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APPENDIX 6

RESULTS OF THE ANALYSIS OF THE FIXED-POINT AND VARIABLE TEMPERATURE BLACKBODY MEASUREMENTS USING THE NPL AND INRIM CALIBRATION FITS

EURAMET 658 EXTENSION PROJECT TO EXAMINE UNDERLYING PARAMETERS IN RADIANCE TEMPERATURE SCALE REALISATION FROM 156 °C TO 1000 °C

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Department for
Business, Energy
& Industrial Strategy

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Results of the Analysis of the Fixed-Point and Variable Temperature Blackbody Measurements using the NPL and INRiM Calibration Fits

EURAMET 658 Extension Project to Examine Underlying Parameters in Radiance Temperature Scale Realisation
From 156 °C to 1000 °C

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Approved on behalf of NPL by
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CONTENTS

1 RESULTS ANALYSIS USING THE NPL AND INRIM FIXED-POINT CALIBRATIONS 1

1.1 THE VTBB RESULTS WITH THE INRIM THERMOMETER....2

1.2 THE VTBB RESULTS WITH THE LP5 THERMOMETER....9

1.3 THE FIXED-POINT RESULTS....20

2 PLOTS OF RESULTS OF THE FIXED-POINT MEASUREMENTS USING THE CALIBRATION FITS FOR THE LP5 AND THE INRIM THERMOMETERS....25

3 DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE LP5 THERMOMETER....31

4 INDIVIDUAL LABORATORY RESULTS: DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE LP5 THERMOMETER....37

5 INDIVIDUAL LABORATORY RESULTS: DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE INRIM THERMOMETER....40

1 RESULTS ANALYSIS USING THE NPL AND INRIM FIXED-POINT CALIBRATIONS

NPL and INRiM carried out measurements using all of the appropriate fixed-points: indium, tin, zinc, aluminium and silver. Conveniently, these measurements had been carried out close to the beginning and at the end of the comparison. The results from these two laboratories were therefore used to provide two calibration fits for each thermometer.

Firstly, for each thermometer, the NPL and INRiM fixed-point results were corrected to a common range or gain ($x10^6$ for the INRiM thermometer; range R1 and also range R2 for the LP5 thermometer) using the NPL or INRiM measured gain or range ratios. A least squares fit of the results was then performed using a version of the Planck form of the Sakuma-Hattori interpolation equation:

$$S(T) = \frac{a_1}{\exp(c_2/(a_2T + a_3)) - 1} \qquad \textbf{Equation 1}$$

where $S(T)$ is the output voltage of the thermometer, T is the temperature in kelvin, c_2 is the second radiation constant and a_1, a_2 and a_3 are constants.

For all laboratories, the fixed-point and variable temperature blackbody results were firstly corrected to the same range or gain setting that was used in the fitting process using the range or gain ratio measurements made at that particular laboratory. The additional uncertainty component arising from correcting the signals for gain was calculated, for each temperature, and included as an additional component in the laboratory measurement uncertainty, as described in Section 5.1.1 of the main report. Where a particular laboratory had not measured sufficient gain ratios for the INRiM thermometer for this to be possible, the average value from the results of all the other laboratories was used instead (see Appendix 3). In this case the standard deviation of the results was taken to be the uncertainty of the gain ratio value.

Using the coefficients calculated from the NPL and INRiM calibration fits, all thermometer signals were converted to temperature. For temperatures other than the zinc point, the correction was scaled using the ratio $(t_{source})^2/(t_{zinc})^2$. An additional uncertainty was also added to the laboratory measurement uncertainty to allow for the drift of the thermometer during the comparison, as described in Section 5.1.1 of the main comparison report.

The results of the comparison of all the fitted measurements are given in Tables 1 to 31. The differences (calibration temperature – blackbody temperature) are plotted in the Figures following the Tables. The results of the fixed-point measurements were kept separate from those of the variable temperature blackbody sources. No DOE or QDE_{95} values were calculated for this method of comparison.

1.1 THE VTBB RESULTS WITH THE INRIM THERMOMETER

t_{BB} / °C	Gain used	Bgrd corrected signal/ A	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (k=2) / °C	Temp from NPL fit / °C	Temp corrected for Zn point drift[a]/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit[b]/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	U (k=2) with gain ratio & drift uncertainty* / °C
156.57	10^10	7.7622E-11	0.776219	7.6972E-05	0.45	156.644	156.679	0.109	156.734	156.747	0.177	0.56
200.00	10^10	5.1354E-10	5.13539	5.0924E-04	0.31	199.863	199.905	-0.095	199.941	199.956	-0.044	0.51
231.88	10^9	1.8387E-09	1.83872	1.6801E-03	0.30	231.934	231.981	0.101	232.005	232.022	0.142	0.30
250.04	10^9	3.3812E-09	3.38116	3.0894E-03	0.30	250.030	250.082	0.042	250.098	250.117	0.077	0.30
300.02	10^8	1.3709E-08	1.37094	1.3638E-02	0.30	300.079	300.141	0.121	300.141	300.163	0.143	0.30
399.89	10^7	1.3620E-07	1.36202	0.136273	0.30	399.815	399.900	0.010	399.874	399.904	0.014	0.31
419.49	10^7	1.9838E-07	1.98385	0.198487	0.30	419.496	419.586	0.096	419.557	419.589	0.099	0.31
499.89	10^7	7.5475E-07	7.54750	0.755141	0.31	499.790	499.902	0.012	499.862	499.902	0.012	0.32
600.03	10^6	2.8378E-06	2.83779	2.837789	0.27	600.037	600.180	0.150	600.137	600.188	0.158	0.29
660.29	10^6	5.4809E-06	5.48088	5.480883	0.28	660.205	660.368	0.078	660.329	660.387	0.097	0.31
700.03	10^6	8.0938E-06	8.09375	8.093755	0.29	699.905	700.083	0.053	700.048	700.111	0.081	0.32
799.87	10^5	1.8994E-05	1.89945	19.000850	0.31	799.785	800.001	0.131	799.985	800.062	0.192	0.35
899.98	10^5	3.8587E-05	3.85866	38.599565	0.33	899.728	899.986	0.006	900.001	900.093	0.113	0.39
232.02	10^9	1.8426E-09	1.84263	1.6836E-03	0.30	231.994	232.042	0.022	232.066	232.083	0.063	0.30
300.08	10^8	1.3751E-08	1.37507	1.3679E-02	0.30	300.191	300.252	0.172	300.252	300.274	0.194	0.30
500.03	10^7	7.5664E-07	7.56645	0.757037	0.31	499.958	500.070	0.040	500.030	500.070	0.040	0.32
699.99	10^6	8.0943E-06	8.09433	8.094334	0.29	699.913	700.090	0.100	700.056	700.119	0.129	0.32
899.88	10^5	3.8564E-05	3.85642	38.577167	0.33	899.639	899.897	0.017	899.911	900.003	0.123	0.39

Table 1- results of the CEM measurements performed on the 'low range' with the INRiM thermometer, analysed using the calibration fits

[a] Using the calculated drift from the NPL measurements;
[b] Using the calculated drift from the INRiM measurements.

t_{BB} / °C	Gain used	Bgrd corrected signal/ A	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (*k*=2) / °C	Temp from NPL fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	U (*k*=2) with gain ratio & drift uncertainty*/ °C
156.57	10^9	8.4268E-11	0.084268	7.6997E-05	0.36	156.650	156.685	0.115	156.741	156.753	0.183	0.36
200.00	10^9	5.5716E-10	0.557157	5.0908E-04	0.30	199.855	199.897	-0.103	199.934	199.948	-0.052	0.31
231.88	10^8	1.6894E-09	0.168944	1.6807E-03	0.30	231.944	231.991	0.111	232.015	232.032	0.152	0.30
250.04	10^8	3.1051E-09	0.310514	3.0890E-03	0.30	250.026	250.078	0.038	250.094	250.113	0.073	0.30
300.02	10^7	1.3631E-08	0.136309	1.3638E-02	0.30	300.079	300.141	0.121	300.140	300.162	0.142	0.30
399.89	10^6	1.3628E-07	0.136278	0.136278	0.30	399.817	399.902	0.012	399.876	399.907	0.017	0.31
419.49	10^6	1.9851E-07	0.198507	0.198507	0.30	419.501	419.591	0.101	419.562	419.594	0.104	0.31
499.89	10^6	7.5514E-07	0.755142	0.755142	0.31	499.790	499.902	0.012	499.862	499.902	0.012	0.32
600.03	10^5	2.8368E-06	0.283681	2.837761	0.27	600.036	600.179	0.149	600.137	600.188	0.158	0.29
660.29	10^5	5.4793E-06	0.547934	5.481181	0.28	660.210	660.374	0.084	660.334	660.392	0.102	0.31
700.03	10^5	8.0911E-06	0.809106	8.093774	0.29	699.905	700.083	0.053	700.048	700.111	0.081	0.32
799.87	10^4	1.9188E-05	0.191880	18.999437	0.31	799.775	799.991	0.121	799.976	800.052	0.182	0.35
899.98	10^4	3.8980E-05	0.389795	38.596576	0.33	899.716	899.974	-0.006	899.989	900.081	0.101	0.39
232.02	10^8	1.6921E-09	0.169206	1.6833E-03	0.30	231.988	232.036	0.016	232.060	232.077	0.057	0.30
300.08	10^7	1.3672E-08	0.136723	1.3679E-02	0.30	300.191	300.253	0.173	300.253	300.275	0.195	0.30
500.03	10^6	7.5692E-07	0.756917	0.756917	0.31	499.947	500.059	0.029	500.020	500.060	0.030	0.32
699.99	10^5	8.0913E-06	0.809125	8.093962	0.29	699.908	700.085	0.095	700.051	700.114	0.124	0.32
899.88	10^4	3.8957E-05	0.389568	38.574084	0.33	899.626	899.884	0.004	899.899	899.991	0.111	0.39

Table 2- results of the CEM measurements performed on the 'high range' with the INRiM thermometer, analysed using the calibration fits

t_{BB} / °C	Gain used	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
156.566	10^10	7.71526E-01	7.64095E-05	0.064	156.491	156.517	-0.049	156.582	156.585	0.019	0.070
200.035	10^10	5.16521E+00	5.11546E-04	0.064	199.977	200.007	-0.027	200.055	200.059	0.024	0.072
231.947	10^9	1.83733E+00	1.67760E-03	0.066	231.891	231.927	-0.020	231.963	231.967	0.021	0.076
250.039	10^9	3.37772E+00	3.08409E-03	0.069	249.977	250.015	-0.024	250.045	250.050	0.011	0.080
300.023	10^8	1.36698E+00	1.35988E-02	0.096	299.973	300.018	-0.005	300.034	300.040	0.017	0.107
400.021	10^7	1.36628E+00	1.36699E-01	0.035	399.974	400.036	0.015	400.033	400.041	0.020	0.075
419.519	10^7	1.98335E+00	1.98439E-01	0.036	419.483	419.549	0.030	419.544	419.552	0.032	0.079
500.020	10^6	7.57357E-01	7.57357E-01	0.039	499.986	500.069	0.049	500.059	500.069	0.049	0.096
600.019	10^6	2.83581E+00	2.83581E+00	0.044	599.978	600.082	0.063	600.078	600.091	0.071	0.120
660.328	10^6	5.48368E+00	5.48368E+00	0.073	660.255	660.375	0.046	660.379	660.394	0.065	0.147
700.032	10^6	8.09714E+00	8.09714E+00	0.075	699.950	700.080	0.048	700.092	700.108	0.076	0.157
800.017	10^5	1.90065E+00	1.90228E+01	0.081	799.934	800.093	0.076	800.135	800.154	0.137	0.187
900.026	10^5	3.86153E+00	3.86484E+01	0.088	899.923	900.113	0.087	900.196	900.219	0.193	0.219
961.728	10^5	5.64752E+00	5.65237E+01	0.094	961.599	961.808	0.080	961.923	961.949	0.221	0.242
156.623	10^10	7.73692E-01	7.66239E-05	0.064	156.550	156.575	-0.048	156.640	156.643	0.020	0.070
250.087	10^9	3.38204E+00	3.08803E-03	0.067	250.017	250.054	-0.033	250.085	250.089	0.002	0.078
419.516	10^7	1.98334E+00	1.98438E-01	0.036	419.482	419.548	0.032	419.543	419.551	0.035	0.079
500.042	10^6	7.57390E-01	7.57390E-01	0.039	499.989	500.071	0.030	500.062	500.072	0.030	0.096
700.048	10^5	8.09186E-01	8.09881E+00	0.075	699.971	700.102	0.053	700.114	700.130	0.082	0.157
961.693	10^5	5.64673E+00	5.65158E+01	0.094	961.575	961.784	0.091	961.899	961.925	0.232	0.242

Table 3 - results of the PTB measurements with the INRiM thermometer, analysed using the calibration fits

t_{BB} / °C	Gain used	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	U (k=2) with gain ratio & drift uncertainty* / °C
156.53	10^8	0.00781	7.76065E-05	0.21	156.815	156.838	0.309	156.905	156.906	0.377	0.21
199.90	10^7	0.00497	4.96682E-04	0.25	199.235	199.264	-0.632	199.314	199.316	-0.581	0.25
199.89	10^7	0.00505	5.05373E-04	0.25	199.671	199.700	-0.194	199.750	199.751	-0.142	0.25
199.90	10^8	0.05125	5.09253E-04	0.25	199.863	199.892	-0.008	199.942	199.944	0.044	0.25
231.76	10^7	0.01624	1.62356E-03	0.28	230.954	230.987	-0.769	231.026	231.028	-0.728	0.28
231.76	10^8	0.16754	1.66481E-03	0.28	231.672	231.705	-0.055	231.743	231.746	-0.014	0.28
249.83	10^7	0.03060	3.05999E-03	0.30	249.736	249.771	-0.058	249.804	249.807	-0.023	0.30
249.83	10^8	0.30785	3.05909E-03	0.29	249.727	249.762	-0.066	249.795	249.798	-0.031	0.30
300.17	10^7	0.13625	0.0136257	0.32	300.046	300.088	-0.087	300.107	300.110	-0.065	0.32
300.08	10^8	1.36625	0.0135764	0.33	299.912	299.955	-0.130	299.974	299.976	-0.108	0.33
399.91	10^7	1.35684	0.135687	0.37	399.596	399.654	-0.251	399.655	399.659	-0.246	0.37
400.12	10^7	1.36585	0.136588	0.33	399.932	399.991	-0.133	399.992	399.996	-0.128	0.34
419.68	10^7	1.98417	0.198421	0.34	419.478	419.540	-0.142	419.539	419.543	-0.139	0.35
500.11	10^7	7.56497	0.756512	0.36	499.911	499.989	-0.119	499.984	499.989	-0.119	0.37
600.11	10^6	2.83329	2.833294	0.38	599.902	600.000	-0.112	600.002	600.008	-0.104	0.39
600.02	10^6	2.82827	2.828271	0.39	599.750	599.848	-0.171	599.850	599.856	-0.163	0.40
600.01	10^6	2.82476	2.824760	1.09	599.644	599.742	-0.272	599.744	599.750	-0.264	1.09
660.02	10^6	5.44766	5.447661	1.08	659.611	659.724	-0.299	659.735	659.742	-0.281	1.09
699.85	10^6	8.04389	8.043894	1.11	699.250	699.372	-0.479	699.392	699.400	-0.451	1.12
700.11	10^6	8.06085	8.060855	1.11	699.473	699.595	-0.517	699.616	699.623	-0.489	1.11
800.20	10^5	1.89383	18.949308	1.40	799.435	799.583	-0.619	799.635	799.644	-0.558	1.41
899.89	10^5	3.84413	38.463648	1.24	899.185	899.362	-0.526	899.457	899.469	-0.420	1.26
899.92	10^5	3.84196	38.441921	1.25	899.098	899.275	-0.640	899.370	899.381	-0.534	1.27
961.62	10^5	5.61892	56.221912	1.54	960.685	960.882	-0.739	961.009	961.022	-0.599	1.55

Table 4 – results of the LNE measurements with the INRiM thermometer, analysed using the calibration fits

t_{BB} / °C	Gain used	Bgrd corrected Signal / mV	Signal at 10^6 gain / mV	Signal at 10^6 gain/ V	lab U (*k*=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	U (*k*=2) with gain ratio & drift uncertainty*/ °C
156.604	10^10	777.185	0.077	7.69634E-05	0.433	156.642	156.668	0.065	156.732	156.737	0.133	0.43
231.915	10^9	1833.114	1.675	1.67462E-03	0.445	231.840	231.878	-0.037	231.912	231.918	0.003	0.45
419.485	10^7	1980.357	198.186	1.98186E-01	0.102	419.414	419.484	-0.001	419.475	419.487	0.002	0.12
660.174	10^6	5508.215	5508.215	5.50821	0.174	660.691	660.818	0.645	660.815	660.837	0.664	0.22
961.861	10^5	5705.270	57081.108	57.08111	0.776	963.276	963.499	1.639	963.602	963.641	1.780	0.81
199.995	10^10	5154.564	0.510	5.10448E-04	0.441	199.922	199.955	-0.039	200.001	200.007	0.012	0.44
249.986	10^9	3368.463	3.077	3.07723E-03	0.358	249.909	249.949	-0.037	249.977	249.984	-0.002	0.36
300.010	10^8	1367.415	13.605	1.36047E-02	0.224	299.989	300.037	0.026	300.050	300.058	0.048	0.23
400.063	10^7	1366.687	136.773	1.36773E-01	0.102	400.001	400.067	0.004	400.061	400.072	0.009	0.12
499.953	10^7	7560.209	756.595	7.56595E-01	0.110	499.919	500.006	0.053	499.991	500.006	0.053	0.14
499.976	10^7	7563.477	756.923	7.56923E-01	0.135	499.948	500.035	0.059	500.020	500.035	0.060	0.16
600.015	10^6	2835.845	2835.845	2.83584	0.119	599.979	600.090	0.075	600.079	600.098	0.083	0.16
599.731	10^6	2825.946	2825.946	2.82595	0.158	599.680	599.791	0.060	599.780	599.799	0.068	0.19
300.040	10^8	1369.291	13.623	1.36233E-02	0.224	300.039	300.087	0.047	300.101	300.109	0.069	0.23
400.058	10^7	1366.927	136.797	1.36797E-01	0.102	400.010	400.076	0.018	400.070	400.081	0.023	0.12
599.988	10^6	2834.872	2834.872	2.83487	0.119	599.949	600.061	0.073	600.050	600.069	0.081	0.16
499.820	10^7	7563.477	756.923	7.56923E-01	0.477	499.948	500.035	0.215	500.020	500.035	0.215	0.48
599.280	10^6	2825.946	2825.946	2.82595	0.507	599.680	599.791	0.511	599.780	599.799	0.519	0.52
699.941	10^6	8125.120	8125.120	8.12512	0.534	700.316	700.454	0.513	700.459	700.483	0.542	0.55
799.917	10^5	1908.946	19098.963	19.09896	0.619	800.450	800.618	0.701	800.651	800.679	0.762	0.64
899.924	10^5	3882.634	38845.676	38.84568	0.719	900.709	900.910	0.985	900.982	901.016	1.092	0.75
1000.048	10^5	7070.470	70739.916	70.73992	0.833	1001.125	1001.362	1.314	1001.485	1001.526	1.478	0.87
799.950	10^5	1909.781	19107.325	19.10732	0.619	800.506	800.675	0.724	800.707	800.736	0.786	0.64
1000.095	10^5	7071.588	70751.095	70.75110	0.833	1001.153	1001.390	1.296	1001.514	1001.555	1.460	0.87

Table 5– results of the METAS measurements with the INRiM thermometer, analysed using the calibration fits

t_{BB} / °C	Gain used	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
201.26	10^9	0.587914	5.37003E-04	0.955	201.202	201.214	-0.047	201.281	201.265	0.004	0.957
250.78	10^9	3.470968	3.17040E-03	0.808	250.828	250.842	0.059	250.896	250.877	0.094	0.810
299.80	10^8	1.365282	1.35800E-02	0.822	299.922	299.939	0.139	299.983	299.961	0.161	0.825
417.73	10^7	1.923257	0.192423	0.860	417.829	417.853	0.119	417.889	417.856	0.122	0.862
497.10	10^7	7.285188	0.728886	0.810	497.425	497.456	0.352	497.496	497.456	0.352	0.815
596.25	10^6	2.739827	2.739827	0.850	597.043	597.082	0.833	597.142	597.090	0.840	0.857
655.68	10^6	5.281204	5.281204	0.822	656.593	656.638	0.959	656.716	656.656	0.977	0.832
695.58	10^6	7.833208	7.833208	0.824	696.444	696.493	0.914	696.585	696.520	0.941	0.835
797.27	10^5	1.910186	19.055416	1.196	800.155	800.215	2.945	800.356	800.276	3.006	1.222
897.37	10^5	3.894053	38.845858	1.193	900.709	900.781	3.409	900.983	900.888	3.515	1.230
1000.09	10^5	7.221856	72.042977	1.084	1004.452	1004.537	4.450	1004.816	1004.703	4.616	1.141

Table 6– results of the UME measurements with the INRiM thermometer, analysed using the calibration fits

t_{BB} / °C	Gain used	Bgrd corrected signal/ V	Signal at 10^6 gain/ V	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty*/ °C
156.63	10^10	0.777632	7.70750E-05	0.20	156.672	156.672	0.040	156.762	156.740	0.108	0.20
199.93	10^9	0.556989	5.08879E-04	0.20	199.845	199.845	-0.085	199.923	199.896	-0.034	0.20
200.02	10^9	0.562683	5.14081E-04	0.20	200.101	200.101	0.080	200.179	200.152	0.131	0.20
200.02	10^10	5.186709	5.14081E-04	0.20	200.101	200.101	0.081	200.179	200.152	0.133	0.20
232.05	10^9	1.841034	1.68201E-03	0.20	231.967	231.967	-0.083	232.038	232.007	-0.043	0.20
250.01	10^9	3.372291	3.08100E-03	0.20	249.947	249.947	-0.065	250.015	249.982	-0.030	0.20
250.05	10^9	3.376714	3.08505E-03	0.20	249.987	249.987	-0.067	250.055	250.022	-0.032	0.20
250.05	10^8	0.310083	3.08505E-03	0.20	249.987	249.987	-0.067	250.055	250.022	-0.032	0.20
300.06	10^8	1.365190	1.35824E-02	0.21	299.928	299.928	-0.129	299.990	299.950	-0.107	0.22
300.02	10^7	0.135586	1.35670E-02	0.21	299.887	299.887	-0.136	299.948	299.908	-0.114	0.22
300.02	10^8	1.363646	1.35670E-02	0.21	299.887	299.887	-0.137	299.948	299.908	-0.115	0.22
400.22	10^7	1.369248	0.137010	0.20	400.089	400.089	-0.134	400.149	400.094	-0.129	0.21
400.00	10^7	1.363649	0.136449	0.20	399.881	399.881	-0.123	399.940	399.885	-0.119	0.21
419.43	10^7	1.976805	0.197803	0.20	419.310	419.310	-0.120	419.371	419.313	-0.117	0.21
499.89	10^7	7.546142	0.755081	0.20	499.784	499.784	-0.103	499.857	499.785	-0.103	0.22
499.89	10^6	0.755081	0.755081	0.20	499.784	499.784	-0.107	499.857	499.785	-0.107	0.22
500.22	10^7	7.612328	0.761704	0.48	500.370	500.370	0.155	500.443	500.371	0.156	0.49
600.05	10^6	2.842331	2.842331	0.47	600.174	600.174	0.123	600.274	600.182	0.131	0.48
600.05	10^5	0.283980	2.842244	0.47	600.171	600.171	0.123	600.272	600.180	0.131	0.48
660.03	10^6	5.477611	5.477611	0.48	660.147	660.147	0.121	660.271	660.165	0.140	0.50
660.03	10^5	0.547319	5.477901	0.48	660.152	660.152	0.120	660.276	660.171	0.138	0.50
699.95	10^6	8.105329	8.105329	0.48	700.057	700.057	0.108	700.200	700.085	0.136	0.50
699.96	10^5	0.809842	8.105389	0.48	700.058	700.058	0.101	700.201	700.086	0.130	0.50
700.00	10^6	8.111707	8.111707	0.48	700.140	700.140	0.140	700.283	700.169	0.169	0.50
799.81	10^5	1.899315	19.009499	0.49	799.844	799.844	0.036	800.044	799.905	0.097	0.52
900.19	10^5	3.867533	38.708629	0.49	900.163	900.163	-0.024	900.436	900.270	0.082	0.53
900.17	10^4	0.390889	38.708630	0.49	900.163	900.163	-0.011	900.436	900.270	0.096	0.53
900.03	10^5	3.865023	38.683503	0.49	900.063	900.063	0.035	900.336	900.169	0.141	0.53
961.78	10^5	5.656693	56.615634	0.49	961.876	961.876	0.096	962.201	962.016	0.236	0.54
1000.00	10^5	7.025350	70.313988	0.49	1000.028	1000.028	0.028	1000.387	1000.191	0.191	0.54
1000.12	10^5	7.034740	70.407971	0.49	1000.270	1000.270	0.151	1000.630	1000.434	0.315	0.54

Table 7– results of the NPL measurements with the INRiM thermometer, analysed using the calibration fits

1.2 THE VTBB RESULTS WITH THE LP5 THERMOMETER

(N.B calibration fits were performed using data corrected to range R1 and corrected to range R2)

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R1/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift[a]/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift[b]/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with range ratio & drift uncertainty*/ °C
231.91	R1	3.02262E-12	3.02262E-12	0.41	231.687	231.714	-0.196	232.026	231.769	-0.141	0.43
250.11	R1	5.72417E-12	5.72417E-12	0.32	250.112	250.141	0.031	250.455	250.179	0.069	0.36
300.09	R1	2.62564E-11	2.62564E-11	0.31	299.997	300.031	-0.059	300.361	300.030	-0.060	0.36
399.94	R1	2.81427E-10	2.81427E-10	0.31	399.866	399.913	-0.027	400.310	399.854	-0.086	0.40
419.55	R1	4.14299E-10	4.14299E-10	0.31	419.538	419.588	0.038	420.004	419.520	-0.030	0.41
499.98	R1	1.63872E-09	1.63872E-09	0.31	499.865	499.928	-0.052	500.440	499.838	-0.142	0.45
600.09	R1	6.39791E-09	6.39791E-09	0.26	600.146	600.225	0.135	600.903	600.134	0.044	0.50
660.35	R2	1.25941E-08	1.25884E-08	0.27	660.302	660.393	0.043	661.192	660.314	-0.036	0.56
700.10	R2	1.88022E-08	1.87938E-08	0.27	699.988	700.086	-0.014	700.976	700.021	-0.079	0.59
799.91	R2	4.51797E-08	4.51593E-08	0.27	799.753	799.873	-0.037	801.023	799.862	-0.048	0.70
900.01	R2	9.36263E-08	9.35841E-08	0.28	899.656	899.799	-0.211	901.258	899.869	-0.141	0.82
232.07	R1	3.05435E-12	3.05435E-12	0.39	231.978	232.005	-0.065	232.316	232.059	-0.011	0.41
300.14	R1	2.63234E-11	2.63234E-11	0.31	300.089	300.123	-0.017	300.453	300.121	-0.019	0.36
500.09	R1	1.64322E-09	1.64322E-09	0.31	500.044	500.107	0.017	500.619	500.017	-0.073	0.45
700.04	R2	1.87879E-08	1.87794E-08	0.27	699.909	700.008	-0.032	700.897	699.942	-0.098	0.59
899.92	R2	9.36075E-08	9.35653E-08	0.28	899.626	899.769	-0.151	901.228	899.839	-0.081	0.82

Table 8 - results of the CEM measurements with the LP5 thermometer, analysed using the calibration fits for range R1

[a] Using the calculated drift from the NPL measurements;
[b] Using the calculated drift from the INRiM measurements.

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
231.91	R2	3.04783E-12	3.04783E-12	2.90	231.909	231.936	0.026	232.222	231.965	0.055	2.90
250.11	R2	5.77088E-12	5.77088E-12	1.54	250.345	250.374	0.264	250.661	250.384	0.274	1.55
300.09	R2	2.61516E-11	2.61516E-11	0.49	299.841	299.875	-0.215	300.172	299.841	-0.249	0.52
399.94	R2	2.81632E-10	2.81632E-10	0.31	399.885	399.932	-0.008	400.283	399.827	-0.113	0.40
419.55	R2	4.14570E-10	4.14570E-10	0.31	419.554	419.604	0.054	419.971	419.488	-0.062	0.41
499.98	R2	1.63960E-09	1.63960E-09	0.31	499.878	499.940	-0.040	500.393	499.790	-0.190	0.46
600.09	R2	6.40066E-09	6.40066E-09	0.26	600.152	600.232	0.142	600.833	600.064	-0.026	0.50
660.35	R2	1.25941E-08	1.25941E-08	0.26	660.312	660.402	0.052	661.114	660.236	-0.114	0.55
700.10	R2	1.88022E-08	1.88022E-08	0.26	699.998	700.097	-0.003	700.891	699.936	-0.164	0.59
799.91	R2	4.51797E-08	4.51797E-08	0.26	799.766	799.885	-0.025	800.920	799.759	-0.151	0.70
900.01	R2	9.36263E-08	9.36263E-08	0.26	899.671	899.814	-0.196	901.135	899.747	-0.263	0.81
232.07	R2	3.08452E-12	3.08452E-12	1.81	232.243	232.269	0.199	232.555	232.298	0.228	1.81
300.14	R2	2.61924E-11	2.61924E-11	0.41	299.897	299.931	-0.209	300.228	299.897	-0.243	0.45
500.09	R2	1.64412E-09	1.64412E-09	0.31	500.057	500.119	0.029	500.572	499.969	-0.121	0.46
700.04	R2	1.87879E-08	1.87879E-08	0.26	699.919	700.018	-0.022	700.812	699.857	-0.183	0.59
899.92	R2	9.36075E-08	9.36075E-08	0.26	899.640	899.784	-0.136	901.105	899.717	-0.203	0.81

Table 9 - results of the CEM measurements with the LP5 thermometer, analysed using the calibration fits for range R2

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with Range R1/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	U (k=2) with gain ratio & drift uncertainty*/ °C
231.946	R1	3.03946E-12	3.03946E-12	0.111	231.84	231.84	-0.10	232.18	231.90	-0.05	0.13
250.089	R1	5.70504E-12	5.70504E-12	0.085	250.01	250.02	-0.07	250.36	250.05	-0.04	0.11
300.020	R1	2.62226E-11	2.62226E-11	0.097	299.95	299.95	-0.07	300.31	299.95	-0.07	0.13
400.021	R1	2.82049E-10	2.82049E-10	0.035	399.98	399.98	-0.04	400.42	399.92	-0.10	0.12
419.530	R1	4.14019E-10	4.14019E-10	0.036	419.50	419.51	-0.02	419.97	419.44	-0.09	0.13
500.015	R1	1.64206E-09	1.64206E-09	0.039	500.00	500.00	-0.01	500.57	499.91	-0.10	0.15
600.017	R1	6.38577E-09	6.38577E-09	0.044	599.99	600.00	-0.02	600.74	599.90	-0.11	0.20
660.312	R2	1.25796E-08	1.25809E-08	0.073	660.24	660.25	-0.06	661.14	660.17	-0.14	0.23
700.031	R2	1.87788E-08	1.87806E-08	0.075	699.92	699.93	-0.11	700.90	699.86	-0.17	0.25
800.012	R2	4.52005E-08	4.52049E-08	0.081	799.88	799.89	-0.12	801.15	799.88	-0.13	0.30
900.011	R2	9.37001E-08	9.37093E-08	0.088	899.86	899.87	-0.14	901.46	899.94	-0.07	0.36
961.748	R2	1.38461E-07	1.38475E-07	0.094	961.45	961.47	-0.28	963.29	961.60	-0.15	0.39
231.947	R1	3.03869E-12	3.03869E-12	0.132	231.84	231.84	-0.11	232.17	231.89	-0.05	0.15
300.027	R1	2.62522E-11	2.62522E-11	0.184	299.99	299.99	-0.03	300.36	299.99	-0.03	0.20
419.512	R1	4.13968E-10	4.13968E-10	0.036	419.50	419.50	-0.01	419.96	419.43	-0.08	0.13
500.049	R1	1.64205E-09	1.64205E-09	0.039	500.00	500.00	-0.04	500.57	499.91	-0.14	0.15
700.028	R2	1.87822E-08	1.87840E-08	0.075	699.93	699.94	-0.08	700.92	699.88	-0.15	0.25
961.696	R2	1.38400E-07	1.38414E-07	0.094	961.38	961.40	-0.30	963.21	961.53	-0.17	0.39

Table 10 - results of the PTB measurements with the LP5 thermometer, analysed using the calibration fits for range R1

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with Range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	U (k=2) with gain ratio & drift uncertainty*/ °C
231.946	R1	3.03946E-12	3.03916E-12	0.111	231.83	231.83	-0.11	232.14	231.86	-0.08	0.13
250.089	R1	5.70504E-12	5.70448E-12	0.085	250.00	250.00	-0.09	250.31	250.01	-0.08	0.11
300.020	R1	2.62226E-11	2.62200E-11	0.097	299.93	299.94	-0.08	300.27	299.90	-0.12	0.13
400.021	R1	2.82049E-10	2.82021E-10	0.035	399.95	399.96	-0.06	400.35	399.85	-0.17	0.12
419.530	R1	4.14019E-10	4.13978E-10	0.036	419.48	419.48	-0.05	419.90	419.37	-0.16	0.13
500.015	R1	1.64206E-09	1.64190E-09	0.039	499.97	499.98	-0.04	500.48	499.82	-0.19	0.16
600.017	R1	6.38577E-09	6.38515E-09	0.044	599.95	599.96	-0.06	600.63	599.79	-0.23	0.20
660.312	R2	1.25796E-08	1.25796E-08	0.073	660.20	660.21	-0.10	661.00	660.04	-0.27	0.23
700.031	R2	1.87788E-08	1.87788E-08	0.075	699.87	699.88	-0.15	700.76	699.72	-0.32	0.25
800.012	R2	4.52005E-08	4.52005E-08	0.081	799.82	799.84	-0.18	800.98	799.71	-0.31	0.30
900.011	R2	9.37001E-08	9.37001E-08	0.088	899.79	899.80	-0.21	901.25	899.73	-0.28	0.36
961.748	R2	1.38461E-07	1.38461E-07	0.094	961.38	961.39	-0.35	963.06	961.37	-0.37	0.39
231.947	R1	3.03869E-12	3.03839E-12	0.132	231.82	231.83	-0.12	232.14	231.85	-0.09	0.15
300.027	R1	2.62522E-11	2.62496E-11	0.184	299.98	299.98	-0.05	300.31	299.94	-0.08	0.20
419.512	R1	4.13968E-10	4.13928E-10	0.036	419.47	419.48	-0.03	419.89	419.36	-0.15	0.13
500.049	R1	1.64205E-09	1.64189E-09	0.039	499.97	499.97	-0.07	500.48	499.82	-0.22	0.16
700.028	R2	1.87822E-08	1.87822E-08	0.075	699.89	699.90	-0.13	700.78	699.74	-0.29	0.25
961.696	R2	1.38400E-07	1.38400E-07	0.094	961.30	961.32	-0.38	962.98	961.30	-0.40	0.39

Table 11 - results of the PTB measurements with the LP5 thermometer, analysed using the calibration fits for range R2

t_{BB} / °C	Range used	Bgrd corrected Signal / nA	Bgrd corrected signal/ A	Signal with range R1/ A	lab U (k=2) / °C	Temp from NPL fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with drift uncertainty*/ °C
231.76	R1	0.00299	2.99090E-12	2.99090E-12	0.60	231.39	231.69	-0.07	231.73	231.74	-0.02	0.60
249.83	R1	0.00559	5.59107E-12	5.59107E-12	0.43	249.41	249.73	-0.10	249.75	249.77	-0.06	0.44
249.84	R1	0.00531	5.30973E-12	5.30973E-12	0.47	247.87	248.19	-1.65	248.22	248.23	-1.61	0.48
249.83	R1	0.00560	5.59853E-12	5.59853E-12	0.44	249.45	249.77	-0.06	249.79	249.81	-0.02	0.44
300.19	R1	0.02609	2.60880E-11	2.60880E-11	0.35	299.77	300.15	-0.05	300.13	300.15	-0.05	0.36
399.93	R1	0.27791	2.77908E-10	2.77908E-10	0.31	399.24	399.77	-0.16	399.69	399.71	-0.22	0.33
400.14	R1	0.27938	2.79379E-10	2.79379E-10	0.32	399.51	400.03	-0.11	399.95	399.97	-0.17	0.34
419.63	R1	0.40981	4.09805E-10	4.09805E-10	0.32	418.97	419.52	-0.10	419.43	419.46	-0.17	0.34
500.11	R1	1.62441	1.62441E-09	1.62441E-09	0.34	499.29	499.99	-0.13	499.87	499.90	-0.22	0.37
600.16	R2	6.32775	6.32775E-09	6.32775E-09	0.41	599.23	600.11	-0.04	599.98	600.02	-0.13	0.45
600.13	R2	6.32566	6.32566E-09	6.32566E-09	0.42	599.20	600.08	-0.04	599.96	599.99	-0.13	0.47
660.06	R2	12.39548	1.23955E-08	1.23955E-08	1.04	658.84	659.84	-0.21	659.72	659.77	-0.29	1.06
699.83	R2	18.47426	1.84743E-08	1.84743E-08	1.03	698.22	699.31	-0.52	699.20	699.25	-0.58	1.06
700.11	R2	18.53000	1.85300E-08	1.85300E-08	1.05	698.53	699.62	-0.49	699.52	699.56	-0.55	1.08
800.07	R2	44.54806	4.45481E-08	4.45481E-08	1.14	798.05	799.38	-0.70	799.31	799.37	-0.70	1.17
899.88	R2	92.29729	9.22973E-08	9.22973E-08	1.17	897.58	899.17	-0.71	899.18	899.25	-0.64	1.22
899.94	R2	92.35645	9.23564E-08	9.23564E-08	1.19	897.68	899.27	-0.67	899.28	899.34	-0.60	1.24
961.63	R2	136.56060	1.36561E-07	1.36561E-07	1.24	959.15	960.91	-0.72	960.97	961.04	-0.58	1.30

Table 12 - results of the LNE measurements with the LP5 thermometer, analysed using the calibration fits for range R1

Note: due to the inconsistent value for the LNE range ratio value it was not possible to correct the signal levels to a different range. The blue highlighted values indicate those that have not been corrected.

t_{BB} / °C	Range used	Bgrd corrected Signal/ nA	Bgrd corrected signal/ A	Signal with range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with drift uncertainty*/ °C
231.76	R1	0.00299	2.99090E-12	2.99090E-12	0.60	231.38	231.68	-0.08	231.70	231.71	-0.05	0.60
249.83	R1	0.00559	5.59107E-12	5.59107E-12	0.43	249.40	249.72	-0.11	249.71	249.73	-0.10	0.44
249.84	R1	0.00531	5.30973E-12	5.30973E-12	0.47	247.86	248.18	-1.66	248.18	248.19	-1.65	0.48
249.83	R1	0.00560	5.59853E-12	5.59853E-12	0.44	249.44	249.76	-0.07	249.75	249.77	-0.06	0.44
300.19	R1	0.02609	2.60880E-11	2.60880E-11	0.35	299.75	300.13	-0.06	300.08	300.10	-0.09	0.36
399.93	R1	0.27791	2.77908E-10	2.77908E-10	0.31	399.23	399.75	-0.18	399.63	399.65	-0.29	0.33
400.14	R1	0.27938	2.79379E-10	2.79379E-10	0.32	399.49	400.01	-0.13	399.89	399.91	-0.23	0.34
419.63	R1	0.40981	4.09805E-10	4.09805E-10	0.32	418.95	419.50	-0.12	419.37	419.39	-0.24	0.34
500.11	R1	1.62441	1.62441E-09	1.62441E-09	0.34	499.27	499.96	-0.15	499.79	499.81	-0.30	0.37
600.16	R2	6.32775	6.32775E-09	6.32775E-09	0.41	599.20	600.08	-0.07	599.88	599.92	-0.24	0.45
600.13	R2	6.32566	6.32566E-09	6.32566E-09	0.42	599.17	600.06	-0.07	599.85	599.89	-0.24	0.47
660.06	R2	12.39548	1.23955E-08	1.23955E-08	1.04	658.80	659.81	-0.25	659.60	659.64	-0.41	1.06
699.83	R2	18.47426	1.84743E-08	1.84743E-08	1.03	698.18	699.28	-0.56	699.07	699.12	-0.71	1.06
700.11	R2	18.53000	1.85300E-08	1.85300E-08	1.05	698.49	699.59	-0.52	699.38	699.43	-0.68	1.08
800.07	R2	44.54806	4.45481E-08	4.45481E-08	1.14	798.00	799.33	-0.74	799.15	799.21	-0.86	1.17
899.88	R2	92.29729	9.22973E-08	9.22973E-08	1.17	897.53	899.12	-0.76	898.99	899.06	-0.83	1.22
899.94	R2	92.35645	9.23564E-08	9.23564E-08	1.19	897.63	899.22	-0.73	899.09	899.15	-0.79	1.24
961.63	R2	136.56060	1.36561E-07	1.36561E-07	1.24	959.09	960.85	-0.78	960.76	960.83	-0.79	1.30

Table 13 - results of the LNE measurements with the LP5 thermometer, analysed using the calibration fits for range R2

Note: due to the inconsistent value for the LNE range ratio value it was not possible to correct the signal levels to a different range. The blue highlighted values indicate those that have not been corrected.

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R1/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
231.913	R1	3.0206E-12	3.02059E-12	0.445	231.669	231.908	-0.005	232.007	231.963	0.050	0.45
419.500	R1	4.1029E-10	4.10295E-10	0.102	419.030	419.480	-0.019	419.495	419.413	-0.086	0.16
660.335	R2	1.2502E-08	1.24947E-08	0.174	659.593	660.410	0.075	660.481	660.332	-0.003	0.28
961.678	R2	1.3834E-07	1.38261E-07	0.776	961.197	962.629	0.951	963.028	962.767	1.089	0.86
249.986	R1	5.6051E-12	5.60506E-12	0.358	249.484	249.741	-0.245	249.827	249.780	-0.205	0.36
300.011	R1	2.6007E-11	2.60067E-11	0.224	299.655	299.963	-0.048	300.018	299.962	-0.049	0.24
400.063	R1	2.8005E-10	2.80050E-10	0.102	399.624	400.049	-0.014	400.068	399.990	-0.073	0.15
499.955	R1	1.6277E-09	1.62775E-09	0.110	499.428	499.989	0.034	500.002	499.900	-0.055	0.19
499.963	R1	1.6276E-09	1.62764E-09	0.135	499.424	499.985	0.022	499.998	499.896	-0.067	0.20
600.014	R1	6.3365E-09	6.33653E-09	0.119	599.345	600.060	0.046	600.100	599.970	-0.045	0.23
599.728	R1	6.3123E-09	6.31232E-09	0.158	599.027	599.742	0.014	599.782	599.652	-0.076	0.25
300.040	R1	2.6079E-11	2.60794E-11	0.224	299.755	300.063	0.023	300.118	300.062	0.022	0.24
400.060	R1	2.8016E-10	2.80163E-10	0.102	399.644	400.069	0.009	400.088	400.010	-0.050	0.15
599.988	R1	6.3348E-09	6.33481E-09	0.119	599.322	600.038	0.050	600.078	599.947	-0.041	0.23
499.803	R1	1.6276E-09	1.62764E-09	0.477	499.424	499.985	0.181	499.998	499.896	0.092	0.50
599.237	R1	6.3123E-09	6.31232E-09	0.507	599.027	599.742	0.506	599.782	599.652	0.415	0.54
699.935	R2	1.8713E-08	1.87029E-08	0.534	699.487	700.377	0.442	700.475	700.313	0.378	0.58
799.890	R2	4.5069E-08	4.50439E-08	0.619	799.432	800.513	0.624	800.701	800.504	0.614	0.68
899.923	R2	9.3482E-08	9.34300E-08	0.719	899.409	900.701	0.779	901.010	900.775	0.852	0.80
1000.039	R2	1.7303E-07	1.72936E-07	0.833	999.477	1000.999	0.960	1001.460	1001.183	1.144	0.93
799.949	R2	4.5097E-08	4.50721E-08	0.619	799.511	800.592	0.643	800.780	800.583	0.634	0.68
1000.080	R2	1.7314E-07	1.73044E-07	0.833	999.587	1001.110	1.029	1001.571	1001.293	1.213	0.93

Table 14 - results of the METAS measurements with the LP5 thermometer, analysed using the calibration fits for range R1

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
231.913	R1	3.0206E-12	3.02225E-12	0.445	231.674	231.914	0.001	231.987	231.943	0.031	0.45
419.500	R1	4.1029E-10	4.10521E-10	0.102	419.041	419.491	-0.009	419.458	419.376	-0.124	0.16
660.335	R2	1.2502E-08	1.25016E-08	0.174	659.612	660.429	0.094	660.413	660.264	-0.071	0.28
961.678	R2	1.3834E-07	1.38337E-07	0.776	961.230	962.662	0.984	962.909	962.648	0.970	0.86
249.986	R1	5.6051E-12	5.60815E-12	0.358	249.490	249.747	-0.239	249.806	249.759	-0.227	0.36
300.011	R1	2.6007E-11	2.60210E-11	0.224	299.662	299.970	-0.041	299.993	299.936	-0.075	0.24
400.063	R1	2.8005E-10	2.80205E-10	0.102	399.634	400.059	-0.004	400.032	399.954	-0.108	0.15
499.955	R1	1.6277E-09	1.62865E-09	0.110	499.441	500.002	0.047	499.955	499.853	-0.102	0.19
499.963	R1	1.6276E-09	1.62854E-09	0.135	499.437	499.998	0.035	499.951	499.849	-0.114	0.20
600.014	R1	6.3365E-09	6.34002E-09	0.119	599.362	600.077	0.063	600.040	599.910	-0.105	0.23
599.728	R1	6.3123E-09	6.31581E-09	0.158	599.044	599.759	0.031	599.722	599.592	-0.136	0.25
300.040	R1	2.6079E-11	2.60938E-11	0.224	299.762	300.070	0.031	300.093	300.037	-0.003	0.24
400.060	R1	2.8016E-10	2.80318E-10	0.102	399.654	400.079	0.019	400.052	399.974	-0.085	0.15
599.988	R1	6.3348E-09	6.33831E-09	0.119	599.339	600.055	0.066	600.018	599.887	-0.101	0.23
499.803	R1	1.6276E-09	1.62854E-09	0.477	499.437	499.998	0.194	499.951	499.849	0.045	0.50
599.237	R1	6.3123E-09	6.31581E-09	0.507	599.044	599.759	0.522	599.722	599.592	0.355	0.54
699.935	R2	1.8713E-08	1.87132E-08	0.534	699.508	700.397	0.463	700.400	700.238	0.303	0.58
799.890	R2	4.5069E-08	4.50687E-08	0.619	799.457	800.539	0.649	800.611	800.414	0.524	0.68
899.923	R2	9.3482E-08	9.34816E-08	0.719	899.439	900.731	0.808	900.902	900.667	0.744	0.80
1000.039	R2	1.7303E-07	1.73032E-07	0.833	999.512	1001.034	0.995	1001.334	1001.056	1.017	0.93
799.949	R2	4.5097E-08	4.50970E-08	0.619	799.536	800.617	0.668	800.690	800.493	0.543	0.68
1000.080	R2	1.7314E-07	1.73140E-07	0.833	999.622	1001.145	1.064	1001.445	1001.167	1.087	0.93

Table 15 - results of the METAS measurements with the LP5 thermometer, analysed using the calibration fits for range R2

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R1/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
250.78	R1	5.76788E-12	5.76788E-12	0.953	250.34	250.47	-0.31	250.68	250.51	-0.27	0.96
299.80	R2	2.60561E-11	2.63989E-11	0.894	300.19	300.35	0.55	300.56	300.35	0.55	1.27
417.73	R2	3.98655E-10	4.03899E-10	0.805	418.21	418.44	0.70	418.67	418.37	0.64	1.54
497.10	R2	1.56268E-09	1.58323E-09	0.831	497.63	497.91	0.81	498.20	497.82	0.72	1.83
596.25	R2	6.07226E-09	6.15213E-09	0.830	596.90	597.26	1.01	597.65	597.17	0.92	2.24
655.68	R2	1.19562E-08	1.21135E-08	0.969	656.66	657.08	1.40	657.54	657.00	1.32	2.57
695.58	R2	1.80514E-08	1.82889E-08	0.921	697.18	697.64	2.06	698.17	697.57	1.99	2.75
797.27	R2	4.40370E-08	4.46163E-08	1.106	798.24	798.79	1.52	799.50	798.78	1.51	3.34
897.37	R2	9.18374E-08	9.30455E-08	1.214	898.79	899.45	2.08	900.39	899.52	2.15	3.96
1000.09	R2	1.72885E-07	1.75159E-07	1.179	1001.73	1002.51	2.43	1003.73	1002.70	2.61	4.59

Table 16 - results of the UME measurements with the LP5 thermometer, analysed using the calibration fits for range R1

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
250.78	R1	5.76788E-12	5.69299E-12	0.953	249.94	250.07	-0.71	250.25	250.08	-0.70	1.20
299.80	R2	2.60561E-11	2.60561E-11	0.894	299.71	299.87	0.07	300.04	299.83	0.03	0.90
417.73	R2	3.98655E-10	3.98655E-10	0.805	417.51	417.74	0.00	417.93	417.62	-0.11	0.81
497.10	R2	1.56268E-09	1.56268E-09	0.831	496.76	497.04	-0.06	497.27	496.89	-0.21	0.84
596.25	R2	6.07226E-09	6.07226E-09	0.830	595.79	596.16	-0.09	596.47	595.99	-0.26	0.85
655.68	R2	1.19562E-08	1.19562E-08	0.969	655.40	655.81	0.13	656.19	655.65	-0.03	0.99
695.58	R2	1.80514E-08	1.80514E-08	0.921	695.81	696.26	0.68	696.69	696.10	0.52	0.95
797.27	R2	4.40370E-08	4.4037E-08	1.106	796.56	797.11	-0.16	797.71	796.98	-0.29	1.14
897.37	R2	9.18374E-08	9.18374E-08	1.214	896.79	897.44	0.07	898.24	897.38	0.00	1.26
1000.09	R2	1.72885E-07	1.72885E-07	1.179	999.36	1000.14	0.05	1001.18	1000.16	0.07	1.25

Table 17 - results of the UME measurements with the LP5 thermometer, analysed using the calibration fits for range R2

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R1/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
232.03	R1	3.061856E-12	3.061856E-12	0.26	232.05	232.05	0.02	232.38	232.10	0.07	0.27
249.99	R1	5.672646E-12	5.672646E-12	0.25	249.84	249.84	-0.15	250.18	249.88	-0.11	0.26
249.99	R1	5.681434E-12	5.681434E-12	0.25	249.89	249.89	-0.10	250.23	249.93	-0.06	0.26
250.06	R1	5.695074E-12	5.695074E-12	0.25	249.96	249.96	-0.09	250.30	250.00	-0.06	0.26
300.06	R1	2.618329E-11	2.618329E-11	0.25	299.90	299.90	-0.16	300.26	299.90	-0.16	0.26
400.00	R1	2.817535E-10	2.817535E-10	0.25	399.92	399.92	-0.07	400.37	399.86	-0.13	0.27
400.06	R1	2.821617E-10	2.821617E-10	0.25	399.99	399.99	-0.07	400.44	399.93	-0.13	0.27
419.42	R1	4.128693E-10	4.128693E-10	0.24	419.36	419.36	-0.07	419.82	419.29	-0.14	0.27
499.89	R2	1.639063E-09	1.638486E-09	0.25	499.86	499.86	-0.04	500.43	499.77	-0.13	0.29
499.89	R1	1.638486E-09	1.638486E-09	0.25	499.86	499.86	-0.04	500.43	499.77	-0.13	0.29
500.22	R1	1.652192E-09	1.652192E-09	0.50	500.40	500.40	0.18	500.98	500.31	0.09	0.52
599.66	R1	6.368180E-09	6.368180E-09	0.50	599.76	599.76	0.10	600.51	599.67	0.01	0.54
600.43	R1	6.428283E-09	6.428283E-09	0.50	600.54	600.54	0.11	601.30	600.45	0.02	0.54
600.04	R1	6.398232E-09	6.398232E-09	0.50	600.15	600.15	0.11	600.91	600.06	0.01	0.54
660.04	R2	1.256802E-08	1.256359E-08	0.51	660.11	660.11	0.08	661.00	660.03	0.00	0.55
700.47	R2	1.890124E-08	1.889459E-08	0.51	700.54	700.54	0.07	701.53	700.47	0.00	0.56
699.36	R2	1.869786E-08	1.869128E-08	0.51	699.42	699.42	0.07	700.41	699.36	0.00	0.56
700.00	R2	1.881512E-08	1.880850E-08	0.51	700.07	700.07	0.07	701.06	700.00	0.00	0.56
700.40	R2	1.892227E-08	1.891561E-08	0.51	700.66	700.66	0.25	701.65	700.59	0.19	0.56
699.29	R2	1.871670E-08	1.871011E-08	0.51	699.53	699.53	0.24	700.51	699.46	0.17	0.56
700.00	R2	1.884819E-08	1.884156E-08	0.51	700.25	700.25	0.25	701.24	700.18	0.18	0.56
799.80	R2	4.515964E-08	4.514375E-08	0.51	799.71	799.71	-0.09	800.98	799.70	-0.10	0.59
900.19	R2	9.380092E-08	9.376791E-08	0.51	899.95	899.95	-0.24	901.55	900.02	-0.17	0.62
900.01	R2	9.385286E-08	9.381983E-08	0.51	900.03	900.03	0.02	901.64	900.10	0.09	0.62
961.05	R2	1.380435E-07	1.379949E-07	0.51	960.88	960.88	-0.17	962.71	961.01	-0.04	0.64
962.03	R2	1.388408E-07	1.387920E-07	0.51	961.83	961.83	-0.20	963.67	961.96	-0.06	0.64
961.78	R2	1.386374E-07	1.385886E-07	0.51	961.59	961.59	-0.19	963.42	961.72	-0.06	0.64
1000.33	R2	1.736251E-07	1.735640E-07	0.51	1000.12	1000.12	-0.22	1002.10	1000.29	-0.04	0.65
999.18	R2	1.725317E-07	1.724710E-07	0.51	999.00	999.00	-0.18	1000.98	999.18	0.00	0.65
1000.00	R2	1.733113E-07	1.732503E-07	0.51	999.80	999.80	-0.20	1001.78	999.97	-0.03	0.65
1000.17	R2	1.734897E-07	1.734286E-07	0.51	999.98	999.98	-0.20	1001.96	1000.15	-0.02	0.65

Table 18 - results of the NPL measurements with the LP5 thermometer, analysed using the calibration fits for range R1

t_{BB} / °C	Range used	Bgrd corrected signal/ A	Signal with range R2/ A	lab U (k=2) / °C	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncertainty* / °C
232.03	R1	3.061856E-12	3.062934E-12	0.26	232.05	232.05	0.02	232.36	232.08	0.05	0.27
249.99	R1	5.672646E-12	5.674643E-12	0.25	249.84	249.84	-0.15	250.16	249.85	-0.14	0.26
249.99	R1	5.681434E-12	5.683434E-12	0.25	249.89	249.89	-0.10	250.20	249.90	-0.09	0.26
250.06	R1	5.695074E-12	5.697079E-12	0.25	249.96	249.96	-0.09	250.28	249.97	-0.08	0.26
300.06	R1	2.618329E-11	2.619250E-11	0.25	299.90	299.90	-0.16	300.23	299.86	-0.19	0.26
400.00	R1	2.817535E-10	2.818527E-10	0.25	399.92	399.92	-0.07	400.32	399.82	-0.18	0.27
400.06	R1	2.821617E-10	2.822610E-10	0.25	399.99	399.99	-0.07	400.39	399.89	-0.17	0.27
419.42	R1	4.128693E-10	4.130146E-10	0.24	419.36	419.36	-0.07	419.77	419.24	-0.18	0.27
499.89	R2	1.639063E-09	1.639063E-09	0.25	499.86	499.86	-0.04	500.37	499.71	-0.19	0.29
499.89	R1	1.638486E-09	1.639063E-09	0.25	499.86	499.86	-0.04	500.37	499.71	-0.19	0.29
500.22	R1	1.652192E-09	1.652774E-09	0.50	500.40	500.40	0.18	500.92	500.25	0.03	0.52
599.66	R1	6.368180E-09	6.370422E-09	0.50	599.76	599.76	0.10	600.44	599.59	-0.07	0.54
600.43	R1	6.428283E-09	6.430545E-09	0.50	600.54	600.54	0.11	601.22	600.37	-0.06	0.54
600.04	R1	6.398232E-09	6.400484E-09	0.50	600.15	600.15	0.11	600.83	599.98	-0.06	0.54
660.04	R2	1.256802E-08	1.256802E-08	0.51	660.11	660.11	0.08	660.92	659.95	-0.09	0.55
700.47	R2	1.890124E-08	1.890124E-08	0.51	700.54	700.54	0.07	701.43	700.38	-0.09	0.56
699.36	R2	1.869786E-08	1.869786E-08	0.51	699.42	699.42	0.07	700.32	699.26	-0.10	0.56
700.00	R2	1.881512E-08	1.881512E-08	0.51	700.07	700.07	0.07	700.96	699.91	-0.09	0.56
700.40	R2	1.892227E-08	1.892227E-08	0.51	700.66	700.66	0.25	701.55	700.49	0.09	0.56
699.29	R2	1.871670E-08	1.871670E-08	0.51	699.53	699.53	0.24	700.42	699.36	0.07	0.56
700.00	R2	1.884819E-08	1.884819E-08	0.51	700.25	700.25	0.25	701.14	700.09	0.09	0.56
799.80	R2	4.515964E-08	4.515964E-08	0.51	799.71	799.71	-0.09	800.86	799.58	-0.22	0.59
900.19	R2	9.380092E-08	9.380092E-08	0.51	899.95	899.95	-0.24	901.42	899.88	-0.31	0.62
900.01	R2	9.385286E-08	9.385286E-08	0.51	900.03	900.03	0.02	901.50	899.96	-0.05	0.62
961.05	R2	1.380435E-07	1.380435E-07	0.51	960.88	960.88	-0.17	962.55	960.86	-0.20	0.64
962.03	R2	1.388408E-07	1.388408E-07	0.51	961.83	961.83	-0.20	963.51	961.81	-0.22	0.64
961.78	R2	1.386374E-07	1.386374E-07	0.51	961.59	961.59	-0.19	963.27	961.57	-0.21	0.64
1000.33	R2	1.736251E-07	1.736251E-07	0.51	1000.12	1000.12	-0.22	1001.94	1000.13	-0.20	0.65
999.18	R2	1.725317E-07	1.725317E-07	0.51	999.00	999.00	-0.18	1000.82	999.02	-0.17	0.65
1000.00	R2	1.733113E-07	1.733113E-07	0.51	999.80	999.80	-0.20	1001.62	999.81	-0.19	0.65
1000.17	R2	1.734897E-07	1.734897E-07	0.51	999.98	999.98	-0.20	1001.80	999.99	-0.18	0.65

Table 19 - results of the NPL measurements with the LP5 thermometer, analysed using the calibration fits for range R2

1.3 THE FIXED-POINT RESULTS

Fixed point	Gain used	Bgrd corrected signal/ V	lab U (*k*=2) / °C	Signal at 10^6 gain/ V	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (*k=2*) with range ratio & drift uncert/ °C
In	10^10	0.775825	0.08	7.68959E-05	156.623	156.623	0.025	156.714	156.691	0.093	0.09
Sn	10^9	1.836495	0.06	0.0016779	231.896	231.896	-0.032	231.967	231.937	0.009	0.07
Zn	10^7	1.984784	0.02	0.198601	419.527	419.527	0.000	419.588	419.530	0.003	0.07
Al	10^6	5.488178	0.03	5.488178	660.335	660.335	0.012	660.459	660.354	0.031	0.13
Ag	10^5	5.653369	0.07	56.582364	961.776	961.776	-0.004	962.100	961.916	0.136	0.23

Table 20 – results of the NPL fixed-point measurements with the INRiM thermometer – analysed using the calibration fits to the data

Fixed point	Gain used	Bgrd corrected signal/ V	Bgrd corrected signal ignoring gain/ V	lab U (*k*=2) / °C	Signal at 10^6 gain / V	Temp from NPL fit/ °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (*k=2*) with range ratio & drift uncert/ °C
Zn	10^7	1.98204E-07	1.982037	0.06	0.198307	419.447	419.537	0.010	419.508	419.540	0.013	0.09
Zn	10^6	1.98307E-07	0.198307	0.06	0.198307	419.447	419.537	0.010	419.508	419.540	0.013	0.09
Ag 1	10^5	5.64260E-05	5.642604	0.20	56.444951	961.361	961.647	-0.133	961.685	961.787	0.007	0.30
Ag 2	10^4	5.70133E-05	0.570133	0.20	56.453143	961.385	961.671	-0.109	961.710	961.811	0.031	0.30

Table 21 – results of the CEM fixed-point measurements with the INRiM thermometer – analysed using the calibration fits to the data

Fixed point	Gain used	Bgrd corrected Signal / mV	Signal corrected for emissivity / mV	Bgrd corrected signal/ V	lab U (*k*=2) / °C	Signal at 10^6 gain / V	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift / °C	(t_{fit} - t_{BB}) / °C	U (*k=2*) with range ratio & drift uncert/ °C
In	10^9	83.71	83.75	0.08375	0.016	7.65000E-05	156.516	156.538	-0.060	156.606	156.606	0.008	0.032
Sn	10^9	1833.09	1833.88	1.83388	0.014	0.0016752	231.850	231.881	-0.047	231.922	231.922	-0.006	0.040
Zn	10^7	1981.61	1982.46	1.98246	0.018	0.198341	419.456	419.514	-0.013	419.517	419.517	-0.010	0.073
Al	10^6	5478.84	5481.20	5.48120	0.022	5.481196	660.210	660.316	-0.007	660.335	660.335	0.012	0.129
Ag	10^5	5642.67	5645.10	5.64510	0.026	56.475224	961.452	961.636	-0.144	961.777	961.777	-0.003	0.224

Table 22– results of the INRiM fixed-point measurements with the INRiM thermometer – analysed using the calibration fits to the data

Fixed point	Gain used	Bgrd corrected signal/ V	lab U (k=2) / °C	Signal at 10^6 gain/ V	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$/ °C	Temp from INRiM fit/ °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$ / °C	U (k=2) with range ratio & drift uncert/ °C
In	10^10	0.772745	0.062	7.65952E-05	156.542	156.551	-0.047	156.632	156.620	0.021	0.078
Sn	10^9	1.834863	0.020	0.0016762	231.867	231.880	-0.048	231.938	231.921	-0.007	0.043
Zn	10^7	1.983950	0.026	0.198495	419.498	419.523	-0.004	419.559	419.526	-0.001	0.075

Table 23– results of the UME fixed-point measurements with the INRiM thermometer – analysed using the calibration fits to the data

Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R1 / A	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$ / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$ / °C	U (k=2) with range ratio & drift uncert/ °C
Sn	R1	3.04800E-12	0.09	3.04800E-12	231.920	231.920	-0.008	232.258	231.975	0.047	0.11
Zn	R1	4.14357E-10	0.04	4.14357E-10	419.545	419.545	0.018	420.011	419.477	-0.050	0.13
Al	R2	1.25937E-08	0.07	1.25893E-08	660.308	660.308	-0.015	661.199	660.229	-0.094	0.23
Ag	R2	1.38800E-07	0.13	1.38751E-07	961.784	961.784	0.004	963.618	961.921	0.141	0.40

Table 24 – results of the NPL fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R1

Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R2 / A	Temp from NPL fit/ °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$ / °C	Temp from INRiM fit / °C	Temp corrected for Zn point drift/ °C	$(t_{fit} - t_{BB})$ / °C	U (k=2) with range ratio & drift uncert/ °C
Zn	R1	4.14357E-10	0.04	4.14503E-10	419.545	419.545	0.018	419.963	419.429	-0.098	0.13
Al	R2	1.25937E-08	0.07	1.25937E-08	660.308	660.308	-0.015	661.111	660.141	-0.182	0.23
Ag	R2	1.38800E-07	0.13	1.38800E-07	961.784	961.784	0.004	963.466	961.768	-0.012	0.40

Table 25– results of the NPL fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R2

(Note that the results for the Sn point are not included for the R2 comparison as they can all be compared on range R1)

Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R1/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift‡ / °C	$(t_{fit} - t_{BB})$/ °C	Temp from INRiM fit / °C	Temp corrected for average Zn point drift / °C	$(t_{fit} - t_{BB})$ / °C	U (k=2) with gain ratio & drift uncert/ °C
Zn 1	R1	4.14927E-10	0.08	4.14927E-10	419.617	419.667	0.140	420.083	419.600	0.073	0.28
Zn 1	R2	4.15112E-10	0.08	4.14925E-10	419.617	419.667	0.140	420.083	419.600	0.073	0.28
Zn 2	R1	4.12569E-10	0.07	4.12569E-10	419.319	419.369	-0.158	419.785	419.302	-0.225	0.28
Zn 2	R2	4.12714E-10	0.07	4.12527E-10	419.314	419.364	-0.163	419.779	419.296	-0.231	0.28
Ag 1	R2	1.38577E-07	0.28	1.38514E-07	961.500	961.659	-0.121	963.333	961.797	0.017	0.94
Ag 2	R2	1.38002E-07	0.12	1.37940E-07	960.810	960.969	-0.811	962.641	961.105	-0.675	0.90

Table 26 – results of the CEM fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R1

‡ average of the two CEM zinc point check measurements

Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R2/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift / °C	$(t_{fit} - t_{BB})$/ °C	Temp from INRiM fit / °C	Temp corrected for average Zn point drift / °C	$(t_{fit} - t_{BB})$ / °C	U (k=2) with gain ratio & drift uncert/ °C
Zn 1	R2	4.15112E-10	0.08	4.15112E-10	419.622	419.672	0.145	420.040	419.557	0.030	0.28
Zn 2	R2	4.12714E-10	0.07	4.12714E-10	419.319	419.369	-0.158	419.736	419.253	-0.274	0.28
Ag 1	R2	1.38577E-07	0.28	1.38577E-07	961.516	961.675	-0.105	963.197	961.662	-0.118	0.93
Ag 2	R2	1.38002E-07	0.12	1.38002E-07	960.827	960.986	-0.794	962.505	960.970	-0.810	0.89

Table 27 – results of the CEM fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R2

Fixed point	Range used	Bgrd corrected signal/ A	Signal corrected for emissivity/ A	lab U (k=2) / °C	Signal on range R1/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM calibration / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with gain ratio & drift uncert/ °C
Sn	R1	3.01179E-12	3.01309E-12	0.516	3.01309E-12	231.600	231.883	-0.045	231.938	231.938	0.010	0.520
Zn	R1	4.10187E-10	4.10363E-10	0.022	4.10363E-10	419.039	419.572	0.045	419.504	419.504	-0.023	0.122
Al	R2	1.24868E-08	1.24922E-08	0.020	1.24763E-08	659.453	660.421	0.098	660.342	660.342	0.019	0.219
Ag	R2	1.37339E-07	1.37398E-07	0.028	1.37224E-07	959.948	961.642	-0.138	961.775	961.775	-0.005	0.383

Table 28 – results of the INRiM fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R1

Fixed point	Range used	Bgrd corrected signal/ A	Signal corrected for emissivity/ A	lab U (k=2) / °C	Signal on range R2/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	Temp from INRiM calibration / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB})/ °C	U (k=2) with gain ratio & drift uncert/ °C
Sn	R1	3.01179E-12	3.01309E-12	0.516	3.01691E-12	231.625	231.908	-0.020	231.938	231.938	0.010	0.520
Zn	R1	4.10187E-10	4.10363E-10	0.022	4.10884E-10	419.087	419.620	0.093	419.504	419.504	-0.023	0.122
Al	R2	1.24868E-08	1.24922E-08	0.020	1.24922E-08	659.540	660.508	0.185	660.341	660.341	0.018	0.219
Ag	R2	1.37339E-07	1.37398E-07	0.028	1.37398E-07	960.100	961.794	0.014	961.775	961.775	-0.005	0.383

Table 29 – results of the INRiM fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R2

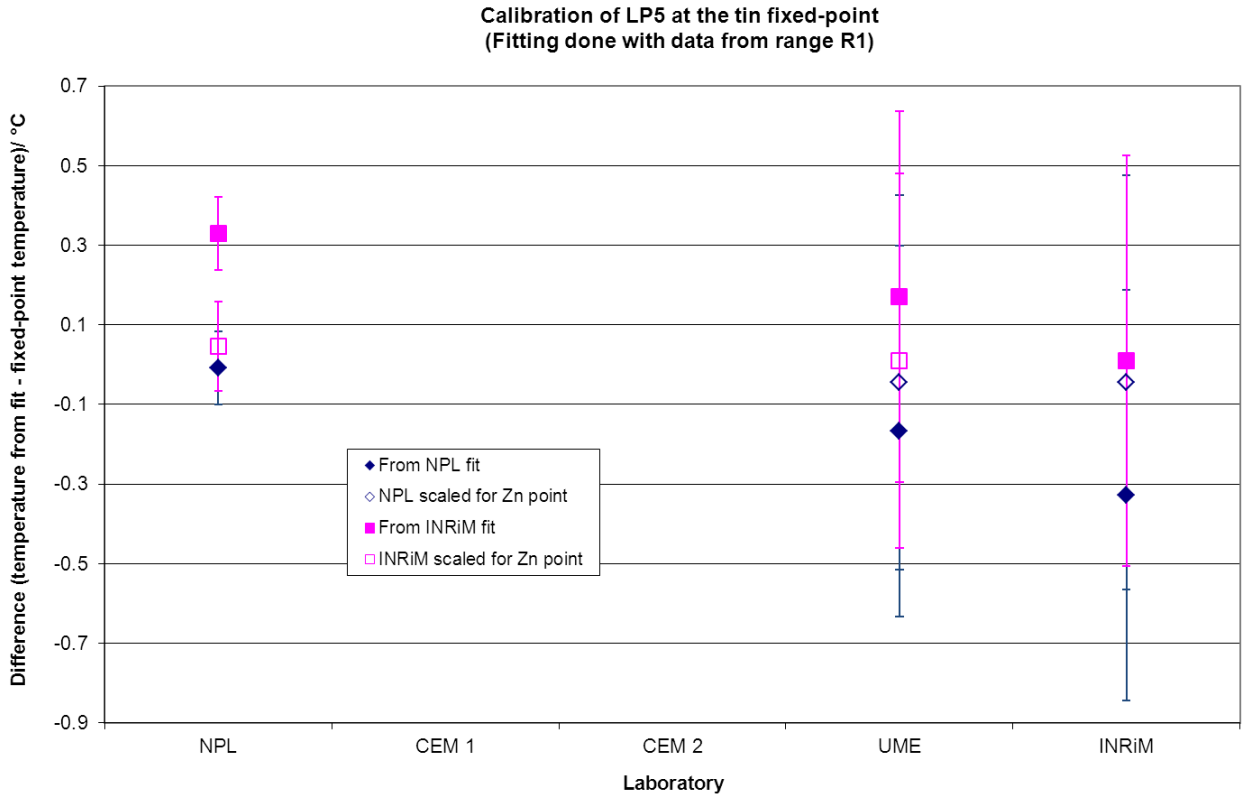
Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R1/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with drift uncert / °C
Sn	R1	3.03065E-12	0.47	3.03065E-12	231.761	231.884	-0.044	232.099	231.938	0.010	0.47
Zn	R2	4.11979E-10	0.13	4.17417E-10	419.931	420.161	0.634	420.397	420.094	0.567	1.29
Al	R2	1.25181E-08	0.05	1.26833E-08	661.016	661.434	1.111	661.908	661.358	1.035	2.29

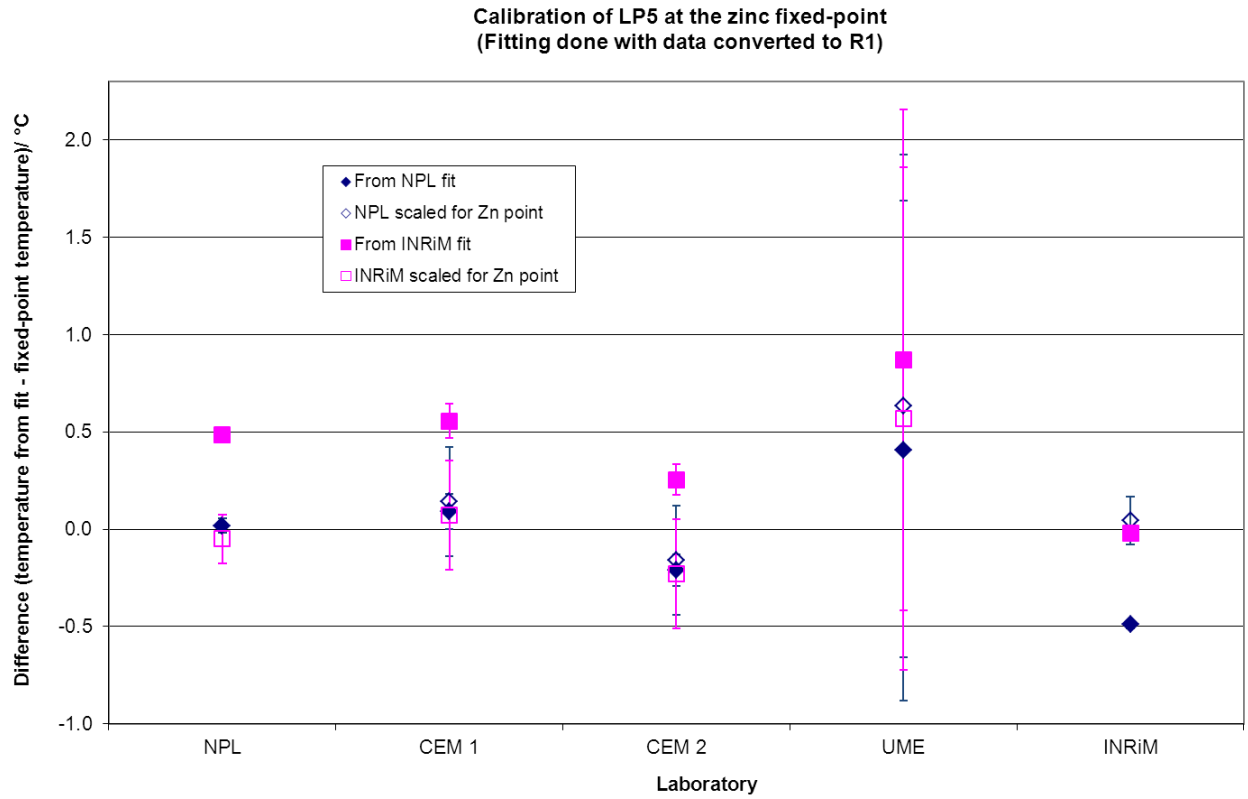
Table 30 – results of the UME fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R1

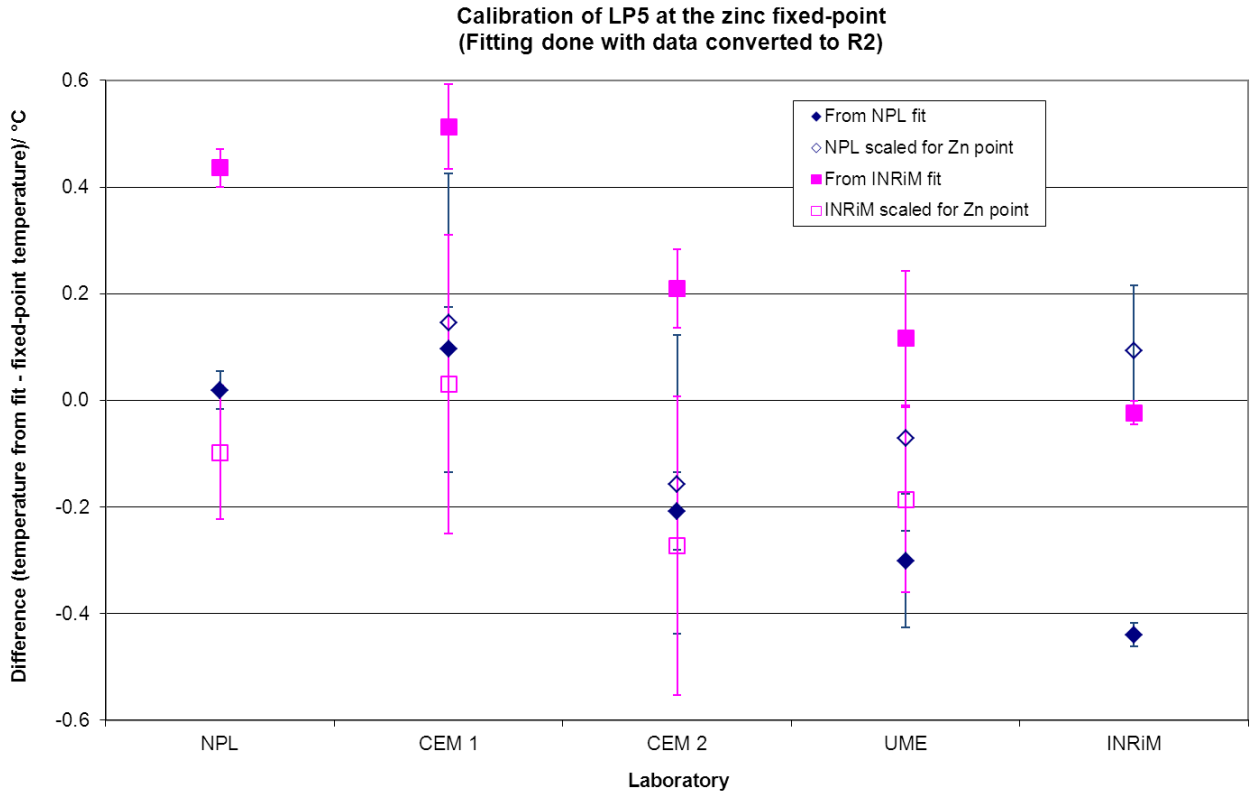
Fixed point	Range used	Bgrd corrected signal/ A	lab U (k=2) / °C	Signal on range R2/ A	Temp from NPL fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	Temp from INRiM fit / °C	Temp corrected for average Zn point drift/ °C	(t_{fit} - t_{BB}) / °C	U (k=2) with drift uncert / °C
Zn	R2	4.11979E-10	0.13	4.11979E-10	419.226	419.456	-0.071	419.643	419.340	-0.187	0.17
Al	R2	1.25181E-08	0.05	1.25181E-08	659.737	660.154	-0.169	660.538	659.988	-0.335	0.22

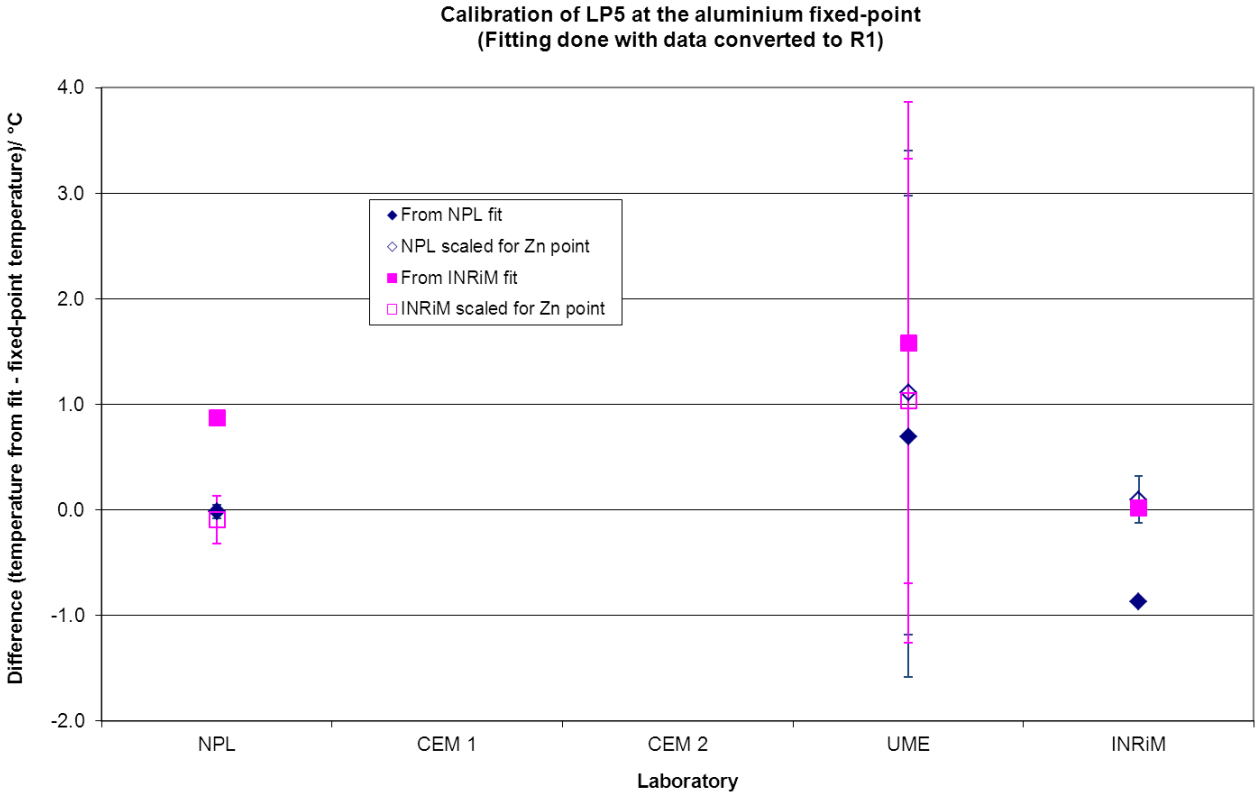
Table 31 – results of the UME fixed-point measurements with the LP5 thermometer – analysed using the calibration fits for range R2

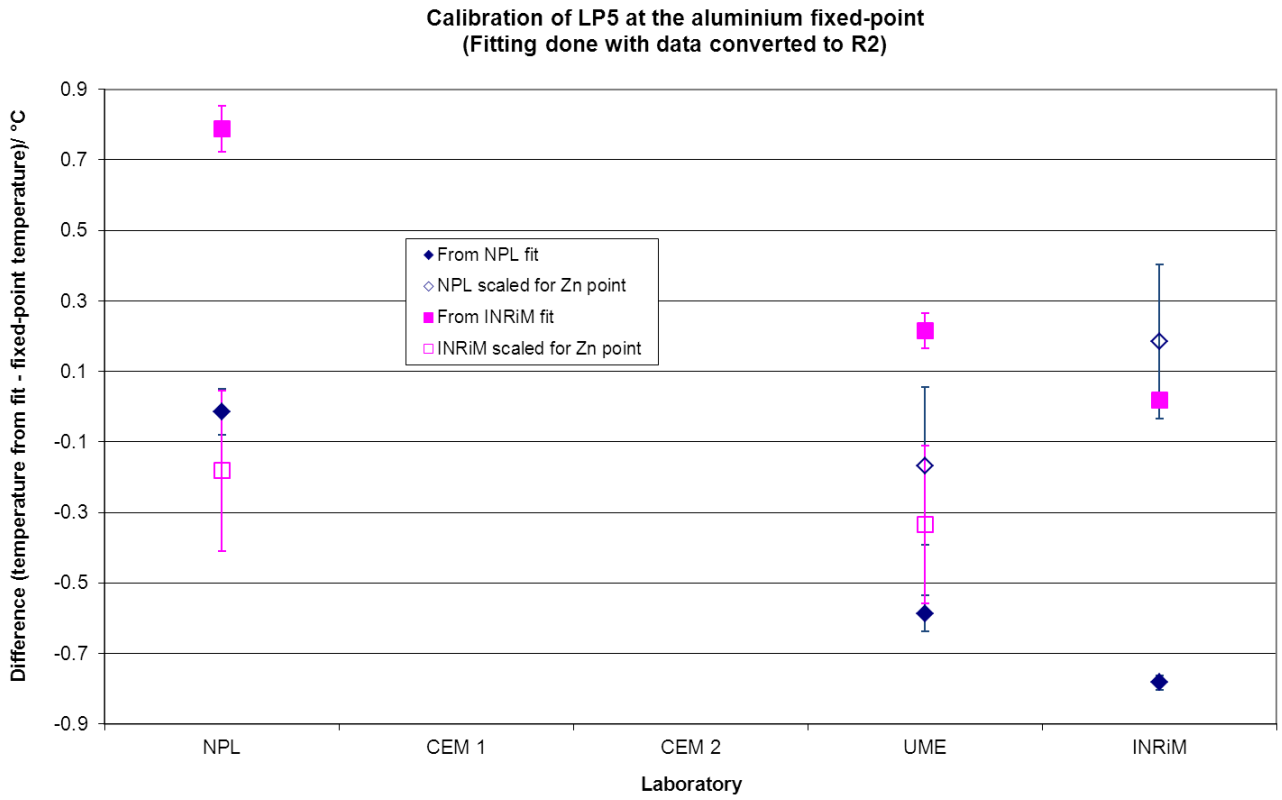
2 PLOTS OF RESULTS OF THE FIXED-POINT MEASUREMENTS USING THE CALIBRATION FITS FOR THE LP5 AND THE INRIM THERMOMETERS

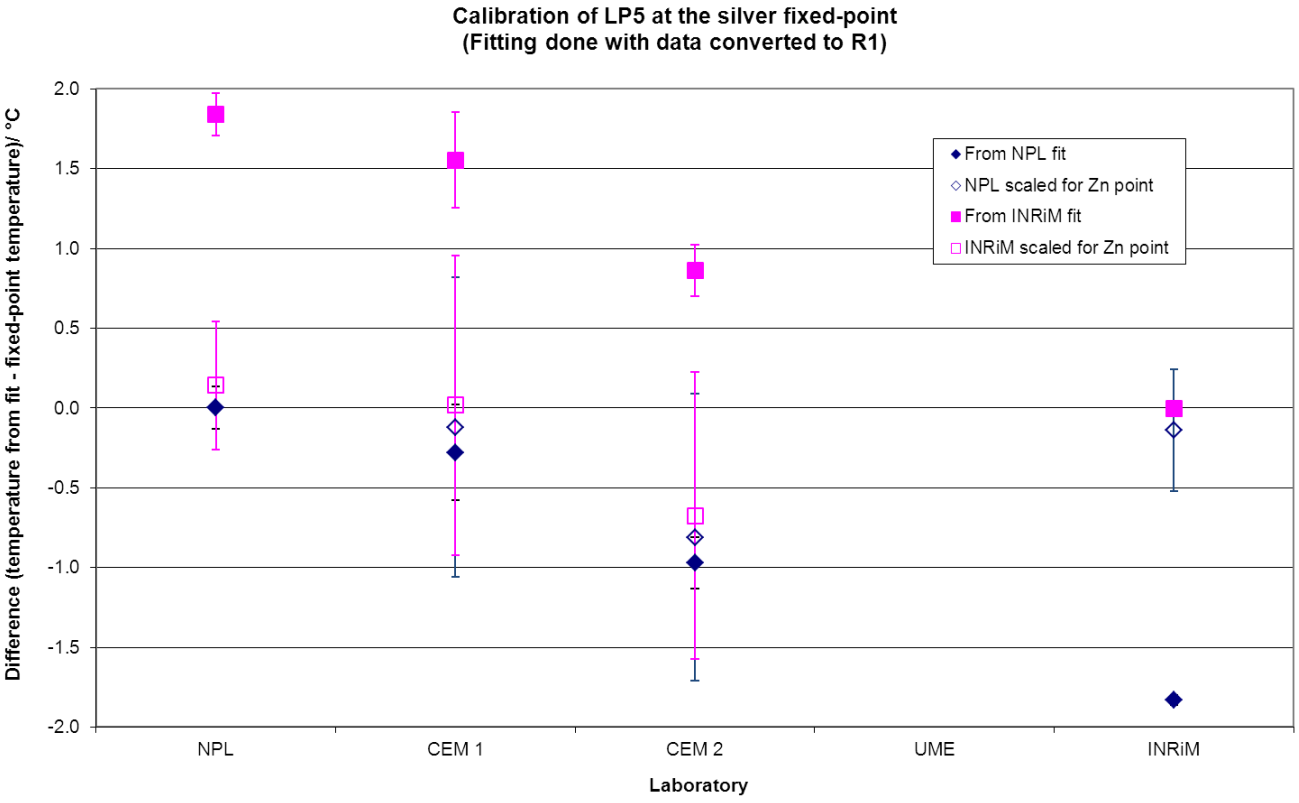


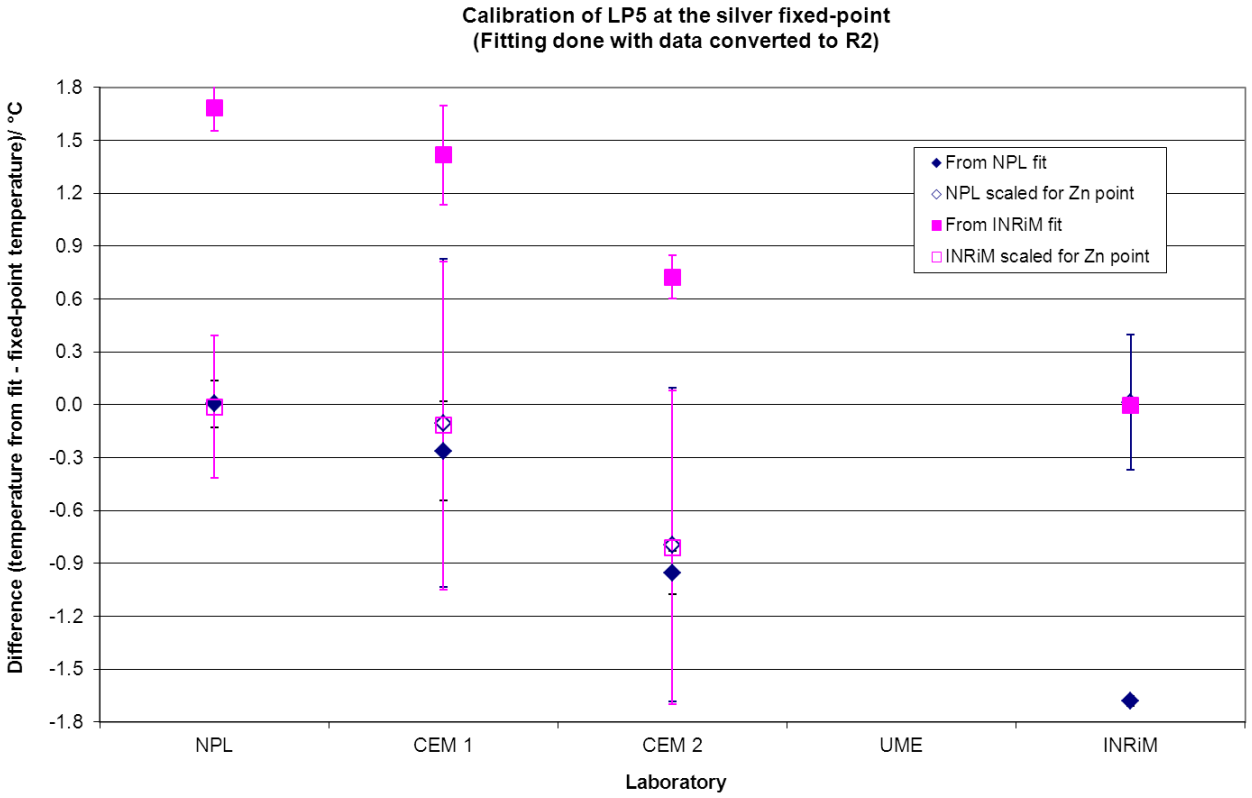


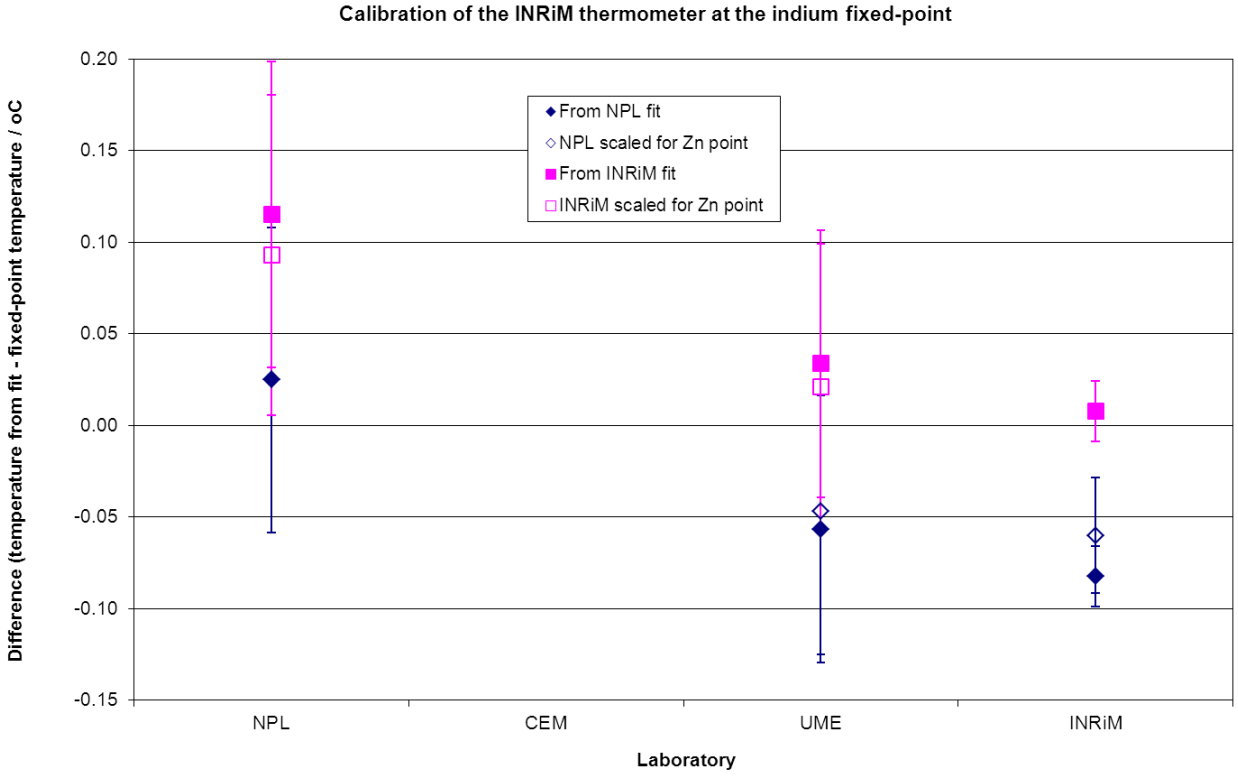

Calibration of LP5 at the zinc fixed-point
(Fitting done with data converted to R2)
Difference (temperature from fit - fixed-point temperature)/ °C
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM 1
CEM 2
UME
INRiM
Laboratory

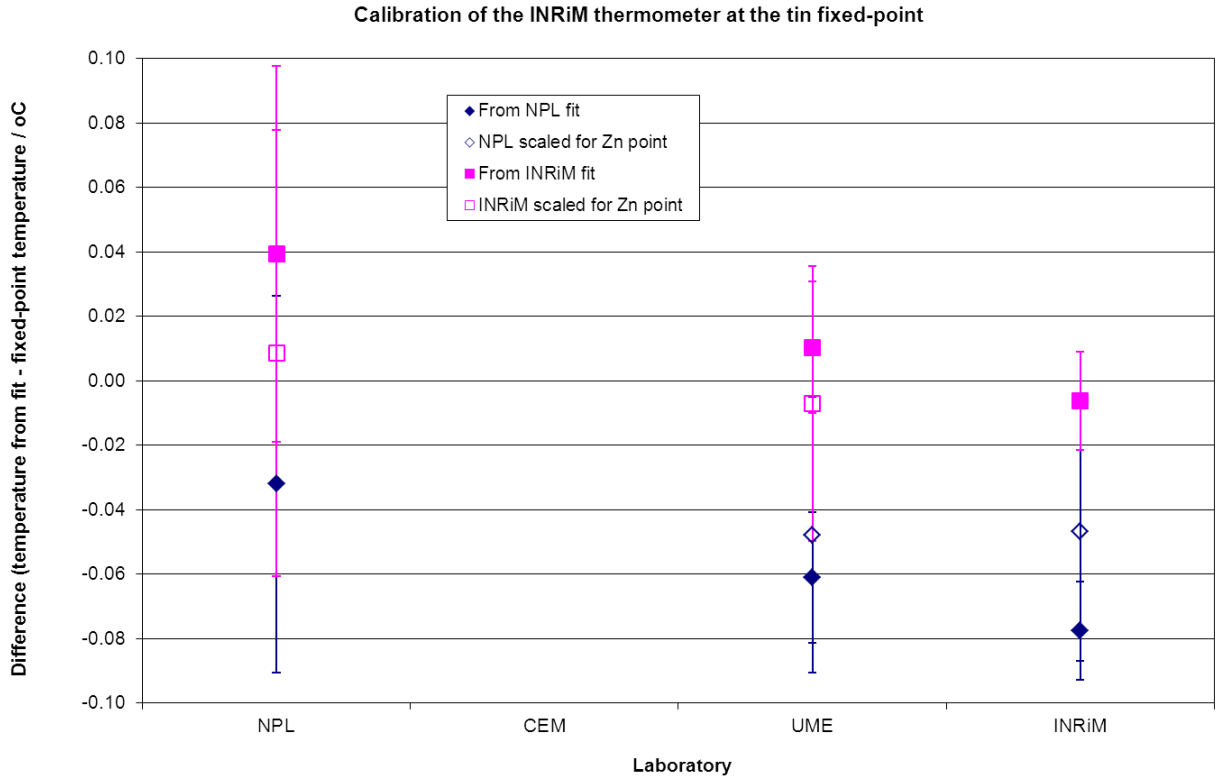

Calibration of LP5 at the aluminium fixed-point
(Fitting done with data converted to R1)
Difference (temperature from fit - fixed-point temperature)/ °C
4.0
3.0
2.0
1.0
0.0
-1.0
-2.0
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM 1
CEM 2
UME
INRiM
Laboratory

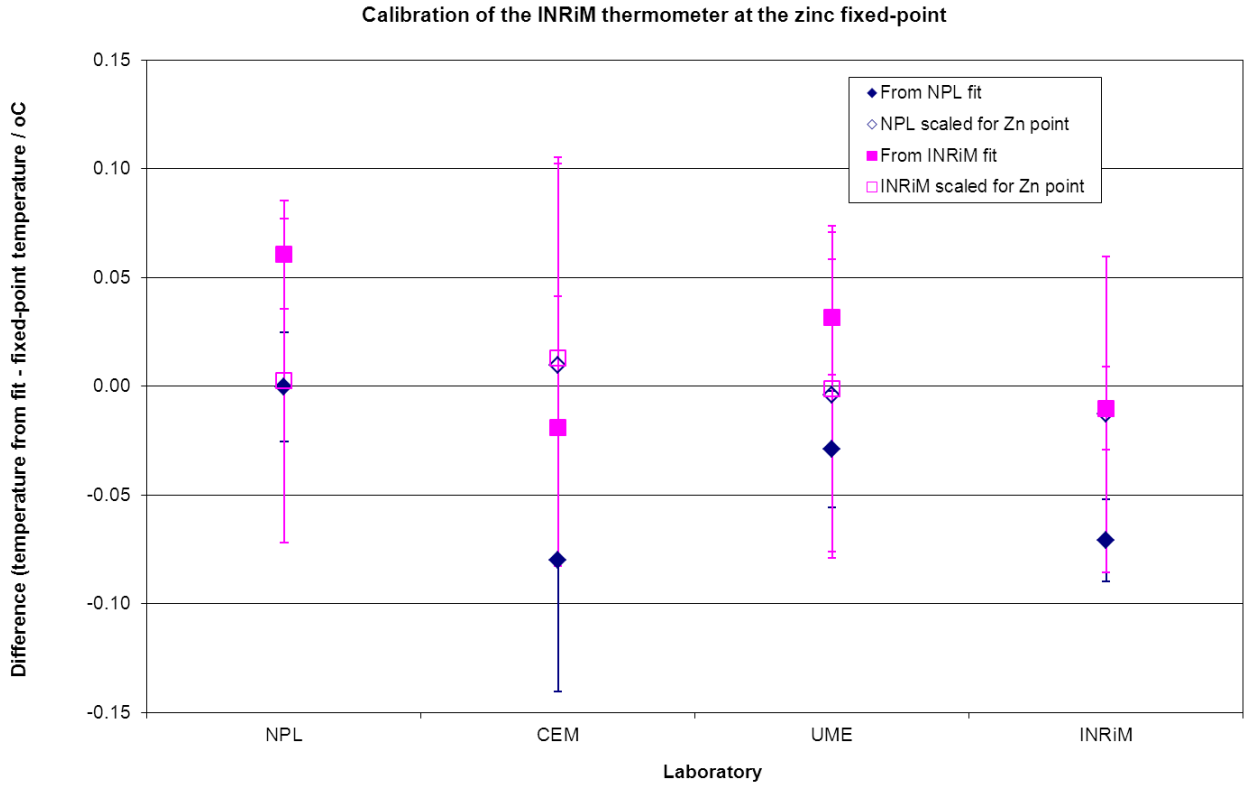

Calibration of LP5 at the aluminium fixed-point
(Fitting done with data converted to R2)
Difference (temperature from fit - fixed-point temperature)/ °C
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.7
-0.9
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM 1
CEM 2
UME
INRiM
Laboratory

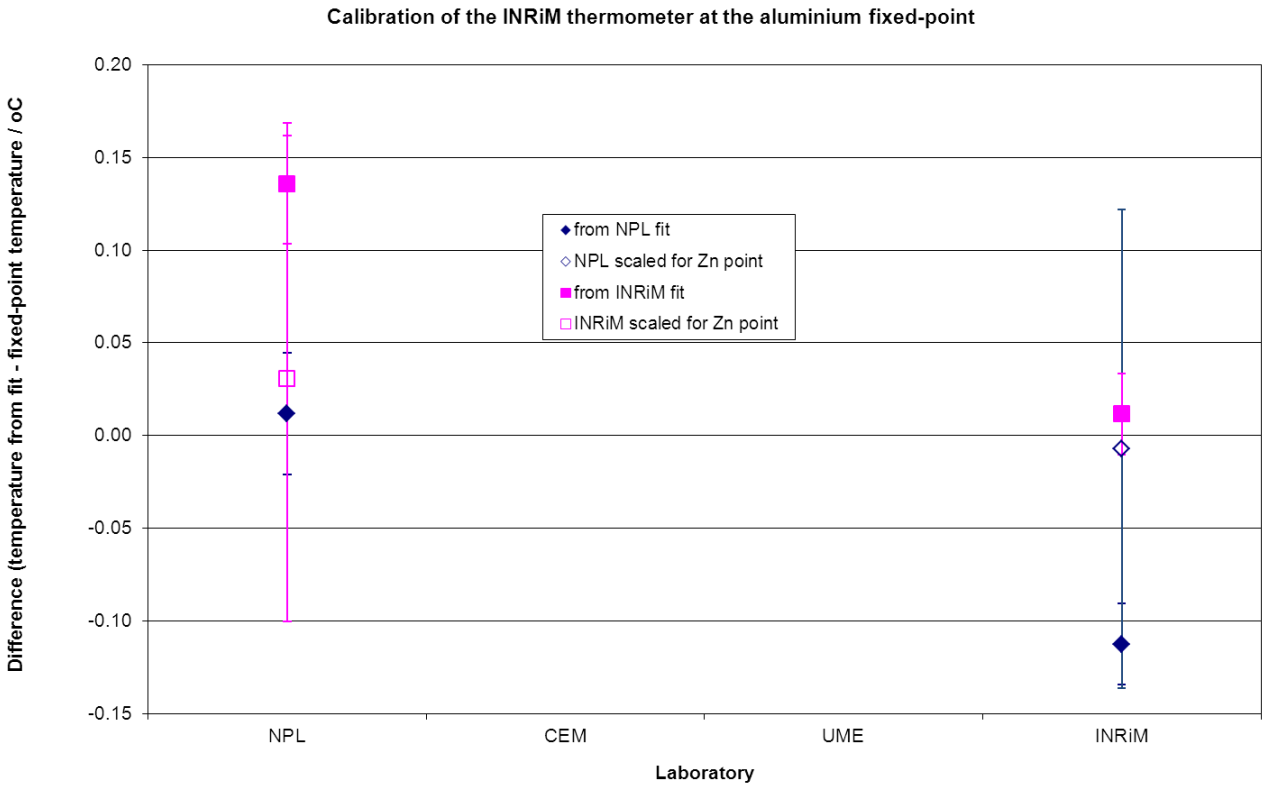

Calibration of LP5 at the silver fixed-point
(Fitting done with data converted to R1)
Difference (temperature from fit - fixed-point temperature)/ °C
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM 1
CEM 2
UME
INRiM
Laboratory

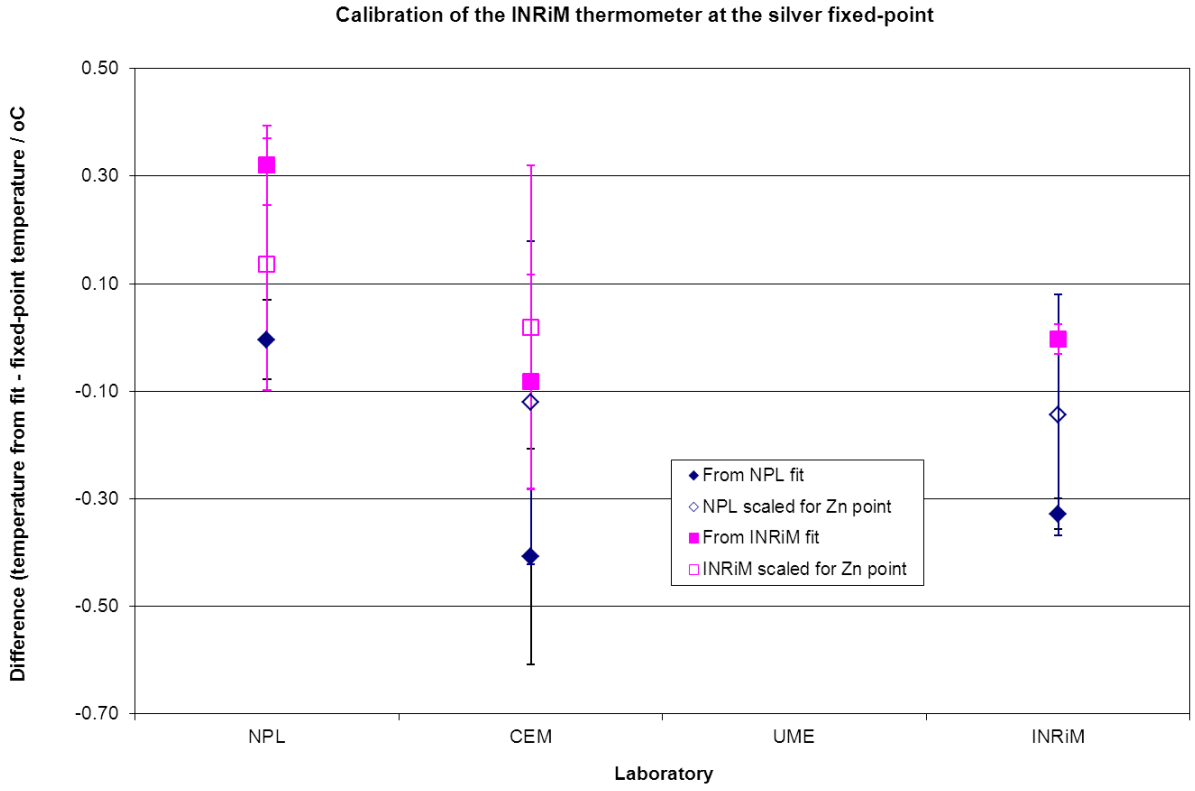

Calibration of LP5 at the silver fixed-point
(Fitting done with data converted to R2)
Difference (temperature from fit - fixed-point temperature)/ °C
1.8
1.5
1.2
0.9
0.6
0.3
0.0
-0.3
-0.6
-0.9
-1.2
-1.5
-1.8
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM 1
CEM 2
UME
INRiM
Laboratory


Calibration of the INRiM thermometer at the indium fixed-point
Difference (temperature from fit - fixed-point temperature / oC
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM
UME
INRiM
Laboratory

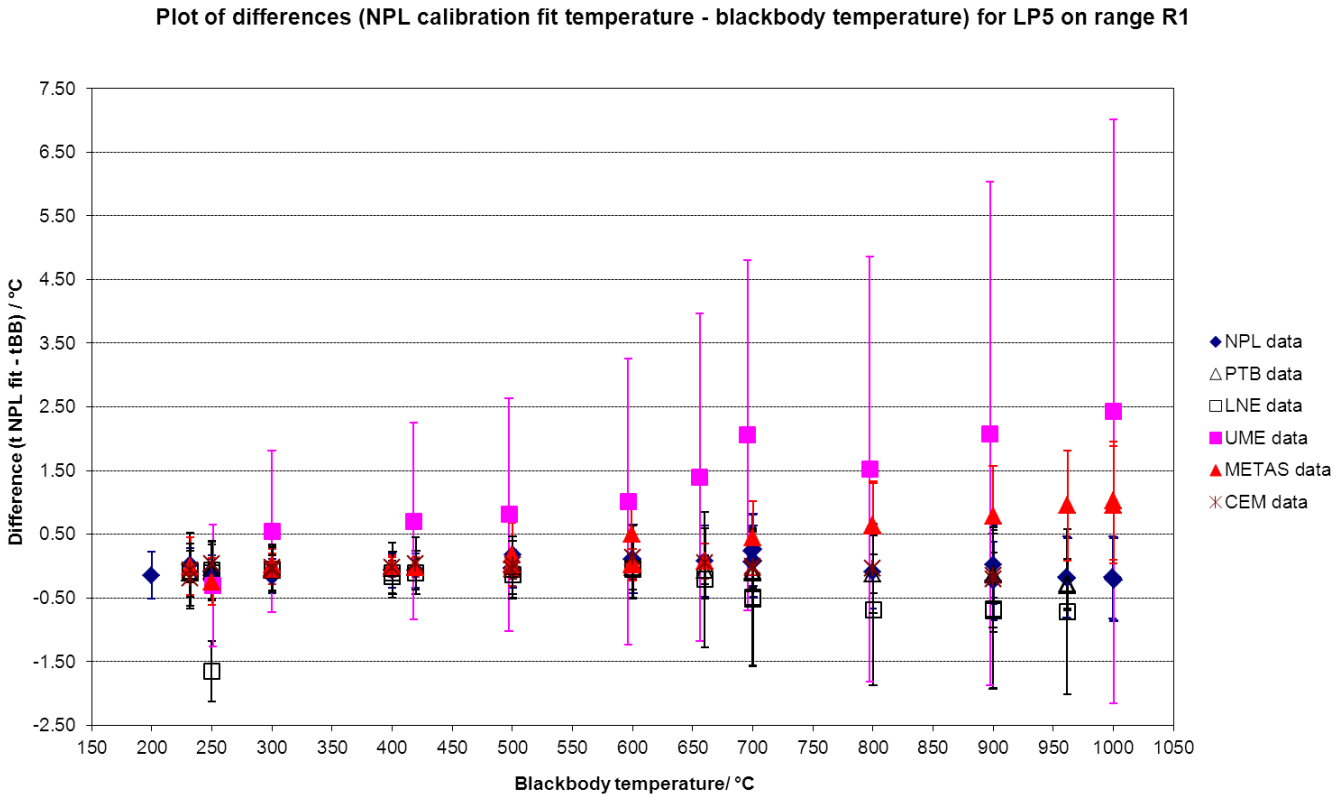

Calibration of the INRiM thermometer at the tin fixed-point
Difference (temperature from fit - fixed-point temperature / oC
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM
UME
INRiM
Laboratory

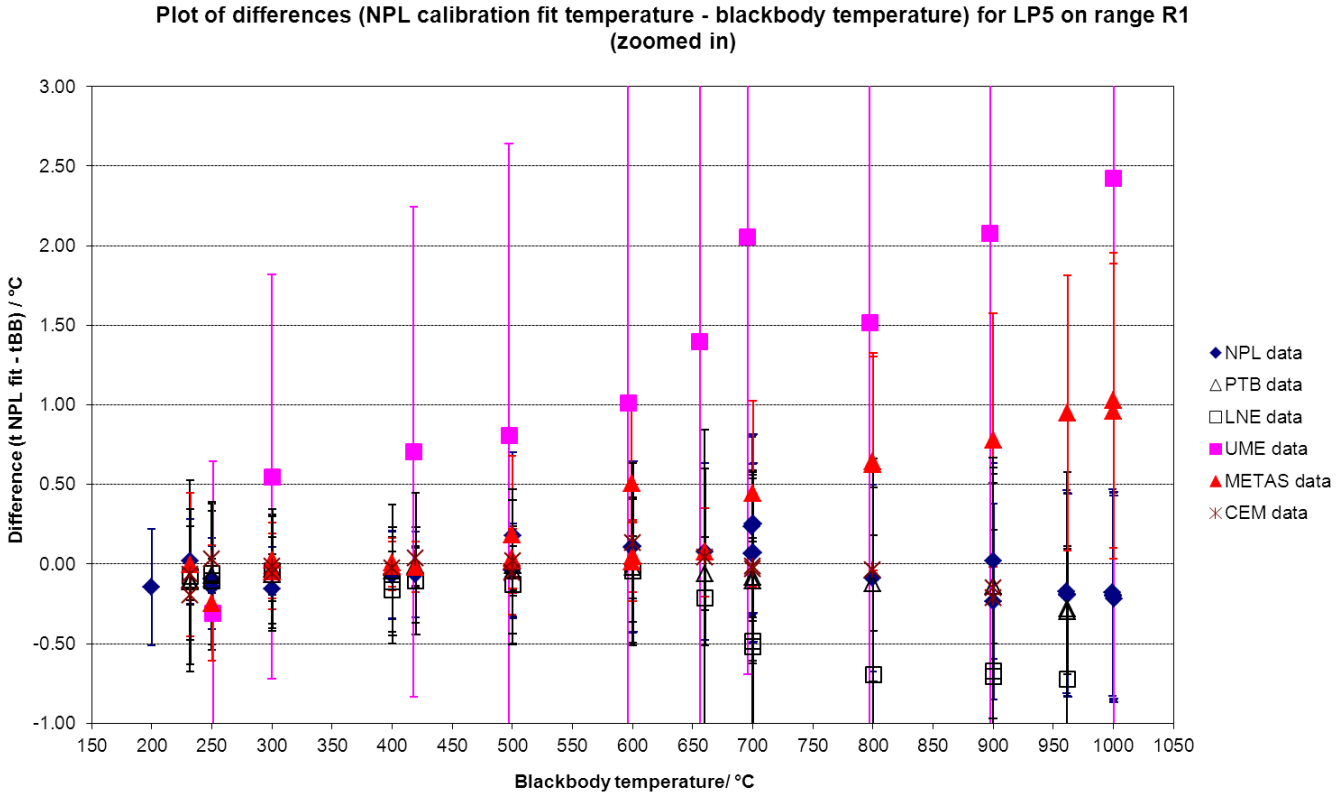

Calibration of the INRiM thermometer at the zinc fixed-point
Difference (temperature from fit - fixed-point temperature / oC
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM
UME
INRiM
Laboratory

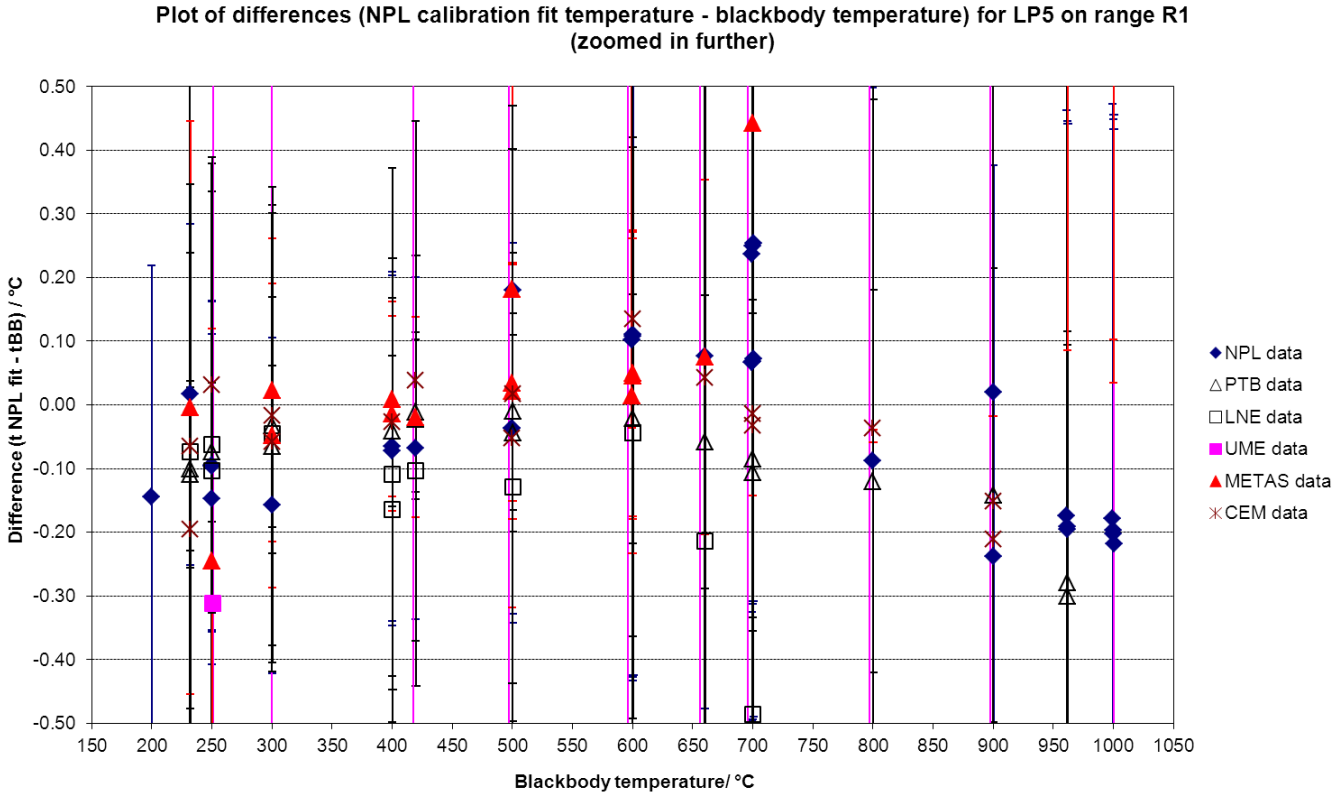

Calibration of the INRiM thermometer at the aluminium fixed-point
Difference (temperature from fit - fixed-point temperature / oC
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
from NPL fit
NPL scaled for Zn point
from INRiM fit
INRiM scaled for Zn point
NPL
CEM
UME
INRiM
Laboratory

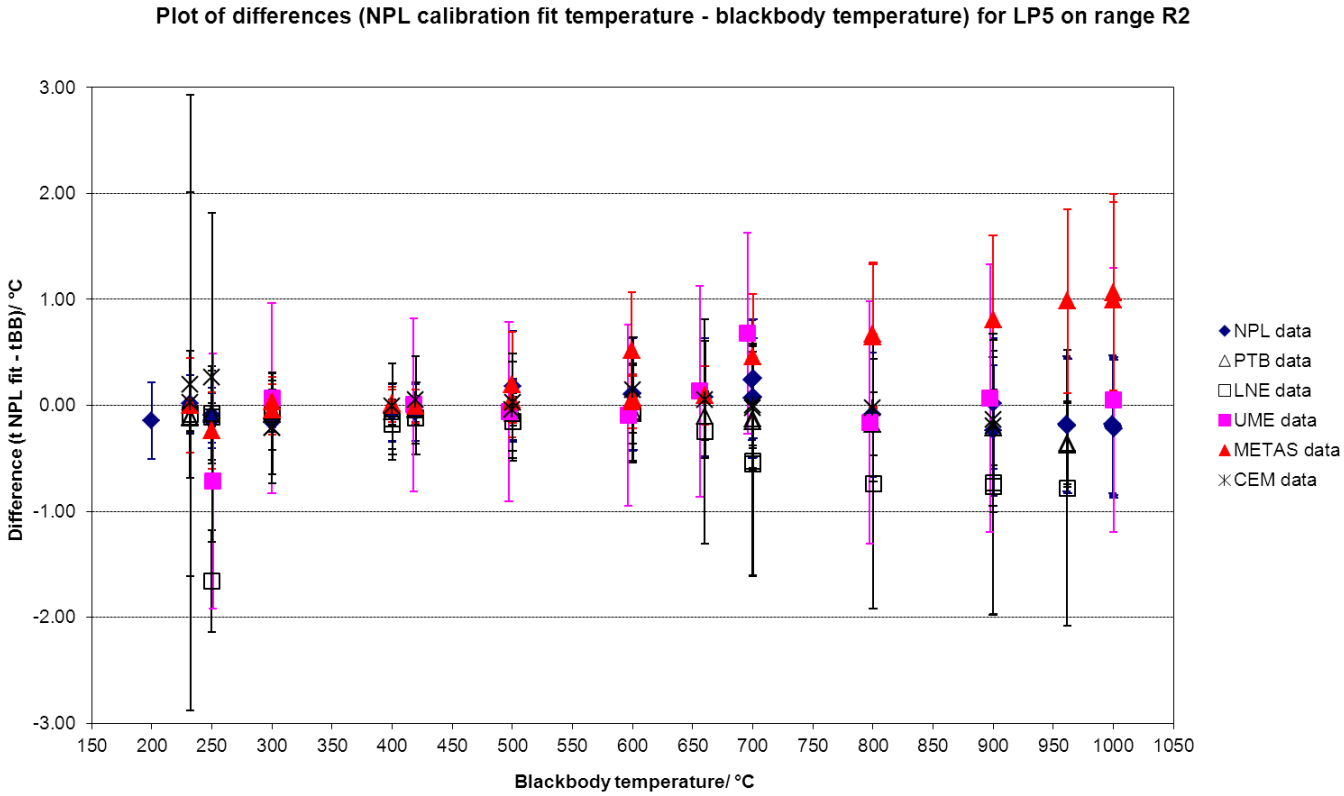

Calibration of the INRiM thermometer at the silver fixed-point
Difference (temperature from fit - fixed-point temperature / oC
0.50
0.30
0.10
-0.10
-0.30
-0.50
-0.70
From NPL fit
NPL scaled for Zn point
From INRiM fit
INRiM scaled for Zn point
NPL
CEM
UME
INRiM
Laboratory

3 DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE LP5 THERMOMETER

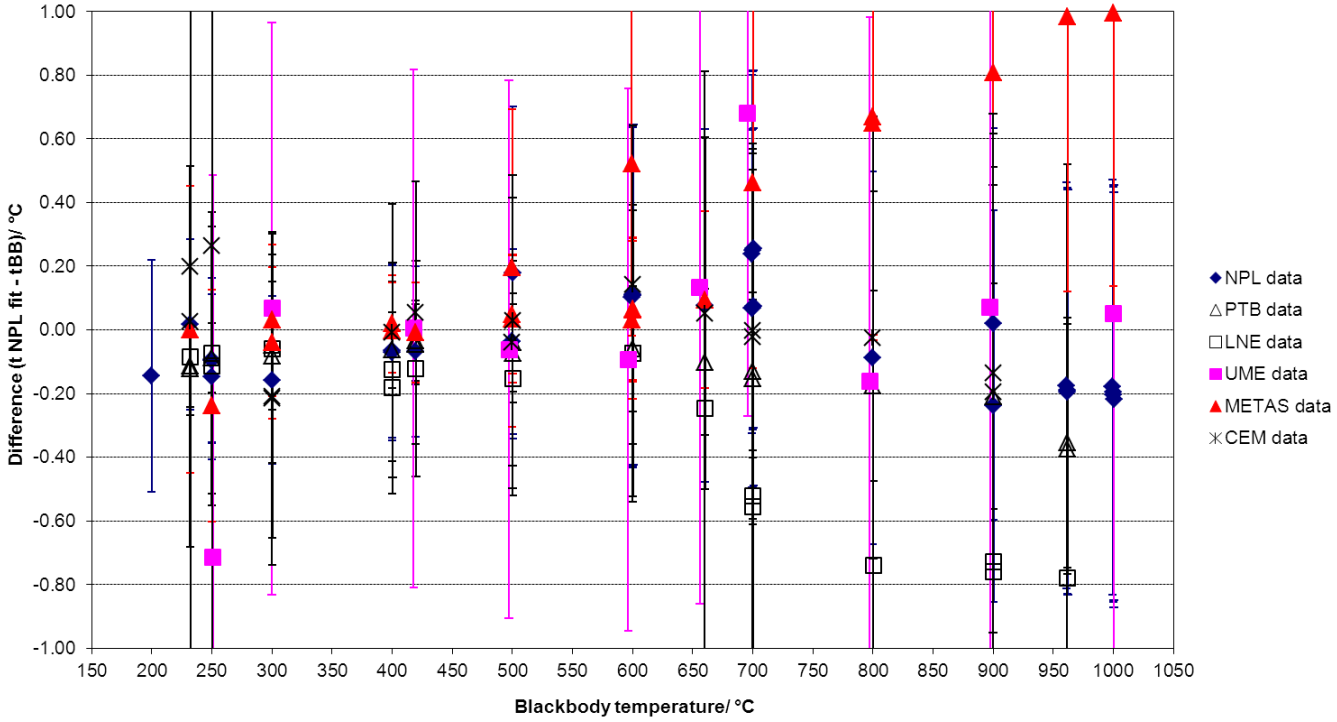




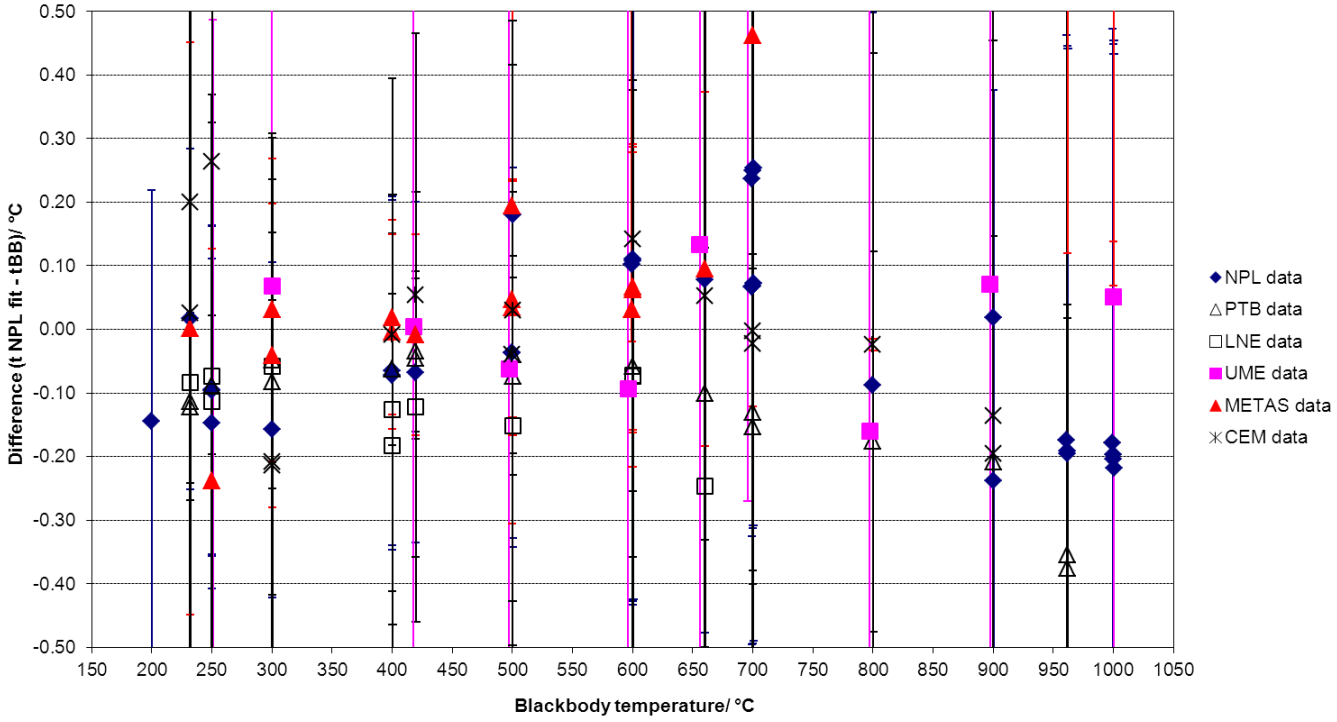

Plot of differences (NPL calibration fit temperature - blackbody temperature) for LP5 on range R1 (zoomed in further)
Difference (t NPL fit - tBB) / °C
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

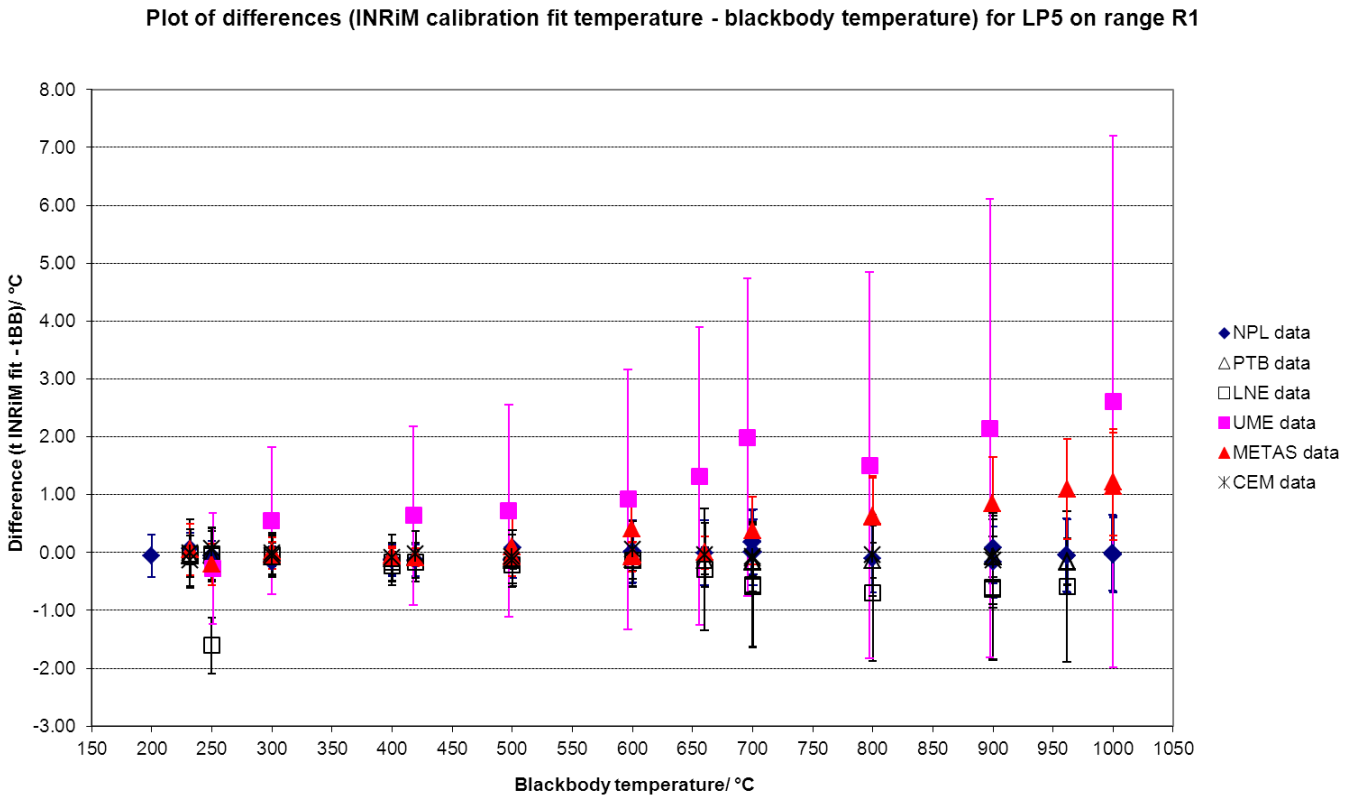

Plot of differences (NPL calibration fit temperature - blackbody temperature) for LP5 on range R2
Difference (t NPL fit - tBB)/ °C
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

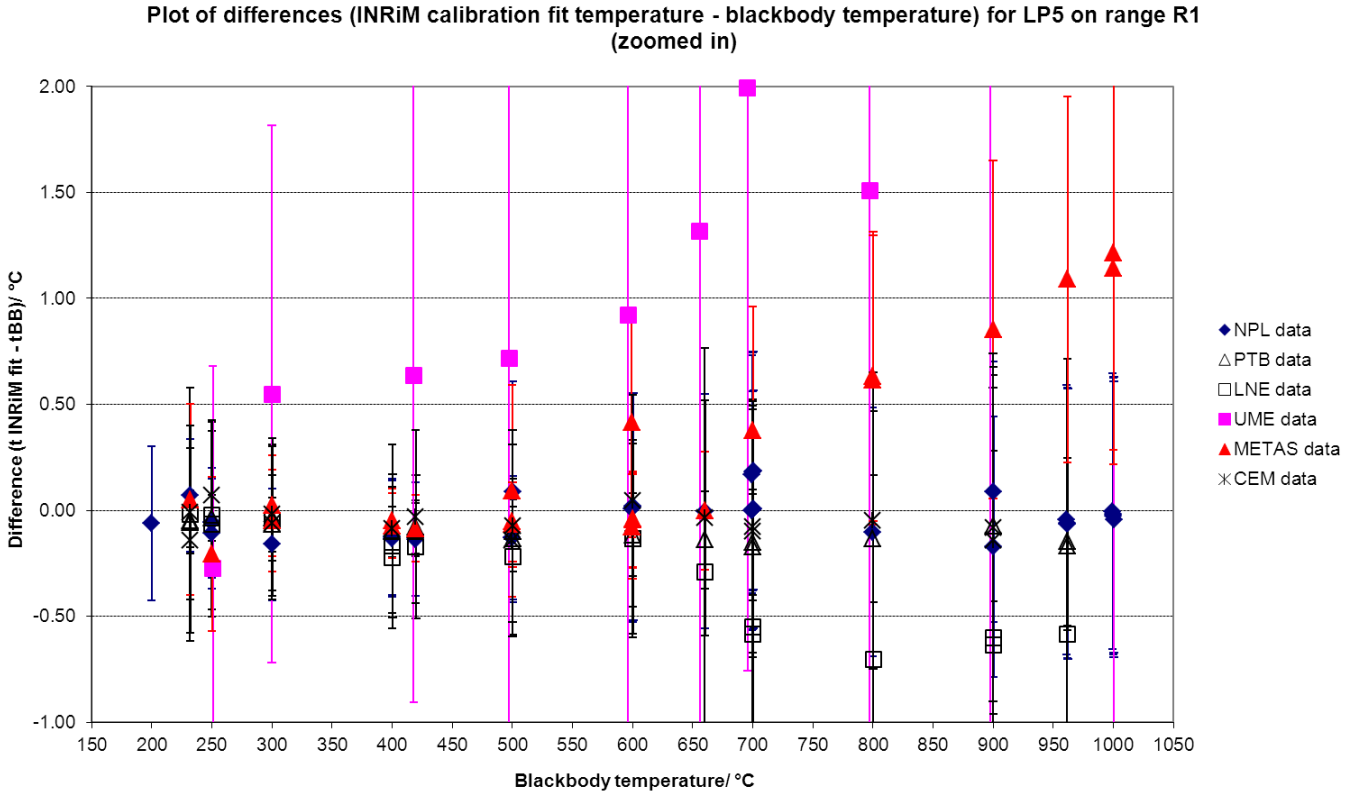
Plot of differences (NPL calibration fit temperature - blackbody temperature) for LP5 on range R2 (zoomed in)

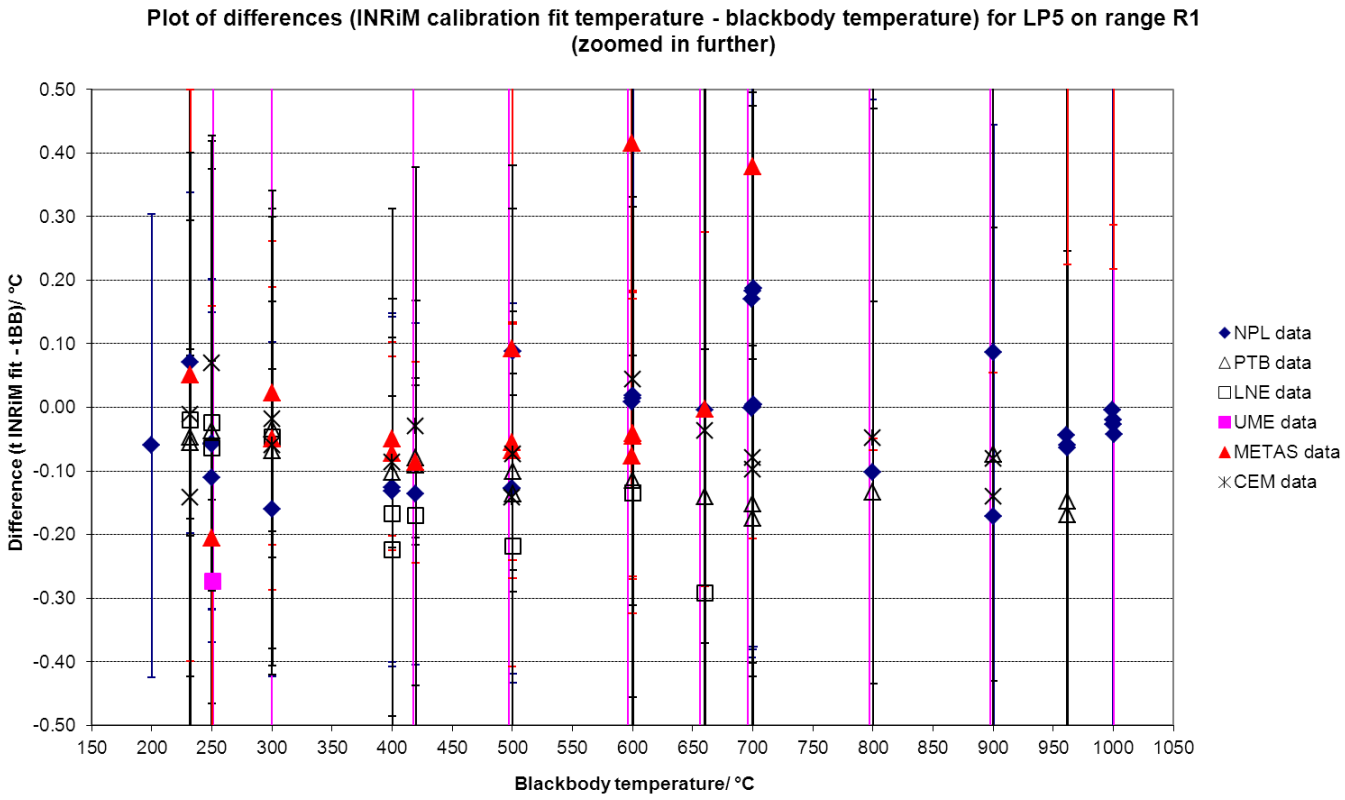


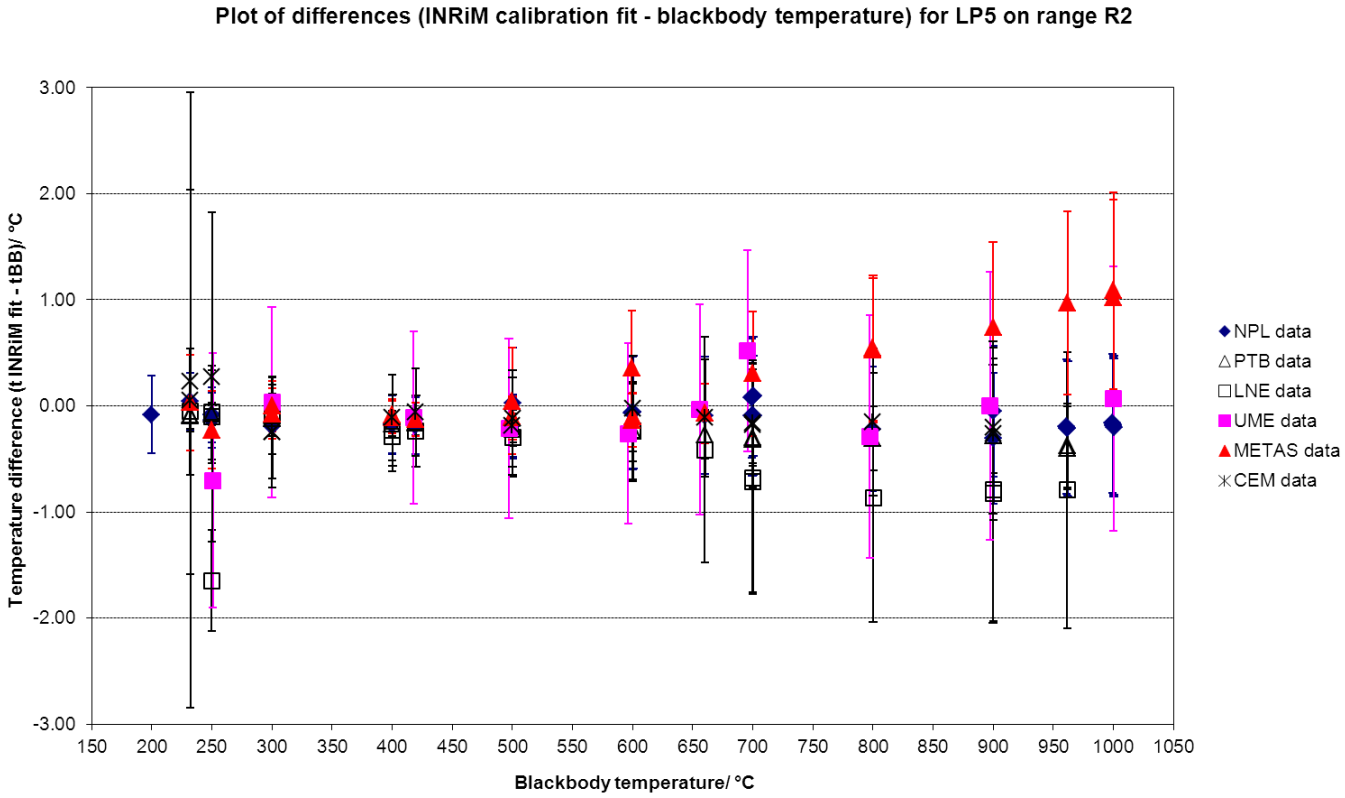
Plot of differences (NPL calibration fit temperature - blackbody temperature) for LP5 on range R2 (zoomed in further)

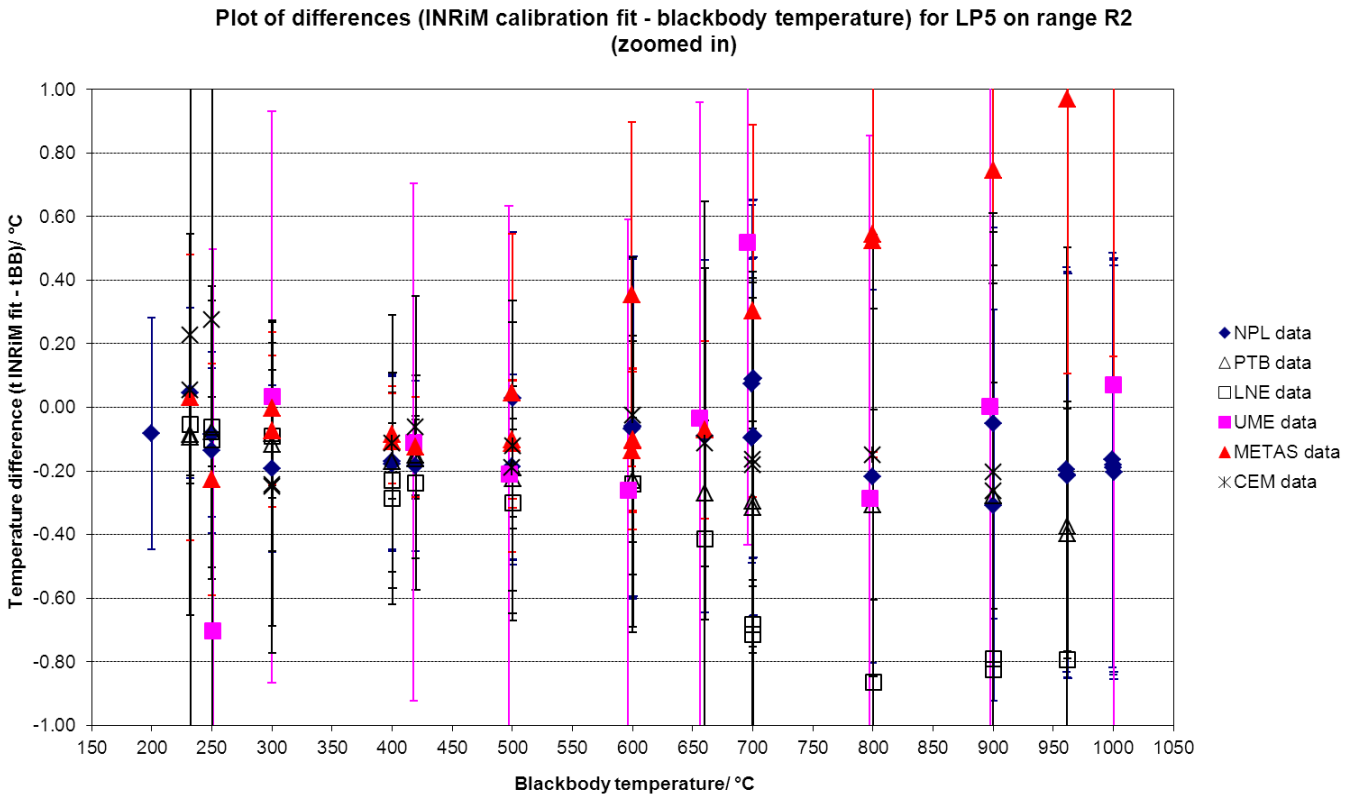


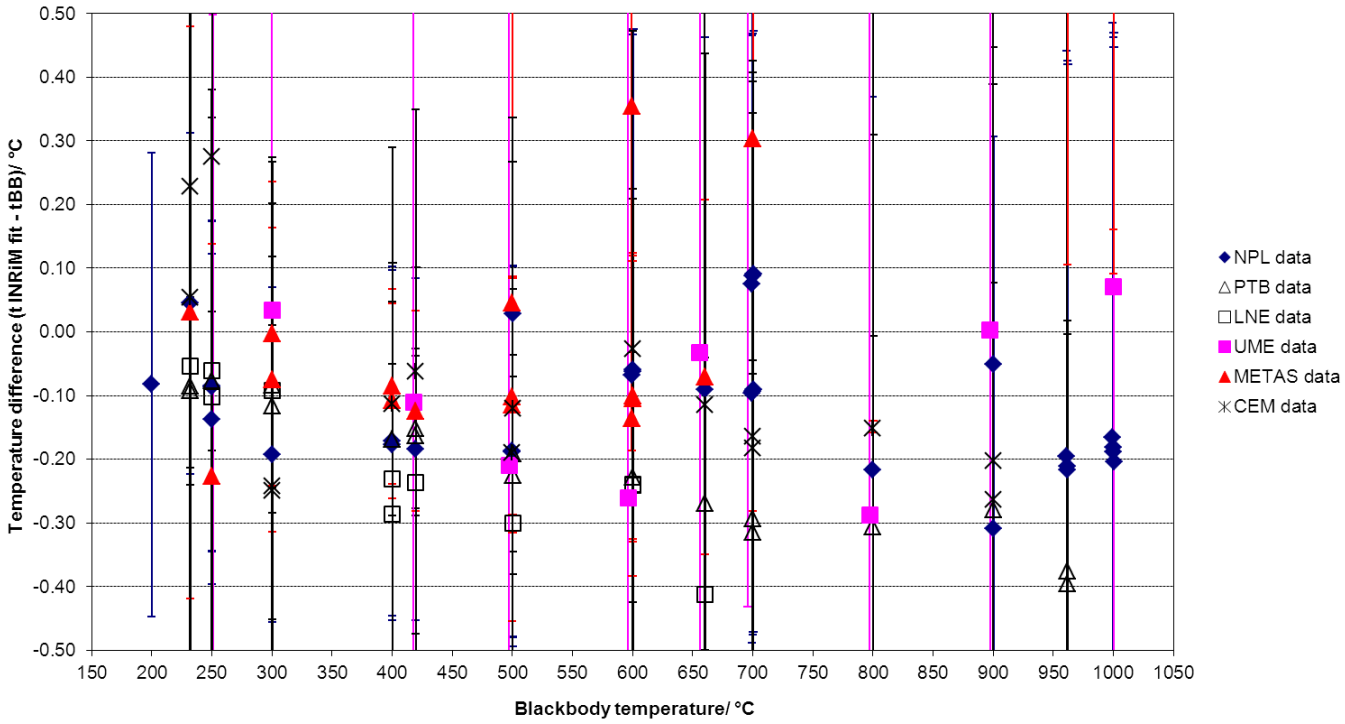

Plot of differences (INRiM calibration fit temperature - blackbody temperature) for LP5 on range R1
Difference (t INRiM fit - tBB)/ °C
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data


Plot of differences (INRiM calibration fit temperature - blackbody temperature) for LP5 on range R1 (zoomed in)
Difference (t INRiM fit - tBB)/ °C
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

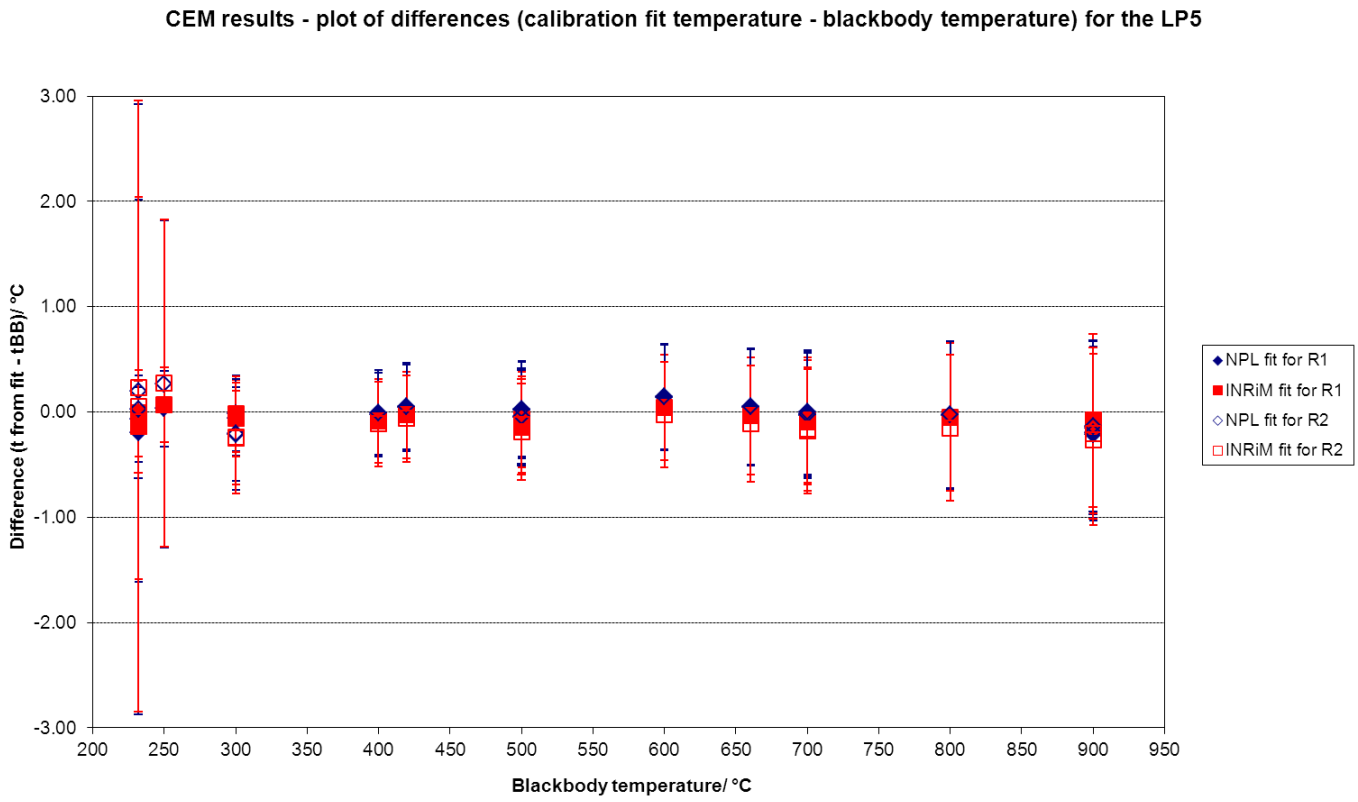

Plot of differences (INRiM calibration fit temperature - blackbody temperature) for LP5 on range R1 (zoomed in further)
Difference (t INRiM fit - tBB)/ °C
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

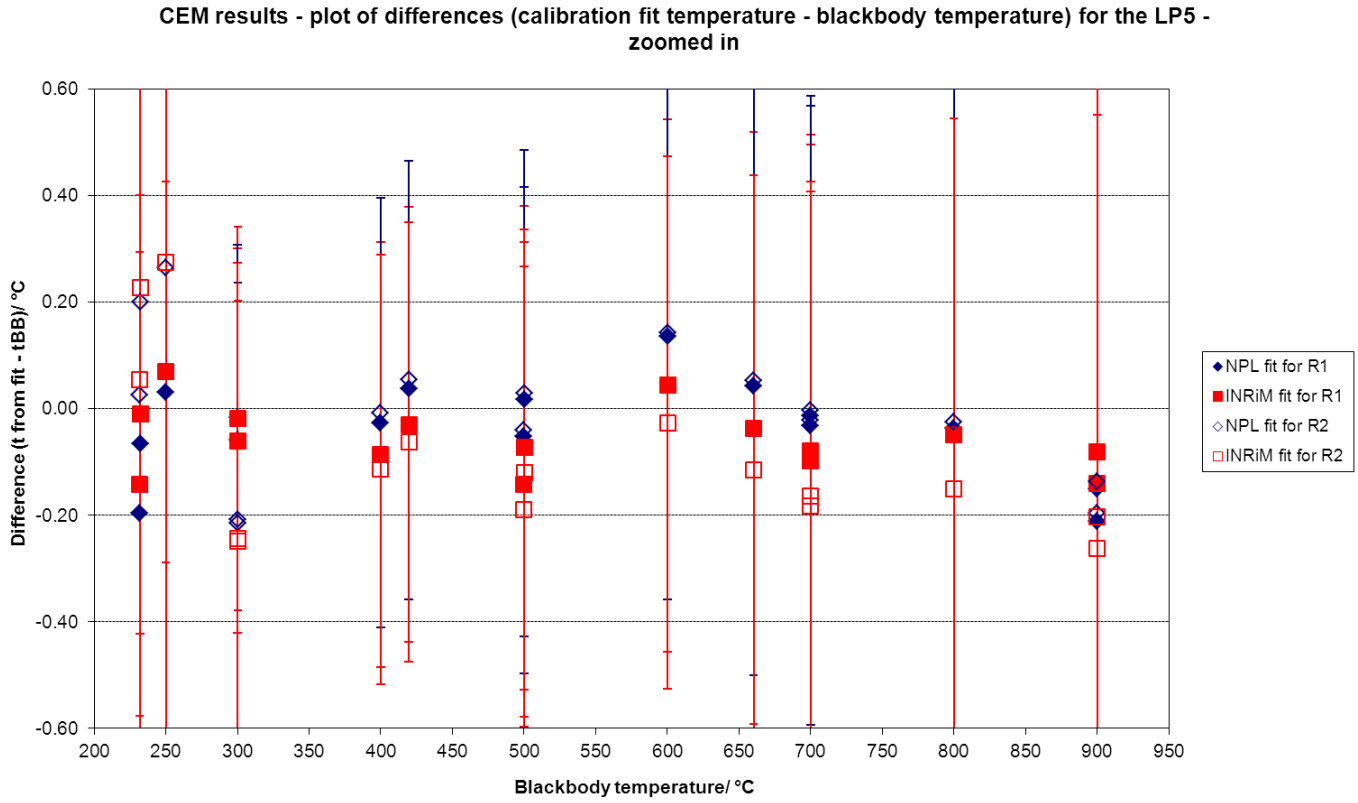

Plot of differences (INRiM calibration fit - blackbody temperature) for LP5 on range R2
Temperature difference (t INRiM fit - tBB)/ °C
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data


Plot of differences (INRiM calibration fit - blackbody temperature) for LP5 on range R2 (zoomed in)
Temperature difference (t INRiM fit - tBB)/ °C
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

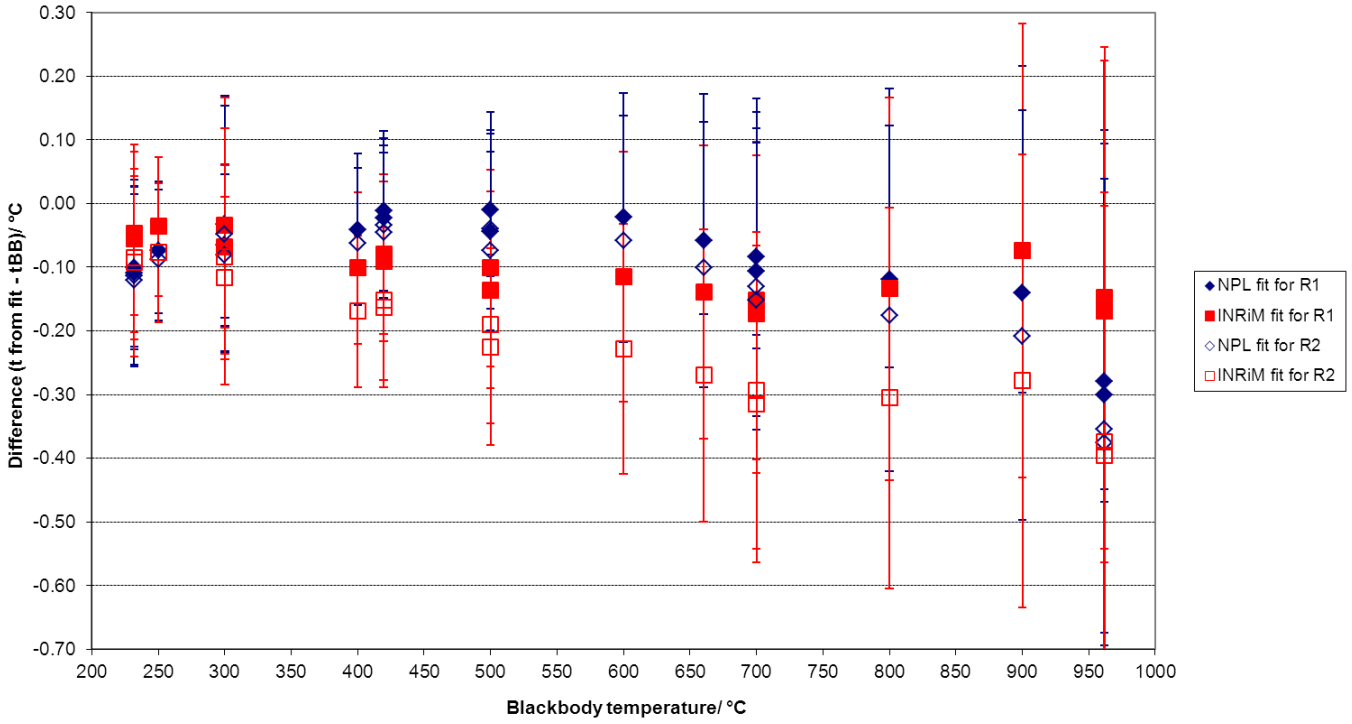

Plot of differences (INRiM calibration fit - blackbody temperature) for LP5 on range R2 (zoomed in further)
Temperature difference (t INRiM fit - tBB)/ °C
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
-0.40
-0.50
150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C
NPL data
PTB data
LNE data
UME data
METAS data
CEM data

4 INDIVIDUAL LABORATORY RESULTS: DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE LP5 THERMOMETER

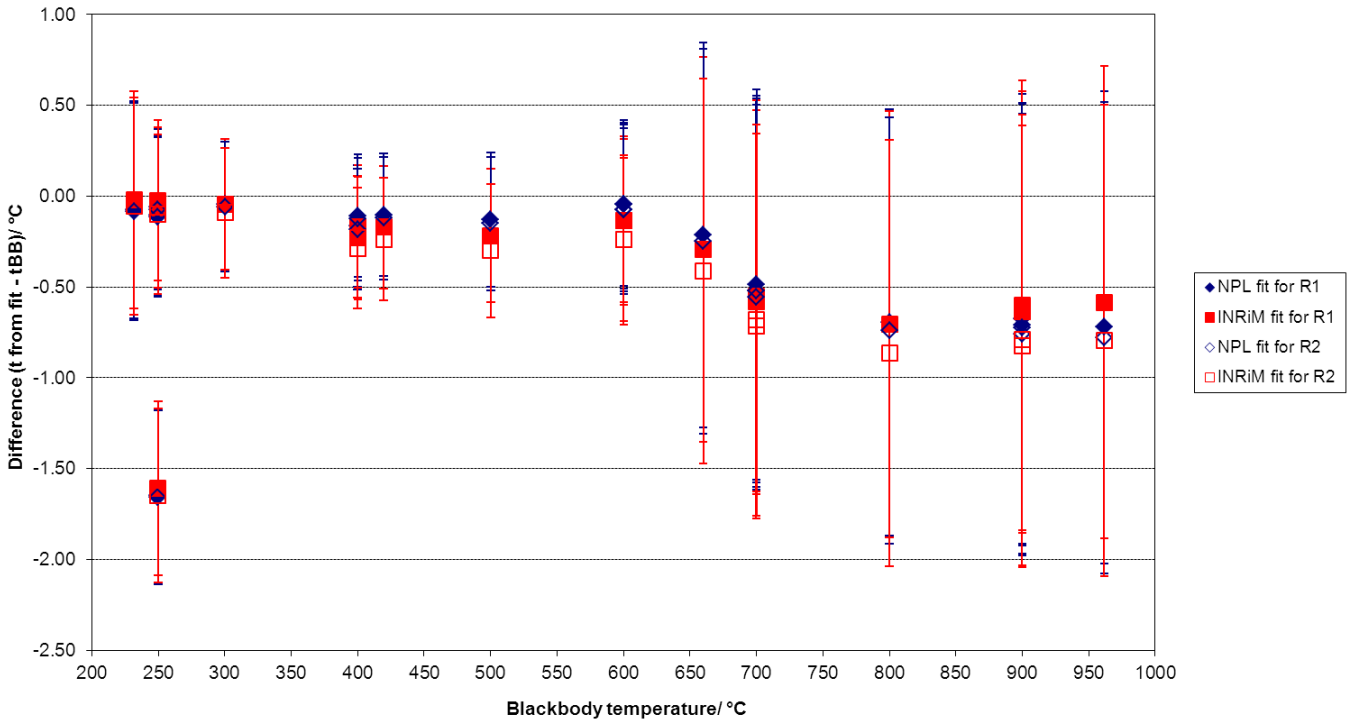




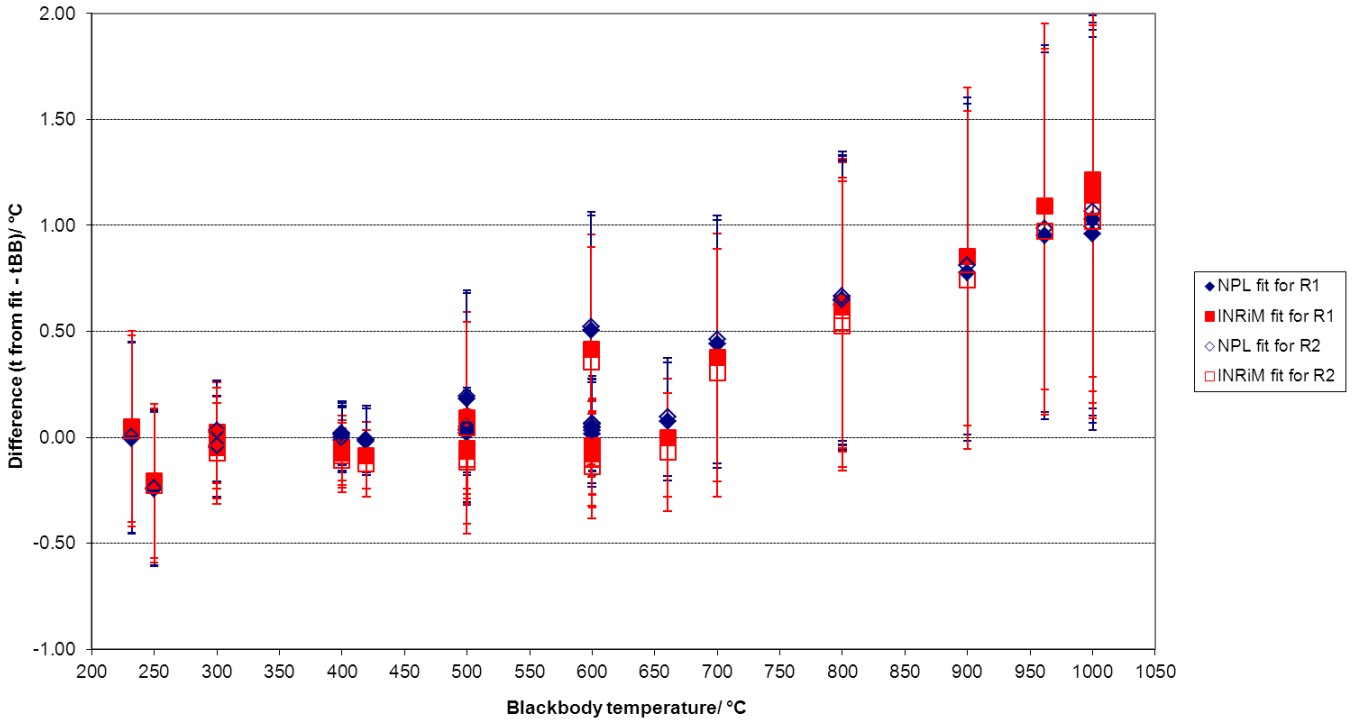
PTB results - plot of differences (calibration fit temperature - blackbody temperature) for the LP5



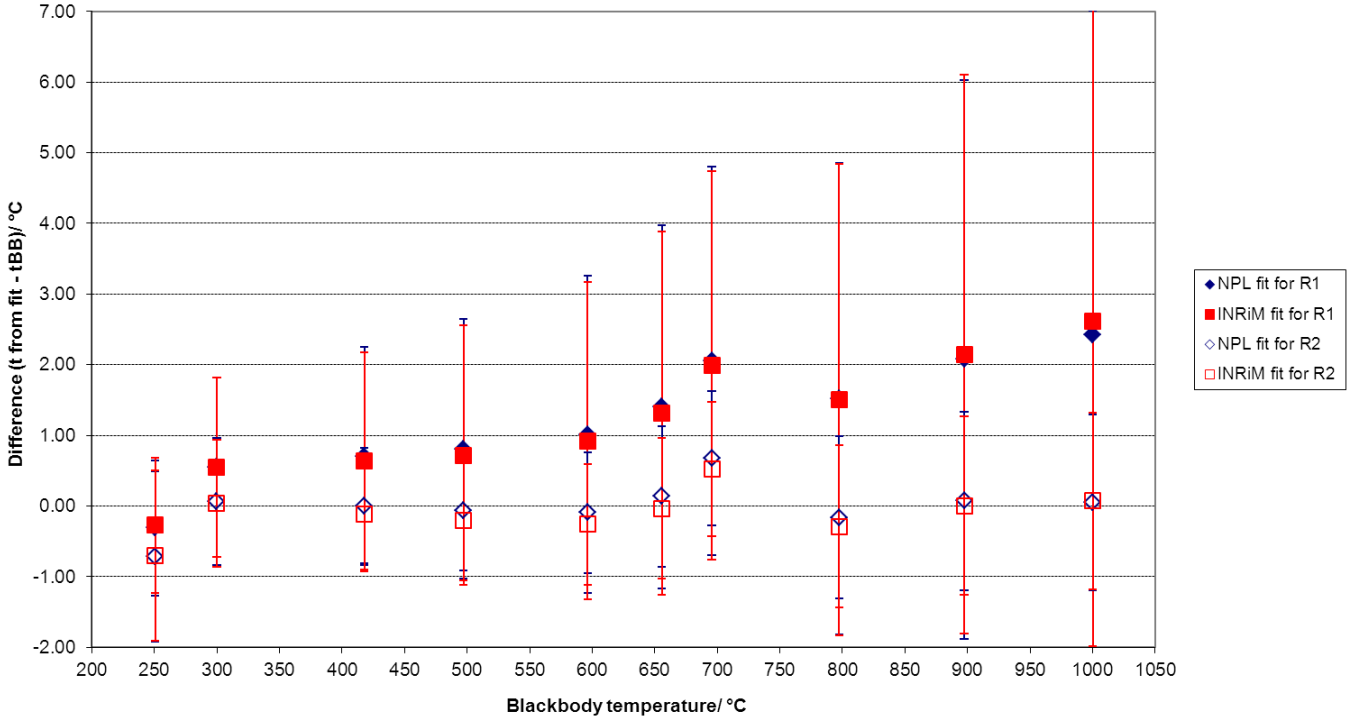
LNE results - plot of differences (calibration fit temperature - blackbody temperature) for the LP5

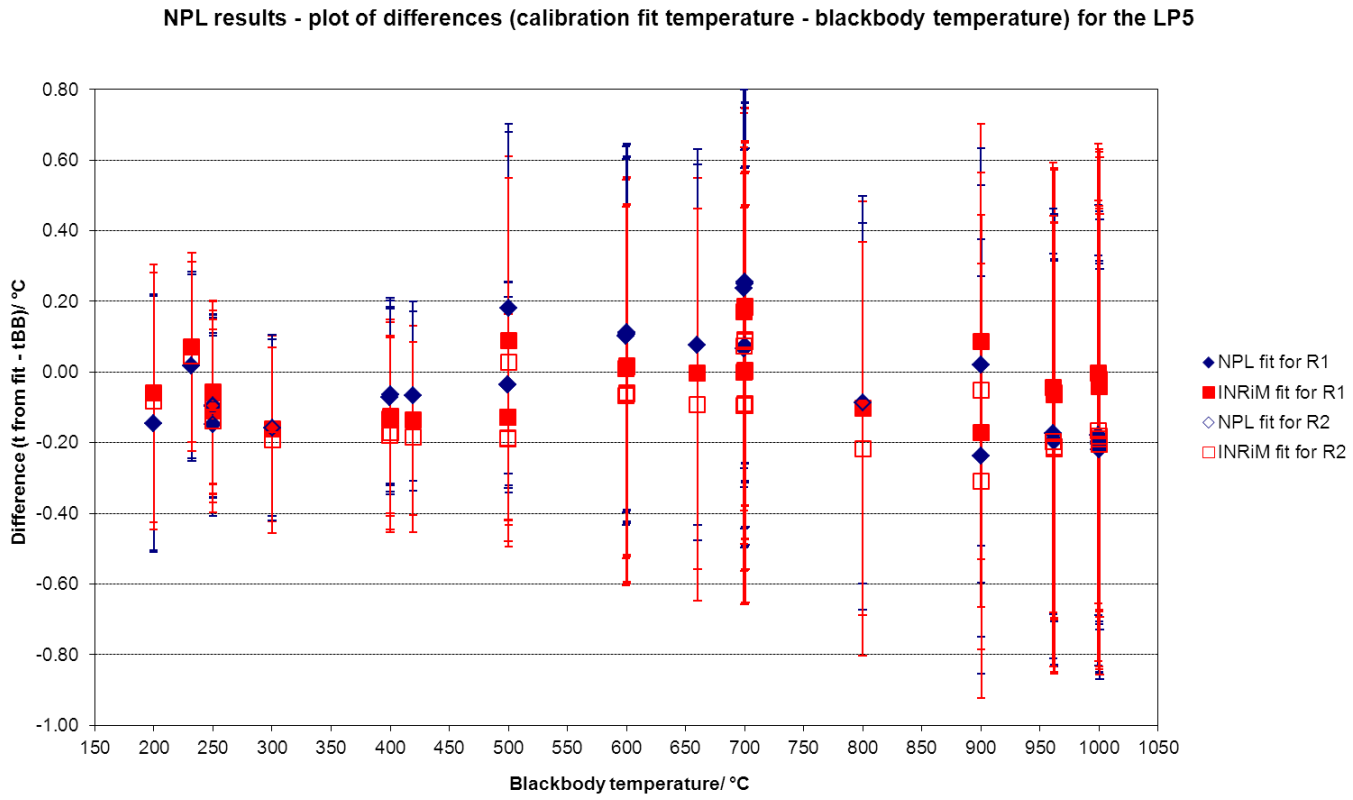


METAS results - plot of difference (calibration fit temperature - blackbody temperature) for the LP5

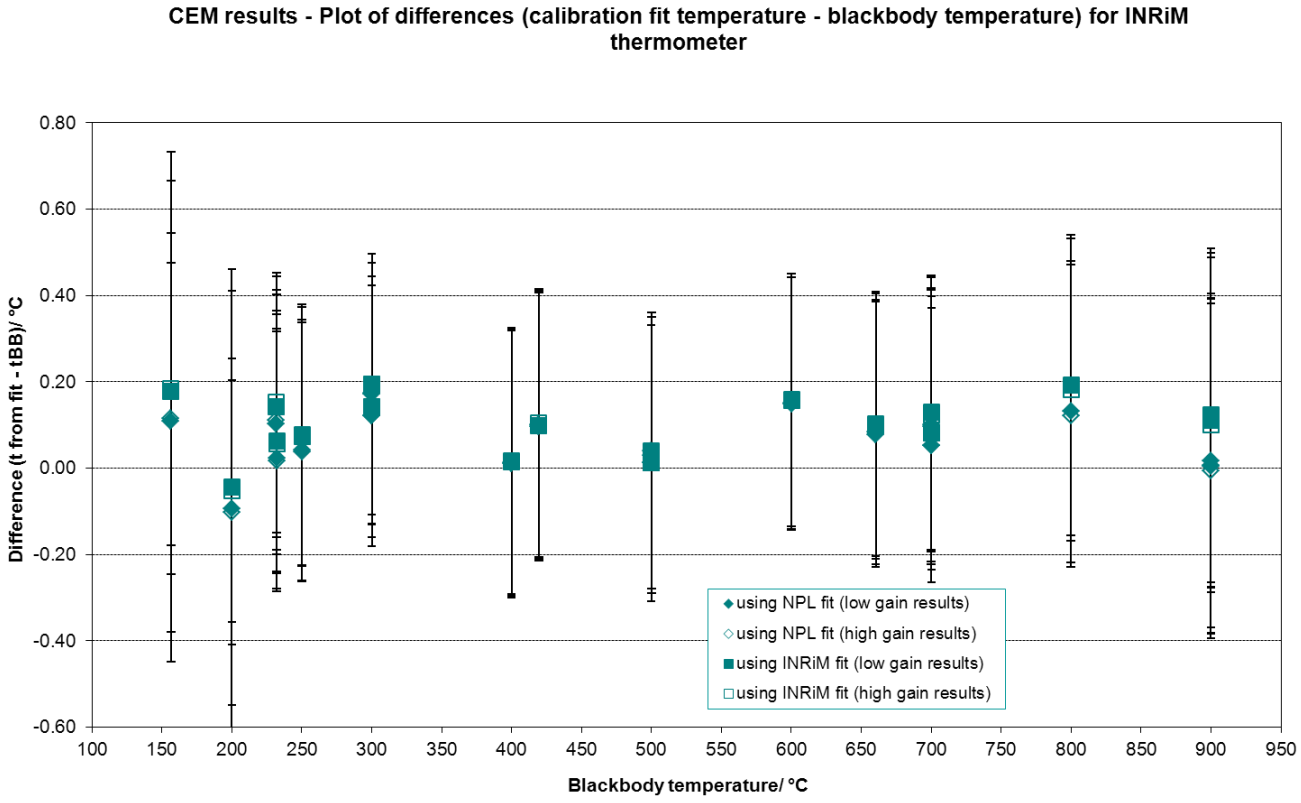


UME results - plot of differences (calibration fit temperature - blackbody temperature) for the LP5

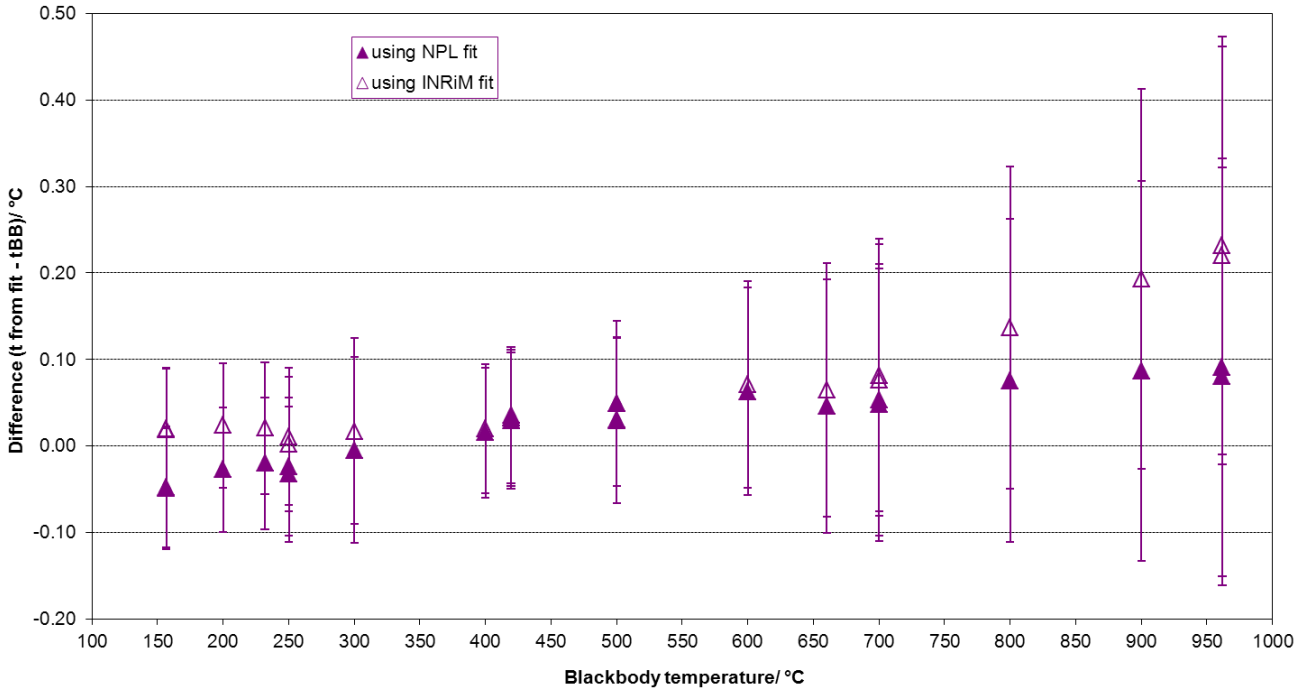




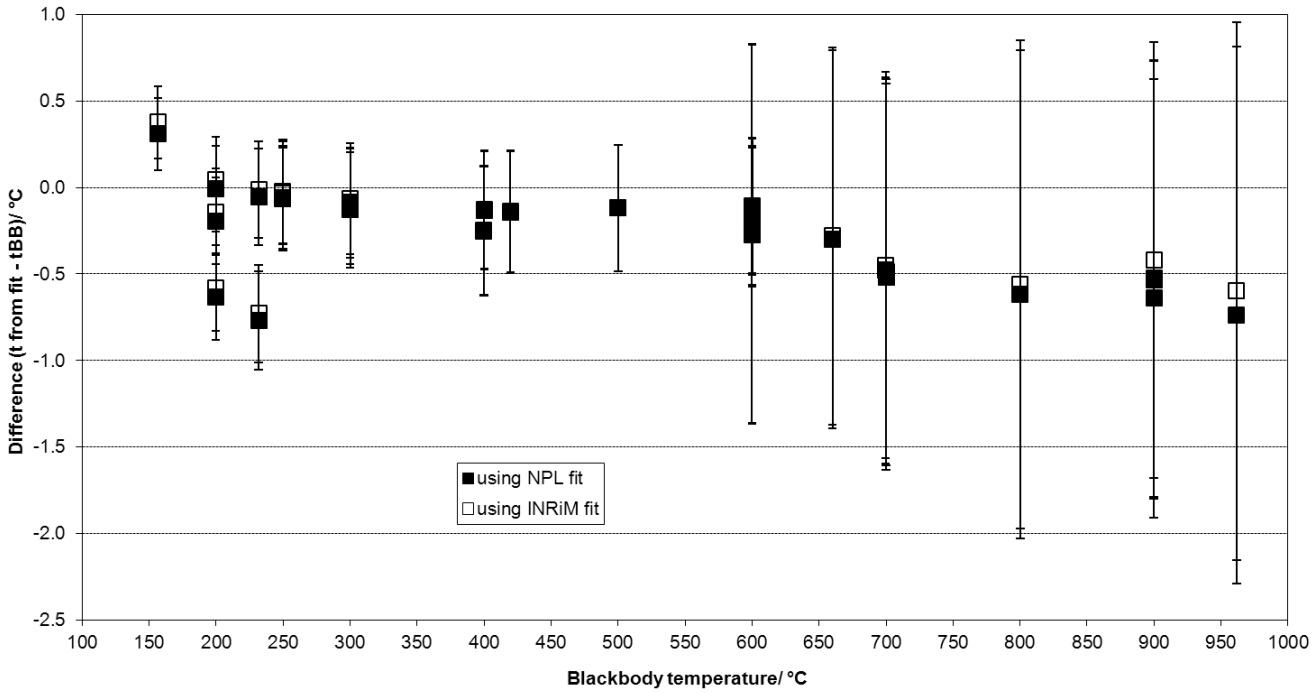
5 INDIVIDUAL LABORATORY RESULTS: DIFFERENCES BETWEEN THE CALIBRATION FITS AND THE BLACKBODY TEMPERATURE FOR THE INRIM THERMOMETER



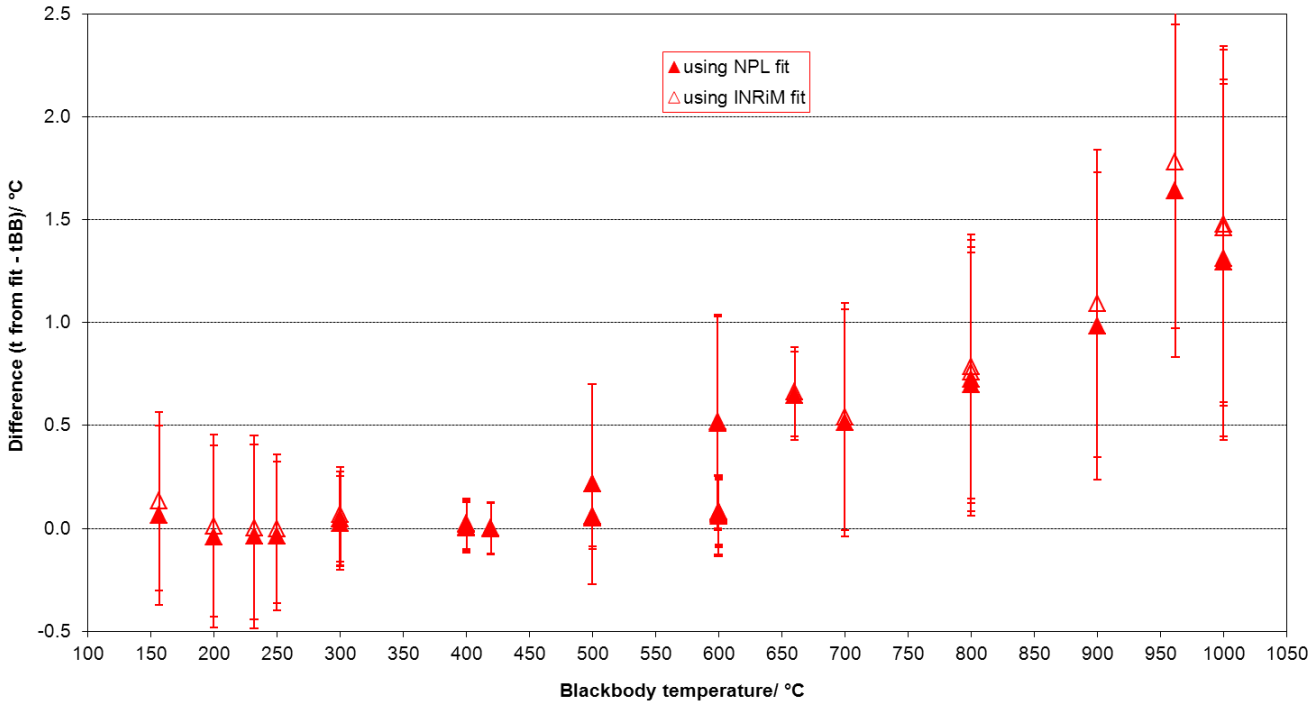
PTB results - Plot of differences (calibration fit temperature - blackbody temperature) for INRiM thermometer



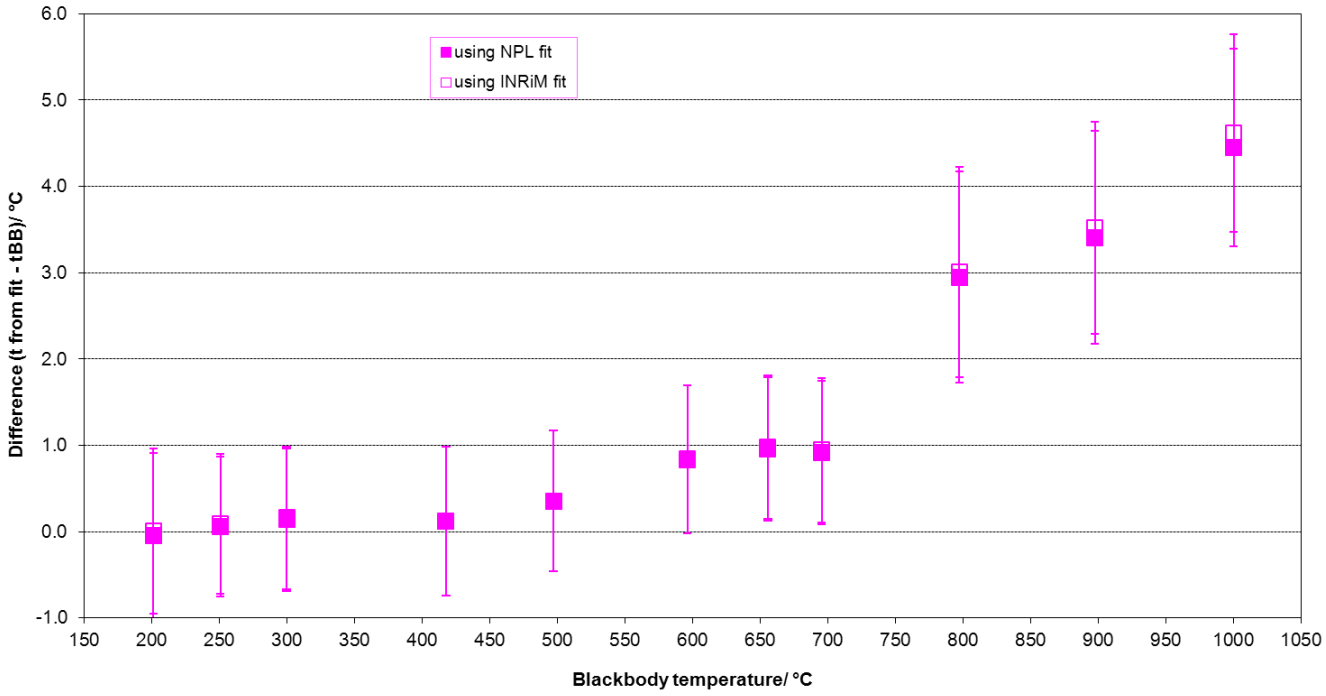
LNE results - Plot of differences (calibration fit temperature - blackbody temperature) for INRiM thermometer

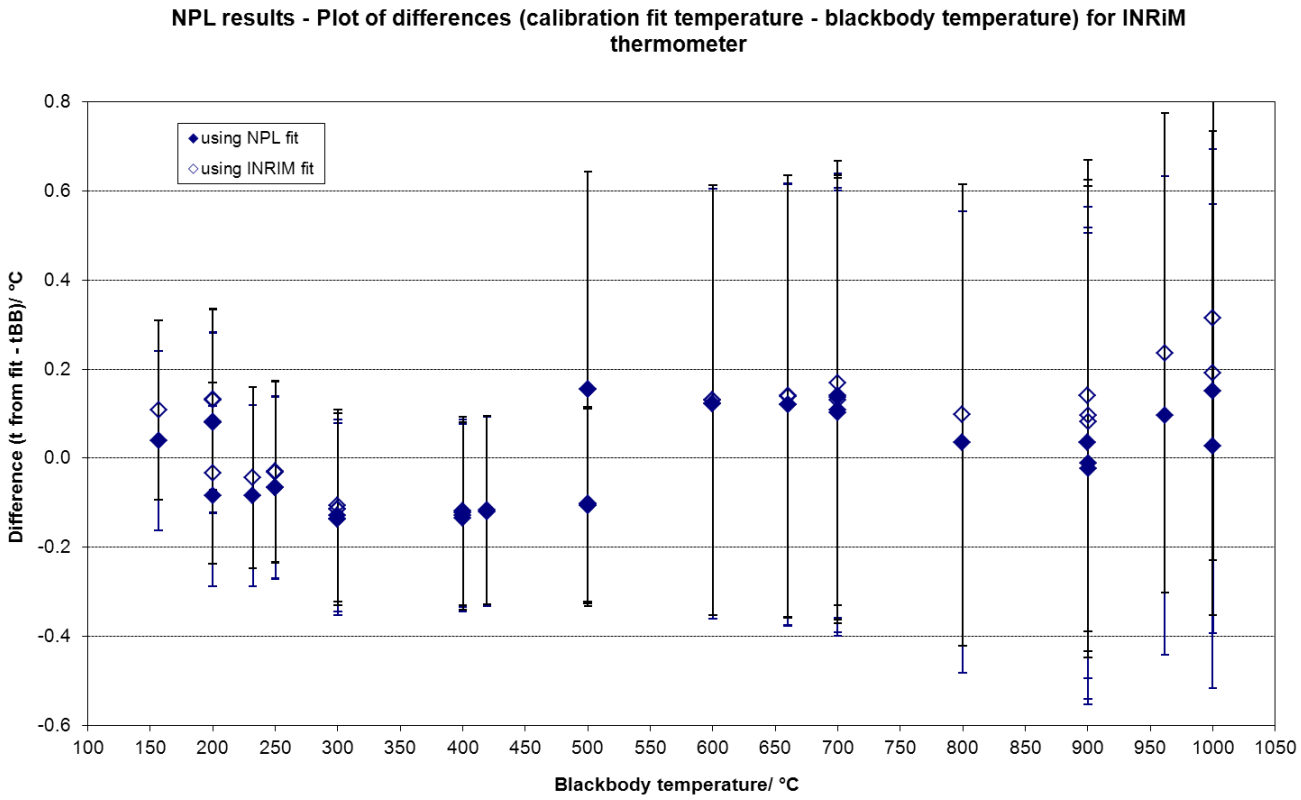


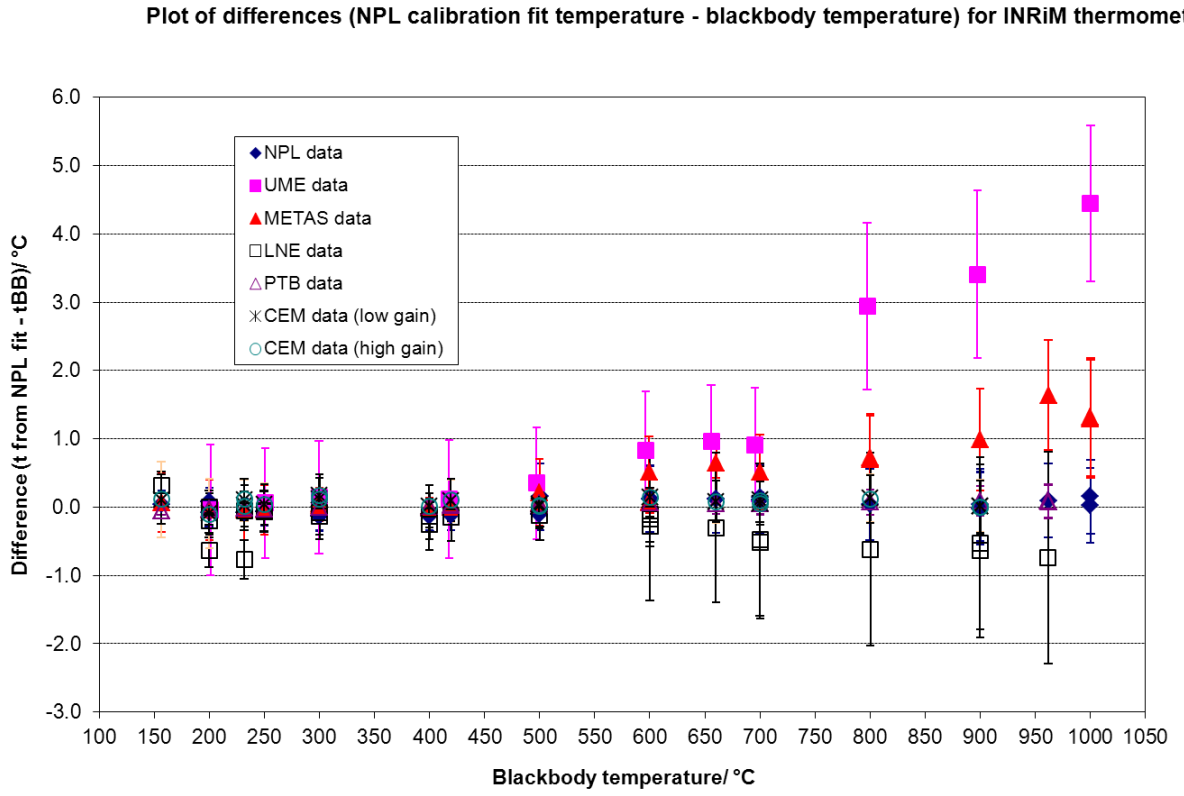
METAS results - Plot of differences (calibration fit temperature - blackbody temperature) for INRiM thermometer

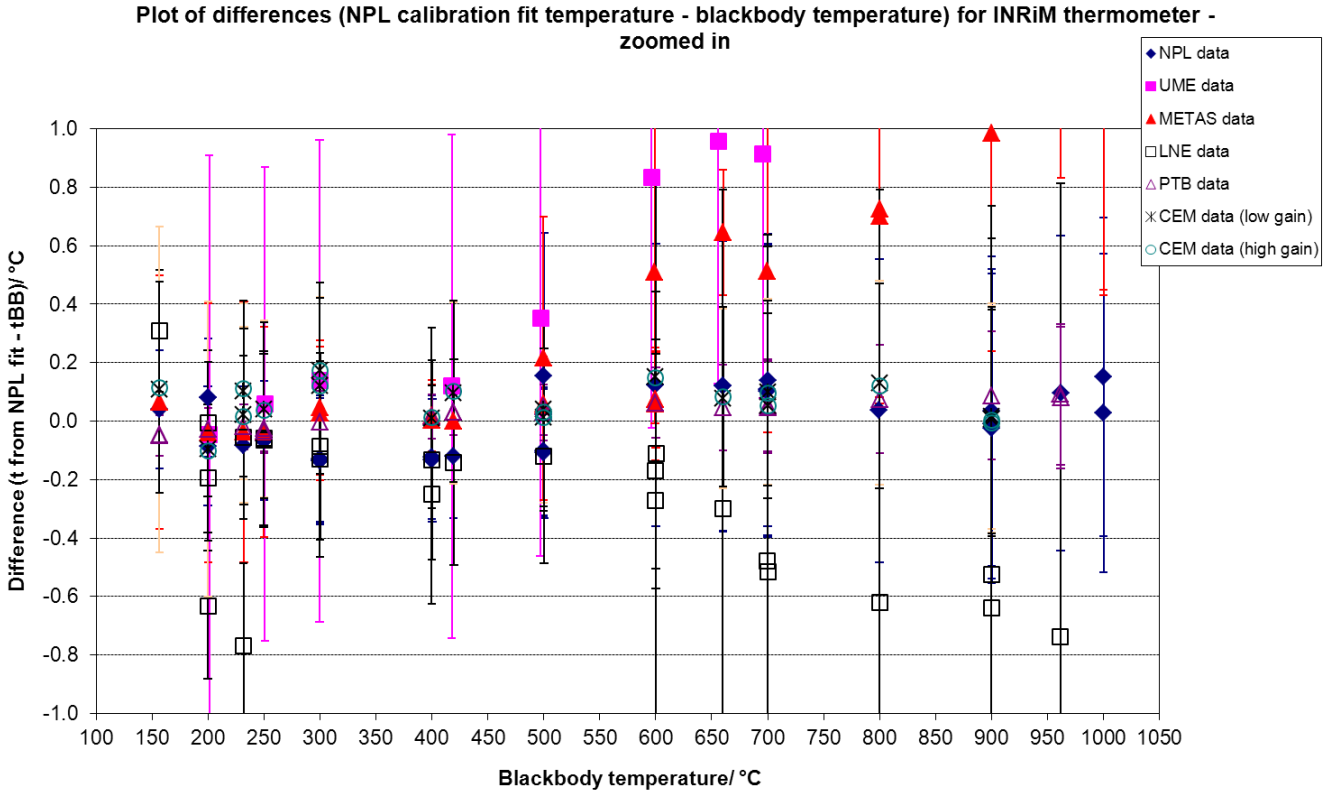


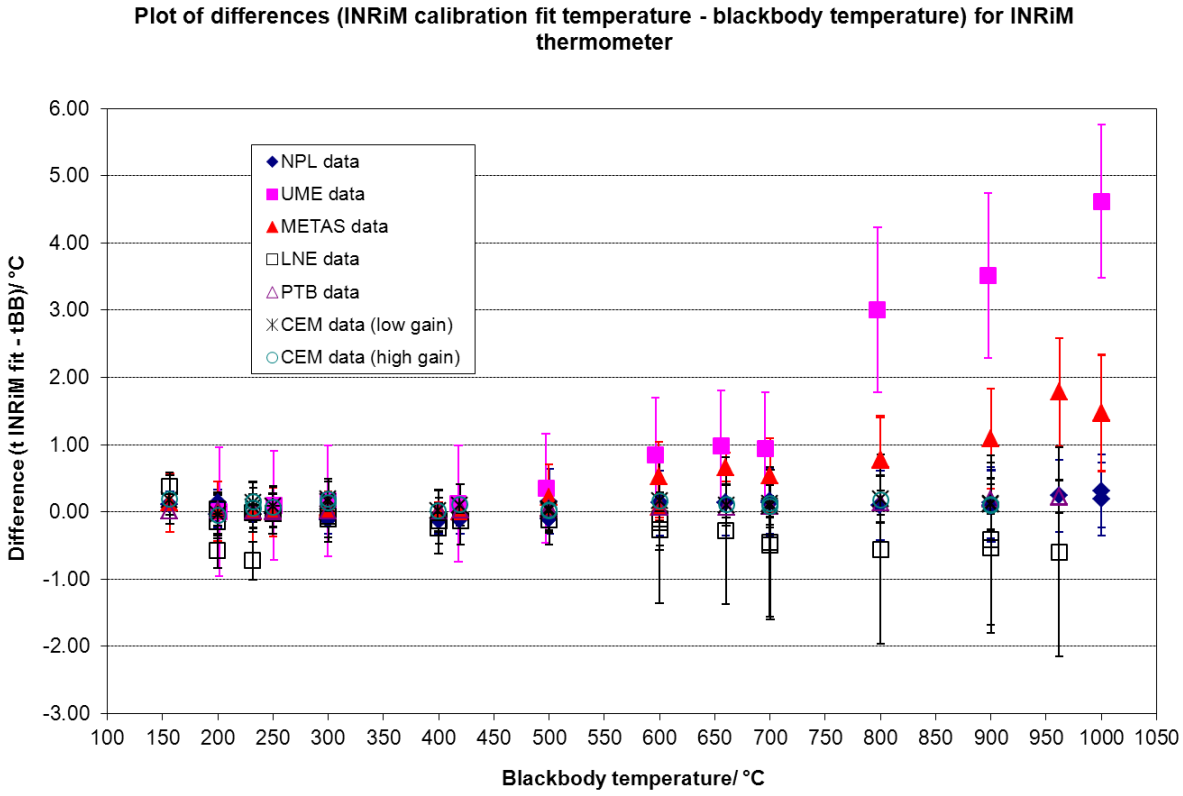
UME results - Plot of differences (calibration fit temperature - blackbody temperature) for INRiM thermometer

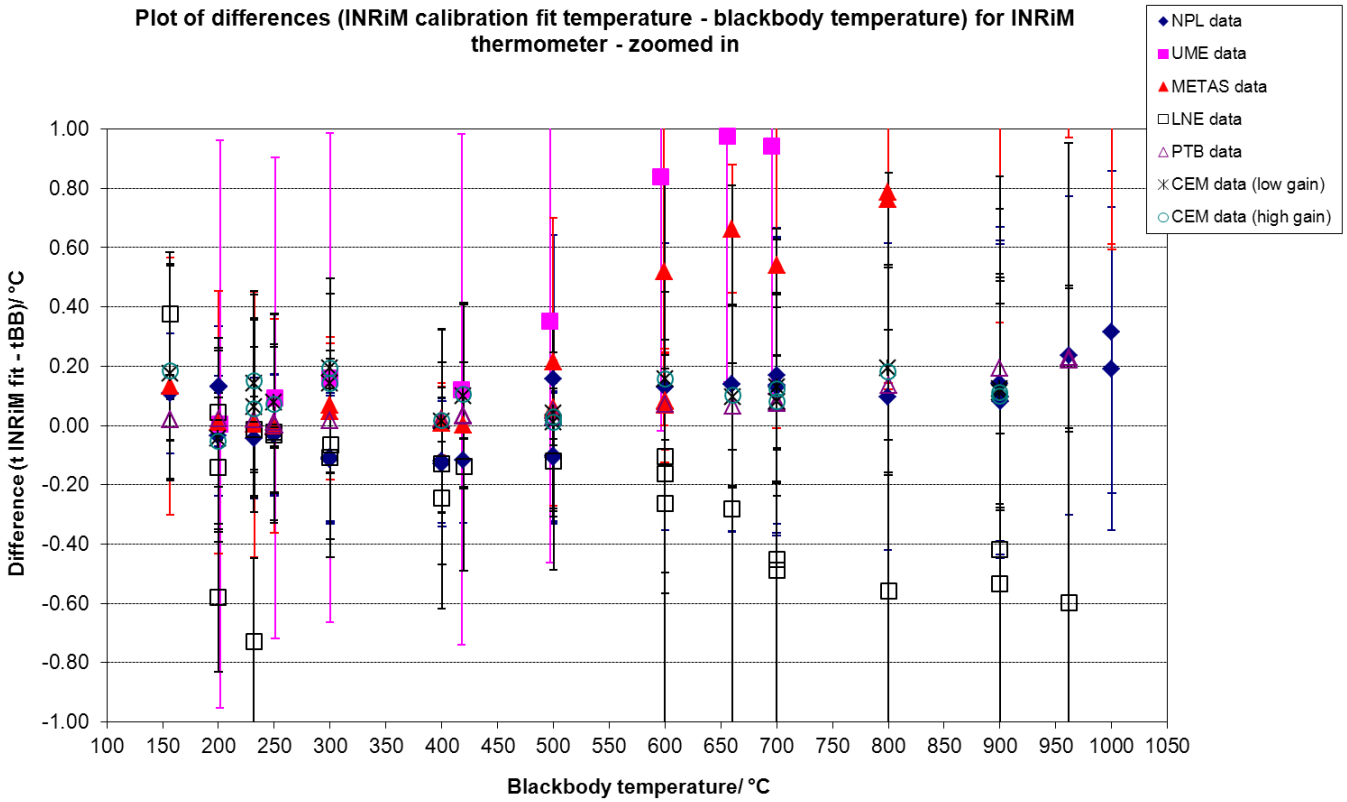



NPL results - Plot of differences (calibration fit temperature - blackbody temperature) for INRiM thermometer
using NPL fit
using INRIM fit
Difference (t from fit - tBB)/ °C
Blackbody temperature/ °C


Plot of differences (NPL calibration fit temperature - blackbody temperature) for INRiM thermometer
NPL data
UME data
METAS data
LNE data
PTB data
CEM data (low gain)
CEM data (high gain)
Difference (t from NPL fit - tBB)/ °C
Blackbody temperature/ °C


Plot of differences (NPL calibration fit temperature - blackbody temperature) for INRiM thermometer - zoomed in
NPL data
UME data
METAS data
LNE data
PTB data
CEM data (low gain)
CEM data (high gain)
Difference (t from NPL fit - tBB)/ °C
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C


Plot of differences (INRiM calibration fit temperature - blackbody temperature) for INRiM thermometer
NPL data
UME data
METAS data
LNE data
PTB data
CEM data (low gain)
CEM data (high gain)
Difference (t INRiM fit - tBB)/ °C
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C


Plot of differences (INRiM calibration fit temperature - blackbody temperature) for INRiM thermometer - zoomed in
NPL data
UME data
METAS data
LNE data
PTB data
CEM data (low gain)
CEM data (high gain)
Difference (t INRiM fit - tBB)/ °C
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.80
-1.00
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050
Blackbody temperature/ °C