European Cooperation in the field of Scientific and Technical Research
- COST -

Secretariat

Brussels, 2 July 2008

COST 233/08

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action MP0803: Plasmonic components and devices

Delegations will find attached the Memorandum of Understanding for COST Action MP0803 as approved by the COST Committee of Senior Officials (CSO) at its 171st meeting on 18-19 June 2008.

MEMORANDUM OF UNDERSTANDING

For the implementation of a European Concerted Research Action designated as

COST Action MP0803

PLASMONIC COMPONENTS AND DEVICES

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 270/07 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.

2. The main objective of this Action is to foster, coordinate, and strengthen European research on the physical properties and technological qualifications of plasmonic structures in view of their integration in Information Technologies and Biosensing devices.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 11 million in 2007 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter V of the document referred to in Point 1 above.

A. ABSTRACT AND KEYWORDS

The COST Action will foster, coordinate and strengthen scientific and technological collaboration in plasmonics in Europe. Over the last 10 years, plasmonics - the optics of metallic nanostructures - has emerged as a very promising technology. Two key applications of plasmonics are the processing of optical information at the nanoscale and label free biosensing. The Action will cover both fields of application, since similar fundamental and technological issues are at stake. Emphasis will be put on the integration of plasmonic components into CMOS and organic devices. The Action will help bridge the gap between fundamental research and European industry; it will also develop and implement a strategy for education on plasmonics in Europe.

Keywords: Plasmonics, photonics, nanophotonics, information technologies, biosensors, integration, metals.

B. BACKGROUND

B.1 General background

Among the various challenges facing our society, two are particularly marked: The continuous growth of required information processing power and the monitoring of health, not only in western aging societies, but also in developing countries.

Addressing these issues requires a variety of technological solutions. The objective of this COST Action is to explore an original venue for optical signal processing and biosensing based on plasmonics.

Over the last 10 years, plasmonics - the optics of metallic nanostructures - has emerged as a very promising technology. The possibility to guide light in the form of surface plasmon waves on metallic films is attractive for integrating photonics with Silicon electronics on a fully compatible platform. Furthermore, the propagation of surface plasmons or the excitation of localized plasmon resonances is extremely sensitive to its immediate environment and provides the basics for very sensitive biosensing.

Since 1995, publications in plasmonics have doubled every five years and this trend is accelerating. Although Europe has kept its historical leadership in this field of research, there is now fierce competition from North America and Asia.

It goes without saying that worldwide research is desirable to advance scientific and technological knowledge. However, in high-tech segments such as photonics, the transformation of this new knowledge into products and economic wealth can only happen where strong links between research, development and production exist. In this respect the networking and capacity-building activities made possible by this COST Action will be an asset for the European economy.

In spite of tremendous progress in our understanding of how plasmonics work, there remain several questions to be addressed. These questions are both fundamental (e.g. how can plasmon propagation losses be reduced, how can plasmons be modulated) and very applied (e.g. how can plasmons be integrated with CMOS technology). Such questions shall be addressed in this COST Action.

Integration of electronic, photonic and sensing components on the same chip will not only make novel devices available that allow faster data processing or higher integration than existing ones; it will permit a completely new paradigm for the creation, transmission and treatment of information based on surface waves. This paradigm will find a broad field of applications from integrated electronic circuits, to photonic networks and point of care biosensors.

B.2 Current state of knowledge

Historically, optical communications have first entered the realm of long-haul connections, featuring fibre-optics based multi-km serial links, as the demand for steadily increasing channel capacity and negligible signal attenuation have made metallic cables obsolete. More recently, the requirement of multi-Gbit/s data throughputs in Local-Area-Networks has led to the substitution of copper cables with optical fibre bundles also in digital connections shorter than 1000 meters, with the related development of innovative opto-electronic interfaces and network topology. However, in recent years, the scenario for the future of chip-to-chip and board-to-board communications is pushing further these trends to even shorter range optical connections. At present, parallel optical links connecting servers and computers are already a reality. In the near future, optics is expected to penetrate an even more intimate level of data processing architectures, down to the board-to-board connections using optical backplanes and even down to the level of optical buses and inter-chip on-board connections.

This deployment of optical solutions to the propagation of data signals on shorter distances will help overcome the foreseen bottleneck in the performances of electronic data processing systems, as recently stated in roadmaps. Actually, electronics has now progressed to a point where the bottleneck for further performance improvements is determined by the time required to carry the digital information across the chip and no more by the transistor switching time. Hence, the delay of interconnections becomes a substantial limitation to the speed of digital circuits, as evidenced lately by the annual increase rate of the clock speed fore microprocessors. While approaching multi-GHz clock rates, a solution to this problem becomes urgent. A solution is the substitution of the metal wires with optical interconnects, providing a data capacity more than 1000 times larger.

For all the above-mentioned applications, typically optical fibre bundles are employed. However, for the empowerment of data connection capacity and speed on chip and boards, optical fibres are not an adequate solution because their dimensions are approximately 1000 larger than gates and because fibre technology is not readily compatible with electronics. When intensively used as I/O terminations, fibres result in bulky configurations, which may often not be applicable. Therefore, various novel approaches for short range optical interconnects have been considered since a few years. These efforts are mainly observed in USA (Intel, Luxtera, IBM) and Europe (FP6-IST-STREP PICMOS).

In this context, plasmonics (the optics of metallic nanostructures) emerges as a very attractive approach. An appealing feature of plasmonic circuitry is to carry optical signals and electric currents through the same thin metal circuitry, thereby providing an ideal scenario for integration. Surface plasmon photonics thus raises the perspective of adapting the current technology of chip-to-chip electrical interconnects to achieve chip-to-chip data transmission at optical speed. This perspective has motivated exploratory projects in USA (MURI projects) in and Europe (FP6-IST NoE Plasmonanodevices).

Diffusion of inorganic and biological worlds represents an important paradigm of modern science and technology. Integration of photonics, biology and nanotechnology leads to new generations of devices that make possible the characterization of chemical and other molecular properties as well as the discovery of novel phenomena and biological processes occurring at the molecular level. The last two decades have witnessed an increasing effort devoted to research and development of optical biosensors worldwide. Recent scientific and technological advances - often initiated in the context of European projects such as NoEs Frontiers and Nano2life - have demonstrated the tremendous potential that such devices hold for applications in areas like genomics, proteomics, medical diagnostics, environmental monitoring, food analysis, agriculture, and security. Label-free optical biosensors based on guided or localized surface plasmons present a unique technology that enables direct observation of molecular interactions in real-time and allows study of molecular systems without the use of labels.

In addition to this thrive for enhanced sensitivity, leading to more subtle and sophisticated biosensors, there is a great need to develop reliable, disposable and cheap sensors for point-of-care applications. Indeed, current sensing devices that use plasmonics are rather cumbersome and very expensive. They are not easily available for private medical practice, let only by for emergency rescue crews on an accident scene. By bringing on the same platform the sensing and some of the optical signal processing circuits and interconnects, integration will make possible new sensors that will fulfil these needs. This integration paradigm is at the heart of this COST Action.

B.3 Reasons for the Action

At the time where European research on plasmonics is maturing nicely and several consortia are pursuing more focused integrated projects, it appears essential to establish a European forum where plasmonics at large can be discussed and fundamental issues can be addressed in this still young field of research.

Concrete outcomes of the Action will be:

- The advancement of scientific knowledge regarding the interaction of light with metallic nanostructures.
- The sharing of this knowledge among the European scientific community, both in academia and industry.
- The utilization of this knowledge, to design, develop, and fabricate new components and devices for Information Technologies and Biosensing.

This Action fits well within the objectives of several European strategic agendas such as the European Technology Platforms in Nanomedecine, in Photonics (Photonics21), and in Nanoelectronics (ENIAC).

A specific feature of COST Actions is their multidisciplinary character. This is definitely the case for this proposal, which addresses applications related both to Information Technologies and Biosensing. A pitfall of multidisciplinarity however, is the risk to loose focus and dilute efforts. This will be avoided in this Action, which is well centred on plasmonics.

The Action also aims at raising awareness on applications of plasmonics among SMEs and larger companies throughout Europe. The Advisory Board on Industrialization will become the privileged partner to European Industries active in this field of research. Several Action Members have expertise in establishing and developing new High-tech SMEs.

The Action will also provide a privileged forum where academic and industrial partners can prepare focused research projects, to be funded by other European Instruments. This way, knowledge generated within the Action will fructify into tangible economical growth.

The two application areas addressed by the Action: Information Technologies and Biosensing have huge economic potentials in Europe and beyond. For example Frost and Sullivan (a global growth consulting company) estimates that the worldwide market for biosensors which was Euro 3.4 billion in 2007 will exceed Euro 7 billion in 2013. Fostering early research and securing IP is essential for Europe to remain a global player in this field.

B.4 Complementarity with other research programmes

Over the last 4 years, members from the Plasmonanodevicess consortium have developed efficient means of collaborating on concrete issues related to plasmonics. This will provide a solid basis for this COST Action, which will become the European forum on plasmonics. It should however be emphasized that this Action shall not be merely a continuation of the NoE. As a matter of fact, specific short-comings of the NoE in terms of industrialization and education have been identified and will be circumvented in this COST Action. Current NoE members represent actually a minority of the Action. The scope of the COST Action is also much broader than that of the NoE, as it includes both Information Technologies and Biosensing.

Other European networks deal with biosensing (NoEs Frontiers and Nano2life; COST B28 and D43) and nanophotonics (NoEs Phoremost, ePIXnet, Nemo, and Metamorphose; COST 288 and MP0702).

The specificity of the Action lies in its focus on plasmonics, which defines the Action community, as well as in the breadth of its field of applications, ranging from Information Technologies to Life Sciences.

C. OBJECTIVES AND BENEFITS

C.1 Main/primary objectives

The main objective of this Action is to foster, coordinate, and strengthen European research on the physical properties and technological qualifications of plasmonic structures in view of their integration in Information Technologies and Biosensing devices.

C.2 Secondary objectives

1) The fundamental physics of plasmonics

- Study and expand the physics of plasmonic structures in 0-, 1-, 2-, and 3-dimensions.
- Develop and assess numerical models and platforms to simulate plasmonic systems over different length scales.
- Investigate the ultimate limits of transmission loss mechanisms in plasmonic systems and develop schemes that reduce or compensate these losses.
- Study new plasmonic materials, including alloys and multilayered structures.
- Further the common understanding of the interaction between plasmonic materials and molecular (fluorescence, luminescence, Raman) or solid state (quantum dots, quantum wells) sources.

2) Applications of plasmonics for Information Technologies

- Properly asses and promote the application possibilities of plasmonic waveguides, (partially) metallic photonic crystals, and structures containing metal nanoparticles.
- Carry out theoretical analysis of the possibilities to reach higher integration density than today in terms of footprint, significantly surpassing silicon photonics, defining requirements on above all materials.
- Develop schemes that can control and modulate the propagation of surface plasmons, with modulation speeds comparable to traditional photonics.

- Enhance the integration density (and also functionality and if applicable power dissipation) of integrated photonic circuits beyond the current state of the art in silicon photonics.
- Study the integration of plasmonic components in traditional photonic.

3) Applications of plasmonics for Biosensing

- Translate results of fundamental plasmonic research into novel bioanalytical devices and systems desired in numerous important sectors such as healthcare, environmental monitoring, food safety and security.
- Increase the sensitivity of plasmonic biosensors.
- Develop novel interaction mechanisms to sense new chemicals.
- Assess the applicability of plasmonic biosensors on real life molecular systems with usually weaker binding affinities compared to model systems (biotin-streptavidin).

4) The integration of these two fields of applications

- Encourage the translational implementation of concepts developed for Information Technologies and for Biosensing.
- Promote the integration of Signal Processing and Sensing components on the same chip to create fully integrated platforms for point-of-care health monitoring.
- Strengthen European industry by providing the fundamental research and the developments required to design new components and devices that operate with localized and propagating plasmons.
- Develop new low-cost mass-production techniques for plasmonic systems.
- Pursue joint efforts in material design, fabrication and evaluation; likewise for device design, fabrication and analysis.

C.3 How will the objectives be achieved?

The objectives will be reached by the development, assessment and deployment of analytical approaches, software tools, fabrication processes and characterization methods for plasmonic structures and devices for guiding, manipulating and sensing light at the nanoscale.

The success of the Action will be measured by the number and the quality of peer reviewed publications, patents, and conference presentations contributed by participating scientists.

Another metric for the Action success will be the number of focused joint research proposals launched within the framework of the Action.

The number of STSMs and the diversity and number of Partners taking advantage of this instrument will indicate the vitality of the Action.

C.4 Benefits of the Action

The benefits of the Action will concern Science and Technology and will contribute to the development of our society. The Action will create a strong network of individuals and institutions working in the field of plasmonics, it will encourage the efficient use of resources in this field of research. The Action is expected to strengthen the European collaboration in the field of plasmonics and to boost the global competitiveness of European photonics research targeted at information technologies and biosensing. The Action will link academic institutions with SMEs and other industries throughout Europe.

The Action will have a scientific impact at many different levels, from the fundamental knowledge of light-matter interactions at the nanoscale, to the very applied technology enabling integration of metals in photonic circuits.

A further benefit will be in fast plasmonic technology dissemination among the end users and facilitation of joint academic-industrial projects to target specific industrial problems and applications.

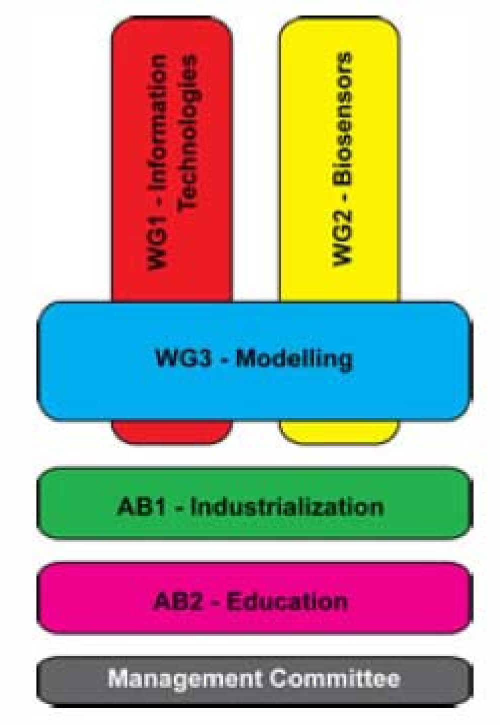
Finally, the Action will broaden the scope of the education programs on photonics by encouraging the study of plasmonics and providing specific training courses and interdisciplinary programs at the interface between Life Sciences and Information Technologies.

C.5 Target groups/end users

The potential target groups are companies engaged in the fabrication of photonic devices for optical communication and biosensing which could profit from the concerted action of academic as well as industrial research laboratories, and the universities and research institutions for which the Action will provide means for accelerated exchange of new ideas and for an efficient education of students and young scientists in this novel field by using of the methods typical for COST Action described below.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus



This COST Action will be organized in 3 Working Groups, including two main scientific Working Groups: Information Technologies (WG1) and Biosensors (WG2); one transversal Working Group on Modelling (WG3) that extends across WG1 and WG2. Two Advisory Boards will focus on Industrialization (AB1) and Education (AB2).

The WG1 Information Technologies will address issues related to the utilization of plasmons for optical signal transmission and processing. These issues include the excitation, propagation losses, modulation and detection of surface plasmons.

The WG2 Biosensors will concentrate on sensing schemes that rely on plasmons as detection mechanism. Instrumental here are the utilization of thin metallic films, nanoparticles, and the combination of the two to enhance sensitivity. Key parameters to be investigated include the reliability, sensitivity and calibration of such plasmon-based devices for label-free biosensing.

Both WG1 and 2 will investigate together the integration of plasmonic components into devices that include sensing and signal processing functions. The Action will have two main platforms: conventional CMOS and organic materials. The former is certainly the technology of choice for devices that will process optical signals and be integrated with conventional electronics. The latter is emerging as a very promising platform for mass production of disposable biosensors; the capability of integrating organic light emitting devices, detectors and organic electronics, makes it also very suitable to embed signal processing modules.

The Action will be focused on both Information Technologies and Biosensing. As a matter of fact, the underlying fundamental and technological issues to be addressed to develop these two applications are similar. Furthermore, the steps required for integrating plasmonics into devices are also similar for both fields of applications. Finally, scientists in plasmonics very often deal both with applications in Information Technologies and Biosensing.

Over the last ten years, Modelling has been key to the development of plasmonics. As a matter of fact, the physical effects involved are rather subtle, the structures to be used have nanometric dimensions, and the realization of plasmonic devices is rather time consuming. Hence modelling in this Action will help unveil and understand the physical effects at hand, show how to implement these effects in practical devices, and determine processing windows where these effects can be used. It is obvious that modelling is relevant for both Information Technologies and Biosensing; hence the WG3 Modelling will be transversal to WG1 and 2.

The aim of this COST Action is also to raise awareness from the European industry on the tremendous potentials of plasmonics and foster joint projects between academic and industrial partners. The Advisory Board for Industrialization (AB1) will be responsible for this task. Three major industry segments will be approached: the semiconductor industry, the chemical industry (in particular organic materials), and the life sciences industry (specifically the biosensing and analytics segments). By inviting European industries and presenting specific plasmonic solutions, the Action will help match-making between industrial and academic groups. This will lead to concrete European research projects. Being an open discussion forum, the Action will also avoid complex intellectual property issues. It is also foreseen that AB1 will become active within professional scientific trade fairs.

The European plasmonics working force is growing steadily. Unfortunately, there has not yet been a concerted effort to develop education in plasmonics. To bear fruits, such effort must rely on scientists at the forefront of plasmonics research. The Advisory Board on Education (AB5) will undertake this mission, setup training schools and encourage the development of pedagogical material on plasmonics. It will also establish links with European initiatives on further education in optics and photonics (e.g. joint Masters), which could benefit from teaching activities in plasmonics.

D.2 Scientific work plan – methods and means

On the one side, the Action will stimulate research in the areas that correspond to the two main Working Groups in Information Technologies (WG1) and in Biosensing (WG2), as detailed below. The Working Group Modelling (WG3) will provide WG1 and WG2 with appropriate tools to model plasmonic systems, from the nanoscopic level to the full integration in complete devices.

Working Group 1 - Information Technologies

- Passive plasmonic devices for photonic communications (couplers, wavelength-selective devices).
- Active plasmonic devices, including plasmonic sources, modulators and detectors.
- Coupling of plasmonic devices with the established fibre optics world.
- Non-linear plasmonic devices for wavelength conversion and optical signal processing.
- Light sources embedding plasmonic structures.
- Loss mechanisms in plasmonic components and how to reduce them.
- Definition of modelling/characterization tasks to be performed by interested laboratories/scientists, and mutual comparison and discussion of results at the WG meetings.
- Fabrication and characterization of plasmonic components: bandwidth, insertion loss, reliability.
- Round-Robin characterization of plasmonic components.

Working Group 2 - Biosensors

- Sensing schemes that exploit guided or localized surface plasmons.
- Relation of the scheme (film, particle) to its sensitivity.
- Integration in optical platforms.
- Biorecognition elements and their immobilization.
- Development of assays for specific applications.

- Characterization and reliability of biosensors.
- Definition of modelling/characterization tasks to be performed by interested laboratories/scientists, and mutual comparison and discussion of results at the WG meetings.
- Interlaboratory comparative studies.
- Protocols for preparation and experimental characterization of plasmonic biosensors.
- Relative merits of different optical detection systems.
- Properties (both optical and mechanical) of molecular coatings.
- Benchmarking of prototypes against best commercial biosensor instruments.
- Comparison of the results obtained using different plasmonic sensing platforms in terms of sensitivity, resolution, limit of detection, and reproducibility.

Working Group 3 - Modelling

- Development of multigrid, multiscale methods that can accurately simulate plasmonic devices at different lengthscales, from the single component to the complete system.
- Comparison and benchmarking of available modelling techniques, assessment of their validity range.
- Study of the influence of model parameters (specifically metal permittivity and geometry details) on the simulation results.
- Modelling side of Round-Robin measurement campaigns undertaken by the Action.
- Support to WG1 and 2 to help advance the fundamental and applied knowledge in plasmonics.

On the other hand, the three Working Groups will work together towards the integration of plasmonic components into devices that can perform either or both Information Technologies and Biosensing functions. Additional focus at the Action level will include materials research: Analysis, evaluation, and device design to identify the structures that lend themselves to integrated plasmonic circuits.

Finally, although the two Advisory Boards will not conduct scientific research per se, they will provide guidance and support to the three Working Groups in the following directions.

Advisory Board 1 - Industrialization

- Industrial fabrication and study of the scalability of plasmonic components and devices for their realization at an industrial level.
- Tools for industrial prototyping and limitation imposed on the range of materials and geometries that may be used (for example, CMOS technology does not accept Ag layers, one of the more useful metals for plasmonics).
- Benchmarking and assessment of plasmonics in comparison to existing or potential competing technologies.
- Analysis of industrial/healthcare norms and the integration of novel plasmonic devices and concepts within these norms.
- Advice on early IP protection, risk/benefit analysis and commercial interest.
- Update on European agendas in Technology and Life Sciences.
- Analysis and surveillance of similar projects and actions outside Europe.

Advisory Board 2 - Education

- Development of didactical concepts for the inclusion of plasmonics in the curriculum in photonics at the high school, undergraduate, and graduate levels.
- Potential synergies with on-going actions on higher education at the local, national and pan-European levels.
- Awareness on the utilization of new technologies for learning and their possible inclusion in the Action web site.

E. ORGANISATION

E.1 Coordination and organisation

The organisation of the Action will conform to the "Rules and procedures for implementing COST Actions" (document COST 270/07).

The Action will achieve its goals via Management Committee meetings, Working Group meetings, Annual Conferences, Training Schools, STSMs, joint publications and presentations, and joint research proposals. The Action will start with a Kick-off Workshop and end with a Final Conference.

A minimum of two Management Committee meetings per year will be organized in participating countries. They will be co-located with Working Group meetings. Additional Working Group meetings will be organized when appropriate.

The Advisory Boards will meet at least once a year, either during the Action Conference or at another moment that would suit their objectives better (e.g. the Advisory Board for Industrialization could meet during a professional industrial fair).

Working Group and Advisory Board leaders will report on progress to the Management Committee, who will supervise progress and report to the COST Office on a yearly basis. The Management Committee will put efforts to guarantee a strong interaction among the different Working Groups and Advisory Boards; it will assure that they remain focused on the common goals of the Action.

The STSM Manager will also report to the Management Committee. This person will advertise the benefits of STSMs among the Action participants and measure the concrete progress achieved by each STSM.

A dedicated web site will be created and regularly updated. This twofold platform will be a central tool for the Action operation and promote the visibility of the Action. For the outside world, this web site will describe the Action and its progress. A specific section of this site will present activities related to the promotion of Women in Science and to the involvement of early-stage researchers. Another section will draw the attention of industry to plasmonics, by describing case studies.

For the participants to the Action, the web site will provide a password-protected common platform to share information and documents.

A main objective of the Action is to foster collaborations and provide a dynamic environment in which Members will be able to create consortia and prepare proposals for submission under specific calls at the European, national and regional levels. The Action shall encourage via its web site a smooth and efficient flow of information regarding such calls and programs related to plasmonics.

STSMs will be extensively used to coordinate the Action activities at the Members'level. They will be selected by the Management Committee, following the recommendations of the STSM Manager. This person will also introduce a simple metrics to assess the impact of each STSM. Furthermore, STSMs will receive special visibility during the yearly Action Conference.

The final report will be published as a book by a renowned scientific publisher. The Management Committee will appoint an Editorial Board to supervise this Final Report.

During the Kick-off Meeting, once the Chairpeson and Vice-chairperson have been elected, the Management Committee of the Action will proceed with basic organization of the Action: establishing the Working Groups and the Advisory Boards and appointing their Chairs and Co-chairs; electing the STSMs Manager; selecting the projects to be accepted as activities of the Action; and introducing collaborative tools.

Within six months from the Kick-off Meeting, the Action will organize its Kick-off Workshop, with the participation of the Action’s members as well as external members. This event shall focus on establishing strong links within the Action’s Community; defining well understood common goals; developing the Action’s identity and projecting this identity towards the outside world.

Although successful collaborations do require face-to-face meetings and imply a great deal of travelling, the Management Committee will undertake all possible to limit the environmental impact of the Action. This will include the extensive use of teleconferencing to expedite current affairs, as well as careful adjustments to the Action’s schedule to collocate meetings with other scientific events related to the field of research of the Action. In that respect, the ratio productivity over environmental impact is particularly favourable to STSMs.

E.2 Working Groups

The objective of the Action is to foster European research in plasmonics with emphasis on Information Technologies and Biosensors. The three Working Groups will therefore be:

- WG1 - Information Technologies
- WG2 - Biosensors
- WG3 - Modelling

In addition to these three Working Groups, the Action will establish two Advisory Boards:

- AB1 - Industrialization
- AB2 - Education

The foreseen structure with 3 Working Groups and 2 Advisory Boards will be reviewed after the first year of operation. It might be adjusted, depending on the number of participants in each Working Group.

Working Groups represent standard organization schemes for a COST Action and they allow a clear focus on the different tasks to be accomplished. Participation to more than one Working Group will be encouraged to foster transdisciplinarity in research. It is indeed one aim of this Action that applications both in Information Technologies and Life Sciences will benefit from progress made in plasmonics at large.

The Advisory Boards provide a more versatile structure than Working Groups. This structure appears chiefly appropriate to tackle Industrialization and Education issues. Such a Board will allow external partners to join the Action during a short period. This will for example enable SMEs to access a specific part of the Action, while limiting their administrative overhead and commitments.

The Advisory Board on Education will also be helpful during the organization of Training Schools, as it will allow local partners involved in higher education to join the Action for this specific event. This way, the Action will build up targeted synergies at the local level, thereby increasing its overall impact and visibility.

E.3 Liaison and interaction with other research programmes

The Action will strongly interact with other consortia and international organizations active in the field of biosensing, plasmonics and nanophotonics. These include NoEs Frontiers, Nano2life, Plasmonanodevicess, Phoremost, ePIXnet, NEMO, and Metamorphose; as well as the COST Actions B28, D34, 264, 288, and MP0702. The latter has a very broad approach to photonic sub-wavelength integration and shares some common goals with the present proposal. However, COST Action MP0702 does not focus on plasmonics and does not include biosensing.

Finally, many Action members have privileged ties with their National Science Agencies. This way, they will be able to implement synergies with these Agencies and relay the progress in plasmonics at all the different levels.

E.4 Gender balance and involvement of early-stage researchers

This COST Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas. The Action will also be committed to considerably involve early-stage researchers. This item will also be placed as a standard item on all MC agendas.

The Action will encourage women to take concrete responsibilities and duties within the Action, especially those with a high visibility profile. In addition to the internal promotion of the role of women in plasmonics, the Action will support the Women in Photonics initiative that has been initiated by the NoE Metamorphose and Phoremost. Two members of the Women in Photonics committee are involved in proposing this Action.

The Action will strongly encourage the participation of early-stage researchers in the scientific and technical activities, as well as in the management of the Action. STSMs will be key to this process. Such missions will receive specific coverage during the Action Annual Conference as well as on the Action website. In this way, the Management Committee will promote mobility among early-stage researchers and offer them the possibility to create their own network.

Training Schools will also provide outstanding opportunities to establish links between young graduate and senior researchers. The ad-hoc Organizing Committee responsible for such a Training School will pay attention to maximize the interaction between lecturers and students and avoid situation where a lecturer, albeit very famous, flies in just before his lecture and disappears immediately afterwards.

F. TIMETABLE

The Action will run for a total of four years. The table below indicates the articulation of the Action. The Action progress will be reviewed at the end of each year during the General Meeting, which will constitute a Milestone of the Action.

Year	Month	Event	
1	0	Kick-off Management Committee meeting	
1	6	Kick-off Workshop, MC & WG Meeting	
1	12	MC & WG Meeting	Milestone 1
2	3	Training school	
2	6	MC & WG Meeting	
2	12	Annual Conference	Milestone 2
3	6	MC & WG Meeting	
3	12	Annual Conference	Milestone 3
4	3	Training School	
4	6	MC & WG Meeting	
4	12	Final Conference	Milestone 4
5	6	Final Report	

G. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, BE, CH, CZ, DE, DK, ES, FR, GR, IE, NL, PL, SE, TR, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at EUR 11 million for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

H. DISSEMINATION PLAN

H.1 Who?

The target audience for the dissemination of the results of the Action include:

- Personnel of the Action Members, with special emphasis on early-stage researchers, including PhD and Ms students.
- Related COST Actions.
- European Consortia, including NoEs and other European Projects.
- Industrial and professional organization bodies.
- Specific SMEs and larger companies, which activities are currently relying - or are likely to rely in the future - on plasmon-based technologies. These include but are not limited to biological and chemical sensing with enhanced sensitivity, point-of-care integrated diagnostics systems, light emitting devices, photodetectors, imaging systems, and advanced optoelectronic components.
- Other researchers working in application areas where plasmonics can be considered as pertinent at the fundamental level such as single molecule manipulation and/or observation, optical interconnects on boards or metamaterials (negative index effect).
- Officers involved in setting up and managing research programs at the regional, national and European levels.

- Actors involved in building strategic agendas such as the European Technology Platform in Nanomedecine, in Photonics (Photonics21), and in Nanoelectronics (ENIAC), as well as specific technology roadmaps (e.g. MONA).
- The general public.

H.2 What?

The dissemination methods will include:

- Publication of information on the public web site.
- Posting of working documents for the Action Members on the private part of the web site.
- Electronic mail distribution lists and forums.
- Annual Progress Reports.
- Final Progress Report to be published as a book.
- Minutes of the Advisory Boards meetings.
- Annual Conferences.
- Training schools.
- Articles in scientific and technical journals.
- Contributions to international conferences.

H.3 How?

The various targeted audiences will find the appropriate level of information on the Action web site. The public part of this site will include links to related projects and institutions, in a way such that the general public can build a larger picture of the field of plasmonics and put it in perspective. The private part of the web site will include detailed information on the Action and its progress, such as Meeting Minutes, consolidated reports, action points and decisions.

Achievements of young researchers within the Action will find a prominent place on the web site. It will also provide information on affirmative actions undertaken by the Action to promote gender balance in plasmonics in particular and in Science and Technology in general. For example, the site will include portraits of women scientists involved in the Action and emphasize their scientific realizations as well as they have endorsed the responsibilities.

Dissemination towards other researchers working in the field of plasmonics will be performed by articles in peer-reviewed scientific and technical journals and by contributions to national and international conferences specialised in plasmonics such as Surface Plasmon Photonics (every odd year, ~320 participants, SPP4 planned in 2009 in Amsterdam and organized by one Action Member); Gordon Research Conference on plasmonics (USA, ~ 150 participants, every even year); Near-Field Optics (~ 360 participants, every even year).

Raising the interest of other researchers and research & development personnel in industries involved in short-term application areas will be performed by contributing to major broad scope scientific & technical events such as CLEO-Europe, EOS annual and topical meetings, IEEE, ECOC, SPIE and MRS conferences.

Specific seminars will be offered to a targeted audience of research and development units in European industries. It is intended that theses seminars be held on the location of such units.

A specific effort will be devoted to providing first-hand information on the technological and industrial perspectives provided by plasmonics to officers involved in setting up and managing research programs to actors involved in building strategic agendas or roadmaps. In addition to inviting these actors to join specific Action events, it is foreseen to propose specific seminars to he held in the headquarters of the corresponding agencies.