

CALIBRATION REPORT

Portable Radiation Package

SERIAL NUMBER 01

DataSet Configuration: 0010
Document date: February 8, 2001

Configuration File:

PRP CALIBRATION INFORMATION FILE -- created: 2001-02-08 (039) 06:12:53
LAST EDIT: new file
CALIBRATION NAME: 0010
DATA POINT OF CONTACT: R. M. Reynolds
POC ADDRESS: 490D; Brookhaven National lab; Upton NY 11973; USA
POC EMAIL: reynolds@bnl.gov
PRP SERIAL NUMBER: 01
FILE NAME: INFO_01_0010.txt
DOCUMENTS: Cal01_0010.pdf
HEAD SERIAL NUMBER: 431
HEAD CALIBRATION ID: 9904
DATALOGGER SERIAL NUMBER: DL00_5
DATALOGGER CALIBRATION ID: 0010
PSP SERIAL NUMBER: 32386F3
PSP CALIBRATION ID: orig
PIR SERIAL NUMBER: 32388F3
PIR THERMOPILE CALIBRATION ID: orig
PIR TEMPERATURE CALIBRATION ID: 0009b
COMMENTS: Reprocess with revised file names and paths



Bldg 490d, Upton NY 11973 — 631-344-7836 — reynolds@bnl.gov

PRP INFO FILE

SETUP FOR PROCESSING PRP CALIBRATIONS: 08-Feb-2001 06:24:25
PRP S/N: 01, Calibration identifier: 0010
Configuration file: hd:instruments:prp:prpcal:prp:01:0010:INFO_01_0010.txt
PRP CALIBRATION
PRP CALIBRATION INFORMATION FILE -- created: 2001-02-08 (039) 06:12:53
LAST EDIT: new file
CALIBRATION NAME: 0010
DATA POINT OF CONTACT: R. M. Reynolds
POC ADDRESS: 490D; Brookhaven National lab; Upton NY 11973; USA
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PRP SERIAL NUMBER: 01
FILE NAME: INFO_01_0010.txt
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HEAD CALIBRATION ID: 9904
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PSP SERIAL NUMBER: 32386F3
PSP CALIBRATION ID: orig
PIR SERIAL NUMBER: 32388F3
PIR THERMOPILE CALIBRATION ID: orig
PIR TEMPERATURE CALIBRATION ID: 0009b
COMMENTS: Reprocess with revised file names and paths

CALIBRATION INFO FOR HEAD 431:

This file : 431.CAL
Data valid from date : 10/05/1998
MFRSR system owner : PNL / S/O 240
YESDAS system password: Langley!
Supervisor password : Irradiance!
System Datalogger ID : \$0000 (Hex), 0 (Dec)
Instrument Head ID : \$277E (Hex), 10110 (Dec)
Instrument Head S/N : 431

DATALOGGER CALIBRATION: ProcLoggerCal (version 101) Run date: 08-Feb-2001 06:25:48
DATALOGGER S/N DL2000_5
CALIBRATION DATE: 20000505/20001005
TECHNICIAN: EDWARDS
VOLTAGE REFERENCE: VOLT-A-VIDER 103264
USE PRECISION VREF CIRCUIT

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Data valid from date : 10/05/1998
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DATALOGGER S/N DL2000_5
CALIBRATION DATE: 20000505/20001005
TECHNICIAN: EDWARDS
VOLTAGE REFERENCE: VOLT-A-VIDER 103264
USE PRECISION VREF CIRCUIT

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PSP CALIBRATION: S/N 32386F3
  Factory calibration: 1998-02-12
8.99
  8.990

```

```

-----
PIR CALIBRATION - S/N: 32388F3
  Factory calibration: 1998-01-13
3.67
  3.670

```

```

-----
PIR THERMISTOR CALIBRATION -- PART 2
Process times from file lacie:instruments:prp:prpcal:pir:32388F3:32388F3_Tcal_0009b.dat
SAVE THE RESULTS TO FILE lacie:instruments:prp:prpcal:pir:32388F3:32388F3_Tcal_0009b.mat
save lacie:instruments:prp:prpcal:pir:32388F3:32388F3_Tcal_0009b.mat readme beta_case beta_dome rcav rcstd
  beta_case and beta_dome are Steinhart-Hart coefficients
  tcase = steinhart(hart(beta_case,r) where r = thermistor resistance in ohms.
  tdome = steinhart(hart(beta_dome ...
  rcav and rcstd are the test resistances and the std dev for each test point.
  rdav and rdstd are ditto for the dome
  tav and tstd are the mean temperature and std dev for each test point as
    computed from the SBE834 temperature probe.
  tc_ysi and td_ysi are computed from the published YSI calibration table.
    (See function 'YSI44006.m'.)
  casefit and domefit are cubic fitted corrections to the YSI computed temperatures.
    If tcaseysi is a vector of case temperatures computed from the YSI44006.m function,
    then  tcase = tcase + polyval(casefit,tcaseysi);
    Ditto for the dome.

```

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COMPUTE PIR THERMISTOR COEFFICIENTS
Use calibrated coefficients for PIR case thermistor

Use calibrated coefficients for PIR doome thermistor

```

ZENITH ANGLE ERROR PLOTS

Head S/N: 431

Cal date: 10/05/1998

Now: 08-Feb-2001 06:18:26

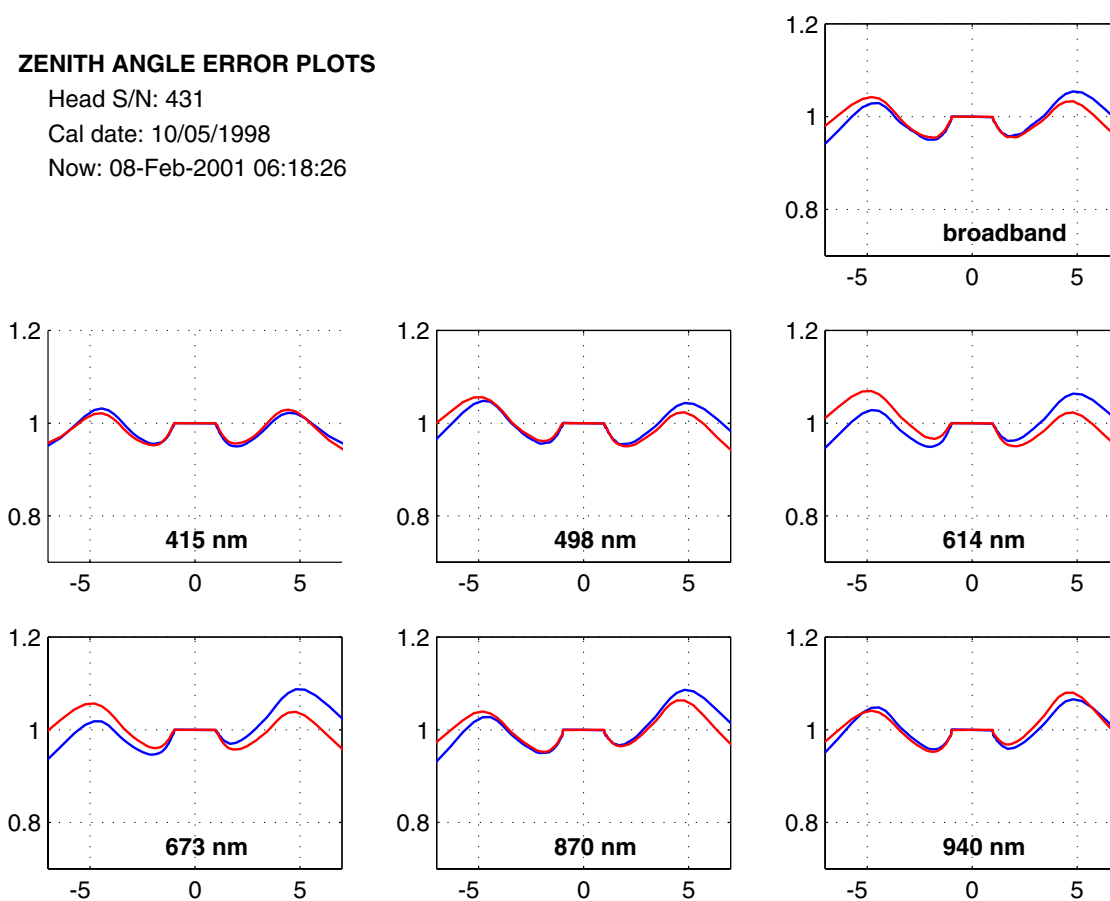


Figure 1: Zenith Angle Error

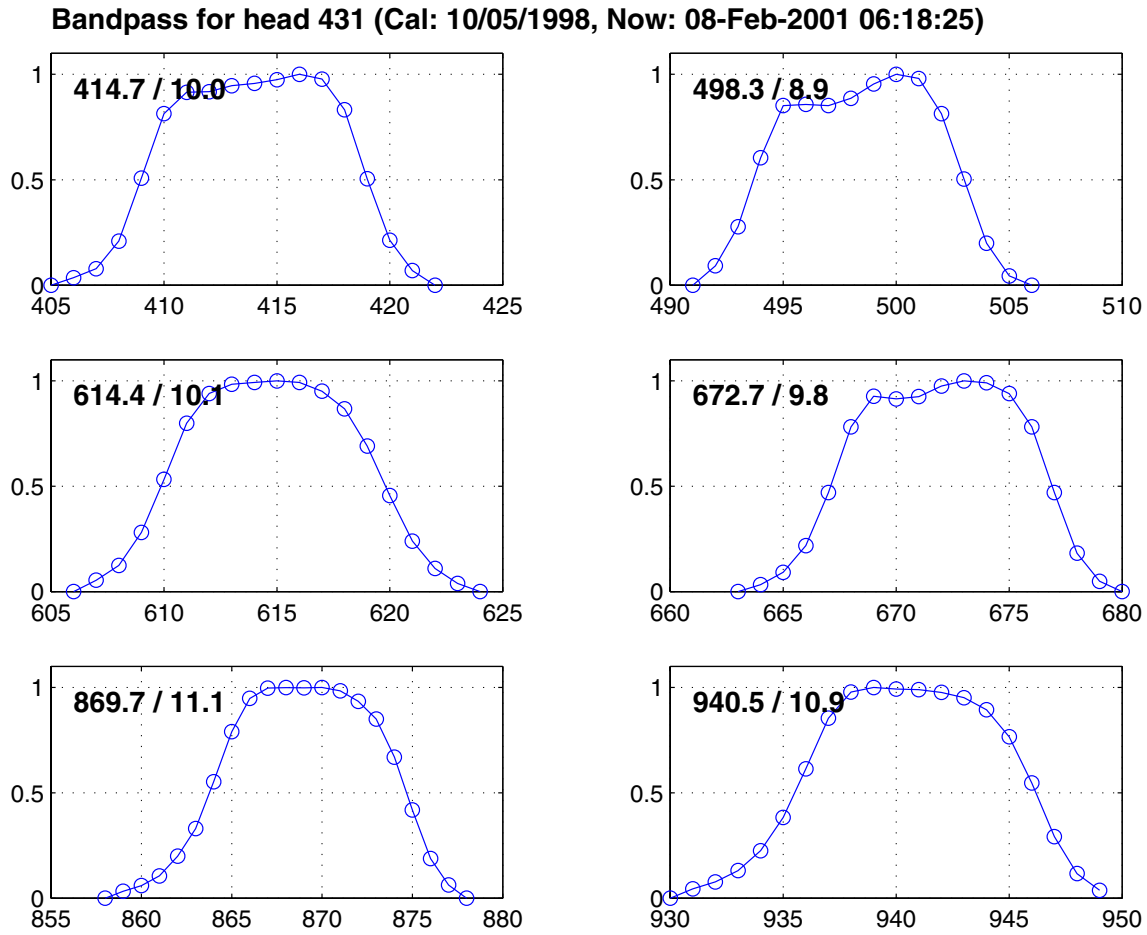


Figure 2: Zenith Angle Error

HEAD 431 TOA IRRADIANCES BASED ON ASTRONOMICAL SOLAR SPECTRUM

WAVELENGTH (nm)			IRRADIANCE (W/m ² /nm)		
LOWER	CENTER	UPPER	LOWER	MEAN	UPPER
405,	414,	422,	1.650,	1.737,	1.824
491,	498,	506,	1.837,	1.934,	2.030
606,	615,	624,	1.623,	1.708,	1.794
663,	672,	680,	1.451,	1.527,	1.604
858,	869,	878,	0.903,	0.950,	0.998
930,	941,	950,	0.779,	0.820,	0.861

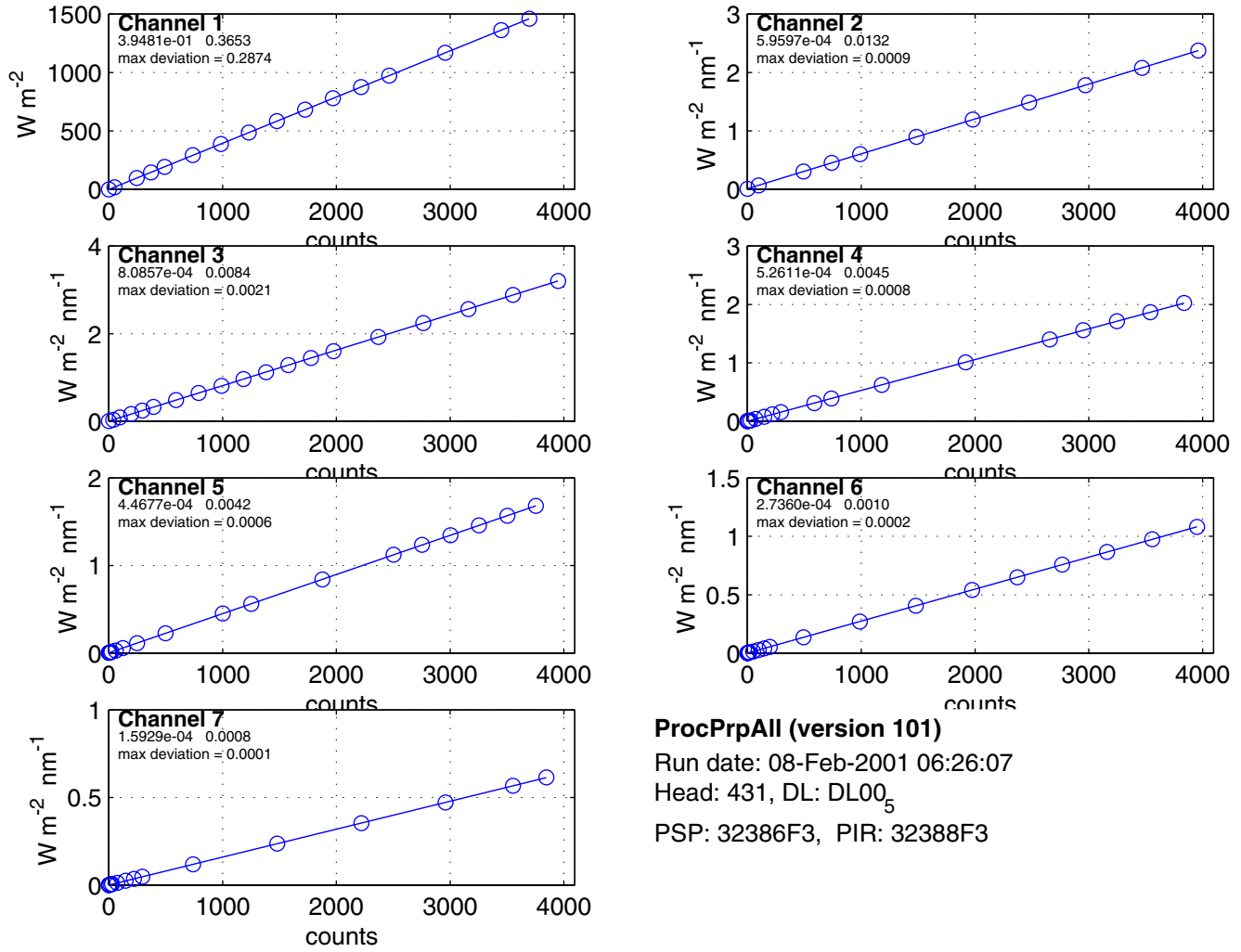
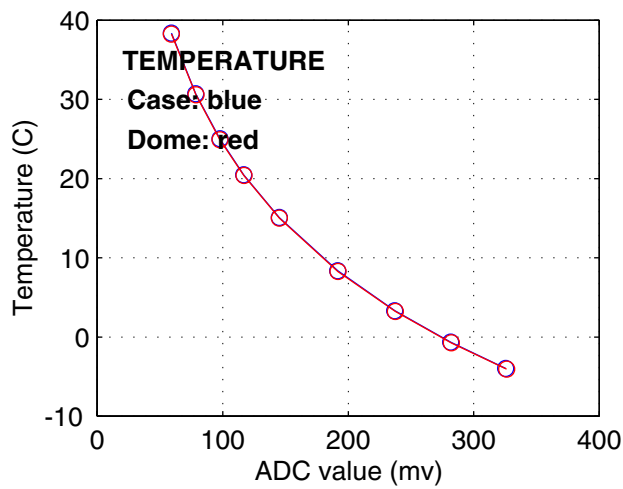
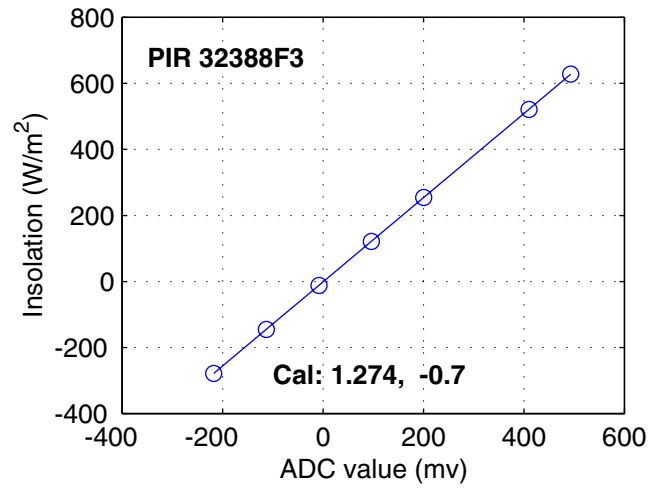
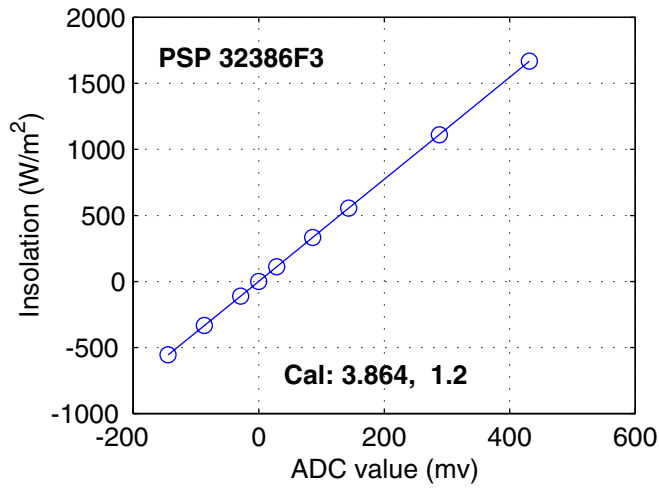


Figure 3: Head and Logger combined gains



$$1/(T+T_0) = p_1 a^3 + p_2 a^2 + p_3 a + p_4$$

$$a = \ln(\text{mvadc}), T_0 = 273.15$$

Case: max err = 0.008 C

$$p_1 = 2.1505 \times 10^{-6}, p_2 = -2.2923 \times 10^{-5}$$

$$p_3 = 3.6348 \times 10^{-4}, p_4 = 1.9630 \times 10^{-3}$$

Dome: max err = 0.009

$$p_1 = 1.9400 \times 10^{-6}, p_2 = -2.0034 \times 10^{-5}$$

$$p_3 = 3.5035 \times 10^{-4}, p_4 = 1.9835 \times 10^{-3}$$

Figure 4: Head and Logger combined gains

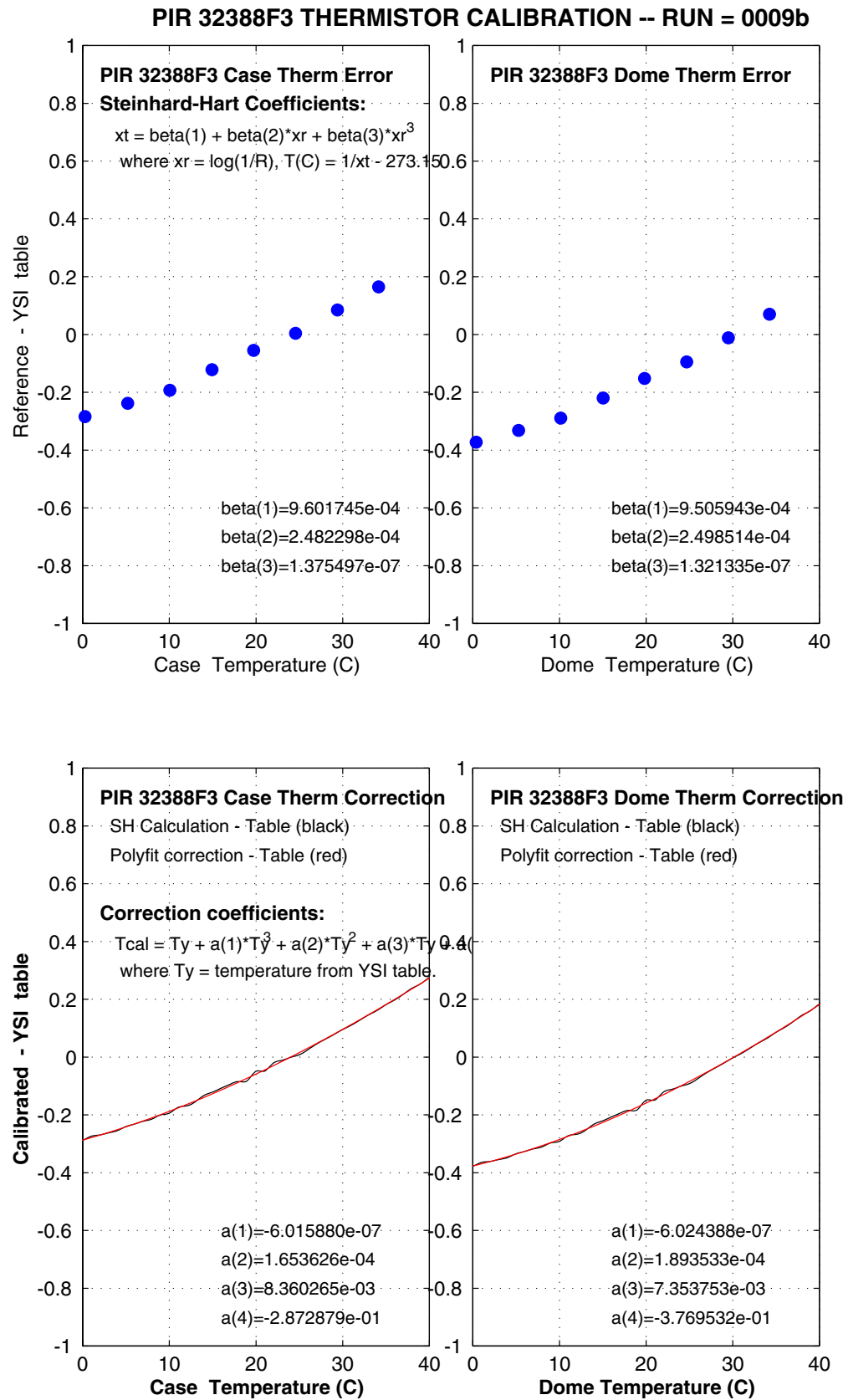
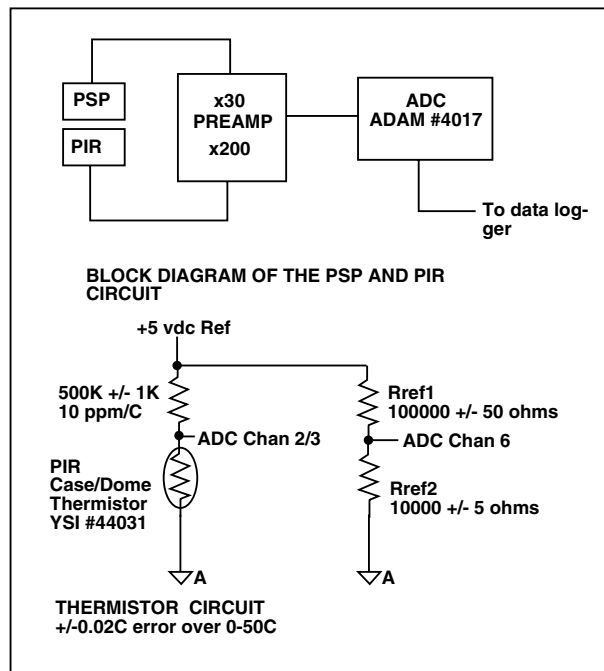


Figure 5: PIR Temperature calibration results.

**TEST PLUG:**
 $R_{case} =$ _____ $T_{44031} =$ _____ Logger Temperature = _____

 $R_{dome} =$ _____ $T_{44031} =$ _____ Logger Temperature = _____

COMPUTE VREF FROM R_REF AND R_THERM

PRP SN: 01 Cal ID: 0010

CASE - Rref = 500800.0

R_cal	v_T	V_REF (computed)
6000	59.1	4991.1
8000	78.5	4990.7
10000	97.7	4989.0
12000	116.7	4988.3
15000	145.1	4987.8
20000	191.6	4988.0
25000	237.1	4986.1
30000	281.7	4984.0
35000	325.4	4982.2

DOME - Rref = 501200.0

R_cal	v_T	V_REF (computed)
6000	59.1	4998.5
8000	78.5	4999.7
10000	97.8	4997.5
12000	116.9	4998.6
15000	145.2	4998.5
20000	191.8	4998.8
25000	237.4	4997.4
30000	282.2	4996.1
35000	326.1	4996.5

(File: hd:instruments:prp:prpcal:prp:01:0010:TcalVref_0010.dat)

```
% CALIBRATION FILE FOR PRPRX DATA COLLECTION SOFTWARE
% PSP CALIBRATION, PSP SN: 32386F3
3.8643      1.1669
% PIR CALIBRATION, PIR SN: 32388F3
1.2745  -0.71788
% TCASE FIT
2.15045e-06  -2.29233e-05      0.000363479      0.00196299
% TDOME FIT
1.94004e-06  -2.00338e-05      0.000350351      0.00198351
% K COEFFICIENT
4.0
% SIGMA
5.67e-8
% EPSILON
0.98
% BATTERY
0.030820  0.0
```

(File: hd:instruments:prp:prpcal:prp:01:0010:prprx_01_0010.txt)

LOGGER CALIBRATION FILE

```

%PRP01                                75 294.63 1.01 296.25 -1.62
%MFRSR: 431                          100 393.74 0.56 395.00 -1.26
%PSP: 32386F3, COEFF: 8.99           150 591.26 1.05 592.50 -1.24
%PIR: 32388F3, COEFF: 3.67           200 788.37 0.96 790.00 -1.63
%PREAMP: 3                           250 989.26 1.05 987.50 1.76
%PIR TCAL - PRECISION DIVIDER RESISTORS 300 1184.26 0.65 1185.00 -0.74
% AND DIVIDER CIRCUIT FOR VREF        350 1381.53 0.70 1382.50 -0.97
DATALOGGER S/N DL2000_5               400 1579.32 1.06 1580.00 -0.68
CALIBRATION DATE: 20000505/20001005   450 1776.74 0.45 1777.50 -0.76
TECHNICIAN: EDWARDS                   500 1974.58 0.77 1975.00 -0.42
VOLTAGE REFERENCE: VOLT-A-VIDER 103264 600 2369.68 0.75 2370.00 -0.32
                                         700 2764.68 0.75 2765.00 -0.32
CHANNEL 1                             800 3159.63 0.76 3160.00 -0.37
0 0.00 0.00                          900 3554.26 0.99 3555.00 -0.74
10 48.84 0.50 49.30 -0.46            1000 3949.74 1.05 3950.00 -0.26
50 245.84 0.69 246.50 -0.66          CHANNEL 4
75 369.53 0.70 369.75 -0.22          0 0.00 0.00 0.00 0.00
100 492.21 1.23 493.00 -0.79         1 1.32 0.89 2.96 -1.64
150 738.68 1.00 739.50 -0.82         5 13.32 0.89 14.80 -1.48
200 985.63 0.83 986.00 -0.37         10 27.84 0.83 29.60 -1.76
250 1231.89 1.15 1232.50 -0.61        25 72.58 0.90 74.00 -1.42
300 1478.11 0.99 1479.00 -0.89        50 145.95 0.85 148.00 -2.05
350 1725.21 0.98 1725.50 -0.29        75 219.95 0.62 222.00 -2.05
400 1971.32 0.95 1972.00 -0.68        100 293.74 0.45 296.00 -2.26
450 2217.63 1.15 2218.50 -0.87        200 589.05 0.71 592.00 -2.95
500 2464.63 0.83 2465.00 -0.37        250 736.79 0.54 740.00 -3.21
600 2957.53 0.77 2958.00 -0.47        400 1179.79 0.63 1184.00 -4.21
700 3450.84 0.69 3451.00 -0.16        650 1917.37 0.83 1924.00 -6.63
750 3697.89 0.32 3697.50 0.39        900 2656.26 0.65 2664.00 -7.74
CHANNEL 2                             1000 2951.21 0.92 2960.00 -8.79
0 0.00 0.00 0.00 0.00               1100 3246.68 0.58 3256.00 -9.32
10 97.47 1.02 98.90 -1.43            1200 3541.84 0.50 3552.00 -10.16
50 493.46 0.93 494.50 -1.04          1300 3836.95 0.86 3848.00 -11.05
75 741.58 0.84 741.75 -0.17          CHANNEL 5
100 989.89 0.32 989.00 0.89          0 0.00 0.00 0.00 0.00
150 1484.79 1.08 1483.50 1.29         1 0.95 0.85 2.50 -1.55
200 1980.32 0.95 1978.00 2.32         5 11.00 0.77 12.50 -1.50
250 2476.11 0.99 2472.50 3.61         10 23.68 0.58 25.00 -1.32
300 2971.00 1.00 2967.00 4.00         25 61.16 0.90 62.50 -1.34
350 3466.84 0.96 3461.50 5.34         50 123.79 0.63 125.00 -1.21
400 3962.68 0.75 3956.00 6.68        100 248.74 0.73 250.00 -1.26
CHANNEL 3                             200 499.53 0.70 500.00 -0.47
0 0.00 0.00 0.00 0.00               400 1000.37 0.68 1000.00 0.37
10 37.68 0.89 39.50 -1.82            500 1250.74 0.56 1250.00 0.74
25 96.89 1.05 98.75 -1.86            750 1876.53 0.77 1875.00 1.53
50 196.16 1.07 197.50 -1.34          1000 2502.58 0.69 2500.00 2.58

```

1100 2752.63 0.68 2750.00 2.63
 1200 3003.68 0.75 3000.00 3.68
 1300 3253.74 0.56 3250.00 3.74
 1400 3504.11 0.94 3500.00 4.11
 1500 3754.47 0.84 3750.00 4.47
 CHANNEL 6
 0 0.00 0.00 0.00 0.00
 1 1.58 0.61 1.97 -0.39
 5 9.00 0.82 9.85 -0.85
 10 18.89 0.32 19.70 -0.81
 25 48.47 0.90 49.25 -0.78
 50 97.89 0.66 98.50 -0.61
 75 147.68 0.67 147.75 -0.07
 100 196.68 0.58 197.00 -0.32
 250 493.68 0.48 492.50 1.18
 500 987.32 0.95 985.00 2.32
 750 1481.58 0.69 1477.50 4.08
 1000 1975.74 0.65 1970.00 5.74
 1200 2370.84 0.37 2364.00 6.84
 1400 2765.79 0.85 2758.00 7.79
 1600 3161.47 0.77 3152.00 9.47
 1800 3556.74 0.45 3546.00 10.74
 2000 3951.84 0.50 3940.00 11.84
 CHANNEL 7
 0 0.00 0.00 0.00 0.00
 1 2.11 0.74 2.96 -0.85
 5 13.74 0.45 14.80 -1.06
 10 28.89 0.32 29.60 -0.71
 25 73.63 0.50 74.00 -0.37
 50 147.21 0.79 148.00 -0.79
 75 221.42 0.69 222.00 -0.58
 100 295.21 0.85 296.00 -0.79
 250 739.47 0.61 740.00 -0.53
 500 1479.47 0.90 1480.00 -0.53
 750 2219.79 0.42 2220.00 -0.21
 1000 2959.63 0.50 2960.00 -0.37
 1200 3551.84 0.37 3552.00 -0.16
 1300 3847.79 0.54 3848.00 -0.21
 PSP
 -5 -144.23 0.02 -145.00 0.77
 -3 -86.69 0.01 -87.00 0.31

-1 -29.10 0.03 -29.00 -0.10
 0 -0.27 0.03 0.00 -0.27
 1 28.50 0.02 29.00 -0.50
 3 86.05 0.02 87.00 -0.95
 5 143.63 0.02 145.00 -1.37
 10 287.57 0.02 290.00 -2.43
 15 431.45 0.02 435.00 -3.55
 PIR 0.00
 -1 -217.83 0.18 -200.00 -17.83
 -1 -113.39 0.12 -100.00 -13.39
 0 -8.52 0.13 0.00 -8.52
 1 96.01 0.16 100.00 -3.99
 1 200.06 0.19 200.00 0.06
 2 409.67 0.20 400.00 9.67
 2 493.14 0.18 480.00 13.14
 CASE 500800 ohms reference
 6000 59.09 0.01
 8000 78.47 0.02
 10000 97.67 0.01
 12000 116.73 .01
 15000 145.05 .01
 20000 191.55 .01
 25000 237.07 .01
 30000 281.69 .01
 35000 325.45 0.01
 DOME 501200 ohms reference
 6000 59.13 0.01
 8000 78.55 0.02
 10000 97.76 0.01
 12000 116.88 .01
 15000 145.25 .01
 20000 191.82 .01
 25000 237.43 .01
 30000 282.16 .01
 35000 326.14 0.01
 VREF RESISTORS - chan 6
 100040 9994
 END