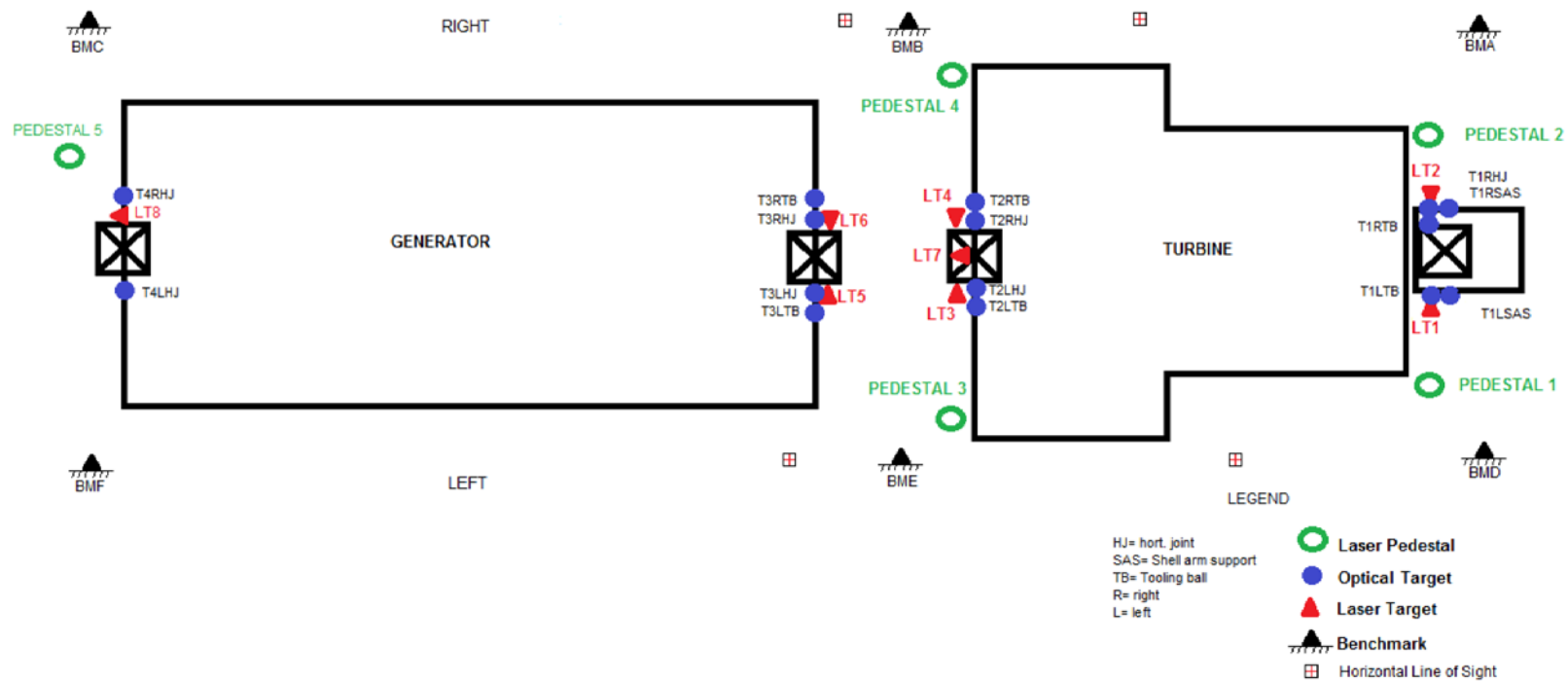


# Thermal Growth/Positional Change Overview of 2016 Powerhouse Unit 197704 at a Papermill

JAN 2016-HOT TO COLD & FEB 2016-COLD TO HOT

# Overall Setup



# Instruments utilized



Figure 1: Permalign



Figure 2; IR Thermometer



Figure 3: Optical Jig Transit



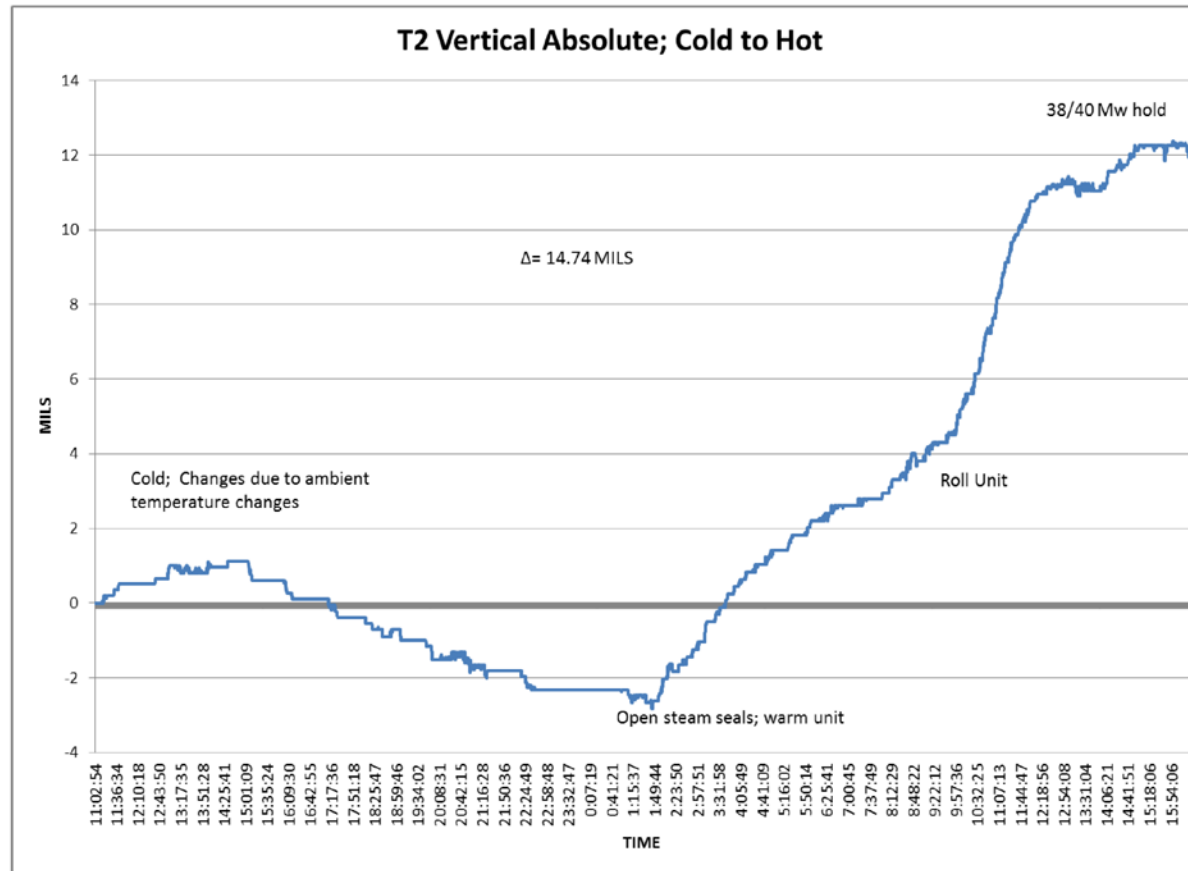
Figure 4: Optical tilting level

- A. Front standard; Left side vertical laser setup
- B. Front standard; Left side vertical optical/laser setup
- C. Optical benchmark
- D. Optical and laser setup on mid standard inboard steam turbine

Note: The purpose of using multiple methods of measurement is to verify data and provide a method of capturing events as they occur during startup or shutdown.



# Example of Continuous Laser Data



# Example of reduced findings at bearing planes and expressed to coupling center

## V. ADDENDUM FINDINGS (COLD TO HOT; OVERALL AVERAGE TARGET RECOMMENDATION; TEST 1 AND TEST 2)

- A. THOUGH THERMALLY STABLE (95%), THE UNIT DID NOT REACH A LEVEL OF HEAT SOAK EQUIVALENT TO TEST 1 - Hot to Cold.
- B. IR Data from TEST 2 – Cold to Hot WAS NOT USED DUE TO ADDENDUM FINDING A
- C. SET GENERATOR HIGH +4 MILS TO TURBINE; COLD; offset at coupling center)
- D. SET GENERATOR LEFT 2 MILS TO TURBINE; COLD; Both turbine and generator move slightly to the right from cold to hot. Generator moves slightly more to the right. (offset at coupling center)
- E. VERTICAL AND HORIZONTAL ANGLES TO BE SET AT 0.0 MILS/COUPLING DIAMETER-COLD
- F. Test 2-Cold to Hot; Vertical Data Summary with associated coupling values based on unit dimensions supplied by GE:

|  |         |         |                                   | Bearing GROWTH AVERAGE; Laser & Optics; Test 2; Cold to Hot |        |       |       | HOT    | HOT          |
|--|---------|---------|-----------------------------------|---|--------|-------|-------|--------|--------------|
|  |         |         |                                   | T1  | T2     | T3    | T4    | MILS   | MILS/CPL DIA |
|  |         |         | Optics                            | 21.1  | 19.9   | 14.7  | 12.6  | → -4.6 | 0.1          |
|  |         |         | Laser                             | 17.62   | 14.74  | 11.5  | 9.9   | → -2.5 | -0.3         |
|  |         | Average | Test 2                            | 19.36   | 17.32  | 13.1  | 11.25 | -3.55  | -0.1         |
|  |         |         |                                   | ↓   | ↓      | ↓     | ↓     | ↓      | ↓            |
|  | Overall | Average | Test 1                            | GROWTH AVERAGE; Laser & Optics; Test 1; Hot to Cold         |        |       |       |        |              |
|  |         |         | Optics                            | 21  | 18     | 14    | 17.5  | -4.5   | -0.8         |
|  |         |         | Laser                             | 16  | 12.5   | 12    | 21    | -2.3   | -1.6         |
|  |         | Average | Test 1                            | 18.5  | 15.25  | 13    | 19.25 | -3.4   | -1.2         |
|  |         |         |                                   |   |        |       |       |        |              |
|  |         |         | OVERALL AVERAGE TEST 1 AND TEST 2 | 18.93   | 16.285 | 13.05 | 15.25 | -3.475 | -0.65        |

COLD-HOT=TARGETS; TURBINE STATIONARY