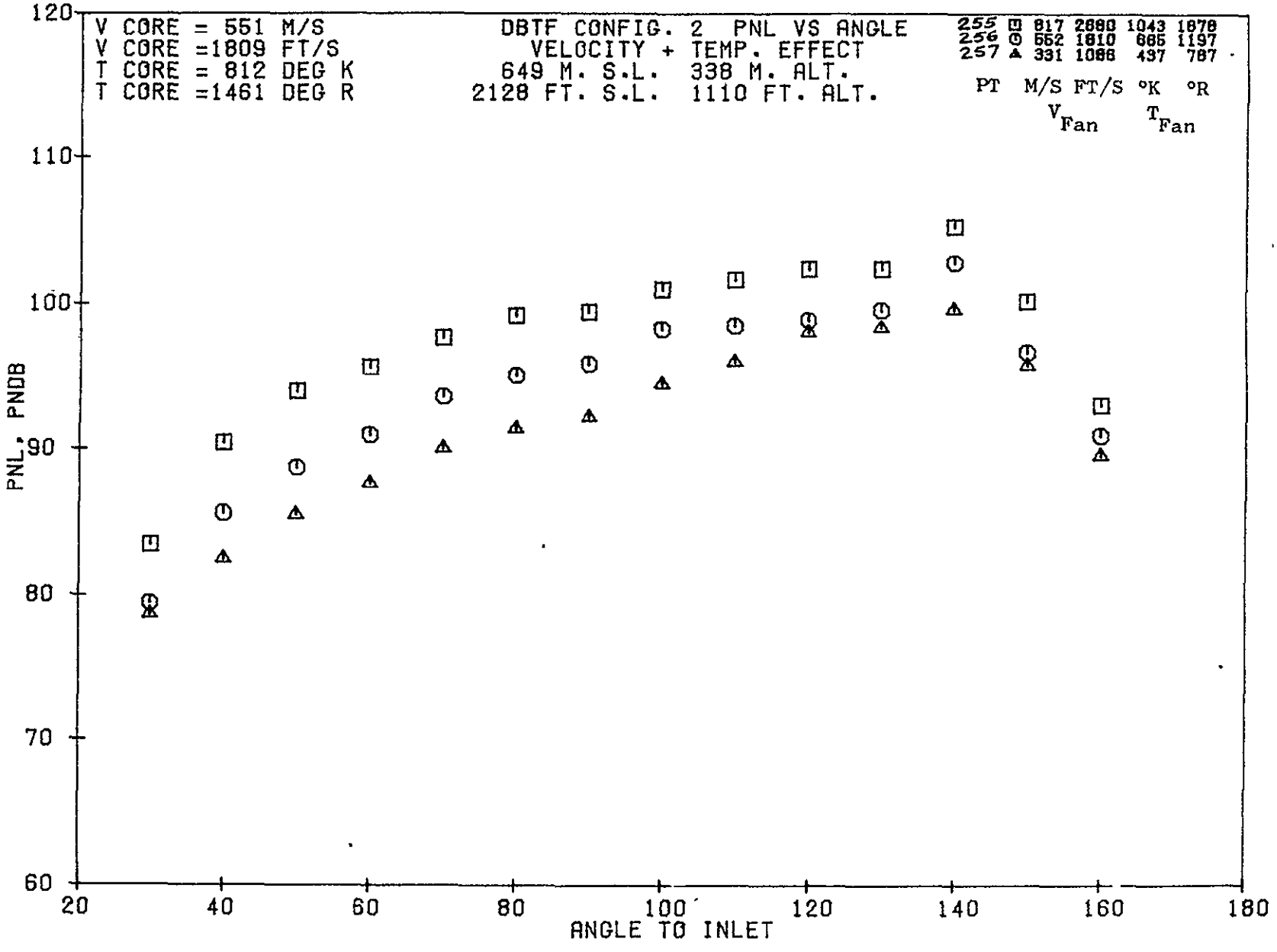

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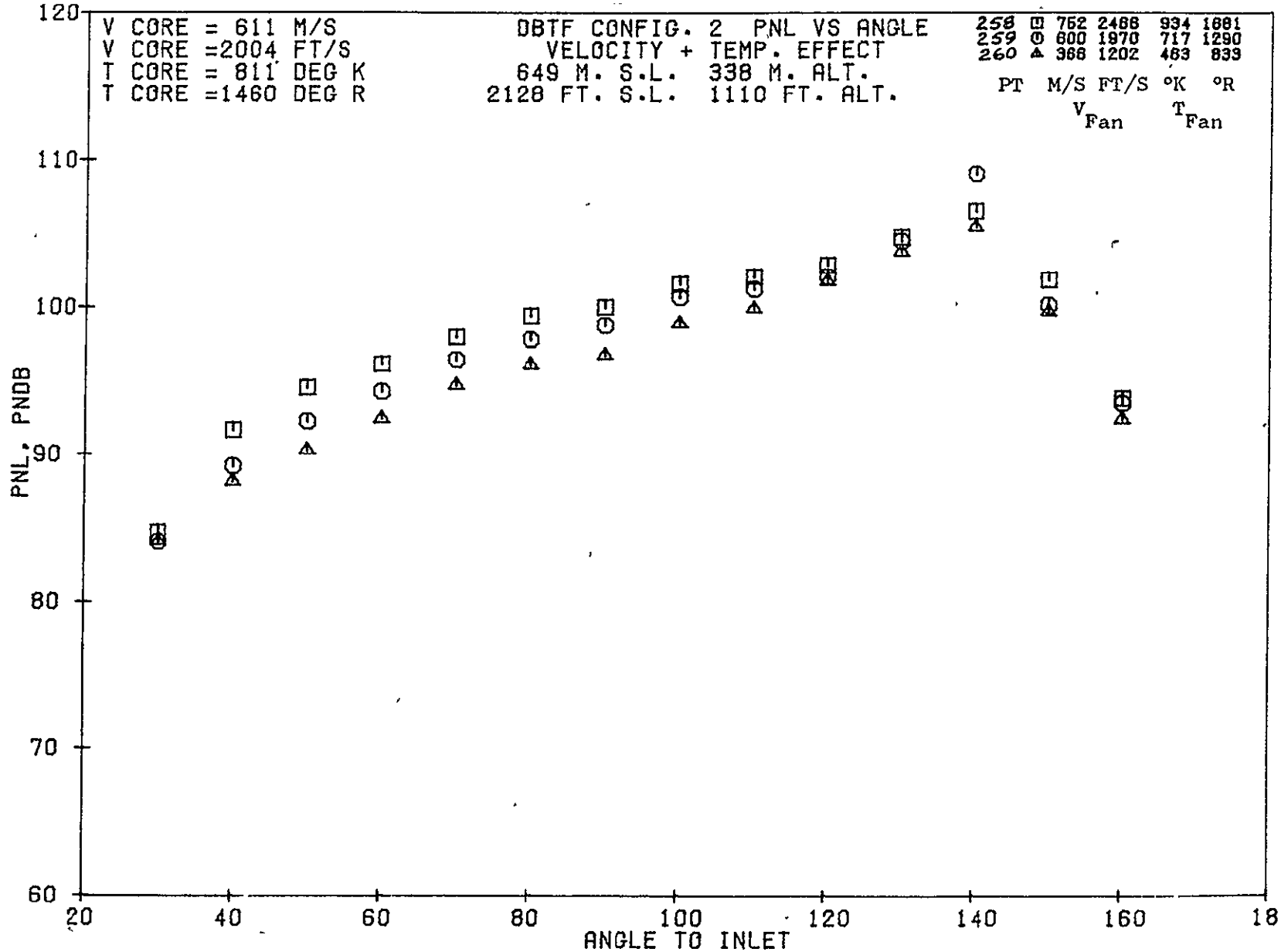

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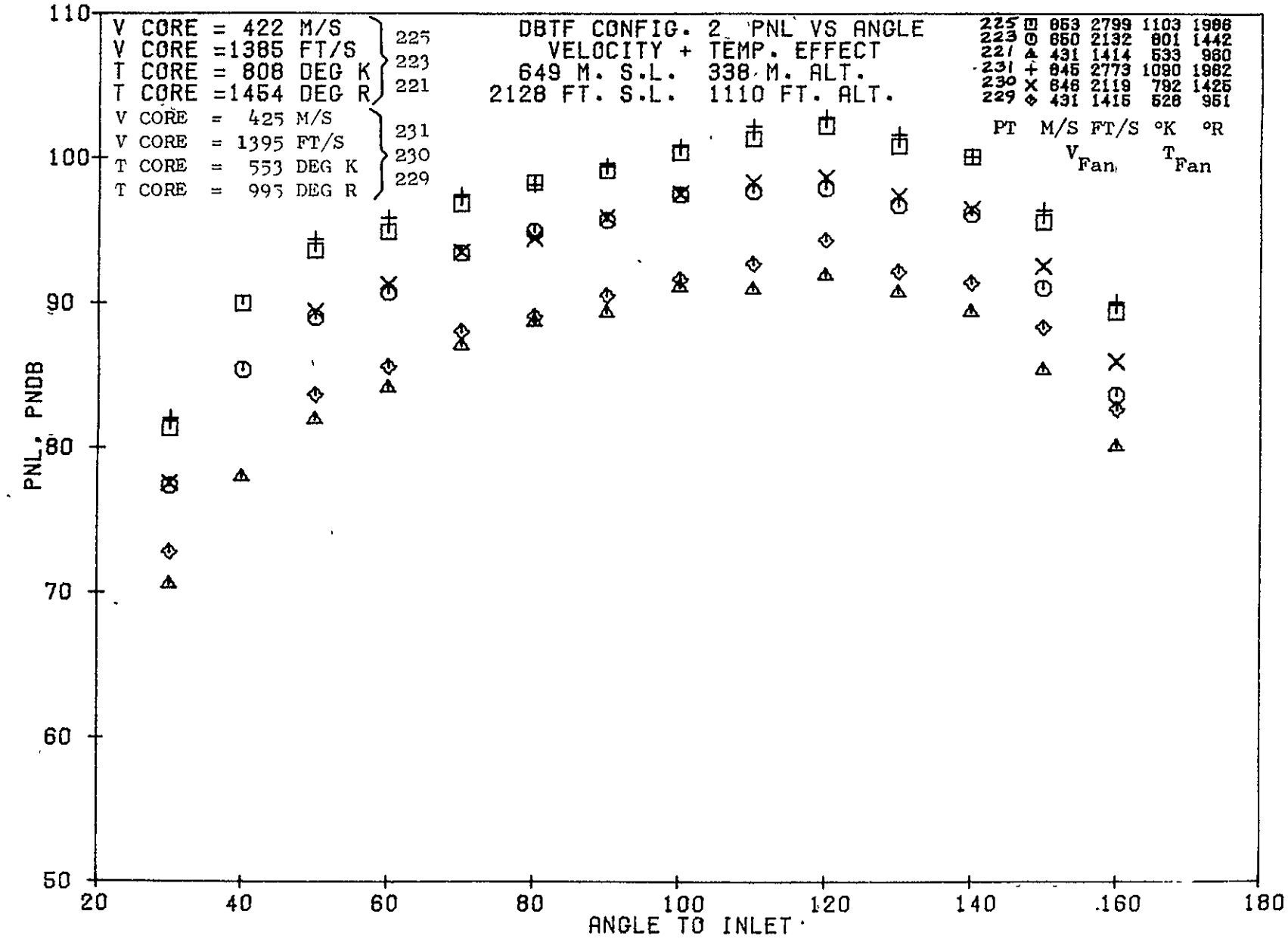

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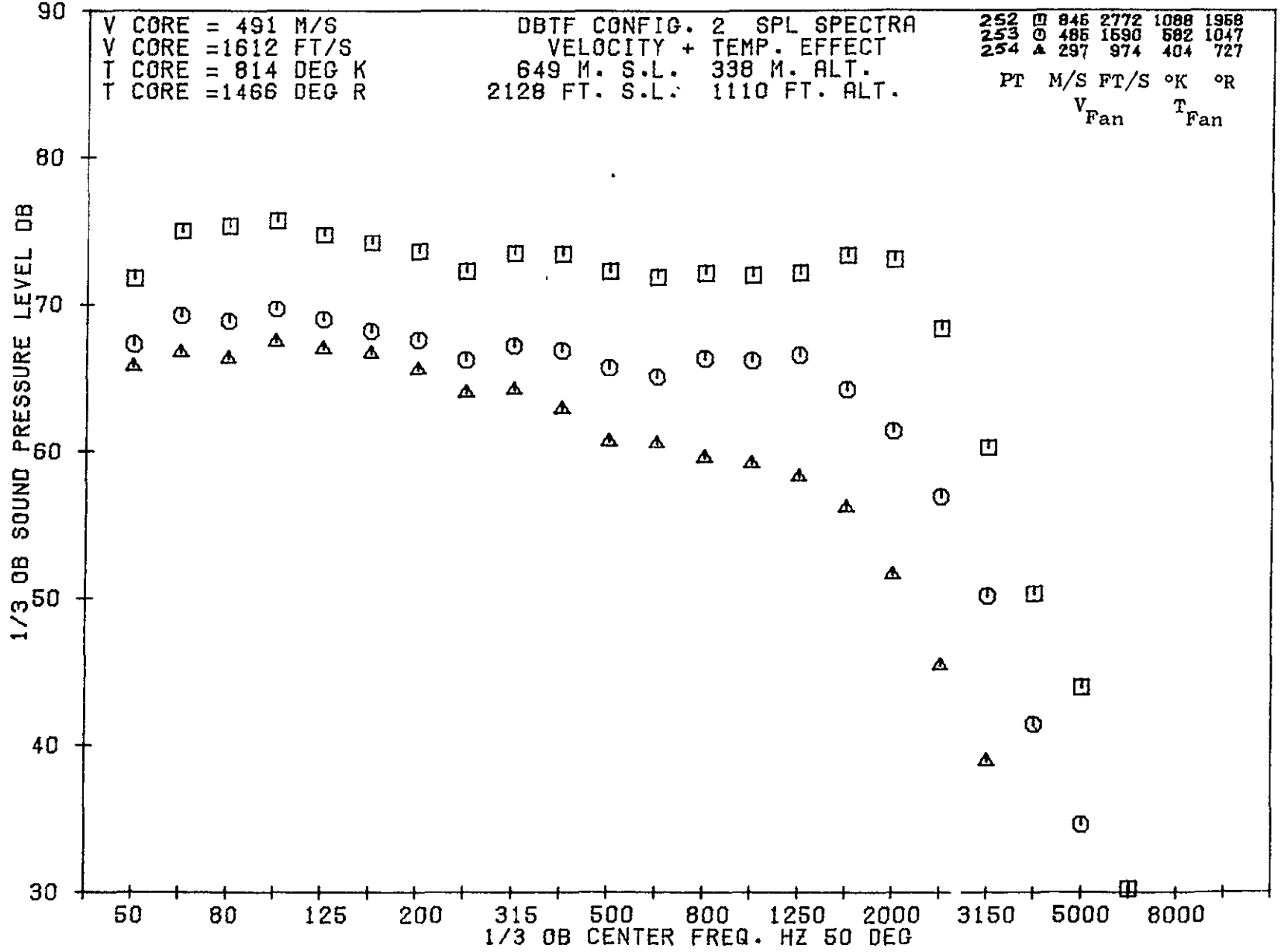

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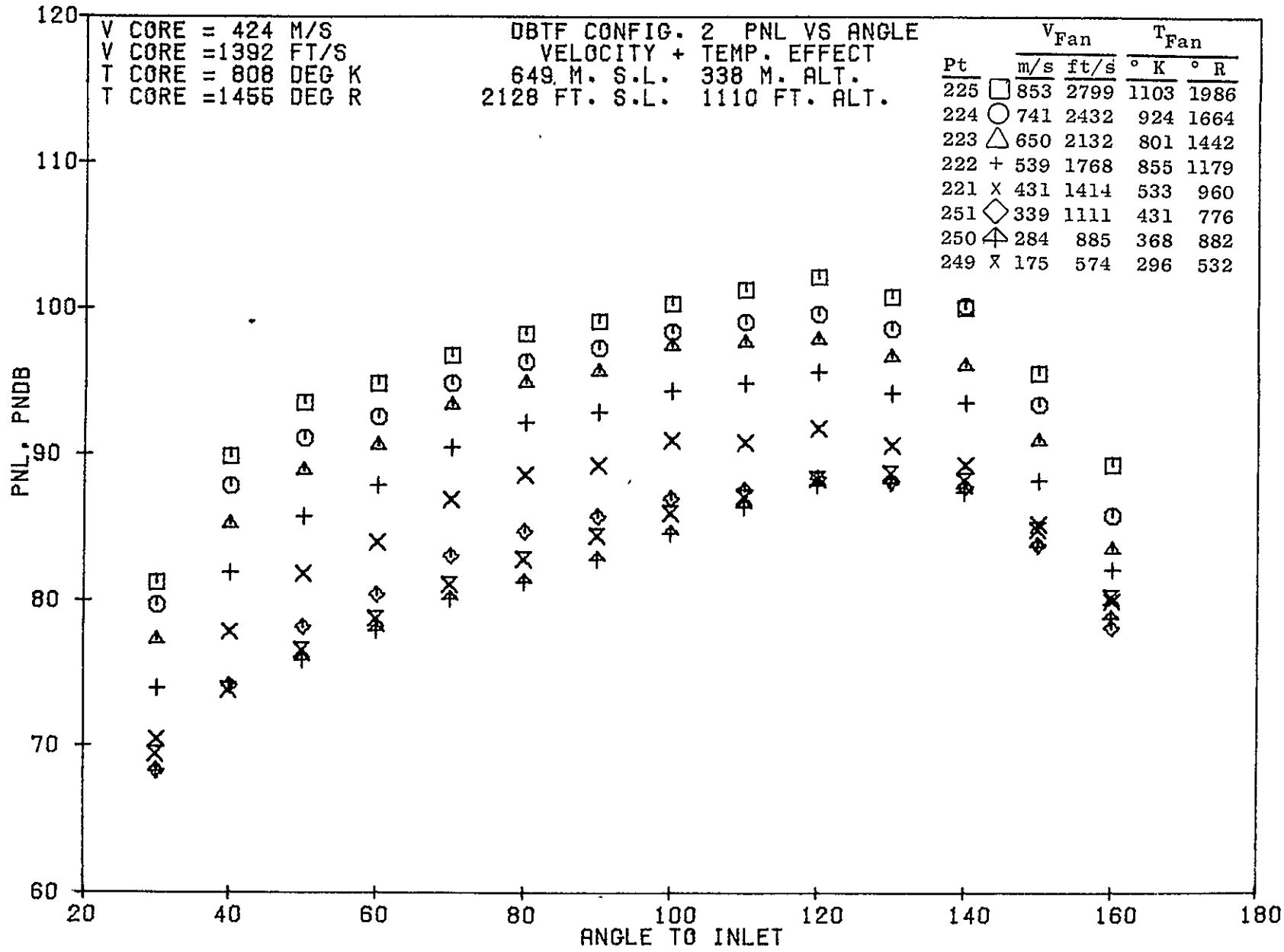

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224 ○	741	2432	924	1664
223 △	650	2132	801	1442
222 +	539	1768	855	1179
221 X	431	1414	533	960
251 ◇	339	1111	431	776
250 ⏀	284	885	368	882
249 ⧖	175	574	296	532

1386

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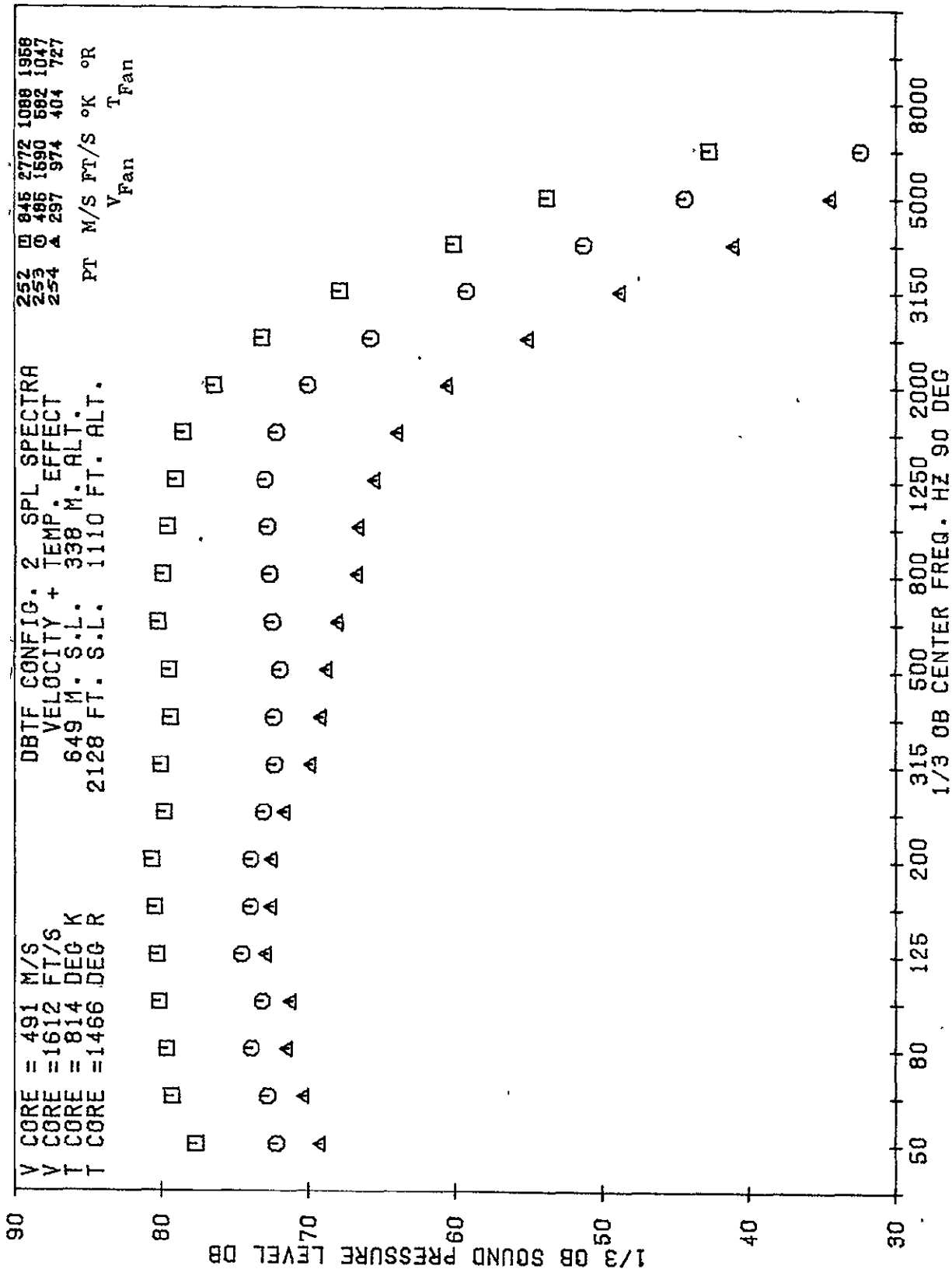

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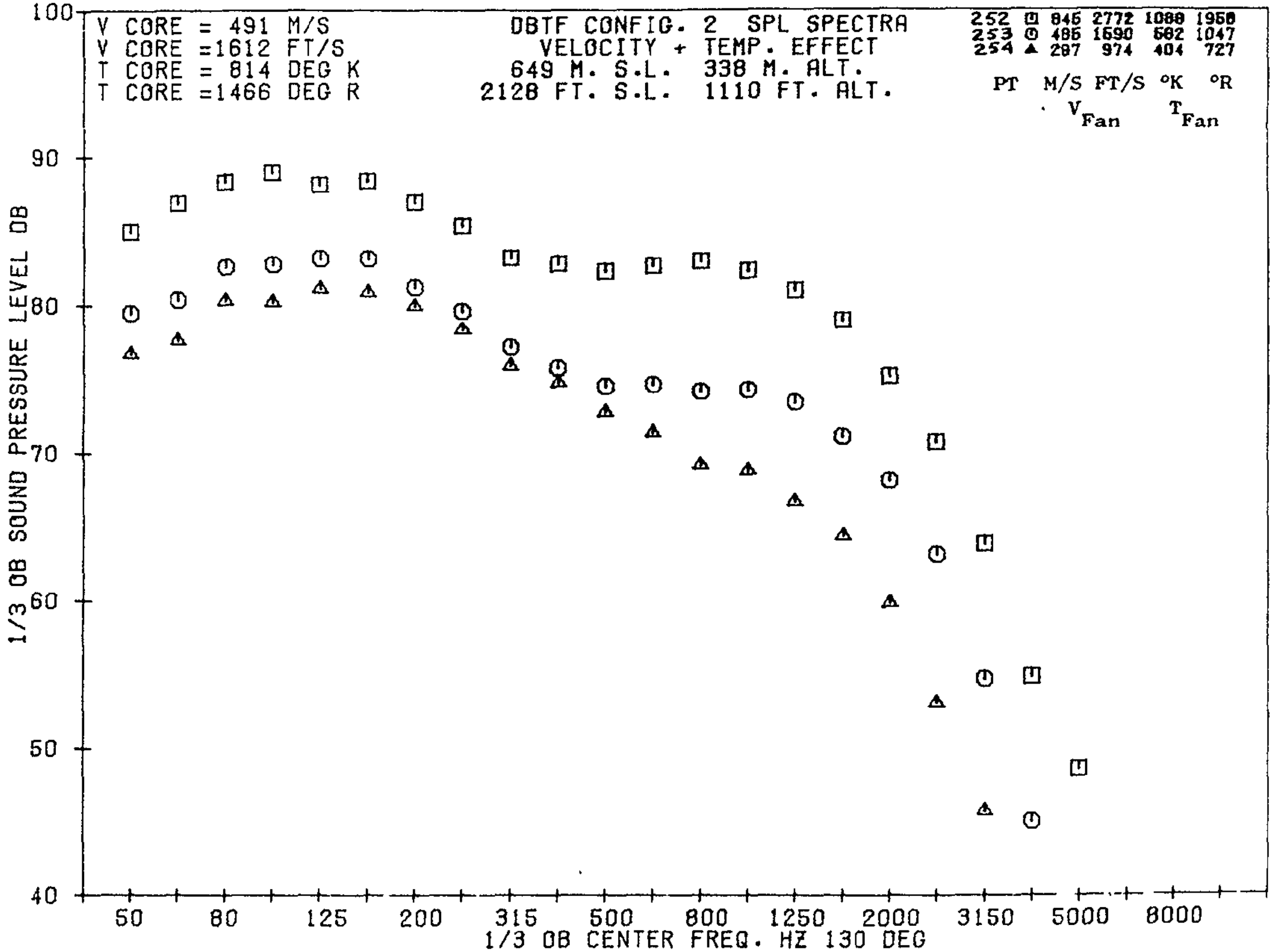
79 BURCH A.

4-155



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5R032-001

79 BURC A.

1388

4-15

Pt	V_{Fan} m/s	V_{Fan} ft/s	T_{Fan} ° K	T_{Fan} ° R
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224 ○	741	2432	924	1664
223 △	650	2132	801	1442
222 +	539	1768	655	1179
221 X	431	1414	533	980
251 ◇	339	1111	431	776
250 ⏃	264	865	368	662
249 ⧖	175	574	296	532

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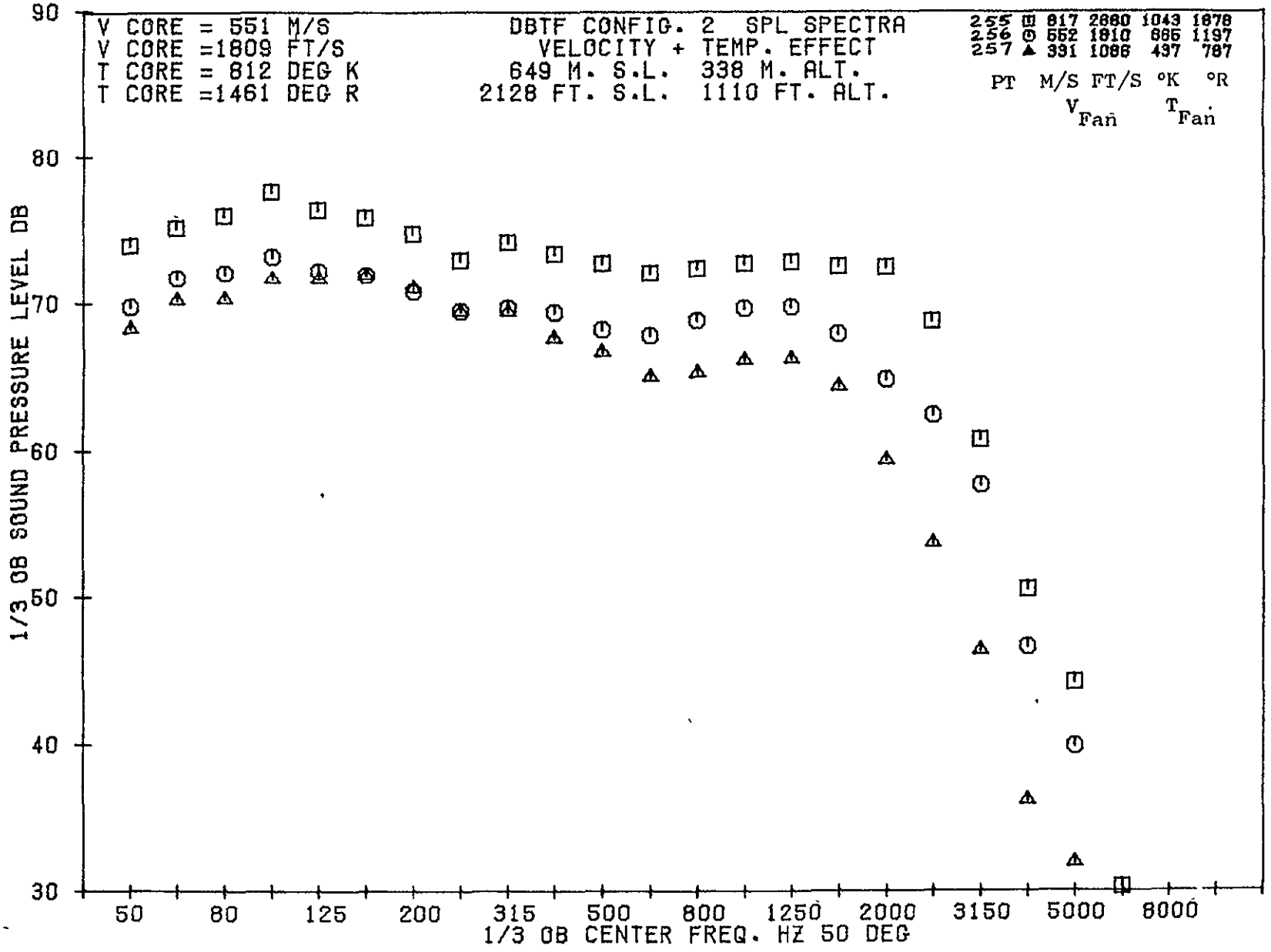
79 BURCH A.



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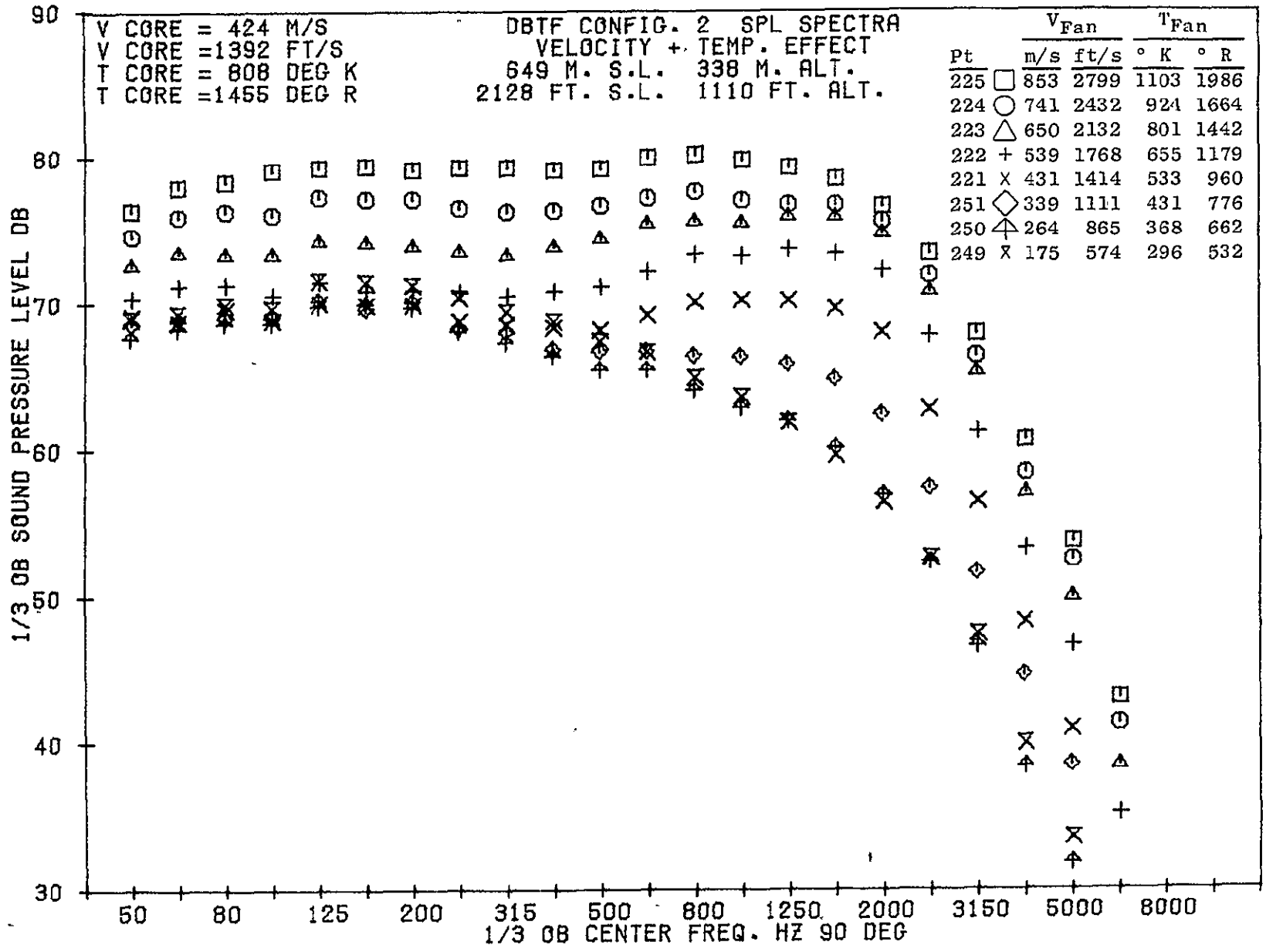

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79 BURCH

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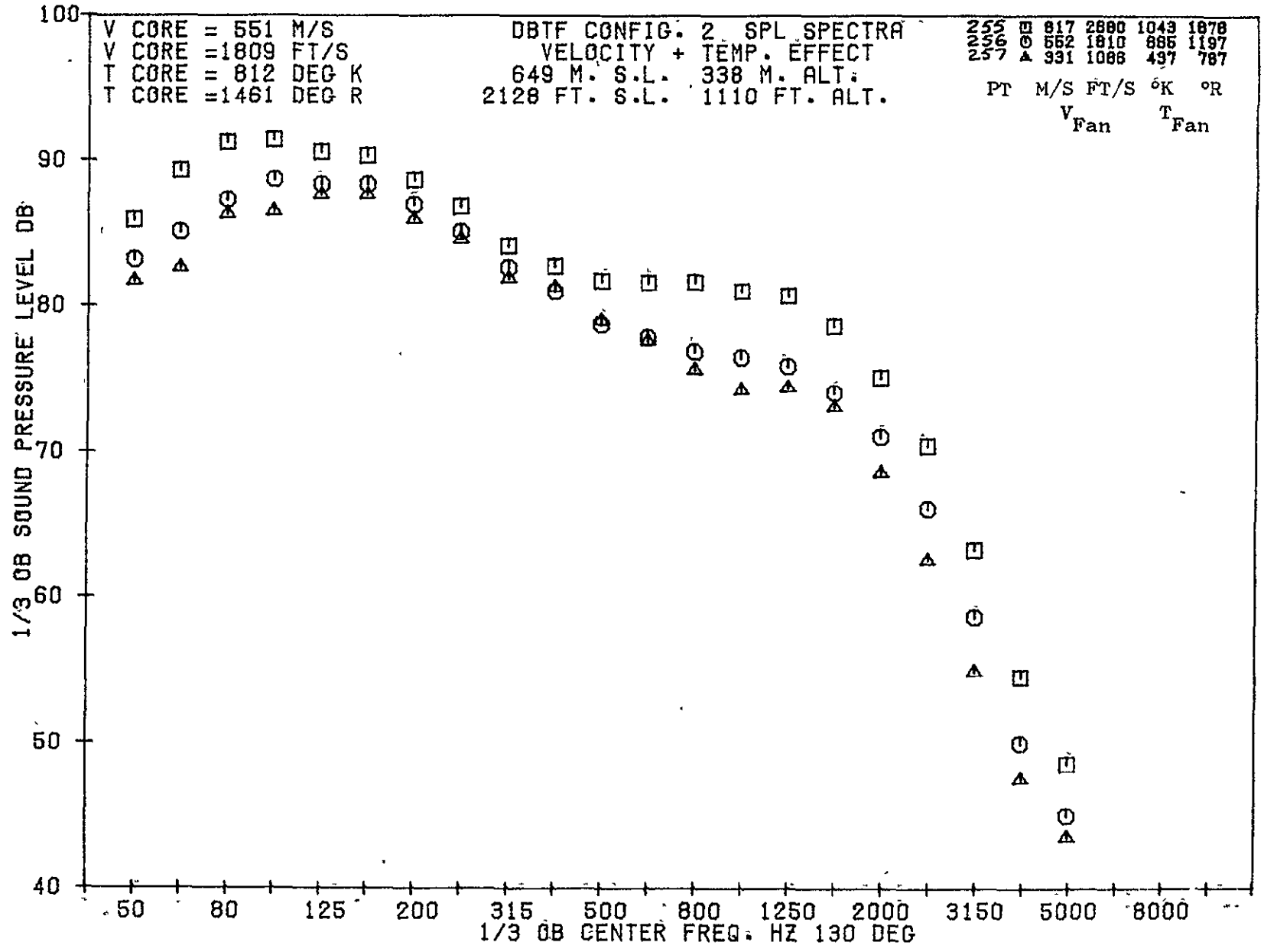

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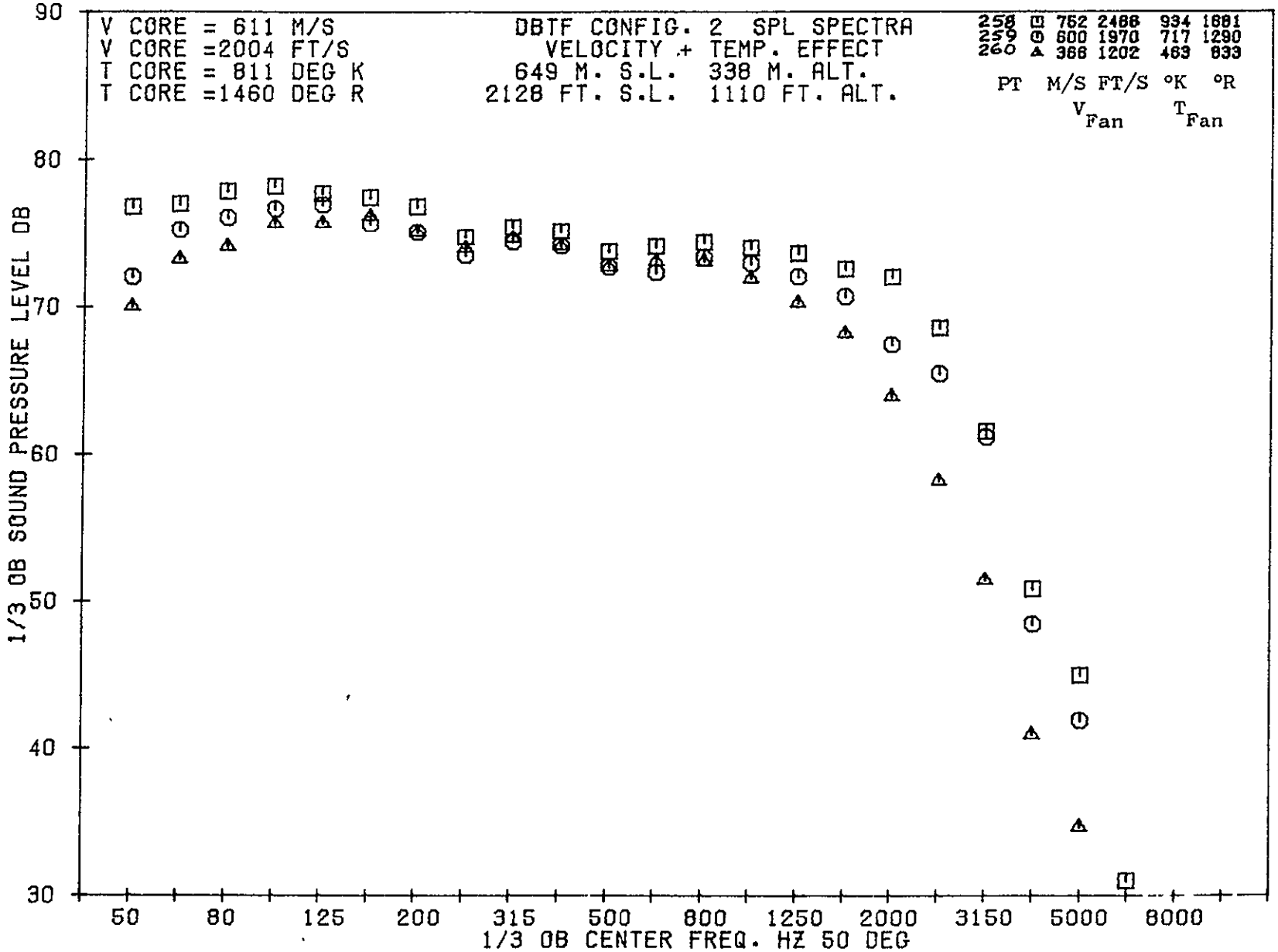
5R266-001



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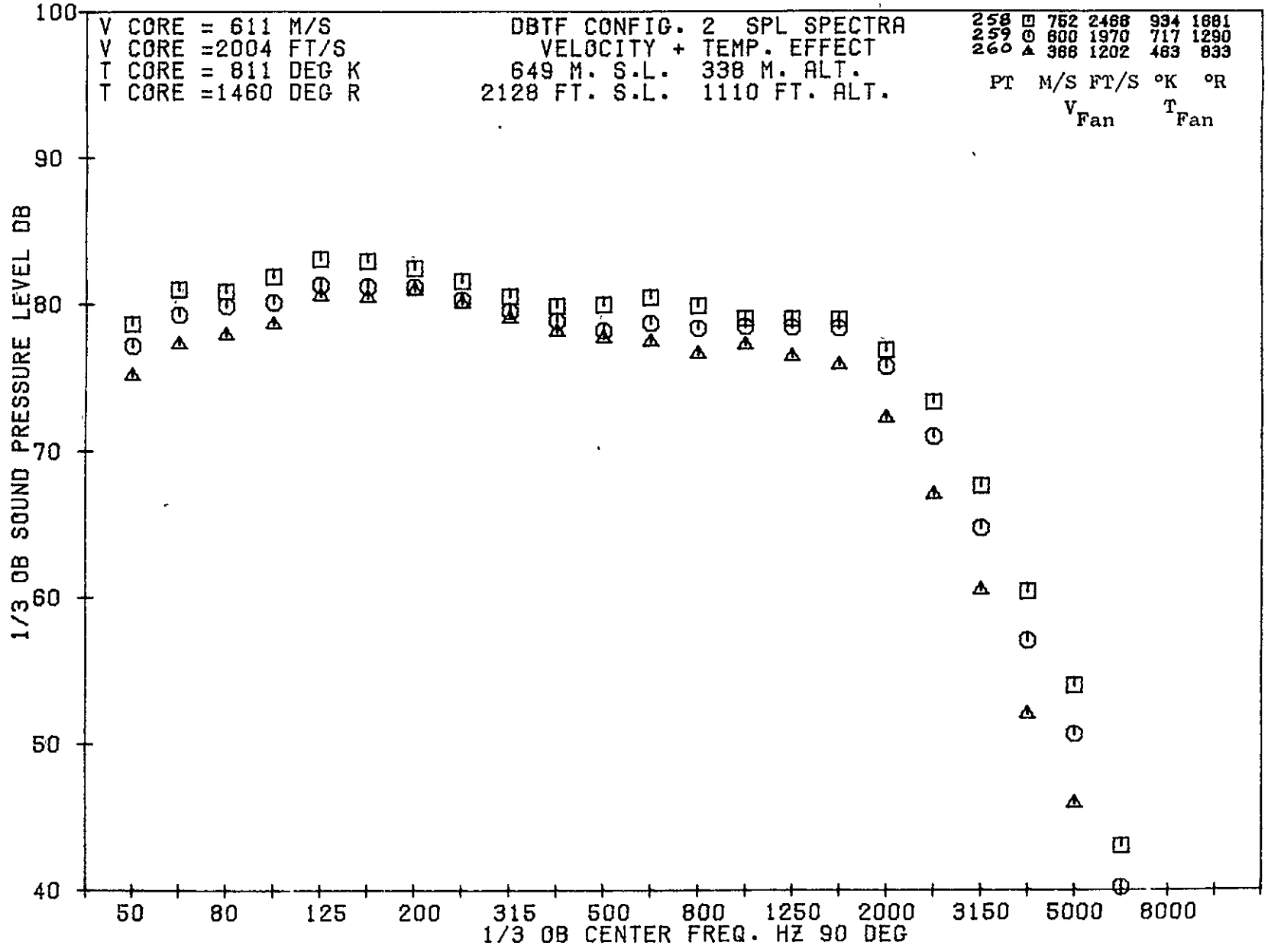

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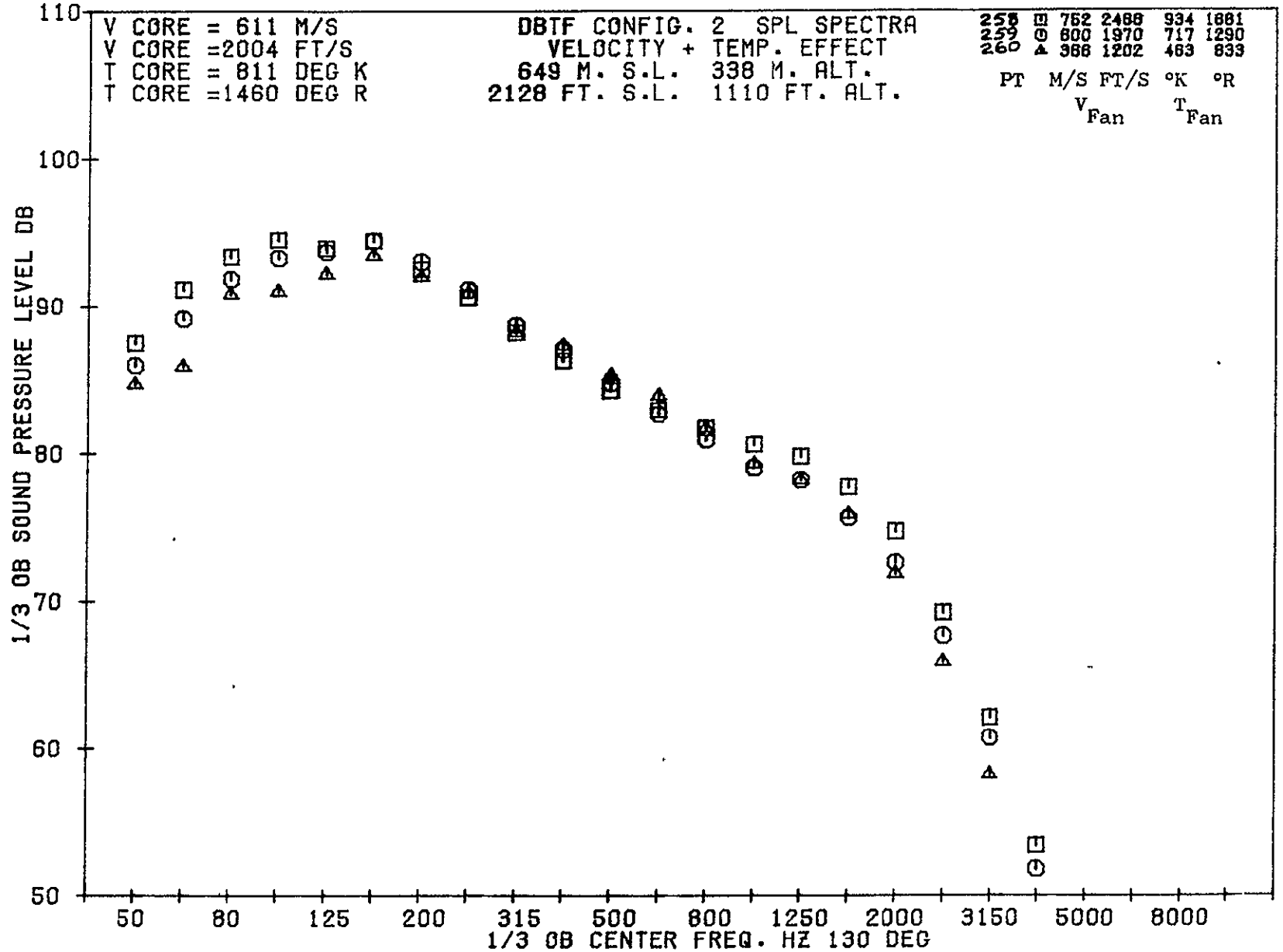

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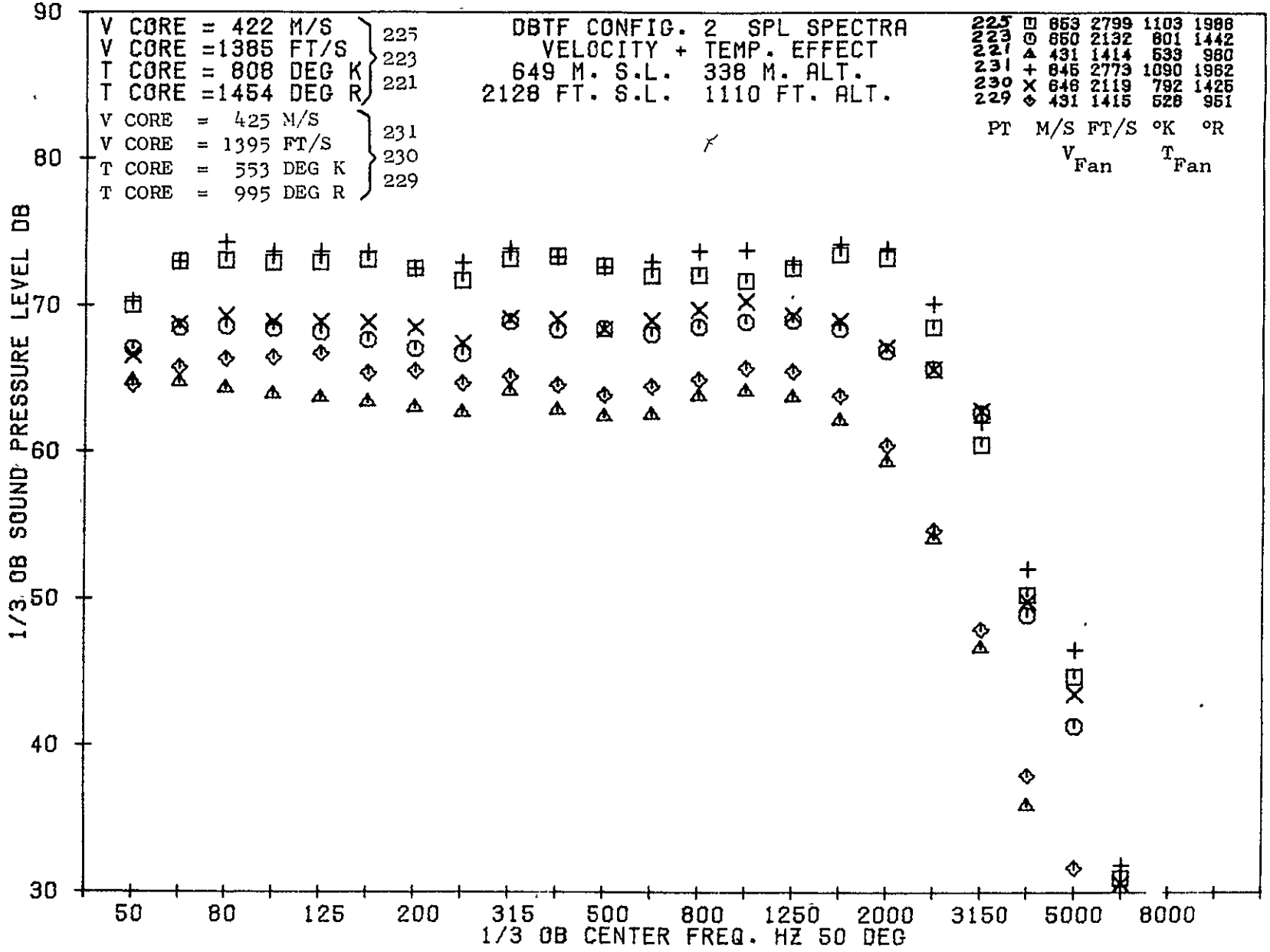

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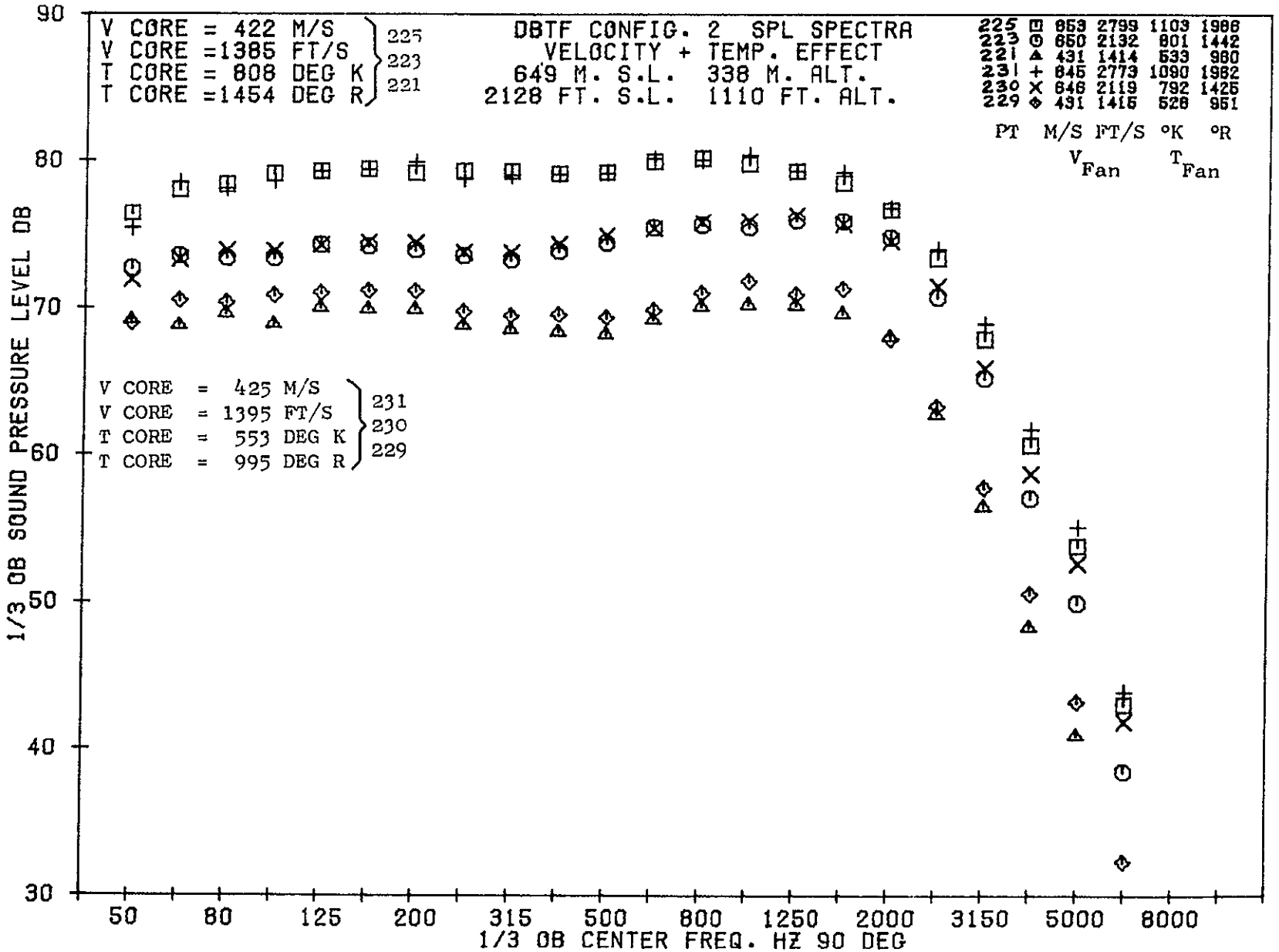

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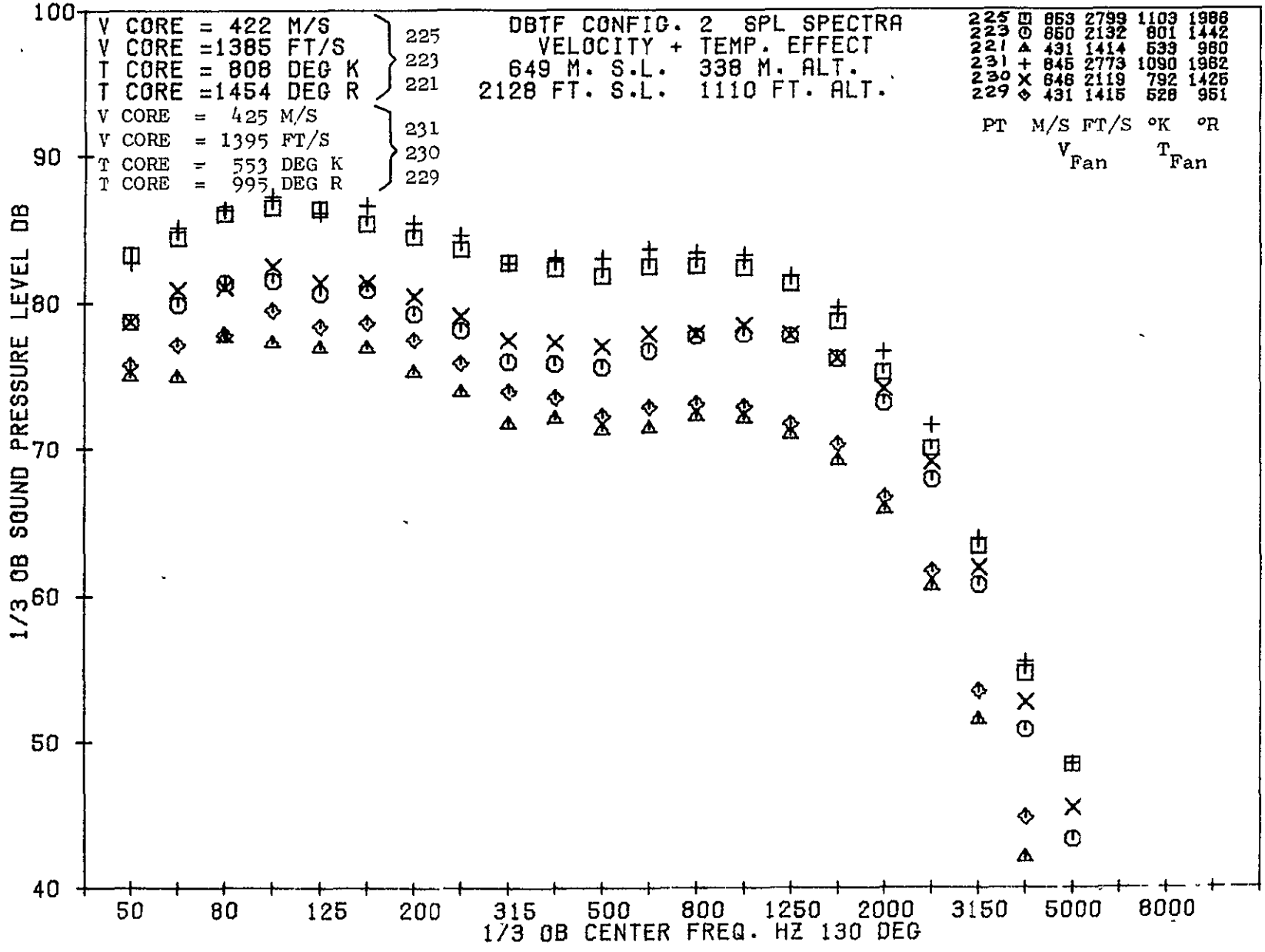

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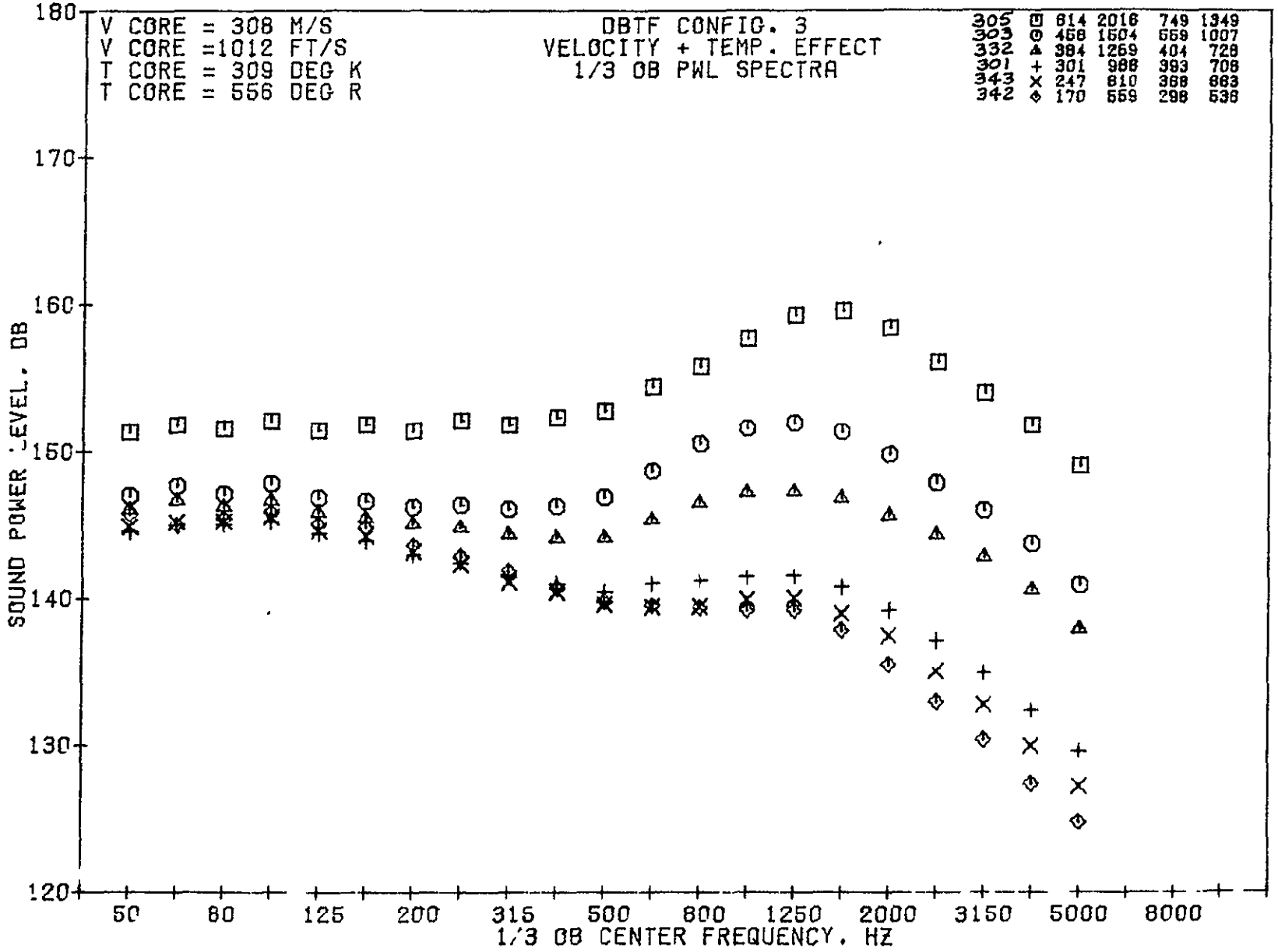

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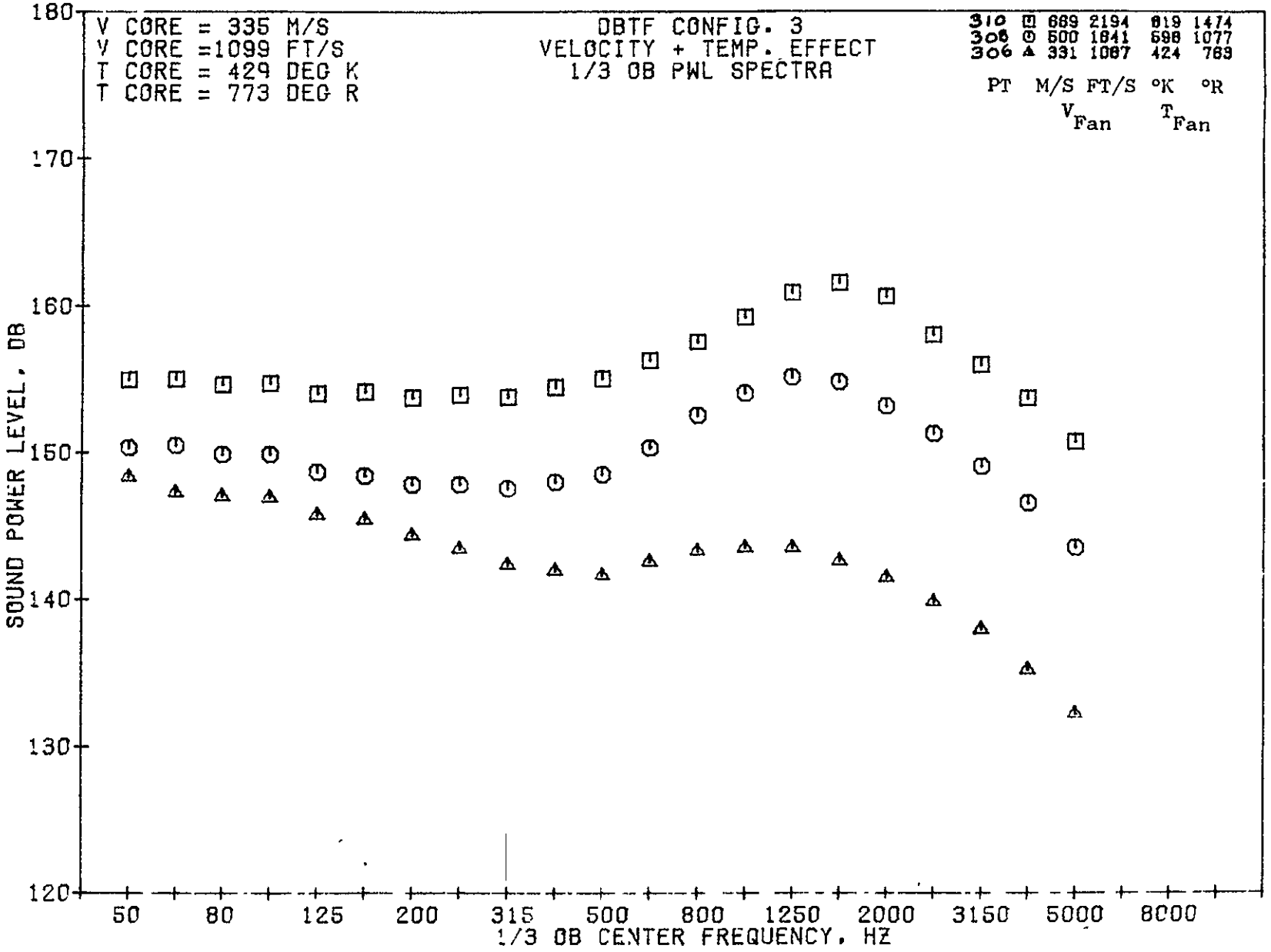

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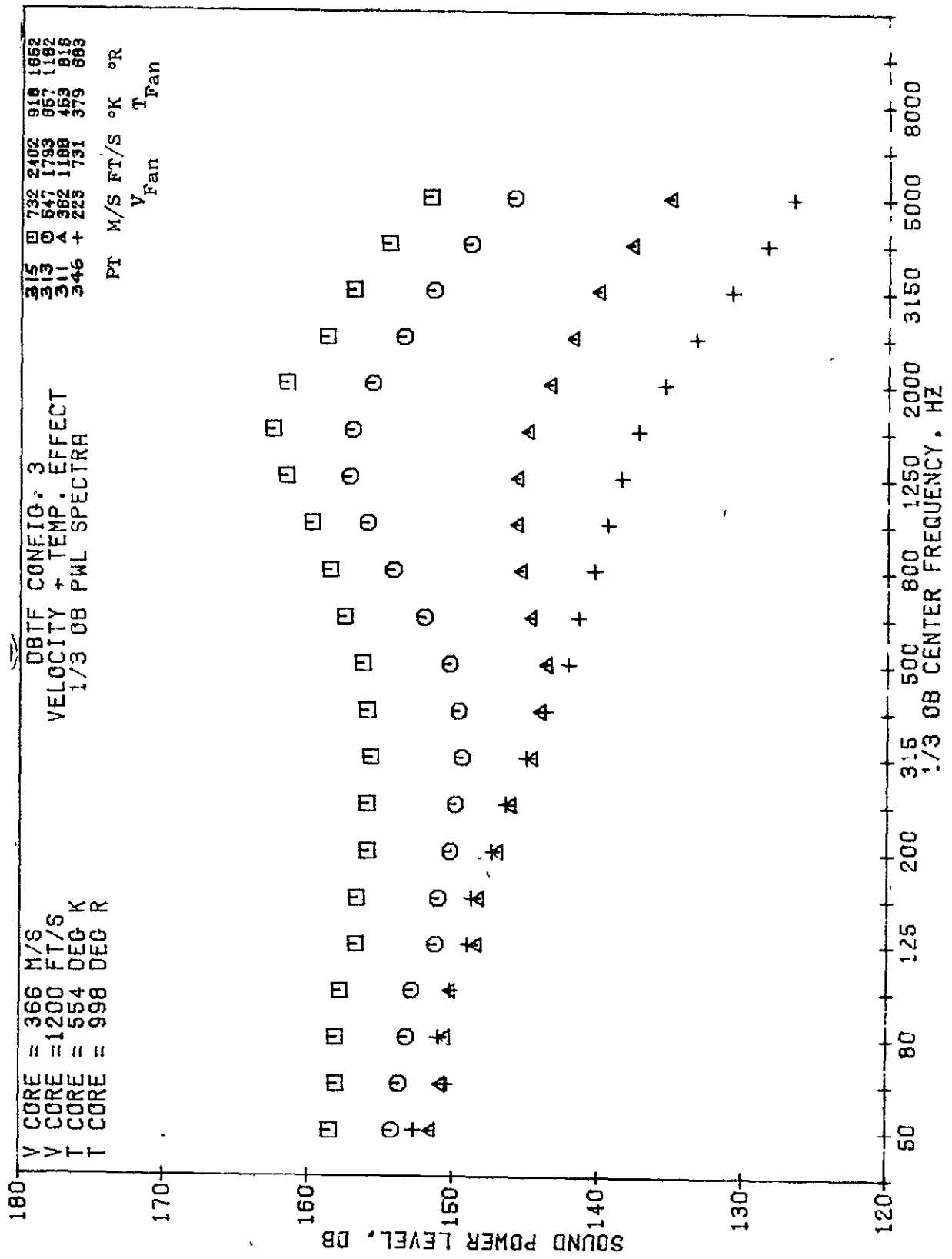

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5R960-001

79 BURCH A.

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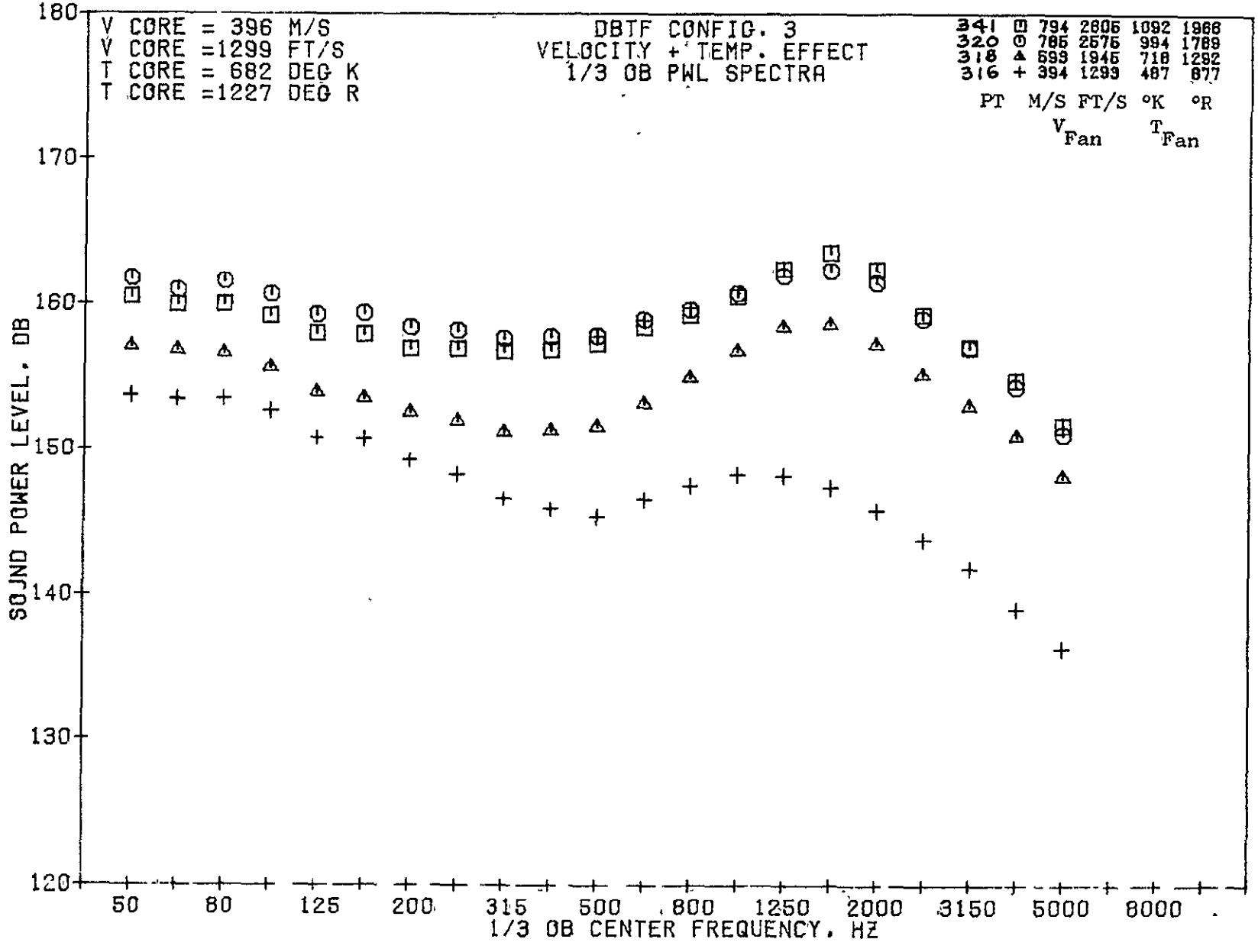

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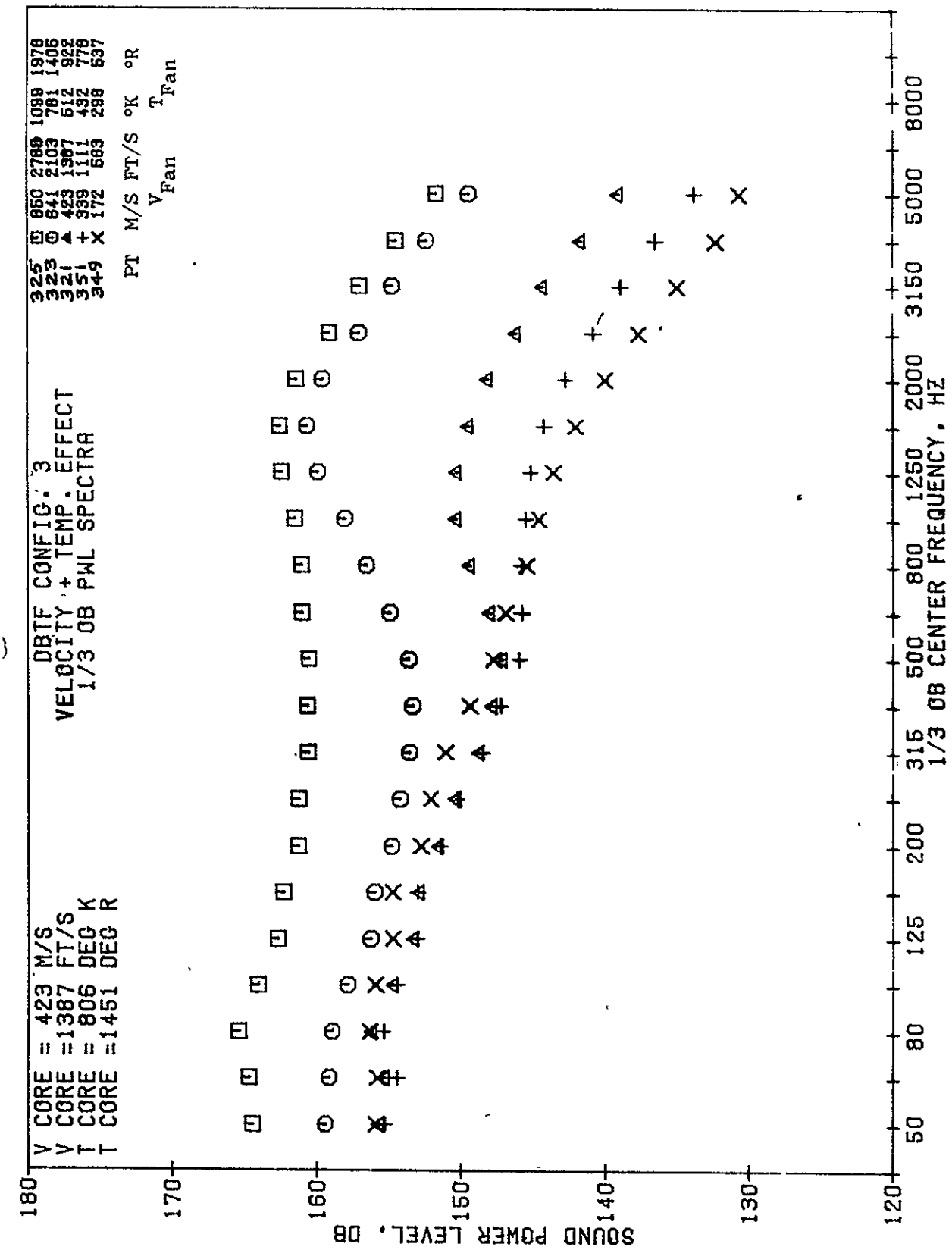
5R960-001



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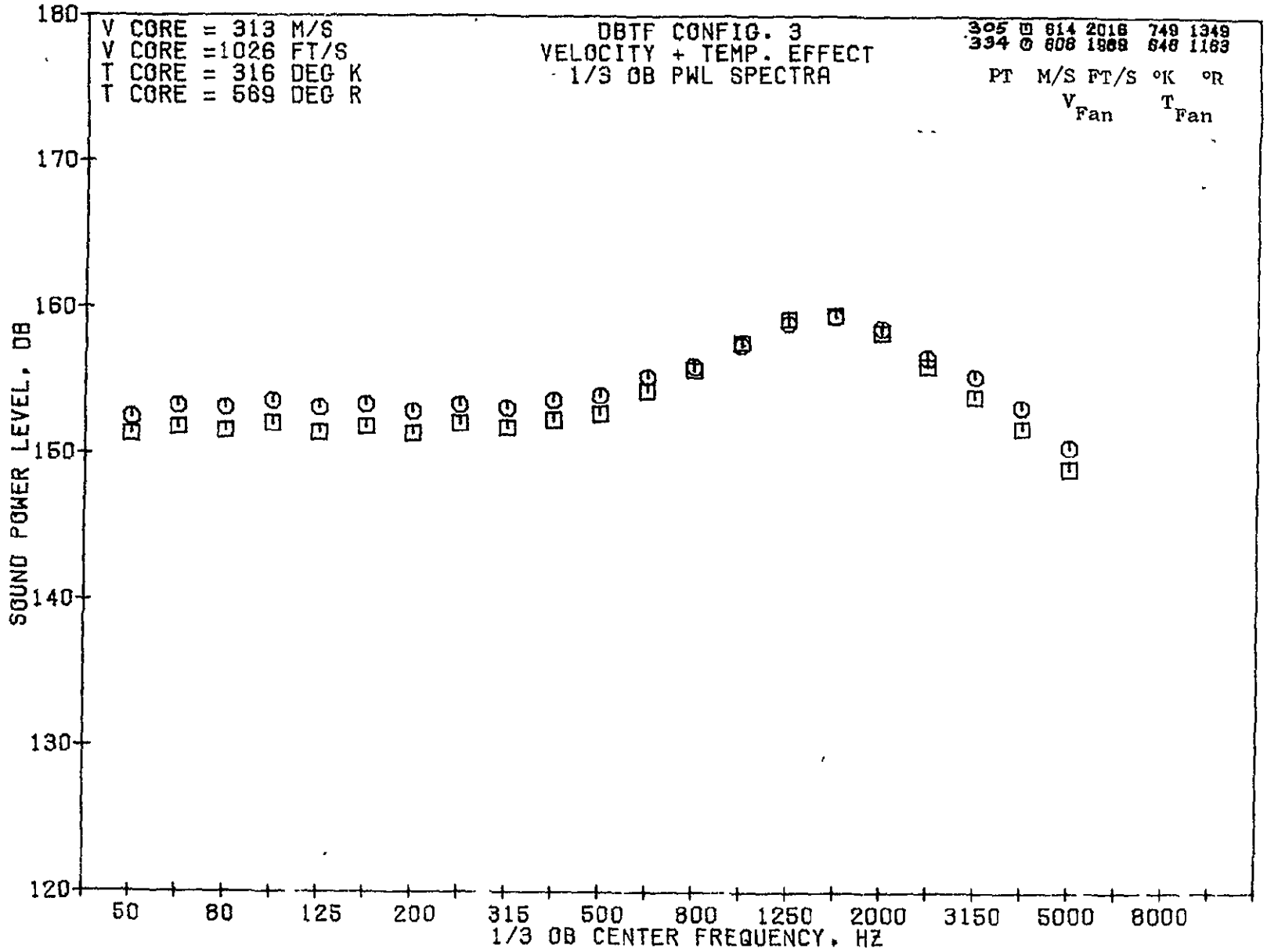
410



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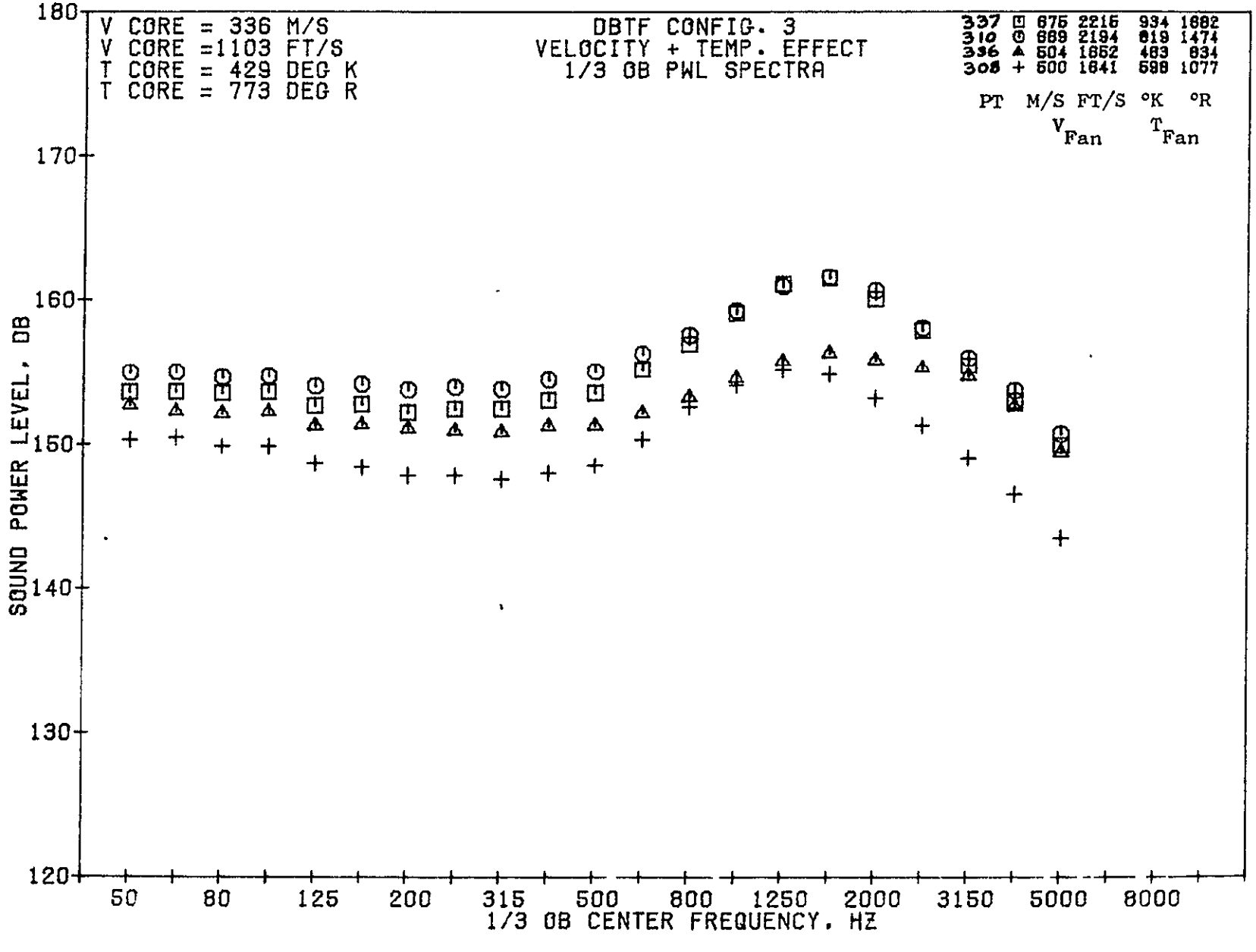

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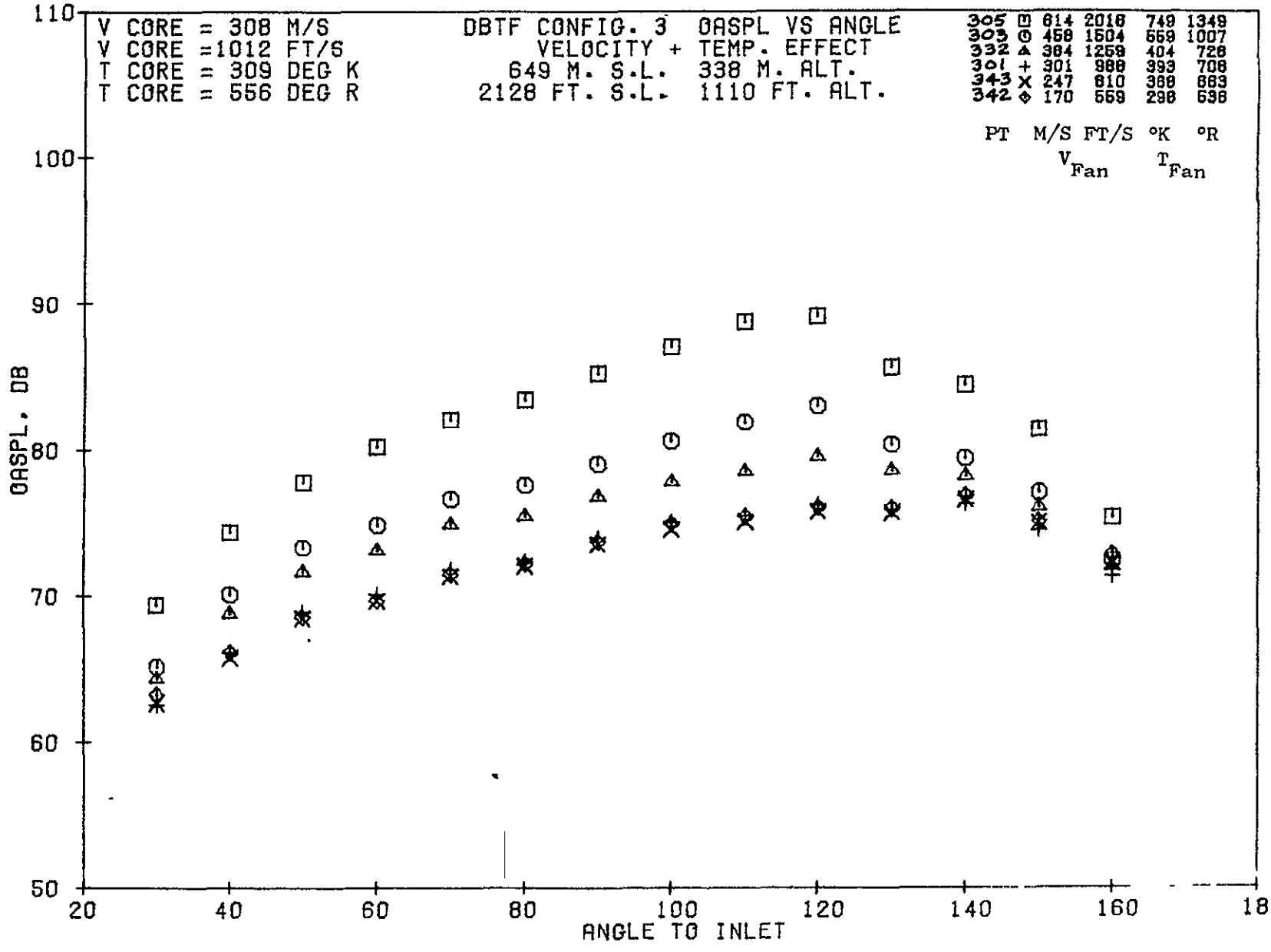

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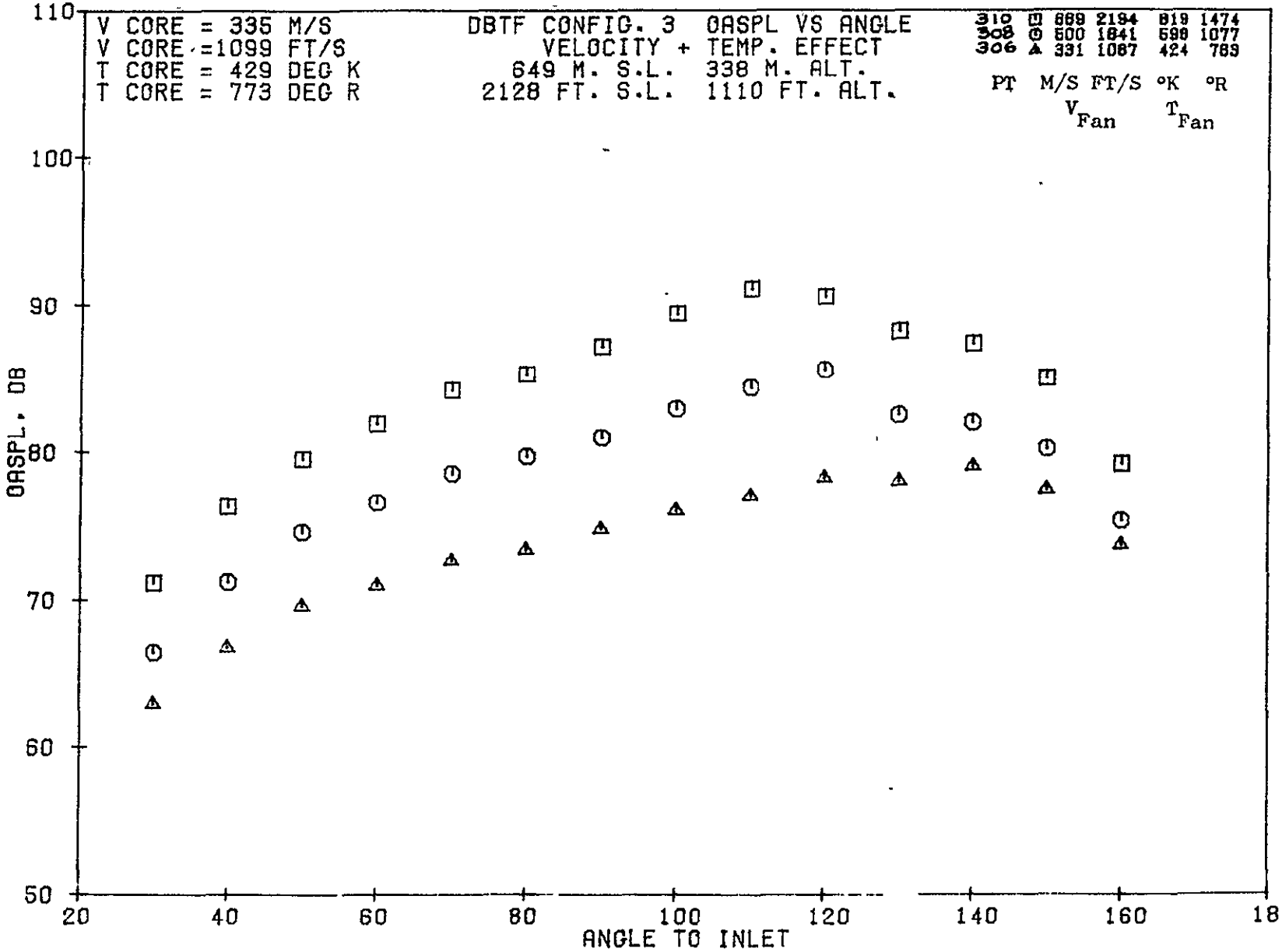

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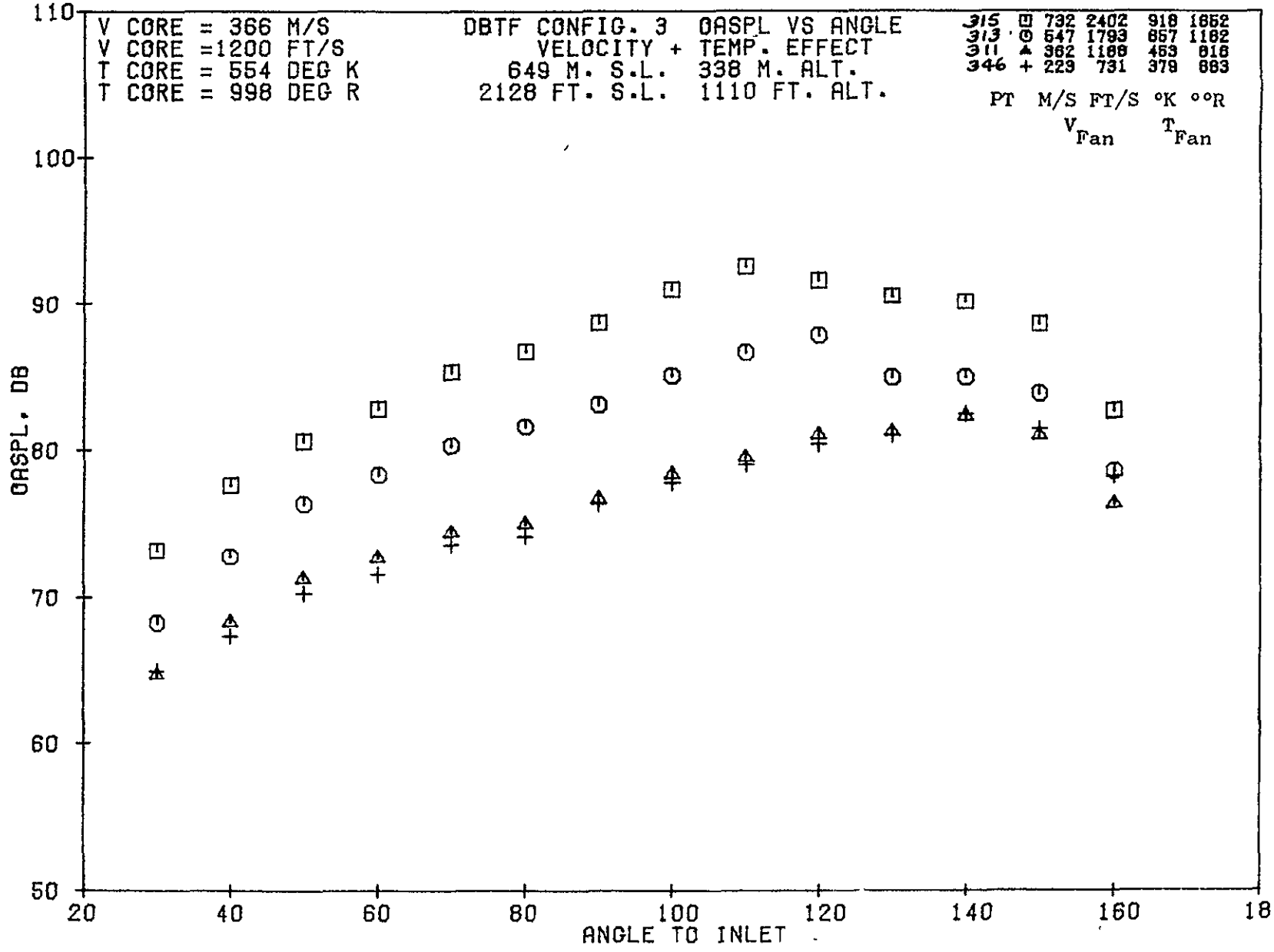

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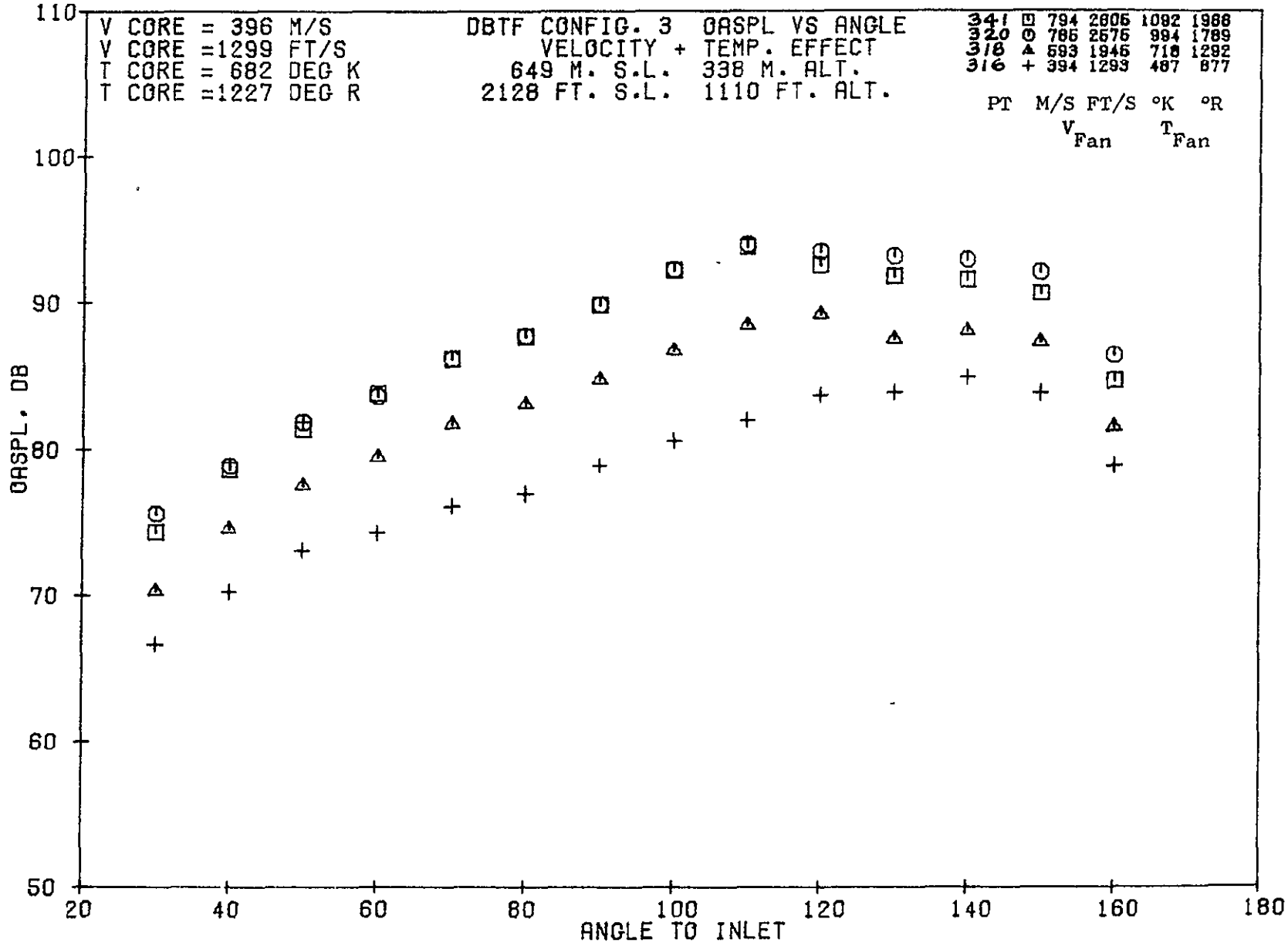

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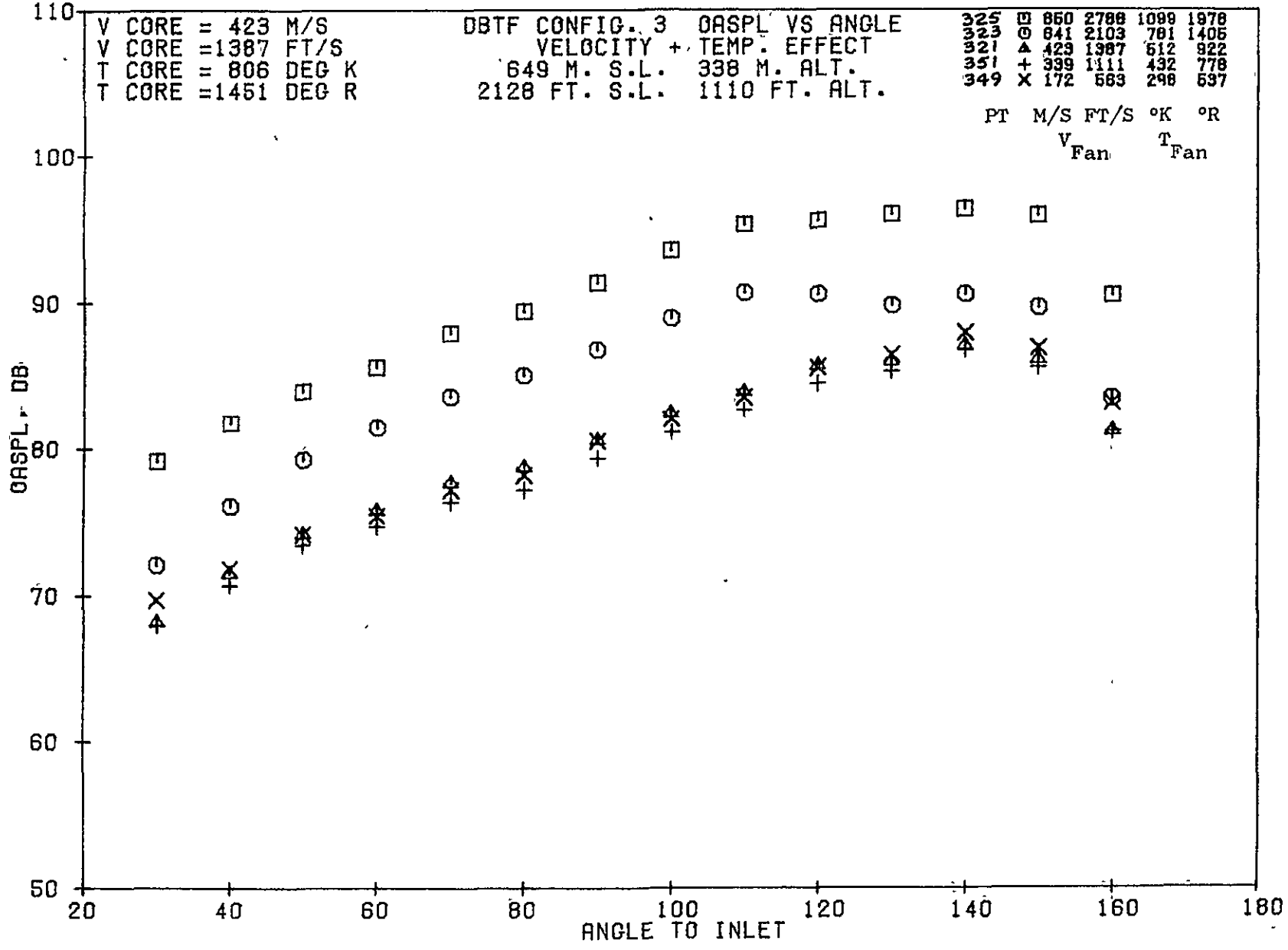

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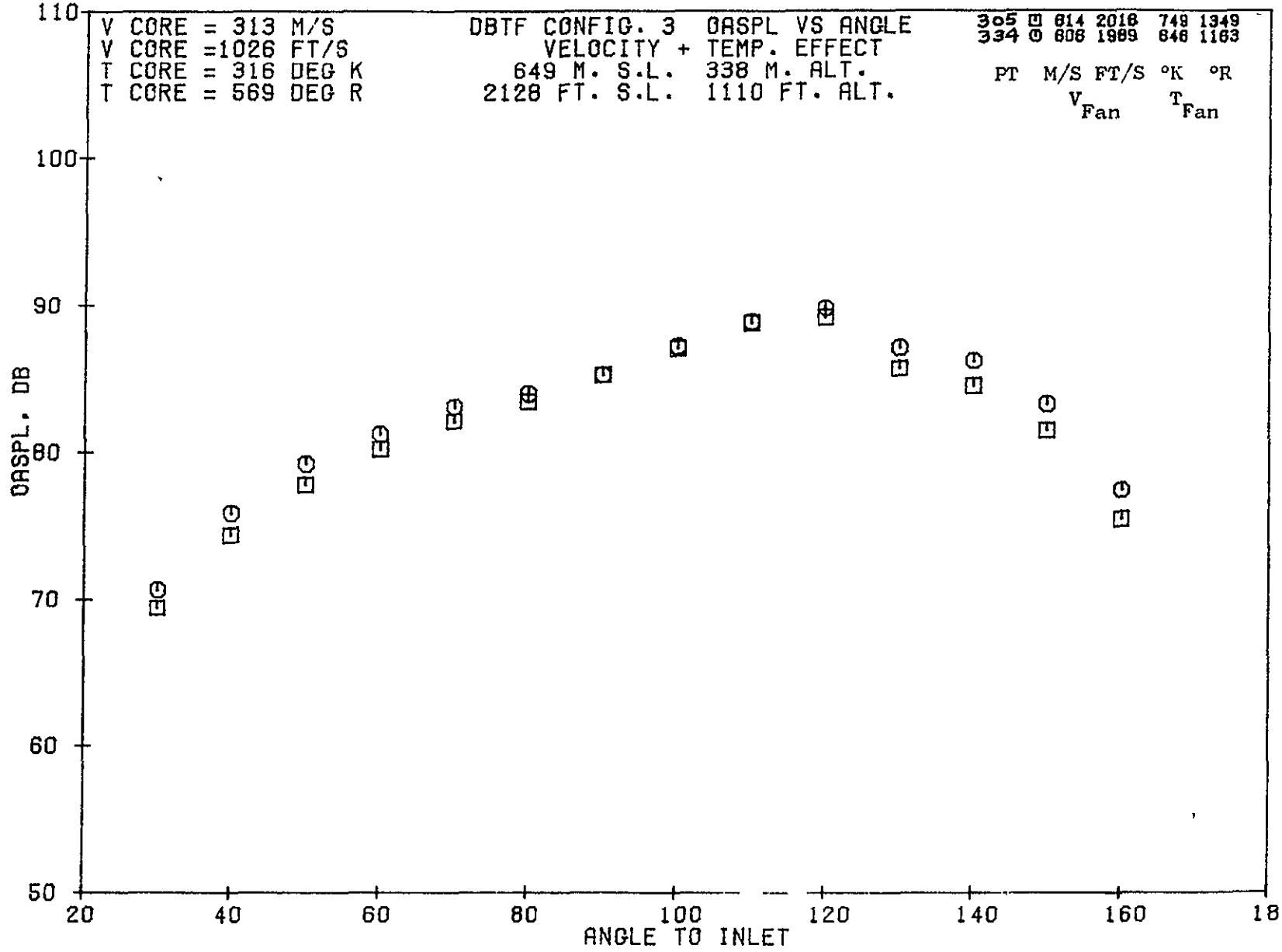
5R960-001



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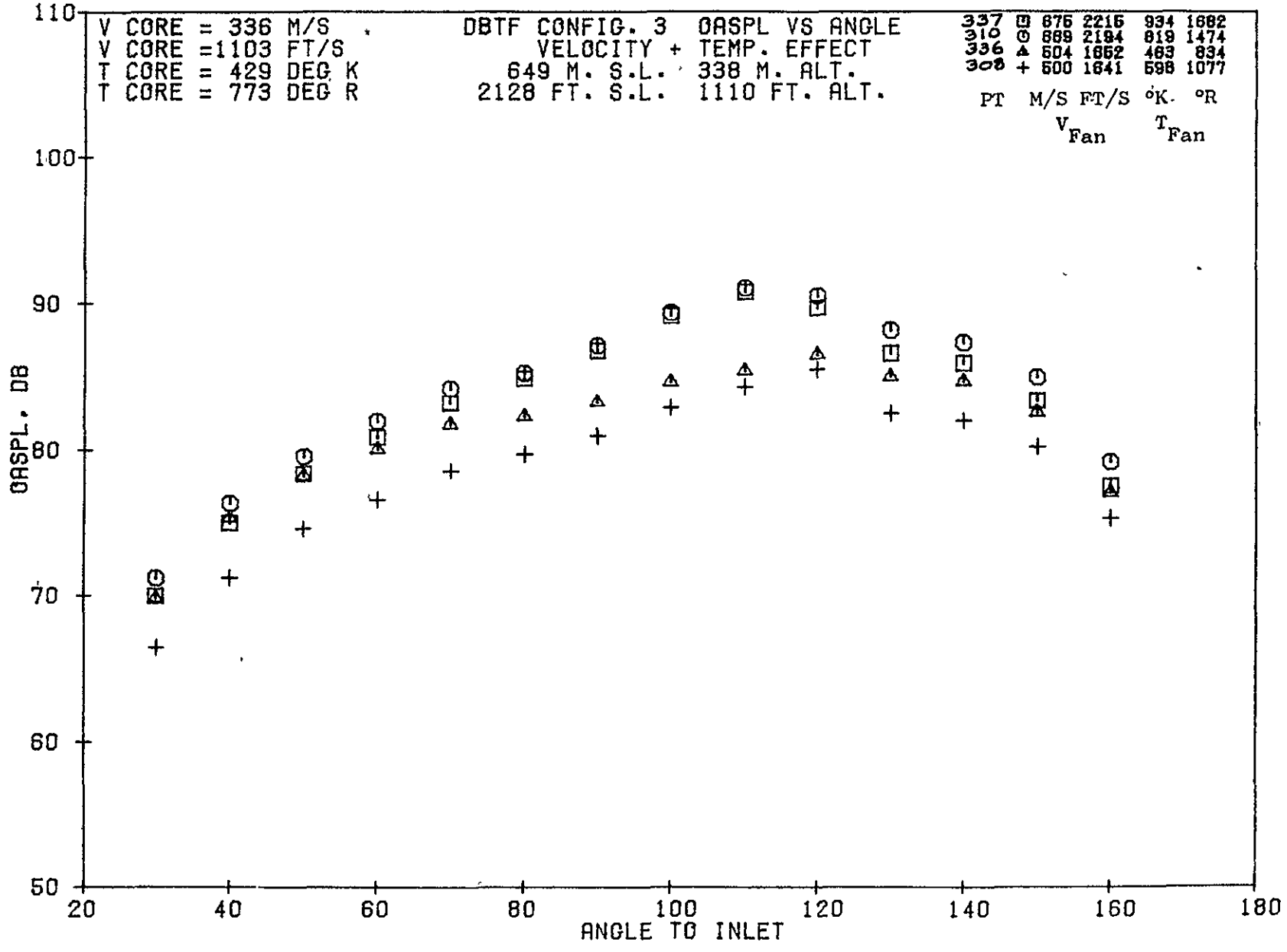

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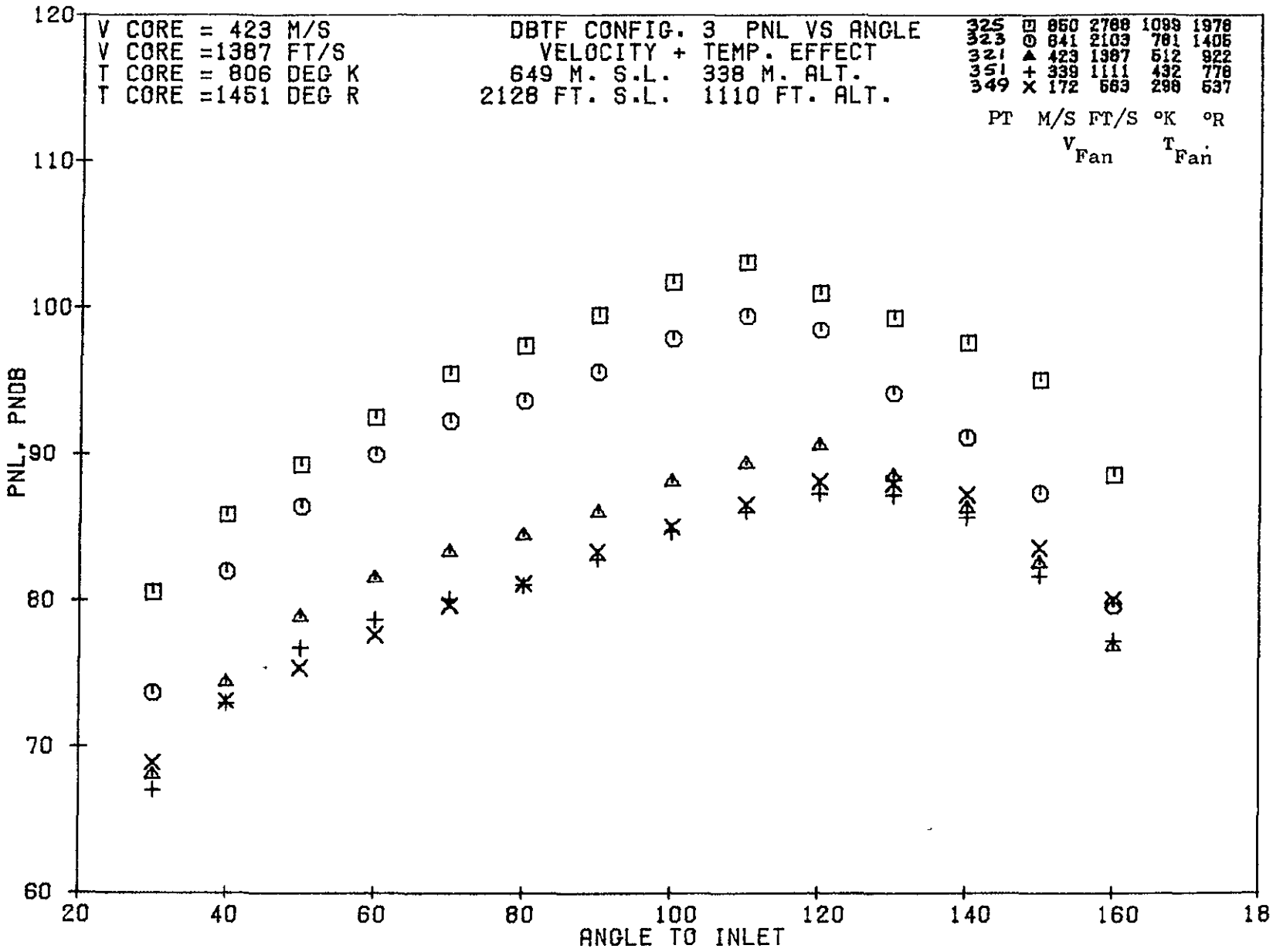

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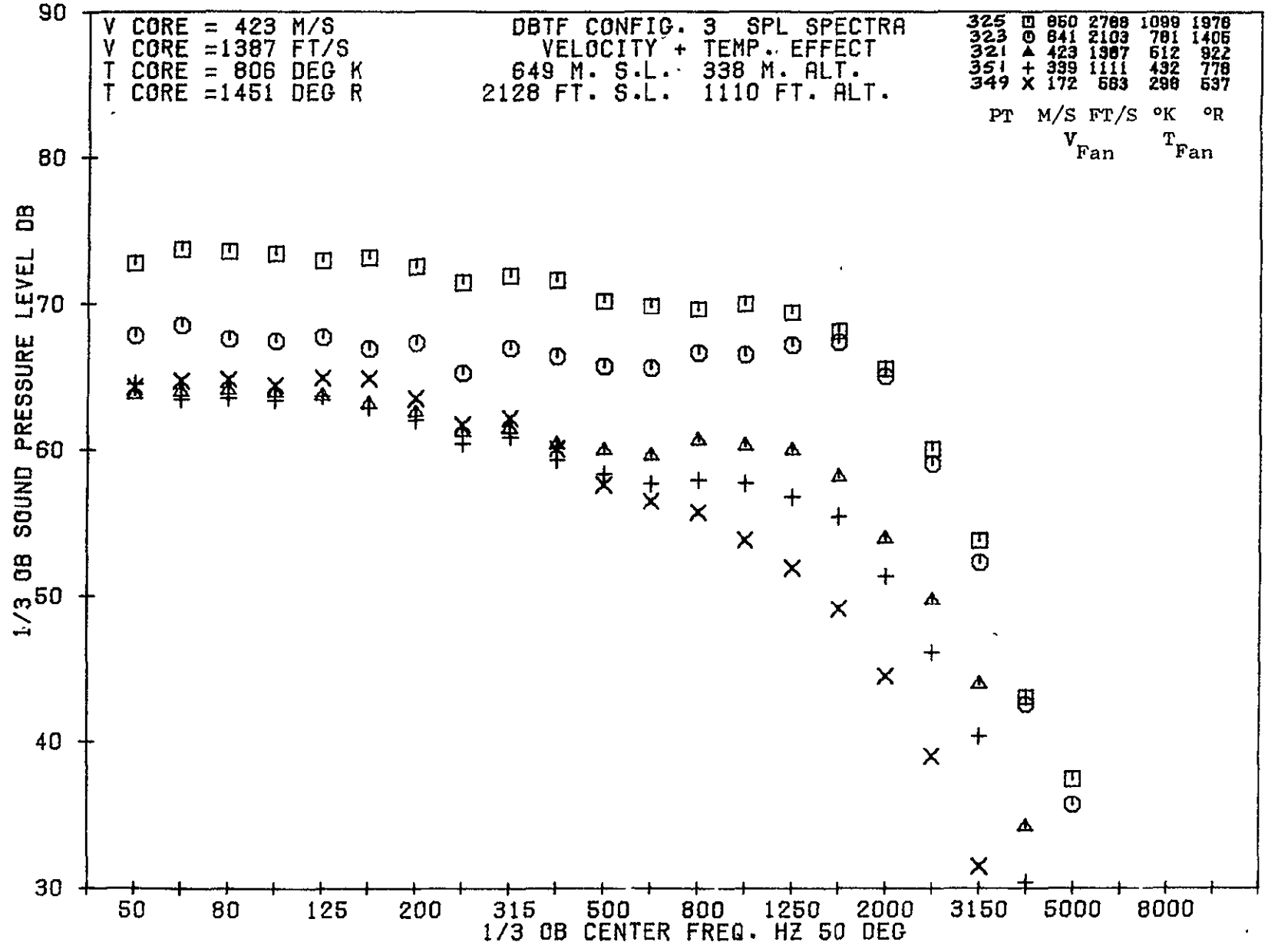

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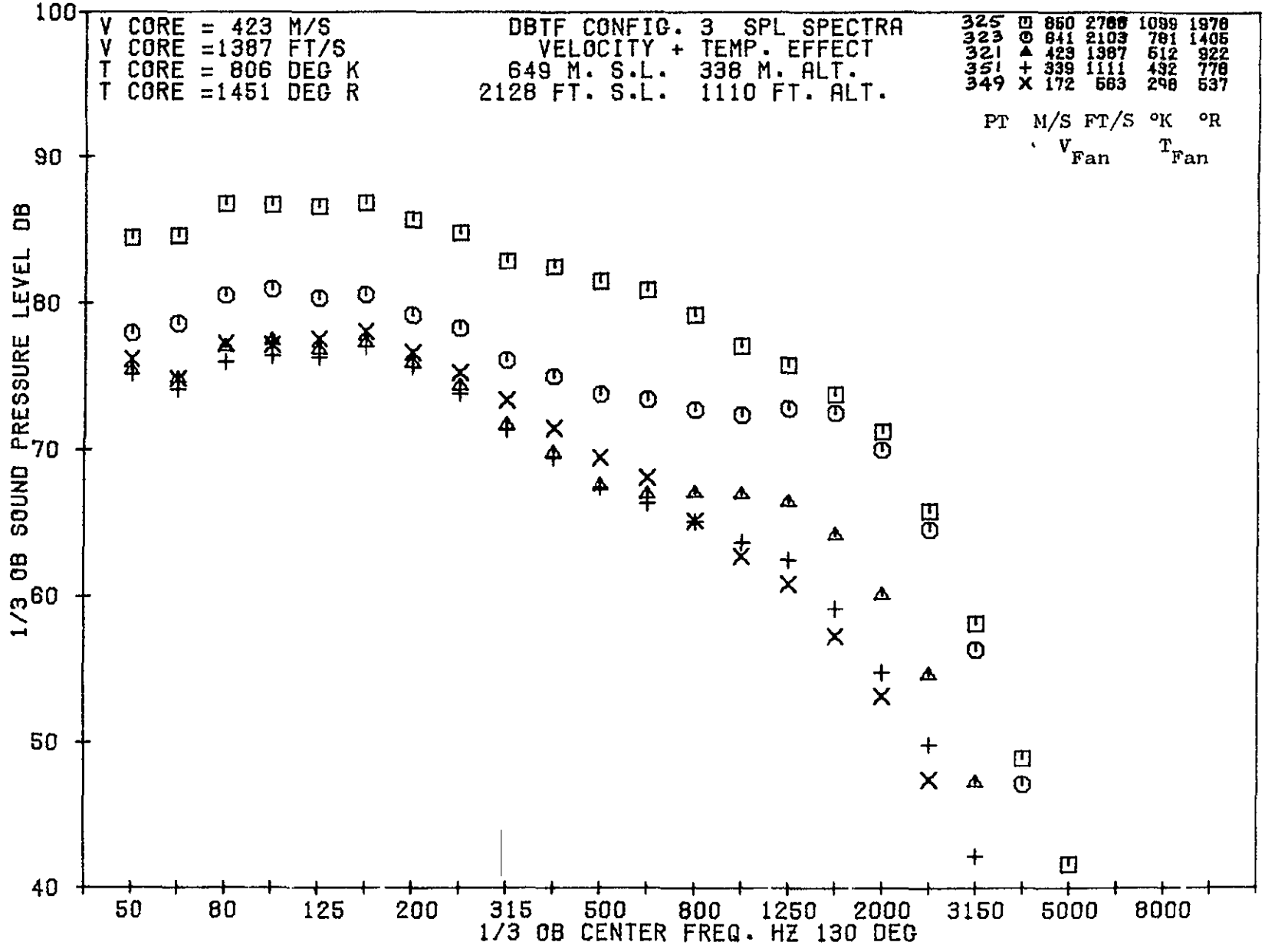

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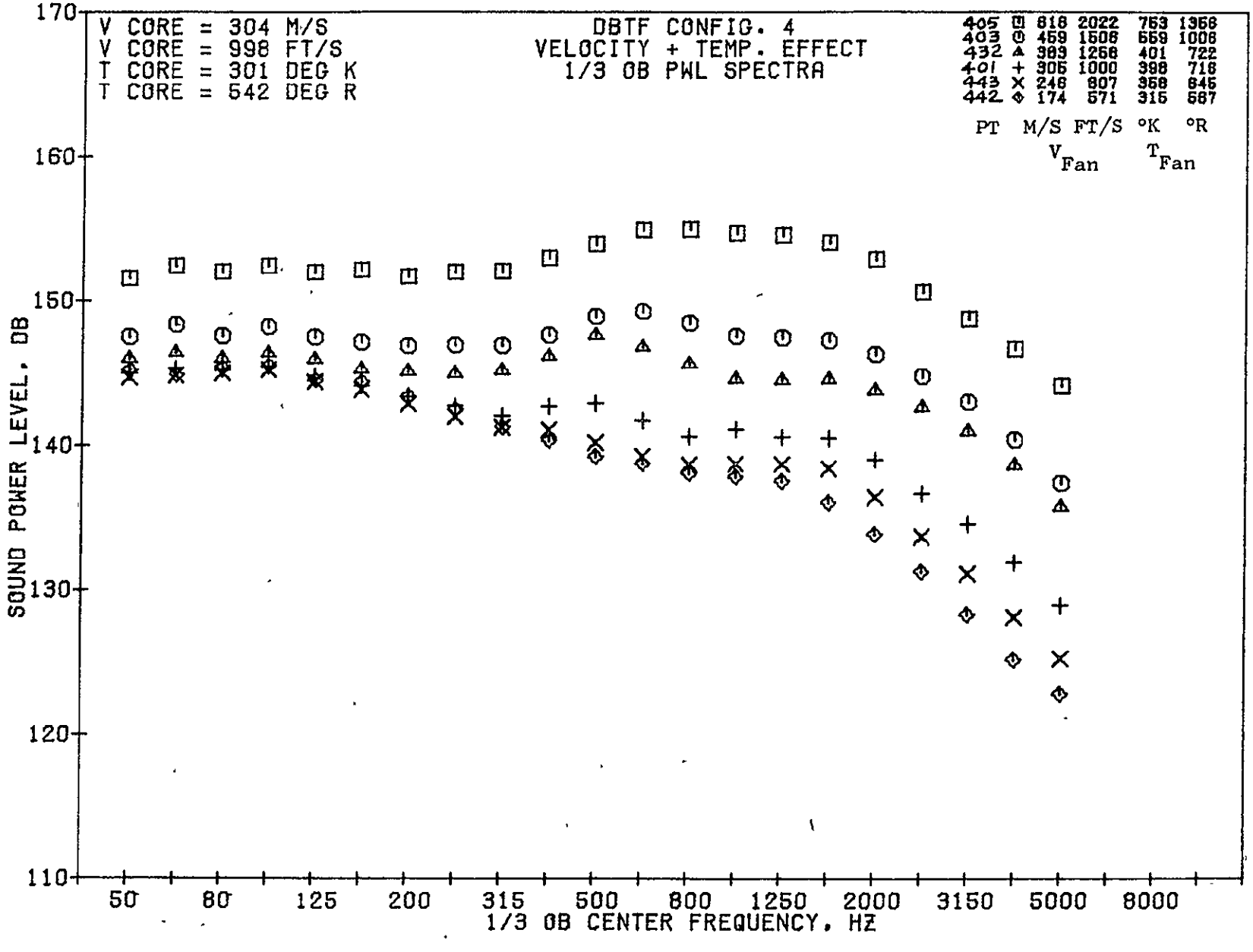

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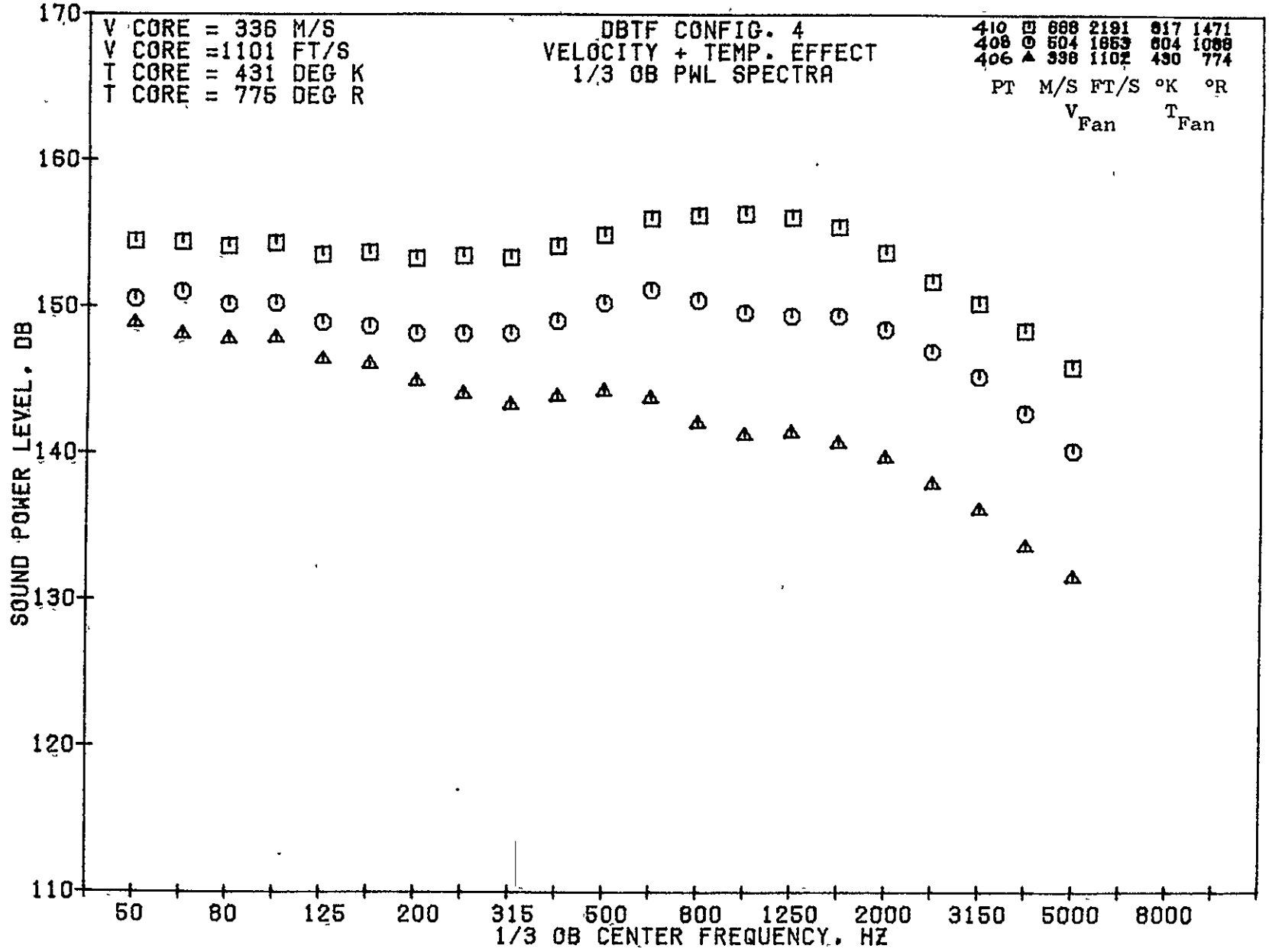

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5R552-001

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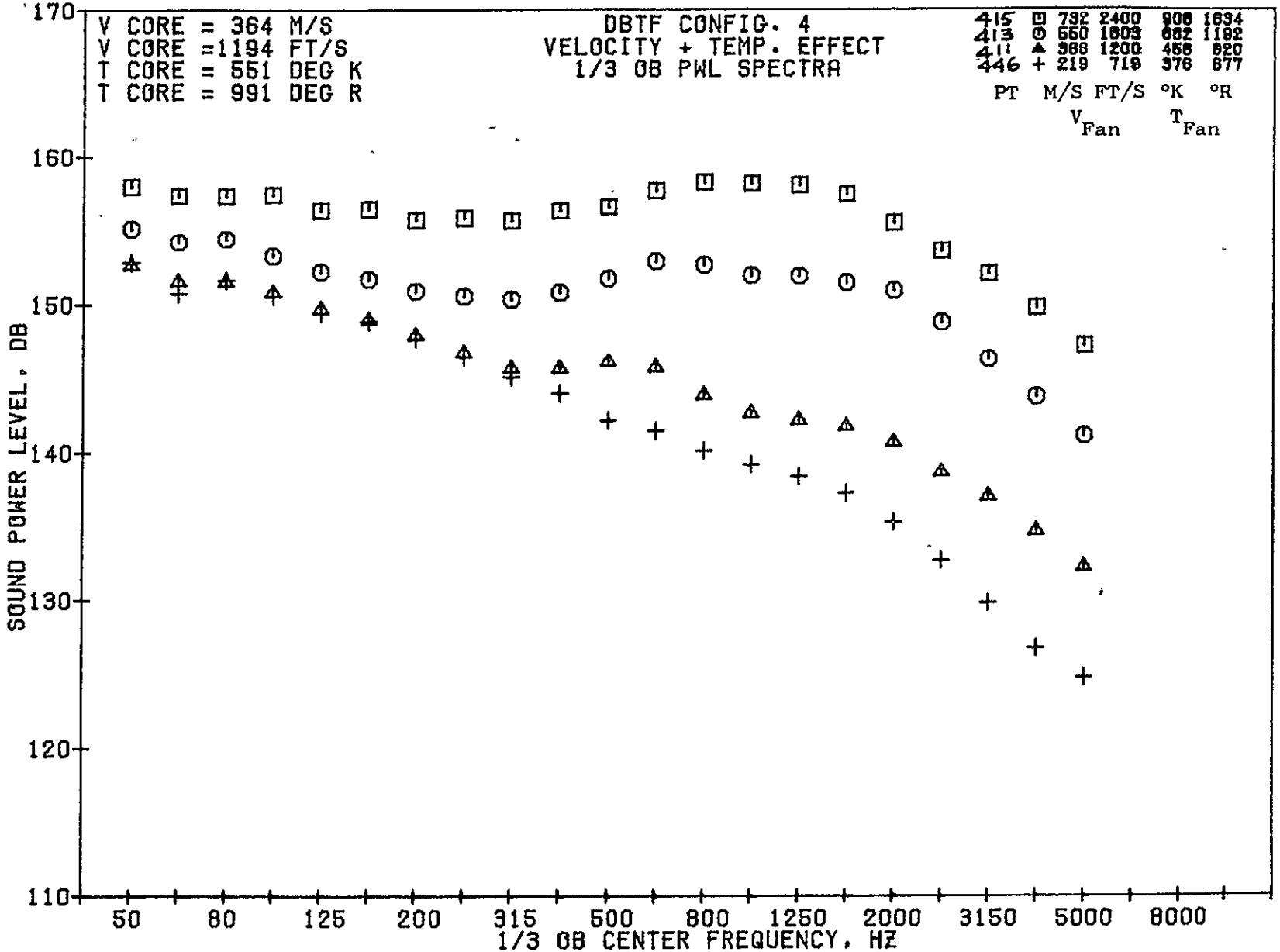

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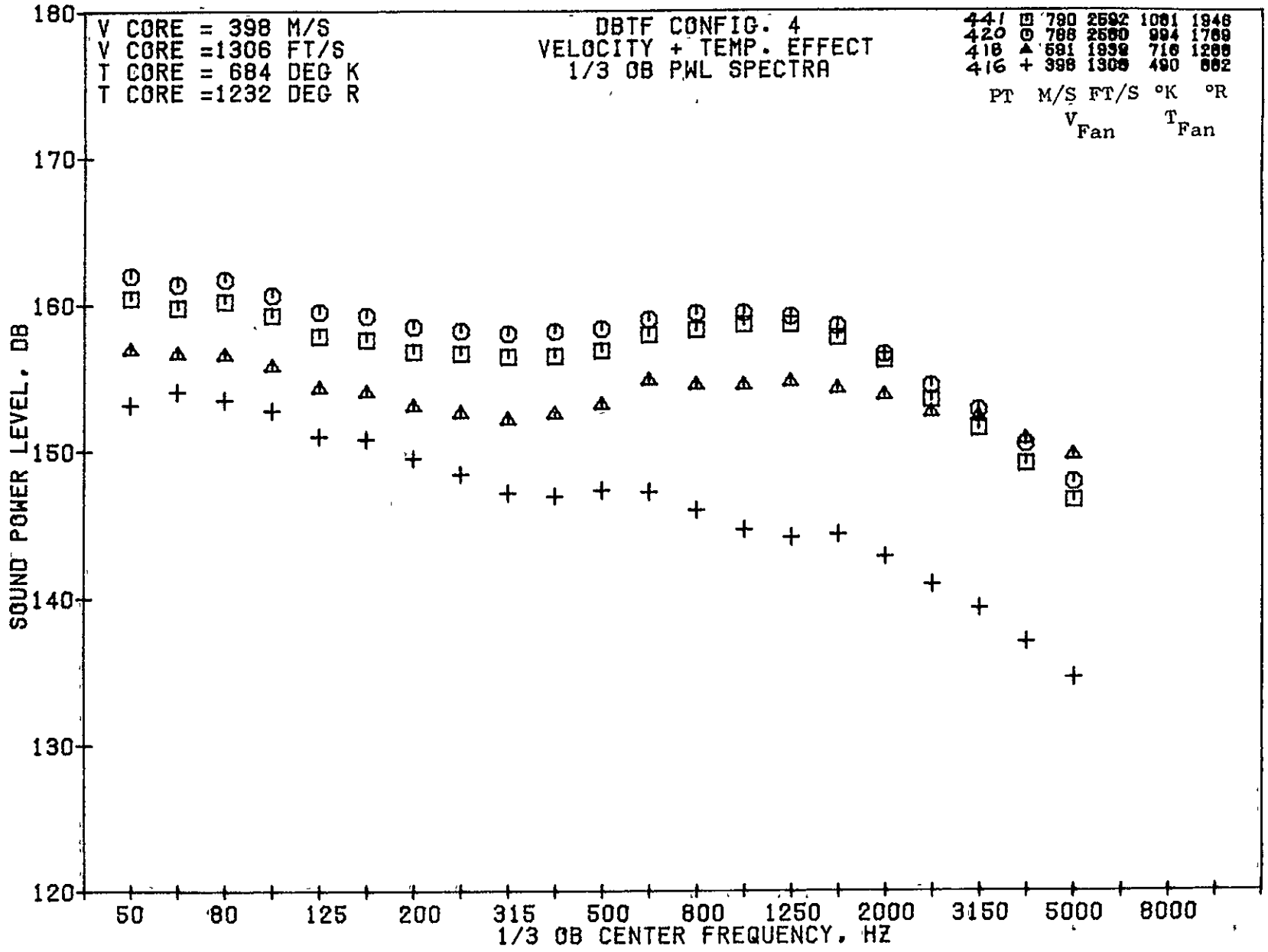

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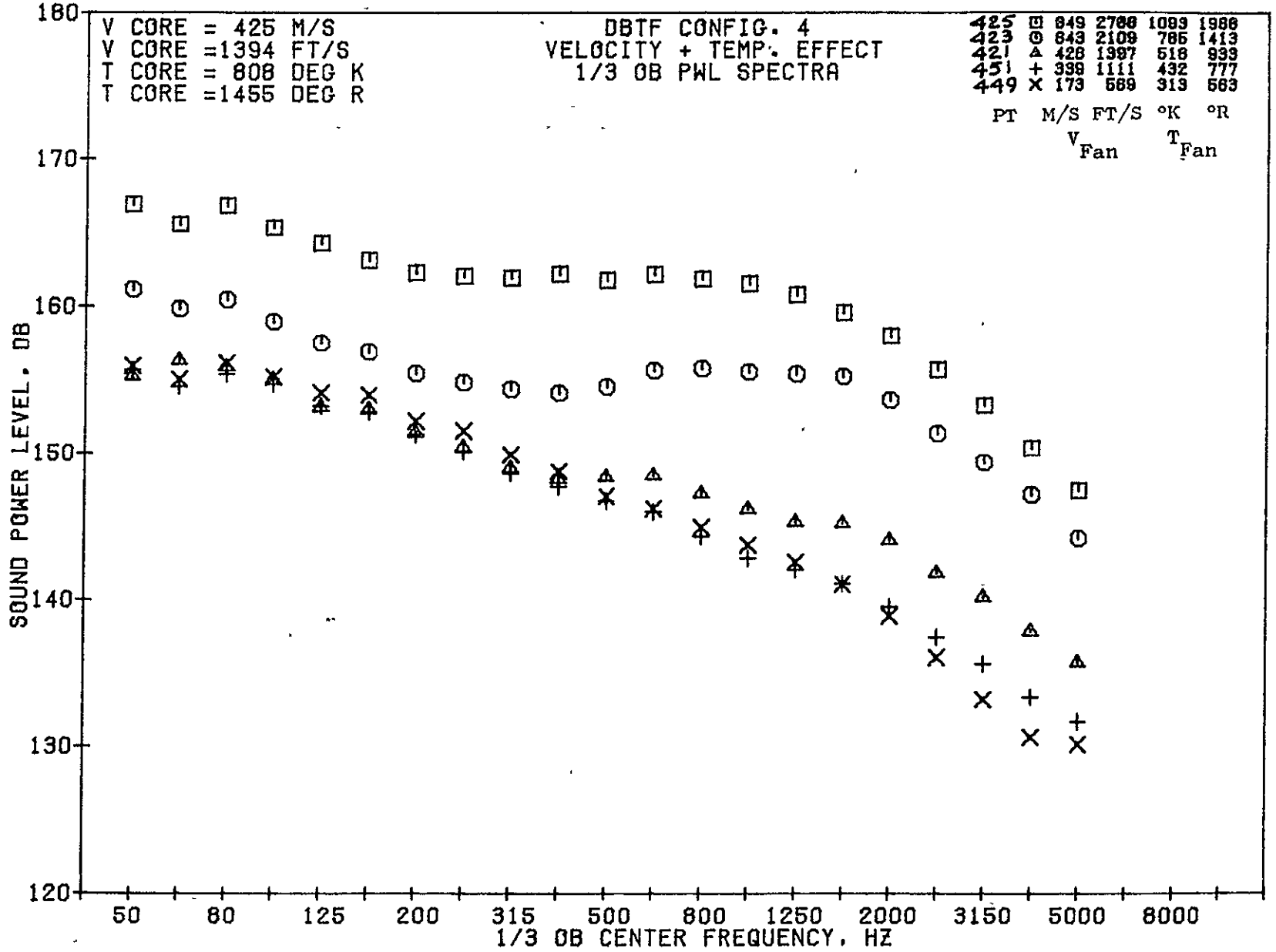

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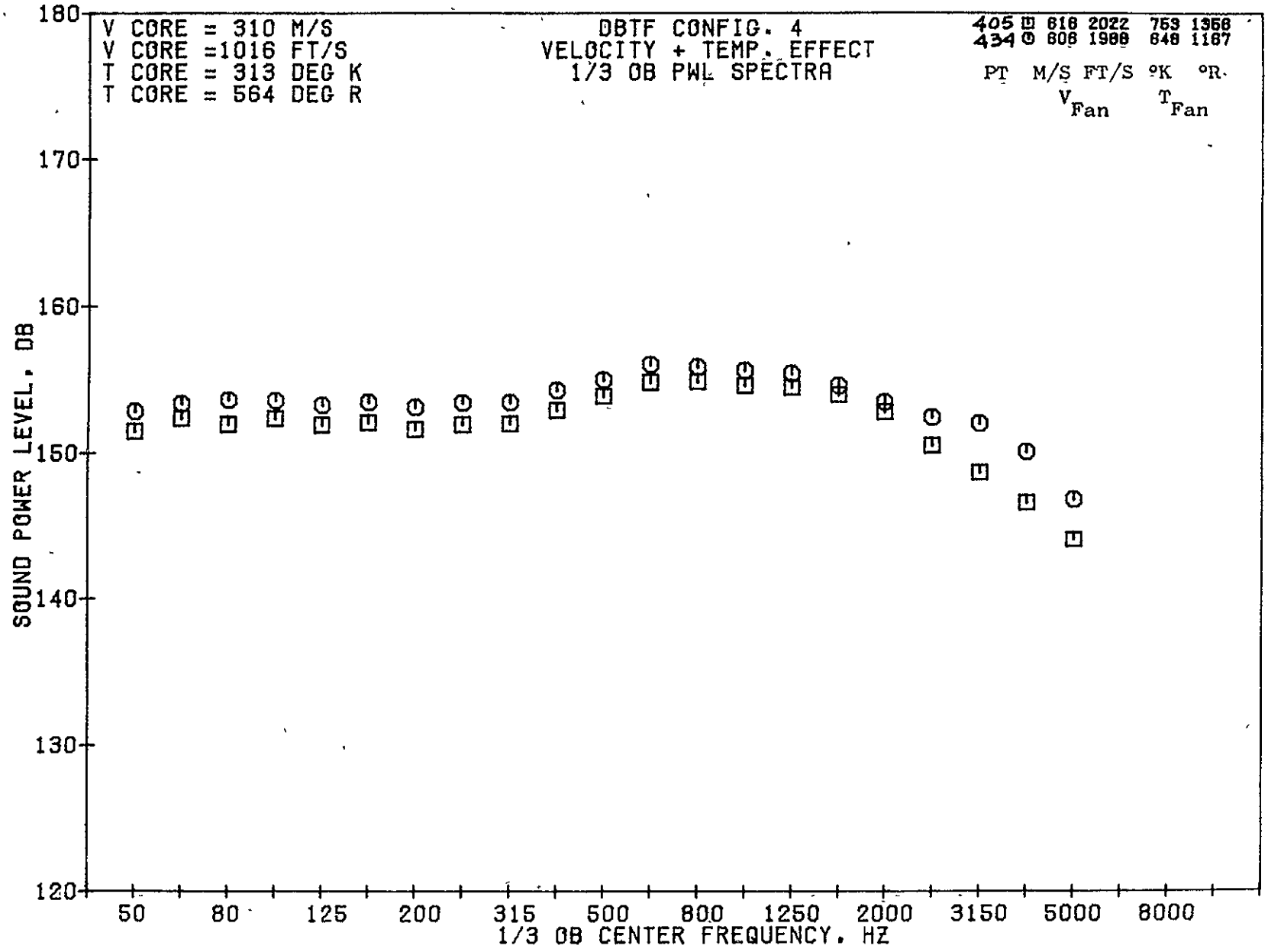

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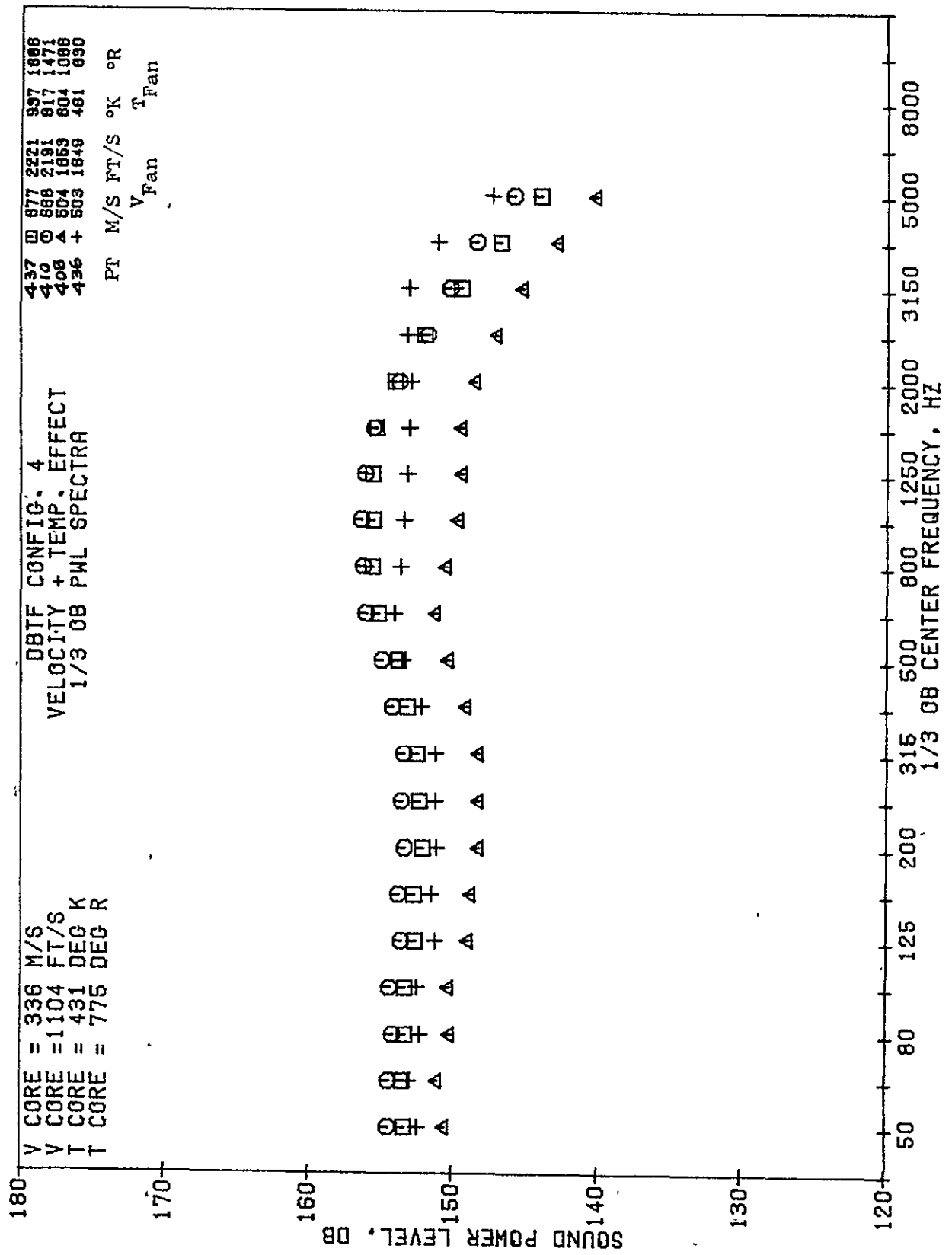

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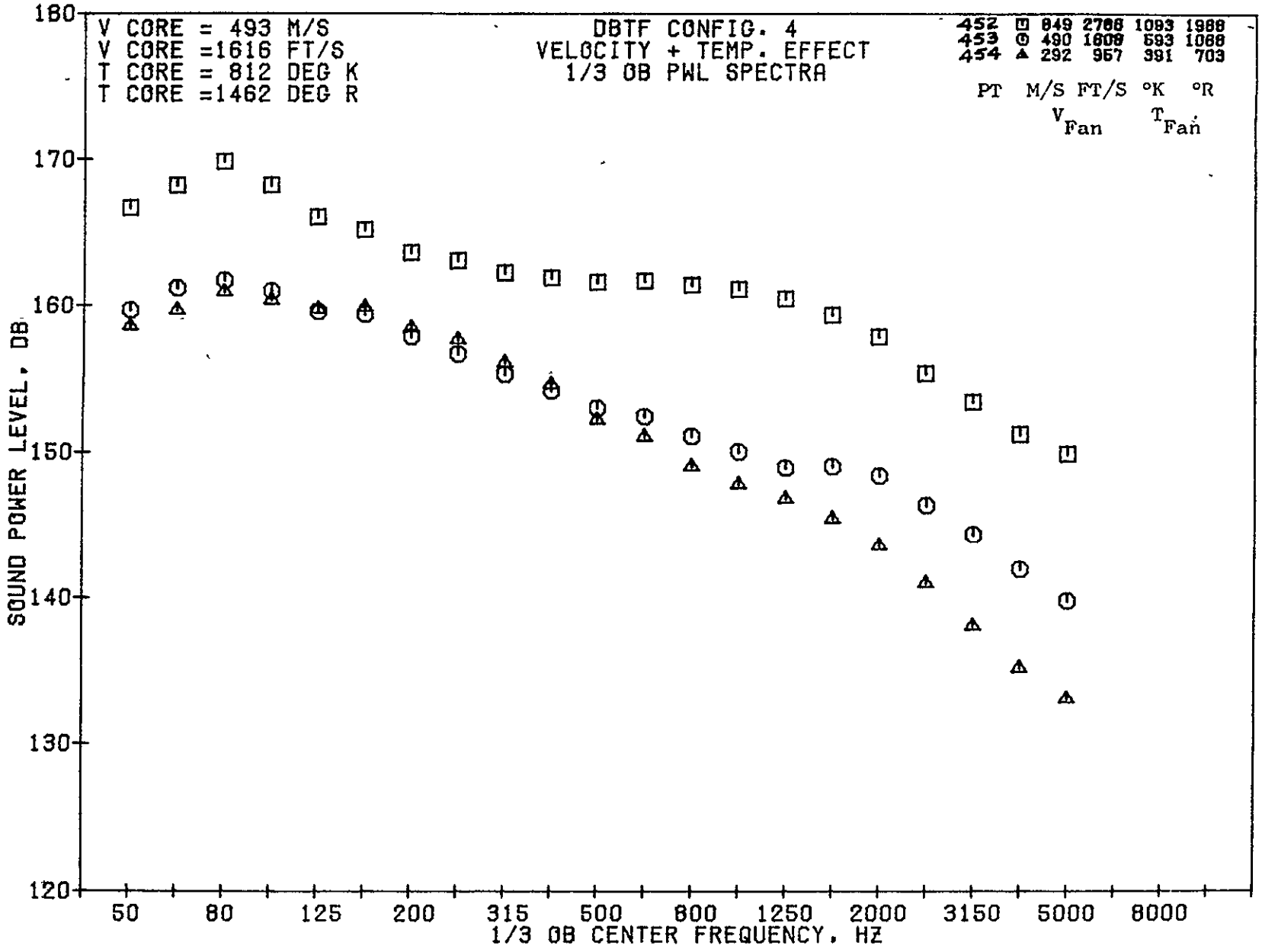

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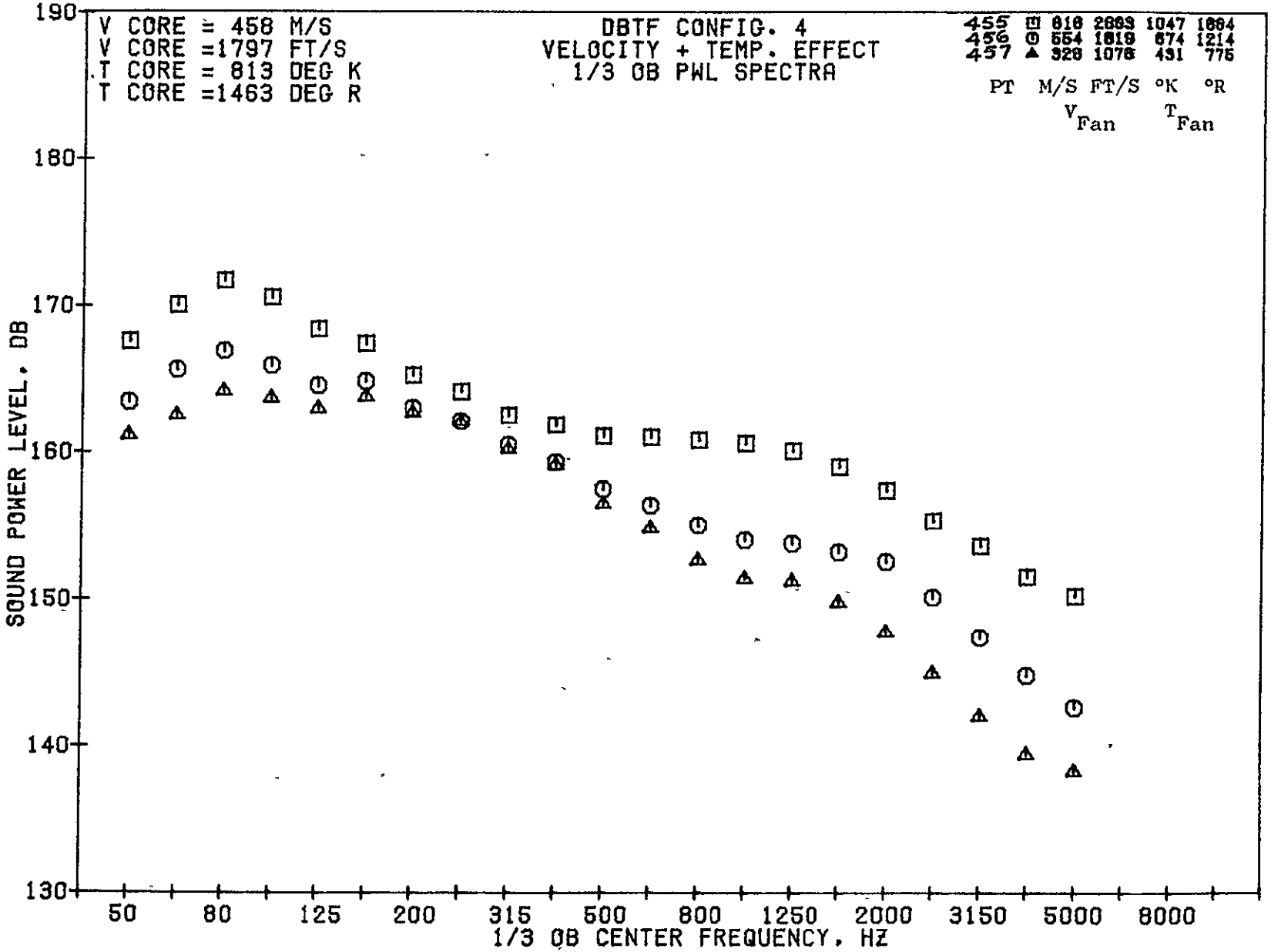

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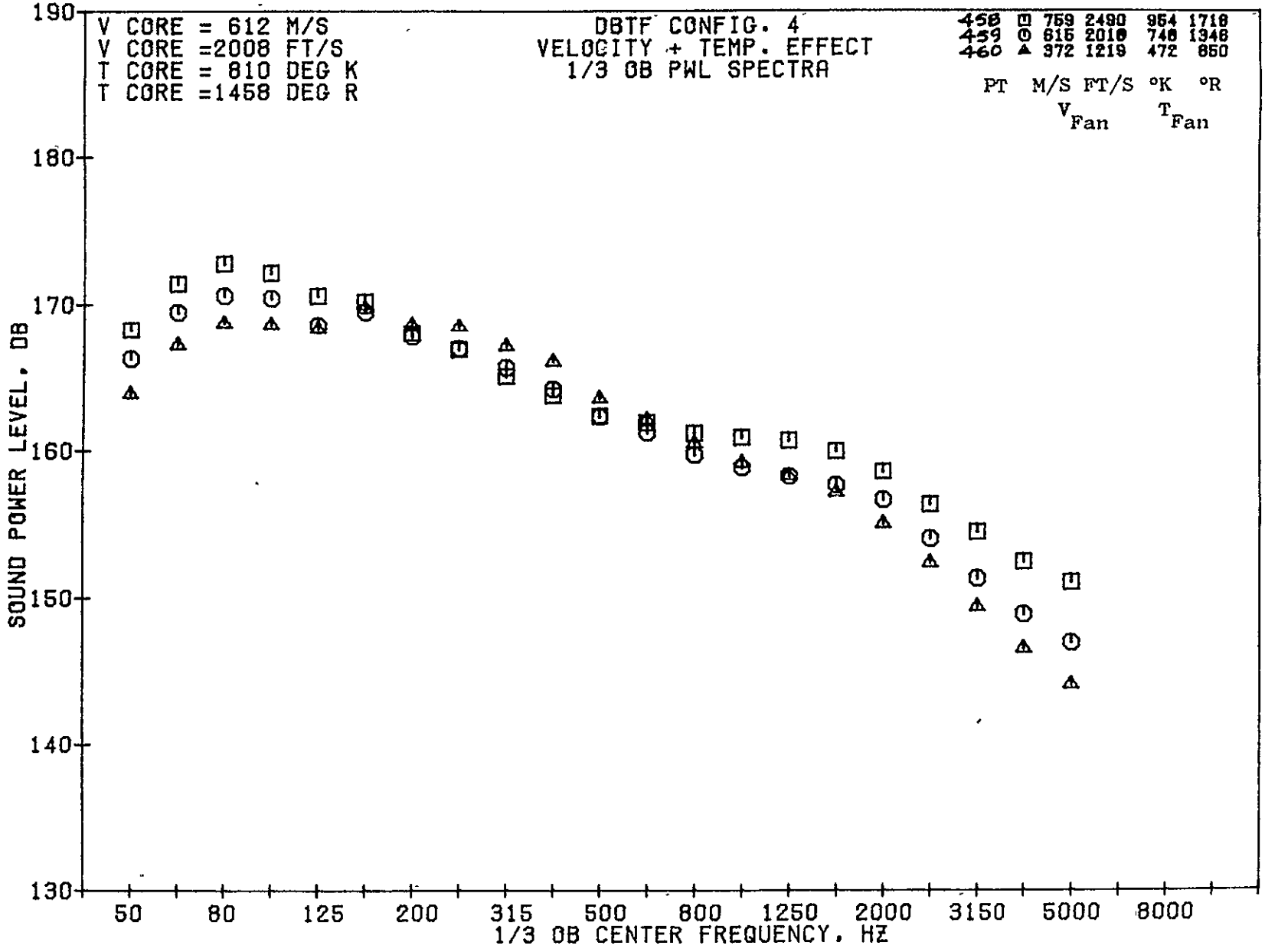

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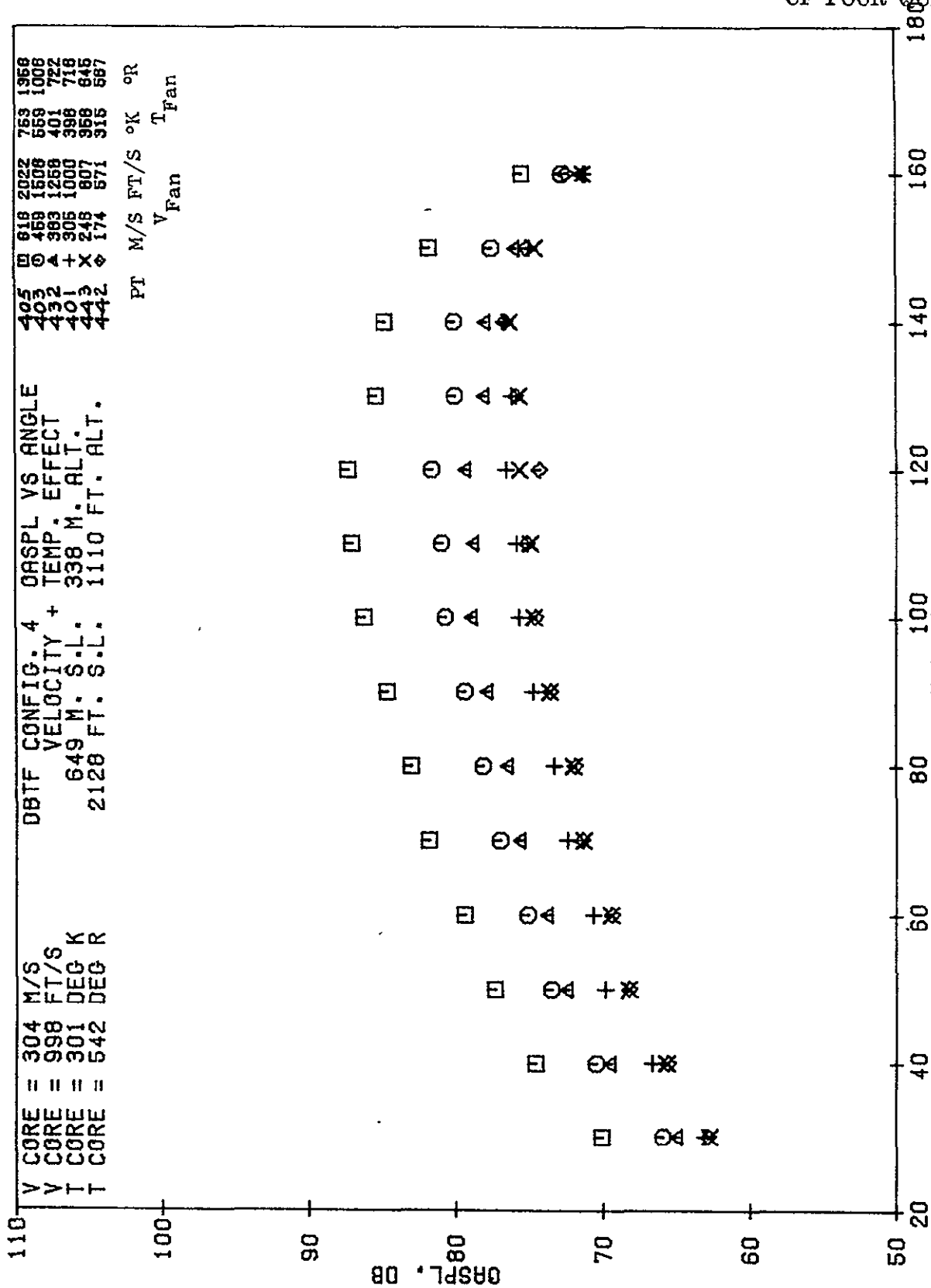

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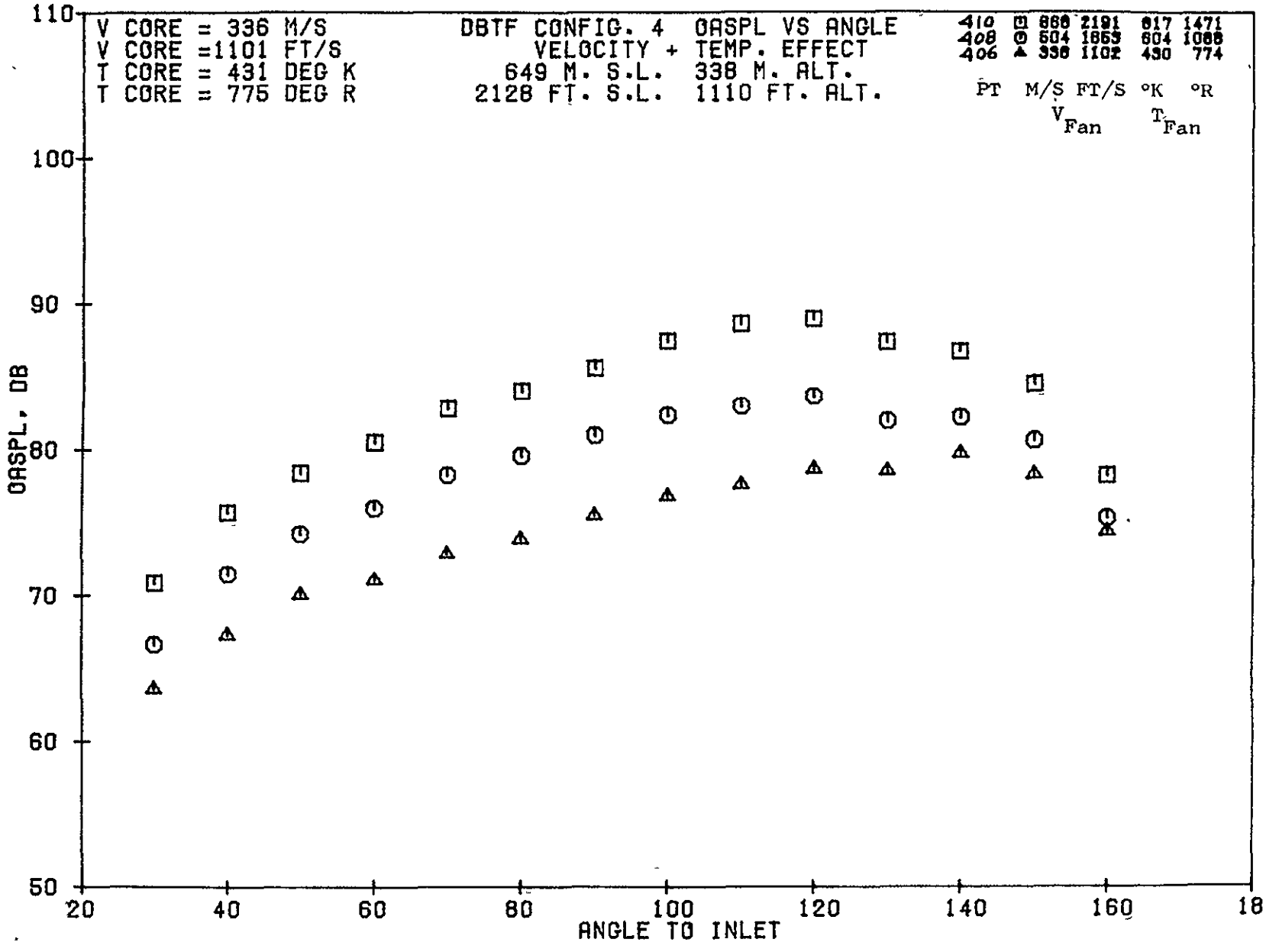

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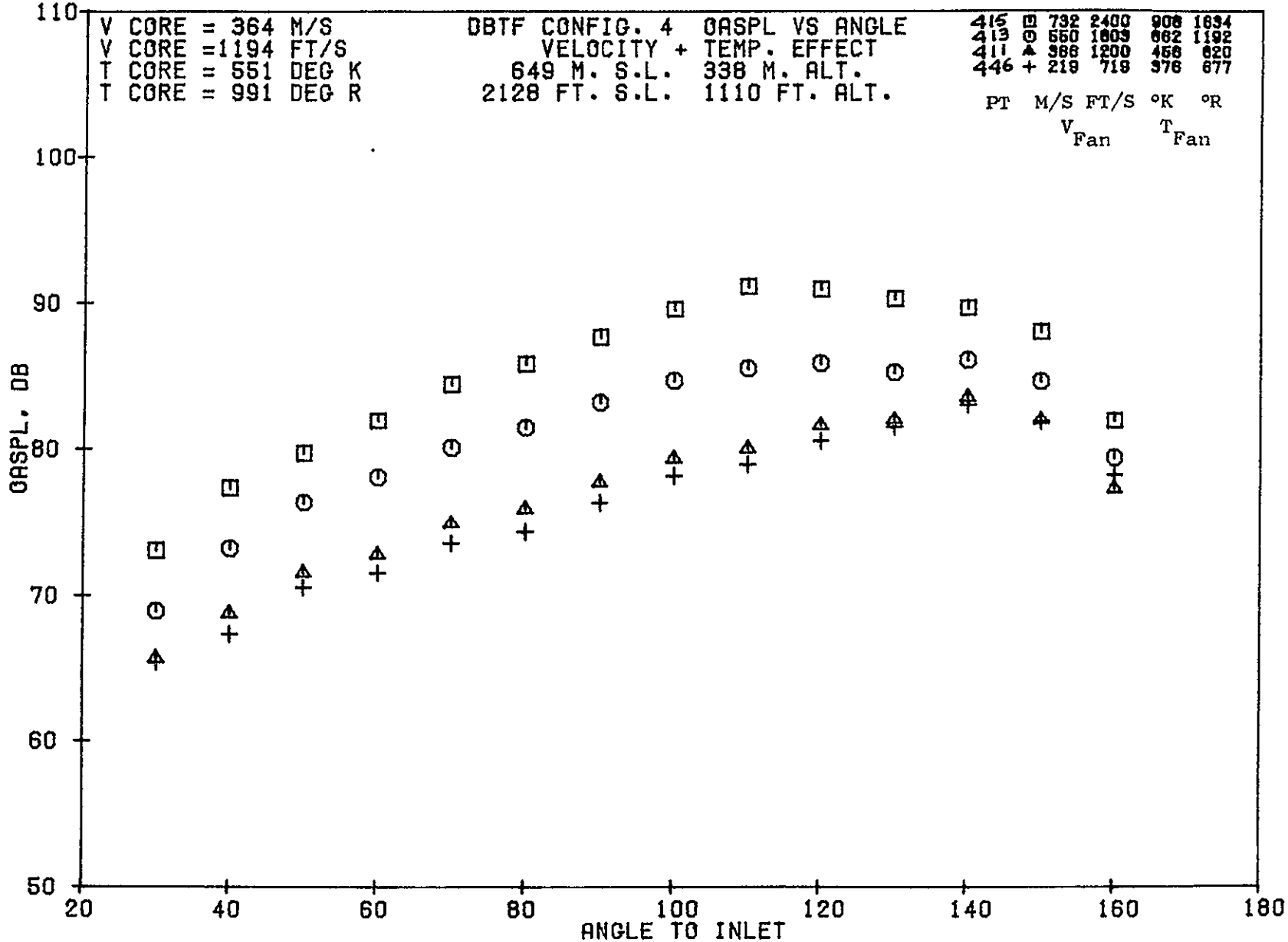

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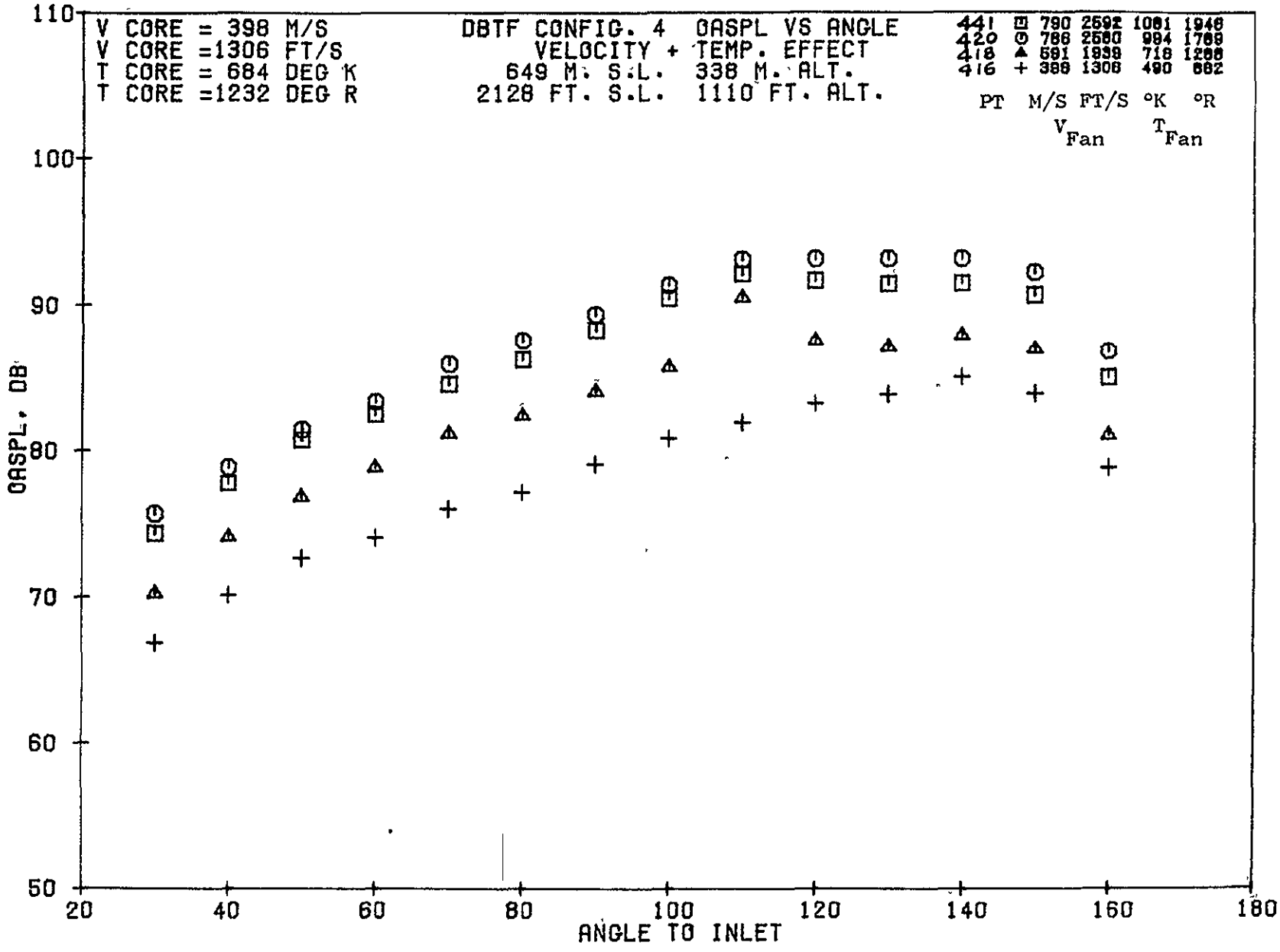

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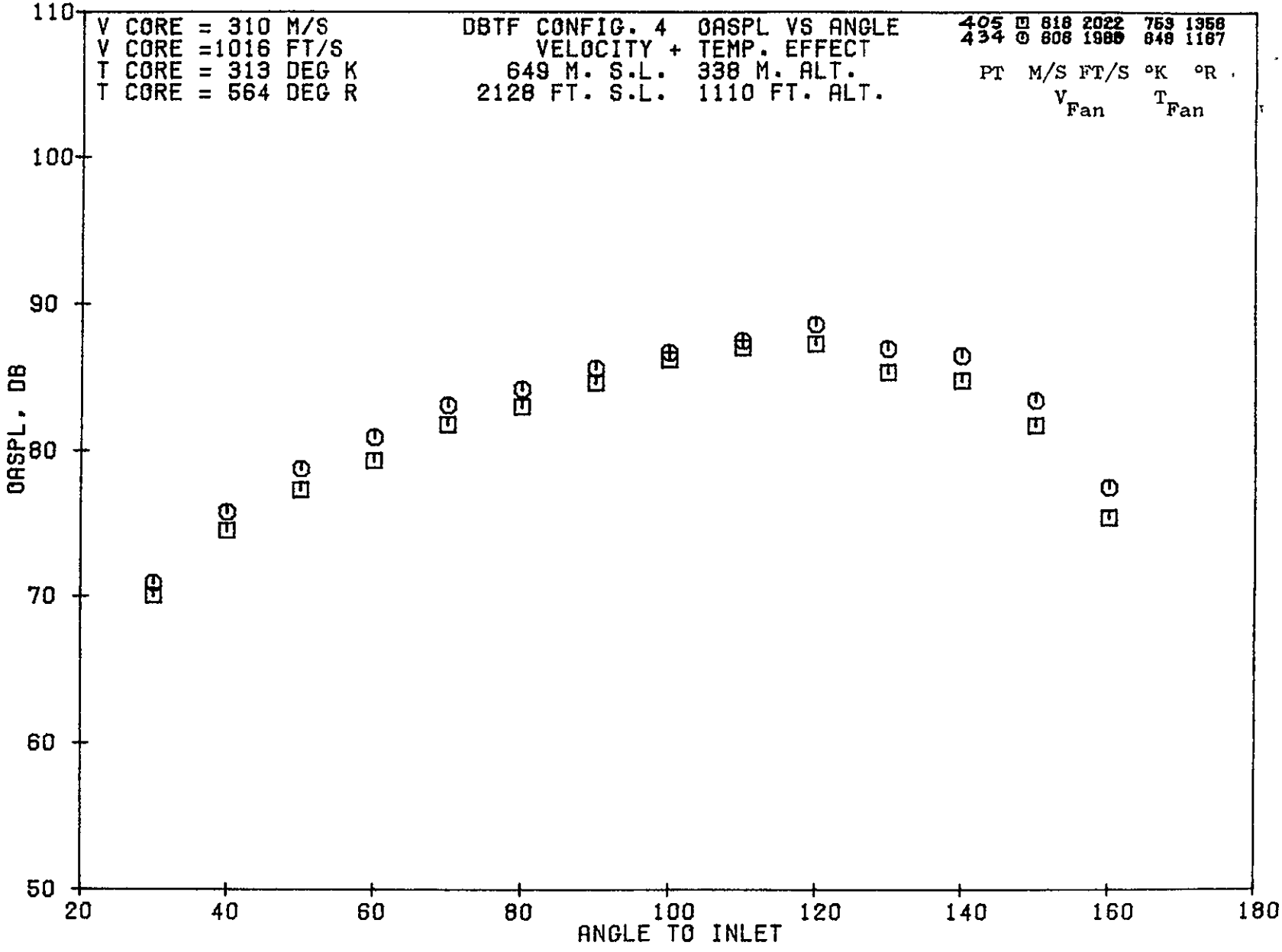

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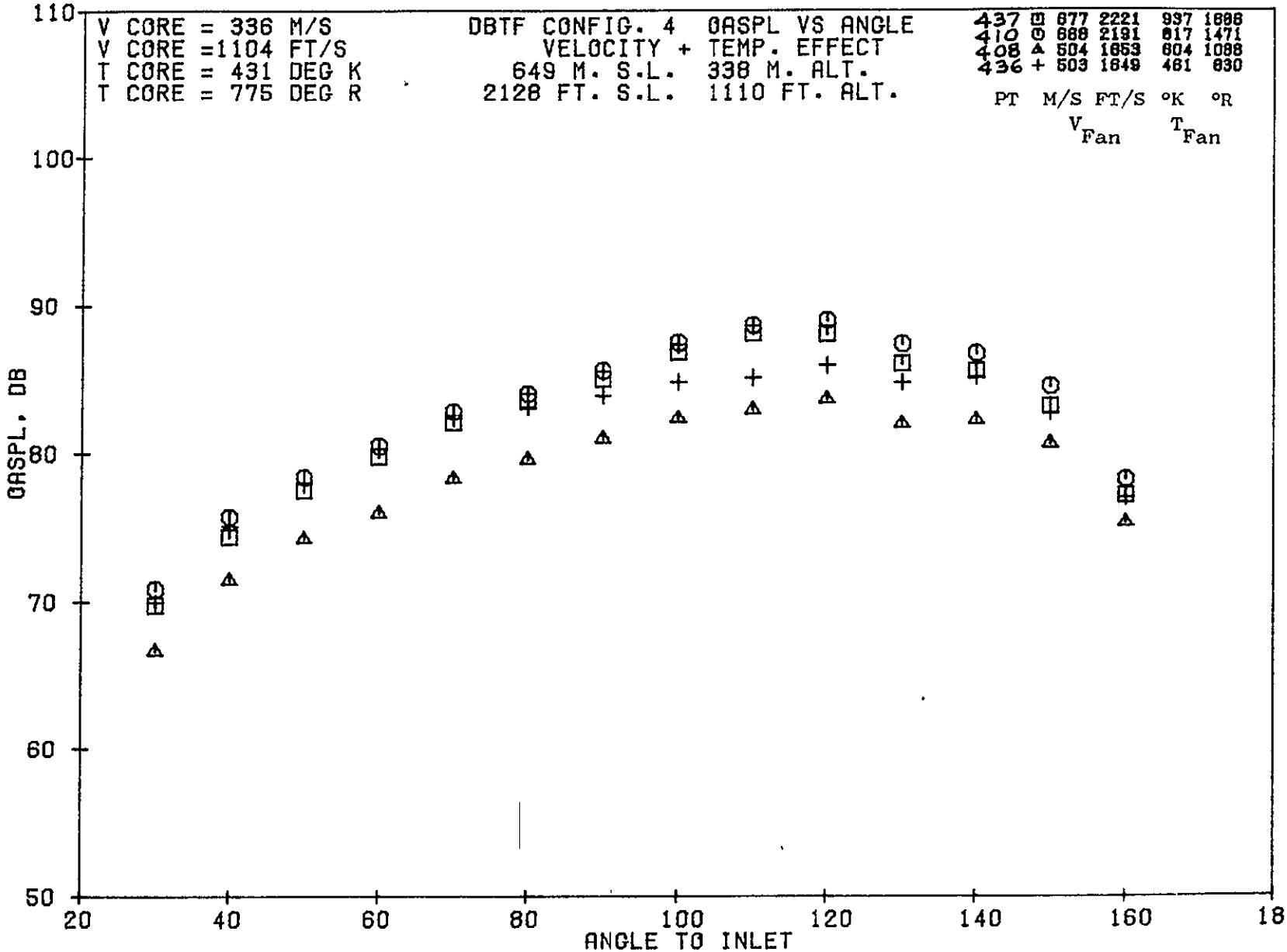

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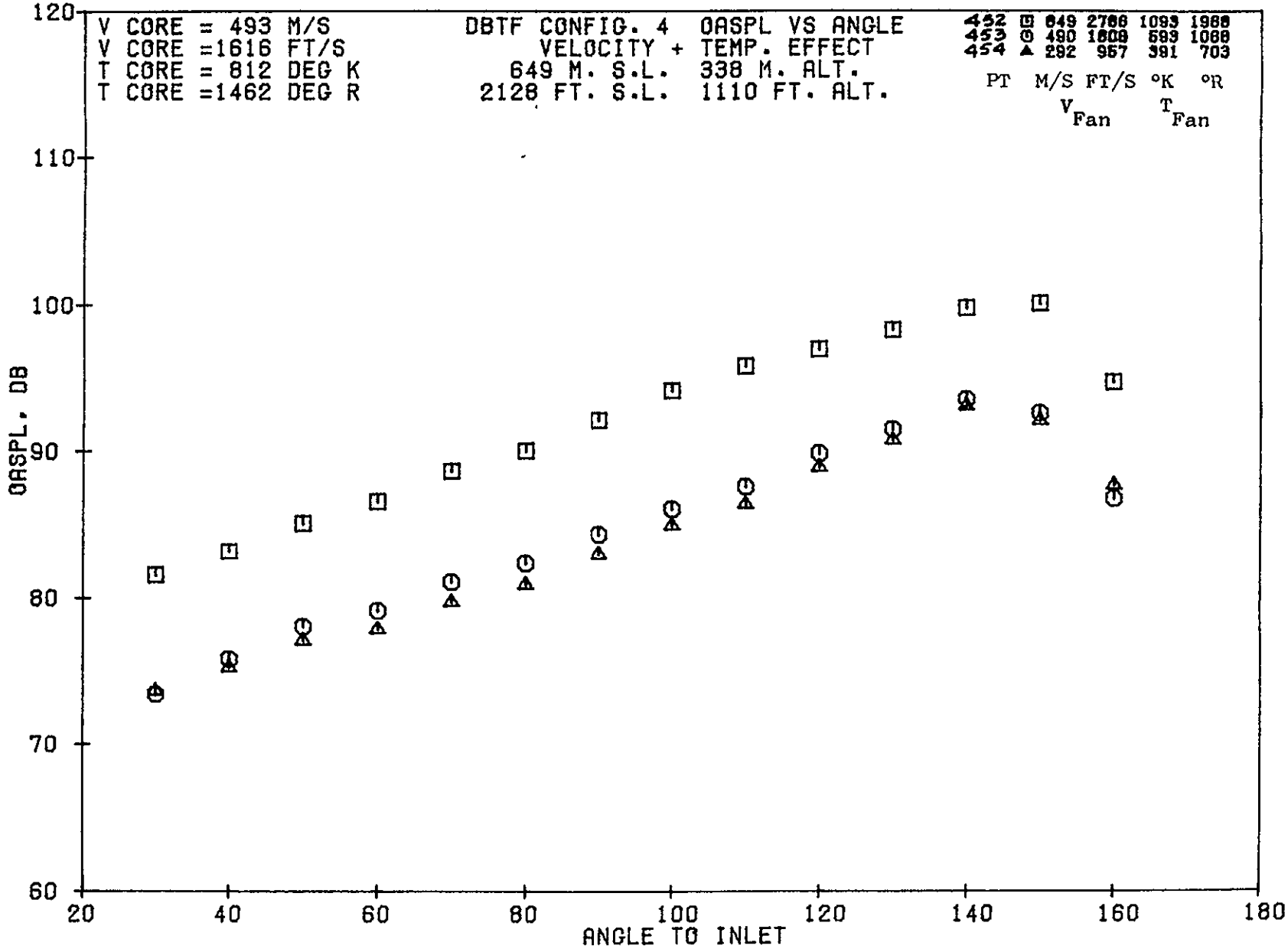

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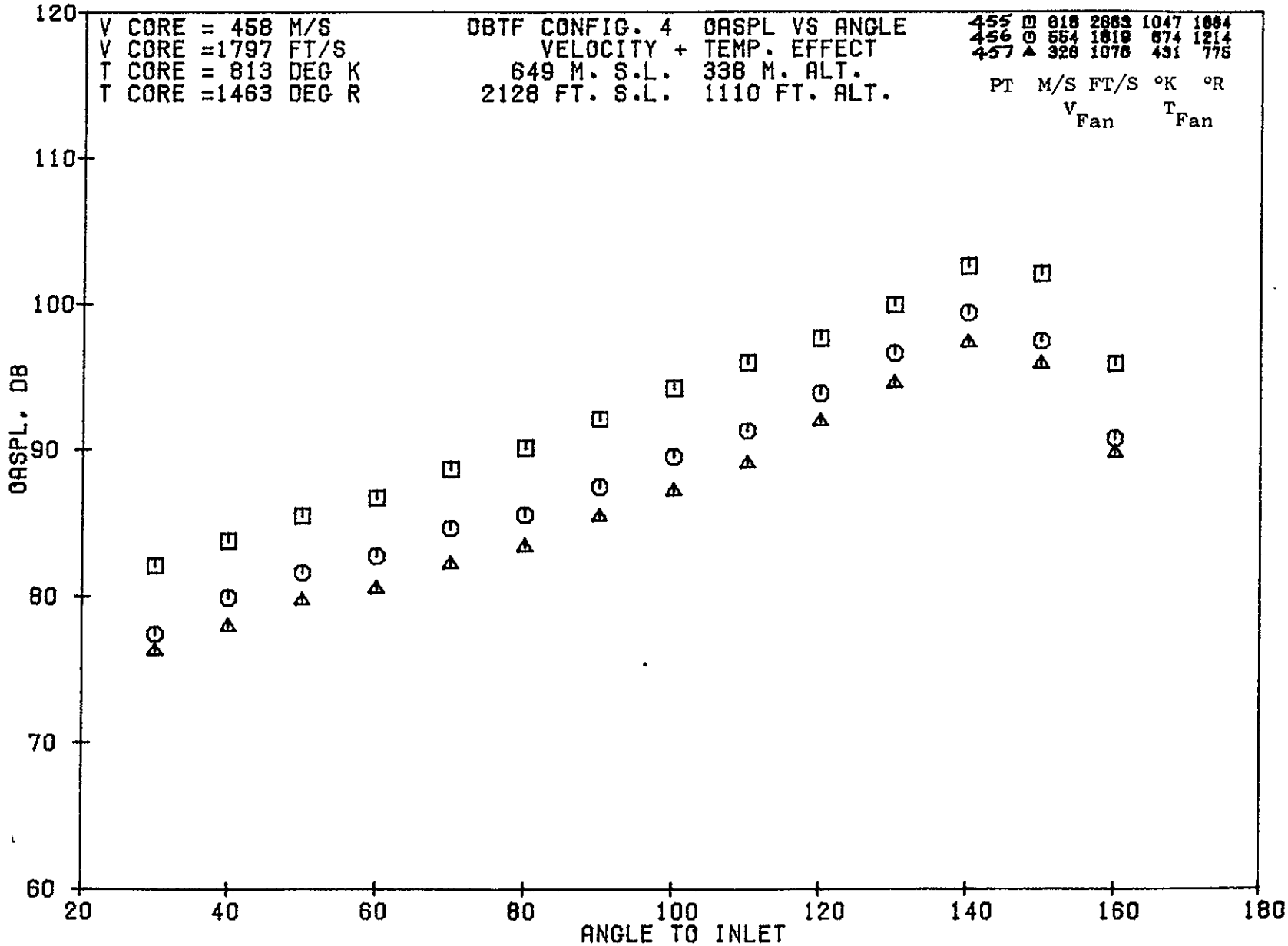

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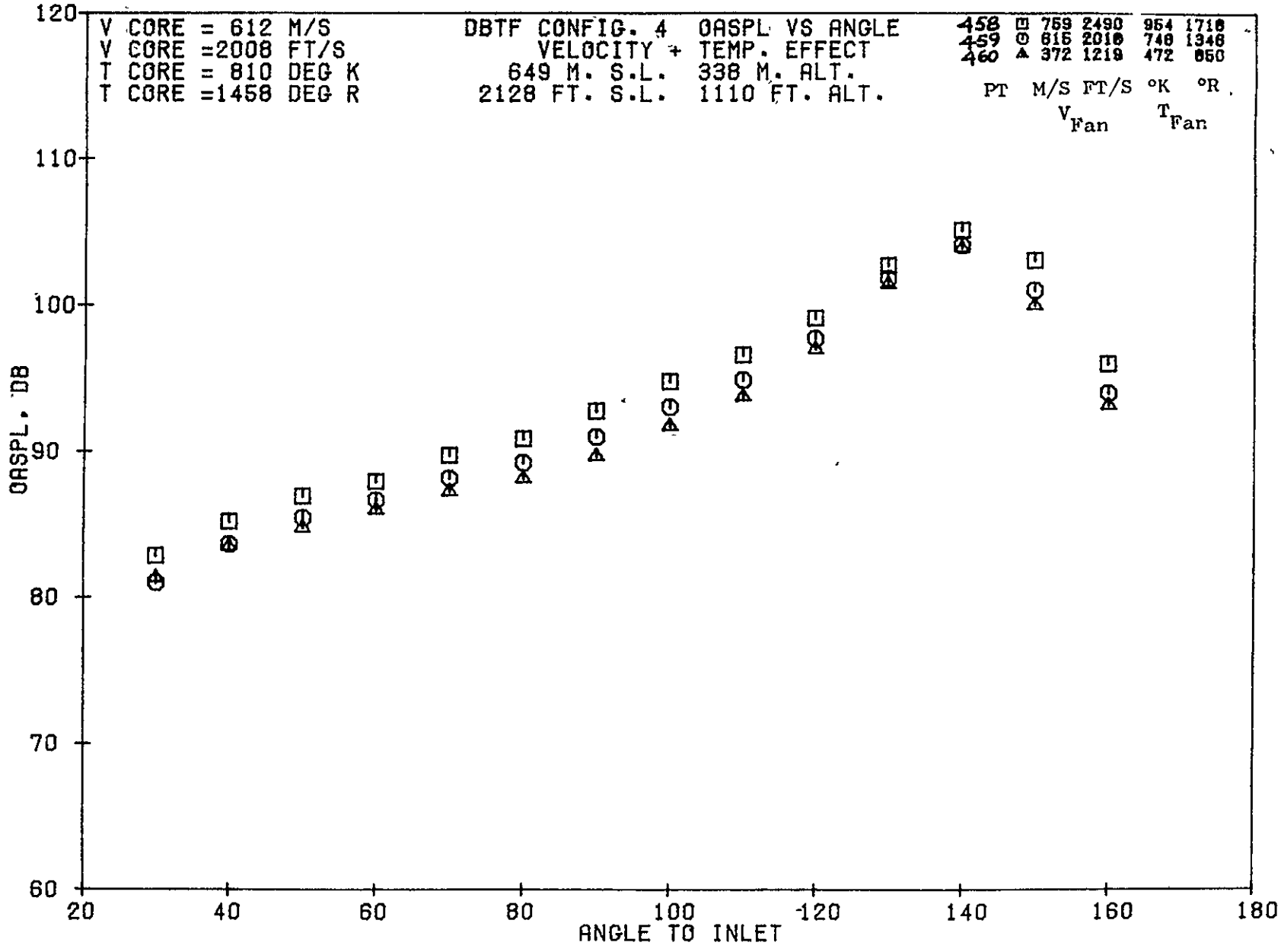

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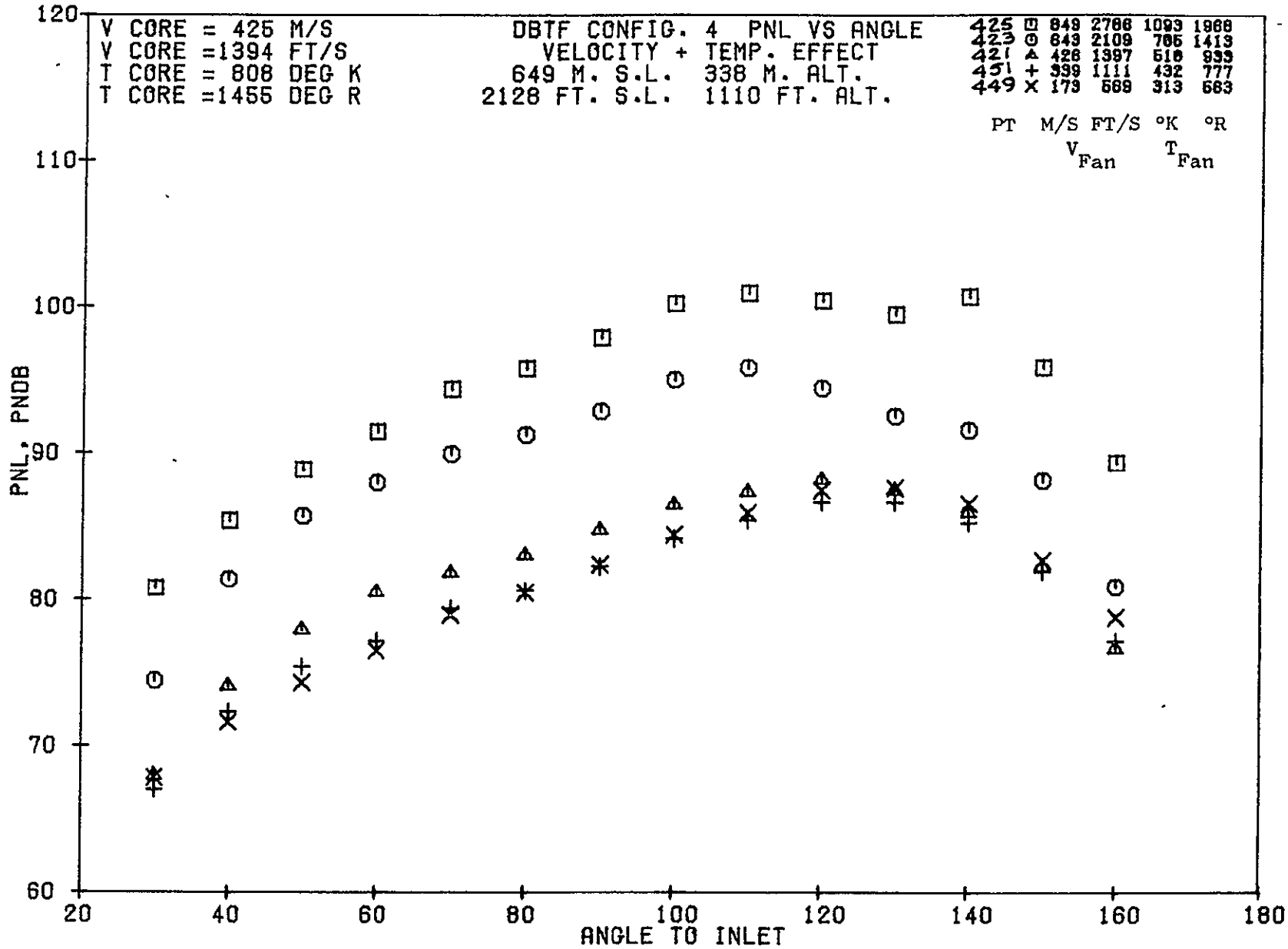

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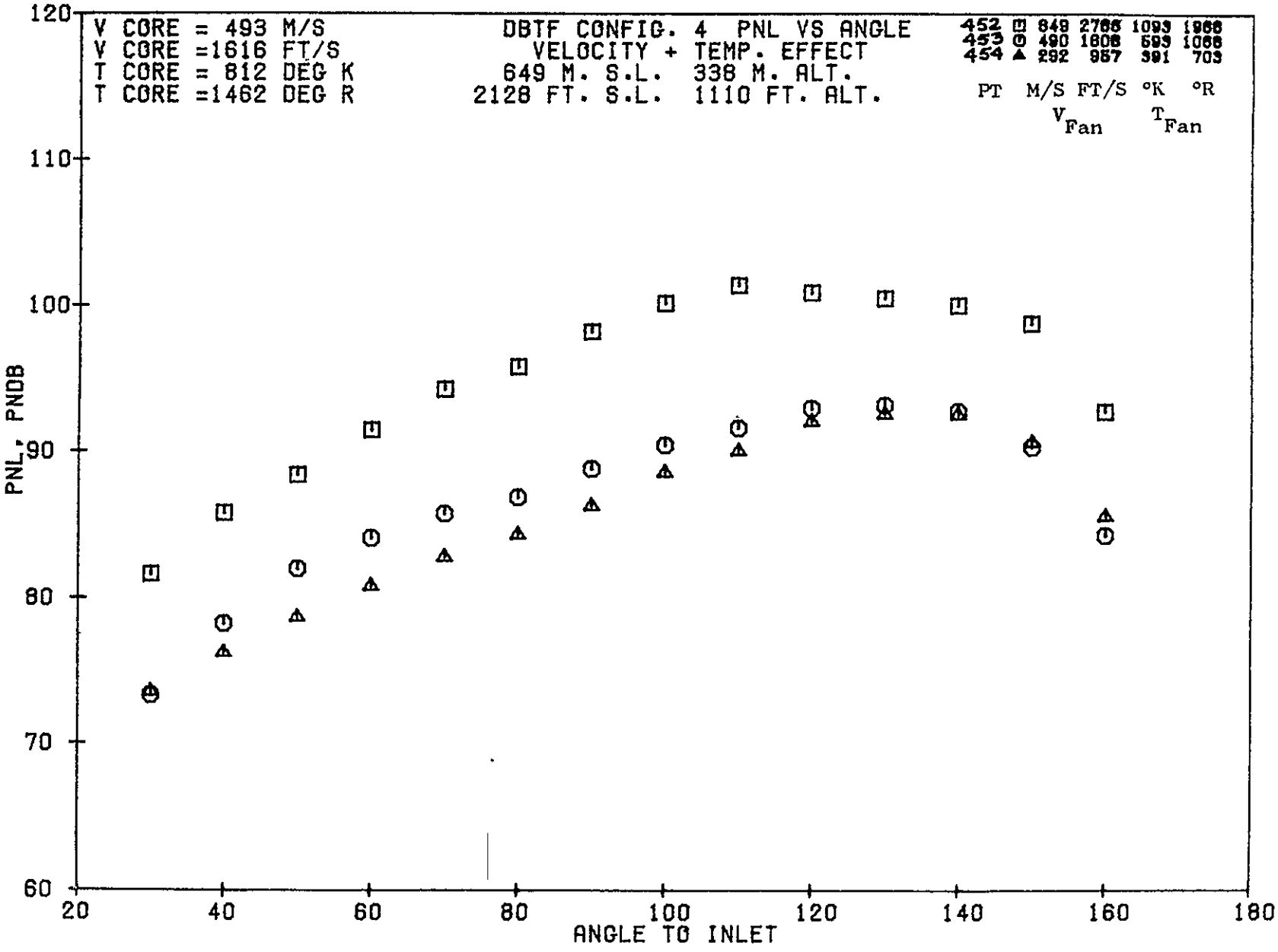

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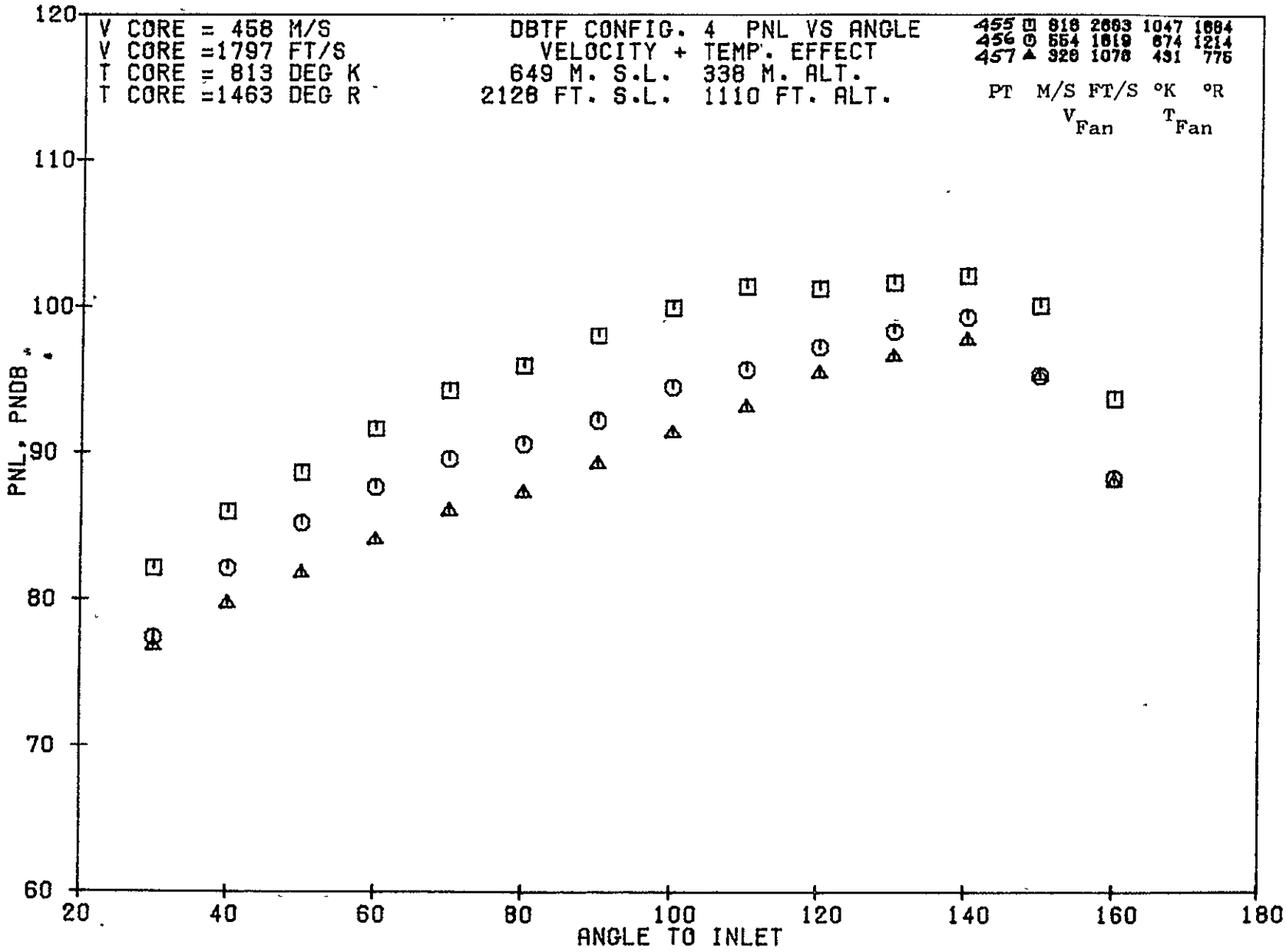

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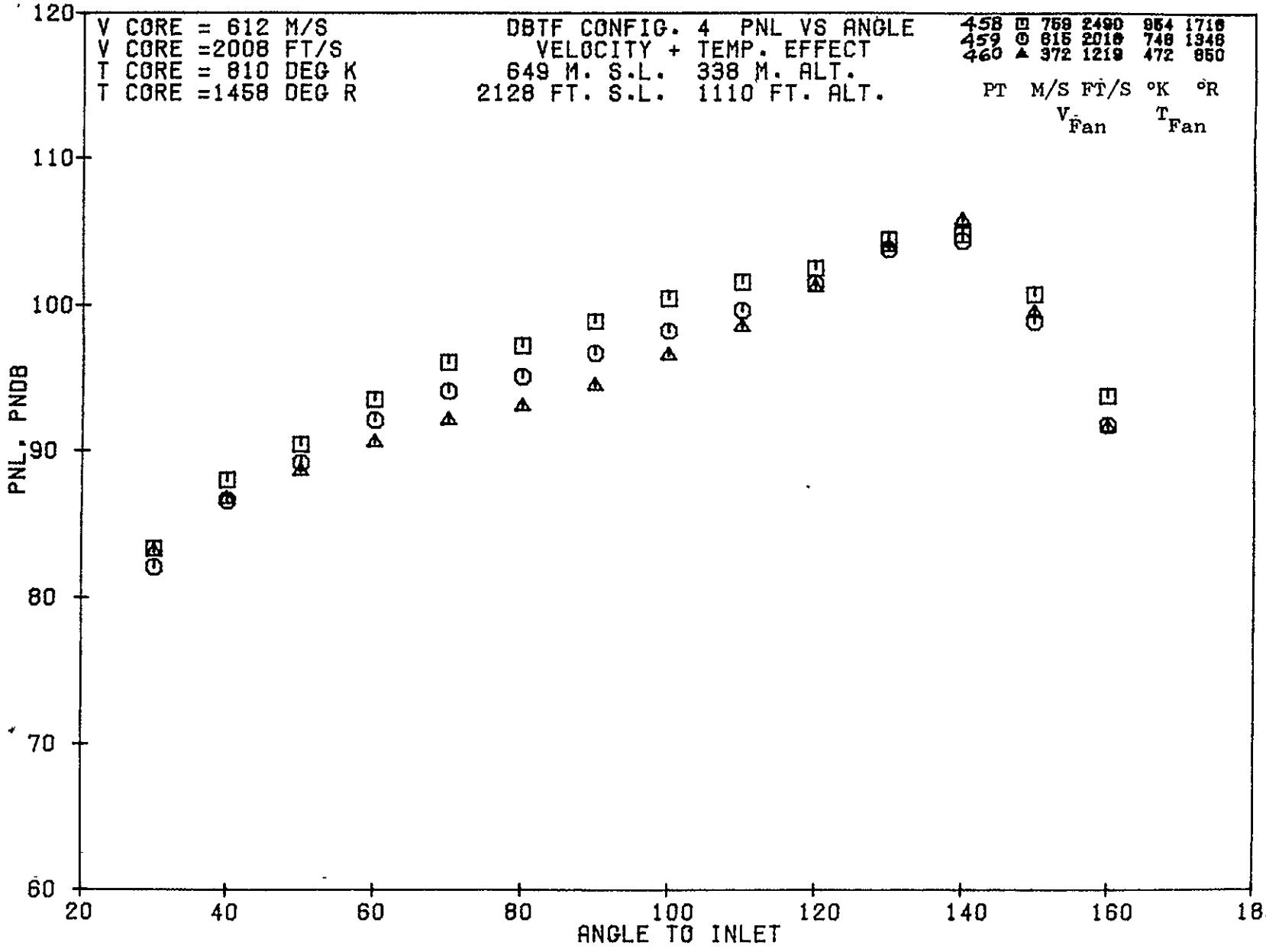

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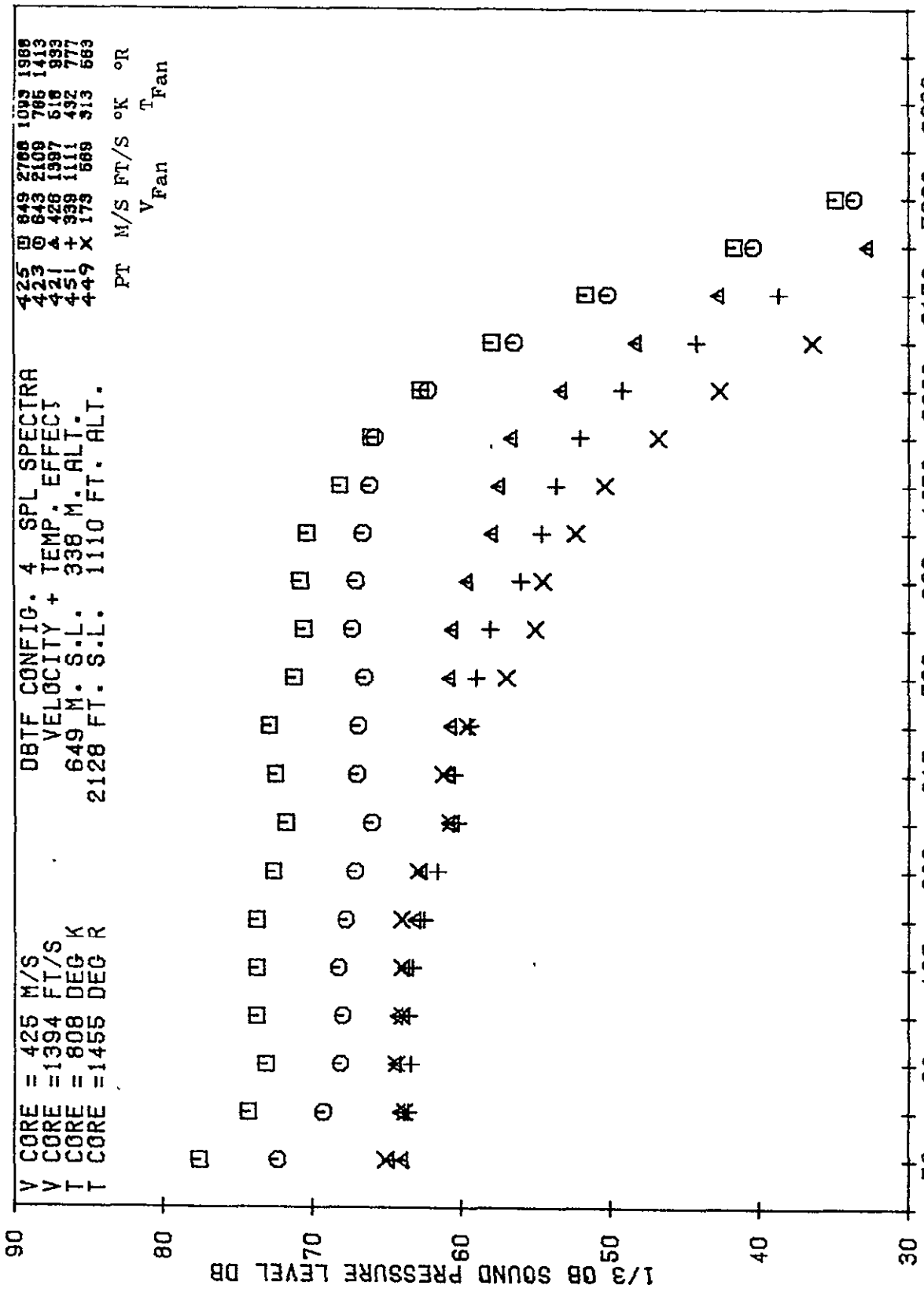

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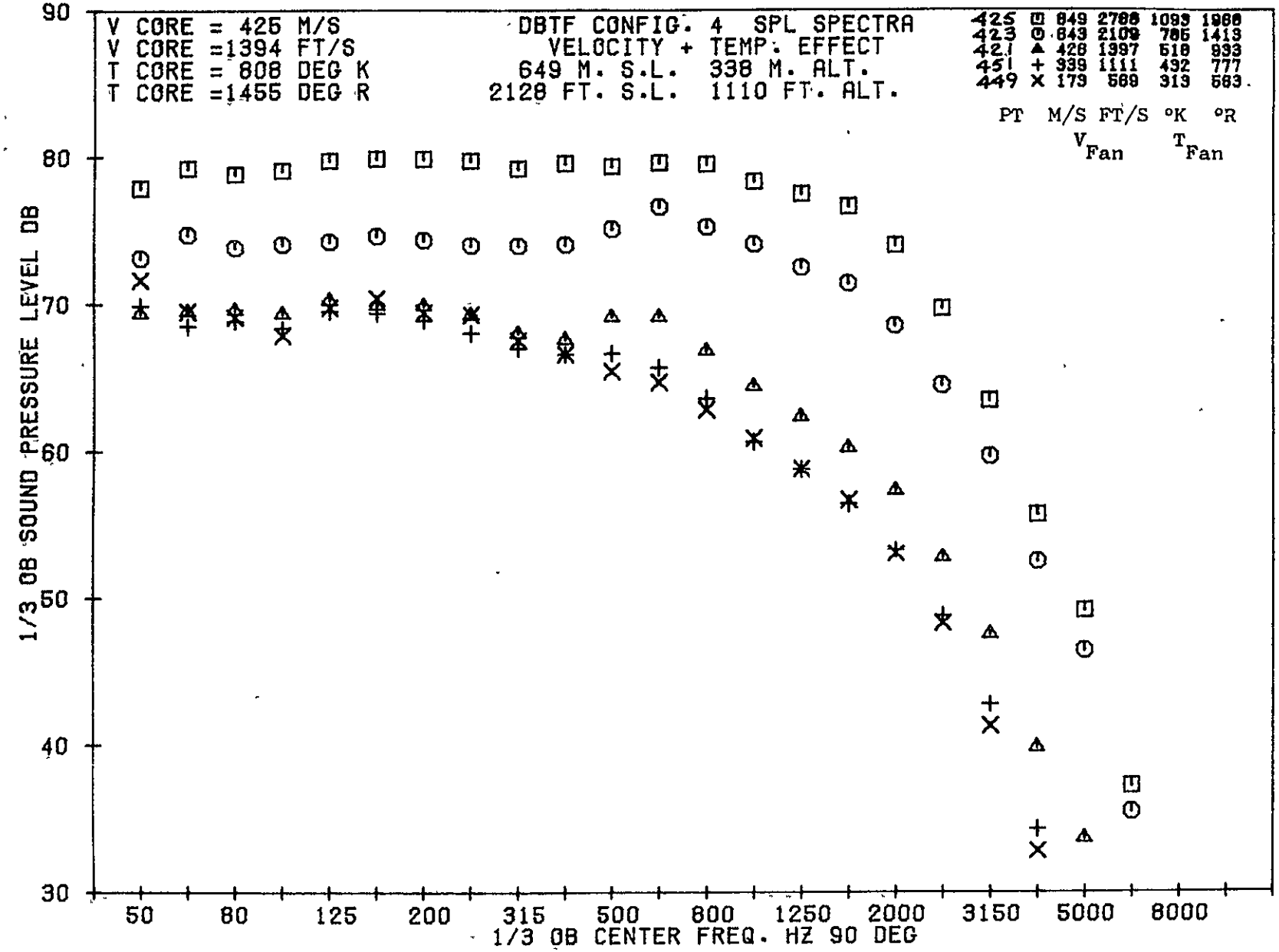

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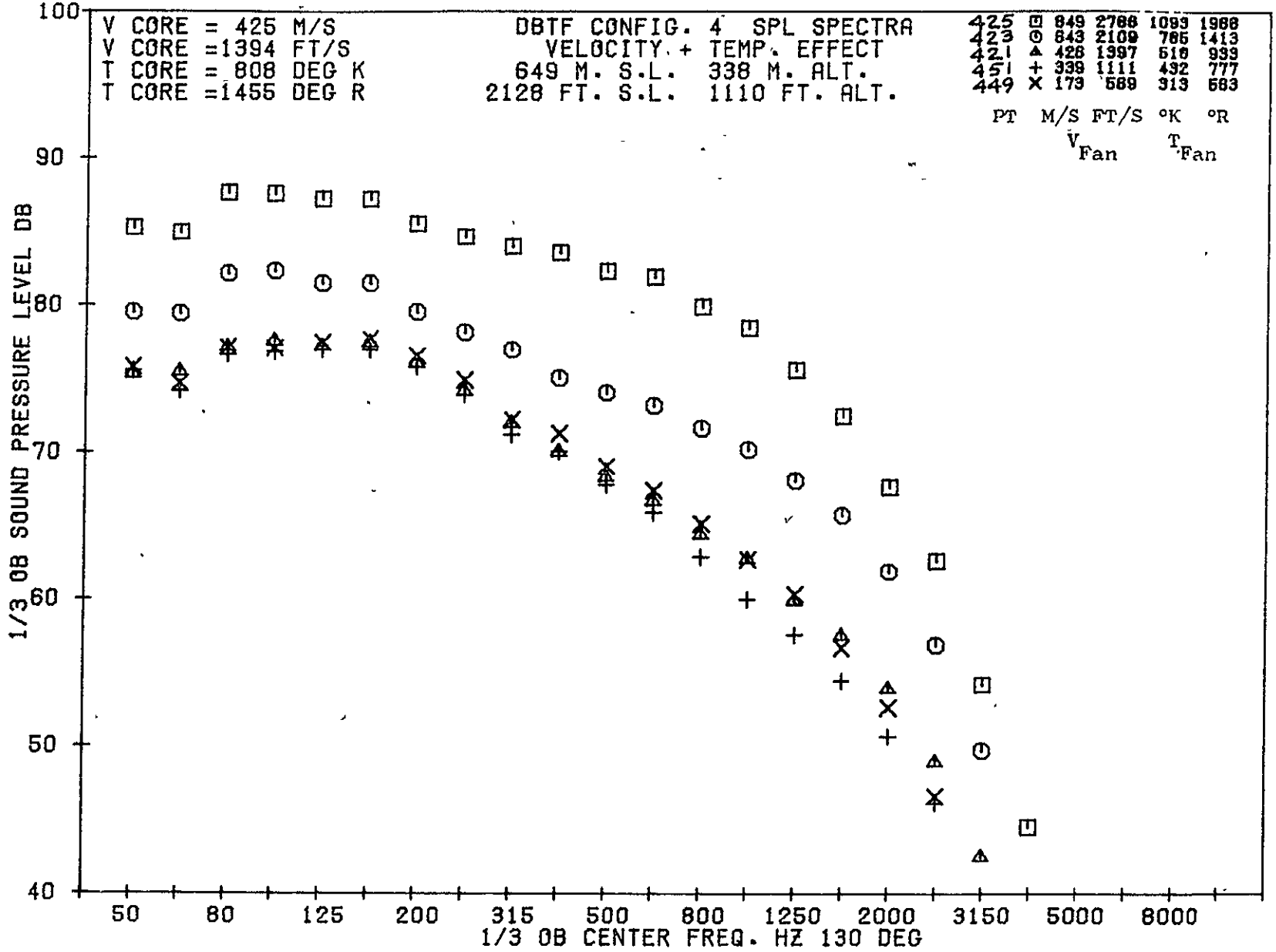

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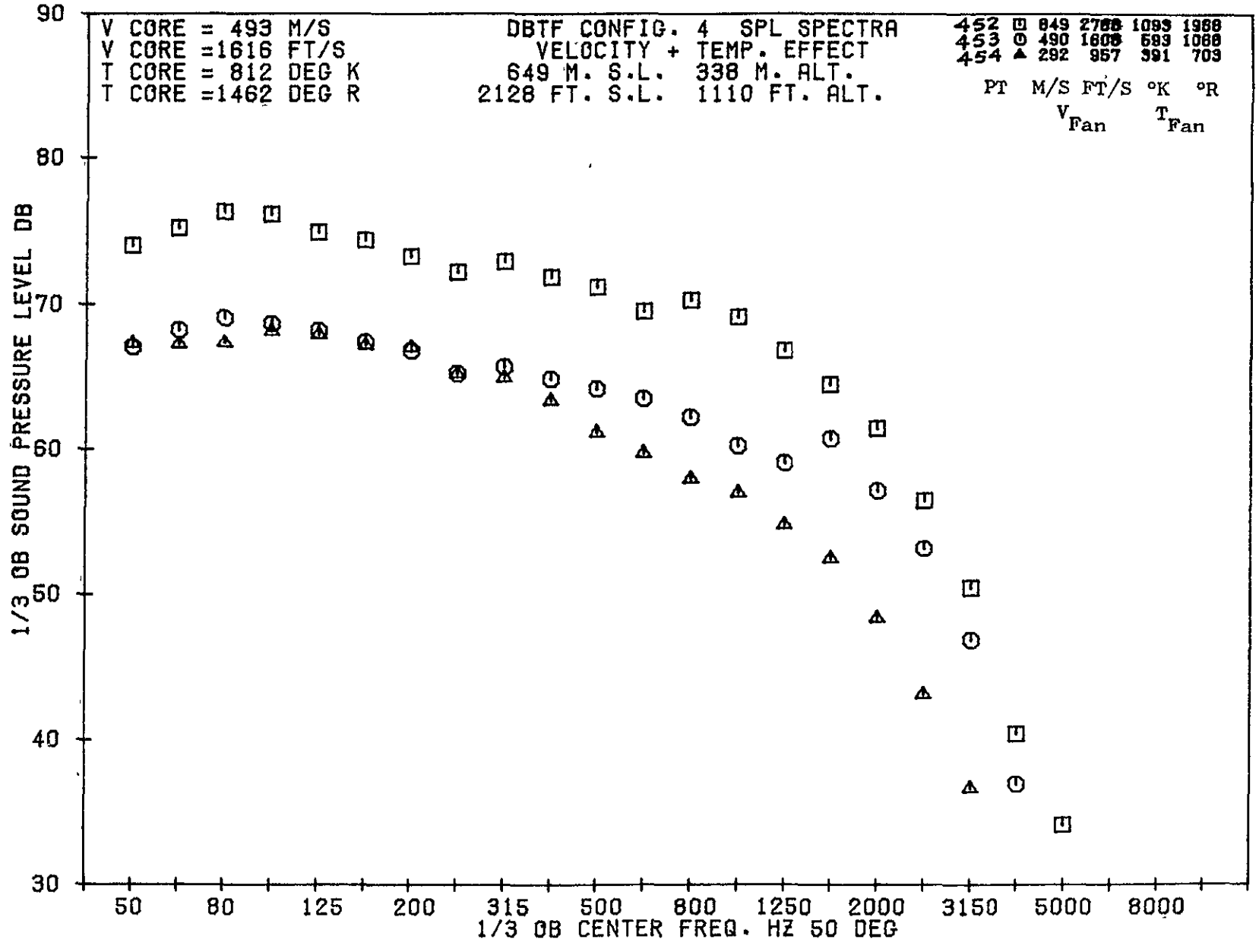

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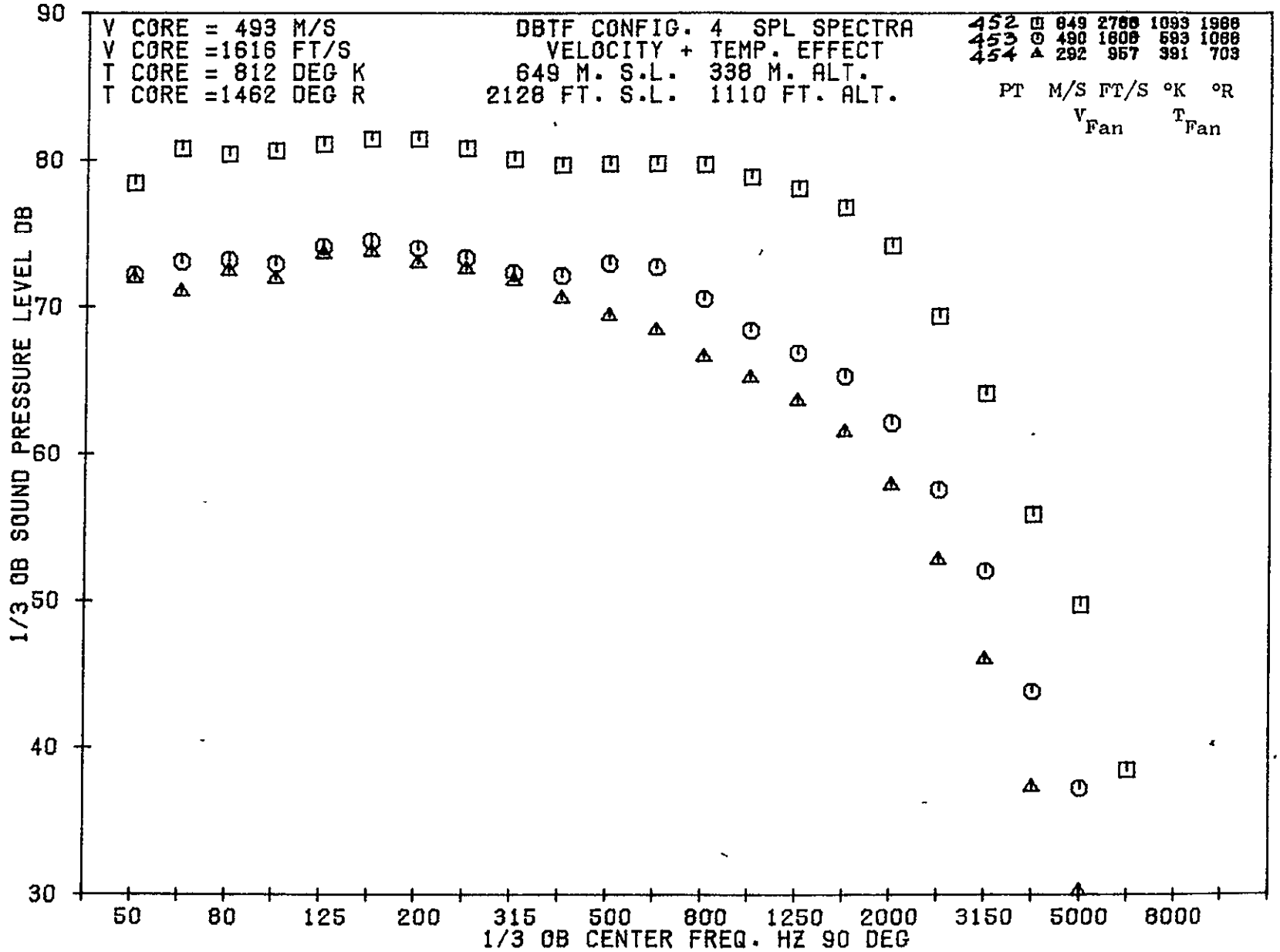

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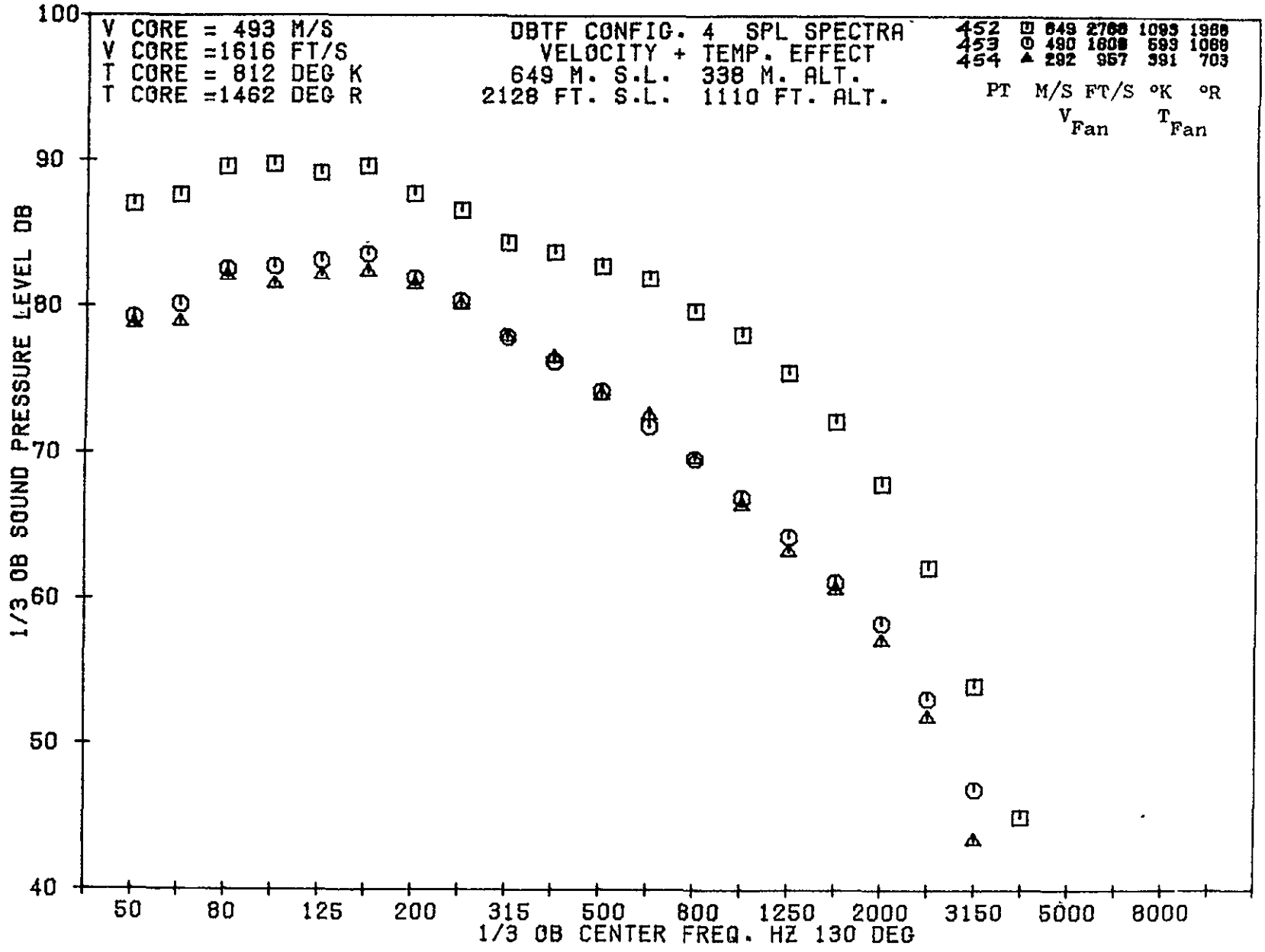

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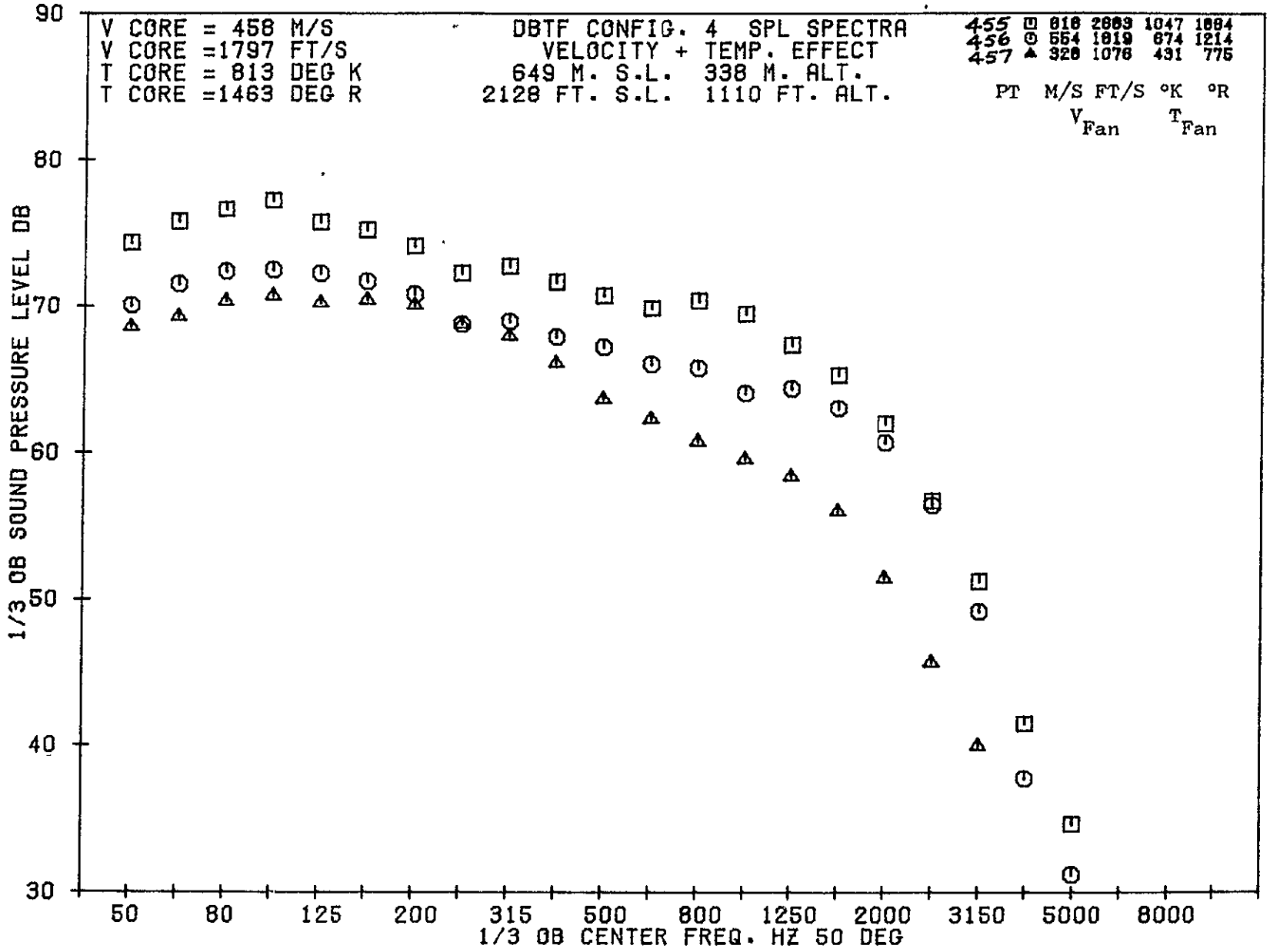

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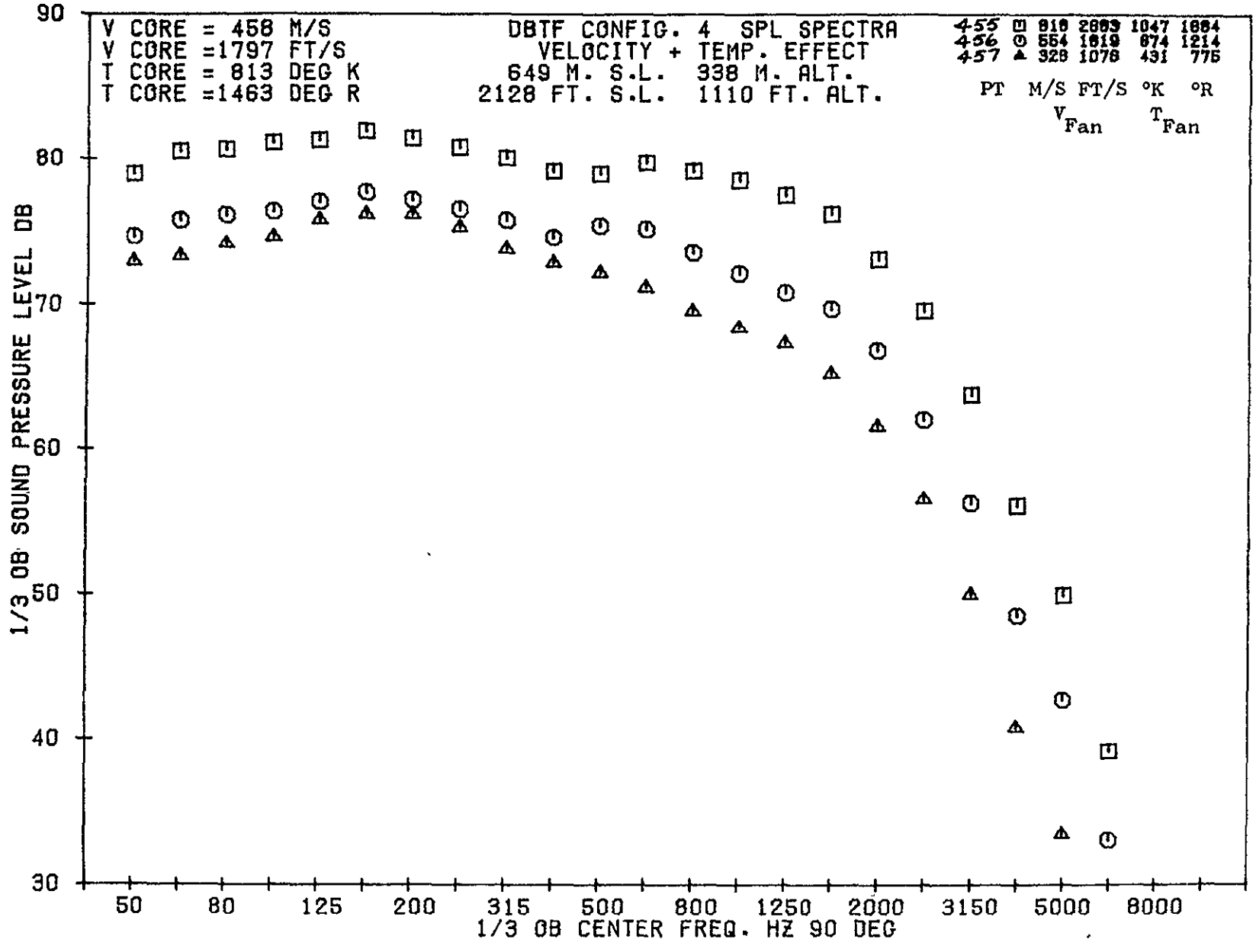

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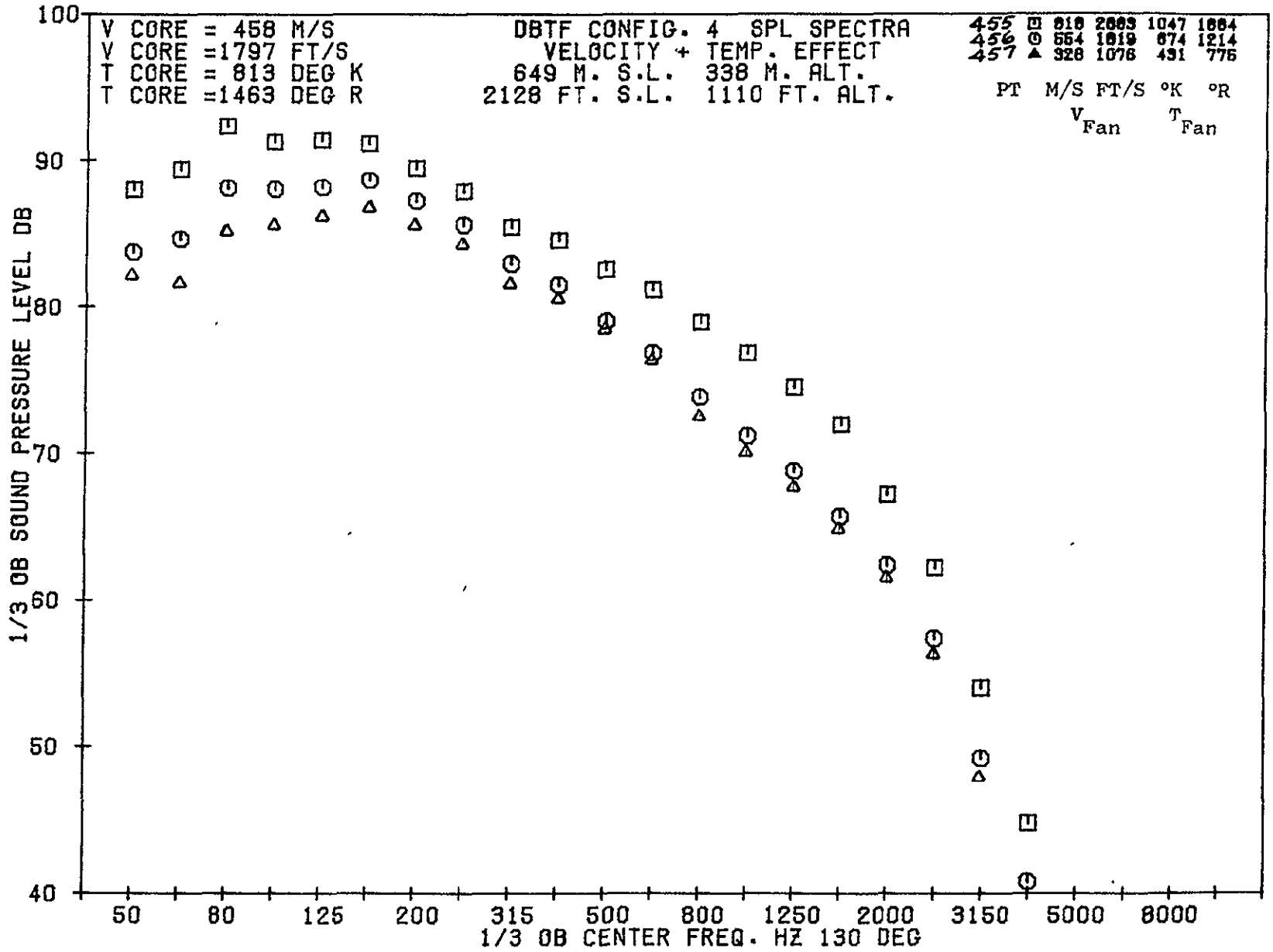

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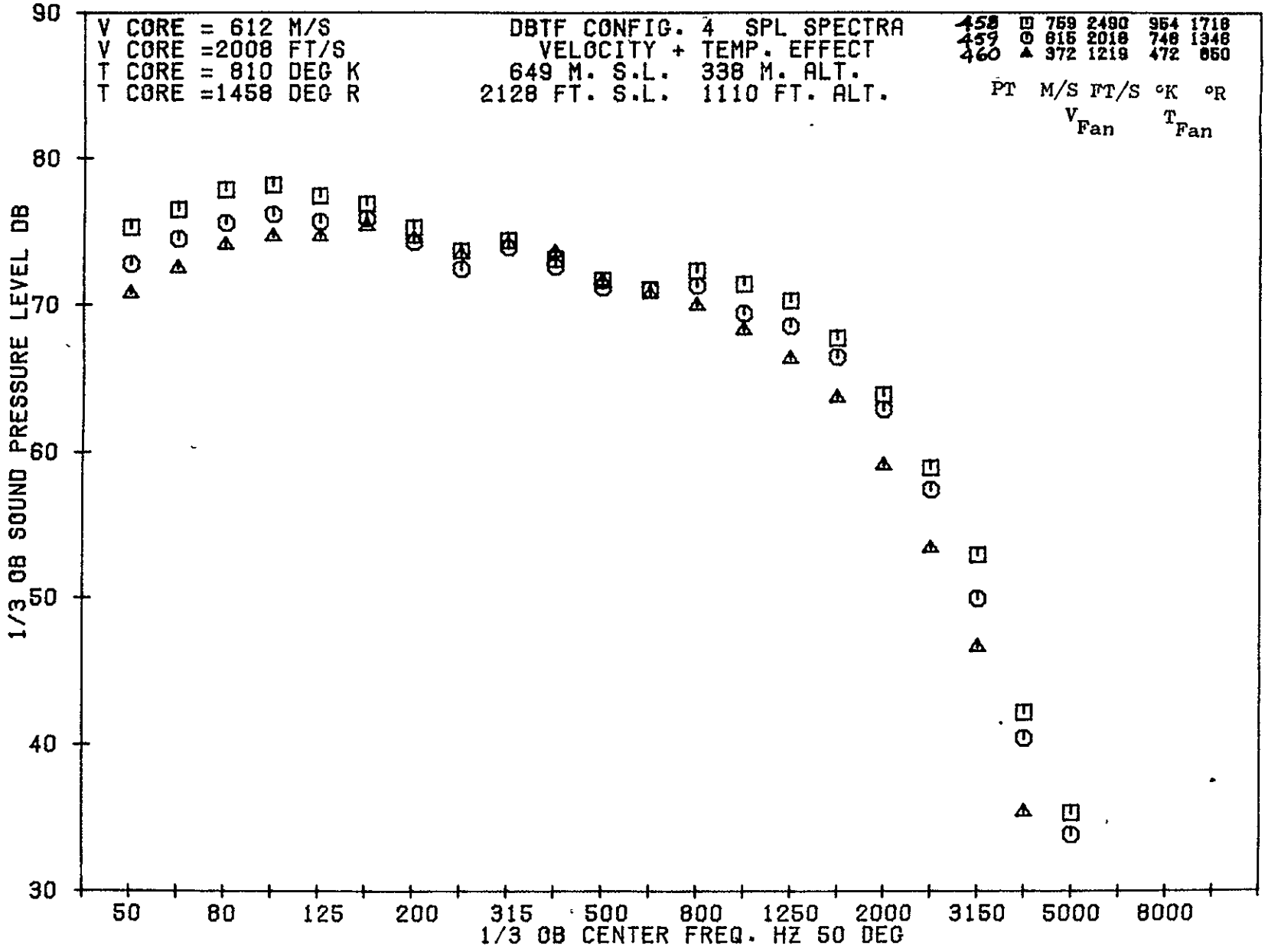

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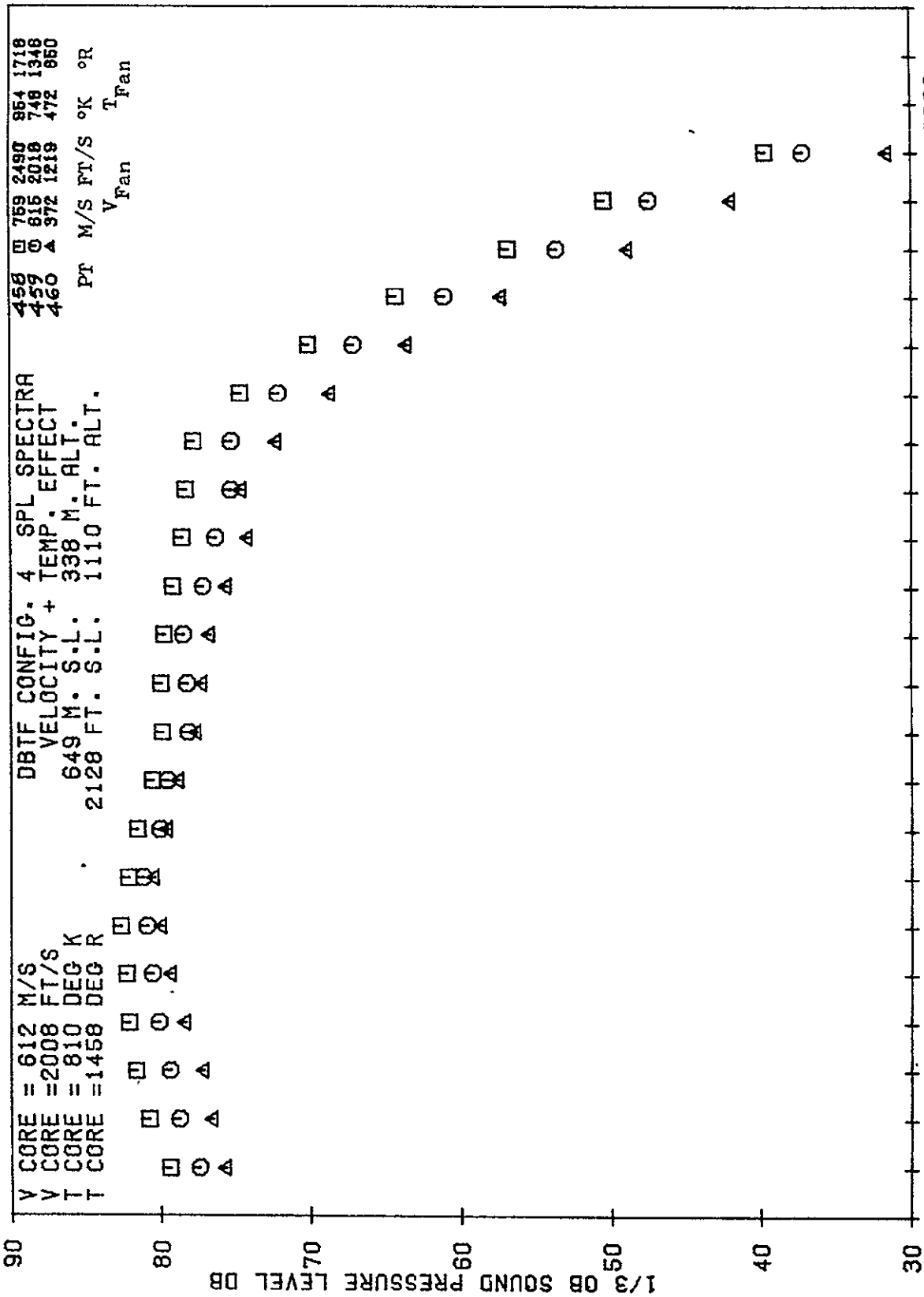

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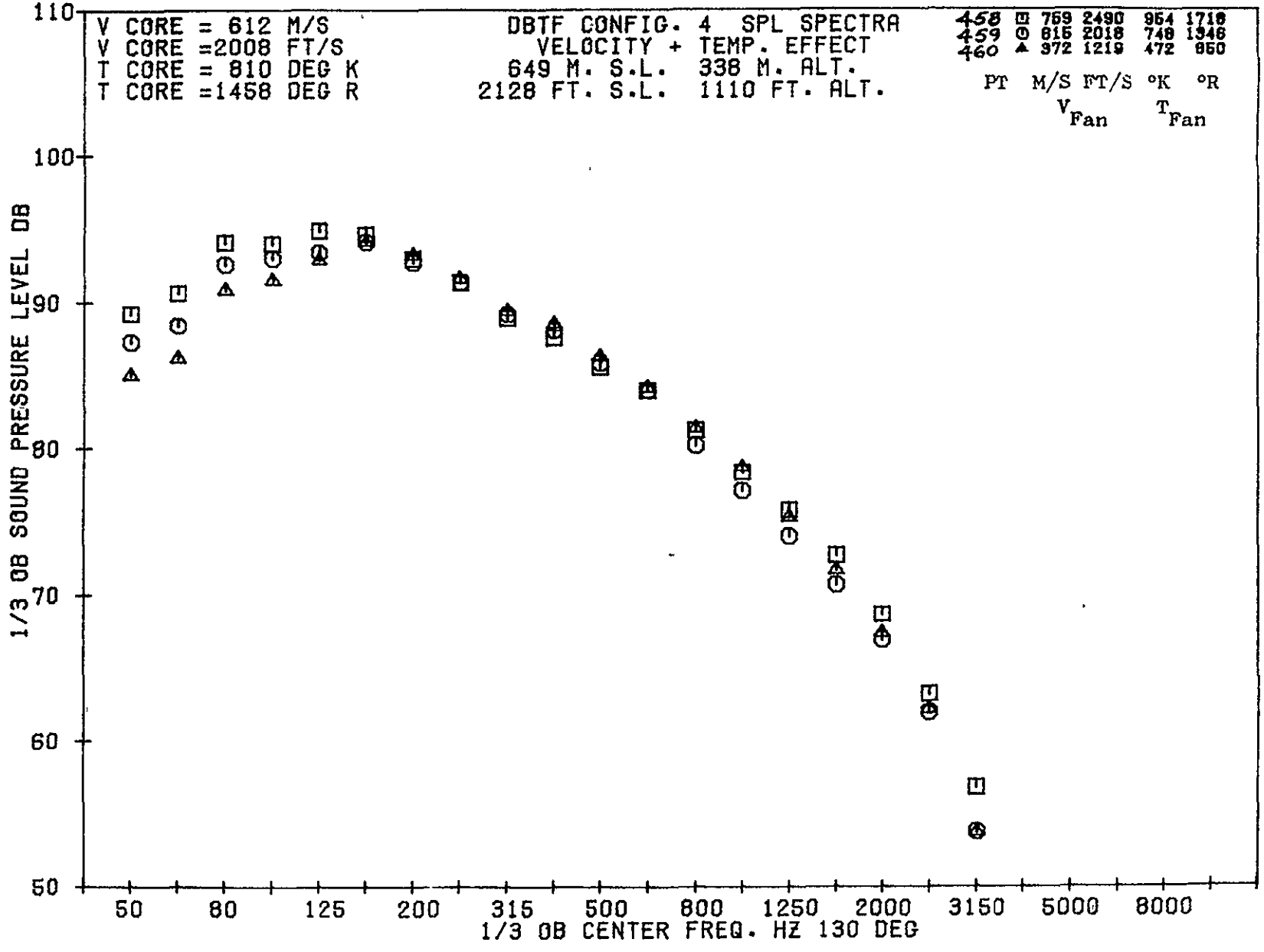

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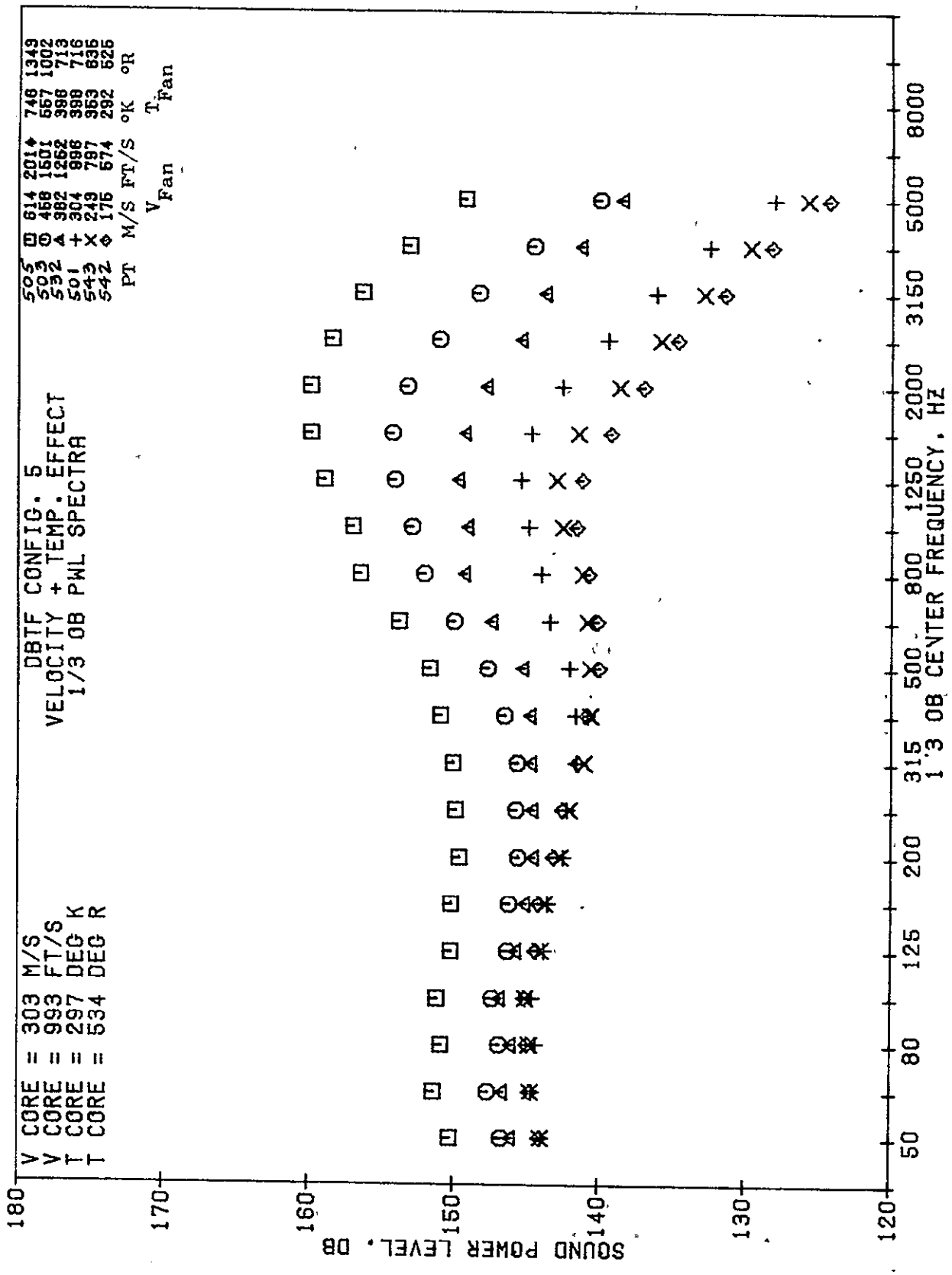

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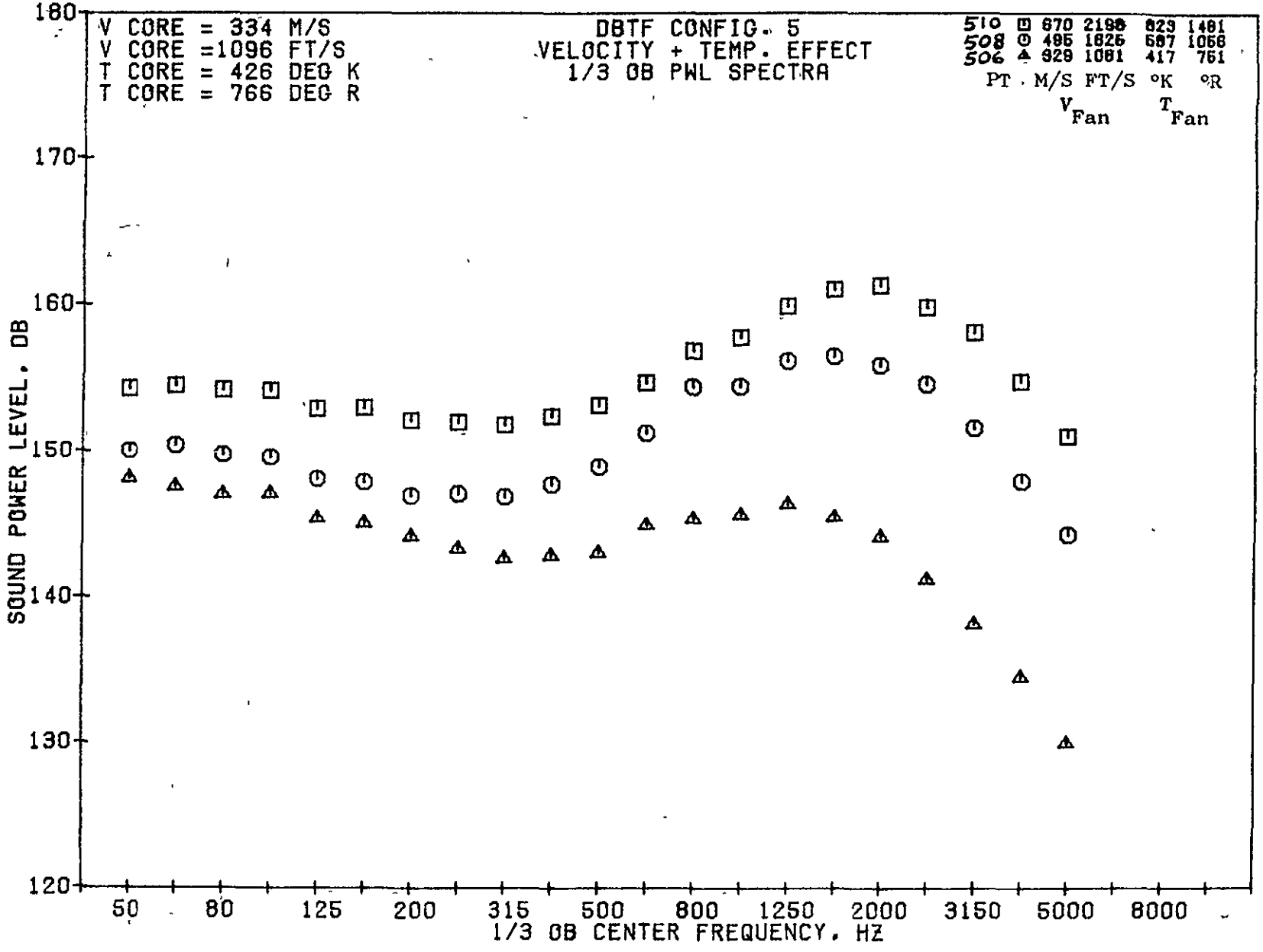

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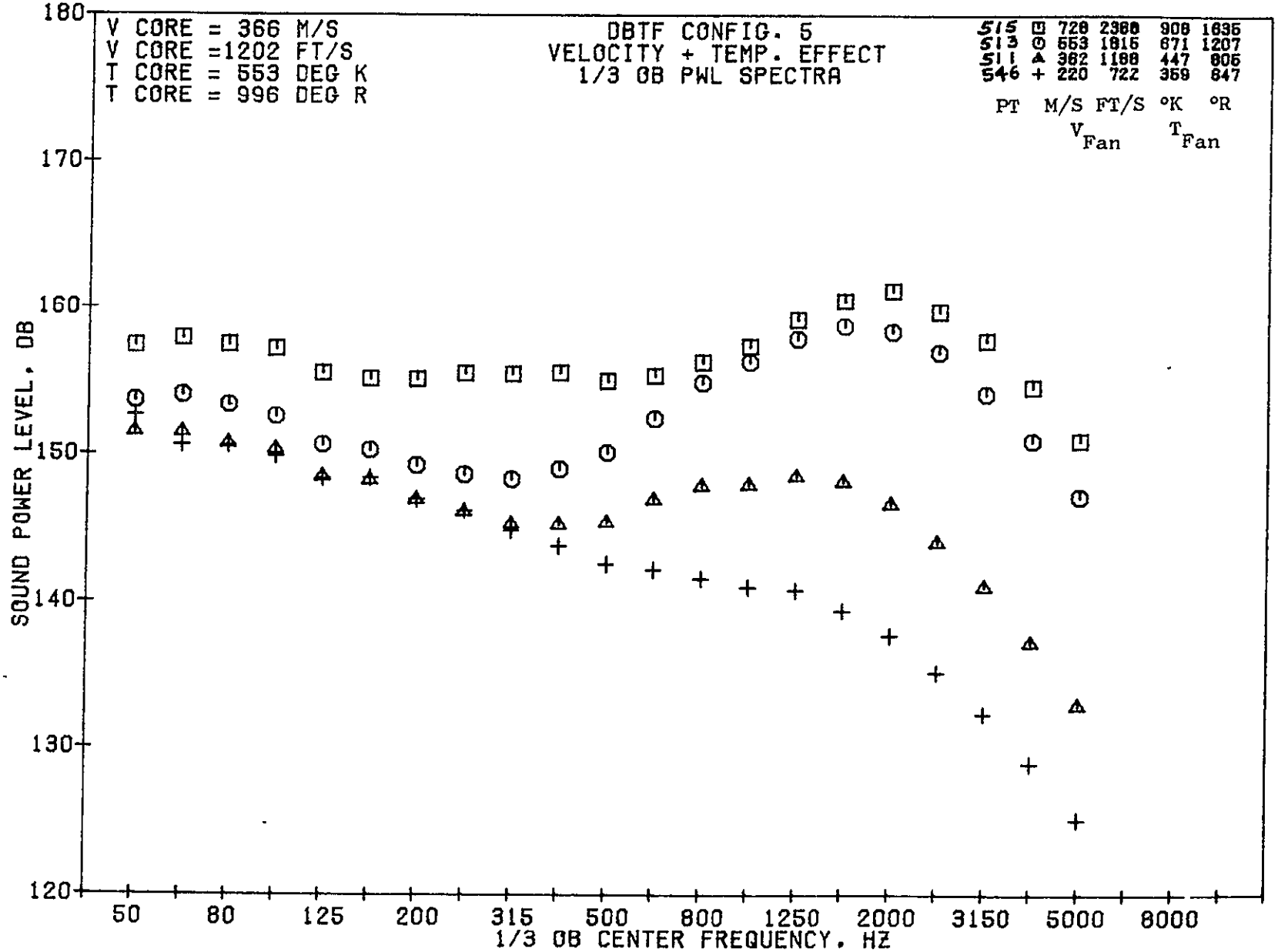

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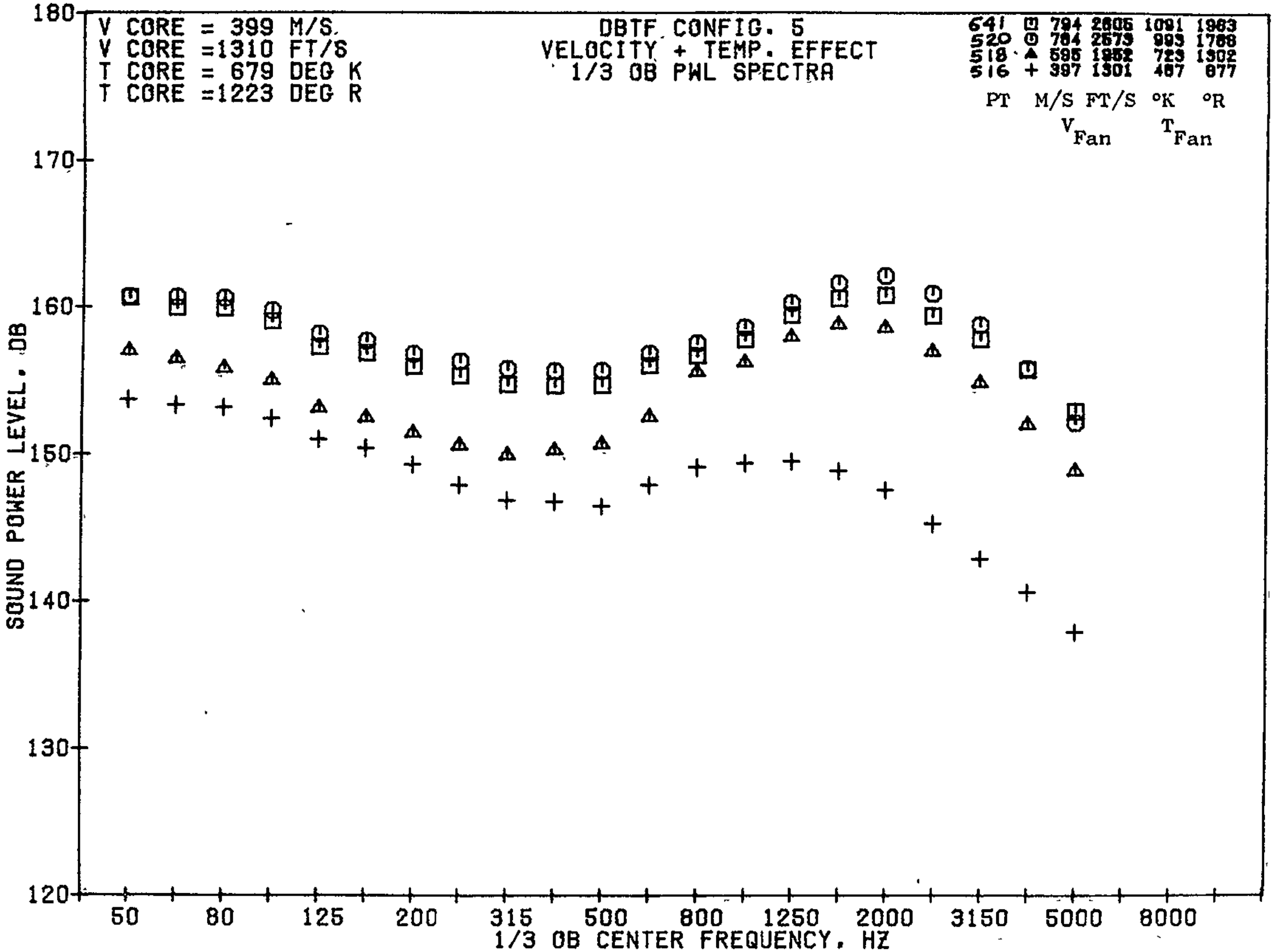

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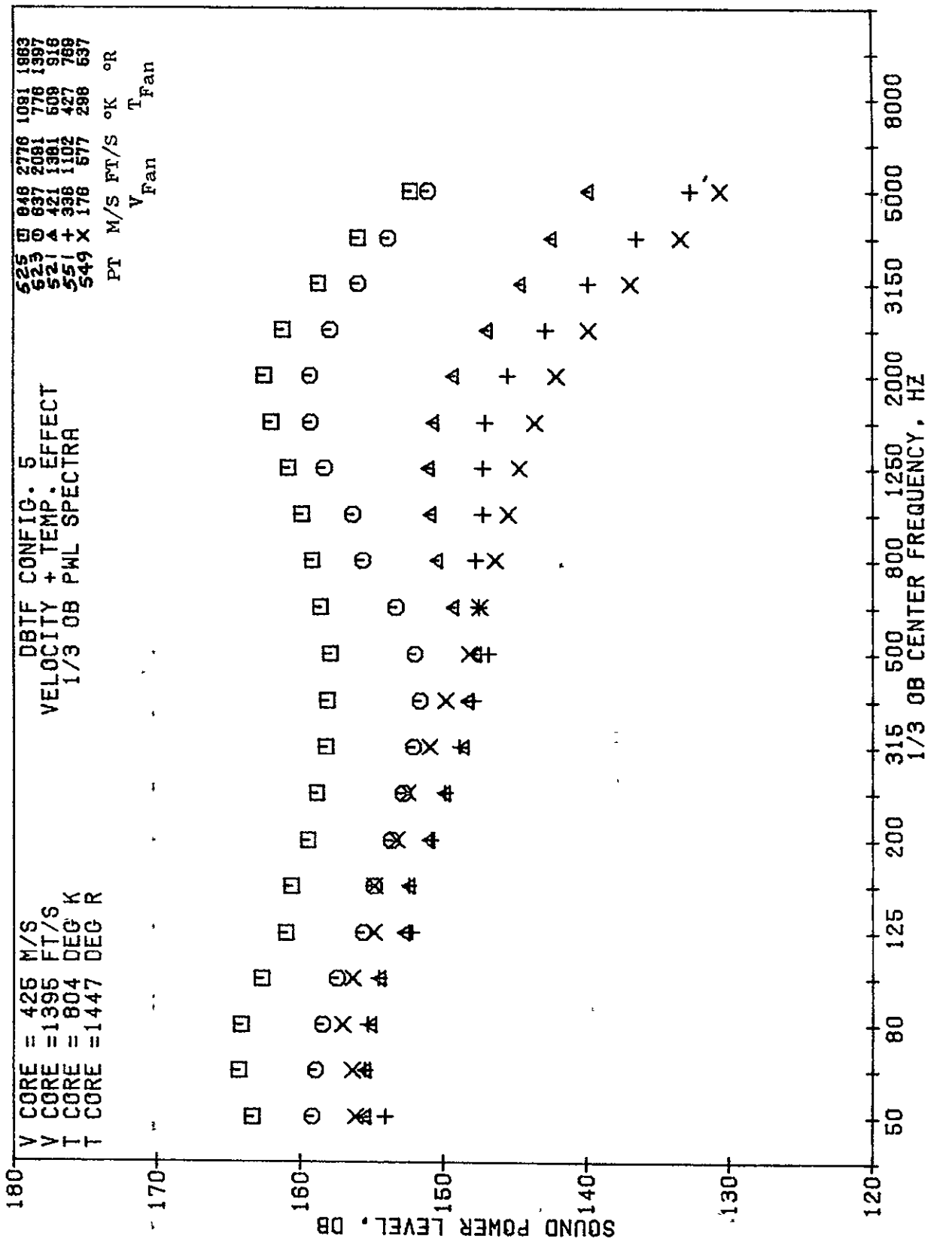

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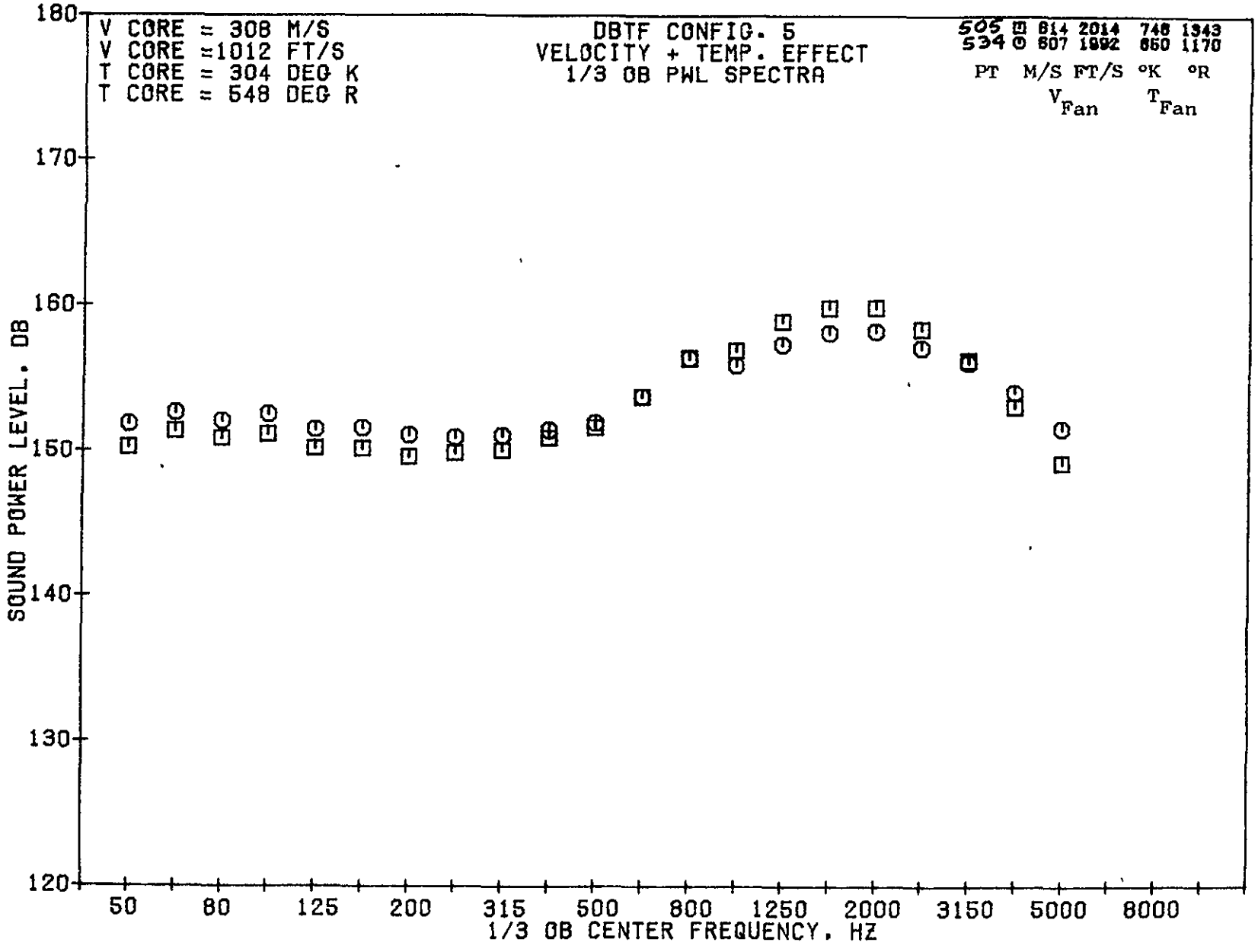

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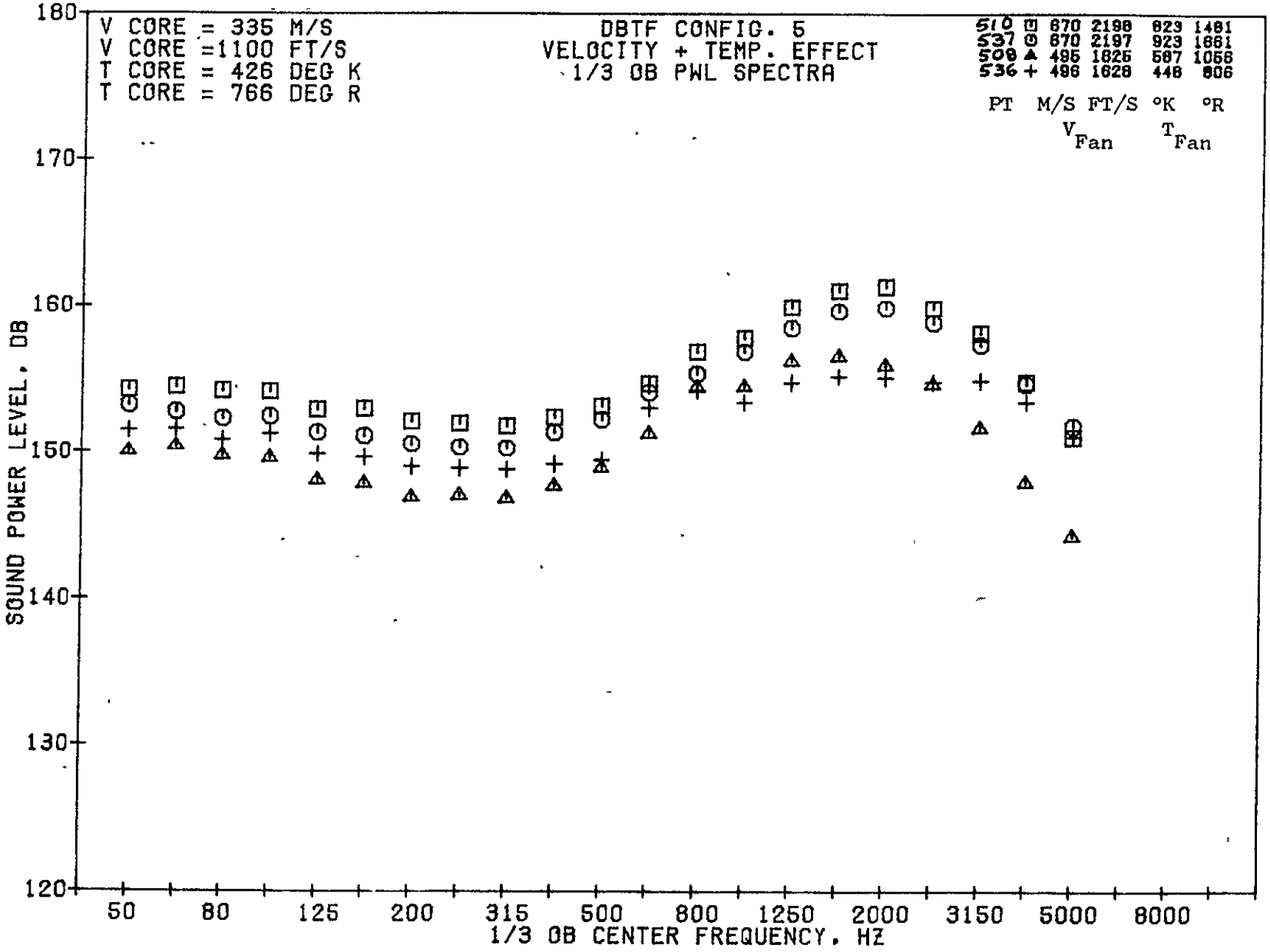

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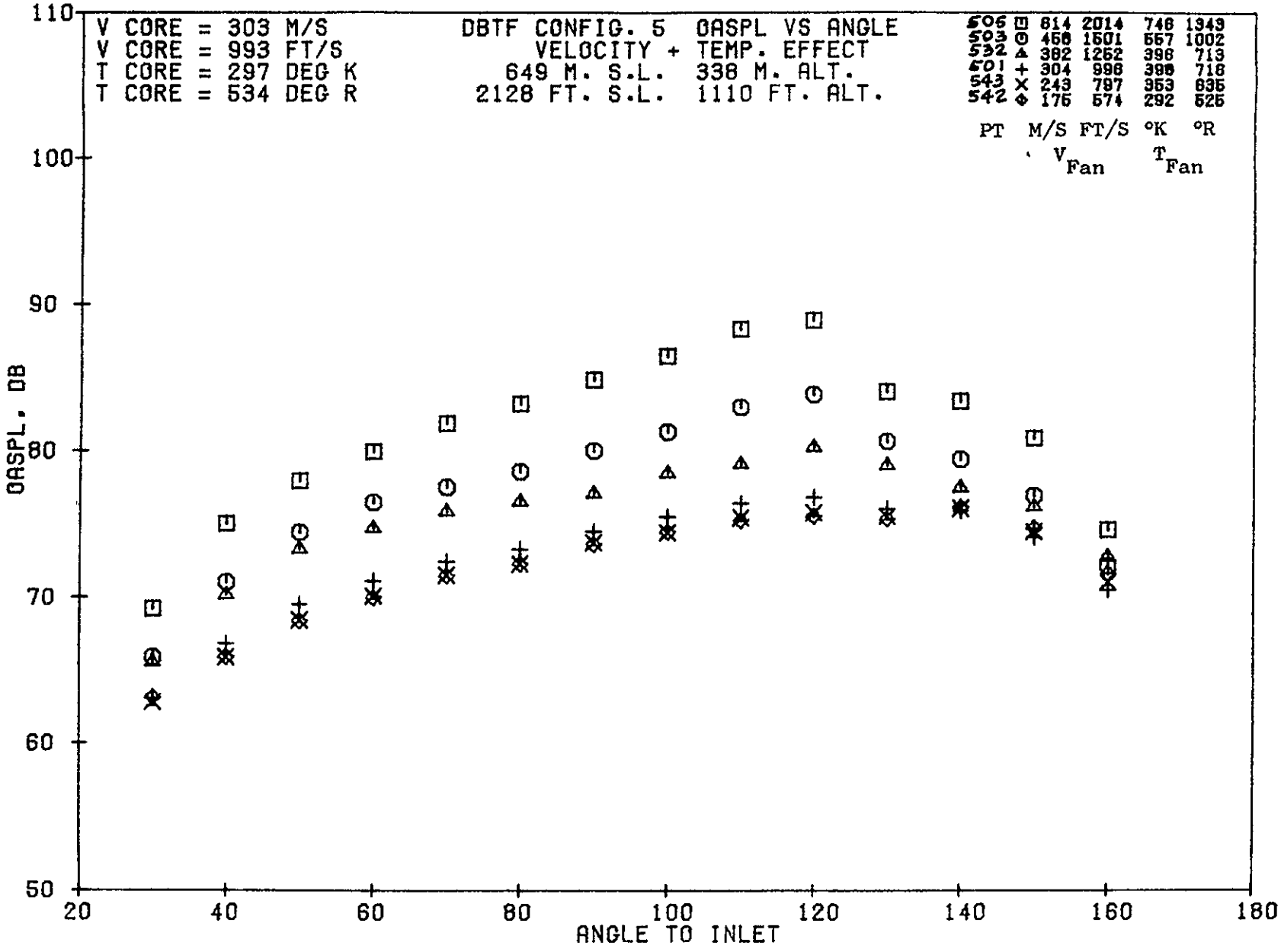

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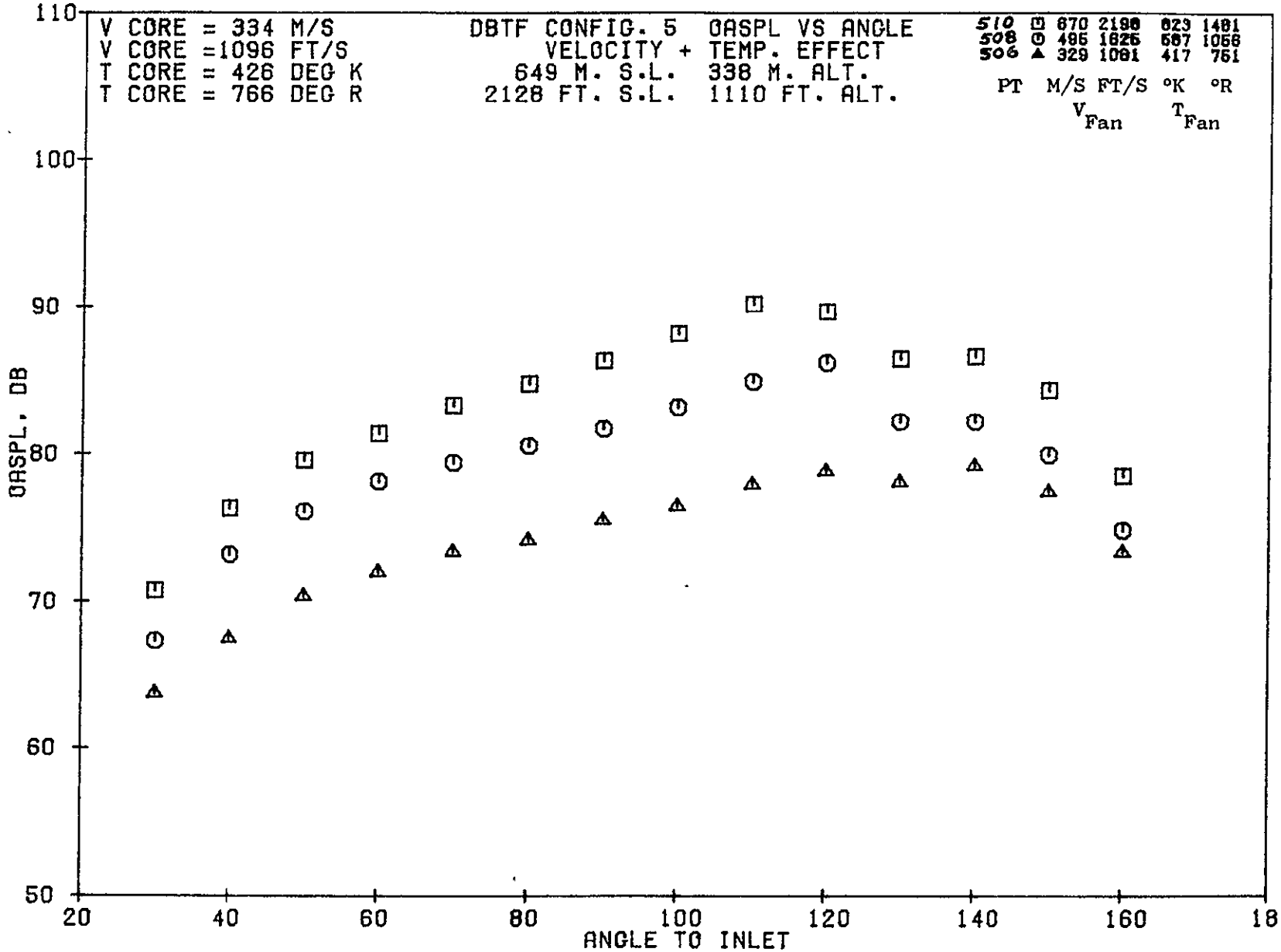

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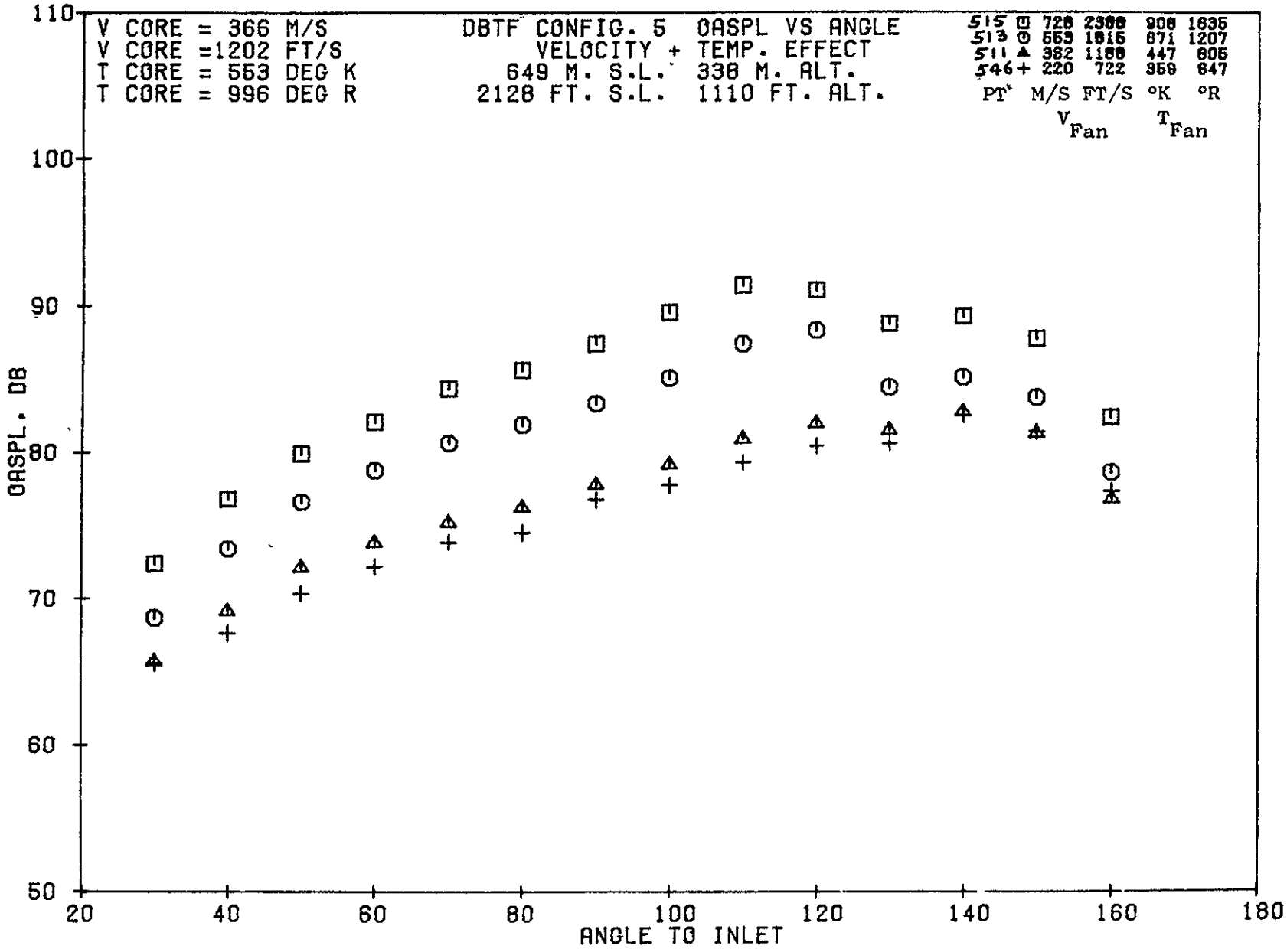

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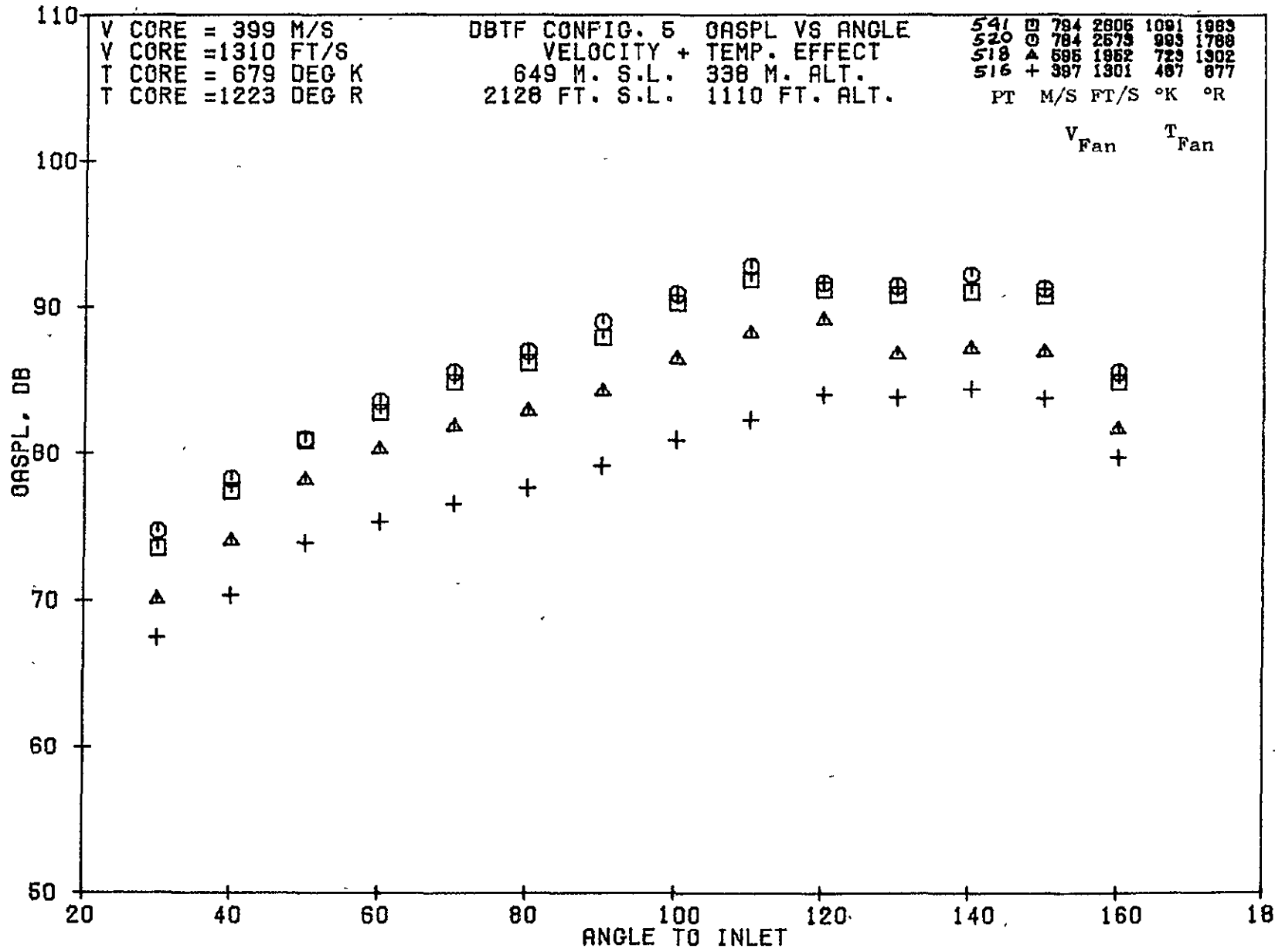

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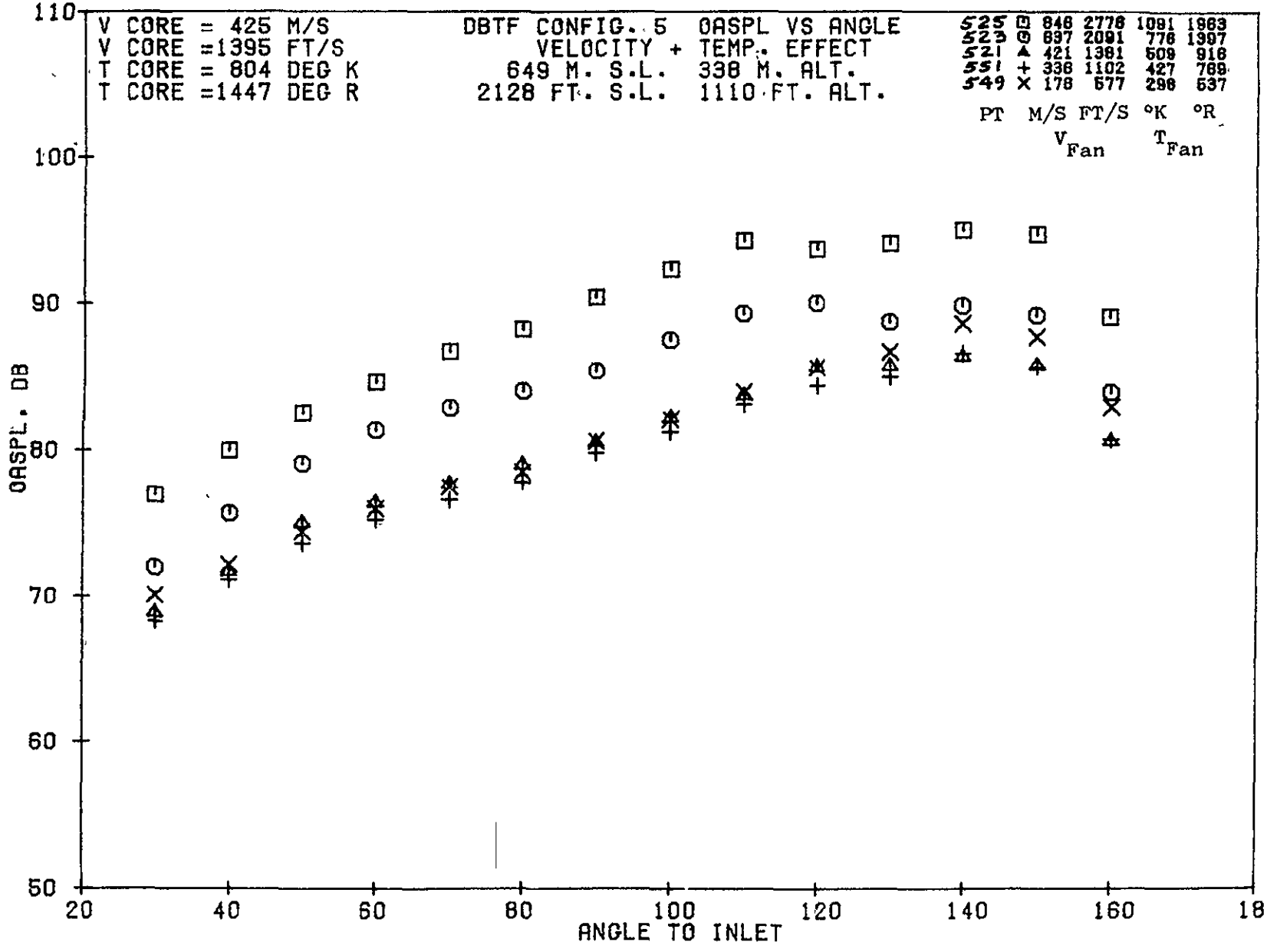

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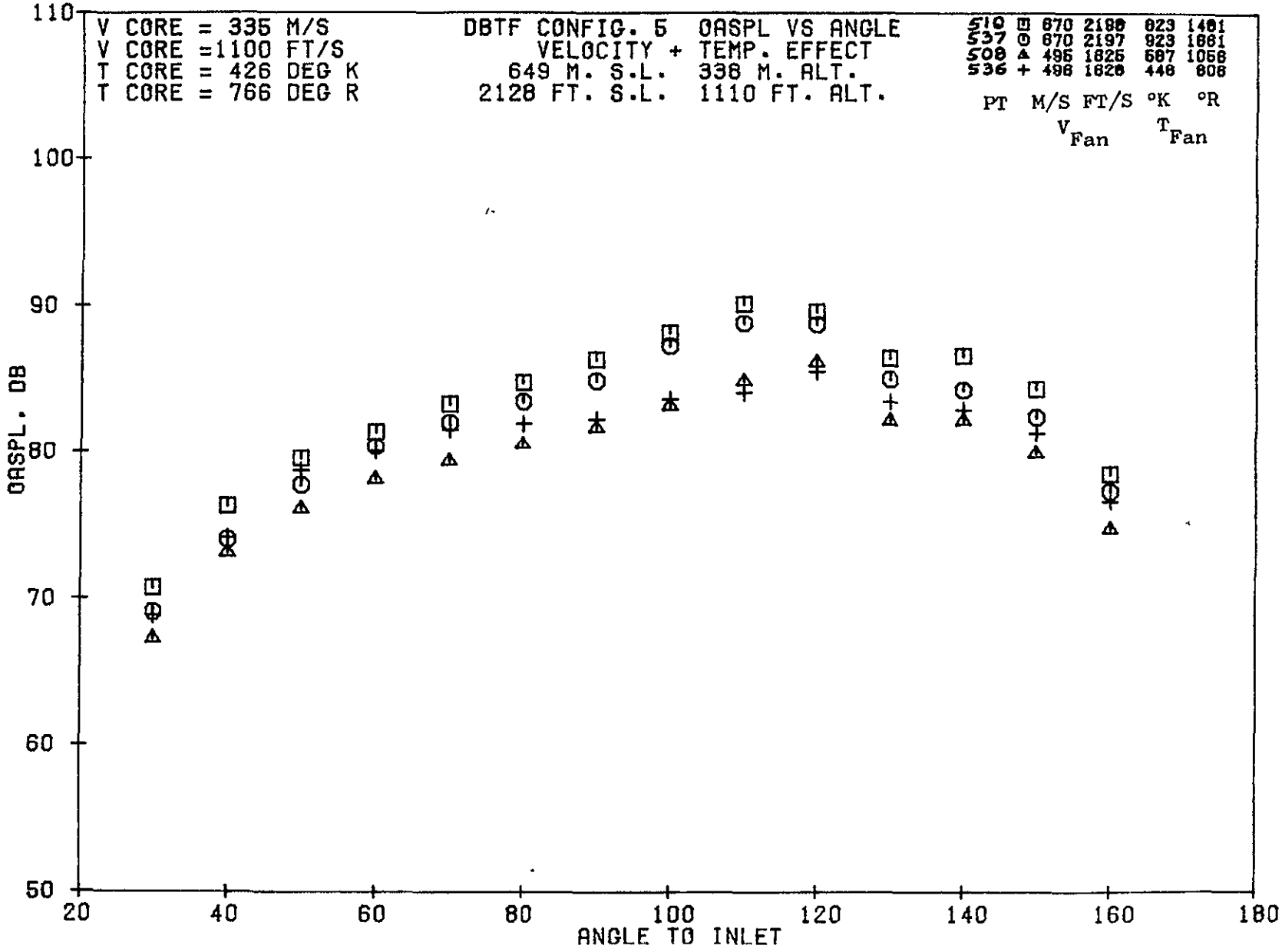

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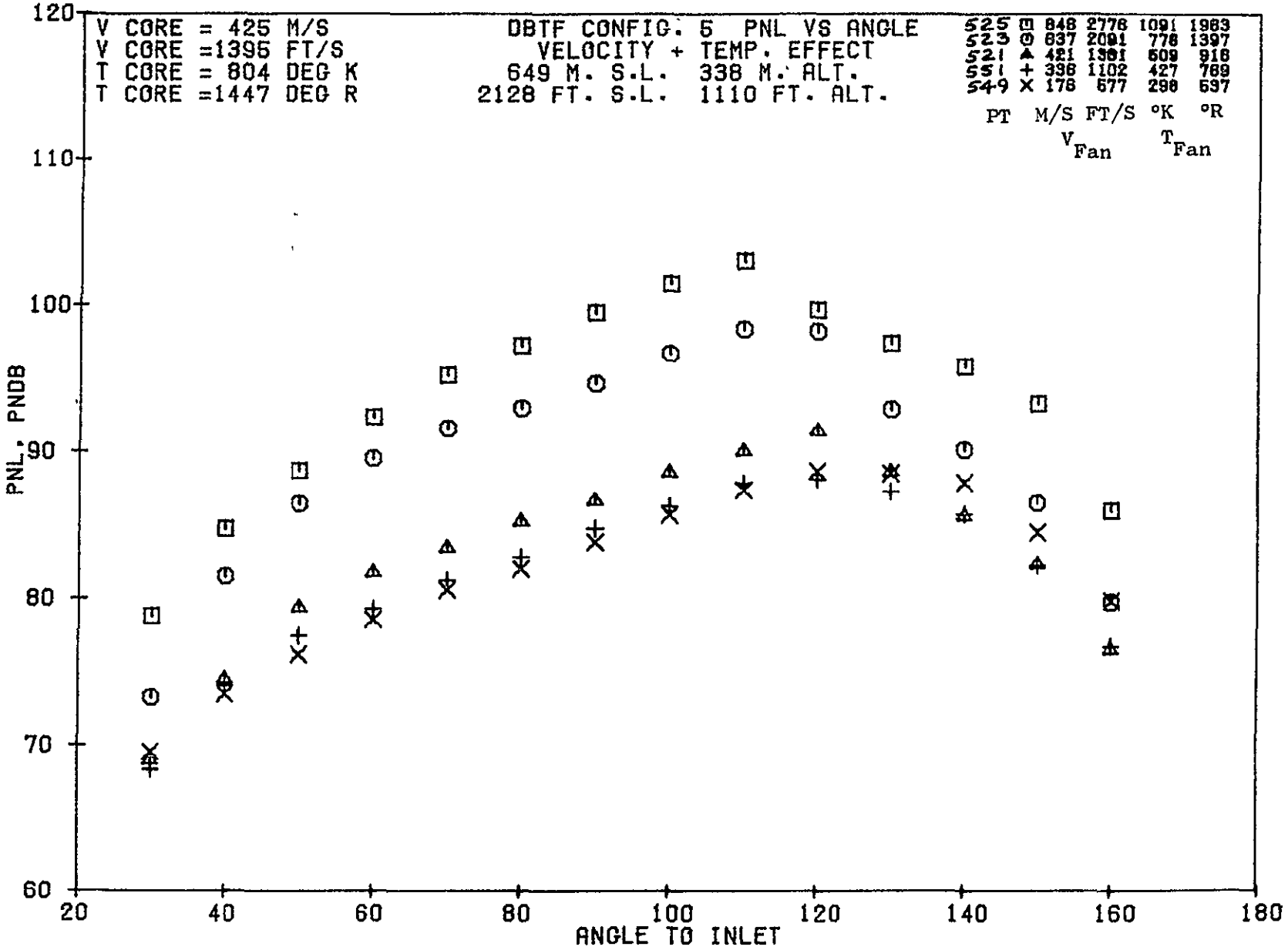

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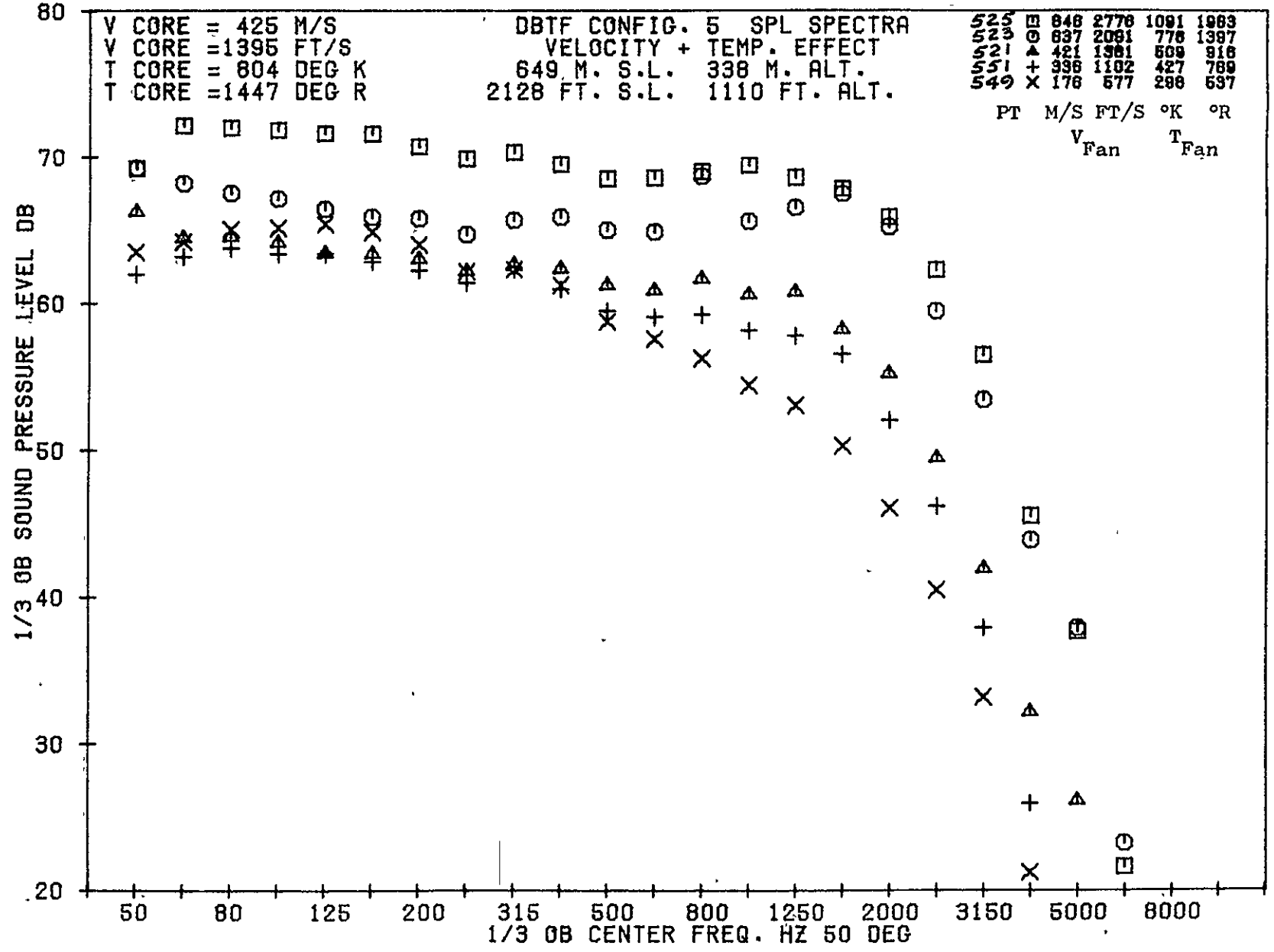

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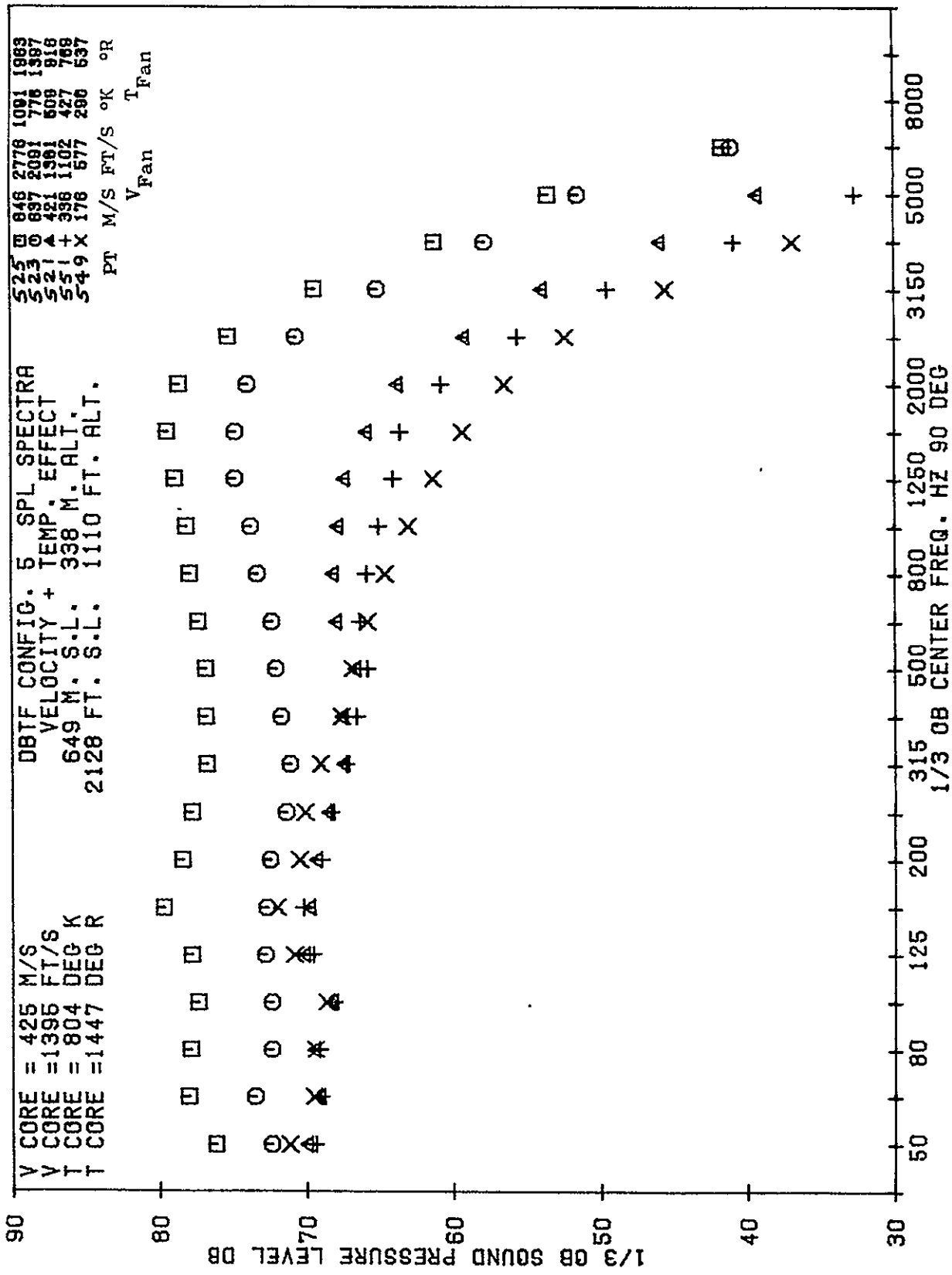

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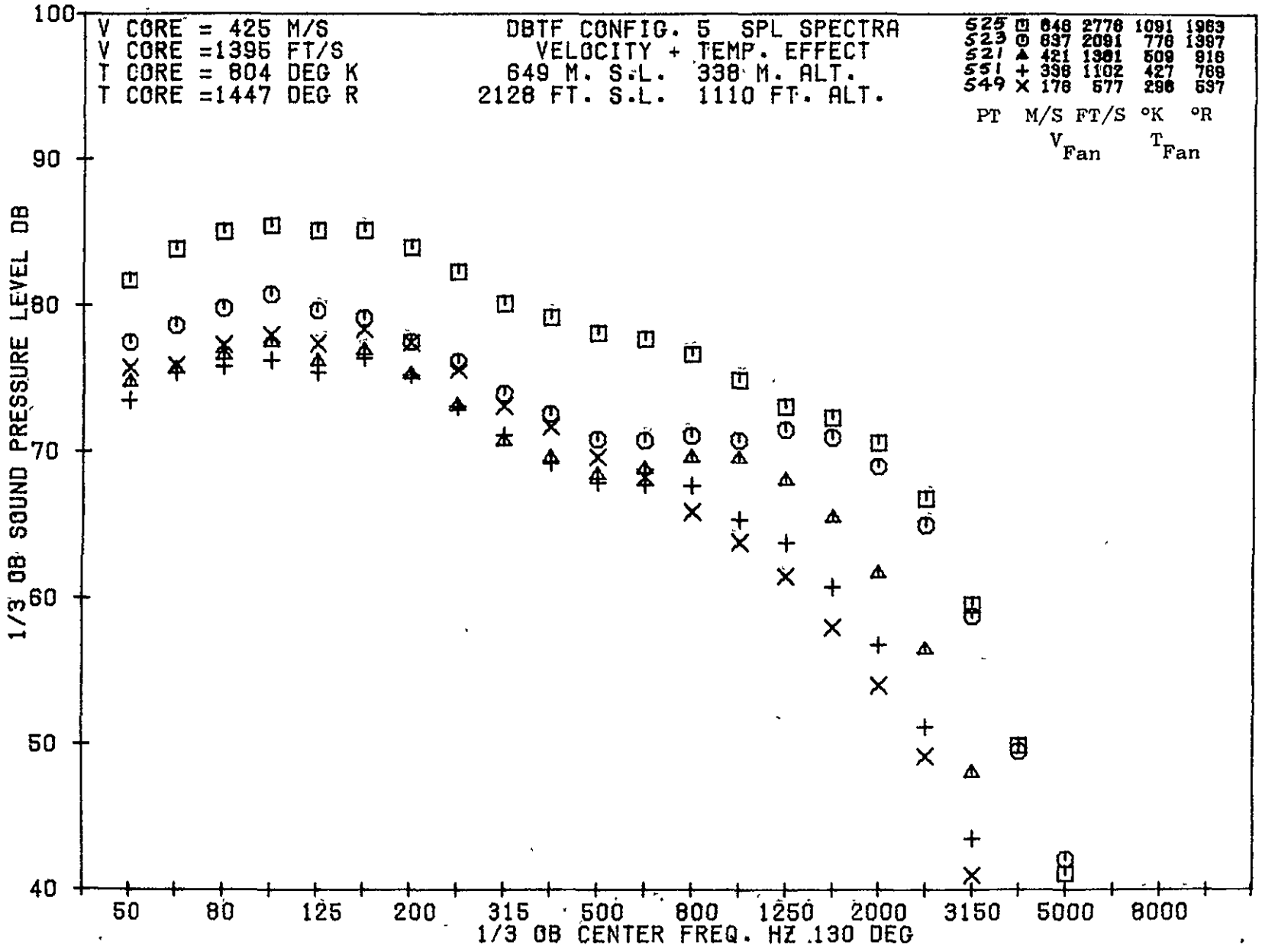

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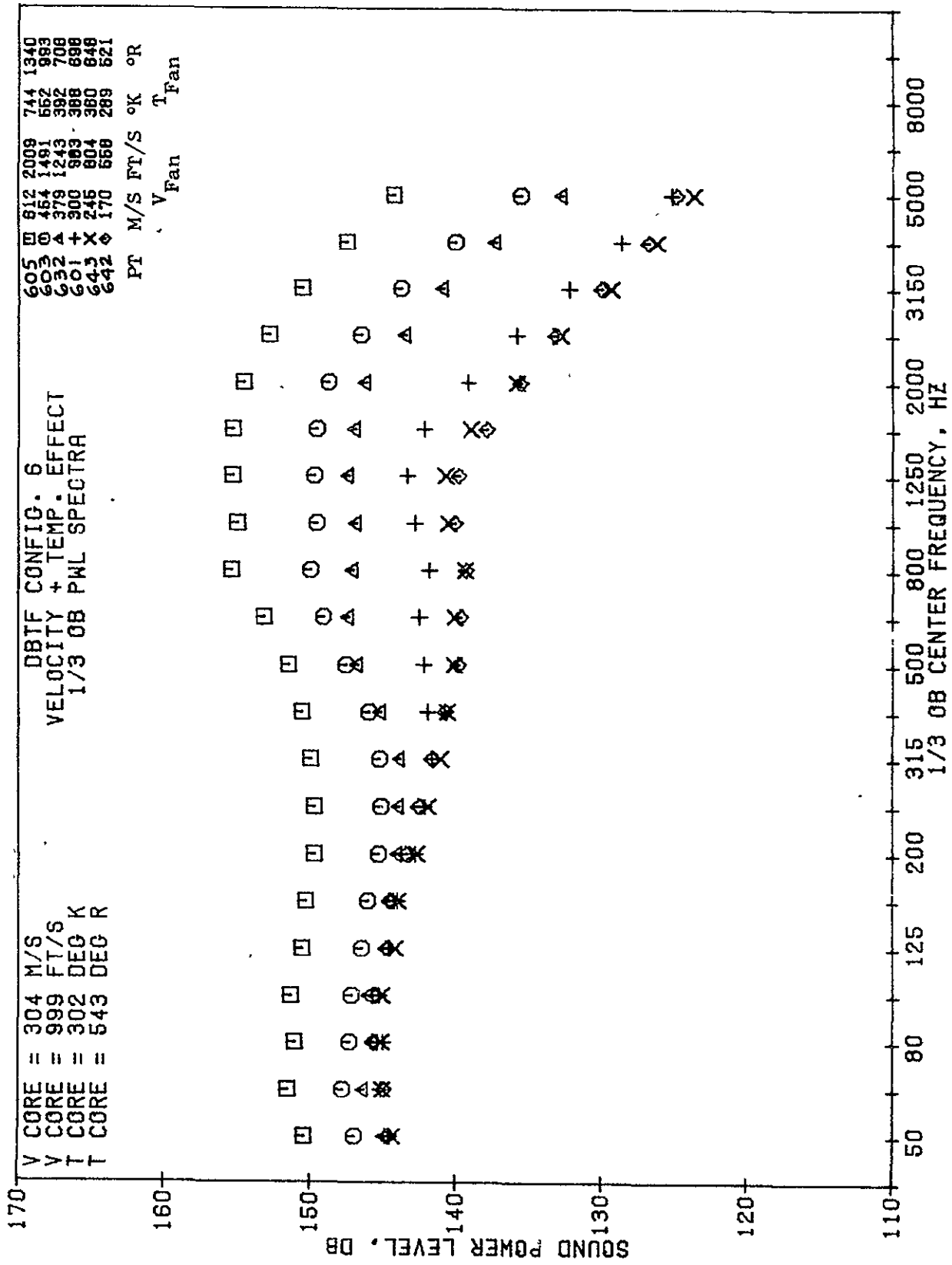

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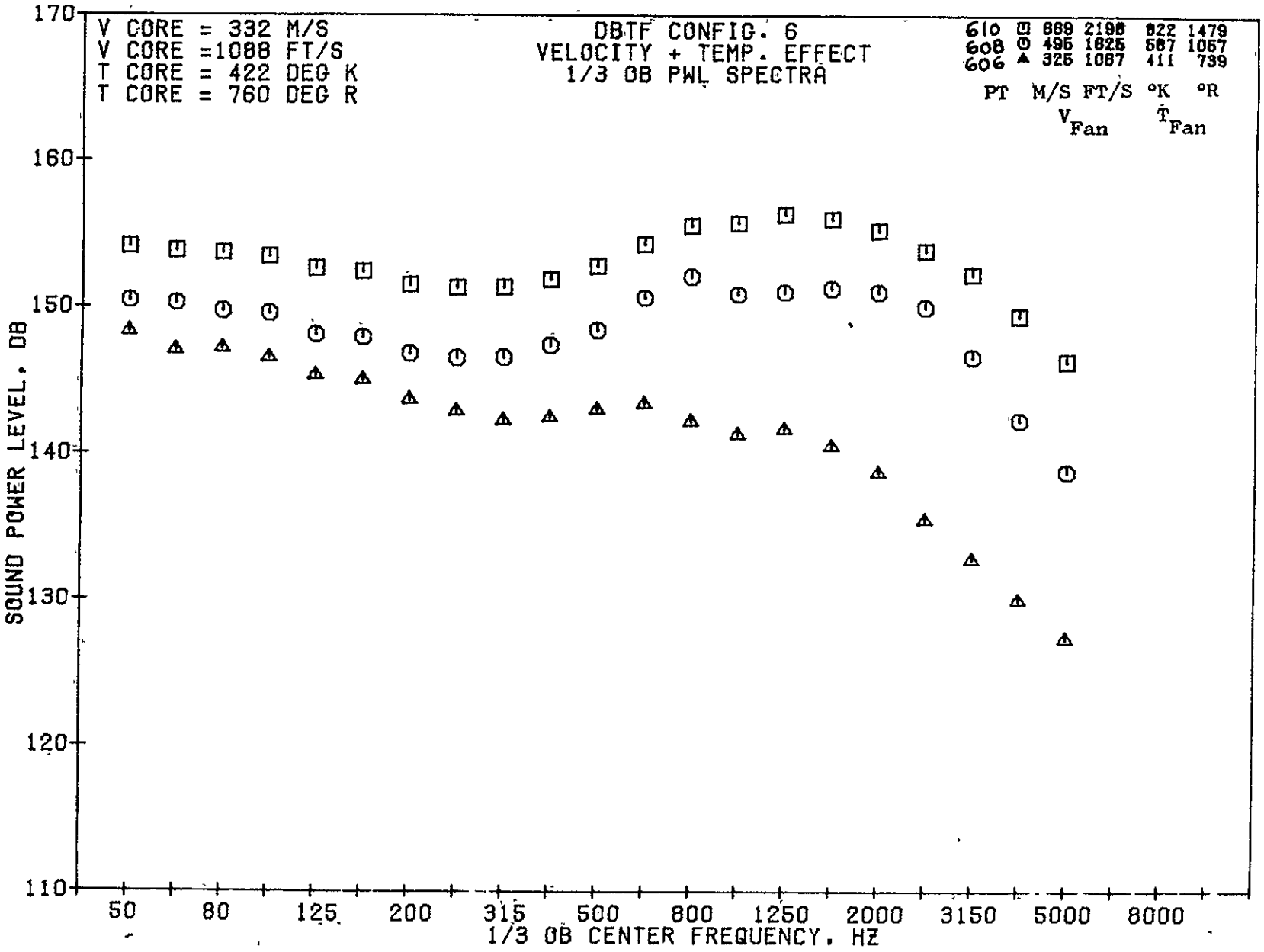

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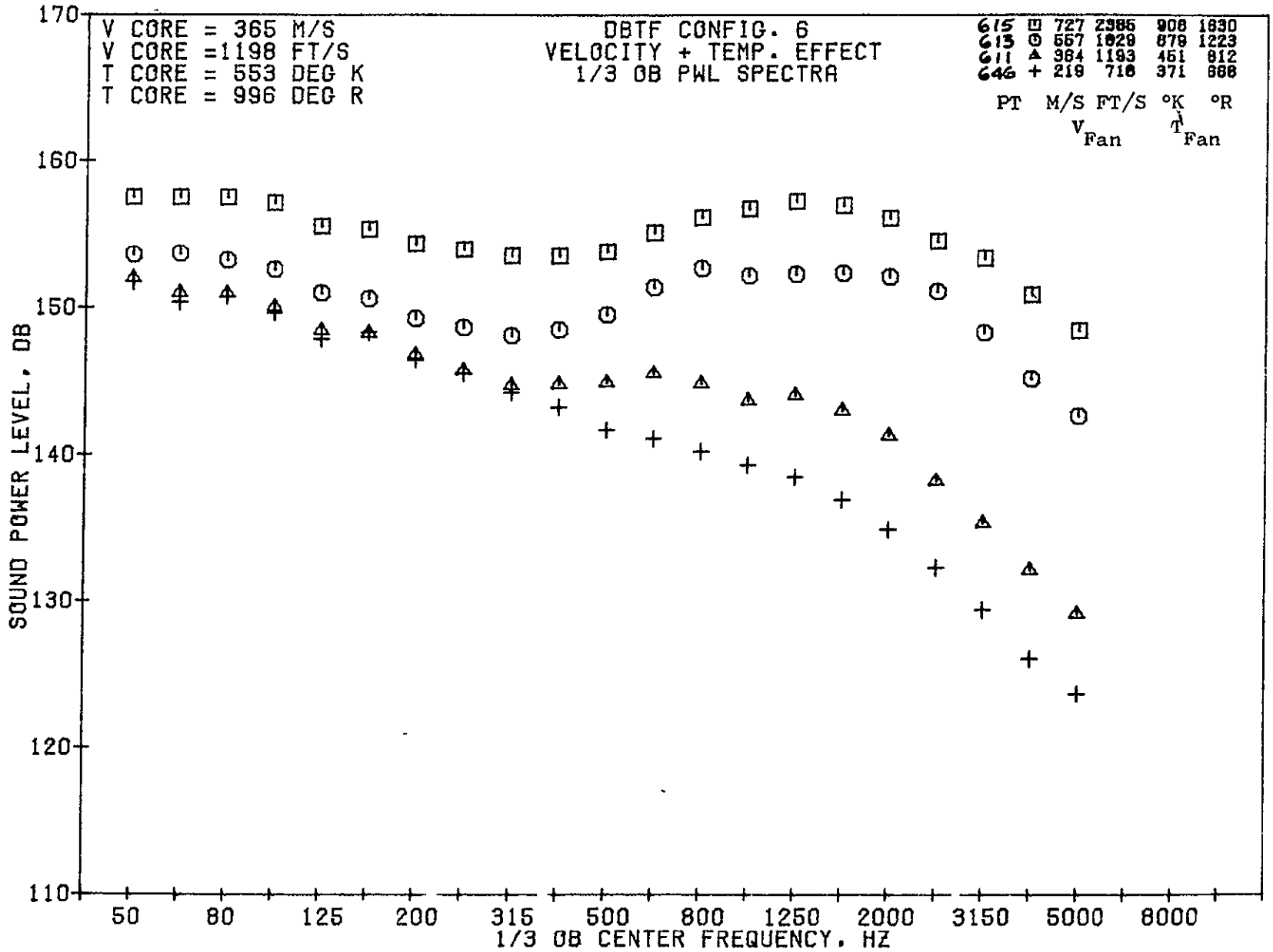

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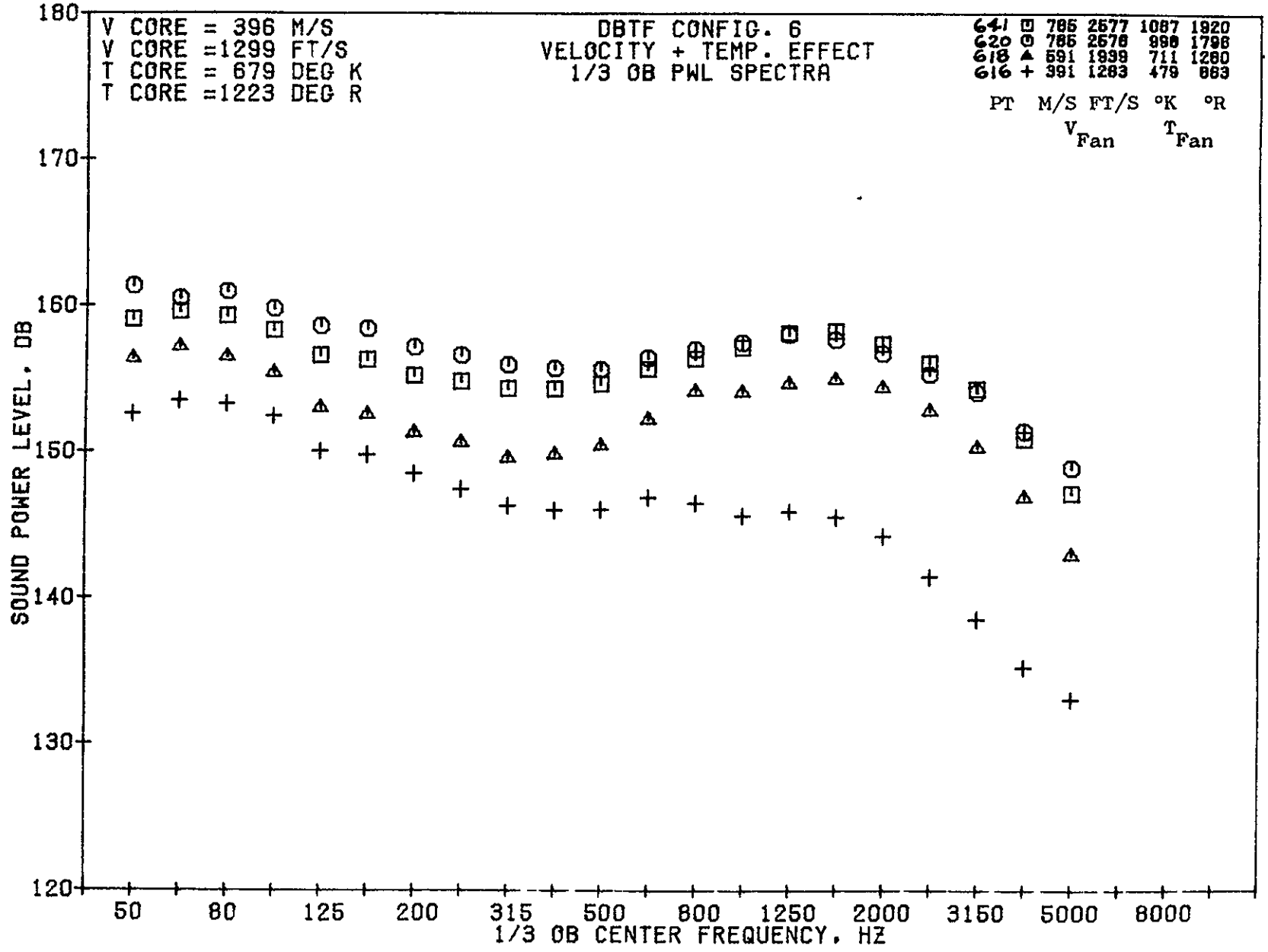

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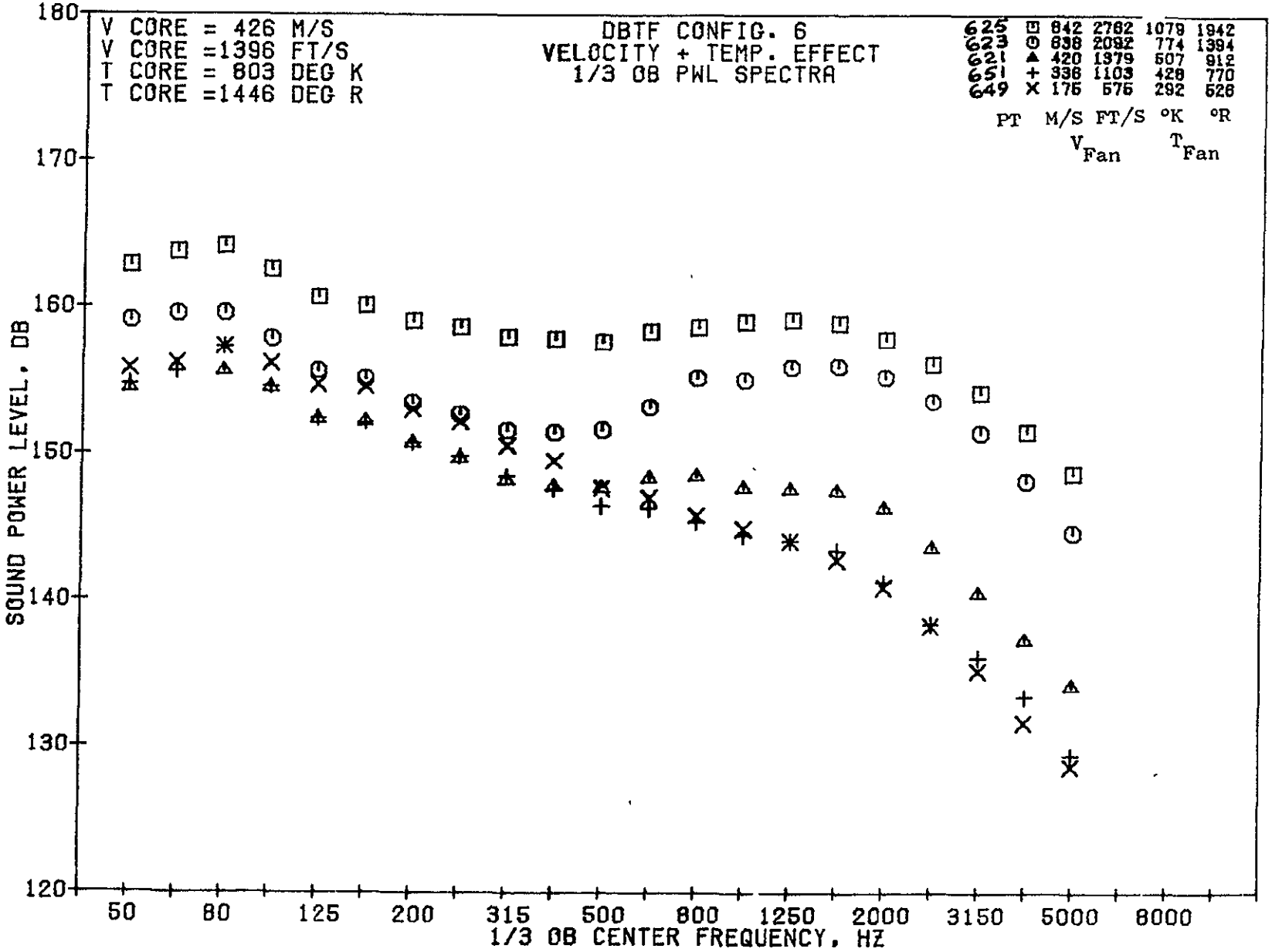

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79 BURCH A.

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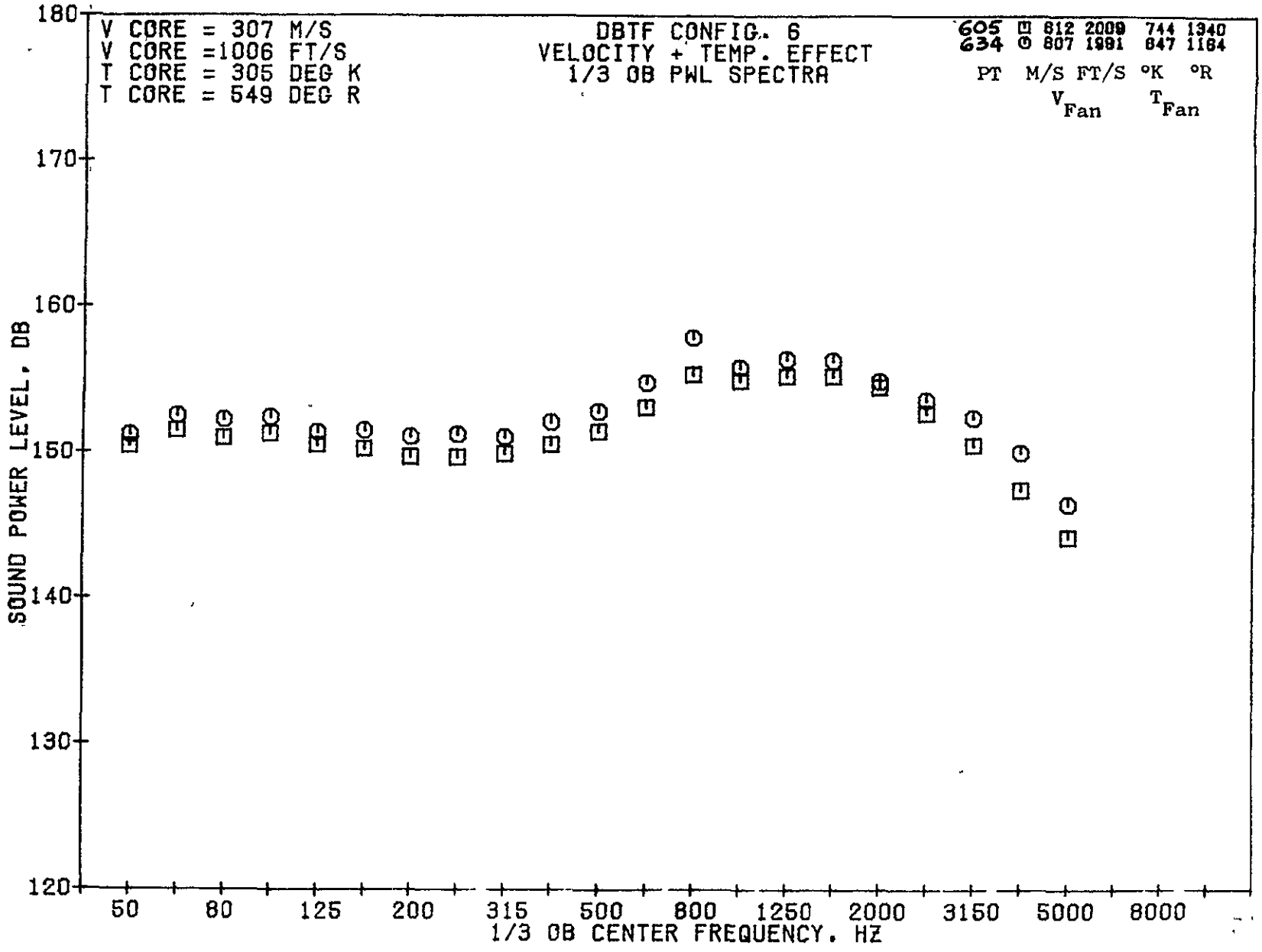

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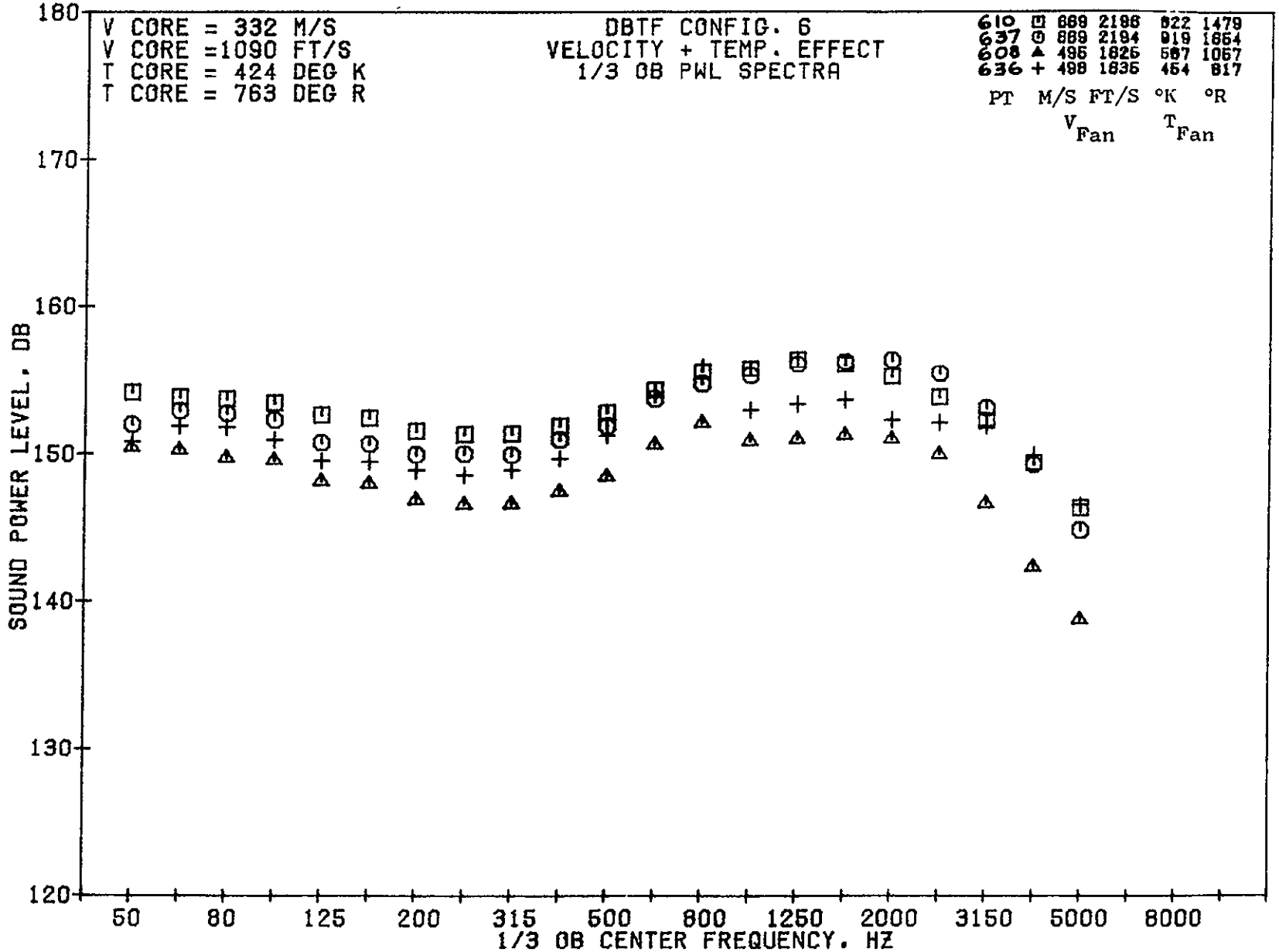

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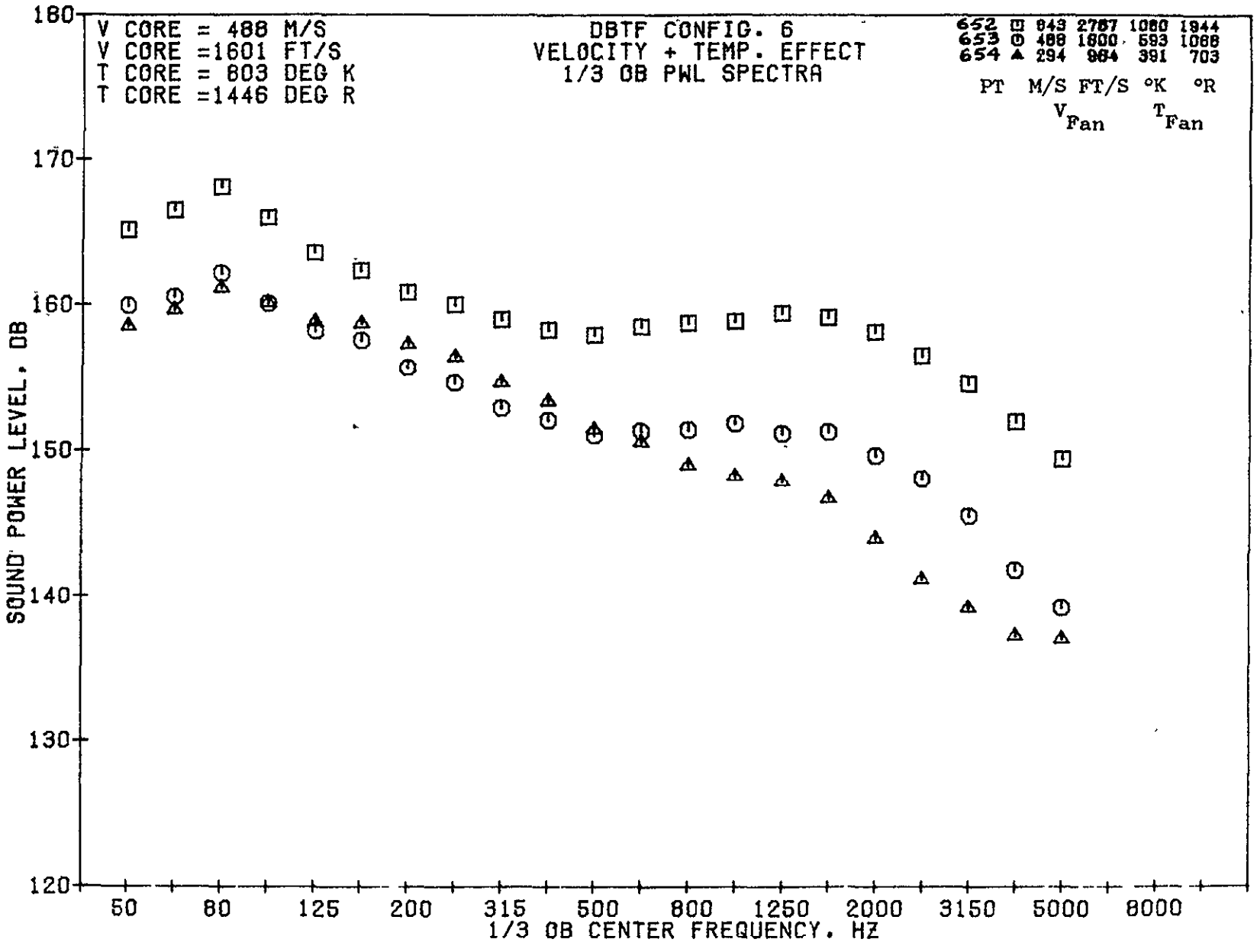

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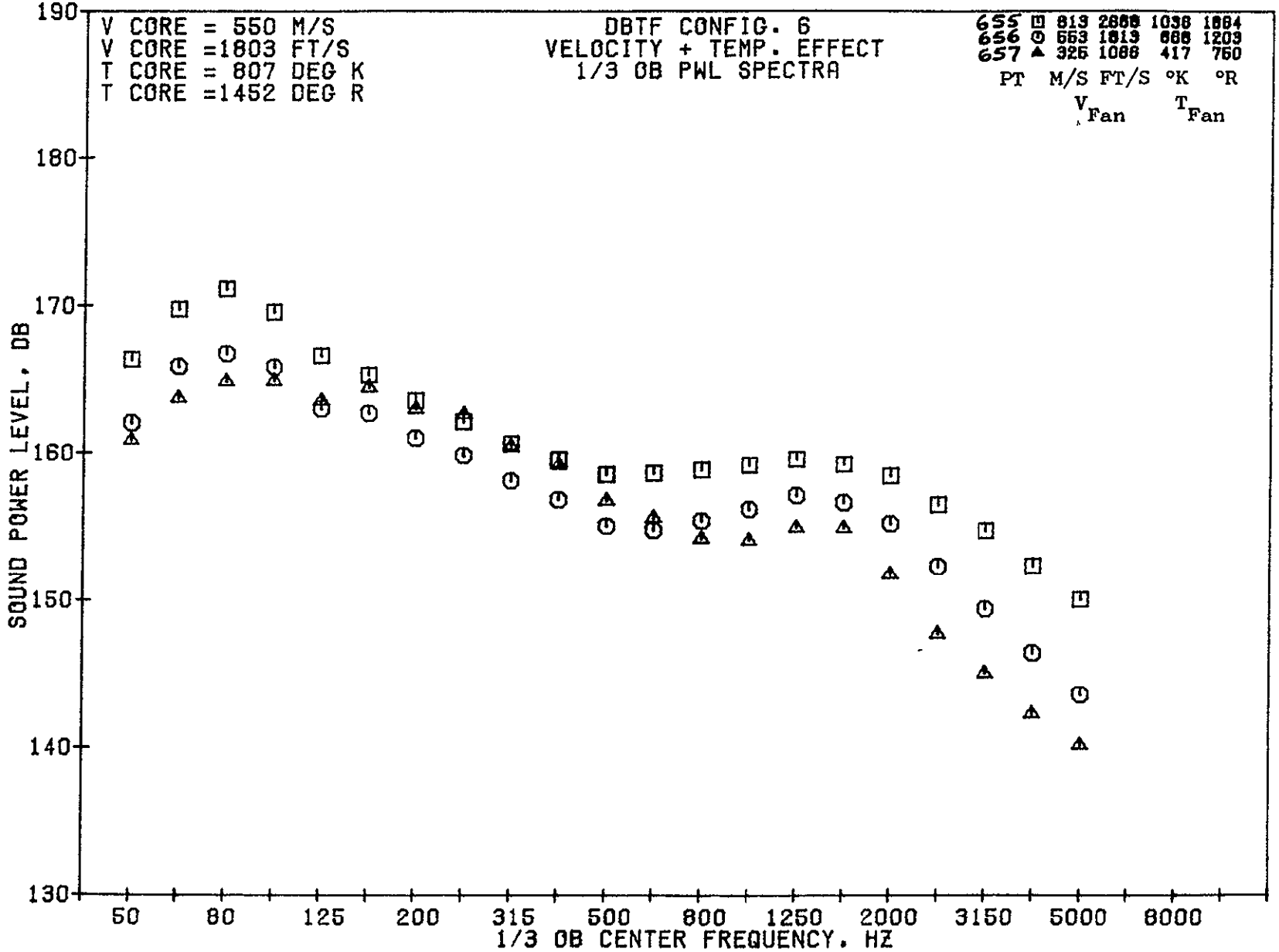

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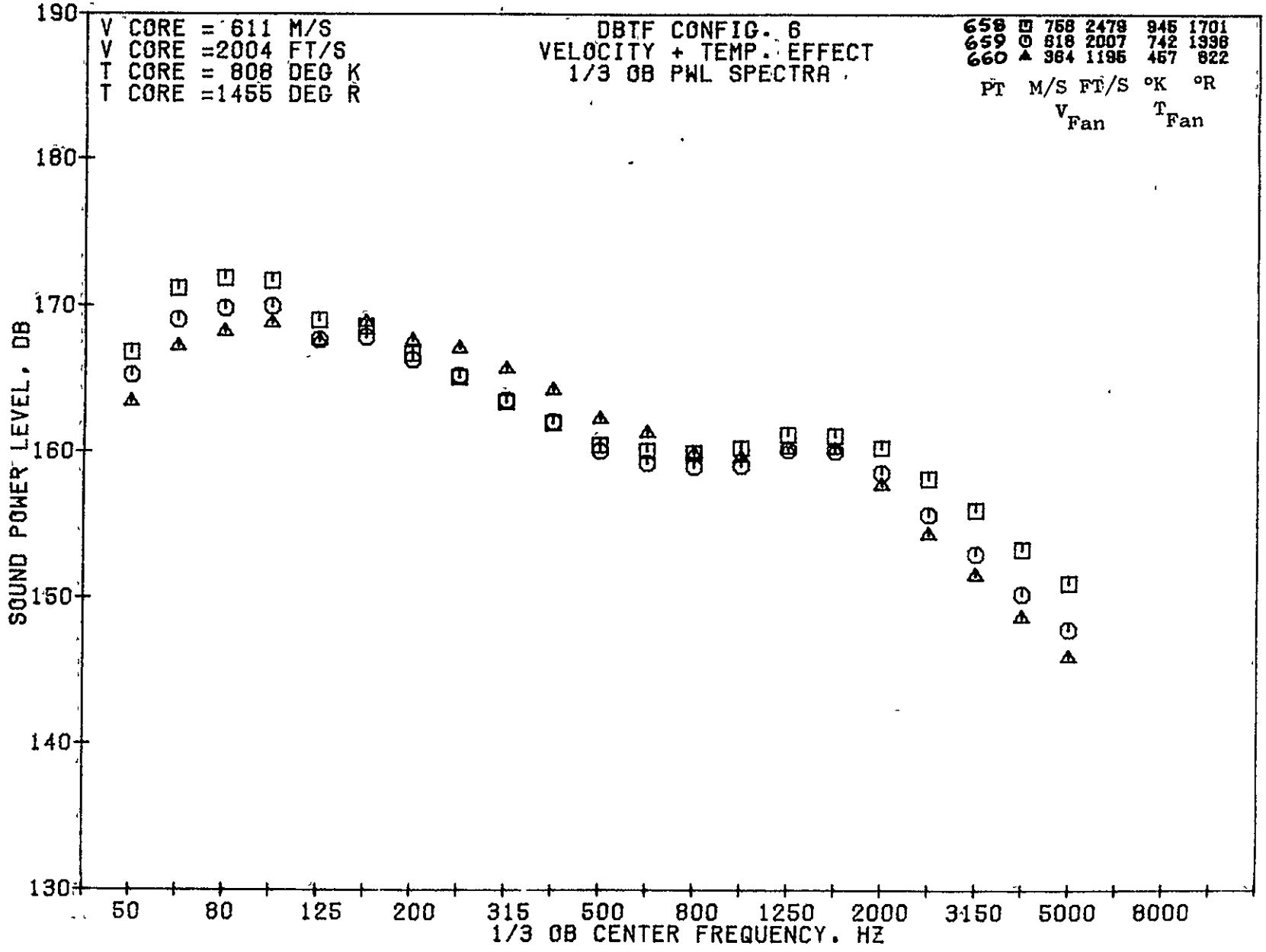

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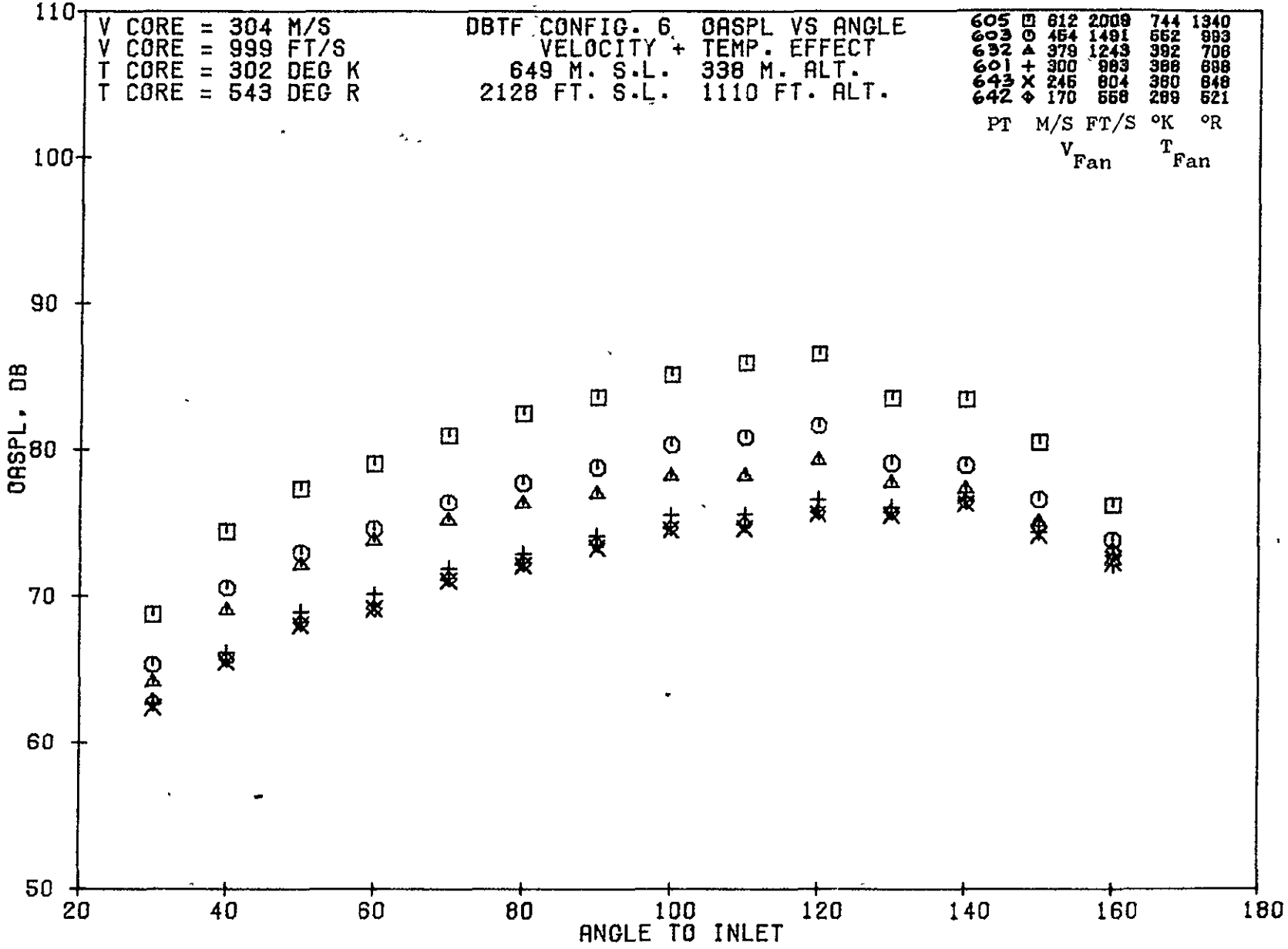

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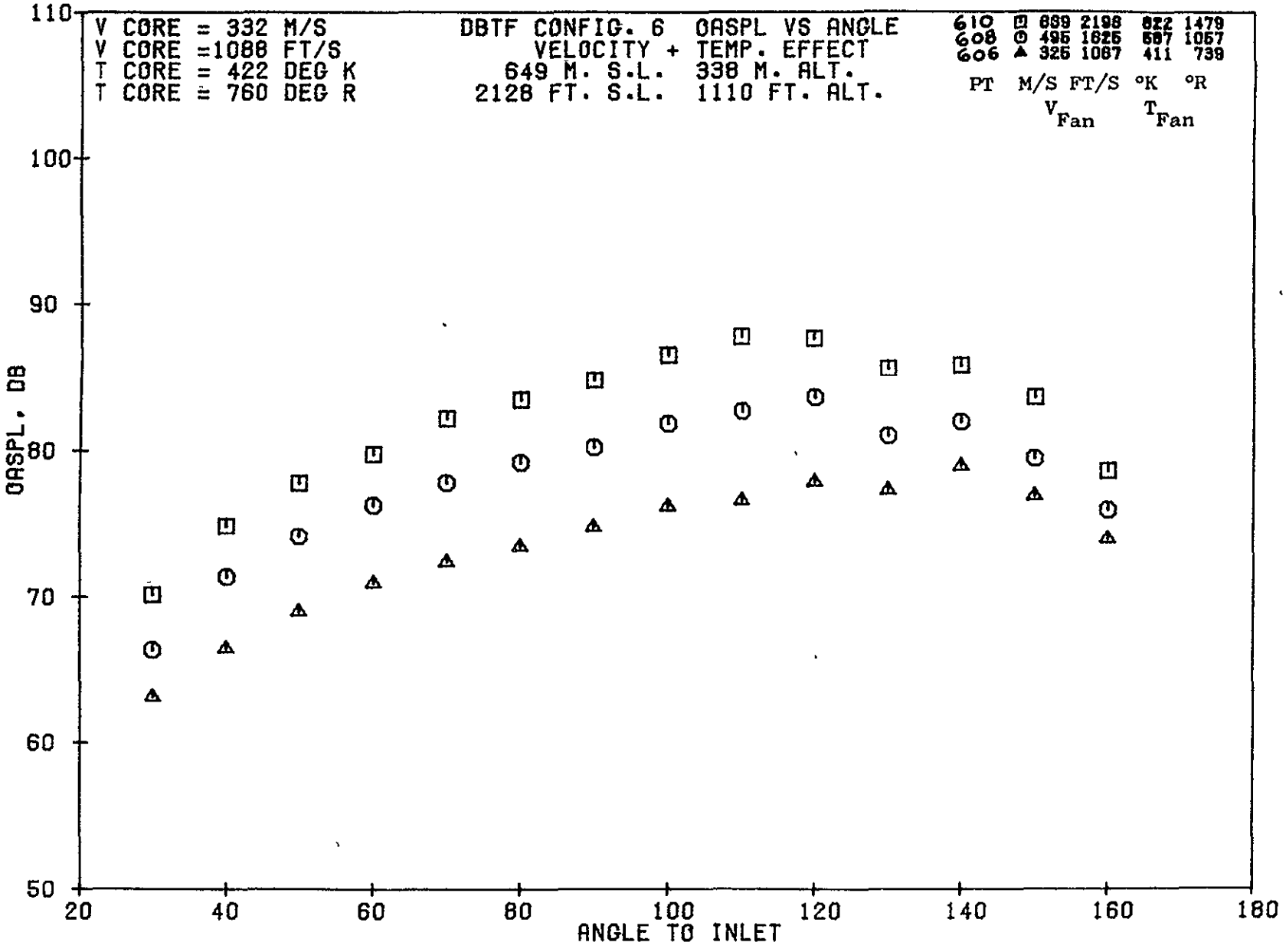
79 BURCH A.



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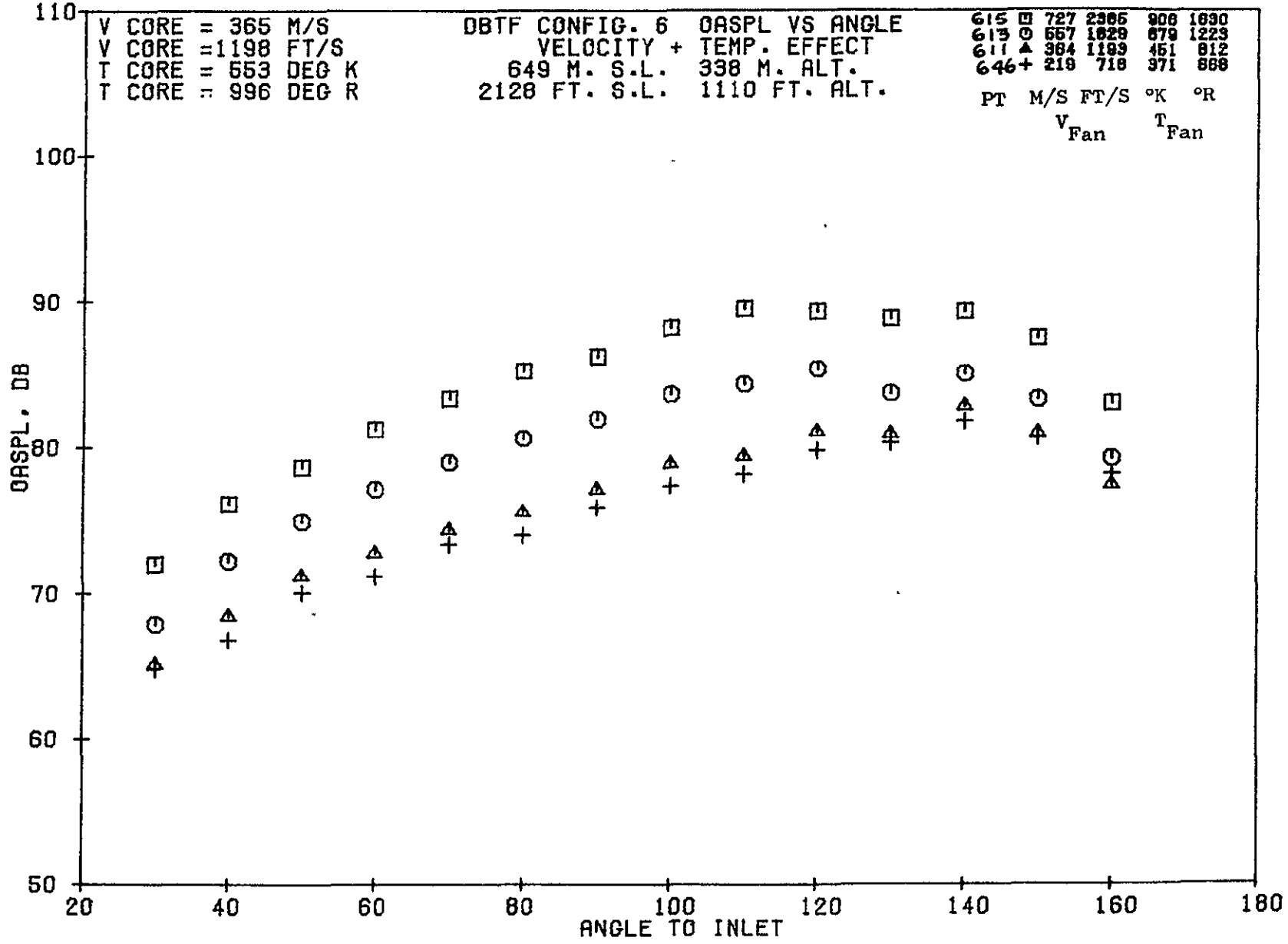

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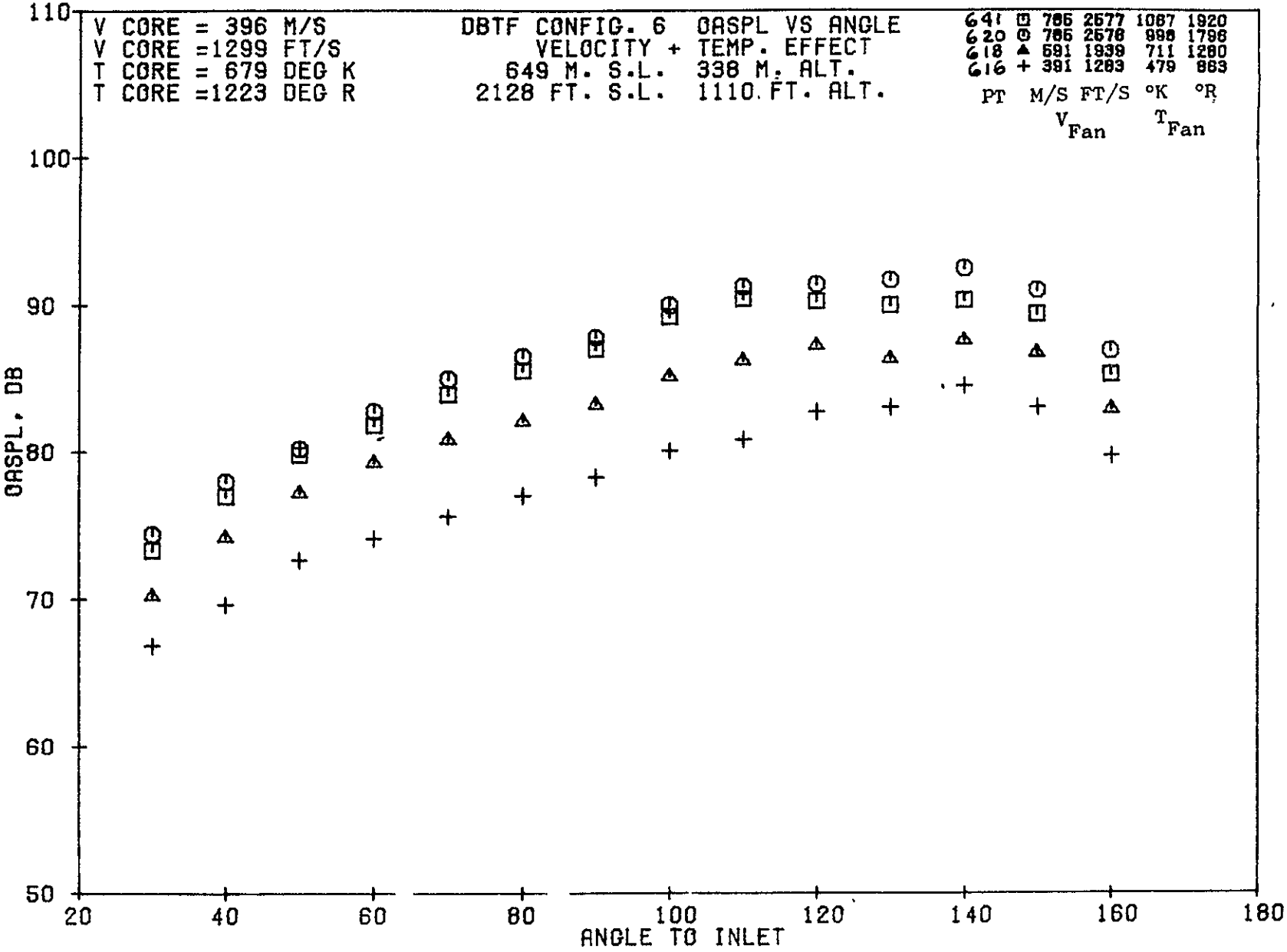

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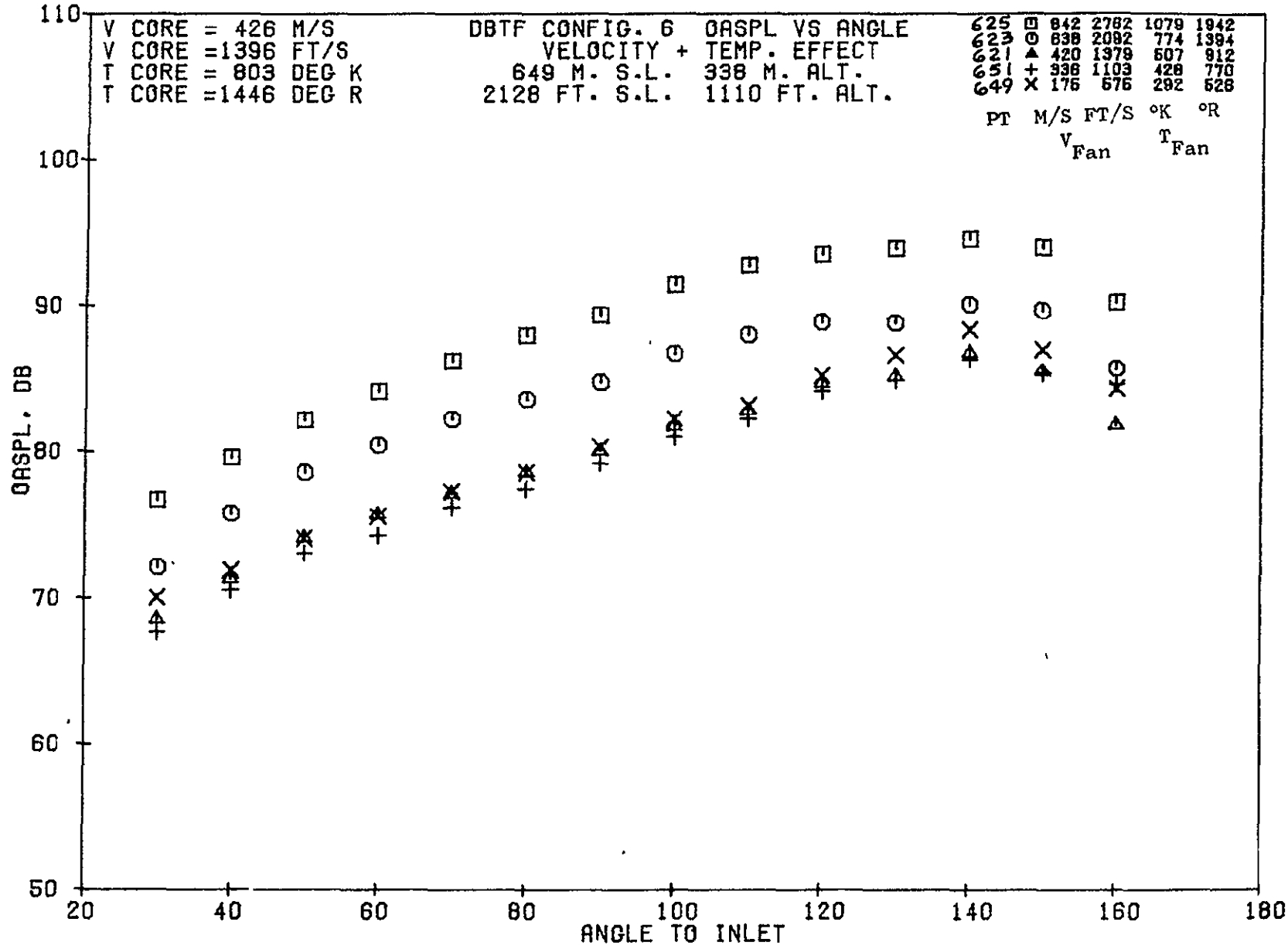

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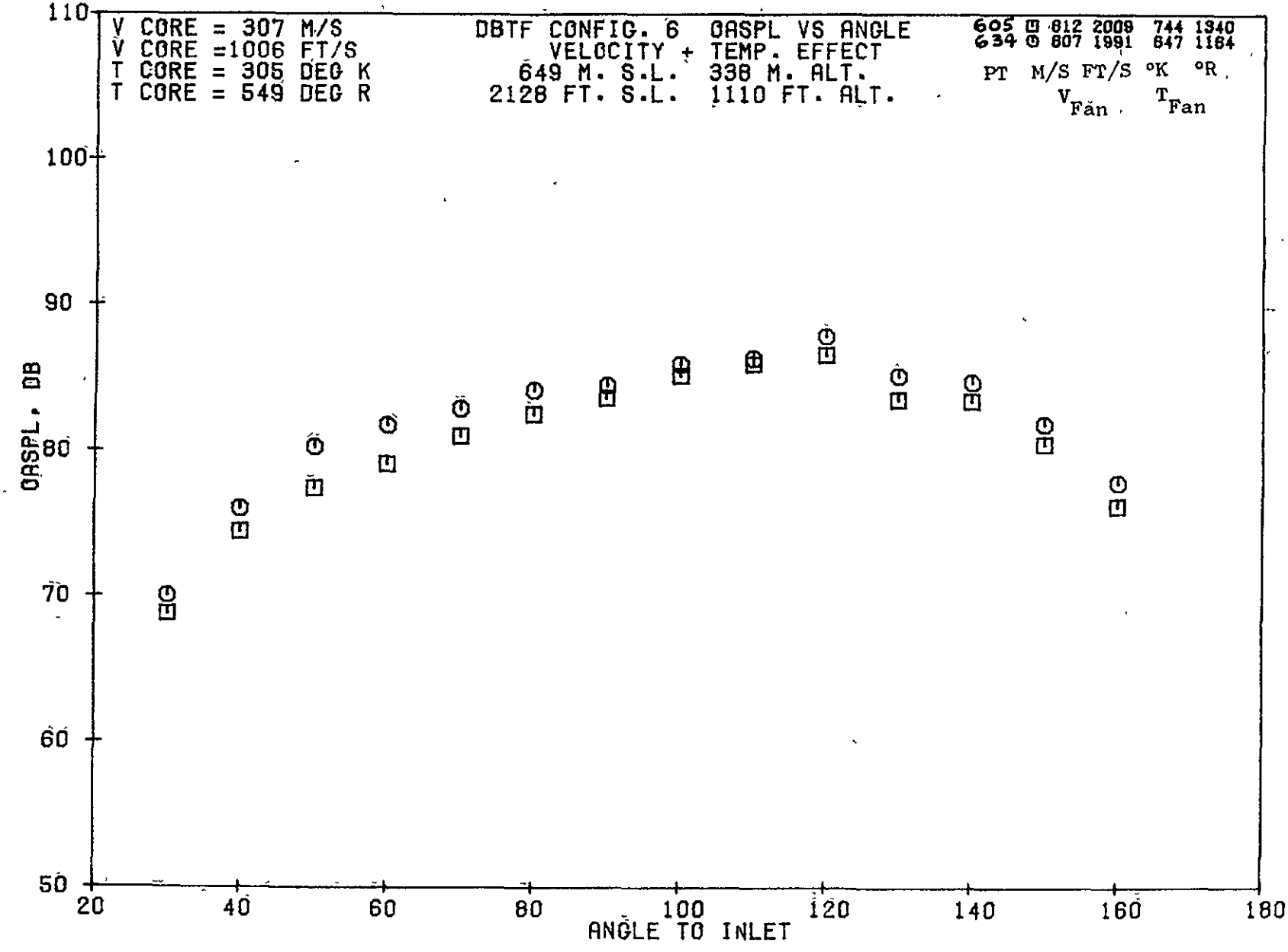

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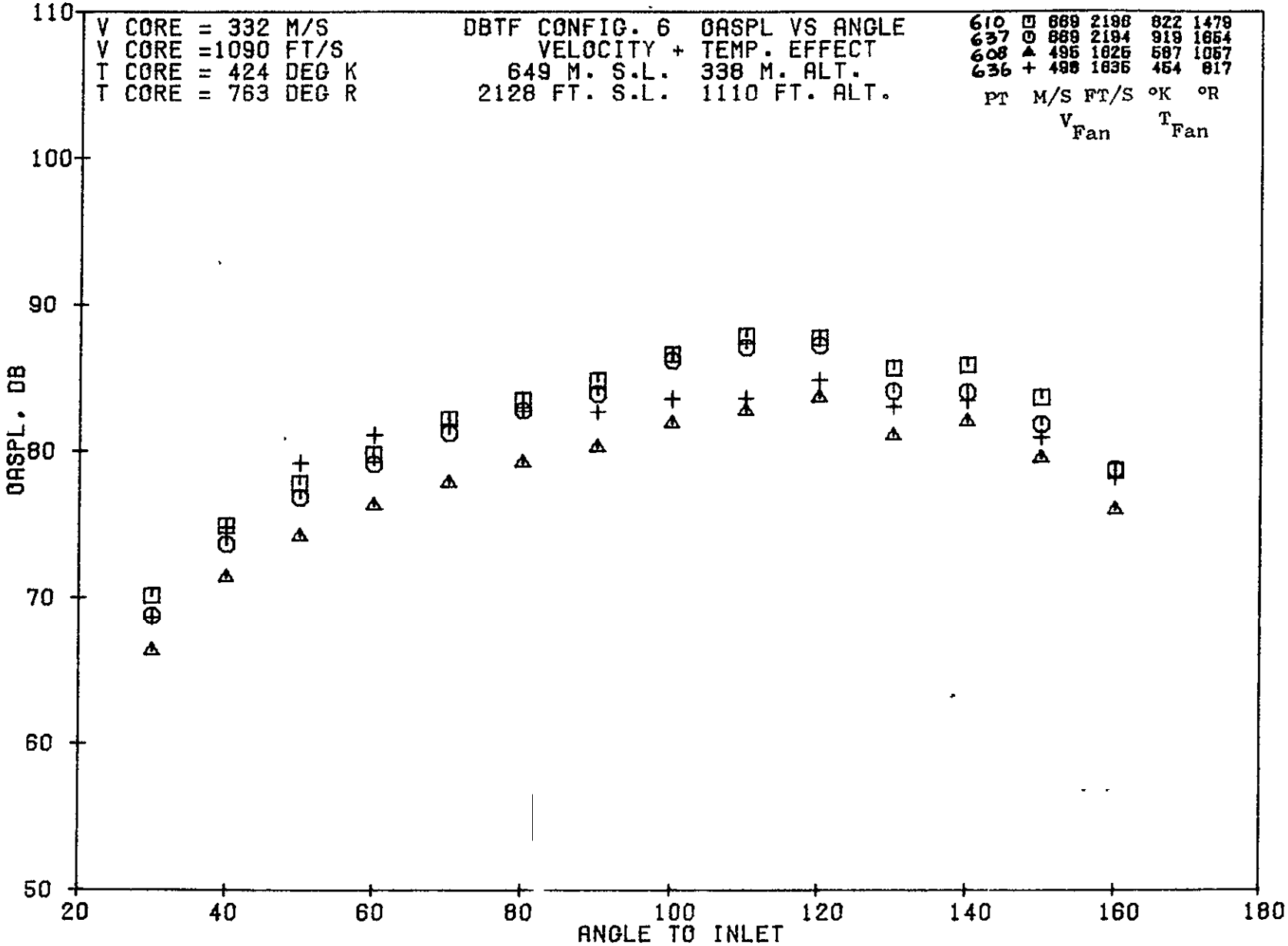

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79 BURCH A.

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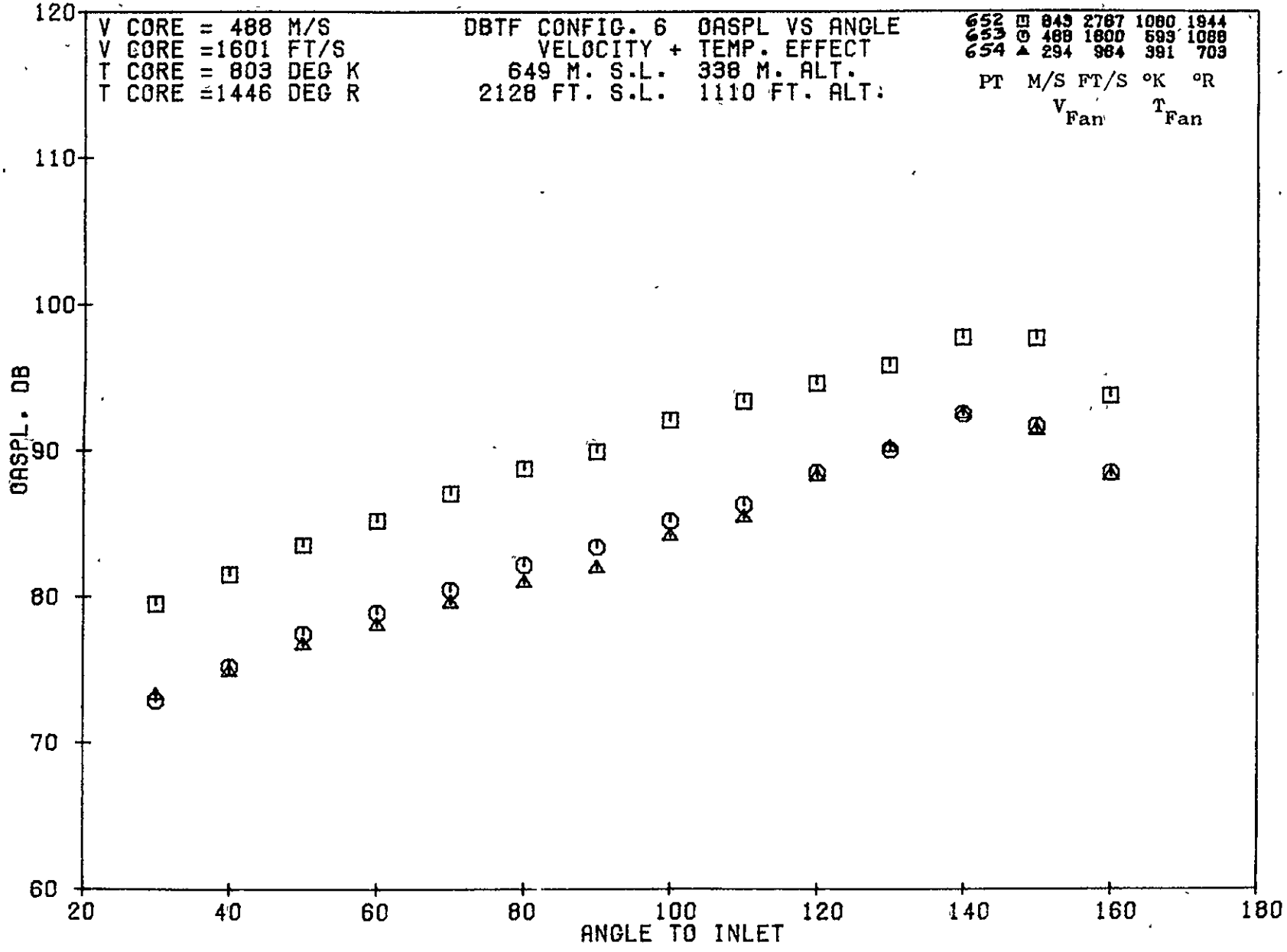

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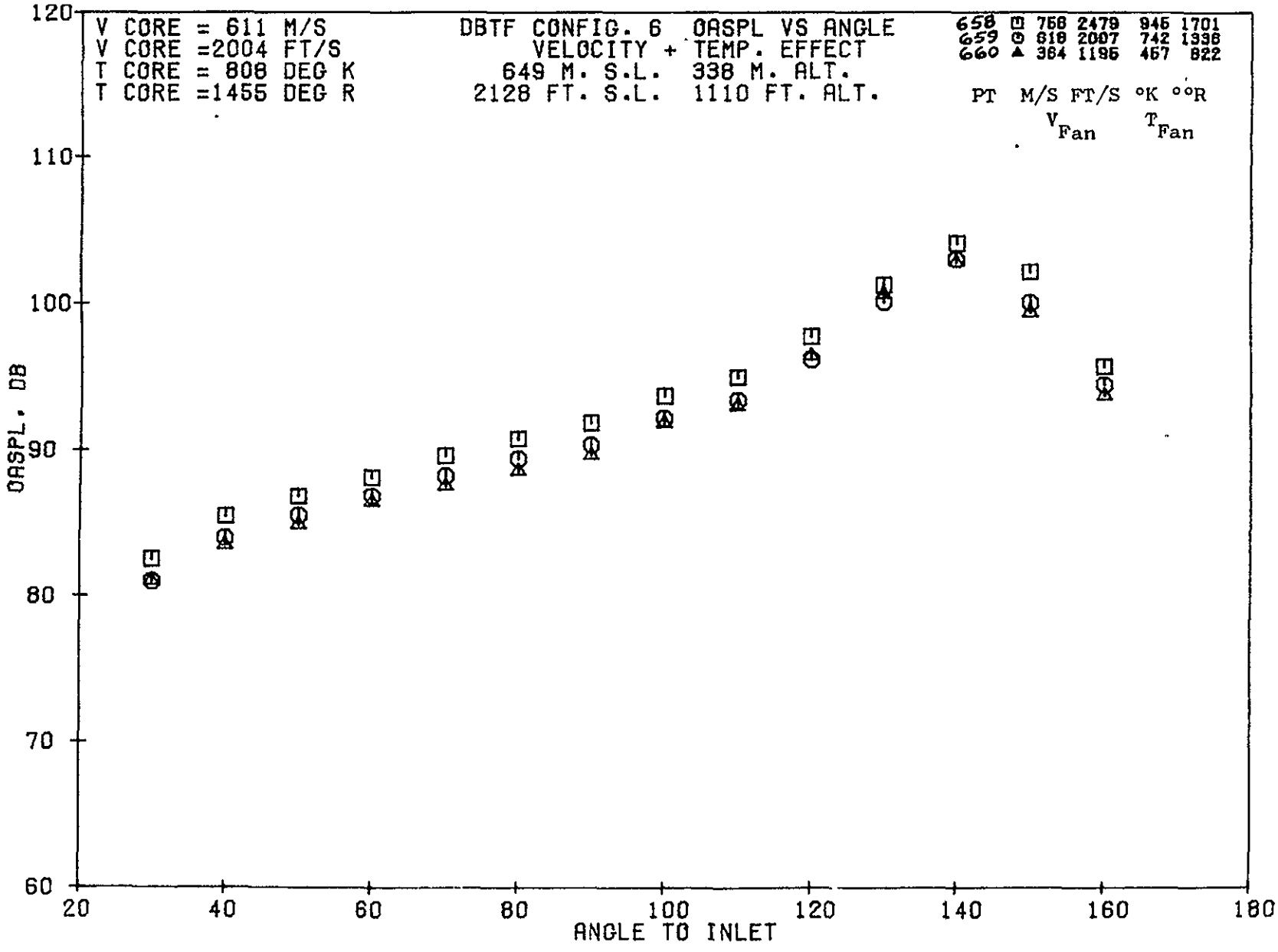

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79 BURCH 9.

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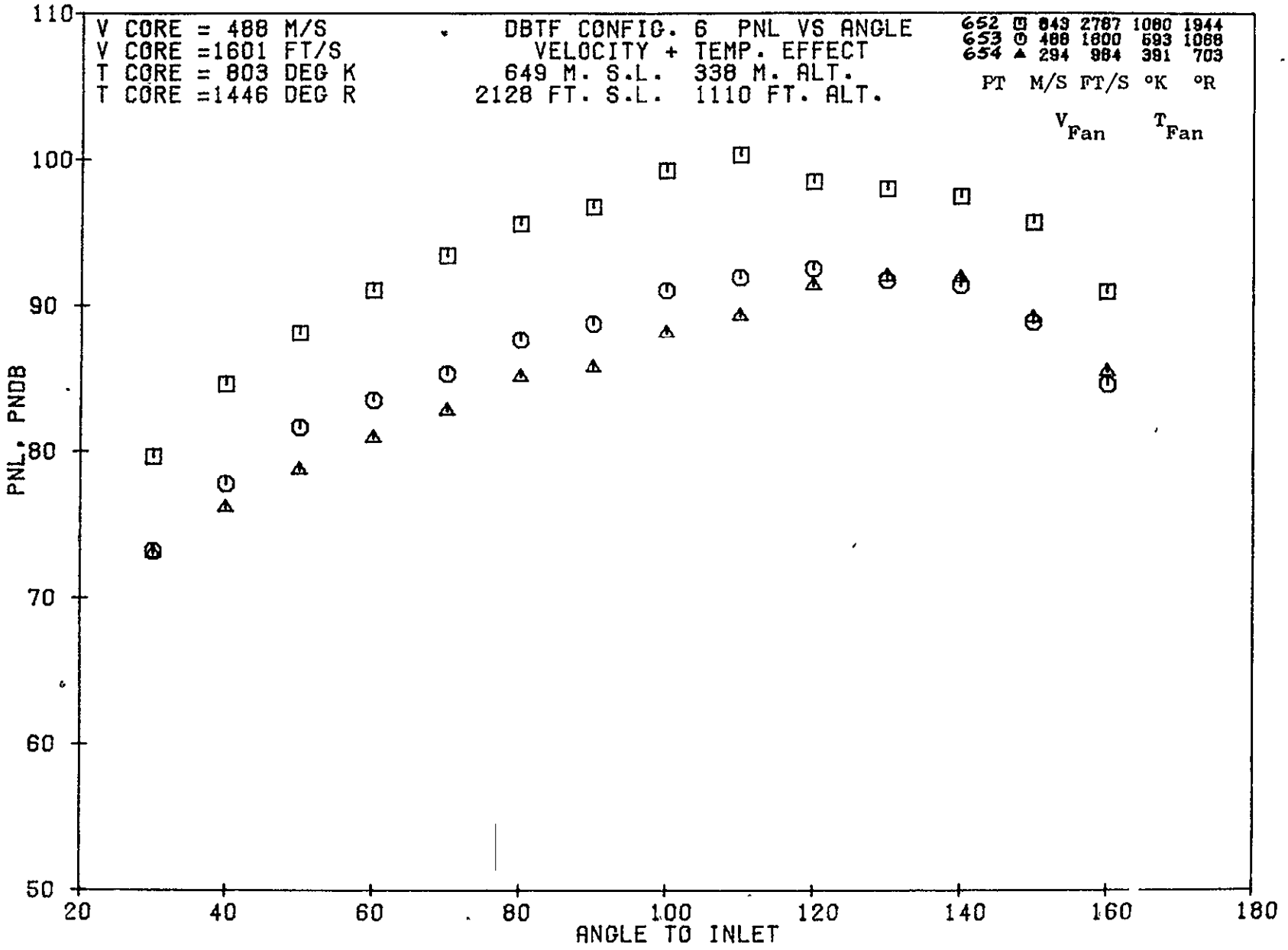
79 BURCH A.



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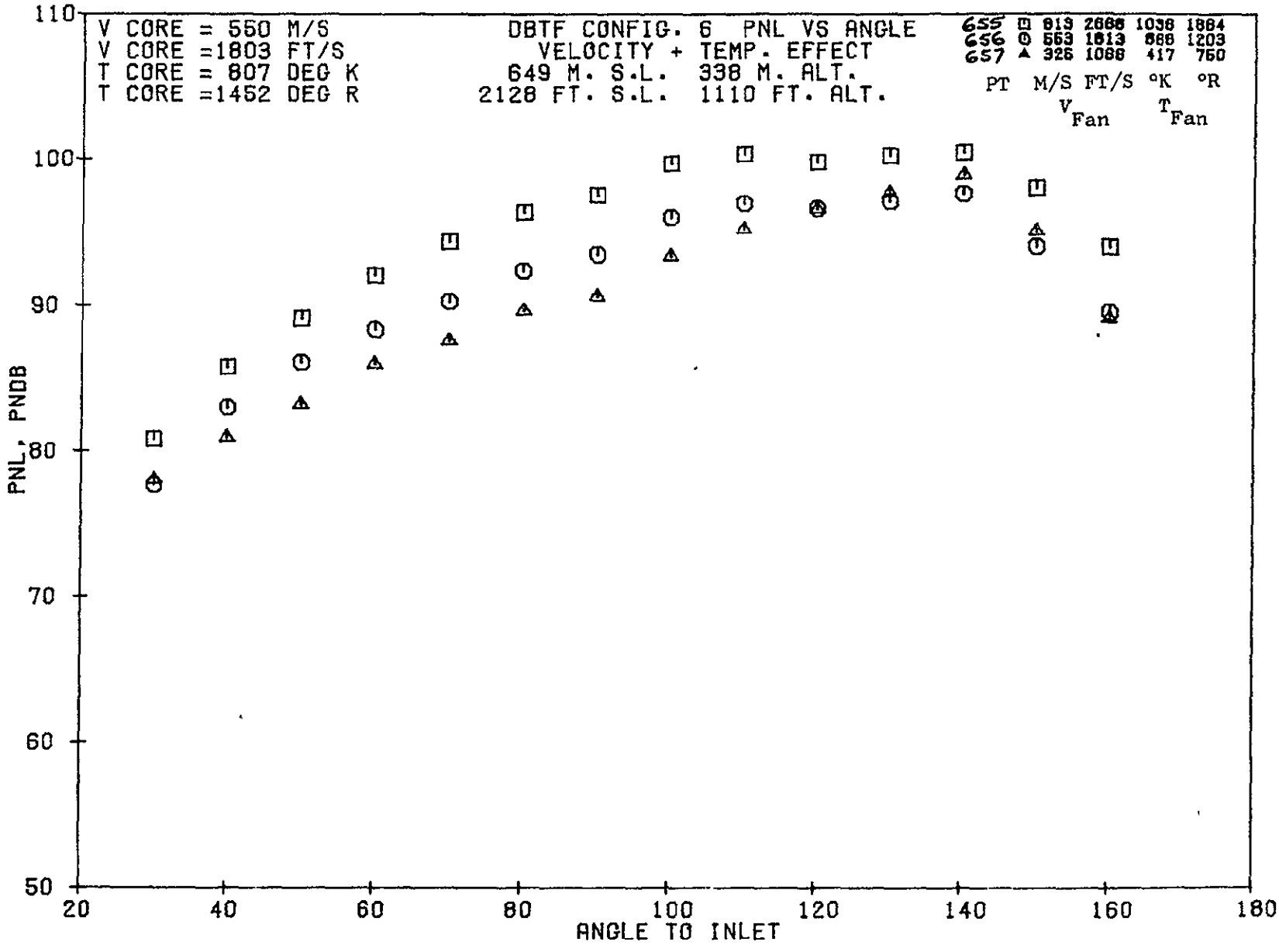

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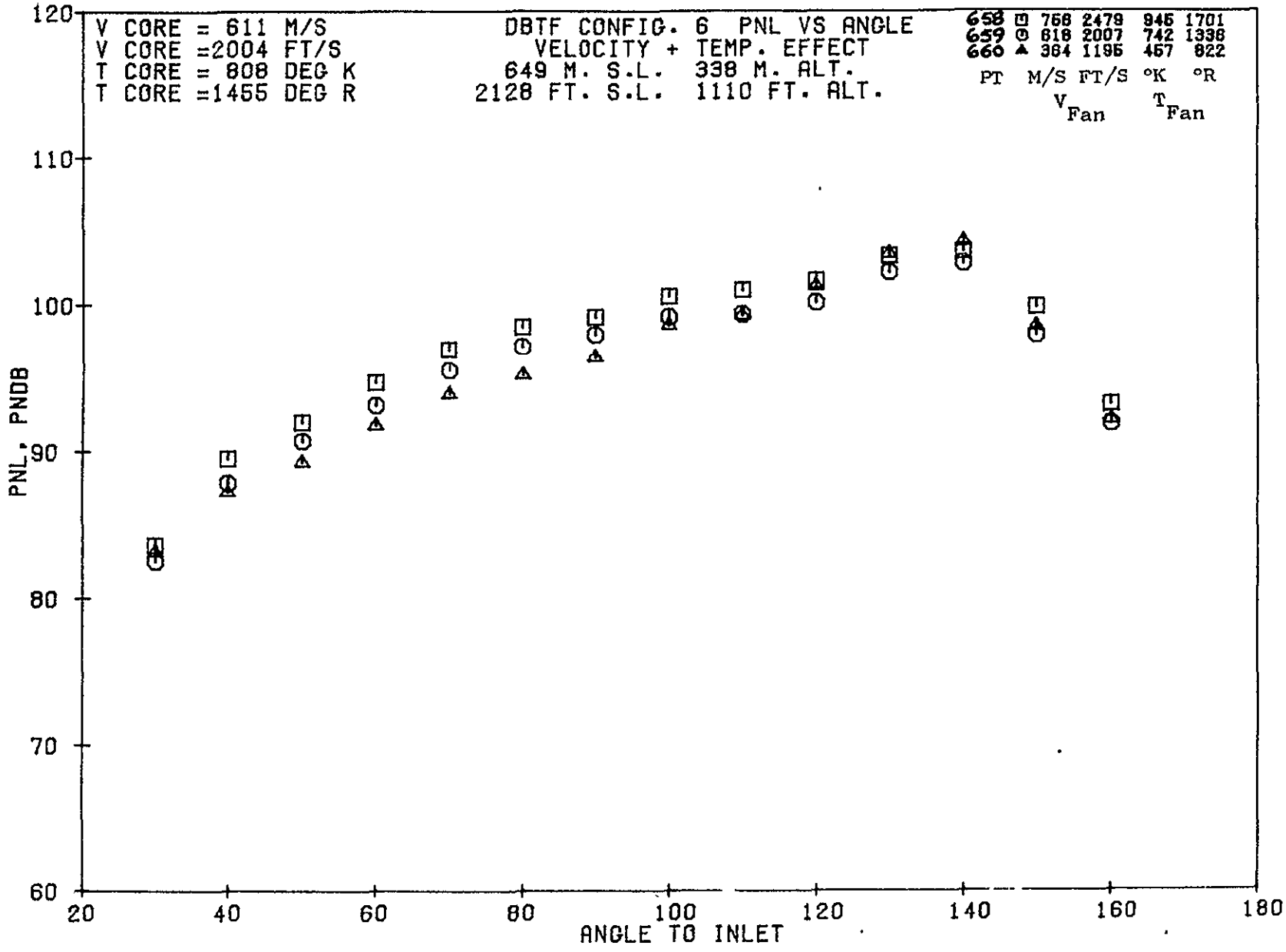

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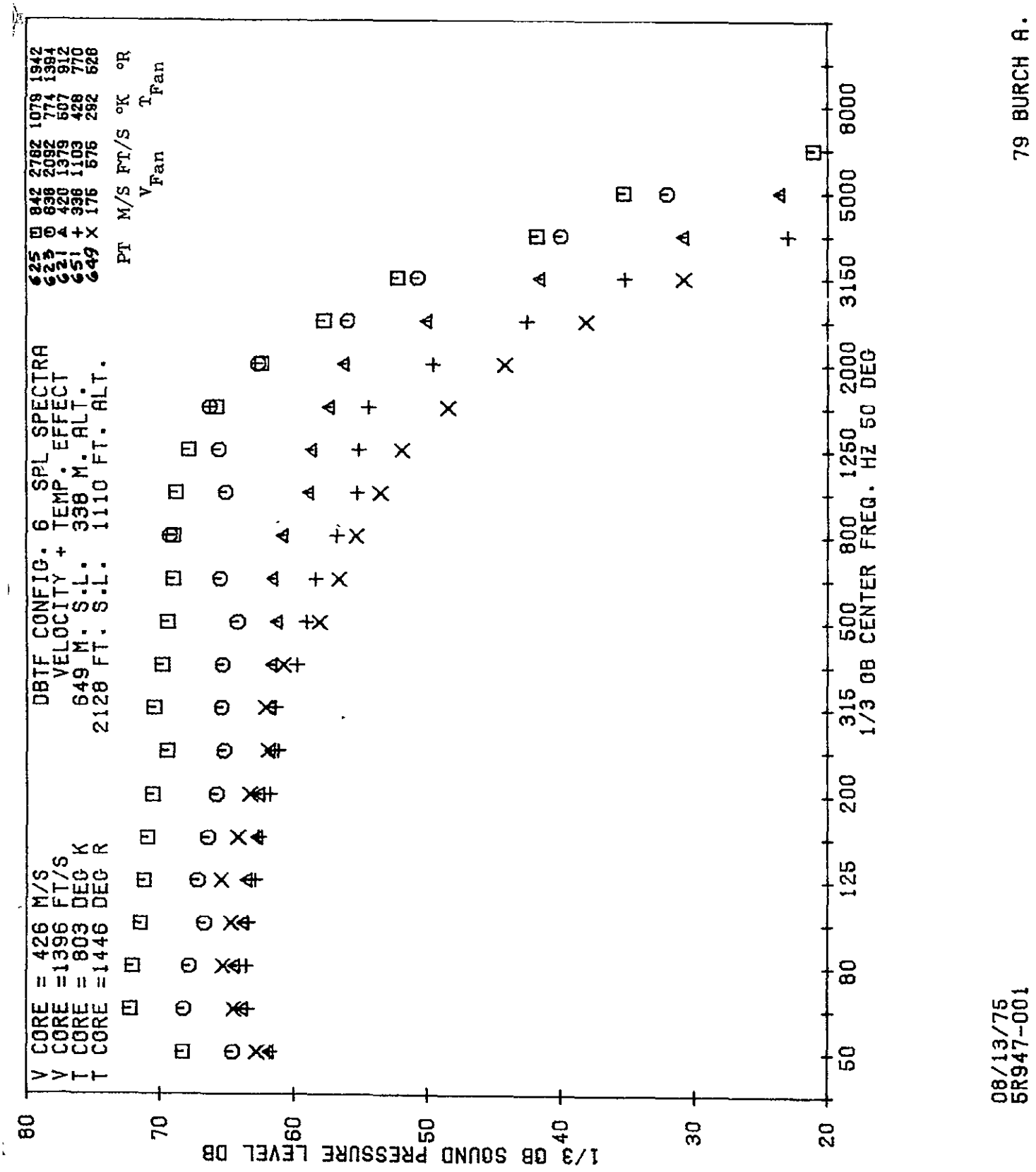

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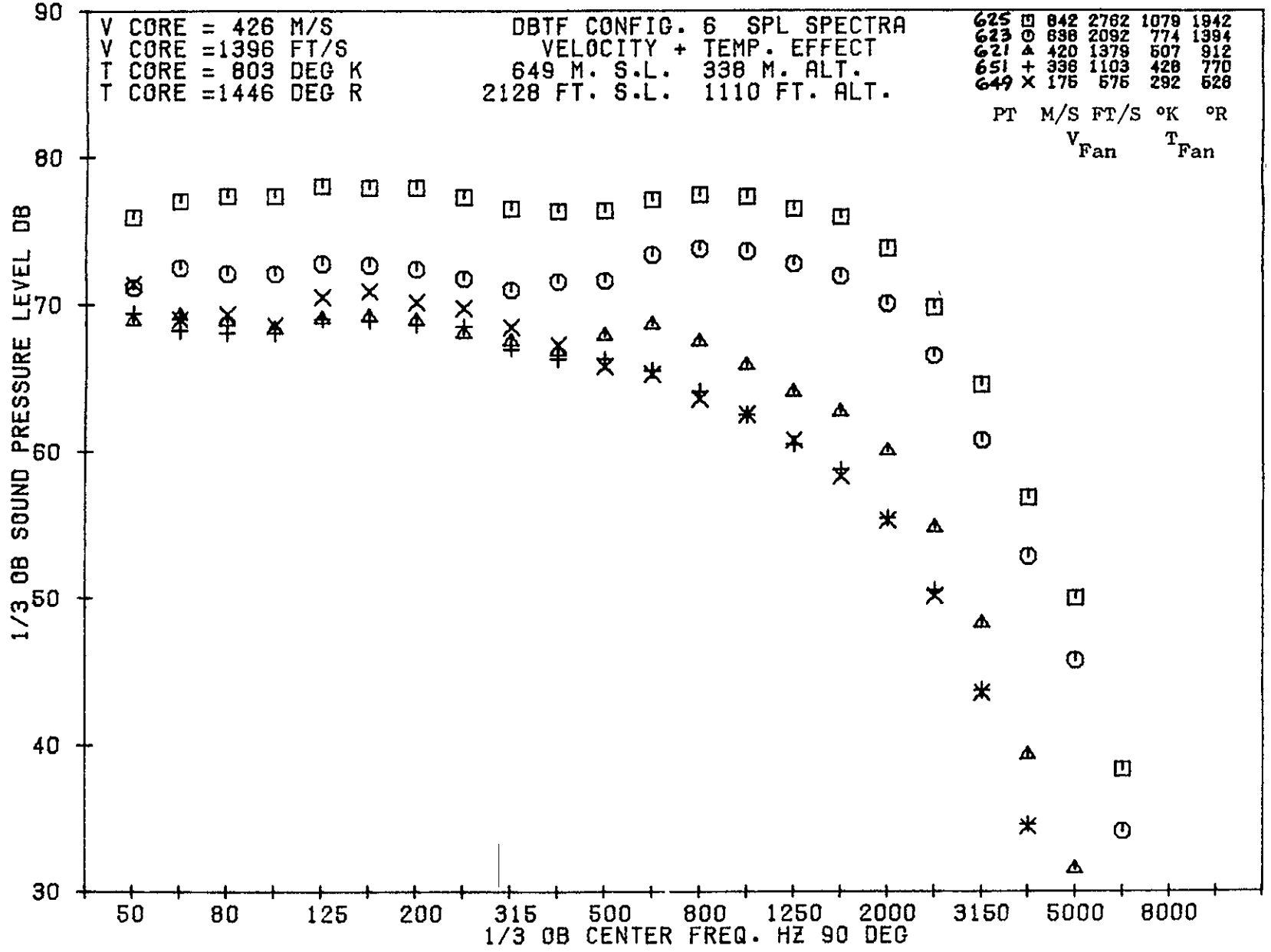

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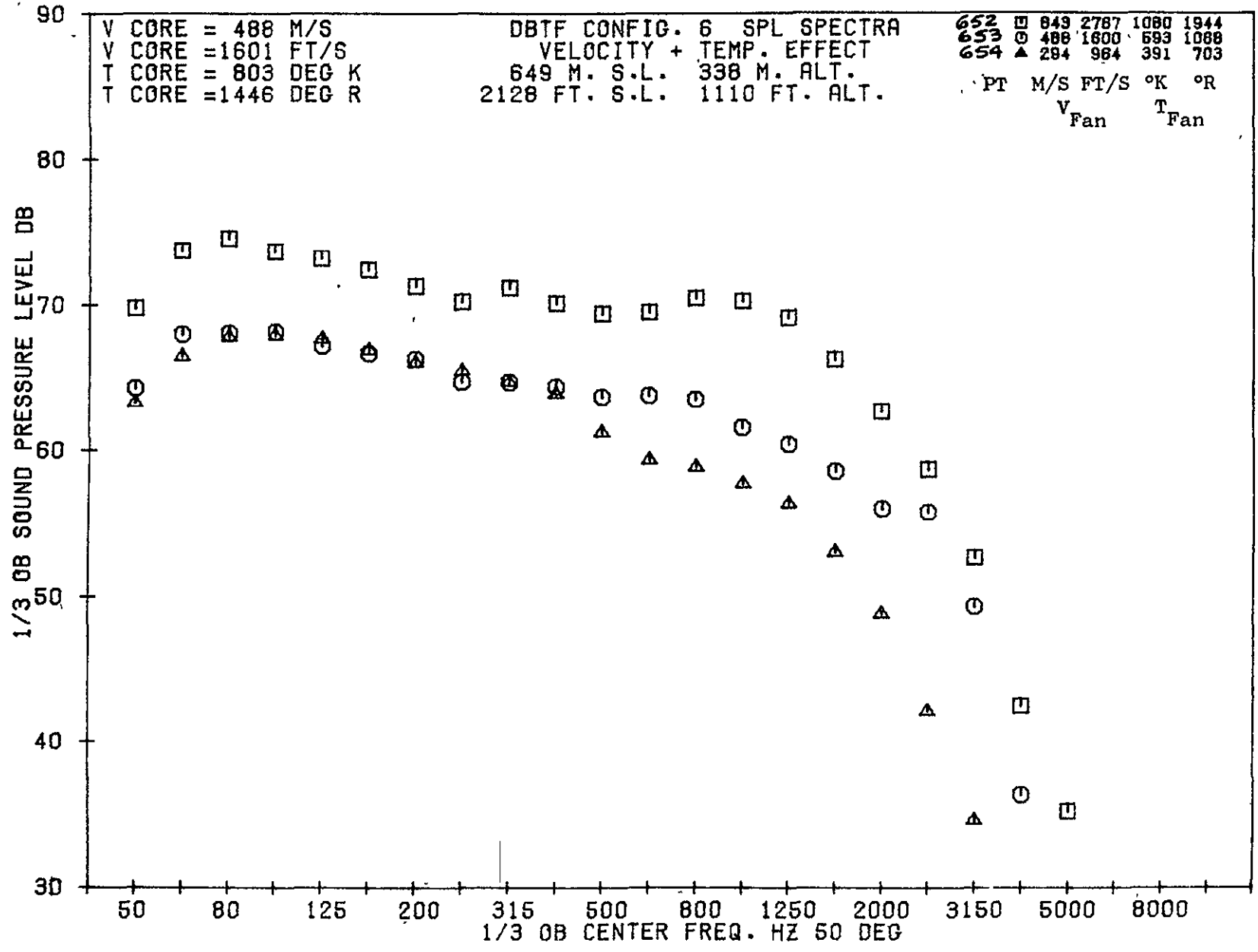

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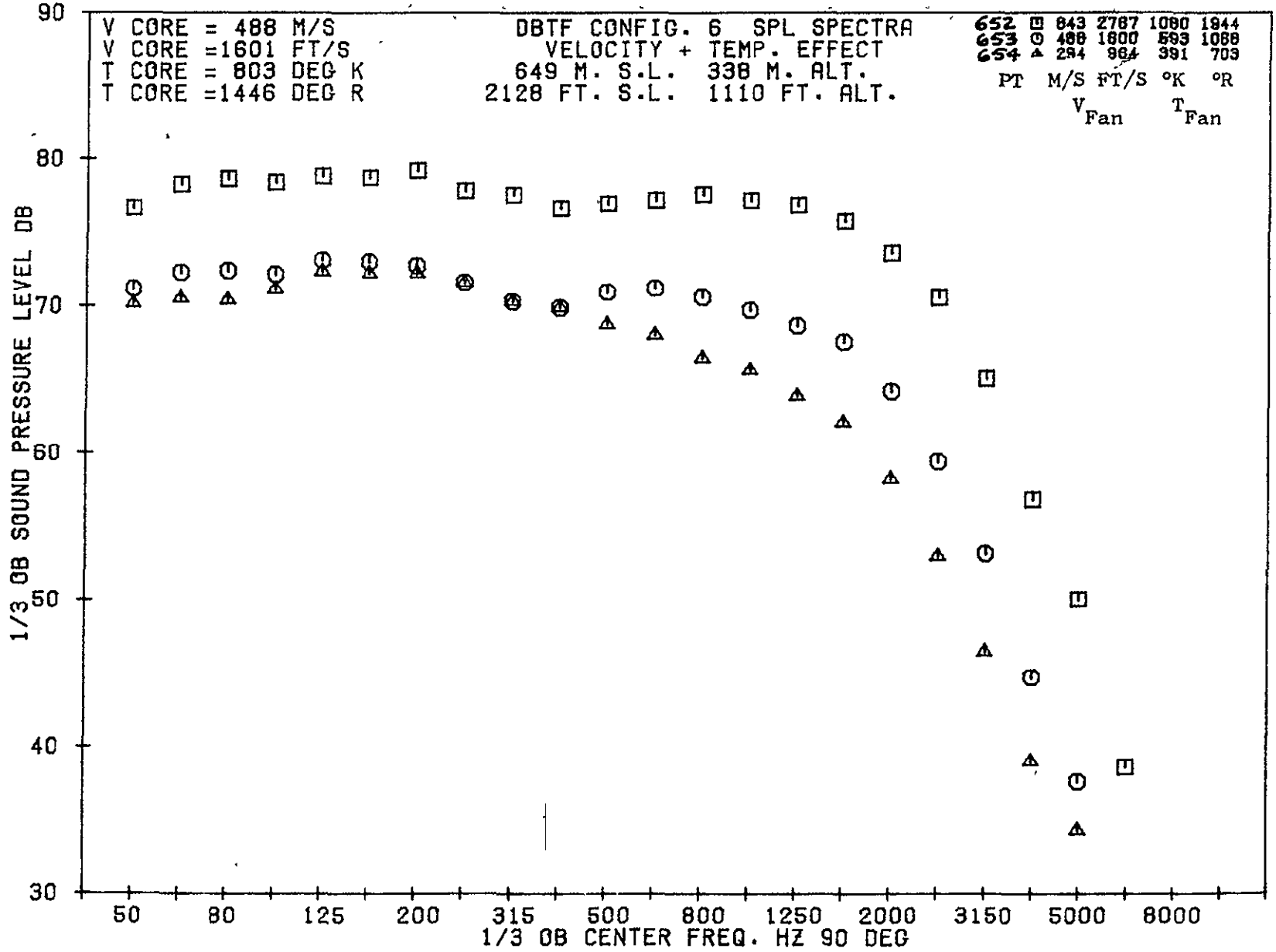

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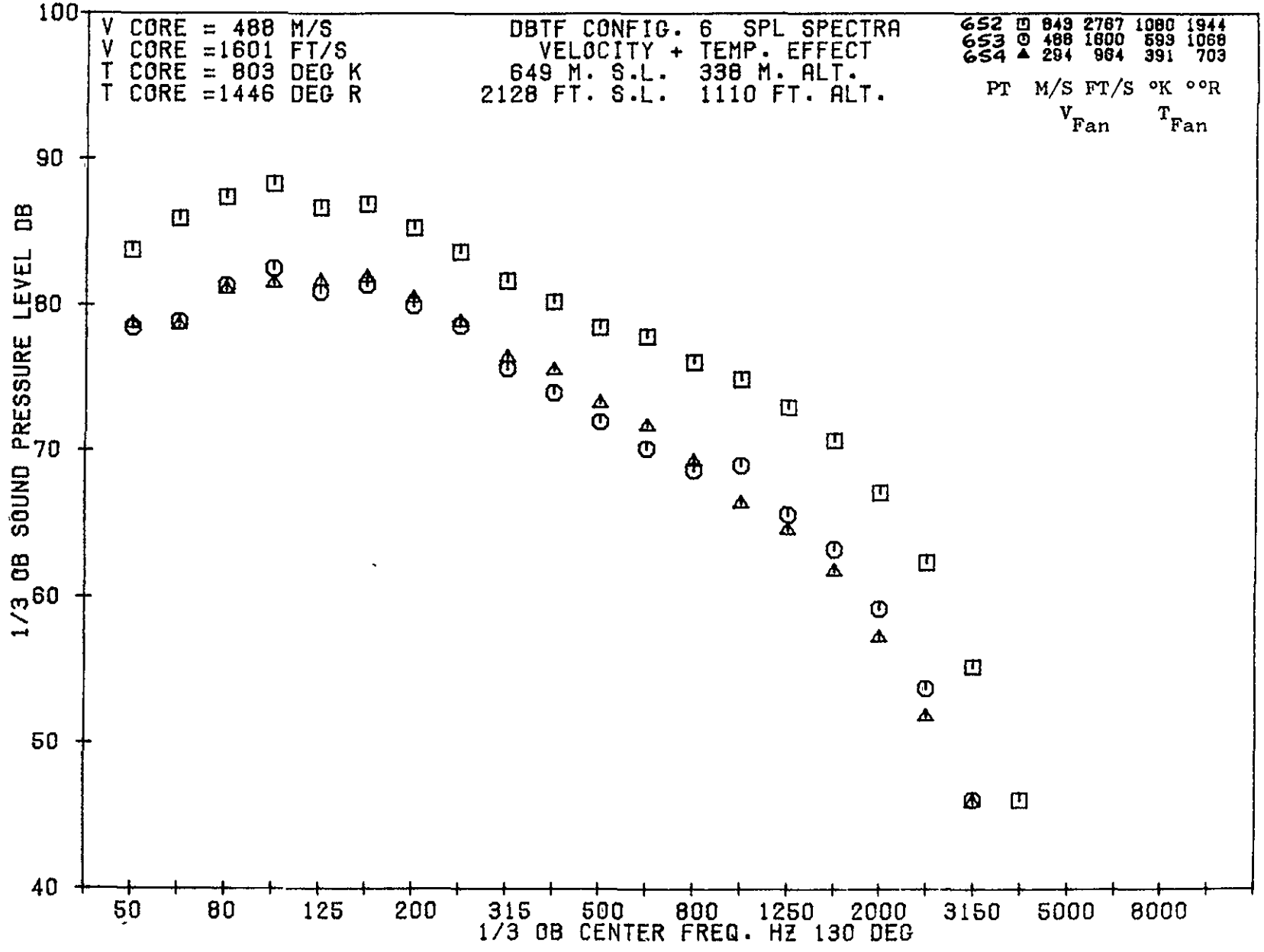

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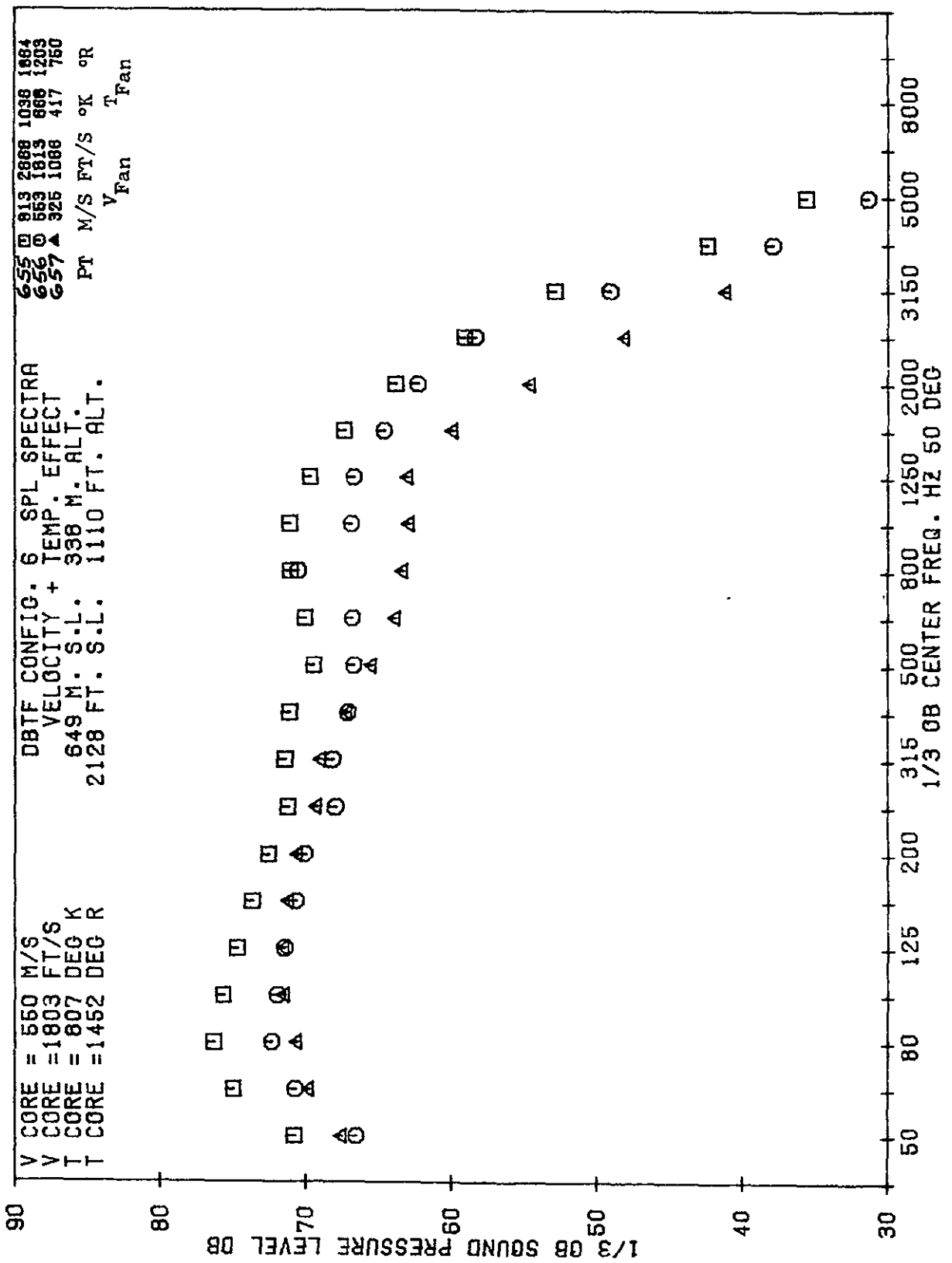

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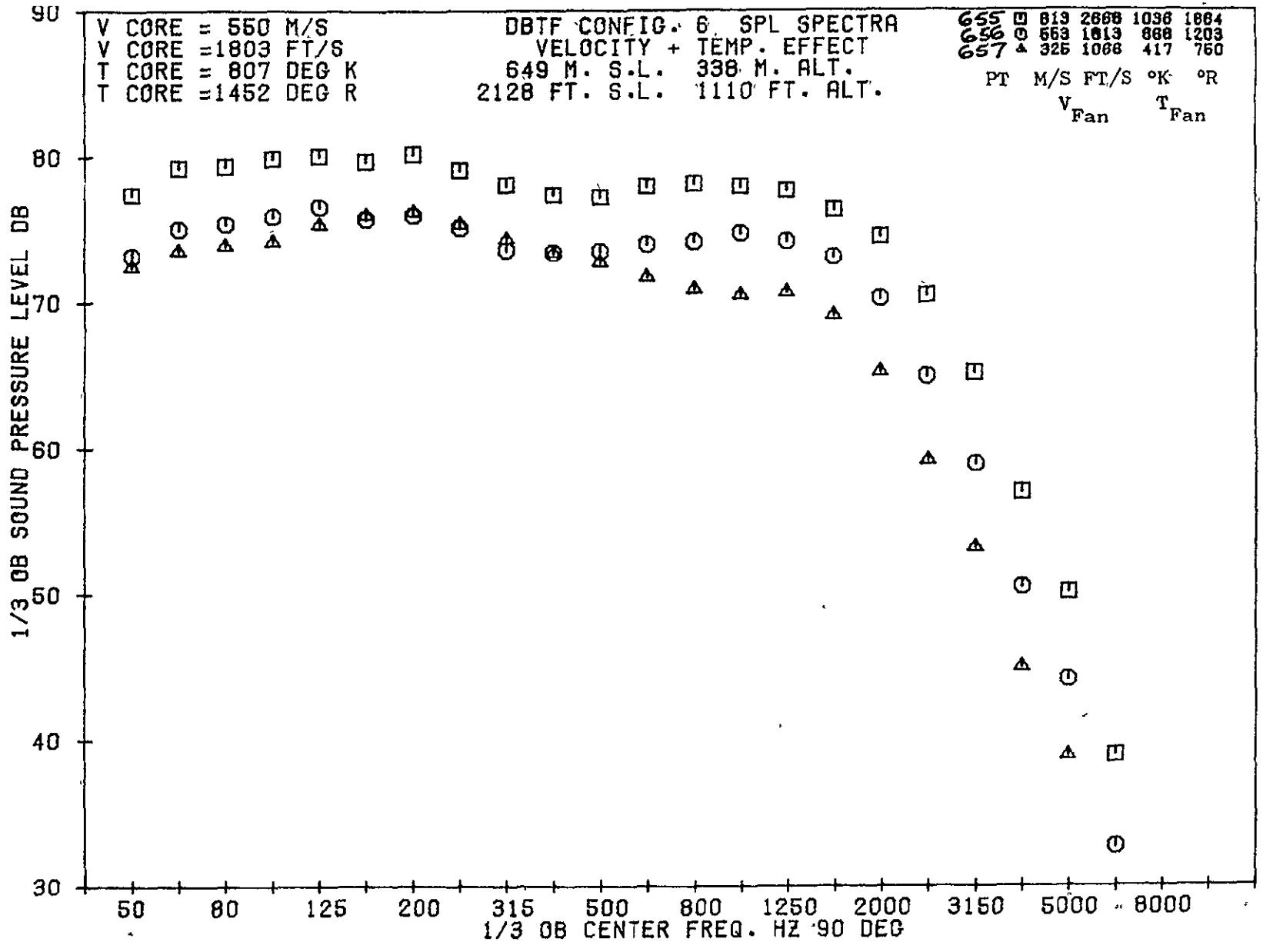

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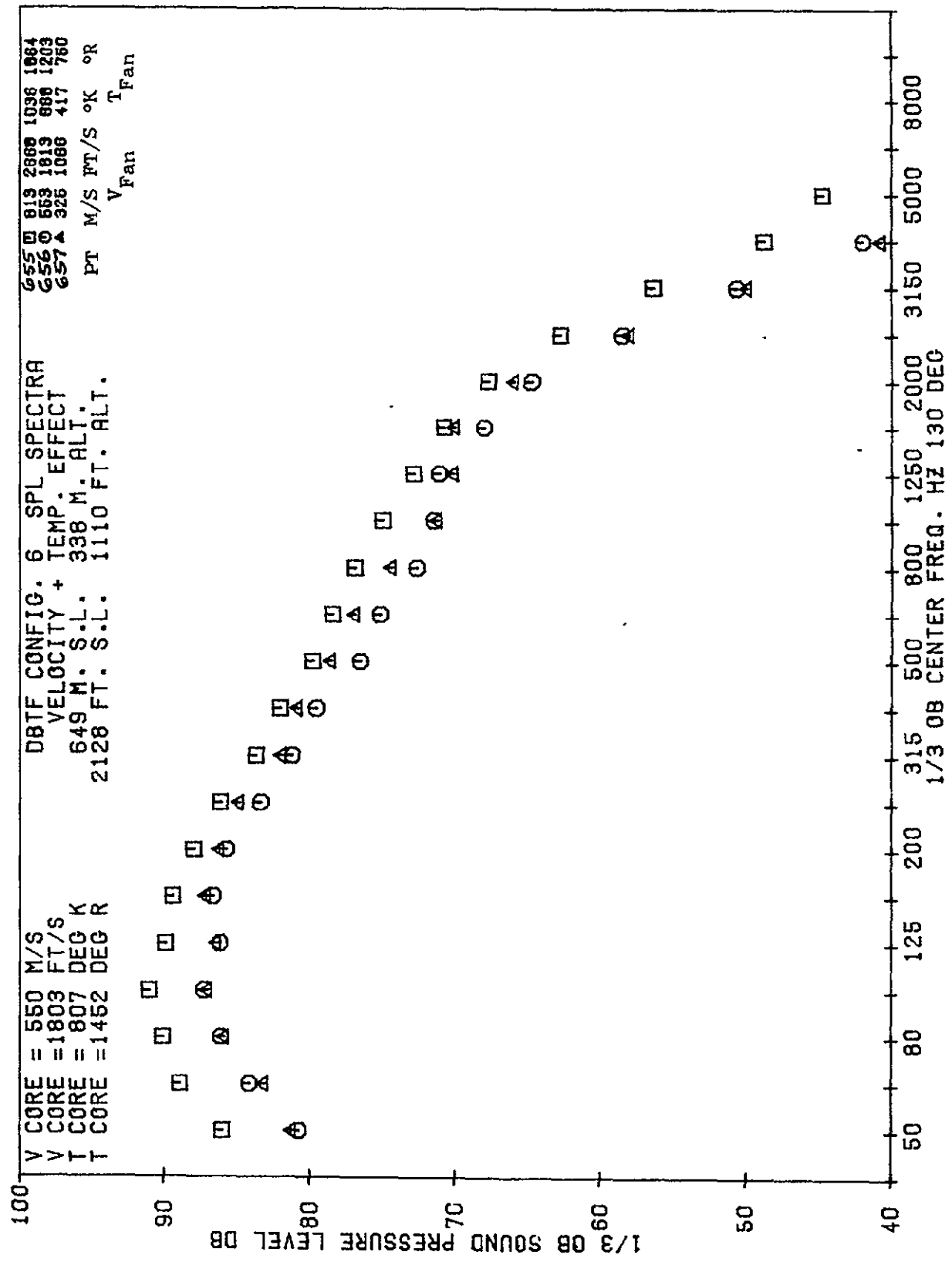

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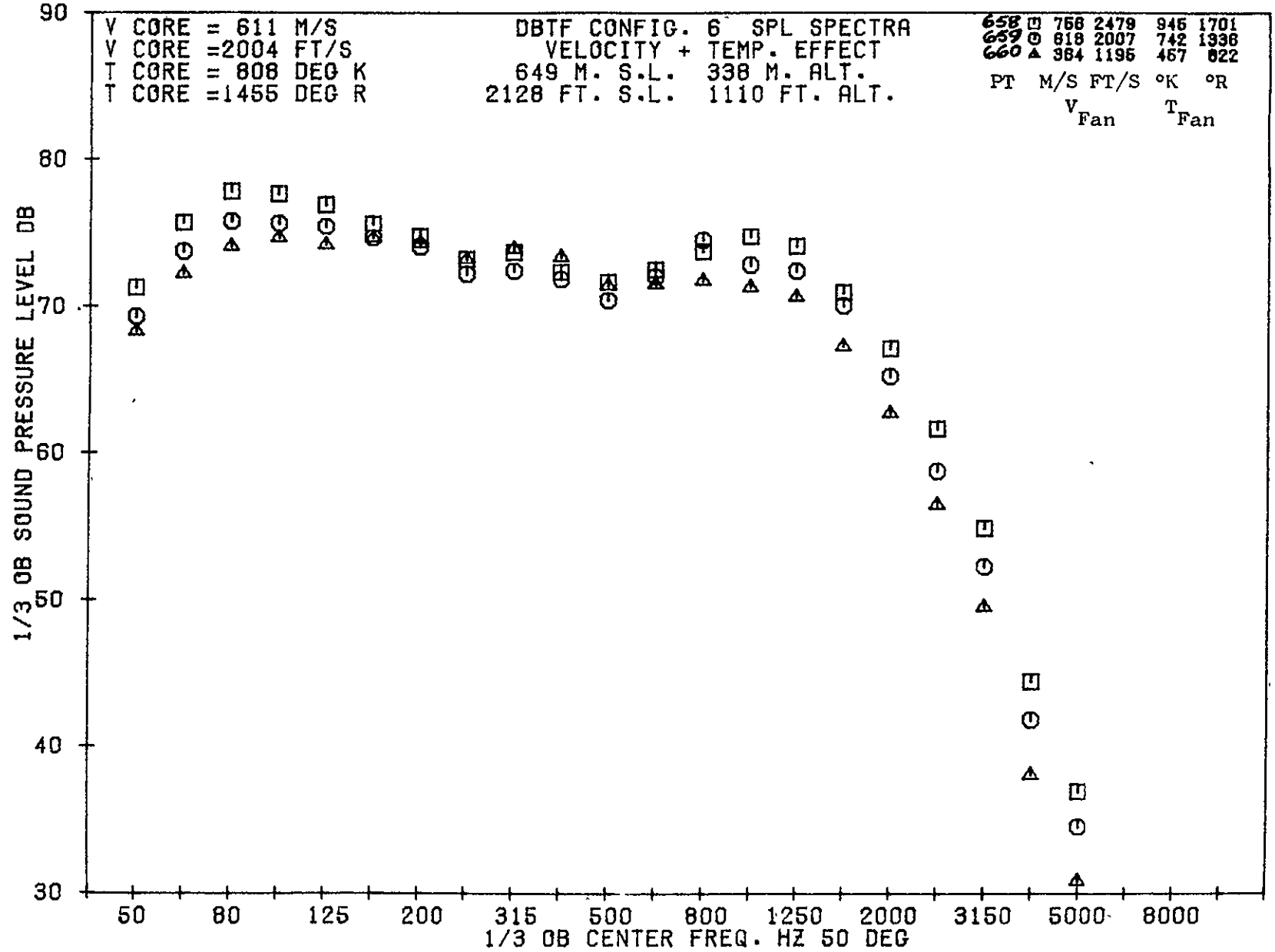

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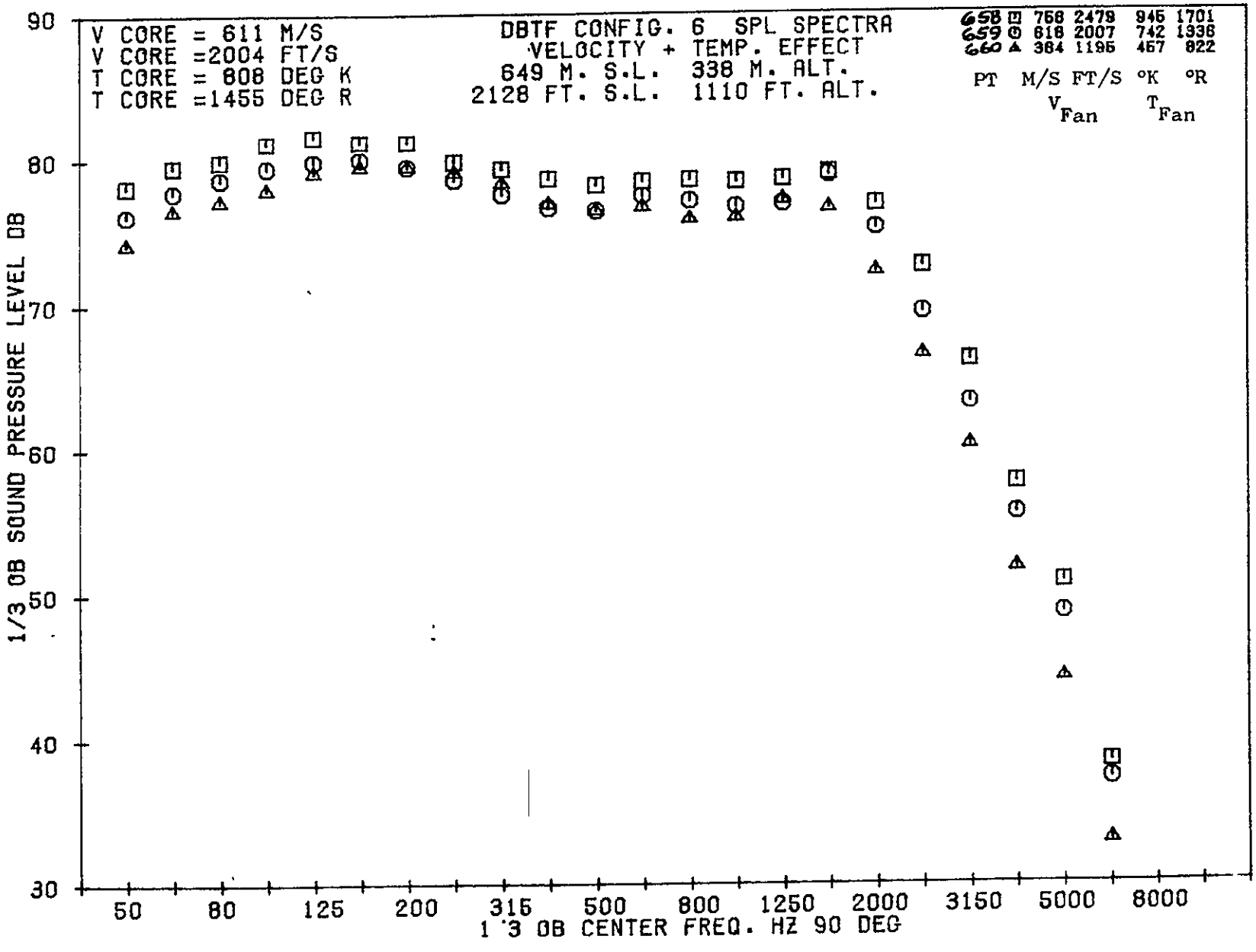

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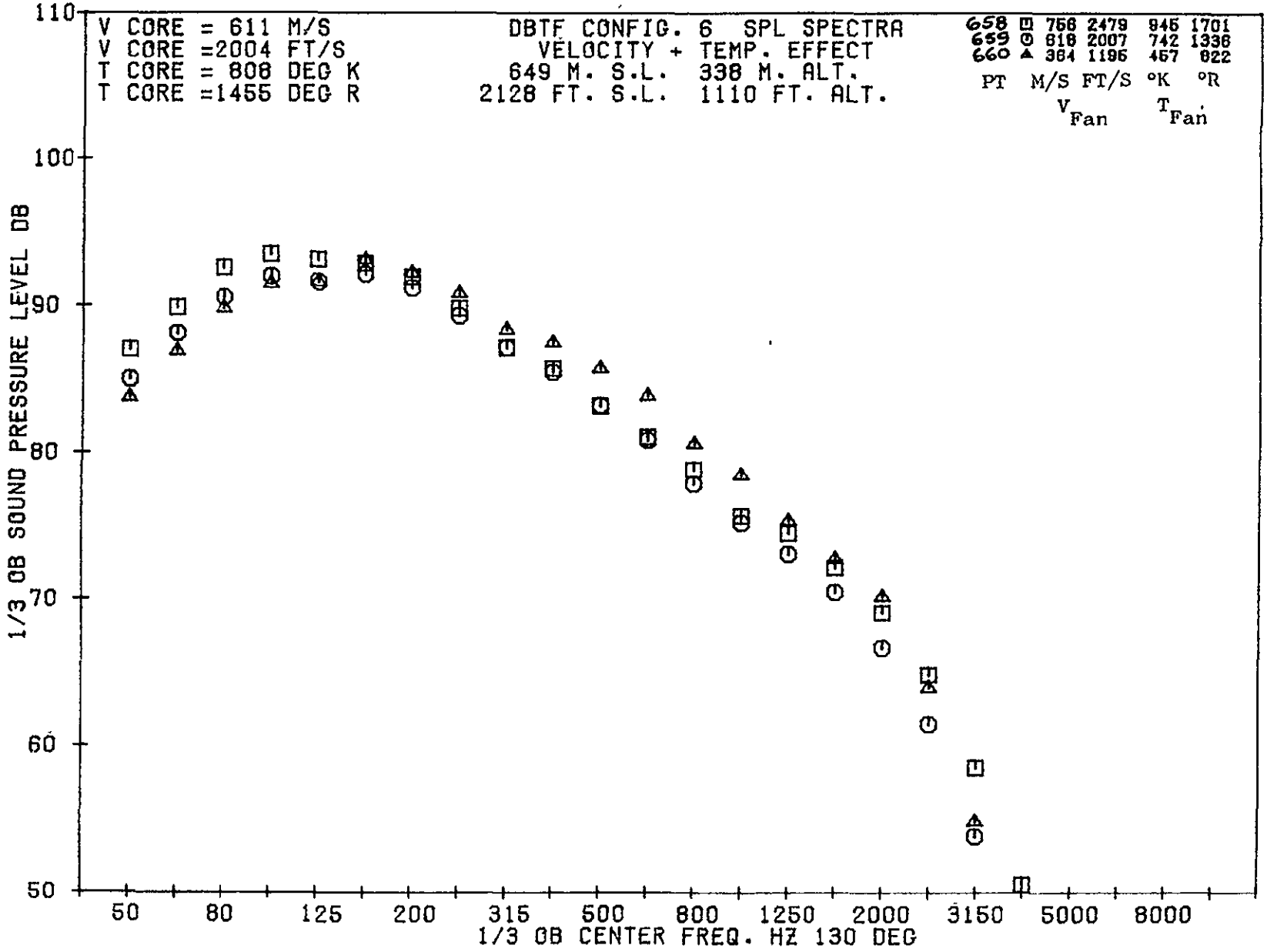

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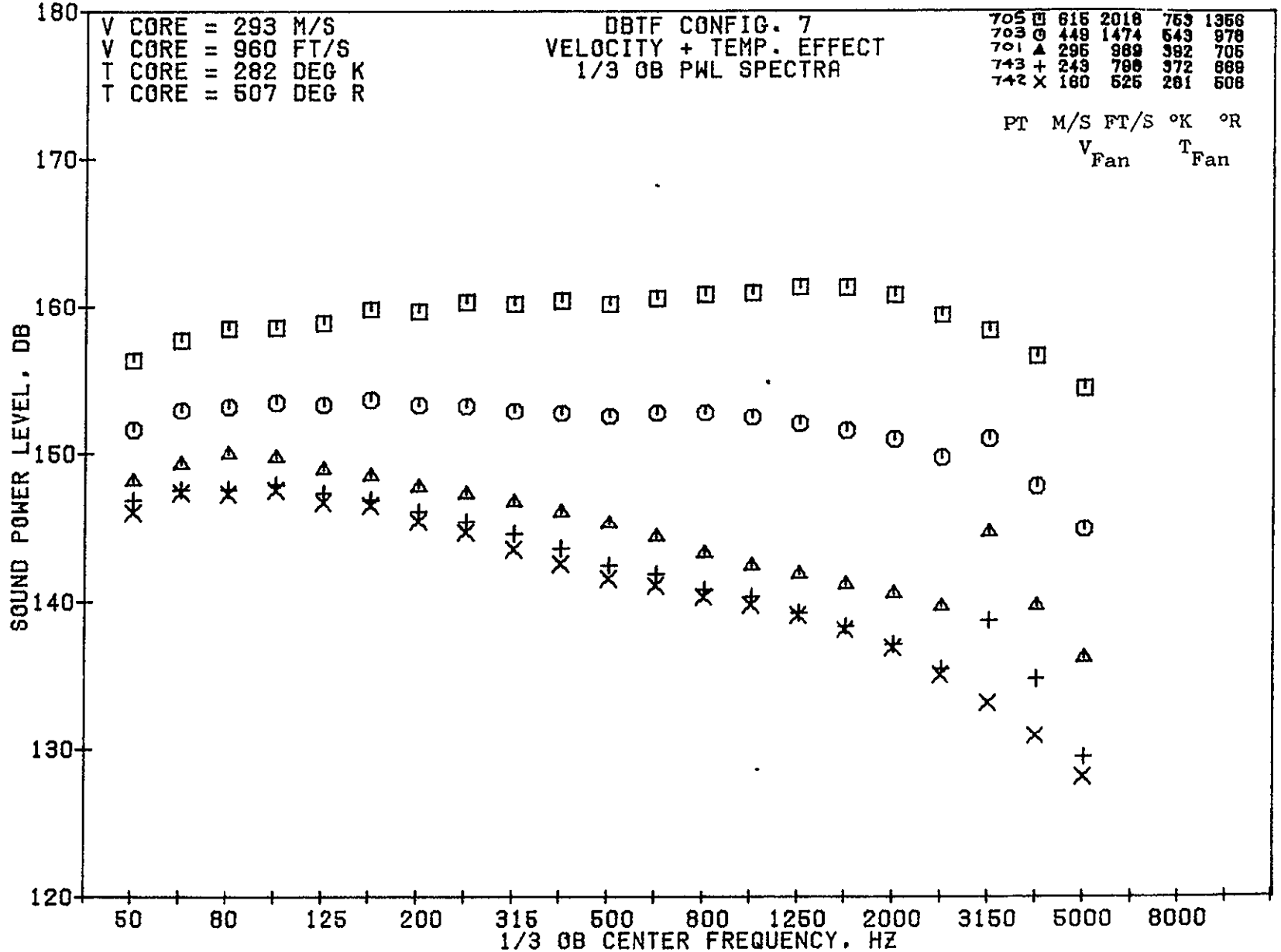

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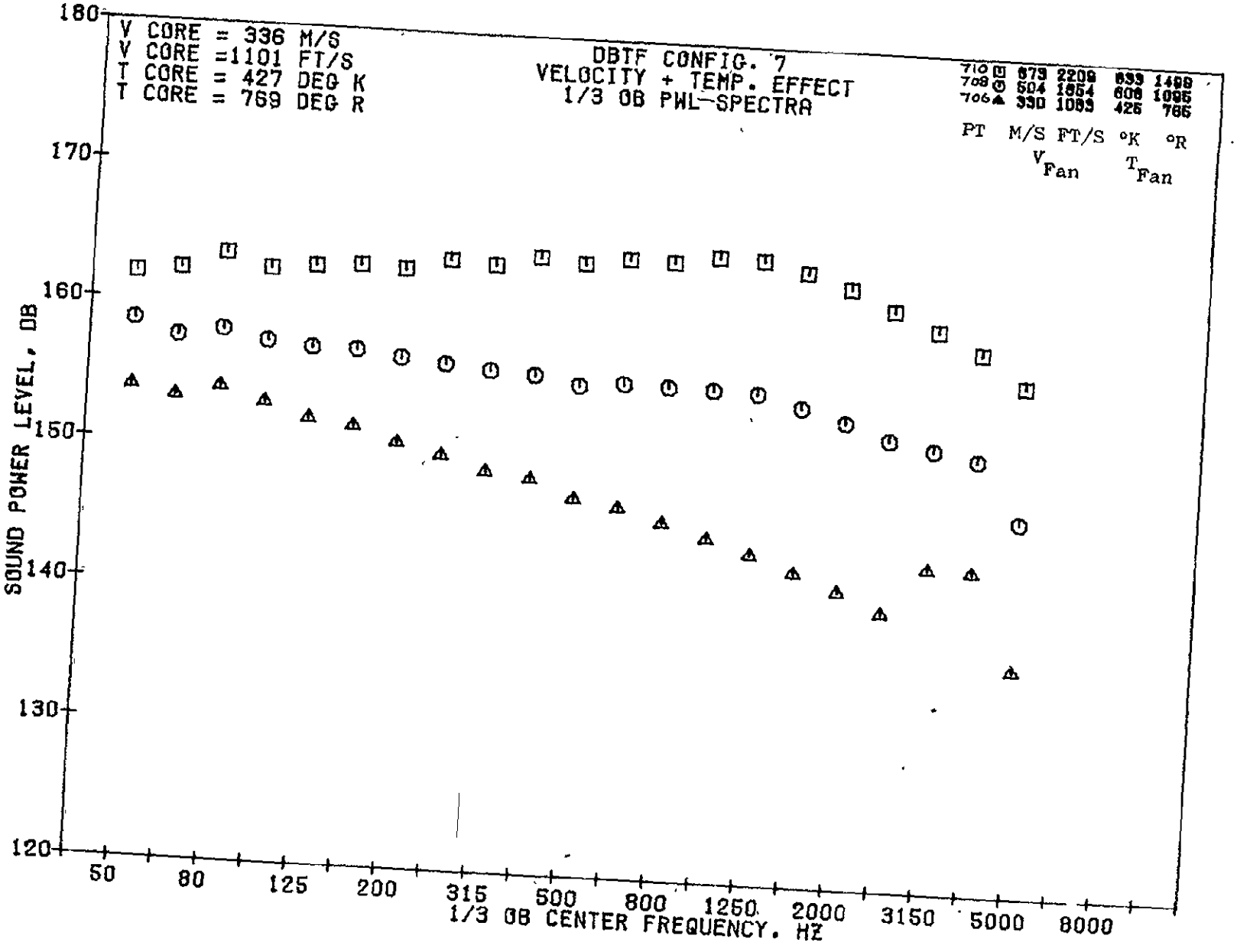

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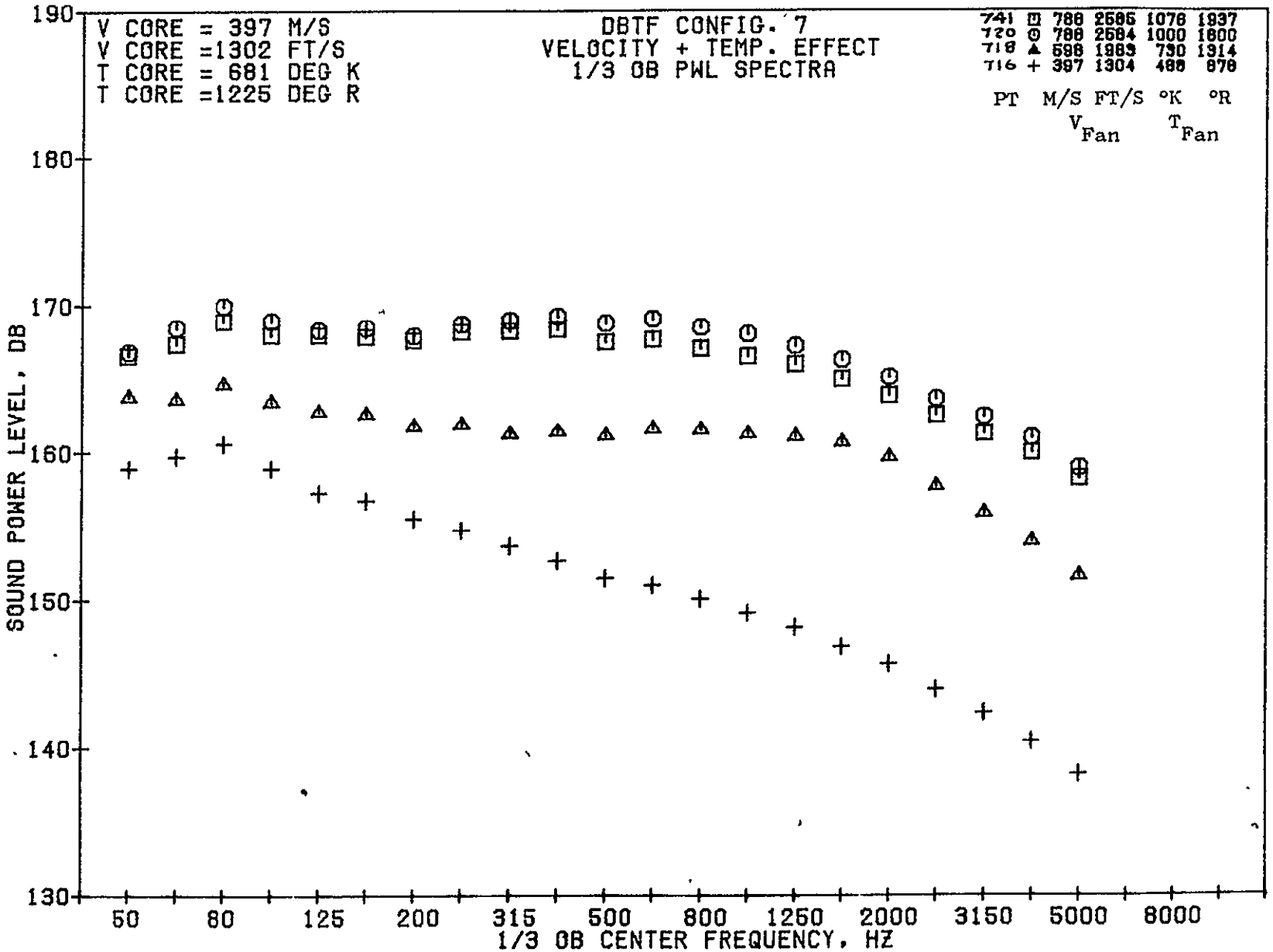

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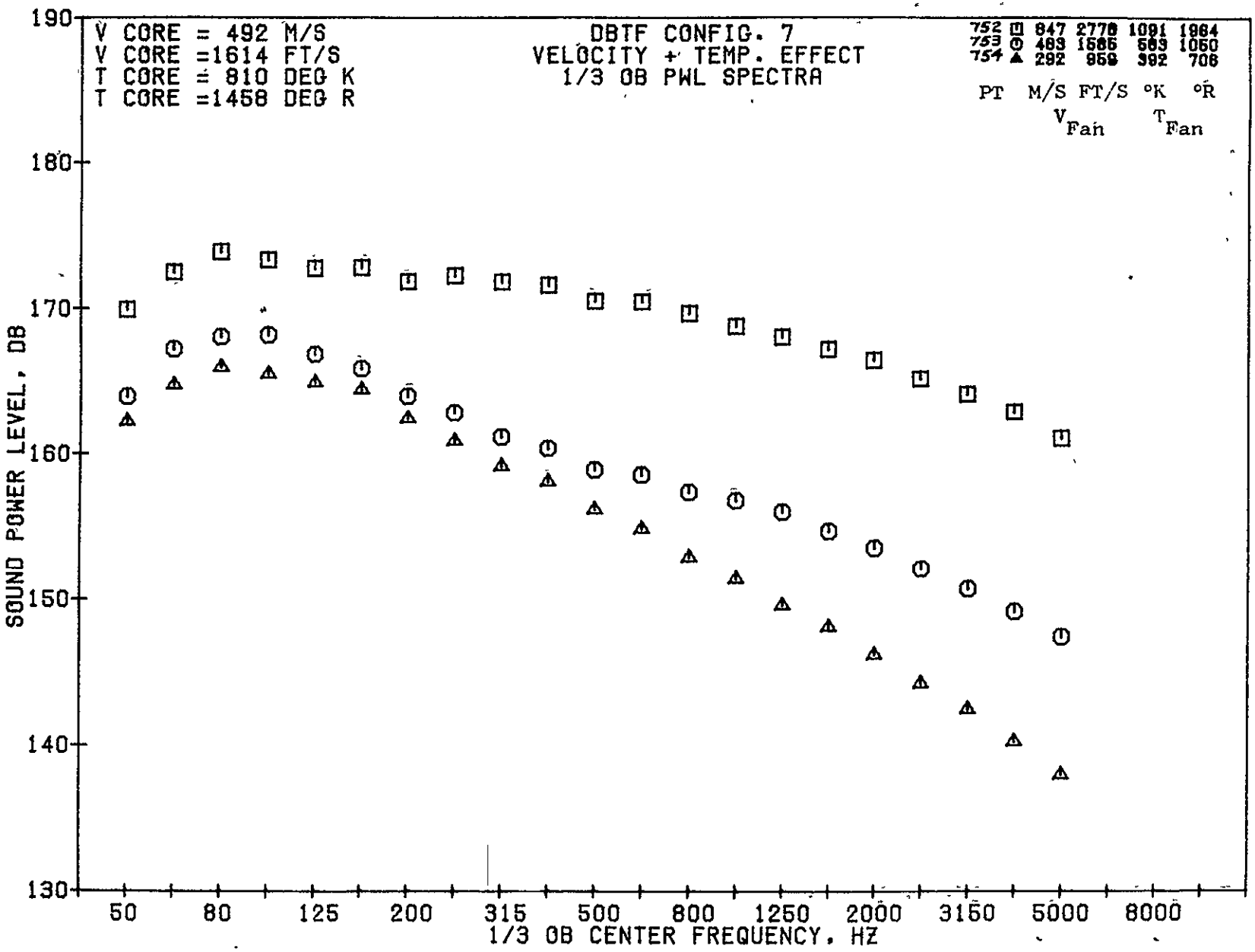

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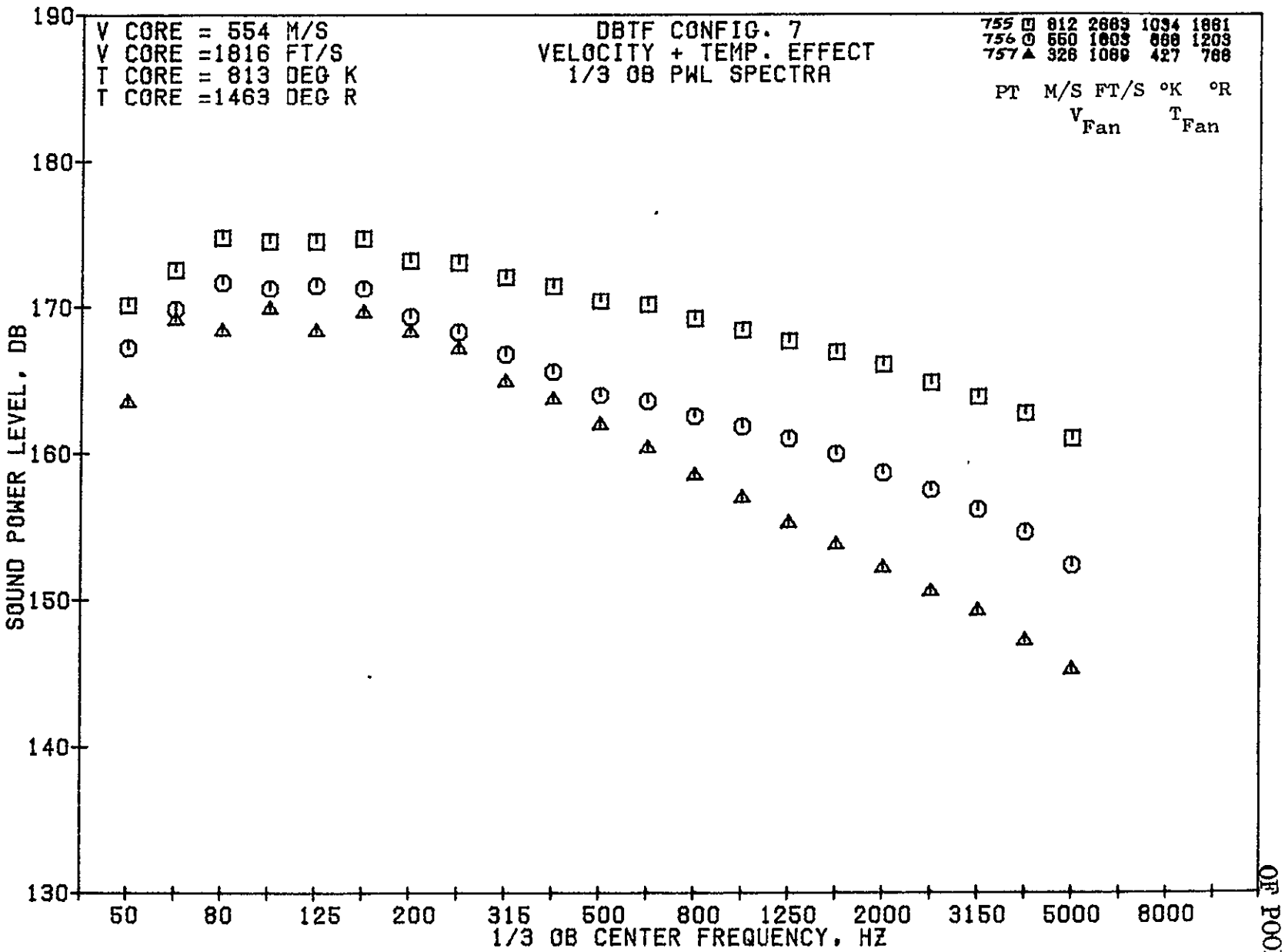

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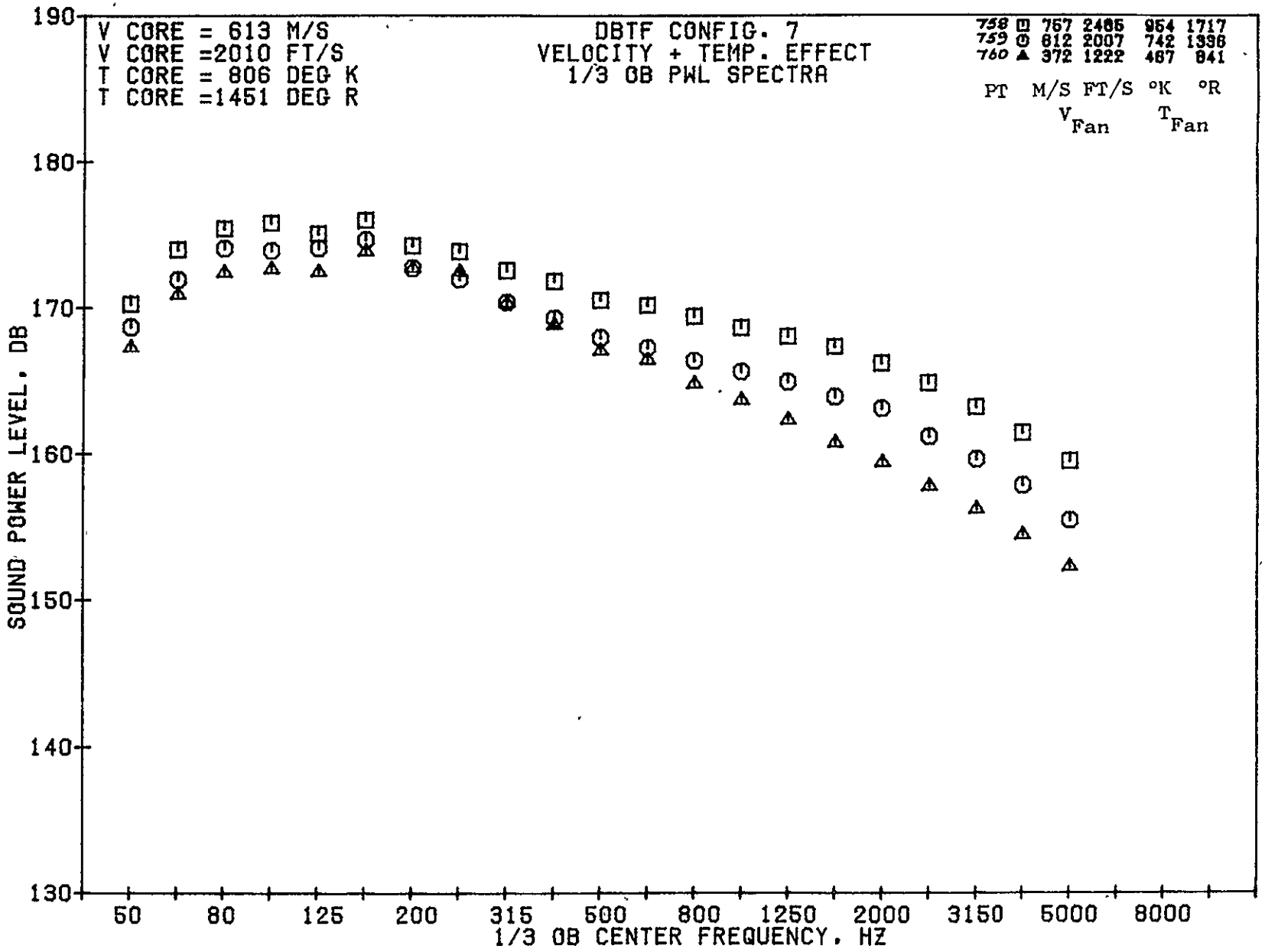

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79 BURCH A.

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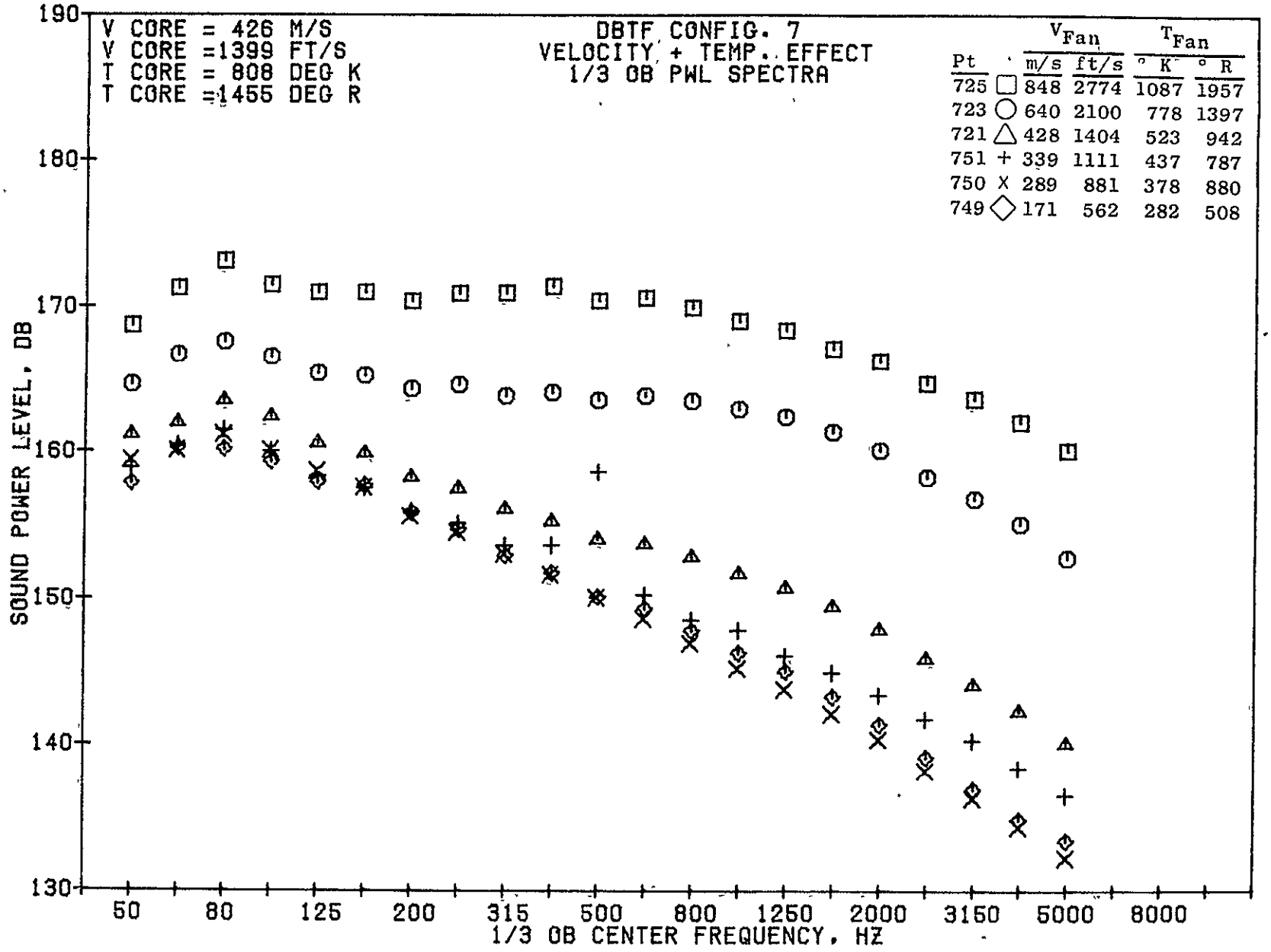

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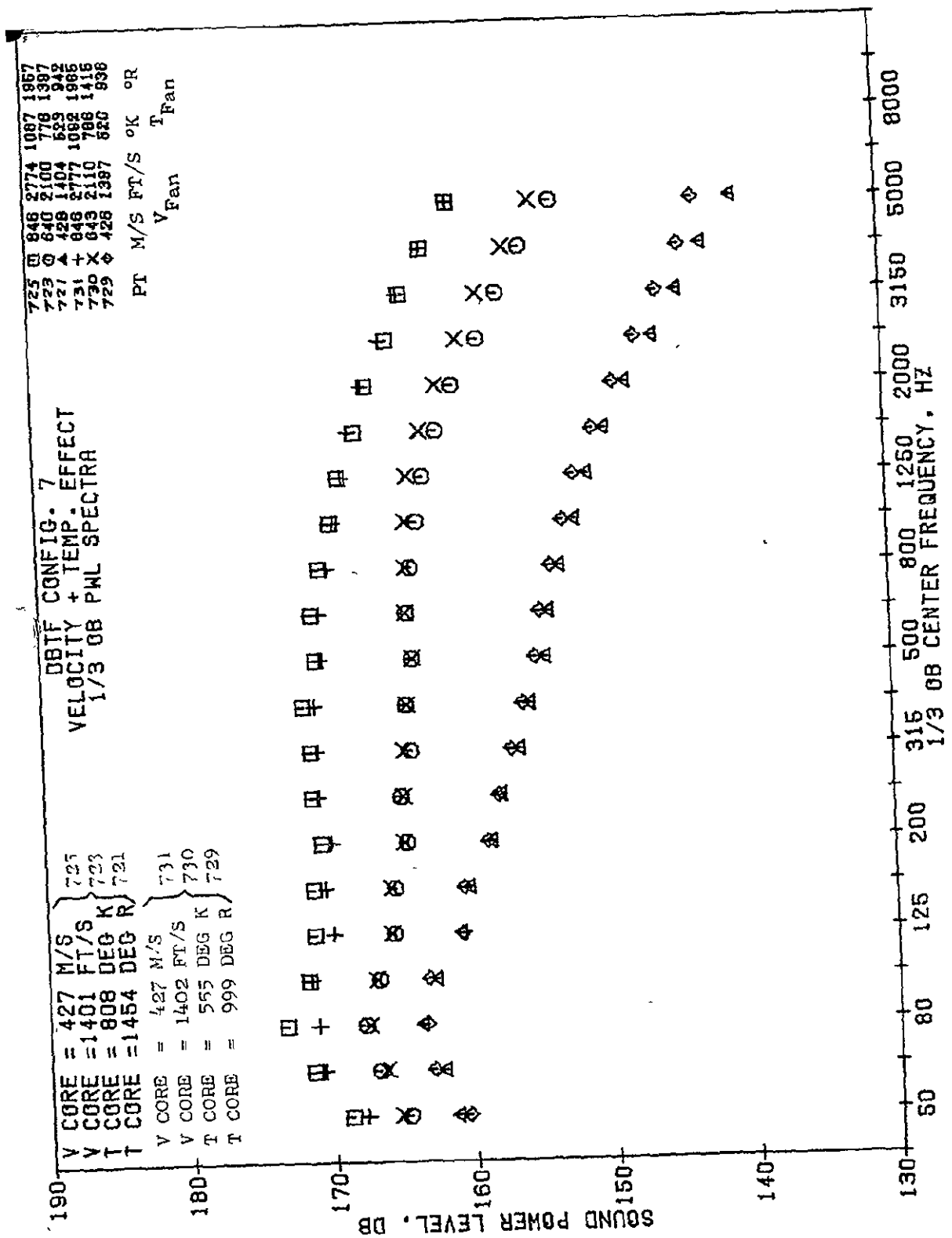

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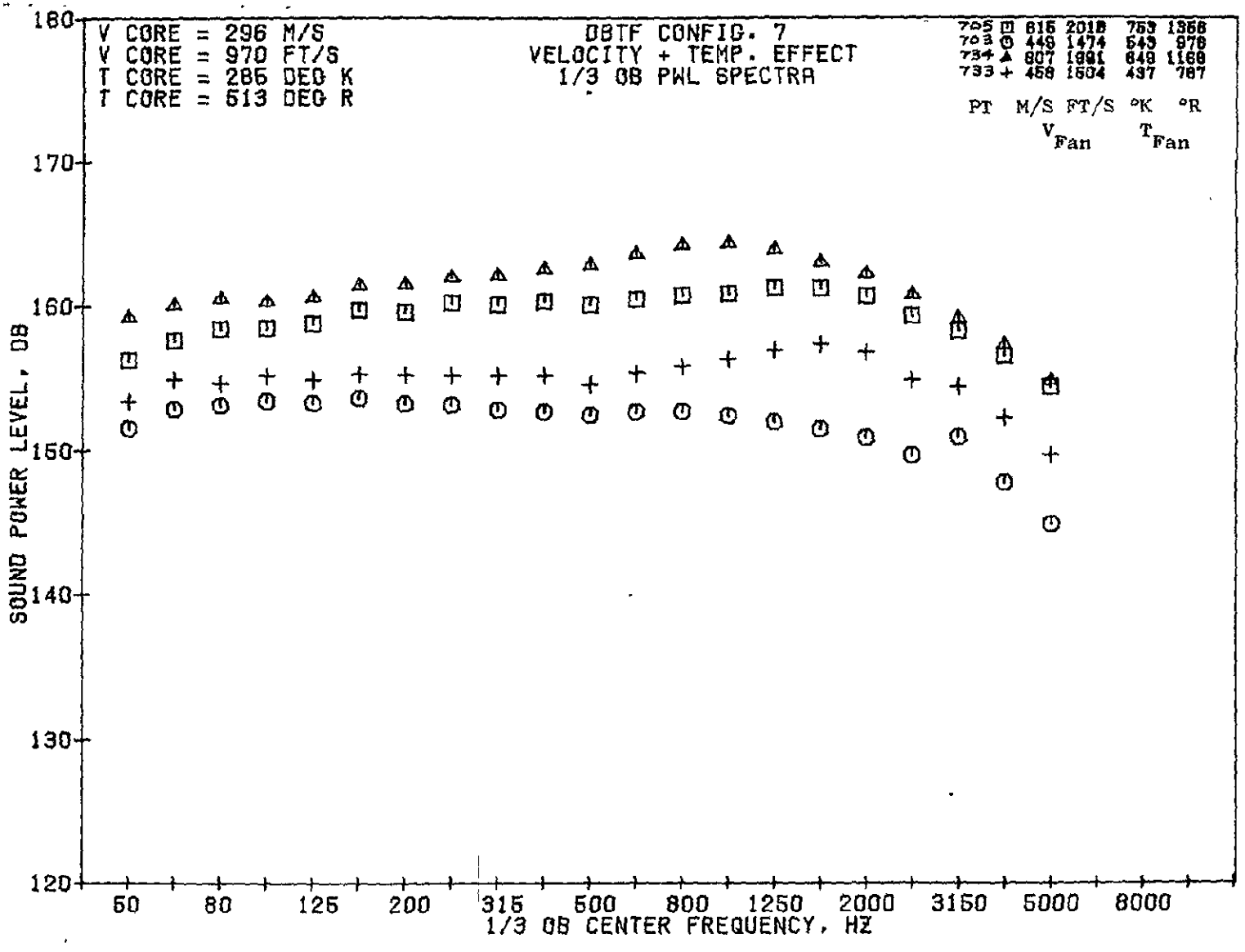

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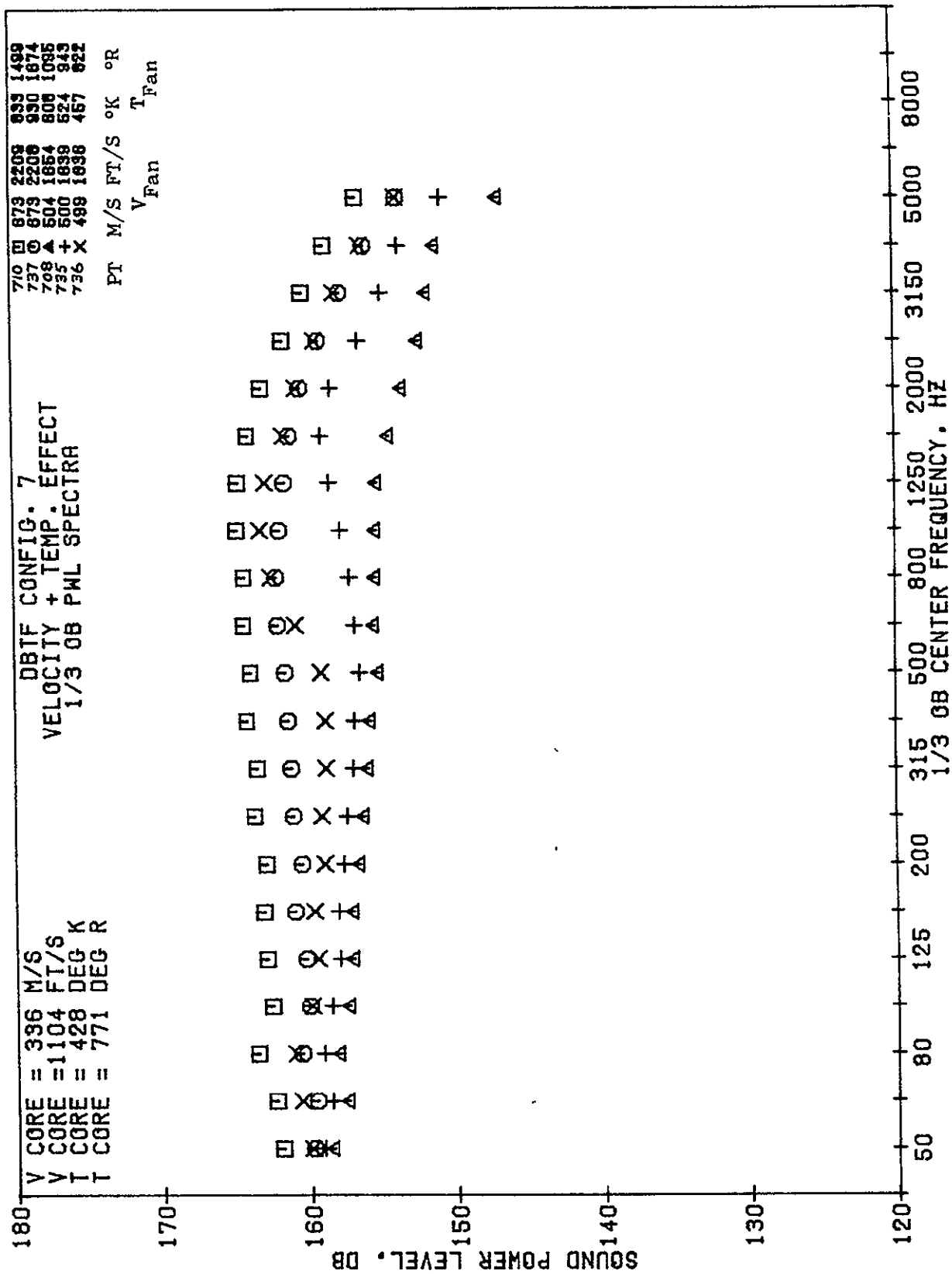

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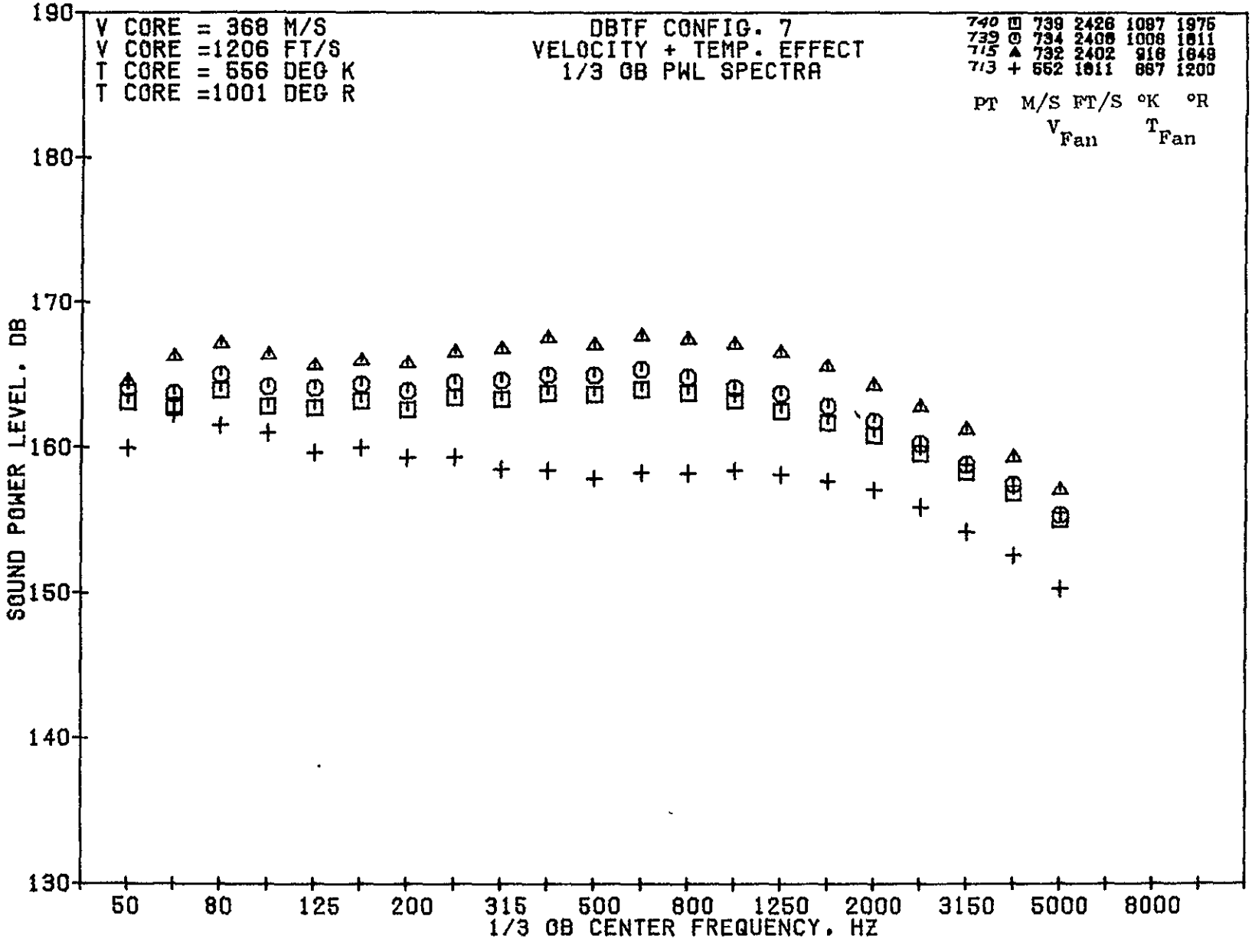

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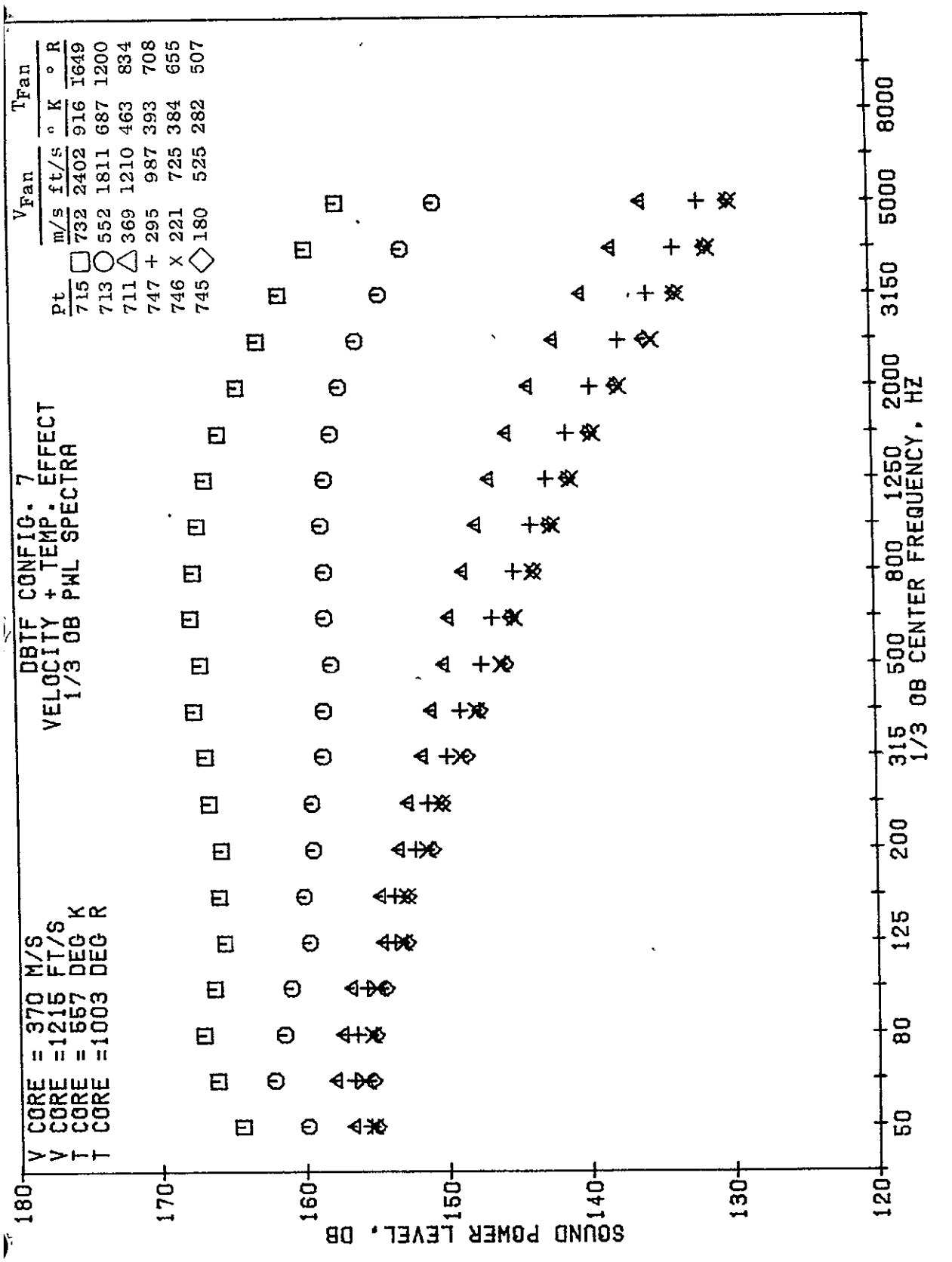

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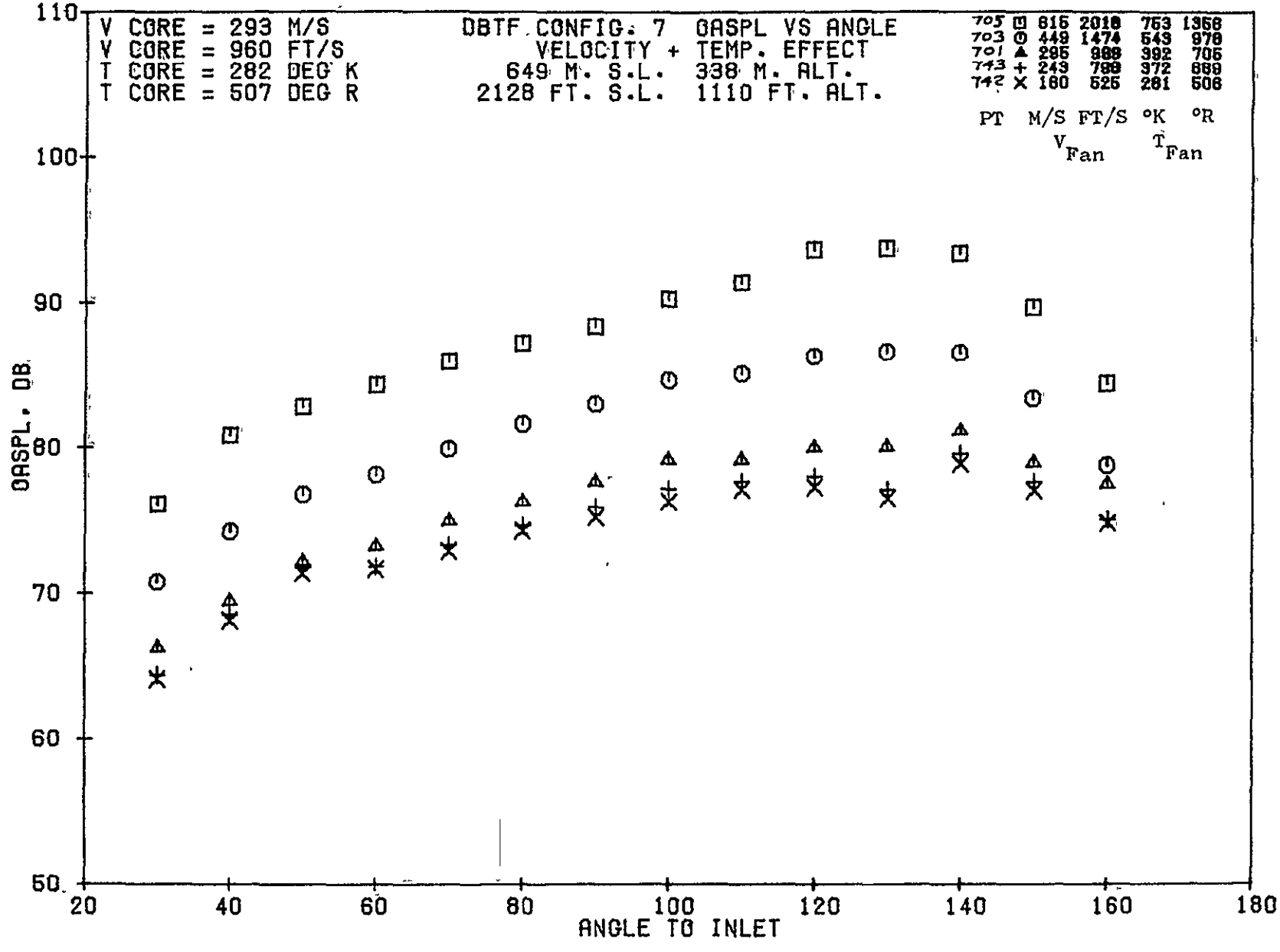

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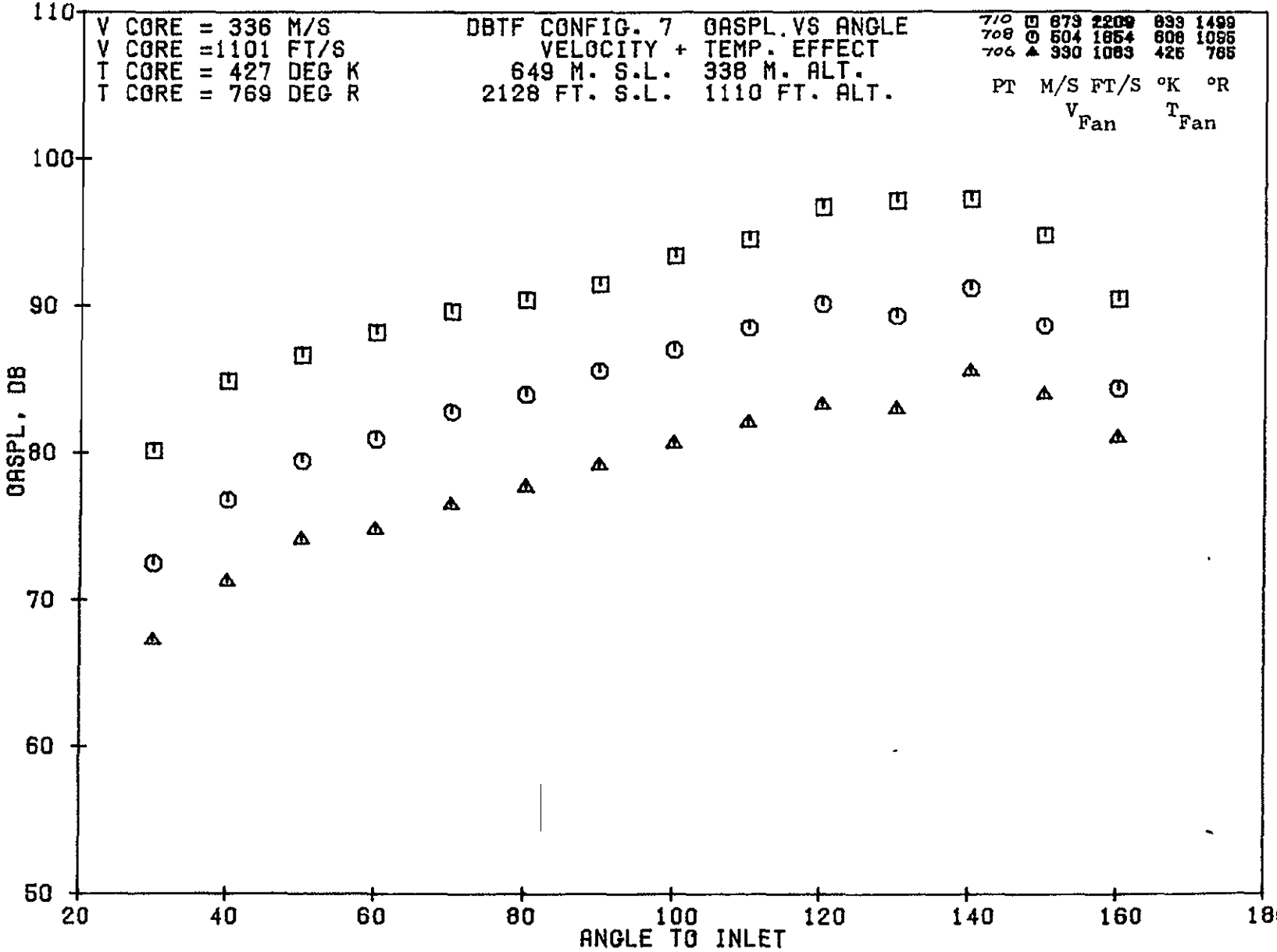

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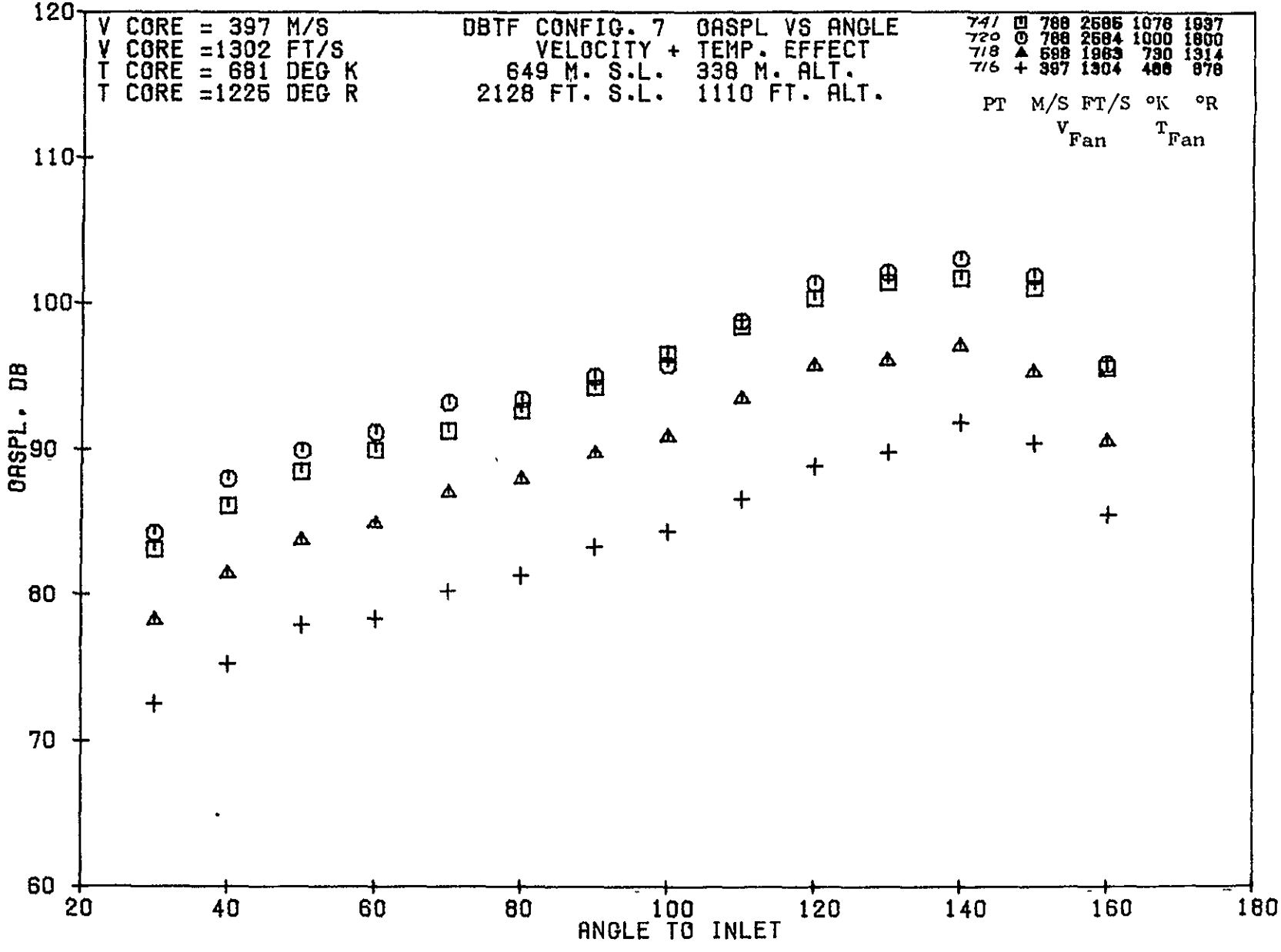

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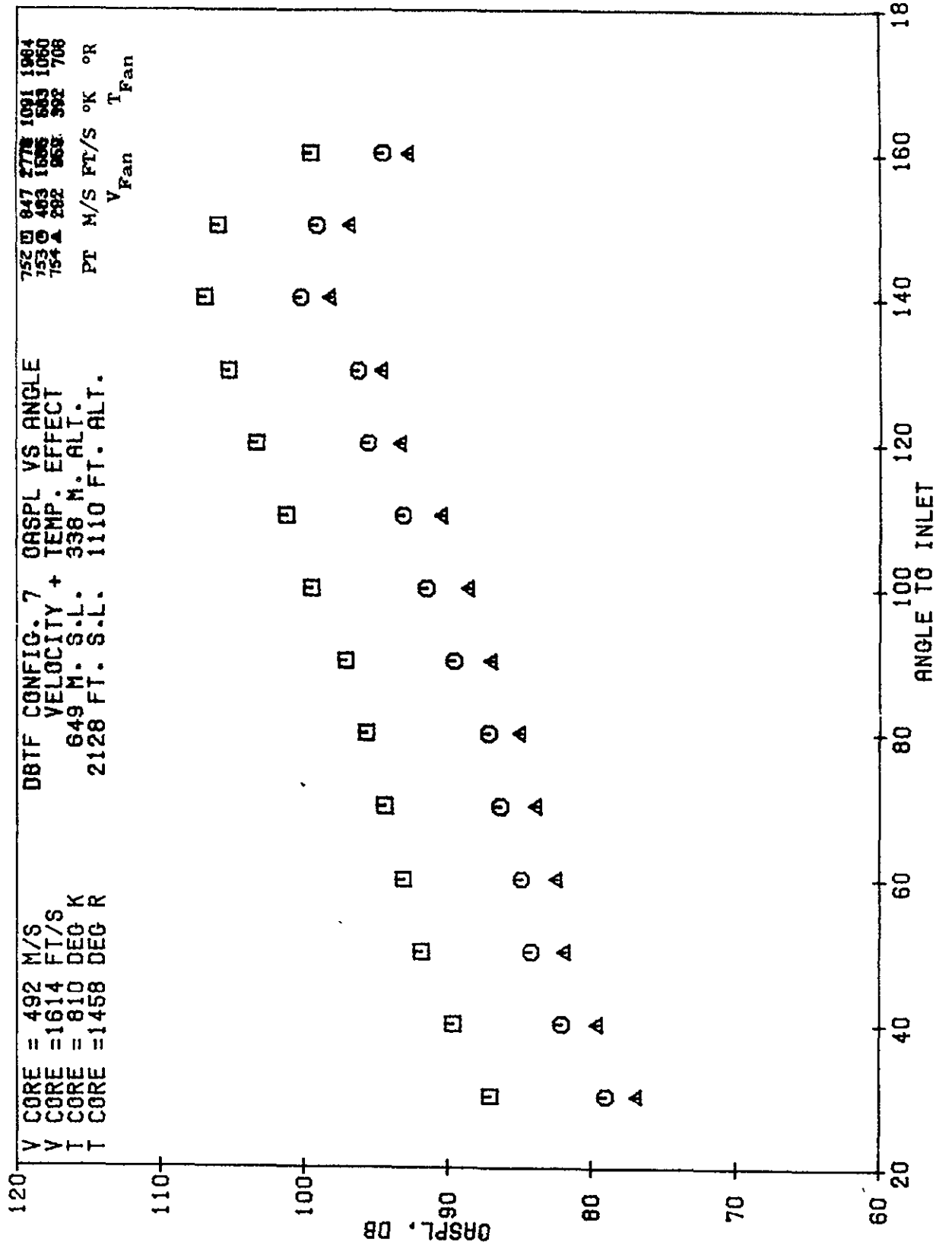

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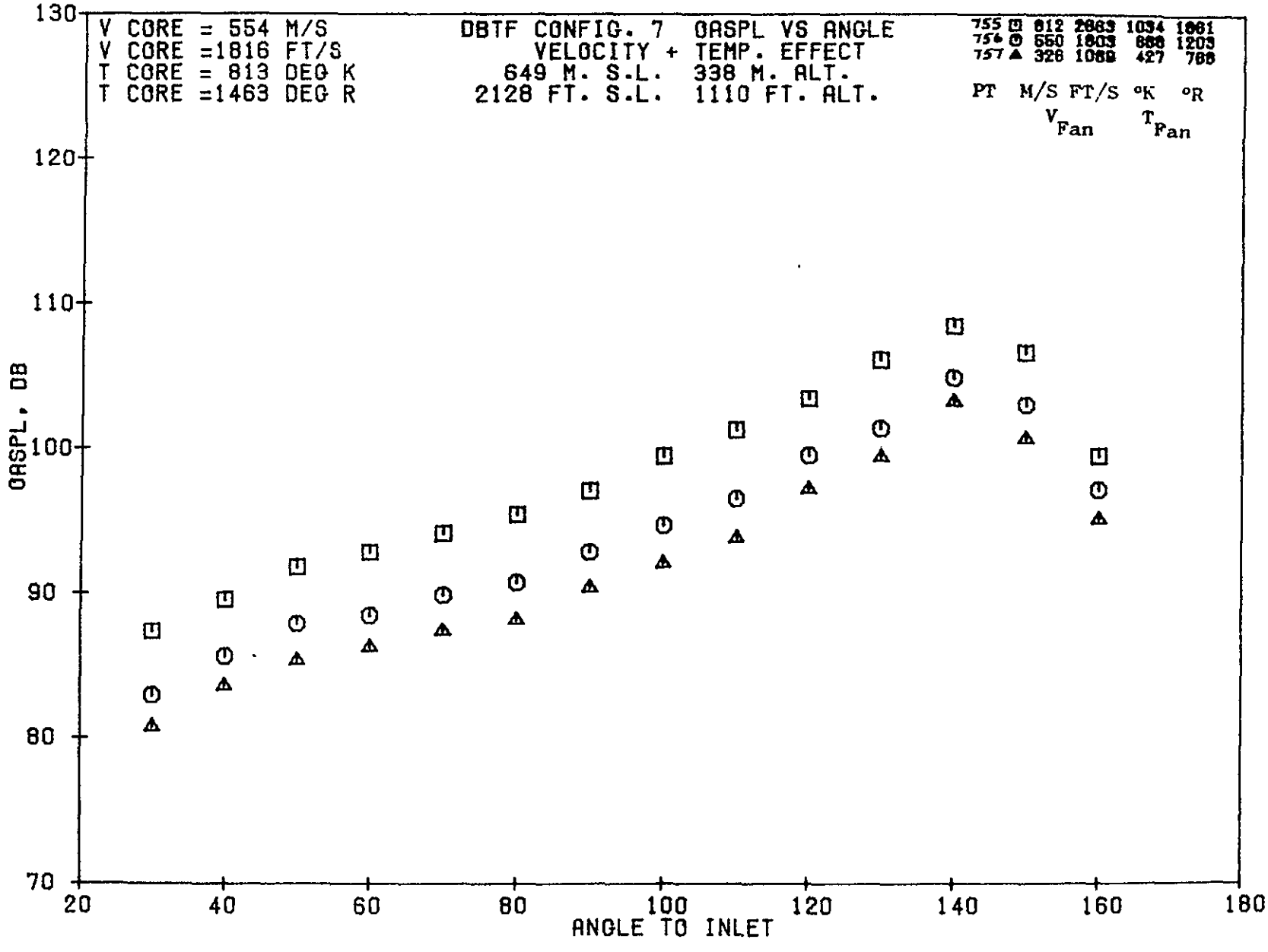

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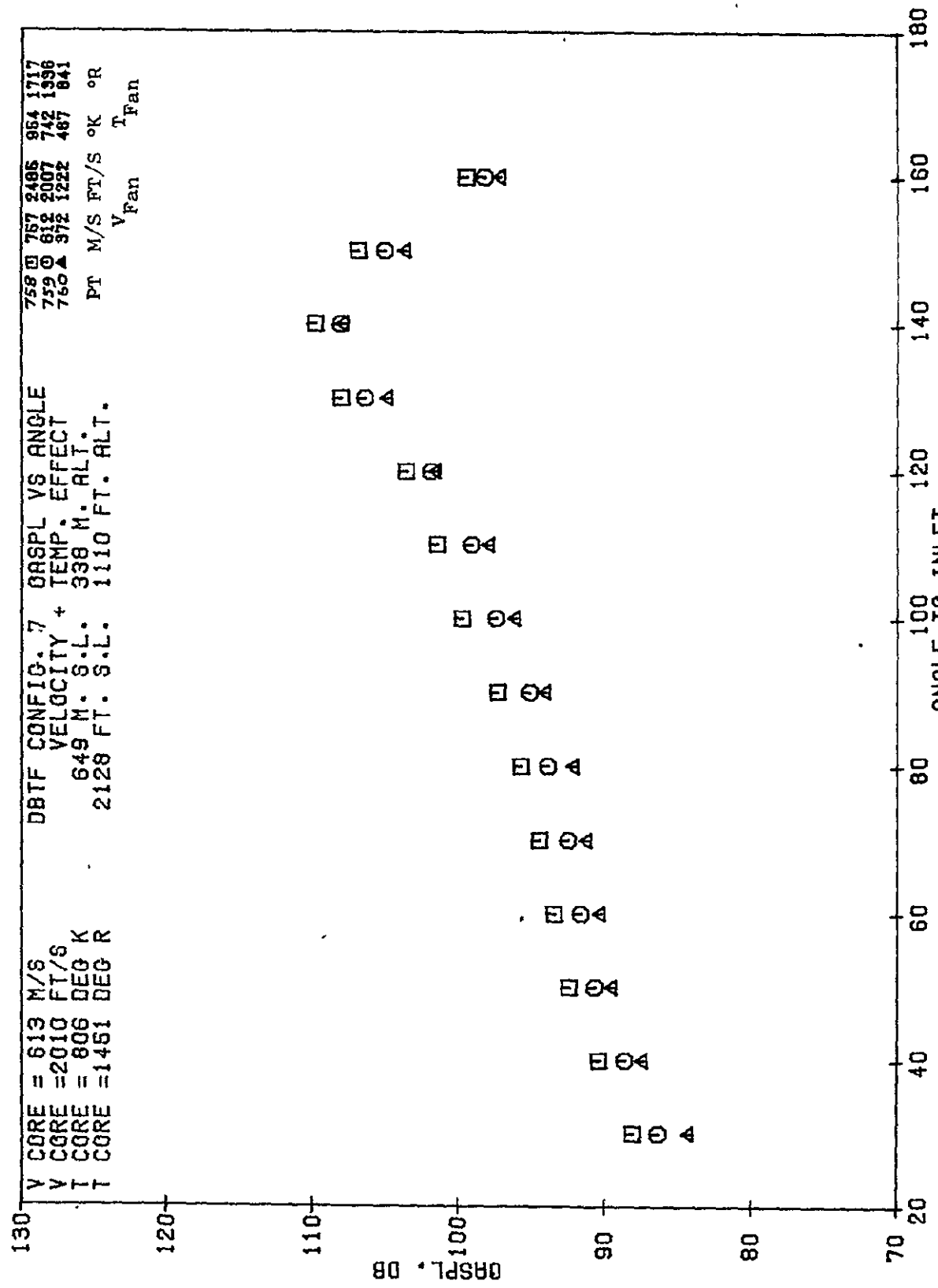

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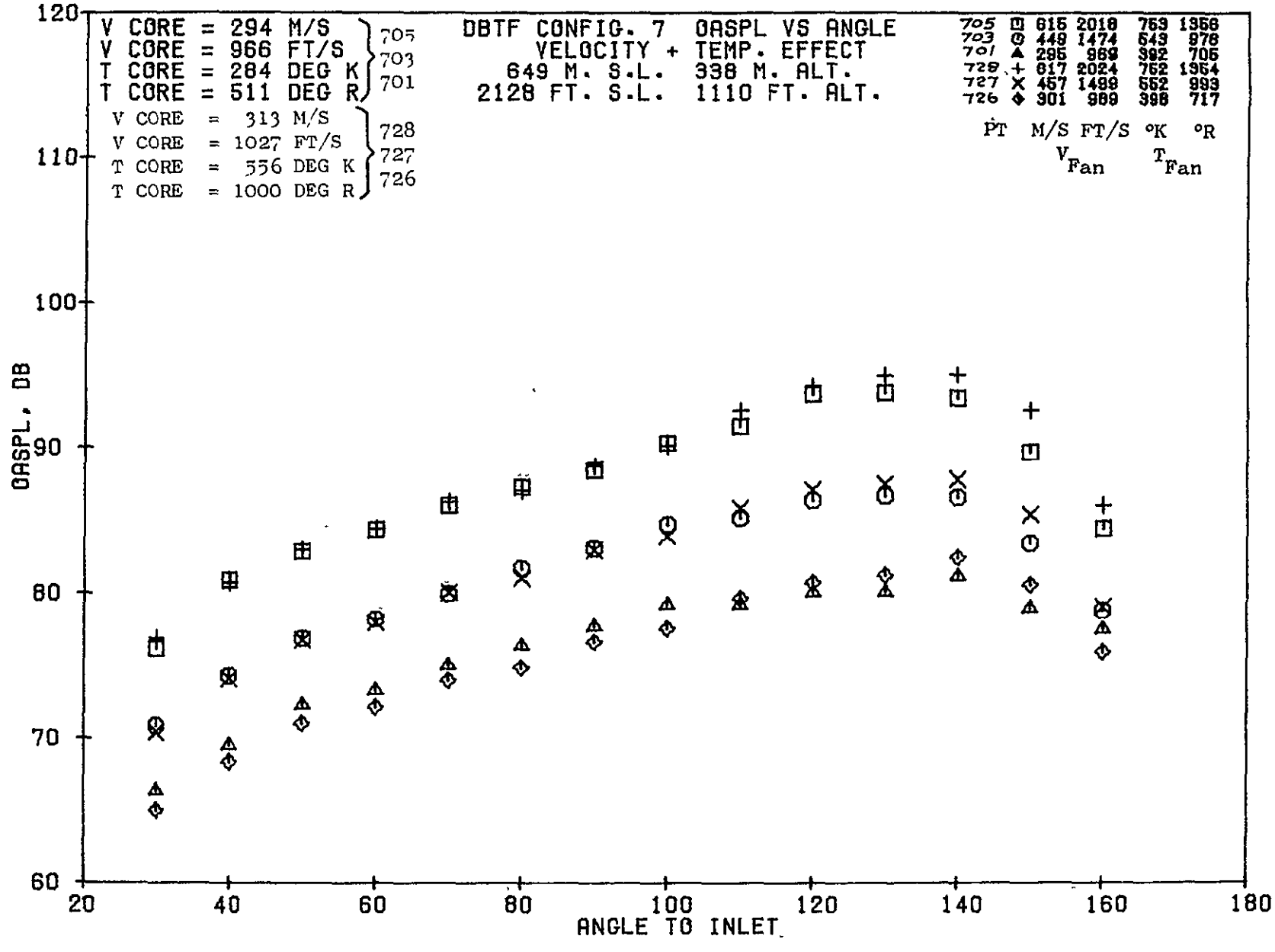

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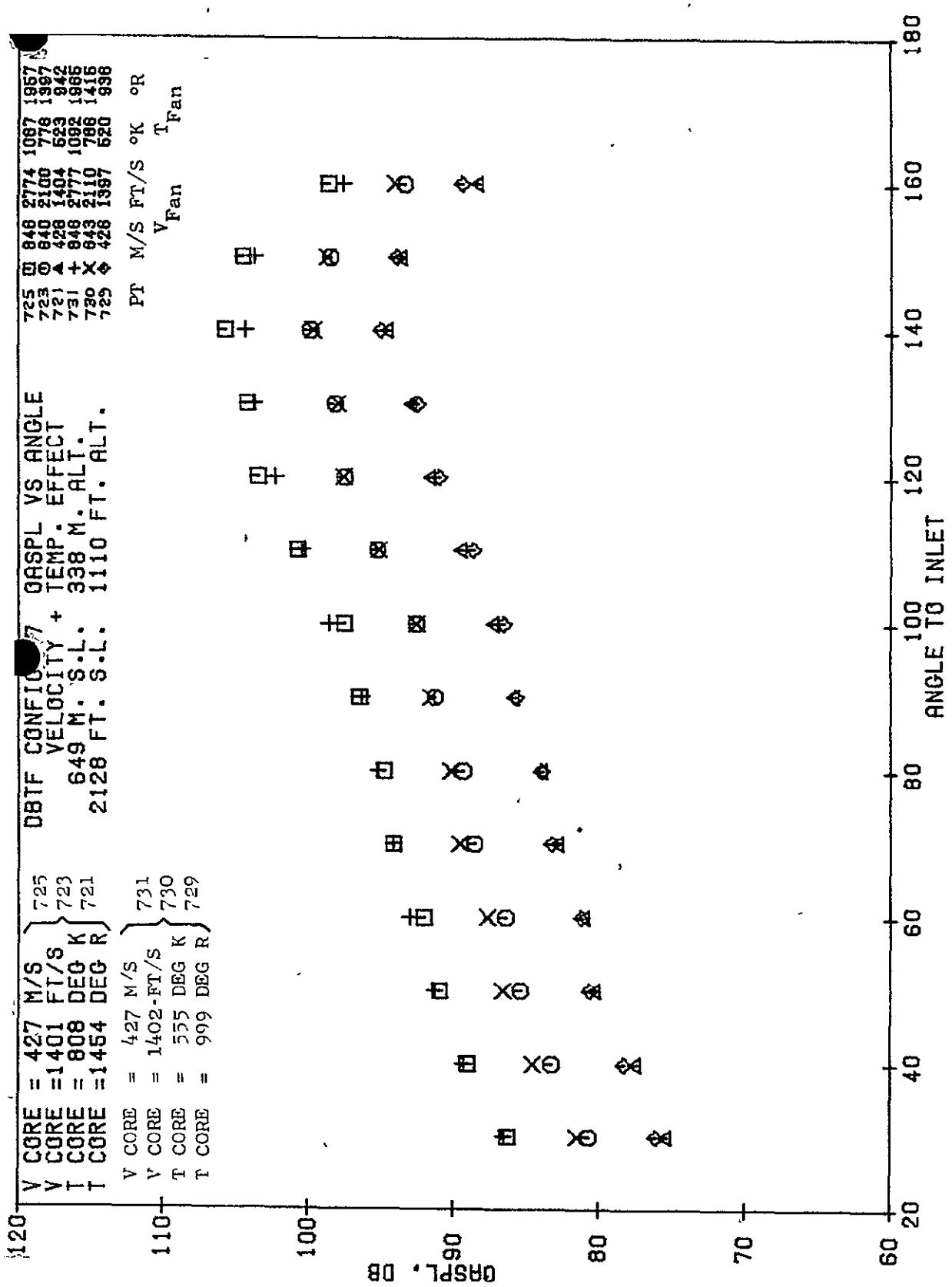

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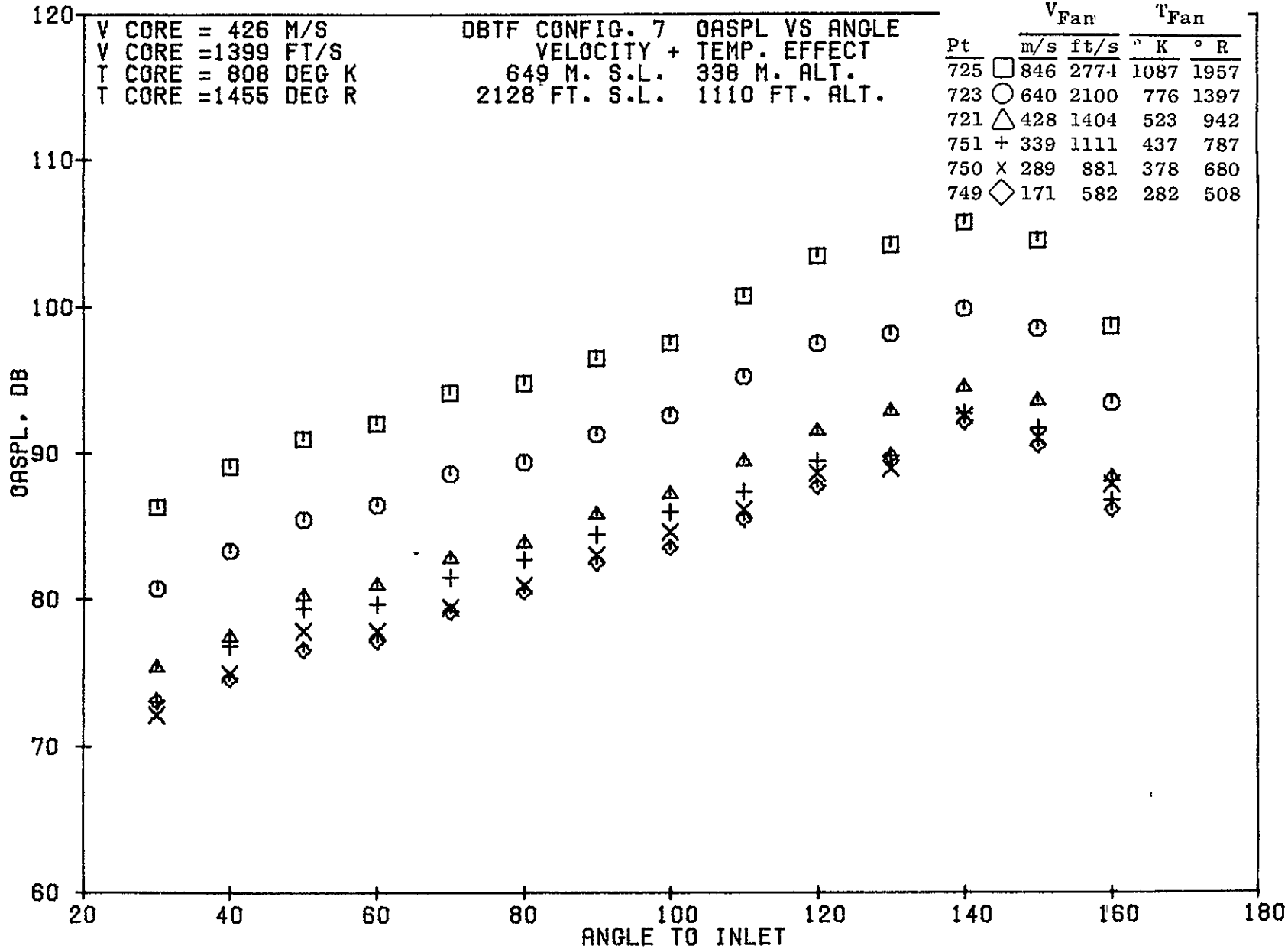

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723	○	640	2100	776	1397
721	△	428	1404	523	942
751	+	339	1111	437	787
750	X	289	881	378	680
749	◇	171	582	282	508

1530

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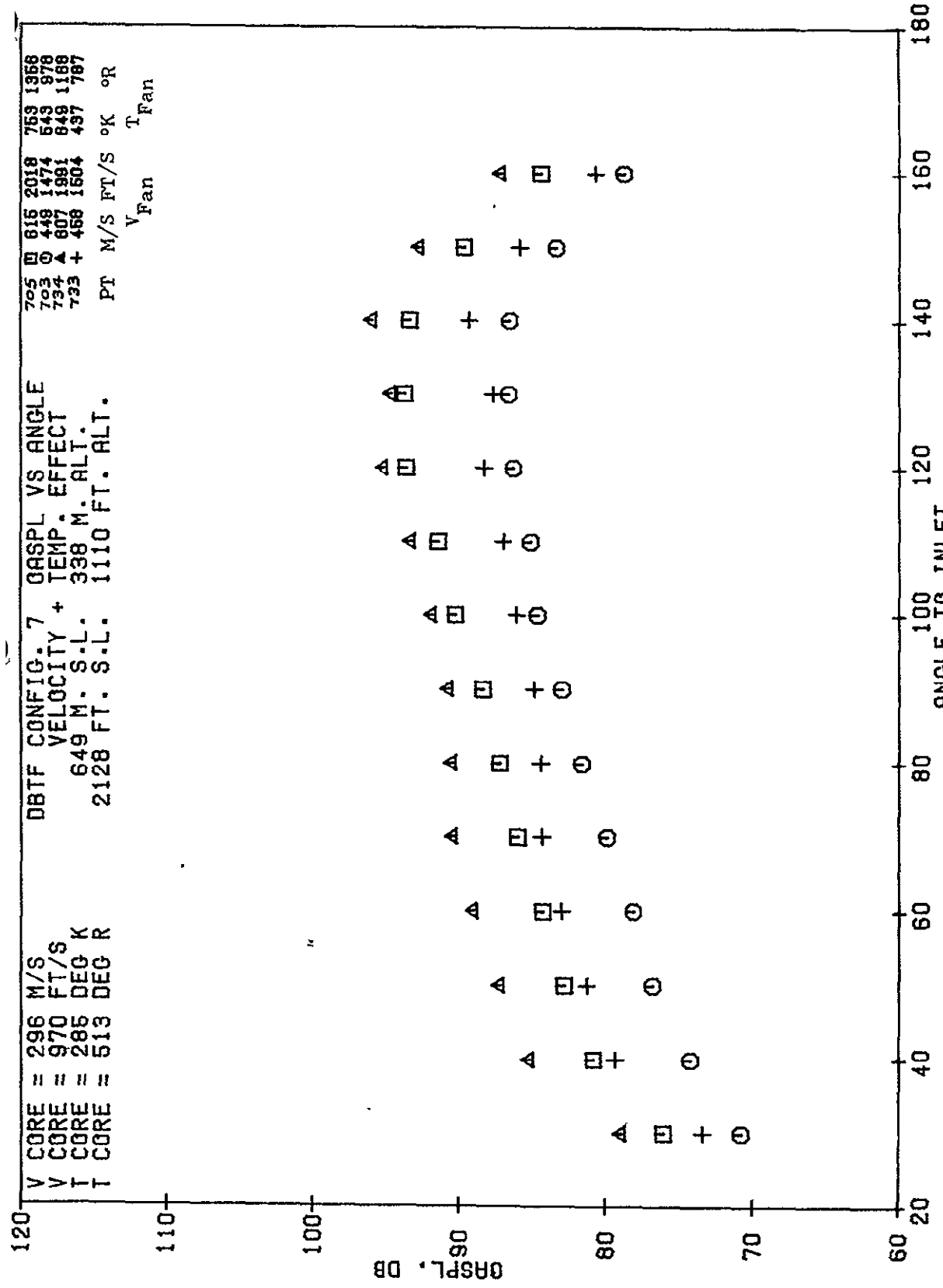
5R412-001

79 BUR[illegible] A.



79 BURCH A.

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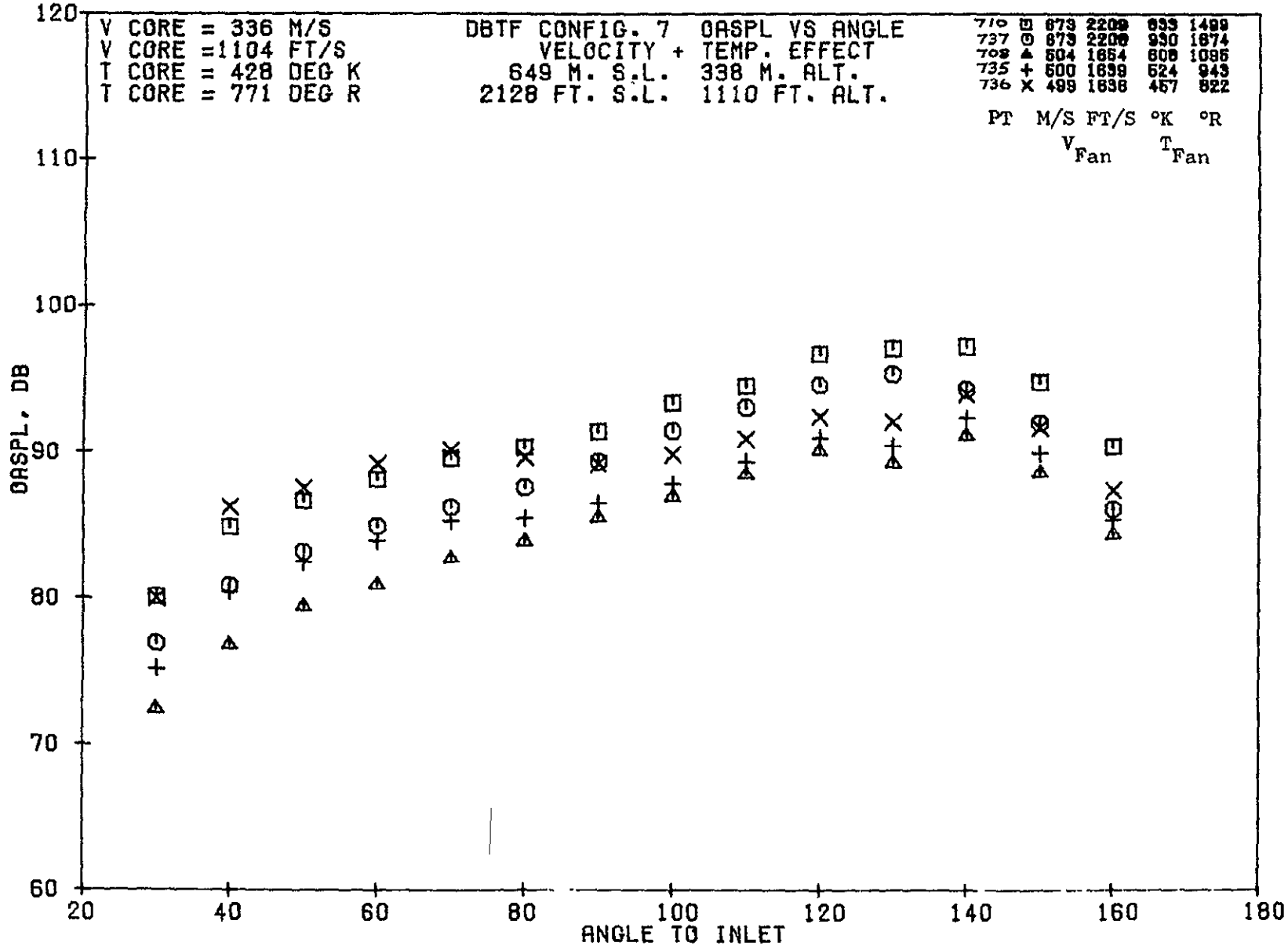

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08/22/75
5R682-001

79 BUR[redacted] A.

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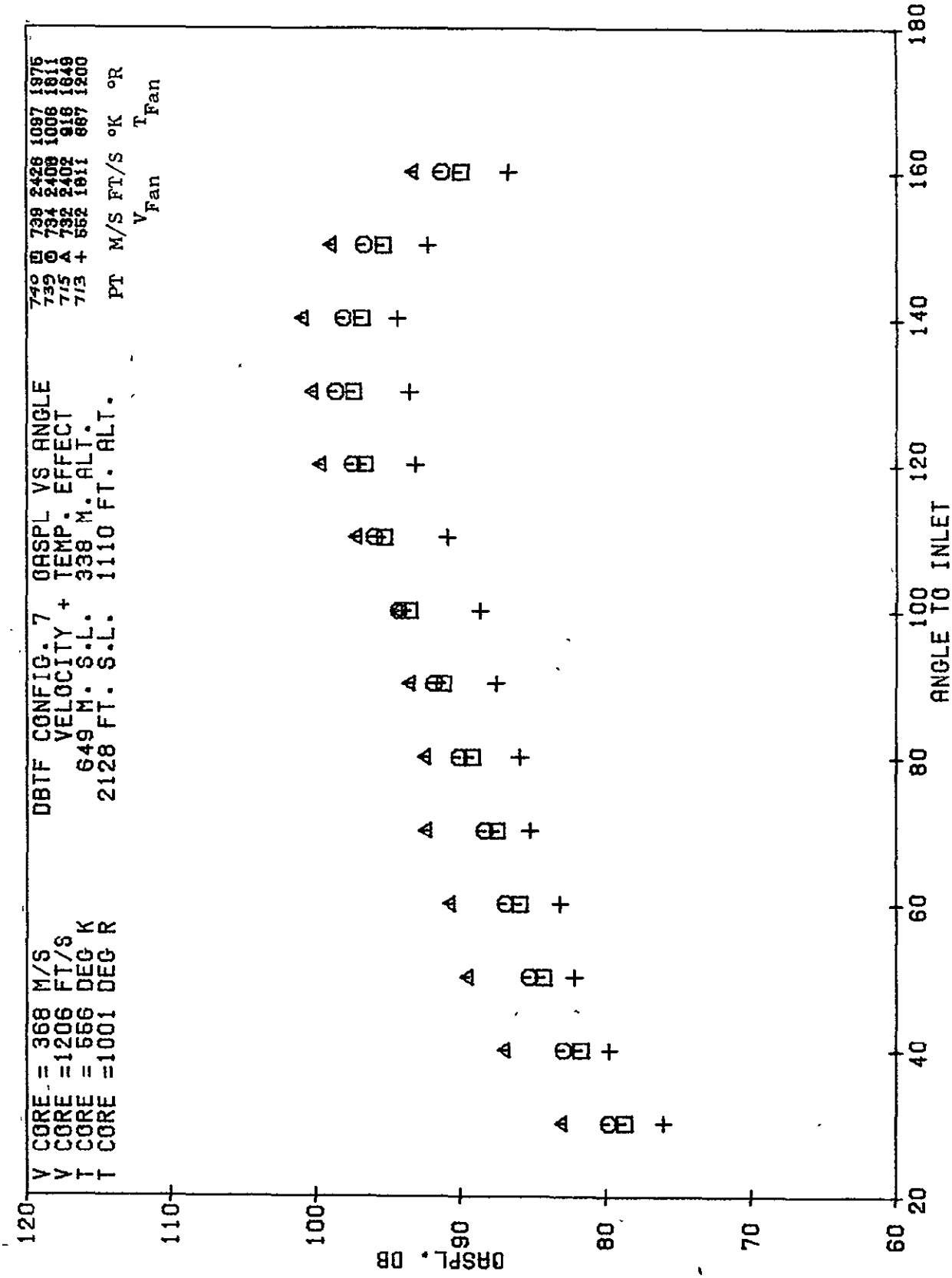

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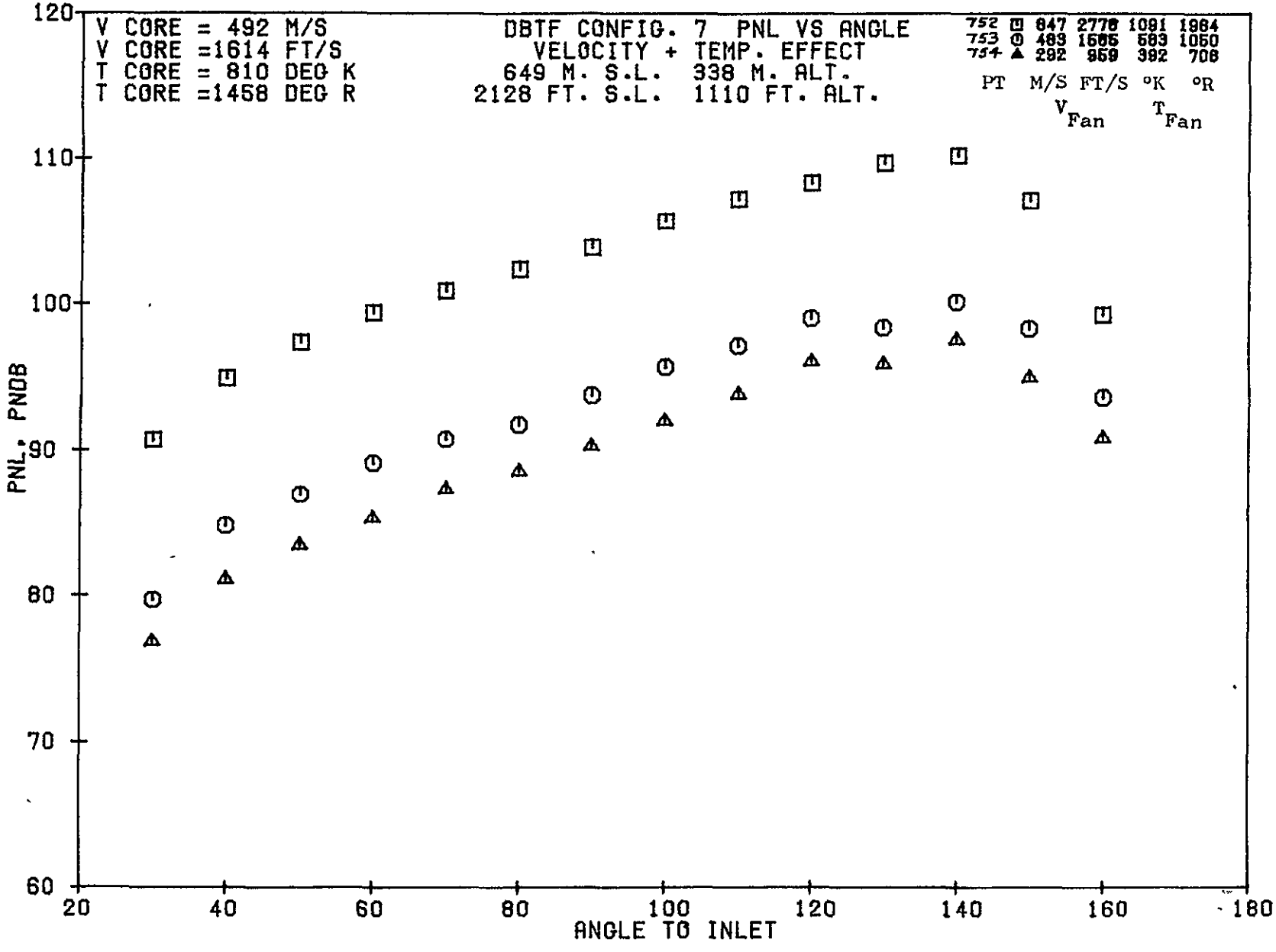
79 BURCH A.

J-295



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79 BURCH A.

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5R412-001

79 BURCH A.

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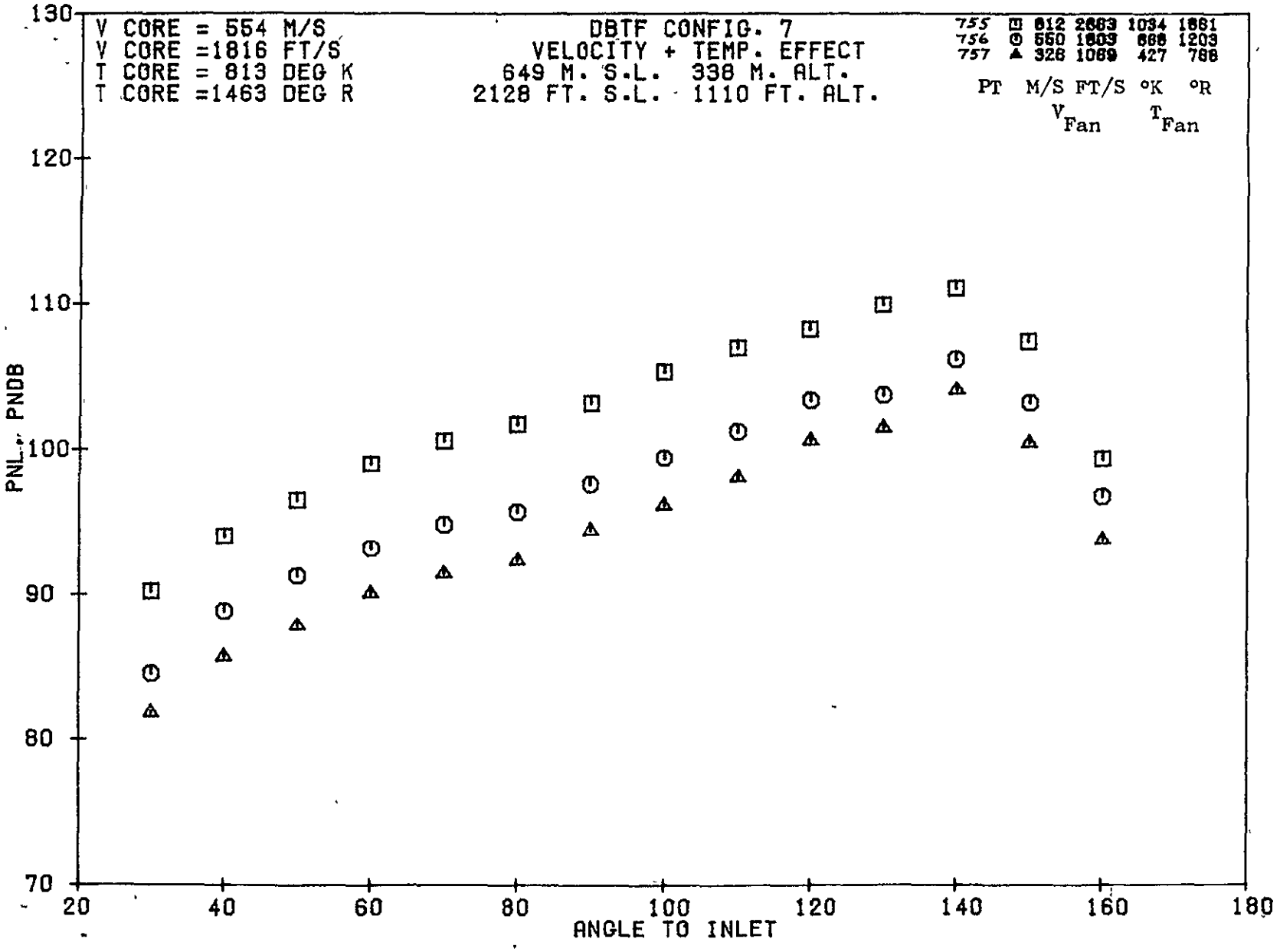

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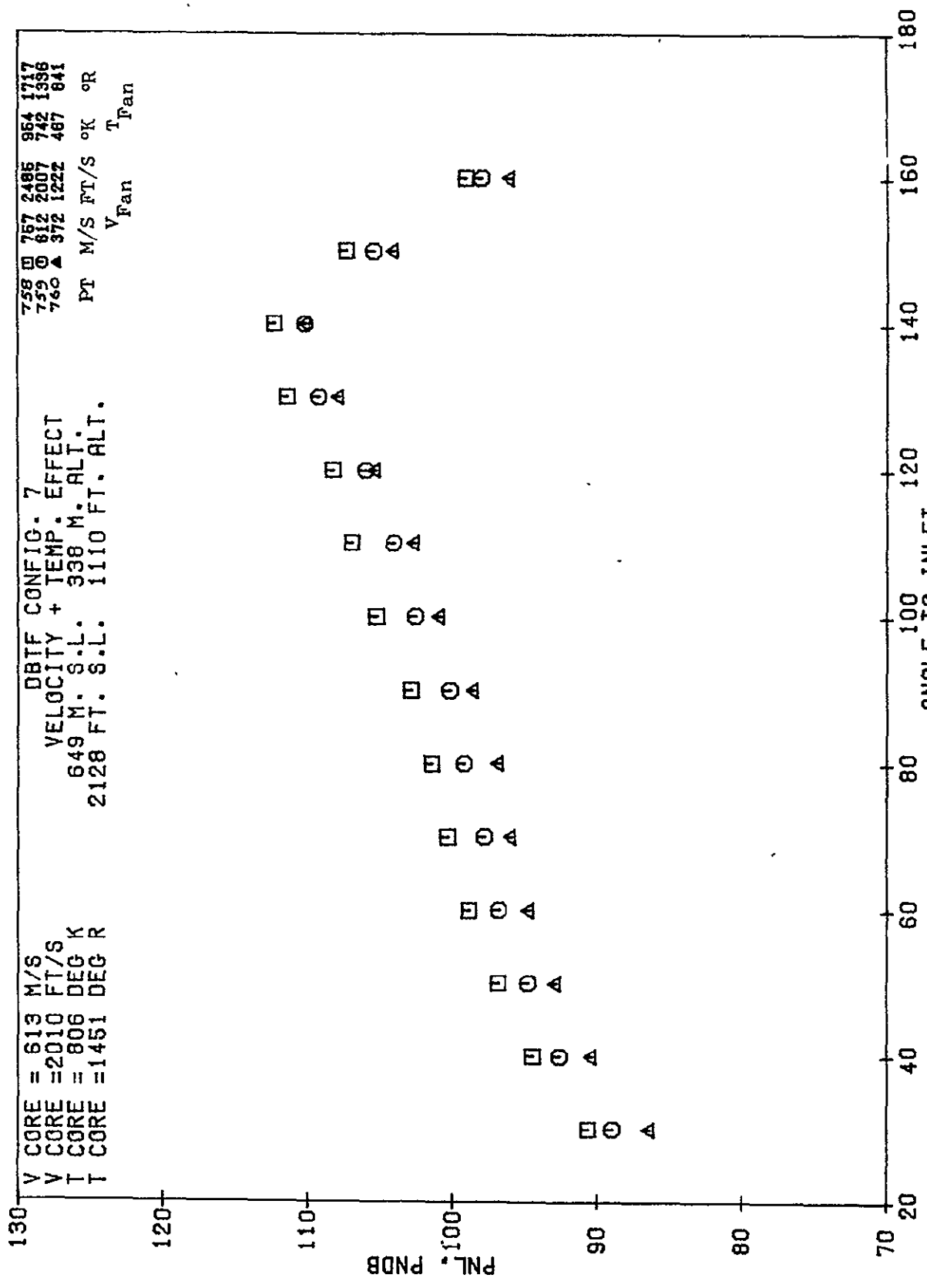
79 BURO[redacted]A.



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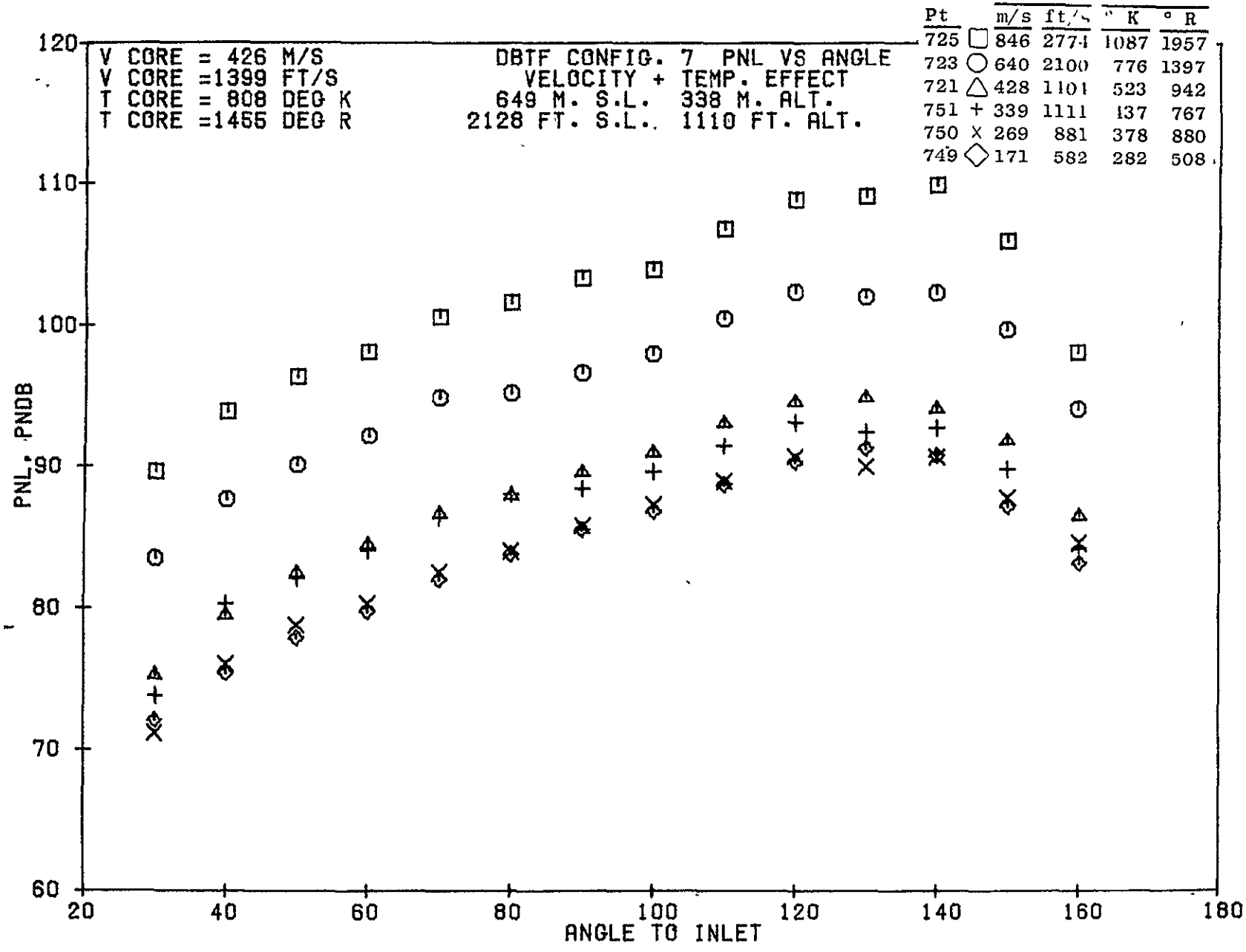

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5R412-001

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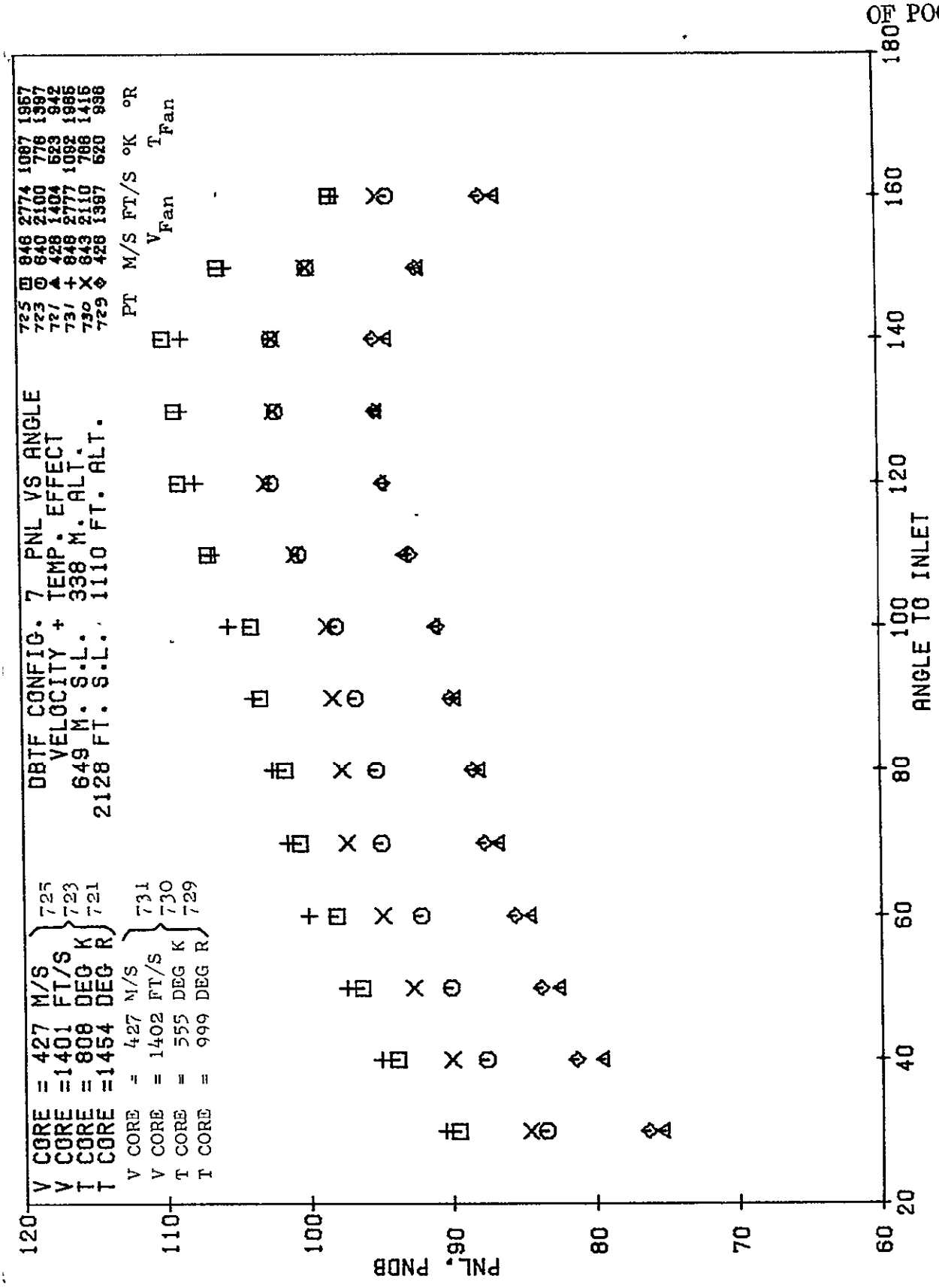

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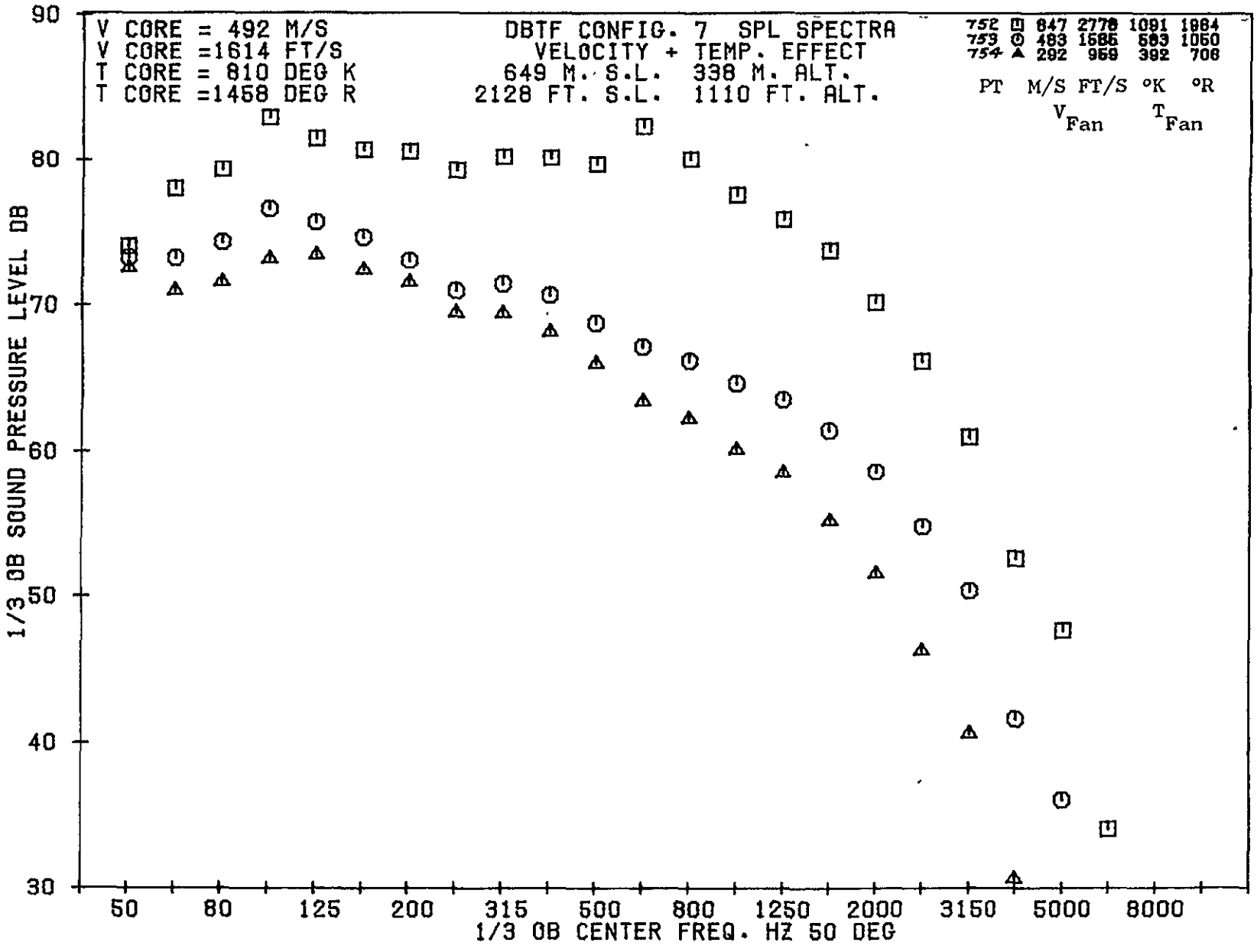

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5R412-001

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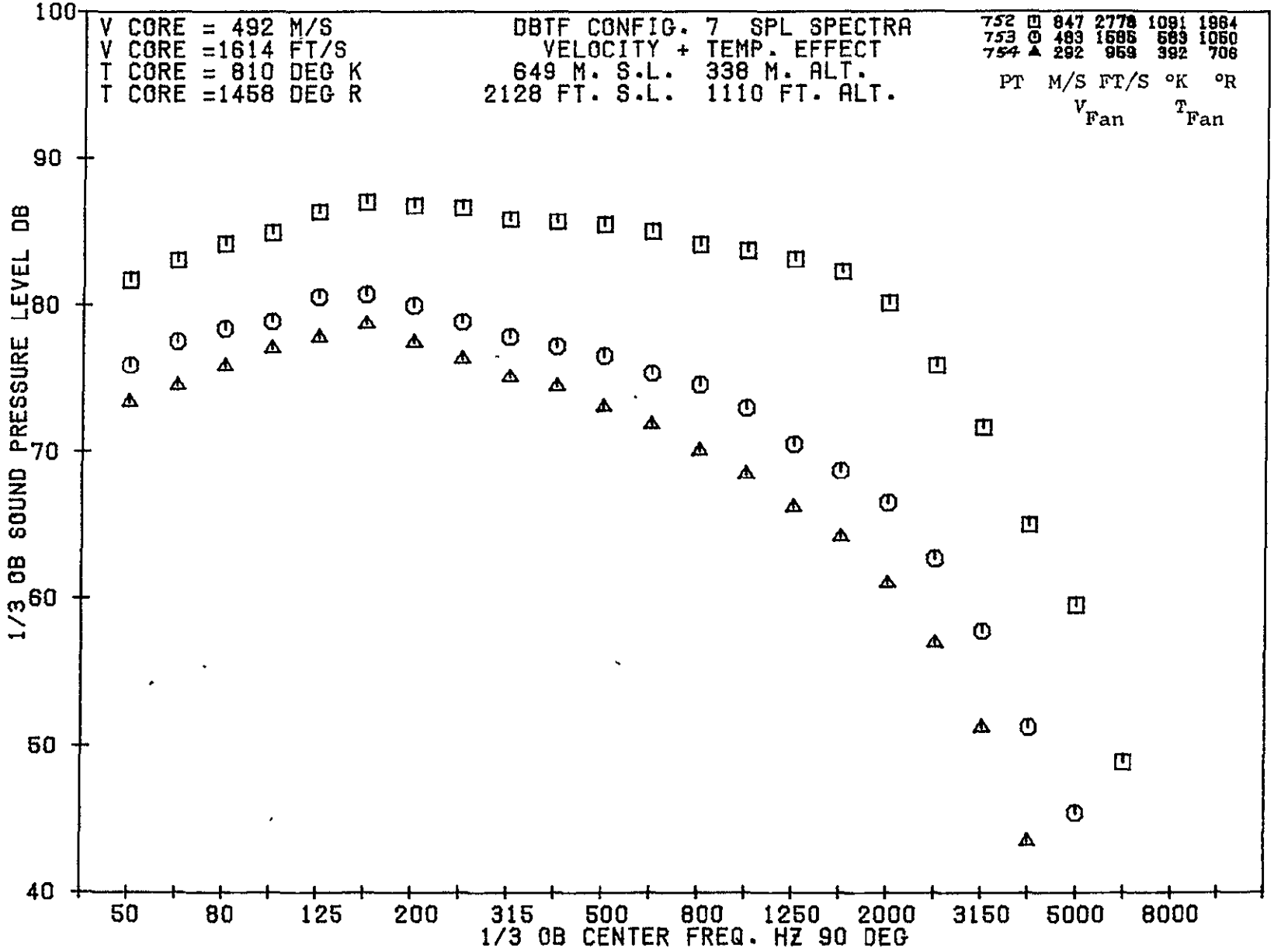

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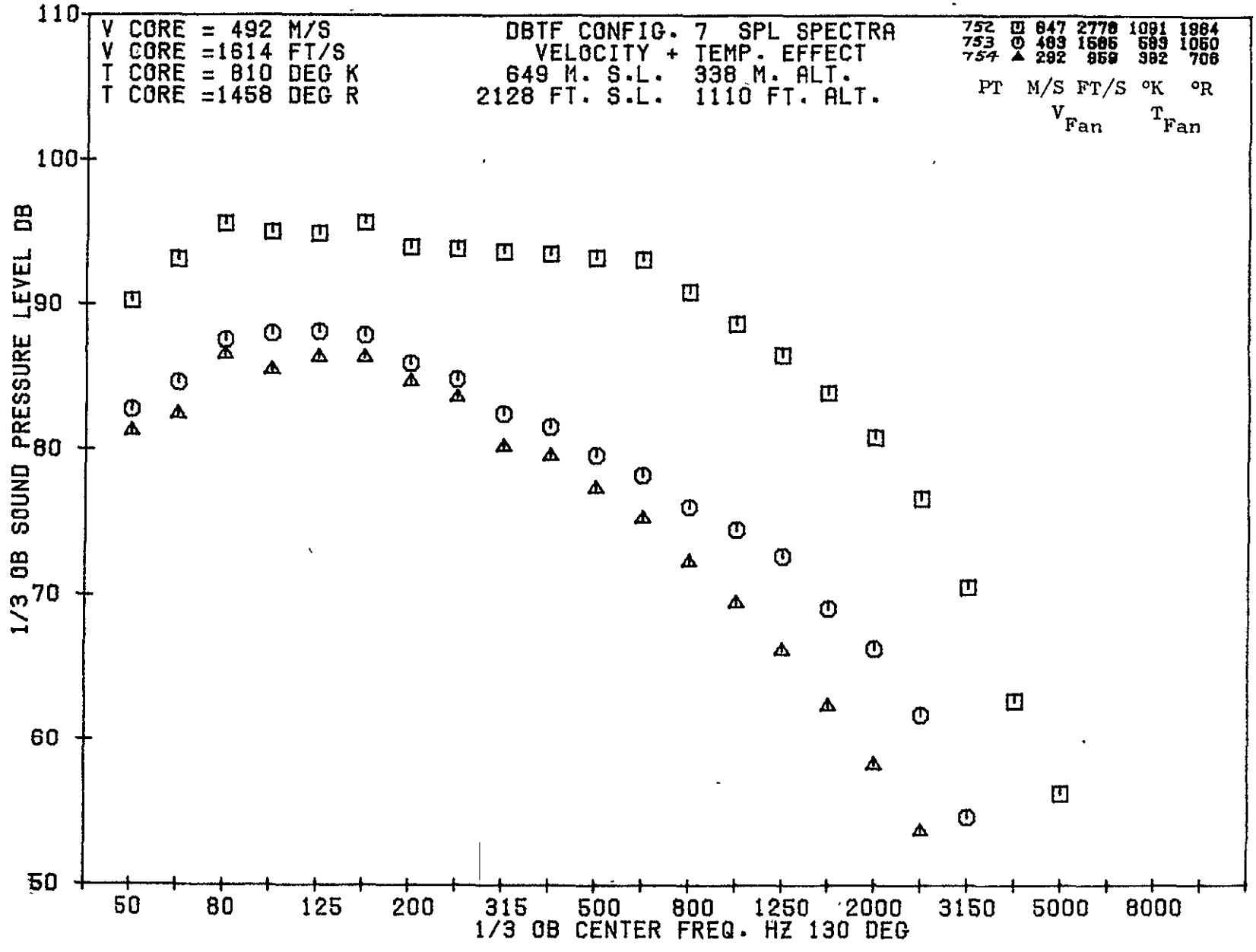

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5R412-001

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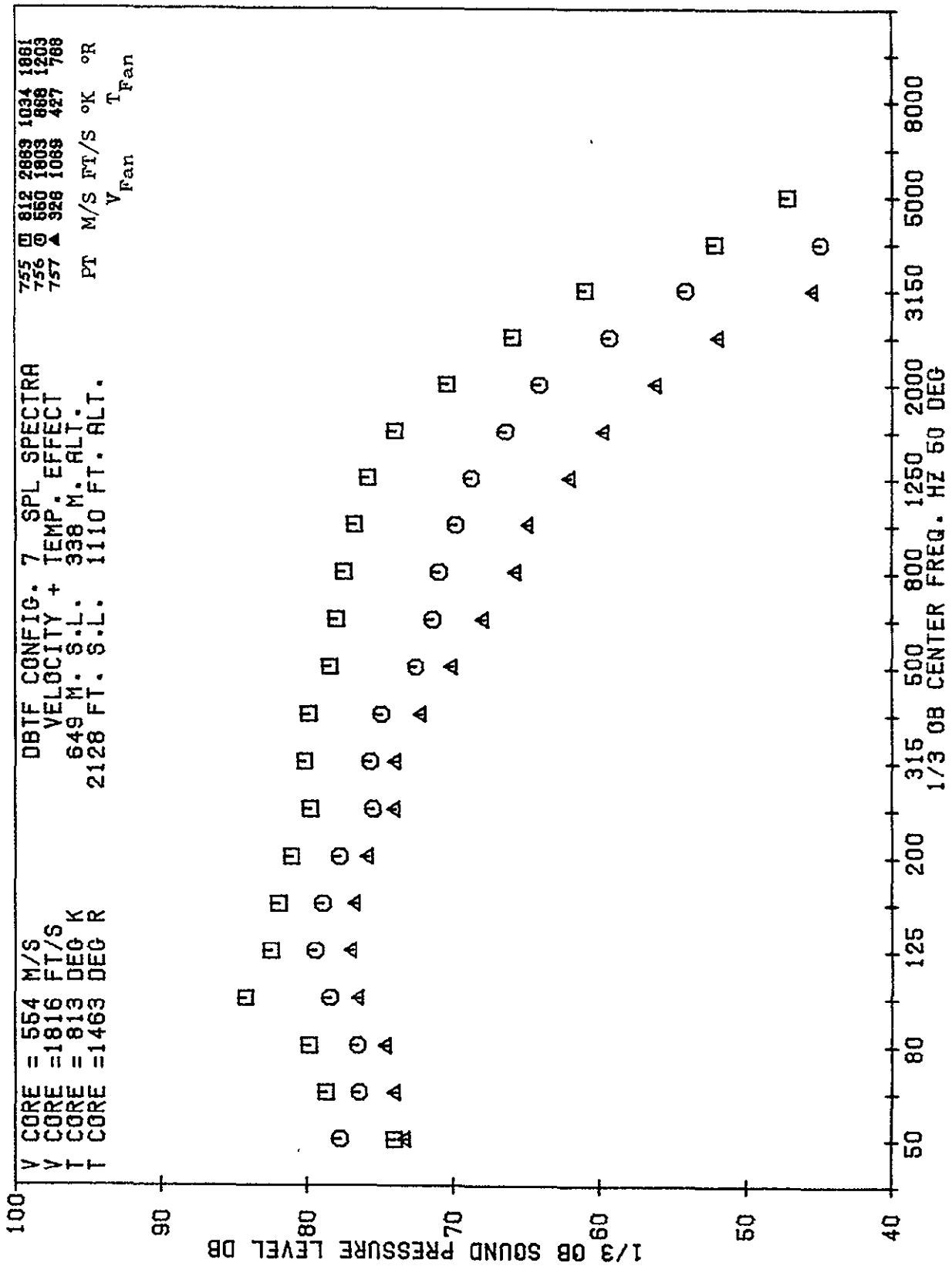

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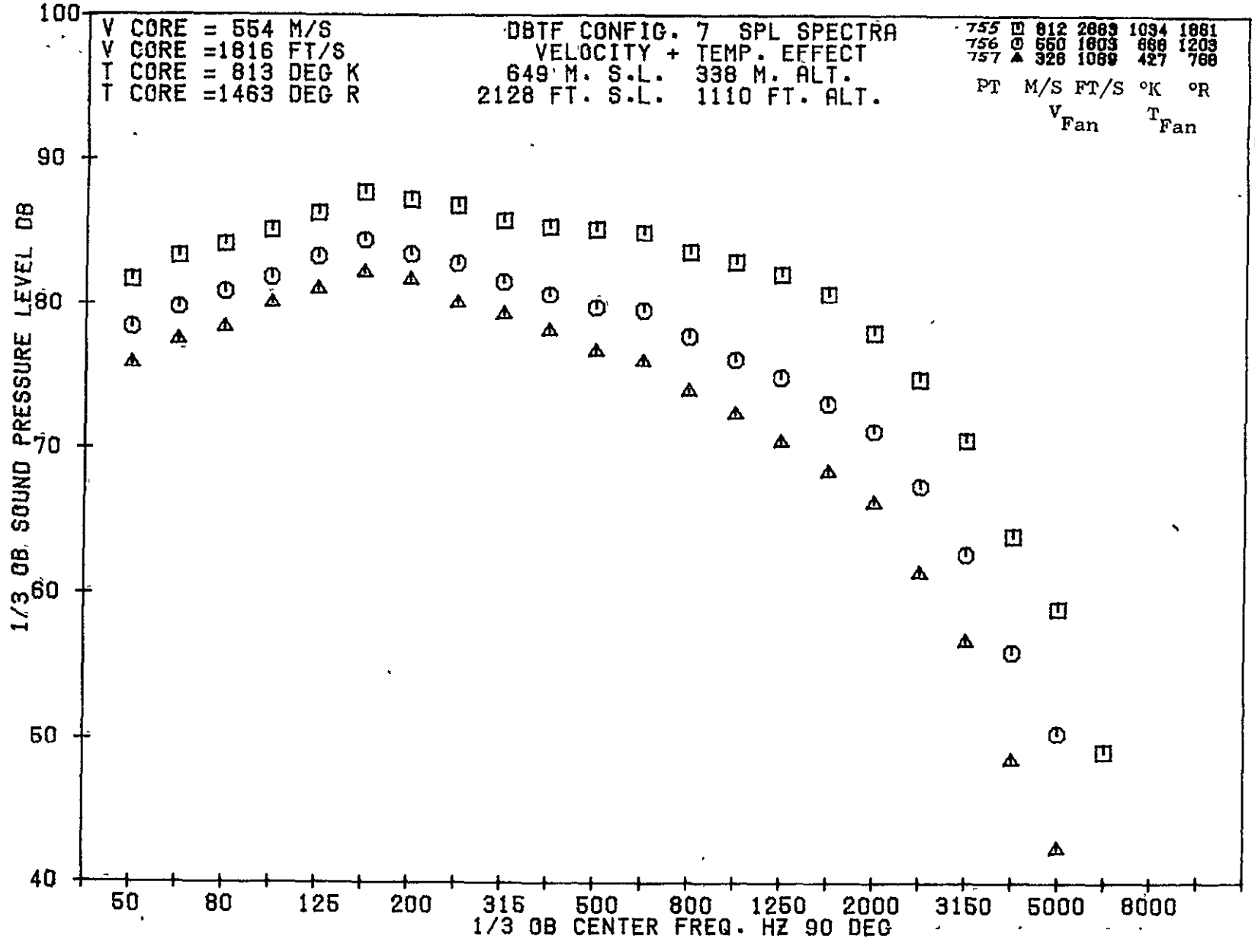

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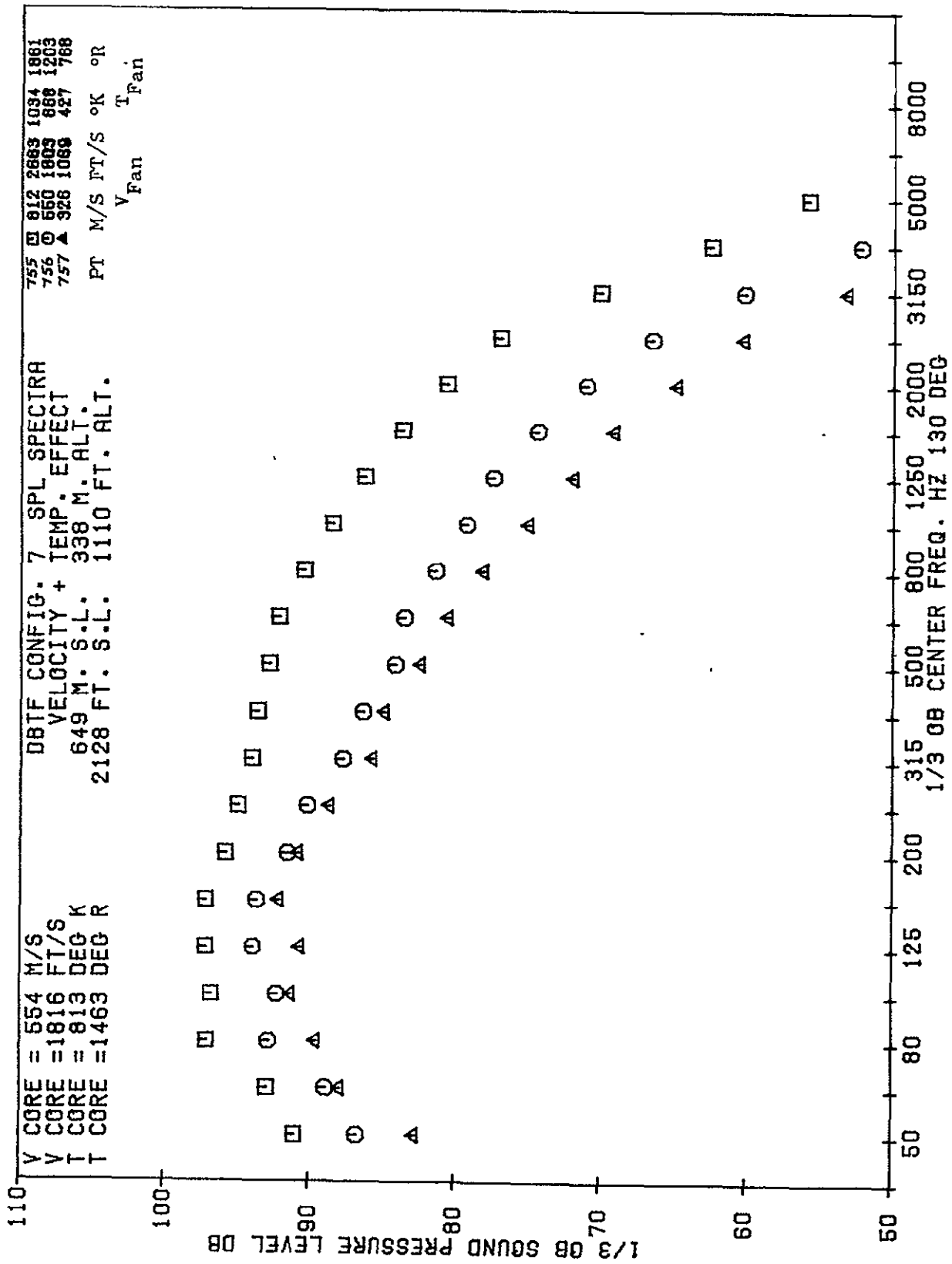

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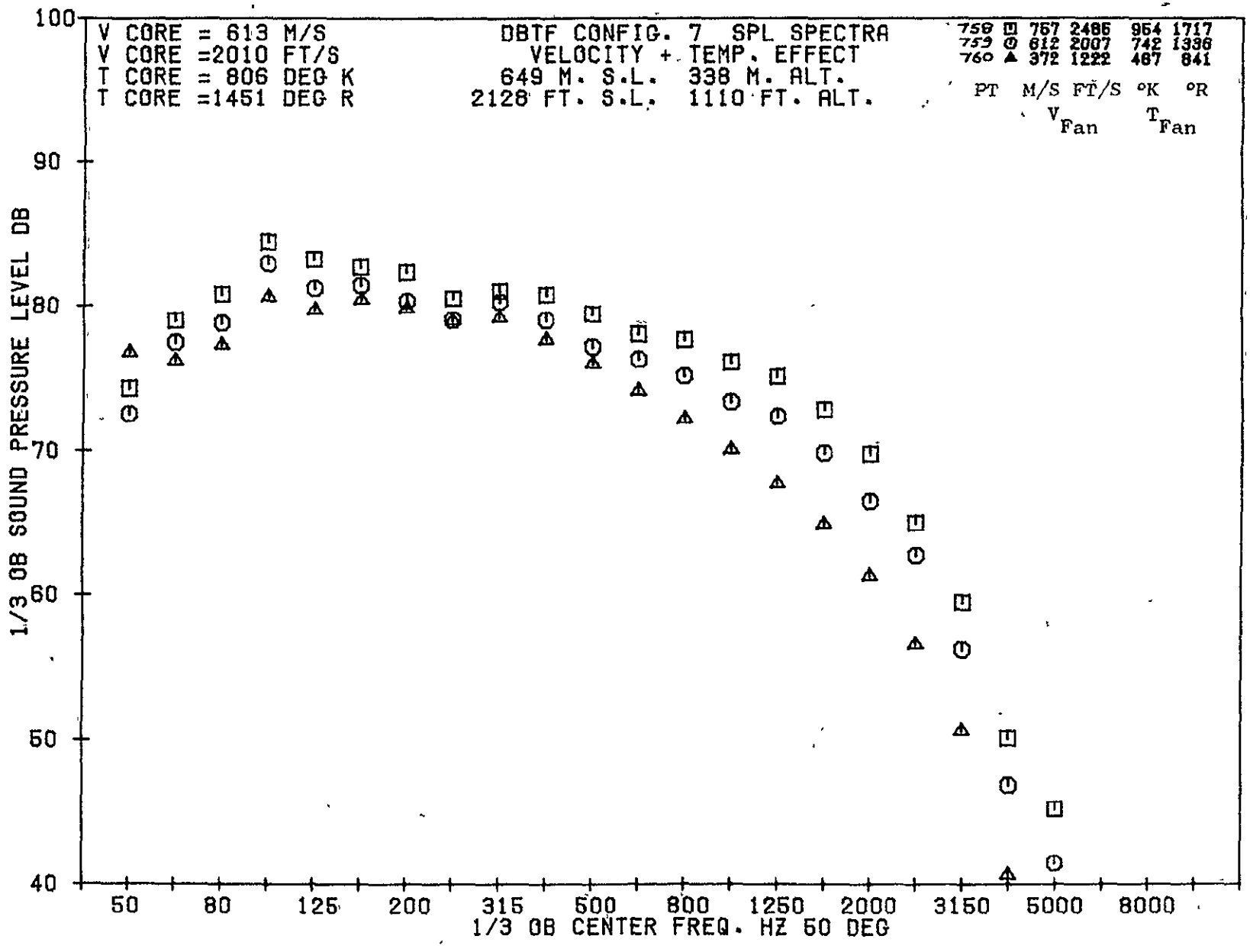

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5R412-001

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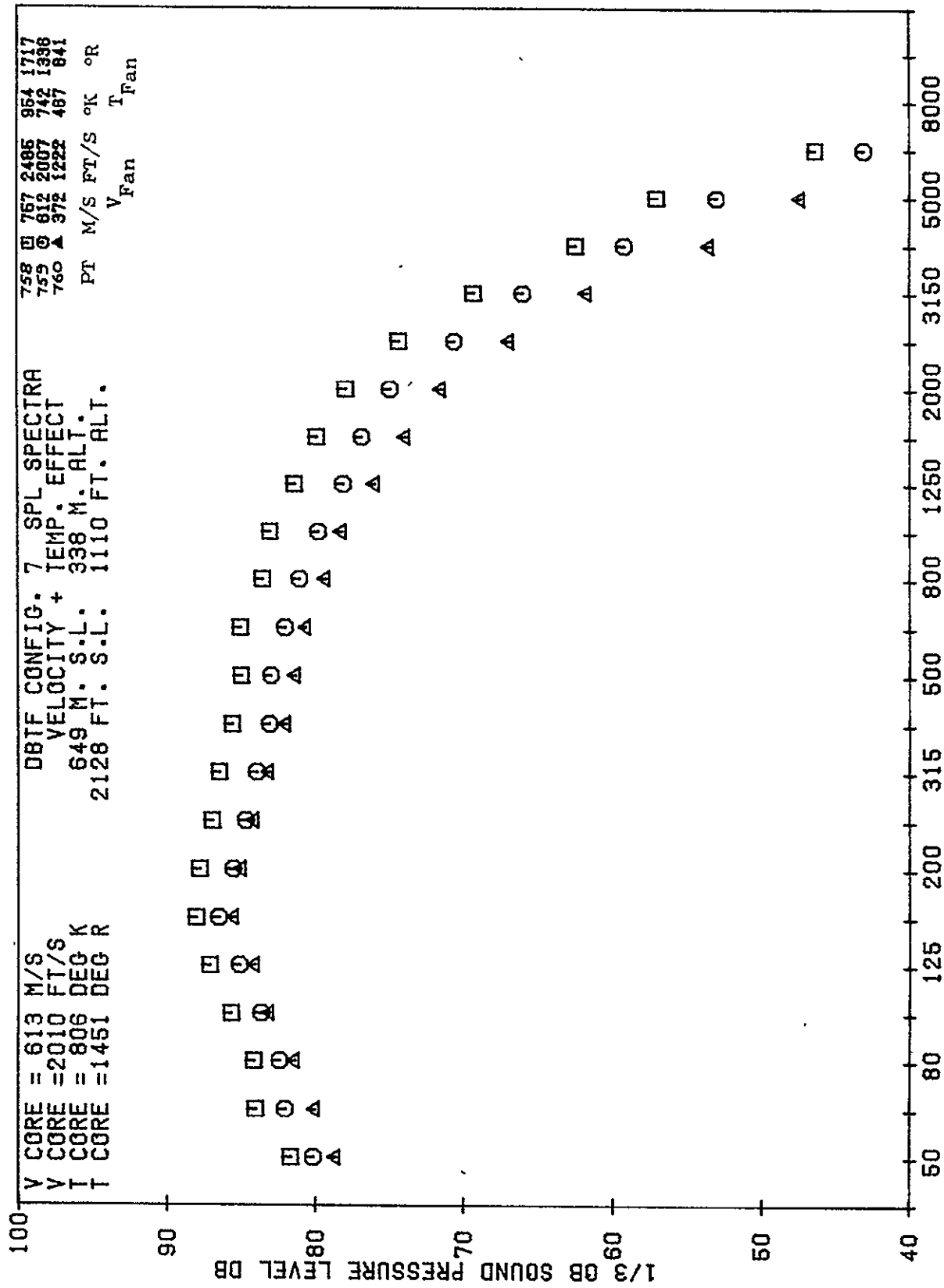

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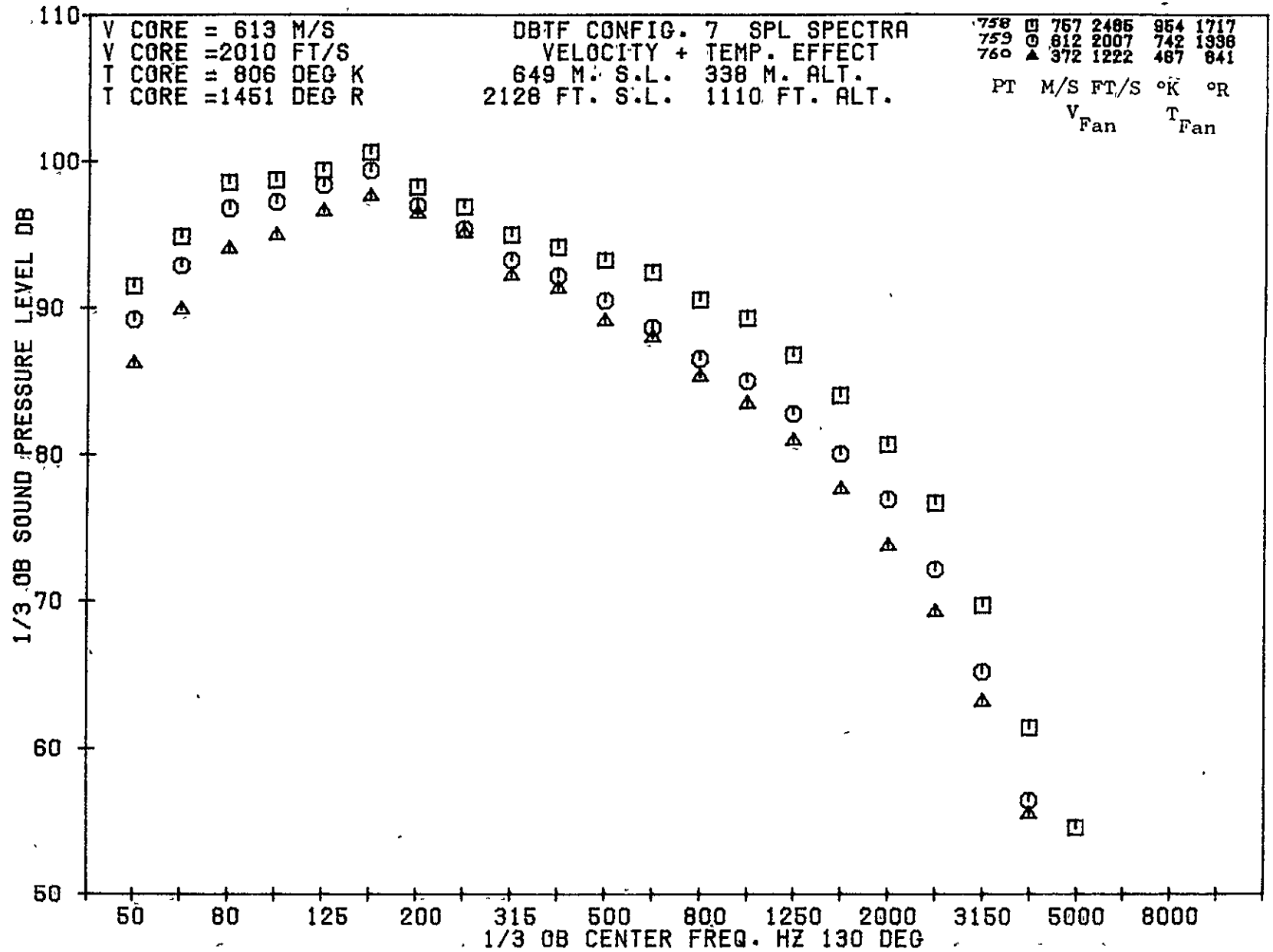

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5R412-001

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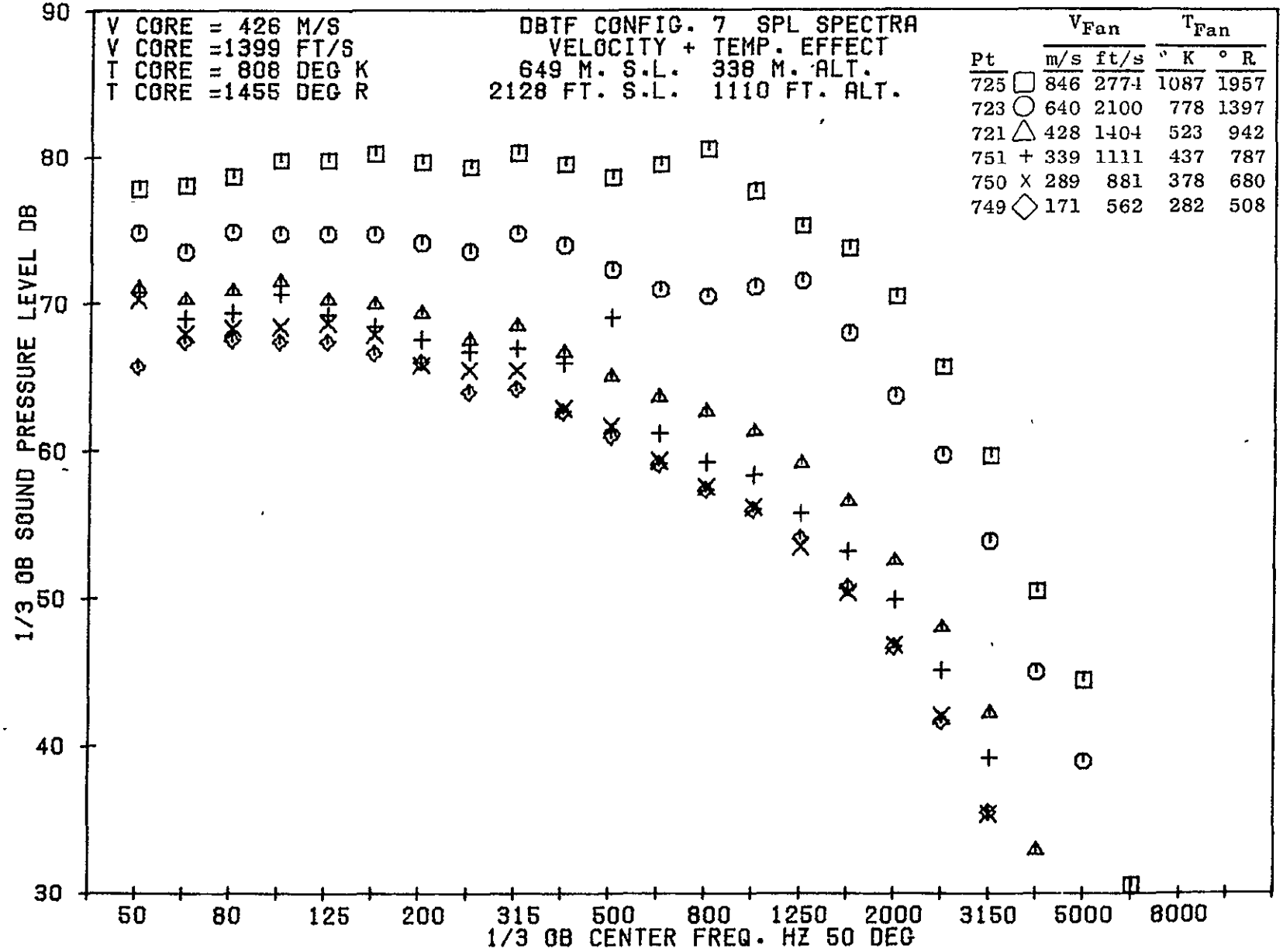

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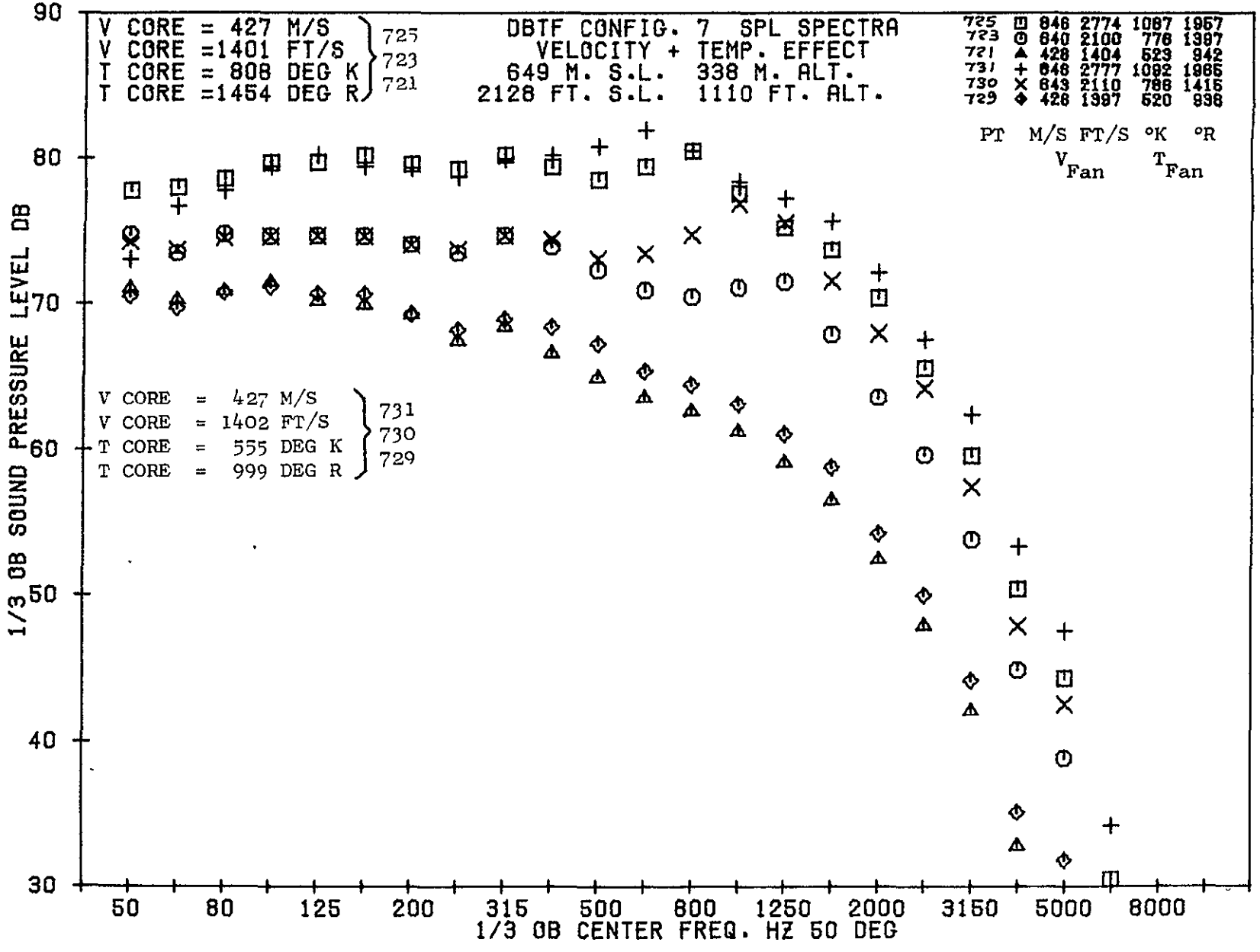

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79 BURCH A.

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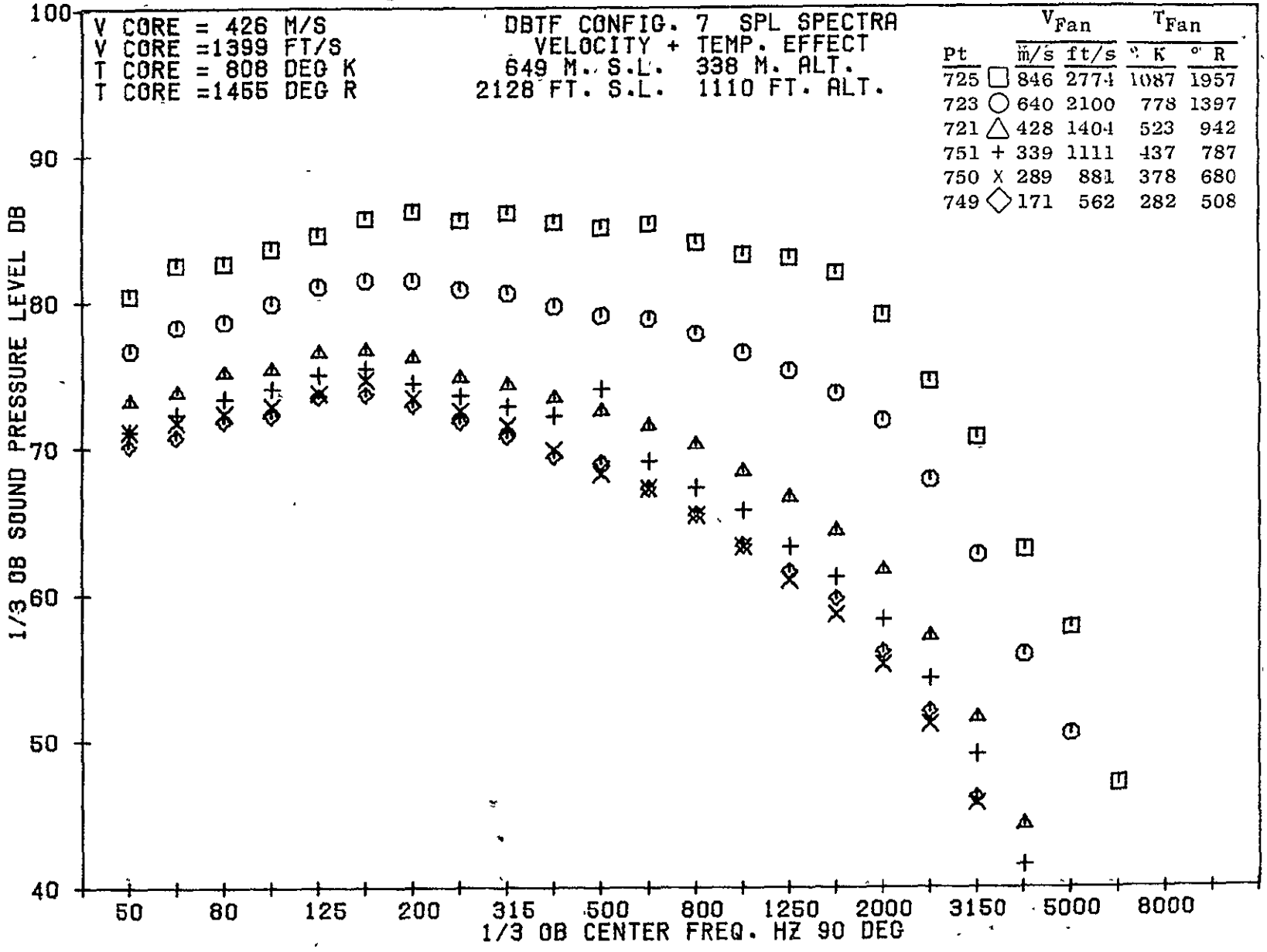

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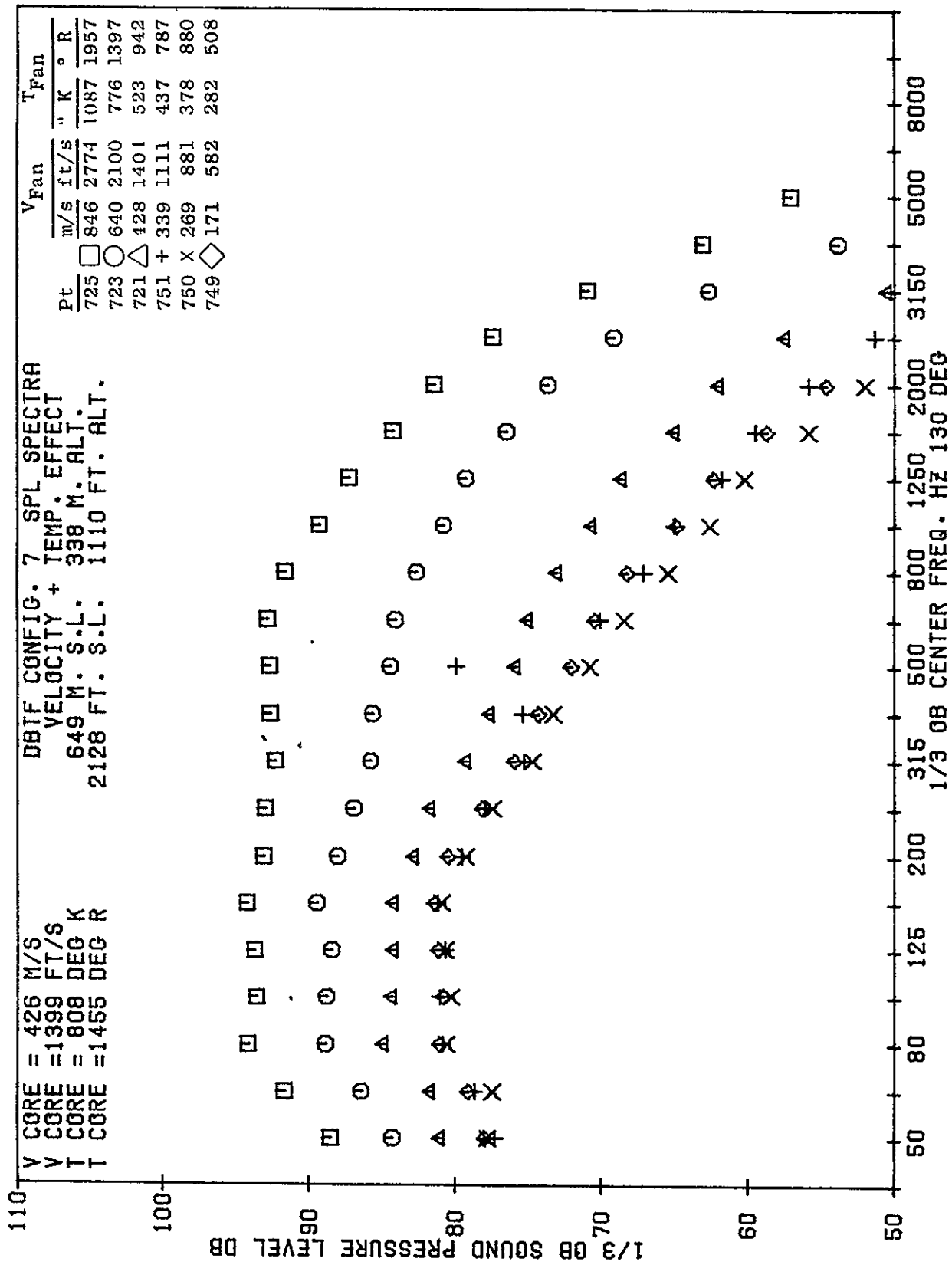

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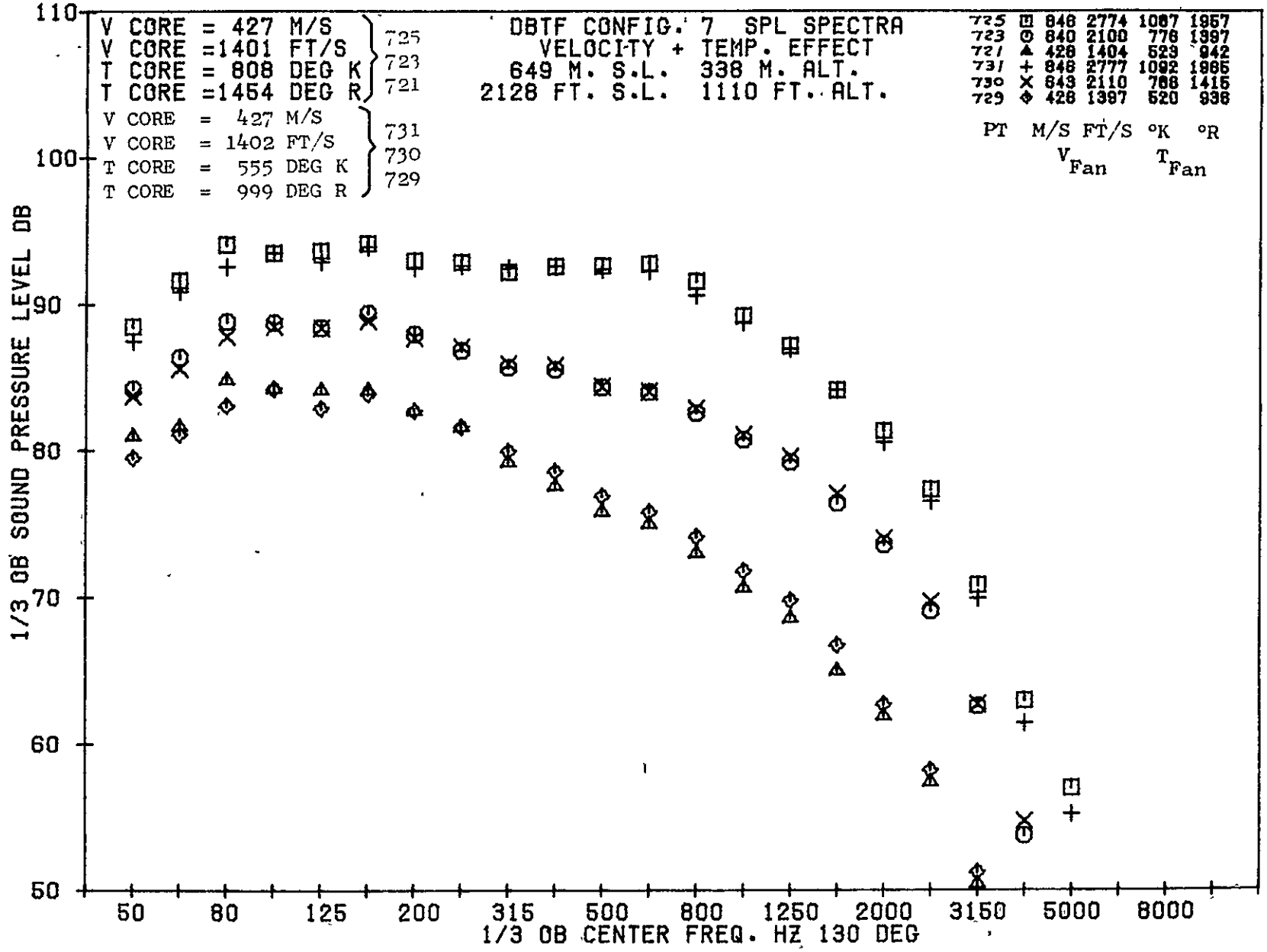

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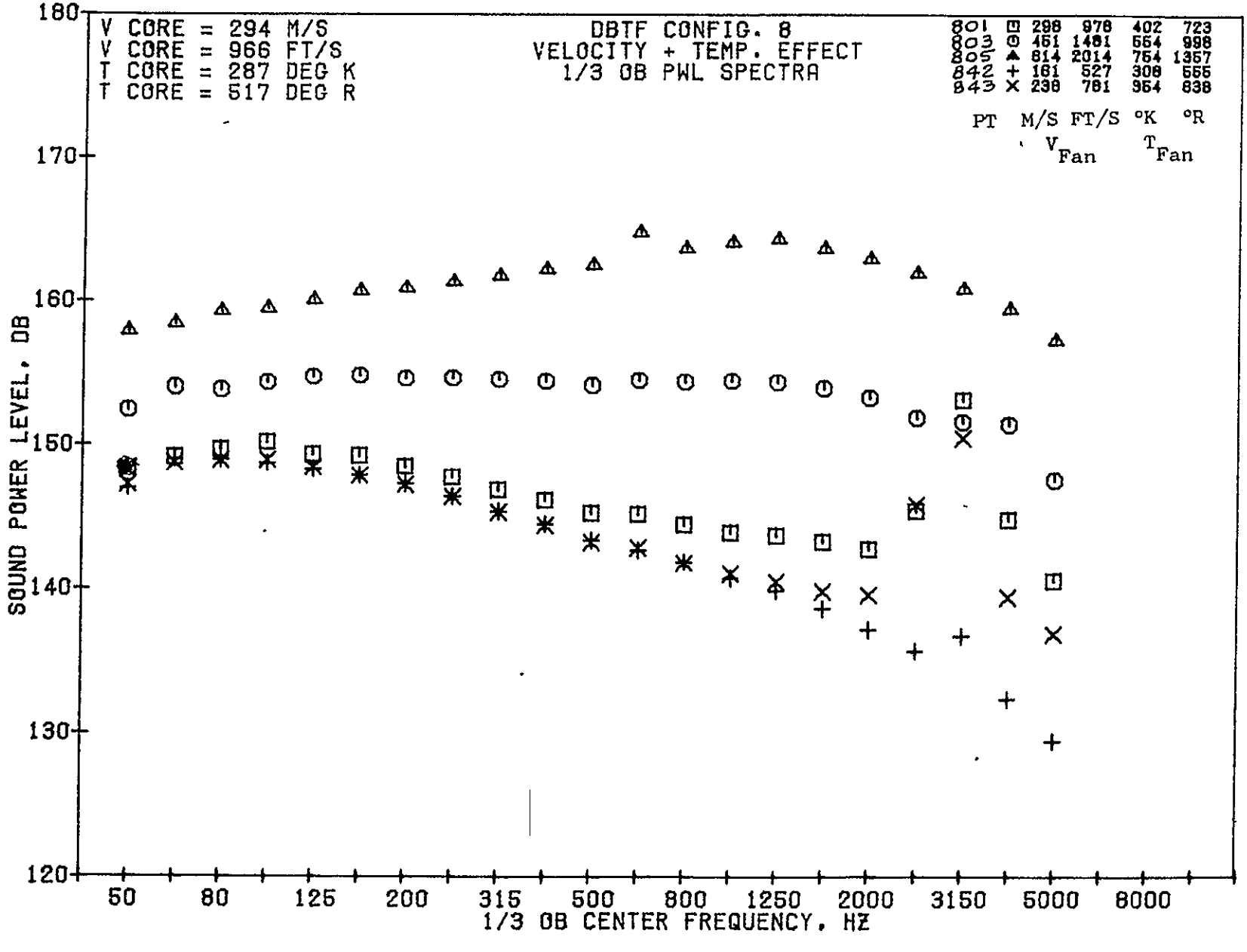

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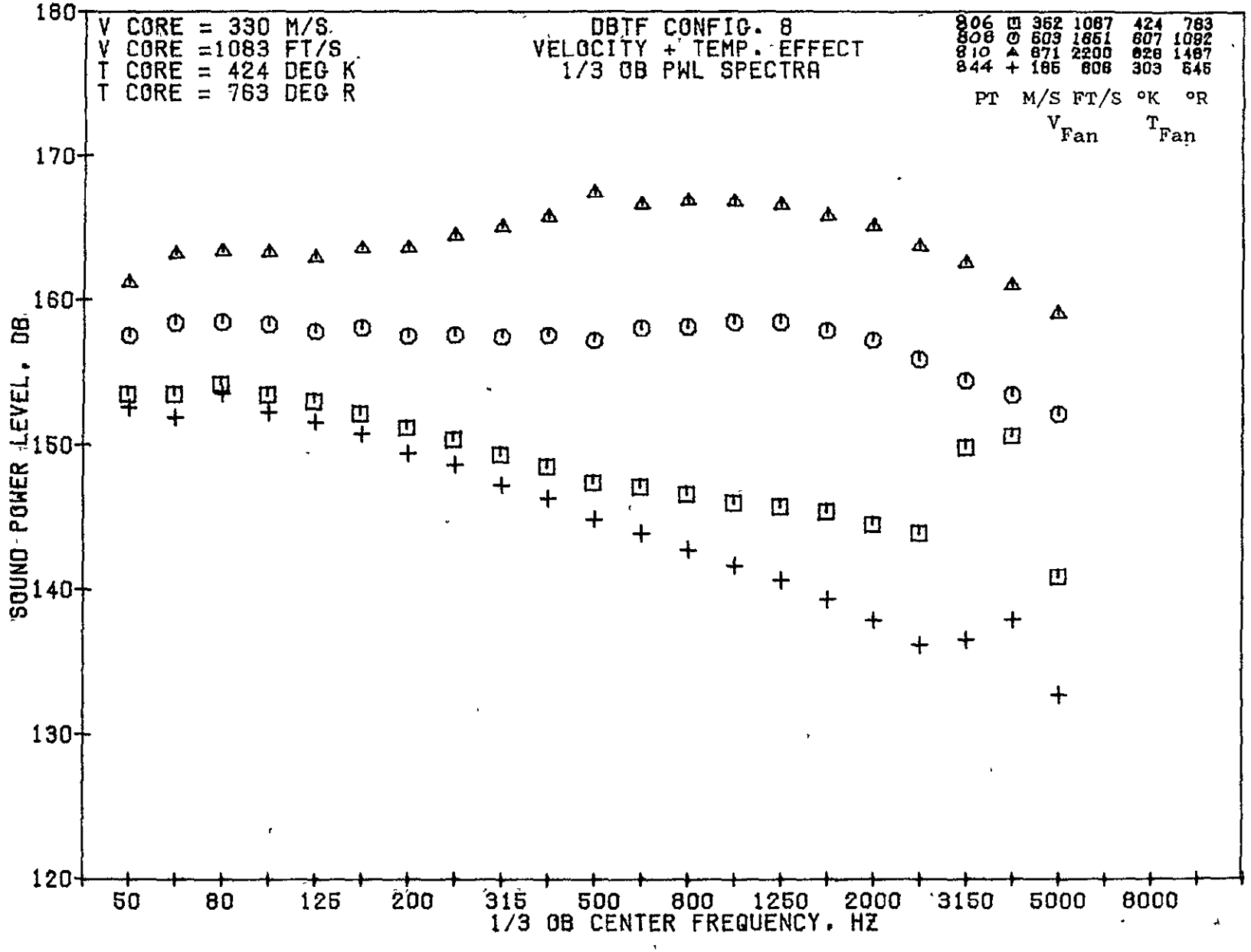

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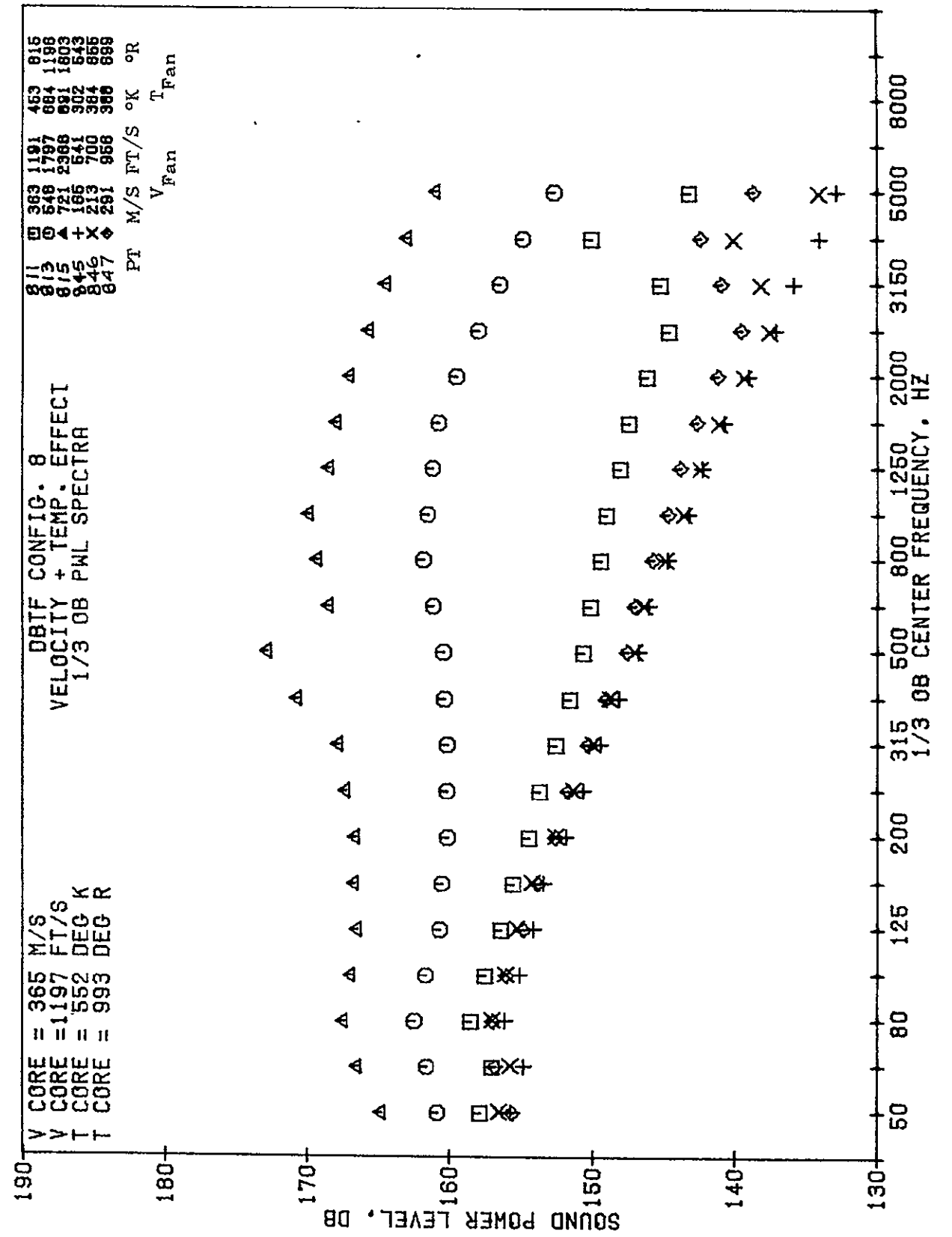

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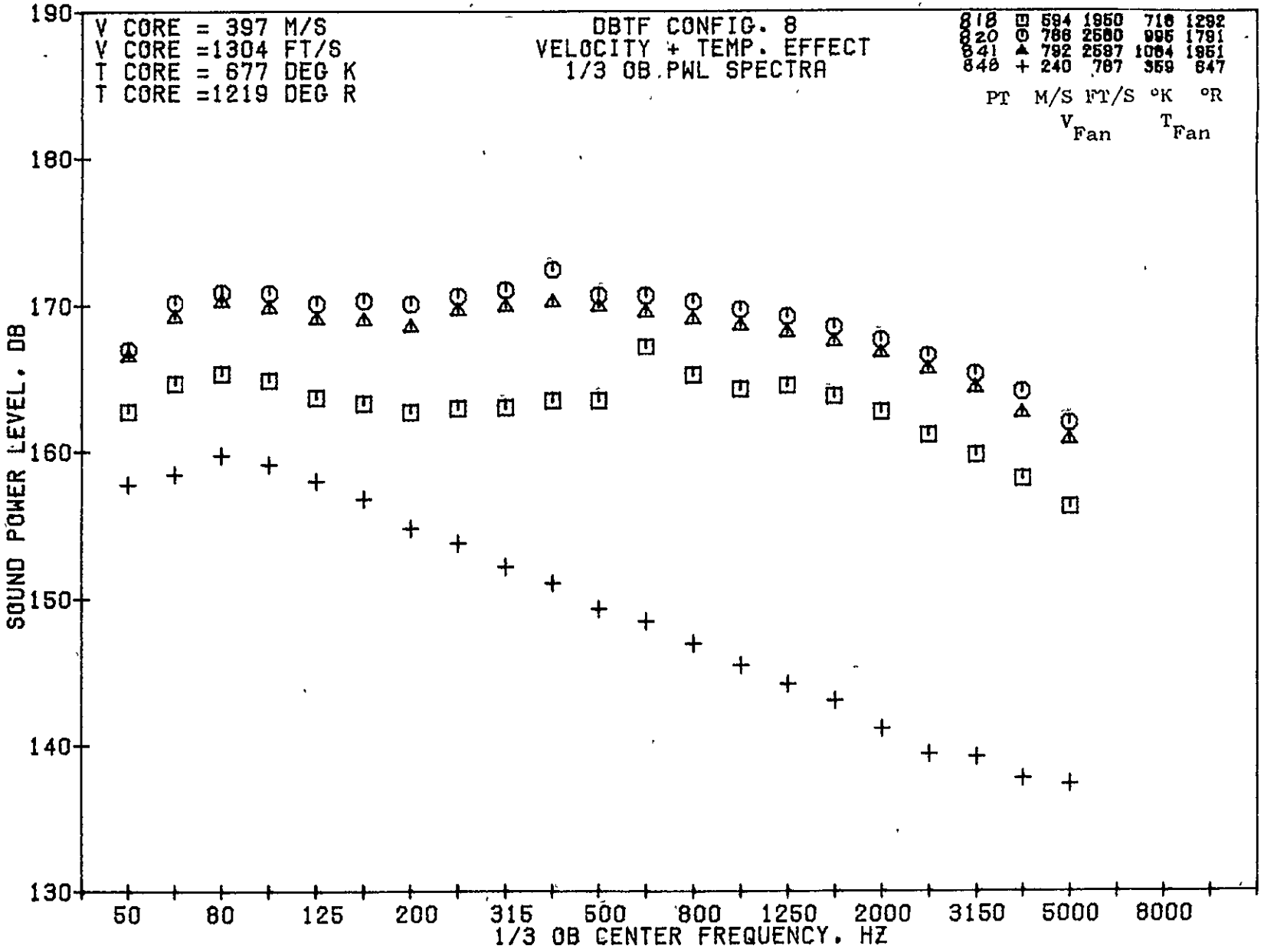

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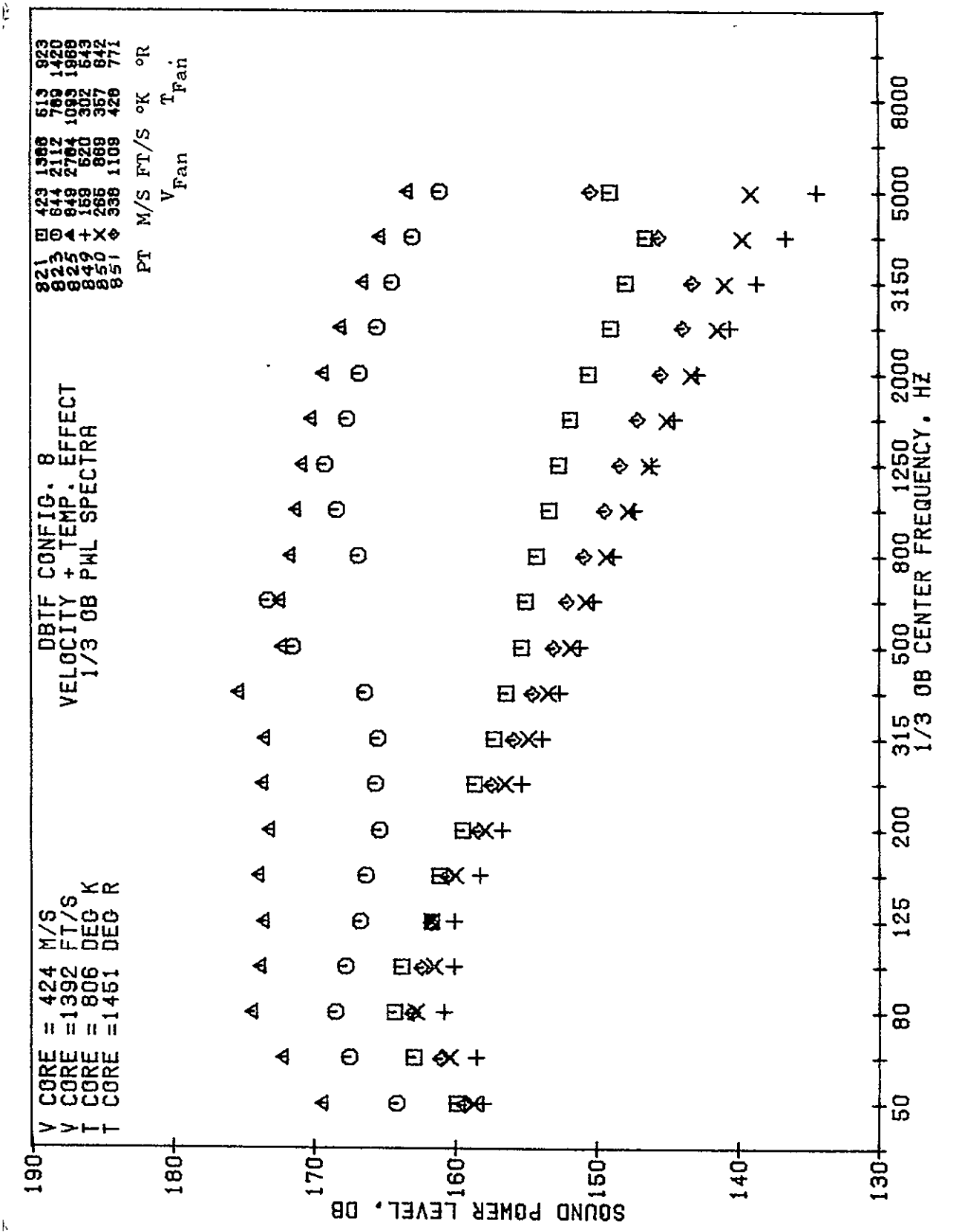

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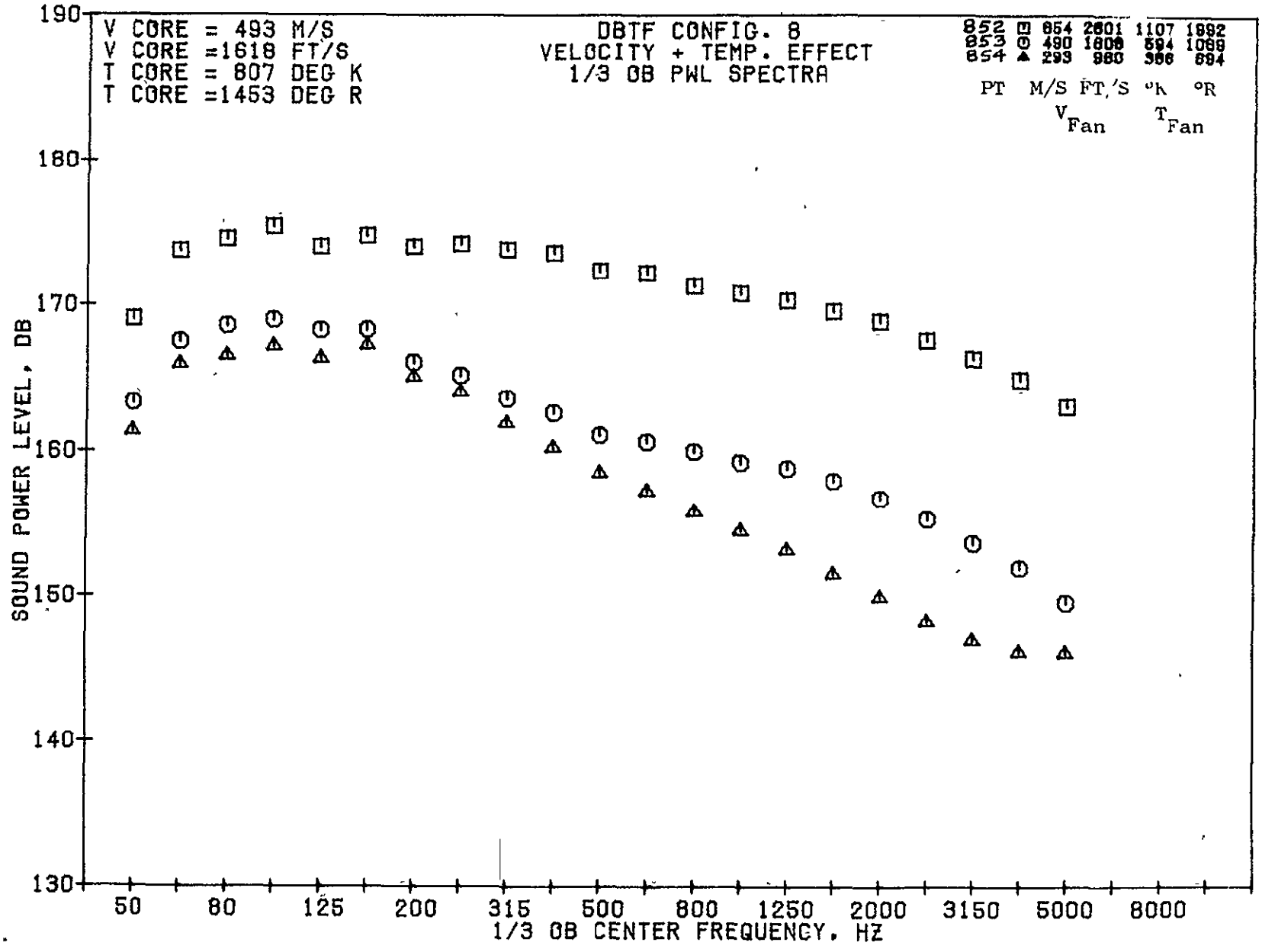

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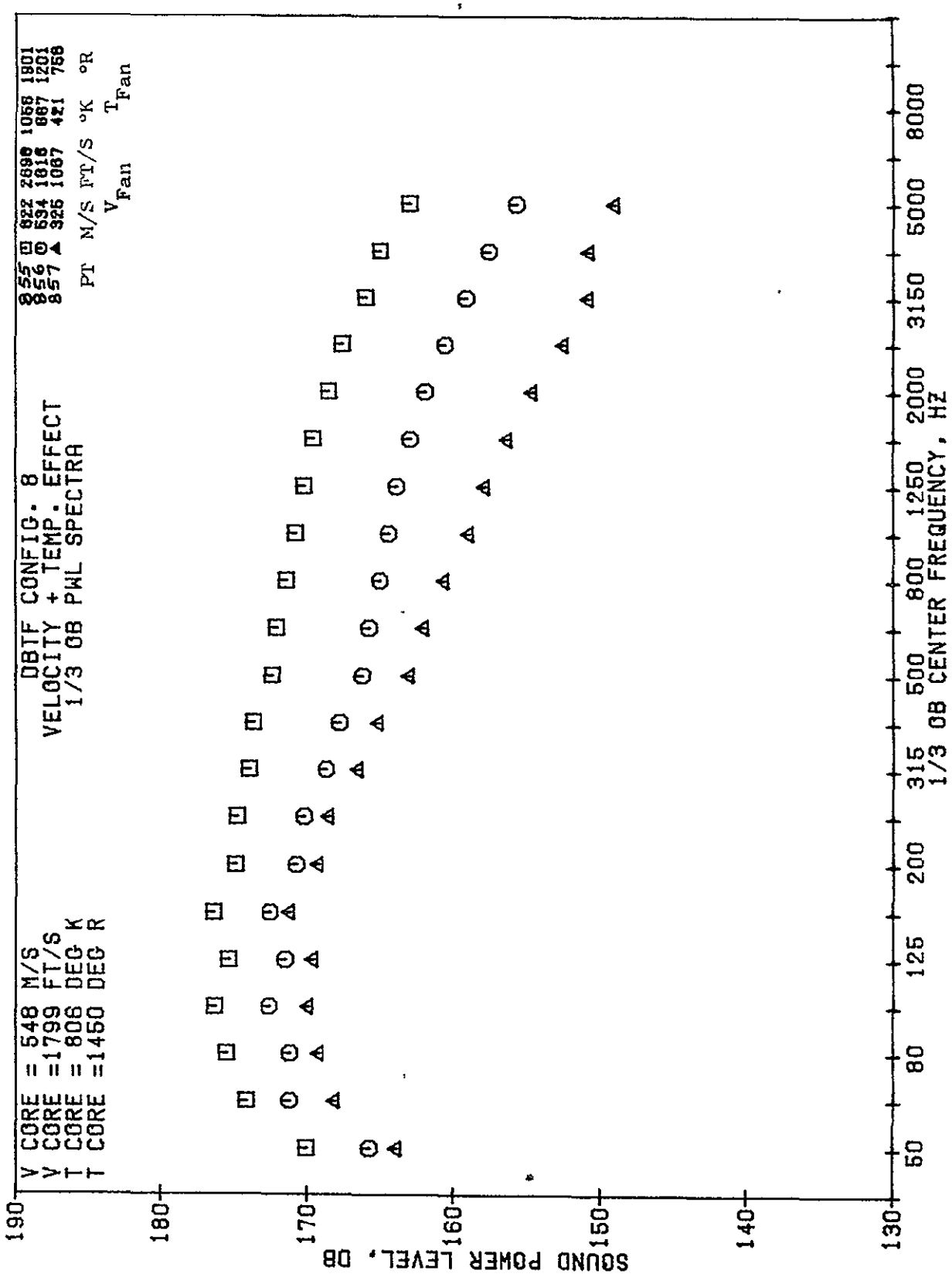

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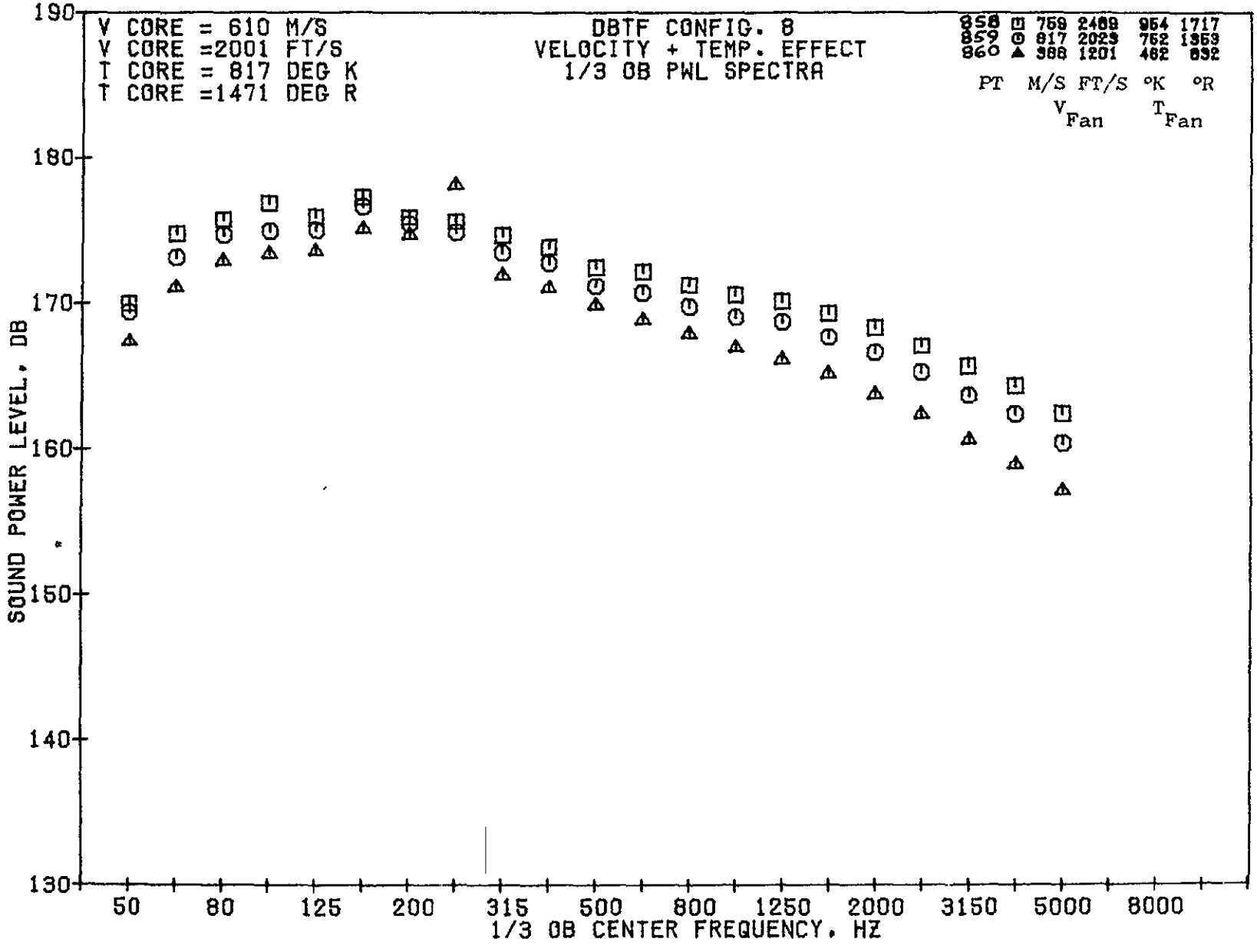

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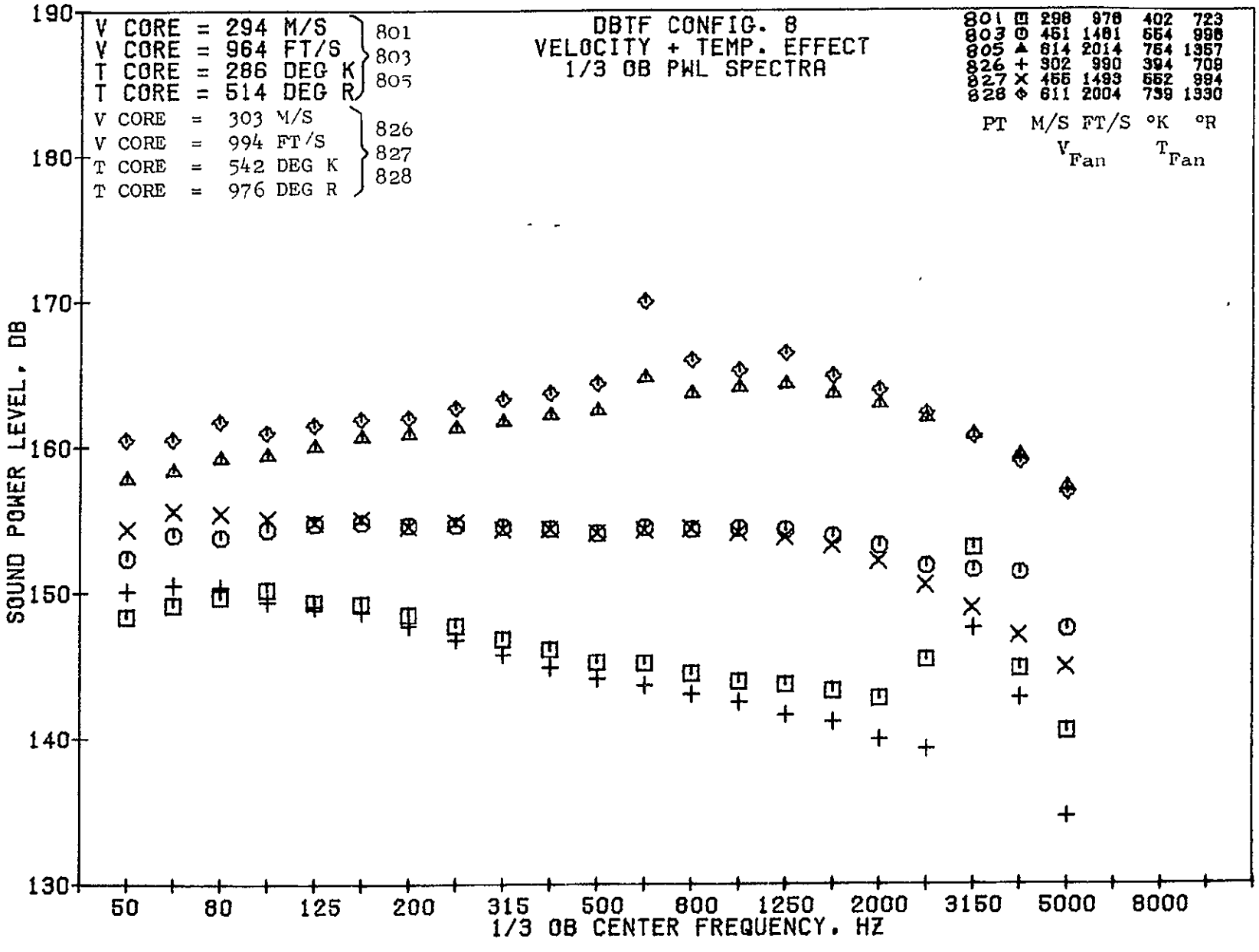

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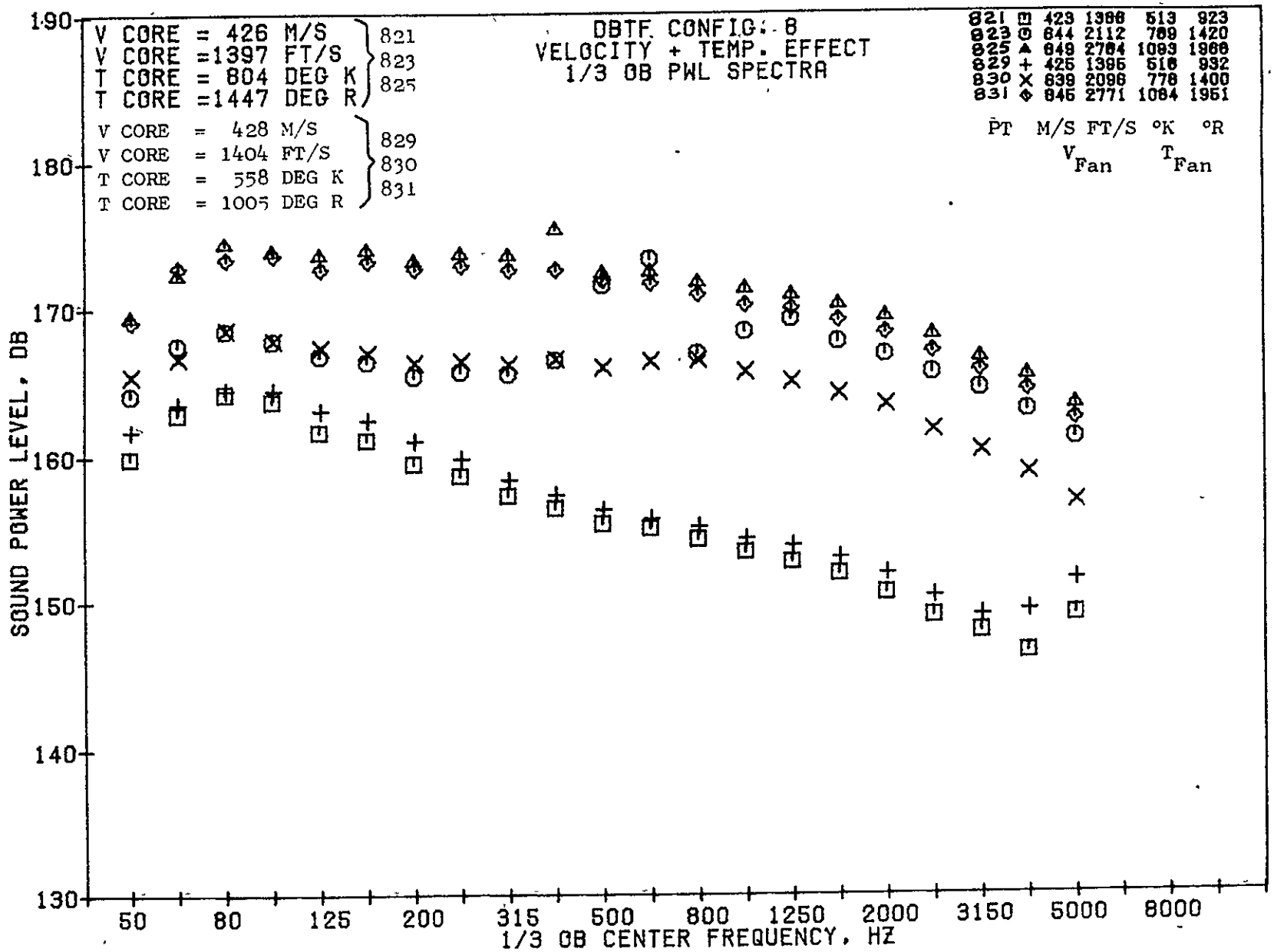

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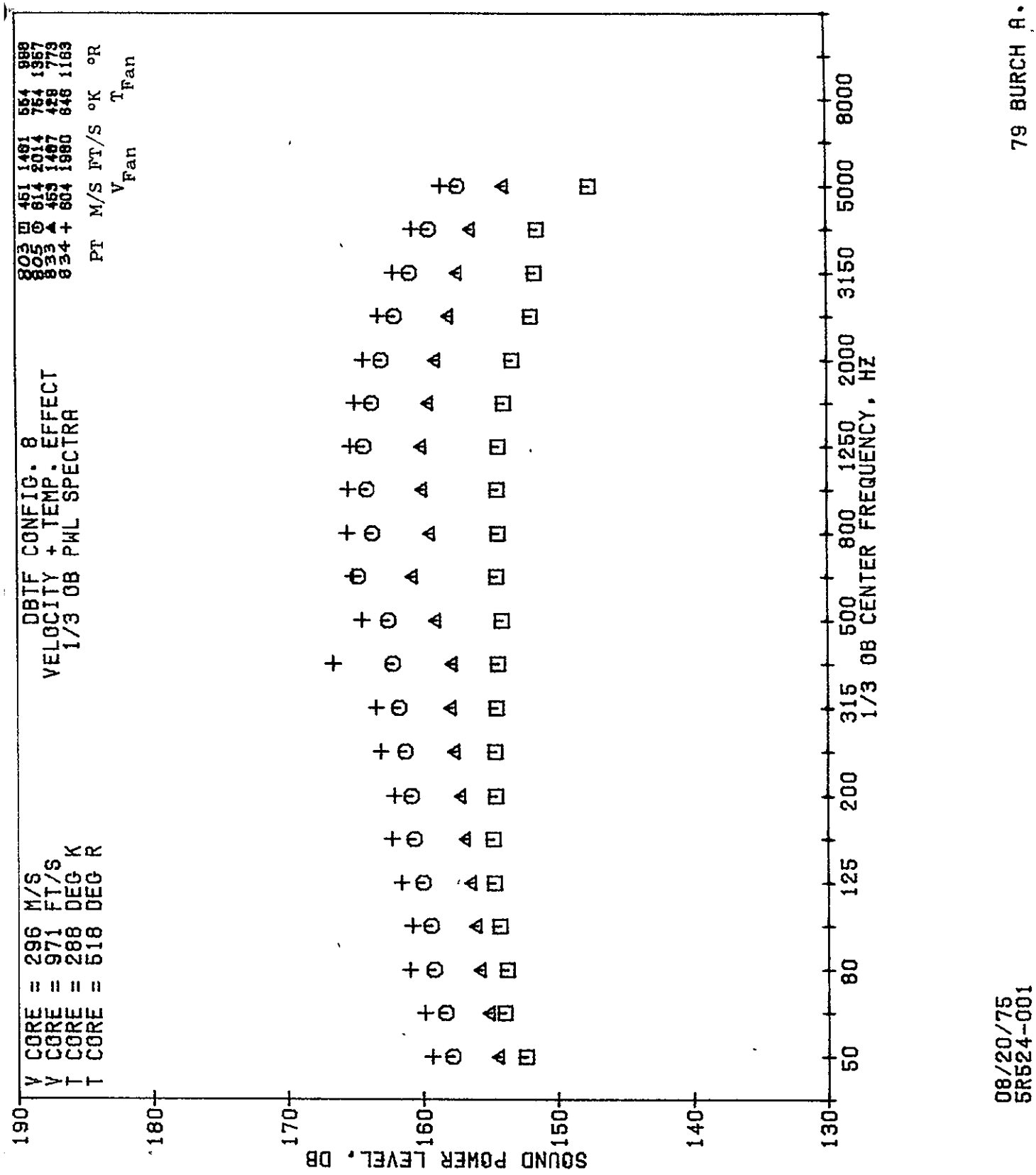

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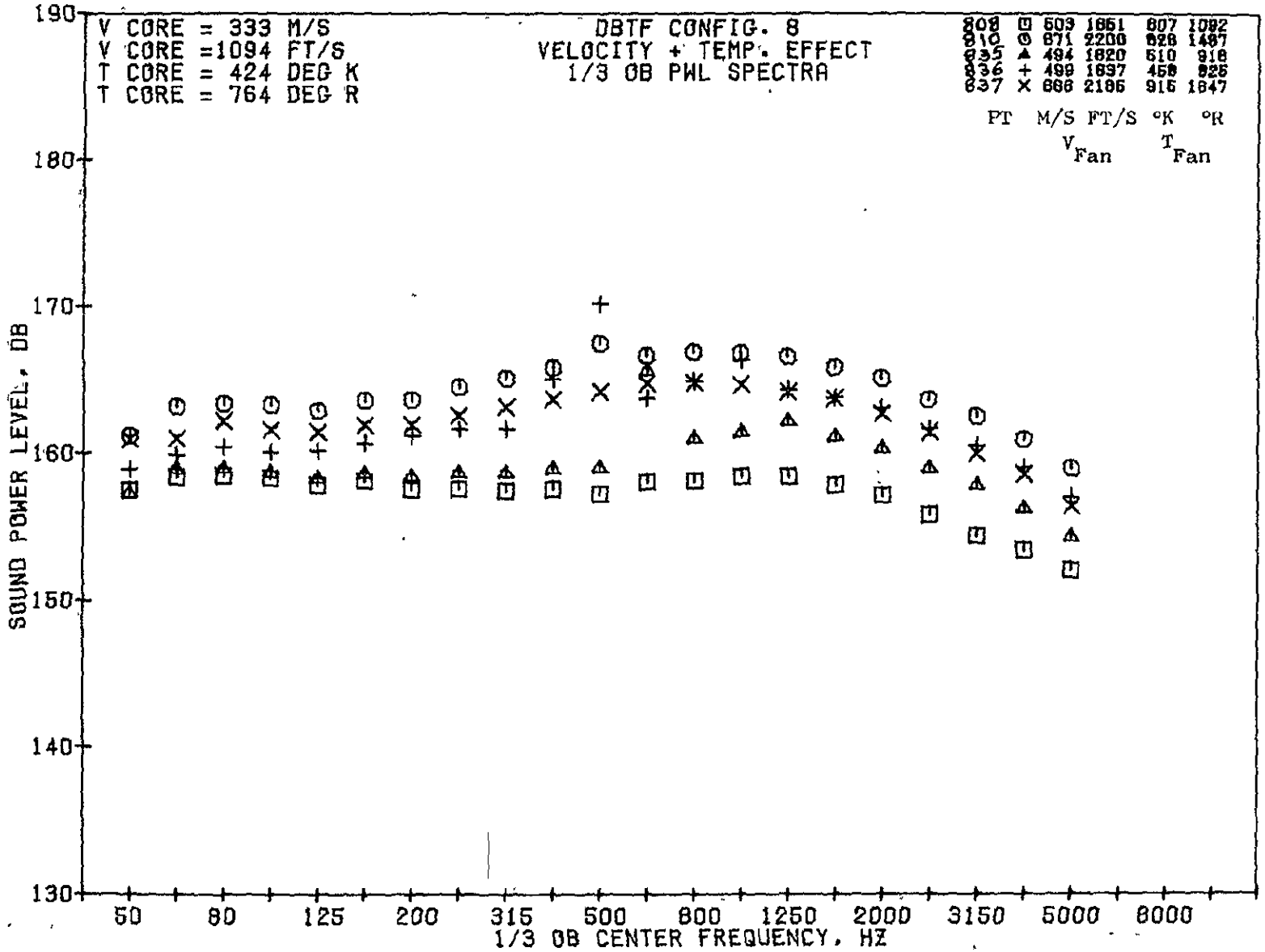

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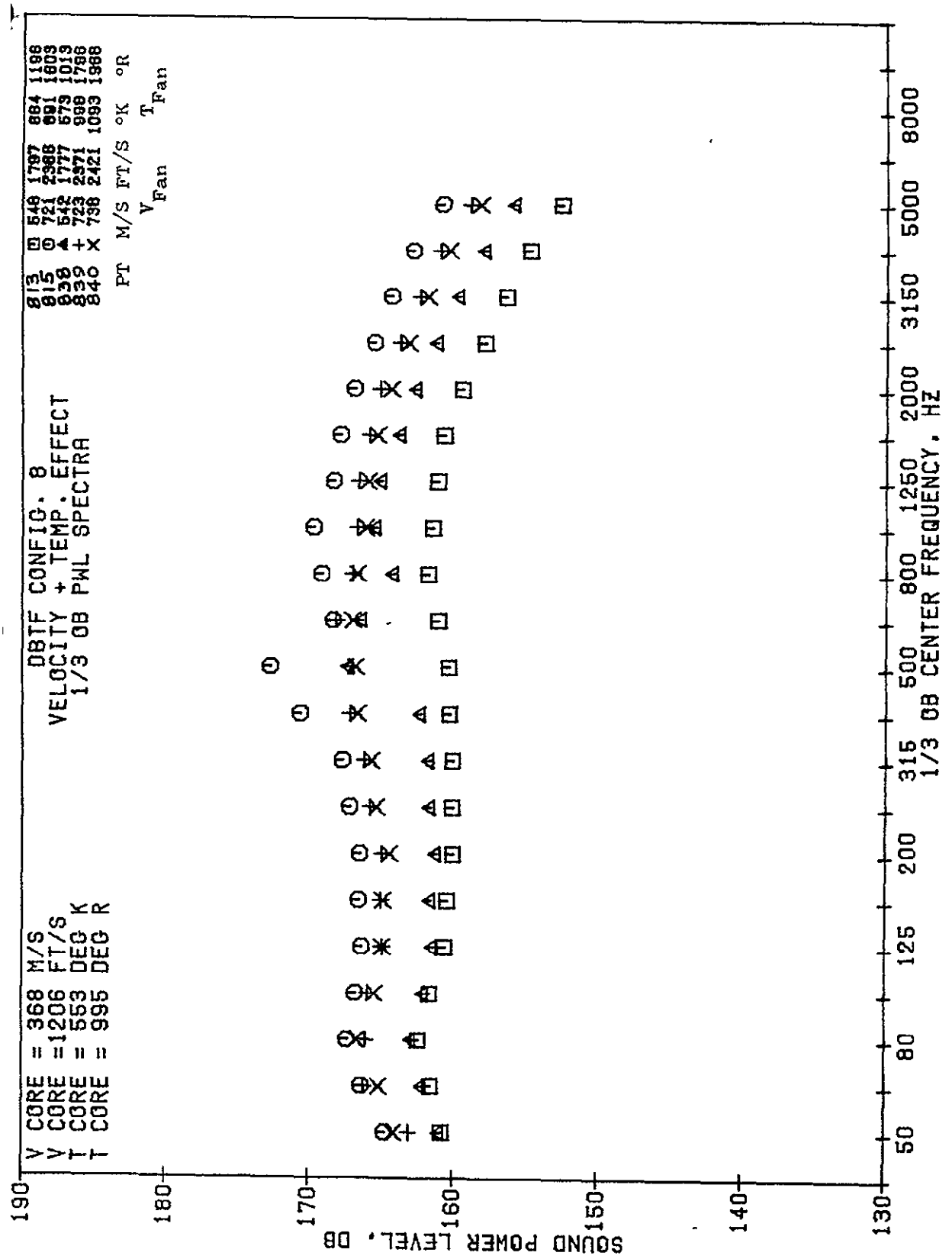

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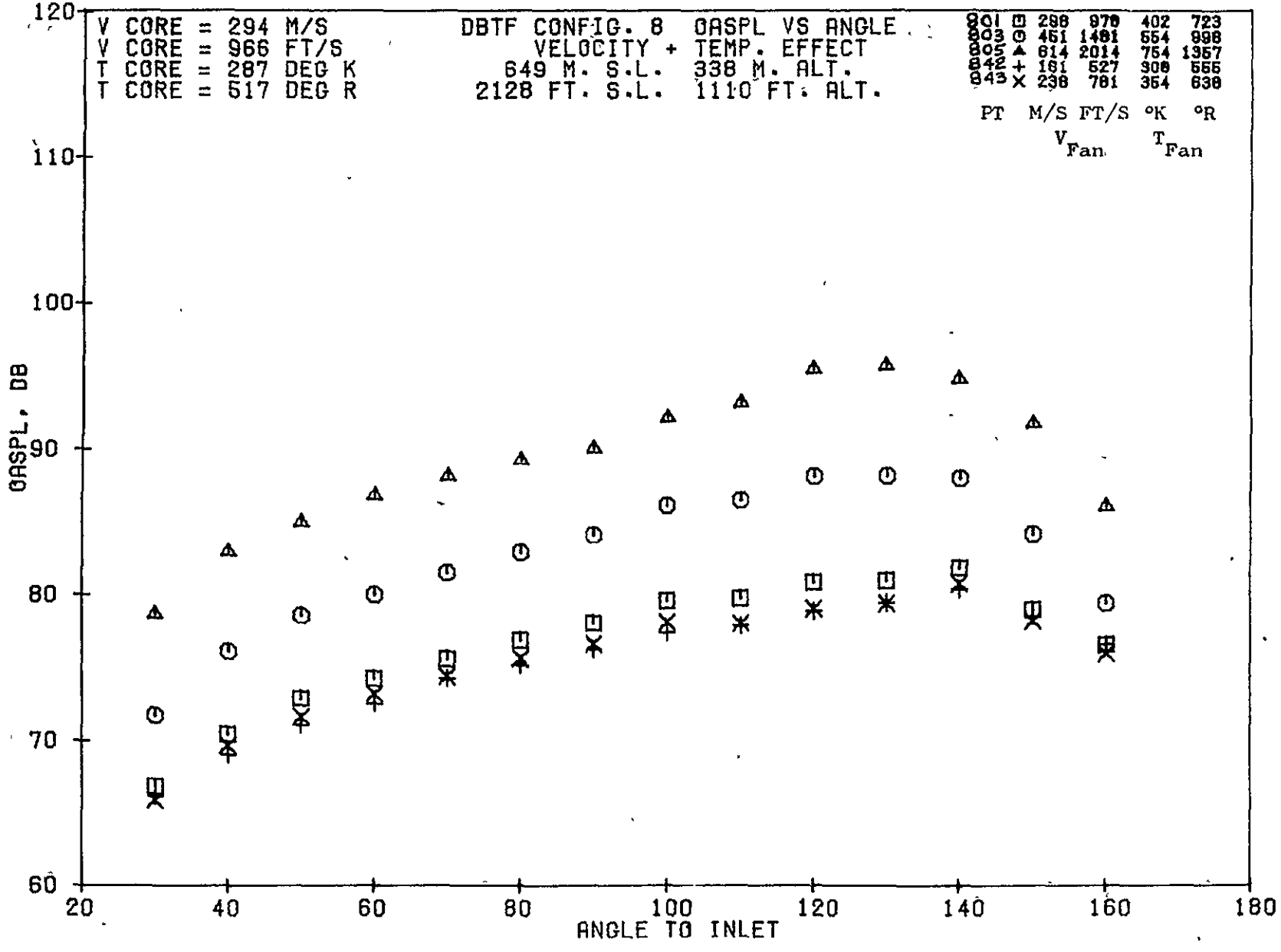

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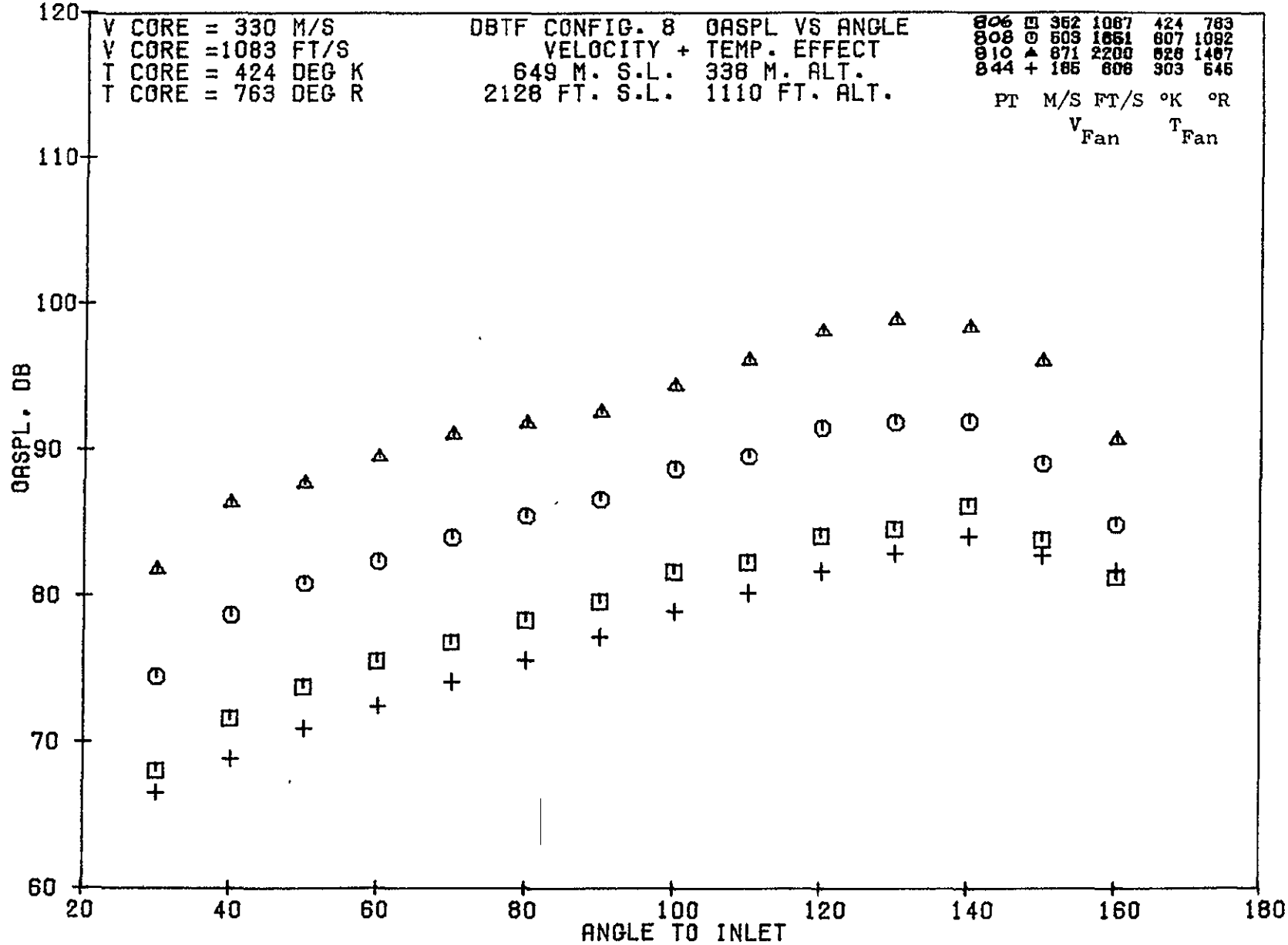

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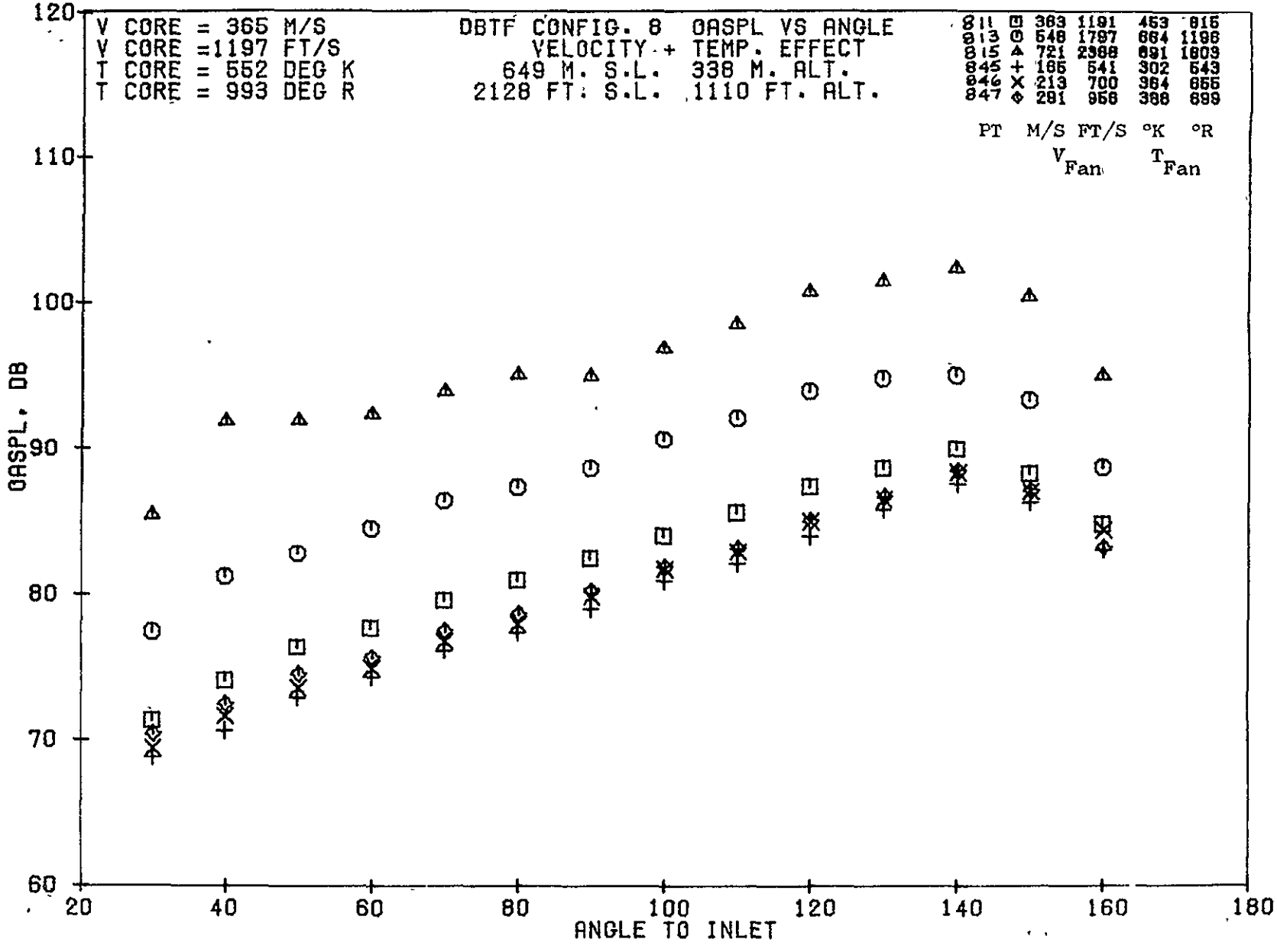

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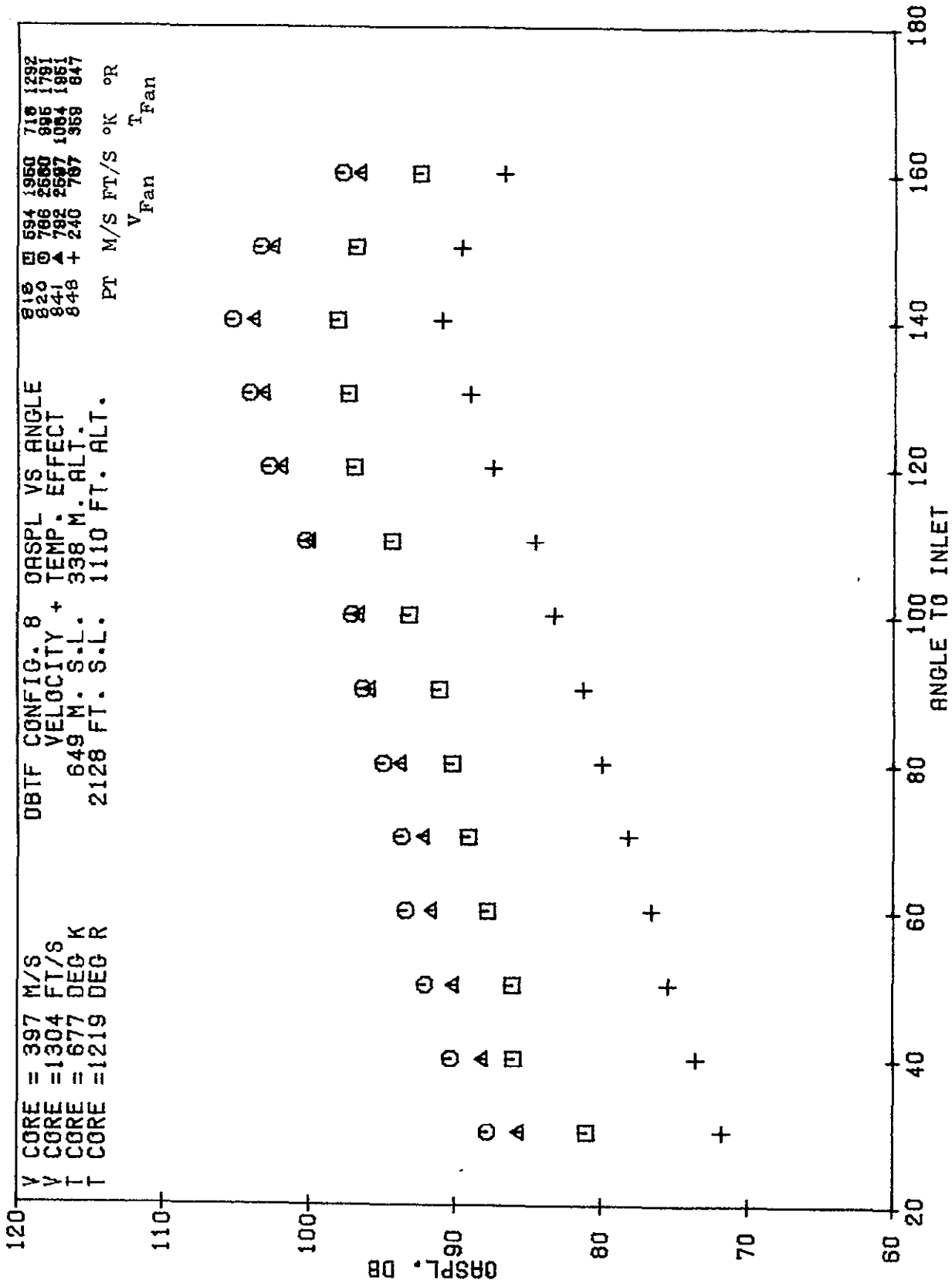

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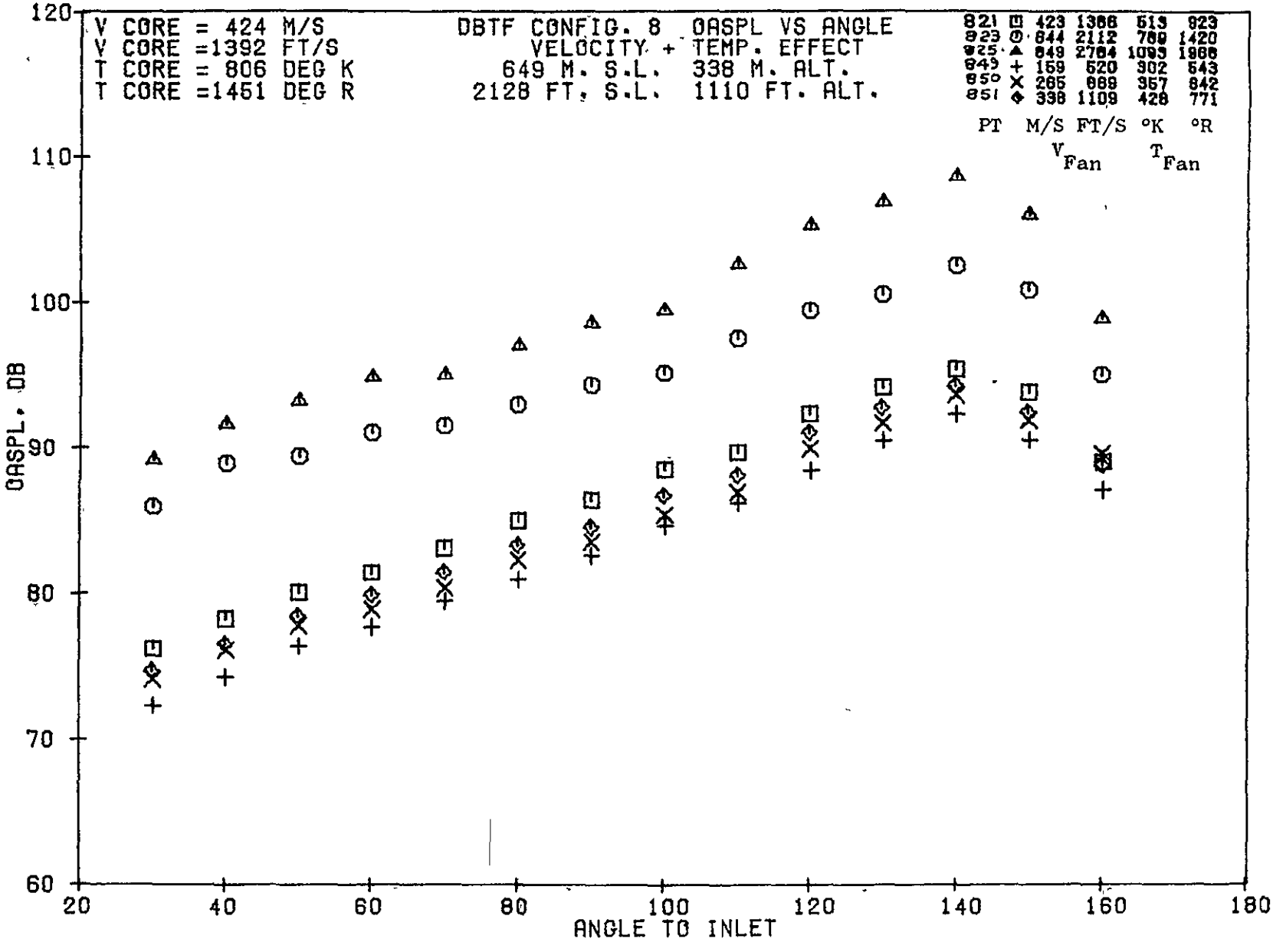

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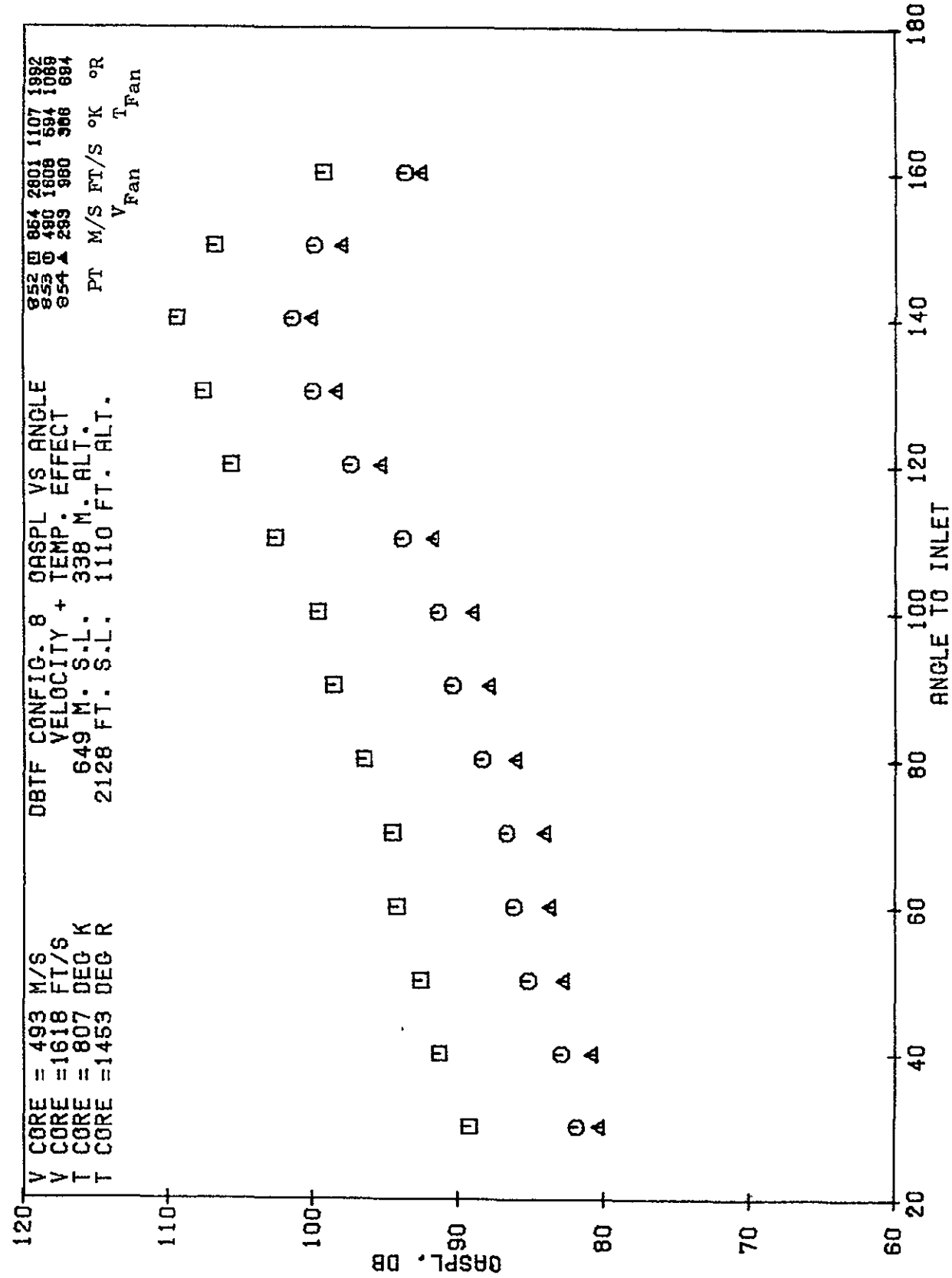

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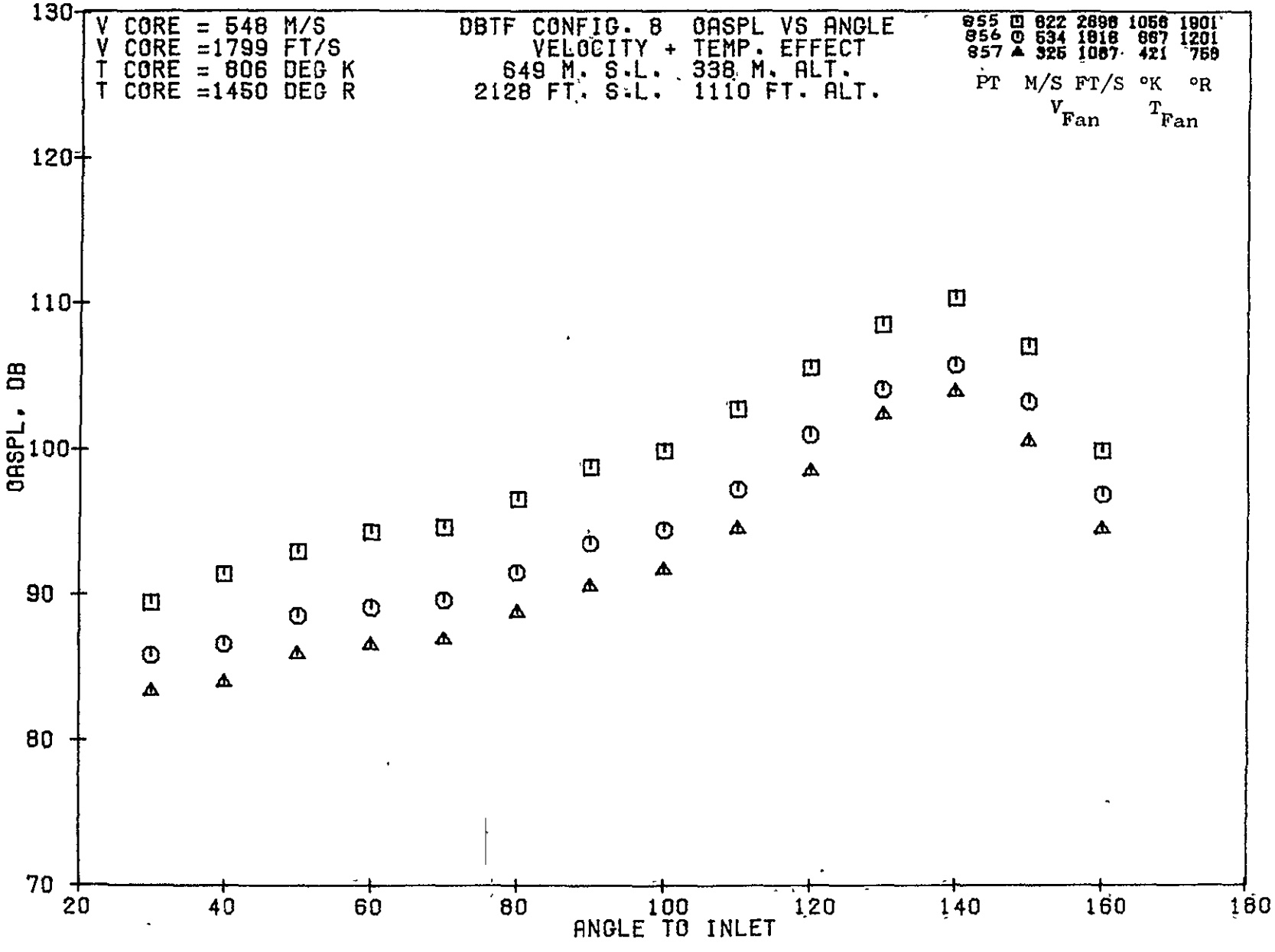

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79 BURR[illegible] A.

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5R524-001

79 BURCH A.

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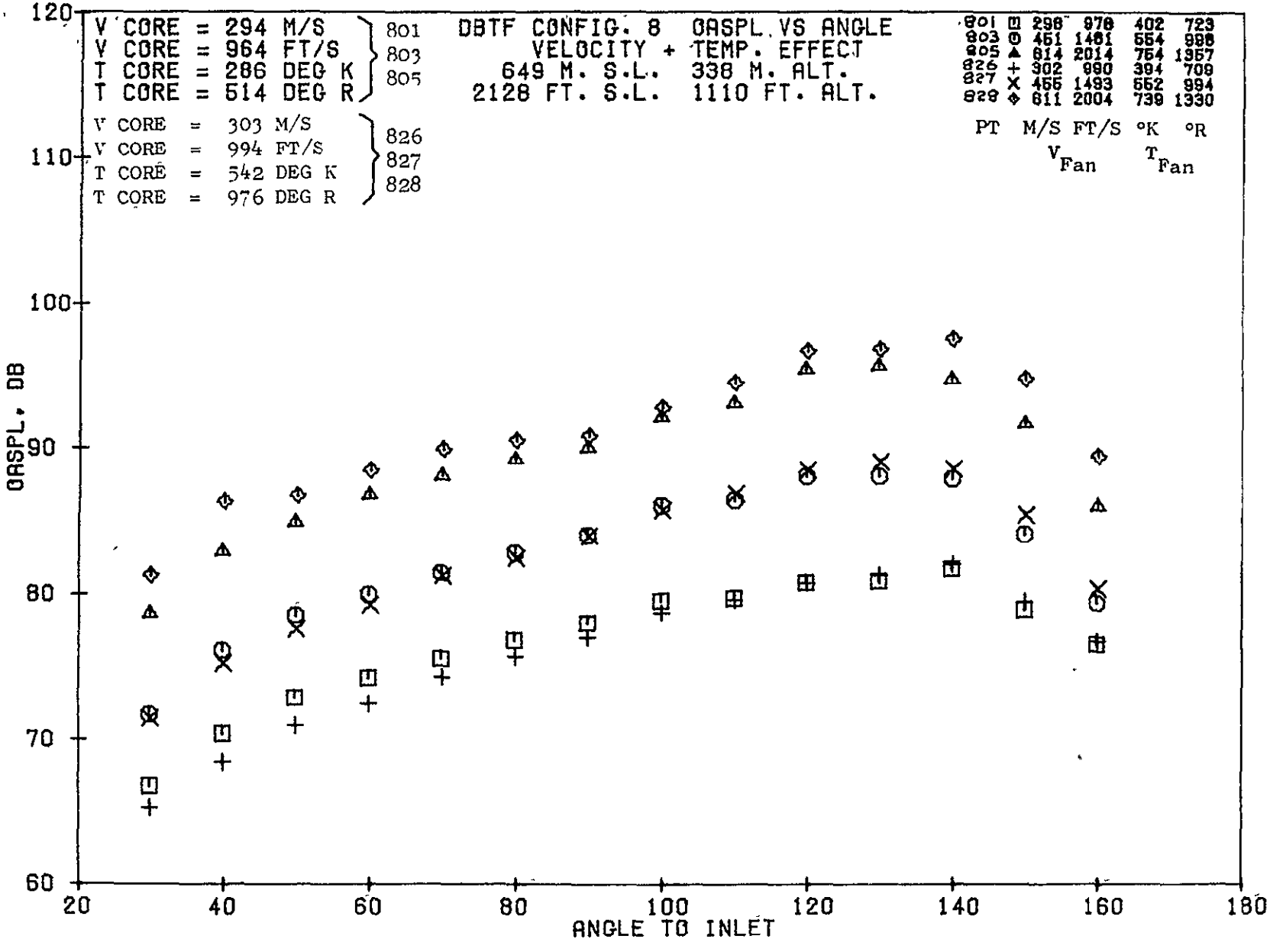

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79 BURC[illegible]A.

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79 BURCH A.

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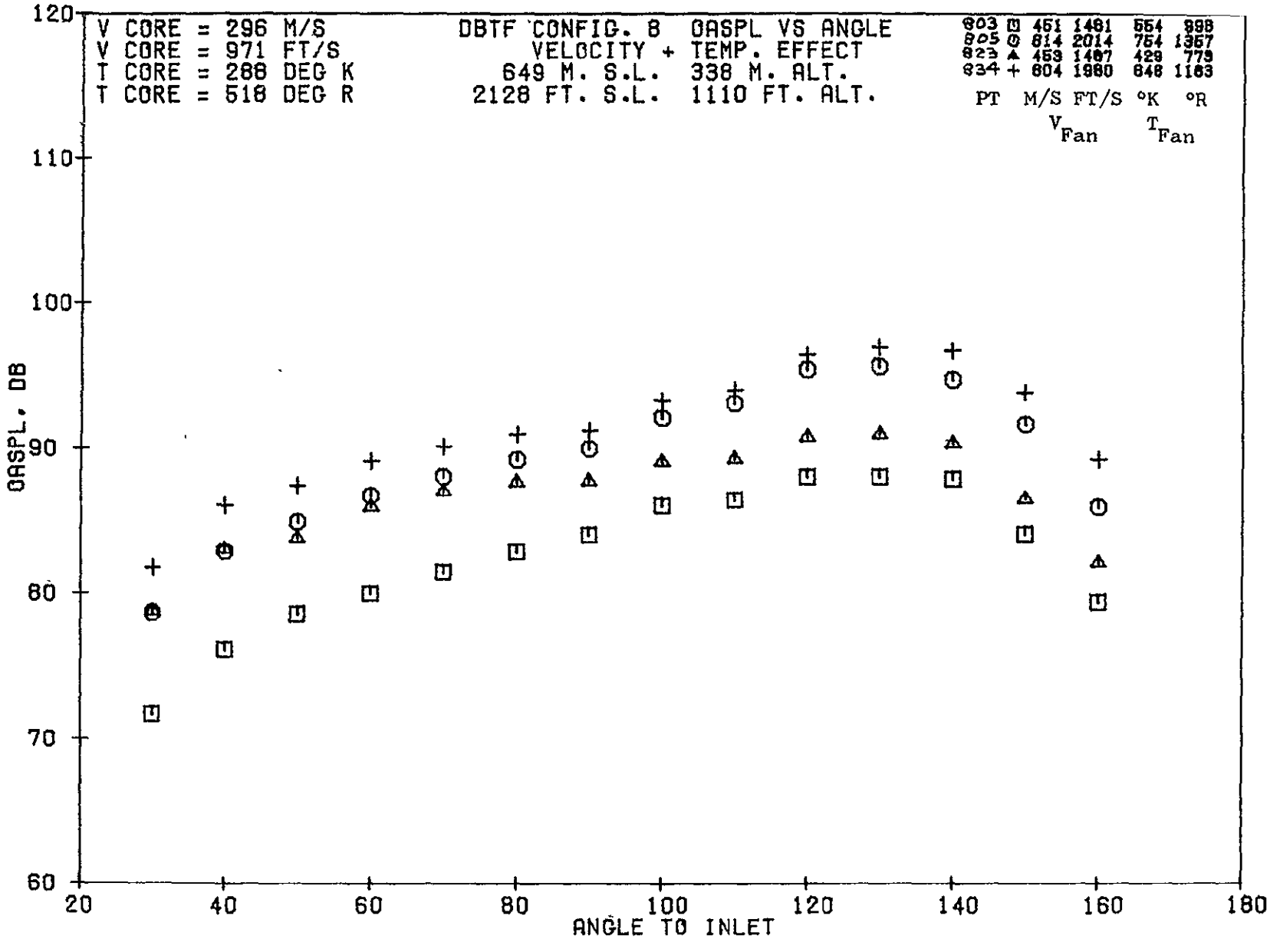

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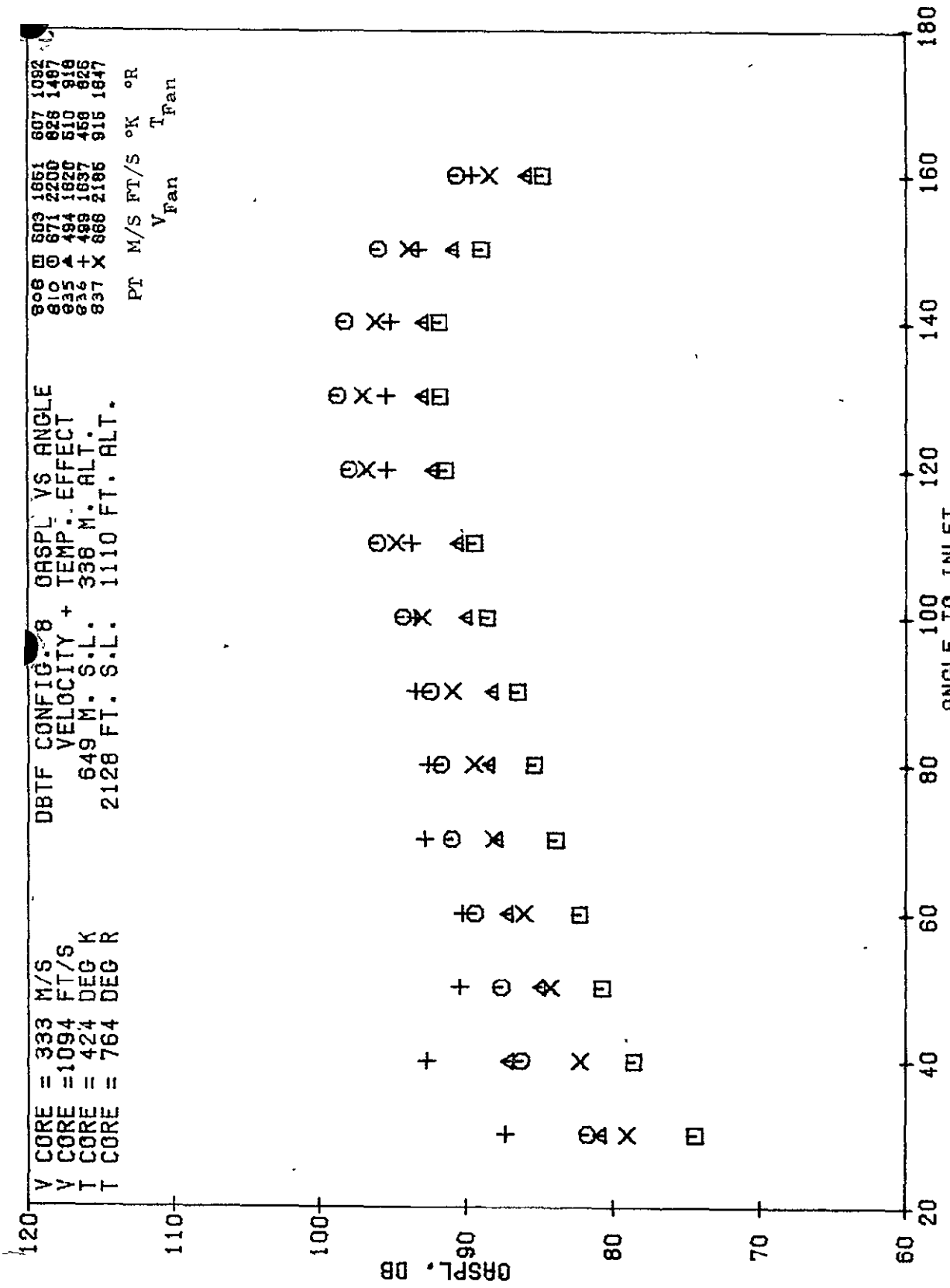

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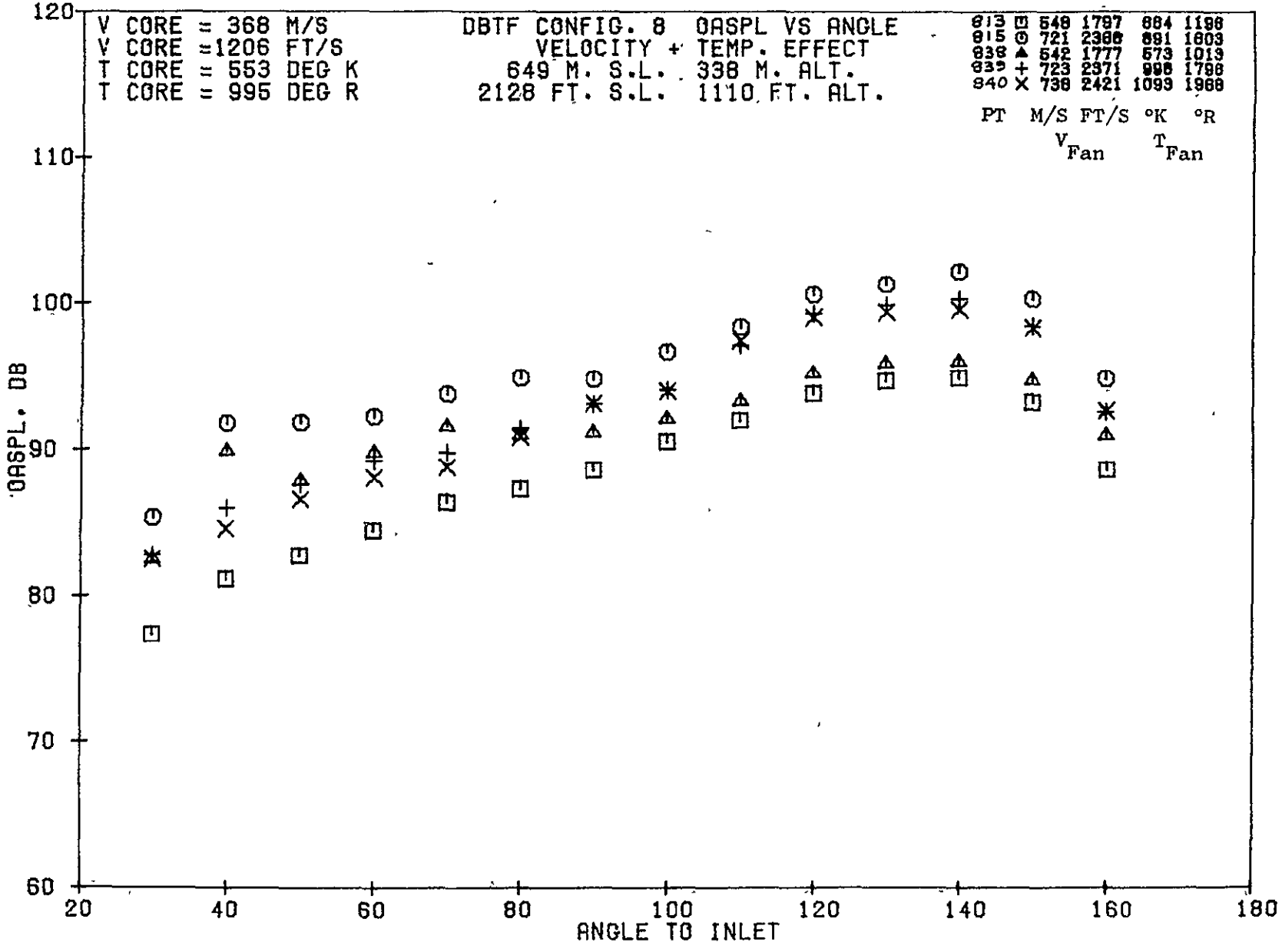

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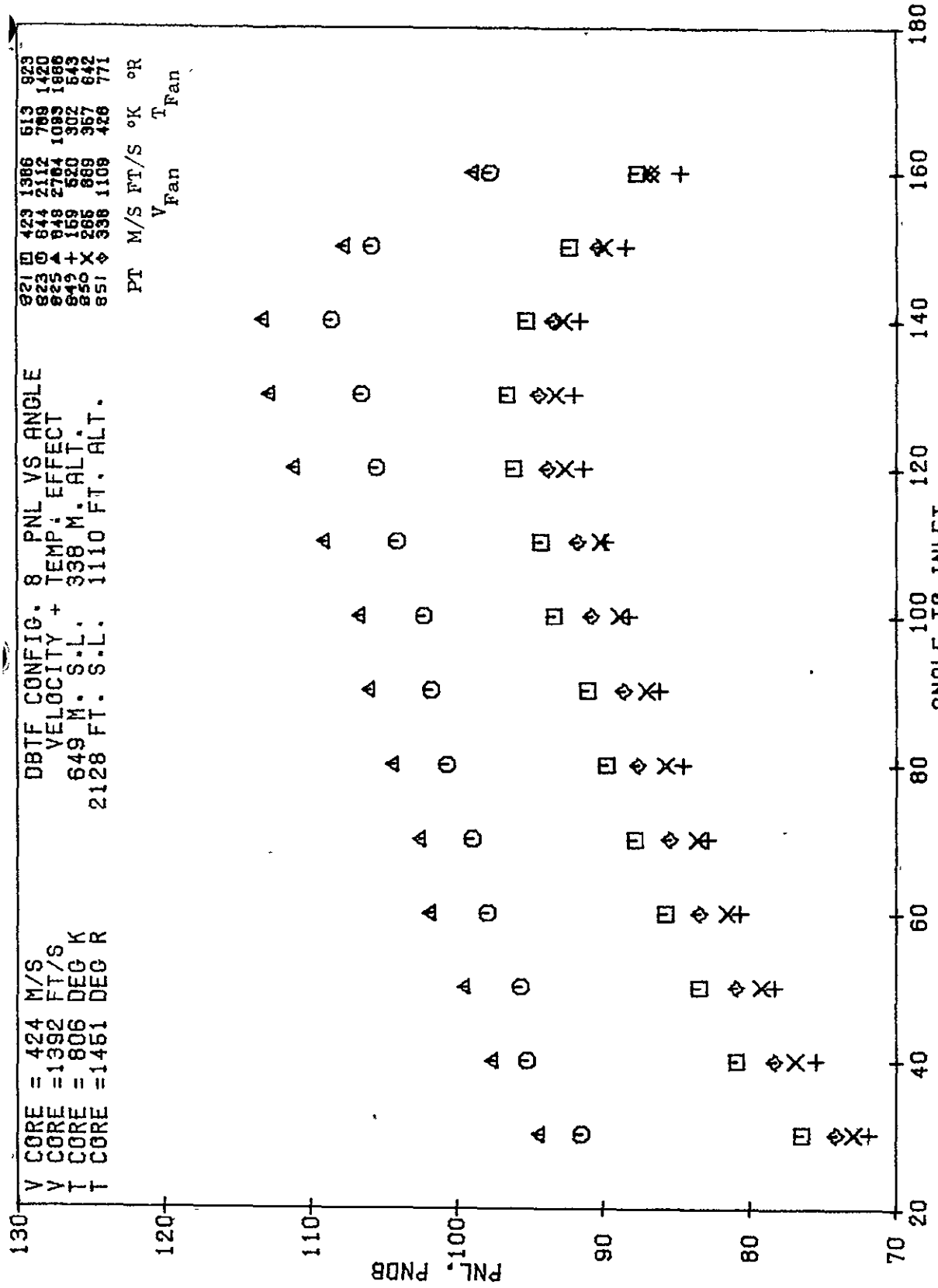

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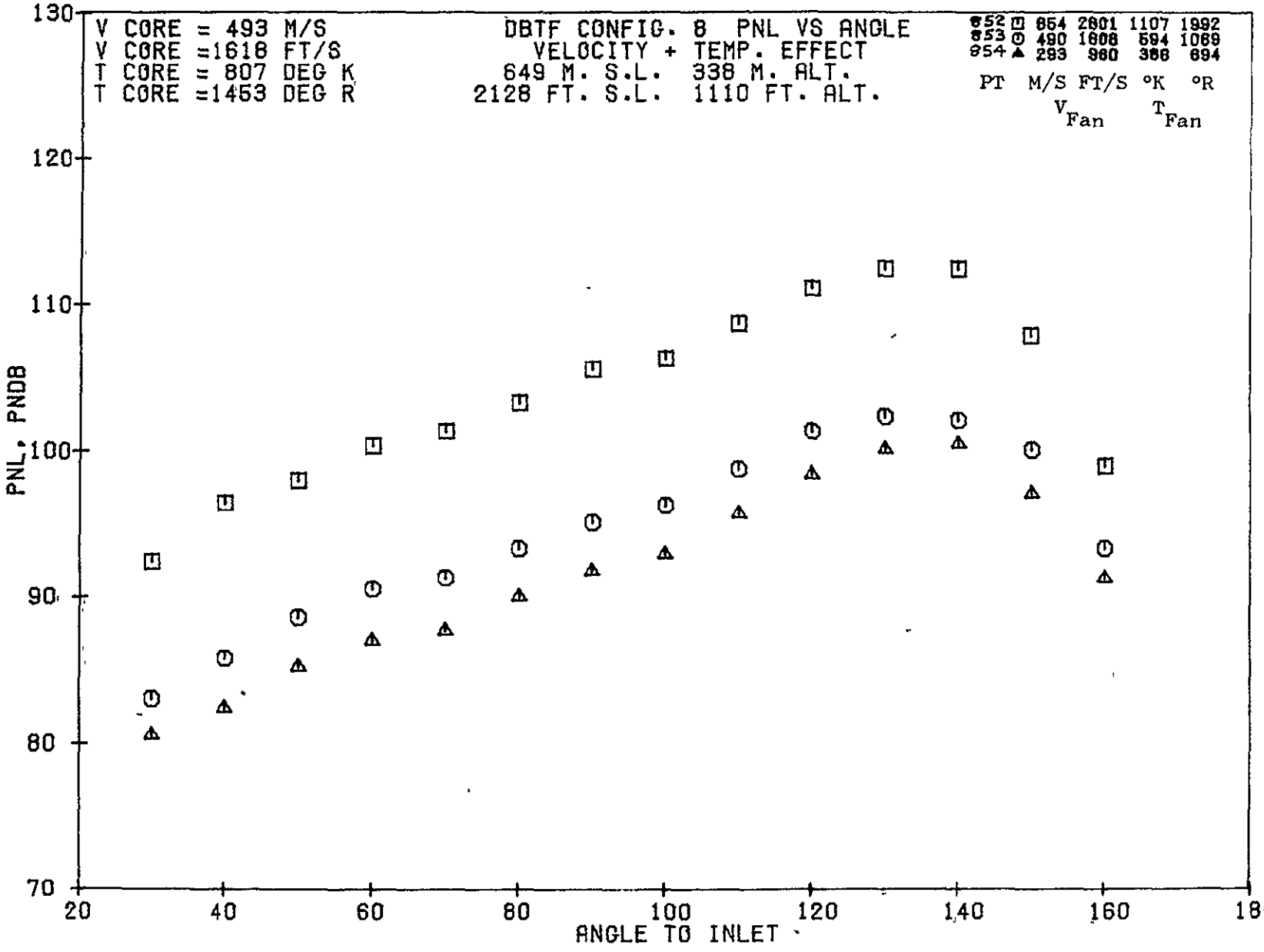

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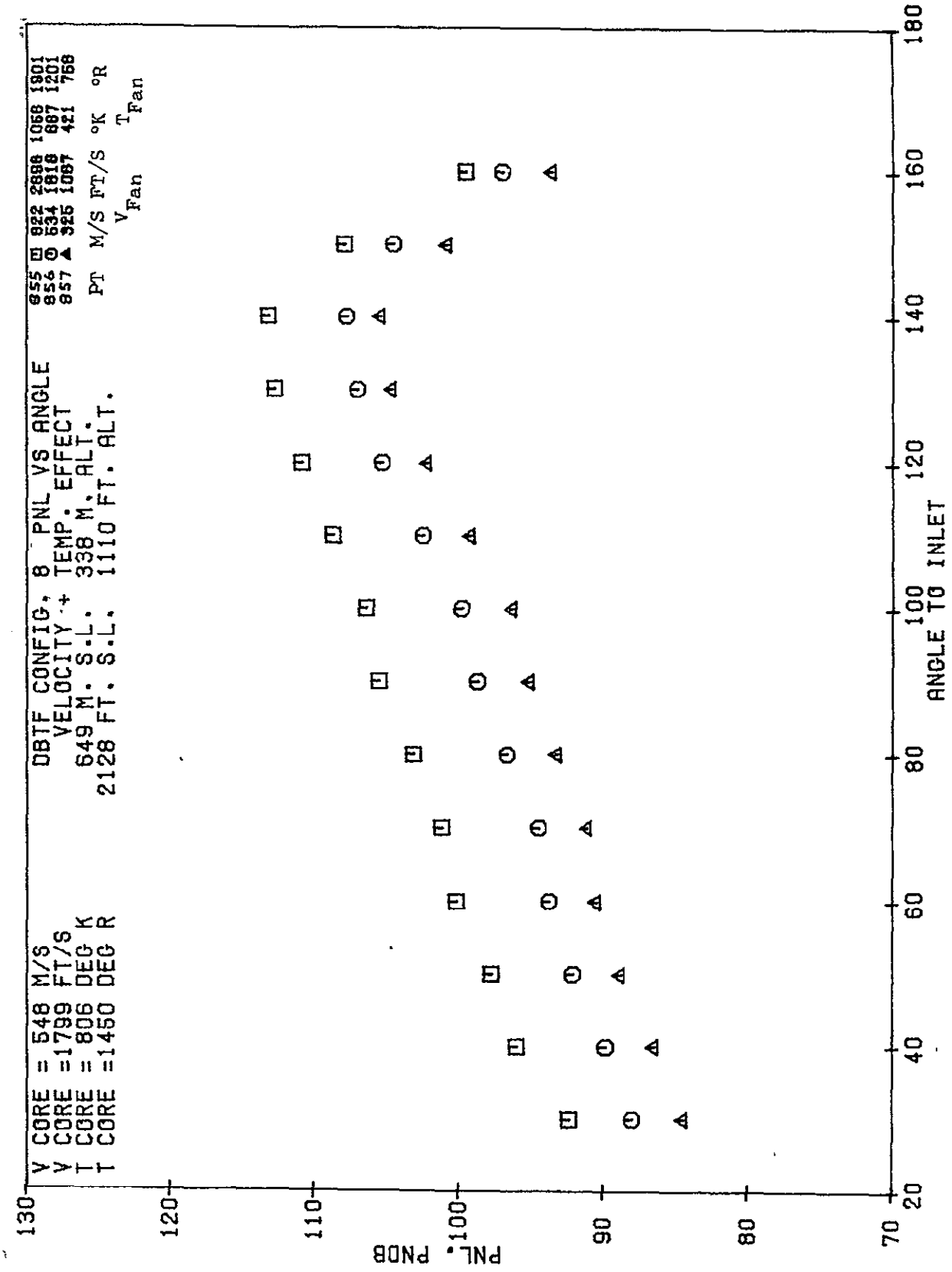
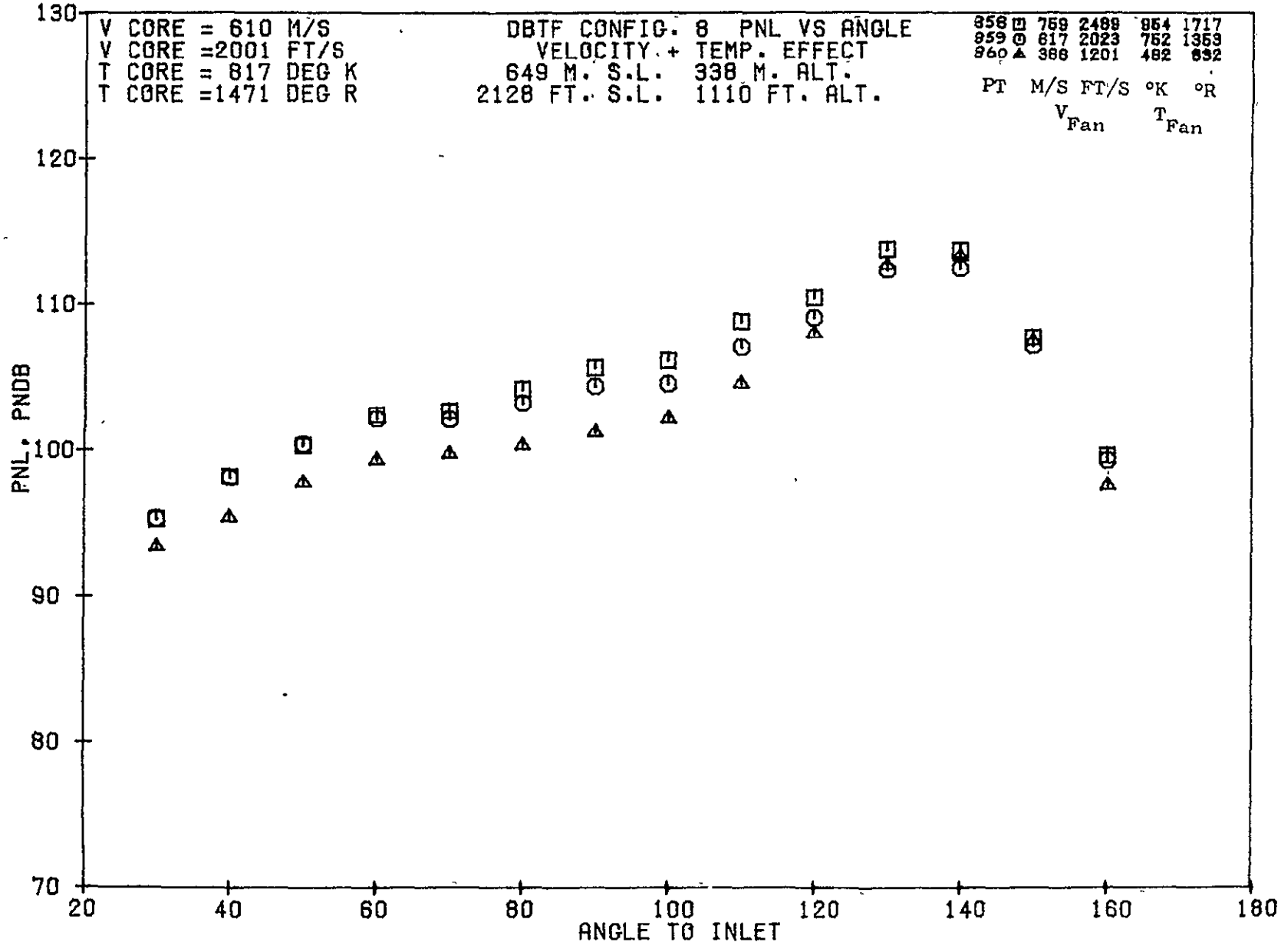


79 BURCH A.

08/20/75
5R524-001

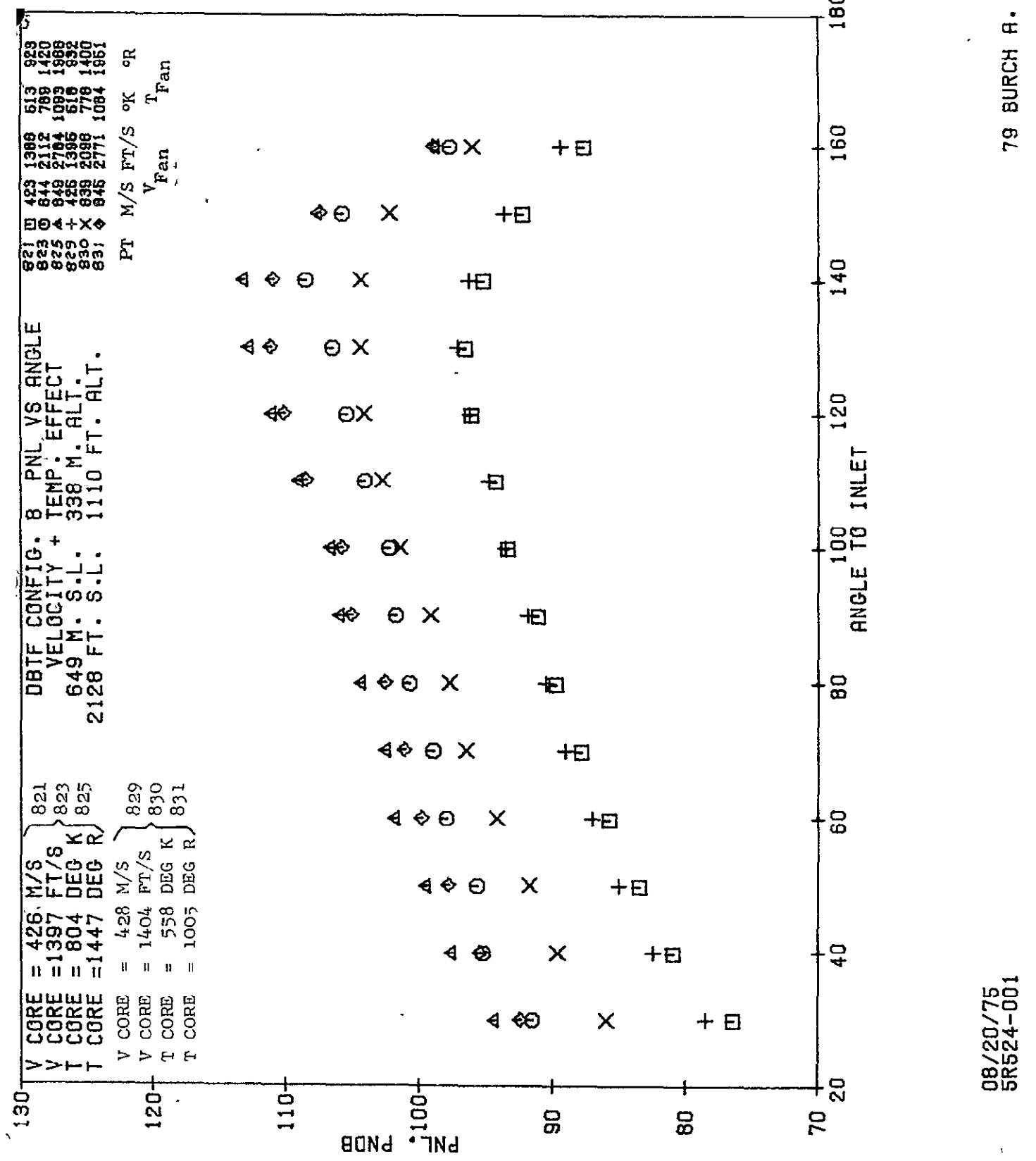
4-31C



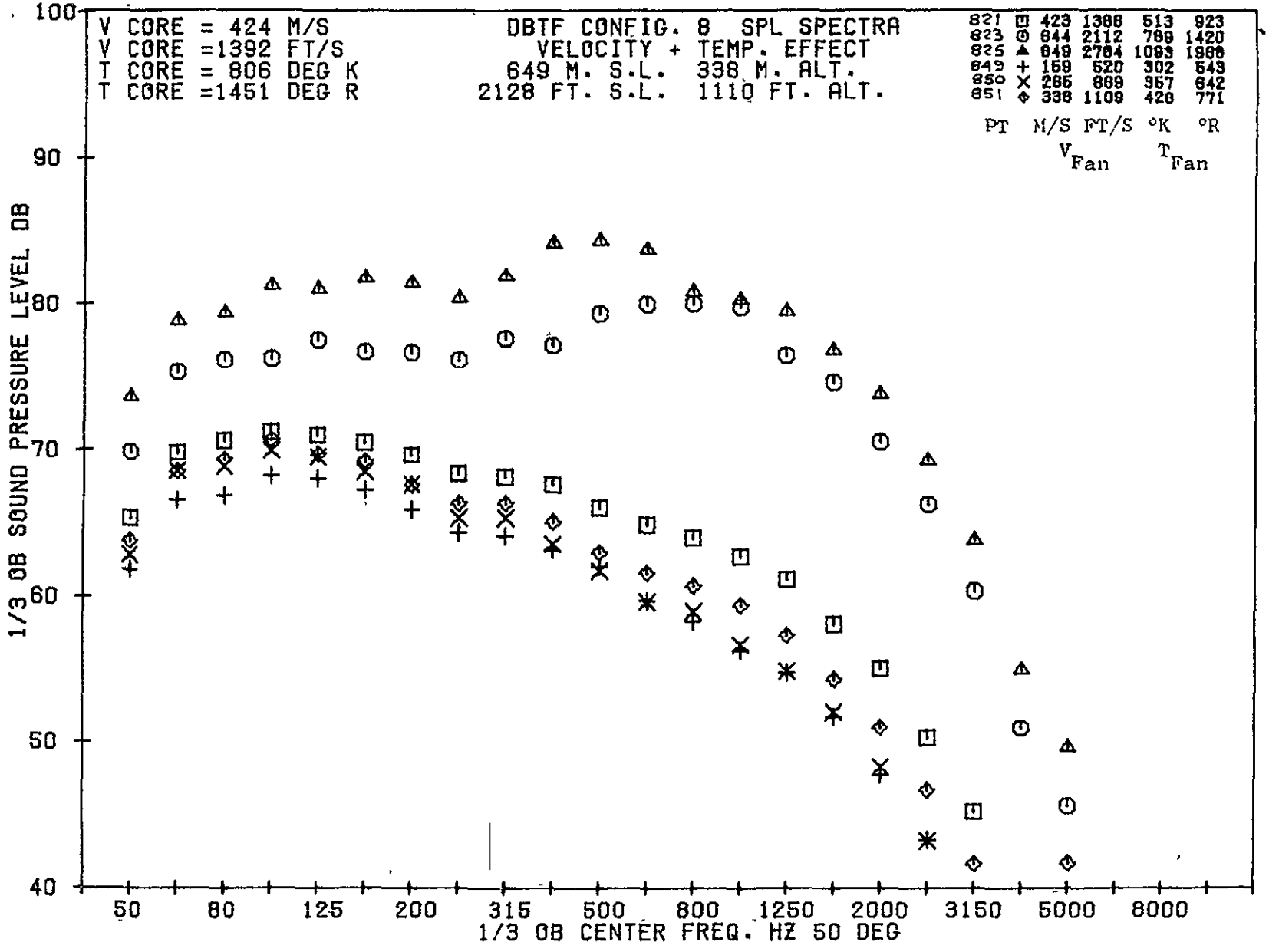
1584

08/20/75
5R524-001

79 BURG A.



4-342

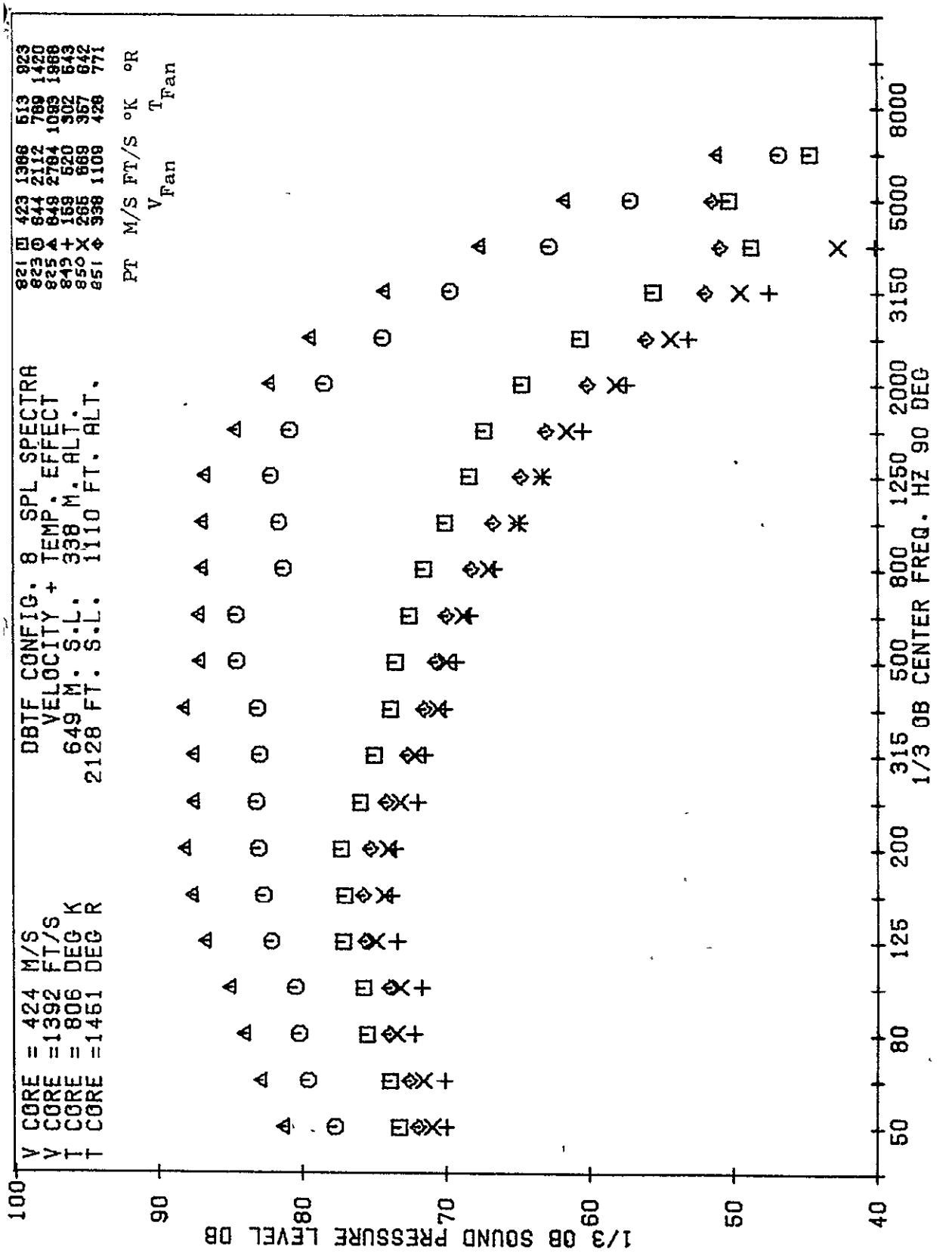


1586

H-343

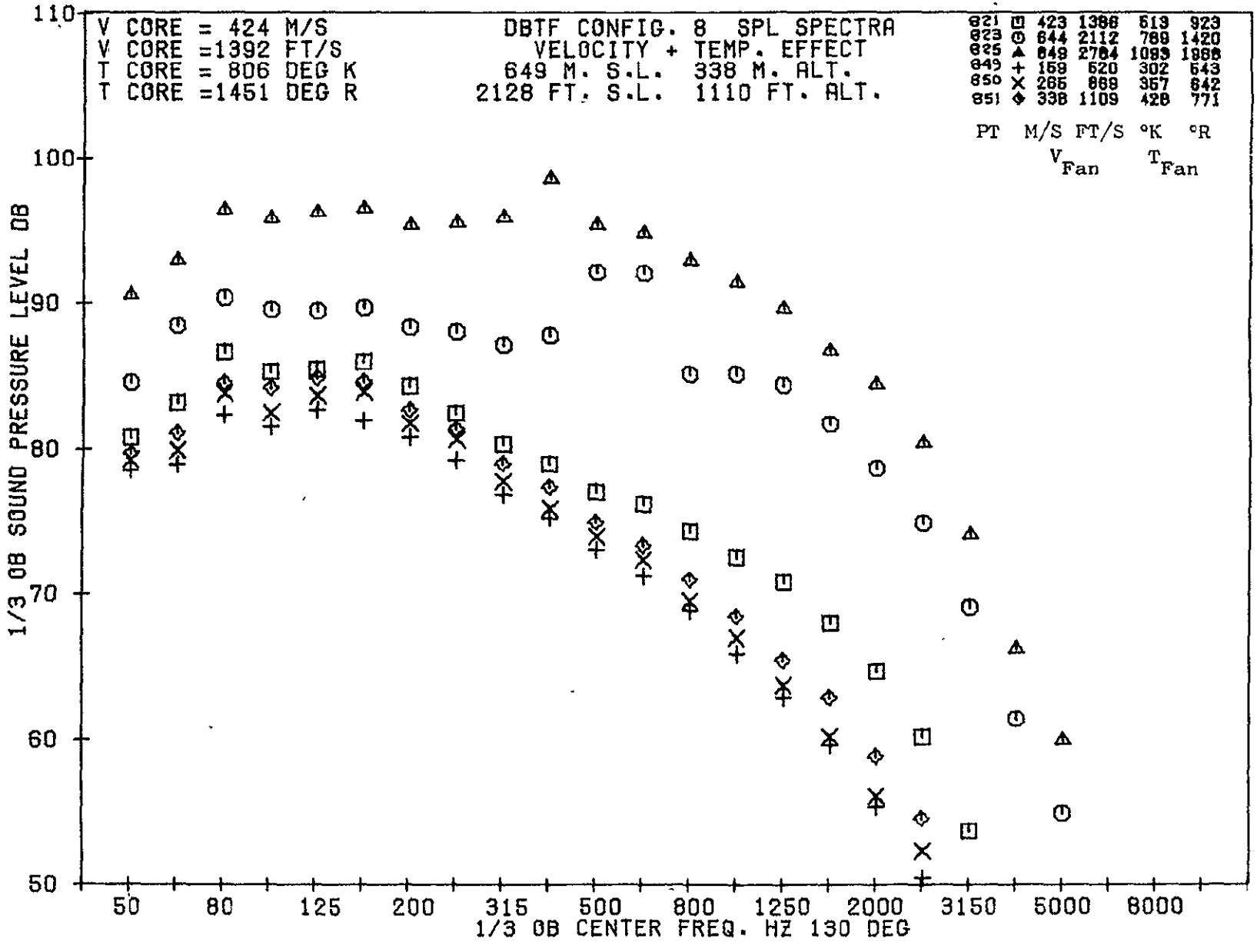
08/20/75
5R524-001

79 BURG A.



79 BURCH A.

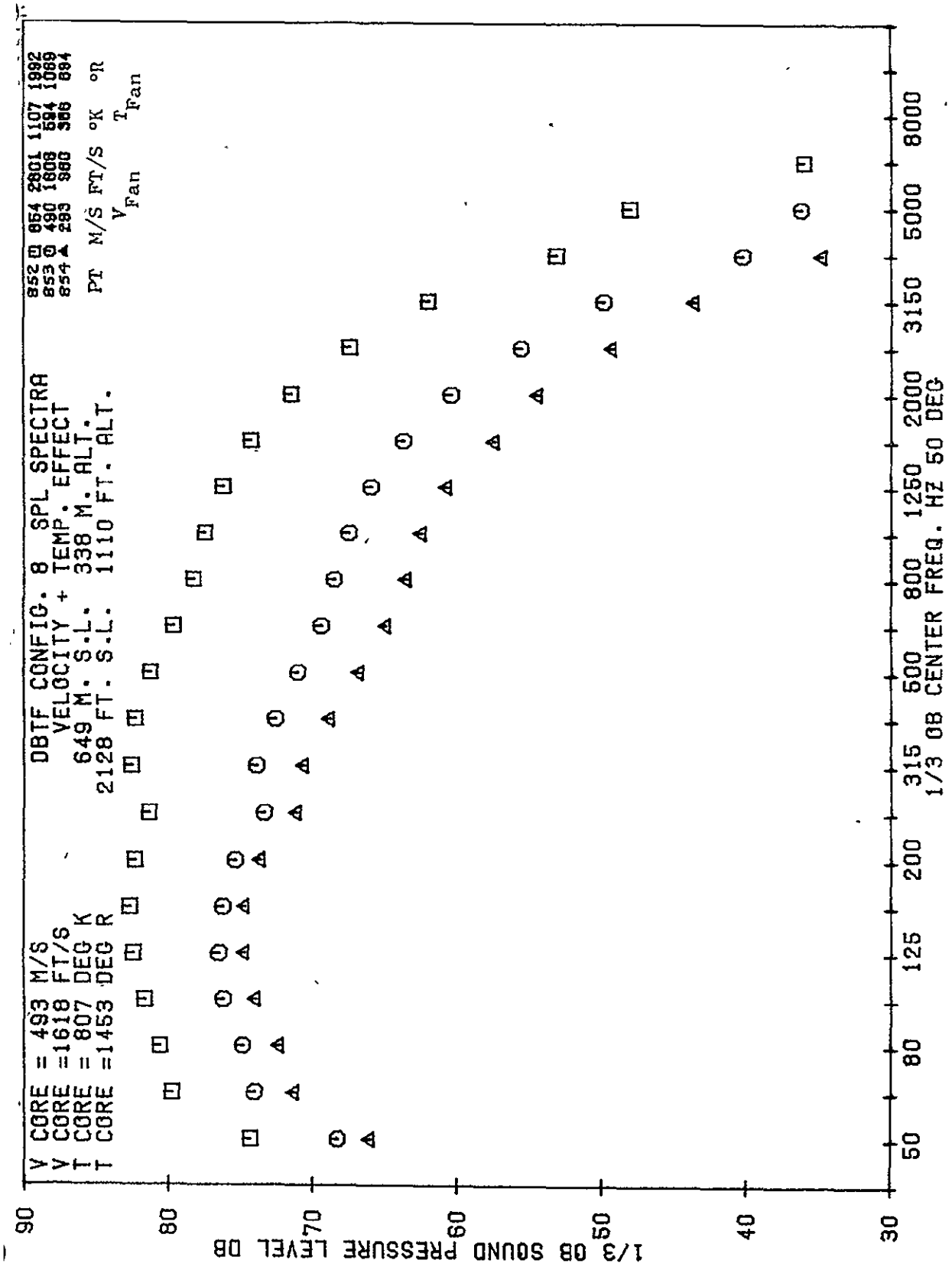
08/20/75
5R524-001



1588

08/20/75
5R524-001

79 BURCH A.



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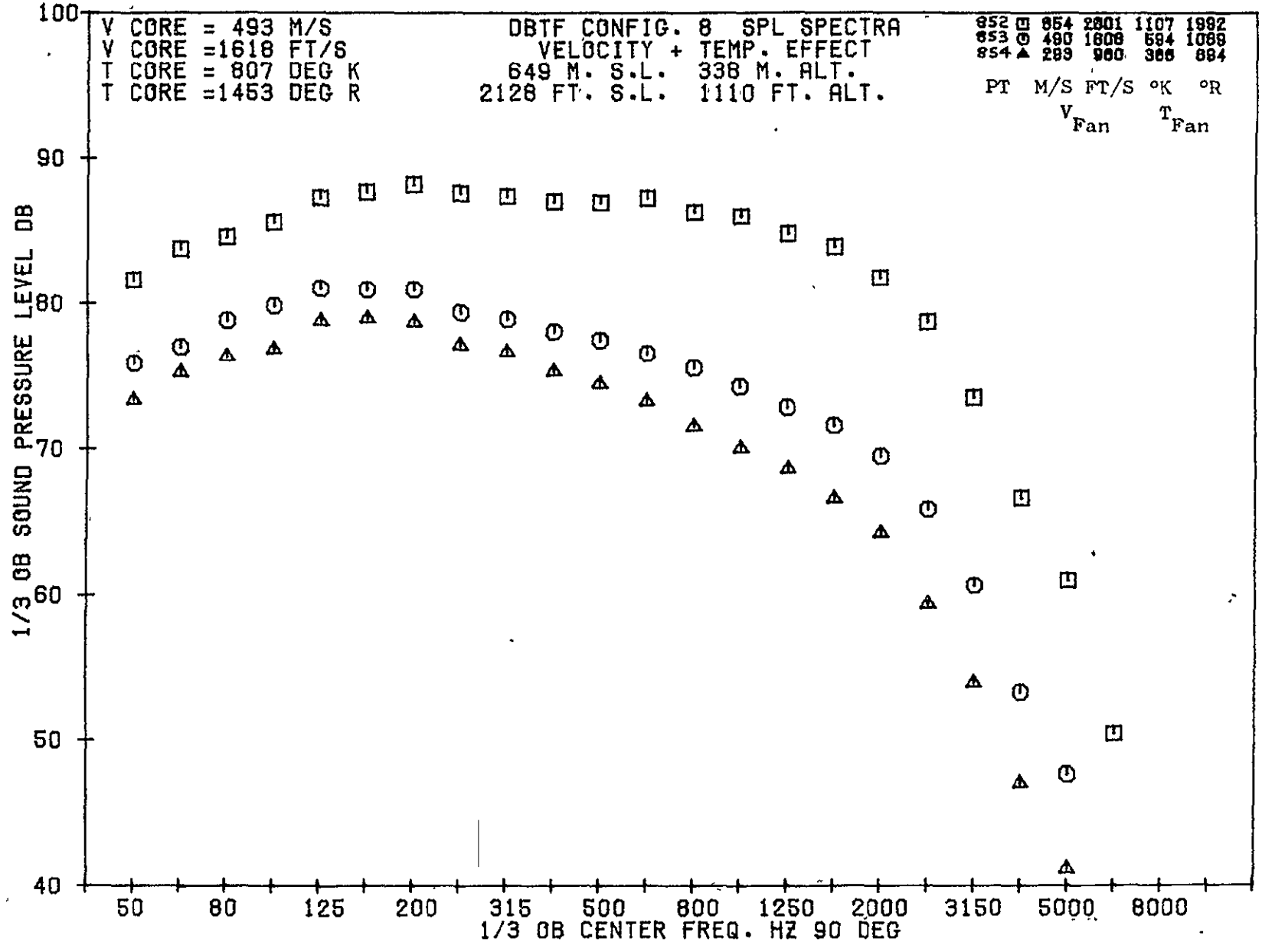
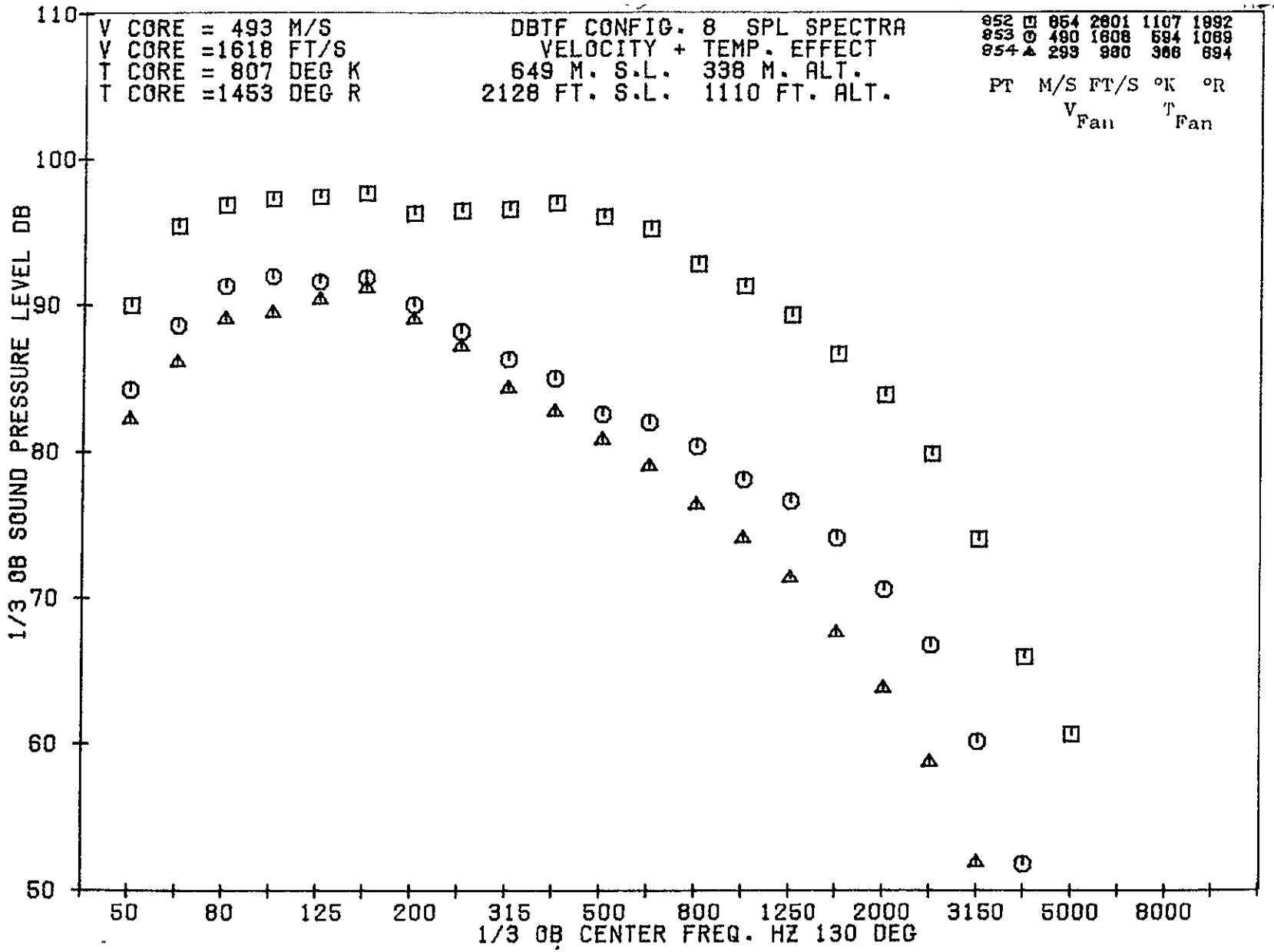
08/20/75
5R524-001



1590

08/20/75
5R524-001

79 BUICK A.



1691

08/20/75
5R524-001

79 BURCH A.

L-348

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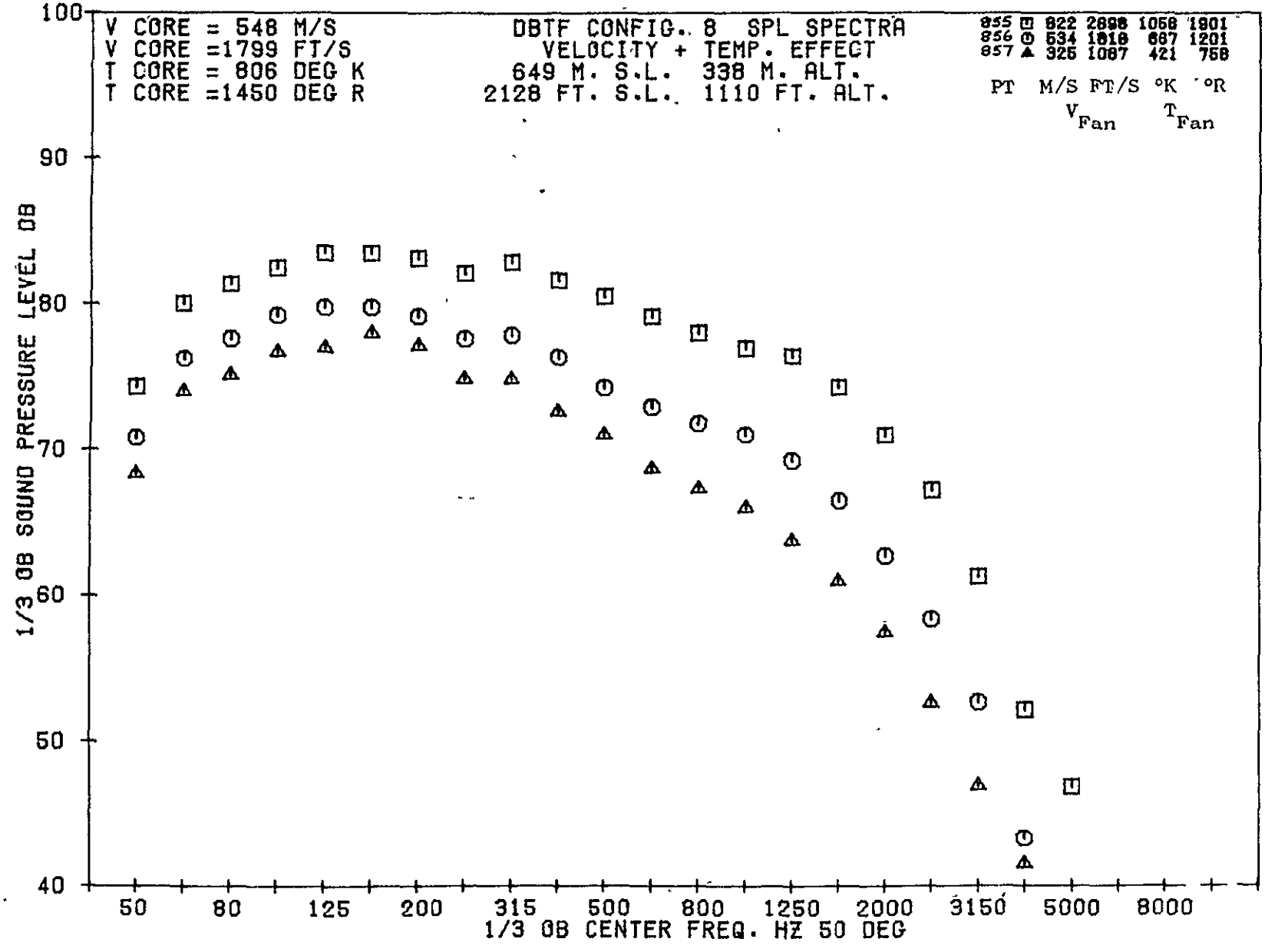

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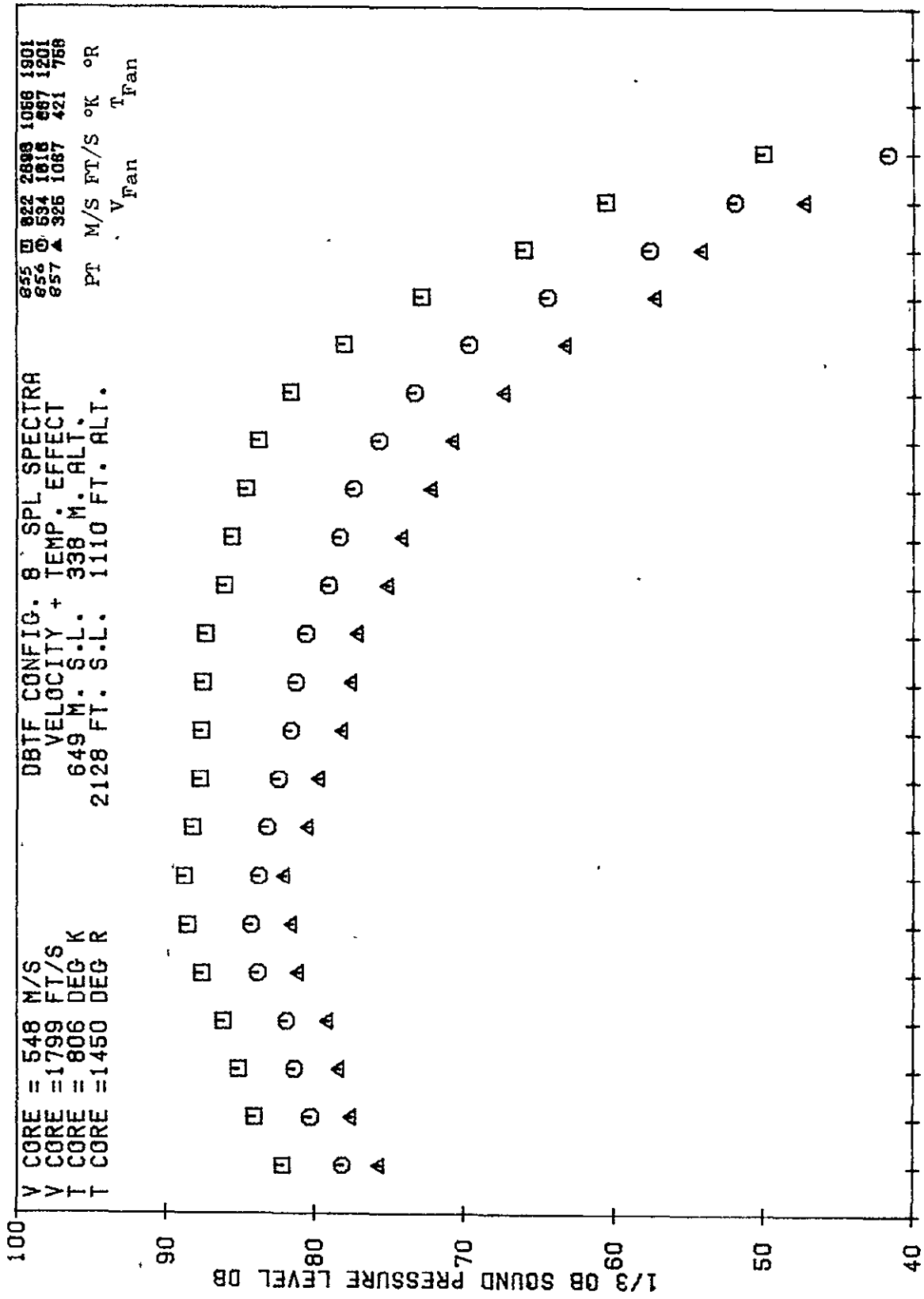
08/22/75
5R682-001

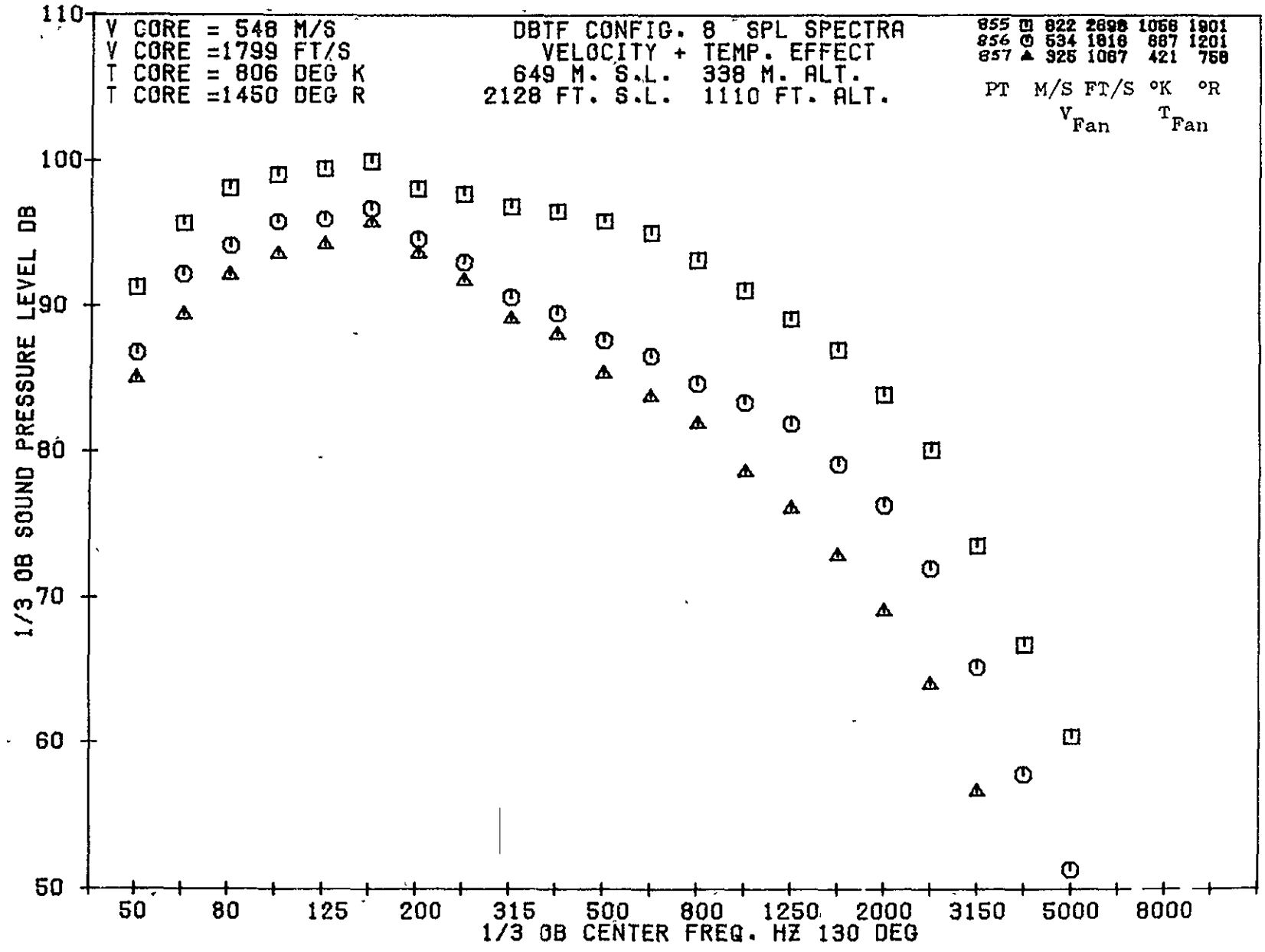
79 BUR[illegible] A.



79 BURCH A.

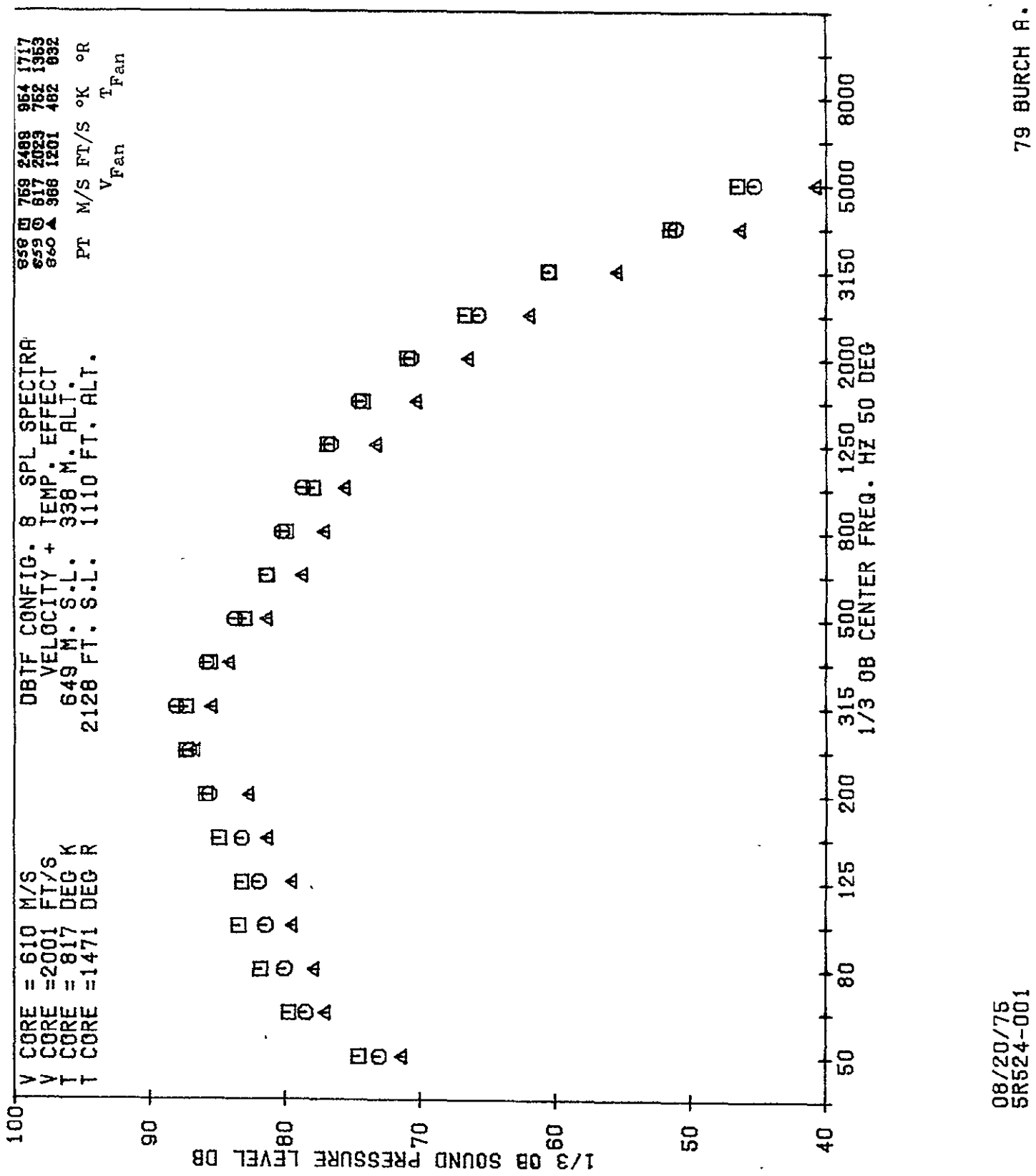
08/22/75
5R682-001

4 350



1594

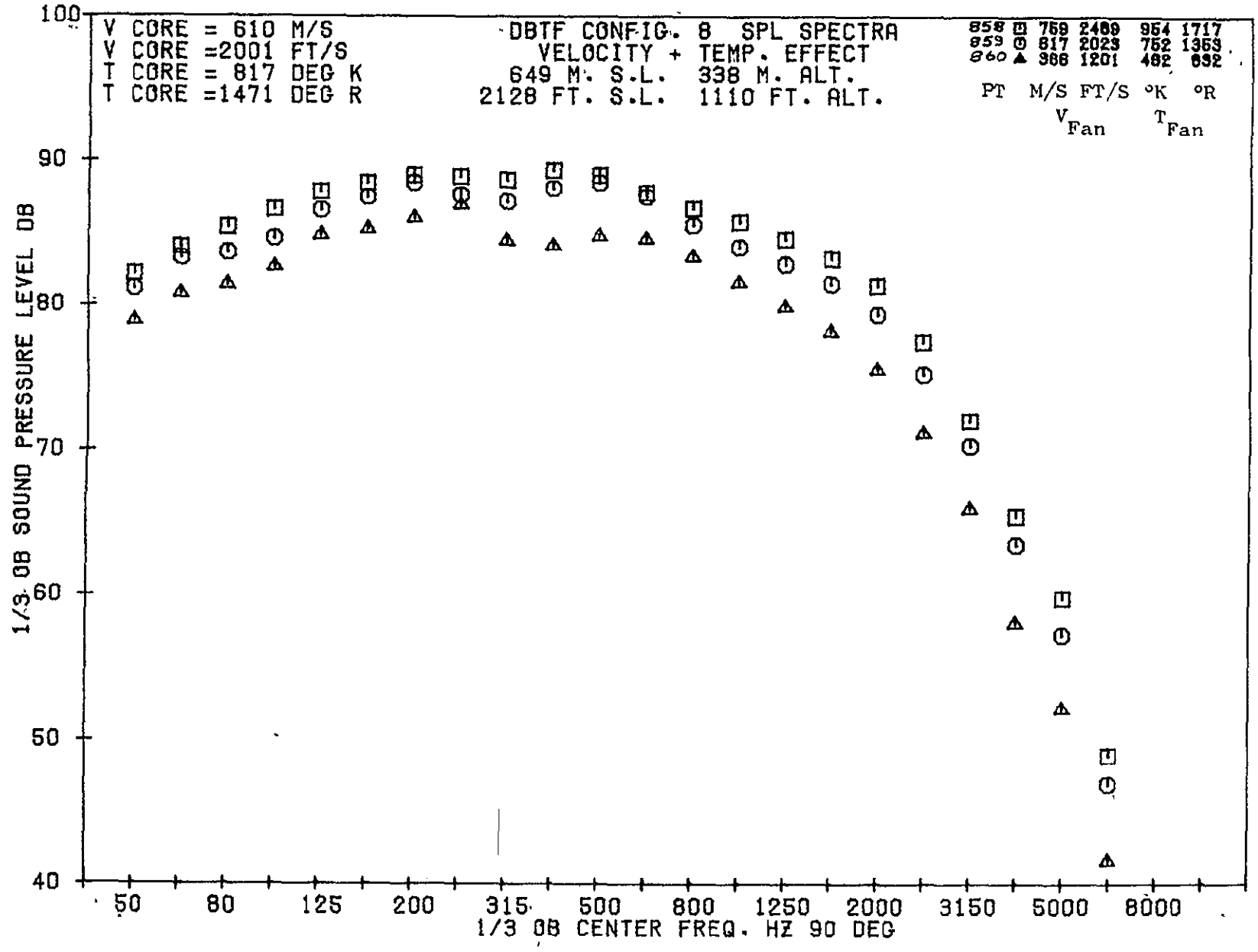
08/22/75
5R682-001



79 BURCH A.

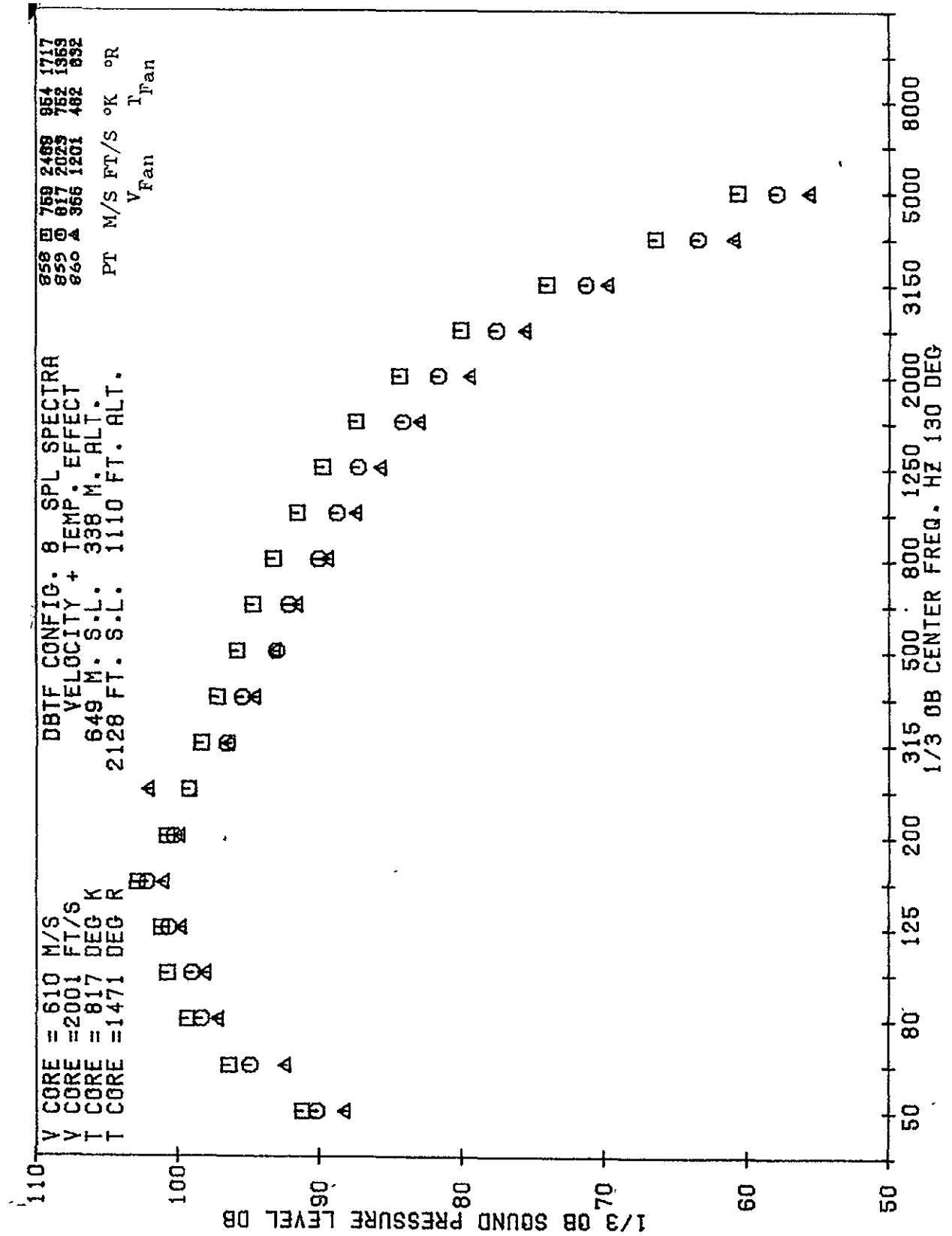
08/20/75
SR524-001

4-352



1596

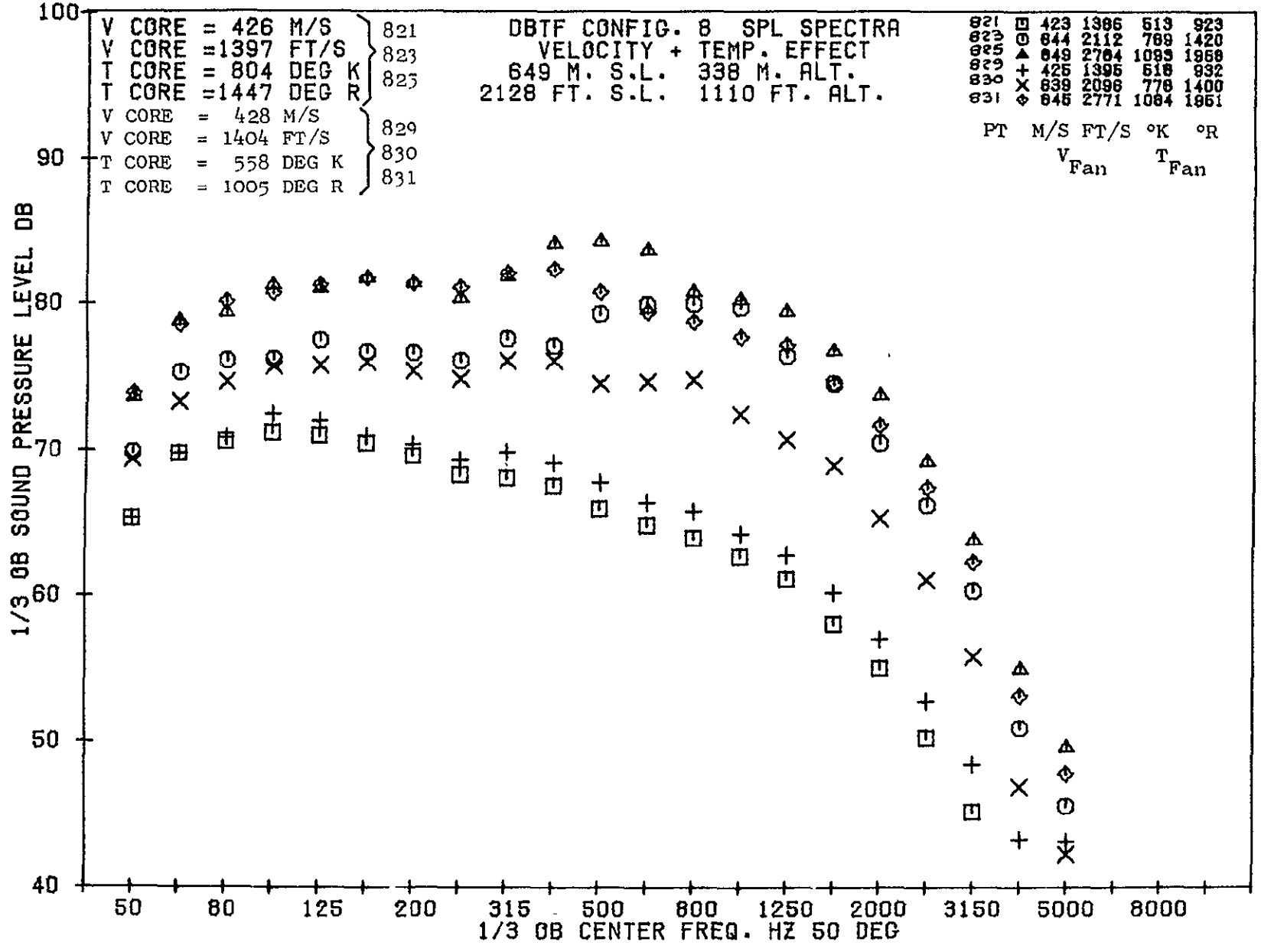
08/20/75
5R524-001



08/20/75
5R524-001

79 BURCH A.

4-354



1598

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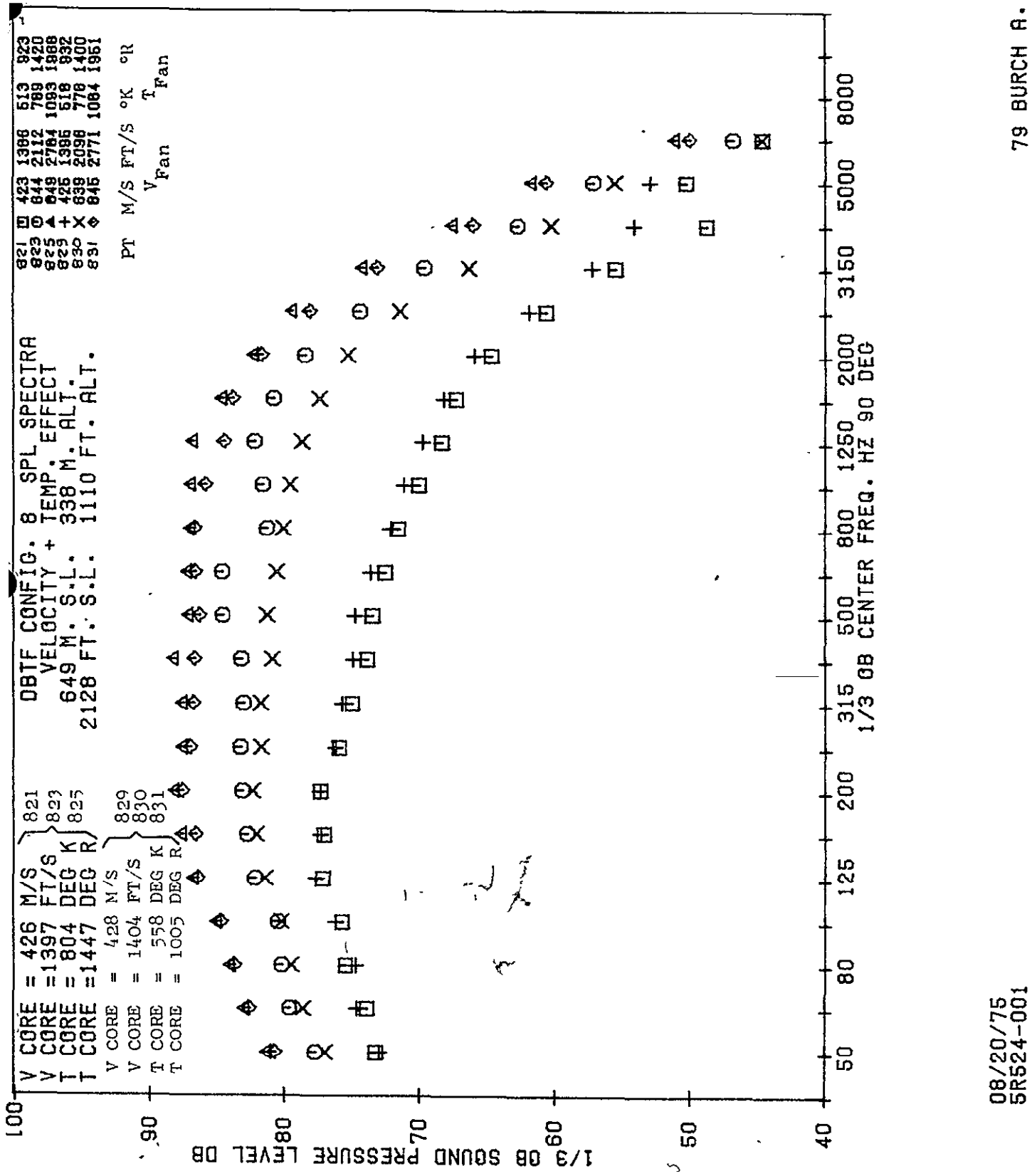
5R524-001

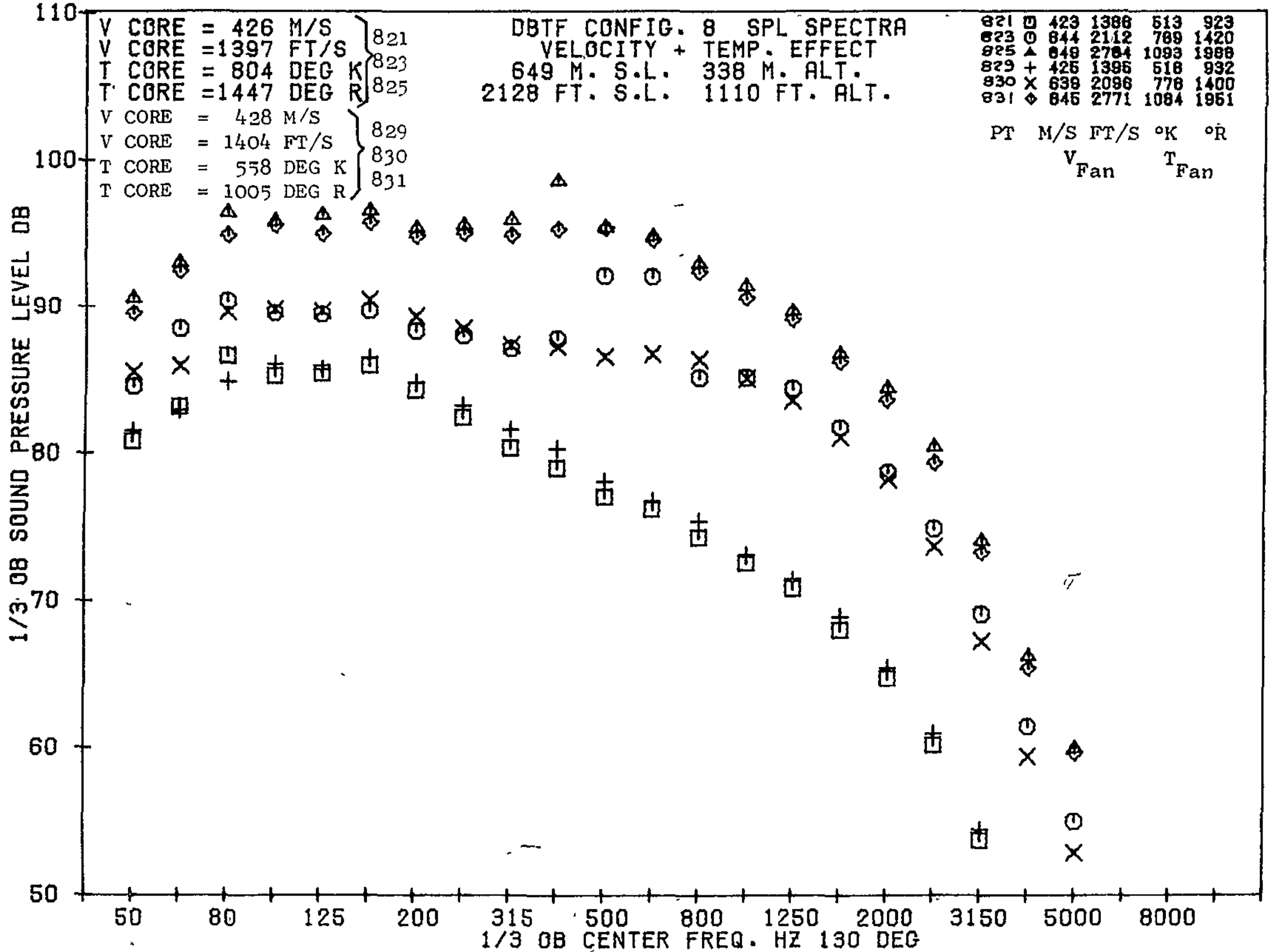
79 BURG[illegible]A.



79 BURCH A.

08/20/75
5R524-001

4-356

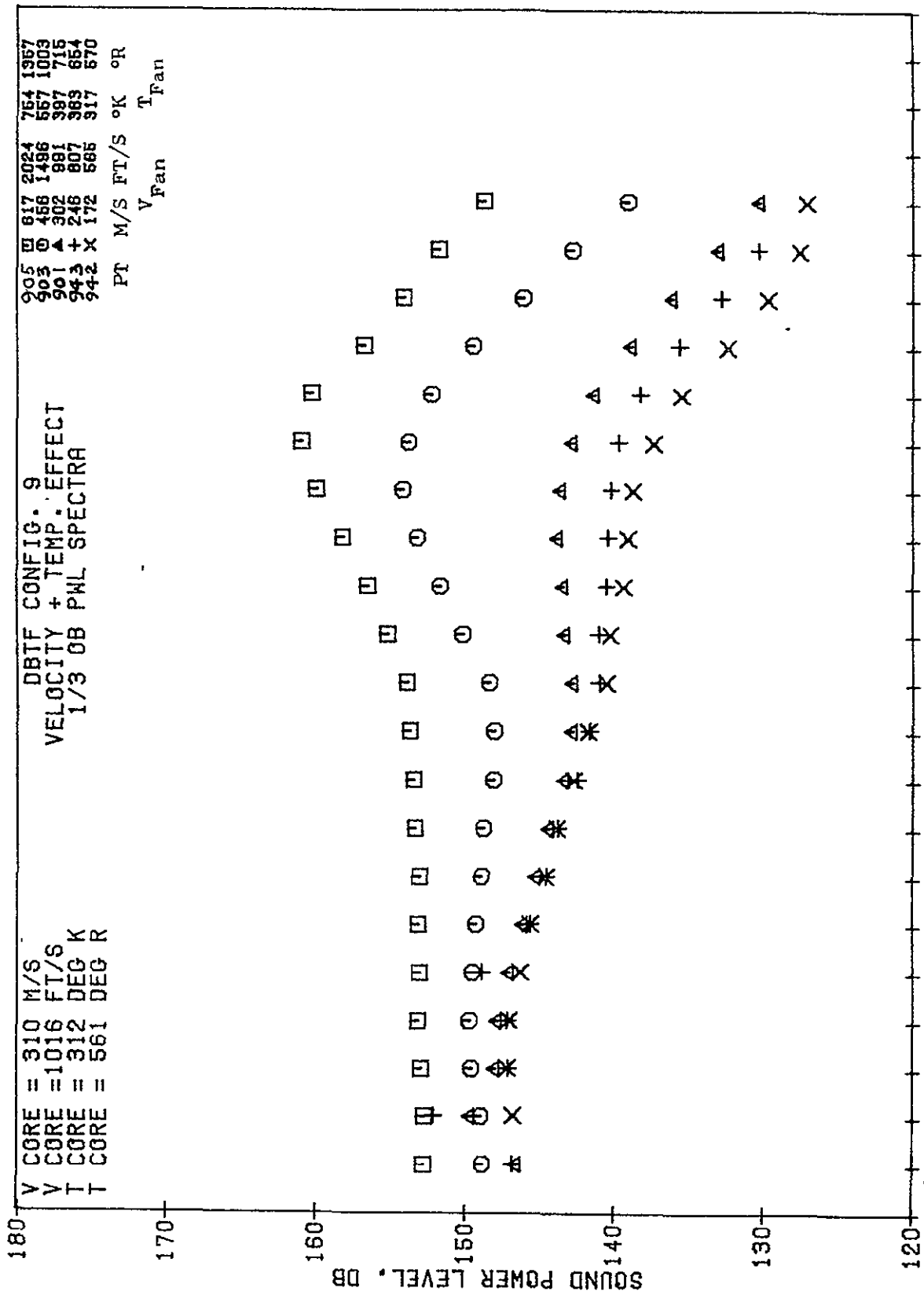


1600

08/20/75
5R524-001

79 BURCH A.

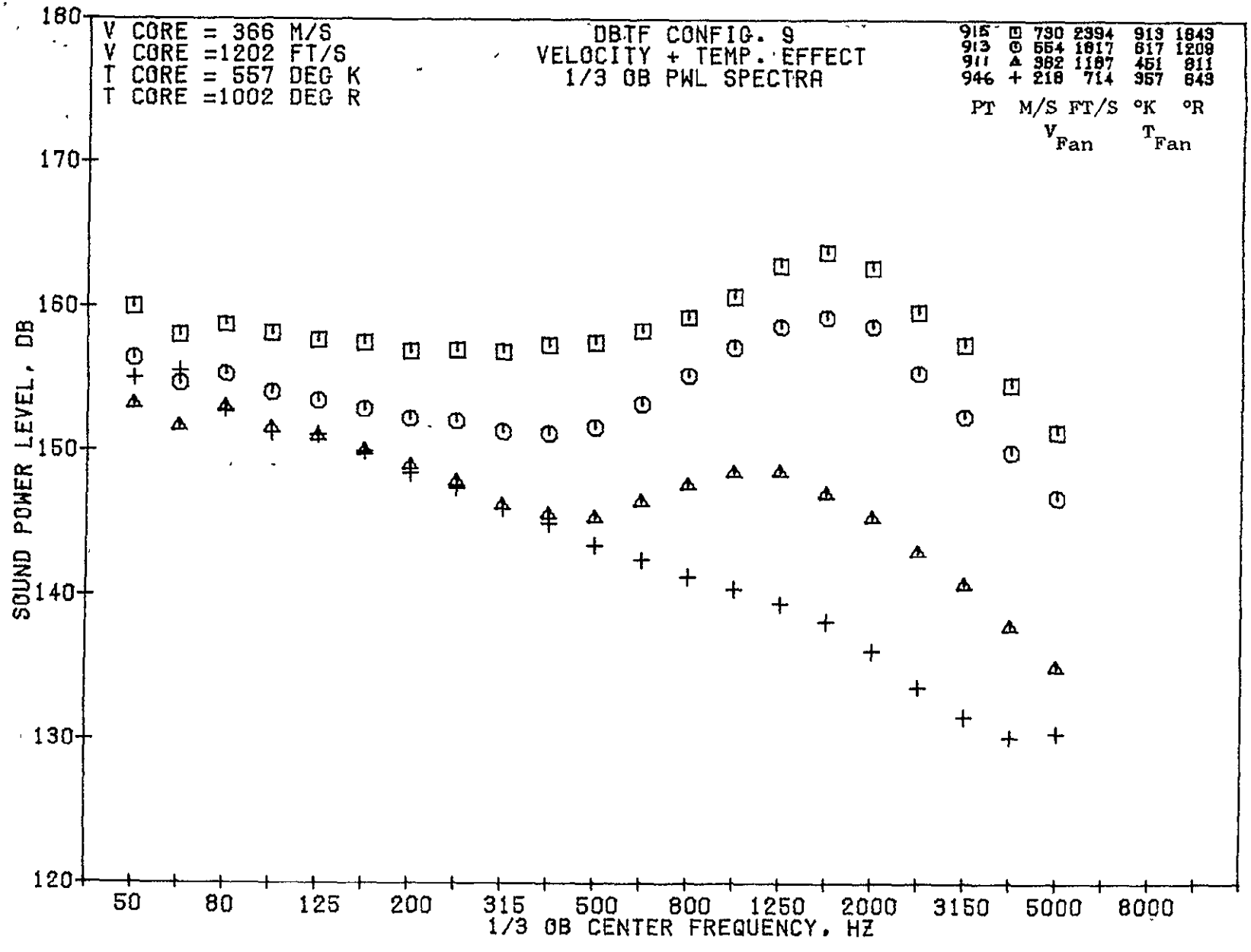
4-357



79 BURCH A.

08/18/75
5R266-001

L358



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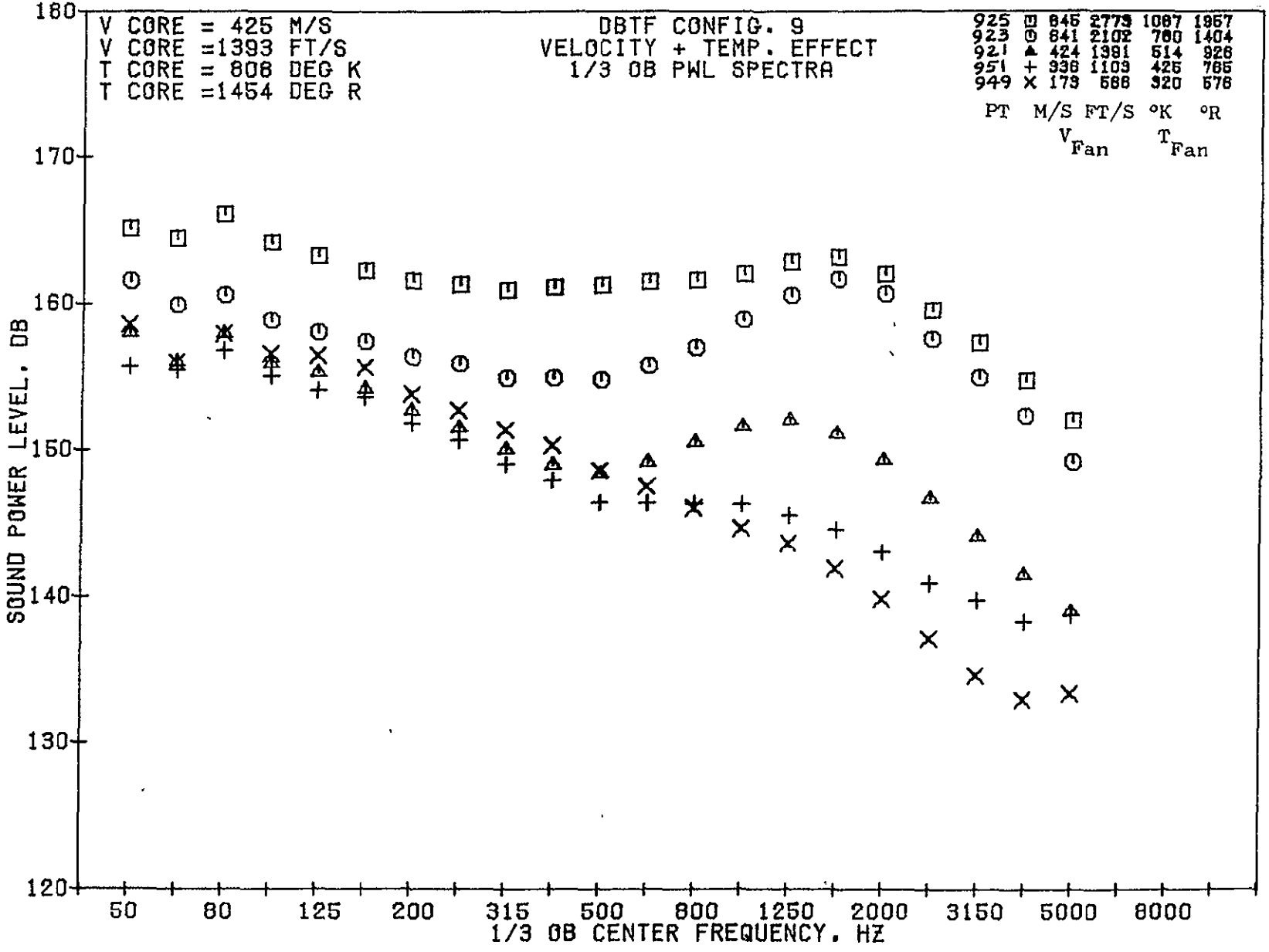
5R266-001



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08/18/75
5R266-001

79 BURCH A.

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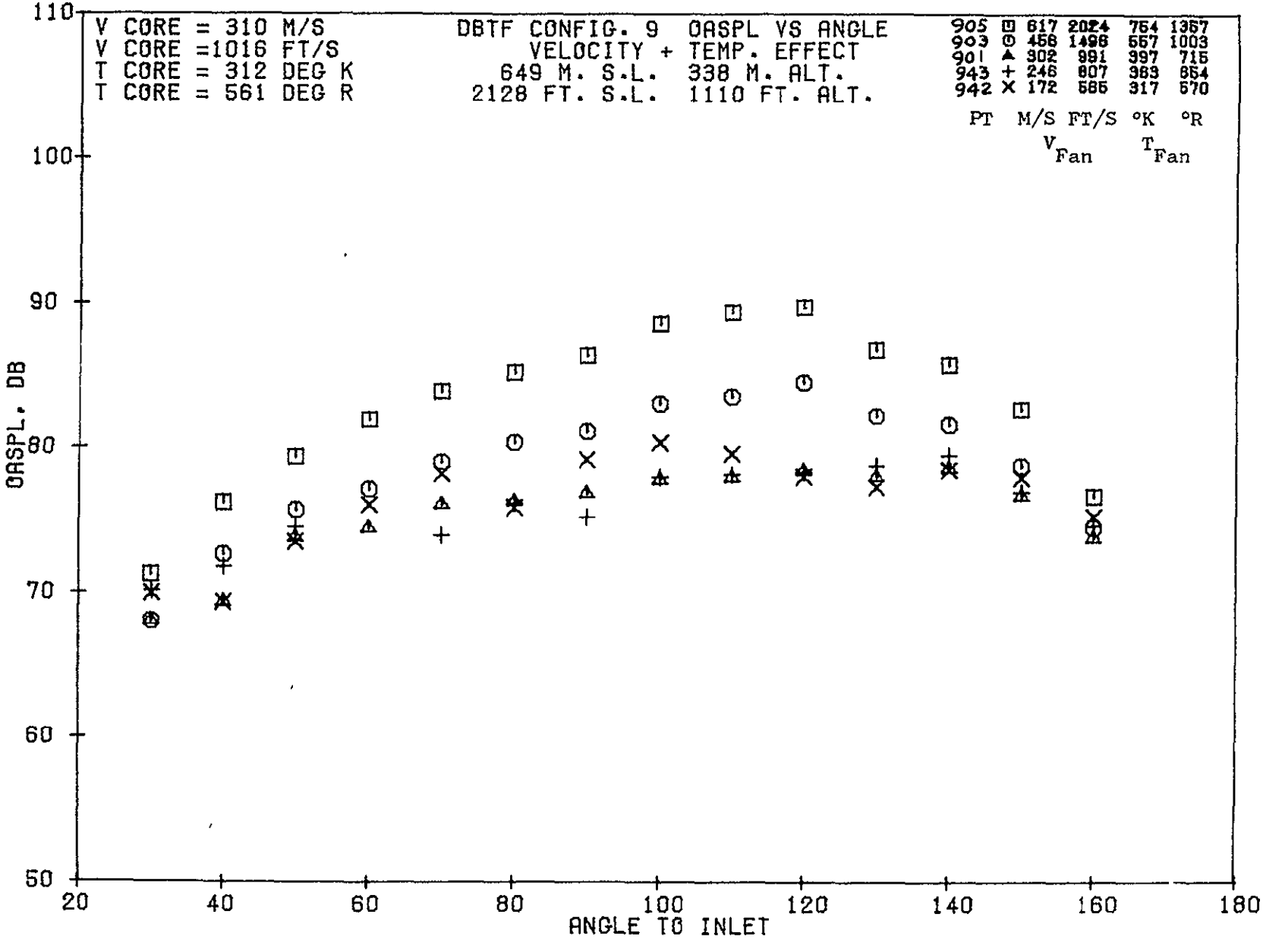

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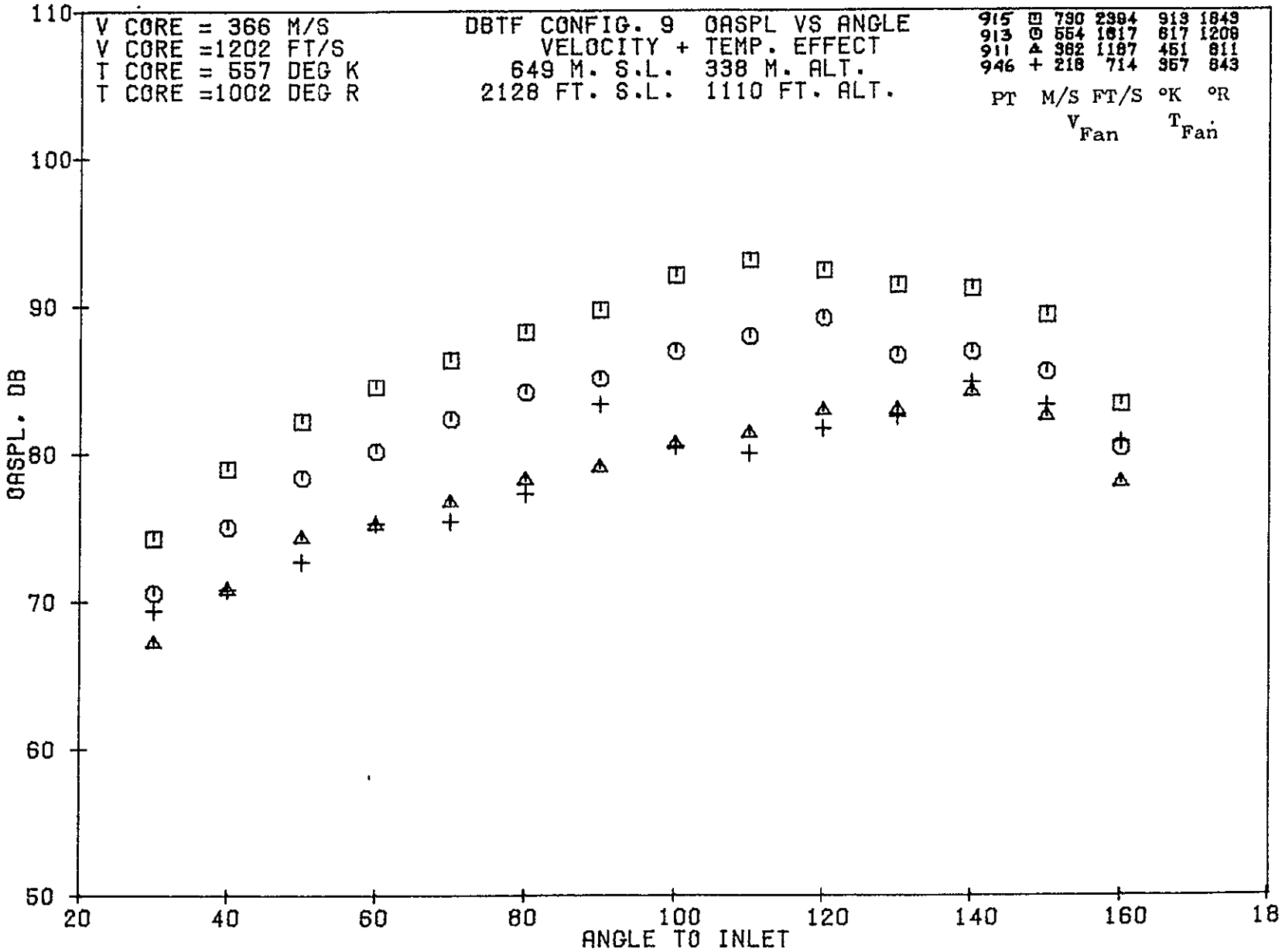
08/18/75
5R266-001



08/18/75
5R266-001

79 BURCH A.

1605

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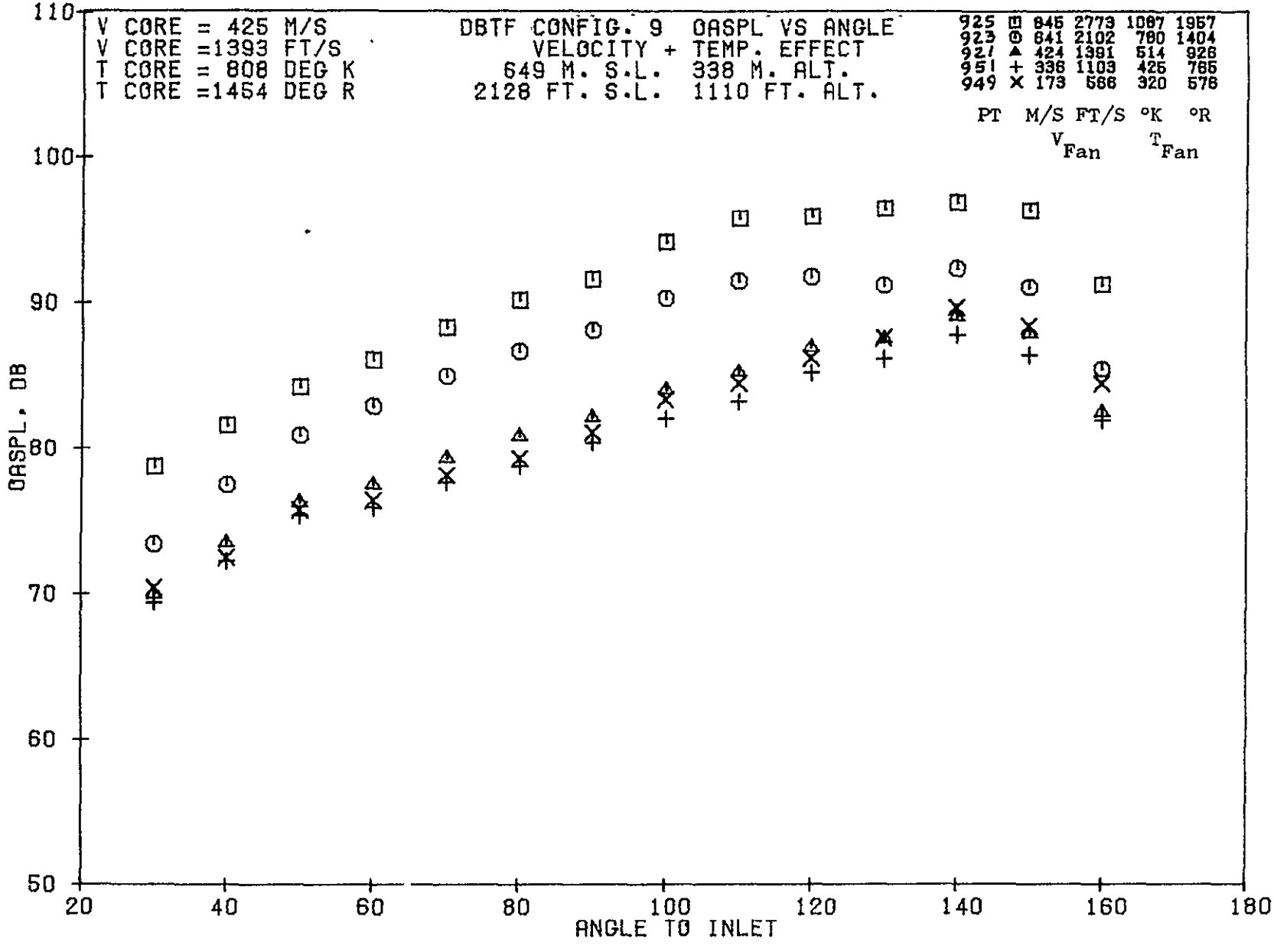

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08/18/75
5R266-001

1607

08/18/75
5R266-001

4-364

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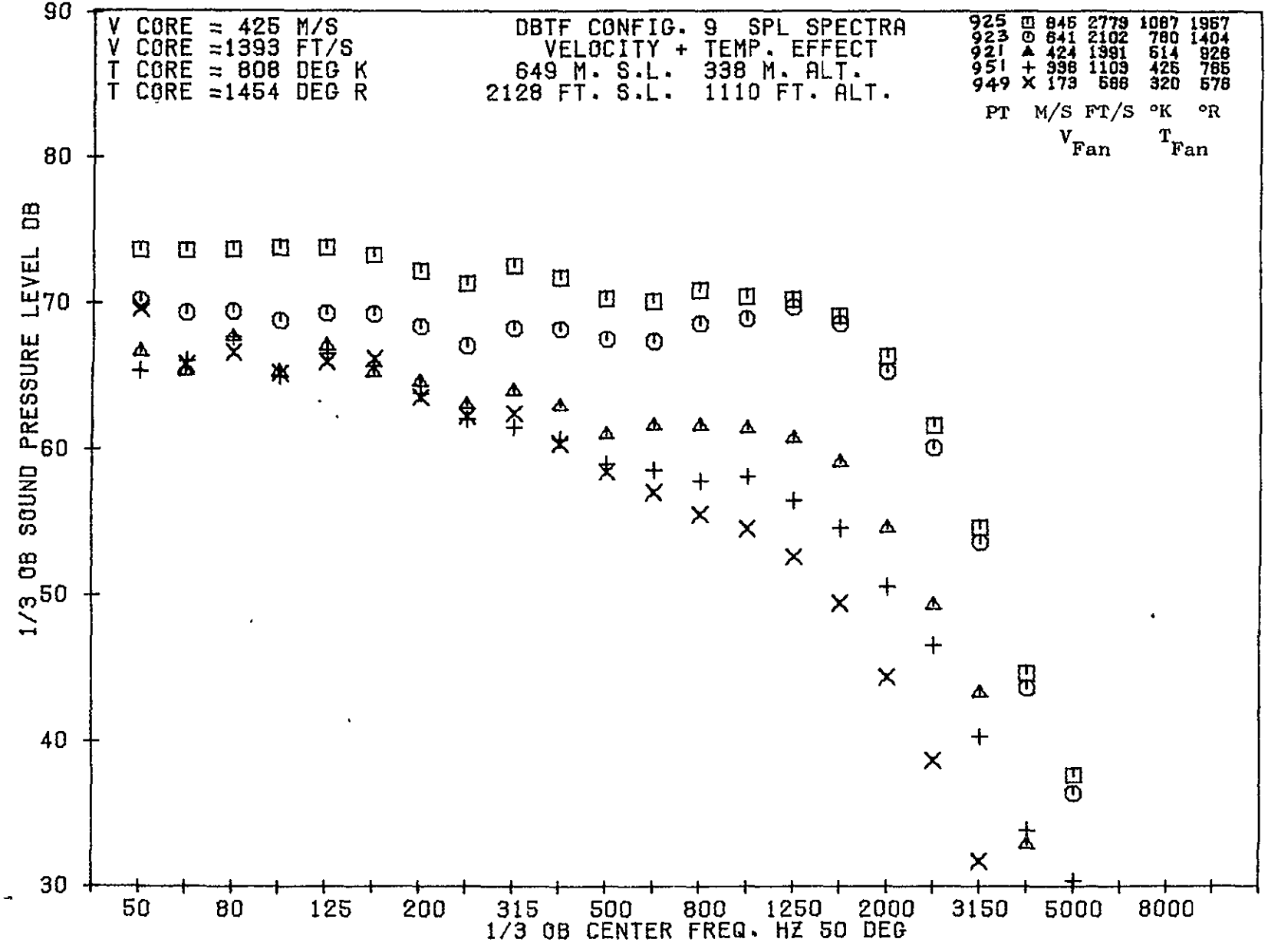

1608

U-365

08/18/75
5R266-001

79 BURC[illegible]A.

1609

08/18/75
5R266-001

79 BURCH A.

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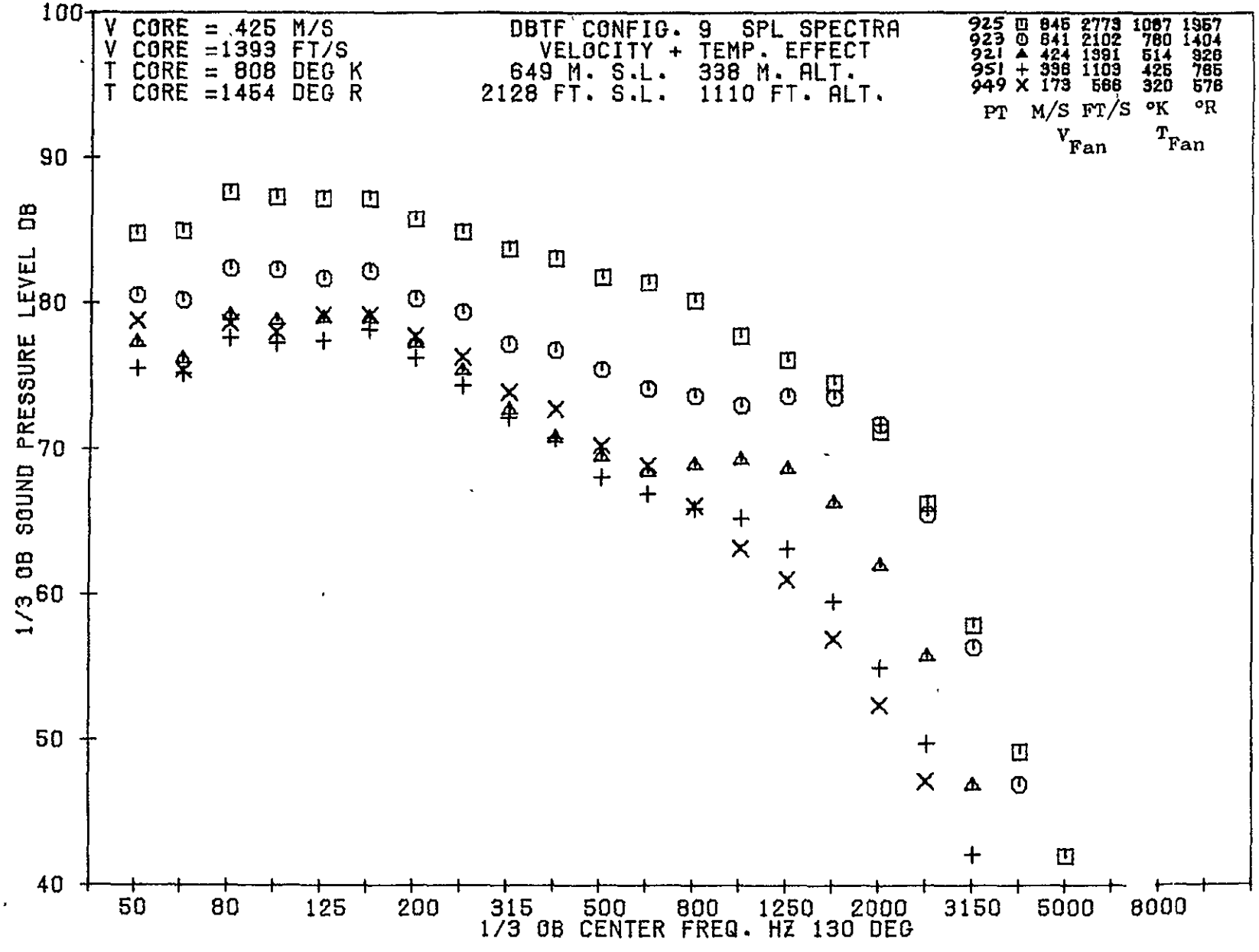


1610

08/18/75
5R266-001

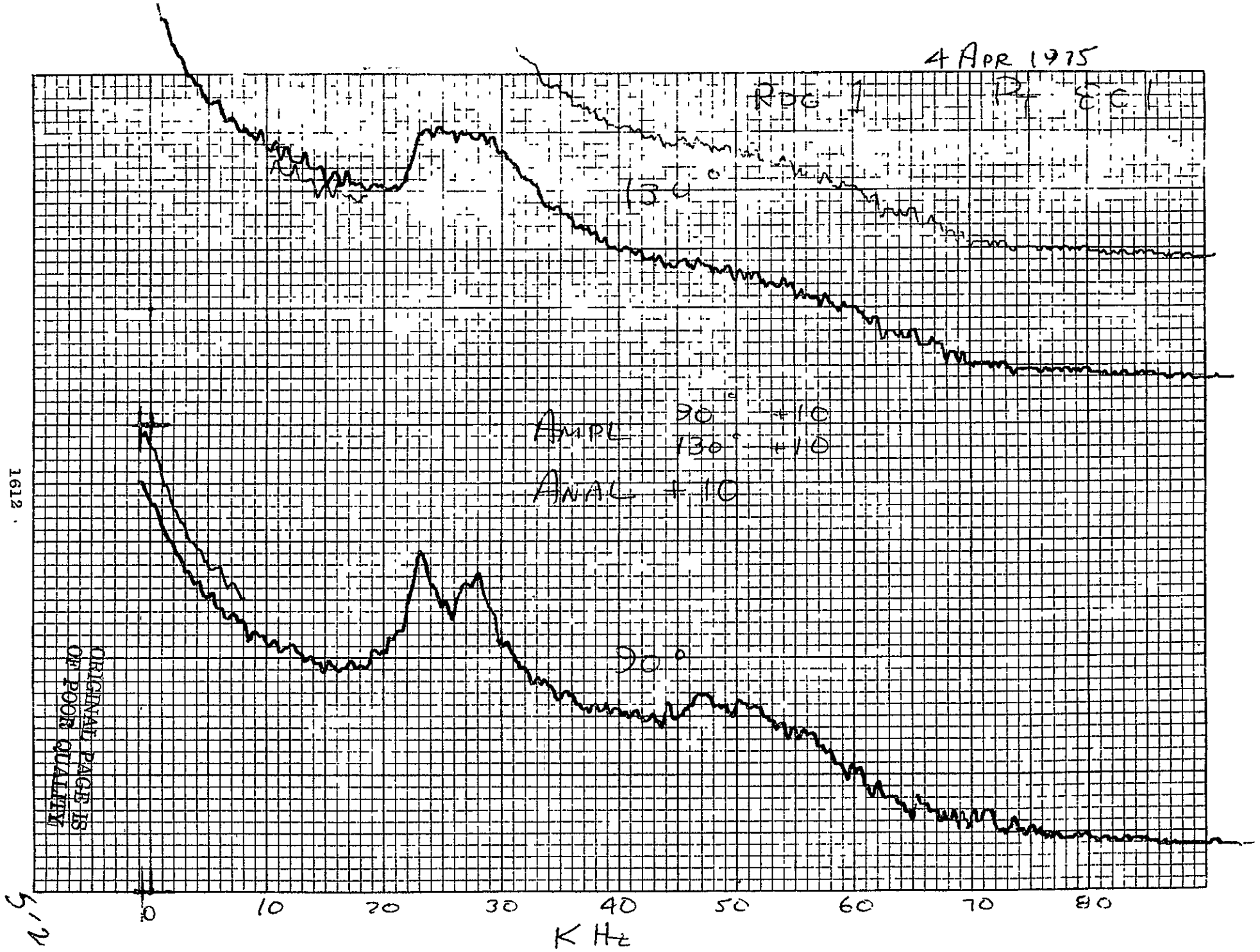
5.0 ON-LINE NARROWBANDS

5.0 ON-LINE NARROWBANDS

The acoustic data was monitored during test with an on-line spectrum analyzer. Any unusual tones were investigated. The narrowbands were documented in graph form using an X-Y plotter.

The following graphs are for Model #8, the coannular, coplanar acoustic configuration. This test model exhibited lip tones when the core and fan velocities were matched and shock tones at pressure ratios above critical. The tones are evident in the 1/3 Octave band spectral plots and the narrowbands verify the actual frequencies at which the tones occurred.

The other test configurations did not have significant tones evident and the 1/3 octave band plots have similar characteristics to the narrowbands. The narrowbands were recorded, but are not included in this document.



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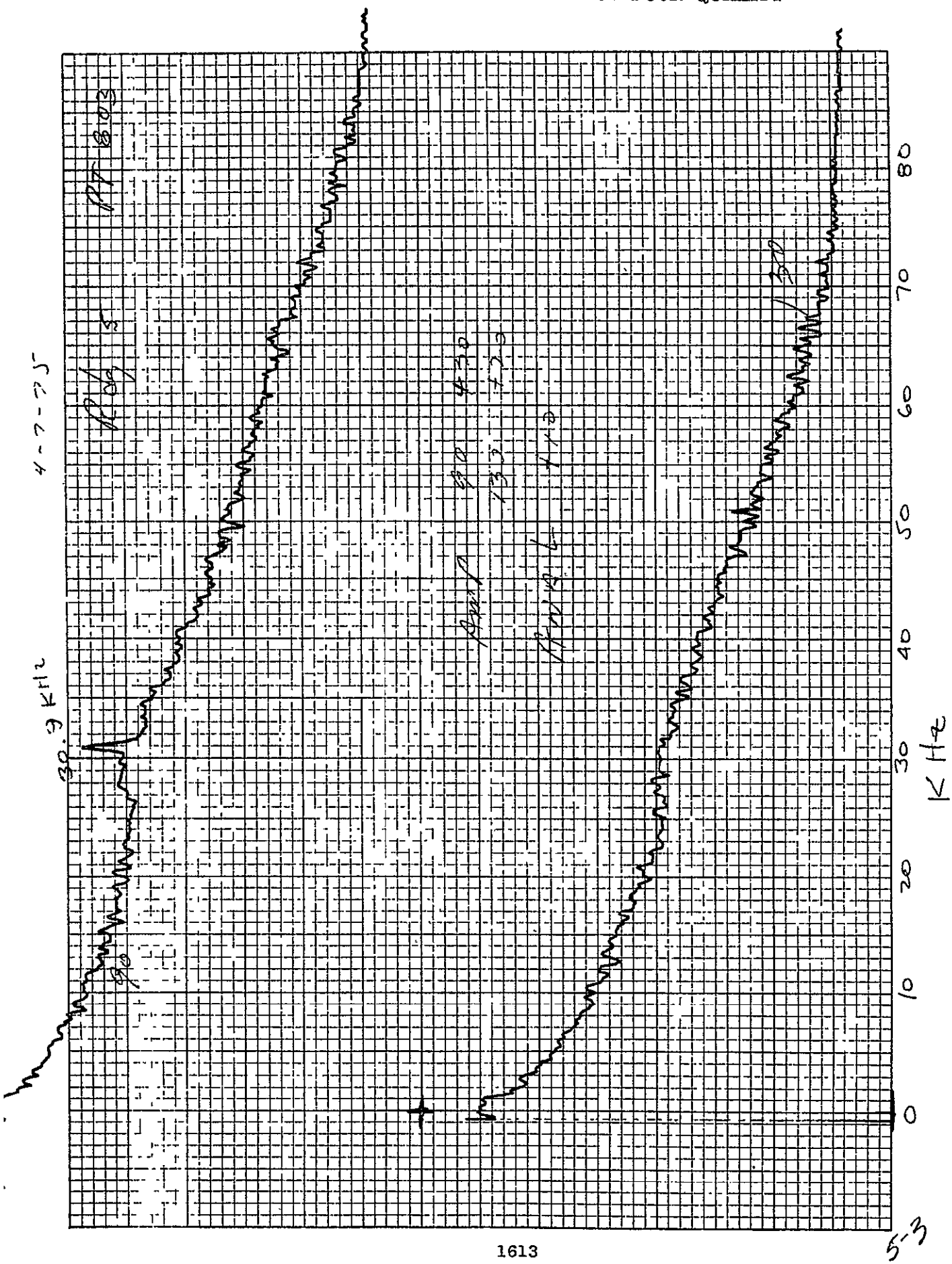
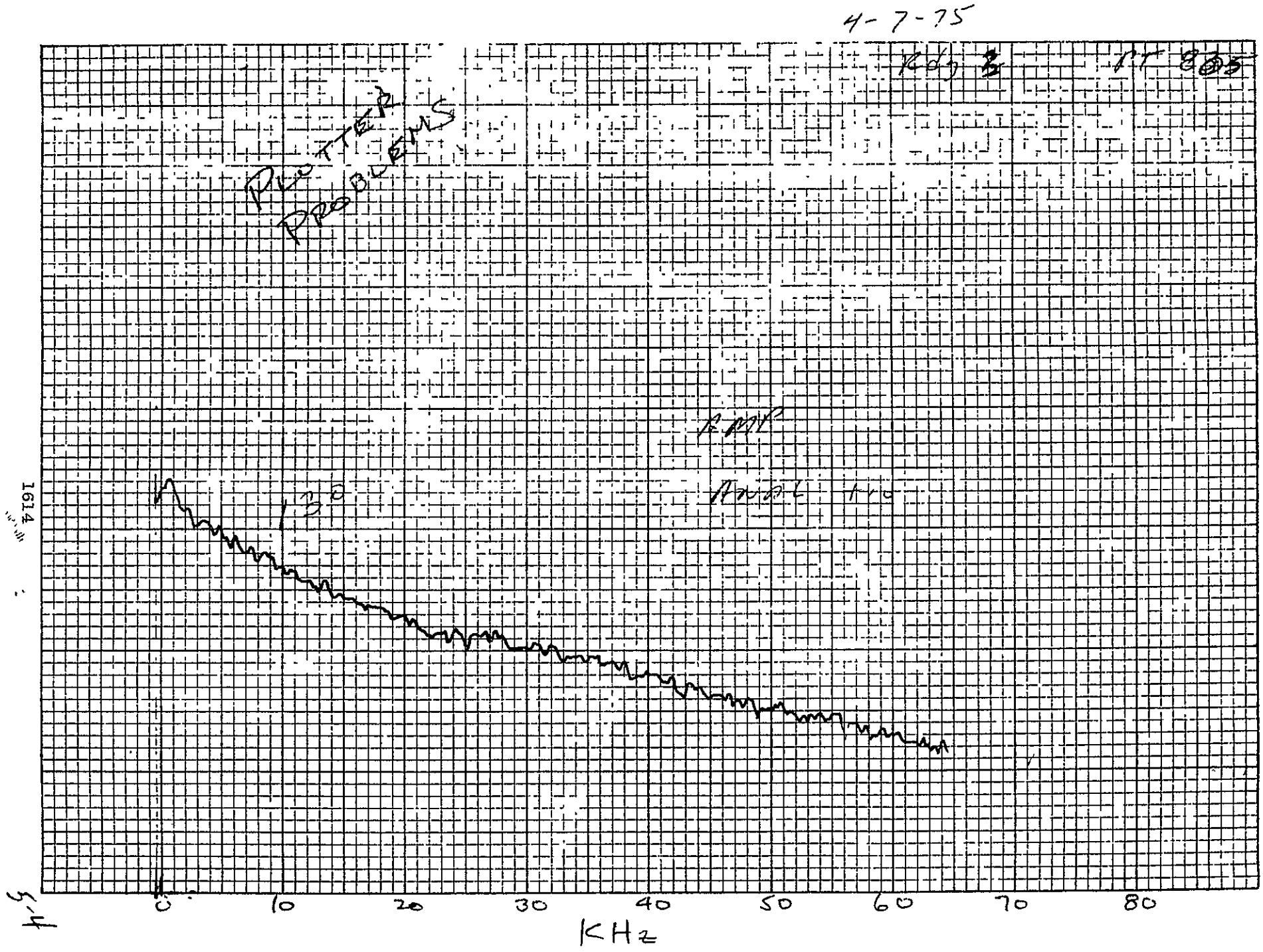
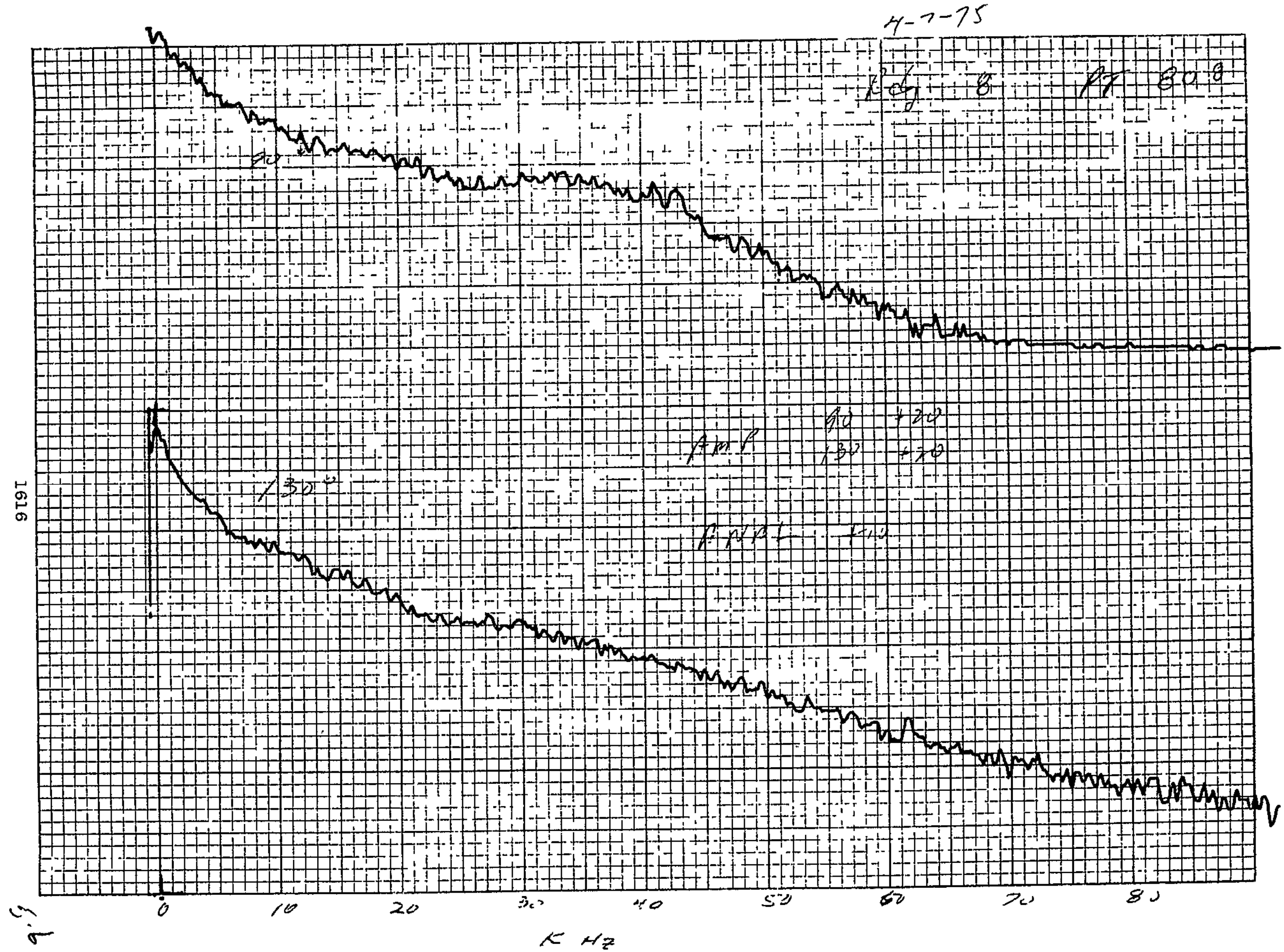
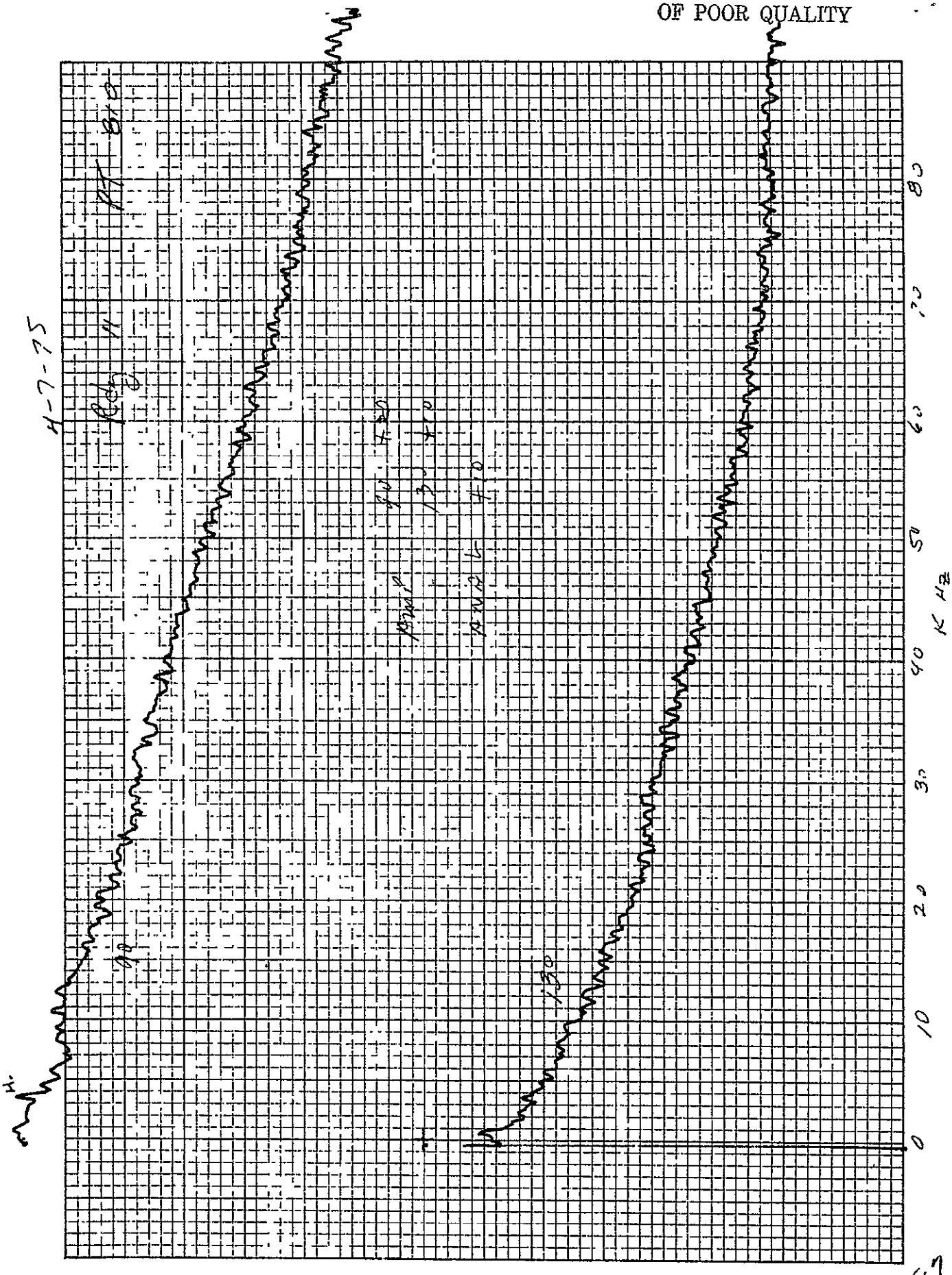


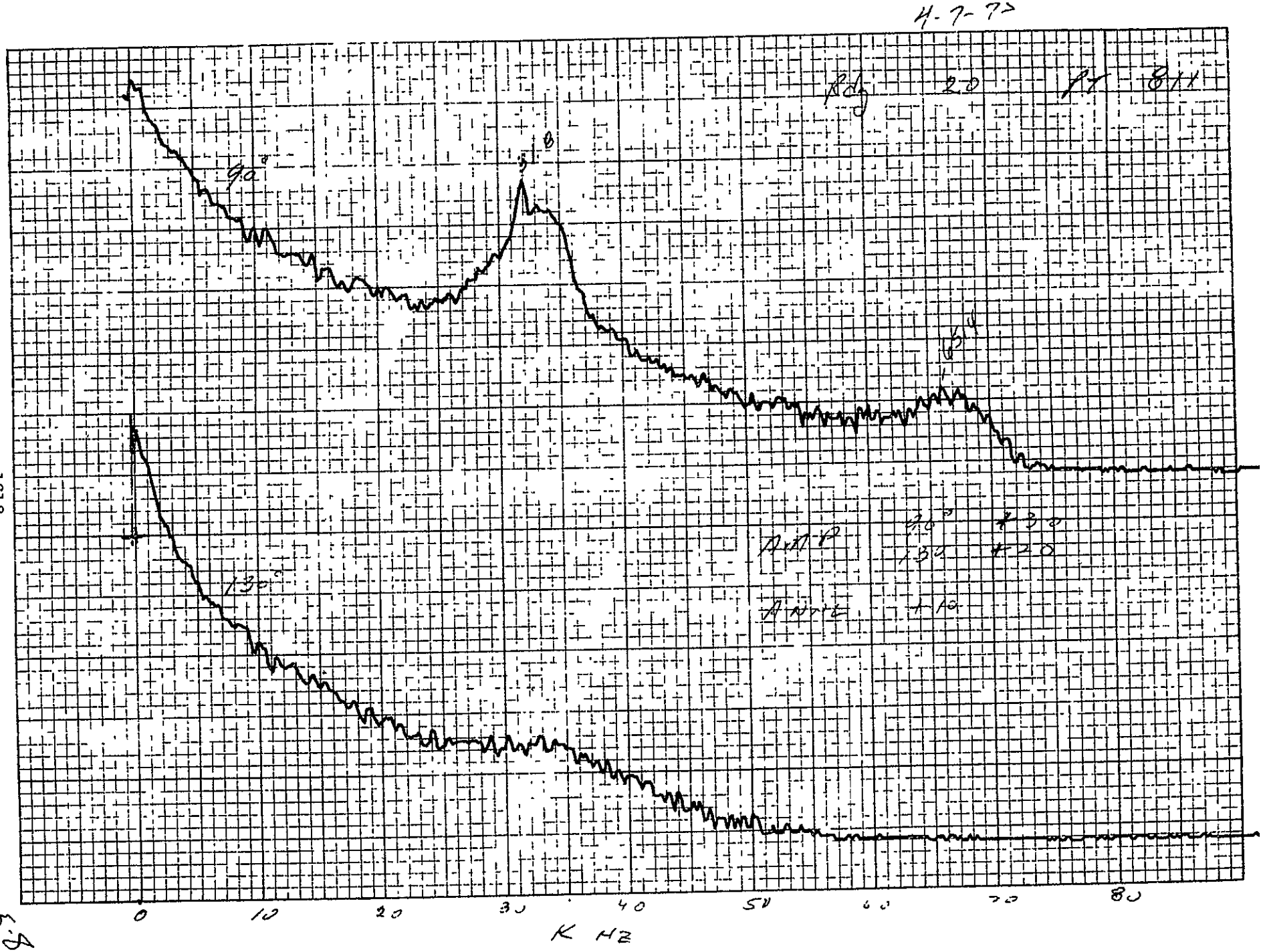
5-3

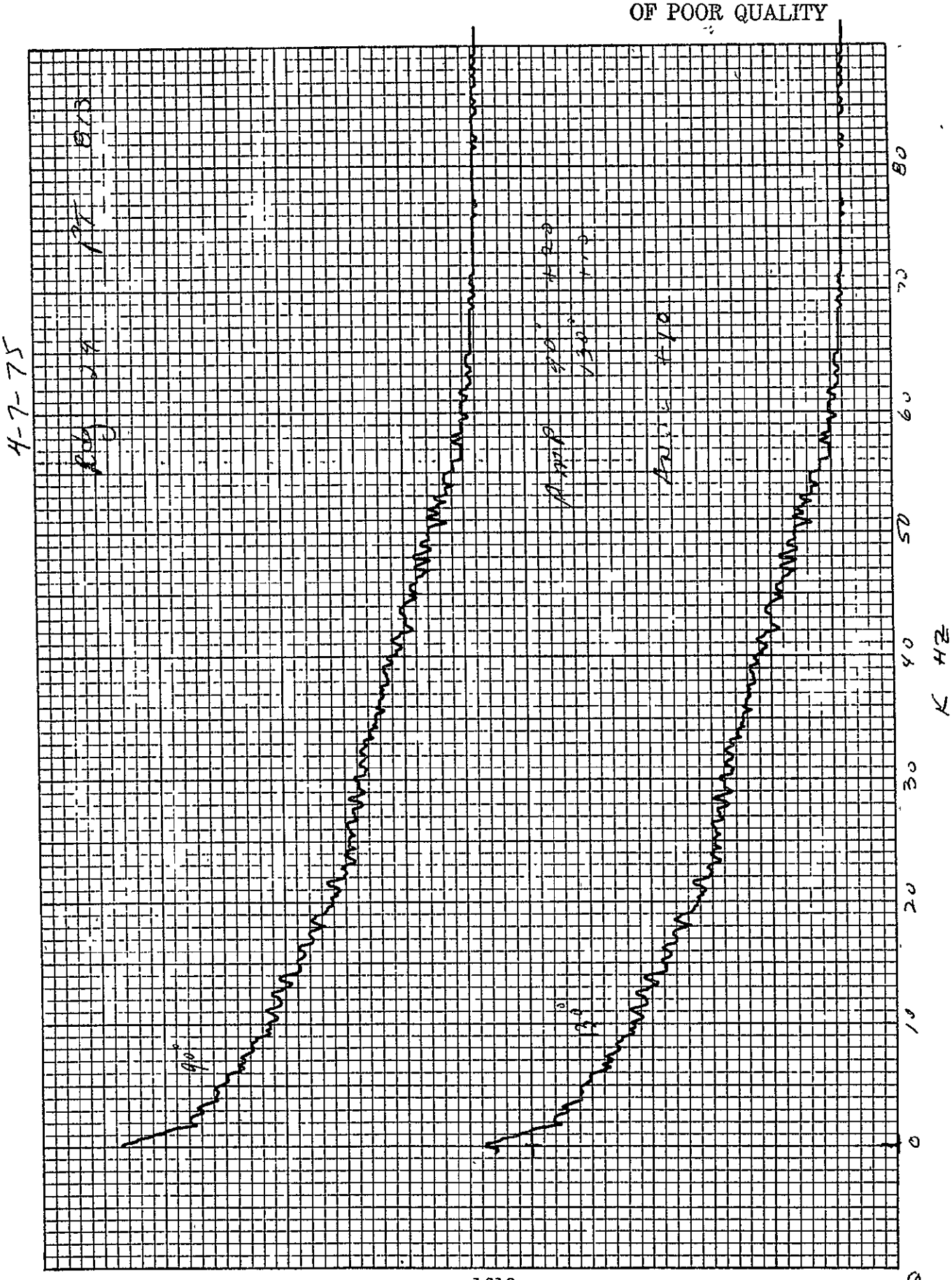

4-7-75
0
10
20
30
40
50
60
70
80
KHz

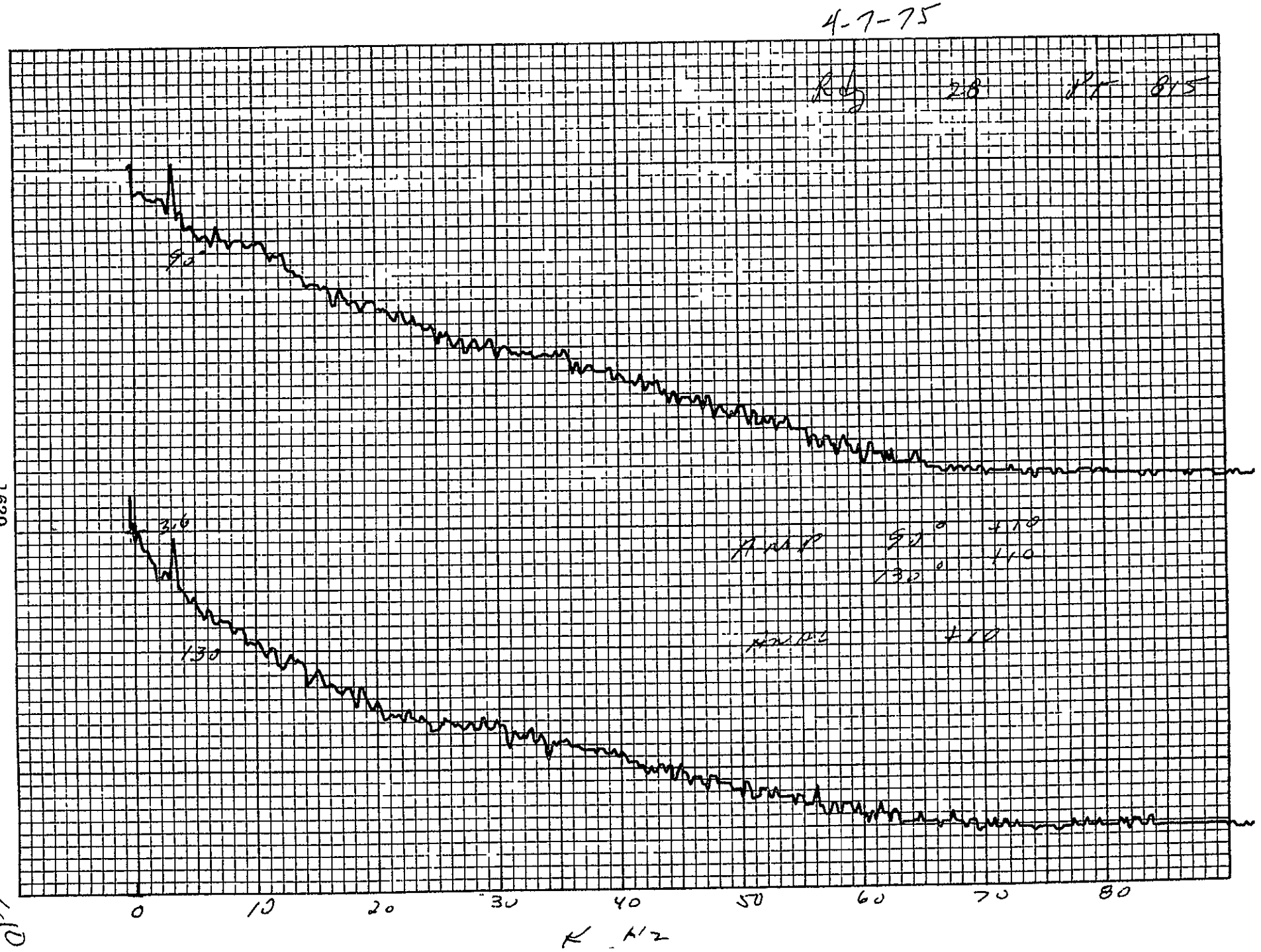


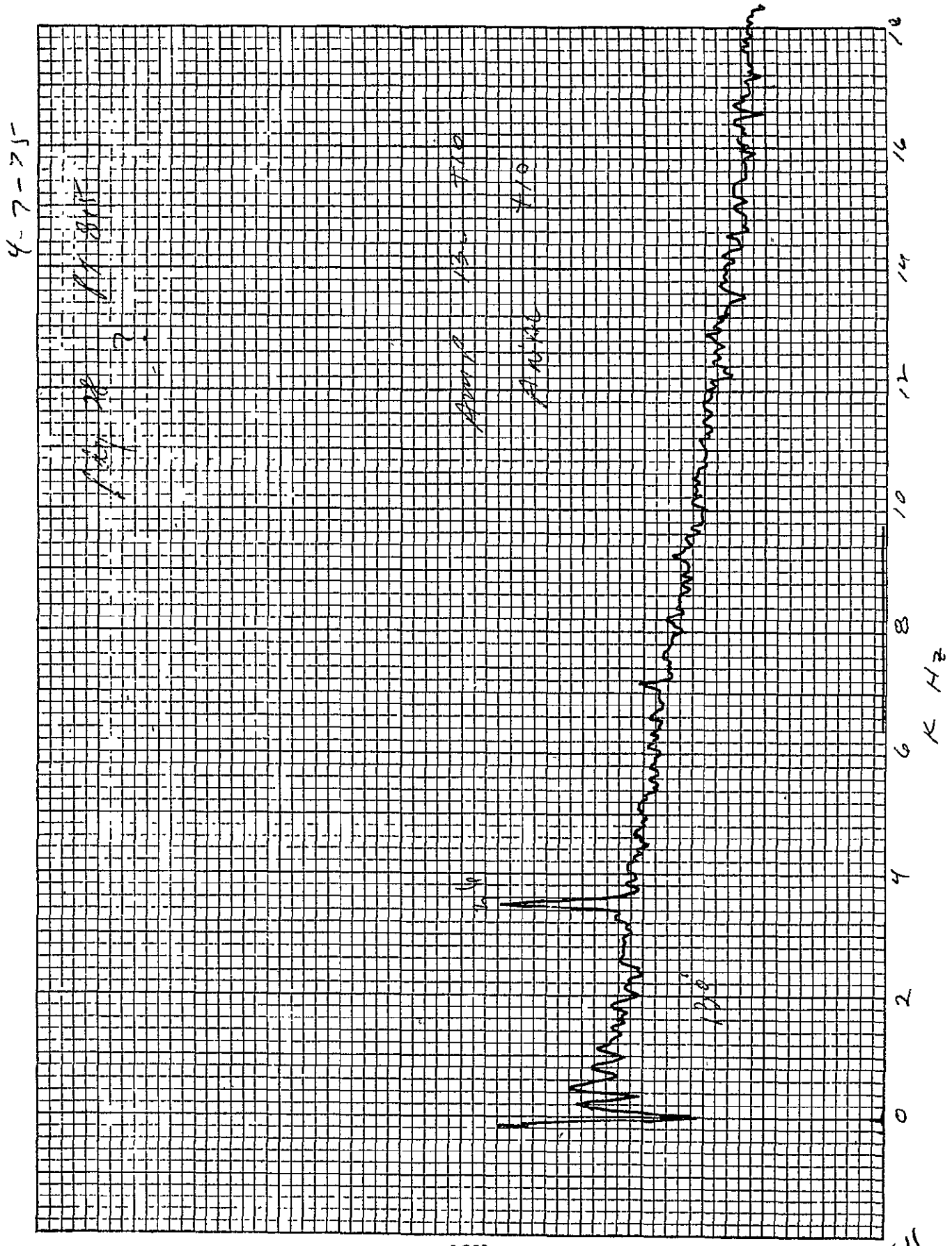
1616

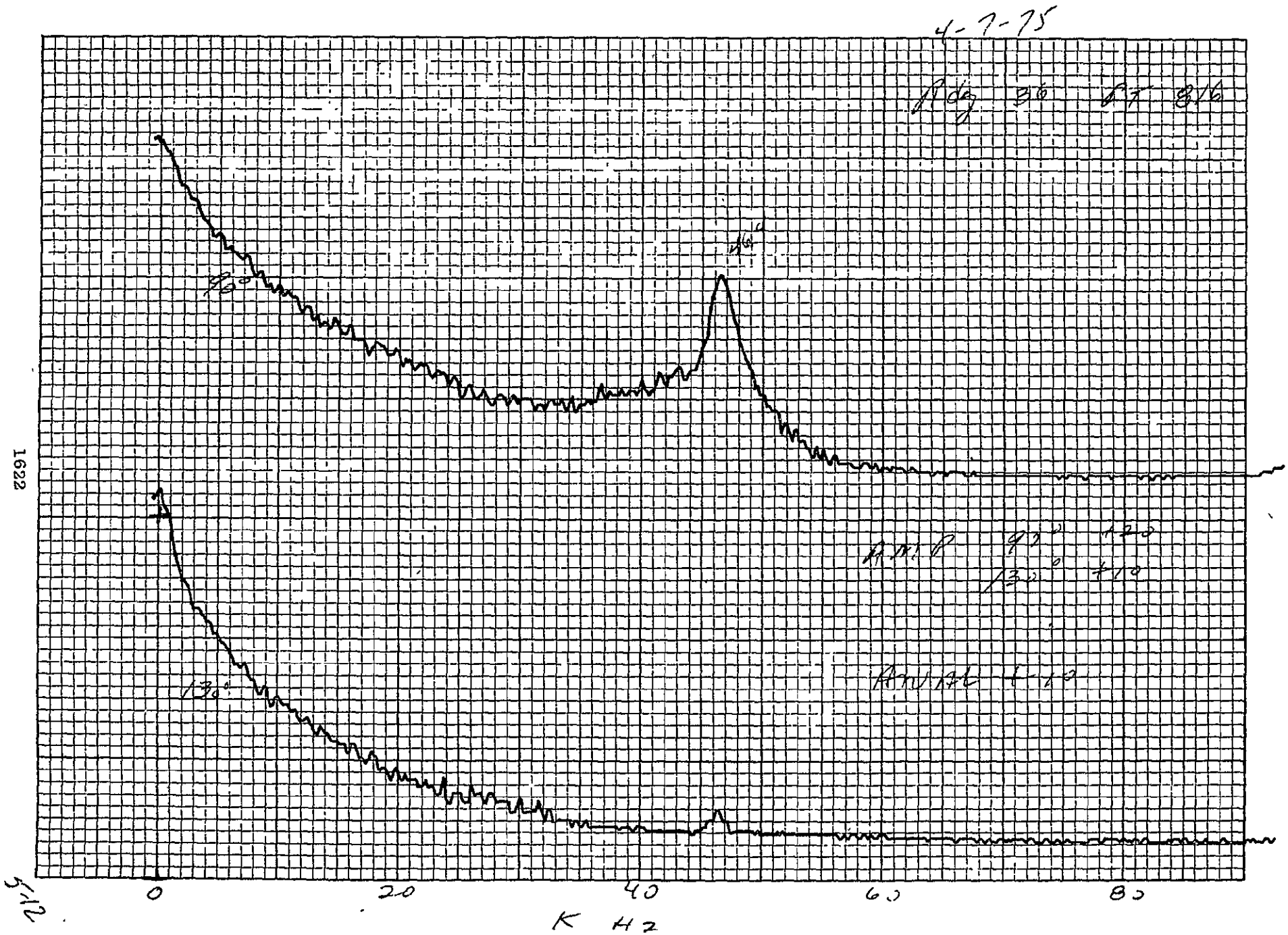



4-7-72
9a
b
13a
b'
0
10
20
30
40
50
60
70
80
K HZ
1618




4-7-75
1620
0
10
20
30
40
50
60
70
80
K Hz




4-7-75
1622
0
20
40
60
80
K Hz

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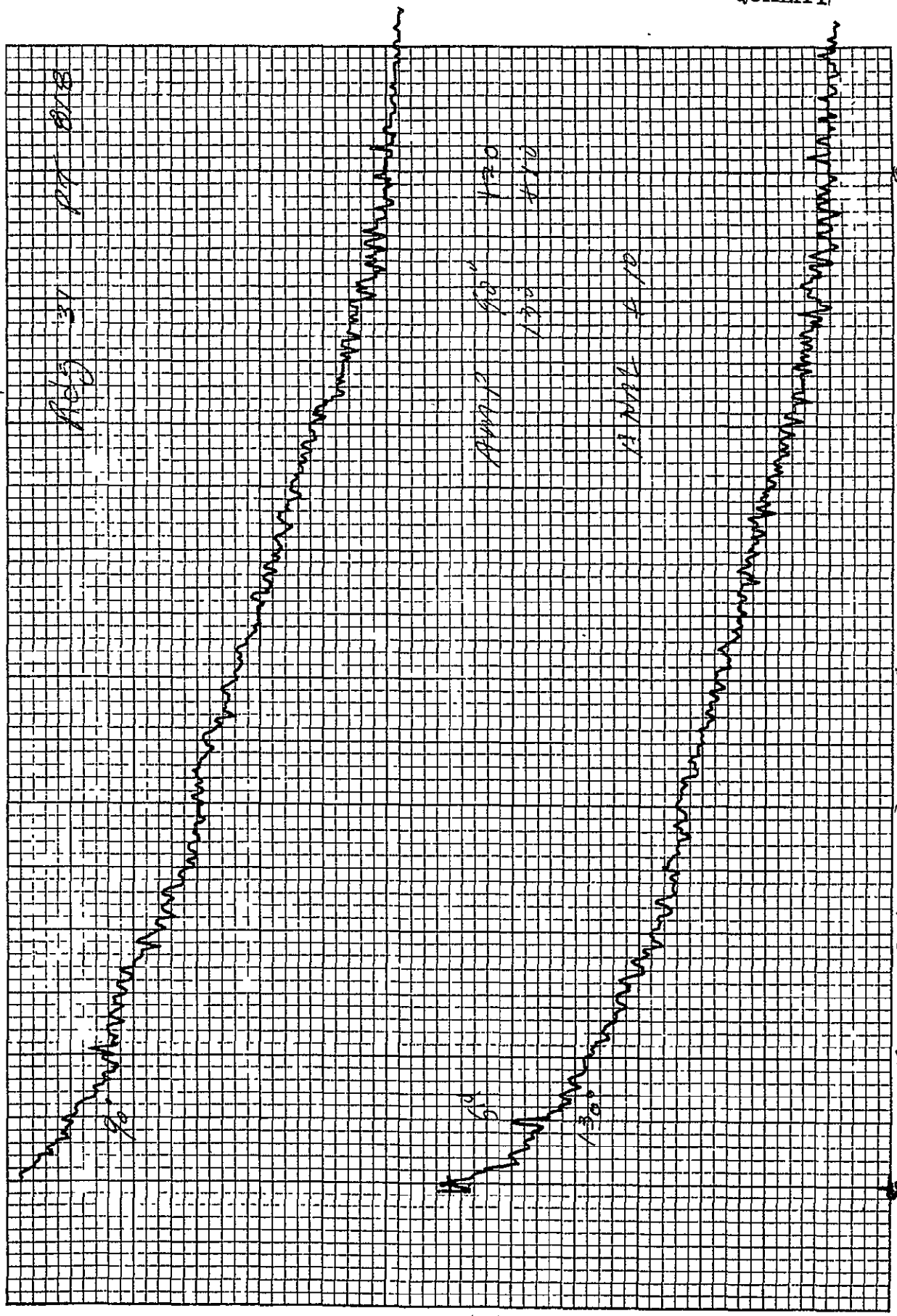
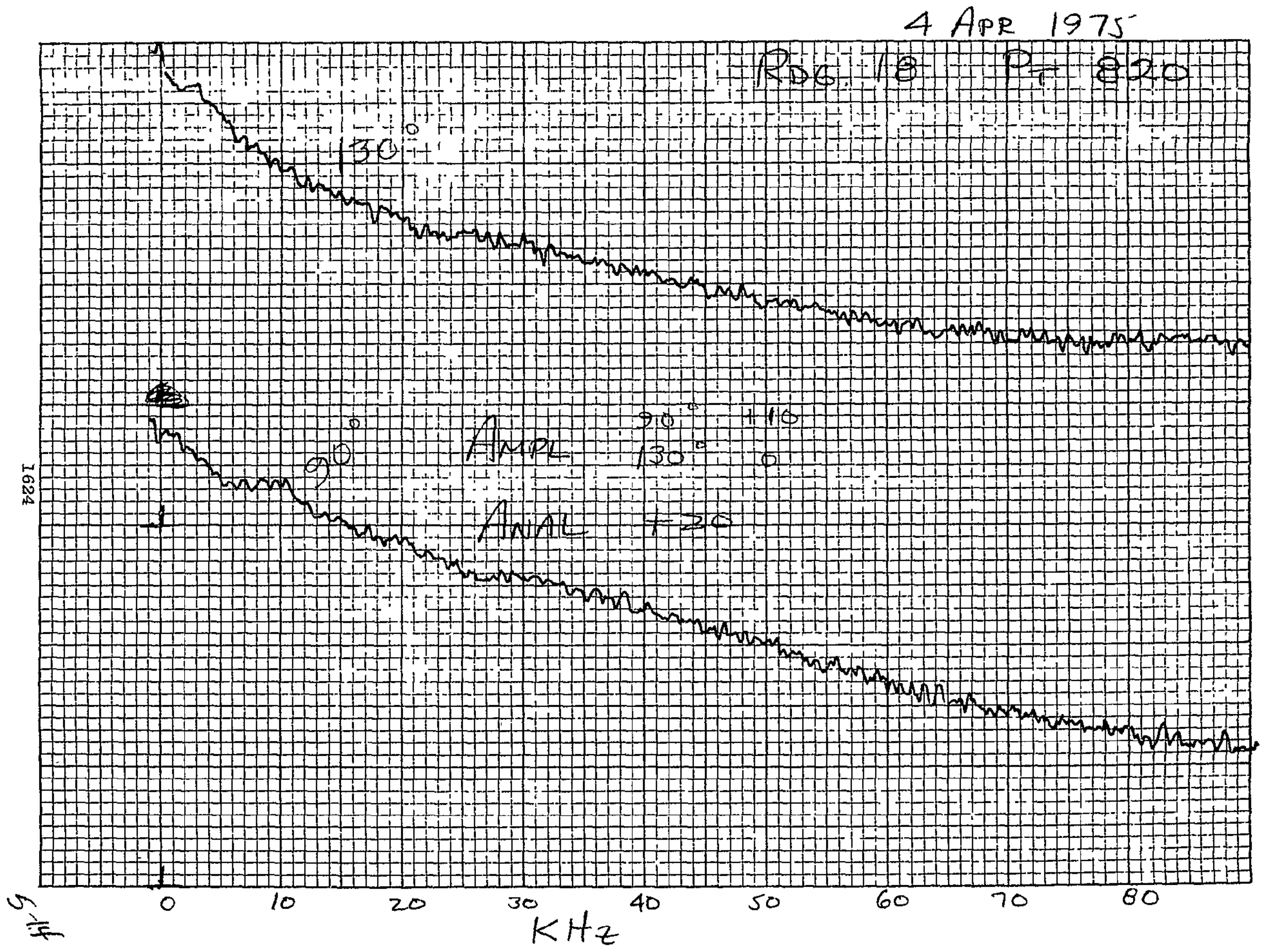
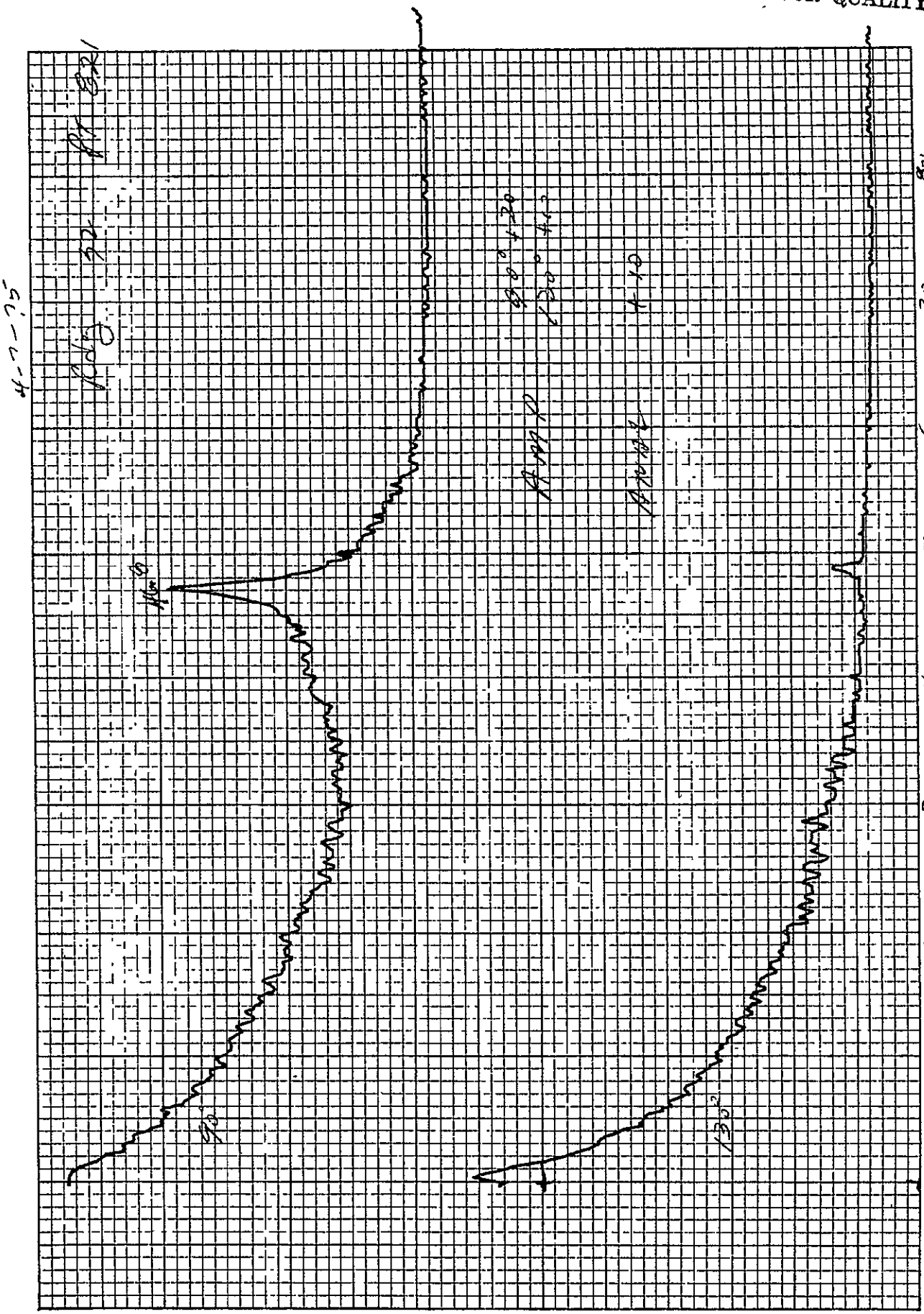


1623

5-13

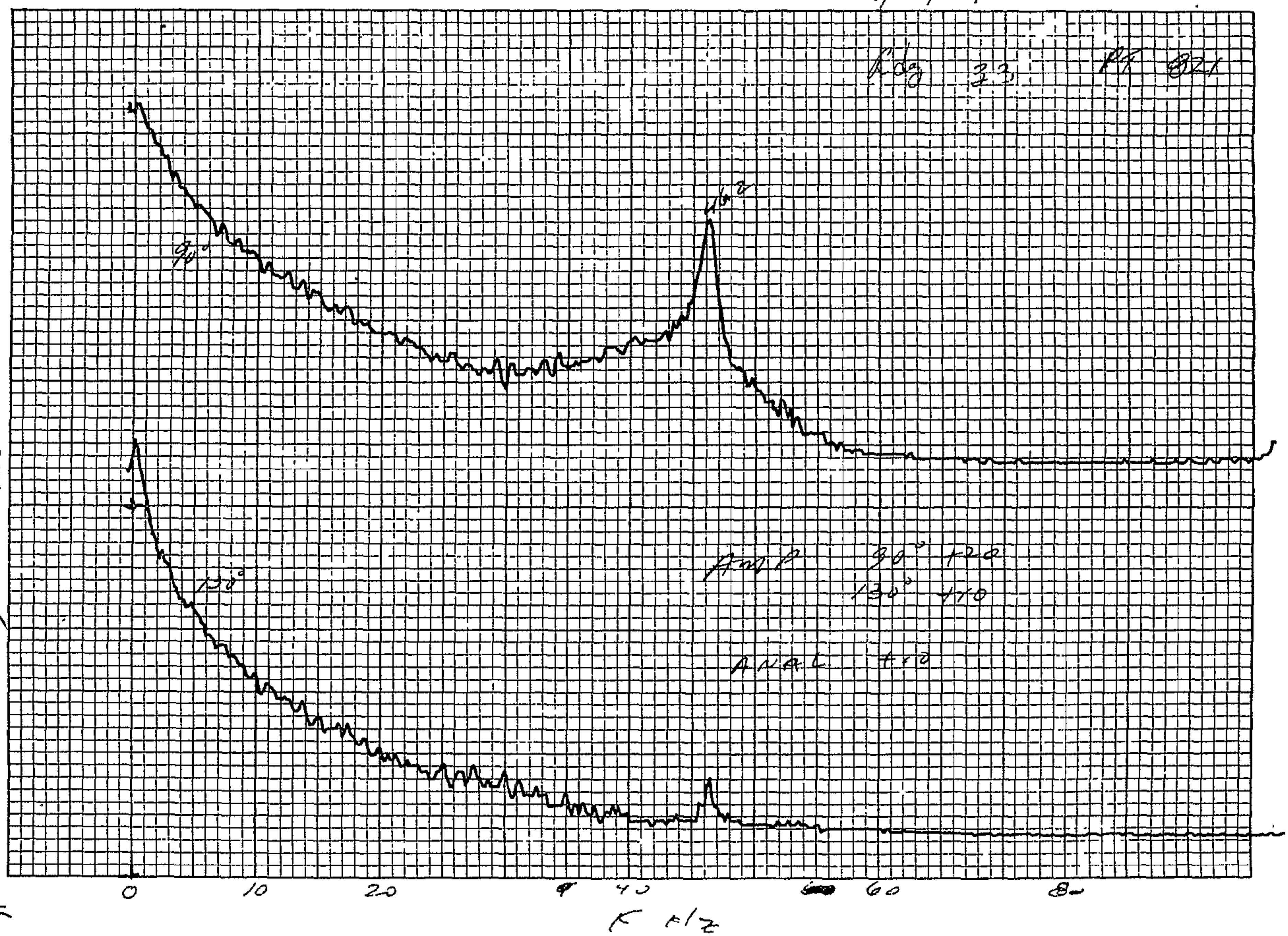


4 APR 1975
RDG. 18 PT 820
130°
90°
AMPL 90° +10
130° 0
ANAL +20
1624
0
10
20
30
40
50
60
70
80
KHz



5-15

4-7-75



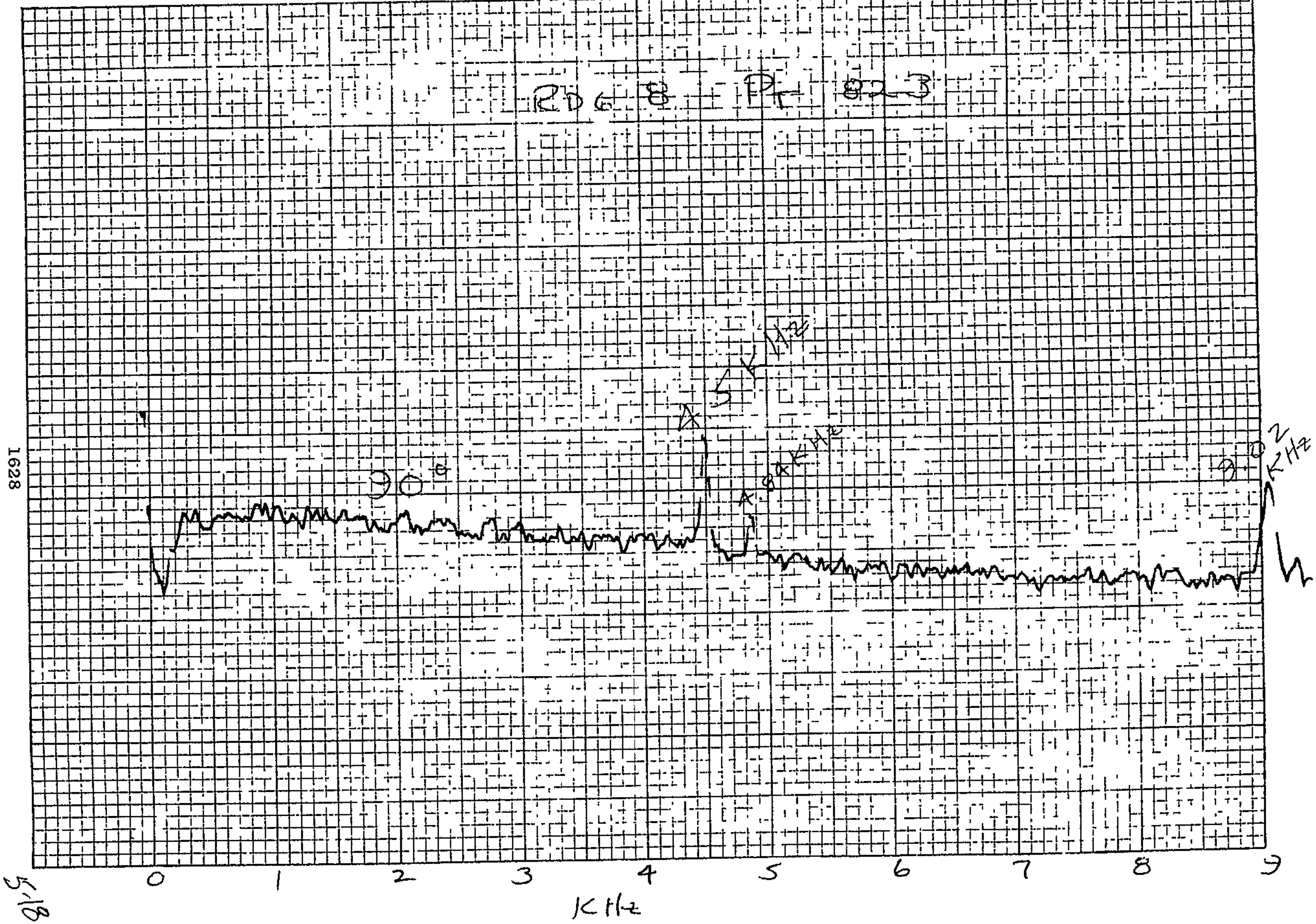
1626

6-5

5-16

5-11

4 APR 1975



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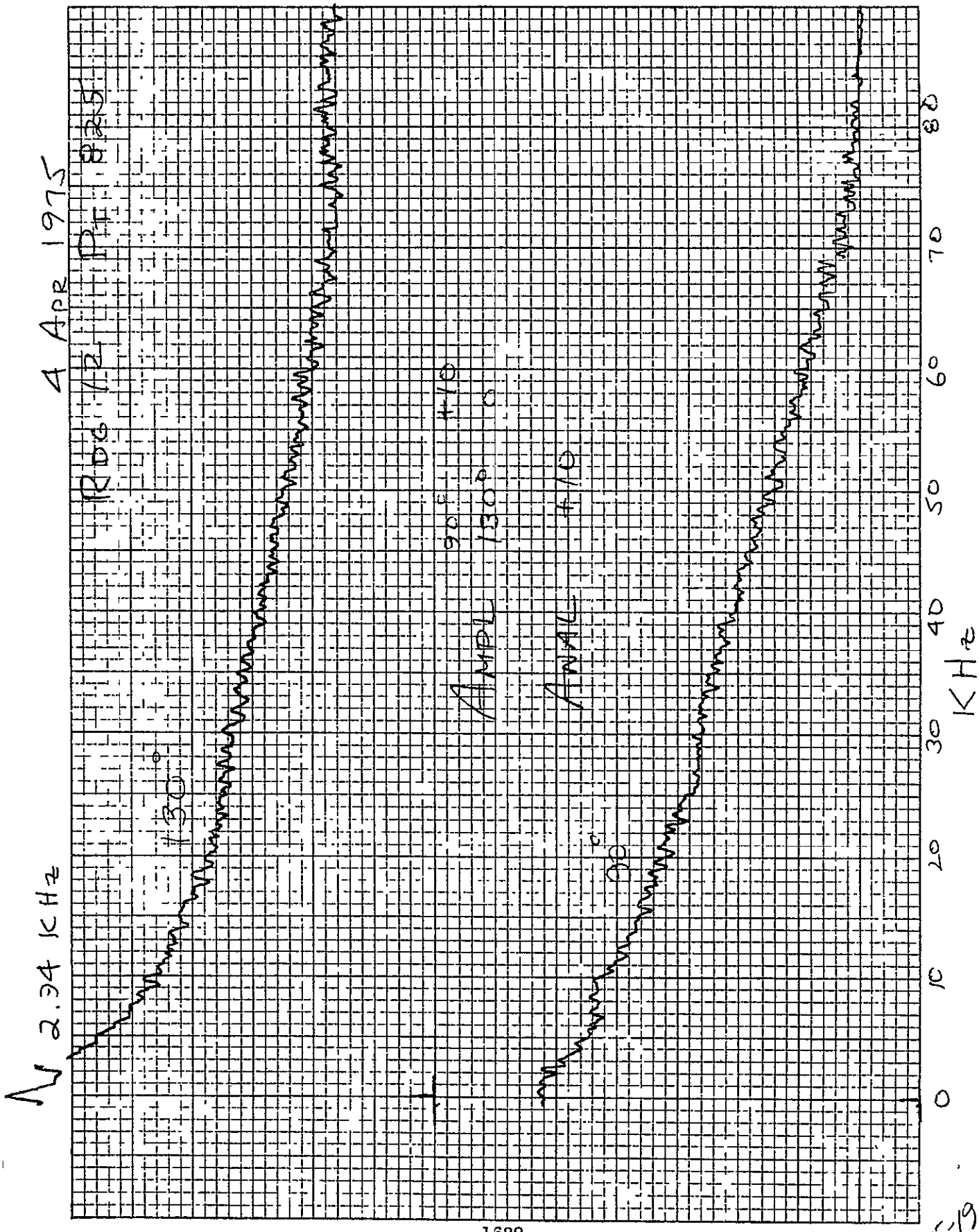

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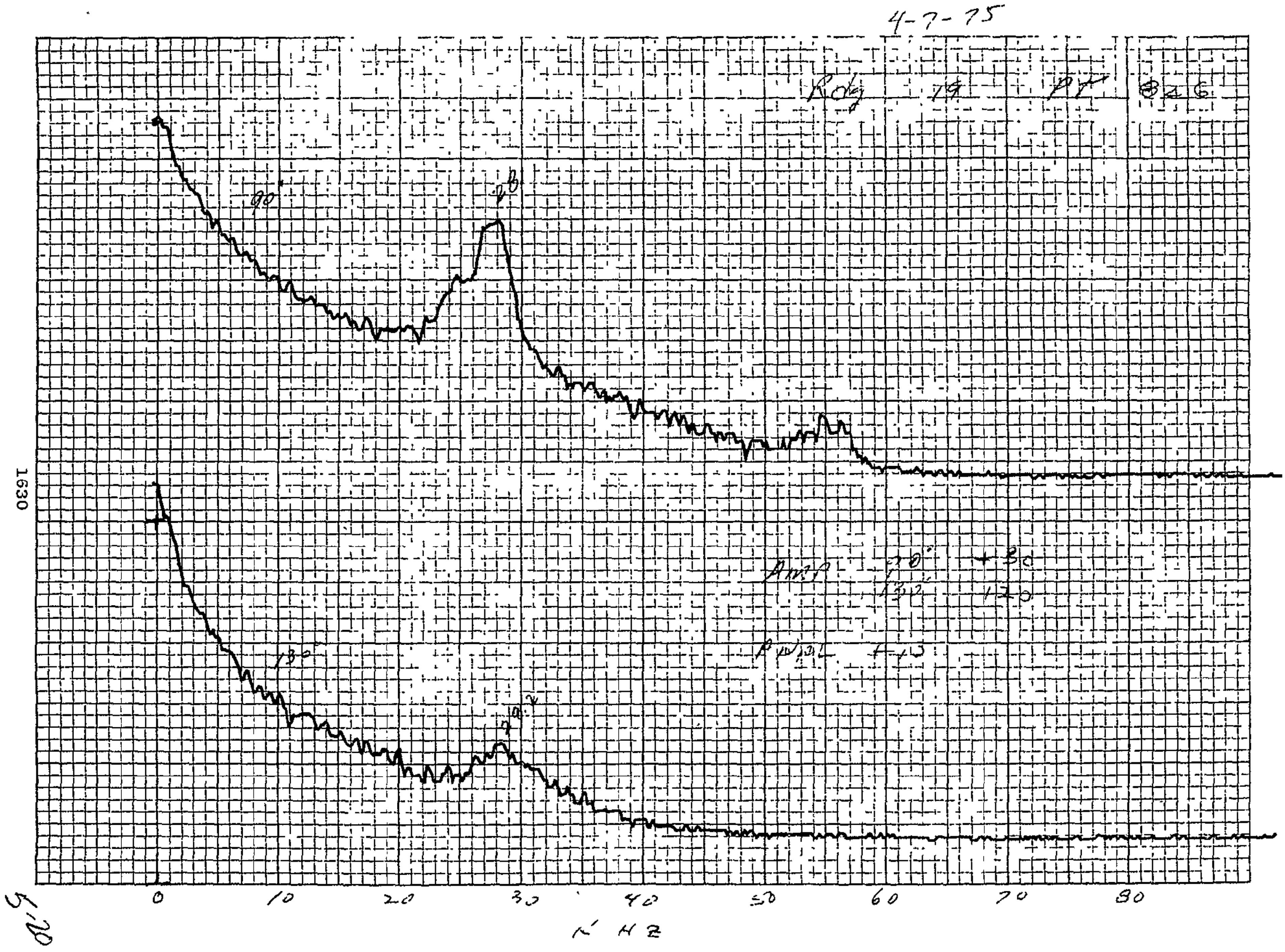
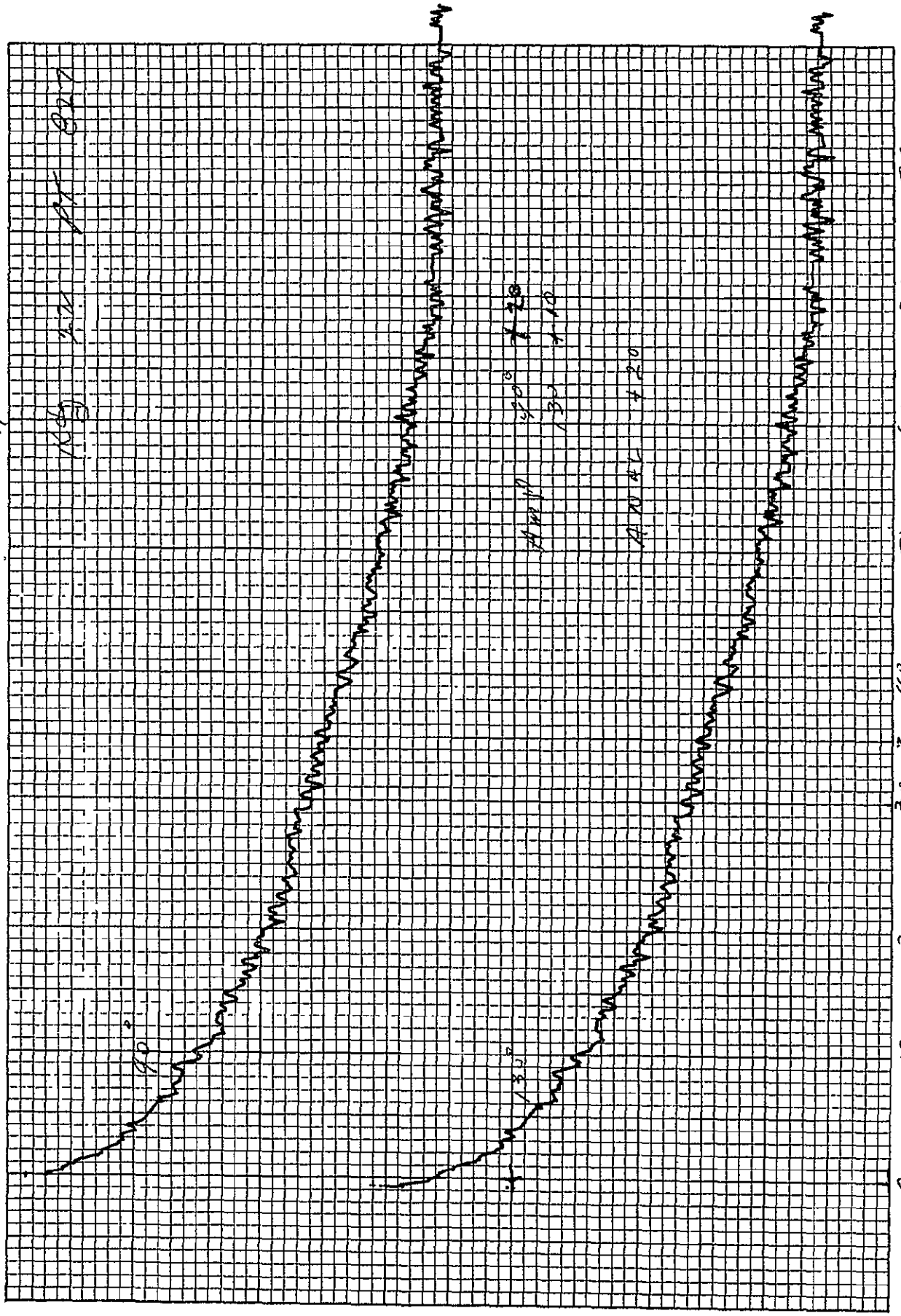
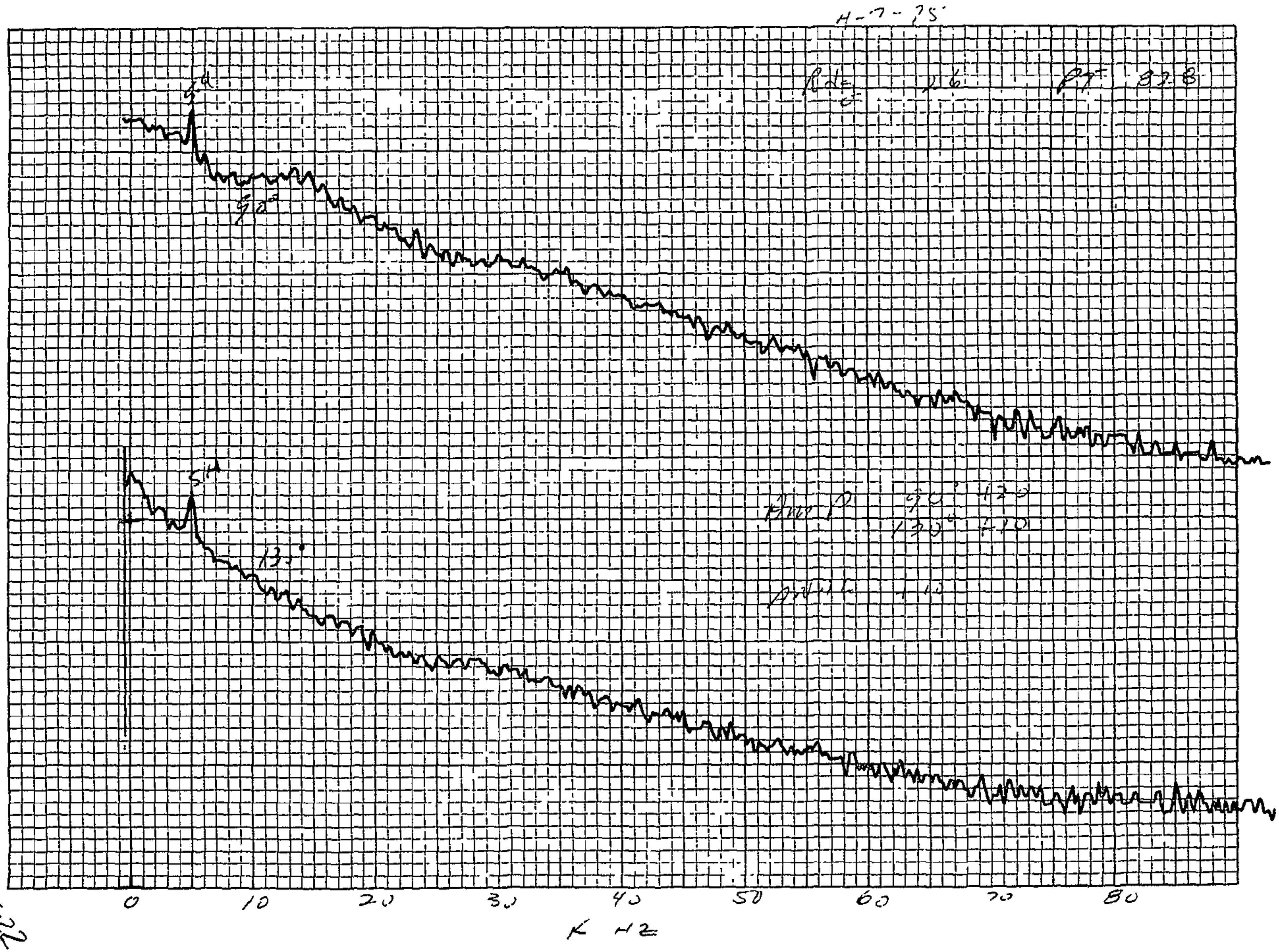

4-7-75
Rdg 19 PF 8&6
90°
28
1630
Amp 90° +30
130° 120
130°
29.4
0
10
20
30
40
50
60
70
80
KHZ
5-20





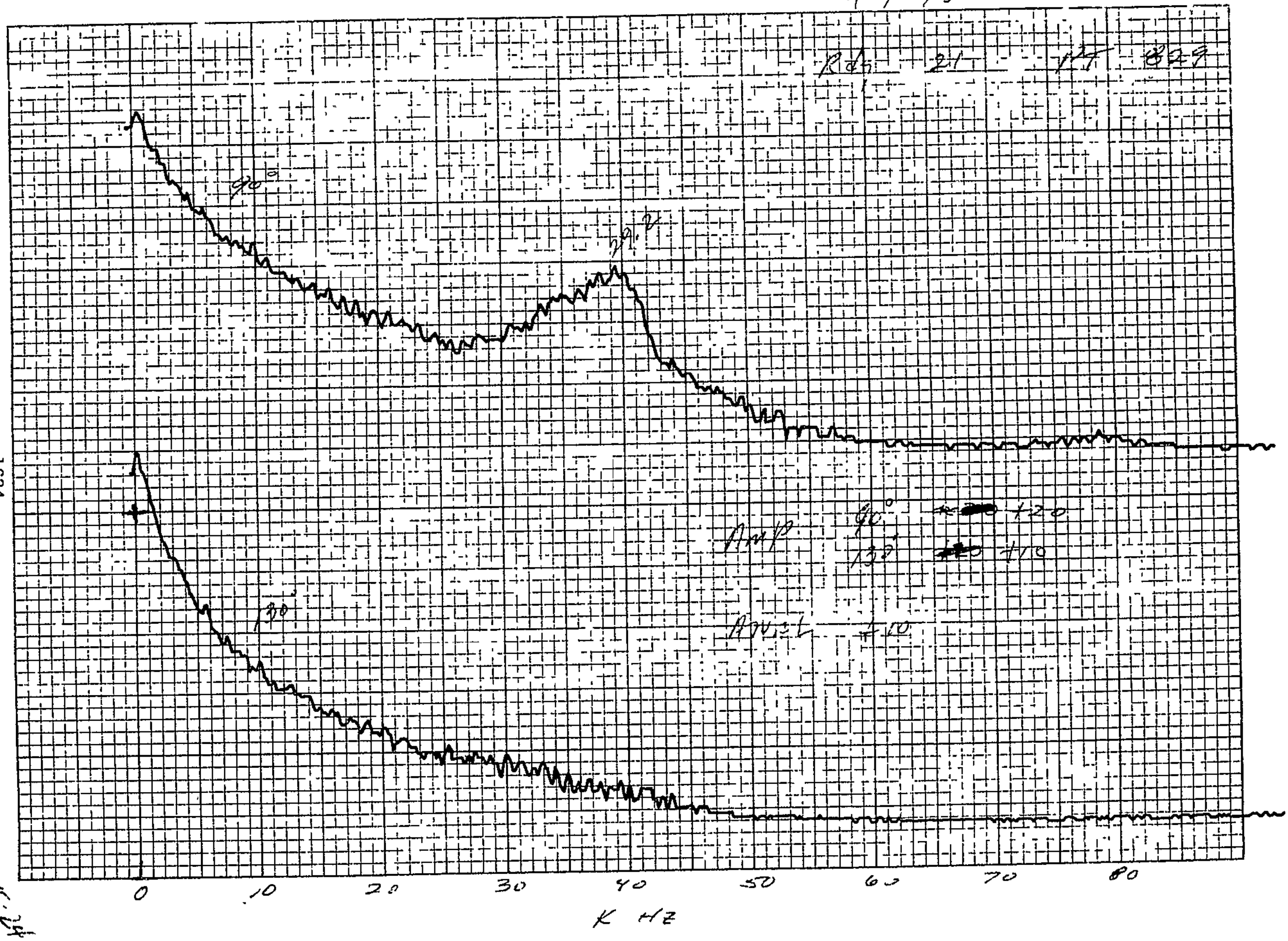
1632

5'22

1633

5-23

4-7-75



Rd 21 HT 829
90°
39.2
130°
Amp 90° 120
130° 110
0
10
20
30
40
50
60
70
80
K HZ

1635

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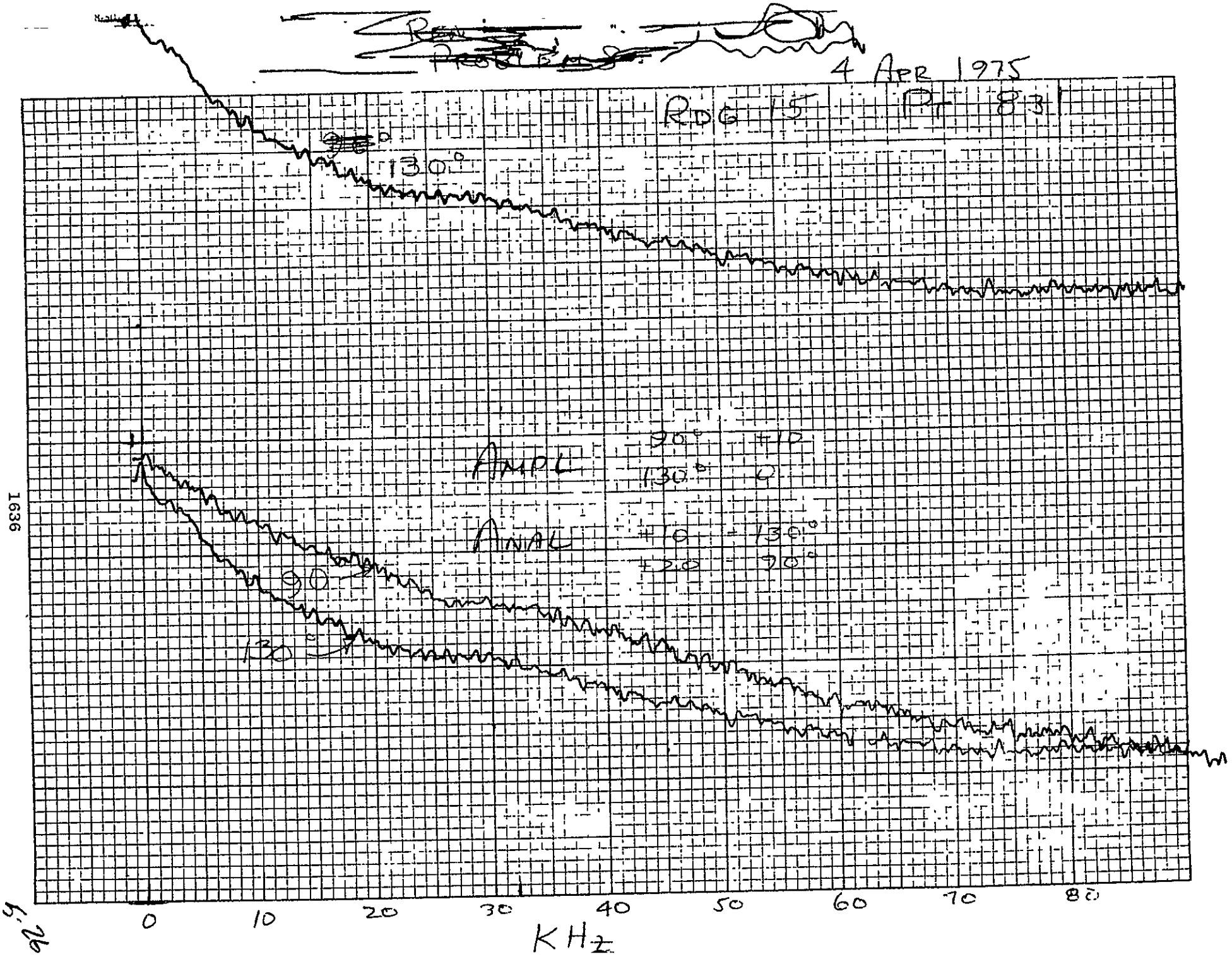
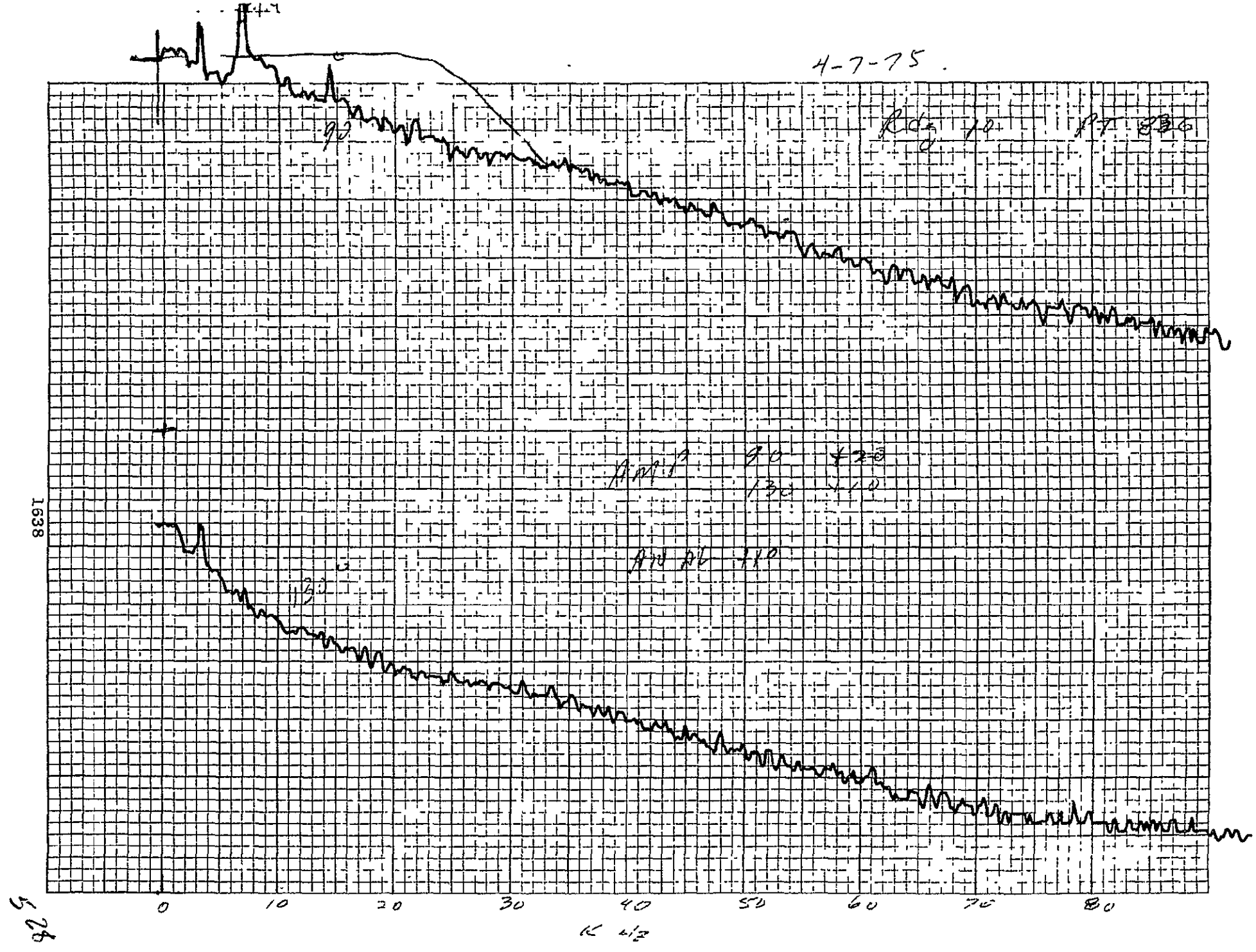

4 APR 1975
RDG 15
PT 83
130°
90°
#10
AMPL
130°
0
AMPL
#10
130°
+20
90°
90°
130°
1636
0
10
20
30
40
50
60
70
80
KHz


4-7-75
1638
0
10
20
30
40
50
60
70
80
K Hz

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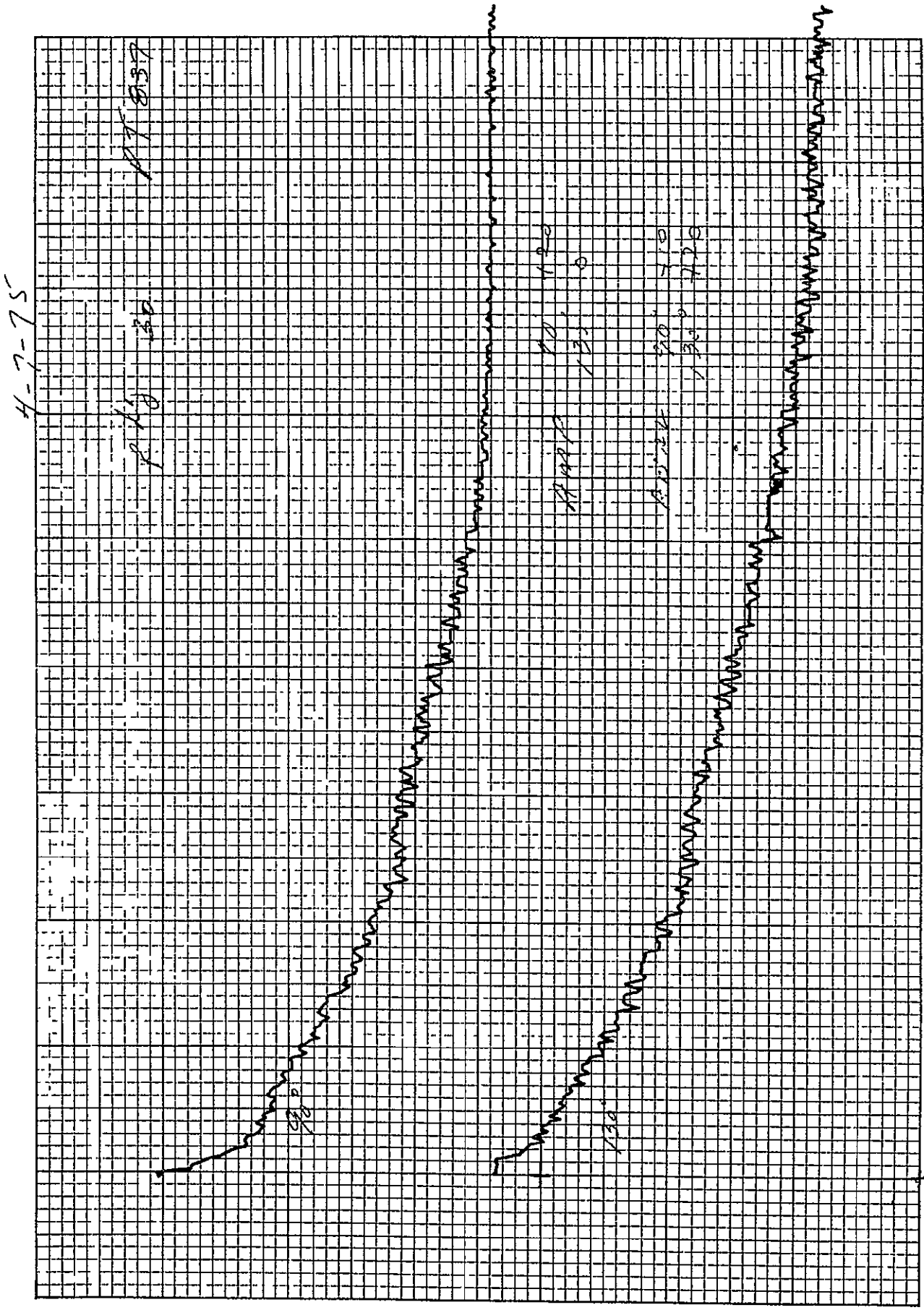
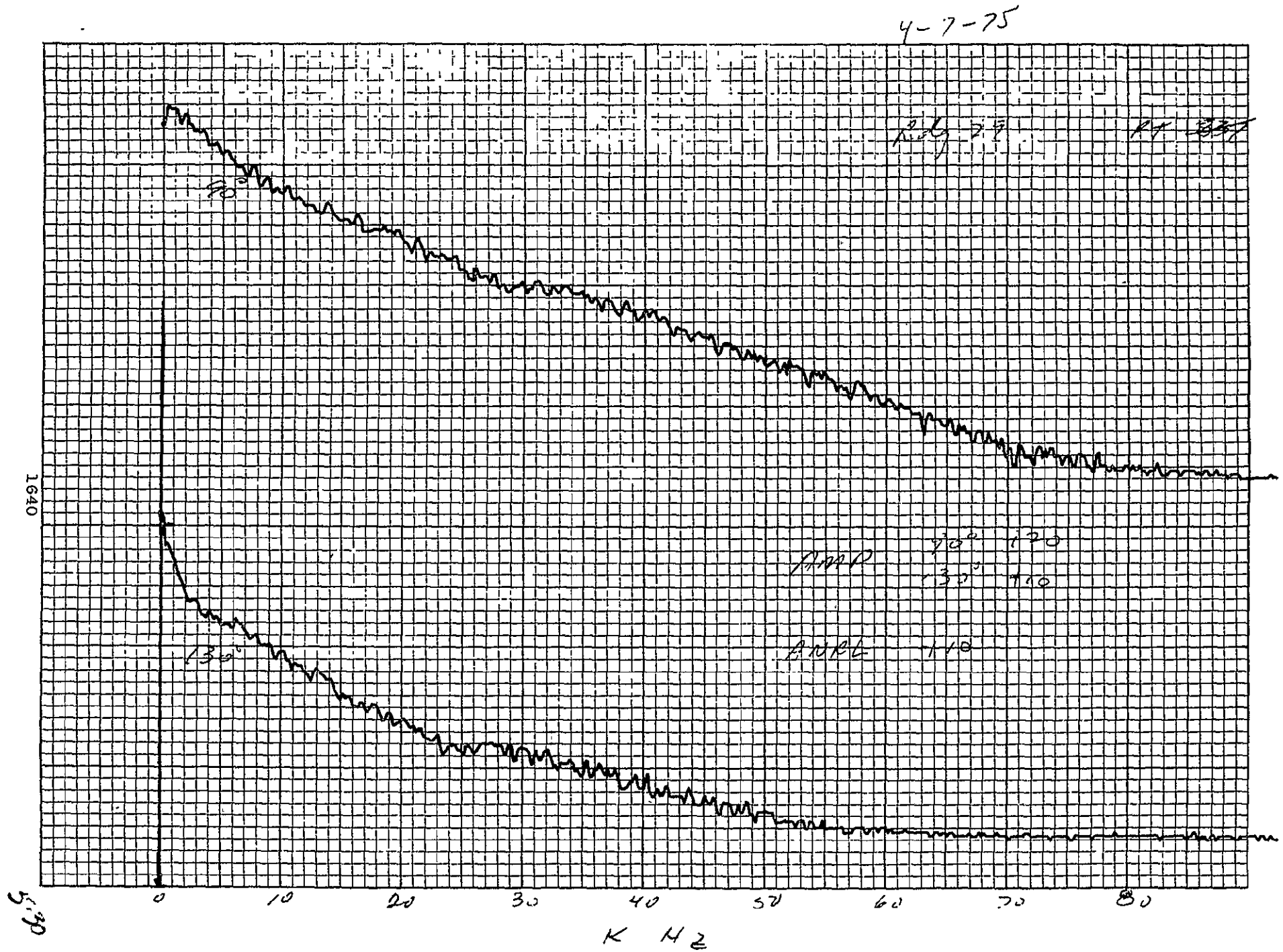
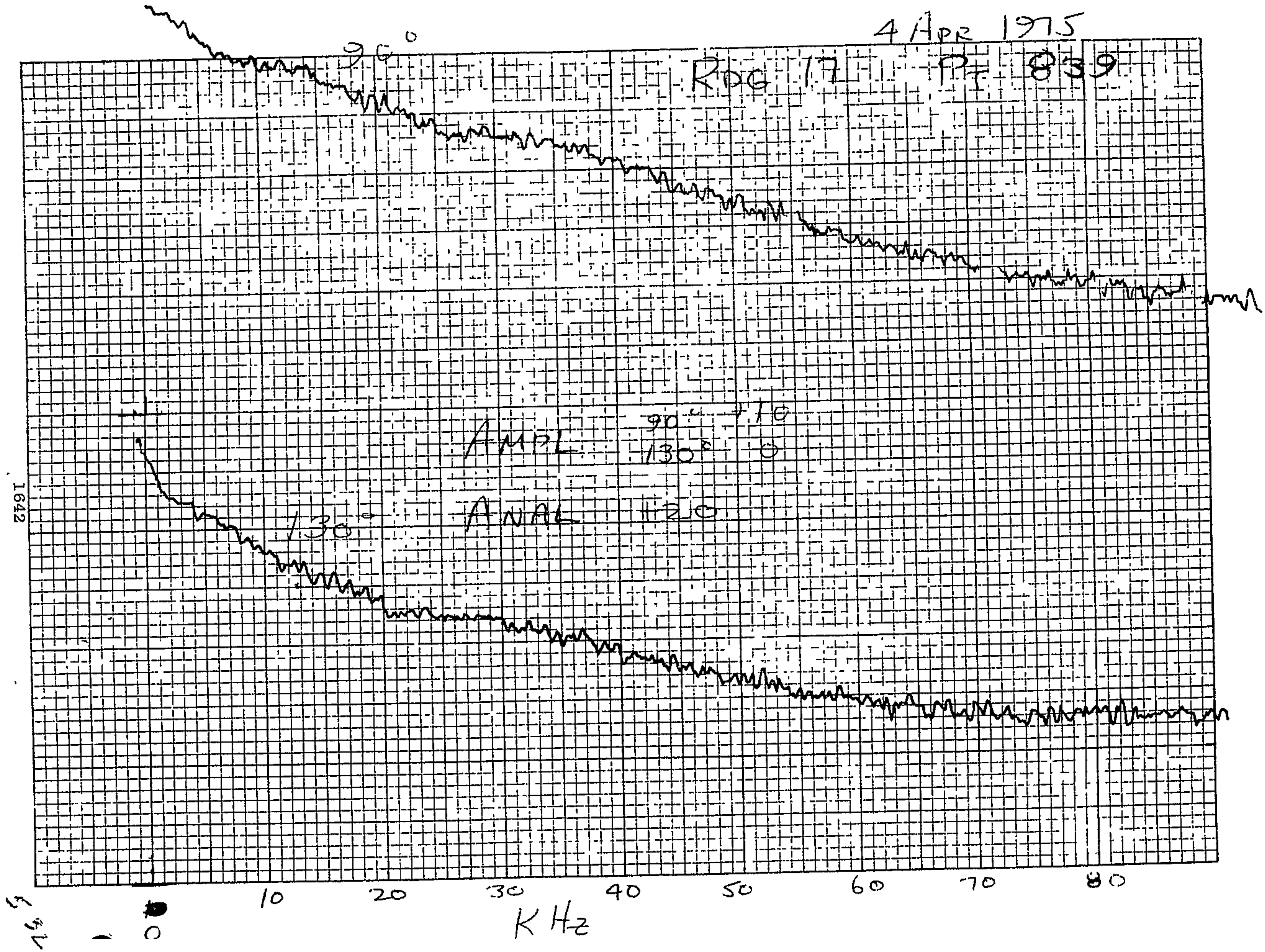



4-7-75
1640
5.30
0
10
20
30
40
50
60
70
80
KHz



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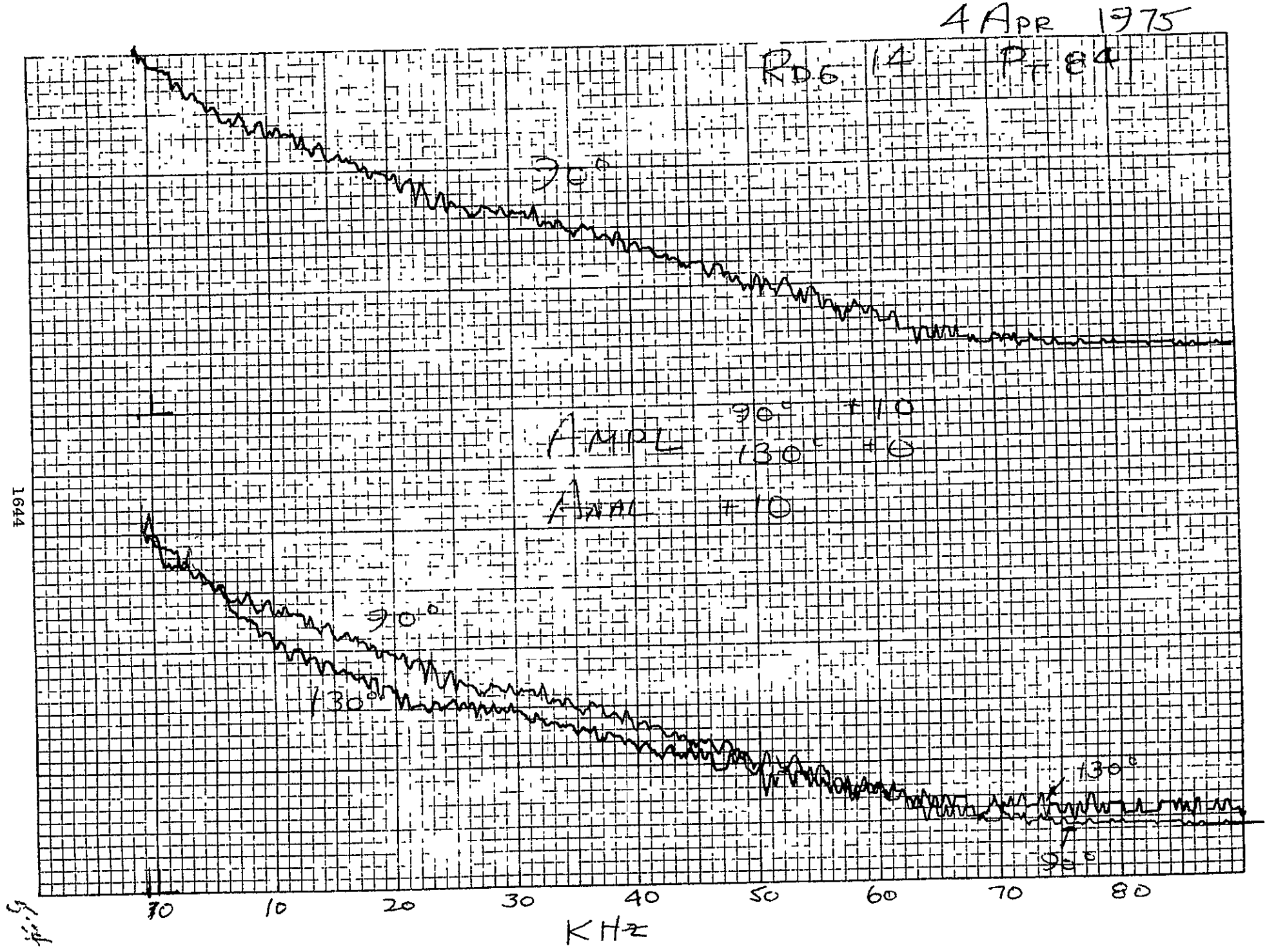
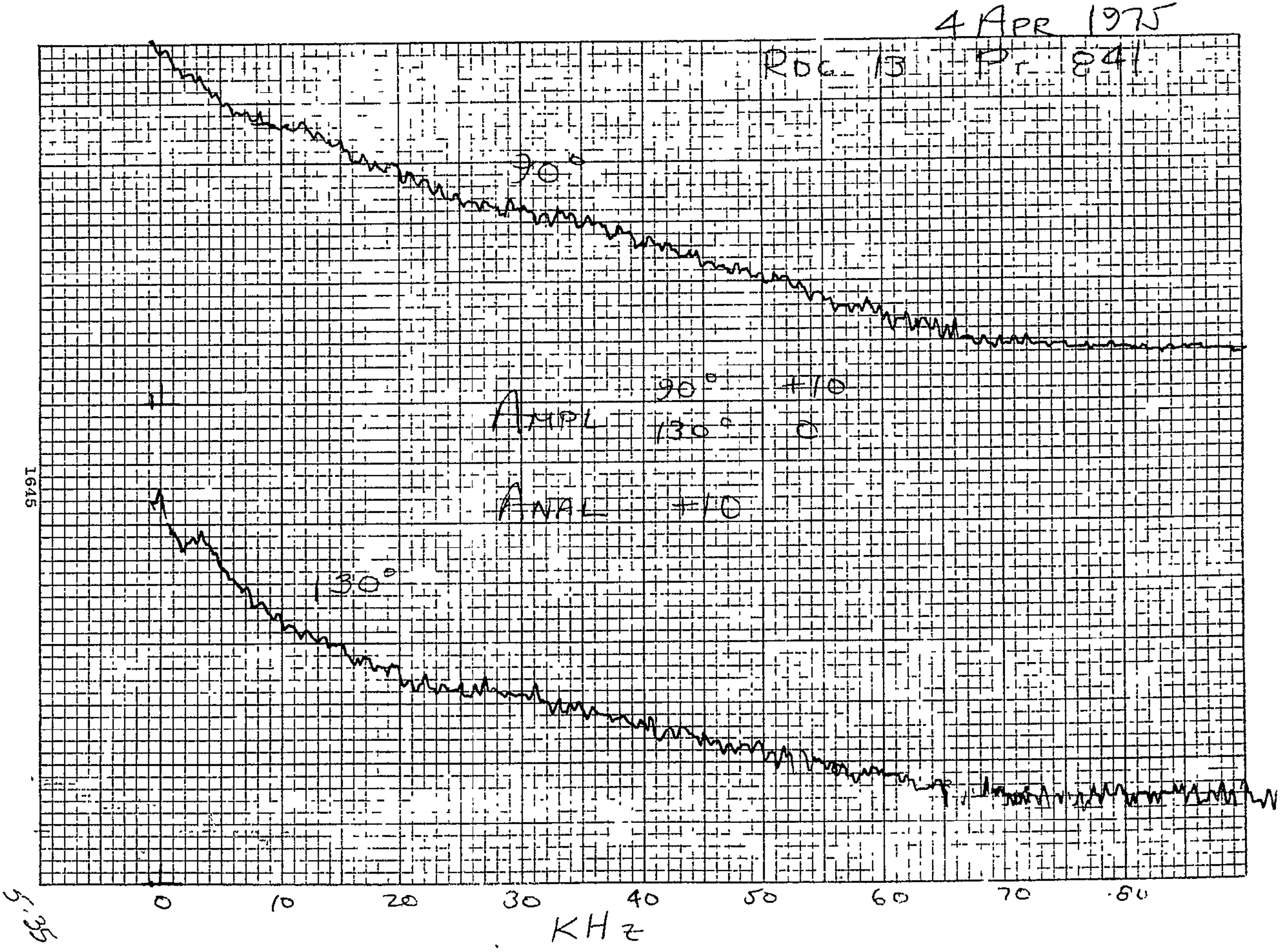
RDG 17
PT 839
90°
AMPL
90° +10
130° 0
ANAL +20
130°
0
10
20
30
40
50
60
70
80
KHz
1642

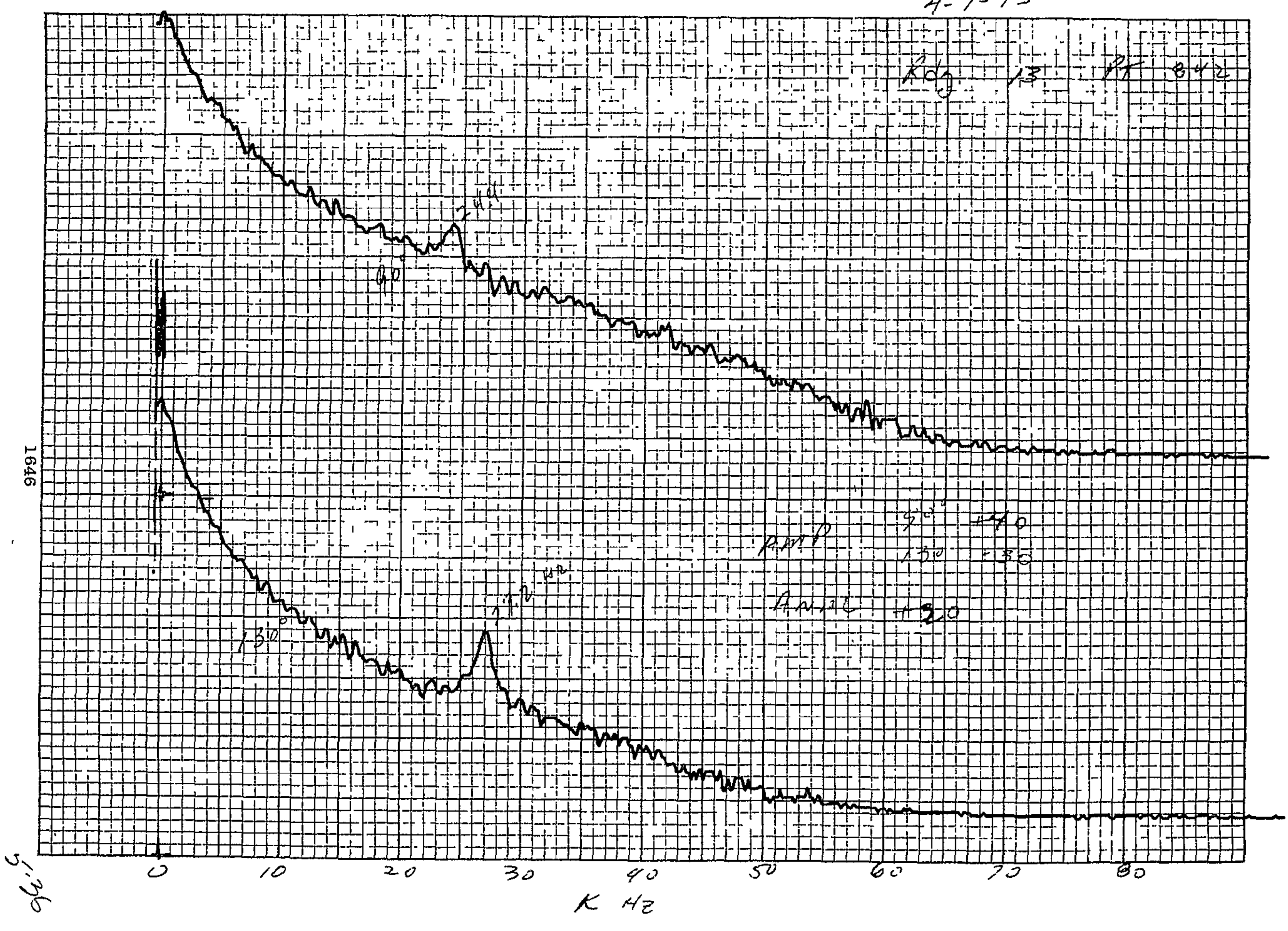
ORIGINAL PAGE IS
OF POOR QUALITY


4 APR 1975
RD6 14 PT 84
90°
AMPL 90° +10
130° +6
ANAL +10
90°
130°
130°
90°
1644
10
20
30
40
50
60
70
80
KHz

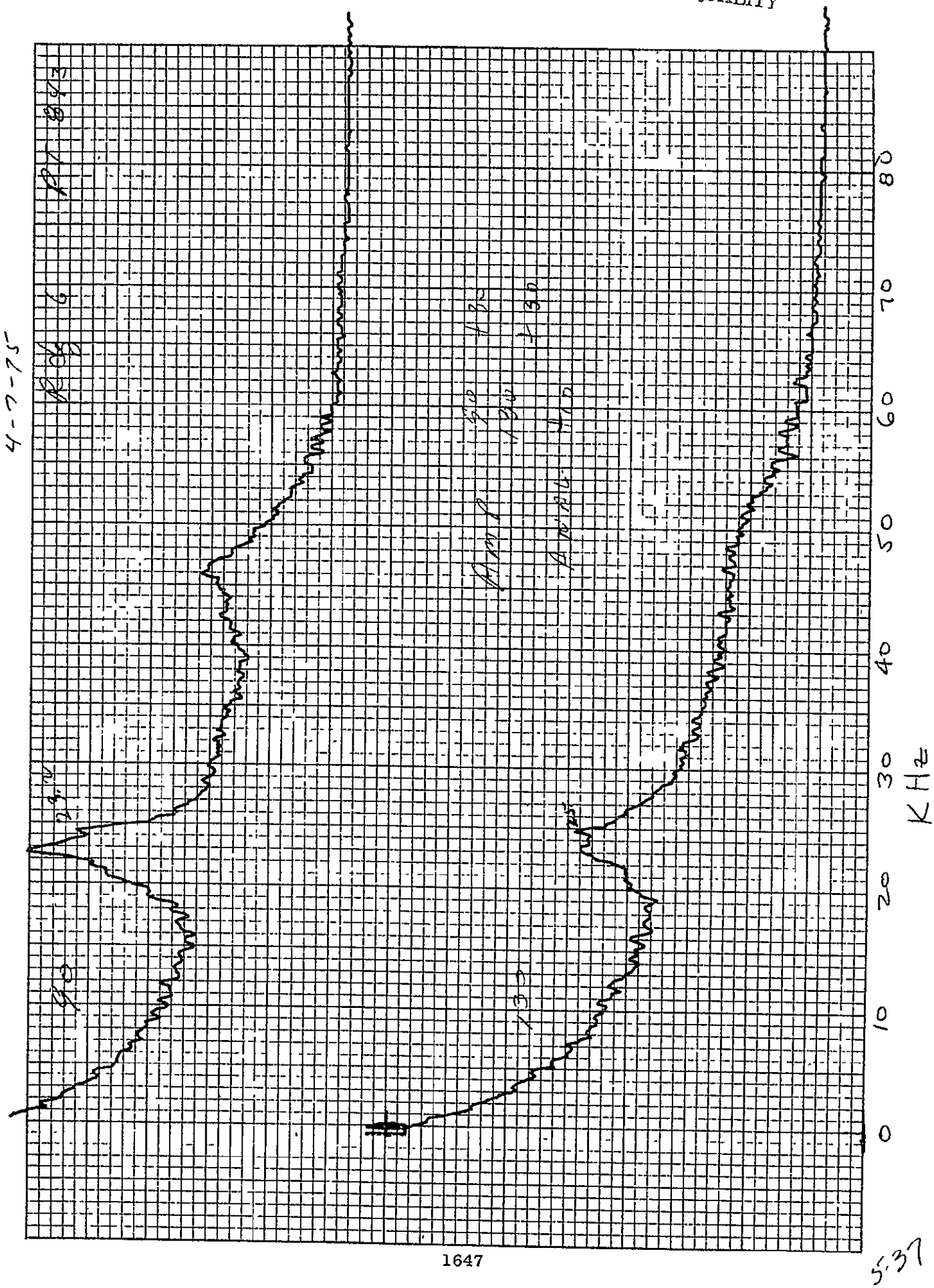
1

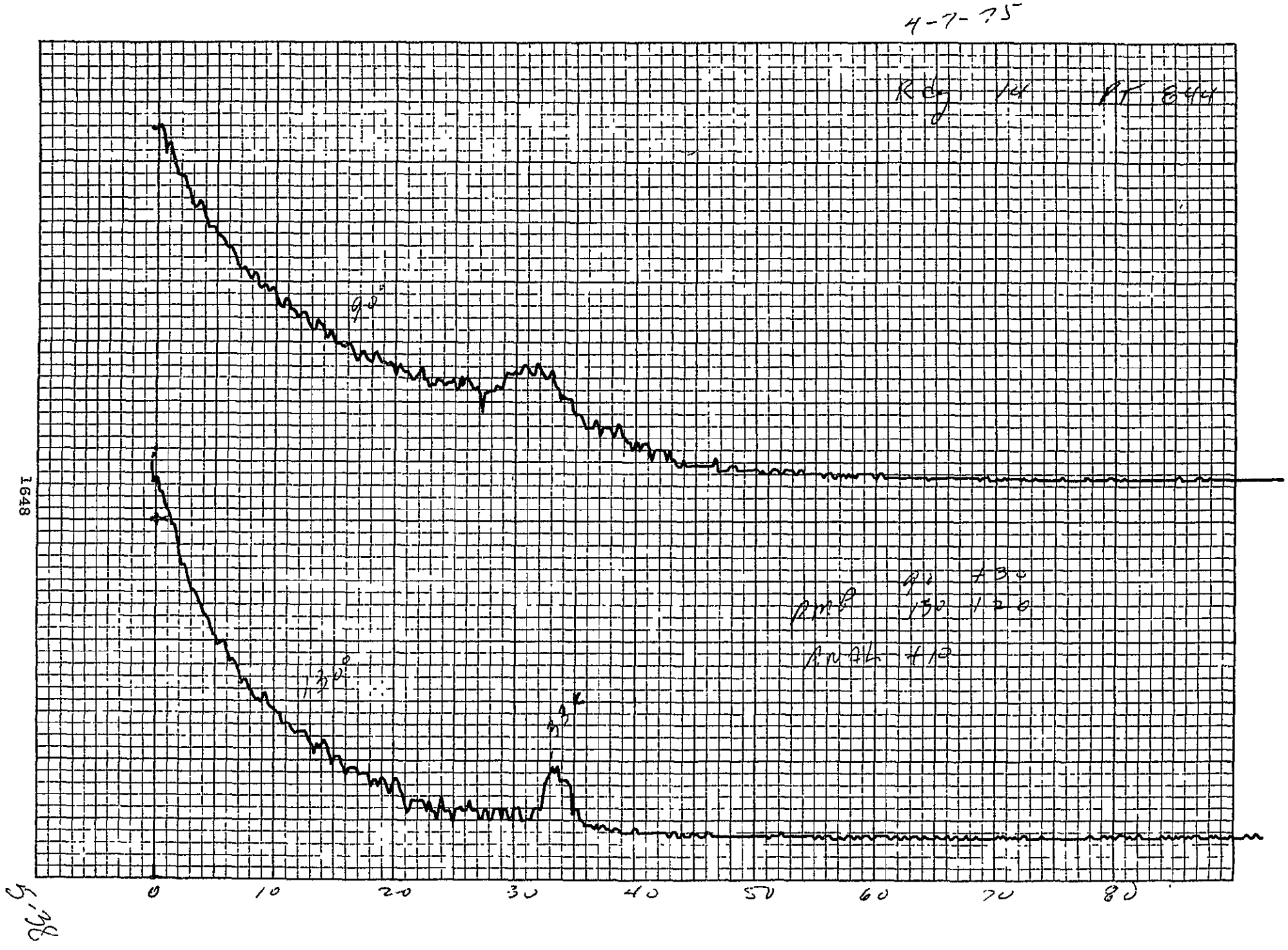


4-7-75



Rdg 13
PT 842
24 kHz
40°
17.2 kHz
130°
AMP 50° +40
130 +30
Anal +20
0
10
20
30
40
50
60
70
80
K Hz
1646
5-36




4-7-75
RCJ
PT
1648
0
10
20
30
40
50
60
70
80

1649

5-39

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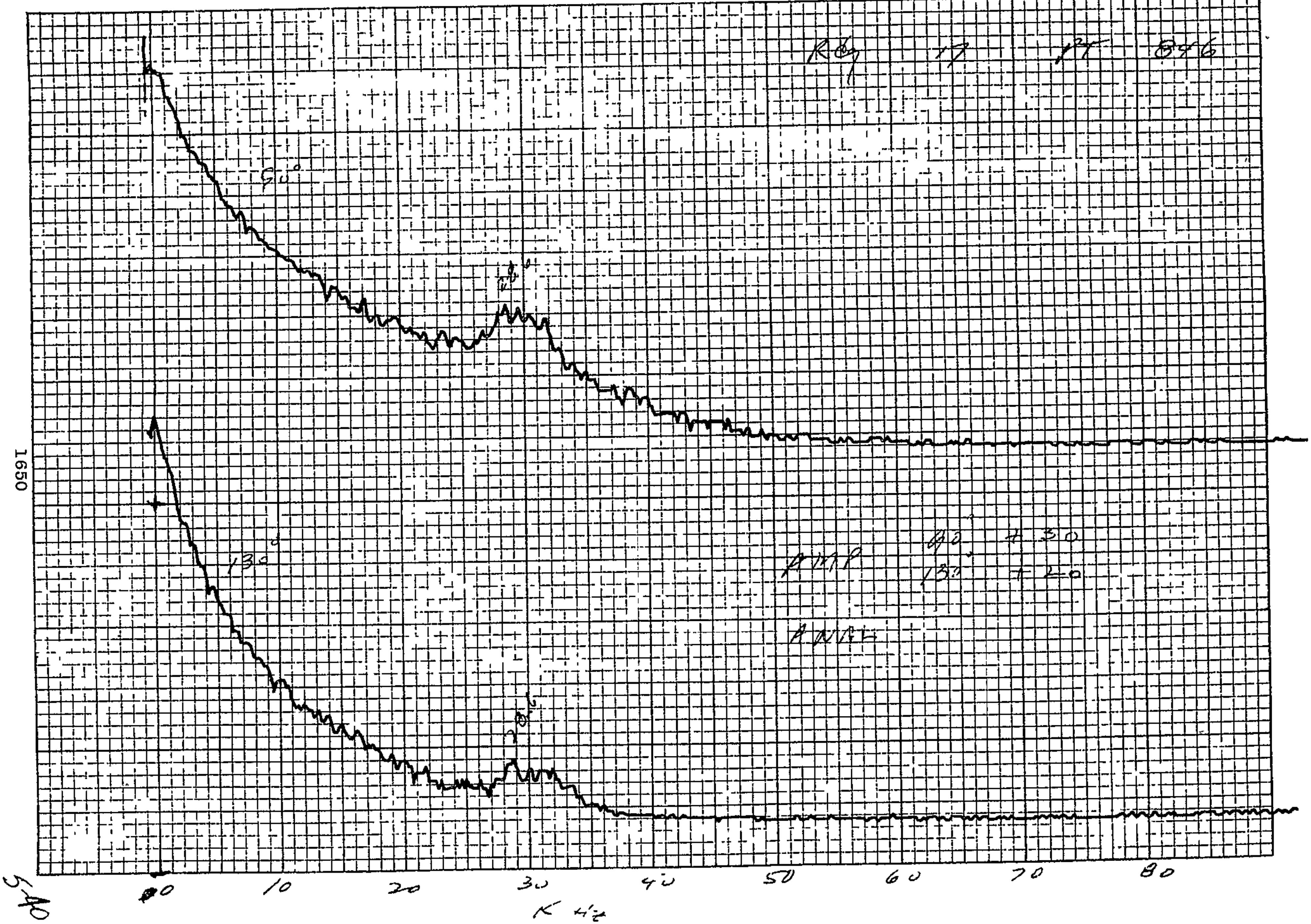
4-7-75

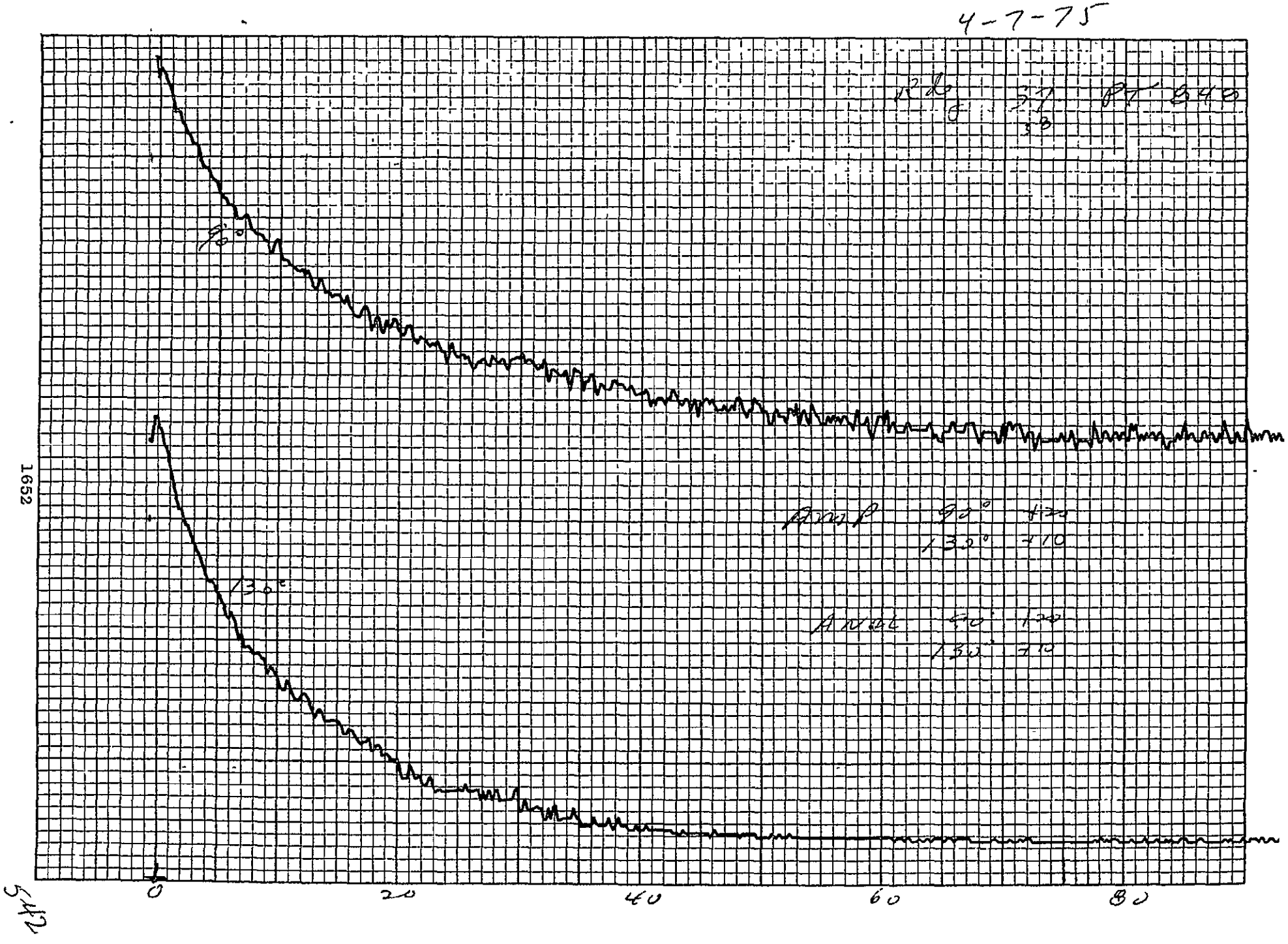


90°
130°
AMP
90° 4.30
130° 1.20
ANAL
1650
540
0
10
20
30
40
50
60
70
80
K Hz

4-7-75

1651

5-41


4-7-75
1652
0
20
40
60
80
90°
130°

4-7-75

1653

ORIGINAL PAGE IS
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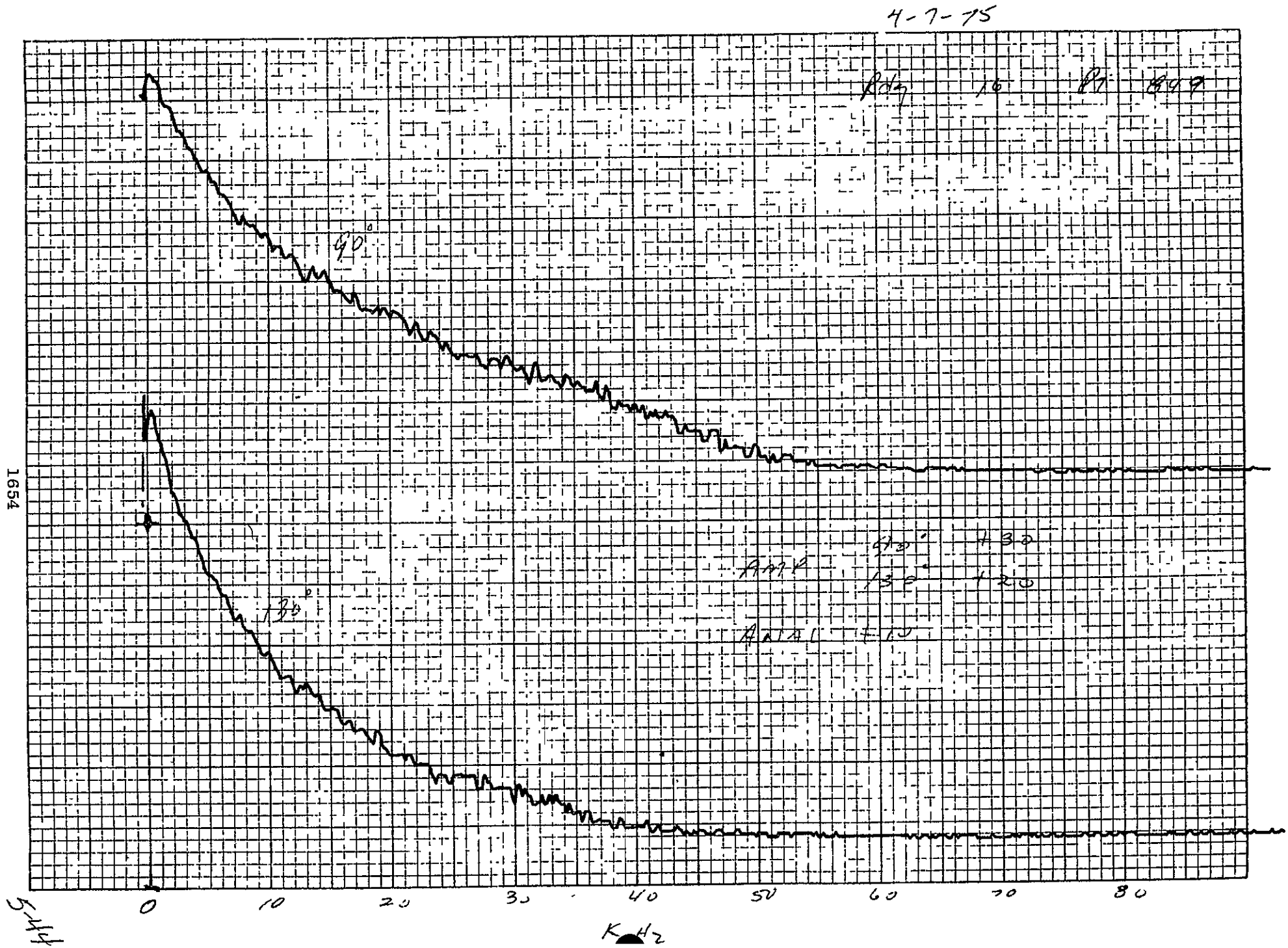
4-7-75
60°
180°
AXIAL
1654
0
10
20
30
40
50
60
70
80
KHz

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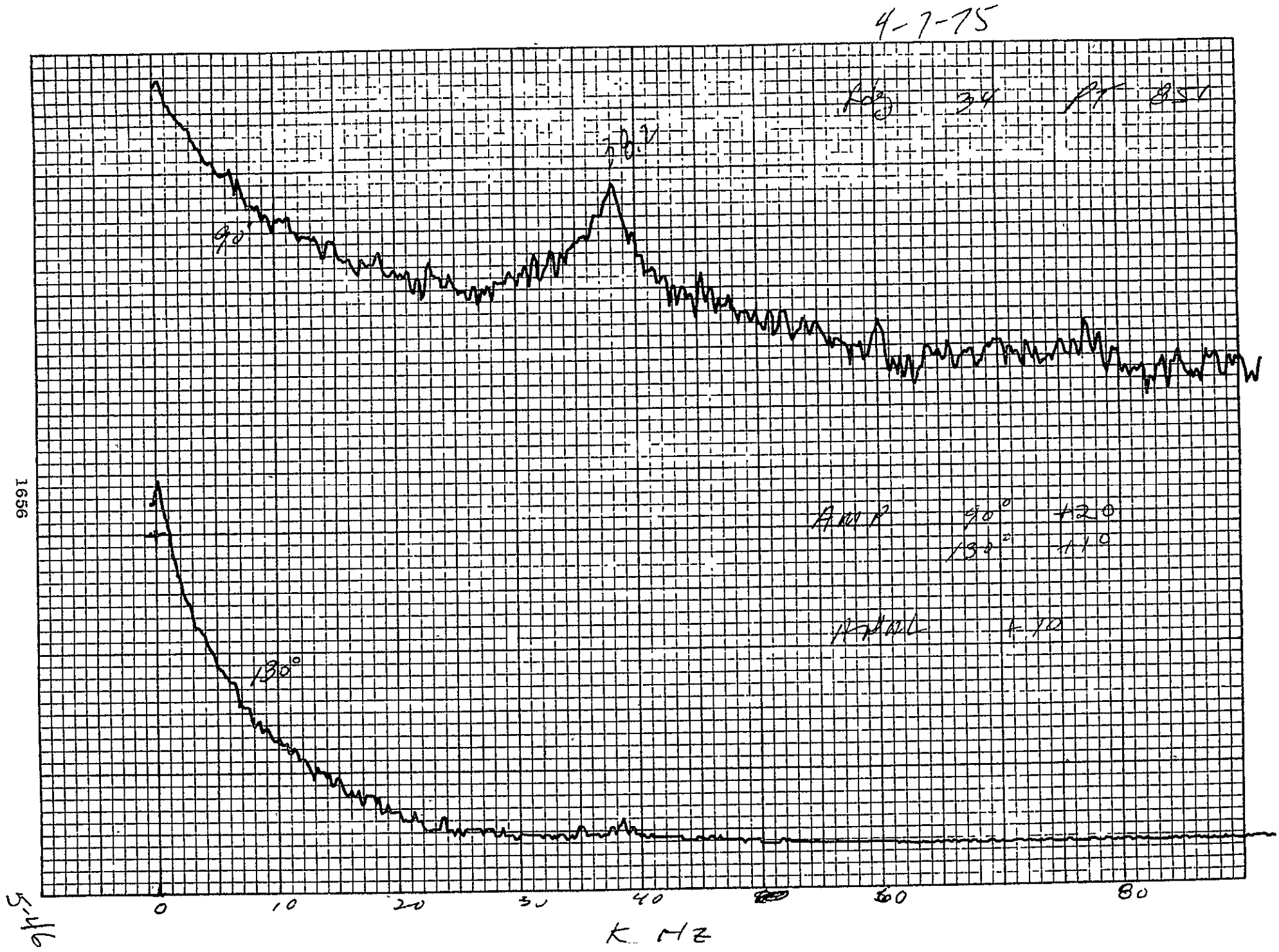
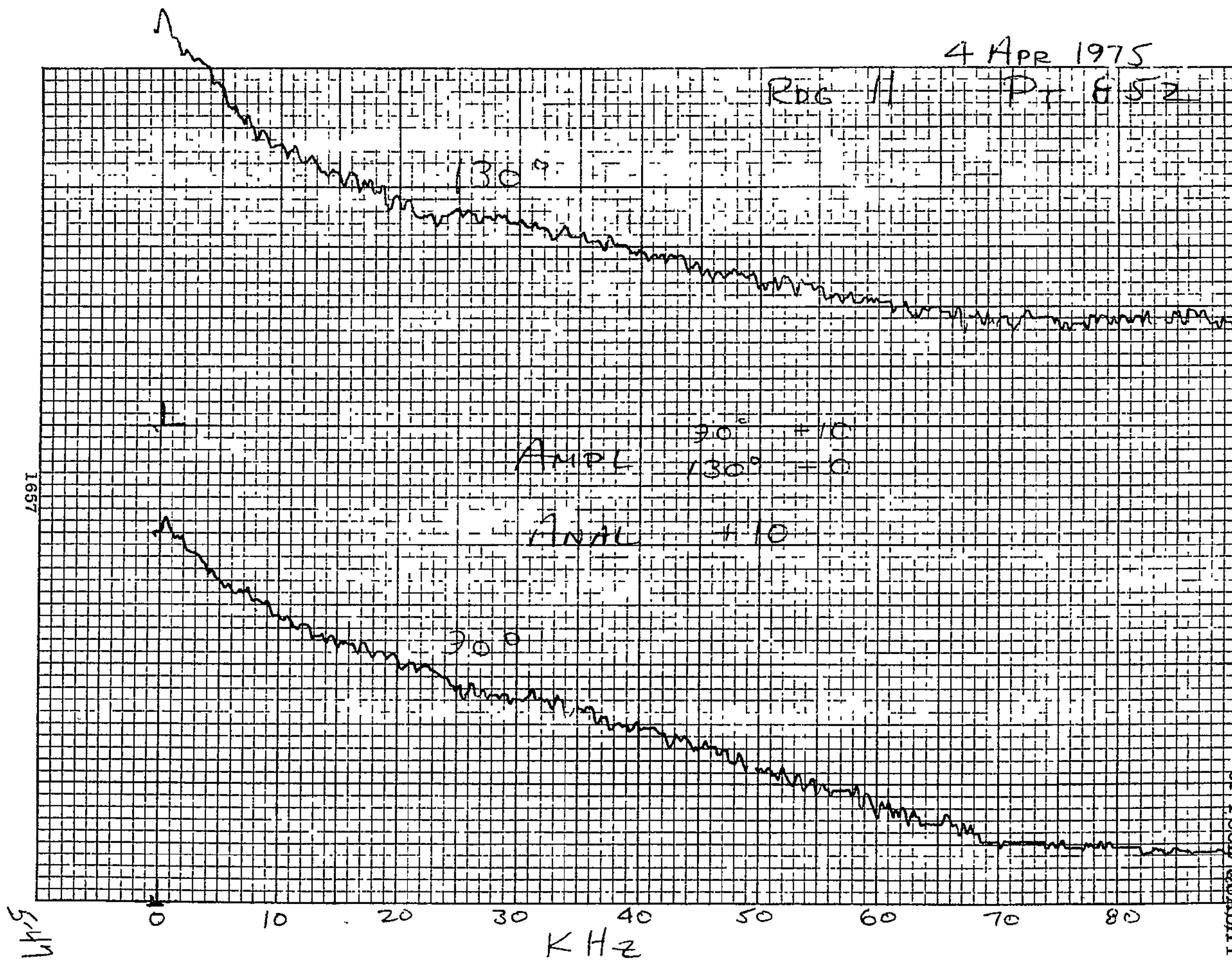
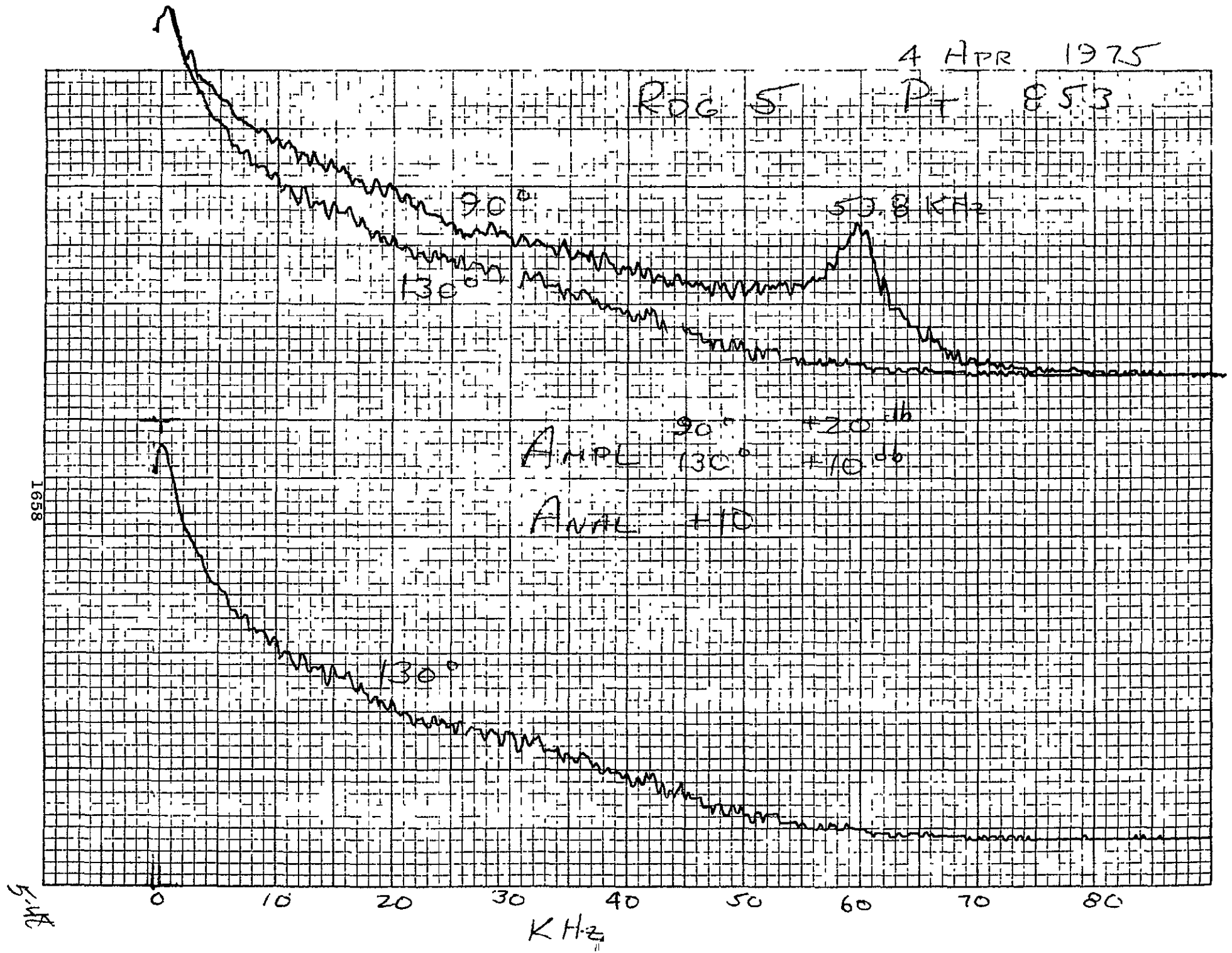
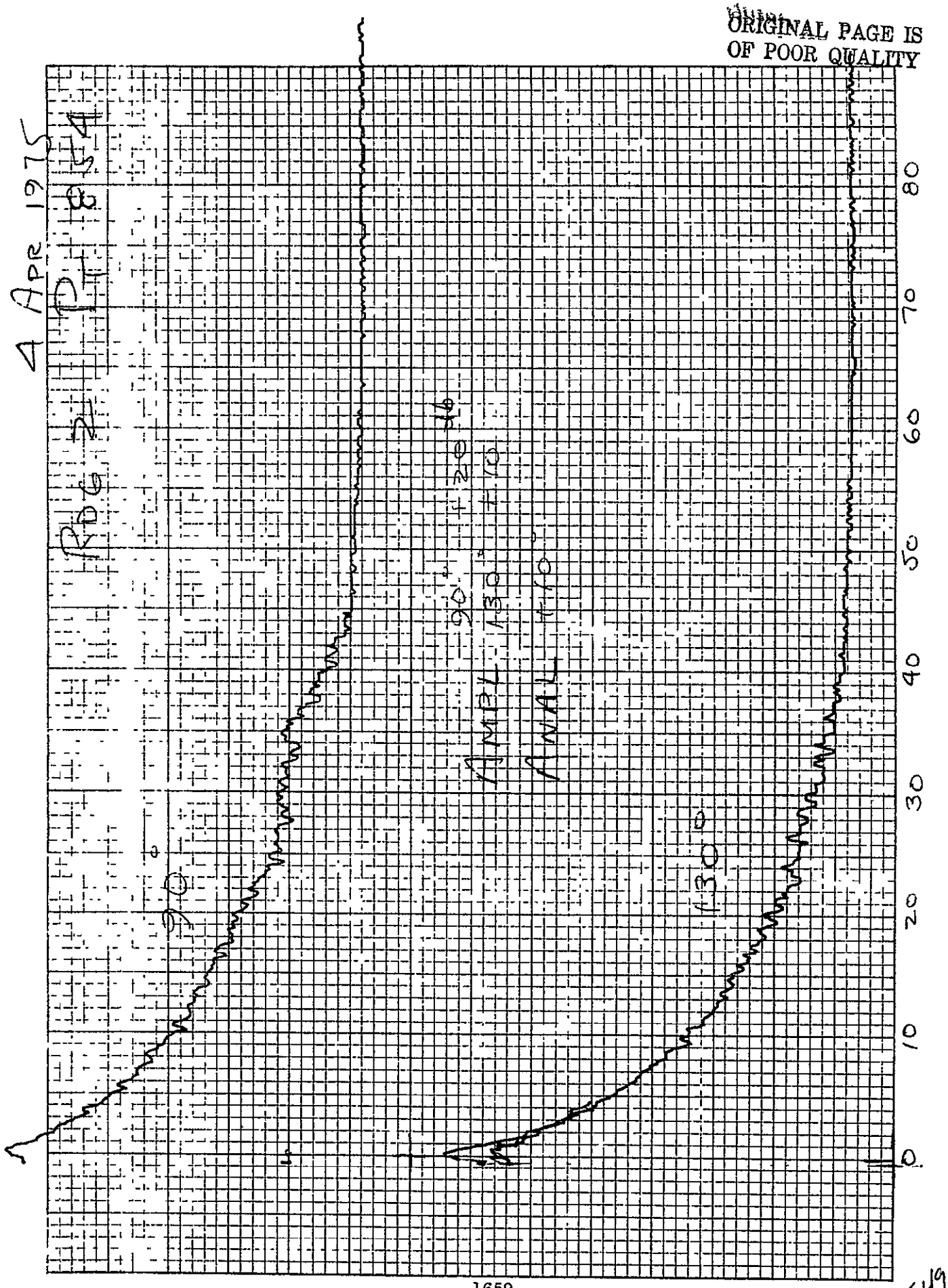
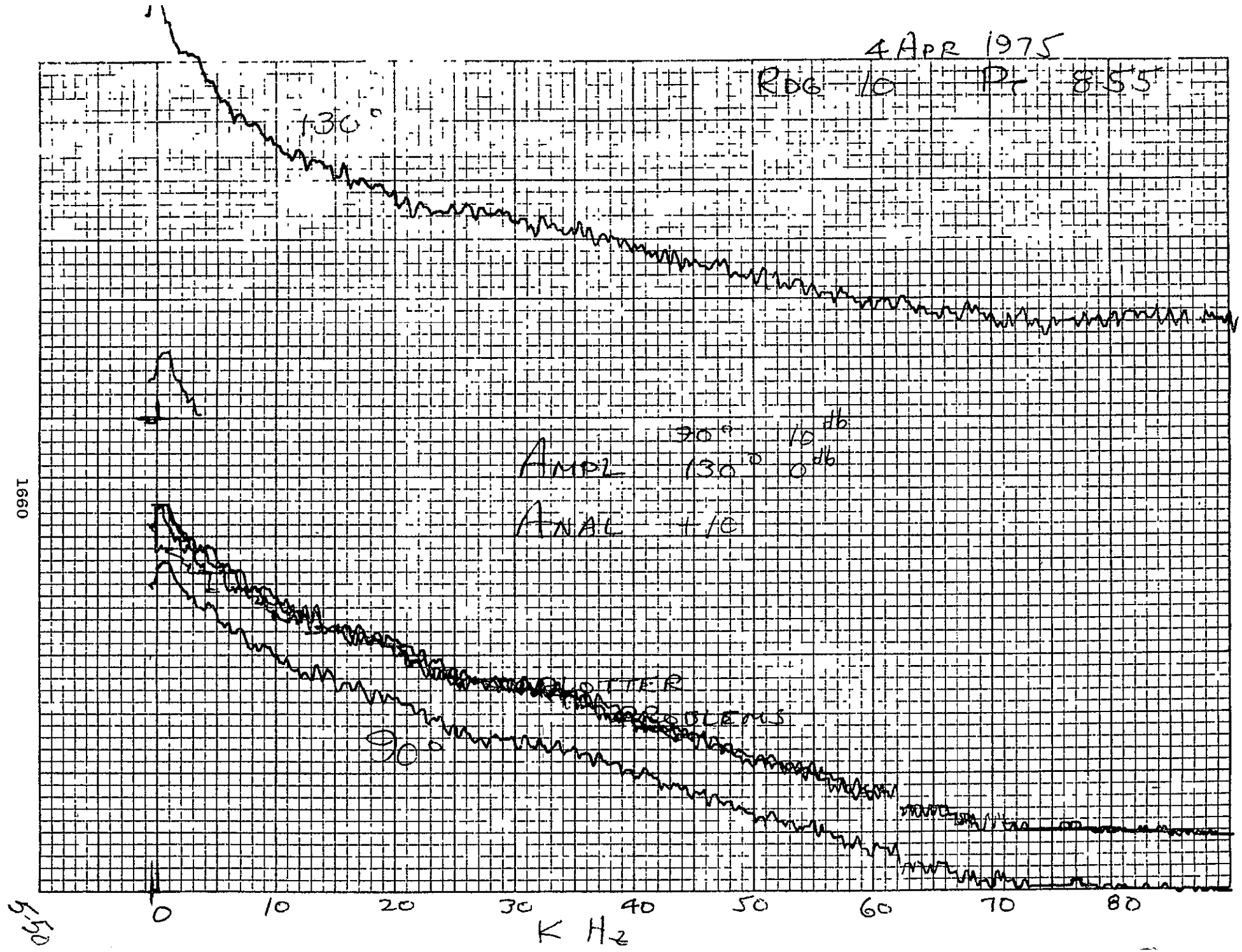
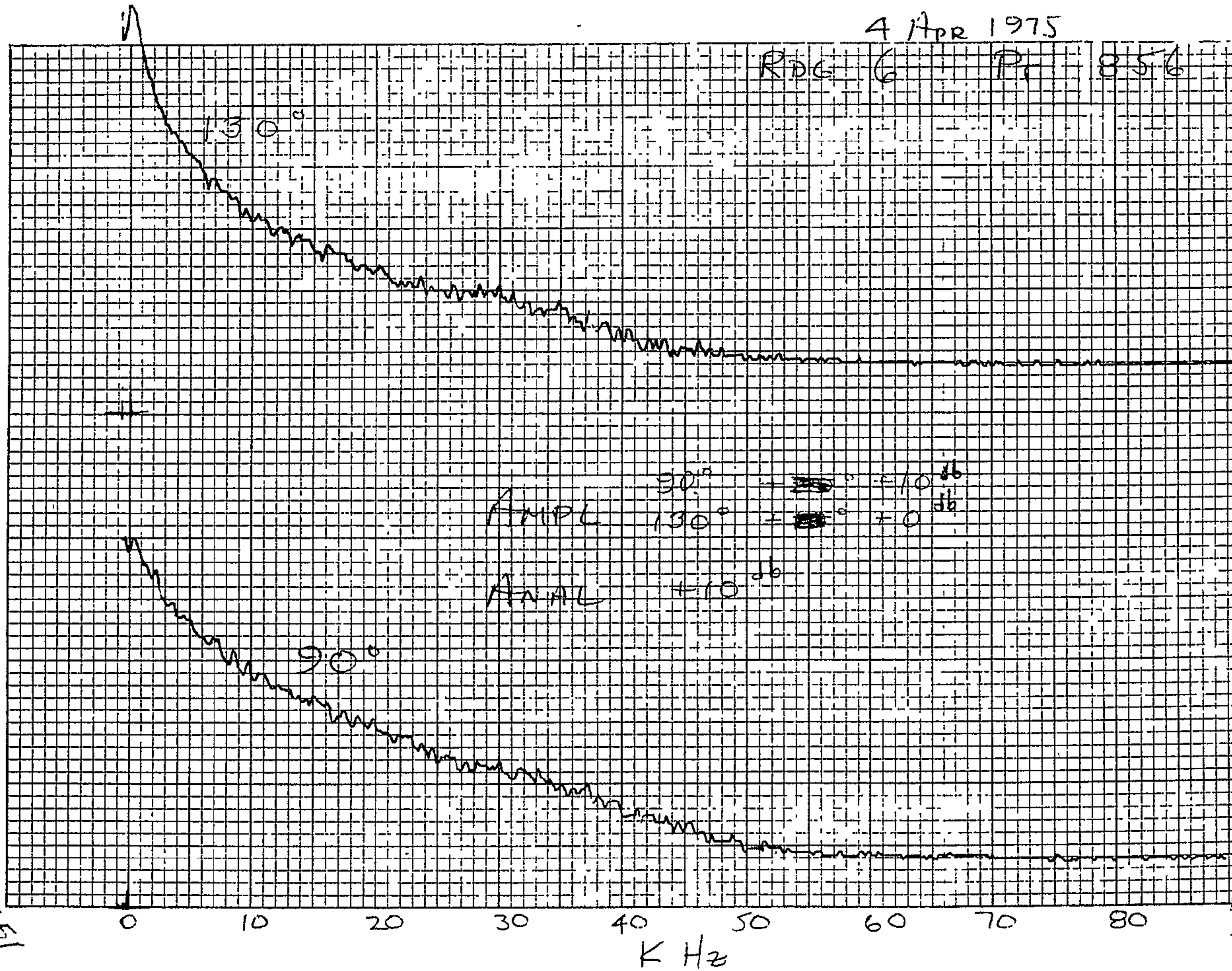

4-7-75
90°
130°
0
10
20
30
40
60
80
KHz
1656
5-46

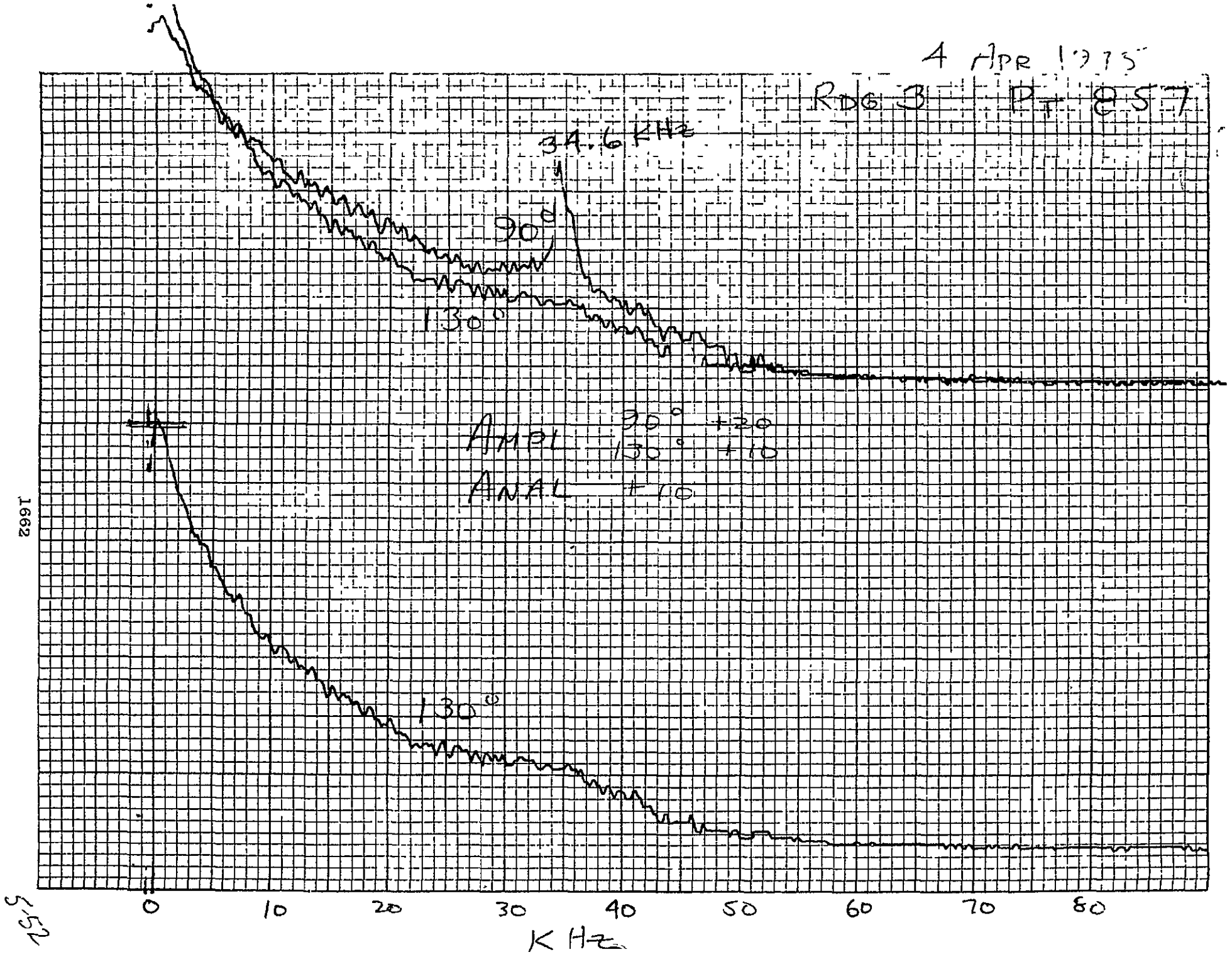


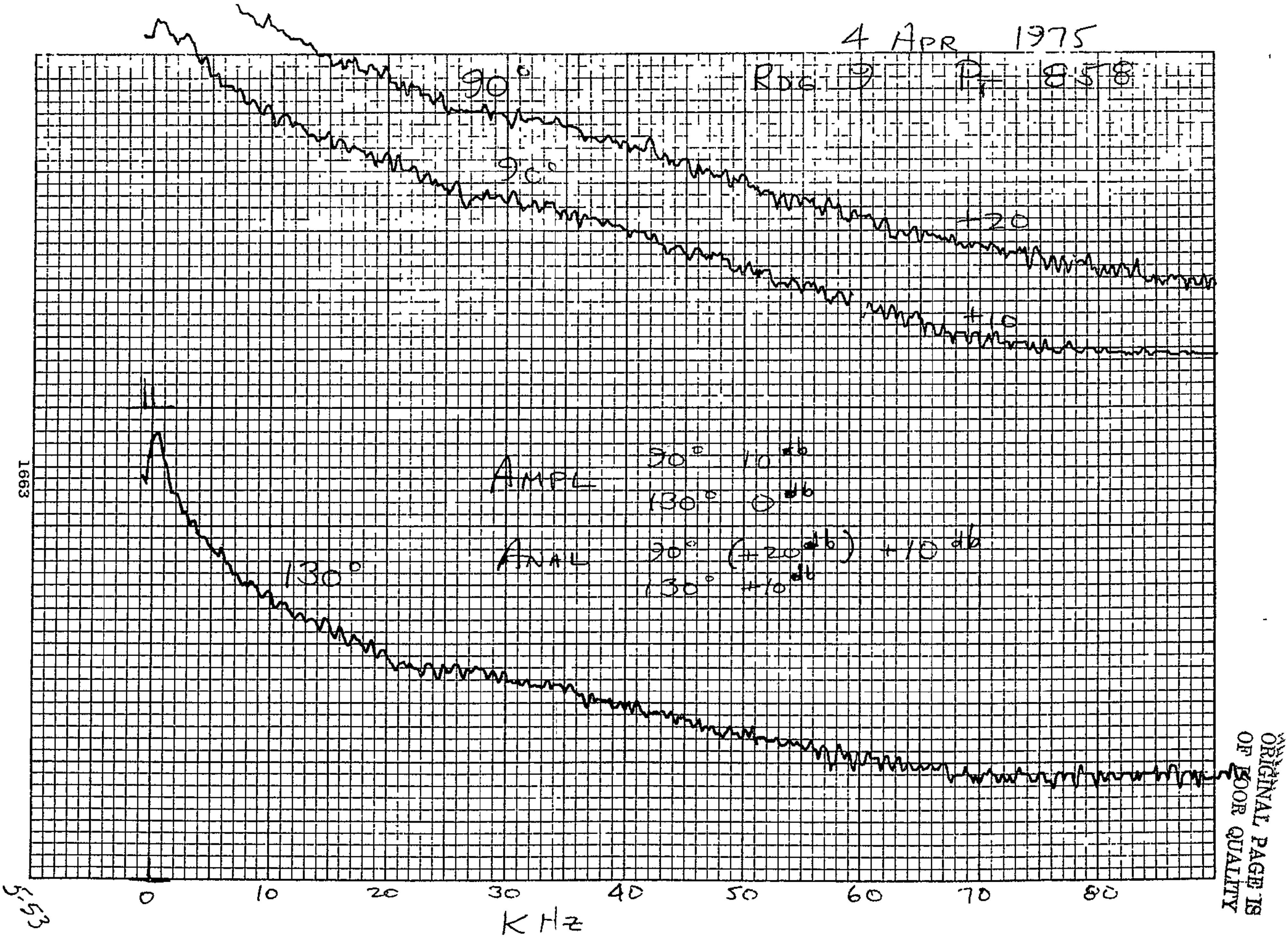

4 APR 1975
ROC 5 Pt 853
90°
53.8 KHz
130°
90°
+20 lb
AMPL
130°
+10 db
AMPL
+10
1658
130°
0
10
20
30
40
50
60
70
80
KHz



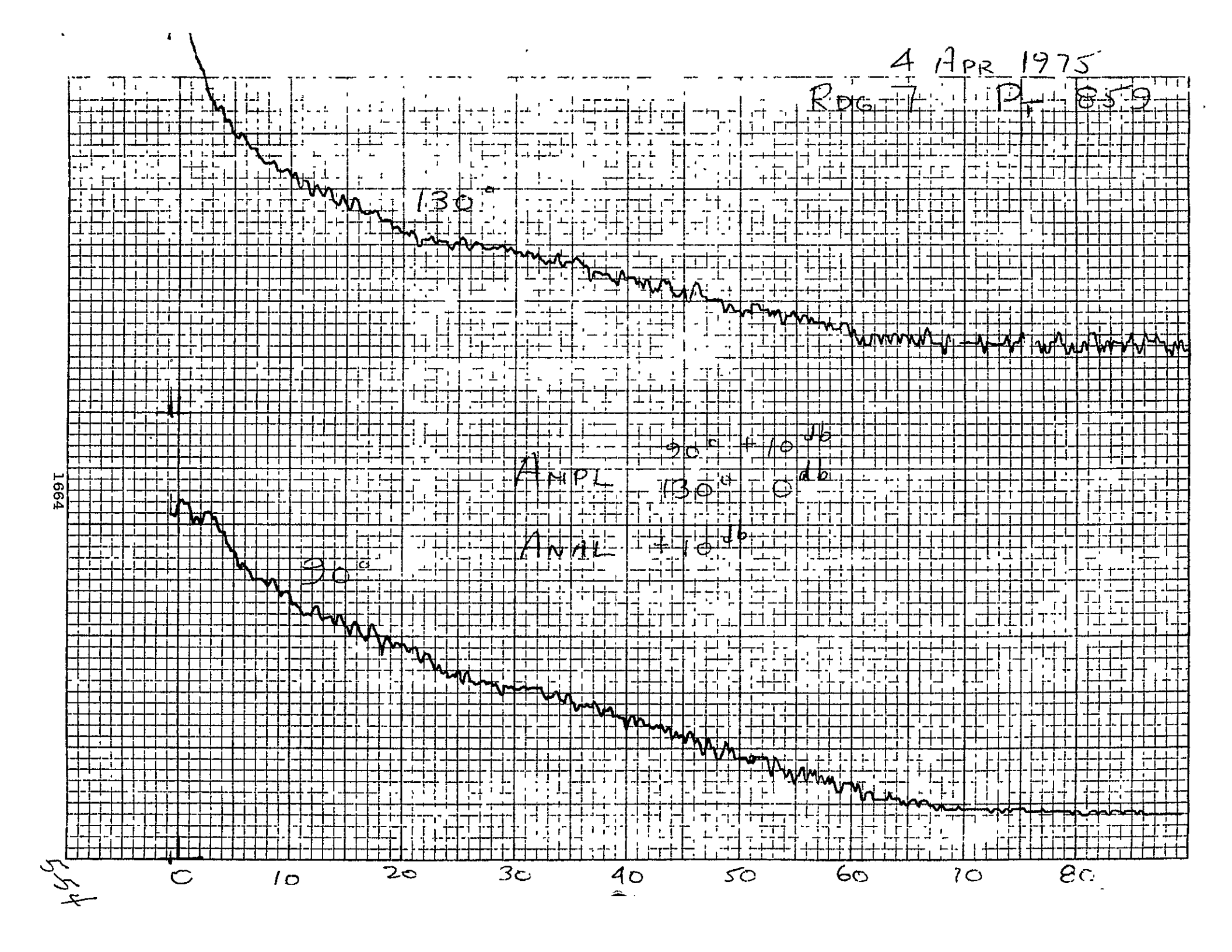

4 APR 1975
RDG 10 PT 855
130°
90°
10 db
0 db
AMPL
130°
ANAL +10
FILTER PROBLEMS
90°
1660
0
10
20
30
40
50
60
70
80
K Hz
550

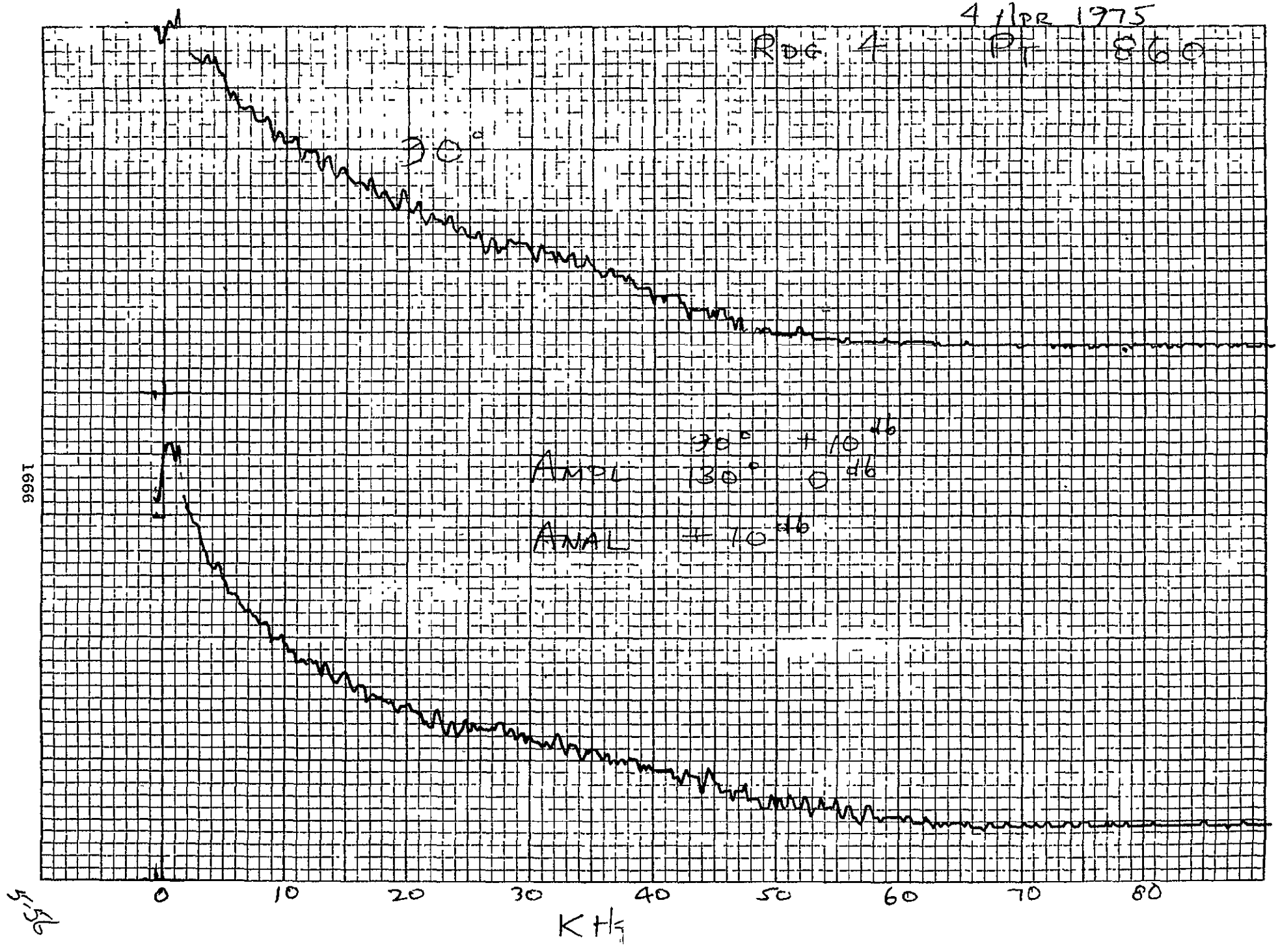



4 APR 1975
RDG 3 PT 857
34.6 KHz
90°
130°
90° +20
130° +10
AMPL
ANAL +10
1662
0
10
20
30
40
50
60
70
80
KHz



ORIGINAL PAGE IS OF POOR QUALITY


4 APR 1975
RDG 7 P 859
130°
90°
ANPL 130° 0 db
ANRL +10 db
90° +10 db
1664
554
0
10
20
30
40
50
60
70
80


4 APR 1975
RDG 4
PT 866
90°
AMPL
130°
+10 db
0 db
ANAL
+10 db
1666
0
10
20
30
40
50
60
70
80
KHz

6.0 AERODYNAMIC DATA FORMAT - ACOUSTIC TESTS

6.0 AERODYNAMIC DATA FORMAT - ACOUSTIC TESTS

The test conditions for the acoustic tests at JENOTS were set using the instrumentation rakes, measuring total pressure and total temperature. The fuel flow to the fan and core burners, the fan air flow, the core (primary airflow) and facility temperatures were monitored and recorded. All this basic data and the resultant calculations were processed through a Time-Sharing computer program. These results were available during the test to validate that the test conditions were as specified.

The following sample output sheet includes the physical geometry constants and reference constants, the summary results of the calculations showing pressure ratio, weight flows, temperatures, and velocities, the averages of the multiple rake input or orifice statics, and a complete listing of each individual measurement in engineering units (psia, °R). A configuration sheet defining each of the measurements is also included.

DUAL FLOW CHECKOUT

4/ 7/75 RUN: 12 RDG: 28 PNT: 315 BAROM: 14.489
MF28 ALPHA OUT OF TABLE
MF3 ALPHA OUT OF TABLE

!List "13" FOIL OUTPUT

*LIst A"13"

^

DUAL FLOW CHECKOUT

4/ 7/75 RUN: 12 RDG: 28 PNT: 315 BAROM: 14.489

CONSTANTS

D7 =	12.0000	D8 =	4.6270	MAO-DIA=	5.0000
MAO-BET=	0.4990	SAO-DIA=	9.1500	SAO-BET=	0.6000
SUBAMP =	0.7530	TSAMP =	512.0000	SECAREA=	10.8420

CALCULATIONS

PT8/P0	=	1.590		PT28/P0	=	3.269	
TT8	=	994.087	DEG. R	TT28	=	1603.352	DEG. R
WA8	=	6.066	PPS	WA28	=	6.691	PPS
WT8	=	6.104	PPS	WT28	=	6.691	PPS
WF8	=	0.038	PPS	WF28	=	0.	PPS
WFT	=	0.148	PPS	WFTV	=	0.038	PPS
F/A8	=	0.006		F/A28	=	0.	
GAM 8	=	1.390		GAM28	=	1.362	
V8	=	1218.833	FT/SEC				
V28	=	2366.023	FT/SEC				
TS8	=	872.757	DEG. R	TS28	=	1170.578	DEG. R

6-2

M3	=	0.844	M28	=	1.430
F8	=	231.050 -F	F28	=	491.623 -F
AE8	=	16.092 SQ. IN	AE28	=	12.187 SQ. IN

10 LOG(R8*A8) = -23.003
10 LOG(R28*A28) = -25.485
10 LOG(R8**2*A8) = -36.489
10 LOG(R28*A2*A28) = -40.246

AVERAGES

FT-7MV(	0)=	0.	T-OUT (	1)=	508.495	MAO-P1(	6)=	29.631
MAO-P2(	6)=	26.563	MAO-T1(	2)=	414.871	WFTCPS(	1)=	0.148
COREPT(	6)=	23.042	CORTT5(	2)=	948.634	FTEMPT(	1)=	512.129
SAO-P1(	4)=	48.465	SAO-P2(	2)=	48.242	SAO-TT(	2)=	526.921
WF1 (	1)=	0.038	WF2 (	1)=	0.	WF3 (	1)=	0.
FTEMP1(	1)=	512.129	COR-IN(	5)=	994.087	FAN-TT(	6)=	1603.352
FAN-PT(	6)=	47.368	CORE-T(	0)=	0.			

ENGINEERING UNITS

CHAN	DATA	CHAN	DATA	CHAN	DATA	CHAN	DATA	CHAN	DATA
3	1254.839	4	964.791	5	1443.913	7	1446.023	8	1548.147
9	10458.670	10	1012.068	18	1282.883	19	1295.630	20	1220.776
21	1396.642	23	1428.720	24	1238.253	25	1203.724	26	1209.692
27	1016.857	28	1008.585	37	994.616	38	990.668	39	991.107
40	1001.019	41	992.423	43	1622.496	44	1459.106	45	1635.691
46	1622.070	47	1639.948	48	1640.799	52	735.239	53	783.807
54	795.952	55	1176.016	57	624.300	59	984.528	61	508.495
62	524.680	63	305.062	64	526.921	65	526.921	66	512.129
68	511.631	69	512.129	70	0.	71	99.722	72	888.248
73	735.685	75	1009.020	76	581.359	77	1661.688	78	1756.255
79	999.440	102	-42.434	103	-79.285	104	-163.037	105	-37.968
106	-3756.561	107	-35.734	108	29.567	109	29.540	110	22.983
111	23.001	112	14.489	113	14.489	114	26.630	115	26.626
116	23.039	117	23.073	118	14.484	119	14.490	120	48.348
121	48.555	122	23.039	123	23.117	124	14.489	125	14.490
126	48.259	127	48.287	128	47.155	129	47.390	130	14.489
131	14.490	132	29.622	133	29.685	134	47.441	135	47.401
136	14.484	137	14.490	138	26.553	139	26.491	140	47.441
141	47.379	142	14.484	143	14.490	144	48.481	145	48.477
146	22.676	147	22.685	148	14.467	149	14.490	150	48.226
151	48.219	152	22.609	153	22.624	154	14.489	155	14.490
156	14.467	157	14.489	158	47.413	159	47.301	160	14.467
161	14.489	162	29.667	163	29.708	164	47.368	165	47.278
166	14.478	167	14.490	168	26.553	169	26.525	170	47.463
171	23.028	172	14.484	173	14.490	178	0.	179	300.154
181	145.900	182	-0.800	183	-7.600	184	289.800	202	9941.000
203	9939.000	204	9935.000	205	9942.000	206	9936.000	207	9938.000

ready

*DONE
SYSTEM ?REMO CLEARFILES
SYSTEM ?

63

COMPUTER CHANNEL	PARAMETER DESCRIPTION	LOCATION
3	T/C - T2	Support Cone - P06
4	T/C - T6	" "
5	T/C - T1	" " - P06
7	T/C - T12	Support Cone - P07
8	T/C - T16	" "
9	T/C - T18	" "
18	T/C - T4	Support Cone - P06
19	T/C - T5	" "
20	T/C - T7	" "
21	T/C - T8	" "
23	T/C - T13	Support Cone - P07
24	T/C - T14	" "
25	T/C - T15	" "
26	T/C - T17	" "
27	T/C - T20	" "
28	T/C - T21	Inner Frame - P08
37	T/C	Core T/C Rake - 0°
38	T/C	" "
39	T/C	Core T/C Rake - 180°
40	T/C	" "
41	T/C	" "
43	T/C	Fan T/C Rake - 30°
44	T/C	" "
45	T/C	" "
46	T/C	Fan T/C Rake - 210°
47	T/C	" "
48	T/C	" "
52	T/C	Fan - Outside Burner
53	T/C	Fan Elbow - Top
54	T/C	Fan Elbow - V.C.L.
55	T/C	Elbow & Plenum
57	T/C	Plenum - Inside
59	T/C	Plenum - Mid Sec. Pipe

COMPUTER CHANNEL	PARAMETER DESCRIPTION	LOCATION
61	T/C	Outside (Amb) Temp.
62	T/C	Main Air Orifice - A
63	T/C	" " " - B
64	T/C	Sec. Air Orifice - A
65	T/C	" " " - B
66	T/C	Fan P/B Fuel
68	T/C	Core P/B Fuel
69	T/C	Total Fuel
70	-	Digital Zero
71	-	Cal. 32.42
72	T/C	Core P/B Dish - T_{T5}
73		
75	T/C	Core P/B Discharge
76	T/C	Fan P/B Discharge
77	T/C	" " "
78	T/C	" " "
79	T/C	" " "
102	Press-Vent A	
103	" -Vent B	
104	" -Vent C	
105	" -Vent D	
106	" -Vent E	
107	" -Vent F	
108	PS	Main Air Orifice - Upstream
109	PS	" " " "
110	PT - 1A	Core 0° Rake
111	PT - 2A	Core 180° Rake
112	Open	
113	Open	
114	PS	Main Air Orifice - Downstream
115	PS	Main Air Orifice - Downstream
116	PT - 1B	Core 0° Rake
117	PT - 2B	Core 180° Rake
118	Open	
119	Open	
120	PS	Sec. Air Orifice - Upstream
121	PS	" " " "
122	PT - 1C	Core 0° Rake
123	PT - 2C	Core 180° Rake

COMPUTER CHANNEL	PARAMETER DESCRIPTION	LOCATION
124	Open	
125	Open	
126	PS	Sec. Air Orifice - Downstream
127	PS	" " " - "
128	PT - 1A	Fan 30° Rake
129	PT - 2A	Fan 210° Rake
130	Open	
131	Open	
132	PS - 1A	Main Air Orifice - Upstream
133	PS - 1B	Main Air Orifice - Upstream
134	PT - 1B	Fan 30° Rake
135	PT - 2B	Fan 210° Rake
136	Open	
137	Open	
138	PS - 2A	Main Air Orifice - Downstream
139	PS - 2B	Main Air Orifice - Downstream
140	PT - 1C	Fan 30° Rake
141	PT - 2C	Fan 210° Rake
142	Open	
143	Open	
144	PS - 1A	Sec. Air Orifice - Upstream
145	PS - 1B	Sec. Air Orifice - Upstream
146	PS	Core Outer - 16°
147	PS	Core Outer - 196°
148	Open	
149	Open	
150	PS - 2A	Sec. Air Orifice - Downstream
151	PS - 2B	Sec. Air Orifice - Downstream
152	PS	Core Inner - 164°
153	PS	Core Inner - 344°
154	Open	
155	Open	
156	Open	
157	Open	
158	PS	Fan Outer - 37.5°
159	PS	Fan Outer - 217.5°
160	Open	
161	Open	
162	PS - 1A	Main Air Orifice - Upstream
163	PS - 1B	Main Air Orifice - Upstream
164	PS	Fan Inner - 37.5°
165	PS	Fan Inner - 217.5°

COMPUTER CHANNEL	PARAMETER DESCRIPTION	LOCATION
166	Open	
167	Open	
168	PS - 2A	Main Air Orifice - Downstream
169	PS - 2B	" " " - "
170	PT - 2B	Fan 210° Rake
171	PT - 1B	Core 0° Rake
172	Open	
173	Open	
178	Zero	AMP - Scanner
179	Cal	Scanner
180	Jump	
181	Fuel Flow	Core Pre-Burner
182	Fuel Flow	Fan Pre-Burner
183	Open	
184	Fuel Flow	Total Flow
202	Volts	Sense
203	"	"
204	"	"
205	"	"
206	"	"
207	"	"

7.0 LASER DATA RECORDING

7.0 LASER VELOCIMETER DATA RECORDING

The actual process of surveying the plume of a scale model jet exhaust nozzle starts with the definition of the traverse planes of interest and the approximate number of histograms to be taken in each plane. When the test point has been set and the test conditions have stabilized, the location of the first traverse position relative to a fixed position on the nozzle at the test conditions is established. Vertical and horizontal traverses are used to verify the location of the nozzle flow centerline. A typical traverse is shown in the following pages with the histogram locations noted.

At each of the noted histogram locations, a histogram is taken, recorded with an X-Y plotter, and processed through an on-line computer. The mean velocity and turbulence level are calculated and printed out as shown.

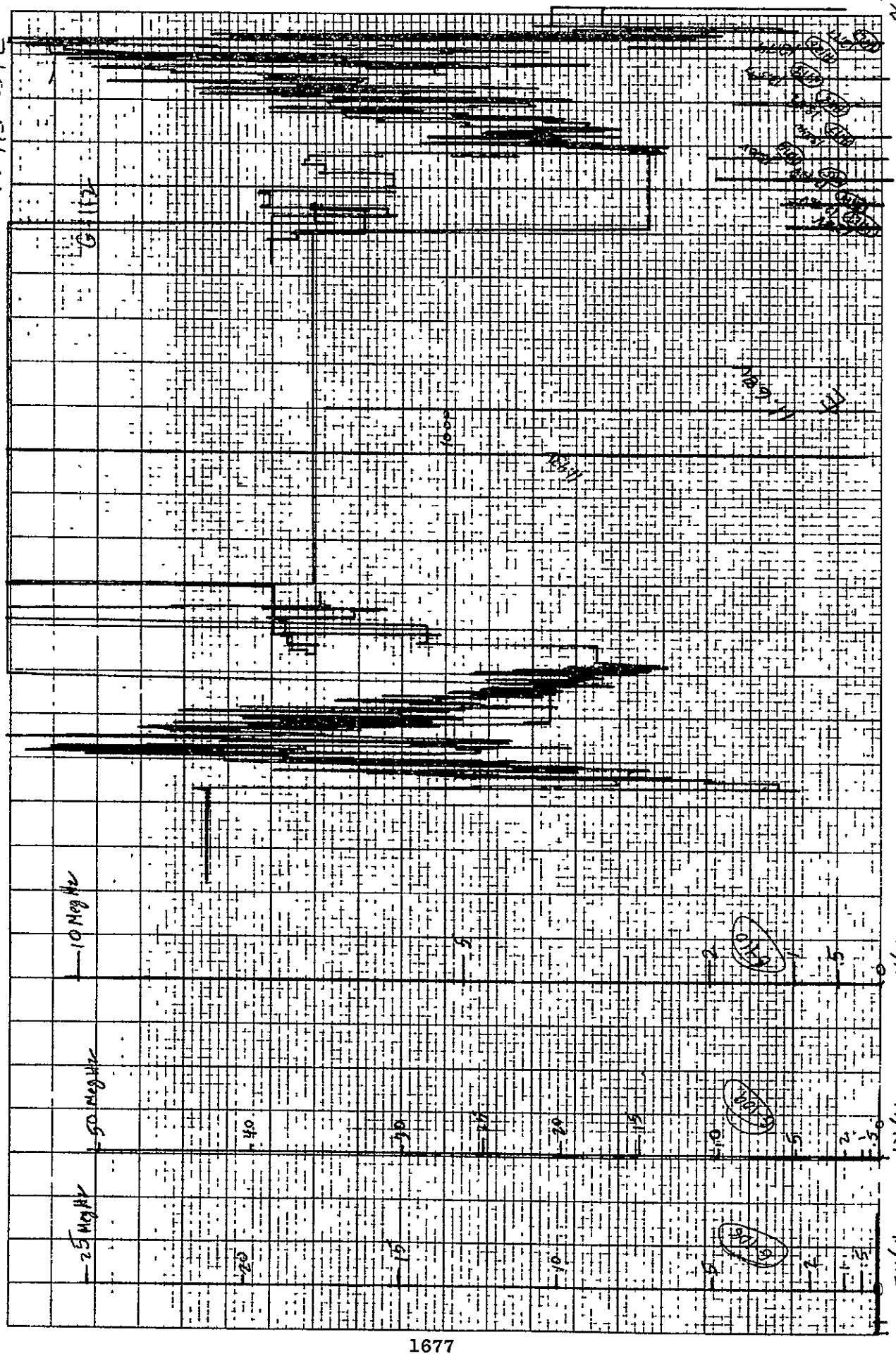
In order to construct the velocity profile from the histograms, the recorded location of each histogram is calculated, and the mean velocity and turbulence level tabulated. These tabulations are plotted as shown in the Final Report.

A sample of the laser velocimeter data records is included.

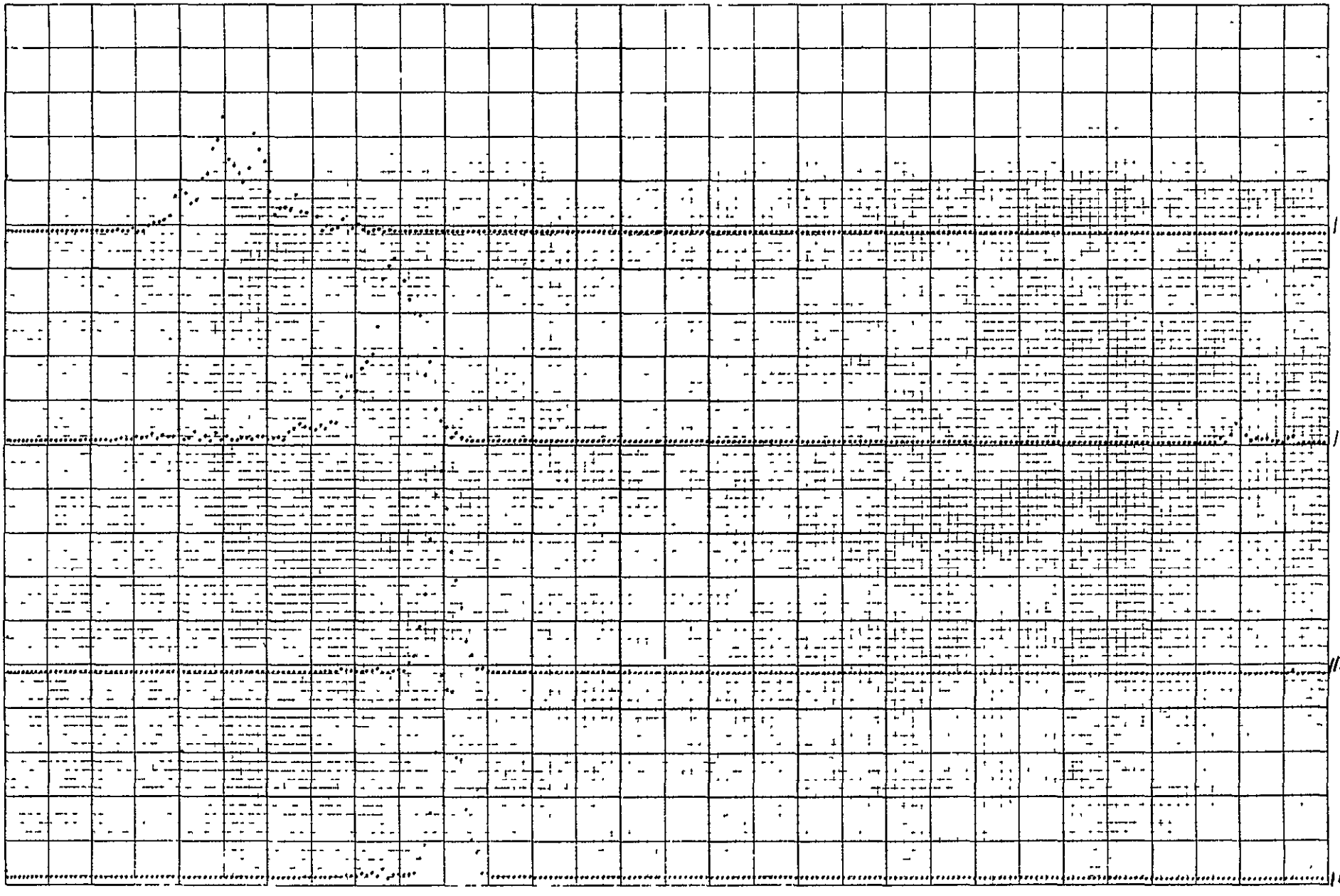
PLANE A
B
C
D
E
BASELINE COANNULAR
NON-COPLANAR MODEL SYSTEM
X/D_EQ 0

1676

2.4



75415-0512



7-4

75415-0512

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75

DBTF MODEL #1 LV ~~11~~ 12 MAY 1975

~~[illegible]~~ X-O. PT 123 ✓

P HISTGM #113

INPUT NUMBER OF DATA POINTS 1000

PLANE A X.
FAN LIP
CORE EXIT

DELTA V 4 51

FINAL POINT NUMBER=500

#113

NUMBER OF DATA POINTS = 1000

PARAMETER	VALUE	95% CONFIDENCE INTERVAL		% ERROR
MEAN	1298 479	(1294 855,	1302 102)	0 2791
TURBULENCE (SD)	57 295	(54 815,	59 947)	4 5228
TURB RATIO	0 044			

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

H NUMBER ? 114

P HISTFM
?FIL NOT FND?

P HISTGM

INPUT NUMBER OF DATA POINTS 600

DELTA V 5C^C
^C

R HISTGM 114.

INPUT NUMBER OF DATA POINTS 600

DELTA V 4 52

FINAL POINT NUMBER=600

7-6

```
NUMBER OF DATA POINTS =   588.

PARAMETER          VALUE              95% CONFIDENCE INTERVAL   % ERROR

MEAN               1301 114        (  1296 259,   1305 970)    0 3732
TURBULENCE (SD)      58 870        (    55 579,     62 462)    5 9208
TURB RATIO            0 045

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3
```

H NUMBER 115

```
R HISTGM

 INPUT NUMBER OF DATA POINTS 600

DELTA V 4 51

FINAL POINT NUMBER=500


NUMBER OF DATA POINTS =   600

PARAMETER          VALUE              95% CONFIDENCE INTERVAL   % ERROR

MEAN               1259 297        (  1254.668,   1263 927)    0 3676
TURBULENCE (SD)      56 702        (    53.563,     60 125)    5 8604
TURB RATIO            0 045

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3



 R HIS

H NUMBER 116

R HISTGM

 INPUT NUMBER OF DATA POINTS 600

DELTA V 4.5
^C
R HI .TGM
^C
^C
^CM


  INPUT NUMBER OF DATA POINTS R
. ^C

. R HISTGM
```

INPUT NUMBER OF DATA POINTS 500

DELTA V 4 45

(3)

FINAL POINT NUMBER=500

#116

NUMBER OF DATA POINTS = 477

PARAMETER	VALUE	95% CONFIDENCE INTERVAL		% ERROR
MEAN	1077 576	(1063 887,	1091 266)	1 2704
TURBULENCE (SD)	149 489	(140 253,	159 668)	6 5650
TURB RATIO	0 139			

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

H NUMBER 117

R HISTGM

INPUT NUMBER OF DATA POINTS 500

DELTA V 4 4

FINAL POINT NUMBER=500

NUMBER OF DATA POINTS = 497

PARAMETER	VALUE	95% CONFIDENCE INTERVAL		% ERROR
MEAN	681 712	(671 482,	691 943)	1 5007
TURBULENCE (SD)	114 014	(107 126,	121 633)	6 4489
TURB RATIO	0 167			

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

H NUMBER 118

R HISTGM

INPUT NUMBER OF DATA POINTS 600

DELTA V 4 5

FINAL POINT NUMBER=500

1-8

NUMBER OF DATA POINTS = 596

PARAMETER	VALUE	95% CONFIDENCE INTERVAL	% ERROR

MEAN	1137.775	(1119 302, 1156.248)	1.6236
TURBULENCE (SD)	225 487	(212.965, 239.148)	5 8803
TURB RATIO	0.198		

118

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

(4)

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OF POOR QUALITY

H NUMBER 119

R HISTGM

INPUT NUMBER OF DATA POINTS 600

DELTA V 4 53

FINAL POINT NUMBER=500

NUMBER OF DATA POINTS = 599

PARAMETER	VALUE	95% CONFIDENCE INTERVAL	% ERROR
MEAN	1370 219	(1347 478, 1392 961)	1 6597
TURBULENCE (SD)	278 295	(262.677, 295 111)	5 8653
TURB RATIO	0 203		

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

H NUMBER 120

R HISTGM

INPUT NUMBER OF DATA POINTS 600

DELTA V 4 53

FINAL POINT NUMBER=500

NUMBER OF DATA POINTS = 599

PARAMETER	VALUE	95% CONFIDENCE INTERVAL	% ERROR
MEAN	1720 443	(1692 176, 1748 711)	1 6431
TURBULENCE (SD)	345.920	(326 755, 366 822)	5 8653
TURB RATIO	0 201		

1=MORE DATA, 2=PRINT HISTOGRAM, 3=END ?3

H NUMBER 121

79

R HISTGM

MODEL #1 TEST 12 MAY 1975

PT 123

PLANE A FAN LIP - CORE EXIT

X = 0 inches V = 1.06

VERTICAL ℄ = 11.68 V

	V	ΔV	R-INCHES	V_{MEAN}	u'	u'/U
H113	12.71	1.03	2.28	1298	57	.044
H114	12.86	1.18	2.61	1301	59	.045
H115	12.99	1.31	2.90	1259	57	045
H116	13.10	1.42	3.14	1078	149	.139
H117	13.24	1.56	3.45	682	114	.167
H118	13.42	1.74	3.85	1138	225	.198
H119	13.57	1.89	4.18	1370	278	.253
H120	13.74	2.06	4.56	1720	346	.201
H121	13.77	2.09	4.62	1572	424	.270

V = 3.84 V

PLANE B PLUG TIP X = 6.15"

Vertical ℄ = 11.68 V

	V	ΔV	R INCHES	V_{MEAN}	u'	u'/U
H128	12.57	.89	1.97	1251	101	.081
H129	12.71	1.03	2.28	1093	122.5	.112
H130	12.86	1.18	2.61	884	88	.100
H131	12.99	1.31	2.90	882	91	.103
H132	13.10	1.42	3.14	990	117	.118
H133	13.24	1.56	3.45	1132	121	.107
H134	13.42	1.74	3.85	1208	136	113
H135	13.57	1.89	4.18	1072	208	.194
H136	13.74	2.06	4.56	803	225	.280
H137	13.89	2.21	4.89	547	194	.355

PT 123 — 12 MAY 1975

PLANE C

V = 8.23 V.
X = 15.86"
VERTICAL ℄ = 11.68 V.

	V.	ΔV	R-INCHES	V MEAN	u'	u'/U
BASE H140	12.17	.49	1.08	1337	67	.050
H141	12.50	.82	1.81	1208	102	.084
H142	12.71	1.03	2.28	1076	93	.086
H143	12.99	1.31	2.90	1033	92	.089
H144	13.24	1.56	3.45	1019	113	.111
H145	13.57	1.89	4.18	866	161	.186
H146	13.89	2.21	4.89	593	167	.282
H147	14.30	2.62	5.80	340	134	.396
H148	14.10	2.42	5.35	440	150	.341

PLANE D

V = 13.56
X = 27.65"
VERTICAL ℄ = 11.68 V.

	V.	ΔV	R-INCHES	V MEAN	u'	u'/U
H150	8.50	-3.18	-7.04	224	107	.478
H151	9.00	-2.68	-5.93	372	123	.330
H152	9.47	-2.21	-4.89	541	155	.287
H153	11.68	0	0	1310	72	.055
H154	11.93	.25	.55	1333	63	.047
H155	12.17	.49	1.08	1302	90	.069
H156	12.71	1.03	2.28	1102	121	.110
H157	12.99	1.31	2.90	992	125	.126
H158	13.24	1.56	3.45	897	140	.156
H159	13.57	1.89	4.18	776	153	.198
H160	13.89	2.21	4.89	612	156	.251

7-11

MODEL #1 TEST 12 MAY 1975

P_T 151

	P_T/P_0	T_T °R	V_j
FAN	1.64	775	
CORE	1.5	1460	1400

PLANE A FAN LIP - CORE EXIT

X = .13 ΔX = .06

Y = 1.06

VERTICAL ℄ = 11.68

	V	ΔV	R-INCHES	$\bar{U}$	u'	u'/$\bar{U}$
~~H162~~	CAL					
H163	12.71	1.03	2.28	1351	41	.030
H=4.85 H164	12.86	1.18	2.61	1328	40	.030
H165	12.99	1.31	2.90	1312	41	.031
H166	13.10	1.42	3.14	1240	69	.056
H167	13.24	1.56	3.45	381	60	.158
H168	13.42	1.74	3.85	588	81	.137
H169	13.57	1.89	4.18	714	89	.125
H170	13.74	2.06	4.56	786	167	.213
H171	13.81	2.13	4.71	635	195	.307
I=4.15* H173	13.57	1.89	4.18 ±	954	138	.144

PLANE B X = 6.28"

ΔX = 2.84

	V	ΔV	R-INCHES	$\bar{U}$	u'	u'/$\bar{U}$
H175	TRAV					
H176	12.15	0.47	1.04	1284	32	.025
H177	12.57	0.89	1.97	1332	64	.048
H178	12.71	1.03	2.28	1210	137	.113
H179	12.85	1.17	2.59	735	152	.207
H180	12.99	1.31	2.90	556	64	.116
H182	13.42	1.74	3.85	627	65	.104
H183	13.57	1.89	4.18	541	95	.176
H184	13.74	2.06	4.56	394	113	.286
H185	13.89	2.21	4.89	257	101	.393
H186	12.78	1.10	2.43	989	187	.189
H181 ~~H186~~	13.24	1.56	3.45	630	59	.093

MODEL #1 TEST 12 MAY 1975

PT 151

PLANE C X = 16.0" ΔX = 7.23

VERT. ℄ = 11.68

	V	ΔV	R-INCHES	U	u'	u'/U
H190	11.68	0	0	1285	77	.060
H191	12.17	0.49	1.08	1382	39	.028
H192	12.50	0.82	1.81	1266	118	.093
H193	12.71	1.03	2.28	963	174	.180
H194	12.99	1.31	2.90	654	73	.111
H195	13.23	1.55	3.43	563	63	.112
H196	13.58	1.90	4.20	462	84	.181
H197	13.89	2.21	4.89	338	88	.260

PLANE D X = 27.7" ΔX = 12.56

	V	ΔV	R-INCHES	U	u'	u'/U
H199	13.89	2.21	4.89	334	94	.280
H200	9.47	2.21	-4.89	315	89	.284
H201	11.68	0	0	1315	61	.047
H202	11.97	0.29	.64	1353	62	.046
H203	12.17	0.49	1.08	1329	86	.065
H204	12.50	0.82	1.81	1131	164	.145
H205	12.71	1.03	2.28	907	172	.190
H206	12.99	1.31	2.90	689	131	.190
H207	13.24	1.56	3.45	550	106	.193
H208	13.57	1.89	4.18	431	99	.229

7-13

MODEL #1 TEST 12 MAY 1975

P_T	125	P_T/P_0	T_T	V_J
	FAN	3 9	1960	2800
	CORE	1.5	1460	1400

PLANE A X = 0.13" ΔX = .06

E = 11.68

	V	ΔV	R-INCHES	$\overline{U}$	u'	u'/$\overline{U}$
TOP H210	12 99	1 31	2.90	1272	47	.037
H211	12.71	1.03	2.28	1318	48	.036
H236	?	?	?	2448	247	.101

PLANE B X = 6.46" ΔX = 2.92

			R-INCHES	$\overline{U}$	u'	u'/$\overline{U}$
H213	10.79	0.89	1.97	1301	26	.028
H214	10.65	1.03	2.28	1296	60	.046
BOTTOM H215	10.50	1.18	2.61	1253	88	.070
H216	10.37	1.31	2 90	1329	132	.099
H217	10.12	1 56	3.45	1698	160	.094
H218	9.94	1.74	3.85	1605	241	.150

7-14

MODEL #1 TEST 12 MAY 1975

PT ~~125~~ 125

PLANE C X = 16.0" ΔX = 7.23

VERT ℄ = 11.68

	V	ΔV	R-INCHES	U	u'	u'/U
H221	11.68	0	0	1296	86	.066
H222	11.19	0.49	1.08	1295	97	.075
H223	10.50	1.18	2.61	1427	117	.082
H224	~~9.47~~	~~2.21~~	~~4.89~~	1294	232	.179
H225	9.78	1.90	4.20	1082	270	.249
H226	9.59	2.09	4.62	819	218	.266
→ H224	9.95	1.73	3.83	1294	232	.179

PLANE D X = 27.7" ΔX = 12.56

	V	ΔV	R-INCHES	U	u'	u'/U
H228	11.68	0	0	1326	82	.062
H229	10.50	1.18	2.61	1381	110	.080
H230	10.12	1.56	3.45	1270	206	.162
H231	9.79	1.89	4.18	954	245	.257
H232	9.59	2.09	4.62	864	235	.272
H233	10.79	0.89	1.97	1346	100	.074
H234	11.19	0.49	1.08	1303	95	.073

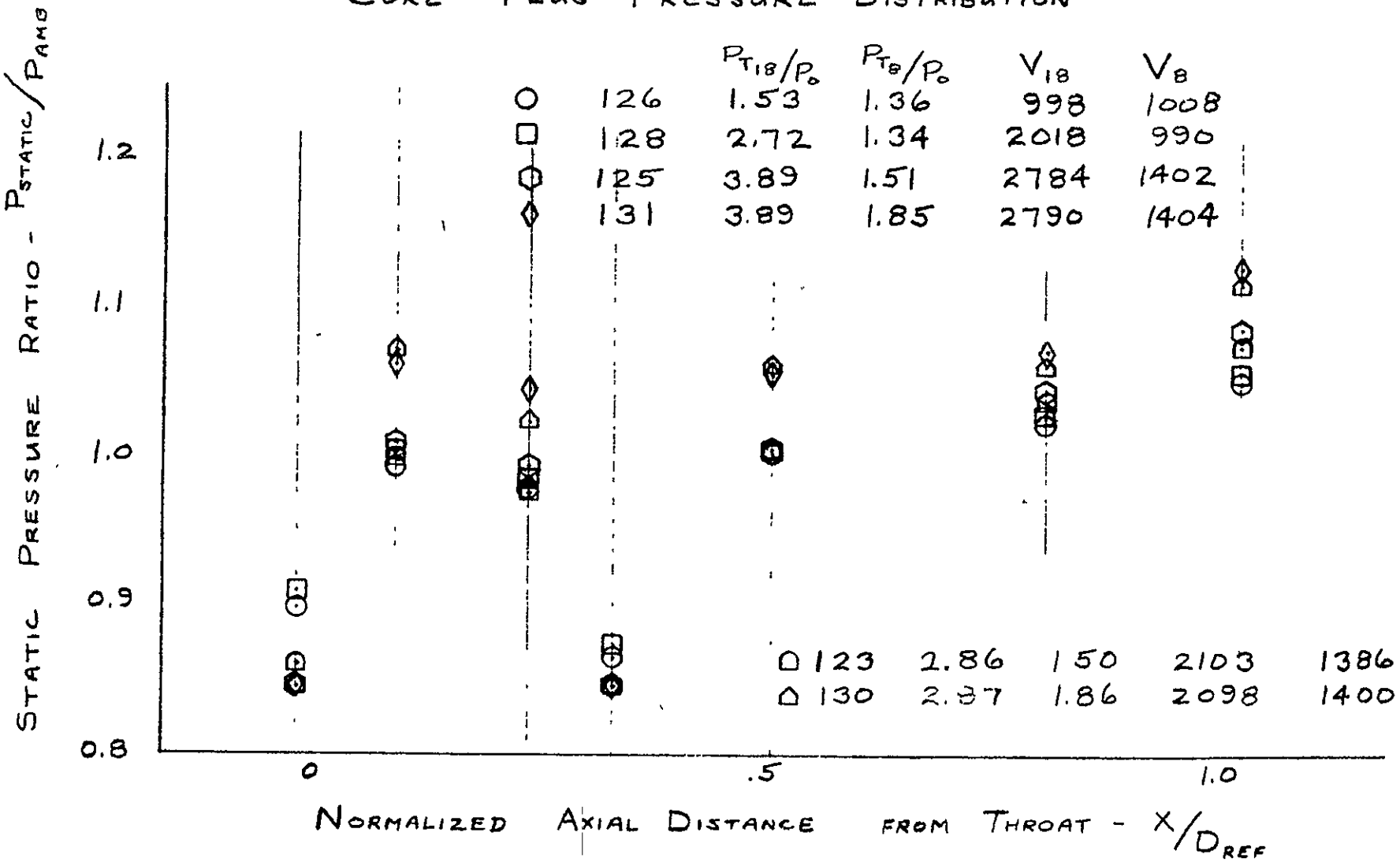
7-15

8.0 STATIC PRESSURES - ACOUSTIC MODELS

8.0 STATIC PRESSURES - ACOUSTIC MODELS

The static pressure data from the acoustic test runs are tabulated for selected conditions.

Core Plug Pressure Distribution



		P_{T18}/P_o	P_{T8}/P_o	V_{18}	V_8	
○	126	1.53	1.36	998	1008	
□	128	2.72	1.34	2018	990	
⬡	125	3.89	1.51	2784	1402	
◇	131	3.89	1.85	2790	1404	
▢	123	2.86	1.50	2103	1386	
△	130	2.87	1.86	2098	1400	

Chute Suppressor without Ejector
Configuration 1

1692

CHUTE SUPPRESSOR WITHOUT EJECTOR
CONFIGURATION 1

1693

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B-3

Model #1

Multi-Chute

Fan Plug

FEC	N-Axial & CW.			GE Line
✓ 51	2.38	355°	Flow	155
50	2 900	345°		
✓ 49	1.625	335°		149
✓ 48	1.272	355°		143
✓ 47	1.005	345°		137
✓ 46	.832	335°		131
			Corner	
145	680	355°		
✓ 44	.315	345°		125
✓ 43	−.145	335°		119
42	−.220	355°		
✓ 41	1.005	90°	Chute	113
40	.832	80°		
✓ 39	.680	70°		172
✓ 38	.315	90°		166
✓ 37	−.145	80°		160
✓ 36	−.220	70°		154

Chute Base

T-Radius

52	3.83	0°	161
53	3 98	10°	
54	4 13	20°	167
55	4.28	30°	
56	4.43	40°	173
57	4.58	50°	
58	4 72	60°	

P_T

Model #1

Multi-Chute Fan Suppressor

Core Plug Statics

Line		X
112	51	-0.1
118	53	.57
124	55	1.44
130	57	1.98
136	60	3.03
142	62	4.84
148	64	6.15

Fan Plug Statics

Line	
154	36
160	37
166	38
172	39
113	41
119	43
125	44
131	46
137	47
143	48
149	49
155	51

Chute Base

161	52
167	54
173	56

Model #1 P_T 113

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	12.172 Cavity	.845
118	14.430	1.002
124	14.186	.985
130	12.172 Cavity	.845
136	14.509	1.007
142	14.931	1.037
148	15.524	1.078

Fan Plug Statics

Line			
154	14.329	.995	36
160	14.321	.994	37
166	14.246	.989	38
172	13.413	.931	39
113	13.570	.942	41
119	15.247	1.058	43
125	13.784	.957	44
131	12.995	.902	46
137	13.464	.935	47
143	13.852	.962	48
149	13.948	.968	49
155	14.446	1.003	51

Chute Base

161	14.079	.978
167	14.125	.981

$P_{T\,amb}$ = 14.403

	P_T/P_0	T_T	V_J
P_T 113			
Core	1.56	1002	1197
Fan	2.45	1188	1801

P_T 115

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Model #1

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	12.172 Cavity	.845
118	14.373	.998
124	14.204	.986
130	12.172 Cavity	.845
136	14.519	1.008
142	15.013	1.042
148	15.632	1.085

Fan Plug Statics

Line		
154	14.035	.996
160	14.207	.986
166	14.152	.982
172	12.760	.886
113	13.088	.908
119	16.090	1.117
125	14.474	1.005
131	12.379	.859
137	13.005	.903
143	13.562	.941
149	13.746	.954
155	14.461	1.004

Chute Base

161	13.999	.972
167	14.034	.974

P_{AMB} = 14.406

	P_T/P_0	T_T	V_J
P_T 115			
Core	1.57	1004	1209
Fan	3.27	1642	2396

8-7

Model #1 P_T 123

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	12.404	.860
118	14.411	.9996
124	14.108	.976
130	12.180	.845
136	14.478	1.004
142	14.929	1.036
148	15.466	1.073

Fan Plug Statics

Line		
154	14.135	.980
160	14.439	1.002
166	14.300	.992
172	13.342	.925
113	13.440	.932
119	17.318	1.201
125	15.307	1.062
131	12.884	.894
137	13.446	.933
143	13.576	.942
149	13.669	.948
155	14.271	.990

Chute Base

161	14.298	.992
167	14.289	.991

P_{AMB} = 14.416

P_T 123	P_T/P_0	T_T	V_J
Core	1.50	1457	1386
Fan	2.86	1405	2103

Model #1 P_T 125

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
51 112	12.181 cavity	.845
53 118	14.549	1.009
55 124	14.305	.992
57 130	12.181 cavity	.845
60 136	14.483	1.005
62 142	15.031	1.043
64 148	15.633	1.084

Fan Plug Statics

Line		
154	14.141	.981
160	13.321	.924
166	15.338	1.064
172	12.181 cavity	.845
113	12.992	.901
119	19.565	1.357
125	15.655	1.086
131	11.995	.832
137	12.825	.890
143	13.232	.918
149	13.232	.918
155	14.468	1.004

Chute Base

161	14.308	.9925
167	14.271	.990

P_{AMB} = 14.416

P_T 125	P_T/P_0	T_T	V_J
Core	1.51	1471	1402
Fan	3.89	1968	2784

Model #1

P_T 126

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	12.943	.898
118	14.320	.993
124	14.107	.978
130	12.456	.864
136	14.433	1.001
142	14.725	1.021
148	15.113	1.048

Fan Plug Statics

Line		
154	14.320	.993
160	14.379	.997
166	14.276	.990
172	14.007	.971
113	14.062	.975
119	14.887	1.032
125	14.088	.977
131	13.903	.964
137	14.039	.974
143	14.162	.982
149	14.214	.986
155	14.422	1.0001

Chute Base

161	14.341	.9945
167	14.374	.997

P_{AMB} = 14.420

	P_T/P_0	T_T	V_J
P_T 126 Core	1.36	1004	1008
P_T 126 Fan	1.53	724	998

P_T 128

Model #1

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	13.097	.909
118	14.467	1.004
124	14.175	.984
130	12.565	.872
136	14.445	1.003
142	14.810	1.028
148	15.196	1.055

Fan Plug Statics

Line		
~~154~~	~~14.274~~	
154	14.274	.991
160	14.130	.981
166	14.317	.994
172	13.281	.922
113	13.477	.936
119	15.107	1.049
125	13.510	.938
131	12.744	.885
137	13.220	.918
143	13.766	.956
149	13.888	.964
155	14.473	1.005

Chute Base

161	14.115	.980
167	14.296	.992

P_{AMB} = 14.406

	P_T 128	P_T/P_o	T_T	V_J
Core		1.34	1004	990
Fan	2.725		1351	2018

41

Model #1

P_T 130

Multi-Chute Fan Suppressor

Core Plug Statics

Line		
112	12.173	.845
118	15.422	1.070
124	14.731	1.022
130	12.173	.845
136	15.269	1.060
142	15.236	1.058
148	16.043	1.114

Fan Plug Statics

Line		
154	14.113	980
160	14.264	990
166	14.311	.993
172	13.121	.911
113	13.334	.926
119	15.914	1.105
125	14.186	.985
131	12.791	.888
137	13.301	.923
143	13.595	.944
149	13.780	.956
155	14.311	.993

Chute Base

161	14.076	.977
167	14.197	.985

P_{AMB} = 14.407

P_T 130	P_T/P_o	T_T	V_J
Core	1.86	1002	1400
Fan	2.87	1398	2098

MODEL #1 P_T 131

MULTI-CHUTE FAN SUPPRESSOR

CORE PLUG STATICS

LINE		
112	12.180	.845
118	15.307	1.062
124	15.044	1.044
130	12.179	.845
136	15.201	1.054
142	15.407	1.069
148	16.214	1.125

FAN PLUG STATICS

LINE		
154	13.216	.917
160	13.026	.904
166	15.499	1.075
172	12.180	.845
113	12.948	.898
119	17.571	1.219
125	15.118	1.048
131	11.997	.832
137	12.843	.891
143	13.243	.918
149	13.218	.917
155	14.443	1.002

CHUTE BASE

161	14.321	.993
167	14.273	.990

P_{AMB} = 14.418

P_T 131	P_T/P_0	T_T	V_J
CORE	1.85	1015	1404
FAN	3.89	1977	2790

4.1B

Model #2

Multi-Tube

Fan Plug Statics

FEC	M.-Axial	∠CW	Behind Inner Row Tube	Behind Middle Tube
49	2.38	0	✓	
48	2.038	15.62°	✓	
47	1.655	31.30°	✓	
46	1.292	0	✓	
45	1.000	15.62°	✓	
44	.835	31.30°	✓	
43	.560	0	✓	
42	.080	15.62°	✓	
41	−.300	31.30°	✓	
40	1.292	54.78°		✓
39	1.000	39.16°		✓
38	.835	23.53°		✓
37	.560	54.78°		✓
36	.080	39.16°		✓

$\Delta\theta = 15.652°$ 23 Tube Row

Model #2

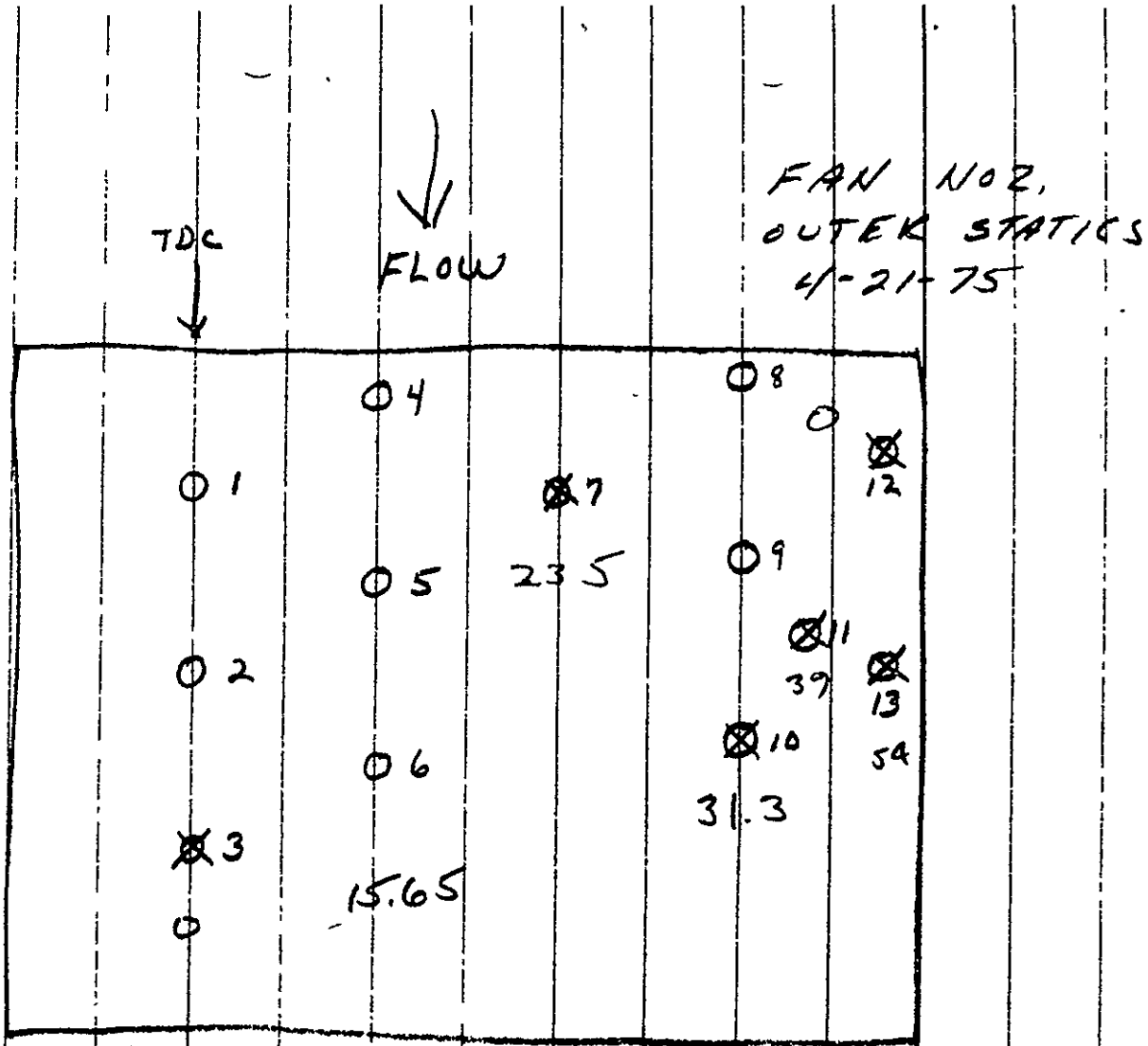
Multi Tube

Fin Plug Statics

GE	FEC		M Axial	θ Circ	Behind Inner Rear Tube	Behind Middle Tube
3 -NG	49		2.38	0	✓	
6	48	161	2.038	15.652°	✓	
10 -NG	47		1.655	31.30°	✓	
2	46	143	1.292	0	✓	
5	45	155	1.000	15.652°	✓	
9	44	173	.835	31.30°	✓	
1	43	137	.560	0	✓	
4	42	149	.080	15.652°	✓	
8	41	167	.300	31.30°	✓	
13	40		1.292	54.78°		✓
11	39		1.000	39.16°		✓
7 -NG	38		.835	23.53°		✓
12	37		.560	54.78°		✓
	36		.080	39.16°		✓

$\Delta\theta$ = 15.652° 23 Tube Row

8-15



Ps #	SCANIVEK	COMP. Ps
1	F-6	137
2	F-7	143
4	F-8	149
5	F-9	155
6	F-10	161
8	F-11	167
9	F-12	173

MODEL #2

1,*4

P_T 210

MODEL *2

CORE PLUG STATICS			FAN PLUG STATICS		
	psia			psia	
112	12.312	.847	137	13.770	.947
118	13.697	.942	143	13.618	.936
124	14.517	.998			
130	14.700	1.011	149	13.810	.950
136	14.725	1.0125	155	13.485	.927
142	13.664	.9395	161	13.960	.960
148	12.313	.847			
154	12.853	.884	167	13.650	.938
160	14.505	.997	173	13.563	.933
166	14.915	1.026			
172	15.125	1.040			
113	15.189	1.044			
119	15.086	1.037			
125	15.865	1.091			
131	16.047	1.103			

P_{amb} = 14.543 psia

	P_T/P_0	T_r	V_J
FAN	3.01	.1495	2214
CORE	1.63	776	1097

q-17

+2, #6
-1, #4

P_T 215

Model #2

Core Plug Statics			Fan Plug Statics		
	psia			psia	
112	12.310	.8465	137	13.660	.939
118	13.856	.953	143	13.522	.930
124	14.414	.991			
130	14.639	1.007	149	13.738	.945
136	14.604	1.004	155	13.410	.922
142	13.610	.936	161	13.889	.955
148	12.311	.8465			
154	13.455	.925	167	13.636	.938
160	14.481	.996	173	13.368	.919
166	14.861	1.022			
172	15.090	1.038			
113	15.186	1.044			
119	15.106	1.039			
125	15.786	1.086			
131	15.963	1.098			

P_{amb} = 14.542 psia

	P_T/P_o	T_T	V_J
Fan	3.28	1632	2390
Core	1.57	1010	1211

*1, *4

PT 220

MODEL *2

	CORE PLUG STATICS psia			FAN PLUG STATICS psia	
112	12.302	.847	137	13.694	.943
118	13.960	.961	143	13.580	.935
124	14.422	.993			
130	14.618	1.006	149	13.719	.944
136	14.573	1.003	155	13.445	.925
142	13.593	.936	161	13.832	.952
148	12.302	.847			
154	13.599	.936	167	13.166	.906
160	14.477	.996	173	13.167	.906
166	14.832	1.021			
172	15.062	1.037			
113	15.174	1.044			
119	15.117	1.040			
125	15.772	1.086			
131	15.922	1.096			

P_{amb} = 14.528 psia

	P_T/P_o	T_T	V_J
FAN	3.56	1782	2571
CORE	1.54	1233	1315

4-19

2, #6
1, #4

PT 223

MODEL # 2

CORE PLUG STATICS psia			FAN PLUG STATICS psia		
112	~~14.479~~ ?	~~.998~~	137	13.897	.958
118	14.034	.968	143	13.764	.949
124	14.536	1.002			
130	14.592	1.006	149	13.804	.952
136	14.476	.998	155	13.686	.944
142	13.268	.915	161	14.000	.965
148	12.616	.870			
154	13.543	.934	167	13.359	.921
160	14.430	.995	173	13.511	.932
166	14.709	1.014			
172	14.935	1.030			
113	15.020	1.036			
119	14.969	1.032			
125	~~14.530~~	~~1.002~~			
131	15.709	1.083			

P_{amb} = 14.504 psia

	P_T/P_o	T_T	V_J
FAN	2.87	~~1442~~ 1442	2132
CORE	1.50	1465	1395

+1,°4

PT 205

MODEL #2

ORIGINAL PAGE IS
OF POOR QUALITY

X			CORE PLUG STATICS psia		FAN PLUG STATICS psia	
-0.1	112	21	12.343	.846	137	13.984	.960
18	118	22	12.342	.846	143	13.845	.950
57	124	23	15.160	~~1.041~~ 1.040			
1.03	130	24	15.020	~~1.043~~ 1.03	149	14.063	.965
1.44	136	25	15.173	1.041	155	13.685	.939
1.80	142	26	14.147	.971	161	14.067	.965
1.98	148	27	12.342	.846			
2.16	154	28	12.342	.846	167	13.875	.952
2.49	160	29	14.397	.988	173	13.583	.932
3.03	166	30	15.331	1.052			
3.84	172	31	15.284	1.049			
4.84	113	32	15.293	1.050			
5.53	119	33	15.112	1.038			
6.15	125	34	14.048	1.101			
6.59	131	35	16.286	1.118			

Pamb = 14.573 psia

	P_T/P_0	T_T	V_J
FAN - 28	2.72	1342	2010
CORE - 8	1.80	552	1010

4.2

2; °6
1; °4

P_T 225

MODEL * 2

	CORE PLUG STATICS psia			FAN PLUG STATICS psia	
112	12.284	.847	137	13.455	.927
118	13.757	.948	143	13.430	.926
124	14.347	.989			
130	14.578	1.005	149	13.579	.936
136	14.536	1.002	155	13.437	.926
142	13.675	.942	161	13.793	.951
148	10.284	.847			
154	13.749	.948	167	12.929	.891
160	14.476	.998	173	13.139	.906
166	14.803	1.020			
172	15.038	1.036			
113	15.161	1.045			
119	15.140	1.043			
125	15.696	1.082			
131	15.808	1.090			

P_{amb} = 14.509 psia

	P_T/P_o	T_T	V_J
FAN	3.90	1986	2799
CORE	1.50	1452	1380

1, 4

PT 237

MODEL #2

CORE PLUG STATICS	psia		FAN PLUG STATICS	psia	
112	14.448	1.000	137	13.992	.967
118	12.216	.846	143	13.848	.957
124	14.355	.994			
130	14.491	1.003	149	13 805	.956
136	14.542	1.007	155	13.804	.956
142	13.306	.921	161	13.995	.969
148	12.444	.861			
154	12.781	.885	167	13.605	.942
160	14.398	.997	173	13.521	.936
166	14.820	1.026			
172	15.027	1.040			
113	15.087	1.044			
119	14.977	1.037			
125	14.535	1.006			
131	15.865	1.098			

Pamb = 14.445 psia

	P_T/P_o	T_T	V_J
FAN	2.60	1706	2226
CORE	1.63	778	1102

9.2

2, #6
1, #4

P_T 254

Model # 2

Core Plug Statics psia			Fan Plug Statics psia		
112	14.497	.9995	137	14.254	.983
118	12.282	.847	143	14.247	.982
124	14.917	1.028			
130	14.649	1.010	149	14.267	.984
136	14 642	1.0095	155	14.199	.979
142	13 457	.928	161		
148	12.282	.847			
154	12.282	.847	167	14.378	.991
160	14.198	.979	173	14.185	.978
166	14.885	1.026			
172	14.923	1.032			
113	14.977	1.033			
119	14.803	1.021			
125	14 548	1.003			
131	15.977	1.101			

P_{amb} = 14.504 psia

	P_T/P_o	T_T	V_J
Fan	1.50	727.	974
Core	1.74	1460.	1608

L+1, 4

PT 257

MODEL # 2

CORE PLUG STATICS

	psia	
112	14.514	1.0006
118	12.841	.885
124	14.062	.969
130	15.164	1.045
136	15.086	1.040
142	14.355	.990
148	12.284	.847
154	12.283	.847
160	12.282	.847
166	15.074	1.039
172	15.777	1.088
113	15.266	1.052
119	15.040	1.037
125	14.569	1.004
131	16.320	1.125

FAN PLUG STATICS

	psia	
137	14.233	.981
143	14.210	.980
149	14.236	.981
155	14.141	.975
161	14.313	.987
167	14.322	.987
173	14.105	.972

Pamb = 14.506 psia

	P_T/P_o	T_T	V_J
FAN	1.59	787.	1086
CORE	2.05	1459	1807

4.20

2, #6
1, #4

PT 260

MODEL #2

	CORE PLUG STATICS psia			FAN PLUG STATICS psia	
112	14.481	.998	137	14.188	.978
118	15.324	1.056	143	14.158	.976
124	15.140	1.044			
130	12.491	.861	149	14.146	.975
136	15.497	1.068	155	14.062	.969
142	14.889	1.026	161	14.249	.982
148	12.285	.847			
154	12.283	.847	167	14.112	.973
160	12.283	.847	173	14.096	.966
166	12.395	.854			
172	16.831	1.160			
113	15.699	1.082			
119	15.994	1.102			
125	14.567	1.004			
131	16.410	1.131			

P_{amb} = 14.506 psia

	P_T/P_o	T_T	V_J
FAN	1.725	833	1202
CORE	2.46	1455	2002

PLUG STATICS

P_T 270

14.446 psia = P_{amb} Bar

CORE PLUG

	14.448
THROAT	14.083
	14.101
	14.149
	14.134
	14.153
	14.138
	14.125
	14.279
	14.068
	14.068
	14.299
	14.563
	14.457
TIP	15.107

$P_{T,18}/P_0 = 3.85$

$T_{T_{18}} = 1967$

P_T 270

$V_{18} = 2775$

$P_{T_8}/P_0 = .983$

$V_8 = 0$

FAN PLUG

P_T	271	270	272
1	13.816	13.653	13.915
2	13.728	13.568	13.845
4	13.838	13.441	13.971
5	13.746	13.581	13.817
6	13.986	13.844	14.048
8	13.522	12.825	13.831
9	13.542	13.316	13.675

PLUG STATICS

PT 271

14.445 psia = P_{amb} BAR

$P_{T,18}/P_0 = 2.83$

$T_{T,18} = 1394$

$V_{18} = 2083$

$P_{T_\theta}/P_0 = .99$

$V_\theta = 0$

CORE PLUG

	14.454
THROAT	14.232
	14.244
	14.272
	14.265
	14.272
	14.298
	14.265
	14.338
	14 226
	14.255
	14.487
	14.709
	14.463
TIP	15.010

FAN PLUG

1	13.86
2	13.728
4	13.838
5	13 746
6	13 986
8	13.522
9	13.542

PLUG STATICS
PT 272

14.492 psia = Pamb BAR

	14.373
	14.395
	14.417
	14.450
	14.440
	14.442
	14.450
	14.454
	14.454
	14.450
	14.431
	14.436
	14.498
	14.617
Tip	14.716

PT 272

$P_{T18}/P_0 = 2.44$

$T_{T18} = 1214\ ^\circ R$

$V_{18} = 1817$

$P_{T8}/P_0 = 1.003$

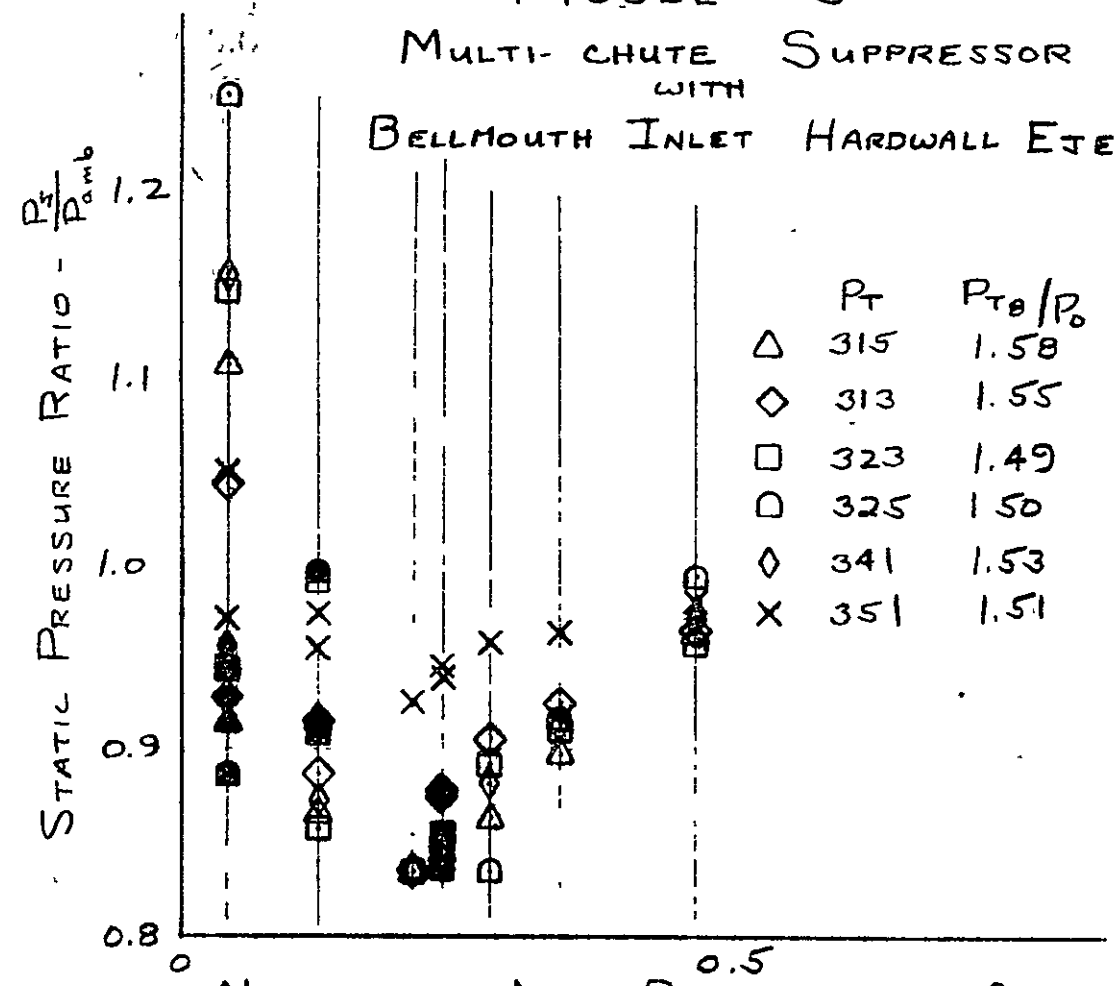
V_8 83.8

FAN PLUG

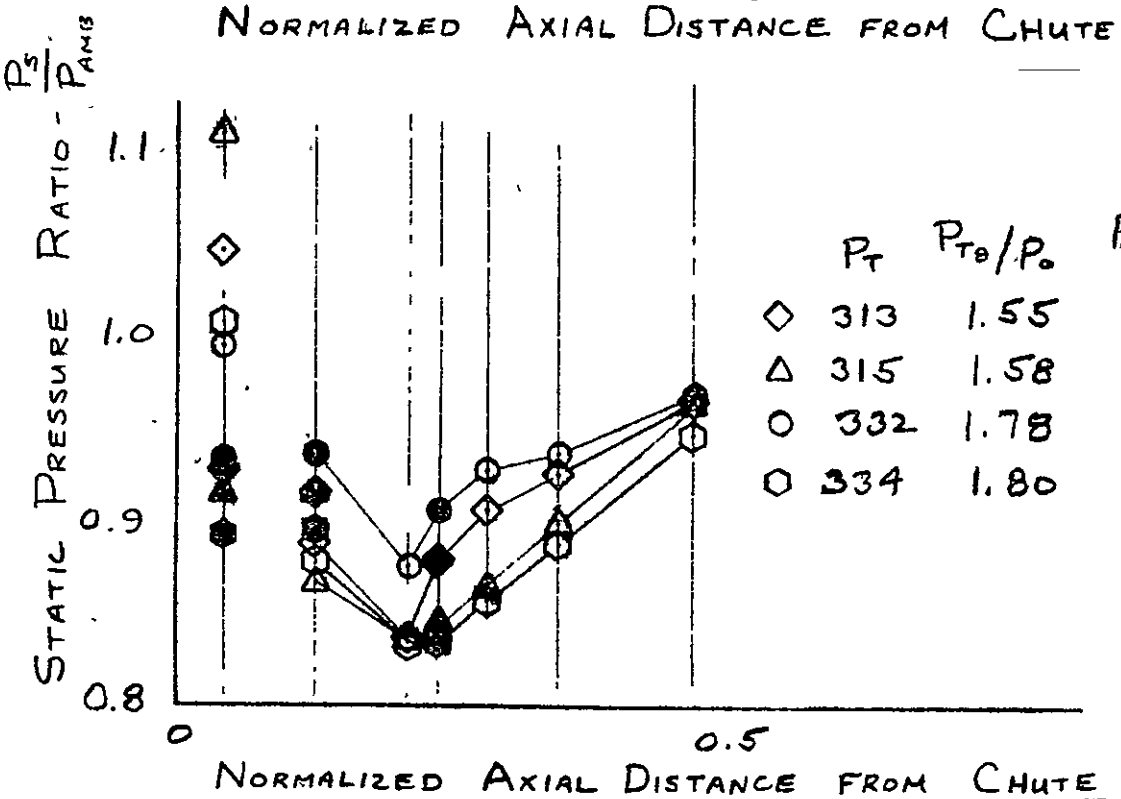
137	1	13.880
143	2	13.955
149	4	13 967
155	5	14.414
161	6	14.079
	8	13 803
	9	13.769

Model #3

Multi-chute Suppressor with Bellmouth Inlet Hardwall Ejector



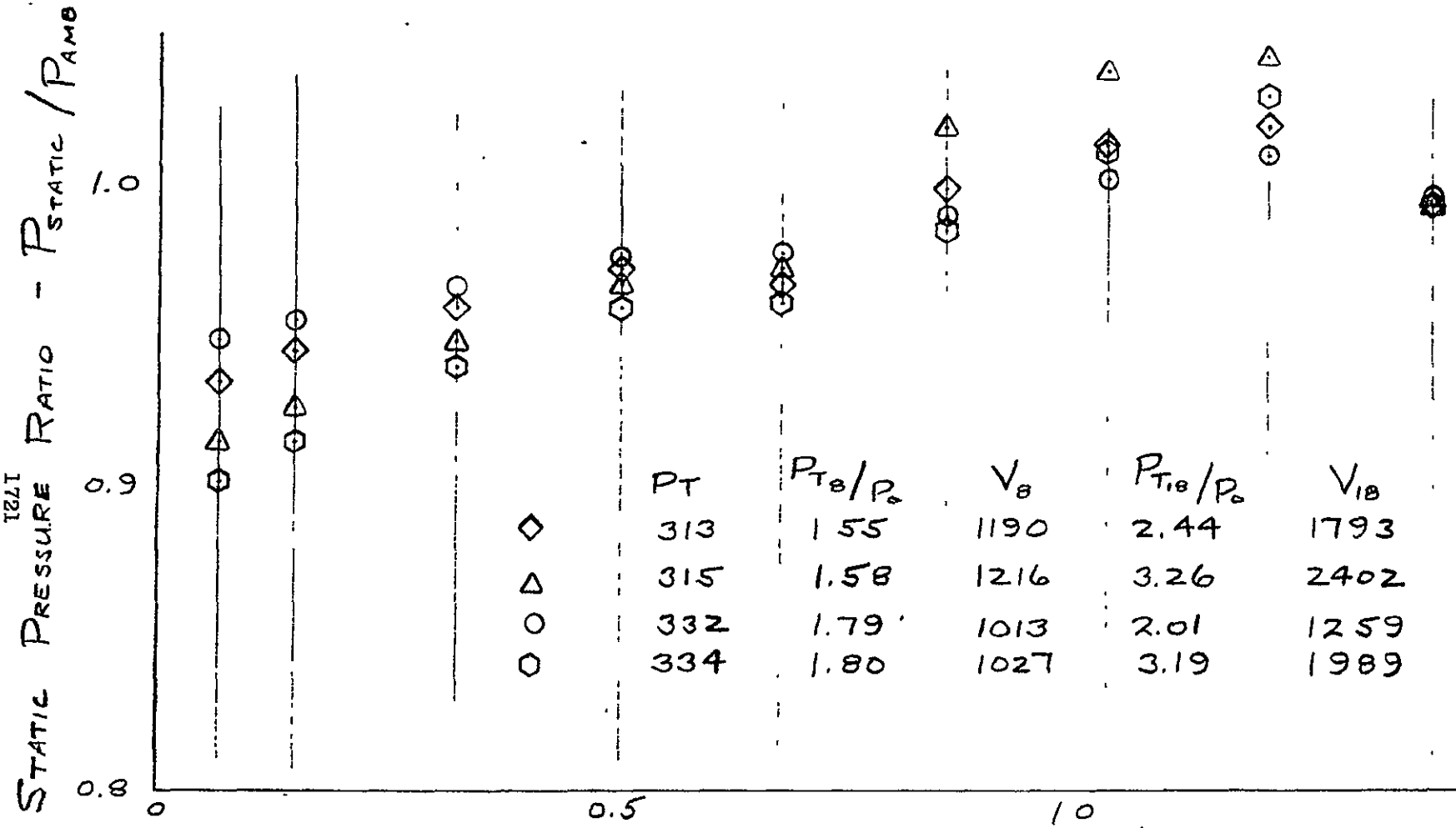
	P_T	P_{T8}/P_0	P_{T18}/P_0
△	315	1.58	3.26
◇	313	1.55	2.44
□	323	1.49	2.86
▢	325	1.50	3.87
◇	341	1.53	3.19
×	351	1.51	1.64



	P_T	P_{T8}/P_0	P_{T18}/P_0
◇	313	1.55	2.44
△	315	1.58	3.26
○	332	1.78	2.01
⬡	334	1.80	3.19

Fan Plug Pressure Distributions 8-30 PHH 26 Sept 75

MULTI-CHUTE SUPPRESSOR WITH BELLMOUTH
INLET HARDWALL EJECTOR

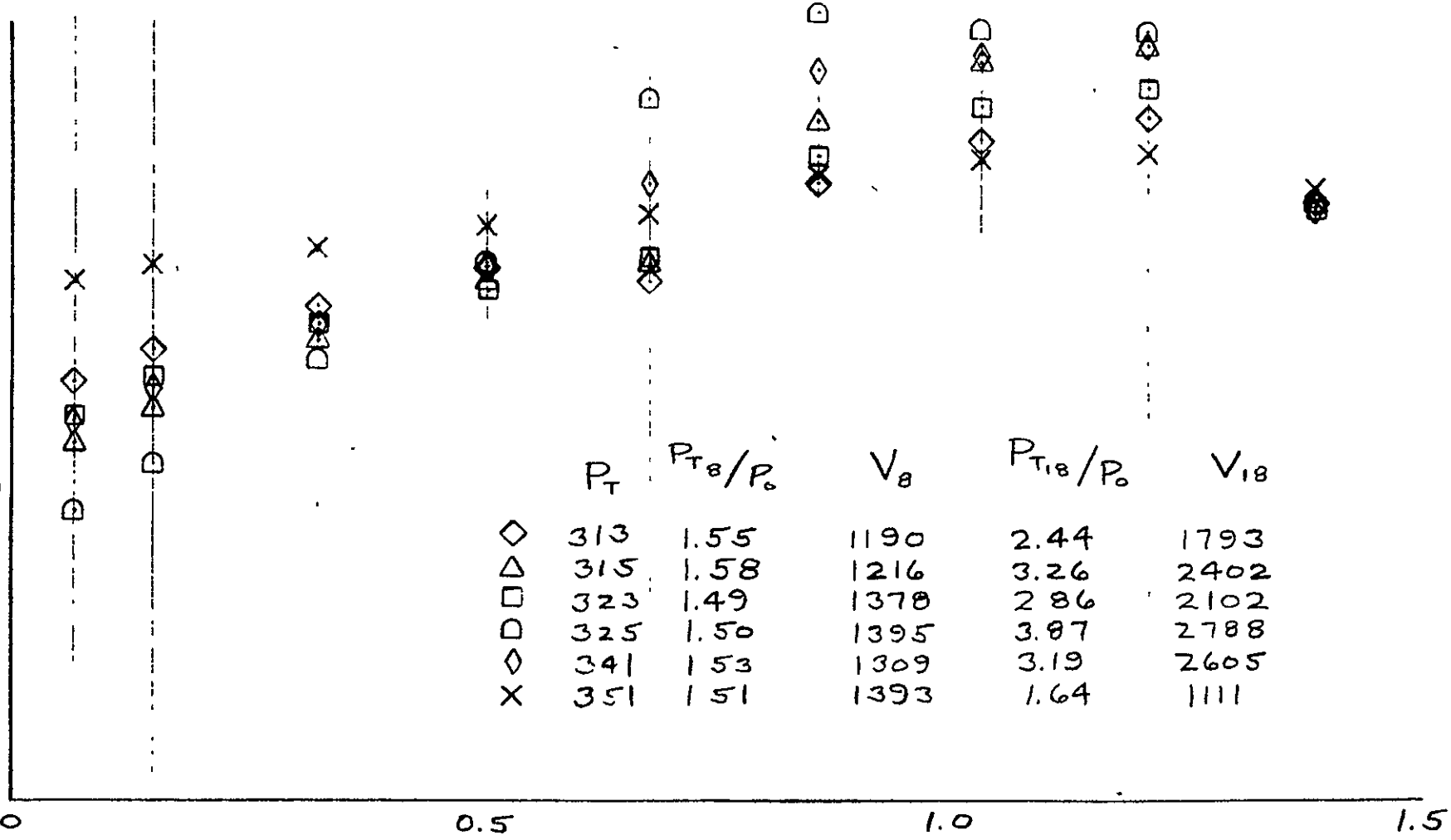


	PT	P_{T_8}/P_o	V_8	$P_{T_{18}}/P_o$	V_{18}
◇	313	1.55	1190	2.44	1793
△	315	1.58	1216	3.26	2402
○	332	1.79	1013	2.01	1259
⬡	334	1.80	1027	3.19	1989

EJECTOR SHROUD PRESSURE DISTRIBUTIONS

MODEL * 3

MULTI CHUTE SUPPRESSOR WITH BELLMOUTH INLET
HARDWALL EJECTOR



	P_T	P_{T_8}/P_o	V_8	$P_{T_{18}}/P_o$	V_{18}
◇	313	1.55	1190	2.44	1793
△	315	1.58	1216	3.26	2402
□	323	1.49	1378	2 86	2102
▭	325	1.50	1395	3.87	2788
◇	341	1 53	1309	3.19	2605
×	351	1 51	1393	1.64	1111

EJECTOR SHROUD PRESSURE DISTRIBUTIONS
MODEL # 3

29 Sept 1975

P_T

MODEL #3

HARDWALL EJECTOR - CHUTES

EJECTOR STATICS

FEC	LINE GE	P_s psia X	P_s/P_o
63	112	.40	
64	118	.90	
65	124	1.96	
66	130	3.02	
67	136	4.08	
68	142	5.14	
69	148	6.20	
70	154	7.26	
71	172	8.32	

FAN PLUG STATICS

LINE GE	FEC	P_s psia X	P_s/P_o X I.D.
160	37	.265	.014
166	38	.725	.111
113	41	1.415	.236
119	43	.265	.044
125	44	.125	.121
131	46	1.242	.207
137	47	1.415	.236
143	48	1.682	.283
149	49	2.035	.339
155	51	2.79	.465

$P_{amb.}$

P_o = psia

CHUTE BASE

	P_s psia	P_s/P_o
161	52	
167	54	
173	56	

	P_T/P_o	T_T	V_J
FAN			
CORE			

4.33

MODEL #1

MULTI-CHUTE

FAN PLUG

FEC	Chute Exit	N-AXIAL	4 CL		GE LINE
51	2.79	2.38	355°	Flow	155
50	2.41	2.000	345°		
49	2.035	1.625	335°		149
48	1.682	1.272	355°		143
47	1.415	1.005	345°		137
46	1.242	.832	335°	Corner	131
45	1.09	.680	355		
44	.725	.315	345°		125
43	.265	-.145	335°		119
42	.19	-.220	355°		
41	1.415	1.005	90°	Chute	113
40	1.242	.832	80°		
39	1090	.680	70°		172
38	.725	.315	90°		166
37	.265	-.145	80°		160
36	.190	-.220	70°		154

Δ = 0.41"

Chute Exit

Chute Base

	T-RADIUS		
52	3.83	0°	161
53	3.98	10°	
54	4.13	20°	167
55	4.28	30°	
56	4.43	40°	173
57	4.58	50°	
58	4.72	60°	

1724

8.34

P_T 313

Model #3

Hardwall Ejector - Chutes

Bellmouth

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.511	.935
118	13.648	.945
124	13.848	.959
130	14.042	.972
136	13.973	.967
142	14.412	.998
148	14.621	1.012
154	14.710	1.018
172	14.327	.992

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	13.400	.928
166	13 227	.916
113	12.696	.879
119	15 066	1.043
125	12.831	.888
131	12.071	.836
137	12 690	.878
143	13.094	.906
149	13.347	.924
155	13.928	.964

$P_{amb.}$

$P_o = 14.445$ psia

Chute Base

	P_s psia	P_s/P_o
161	13.379	.926
167	13.434	.930
173	13 245	.917

	P_T/P_o	T_T	V_J
Fan	2.44	1182	1793
Core	1.55	995	1190

9.75

P_T 315

Model #3

Hardwall Ejector - Chutes

Bellmouth

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.206	.915
118	13.368	.926
124	13.685	.948
130	13.962	.967
136	14.036	.972
142	14.703	1.018
148	14.954	1.036
154	15.028	1.041
172	14.305	.991

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	13.194	.914
166	13.205	.915
113	12.166	.843
119	16.005	1.109
125	12.508	.866
131	12.019	.833
137	12.127	.840
143	12.452	.863
149	12.970	.898
155	13.874	.961

$P_{amb.}$

$P_o = 14.435$ psia

Chute Base

	P_s psia	P_s/P_o
161	12.878	.892
167	13.370	.926
173	13.163	.912

	P_T/P_o	T_T	V_J
Fan	3.265	1652	2402
Core	1.58	1008	1216

P_T 323

MODEL #3

HARDWALL EJECTOR - CHUTES

EJECTOR STATICS

LINE	P_s psia	P_s/P_o
112	13.334	.924
118	13.496	.936
124	13.751	.953
130	13.976	.969
136	14.056	.974
142	14.519	1.0065
148	14.746	1.022
154	14.834	1.028
172	14.285	.990

Fan Plug Statics

LINE	P_s psia	P_s/P_o
160	13.585	.942
166	13.134	.910
113	12.314	.854
119	16.558	1.148
125	12.376	.858
131	12.013	.833
137	12.262	.850
143	12.865	.892
149	13.129	.910
155	13.823	.958

$P_{amb.}$

$P_o = 14.425$ psia

CHUTE BASE

	P_s psia	P_s/P_o
161	13.315	.923
167	13.377	.927
173	13.153	.912

	P_T/P_o	T_T	V_J
FAN	2.86	1405	2102
CORE	1.49	1450	1378

4.251

P_T 325

Model #3

Hardwall Ejector - Chutes

Bellmouth

Ejector Statics

Line	P_s psia	P_s/P_o
112	12.887	.894
118	13.099	.909
124	13.580	.942
130	14.031	.973
136	14.781	1.025
142	15.161	1.052
148	15.100	1.047
154	15.076	1.046
172	14.301	.992

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	12.777	.886
166	14.374	.997
113	12.005	.833
119	18.032	1.251
125	14.273	.990
131	12.005	.833
137	12.004	.833
143	12.004	.833
149	13.193	.915
155	14.302	.992

$P_{amb.}$

$P_o = 14.416$ psia

Chute Base

	P_s psia	P_s/P_o
161	12 643	.877
167	13.439	.932
173	13 360	.927

	P_T/P_o	T_T	V_J
Fan	3.87	1978	2788
Core	1.50	1470	1395

4/25

P_T 341

Model #3
Hardwall Ejector - Chutes

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.300	.922
118	13.455	.933
124	13.744	.953
130	14.020	.972
136	14.393	.998
142	14.903	1.034
148	14.982	1.039
154	15.011	1.041
172	14.258	.989

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	13.765	.955
166	13.218	.917
113	12.244	.849
119	16.680	1.157
125	12.576	.872
131	12.008	.833
137	12.237	.849
143	12.697	.881
149	13.144	.912
155	13.979	.970

$P_{amb.}$

$P_o = 14.418$ psia

Chute Base

	P_s psia	P_s/P_o
161	13.168	.913
167	13.463	.934
173	13.325	.924

	P_T/P_o	T_T	V_J
Fan	3.19	1966	2605
Core	1.53	1243	1309

P_T 351

Model # 3

Hardwall Ejector - Chutes

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.968	.967
118	14.034	.972
124	14.127	.978
130	14.225	.985
136	14 266	.988
142	14.443	1.000
148	14.510	1.005
154	14.544	1.007
172	14.376	.996

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	14.001	.970
166	13.780	.954
113	13.554	.939
119	15 138	1.048
125	14.021	.971
131	13.331	.923
137	13 613	.943
143	13.772	.954
149	13.875	.961
155	14.141	.979

$P_{amb.}$

P_o = 14.440 psia

Chute Base

	P_s psia	P_s/P_o
161	13 787	.955
167	13.756	.953
173	13 700	.949

	P_T/P_o	T_T	V_J
Fan	1.64	778	1111
Core	1.51	1450	1393

6-4.1

P_T 332

Model #3

Hardwall Ejector - Chutes

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.697	.9485
118	13.797	.955
124	13.950	.966
130	14 100	.976
136	14.105	.977
142	14.282	.989
148	14.471	1.002
154	14.572	1.009
172	14.370	.995

Fan Plug Statics

Line	P_s psia	P_s/P_o
160	13.466	.932
166	13.518	.936
113	13.063	.905
119	14.333	.993
125	13.519	.936
131	12.637	.875
137	13 084	.906
143	13.405	.928
149	13.531	.937
155	13.979	.968

Chute Base

	P_s psia	P_s/P_o
161	13 563	.939
167	13.487	.934
173	13.447	.931

$P_{amb.}$

$P_o = 14.440$ psia

	P_T/P_o	T_T	V_J
Fan	2.011	728	1259
Core	1.79	556	1013

P_T 334

Model # 3

Hardwall Ejector - Chutes

Ejector Statics

psia

Line	P_s	P_s/P_o
112	13 028	.902
118	13.218	.915
124	13.566	.939
130	13 851	.959
136	13.864	.960
142	14.214	.984
148	14.596	1.010
154	14.846	1.028
172	14 328	.992

Fan Plug Statics

psia

Line	P_s	P_s/P_o
160	12.889	.892
166	12.915	.894
113	12.058	.835
119	14.546	1.007
125	12.665	.877
131	12.026	.832
137	12 089	.837
143	12.386	.857
149	12.818	.887
155	13.679	.947

$P_{amb.}$

$P_o = 14.447$ psia

Chute Base

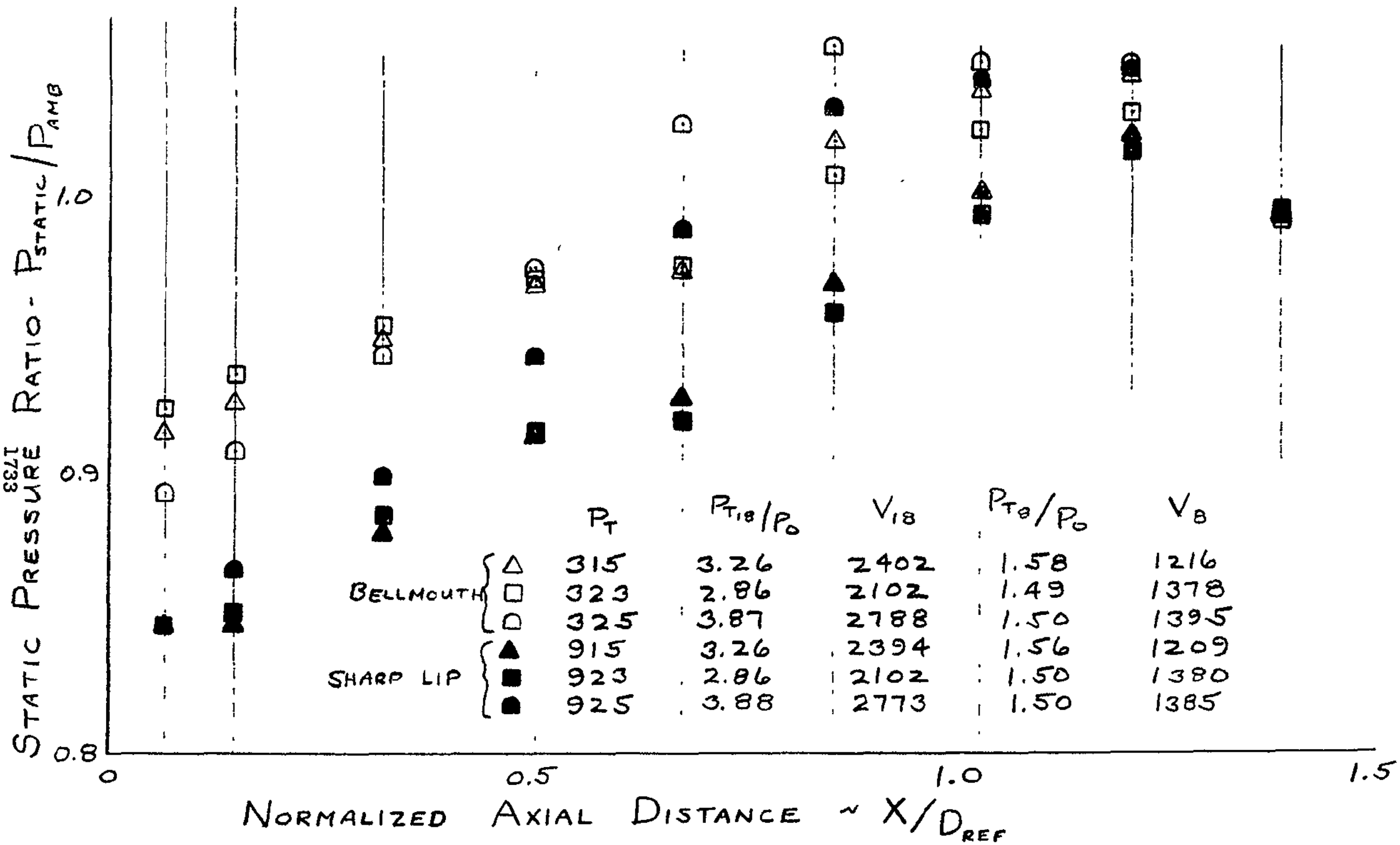
psia

	P_s	P_s/P_o
161	12.912	.894
167	13 135	.909
173	12.768	.898

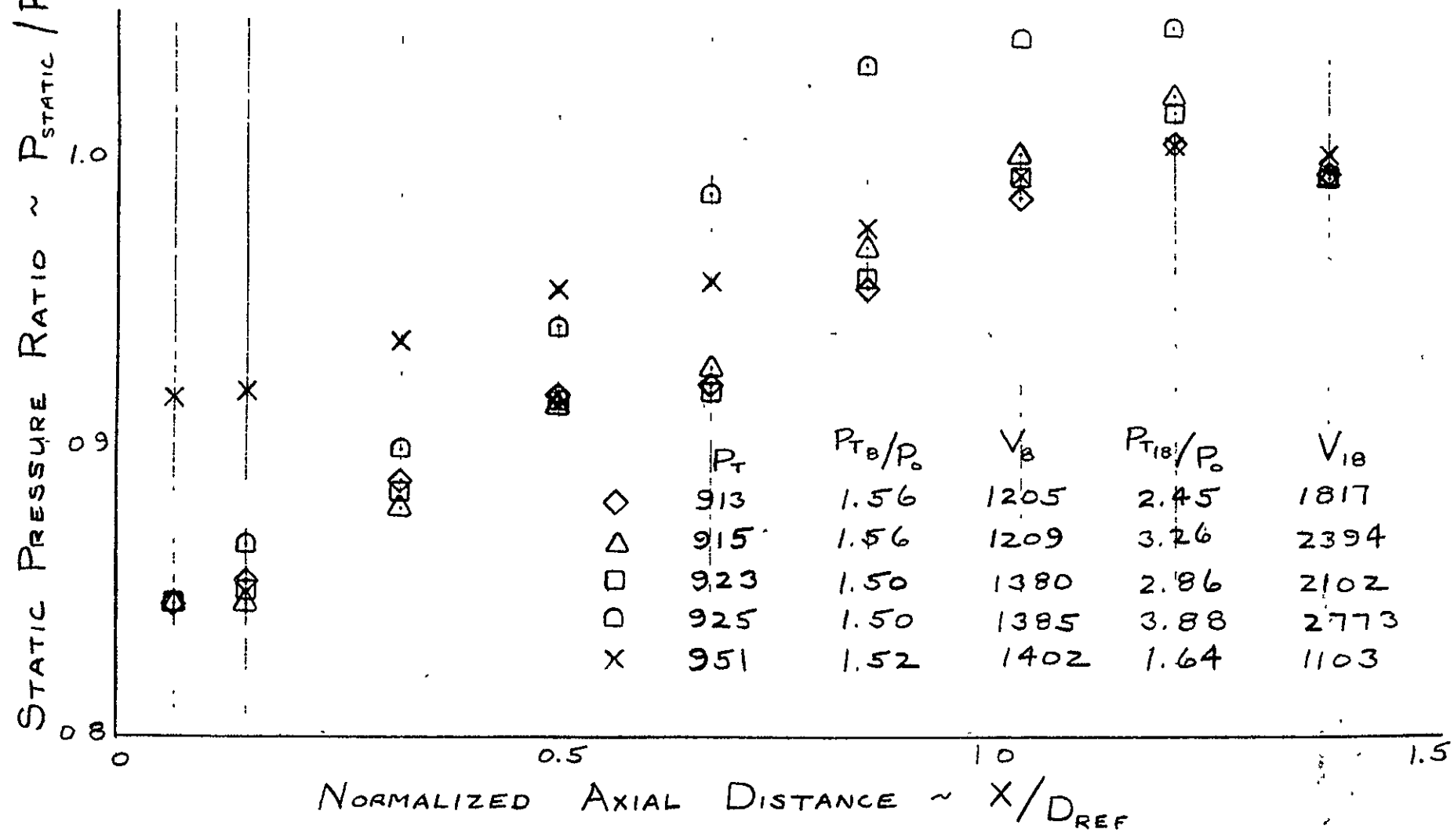
	P_T/P_o	T_T	V_J
Fan	3.19	1163	1989
Core	1.80	570	1027

G-H

MULTI-CHUTE SUPPRESSOR WITH HARDWALL EJECTOR



MULTI-CHUTE SUPPRESSOR WITH SHARP LIP INLET HARDWALL EJECTOR



	P_T	P_{T_B}/P_o	V_B	$P_{T_{IB}}/P_o$	V_{IB}
◇	913	1.56	1205	2.45	1817
△	915	1.56	1209	3.26	2394
□	923	1.50	1380	2.86	2102
⌂	925	1.50	1385	3.88	2773
X	951	1.52	1402	1.64	1103

1734

EJECTOR SHROUD PRESSURE DISTRIBUTIONS
MODEL * 9

PT 913

MODEL # [redacted] 9

HARDWALL EJECTOR - CHUTES
SHARP LIP

EJECTOR STATICS

LINE	P_s psia	P_s/P_o
112	12.221	.846
118	12.338	.854
124	12.828	.888
130	13.269	.918
136	13.308	.921
142	13.783	.954
148	14.234	.985
154	14.503	1.004
[redacted]	14.368	.994

FAN PLUG STATICS

LINE	P_s psia	P_s/P_o
112 [redacted]	12.219	.846
166	13.454	.931
113	12.043	.833
119	15.464	1.070
125	13.054	.903
131	12.043	.833
137	12.043	.833
143	12.175	.842
149	12.370	.856
155	13.194	.913

CHUTE BASE

	P_s psia	P_s/P_o
161	14.054	.972
167	14.176	.981
173	14.179	.981

$P_{amb.}$

$P_o = 14.451$ psia

	P_T/P_o	T_T	V_J
FAN	2.45	1209	1817
CORE	1.56	1005	1205

PT 915

MODEL # [redacted] 9

HARDWALL EJECTOR - CHUTES

SHARP LIP

EJECTOR STATICS

LINE	P_s psia	P_s/P_o
112	12.221	.846
118	12.219	.846
124	12.702	.879
130	13.203	.914
136	13.389	.927
142	13.985	.968
148	14.450	1.000
154	14.740	1.020
[redacted]0	14.330	.992

FAN PLUG STATICS

LINE	P_s psia	P_s/P_o
172 [redacted]	12.220	.846
166	13.609	.942
113	12.043	.833
119	16.137	1.117
125	13.097	.906
131	12.041	.833
137	12.040	.833
143	12.041	.833
149	12.041	.833
155	13.183	.912

$P_{amb.}$

$P_o = 14.450$ psia

CHUTE BASE

	P_s psia	P_s/P_o
161	14.113	.977
167	14.134	.978
173	14.160	.980

	P_T/P_o	T_T	V_J
FAN	3.26	1643	2394
CORE	1.56	1013	1209

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P_T 923

MODEL # 9

HARDWALL EJECTOR CHUTES
SHARP LIP

EJECTOR STATICS

LINE	P_s psia	P_s/P_o
112	12.219	.8465
118	12.261	.85
124	12.776	.885
130	13.203	.915
136	13.265	.919
142	13.806	.957
148	14.308	.992
154	14.635	1.014
160	14.343	.993

Fan Plug Static

LINE	P_s psia	P_s/P_o
172	12.217	.8465
166	13.535	.9375
113	12039	.8335
119	16.664	1.154
125	12.832	.889
131	12.040	.8335
137	12.039	.8335
143	12.039	.8335
149	12.115	.84
155	13.125	.909

$P_{amb.}$

$P_o = 14.447$ psia

CHUTE BASE

	P_s psia	P_s/P_o
161	14.013	.97
167	14.162	.9815
173	14.165	.9815

	P_T/P_o	T_T	V_J
FAN	2.86	1404	2102
CORE	1.50	1451	1380

P_T 925

Model #8 #9

Hardwall Ejector - Chutes

Sharp Lip

Ejector Statics

Line	P_s psia	P_s/P_o
112	12.219	.846
118	12.514	.866
124	12.991	.899
130	13.591	.941
136	14.261	.987
142	14.888	1.0305
148	15.022	1.040
154	15.077	1.044
~~160~~	14.325	.992

Fan Plug Statics

Line	P_s psia	P_s/P_o
172 ~~160~~	12.217	.846
166	14.474	1.002
113	12.040	.833
119	17.838	1.235
125	15.102	1.045
131	12.040	.833
137	12.041	.833
143	12.040	.833
149	12.543	.862
155	13.966	.967

$P_{amb.}$

$P_o = 14.447$ psia

Chute Base

	P_s psia	P_s/P_o
161	13.293	.920
167	14.054	.973
173	14.178	.981

	P_T/P_o	T_T	V_J
Fan	3.88	1957	2773
Core	1.50	1463	1385

e.4

P_T 951

Model # 9

Hardwall Ejector - Chutes

Sharp Lip

Ejector Statics

Line	P_s psia	P_s/P_o
112	13.249	.917
118	13.278	.919
124	13.518	.936
130	13.787	.954
136	13.805	.956
142	14.068	.974
148	14.329	.992
154	14.484	1.003
[redacted]	14.449	1.0003

Fan Plug Statics

Line	P_s psia	P_s/P_o
172 [redacted]	13.031	.902
166	13.813	.956
113	13.117	.908
119	15.289	1.058
125	13.833	.958
131	12.965	.898
137	13.207	.914
143	13.351	.924
149	13.395	.927
155	13.739	.951

$P_{amb.}$

$P_o = 14.445$ psia

Chute Base

	P_s psia	P_s/P_o
161	14.221	.984
167	14.309	.991
173	14.300	.990

	P_T/P_o	T_T	V_J
Fan	1.64	765	1103
Core	1.52	1454	1402

PT 5C8

MODEL #5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.149
130	13.948
148	12.149
166	14.608
119	14.952
131	15.904

FAN PLUG STATICS

	psia
137	12.669
143	12.852
149	12.564
155	~~14.956~~
161	13.006
167	12.433
173	12.512

EJECTOR STATICS

	psia
118	13.109
124	13.262
136	13.524
142	13.716
154	13.915
160	14.375
172	14.532
113	14.617
125	14.259

P_{amb} = 14.376 psia

	P_T/P_o	T_T	V_J
FAN	2.26	1056	1625
CORE	1.630	766	1075

P_T 510

MODEL #5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.142
130	13.730
148	12.141
166	14.643
119	15.166
131	16.102

EJECTOR STATICS

	psia
118	12.715
124	12.872
136	13.165
142	13.425
154	13.697
160	14.342
172	14.641
113	14.848
125	14.131

FAN PLUG STATICS

	psia
137	11.958
143	12.147
149	11.954
155	~~14.262~~
161	12.396
167	11.955
173	11.954

P_{amb} = 14.376 psia

	P_T/P_0	T_T	V_J
FAN	2.99	1481	2198
CORE	1.64	768	1104

PT 5.20

MODEL *5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.150
130	13.607
148	12.150
166	14.516
119	15.213
131	15.911

EJECTOR STATICS

	psia
118	12.554
124	12.682
136	13.001
142	13.304
154	13.642
160	14.336
172	14.686
113	14.995
125	14.073

FAN PLUG STATICS

	psia
137	11.966
143	11.964
149	11.964
155	~~14.206~~
161	12.253
167	11.963
173	11.963

P_{amb} = 14.381 psia

	P_T/P_0	T_T	V_J
FAN	3.54	1788	2573
CORE	1.54	1219	1310

P+551

MODEL #5

HARDWALL EJECTOR

CORE PLUG STATICS psia

112	12.143	.845
118		
124		
130	13.998	
136		
142		
148	12.142	.845
154		
160		
166	14.420	
172		
113		
119	14.733	
125		
131	15.501	

FAN PLUG psia

137	13.405	.933
143	13 536	.942
149	13 421	.934
155	~~14.142~~	
161	13 665	.952
167	13.501	.940
173	13 398	.932

EJECTOR STATICS psia

	13.686	.9525
	13.781	
	13.931	
	14.029	
	14 109	
	14 319	
	14 441	
	14 476	
	14.327	

P_{amb} = 14.378 psia

	P_T/P_o	T_T	V
FAN	1.52	1439	1395
CORE	1.64	769	1102

PT 525

MODEL *5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.150
130	13.632
148	12.150
166	14.549
119	15.1282
131	15.834

EJECTOR STATICS

	psia
118	12.574
124	12.679
136	12.992
142	13.309
154	13.682
160	14.409
172	14.740
113	15.111
125	13.982

FAN PLUG STATICS

	psia
137	11.968
143	11.964
149	11.965
155	~~14.805~~
161	11.965
167	11.964
173	11.963

P_{amb} = 14.381 psia

	P_T/P_0	T_T	V_J
FAN	3.87	1363	2776
CORE	1.50	1460	1390

P_T 5 13

Model *5

Hardwall Ejector

Core Plug Statics

	psia
112	12.150
130	13.828
148	12.150
166	14.545
119	14.978
131	15.785

Ejector Statics

	psia
118	12.954
124	13.129
136	13.430
142	13.651
154	13.872
160	14.404
172	14.580
113	14.673
125	14.252

Fan Plug Statics

	psia
137	12.385
143	12.612
149	12.514
155	~~14.926~~
161	12.873
167	11.971
173	12.260

P_{amb} = 14.381 psia

	P_T/P_0	T_T	V_J
Fan	2.45	1207	1815
Core	1.57	988	1178

P_T 515

Model #5

Hardwall Ejector

Core Plug Statics

	psia
112	12.151
130	13.648
148	12.151
166	14.525
119	15.168
131	15.950

Ejector Statics

	psia
118	12.591
124	12.748
136	13.058
142	13.355
154	13.652
160	14.331
172	14.670
113	14.925
125	14.130

Fan Plug Statics

	psia
137	11.966
143	12.000
149	11.964
155	~~14.817~~
161	12.387
167	11.964
173	11.964

P_{amb} = 14.382 psia

	P_T/P_0	T_T	V_J
Fan	3.26	1635	2348
Core	1.57	988	1199

PT 503

MODEL #5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.142
130	14.124
148	12.142
166	14.954
119	14.954
131	16.119

FAN PLUG STATICS

	psia
137	12.867
143	13.017
149	12.875
~~155~~	~~14.206~~
161	13.241
167	13.047
173	12.891

EJECTOR STATICS

		psia
63	118	13.236
64	124	13.700
65	136	13.602
66	142	13.778
67	154	13.925
68	160	14.277
69	172	14.506
70	113	14.573
71	125	14.304

P_{amb} = 14.38 psia

	P_T/P_o	T_T	V_J
FAN	2.06	1002	1501
CORE	1.80	536	1000

PT 505

MODEL *5

HARDWALL EJECTOR

CORE PLUG STATICS

	psia
112	12.142
130	13.840
148	12.140
166	14.802
~~15~~	~~15.190~~
119	15.190
131	16.362

EJECTOR STATICS

	psia
118	12.809
124	12.968
136	13.247
142	13.482
154	13.774
160	14.418
172	14.614
113	14.772
125	14.190

FAN PLUG STATICS

	psia
137	12.126
143	12.376
149	12.136
155	~~14.233~~
161	12.593
167	11.953
173	11.974

$P_{amb} = 14.377$ psia

	P_T/P_0	T_T	V_J
FAN	2.73	1343	2014
CORE	1.80	545	1006

P_T .534

Model *5

Hardwall Ejector

Core Plug Statics

	psia	
112	12.276	.846 ?
130	13.976	.964
148	12.276	.846 ?
166	14.285	.984
119	15.340	1.057
131	16.558	1.141

Ejector Statics

	psia	
118	12.410	.856
124	12.611	.87
136	12 783	.895
142	13.300	.917
154	13.544	.933
160	14 021	.966
172	14 576	1.005
113	14 943	1.030
125	14.307	.988

Fan Plug Statics

	psia	
137	12.094	Cavity P_s .834
143	12.094	
149	12.094	
155	14.683	1.011
161	12.224	.843
167	12.094	Cavity P_s
173	12 094	

P_{amb} = 14.514 psia

	P_T/P_0	T_T	V_J
Fan	3.17	1170	1992
Core	1 81	551	1018

P_T 536.

Model #5 Hardwall Ejector

Core Plug Statics

	psia	
112	12.256	.846
130	13.798	.953
148	12.256	.846
166	14.480	.999+
119	15.124	1.045
131	16.106	1.112

Ejector Statics

	psia	
118	12.393	.856
124	12.625	.872
136	13.023	.90
142	13.315	92
154	13 547	.936
160	13.917	.962
172	14 464	.999
113	14.812	1.024
125	14.321	.989

Fan Plug Statics

	psia	
137	12.076	.834
143	12.075	
149	12 075	
155	14.604	1.009
161	12.354	.854
167	12 075	.834
173	12.075	

P_{amb} = 14.494 psia

	P_T/P_0	T_T	V_J
Fan	3.05	806	1628
Core	1.63	761	1092

*2, *6
— *4

PT 726

MODEL #7

CORE PLUG STATICS psia		FAN PLUG STATICS psia	
112	13.963	137	14.502
118	14.847	143	14.502
124	14.891		
130	14.563	149	14.502
136	14.251	155	14.500
142	14.067	161	14.500
148	12.269		
154	13.715	167	14.502
160	14.339	173	14.500
166	14.490		
172	14.703		
113	14.804		
119	14.765		
125	15.263		
131	15.382		

Pamb ~ 14.504 psia

	P_T/P_0	T_T	V_J
FAN	1.524	717	989
CORE	1.369	1004	1018

*2, *6
*1, *4

15/2

P_T 728

Model #7

Core Plug Statics psia			Fan Plug Statics psia	
112	14.785	1.021	137	Amb
118	15.659	1.081	143	✓
124	15.740	1.086		
130	15.212	1.050	149	✓
136	14.681	1.013	155	✓
142	14.131	.975	161	✓
148	12.270	.847		
154	13.765		167	✓
160	14.368		173	✓
166	14.579			
172	14.862			
113	15.009			
119	15.002			
125	15.495			
131	15.619			

P_{amb} = 14.498 psia

	P_T/P_o	T_T	V_J
Fan	2.734	1354	2024
Core	1.389	992	1035

#2, #6
#1, #4

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Model #7[redacted] PT730 (FEC20)

Core Plug Statics psia			Fan Plug Statics psia	
112	13.775	.952	137	Amb
118	16.969	1.173	143	✓
124	17.404	1.202		
130	16.132	1.115	149	✓
136	15.705	1.086	155	✓
142	14.388	.994	161	Amb
TY 148	12.252	.865		
154	12.250	.864	167	✓
160	12.249	.863	173	✓
166	14.222	983		
172	15.981	1.105		
113	15.657	1.081		
119	15.275	1.055		
125	16.294	1.125		
131	16.679	1.153		

P_{amb} = 14.475 psia

	P_T/P_o	T_T	V_J
Fan	2.861	1415	2110
Core	1.869	1003	1406

*2, *6
*1, *4

17/2

MODEL \# 7

P_T 731 (FEC 21)

	CORE PLUG STATICS psia			FAN PLUG STATICS psia
CAVITY 112	12.411	.848	137	Amb
" 118	12.410	.848	143	✓
124	16.271	1.111		
130	16.679	1.140	149	✓
136	16.822	1.149	155	✓
142	14.697	1.004	161	✓
CAVITY 148	12.412	.848		
" 154	12.410	.848	167	✓
160	12.420	.8485	173	✓
166	13.739	.938		
172	15.631	1.068		
113	15.933	1.089		
119	15.788	1.078		
125	16.758	1.132		
131	17.187	1.174		

P_{amb} = 14.645 psia

	P_T/P_o	T_T	V_J
FAN	3.864	1965	2777
CORE	1.86	1002	1409