

CalWind Resources Inc.

October 8, 2009

**Condition Monitoring on 47 meter
Wind turbines
by Jon Powers**

CalWind Projects: Wind Resource 1 Tehachapi, California

- 134 @ Nordtank 65/13 wind turbines installed 1984-85
- All wind turbines in current operation
- 9 Megawatt Facility

Nordtank 65/13



Wind Resource 2 – Tehachapi, California

- 200+ @ Bonus 65/13 wind turbines installed 1983 to 1985
- Purchased & Operated by CalWind since 1997
- 22 Megawatt Facility

Bonus 65/13



Condition Monitoring Turbines

- 13 @ 600+ KW wind turbines
- Operating for 6+ years
- Condition Monitoring for 2+ year

600+ KW Wind Turbine



Oil Sampling and Trending



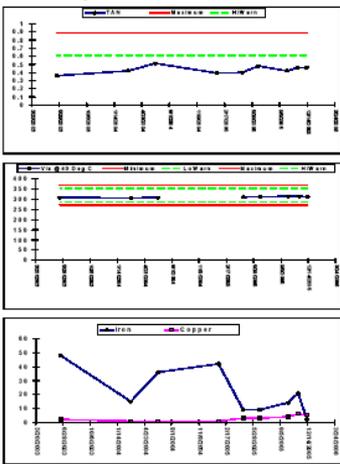
101 Corporate Place, Vallejo, CA 94590

Unit Type : Gear (GN_GR001) GN_GR001
 Oil Type : Texaco Meropa 320 ISO VG 320 (TE_136) TE_136 P.O. # B6248
 Sampled : 12/12/05 Shipped : 12/12/05 Received : 12/13/05 Printed: 12/14/05

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 08:04:59

ABNORMAL: Abnormal results for oil are present. Equipment appears satisfactory. The particle count is higher than desirable and/or acceptable. See enclosed Ferrographic Analysis for more detail. Check vibration data and/or perform other diagnostics to investigate the severity of the wear. Recommend purifying lubricant. Resample at half your regular interval.

Tehachapi, CA 93581-0604



Lab Number	Minimum	Maximum	Ref Oil	T57955	T72660	T93500	U11806	U17576
Sample Date			06/09/04	04/21/05	09/21/05	10/03/05	11/10/05	12/12/05
URS time				1514	2911	18015	0	0
Oil Time				0	0	4202	0	0
Via @40 Deg C mm	272.0	368.0	299.7	310.2	313.0	313.9	315.3	312.4
TAN mg KOH/g		0.99	0.33	0.40	0.48	0.42	0.46	0.46
Metals								
Iron ppm	150	<1	9	9	14	21	2	
Aluminum ppm	10	<1	<1	<1	<1	<1	<1	
Chromium ppm	5	<1	<1	<1	<1	<1	<1	
Copper ppm	50	<1	3	3	4	6	5	
Lead ppm	75	<1	<1	1	<1	<1	<1	
Tin ppm	5	<1	<1	<1	<1	<1	<1	
Nickel ppm	5	<1	<1	<1	<1	<1	<1	
Silver ppm	5.0	<1	0.4	0.4	0.4	0.4	0.4	
Silicon ppm	20	4	1	6	3	5		
Sodium ppm		<3	<4	<4	<4	<4	<4	
Boron ppm		<8	<3	<3	3	<3	15	
Zinc ppm		2	6	8	12	11	4	
Phosphorus ppm		304	359	299	368	236	254	
Calcium ppm		1	<1	1	<1	1	24	
Magnesium ppm		<1	<1	<1	<1	<1	1	
Barium ppm		<1	<1	<1	<1	<1	9	
Molybdenum ppm		<1	<1	<1	<1	<1	1	
Potassium ppm		<5	<3	<3	<3	<3	4	
Particulate Count								
4-6 um /100 mL		28453	152432	142282	191111	2695135	3653724	
6-10 um /100 mL		19955	20360	25105	50811	3408378	361111	
10-14 um /100 mL		4970	2042	3594	7117	349219	7427	
14-25 um /100 mL		2402	1201	2012	2553	8599	1952	
25-50 um /100 mL		300	300	420	541	390	270	
50-100 um /100 mL		15	90	120	120	30	90	
> 100 um /100 mL		0	0	0	0	0	30	
ISO Contam. Code		17/15/12	16/15/12	18/15/11	19/16/12	23/22/14	22/19/12	
Water by KF ppm		250	16	13	17	<10	25	16
DR Ferrography								

Evaluated By: David P. Fryckl, CLS - Certified LS - For questions about this report, please call 888-437-4882. Code: CALWIN Calwind Inc. Phone: (861) 822-7649 Fax: (861) 822-3262
 These results are submitted pursuant to our current Terms, Conditions and Limitations and Laboratory Pricing Policy. No responsibility or liability is assumed for the manner in which these results are used or interpreted.



101 Corporate Place, Vallejo, CA 94590

Unit Type : Gear (GN_GR001) Gear (GN_GR001)
 Oil Type : TE_136 Texaco Meropa ISO VG 320 (Mineral) P.O. # B6286
 Sampled : 01/23/06 Shipped : 01/30/06 Received : 01/31/06 Printed: 02/02/06

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 15:54:57

ABNORMAL: The ferrous debris consists of a few cutting, sliding/scuffing, and normal rubbing wear particles. Approximately 2% of the wear particles are of a copper alloy origin. The foreign contaminants are inorganic crystalline and fibers. This sample is rated normal, however the ratio of large to small particles (L/Ds) and non-ferrous debris observed warrants monitoring.

Analytical Ferrography

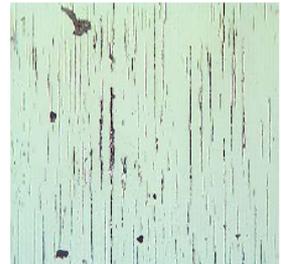


Photo 1: 100X shows the concentration of particles at the entry region.

Density Large	8.8
Density Small	2.1
Wear Particle	10.9
Caution	59.6
Alarm	79.7
Percent Large	61
Severity Index	73
Dilution Factor	1
Wear Particles	
Rubbing Wear	65 %
Sliding Wear	1 %
Cutting Wear	2 %
Fatigue Wear	0 %
Laminar Wear	2 %
Spherical Wear	0 %
Ferrous Oxides	
Red Oxide	0 %
Dark Metallo-ox	0 %
Black Oxide	1 %
Corrosion	0 %
Contaminants	
Friction Polymr	0 %
Sand, Dirt	25 %
Fibers	3 %
Spines	0 %
Other	1 %

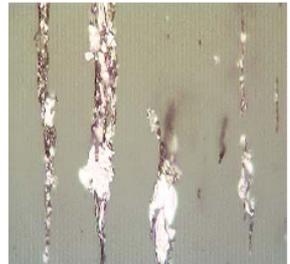
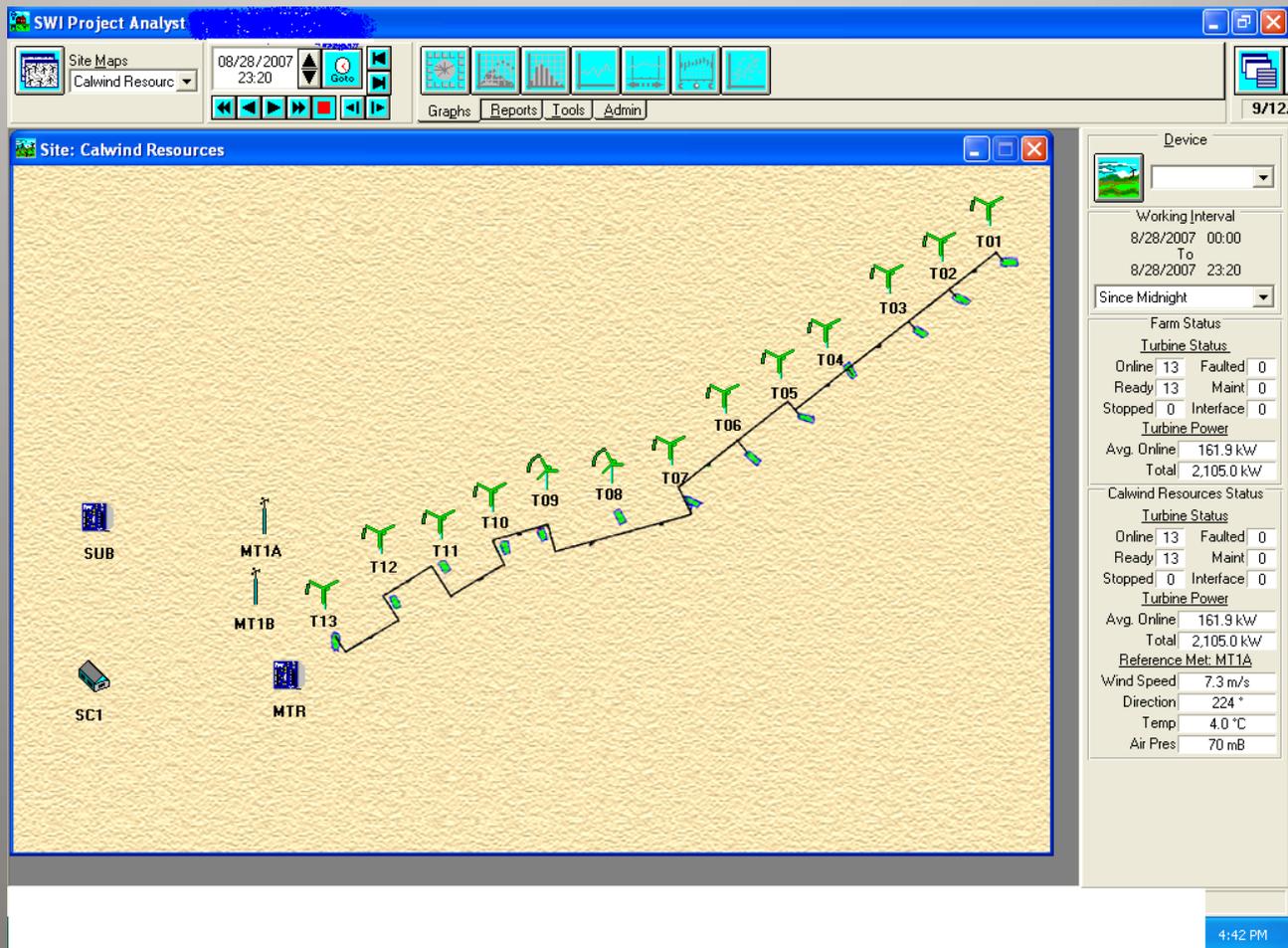


Photo 2: 500X shows some of the larger wear particles at the entry region. The largest one seen here is approximately 22 x 20 microns.

For questions about this report, please call 888 HER-OUTH (437-4884) between 8:00 am and 5:00 pm PST. A Technical Support Representative will be glad to help you. Code: CALWIN Calwind Inc. Phone: (861) 822-7649 Fax: (861) 822-3262
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Second Wind Advanced Distributed Monitoring System



CTM Installed on Turbine Controller

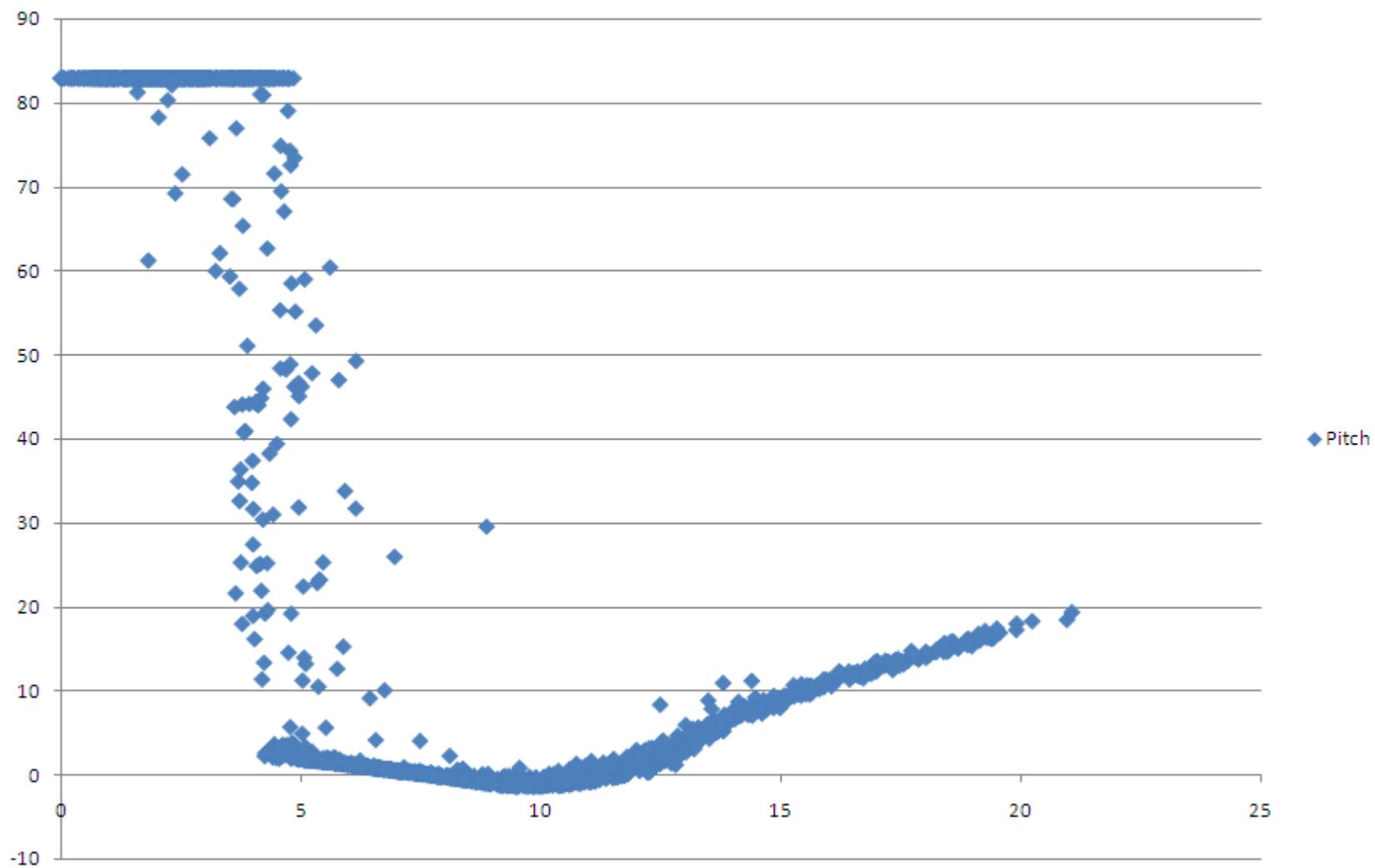


• VMP Controller

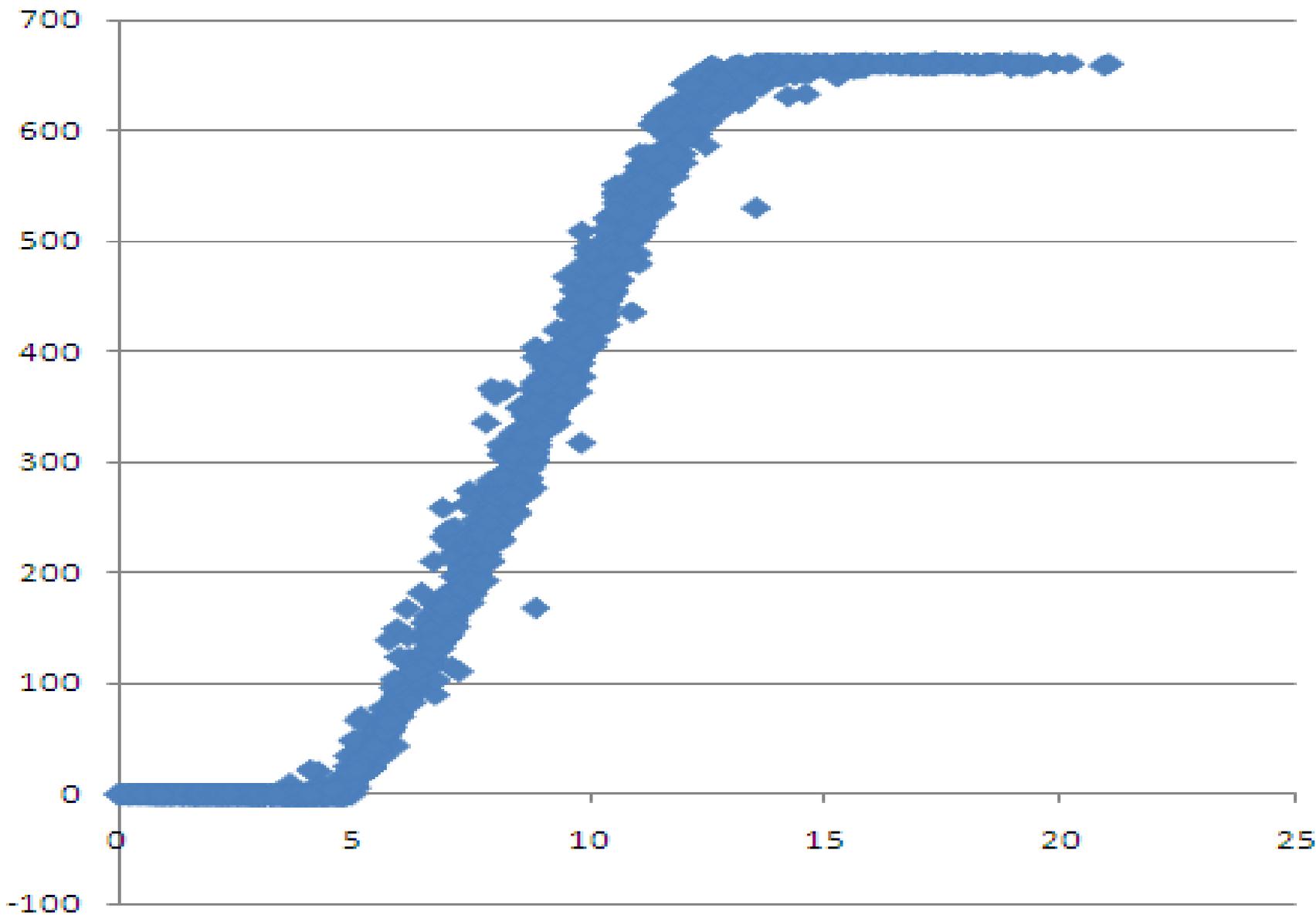


Second Wind CTM

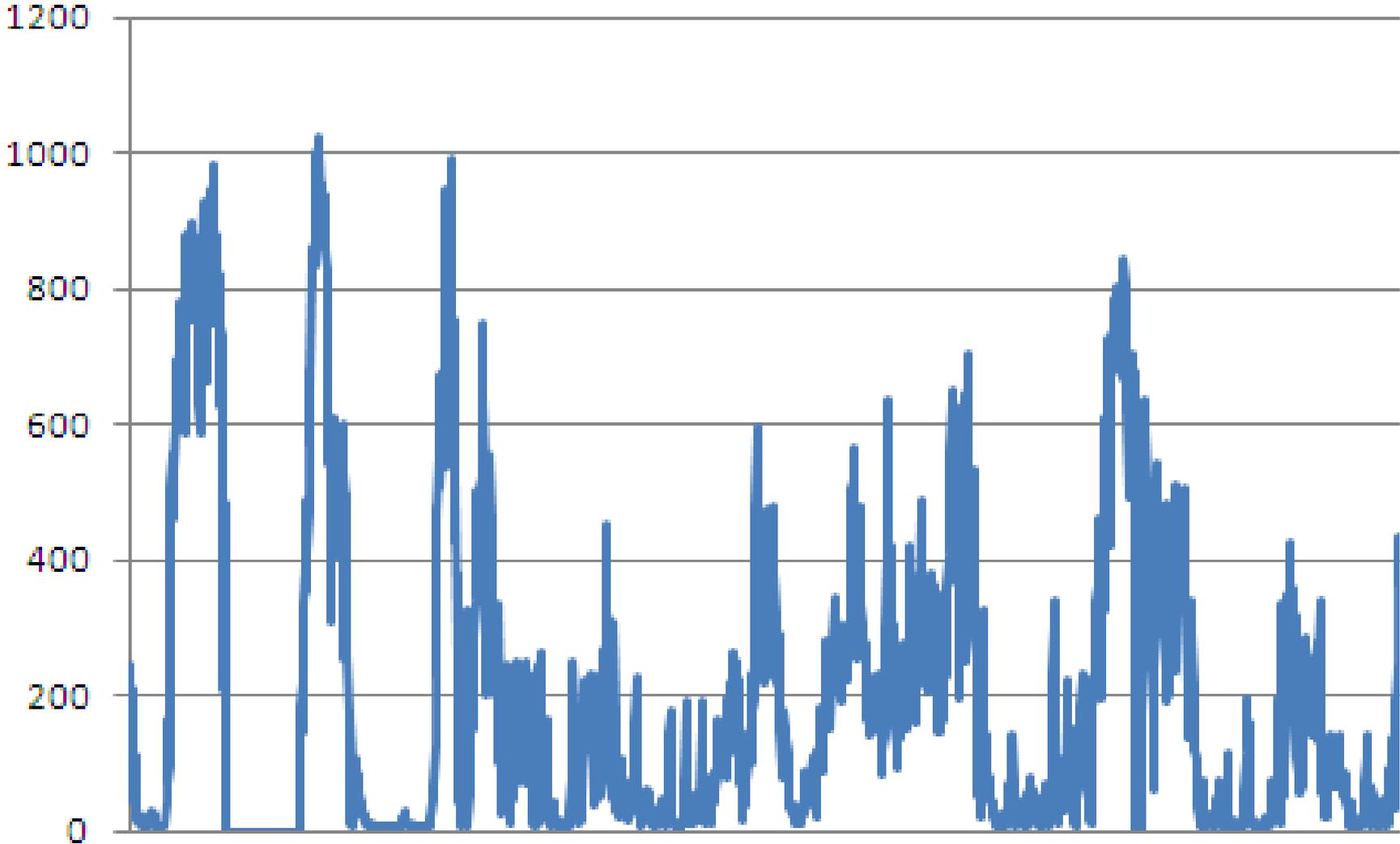
Pitch



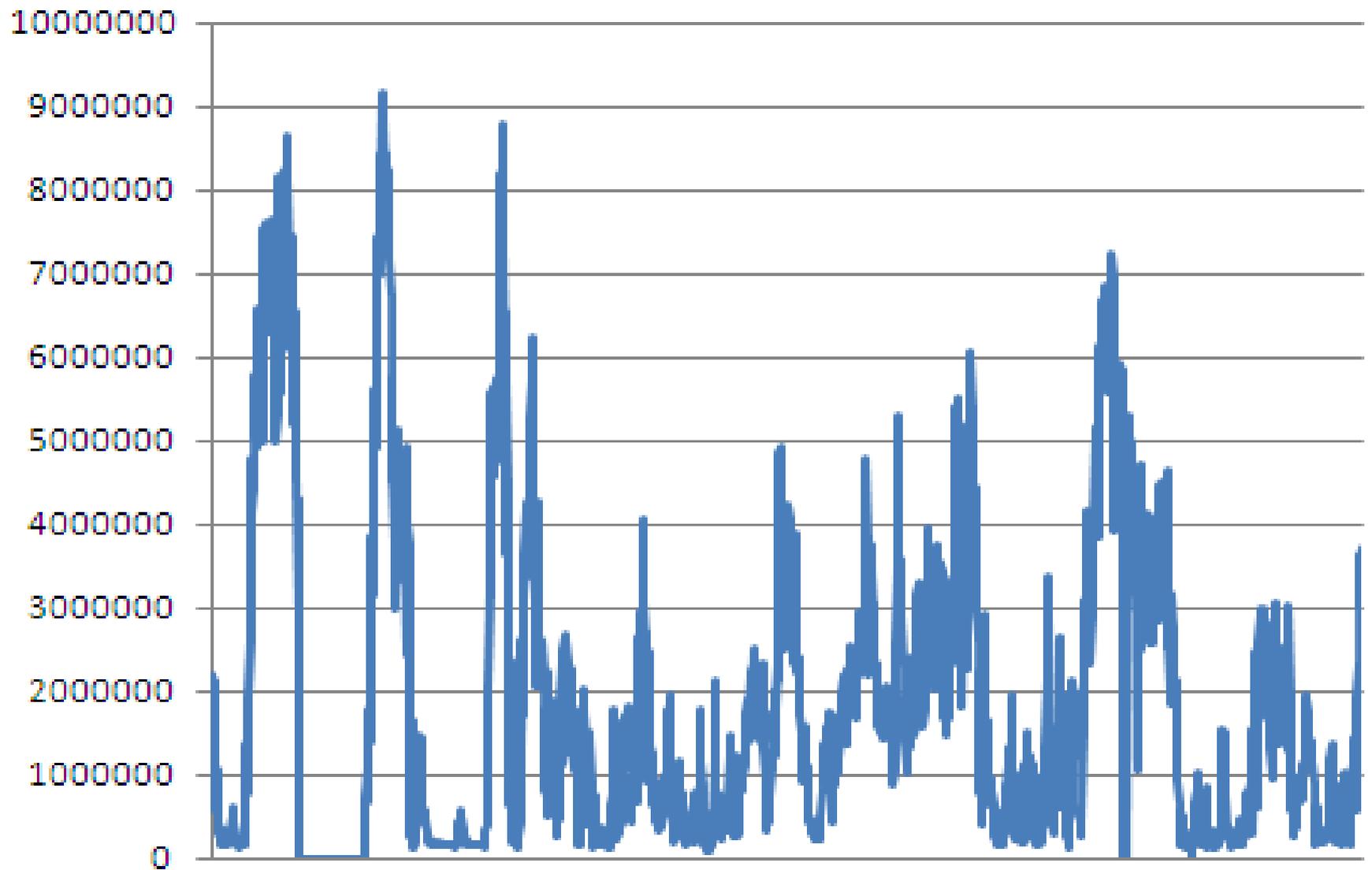
kW vs Mps



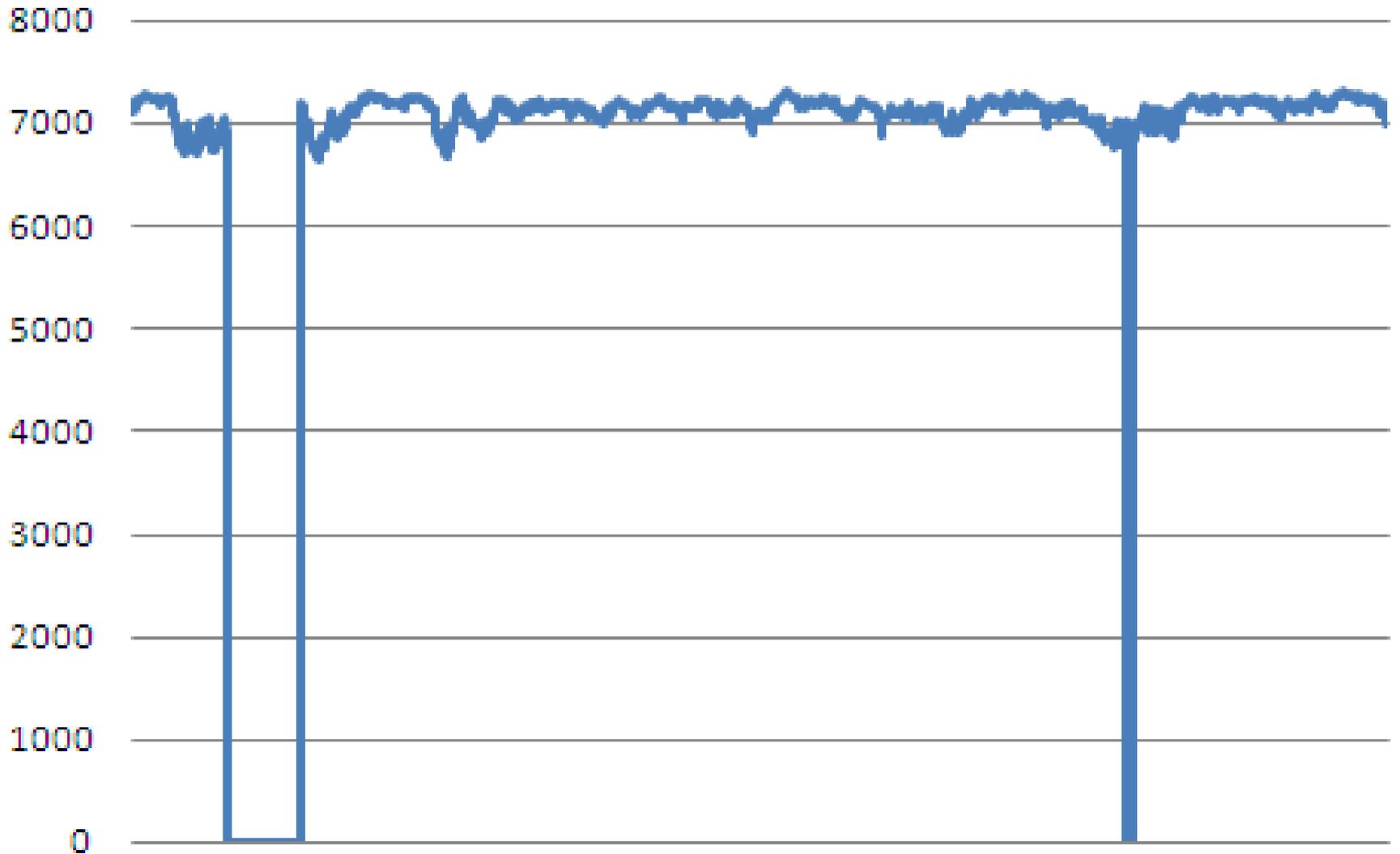
sub station amps



sub station VAR



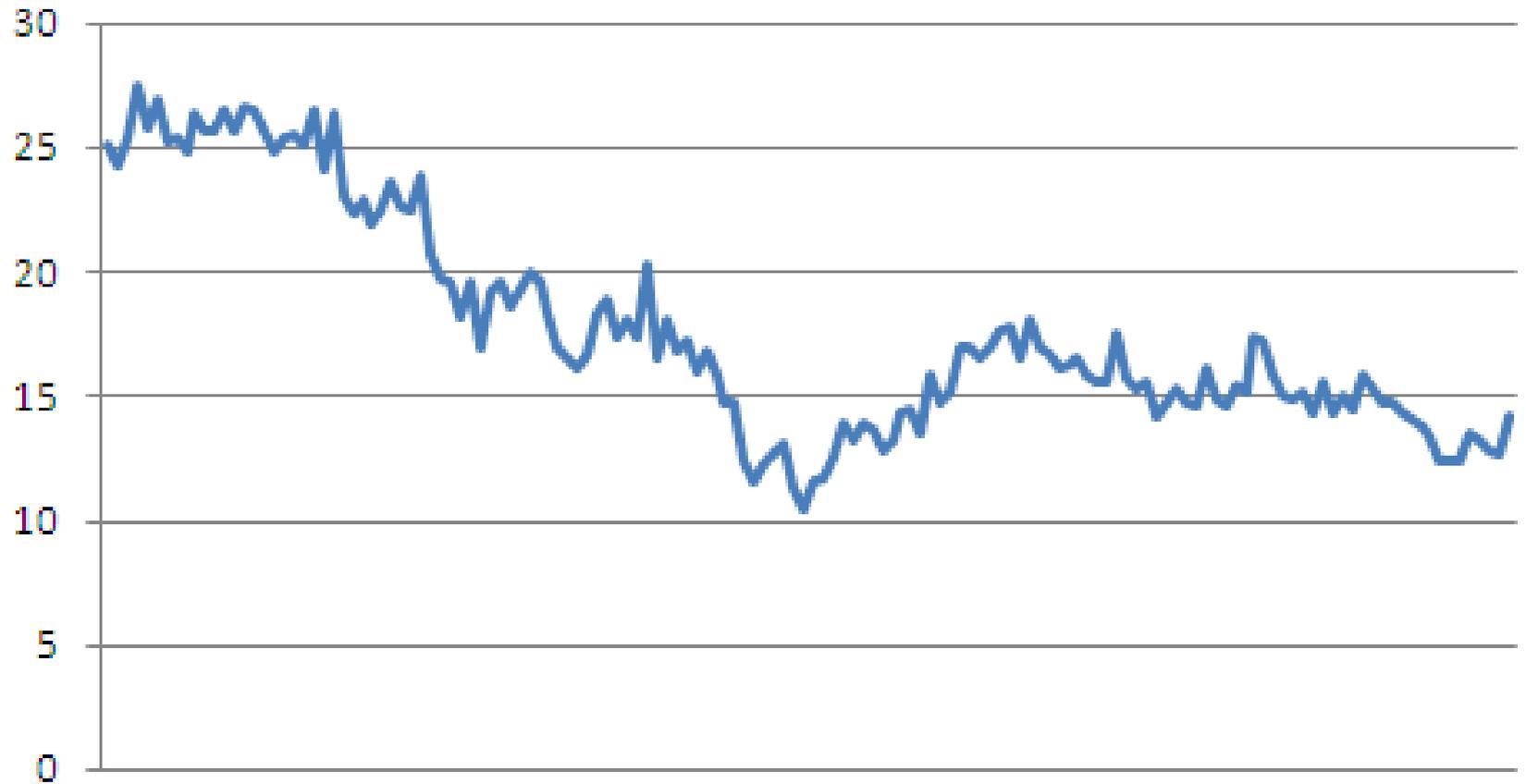
sub station volts



Fault Report					
Site Name: CalWind					
Start Time: 00:00 Wednesday, April 01, 2009					
Finish Time: 00:00 Friday, May 01, 2009					
30 days					
Notes:					
Turbi	Time Of Fault	Fault Description			
T13	4/1/2009 0:29	144 High windspeed			
T13	4/3/2009 4:06	362 Windshear ___ . _m/s,Nac. ___ . _m			
T13	4/3/2009 7:30	144 High windspeed			
T13	4/3/2009 8:13	315 ExEx low voltage			
T13	4/3/2009 8:22	CTM lost A.C. power			
T13	4/3/2009 8:23	Device Interface Error			
T13	4/3/2009 9:29	315 ExEx low voltage			
T13	4/3/2009 9:33	144 High windspeed			
T13	4/3/2009 9:47	315 ExEx low voltage			
T13	4/3/2009 9:48	CTM lost A.C. power			
T13	4/3/2009 9:49	Device Interface Error			
T13	4/3/2009 9:58	315 ExEx low voltage			
T13	4/3/2009 10:07	144 High windspeed			
T13	4/3/2009 12:26	144 High windspeed			
T13	4/3/2009 12:56	144 High windspeed			
T13	4/3/2009 17:27	144 High windspeed			

Event Report					
Site Name: CalWind					
Start Time: 00:00 Wednesday, April 01, 2009					
Finish Time: 00:00 Friday, May 01, 2009					
30 days					
Notes:					
Device Name,"Time Of Event","Event Description"					
T13,"4/1/2009 12:29:15 AM","Vestas VMP State = "PAUSE""					
T13,"4/1/2009 12:29:15 AM","End Normal State"					
T13,"4/1/2009 12:29:15 AM","Begin Errorstate"					
T13,"4/1/2009 12:29:15 AM","144 High windspeed"					
T13,"4/1/2009 12:29:15 AM","Turbine Went Not Ready"					
T13,"4/1/2009 12:29:30 AM","Turbine Went Offline"					
T13,"4/1/2009 3:52:05 AM","Vestas VMP State = "RUN""					
T13,"4/1/2009 3:52:05 AM","End Errorstate"					
T13,"4/1/2009 3:52:05 AM","Begin Normal State"					
T13,"4/1/2009 3:52:05 AM","Turbine Went Ready"					
T13,"4/1/2009 3:53:05 AM","Turbine Went Online"					
T13,"4/3/2009 4:06:10 AM","Vestas VMP State = "STOP""					
T13,"4/3/2009 4:06:10 AM","End Normal State"					
T13,"4/3/2009 4:06:10 AM","Begin Errorstate"					
T13,"4/3/2009 4:06:10 AM","362 Windshear __. _m/s,Nac. __. _m"					
T13,"4/3/2009 4:06:10 AM","Turbine Went Not Ready"					

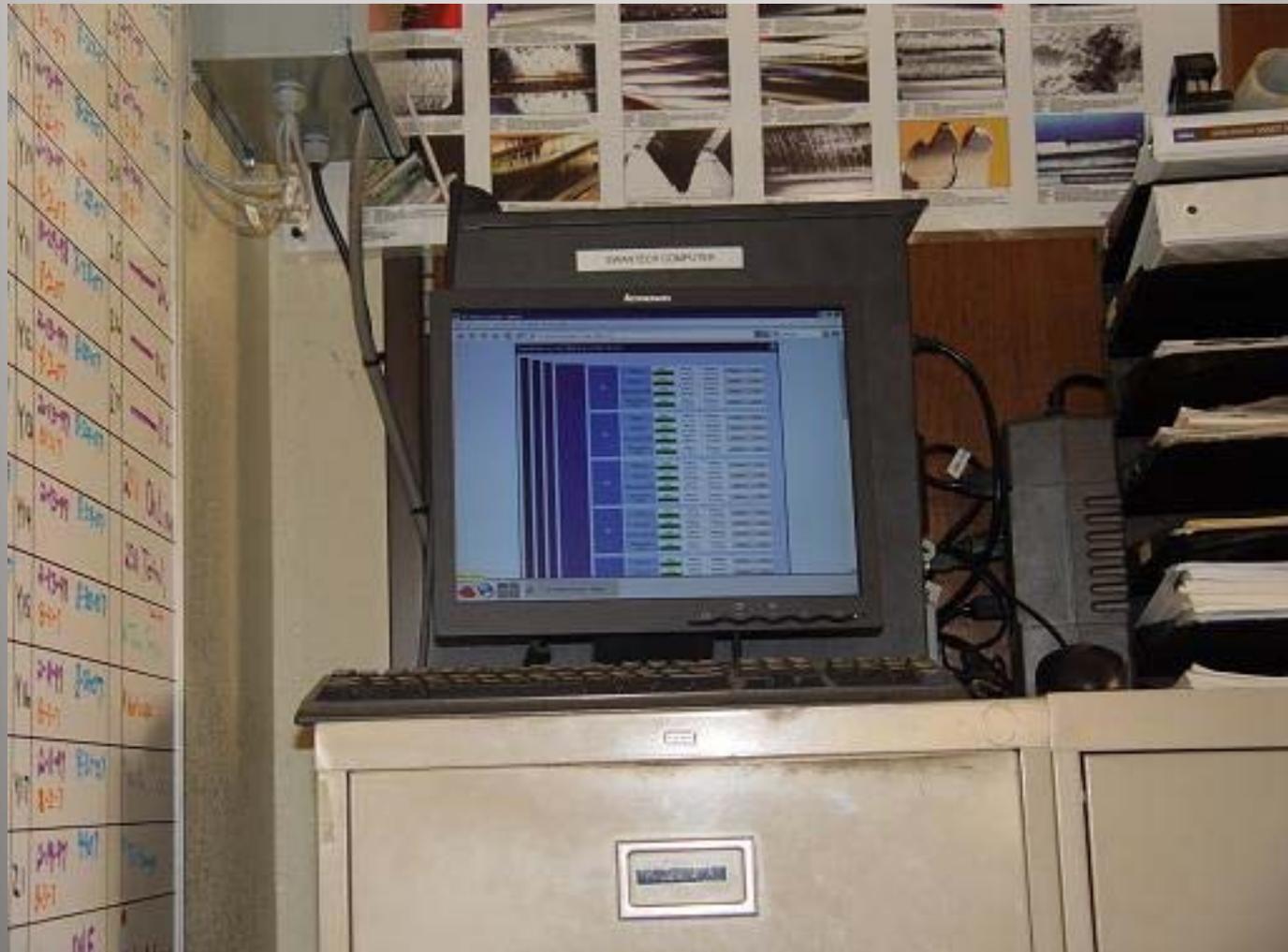
Wind speed (m/s)



Components of the Swantech System:

- Base Unit
- Base Radio Antenna
- Swan Guard
- Sensors on Gearbox
- Sensors on Generator
- Sensors on Yaw Drive & Main Shaft

Base Unit



Base Radio Antenna



13 @600+KW Wind Turbines 1 mile



Sensors on Gearbox



Planet sensor



Helical sensor

Sensors on Generator



Drive end



Non drive end

Sensors on Yaw Drive & Main Shaft



Yaw sensor

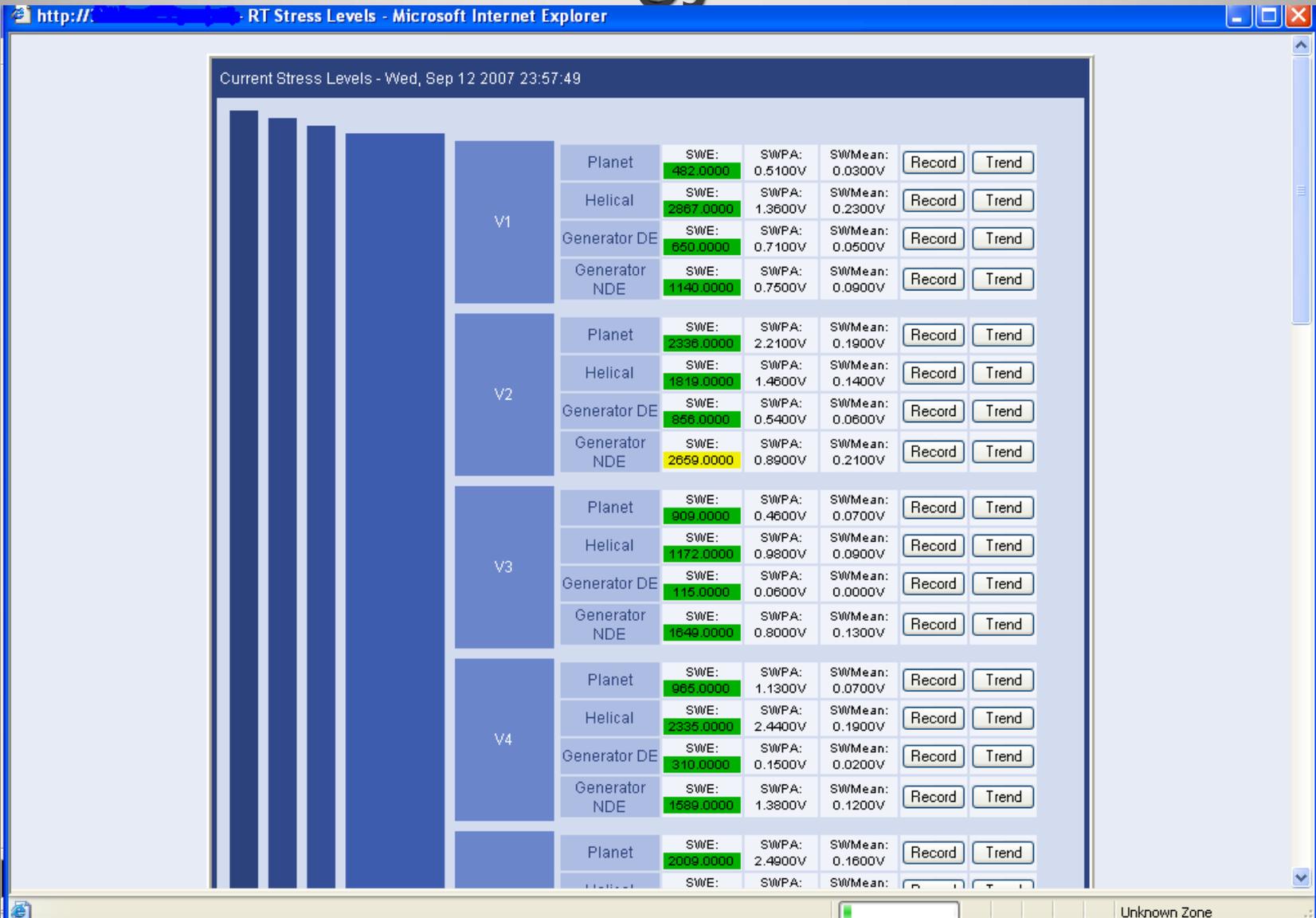


Main shaft sensor

Stress Wave Analysis

- **Stress Wave Analysis (SWAN)** is a patented technology that provides measurement of overall machine health SWAN detects Stress Wave Energy that is created by shock and friction events SWAN enables the separation of these high frequency stress waves from the much lower range of operating machinery dynamics and audible noise, providing a clear indication of machine health.

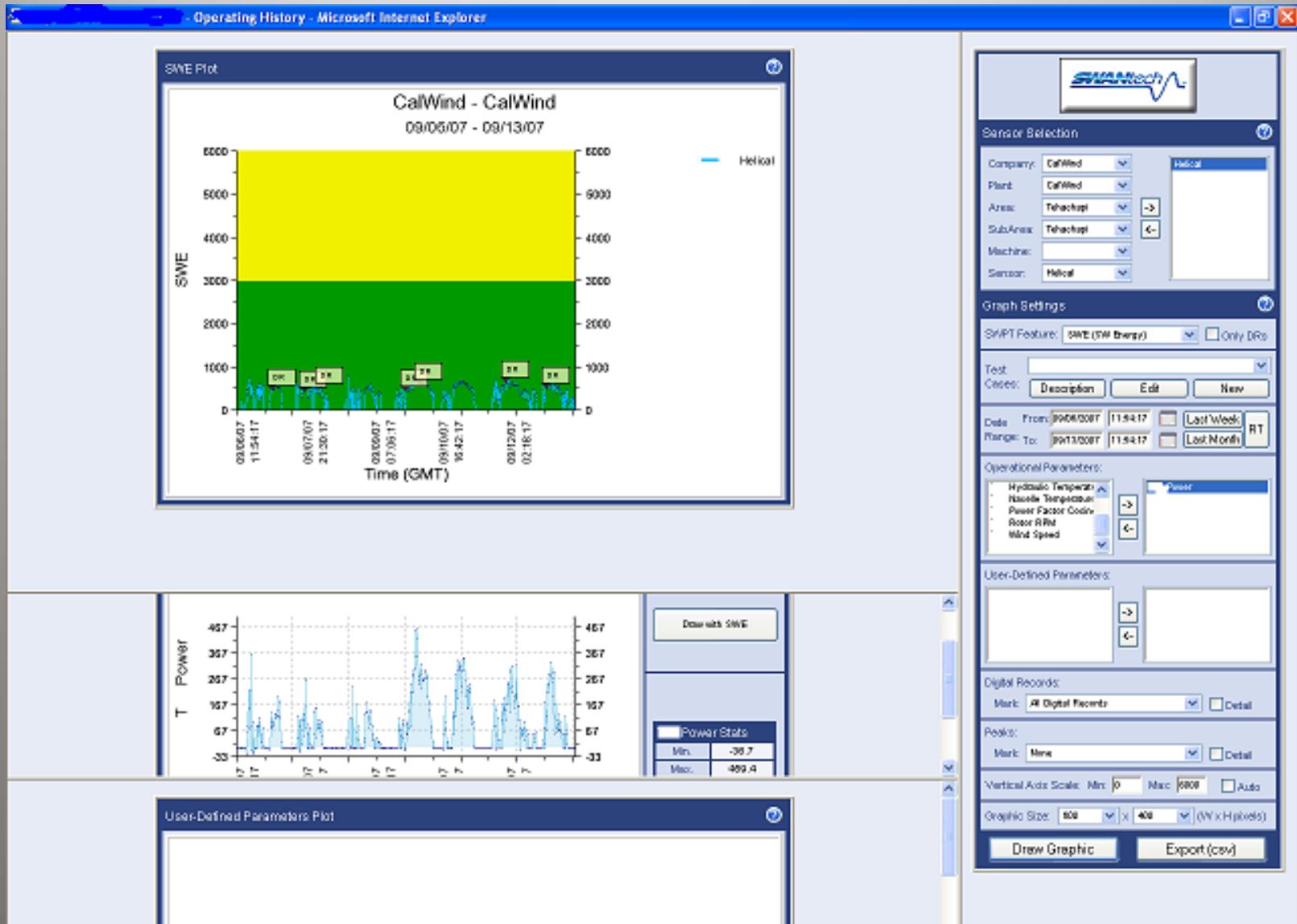
Swan Stress Energy Screen



Operational Parameters for Digital Record Triggering

Planetary	Name	Description	Persist	Cease	Condition
	High Wind				
	100 KW				
	300 KW				
	660 KW				
	Oil Sump Temp				
	Gear Bearing Tmp				
Helical	Name	Description	Persist	Cease	Condition
	High Wind				
	100 KW				
	300 KW				
	660 KW				
	Oil Sump Temp				
	Gear Bearing Tmp	See Shutdown Temp - 5°C			

SWE Plot - Normal



SWE Plot - Abnormal

Operating History - Microsoft Internet Explorer

SWE Plot

CalWind - CalWind
09/06/07 - 09/13/07

Y-axis: SWE (0 to 14000)
X-axis: Time (GMT)

Legend: Helical

Power

Y-axis: Power (-35 to 465)

Buttons: Draw with SWE

Power Stats	
Min.	-38.7
Max.	443.6

User-Defined Parameters Plot

User Defined Parameters not Available or not Selected

Sensor Selection

Company: CalWind
Plant: CalWind
Area: Tehachapi
SubArea: Tehachapi
Machine:
Sensor: Helical

Graph Settings

SWPT Feature: SWE (SW Energy) Only DRs

Test:
Cases: Description Edit New

Date From: 09/06/2007 11:54:17 Last Week RT
Range To: 09/13/2007 11:54:17 Last Month

Operational Parameters:

- Generator RPM
- Generator Temperat
- Hydraulic Temperat
- Nacelle Temperature
- Power Factor Cosin
- Rotor RPM

User-Defined Parameters:

Digital Records:

Mark: All Digital Records Detail

Peaks:

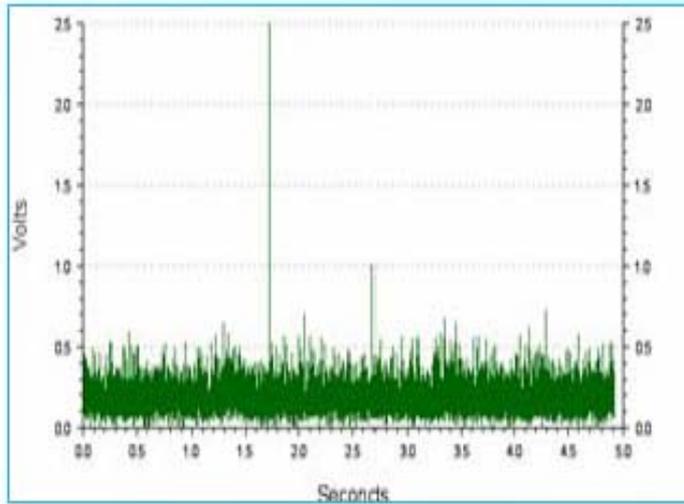
Mark: None Detail

Vertical Axis Scale: Min: 0 Max: 16000 Auto

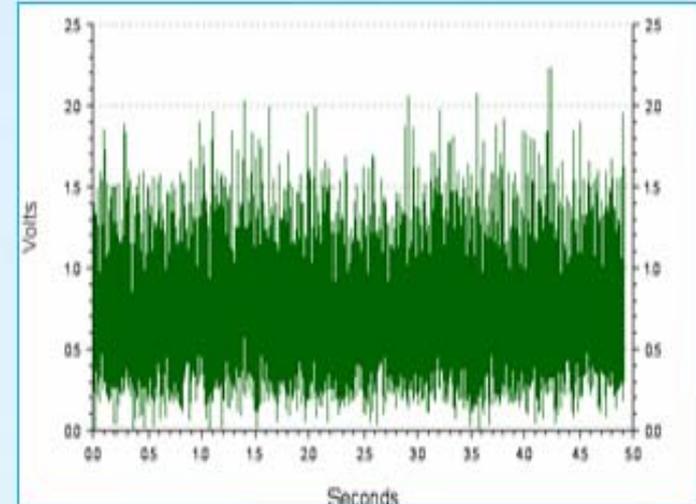
Graphic Size: 600 x 400 (W x H pixels)

Buttons: Draw Graphic Export (csv)

Generic Domain Time Series



Healthy



Random Friction

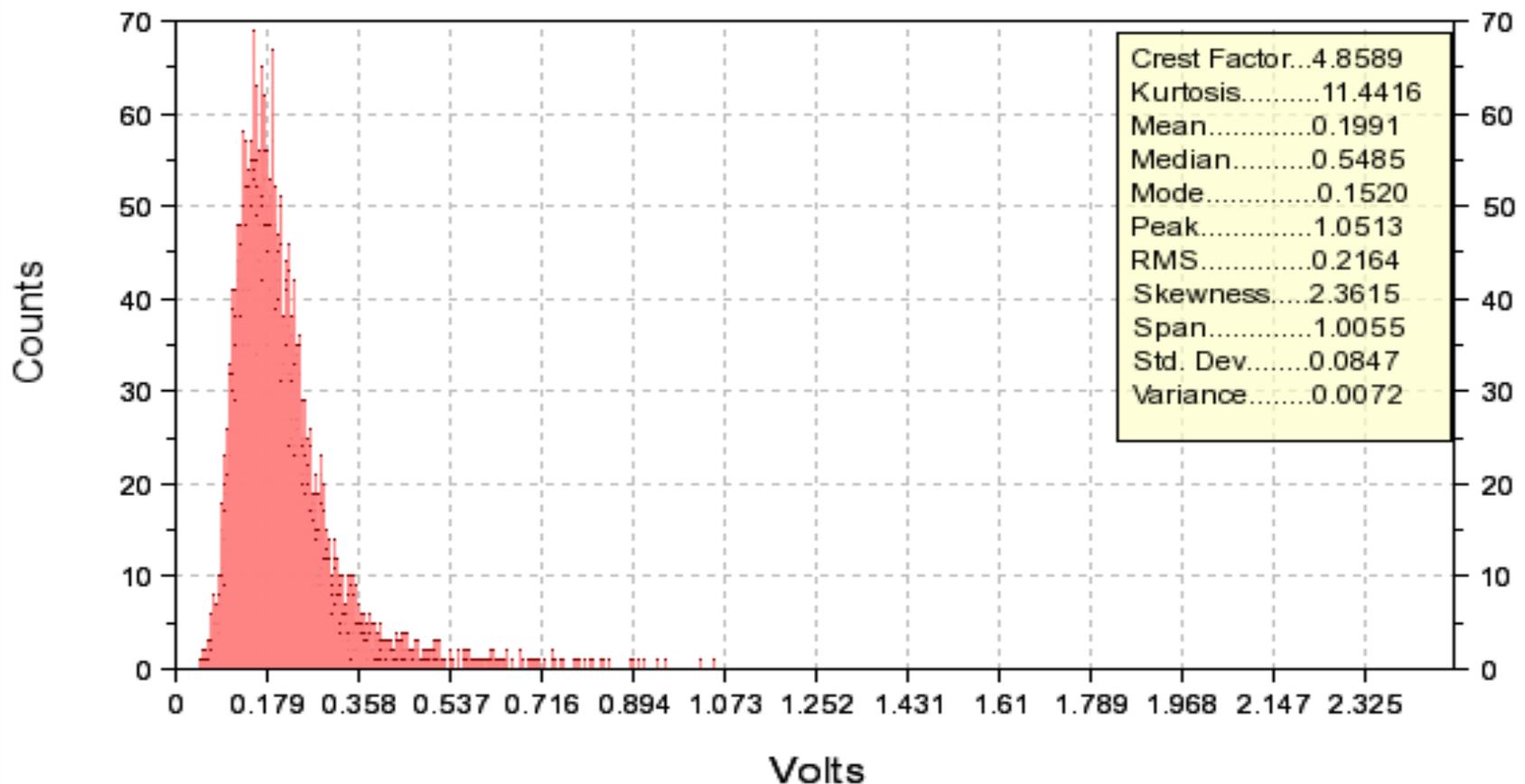
- Demodulated sensor signal
- Shows random friction and shock events

Histogram Plot - Normal

CalWind - CalWind - Tehachapi

Tehachapi - - Helical

Date Recorded: 09/04/07 09:42:55

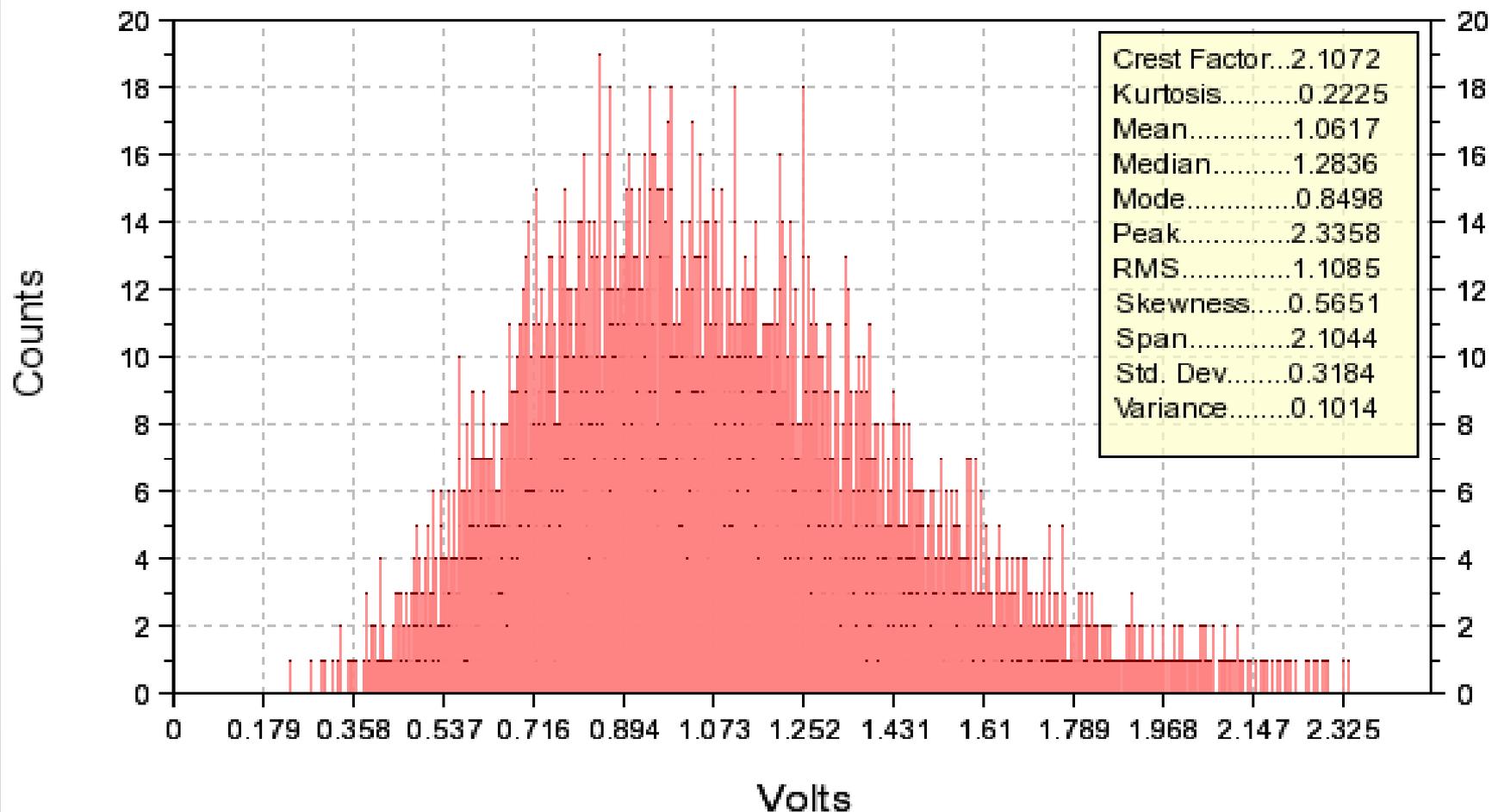


Histogram Plot - Abnormal

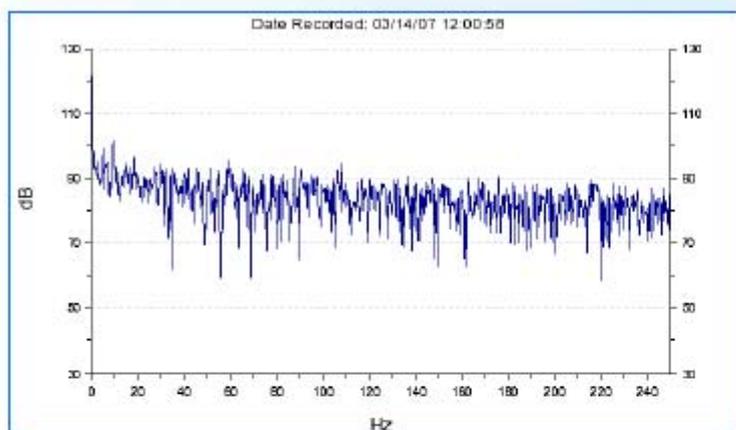
CalWind - CalWind - Tehachapi

Tehachapi - - Helical

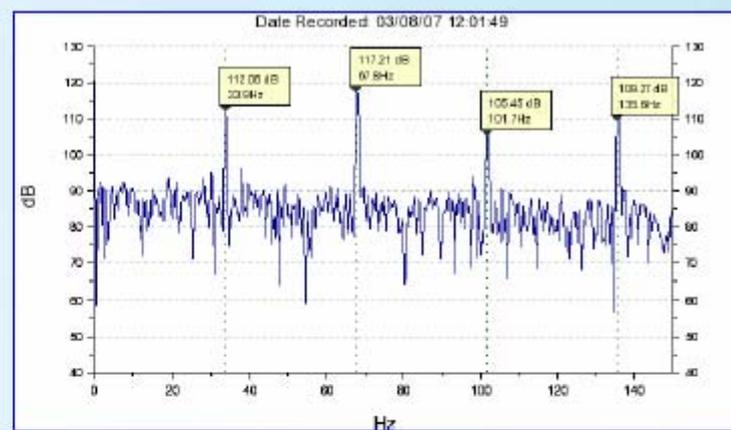
Date Recorded: 09/04/07 19:43:43



Generic FFT Spectral Analysis



Healthy



Repetitive Shock

- Spectrum only contains friction and shock events
- Healthy components produce a flat spectrum
- Repetitive shock/friction events show up as significant spectral lines

Project overview

CALWIND

CRI

CalWind Overview

SWANwind

Company Overview > CalWind

11:28 AM

Machine Conditions



Current Operating Parameters

Name	Value
Power	641.8000
Generator F	1896.0000
Rotor RPM	29.6000
Wind Speed	11.5000
Power	676.3000

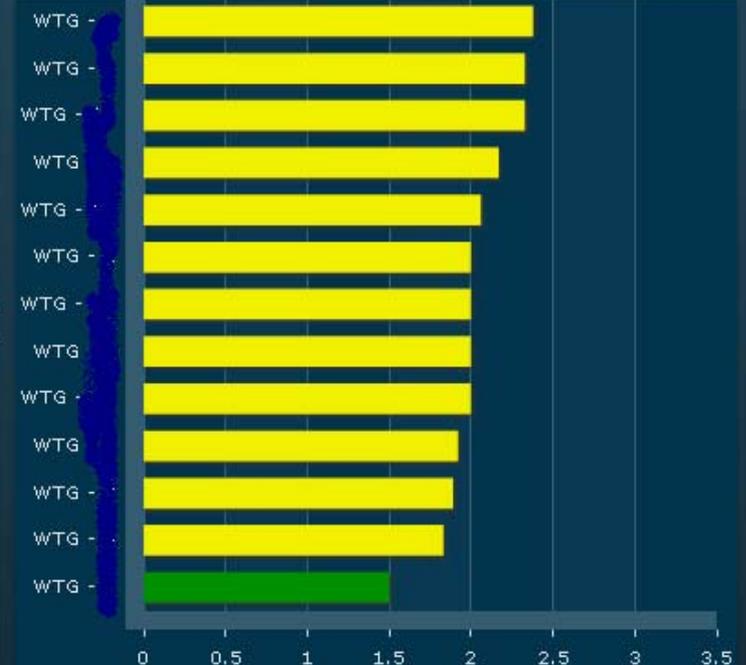
Plant Overview

Tehachapi



Machine condition

CalWind



Maintenance & Alarms

Options

Date	Machine	# Alarms	Component	Event Description
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Stress Performance Index Trend

Stress Performance Index Trends

Sensors Selection

CRI - CalWind

GBX HSS

GBX LSS

GEN DE

GEN NDE

MSB - 1

Yaw

Date Range Selection

From: 09/19/09

To: 10/04/09

Trend Settings

Max. SPI: 2000

Auto-Scale

Sort by Machine

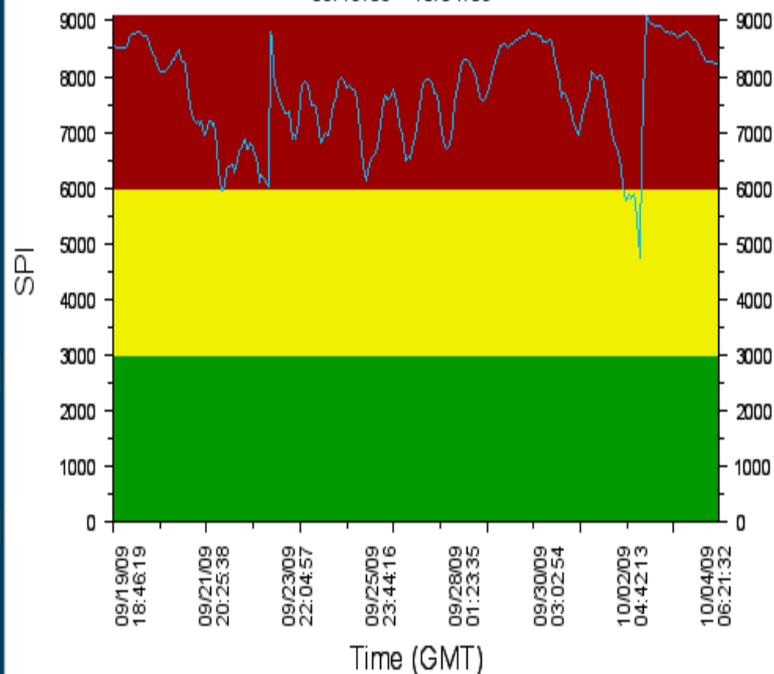
Generate Report

Generate Report

CalWind - CalWind

WTG - GBX HSS

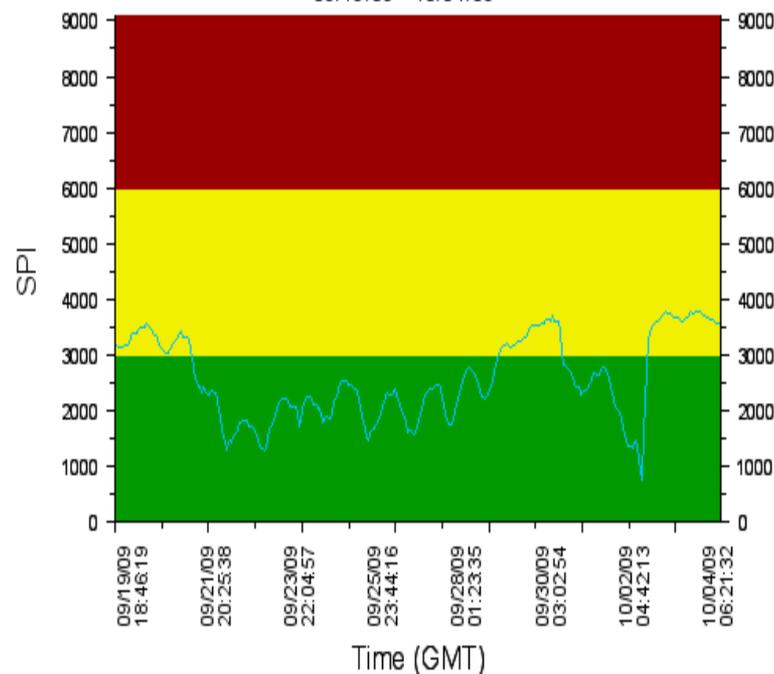
09/19/09 - 10/04/09



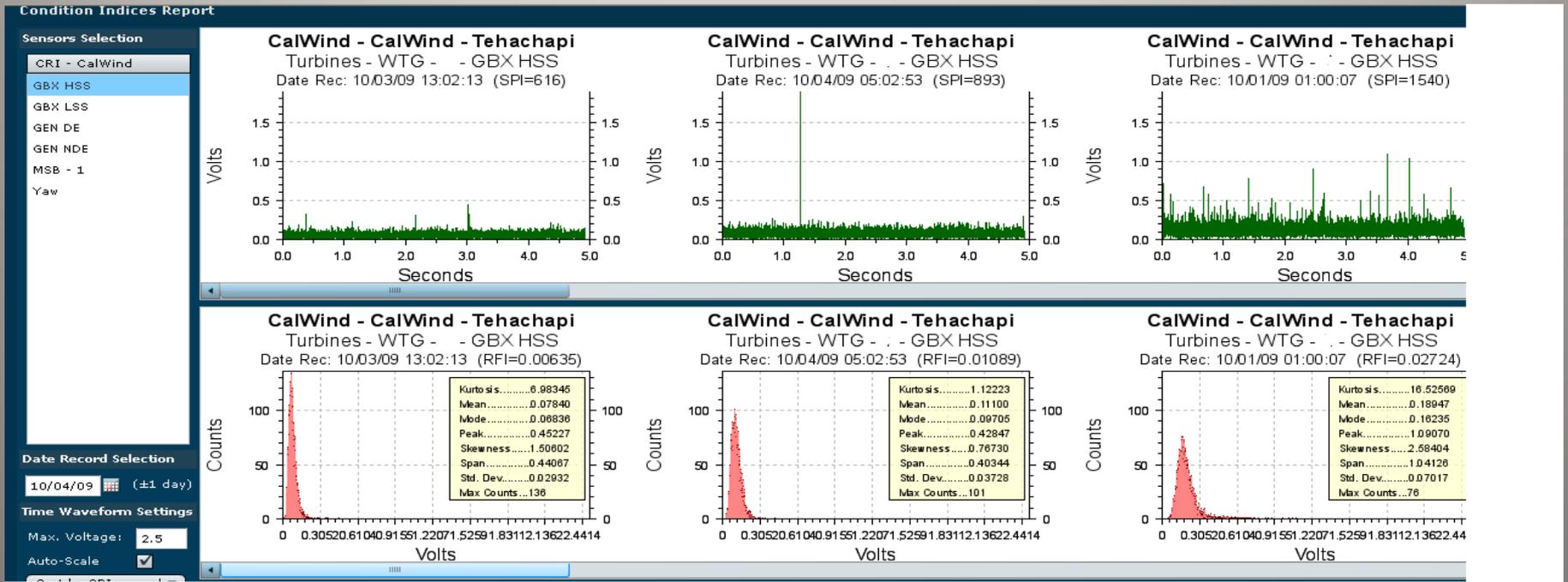
CalWind - CalWind

WTG - GBX HSS

09/19/09 - 10/04/09



Condition Indices Report



Concluding Summary:

- SCADA – Second Wind ADMS for operational data
- Oil samples with analytical ferrography
- Swantech condition monitoring system
- Not discussed:
- Manufactures training and repair procedures and specifications
- Documentation of service

