

Key comparisons APMP.T-K3 and APMP.T-K3.1

Realizations of the ITS-90 from 234.3156 K to 692.677 K

Key comparison APMP.T-K3

NOMINAL TEMPERATURES :	Mercury Triple Point, 234.3156 K	Tin Freezing Point, 505.078 K
	Gallium Melting Point, 302.9146 K	Zinc Freezing Point, 692.677 K
	Indium Freezing Point, 429.7485 K	

The individual laboratory measurements, together with associated uncertainties estimated at a 95 % level of confidence, are given in Section 5 of the APMP.T-K3 Final Report (Table 2 and Table 3 on pages 5 and 6) for the five fixed-point temperatures.

The analysis of the changes in the characteristic of the travelling artefact led to an unified estimation of the differences between each laboratory and the Pilot Laboratory, for each of the fixed-point temperature, as explained in Section 6 of the APMP.T-K3 Final Report.

Key comparison APMP.T-K3.1

NOMINAL TEMPERATURES :	Mercury Triple Point, 234.3156 K	Tin Freezing Point, 505.078 K
	Gallium Melting Point, 302.9146 K	Zinc Freezing Point, 692.677 K

The individual laboratory measurements, together with associated uncertainties estimated at a 95 % level of confidence, are given in Sections 5 and 6 of the APMP.T-K3.1 Final Report (Tables 1, 4 and 5) for the four fixed-point temperatures.

Key comparisons APMP.T-K3 and APMP.T-K3.1

Realizations of the ITS-90 from 234.3156 K to 692.677 K

NOMINAL TEMPERATURES : Mercury Triple Point, 234.3156 K
 Gallium Melting Point, 302.9146 K
 Indium Freezing Point, 429.7485 K

Tin Freezing Point, 505.078 K
Zinc Freezing Point, 692.677 K

Linking key comparison APMP.T-K3 to key comparison CCT-K3

The linkage of key comparison APMP.T-K3 to key comparison CCT-K3 is computed using the results of the two common participants, KRISS and NMIA.

There is no key comparison reference value in CCT-K3. The 22nd CCT, at its meeting of May 2003, adopted, however, the proposal to use the "average reference value", ARV, as reference value, for the purposes of CMC review. The ARV is defined as the average of the mean, the weighted mean and the median. Its uncertainty is the simple average of the respective uncertainties of the mean, the weighted mean, and the median (see Section 6 of the [22nd CCT Report](#)).

For each fixed-point temperature, the degree of equivalence of laboratory i with respect to the ARV is given by a pair of terms, both expressed in mK: D_i and U_i , its expanded uncertainty ($k = 2$). The details of the calculation are given in Sections 7 and 8 of the APMP.T-K3 Final Report.

For each fixed-point temperature, the degree of equivalence between two laboratories i and j is given by a pair of terms, both expressed in mK: $D_{ij} = D_i - D_j$, and U_{ij} , its expanded uncertainty ($k = 2$). The details of the calculation are given in Section 9 of the APMP.T-K3 Final Report. The following tables include the pair-wise degrees of equivalence inside key comparison APMP.T-K3. Pair-wise degrees of equivalence between participants in CCT-K3 and in APMP.T-K3 can be found starting page 23 of the APMP.T-K3 Final Report.

Linking key comparison APMP.T-K3.1 to key comparisons APMP.T-K3 and CCT-K3

The linkage of key comparison APMP.T-K3.1 to key comparison APMP.T-K3 is computed using the results of the common participant, NMISA. The linkage uncertainty is negligible except for the Gallium fixed point, for which it is equal to 0.3 mK (expanded value), see Section 7 of the APMP.T-K3.1 Final Report.

For each fixed-point temperature, the degree of equivalence of VMI-STAMEQ, participant in APMP.T-K3.1 only, with respect to the CCT-K3 ARV is given by a pair of terms, both expressed in mK: D_i and U_i , its expanded uncertainty ($k = 2$), computed using the link of NMISA to CCT-K3. The details of the calculation are given in Section 8 of the APMP.T-K3.1 Final Report.

The pair-wise degrees of equivalence involving VMI-STAMEQ and the other participants in APMP.T-K3 and CCT-K3 are given in Table 13 of the APMP.T-K3.1 Final Report. They are not reported here.

Key comparisons APMP.T-K3 and APMP.T-K3.1

NOMINAL TEMPERATURE :

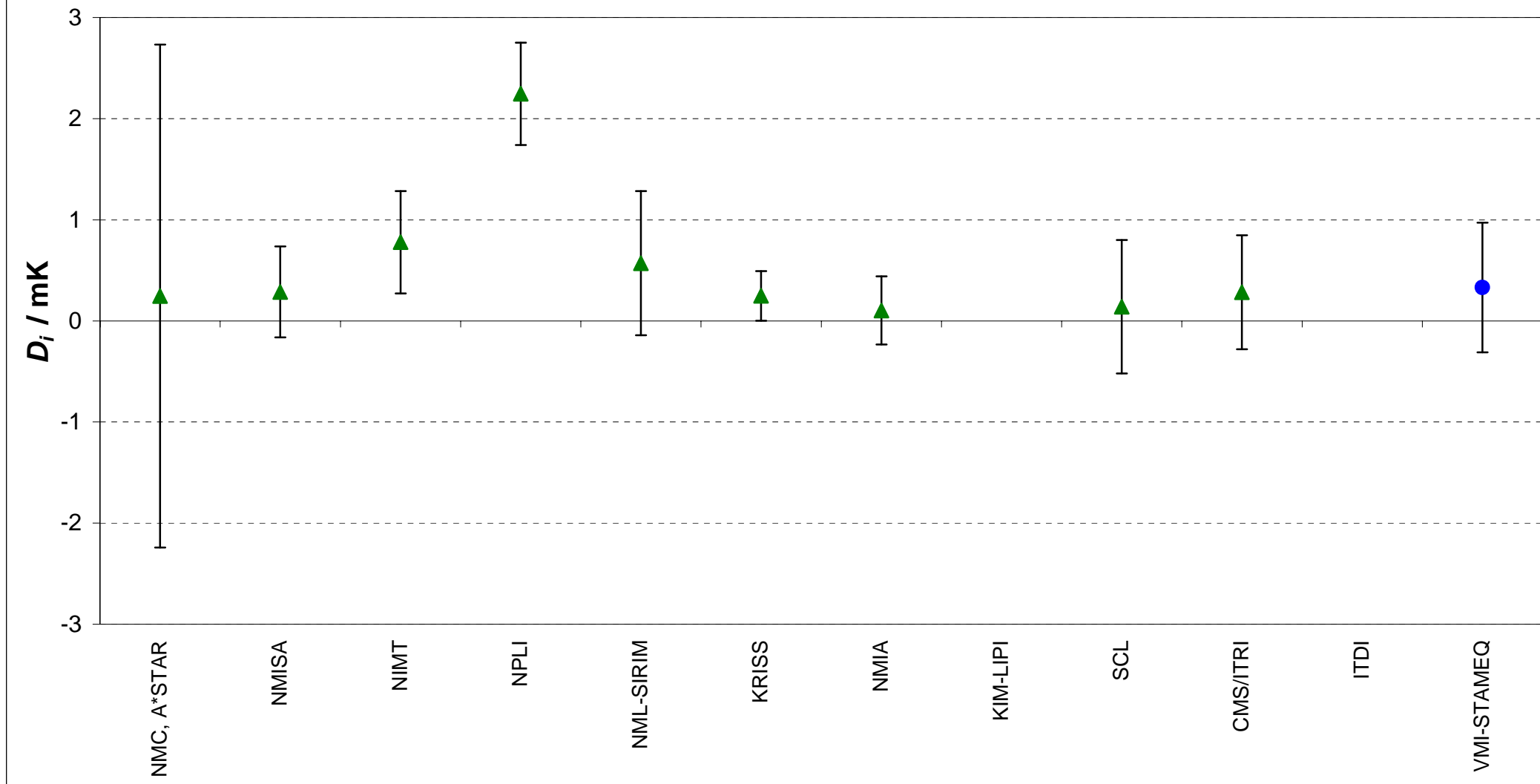
Mercury Triple Point, 234.3156 K

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →											
			NMC, A*STAR		NMISA		NMIT		NPLI		NML-SIRIM		KRISS	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	0.25	2.49			-0.04	2.52	-0.53	2.53	-2.00	2.53	-0.32	2.58	0.00	2.49
NMISA	0.29	0.45	0.04	2.52			-0.49	0.63	-1.96	0.63	-0.28	0.81	0.04	0.45
NIMT	0.78	0.51	0.53	2.53	0.49	0.63			-1.47	0.67	0.21	0.84	0.53	0.50
NPLI	2.25	0.51	2.00	2.53	1.96	0.63	1.47	0.67			1.68	0.84	2.00	0.51
NML-SIRIM	0.57	0.71	0.32	2.58	0.28	0.81	-0.21	0.84	-1.68	0.84			0.32	0.71
KRISS	0.25	0.25	0.00	2.49	-0.04	0.45	-0.53	0.50	-2.00	0.51	-0.32	0.71		
NMIA	0.10	0.34	-0.14	2.50	-0.18	0.51	-0.67	0.56	-2.14	0.56	-0.47	0.75	-0.14	0.33
KIM-LIPI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCL	0.14	0.66	-0.11	2.56	-0.15	0.76	-0.64	0.79	-2.11	0.79	-0.43	0.94	-0.11	0.66
CMS/ITRI	0.28	0.56	0.04	2.54	0.00	0.68	-0.49	0.72	-1.96	0.72	-0.29	0.87	0.04	0.56
ITDI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMI-STAMEQ	0.33	0.64												

Blue: participant in APMP.T-K3.1 only

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →									
			NMIA		KIM-LIPI		SCL		CMS/ITRI		ITDI	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	0.25	2.49	0.14	2.50	-	-	0.11	2.56	-0.04	2.54	-	-
NMISA	0.29	0.45	0.18	0.51	-	-	0.15	0.76	0.00	0.68	-	-
NIMT	0.78	0.51	0.67	0.56	-	-	0.64	0.79	0.49	0.72	-	-
NPLI	2.25	0.51	2.14	0.56	-	-	2.11	0.79	1.96	0.72	-	-
NML-SIRIM	0.57	0.71	0.47	0.75	-	-	0.43	0.94	0.29	0.87	-	-
KRISS	0.25	0.25	0.14	0.33	-	-	0.11	0.66	-0.04	0.56	-	-
NMIA	0.10	0.34			-	-	-0.04	0.70	-0.18	0.61	-	-
KIM-LIPI	-	-	-	-			-	-	-	-	-	-
SCL	0.14	0.66	0.04	0.70	-	-			-0.14	0.83	-	-
CMS/ITRI	0.28	0.56	0.18	0.61	-	-	0.14	0.83			-	-
ITDI	-	-	-	-	-	-	-	-	-	-	-	-

APMP.T-K3 and APMP.T-K3.1
ITS-90, Mercury Triple Point, 234.3156 K
Degrees of equivalence [D_i and its expanded uncertainty ($k = 2$), U_i]



Green triangles: participants in APMP.T-K3
Blue circle: participant in APMP.T-K3.1 only

Key comparisons APMP.T-K3 and APMP.T-K3.1

NOMINAL TEMPERATURE :

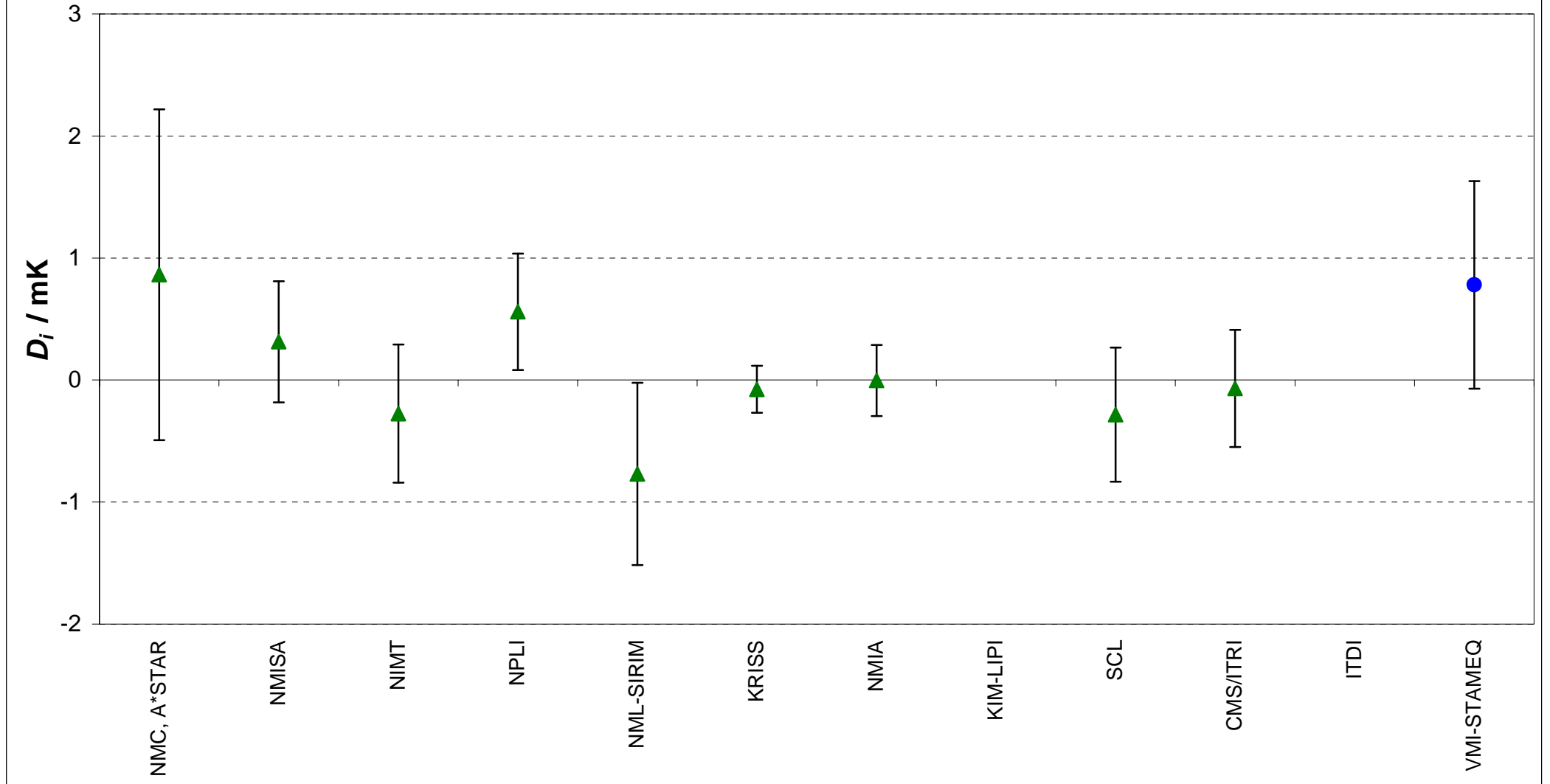
Gallium Melting Point, 302.9146 K

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →											
			NMC, A*STAR		NMISA		NMIT		NPLI		NML-SIRIM		KRISS	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	0.86	1.36			0.55	1.43	1.14	1.46	0.30	1.42	1.63	1.54	0.94	1.36
NMISA	0.31	0.50	-0.55	1.43			0.59	0.73	-0.25	0.66	1.08	0.88	0.39	0.50
NIMT	-0.28	0.57	-1.14	1.46	-0.59	0.73			-0.84	0.72	0.49	0.92	-0.20	0.57
NPLI	0.56	0.48	-0.30	1.42	0.25	0.66	0.84	0.72			1.33	0.87	0.64	0.48
NML-SIRIM	-0.77	0.75	-1.63	1.54	-1.08	0.88	-0.49	0.92	-1.33	0.87			-0.69	0.75
KRISS	-0.08	0.19	-0.94	1.36	-0.39	0.50	0.20	0.57	-0.64	0.48	0.69	0.75		
NMIA	0.00	0.29	-0.87	1.37	-0.32	0.55	0.27	0.61	-0.56	0.53	0.77	0.78	0.07	0.30
KIM-LIPI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCL	-0.28	0.55	-1.15	1.45	-0.60	0.72	-0.01	0.77	-0.84	0.70	0.49	0.91	-0.21	0.55
CMS/ITRI	-0.07	0.48	-0.93	1.43	-0.38	0.67	0.21	0.72	-0.63	0.65	0.70	0.87	0.01	0.48
ITDI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMI-STAMEQ	0.78	0.85												

Blue: participant in APMP.T-K3.1 only

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →									
			NMIA		KIM-LIPI		SCL		CMS/ITRI		ITDI	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	0.86	1.36	0.87	1.37	-	-	1.15	1.45	0.93	1.43	-	-
NMISA	0.31	0.50	0.32	0.55	-	-	0.60	0.72	0.38	0.67	-	-
NIMT	-0.28	0.57	-0.27	0.61	-	-	0.01	0.77	-0.21	0.72	-	-
NPLI	0.56	0.48	0.56	0.53	-	-	0.84	0.70	0.63	0.65	-	-
NML-SIRIM	-0.77	0.75	-0.77	0.78	-	-	-0.49	0.91	-0.70	0.87	-	-
KRISS	-0.08	0.19	-0.07	0.30	-	-	0.21	0.55	-0.01	0.48	-	-
NMIA	0.00	0.29			-	-	0.28	0.59	0.06	0.53	-	-
KIM-LIPI	-	-	-	-			-	-	-	-	-	-
SCL	-0.28	0.55	-0.28	0.59	-	-			-0.22	0.70	-	-
CMS/ITRI	-0.07	0.48	-0.06	0.53	-	-	0.22	0.70			-	-
ITDI	-	-	-	-	-	-	-	-	-	-	-	-

APMP.T-K3 and APMP.T-K3.1 ITS-90, Gallium Melting Point, 302.9146 K
 Degrees of equivalence [D_i and its expanded uncertainty ($k = 2$), U_i]



Green triangles: participants in APMP.T-K3

Blue circle: participant in APMP.T-K3.1 only

Key comparison APMP.T-K3

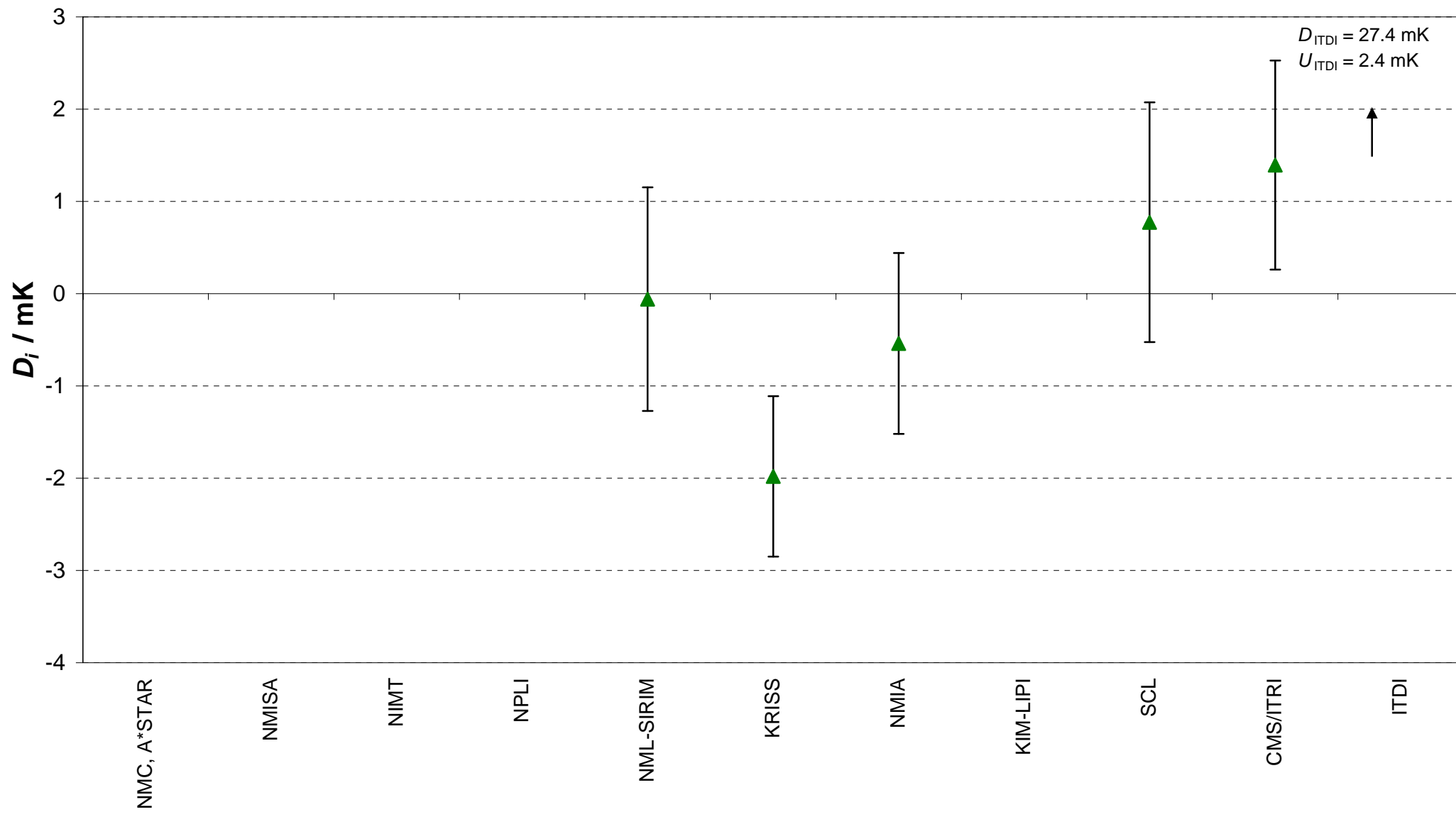
NOMINAL TEMPERATURE :

Indium Freezing Point, 429.7485 K

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →											
			NMC, A*STAR		NMISA		NMIT		NPLI		NML-SIRIM		KRISS	
	D_{ij}	U_{ij}	D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK	
NMC, A*STAR	-	-			-	-	-	-	-	-	-	-	-	-
NMISA	-	-	-	-			-	-	-	-	-	-	-	-
NIMT	-	-	-	-	-	-			-	-	-	-	-	-
NPLI	-	-	-	-	-	-	-			-	-	-	-	-
NML-SIRIM	-0.06	1.21	-	-	-	-	-	-	-			1.92	1.27	
KRISS	-1.98	0.87	-	-	-	-	-	-	-	-	-1.92	1.27		
NMIA	-0.54	0.98	-	-	-	-	-	-	-	-	-0.48	1.35	1.44	1.06
KIM-LIPI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCL	0.77	1.30	-	-	-	-	-	-	-	-	0.83	1.60	2.76	1.36
CMS/ITRI	1.39	1.13	-	-	-	-	-	-	-	-	1.45	1.48	3.37	1.21
ITDI	27.36	2.38	-	-	-	-	-	-	-	-	27.42	2.56	29.34	2.42

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →									
			NMIA		KIM-LIPI		SCL		CMS/ITRI		ITDI	
	D_{ij}	U_{ij}	D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK		D_{ij} U_{ij} / mK	
NMC, A*STAR	-	-	-	-	-	-	-	-	-	-	-	-
NMISA	-	-	-	-	-	-	-	-	-	-	-	-
NIMT	-	-	-	-	-	-	-	-	-	-	-	-
NPLI	-	-	-	-	-	-	-	-	-	-	-	-
NML-SIRIM	-0.06	1.21	0.48	1.35	-	-	-0.83	1.60	-1.45	1.48	-27.42	2.56
KRISS	-1.98	0.87	-1.44	1.06	-	-	-2.76	1.36	-3.37	1.21	-29.34	2.42
NMIA	-0.54	0.98			-	-	-1.31	1.43	-1.93	1.30	-27.90	2.46
KIM-LIPI	-	-	-	-			-	-	-	-	-	-
SCL	0.77	1.30	1.31	1.43	-	-			-0.62	1.55	-26.58	2.60
CMS/ITRI	1.39	1.13	1.93	1.30	-	-	0.62	1.55			-25.96	2.50
ITDI	27.36	2.38	27.90	2.46	-	-	26.58	2.60	25.96	2.50		

APMP.T-K3 ITS-90, Indium Freezing Point, 429.7485 K
Degrees of equivalence [D_i and its expanded uncertainty ($k = 2$), U_i]



Key comparisons APMP.T-K3 and APMP.T-K3.1

NOMINAL TEMPERATURE :

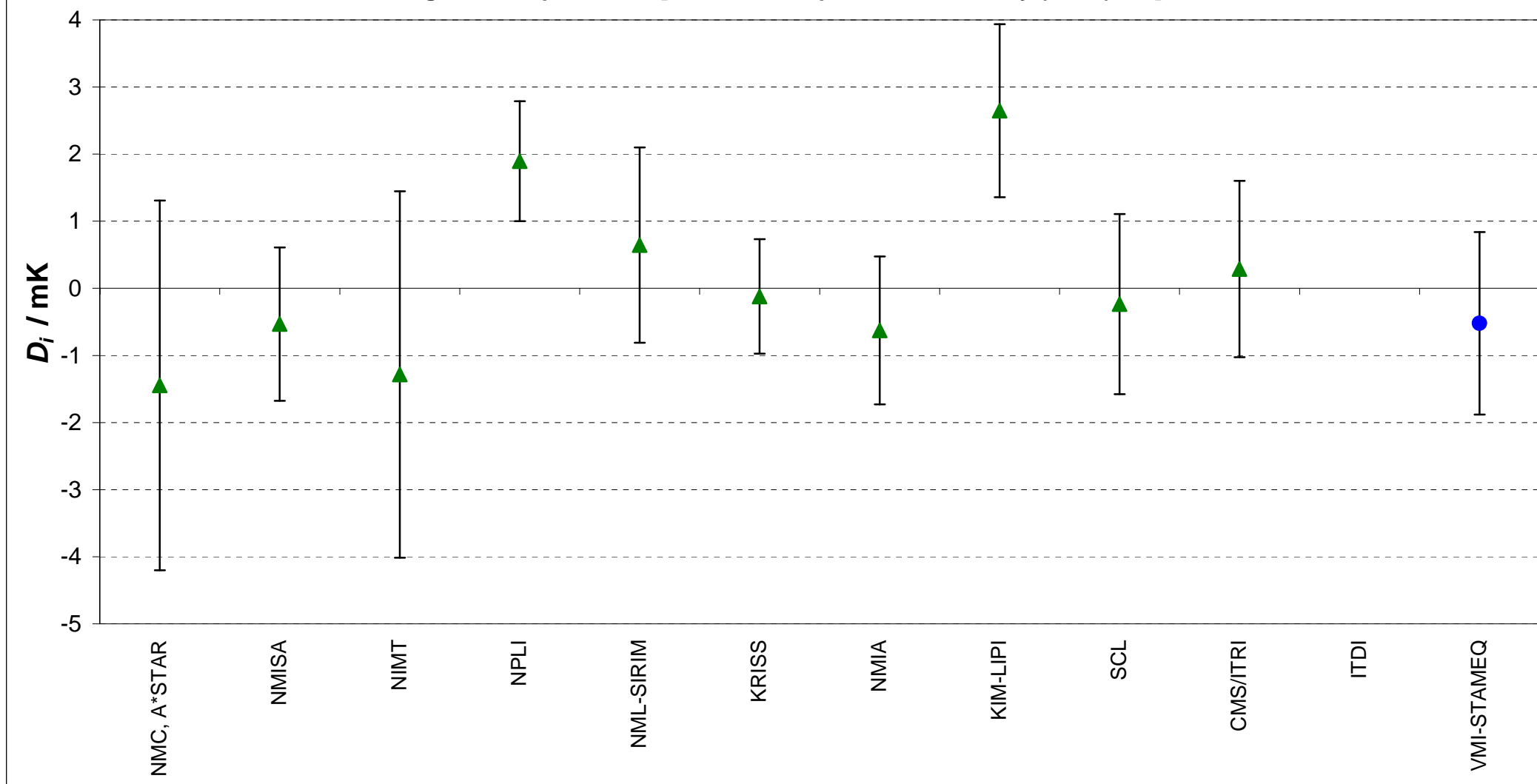
Tin Freezing Point, 505.078 K

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →											
	D_{ij} / mK	U_{ij} / mK	NMC, A*STAR		NMISA		NMIT		NPLI		NML-SIRIM		KRISS	
NMC, A*STAR	-1.45	2.75			-0.91	2.85	-0.16	3.78	-3.34	2.76	-2.09	2.99	-1.33	2.75
NMISA	-0.53	1.14	0.91	2.85			0.75	2.83	-2.43	1.16	-1.18	1.64	-0.41	1.14
NIMT	-1.29	2.73	0.16	3.78	-0.75	2.83					-1.93	2.97	-1.16	2.73
NPLI	1.89	0.89	3.34	2.76	2.43	1.16	3.18	2.74			1.25	1.48	2.02	0.89
NML-SIRIM	0.65	1.46	2.09	2.99	1.18	1.64	1.93	2.97	-1.25	1.48			0.77	1.43
KRISS	-0.12	0.85	1.33	2.75	0.41	1.14	1.16	2.73	-2.02	0.89	-0.77	1.43		
NMIA	-0.63	1.10	0.82	2.84	-0.10	1.34	0.66	2.82	-2.52	1.13	-1.27	1.59	-0.51	1.07
KIM-LIPI	2.65	1.29	4.09	2.92	3.18	1.49	3.93	2.90	0.75	1.31	2.00	1.73	2.77	1.26
SCL	-0.23	1.34	1.21	2.94	0.30	1.54	1.05	2.92	-2.13	1.37	-0.88	1.77	-0.11	1.31
CMS/ITRI	0.29	1.31	1.74	2.93	0.82	1.52	1.57	2.91	-1.60	1.34	-0.36	1.76	0.41	1.31
ITDI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMI-STAMEQ	-0.52	1.36												

Blue: participant in APMP.T-K3.1 only

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →									
	D_{ij} / mK	U_{ij} / mK	NMIA		KIM-LIPI		SCL		CMS/ITRI		ITDI	
NMC, A*STAR	-1.45	2.75	-0.82	2.84	-4.09	2.92	-1.21	2.94	-1.74	2.93	-	-
NMISA	-0.53	1.14	0.10	1.34	-3.18	1.49	-0.30	1.54	-0.82	1.52	-	-
NIMT	-1.29	2.73	-0.66	2.82	-3.93	2.90	-1.05	2.92	-1.57	2.91	-	-
NPLI	1.89	0.89	2.52	1.13	-0.75	1.31	2.13	1.37	1.60	1.34	-	-
NML-SIRIM	0.65	1.46	1.27	1.59	-2.00	1.73	0.88	1.77	0.36	1.76	-	-
KRISS	-0.12	0.85	0.51	1.07	-2.77	1.26	0.11	1.31	-0.41	1.31	-	-
NMIA	-0.63	1.10			-3.28	1.44	-0.39	1.49	-0.92	1.49	-	-
KIM-LIPI	2.65	1.29	3.28	1.44			2.88	1.63	2.36	1.63	-	-
SCL	-0.23	1.34	0.39	1.49	-2.88	1.63			-0.52	1.67	-	-
CMS/ITRI	0.29	1.31	0.92	1.49	-2.36	1.63	0.52	1.67			-	-
ITDI	-	-	-	-	-	-	-	-	-	-	-	-

APMP.T-K3 and APMP.T-K3.1
ITS-90, Tin Freezing Point, 505.078 K
Degrees of equivalence [D_i and its expanded uncertainty ($k = 2$), U_i]



Green triangles: participants in APMP.T-K3
Blue circle: participant in APMP.T-K3.1 only

Key comparisons APMP.T-K3 and APMP.T-K3.1

NOMINAL TEMPERATURE :

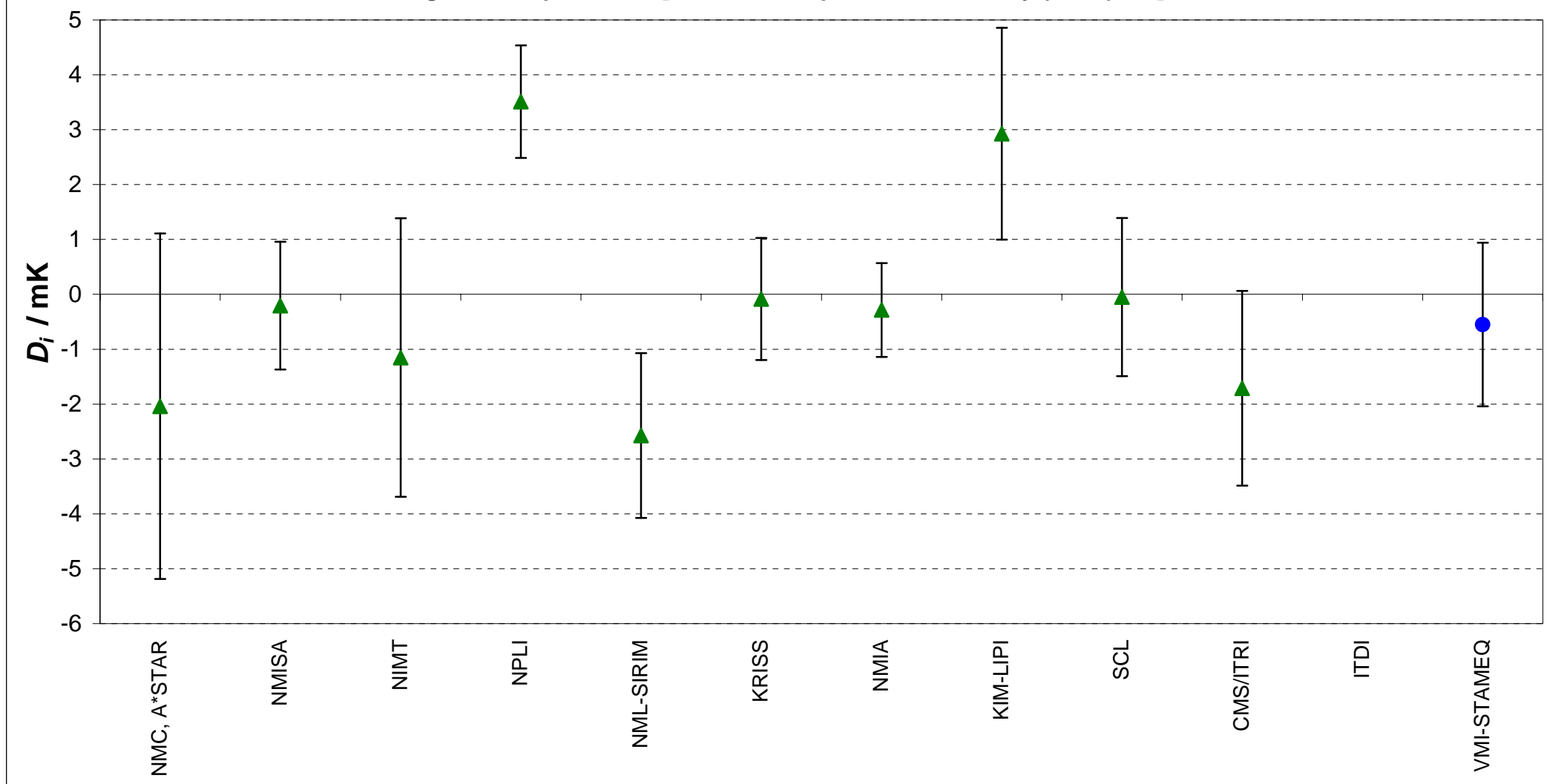
Zinc Freezing Point, 692.677 K

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →											
			NMC, A*STAR		NMISA		NMIT		NPLI		NML-SIRIM		KRISS	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	-2.04	3.15			-1.83	3.30	-0.89	3.99	-5.55	3.25	0.53	3.44	-1.95	3.29
NMISA	-0.21	1.16	1.83	3.30			0.95	2.72	-3.72	1.41	2.37	1.81	-0.12	1.50
NIMT	-1.15	2.54	0.89	3.99	-0.95	2.72			-4.66	2.66	1.42	2.89	-1.07	2.71
NPLI	3.51	1.03	5.55	3.25	3.72	1.41	4.66	2.66			6.08	1.73	3.60	1.40
NML-SIRIM	-2.57	1.50	-0.53	3.44	-2.37	1.81	-1.42	2.89	-6.08	1.73			-2.49	1.67
KRISS	-0.09	1.11	1.95	3.29	0.12	1.50	1.07	2.71	-3.60	1.40	2.49	1.67		
NMIA	-0.28	0.85	1.76	3.21	-0.08	1.33	0.87	2.62	-3.80	1.21	2.29	1.52	-0.20	1.13
KIM-LIPI	2.93	1.93	4.97	3.65	3.13	2.18	4.08	3.14	-0.58	2.11	5.50	2.30	3.01	2.06
SCL	-0.05	1.44	1.99	3.42	0.16	1.76	1.10	2.86	-3.56	1.67	2.52	1.91	0.04	1.62
CMS/ITRI	-1.71	1.77	0.33	3.57	-1.51	2.04	-0.56	3.04	-5.22	1.97	0.86	2.25	-1.63	2.01
ITDI	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMI-STAMEQ	-0.55	1.49												

Blue: participant in APMP.T-K3.1 only

Lab <i>i</i> ↓	D_i U_i / mK		Lab <i>j</i> →									
			NMIA		KIM-LIPI		SCL		CMS/ITRI		ITDI	
	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}	D_{ij}	U_{ij}
			/ mK		/ mK		/ mK		/ mK		/ mK	
NMC, A*STAR	-2.04	3.15	-1.76	3.21	-4.97	3.65	-1.99	3.42	-0.33	3.57	-	-
NMISA	-0.21	1.16	0.08	1.33	-3.13	2.18	-0.16	1.76	1.51	2.04	-	-
NIMT	-1.15	2.54	-0.87	2.62	-4.08	3.14	-1.10	2.86	0.56	3.04	-	-
NPLI	3.51	1.03	3.80	1.21	0.58	2.11	3.56	1.67	5.22	1.97	-	-
NML-SIRIM	-2.57	1.50	-2.29	1.52	-5.50	2.30	-2.52	1.91	-0.86	2.25	-	-
KRISS	-0.09	1.11	0.20	1.13	-3.01	2.06	-0.04	1.62	1.63	2.01	-	-
NMIA	-0.28	0.85			-3.21	1.94	-0.24	1.45	1.43	1.88	-	-
KIM-LIPI	2.93	1.93	3.21	1.94			2.98	2.26	4.64	2.56	-	-
SCL	-0.05	1.44	0.24	1.45	-2.98	2.26			1.66	2.21	-	-
CMS/ITRI	-1.71	1.77	-1.43	1.88	-4.64	2.56	-1.66	2.21			-	-
ITDI	-	-	-	-	-	-	-	-	-	-	-	-

APMP.T-K3 and APMP.T-K3.1 ITS-90, Zinc Freezing Point, 692.677 K
 Degrees of equivalence [D_i and its expanded uncertainty ($k = 2$), U_i]



Green triangles: participants in APMP.T-K3
 Blue circle: participant in APMP.T-K3.1 only