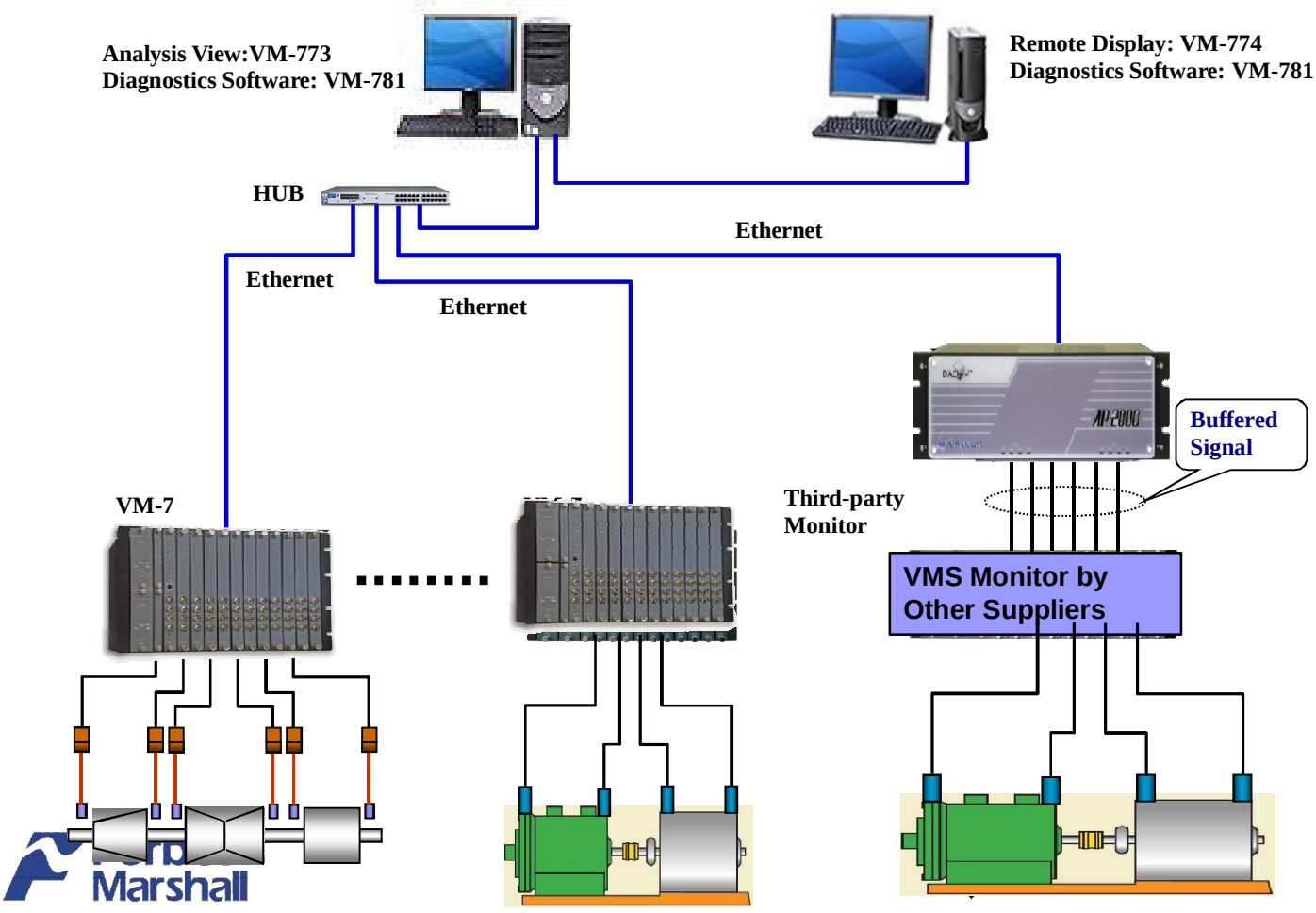
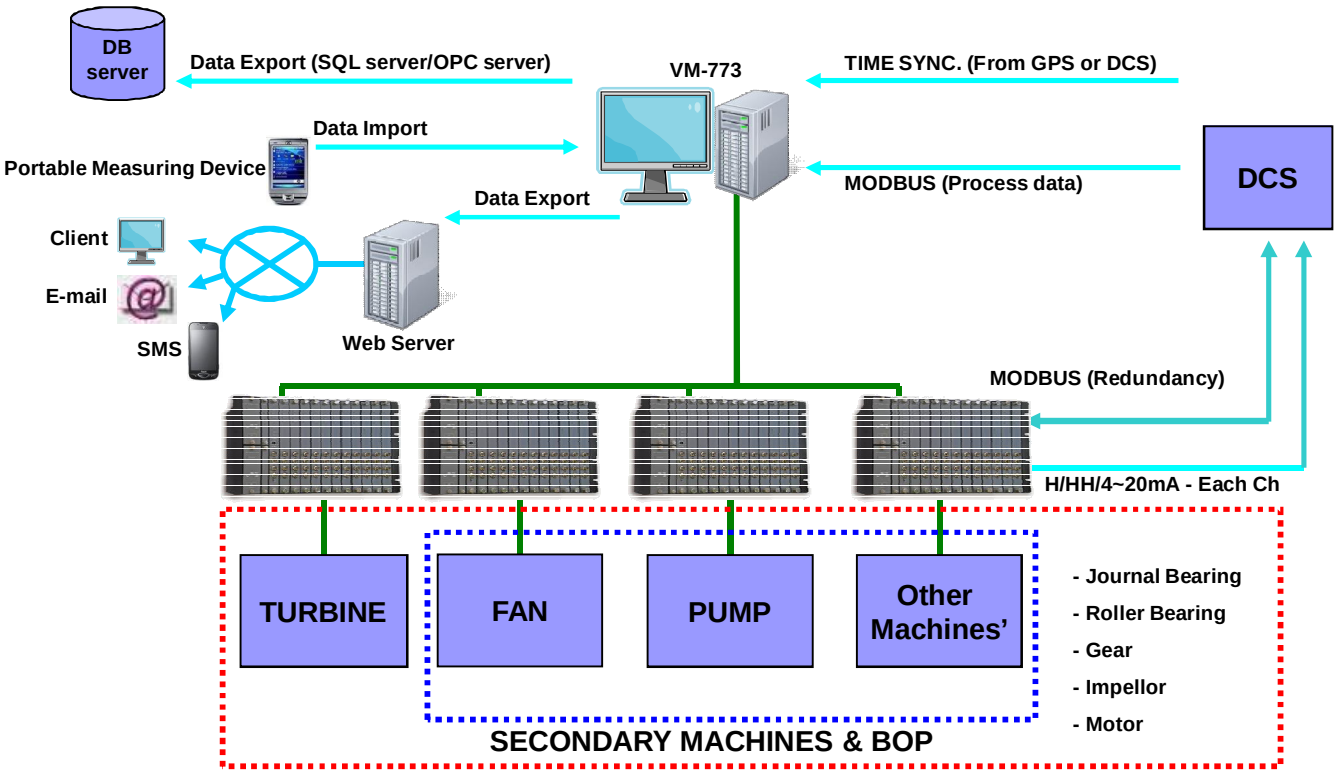
Power Plant with Multiple VMS Supplier …Integration is possible..



POWER PLANT WIDE ON LINE ANALYSIS & DIAGNOSIS



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Real Time VMS Analysis & Diagnosis System

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SHINKAWA

How it works ?

- It displays Spectrum , Waveforms and all respective plots for giving inside information of machine condition on health before it goes to shut down.

  - It based on type of bearing used in the machine.
    - Fluid Film Bearing – Main TG / BFP etc
    - Roller Bearing – Pump / Fan / Motors etc

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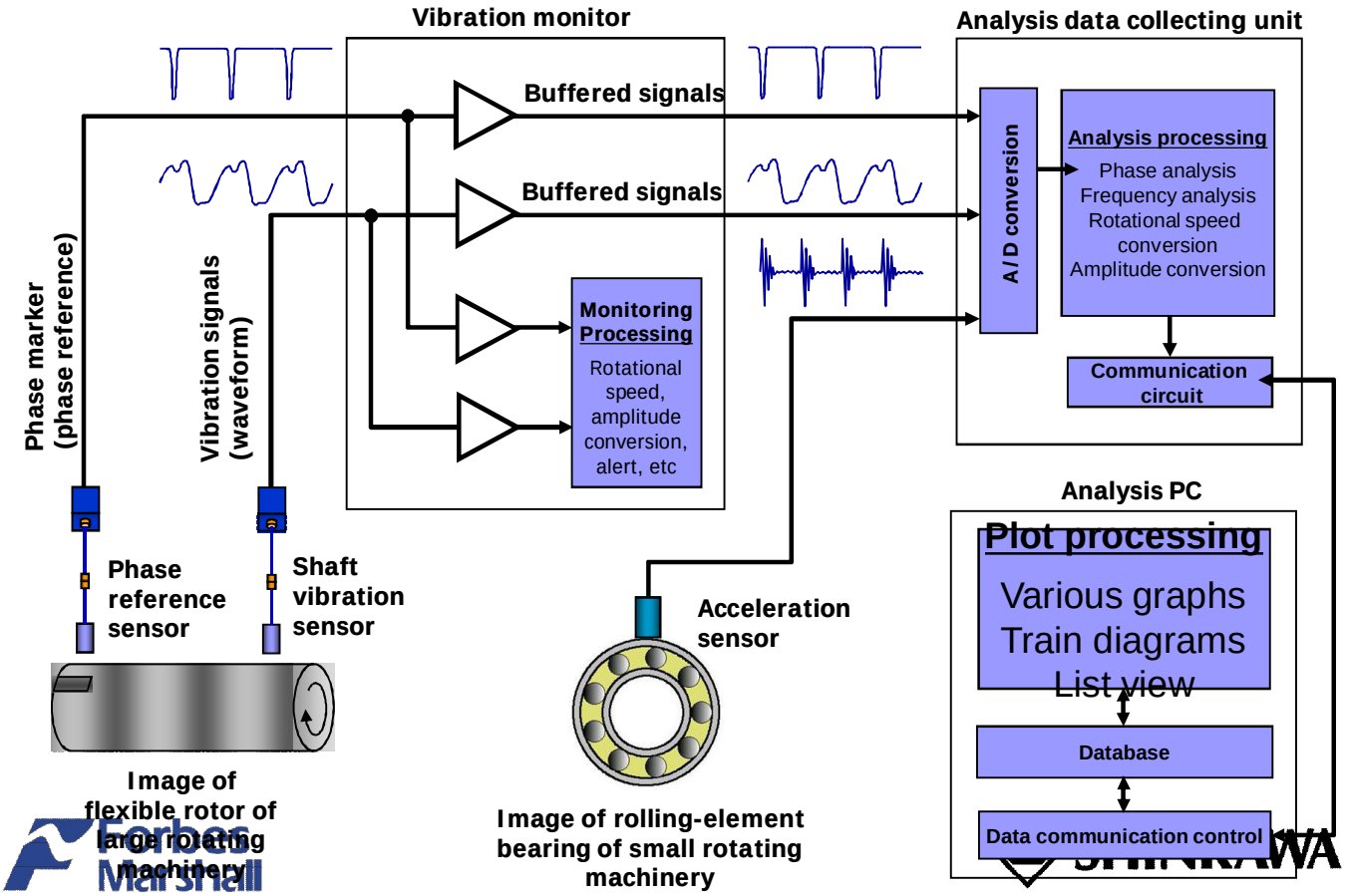
Complete Vibration Analysis and Diagnostic System



Graph Display Function

- **Current Value/Long-term Trend Graph (Rotational speed, OA Amp, GAP, 0.5X Amp/Phase, 1X Amp/Phase, 2X Amp/Phase, Not-1X Amp)**
- **Bar Graph**
- **Nyquist Diagram (Vector Diagram)**
- **Axis Locus**
- **Lissajous & Waveform Graph**
- **Spectrum & Waveform Graph (Normal state)**
- **X-Y Graph**
- **Waterfall**
- **Trend Graph at Alarm State**
- **Spectrum & Waveform Graph at Alarm State**
- **Graph at Transient (Trend, Body, Polar, Lissajous & Waveform, Spectrum & Waveform, Axis Locus, Waterfall)**
- **S-V Graph**
- **Full Spectrum**

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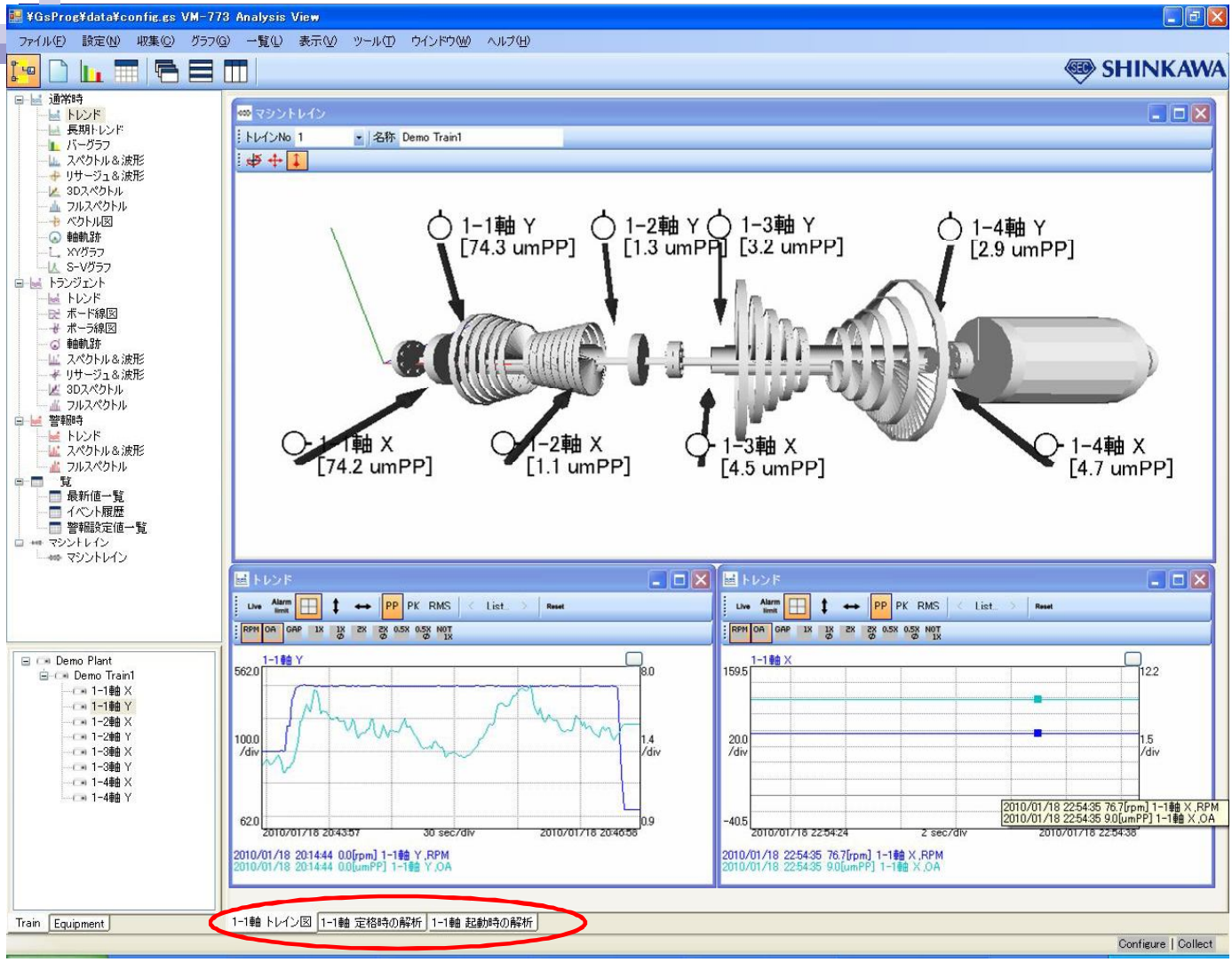
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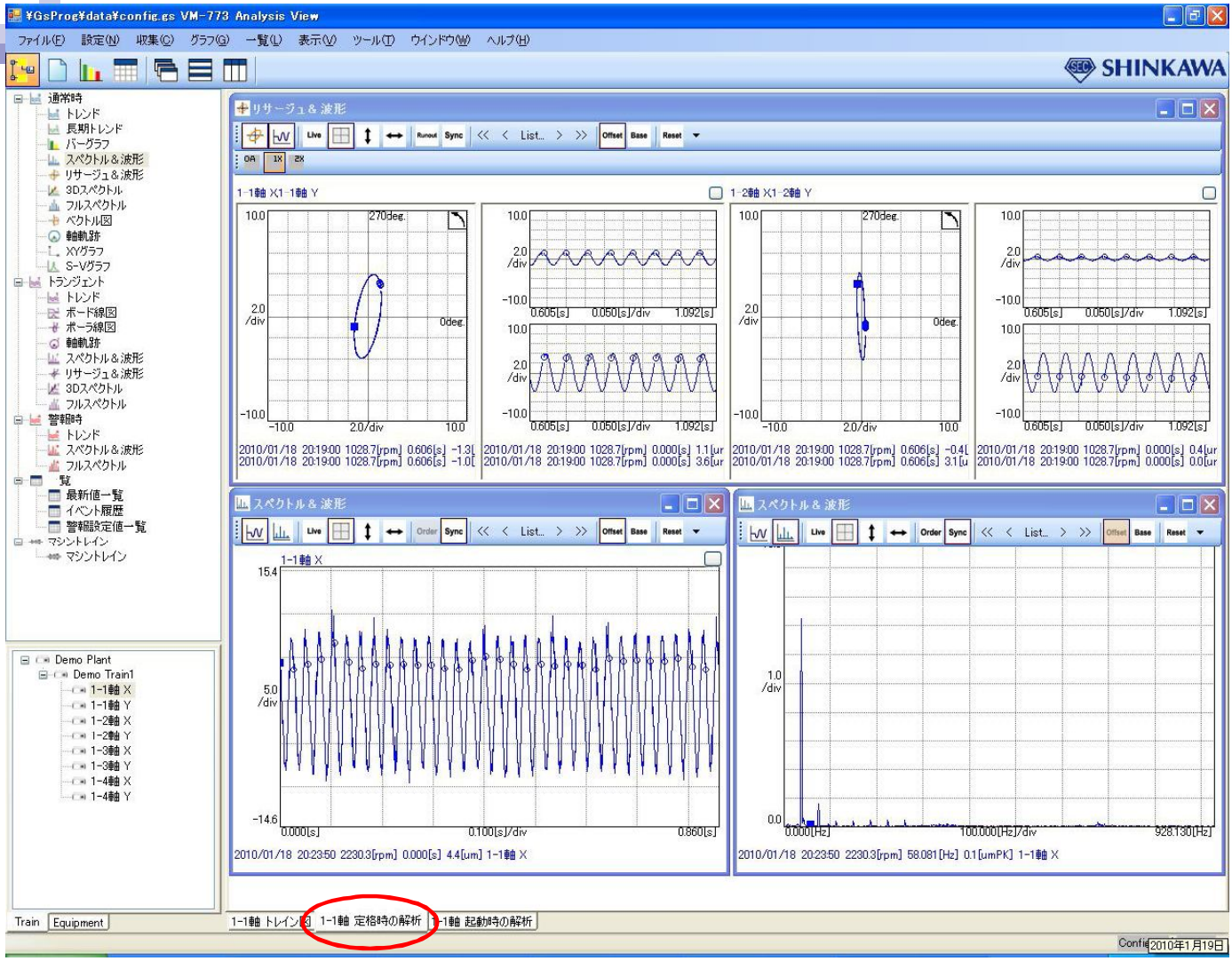
SHINKAWA
通常時
トレンド
長期トレンド
バーグラフ
スペクトル＆波形
リサージュ＆波形
3Dスペクトル
フルスペクトル
ベクトル図
軸軌跡
XYグラフ
S-Vグラフ
トランジェント
トレンド
ボード線図
ポーラ線図
軸軌跡
スペクトル＆波形
リサージュ＆波形
3Dスペクトル
フルスペクトル
警報時
トレンド
スペクトル＆波形
フルスペクトル
一覧
最新値一覧
イベント履歴
警報設定値一覧
マシントレイン
マシントレイン
マシントレイン
トレインNo 1
名称 Demo Train1
1-1軸 Y [74.3 umPP]
1-2軸 Y [1.3 umPP]
1-3軸 Y [3.2 umPP]
1-4軸 Y [2.9 umPP]
1-1軸 X [74.2 umPP]
1-2軸 X [1.1 umPP]
1-3軸 X [4.5 umPP]
1-4軸 X [4.7 umPP]
トレンド
1-1軸 Y
562.0
100.0 /div
62.0
8.0
1.4 /div
0.9
2010/01/18 20:43:57
30 sec/div
2010/01/18 20:46:56
2010/01/18 20:14:44 0.0[rpm] 1-1軸 Y,RPM
2010/01/18 20:14:44 0.0[umPP] 1-1軸 Y,OA
トレンド
1-1軸 X
159.5
20.0 /div
-40.5
12.2
1.5 /div
2010/01/18 22:54:24
2 sec/div
2010/01/18 22:54:38
2010/01/18 22:54:35 76.7[rpm] 1-1軸 X,RPM
2010/01/18 22:54:35 9.0[umPP] 1-1軸 X,OA
2010/01/18 22:54:35 76.7[rpm] 1-1軸 X,RPM
2010/01/18 22:54:35 9.0[umPP] 1-1軸 X,OA
Demo Plant
Demo Train1
1-1軸 X
1-1軸 Y
1-2軸 X
1-2軸 Y
1-3軸 X
1-3軸 Y
1-4軸 X
1-4軸 Y
Train
Equipment
1-1軸 トレイン図
1-1軸 定格時の解析
1-1軸 起動時の解析
Configure
Collect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通常時
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長期トレンド
バーグラフ
スペクトル＆波形
リサージュ＆波形
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フルスペクトル
ベクトル図
軸軌跡
XYグラフ
S-Vグラフ
トランジェント
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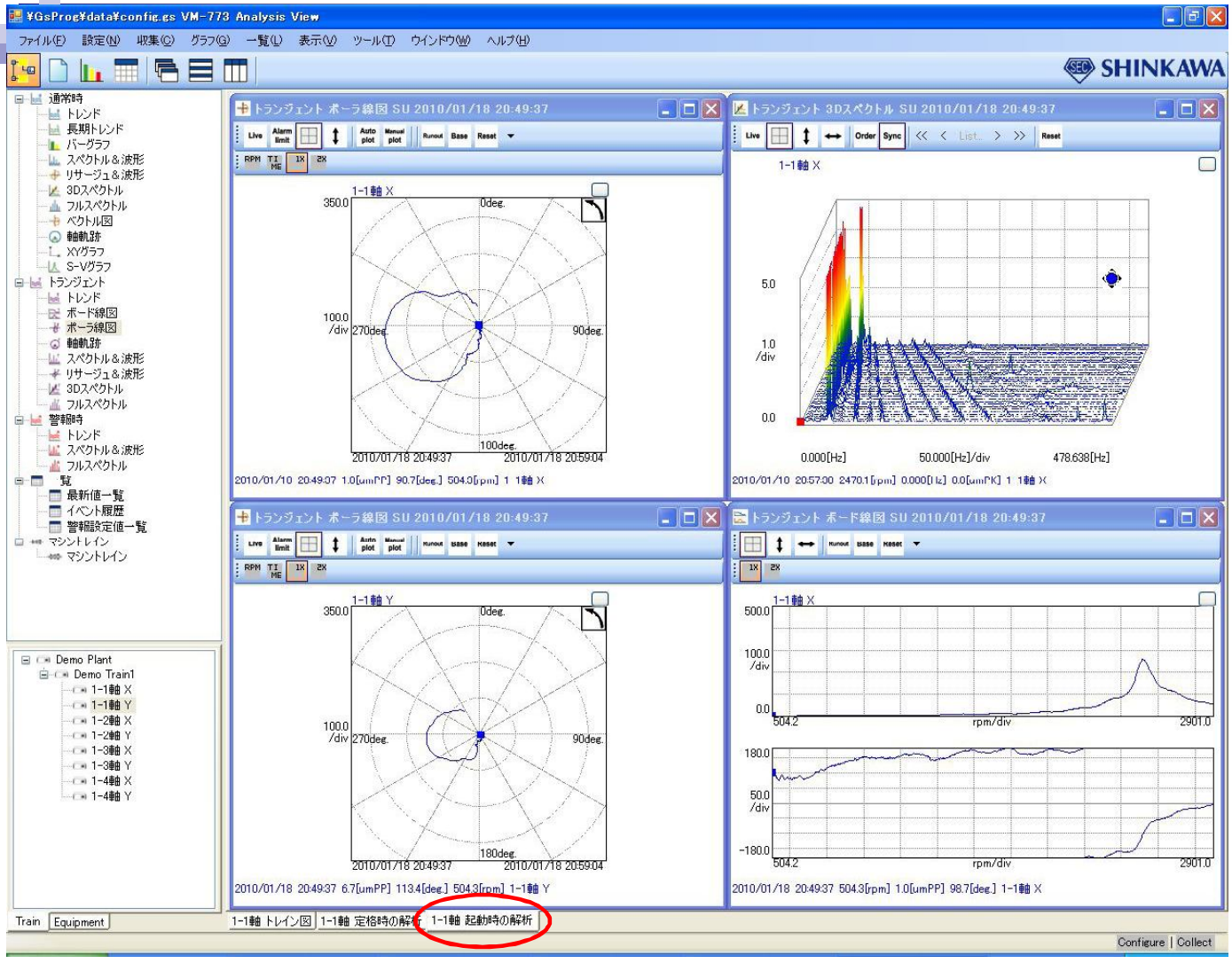
1-3軸 Y
1-4軸 X
1-4軸 Y
Train
Equipment
リサージュ＆波形
1-1軸 X1-1軸 Y
1-2軸 X1-2軸 Y
スペクトル＆波形
1-1軸 X
スペクトル＆波形
1-1軸 トレンド
1-1軸 定格時の解析
1-1軸 起動時の解析
2010年1月19日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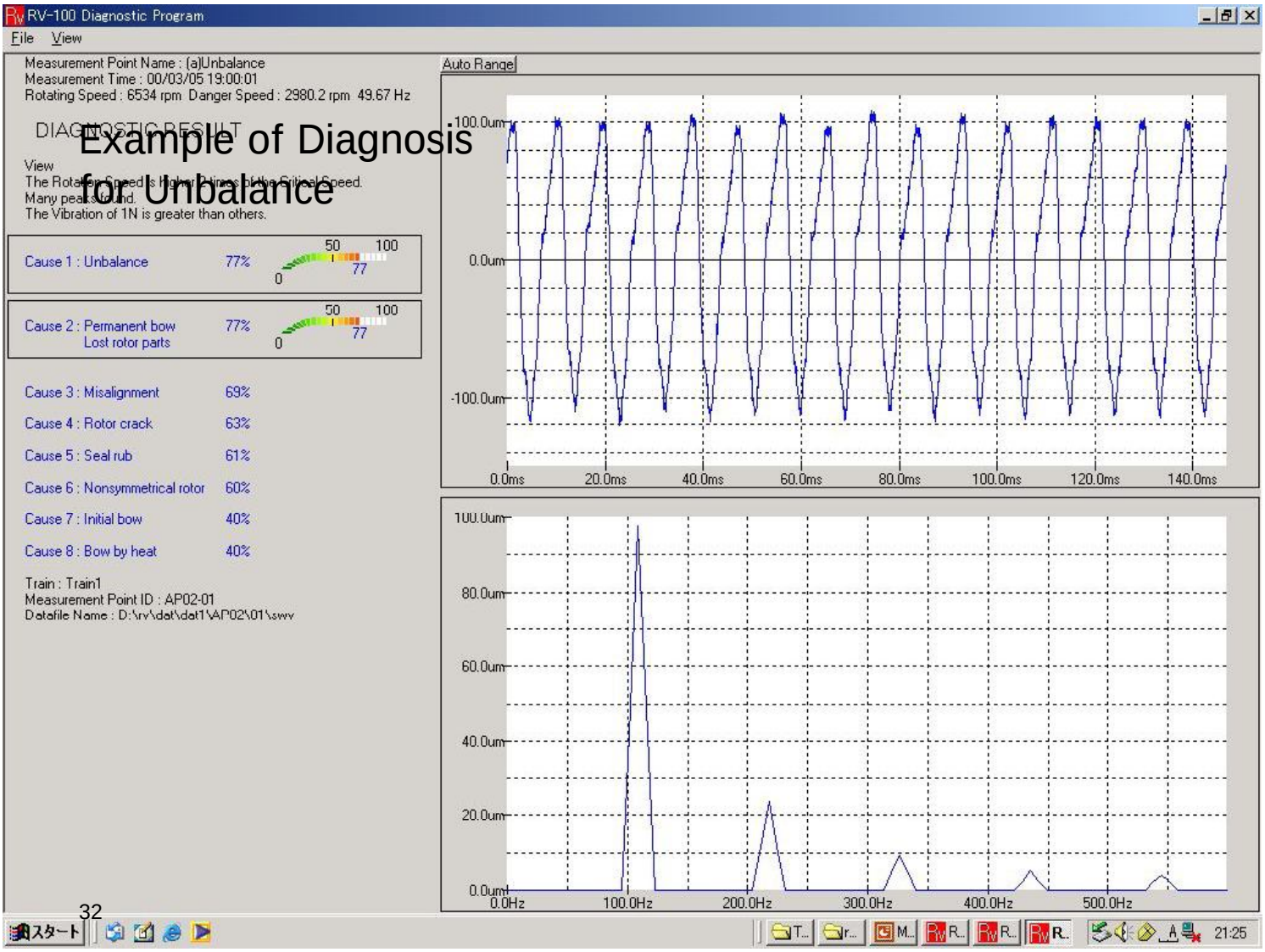
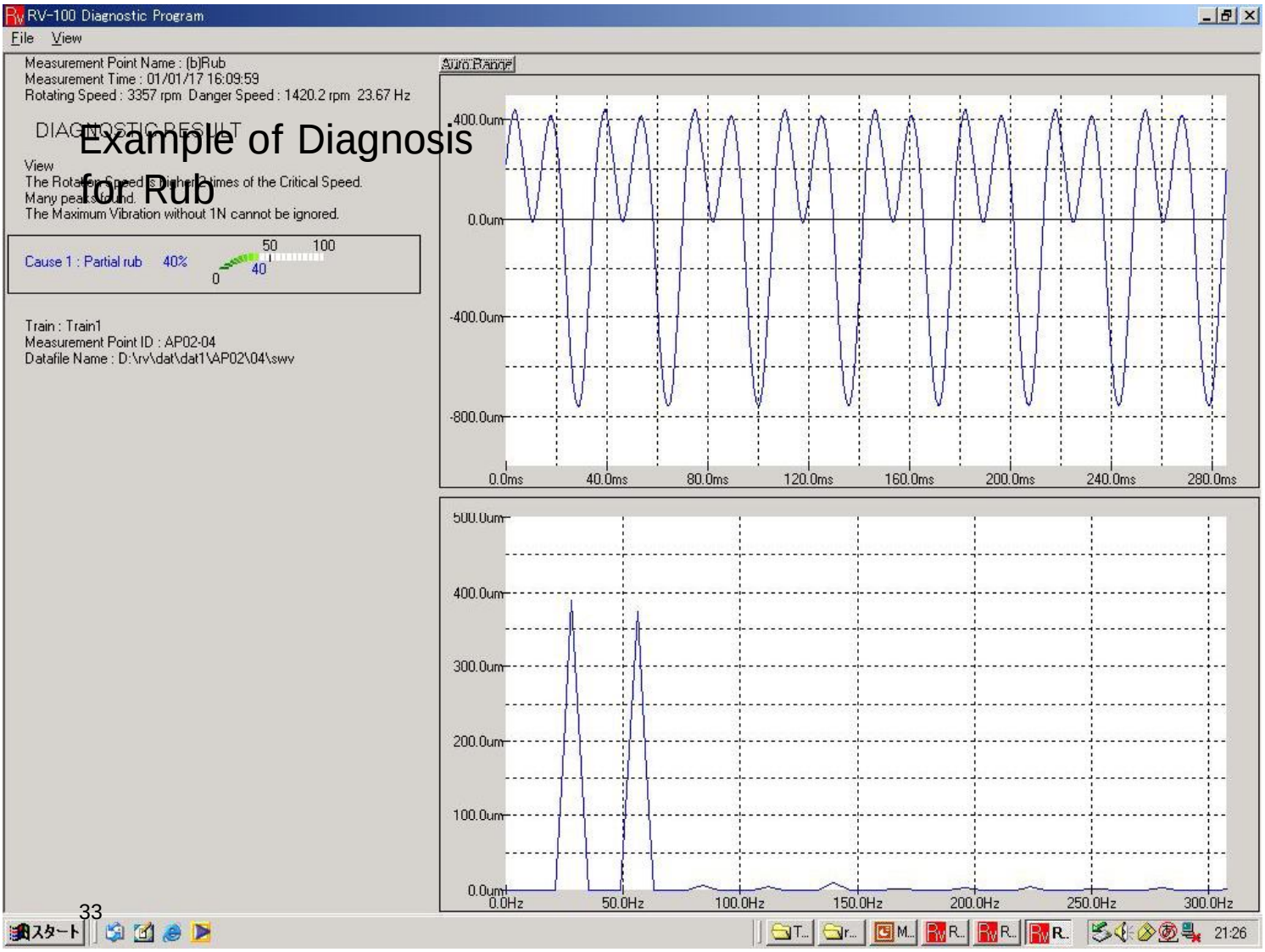
1-1軸 Y
1-2軸 X
1-2軸 Y
1-3軸 X
1-3軸 Y
1-4軸 X
1-4軸 Y
Train
Equipment
トランジェント ポーラ線図 SU 2010/01/18 20:49:37
1-1軸 X
350.0
100.0 /div
0deg.
90deg.
180deg.
270deg.
2010/01/18 20:49:37
2010/01/18 20:59:04
トランジェント 3Dスペクトル SU 2010/01/18 20:49:37
1-1軸 X
5.0
1.0 /div
0.0
0.000[Hz]
50.000[Hz]/div
478.638[Hz]
トランジェント ポーラ線図 SU 2010/01/18 20:49:37
1-1軸 Y
トランジェント ボード線図 SU 2010/01/18 20:49:37
1-1軸 X
500.0
100.0 /div
0.0
504.2
rpm/div
2901.0
180.0
50.0 /div
-180.0
1-1軸 トレン図
1-1軸 定格時の解析
1-1軸 起動時の解析
Configure
Collect

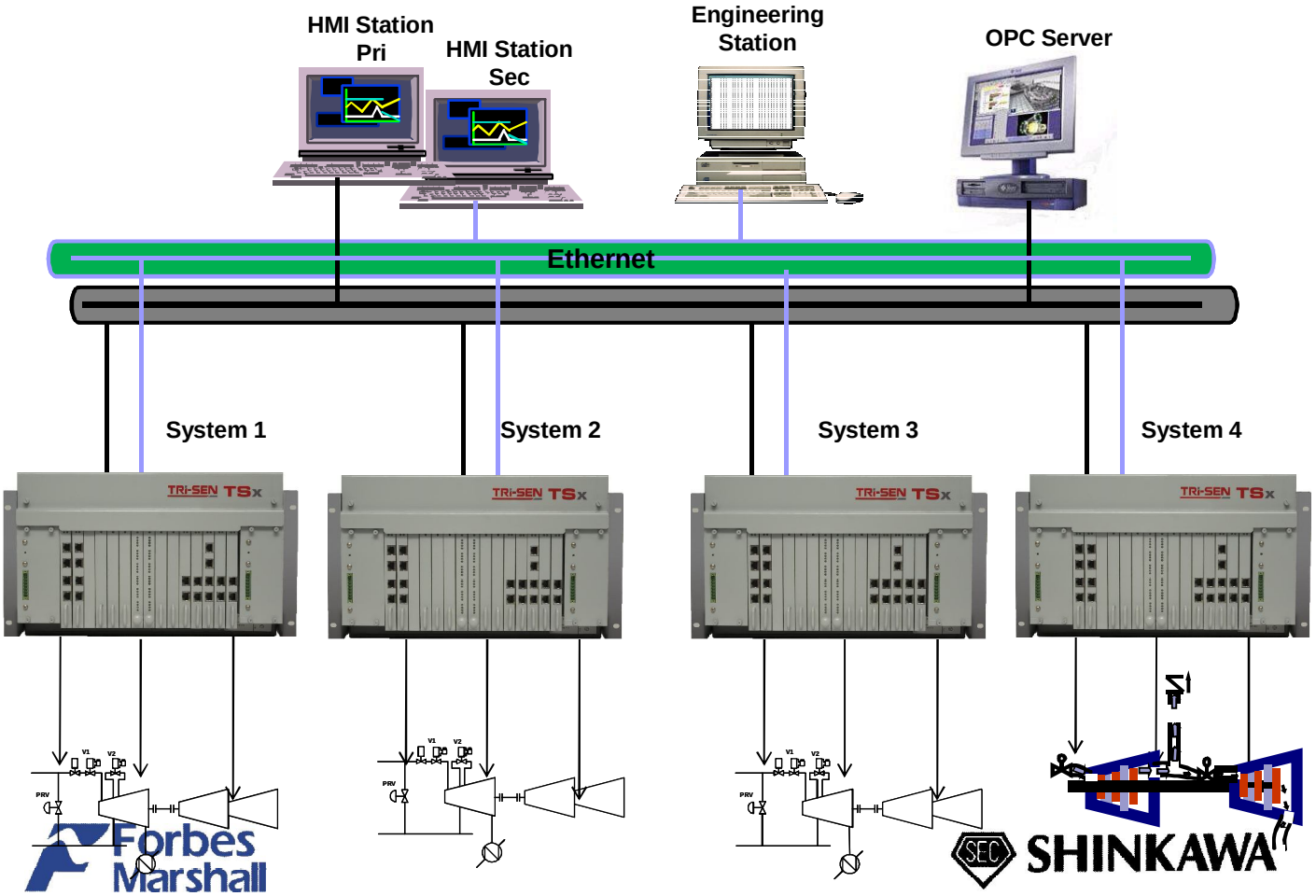
Example of Diagnosis for Unbalance



Example of Diagnosis for Rub



Forbes Marshall – Trisen – Turbine Control System.



Future of On Line VMS

- **We predict that for Main TSI – API 670 Systems will continue to be most critical machine.**
- **For Secondary / BOP Machines – There is enough space to change the system by using optimum technologies to avoid duplication of signal integration…4-20ma/Relays. Modbus or Ethernet out put directly to DCS System.**
- **Wireless System – Still under evaluation… Battery Life / Time Interval / Reliability / Line Of Sight/ Security/ Depend on one vendor….Many issues to be answered.**
- **We supply Best Instrumentation. Is this used 100% & Engineers are Trained ? Key are to work on.**

Forbes Marshall

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SOLAR THERMAL POWER PLANTS

- AN OVERVIEW OF AUTOMATION

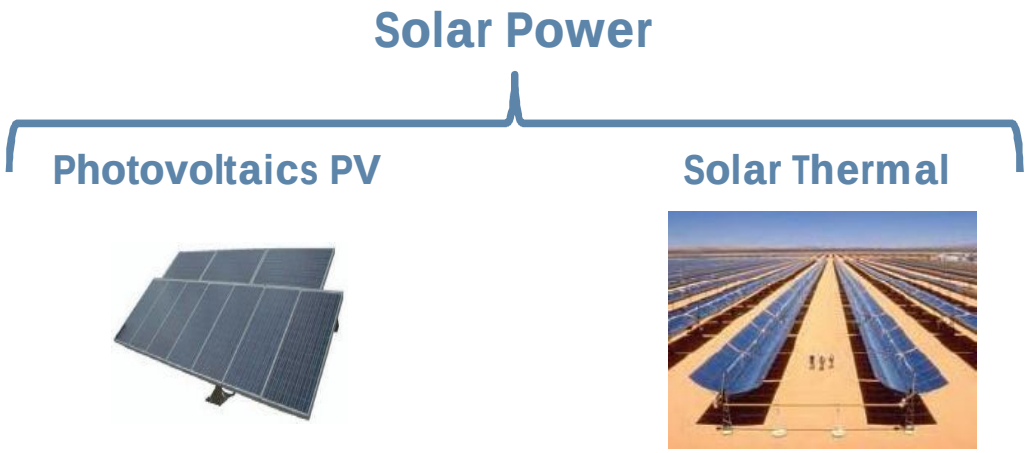
Ramesh Kasinathan

ABB Limited, Bangalore

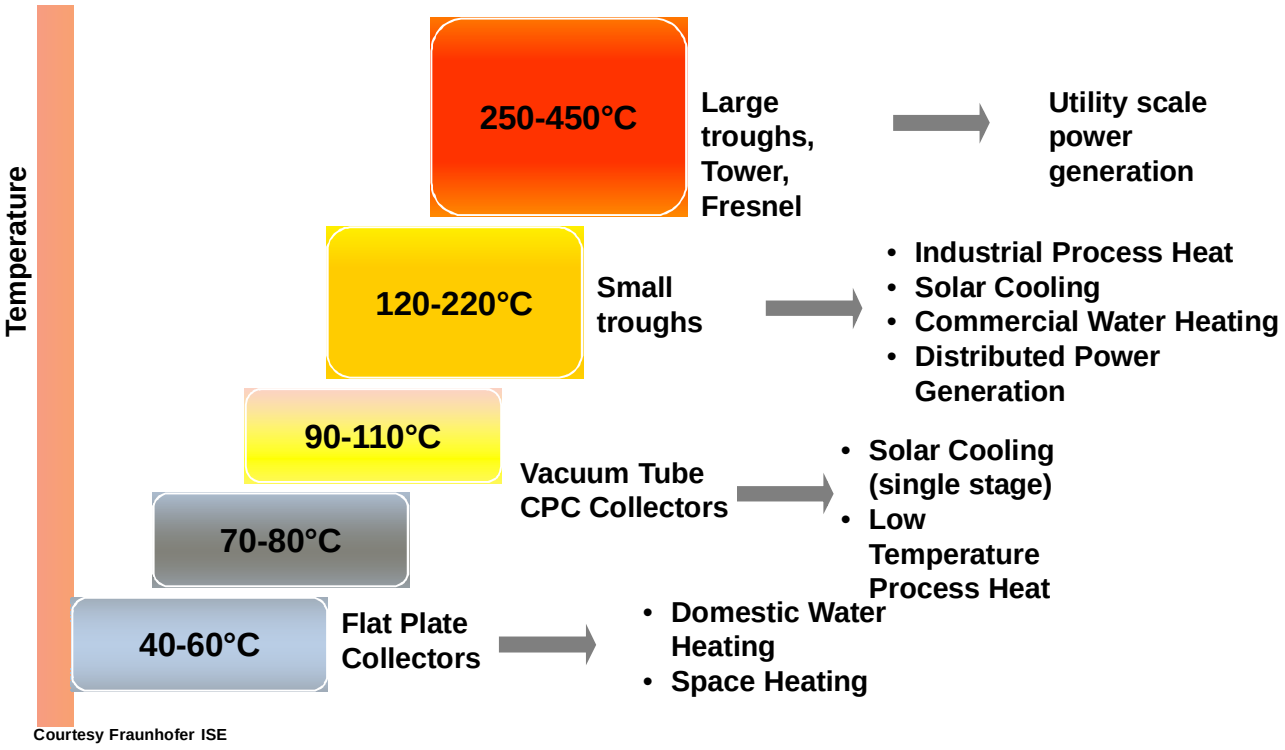
ISA(D) POWAT-INDIA 2012, New Delhi January 13th -14th, 2012

Technology segmentation
Solar Power

- **Solar power can be dived in to two segments, Solar Thermal and Photovoltaics PV.**
- **Photovoltaics PV**
  - Solar cells, also known as photovoltaics convert light directly into electricity. These system can be scaled from large plants with grid connection to smaller systems that can supply single family homes
- **Solar Thermal**
  - Solar thermal is a long-established technology for space heating and domestic hot water. After the substance is heated it runs through a heat exchanger that generates steam that goes in to a steam turbine, witch generates electricity.

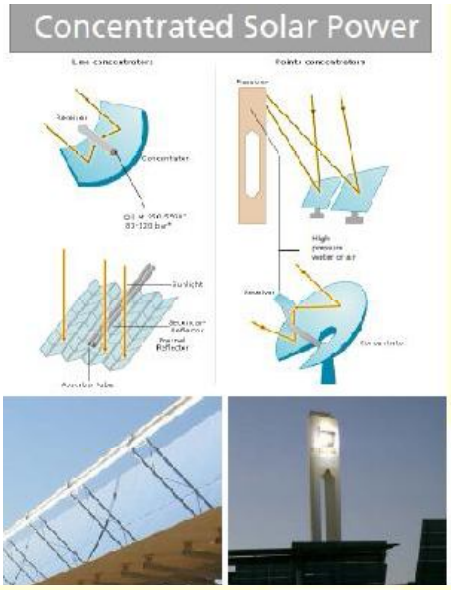


Solar Thermal Technology
Power, Cooling, Heating



Courtesy Fraunhofer ISE

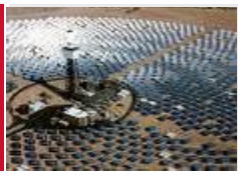
Concentrated Solar Power (CSP)



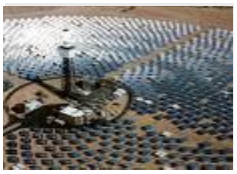
- **CSP technology is based on solar radiation concentration to produce steam or hot air which could then be used on conventional electric plants.**

- **Main components**
  - **Concentrator**: Different optics elements as mirrors, concentrate the sun on a point or a line where the receiver is located.
  - **Receiver**: The receiver collects the concentrated sun rays and transfers the energy to a heat transfer fluid.
  - **Heat Exchanger**: At the evaporator the heat transfer fluid transfers heat the water that becomes steam
  - **Turbine and Generator:** To convert the steam into electrical power

CSP technologies
Fields of Automation application

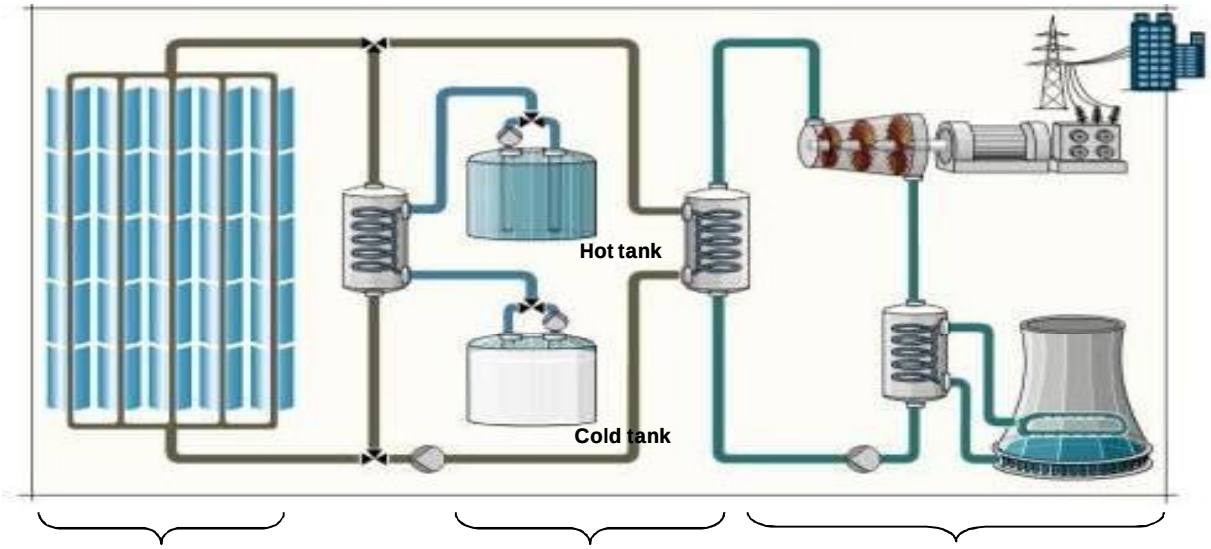
		Process Description
Parabolic trough		▪ Parabolic mirrors focus the sun's rays onto a linear tube containing a fluid ▪ The fluid is heated to ~400°C & used to create steam which in turn drives a steam turbine
Linear fresnel		▪ Simplified version of parabolic trough which uses cheaper flat mirrors ▪ Reduced solar field cost, better land utilisation but lower efficiency due to reduced temperatures
Power tower / central receiver		▪ Movable flat mirrors (heliostats) focus the sun onto a receiver at the top of a central tower ▪ Fluid in the receiver is heated to ~550°C & used to create steam which drives a steam turbine
ISCC		▪ An ISCC Integrated Solar Combined Cycle is a CCPP with the additional heat supply of a solar field ▪ Typically using parabolic troughs

CSP technologies
Automation viewpoint

		Particular Features
Parabolic trough		▪ Highly distributed solar field control ▪ HTF stability ▪ Critical Molten Salts Thermal Storage System
Linear fresnel		▪ Reduced solar field complexity ▪ Critical Direct Steam Generation stability
Power tower / central receiver		▪ Huge Solar field highly distributed ▪ Solar vector pointing accuracy ▪ HTF based on molten salts
ISCC		▪ Low size solar field ▪ Critical coordination between CCPP and solar field

Concentrated Solar Power
Parabolic Trough & TES Functional Layout

Turbine island
- Steam Turbine
- Reheat steam turbine
- Wet cooling



Solar field
- Solar Resource: 2,136 kWh/m2/yr
- Output temperature = 393°C

Source: NREL National Renewable Energy Laboratory

TES
- 7.5 hours of full-load storage
- 28,500 tons of molten salt (60% $NaNO_3$ + 40% KNO_3)
- Tanks are 14m high & 36 m in diameter (50MW)

BOP
- Electrical Portion
- W/S cycle
- Main Pumps

Concentrated Solar Power
Parabolic Trough

The parabolic troughs are used to track the sun and concentrate sunlight on to the thermally efficient receiver tubes placed in the trough focal line. In these tubes, a thermal transfer fluid is circulated, such as synthetic thermal oil. This oil is then pumped through a series of heat exchangers to produce steam. The steam is converted to electrical energy in a conventional steam turbine generator.

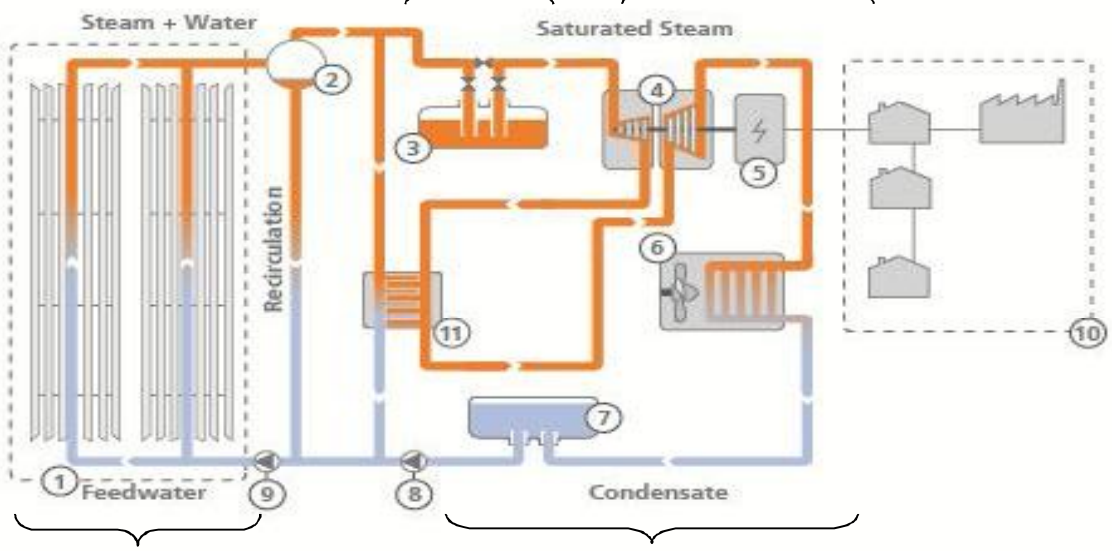
Main components:

- **Reflector**
- **Absorber tube**
- **Tracking system**
- **Structure**

Concentrated Solar Power
Fresnel Functional Layout

Turbine island
Steam Turbine
Reheat steam turbine
Wet cooling

TES
Steam Reservoir



Solar field
Solar Resource: 2,095 kWh/m2/yr
Direct Steam Generation
Output temperature = 270°C

BOP
Electrical Portion
W/S cycle
Main Pumps

Source: Novatec & NREL National Renewable Energy Laboratory

Concentrated Solar Power
Linear Fresnel - Overview

Linear Fresnel CSP systems use a parallel array of flat mirrors to focus the solar power on a fixed central linear receiver. The solar heat flux is used to produce steam by boiling water for use in a steam turbine power system

- Linear Fresnel modules offers low cost of solar field by using commodity products
- Reduced optical efficiency and higher thermal losses are compensated by higher land use factor
- Direct steam production reduces the need for heat exchanger between solar field and power unit
- Generated Steam conditions: 275°C - 70 bar up to 450°C -100 bar

Concentrated Solar Power
Power Tower – Functional Layout

Solar field

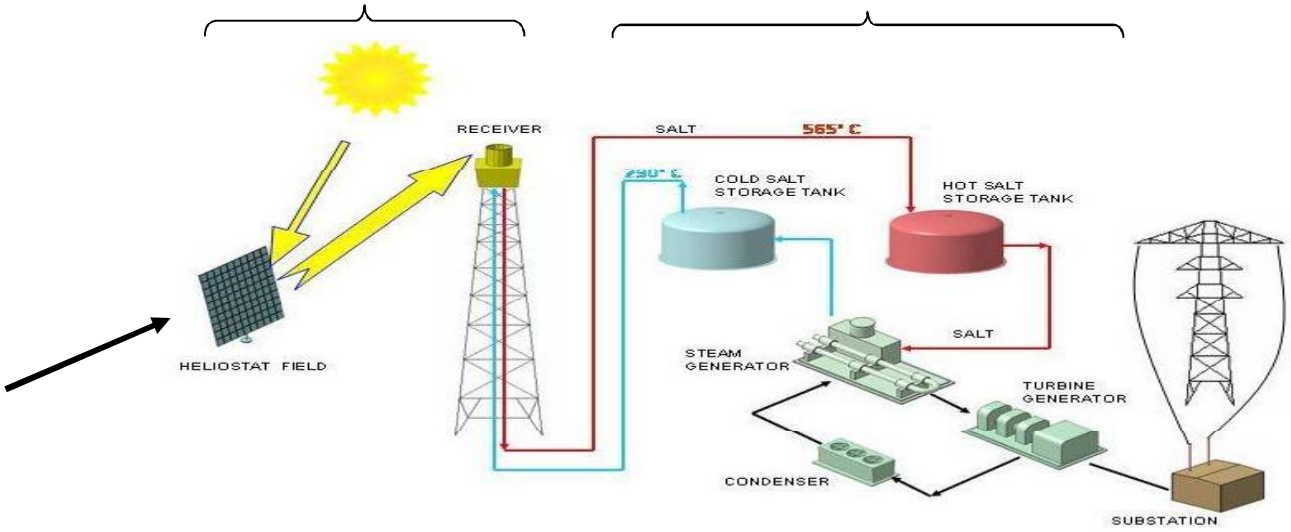
100-200 m tower height

Solar Resource: 2,062 kWh/m2/yr

Output temperature = 560°C

TES

8 hours of full-load molten salt storage



BOP

Electrical Portion

W/S cycle

Main Pumps

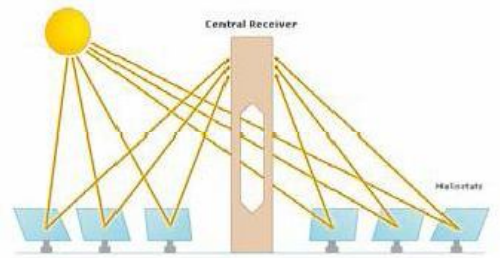
Turbine island

Steam rankine cycle

Reheat steam turbine

Source: NREL National Renewable Energy Laboratory

Concentrated Solar Power
Power Tower

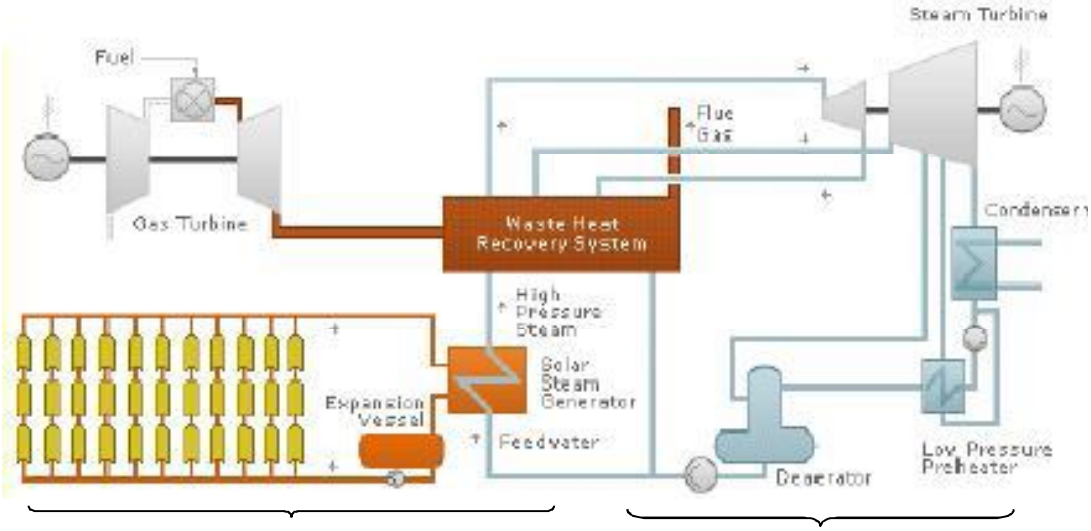


- **A circular array of heliostats (2 axis tracking mirror) is used to concentrate sunlight to a central receiver mounted on the top of a tower. A heat transfer medium in this receiver absorbs the highly concentrated radiation and coverts it into thermal energy to be used by a turbine.**

- **Main components:**
  - Heliostats
  - Tower
  - Receptor
- **Characteristics:**
  - High temperatures = High yields
  - Output temperature = 560°C

Concentrated Solar Power
Integrated Solar CCPP – Functional Layout

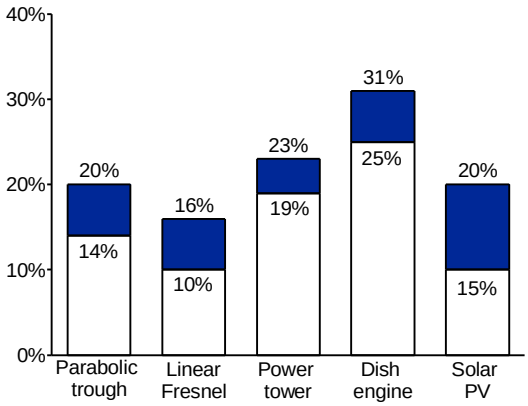
Turbine islands
Steam & Gas Turbines
Reheat steam turbine
Wet cooling



Solar field
Solar Resource: 2,060 kWh/m2/yr
Output temperature = 393°C

CCPP BOP
Electrical Portion
W/S cycle
Main Pumps

Efficiency comparison



Levelized cost of electricity ↔ solar field cost / m^2 x $\frac{1}{\text{solar to grid efficiency}}$

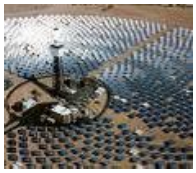
MINIMIZE

MAXIMIZE

Parabolic trough

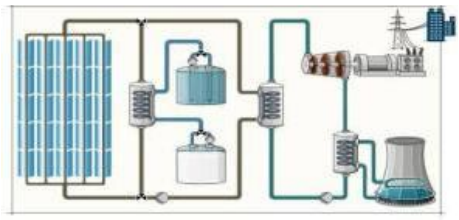
Linear Fresnel

Power tower

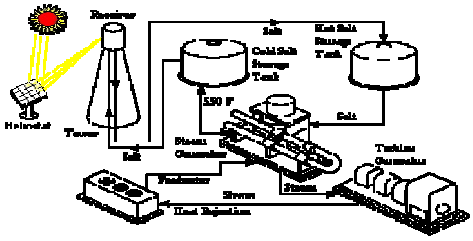


SOLAR THERMAL AUTOMATION SOLUTIONS

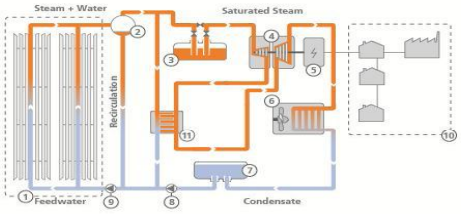
Different CSP Technologies
Automation: Focus on Common areas



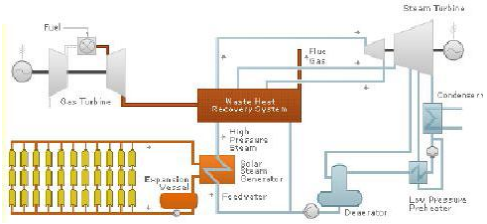
Parabolic Trough



Power Tower

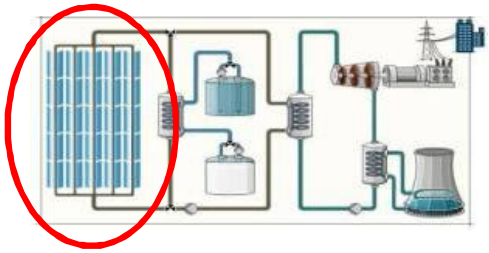


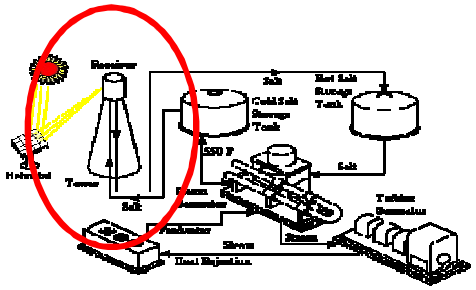
Fresnel Plants



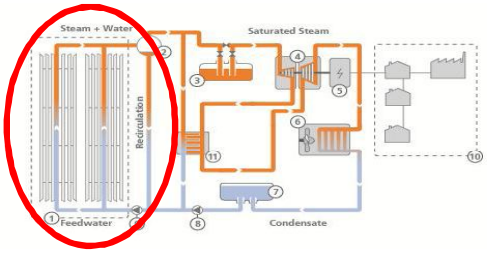
Integrated Solar Combined Cycle

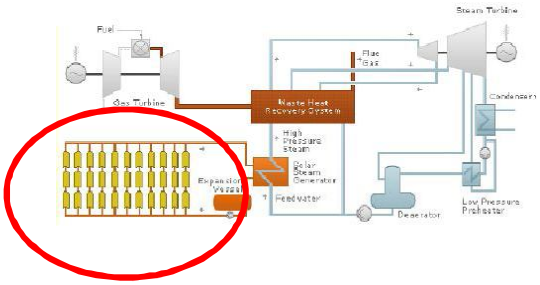
Different CSP Technologies
Automation: Focus on Common areas



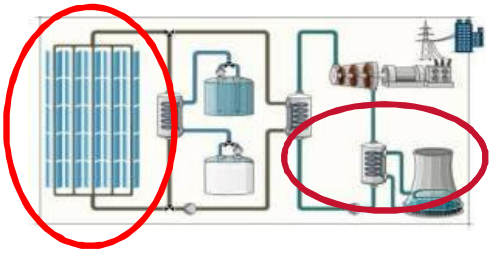


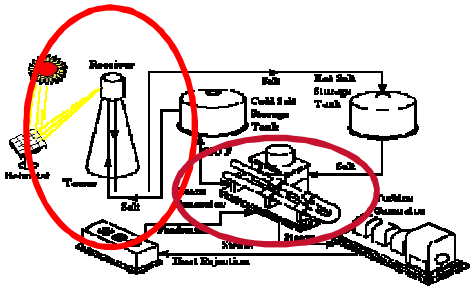
Boiler System – The Solar Field





Different CSP Technologies
Automation: Focus on Common areas





Boiler System – The Solar Field

BOP System – Power Plant Core