



1. IR TC members and their status

As a result of transition from EUROMET to EURAMET on the last year, the composition and scientific activity of Ionising Radiation Technical Committee has changed a few as it can be seen in table below. The Turkish Atomic Energy Authority (TAEK) was announced by UME as new DI and the Croatian Rudjer Boskovic Institute (IRB) needs confirmation as DI by the respective NMI (DZM).

In addition to the traditional types of collaboration projects the execution of EMRP has been started in the frame of ERANET plus program funded by the EC. Two ionisation radiation projects marked T2.J06 and T2.J.07 have been selected as part of the "Health Targeted Program". The scheduled stating date is June 2008.

Some statistic about the IR TC are in the table bellow.

	Published CMCs	neutron	dosimetry	activity	EMRP mem.	ERANET+ TP2 J06/J07	Status DI/NMI	NMI/country
	Total	115	605	1067	21	10/8	17/12	31
1	CIEMAT (ES)		36	97	*		DI	CEM/Spain
2	IFIN (RO)			34	*		DI	INM/Romania
3	SMU (SK)	15	58	37	*	/*	NMI	SMU/Slovakia
4	RMTC(LV)		12	131			DI	LNMC/Latvia
5	NRPA(NO)		22		*		DI	JV/Norway
6	NCM(BG)		7				NMI	NCM/Bulgaria
7	NPL (UK)	38	41	121	*	/*	NMI	NPL/UK
8	PTB (DE)	26	59	0	*	/*	NMI	PTB/Germany
9	LNE-LNHB (FR)	15	61	160	*	/*	NMI	LNE/France
10	IRMM (EC)			85	obs.		As	EC
11	IAEA		13				?	UN
12	BEV (AT)		49	74	*	/*	NMI	BEV/Austria
13	CMI (CZ)	12	7	104	*	/*	NMI	CMI/Czech Rep.
14	METAS (CH)		8	21	*		NMI	METAS/Switzerland
15	NMi (NL)		28	57	*	/*	NMI	Nmi/Netherland
16	MKEH (HU)		20	74	*		NMI	MKEH/Hungary
17	ENEA (IT)	9	76	14	*	/*	DI	INRIM/Italy
18	GUM (PL)		5	58			NMI	GUM/Poland
19	STUK (FI)		31		*	/*	DI	MIKES/Finland
20	ITN (PT)		43		*	/*	DI	IPQ/Portugal
21	SSI (SE)		29		*	/*	DI	SP/Sweden
22	RPII (IE)						DI	NML/Ireland
23	DTU (DK)				*		DI	DFM/Denmark
24	SMD (BE)				*		NMI	SMD/Belgium
25	SZMDM (YU)						NMI	DMDM/Serbia
26	IJS (SI)				*		DI	MIRS/Slovenia
27	PFI (LT)						DI	VMT/Lithuania
28	IRB (HR)						DI?	DZM/Croatia
29	HAEC						DI	EIM/Greece
30	TAEK				*		DI	UME/Turkey
31	GR (IS)						DI	NEST/Iceland



2. Projects

There are 12 running projects of the IR TC in the period of review from last March to date. The measurement parts of these projects have been completed except projects number #813 and #628. Some details are in the table below.

Project No.	Type	Subfield	No. of. part.	Pilot lab.	Status	Duration
909	Traceability	activity	2	PTB	Measurements completed, publication in progress	2006-2008
907	R(II)-S5.Sb-124 comparison	activity	9	LNE	Measurements completed,	2006-2008
749	Co-operation	activity	5	IRMM	Final report in progress	2004-2007
608	R(III) S1 comparison	neutron	3	IPSN	STOPPED!	2002-2007
822	R(III) S2 comparison	neutron	3	PTB	Measurements completed Draft A report in progress	2004-2007
1021	comparison	dosimetry	3	BEV	Planned Technical Prot. in progress	2008-2009
814	R(I) S6 comparison	dosimetry	2	LNE	Measurements is completed Publication in progress	2004-2007
813	R(I)-K1&K2 comparison	dosimetry	25	MKEH	Measurements in progress	2005-2008
739	R(I) S2 comparison	dosimetry	8	PTB	The project completed Draft B report accepted	2004-2007
738	R(I) S5 comparison	dosimetry	17	PTB	Measurements completed Draft A in progress	2005-2008
628	Comparison	dosimetry	4	NPL	Measurements in progress	2005-2009
605	Co-operation	dosimetry	6	METAS	Final report in progress	2004-2008
545	R(I) S3 comparison	dosimetry	10	PTB	Draft B report completed	2001-2008

2.1 Co-operations in research:

Project 749: Alpha-particle emission probabilities and energies in the decay of ^{240}Pu

The challenge is that the small alpha peaks are hidden in the tailing of the larger peaks in the spectrum. The IRMM has sent their vacuum evaporated ^{240}Pu sources to CIEMAT, NPL, LNE and PTB for measurement. The measured 7 alpha spectra involved different techniques and were circulated among the participants for analysis. From the measured gamma spectra additional information on the alpha particle emission was derived at the IRMM. The emission probability and other decay data calculation have been performed by IRMM, CIEMAT and UNEX. The final report is scheduled by June 2008.

Project 605: Beam Quality Specification of High- Energy Photon beams

A set of four cylindrical ionisation chambers belonging to METAS (two of type NE2571A, one of NE2561 and one of NE2611A) have been calibrated in terms of absorbed dose to water in the ^{60}Co beams and in several high-energy X-ray beams in the range 4 MeV-21 MeV at participating laboratories (ENEA, LNE, METAS, NPL, NRC and PTB). Beam quality measurements have been



performed in the accelerator beams in order to compare the efficacy of $\text{TPR}_{20,10}$ and $\%dd(10)_x$ terms as beam quality specifiers. In total 28 accelerator beams were measured. The measurements and data analysis have been completed in 2007. The final report is scheduled for spring 2008.

2.2 Comparisons

Project 1021: Direct comparison of primary standards of absorbed dose to water in ^{60}Co and high energy photon beams

This project is proposed for the direct comparison of primary standards for absorbed dose to water of BEV, METAS and PTB in ^{60}Co and high energy photon beams. The primary standards for application in this comparison are one graphite calorimeter (BEV) and two water calorimeters (METAS, PTB). The planned starting time is March 2008-02-13

Project 907: EUROMET.RI(II)-S5.Sb-124 Measurement of Sb-124 activity and determination of photon emission probabilities.

The first part of this exercise was dedicated to activity measurements, the 9 participants were asked to use all techniques available in their laboratory. The ampoules of Sb-124 were sent to the participants in March 2007. The second part is dedicated to gamma-ray measurements. The participants have already sent their data to LNE-LNHB where the decay data evaluation is under calculation. The expected completion of the project is the end of 2008.

Project 822: EUROMET RI(III)-S2 Comparison of neutron fluence measurements for neutron energies of 15.5, 16, 17, 19 MeV

The determination of the neutron fluence in quasi-monoenergetic neutron fields at neutron energies using primary standard instruments of the participating laboratories started in 2005. The involved neutron fields are available at the accelerator facility of PTB in Braunschweig. The measurements have already been completed. Because the recoil proton telescopes used by IRMM and PTB are not sensitive for the low energy part of the spectrum whereas the “de Pangher” Long Counter primary standard of NPL takes into account this continuum from D(d,n) , Ti(d,n) , Ag(d,n) , O(d,n) , C(d,n) reactions, some extra TOF measurements and further calculations are required. Final report is expected in 2008

Project 814: EUROMET RI(I)-S6 Bilateral comp. of air kerma standards of BNM-LNHB and NPL for ^{192}Ir HDR brachytherapy sources

Brachytherapy sources' dose distribution determination is one of the recent challenge of dosimetry laboratories. Air kerma rate determination in vacuum at a reference distance is usually a first step in this procedure. The calibration coefficient of BNM-LNHB ionisation chamber type NE 2571 used for air kerma measurements is based on the extrapolation technique of 250 kV X-ray, ^{137}Cs and ^{60}Co calibrations. The NPL absolute chamber sensitivity is calculated on the basis of its volume, the uncertainty budget are under review. The Draft A report of the comparison is under preparation.



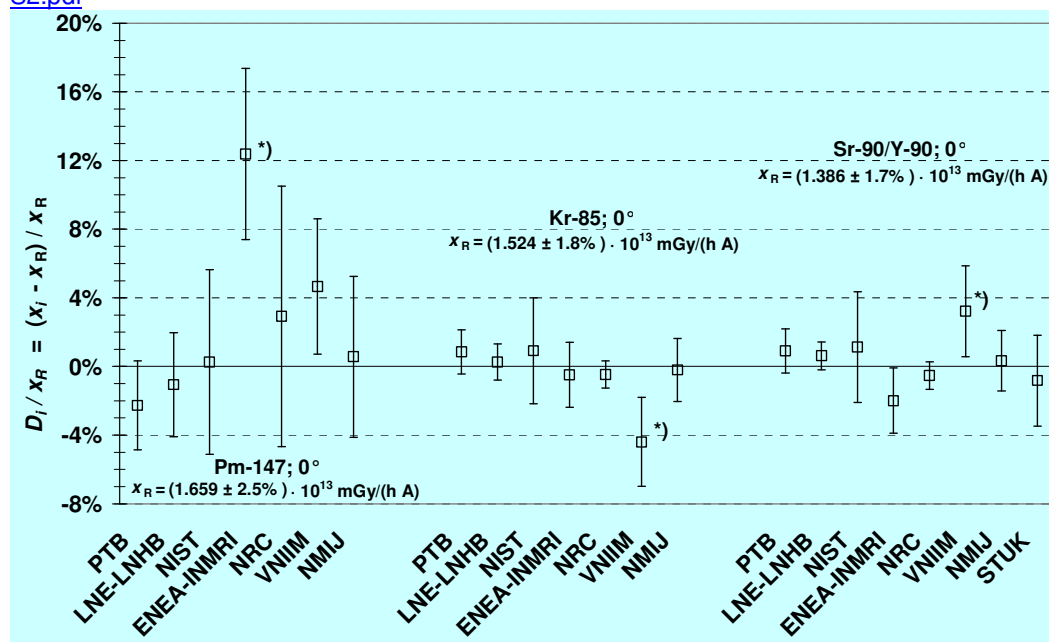
Project 813: EUROMET RI(I)-K1&K2 Comparison of air kerma and absorbed dose to water measurements of ^{60}Co radiation in radiotherapy

In addition to the 13 SSDL participants who have already completed the measurements in 2006, in 2007 all the 12 primary laboratories have performed the calibration of the 4 transfer instruments except ARPANSA (Australia). In addition to the EURAMET participants 4 SIM and 2 APMP laboratories participate as well. This large double regional key comparison coordinated by the MKEH is on schedule. The Draft A report will be prepared before the next IR TC meeting in October 2008.

Project 739: EUROMET RI(I)-S2 Intercomparison of extrapolation chamber measurements of the absorbed dose rate in tissue for beta radiation.

The involved radionuclides were ^{147}Pm ; ^{204}Tl ; ^{85}Kr ; ($^{90}\text{Sr}/^{90}\text{Y}$) with radiation angle of 0° , 45° and or 60° . All the eight participants having primary standard completed the measurements. Draft B report including the degrees of equivalence is accepted, see the graph below, the results are available at the BIPM website.

[http://www.bipm.org/utis/common/pdf/final_reports/RI/EUROMET.RI\(I\)-S2/EUROMET.RI\(I\)-S2.pdf](http://www.bipm.org/utis/common/pdf/final_reports/RI/EUROMET.RI(I)-S2/EUROMET.RI(I)-S2.pdf)



Project 738: EUROMET RI(I)-S5 Intercomparison of the personal dose equivalent ($H_p(10)$) for photon radiation

$H_p(10)$ as operational quantity for individual monitoring to access the effective dose in radiation protection was adopted by 96/29 EURATOM directive. All the laboratories which have CMC lines for personal dose equivalent quantity for X-ray beam qualities have joined (except ENEA) and completed the measurements. The special transfer chamber dedicated to measure the $H_p(10)$ and the complete current measuring system have good stability during the comparison. Preliminary evaluation of the 15 results shows a good agreement within the stated uncertainties. The Draft A is under preparation.



Project 628: Direct comparison of primary standards of air kerma for medium energy (300 kV) X-rays

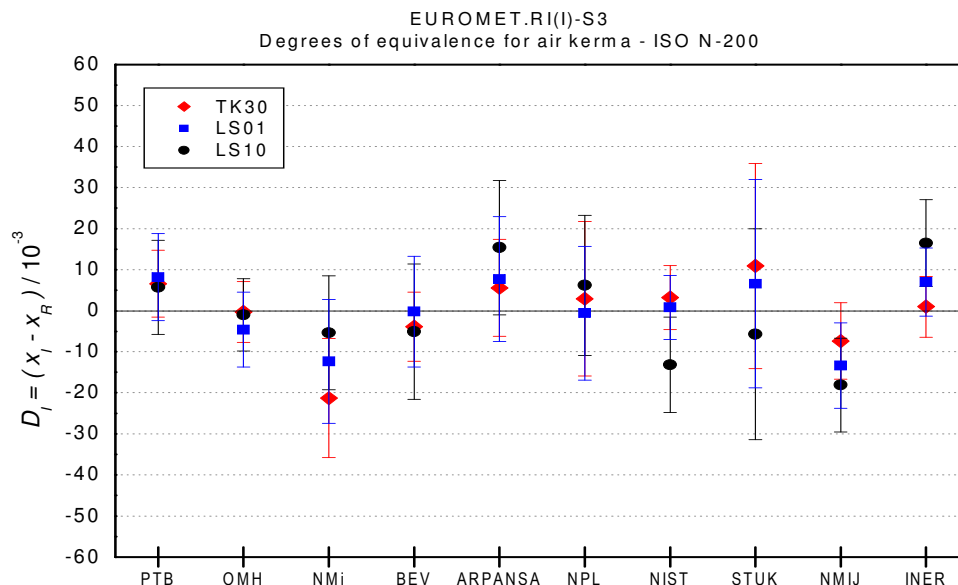
The PTB and NMi have already completed the comparisons involving the BIPM reference beam qualities, the ISO 4037 narrow beam qualities and IEC 61267 RQR, RQA beam qualities. These results are under publication. Some correction and its uncertainties of the NPL free air chamber as transfer instrument need further investigation. Next participant could be the ENEA.

Project 608: EUROMET RI(III)-S1 Test program of instrument calibrations for neutron dosimetry

The project was ceased in 2008 having several technical problems. The results of IRSN, SCK, KRISS, CMI, IEA, SMU who have already performed the comparison measurements would be published. Organization of a new EURAMET supplementary comparison with similar task has been launched involving CMI, NPL, PTB, VNIIM, CIAE. Further potential participants are welcomed.

Project 545: EUROMET RI(I)-S3 Intercomparison of NMI's air kerma standards for ISO 4037 narrow spectrum series X-ray radiation

An indirect supplementary comparison of the national primary standards was performed by a small (TK 30; 4 cm) diameter transfer chamber for these important 10 beam qualities (N30-N300) used in radiation protection. The influences of the different field sizes, uniformities and dose rates to the uncertainties of calibrations claimed in the CMC database were investigated by two other large diameter (LS01; 14 cm, LS10; 27.5 cm) transfer chambers. The ten participants have completed the measurements. Draft B report including degrees of equivalence is under circulation. An example of degree of equivalence can be seen in the figure below.





2.3 Traceability:

Project 909: Calibration of an ionisation chamber for activity measurements

Establishment of a data acquisition system for a PTW Curiementor 3 belong the NCM (Bulgaria) was performed. Checking of linearity using about 30 GBq of Tc-99m, the geometry dependence (position of source, filling height), long-term stability using Cs-137 sources and measurements of more than 30 selected radionuclides to determine calibration factors were also performed. Computing of energy-dependent efficiency curves for photon and beta emitters which allow to compute further calibration factors (e.g. for radioactive impurities) is a significant development of Curiementor's usage. The results have been presented at the ICRM 2007 conference in Cape Town (proceedings will appear in 2008 in Appl. Radiat. and Isotopes)

The main reason of small number of radioactivity comparison projects at regional (EURAMET) level is that the CIPM CCRI(II) and BIPM.RI(II) K1 (SIR) key comparisons (114) has been running from 1976 and can support relevant CMCs of NMIs.

However, after that our T2.J08 project proposal titled "Emerging radionuclides in diagnostic and therapy applications" having been failed, an important part of this project, **determination of improved decay data and impurities, as well as standardisation of four emerging radionuclides for medical application having short half life, Lu-177; At-211; Cu-64; Cu-67 has been proposed by LNE-LNHB.** The respective four conventional EURAMET research and comparison project proposals are drafting.

3. Participation in iMERA-Plus

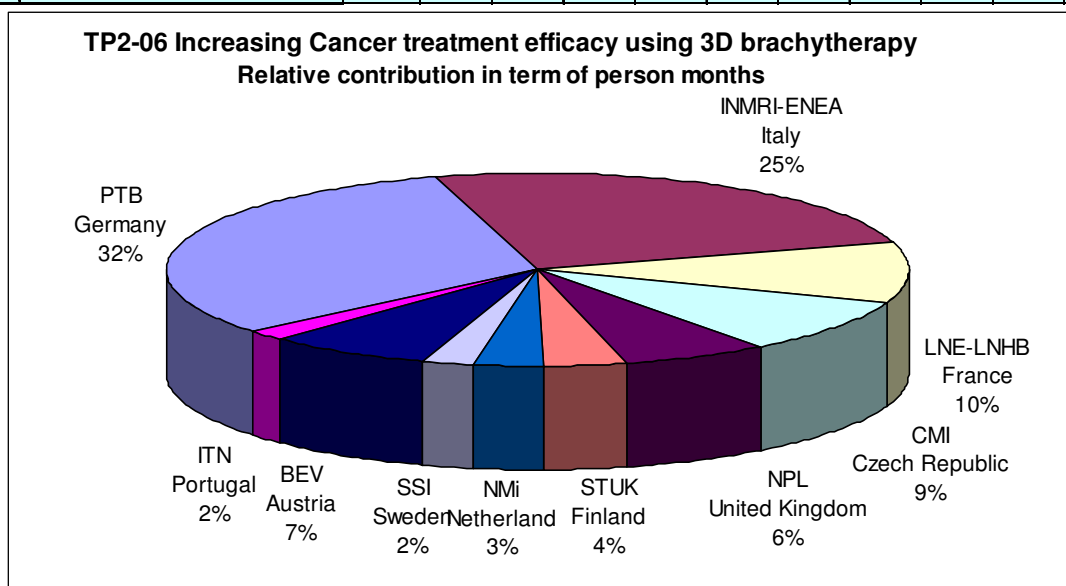
On the basis of the three IR roadmaps having been prepared and the evaluation of the Eol of potential participants, three project proposals were submitted last October. As a result of the selection procedure, two from the three proposals were recommended for EC funding with 33% of the eligible cost. Both of them belong to the **"Health Targeted Program"**.

The scope of the project **T2.J06** is that brachytherapy dosimetry be based on absorbed dose standards and that the accuracy in brachytherapy treatments result can be comparable to radiotherapy treatments with external beams produced by clinical accelerators. The project establishes a metrological basis for brachytherapy across Europe and a significant improvement of accuracy on the absorbed dose imparted to cancer patients in brachytherapy treatments.

The project is coordinated by **Maria Pia Toni (ENEA)** The title of the work packages, distribution of the total 330 person months required to achieve the task, and the 1220 € EC funding are in the in table and graph below.



Work Packages	Increasing Cancer treatment efficacy using 3D brachytherapy TP2-06	1 PTB Germany	3 INMRI- ENEA Italy	4 LNE- LNHB France	5 CMI Czech Republic	2 NPL United Kingdom	6 STUK Finland	7 NMI Netherlan d	8 SSI Sweden	9 BEV Austria	10 ITN Portugal	TOTAL
WP1	JRP Management and Coordination	2	6	2	2	2	1	1	0.5	2	0.4	18.9
WP2	Development and commissioning of a primary standards system for measurement of the absorbed dose to water (aim for an uncertainty $u(D_w) \leq 2\%$, $k=1$) due to low-dose-rate (LDR) brachytherapy sources.	36	36	23.4								95.4
WP3	Development and commissioning of primary standards system for measurement of the absorbed dose to water (aim for an uncertainty $u(D_w) \leq 2\%$, $k=1$) due to high-dose-rate (HDR) brachytherapy sources.	36	32.4			11.4		8				87.8
WP4	Absorbed-dose-to-water based metrology chain for high-dose-rate (HDR) and low-dose-rate (LDR) brachytherapy sources	10	2	3.9		1.7		0.5		8		26.1
WP5	Relative 3D distribution of the absorbed dose- to-water rate by brachytherapy sources, in a water phantom	16		2	26.7	3.8	9.3		5.4	11.5	4.8	79.5
WP6	IMPACT: exploitation, dissemination and knowledge transfer	5	6	2	2	2	1	1	0.5	2	0.4	21.9
TOTAL work month		105	82.4	33.3	30.7	20.9	11.3	10.5	6.4	23.5	5.6	329.6
EU funding k€		398	273	129	62	141	43	72	26	60	10	1220

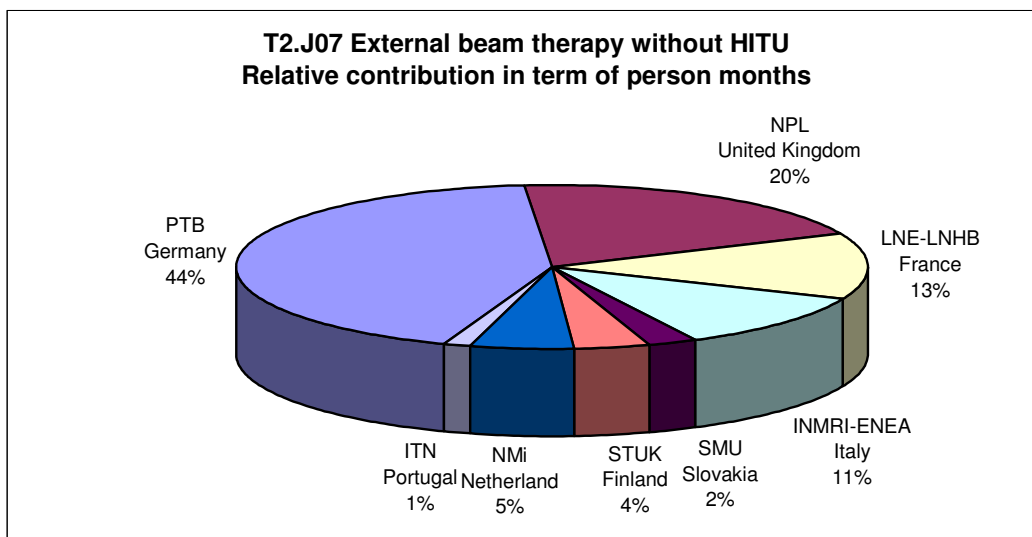


The scope of the project **TP.2J07** is to extend the useful range of primary standards for hadron therapy and IMRT towards the conditions used in modern forms of therapy (IMRT, Gamma-knife etc.). This will be achieved either by building new instruments or by applying more powerful methods for evaluating the experimental data. Well-behaving secondary standards like alanine or diamond detectors will play an essential role towards dose determinations in fields of the smallest sizes considered in this study. To this end Monte Carlo state-of-the art radiation transport calculations will be employed. Beam specifiers will be developed by means of which the radiation quality



can be characterized in terms of both energy and field size. The project is coordinated by **Hans Michael Kramer (PTB)**. The title of the work packages, distribution of the total 240 months required to achieve the task without the WP2, and the 1002 k€ EC funding are in the in table and graph below.

Work packages	External beam therapy T.2J07	PTB Germany ¹	NPL United Kingdom ²	LNE-LNHB France ³	INMRI-ENEA Italy ⁴	SMU Slovakia ⁵	STUK Finland ⁶	NMi Netherlands ⁷	TOTAL
WP1	JRP Management and Coordination	6	2	1	1	1	1	1	13
WP2	High Intensity Therapeutic Ultrasound								0
WP3	Hadron therapy	20	10			8			38
WP4	Primary standards for IMRT	22	6	15					43
WP5	Secondary standards for IMRT	48	4	5	28				85
WP6	IMRT Beam Specifier and reference conditions	9	7	10	4				30
WP7	Verification of treatment planning systems for IMRT	3					9	6	18
WP8	IMPACT: exploitation, dissemination and knowledge transfer	3	2	3	1	2	1	1	13
TOTAL		111	31	34	34	11	11	8	240
EU funding		436	201	132	113	25	41	53	1002



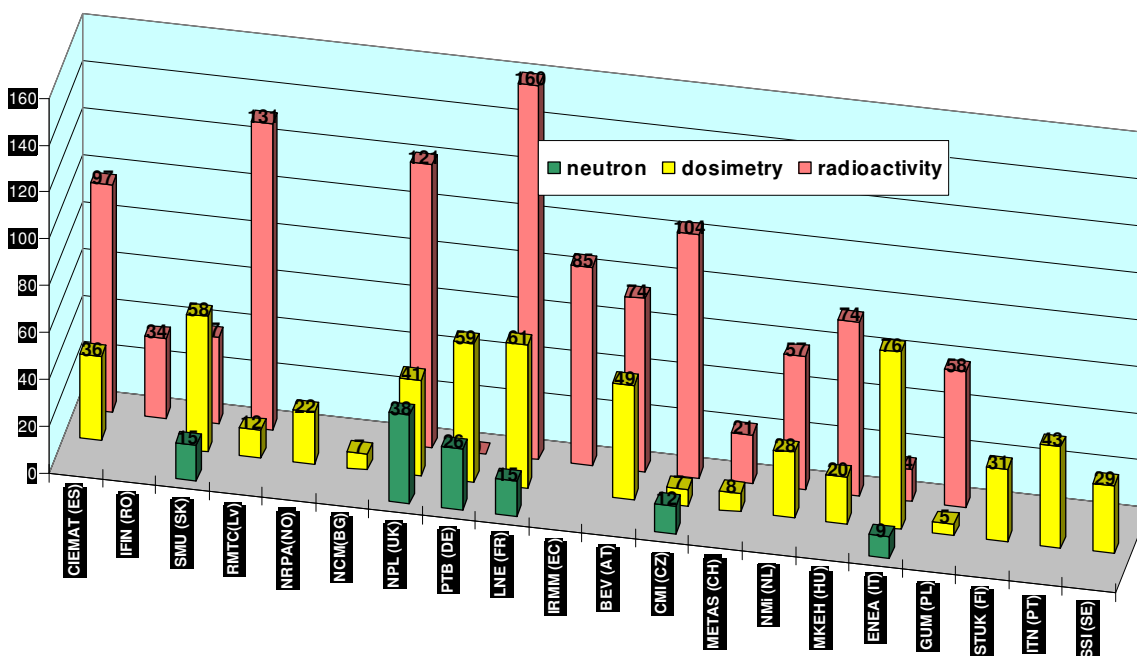
4. MRA CMC

From the 31 laboratories 10 have no any published CMC. Five of these laboratories intend to publish service lines. Some statistics from the published 1775 CMC claims can be seen in the table and figure below.



Published CMCs

Subfield	JCRB file name	Date of publication	NMIs	Claims
Radioactivity	RI.1.2001	15/09/2003	10	768
	RI.6.2006	18/01/2007	1	131
	RI.8.2007	16/05/2008	3	168
Dosimetry	RI.3.2001	11/03/2005	13	460
	RI.7.2006	06/10/2006	1	1
	RI.6.2006	18/01/2007	1	12
	RI.5.2006	14/02/2007	2	28
	RI.8.2007	16/05/2008	2	94
Neutron meas.	RI.4.2001	19/05/2005	5	99
	RI.8.2007	16/05/2008	1	15



Pending EUROMET IR CMC claims in different phases:

Internal review: Dosimetry: Portugal, Germany (2th batch)
Under prep.: Dosimetry: Croatia, Greece
 Activity : Germany,



IR TC review of other RMO's new CMCs in 2007-2008

Subfield	RMO/country/NMI	Num. NMIs	Num. claims
Dosimetry	APMP/Malaysia/MNA	1	22
Dosimetry	SIM/Brazil/IRD	1	8
Activity	SIM/ Argentina/CNEA	1	2
Activity	SIM/Mexico/ININ	1	43
Total		4	75

According to the three subfields within the IR TC, three CMC working groups have been working led by the three convenors listed below:

Dosimetry: T. Aalbers (NL), H.- M. Kramer (De), H. Bjerke (No), C. Hourdakakis (Gr), J.-M Bordy (Fr)

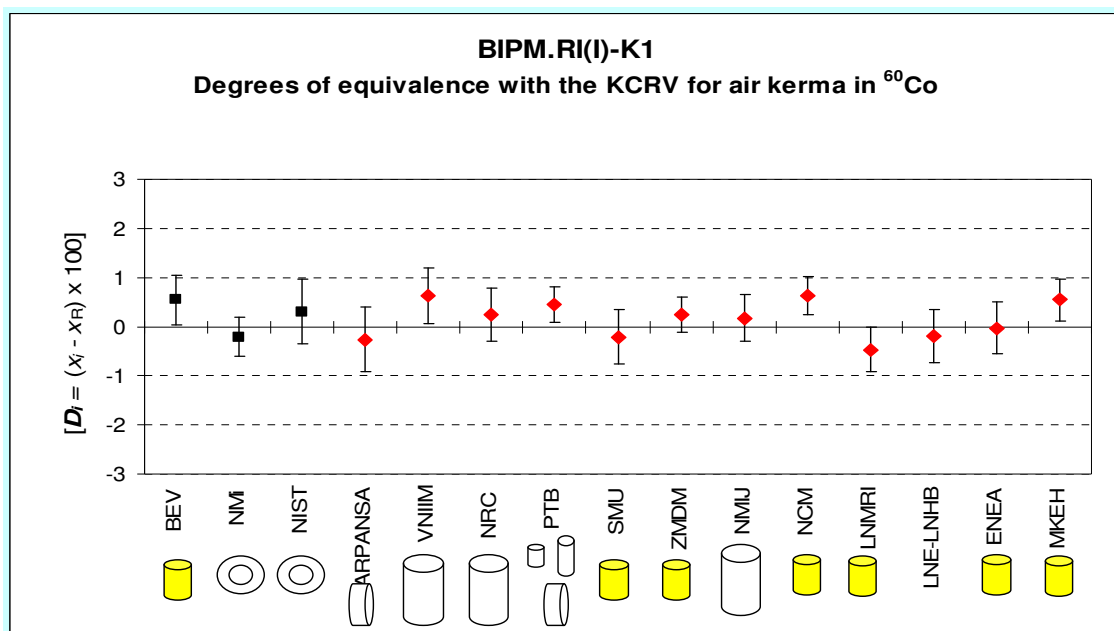
Radioactivity: Burno Chauvenet (Fr), F.-J. Maringer (AT), Jose M. de Los Arcos (ES),

Neutron: M. Kralik (Cz), L. van Ryckeghem (Fr)

The co-operation and communication between EUROMET and the other RMOs colleagues concerning the review procedures are efficient. Most of our comments on technical details of claims have been appreciated and expected. However, supporting comparisons and quality assurance of the CMC claimed are those issues where few differences between EURAMET and other RMOs approach have been remained. Publication of new IR CMCs by the RMOs has slowed in recent years.

MRA Key comparisons

The nine primary dosimetry laboratories are taking part in the ongoing BIPM.RI(I) K1-K5 comparisons for air kerma of ^{60}Co , ^{137}Cs , low and medium energy X-rays, as well as absorbed dose to water of ^{60}Co radiations. **The degrees of equivalence for air kerma of ^{60}Co gamma radiation has been published and the SI reference value, having 0.15% standard uncertainty, changed with 0.54%!** The recently published degrees of equivalence of primary standards of air kerma can be seen in the figure below.



The twelve primary radioactivity laboratories are also taking part in most of the ongoing BIPM.RI(II) K1 and the CCRI(II) K2.P-32 CCRI(II) K2.Kr-85 comparisons. Seven of the ongoing supplementary comparisons are organised and coordinated by the EURAMET IR TC.

Unfortunately, **there is no running neutron key comparison**. The two supplementary comparisons are co-ordinated by EUROMET.

5. Meetings and Workshops

- The „**Absorbed Dose and Air Kerma Primary Standards**” Workshop was held by LNE, CEA-LIST-LNHB & BIPM - 9-11 May, 2007, Paris. 63 participants from 18 NMIs and two universities contribute with 32 presentations to the success of the workshop. The presentations are available on the website http://www.nucleide.org/ADAKPS_WS/ADAKPS_2007.htm
- The biannual **CIPM Consultative Committee Meetings of the three sections of CCRI** were held at BIPM in May 2007. The main issues were: Professor G. Moscati stepped down as president of CCRI, congratulation on his effort, the **new president is dr. Kim Karneiro** from Denmark. New averaged volume and correction determination of BIPM cavity chamber used in ^{60}Co radiation was accepted, hence air kerma KCRV changed by 1.0054. (**Metrologia 44. No. 6**) The 17 recommendations of the LNHB/BIPM satellite Dosimetry Workshop were accepted by the CCRI(I) pointing the main research areas in radiation dosimetry. The high energy photon beam (Linac) project at BIPM was postponed to 2011. For measurement of short half life radionuclides in the SIR, a well-type ionisation chamber as transfer standard was introduced at the BIPM. The **Special issue of Metrologia “Radionuclide Metrology” 2007 44 No. 4** has been published. There are three sections to this issue, starting with papers on how the CIPM MRA has been implemented for radionuclide metrology, following into the bulk of the publica-



tion with articles on the 'state of the art' in radionuclide metrology and ending with traceability to national/international standards in nuclear medicine, environmental monitoring, radiation protection and decommissioning. Two BIPM monographies have also been published, see <http://www.bipm.org/en/publications/monographies-ri.html>. Most of the scientific reports of the three CCRI meetings are available on the BIPM website <http://www.bipm.org/en/committees/cc/ccri>

- The **16th International Conference on Radionuclide Metrology** and its Application was held in Cape Town hosted by the NMISA 3-7 September 2007. 37 oral and 43 poster presentations were accepted from the 110 participants coming from 30 countries. All papers accepted by the appointed referees will be published in the conference proceedings, a **special volume of the Applied Radiation and Isotopes** scientific journal. In addition to the paper presentations, seven Working Group meetings, the meeting of the ICRM Executive Board and the ICRM General Meeting were held.
- The **yearly IR CP Meeting** was held on 25-26 October 2007 in Braunschweig hosted by the PTB. All the presentation of the 23 participant NMIs and other documents referred to in the agenda are available on the restricted area of EURAMET IR TC website. The transition of EUROMET to EURAMET was explained in detail. In addition to the discussion of IR projects and CMC business the two selected ERANET plus IR JRPs were presented. The CMC-BMC dispute and peer evaluation of QS issues were also addressed. The first scientific one day meetings of the JRP T2-J06 and JRP T2-J07 participants will be on 7 and 8 October hosted by the ENEA in Cassaccia, and the next IR TC CP meeting will be there also on 9-10 October 2008.





- **The yearly CIPM CCRI RMOs Working Group meeting on Ionizing Radiation CMCs** was held at BIPM in November 2007. There was discussed the JCRB decision on publication of CMC claims being traceable via other NMI services, these later ones should have already been published CMC lines. Example was the unpublished PTB CMC claims of radioactive reference material measurements being referred as traceability route by other NMIs having CMC lines.

Csete István
IR TC chairperson