Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

MEASURAND : Temperature
NOMINAL TEMPERATURE : T_{nom} = 1400 °C

Key comparison CCT-K5

Four Tungsten-strip lamps were used as transfer standards for radiance temperature measurements at specific currents corresponding to each nominal temperature T_{nom}. To shorten the measurement time significantly the set of transfer standards was split in two sets of two lamps for simultaneous comparisons in two loops. The pilot of each loop measured both lamp sets in order to establish a linkage mechanism described on page 19 of the CCT-K5 Final Report.

T_i : temperature value measured by laboratory *i*
u_i : standard uncertainty of T_i

Lamp S/N C564

Lab*i*	T_i / °C	u_i / °C
VSL	1402.315	0.16
NMIA	1402.395	0.02
KRISS	1402.315	0.16
NIM	1402.375	0.21
A*STAR	1401.645	0.23
NMIJ	1402.655	0.21
VNIIM	1401.685	0.60

Lamp S/N C860

Lab*i*	T_i / °C	u_i / °C
NPL	1400.245	0.28
NIST	1401.165	0.39
CENAM	1400.715	0.44
LNE-INM	1400.005	0.26
INRIM	1400.955	0.14
PTB	1400.795	0.24

Lamp S/N C681

Lab*i*	T_i / °C	u_i / °C
VSL	1402.715	0.16
NMIA	1402.815	0.02
KRISS	1402.915	0.16
NIM	1403.135	0.21
A*STAR	1401.705	0.23
NMIJ	1403.085	0.21
VNIIM	1401.675	0.60

Lamp S/N C864

Lab*i*	T_i / °C	u_i / °C
NPL	1400.165	0.28
NIST	1400.785	0.39
CENAM	1400.615	0.44
LNE-INM	1400.405	0.26
INRIM	1400.705	0.14
PTB	1400.635	0.24

Key comparison CCT-K5.1

This is a bilateral comparison between the PTB and the NRC.
T_{NRC}: temperature value measured at the NRC
u_{NRC}: standard uncertainty of T_{NRC}

Lamp C598	T_{NRC} = 1400.31 °C u_{NRC} = 0.38 °C	**Lamp 644C**	T_{NRC} = 1400.31 °C u_{NRC} = 0.38 °C

Key comparison APMP.T-K5

Laboratory individual measurements of APMP.T-K5 participants are given in Appendix B of the APMP.T-K5 Final Report both in tabulated and in graphical forms. There were taken between 1997 and 2000.

Key comparison EUROMET.T-K5

This comparison involved eight participants and was carried out from October 1999 to February 2001.
The two transfer standards were Lamp S/N C564 and Lamp S/N C681 already used in CCT-K5.
The individual laboratory measurements and their uncertainties are given in Tables 5 to 11 of the EUROMET.T-K5 Final Report.

Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

Ky comparison CCT-K5

MEASURAND : Temperature
NOMINAL TEMPERATURE : T_{nom} = 1400 °C

The key comparison reference value T_R for each nominal temperature T_{nom} and each lamp k is calculated on the basis of the median of measured radiance temperatures $T_i(k, T_{nom})$. Its standard uncertainty, $u(T_R)$, is obtained as the standard uncertainty of the

Lamp	T_R / °C	$u(T_R)$ / °C
C564	1402.410	0.086
C681	1402.710	0.042
C860	1400.800	0.103
C864	1400.630	0.060

For each temperature T_{nom} the degree of equivalence of laboratory i with respect to the key comparison reference value is given by a pair of terms: D_i and its expanded uncertainty U_i (k = 2) both expressed in K. The computation of D_i and U_i is explained in the Addendum of the CCT-K5 Final Report.

For each temperature T_{nom} the pair-wise degree of equivalence between laboratory i and j is given by two terms: D_{ij} and its expanded uncertainty U_{ij} (k = 2).The computation of D_{ij} and U_{ij} is also explained in the Addendum of the CCT-K5 Final Report.

Linking key comparison CCT-K5.1 to CCT-K5

The linkage is made through the common participation of PTB in both key comparisons, and is detailed in the CCT-K5 and CCT-K5.1 Linkage Report.

Linking key comparison APMP.T-K5 to CCT-K5

The linkage is made through the common participation of NMIJ, NIM, KRISS and NMIA in both key comparisons, and is detailed in the Addendum to the APMP.T-K5 Final Report.

Linking key comparison EUROMET.T-K5 to CCT-K5

The measurements of the EUROMET.T-K5 participants are directly linked to the key comparison reference value obtained in CCT-K5 as the protocols of the two key comparisons are identical and the transfer standards are the same (see in Chapter VII of the EUROMET.T-K5 Final Report).

Degrees of equivalence relative to the CCT-K5 key comparison reference values are computed for each of the transfer standards.
Pair-wise degrees of equivalence inside EUROMET.T-K5 are available in the EUROMET.T-K5 Final Report (Tables 15 to 36).

Key comparisons CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5

MEASURAND : Temperature
NOMINAL TEMPERATURE : T_{nom} = 1400 °C
Degrees of equivalence relative to the CCT-K5 key comparison reference value

Lab*i* ⇩	D_i / K	U_i / K
VSL	-0.045	0.385
NPL	-0.510	0.600
NMIA	0.045	0.221
KRISS	0.055	0.410
NIM	0.195	0.522
A*STAR	-0.885	0.519
NMIJ	0.310	0.473
VNIIM	-0.880	1.228
NIST	0.260	0.815
CENAM	-0.050	0.906
LNE-INM	-0.510	0.629
INRIM	0.115	0.352
PTB	0.000	0.352
NRC	0.070	0.968
A*STAR	0.22	0.79
CMS/ITRI	-0.69	1.31

Lamp S/N C564

	D_i / K	U_i / K
CEM	0.18	0.40
IPQ	-0.23	1.12
UME	-1.77	0.57
MKEH	-1.87	2.13
SMU	-1.45	0.44
SP	-0.89	1.25
MIKES	-0.73	1.59
VSL	0.07	0.37

Lamp S/N C681

	D_i / K	U_i / K
CEM	0.12	0.47
IPQ	-0.63	1.16
UME	-1.88	0.57
MKEH	-2.00	2.40
SMU	-1.14	0.43
SP	-0.99	1.24
MIKES	-0.52	1.40
VSL	-0.09	0.33

Black: participants in CCT-K5
Green: participant in CCT-K5.1
Blue: participants in APMP.T-K5
Orange: participants in EUROMET.T-K5 (measurements with Lamp S/N C564)
Grey: participants in EUROMET.T-K5 (measurements with Lamp S/N C681)

Key comparisons CCT-K5 and CCT-K5.1

MEASURAND : Temperature

NOMINAL TEMPERATURE : T_{nom} = 1400 °C

Matrix of equivalence

Pair-wise degrees of equivalence involving APMP.T-K5 participants are not computed.

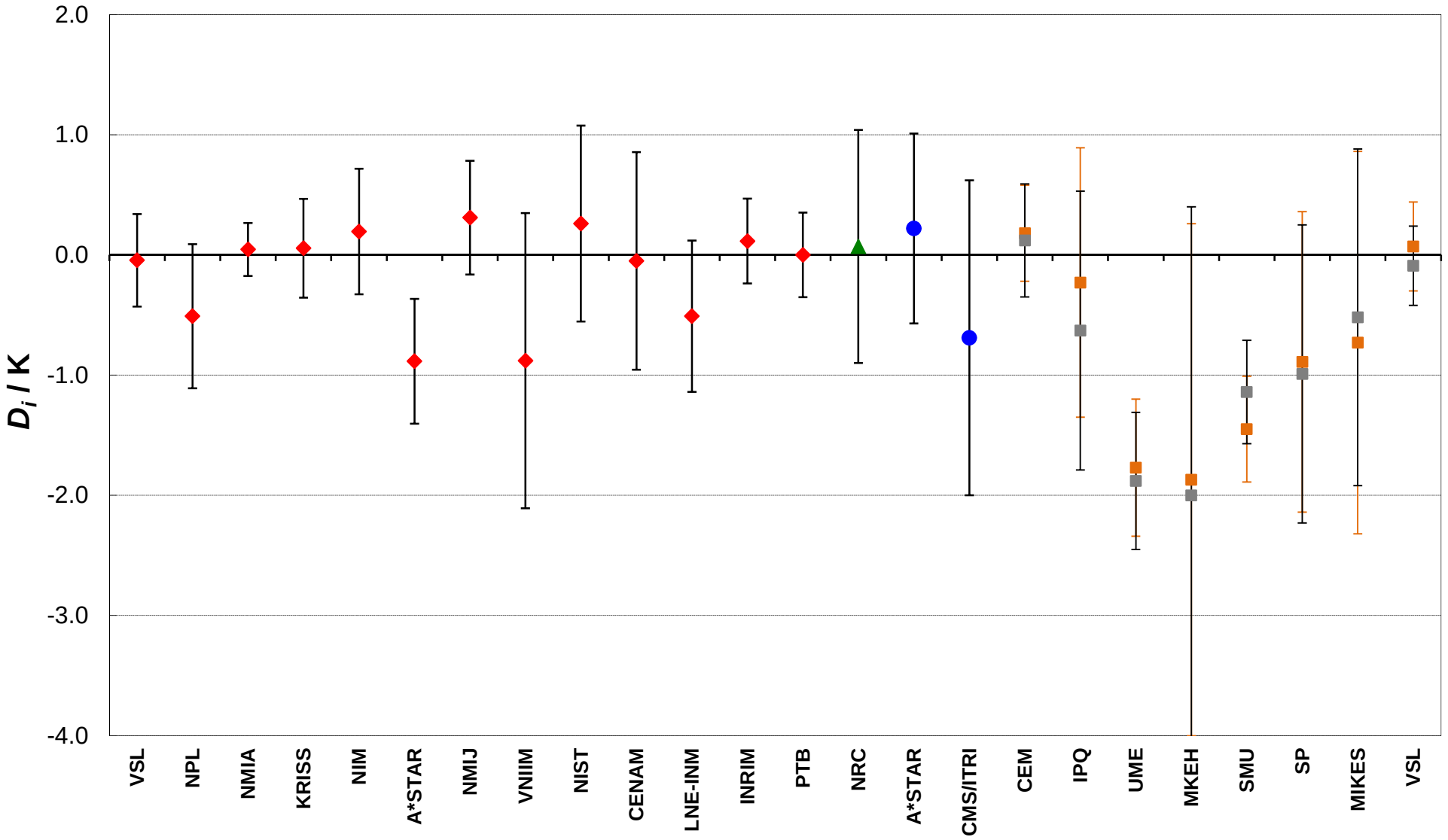
Lab*j* ⟹

Lab*i* ⇩	D_i / K	U_i / K	VSL D_{ij} / K	VSL U_{ij} / K	NPL D_{ij} / K	NPL U_{ij} / K	NMIA D_{ij} / K	NMIA U_{ij} / K	KRISS D_{ij} / K	KRISS U_{ij} / K	NIM D_{ij} / K	NIM U_{ij} / K	A*STAR D_{ij} / K	A*STAR U_{ij} / K	NMIJ D_{ij} / K	NMIJ U_{ij} / K	VNIIM D_{ij} / K	VNIIM U_{ij} / K
VSL	-0.045	0.385			0.465	0.656	-0.090	0.322	-0.100	0.464	-0.240	0.558	0.840	0.585	-0.355	0.528	0.835	1.259
NPL	-0.510	0.600	-0.465	0.656			-0.555	0.575	-0.565	0.661	-0.705	0.722	0.375	0.738	-0.820	0.710	0.370	1.332
NMIA	0.045	0.221	0.090	0.322	0.555	0.575			-0.010	0.334	-0.150	0.455	0.930	0.496	-0.265	0.422	0.925	1.220
KRISS	0.055	0.410	0.100	0.464	0.565	0.661	0.010	0.334			-0.140	0.534	0.940	0.622	-0.255	0.535	0.935	1.279
NIM	0.195	0.522	0.240	0.558	0.705	0.722	0.150	0.455	0.140	0.534			1.080	0.715	-0.115	0.616	1.075	1.328
A*STAR	-0.885	0.519	-0.840	0.585	-0.375	0.738	-0.930	0.496	-0.940	0.622	-1.080	0.715			-1.195	0.650	-0.005	1.285
NMIJ	0.310	0.473	0.355	0.528	0.820	0.710	0.265	0.422	0.255	0.535	0.115	0.616	1.195	0.650			1.190	1.290
VNIIM	-0.880	1.228	-0.835	1.259	-0.370	1.332	-0.925	1.220	-0.935	1.279	-1.075	1.328	0.005	1.285	-1.190	1.290		
NIST	0.260	0.815	0.305	0.854	0.770	0.972	0.215	0.792	0.205	0.858	0.065	0.905	1.145	0.918	-0.050	0.896	1.140	1.440
CENAM	-0.050	0.906	-0.005	0.944	0.460	1.043	-0.095	0.889	-0.105	0.947	-0.245	0.991	0.835	1.003	-0.360	0.983	0.830	1.496
LNE-INM	-0.510	0.629	-0.465	0.643	0.000	0.801	-0.555	0.560	-0.565	0.648	-0.705	0.710	0.375	0.726	-0.820	0.699	0.370	1.326
INRIM	0.115	0.352	0.160	0.443	0.625	0.632	0.070	0.308	0.060	0.450	-0.080	0.535	1.000	0.556	-0.195	0.520	0.995	1.241
PTB	0.000	0.352	0.045	0.589	0.510	0.739	-0.045	0.496	-0.055	0.594	-0.195	0.661	0.885	0.679	-0.310	0.649	0.880	1.301
NRC	0.070	0.968	0.115	1.042	0.580	1.139	0.025	0.993	0.015	1.052	-0.125	1.100	0.955	1.099	-0.240	1.078	0.950	1.564

Lab*j* ⟹

Lab*i* ⇩	D_i / K	U_i / K	NIST D_{ij} / K	NIST U_{ij} / K	CENAM D_{ij} / K	CENAM U_{ij} / K	LNE-INM D_{ij} / K	LNE-INM U_{ij} / K	INRIM D_{ij} / K	INRIM U_{ij} / K	PTB D_{ij} / K	PTB U_{ij} / K	NRC D_{ij} / K	NRC U_{ij} / K
VSL	-0.045	0.385	-0.305	0.854	0.005	0.944	0.465	0.643	-0.160	0.443	-0.045	0.589	-0.115	1.042
NPL	-0.510	0.600	-0.770	0.972	-0.460	1.043	0.000	0.801	-0.625	0.632	-0.510	0.739	-0.580	1.139
NMIA	0.045	0.221	-0.215	0.792	0.095	0.889	0.555	0.560	-0.070	0.308	0.045	0.496	-0.025	0.993
KRISS	0.055	0.410	-0.205	0.858	0.105	0.947	0.565	0.648	-0.060	0.450	0.055	0.594	-0.015	1.052
NIM	0.195	0.522	-0.065	0.905	0.245	0.991	0.705	0.710	0.080	0.535	0.195	0.661	0.125	1.100
A*STAR	-0.885	0.519	-1.145	0.918	-0.835	1.003	-0.375	0.726	-1.000	0.556	-0.885	0.679	-0.955	1.099
NMIJ	0.310	0.473	0.050	0.896	0.360	0.983	0.820	0.699	0.195	0.520	0.310	0.649	0.240	1.078
VNIIM	-0.880	1.228	-1.140	1.440	-0.830	1.496	-0.370	1.326	-0.995	1.241	-0.880	1.301	-0.950	1.564
NIST	0.260	0.815			0.310	1.184	0.770	1.015	0.145	0.832	0.260	0.923	0.190	1.266
CENAM	-0.050	0.906	-0.310	1.184			0.460	1.052	-0.165	0.926	-0.050	1.002	-0.120	1.326
LNE-INM	-0.510	0.629	-0.770	1.015	-0.460	1.052			-0.625	0.674	-0.510	0.761	-0.580	1.155
INRIM	0.115	0.352	-0.145	0.832	0.165	0.926	0.625	0.674			0.115	0.558	0.045	1.030
PTB	0.000	0.352	-0.260	0.923	0.050	1.002	0.510	0.761	-0.115	0.558			-0.070	1.030
NRC	0.070	0.968	-0.190	1.266	0.120	1.326	0.580	1.155	-0.045	1.030	0.070	1.030		

CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5 Nominal temperature, T_{nom} = 1400 °C
Degrees of equivalence, D_i, and expanded uncertainties (k = 2) U_i, expressed in K



Red diamonds: participants in CCT-K5
Green triangle: participant in CCT-K5.1
Blue circles: participants in APMP.T-K5

Orange squares: participants in EUROMET.T-K5 (measurements with Lamp S/N C564)
Grey squares: participants in EUROMET.T-K5 (measurements with Lamp S/N C681)