

BIPM.RI(I)-K3, APMP.RI(I)-K3 and SIM.RI(I)-K3

Key comparison BIPM.RI(I)-K3

MEASURAND : Air kerma
Radiation quality 100 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air kerma determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value determined by the BIPM standard
 u_i : combined standard uncertainty of x_i taking correlation into account

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NPL	0.0028	0.9999	0.0032	1997
NIM	0.0022	1.0043	0.0030	2001
LNE-LNHB	0.0030	1.0004	0.0039	2007
GUM	0.0023	1.0009	0.0028	2010
ARPANSA	0.0032	1.0037	0.0038	2010
MKEH	0.0026	0.9996	0.0034	2010
VNIIM	0.0022	1.0014	0.0018	2010
PTB	0.0024	1.0027	0.0025	2014
ENEA-INMRI	0.0029	1.0039	0.0031	2014
BEV	0.0032	1.0032	0.0032	2014
NRC	0.0027	1.0031	0.0033	2014
NMIJ	0.0031	0.9992	0.0031	2015
VSL	0.0031	0.9990	0.0032	2016
NIST	0.0038	0.9978	0.0038	2016

MEASURAND : Air kerma
Radiation quality 100 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air-kerma calibration coefficients determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard, derived from the calibration coefficients through
the results of the linking laboratories as detailed in the APMP.RI(I)-K3 Final Report
 u_i : combined standard uncertainty of x_i taking correlation into account

Key comparison APMP.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
INER	0.0035	1.0037	0.0039	2003
Nuclear Malaysia	0.0064	1.0142	0.0064	2003
DMSc	0.0065	0.9969	0.0067	2003
NMIJ	0.0048	1.0035	0.0051	2003
BARC	0.0074	1.0085	0.0076	2003
NMISA	0.0031	1.0045	0.0028	2003
KRISS	0.0030	0.9916	0.0026	2003
IAEA	0.0040	1.0043	0.0037	2003

Key comparison SIM.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NRC	0.0029	0.9995	0.0034	2007
CNEA	0.0037	0.9940	0.0072	2008
LMNRI/IRD	0.0056	0.9905	0.0061	2008
ININ	0.0063	0.9907	0.0081	2008

Key comparison BIPM.RI(I)-K3

MEASURAND : Air kerma
Radiation quality 135 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air kerma determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value determined by the BIPM standard
 u_i : combined standard uncertainty of x_i taking correlation into account

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NPL	0.0028	1.0005	0.0032	1997
NIM	0.0022	1.0019	0.0030	2001
LNE-LNHB	0.0030	1.0012	0.0039	2007
GUM	0.0023	1.0038	0.0028	2010
ARPANSA	0.0032	1.0056	0.0038	2010
MKEH	0.0026	1.0009	0.0034	2010
VNIIM	0.0022	1.0018	0.0018	2010
PTB	0.0024	1.0045	0.0025	2014
ENEA-INMRI	0.0029	1.0042	0.0031	2014
BEV	0.0032	1.0047	0.0032	2014
NRC	0.0027	1.0023	0.0033	2014
NMIJ	0.0031	0.9986	0.0031	2015
VSL	0.0031	0.9996	0.0032	2016
NIST	0.0038	0.9967	0.0038	2016

MEASURAND : Air kerma
Radiation quality 135 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air-kerma calibration coefficients determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard, derived from the calibration coefficients through
the results of the linking laboratories as detailed in the APMP.RI(I)-K3 Final Report
 u_i : combined standard uncertainty of x_i taking correlation into account

Key comparison APMP.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
INER	0.0035	1.0043	0.0039	2003
Nuc. Malaysia	0.0064	1.0162	0.0064	2003
DMSc	0.0065	1.0042	0.0067	2003
NMIJ	0.0048	1.0023	0.0051	2003
BARC	0.0074		0.0076	2003
NMISA	0.0031	1.0020	0.0028	2003
KRISS	0.0030	1.0011	0.0026	2003
IAEA	0.0040	1.0092	0.0037	2003

Key comparison SIM.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NRC	0.0029	0.9985	0.0034	2007
CNEA	0.0037	1.0011	0.0072	2008
LMNRI/IRD	0.0056	0.9906	0.0061	2008
ININ	0.0063	0.9879	0.0081	2008

Key comparison BIPM.RI(I)-K3

MEASURAND : Air kerma
Radiation quality 180 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air kerma determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard
 u_i : combined standard uncertainty of x_i taking correlation into account

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NPL	0.0028	1.0013	0.0032	1997
NIM	0.0022	1.0020	0.0030	2001
LNE-LNHB	0.0030	0.9999	0.0039	2007
GUM	0.0023	1.0035	0.0028	2010
ARPANSA	0.0032	1.0060	0.0038	2010
MKEH	0.0026	1.0004	0.0034	2010
VNIIM	0.0022	1.0026	0.0018	2010
PTB	0.0024	1.0049	0.0025	2014
ENEA-INMRI	0.0029	1.0073	0.0031	2014
BEV	0.0032	1.0041	0.0032	2014
NRC	0.0027	1.0013	0.0033	2014
NMIJ	0.0031	0.9976	0.0031	2015
VSL	0.0031	1.0000	0.0032	2016
NIST	0.0038	0.9973	0.0038	2016

MEASURAND : Air kerma
Radiation quality 180 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air-kerma calibration coefficients determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard, derived from the calibration coefficients through
the results of the linking laboratories as detailed in the APMP.RI(I)-K3 Final Report
 u_i : combined standard uncertainty of x_i taking correlation into account

Key comparison APMP.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
INER	0.0035	1.0060	0.0039	2003
Nuc. Malaysia	0.0064	1.0150	0.0064	2003
DMSc	0.0065	1.0096	0.0067	2003
NMIJ	0.0048	1.0028	0.0051	2003
BARC	0.0074		0.0076	2003
NMISA	0.0031	1.0048	0.0028	2003
KRISS	0.0030	1.0066	0.0026	2003
IAEA	0.0040	1.0131	0.0037	2003

Key comparison SIM.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NRC	0.0029	0.9987	0.0034	2007
CNEA	0.0037	1.0021	0.0072	2008
LMNRI/IRD	0.0056	0.9920	0.0061	2008
ININ	0.0063	0.9889	0.0081	2008

Key comparison BIPM.RI(I)-K3

MEASURAND : Air kerma
Radiation quality 250 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air kerma determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard
 u_i : combined standard uncertainty of x_i taking correlation into account

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NPL	0.0028	0.9993	0.0032	1997
NIM	0.0022	1.0003	0.0030	2001
LNE-LNHB	0.0030	0.9980	0.0039	2007
GUM	0.0023	1.0045	0.0028	2010
ARPANSA	0.0032	1.0053	0.0038	2010
MKEH	0.0026	1.0004	0.0034	2010
VNIIM	0.0022	1.0026	0.0018	2010
PTB	0.0024	1.0055	0.0025	2014
ENEA-INMRI	0.0029	1.0056	0.0031	2014
BEV	0.0032	1.0011	0.0032	2014
NRC	0.0027	1.0004	0.0033	2014
NMIJ	0.0031	0.9963	0.0031	2015
VSL	0.0031	0.9979	0.0032	2016
NIST	0.0038	0.9942	0.0038	2016

MEASURAND : Air kerma
Radiation quality 250 kV

$u_{\text{Lab } i}$: relative standard uncertainty of air-kerma calibration coefficients determined by Lab i
 x_i : air kerma determined by Lab i at the BIPM, relative to the reference value
determined by the BIPM standard, derived from the calibration coefficients through
the results of the linking laboratories as detailed in the APMP.RI(I)-K3 Final Report
 u_i : combined standard uncertainty of x_i taking correlation into account

Key comparison APMP.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
INER	0.0035	1.0055	0.0039	2003
Nuc. Malaysia	0.0064	1.0159	0.0064	2003
DMSc	0.0065	1.0130	0.0067	2003
NMIJ	0.0048	1.0029	0.0051	2003
BARC	0.0074	1.0148	0.0076	2003
NMISA	0.0031	1.0075	0.0028	2003
KRISS	0.0030	1.0076	0.0026	2003
IAEA	0.0040	1.0140	0.0037	2003

Key comparison SIM.RI(I)-K3

Lab i	$u_{\text{Lab } i}$	x_i	u_i	Date of measurement
NRC	0.0029	0.9972	0.0034	2007
CNEA	0.0037	1.0014	0.0072	2008
LMNRI/IRD	0.0056	0.9915	0.0061	2008
ININ	0.0063	0.9880	0.0081	2008

Key comparisons BIPM.RI(I)-K3, APMP.RI(I)-K3, and SIM.RI(I)-K3

MEASURAND : Air kerma
 Radiation quality 100 kV, 135 kV, 180 kV and 250 kV

For a comparison with laboratory i , the key comparison reference value is the BIPM air-kerma determination $x_{R,i}$ and its standard uncertainty $u_{R,i}$

The degree of equivalence of laboratory i with respect to $x_{R,i}$ is given by a pair of terms, both expressed in mGy/Gy:

D_i and $U_i = 2u_i$, its expanded uncertainty ($k = 2$). In evaluating u_i for BIPM comparisons, account is taken of correlation between $u_{\text{Lab } i}$ and $u_{R,i}$ (see the BIPM.RI(I)-K3 Summary Report of November 2003 or the relevant Final Report).

For regional comparisons, additional linking uncertainties are included (see APMP.RI(I)-K3 Final Report and SIM.RI(I)-K3 Final Report).

When required, the degree of equivalence between two laboratories i and j can be evaluated by a pair of terms, both expressed in mGy/Gy:

$D_{ij} = D_i - D_j$ and $U_{ij} = 2u_{ij}$, its expanded uncertainty ($k = 2$). In evaluating u_{ij} , account should be taken

of correlation between u_i and u_j (see the BIPM.RI(I)-K3 Summary Report of November 2003). For regional comparisons

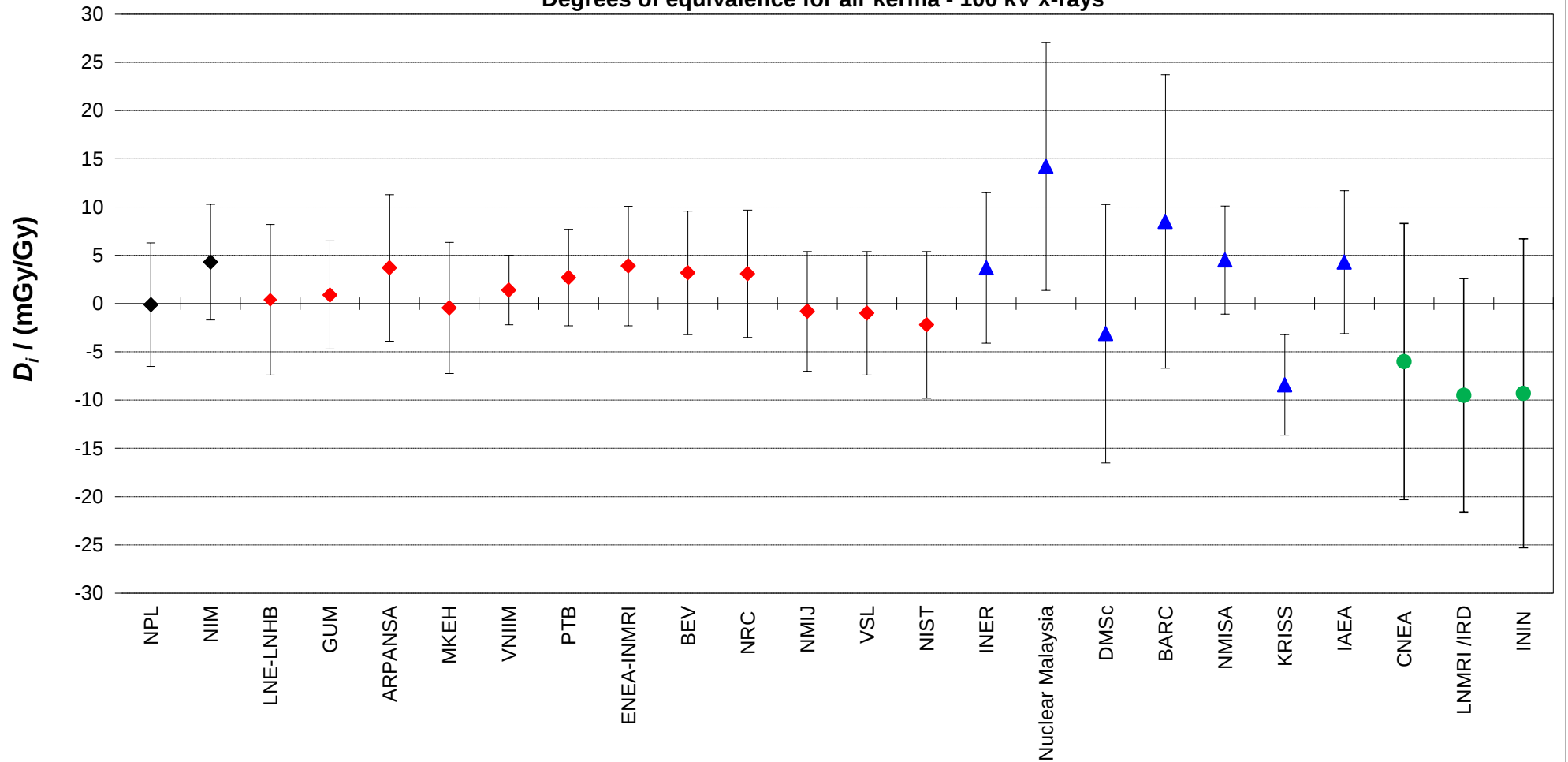
involving secondary standards, this includes correlation related to traceability (see APMP.RI(I)-K3 Final Report and SIM.RI(I)-K3 Final Report).

Key comparisons BIPM.RI(I)-K3, APMP.RI(I)-K3 and SIM.RI(I)-K3

MEASURAND : Air kerma
Radiation quality 100 kV, 135 kV, 180 kV and 250 kV

Lab <i>i</i> ↓	100 kV		135 kV		180 kV		250 kV	
	D_i	U_i	D_i	U_i	D_i	U_i	D_i	U_i
	I (mGy/Gy)		I (mGy/Gy)		I (mGy/Gy)		I (mGy/Gy)	
NPL	-0.1	6.4	0.5	6.4	1.3	6.4	-0.7	6.4
NIM	4.3	6.0	1.9	6.0	2.0	6.0	0.3	6.0
LNE-LNHB	0.4	7.8	1.2	7.8	-0.1	7.8	-2.0	7.8
GUM	0.9	5.6	3.8	5.6	3.5	5.6	4.5	5.6
ARPANSA	3.7	7.6	5.6	7.6	6.0	7.6	5.3	7.6
MKEH	-0.4	6.8	0.9	6.8	0.4	6.8	0.4	6.8
VNIIM	1.4	3.6	1.8	3.6	2.6	3.6	2.6	3.6
PTB	2.7	5.0	4.5	5.0	4.9	5.0	5.5	5.0
ENEA-INMRI	3.9	6.2	4.2	6.2	7.3	6.2	5.6	6.2
BEV	3.2	6.4	4.7	6.4	4.1	6.4	1.1	6.4
NRC	3.1	6.6	2.3	6.6	1.3	6.6	0.4	6.6
NMIJ	-0.8	6.2	-1.4	6.2	-2.4	6.2	-3.7	6.2
VSL	-1.0	6.4	-0.4	6.4	0.0	6.4	-2.1	6.4
NIST	-2.2	7.6	-3.3	7.6	-2.7	7.6	-5.8	7.6
INNER	3.7	7.8	4.3	7.8	6.0	7.8	5.5	7.8
Nuclear Malaysia	14.2	12.8	16.2	12.8	15.0	12.8	15.9	12.8
DMSc	-3.1	13.4	4.2	13.4	9.6	13.4	13.0	13.4
BARC	8.5	15.2	-	-	-	-	14.8	15.2
NMISA	4.5	5.6	2.0	5.6	4.8	5.6	7.5	5.6
KRISS	-8.4	5.2	1.1	5.2	6.6	5.2	7.6	5.2
IAEA	4.3	7.4	9.2	7.4	13.1	7.4	14.0	7.4
CNEA	-6.0	14.3	1.1	14.3	2.1	14.3	1.4	14.3
LNMRI/IRD	-9.5	12.1	-9.4	12.1	-8.0	12.1	-8.5	12.1
ININ	-9.3	16.0	-12.1	16.0	-11.1	16.1	-12.0	16.1

BIPM.RI(I)-K3, APMP.RI(I)-K3, and SIM.RI(I)-K3
Degrees of equivalence for air kerma - 100 kV x-rays

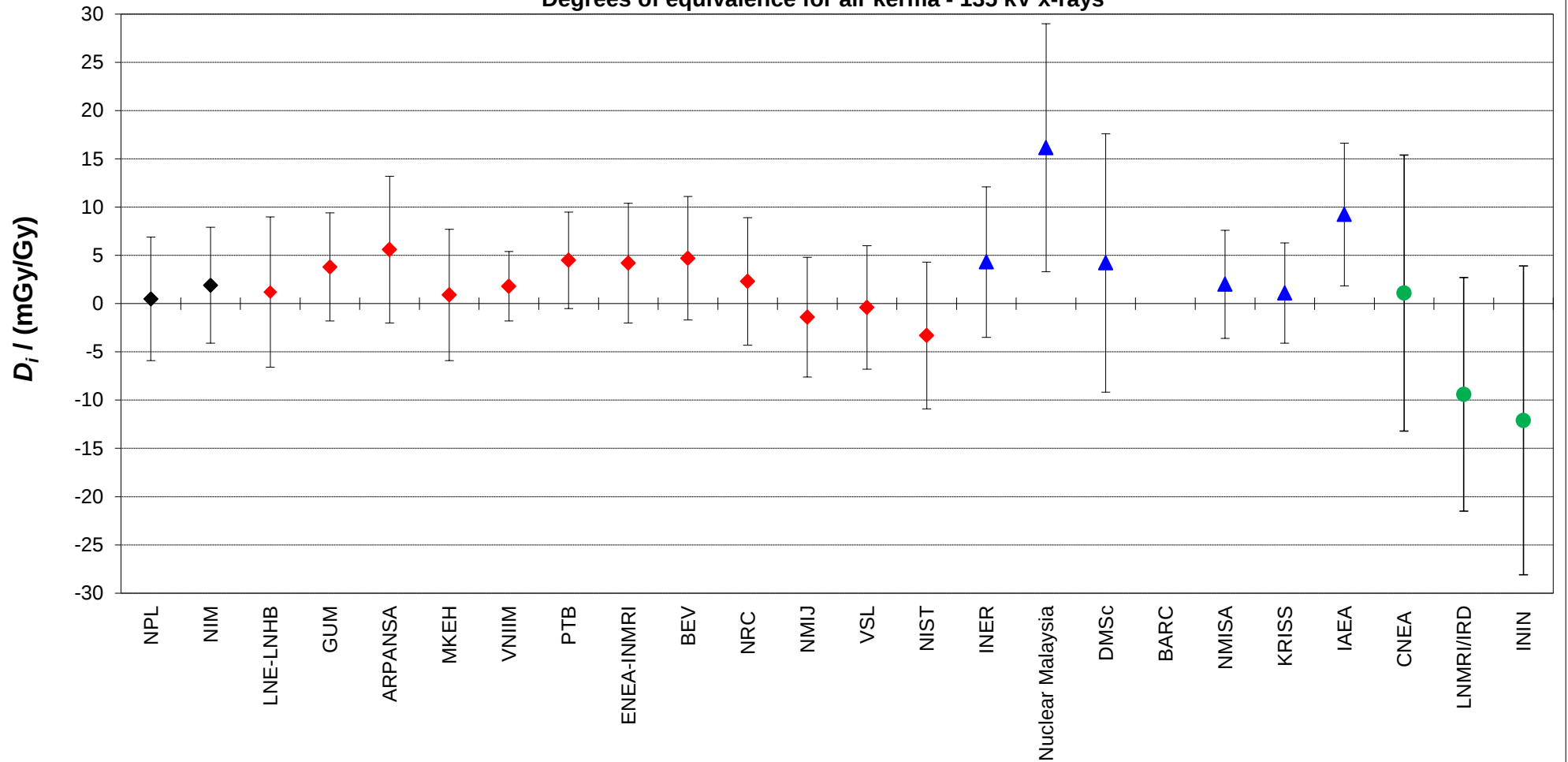


Diamonds: participants in BIPM.RI(I)-K3 (in black: results that are more than 15 years old)

Blue triangles: participants in APMP.RI(I)-K3

Green circles: participants in SIM.RI(I)-K3

BIPM.RI(I)-K3, APMP.RI(I)-K3, and SIM.RI(I)-K3
Degrees of equivalence for air kerma - 135 kV x-rays

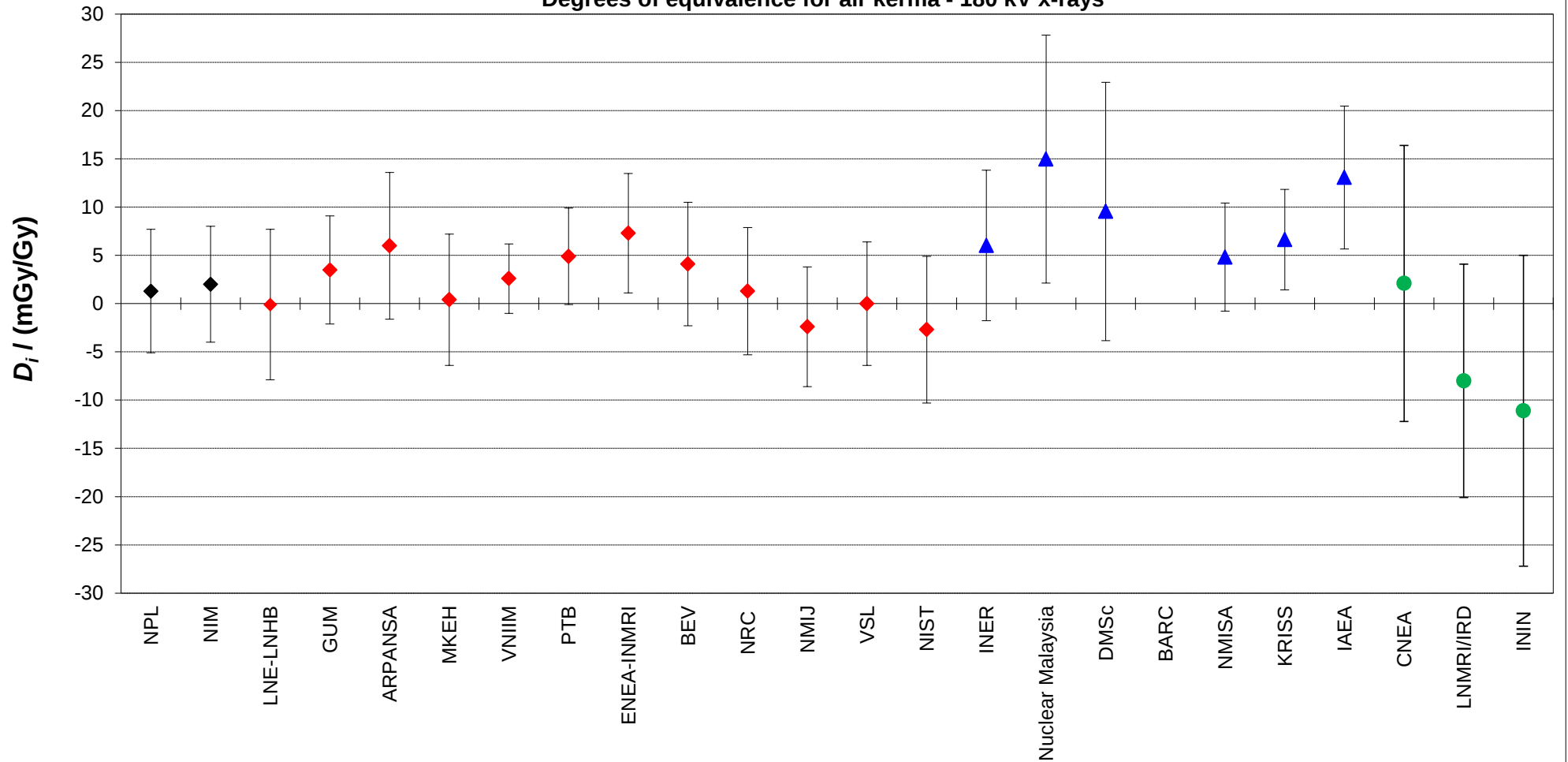


Diamonds: participants in BIPM.RI(I)-K3 (in black: results that are more than 15 years old)

Blue triangles: participants in APMP.RI(I)-K3

Green circles: participants in SIM.RI(I)-K3

BIPM.RI(I)-K3, APMP.RI(I)-K3, and SIM.RI(I)-K3
Degrees of equivalence for air kerma - 180 kV x-rays

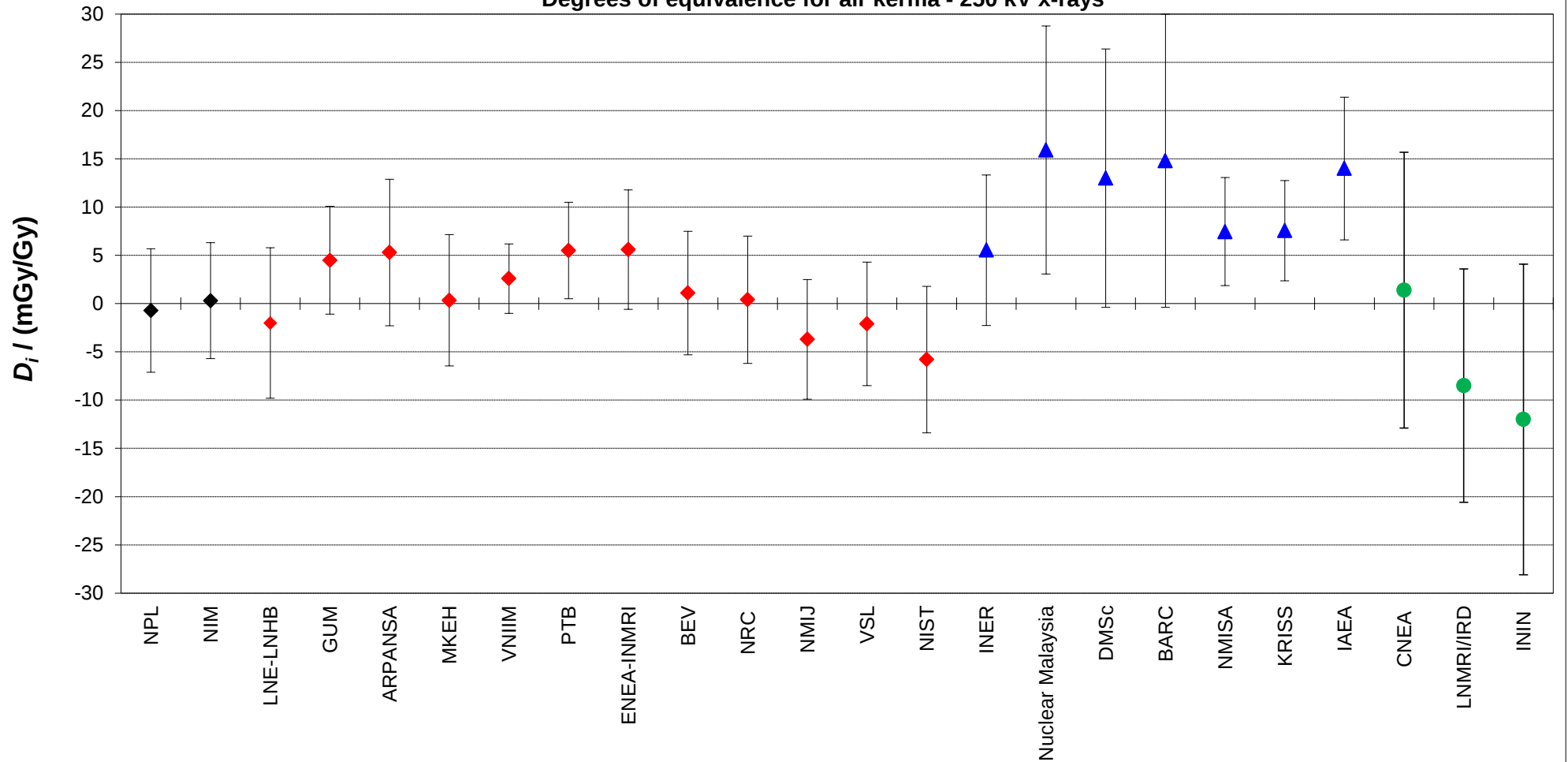


Diamonds: participants in BIPM.RI(I)-K3 (in black: results that are more than 15 years old)

Blue triangles: participants in APMP.RI(I)-K3

Green circles: participants in SIM.RI(I)-K3

BIPM.RI(I)-K3, APMP.RI(I)-K3, and SIM.RI(I)-K3
Degrees of equivalence for air kerma - 250 kV x-rays



Diamonds: participants in BIPM.RI(I)-K3 (in black: results that are more than 15 years old)

Blue triangles: participants in APMP.RI(I)-K3

Green circles: participants in SIM.RI(I)-K3