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**National Highway
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Final Report

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EVALUATION OF THE BIOSID DUMMY MDB-To-Car Side Impact Test of a 26° Crabbed Moving Deformable Barrier into a 1988 Hyundai Excel 4-door sedan at 33.7 MPH

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15. Supplementary Notes

This test was conducted as part of VRTC Project No. VRTC-89-0138 Evaluation of the BioSid Dummy

16. Abstract

This test report documents a crash test to evaluate the response of BioSid dummies in a moving deformable barrier into stationary vehicle side impact crash test. Testing was conducted on a 1988 Hyundai Excel GL 4-door Sedan at the TRC Crash Test Facility, East Liberty, Ohio. The test vehicle was impacted on the left side by a moving deformable barrier, crabbed to 26°, at 33.7 mph. The test was a simulation of a 90° intersection collision with the striking vehicle travelling 30 mph and the struck vehicle travelling at 15 mph. Occupant responses of two side impact dummies were measured. One dummy was located in the driver's designated seating position and one was located in the left rear seating position. The test date was May 21, 1990 and the ambient temperature was 59°F.

	DRIVER	PASSENGER
Head Injury Criteria (HIC)	210	163
Upper Spine Acceleration,g	68	39
Left Upper Rib Acceleration,g	174	66
Left Center Rib Acceleration,g	205	87
Left Lower Rib Acceleration,g	226	92
Lower Spine Acceleration,g	77	78
Thoracic Trauma Index (TTI)	152	85
Pelvis Acceleration, g	137	153

17. Key Words	18. Distribution Stotement
BioSid Dummy Occupant Response Moving barrier Crash Testing	Available from: National Technical Information Service Springfield, Virginia 22161

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PURPOSE AND TEST SUMMARY

PURPOSE

The purpose of this test was to evaluate the response of BioSid dummies in a moving deformable barrier into stationary vehicle side impact test. The vehicle was tested using conditions not currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A stationary 1988 Hyundai GL Excel 4-door sedan was impacted on the left side by a Moving Deformable Barrier (MDB) on May 21, 1990. The test was to simulate an intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. The orientation angle of the striking vehicle was 90° counterclockwise with respect to the longitudinal axis of the struck vehicle. The leading edge of contact was to be 37 inches forward of the midpoint of the wheelbase.

To simulate this collision, the MDB was to be towed into the stationary Hyundai Excel at 33.5 mph with MDB's wheels crabbed clockwise to 26°. The actual test speed was 33.7 mph and the actual leading edge of contact was 36.0 inches forward of the midpoint of the Hyundai Excel's wheelbase.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains Data Plots. Appendix C contains Dummy Certification Data.

SECTION 2.0

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Hyundai Motor Company

MAKE/MODEL: Hyundai/Excel GL VIN: KMHLF21J9JU368052

BODY STYLE: 4-door sedan MODEL YEAR: 1988

NHTSA NO.: NA COLOR: Graphite

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.5 liter

TRANSMISSION DATA: _5_SPEED, _X_MANUAL, ___AUTOMATIC, _X_FWD, ___RWD, ___4WD

DATE VEHICLE RECEIVED: 5/14/90 ODOMETER READING: 36800.9

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good

DATA FROM VEHICLE'S CERTIFICATION LABEL:

VEHICLE MANUFACTURED BY: Hyundai Motor Company

DATE OF MANUFACTURE: 1/23/88 VIN: KMHLF21J9JU368052

GVWR: 3185 LBS

GAWR: FRONT: 1653 LBS., REAR: 1587 LBS.

TEST VEHICLE INFORMATION CONTINUED

VEHICLE TIRE DATA:

RECOMMENDED COLD TIRE PRESSURE: FRONT 35 psi; REAR 35 psi

TIRES ON VEHICLE (MFR. & LINE, SIZE): Goodyear/Corsa GT P155/80R13

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 1

IS SPARE TIRE "SPACE SAVER"? NA

IS SPARE TIRE STANDARD EQUIPMENT? NA

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS):

RIGHT FRONT	670 LBS.	RIGHT REAR	410 LBS.
LEFT FRONT	680 LBS.	LEFT REAR	460 LBS.
TOTAL FRONT WEIGHT	1350 LBS.	(60.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	870 LBS.	(39.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	2220 LBS.		

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	RF	24.6;	LF	24.6;	RR	23.8;	LR 23.9
PRE-TEST ATTITUDE:	RF	24.5;	LF	24.1;	RR	22.1;	LR 21.9
POST-TEST ATTITUDE:	RF	23.9;	LF	22.9;	RR	25.1;	LR 22.0

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 152 LBS. CARGO:

RIGHT FRONT	747 LBS.	RIGHT REAR	576 LBS.
LEFT FRONT	739 LBS.	LEFT REAR	640 LBS.
TOTAL FRONT WEIGHT	1486 LBS.	(55.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1216 LBS.	(45.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2702 LBS.		

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

TEST VEHICLE INFORMATION CONTINUED

TEST FLUID TYPE

TEST FLUID TYPE: PURPLE STODDARD SOLVENT 2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USABLE" CAPACITY*: NA GALLONS

TEST VOLUME: 0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): NA GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: DNA FUEL INJECTION: DNA

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? DNA

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.:

RECOMMENDED COLD TIRE PRESSURE: FRONT 30 psi; REAR 30 psi

RECOMMENDED TIRE SIZE: P155/80R13 LOAD RANGE X B, C

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
3 REAR
5 TOTAL

CARGO LOAD 66 LBS.

TOTAL 816 LBS.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
(Number of Dummies X 165 lbs.) +
Cargo Weight*

To achieve test weight, the battery, exhaust, carburetor, exhaust manifold, air cleaner, radiator, hoses and washer fluid container were removed. The fuel tank was empty. The weight of the test vehicle was measured by placing each wheel on a KJ Law Force Plate.

*A total test weight of 2770 pounds was used to duplicate a previous side impact test using a Hyundai Excel.

TEST CONDITIONS

TEST NUMBER: 900521

DATE OF TEST: 5/21/90 TIME OF TEST: 1330

DRIVER DUMMY TEMPERATURE: 68° F

PASSENGER DUMMY TEMPERATURE: 68° F

AMBIENT TEMPERATURE AT IMPACT AREA: 59° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 68° F

MAX. LENGTH = 167.2 MAX. WIDTH = 63.2 TOP WIDTH = 37.0

WHEELBASE = 93.7 C.G. = 42.2 REARWARD OF FRONT WHEEL CENTERLINE

LEFT FRONT DOOR: UNLOCKED WINDOW: UP

LEFT REAR DOOR: UNLOCKED WINDOW: UP

RIGHT FRONT DOOR: UNLOCKED WINDOW: DOWN

RIGHT REAR DOOR: UNLOCKED WINDOW: DOWN

EMERGENCY BRAKE: OFF

TRANSMISSION: NEUTRAL

STEERING COLUMN: NON-ADJUSTABLE

SEAT TRACKS: MID POSITION

SEAT BACK ANGLE: 23.°

TYPES OF SEATS: FRONT - BUCKET; REAR - BENCH

TIRE PRESSURE: FRONT 30 psi; REAR 30 psi

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

TEST CONDITIONS, CONTINUED

SUBJECT VEHICLE DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (LBS.)	2702	2700
MDB TEST WEIGHT (LBS.)	2903	2900
MDB VELOCITY (MPH)*	33.7	33.5
IMPACT POINT (INCHES)**	36.0	37.0

DUMMY DATA

	DRIVER	LEFT REAR PASSENGER
TYPE:	BioSid	BioSid
SERIAL NO.:	001	002
INSTRUMENTATION:		
HEAD	3 accel.	3 accel
SHOULDER	1 accel., 3 force, & 1 displ.	1 accel. & 1 displ.
UPPER SPINE	4 accel.	3 accel.
LEFT UPPER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LEFT CENTER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LEFT LOWER THORAX RIB	2 accel. & 1 displ.	2 accel. & 1 displ.
LOWER SPINE	4 accel.	4 accel.
LEFT UPPER ABDOMEN	1 accel. & 1 displ.	1 accel. & 1 displ.
LEFT LOWER ABDOMEN	1 accel. & 1 displ.	1 accel. & 1 displ.
PELVIS	3 accel. & 3 force	3 accel.

RESTRAINT SYSTEM: Both dummies were unrestrained.

*As measured over final one foot of travel.
**As measured forward of the midpoint of the test vehicle's wheelbase.

POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #001	PASSENGER #002
HEAD	Roof and right front seat	Left C-pillar & roof
CHEST	Left front door and right shoulder contact the windshield	Left rear door
ABDOMEN	Left front door	Left rear door
LEFT KNEE	Left front door	Left rear door
RIGHT KNEE	Left knee	Left knee

DOOR OPENING:

	LEFT	RIGHT
FRONT	*	Easy
REAR	*	Easy

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	NA	NA
REAR	NA	NA

GLAZING DAMAGE:

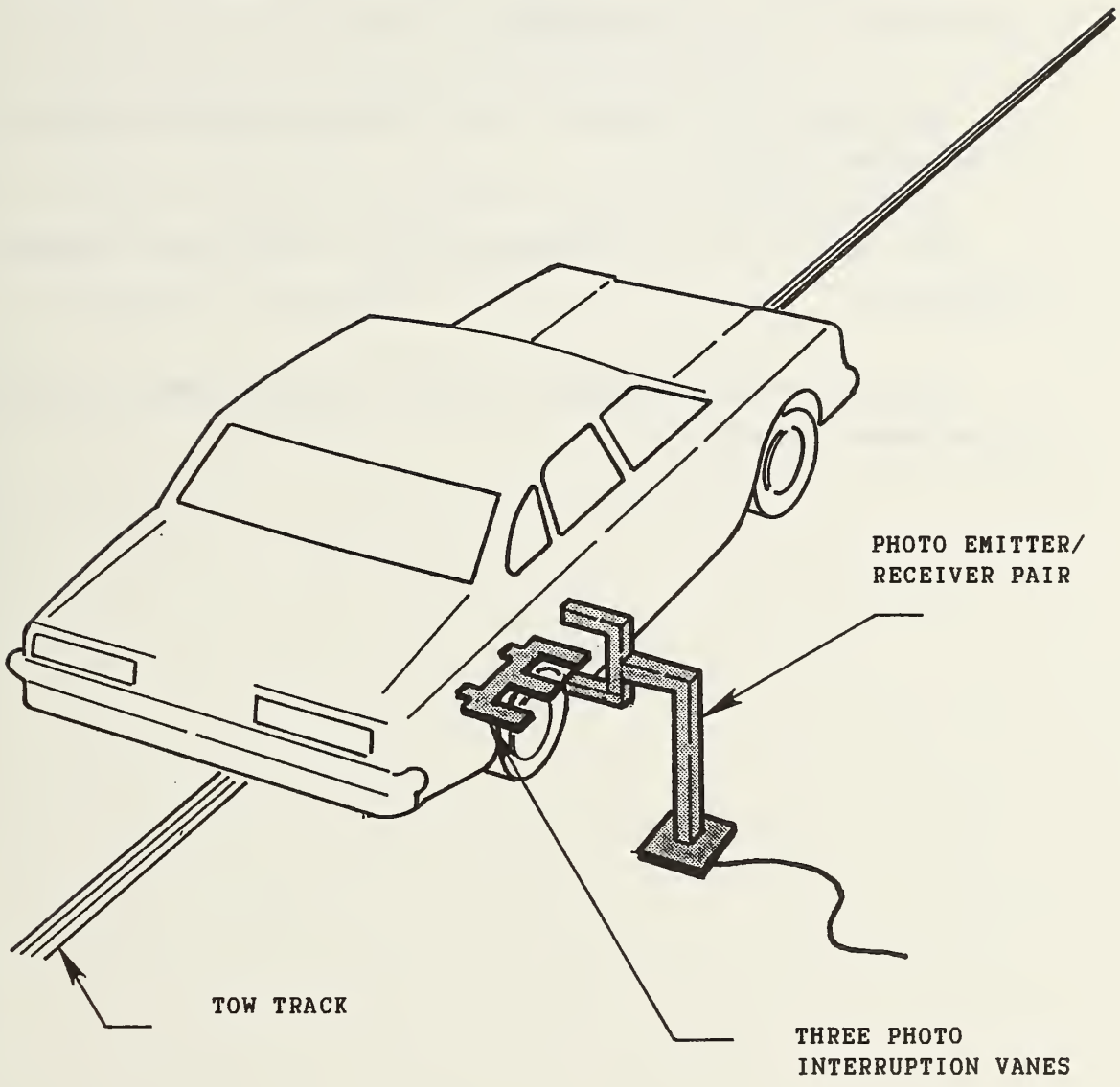
The left side windows were shattered. The windshield was cracked.

OTHER NOTABLE IMPACT EFFECTS:

None

*The left front door to be opened later by VRTC.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

TEST ANOMALIES

The driver's left shoulder Y-axis accelerometer, SHLYG1, data is questionable at 236.8 milliseconds.

The driver's left shoulder Y-axis velocity, SHLYV1, data was affected by the above anomaly.

The barrier rear crossmember X-axis accelerometer, BRCXG, data is unrealistic.

The barrier rear crossmember X-axis velocity, BRCXV, data was affected by the above anomalies.

SECTION 3.0

DATA REQUIRED BY R&D

The following pages are included in this section:

1. Dummy temperature control and positioning data
2. Dummy kinematic summary
3. Vehicle crush data
4. Dummy and vehicle accelerometer location and data summary
5. High speed camera information
6. Transducer information

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 2 hours prior to the test. Temperature inside the vehicle and ambient temperature at the crash area were recorded. Dummy temperature while outside the crash test building was maintained by portable air conditioning units until approximately 1 minute prior to the test.

The following Side Impact Dummy Seating Procedure summarizes the steps taken to position the intrumented, calibrated dummies in the test vehicle.

SIDE IMPACT DUMMY SEATING PROCEDURE

1. Seat Positioning

A. Place seat at the longitudinal midpoint of fore to aft adjustment (forward most locking position to rear most locking position). If no locking position is available at mid-travel, use the position immediately rearward of mid-travel.

B. If the seat back angle is adjustable, place it in the manufacturer's stated nominal design location. If not specified, set it at the first detent rearward of 25°.

C. Adjustable head restraints are set so that the top surface of the restraint is level with the cg of the dummy's head.

D. If the seat is equipped with adjustable side or lumbar supports, they are set in their "released" or full back positions.

E. All other seat adjustments are positioned to their mid-travel locations. If locking positions are not available at these mid-points, use the position immediately rearward, down, left or clockwise of mid-travel. Clockwise is defined looking rear to front or left to right relative to the vehicle. This also applies to adjustable steering columns.

2. H-point Determination

A. The SAE three-dimensional H-point machine (SAE J826 APR80 - 50th percentile male configuration) is used to locate the H-point for each surrogate.

B. The H-point machine is positioned on the seat as follows:

1. Bucket or Contoured Seats - The H-point machine is centered on the bucket or contour such that its midsagittal plane is vertical and longitudinal.

2. Bench Seats

a. driver position - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.

b. outboard passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and the same distance from the longitudinal vehicle centerline as that for the driver position.

c. center passenger positions - The H-point machine is positioned such that its midsagittal place is vertical and contains the longitudinal vehicle centerline.

C. Locate the H-point position using the steps outlined in sections 4 through 6 of SAE Standard J826 APR80, unless otherwise specified in section 1 or 2 of this document. Record the coordinates of this point, relative to the vehicle, for use in sections 4 and 5 of this document.

3. Test Dummies

A. This side impact crash test uses the BioSid side impact dummy.

B. The arm position is fully down and the end of the arm is 1/4" away from the left side of the dummy.

C. All dummy joints are inspected for mobility prior to each test usage and reset to hold between 1 and 2 g's. This amount just barely restrains the weight of the individual limb when it is extended horizontally.

D. Each test dummy is clothed in form-fitting cotton stretch underwear with short sleeves and mid-calf length pants. Each foot of the dummy is equipped with a size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 1.25 ± 0.2 pounds. All the above items are supplied by the contractor.

4. Initial Dummy Placement

The BioSid dummy(s) is placed in the vehicle seat with its pelvis positioned such that a lateral line passing through the dummy H-point is perpendicular to the longitudinal centerplane of the vehicle.

A. Bucket or Contoured Seats. The dummy is centered on the bucket or contoured seat such that its midsagittal place is vertical and longitudinal. The legs are positioned as follows, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible.

1. driver position placement - The right foot of the dummy is initially placed on the undepressed accelerator pedal, with the heel resting on the floorpan as far forward as possible. The knees of the dummy are initially set 8 1/2 inches apart, measured between the center surfaces of the knee.

2. passenger position placement - The knees of the dummy are initially set 8 1/2 inches apart, measured between the center surfaces of the knee. If a center tunnel prevents this, place the feet on either side of the tunnel.

3. center passenger position - The dummy is positioned in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical and contains the vehicle centerline.

5. Initial Dummy Positioning

A. H-Point Positioning

1. Determine the dummy's H-point target location which is the point .25-inch below the H-point position determined by using the SAE J826 APR80 manikin in section 2.0.

2. With the dummy laterally positioned as in section 4, insert the pelvis angle indicator bar in the hole provided above, and to the

rear of the dummy H-point. Position the longitudinal pelvis angle between 23° and 25° to the horizontal. This may be accomplished by raising the legs or flexing the upper torso forward and allowing the pelvis to rotate. The lateral pelvis angle is to be horizontal.

3. Apply sufficient force on the lower torso in a horizontal and vertical direction to place the dummy H-point at the coordinates obtained in section 5.A.1.

4. If the H-point cannot be placed at the desired coordinates, adjust the pelvis angle within the 2° band and reposition to the coordinates. After repositioning the H-point, any deviation from the desired coordinates is recorded and used to indicate actual H-point locations. This deviation is not to exceed 1/2".

6. Final Dummy Positioning

A. Driver Position. Without inducing pelvis or torso movement, the dummy's right foot is maintained on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. If possible within these constraints, the dummy's thighs should be in contact with the seatpan.

B. Front Passenger Positions. Without inducing pelvis or torso movement, place the dummy's feet on the vehicle's toeboard with the heels resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.

C. Rear Passenger Positions. Without inducing pelvis or torso movement, the feet are placed flat on the floorpan and beneath the front seat as far forward as possible without front seat interference. If necessary, change the distance between the knees as required to place the feet beneath the seat. Record the new distance.

D. Vehicles with wheelhouse projections in the passenger compartment. The foot (feet) in question is placed in the wheel of the floorpan/toeboard and not on the wheelhouse projection. This is done by twisting the foot at the ankle, maintaining the upper and lower leg positions outlined in section 4. If this does not resolve the situation, move the leg of the foot in question just enough to achieve the correct position, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible. Record the new distance between the knées.

E. The knee positions are to be as outlined in section 4, unless modified as in section 6. The plane containing the femur and tibia centerlines for each leg is to be as near to vertical as possible without inducing pelvis or torso movement. Record the distance between the knees for each dummy.

F. Prior to conducting the test, the dummy position is visually checked. The dummy is to be properly positioned laterally with its midsagittal plane vertical and longitudinal, and the upper torso resting against the seat back. The H-point and pelvis angle are to be within the specified ranges and the foot, knee, and leg placements are to be as outlined. The COTR is to be satisfied with the final dummy position and any deviations from this procedure are to be approved by the COTR.

G. The final dummy position is recorded. These measurements are to include, but not be limited to, pelvis and head angles as well as actual H-point and head cg locations relative to the vehicle. The straight-line distance from the H-point to the center of the outer ankle bolt is also recorded for one of the legs (eg. left H-point to left ankle bolt).

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: Hyundai Motor Company/Hyundai/Excel GL

SEAT TYPE: X Bench - rear
X Bucket - front
_____ Split bench

ADJUSTER TYPE: X Manual
_____ Power
_____ Non-adjustable

BUCKET SEAT BACK TYPE: _____ Non-adjustable
X Adjustable reclining

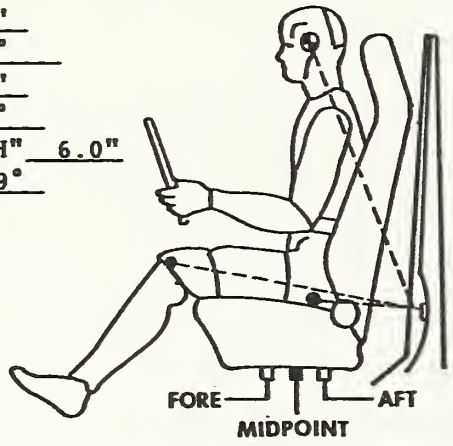
POSITIONING DATE: 5/21/90

AMBIENT TEMP.: 70° F TIME: 1000

TECHNICIANS:
1. B. Miller
2. B. Crabtree
3. S. Ericksen
4. _____

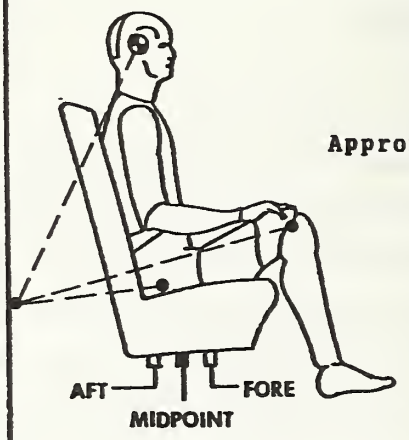
DRIVER DUMMY* # 001 TYPE: BioSid

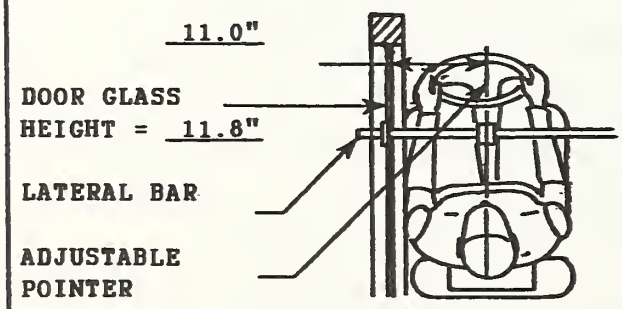
Head 21.4"
Target 2°
Knee 20.6"
Joint 89°
Approx. "H" 6.0"
Point 139°



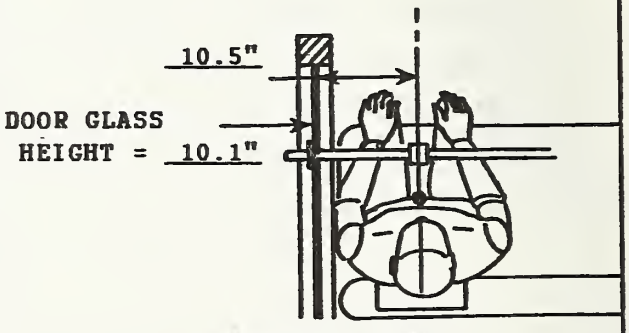
PASSENGER DUMMY** # 002 TYPE: BioSid

Head 16.6"
Target 7°
Knee 26.1"
Joint 103°
Approx. "H" 13.5"
Point 139°





DRIVER DUMMY

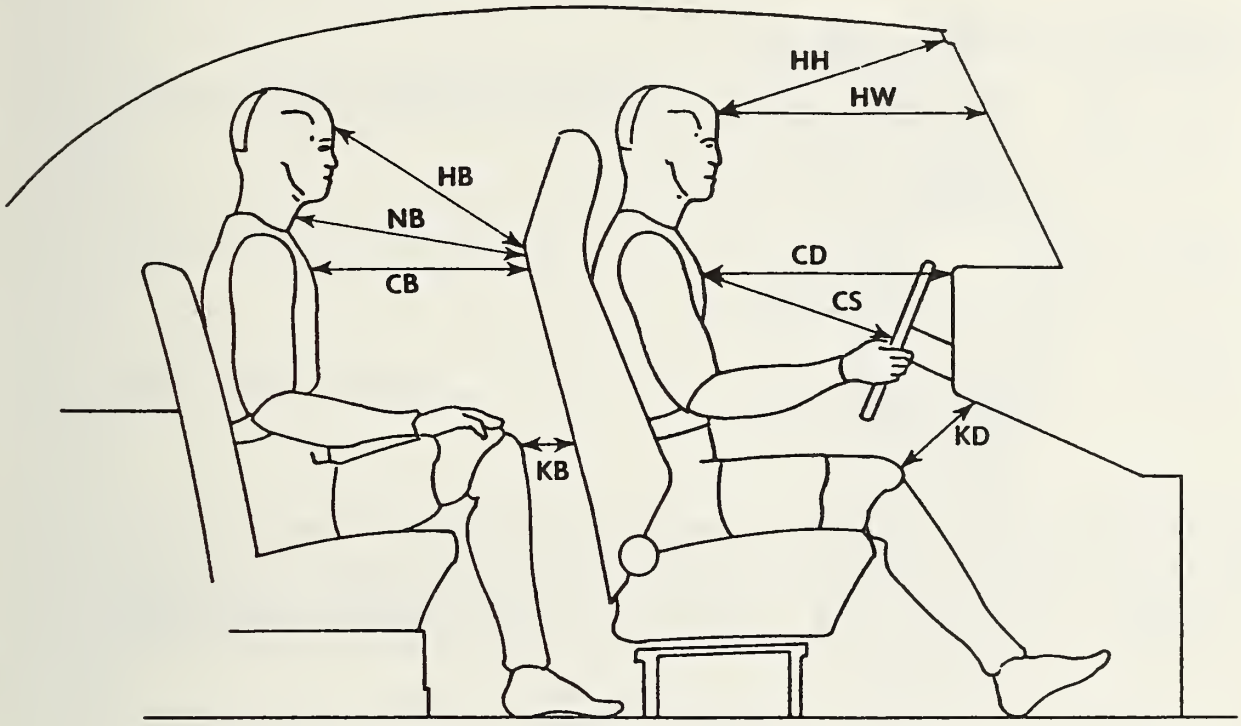


PASSENGER DUMMY

*Driver dummy measurements are referenced to top of left front door striker bolt and all angles referenced to vertical.

**Passenger dummy measurements are referenced to top of left rear door striker bolt and all angles are referenced to vertical.

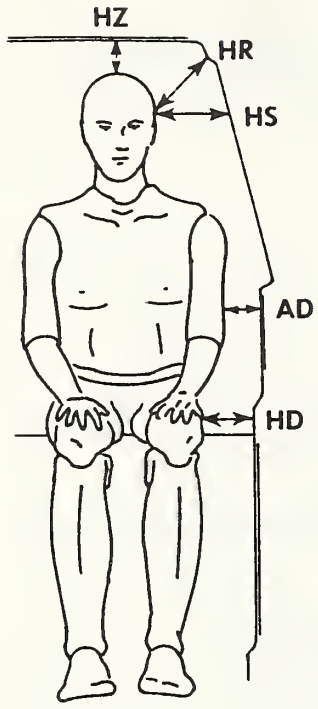
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

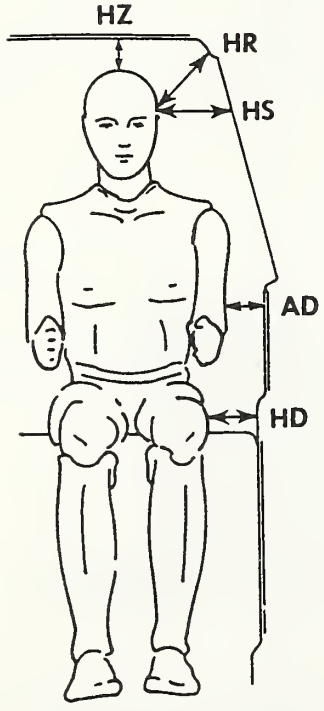


	DRIVER	REAR PASSENGER
HH	13.2	NA
HW	17.5	NA
CD	19.1	NA
CS	11.8	NA
KDL	6.1	NA
KDR	5.2	NA
HB	NA	27.2
NB	NA	24.9
CB	NA	19.0
KBL	NA	5.2
KBR	NA	5.0

ALL MEASUREMENTS ARE IN INCHES.

DUMMY LATERAL CLEARANCE DIMENSIONS





	DRIVER	PASSENGER
HR	5.4	5.0
HS	7.5	5.5
AD	3.9	3.4
HD	6.2	5.4
HZ	2.2	1.0

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

SAE 3D H-POINT MACHINE LOCATION AND DUMMY LOCATION DATA

	DRIVER #001	PASSENGER #002
SAE 3D H-POINT MACHINE LOCATION:	X = 5.7	X = 9.6
	Z = -4.9	Z = -11.7
DUMMY H-POINT LOCATION:	X = 5.5	X = 9.3
	Z = -4.6	Z = -11.5
DUMMY PELVIC ANGLE:	23.5°	25°

*Driver location measurements referenced to left front door striker bolt and passenger location measurements referenced to left rear door striker bolt in two-dimensional rectangular coordinates: +X = forward, +Z = upward

All dimensions in inches except as noted.

All angles referenced to horizontal, positive is upward.

DUMMY KINEMATIC SUMMARY

DRIVER

During impact, the dummy's torso contacted the driver's door. The dummy rebounded laterally across the front occupant compartment. The upper torso rotated and the right shoulder contacted the right top corner of the windshield and the dummy's head contacted the roof and the right front seat. The left knee contacted the left front door and the right knee contacted the left knee. The dummy's back came to rest against the right front door and the head leaning against the right front seat.

PASSENGER

During impact, the dummy's torso contacted the left rear door and the head contacted the left C-pillar and the roof. The dummy rebounded laterally across the rear occupant compartment. The left knee contacted the left rear door and the right knee contacted the left knee. The dummy came to rest seated upright in the right rear seat.

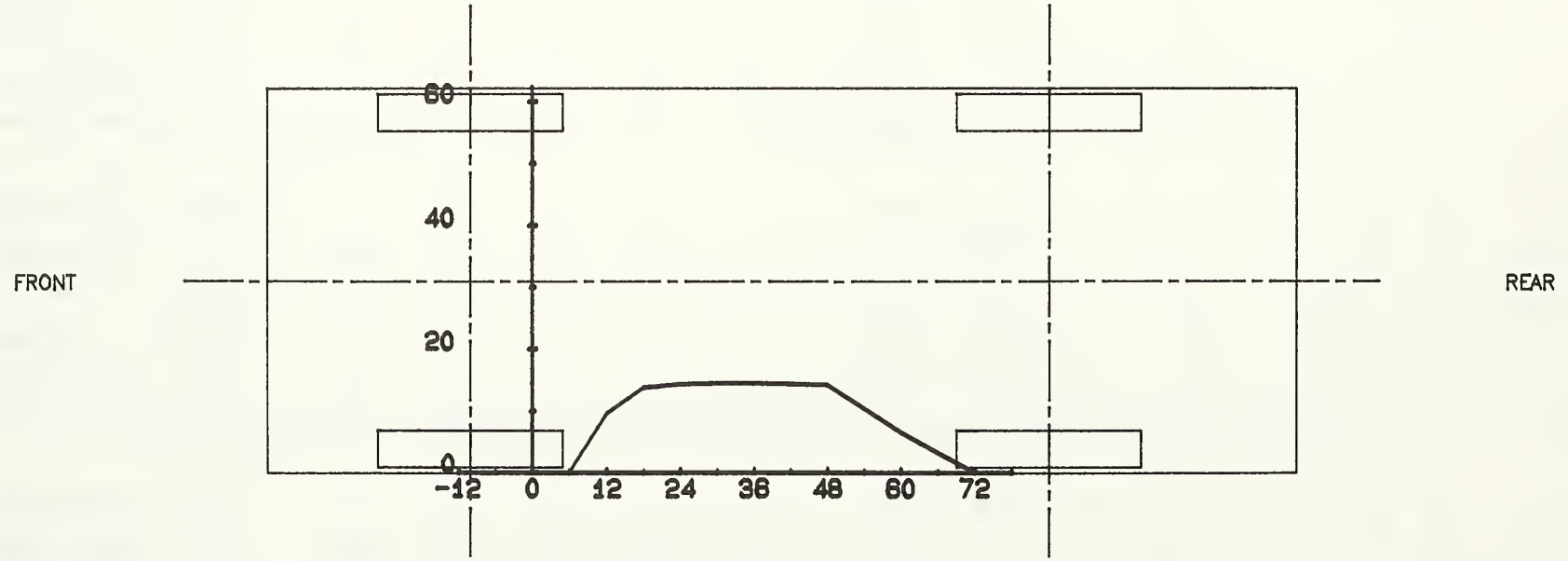
VEHICLE EXTERIOR PROFILES AND STATIC CRUSH
ZERO DISTANCE AT PROJECTED IMPACT POINT*

LOCATION	HEIGHT(IN)	-6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE)**																
Axle Height	10.5	X	X	X	19.4	19.3	19.4	19.2	19.1	19.2	19.2	19.2	19.3	19.5	X	X
H-Point	18.9	X	X	17.1	16.9	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.9	17.0	17.1	X
Mid Door	23.8	X	16.9	18.0	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.9	17.0	17.1	17.2	17.0
Window Sill	33.8	18.8	18.5	18.6	18.9	19.0	18.9	18.9	18.9	19.0	19.0	19.0	19.0	19.1	19.2	19.3
Window Top	51.0	X	X	X	X	X	X	28.1	28.1	28.2	28.4	28.5	28.6	28.6	28.8	28.9
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE)**																
Axle Height	10.5	X	X	X	29.0	33.1	33.7	33.7	33.6	33.6	33.4	29.6	25.8	22.6	X	X
H-Point	18.9	X	X	31.7	33.2	33.8	34.3	34.8	35.2	35.6	35.1	36.1	36.1	35.5	20.2	X
Mid Door	23.8	X	26.8	28.8	29.6	30.0	30.6	31.8	31.7	32.3	34.1	33.9	33.4	33.0	29.5	19.2
Window Sill	33.8	22.3	23.4	25.4	28.0	29.4	29.6	30.1	30.6	31.2	33.1	31.1	33.2	33.2	28.6	23.9
Window Top	51.0	X	X	X	X	X	X	25.8	26.0	26.8	27.6	31.1	29.6	28.0	26.4	31.5
STATIC CRUSH (IN)																
Axle Height	10.5	X	X	X	9.6	13.8	14.3	14.5	14.5	14.4	14.2	10.4	6.5	3.1	X	X
H-Point	18.9	X	X	14.6	16.3	17.0	17.5	18.0	18.4	18.8	18.3	19.3	19.2	18.5	3.1	X
Mid Door	23.8	X	9.9	11.8	12.8	13.2	13.8	15.0	14.9	15.5	17.3	17.0	16.4	15.9	12.3	2.2
Window Sill	33.8	3.5	4.9	6.8	9.1	10.4	10.7	11.2	11.7	12.2	14.1	12.1	14.2	14.1	9.4	4.6
Window Top	51.0	X	X	X	X	X	X	-2.3	-2.1	-1.4	-0.8	2.6	1.0	-0.6	-2.4	2.6

* Projected impact point is 37 inches forward of driver's side wheelbase midpoint. Column readings are front to rear from left to right.

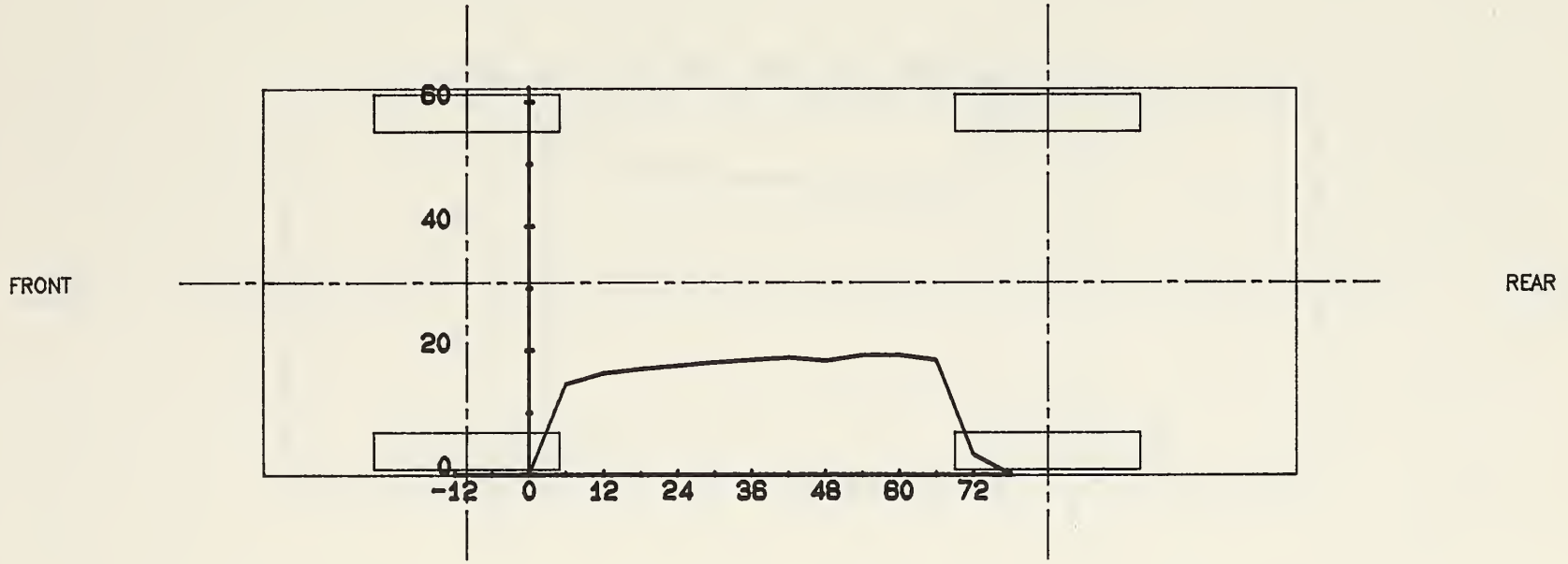
** Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



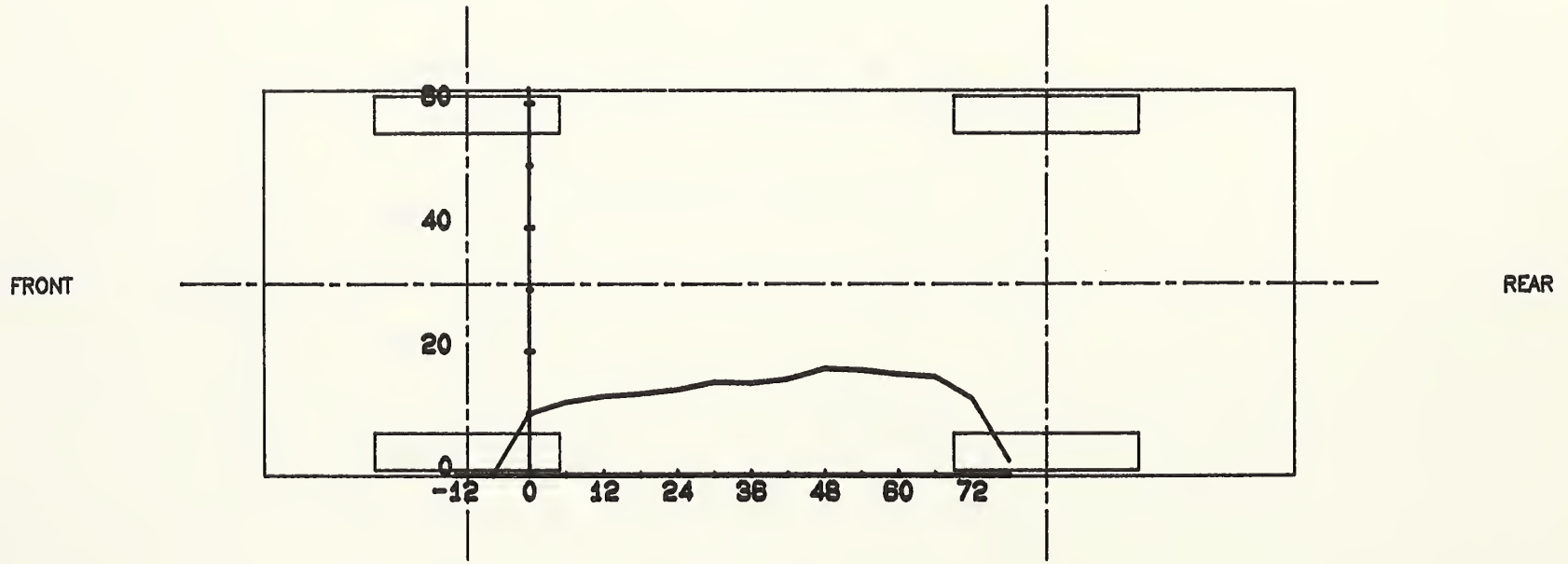
PROFILE LEVEL EQUALS AXLE HEIGHT WHICH IS 10.5 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.037

VEHICLE EXTERIOR STATIC CRUSH PROFILE



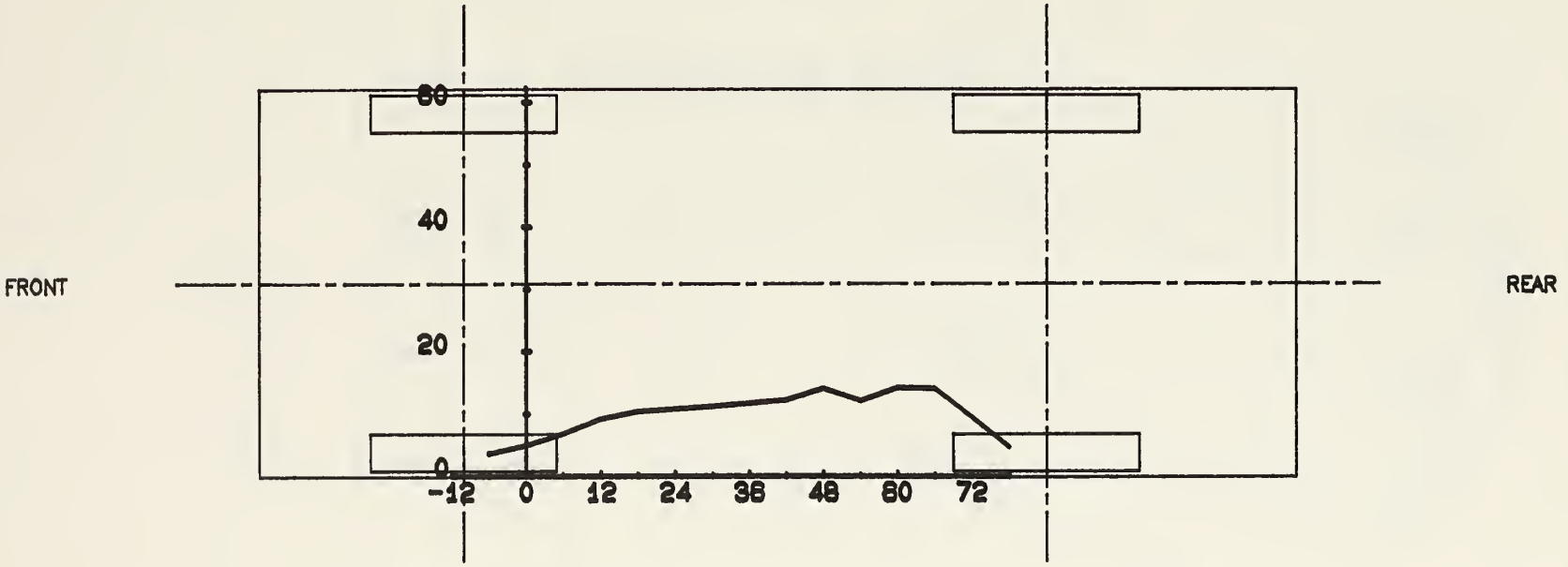
PROFILE LEVEL EQUALS H-POINT HEIGHT WHICH IS 18.9" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.037

VEHICLE EXTERIOR STATIC CRUSH PROFILE



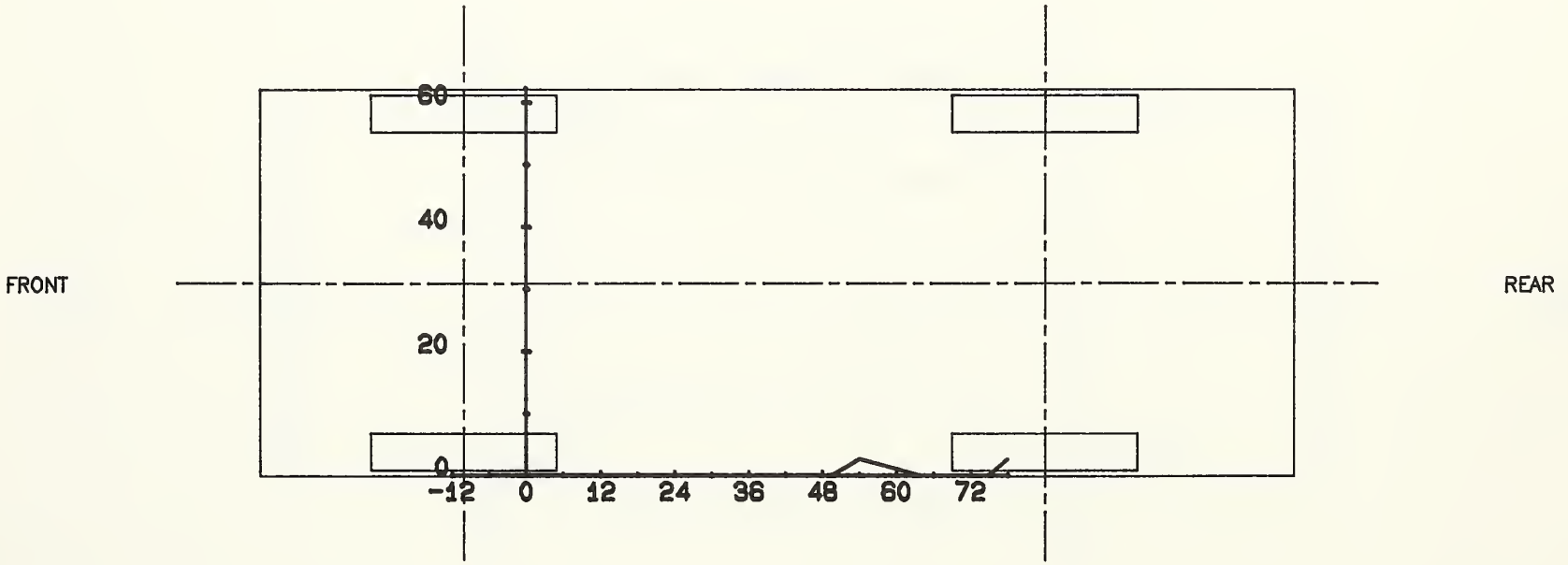
PROFILE LEVEL EQUALS MID DOOR HEIGHT WHICH IS 23.8 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.037

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW SILL HEIGHT WHICH IS 33.8 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.037

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW TOP HEIGHT WHICH IS 51.0 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.037

DUMMY DATA SUMMARY

TEST NUMBER 900521

DRIVER DUMMY
SN: 001

	POSITIVE DIRECTION MAX	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX	NEGATIVE DIRECTION MSEC
HEAD				
LONGITUDINAL ACCEL. (g)	36.7	247.6	16.9	268.6
LATERAL ACCEL. (g)	18.9	70.0	7.5	147.5
DELTA V (MPH)	19.0	121.6		
VERTICAL ACCEL. (g)	17.4	245.5	53.3	48.0
RESULTANT ACCEL. (g)	55.8	48.0		
HIC	210.4 FROM 41.0 TO 58.9 MSEC			
LEFT SHOULDER				
LATERAL ACCEL. (g)	166.0	35.0 Y	67.1	40.0 Y
DELTA V (MPH)	9.5	28.8 Y		
LONGITUDINAL FORCE (N)	1179.2	246.0	307.5	39.0
LATERAL FORCE (N)	4300.6	42.6	904.8	247.3
VERTICAL FORCE (N)	787.5	246.3	617.8	36.3
LATERAL DISPL. (mm)	46.9	43.0	1.7	248.5
UPPER SPINE				
LONGITUDINAL ACCEL. (g)	14.4	260.0	6.5	73.8
LATERAL (P) ACCEL. (g)	67.9	40.0	17.7	60.0
DELTA V (MPH)	25.9	54.4		
LATERAL (R) ACCEL. (g)	69.1	40.0	17.8	59.4
DELTA V (MPH)	26.3	54.4		
VERTICAL ACCEL. (g)	14.9	40.0	8.1	70.0
RESULTANT (P) ACCEL. (g)	69.8	40.0		
RESULTANT (R) ACCEL. (g)	70.9	40.0		
LEFT UPPER THORAX RIB				
LATERAL (P) ACCEL. (g)	174.2	35.6	72.7	40.6
DELTA V (MPH)	9.5	28.8		
LATERAL (R) ACCEL. (g)	176.2	35.6	72.5	40.6
DELTA V (MPH)	10.0	28.8		
LATERAL DISPL. (mm)	46.7	42.6	0.0	16.5

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900521

	DRIVER DUMMY SN: 001			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
LEFT CENTER THORAX RIB				
LATERAL (P) ACCEL. (g)	205.3	35.0	99.2	30.0
DELTA V (MPH)	12.1	28.1		
LATERAL (R) ACCEL. (g)	199.7	35.0	94.2	30.0
DELTA V (MPH)	12.2	28.1		
LATERAL DISPL. (mm)	53.1	41.9	0.0	16.5
LEFT LOWER THORAX RIB				
LATERAL (P) ACCEL. (g)	226.5	35.0	137.2	30.0
DELTA V (MPH)	14.4	28.1		
LATERAL (R) ACCEL. (g)	217.9	35.0	133.2	30.0
DELTA V (MPH)	14.8	28.1		
LATERAL DISPL. (mm)	56.5	41.6	0.4	65.1
THORACIC TRAUMA INDEX				
TTI (P)	151.6			
TTI (R)	146.7			
LOWER SPINE				
LONGITUDINAL ACCEL. (g)	22.2	34.4	15.0	48.1
LATERAL (P) ACCEL. (g)	76.7	36.3	10.9	59.4
DELTA V (MPH)	27.7	55.0		
LATERAL (R) ACCEL. (g)	75.6	36.3	12.0	59.4
DELTA V (MPH)	27.2	55.0		
VERTICAL ACCEL. (g)	26.1	36.3	4.6	126.9
RESULTANT (P) ACCEL. (g)	82.9	35.6		
RESULTANT (R) ACCEL. (g)	81.9	36.3		
LEFT UPPER ABDOMEN				
LATERAL ACCEL. (g)	94.0	58.8	44.1	64.4
DELTA V (MPH)	21.6	40.0		
LATERAL DISPL. (mm)	63.2	41.1	0.1	20.8
LEFT LOWER ABDOMEN				
LATERAL ACCEL. (g)	117.9	21.3	27.5	68.8
DELTA V (MPH)	21.9	38.8		
LATERAL DISPL. (mm)	77.8	40.8	0.4	64.8

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900521

	DRIVER DUMMY SN: 001			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
PELVIS				
LONGITUDINAL ACCEL. (g)	8.7	100.0	23.3	35.6
LATERAL ACCEL. (g)	137.5	31.9	8.2	117.5
DELTA V (MPH)	34.3	105.0		
VERTICAL ACCEL. (g)	27.7	35.0	8.5	40.0
RESULTANT ACCEL. (g)	139.5	31.9		
PELVIS PUBIC SYMPHYSIS				
LATERAL FORCE (N)	4944.8	34.1	87.6	203.6
PELVIS SACRUM				
LATERAL FORCE (N)	687.7	125.3	6272.4	33.0
PELVIS ILIAC				
LATERAL FORCE (N)	3593.4	34.1	290.2	53.9

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	RIGHTWARD	LATERAL:	LEFTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
FORCE:	COMPRESSION	FORCE:	EXTENSION

NOTES:

For dummy channels Delta V is the velocity change at the approximate time of separation from the contact area.

(P) Primary Sensor
(R) Redundant Sensor

γ See TEST ANOMALIES

DUMMY DATA SUMMARY

TEST NUMBER 900521

	PASSENGER DUMMY SN: 002			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
HEAD				
LONGITUDINAL ACCEL. (g)	5.1	194.0	20.8	65.3
LATERAL ACCEL. (g)	46.4	43.9	7.2	194.3
DELTA V (MPH)	26.1	138.8		
VERTICAL ACCEL. (g)	19.3	39.6	21.2	37.9
RESULTANT ACCEL. (g)	46.6	43.9		
HIC	162.5 FROM 39.4 TO 69.4 MSEC			
LEFT SHOULDER				
LATERAL ACCEL. (g)	49.4	40.0	6.0	197.5
DELTA V (MPH)	19.6	65.6		
LATERAL DISPL. (mm)	2.8	51.9	1.0	32.0
UPPER SPINE				
LONGITUDINAL ACCEL. (g)	3.7	108.8	12.1	45.6
LATERAL (P) ACCEL. (g)	39.4	44.4	3.4	191.9
DELTA V (MPH)	19.4	70.0		
VERTICAL ACCEL. (g)	14.1	40.0	16.5	51.9
RESULTANT (P) ACCEL. (g)	41.3	45.0		
LEFT UPPER THORAX RIB				
LATERAL (P) ACCEL. (g)	65.9	40.0	9.7	197.5
DELTA V (MPH)	16.6	66.9		
LATERAL (R) ACCEL. (g)	72.7	40.0	4.1	180.0
DELTA V (MPH)	22.3	67.5		
LATERAL DISPL. (mm)	11.5	49.3	0.1	19.5
LEFT CENTER THORAX RIB				
LATERAL (P) ACCEL. (g)	87.3	38.8	5.0	20.6
DELTA V (MPH)	16.6	44.4		
LATERAL (R) ACCEL. (g)	87.8	38.8	4.6	20.6
DELTA V (MPH)	17.0	44.4		
LATERAL DISPL. (mm)	26.3	48.3	0.5	24.9
LEFT LOWER THORAX RIB				
LATERAL (P) ACCEL. (g)	92.1	37.5	7.2	93.1
DELTA V (MPH)	20.4	43.1		
LATERAL (R) ACCEL. (g)	93.9	38.1	7.7	44.4
DELTA V (MPH)	21.4	43.1		
LATERAL DISPL. (mm)	36.1	47.9	0.4	25.3
THORACIC TRAUMA INDEX				
TTI (P)	85.2			
TTI (R)	84.5			

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 900521

	PASSENGER DUMMY SN: 002			
	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
LOWER SPINE				
LONGITUDINAL ACCEL. (g)	8.9	36.3	7.7	41.9
LATERAL (P) ACCEL. (g)	78.4	37.5	11.8	60.6
DELTA V (MPH)	24.3	54.4		
LATERAL (R) ACCEL. (g)	75.0	37.5	11.2	61.2
DELTA V (MPH)	23.5	54.4		
VERTICAL ACCEL. (g)	60.5	38.8	14.1	88.1
RESULTANT (P) ACCEL. (g)	97.8	38.1		
RESULTANT (R) ACCEL. (g)	95.5	38.1		
LEFT UPPER ABDOMEN				
LATERAL ACCEL. (g)	90.5	25.6	15.7	49.4
DELTA V (MPH)	11.7	30.6		
LATERAL DISPL. (mm)	54.3	41.9	0.2	14.6
LEFT LOWER ABDOMEN				
LATERAL ACCEL. (g)	122.9	23.1	25.2	49.4
DELTA V (MPH)	20.5	39.4		
LATERAL DISPL. (mm)	65.4	42.5	0.1	19.1
PELVIS				
LONGITUDINAL ACCEL. (g)	8.6	66.9	45.8	33.1
LATERAL ACCEL. (g)	153.1	31.3	15.9	40.6
DELTA V (MPH)	27.5	38.8		
VERTICAL ACCEL. (g)	38.2	35.6	18.2	41.2
RESULTANT ACCEL. (g)	159.1	31.3		

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	RIGHTWARD	LATERAL:	LEFTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
FORCE:	COMPRESSION	FORCE:	EXTENSION

NOTES:

For dummy channels Delta V is the velocity change at the approximate time of separation from the contact area.

(P) Primary Sensor
(R) Redundant Sensor

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900521

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	RIGHT SILL AT FRONT SEAT	104.3	23.0	11.3				
	LONGITUDINAL				1.7	86.6	6.0	23.0
	LATERAL				15.2	11.3	2.4	181.4
	VERTICAL				3.5	19.1	3.9	25.4
	RESULTANT				15.8	11.4		
	Delta VY is 13.2 MPH @ 79.6 MSEC							
2	RIGHT SILL AT REAR SEAT	73.0	23.5	10.7				
	LONGITUDINAL				1.5	42.3	5.6	22.5
	LATERAL				16.7	26.6	2.0	184.6
	VERTICAL				4.2	29.6	4.5	35.4
	RESULTANT				17.0	26.5		
	Delta VY is 15.9 MPH @ 79.9 MSEC							
3	REAR DECK OVER AXLE	36.6	0.0	12.5				
	LONGITUDINAL				9.3	42.6	5.9	85.5
	LATERAL				20.7	28.8	2.6	137.6
	VERTICAL				21.3	43.8	24.3	35.4
	RESULTANT				25.6	35.4		
	Delta VY is 18.7 MPH @ 104.0 MSEC							
4	LEFT SILL AT REAR SEAT	70.7	-23.3	11.1				
	LATERAL				40.2	10.6	19.1	35.9
	Delta VY is 12.0 MPH @ 30.9 MSEC							
5	LEFT SILL AT FRONT SEAT	105.7	-23.6	10.3				
	LATERAL				106.0	9.4	51.7	15.0
	Delta VY is 12.9 MPH @ 41.9 MSEC							
6	LEFT FRONT DOOR CENTERLINE	98.0	-25.4	26.7				
	LATERAL				172.1	15.1	167.1	28.4
	Delta VY is 27.0 MPH @ 23.1 MSEC							
7	RIGHT TRUNK FLOOR	39.4	15.8	38.8				
	LONGITUDINAL				1.4	151.8	6.0	15.5
8	LEFT REAR DOOR MID CENTERLINE	58.9	-24.9	29.7				
	LATERAL				82.5	11.5	73.9	29.1
	Delta VY is 26.6 MPH @ 23.2 MSEC							

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY CONTINUED

TEST NUMBER 900521

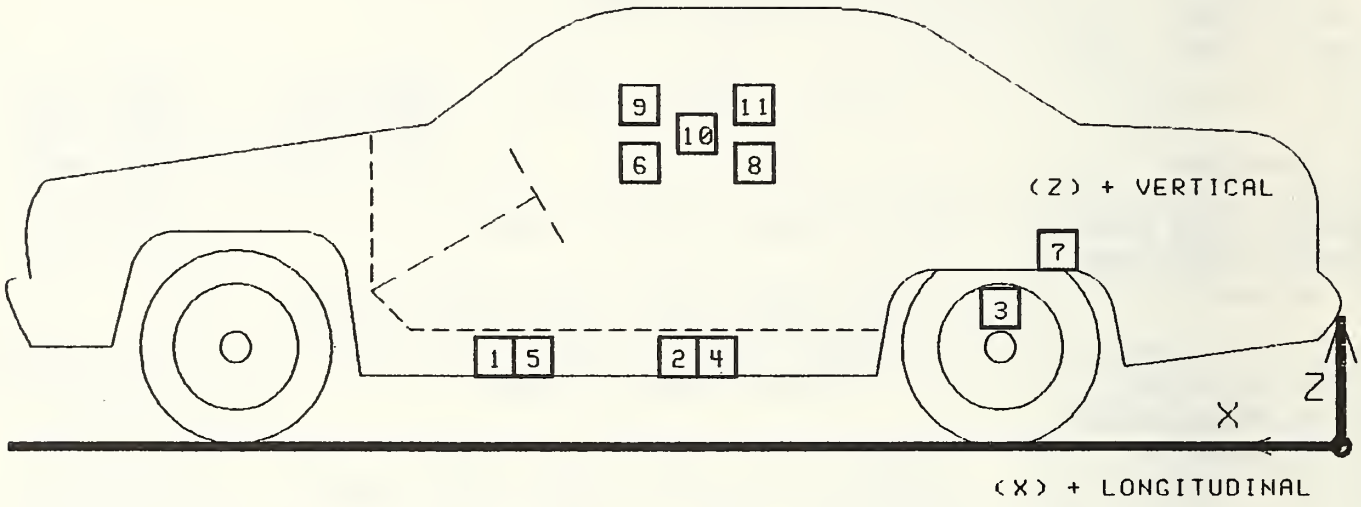
No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
9	UPPER LEFT FRONT DOOR CENTERLINE	98.0	-25.1	32.8				
	LATERAL				145.5	22.3	180.6	31.1
	Delta VY is 27.4 MPH @ 23.9 MSEC							
10	MIDFRONT OF LEFT FRONT DOOR	92.9	-25.5	27.6				
	LATERAL				131.4	15.6	138.7	29.1
	Delta VY is 26.5 MPH @ 22.6 MSEC							
11	LEFT REAR DOOR UPPER CENTERLINE	62.9	-24.7	32.5				
	LATERAL				114.0	16.8	60.7	31.6
	Delta VY is 27.7 MPH @ 24.8 MSEC							

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

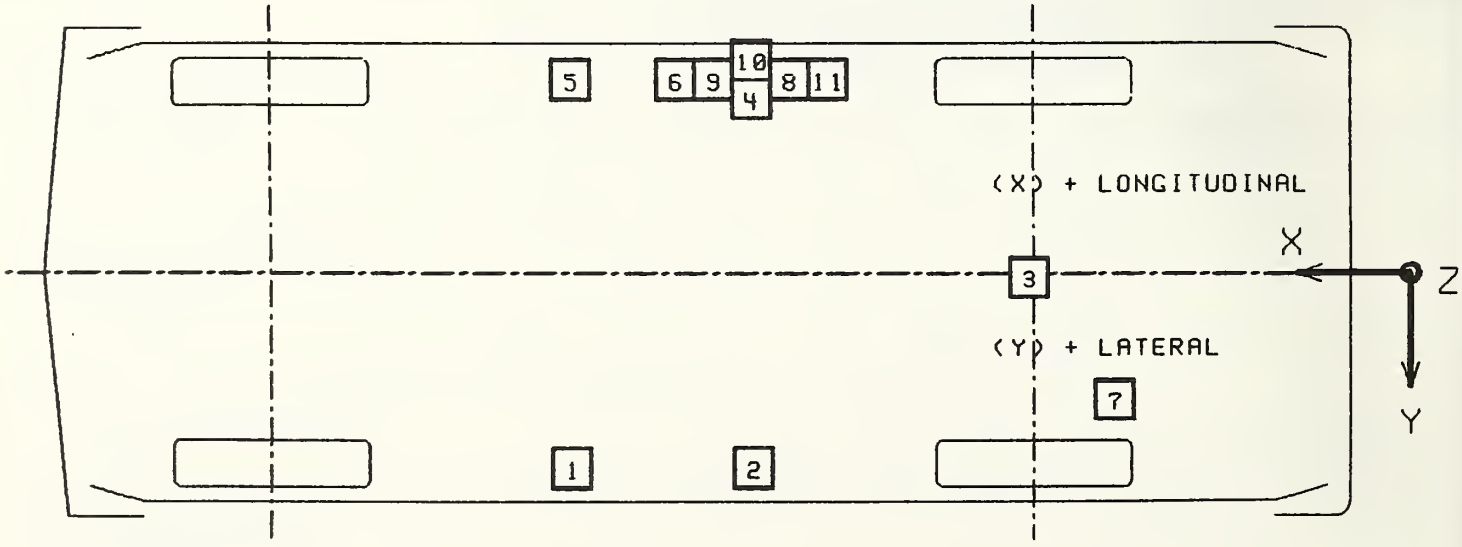
REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + RIGHTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

All measurements of accelerometer locations in inches.

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900521

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	CENTER OF GRAVITY	74.2	0.0	12.2				
	LONGITUDINAL				1.2	186.9	15.3	38.1
	LATERAL				2.2	56.1	6.2	26.3
	VERTICAL				4.7	31.1	5.0	23.0
	RESULTANT				17.1	37.9		
	Delta VX is 16.8 MPH @ 126.4 MSEC							
	Delta VY is 3.9 MPH @ 126.4 MSEC							
2	REAR FRAME MEMBER	19.2	0.0	12.0				
	LONGITUDINAL				31.4	51.0 Y	330.0	44.4 Y
	LATERAL				5.8	22.6	2.2	99.4
	Delta VX is 52.8 MPH @ 49.4 MSEC Y							
	Delta VY is -1.8 MPH @ 49.4 MSEC							

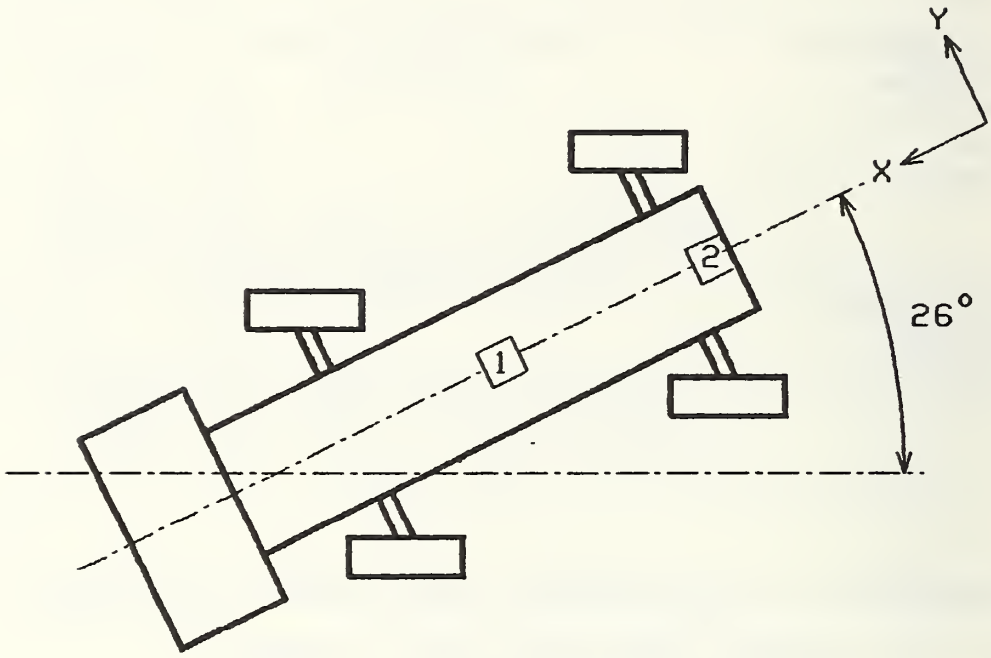
* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR POINT OF FRAME
Y: + RIGHTWARD FROM BARRIER CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

All measurements of accelerometer locations in inches.

Y See TEST ANOMALIES

MOVING BARRIER ACCELEROMETER PLACEMENT

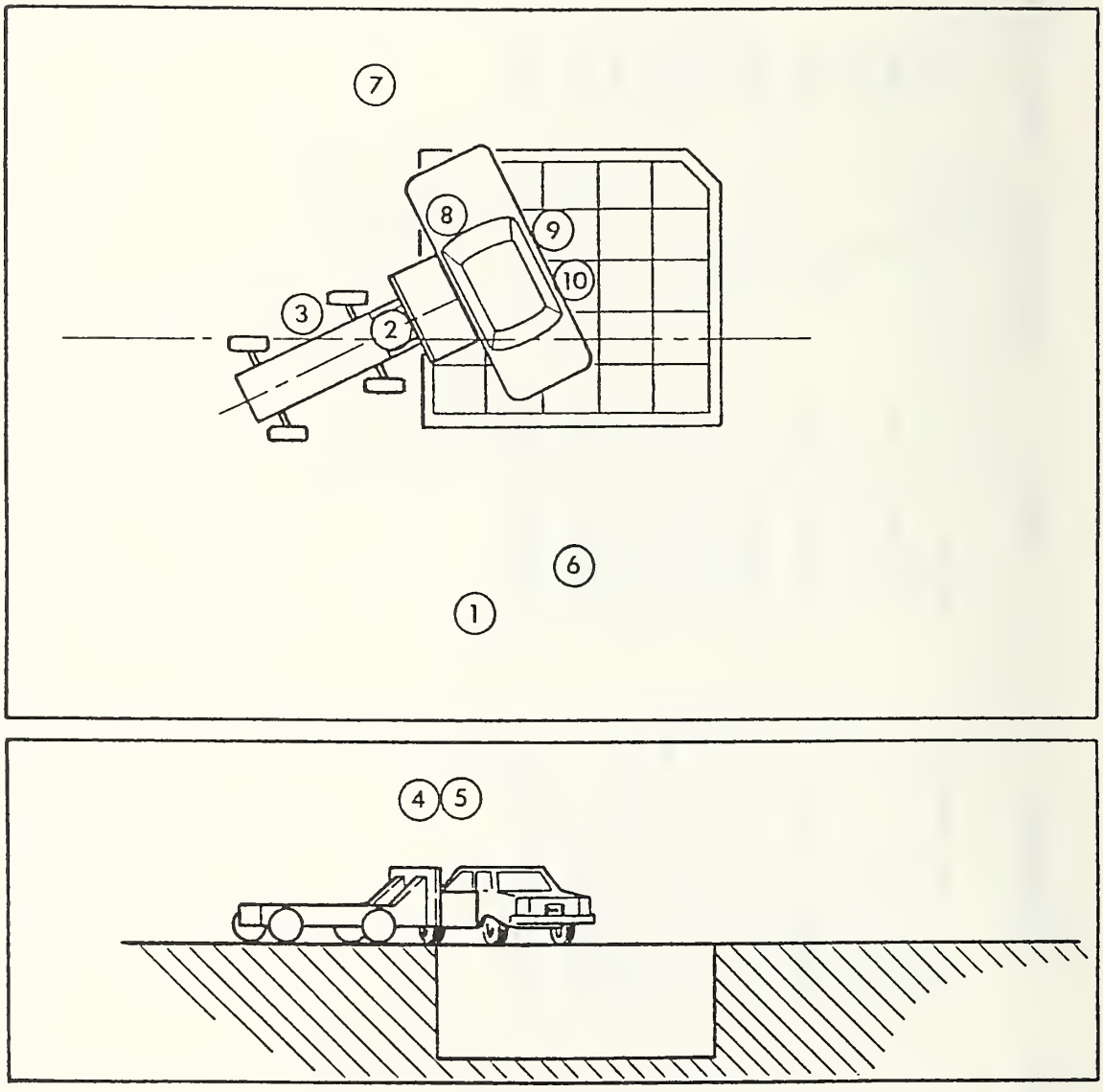


TOP VIEW

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side panning	Kodak	25	24	Real time documentation
2	Onboard MDB - wide	Photosonic 1B	13	895	Dummy kinematics
3	Onboard MDB - tight	Photosonic 1B	25	1005	Close-up of impact point
4	Overhead - wide	Photosonic 1B	8.5	500	Vehicle dynamics
5	Overhead - tight	Photosonic 1B	25	500	Close-up vehicle dynamic
6	Ground level - right	Photosonic 1B	25	490	Overall view
7	Ground level - left	Photosonic 1B	13	502	Overall view
8	Onboard windshield	Photosonic 1B	8	1000	Driver kinematics - Frt.
9	Onboard driver	Photosonic 1B	8	1000	Driver kinematics
10	Onboard passenger	Photosonic 1B	8	1002	Passenger kinematics

CAMERA LOCATION



APPENDIX A

PHOTOGRAPHS

Figure A-1. PRE-TEST VEHICLE FRONT AND BARRIER VIEW

Figure A-2. POST-TEST VEHICLE FRONT AND BARRIER VIEW

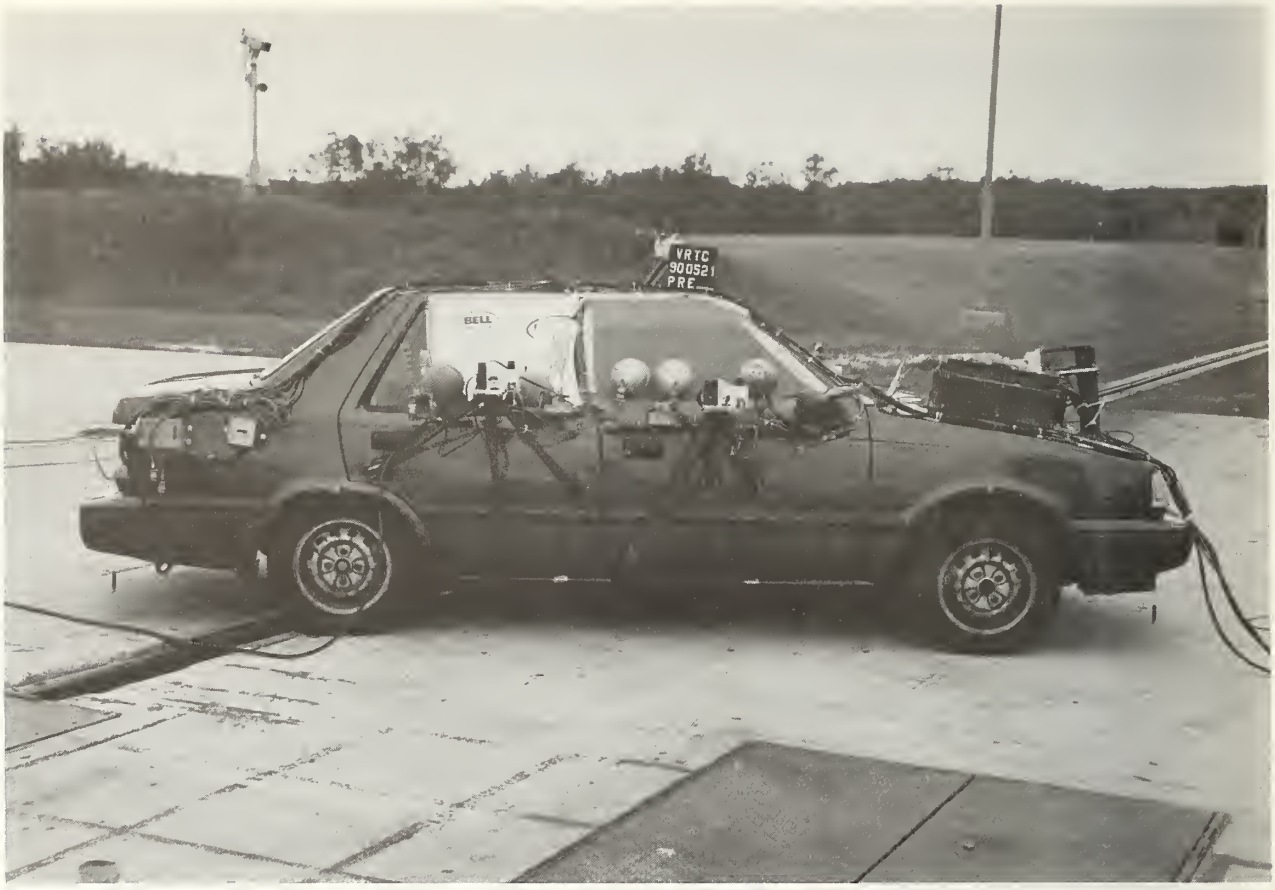


Figure A-3. PRE-TEST VEHICLE RIGHT SIDE VIEW

Figure A-4. POST-TEST VEHICLE RIGHT SIDE VIEW

Figure A-5. PRE-TEST VEHICLE REAR AND BARRIER VIEW

Figure A-6. POST-TEST VEHICLE REAR AND BARRIER VIEW

Figure A-7. PRE-TEST VEHICLE LEFT AND BARRIER VIEW

Figure A-8. POST-TEST VEHICLE LEFT SIDE VIEW

Figure A-9. PRE-TEST VEHICLE LEFT FRONT CLOSE-UP VIEW

Figure A-10. POST-TEST VEHICLE LEFT FRONT CLOSE-UP VIEW

Figure A-11. PRE-TEST VEHICLE LEFT REAR CLOSE-UP VIEW

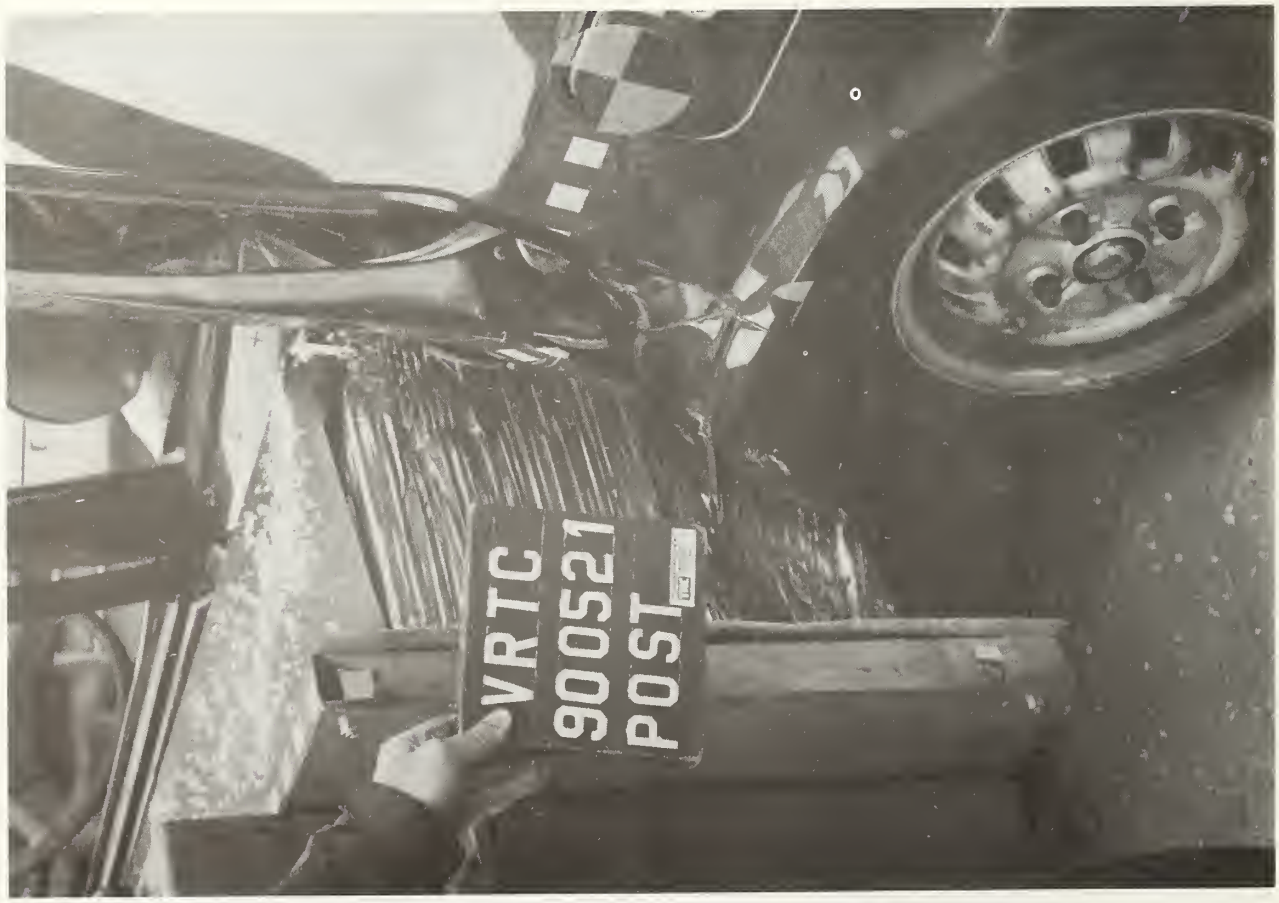


Figure A-12. POST-TEST VEHICLE LEFT REAR CLOSE-UP VIEW

Figure A-13. PRE-TEST VEHICLE TOP - VIEW 1

Figure A-14. PRE-TEST VEHICLE TOP - VIEW 2

Figure A-15. POST-TEST VEHICLE TOP - VIEW 1

Figure A-16. POST-TEST VEHICLE TOP - VIEW 2

Figure A-17. PRE-TEST LEFT FRONT DOOR ACCELEROMETERS VIEW

Figure A-18. PRE-TEST LEFT FRONT SILL ACCELEROMETER VIEW

Figure A-19. PRE-TEST LEFT REAR DOOR ACCELEROMETERS VIEW

Figure A-20. PRE-TEST LEFT REAR SILL ACCELEROMETER VIEW

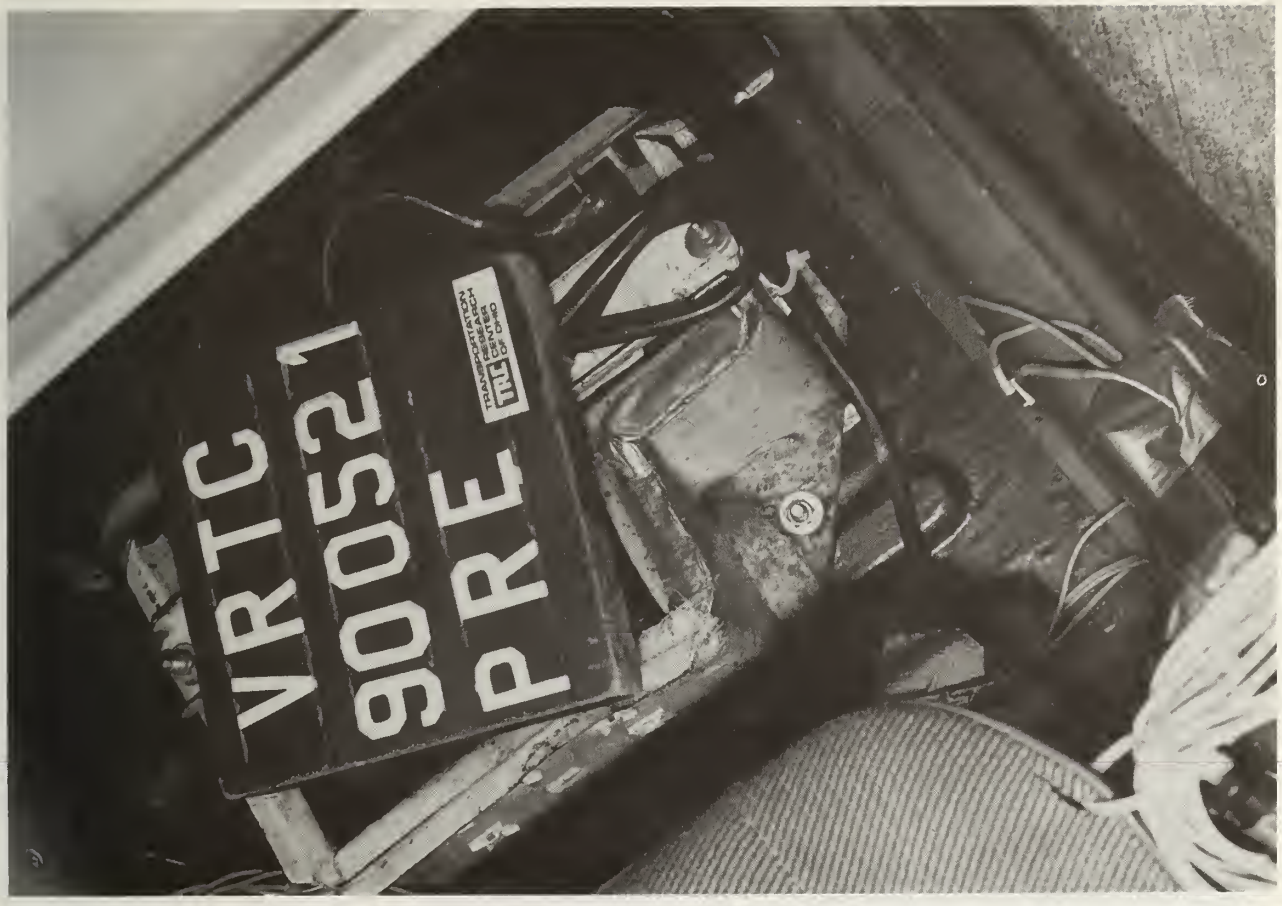


Figure A-21. PRE-TEST RIGHT FRONT SILL ACCELEROMETERS VIEW

Figure A-22. PRE-TEST RIGHT REAR SILL ACCELEROMETER VIEW

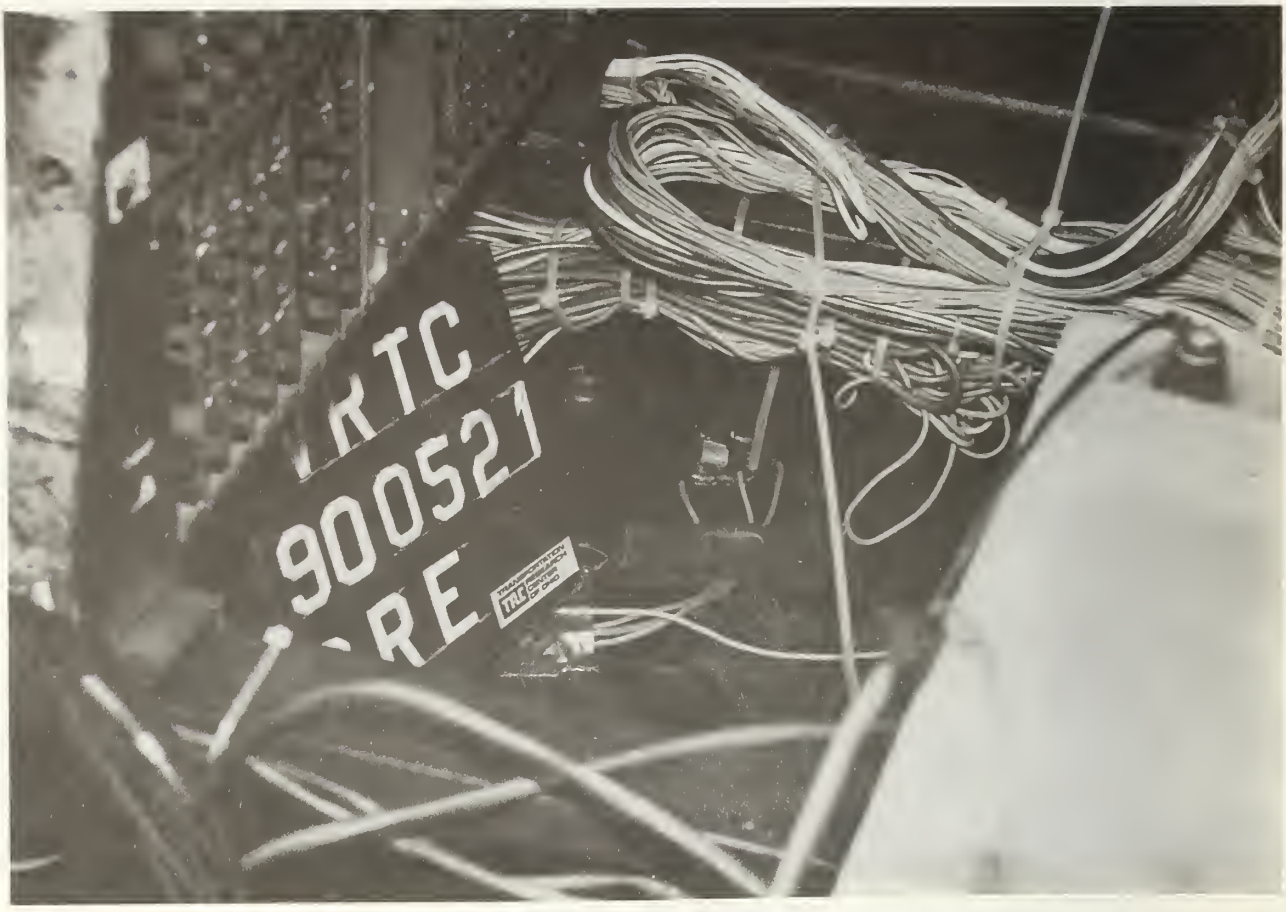


Figure A-23. PRE-TEST TRUNK AREA ACCELEROMETER - VIEW 1

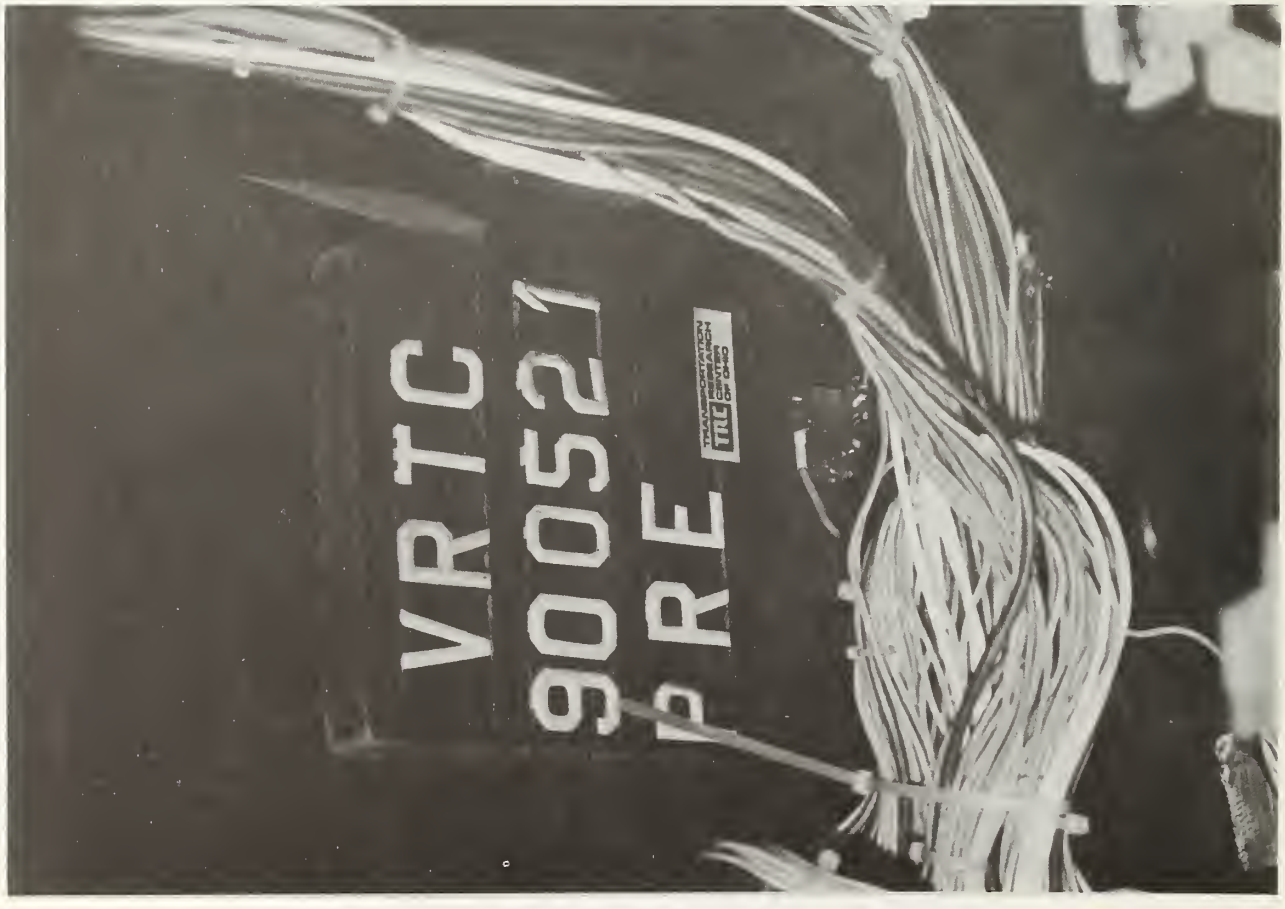


Figure A-24. PRE-TEST TRUNK AREA ACCELEROMETER - VIEW 2

Figure A-25. PRE-TEST DRIVER AND PASSENGER DUMMIES LEFT SIDE VIEW

Figure A-26. POST-TEST DRIVER AND PASSENGER DUMMIES RIGHT SIDE VIEW

Figure A-27. PRE-TEST DRIVER DUMMY - VIEW 1

Figure A-28. PRE-TEST DRIVER DUMMY - VIEW 2

Figure A-29. PRE-TEST DRIVER DUMMY - VIEW 3

Figure A-30. POST-TEST DRIVER DUMMY VIEW

Figure A-31. PRE-TEST PASSENGER DUMMY - VIEW 1

Figure A-32. PRE-TEST PASSENGER DUMMY - VIEW 2

Figure A-33. PRE-TEST PASSENGER DUMMY - VIEW 3

Figure A-34. POST-TEST PASSENGER DUMMY VIEW

Figure A-35. POST-TEST DRIVER DUMMY CONTACT - VIEW 1

Figure A-36. POST-TEST DRIVER DUMMY CONTACT - VIEW 2

Figure A-37. POST-TEST PASSENGER DUMMY CONTACT - VIEW 1

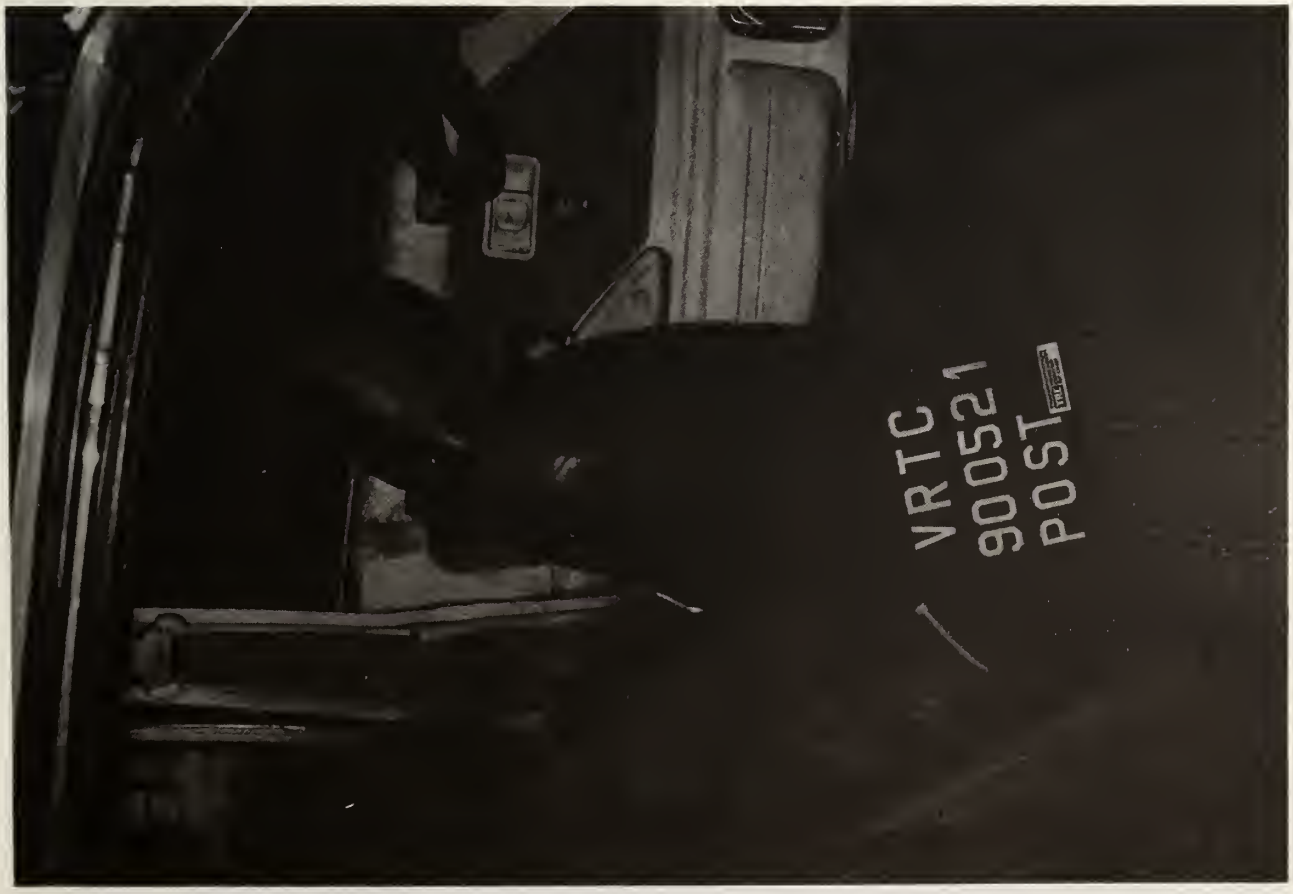


Figure A-38. POST-TEST PASSENGER DUMMY CONTACT - VIEW 2

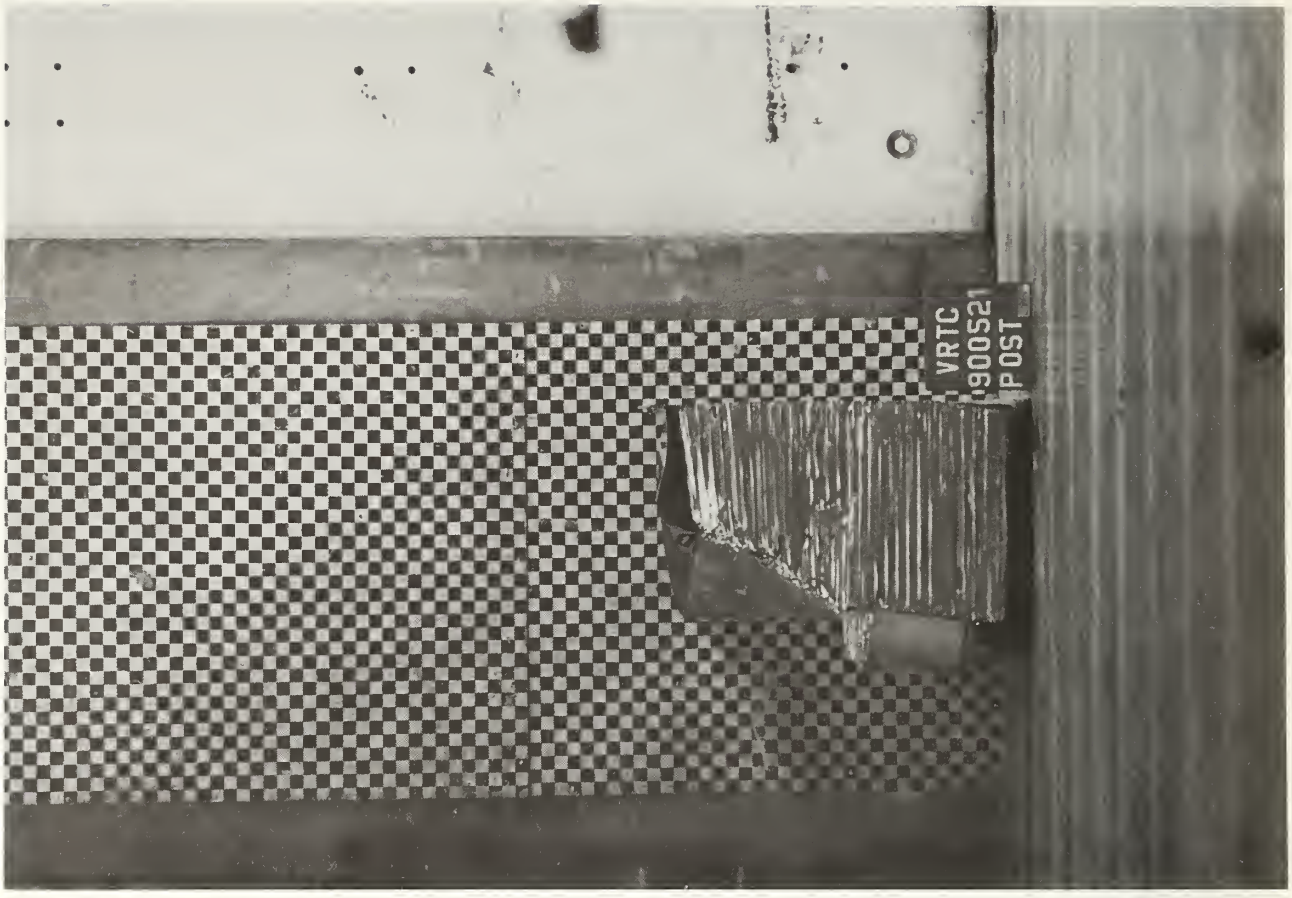


Figure A-39. POST-TEST BARRIER FACE - VIEW 1

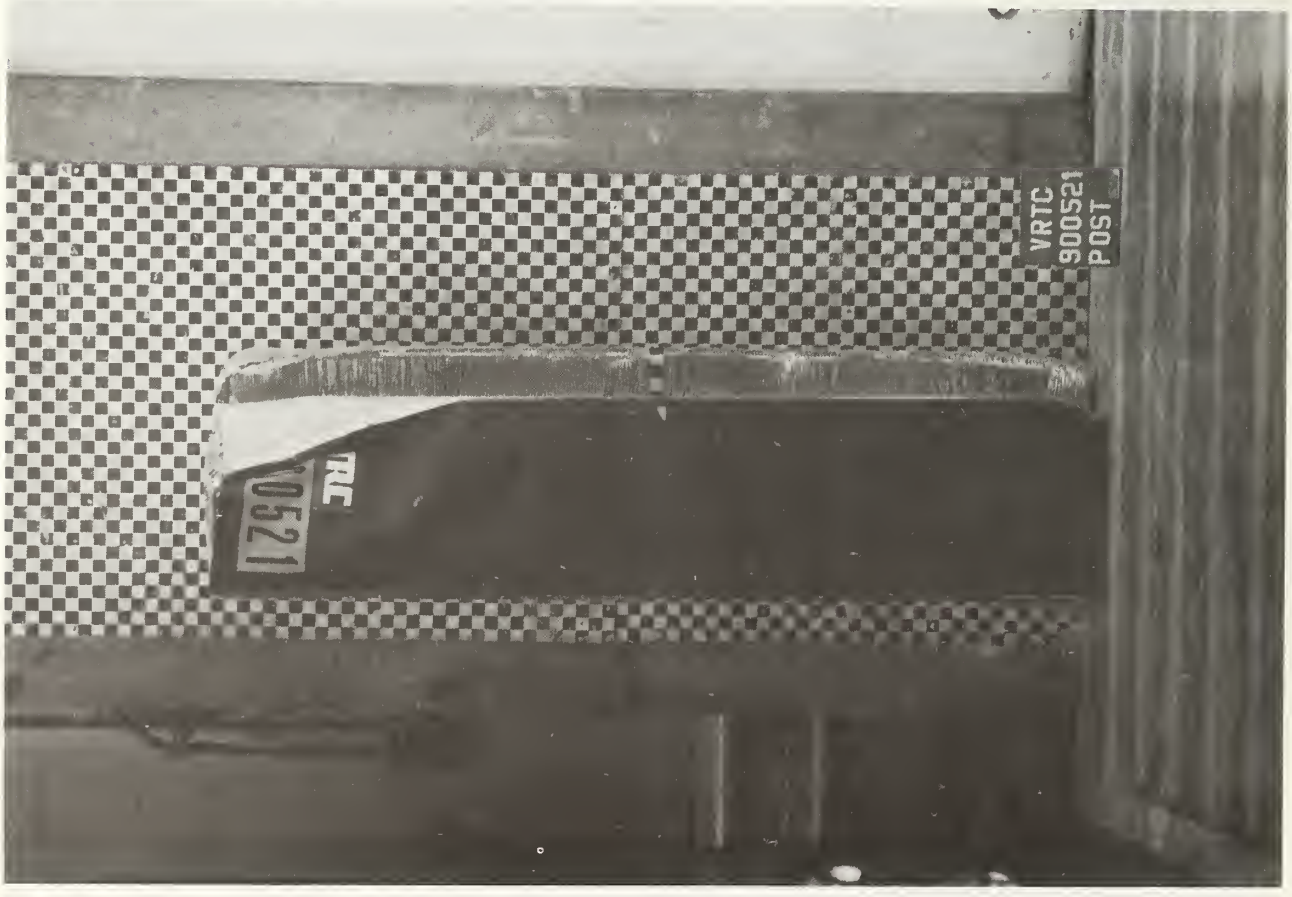
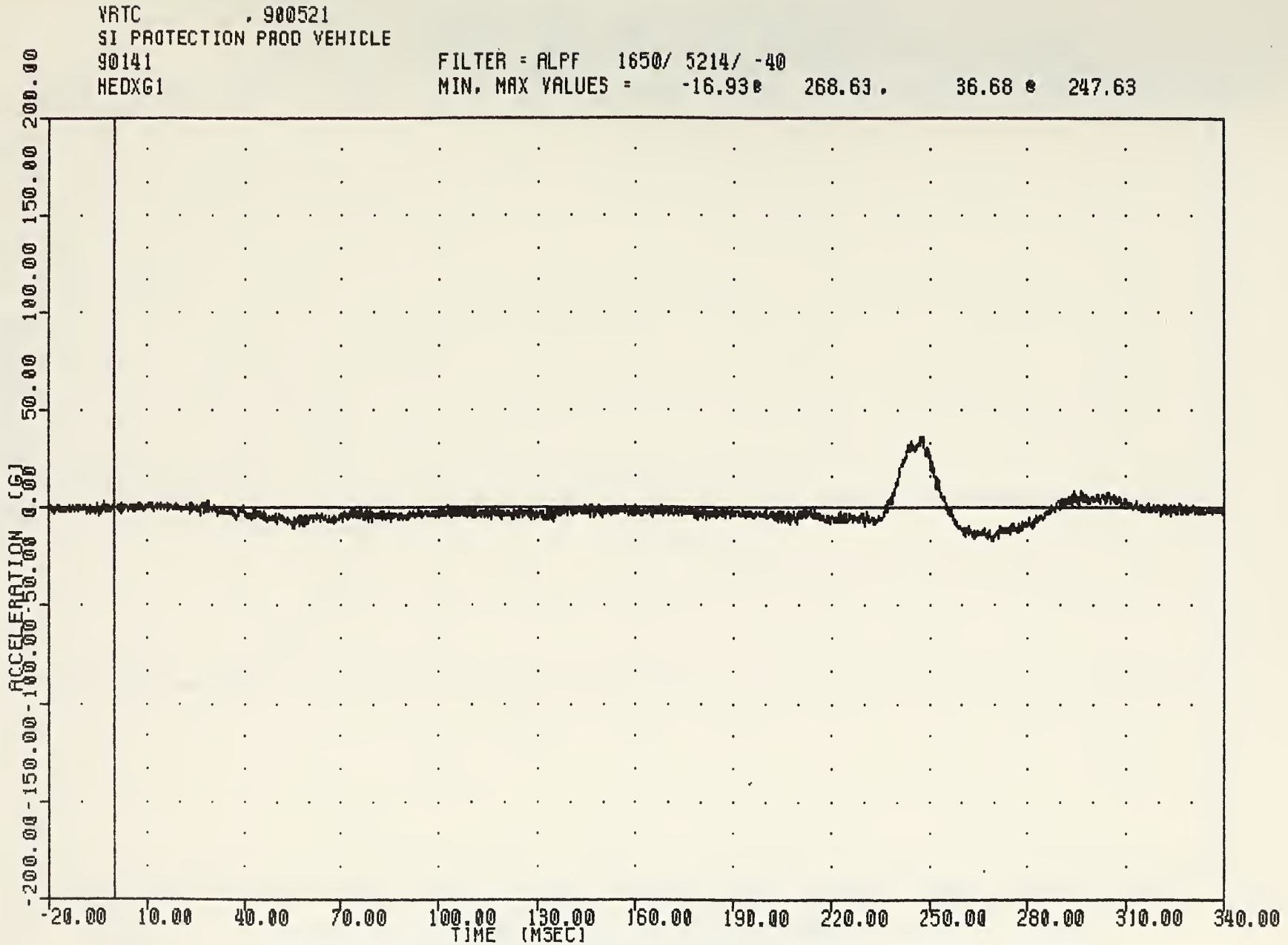


Figure A-40. POST-TEST BARRIER FACT - VIEW 2

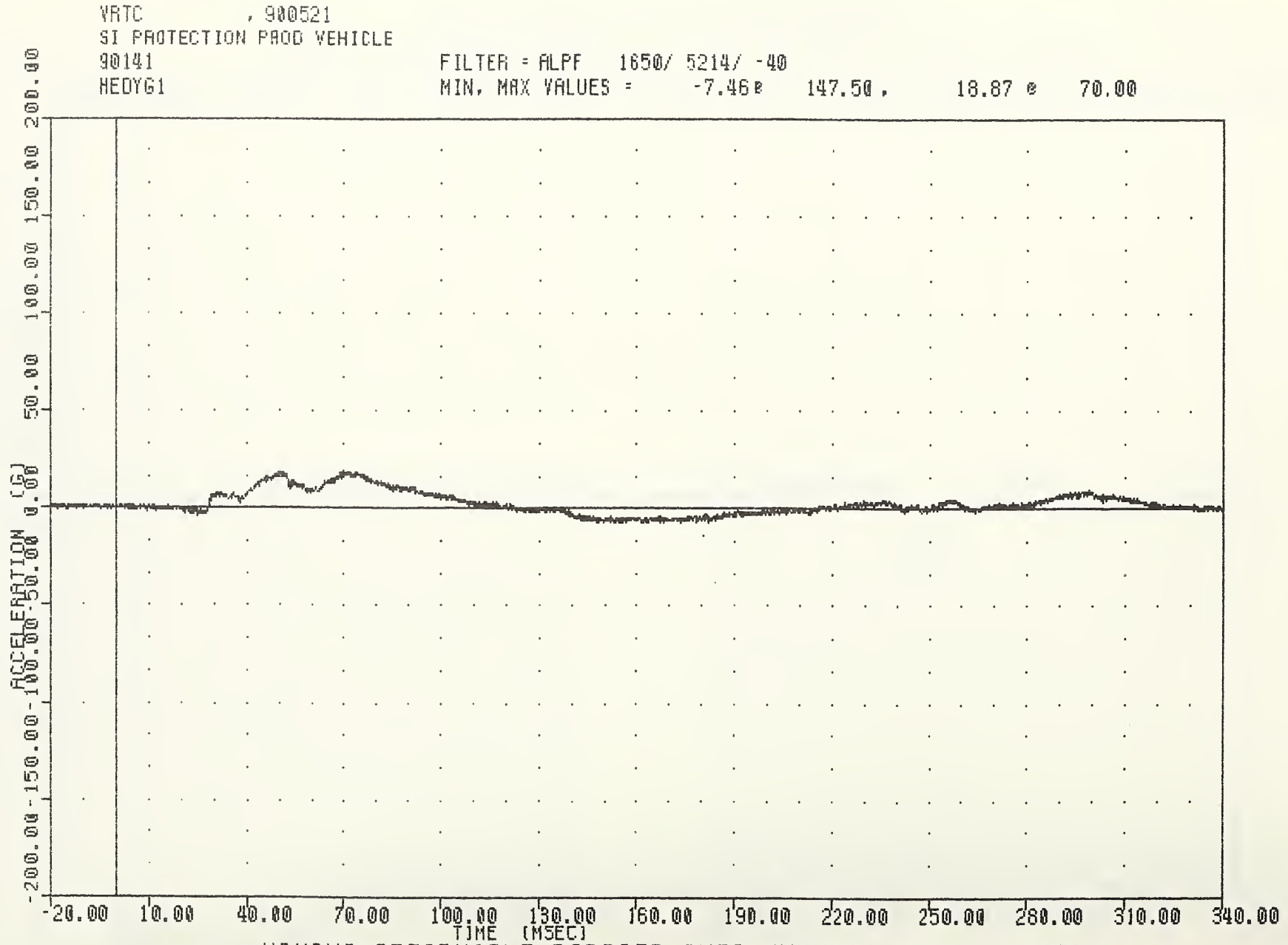
APPENDIX B

DATA PLOT PRESENTATION

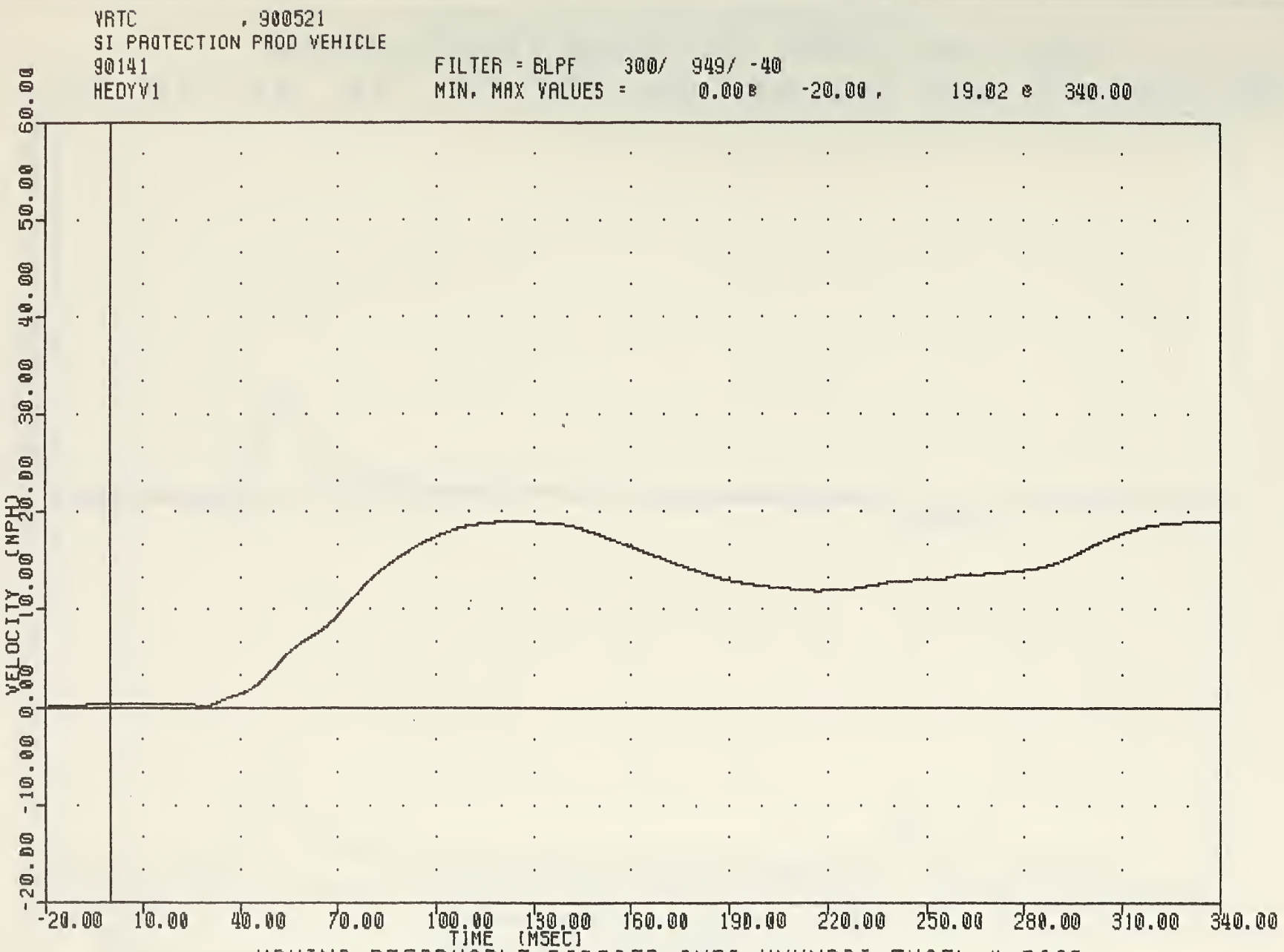
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211b, except that dummy thorax and pelvis data were filtered using the HSRI filter.



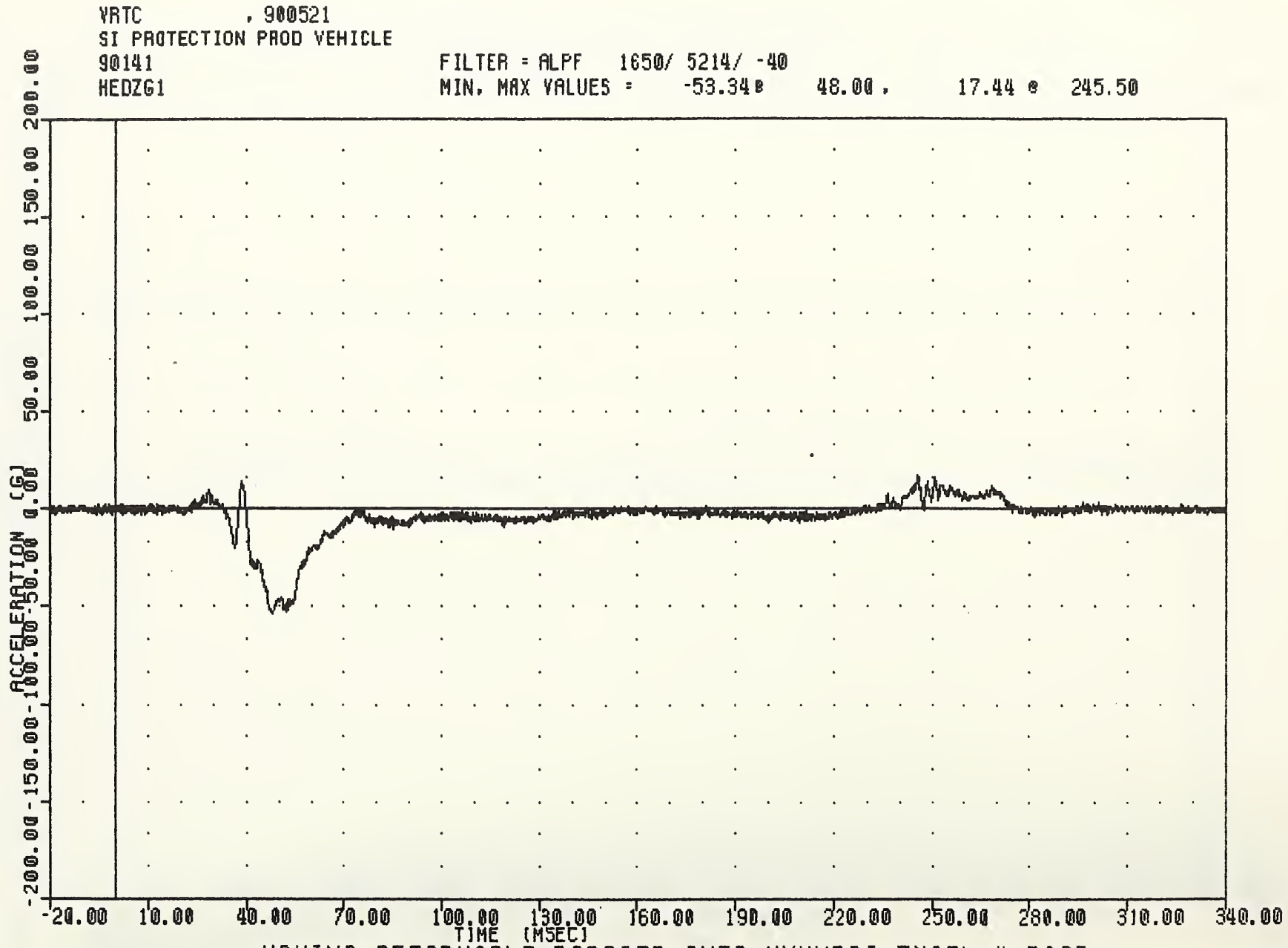
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER HEAD X-AXIS ACCELERATION



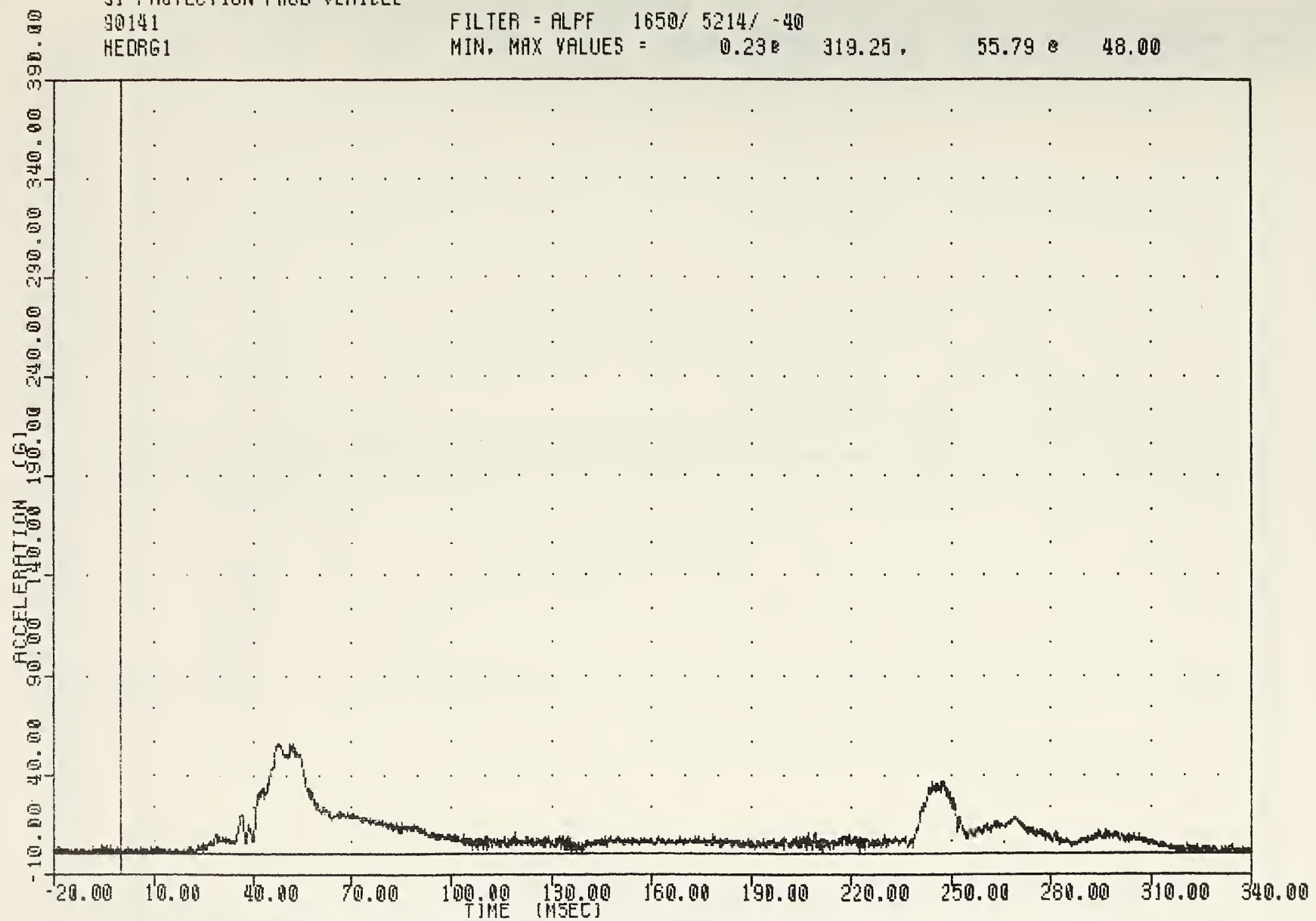
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER HEAD Y-AXIS ACCELERATION



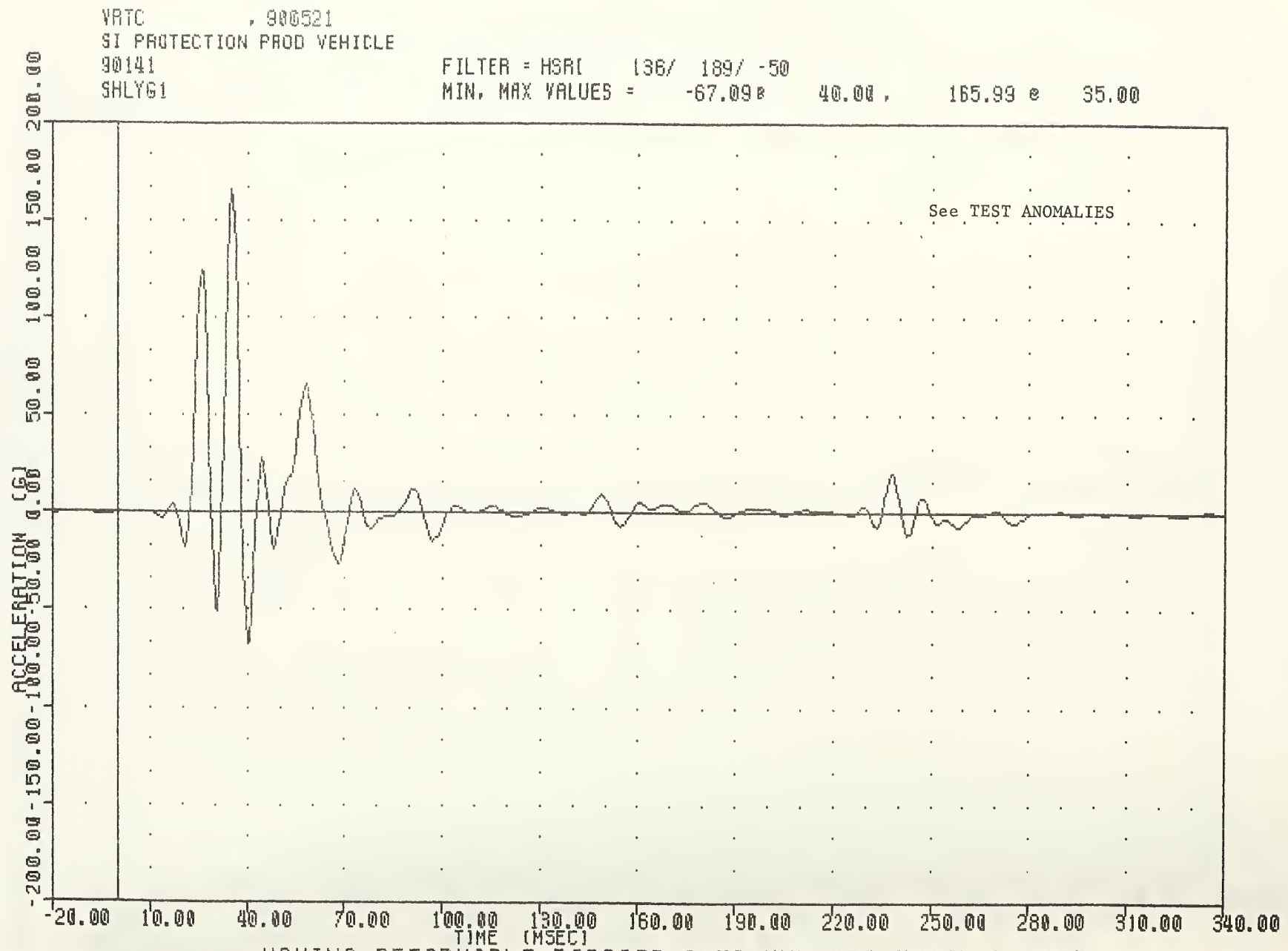
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER HEAD Y-AXIS VELOCITY



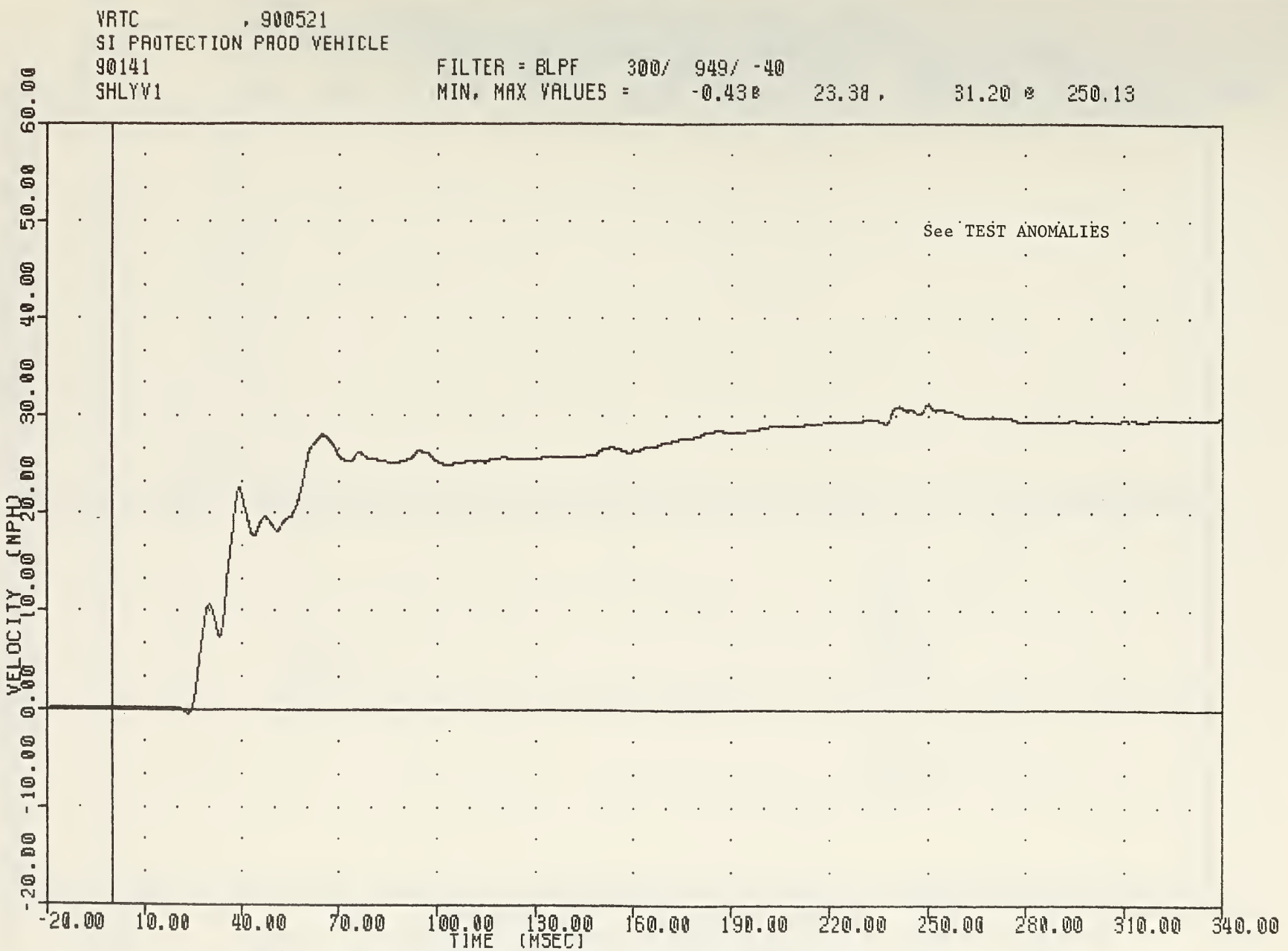
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER HEAD Z-AXIS ACCELERATION



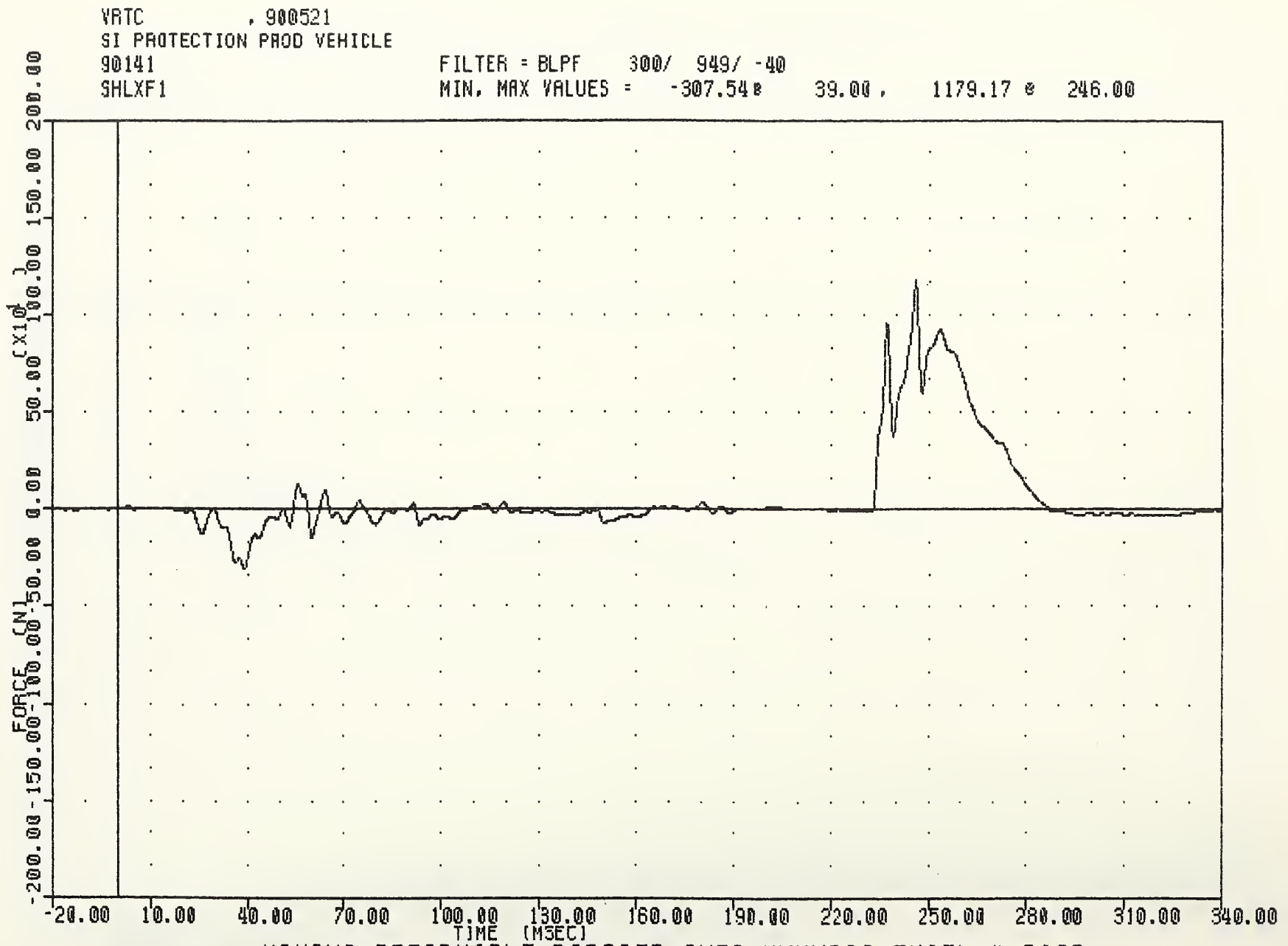
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER HEAD RESULTANT ACCELERATION



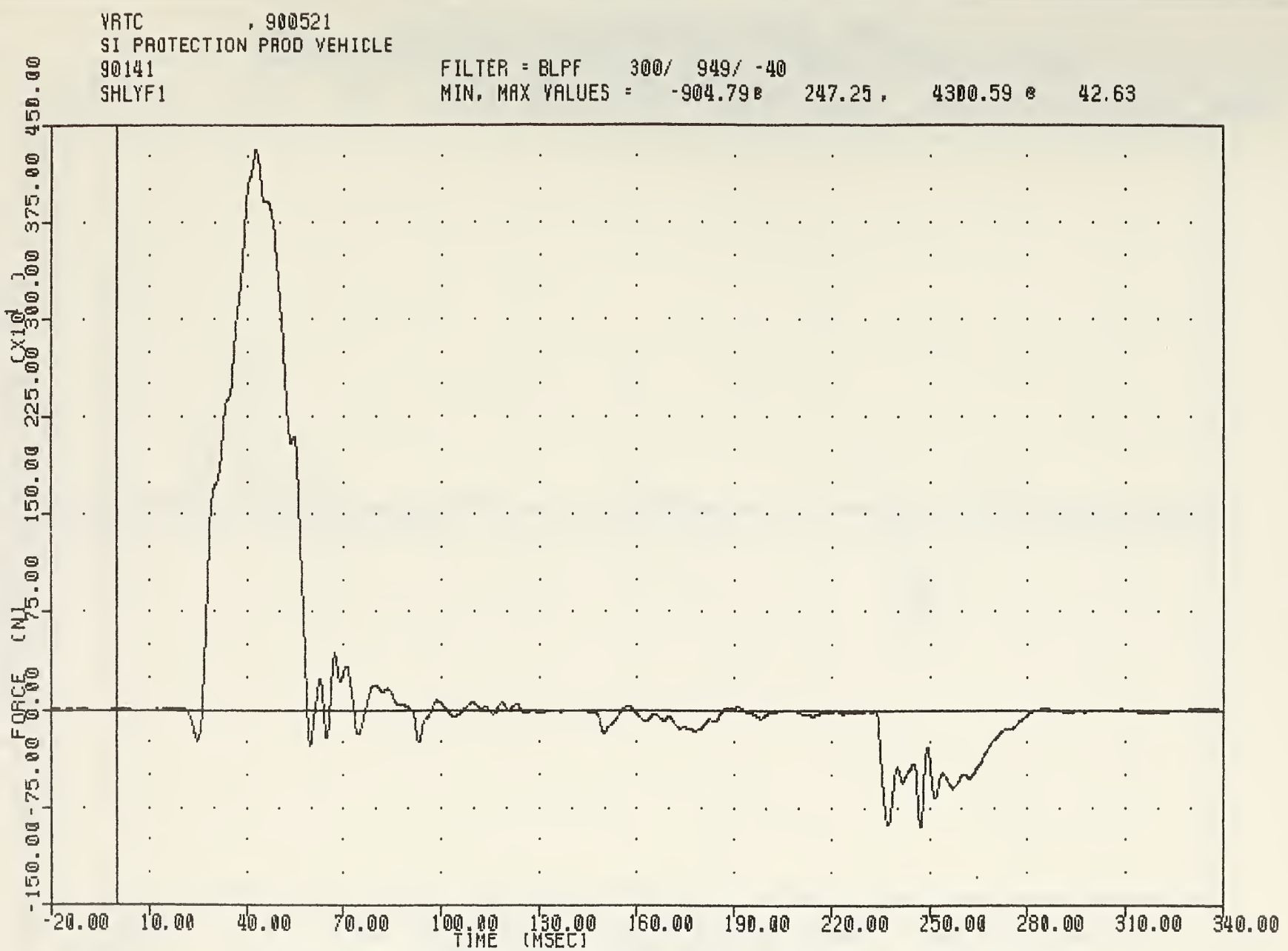
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER Y AXIS ACCELERATION



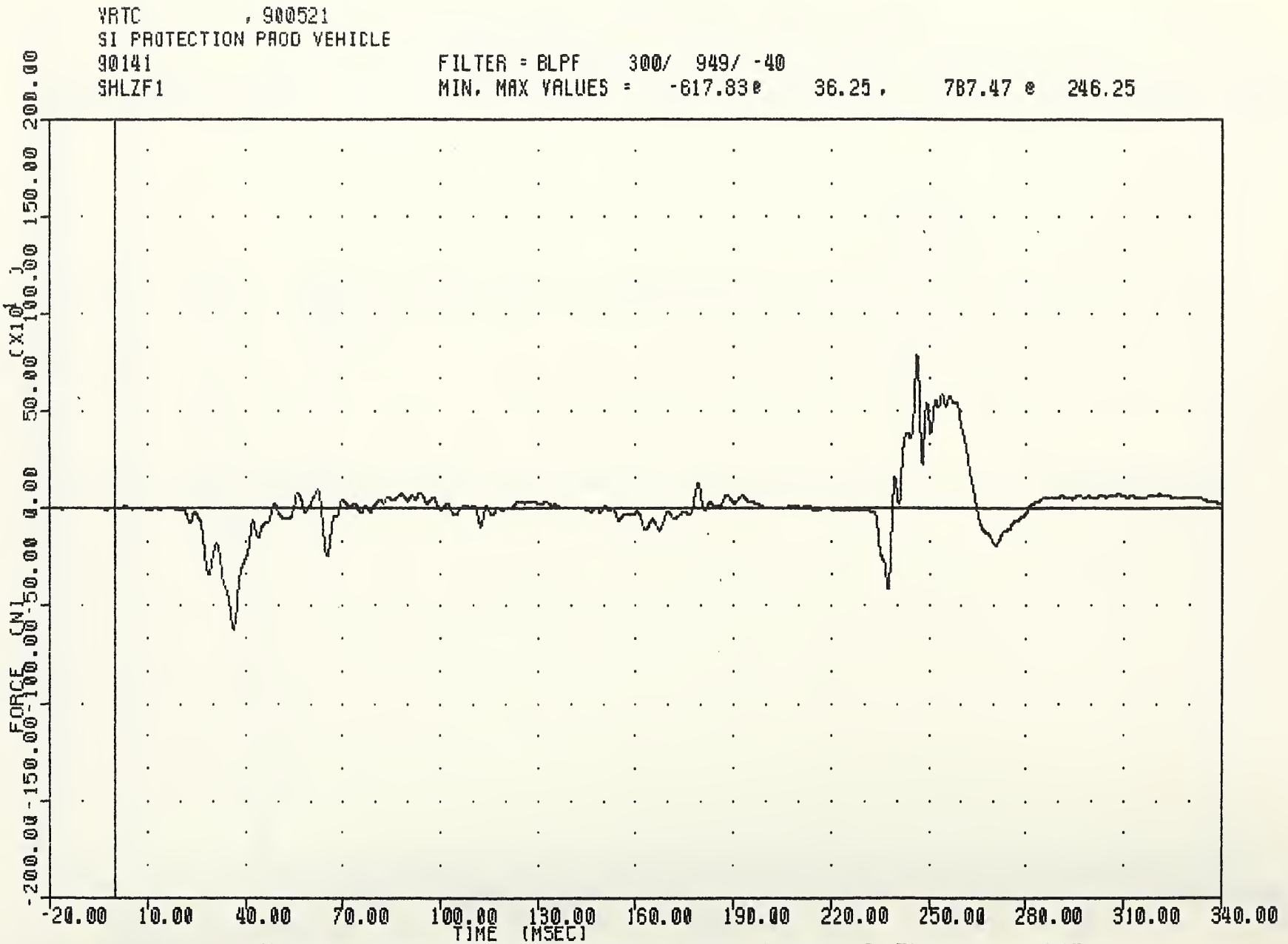
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER Y-AXIS VELOCITY



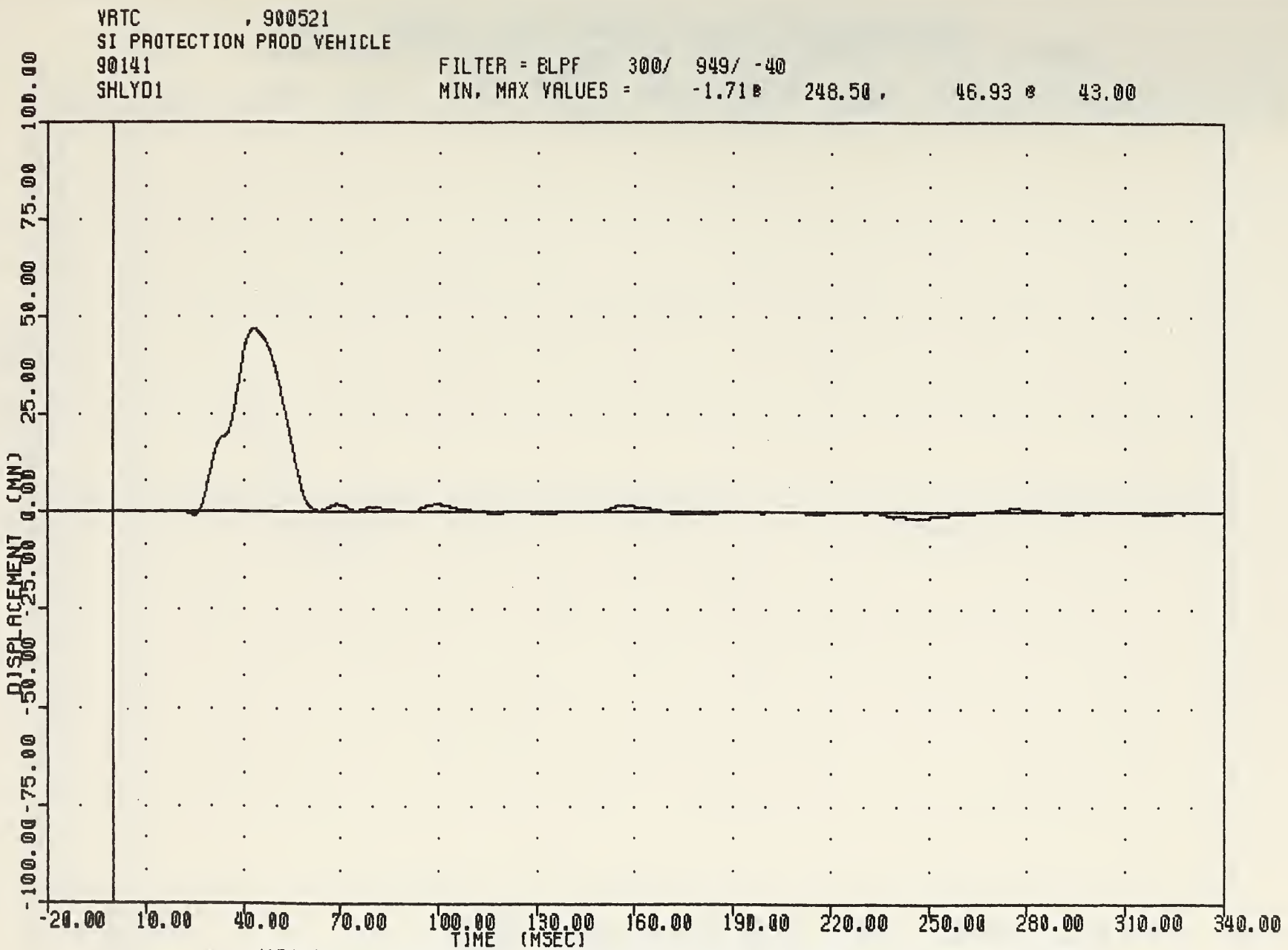
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER X-AXIS FORCE



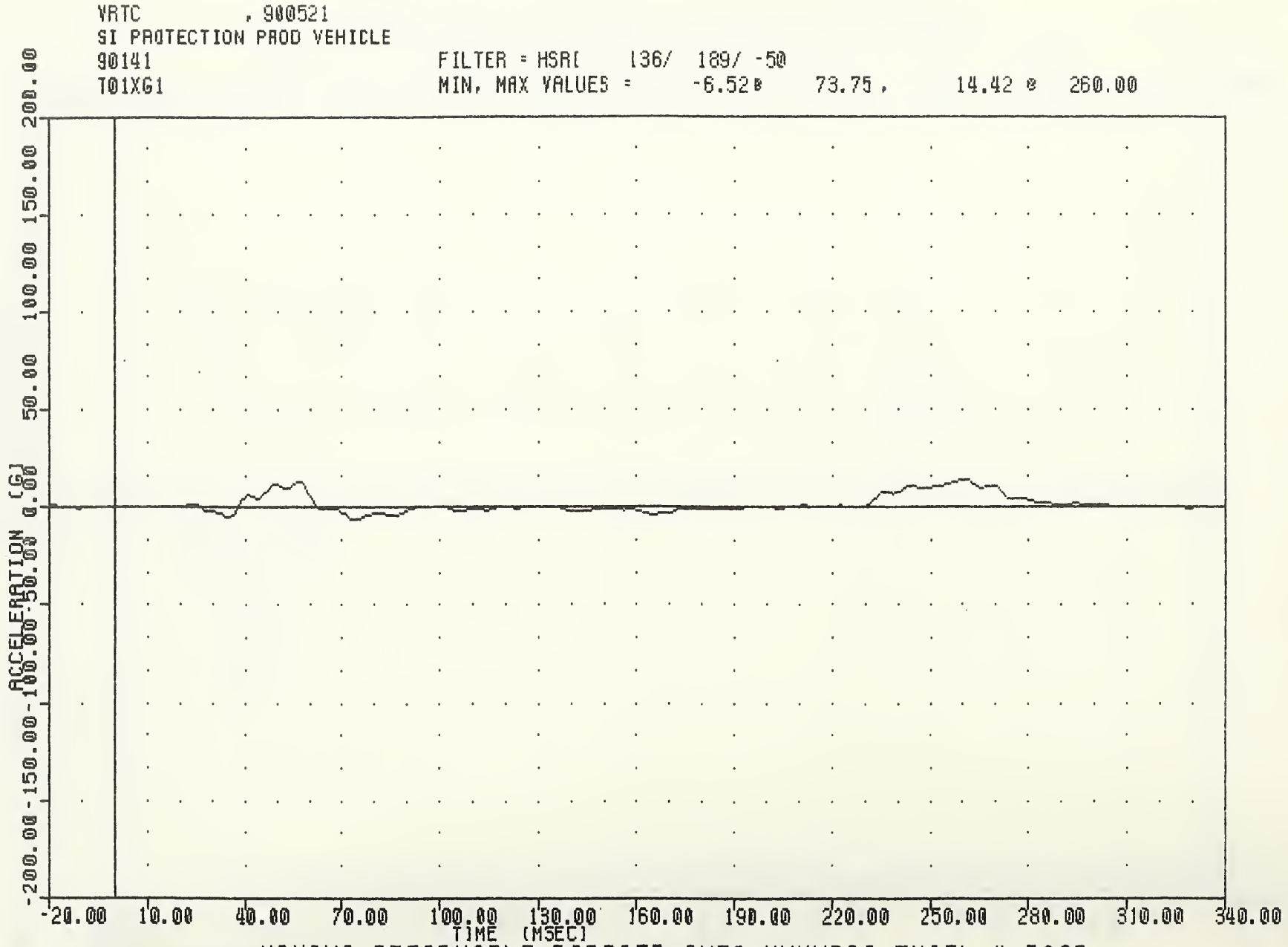
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER Y-AXIS FORCE



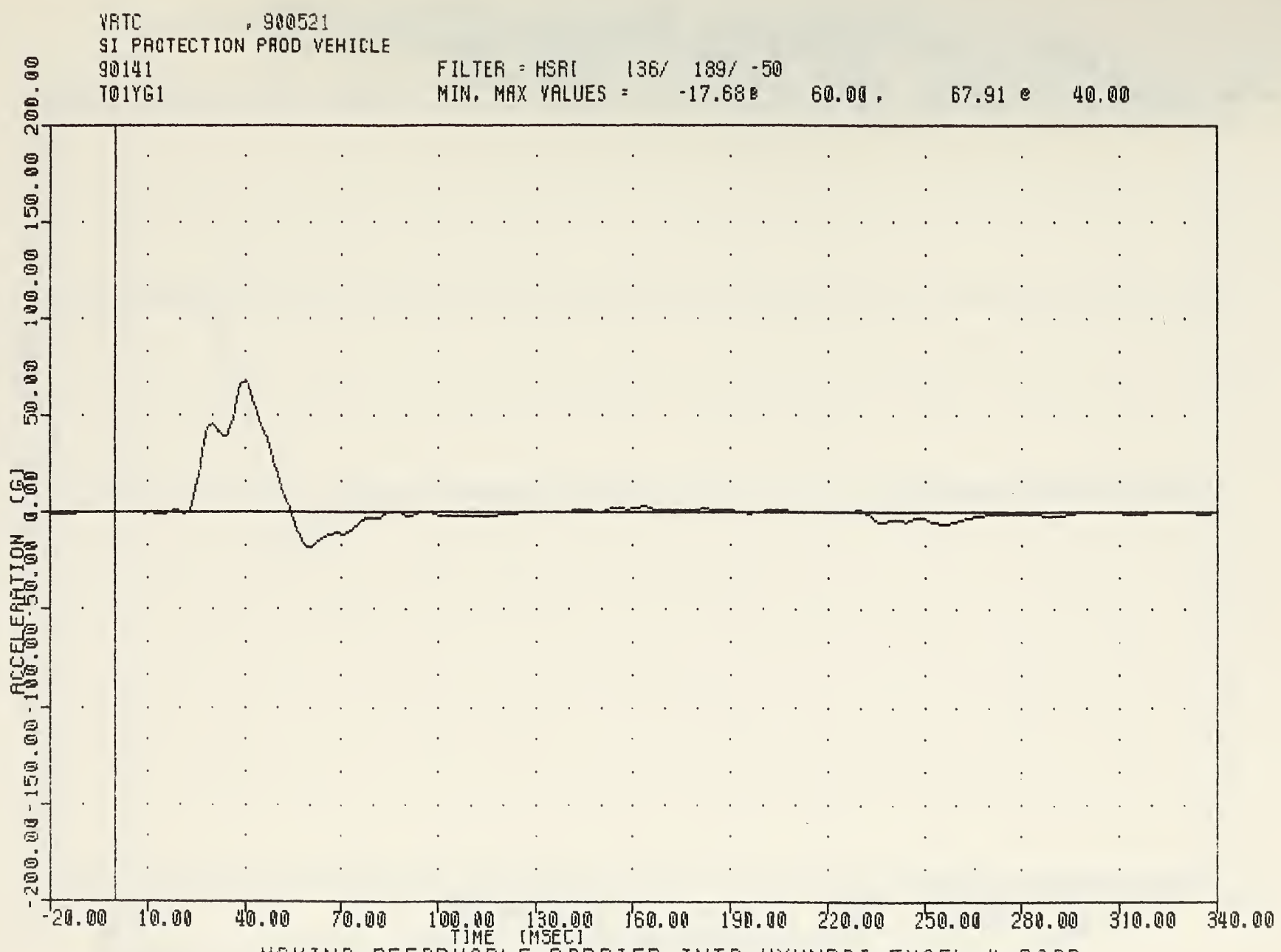
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER Z-AXIS FORCE



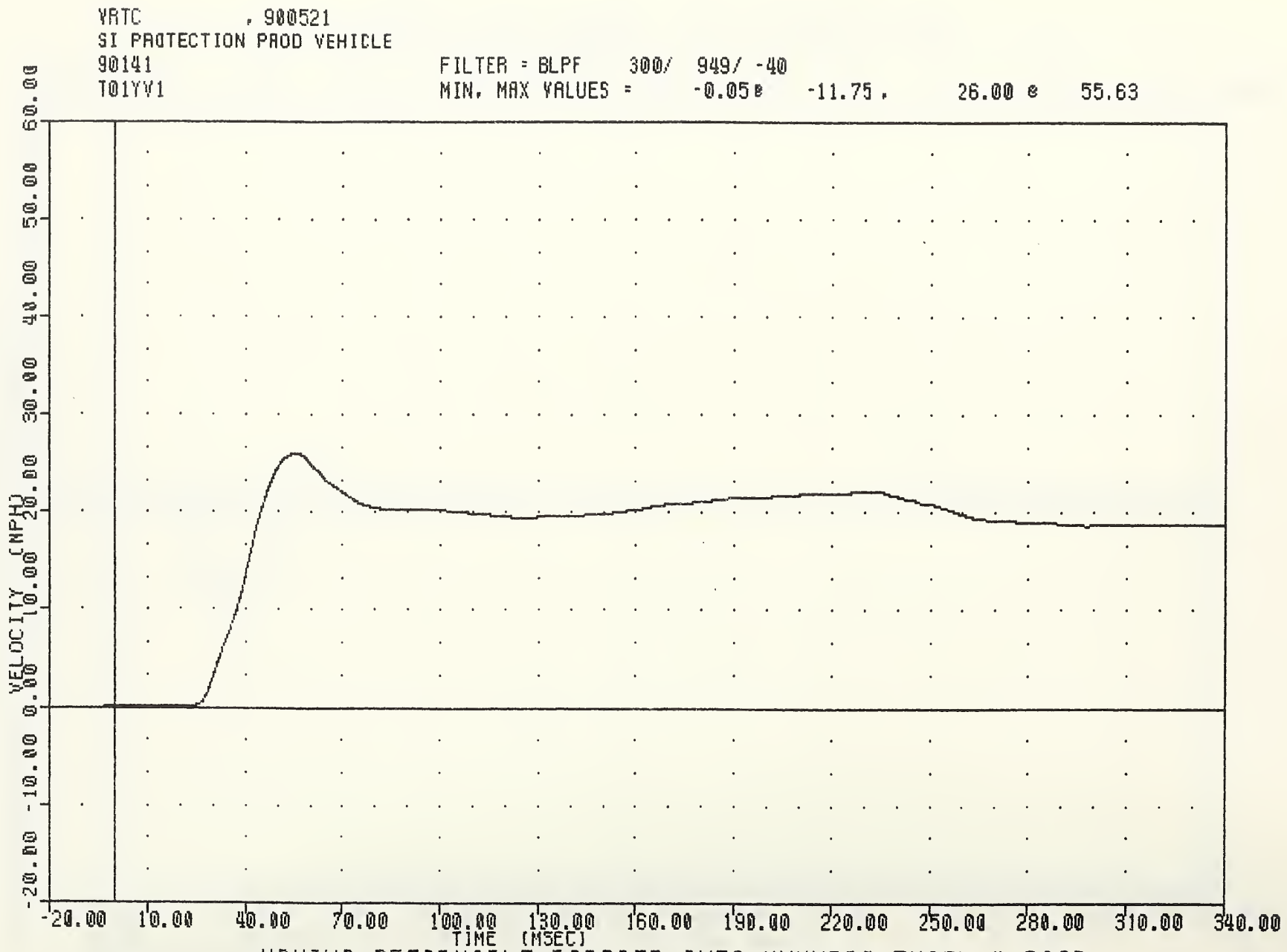
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT SHOULDER TO SPINE DISPLACEMENT



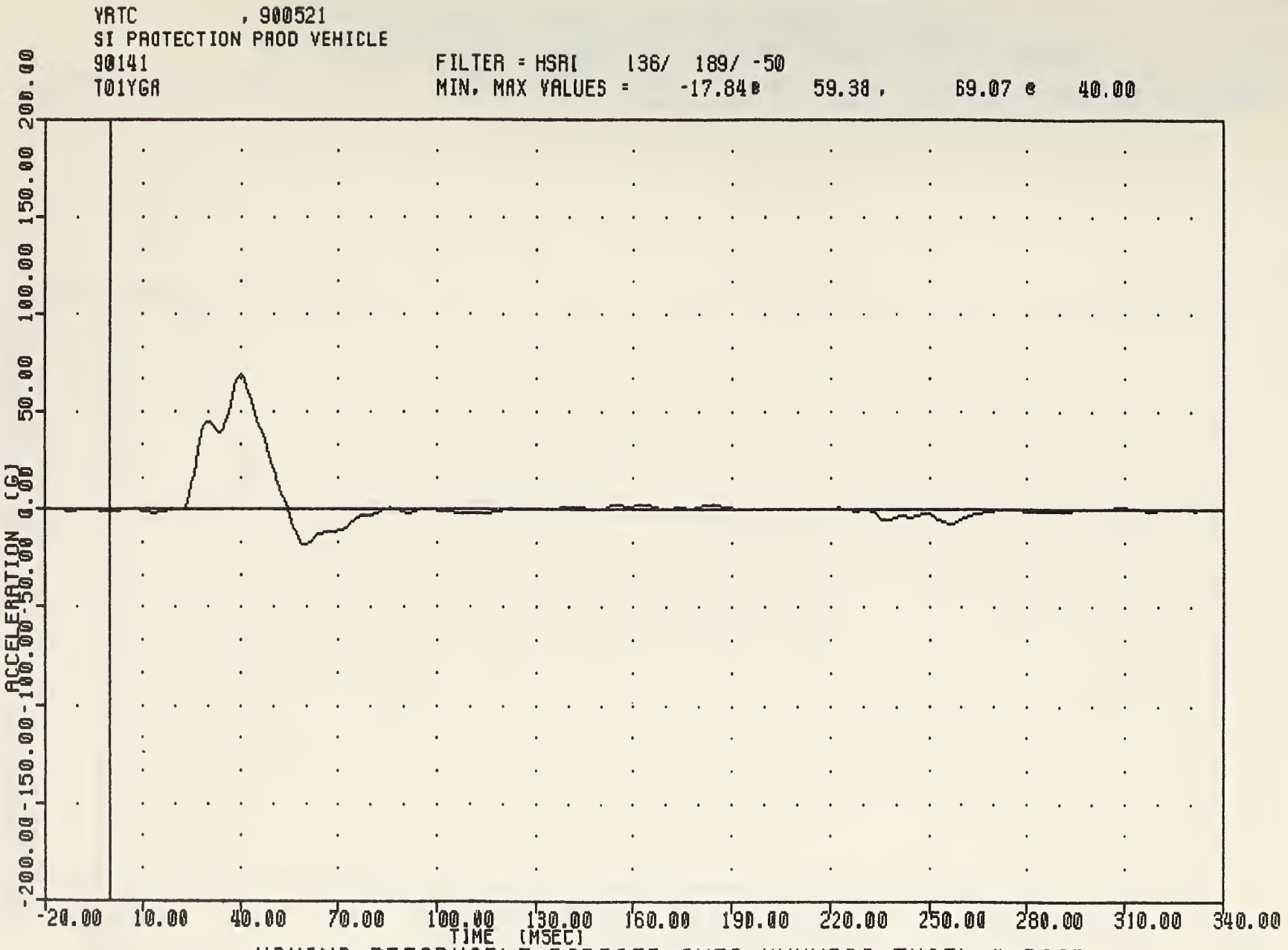
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE X-AXIS ACCELERATION



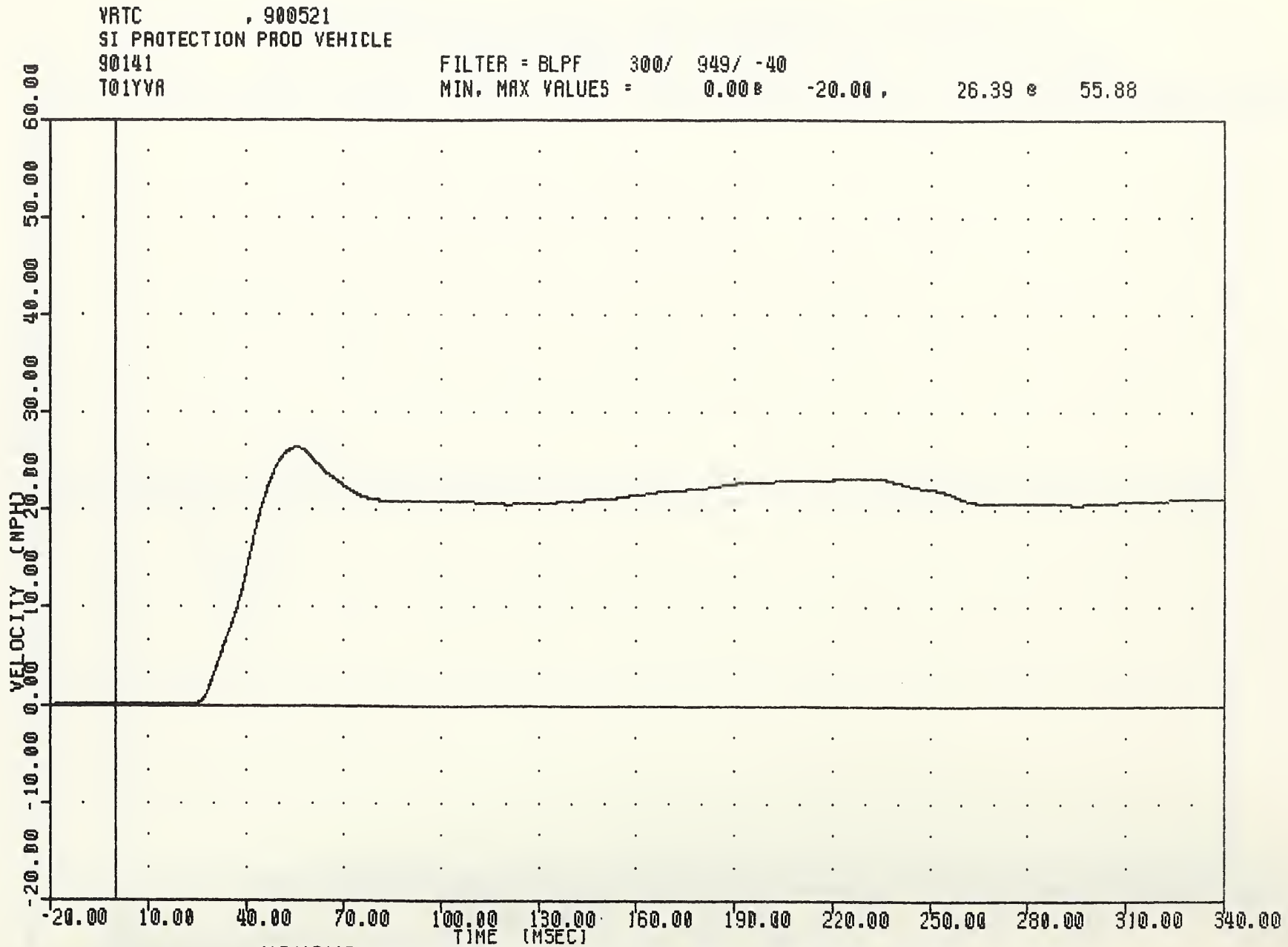
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE Y-AXIS ACCELERATION



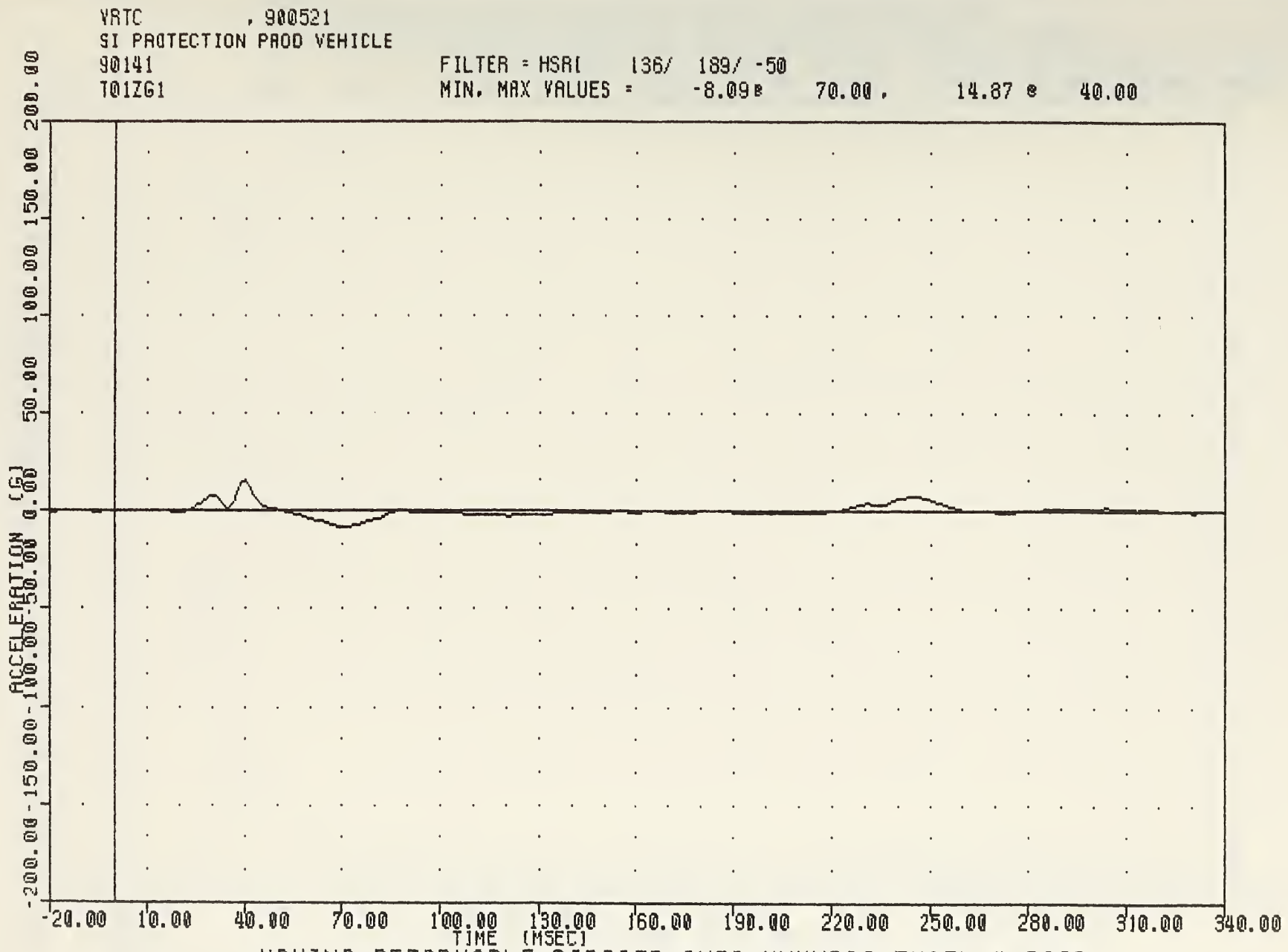
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE Y-AXIS VELOCITY



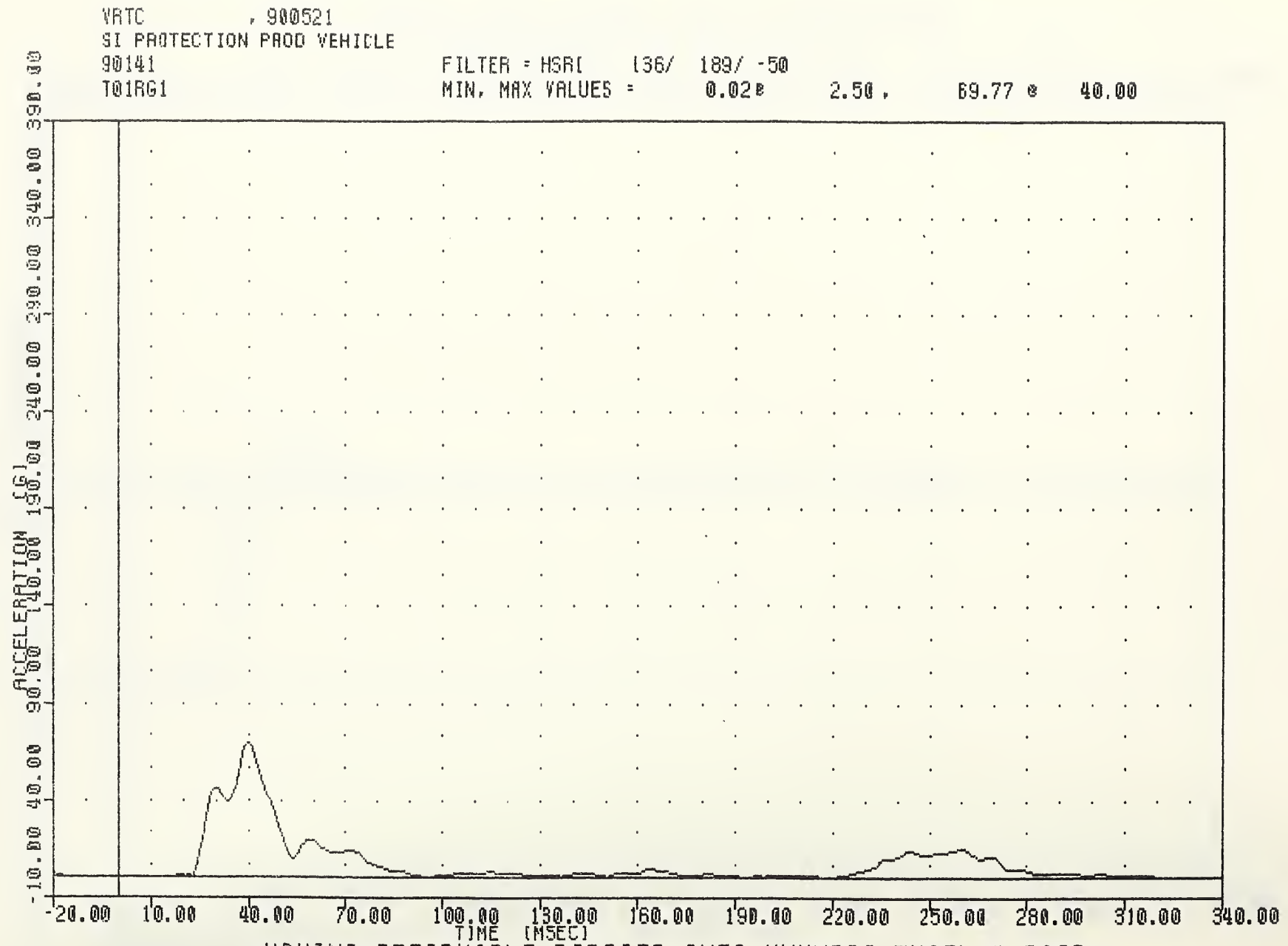
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE Y-AXIS REDUNDANT ACCELERATION



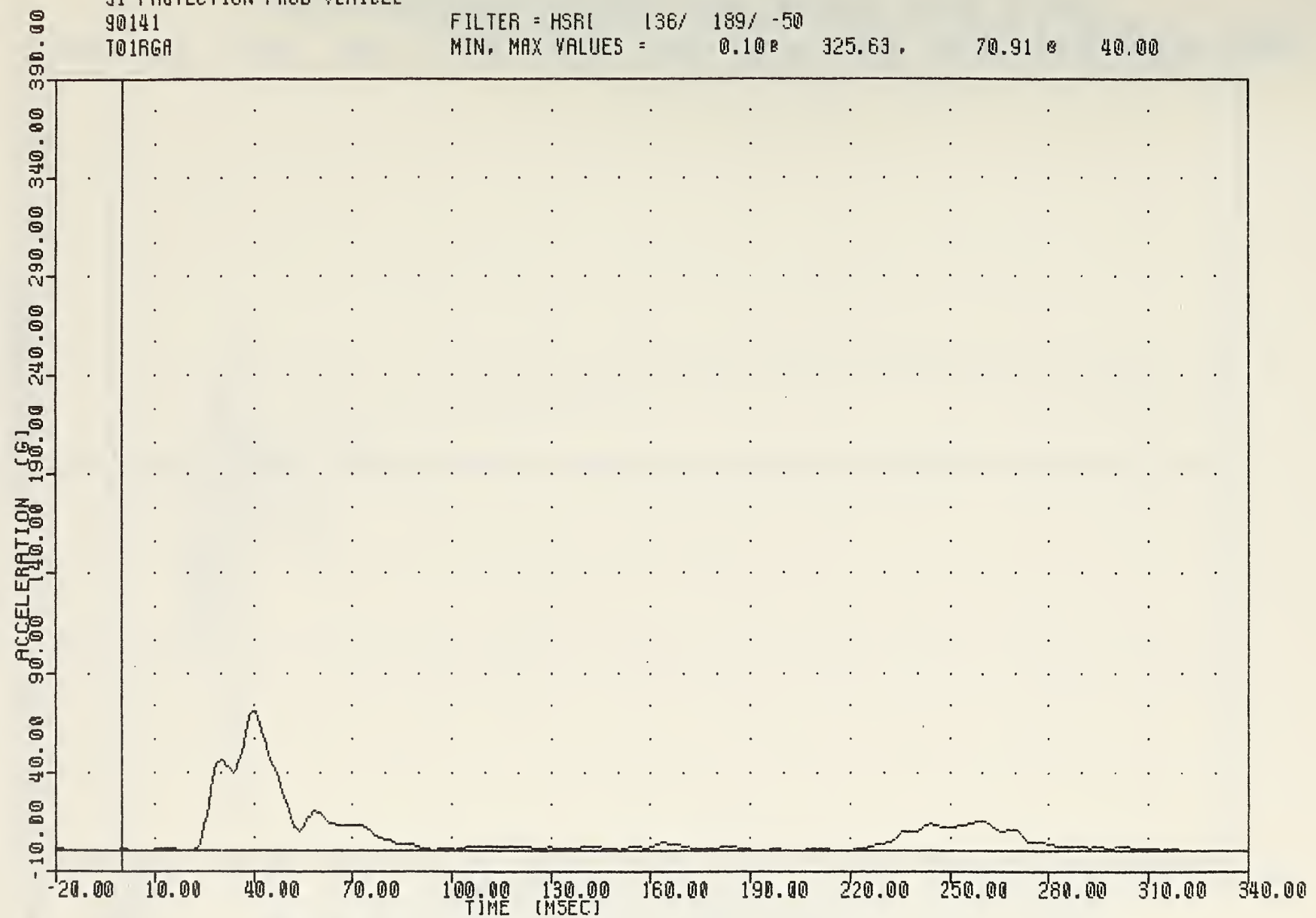
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE Y-AXIS REDUNDANT VELOCITY



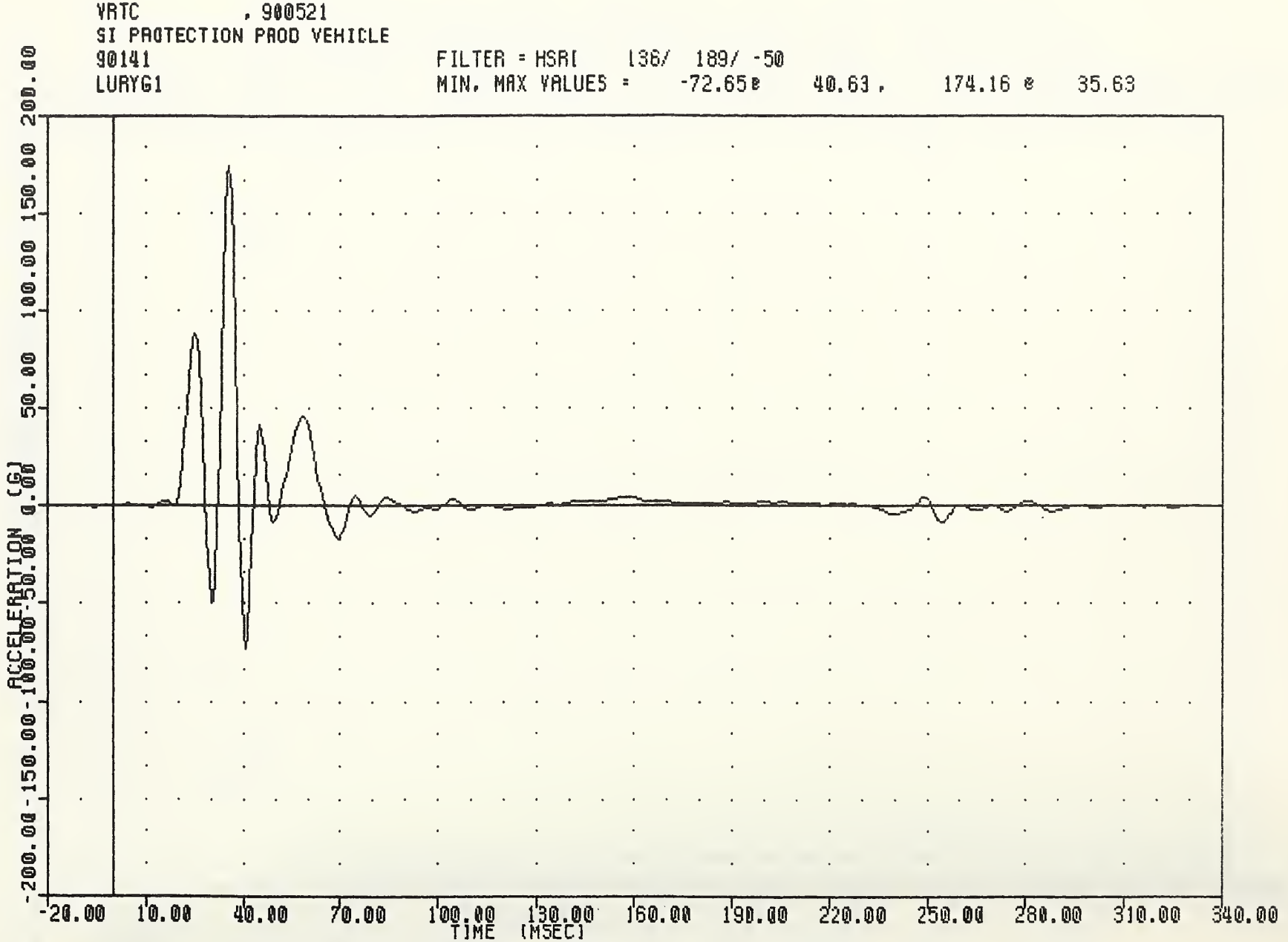
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE Z-AXIS ACCELERATION



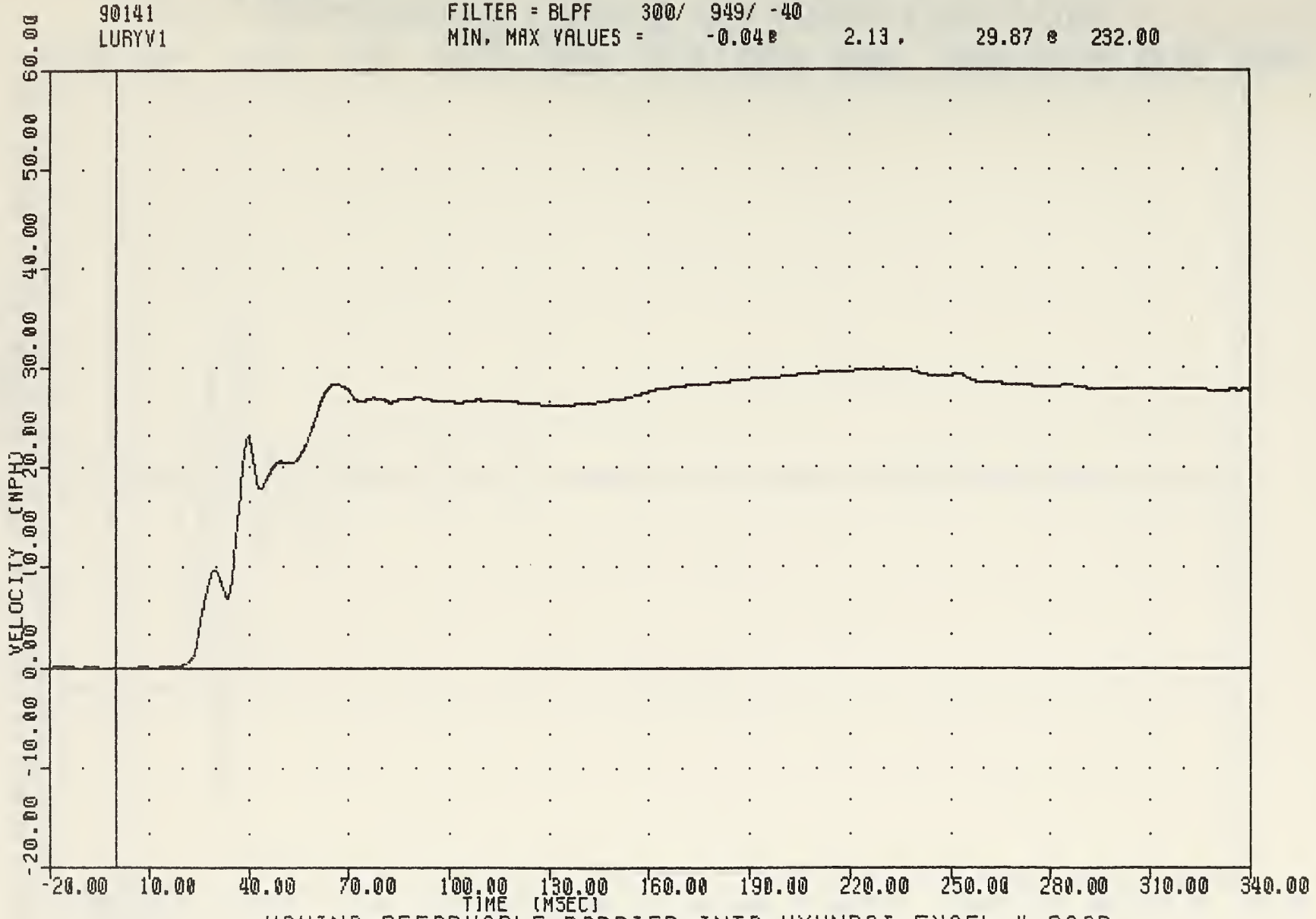
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE RESULTANT ACCELERATION



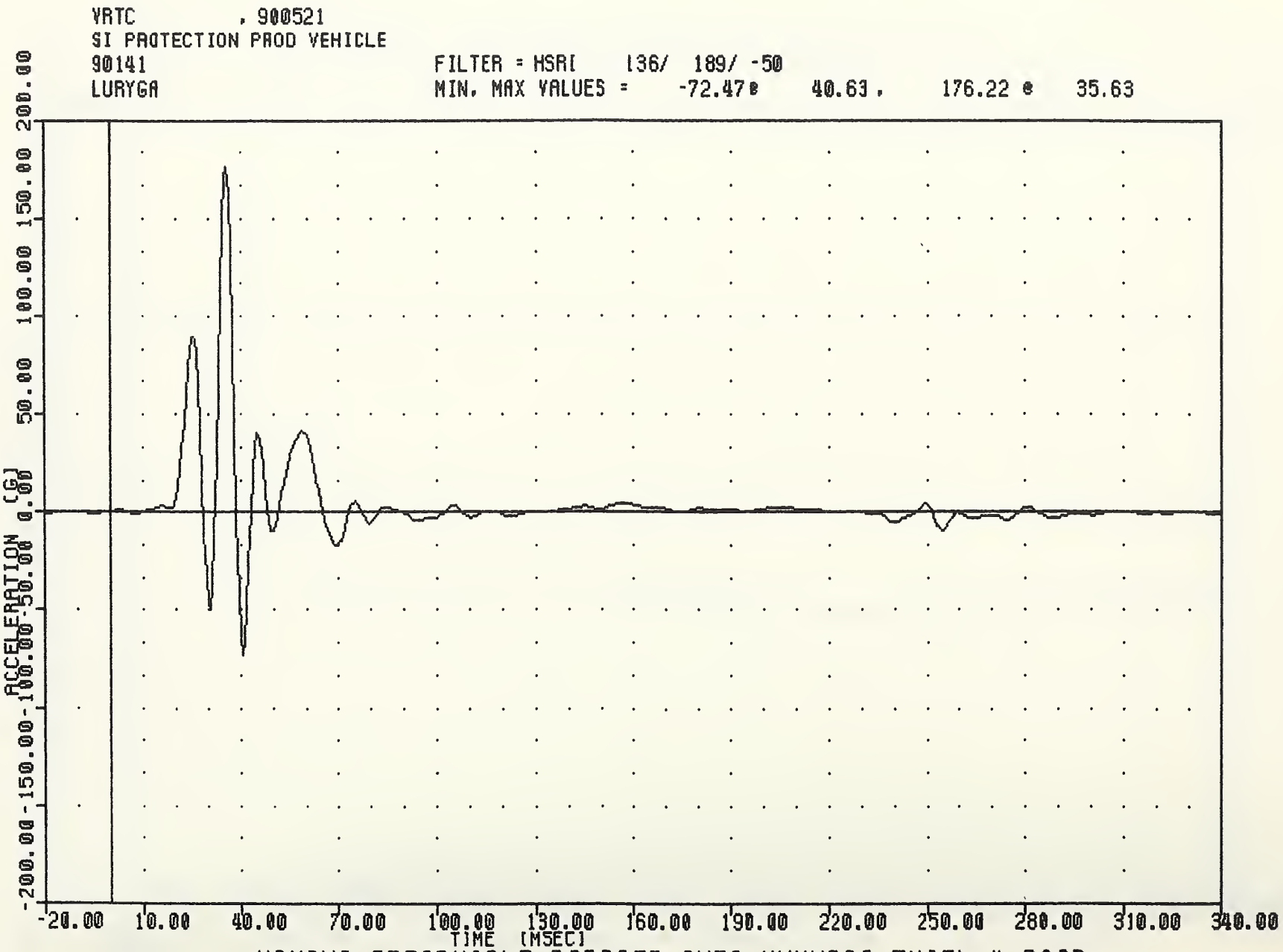
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER UPPER SPINE REDUNDANT RESULTANT ACCELERATION



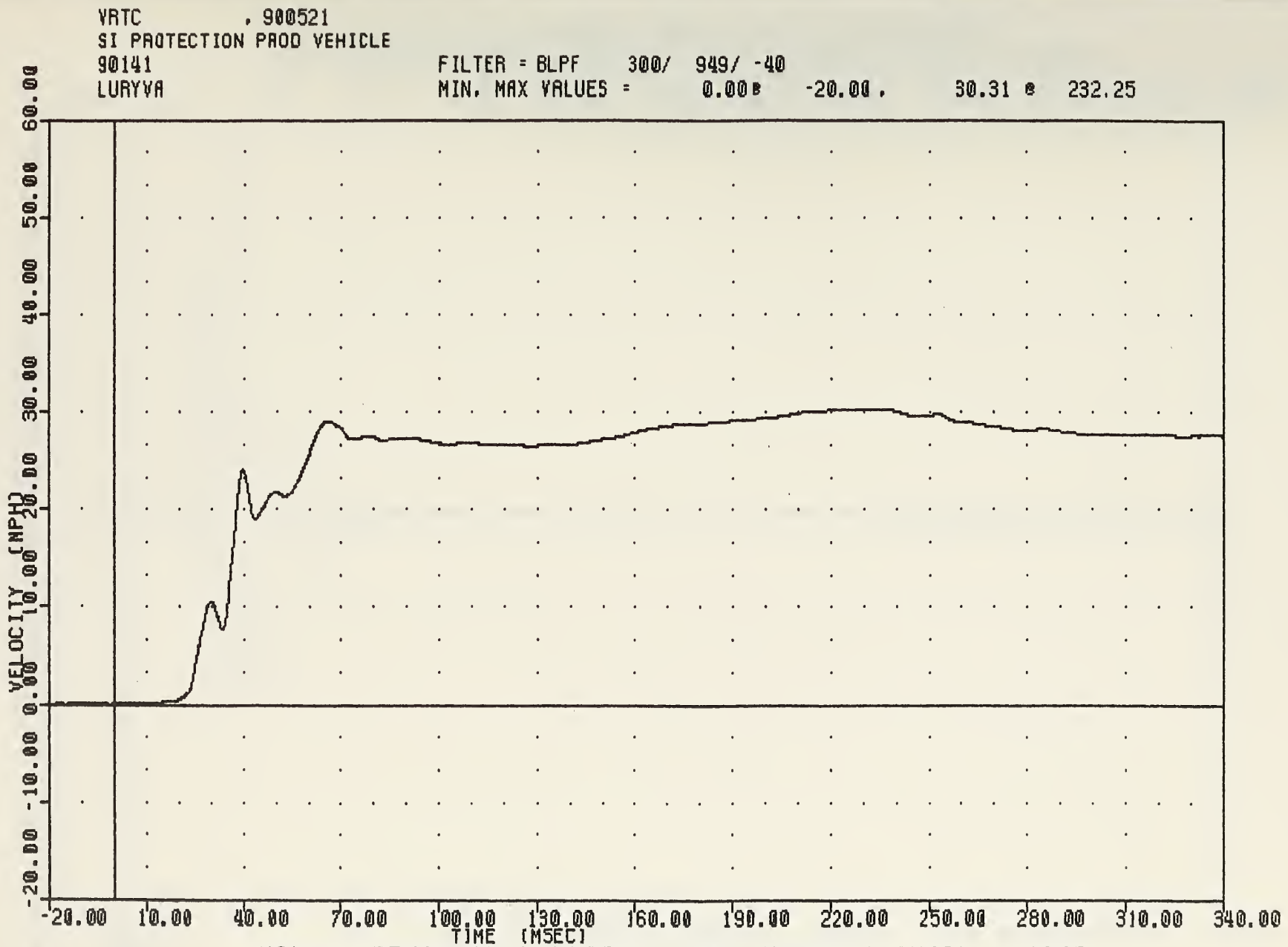
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER THORAX RIB Y-AXIS ACCELERATION



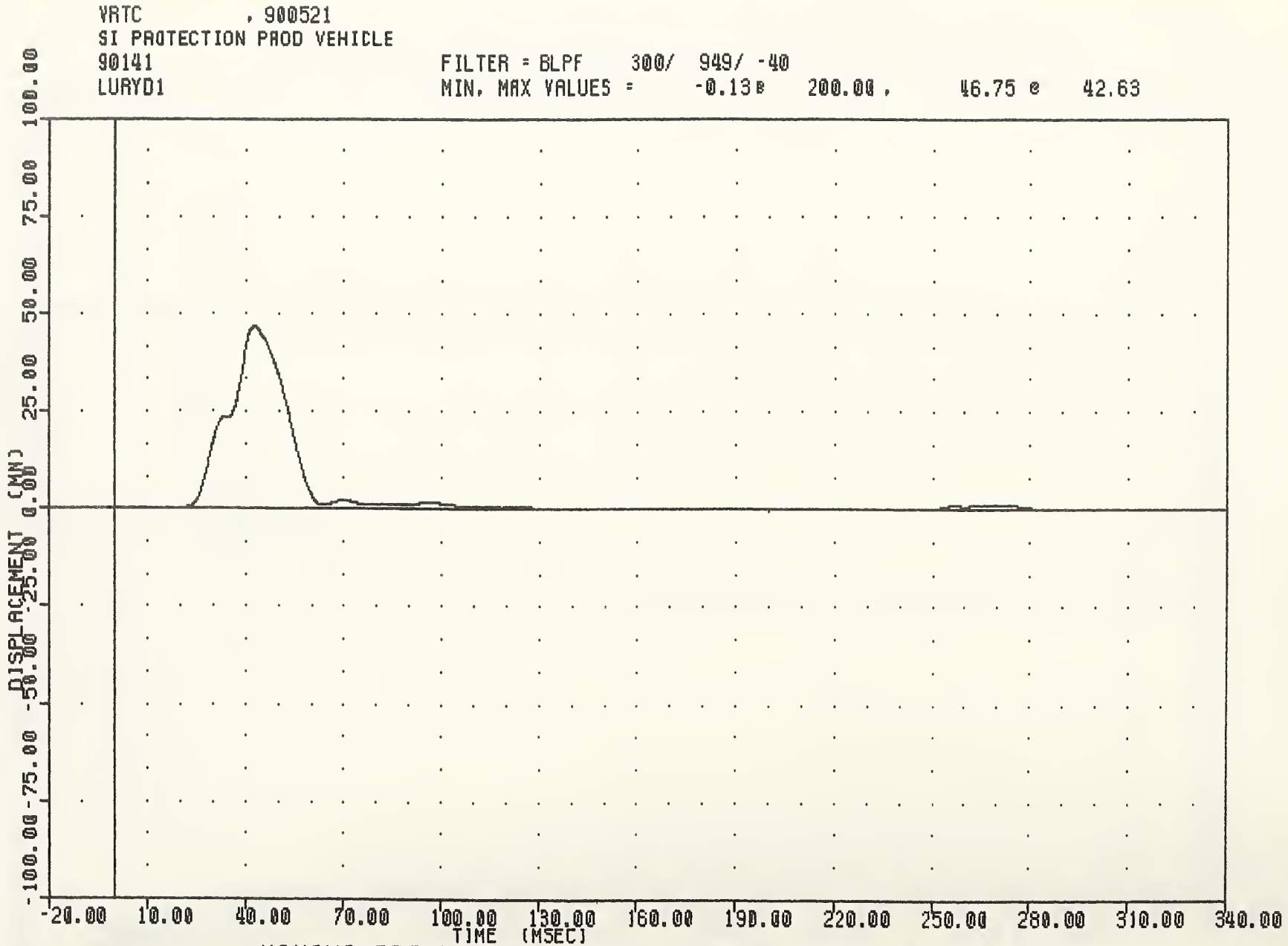
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER THORAX RIB Y-AXIS VELOCITY



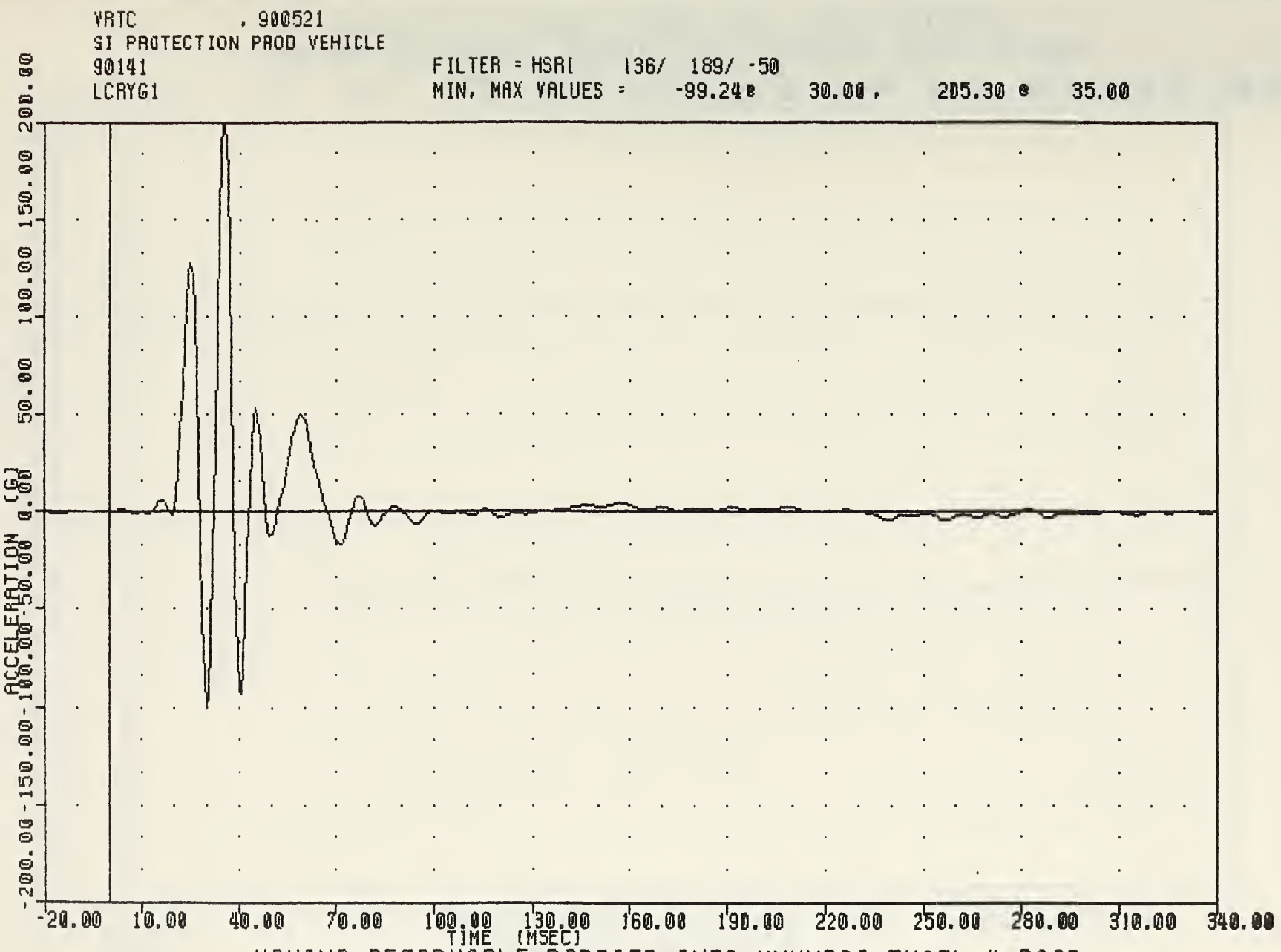
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



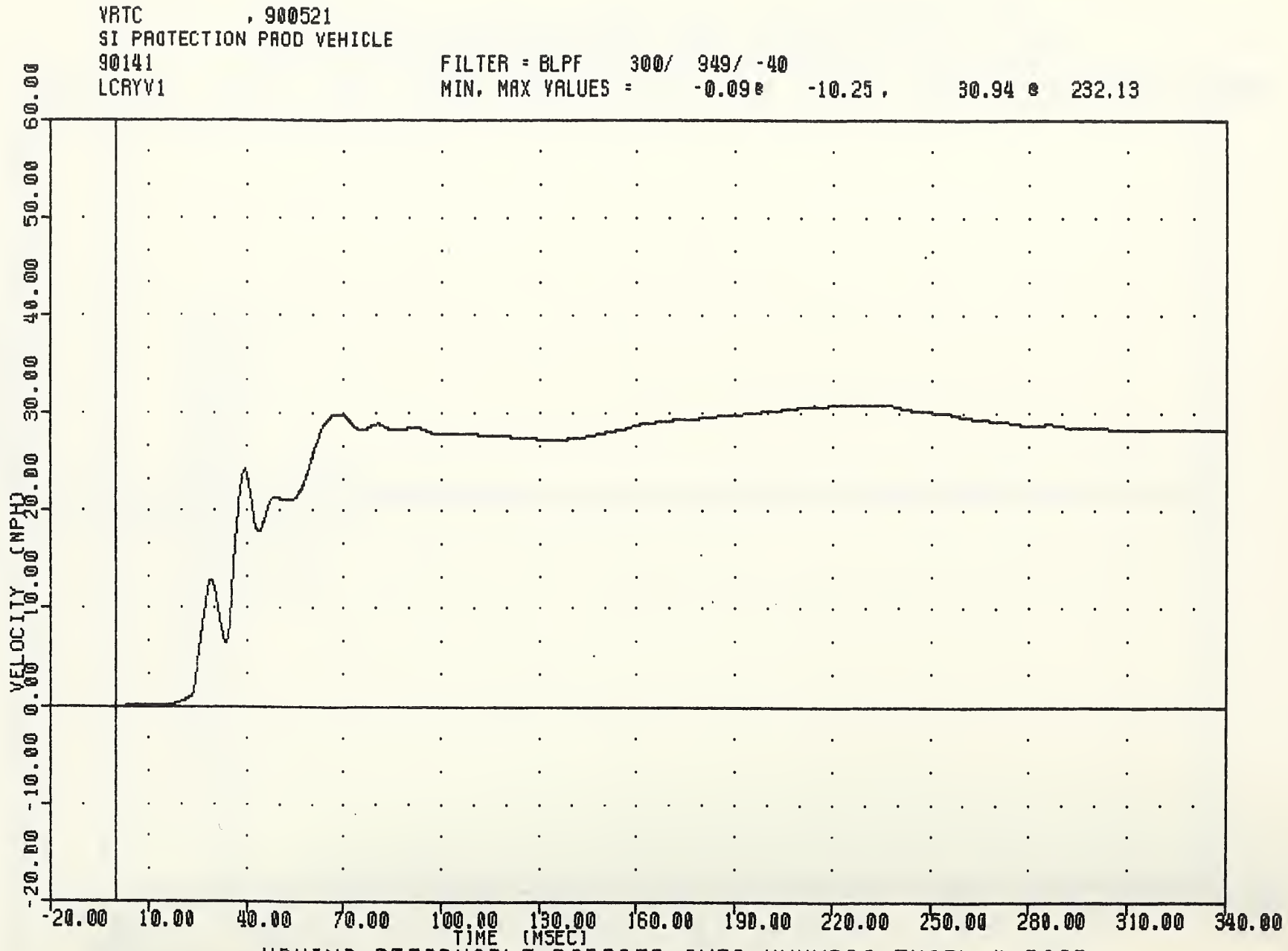
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER THORAX RIB Y-AXIS REDUNDANT VELOCITY



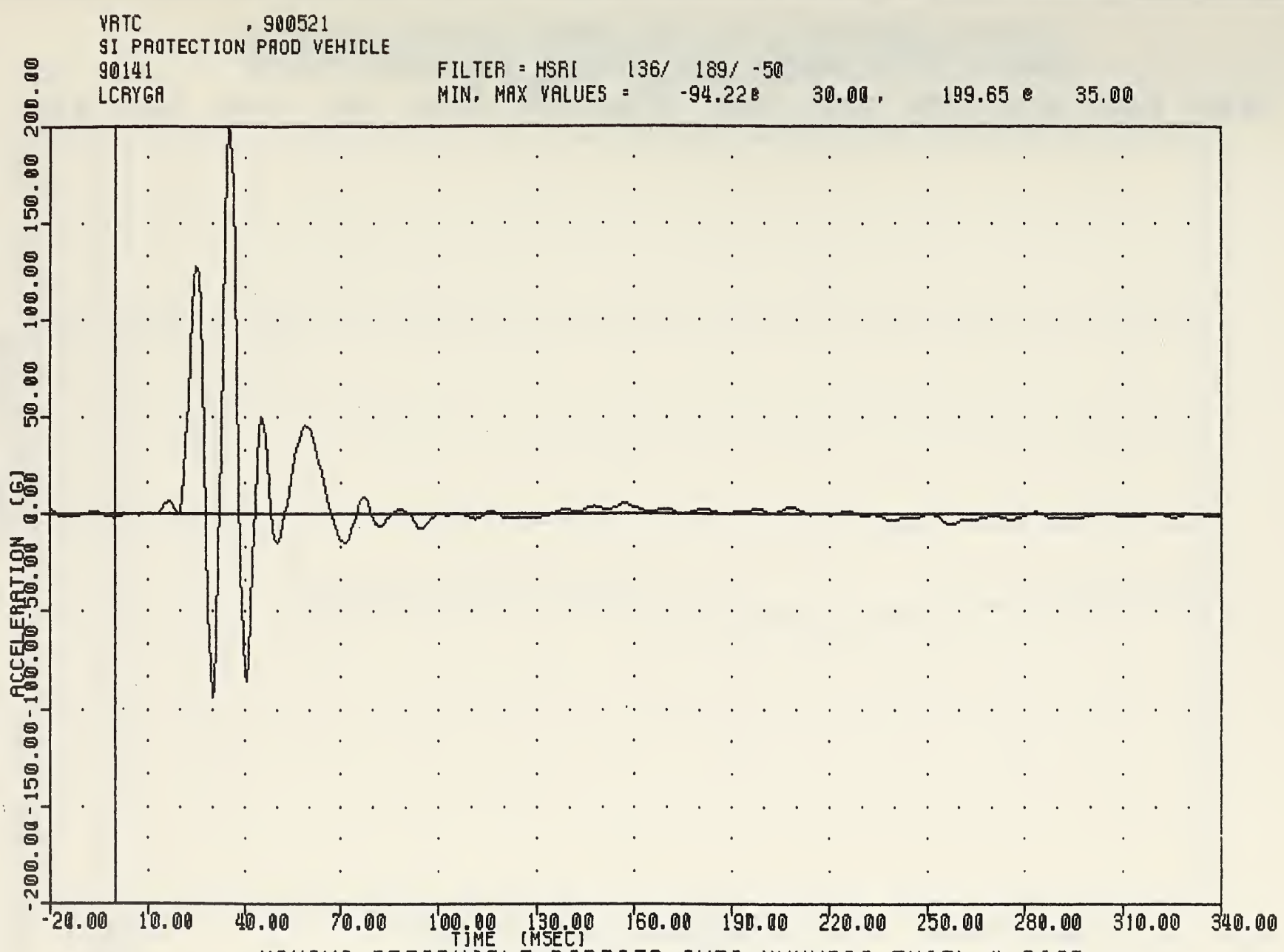
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER THORAX RIB DISPLACEMENT



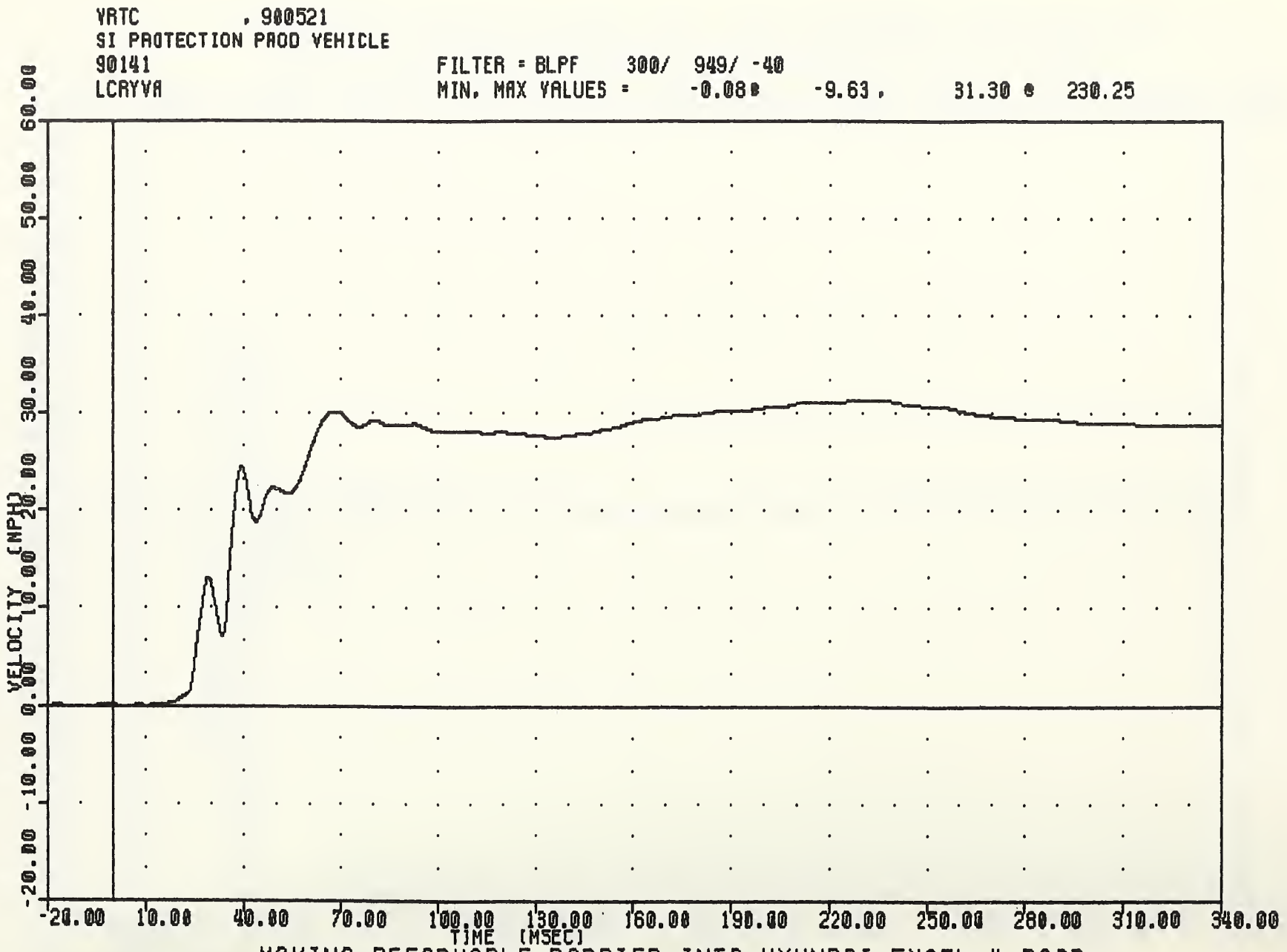
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT CENTER THORAX RIB Y-AXIS ACCELERATION



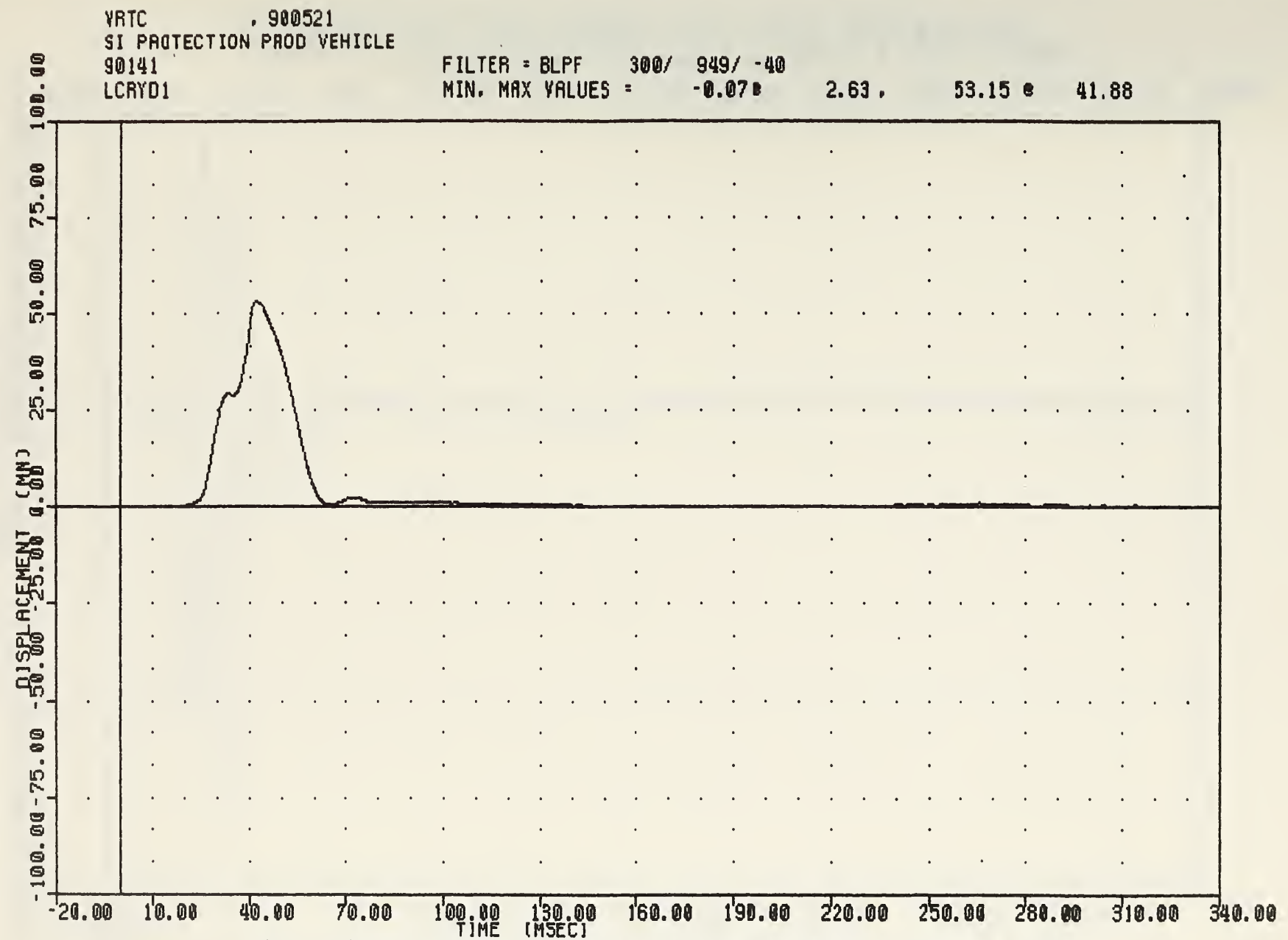
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT CENTER THORAX RIB Y-AXIS VELOCITY



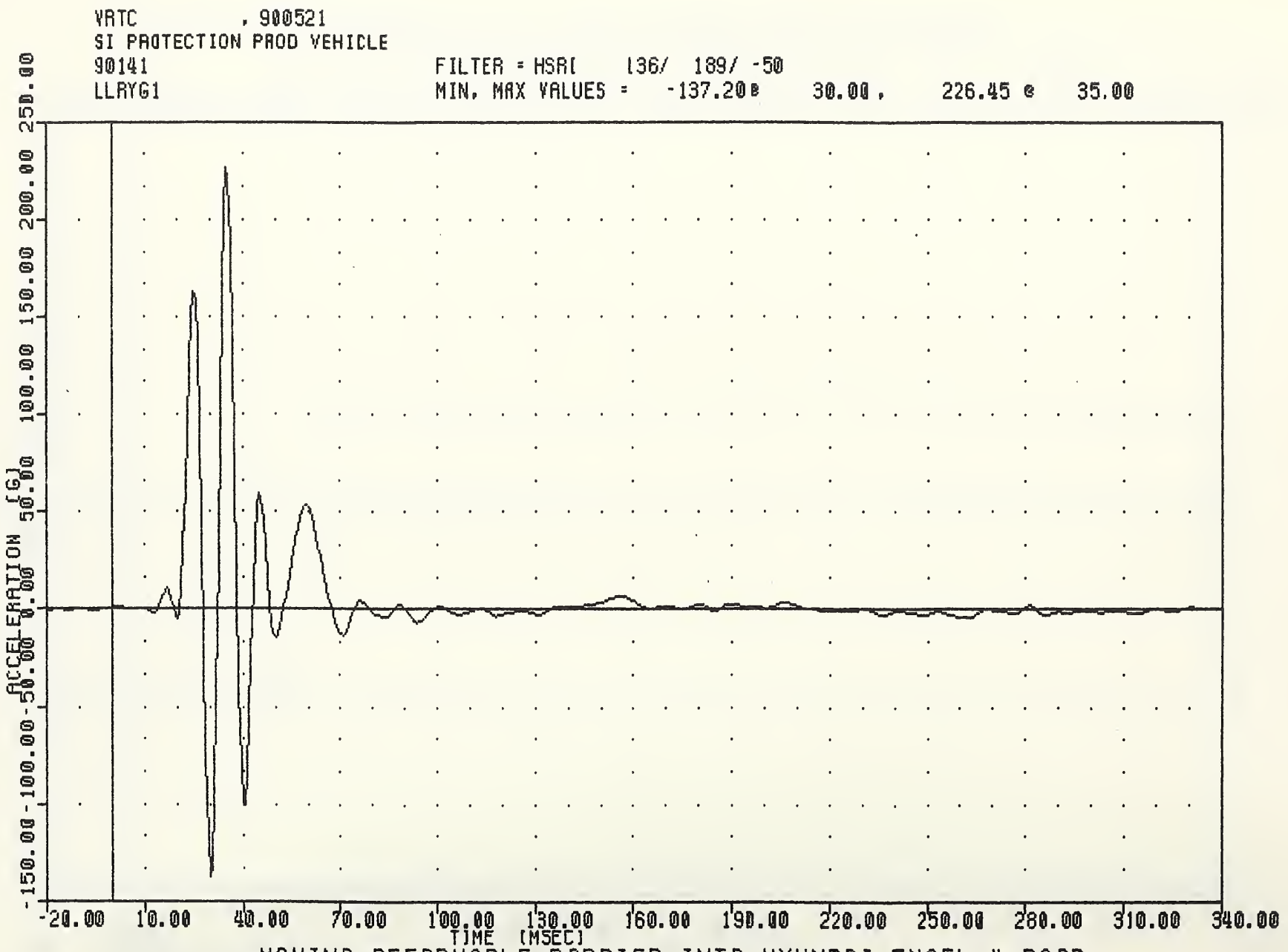
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



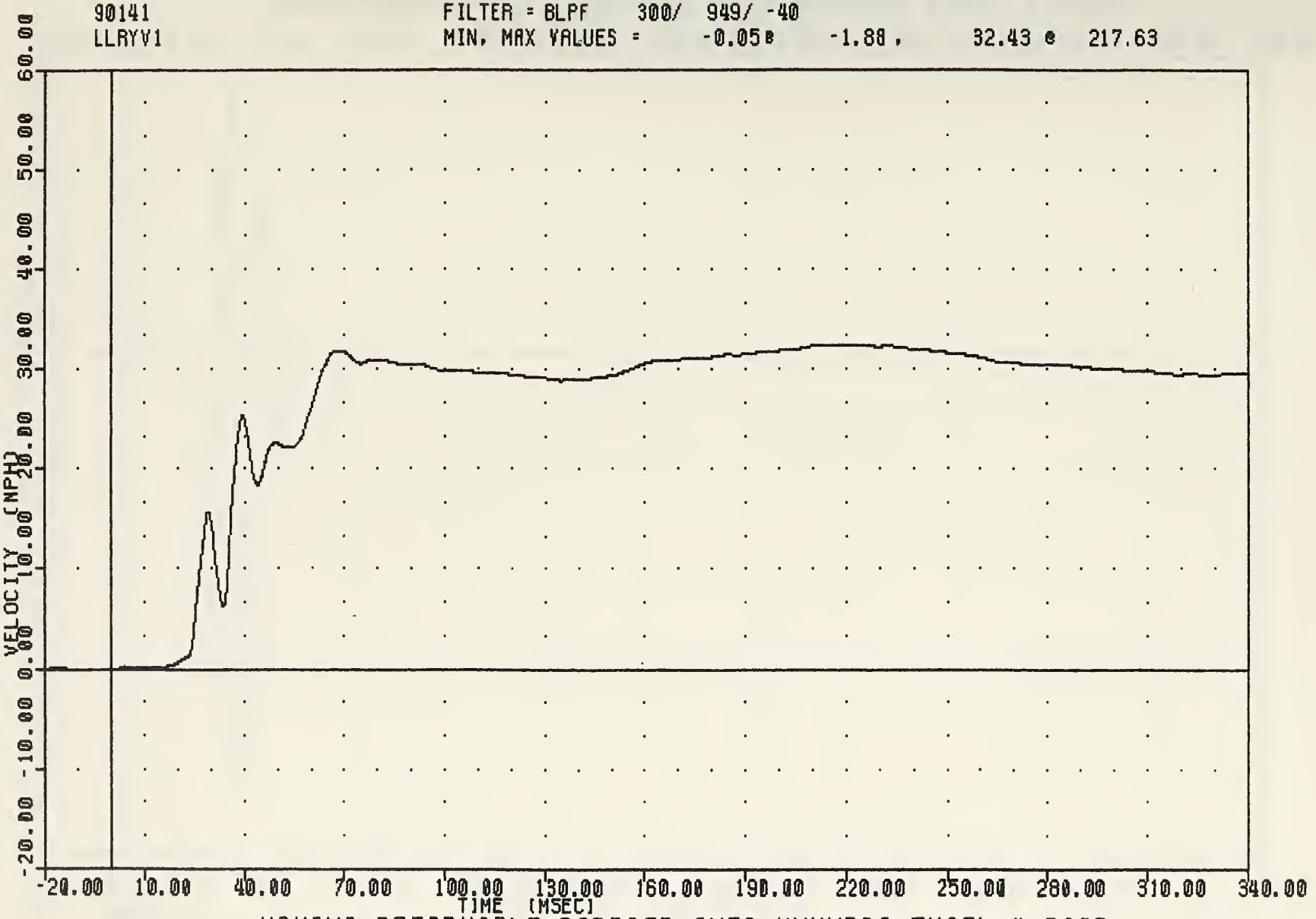
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT VELOCITY



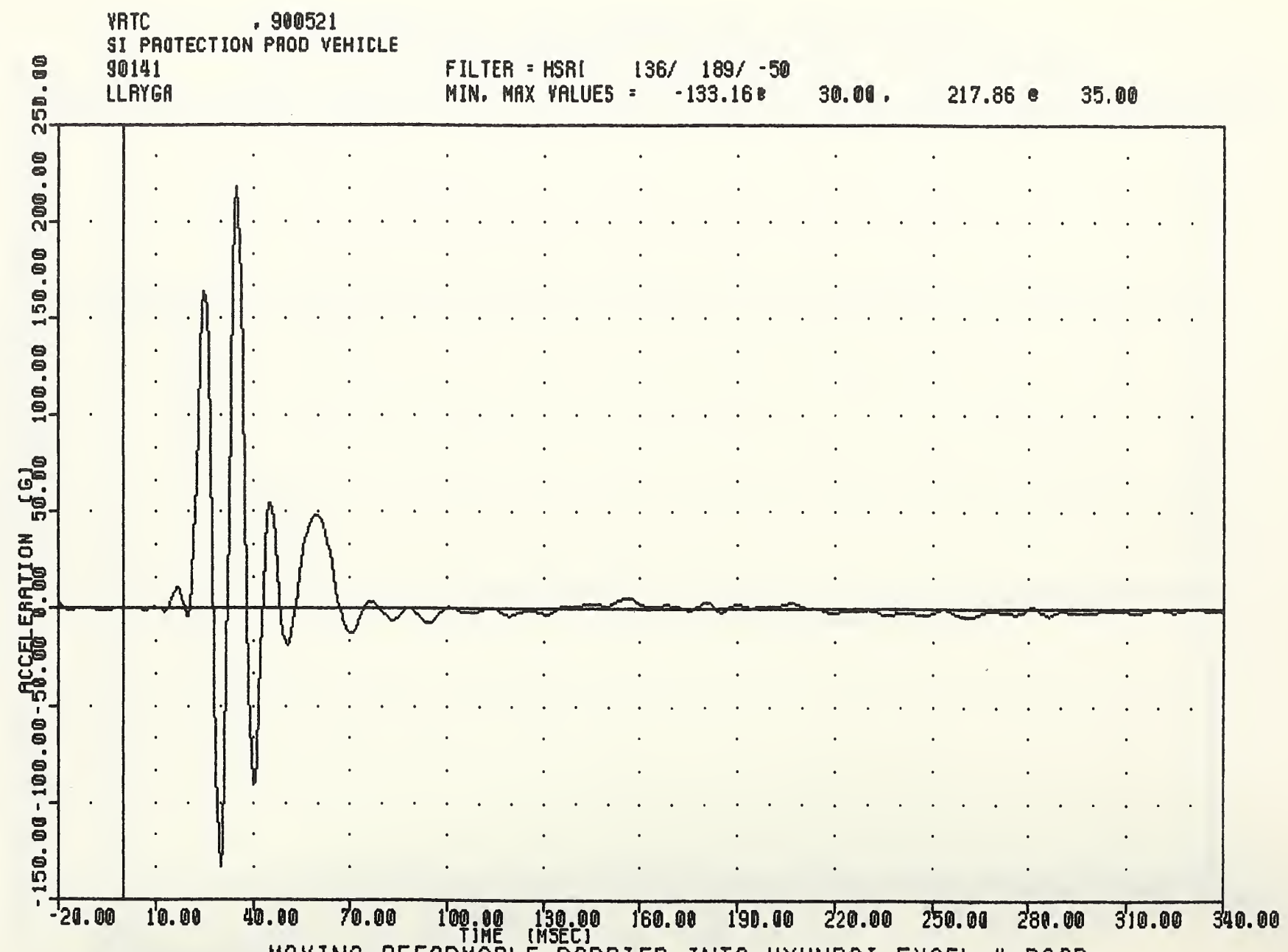
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT CENTER THORAX RIB DISPLACEMENT



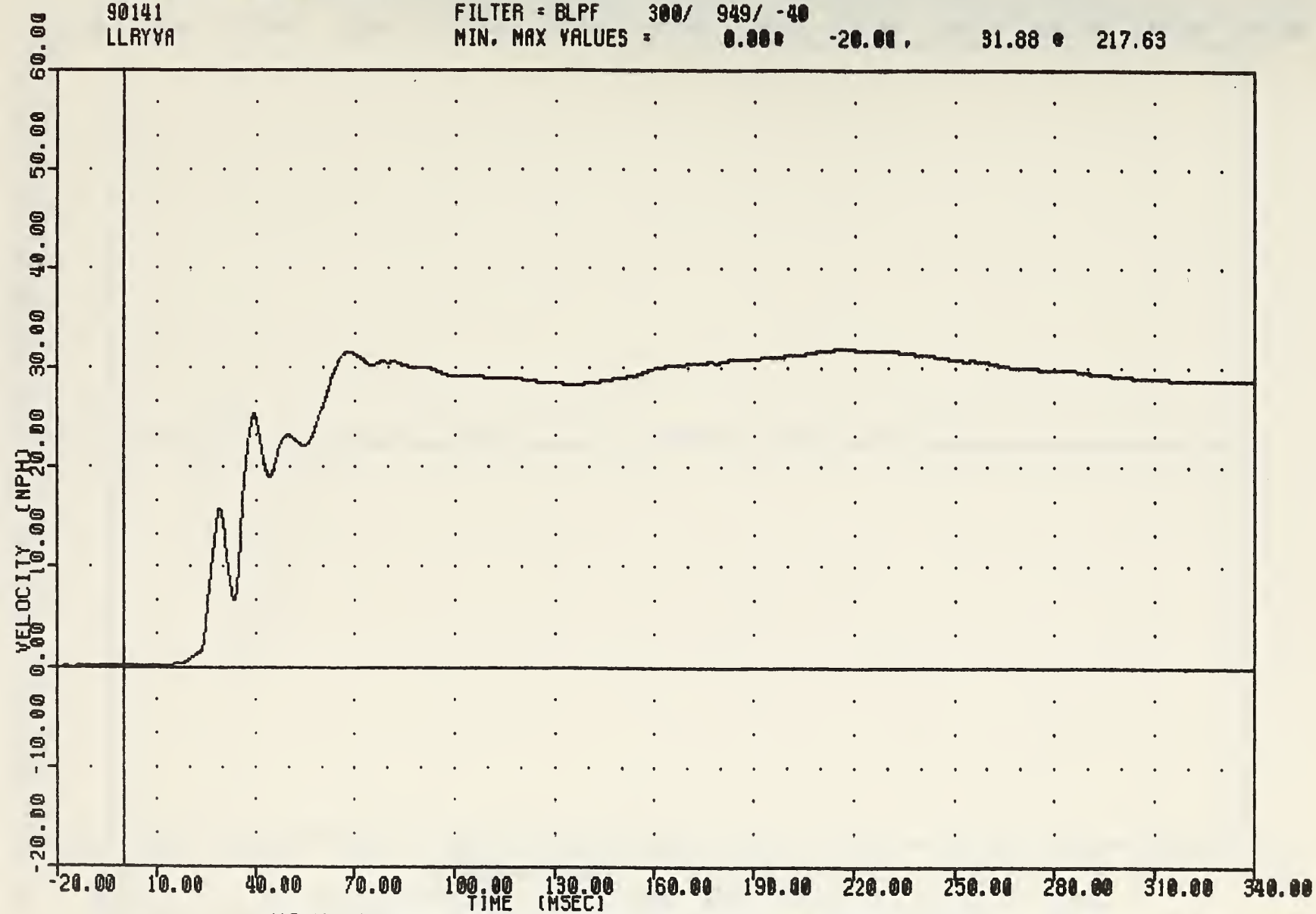
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER THORAX RIB Y-AXIS ACCELERATION



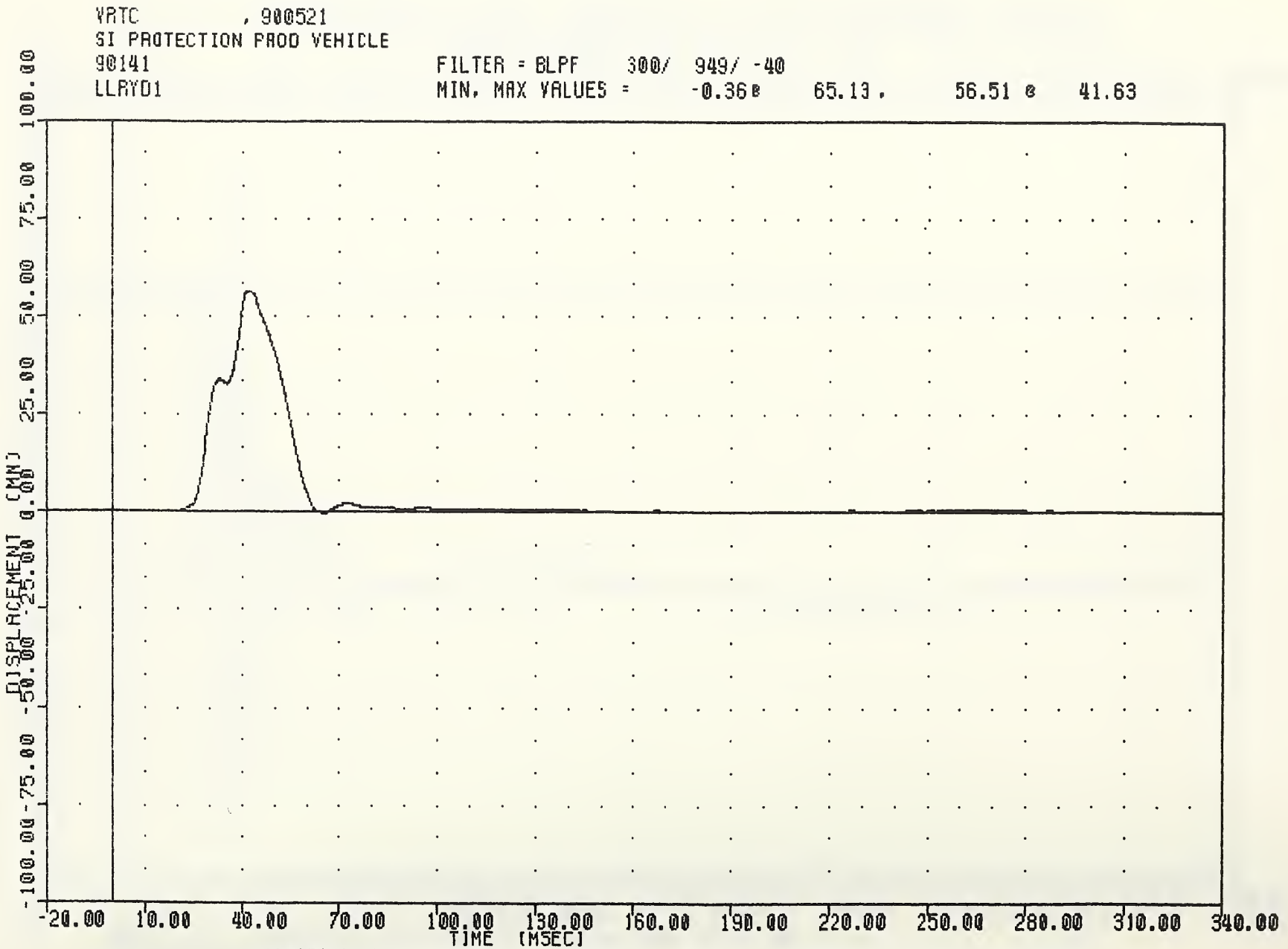
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER THORAX RIB Y-AXIS VELOCITY



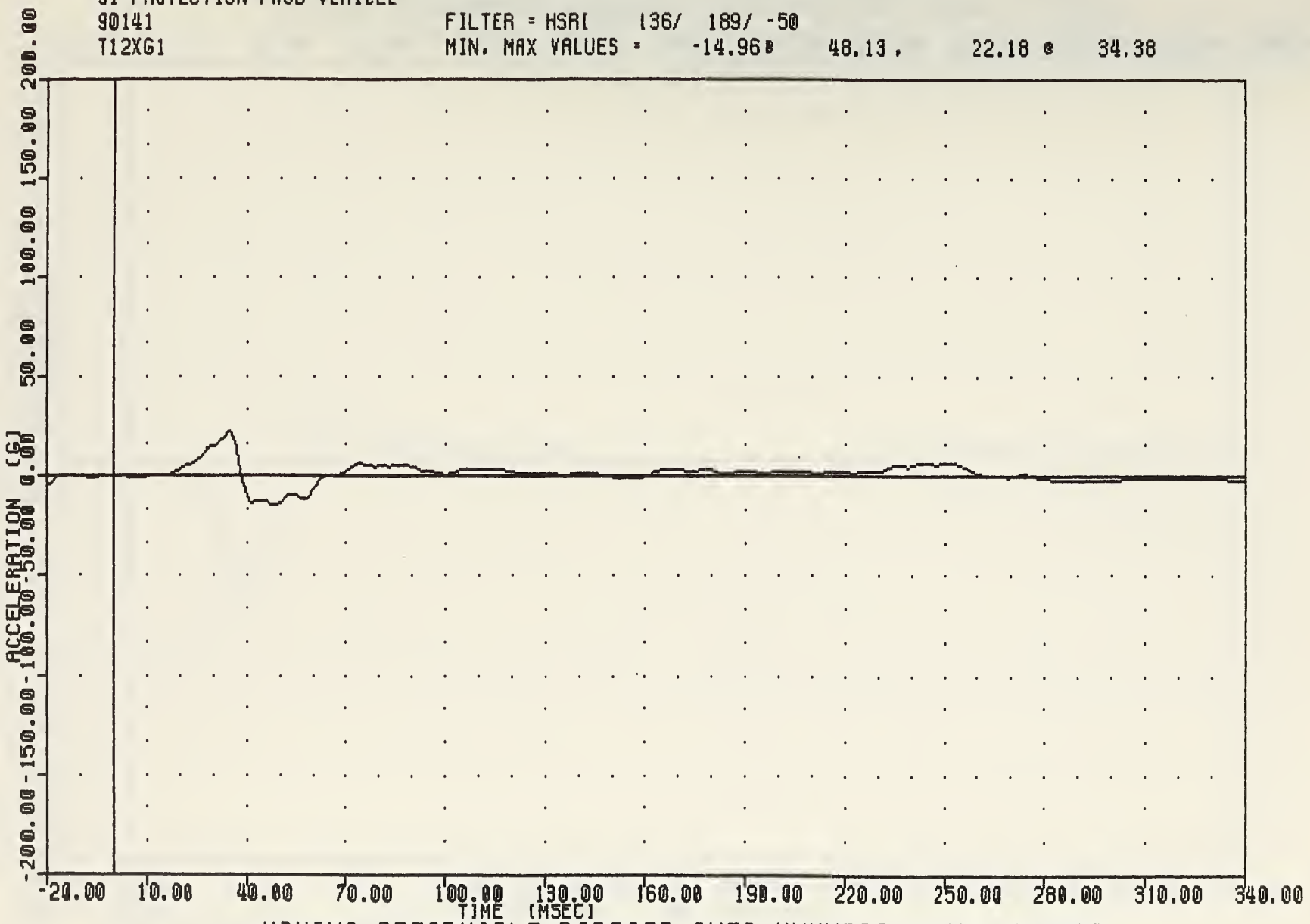
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



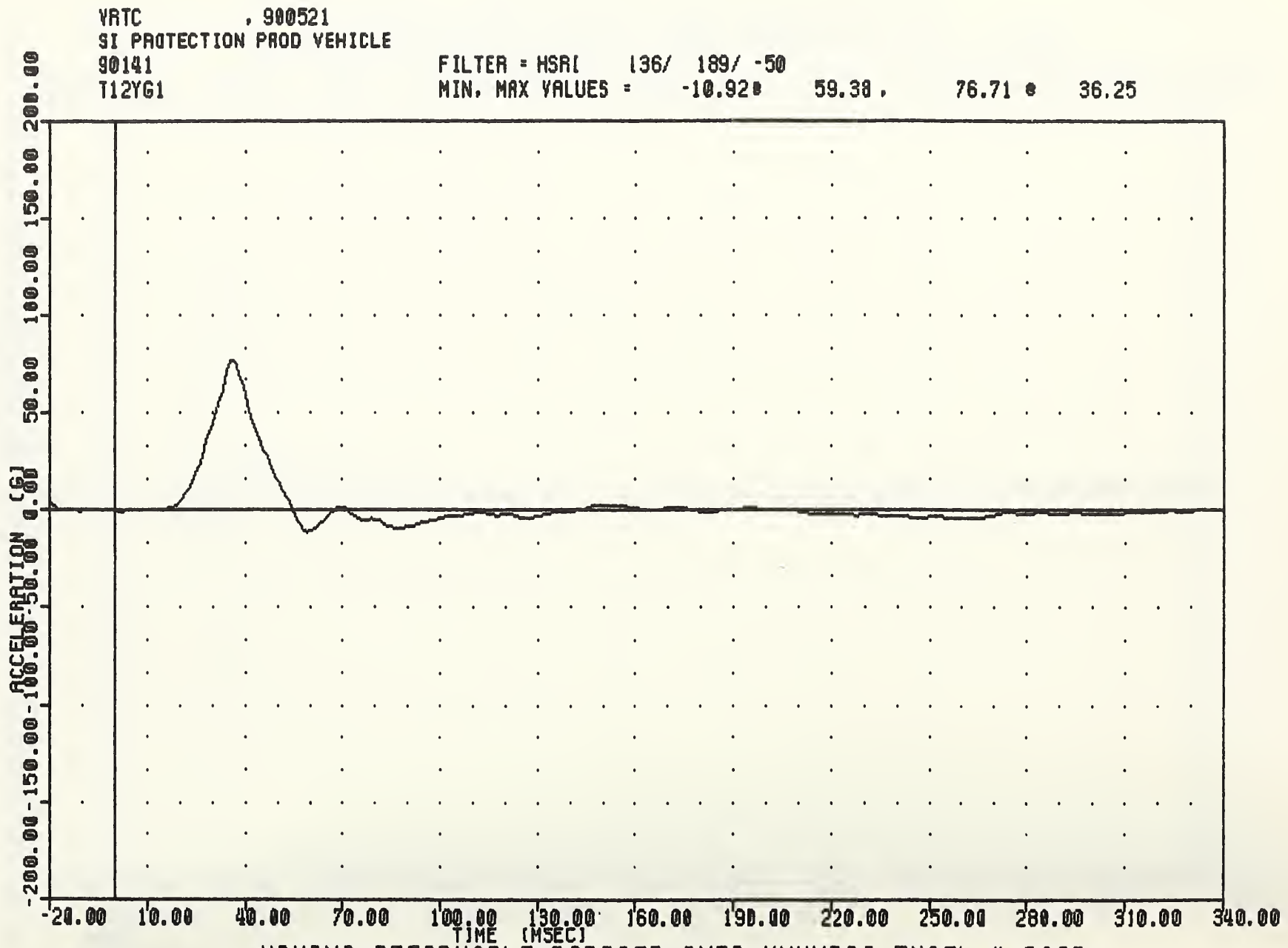
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT VELOCITY



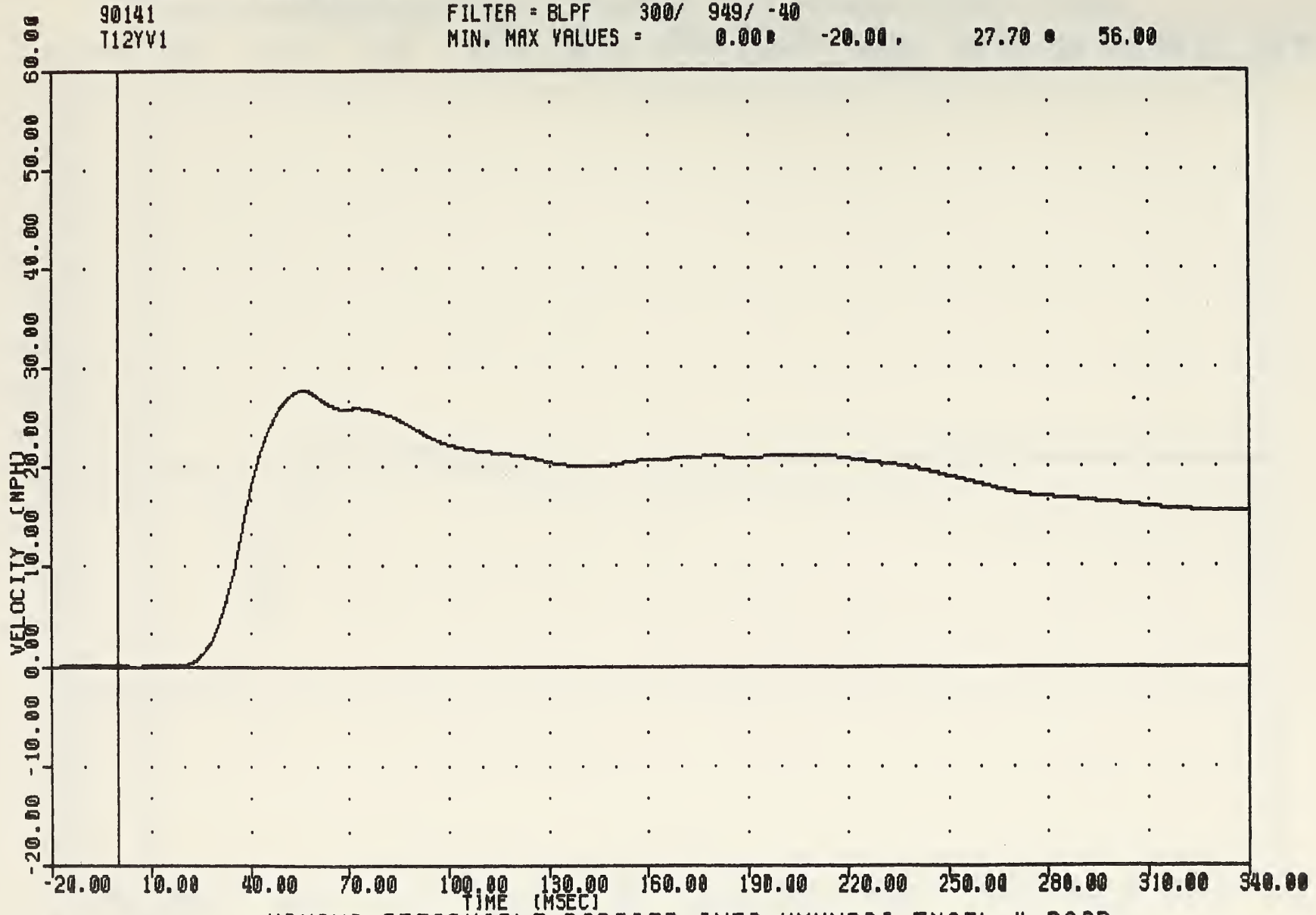
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER THORAX RIB DISPLACEMENT



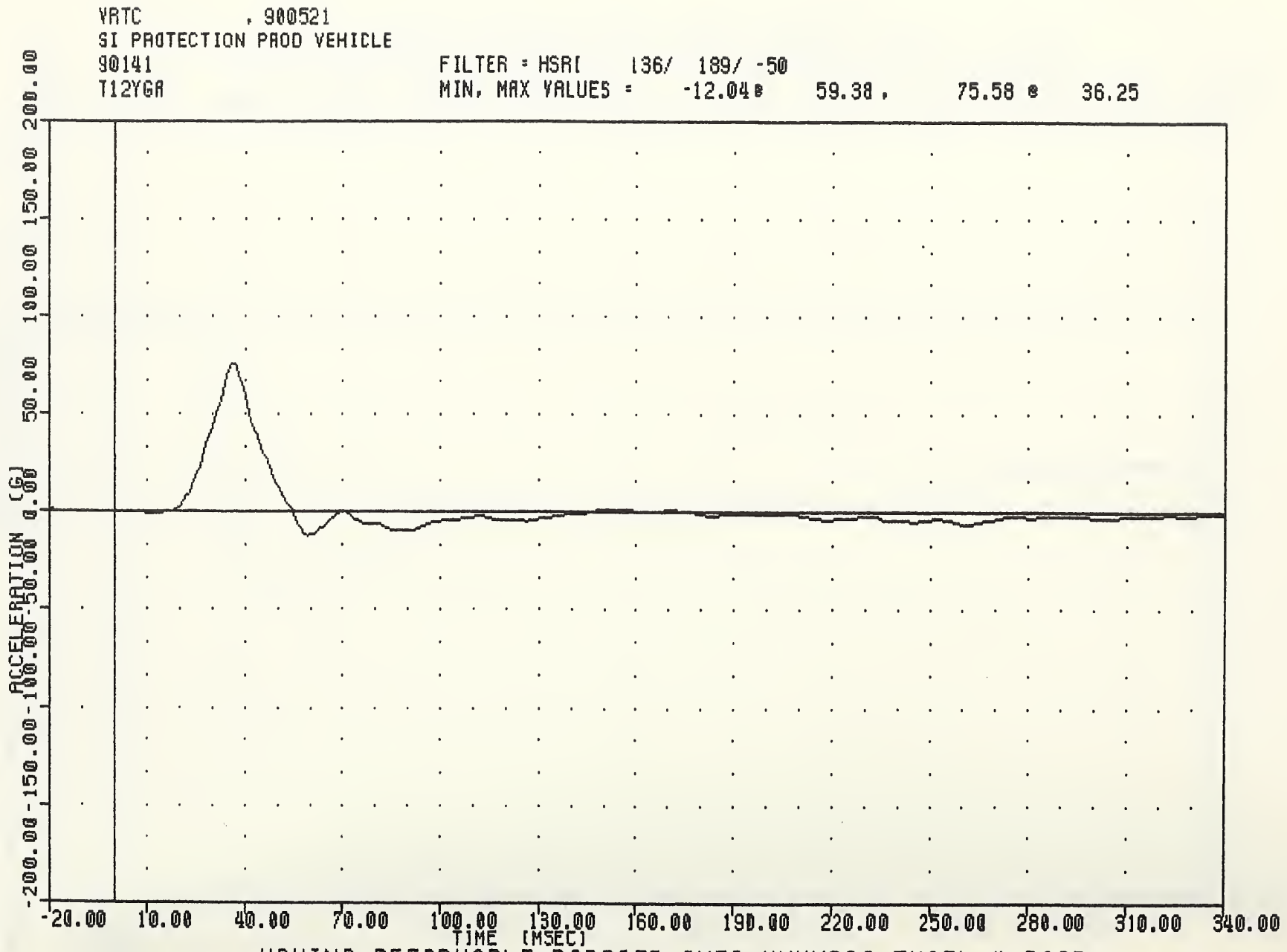
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE X-AXIS ACCELERATION



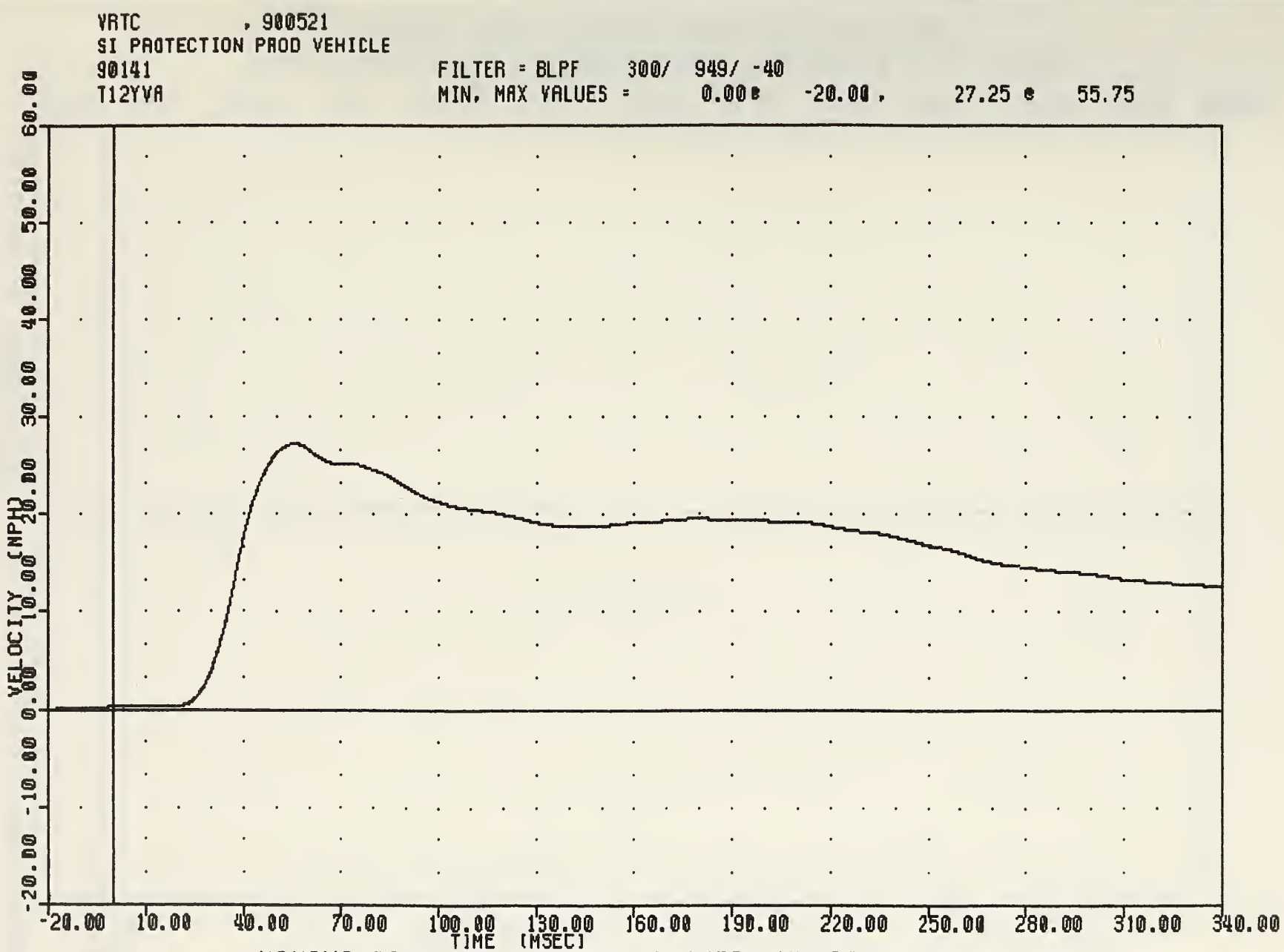
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE Y-AXIS ACCELERATION



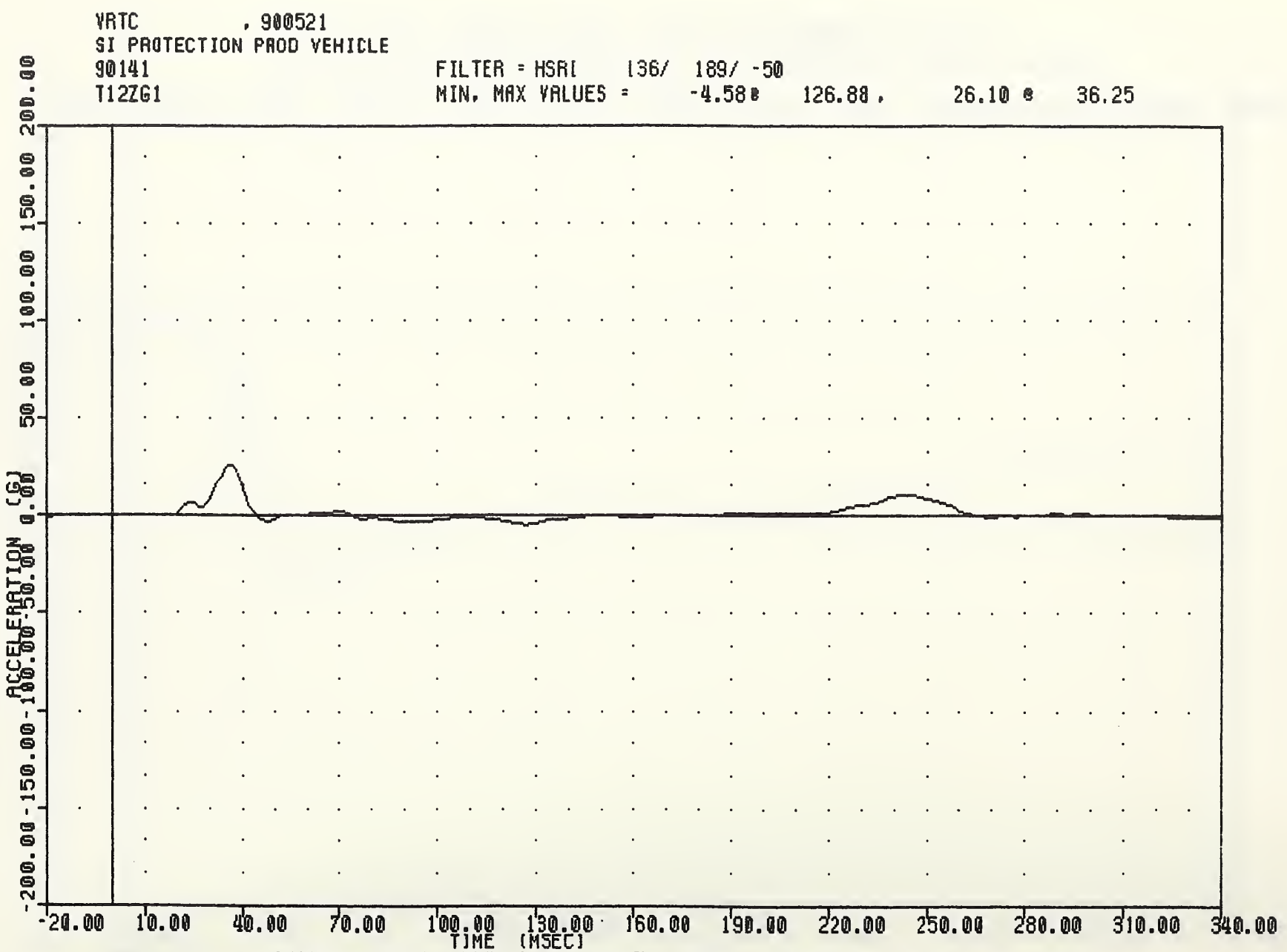
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE Y-AXIS VELOCITY



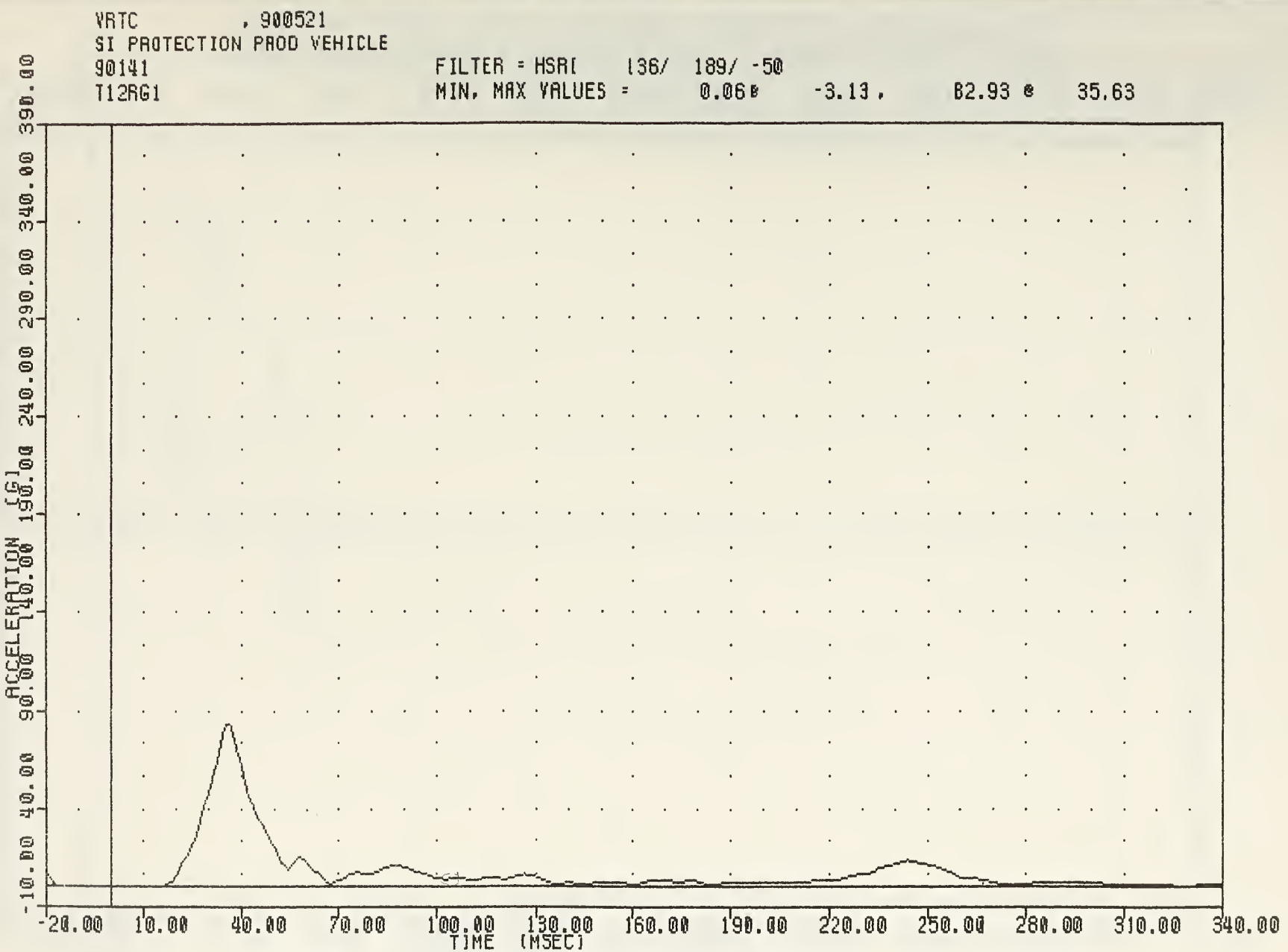
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE Y-AXIS REDUNDANT ACCELERATION



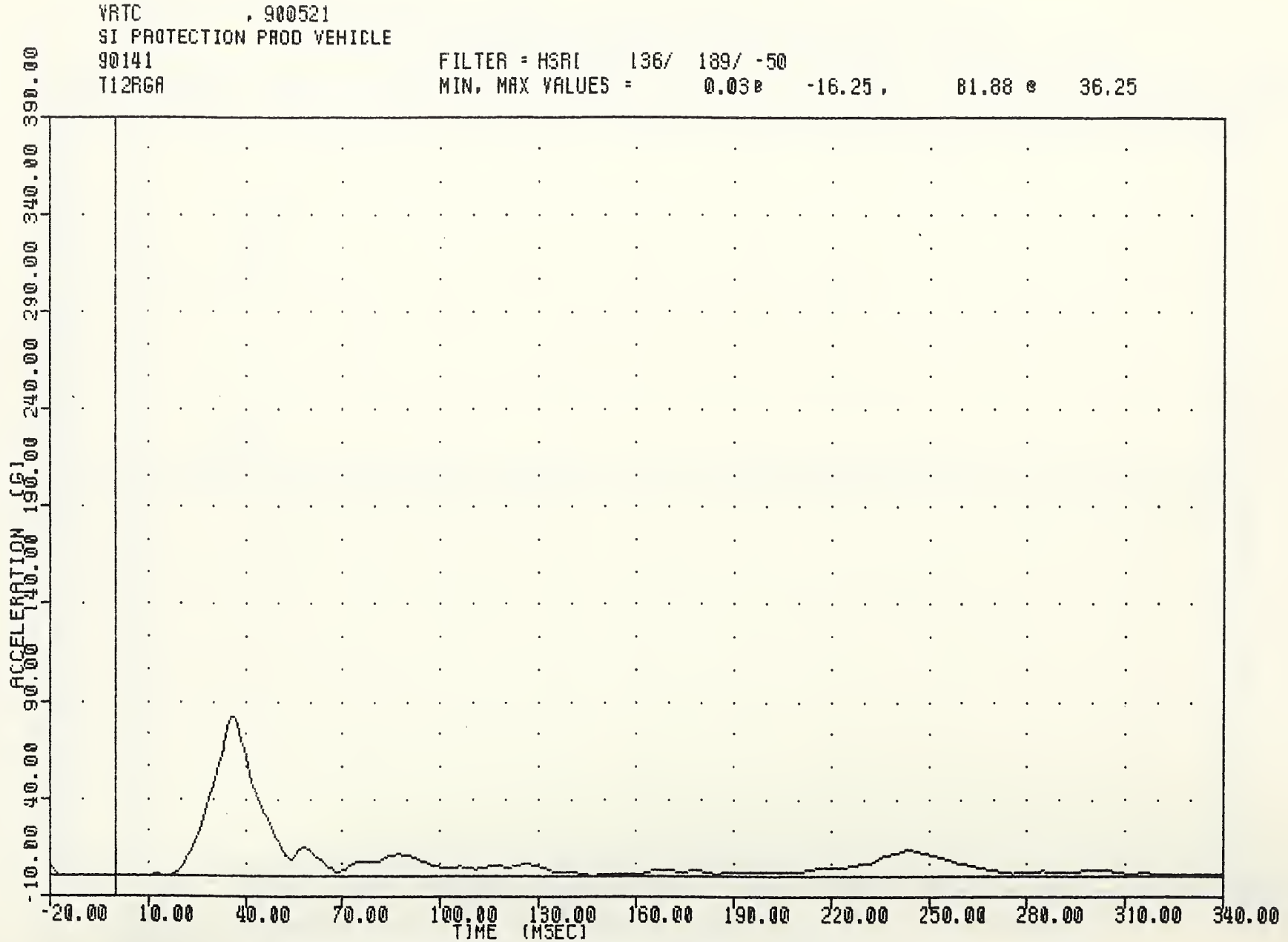
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE Y-AXIS REDUNDANT VELOCITY



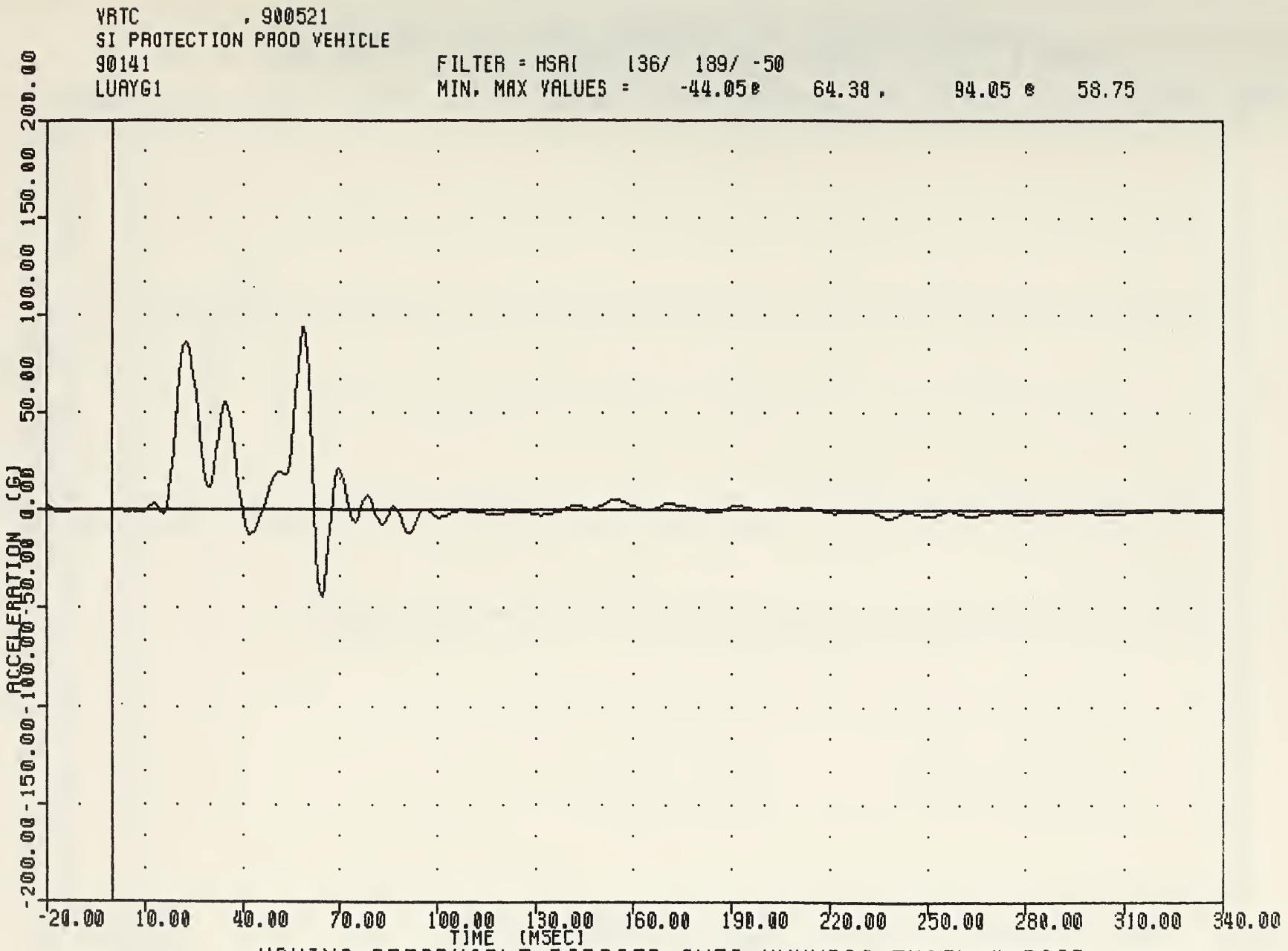
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE Z-AXIS ACCELERATION



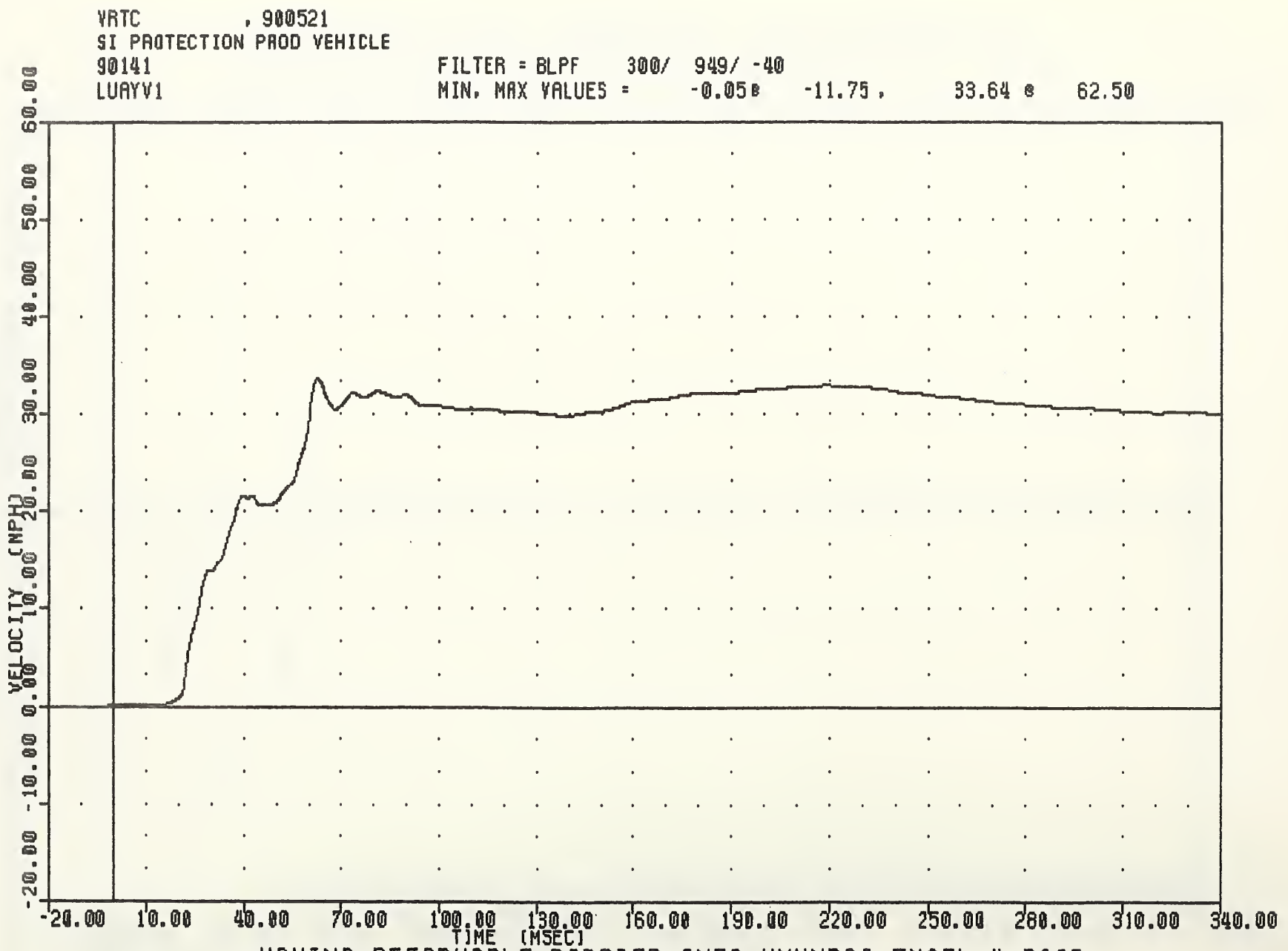
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE RESULTANT ACCELERATION



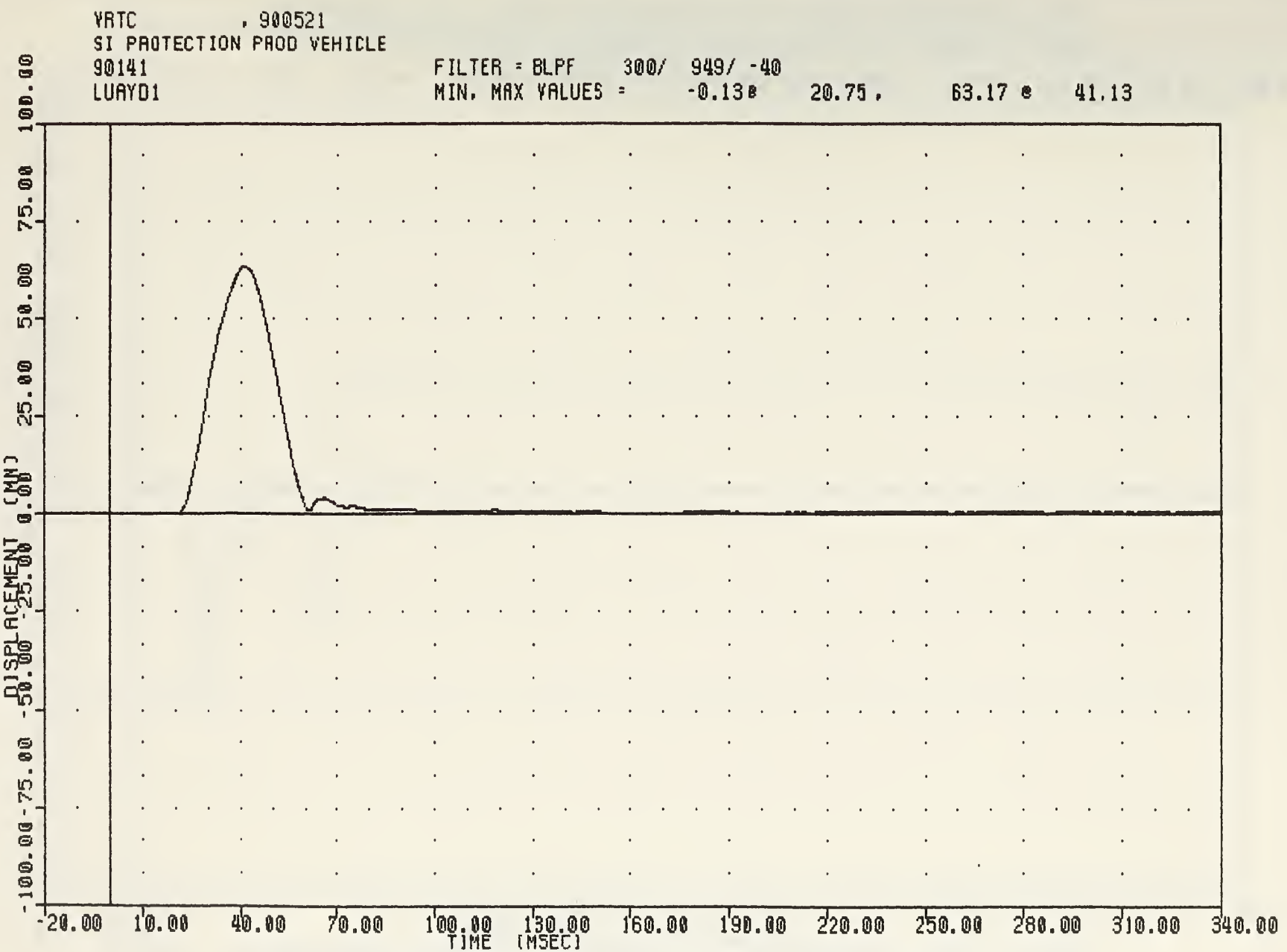
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LOWER SPINE REDUNDANT RESULTANT ACCELERATION



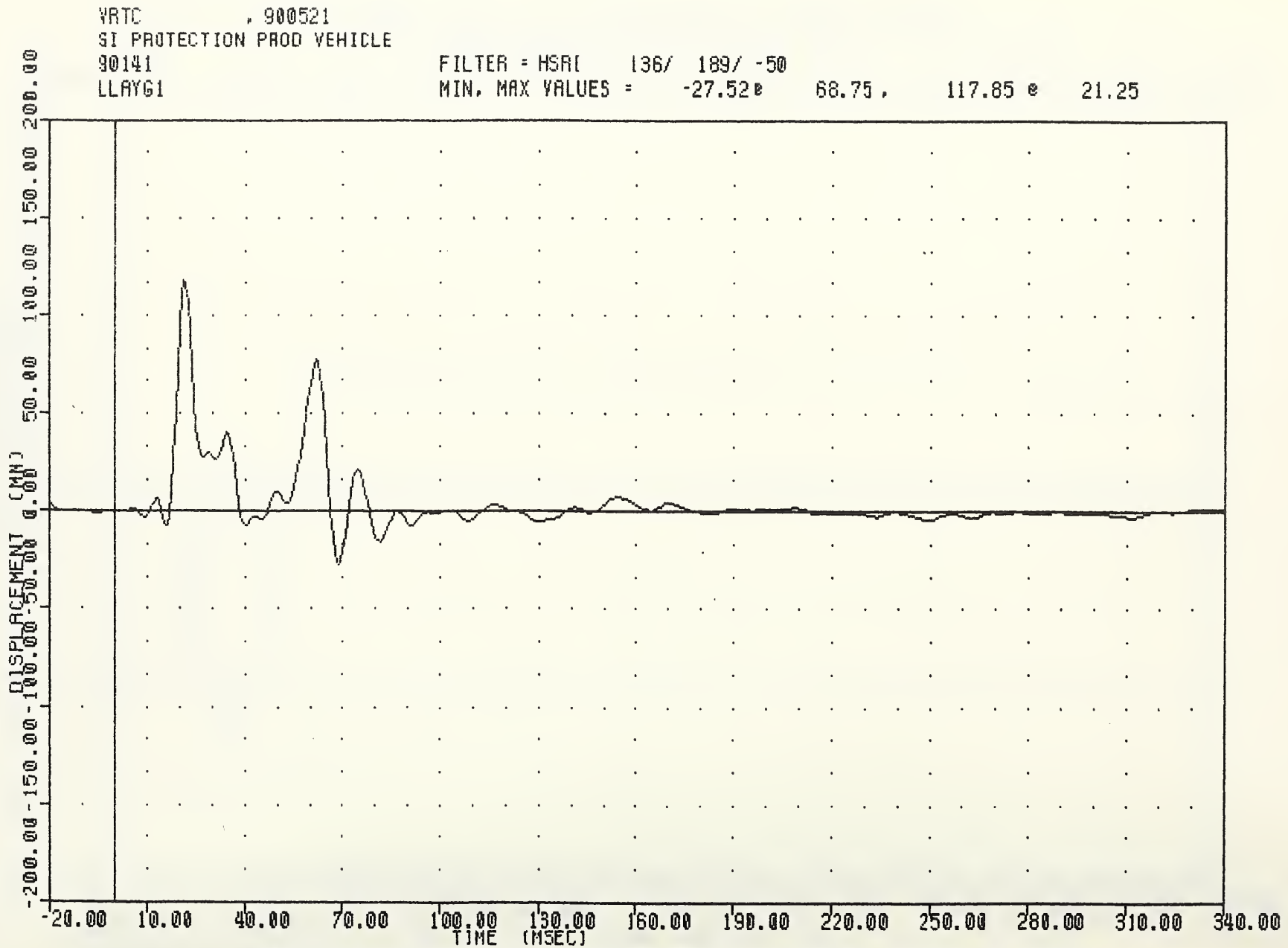
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER ABDOMEN RIB Y-AXIS ACCELERATION



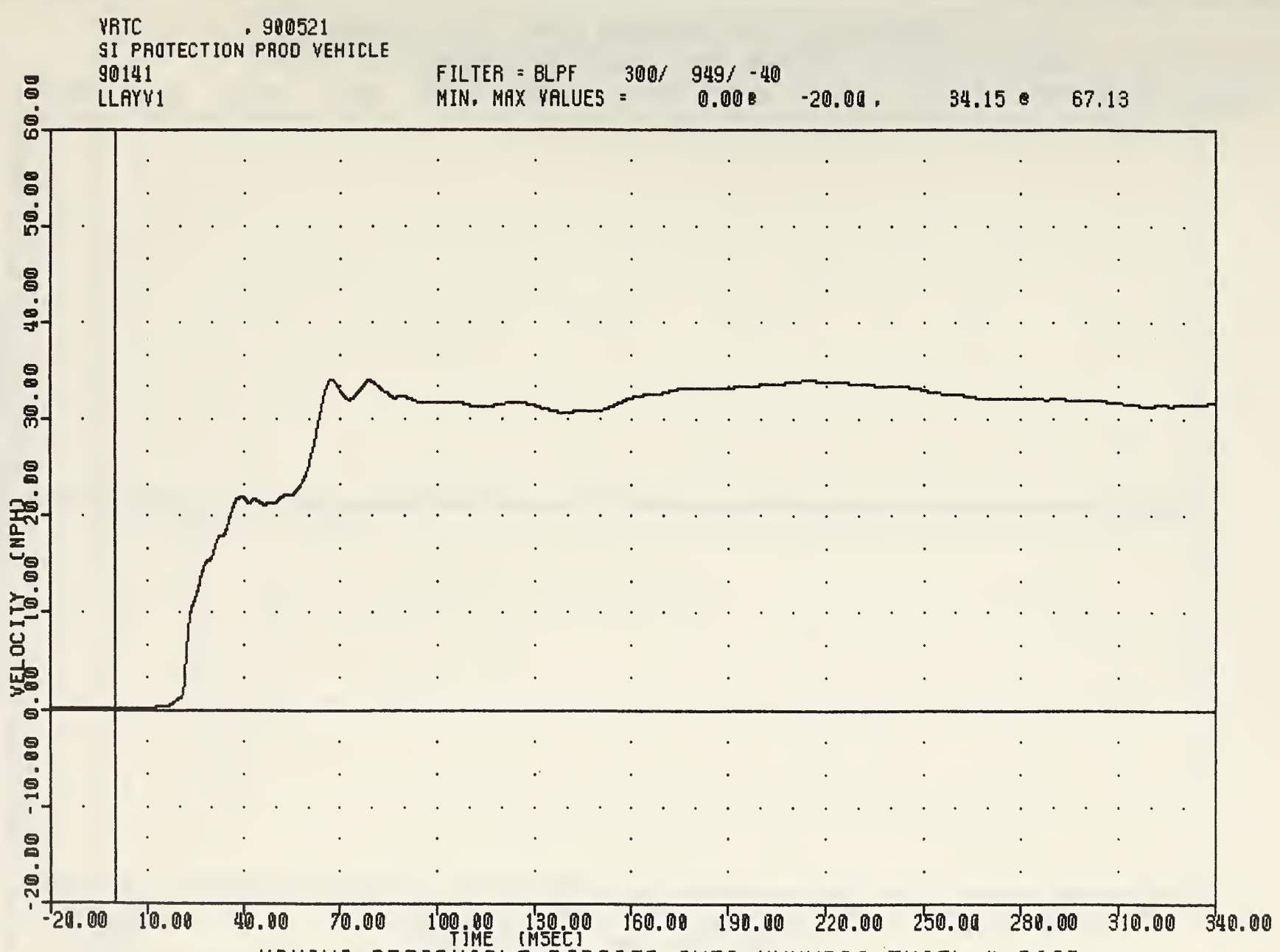
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER ABDOMEN RIB Y-AXIS VELOCITY



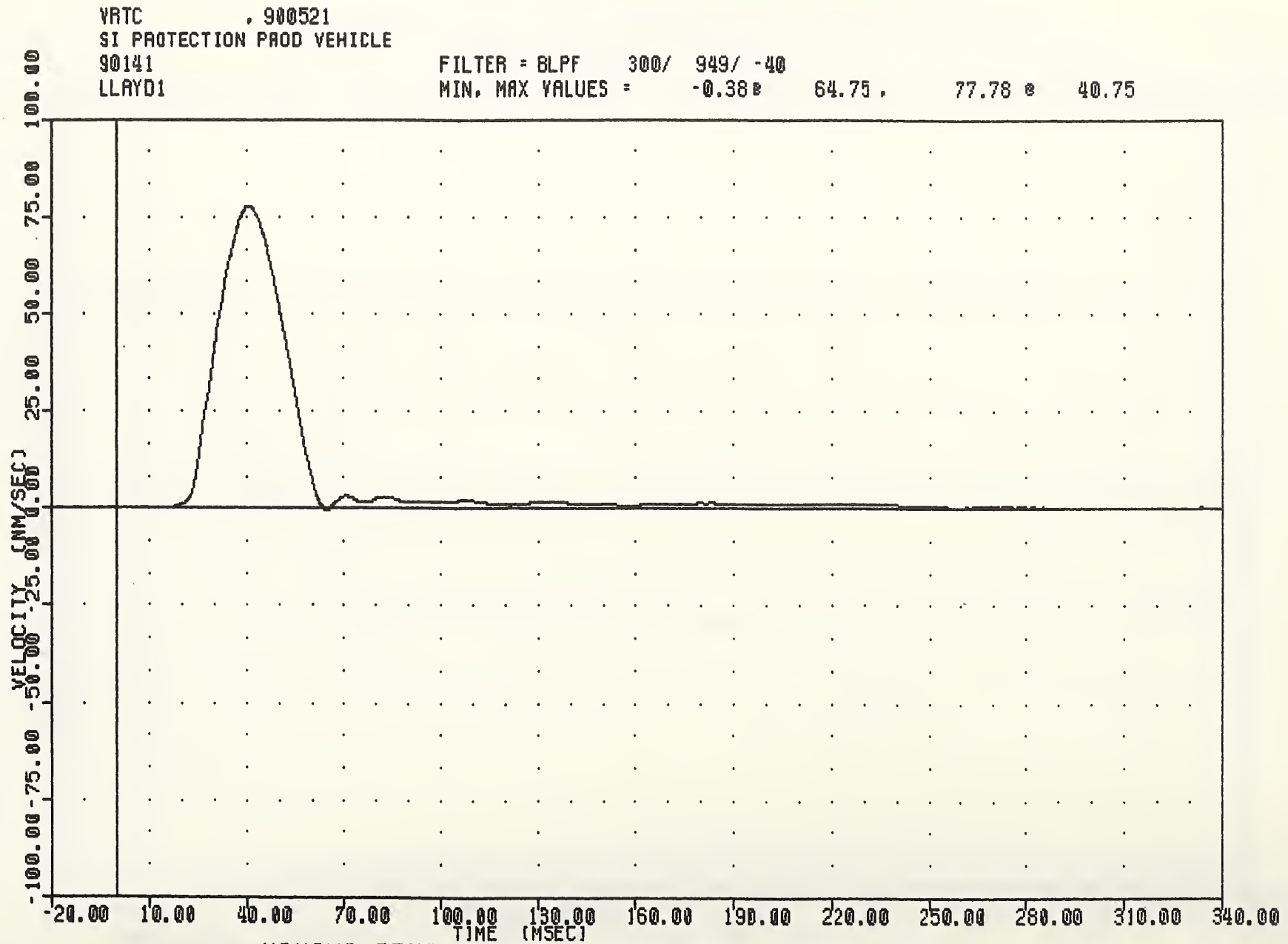
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT UPPER ABDOMEN RIB DISPLACEMENT



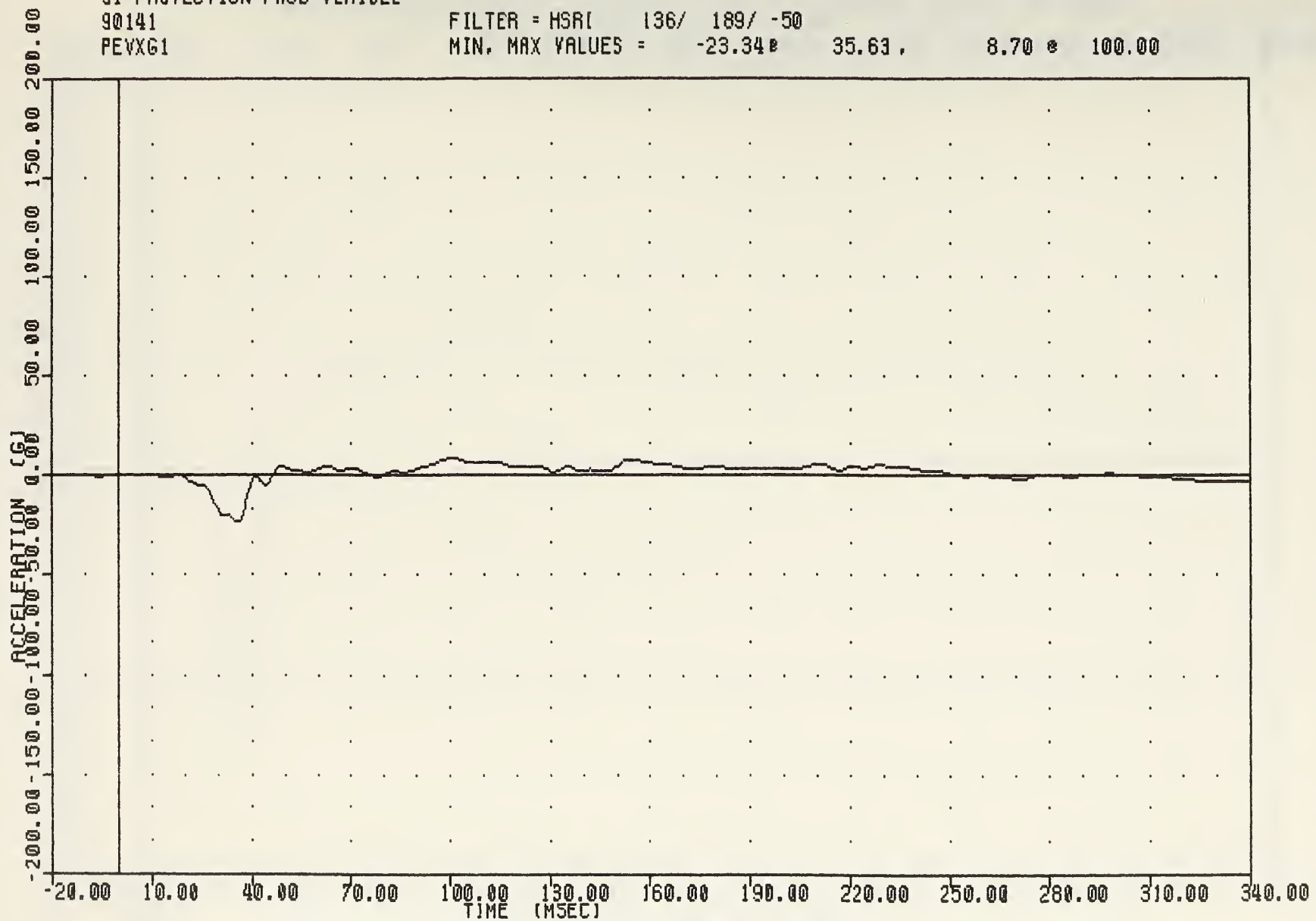
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER ABDOMEN RIB Y-AXIS ACCELERATION



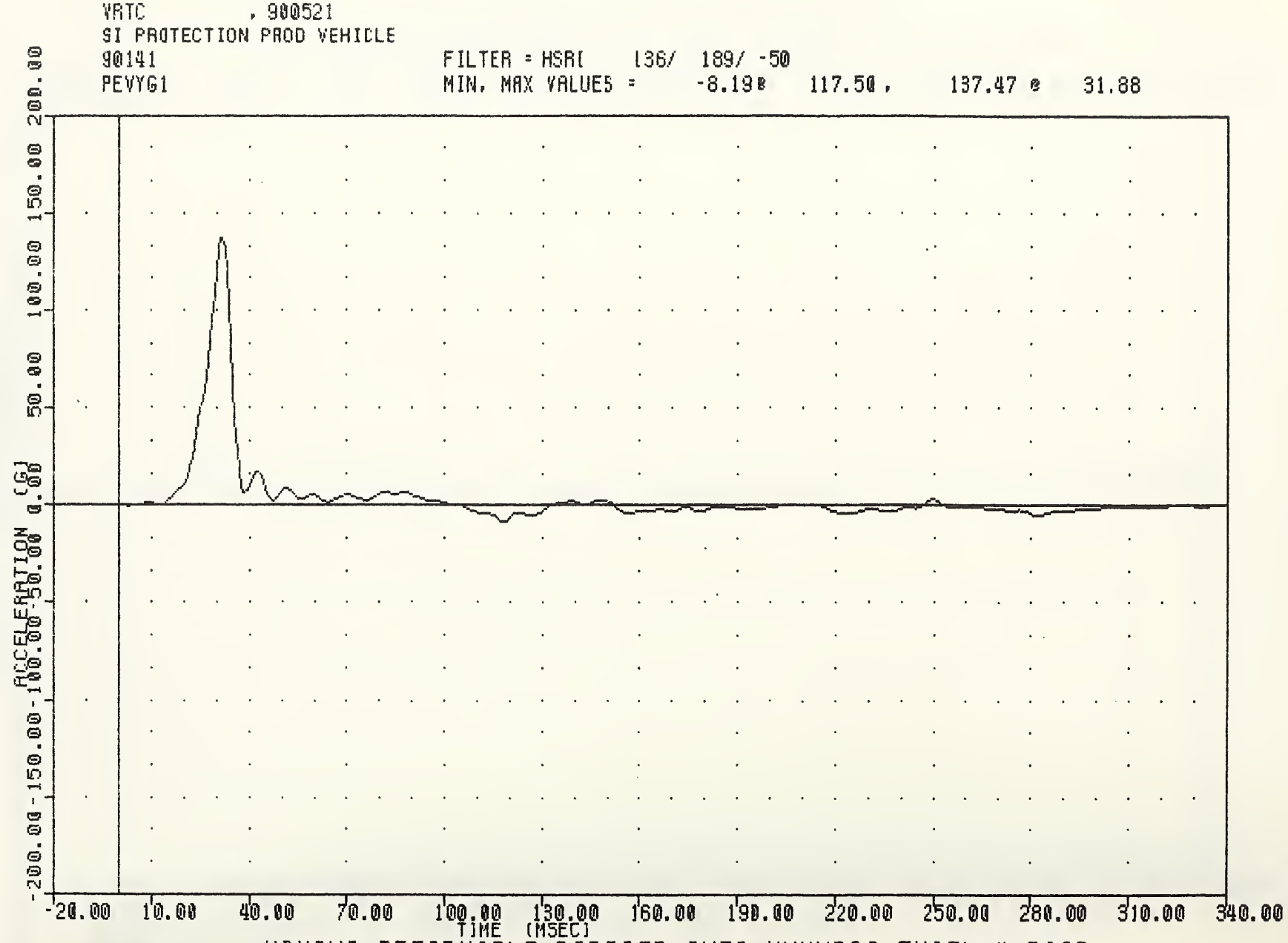
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER ABDOMEN RIB Y-AXIS VELOCITY



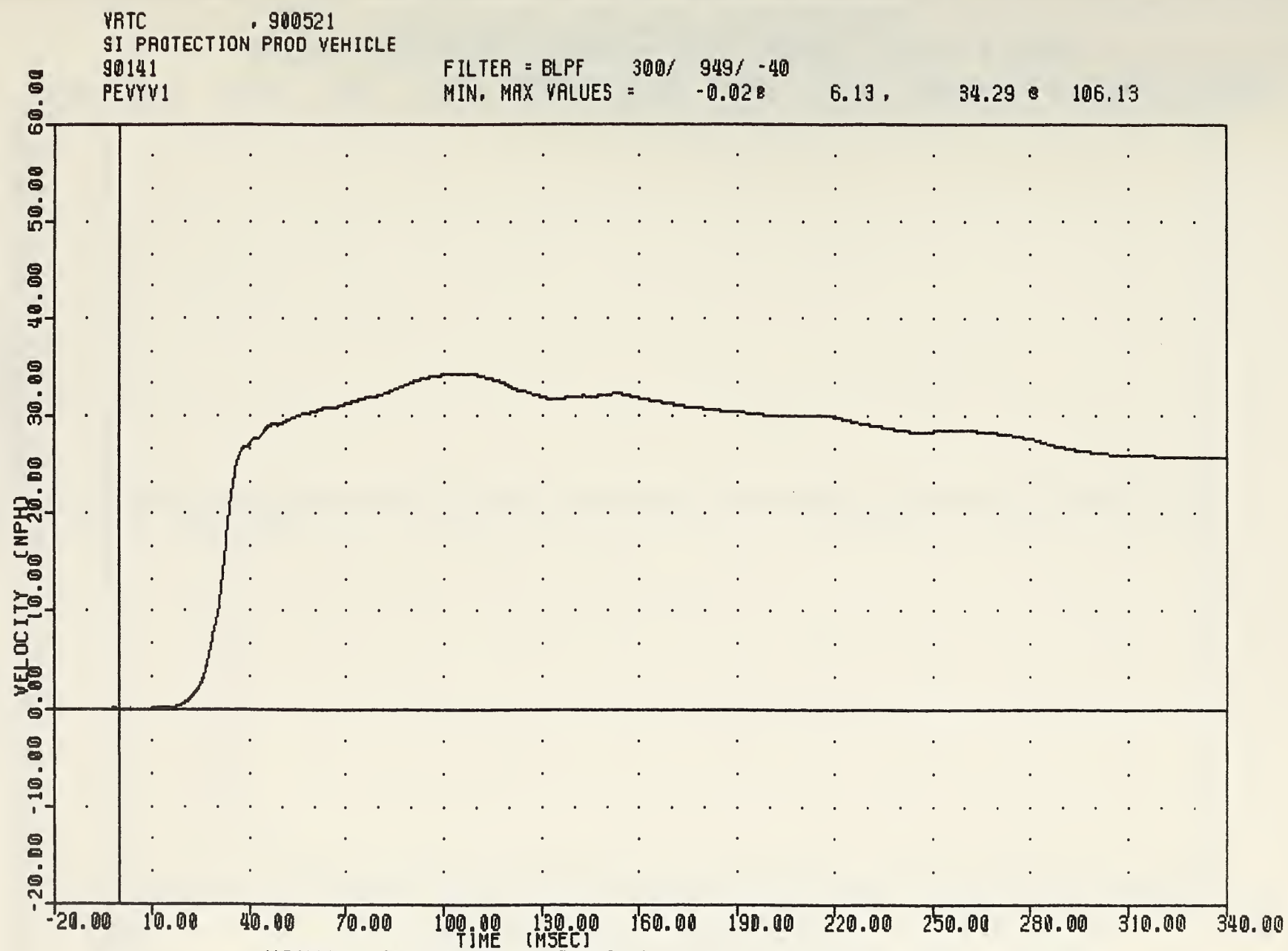
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER LEFT LOWER ABDOMEN RIB DISPLACEMENT



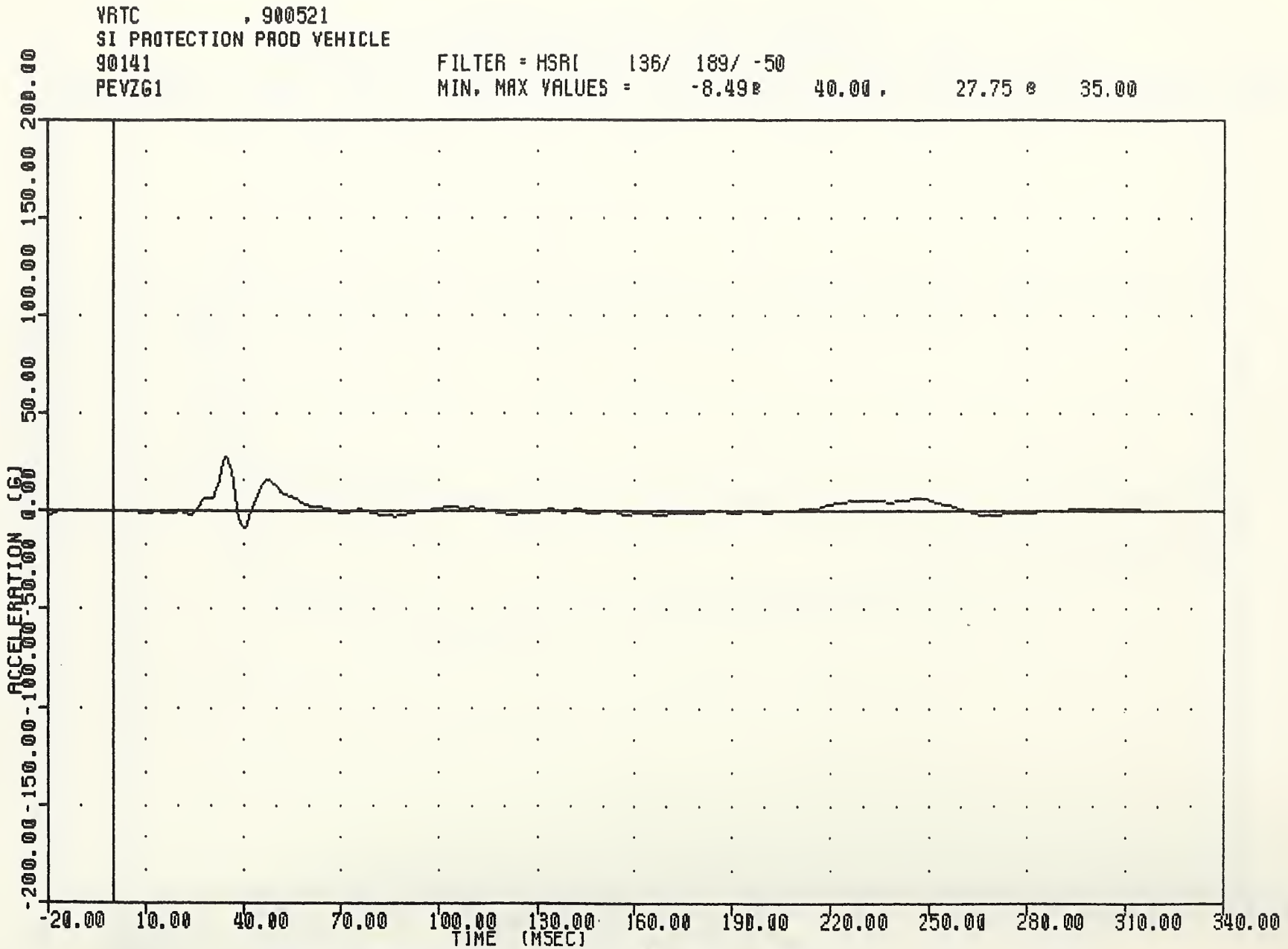
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS X-AXIS ACCELERATION



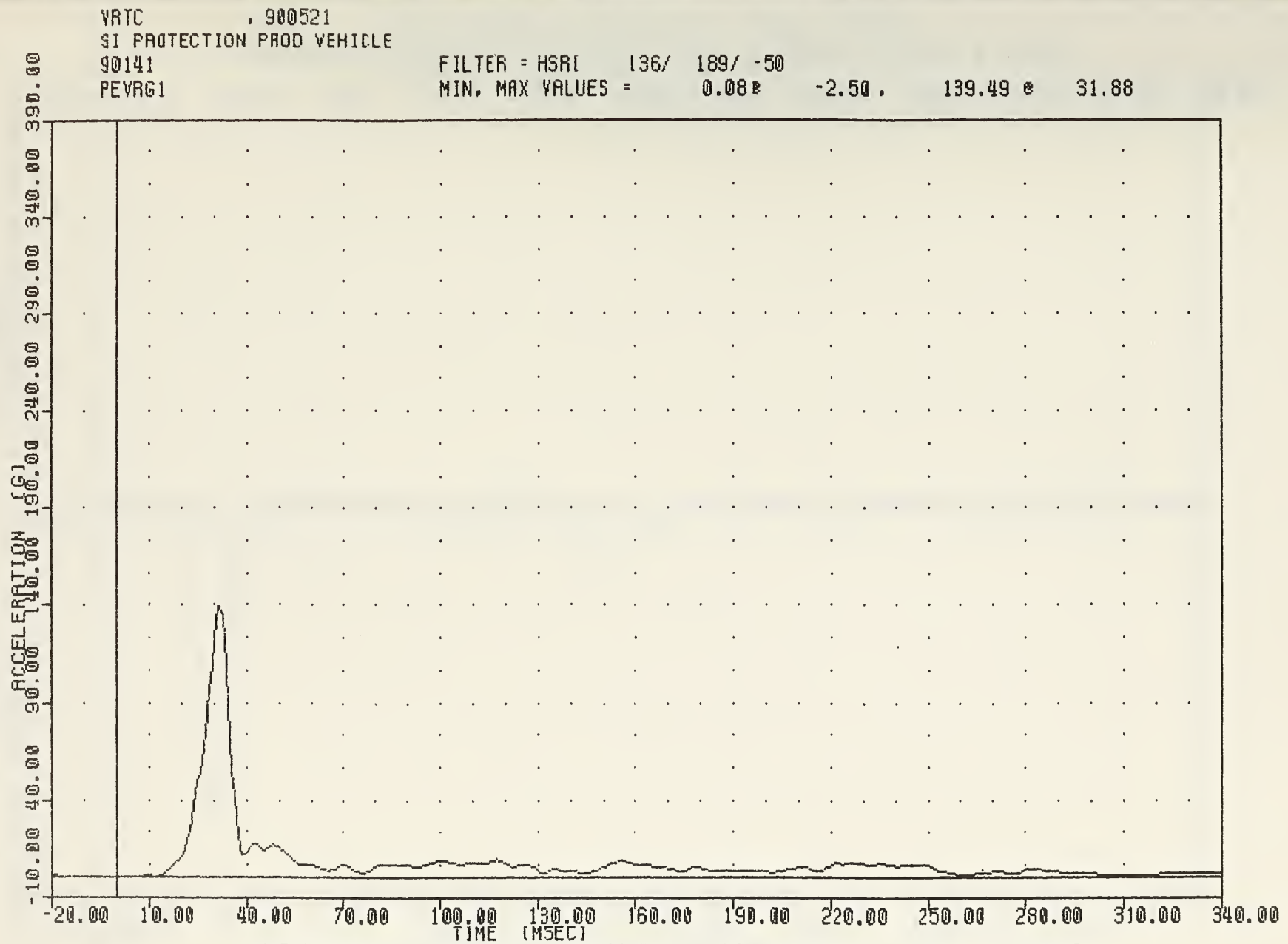
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS Y-AXIS ACCELERATION



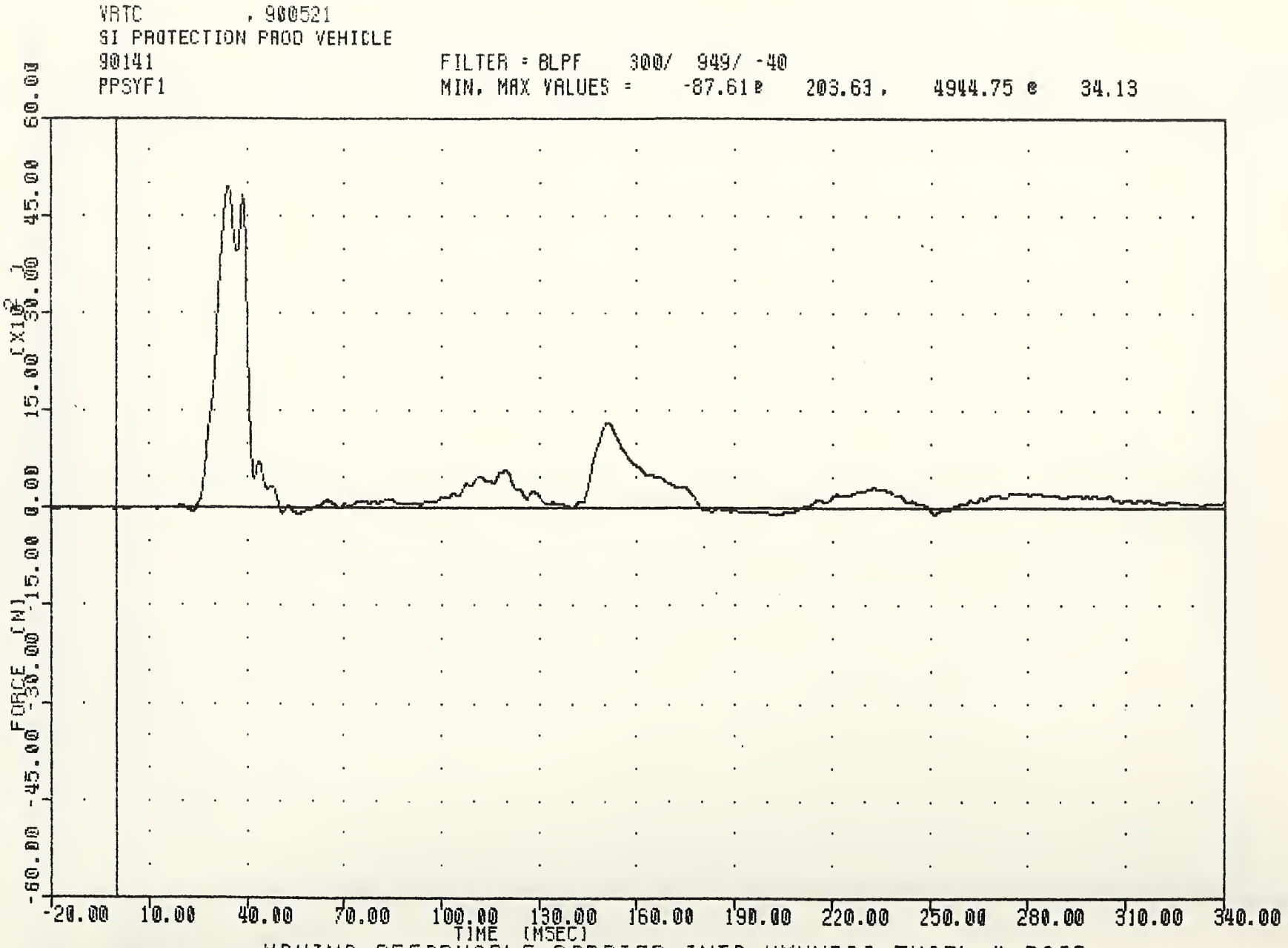
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS Y-AXIS VELOCITY



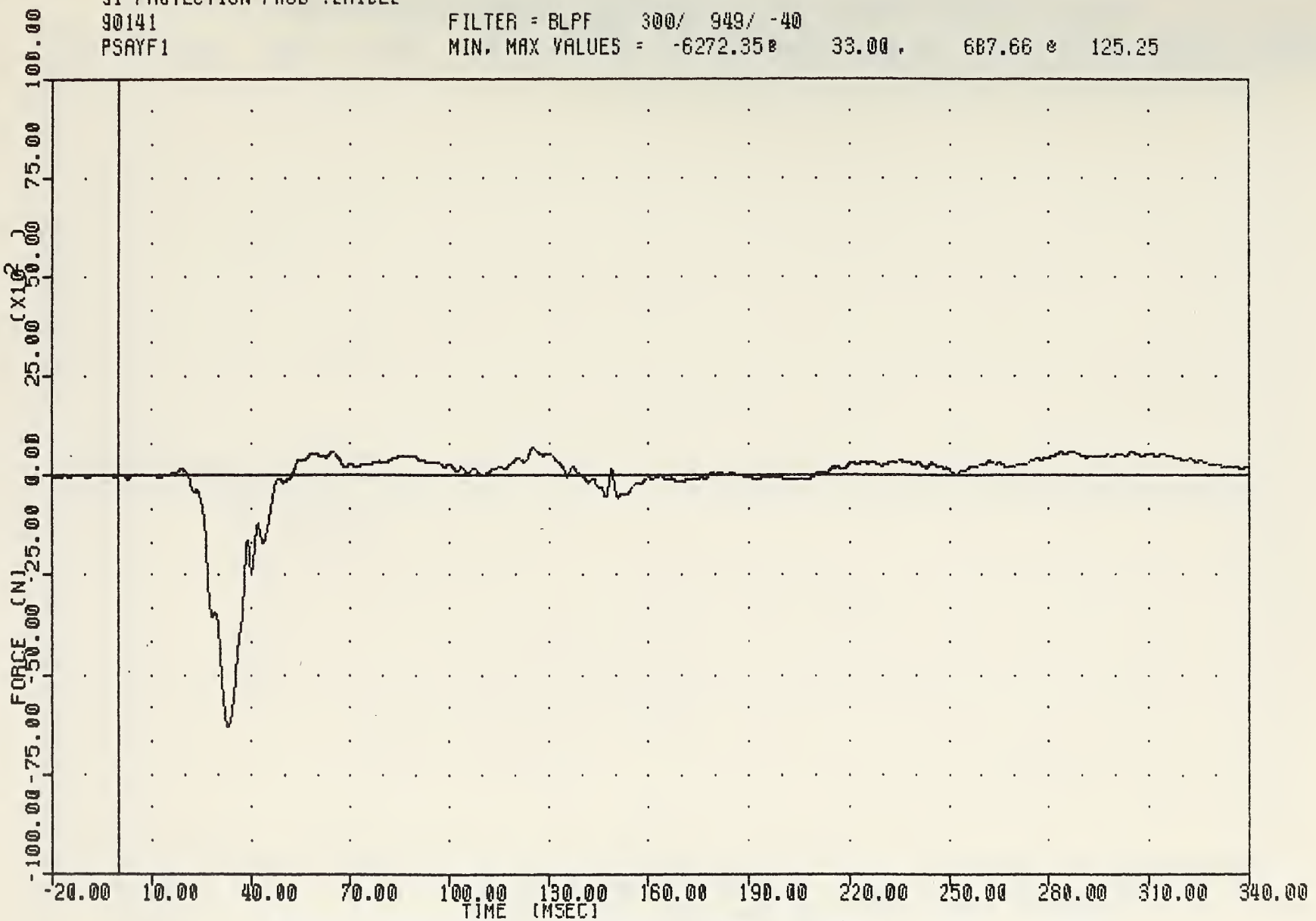
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS Z-AXIS ACCELERATION



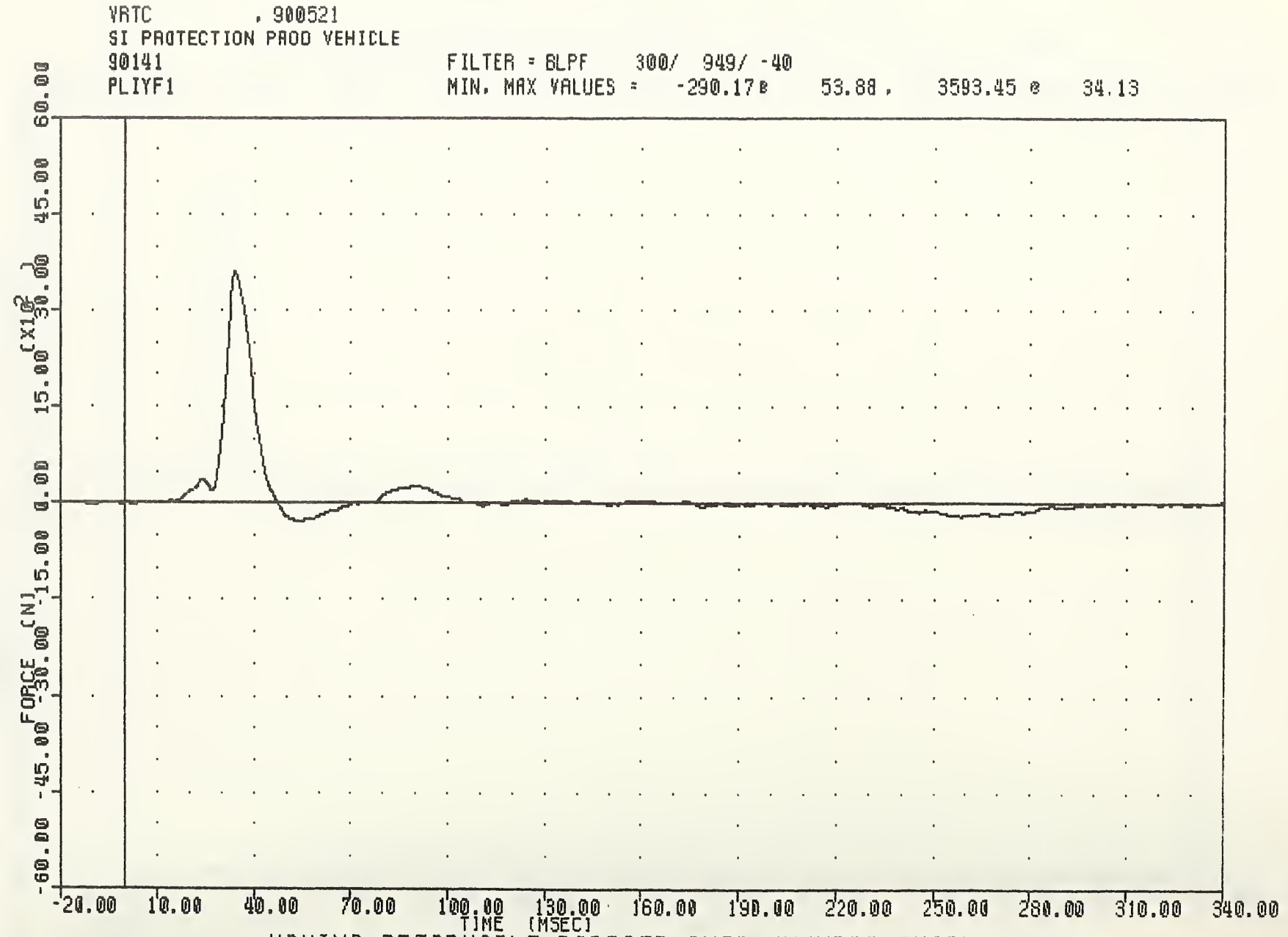
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS RESULTANT ACCELERATION



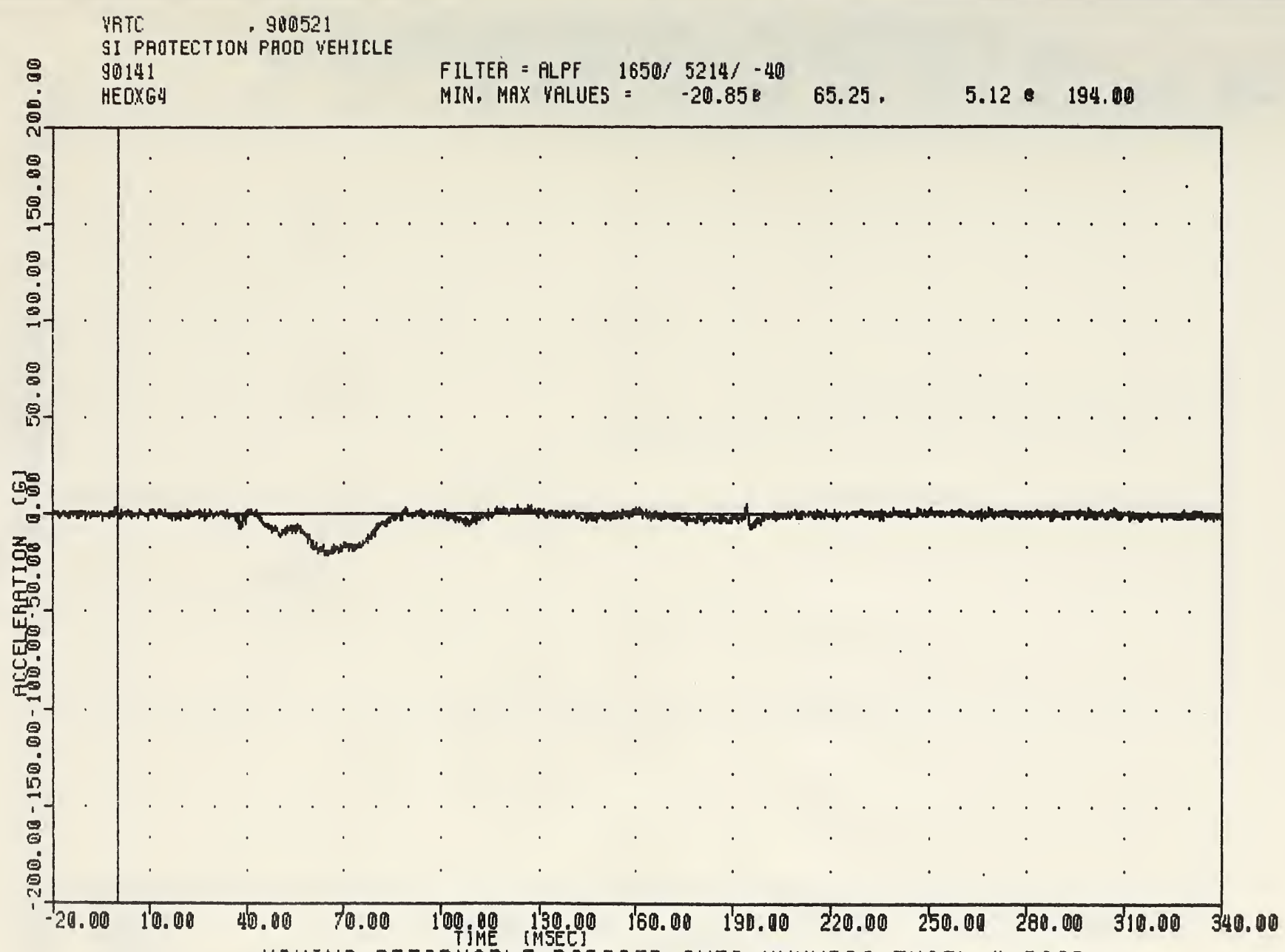
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PUBIC SYMPHYSIS Y-AXIS FORCE



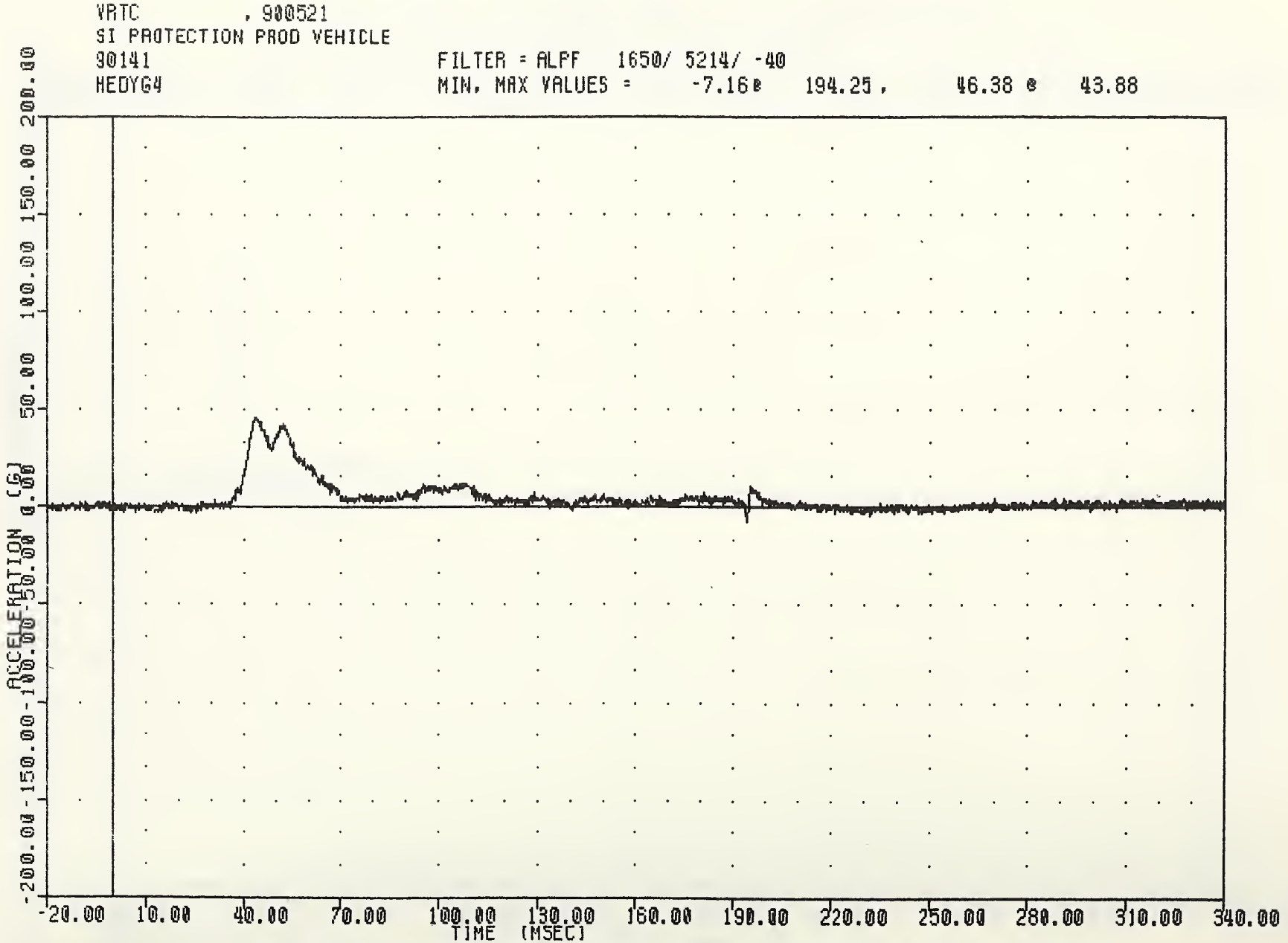
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS SACRUM Y-AXIS FORCE



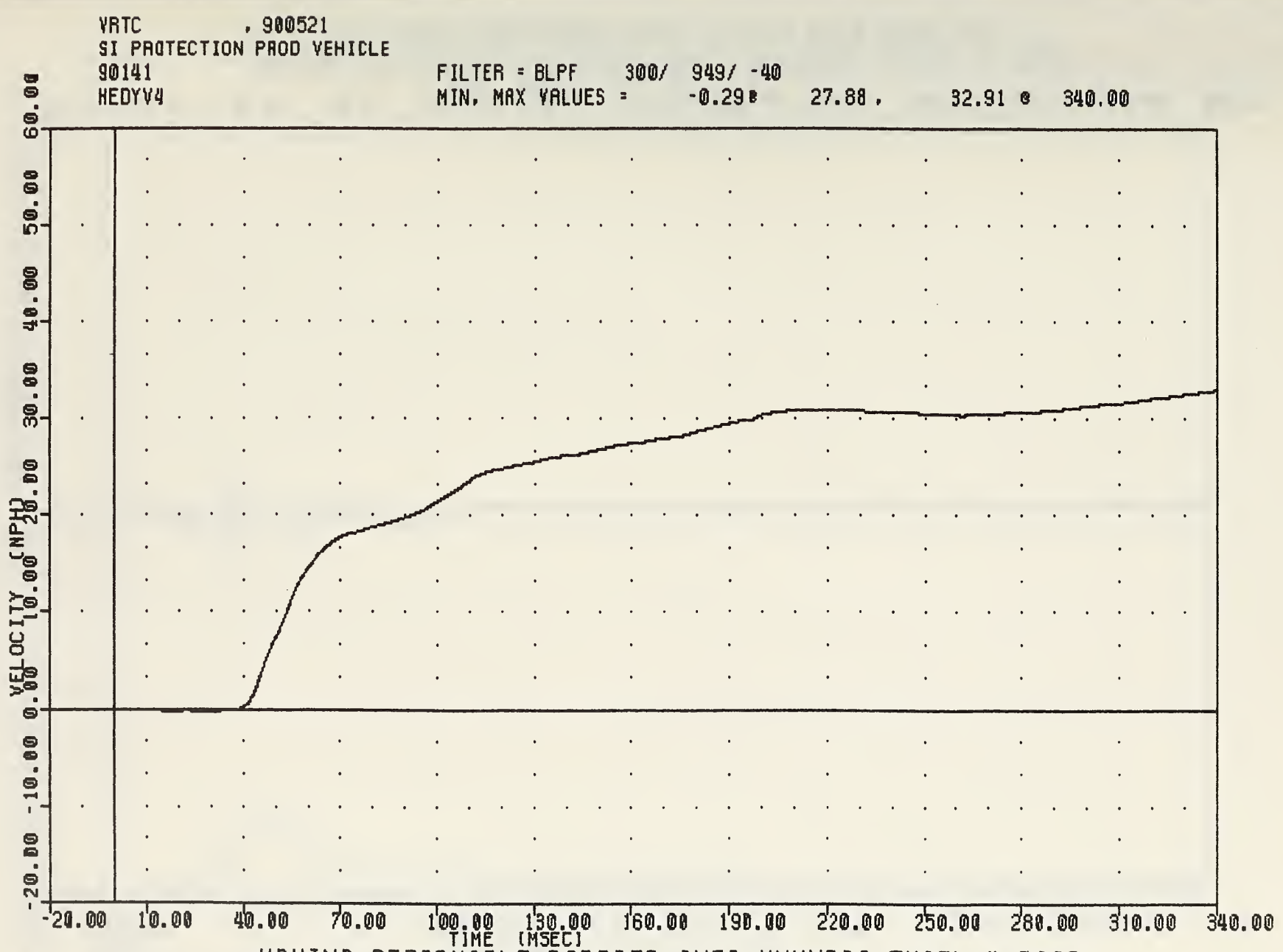
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
DRIVER PELVIS ILIAC Y-AXIS FORCE



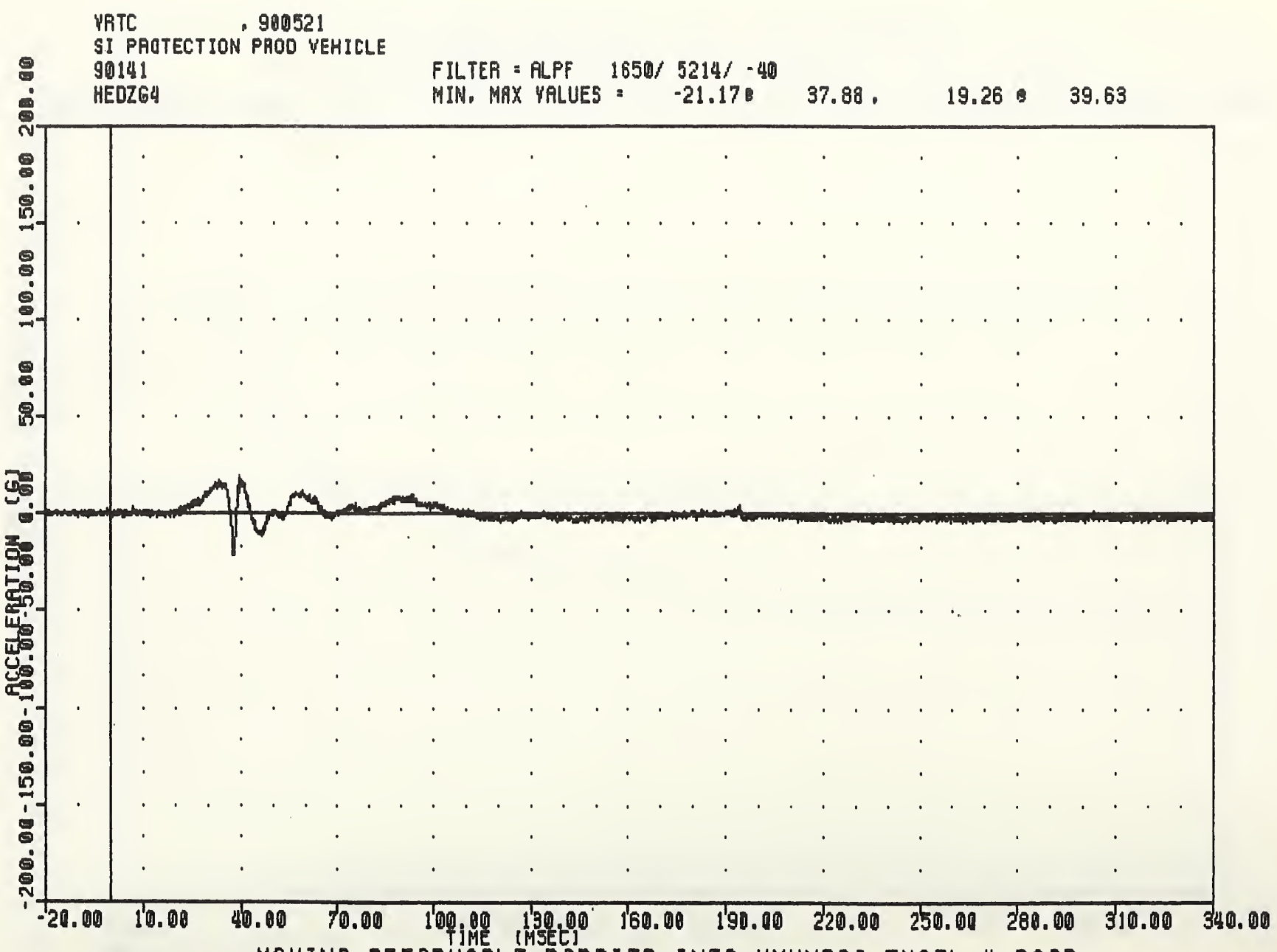
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER HEAD X-AXIS ACCELERATION



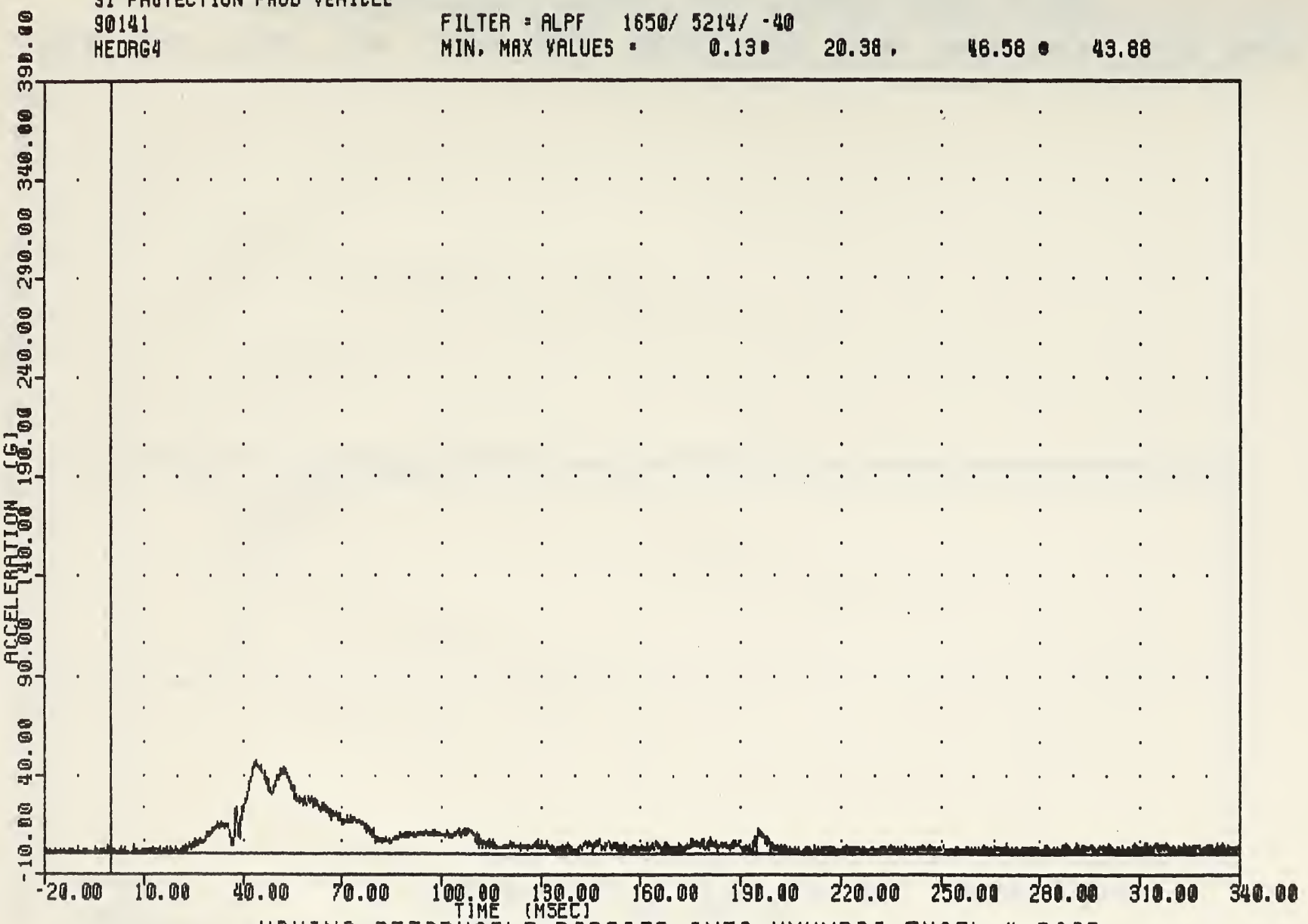
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER HEAD Y-AXIS ACCELERATION



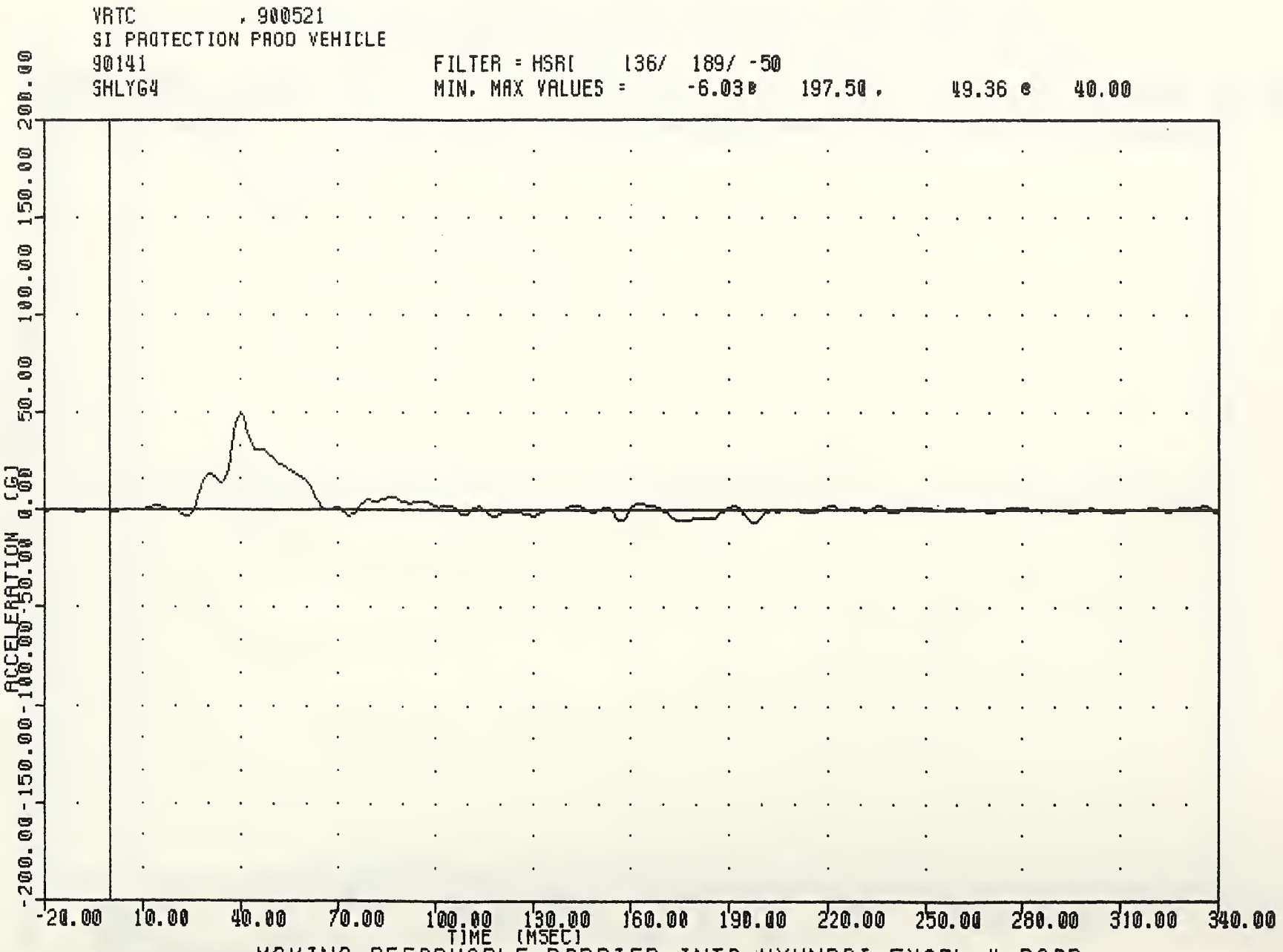
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER HEAD Y-AXIS VELOCITY



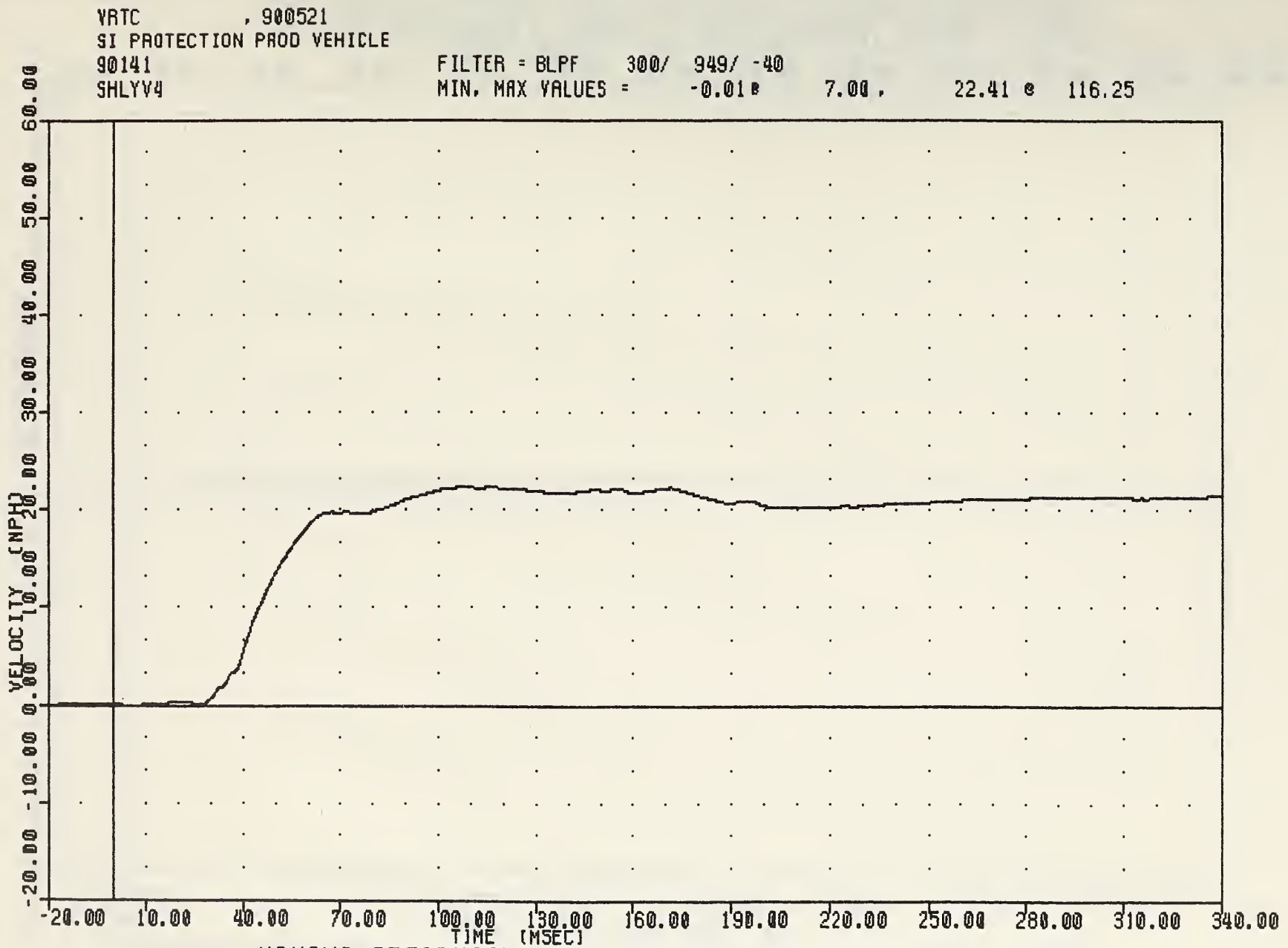
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER HEAD Z-AXIS ACCELERATION



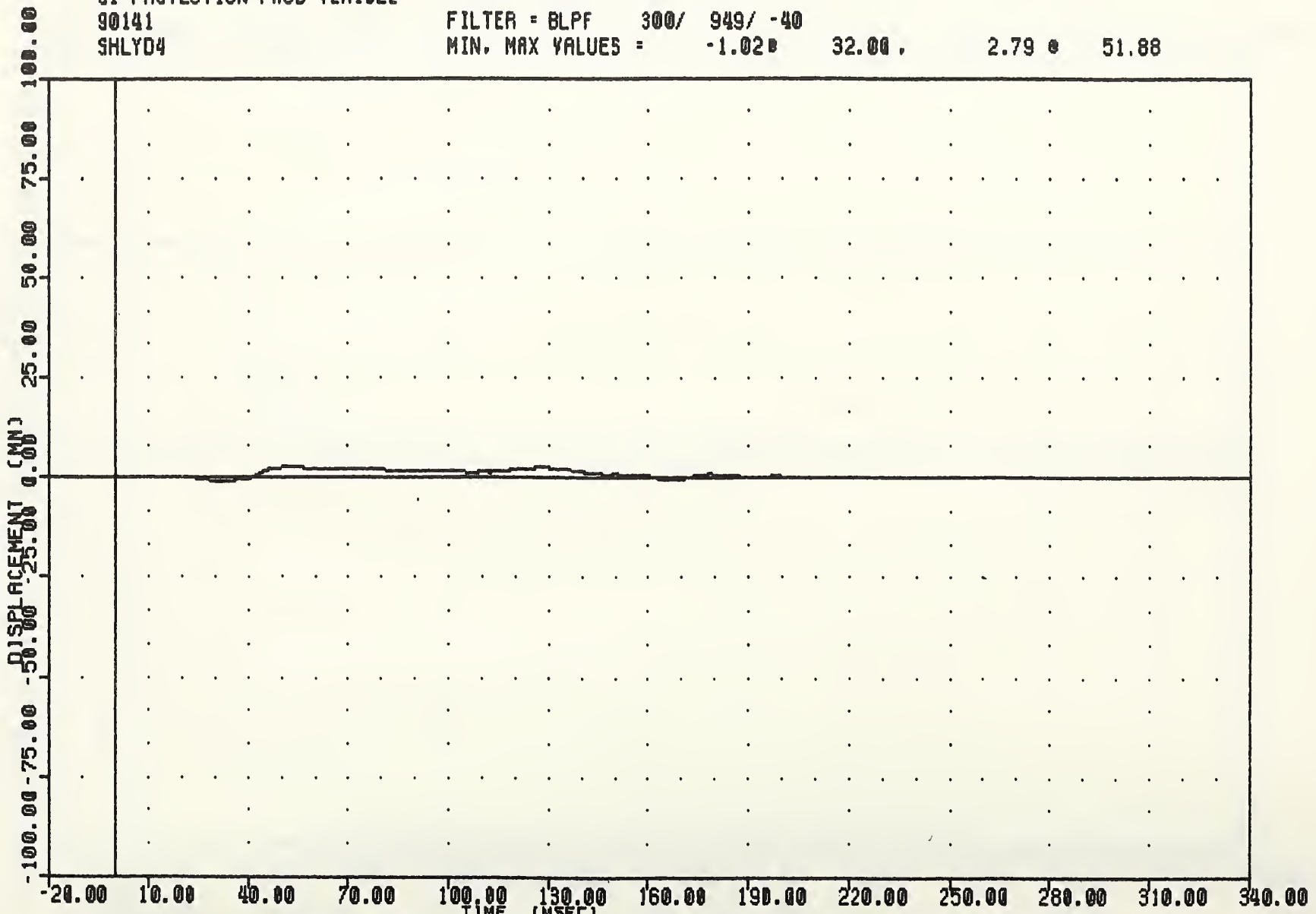
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER HEAD RESULTANT ACCELERATION



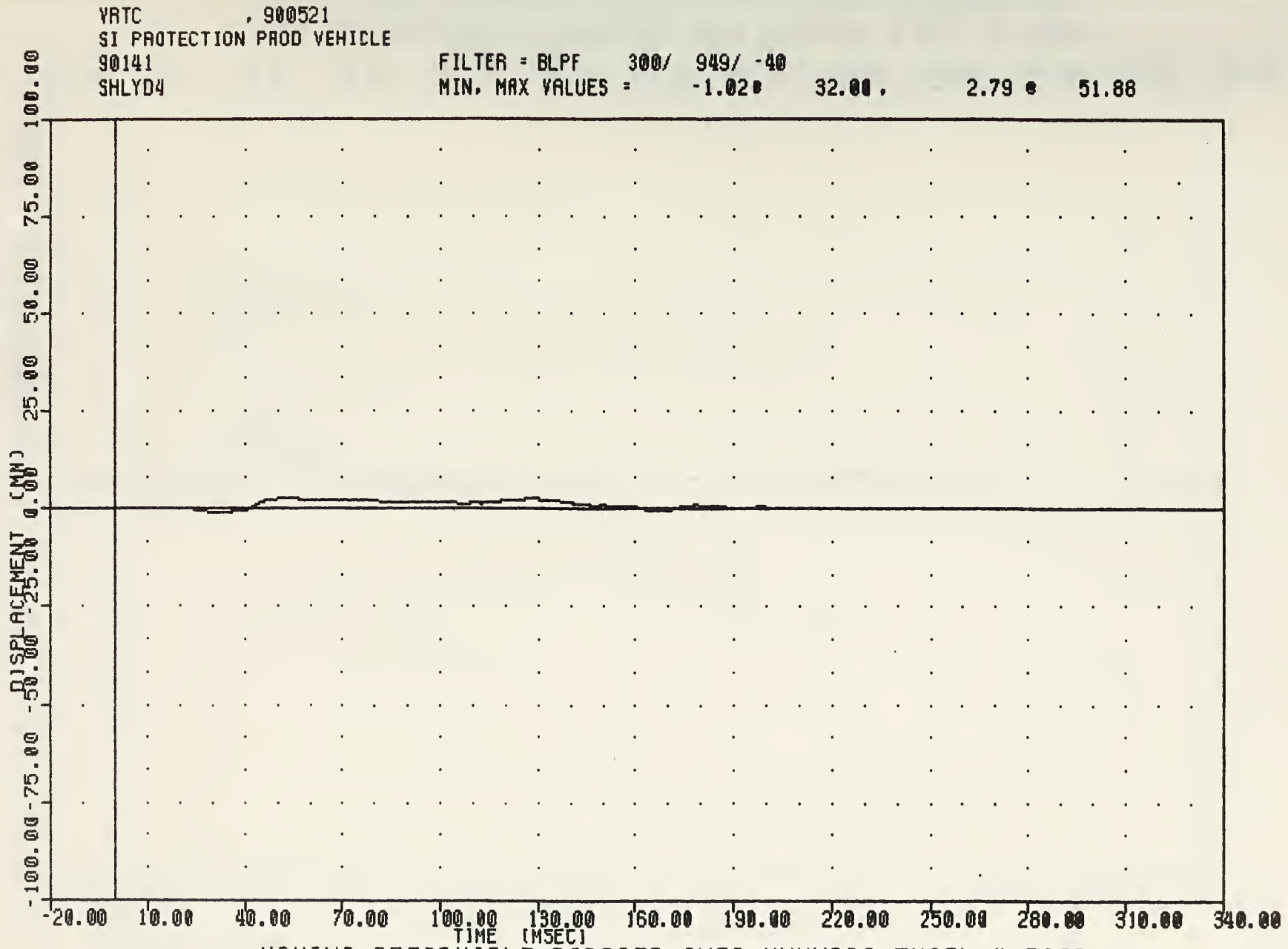
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT SHOULDER X-AXIS ACCELERATION



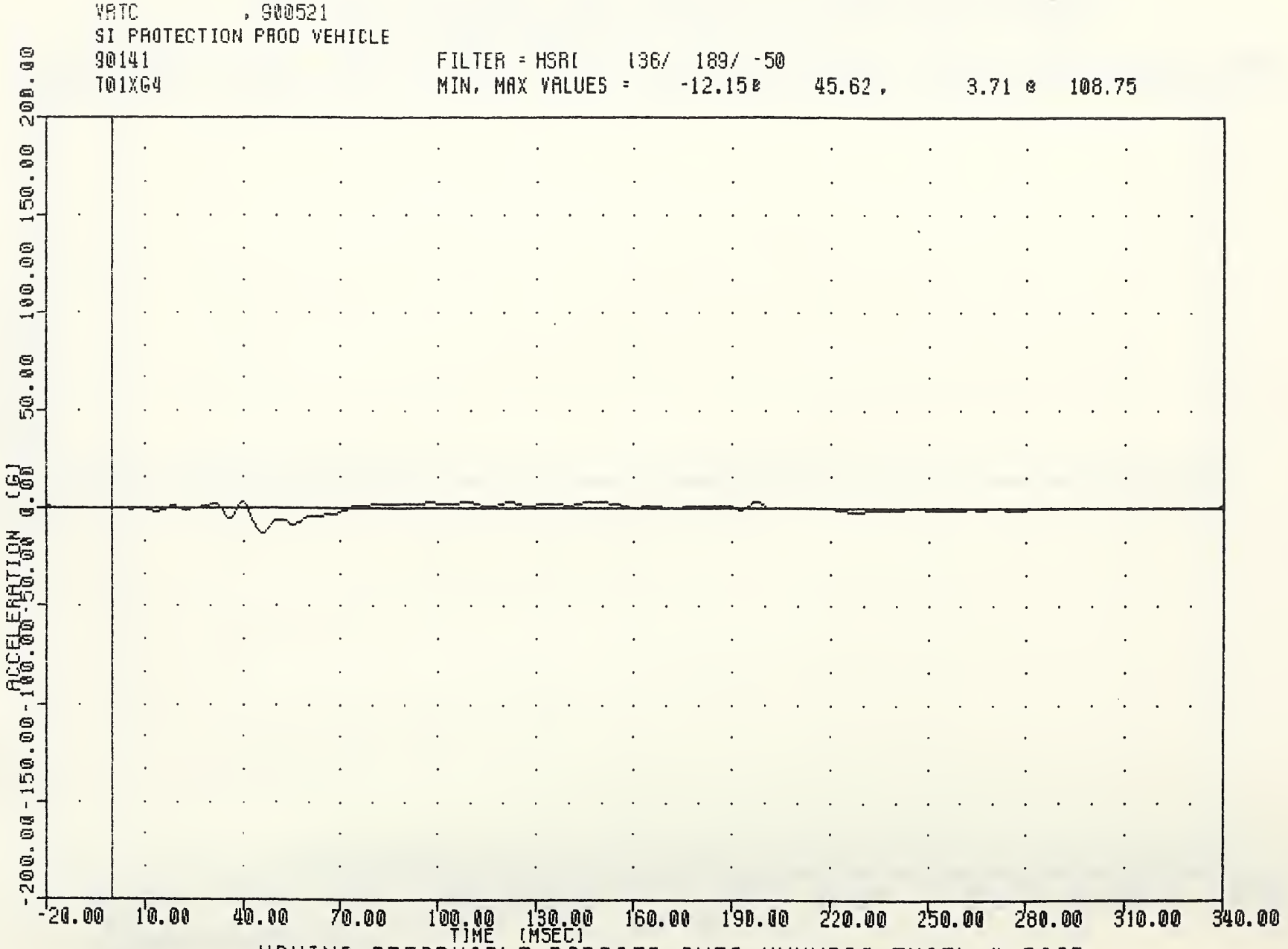
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT SHOULDER Y-AXIS VELOCITY



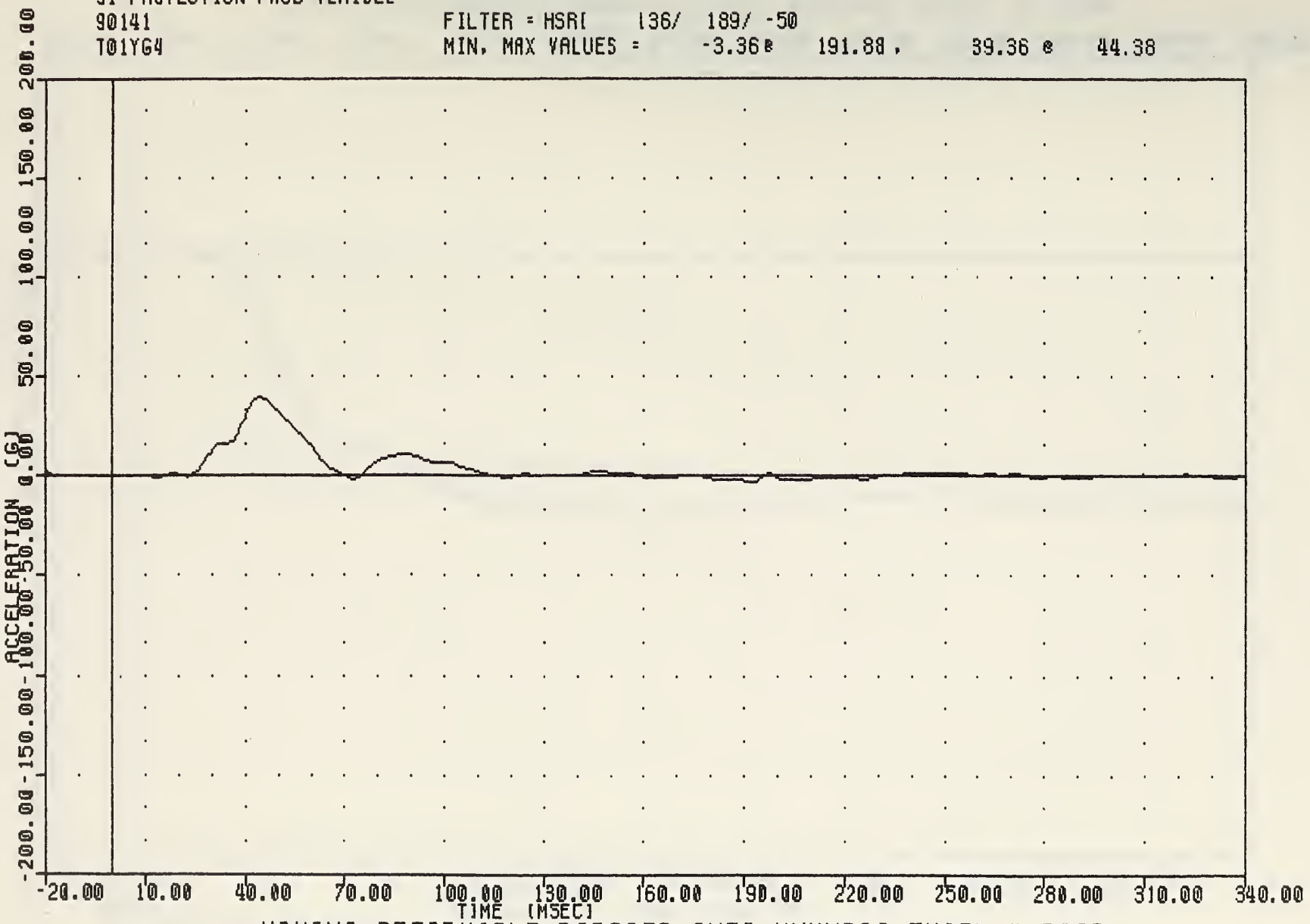
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT SHOULDER TO SPINE DISPLACEMENT



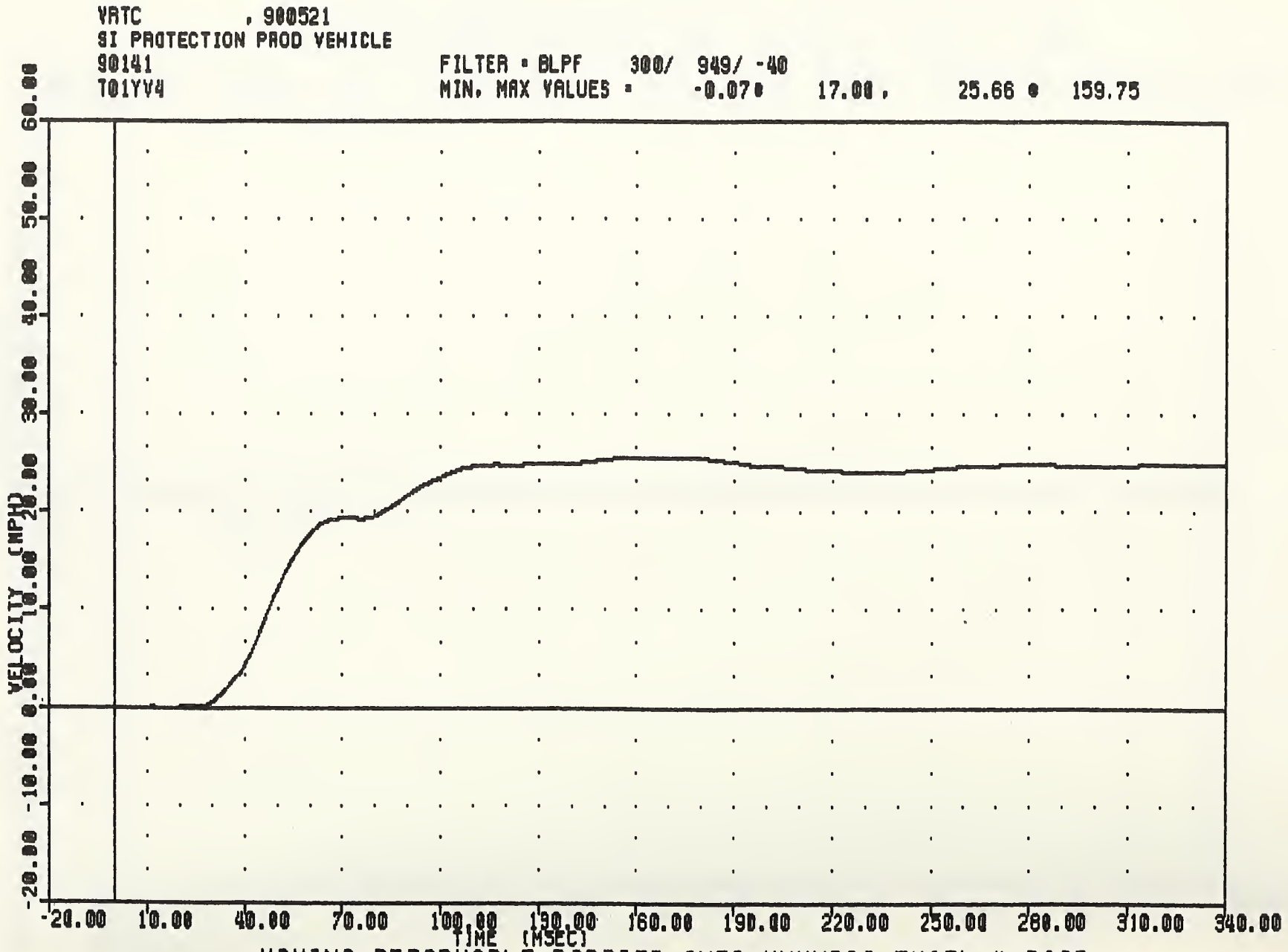
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT SHOULDER TO SPINE DISPLACEMENT



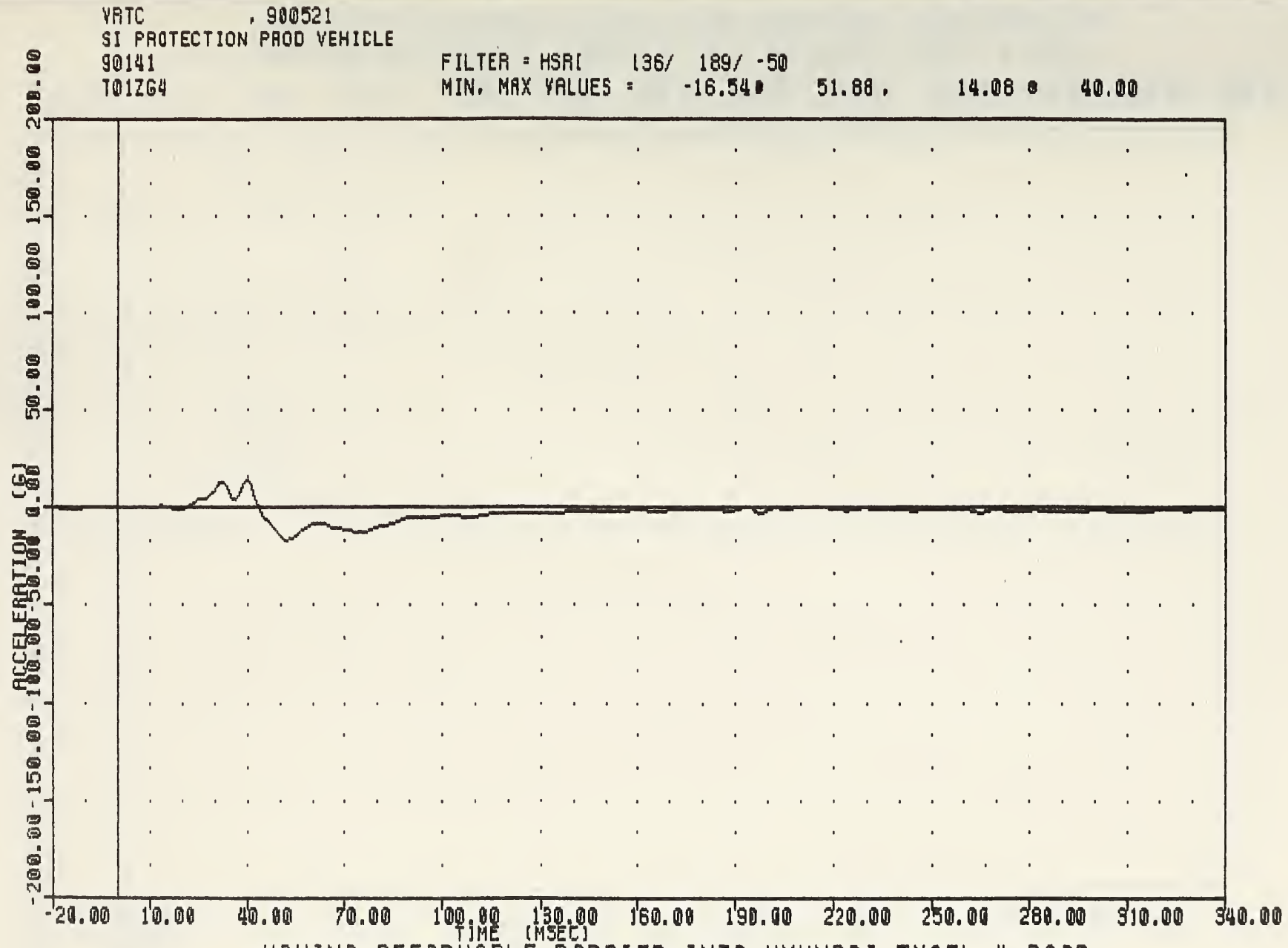
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER UPPER SPINE X-AXIS ACCELERATION



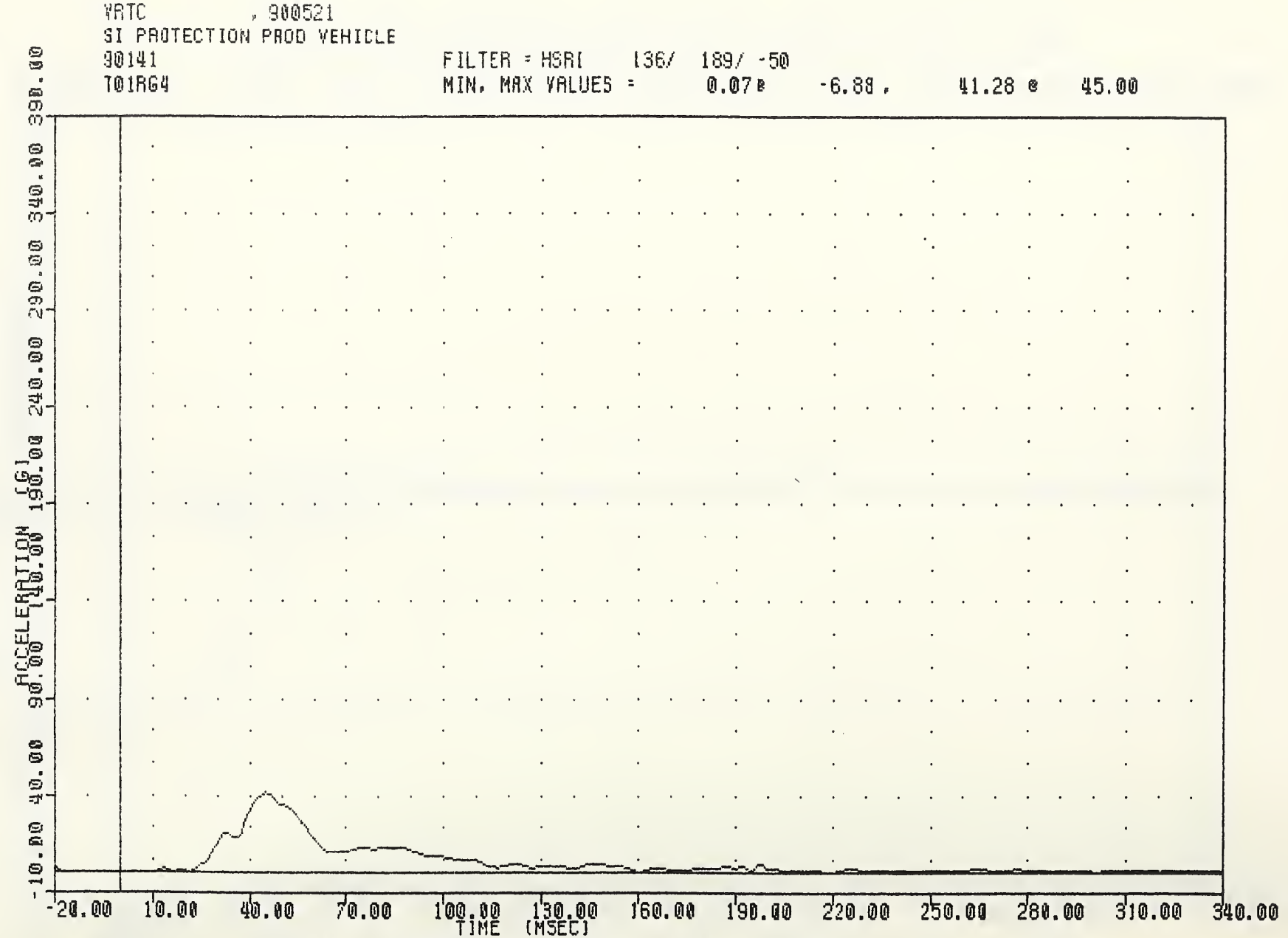
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER UPPER SPINE Y-AXIS ACCELERATION



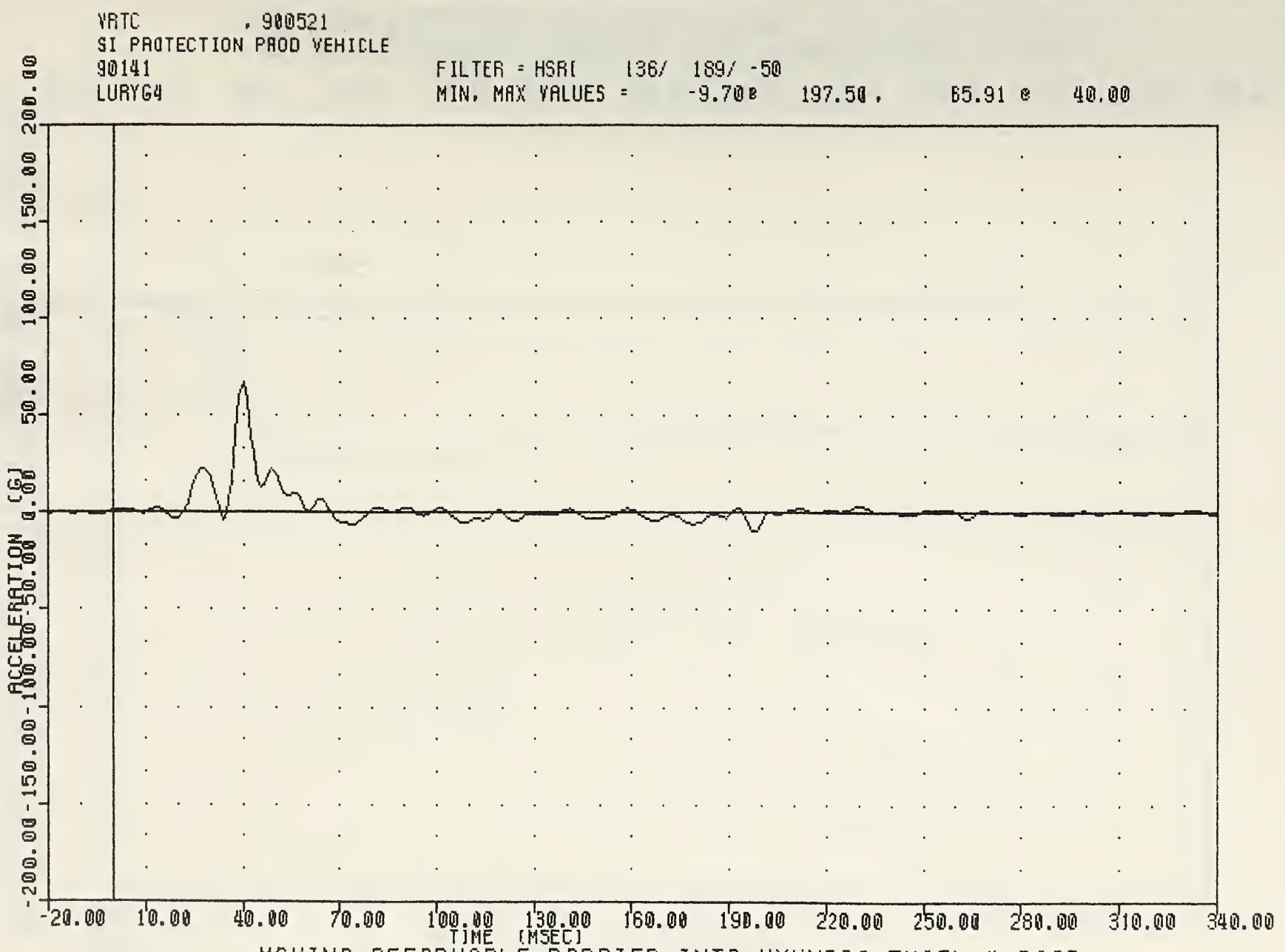
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER UPPER SPINE Y-AXIS VELOCITY



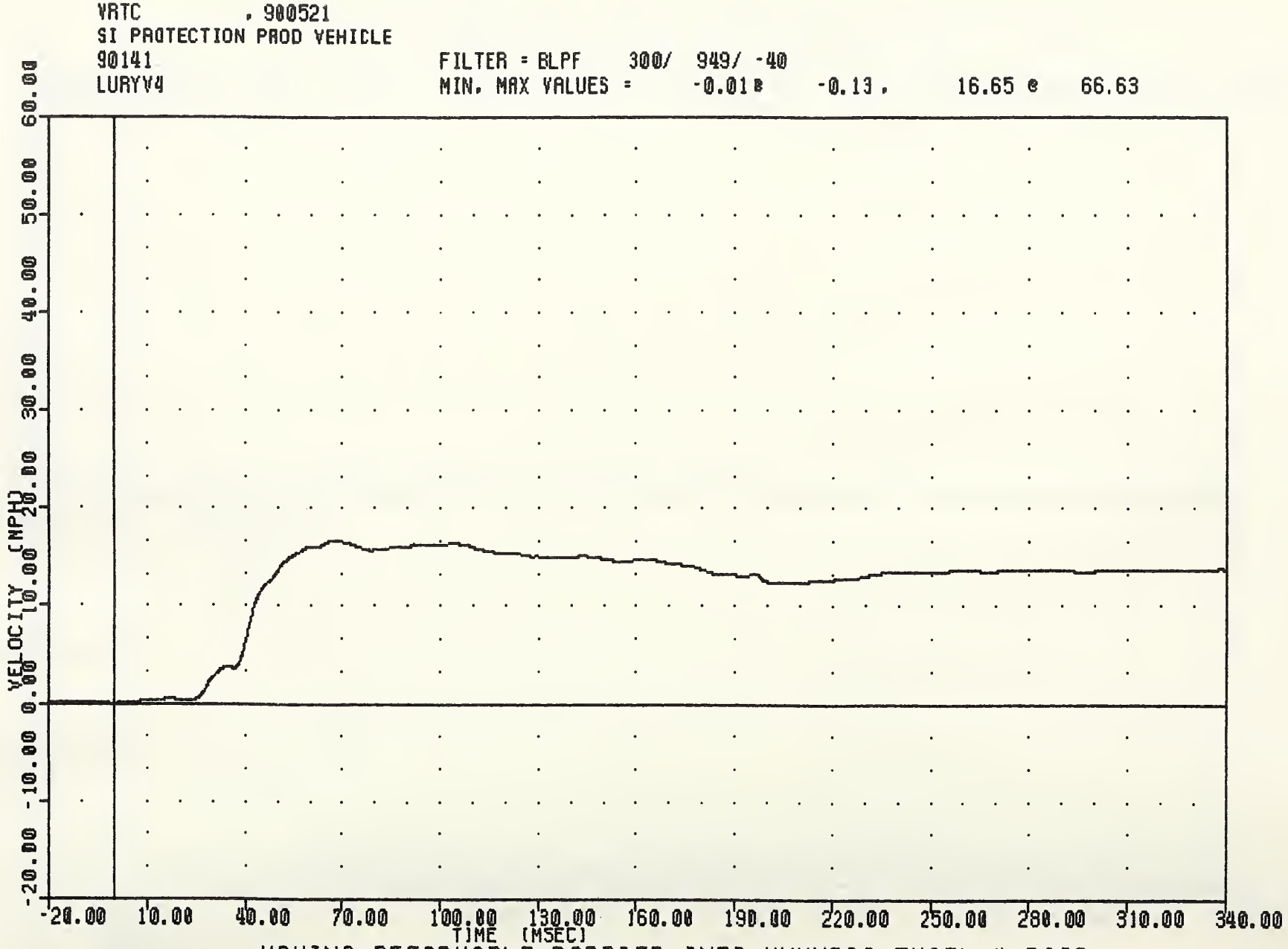
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER UPPER SPINE Z-AXIS ACCELERATION



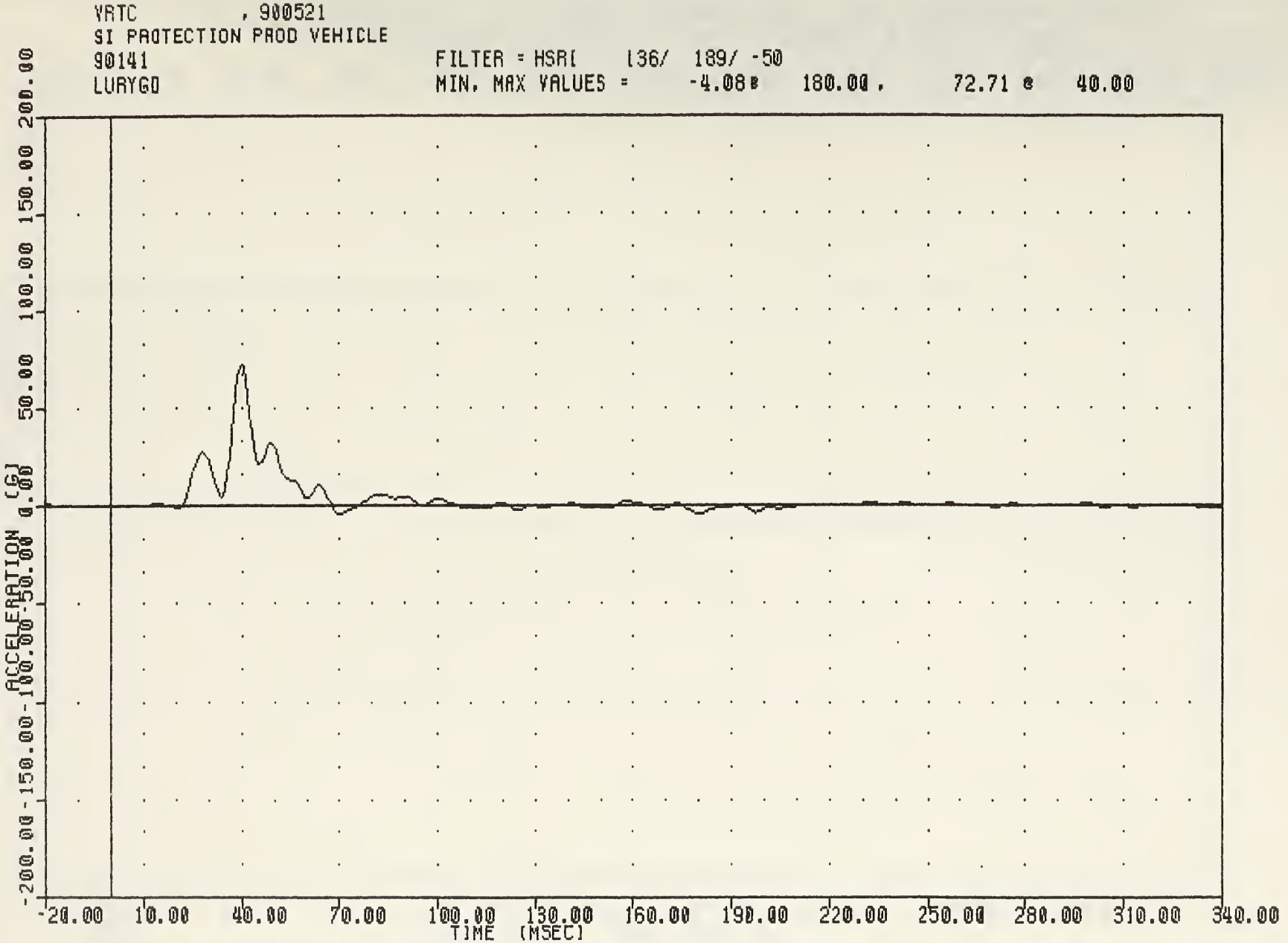
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER UPPER SPINE RESULTANT ACCELERATION



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER THORAX RIB Y-AXIS ACCELERATION

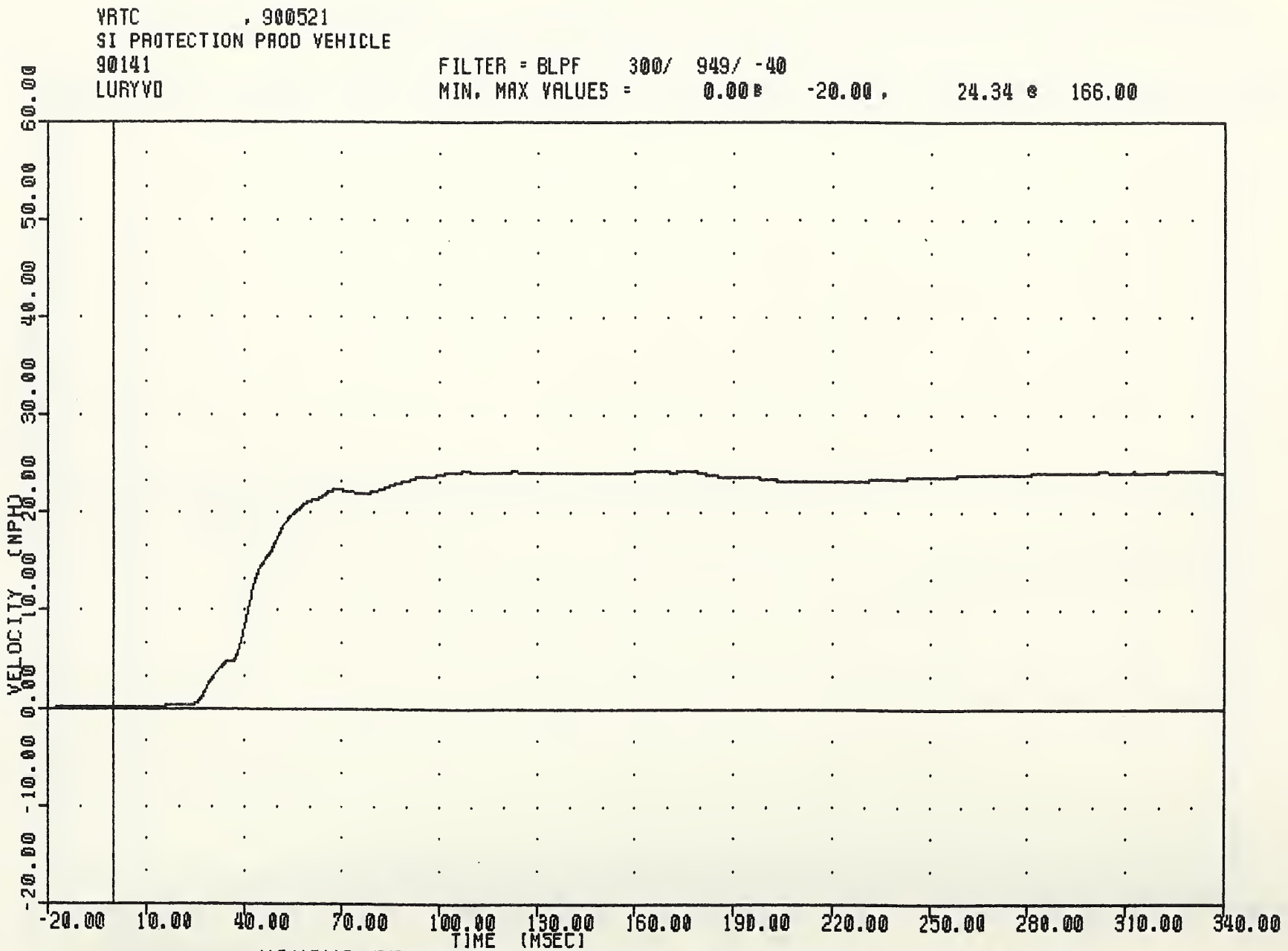


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER THORAX RIB Y-AXIS VELOCITY



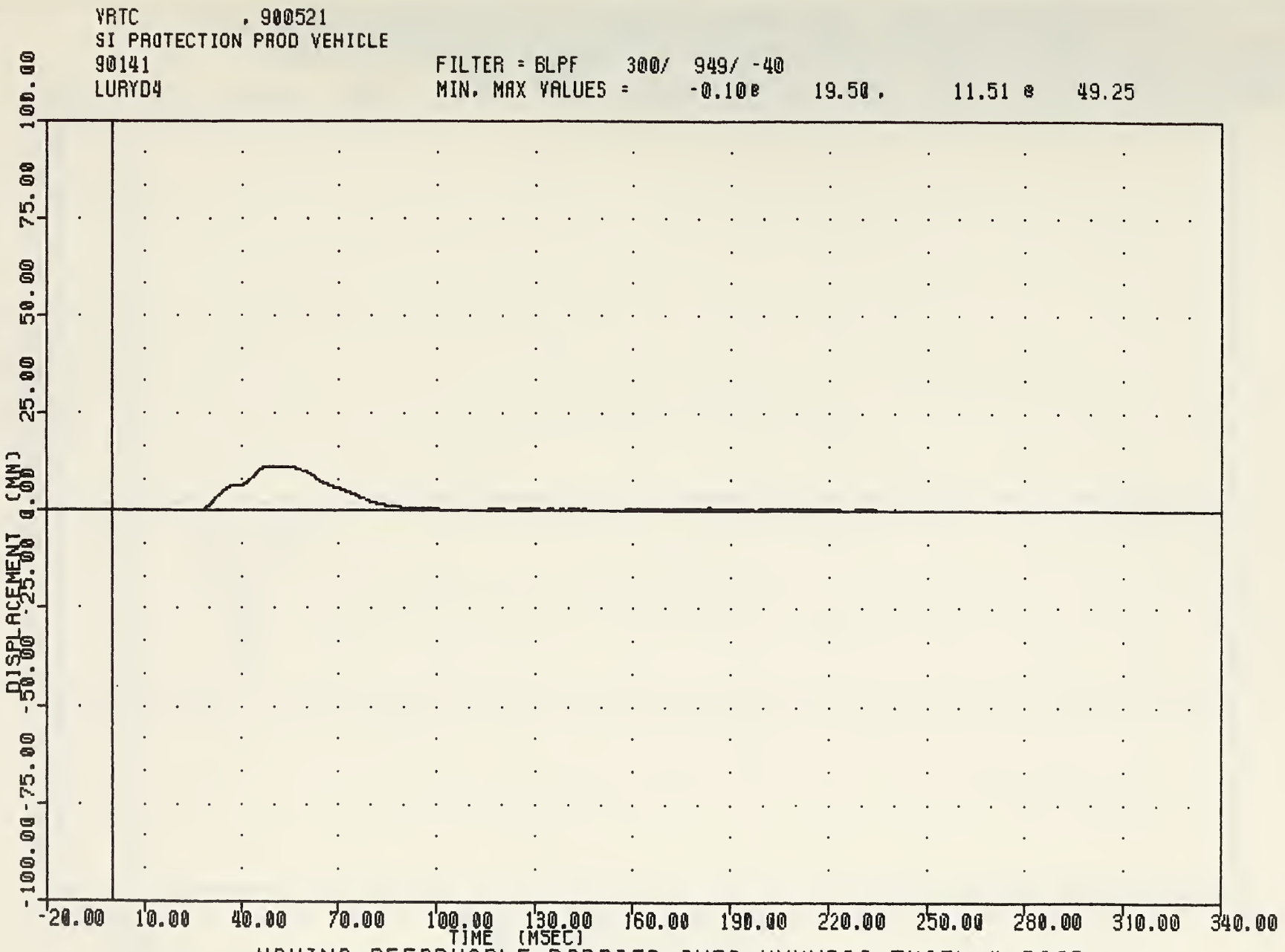
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR

LEFT REAR PASSENGER LEFT UPPER THORAX RIB Y-AXIS REDUNDANT ACCELERATION

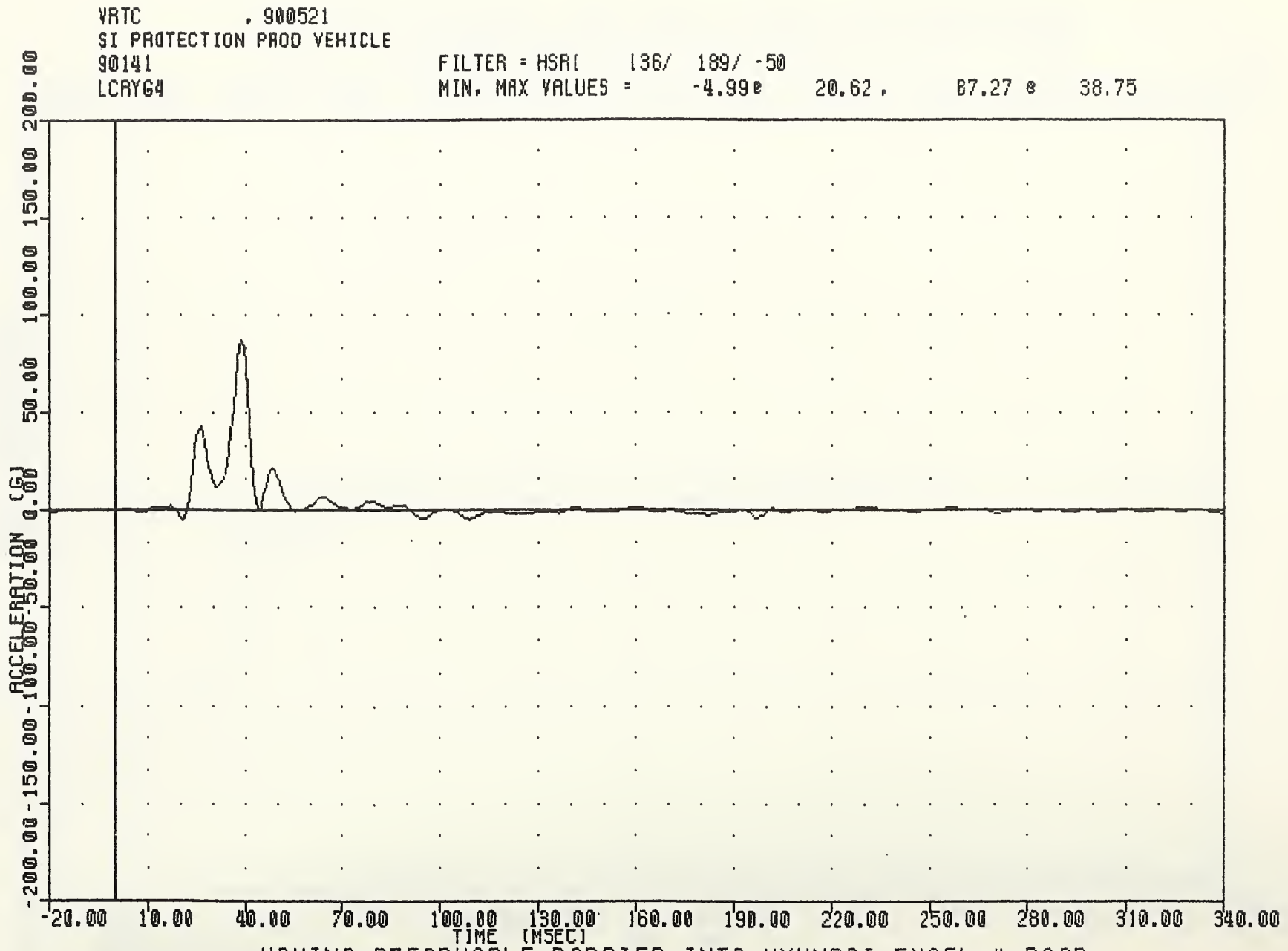


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR

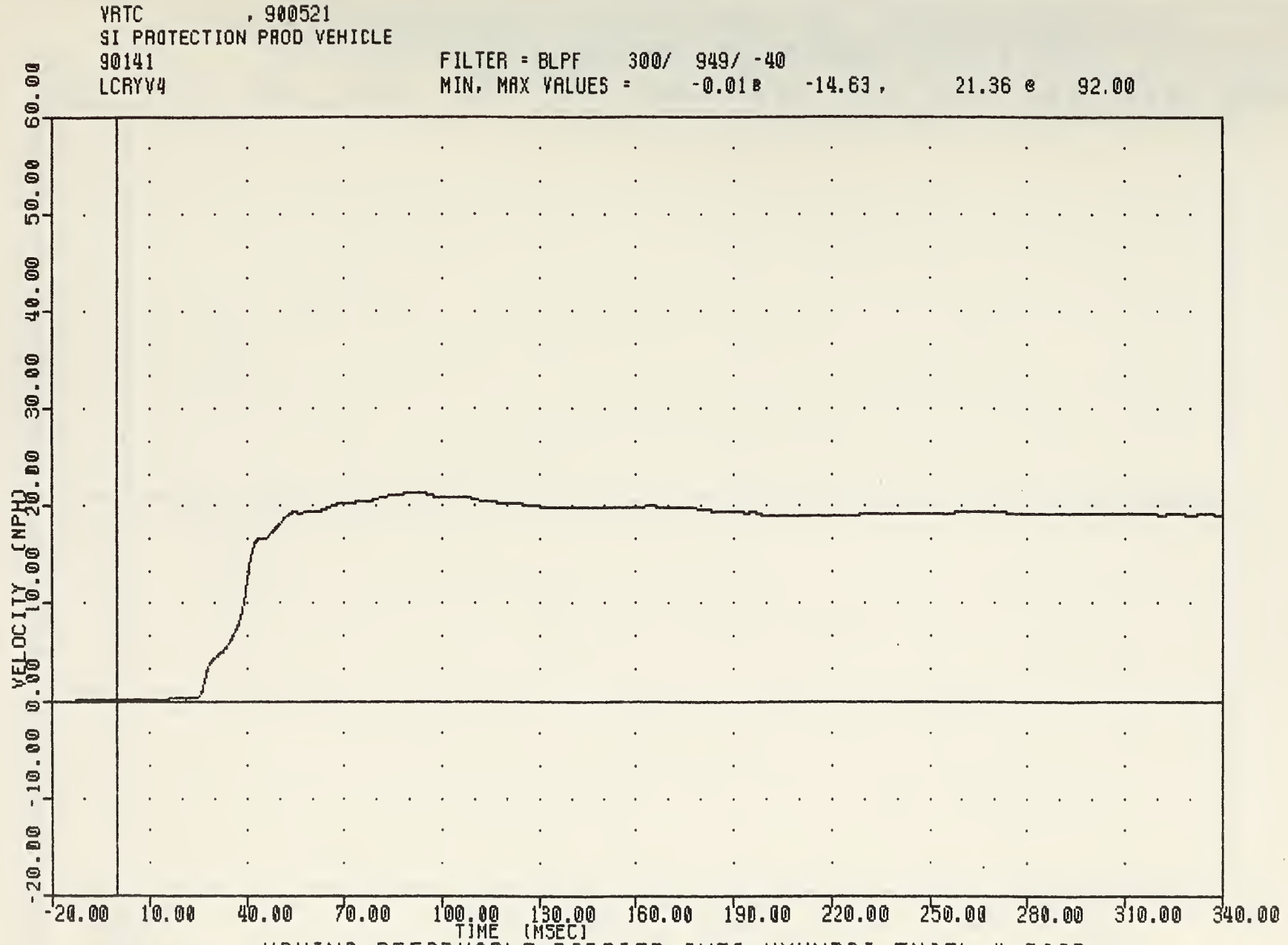
LEFT REAR PASSENGER LEFT UPPER THORAX RIB Y-AXIS REDUNDANT VELOCITY



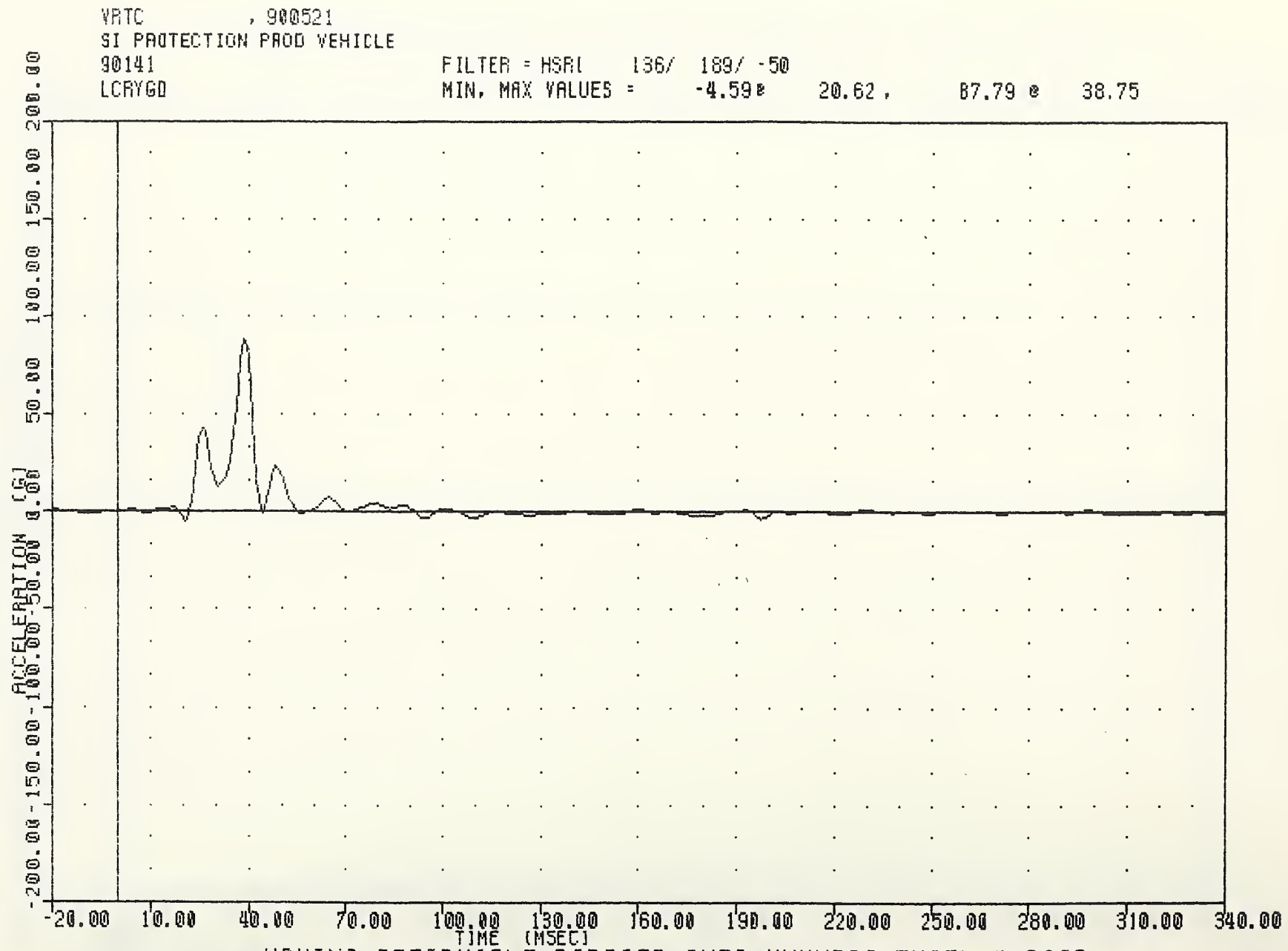
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER THORAX RIB DISPLACEMENT



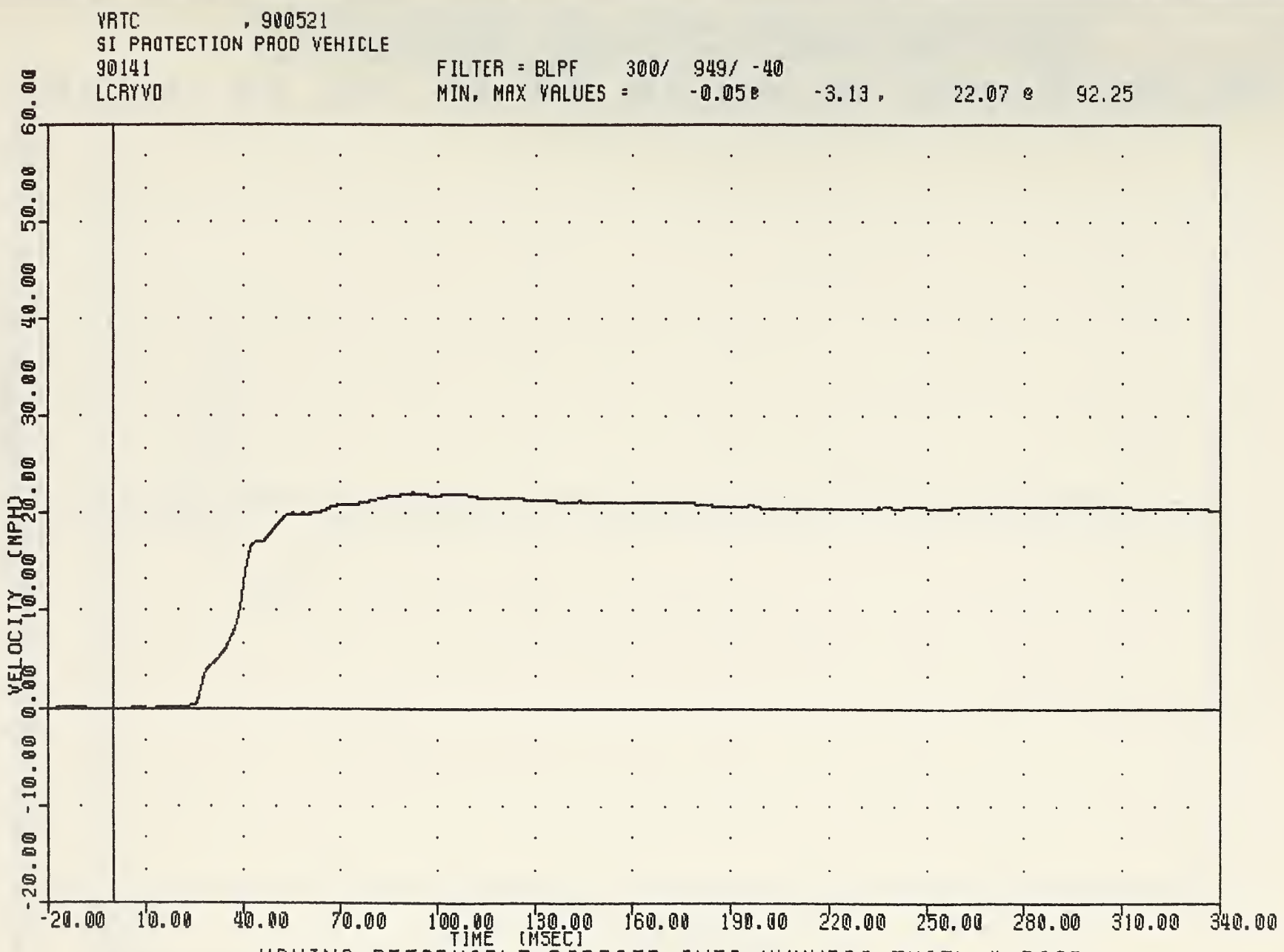
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS ACCELERATION



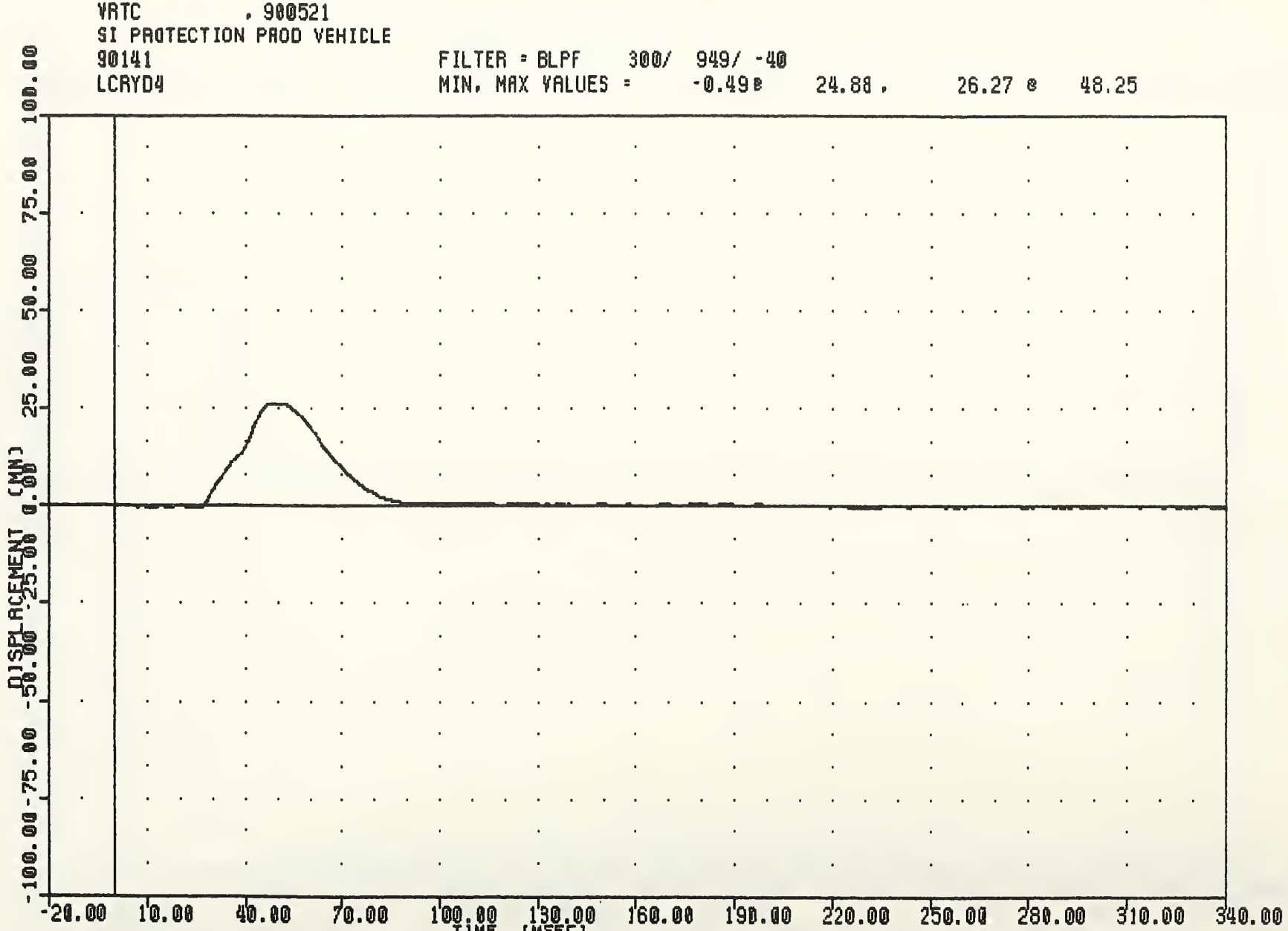
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS VELOCITY



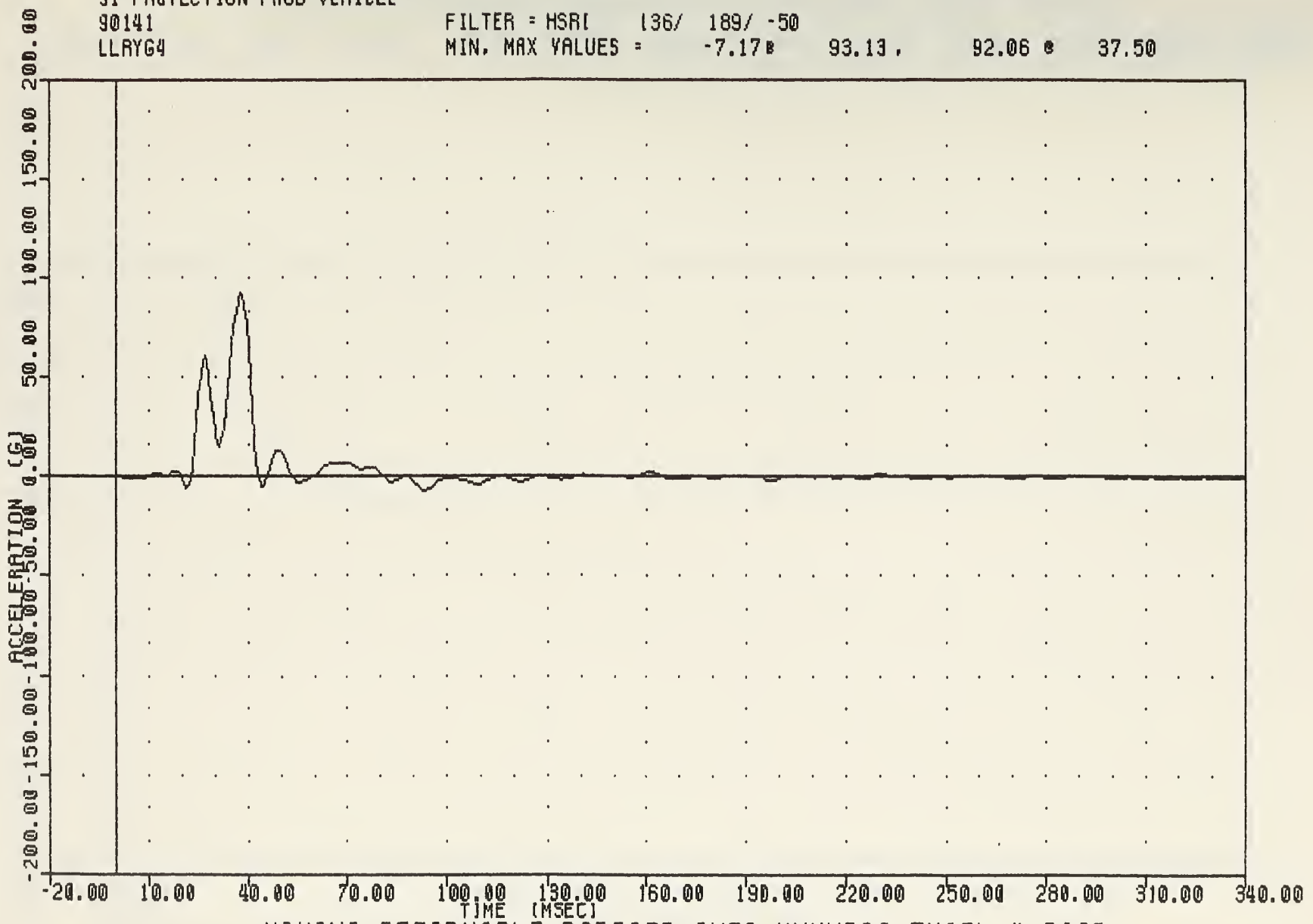
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT ACCEL



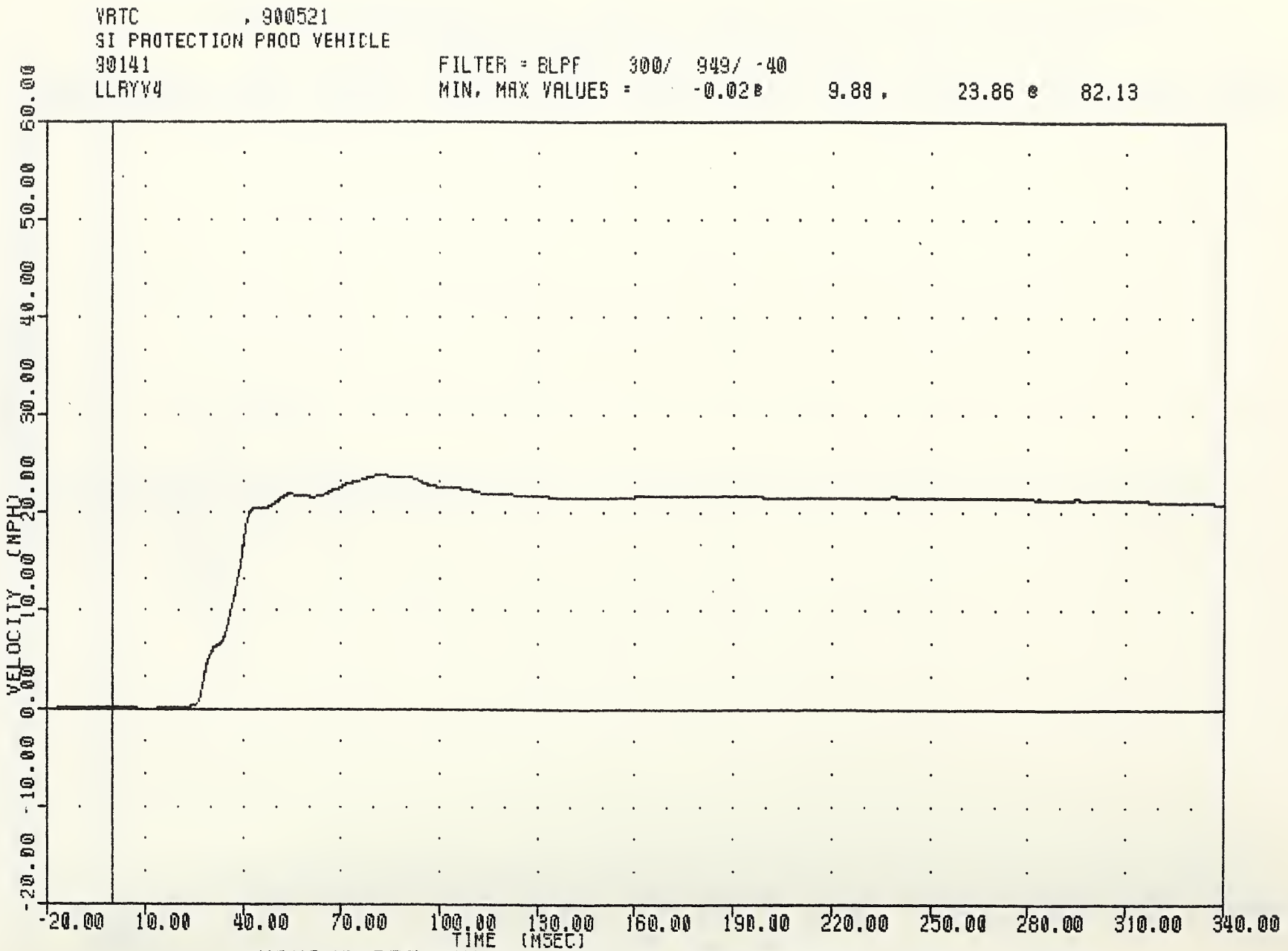
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT CENTER THORAX RIB Y-AXIS REDUNDANT VELOCITY



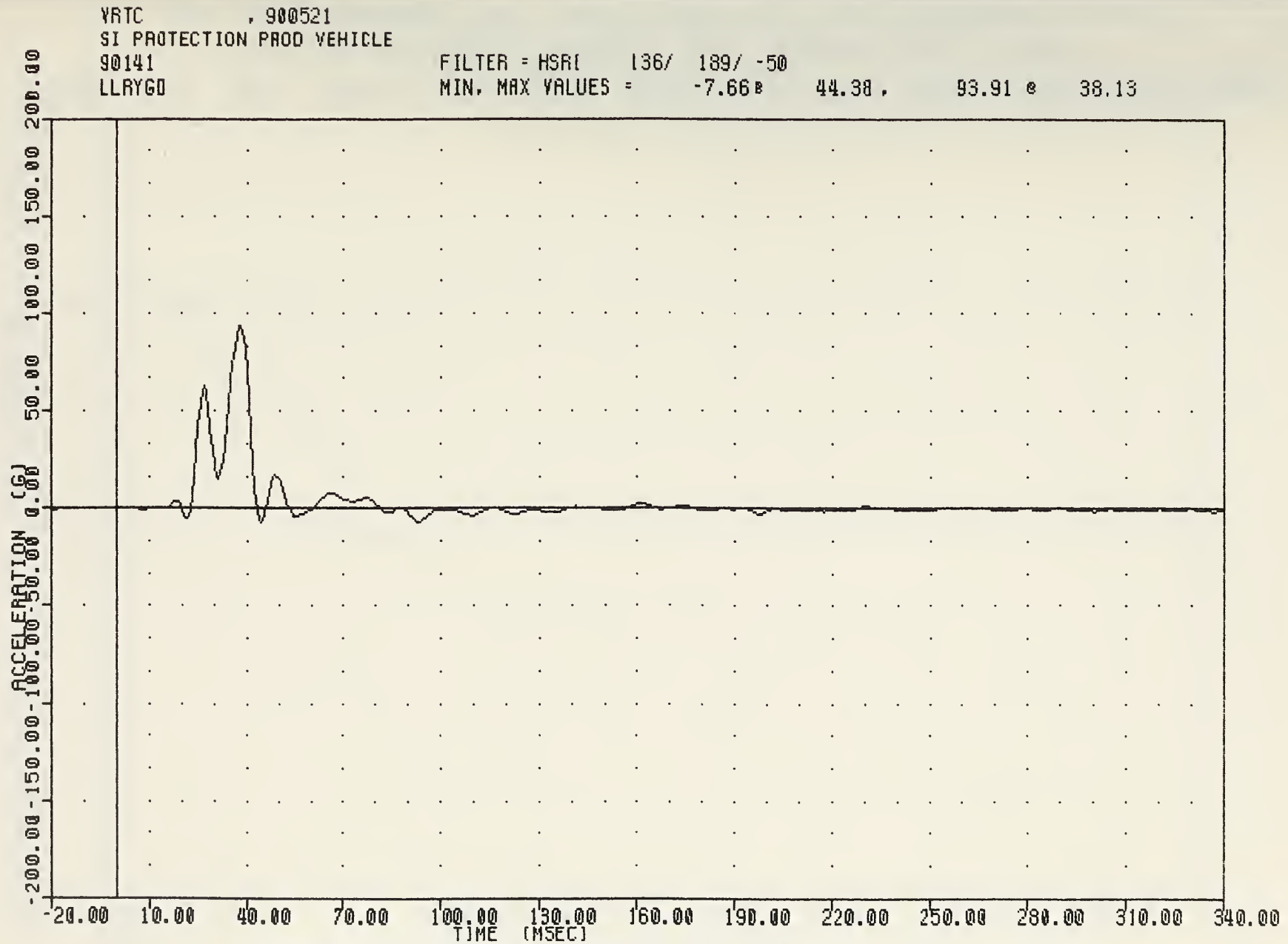
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT CENTER THORAX RIB DISPLACEMENT



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS ACCELERATION

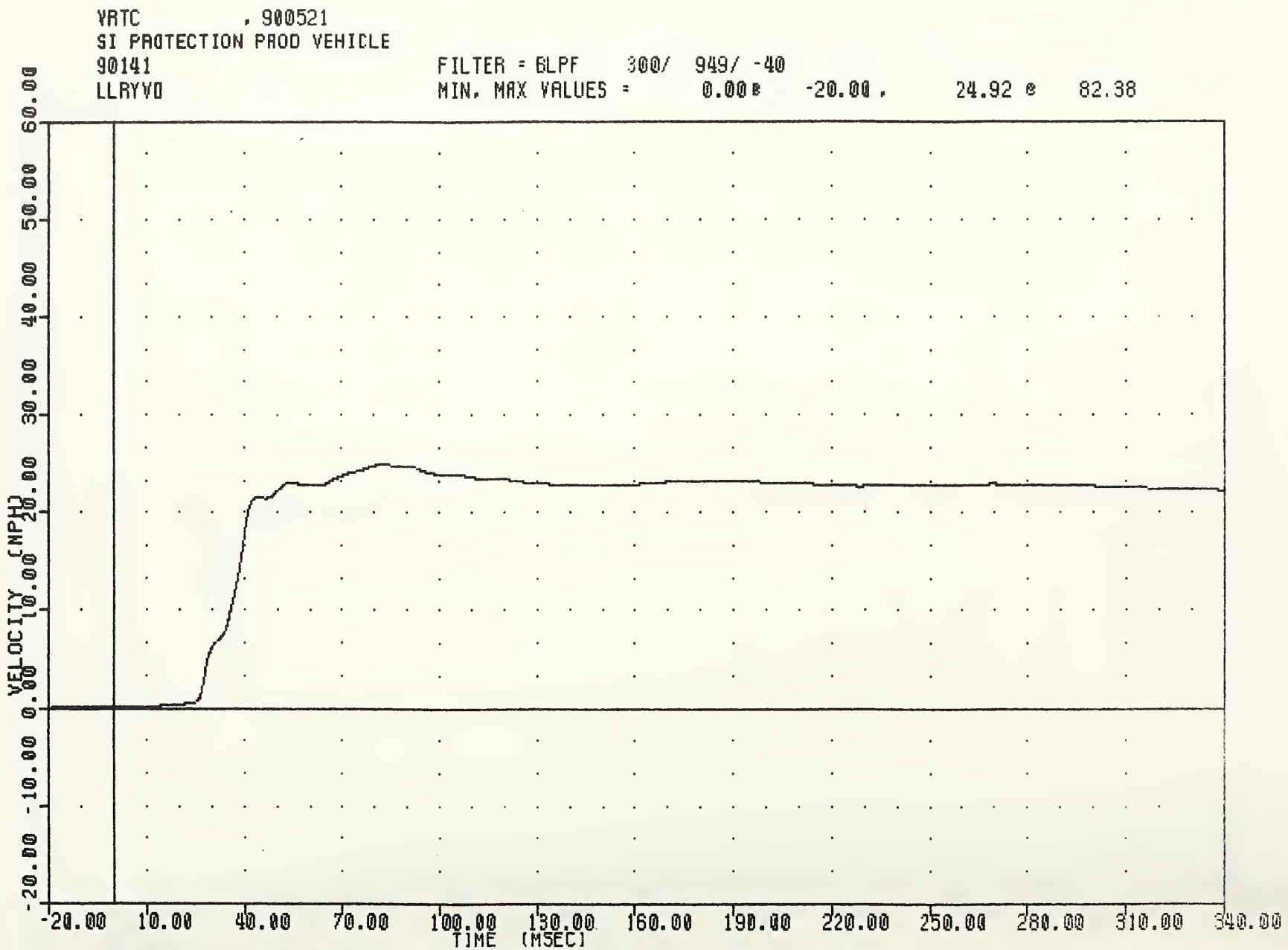


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS VELOCITY

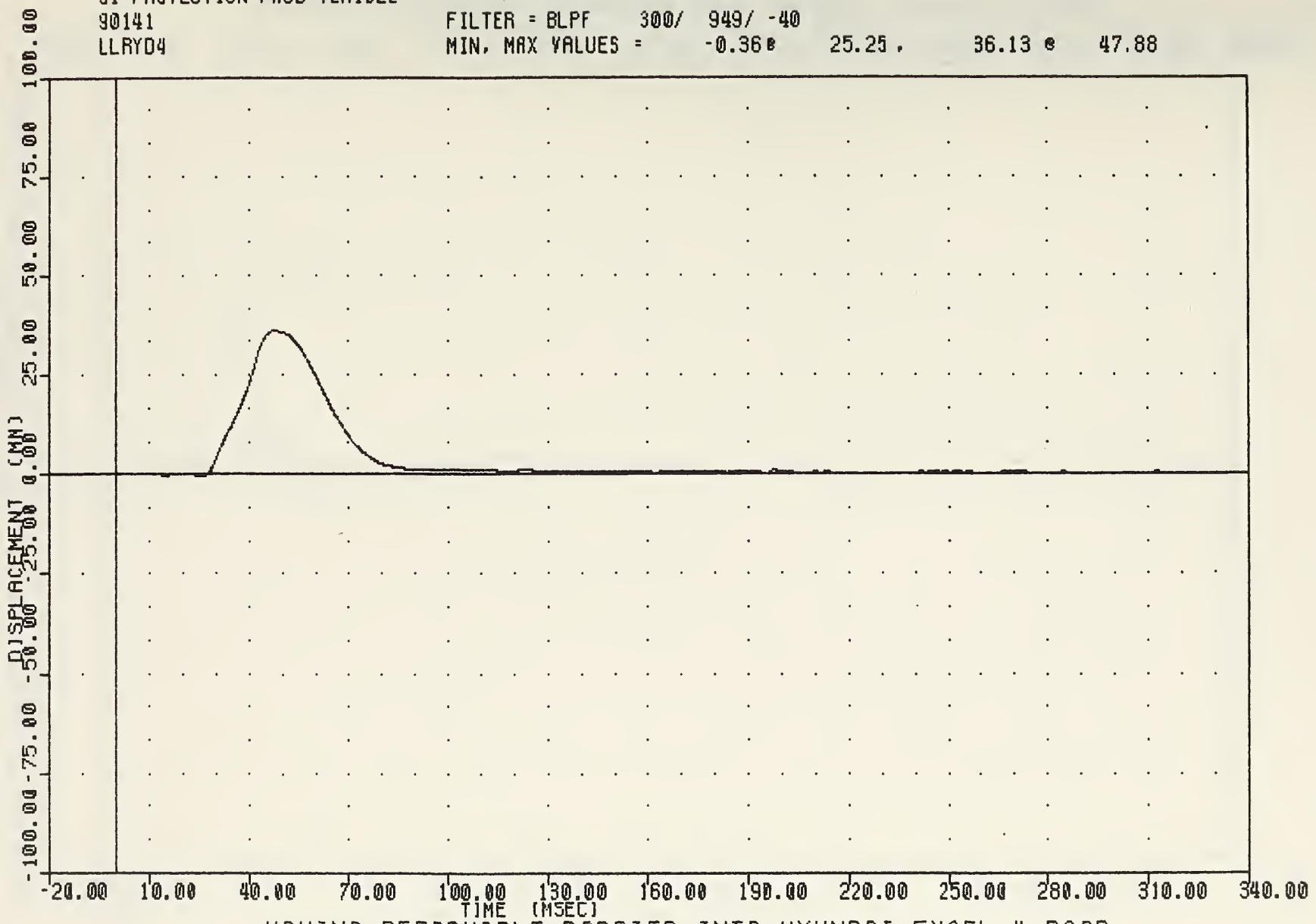


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR

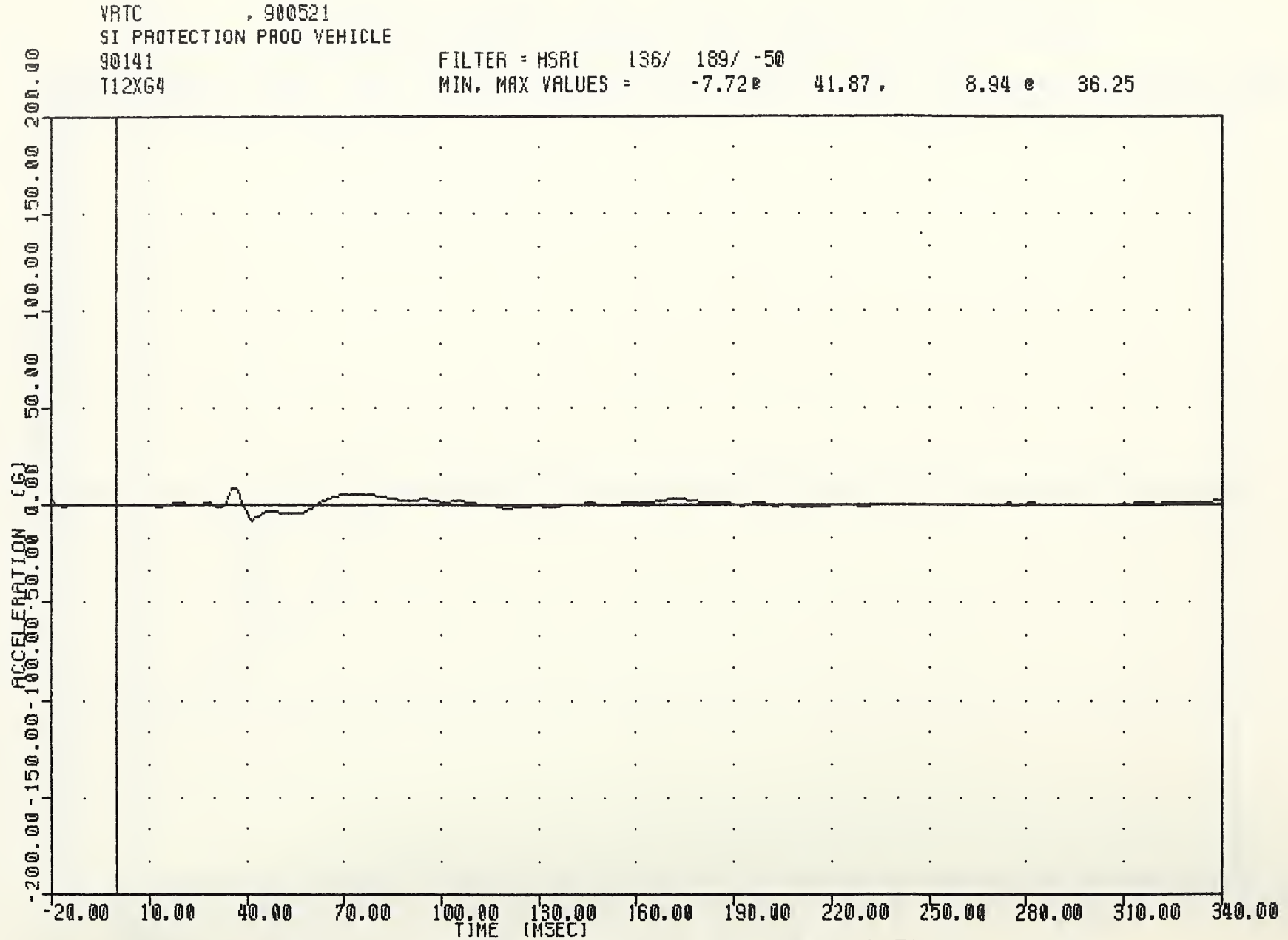
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT ACCELERATION



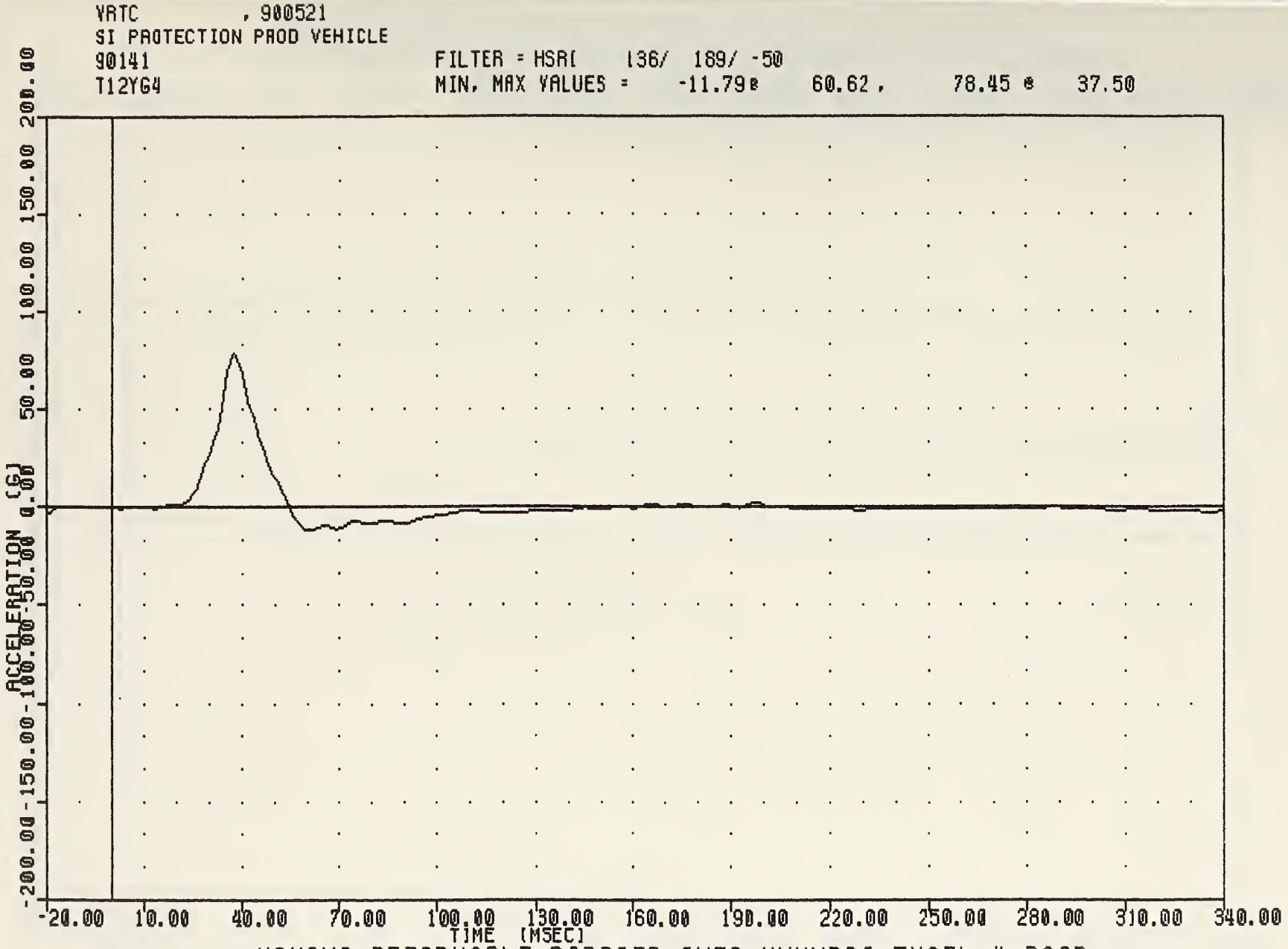
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER THORAX RIB Y-AXIS REDUNDANT VELOCITY



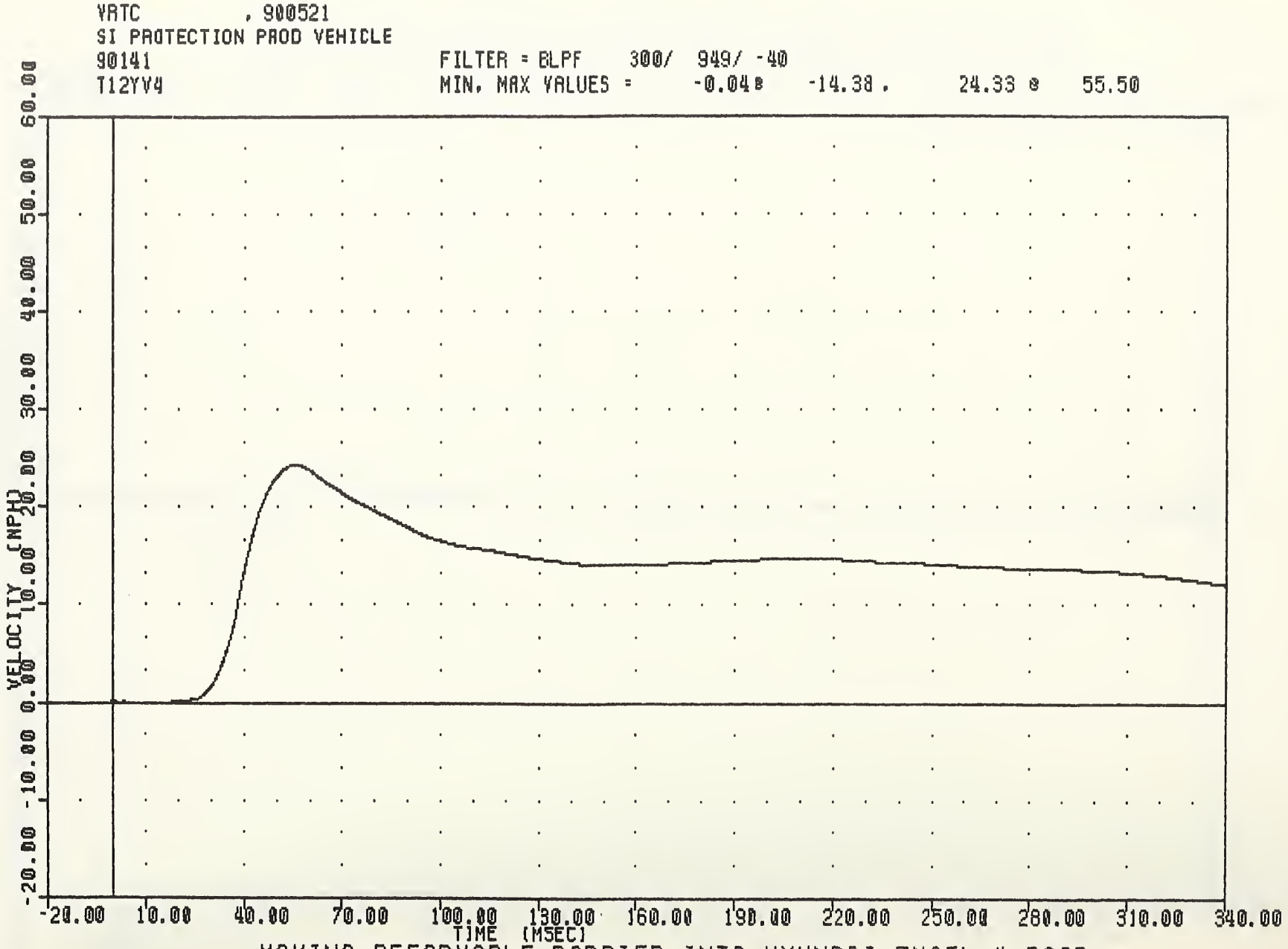
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER THORAX RIB DISPLACEMENT



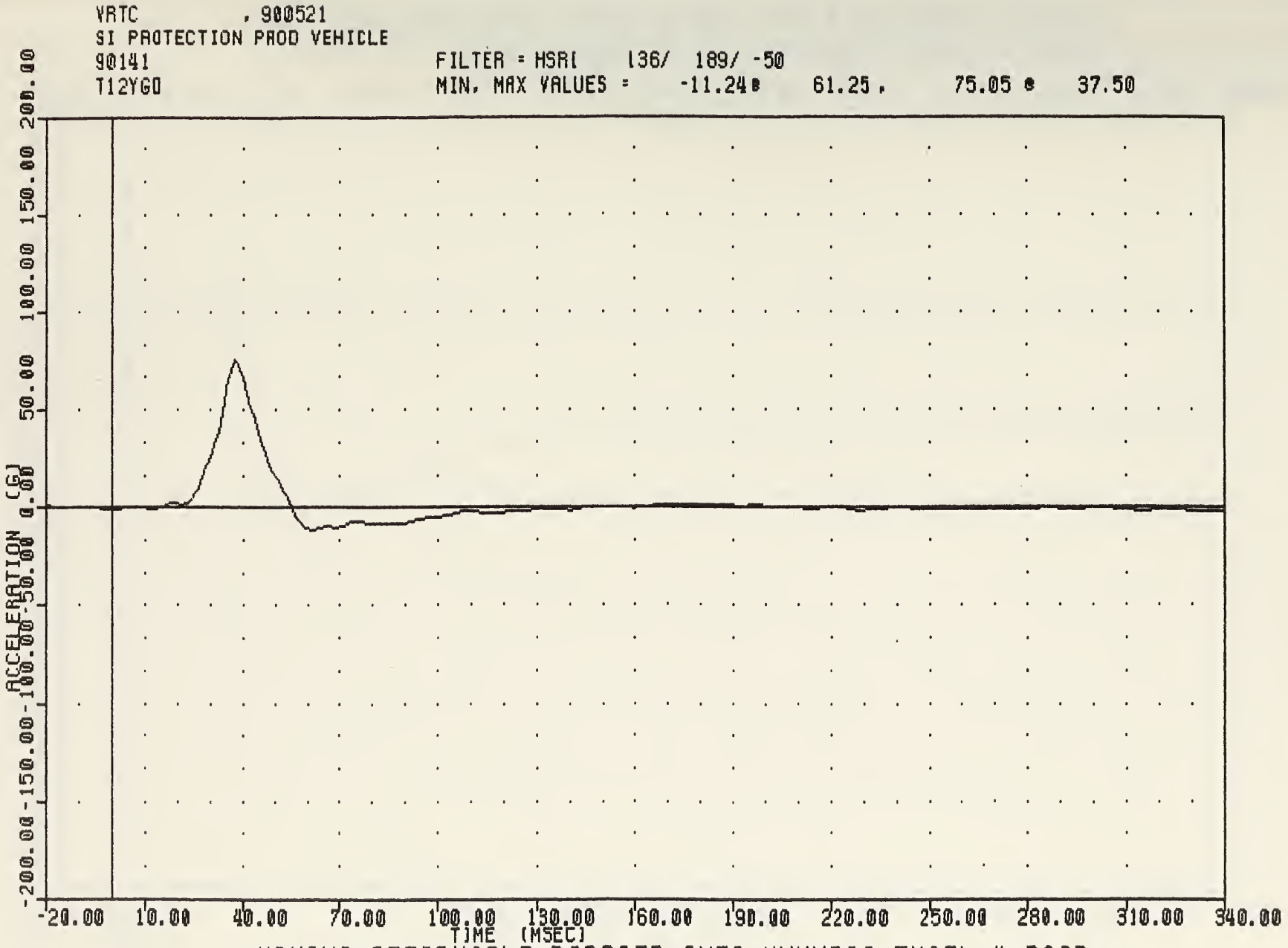
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE X-AXIS ACCELERATION



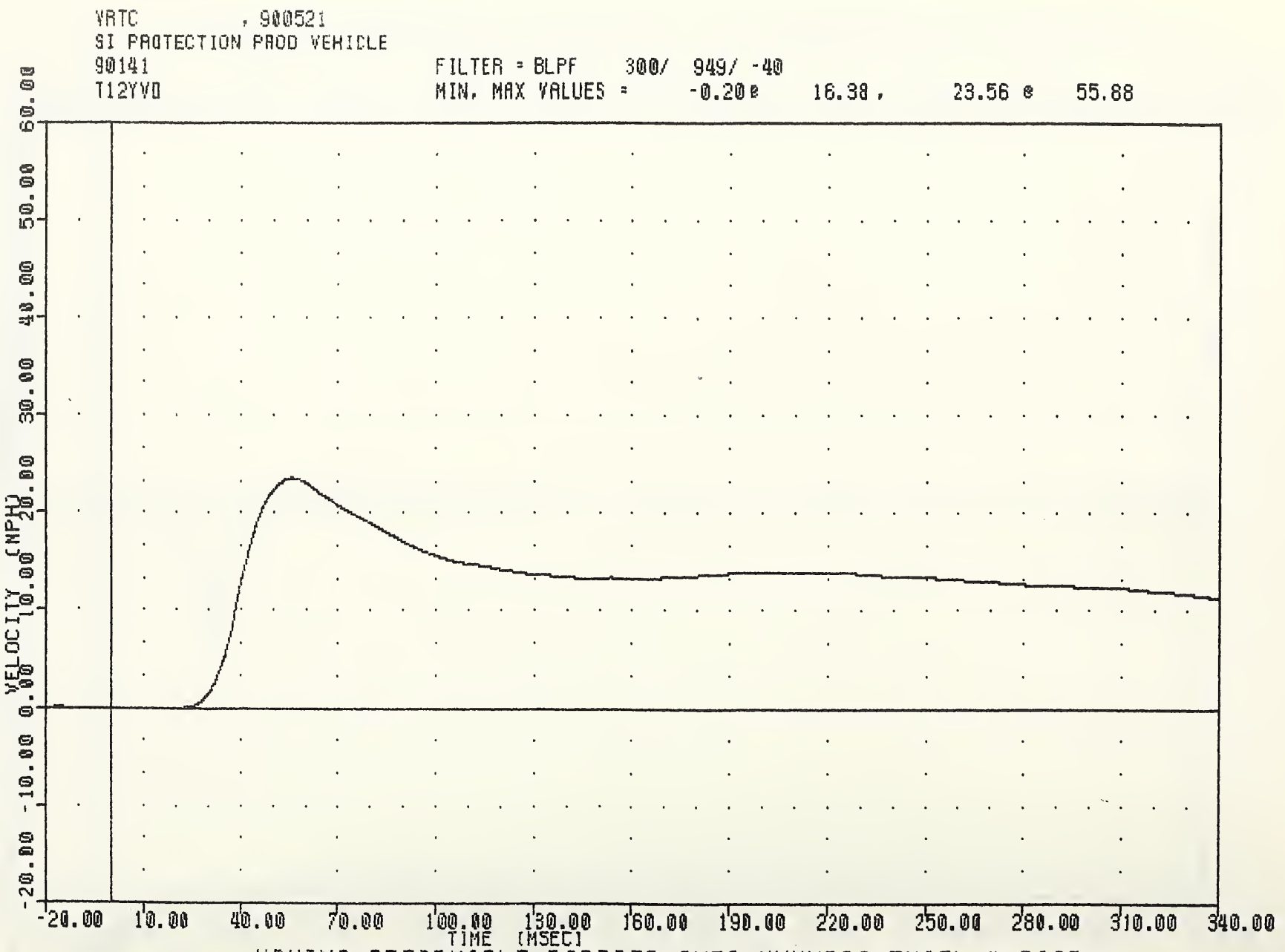
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE Y-AXIS ACCELERATION



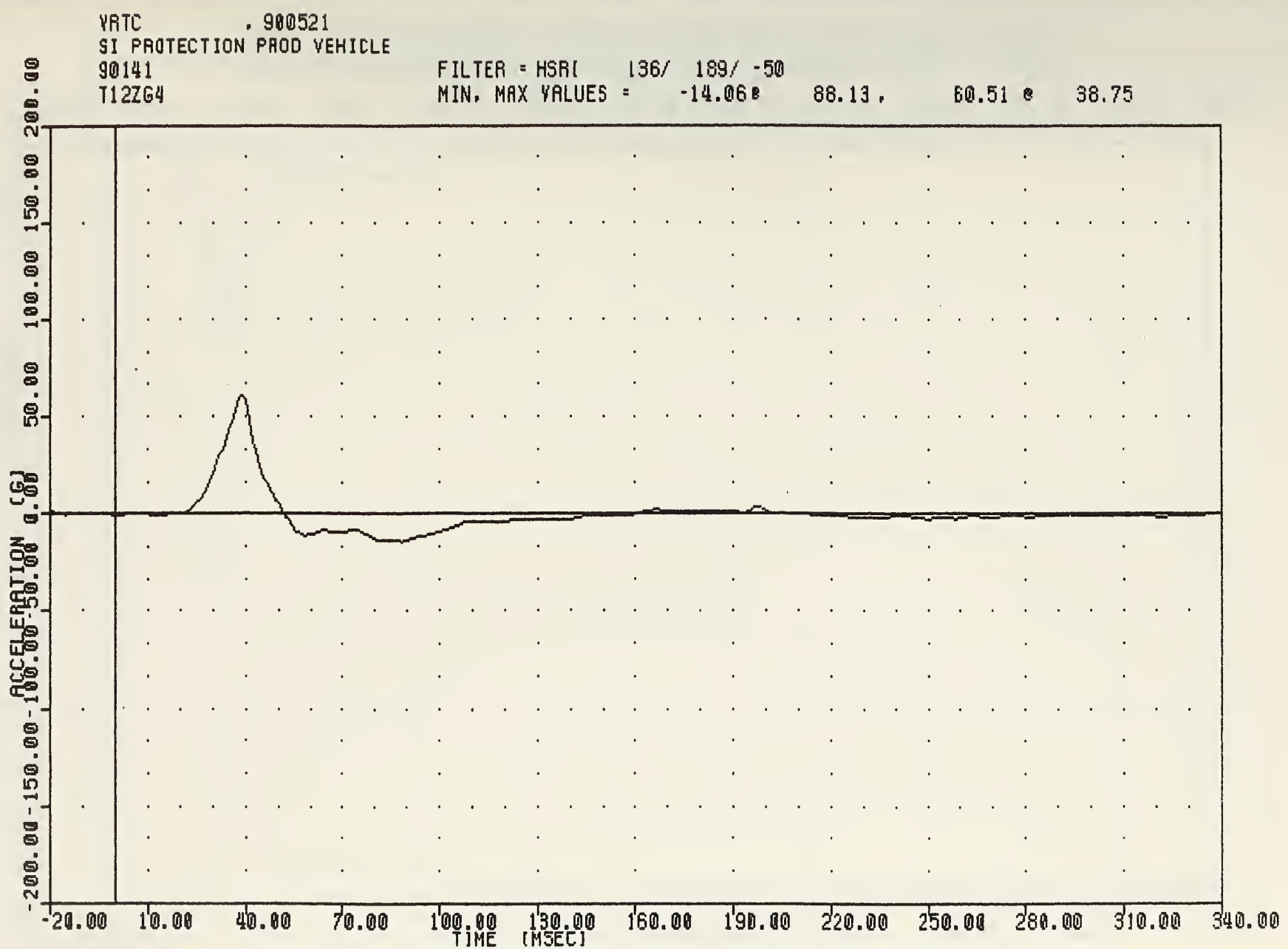
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE Y-AXIS VELOCITY



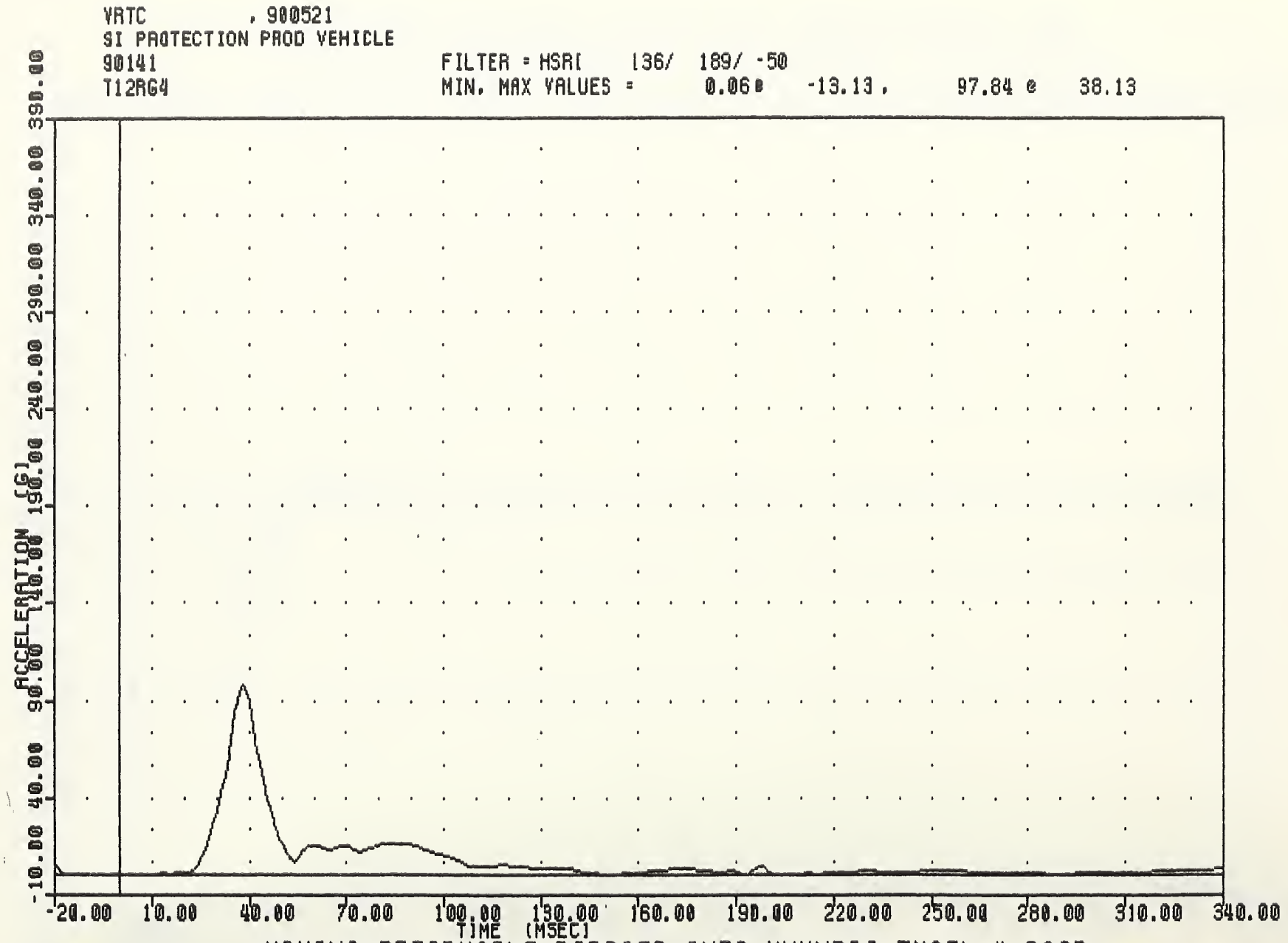
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE Y-AXIS REDUNDANT ACCELERATION



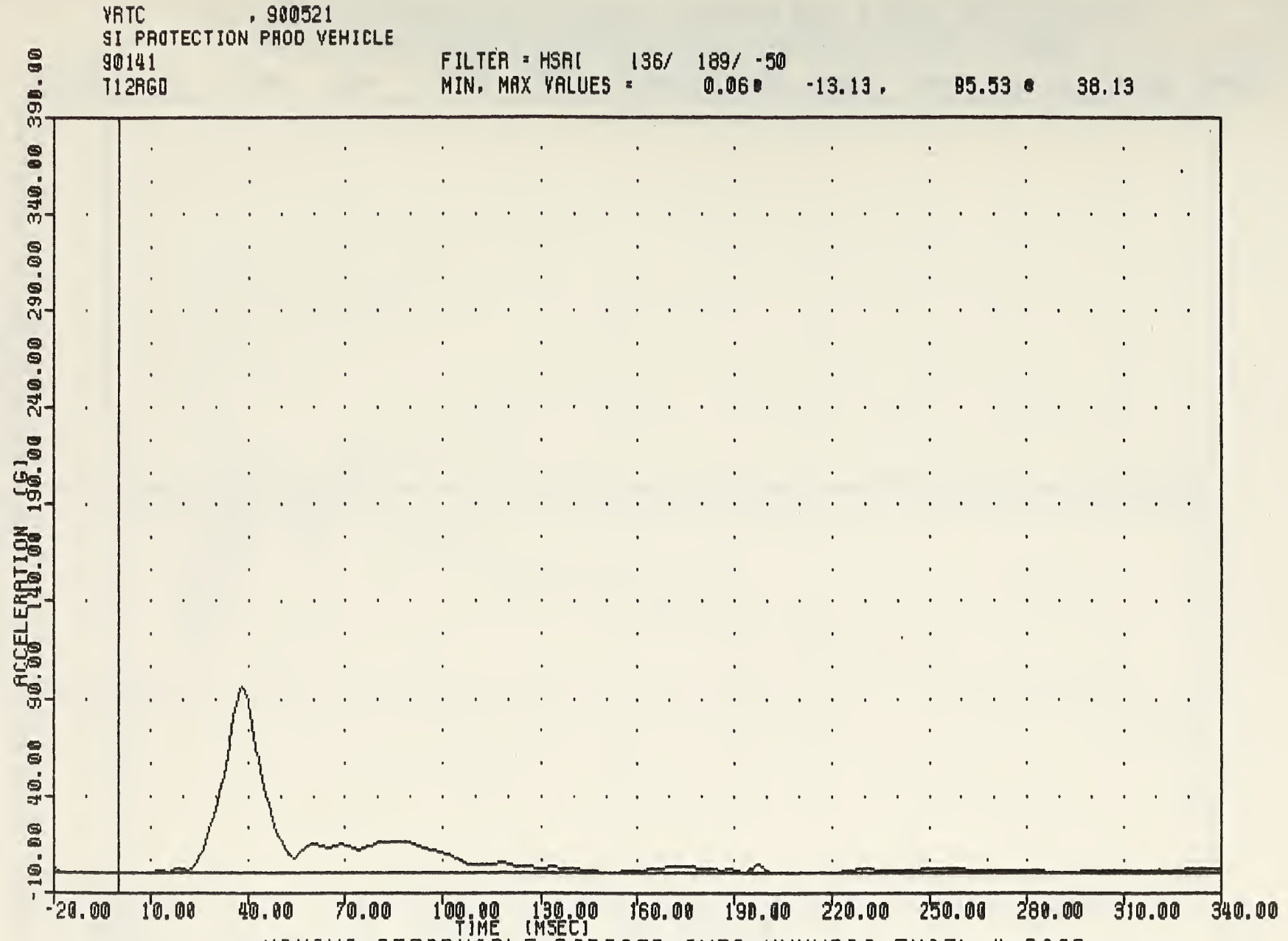
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE Y-AXIS REDUNDANT VELOCITY



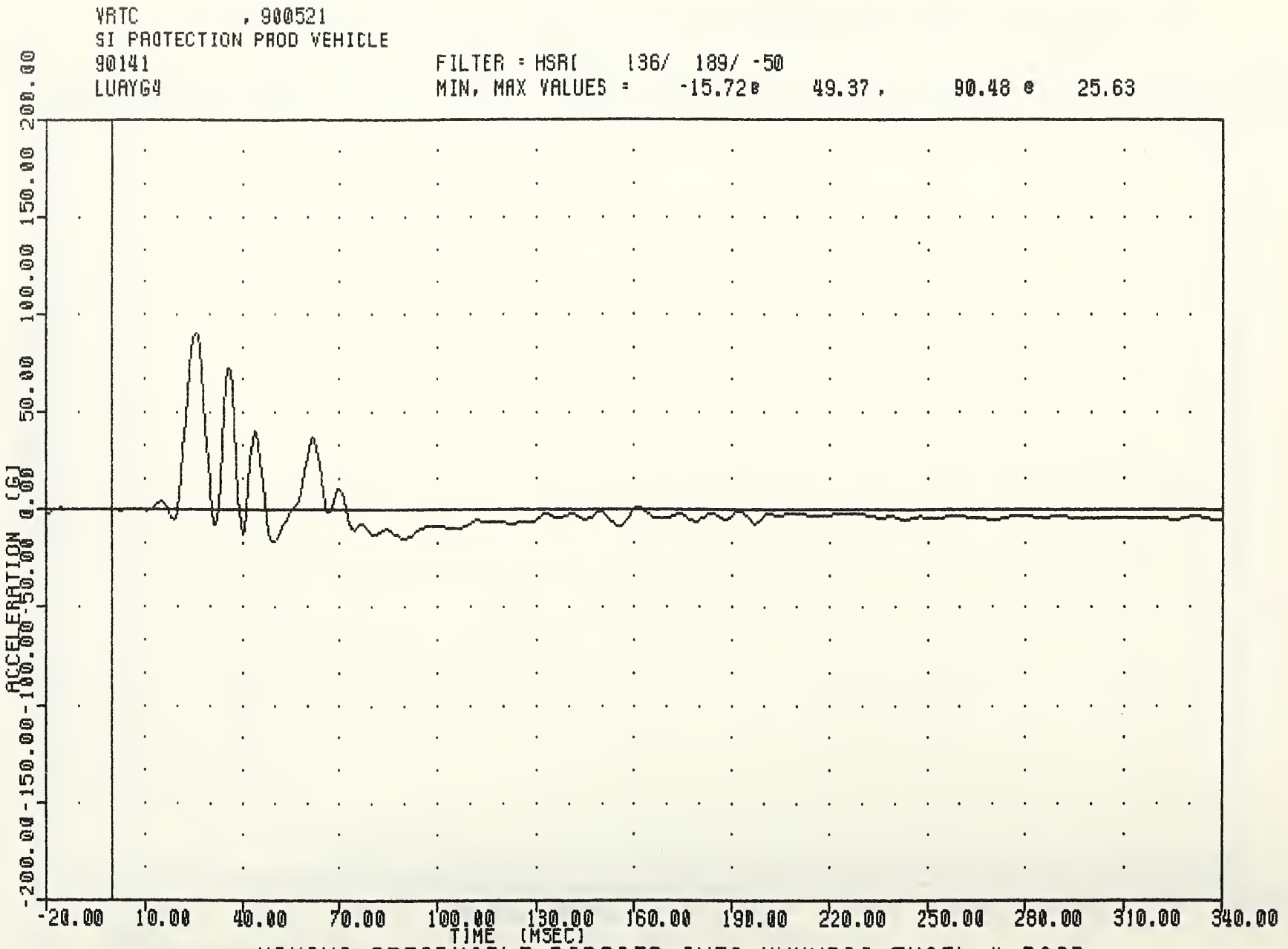
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE Z-AXIS ACCELERATION



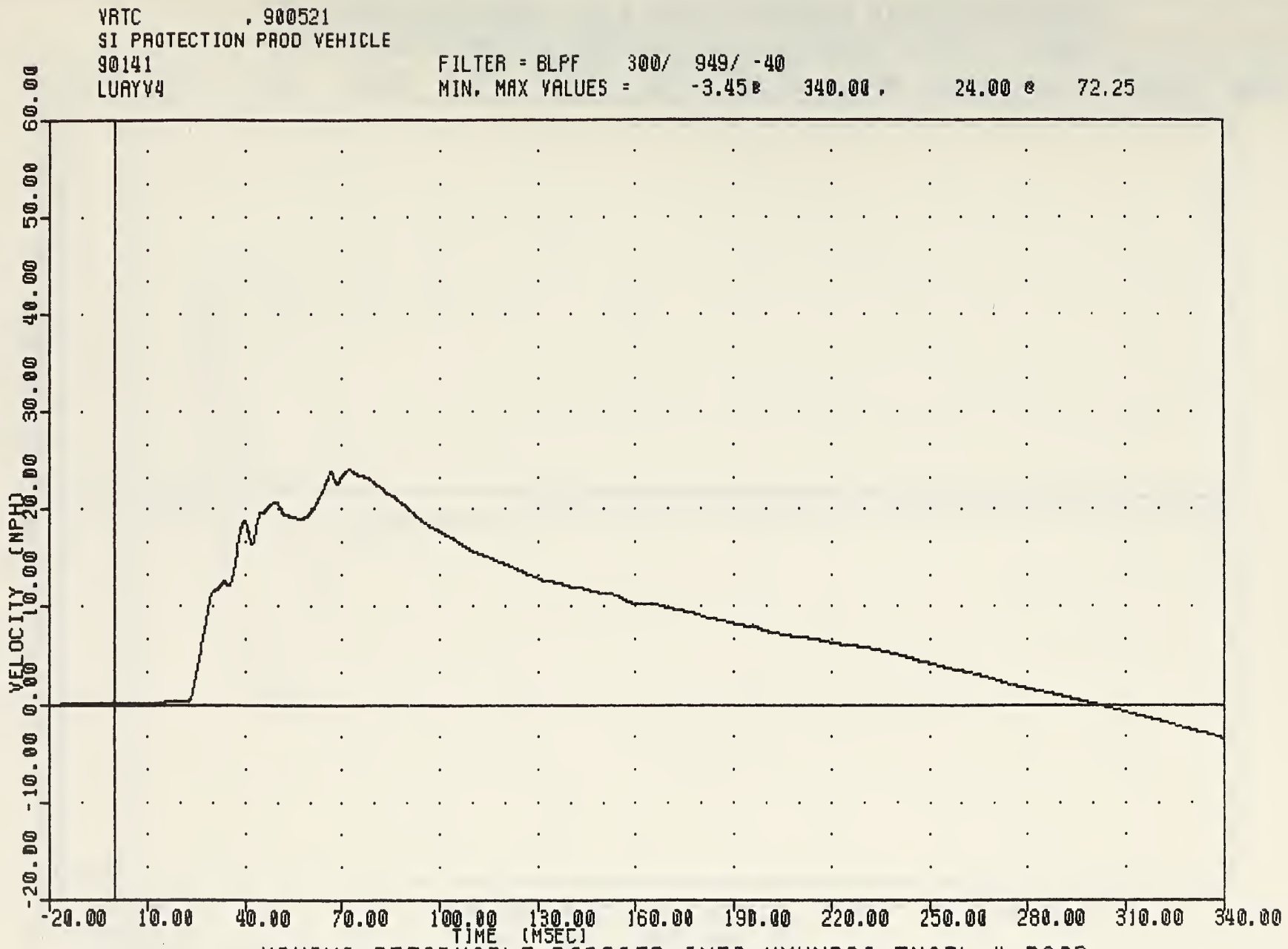
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE RESULTANT ACCELERATION



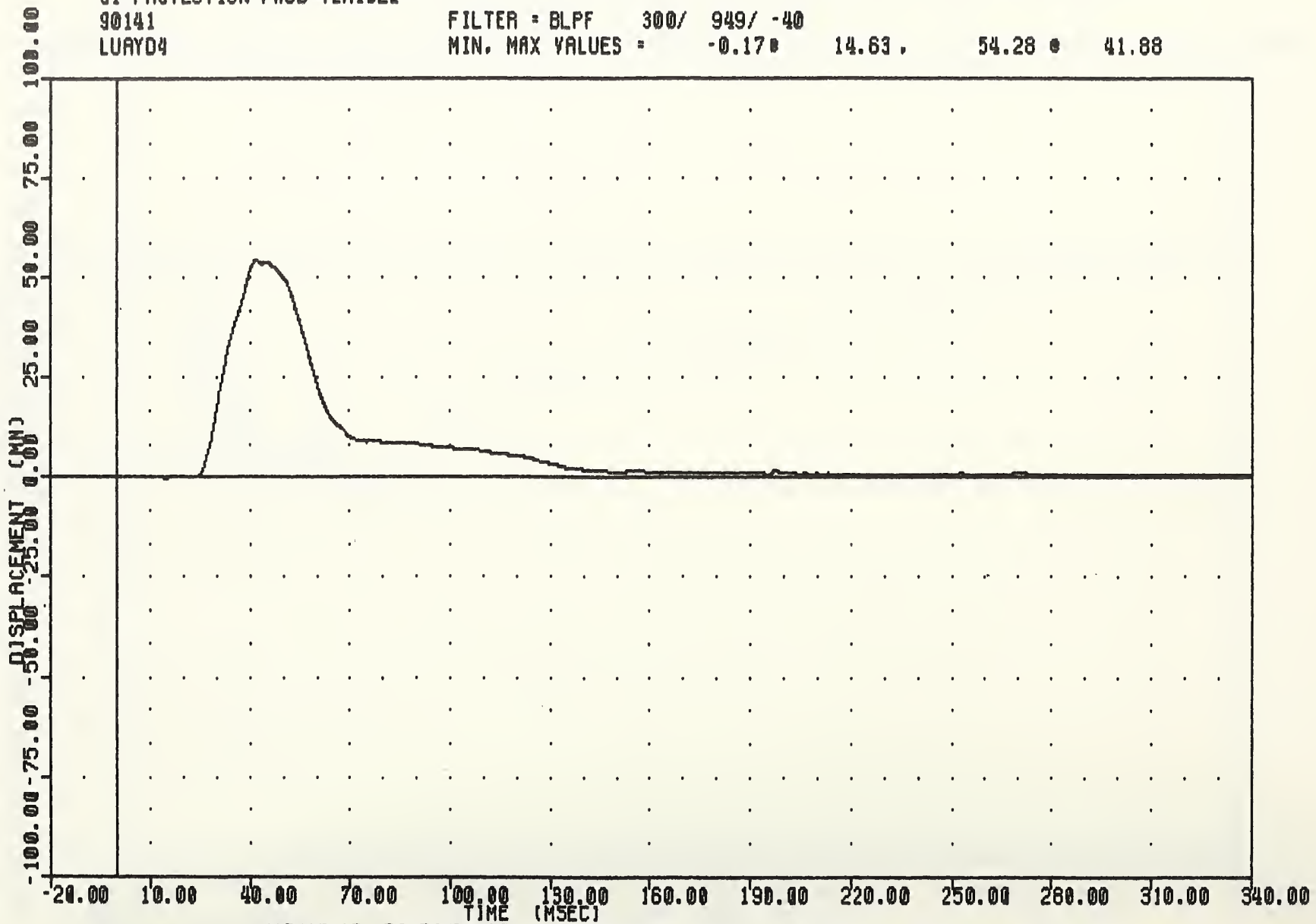
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LOWER SPINE REDUNDANT RESULTANT ACCELERATION



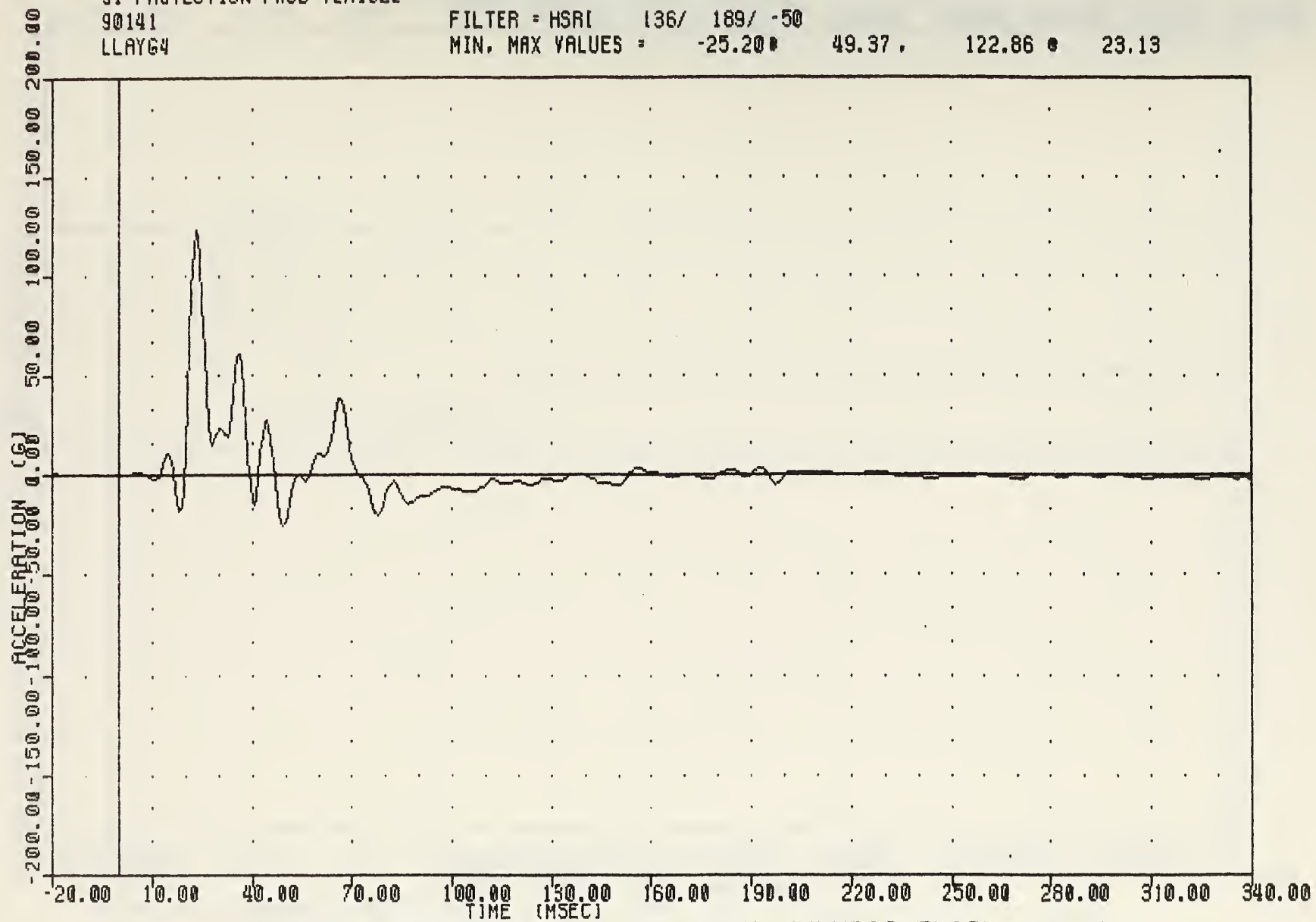
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER ABDOMEN RIB Y-AXIS ACCELERATION



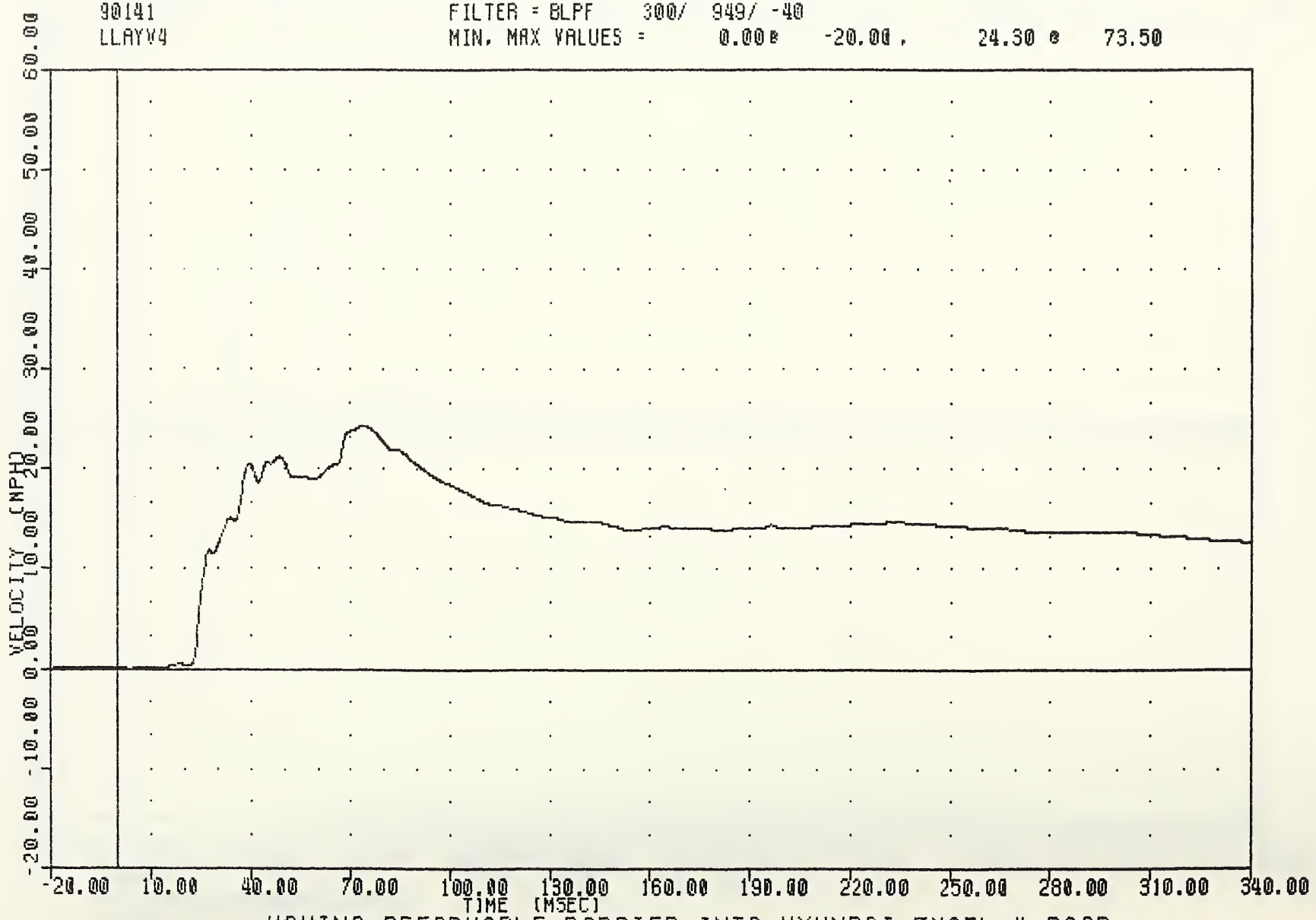
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER ABDOMEN RIB Y-AXIS VELOCITY



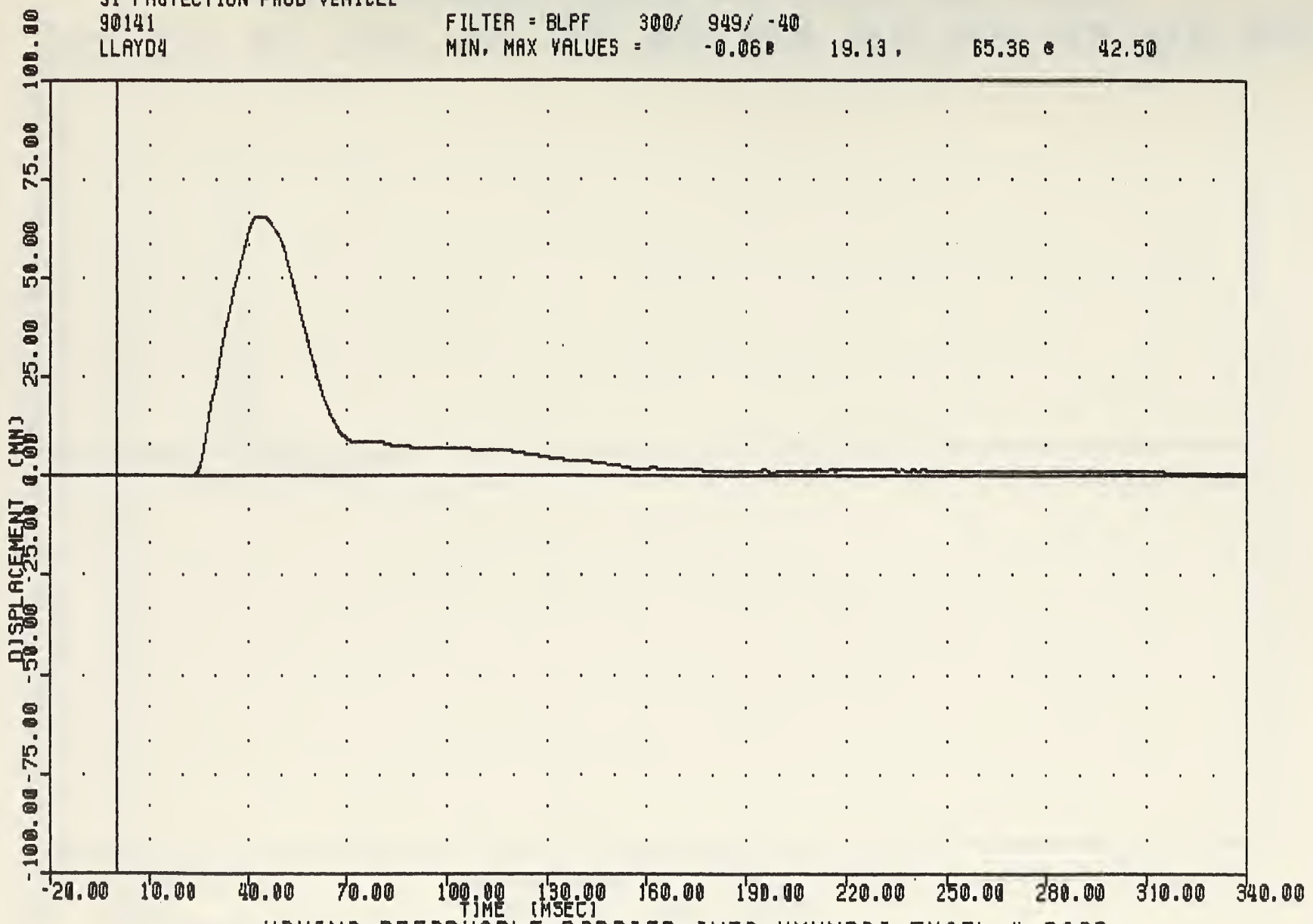
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT UPPER ABDOMEN RIB DISPLACEMENT



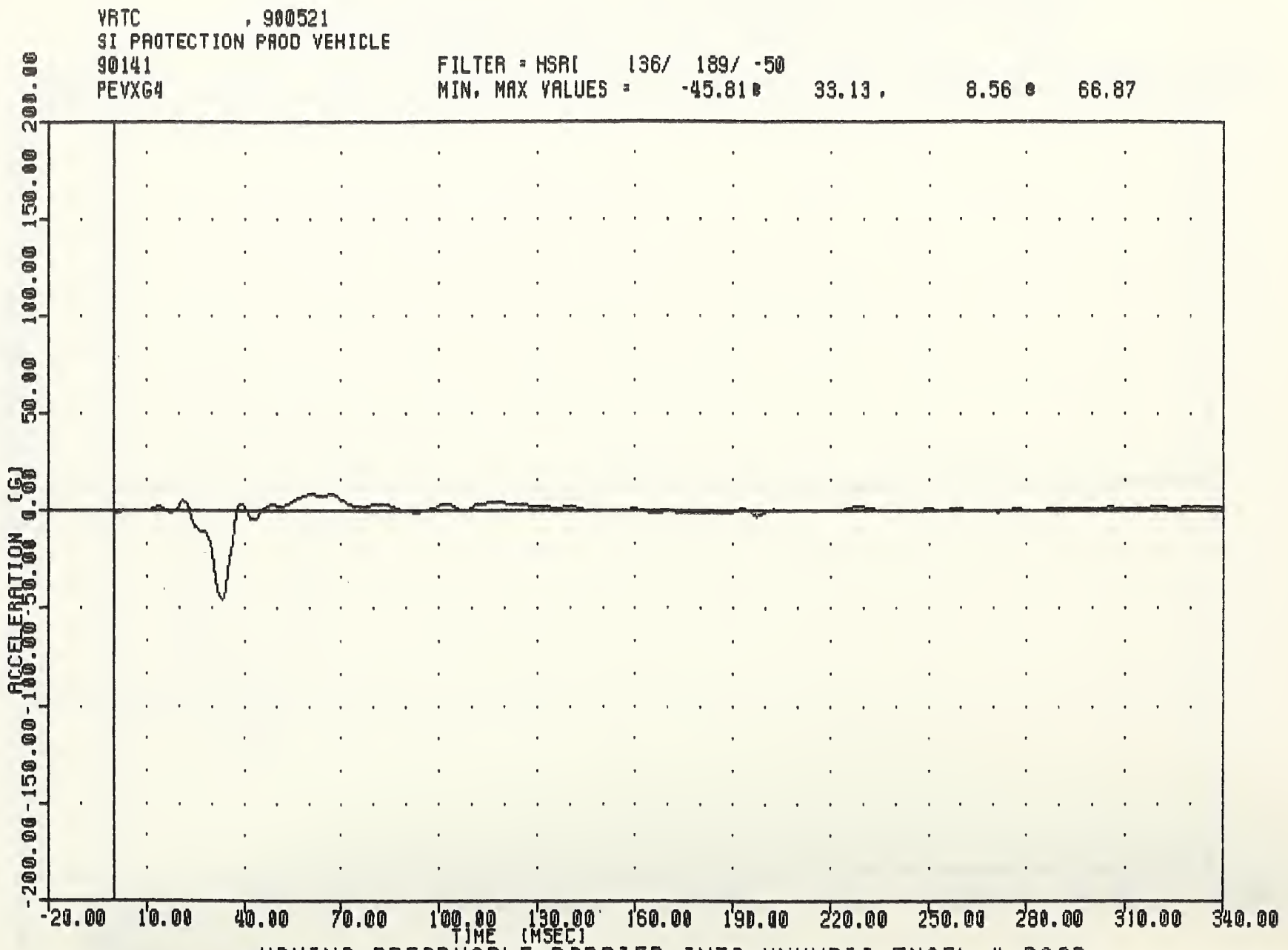
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB Y-AXIS ACCELERATION



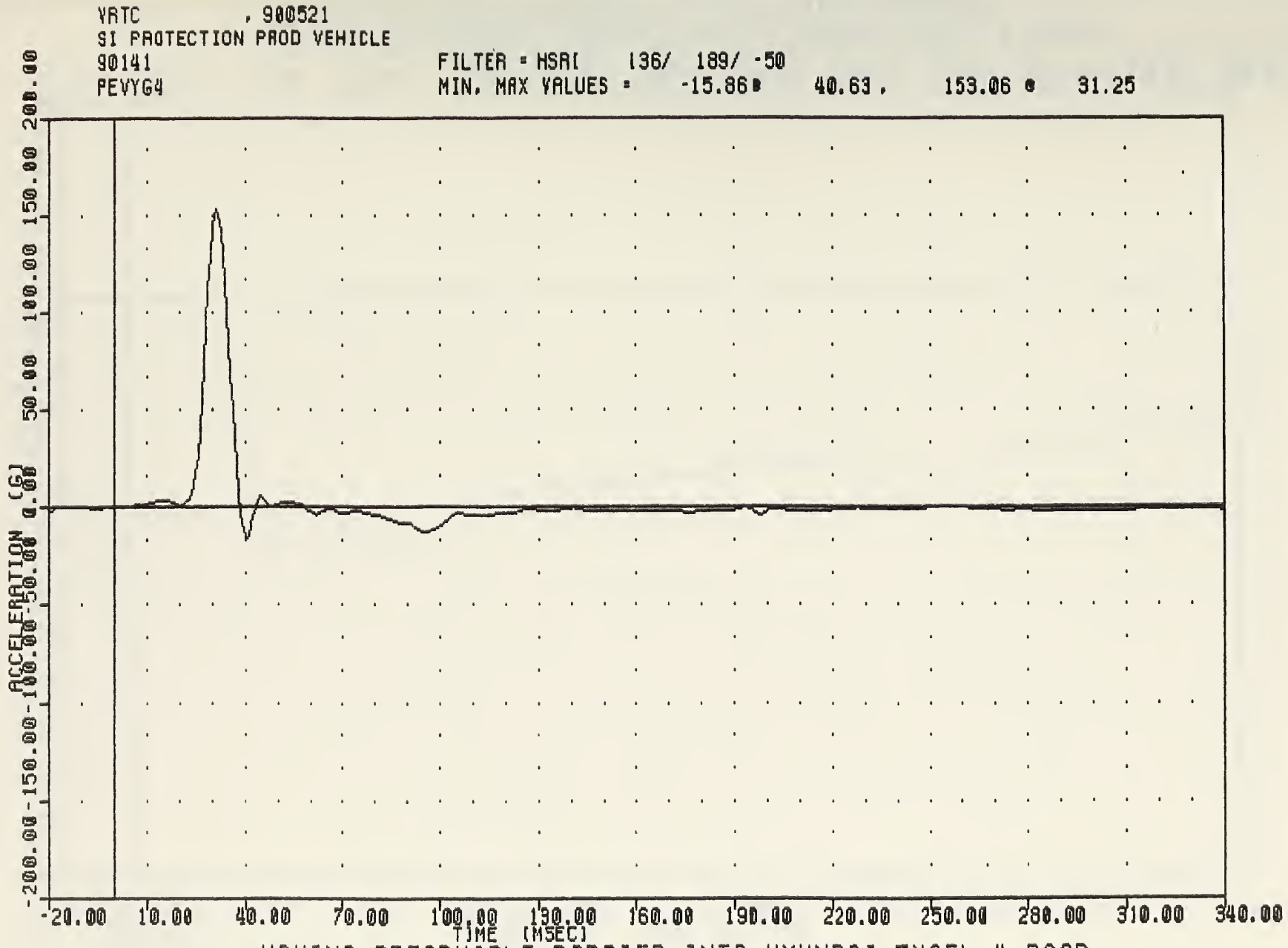
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB Y-AXIS VELOCITY



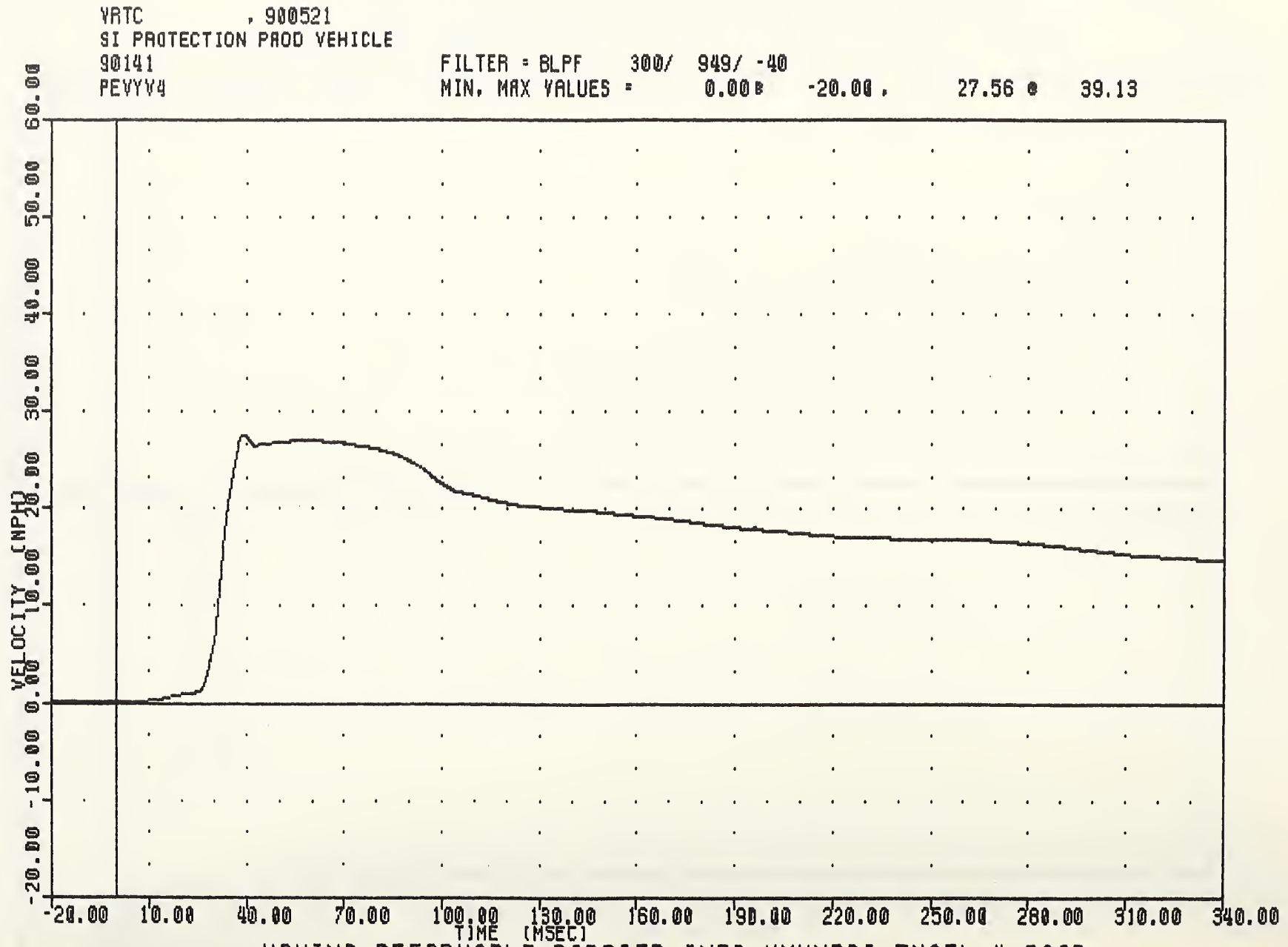
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER LEFT LOWER ABDOMEN RIB DISPLACEMENT



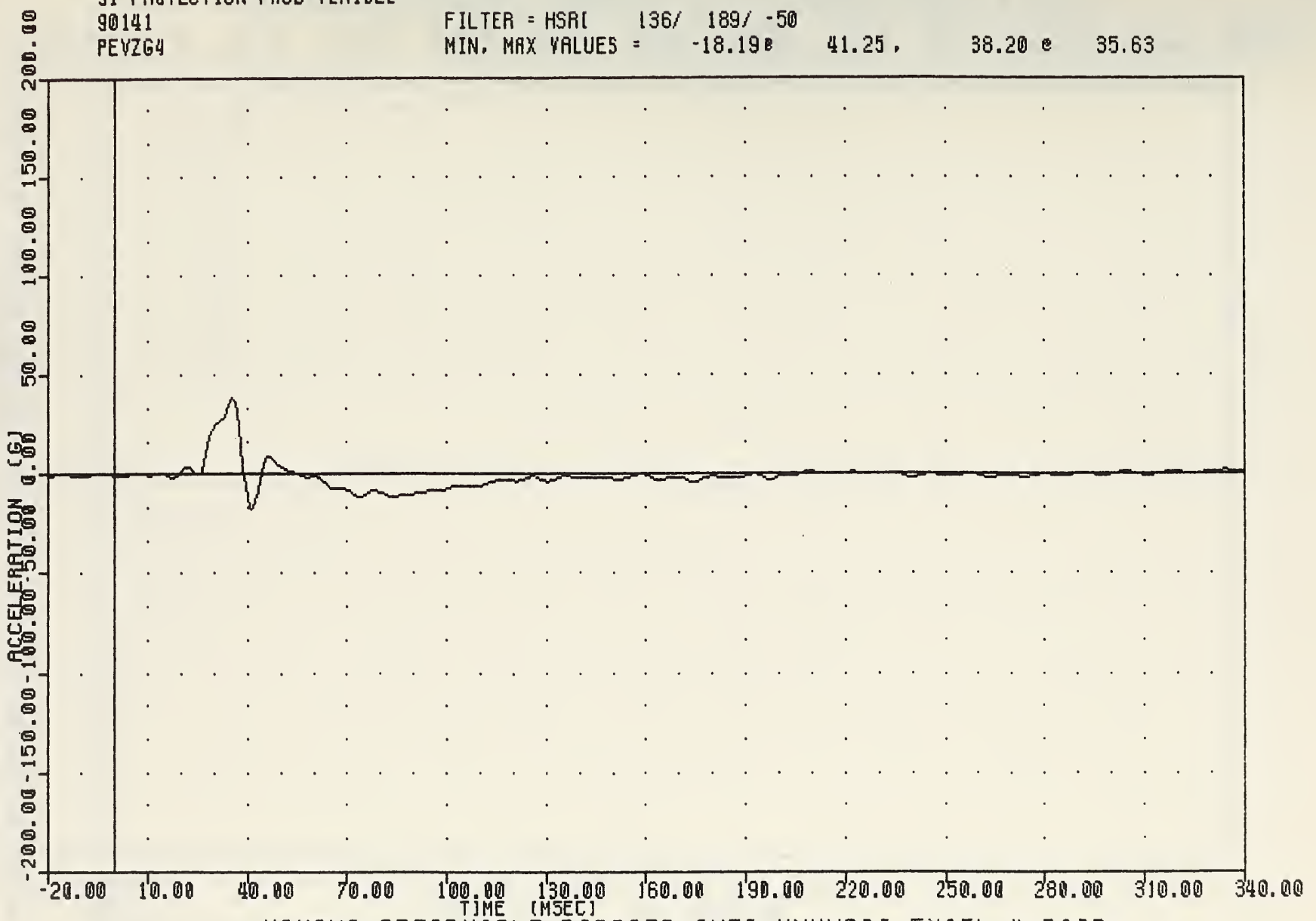
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER PELVIS X-AXIS ACCELERATION



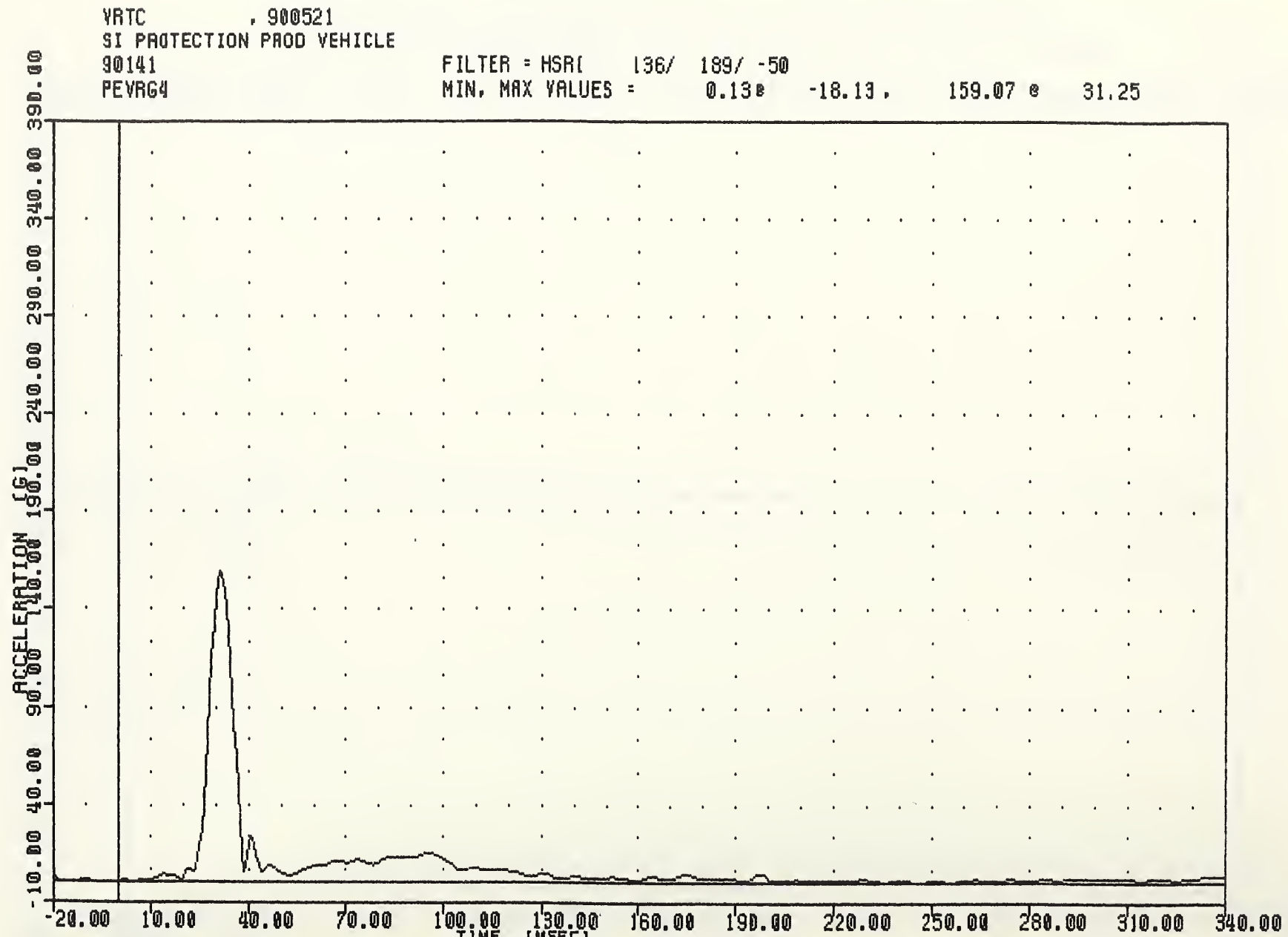
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER PELVIS Y-AXIS ACCELERATION



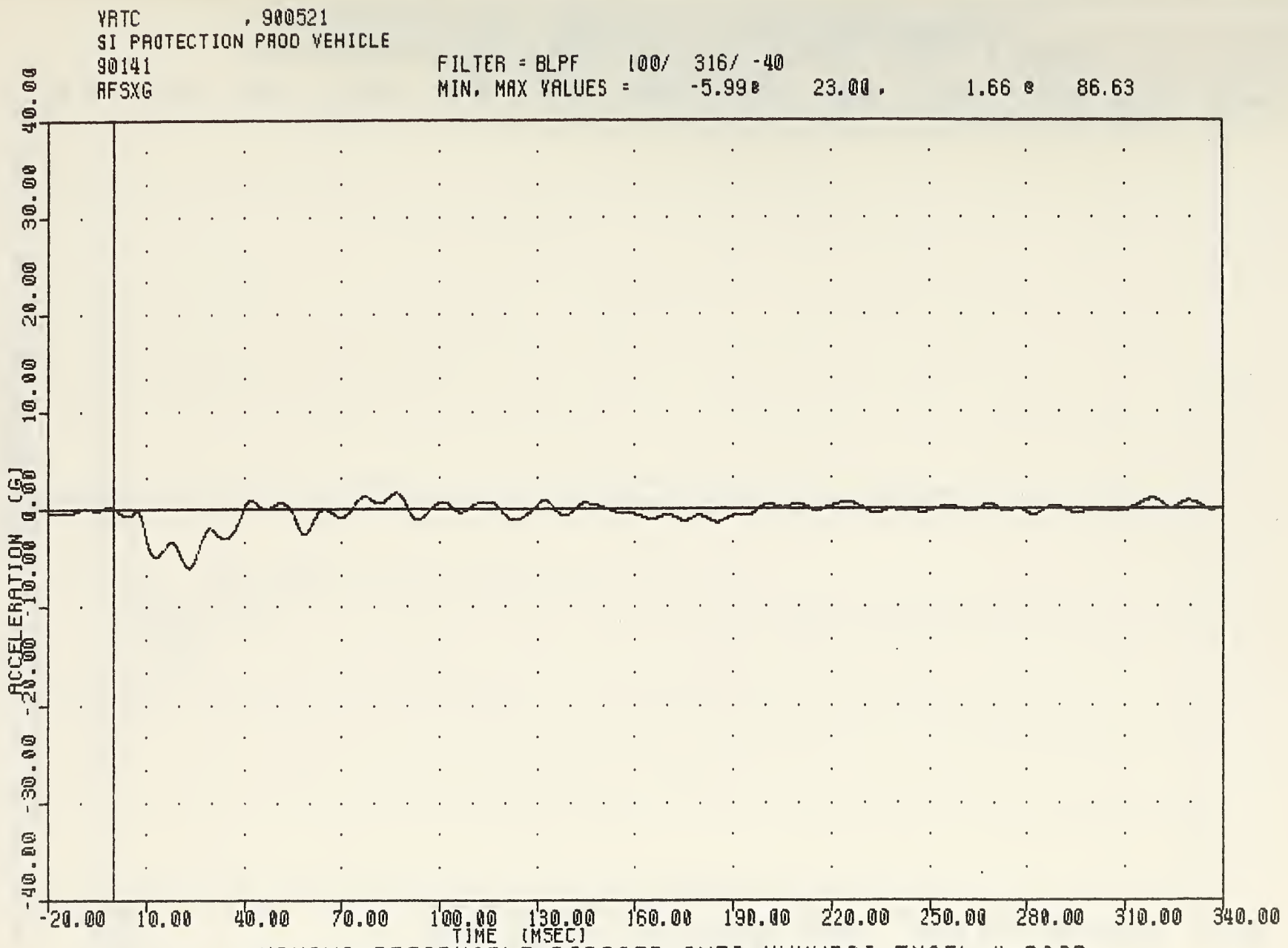
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER PELVIS Y-AXIS VELOCITY



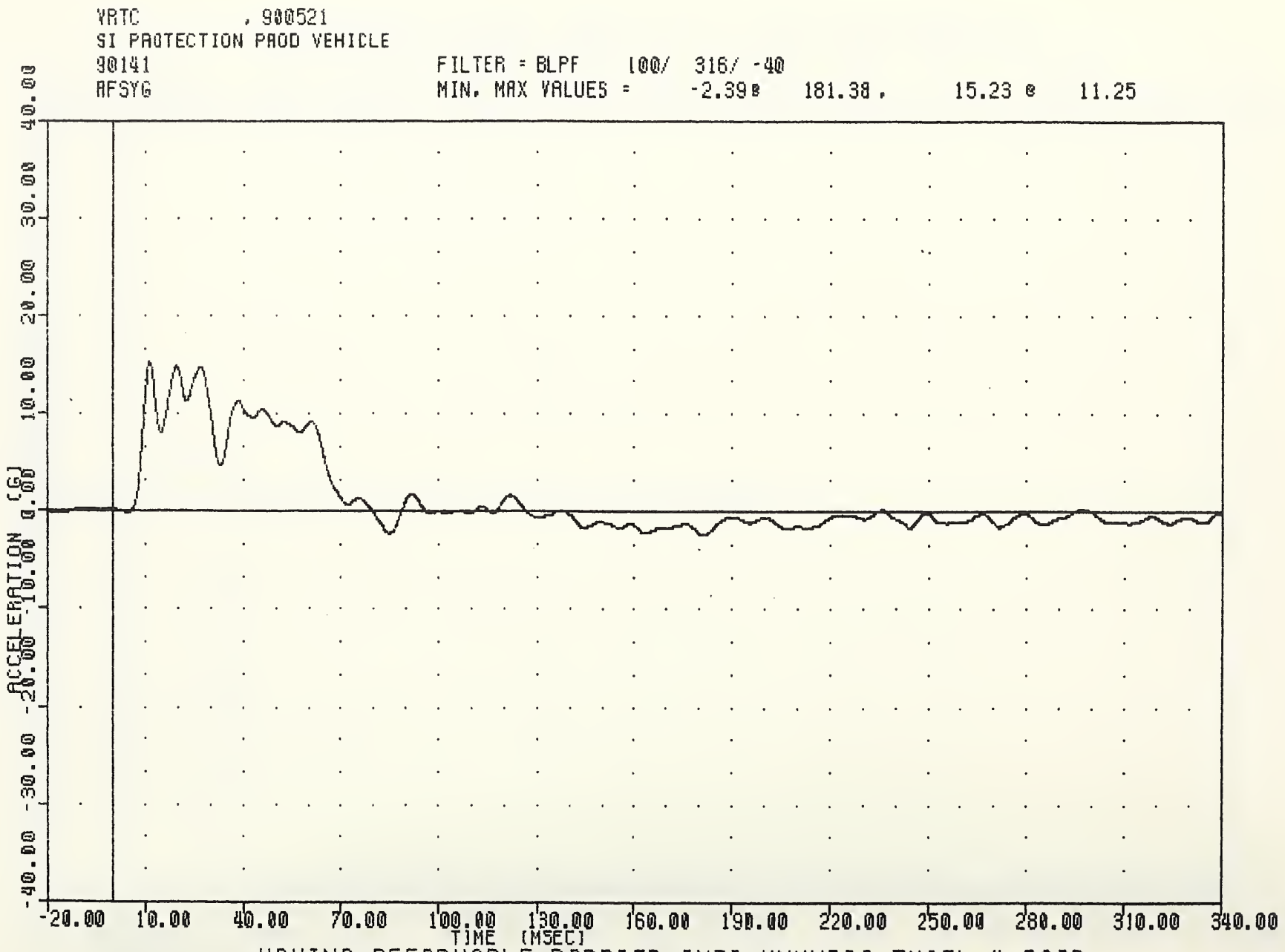
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER PELVIS Z-AXIS ACCELERATION



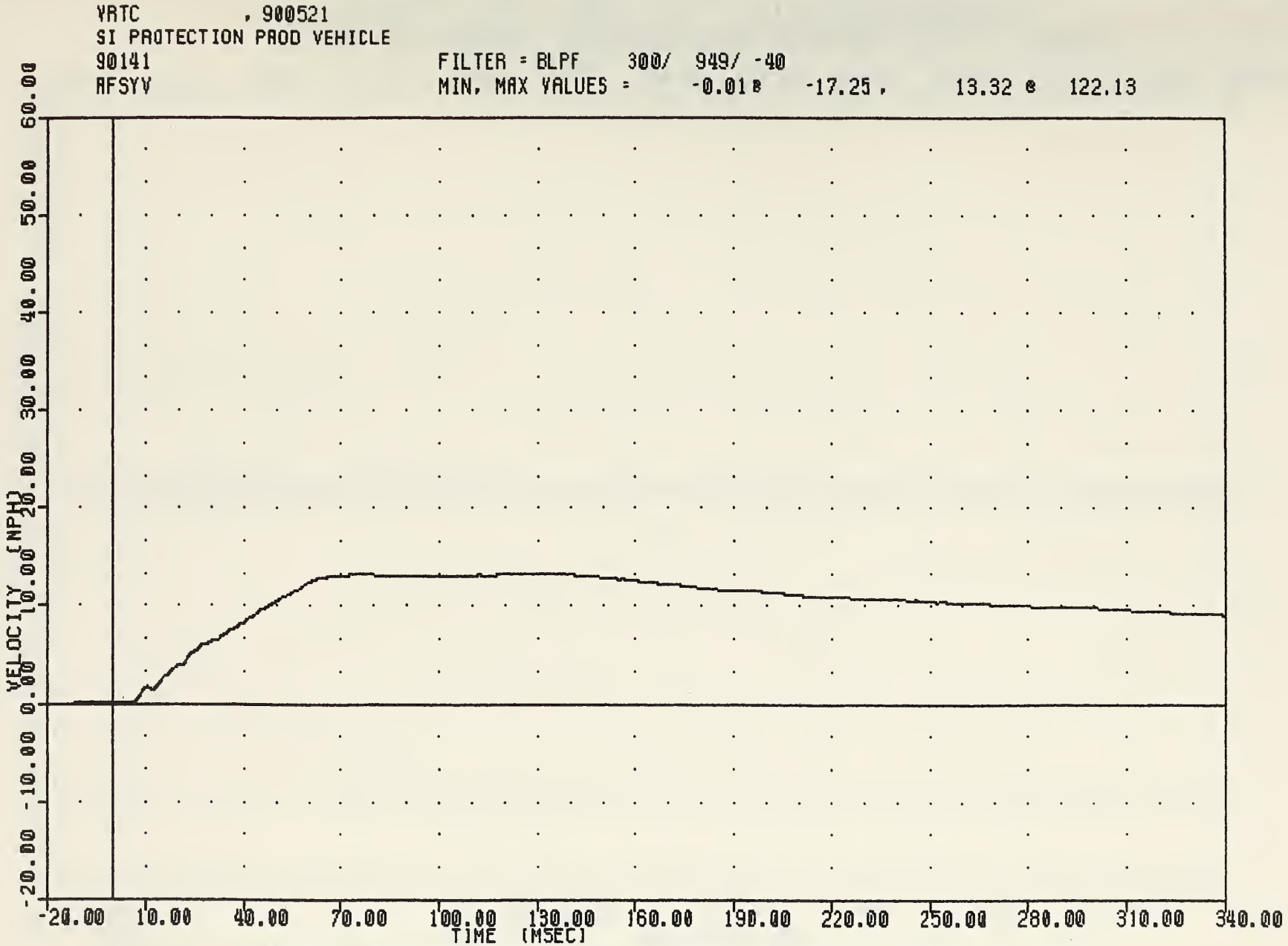
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
LEFT REAR PASSENGER PELVIS RESULTANT ACCELERATION



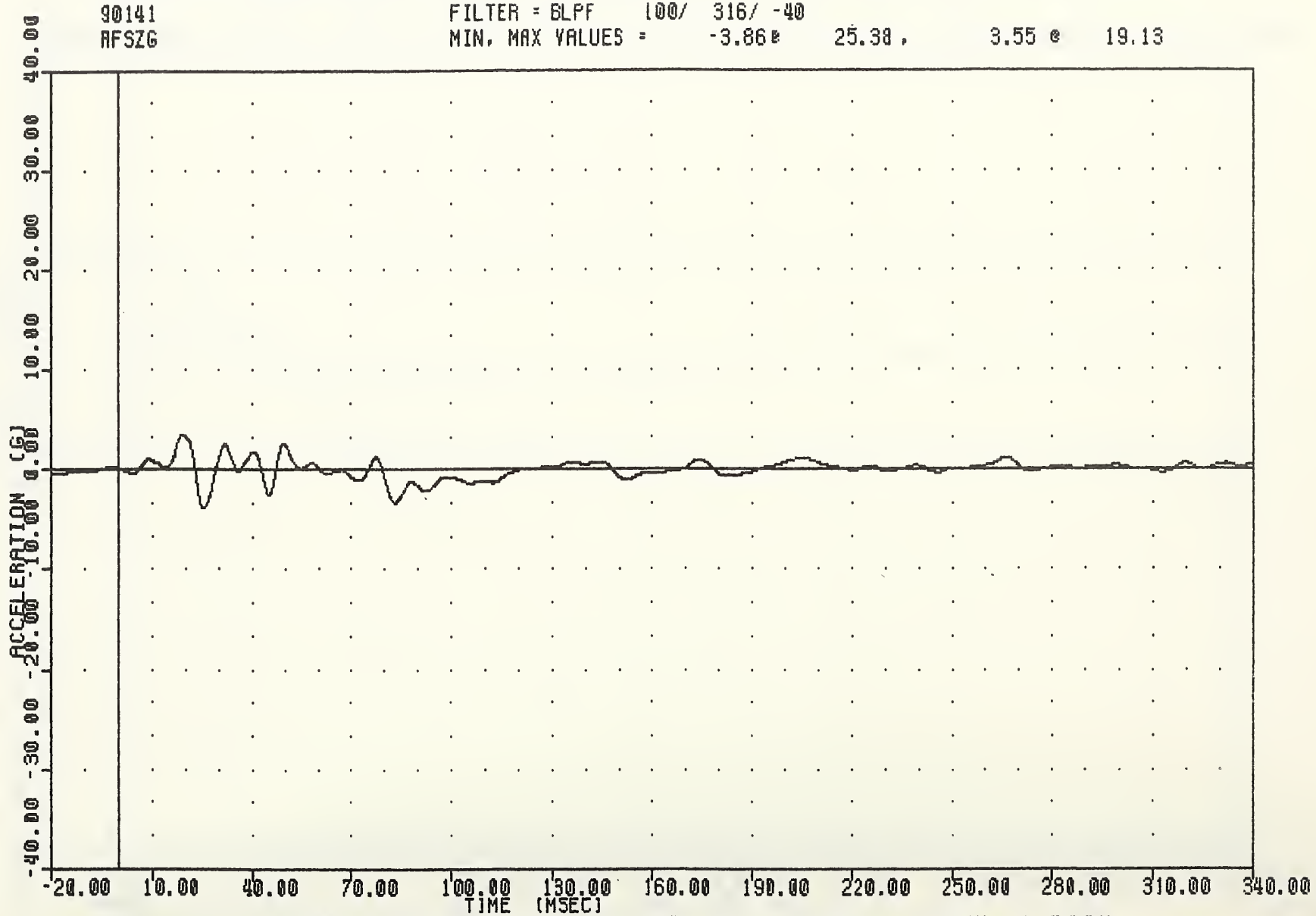
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT FRONT SILL X-AXIS ACCELERATION



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT FRONT SILL Y-AXIS ACCELERATION

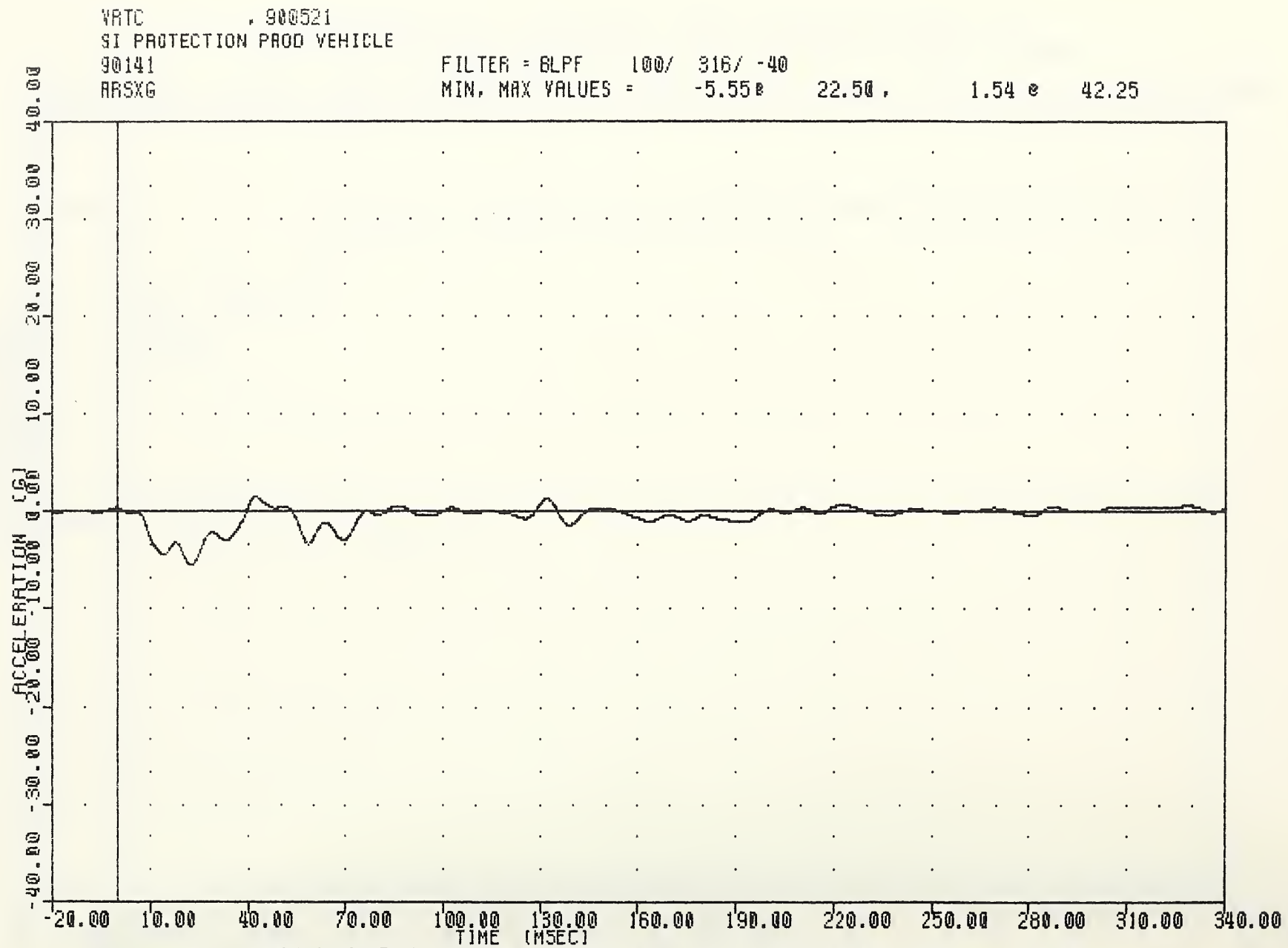


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT FRONT SILL Y-AXIS VELOCITY

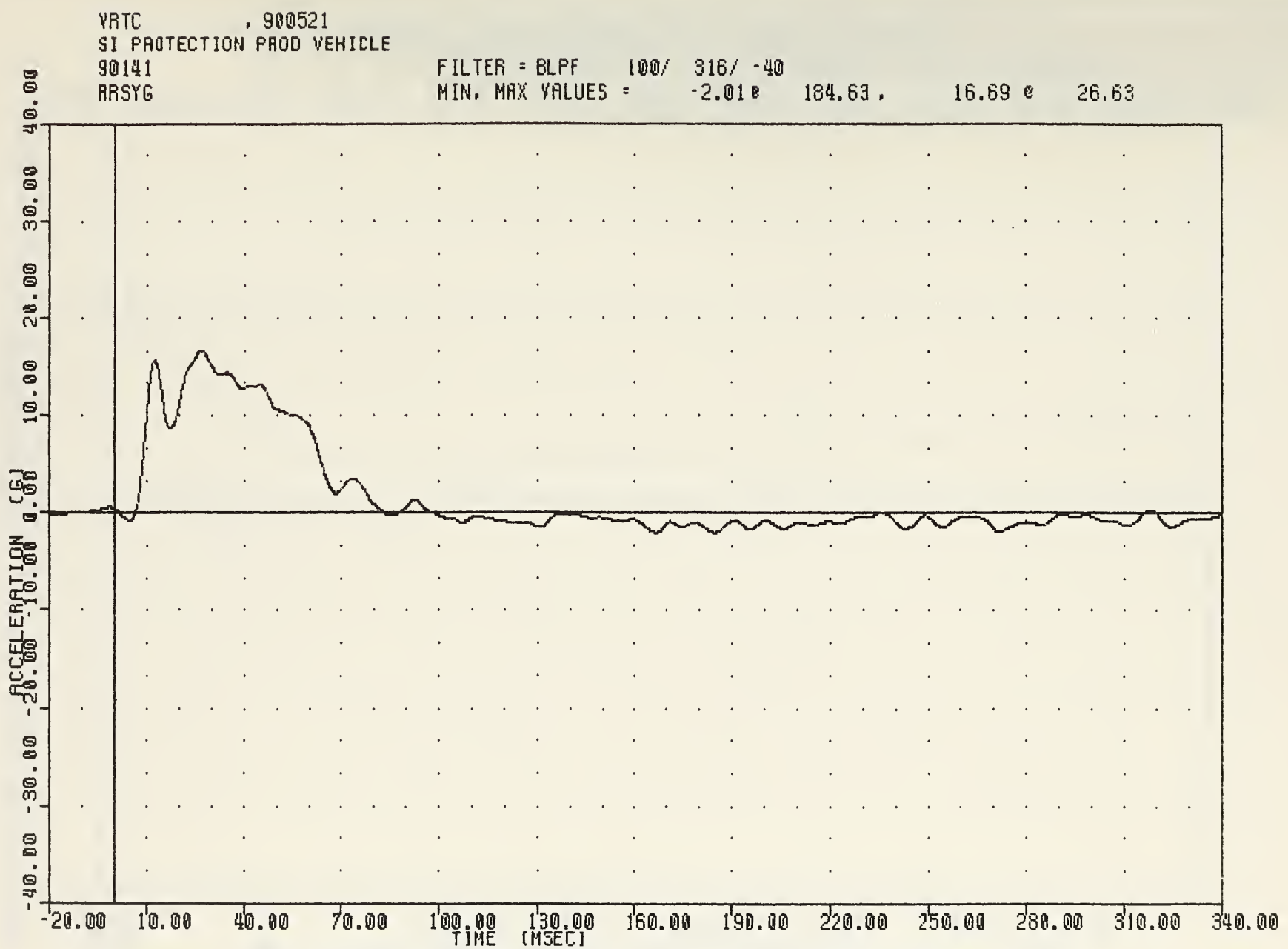


MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT FRONT SILL Z-AXIS ACCELERATION

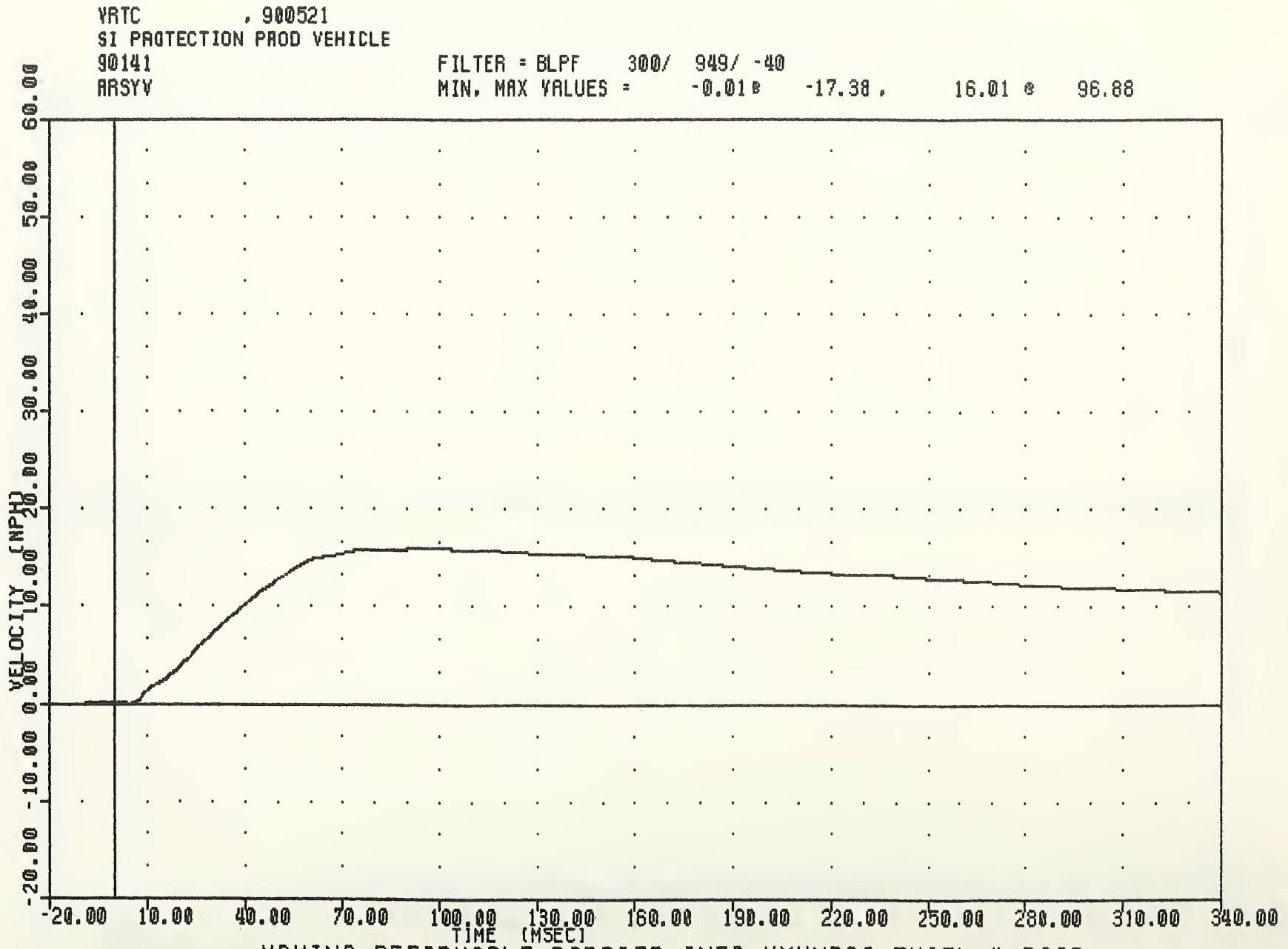
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT FRONT SILL RESULTANT ACCELERATION



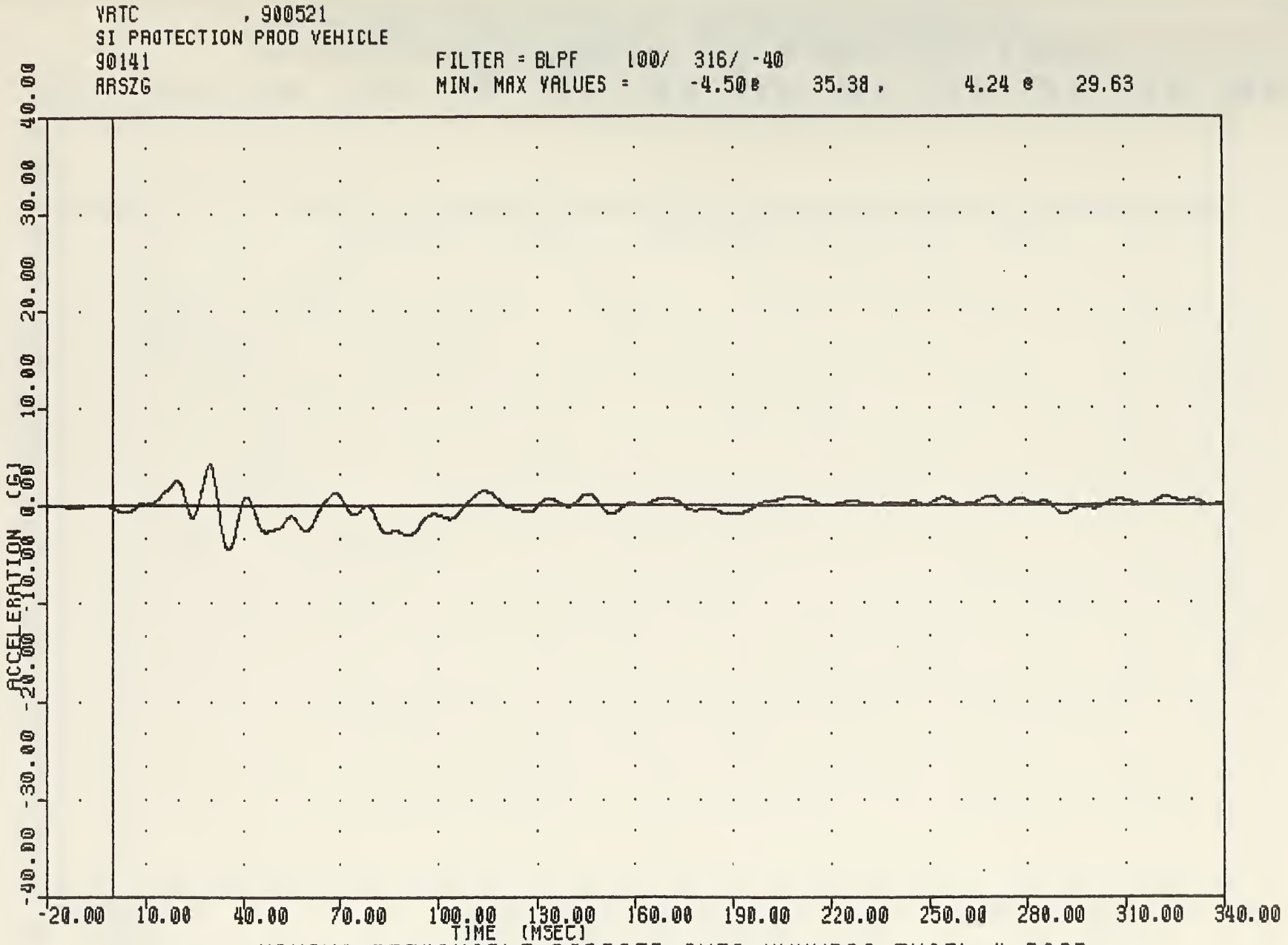
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT REAR SILL X-AXIS ACCELERATION



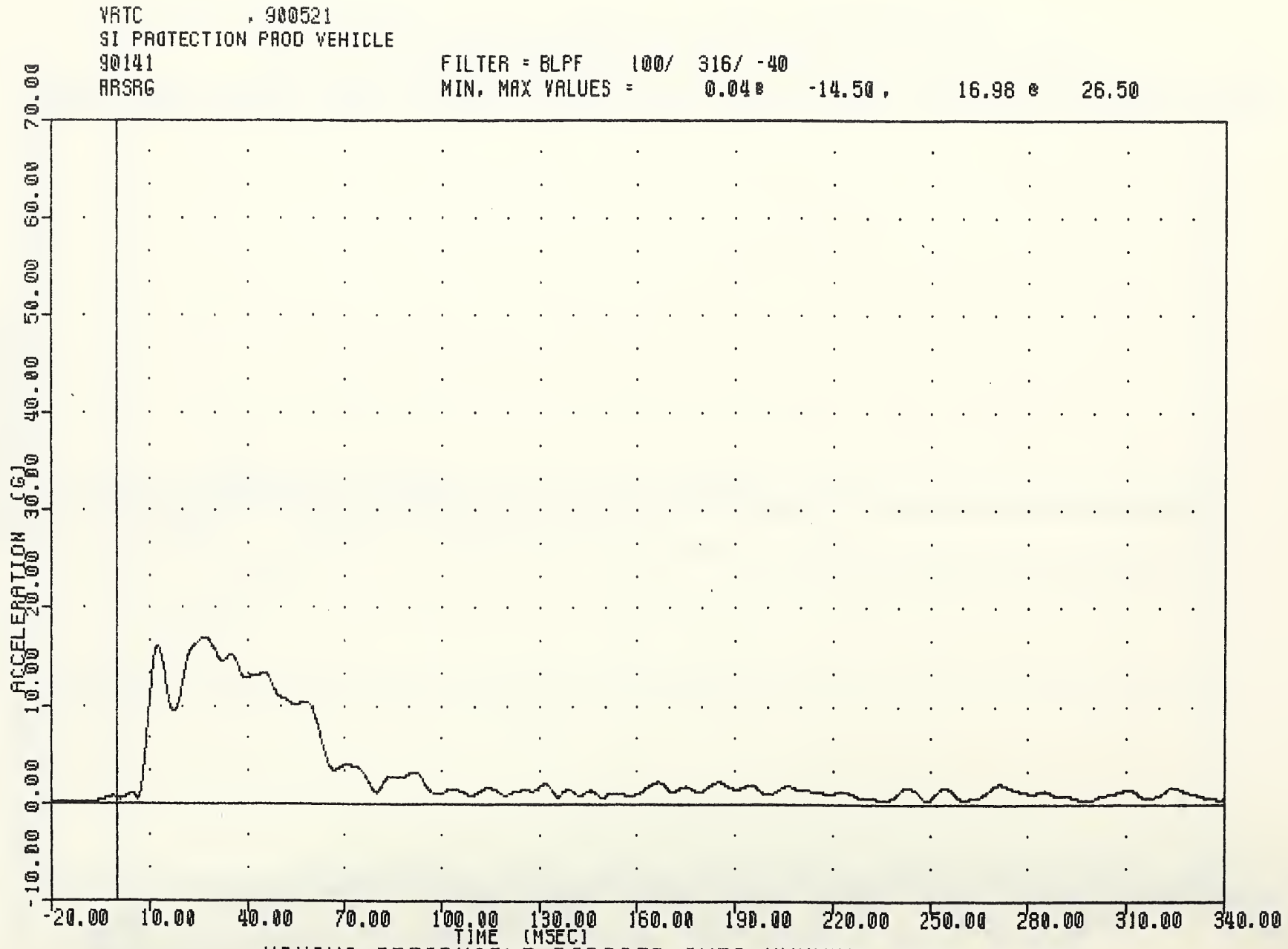
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT REAR SILL Y-AXIS ACCELERATION



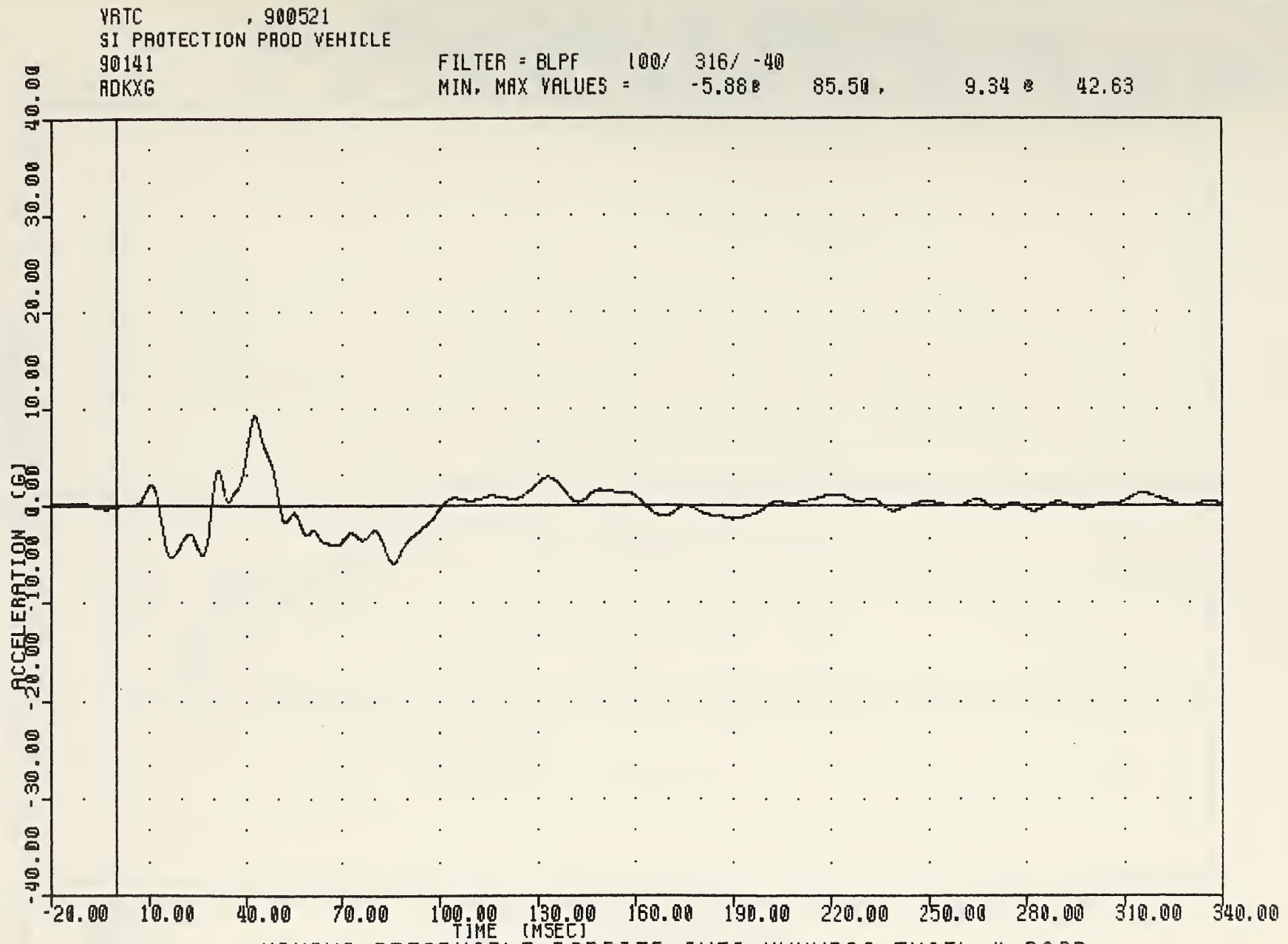
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT REAR SILL Y-AXIS VELOCITY



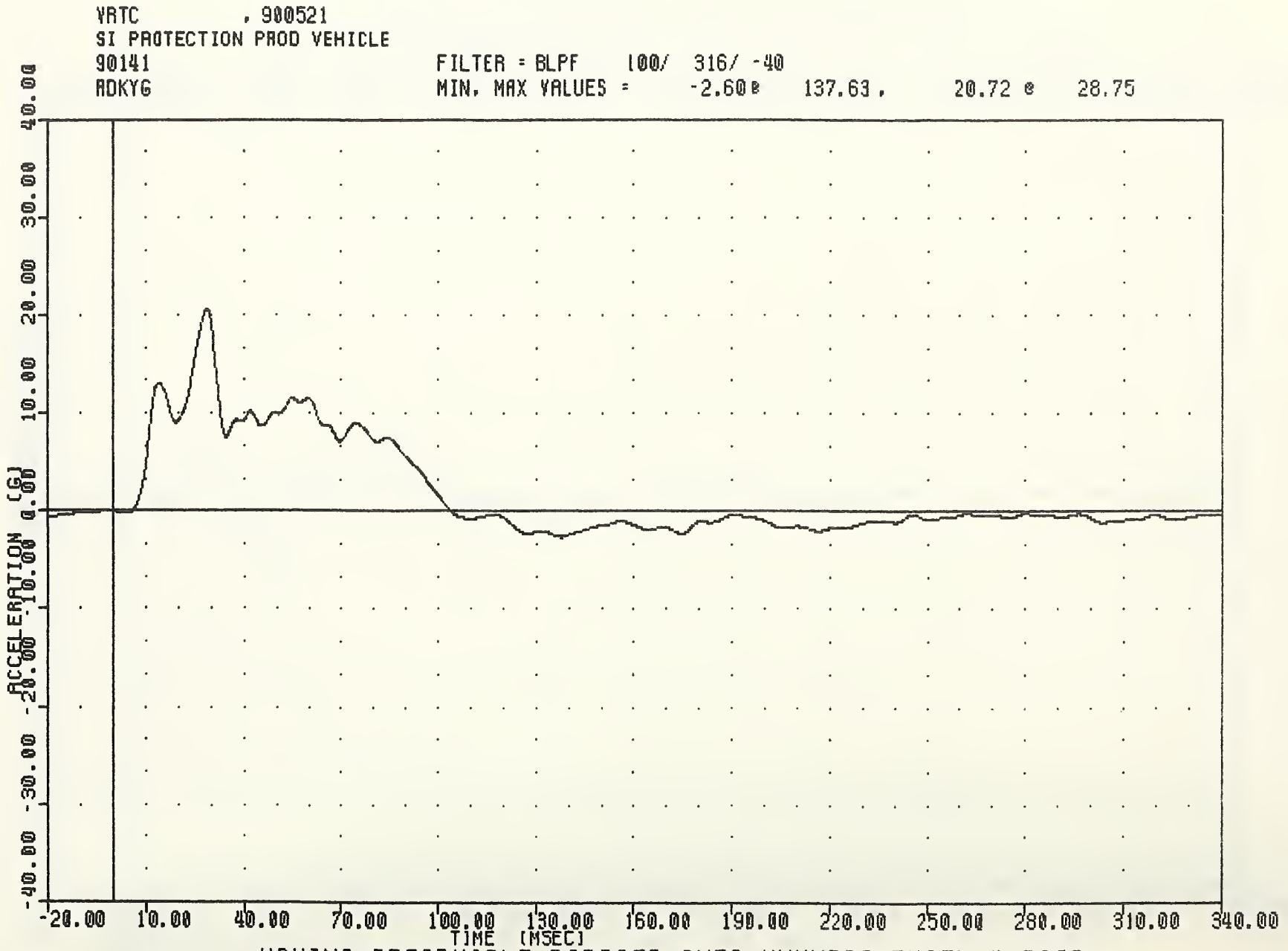
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT REAR SILL Z-AXIS ACCELERATION



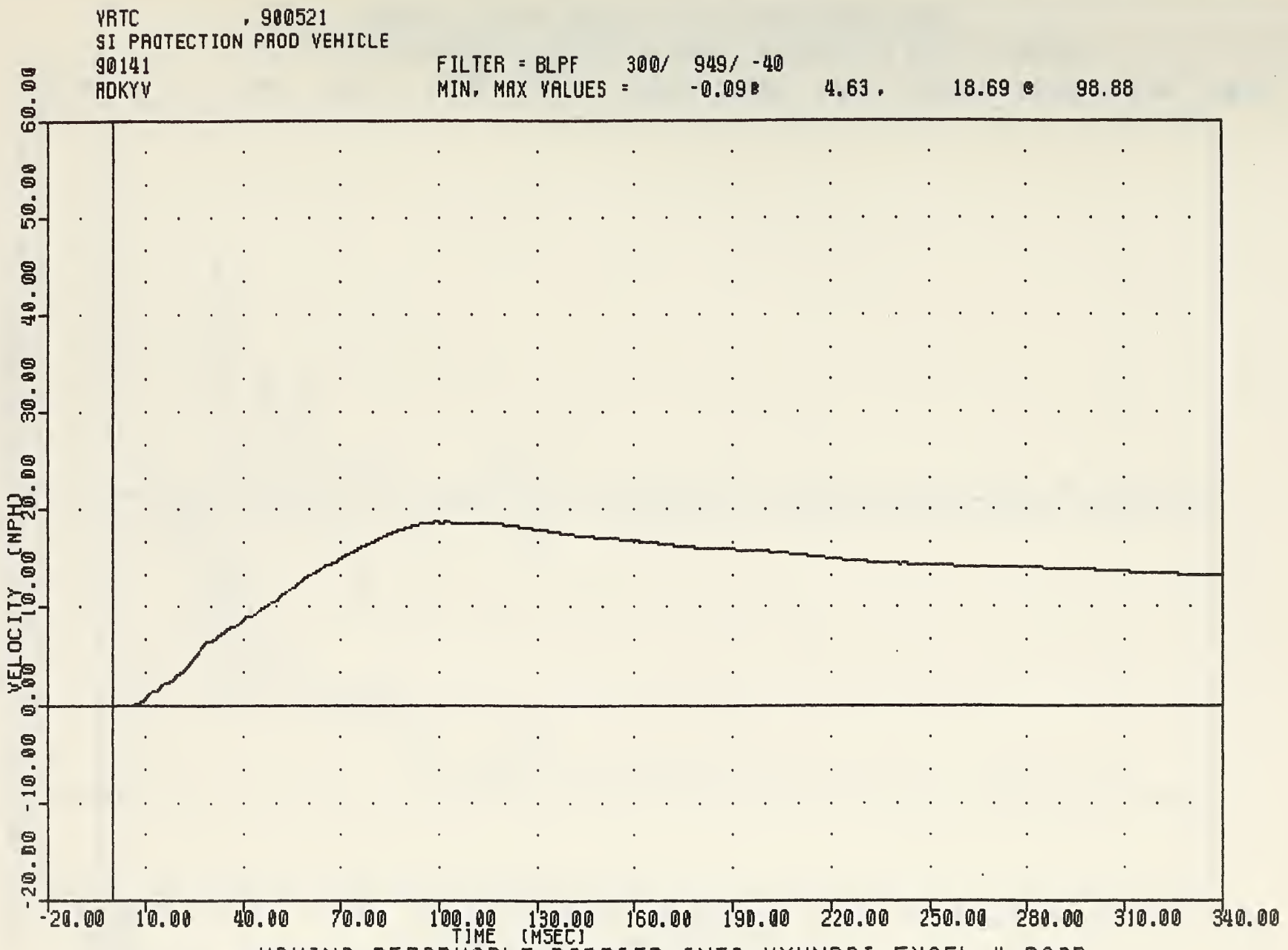
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE RIGHT REAR SILL RESULTANT ACCELERATION



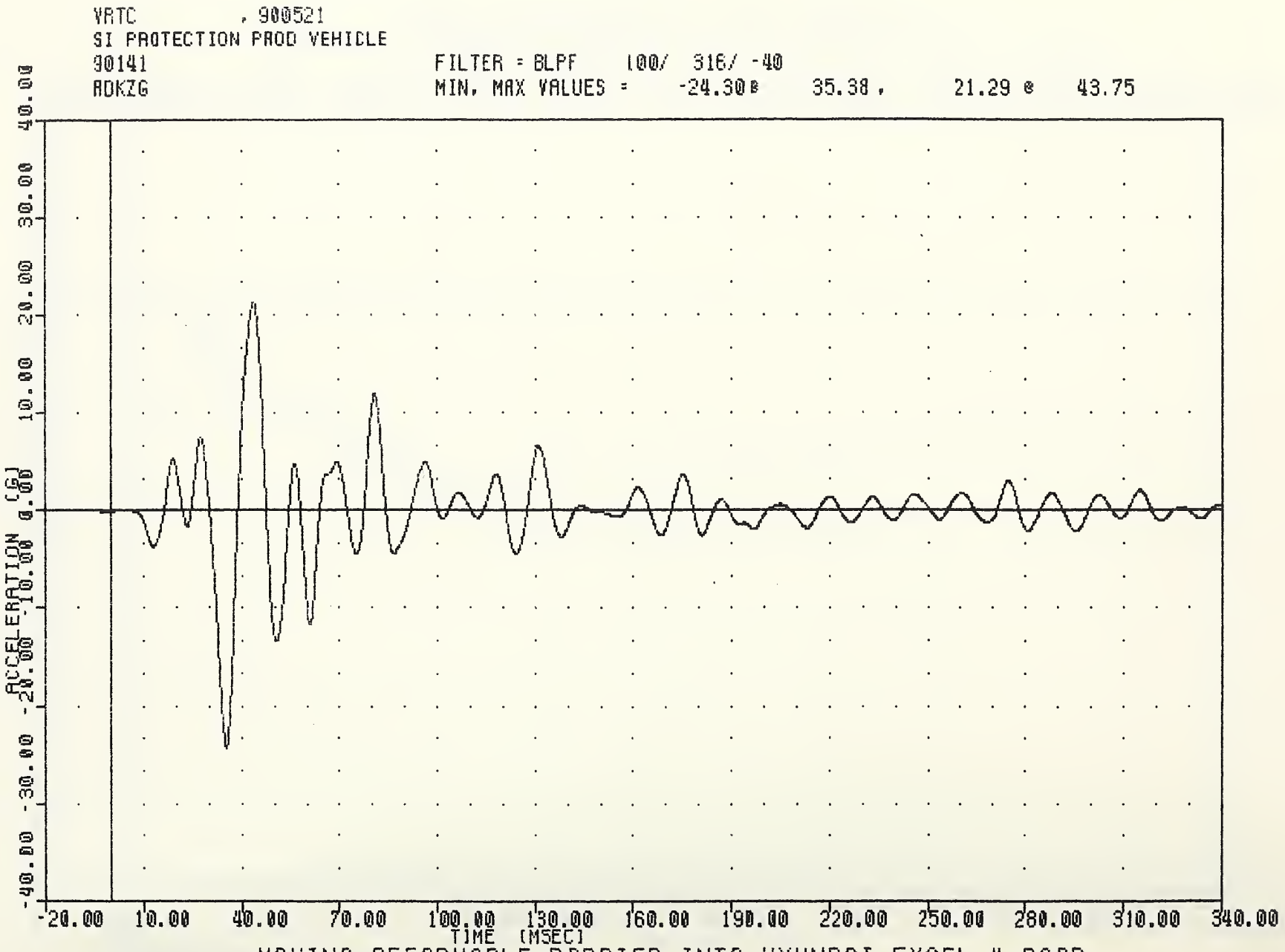
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE REAR DECK X-AXIS ACCELERATION



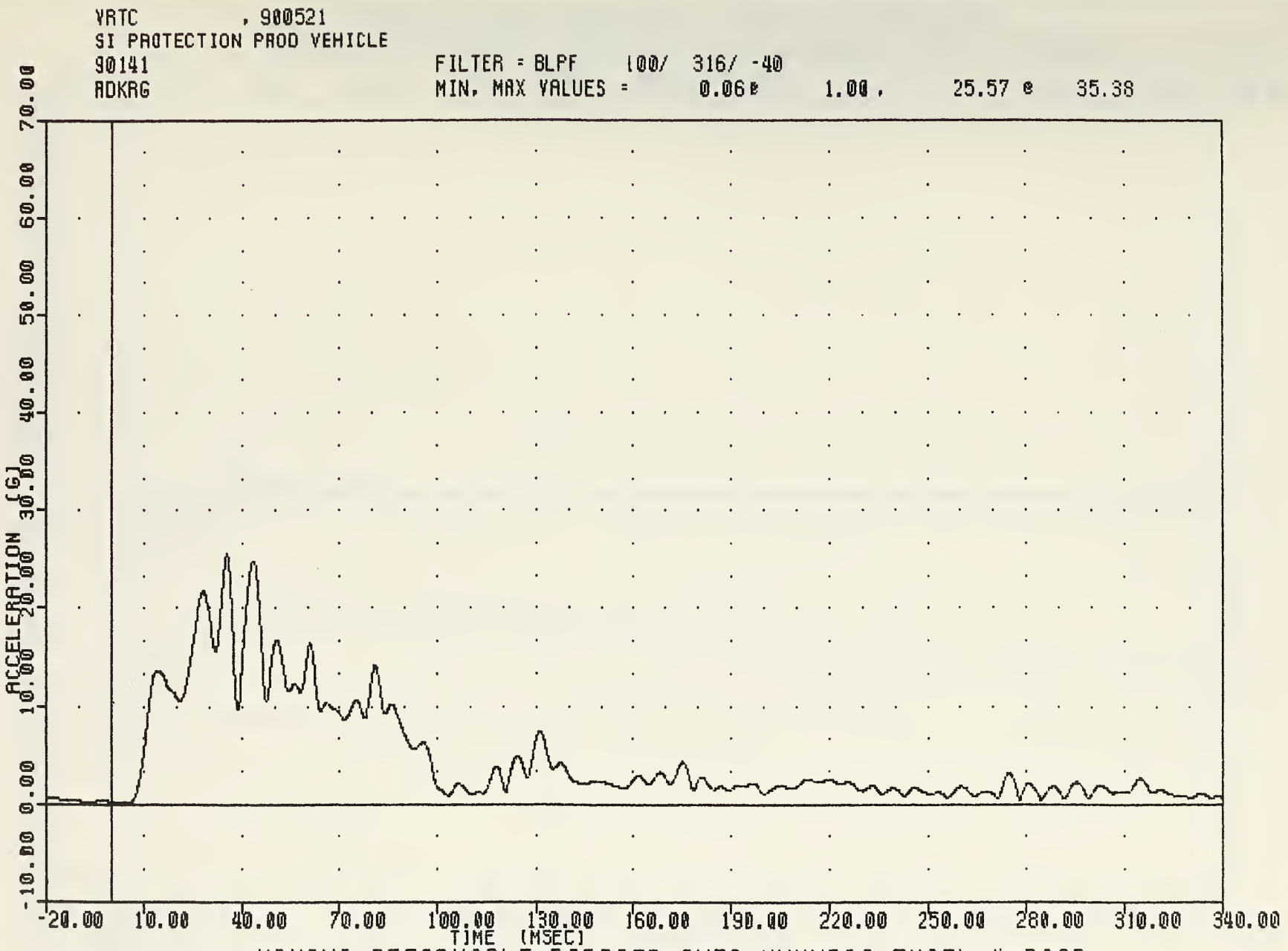
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE REAR DECK Y-AXIS ACCELERATION



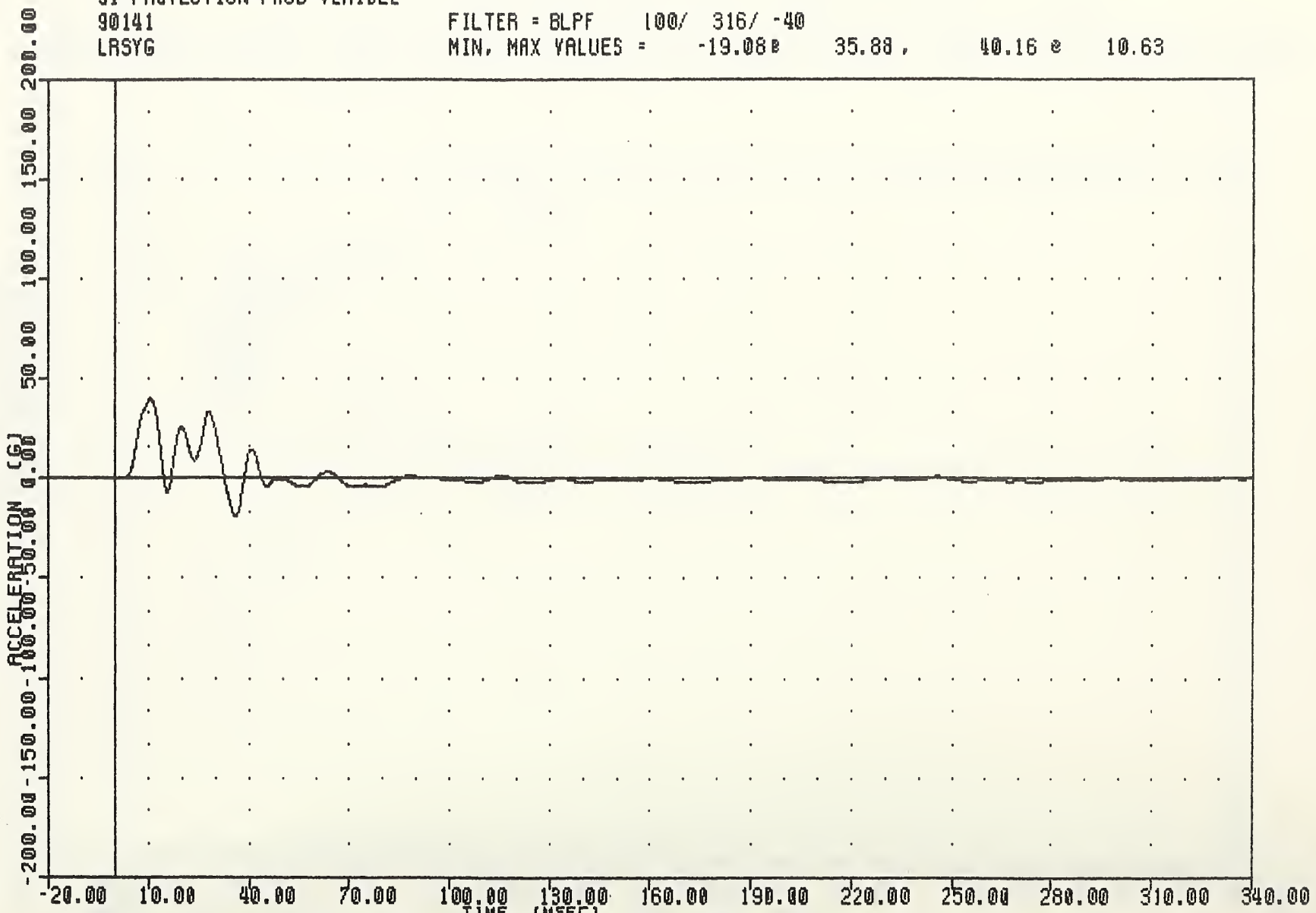
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE REAR DECK Y-AXIS VELOCITY



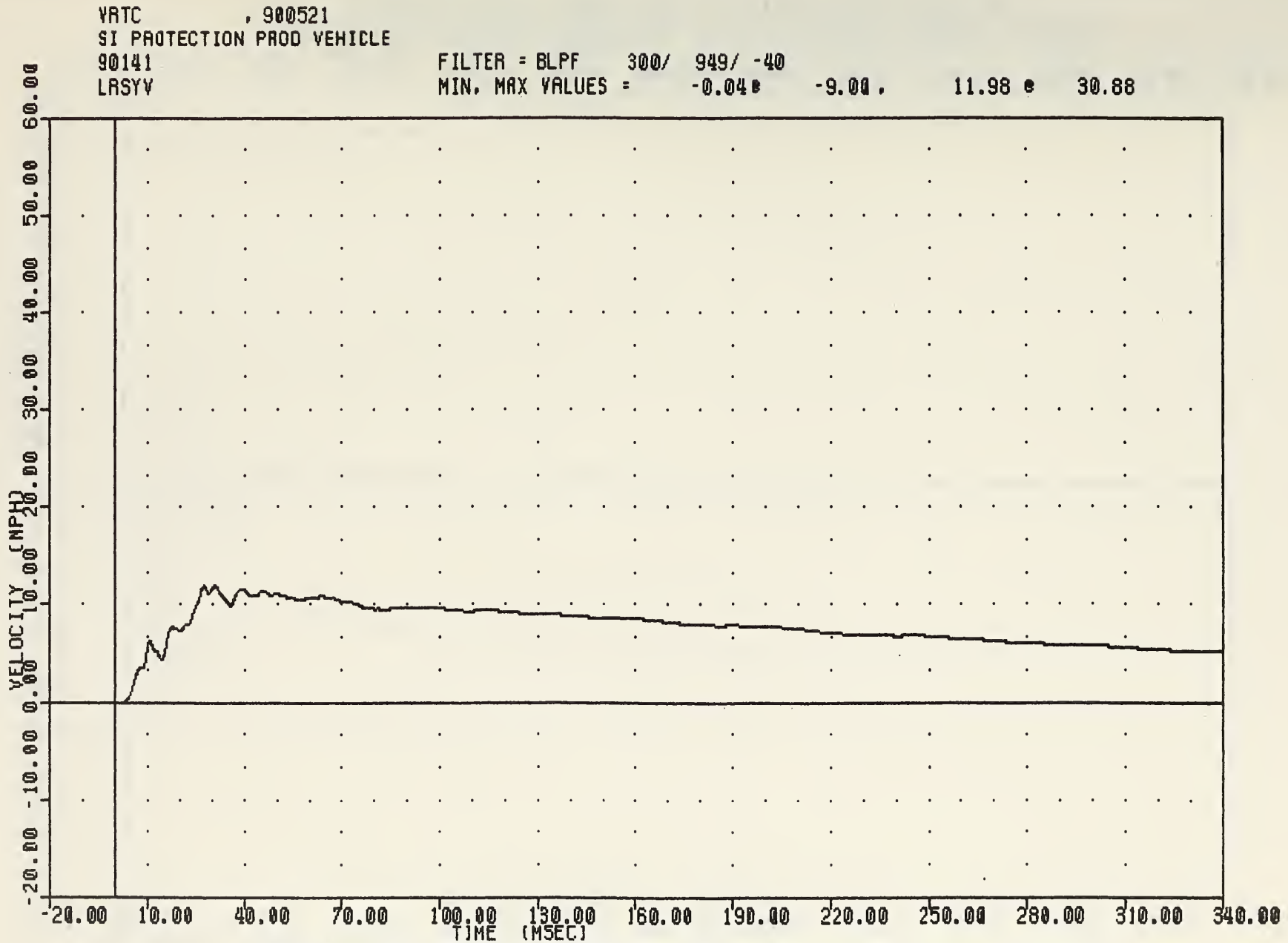
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE REAR DECK Z-AXIS ACCELERATION



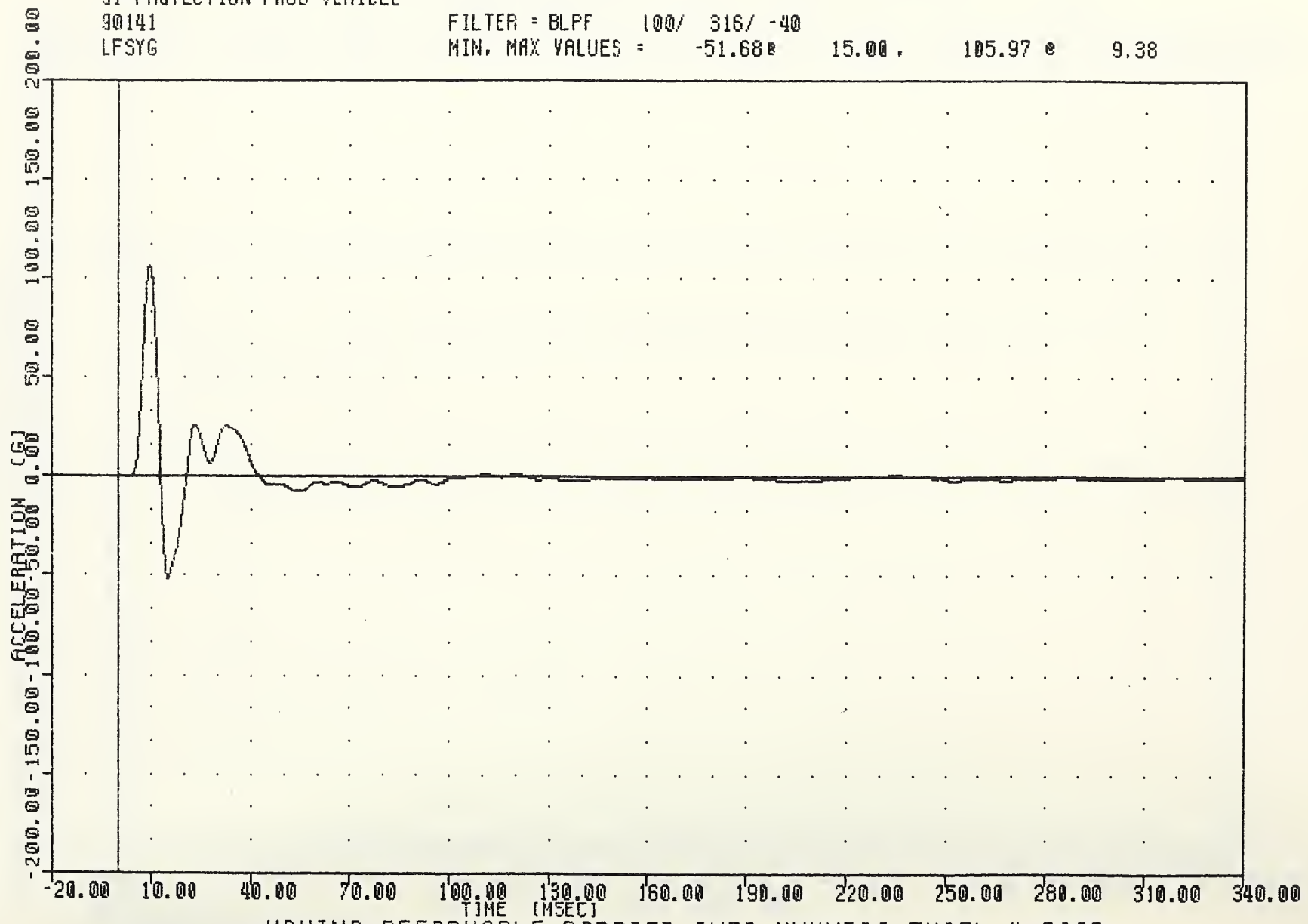
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE REAR DECK RESULTANT ACCELERATION



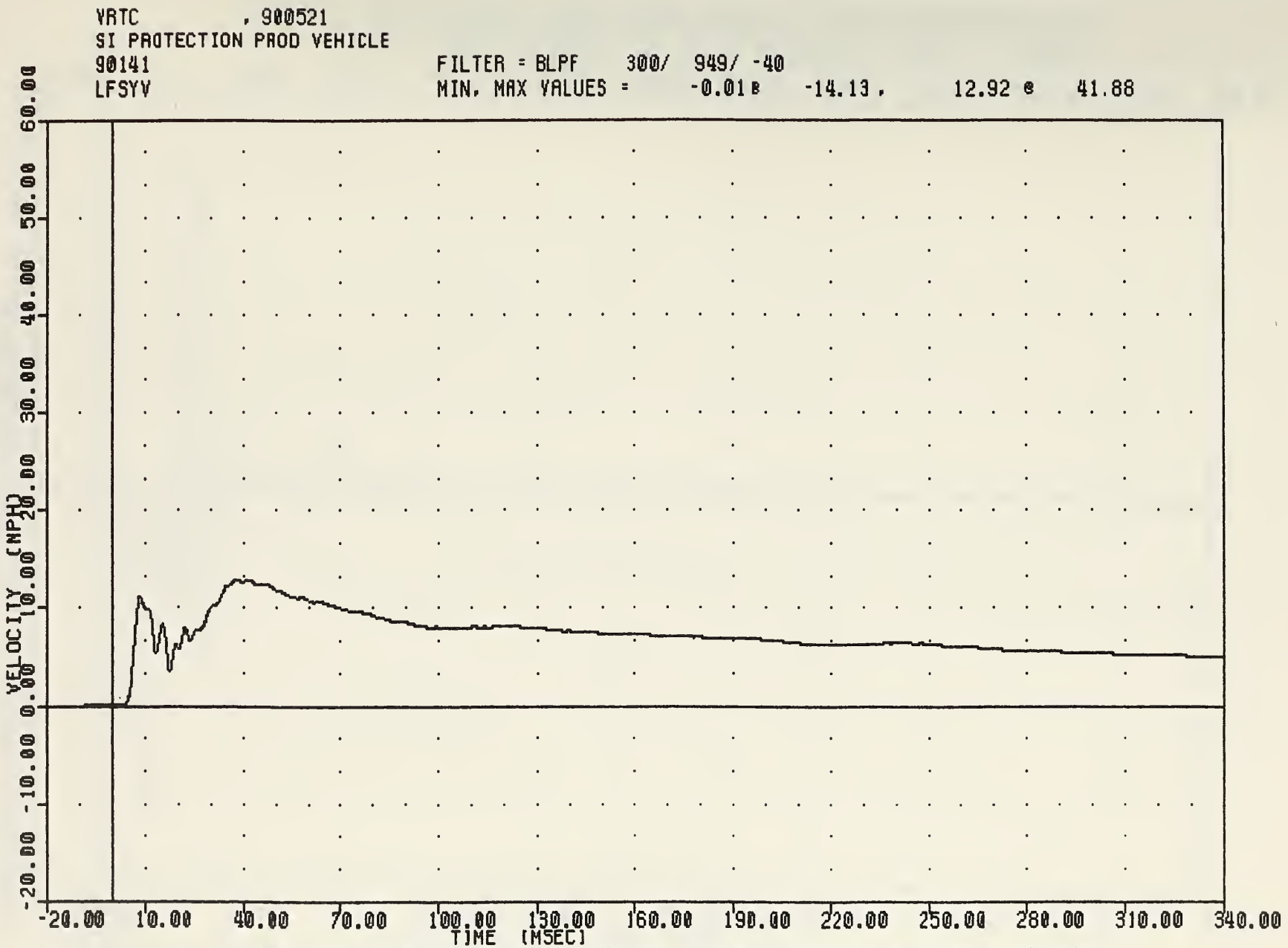
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR SILL Y-AXIS ACCELERATION



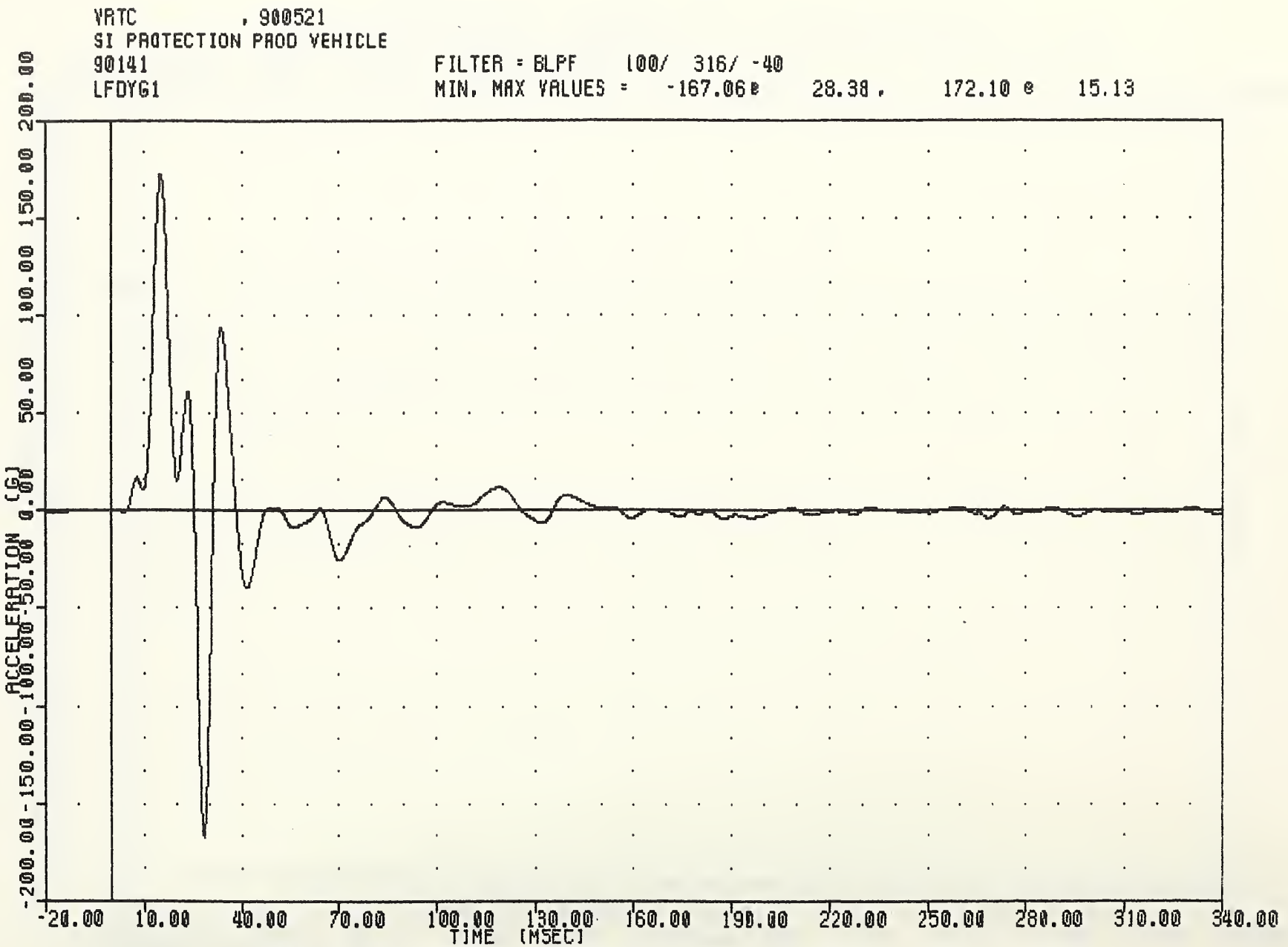
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR SILL Y-AXIS VELOCITY



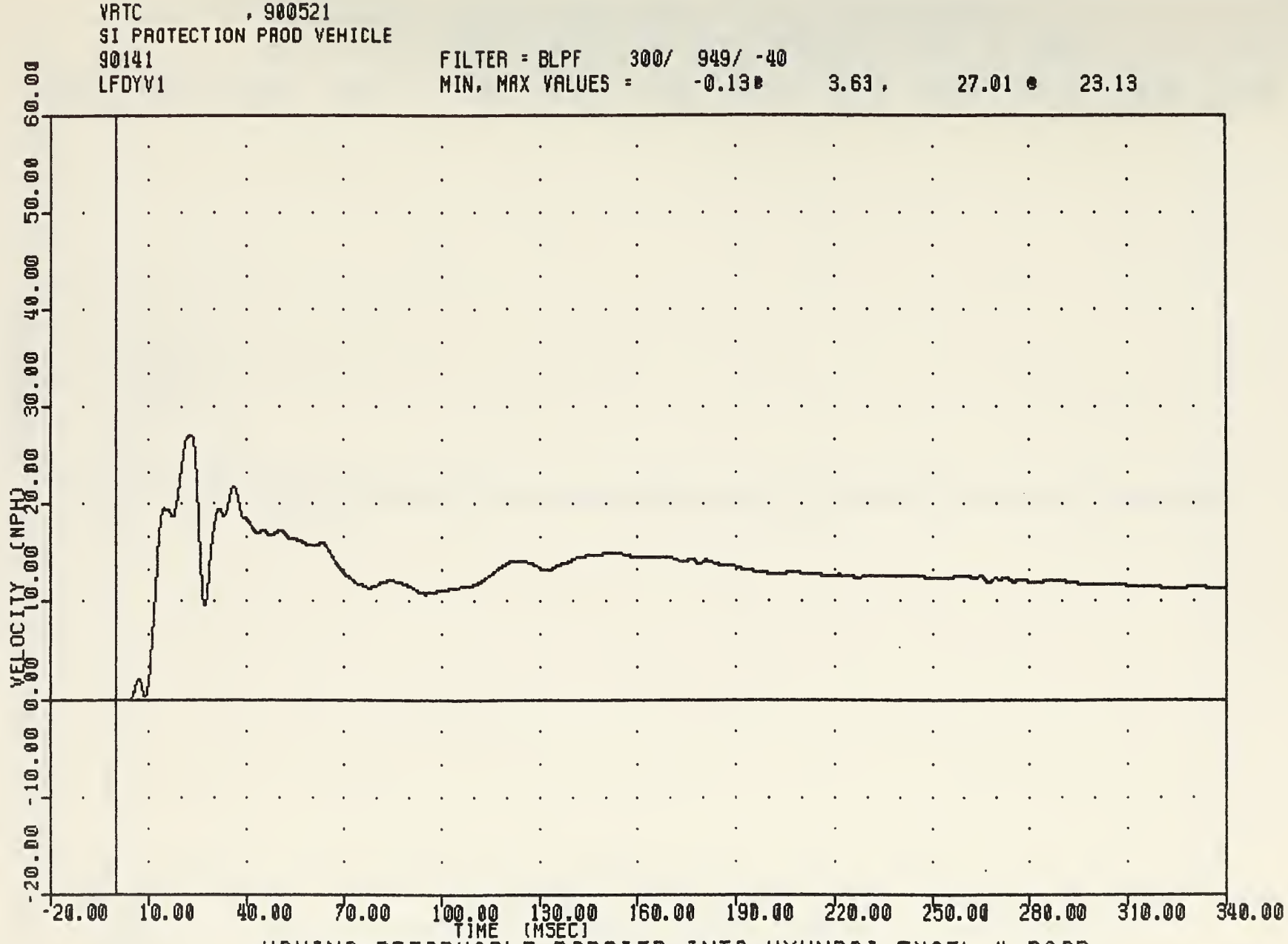
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT SILL Y-AXIS ACCELERATION



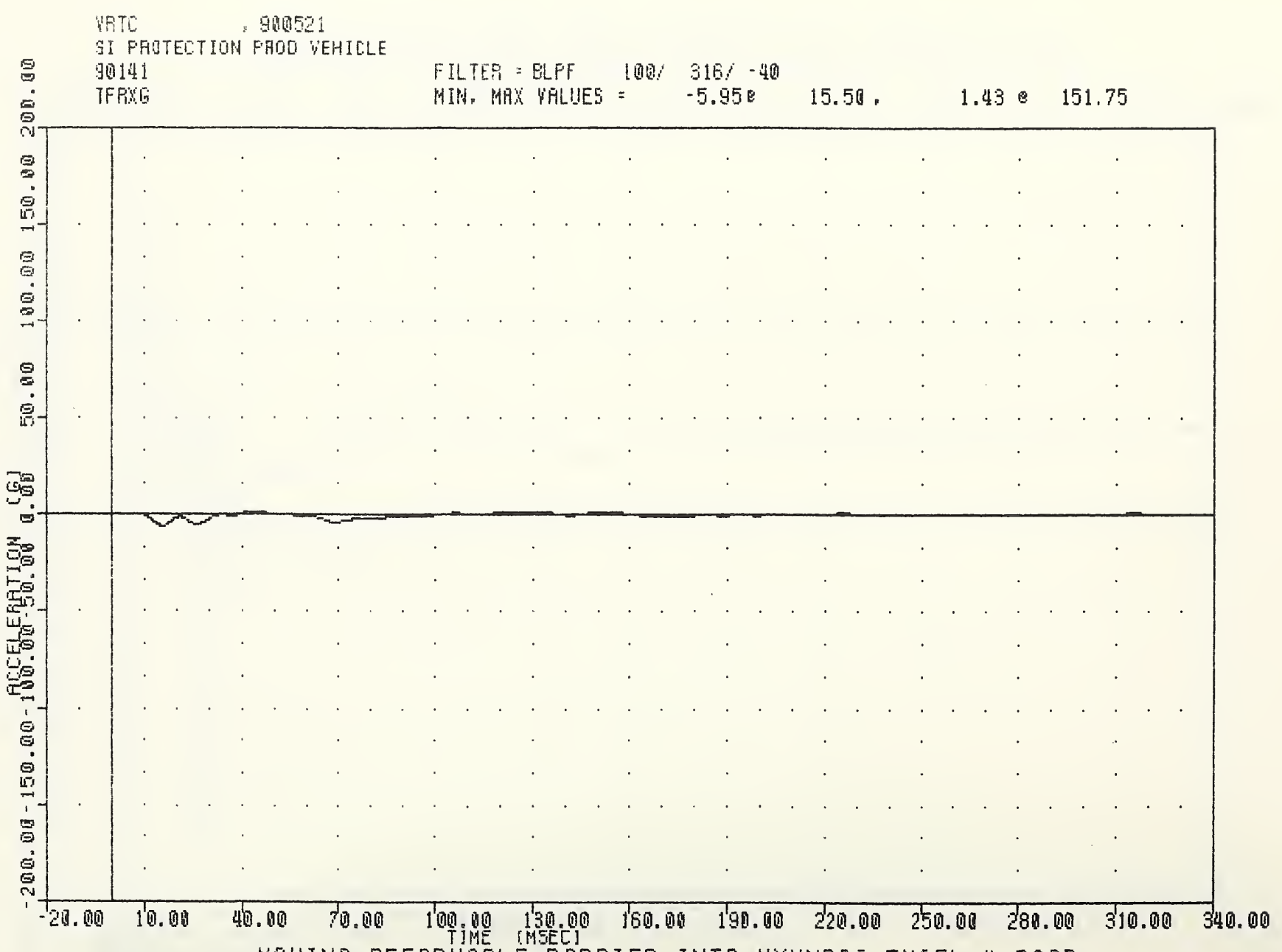
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT SILL Y-AXIS VELOCITY



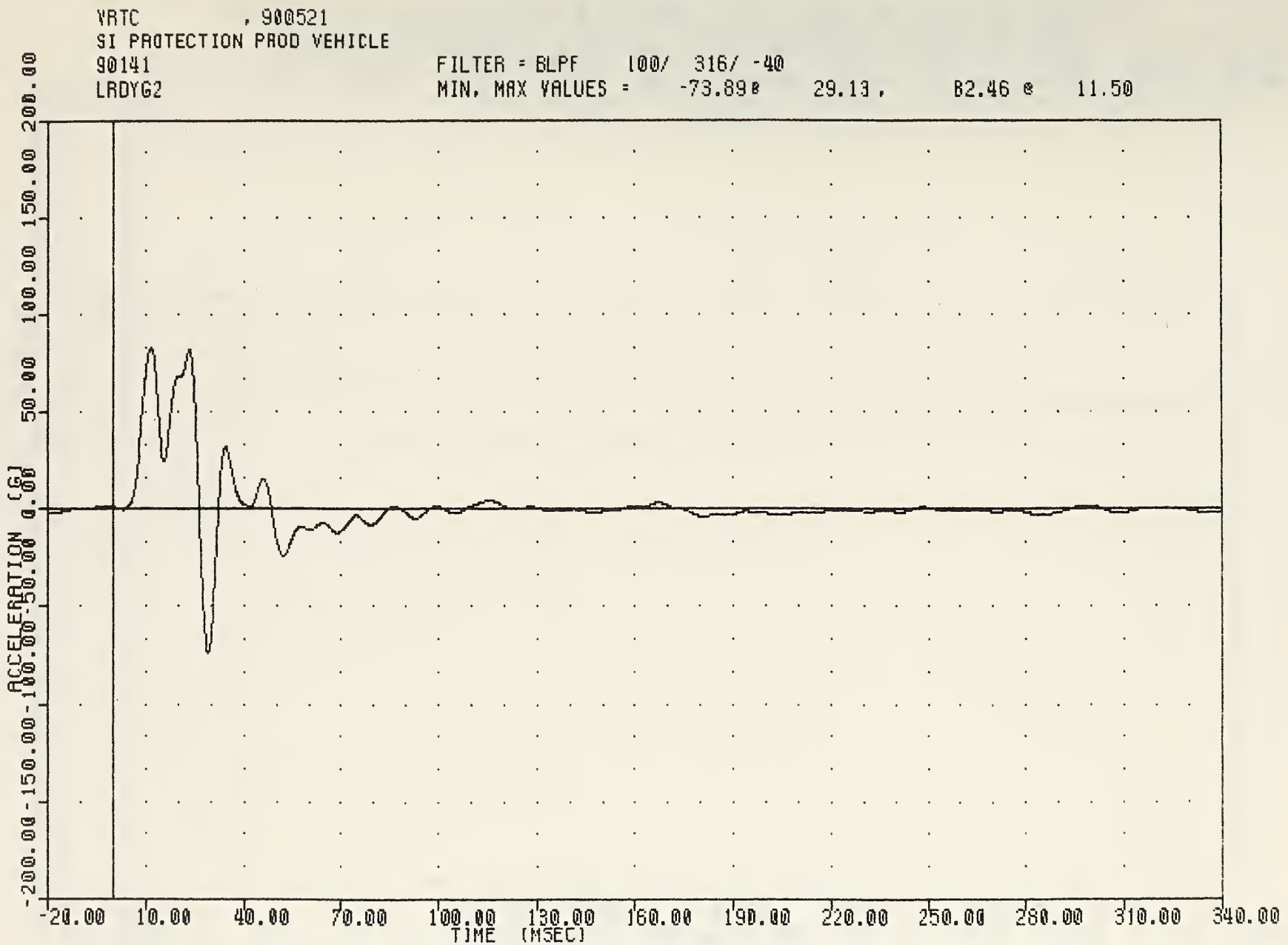
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 6) Y-AXIS ACCELERATION



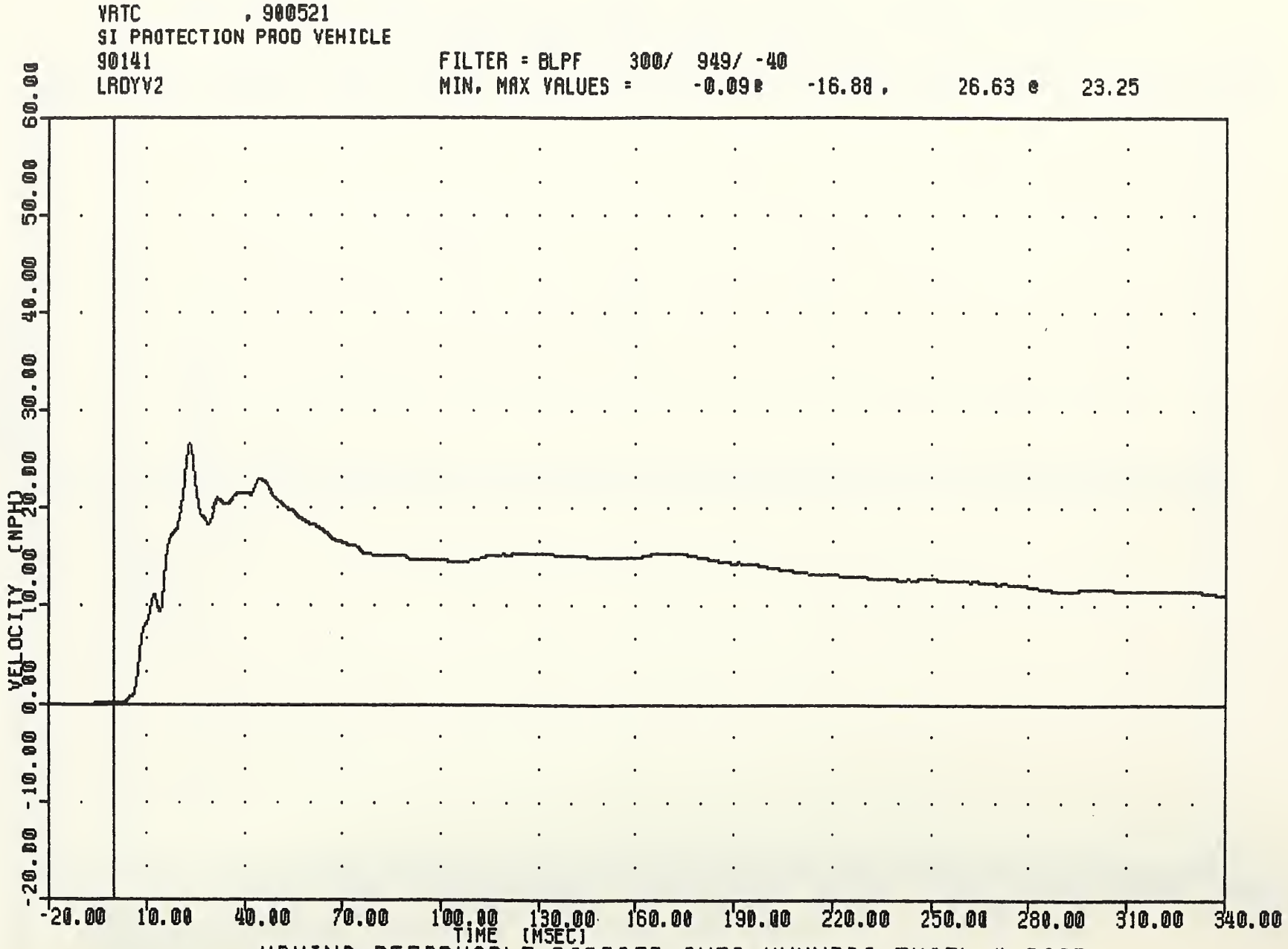
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 6) Y-AXIS VELOCITY



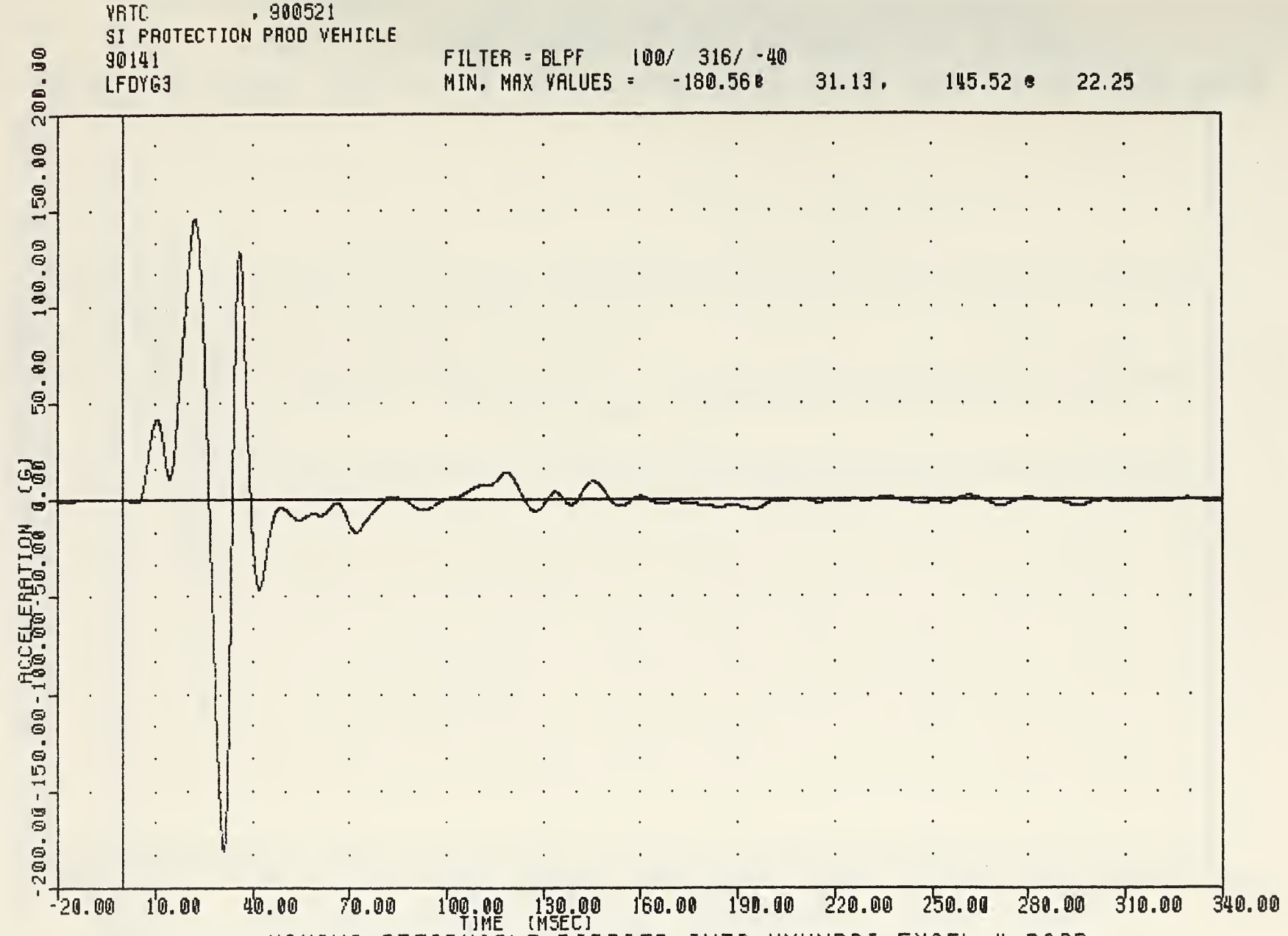
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE TRUNK FLOOR RIGHT X-AXIS ACCELERATION



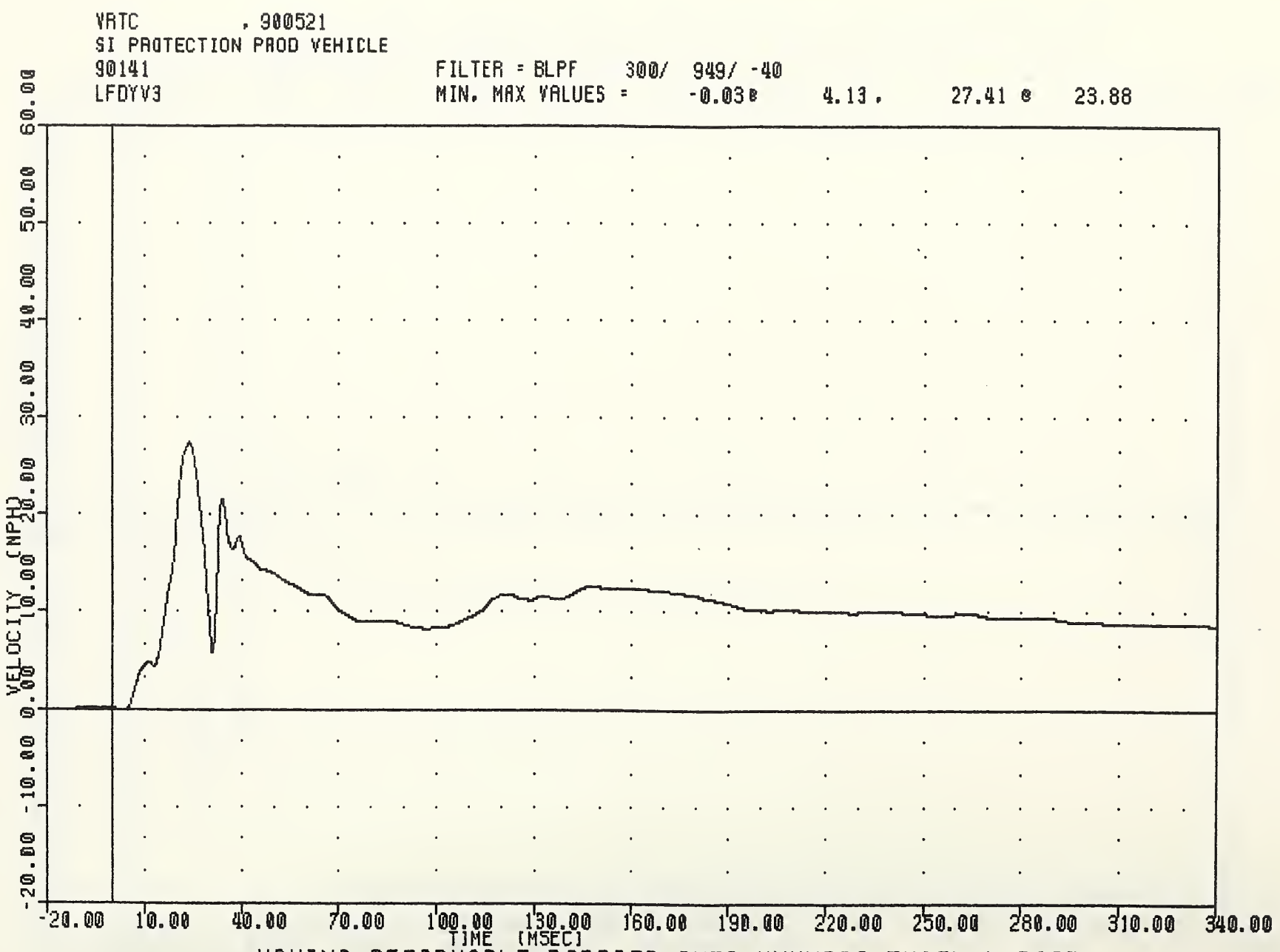
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR DOOR MID REAR (POSITION 8) Y-AXIS ACCELERATION



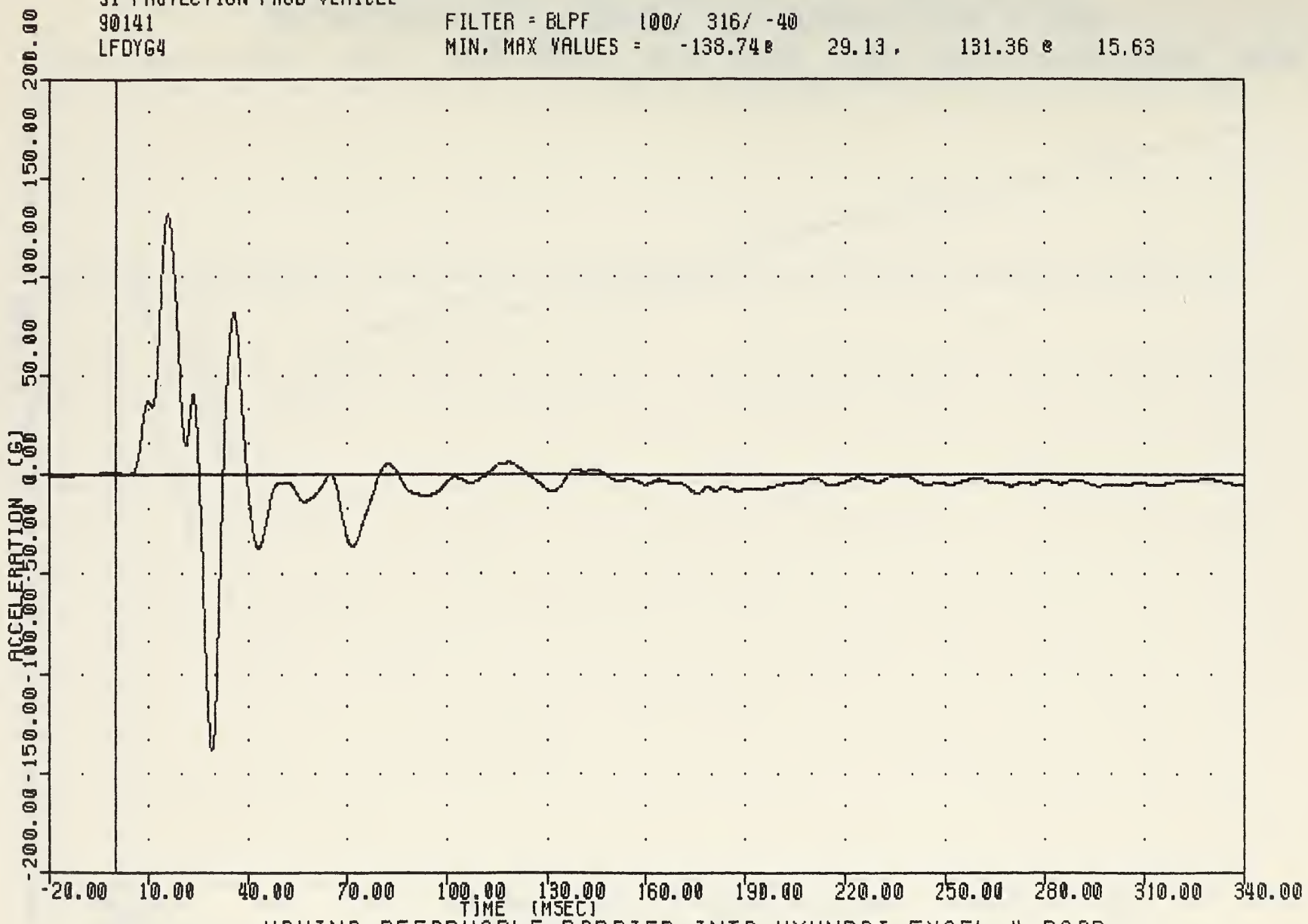
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR DOOR MID REAR (POSITION 8) Y-AXIS VELOCITY



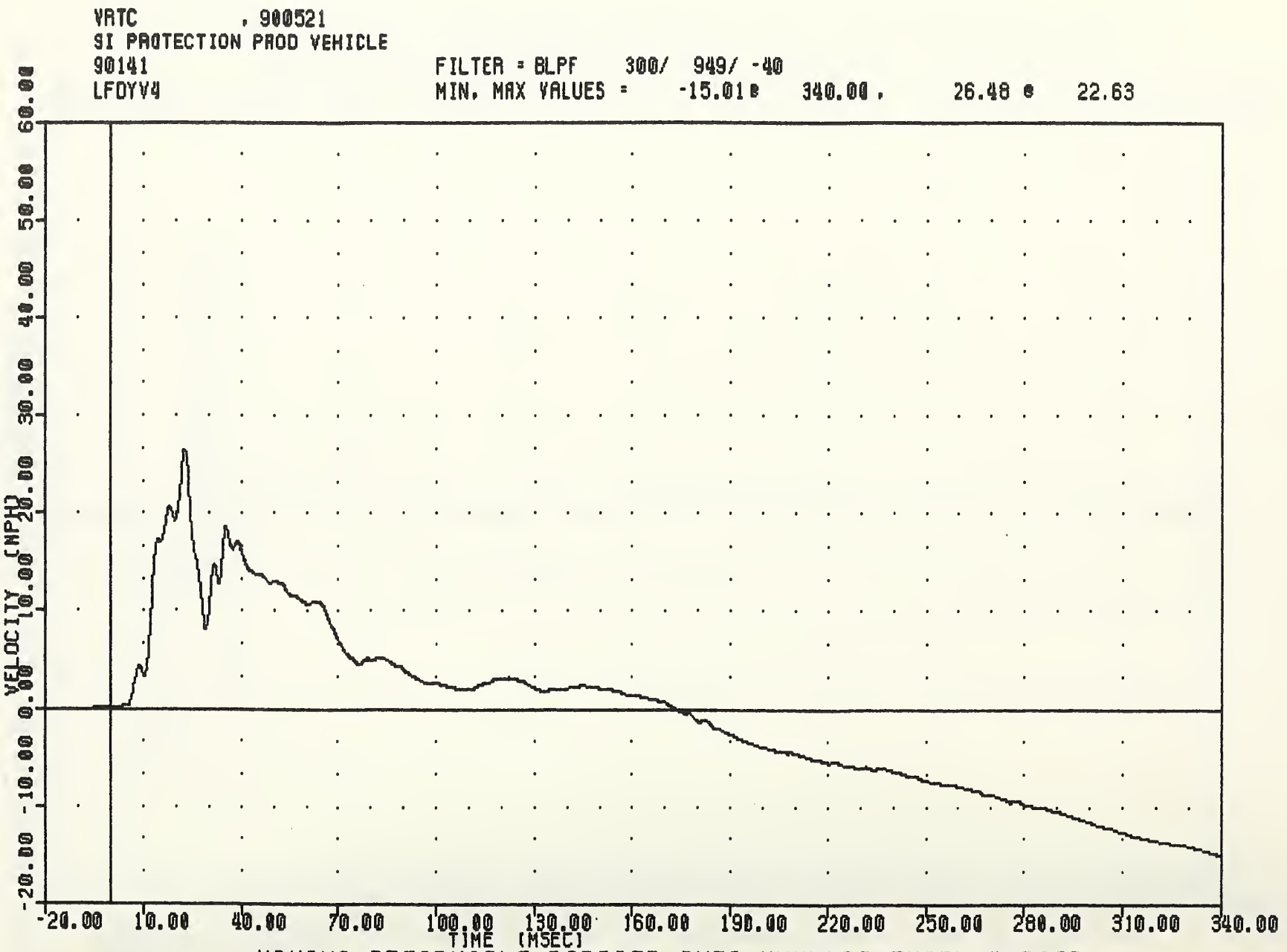
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 9) Y-AXIS ACCELERATION



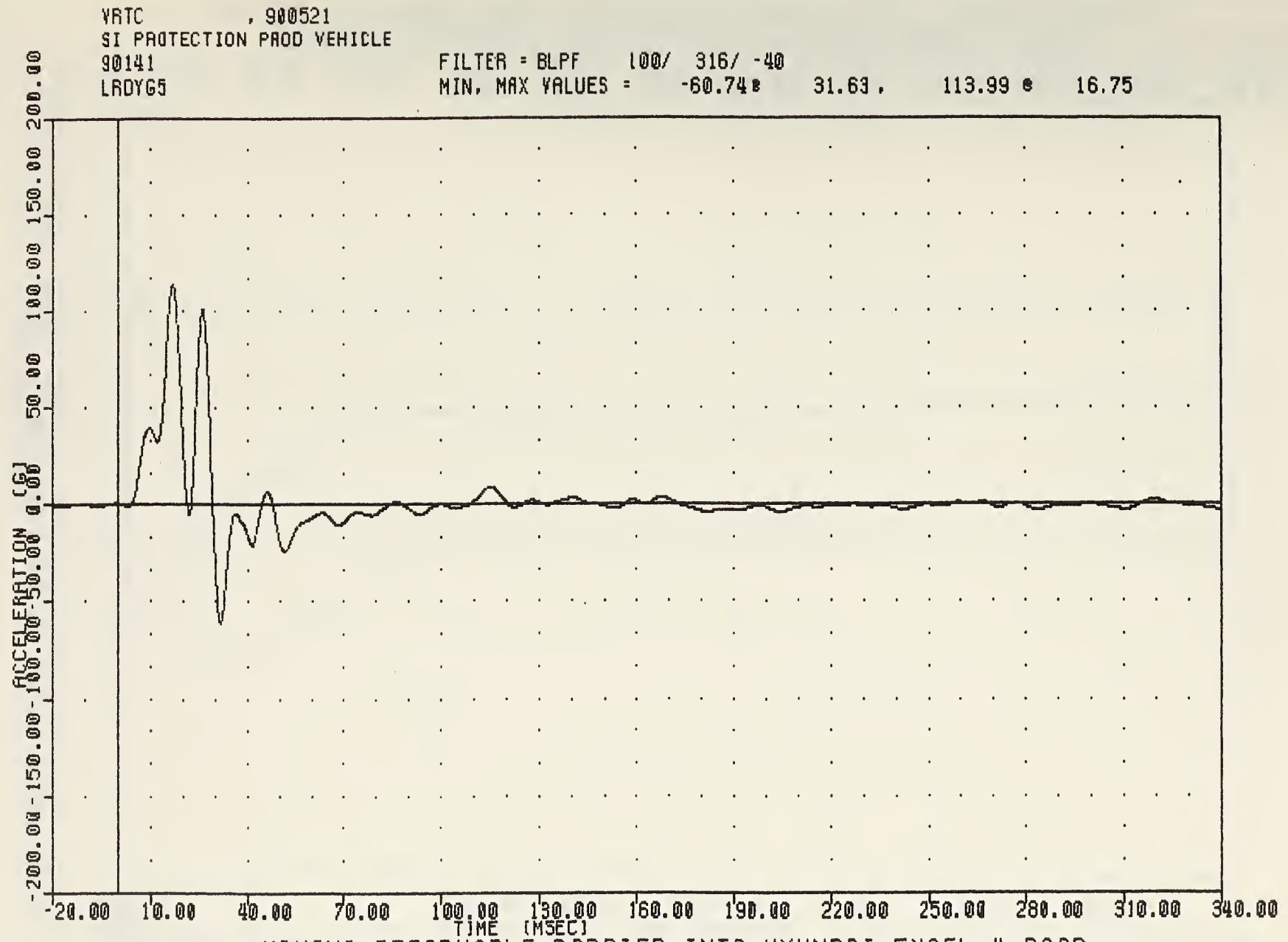
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 9) Y-AXIS VELOCITY



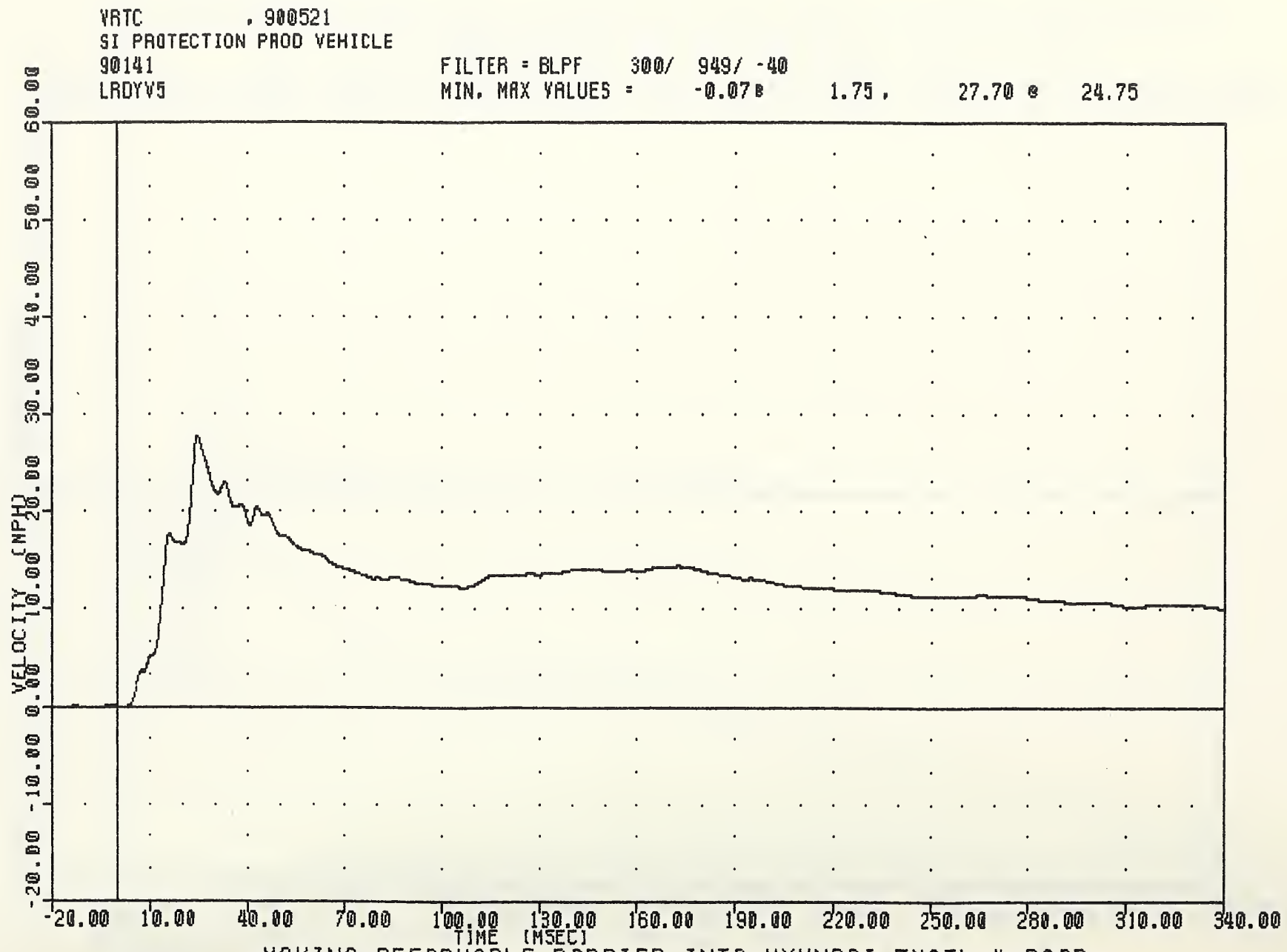
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 10) Y-AXIS ACCELERATION



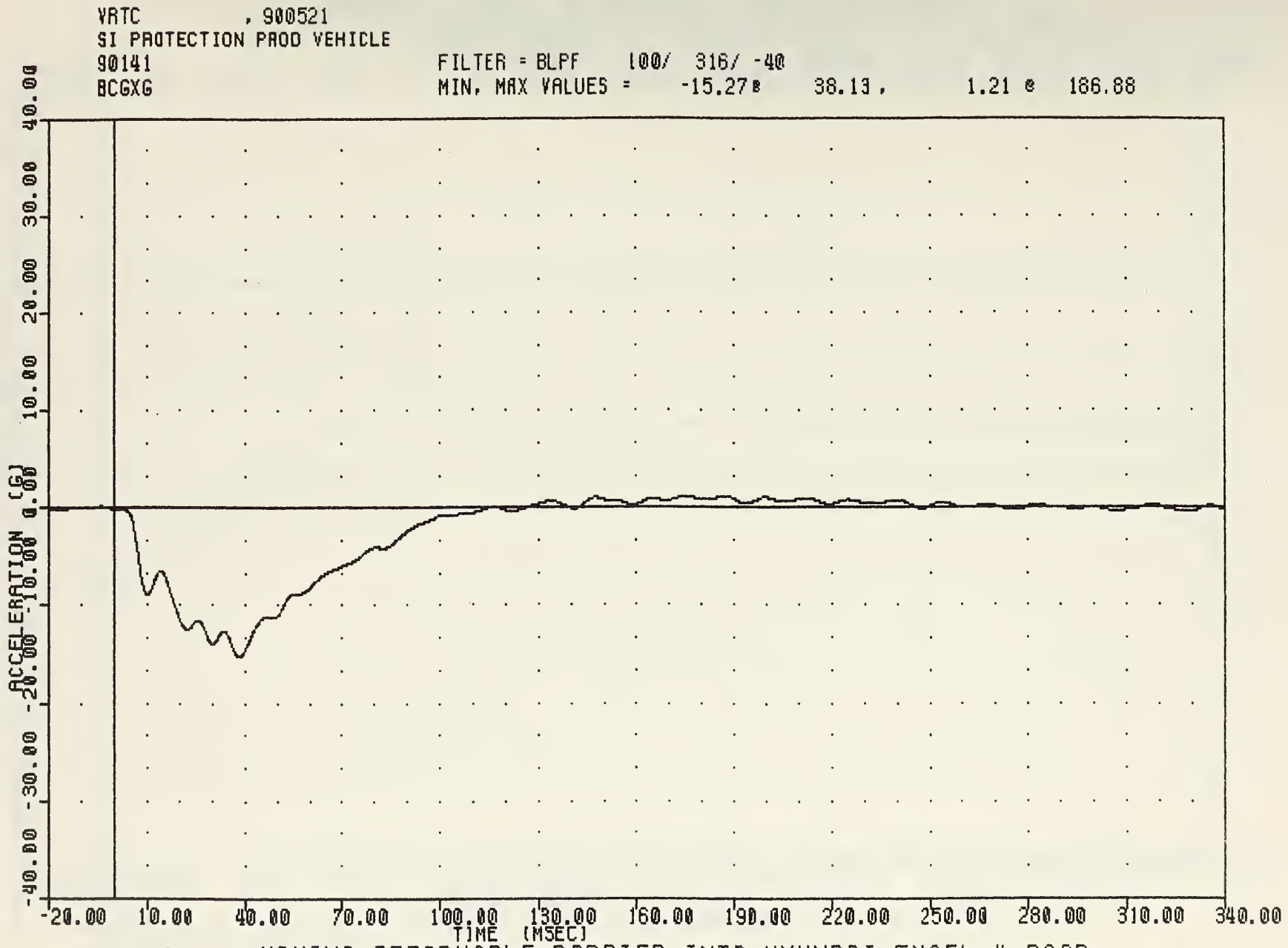
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT FRONT DOOR (POSITION 10) Y-AXIS VELOCITY



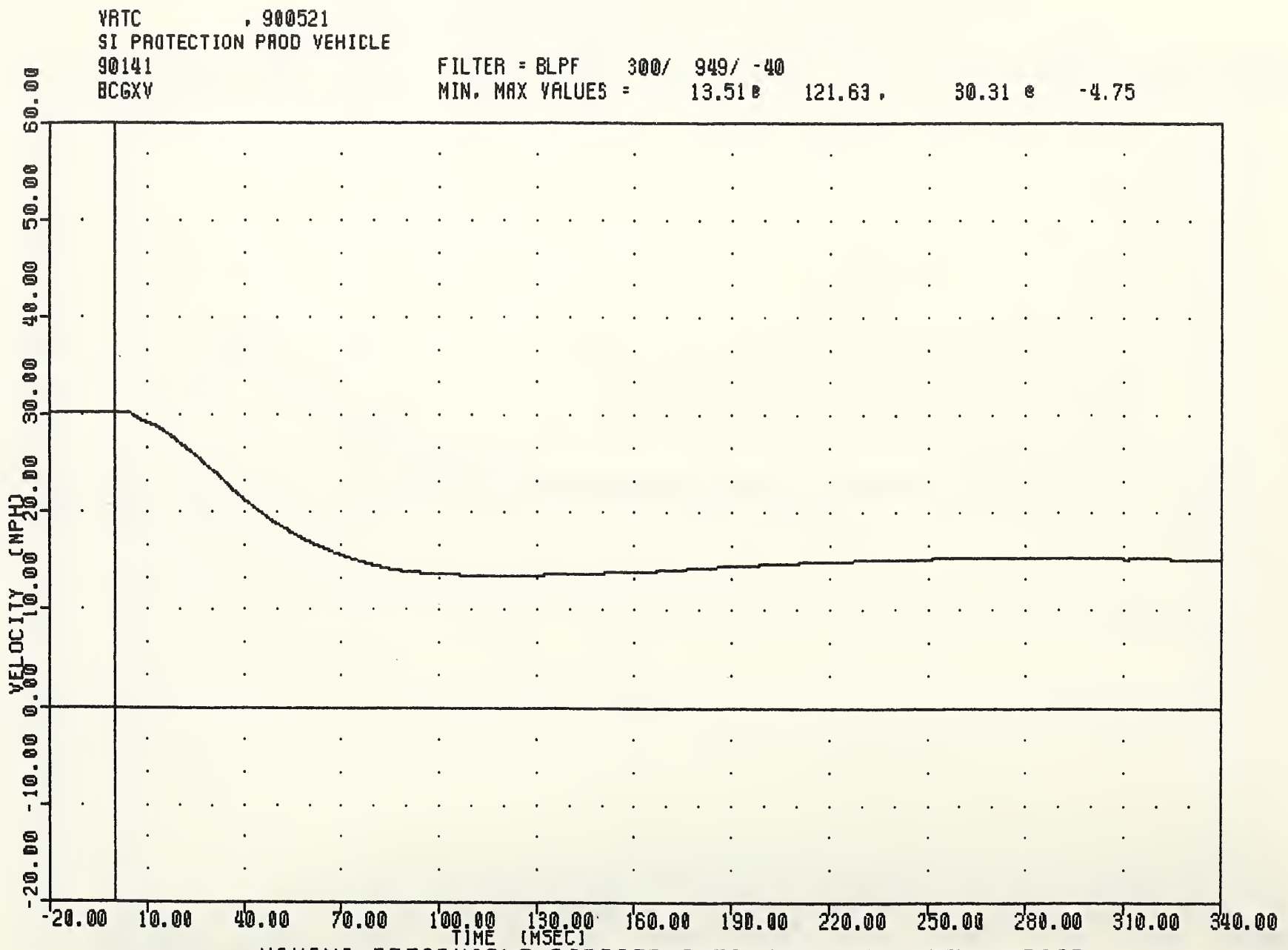
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR DOOR CENTERLINE (POSITION 11) Y-AXIS ACCELERATION



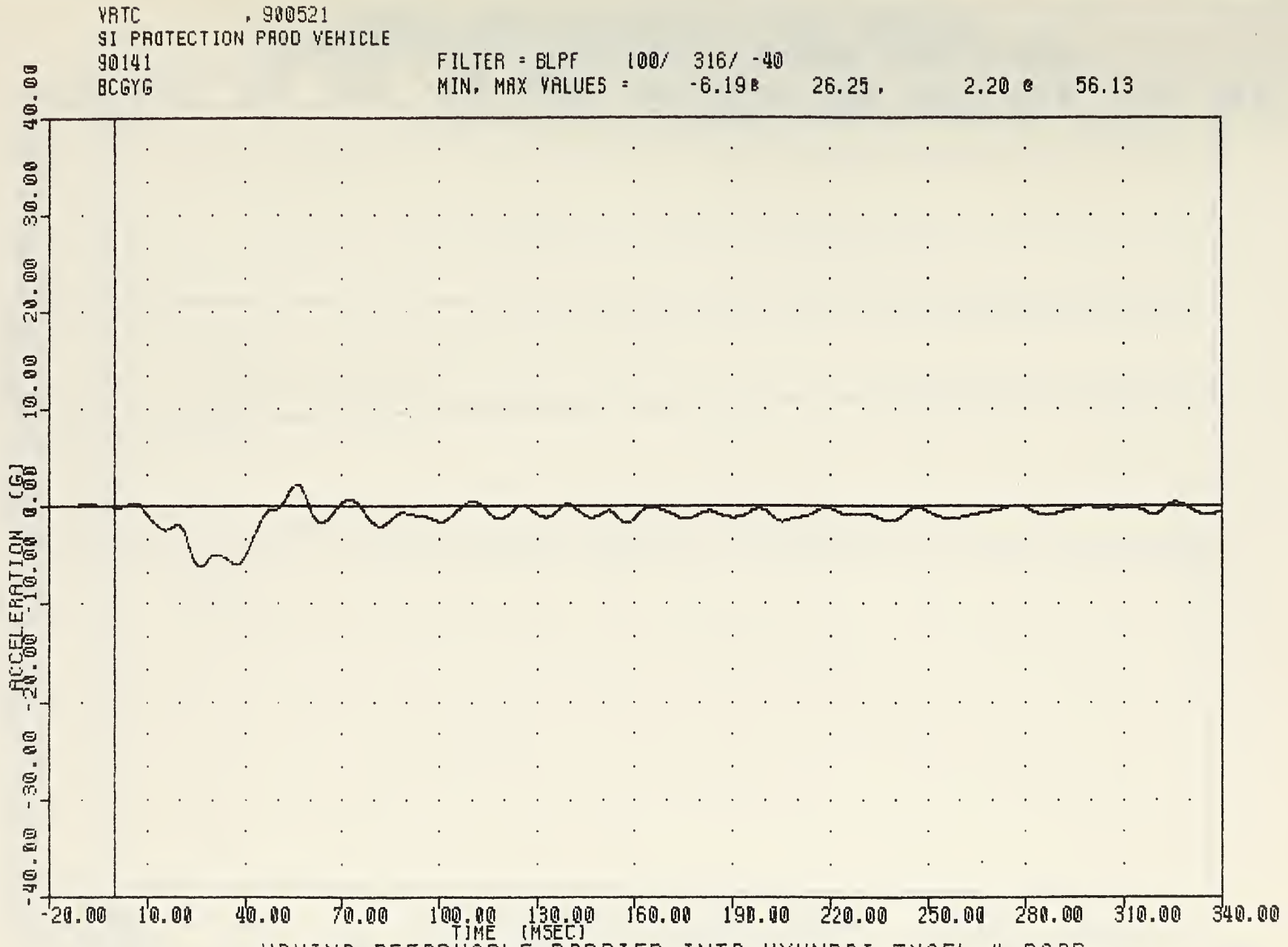
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
VEHICLE LEFT REAR DOOR CENTERLINE (POSITION 11) Y-AXIS VELOCITY



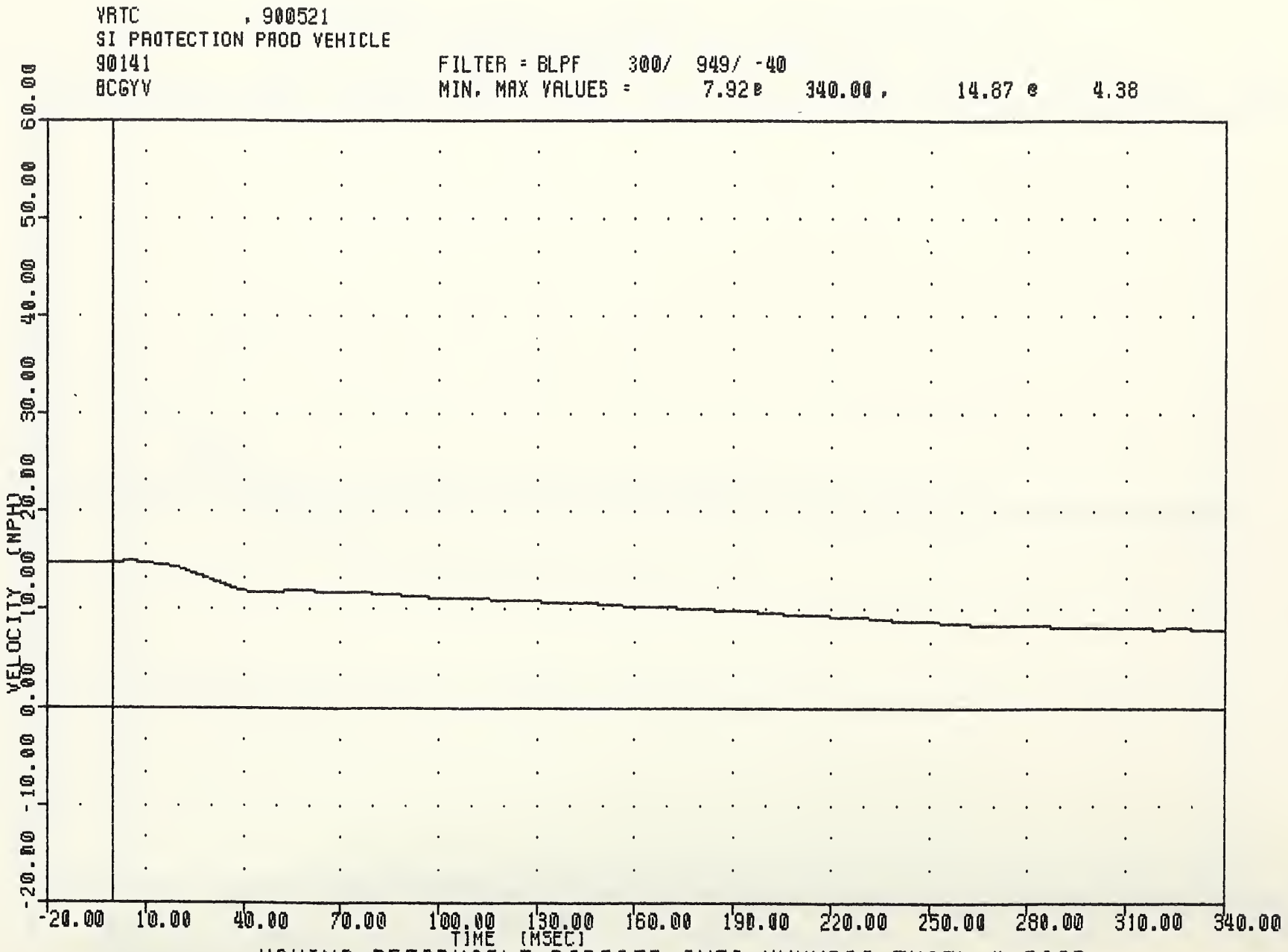
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY X-AXIS ACCELERATION



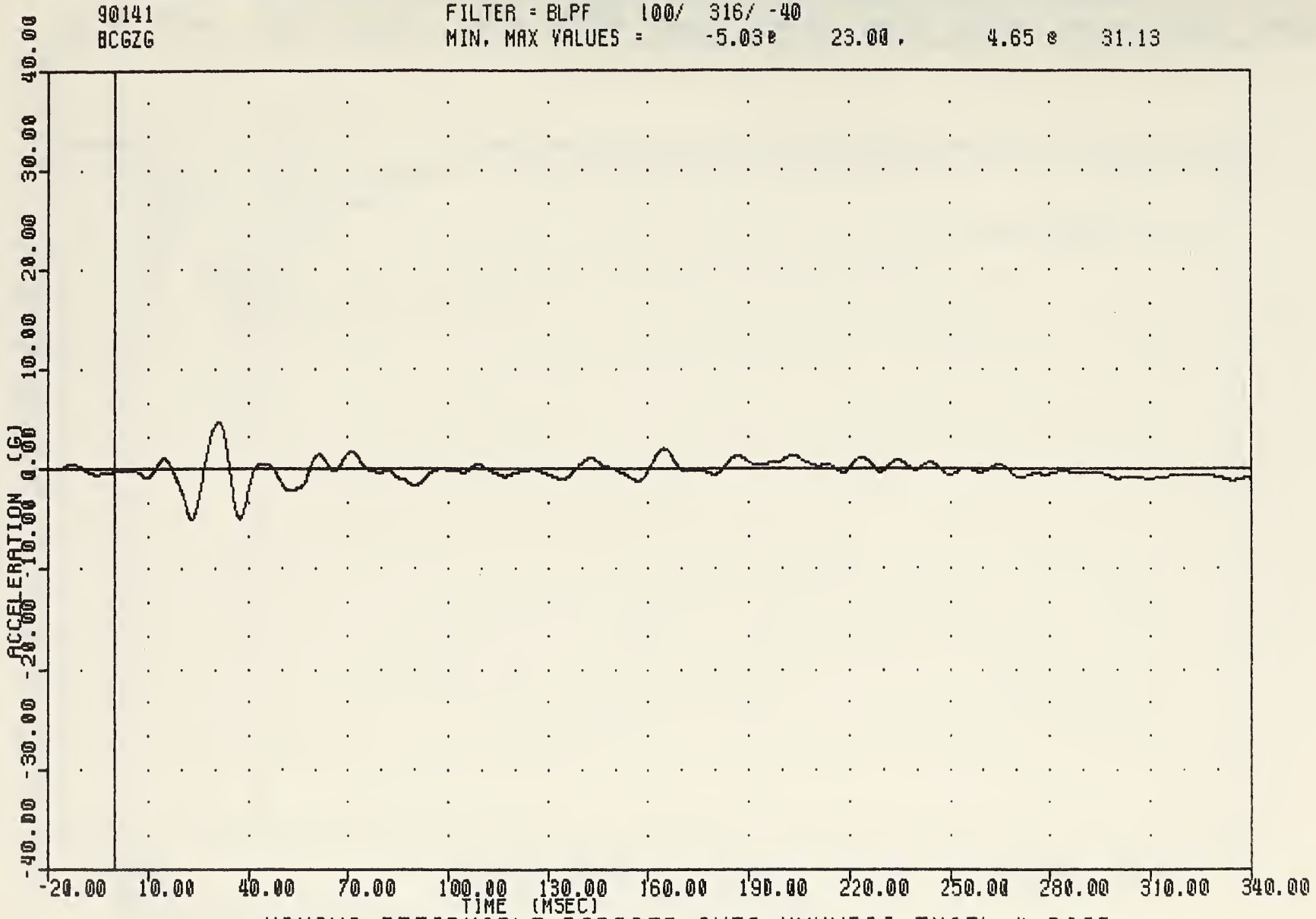
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY X-AXIS VELOCITY



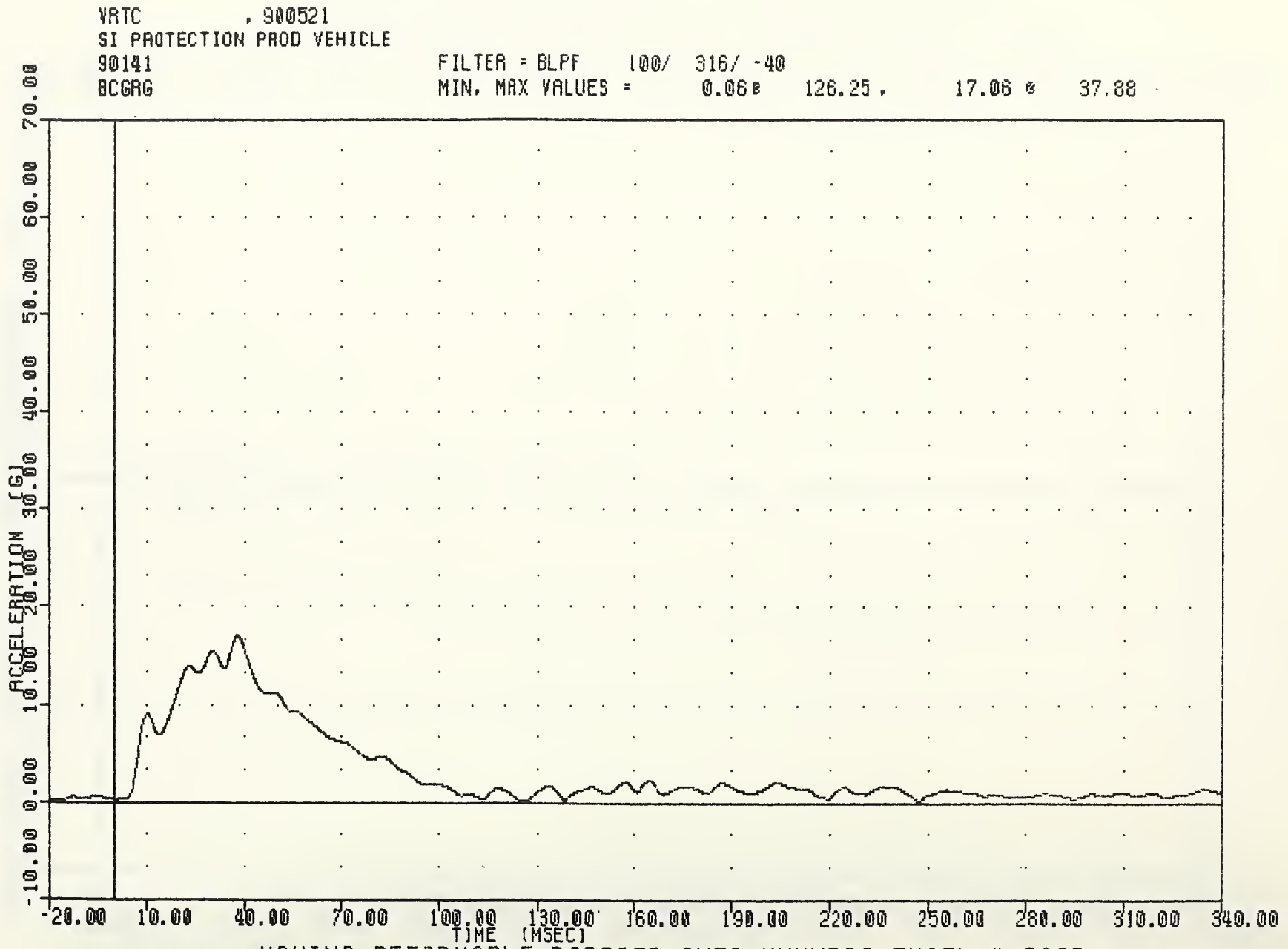
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY Y-AXIS ACCELERATION



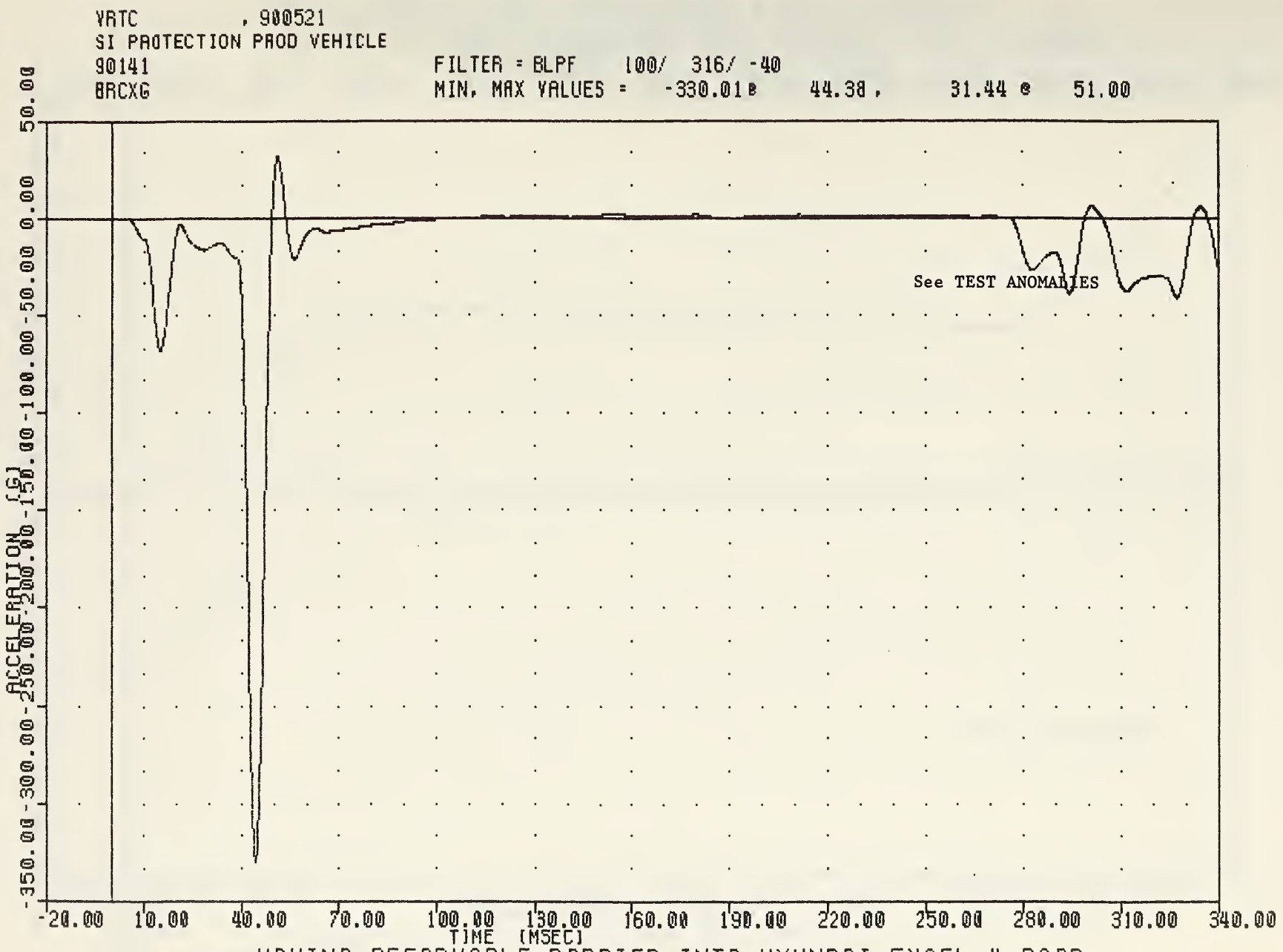
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY Y-AXIS VELOCITY



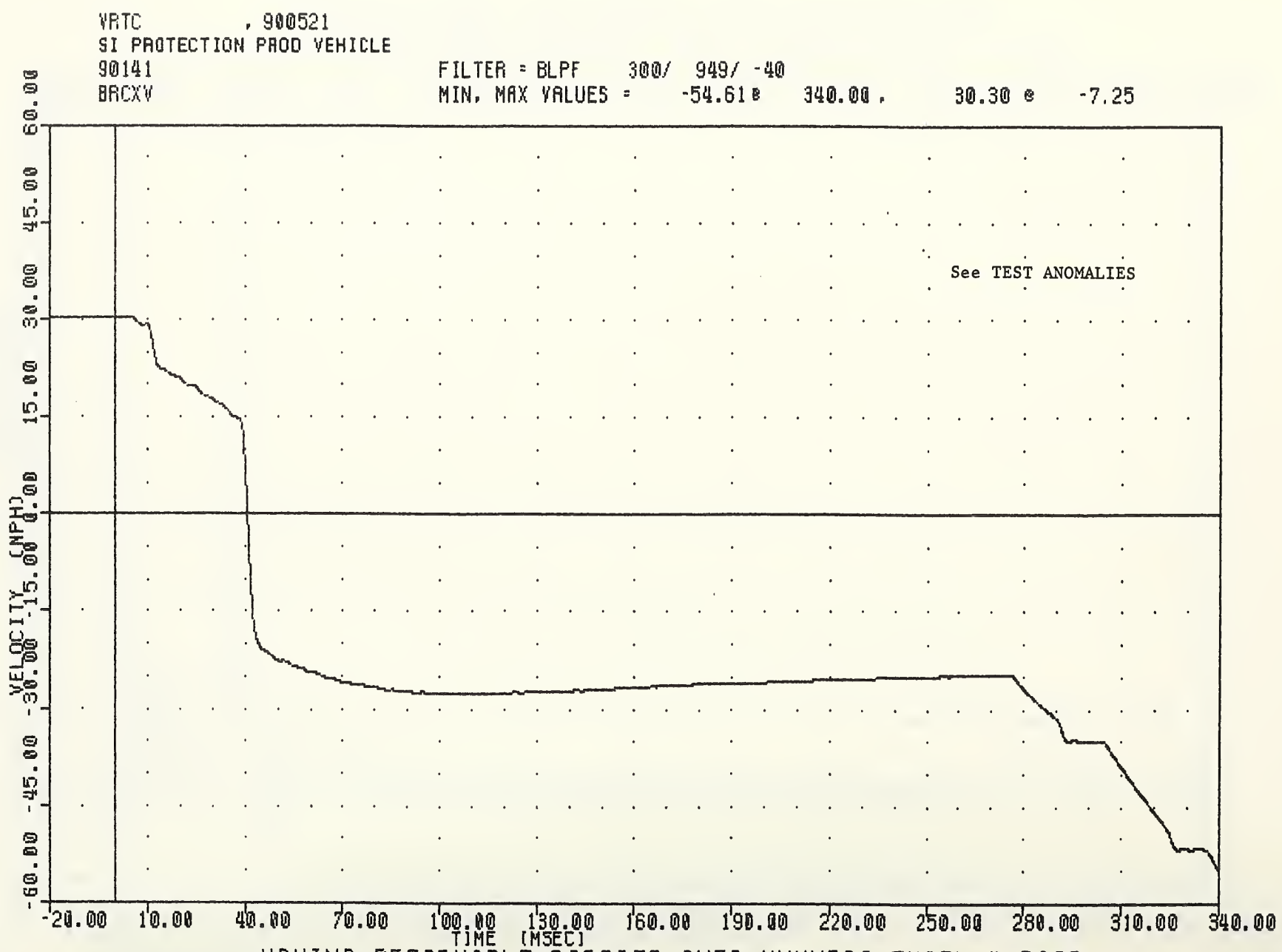
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY Z-AXIS ACCELERATION



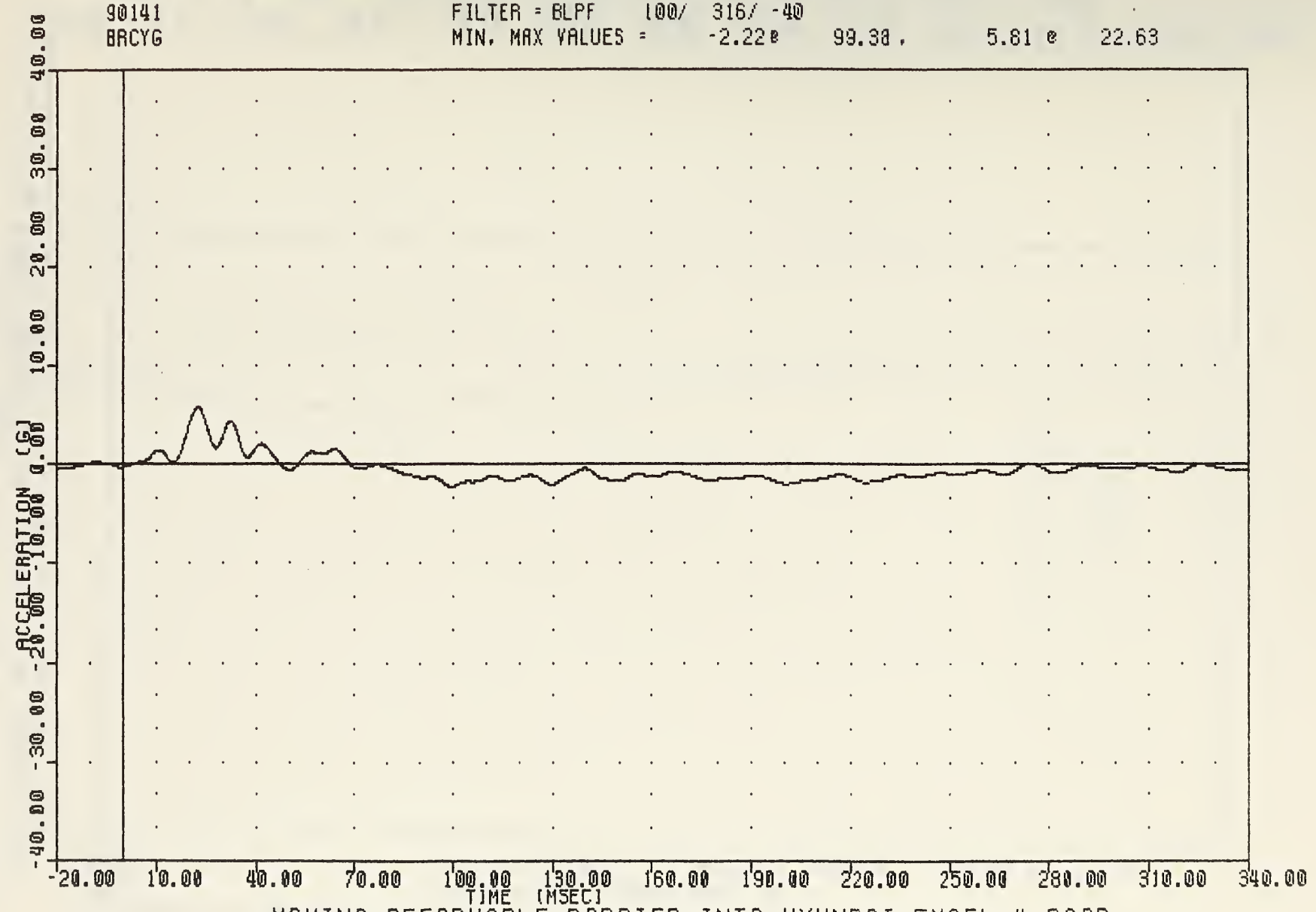
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER CENTER OF GRAVITY RESULTANT ACCELERATION



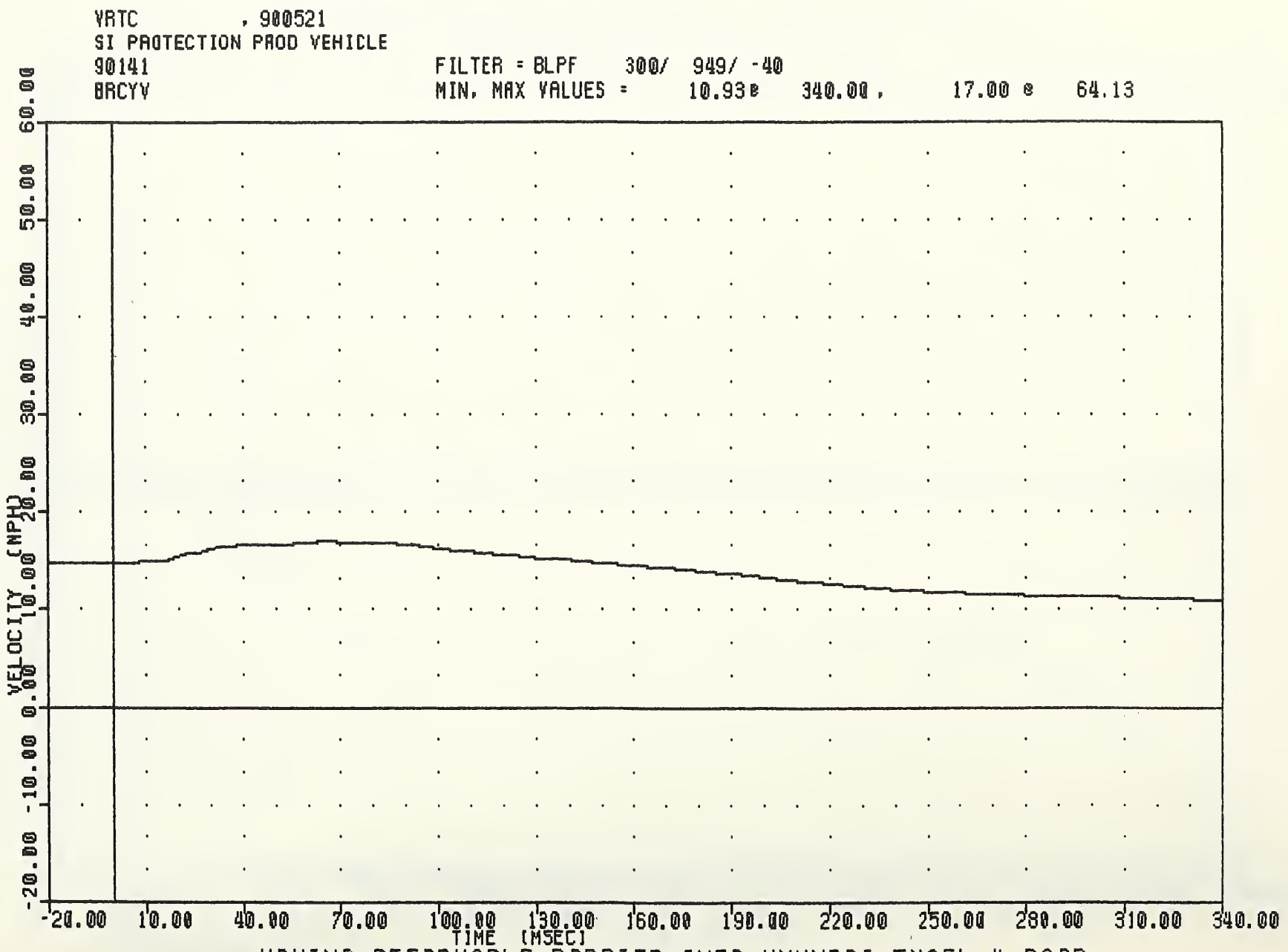
MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER REAR CROSSMEMBER X-AXIS ACCELERATION



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER REAR CROSSMEMBER X-AXIS VELOCITY



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER REAR CROSSMEMBER Y-AXIS ACCELERATION



MOVING DEFORMABLE BARRIER INTO HYUNDAI EXCEL 4-DOOR
BARRIER REAR CROSSMEMBER Y-AXIS VELOCITY

APPENDIX C

DUMMY CERTIFICATION

APPENDIX D

DUMMY CALIBRATION

DRIVER DUMMY

DUMMY NO.: 01

BIOSID CALIBRATION RESULTS

PRE-TEST CALIBRATION FOR TEST #900514

DUMMY NO. 01 SERIES NO. TRC-CAL 9 DATE 05/17/90

CALIBRATION TEST	SAE* CORRIDOR	RESULTS
SHOULDER		
IMPACT FORCE (kN)	3.7 - 4.6	3.88
SHOULDER ACCEL. (g)	NA	82.3
SHOULDER DISPL. (mm)	21 - 31	25.3
THORAX - NO ARM		
IMPACT FORCE (kN)	5.4 - 6.7	5.74
UPPER RIB ACCEL. (g)	120 - 180	154.5
CENTER RIB ACCEL. (g)	120 - 180	153.8
LOWER RIB ACCEL. (g)	120 - 180	157.5
UPPER RIB DISPL. (mm)	50 - 70	58.5
CENTER RIB DISPL. (mm)	50 - 70	63.6
LOWER RIB DISPL. (mm)	50 - 70	65.4
UPPER SPINE ACCEL. (g)	16 - 24	20.5
LOWER SPINE ACCEL. (g)	11 - 17	14.4
THORAX - ARM DOWN		
IMPACT FORCE (kN)	6.2 - 7.9	6.89
SHOULDER ACCEL. (g)	NA	71.5
UPPER RIB ACCEL. (g)	52 - 78	63.8
CENTER RIB ACCEL. (g)	66 - 99	86.9
LOWER RIB ACCEL. (g)	85 - 128	113.8
SHOULDER DISPL. (mm)	17 - 27	22.7
UPPER RIB DISPL. (mm)	20 - 30	27.3
CENTER RIB DISPL. (mm)	30 - 44	37.0
LOWER RIB DISPL. (mm)	40 - 55	53.3
UPPER SPINE ACCEL. (g)	34 - 46	37.6
LOWER SPINE ACCEL. (g)	14 - 21	15.3
ABDOMEN		
IMPACT FORCE (kN)	2.9 - 3.6	3.26
UPPER ABDOMEN ACCEL. (g)	52 - 80	64.8
LOWER ABDOMEN ACCEL. (g)	55 - 87	66.1
UPPER ABDOMEN DISPL. (mm)	40 - 55	47.0
LOWER ABDOMEN DISPL. (mm)	38 - 52	42.1
UPPER SPINE ACCEL. (g)	5.4 - 8.1	6.5
LOWER SPINE ACCEL. (g)	8 - 12	9.5
PELVIS		
IMPACT FORCE (kN)	7.5 - 9.5	8.76
PELVIS ACCEL. (g)	45 - 63	50.8

*PROPOSED SAE CORRIDORS; DRAFT BIOSID USER'S MANUAL, MAY 1990.

LEFT REAR PASSENGER DUMMY

DUMMY NO.: 02

BIOSID CALIBRATION RESULTS

PRE-TEST CALIBRATION FOR TEST #900514

DUMMY NO. 02 SERIES NO. TRC-CAL 4 DATE 05/17/90

CALIBRATION TEST	SAE* CORRIDOR	RESULTS
SHOULDER		
IMPACT FORCE (kN)	3.7 - 4.6	4.00
SHOULDER ACCEL. (g)	NA	89.0
SHOULDER DISPL. (mm)	21 - 31	26.6
THORAX - NO ARM		
IMPACT FORCE (kN)	5.4 - 6.7	5.73
UPPER RIB ACCEL. (g)	120 - 180	155.6
CENTER RIB ACCEL. (g)	120 - 180	154.3
LOWER RIB ACCEL. (g)	120 - 180	160.6
UPPER RIB DISPL. (mm)	50 - 70	59.6
CENTER RIB DISPL. (mm)	50 - 70	66.3
LOWER RIB DISPL. (mm)	50 - 70	65.7
UPPER SPINE ACCEL. (g)	16 - 24	20.3
LOWER SPINE ACCEL. (g)	11 - 17	15.0
THORAX - ARM DOWN		
IMPACT FORCE (kN)	6.2 - 7.9	6.80
SHOULDER ACCEL. (g)	NA	60.3
UPPER RIB ACCEL. (g)	52 - 78	73.3
CENTER RIB ACCEL. (g)	66 - 99	83.5
LOWER RIB ACCEL. (g)	85 - 128	103.6
SHOULDER DISPL. (mm)	17 - 27	22.1
UPPER RIB DISPL. (mm)	20 - 30	25.3
CENTER RIB DISPL. (mm)	30 - 44	38.8
LOWER RIB DISPL. (mm)	40 - 55	47.7
UPPER SPINE ACCEL. (g)	34 - 46	38.2
LOWER SPINE ACCEL. (g)	14 - 21	14.5
ABDOMEN		
IMPACT FORCE (kN)	2.9 - 3.6	3.09
UPPER ABDOMEN ACCEL. (g)	52 - 80	69.0
LOWER ABDOMEN ACCEL. (g)	55 - 87	66.7
UPPER ABDOMEN DISPL. (mm)	40 - 55	47.6
LOWER ABDOMEN DISPL. (mm)	38 - 52	41.6
UPPER SPINE ACCEL. (g)	5.4 - 8.1	7.8
LOWER SPINE ACCEL. (g)	8 - 12	9.2
PELVIS		
IMPACT FORCE (kN)	7.5 - 9.5	8.86
PELVIS ACCEL. (g)	45 - 63	58.0

*PROPOSED SAE CORRIDORS; DRAFT BIOSID USER'S MANUAL, MAY 1990.