Key comparisons CCQM-K34, CCQM-K34.1 and CCQM-K34.2

Key comparison CCQM-K34

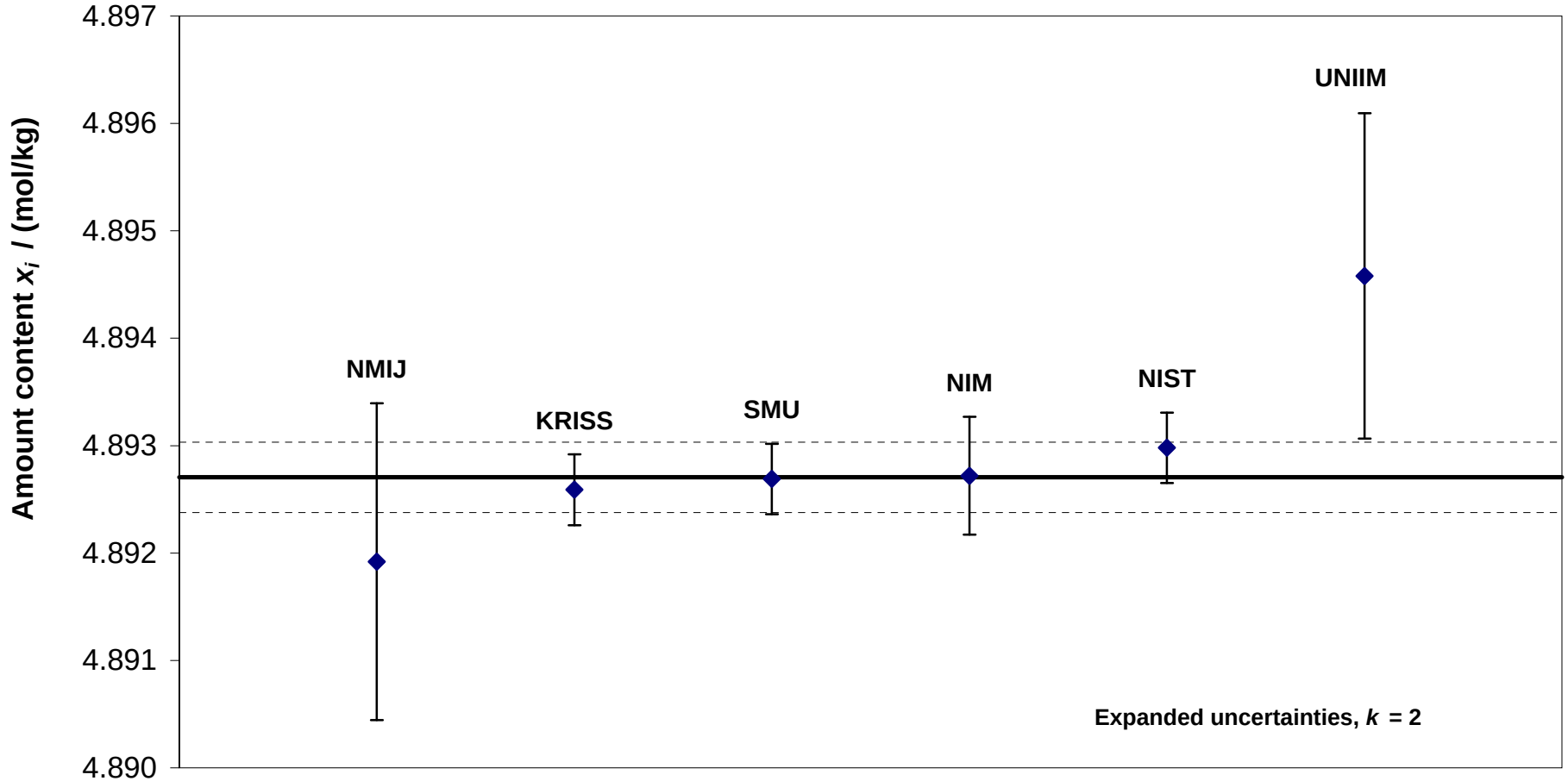
MEASURAND : Amount content of weak acid in potassium hydrogen phthalate
NOMINAL VALUE : ~ 4.897 mol/kg

x_i : result of measurement carried out by laboratory *i*
u_i : combined standard uncertainty of x_i

Lab *i*	x_i / (mol/kg)	u_i / (mol/kg)	(u_i / x_i) / %	Date of measurement
NMIJ	4.89192	0.00074	0.0151	Jun / Jul 2004
KRISS	4.89259	0.00016	0.0034	Aug 2004
SMU	4.89269	0.00016	0.0033	Jul 2004
NIM	4.89272	0.00027	0.0056	Jul / Aug 2004
NIST	4.89298	0.00016	0.0034	Jul 2004
UNIIM	4.89458	0.00076	0.0155	Aug 2004

CCQM-K34 Amount content of weak acid in potassium hydrogen phthalate

Laboratory individual measurements



Key comparison reference value:
x_R = 4.89270 mol/kg and U_R expanded uncertainty (k = 2),
$U_R = 2u_R$ = 0.00033 mol/kg

Key comparison CCQM-K34.1

MEASURAND : Amount content of weak acid in potassium hydrogen phthalate
NOMINAL VALUE : ~ 4.897 mol/kg

$x_{i\ \text{-K34.1}}$: result of measurement carried out by laboratory *i* participating in CCQM-K34.1
$u_{i\ \text{-K34.1}}$: combined standard uncertainty of $x_{i\ \text{-K34.1}}$

Lab *i*	$x_{i\ \text{-K34.1}}$ / (mol/kg)	$u_{i\ \text{-K34.1}}$ / (mol/kg)	($u_{i\ \text{-K34.1}}$ / $x_{i\ \text{-K34.1}}$) / %	Date of measurement
BAM	4.89530	0.00016	0.0033	May / Jun 2005
SMU	4.89520	0.00018	0.0037	May / Jun 2006

Key comparison CCQM-K34.2

MEASURAND : Amount content of weak acid in potassium hydrogen phthalate
NOMINAL VALUE : ~ 4.897 mol/kg

$x_{i\ \text{-K34.2}}$: result of measurement carried out by laboratory *i* participating in CCQM-K34.2
$u_{i\ \text{-K34.2}}$: combined standard uncertainty of $x_{i\ \text{-K34.2}}$

Lab *i*	$x_{i\ \text{-K34.2}}$ / (mol/kg)	$u_{i\ \text{-K34.2}}$ / (mol/kg)	($u_{i\ \text{-K34.2}}$ / $x_{i\ \text{-K34.2}}$) / %	Date of measurement
INMETRO	4.89643	0.00018	0.0036	Oct 2008
UNIIM	4.89656	0.00034	0.0070	Dec 2008
SMU	4.89683	0.00015	0.0031	Oct 2008

Key comparisons CCQM-K34, CCQM-K34.1 and CCQM-K34.2

Key comparison CCQM-K34

MEASURAND : Amount content of weak acid in potassium hydrogen phthalate
NOMINAL VALUE : ~ 4.897 mol/kg

The key comparison reference value, x_R, is calculated as the median of the participant results. Its standard uncertainty, u_R, is based on the median of the absolute deviations (see on page 7 of the Final Report). x_R = 4.89270 mol/kg, u_R = 0.00016 mol/kg

The degree of equivalence of laboratory *i* with respect to the key comparison reference value is given by a pair of terms, both expressed in mol/kg: $D_i = (x_i - x_R)$ and its expanded uncertainty U_i ($k = 2$), $U_i = 2(u_i^2 + u_R^2)^{1/2}$.

The degree of equivalence between two laboratories *i* and *j* is given by a pair of terms both expressed in mol/kg: $D_{ij} = (D_i - D_j) = (x_i - x_j)$ and its expanded uncertainty U_{ij} ($k = 2$), $U_{ij} = 2(u_i^2 + u_j^2)^{1/2}$.

Linking CCQM-K34.1 and CCQM-K34.2 to CCQM-K34

SMU result is used as a link to the key comparison reference value from CCQM-K34. The results in the comparisons differ by less than 0.1 %, so the degrees of equivalence are directly comparable.

The degree of equivalence of the participant *i* with respect to the key comparison reference value is given by a pair of terms, both expressed in mol/kg: $D_i = (D_{\text{SMU-K34}} + x_{i\text{-K34.a}} - x_{\text{SMU-34.a}})$, where a = 1 or 2, and its expanded uncertainty U_i ($k = 2$), $U_i = 2(u_{\text{SMU-K34.a}}^2 + u_{i\text{-K34.a}}^2 + u_R^2)^{1/2}$.

The pair-wise degrees of equivalence between BAM and laboratory *j* participant in CCQM-K34 is given by a pair of terms both expressed in mol/kg: $D_{\text{BAM},j} = (D_{\text{BAM}} - D_j)$ and its expanded uncertainty $U_{\text{BAM},j}$ ($k = 2$), $U_{\text{BAM},j} = 2(u_{\text{BAM-K34.1}}^2 + u_{\text{SMU-K34.1}}^2 + u_j^2)^{1/2}$.
Pair-wise degrees of equivalence involving CCQM-K34.2 participants are not calculated.

Key comparisons CCQM-K34, CCQM-K34.1 and CCQM-K34.2

MEASURAND : Amount content of weak acid in potassium hydrogen phthalate **NOMINAL VALUE : ~ 4.897 mol/kg**

Lab *j* ⇨

Lab *i* ⇩

	D_i / (mol/kg)	U_i / (mol/kg)
NMIJ	**-0.0008**	0.0015
KRISS	**-0.00012**	0.00046
SMU	**-0.00001**	0.00046
NIM	**0.00001**	0.00064
NIST	**0.00028**	0.00046
UNIIM	**0.0019**	0.0016
BAM	**0.0001**	0.00058
INMETRO	**-0.0004**	0.00057
UNIIM	**-0.0003**	0.00082

	NMIJ		KRISS		SMU		NIM		NIST		UNIIM		BAM	
	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)	D_{ij} / (mol/kg)	U_{ij} / (mol/kg)
NMIJ			**-0.0007**	0.0015	**-0.0008**	0.0015	**-0.0008**	0.0016	**-0.0011**	0.0015	**-0.0027**	0.0021	**-0.0009**	0.0016
KRISS	**0.0007**	0.0015			**-0.0001**	0.0005	**-0.0001**	0.0006	**-0.0004**	0.0005	**-0.0020**	0.0016	**-0.0002**	0.0006
SMU	**0.0008**	0.0015	**0.0001**	0.0005			**0.0000**	0.0006	**-0.0003**	0.0005	**-0.0019**	0.0016	**-0.0001**	0.0006
NIM	**0.0008**	0.0016	**0.0001**	0.0006	**0.0000**	0.0006			**-0.0003**	0.0006	**-0.0019**	0.0016	**-0.0001**	0.0007
NIST	**0.0011**	0.0015	**0.0004**	0.0005	**0.0003**	0.0005	**0.0003**	0.0006			**-0.0016**	0.0016	**0.0002**	0.0006
UNIIM	**0.0027**	0.0021	**0.0020**	0.0016	**0.0019**	0.0016	**0.0019**	0.0016	**0.0016**	0.0016			**0.0018**	0.0016
BAM	**0.0009**	0.0016	**0.0002**	0.0006	**0.0001**	0.0006	**0.0001**	0.0007	**-0.0002**	0.0006	**-0.0018**	**0.0016**		

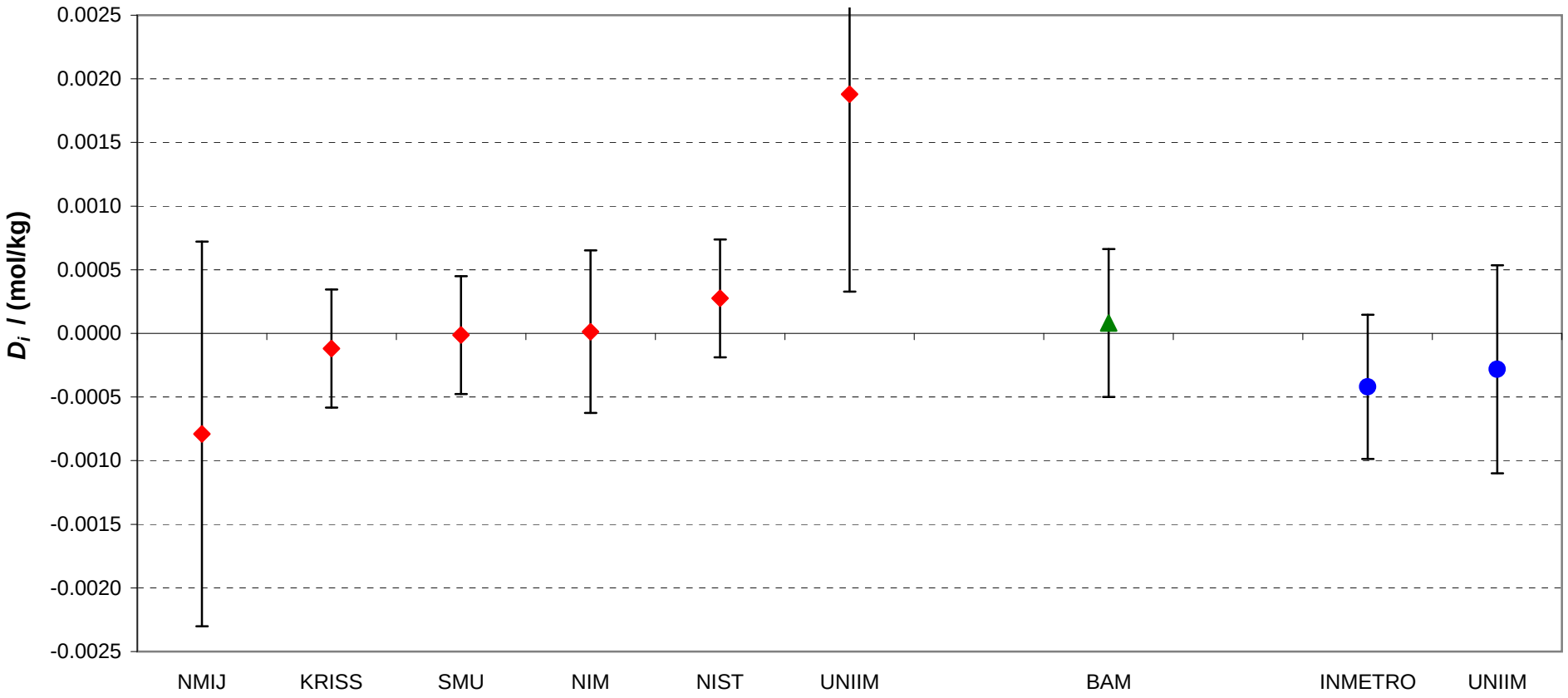
In relative terms:

Lab *i* ⇩

	(D_i / x_R) / %	(U_i / x_R) / %
NMIJ	**-0.016**	0.031
KRISS	**-0.002**	0.009
SMU	**0.000**	0.009
NIM	**0.000**	0.013
NIST	**0.006**	0.009
UNIIM	**0.038**	0.032
BAM	**0.002**	0.012
INMETRO	**-0.009**	0.012
UNIIM	**-0.006**	0.017

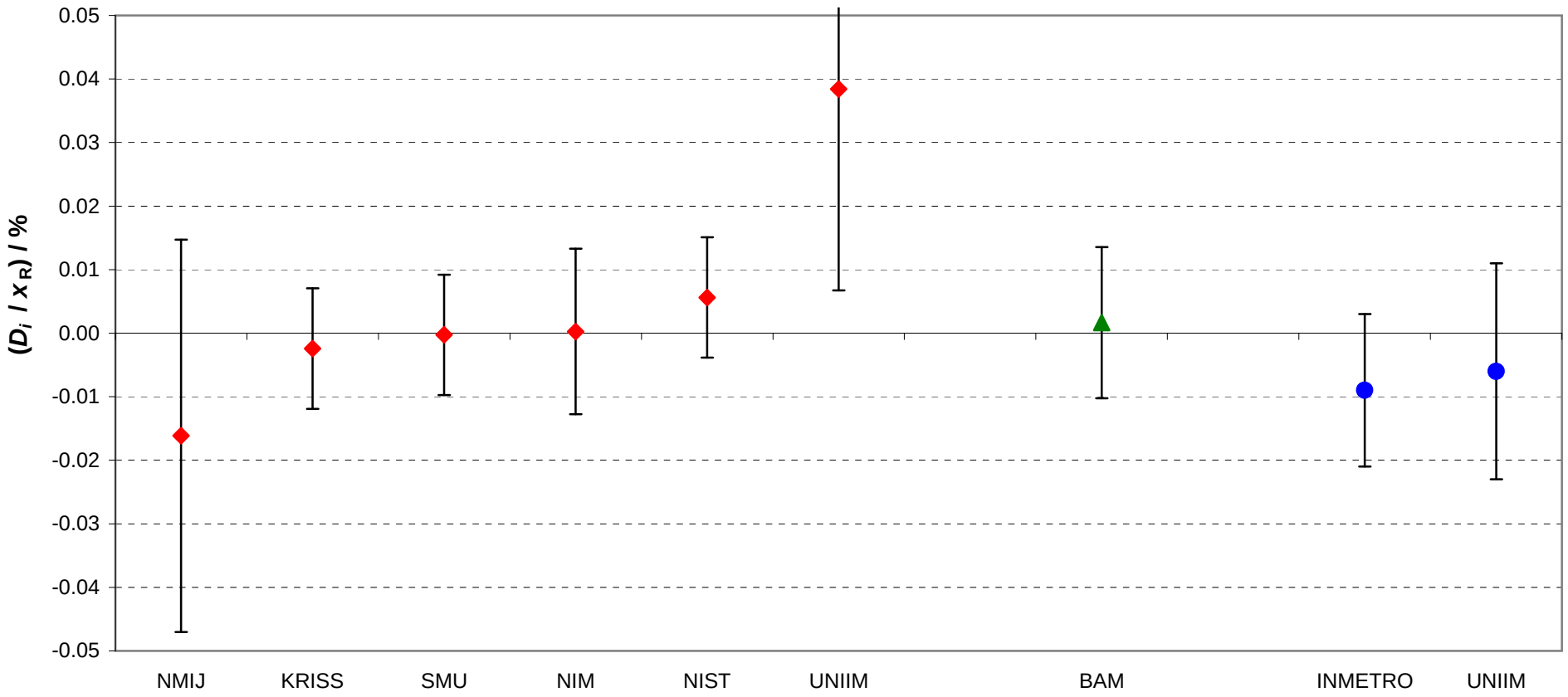
	NMIJ		KRISS		SMU		NIM		NIST		UNIIM		BAM	
	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(U_{ij} / x_R) / %	(D_{ij} / x_R) / %	(D_{ij} / x_R) / %
NMIJ			**-0.014**	0.031	**-0.016**	0.031	**-0.016**	0.032	**-0.022**	0.031	**-0.055**	0.043	**-0.018**	0.032
KRISS	**0.014**	0.031			**-0.002**	0.009	**-0.003**	0.013	**-0.008**	0.010	**-0.041**	0.032	**-0.004**	0.012
SMU	**0.016**	0.031	**0.002**	0.009			**-0.001**	0.013	**-0.006**	0.009	**-0.039**	0.032	**-0.002**	0.012
NIM	**0.016**	0.032	**0.003**	0.013	**0.001**	0.013			**-0.005**	0.013	**-0.038**	0.033	**-0.001**	0.015
NIST	**0.022**	0.031	**0.008**	0.010	**0.006**	0.009	**0.005**	0.013			**-0.033**	0.032	**0.004**	0.012
UNIIM	**0.055**	0.043	**0.041**	0.032	**0.039**	0.032	**0.038**	0.033	**0.033**	0.032			**0.037**	0.032
BAM	**0.018**	0.032	**0.004**	0.012	**0.002**	0.012	**0.001**	0.015	**-0.004**	0.012	**-0.037**	**0.032**		

CCQM-K34, CCQM-K34.1 and CCQM-K34.2
Amount content of weak acid in potassium hydrogen phthalate
Degrees of equivalence, D_i and expanded uncertainty U_i (k = 2)



Red diamonds: participants in CCQM-K34
Green triangle: participant in CCQM-K34.1
Blue circles: participants in CCQM-K34.2

CCQM-K34, CCQM-K34.1 and CCQM-K34.2
Amount content of weak acid in potassium hydrogen phthalate
Degrees of equivalence, (D_i / x_R) and expanded uncertainty (U_i / x_R) (k = 2)



Red diamonds: participants in CCQM-K34
Green triangle: participant in CCQM-K34.1
Blue circles: participants in CCQM-K34.2