SEVENTH FRAMEWORK PROGRAMME
Capacities Specific Programme
Research Infrastructures

Grant agreement for Collaborative Project
(Design Study)

Annex I - "Description of Work"

Project acronym: ***NFFA***

Project full title: Nanoscience Foundries and Fine Analysis

Grant agreement no.: ***212348***

Date of preparation of Annex I (latest version): 11-02-2008
Date of approval of Annex I by Commission: 12-02-2008

Date of revision of Annex I: 17-03-2010
Date of approval of revision of Annex I by Commission: 17-03-2010

Table of contents

PART A Budget breakdown and project summary

A1. Overall Budget breakdown for the project

Participant number in this project	Participant short name	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EC contribution
		RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	TOTAL A+B+C+D		
1	CNR-IOM	643.899	0	162.121	58.683	864.703	0	703.728
2	STFC	392.224	0	27.454	28.095	447.773	0	349.717
3	CSIC-CNM	290.670	0	22.970	22.970	336.610	0	263.943
4	PSI	243.000	0	16.200	33.600	292.800	0	232.050
5	OEAW	303.468	0	11.478	11.483	326.429	0	250.562
Total		1.873.261	0	240.223	154.831	2.268.315	0	1.800.000

A2. Project summary

General Information			
Project Title[i]	*Nanoscience Foundries and Fine Analysis*		
Starting date [ii]	*First day following signature of contract by the Commision*		
Duration in months[iii]	*32*	*Call (part) identifier*[iv]	*FP7-INFRASTRUCTURES-2007-1*
Activity code(s) most relevant to your topic[v]	INFRA-2007-2.1-01		
Free keywords[vi]	Nanoscience, Nanofabrication, Users Facilities, Synchrotron Radiation Experiments in Nanoscience		

Abstract[vii] *(max. 2000 char.)*

We intend to study the feasibility of an European cluster of nanoscience facilities, which will consist of 3-6 Centres closely attached to a number of selected Large Scale Facilities located within Europe (synchrotron radiation sources, neutron scattering sources, high power lasers including free electron lasers and high performance computing, etc). This cluster of nanoscience facilities will enable users to conduct fine analysis experiments and modelling at the nanoscale by offering access to state-of-the-art synthesis, nanofabrication and analysis to a wide research community. Hence, by providing innovative cutting edge preparation and characterization technologies to European scientists, this delocalized institution will raise the standards of nanoscience experiments in the European Research Area and allow full exploitation of the affiliated Large Scale Facilities.

The NFFA design study will develop the Emerging Proposals, named NANOSCIENCE, in synergy with the ESFRI roadmap 2006. NFFA is a structuring project for the ERA that requires to be started with support by the EC under FP7, in order to reach the maturity to be validated as a potential RI by ESFRI. The NFFA Centres for users will share a common technical platform for advanced nanofabrication and characterization of nanostructures, complemented by specialised methods for synthesis of materials, specific analysis, computational methods of simulation, according to a co-ordinated science plan.

The NFFA design study will analyse the full spectrum of Research Infrastructures relevant for nanoscience that are currently in operation OR in the preparatory phase of FP7.

A3. List of beneficiaries

List of Beneficiaries

Beneficiary Number	**Beneficiary name**	**Beneficiary short name**	**Country**	**Date enter project**	**Date exit project**
1 (coordinator)	Consiglio Nazionale delle Ricerche – Istituto Officina dei Materiali	CNR-IOM	Italy	1	32
2	Science and Technology Facility Council	STFC	United Kingdom	1	32
3	Agencia Estatal Consejo Superior de Investigaciones Cientificas - Centro Nacional de Microelectronica	CSIC-CNM	Spain	1	32
4	Paul Scherrer Institute, Laboratory for Micro- and Nanotechnology	PSI	Switzerland	1	32
5	Austrian Academy of Sciences (Österreichische Akademie der Wissenschaft), Institute of Biophysics and Nanosystems Research	OEAW	Austria	1	32

PART B

B1. Concept and objectives, progress beyond state-of-the-art, S/T methodology and work plan

B1.1 Concept and project objectives

The proposed Design Study is a co-ordinated, joint effort of 5 European initial partner institutions to study the feasibility of a new kind of users infrastructure for nanoscience, based on a cluster of Foundry Centres strongly linked with the Large Scale Facilities for Fine Analysis of Matter.

B1.1.1 Concept of the Design Study

Nanoscience has proved to be of enormous potential in the development of new materials and functional systems, tailored at the nanoscale, which will have significant impacts on many aspects of economy, health, and society. The worldwide awareness of this potential has prompted various supporting schemes and research infrastructures dedicated to nanoscience and for nanotechnology, in many industrialised and developing nations, aiming at bridging between the fundamental research and the industry oriented development research. One of the examples of such specific infrastructures is the National Nanotechnolgy Initiative (NNI) and Department Of Energy (DOE) plan of Nanoscience Centres in the United States of America (US).

Detailed analyses of the emerging need of infrastructure to sustain the European research in nanoscience have been done by National Science Plans and by the GENNESYS (Grand European initiative on nanoscience and nanotechnology using neutron and synchrotron radiation sources) exercise (White Book to be published in Jan 2008) over the last 5 years. The need of such infrastructures has been explicitly stated in the Assessment of Feasibility of the European Institute of Technology (EIT) (IP/A/ITREC/IT/2006-157):

“Analyses made by the key players in, for example, microelectronics and nanoscience and nanotechnology, strongly indicate that the key feature of the desired European landscape is a series of strong, critical mass centres at existing universities or research institutes coupled with a few large scale institutions to bridge the gap between academic research and company in-house technology development.”

Also several Joint Technology Inititatives (JTI) under discussion in FP7 do include, with an industrial application perspective, the description of an enhanced use of Large Scale Facilities (LSFs) for accelerating the development of applied research and prototyping of new technologies.

Europe has a great potential in impacting nanoscience and nanotechnology, thanks to its remarkable infrastructure of large scale facilities, mostly synchrotrons, neutrons, novel Free Electron Laser sources, planned high power laser facilities, and the presence of strong, mostly academically based, computational and simulation groups. In order to produce that impact in nanoscience, it is necessary for Europe to develop a network of nanoscience facilities, organized as a distributed infrastructure, in close connection with fine-analysis centres, and equipped with clean rooms, basic technologies

for top-down and bottom-up nanostructuring of matter, materials growth and atom/by/atom, molecule/by/molecule manipulation, such as to allow for direct application of the most advanced structural and functional physical probes, from IR pulsed radiation to variable polarization X-rays, from prototypical interfaces to well controlled and reproducible artificial systems with nano-scale architectures.
In this connection the concept of nanoscience facilities attached to LSFs was included in the 2006 ESFRI roadmap as one of the Emerging Proposals named NANOSCIENCE.

<u>NFFA proposes to investigate in detail the feasibility of the NANOSCIENCE Emerging Proposal, to develop the concept into an implementation plan for consideration in the next update of the ESFRI roadmap as a mature project for an European Research Infrastructure on Nanoscience and Nanotechnology.</u>

NFFA will perform the feasibility study and technical study for the RI that will offer to its users the full advantage combining state of the art nanofabrication and characterization with the most advanced tools and methods for fine analysis based on:

i) pulsed photon beams from fs to ns and from IR to X-rays as produced by synchrotrons, free electron lasers (FELs), high power lasers and neutron methods,
ii) atomic modelization and computational simulation.

The NFFA infrastructure will be ***geographically distributed*** on a small number (3 to 6) of ***multidisciplinary Foundry Centres for NanoScience Research*** located in the vicinity of those LSFs that will appear as the most suitable to effectively develop the synergy with nanoscience activities and the best potential to integrate the larger users facility brought about by the NFFA Centre.

The NFFA Centres will provide an effective integration of research efforts in nanoscience by academic, research, industry and civil services. The openness and effective impact on European research will be the key ingredients of NFFA.

The NFFA Centres will share a common technical platform for advanced nanofabrication and characterization of nanostructures, thus providing European users with ***metrologically well defined and comparable nanofabrication protocols***, also complemented by specialised methods for synthesis of materials, specific analysis, computational methods of simulation, that will be implemented in specific locations, according to a coordinated science plan.
The NFFA Centres will also develop strong links with theory groups with the aim of providing users access also to advanced methods of atomic modelling and computer simulations of nanosystems and of the "intelligent synthesis" of new materials and nanosystems.

The NFFA centres will develop the first ***Repository of Nanoscience Data and Protocols*** for Metrology, Synthesis, Analysis on systems selected by the research community. A general rule, to be fine tuned in case of industrial user projects, will be that the new knowledge produced with a main role of the NFFA centres could be put in a repository allowing the broadest research community to access data and metadata, under transparent rules of access but also protecting adequately the intellectual property.

The geographical neighbourhood of each Foundry Centre with an existing Large Scale Facility, will also provide technical support and access facilities to users. The nanoscience community will be ready to conduct fine analysis of the samples with the LSF instruments, adding an enormous value to the research projects on new materials and functional systems. The general users' community of LSFs, on the other hand, will have access to today generally unavailable clean room methods for preparing high quality research samples using nanofabrication and material synthesis tools directly "on site" and, where appropriate "*in situ*".

A much wider community of scientist and technical operators will benefit, via the Repository, of the work on nanoscience done at the LSFs, than today. The overall impact of the LSF in nanoscience is expected to increase considerably with NFFA.

B1.1.2 NFFA and Large Scale Facilities for Fine Analysis

The scientific rationale for housing the NFFA-RI Centres next to LSF for fine analysis is the following:

1) The wavelength or energy range of the radiation provided by synchrotron radiation and free-electron-laser facilities is ideally suited for the reciprocal or real space characterization of nanoscopic structures, which have spatial dimensions from tenths to thousands of nanometers. X–rays in the 7–10 keV range are a perfect match for nanomaterials structural characterization. The high flux of these sources makes possible probing either the static structure or real–time changes in nanoscale structure. Soft X–rays can be used for real–space imaging through X–ray microscopy, also with magnetic contrast via dichroism with lateral resolution reaching the nanometer scale, and therefore almost meeting the domain of electron microscopies. The characterization of multicomponent systems, including inorganic materials, can exploit anomalous X-ray scattering. The electronic structure of materials undergoes substantial changes as the size scale is reduced, and is directly accessible by spectroscopy.
2) The time domain is of key relevance both for fundamentally understanding the properties of matter that determine macroscopic behaviours, like the macroscopic magnetization reversal of a magnetic bit or the proceeding of catalysis, contributing also key information for applications. Synchrotrons provide a unique access to the 30-100 ps time scale in combination with photon scattering or with electron spectroscopy. Free electron lasers (FELs) provide a unique access to 10-500 fs time scale for experiments on diluted matter (gas phase, in flight clusters) or condensed matter (photon scattering, spectroscopies). Furthermore hard and soft x–rays can be used for lithography to the nanometer level in 3D thanks to oblique incidence techniques. Extreme power and fast lasers push time resolution even further.
3) Theory groups exist in connection with several LSFs that are active both in the understanding of the interaction of radiation and matter, and in the study of the properties of matter at the nanoscale, in particular by the computer-experiment methodology which addresses in a direct way also the dynamical properties at the picosecond time scale. NFFA will address the possibility to support users' access also to relevant computational methods.

Conversely LSF are tributary to nanoscience for advanced instrumentation. X-ray optical devices for extreme focussing are based on nanofabrication (diffractive optics, zone plates) and all synchrotrons and FELs strive with the need of developing their own optical elements by means of expensive nanolithography equipment. Likewise the need of submicrometric accuracy in sample positioning and handling relies, for example, on microfluidics and optical manipulation which require nanofabrication.

NFFA-RI will be synergetic with LSF also in the sense of providing the proper environment for instrument development and fabrication based on nanotechnologies.

Synergy with LSFs as neighbouring installations of NFFA-RI will represent also many non-scientific advantages connected with their intrinsic organization as users facilities with large turnover of international users. The neighbourhood would be beneficial in many ways in organizing the users flux, in sharing existing, or new, user facilities like guesthouse, canteens, travel offices, meeting rooms, data treatment/storage/retrieving technologies etc.

B1.1.3 Objectives of the Design Study

The goal of the NFFA-Design Study is to bring to maturity the concept, that was introduced as Emerging Proposal (NANOSCIENCE) in the ESFRI 2006 roadmap, of an European Research Infrastructure for users of nanoscience methods of design, synthesis, and characterization of nanostructures and functional nano-systems, in close connection with the use of advanced Fine Analysis methods of investigation available at the Large Scale Facilities (Synchrotrons, Free Electron Laser radiation and Neutron sources).

Summary of the objectives of NFFA-Design Study:

1) to design a RI based on several (3-6) Foundry Centres in close connection with LSFs thus providing European researchers a substantial access to state-of-the-art nanoscience instruments and methods and fine analysis therefore increasing the competitiveness of European research by structuring the ERA and creating an ideal environment for advanced training of researchers

2) to raise the standard of sample definition and characterization for advanced experiments with ultrafast, nanofocused, high energy resolution probes available at Synchrotrons, FELs and Neutron facilities, therefore maximising the impact of LSFs on European science and technology

3) to design a repository-type data bank on nanoscience data, with wide regulated access by research community

The feasibility study will include:

i) a thorough analysis of the number and quality/focus of nanoscience projects requiring design/simulation studies, synthesis, nanofabrication of samples and functional systems, and advanced analysis and experimentation with time/space/energy high resolution probes.

ii) a technical analysis and design study of an **optimised offer of advanced nanofabrication methods** to European nanoscience, i.e. high energy electron-beam lithography, X-ray lithography, cryogenic scanning probes, specialized Molecular Beam Epitaxy or Chemical Methods for materials synthesis, etc…, with careful technical definition of tools and methods that will make it actually feasible and advantageous to operate as a users facility

iii) a **technical analysis and design study of the basic requirements** for clean rooms and other infrastructure to define a basic common standard of all Centres

iv) a **strategic plan for a scaled implementation of Centres and their locations** in Europe both in close connection and synergy with specific LSFs and providing effective services also to nanoscience users from Countries that do not host LSFs.

v) **development of a RI science policy** and perspective joint management to monitor and coordinate in the best cost/benefit approach the overall development of the Centres and their impact in European nanoscience by monitoring the effective response to users needs, both qualitative and quantitative, as well as the effective role of NFFA in increasing the volume of high quality research and advanced training in multidisciplinary nanoscience

vi) a general scheme of "**quick technical feasibility assessment and quick peer review**" for enforcing the users access policy, making attractive for both research institution and industry to use NFFA in order to increase their competitiveness in science and technology. A general scheme of coordinated access to LSF beamtime when appropriate for the specific project.

vii) a scheme of **personnel hired by** NFFA-RI at the Centres with both research duties (method developments and specific advanced studies) and users support duties, and a scheme of associated personnel from academic/research institutions contributing locally to NFFA Centres

viii) a general policy of **users support and in-house research**

ix) a scheme for **possible coordinated access to** NFFA-RI **and LSF** where the science proposals by users do require/justify it. The high standard of nanostructured systems realized by users at NFFA-RI Centres will be an effective advantage for application to beamtime at any LSFs, but in some cases a coordinated action may be required by users and accordingly a proper scheme must be studied and agreed upon with the individual LSFs.

x) A scheme for establishing **common protocols and standards in nanofabrication and metrology**, and/or for validating protocols and standards developed by users

xi) a scheme for a **nanoscience data repository** that, with proper rules about intellectual property by researchers, institutions, or industry, could give transparent access to the scientific results and established protocols to the whole scientific community.

The key deliverable of the design study will be a ***proof of feasibility of setting up the Nanoscience Foundry cluster, as part of European Research Infrastructure*** for all users of nanoscience that may have a direct or indirect advantage for their research in the specificity of NFFA-RI, that is, ***its strong link to the fine analysis methods available at the Large Scale Facilities*.**

The feasibility study will produce an implementation plan describing the *method of operation, its governance, the standard of the facilities* offered by NFFA-RI and the *mechanism of access* for both academics (groups or individuals) and industrial or other service enterprises.
The feasibility study will also include the detailed description of at least three feasible Centres of NFFA and their location, and the details of the possible agreements with the institutions to be involved in the construction of such Centres, including the rules defining mutual privileges and engagements with the LSFs.
The feasibility study will provide a description of a repository of nanoscience data.

B1.2 Progress beyond the state of the art

The development of nanoscience, including methods and tools for nanotechnology, can be substantially improved by making available to all European prospective users, the best infrastructures and a full exploitation of the methods of fine analysis of matter and of modelling and simulation, while avoiding the risk of duplicating efforts and decreasing the cost effectiveness. The multidisciplinary environment of SR and FEL laboratories adds also a fundamental value to nanoscience research programs, if these are adequately supported by a proper technological and methodological nanoscience infrastructure.

A similar rationale has motivated in recent years a number of nanoscience / nano-technology initiatives, including the remarkable one in the US by the DOE (Department of Energy), based on the construction of 5 nanoscience centres (Berkeley, Oak Ridge, Sandia, Brookhaven, Argonne), closely connected with the large-scale national laboratories for X-rays and neutrons (http://www.sc.doe.gov/bes/BESfacilities.htm#NSRC). Only few examples of such an approach can be found in Europe, e.g. in the biosciences, the EMBL (located near Hamburg), the Partnership for Structural Biology laboratory (located at Grenoble, on the same site as ILL and ESRF). Those research laboratories have privileged access to large scale neutrons and synchrotron facilities, and share with those the general users' support infrastructures.

The European potential users of NFFA-RI belong to diverse areas: materials science, physics, chemistry, life-sciences, various branches of engineering, bio-medical application, etc., and come from academia, national research institutions, and industry.

Currently there are no open facilities for supporting full nanoscience projects involving design and nanofabrication of samples and functional systems. The research is done via collaborations between different institutions, with a generally low pace when complex processes are involved at far away institutions (like growth, lithography, electrical characterization, protection of samples, acquisition of beam time at a LSF, …).

The quality and the effectiveness of research on nanosystems will be substantially improved via the use of dedicated facilities, where multimodal access is possible. The main improvement in the state-of-the-art will be:

i) the wide availability of advanced nanoscience methods to a wide users community
ii) the merging of fundamental research and nanoscale material science in an infrastructure designed to support multidisciplinary research and to link nanofabrication and nanometrology with the most advanced fine analysis methods
iii) to substantially accelerate the development of new science and applications by greatly improving the reproducibility and test of new results at different Centres, by different research user groups, both academic and industry oriented.
iv) the availability, under proper access rules, of detailed knowledge resulting from research at NFFA-RI that could be beneficial to other research institutions and groups.

The basic infrastructure of each NFFA-RI centre will be designed to allow flexibility for quick implementation of new methods in nanoscience, such to make the state-of-the-art methods available to a wide community of users, in very short time with respect to the relevant discovery/innovation, in this way maximizing the return from the investment.

To ensure the quality of external service and continuous upgrade of the techniques, the NFFA-RI Centres will also support advanced and competitive "in house" research projects, focussing on different areas of nanoscience, with multidisciplinary approach, involving scientific networks with prospective users, to allow also the growth of a common culture. These in-house science programs will identify each Centre and strengthen its speciality also in the users program. The Centres will provide to their users, as well as to users of the nearby LSFs, wide open access and collaboration for the development of science programs at a much high effectiveness level than today. The "local" specialization of each centre will reflect the local strength in research (nearby universities, research institutions, international centres etc.). The aim of this is to have research institutions deeply involved with NFFA-RI centres. This is a guarantee that the NFFA-RI will be effectively integrated in the research circuit (academic-public laboratories-facilities). Interfaces should be at the same time completely transparent and with the lowest possible barriers, except for a flexible but entirely scientific assessment of the merit of the proposals.

B1.3 S/T Methodology and associated work plan

The NFFA Design Study will perform the activities described in five work packages (WPs) with the aim of developing a clear mission, a feasible structure, and a scheme of implementation of the new European Research Infrastructure.

a) definition of the mission of NFFA as European RI and of its Centres, analysis of the multidisciplinary users communities and of the access policy, analysis of all the existing national activities in nanoscience that could usefully converge in participating/supporting NFFA-RI Centres.

b) definition of the specifications of the general structure of the Centres, which will define the NFFA standard. This includes technical work in the development of novel schemes of technical infrastructure (definition of user accessible clean rooms) with built-in flexibility, of instrumentation for nanofabrication and for characterization of materials and systems, of methods of analysis including computation.

c) definition of specialised NFFA Centres and of the users communities that would take maximum benefits from their existence.

d) analysis of the existing LSFs in terms of the best synergies that could be developed with NFFA and definition of a possible roadmap for the RI.

e) definition of schemes for the future training activities at NFFA-RI Centres. Definition of the specifications of a NFFA-RI data repository and its rules of access. Dissemination of the NFFA concept via web site, public workshops and NFFA book.

The method that will be followed is to cover the points a-e by actions described in specific work packages that will be co-ordinated by the initial partners of NFFA-Design Study who will aim, during the first year of the Design Study, to reach a full European dimension of the project, also by seeking the direct involvement of more partners who are not in the proposers' list. Explicit interest in NFFA-Design Study has been expressed by institutions who declare to consider joining NFFA-Design Study after start.

This is an important goal of NFFA-Design Study. The initial partners do provide a wide coverage of competences and do represent a relevant part of the future European users community, but by far not all of it, nor most of it. It is nevertheless very appropriate that the starting group is of adequate size to draft the Design Study while reaching out to all relevant LSFs and nanoscience institutions that are needed for a full assessment of NFFA-Design Study objectives.

A series of targeted and widely advertised workshops will guide the definition of priorities for sustaining European nanoscience with a direct exposure to the users community.

B1.3.1 Overall strategy and general description

In the spirit of a light and efficient structure, the number of WPs has been limited to the essential ones. WP1 is the general management of the Design Study, WP2 is targeted to the monitoring and survey of the users community, WP3-WP4 mimic the JRA activities of an I3 project and include the design of a Data Repository, WP5 concerns the design of training practices in NFFA-RI centres and dissemination activities and documents. The performances of such activities will be the perfect project indicators towards the definition of a mature Research Infrastructure.

The workplan is organised in analysis and feasibility tasks.

WP1: Management of NFFA Design Study

The Overall Project Management will ensure timely achievement of project results through technical and administrative management. The main objectives are: administrative and financial co-ordination of the project, including control of work package commitments, and installation of effective means for quality control of the project. Also the organisation of usage and exploitation of knowledge derived from the project is assumed.
Tasks of WP1 include:

- web-homepage of the Design Study;
- database of NFFA, to be considered as the collection of information/documentation relevant to the 5 beneficiaries in the design study phase and should serve as a common platform;
- organisation of periodic meetings of the Co-ordination Board;
- organization of the FORUM (see B2.1 Management Structure and procedures);
- contacts with the Advisory Board;
- preparation of documents for all beneficiaries;
- preparation and supervision of annual cost claims, audit certificates submitted by all project beneficiaries and EC reporting;
- organization of workshops and meetings;
- issuing and filing of financial records;
- collection and dissemination of knowledge generated by the consortium.

Also progress review, decision-making, risk review and conflict resolution will be embedded actions in the WP1 tasks, as well as monitoring of the status of the technical tasks and the timely arrival of the proposed deliverables.

WP2: Analysis of users and science program, development of NFFA roadmap

The detailed analysis of the needs of nanoscience users in the next 10 years will be carried out by the proponent participants, this will include:

a) A survey of the groups that are already users, or who are clearly potential users, of synchrotrons, high power lasers, FELs and neutron sources for experiments in the domain of nanoscience. This will provide a map of the existing competences in nanoscience that already operate synergies with the LSFs.

b) A broader analysis of the range of impact of NFFA in domains of nanoscience that are **not yet** connected with the access to LSFs. This includes research on functional materials and systems, but also on metrology, toxicology of nanoparticles, certification.

c) An estimate of the overall community that could benefit form NFFA not necessarily as active users but also as users of the data repository of results, nanofabrication/synthesis protocols, remote access.

It is of utmost importance that nanoscience does not remain confined to research but the applied aspects of nanoscience lead to competitive advantages for the most advanced and dynamic European industries. Therefore, the project will define guidelines for a balanced access to the facilities by the scientific community, by the industry and by civil services. The access to the NFFA by industry has the merit of providing a wide spectrum of technologies in an environment of advanced scientific knowledge and technical know-how, in which industry could perform part of research and development activities, and to lower the barriers between application oriented research and fundamental research.

WP3: Design study of NFFA-RI Centres, technical layout of instrumentation and tools.

A feasibility study will be carried out defining the technical layout of the NFFA Centres, the common configuration of infrastructure (clean rooms specifications, particle beam lithographies and nanofabrication, characterisation and nanometrology tools) and the domains of specialization at different Centres (e.g. atomic resolution microscopies and spectromicroscopies based on electron beams TEM, SEM, LEEM and complementary nanometer resolution microscopies and spectromicroscopies based on X-ray beams). Main subjects of the activities will be optical manipulation of micrometric/submicrometric samples; planar lithographies with high lateral resolution and nanofabrication with high aspect ratios; nano-bio labs for the synthesis of hybrid organic/inorganic, or bio/inorganic systems; development of sample protocols for combinatorial material libraries for scanning probes; synthesis of nanostructured materials with tailored properties like nanowires, nanotubes, dots, 1D, 2D and 3D systems; micro-fluidics. One of the main objectives will be the optimal use of nanofabrication tools for translating planar lithographies with high lateral resolution into nanofabrication with high aspect ratios (ICP, deep RIE, electrochemical growth), in order to obtain a better saturation of top equipment and duplicating only the really "user hands-on" instruments.
Metrology is an important issue for the development of nanoscience and nanotechnology. Experiments on physical, chemical, biological nanosystems, whether assembled with the help of nanotechnology or found directly in nature, need accurate metrological pre-characterisation, in order to establish accurate correlations between structural and other physical properties. The topic of metrology will be the objective of a specific task, devoted to identify the type of tools, their distribution in the facility network and the effort in terms of investments and personnel resources that should be devoted to this crucial aspect for the development of the nanoscience field. Furthermore, the possibility of a joint development of new metrology techniques and tools for nanoscience based on X-rays and neutron will be explored in collaboration with teams of large scale facilities. The deliverable will be the first project of a user-oriented state-of-the-art clean room environment for nanoscience, with proper safety rules and adequate technical and scientific NFFA personnel to enforce the high standard. The possible role of NFFA and fine analysis methods for toxicology estimates of nanoparticle environmental and health impact will be explored. Analysis of costing of capital equipment and operation as a facility will be monitored.

WP4: Development of management structure and format of user access for NFFA-RI Centres. Design of NFFA Data Repository and access criteria. Intellectual property issues.

The detailed mission of NFFA will be outlined. The management structure to operate the RI and the Centres, each one strongly connected with local academic, research institutions and LSFs, will be developed in this work package in close connection with WP3, where the first scheme of a distributed facility will appear. The synergy between NFFAs and the LSFs will serve users in multiple ways since LSFs could also be ”clients” of NFFAs for their own in-house research and, in particular, their need of nanofabricated devices for developing the facilities themselves.
The NFFA will develop and follow science plans with defined general and specific priorities for the individual centres, as well as the flexibility to allow quick investment in novel research methods and instrumentations, and to make it quickly available to users.
The NFFA users will perform research on-site using the state-of-the-art facility equipment and staff support, according to their own expertise. Alternatively the users will access to advanced hands-on training courses in nanofabrication, analysis, and modelling-simulation at the atomic scale, offered by NFFA. The expert user groups will be capable to reproduce their own protocols in close connection with Fine Analysis experiments at LSF, and the large number of research groups that do not have direct access to advanced nanofabrication techniques will be capable as well to lead experimental studies on samples and systems synthesised and characterised at the state of the art, making the overall comparison of results by different groups and advancement of nanoscience easier and faster. The NFFA users typically will spend limited periods of time at the NFFA centres to complete their project. Practical concepts for remote usage of NFFA will be evaluated.
The WP will also produce a general scheme of user access to the NFFA Centres either a direct usage of the facilities, or as clients of the facilities, or as trainees at the facilities. We will develop a high-quality quick project acceptance process capable to enable the use of facilities within one month, or less, by the users of NFFA. We will also develop a scheme for negotiating quotas of access by NFFA to LSF beams, when appropriate, also on a quick basis. This is aimed to both fostering the advancement of new science, and to make attractive to industry to submit to NFFA projects of advanced technological development.

The design of a Repository of nanoscience data produced at NFFA open, under specific rules, to the general scientific community and beyond is also a target of WP4. We will study a general scheme for access to a repository of NFFA data and metadata capable to enable remote users to reproduce or develop their own nanoscience such as growth/fabrication protocols, metrology results etc. Data Repositories can be extremely effective if proper data and metadata formats are designed that could enable remote users to retrieve full knowledge on the results and of the conditions the results were obtained and could be reproduced. This includes growth and nanofabrication protocols, metrology protocols and results, physical data on specific systems. Interoperability issues, access by Internet and related technical aspects will be defined.

The related issues of intellectual property will be addressed.

This feasibility study may have as an option to start a “Limited Pilot Program” (LPP) to support the access of users to existing facilities operated by participating centres, with the aim of developing and testing the best practices for user access.

WP5: Schemes of future dissemination activities: a) training at NFFA-RI Centres, b) schools and public conferences, c) NFFA book.

The NFFA centres will naturally qualify as ideal places for advanced training of young scientists and engineers, for technical personnel and for personnel from industry or civil services. The state-of-the-art facility equipment and highly qualified staff support, and the international users will create a dynamical concentration of multidisciplinary knowledge and means very relevant for nanoscience and for the formation of a new generation of science and technology developers and operators. The advanced training for scientists, engineers and technical operators in nanoscience processes will also be a key issue in the program and operation of the NFFA centres.
Similarly a scheme of periodic NFFA-RI summer schools and open conferences will be defined in order to reach the widest public and to introduce to the use of the Data Repository.

During the Design Study phase of NFFA we will develop new concepts for an advanced training program in nanoscience at the NFFA centres. All NFFA partner institutions have advanced educational programs ongoing as well as research contracts with industry. The linking together of these various teams in the NFFA project will produce a high level, interdisciplinary training environment. A scheme will be developed by exploring the feasibility of agreements between NFFA and academic bodies for validating training courses and practices at the doctoral level, for engineers and for technical operators of nanoscience processes. This will further ensure the establishment of roots of the NFFA in the academic environment.

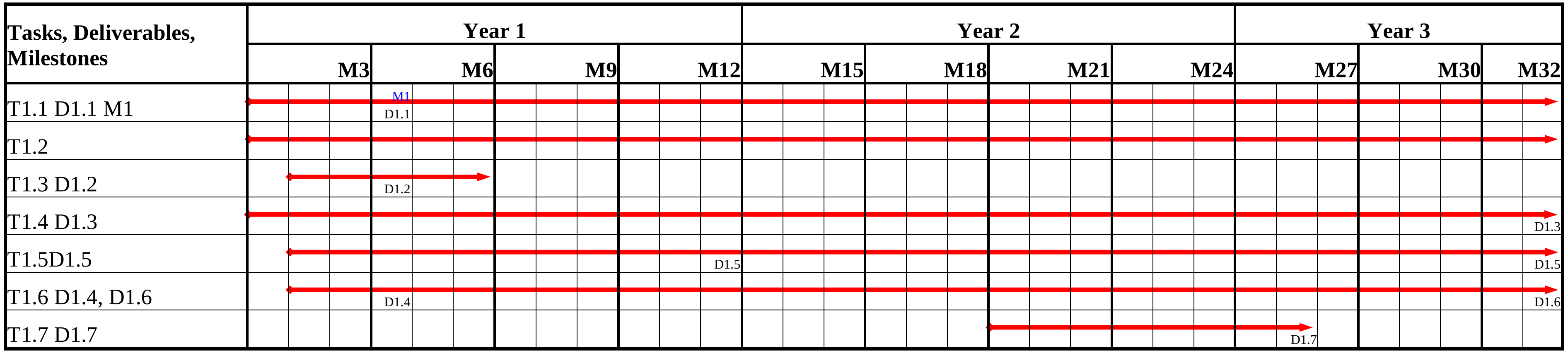
Summary book of the NFFA concept will be written and distributed as a work document for the follow-up of the NFFA project and as a reference book for European nanoscience.

Protocols for risk assessment

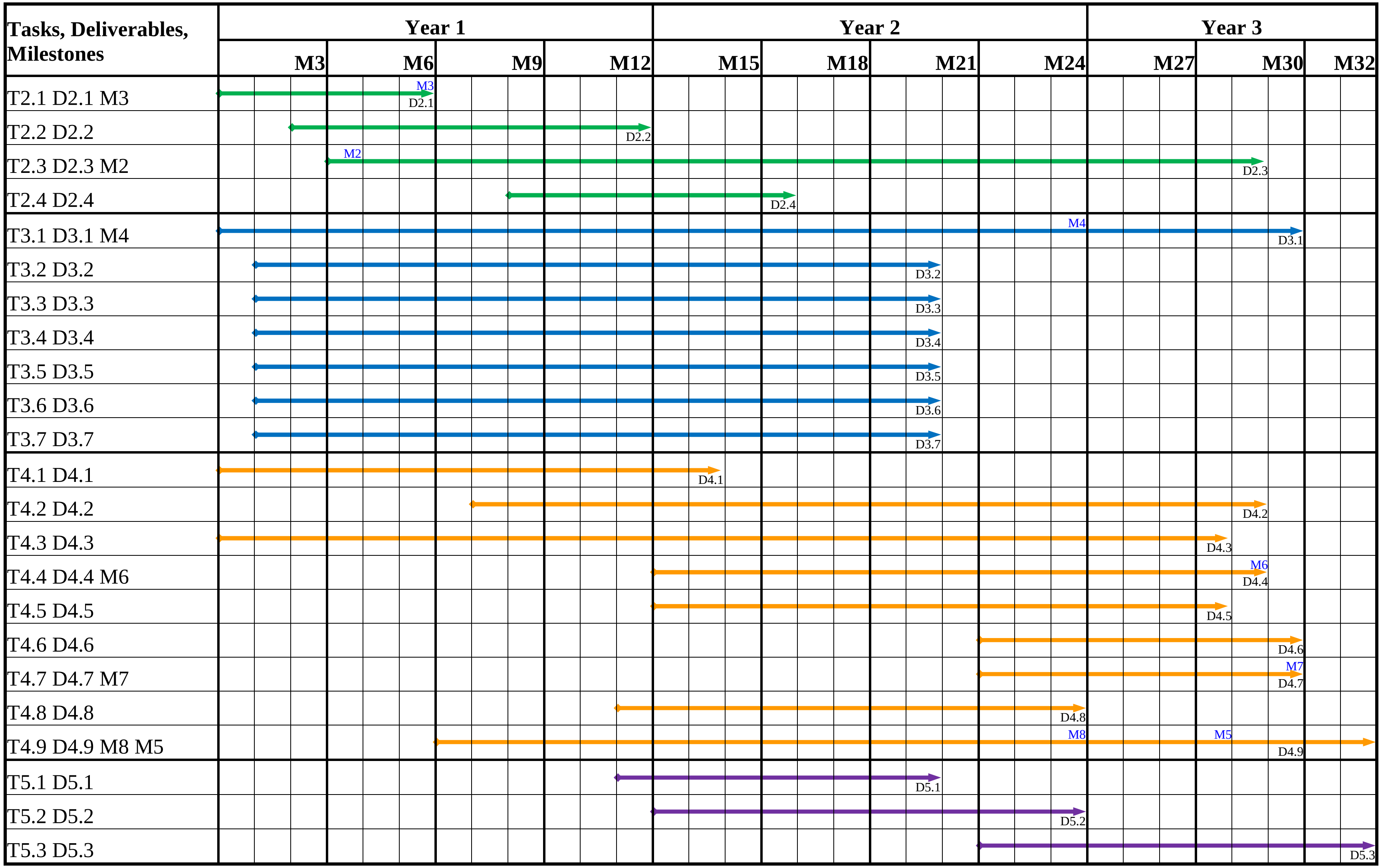
The NFFA Centres will operate equipment by following strict safety rules where they are applicable and developing certified best practices as a part of the definition of NFFA standards for nanoscience experiments and users operation. The activity of development of a standard for safe user nanoscience laboratory will address, albeit marginally, some issues connected with the potential toxicity risks of nanotechnology. This knowledge, will also be made available in the data and metadata repository of NFFA.

B1.3.2 Timing of work packages and their components Missing timing for both deliverables and Milestones below

TIMING DIAGRAM AND MILESTONES OF THE MANAGEMENT WP:



TIMING DIAGRAM AND MILESTONES OF THE TECHNICAL WORK PACKAGES:



B1.3.3 Work package list / overview

Work package list

Work package No[1]	Work package title	Type of activity[2]	Lead beneficiary No[3]	Person-months[4]	Start month[5]	End month[6]
WP1	Management of NFFA Design Study	MGT	1	22	1	32
WP2	Analysis of users and science program, development of NFFA roadmap	RTD	2	34	1	29
WP3	Design study of NFFA-RI Centres, technical layout of instrumentation and tools	RTD	4	83	1	30
WP4	Development of management structure and format of user access for NFFA-RI Centres. Design of NFFA Data Repository and access criteria. Intellectual property issue	RTD	1	62	1	32
WP5	Schemes of future dissemination activities: a) training at NFFA-RI Centres, b) schools and public conferences, c) NFFA book	OTHER	3	13	6	32
	TOTAL			214		

1 Workpackage number: WP 1 – WP n.

2 Insert one of the following 'types of activities' per WP (only if applicable for the chosen funding scheme – must correspond to the GPF Forms):

RTD = Research and technological development including scientific coordination applicable for collaborative projects and NoEs

DEM = Demonstration - applicable for collaborative projects

OTHER = Other activities (including management) applicable for collaborative projects, NoEs, and CSA

MGT = Management of the consortium - applicable for all funding schemes

COORD = Coordination activities – applicable only for CAs

SUPP = Support activities – applicable only for SAs

3 Number of the beneficiary leading the work in this work package.

4 The total number of person-months allocated to each work package.

5 Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

6 Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

- **B1.3.4 Deliverables list:**

List of Deliverables – to be submitted for review to EC[7]

Del. no. [8]	**Deliverable name**	**WP no.**	**Lead bene-ficiary**	***Estimated indicative person-months***	**Nature**[9]	**Dissemi-nation level** [10]	**Delivery date**[11] **(proj. month)**
D1.1	Homepage NFFA	1	1	*2*	*O*	*PU*	*4*
D1.2	Call for new participant	1	1	*1*	*O*	*PU*	*4*
D1.4	Presentation to ESFRI	1	1	*3*	*R*	*PP*	*4*
D2.1	NFFA Users Survey	2	2	*10*	*R*	*PU*	*6*
D1.5	1st Annual Report to EC	1	1	*2*	*R*	*PP*	*12*
D2.2	Draft of NFFA scientific program	2	2	*8*	*R*	*PP*	*12*
D4.1	Mission Statement of NFFA-RI	4	1	*8*	*R*	*PU*	*14*
D2.4	Industrial Liaison Office	2	2	*3*	*P*	*PP*	*16*
D3.2	Design of Nanolitho Facility	3	4	*13*	*R,P*	*PU*	*20*
D3.3	Design of Growth Facility	3	4	*13*	*R,P*	*PU*	*20*
D3.4	Design of High Resolution Metrology Facility	3	4	*13*	*R,P*	*PU*	*20*
D3.5	Design of Nano-Manipulation Facility	3	4	*13*	*R,P*	*PU*	*20*
D3.6	Design of Nano-Bio Facility	3	4	*10*	*R,P*	*PU*	*20*
D3.7	Scheme for Technical Synergies	3	4	*6*	*R*	*PU*	*20*
D5.1	Scheme for NFFA-RI staff training	5	3	*3*	*R*	*PU*	*20*
D4.8	Definition of quality standard for NFFA	4	1	*6*	*R,P*	*PU*	*24*

7 In a project which uses 'Classified information[7]' as background or which produces this as foreground the template for the deliverables list in Annex 7 has to be used

8 Deliverable numbers in order of delivery dates: D1 – Dn

9 Please indicate the nature of the deliverable using one of the following codes:
R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

10 Please indicate the dissemination level using one of the following codes:
PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

11 Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

D5.2	Scheme for Users Training Courses	5	3	*3*	*R,P*	*PU*	*24*
D1.7	Conference with industrialists	1	1	*2*	*O*	*PU*	*26*
D4.3	Design of NFFA-RI Scientific Management	3	1	*7*	*R*	*PU*	*28*
D4.5	Schemes for Sharing Facilities	4	1	*5*	*R*	*PU*	*28*
D4.9	Scheme for Data / metadata repository	5	3	*7*	*R*	*PU*	*30*
D2.3	NFFA Roadmap	2	2	*13*	*R*	*PP*	*29*
D4.2	Structure of the NFFA-RI Governance	4	1	*7*	*R*	*PU*	*29*
D4.4	Users Access Scheme	4	1	*7*	*R*	*PU*	*29*
D3.1	Design of the NFFA Infrastructure	3	4	*15*	*R,P*	*PU*	*30*
D4.6	Construction Cost Analysis NFFA-RI	4	1	*6*	*R*	*PU*	*30*
D4.7	Analysis of Operation Costs of NFFA-RI	4	1	*6*	*R*	*PU*	*30*
D1.3	Audited Financial Reporting	1	1	*2*	*R*	*PP*	*32*
D1.5	2nd and final Report to EC	1	1	*4*	*R*	*PP*	*32*
D1.6	Final Documents concluding the Design Study	1	1	*6*	*R*	*PU*	*32*
D5.3	NFFA Book	5	3	*7*	*O*	*PU*	*32*
			TOTAL	*211*			

B1.3.5 Work package descriptions

Work package description

Work package number	1		**Start date or starting event:**			1					
Work package title	Management of NFFA Design Study										
Activity Type[12]	MGT										
Participant id	1	2	3	4	5						
Person-months per beneficiary:	16	2	2	1	1						22

Objectives General governance of NFFA Design Study, including scientific and administrative management. Handling and distribution of funds.

Description of work (possibly broken down into tasks), and role of participants

T1.1) Control of Design Study: To enforce rules, support work-packages and tasks approved by EC as well as the timely reporting by all partners. Supervision and the contact with the Commission will be assured during the whole Design Study.

T1.2) Handling and Distribution of funds: based on the rules of EC, the funds for the work packages and tasks approved by EC will be handled, managed, controlled and auditing and reporting will be assured by the co-ordinator institution that is CNR-IOM, with only a partial extra support of management personnel.

T1.3) Calls for participation of new participants to NFFA Design Study. New participants may join NFFA within the first year, and might be eligible for partial support of some direct costs. However the number of signatories of the contract will not increase.

T1.4) Administration of Design Study: The design study office at CNR-IOM (home institution of co-ordinator) will serve as administrative link between the partners and the EC and handle the central administrative operations.

T1.5) Collecting, editing and publishing of data-base, documentation and activity reports. Reports are expected to be delivered by the work package co-ordinators in a form in which they can be easily edited and made public on the NFFA web-site, or in printed publications.

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[12] For all FP7 Projects each workpackage must relate to one (and only one) of the following possible Activity Types

RTD = Research and technological development including scientific coordination applicable for collaborative projects and NoEs
DEM = Demonstration - applicable for collaborative projects
OTHER = Other activities (including management) applicable for collaborative projects, NoEs, and CSA
MGT = Management of the consortium - applicable for all funding schemes
COORD = Coordination activities – applicable only for CAs
SUPP = Support activities – applicable only for SAs

T1.6) Reports will be produced both for presenting the NFFA project to ESFRI for evaluation in view of the update of the RI roadmap, and for final conclusions of the Design Study**.**

T1.7) Conference to inform potential industrial users. NFFA will alternatively participate to industry-oriented European workshops, conferences and fairs.

Deliverables (brief description) Here for each WP you must also identify respective milestones and their timing

- **D1.1)** Homepage NFFA – public web site (month 4)
- **D1.2)** Call for new participants (month 4)
- **D1.3)** Audited financial reporting (month 32)
- **D1.4)** Document for presenting NFFA to ESFRI (month 4)
- **D1.5)** Annual Reports to EC (months 12 and 32)
- **D1.6)** Final Documents concluding the Design Study (month 32)
- **D1.7)** Conference to inform potential industrial users (month 26)

- **M1** Public web site (month 4)

Work package number	2		**Start date or starting event:**					1			
Work package title	Analysis of users and science program, development of NFFA roadmap										
Activity Type[13]	RTD										
Participant id	1	2	3	4	5						
Person-months per beneficiary:	7	11	7	5	4						34

Objectives

Survey and analysis of LSF users

Explore the range and size of the general nanoscience community benefiting from NFFA-RI

Define the Science Program of NFFA-RI and its implementation schedule

Description of work (possibly broken down into tasks), and role of participants

T2.1) The **detailed analysis of** nanoscience **users needs** in the perspective of the next 10 years will be carried out by the proponent participants. All participants will compare their medium term plans and those of other European institutions in the field in order to understand the patterns of investment in nanoscience and the way NFFA can intervene.

T2.1.1) A **survey of established collaborating groups** operating at LSFs will provide a complete map of the existing distribution of competences in nanoscience that already operate synergies with LSFs and the pattern of specialised centres that can emerge from it.

T2.1.2) A survey of nanoscience activities that are **NOT involved with LSFs** but would benefit from NFFA either becoming users of NFFA and LSFs, or becoming users of the NFFA repository of data and standards.

T2.2) Definition of a science program for NFFA-RI which will be composed of two synergic activities: the in-house research projects under the responsibility of NFFA-RI staff and associated scientists and the users' scientific projects.

T2.3) Definition of a roadmap for the construction of NFFA (localization of potential sites, definition of a time scale for construction phasing). NFFA will be part of the landscape of European research infrastructures, particularly the analytical facilities. Such landscape is being shaped by new RIs like FELs, ELI, new synchrotron radiation and neutron spallation sources, and by strategy analyses like GENNESYS. The NFFA roadmap towards implementation of the NFFA distributed

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13 For all FP7 Projects each workpackage must relate to one (and only one) of the following possible Activity Types

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MGT = Management of the consortium - applicable for all funding schemes
COORD = Coordination activities – applicable only for CAs
SUPP = Support activities – applicable only for SAs

ERIC will take into account all the ongoing developments by other projects.

T2.4) Set up an Industrial Liaison Office to manage economical and R&D relations with external companies. Public and private/public projects will be considered taking into account procedures for intellectual property protection.

Deliverables (brief description)

- **D2.1** Users survey (month 6)
- **D2.2** Draft of NFFA in-house scientific program (month 12)
- **D2.3** NFFA roadmap (month 29)
- **D2.4** Industrial Liaison Office (month 16)
- **M2** NFFA Roadmap – presentation to ESFRI (month 4)
- **M3** Users Database (month 6)

Work package number	3		**Start date or starting event:**		1					
Work package title	Design study of NFFA-RI Centres, technical layout of instrumentation and tools.									
Activity Type[14]	RTD									
Participant id	1	2	3	4	5					
Person-months per beneficiary:	28	8	12	10	25					83

Objectives

Design study of NFFA-RI centres, technical layout of instrumentation andtools,

Description of work (possibly broken down into tasks), and role of participants

T3.1) Design study of overall infrastructure (clean rooms specifications and operation criteria, layout of growth, lithography, microscopy, characterization facilities, possible end-of-beamline facilities, users access areas and restricted areas). The basic infrastructure of each NFFA centre will allow flexibility for quick implementation of new methods in nanoscience, including analysis of costing of capital equipment and operation of the facility. The clean room design will consider applications not only devoted to science oriented experiments but also compatible with typical industrial requirements and standards.

A rationale for a theory facility will be developed as a component of NFFA and of each NFFA centre. The theory facility will provide access to computation methods (modellization, simulation, energy landscape) and computation resources to users in connection with NFFA proposals. A workshop of theoretical facilities of relevance for nanoscience will be participated and sponsored by NFFA.

T3.2) Design study of nanolithography station within the facility. Electron lithography and focussed ion beam lithographies are at the core of top-down nanofabrication, along with X-ray near field lithography. At present, some equipments of this kind are operated directly by the LSF facilities or by collaborating institutions, which is generally not sufficient for the in-house needs (both in terms of quality and availability) and certainly it is not sufficient for external user operation. NFFA will address an overall balance of user access (as operators or clients) to e-beam, FIB, X-ray lithography labs such to provide the LSF with key instruments for beam shaping devices, such as diffractive optics, zone plates etc., and to provide users with state of the art production of samples and functional systems for their science or technology projects. Analysis of capital investment and operation costs will be done. Intensive use of lithography equipment by staff and qualified users will make it economically viable to upgrade/replace it at the pace of the state of the art. This point will be thoroughly analysed also from the economic point of view. Rotation schemes among the Centres for the ultimate performance equipment will be also analysed such that,

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SUPP = Support activities – applicable only for SAs

say for electron lithography as a pure example, there will be always at least one NFFA Centre at the forefront of technology, in rotation with the other centres. The equipment will be discontinued as it will fall off the NFFA standard that will be periodically upgraded to cope with the new nanoscience needs.

T3.3) Design study of user-oriented material growth facilities for speciality samples (composition grades samples, thickness grades samples, stress grades samples, cross wedges, nanowires, quantum dots, etc.). MBE and CVD, PLD systems for special materials (metal oxides, highTc superconductors) that can either be coupled directly (in situ) with fine analysis spectrometers, or provide samples in optimised environments for synchrotron source, neutron source or FEL experiments. Also for synthesis and growth the complementarity between Centres will be organised in such a way that at least one NFFA Centre will be equipped to support new research directions as they are defined by users needs.

T3.4) Design study of user-oriented metrology facilities, including high resolution analytical microscopy based on electron beams (FEG-TEM, FEG-SEM, LEEM) with elemental analysis by HAADF, EDS, EELS and CHIRALTEM analysis, reflectometry with x-rays, interferometry, scanning probes. Access by users will be regulated according to experience and some remote access will be implemented as already demonstrated in the US over the last ten years. The facilities will be synergic radiation sources. Metrology will be developed both as an internal tool to NFFA for defining and controlling its own standards, and as a service to the users community and also providing access to metrology data and protocols on the NFFA repository.

T3.5) Design study of molecule and nano-particle manipulation lab. A key issue in nanoscience is the precise manipulation of nanostructures both for analysis and use. Very recently, due to the advances of miniaturization, the combination of optical manipulation (laser tweezers -LT) and synchrotron beams has become a powerful tool for several research fields ranging from soft matters to bio and nanomedicine. In fact, the external optical field can be used not only for manipulation, but can serve to bind matter in new organized form, or induce phase transitions. The synchrotron beam can represent the sophisticated probe to obtain new insight on biological samples. Optical tweezers based microscopes, can be combined with synchrotron beam in order to obtain information on isolated and interacting objects such as cells, liposomes, vescicles etc. Another manipulation technique we intend to investigate and test for X-ray beams experiments is based on magnetic tweezers (MT). MT manipulation offers two potential advantages over the OMT: out-of plane rotations and thus torques can be considered and the potential damage to the bio-sample via laser radiation is eliminated. The manipulation is naturally relevant also to inorganic systems, like magnetic material and combined with microfluidic system to further increase the variability of the experiment contents. Such facility will be a unique feature of NFFA.

T3.6) Design study of nano-bio labs for the synthesis of hybrid organic/inorganic, or bio/inorganic systems; development of sample protocols for combinatorial material libraries for scanning probes; synthesis of nanostructured materials with tailored properties like nanowires, nanotubes, dots, 1D, 2D and 3D systems; micro-fluidics; biomimetics interfaces; solid supported membranes, etc.). Diverse routes can be followed to develop nano-bio facilities and will be thoroughly analysed in the Design Study. Certainly a common infrastructure for wet-chemistry and dry-chemistry will be included in all centres as complementary to clean rooms. Sterile rooms will be also evaluated as a function of users needs.

T3.7) Assessment of possible contributions from existing facilities that could be integrated in NFFA-RI Centres if suitable for users operation, or else for “client” servicing within the scopes of

NFFA. For example the use of particularly expensive lithography equipment could be “shared” by NFFA and participating institutions (e.g. the relevant LSF) provided that access is defined in a proper way. Also in the Design Study phase the use of existing participating laboratories or equipment owned by new partners will be exploited to support technical tasks (definition of metrology and standards) as well as possible, limited, pilot user programs aimed at testing user access schemes.

Deliverables (brief description)

- **D3.1)** Design of overall infrastructure of the Nanoscience Foundry, with proper safety rules and adequate technical and scientific NFFA personnel to enforce the high standard. (month 30)
- **D3.2)** Design of a user friendly nanolithography facility. Criteria for upgrades, possibly with a rotation mechanism among the Centres. The overall costs will be minimised by a balanced distribution of equipments among the centres. (month 20)
- **D3.3)** Design of a distributed facility for the growth of nanostrcuctured materials for experiments, including analysis of capital investment and operation costs. Scheme of upgrades.(month 20)
- **D3.4)** Design of a distributed facility for high resolution metrology. (month 20)
- **D3.5)** Design of a distributed facility for optical/electrical/magnetic manipulation of nanostructured samples or microscopic samples combined with LSF experiments with highly focussed radiation from synchrotrons and lasers. (month 20)
- **D3.6)** Design of a distributed facility for the synthesis of nano-bio functional systems. (month 20)
- **D3.7)** Establishing a scheme for technical synergies between NFFA and other institutions interested in exchanging services and sharing costs for equipment and operation. (month 20)

- **M4** NFFA Standard protocols (month 24)

Work package number	4		**Start date or starting event:**				1				
Work package title	Development of management structure and format of user access for NFFA-RI Centres. Design of NFFA Data Repository and access criteria. Intellectual property issues.										
Activity Type[15]	RTD										
Participant id	1	2	3	4	5						
Person-months per beneficiary:	31	10	8	4	9						62

Objectives

Define the mission and the general structure of the future NFFA-RI, including general management of the central RI and of the local facilities, access criteria via quick international review of projects.

Develop schemes for implementing a NFFA-RI repository of data and protocols and to make it available to the general users. Develop schemes for remote use of NFFA-RI.

Set quality standards of production. Define efficient users' access.

Description of work (possibly broken down into tasks), and role of participants

T4.1) Definition of the **mission of NFFA-RI**, developing the initial concepts:

a) To enable rapid advancements in science, engineering and technology at the nano-scale by providing efficient access to nanotechnology infrastructure and to the available fine analysis infrastructures (synchrotrons, high power lasers and FELs, neutron sources) to users from scientific institutions and industry.

b) To provide shared, open, and geographically distributed laboratories, for design, nanofabrication, synthesis, characterization, and resources to build structures, devices, and functional systems with top-down and bottom-up approaches, also to be the final stop for advanced fine analysis experiments at closely located large scale facilities (LSF). To provide an open access data repository on nanoscience.

c) To set standards in the production of well controlled nanostructured systems and the relevant metrology, and to greatly improve the reproducibility and comparison of experimental results in the energy, space and time domain performed with photon and particle beams at the LSFs.

d) To exploit the advantages of proximity to Synchrotrons and/or FELs and/or Neutron sources by making possible advanced experiments in nanoscience on both static and dynamic

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[15] For all FP7 Projects each workpackage must relate to one (and only one) of the following possible Activity Types

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properties and functional behaviour and to optimize instrumentation, methods and metrology for nanoscience.

e) To establish a general scheme for specific access to industry. The aim is not only to determine access route for applicative proposals, but also the correct environmental and laboratories in terms of standard processes, equipment reliability, confidentiality of the research activities that will help to make NFFA attractive for industrial companies. In particular the effort will be devoted to match interest and fast technological transfer to Small and Medium Enterprises.

f**)** To define a standard and the related intellectual property issues for a NFFA-RI repository of data and metadata on nanoscience results and protocols that should guarantee open accessibility, under transparent rules, by the general science community and others. Definition of the restrictions of access to protect publication time and/or other intellectual property issues.

T4.2) Design the governance of a Research Infrastructure operating several Centres, each one strongly connected with local academic, research institutions, and the Large Scale Facilities (LSF). The synergy between NFFA-RI and the LSF will support various schemes of collaboration agreement to mutually benefit the development of the facilities. An ERIC compatible statute of NFFA will be drafted according to the need for a distributed ERIC and taking advantage of the ongoing efforts to shape the first ERICs.

T4.3) Design of a scientific management of NFFA-RI who will formulate the general and specific science plans and who will steer the action with much flexibility in order to serve the users in a particularly fast grooving and diversifying field of multidisciplinary research.

T4.4) Develop a robust **scheme for the access by users to the NFFA-RI Centres and to the NFFA-RI Data Repository**. Multiple modes of work at/with NFFA-RI will be described. Users will have quality of direct operators of the facilities, or of clients of the facilities, or of trainees at the facilities, according to expertise and effective need/possibility. Remote access to some NFFA-RI facilities will also be evaluated and implemented as a possibility. Rules of access to the NFFA-RI Repository. Issues of intellectual property of NFFA products.

T4.5) Assess possible **agreements between NFFA-RI and other existing facilities** for sharing/using instrumentation and services as well as for channelling knowledge. The deliverable will be a scheme for sharing facilities between NFFA-RI and other institutions interested in exchanging services and sharing costs for equipment and operation.

T4.6) Establish and analyse the **financial issues related to the NFFA-RI construction and exploitation**, taking into account the possibilities of different sites and different number of NFFA Centres to be started according with the NFFA roadmap (T2.3). The scenarios will be assessed by using external expertise when necessary, and/or acquiring financial software tools.

T4.7) Assess the **cost analysis of the operation of NFFA-RI and of a prototypical reference Centre located nearby a LSF.** Realistic analysis with candidate Centres will be done also by taking into account the specific cost breakdown. The running costs of NFFA-RI will be compared with those of existing similar Centres. The scenarios will be assessed by using external expertise when necessary, and/or acquiring financial software tools.

T4.8) Define the **quality standard for NFFA-RI products and service**. The definition of standards, using the results of metrology, will provide the reference basis for the plan on how to enforce standards in all NFFA-RI Centres, and how to revise and upgrade standards periodically. Quality control of NFFA must include technical definitions (metrology, reproducibility) laboratory procedures for data and management (time to access, peer review) as well as availability of data in the repository in useful form for remote consulting and for remote users, and for interoperability.

T4.9) Design of NFFA-RI Data Repository. Analysis of current **repositories for scientific data and metadata**, for possible remote data analysis codes, for remote use of NFFA-RI and integration in advanced training at universities or other science institutions. Definition of standards of data and metadata (format, remote access via WEB, remote data analysis, preservation, maintenance and curation of data). Technical aspects and realization of a prototype of NFFA repository. Criteria of interoperability based on open standards.

Deliverables (brief description)

- **D4.1)** Mission statement of NFFA-RI (month 14)
- **D4.2)** Structure of the governance of NFFA-RI, as distributed RI (month 29)
- **D4.3)** Structure of scientific management of NFFA-RI (month 28)
- **D4.4)** Users access scheme. (month 29)
- **D4.5)** Schemes for sharing facilities (month 28)
- **D4.6)** Cost analysis of NFFA-RI and its Centres according with the scientific roadmap (month 30)
- **D4.7)** Operation Cost analysis of NFFA-RI and NFFA-RI Centres (month 30)
- **D4.8)** Definition of standard of quality for NFFA-RI products and services (month 24)
- **D4.9)** Scheme for NFFA-RI Data Repository and its use for scientific, technological and educational purposes (month 30)

- M5 Scheme and rules of Limited Pilot Projects (LPP) (month 28)
- M6 Users' policy and rules (month 29)
- M7 Financial assessment of NFFA-RI(month 30)
- M8 Scheme and rules of Data Repository (month 24)

Work package number	5			**Start date or starting event:**				6			
Work package title	Schemes of future dissemination activities: a) training at NFFA-RI Centres, b) schools and public conferences, c) NFFA book.										
Activity Type[16]	OTHER										
Participant id	1	2	3	4	5						
Person-months per beneficiary:	3	2	3	4	1						13

Objectives

Develop actions aimed at increasing the amount of competences in nanoscience methods. Training of NFFA-RI staff to users access. Scientific and technological training of users involved in NFFA-RI activity. Advanced training for nanoscience and nanotechnology operators and researchers. Dissemination material and writing of the NFFA book.

Non commercial exploitation of results.

Description of work (possibly broken down into tasks), and role of participants

T5.1) Preparation of schemes for **Training Lessons/courses for NFFA-RI staff**, focused on transfer of know-how to potential users, optimisation of access within the NFFA facility, time sharing and use at LSF. Access to the NFFA-RI facility will require a specialized training of the staff researcher. Access of external users to laboratory will be: direct access for running experiments on defined protocols, remote access to specific services (growth, lithographies, microscope, on-site beamlines of LSFs), including direct remote access to 'user-friendly' codes and instruments. This can be done only if permanent or seconded staff is capable, through specialized training to organize and monitor the required service, at any level. This task will develop such objectives and hold a specific workshop.

T5.2) Preparation of schemes for **Training Lessons/courses for potential users**, dedicated to the co-ordinated access to existing facilities within NFFA-RI. The requirements of general users are vast, and sometimes, the requested flexibility may induce a decrease in effective results. Specific training, with a full understanding of a common policy within the scientific/technical activity, will guarantee a fruitful use of the sophisticated tools available at the facilities. Researchers from collaborating institutions will, through both secondment and short term visit/training courses, increase their knowledge in terms of potential use of the NFFA-RI tools. This will take place in the future NFFA-RI operating facility. Schemes for periodic NFFA-RI summer schools and open conferences will be defined in order to reach the widest public and promote the use of the Data Repository.

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[16] For all FP7 Projects each workpackage must relate to one (and only one) of the following possible Activity Types

RTD = Research and technological development including scientific coordination applicable for collaborative projects and NoEs
DEM = Demonstration - applicable for collaborative projects
OTHER = Other activities (including management) applicable for collaborative projects, NoEs, and CSA
MGT = Management of the consortium - applicable for all funding schemes
COORD = Coordination activities – applicable only for CAs
SUPP = Support activities – applicable only for SAs

T 5.3) Writing and distribution of a book about the NFFA concept and its roadmap of development in the relevant fields of nanoscience. Publication and distribution of the book.

Deliverables (brief description)

- **D5.1)** Scheme for Training lessons for NFFA-RI staff (month 20)
- **D5.2)** Scheme for Training lessons and scheme for users. (month 24)
- **D5.3)** Book (month 32)

B1.3.6 Efforts for the full duration of the project

Project Effort Form 1 - Indicative efforts per beneficiary per WP

Workpackage[17]	WP1	WP2	WP3	WP4	WP5	TOTAL per Beneficiary
Beneficiary 1 CNR-IOM	16	7	28	31	3	**85**
Beneficiary 2 STFC	2	11	8	10	2	**33**
Beneficiary 3 CSIC-CNM	2	7	12	8	3	**32**
Beneficiary 4 PSI	1	5	10	4	4	**24**
Beneficiary 5 OEAW	1	4	25	9	1	**40**
TOTAL	**22**	**34**	**83**	**62**	**13**	**214**

[17] Please indicate in the table the number of person months over the whole duration for the planned work , for each work package by each beneficiary

Project Effort Form 2 - indicative efforts per activity type per beneficiary

Activity Type	Beneficiary 1 CNR-IOM	Beneficiary 2 STFC	Beneficiary 3 CSIC-CNM	Beneficiary 4 PSI	Beneficiary 5 OEAW	TOTAL ACTIVITIES
RTD/Innovation activities						
WP2 Analysis of users and science program, development of NFFA roadmap	7	11	7	5	4	34
WP3 Design Study of NFFA-RI Centres, technical layout of instrumentation and tools	28	8	12	10	25	83
WP4 Development of management structure and format of user access for NFFA-RI Centres. Design of NFFA Data Repository and, access criteria. Intellectual property issues.	31	10	8	4	9	62
Total 'research'	**66**	**29**	**27**	**19**	**38**	**179**
Consortium management activities	CNR-IOM	STFC	CSIC-CNM	PSI	OEAW	TOTAL ACTIVITIES
WP1 Management of NFFA Design Study	16	2	2	1	1	22
Total 'management'	**16**	**2**	**2**	**1**	**1**	**22**
Other activities	CNR-IOM	STFC	CSIC-CNM	PSI	OEAW	TOTAL
WP5 Schemes of future disseminating activities: a) training at NFFA-RI Centres, b) schools and public conferences, c) NFFA book.	3	2	3	4	1	13
Total 'other'	**3**	**2**	**3**	**4**	**1**	**13**
TOTAL BENEFICIARIES	**85**	**33**	**32**	**24**	**40**	**214**

B1.3.7 List of milestones and planning of reviews

List and schedule of milestones					
Milestone no.	**Milestone name**	**WPs no's.**	**Lead beneficiary**	**Delivery date from Annex I** [18]	***Comments***
M1	Public web site	WP1	1	4	Check running flawlessly on website
M2	NFFA roadmap	WP2	2	4	Workshop presentation to ESFRI
M3	Users database	WP2	2	6	External validation
M4	NFFA Standard protocols	WP3	4	24	Workshop, Pilot experiments
M8	Scheme and rules of Data Repository	WP4	1	24	Advisory Board validation
M5	Scheme and rules of LPP	WP4	1	28	Advisory Board validation
M6	Users policy and rules	WP4	1	29	Advisory Board validation + External validation
M7	Financial assessment of NFFA-RI	WP4	1	30	Advisory Board validation or other validation

18 Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

Planned reviews

Tentative schedule of project reviews			
Review no.	**Tentative timing, i.e. after month X = end of a reporting period** [19]	***planned venue of review***	***Comments , if any***
1	After project month: 12	**Brussels**	

[19] Month after which the review will take place. Month 1 marking the start date of the project, and all dates being relative to this start date.

B2. Implementation

B2.1 Management structure and procedures

The NFFA-Design Study involves 5 European legal entities at its submission stage, and is organised in four technical work packages plus one management work package. The number of partner institutions is expected to increase as the awareness of NFFA and a specific call will be done as a task of management.

The management structure is very simple and flexible as needed for a Design Study.

The Work Package leaders and/or one representative per each participant institution/country will form the Co-ordination Board that is the executive body of NFFA and will deliver the design study.
The need of maximum openness and reach of all possible stakeholders of NFFA is addressed by the Forum that will operate with open workshops, but also with a continuous interface via the NFFA portal (web operated) that will collect inputs from the whole scientific community and make public the continuous update of the progress of the work packages.
The Co-ordination Board will seek independent advice on technical (mostly legal) aspects connected to the feasibility of NFFA by nominating an advisory board, as a consulting/advisory body.

The **Co-ordination Board** consists of one delegate per partner and is chaired by Giorgio Rossi. It is the final decision making body. A partner is an institution which commits resources to the design study, i.e. the institutions signing the proposal as well as any other institutions joining in the first year of execution of the Design Study. The board names the coordinator, the work package co-ordinators, evaluates and accepts new partner institutions, and appoints the advisory committee. The board receives advice by the Forum. The board is the executive body of the design study.

The Co-ordination Board:

- It decides major changes in the implementation plan including e.g. the re-distribution of the budget.
- It can delegate specific responsibilities to the Project Co-ordinator.
- It nominates the members of the **Scientific Panel**
- It decides the schedule of meetings and communicates it along with the program to all participants and stakeholders.

The **Forum** is an open discussion forum about the work packages, the ongoing work and the outcome that includes all the stakeholders, observers and external contributors.

The **Scientific Panel** will be made of representative users from European laboratories, representative officers from the relevant international nanoscience lab systems (US, Canada, Japan,…), and at least one representative of industry who will contribute and monitor the quality of NFFA as a useful facility also from the industrial point of view.

The **Advisory Committee** consists of five external experts in following fields: legal aspects, finances, management, science, industrial access, start-up enterprises connected to NFFA, intellectual property issues. Travel and living expenses of the experts will be fully covered by NFFA budget.

The Project Co-ordinator

The project Co-ordinator is responsible for the timely collection and preparation of reports and the transmission to the European Commission, and to ensure prompt delivery of all deliverables identified in the Contract or requested by the European Commission for reviews and audits, including the results of the financial audits prepared by independent auditors.

WP leaders and task leaders

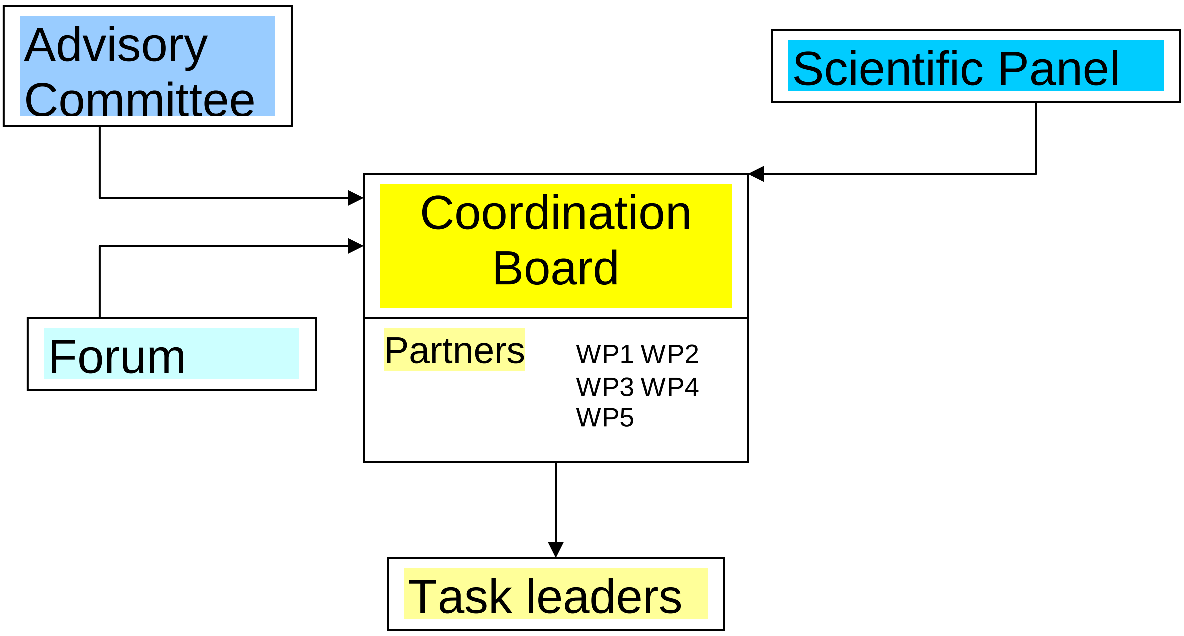
- They are responsible for the organisation of the activities within the work package and task.
- Together with the participating groups they decide all the technical matters concerning the specific design study.
- They are responsible for the timely submission of milestones and deliverables to the co-ordinator and they monitor the progress of the technical work. They are also responsible for the communication between the groups involved in the activity and organise special discussion meetings on technical subjects as required.

Additional Partner's policy.

The admission of members to the Board will be handled in a very open and non restrictive way. Up to now we did not publicise such a possible membership on a larger scale due to the fact that people have been absorbed to a large extent by setting up the proposal for the design study, nevertheless we have already diffused some information.
Expressions of interest in NFFA have been obtained from representative institutions in other European countries who have preliminarily agreed to join in NFFA after the start of the Design Study. It was not the proponent's aim to have all the partners joining in from the proposal stage, for practical reasons. All informal contacts have been positive about the sound motivations and great opportunities of NFFA. After start of the contract we will actively seek to make formal the involvement of more partner institutions in the activities of the Design Study, as this is very useful for performing a full feasibility study at European scale of NFFA.
Late entrance of new partners will be accepted by the Co-ordination Board, based on a unanimous understanding of the relevance for NFFA of the new association. The involvement of new partners will not affect the number of signatories of the contract.
A veto to the association of a new party can be issued by one or more of the members of the Co-ordination Board if a substantial threat of conflict of strategic institutional interest is likely to exist which cannot be resolved by any other measure.

In the early stage of the project, a Consortium Agreement will be signed among participants, if needed, with rules mainly addressing future's admission, patent regulation and intellectual property rights.

NFFA Management structure



B2.2 Beneficiaries

Beneficiary 1 - Coordinator
CNR-IOM
IOM (Institute for Materials Manufacturing) is an institute of the National Research Council (CNR), the main Italian public research organisation. It promotes, coordinates and carries out fundamental and applied research activities in the field of physics of matter, through a wide network of research centres based at Italian Universities and at large international research laboratories.
The strong participation in the EU RTD initiatives, together with the involvement in the activities of other international organisations (ESF, EUPRO, EPS, EARMA, VAMAS, HFSP) has enabled the Institute to achieve a considerable level of Europeanization as regards the management methods chosen, the available resources, and the experimentation of advanced methodology of evaluation and assessment. IOM possesses adequate skills and capability in workshops and meetings organisation, in the management of technology transfer of advanced academic know-how to the industrial environment, in the training of young researchers, in the diffusion of scientific culture and results to the wide public. The Institute has also long experience in the co-ordination of activities at international facilities (namely synchrotrons and neutron sources, such as ESRF and ILL), in the promotion and support of the Italian community access, and in the development of advanced instrumentation for neutron and X-ray scattering. CNR-IOM has a network of Centres for Research and Developments in partnership with several Italian universities. It is a part of the Department of Materials and Devices

(DMD) of the Consiglio Nazionale delle Ricerche (CNR) of Italy, i.e. a public research institute monitored by the Italian ministry of research and university.
TASC (http://www.tasc-infm.it/), former National Laboratory of CNR-INFM, is now the headquarters of CNR-IOM with a mission of providing advanced instrumentation and methods for supporting experimental projects in nanoscience and material science for the Italian community of physics of matter. IOM operates laboratories and beamlines at Trieste and Grenoble. Over 150 scientists work at IOM.

Beneficiary 2

Science and Technology Facilities Council (STFC) , UK

The Science and Technology Facilities Council (STFC) is the UK largest public research organisation. It operates world-class, large scale research facilities, including synchrotron radiation source, neutron scattering source, high power laser sources and high performance computing systems, and a broad range of scientific and technical expertise in space and ground-based astronomy technologies, microelectronics, wafer scale manufacturing, particle and nuclear physics, alternative energy production, radio communications and radar. It has over 2200 staff members and an annual operating budget in excess of €800M.

The **Division** that participates to the NFFA consortium is the Central Microstructure Facility (CMF) within the Technology Department of STFC. CMF was established in 1979 and has been an open facility ever since, to provide microfabrication and nanofabrication and nanometrology support to the large scale facilities within the organisation, as well as UK academic and industry users. It has equipments and expertise in a wide range of fields, including micro and nanofabrication, nanoscale characterization technologies, and has played a vital role in the UK to promote and support UK nanoscience and nanotechnology development. It has been named as one of the technology nodes in the UK micro- and nano-technology (MNT) network. The key expertise at CMF includes electron
beam nanolithography, optical lithography, X-ray LIGA technology, deep structure patterning and transfer technology and nanoimprinting technology. In the last 20 years, CMF participated a number of European projects, both as partners and as co-ordinators. Currently CMF operates over 20 research projects, all of them involving external academic or industrial partners.
Because CMF is part of the STFC and closely attached to the large scale facilities (LSFs) within STFC, it naturally serves as a centre for the users of LSFs for their needs in nanostructuring and sample preparation. CMF has already conducted a number of research projects with the synchrotron radiation source to make novel X-ray focusing lenses, with the high power lasers to make laser targets and with the neutron scattering source to make large area magnetic samples. In addition, CMF has formal contact with the Centre for Nanoscale Materials attached to the Argonne National Laboratory in US, to collaborate on development of nanoscience facility. Our experience in working with the LSFs will be highly valuable to the NFFA project. We believe such experience and practice can be extended to European wide, so that a wide scientific community in nanoscience research can benefit from the Nanoscience foundry clusters within Europe.

Beneficiary 3

CNM (National Centre of Microelectronics), CSIC-[BNC (Barcelona Nano Cluster), CSIC and UAB]

BNC-b (Barcelona Nanocluster- Bellaterra), is a virtual entity clustering the capabilities and expertises of two research centres fully owned by Agencia Estatal CSIC[20], **CNM** (National Centre of Microelectronics, Bellaterra-Barcelona) and **ICMAB** (Institute of Materials, Bellaterra-Barcelona), a new joined CSIC and ICN (Catalonian Institute of Nanotechnology-Foundation) centre, **CIN2** (Centre for Research in Nanoscience and Nanotechnology, Bellaterra-Barcelona), and several Groups and Laboratories belonging to **UAB** (Autonomous University of Barcelona, Bellaterra-Barcelona). BNC-b gathers a human potential of 400 researchers with a broad set of skills and competences in materials, characterization, process technologies and device&systems design and manufacture, both in micro and nano fields. Together with a micro and nanofabrication facility, housed in a 1.500 m_2 Clean Room, all these resources are located at the UAB campus (within a 300 meters radius circle), 2 kms from the LSF SR-"Alba".
BNC manages the different capabilities of these centres, dealing with programmes and projects in nanoscience and nanotechnology, co-ordinating capabilities and efforts under a synergetic approach from a scientific and technological perspective, though each centre has its own organization, access and administrative policies. Three out of four centres belongs to CSIC, the parent organization, while the last is the UAB. This is the reason why we propose that, from the administrative viewpoint, **CSIC will be the partner** (and **CNM will be the technical representative**, being CNM the organization focal point of BNC) and UAB will be subcontracted, to maintain the strength of the whole BNC-b in the same partnership.

CNM and ICMAB have a large experience dealing with FP projects and international relations as well as organising studies, projects, meetings and workshops. Together with the rest of the BNC members, they have a broad knowledge and expertise to assess micro and nanotechnologies, technological approaches and characterization methods for different fields. As an example, currently CNM's technological facility is fabricating optical nanodevices for the SR-"Alba" project.

Both top-down and bottom-up approaches are available within BNC, based on e beam, nanoimprint, dry etching, ion implantation, ALD, crystal growth, PVD and CVD processes, functionalization, etc…, together with MEMS / NEMS design and fabrication processes. Integration of all of them under a flexible scheme gives a non usual and non negligible added value to these capabilities. Characterization of micro and nano devices and materials through SEM, TEM, X-Ray, Raman, etc…, is also available.

The combined expertise provides the whole BNC a singular position concerning the evaluation and assessment of technological issues. Methodology and management may also be addressed, based on CNM's Clean Room experience as European LSF (years 2000 to 2003) and Spanish LSF (since 2004). Both activities imply a broad interactive and collaborative tasks and duties related with a large number of external Laboratories and Centres.

Beneficiary 4

[20] The Consejo Superior de Investigaciones Cientificas became Agencia Estatal Consejo Superior de Investigaciones Cientificas (CSIC) on December 21, 2007 by Royal Decree n.1730/2007.

Paul Scherrer Institut (PSI), Laboratory for Micro- and Nanotechnology (LMN)

PSI is a national laboratory in Switzerland belonging to the Board of Swiss Federal Institutes of Technology. With about 1200 employees PSI is one of the largest research institutions in Switzerland, mainly active in materials science, energy research and the building and operation of large scale facilities for science. In this context PSI operates a modern synchrotron light source and a spallation-based neutron source, both installations mainly being used for materials science through a large number of external and internal users.
Starting 1993 PSI started building up the Laboratory for Micro- and Nanotechnology (LMN) with the goal to do high level scientific research based mainly on the technological capabilities of advanced nanofabrication methods.
The main research activities of LMN are: X-ray optics and X-ray lithography; investigations of nanomagnetic structures; molecular nanotechnology on surfaces; optical investigations of semiconducting nanomaterials (mainly Si-Ge); nanofabrication technologies in polymers; high current field emitter technology for applications in advanced FELs. Details can be found at http://lmn.web.psi.ch . About 60 peer review papers and more than 150 conference contributions are produced annually by LMN.
350m2 of clean room laboratories are operated by LMN equipped with all kinds of nanofabrication equipment. This includes: electron-beam lithography, optical and soft X-ray lithography, five different dry etching machines for pattern transfer, thin film deposition equipment (evaporation, sputtering, LPCVD, PECVD), Si-oxidation and more. This lab is also available to external users.

Link to the goals of this proposal

Already now LMN is heavily engaged in the micro- and nanofabrication of samples to be investigated by synchrotron radiation or by neutrons. In parallel, LMN is working on micro-devices to improve the large facilities such as e.g. X-ray optical devices or detectors and beam monitors. Thus, LMN can bring in valuable experience for this planned project. If this proposal will be funded, LMN can further increase and reinforce its activities in this important field. Some achieved highlights in this context include: 1. World record for resolution (12 nm lines/spaces) in photon based lithography using coherent soft X-rays from our synchrotron. 2. Diffractive optical elements (gratings/zone plates) for high resolution (sub 100nm), synchrotron based hard X-ray tomography.
3. Electron-beam lithography for fabrication of ferromagnetic nanostructures for synchrotron/PEEM experiments. 4. Diffraction gratings for interferometers for phase-contrast neutron radiography.

Beneficiary 5

Institute of Biophysics and Nanosystems Research - Austrian Academy of Sciences

The **Austrian Academy of Sciences** (Österreichische Akademie der Wissenschaften, **OEAW**) is the largest public non university academic research organization in Austria in order to conduct an extensive research program ranging from social till natural sciences. More than 1100 employees are working currently at the Austrian Academy of Sciences.
The **Institute of Biophysics and Nanosystems Research (IBN)** (http://www.ibn.oeaw.ac.at) is a research institute of the Austrian Academy of Sciences with more than 30 employees located in Graz (Austria). The research is focused mainly on Biophysics and structural investigations on biological/nano-materials targeted on new antibiotics and drug delivery systems. The institute is embedded in the LSF, as since 1992 it has constructed and operates the Austrian Small Angle Scattering beamline in collaboration with Sincrotrone Trieste at

ELETTRA. Due to the operation of the beamline the institute has established a permanent outstation located directly at the synchrotron radiation facility ELETTRA, which supports with its laboratory facility (wet chemical laboratory, laboratory SAXS instrument etc.) the user operation of its own beamline and partly also of other beamlines ELETTRA. The research field of the outstation is directed to fast structural phenomena in bulk and on surfaces with applications from biophysics to nanomaterials. In particular the institute has profound experience in biomimetic coatings - i.e. for bacterial and eukaryotic membrane mimicking coatings- antibacterial peptides as well as mesoporous materials in bulk and thin films. The beamline produces annually about 60 contributions in peer reviewed journals.
The outstation has ongoing collaborations with the CNR-IOM (formerly TASC-INFM) group in the field of microfluidics, sample manipulation by means of light tweezers. More specifically the IBN will enforce the NFFA consortium with its expertise in the field of nanostructured/biomimetic coatings and on microfluidic sample environments for synchrotron experiments.

B2.3 Consortium as a whole

The goal of the Design Study is quite ambitious since it addresses a new kind of Research Infrastructure (RI) that interfaces with a wide and diversely organised scientific community whose activities are simultaneously at the forefront of basic science and of technological exploration. The new Research infrastructure implies a novel symbiosis with the existing European Large Scale Facilities infrastructures which are already operational or under development, such as the Free Electron Lasers and the Power Lasers, and which are up to now mostly exploited only for fundamental researches and experiments.

The methods of nanoscience, both in the nanofabrication and characterization, are highly costintensive in terms of equipments and instrumentation. The state-of-the-art nanoscience research requires a full top-down platform (lithographies and ion or plasma etchings) with nano-metrolgy and atomic resolution microprobes, as well as a continuous improvement in the bottom-up methods and the combinations of both.

A strong technical competence in nanofabrication and a strong vision of nanoscience are required for the NFFA to be as a much flexible RI capable to serve European science for many years to come at the highest level and with overall competitive costs.

The technical and organization challenges require scientists and laboratory managers with great experience and visibility, in the fields of nanoscience as defined in physics, chemistry, biophysics, biochemistry, biomedicine, materials science and in the technical fields of nanolithography, nanofabrication, diagnostics with nanometric and atomic resolution, synchrotron radiation spectroscopies, laser, free electron laser methods, and neutron scattering.

NFFA will bring together such specialists with LSF users' laboratory managers in order to develop and specialise the scope of the Research Infrastructure, and the technical aspects that will define its standards, the operation scheme.

The NFFA Consortium in its present form is an excellent starting nucleus with a good balance of scientific and technical competences in nanoscience, nanofabrication and use of LSFs, and direct experience in operating established users facilities at national level, and a partial but significant coverage of European science communities.

Strong competence in clean room techniques, high resolution lithography, nanofabrication, physical growth methods, atomic resolution probes, X-ray probes, nanofabrication of X-ray and neutron instrumentation, fine analysis methods with synchrotron radiation, are available in the proposal Consortium. This warrants an adequate leadership of all technical tasks, and a complete linkage with the relevant European institutions and LSFs, to be capable of quickly representing the full European dimension of the Design Study.

Several partners are already interacting as collaborating institutions or as branches of the same institution, with national synchrotron radiation centres. On the other hand, one of the partners, the Austrian Academy of Sciences, represents a scientific community that does not have a national LSF for fine analysis. They can be an excellent example showing how the NFFA study is to provide European researchers with an all-new concept of RI that will allow them to interface and to access in a new, optimised way, to the European LSFs so as to enhance their impact on nanoscience.

Most Consortium members have already had good personal and institutional knowledge of each other and have been collaborating on specific projects, in international review panels of some of the participating labs. Each of the partner laboratories already has a significant presence in the domain of nanoscience, and has in various extents been involved in many other collaborations at national, EC and international level. The Consortium members also operate research contracts with industry.
The Consortium will be capable to expand in the first year of Design Study to link, or possibly include, all the relevant actors for the NFFA project.
The linking together of NFFA Consortium institutions will produce also a high level, interdisciplinary training environment to serve as a prototype of the future developments.

i) Sub-contracting: Within the activity of Partner 3 (CNM-CSIC) a subcontract with UAB (49.000 €) is foreseen, due to the clustering and integration of 3 CSIC nanotechnology-oriented centres and several laboratories of the UAB. The Centro Nacional de Microelectronica (CNM), the Instituto de Ciencias de Materiales de Barcelona (ICMAB) and the Centro de Investigación en Nanociencia y Nanotecnologia (CIN2), all of them belonging to CSIC and represented by CNM in view of this project, are three out of the four actors within the the BNC (Barcelona NanoCluster), a virtual entity, gathering capabilities of the main partners located in the UAB campus. The fourth actor is the University itself, which, as it has been said, will be subcontracted by CNM. Synergy between the four BNC partners is strong, and part of the CNM-CSIC activity related to WP3 will be developed by ICMAB, CIN2 and UAB through the subcontract.
Within the activity of Partner 1 (CNR-IOM), concerning WP4, T4.9, a subcontract with CINECA (Consorzio Interuniversitario) is foreseen for the layout of the digital repository, including the schemes of preservation, maintenance and curation of data in agreement with the users community. Subcontracting is the best choice due to the lack of direct competences within the NFFA-Design Study partners (45.000 €). For the same reason, the design and production of the NFFA web site (WP1) (10.000€) and the layout, editing and production of the NFFA book (WP5) (25.000€) will also be subcontracted to professional providers. Should the Consortium decide to organize three local conferences abroad instead of one general in Trieste for the publicizing to industry, Partner 1 will need to subcontract services such as catering, renting of conference room and other minor services to professionals abroad, with consequent shifting of the financial allocation (30.000 €) from "other direct costs" to "subcontracting" in WP1. The AUDIT will also be subcontracted (WP1) (4.000 €).

ii) Additional partners and observers: More partners are actually expected to join in after the submission of NFFA, based on expressions of interest. They could not be involved at the proposal writing stage mostly because of time constrains and the need to establish national consortia or other agreements. One general criterion of acceptance or invitation of new partners will be their representing complementary technical competences within the NFFA scope, and representing new national communities or specific science communities, or industrial development activities, not yet present in the NFFA Consortium. Observers will be expected to continuously contribute through the Forum and at the workshops. They represent a link to funding agencies that do not participate to the Design Study, but that are potential stake-holders of NFFA.

B2.4 Resources to be committed

A total of 214 PM will be invested in this Design Study of NFFA corresponding to roughly 525% of total EC contribution. The distribution of work among the partners is summarised in table 1.3d. The main foreseen expenditures of the project are:

1. communication between the beneficiaries, technical work sessions (Co-ordination board meetings 5/year max 7 people x 2 years 30K€, Scientific Panel meetings 3 x 5 members, 20K€)
2. Publicizing to industry: information meetings for the industry (one general vs. 2-3 local). Other communication tools, documentation, 30K€
3. site visits to evaluate the potential LSF partners of NFFA Centres (within Europe) 30K€ (10 potential European sites, 2-3 NFFA officers per visit)
4. site visits to existing foundries overseas: mainly US DOE Centres (one tour by 2/3 people) and Japan (one tour by 2/3 people) 15K€
5. Subcontracting will be limited to very specific technical tasks: partnership with UAB (49.000€); external auditors for validation purposes (4.000€); design and construction of the NFFA Data Repository (45.000€) and of the web site (10.000€), layout and publication of NFFA book (25.000€). The total amount of subcontracting will be 133K€ i.e. 5,8% of total costs. Should the Consortium decide to organize three local conferences abroad instead of one general in Trieste for the publicizing to industry, the subcontracting would increase consequently to 163K€ corresponding to 7,1% of total costs.
6. Some provisions are made for late association of new partners: WP3 includes reimbursement costs for travel and accommodation for new partners. (40.000 €). The new entries will not increase the number of the signatories of the contract.
7. Creation of the NFFA Industrial Liaison Office, database of users, meetings (15.000 €).
8. RTD activity in WP2, WP3, and WP4, for a total of 283.800 € (except subcontracting, personnel and indirect costs). This includes prototyping, technical design, access to state of the art facilities for testing. i.e., 12,5% of total cost of NFFA.

According to the rules described at page 38 of the guide of applicants - design study CP method, co-ordination and management costs specific to research and technological developments have been labelled as RTD actions.
RTD actions correspond to the 82.5 % of the total cost, in line with the main action of the project (CP). Accordingly, research effort (person/month) in RTD WPs will have a major role in NFFA.

The request contribution from EU is 1.800.000 € in total.

The bulk of the resources committed by the present proposal are for support of personnel and for technical work in the definition of the various aspects of the NFFA infrastructure. Resources from WP1-5 also include internal and open public workshops. As a general scheme the NFFA work meetings include also scientific sessions open to the public. Much of the technical work, in particular in connection with the definition of the NFFA standard, will actually rely on external resources provided by the participants in terms of use of specialised equipment, testing of clean-room configurations etc. These activities are expected to be substantial and could not be directly covered by the Design Study FP-VII budget. The existence of nanoscience installations and instrumentation at the partner's locations is a great additional benefit for NFFA. The detailed costs connected to this access are hard to evaluate at this point, as all partners do have different accounting schemes, but it will very substantially increase the value of NFFA if all the "full cost" analysis of the effort by participating partners would be detailed. This economic analysis will certainly be done as NFFA will progresses, and will be a part of the final feasibility assessment.

With this relevant external support the overall goals of the NFFA Design Study are well reachable with the requested budget to FP-VII.
No large capital equipment orders (> 100 k Euro) are foreseen in NFFA at the Design Study level. In fact the access to instrumentation owned and/or operated by the Partners is the technical and economical asset on which the action of feasibility and standardization of methodologies is based.

B3. Impact

B3.1 Strategic impact

The concept of a cluster of nanoscience facilities attached to LSFs, which aims at raising the standards of nanoscience experiments and offering access to state-of-the-art synthesis and nanofabrication to a wide research user's community, has been included in the 2006 ESFRI roadmap by one of the specific Emerging Proposals named NANOSCIENCE. Thus, the NFFA proposal fully enters in the structuring project for the ERA, with the support of the EC under FP7.

The European potential users of NFFA belong to diverse areas: materials science, physics, chemistry, life-sciences, various branches of engineering, bio-medical application, etc., and come from academia, national research institutions, and industry. Currently there are no open facilities for supporting full nanoscience projects involving design and nanofabrication of samples and functional systems. The research is done via collaborations between different institutions, with a generally low pace when complex processes are involved at far away institutions (like growth, lithography, electrical characterization, protection of samples, acquisition of beam time at a LSF).
For this reasons, a strategic plan for a scaled implementation of Centres and their locations in Europe both in close connection and synergy with specific LSFs is needed at European level. This action will provide effective services also to nanoscience users from Countries that do not host LSFs.

The NFFA activity will directly impact on European nanoscience by monitoring the effective response to users needs, both qualitative and quantitative, contributing to the development of a RI science policy.

The often rather expensive equipment for nanofabrication will be optimised and used much more efficiently in NFFA user Centres than conventional operating mode, allowing also for a faster update. E-beam lithography machines or TEMs, as examples, are multi-million Euro instruments with a 5-6 year life at the edge of technology. Intensive use at NFFA Centres will make overall financially possible to stay at the state-of-the-art by replacing and upgrading even the top equipment. This is hardly affordable by typical nanoscience national laboratories in Europe, and simply not available to most of the academic research groups, or to entire national research communities within Europe.
Routine technical cross checking of the nanofabrication and nanoprobing capabilities of the NFFA Centres will provide the metrology for establishing a NFFA standard that should result in great benefits for European research in nanoscience.

Just one example of research that will take advantage of the NFFA paradigm is the wide effort in the study, design, fabrication and experimentation in vitro and in vivo of nanostructured devices and micro systems of biomedical interest for in *situ* release of drugs (e.g., oncological cures, pharmacological treatment of tumours). The world-wide research is aiming to the development of smart systems that allow to drive in time and space the release of drugs inside the human body by means of an in-out interactive communication, leading to an in *situ* controlled drug release. NFFA Centres would be excellent faculties for the materials synthesis and nanofabrication stages of this research, and for designing and performing innovative experiments using diagnostics of the LSF sources.

Integration. Researchers joining the project will be part of a truly European cluster, with co-ordinated science planning and with geographically distributed Centres sharing common facilities as well as specialised methods and tools. This implies that NFFA researchers will be certainly mobile within the NFFA Centres, as a key feature of NFFA, which will be able to enforce effectively the uniformity of quality standard.

The NFFA researchers will be exposed to a high flux of international users bringing in their advanced research projects (selected by international review) and the related challenges that will often push forward the state-of-the-art of nanoscience, and the standard of NFFA. The NFFA researchers will be in close contact with the scientific and technical staff, as well as with the users groups operating at the neighbouring LSF, making the overall environment extremely rich and multidisciplinary. Mutual benefits of seminal and conference activities at the NFFA and LSF are easily foreseen. The NFFA researchers and associated personnel will also carry out in-house research programs with full access to the advanced facilities, i.e. in a unique environment for Europe. We expect NFFA researchers to be, after a 3-5 year working term, extremely qualified to contribute at the highest level to industrial research and development, or to start own activities, perhaps with NFFA spin-off or start-up schemes to be analysed at a later stage of structuring of NFFA.

Users' serving or coaching as well as teaching and training in nanoscience will also be an opportunity for NFFA researchers to develop communication skills that will develop their attitudes to co-ordinate research in nanoscience and in general, helping the formation of a much needed technically and scientifically aware European leadership.

We believe that NFFA will increase the level of cultural uniformity in research at the highest level, so **it will favour integration in its broad sense**. We also believe that the project itself will take advantage from the melting of different points of view and cultural roots.

Finalizing dispersed high quality research. European research in nanosciences has strength and weaknesses typical of the large number of good level scientists, but the relatively small number of "critical mass" groups and centres capable to fully support the exploitation of new ideas and the reproducibility of results such to help in quickly translating into nanotechnology the nanoscience findings that bear that potentiality. NFFA can fill in part this lack of infrastructures by making a top-quality one open to the users. Active groups will be supported and best projects by sub-critical groups may become joint projects involving some in-house effort. All these effects should be greatly beneficial to European science and to integration of research efforts.

A cultural community of European scientists exists already: the NFFA project will strongly contribute in optimizing their activity in the very important field of nanoscience and nanotechnology.

B3.2 Plan for the use and dissemination of foreground

In the Design Study of NFFA we will address the dissemination of nanoscience culture, by making fully public all technical and methodological advances of NFFA Centres, and, of course by making available in proper way the results of in-house and users' research. In the end all results will be open for exploitation by the entire scientific community, but users' intellectual right policies will be studied and enforced, with special attention to industrial users, similar to the normal practice at the LSFs.

Regular workshops and conferences, publications in international scientific and technical journals will be the standard dissemination tools as well as an interactive web-site with specific chapters for all Centres and update of performances supported by explicit methodology.

Possible web repository of data (NFFA data-bank) will be openly accessible concerning completed/published work, while work in progress will be password protected. The key elements of dissemination of results and know-how within project, out of workshops and training lessons, will be the users work at NFFA, the exchange of personnel and joint work at the infrastructures, the output of highly trained researchers towards industry, academia and other research institutions.

As mentioned in section 2.1, a consortium agreement will be discussed in case of specific policy for patents policy.

B4. Ethical issues

No ethical issues arise from this proposal

B5. Gender aspects

The gender unbalance which is typical of hard sciences will be corrected wherever possible at two levels: responsibilities will be shared on pure merit, which brings naturally some reduction of unbalance, and hiring of younger scientists will be done after extensive interviews. The Design Study project does require some preliminary personal experience, so we will hire, at this stage, from a highly unbalanced "market".

Reference to the results of the ETAN report (http://cordis.europa.eu/improving/women/documents.htm) of FP5 and of the SSA "Strengthening the Role of Woman Scientists in Nano-Science" (http://www.womeninnano.de/) started under FP6, will be made with the aim of finding adequate measures for enlarging the women scientist group working in nanoscience and effectively supporting their career development and leadership. Measures will be studied to avoid the "scissors trend" that increases the gender unbalance as career progresses. Being a geographically distributed cluster of Centres the mobility for women among the Centres will be particularly favoured when this will be relevant or desirable for women scientists and technical operators.
If NFFA will develop later in a RI the more extensive hiring should, on the other hand, be done interviewing perspective researchers at the doctor student level, before further steps of unbalance are established (i.e. at the Postdoctoral level).
NFFA Centres will be advertised as multidisciplinary environments of advanced research where brilliant people with diverse scientific background will have equal opportunity to establish leadership. In this sense the gender unbalance that is very severe in physics may be partially mitigated by the enrollment of chemists and biologists whom are needed for the NFFA science.
As a reference starting point two Parter Institutions (1,2) have 20% women scientists.

APPENDIX 1 Observers

The role of observer is that of a collaborating group whose institution is not directly committed to NFFA Design Study at present, but is interested in the development of NFFA-RI and a potential partner of the construction phase.

OBSERVER 1. **IEF Institut d’Electronique Fondamentale**

IEF is a joint research unit between CNRS and Universite Paris Sud (Orsay, France). It is comprised of about 230 persons, including 35 full-time researchers from CNRS, 58 professors and assistant-professors, 40 technicians and engineers, 95 PhDs, post-docs and other persons with non-permanent positions. The main activities of IEF include: nanomagnetism and spintronics, Si based- nanoelectronics, III-V and Si - based nanophotonics, microsystems, autonomous and complex systems. Most of these activities are supported by the nanotechnology centre IEF-Minerve which is recognized as one of the 6 centres of the French "Basic Technology Research" (BTR) network.