

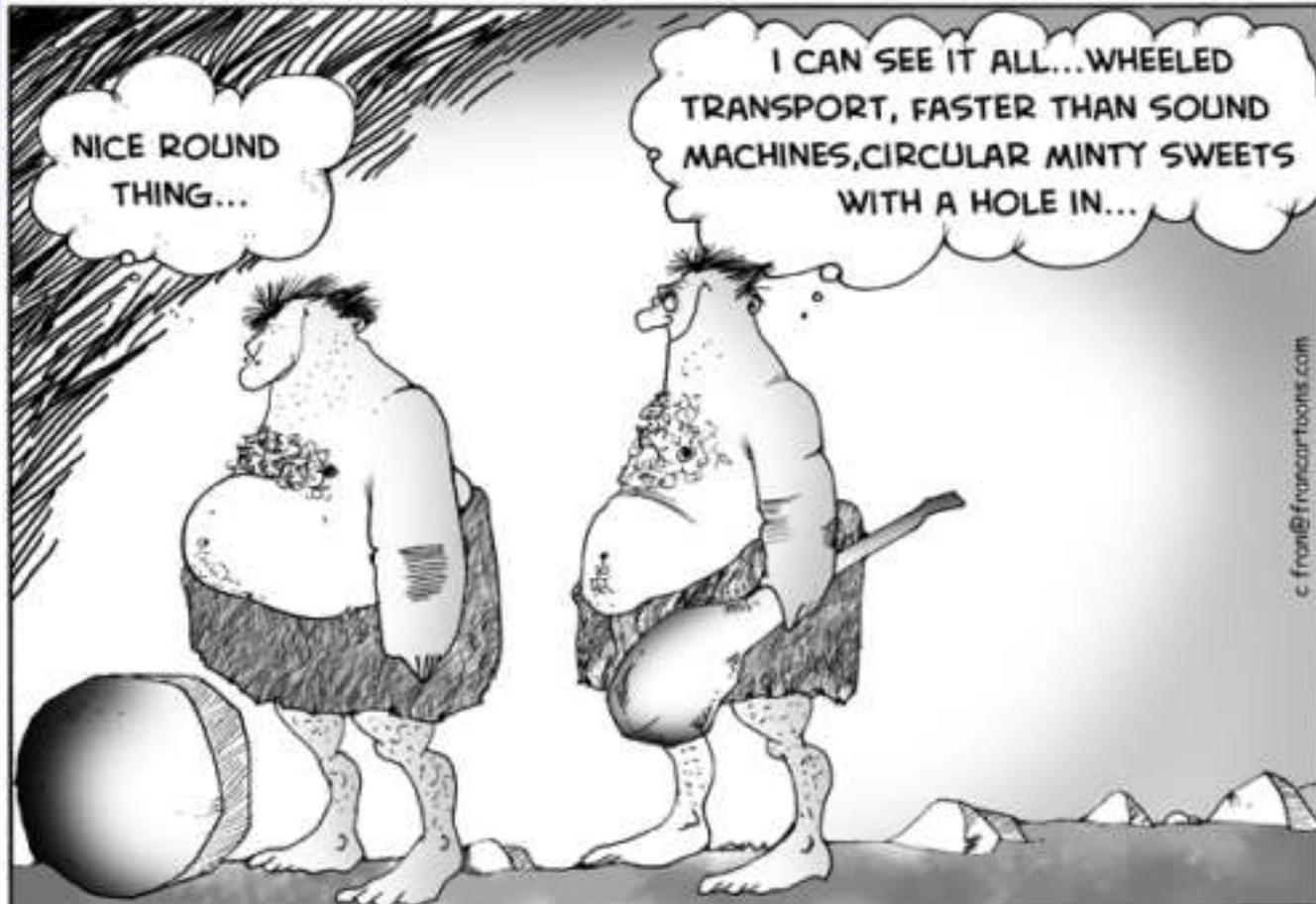
A Better Understanding of Modern Rail and Wheel Inspection on North American Railways



BeenaVision

The question is not what you look at, but what you see.

Henry David Thoreau



Why improve Wheel and Rail Inspection?

1. Increase critical defect detection.
2. Improve data collection and accuracy.
3. Reduce subjectivity in data.
4. Improve work efficiencies with better planning tools provided by trended data.
5. Drive down costs through improved maintenance procedures.
6. Prevent derailments.
7. Increase Safety.

Man is driven to improve.

“No matter how good you get you can always get better, and that's the exciting part.”

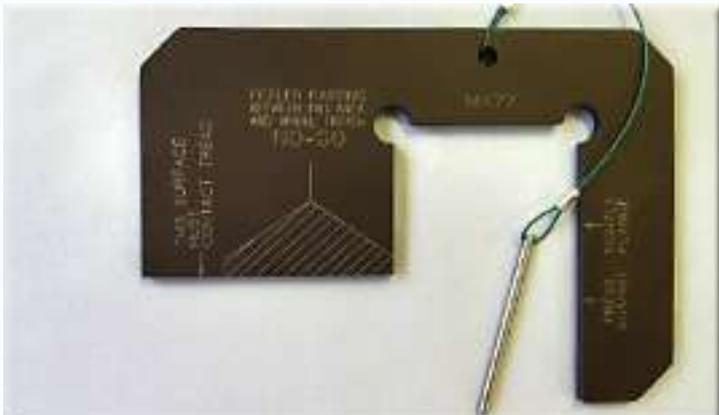
— [Tiger Woods](#)

Wheel Inspection Tools

The manual way it's done now.
Eyeball it, then measure it.

Go or No-Go

Resolution = 1/16"



Better Idea!

- Collect the wheel Profile & Measure it!



“Old School” Method of Wheel Profiling



Using a carpenter's tool, the profile was collected then transcribed to a paper.



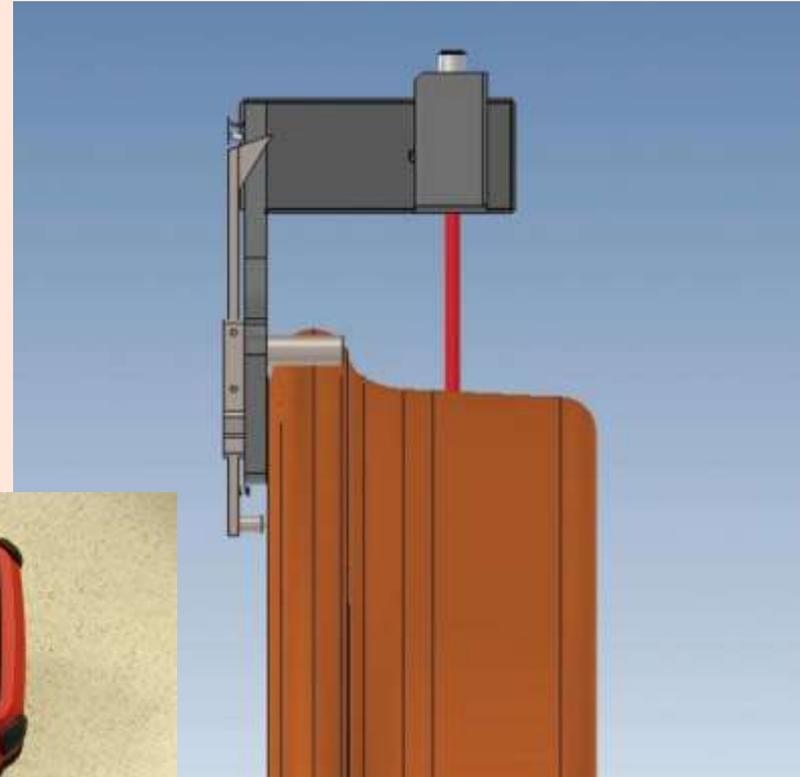
A Better Idea on a Better Idea

Non-Contact Laser Based Wheel Profile Devices –

Handheld

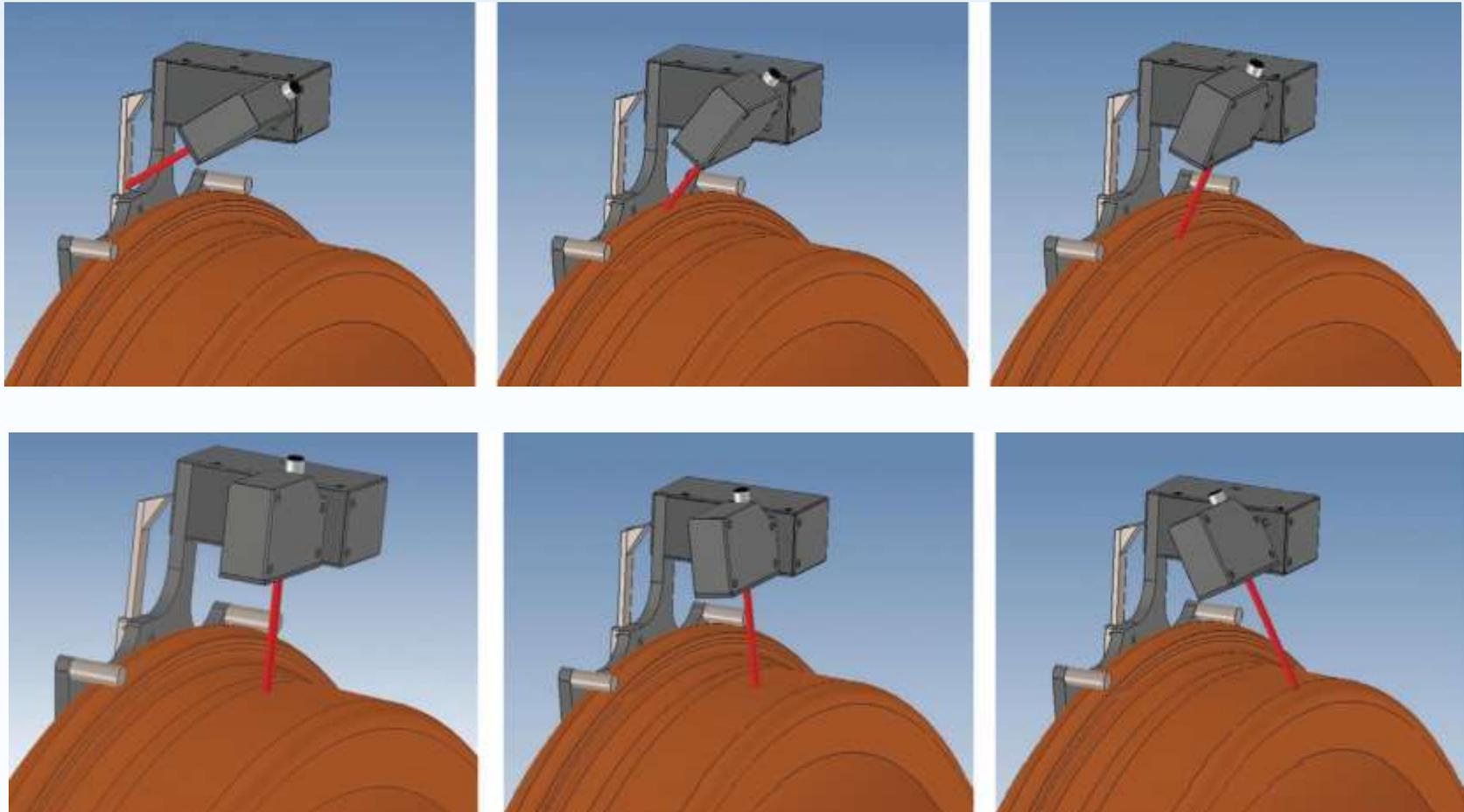
Automated

Handheld Wheel Profile Device Non-Contact Laser



Handheld Wheel Profile Device Non-Contact Laser Type

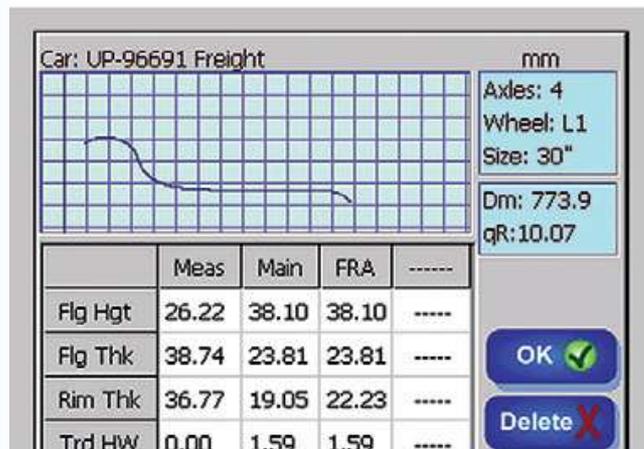
BeenaVision



Handheld Wheel Profile Device Non-Contact Laser Type



Hand Held Computer Screens

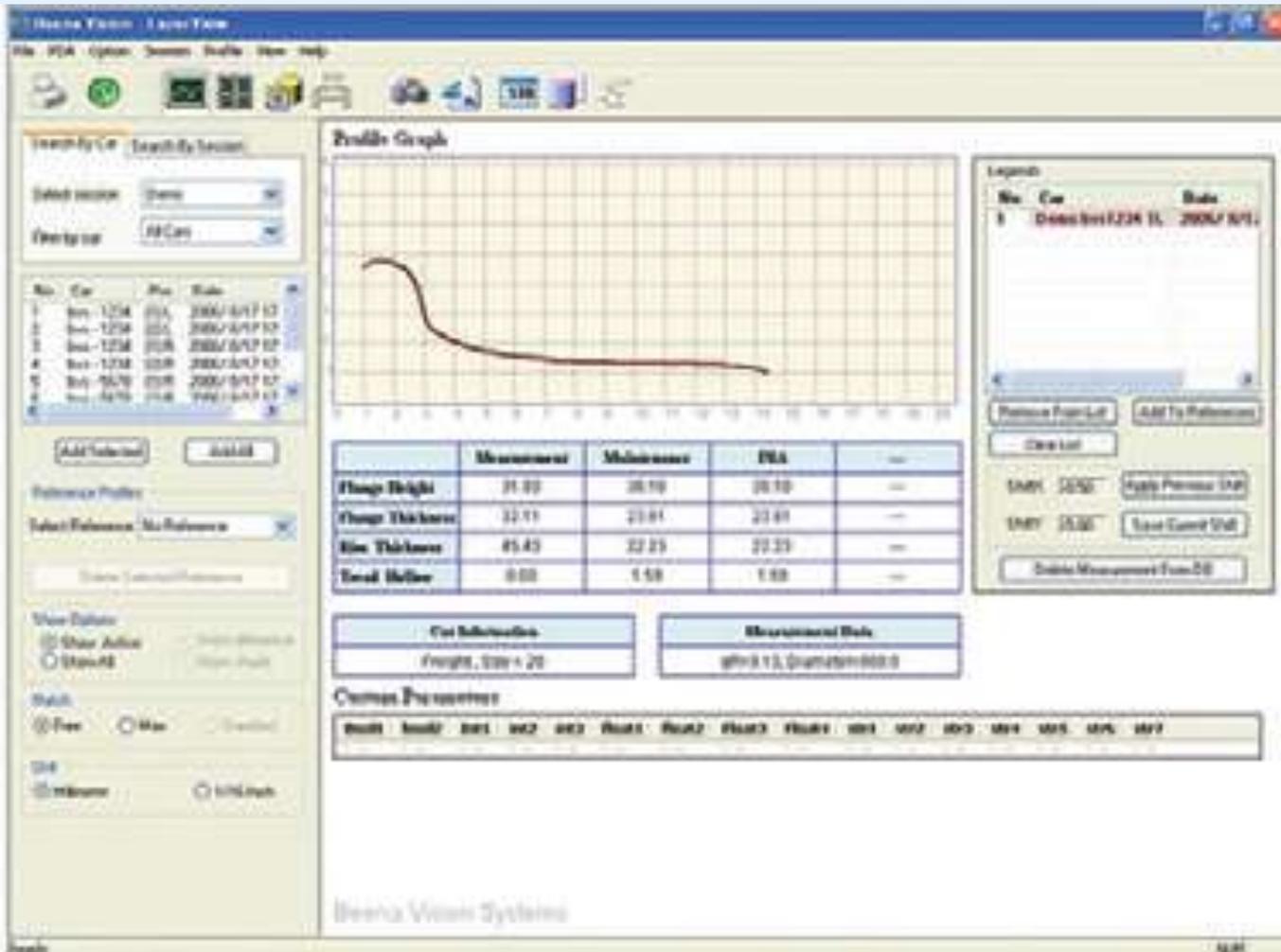


Hand Held screens provide setup, organization and feedback for operations

Handheld Wheel Profile Device Non-Contact Laser Type



Data can be downloaded to Desktop Software

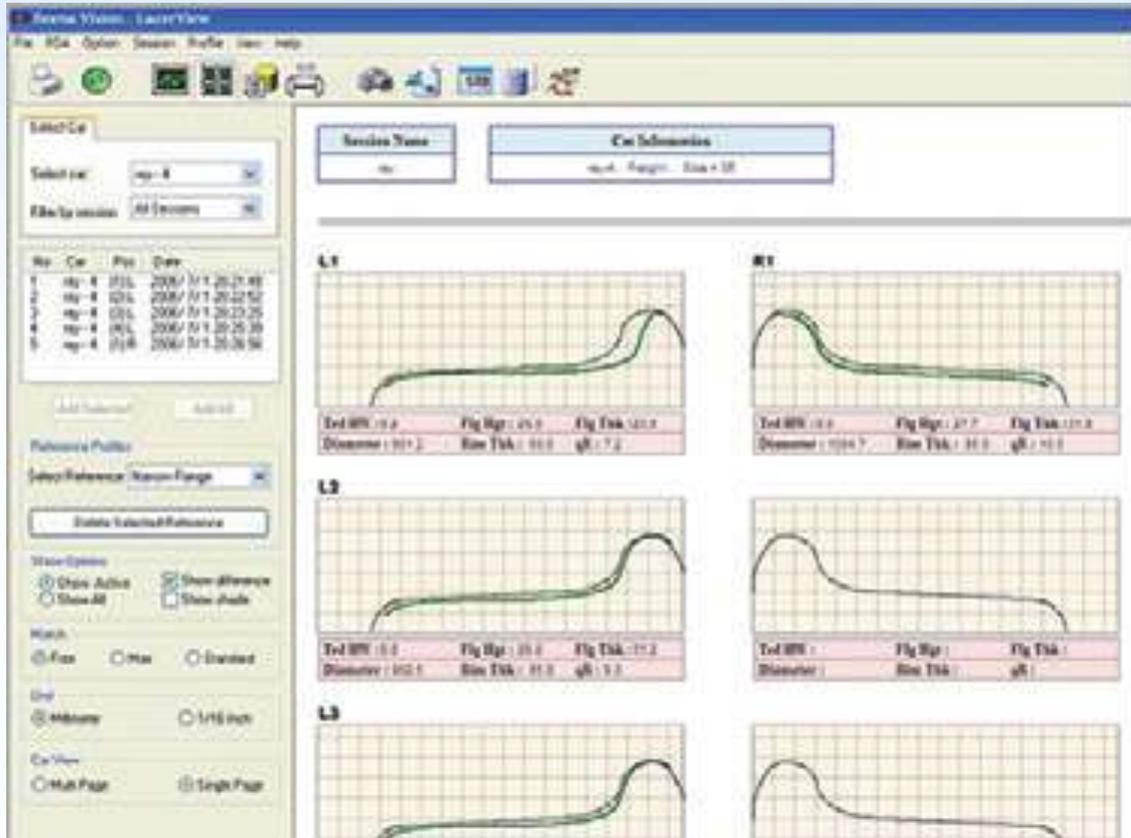


The profiles can be uploaded to the Desktop software, and then displayed with additional detail. Profiles can be overlaid to display wear.

Handheld Wheel Profile Device Non-Contact Laser Type



Desktop Software



The Desktop software provides database interface and reporting. In this report the "Truck View" displays the profiles and their Relationship to each other. It provides the ability to display multiple profiles with overlay, and overlay of standard profiles For comparison purposes.

■ Handheld Wheel Profile Measurement

■ Advantages

- Lower Cost than in-track systems
- Increased accuracy compared to gage measurement
- Database integration provides historical information with data trending capabilities

■ Disadvantages

- More labor intensive than automated in-track systems.

The Best Idea Yet!

Automated-in-Track

Laser Based
Wheel Profile Measurement



BeenaVision

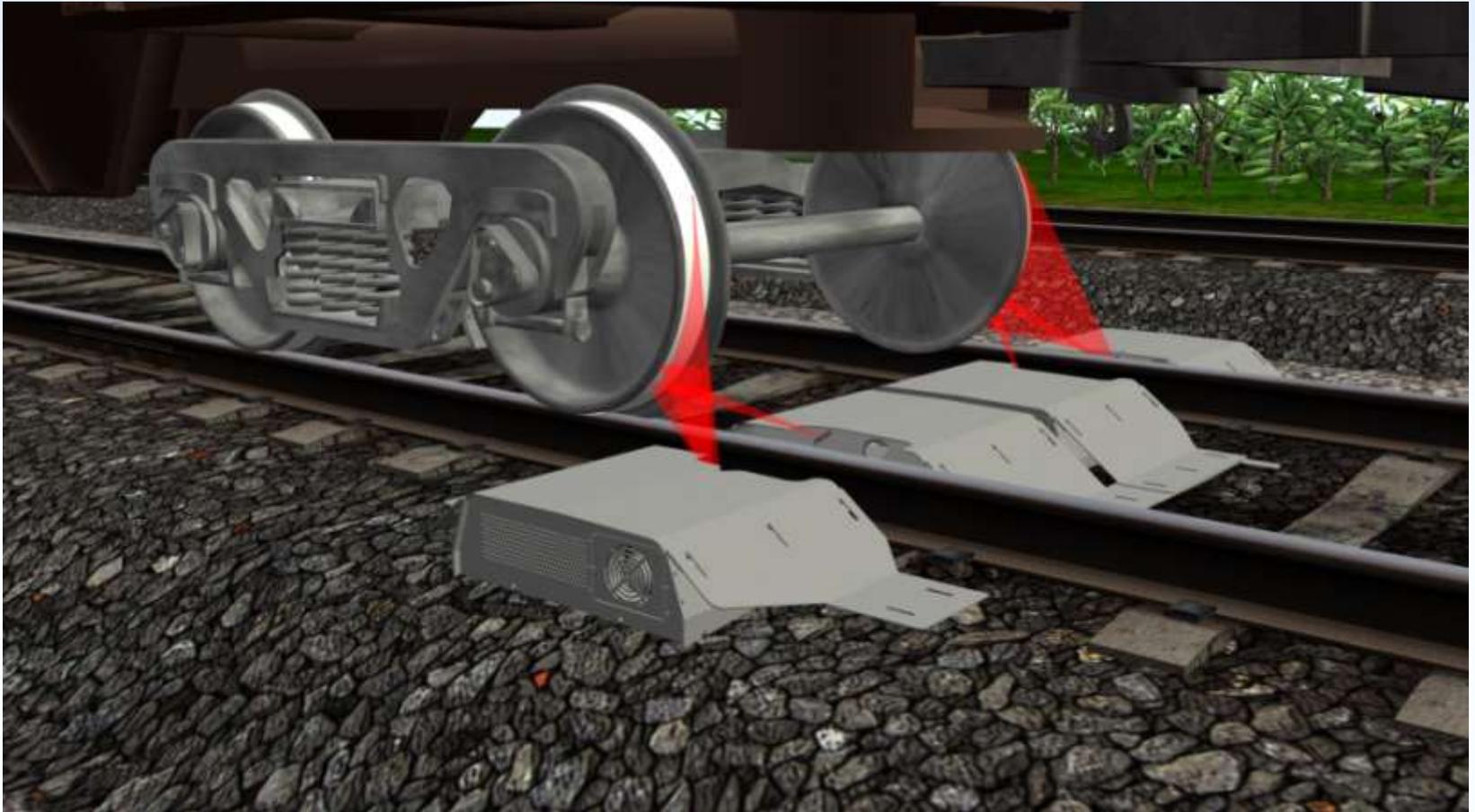
In Track - Automated



- Laser Profile Measurement of Wheels



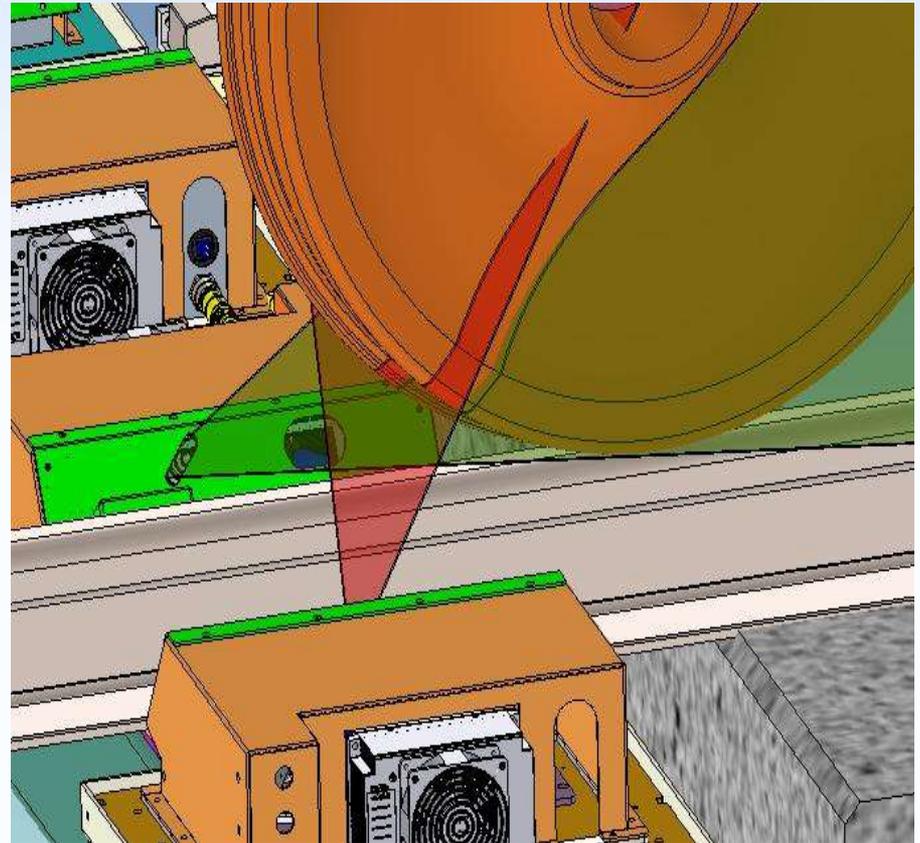
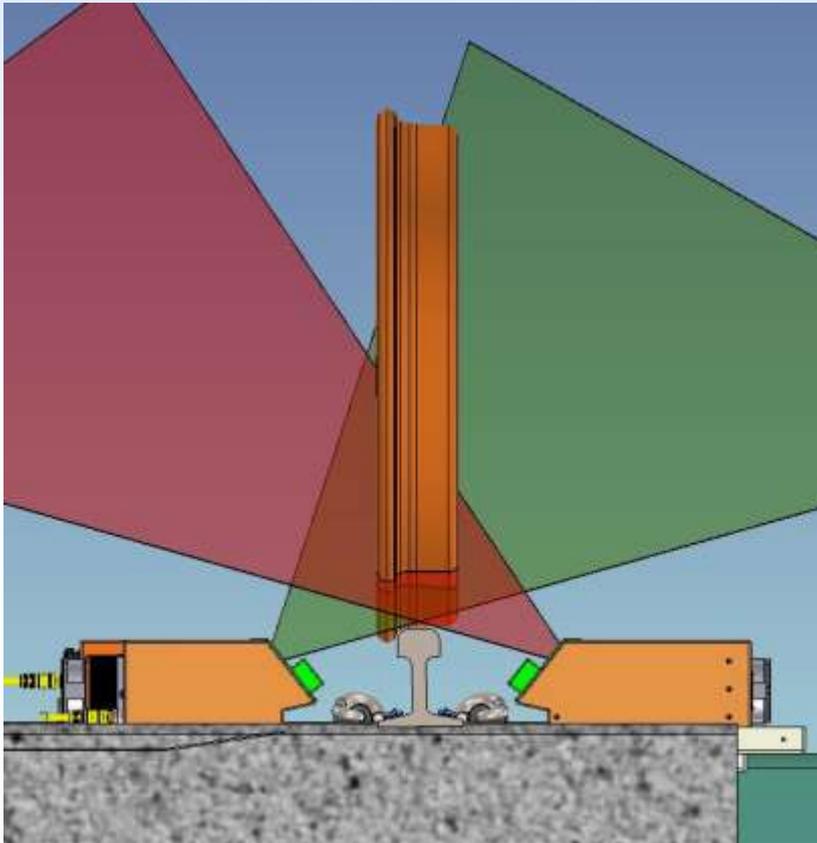
Laser Based



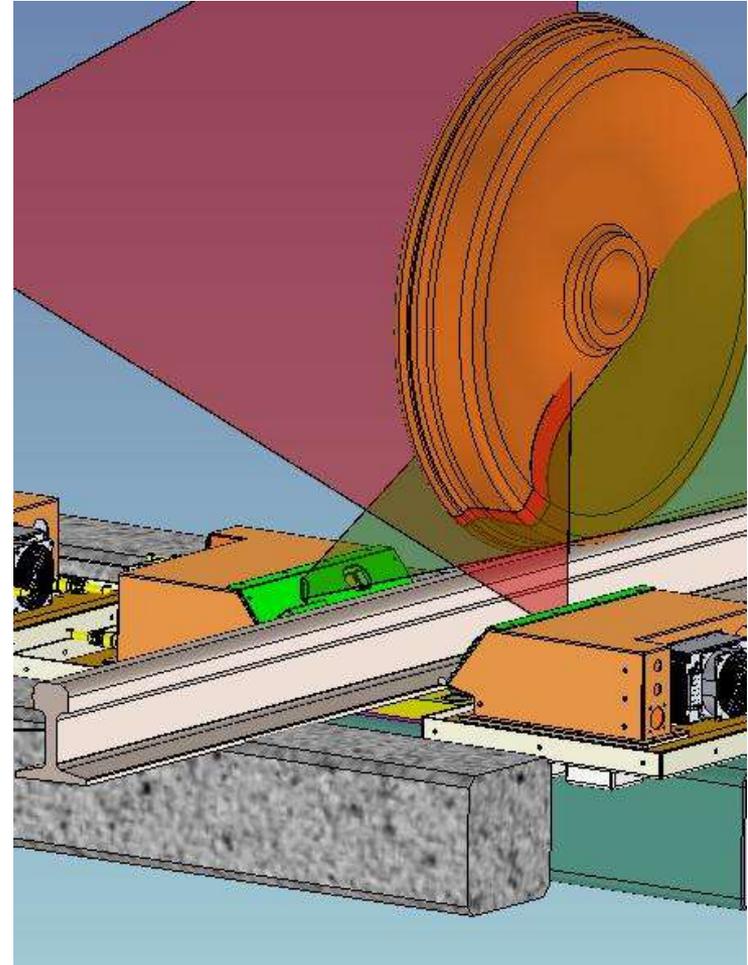
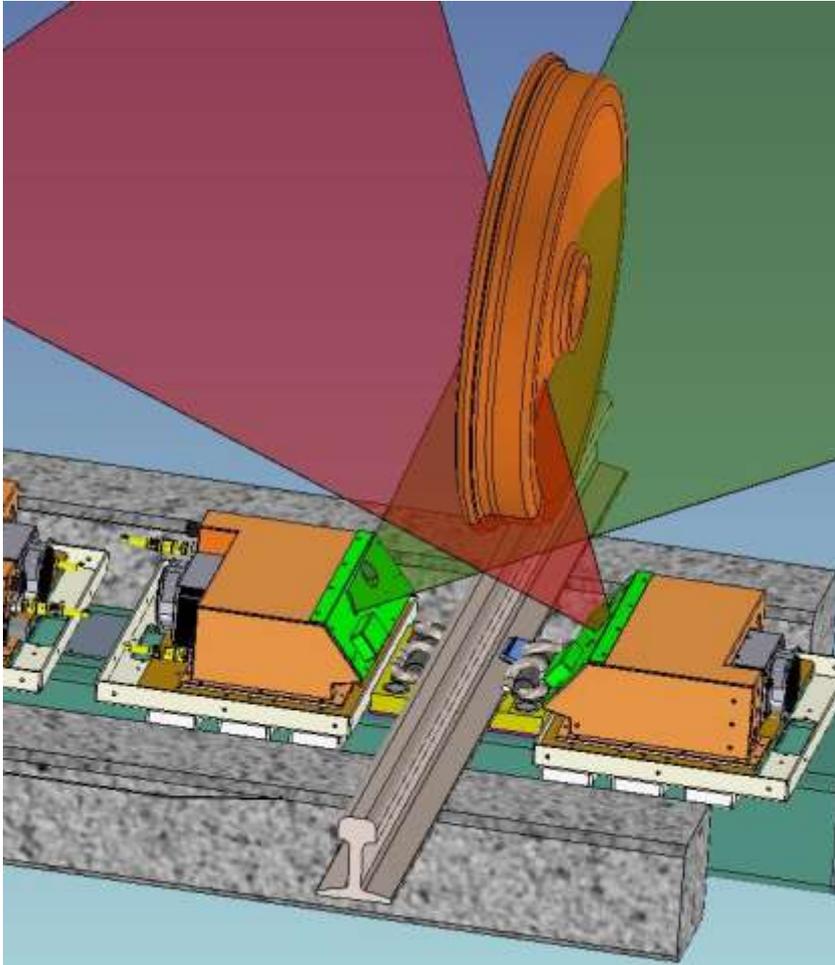
How it works.



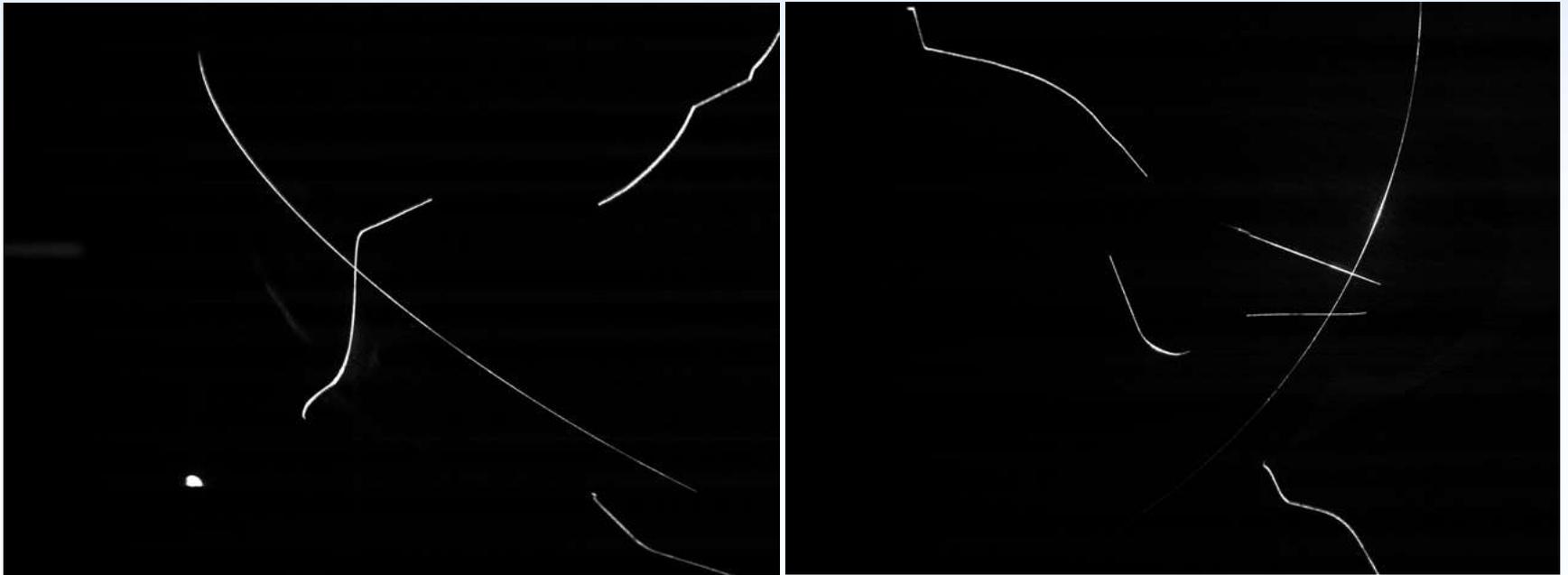
Laser Profiles



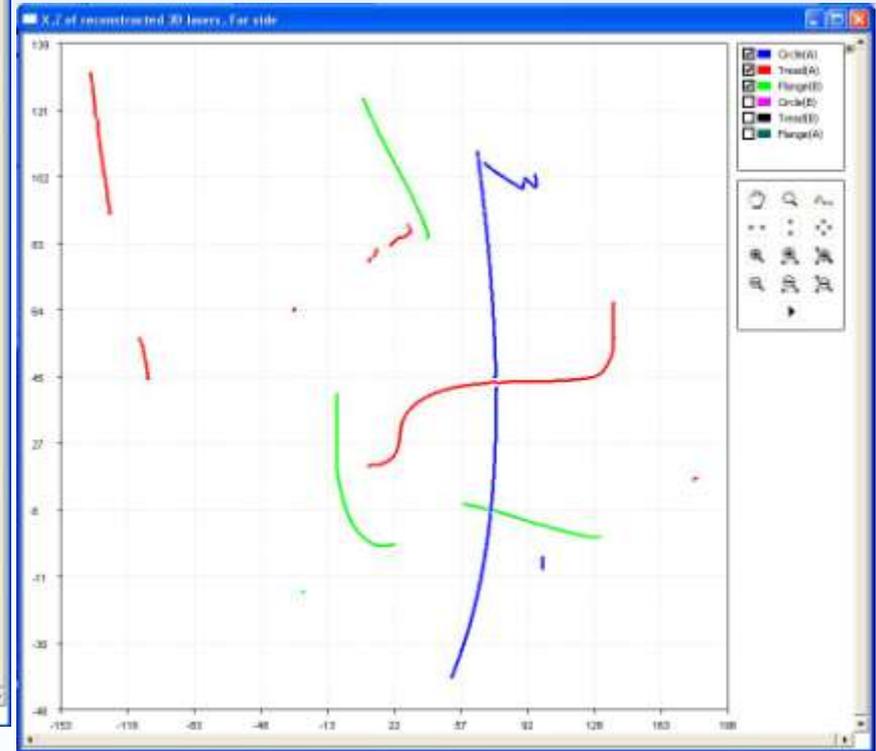
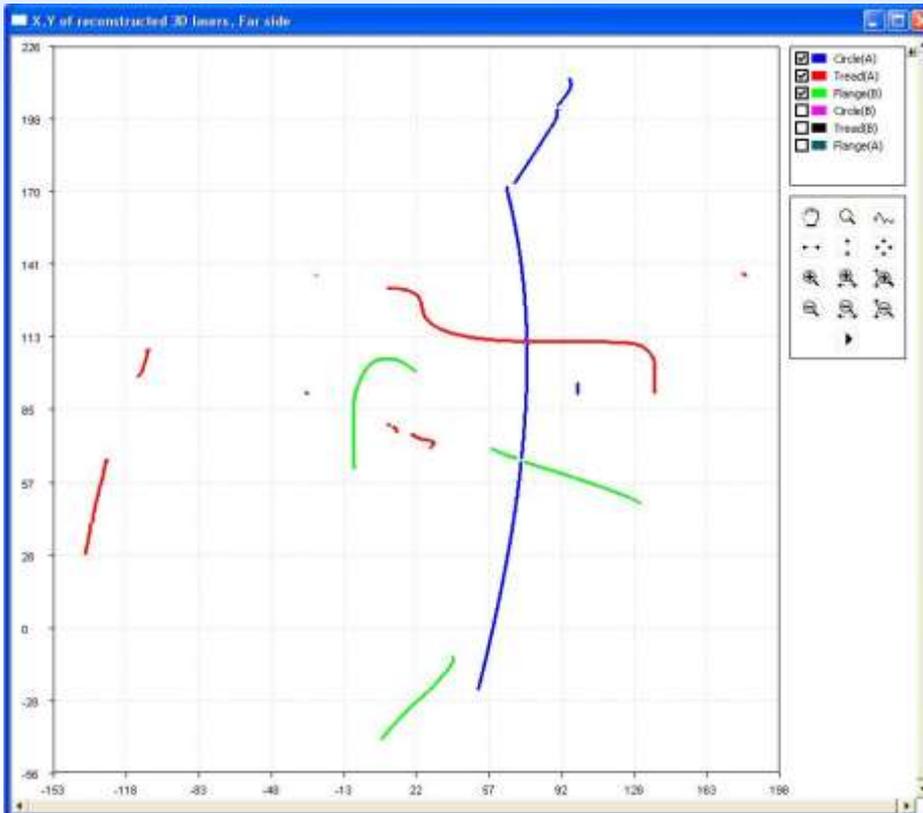
Wheel Profile Measurement Principle



Raw Image Quality



Raw Laser Data



Parameter Measurement



Wheel Profile Measurement

- Standard Measurements
 - Flange Height
 - Flange Thickness
 - Flange Slope
 - Tread Hollow
 - Rim Thickness
- Extensions
 - Back-to-Back
 - Wheel Type (straight plate, etc.)
 - Tracking Position

These systems are not fragile, and work in all environments.

- Saudi Arabia (Dry and Hot)



- South America (Hot and Humid)



- Finland (Extreme Cold, Snow, Ice)



Shutters

BeenaVision



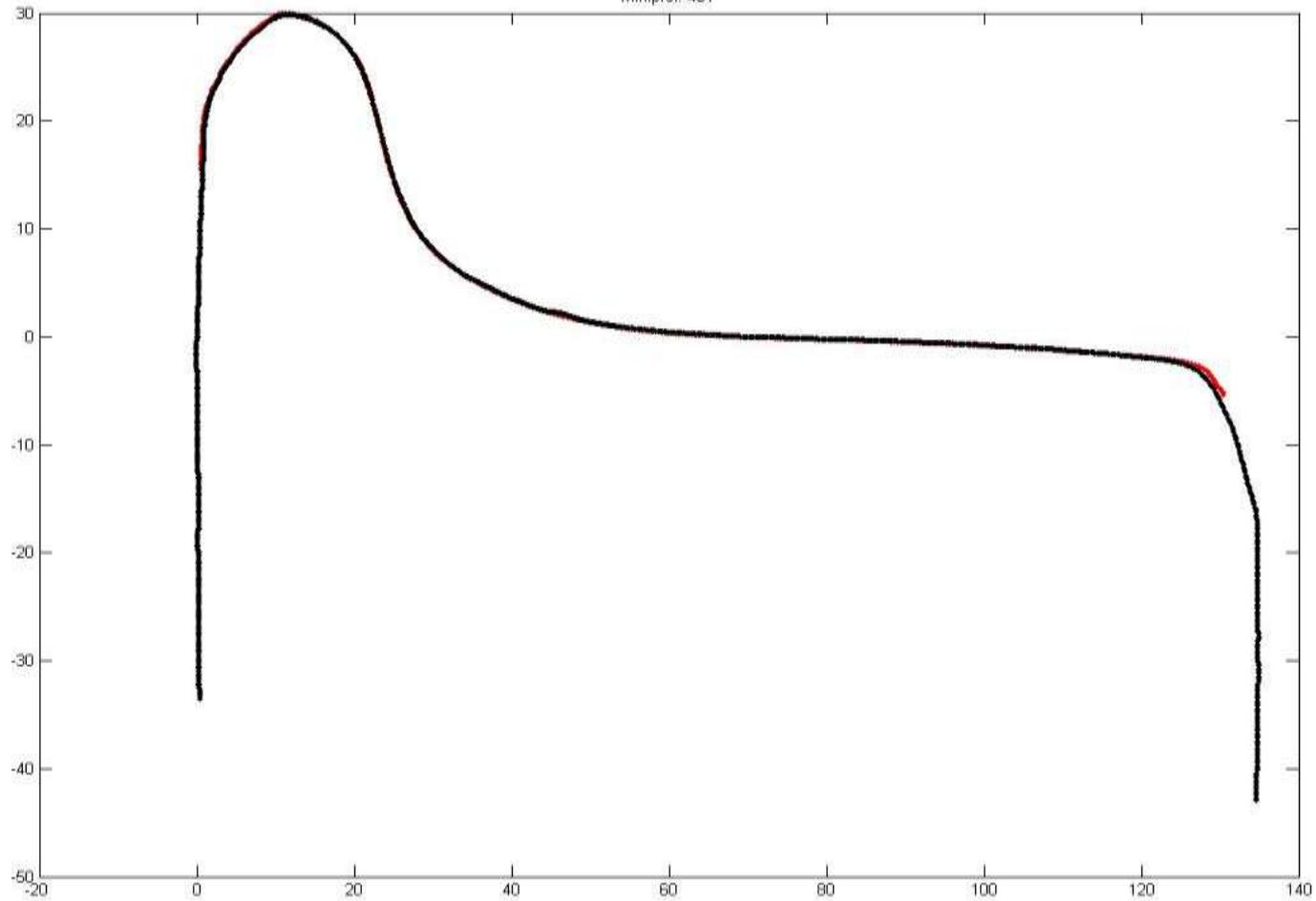
Air Purge System

BeenaVision

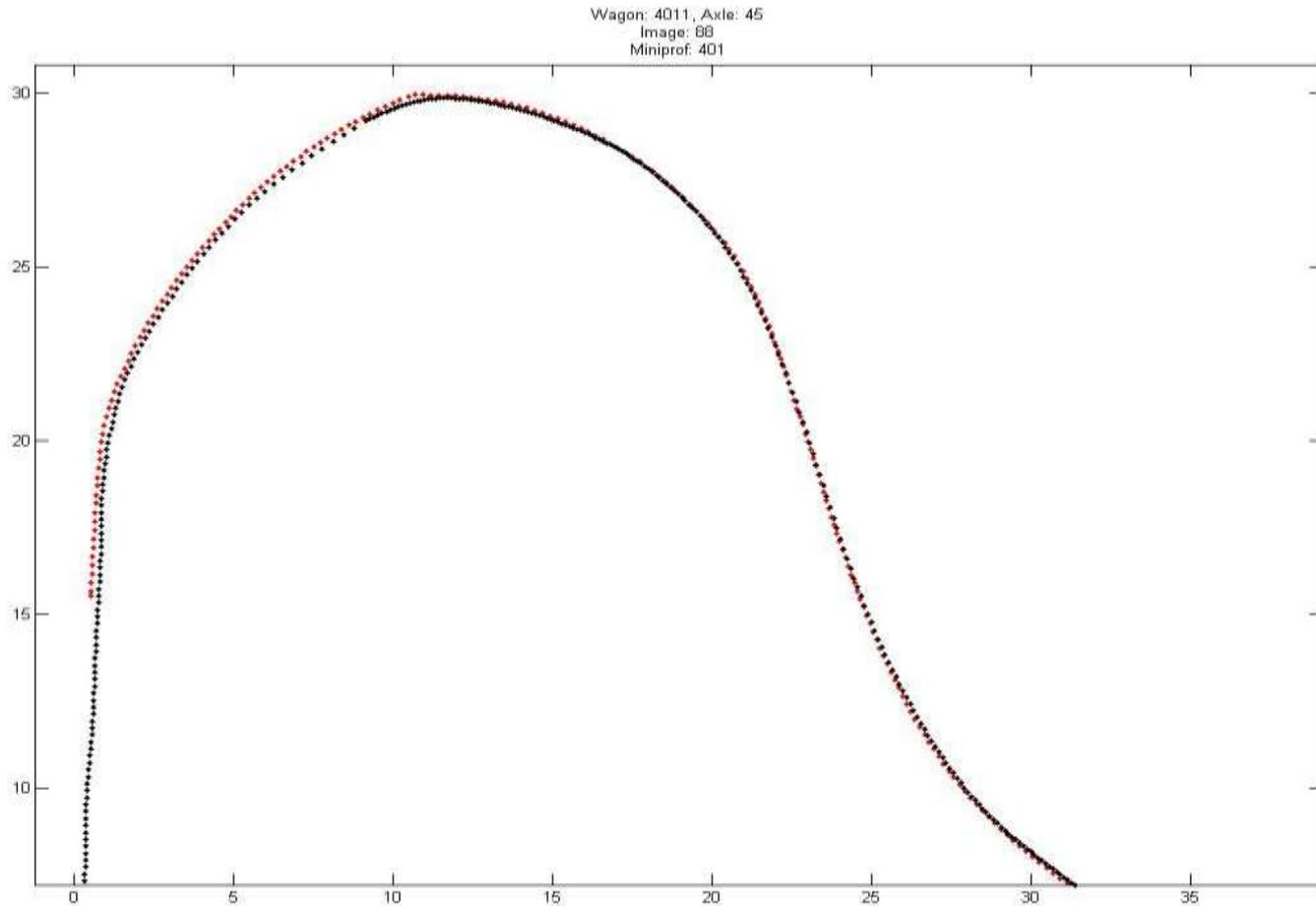


Accuracy

Wagon: 4011, Axle: 45
Image: 88
Miniprof: 401



Flange - Top Area

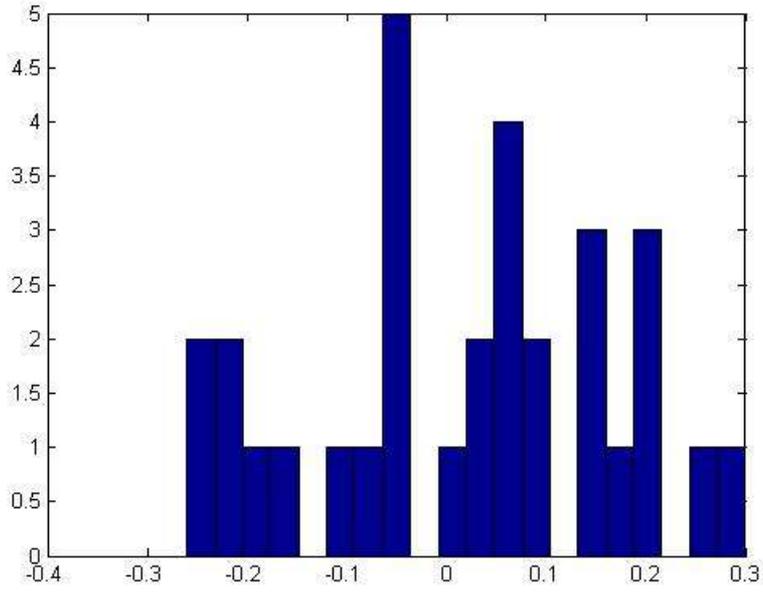


Typical Error Distribution

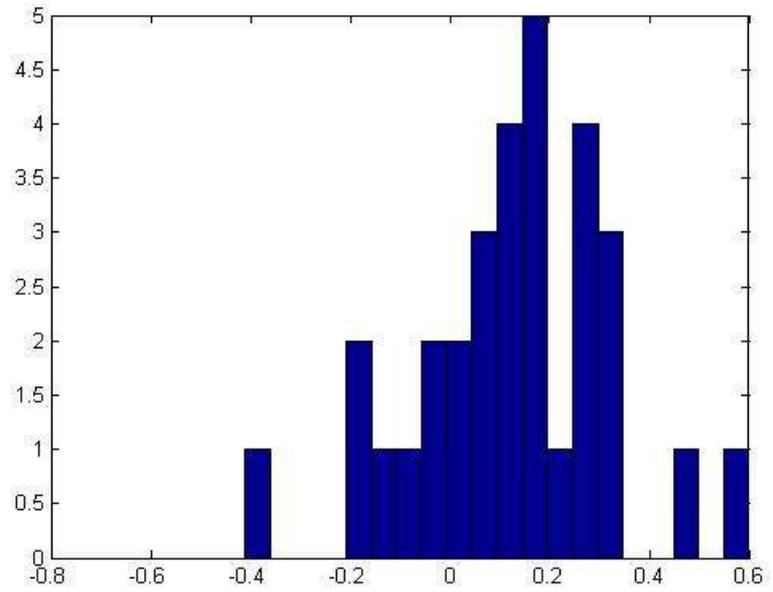


- Performed for 30 wheels at 130km/h speed

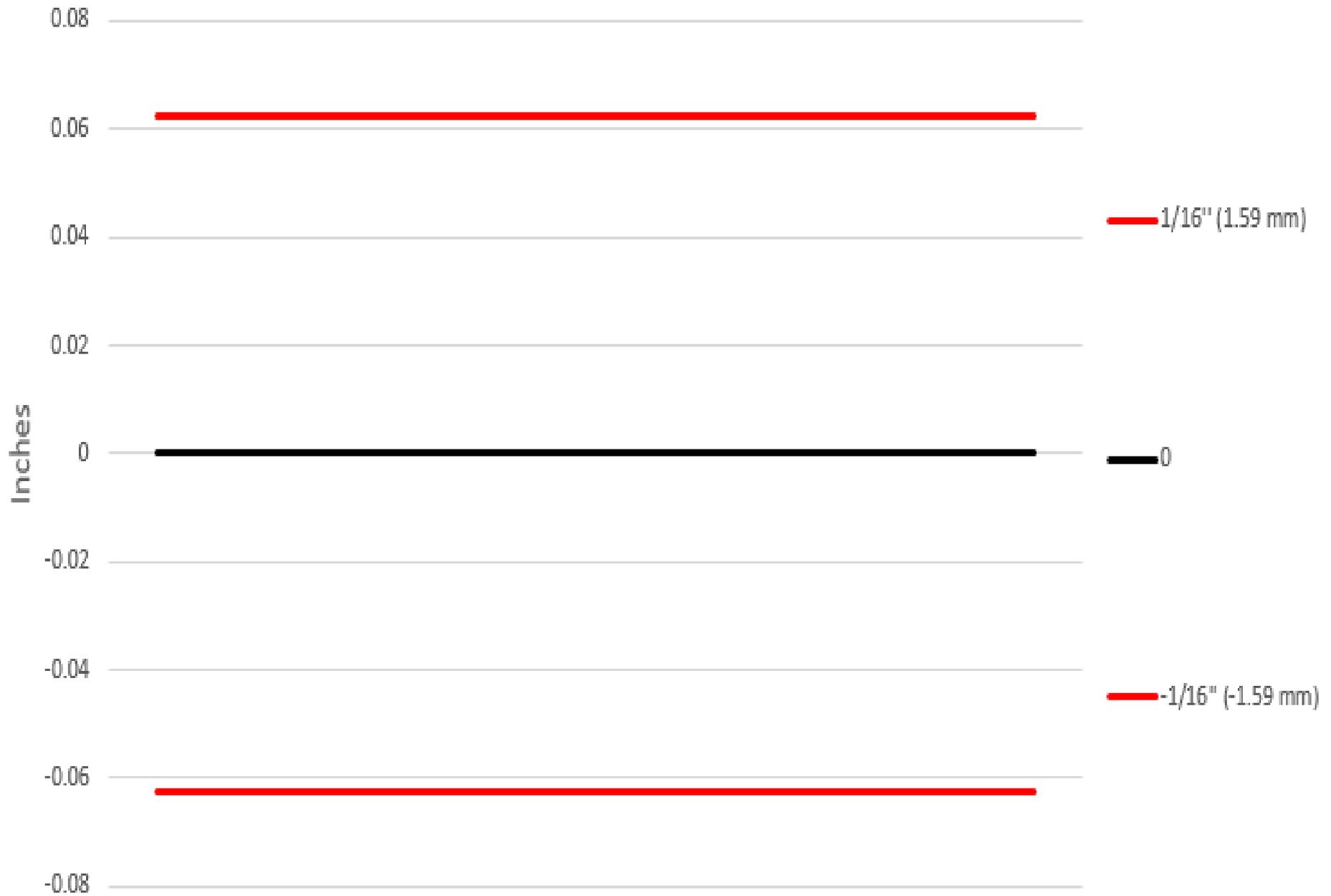
Flange Height



Flange Thickness



Wheel Profile Accuracy



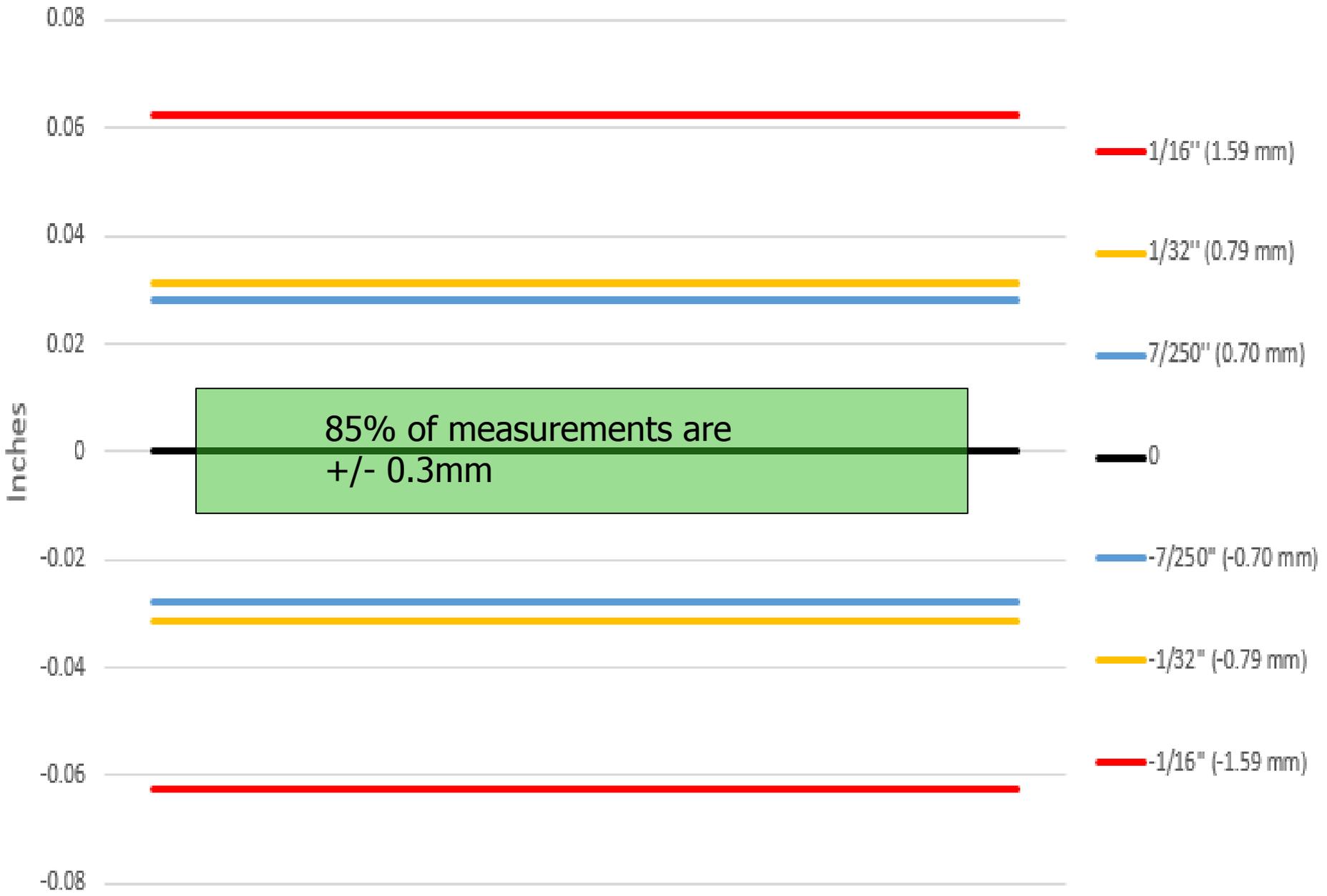
Wheel Profile Accuracy



Wheel Profile Accuracy



Wheel Profile Accuracy



Reporter

Reporter

- The Report Module is responsible for sending emails to a recipient list
- List of message types:
 - Train Reports
 - Contains information about the train tested
 - Lists all of the wheels which are non conforming
 - Critical Error Report
 - Contains information about a system fault, hardware error, or some other critical event
 - Daily Processing Report
 - Contains system health information

Reporter – Train Report



- **Train Summary Report**

////////////////////////////////////

Train Information

Train Number : 514
Arrival Date/Time : 2009/10/14 - 13:06:26
Axle Count : 176
Near Side Wheel Count : 176
Far Wheel Count : 176
Train Direction : N
Train Speed : 58 (MPH)
Near Process Rate : 99%
Far Process Rate : 100%
Overall Process Rate : 99.5%
Labeling Method: Tag
Total Locos : 2
Tagged Locos : 2
Total Railcars : 41
Tagged Railcars : 41

Reporter – Fault Report



- Fault Information

////////////////////////////////////

- Fault Count : 2

Fault Number : 1

Wheel Index : 000188

Fault Flag : Hollow Tread

Car Initial : Car Number : 360778

Wheel Position : Right Axle Number : 7

- Flange Height : 22.83 (1/16 inch)
Flange Thickness : 18.66 (1/16 inch)
Rim Thickness : 21.92 (1/16 inch)
Tread Hollow : 4.31 (mm)

Fault Number : 2

Wheel Index : 000316

Fault Flag : Hollow Tread

Car Initial : Car Number : 620963

Wheel Position : Left Axle Number : 10

- Flange Height : 23.23 (1/16 inch)
Flange Thickness : 15.48 (1/16 inch)
Rim Thickness : 17.87 (1/16 inch)
Tread Hollow : 4.28 (mm)

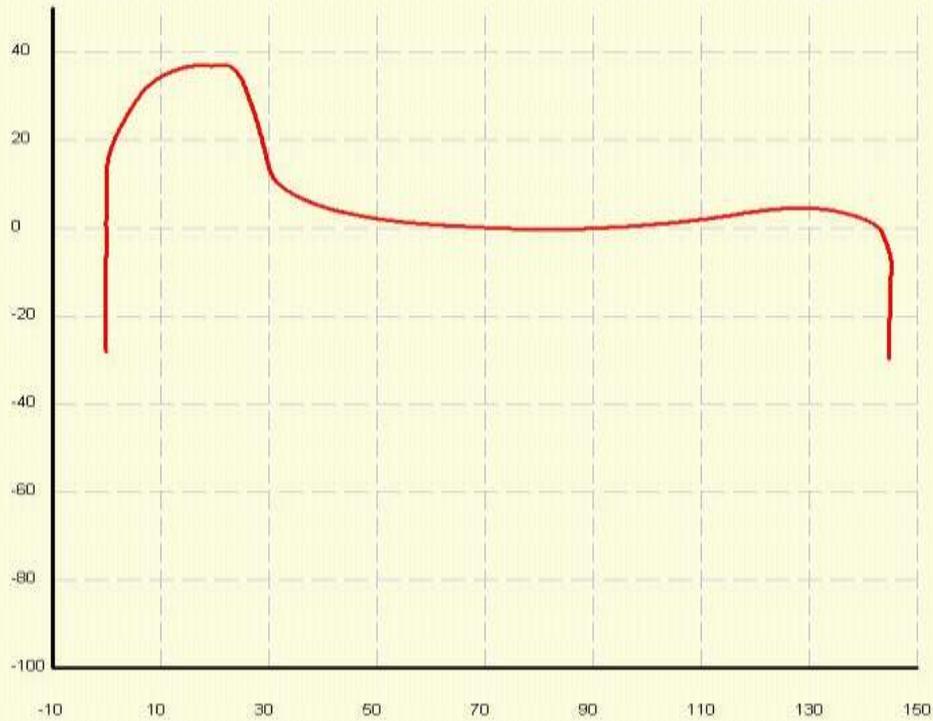
Reporter – Fault Report



Wheel Index = 000230
Train Number : 218
Car Initial : DCEP
Car Number : 43436

Axle Number : 8
Wheel Position : Left

Flange Height : 23.2 (1/16 Inch)
Flange Thickness : 20.1 (1/16 Inch)
Rim Thickness : 17.6 (1/16 Inch)
Tread Hollow : 4.9 [mm] [Faulty]



Advantages Automated Profiling



- More frequent inspections/ Measurements
- Trending predicts wear limits - and to evaluate consistency – system provides self evaluation/correction.
- Provides historical data.
- Provides alarms for repair purposes.

Example:

- One wheel profiler at one mainline location for one week.
 - 257 Trains
 - 12189 cars
 - 156128 Wheels
 - 780640 Measurements

Data Trending



BeenaVision

Wheel Query Database



BeenaVision

Wheel Query DB



WheelQuery

File Edit Tools Settings Help

Drive Files or Results

Delete Selection

Data Type

Alter Description

Show Results

Page # 1

Displaying records (1 to 900) of 56748

No	Train Number	Train Arrival Time	Car Initial	Train Speed	Car Number	Axle Number	Wheel Number	Wheel Direction	Flange Height	Flange Thickness	Rim Thickness	Tread Hollow	Wheel Width	File Index	Wheel Diameter
1	6101	2009-06-17 22:40:01	CSDT	43.00	45321	4	7	Left	27.50	34.61	43.00	0.00	145.78	000750...	909.00
2	6101	2009-06-17 22:40:01	CSDT	43.00	45321	4	8	Right	27.50	31.99	43.00	0.00	142.77	000750...	925.00
3	6101	2009-06-17 22:40:01	CSDT	43.00	45321	2	3	Left	30.27	31.60	30.85	0.47	146.30	000750...	885.00
4	6101	2009-06-17 22:40:01	CSDT	43.00	45321	2	4	Right	30.27	31.60	30.85	0.47	144.71	000750...	911.00
5	6101	2009-06-17 22:40:01	ARPN	43.00	45770	3	5	Left	29.70	30.86	37.48	0.00	143.84	000750...	911.00
6	6101	2009-06-17 22:40:01	ARPN	43.00	45770	3	5	Left	29.70	30.86	37.48	0.00	145.29	000750...	902.00
7	6101	2009-06-17 22:40:01	ARPN	43.00	45770	4	8	Right	30.46	37.90	37.49	0.00	144.53	000750...	903.00
8	6101	2009-06-17 22:40:01	ARPN	43.00	45770	4	7	Left	30.06	35.79	35.63	0.00	145.98	000750...	913.00
9	6101	2009-06-17 22:40:01	ARPN	43.00	45292	4	7	Left	30.11	38.94	42.57	0.00	145.88	000750...	905.00
10	6101	2009-06-17 22:40:01	ARPN	43.00	45292	4	8	Right	31.60	35.05	41.98	0.00	144.00	000750...	891.00
11	6101	2009-06-17 22:40:01	ARPN	43.00	45292	3	5	Left	31.02	36.02	33.27	0.15	143.81	000750...	905.00
12	6101	2009-06-17 22:40:01	ARPN	43.00	45292	3	6	Right	31.43	36.00	27.07	0.00	144.00	000750...	891.00
13	6101	2009-06-17 22:40:01	BYMS	43.00	39059	3	5	Left	26.90	34.95	28.43	0.00	145.67	000750...	921.00
14	6101	2009-06-17 22:40:01	BYMS	43.00	39059	3	6	Right	27.30	31.14	27.93	0.00	142.89	000750...	907.00
15	6101	2009-06-17 22:40:01	ARPN	43.00	45273	4	7	Left	29.84	36.50	35.77	0.00	146.44	000750...	941.00
16	6101	2009-06-17 22:40:01	ARPN	43.00	45273	4	8	Right	29.13	33.29	36.22	0.00	145.88	000750...	935.00
17	6101	2009-06-17 22:40:01	CSWQ	43.00	2940	1	2	Right	31.98	34.95	44.15	0.25	140.66	000750...	917.00
18	6101	2009-06-17 22:40:01	CSWQ	43.00	2940	1	1	Left	31.98	34.95	44.15	0.25	145.44	000750...	917.00
19	6101	2009-06-17 22:40:01	APQP	43.00	46163	3	5	Left	29.33	34.63	40.35	0.00	142.50	000750...	917.00
20	6101	2009-06-17 22:40:01	APQP	43.00	46163	2	6	Right	29.82	30.32	39.32	0.14	141.38	000750...	928.00
21	6101	2009-06-17 22:40:01	APQP	43.00	46186	3	5	Left	29.82	31.75	44.39	0.00	144.29	000750...	929.00
22	6101	2009-06-17 22:40:01	APQP	43.00	46215	1	2	Right	29.23	31.75	44.39	0.00	142.27	000750...	919.00
23	6101	2009-06-17 22:40:01	APQP	43.00	46215	1	1	Left	30.53	31.52	42.00	0.00	147.27	000750...	907.00
24	6101	2009-06-17 22:40:01	APQP	43.00	46215	3	6	Right	29.10	35.12	37.50	0.11	147.37	000750...	911.00
25	6101	2009-06-17 22:40:01	APQP	43.00	46215	3	5	Left	29.07	32.42	37.66	0.00	143.40	000750...	911.00
26	6101	2009-06-17 22:40:01	CSWQ	43.00	54932	1	2	Right	29.57	35.92	41.87	0.29	143.34	000750...	903.00
27	6101	2009-06-17 22:40:01	CSWQ	43.00	54932	1	1	Left	28.39	41.13	40.50	0.00	140.50	000750...	931.00
28	6101	2009-06-17 22:40:01	CSWQ	43.00	54932	3	6	Right	29.28	36.60	40.11	0.14	143.55	000750...	917.00
29	6101	2009-06-17 22:40:01	CSWQ	43.00	54932	3	5	Left	30.19	40.09	40.09	0.12	140.67	000750...	919.00
30	6101	2009-06-17 22:40:01	APQP	43.00	46101	3	6	Right	31.70	34.60	40.54	1.15	146.13	000750...	911.00
31	6101	2009-06-17 22:40:01	APQP	43.00	46101	3	5	Left	32.71	31.49	39.16	0.36	142.77	000750...	903.00
32	6101	2009-06-17 22:40:01	CRVX	43.00	5257	3	6	Right	29.60	37.02	42.44	0.00	144.27	000750...	896.00
33	6101	2009-06-17 22:40:01	CRVX	43.00	5257	3	5	Left	29.69	37.11	44.69	0.00	144.66	000750...	923.00
34	6101	2009-06-17 22:40:01	CRVX	43.00	5257	4	8	Right	29.10	44.33	46.33	0.00	141.84	000750...	913.00
35	6101	2009-06-17 22:40:01	CRVX	43.00	5257	4	7	Left	28.66	36.76	46.07	0.00	144.50	000750...	913.00
36	6101	2009-06-17 22:40:01	CRVX	43.00	5257	4	7	Left	29.16	40.56	40.56	0.00	139.87	000750...	906.00
37	6101	2009-06-17 22:40:01	BSQP	43.00	7527	2	4	Right	32.30	39.19	40.00	0.29	144.52	000750...	891.00
38	6101	2009-06-17 22:40:01	BSQP	43.00	7527	2	3	Left	32.30	39.19	40.00	0.29	145.52	000750...	891.00
39	6101	2009-06-17 22:40:01	BSQP	43.00	7288	4	8	Right	27.58	34.37	32.82	0.00	146.29	000750...	909.00
40	6101	2009-06-17 22:40:01	BSQP	43.00	7288	4	7	Left	30.18	29.64	31.82	0.00	146.29	000750...	899.00
41	6101	2009-06-17 22:40:01	BSQP	43.00	7288	4	7	Left	27.00	33.42	31.67	0.00	146.29	000750...	899.00
42	6101	2009-06-17 22:40:01	BSQP	43.00	7288	4	7	Left	27.00	33.42	31.67	0.00	146.29	000750...	899.00
43	6101	2009-06-17 22:40:01	BSQP	43.00	7288	4	7	Left	27.00	33.42	31.67	0.00	146.29	000750...	899.00

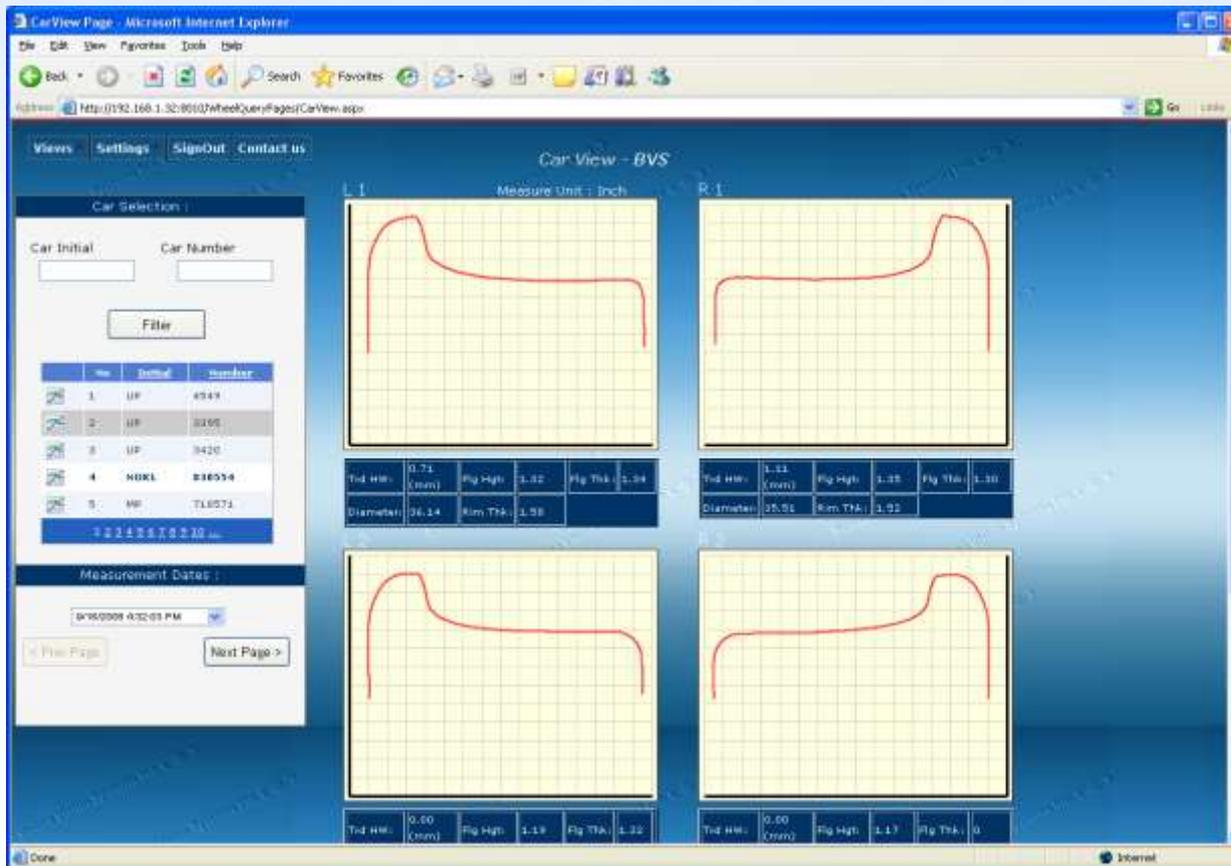
Wheel Position Info

Station Name	ATL
Train Number	6101
Car Initial	BYMS
Car Number	29069
Axle Number	3
Wheel Direction	Left

Ready

N.M.I.

Sample Truck Wheel Profiles



Wheel Query



Screenshot of the BeenaVision software interface showing a 'Wheel Query' window. The window displays a table of wheel data for three different cars, along with a 'Train Info' panel on the right and a 'Train Speed' graph at the bottom right.

Wheel Data Table:

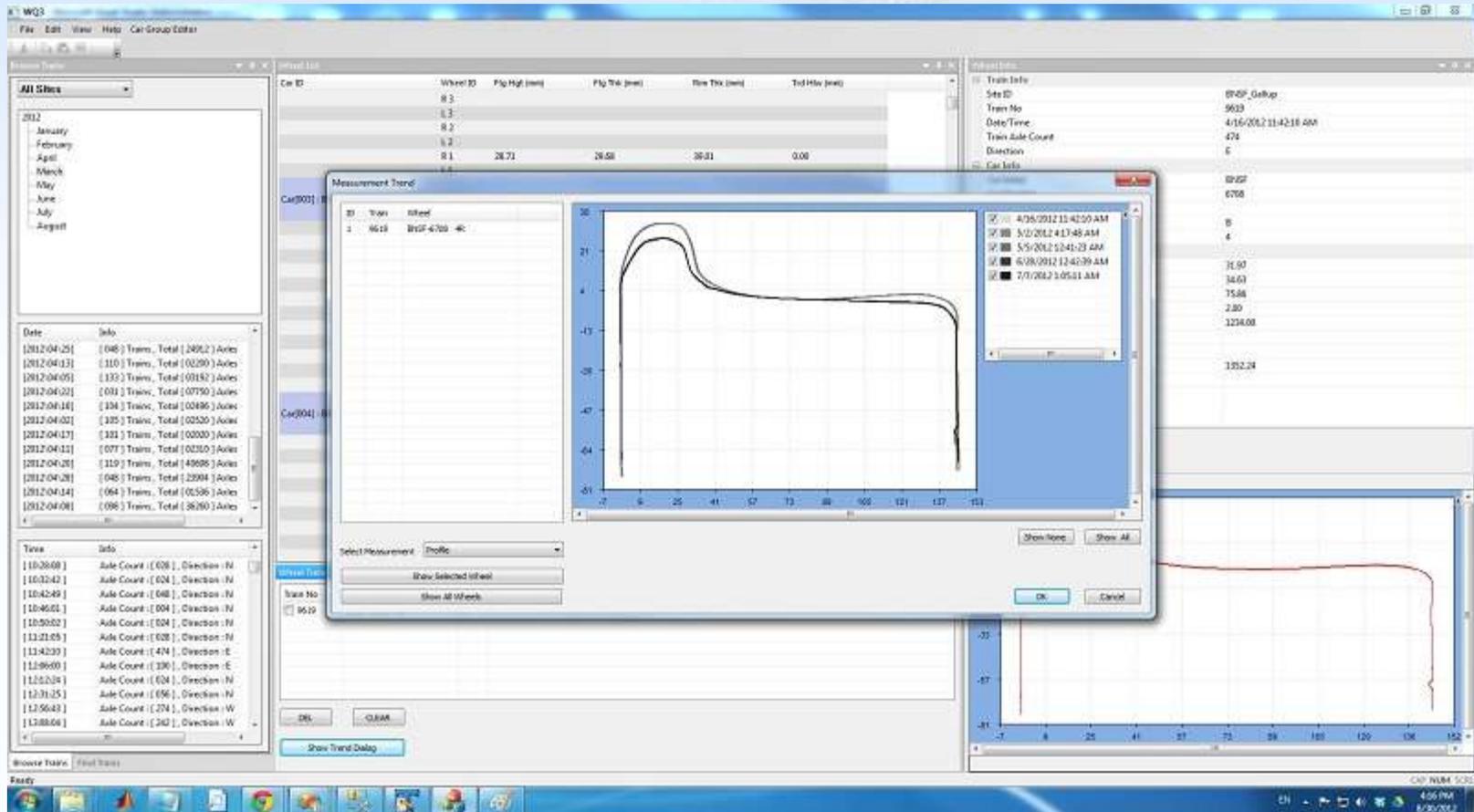
Car ID	Wheel ID	Flg Rot speed	Flg Thr speed	Rot Thr speed	Rot Acc speed
Car000 (790-1004-00)	L-1	27.90	28.54	28.54	0.00
	R-1	27.87	28.51	28.51	0.00
	L-4	28.15	29.74	29.74	0.00
	R-4	27.85	28.57	28.57	0.00
	L-3	28.00	29.88	29.88	0.00
	L-2	28.26	29.59	29.59	0.00
Car000 (790-1004-01)	R-2	28.07	29.58	29.58	0.00
	L-1	27.86	28.79	28.79	0.00
	R-1	27.94	28.43	28.43	0.00
	L-4	27.90	28.52	28.52	0.00
	R-4	27.47	28.52	28.54	0.00
	L-3	27.96	28.88	28.88	0.00
Car000 (790-1004-02)	R-3	27.79	28.87	28.87	0.00
	L-2	28.09	29.89	29.94	0.00
	R-2	28.14	29.19	29.29	0.00
	L-3	27.88	29.88	29.88	0.00
	R-1	27.90	29.88	29.88	0.00
	L-1	27.90	27.89	27.89	0.00
Car000 (790-1004-03)	L-2	27.90	27.90	27.90	0.00
	L-1	27.90	27.90	27.90	0.00
	R-1	27.90	27.90	27.90	0.00

Train Info Panel:

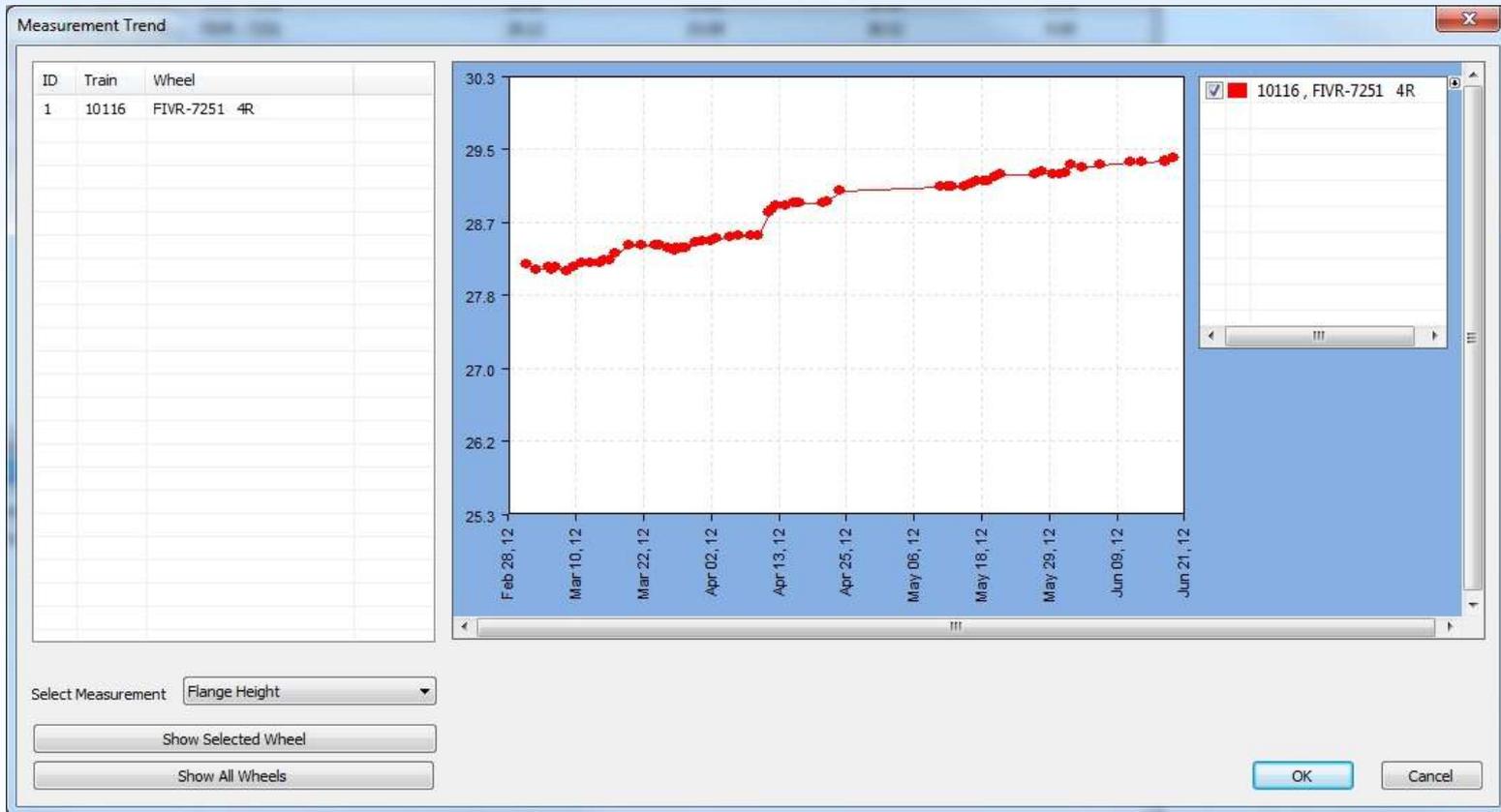
- Train Info
- Site ID: Prasad_012
- Train No: 12405
- Date/Time: 01/01/2010 00:00:00
- Train Axis Count: 24
- Direction: S
- Car Info:
 - Car Index: 790
 - Car Number: 1004
 - Car Axis Count: 4
 - Orientation: A
 - Car Axis ID: 1
- Dimensional Info:
 - Flange Height: 28.39
 - Flange Thickness: 21.28
 - Rail Thickness: 33.28
 - Track Height: 8.00
 - Flange Slope: 0.0000
 - Diameter: 21.28
 - Angle of Attack: 144.17
 - Back to Back Gauge: 144.17
 - Minimum Flange Gauge: 144.17

Train Speed Graph:

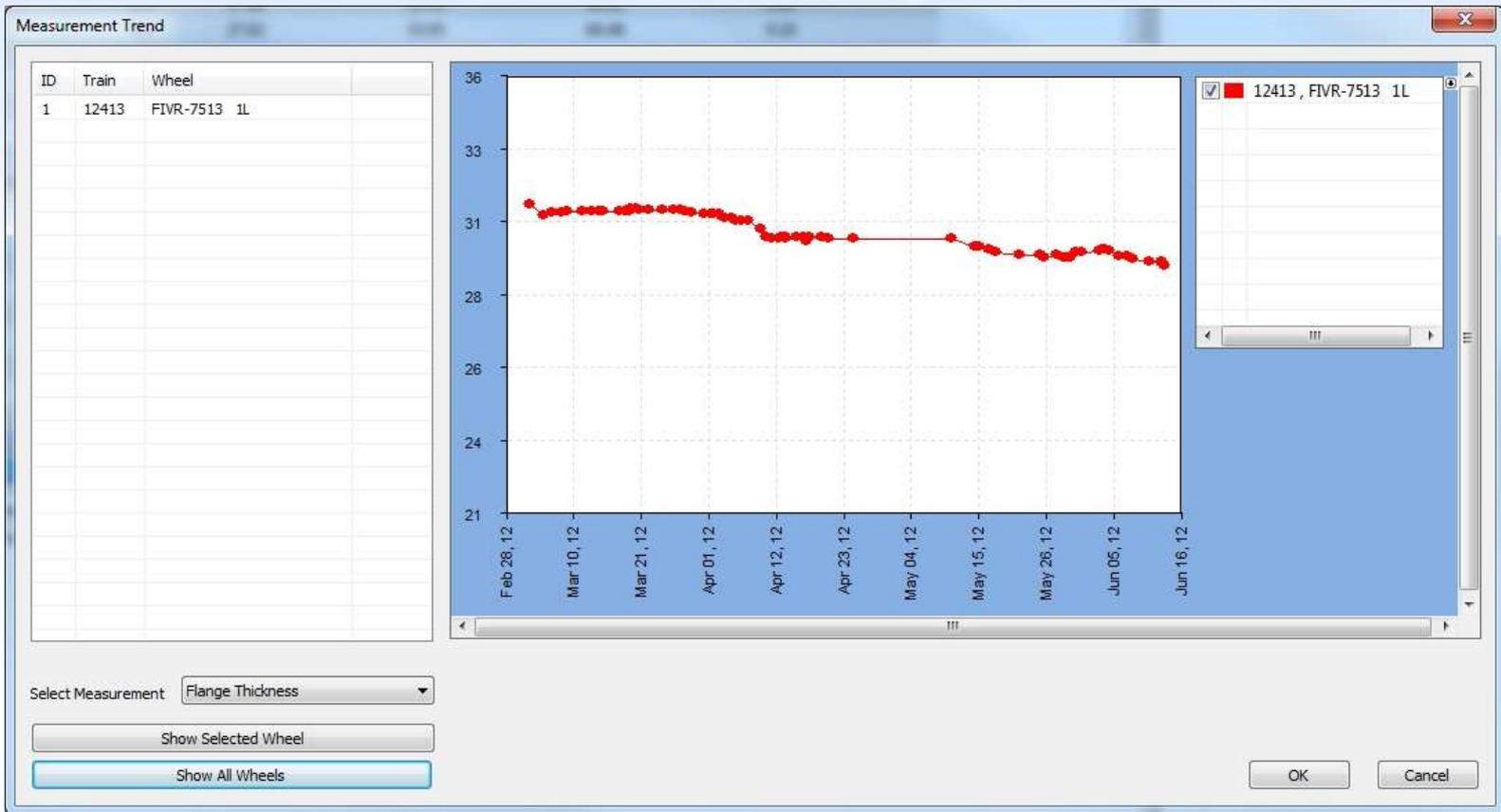
Wheel Change



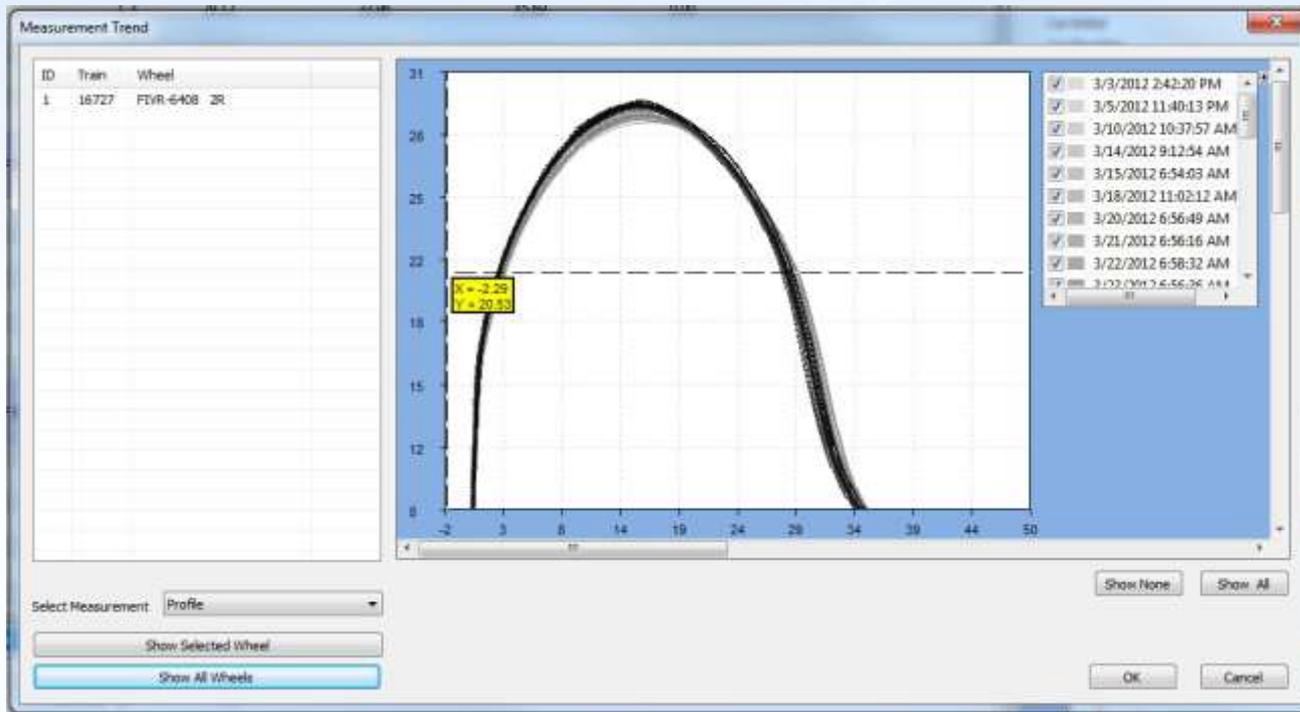
Trending



Trending



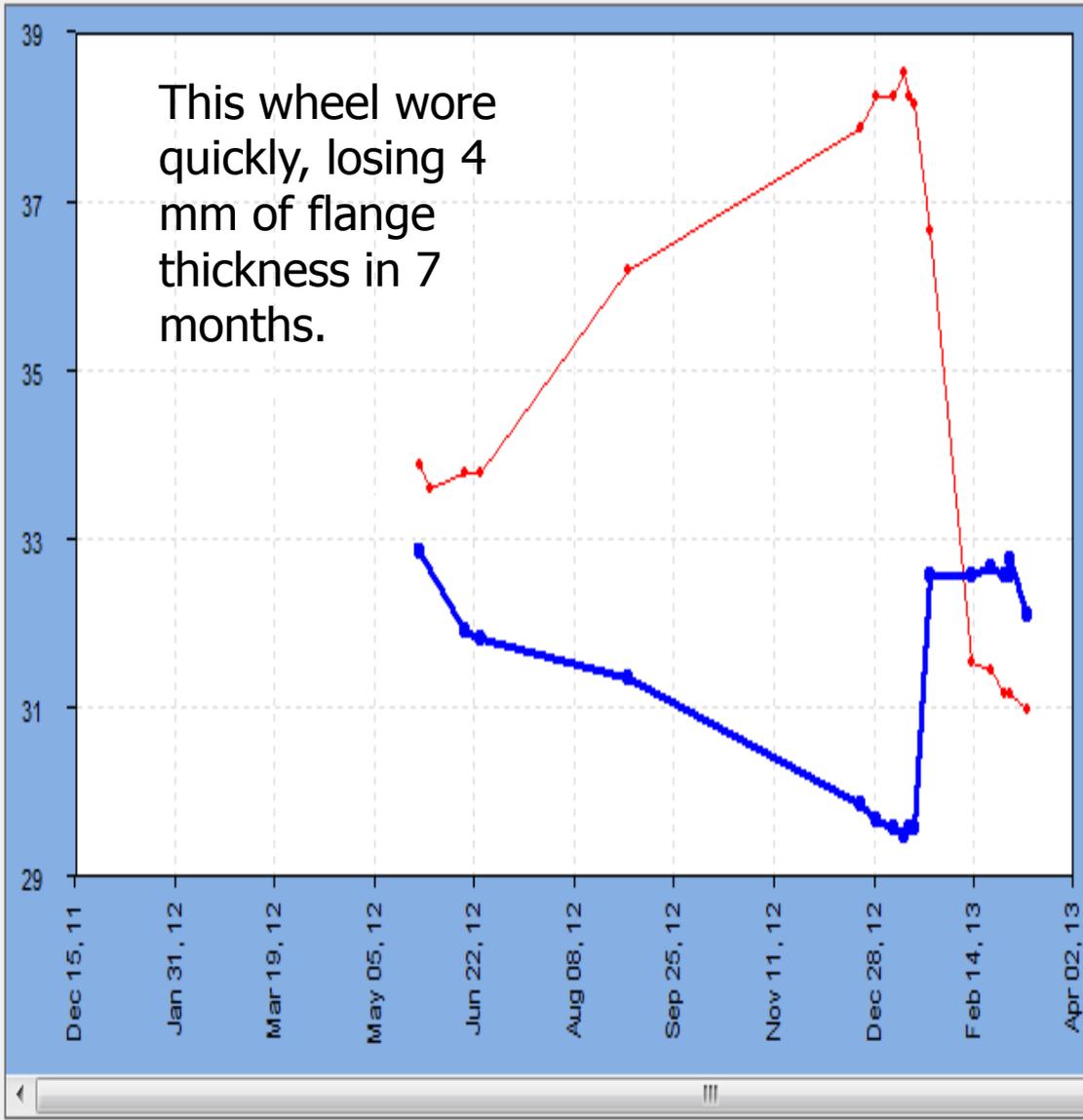
Profile Overlay



Sample Visuals

Of Profiles and Trends

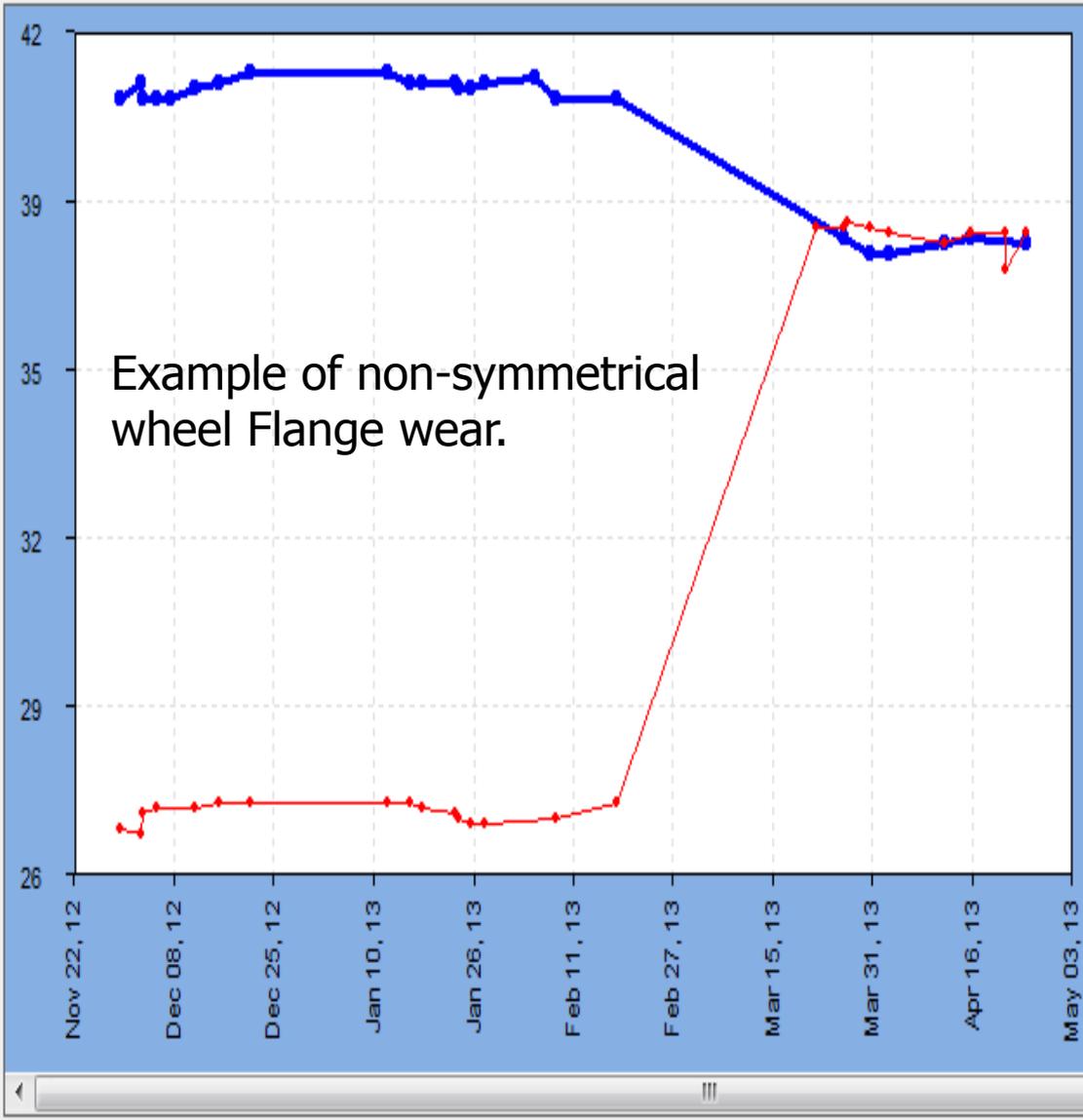
ID	Train	Wheel
1	23538	-6745 R 6
2	23538	-6745 L 6



- 23538 -6745 R 6
- 23538 -6745 L 6

Wheel changed, not due to thin flange.

ID	Train	Wheel
1	23740	652979 L 3
2	23740	652979 R 3



Example of non-symmetrical wheel Flange wear.

- 23740 652979 L 3
- 23740 652979 R 3

Wheel changed, not due to thin flange.

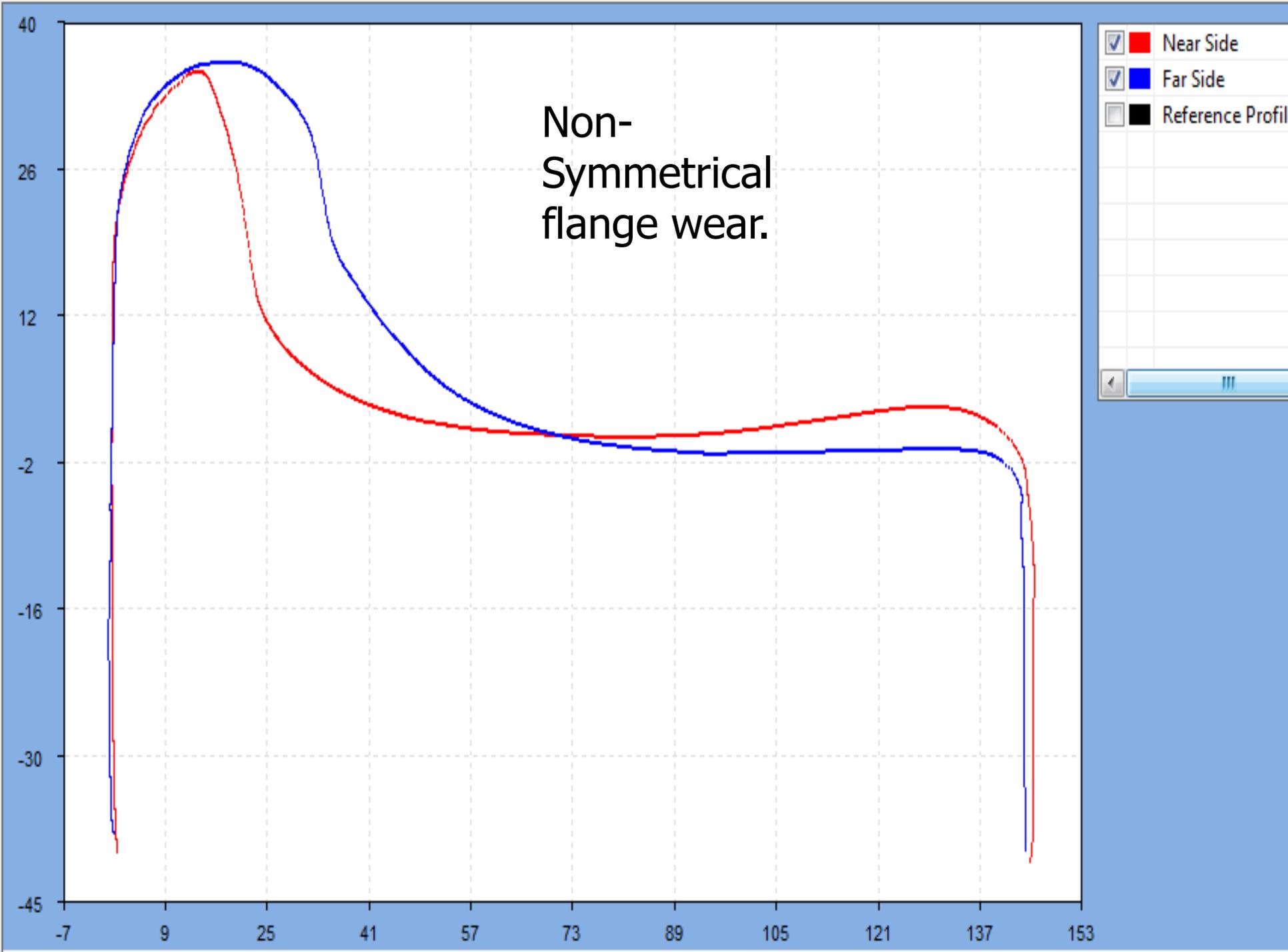
Select Measurement Flange Thickness

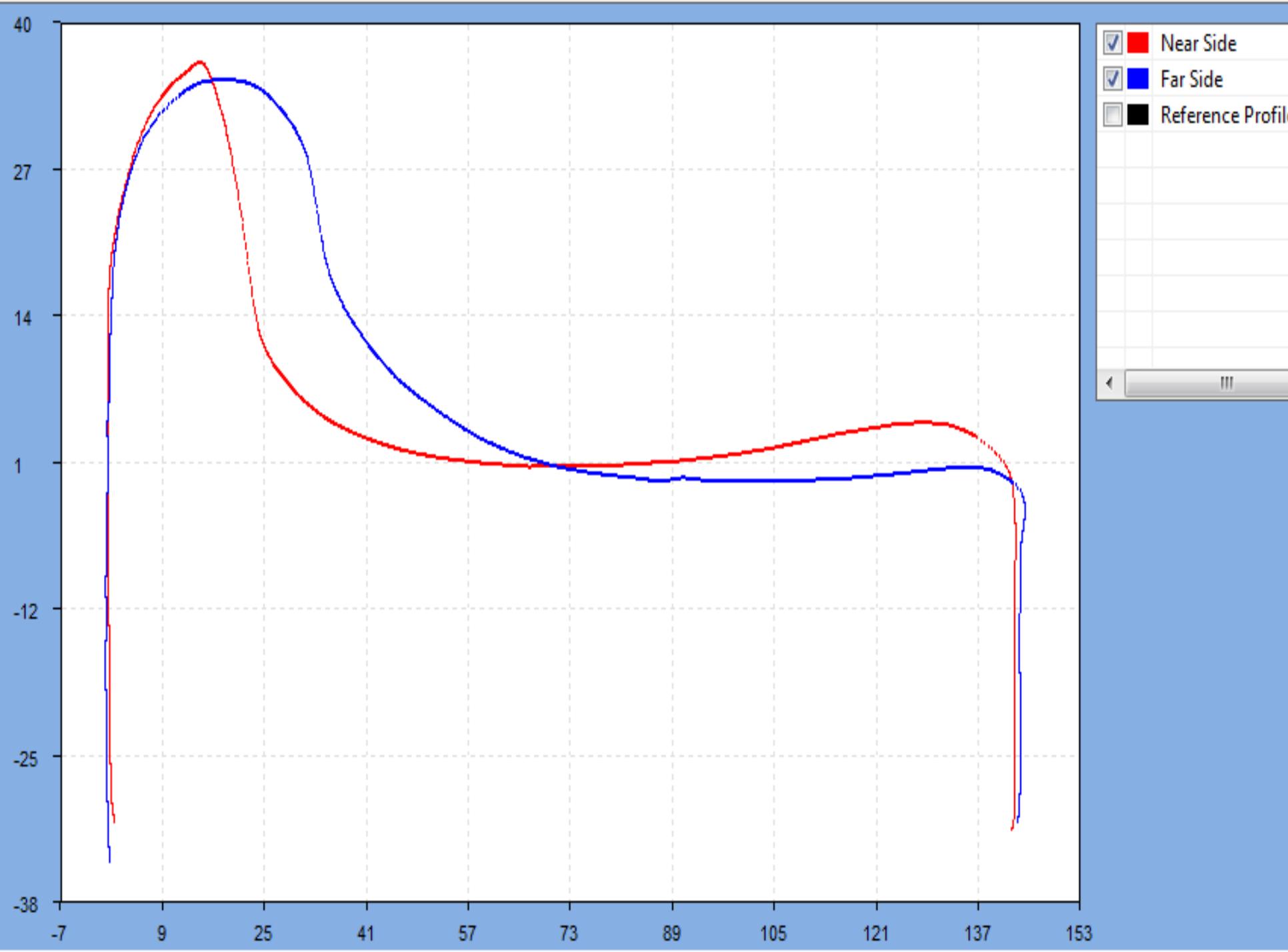
Show Selected Wheel

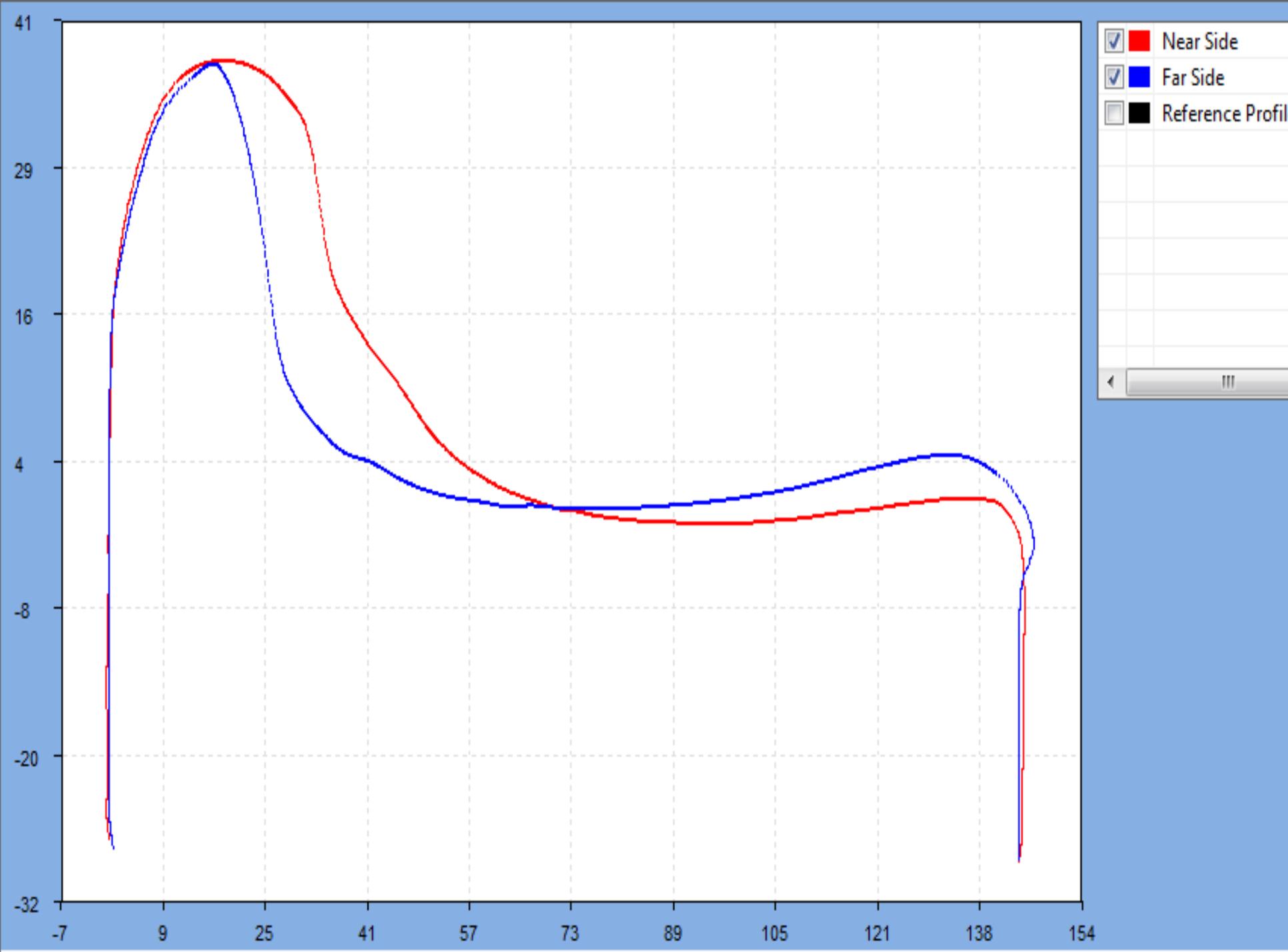
Show All Wheels

Sample Profiles

Large Differences in Flange
Thickness

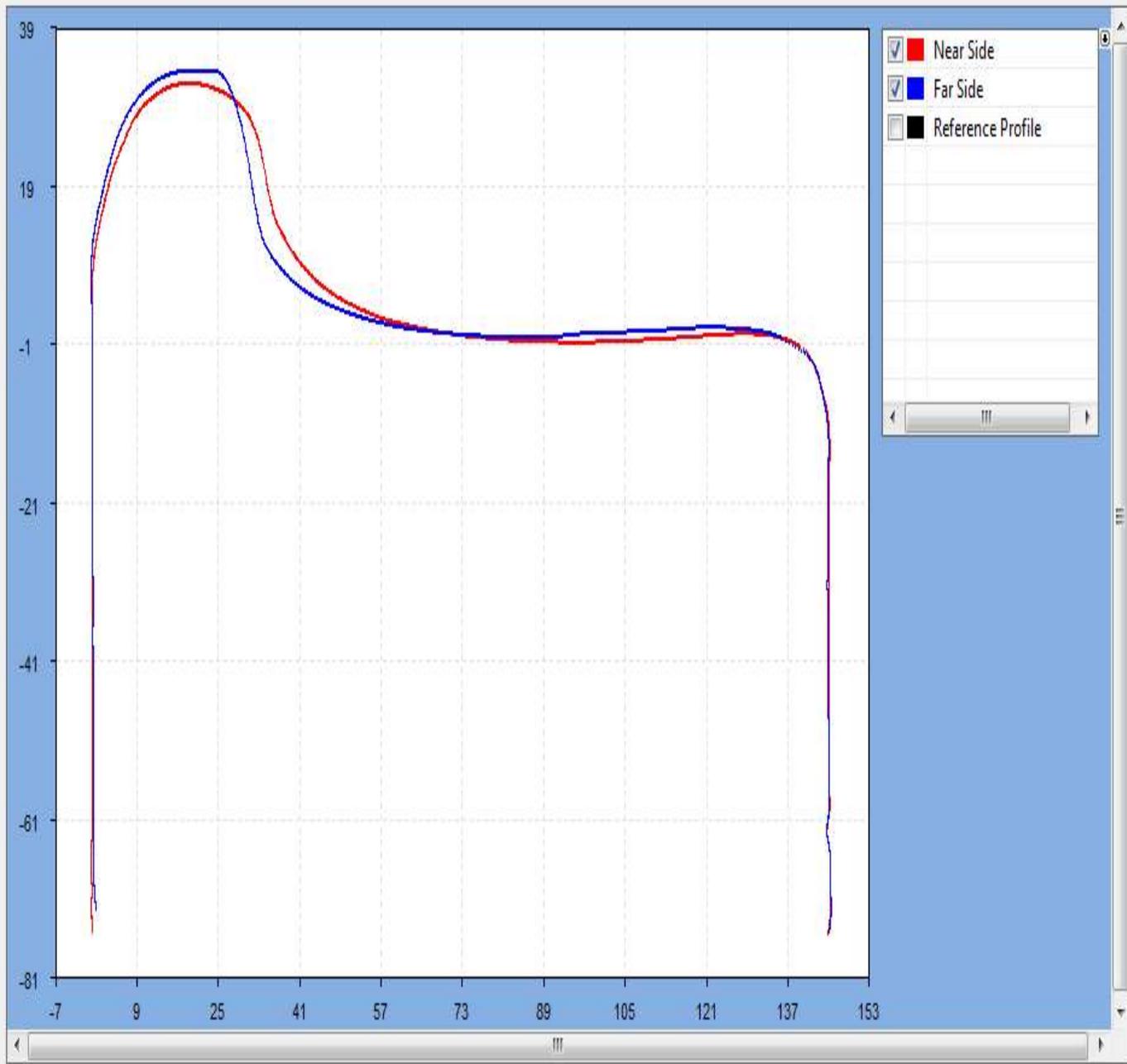






No Mileage data was available,
all trending is based on time.

Sample Axle 1



- Near Side
- Far Side
- Reference Profile

Near Side

Auto Align

Far Side

Auto Align

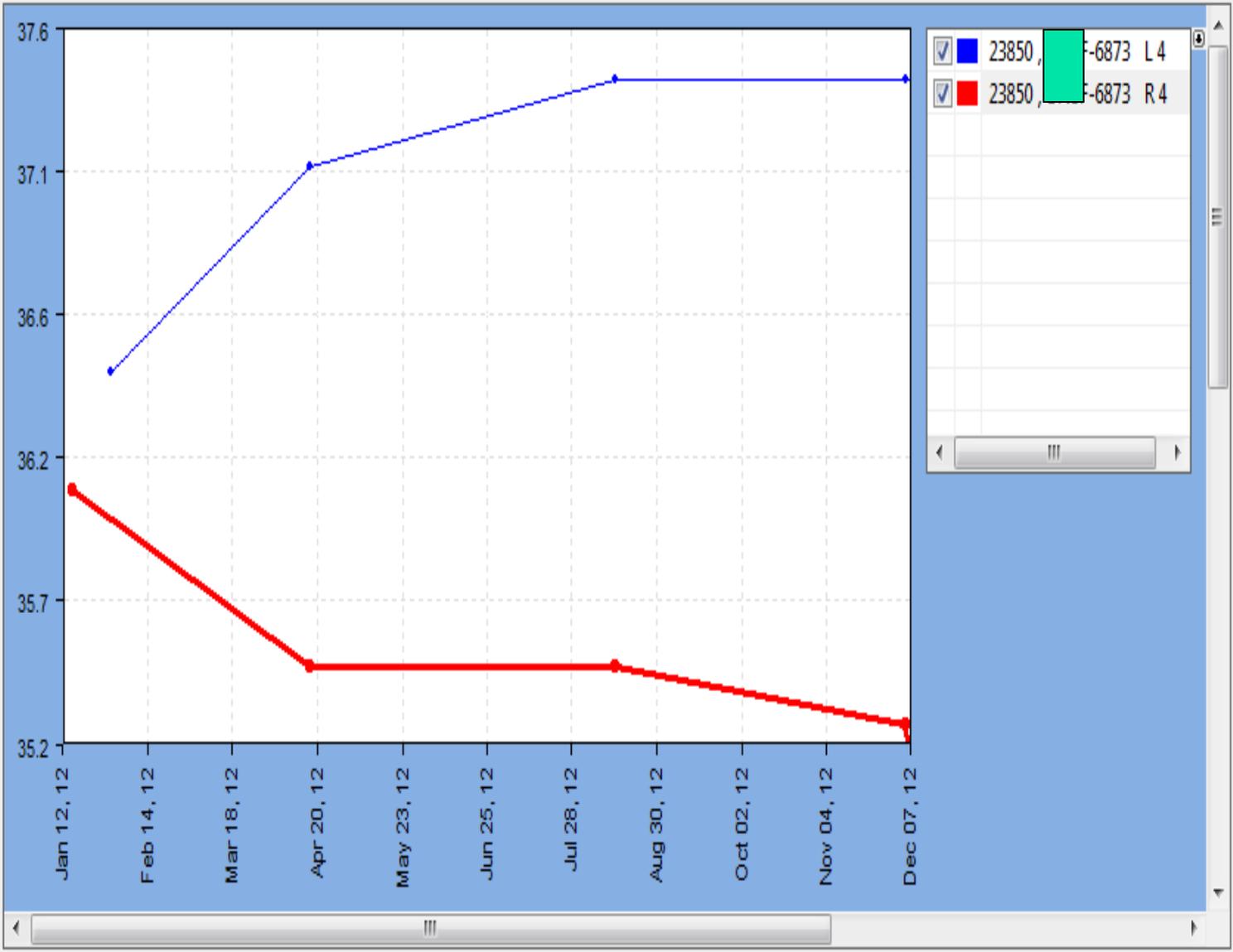
Select Reference Profile: US Narrow Flange

AEI Info

Train : 18690
Car : 6873
Time : 12/13/2012 3:45:27 AM
Near Side : Left
Far Side : Right

Measurement Trend

ID	Train	Wheel
1	23850	F-6873 L 4
2	23850	F-6873 R 4

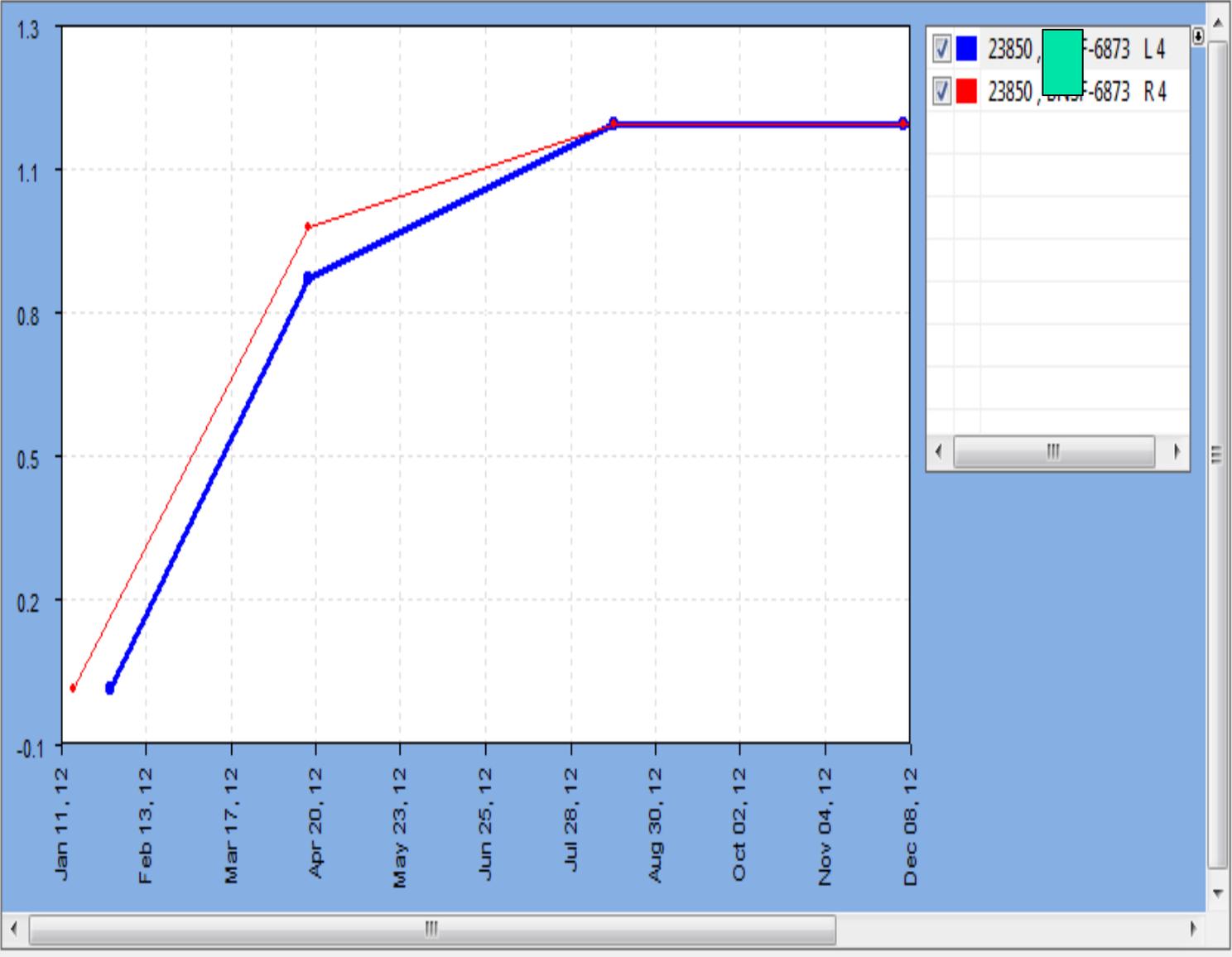


Select Measurement Flange Thickness

Show Selected Wheel

Show All Wheels

ID	Train	Wheel
1	23850	6873 L 4
2	23850	6873 R 4

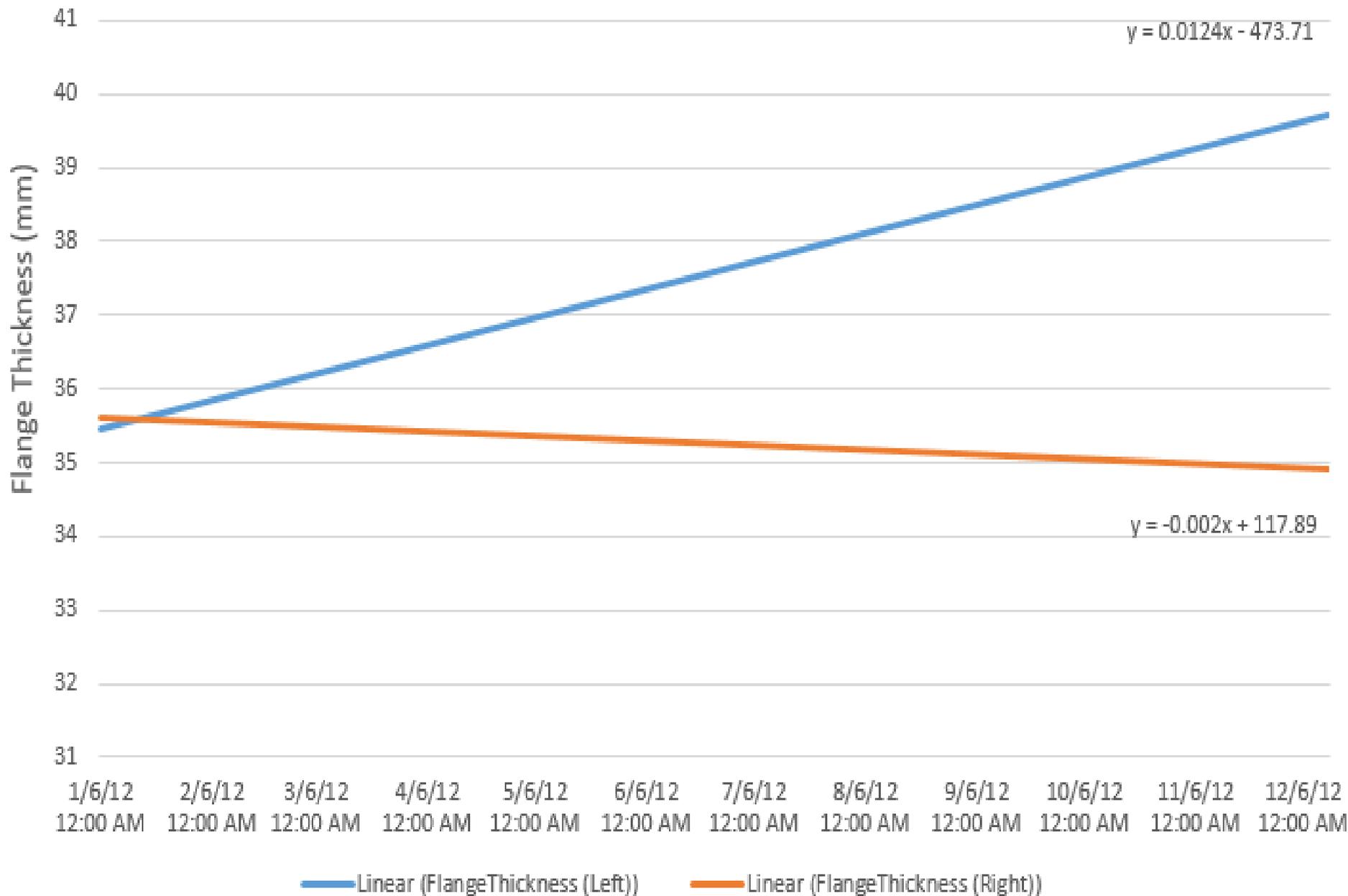


Select Measurement Tread Hollow

Show Selected Wheel

Show All Wheels

Flange Thickness



Months to non-compliance



Range: January – December (12 months)

Earliest Flange Thickness Measurement: 1.42" (36.0 mm)

Latest Flange Thickness Measurement: 1.39" (35.2 mm)

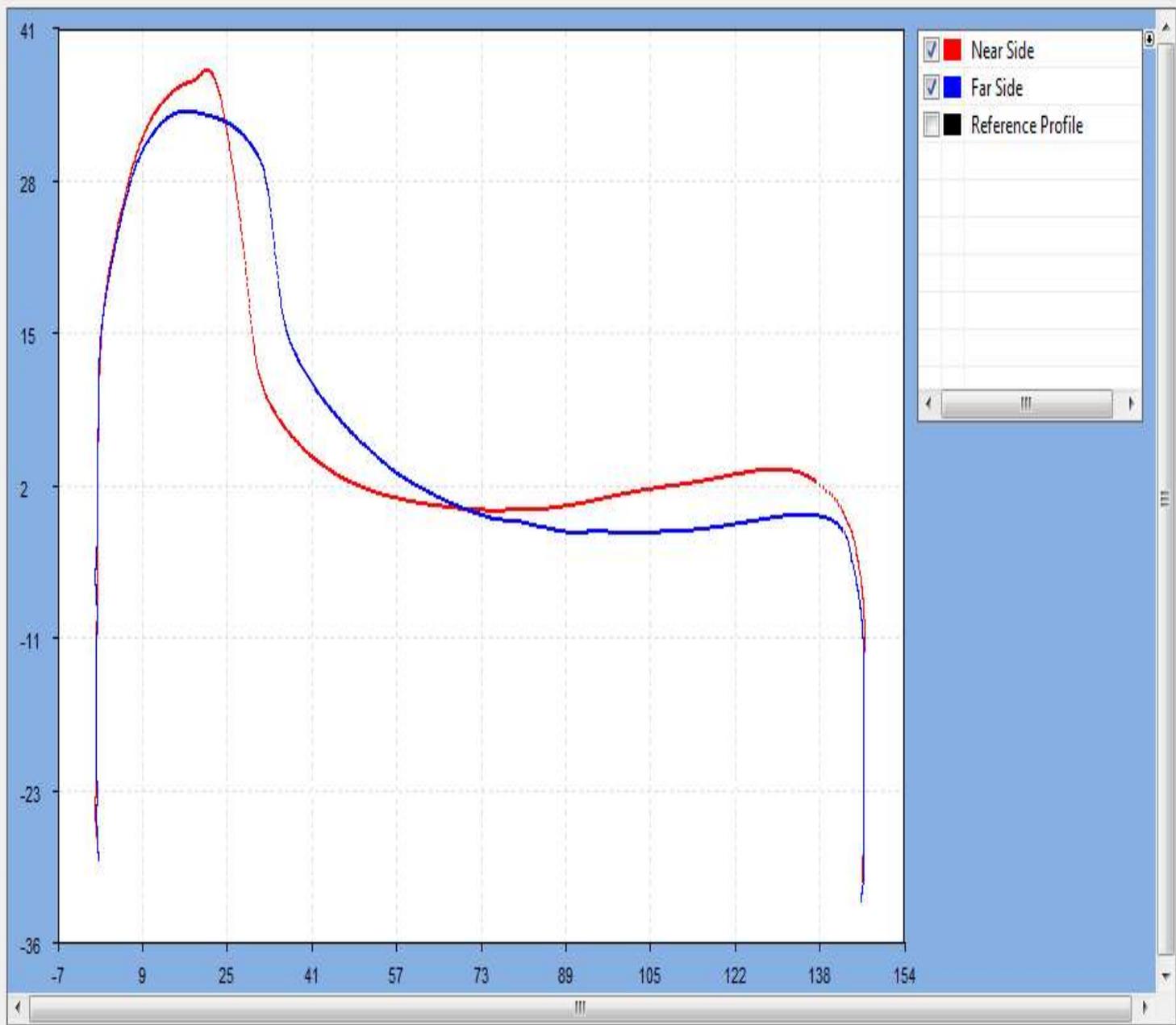
Amount of wear per month:

$$\frac{FT_{Begin} - FT_{End}}{\text{Number of Months}} = \frac{1.42 - 1.39}{12} = 0.003'' \text{ (**0.07 mm**) per month}$$

Projected Number of Months Left until Considered Dead by FRA ($\frac{7}{8}$):

$$\left\lfloor \frac{FT_{End} - FT_{FRA}}{\text{Inches per month}} \right\rfloor = \left\lfloor \frac{1.39 - \frac{7}{8}}{0.003} \right\rfloor = 171 \text{ Months left (Before thin flange)}$$

Sample Axle 2



- Near Side
- Far Side
- Reference Profile

Near Side

Auto Align

Far Side

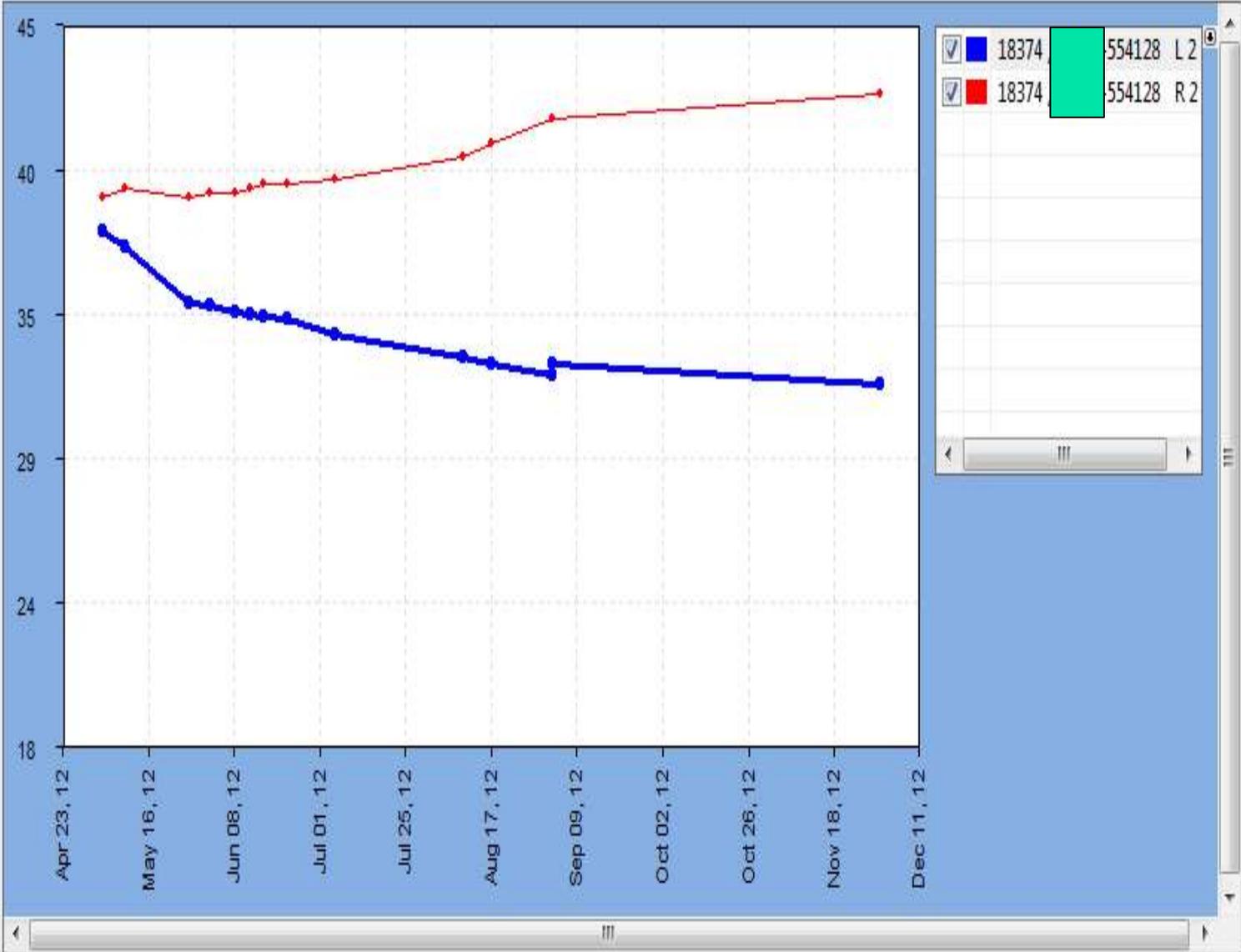
Auto Align

Select Reference Profile US Narrow Flange

AEI Info

Train : 18374
Car : 554128
Time : 12/5/2012 2:40:18 PM
Near Side : Left
Far Side : Right

ID	Train	Wheel
1	18374	554128 L 2
2	18374	554128 R 2



Select Measurement Flange Thickness

Show Selected Wheel

Show All Wheels



ID	Train	Wheel
1	18374	-554128 L 2
2	18374	-554128 R 2



18374, -554128 L 2

18374, -554128 R 2

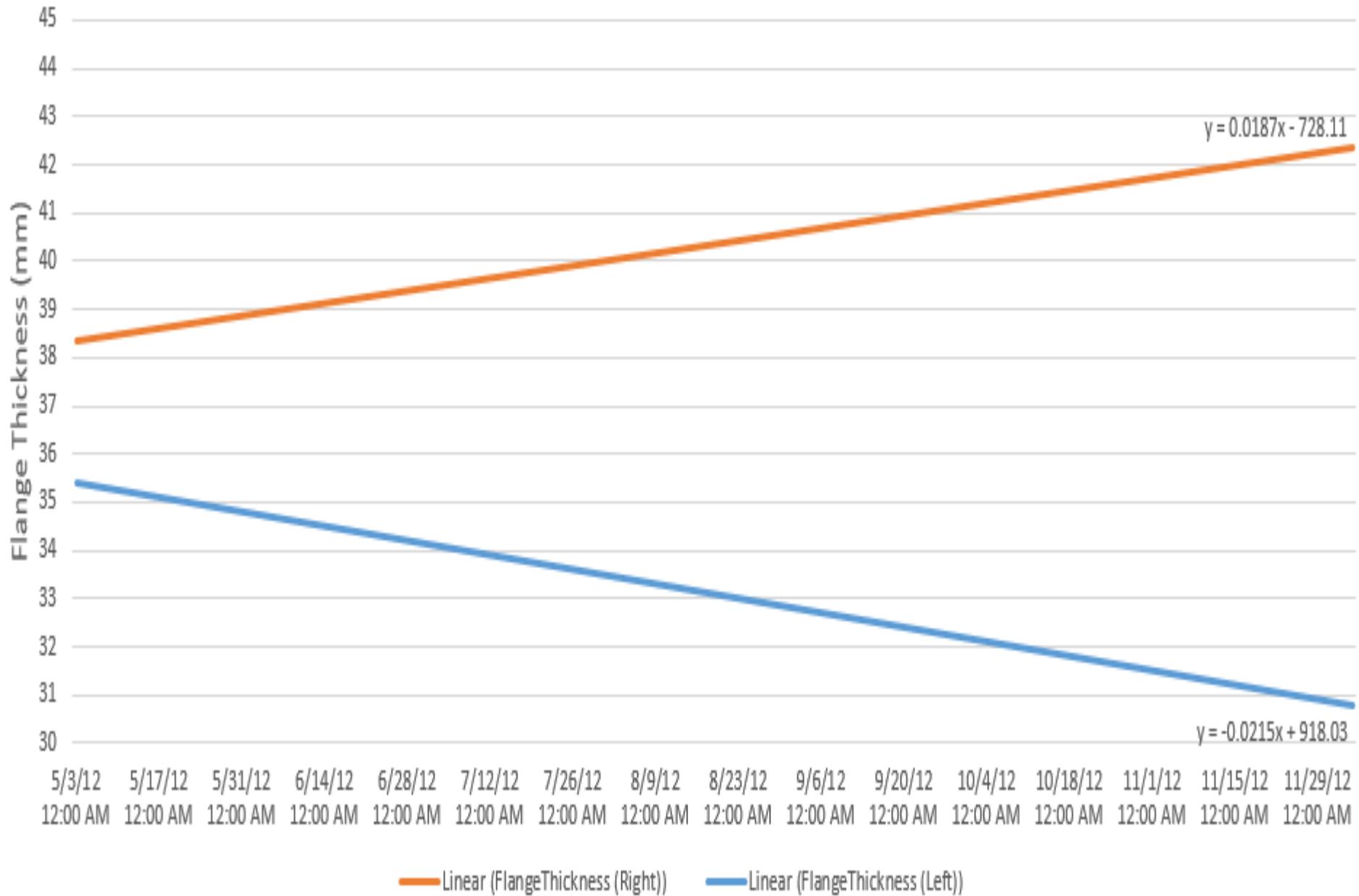
Tread Hollow
=>4mm

Select Measurement Tread Hollow

Show Selected Wheel

Show All Wheels

Flange Thickness



Months to non-compliance



Range: May – December (8 months)

Flange Thickness in May: 1.47" (37.3 mm)

Flange Thickness in December: 1.25" (31.7 mm)

Amount of wear per month:

$$\frac{FT_{Begin} - FT_{End}}{\text{Number of Months}} = \frac{1.47 - 1.25}{8} = 0.03 \text{ inches } (\mathbf{0.7 \text{ mm}}) \text{ per}$$

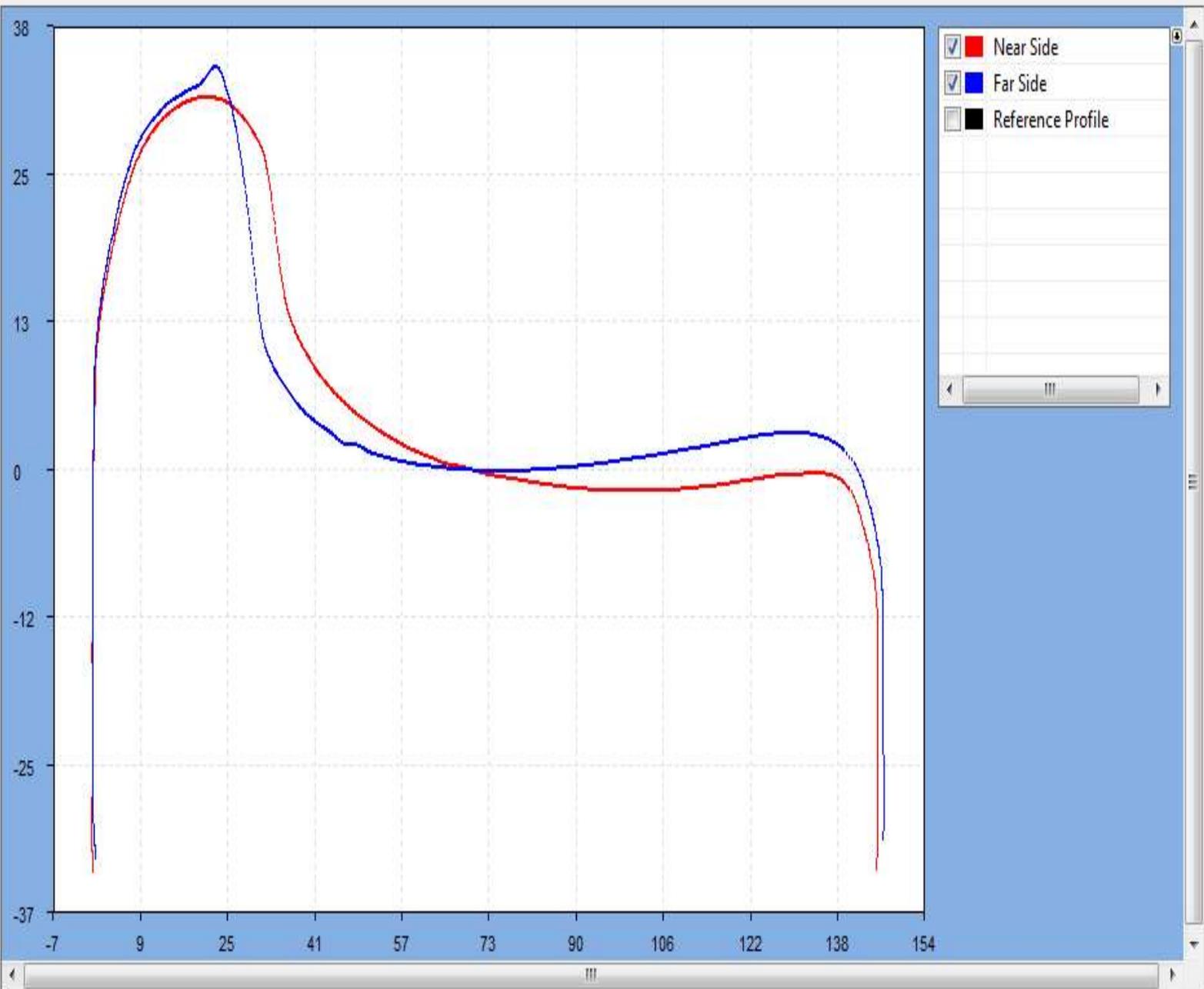
month

Projected Number of Months Left until Considered Dead by FRA ($\frac{7}{8}$):

$$\left\lfloor \frac{FT_{End} - FT_{FRA}}{\text{Inches per month}} \right\rfloor = \left\lfloor \frac{1.25 - \frac{7}{8}}{0.03} \right\rfloor = 12 \text{ Months till Thin Flange}$$

Will probably reach flange height before 12 months.

Sample Axle 3



- Near Side
- Far Side
- Reference Profile

Near Side

Auto Align

Far Side

Auto Align

Select Reference Profile

AEI Info

Train : 12615
Car : 53957
Time : 7/8/2012 3:42:36 AM
Near Side : Left
Far Side : Right

ID	Train	Wheel
1	12615	553957 L 4
2	12615	553957 R 4

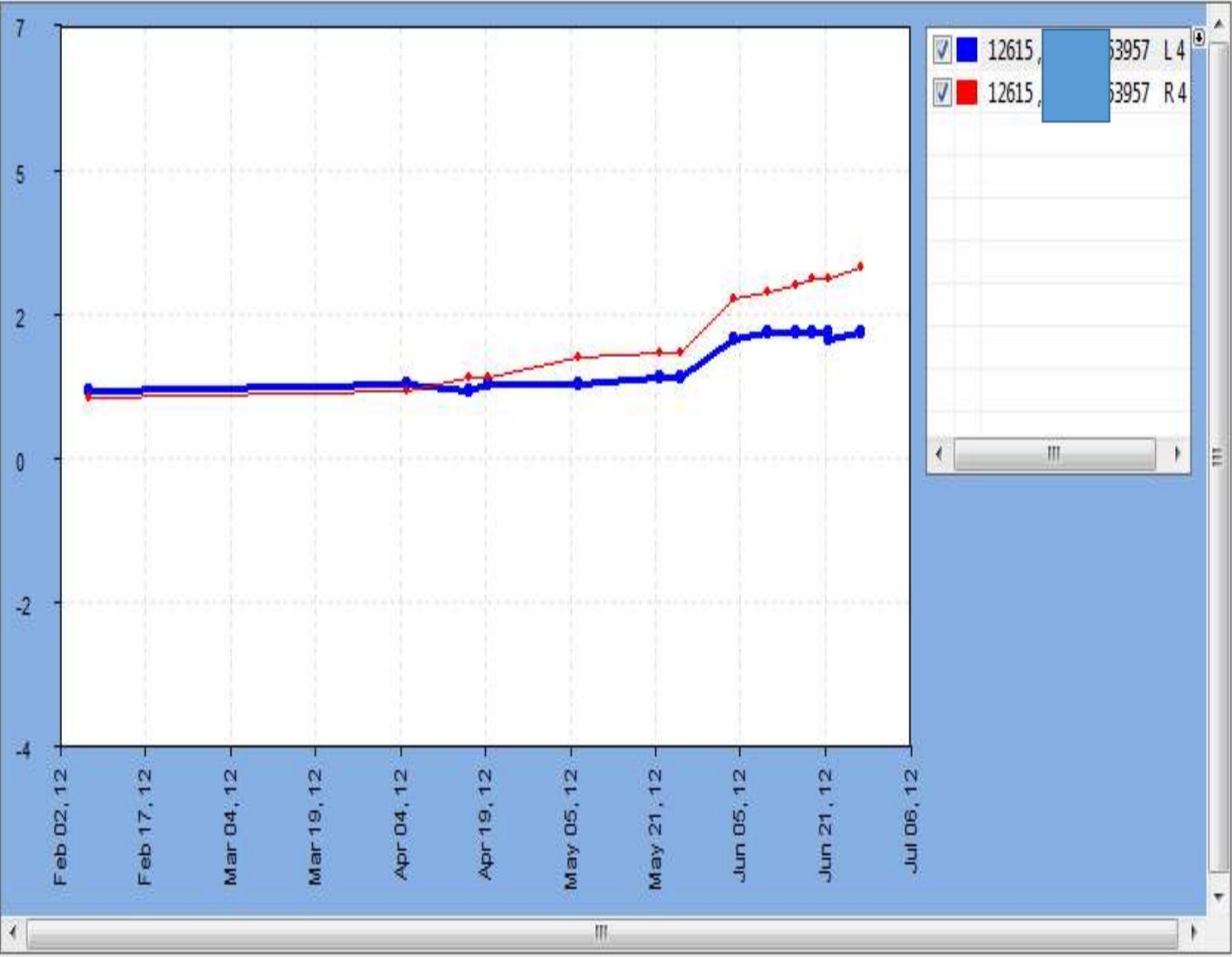


Select Measurement Flange Thickness

Show Selected Wheel

Show All Wheels

ID	Train	Wheel
1	12615	53957 L 4
2	12615	53957 R 4

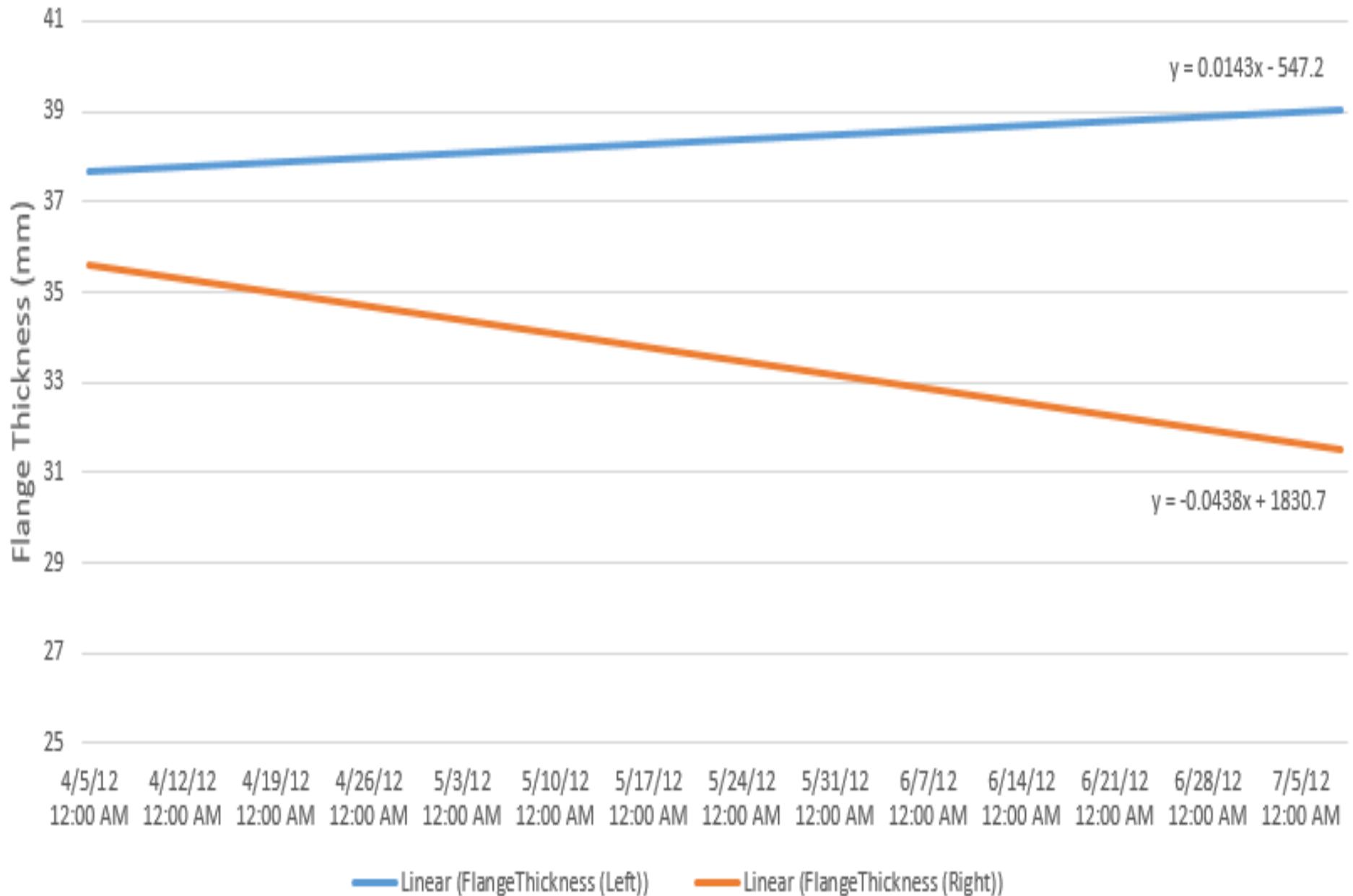


Select Measurement Tread Hollow

Show Selected Wheel

Show All Wheels

Flange Thickness



Months to Non-Compliance

Range: April – July (4 months)

Flange Thickness in April: 1.42'' (36.0 mm)

Flange Thickness in July: 1.25'' (31.8 mm)

Amount of wear per month:

$$\frac{FT_{Begin} - FT_{End}}{\text{Number of Months}} = \frac{1.42 - 1.25}{4} = 0.0425 \text{ inches}$$

(1.05 mm) per month

Projected Number of Months Left until Considered Dead by FRA ($\frac{7}{8}$ '')

$$\left\lfloor \frac{FT_{End} - FT_{FRA}}{\text{Inches per month}} \right\rfloor = \left\lfloor \frac{1.25 - \frac{7}{8}}{0.0425} \right\rfloor = 8 \text{ Months left}$$

What's next?

Complete Wheel Tread Scanning

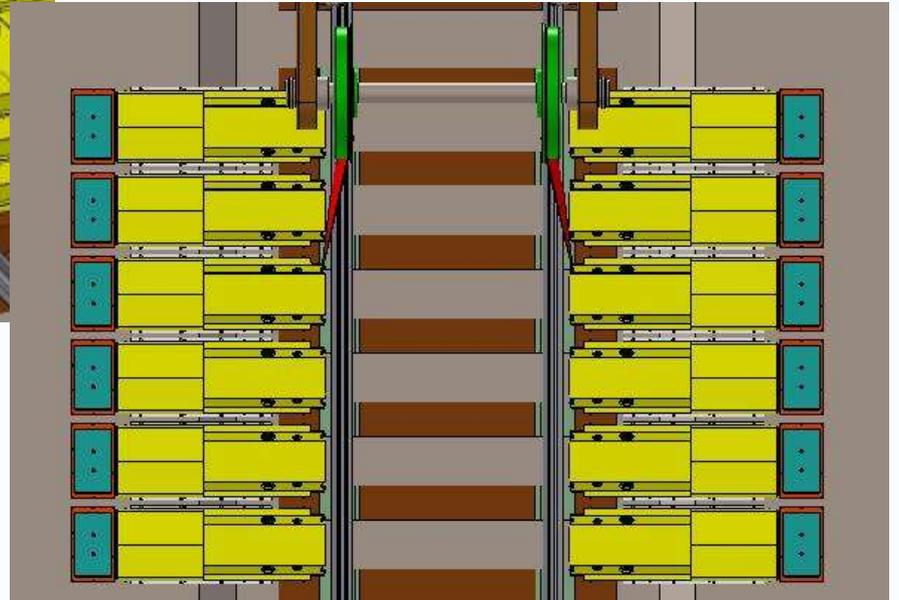
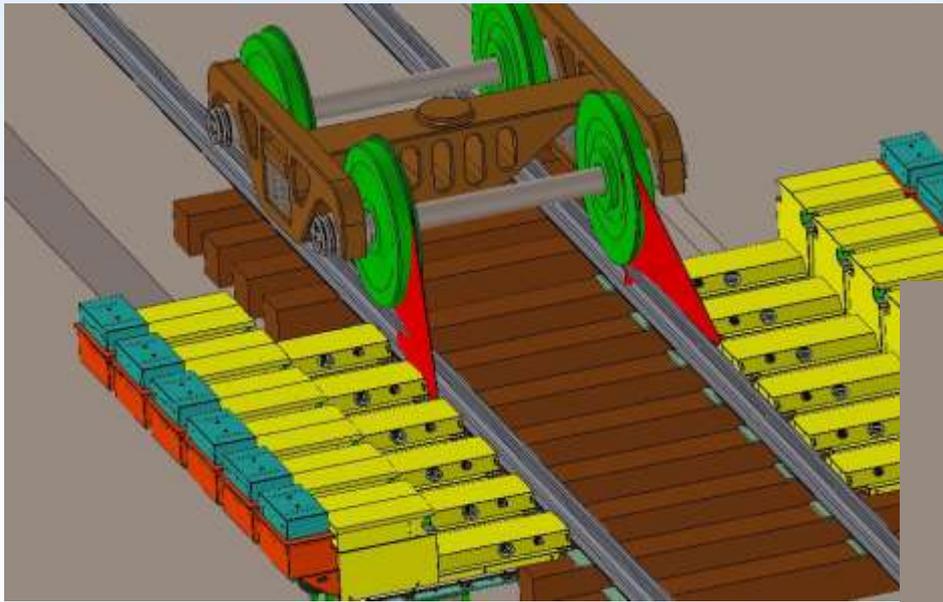
- Full Wheel Optical Scanning
- Dense Wheel Surface Inspection
- Extremely High Data Rate
- Full Laser and Optical Inspection
- Full Track Train Speeds

Vision- System Capabilities



- Detect all visible wheel defects such as:
 - Built-Up Tread
 - Shelled Tread
 - Grooved Tread
 - Slid Flat
 - Pieces missing from wheel
 - Visible cracks or breaks in the wheel tread/flange
- Profile Parameters (Optional)
 - Hollow Tread (deepest)
 - High Flange (at highest point)
 - Thin Rim (at thinnest point)
 - Thin Flange (at thinnest point)
- Based on AAR Tolerances

System Operation



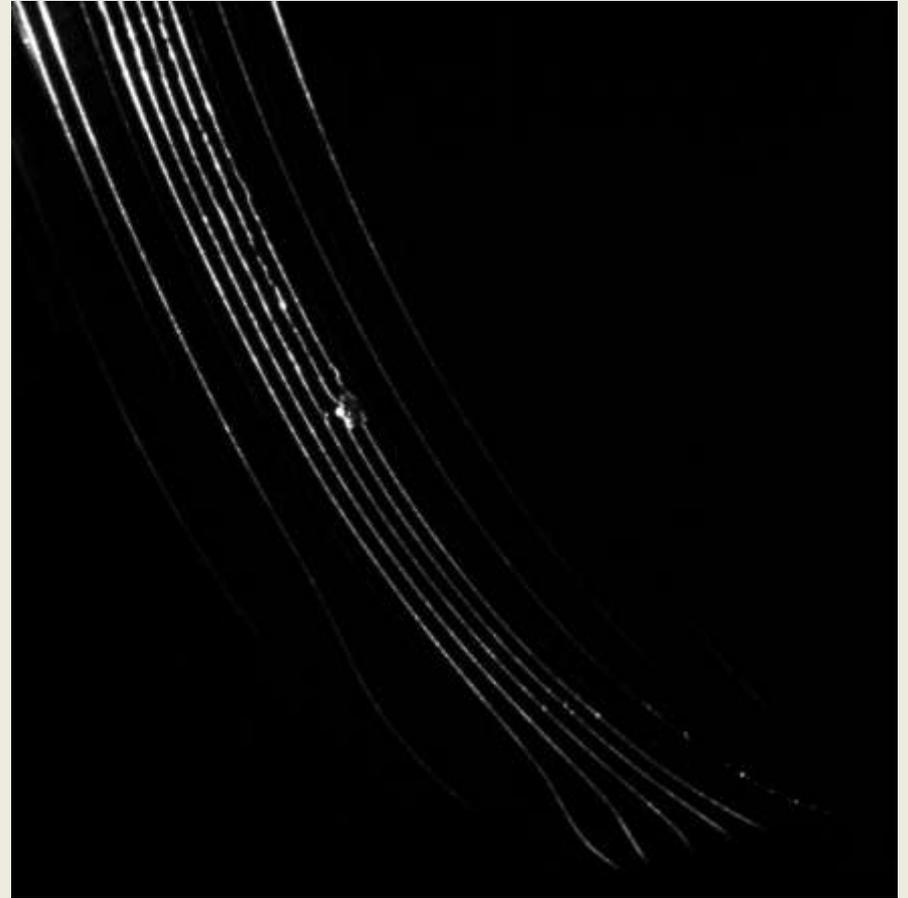
Tread Scan



Tread Scan



Tread Scan



Tread Scan



Rail Profile and Gauge Measurement Systems

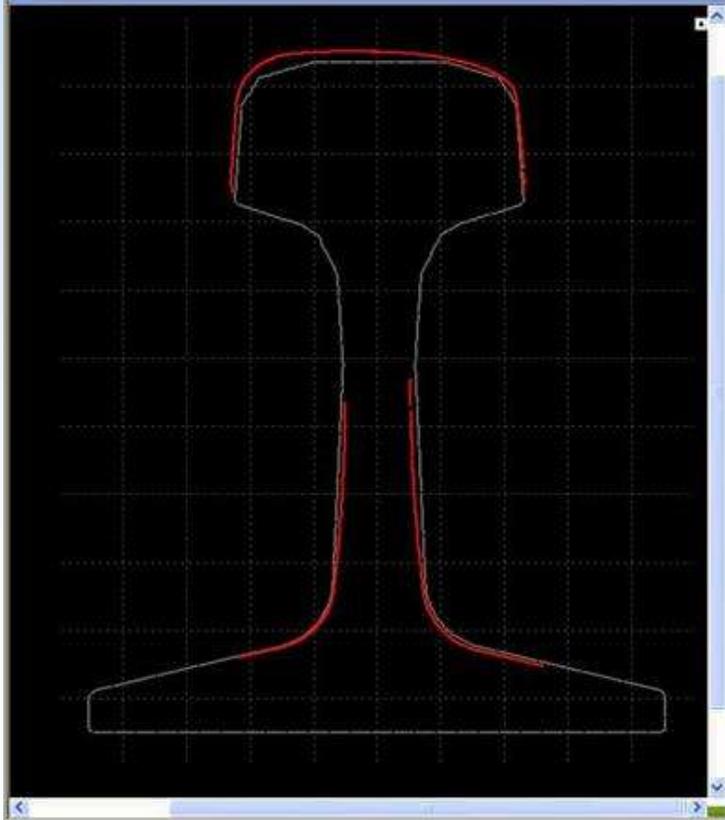


BeenaVision

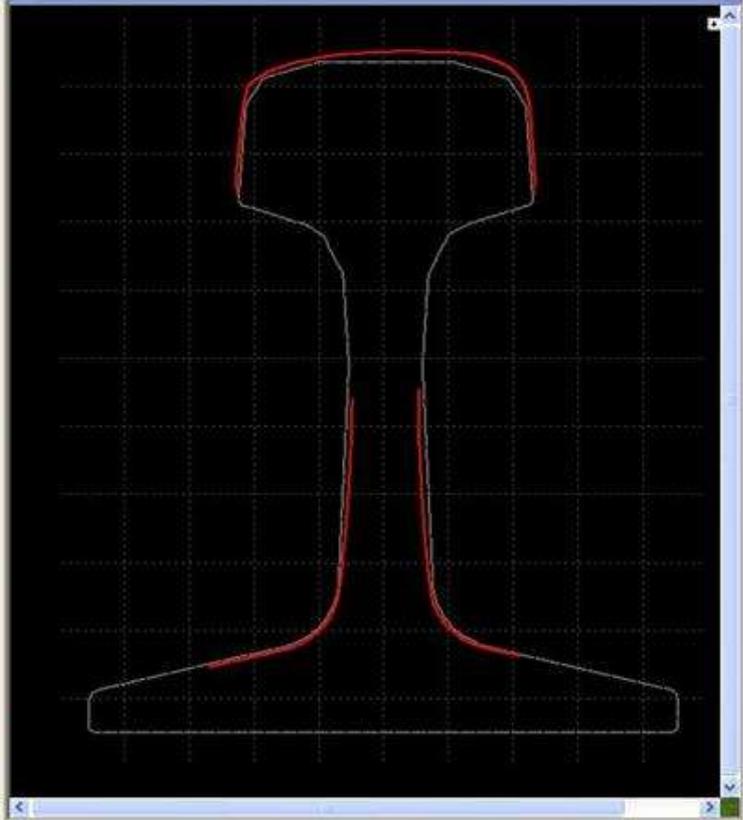
Track-Profile

- Laser Based Rail Profile measurement
 - Adjustable Profile Rate
 - 1 profile per foot at 45 mph with 60fps cameras
 - Up to 120 fps in standard version, 480fps in HS version
 - 1024 points per profile
 - Ambient light insensitive (High power laser)
 - Custom integration into customer systems
 - Flexible design for different vehicle installations
 - Real Time Profile Generation

Passenger Side



Driver Side



ion

Properties

Passenger Side Measurements

Rail Type	140LB, RE
Cant (degree)	1.725
Rail Height (Inch)	
Head Width (Inch)	3.041
Gage Wear (Inch)	
Vertical Wear (Inch)	
Percent Head Loss (%)	
Gage Lip (Inch)	0.0
Field Lip (Inch)	0.003
Center Shift (Inch)	1.516

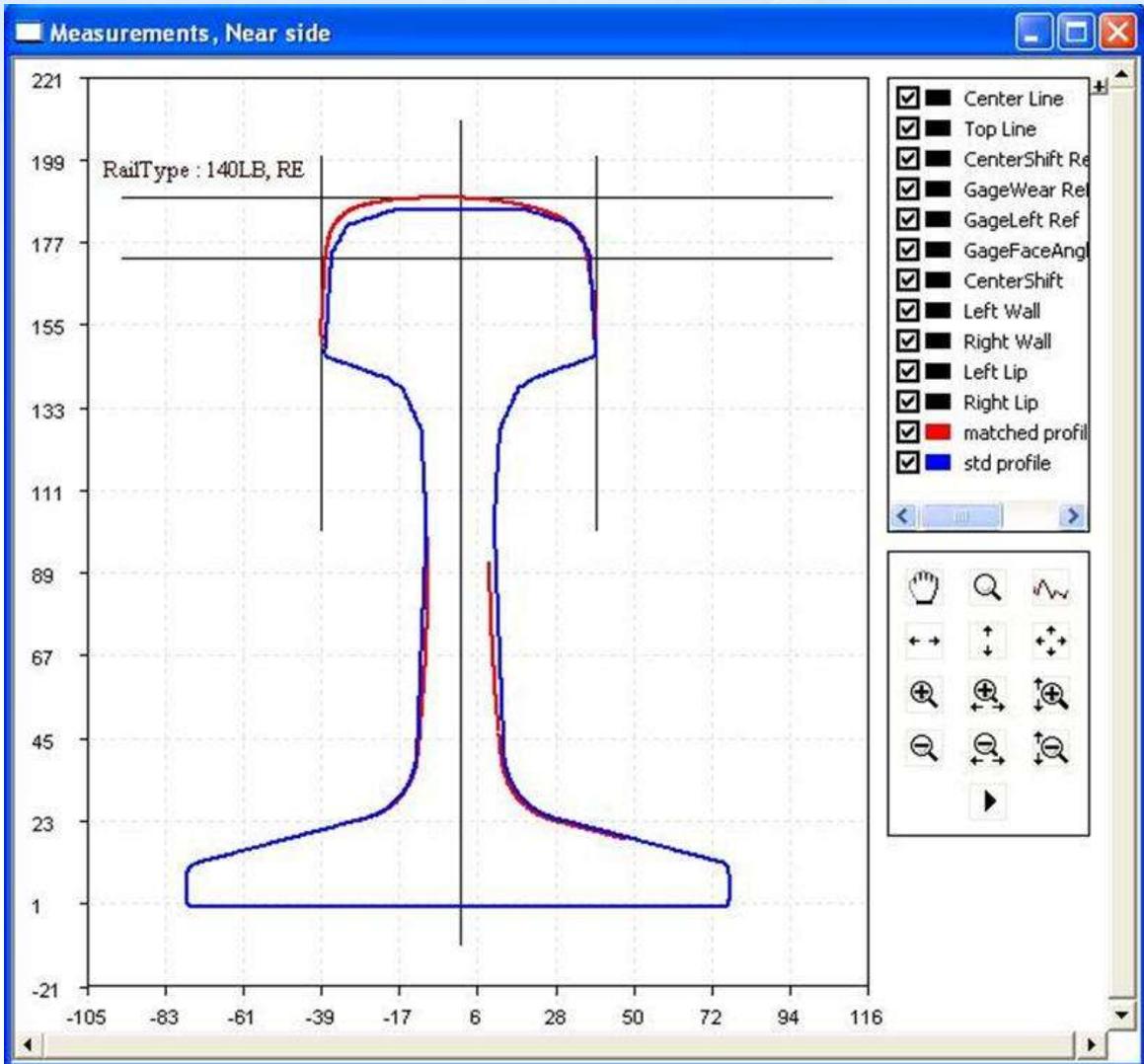
Common Measurements

Gage	
------	--

Driver Side Measurements

Rail Type	140LB, RE
Cant (degree)	2.547
Rail Height (Inch)	
Head Width (Inch)	3.038
Gage Wear (Inch)	
Vertical Wear (Inch)	
Percent Head Loss (%)	
Gage Lip (Inch)	0.0
Field Lip (Inch)	0.003
Center Shift (Inch)	1.511

Measurements



Measurements

- Rail Cant
- Track Gage
- Rail Height
- Head Width
- Gage Lip
- Field Lip
- Vertical Wear
- 45 Degree Wear
- Head Loss Percent
- Gauge Face Width
- Rail Center Position
- Matching Rail Type or Weight

Track-Rail

Track and Rail Imaging and Inspection Systems



BeenaVision

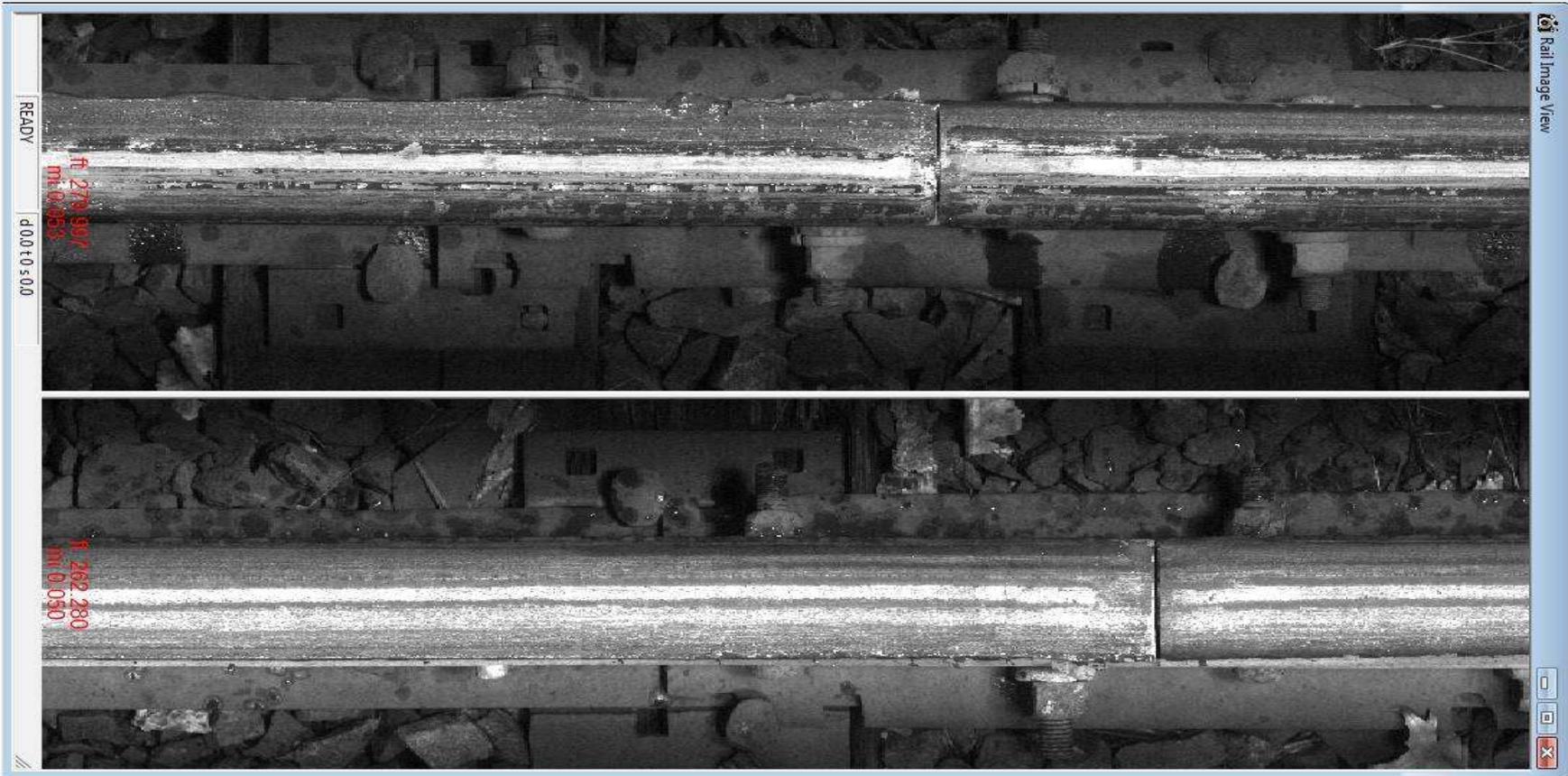
Hi-Rail Truck Installation



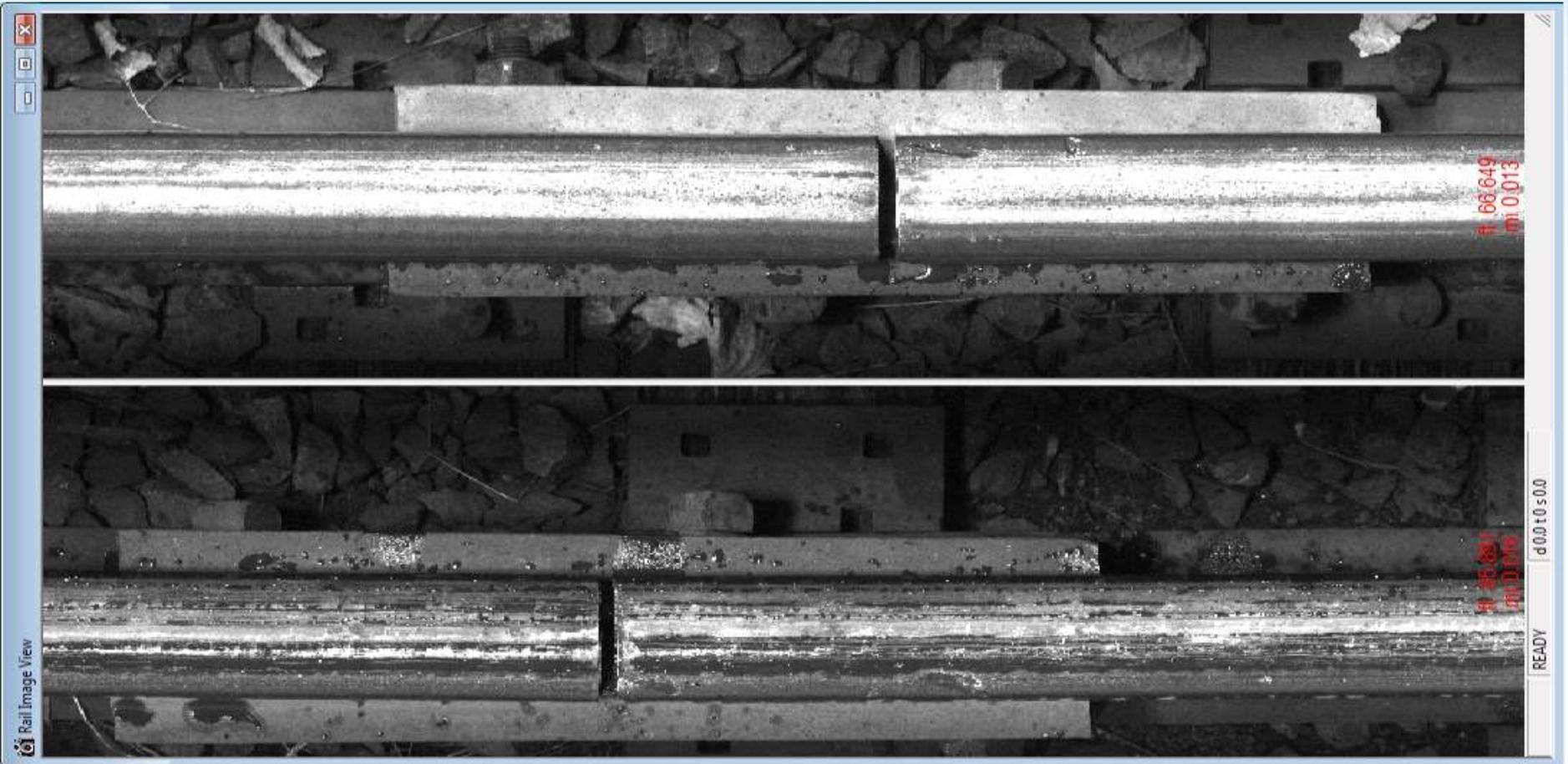
Rail and Track Imaging

- Line Scan Technology
- Infrared and Visible Spectrums Covered
- High Image Quality
- Rail Top View
- Rail Side View
- Track Structure such as spikes, tie plates, ties, etc.

Rail Surface Images



Rail-top Camera Images



System Features

- Multiple cameras (up to nine cameras)
 - Rail top
 - Rail web
 - Rail base
 - Ties
 - Fasteners
- High Speed line scan technology
- IR or Visible Lighting

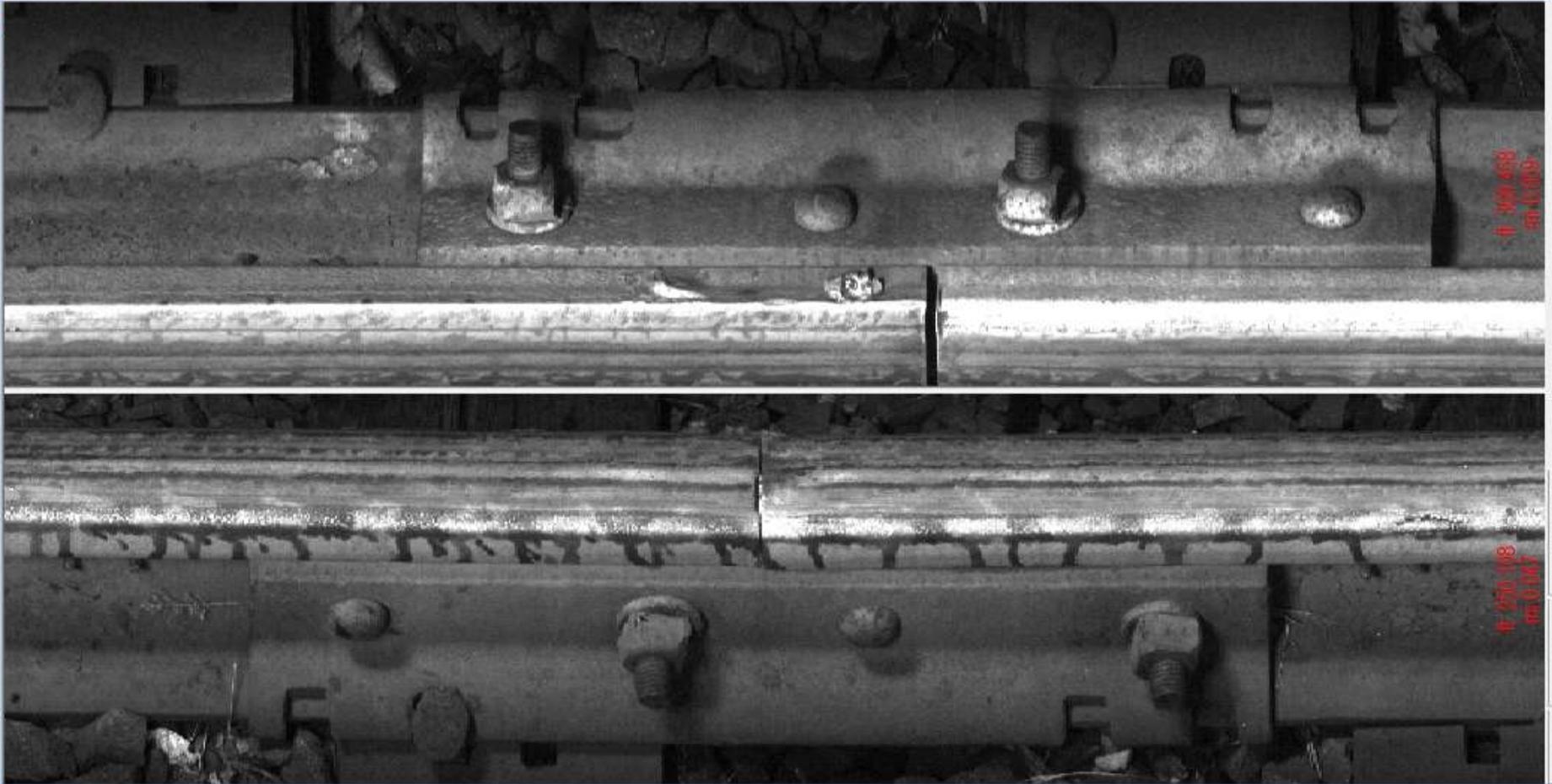
Applications

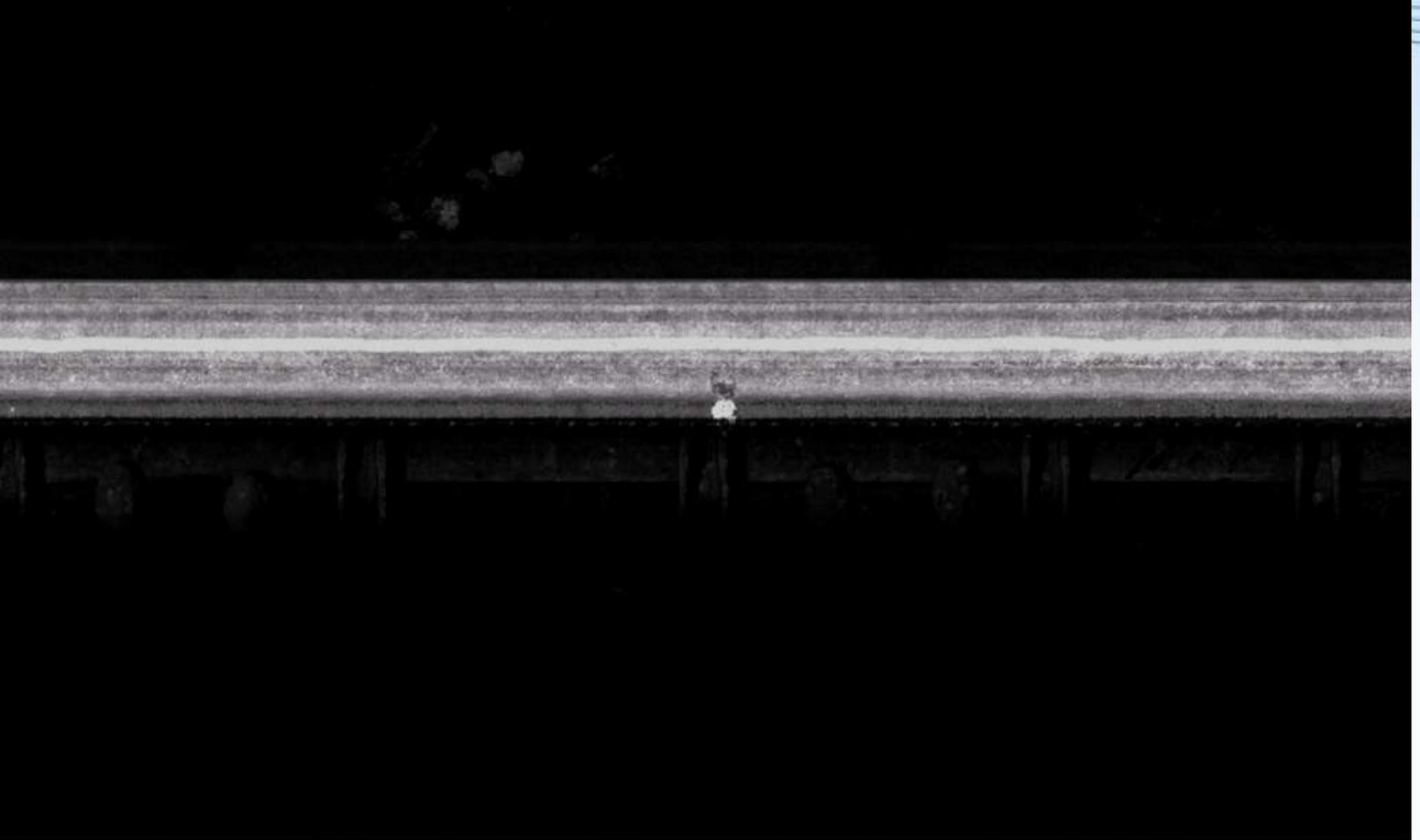
- Rail Surface Evaluation
- Joint Counting
- Joint Evaluations
- Rail Weight Recognition
- Track Inspection (ballast condition, vegetation)
- Tie Inspection
- Fastener Inspection

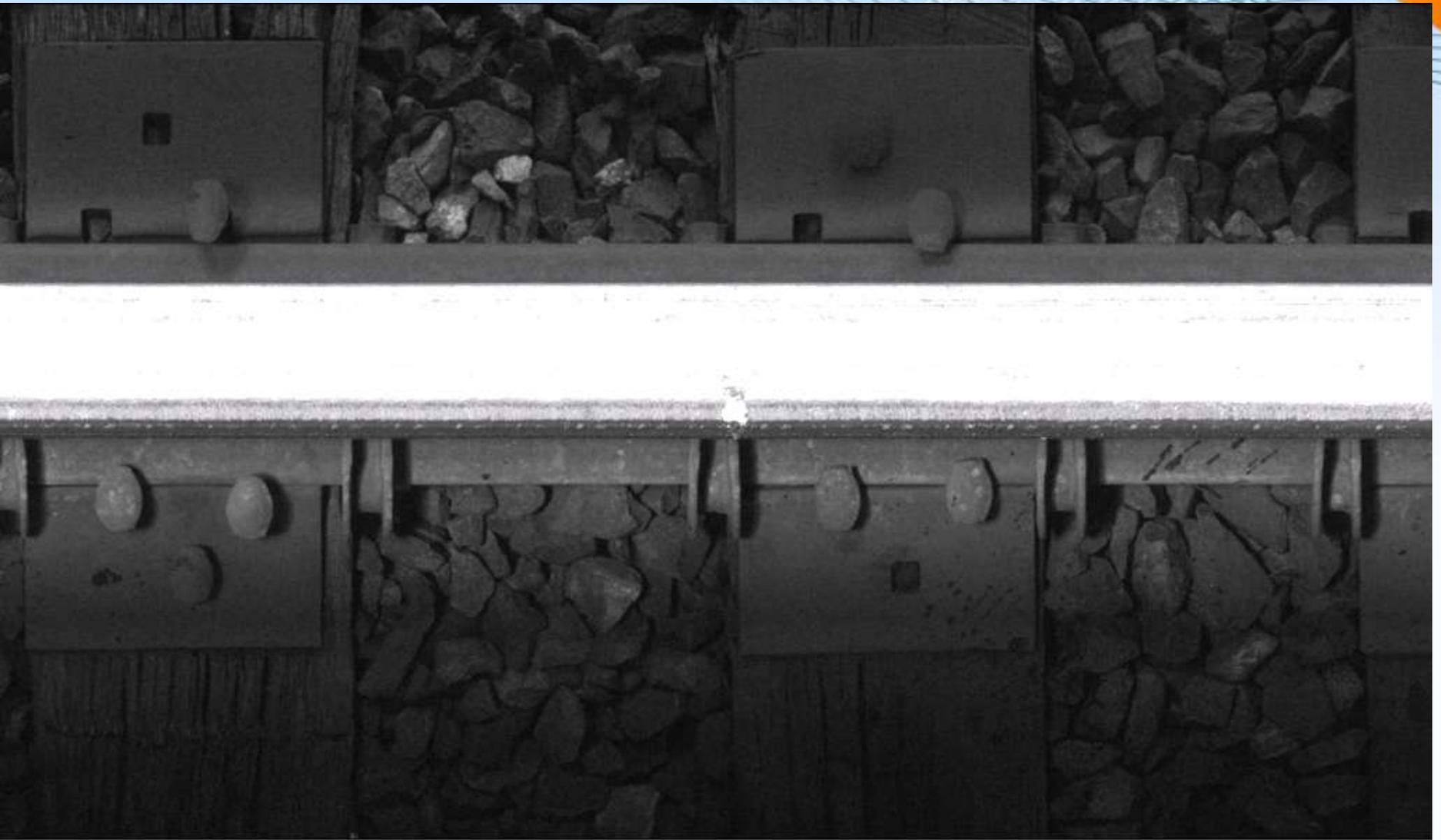
Lighting (Visible & IR)



Side Angled Camera Images







Vision Systems

- Innovative Solutions for Railroad Industry
- Laser Based Profile measurement Systems
- Image Based Inspections Systems

The End

