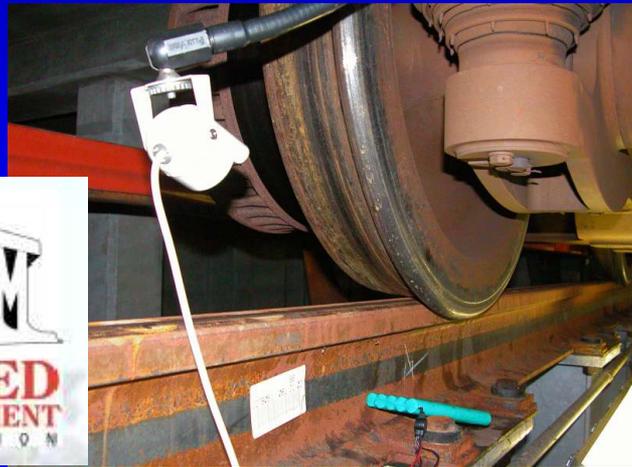




Effective Measurement Tools to Evaluate Vehicle/Track Interaction



Chicago – May 6, 2013



OPTIMIZING WHEEL/RAIL INTERACTION



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- **Rail Measurement**
- **Wheel Measurement**

- V
- R
- V
- T



gration



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Rail Measurement

- *Generate rail wear database*
 - *wear charts*
 - *comparisons, queries, automated classification, identification of section (115, 136, etc)*
 - *trend analysis / forecasting capability*
- *Support rail grinding operations*
 - *Electronic BAR gauge*
 - *pre-grind survey plan generation*
 - *real time quality control (following grinder)*



- **Rail Measurement**
- **Wheel Measurement**



ORMV-1



ORMV-2

Profile
ling
ry &



- **Rail Measurement**
- **Wheel Measurement**
- **Wheel & Rail Profile Design**



ir
y

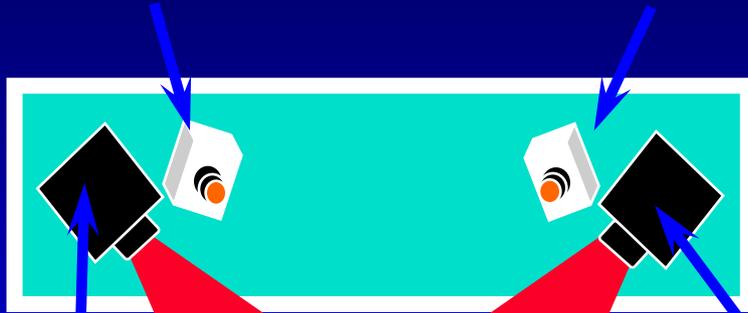


ORIAN

Rail Measurement Sensor Heads

Field Side
Camera

Gauge Side
Camera



Field Side
Laser

Gauge Side
Laser

Left Rail

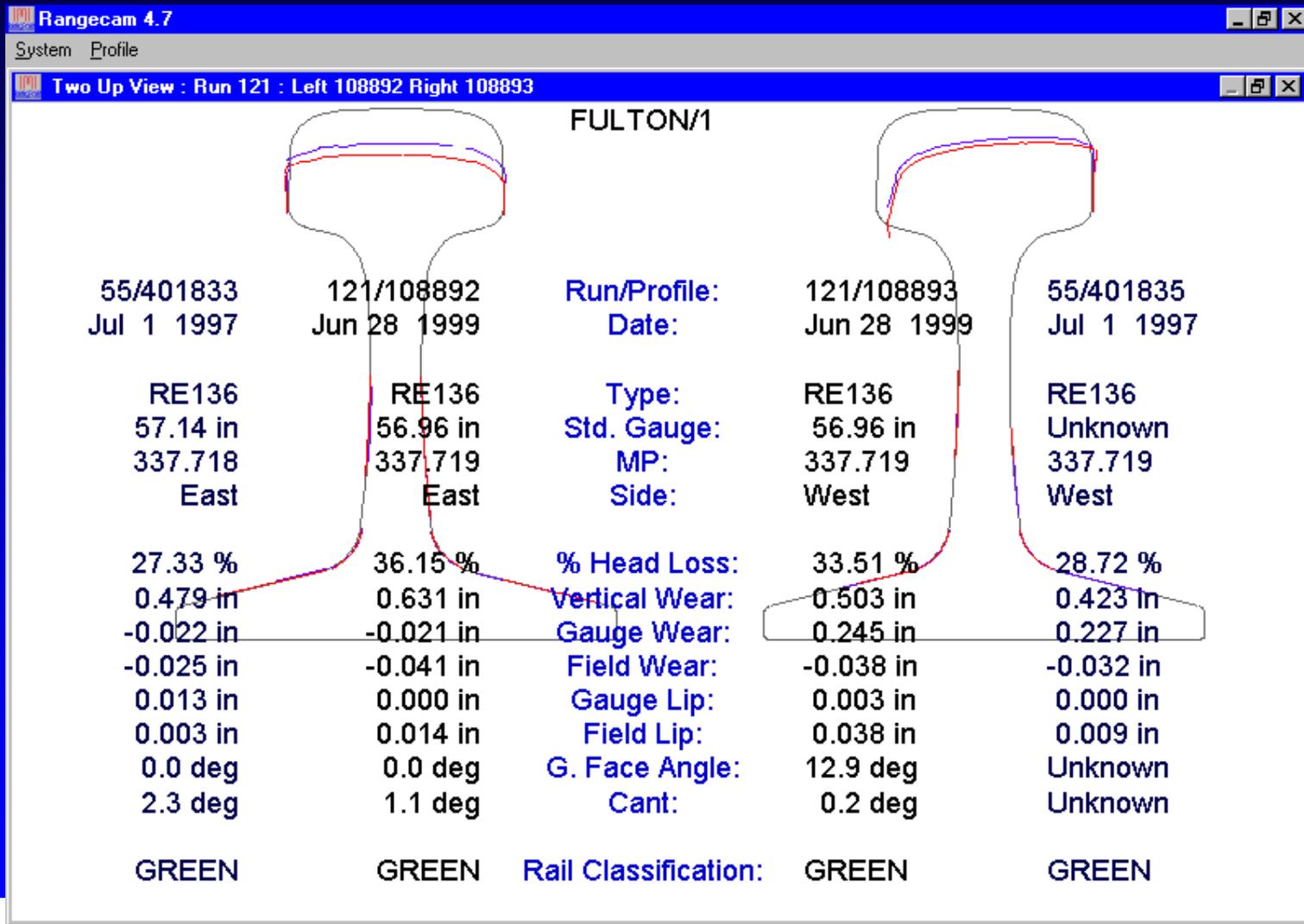
Right Rail



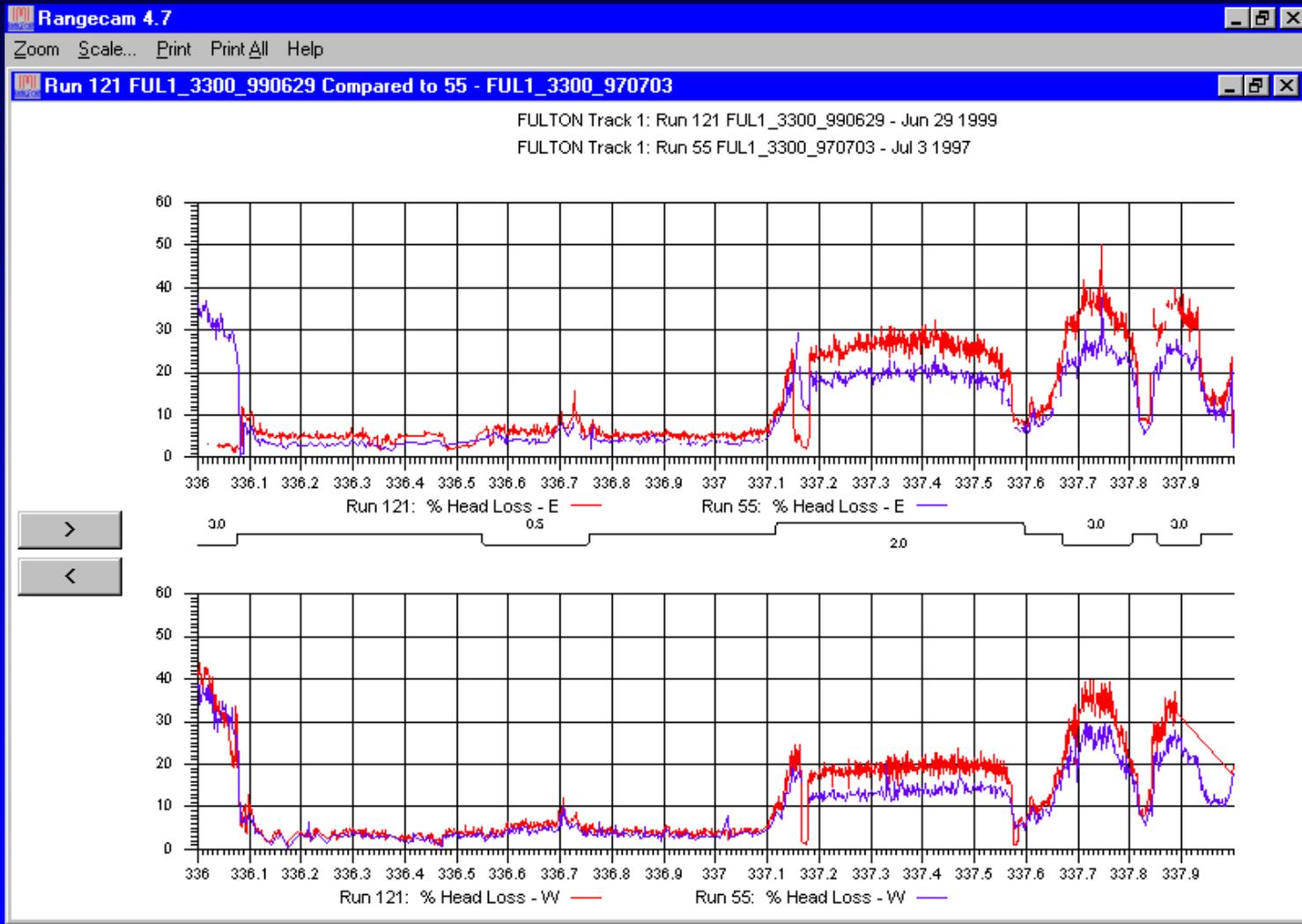
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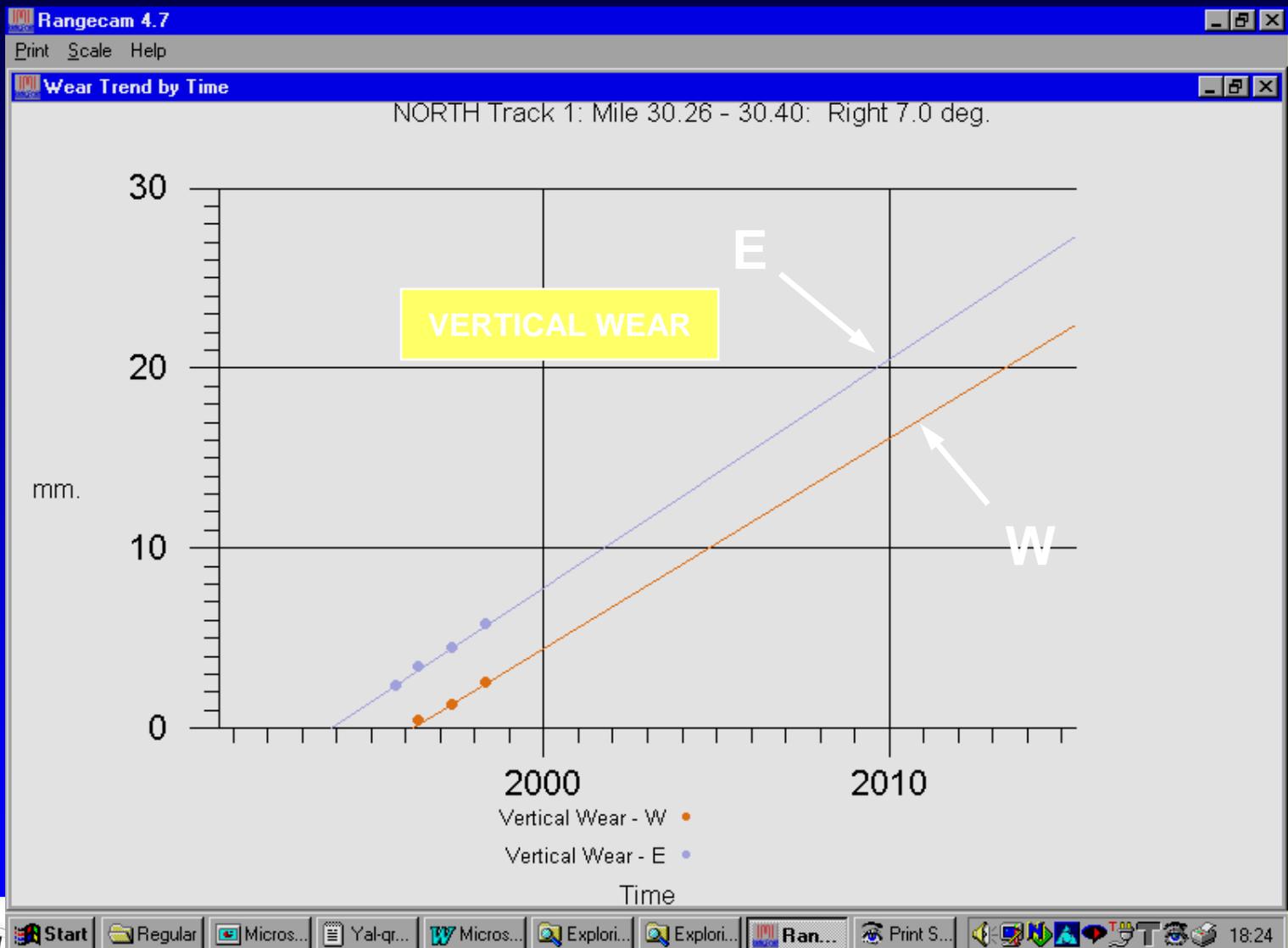
"TWO-UP" COMPARISON VIEW



COMPARISON CHART



TREND CHART-1



- *Rail Measurement*
- *Wheel Measurement*

- W
- R
- W
- T



ation



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Wheel Measurement

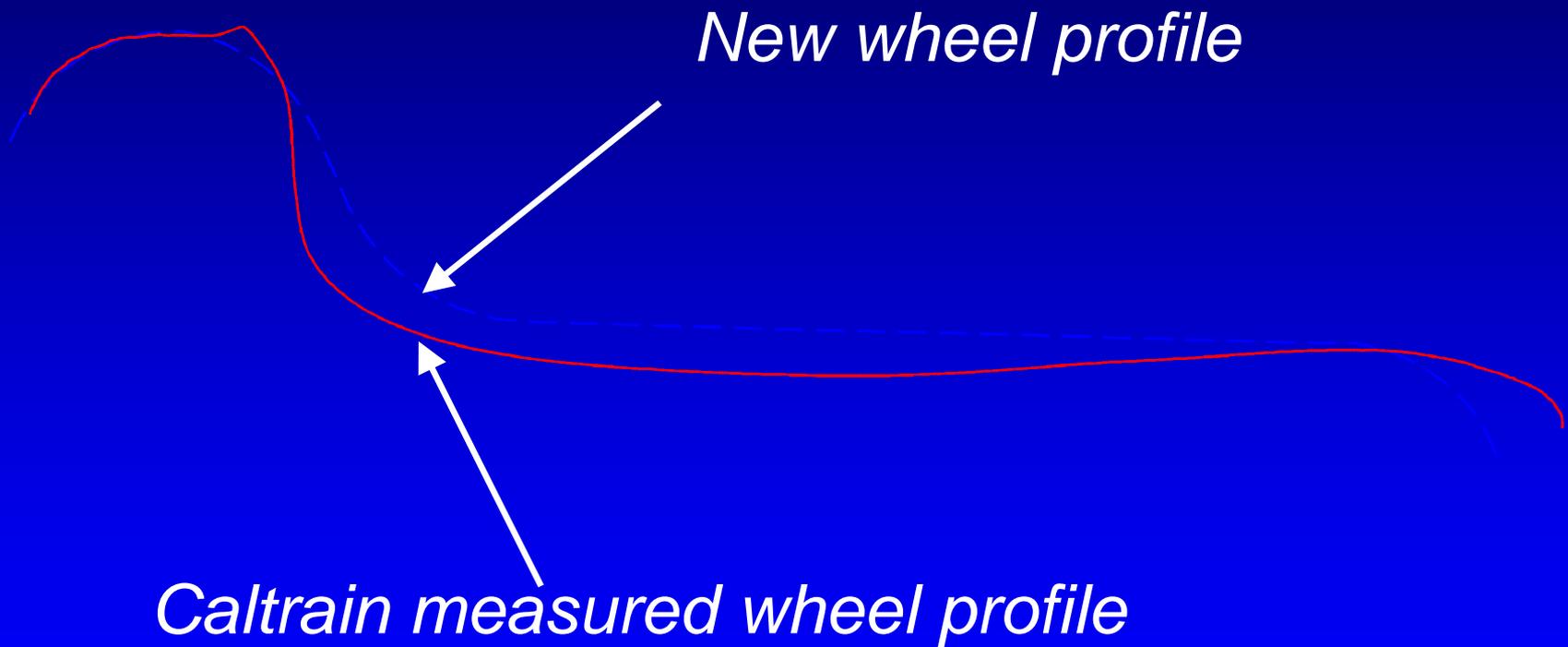
- *Generate wheel wear database*
 - *wear charts*
 - *forecasting capability*
 - *comparisons, queries, automated classification*
- *Support wheel reprofiling operations*
 - *real time quality control (following reprofiling)*
 - *monitor wheel/rail contact conditions*



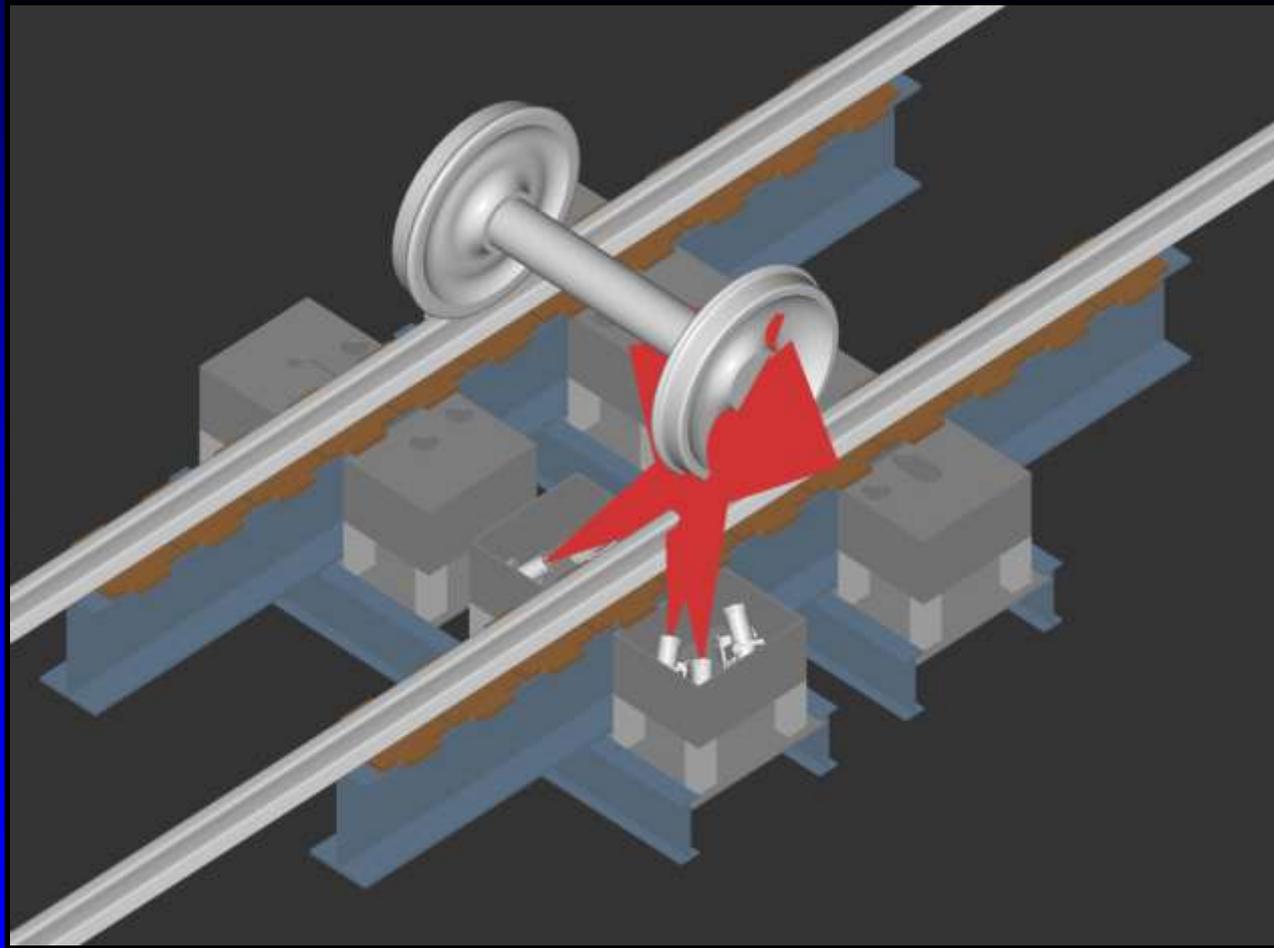
Wheel Measurement



Wheel Measurement



Automated Wheel Inspection *(WheelScan)*



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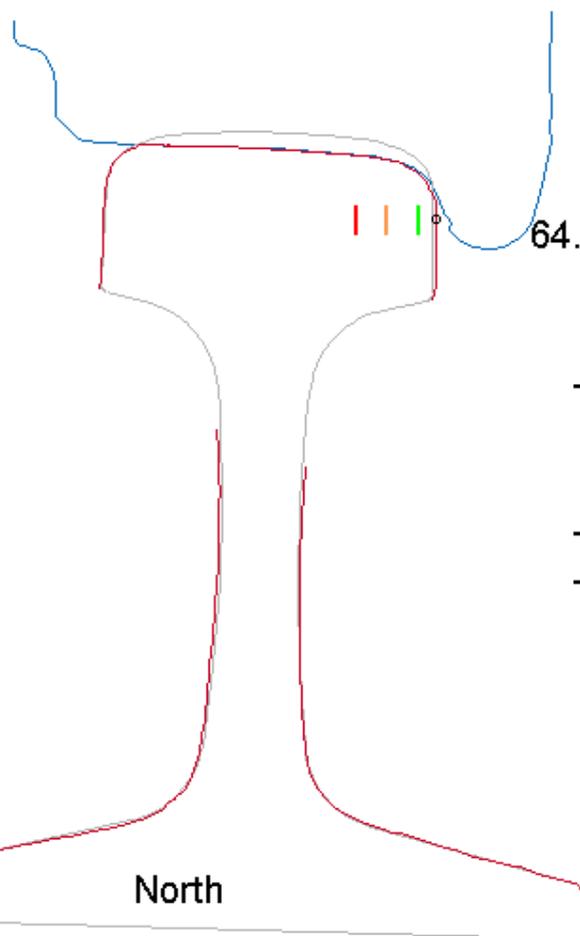
Wheel-set Position

0.00 in

MBTA - GREEN
LINE_A - Track EB

6/3682-2L	Test/Wheel	6/3682-2R
Dec 12 2003	Run - Date - Test	Sep 21 2004
20.002	Stn.	20.002

#T: Tangent



64.023 deg.
0.769 in.
0.950 in.
-0.048 in.

0.137 in.
-0.026 in.
-0.012 in.
7.33 %

Flange Angle
Flange Height
Flange Thick
Tread Wear

Vertical Wear
Gauge Wear
Field Wear
% Head Loss

1.6 deg.
0.0 deg.

Cant
GFA

115RE

Rail Type

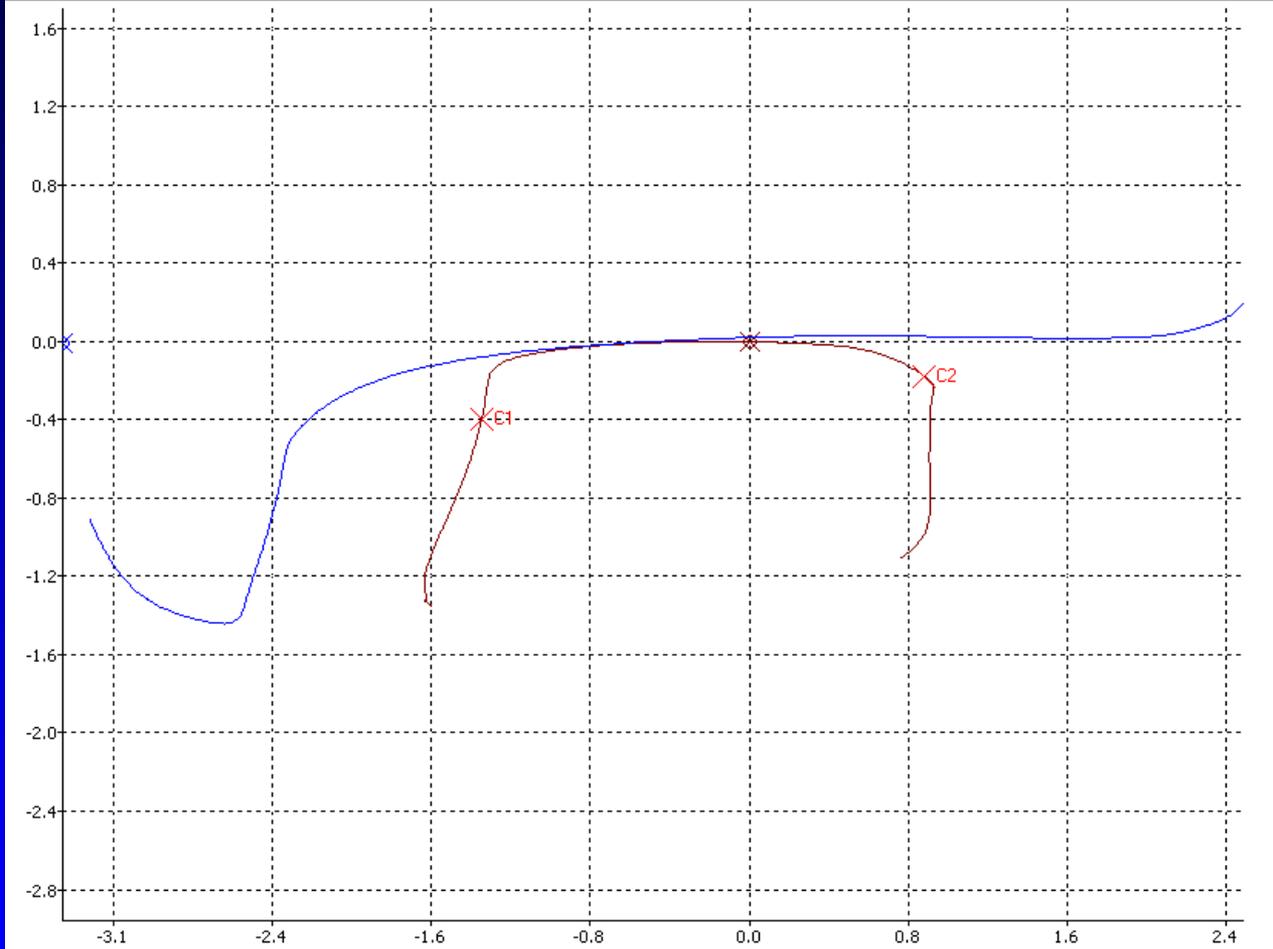


69.318 deg.
0.747 in.
0.954 in.
-0.054 in.

0.121 in.
-0.011 in.
-0.008 in.
5.86 %

3.6 deg.
0.0 deg.

115RE



Profiles Shift+F5

- 11062002-0011.ban [1]
- wheel test 1.whl [1]

Cursors Shift+F6

Cursor 1: (-1.326;-0.390)
 Cursor 2: (0.866;-0.174)
 (dx;dy): (2.193;0.216)
 |C2-C1|: 2.203 inch
 <C2-C1: 5.630 °
 l(C1): 1.019 inch
 l(C2): 3.468 inch
 <t(C1): 75.986 °
 <t(C2): -37.746 °

Results Shift+F7

Stock:
 Car number:
 Axle number:
 Wheel ID:
 Sd: 1.211 inch
 Sh: 1.408 inch
 qR: 0.310 inch

11062002-0011



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UNDER CAR VIDEO DEMONSTRATION

- *To investigate concerns of poor ride quality on a given system*



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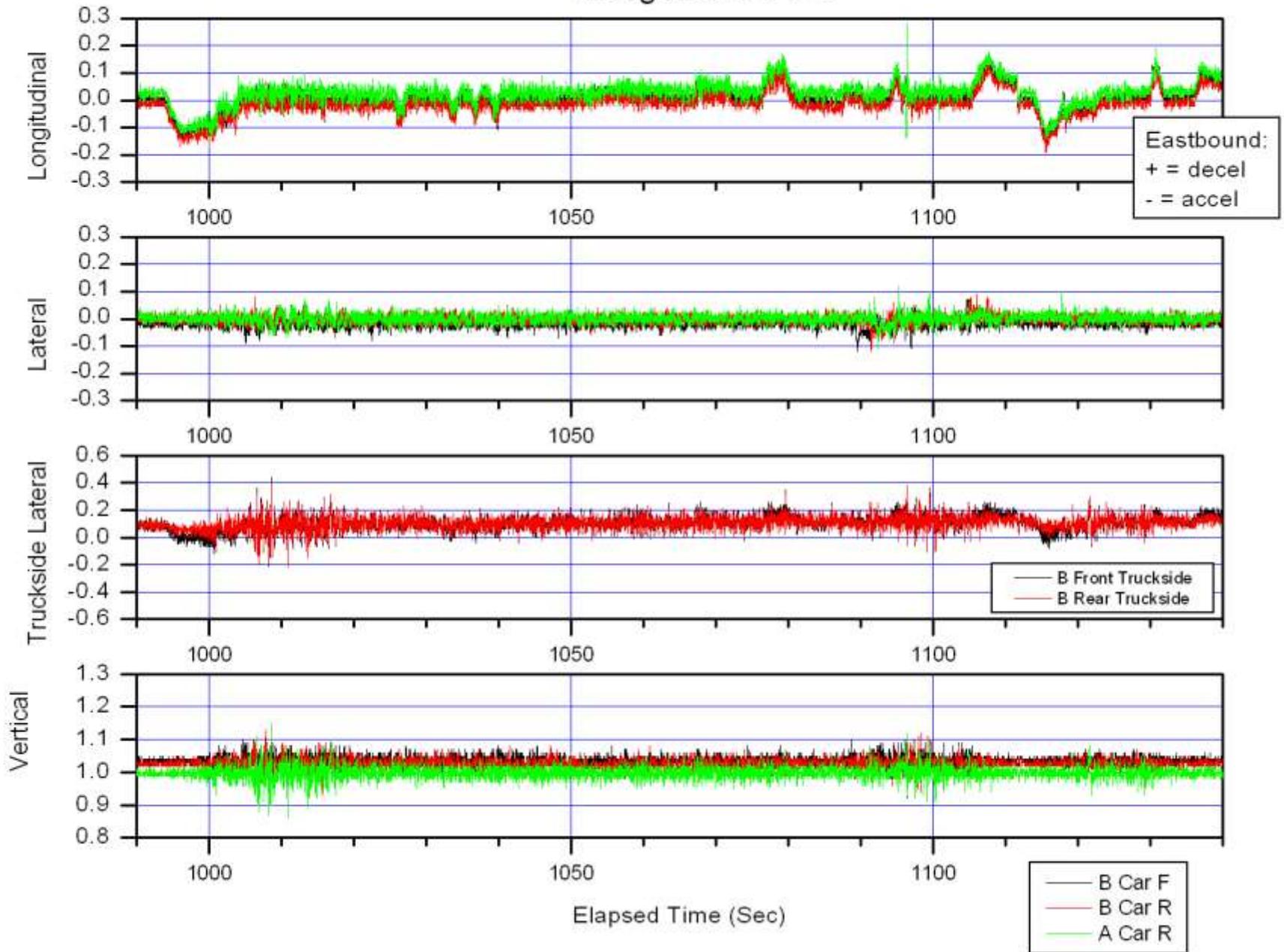
Accelerometer Data samples



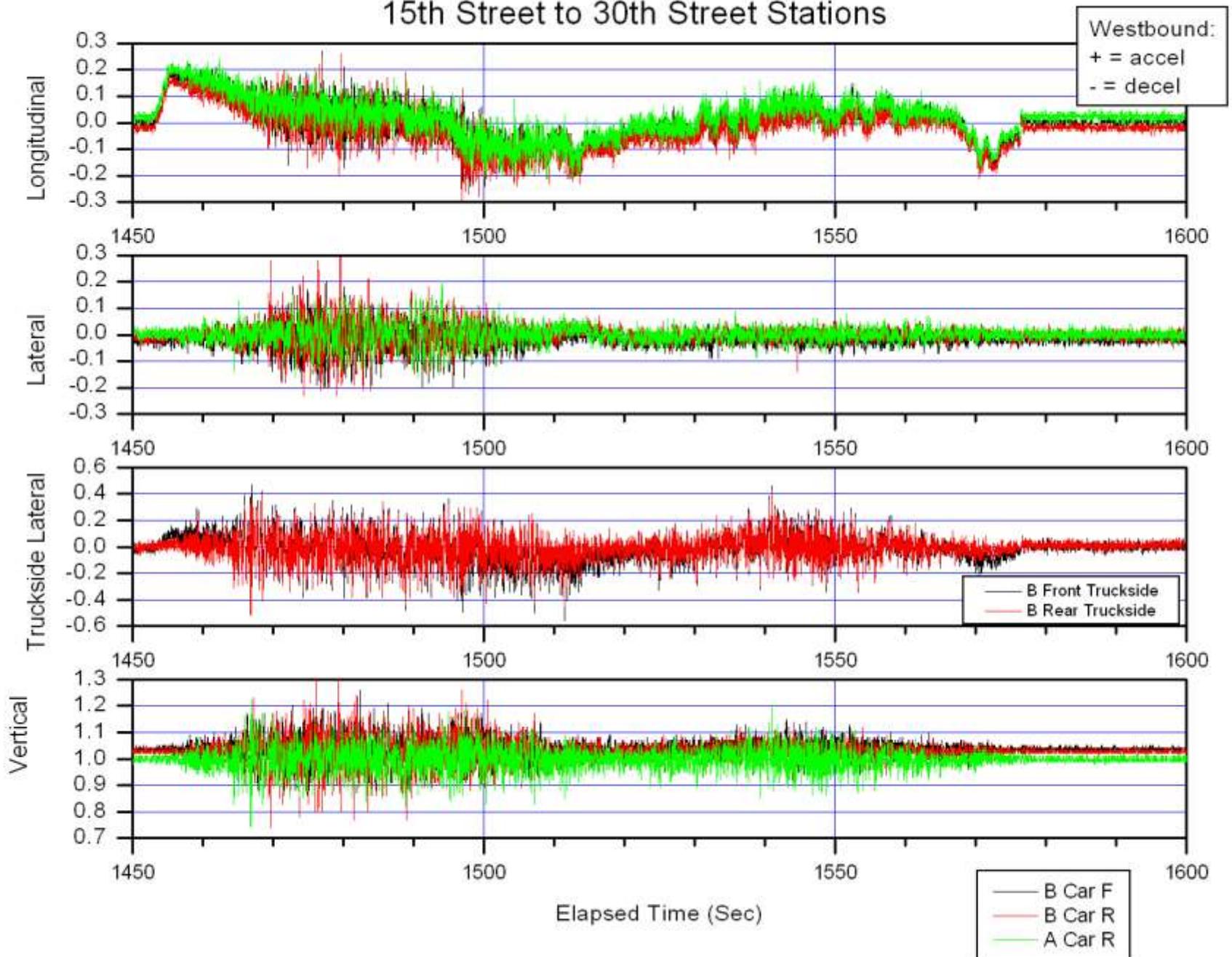
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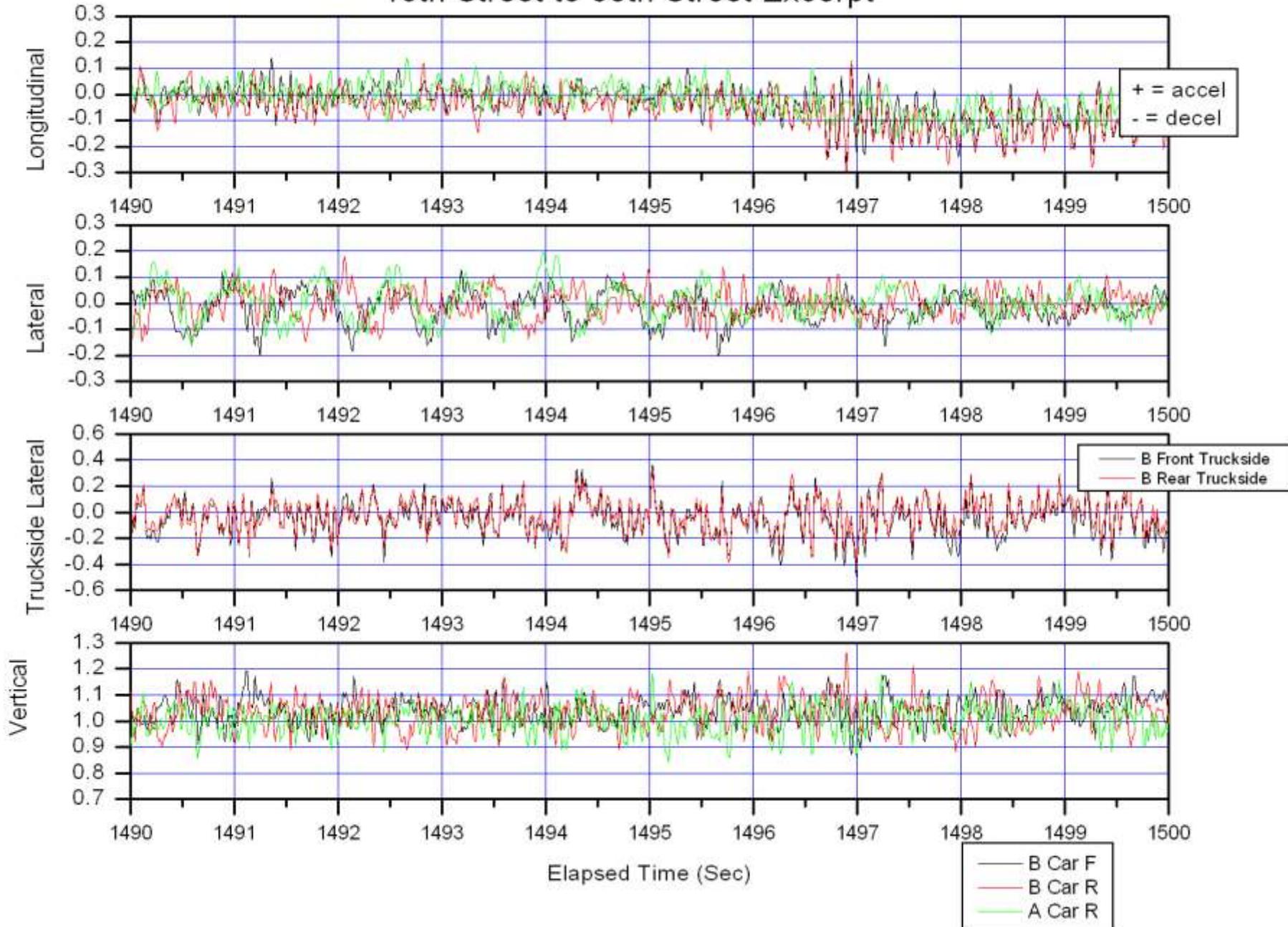
SEPTA 1070 - Eastbound 69th Street to FTC Margaret to FTC



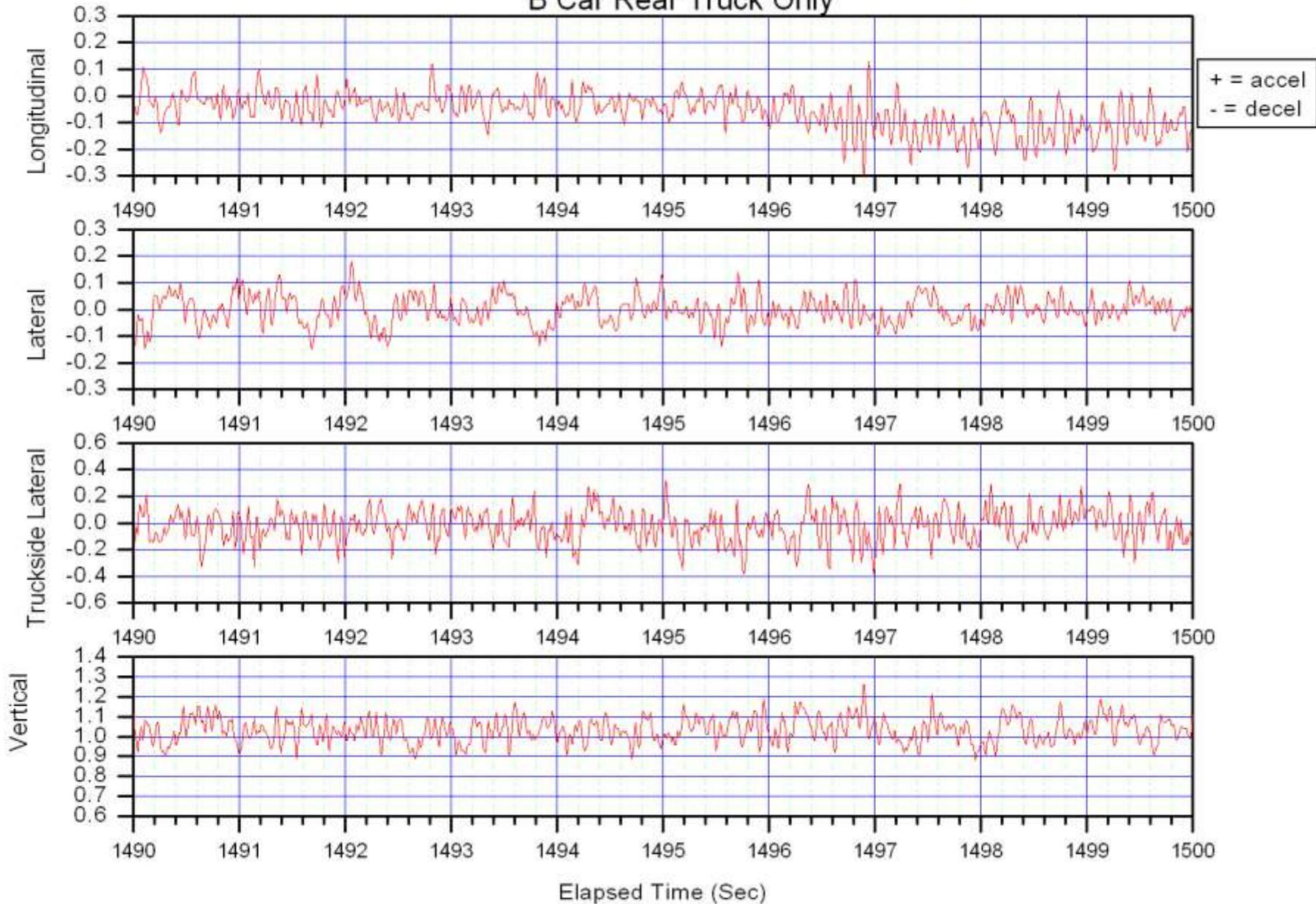
SEPTA 1070 - Westbound FTC to 69th Street 15th Street to 30th Street Stations



SEPTA 1070 - Westbound FTC to 69th Street 15th Street to 30th Street Excerpt



SEPTA 1070 - Westbound FTC to 69th Street Run
15th Street to 30th Street Stations
B Car Rear Truck Only



OPTIMIZING WHEEL/RAIL INTERACTION



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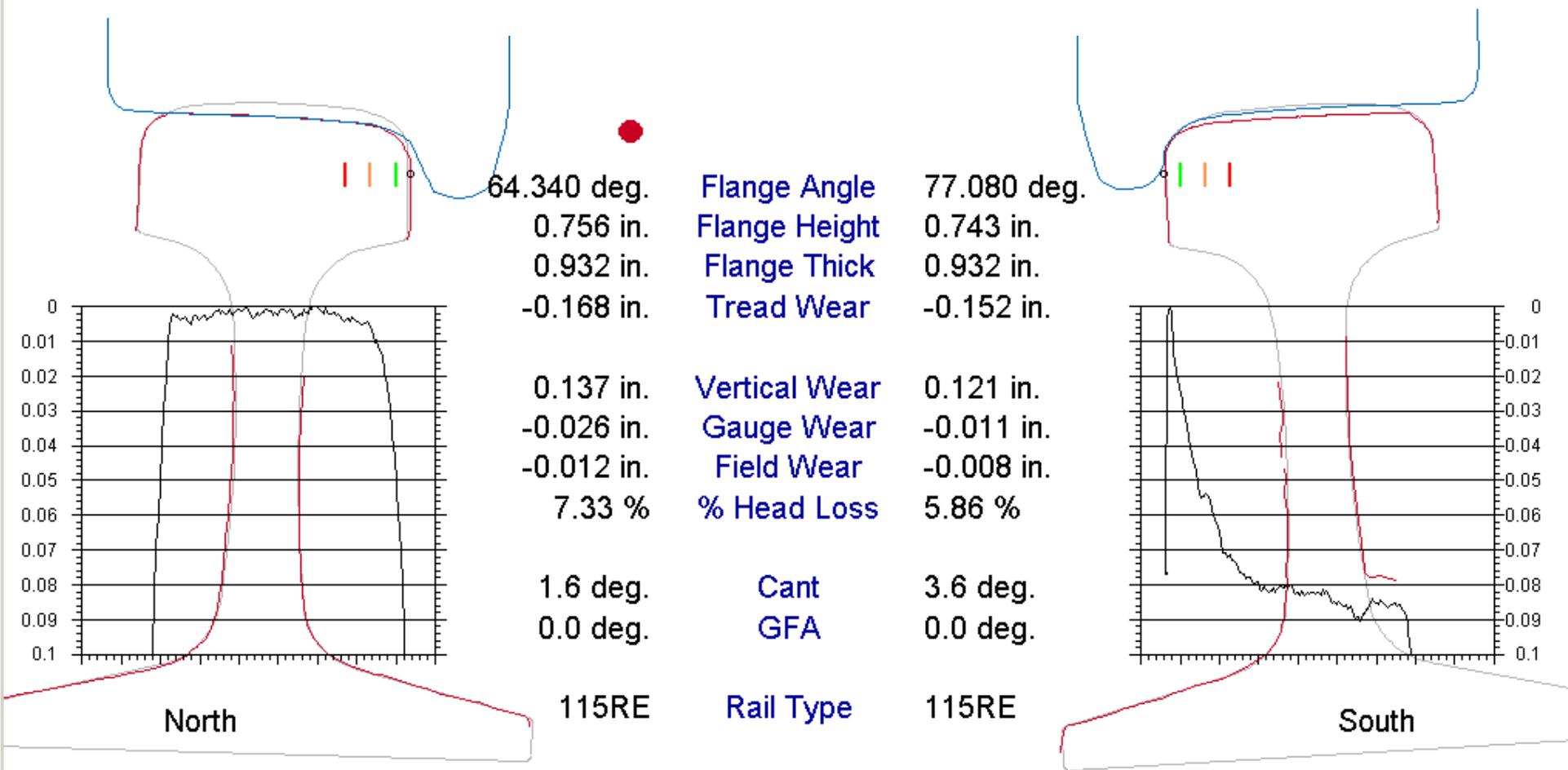
Wheel-set Position

◀ 0.06 in ▶

Reset

MBTA - GREEN
LINE_A - Track EB

Wheel/rail data integration



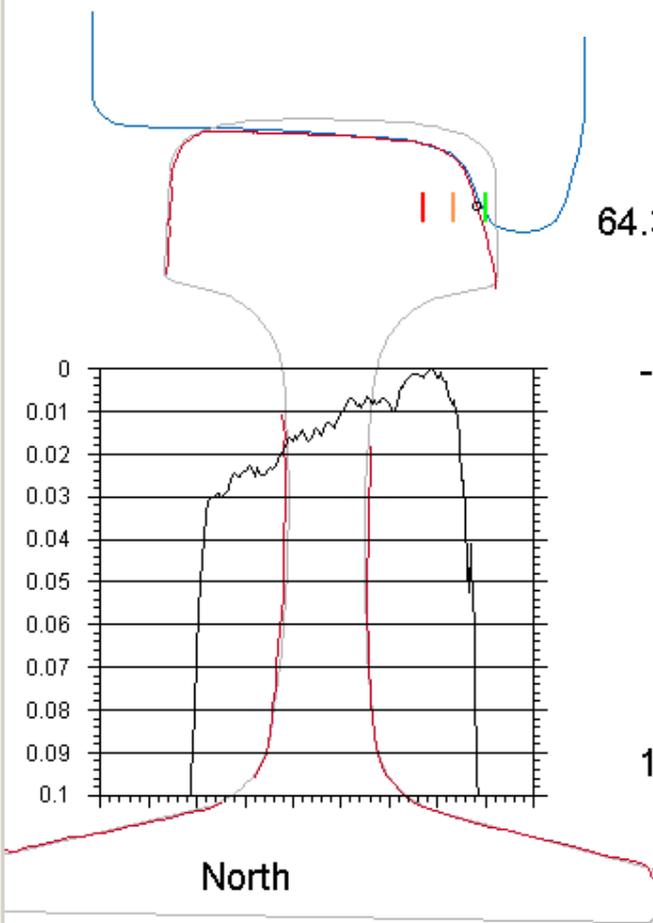


Wheel-set Position

-0.27 in Reset

MBTA - GREEN
LINE_A - Track EB

Wheel/rail data integration



64.340 deg.
0.756 in.
0.932 in.
-0.168 in.

0.136 in.
0.154 in.
0.015 in.
11.73 %

Flange Angle
Flange Height
Flange Thick
Tread Wear

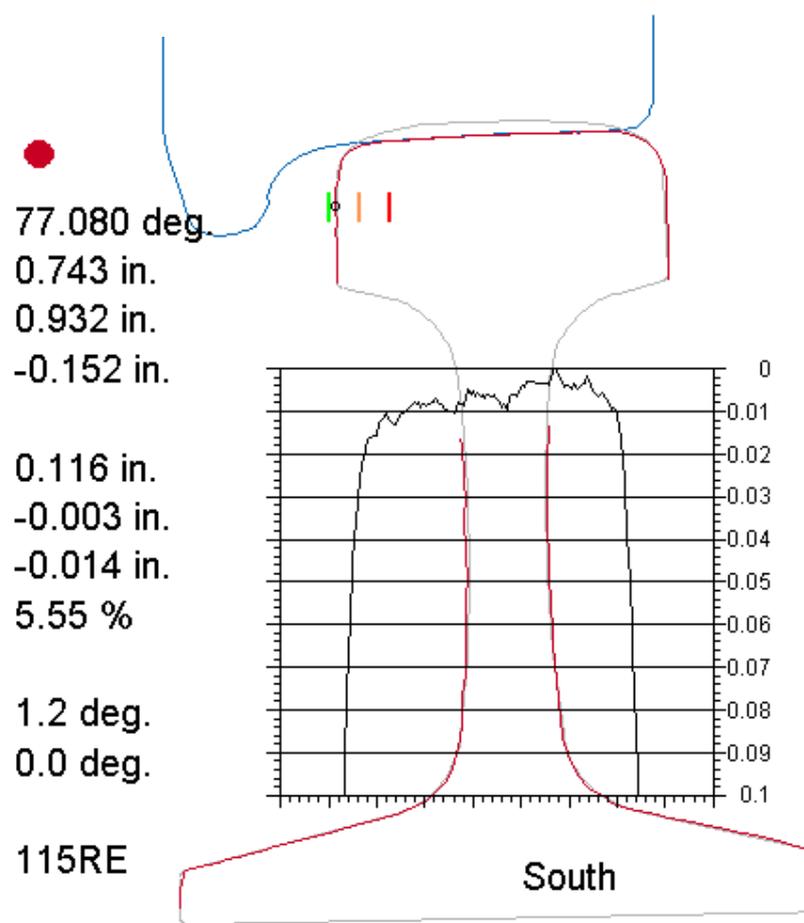
Vertical Wear
Gauge Wear
Field Wear
% Head Loss

1.0 deg.
15.8 deg.

Cant
GFA

115RE

Rail Type



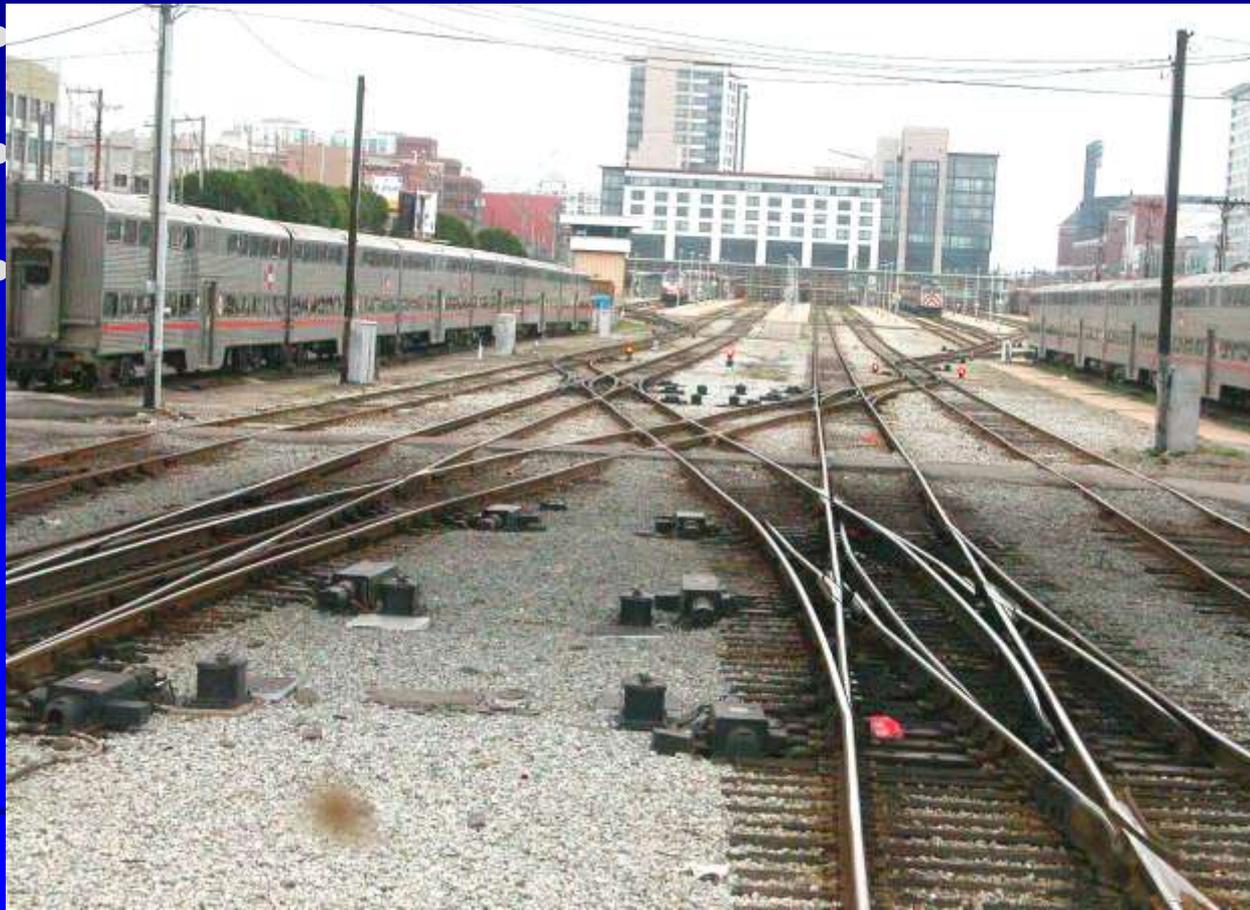
77.080 deg.
0.743 in.
0.932 in.
-0.152 in.

0.116 in.
-0.003 in.
-0.014 in.
5.55 %

1.2 deg.
0.0 deg.

115RE

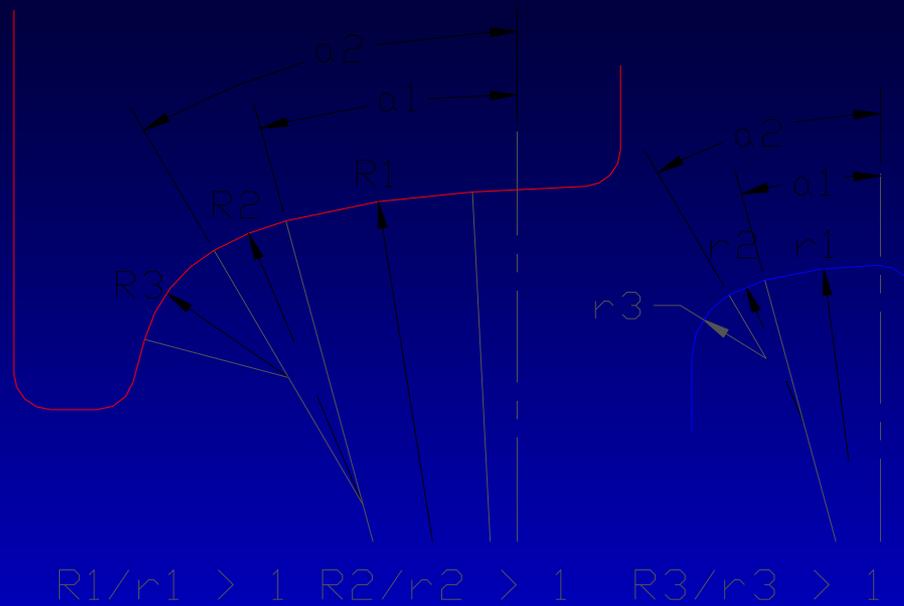
- *Rail Measurement*
- *Wheel Measurement*
- *Wheel & Rail Profile Design*



ation



Designing the Progressively Curved Wheel/Rail Profile Pair



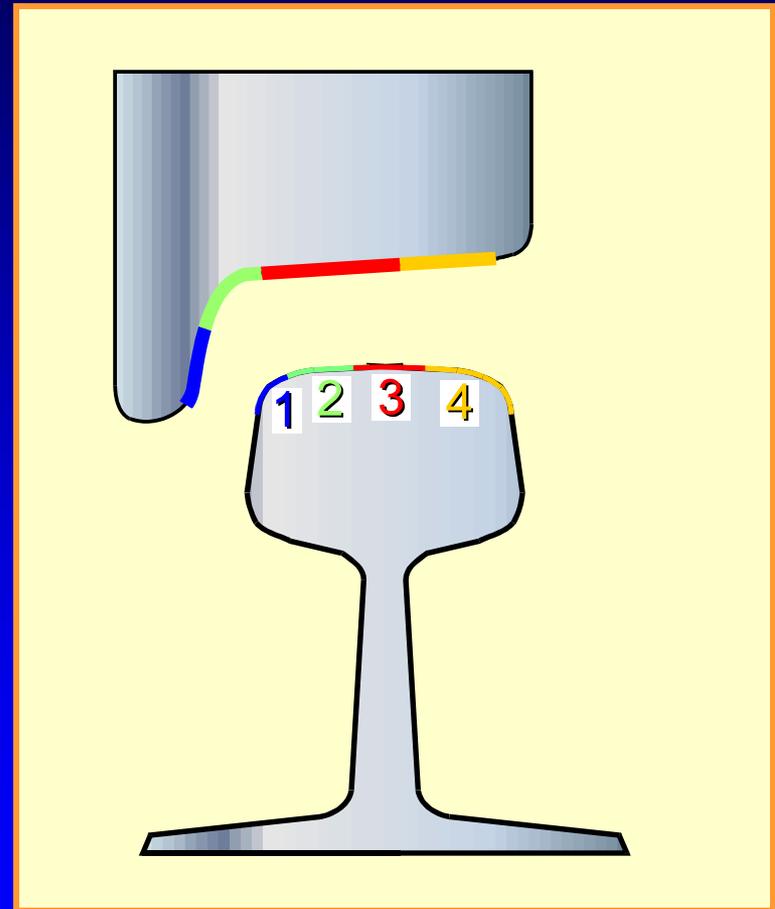
In order to ensure that the contact never ‘jumps’ as the wheel moves laterally across the rail head, the angle at which the transition from one radius to the next occurs must be the same for both the wheel and for the rail. If $r1$ was greater than $R2$ (which is likely) and if it continued too far there would come a point when contact would jump.

As noted above, the ratio of Rr/rw must be greater than 1 but it doesn’t have to be the same for each region of the profile.



Pummeling Effects

- *Split wheel and rail profiles into contact zones*
- *accept some degree of overlap*
- *Attempt to distribute contact across rail and wheel equally*



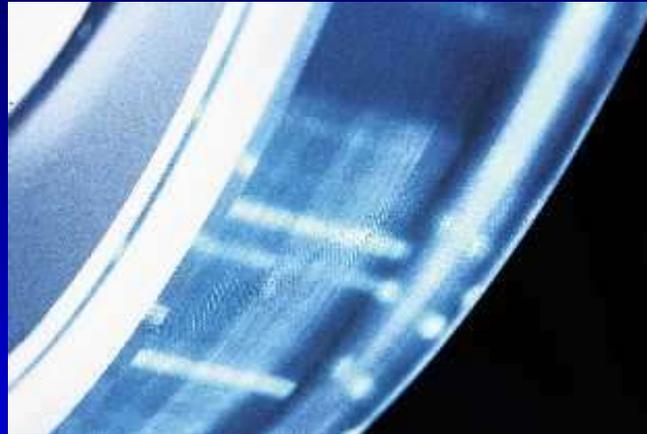
Comparison of Wheel Profile for LA Red Line vs AAR1B



RESCO Engineering
Railroad Trucks that Outperform



Rail / Wheel Optimization



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Effective Measurement Tools to Evaluate Vehicle/Track Interaction



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