JRP INTERIM / PERIODIC PROGRESS REPORT

JRP-Contract number	ENG99
JRP short name	TriboFlex
JRP full title	Assessment of the tribological flexibility of a novel polymer coated metallic widget
Version numbers of latest contracted Annex Ia and Annex Ib against which the assessment will be made	Annex Ia: V1.0 Annex Ib: V1.0
Periodic Progress Report	6 month ☐ 12 month ☐ 18 month ☒ 24 month ☐ 30 month ☐ 36 month ☐
Period covered (dates)	From 01 January 2012 to 30 June 2013

JRP start date and duration:	01 January 2012, 36 months
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JRP-Partners: JRP-Partner 1 AAA, UK JRP-Partner 2 BBB, Germany JRP-Partner 3 CCC, France JRP-Partner 4 DDD, Spain	JRP-Partner 5 EEE, Italy
REG-Researcher (associated Home Organisation): REG-Researcher (associated Home Organisation):	Paloma Mann, Greece XXX, Poland Claude Penn, Belgium YYY, Austria

Report Status: CO Confidential, only for members of the JRP-Consortium (including EURAMET and the Commission Services)

ENG99 TriboFlex

TABLE OF CONTENTS

1 Summary

1.1 Highlights & Issues

1.1.1 Highlights

In WP1 the newly developed metrology for AMR sensors has been used for the first time for the characterisation of industrial AMR sensors. The results have immediately opened up new paths for the improvement of industrial AMR field sensors. In WP2 new calibration facilities have been established and improved. First calibrations of industrial sensors from stakeholders in the new facilities have been carried out successfully. Furthermore the strong interaction with stakeholders has led to a joint draft of a best practise guide for magnetic field measurements. In WP3 a first probe head for the wafer-scale inductive characterisation of magnetic thin film materials has been designed and tested. In WP4 the development of new standard problems for micromagnetic simulations is a further step towards more reliable micromagnetic simulation tools. In WP5 the realisation and simulation of graphene based nano Hall-sensors is an important step for the application of this promising new material for magnetic bead detection in bio-medical applications.

1.1.2 Good News Stories

Industrial manufacturer Med Gmbh has included the measurement technique developed in this project in their ceramic hip implant manufacturing process thereby doubling their productively. In addition the project's paper on "Infection associated with medical implants" has been published in the high impact journal *The New England Journal of Medicine*.

1.1.3 Issues

Apart from a few minor delays, which will not affect the overall delivery, the project is on schedule.

1.1.4 Financial issues

There are individual deviations from plan:

- **AAA.** Some deliverables were more technically demanding than anticipated, therefore more time than planned was expended. In addition staff injury and illness resulted in inefficient staff utilisation. AAA are confident of delivering the balance of the JRP on time and on budget.
- **BBB.** Most of BBB's activities are ahead of schedule. They plan to have most of their activities completed by the end of the year. BBB do not envisage any problems in meeting the targets.
- **DDD.** DDD are close to budget on consumables and T&S. The shortfall of a little over 1 person-month is due to a delay in completing the work in WPn. There will be no impact on the project's overall delivery as DDD will catch up in the second half of the project.
- **EEE.** EEE underestimated the time needed for equipping a suitable laboratory room. Due to unexpected delays in delivery of new equipment and break down of a key instrument, the work did not progress according to the original schedule. All the installation work is now completed. EEE's work will be back to schedule by the end of the year. EEE confirms that they will still be able to deliver the work planned even if they spend more than originally budgeted.
- **FFF.** The discrepancy between budgeted and reported costs is due to the amount reported for "Consumables" being less than expected. Some relevant expenses have been postponed to the second period and some payments to suppliers have yet to be completed. FFF's expenditure will be back on course during the second period.
- **III.** III significantly underspent on labour costs in WPn due to a lack of staff. As a result of this, some of the WPn work was delayed. A recruitment program has solved this issue and the work is getting back on track to meet the project deadlines (making up the shortfall of approximately 7 person-months).

1.2 Effective cooperation

1.2.1 Cooperation between the JRP-Partners

The project was designed to build a European response to a European policy need. The JRP-Partners bring a range of expertise from basic metrology to applications in horticulture and art curation, and some bring key

end users such as the Italian contacts that can test these products in road traffic tunnels. The project is progressing and cooperation is effective.

1.2.2 Joint research

The breadth of stakeholders and outputs, and the ability to respond to EU consultations and standardisation bodies with a European metrology voice could not be achieved without the close cooperation in this project.

1.3 Scientific excellence

1.3.1 Progress beyond the state of the art and stimulation of innovation

WP1: BBB and EEE built the first luminance meter that works over the whole mesopic range. The instrument can perform nearly real-time measurements at low luminance levels.
WP2: DDD filed 2 patents based on the results of the work on temperature measurements.
WP3: The lighting experiment is one of the most important experiments never before achieved. A computer program has been developed to implement metrics with modular components. These tools will enable us to assess and improve metrics.
WP4: This WP has yet to produce results which go beyond the start of the art.
WP5: This WP has yet to commence.

1.3.2 Publications, presentations and patents

The JRP output and impact report lists 8 publications, 33 presentations, and 1 patent for the life of this project.

1.4 Impact

1.4.1 Stakeholder Engagement

A JRP website has been set up. The JRP also created a Stakeholder Committee (SC) of 20 members from 16 organisations including CCM and BIPM representatives, balance and weight manufacturers and national accreditation and legal metrology bodies, representing at least 12 European countries. The first meeting of the SC was held.

1.4.2 Dissemination:

Standards

As part of Task 4.1: 'Make recommendations to ISO/CEN standardisation' (D4.1.1), a meeting of TC99/SC9/WG9 group was attended in January 2012 by AAA and the JRP was presented to the group. Positive feedback was received and the group has requested to keep them up to date with progress. Also D4.1.2 "An overview of the JRP-Participant's memberships in the ISO/ CEN/ OIML/ GIIGNL/ WELMEC/ EURAMET committees" has been prepared.

End users

Polymer coated widgets will be the key output from the JRP ENG99 Triboflex. Widgets have never been coated with the GHDHS polymer before and this is expected to be a key development in the field. Development of this new type of widget alone will not lead to its uptake by end users, therefore, the JRP plans to disseminate its findings at conferences, through publications, via the JRP website, stakeholder workshops, training courses, and via standardisation activities. As the JRP is still at an early stage, potential uptake by end users is being promoted by these dissemination activities. It is expected that these polymer coated widgets will be used as the industry standard by the end of the JRP.

1.4.3 Impact beyond the end of the JRP

Financial and environmental impact

Safe and effective food transportation (cool chain) relies on the correct operation of refrigeration equipment control sensors. When these sensors malfunction food spoilage occurs. Currently this results in losses of EUR 30 million per annum in Europe. Discussions with the manufacturers of refrigeration equipment, Abacus, Quadrilex, and Vacucool, indicate that there will be a significant reduction in these losses when the metrological improvements to the temperature control sensors, developed in ENG99 TriboFlex, are implemented. Conservative estimates indicate that a saving of EUR 6 million per annum is achievable. Similar savings are likely to be achieved in other areas where this technology is applicable such as in the cold storage of pharmaceuticals and beverages. The reduction of food and other wastes will also benefit the

environment through a reduction in the amount of waste being sent to landfill, and through a reduction in the associated unnecessary transport and production costs.

Social Impact

The significant improvements made to the metrology of temperature control by this JRP have been discussed with major manufacturers of refrigeration equipment, Abacus, Quadrilex, and Vacucool. End user uptake of these metrological developments will occur after the JRP has ended. It is anticipated that these developments will lead, in the longer term, to improvements in public safety, for instance with regards to food transport (cool chain) and to the safe use of medicines that need to be stored in a temperature controlled environment (e.g. vaccines).

2 Use of Resources and Financial Spend (* Section 2 - only to be completed for Periodic Reports)

Cost Budget Analysis Table

JRP Cost Budget Analysis Table: ENG99 TRIBOFLEX

		ELIGIBLE COSTS							TIME						
		Total costs to date	Budget costs to date	Costs as % of Budget to date	Costs Variance		Total Budget costs	Costs as % of Total Budget	Total months to date	Budget months to date	Months as % of Budget to date	Months Variance		Total Budget months	Months as % of Total Budget
Total JRP		**1,358**	**1,430**	**95%**	**-72**		**2,864**	**47%**	**97**	**97**	**100%**	**0**		**189**	**51%**
Partner		k Euros	k Euros	%	k Euros		k Euros	%	Months	Months	%	Months		Months	%
1	AAA	460	382	120%	77	1	803	57%	35	26	136%	9	1	53	65%
2	BBB	374	242	154%	131	1	490	76%	15	12	124%	3	0	25	62%
3	CCC	17	17	100%	0	0	29	59%	7	7	104%	0	0	9	78%
4	DDD	26	46	57%	-20	1	97	27%	2	3	59%	-1	0	7	28%
5	EEE	88	100	88%	-12	1	199	44%	8	8	107%	1	0	17	50%
6	FFF	48	55	87%	-7	1	91	52%	4	4	95%	0	0	7	59%
7	GGG	7	8	87%	-1	0	16	41%	1	1	116%	0	0	2	58%
8	HHH	171	173	99%	-1	0	348	49%	13	16	82%	-3	0	31	41%
9	III	167	406	41%	-239	1	791	21%	12	20	58%	-8	1	38	30%
Integral REGs Total									12	15	80%	-3	1	24	50%
Unfunded Partners Total									1	1	100%	0	0	2	50%
							Explanation is required in the JRP Periodic report for items marked:						1		

ENG99 TriboFlex

Explanations from the Cost Budget Analysis Table (by participant):

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3 JRP 'deliverables status' table and progress

Del. No.	Deliverable description	Lead JRP-Partner	Other JRP-Participants	Delivery date as per Annex Ia	Actual Delivery date	Status and activity (one paragraph includes all JRP-Participants)
1.1.3	Batch 1 of at least 10 GaAs all-gate defined tuneable-barrier pumps (type i) produced	BBB		Jan 2012	Mar 2012	*This deliverable is complete.* BBB produced the first batch of 10 GaAs all-gate defined tuneable-barrier pumps (type i). The slight delay in the completion of this deliverable was a knock on effect of GHSD not being able to supply the GaAs materials by the time originally foreseen in the JRP-Protocol. The GaAs barrier pumps (type i) have been sent to JRP-Partner UUU for characterisation and validation.
2.2.4 (REG (XXX) D3.6)	Pumping accuracy of 'self-referenced' SOI-CMOS devices assessed, based on error detection investigations. Target uncertainty is 0.1 ppm or better at a current of ≥ 100 pA	REG(XXX)	CCC	Mar 2012	Mar 2012	*This deliverable is complete.* CCC provided the 'self-referenced' SOI-CMOS devices to REG(XXX) for assessment. REG(XXX) assessed the pumping accuracy of the 'self-referenced' SOI-CMOS devices. The error detection investigation method proved to be a suitable method for assessing pumping accuracy. The target uncertainty of 0.1 ppm, at a current of ≥ 100 pA, was achieved.
3.2.3 (REG (YYY) D1.8)	Report on the sensitivity analysis of external *E*-, *H*-fields to internal, localised induced phenomena in presence of phantoms	AAA	REG(YYY), CCC	Jun 2012		*This deliverable is delayed to February 2013.* There was a delay in the production of the phantoms by REG(YYY). The phantoms have now been completed by REG(YYY) and the work is getting back on track. The model developed in D3.2.3 has been developed and used in this activity. AAA and CCC have commenced performing the sensitivity analysis of external fields to phantom characteristics using the typical MRI exposure conditions defined in D3.2.1. AAA will produce a report on the sensitivity analysis by February 2013.
3.2.4	Primary measurement method for ^{90}Y-microspheres developed	EEE	BBB, CCC	Sep 2012		*This deliverable is delayed to November 2012.* EEE and BBB have developed and validated the Monte Carlo model of the TDCR-Cerenkov detectors using the code GEANT4. This model takes into account the influence of the ^{90}Y microspheres. CCC has yet to commence their work on the response of the TDCR detection system. BBB have yet to commence work on the identification and quantification of impurities in ^{90}Y microspheres because it took longer than expected to obtain the ^{90}Y-microspheres.

						It is expected that this report will be delivered 2 months late.
4.1.1	IR radiation thermometer with tuneable operating wavelength designed	DDD		Dec 2012		*This deliverable is on schedule.* DDD has commenced designing an IR radiation thermometer with tuneable operating wavelength. The operating wavelength parameters are being investigated and the IR radiation thermometer is being designed to work within the 500 ^{O}C – 1500 ^{O}C temperature range. Three draft technical drawings have been prepared thus far and improvements continue to be made as new results become available. The final technical drawing has yet to be completed, but it is expected to be ready in December 2012.
5.2.1	At least 6 new Au/Pt thermocouples of different designs constructed	DDD	AAA, BBB, CCC	Jul 2012		*Work has not yet started on this deliverable.*
6.1.2	At least 10 peer reviewed papers submitted for publication in peer-reviewed journal	BBB	All JRP-Partners	Dec 2012 Dec 2013 Dec 2014	Dec 2012	*The first part of this deliverable is complete.* A paper on the primary measurement method for ^{90}Y-microspheres was submitted for publication in the journal Cancer Biotherapy and Radiopharmaceuticals.
6.1.3	Paper on the HT-SPRTs and thermocouple non-uniqueness study between Al and Ag fixed points submitted for publication in a peer-reviewed journal	REG(XXX)	CCC	Dec 2012	Dec 2012	*This deliverable is complete.* A paper on the HT-SPRTs and thermocouple non-uniqueness study between Al and Ag fixed points was submitted for publication in the International Journal of Thermophysics.
6.1.4	Information provided to standards/technical committees and feedback from the committees provided to JRP-Consortium	FFF	BBB, DDD,EEE	Dec 2014		*This deliverable is on schedule.* IEC: TC 65 SC 65B WG5 “Temperature sensors and instruments” DDD chairs the subgroup, “Radiation thermometry” within the IEC technical committee and the working group “Applied radiation thermometry” within the VDI. DDD attended the meetings of the respective standardisation bodies and disseminated the outputs of the JRP by providing input for the future reviews of the standards VDI 3511, part 4 “Radiation Thermometry” and IEC/TS 62492-1 “Industrial process control devices – Radiation thermometers”.

NB: In an actual JRP Interim / Periodic Progress Report <u>all</u> project deliverables would be included in the Section 3 table.

4 Changes requested **(*Section 4 - not to be completed for the Month 36 Periodic Reports)**

At present, no changes are required to the JRP-Contract.

5 Commentary on EMRP Grant Researcher's input

REG(XXX) has made good progress against plan and all the deliverables have been produced on time. The activity during this period has largely been on the 'self-referenced' SOI-CMOS devices which CCC provided to REG(XXX) for assessment. REG(XXX) assessed the pumping accuracy of the 'self-referenced' SOI-CMOS devices. The error detection investigation method proved to be a suitable method for assessing pumping accuracy. The target uncertainty of 0.1 ppm, at a current of $\geq$ 100 pA, was achieved.

REG(YYY) was unable to start on time as Claude Penn had to return to Belgium due to ill health after just 2 weeks in post. After 3 months convalescence he was able to work at YYY in Austria. This led to a delay in the production of the phantoms by REG(YYY). The phantoms have now been completed by REG(YYY) and the work is getting back on track. The phantoms have been supplied to AAA for use in JRP D3.2.3.

6 Management summary

Project progress against plan	This JRP is at variance with the plan described in the current version of the JRP-Protocol but the variance is recoverable.
Financial progress against plan	This JRP is proceeding according to plan described in the current version of the JRP-Protocol / JRP Costing Spreadsheet.
JRP-Consortium	The JRP-Participants* details are up-to-date and they match those in the current version of the JRP-Contract
Contract and consortium performance	There are issues with one or more JRP-Participants* which are recoverable without change requests.
Funding source acknowledged	All JRP-Participants* have fulfilled Clause 13 "Publication and Public Access" of the JRP-Contract. All published material includes the following statement to indicate the co-funding by the European Union: "The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union."
JRP website	The JRP website** exists and its content is up-to-date.
JRP publications submitted for inclusion in the EURAMET Publications Repository	The JRP-Coordinator has submitted all of the publications listed in the JRP Output and Impact Report for inclusion in the EURAMET Publications Repository.

There are no issues that have not been covered elsewhere in the report.