

REMEDIAL ACTION STEP OF SUBSYNCHRONOUS VIBRATION TRIP ON STEAM TURBINE

A CASE STUDY OF EGAT SOUTH BANGKOK POWER PLANT

18th Conference of the Electric Power Supply Industry (CEPSI)

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OUTLINES



Event Overview



Introduction



Methods



Results



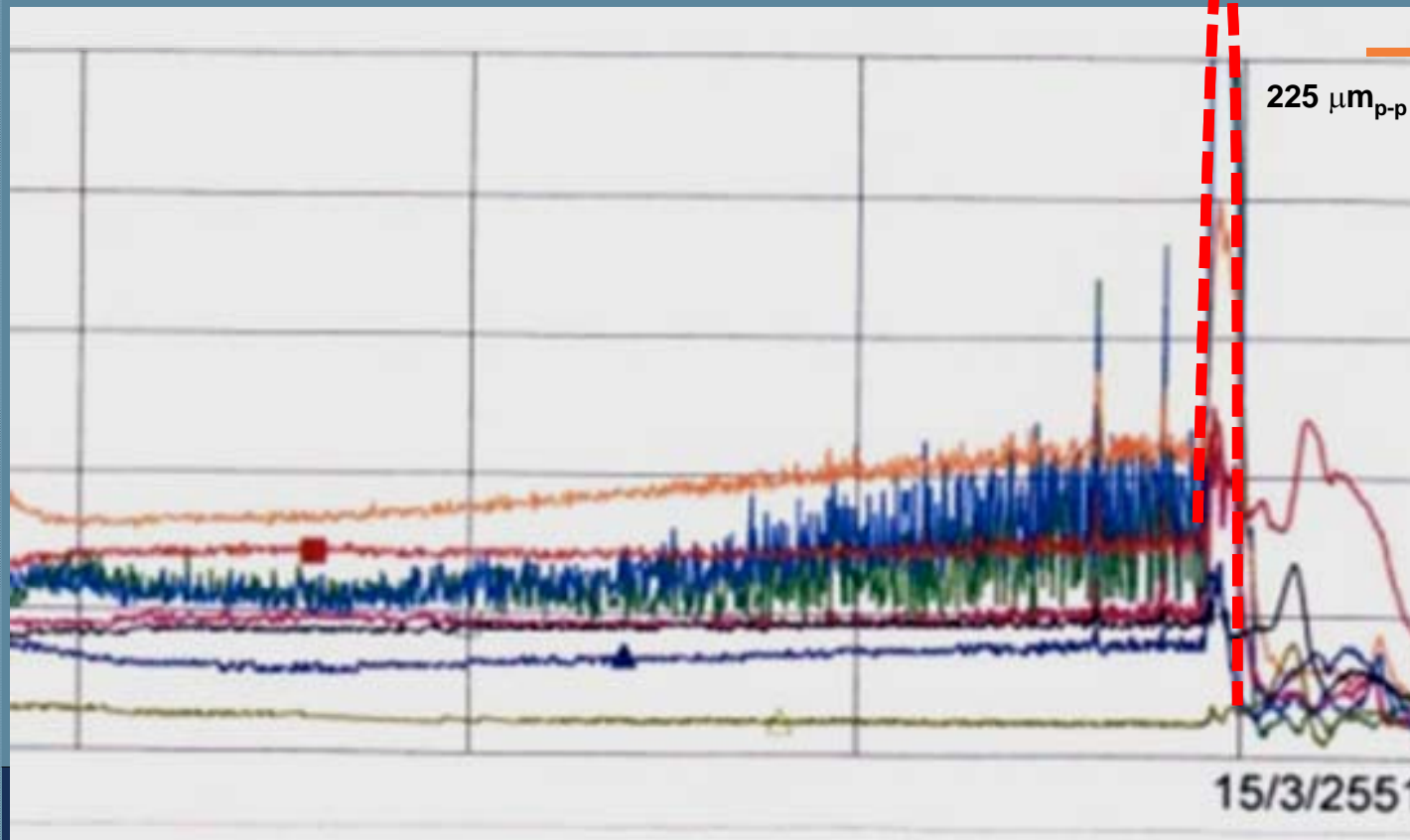
Conclusions



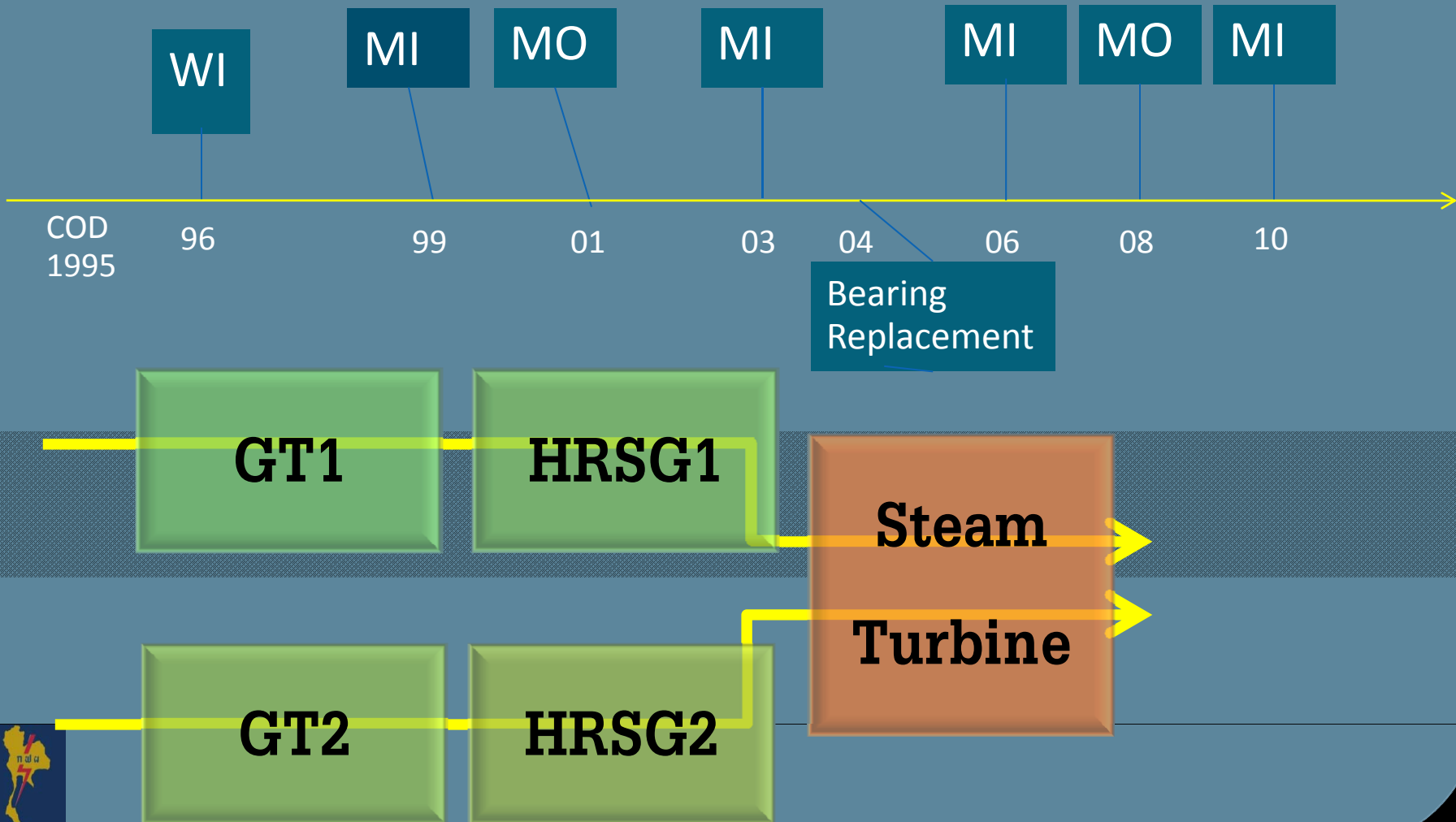
Event Overview

March 15th, 2008

Trip Setting $225 \mu\text{m}_{\text{p-p}}$

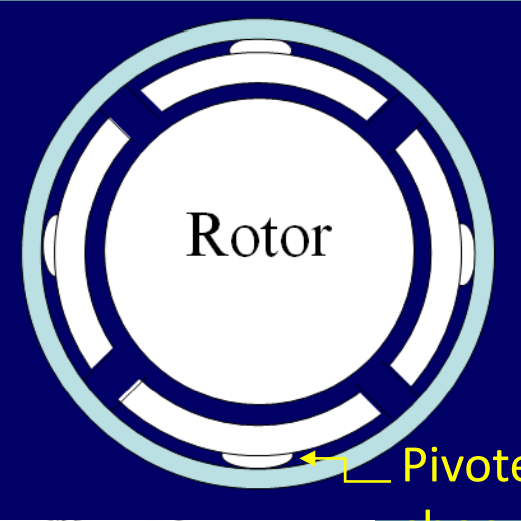
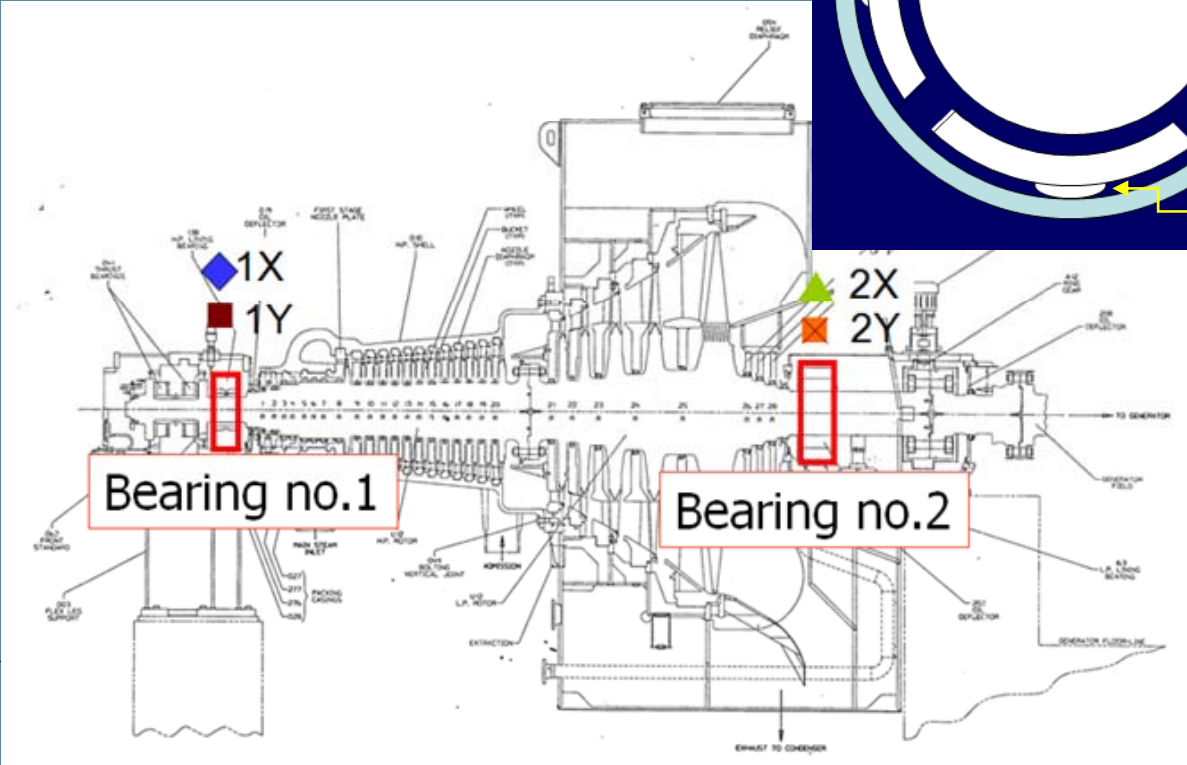


Introduction



Introduction

Tilt Pad Bearing from Kingsbury Inc.



Pivoted shoe

Standard of Condition Monitoring

Overall Shaft Vibration

Bearing Metal Temperature

Lube Oil Inlet Temperature

Generator Cooling Temperature

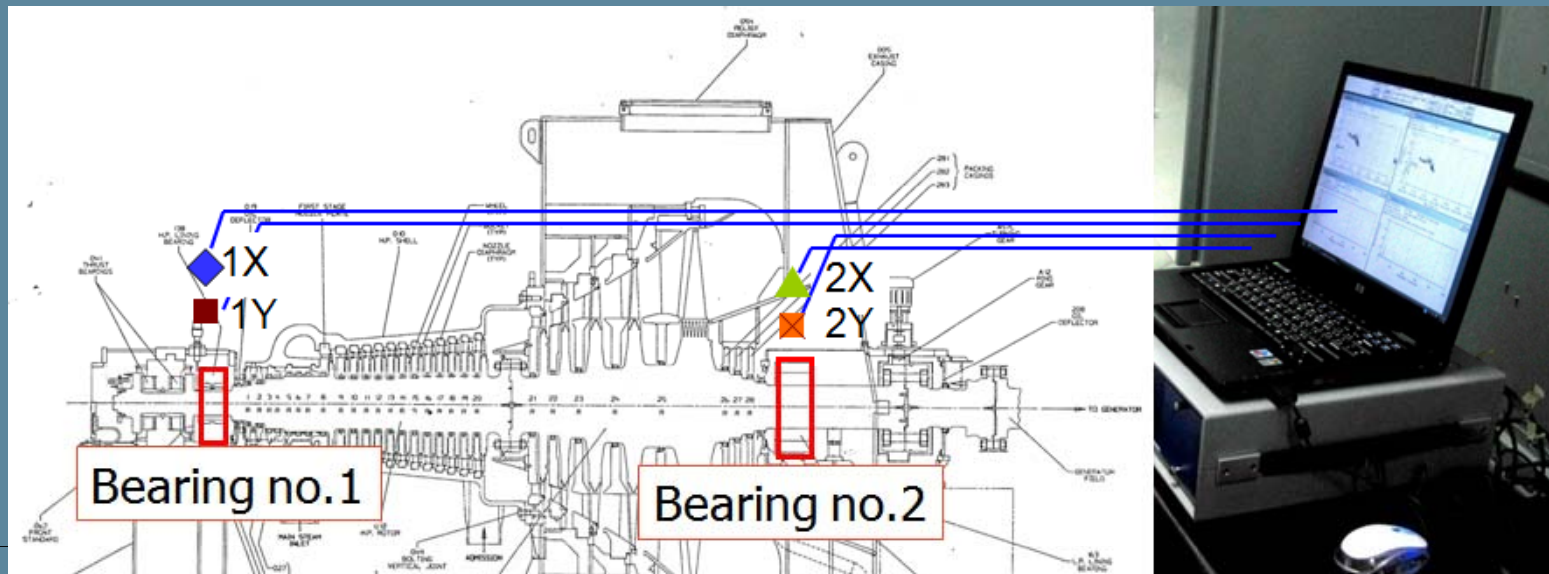


Methods

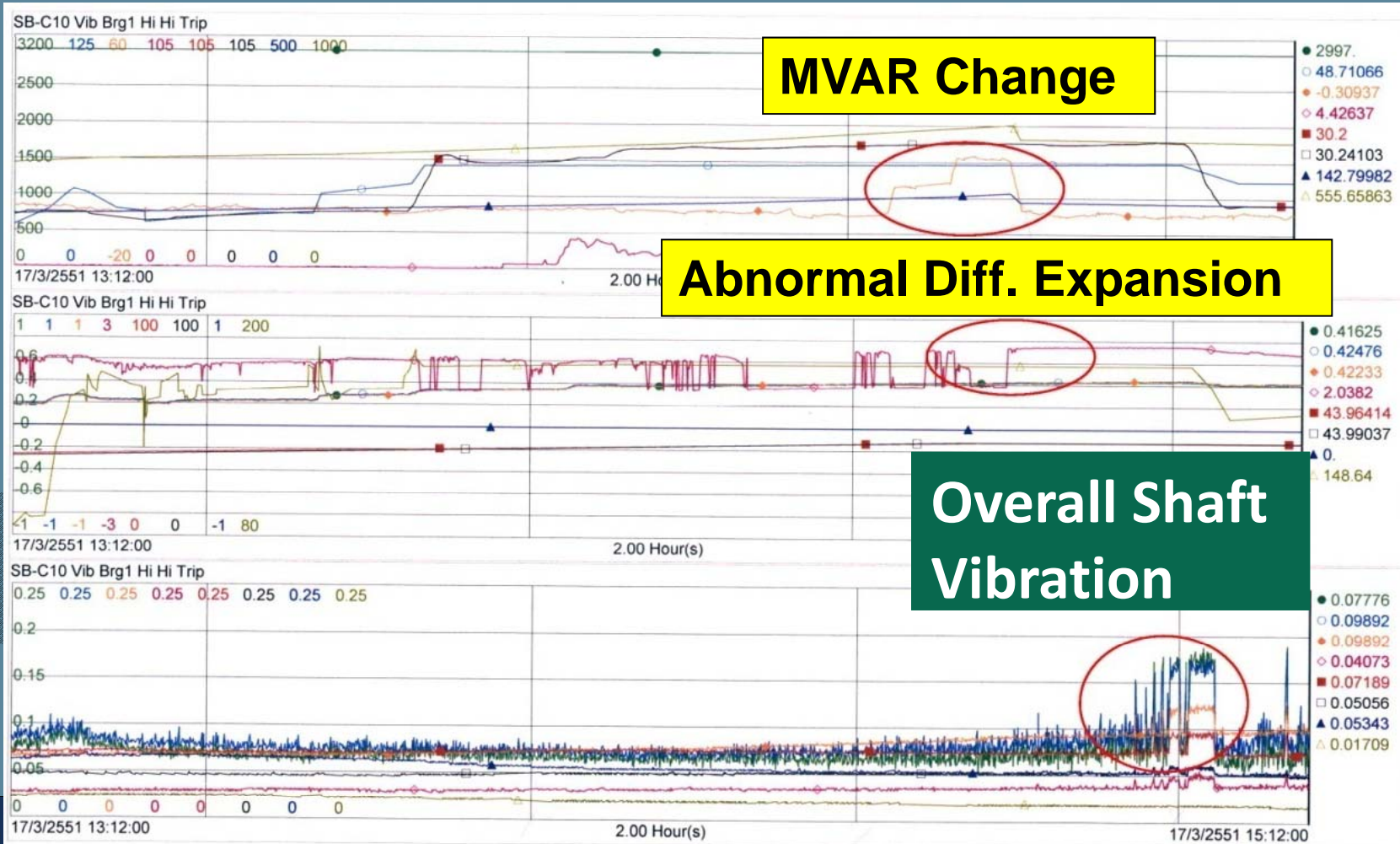
Vibration



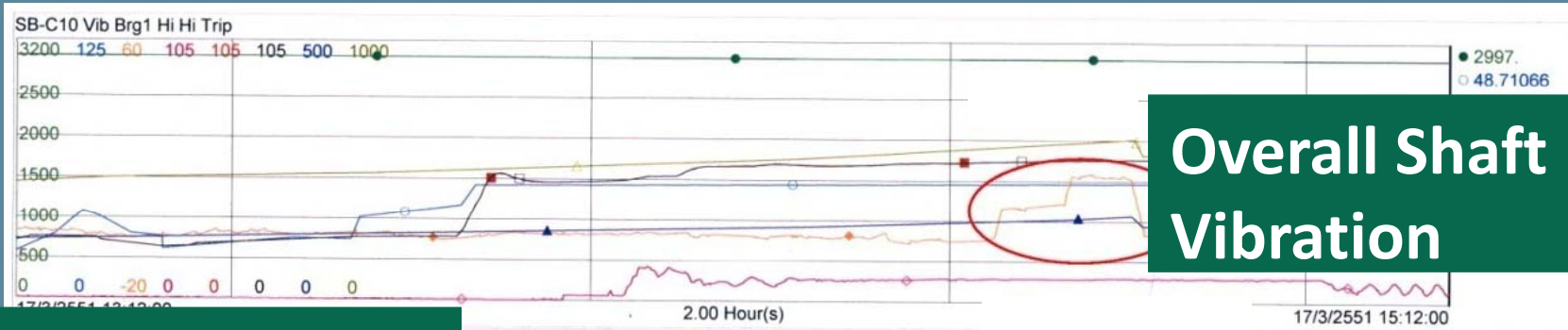
Subsynchronous



Methods



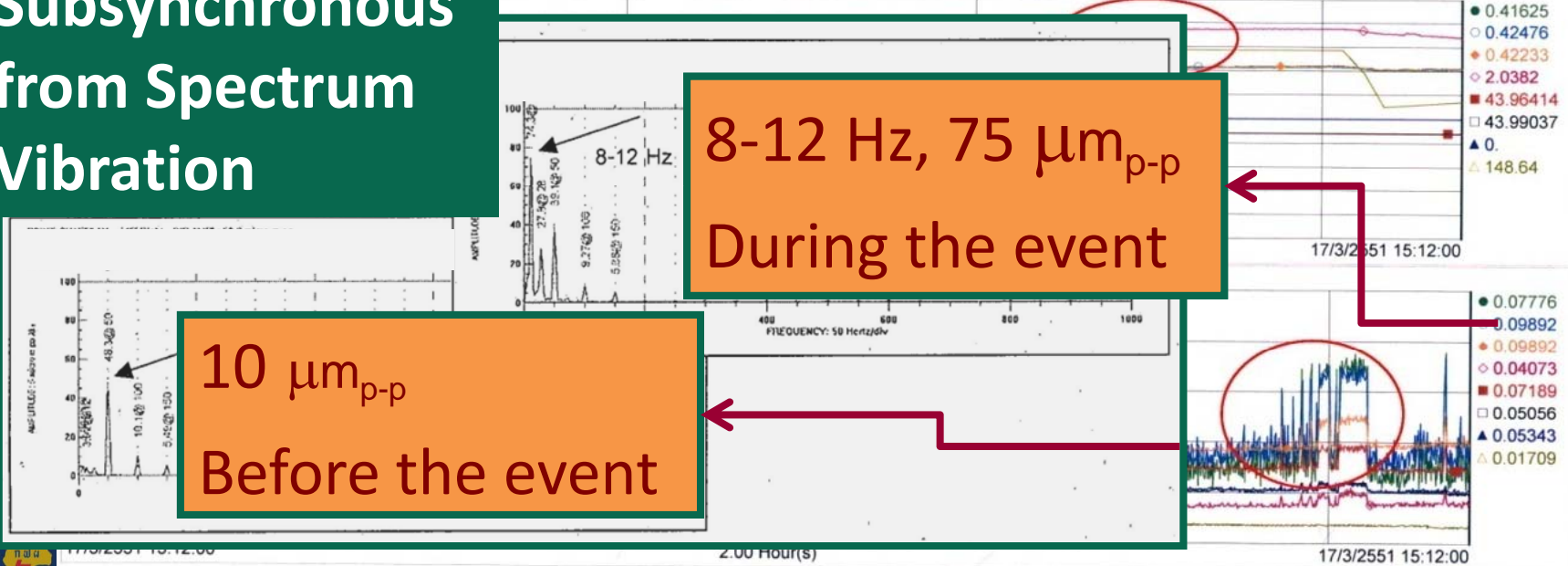
Methods



**Subsynchronous
from Spectrum
Vibration**

**8-12 Hz, 75 $\mu\text{m}_{\text{p-p}}$
During the event**

**10 $\mu\text{m}_{\text{p-p}}$
Before the event**



3 options to correct

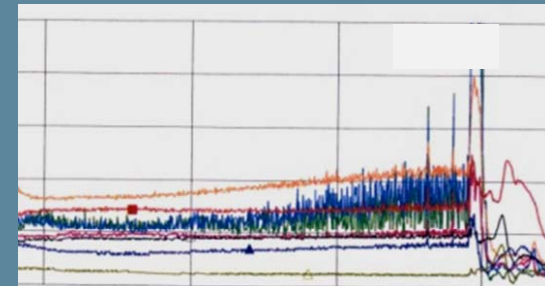
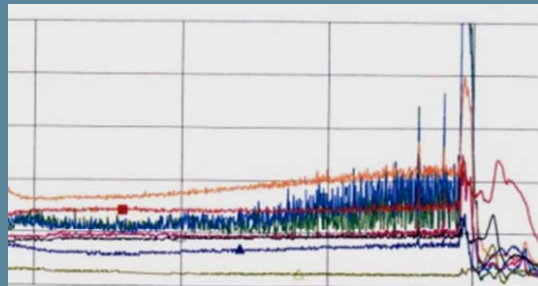
**“Fluid Induced Instability”
without Internal Inspection**

- ① **6-day Compromised Balancing**
- ② **8-day Bearing Inspection**
- ③ **Lube Oil Temperature Adjusting**



3 options to correct “Fluid Induced Instability” without Internal Inspection

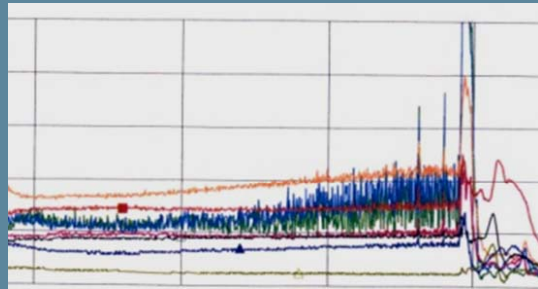
March - April 2008



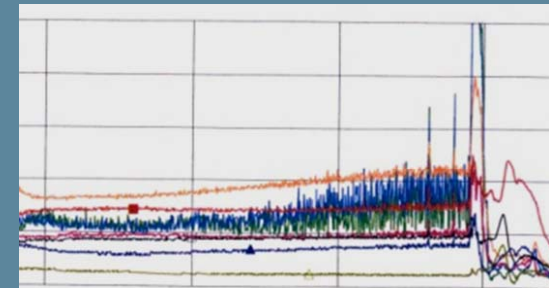
**Compromised
Balancing**

**Lube Oil Temp.
Adjusting
(Fine Tuning)**

3 options to correct “Fluid Induced Instability” without Internal Inspection



**Bearing
Inspection**



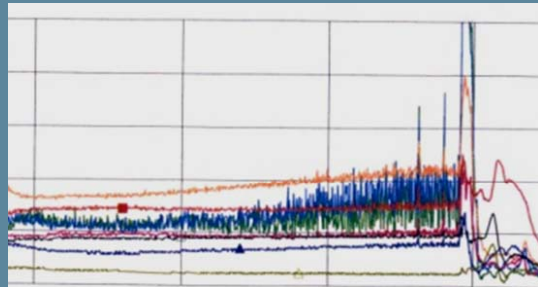
Bearing
Replacing



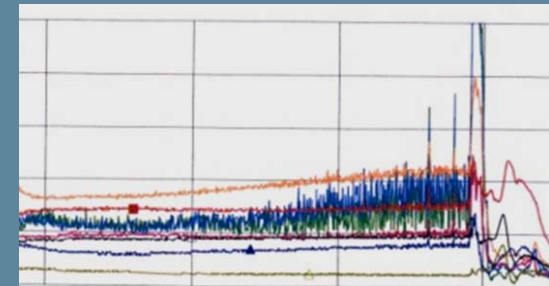
“Higher Load
Supply
Run Longer”



3 options to correct “Fluid Induced Instability” without Internal Inspection



**Bearing
Inspection**



Although “Higher Load Supply
Run Longer”, it could not be reduced Vibration
without Internal Part Correction anymore!!!



Correcting Activities in Overhaul

May - June
2008



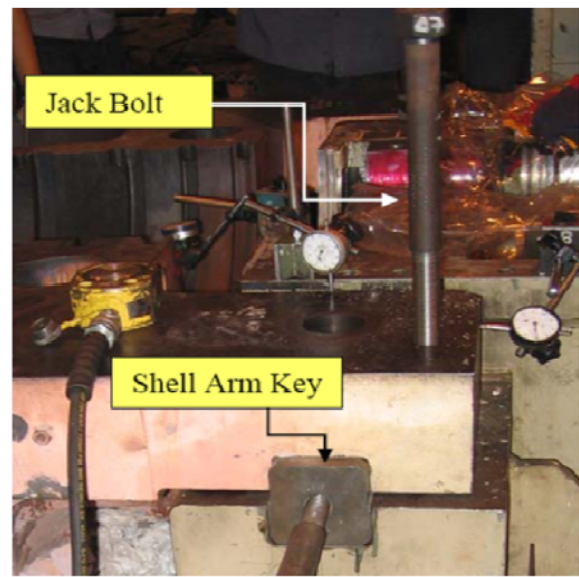
Correcting Activities in Overhaul

Front Casing Weight Balancing

May - June
2008

69%

10%



Correcting Activities in Overhaul

Rubbing Decreasing



Correcting Activities in Overhaul

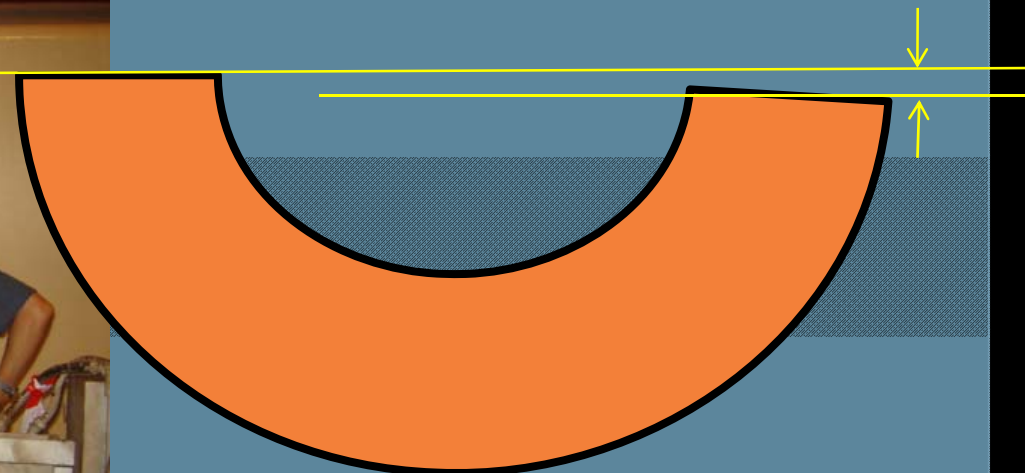
Rubbing Decreasing



Condition Monitoring after Overhaul

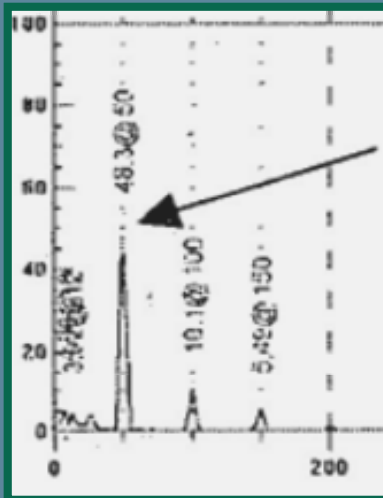
Foundation Level

Right Side of LP Casing Level
Lower than Left Side 2.7 mils



Results

July
2008

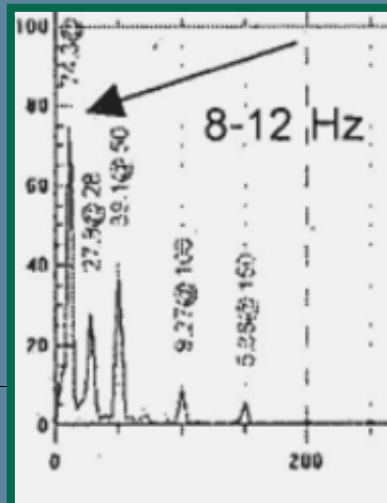


Before

Subsynchronous of $10 \mu\text{m}_{\text{p-p}}$

Trip at $1X=230 \mu\text{m}_{\text{p-p}}$

@60 MW (52% Load)



After

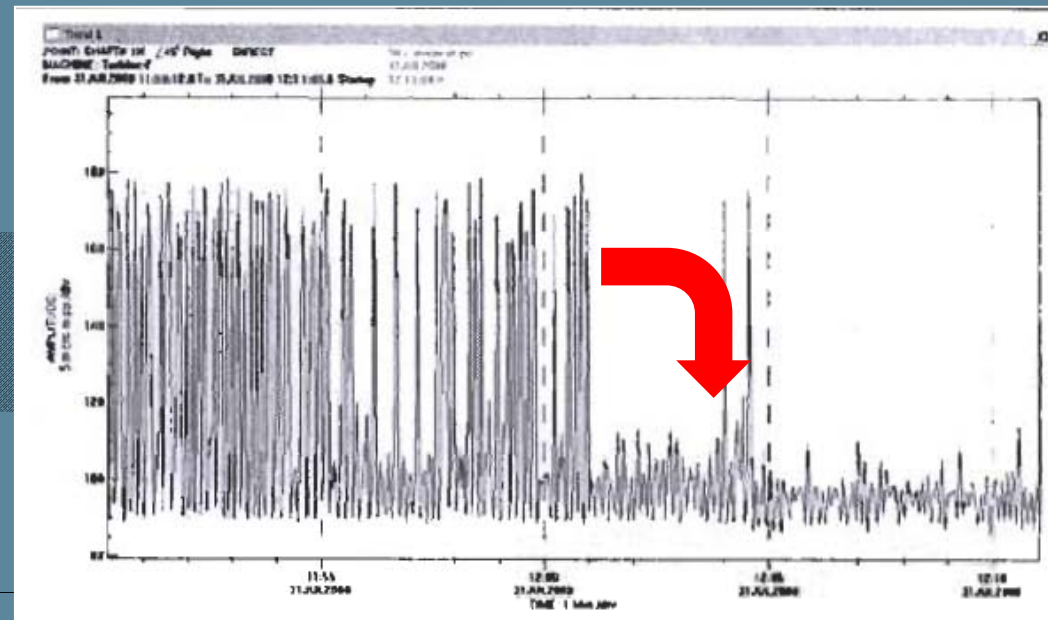
Subsynchronous of $80 \mu\text{m}_{\text{p-p}}$

@100 MW (87% Load)



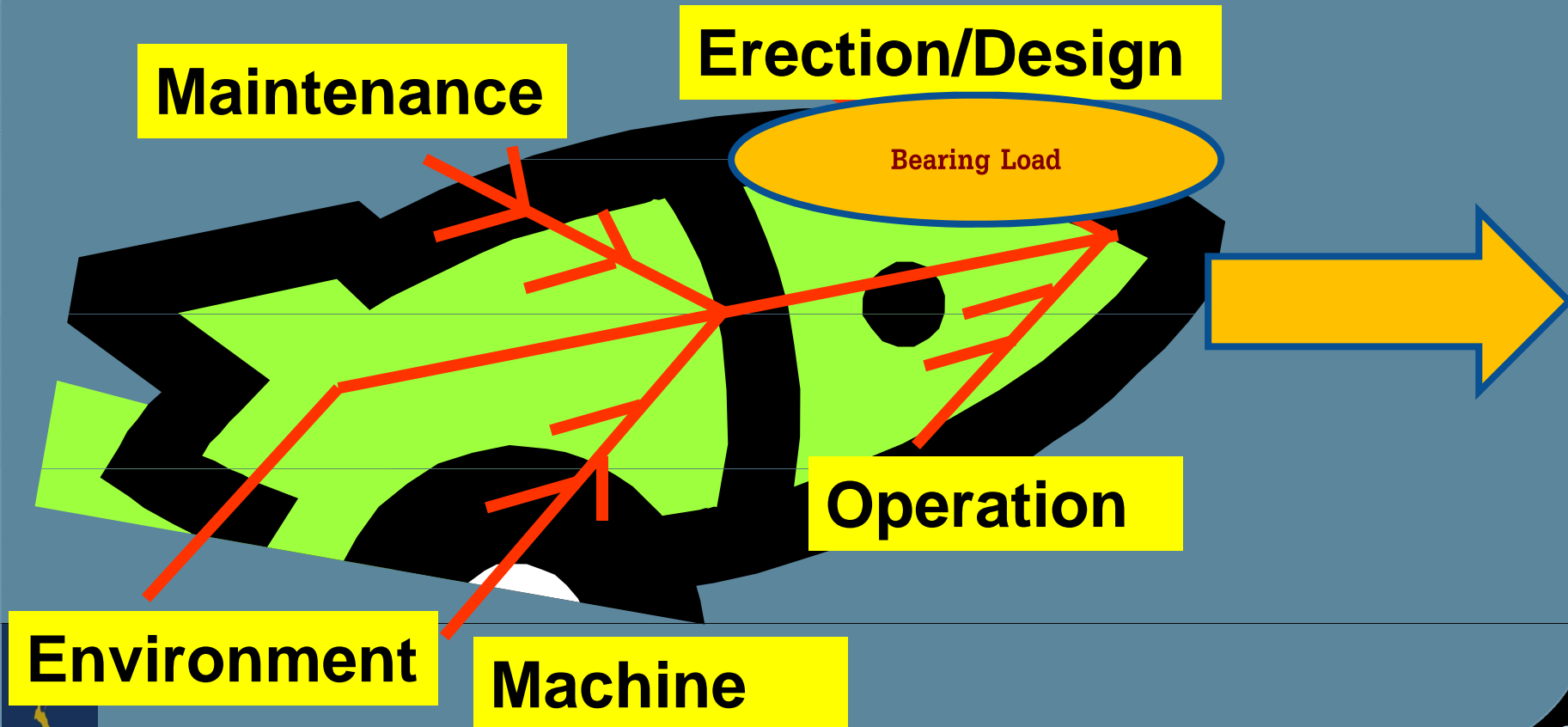
Results

More Stable ; however, Need more Fine Tuning
By Lube Oil Temp. Decreasing from 49°C to 45 °C

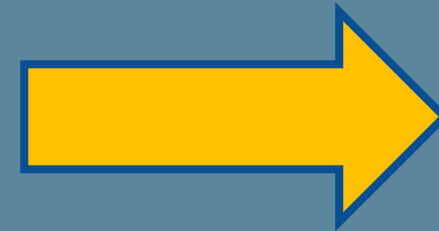
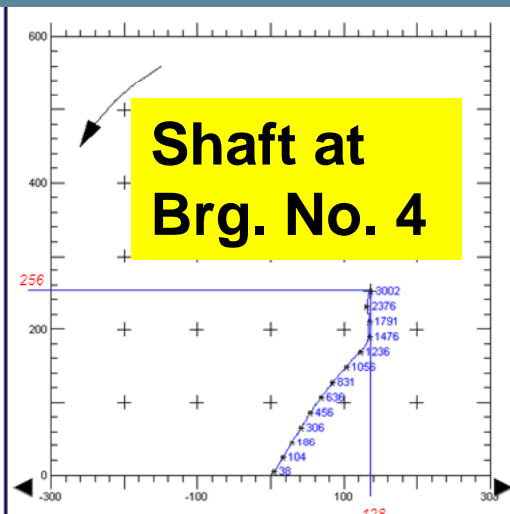
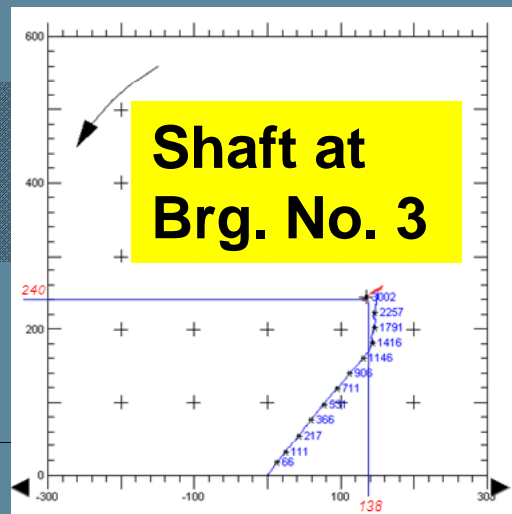
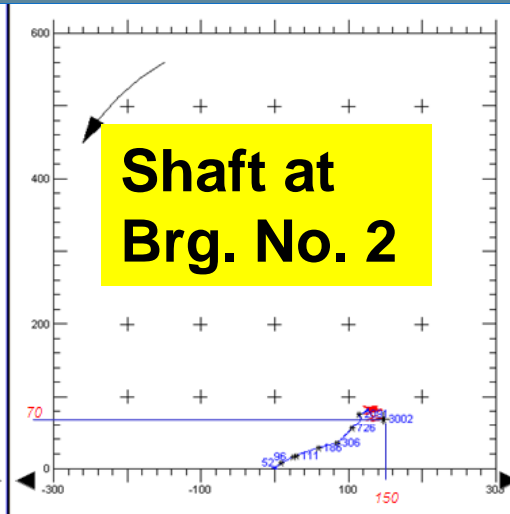
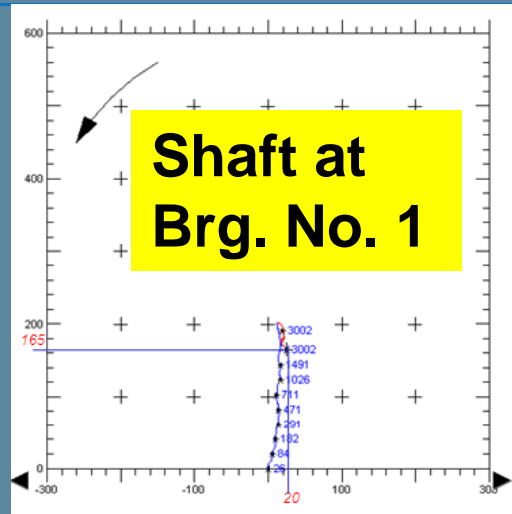


Updated Results on October, 2010

“Last possible cause in the fish bone diagram was found and corrected.”

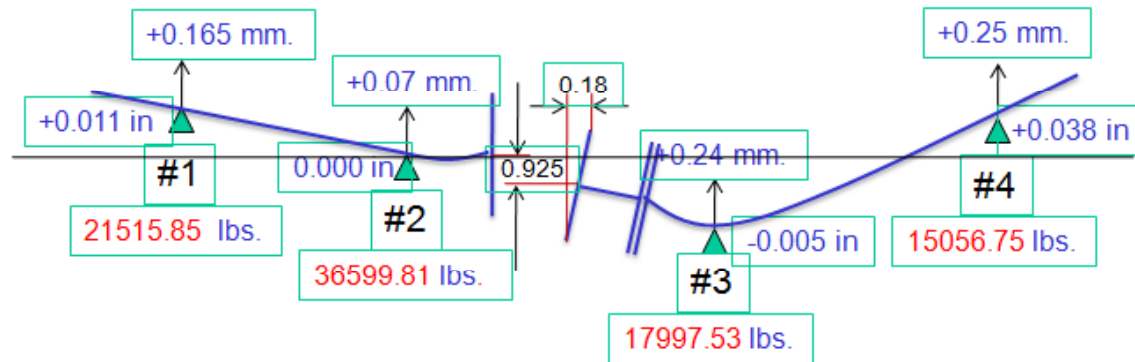


Updated Results on October, 2010

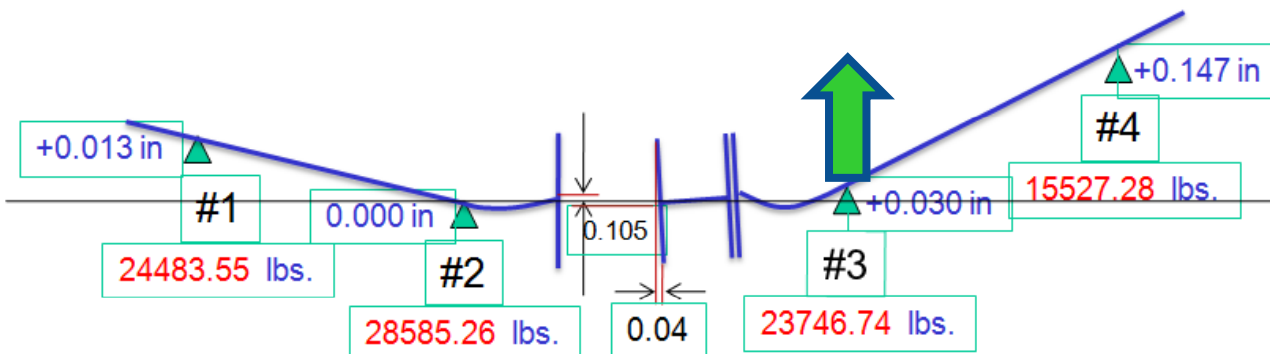


Updated Results on October, 2010

Before



After



Conclusion

Remedial Action Step

Subsynchronous

Turbine Condition

Appear

Normal

80 $\mu\text{m}_{\text{p-p}}$ @87% Load

Abnormal

10 $\mu\text{m}_{\text{p-p}}$ @52% Load
(Trip)

Severe



Remedial Action Step

Turbine Condition	Action
Normal	Monitoring & Next Outage Planning
Abnormal	<ol style="list-style-type: none">1. Lube Oil Temp. Adjusting 1-2 days2. Compromised Balancing 2-6 days3. Bearing Inspection 8 days
Severe	Internal Part Inspection (Overhaul)



Remedial Action Step

Turbine Condition Action

Normal	Monitoring & I
Abnormal	1. Lube Oil T 2. Comprom 3. Bearing In
Severe	Internal Part In

Can be Operated

“The condition is Abnormal, but it needs to be Operated. It is necessary to Control MVAR, and/or Decrease Load.”



Need to be Shut down



Thank you for your kind attention

