Motiva Enterprises NMR-Enhanced Diesel Blender

Terry Sparkman

Project Development

- Need
- Justification

Project Goals

- Blend Optimization
- Direct Blending To Pipeline

Project Description

- Utilize DCS BRC for Blend Optimization
- Install Analyzers
- Modify Piping and Control Loop

Technology Used

- Analyses Needed
  - pour point, cloud point, distillation, cetane index, gravity, sulfur
- New Technology Considered - NMR
  - Proven technology
  - Reduction in number of analyzers
  - Less space needed allowing utilization of existing analyzer building
  - Reduced maintenance and calibration

Technology Used

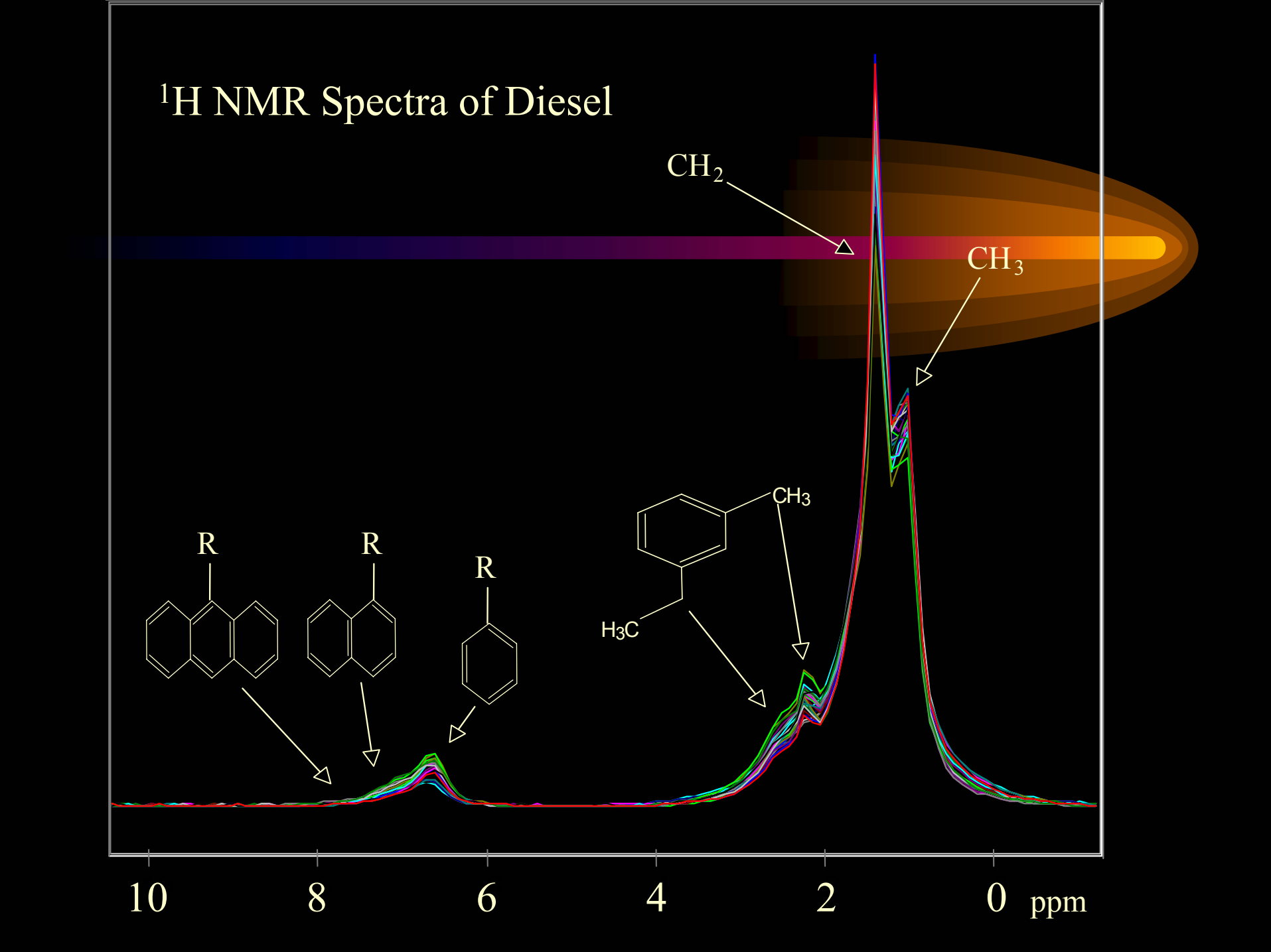
- Drawbacks to New Technology
  - Not familiar with technology
  - Limited local plant support
  - New design
  - Not a proven process analyzer in this application

Installation/Start-up

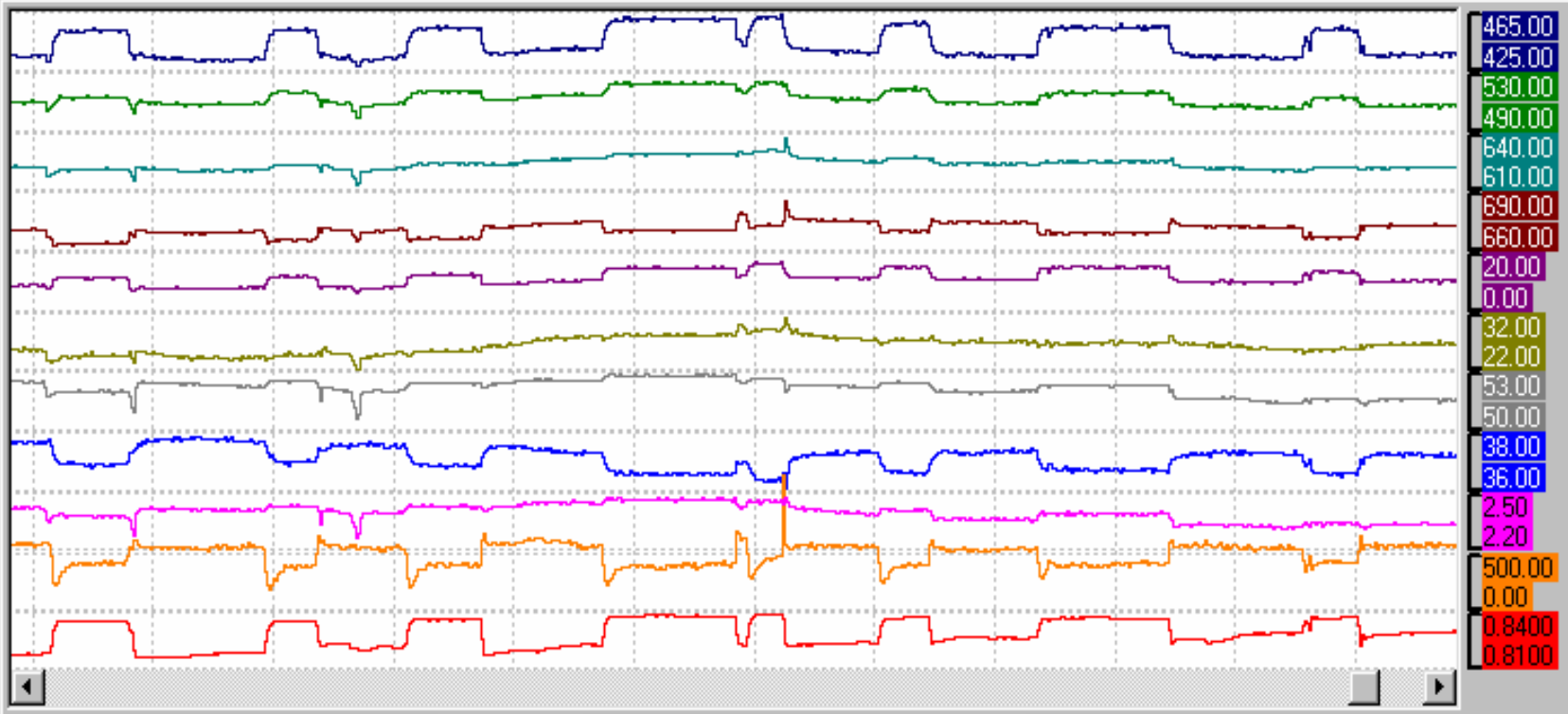
- Utilization of existing equipment
- Hardware details
  - Provided by Foxboro
  - Provided by Motiva Enterprise
- Software details
- Service
- Training
- Delays

Blender Utilization

- High Sulfur Blends
- Low sulfur Blends
- Outliers
- Current Status


^{1}H NMR Spectra of Diesel
CH_2
CH_3
R
R
R
CH_3
H_3C
10
8
6
4
2
0
ppm

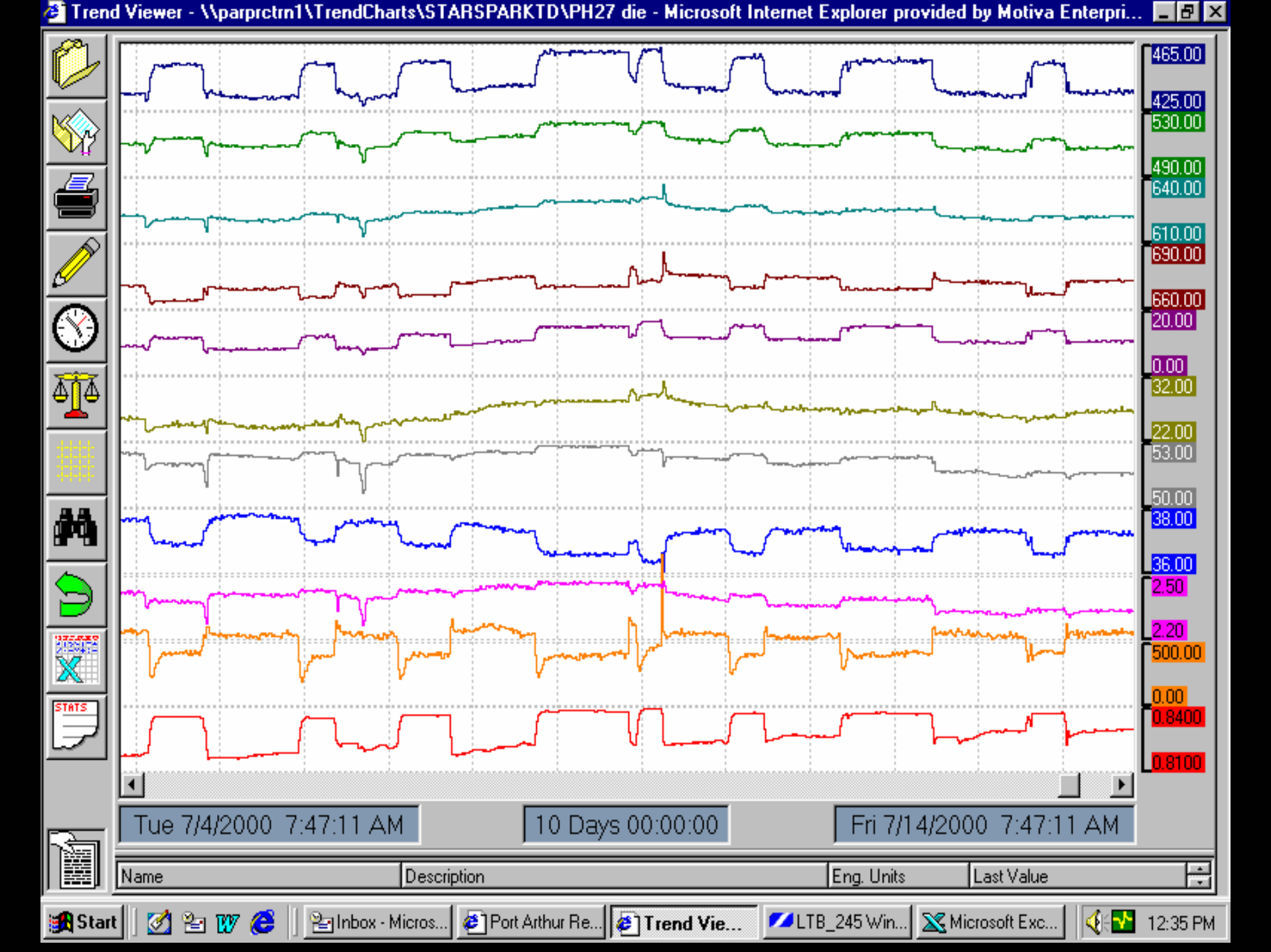
Trend Viewer - \\parprctrn1\TrendCharts\STARSPARKTD\PH27 die - Microsoft Internet Explorer provided by Motiva Enterpri...

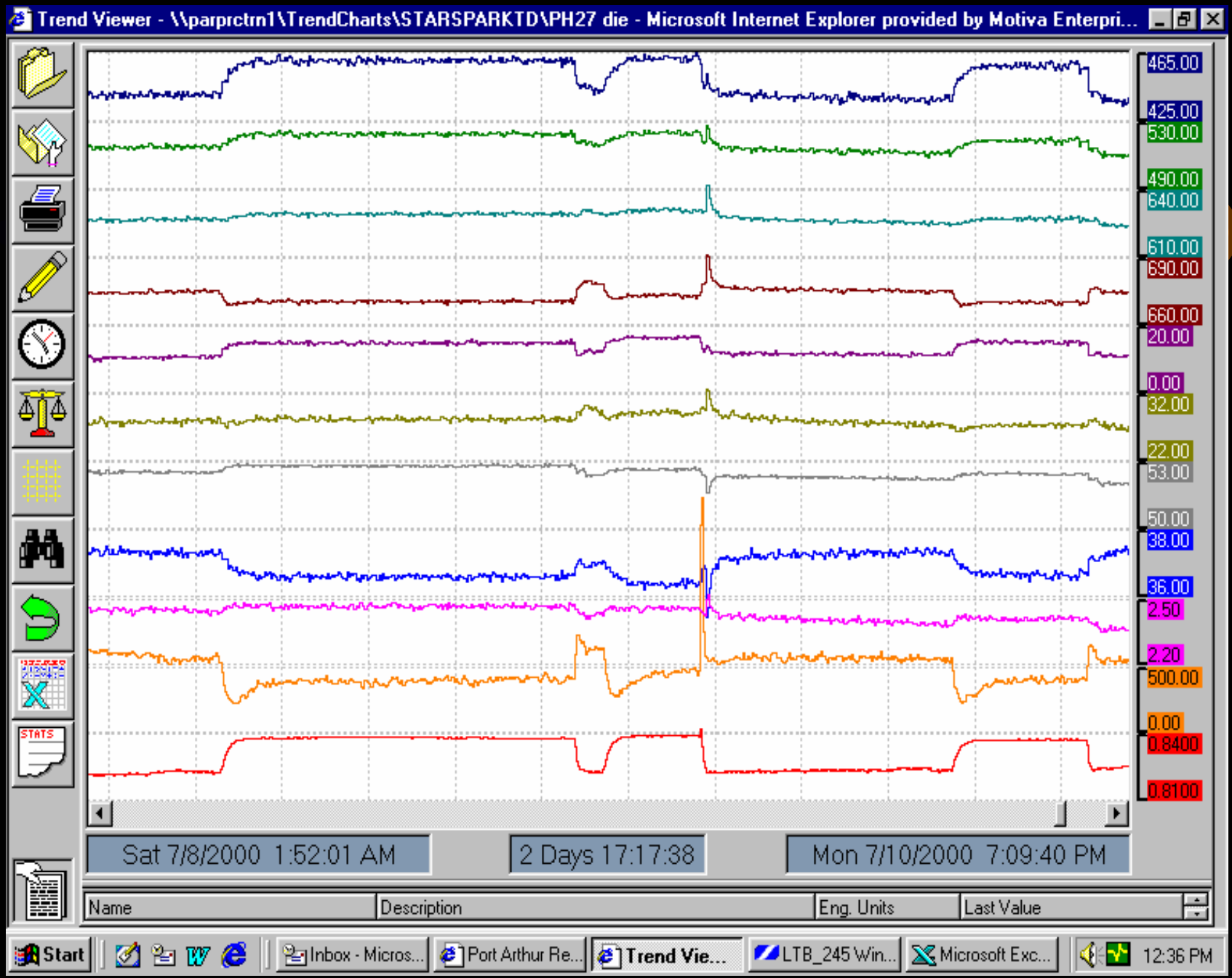


Tue 7/4/2000 7:47:11 AM | 10 Days 00:00:00 | Fri 7/14/2000 7:47:11 AM

Name	Description	Eng. Units	Last Value
PAR_PH27_SEC:6AI0422A	DIESEL NMR T10	DEG F	439.96
PAR_PH27_SEC:6AI0422B	DIESEL NMR T50	DEG F	504.69
PAR_PH27_SEC:6AI0422C	DIESEL NMR T90	DEG F	614.47
PAR_PH27_SEC:6AI0422D	DIESEL NMR EP	DEG F	658.44
PAR_PH27_SEC:6AI0422E	DIESEL NMR POUR	DEG F	7.92
PAR_PH27_SEC:6AI0422F	DIESEL NMR CLOUD	DEG F	20.25
PAR_PH27_SEC:6AI0422G	DIESEL NMR CETANE	DEG F	52.33
PAR_PH27_SEC:6AI0422H	DIESEL NMR API	API	37.81
PAR_PH27_MIN:6AI0423A	DIESEL SULFUR ANLYZ PPM	PPM	4,831.01
PAR_PH27_MIN:6AI0423B	DIESEL SULFUR ANLYZ DENS	SPGR	0.8528

Start | Inbox - Microsoft O... | Port Arthur Refinery... | Trend Viewer - ... | LTB_245 Windows... | 12:34 PM

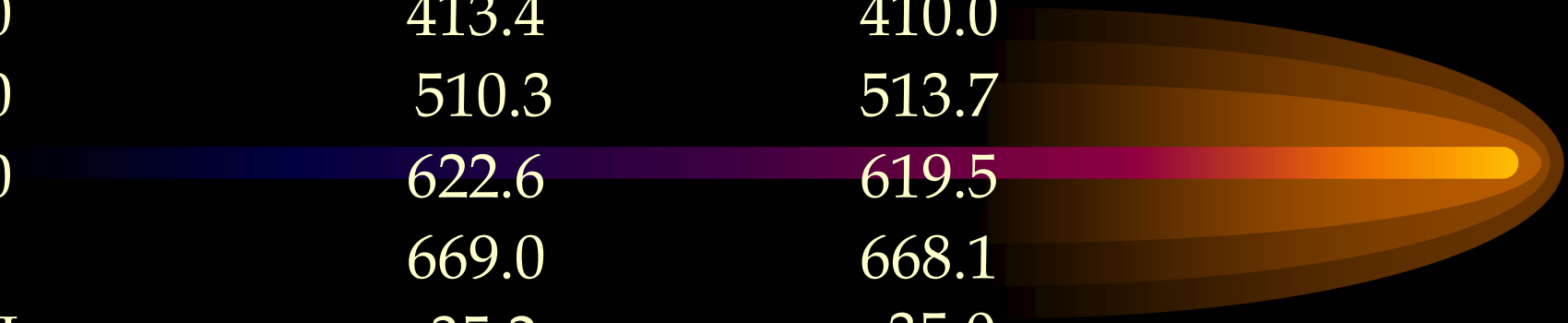

Trend Viewer - \\parprctrn1\TrendCharts\STARSPARKTD\PH27 die - Microsoft Internet Explorer provided by Motiva Enterpri...
465.00
425.00
530.00
490.00
640.00
610.00
690.00
660.00
20.00
0.00
32.00
22.00
53.00
50.00
38.00
36.00
2.50
2.20
500.00
0.00
0.8400
0.8100
Tue 7/4/2000 7:47:11 AM
10 Days 00:00:00
Fri 7/14/2000 7:47:11 AM
Name
Description
Eng. Units
Last Value
Start
Inbox - Micros...
Port Arthur Re...
Trend Vie...
LTB_245 Win...
Microsoft Exc...
12:35 PM


Trend Viewer - \\parprctrn1\TrendCharts\STARSPARKTD\PH27 die - Microsoft Internet Explorer provided by Motiva Enterpri...
465.00
425.00
530.00
490.00
640.00
610.00
690.00
660.00
20.00
0.00
32.00
22.00
53.00
50.00
38.00
36.00
2.50
2.20
500.00
0.00
0.8400
0.8100
Sat 7/8/2000 1:52:01 AM
2 Days 17:17:38
Mon 7/10/2000 7:09:40 PM
Name
Description
Eng. Units
Last Value
Start
Inbox - Micros...
Port Arthur Re...
Trend Vie...
LTB_245 Win...
Microsoft Exc...
12:36 PM

Parameter	Primary Test	Range	SEP
Cetane Index	D976	21 to 56 C.N.	1.0
Cetane Index	D4737	21 to 56 C. n.	1.0
Cloud Point	D2500	-87 to +21 deg. F	4.5 deg. F
Pour Point	D97	-85 to +20 deg. F	4 deg. F
T10	D86	312 to 496 deg. F	5 deg. F
T50	D86	340 to 565 deg. F	5 deg. F
T90	D86	400 to 662 deg. F	5 deg. F
End Point	D86	445 to 694 deg. F	5 deg. F
API Gravity	D4052	13 to 46 deg.	0.9 deg. F
Viscosity	D445	1.00 – 3.3 cSt	0.04 cSt
Sulfur	D2622	0.01 to 1.92 wt%	0.02 wt%

Tank 1522 High Sulfur Diesel 5/26/00 final blend results

	NMR	Lab
T10	413.4	410.0
T50	510.3	513.7
T90	622.6	619.5
EP	669.0	668.1
API	35.2	35.0
Cetane	48.0	47.3
Pour *	15	10
Cloud	19.8	15



* pour depressent added

	Berthold	Lab
Sulfur	2407(2707**)	2986

** sulfur analyzer is calibrated 300 ppm low

Future Plans

- Future Diesel Specifications
  - EPA Mandates
- Relocate
  - HCU Diesel/Avjet

Graphs and Pictures

Diesel Blender Sample Taps

Sample Pump

Sample Conditioning Plate

Analyzer Building

Foxboro NMR Analyzer

Sample/Proto Switching Plate

Analyzer Sample Line By-Pass Loop

Summary & Questions