Key comparisons CCM.M-K3 and CCM.M-K3.1

MEASURAND : Mass
NOMINAL VALUE : 50 kg

Key comparison CCM.M-K3

The comparison is organized in three petals (petal 1, 2 and 3) pivoted around the pilot laboratory, the BNM-LNE, and two different travelling standards are used.

m_i **mass of the travelling standard measured by laboratory *i***
m_0 **mass nominal value of the travelling standard**
u_i **: combined standard uncertainty of (m_i - m_0)**
m_{Ci} **corrected result of laboratory *i* : m_{Ci} = (m_i - m_0) - m_P where m_P is the average of (m_i - m_0) over petal P, see page 6 of the CCM.M-K3 Final Report**
S/N **travelling standard serial number**

Lab *i*	m_i - m_0 / mg	u_i / mg	m_{Ci} / mg	S/N	Date of measurement
CEM	43.4	5.8	52.05	9	Mar 01
SP	46.0	4.0	54.65	9	Apr 01
NMIJ	44.8	3.5	53.45	9	May 01
KRISS	39.8	2.8	48.45	9	Jun 01
CENAM	42.4	2.8	51.00	9	Oct 01
NRC	41.9	1.5	50.50	9	Nov 01
GUM	38.1	6.5	46.70	9	Dec 01
NPL	39.0	2.8	47.60	9	Jan 02
BNM-LNE	18.0	4.2	51.50	6	Jul 01
VSL	20	12	53.50	6	Sep 01
PTB	15.53	0.98	49.03	6	Oct 01
SMU	16.7	4.0	50.20	6	Nov 01
METAS	19.6	2.5	53.07	6	Dec 01
INRIM	19.3	5.0	52.80	6	Jan 02

Petal 1
Petal 2
Petal 3

Key comparison CCM.M-K3.1

This is a subsequent bilateral comparison to CCM.M-K3 between CEM and LNE. Results obtained with the two travelling standards 6' and MP9 are given in Table 5 on page 5 of the CCM.M-K3.1 Final Report.

Key comparisons CCM.M-K3 and CCM.M-K3.1

MEASURAND : Mass
NOMINAL VALUE : 50 kg

Key comparison CCM.M-K3

The key comparison reference value, m_{CR}, is the median of the corrected laboratory results m_{Ci}. Its standard uncertainty, u_R, is obtained as the standard uncertainty of the median of the m_{Ci} values.
m_{CR} = 51.25 mg u_R = 1.1 mg

The degree of equivalence of each laboratory *i* with respect to the reference value is given by a pair of terms:
$D_i = (m_{Ci} - m_{CR})$ and U_i, its expanded uncertainty ($k = 2$), both expressed in mg.
U_i can be computed from Equation 5 given in page 7 of the CCM.M-K3 Final Report.

The degree of equivalence between two laboratories *i* and *j* is given by a pair of terms:
$D_{ij} = D_i - D_j = (m_{Ci} - m_{Cj})$ and U_{ij}, its expanded uncertainty ($k = 2$), both expressed in mg.
U_{ij} can be computed from Equation 7 given in page 8 of the Final Report, for two laboratories of the same petal, or from Equation 9 given in page 8 of the Final Report for two laboratories of different petals.

Linking CCM.M-K3.1 to CCM.M-K3

The linking laboratory is the LNE.
The linkage process is detailed in Section 3.5 of the CCM.M-K3.1 Final Report. It leads to the computation of two degrees of equivalence for CEM relative to the CCM.M-K3 key comparison reference value: one for transfer standard 6' and one for transfer transfer MP9.

No pair-wise degrees of equivalence involving CEM as participant in CCM.M-K3.1 have been computed.

Key comparisons CCM.M-K3 and CCM.M-K3.1

50 kg mass

Matrix of equivalence

Lab *i* ⇩ / Lab *j* ⇨

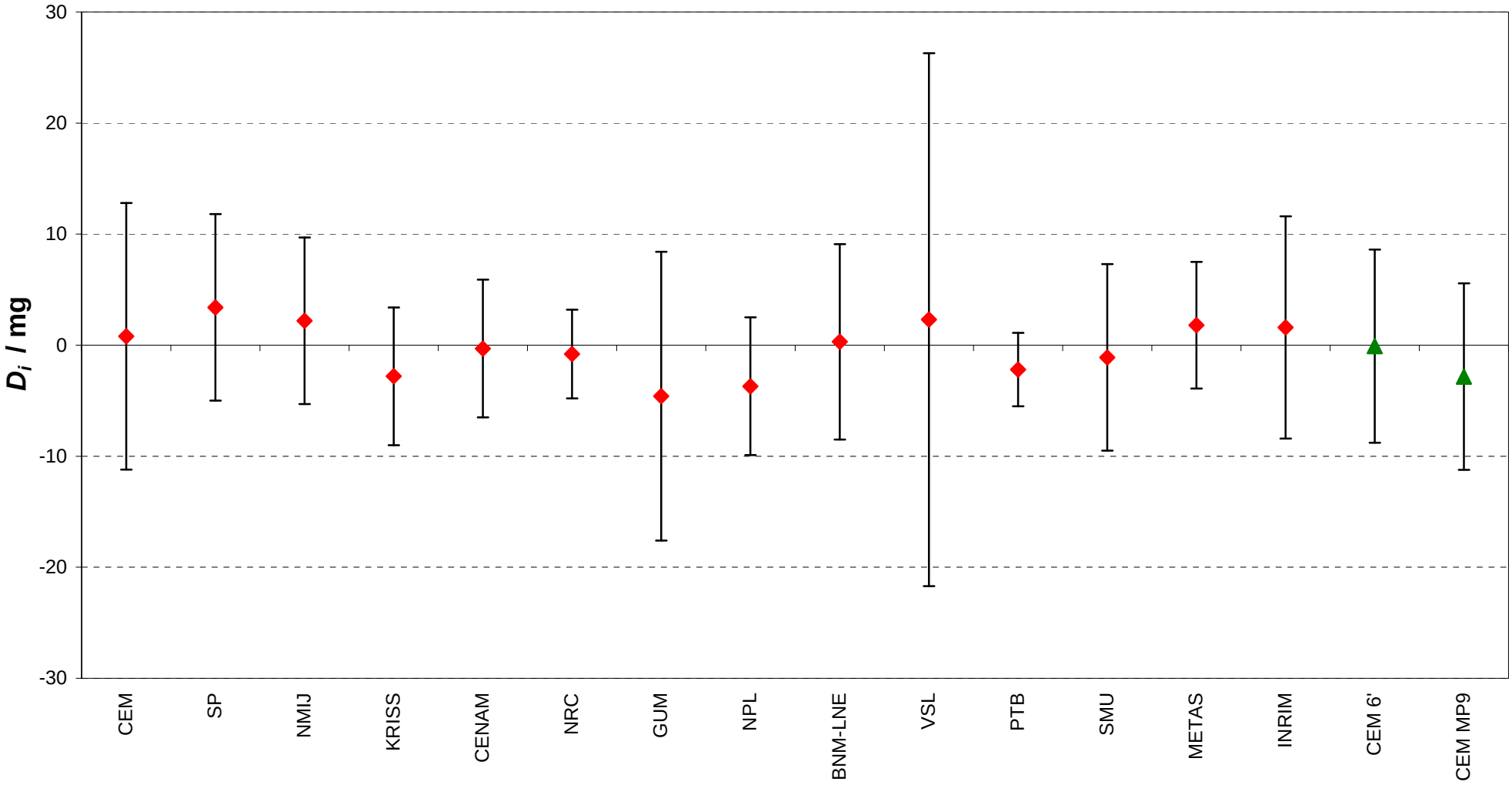
Lab *i*	D_i / mg	U_i / mg	CEM D_{ij} / mg	CEM U_{ij} / mg	SP D_{ij} / mg	SP U_{ij} / mg	NMIJ D_{ij} / mg	NMIJ U_{ij} / mg	KRISS D_{ij} / mg	KRISS U_{ij} / mg	CENAM D_{ij} / mg	CENAM U_{ij} / mg	NRC D_{ij} / mg	NRC U_{ij} / mg	GUM D_{ij} / mg	GUM U_{ij} / mg	NPL D_{ij} / mg	NPL U_{ij} / mg	BNM-LNE D_{ij} / mg	BNM-LNE U_{ij} / mg
CEM	0.8	12			-2.6	14	-1.4	14	3.6	13	1.1	13	1.6	12	5.3	18	4.5	13	0.5	15
SP	3.4	8.4	2.6	14			1.2	11	6.2	10	3.7	10	4.2	8.8	8.0	15	7.1	10	3.2	12
NMIJ	2.2	7.5	1.4	14	-1.2	11			5.0	9.1	2.5	9.3	3.0	8.0	6.7	15	5.8	9.2	2.0	11
KRISS	-2.8	6.2	-3.6	13	-6.2	10	-5.0	9.1			-2.6	8.2	-2.1	6.8	1.7	14	0.8	8.2	-3.1	10
CENAM	-0.3	6.2	-1.1	13	-3.7	10	-2.5	9.3	2.6	8.2			0.5	6.6	4.3	14	3.4	8.1	-0.5	10
NRC	-0.8	4.0	-1.6	12	-4.2	8.8	-3.0	8.0	2.1	6.8	-0.5	6.6			3.8	13	2.9	6.5	-1.0	9.2
GUM	-4.6	13	-5.3	18	-8.0	15	-6.7	15	-1.7	14	-4.3	14	-3.8	13			-0.9	14	-4.8	16
NPL	-3.7	6.2	-4.5	13	-7.1	10	-5.8	9.2	-0.8	8.2	-3.4	8.1	-2.9	6.5	0.9	14			-3.9	10
BNM-LNE	0.3	8.8	-0.5	15	-3.2	12	-2.0	11	3.1	10	0.5	10	1.0	9.2	4.8	16	3.9	10		
VSL	2.3	24	1.5	27	-1.2	25	0.1	25	5.1	25	2.5	25	3.0	24	6.8	27	5.9	25	2.0	25
PTB	-2.2	3.3	-3.0	12	-5.6	8.6	-4.4	7.6	0.6	6.4	-2.0	6.4	-1.5	4.3	2.3	13	1.4	6.4	-2.5	8.8
SMU	-1.1	8.4	-1.8	14	-4.5	12	-3.2	11	1.8	10	-0.8	10	-0.3	8.9	3.5	15	2.6	10	-1.3	12
METAS	1.8	5.7	1.0	13	-1.6	10	-0.4	8.9	4.6	7.9	2.1	7.9	2.6	6.3	6.4	14	5.5	7.8	1.6	10
INRIM	1.6	10	0.8	15	-1.9	13	-0.6	12	4.4	12	1.8	12	2.3	11	6.1	17	5.2	12	1.3	13

CEM 6'	-0.1	8.7
CEM MP9	-2.8	8.4

	VSL D_{ij} / mg	VSL U_{ij} / mg	PTB D_{ij} / mg	PTB U_{ij} / mg	SMU D_{ij} / mg	SMU U_{ij} / mg	METAS D_{ij} / mg	METAS U_{ij} / mg	INRIM D_{ij} / mg	INRIM U_{ij} / mg
CEM	-1.5	27	3.0	12	1.8	14	-1.0	13	-0.8	15
SP	1.2	25	5.6	8.6	4.5	12	1.6	10	1.9	13
NMIJ	-0.1	25	4.4	7.6	3.2	11	0.4	8.9	0.6	12
KRISS	-5.1	25	-0.6	6.4	-1.8	10	-4.6	7.9	-4.4	12
CENAM	-2.5	25	2.0	6.4	0.8	10	-2.1	7.9	-1.8	12
NRC	-3.0	24	1.5	4.3	0.3	8.9	-2.6	6.3	-2.3	11
GUM	-6.8	27	-2.3	13	-3.5	15	-6.4	14	-6.1	17
NPL	-5.9	25	-1.4	6.4	-2.6	10	-5.5	7.8	-5.2	12
BNM-LNE	-2.0	25	2.5	8.8	1.3	12	-1.6	10	-1.3	13
VSL			4.5	24	3.3	25	0.4	25	0.7	26
PTB	-4.5	24			-1.2	8.4	-4.0	5.6	-3.8	10
SMU	-3.3	25	1.2	8.4			-2.9	10	-2.6	13
METAS	-0.4	25	4.0	5.6	2.9	10			0.3	11
INRIM	-0.7	26	3.8	10	2.6	13	-0.3	11		

CCM.M-K3 and CCM.M-K3.1 Mass standards, nominal value 50 kg

Degrees of equivalence [D_i and expanded uncertainty (k = 2) U_i]



Red diamonds: participants in CCM.M-K3

Green triangles: CEM participant in CCM.M-K3.1 (results obtained with transfer standard 6' and with transfer standard MP9)