R*TIME Traversing Incore Probe(TIP) Processing

Brent Young

SCIENTECH, LLC

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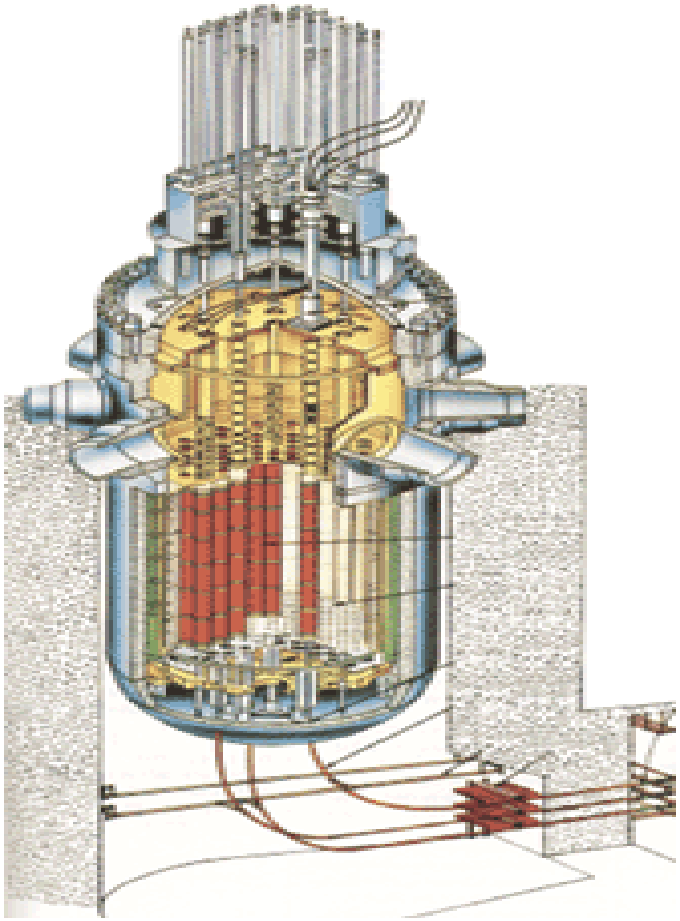
What is a TIP?

- A TIP is a mobile Low Power Range Monitor (LPRM) that Traverses through a cross section in the core taking flux readings.

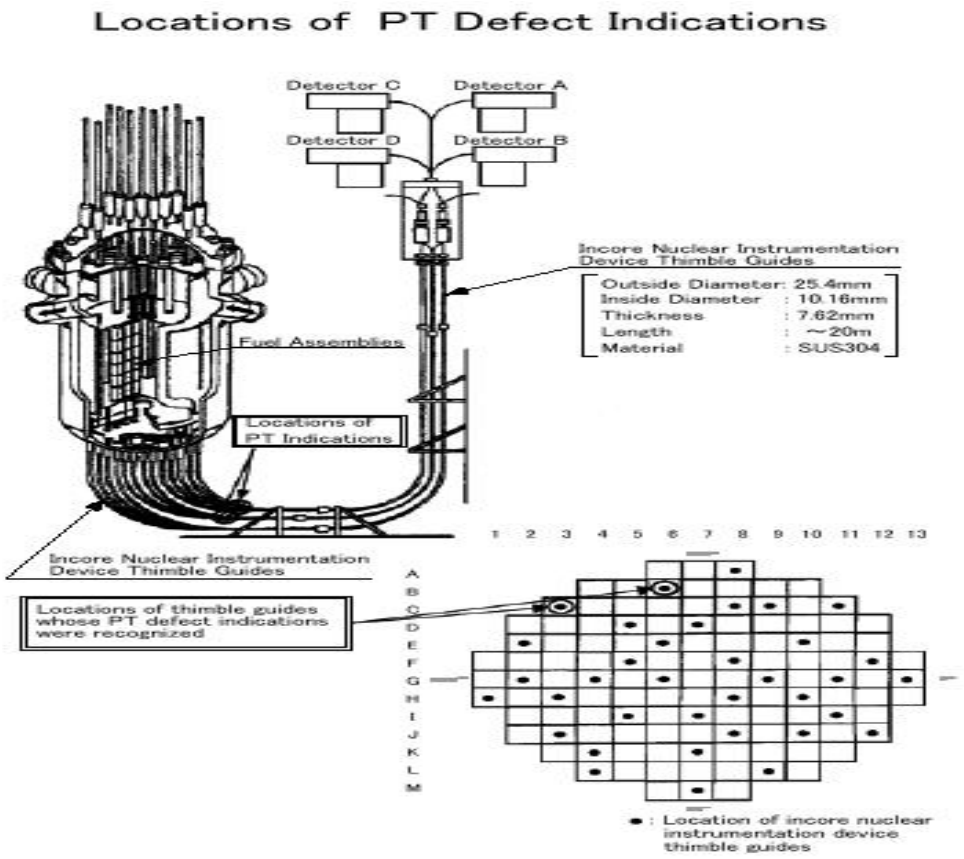
Traversing Incore Probe Basics

- Purpose:
  - To calibrate Low Power Range Monitors(LPRMs).
  - Check core Balance.
  - Provide data for Fuel Burn-up Calculations.

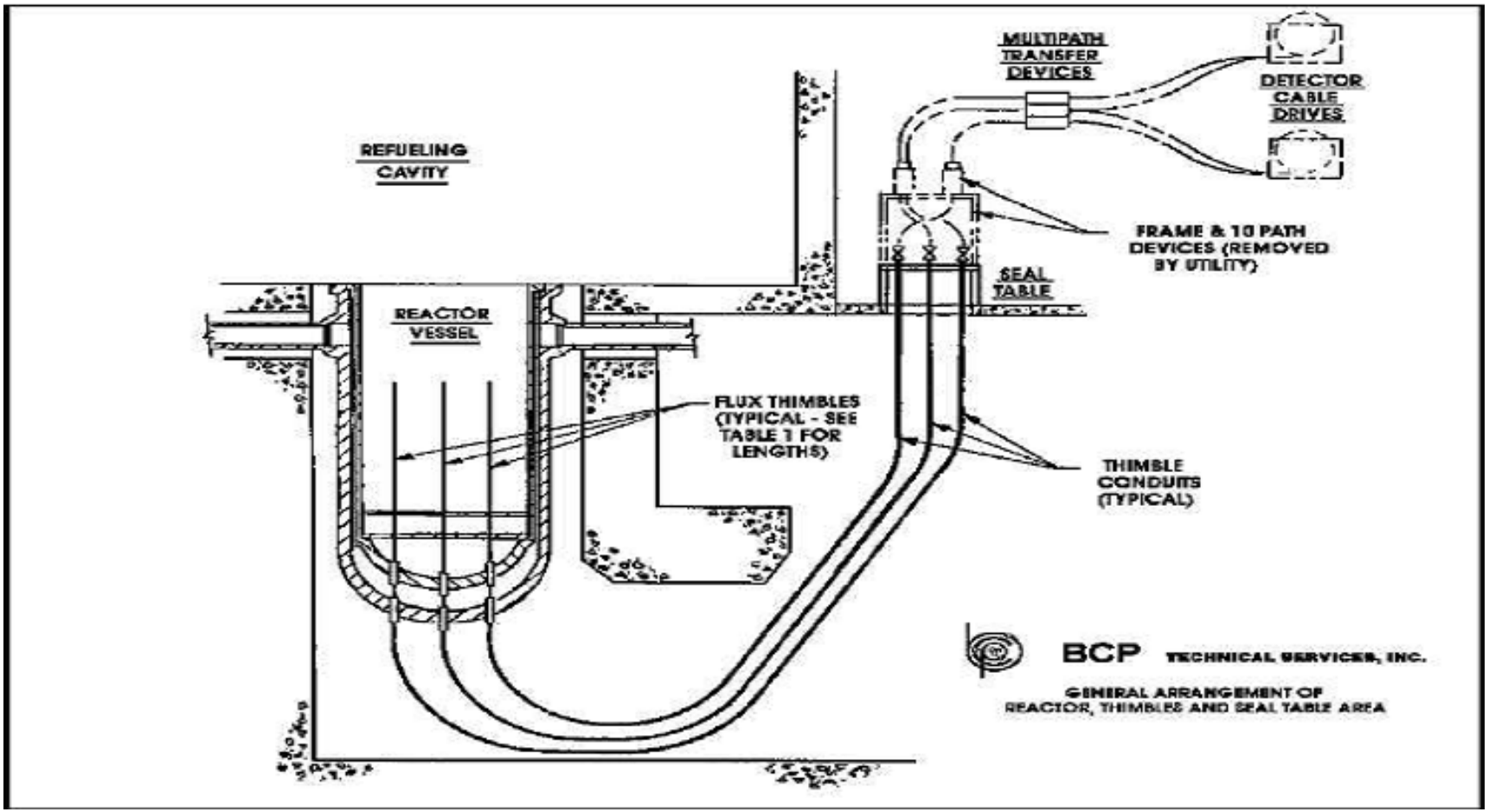
TIP Core Sensors



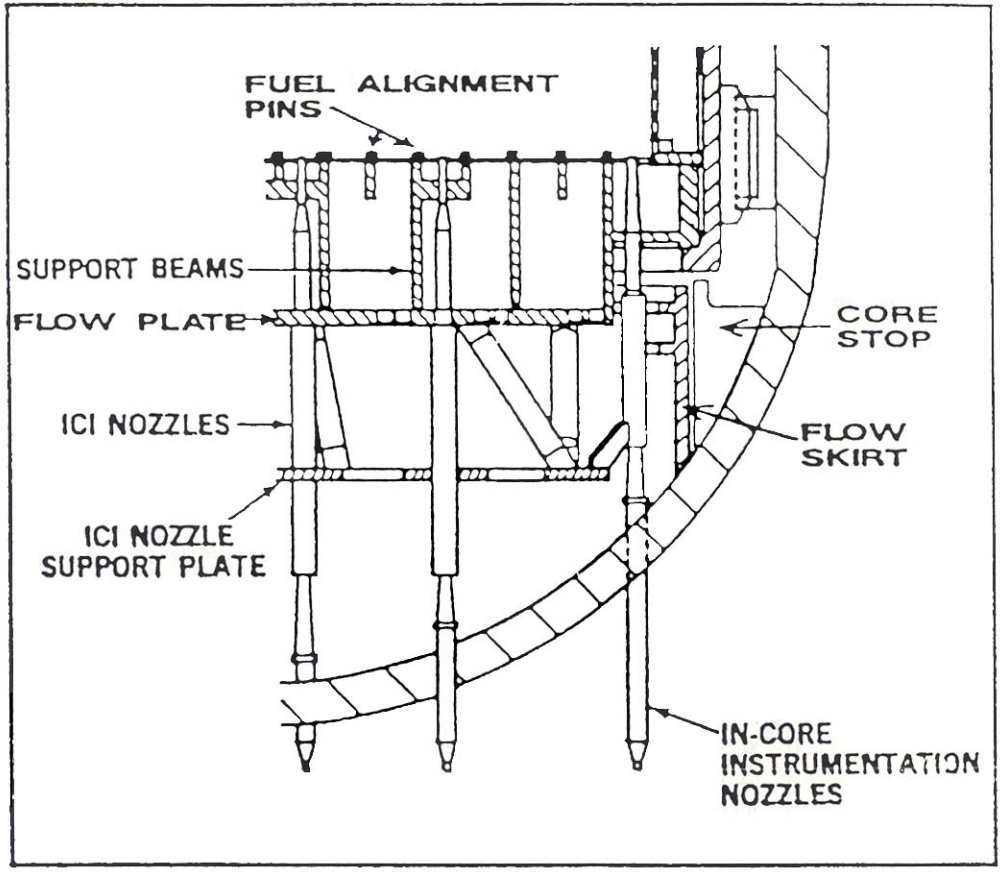
TIP Core Sensors



TIP Core Sensors



TIP Core Sensors



LPRM Sensors

Traversing Incore Probe Basics

- How it works:
  - A specified channel is selected.
  - The Traversing Incore Probe is moved to the top of the core.
  - The Probe is sent to the bottom of the core through the selected channel.
  - While traversing to the bottom at each inch a flux reading is saved.
  - When the probe is adjacent to a stationary LPRM, the LPRM flux is saved for comparison purposes.

*R*TIME TIP Processing Features Configuration*

- Configuration:
  - Configuration of the R*TIME TIP Processing is Controlled through the tip.ini file located in the %RTIMEHOME\data directory.
  - Tip.ini references other configuration files, the names of which are configurable.

R*TIME TIP Processing Features Configuration (Cont.)

- **TIP.ini Sections**:
  - General – Contains information on PowerPlex data file names, tip data file directories, RTP2000 net arrays name, display security settings, RTP2000 settings, default APRM points, points used in other TIP calculations, and the LPRM core locations.
  - Rod Positions – Contains the information on the number of Rods in the Core, and database name of each control Rod point, and the x-y core location of each rod.

R*TIME TIP Processing Features Configuration(Cont.)

- Sections:
  - TIP Machines – Contains the number of TIP machines available, the maximum number of channels per TIP machine, the associated TIP String number associated with each channel of each TIP machine, including spare channels. Also contains the Channel index point name for the channel indicators, as well as the associated flux points per TIP machine, and the withdraw counters per TIP machine.

R*TIME TIP Processing Features Configuration(Cont.)

- Sections:
  - Traverse Tubes – Contains the x-y core location for each of the traverse tubes, a list of the LPRMs by location for each traverse tube, the adjacent control rods to each traverse tube, and the fuels spacer settings for each traverse tube.

R*TIME TIP Processing Features
TIP Acquiring

- Running TIP:
  - The TIP software runs in the background on the R*TIME server and continually watches for a valid TIP at TOP signal. When the signal is received it begins gathering data on the traverse, until the traverse completes.
  - If errors are present, or occur during a traverse, the errors are logged to the R*TIME System message files.
  - After a completed traverse the raw data gathered during the traverse, has manual adjustment factors applied to it to get the adjusted flux values.

*R*TIME TIP Processing Features*
TIP Acquiring

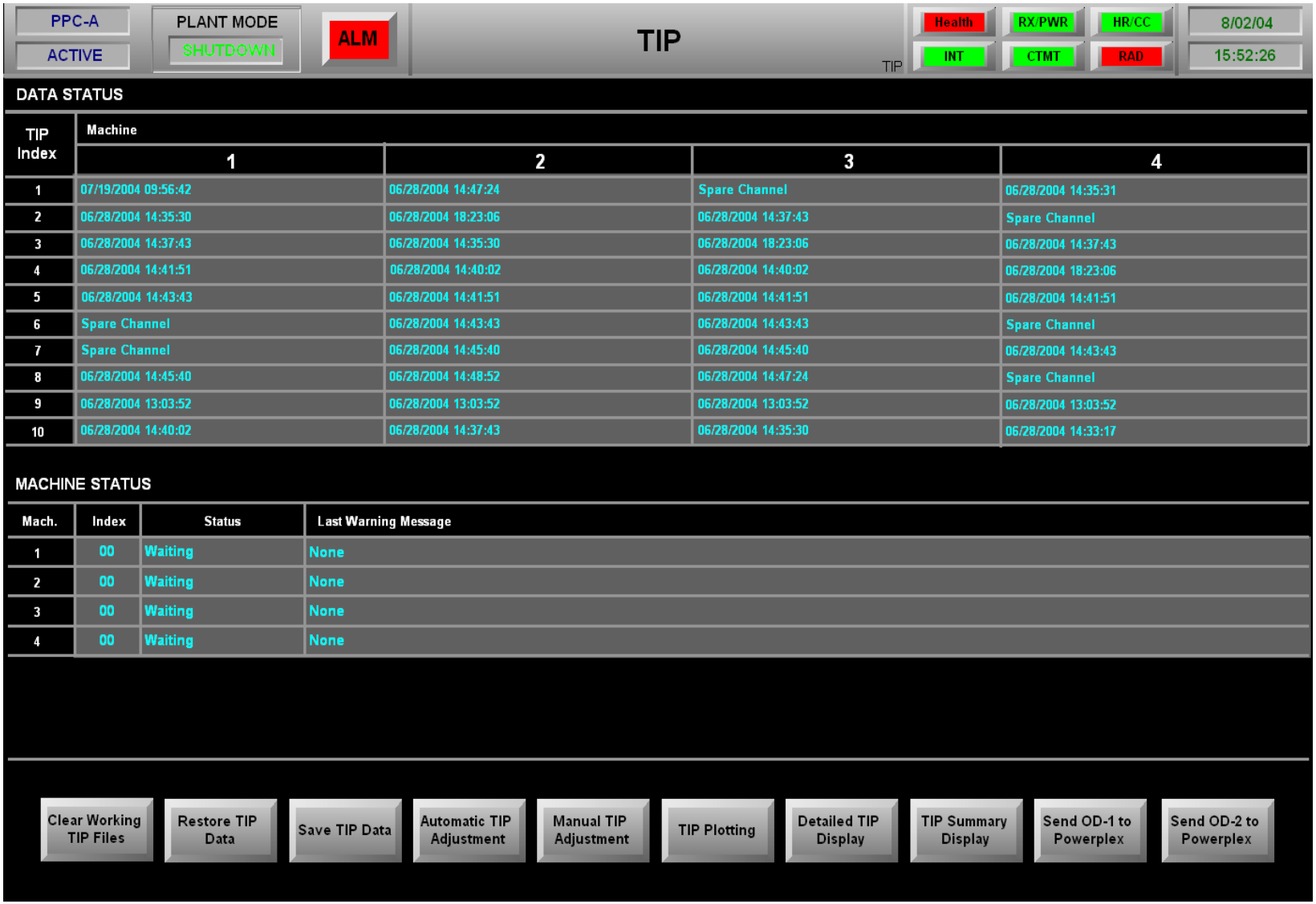
- Running TIP:
  - After the adjusted flux values are calculated, both the raw and adjusted flux values are written to disk in the user configurable file location.
  - All saved files are automatically backed up on the R*TIME redundant server.

*R*TIME TIP Processing Features*
Main TIP Display

- Main Tip Display:
  - Shows the available channels, and last traverse times per TIP machine.
  - Shows the current status, and last status message of the TIP machines.
  - Serves as a menu to get to all other TIP displays.
  - Provides an additional level of security on accessing TIP functions.

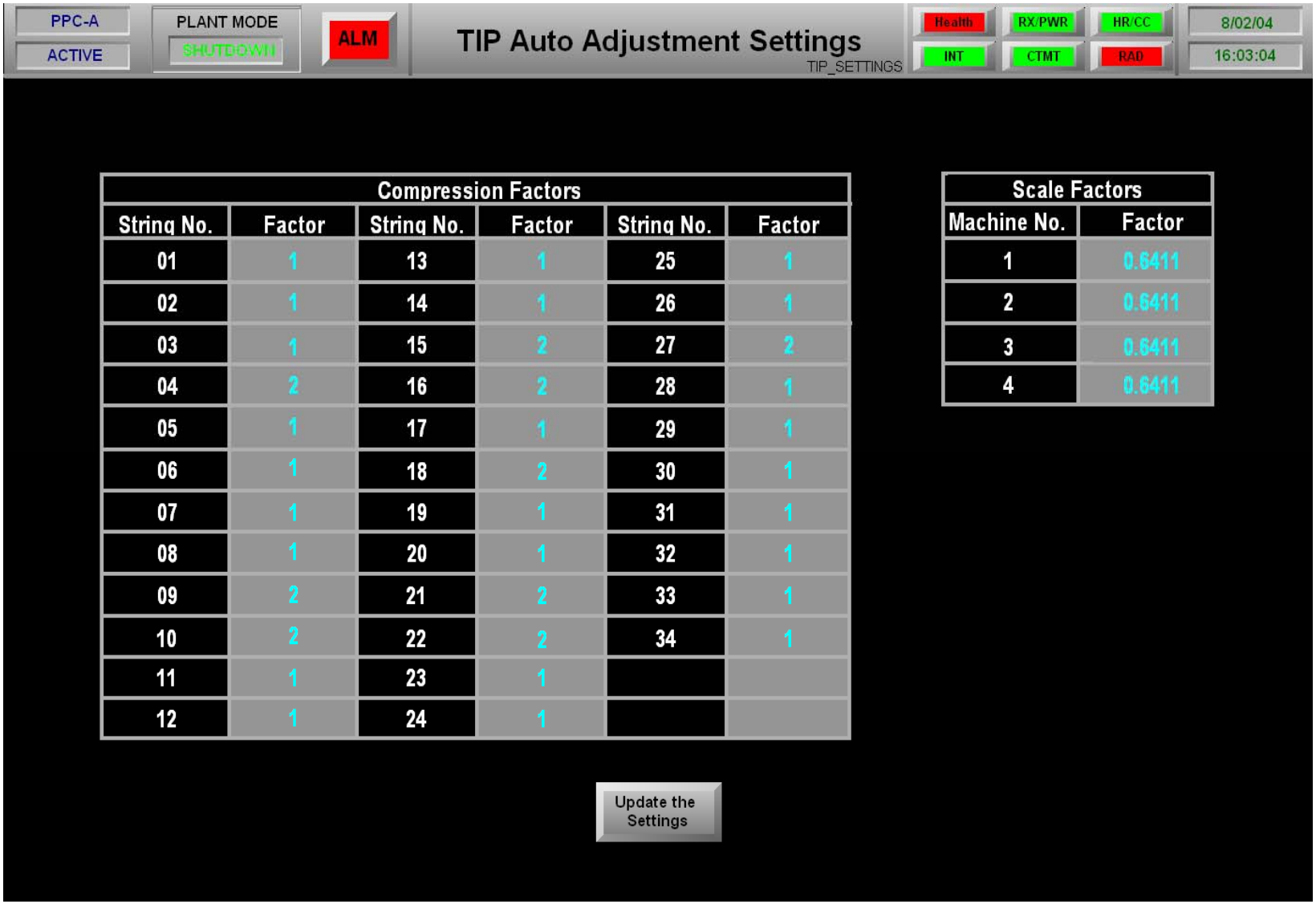
*R*TIME TIP Processing Features*
Main Tip Display(Cont.)

- Main Tip Display:
  - Allows user with access the ability to clear all working traverse files.
  - Allows user with access the ability to apply new manual adjustment factors to the raw traverse data.
  - Allows user with access the ability to archive working traverse files.
  - Allows user with access the ability to send traverse data to a Power Plex computer for addition computation.


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
ALM
TIP
TIP
Health
RX/PWR
HR/CC
INT
CTMT
RAD
8/02/04
15:52:26
DATA STATUS
TIP Index
Machine
1
2
3
4
1 07/19/2004 09:56:42 06/28/2004 14:47:24 Spare Channel 06/28/2004 14:35:31
2 06/28/2004 14:35:30 06/28/2004 18:23:06 06/28/2004 14:37:43 Spare Channel
3 06/28/2004 14:37:43 06/28/2004 14:35:30 06/28/2004 18:23:06 06/28/2004 14:37:43
4 06/28/2004 14:41:51 06/28/2004 14:40:02 06/28/2004 14:40:02 06/28/2004 18:23:06
5 06/28/2004 14:43:43 06/28/2004 14:41:51 06/28/2004 14:41:51 06/28/2004 14:41:51
6 Spare Channel 06/28/2004 14:43:43 06/28/2004 14:43:43 Spare Channel
7 Spare Channel 06/28/2004 14:45:40 06/28/2004 14:45:40 06/28/2004 14:43:43
8 06/28/2004 14:45:40 06/28/2004 14:48:52 06/28/2004 14:47:24 Spare Channel
9 06/28/2004 13:03:52 06/28/2004 13:03:52 06/28/2004 13:03:52 06/28/2004 13:03:52
10 06/28/2004 14:40:02 06/28/2004 14:37:43 06/28/2004 14:35:30 06/28/2004 14:33:17
MACHINE STATUS
Mach. Index Status Last Warning Message
1 00 Waiting None
2 00 Waiting None
3 00 Waiting None
4 00 Waiting None
Clear Working TIP Files
Restore TIP Data
Save TIP Data
Automatic TIP Adjustment
Manual TIP Adjustment
TIP Plotting
Detailed TIP Display
TIP Summary Display
Send OD-1 to Powerplex
Send OD-2 to Powerplex

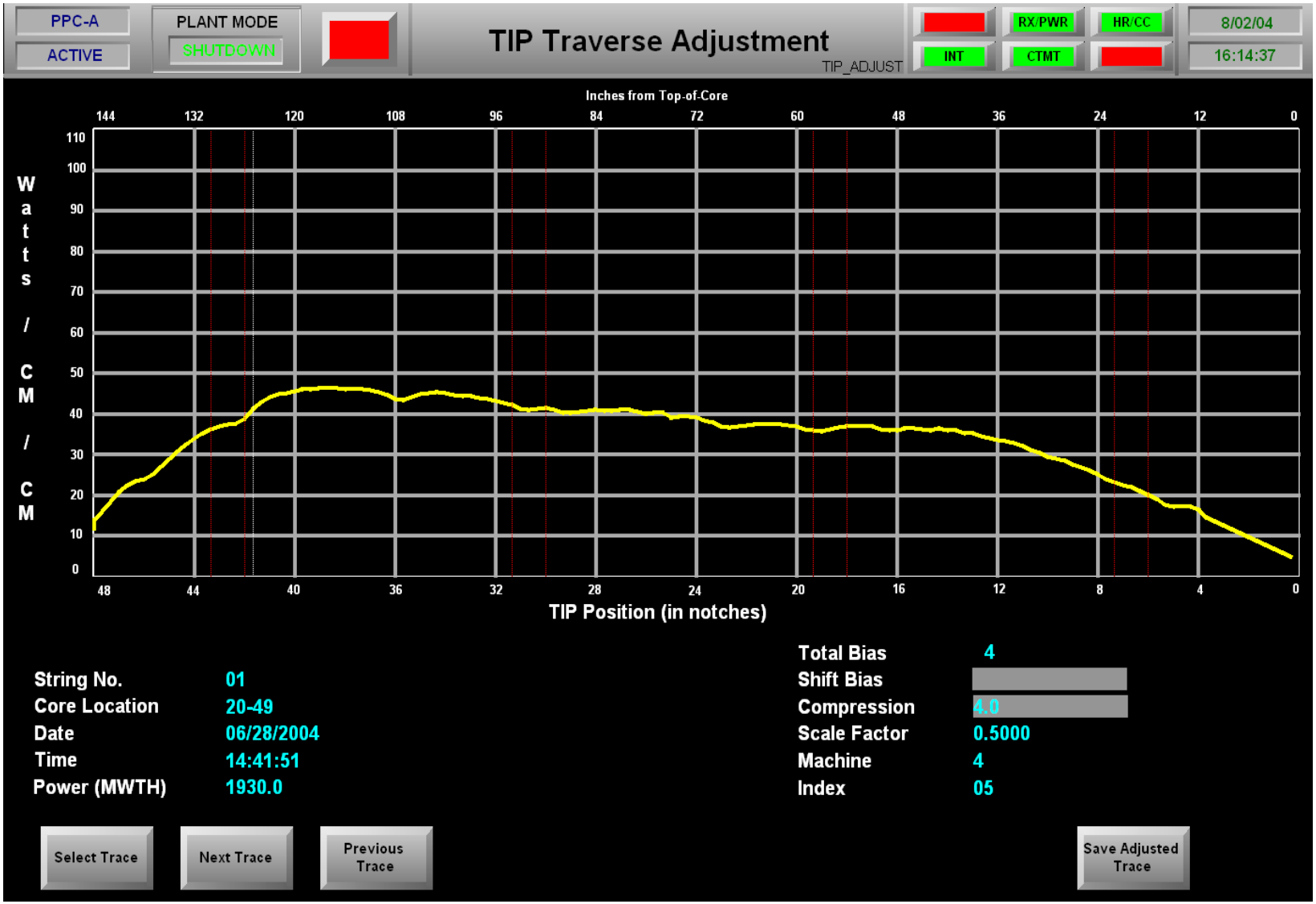
*R*TIME TIP Processing Features*
Automatic TIP Adjustment Display

- Automatic Tip Adjustment Display:
  - Allow the user to set new Compression Factors on a per Tube basis.
  - Allows the user to set new Scale Factors on a per machine basis.
  - (The factors will be applied to all new Traverses, or can be reapplied to old traverses through the main TIP display.)


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
ALM
TIP Auto Adjustment Settings
TIP_SETTINGS
Health
RX/PWR
HR/CC
INT
CTMT
RAD
8/02/04
16:03:04
Compression Factors
String No. Factor String No. Factor String No. Factor
01 1 13 1 25 1
02 1 14 1 26 1
03 1 15 2 27 2
04 2 16 2 28 1
05 1 17 1 29 1
06 1 18 2 30 1
07 1 19 1 31 1
08 1 20 1 32 1
09 2 21 2 33 1
10 2 22 2 34 1
11 1 23 1
12 1 24 1
Scale Factors
Machine No. Factor
1 0.6411
2 0.6411
3 0.6411
4 0.6411
Update the Settings

*R*TIME TIP Processing Features*
Automatic TIP Adjustment Display

- Automatic Tip Adjustment Display:
  - Allow the user to set a new Bias and Compression Factors on a per Traverse basis.

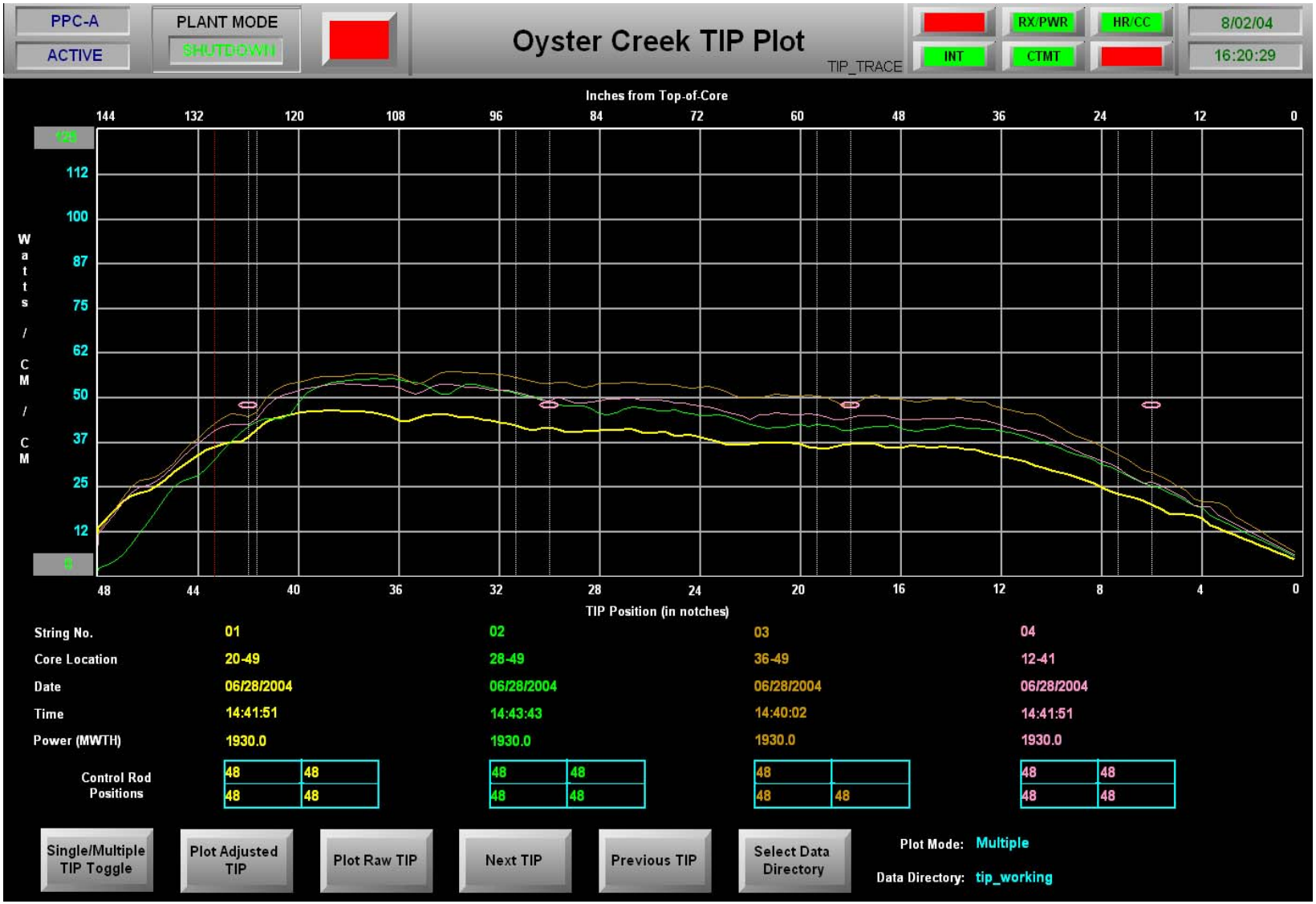

PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
TIP Traverse Adjustment
TIP_ADJUST
RX/PWR
HR/CC
INT
CTMT
8/02/04
16:14:37
Inches from Top-of-Core
144 132 120 108 96 84 72 60 48 36 24 12 0
Watts / CM / CM
110 100 90 80 70 60 50 40 30 20 10 0
48 44 40 36 32 28 24 20 16 12 8 4 0
TIP Position (in notches)
String No. 01
Core Location 20-49
Date 06/28/2004
Time 14:41:51
Power (MWTH) 1930.0
Total Bias 4
Shift Bias
Compression 4.0
Scale Factor 0.5000
Machine 4
Index 05
Select Trace
Next Trace
Previous Trace
Save Adjusted Trace

*R*TIME TIP Processing Features*
TIP Plotting Display

- Tip Plotting Display:
  - Allows the user to plot 1, 2, 3, or 4 TIP traverses at a time.
  - Plots LPRM data along with the Traverses.
  - Plots Fuel spacer data along with the Traverses.
  - Color codes the traverses and LPRMs together.

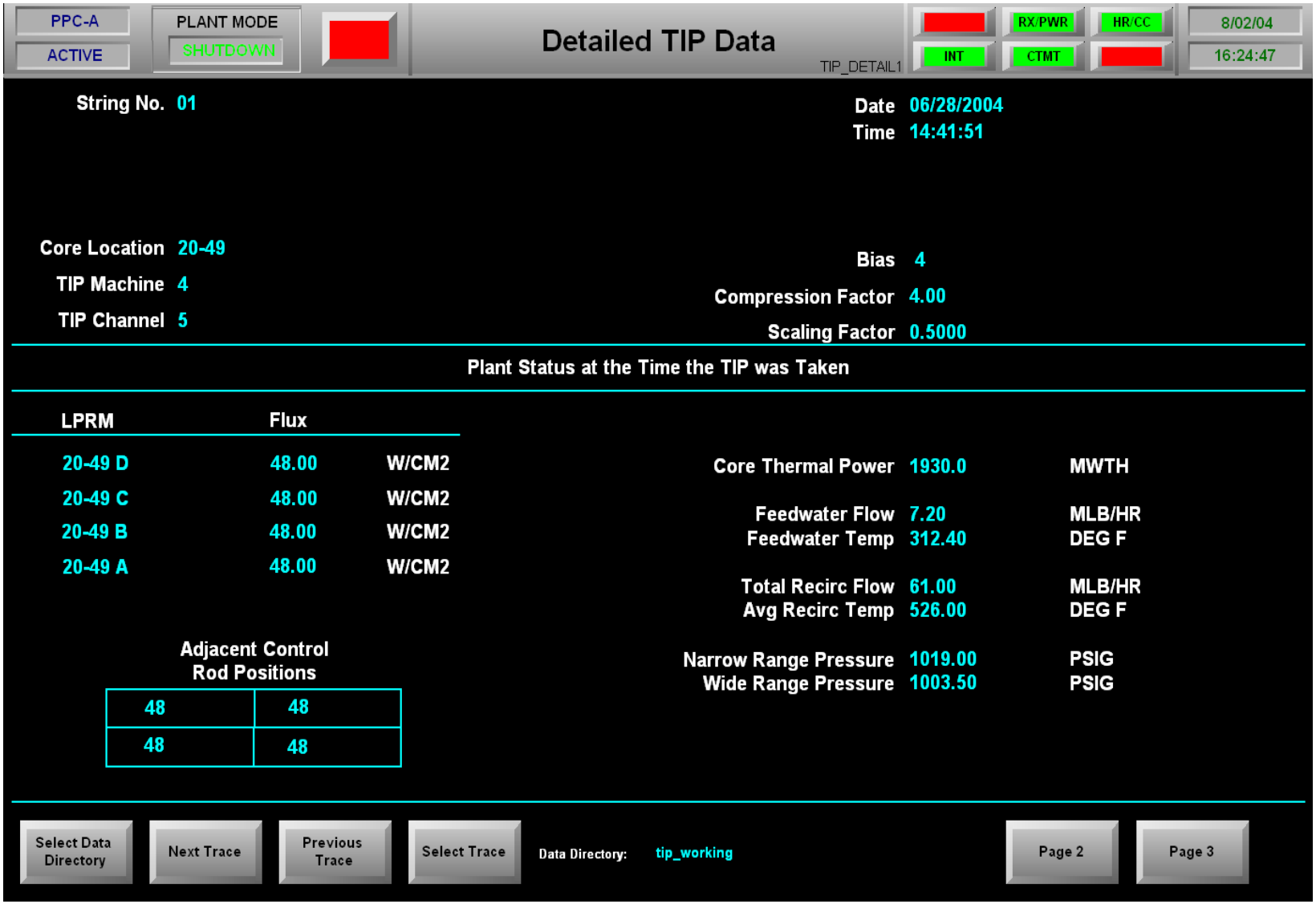
R*TIME TIP Processing Features
TIP Plotting Display(Cont.)

- Tip Plotting Display:
  - The positions and colors of the fuel spacers are configurable via the tip.ini file, which points to additional files for configuration.
  - The fuel spacers can be plotted in up to 10 colors.
  - The fuel spacers, on the plot can exist every inch.


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
Oyster Creek TIP Plot
TIP_TRACE
RX/PWR
HR/CC
INT
CTMT
8/02/04
16:20:29
Inches from Top-of-Core
144 132 120 108 96 84 72 60 48 36 24 12 0
Watts / CM / CM
125 112 100 87 75 62 50 37 25 12 0
48 44 40 36 32 28 24 20 16 12 8 4 0
TIP Position (in notches)
String No. 01 02 03 04
Core Location 20-49 28-49 36-49 12-41
Date 06/28/2004 06/28/2004 06/28/2004 06/28/2004
Time 14:41:51 14:43:43 14:40:02 14:41:51
Power (MWTH) 1930.0 1930.0 1930.0 1930.0
Control Rod Positions
48 48 48 48 48 48 48 48 48 48 48 48 48 48 48 48
Single/Multiple TIP Toggle
Plot Adjusted TIP
Plot Raw TIP
Next TIP
Previous TIP
Select Data Directory
Plot Mode: Multiple
Data Directory: tip_working

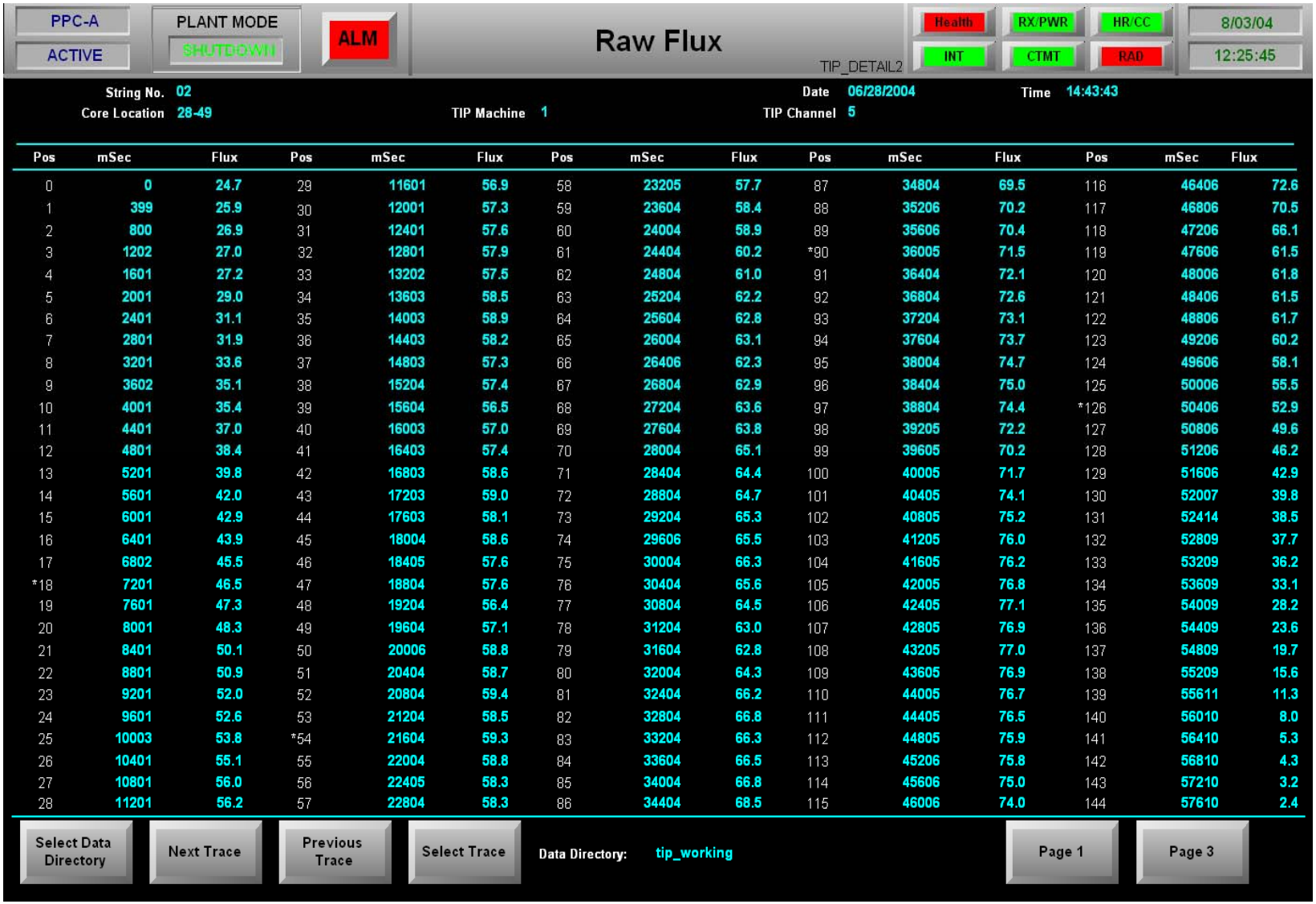
R*TIME TIP Processing Features
Detail TIP data Display page 1

- Detail TIP data Display page 1:
  - Shows the user the TIP data associated with the Traverse, including the Adjustment Factors applied.
  - Gives the user some key database values at the time of the traverse.
  - Shows the user the values of the LPRMs that were received during the Traverse.
  - Shows the user the adjacent control rod positions to the traverse tube.


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
Detailed TIP Data
TIP_DETAIL1
RX/PWR
HR/CC
INT
CTMT
8/02/04
16:24:47
String No. 01
Date 06/28/2004
Time 14:41:51
Core Location 20-49
TIP Machine 4
TIP Channel 5
Bias 4
Compression Factor 4.00
Scaling Factor 0.5000
Plant Status at the Time the TIP was Taken
LPRM
Flux
20-49 D 48.00 W/CM2
20-49 C 48.00 W/CM2
20-49 B 48.00 W/CM2
20-49 A 48.00 W/CM2
Core Thermal Power 1930.0 MWTH
Feedwater Flow 7.20 MLB/HR
Feedwater Temp 312.40 DEG F
Total Recirc Flow 61.00 MLB/HR
Avg Recirc Temp 526.00 DEG F
Narrow Range Pressure 1019.00 PSIG
Wide Range Pressure 1003.50 PSIG
Adjacent Control Rod Positions
48 48
48 48
Select Data Directory
Next Trace
Previous Trace
Select Trace
Data Directory: tip_working
Page 2
Page 3

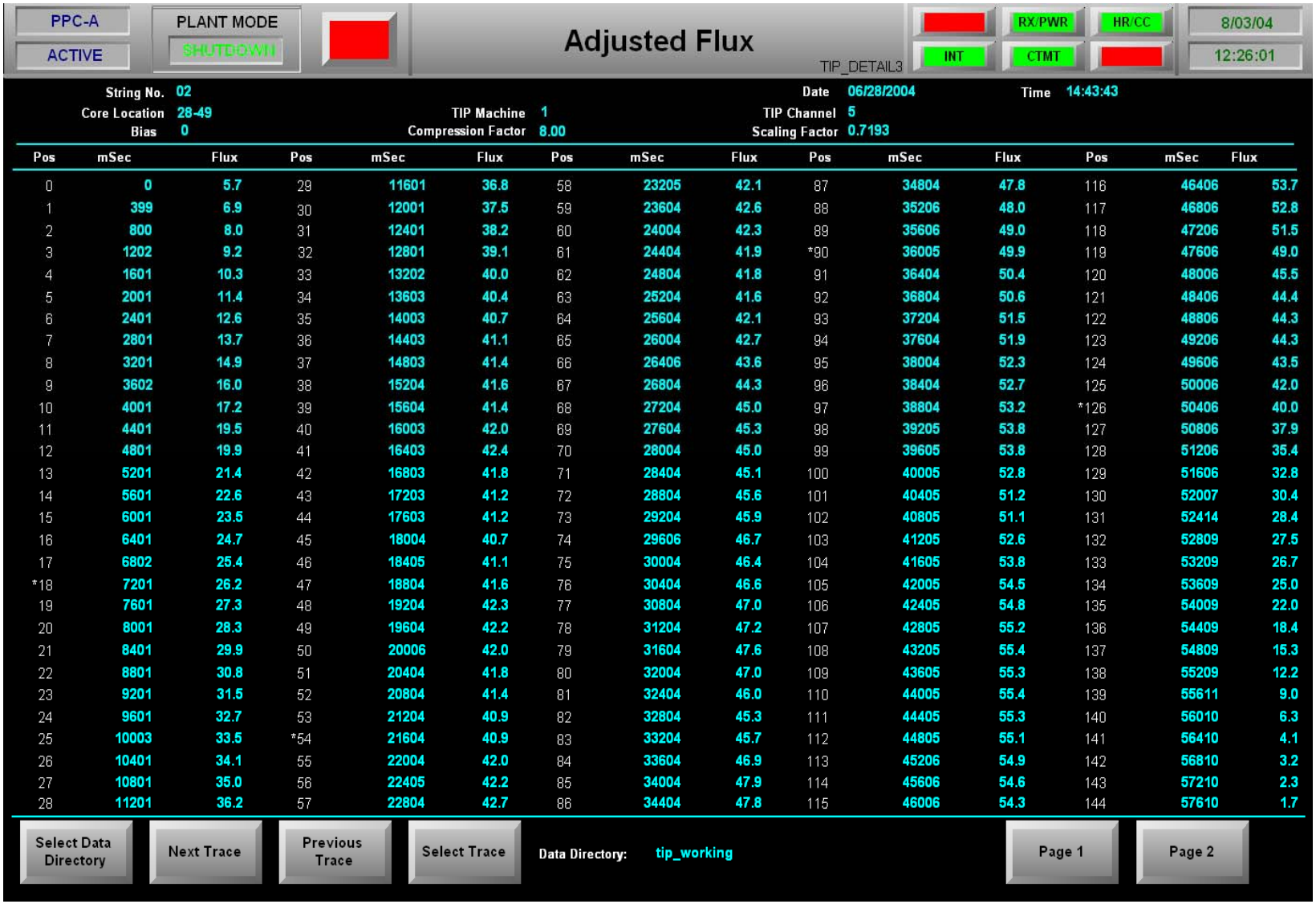
*R*TIME TIP Processing Features*
Detail TIP data Display page 2.

- Detail TIP data Display page 2:
  - Shows the user the raw flux data gathered during the traverse.
  - Shows the timing that the data was gathered.


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
ALM
Raw Flux
TIP_DETAIL2
Health
RX/PWR
HR/CC
INT
CTMT
RAD
8/03/04
12:25:45
String No. 02
Core Location 28-49
TIP Machine 1
Date 06/28/2004
Time 14:43:43
TIP Channel 5
Pos mSec Flux Pos mSec Flux Pos mSec Flux Pos mSec Flux Pos mSec Flux
0 0 24.7 29 11601 56.9 58 23205 57.7 87 34804 69.5 116 46406 72.6
1 399 25.9 30 12001 57.3 59 23604 58.4 88 35206 70.2 117 46806 70.5
2 800 26.9 31 12401 57.6 60 24004 58.9 89 35606 70.4 118 47206 66.1
3 1202 27.0 32 12801 57.9 61 24404 60.2 *90 36005 71.5 119 47606 61.5
4 1601 27.2 33 13202 57.5 62 24804 61.0 91 36404 72.1 120 48006 61.8
5 2001 29.0 34 13603 58.5 63 25204 62.2 92 36804 72.6 121 48406 61.5
6 2401 31.1 35 14003 58.9 64 25604 62.8 93 37204 73.1 122 48806 61.7
7 2801 31.9 36 14403 58.2 65 26004 63.1 94 37604 73.7 123 49206 60.2
8 3201 33.6 37 14803 57.3 66 26406 62.3 95 38004 74.7 124 49606 58.1
9 3602 35.1 38 15204 57.4 67 26804 62.9 96 38404 75.0 125 50006 55.5
10 4001 35.4 39 15604 56.5 68 27204 63.6 97 38804 74.4 *126 50406 52.9
11 4401 37.0 40 16003 57.0 69 27604 63.8 98 39205 72.2 127 50806 49.6
12 4801 38.4 41 16403 57.4 70 28004 65.1 99 39605 70.2 128 51206 46.2
13 5201 39.8 42 16803 58.6 71 28404 64.4 100 40005 71.7 129 51606 42.9
14 5601 42.0 43 17203 59.0 72 28804 64.7 101 40405 74.1 130 52007 39.8
15 6001 42.9 44 17603 58.1 73 29204 65.3 102 40805 75.2 131 52414 38.5
16 6401 43.9 45 18004 58.6 74 29606 65.5 103 41205 76.0 132 52809 37.7
17 6802 45.5 46 18405 57.6 75 30004 66.3 104 41605 76.2 133 53209 36.2
*18 7201 46.5 47 18804 57.6 76 30404 65.6 105 42005 76.8 134 53609 33.1
19 7601 47.3 48 19204 56.4 77 30804 64.5 106 42405 77.1 135 54009 28.2
20 8001 48.3 49 19604 57.1 78 31204 63.0 107 42805 76.9 136 54409 23.6
21 8401 50.1 50 20006 58.8 79 31604 62.8 108 43205 77.0 137 54809 19.7
22 8801 50.9 51 20404 58.7 80 32004 64.3 109 43605 76.9 138 55209 15.6
23 9201 52.0 52 20804 59.4 81 32404 66.2 110 44005 76.7 139 55611 11.3
24 9601 52.6 53 21204 58.5 82 32804 66.8 111 44405 76.5 140 56010 8.0
25 10003 53.8 *54 21604 59.3 83 33204 66.3 112 44805 75.9 141 56410 5.3
26 10401 55.1 55 22004 58.8 84 33604 66.5 113 45206 75.8 142 56810 4.3
27 10801 56.0 56 22405 58.3 85 34004 66.8 114 45606 75.0 143 57210 3.2
28 11201 56.2 57 22804 58.3 86 34404 68.5 115 46006 74.0 144 57610 2.4
Select Data Directory
Next Trace
Previous Trace
Select Trace
Data Directory: tip_working
Page 1
Page 3

*R*TIME TIP Processing Features*
Detail TIP data Display page 3.

- Detail TIP data Display page 3:
  - Shows the user the adjusted flux data gathered during the traverse.
  - Shows the timing that the data was gathered.
  - Shows the adjustment factors applied to the raw data.


PPC-A
ACTIVE
PLANT MODE
SHUTDOWN
Adjusted Flux
TIP_DETAIL3
RX/PWR
HR/CC
INT
CTMT
8/03/04
12:26:01
String No. 02
Core Location 28-49
Bias 0
TIP Machine 1
Compression Factor 8.00
Date 06/28/2004
TIP Channel 5
Scaling Factor 0.7193
Time 14:43:43
Pos mSec Flux Pos mSec Flux Pos mSec Flux Pos mSec Flux Pos mSec Flux
0 0 5.7 29 11601 36.8 58 23205 42.1 87 34804 47.8 116 46406 53.7
1 399 6.9 30 12001 37.5 59 23604 42.6 88 35206 48.0 117 46806 52.8
2 800 8.0 31 12401 38.2 60 24004 42.3 89 35606 49.0 118 47206 51.5
3 1202 9.2 32 12801 39.1 61 24404 41.9 *90 36005 49.9 119 47606 49.0
4 1601 10.3 33 13202 40.0 62 24804 41.8 91 36404 50.4 120 48006 45.5
5 2001 11.4 34 13603 40.4 63 25204 41.6 92 36804 50.6 121 48406 44.4
6 2401 12.6 35 14003 40.7 64 25604 42.1 93 37204 51.5 122 48806 44.3
7 2801 13.7 36 14403 41.1 65 26004 42.7 94 37604 51.9 123 49206 44.3
8 3201 14.9 37 14803 41.4 66 26406 43.6 95 38004 52.3 124 49606 43.5
9 3602 16.0 38 15204 41.6 67 26804 44.3 96 38404 52.7 125 50006 42.0
10 4001 17.2 39 15604 41.4 68 27204 45.0 97 38804 53.2 *126 50406 40.0
11 4401 19.5 40 16003 42.0 69 27604 45.3 98 39205 53.8 127 50806 37.9
12 4801 19.9 41 16403 42.4 70 28004 45.0 99 39605 53.8 128 51206 35.4
13 5201 21.4 42 16803 41.8 71 28404 45.1 100 40005 52.8 129 51606 32.8
14 5601 22.6 43 17203 41.2 72 28804 45.6 101 40405 51.2 130 52007 30.4
15 6001 23.5 44 17603 41.2 73 29204 45.9 102 40805 51.1 131 52414 28.4
16 6401 24.7 45 18004 40.7 74 29606 46.7 103 41205 52.6 132 52809 27.5
17 6802 25.4 46 18405 41.1 75 30004 46.4 104 41605 53.8 133 53209 26.7
*18 7201 26.2 47 18804 41.6 76 30404 46.6 105 42005 54.5 134 53609 25.0
19 7601 27.3 48 19204 42.3 77 30804 47.0 106 42405 54.8 135 54009 22.0
20 8001 28.3 49 19604 42.2 78 31204 47.2 107 42805 55.2 136 54409 18.4
21 8401 29.9 50 20006 42.0 79 31604 47.6 108 43205 55.4 137 54809 15.3
22 8801 30.8 51 20404 41.8 80 32004 47.0 109 43605 55.3 138 55209 12.2
23 9201 31.5 52 20804 41.4 81 32404 46.0 110 44005 55.4 139 55611 9.0
24 9601 32.7 53 21204 40.9 82 32804 45.3 111 44405 55.3 140 56010 6.3
25 10003 33.5 *54 21604 40.9 83 33204 45.7 112 44805 55.1 141 56410 4.1
26 10401 34.1 55 22004 42.0 84 33604 46.9 113 45206 54.9 142 56810 3.2
27 10801 35.0 56 22405 42.2 85 34004 47.9 114 45606 54.6 143 57210 2.3
28 11201 36.2 57 22804 42.7 86 34404 47.8 115 46006 54.3 144 57610 1.7
Select Data Directory
Next Trace
Previous Trace
Select Trace
Data Directory: tip_working
Page 1
Page 2