LandMark™ 50 INS/GPS

- High Performance NON-ITAR Commercial MEMS GPS-Aided INS with CAN BUS
- 4 NMPH Free Inertial *(Short-Term GPS Outages)*
- 72 Channel GNSS: GPS, GLONASS, BeiDou, QZSS & SBAS (Galileo Ready*)
- SBAS: *WAAS, EGNOS & MSAS*
- Up to 18 Hz Navigation Update Rate *GPS*
- GPS Velocity Accuracy *0.05 m/s*
- GPS Heading Accuracy *0.3 degrees*
- GPS Horizontal Accuracy *±2.0m CEP w/SBAS*
- Pitch & Roll Angles *±0.1° stationary*
- Ultra Low Noise Gyros *0.0009° /sec/√Hz*
- Low Noise Accels *0.02mg/√Hz (2g)*
- In-Run Gyro Bias *1° /hour 1σ*
- Fully Compensated Bias & Scale Factor Over Temperature *-40°C to +85°C*
- RS422/RS485/CAN 2.0B Serial Data Format
- Low Power *<1.2 W typical*
- Input Voltage *+6V to 36V*
- Light Weight *<550 grams*
- Small Size *<360cm³/21.8in³*

Applications

Platform Stabilization
EO/IR Stabilization
Antenna Stabilization & Pointing
Railway Motion Monitoring
Flight Control
Navigation
Automotive Testing
Laboratory Use

Export Classification:
Commerce ECCN7A994 (NLR)

High Performance MEMS INS/GPS with Low Noise and Low Bias Performance

Gladiator Technologies
Division of LKD Aerospace
High Performance Inertial MEMS

Gladiator Technologies Division
LKD Aerospace, Inc.
8020 Bracken Place SE
Snoqualmie, WA 98065 USA

Rev. 15May14
SN: 700

LandMark™ 50 INS/GPS

Specification

PARAMETER	RATE AXES			ACCEL AXES		
Power Requirements						
Input Voltage	+6.0V to +36V Max. Input Voltage (Input Transient Protection to 80V)					
Power	1.2W Typical (1.3W Max) at 12V					
Inertial Performance						
Standard Full Scale Ranges	±100°/sec	±175°/sec	±300°/sec	±2 g's	±6 g's	±10 g's
Bias (In Run Stability) *1σ*	1°/hour	1.5°/hour	2°/hour	0.02mg	0.04mg	0.05mg
Angle Random Walk *1σ*	0.0009°	0.0025° /sec/√Hz *1σ*	0.003°	0.02	0.065 mg/√Hz *1σ*	0.07
Bias Over Temp. *1σ*	<0.01°/sec	<0.02°/sec		<1.0mg	<1.3mg	<1.5mg
Scale Factor Error %	≤0.06% *(over temperature)*					
Non-Linearity % of FS	<0.1		<0.5	<2	<.025	<0.05
Sensor Resolution	0.0005°/sec	0.0012°/sec	0.0015°/sec	0.02mg	0.05mg	0.06mg
Alignment	< 0.5 mrad *1σ*					
G-Sensitivity	<0.002°/sec/g *1σ*					
INS/GPS System Performance						
Free Inertial typical	4 NMPH	10 NMPH	<60 sec Duration			
Channels	72 Channels					
GNSS Receiver	GPS *L1C/A* GLONASS *L1of* BeiDou *B1* GALILEO *E1B/C*					
SBAS	WAAS EGNOS QZSS					
Max Navigation Update Rate (GPS)	Up to 18 Hz					
Concurrent GPS/GLONASS or GPS/BeiDou	Up to 10 Hz					
GPS Horizontal Position Accuracy	Autonomous 2.5 m					
SBAS - EGNOS WAAS MSAS	2.0 m					
Velocity Accuracy	0.05 m/s					
Heading Accuracy *(GPS)*	0.3 degrees					
Heading *(sole inertial)*	± 0.5° *typical*					
Pitch & Roll Angles *(sole inertial)*	± 0.1° *typical*					
Altitude *(barometric)*	± 3m *typical*					
Start-Up Time *(inertial)*	< 0.65 sec *typical (alignment < 2 minutes)*					
Time-To-First-Fix						
GPS Acquistion (Cold start)	29 sec					
GPS Reacquisition (Aided start)	2 sec					
GPS Reacquisition (Hot start)	1 sec					
Sensitivity						
Tracking	-166 dBm					
Reacquistion	-159 dBm					
Cold Start	-148 dBm					
Hot Start	-148 dBm					
Accuracy of time pulse signal	RMS 30ns 99% 60ns					
Update Rate (synced inertial) INS/GPS	100 Hz					
Physical						
Weight	< 550 grams					
Size *U.S.:*	3.0 X 3.06 X 2.38 = 21.8 in^3					
Metric:	7.62 X 7.8 X 6.05 = 360 cm^3					
Operating Life	10 Years *typical*					
Environments						
Operating Temperature	-40°C to +85°C					
Storage Temperature	-55°C to +100°C					
Dynamics (GPS)	≤ 4 g					
Altitude	50,000 m					
Velocity	500 m/s					
Vibration Operating *(inertial)*	6gRMS *(20Hz to 2KHz ~ 10g accelerometers)*					
Shock	500g's ½ sine 1 msec powered, any axis					

Specification subject to change without notice

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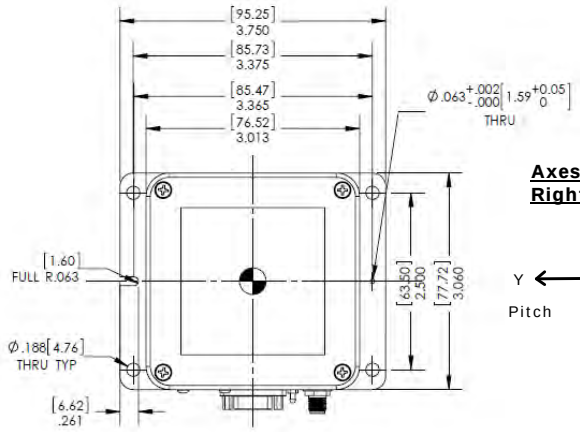
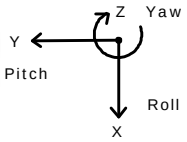
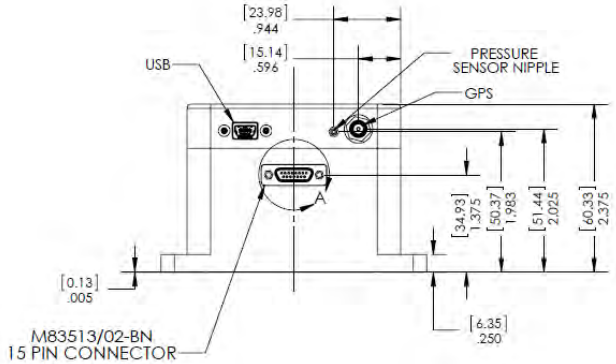


Axes (Top View) Right Hand Rule

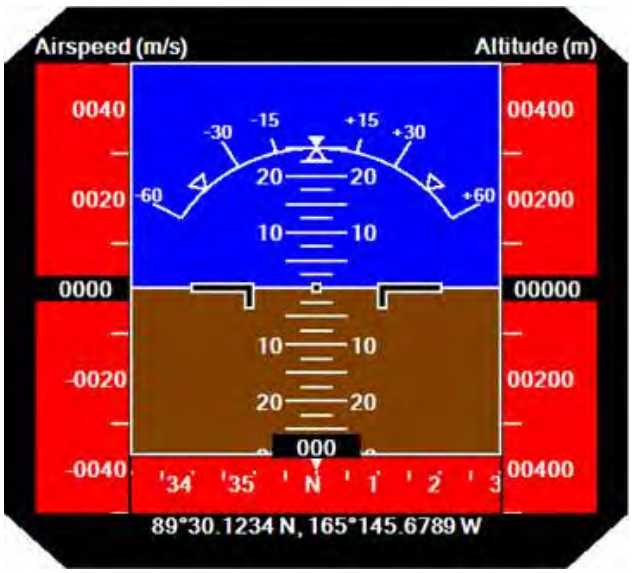




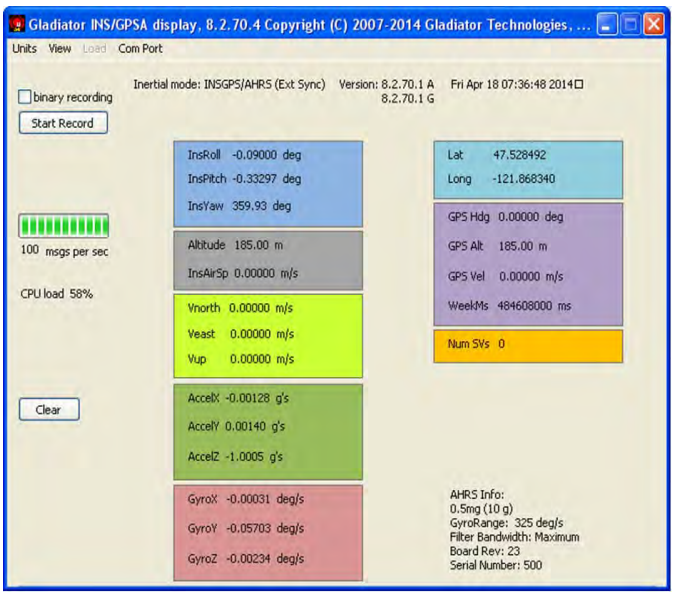
LandMark™ 50 INS/GPS CAN P/N:
LMRK50INSGPS-100-**02**-200 or -**06** or -**10**
LMRK50INSGPS-175-**02**-200 or -**06** or -**10**
LMRK50INSGPS-300-**02**-200 or -**06** or -**10**

Pin No.	GPS/AHRS Assignment
1	RS-422/RS-485 A (+) AHRS
2	RS-422/RS-485 B (-) AHRS
3	Power Ground
4	RS-422/RS-485 A (+) Combined GPS/AHRS
5	**+6V to +36V Input Power**
6	RS-422/RS-485 B (-) Combined GPS/AHRS
7	1 PPS Output
8	Signal Ground
9	Self Test
10	CAN H
11	CAN L
12	CAN Gnd
13	NC
14	NC
15	Case

Outputs	Serial Sequence at 100Hz
1, 2, 3	Gyros: Roll (X), Pitch (Y), Yaw (Z)
4, 5, 6	Accels: Fwd (X), Right (Y), Down (Z)
7	Temperature
8, 9, 10	Angles: Roll (X), Pitch (Y), Yaw (Z)
11, 12, 13	Baro Altitude, Airspeed
13, 14	vDOP, hDOP
15, 16	Longitude, Latitude
17, 18	Time ms, Time Week
19, 20, 21	GPS: Altitude, Velocity, Heading
22	No. of SV's
23, 24	AHRS Status/ Status, Checksum



SDK Attitude Indicator Display



SDK Data Display & Recording Software

M83513/01-BN
15 PIN CONNECTOR

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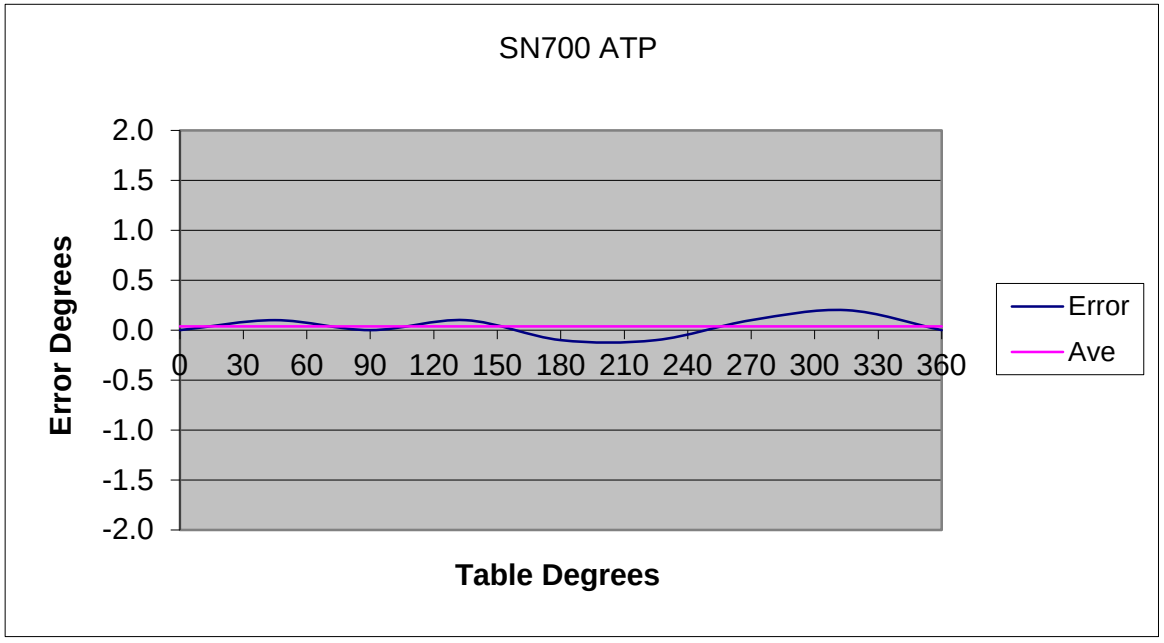
Table Position	Heading	Error	Average
degrees from N	AHRS °	degrees	degrees
0	0.0	0.0	0.0
45	45.1	0.1	0.0
90	90.0	0.0	0.0
135	135.1	0.1	0.0
180	179.9	-0.1	0.0
225	224.9	-0.1	0.0
270	270.1	0.1	0.0
315	315.2	0.2	0.0
360		0.0	0.0
	ave err =	0.0	



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SN700 ATP

3/30/2015

LMRK50INSGPS-300-10-200

Rate Spin Test

Test	gyroX	gyroY	gyroZ	accelX	accelY	accelZ	temp X
PX	14398.83	-11.963	1.077	-0.022	-1.959	-9.7175	2626.085
NX	-14400.37	-10.165	2.405	0.0115	-1.964	-9.538	2625.882
Diff/2	14399.6	-0.899	-0.664	-0.01675	0.0025	-0.08975	0.1015
Ave	-0.7685	-11.064	1.741	-0.00525	-1.9615	-9.62775	2625.984
PY	-15.943	14401.9	3.181	-3.7315	1.2185	-9.7455	2622.413
NY	-1.257	-14398.48	2.717	-3.708	1.1835	-9.664	2622.602
Diff/2	-7.343	14400.19	0.232	-0.01175	0.0175	-0.04075	-0.0945
Ave	-8.6	1.7105	2.949	-3.71975	1.201	-9.70475	2622.508
PZ	-8.677	-8.41	14398.02	-11.3205	-1.9295	2.015	2609.063
NZ	-8.141	-9.827	-14400.98	-11.5015	-1.8695	1.9795	2610.159
Diff/2	-0.268	0.7085	14399.5	0.0905	-0.03	0.01775	-0.548
Ave	-8.409	-9.1185	-1.4835	-11.411	-1.8995	1.99725	2609.611
RSF Norm	0.999972	1.000013	0.999965				Temp ºC 26.19

Gyro Mis-Align deg/sec

				Input Rate
x		-0.07	0.00	x
y	-0.01		0.01	y
z	-0.01	0.00		z

Gyro Mis-align mrad

				Input Rate
x		-0.51	-0.02	x
y	-0.06		0.05	y
z	-0.05	0.02		z

Accepted by:

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SN700 ATP

3/30/2015

LMRK50INSGPS-300-10-200
Accelerometer Tumble Test

Test	gyroX	gyroY	gyroZ	accelX	accelY	accelZ	temp X
PX	0.403	0.381	0.119	997.4715	1.6775	0.014	2621.475
NX	0	-0.206	0.029	-1002.576	0.4025	-0.466	2620.706
Diff/2	0.2015	0.2935	0.045	1000.024	0.6375	0.24	0.3845
Ave	0.2015	0.0875	0.074	-2.55225	1.04	-0.226	2621.091
PY	-0.37	-0.381	-0.435	-0.065	997.938	0.308	2624.46
NY	0.106	-0.658	-0.182	0.0005	-1002.247	-0.054	2625.158
Diff/2	-0.238	0.1385	-0.1265	-0.03275	1000.093	0.181	-0.349
Ave	-0.132	-0.5195	-0.3085	-0.03225	-2.1545	0.127	2624.809
PZ	-0.338	-0.141	-0.216	0.197	-1.156	999.6185	2624.851
NZ	-0.358	-0.374	-0.015	0.2085	-0.591	-1000.531	2624.659
Diff/2	0.01	0.1165	-0.1005	-0.00575	-0.2825	1000.075	0.096
Ave	-0.348	-0.2575	-0.1155	0.20275	-0.8735	-0.456	2624.755
Bias °/s,mg	-0.001	-0.002	-0.001	0.09	0.08	-0.05	26.24
ASF Norm				1.0000	1.0001	1.0001	Temp °C

Gyro °/s /g		Input g =		Accel In g's
x	0.002	-0.002	0.000	x
y	0.003	0.001	0.001	y
z	0.000	-0.001	-0.001	z

	Accel Mis-Align	mrads	Accel In
	-0.03	-0.01	x
0.64		-0.28	y
0.24	0.18		z

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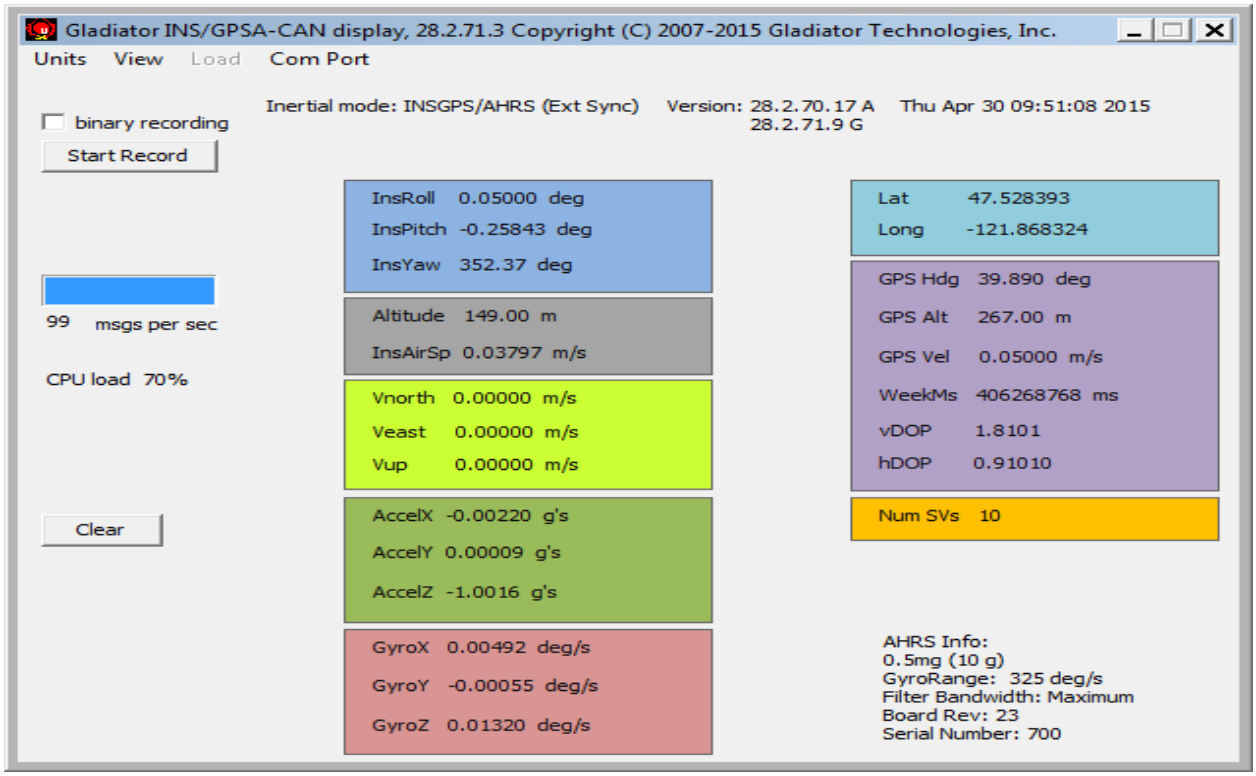
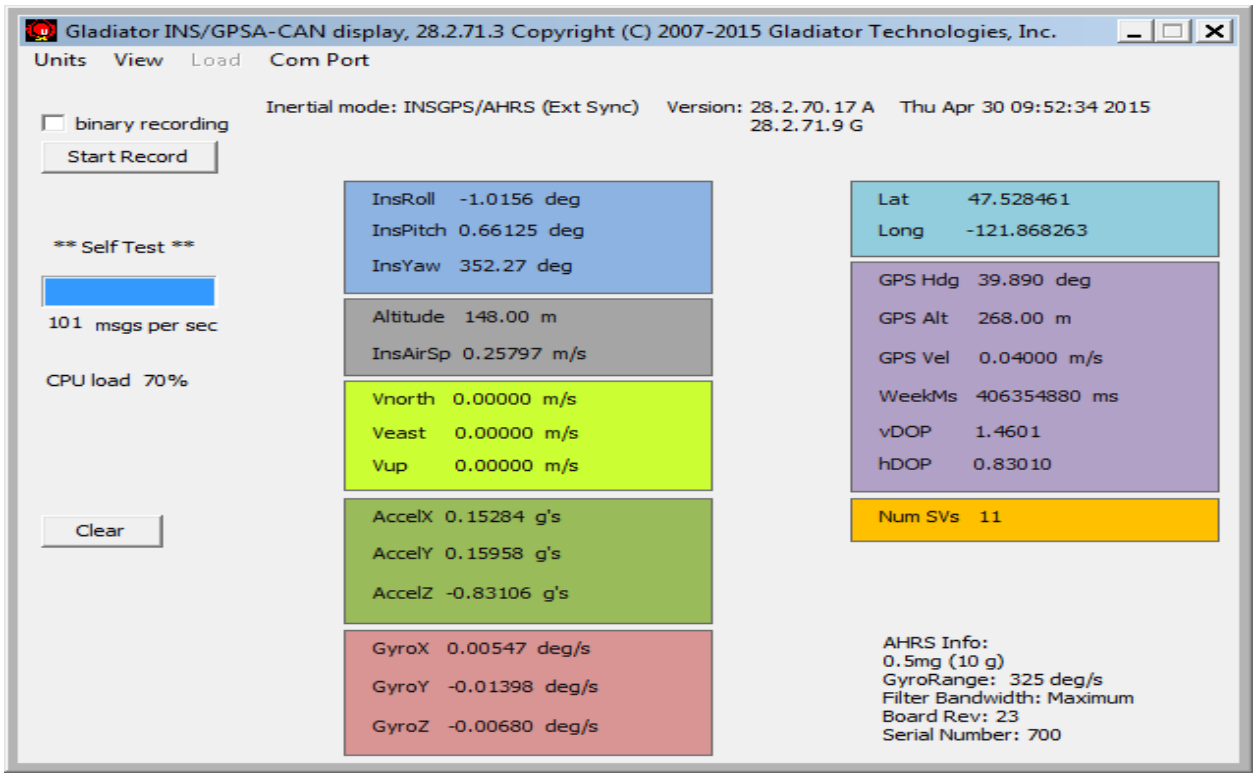


Initial Bench Readout (above)



Self Test (below)

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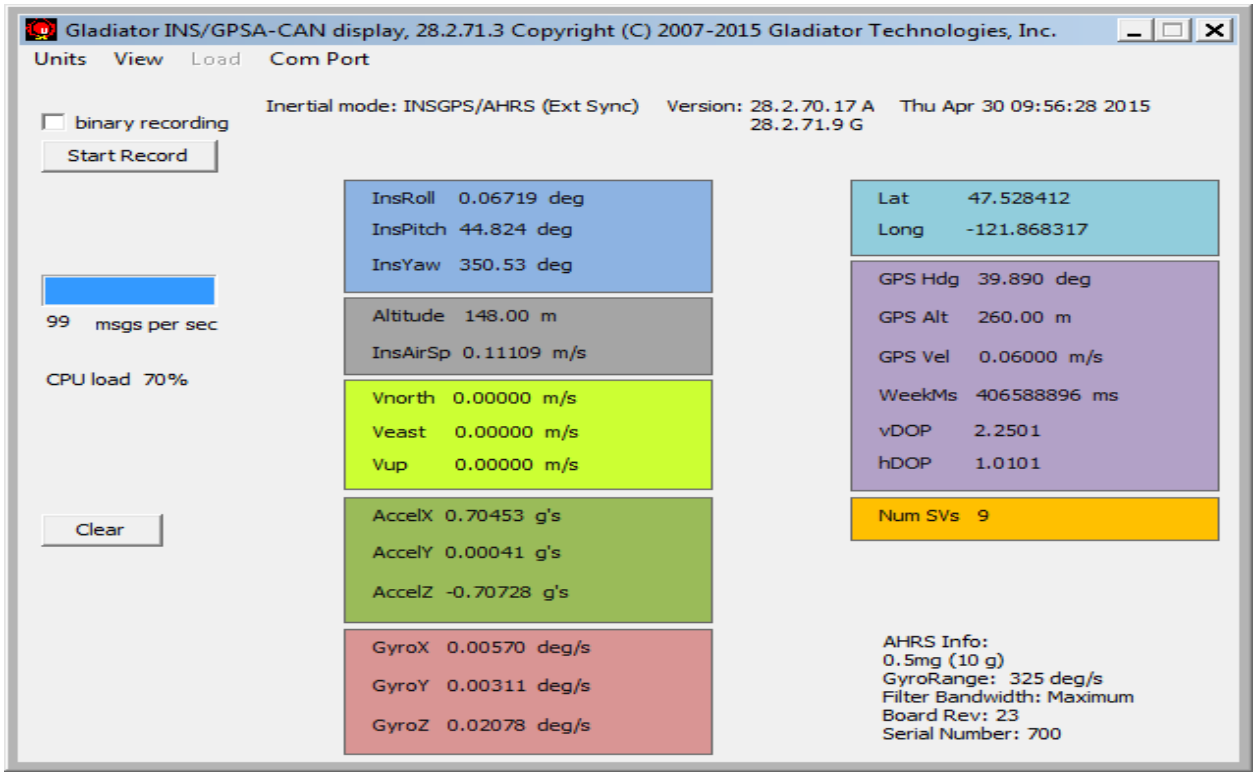
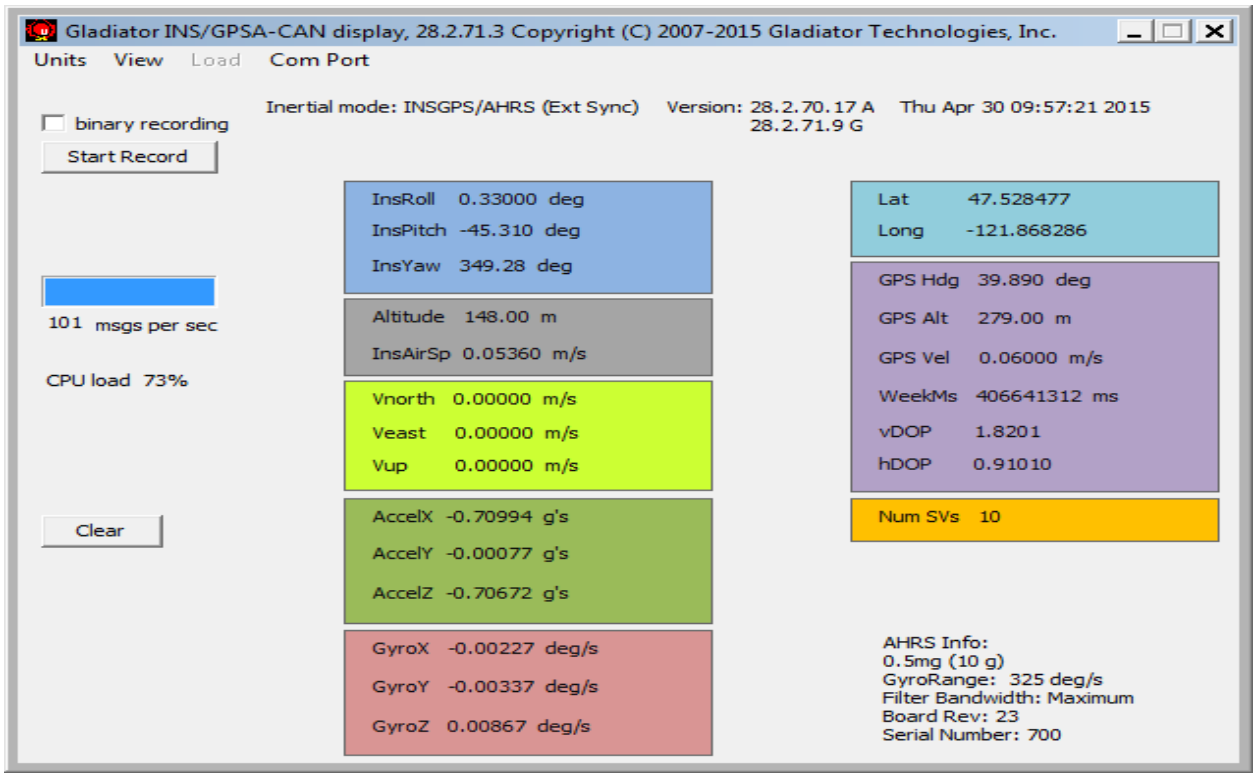


Pitch Up 45° (above) Pitch Down 45° (below)



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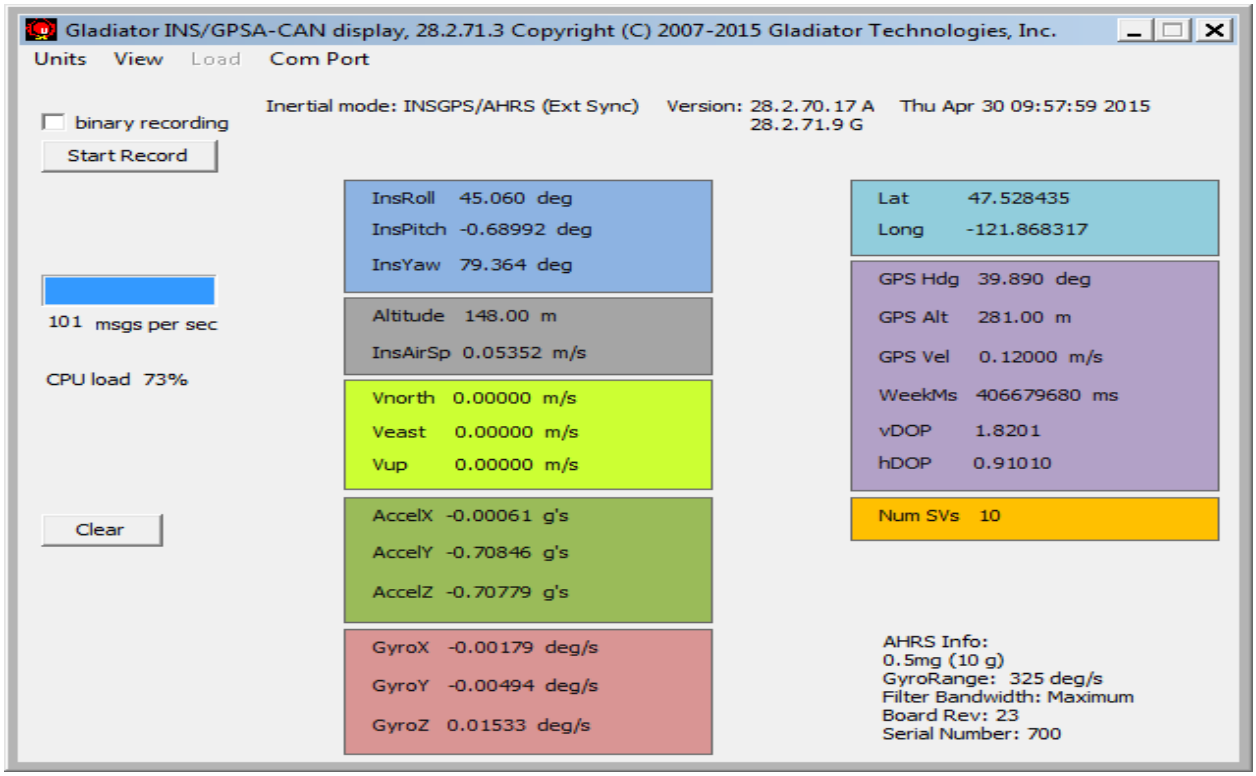
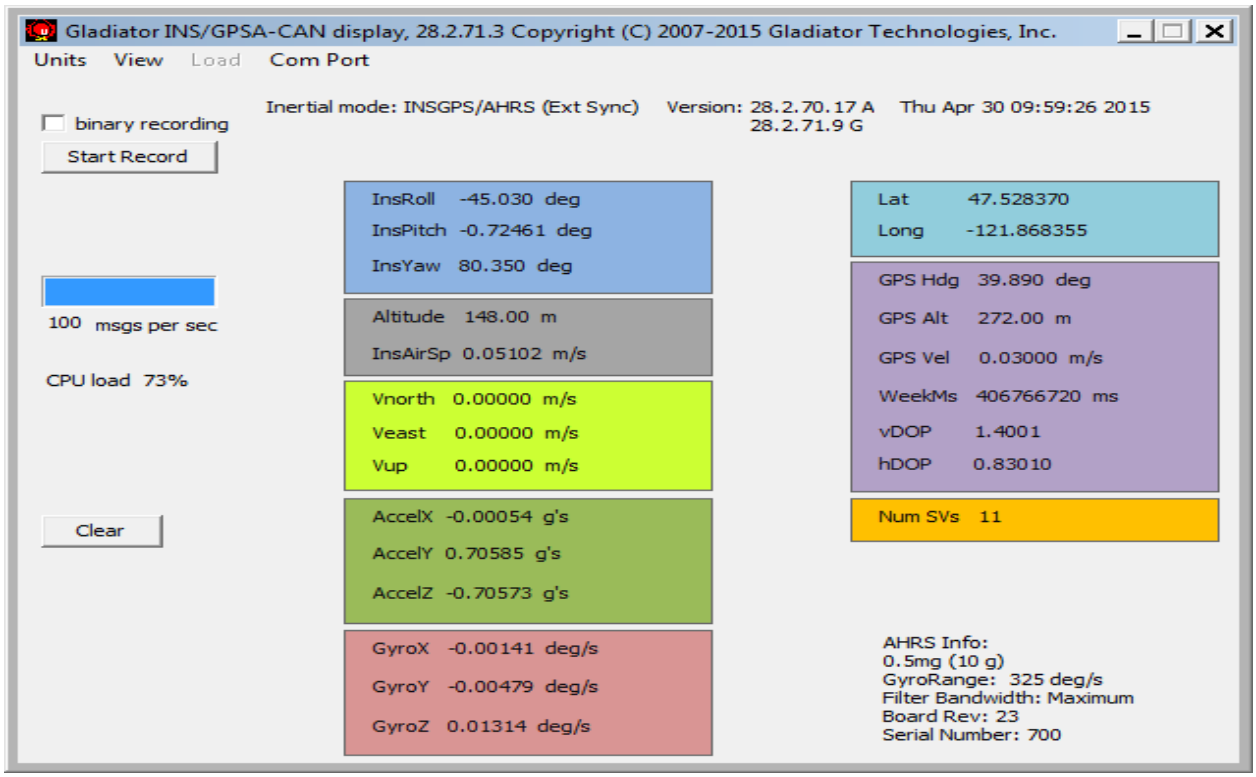


Roll 45° (above) Roll -45° (below)



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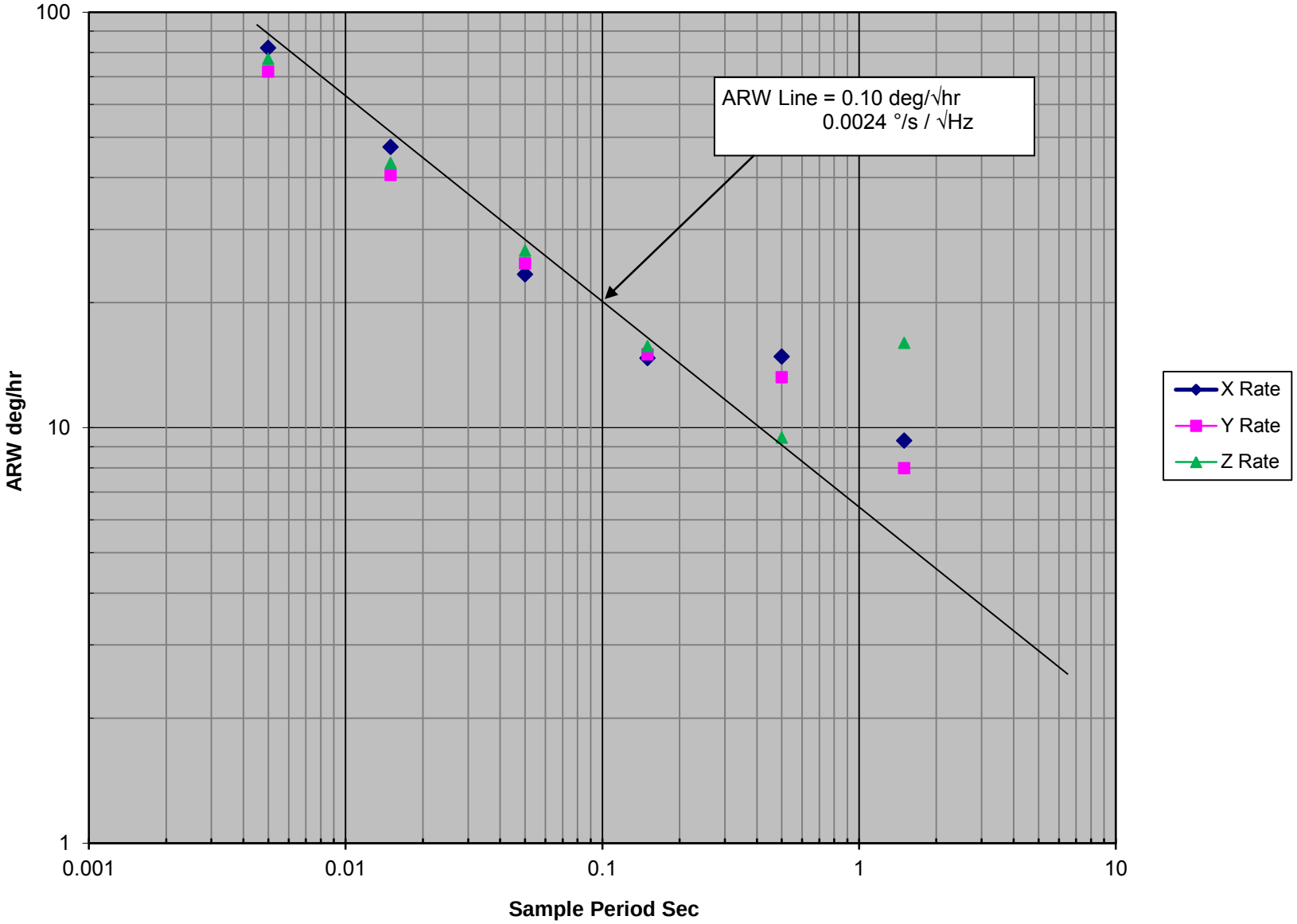

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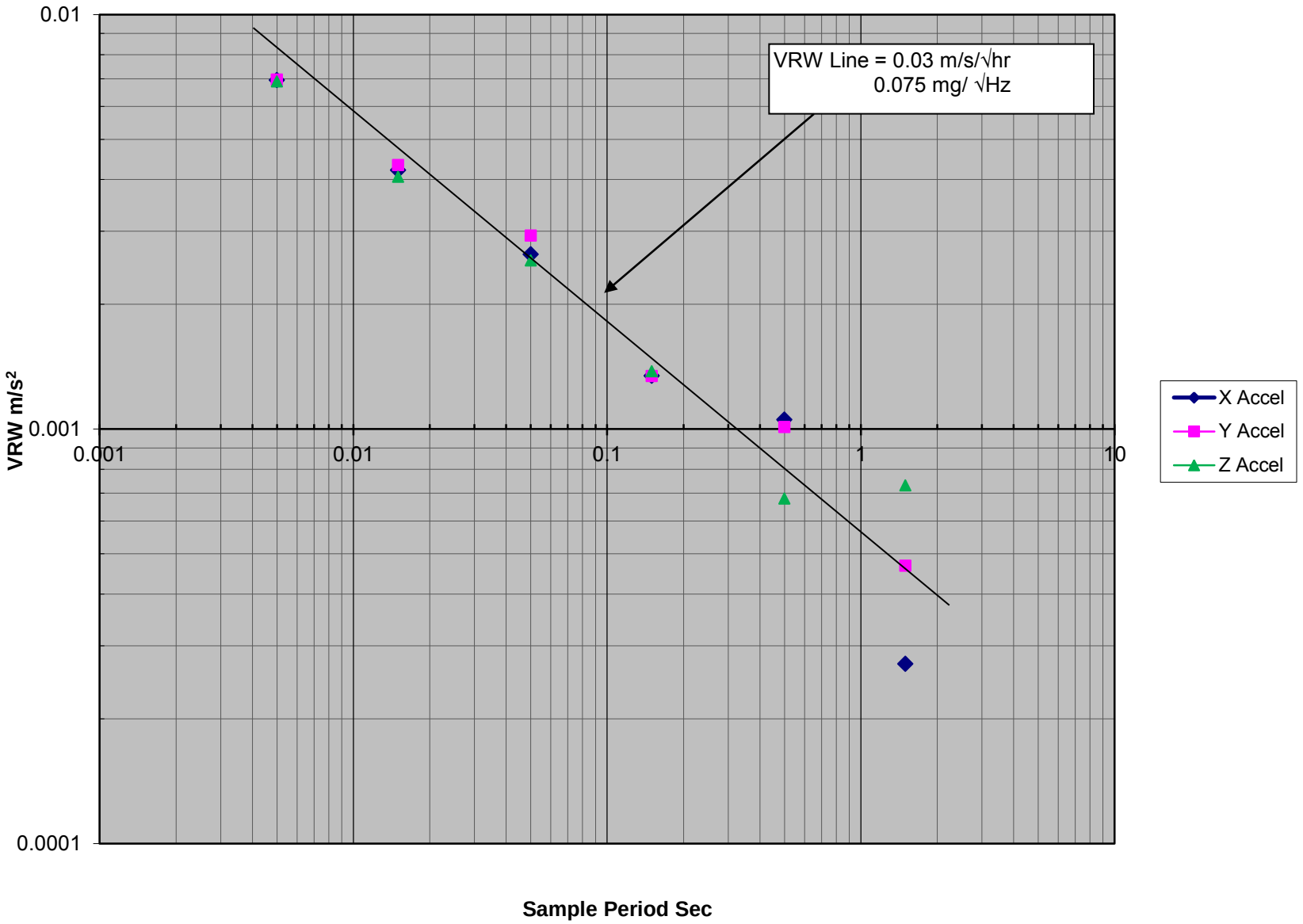

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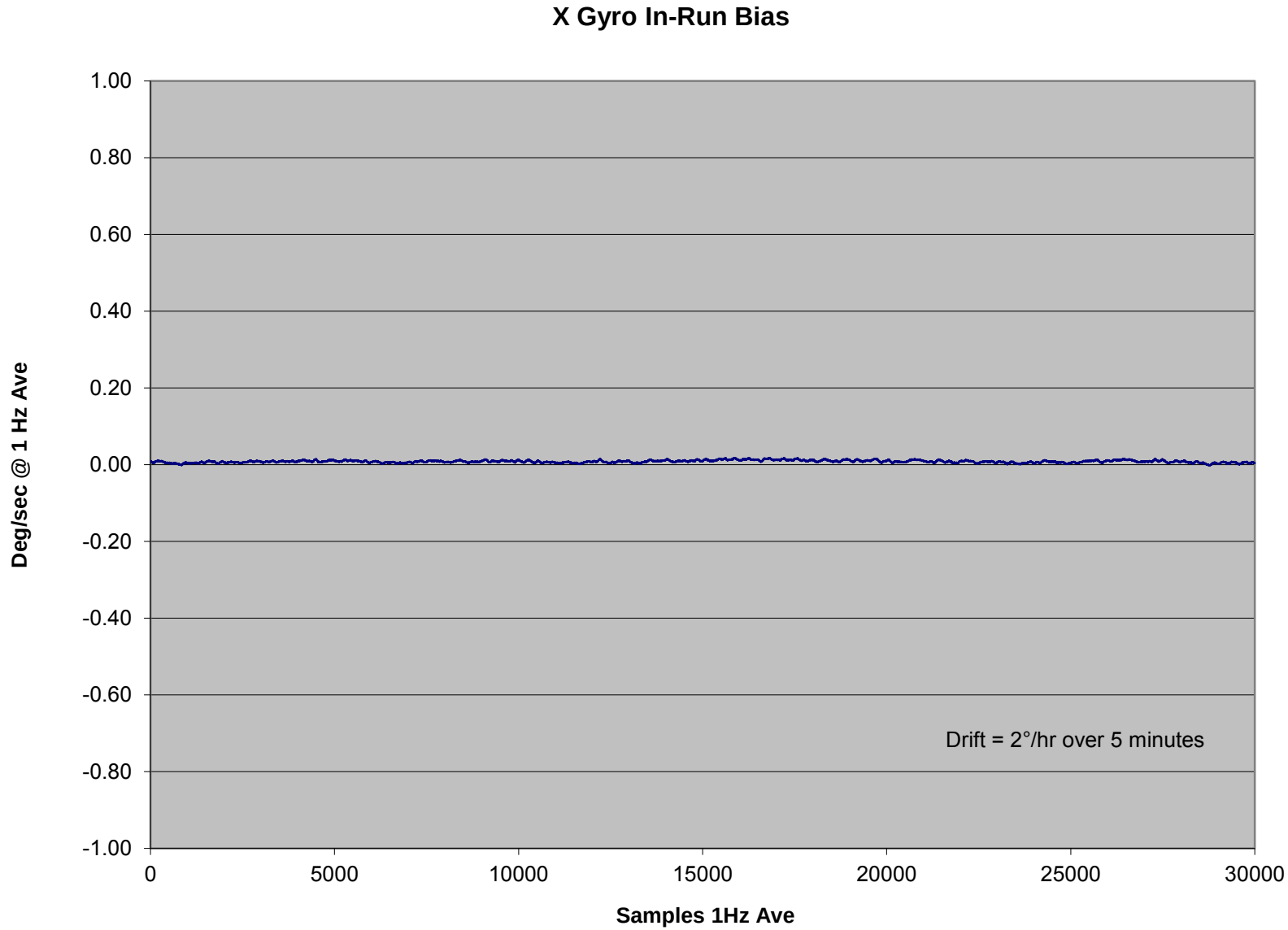

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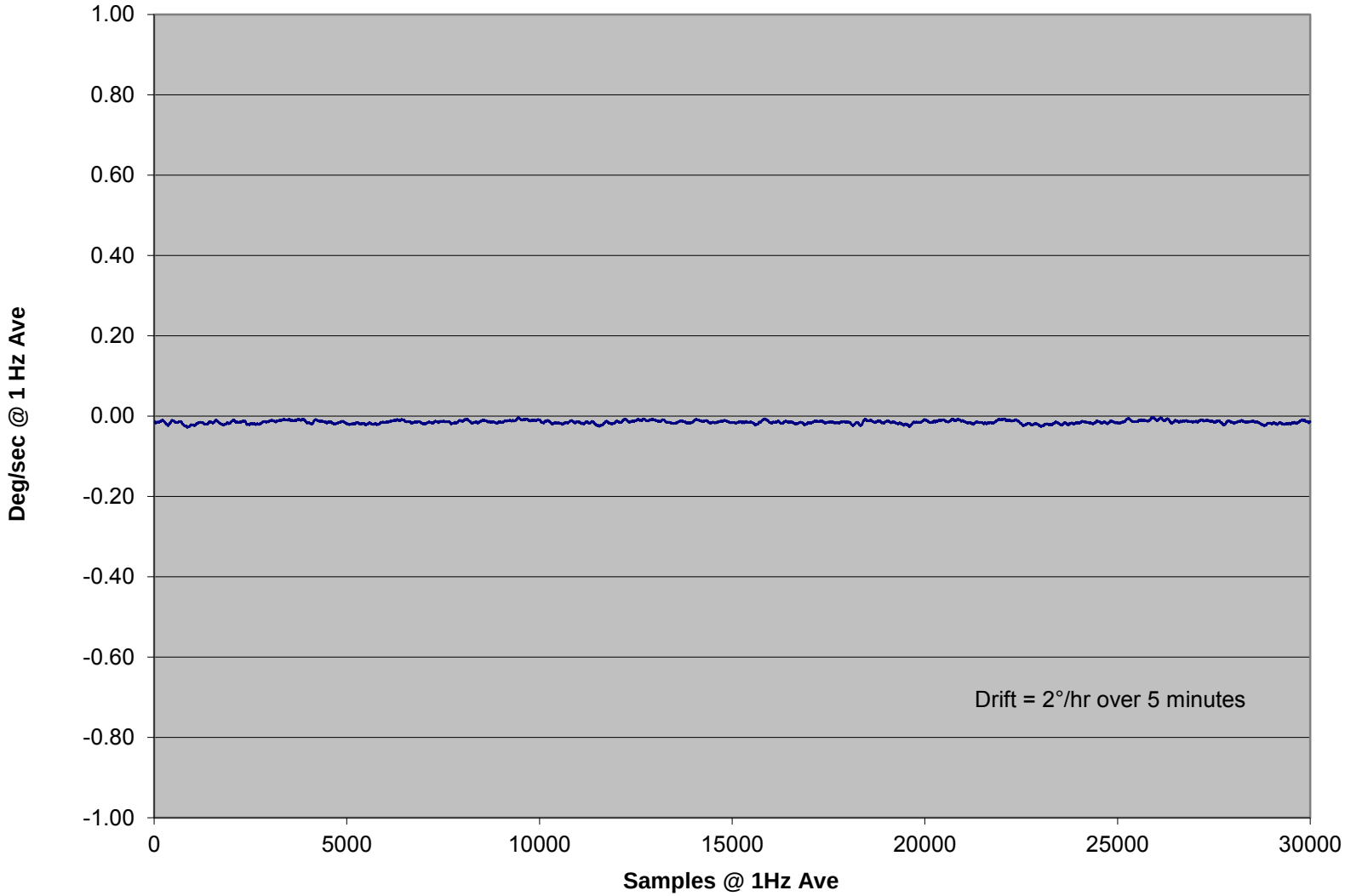
Y Gyro In-Run Bias



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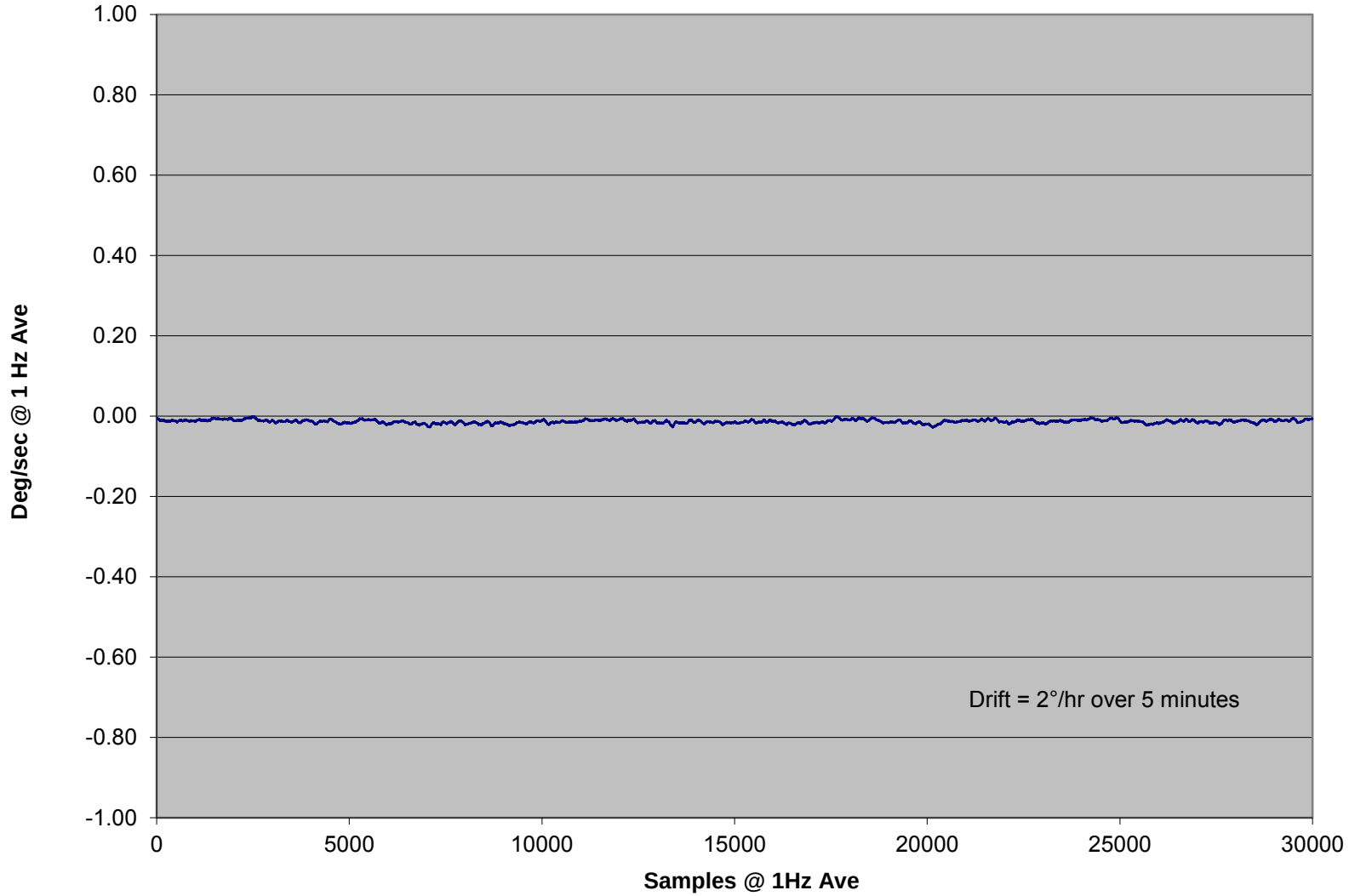
Z Gyro In-Run Bias



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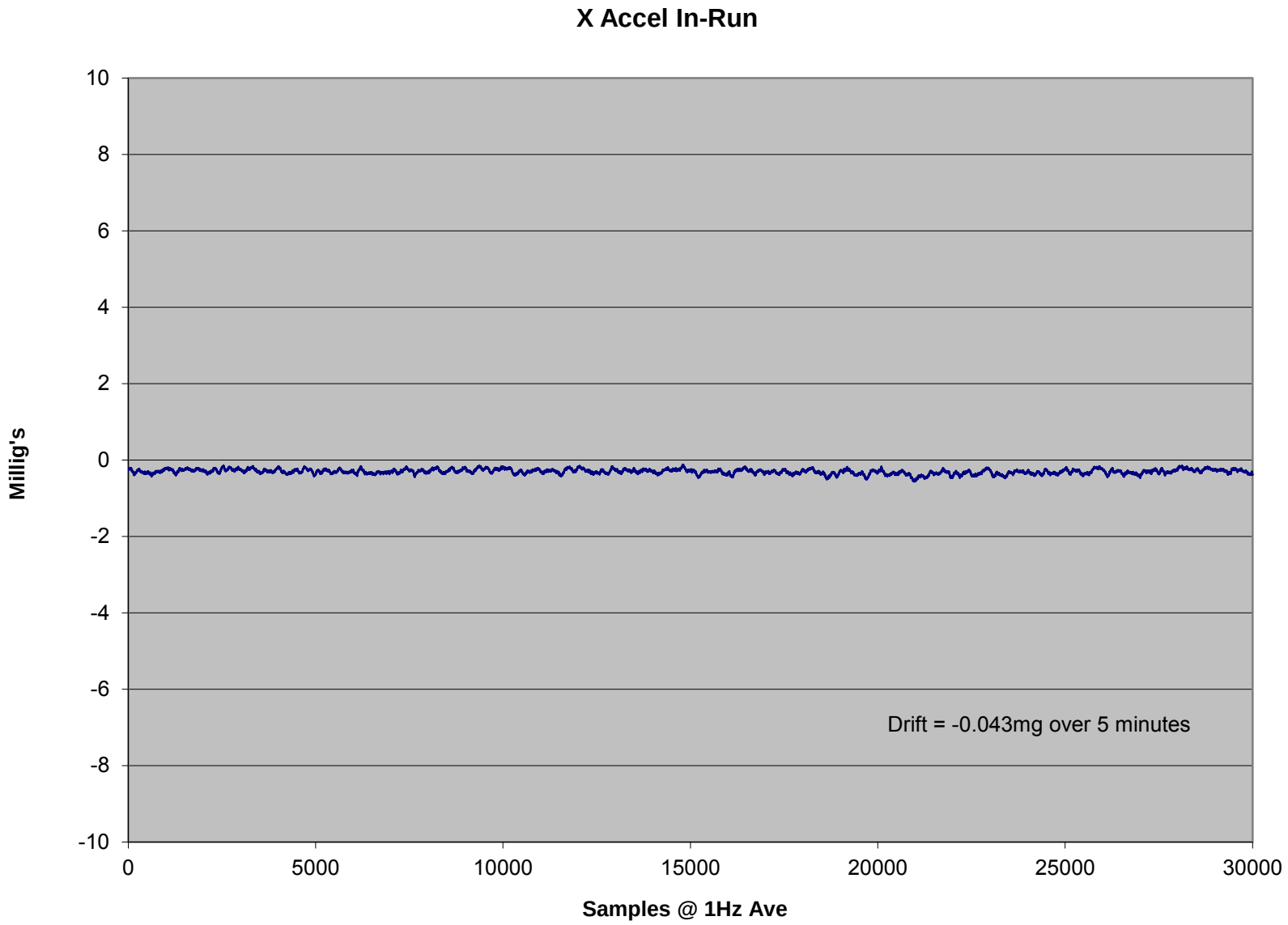

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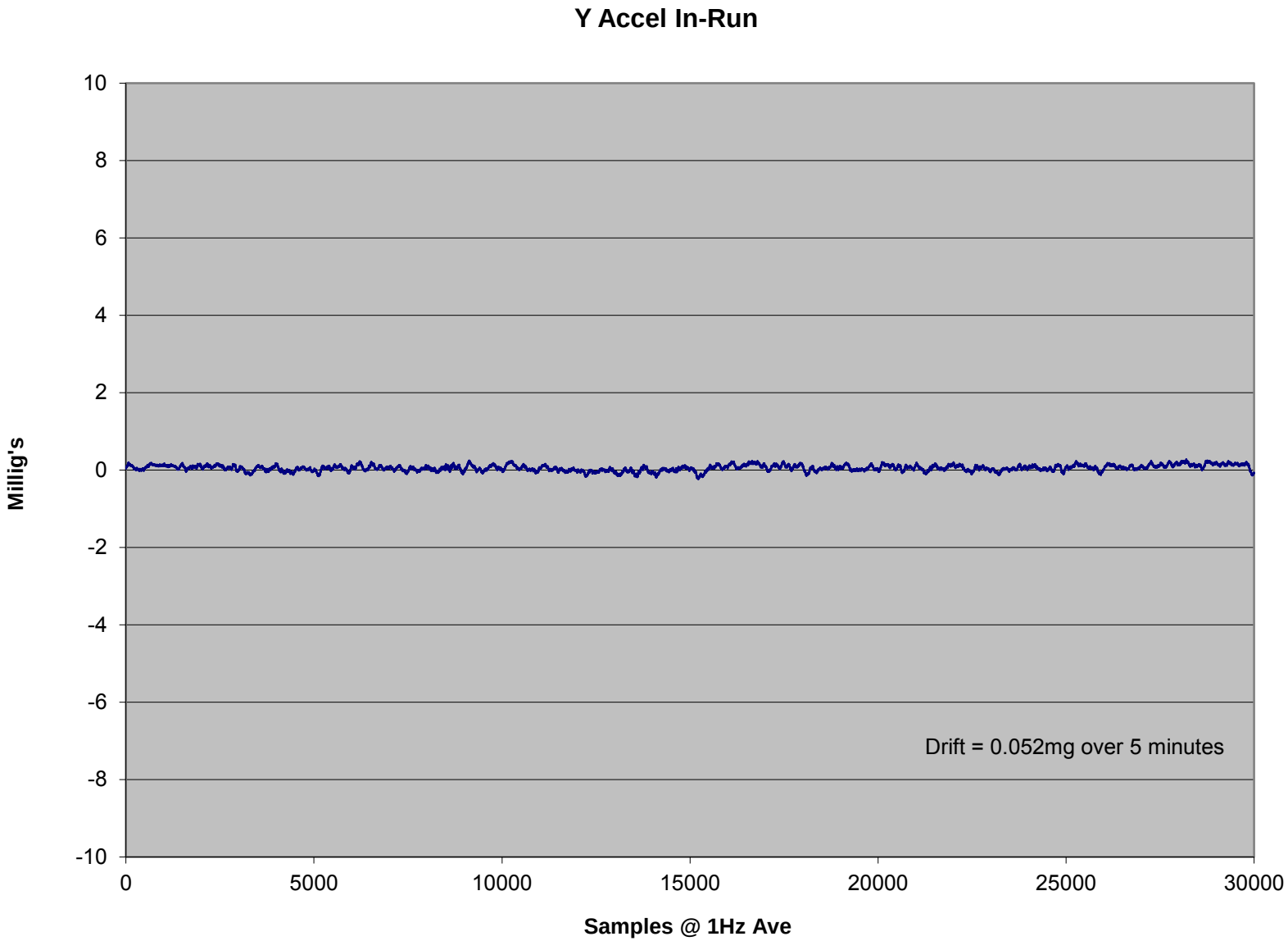

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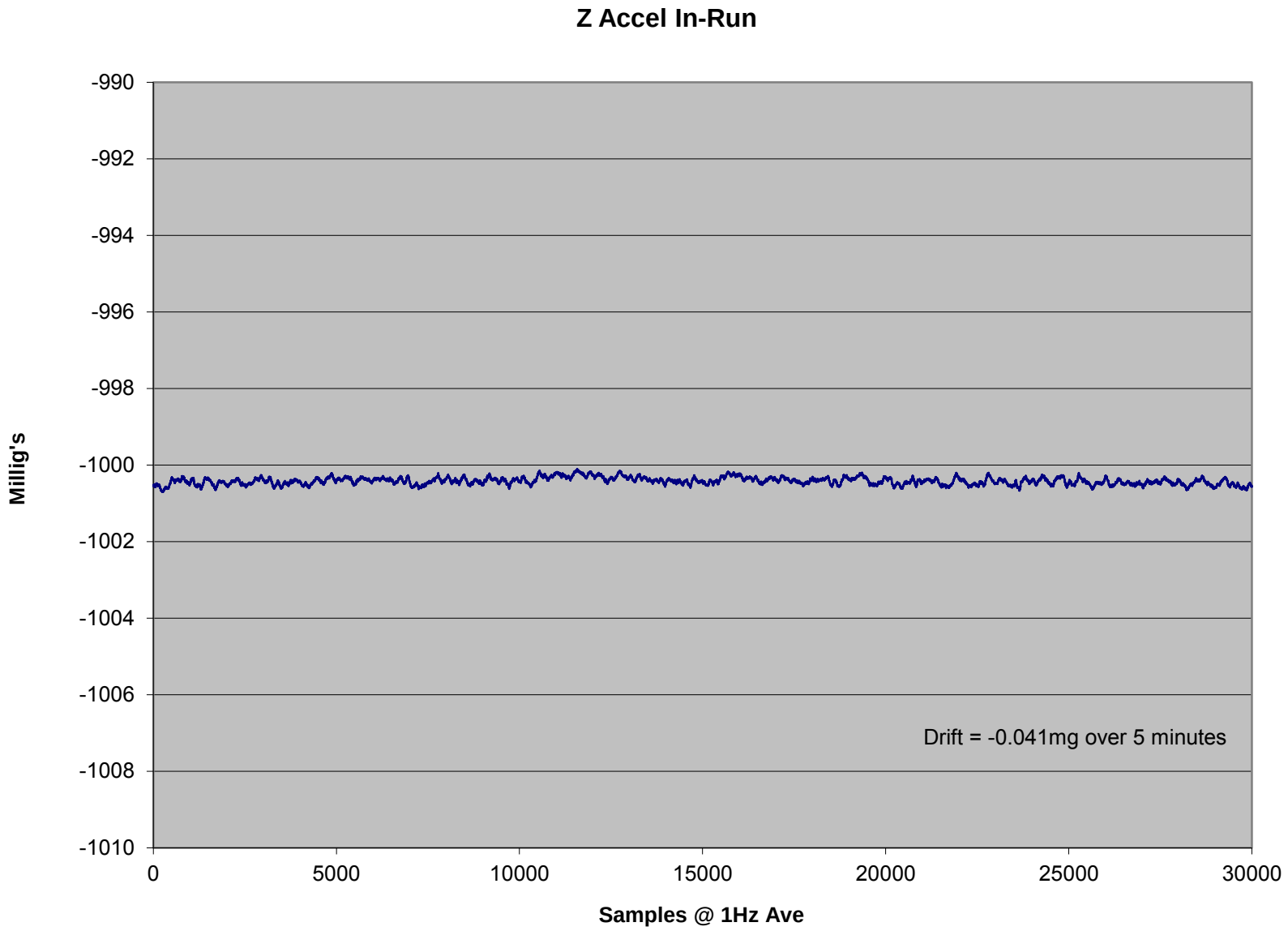

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GPS-Aided Units Road Test Checklist

PN LMRK50INSGPS-300-10-200 **SN** 700 **Date** 4/15/2015

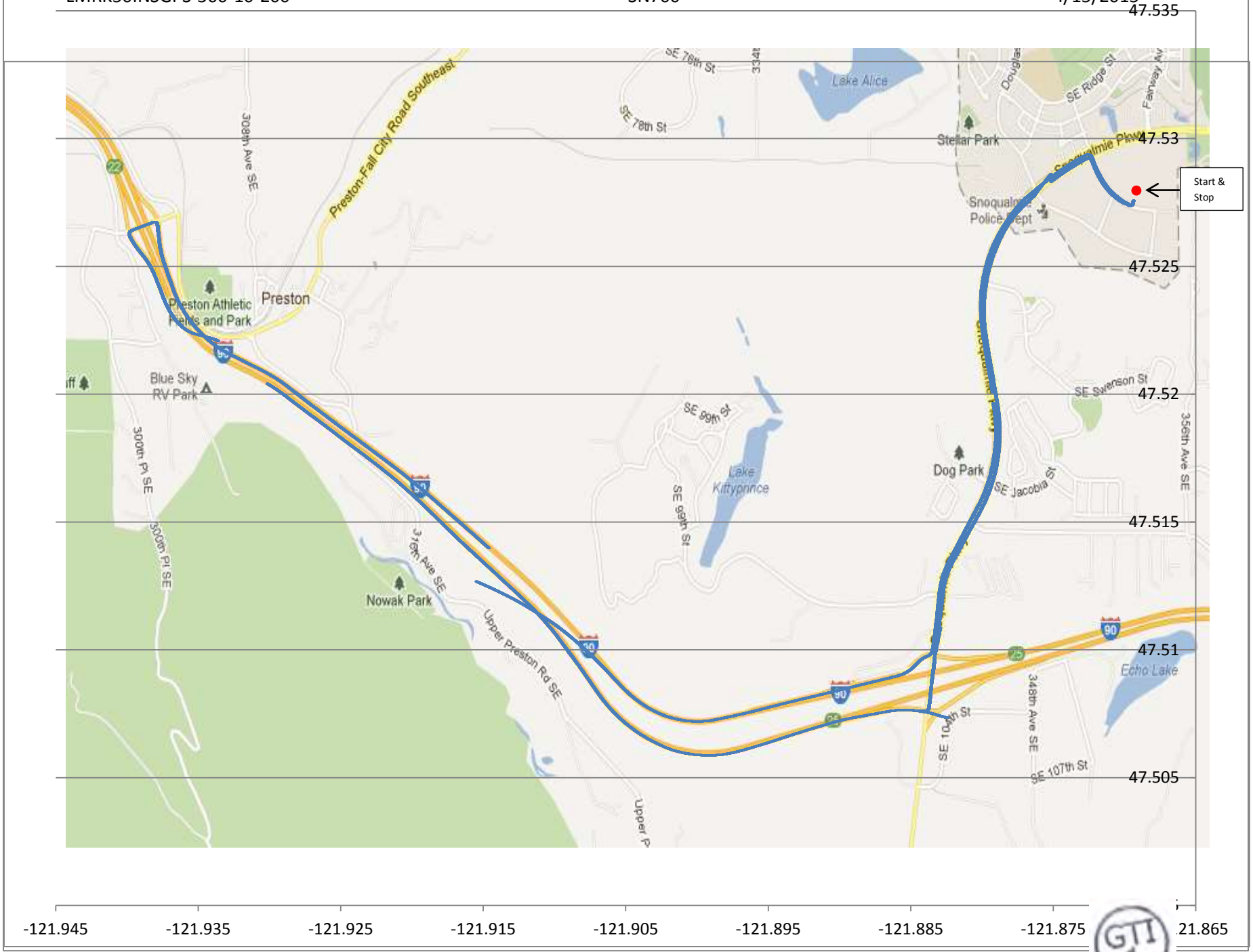
2 Minute Warm-up:	✔
Data Outputs:	✔
Display:	✔
Self-Test:	✔
GPS Satellities:	12
GPS Time (ms) :	336179940
LAT/LONG:	47.5275574 / -121.8694382
GPS Altitude:	263
Barometric Altitude (after Reset):	250
GPS Velocity vs. Vehicle Velocity:	✔
Display Correct During Run:	✔
Speed:	✔
Pitch:	✔
Pitch Error:	✔
Roll:	✔
Roll Error:	✔
Z Accel:	✔
Data Pack to Engineering for Test Data Review:	✔

PASS: ☒ GTI 5 **FAIL:** ☐

GPS Road Test Check List Rev. 02/03/2015

LONGITUDE (deg)

LMRK50INSGPS-300-10-200 SN700 4/15/2015



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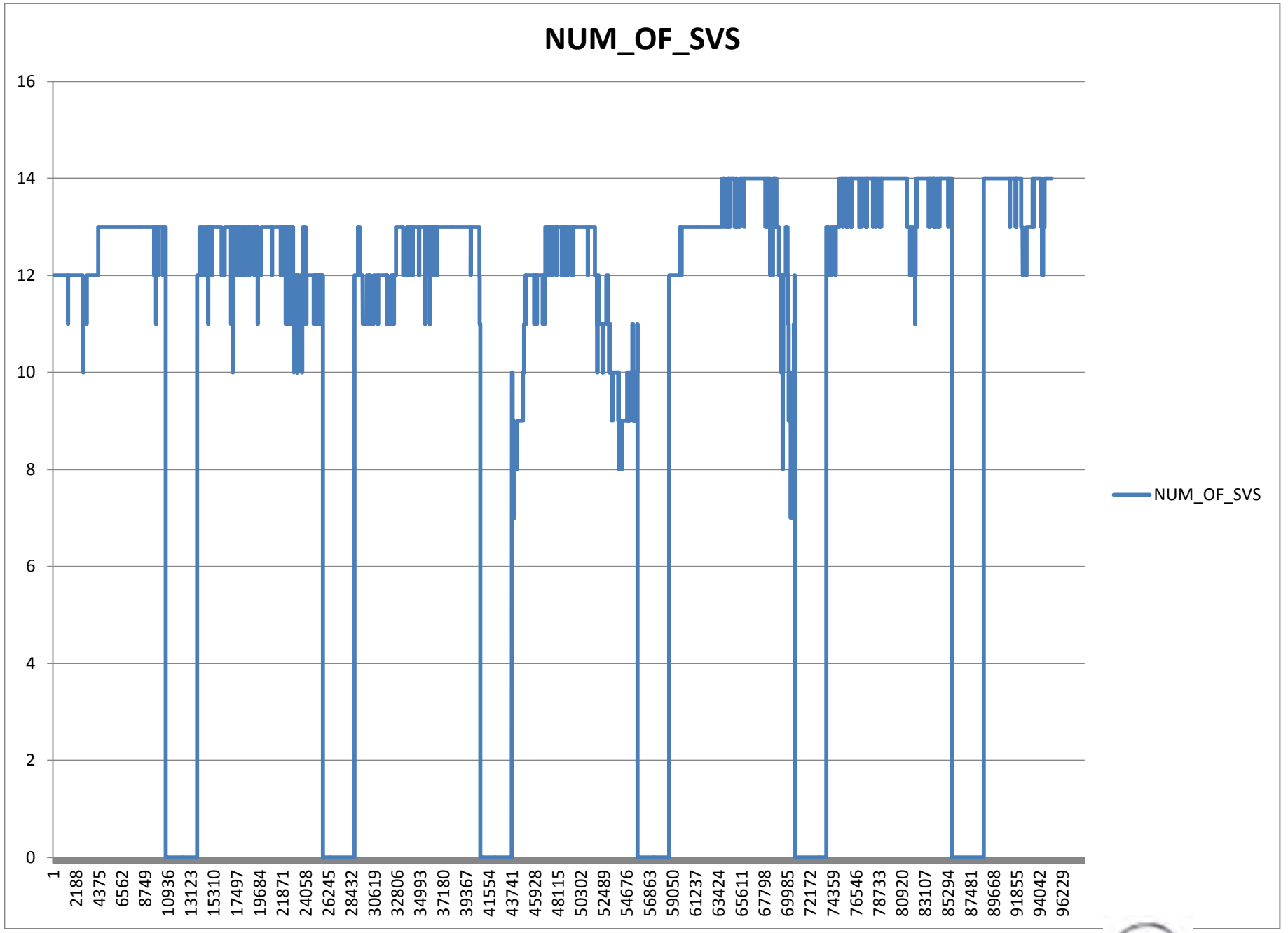

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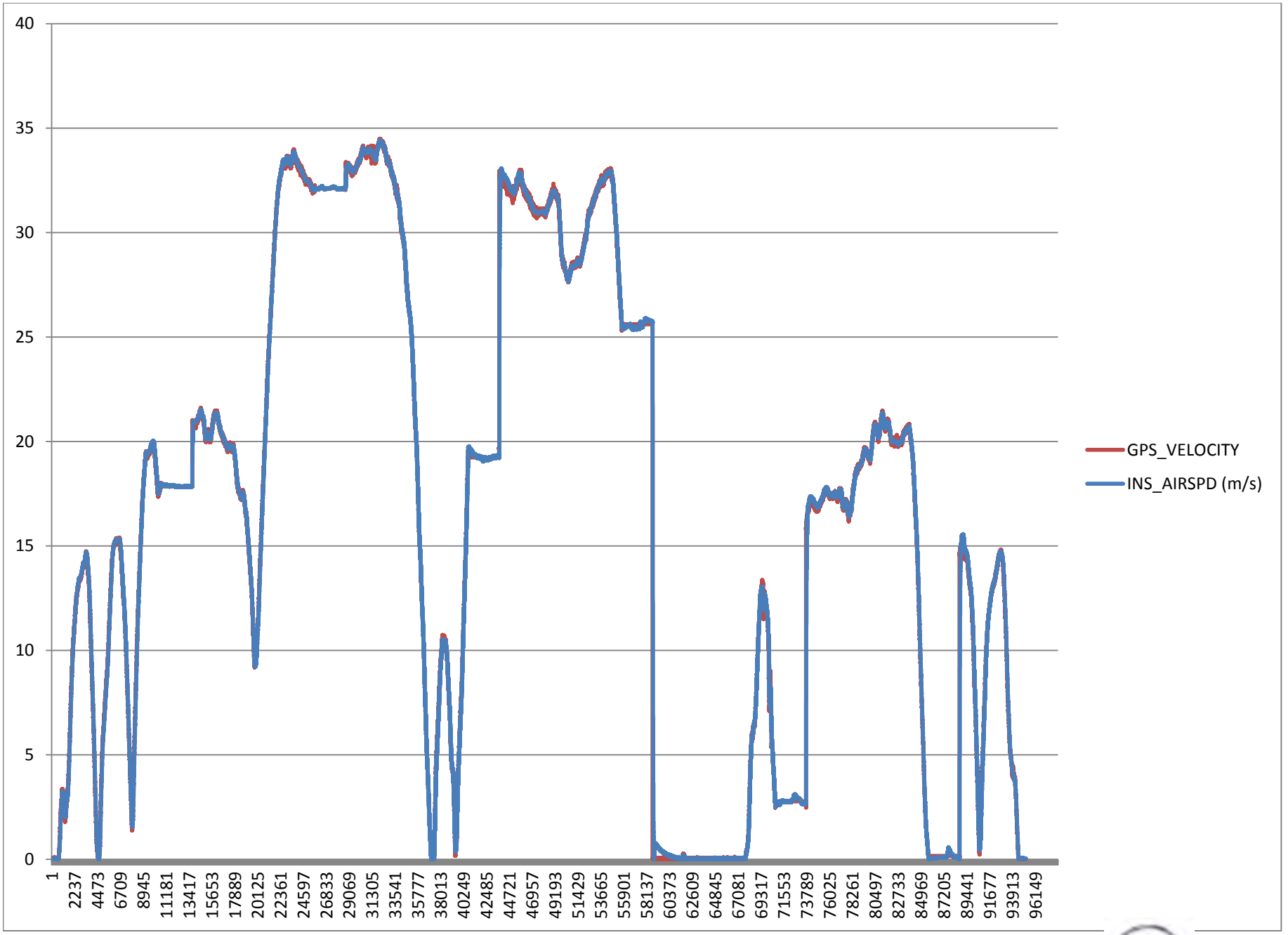

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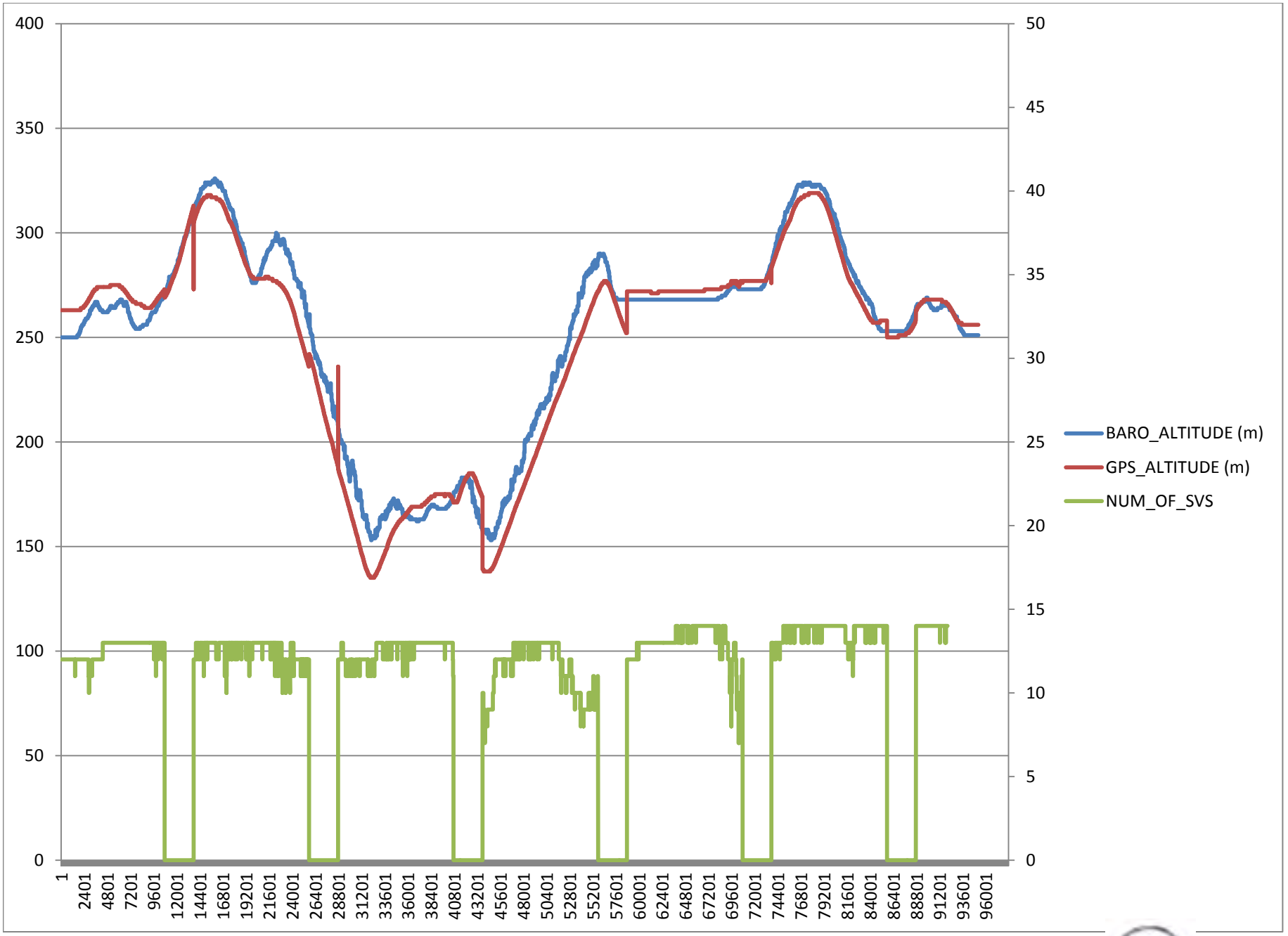

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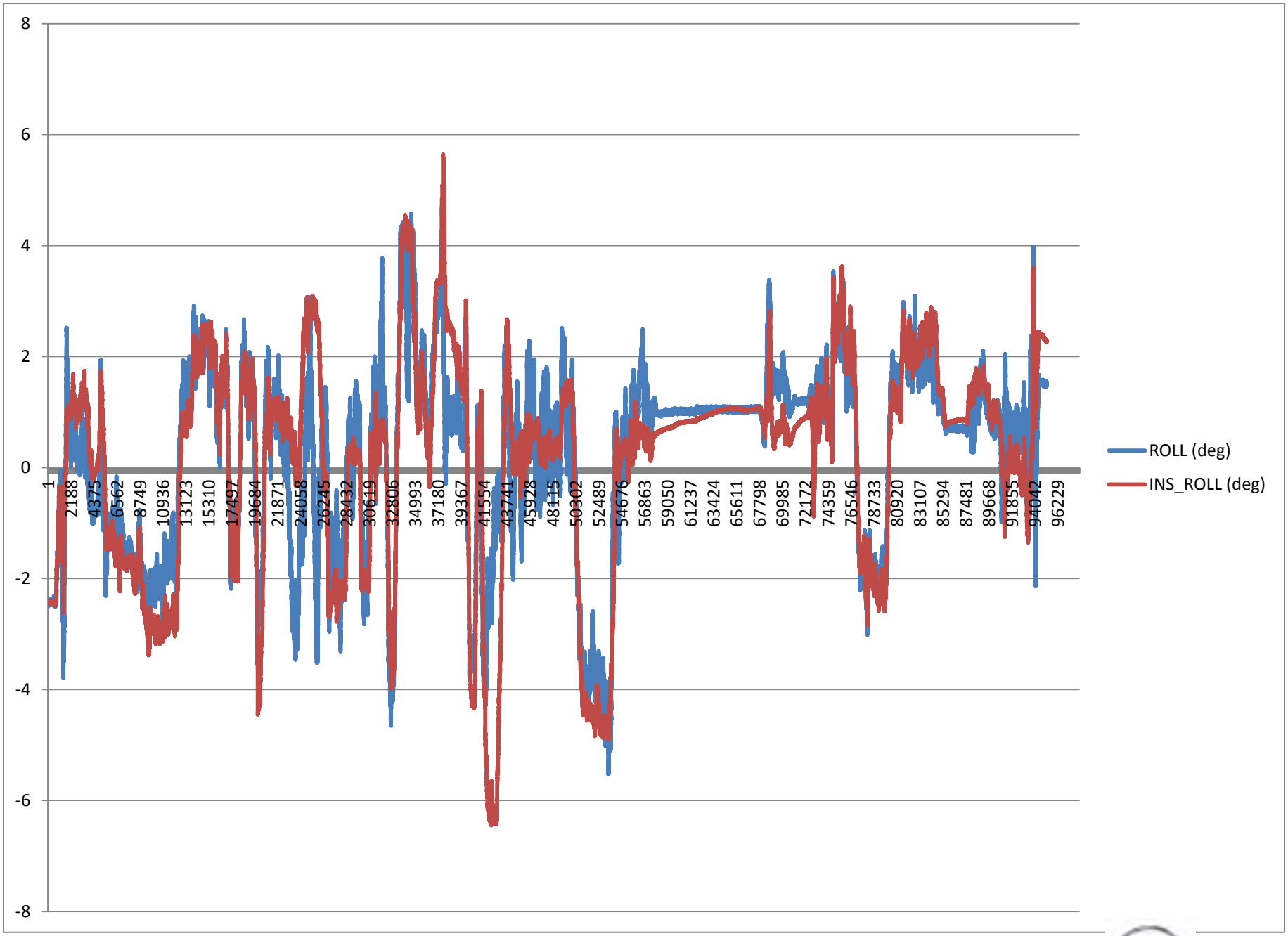

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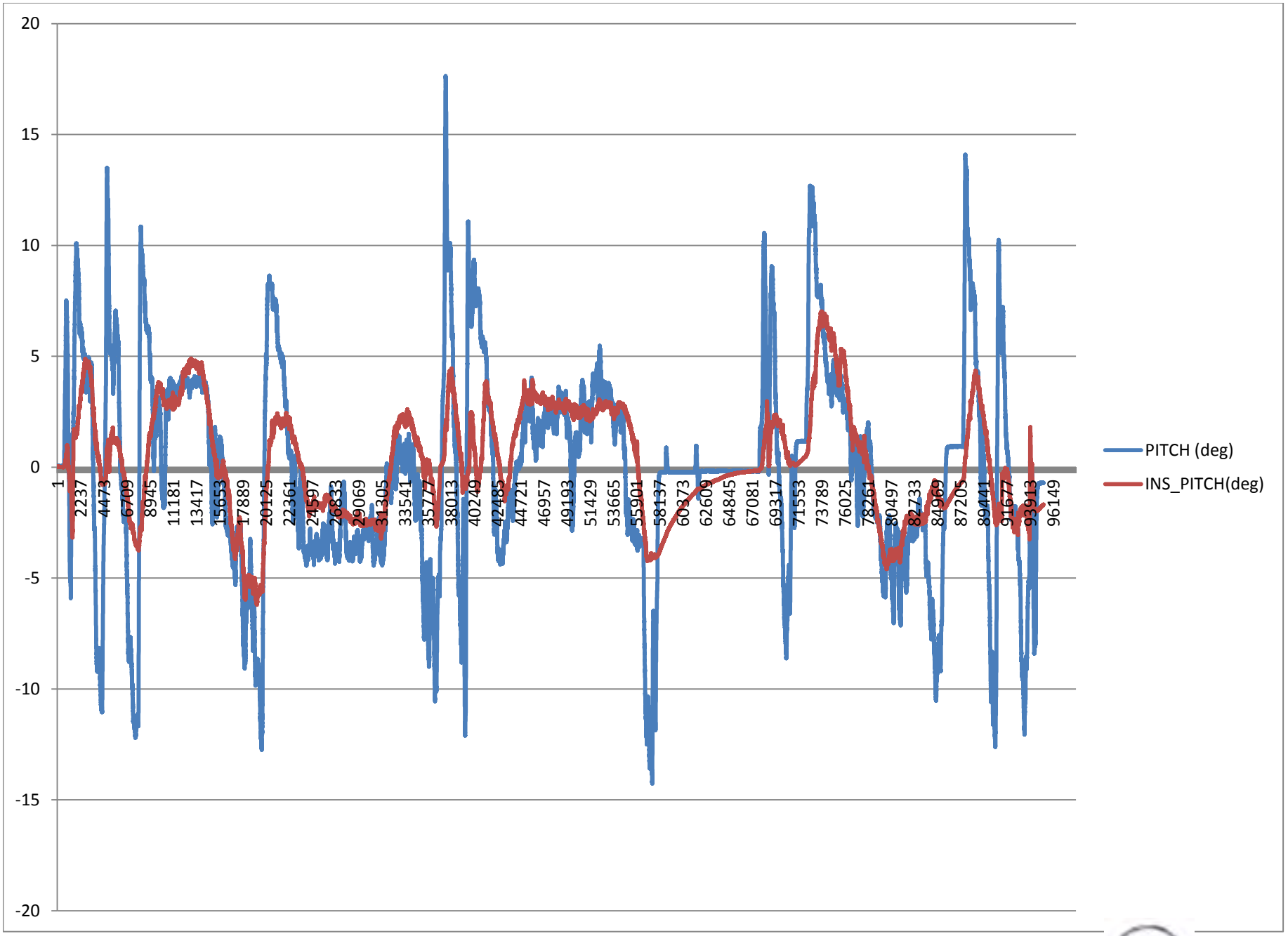

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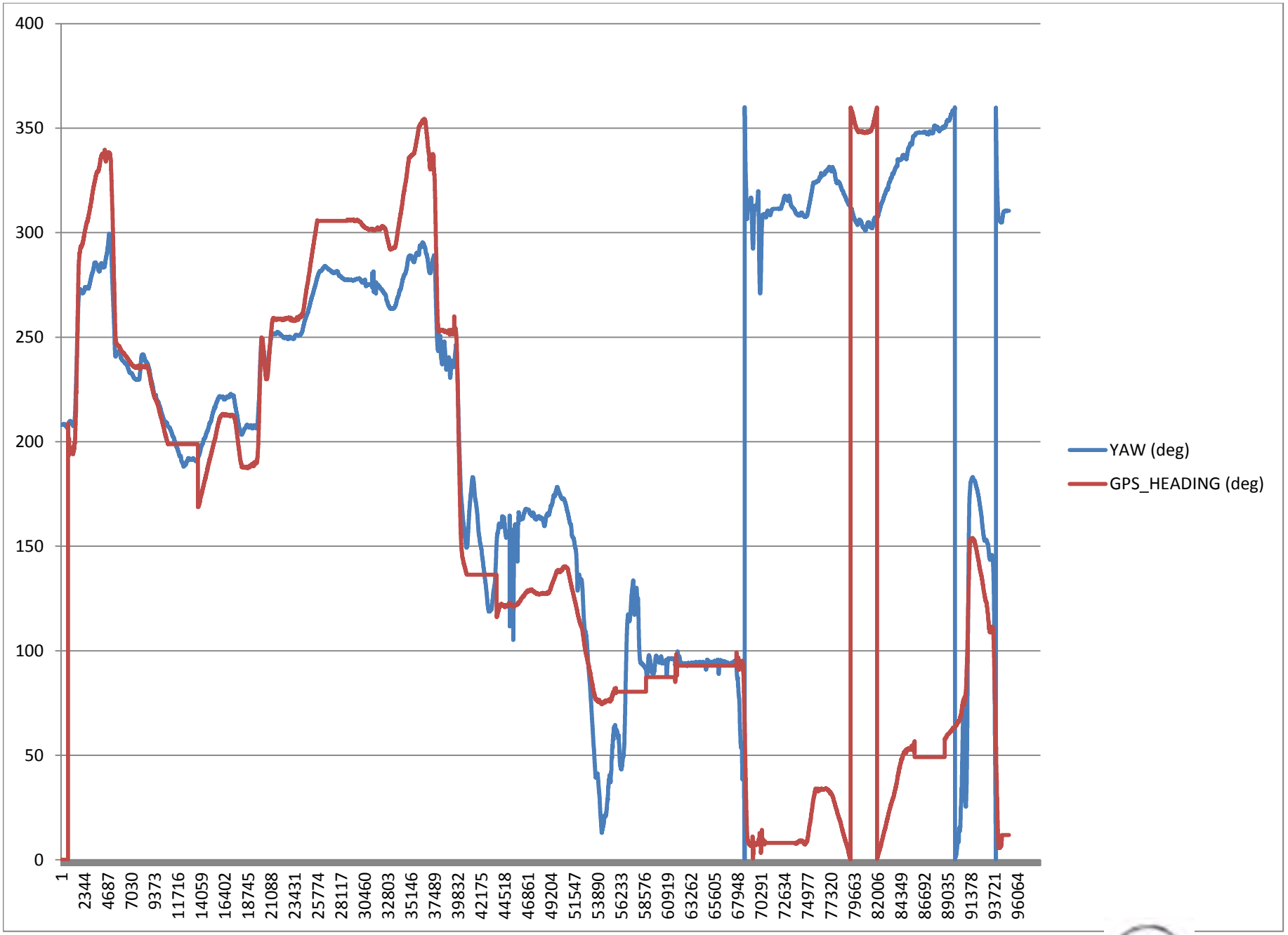

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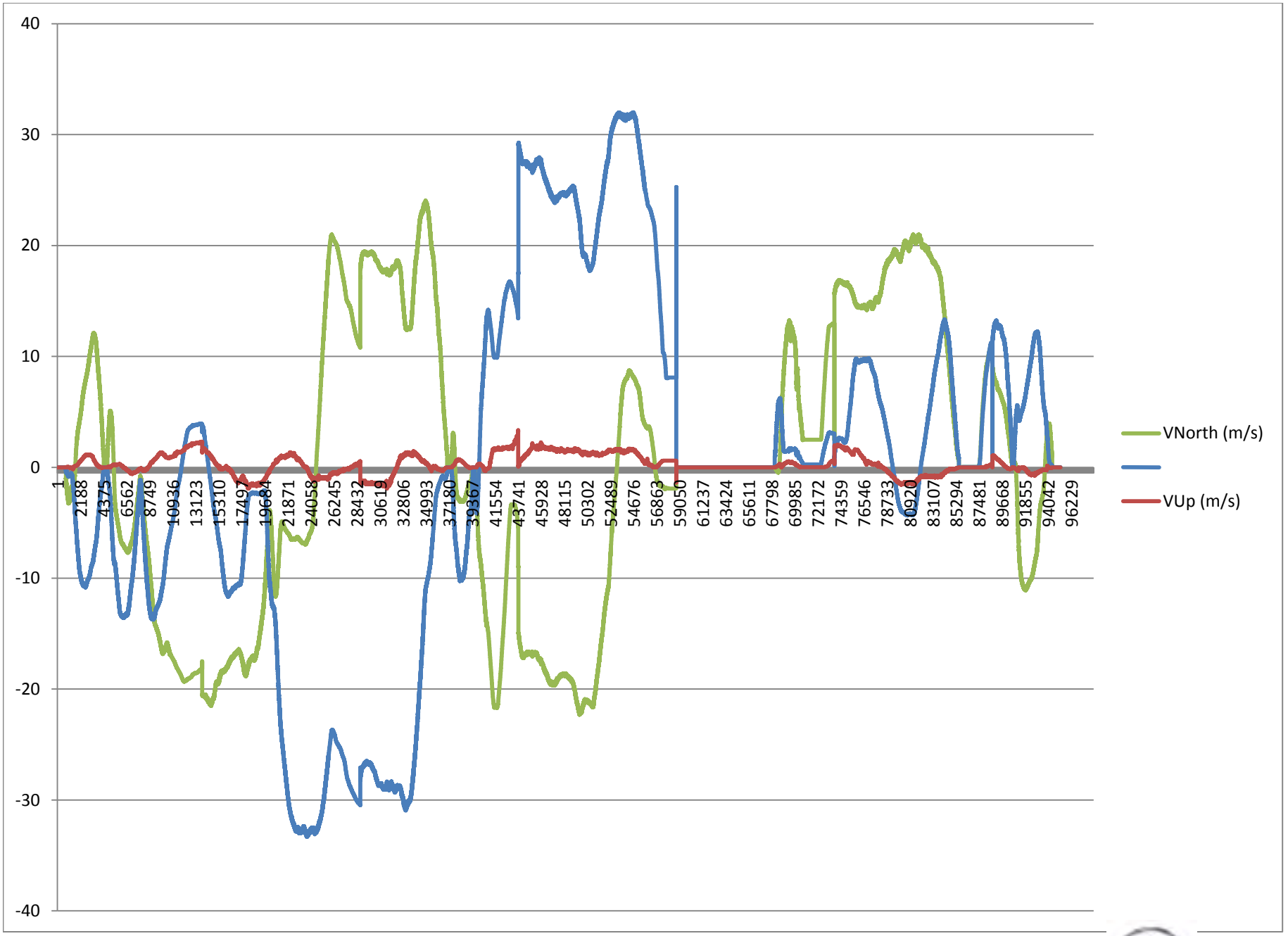

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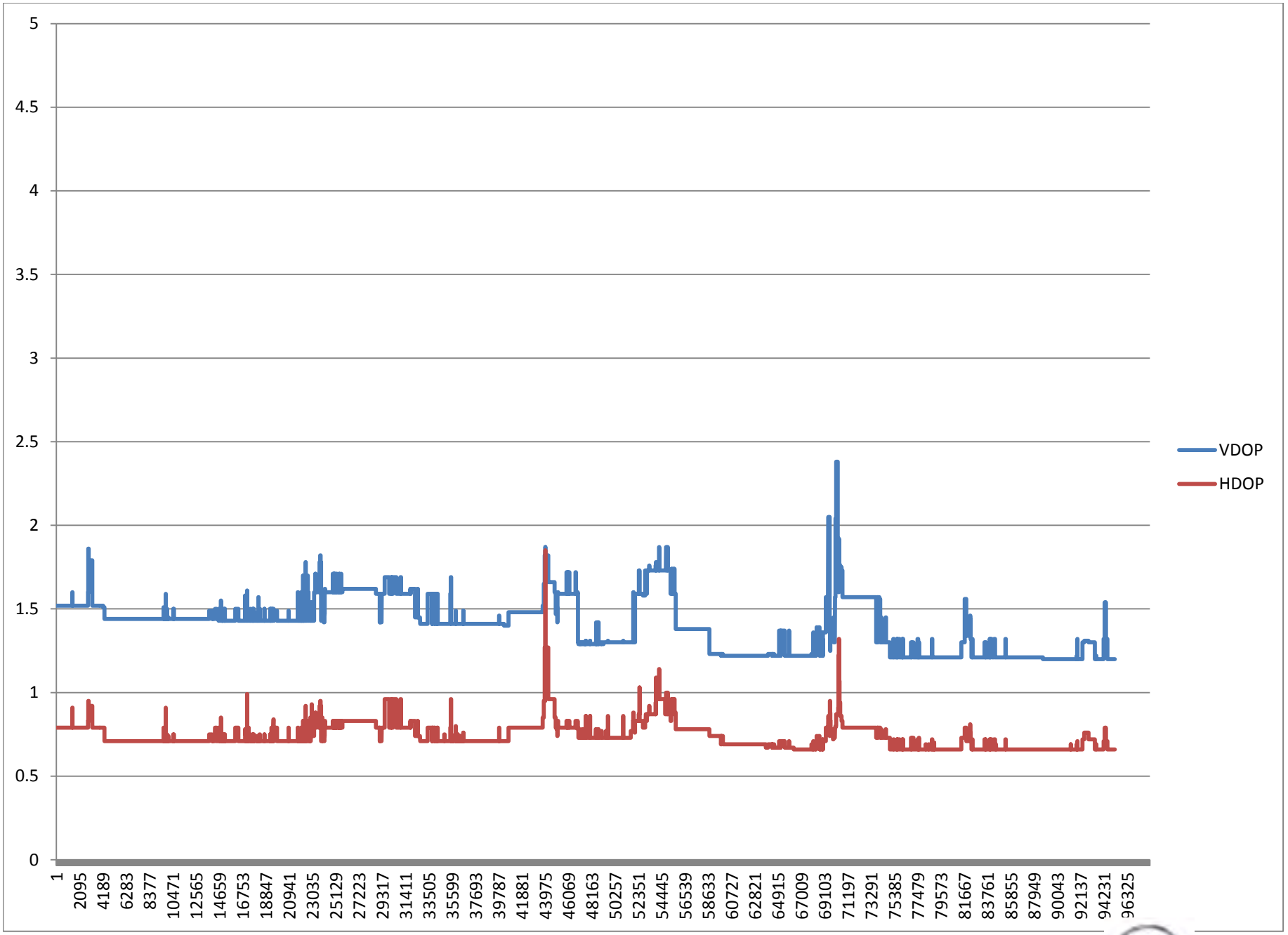

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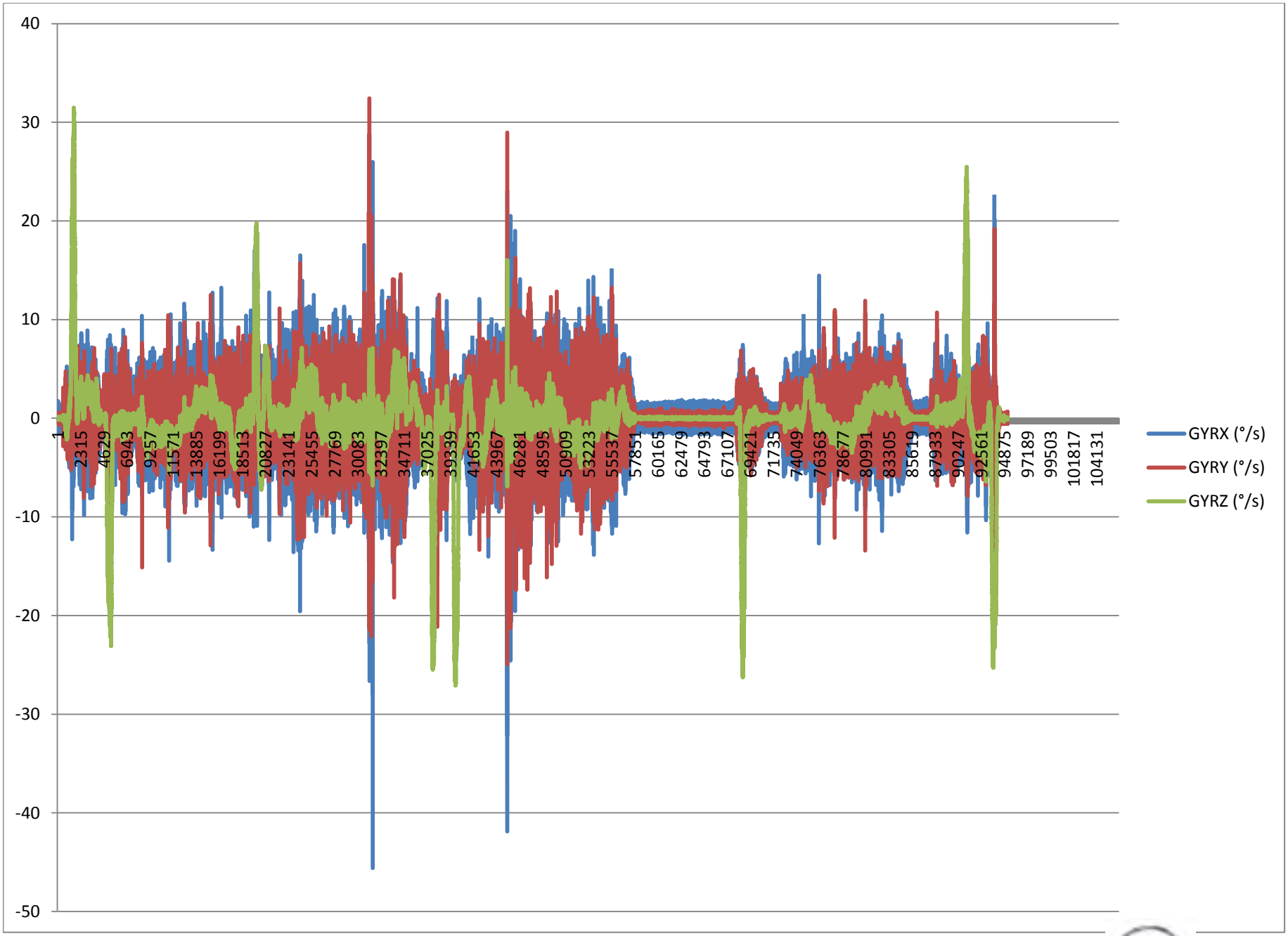

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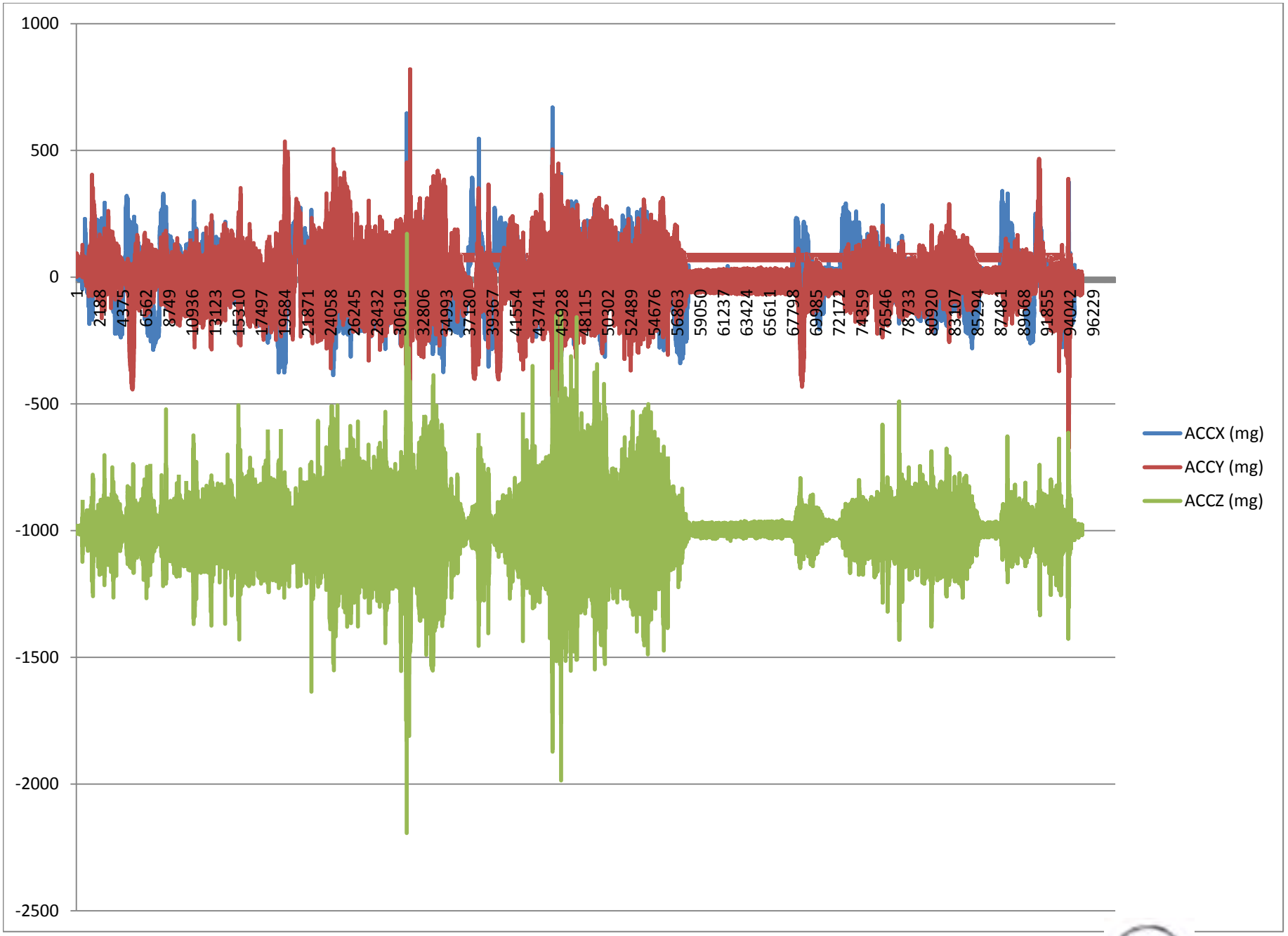

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