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

MEASURAND : Temperature
NOMINAL TEMPERATURE : T_{nom} = 1100 °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	1102.041	0.11
NMIA	1102.011	0.02
KRISS	1102.001	0.10
NIM	1102.111	0.14
A*STAR	1101.601	0.16
NMIJ	1102.161	0.13
VNIIM	1101.961	0.21

Lamp S/N C860

Lab*i*	T_i / °C	u_i / °C
NPL	1100.102	0.16
NIST	1100.762	0.27
CENAM	1100.502	0.26
LNE-INM	1099.902	0.17
INRIM	1100.602	0.09
PTB	1100.462	0.18

Lamp S/N C681

Lab*i*	T_i / °C	u_i / °C
VSL	1101.925	0.11
NMIA	1101.965	0.02
KRISS	1102.015	0.10
NIM	1102.205	0.14
A*STAR	1101.245	0.16
NMIJ	1102.045	0.13
VNIIM	1101.645	0.21

Lamp S/N C864

Lab*i*	T_i / °C	u_i / °C
NPL	1100.108	0.16
NIST	1100.508	0.27
CENAM	1100.438	0.26
LNE-INM	1100.258	0.17
INRIM	1100.398	0.09
PTB	1100.268	0.18

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} = 1100.34 °C u_{NRC} = 0.24 °C	**Lamp 644C**	T_{NRC} = 1100.40 °C u_{NRC} = 0.24 °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

Key comparison CCT-K5

MEASURAND : Temperature
NOMINAL TEMPERATURE : T_{nom} = 1100 °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 median.

Lamp	T_R / °C	$u(T_R)$ / °C
C564	1102.110	0.103
C681	1101.890	0.041
C860	1100.450	0.115
C864	1100.350	0.084

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 to 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} = 1100 °C
Degrees of equivalence relative to the CCT-K5 key comparison reference value

Lab*i*	D_i / K	U_i / K
VSL	-0.017	0.250
NPL	-0.295	0.342
NMIA	-0.012	0.145
KRISS	0.008	0.255
NIM	0.158	0.339
A*STAR	-0.577	0.345
NMIJ	0.103	0.287
VNIIM	-0.197	0.437
NIST	0.235	0.556
CENAM	0.070	0.531
LNE-INM	-0.320	0.424
INRIM	0.100	0.216
PTB	-0.035	0.211
NRC	0.000	0.637
CMS/ITRI	0.18	1.45

Lamp S/N C564

	D_i / K	U_i / K
CEM	0.04	0.33
IPQ	0.02	0.75
UME	-1.39	0.41
MKEH	-0.90	1.77
SMU	-1.24	0.41
SP	-0.57	0.84
MIKES	-0.46	1.12
VSL	0.11	0.30

Lamp S/N C681

	D_i / K	U_i / K
CEM	0.06	0.25
IPQ	-0.17	0.76
UME	-1.49	0.39
MKEH	-0.95	1.82
SMU	-0.92	0.37
SP	-0.59	0.82
MIKES	-0.44	0.98
VSL	-0.04	0.23

Black: participants in CCT-K5
Green: participant in CCT-K5.1
Blue: participant 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} = 1100 °C

Matrix of equivalence

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

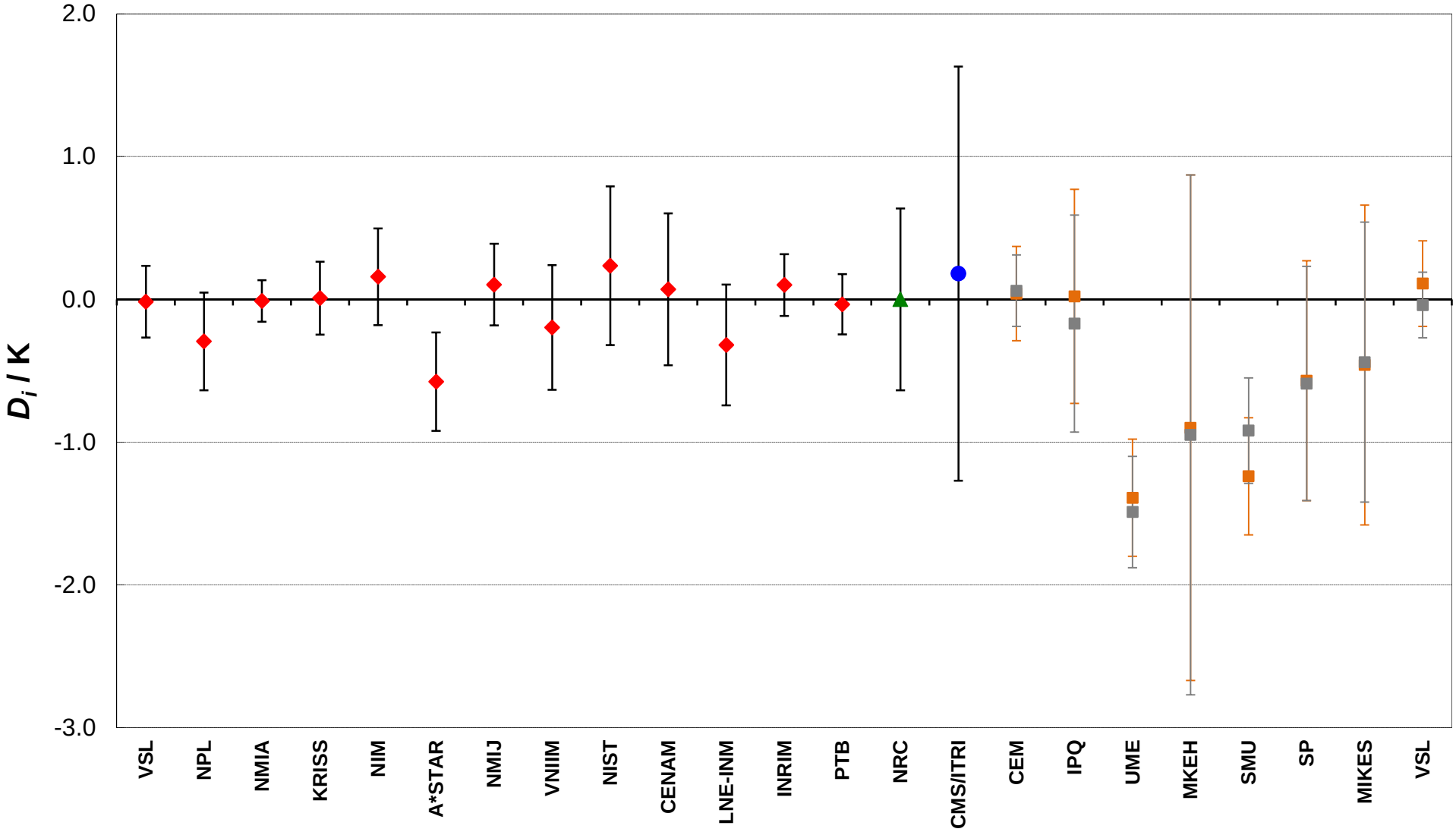
Lab*j* ⇒

Lab*i* ⇓	D_i / K	U_i / K	VSL		NPL		NMIA		KRISS		NIM		A*STAR		NMIJ		VNIIM	
			D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K
VSL	-0.017	0.250			0.278	0.412	-0.005	0.227	-0.025	0.304	-0.175	0.371	0.560	0.406	-0.120	0.341	0.180	0.484
NPL	-0.295	0.342	-0.278	0.412			-0.283	0.353	-0.303	0.406	-0.453	0.455	0.282	0.474	-0.398	0.435	-0.098	0.546
NMIA	-0.012	0.145	0.005	0.227	0.283	0.353			-0.020	0.206	-0.170	0.292	0.565	0.357	-0.115	0.265	0.185	0.443
KRISS	0.008	0.255	0.025	0.304	0.303	0.406	0.020	0.206			-0.150	0.346	0.585	0.420	-0.095	0.334	0.205	0.493
NIM	0.158	0.339	0.175	0.371	0.453	0.455	0.170	0.292	0.150	0.346			0.735	0.481	0.055	0.396	0.355	0.545
A*STAR	-0.577	0.345	-0.560	0.406	-0.282	0.474	-0.565	0.357	-0.585	0.420	-0.735	0.481			-0.680	0.429	-0.380	0.528
NMIJ	0.103	0.287	0.120	0.341	0.398	0.435	0.115	0.265	0.095	0.334	-0.055	0.396	0.680	0.429			0.300	0.504
VNIIM	-0.197	0.437	-0.180	0.484	0.098	0.546	-0.185	0.443	-0.205	0.493	-0.355	0.545	0.380	0.528	-0.300	0.504		
NIST	0.235	0.556	0.252	0.600	0.530	0.641	0.247	0.561	0.227	0.595	0.077	0.630	0.812	0.644	0.132	0.615	0.432	0.698
CENAM	0.070	0.531	0.087	0.581	0.365	0.612	0.082	0.540	0.062	0.576	-0.088	0.612	0.647	0.625	-0.033	0.597	0.267	0.682
LNE-INM	-0.320	0.424	-0.303	0.447	-0.025	0.499	-0.308	0.392	-0.328	0.442	-0.478	0.486	0.257	0.504	-0.423	0.468	-0.123	0.572
INRIM	0.100	0.216	0.117	0.316	0.395	0.382	0.112	0.233	0.092	0.308	-0.058	0.370	0.677	0.393	-0.003	0.345	0.297	0.477
PTB	-0.035	0.211	-0.018	0.444	0.260	0.492	-0.023	0.389	-0.043	0.438	-0.193	0.483	0.542	0.501	-0.138	0.465	0.162	0.569
NRC	0.000	0.637	0.017	0.684	0.295	0.723	0.012	0.653	-0.008	0.686	-0.158	0.721	0.577	0.724	-0.103	0.698	0.197	0.772

Lab*j* ⇒

Lab*i* ⇓	D_i / K	U_i / K	NIST		CENAM		LNE-INM		INRIM		PTB		NRC	
			D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K	D_{ij} / K	U_{ij} / K
VSL	-0.017	0.250	-0.252	0.600	-0.087	0.581	0.303	0.447	-0.117	0.316	0.018	0.444	-0.017	0.684
NPL	-0.295	0.342	-0.530	0.641	-0.365	0.612	0.025	0.499	-0.395	0.382	-0.260	0.492	-0.295	0.723
NMIA	-0.012	0.145	-0.247	0.561	-0.082	0.540	0.308	0.392	-0.112	0.233	0.023	0.389	-0.012	0.653
KRISS	0.008	0.255	-0.227	0.595	-0.062	0.576	0.328	0.442	-0.092	0.308	0.043	0.438	0.008	0.686
NIM	0.158	0.339	-0.077	0.630	0.088	0.612	0.478	0.486	0.058	0.370	0.193	0.483	0.158	0.721
A*STAR	-0.577	0.345	-0.812	0.644	-0.647	0.625	-0.257	0.504	-0.677	0.393	-0.542	0.501	-0.577	0.724
NMIJ	0.103	0.287	-0.132	0.615	0.033	0.597	0.423	0.468	0.003	0.345	0.138	0.465	0.103	0.698
VNIIM	-0.197	0.437	-0.432	0.698	-0.267	0.682	0.123	0.572	-0.297	0.477	-0.162	0.569	-0.197	0.772
NIST	0.235	0.556			0.165	0.756	0.555	0.707	0.135	0.570	0.270	0.650	0.235	0.845
CENAM	0.070	0.531	-0.165	0.756			0.390	0.656	-0.030	0.554	0.105	0.635	0.070	0.829
LNE-INM	-0.320	0.424	-0.555	0.707	-0.390	0.656			-0.420	0.476	-0.285	0.566	-0.320	0.765
INRIM	0.100	0.216	-0.135	0.570	0.030	0.554	0.420	0.476			0.135	0.402	0.100	0.672
PTB	-0.035	0.211	-0.270	0.650	-0.105	0.635	0.285	0.566	-0.135	0.402			-0.035	0.671
NRC	0.000	0.637	-0.235	0.845	-0.070	0.829	0.320	0.765	-0.100	0.672	0.035	0.671		

CCT-K5, CCT-K5.1, APMP.T-K5 and EUROMET.T-K5 Nominal temperature, T_{nom} = 1100 °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 circle: participant 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)