

# WORKPACKAGE REPORT

## WP 5 – Management

Grant Agreement number: 250072

Project acronym: ISENSE

Project title: Integrated Quantum Sensors

Funding Scheme: STREP (ICT-FET-Open)

Date of latest version of Annex I against which the assessment will be made: 4. March 2011

Periodic report:                      1<sup>st</sup> ☐    2<sup>nd</sup> **X**    3<sup>rd</sup> ☐    4<sup>th</sup> ☐

Period covered:                      from   1. July 2011   to   30. June 2012

## **WP 5 - Management**

Work package leader: Bham

### ***Management tasks and achievements;***

#### ***Management tools***

Management of the consortium involves several mechanisms. Each participant is required to provide the respective work package leader with a quarterly status update on the tasks he has carried out. The quarterly status updates are composed into quarterly status update reports for each work package produced by the respective work package leader. They summarize the preceding three months' of research and in particular highlight if the work package is on course to deliver the deliverables and milestones as prescribed in the proposal. If not on course they discuss the reasons and what remedies are sought to improve the situation and what potential knock-on effects there will be on other work packages.

The project coordinator holds meetings with individual work package leaders as required to monitor progress and problems, and apply corrective actions where necessary. They are also utilised by the coordinator to identify points where work packages meet and there are consequent impacts on integration. The level of detail in individual meetings is much higher than achievable in an hour long meeting of the STEM committee. In addition some work packages involving several sites have individual meetings as required to keep the workflow going smoothly. Overall, there have been ~20 such meetings in the reporting period.

Most of the meetings are using electronic communication tools such as Skype, Webex and email extensively. Important documents from meetings are posted regularly on the project wiki.

#### ***Research coordination visits between partners***

| <b>Date (from and to)</b> | <b>Visiting partner</b> | <b>Visited Partner</b> | <b>Number travelling</b> |
|---------------------------|-------------------------|------------------------|--------------------------|
| 15/08-14/11/2011          | Bham                    | LUH                    | 1                        |
| 26/09/2011                | IQOQI -OEAW             | Bham                   | 1                        |
| 17/11/2011                | IQOQI -OEAW             | Bham                   | 1                        |
| 18/11/2011                | IQOQI -OEAW             | UNOTT                  | 1                        |
| 01/03/2012                | Bham                    | FBH                    | 1                        |
| 02/03/2012                | Bham                    | LUH                    | 1                        |
| 23/03/2012                | Bham                    | IOGS (CNRS)            | 1                        |
| 20-22/05/2012             | UNOTT                   | UHH                    | 1                        |

In addition we had numerous visits with discussions relevant to iSense between UNott and Bham within the Midlands Ultracold Atom Research Centre, between UHH, LUH and FBH within the QUANTUS collaboration as well as between the different subgroups included under CNRS (in particular SYRTE and IOGS).

#### ***Co-operation with other projects/programmes***

An essential component of the iSense collaboration is to build on the existing expertise and foster synergies between fragmented related programmes across Europe, in particular the FINAQS, LASUS, QUANTUS, SAI, ICE, SOC, QWEP and STE-QUEST projects. We co-operate with these projects via the direct involvement of iSense partners. This ensures that

iSense technology developments are gauged by the up-to-date needs of the community and will find rapid and sustained use.

In addition iSense is using the respective project meetings to realise informal in-person meetings for the discussion and synchronisation of iSense matters. Some of these are:

| Date          | Venue    | Programme | iSense partners meeting     |
|---------------|----------|-----------|-----------------------------|
| 04/11/2011    | Berlin   | Quantus   | Bham, FBH, LUH, UHH         |
| 27/01/2012    | ESTEC    | STE-QUEST | CNRS, UNIFI                 |
| 30-31/01/2012 | Bremen   | Quantus   | Bham, UHH, LUH, FBH         |
| 3/03/2012     | ESTEC    | FPAC      | Bham, LUH                   |
| 3-4/04/2012   | Bordeaux | STE-QUEST | Bham, CNRS, LUH, UNIFI, FBH |
| 26-27/03/2012 | Berlin   | LASUS     | FBH, LUH, UHH               |
| 24/05/2012    | ESTEC    | STE-QUEST | Bham, CNRS, FBH, LUH        |
| 25/06/2012    | ESTEC    | QWEP      | UNIFI, LUH, CNRS-IOGS       |

***Problems which have occurred and how they were solved or envisaged solutions;***

We realised during the project meeting in September 2011, that the original work programme did not foresee sufficient time for the actual construction of components. In particular the laser system and the vacuum system were identified as critical in this respect. We therefore established a laser workgroup and a vacuum workgroup. Both contained a set of experts for the respective components and enabled us to establish the vacuum and laser system design ahead of the original work schedule, leaving more time for construction. This was helped by taking the decision on the sensor scheme in March 2012, 3 months ahead of schedule.

The delays, which are present in the parts of the project, are due to the occurrence of risks. They are sufficiently small that they can be compensated for by enhanced parallel processing and focusing of resources during the setup of the sensor.

***Changes in the consortium, if any;***

NA

***List of project meetings, dates and venues;***

| Date          | Venue          | Purpose                                                            | N attending |
|---------------|----------------|--------------------------------------------------------------------|-------------|
| 14-16/9/2011  | Brussels       | Project, STEM and review meeting                                   | 19          |
| 02/12/2012    | Teleconference | Vacuum Workgroup Meeting                                           | 5           |
| 11/01/2012    | Teleconference | Laser Workgroup Meeting                                            | 12          |
| 22/02/2012    | Birmingham     | Vacuum Workgroup Meeting                                           | 8           |
| 27/02/2012    | Hamburg        | Laser Workgroup Meeting                                            | 10          |
| 22-23/03/2012 | Paris          | Project and STEM meeting<br>Workshop on iSense scheme              | 20          |
| 08/05/2012    | Birmingham     | Laser Workgroup Meeting                                            | 8           |
| 17/05/2012    | Nottingham     | Waveguide meeting                                                  | 5           |
| 9-12/06/2012  | Hanover        | Project and STEM meeting on the<br>occasion of the iSense Workshop | 14          |

***Project planning and status;***

The project is meeting its scientific goals, and is on course to hit all the Milestones. Preceding the review meeting there will be a meeting to plan the marketing activities and the iSense film. A meeting of the STEM will be held Feb or March 2013, which will be complemented by teleconferences as needed.

***Impact of possible deviations from the planned milestones and deliverables, if any;***  
NA

***Any changes to the legal status of any of the beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs;***  
We can confirm that there have been no legal changes to the status of any of the beneficiaries.

***Development of the Project website, if applicable;***

The project has two web interfaces: an internal wiki and a globally accessible website. The wiki is being used extensively to support management activities. Project meeting minutes, documents on integration, slides from presentations and many other documents are stored on the wiki. The global website summarizes the project, introduces its members and disseminates new results. It is planned to expand this website during the next year.

***Use of foreground and dissemination activities during this period (if applicable).***

**Publications**

1. S. Pelisson, R. Messina, M.-C. Angonin, and P. Wolf, Phys. Rev. A 86, 013614 (2012)
2. G. Tackmann, B. Pelle, A. Hilico, Q. Beaufils, and F. Pereira dos Santos, “Raman-laser spectroscopy of Wannier-Stark states”, Phys. Rev. A 84, 063422 (2011)
3. R. Geiger, V. M  noret, G. Stern, N. Zahzam, P. Cheinet, B. Battelier, A. Villing, F. Moron, M. Lours, Y. Bidel, A. Bresson, A. Landragin and P. Bouyer, “Detecting inertial effects with airborne matter-wave interferometry”, Nat. Comm. 2,474
4. S. Stellmer, R. Grimm and F. Schreck, “Detection and manipulation of nuclear spin states in fermionic strontium”, Phys. Rev. A 84, 043611 (2011)
5. T. Plisson, B. Allard, M. Holzmann, G. Salomon, A. Aspect, P. Bouyer, and T. Bourdel, “Coherence properties of a two-dimensional trapped Bose gas around the superfluid transition”, Phys. Rev. A 84, 061606(R) (2011)
6. R. Kohlhaas, T. Vanderbruggen, S. Bernon, A. Bertoldi, A. Landragin, and P. Bouyer, “Robust laser frequency stabilization by serrrodyne modulation”, Optics Letters 37, 1005 (2012)
7. B. Allard, T. Plisson, M. Holzmann, G. Salomon, A. Aspect, P. Bouyer, and T. Bourdel, “Effect of disorder close to the superfluid transition in a two-dimensional Bose gas”, Phys. Rev. A 85, 033602 (2012)
8. M. G. Tarallo, A. Alberti, N. Poli, M. L. Chiofalo, F.-Y. Wang, and G. M. Tino, "Delocalization-enhanced Bloch oscillations and driven resonant tunneling in optical lattices for precision force measurements", to be published on PRA, arXiv:1207.2123v1
9. F. Sorrentino, A. Bertoldi, Q. Bodart, L. Cacciapuoti, M. de Angelis, Y.-H. Lien, M. Prevedelli, G. Rosi, and G. M. Tino, "Simultaneous measurement of gravity acceleration

and gravity gradient with an atom interferometer", accepted for publication on Appl. Phys. Lett.

10. Simon Stellmer, Benjamin Pasquiou, Rudolf Grimm, Florian Schreck, "Creation of ultracold Sr<sub>2</sub> molecules in the electronic ground state", arXiv:1205.4505
11. T. Vanderbruggen, R. Kohlhaas, A. Bertoldi, S. Bernon, A. Aspect, A. Landragin, P. Bouyer, "Protecting atomic coherent spin states with weak measurements and feedback", arXiv:1207.3203v1

### Conference/Workshop talks

1. Stellmer, Simon; *News from the Innsbruck strontium experiment*; 43rd Annual DAMOP meeting, June 4-8, 2012, Anaheim, USA
2. Stellmer, Simon; *Quantum degenerate gases of strontium*; 12. Meeting of SFB FoQuS, July 7th - 8th 2011, University of Innsbruck
3. K. Bongs, "MUARC Activities", India-UK Royal Society DSTL workshop, Bhubaneswar, India, 08.03.2012.
4. K. Bongs, "What cold atoms can reveal about the underworld", GG-TOP launch workshop, Science Museum London, 2.05.2012.
5. B. Pelle, A. Hilico, Q. Beaufils, G. Tackmann, X. Wang, F. Pereira dos Santos, S. Pelisson, R. Messina, M.-C. Angonin and P. Wolf, "A trapped atom interferometer for the measurement of short range forces", PSAS 2012, Eltville, Germany, June 2012
6. K. Bongs, "iSense", iSense Atom-interferometry, Geodesy Workshop, Hanover, 10.June 2012.
7. Q. Bodart, Y.-H. Lien, G. Rosi, F. Sorrentino, G. M. Tino, L. Cacciapuoti, and M. Prevedelli, *The MAGIA experiment: status and prospects*, EGAS 2012, 9-13 July, Gothenburg, Sweden
8. A. Hilico, B. Pelle, Q. Beaufils, G. Tackmann, S. Pélisson, M.-C. Angonin, P. Wolf, and F. Pereira Dos Santos, "A trapped atom interferometer for the measurement of short range forces", EGAS, 44th Conference of the European Group on Atomic Systems, Gotenborg (Sweden), 9-13 July 2012

## Conference/Workshop posters

1. Q. Beaufils, G. Tackmann, X. Wang, B. Pelle, S. Pélisson, P. Wolf et F. Pereira Dos Santos, "Un interféromètre atomique piégé pour la mesure de forces à faible distance", COLOQ 12, Marseille (France), 4-7 juillet 2011
2. B. Pelle, A. Hilico, G. Tackmann, Q. Beaufils, F. Pereira dos Santos, S. Pélisson, R. Messina, M.-C. Angonin, P. Wolf, "A trapped atom interferometer for the measurement of short range forces", Journée d'inauguration du DIM "Des atomes froids aux nanosciences", Paris (France), 6 février 2012
3. J. Malcolm, V. Boyer, T. Valenzuela and K. Bongs for the iSense Consortium, *iSense: a portable ultracold-atom-based gravimeter*, Young Atom Opticians Conference, Krakow, Poland, 26<sup>th</sup>-30<sup>th</sup> March 2012
4. J. Malcolm, V. Boyer, T. Valenzuela and K. Bongs for the iSense Consortium, *iSense: a portable ultracold-atom-based gravimeter*, GG-TOP Launch Event, London, UK, 2<sup>nd</sup> May 2012
5. J. Malcolm, V. Boyer, T. Valenzuela and K. Bongs for the iSense Consortium, *iSense: a portable ultracold-atom-based gravimeter*, 508. Heraeus-Seminar, Bad Honnef, Germany, 4<sup>th</sup>-8<sup>th</sup> June 2012
6. T. Wendrich, E.M. Rasel, W. Ertmer. "Compact electronics for laser system in microgravity", DPG-Frühjahrstagung 2012, Stuttgart 12<sup>th</sup>-16<sup>th</sup> March 2012
7. Florian Schreck, *Degenerate Quantum Gases of Strontium*; BEC 2011 - Frontiers in Quantum Gases, September 10-16, Sant Feliu, Spain; 13<sup>th</sup> Sept. 2011
8. F. Pereira dos Santos, B. Pelle, A. Hilico, Q. Beaufils, G. Tackmann, S. Pélisson, R. Messina, M.-C. Angonin, P. Wolf, "A trapped atom interferometer for short range forces measurements", ICAP 2012, The 23rd International Conference on Atomic Physics, Palaiseau (France), 23-27 July 2012
9. N. Poli, M. G. Tarallo, F.-Y. Wang, M. Schioppo, D. Sutyrin, M. Prevedelli, and G. M. Tino, *Strontium atoms in optical lattices: applications to optical lattices for precision force measurements*, ICAP 2012, 23-27 July 2012, Palaiseau, France