SEVENTH FRAMEWORK PROGRAMME
THE PEOPLE PROGRAMME

Grant agreement for: **Initial Training Networks**

Annex I - "Description of Work"

Project acronym : CATHI

Project full title : Cryogenics, Accelerators and Targets at HIE-ISOLDE

Grant agreement no. : 264330

Start date: 1 November 2010

Date of approval of Annex I by Research Executive Agency: 21 July 2010

PART A:
A 1 List of beneficiaries and project summary

A.1.1 List of Beneficiaries

Beneficiary Number	**Beneficiary name**	**Beneficiary short name**	**Country**	**Date enter project**	**Date exit project**
1(Coordinator)	European Organization for Nuclear Research	CERN	CH	Month 1	Month 48

List of Associated Partners

Associated partner Number	**Associated Partner name**	**Associated Partner short name**	**Country**	**Role in the project (*)**	**Organisation Status (**)**
1	CINEL Scientific Instruments S.r.l.	CINEL	IT	Secondment	Private
2	CNRS/IN2P3- Université Paris Sud	IPN-Orsay	FR	Research and Secondment	Public
3	CNRS/IN2P3- Ensicaen, Université	LPC-Caen	FR	Research and Secondment	Public
4	Cockcroft Institute	CI	UK	Research and Scientific Training	Public
5	CEA/CNRS/IN2P3	GANIL	FR	Research and Secondment	Public
6	Istituto Nazionale di Fisica Nucleare	INFN-LNL	IT	Research and Secondment	Public
7	Max Planck Institute for Nuclear Physics	MPIK	DE	Research and Scientific Training	Public
8	National Superconducting Cyclotron Laboratory at	NSCL-MSU	US	Research and Secondment	Public

	Michigan State University				
9	Scientific Magnetics	SM	UK	Research and Secondment	Private
10	SDMS Technologies	SDMS	FR	Secondment	Private
11	SIDeA S.r.l.	SIDeA	IT	Secondment	Private
12	University of Jyvaskyla – Institute of Physics	JYFI	FIN	Research and Scientific Training	Public
13	Ettore Zanon S.p.a.	ZANON	IT	Secondment	Private

A.1.2 Project Summary

Free Keywords

Accelerator technology; Mechanical design; High vacuum technology; Control engineering; Computational physics; Surface chemistry; Electronic, magnetic and superconductive properties.

Abstract

CATHI is a mono-site Initial Training Network (ITN), with CERN as main host institution, offering research training in the application of advanced accelerator technology, beam instrumentation, ultra-high vacuum, cryogenics, radiation protection and advanced material technologies in one of Europe's leading Radioactive Ion Beam facilities (ISOLDE) at CERN, and its future upgrade (HIE-ISOLDE).

The proposed upgrade, which consists in the design and construction of a Super-Conduction linear accelerator and associated high-power target, offers tremendous opportunities for research training in an international, multidisciplinary environment, thereby ensuring that the expertise present in Europe will continue playing an important role in the progress of nuclear physics and related fields.

Training projects will have concrete objectives and deliverables. The young researchers will be supervised and mentored by internationally recognized experts and have access to state-of-the-art equipment. Hands-on project training will be supplemented with formal training courses in relevant and related fields, and a wide variety of complementary training courses, colloquia and seminars. Mobility within the ITN will ensure exposure to complementary research and industry environments.

CATHI will provide Early Stage Researchers (ESRs) and Experienced Researchers (ERs) with unparalleled research training opportunities in the framework of established, trans-national research networks (ISOLDE Collaboration, EURONS, ENSAR). It will provide hands-on experience through participation in the R&D, construction and commissioning of the super-conducting linac systems and in the design study to prepare for a future increase in intensity of the PSB beam.

PART B:

B.1 Description of the joint Research Training Project

B.1.1 Project Overview

This is a mono-site Initial Training Network (ITN), with CERN as main host institution, offering research training in the application of advanced accelerator technology, beam instrumentation, ultra-high vacuum, cryogenics, radiation protection and advanced material technologies in one of Europe's leading Radioactive Ion Beam facilities (ISOLDE) at CERN, and its future upgrade (HIE-ISOLDE). By integrating the complementary, multidisciplinary and intersectorial expertise of the associated partners, and through visiting scientists and the secondment of young researchers to the associated partners, this ITN will help strengthen Europe's human resources in key technologies for enhancing industry competitiveness in domains where there exist technology gaps with other high-tech economies.

The young researchers will be supervised and mentored by internationally recognized experts and have access to state-of-the-art equipment. Hands-on project training will be supplemented with formal training courses in relevant and related fields, and a wide variety of complementary training courses, colloquia and seminars. Mobility within the ITN will ensure exposure to complementary research and industry environments. Supervision will follow a model similar to CERN's established and successful Fellowship Programme, in which projects/objectives are defined and monitored by a CERN supervisor.

The CATHI project will provide Early Stage Researchers (ESRs) and Experienced Researchers (ERs) with unparalleled research training opportunities in the framework of established, trans-national research networks (ISOLDE Collaboration, EURONS, ENSAR, EURISOL-NET, NUPNET, etc…). It will provide hands-on experience through participation in the R&D, construction and commissioning of the super-conducting linac systems and in the design study to prepare for a future increase in intensity of the PSB beam.

B.1.2 Concept and Project Objective(s)

The majority of the research topics presented in this project will be carried out within the accelerators and technology sector of CERN, complemented with the 13 associated partners listed in pages 1 and 2, of which 5 are from industry. The associated partners will contribute to the research & development and training in specific work packages, review individual ESR/ER research projects, and participate in the organization of workshops and other training events.

The research training topics are in accelerator physics, cryogenics, applied informatics, mechanical and electronics engineering projects related to the design and construction of a 10 MeV/u super-conducting linac and R&D for the future intensity upgrade of the HIE-ISOLDE facility. Table 1 lists the themes in which individual research training projects for a total of 20 young researchers. There are nine main themes covering the three main HIE-ISOLDE subsystems described above. For each of these themes the state-of art, research objectives, and the roles of the associated partners are outlined in the remainder of this section.

Table 1: Overview of the 9 research training work packages of this ITN

HIE-ISOLDE Subsystem	Work Package (Research Training Theme)	No. ESR	No. ER
I. SC Linac	1. Super-Conducting Cavity Development and Tests	2	1
	2. Beam Instrumentation Development	1	1
	3. New Magnets	1	-
	4. Linac Integration and Innovative Alignment Method	2	-
	5. Linac Commissioning	1	-

II. Design Study for intensity upgrade	6. New Target and Front-End Design	5	-
	7. ISOLDE target area and Class-A Laboratory Upgrade	2	-
	8. Beam Quality Improvements	2	1
III. Safety	9. General Safety and Radiation Protection Implications Studies	-	1
	TOTAL	16	4

The HIE (**H**igh **I**ntensity and **E**nergy)-ISOLDE project embraces new developments in radioisotope selection, improvements in charge-breeding and target-ion source development. For extending the physics reach of the facility, the most significant component is the Superconducting linear accelerator with a minimum energy of 10 MeV/u (HIE-LINAC) which will replace most of the existing ISOLDE post accelerator.

It must be stressed that the design and construction of a SC accelerator is a highly multidisciplinary task. The ESRs and ERs will work on individual projects in the context of the following R&D themes but they will necessarily be exposed to a variety of disciplines that will complement the technical training:

Work Package 1: SC Cavity Development and Tests

- ESR1: Cavity manufacturing and surface treatment
- ER1: LLRF system
- ESR2: Cavity and Cryomodule tests

Work Package 2: Beam Instrumentation Development

- ER2: Design of beam instruments
- ESR3: R&D on solid state detectors

Work Package 3: New Magnets

- ESR4: New Magnet

Work Package 4: Linac Integration and Innovative Alignment Method

- ESR5: Development and participation to the integration studies
- ESR6: Development and participation to the control, alignment and positioning metrology

Work Package 5: Linac Commissioning

- ESR7: LINAC Commissioning

Work Package 6: Studies for ISOL Target & Front-End upgrades

- ESR8: Target material studies
- ESR9 and ESR10: Target conceptual design
- ESR11: Extraction optics and front-end design
- ESR12: Low-level controls

Work Package 7: ISOLDE target area and Class-A Laboratory Upgrade

- ESR13: Cooling and Ventilation Design Study
- ESR14: Design study of the vacuum system for the Front End of the Isolde facility

Work Package 8: Radioactive Ion Beams Quality Improvements

- ESR15: Off-line separator and High-resolution separator magnet
- ESR16: RFQ cooler and pre-separator
- ER3: Design study of a replacement charge breeder for REXEBIS

Work Package 9: General Safety and Radiation Protection Implications Studies

- ER4: Safety and Radiation Protection

B.1.3 Scientific and technological objectives of the research and training Programme

B.1.3.1 S & T Objectives of the Research Programme

The scientific and technological objectives of the research projects have been described in the previous section (B1.2). They will be achieved through the nine parallel work packages listed in table 1. Each of these work packages will involve collaboration between CERN and one or more of the associated partners. The following subsections briefly describe how the network will combine and exploit the complementary expertise of network members and of institutions outside the network (academia and private sector) in order to develop multidisciplinary/intersectorial knowledge and knowledge transfer (secondments, short training in company premises, etc…).

For the ERs and ESRs participation in the SC Linac Development

The hands-on, project-driven learning and the in-house CERN training schemes will be supplemented by external training at the associated partners, as indicated in Table 2 below. For instance, LPC-Caen, GANIL and JYFL-Jyvaskyla have excellent track record in the development of RFQ Coolers, beam transport, target and ion source development and mass separation. Training in these domains will be organized using the lab facilities available.

The industrial partners, CINEL, SDMS and ZANON will provide appropriate industrial training in cavity and cryomodule design and manufacturing processes through the secondment of researchers on their premises.

Training through the associated partner Cockcroft Institute will enable the researchers to follow a series of lectures on Magnet Design in collaboration with the Universities of Liverpool and Manchester and combined with industrial training at Scientific Magnetics premises.

The ESRs and ERs will also be able to deepen their knowledge through selective participation in the well-known, high-quality series of courses organized by the Joint Universities Accelerator School in Archamps (France), 7 km from Geneva (Switzerland).

For the ER and ESRs participation in the Design Study for Intensity Upgrade

The researchers training plan will have two different phases. They will start with a 6 month familiarization phase of training on the job in their respective groups. The experience from this phase will allow them to understand the needs for optimization of the facility in the light of a future intensity upgrade. The deepened knowledge acquired in this phase will then be applied to the practical problems, closely followed by their supervisors. In this second phase the ERs and ESRs will be hosted by our associated partners for periods varying between 1 and 2 months to get practical experience. In this respect, due to the advancement of their projects, INFN-LNL and IPN-Orsay are in an excellent position to provide in-situ practical and research training in the field of actinide target and ion sources development for high intensity upgrade and operation. Other possibilities include detail thermo-mechanical and structural analysis.

To succeed with the electron beam simulations for the beam quality improvements, a close contact with specialists at NSCL at Michigan State University is essential. Secondment at NSCL-MSU will be proposed to the Experienced researcher in charge to obtain sufficient base knowledge. The ER should act as the CERN link person with the established network for next-generation EBIT charge breeder, which recently received the approval from DOE, US. Initial contacts with electron cathode and magnet producers (e.g. AP Tech, Oxford Instruments, Accel Instruments, Scientific Magnetics) should be taken in order to discuss electron gun and solenoid design issues.

For the ER participation in the General Safety and Radiation Protection Studies

The Safety aspects of the RIB production targets, comparable in radioactive inventory to the fuel element of a research reactor, will become decisive in limiting the intensities, in selecting the production method and in the cost of the future target area upgrade within HIE-ISOLDE. With its dedication to radiation protection and safety issues the ER training programme in this theme, represents an indispensable complement to the intense efforts towards the realization of highest-quality radioactive ion beams for forefront nuclear physics research in Europe. As European radiation safety standards converge, it is intended that the Experience Researcher in charge carries out an exchange of safety studies, computer simulations and a coordination of specific and innovative technological developments in collaboration with the European network SAFERIB. This will increase the safety of the facility, avoids costly parallel developments and leads to a new evaluation and perspective for the realization of the high-intensity upgrade for HIE-ISOLDE. The ER should act as the CERN link person with the SAFERIB network partners.

SAFERIB is a Joint Research Activity on Radiation Protection Issues related to Radioactive Ion Beam Facilities established within the EURONS Integrated Infrastructure Initiative of the European 6th Framework Programme. Secondments at SAFERIB participating institutes (GANIL/SPIRAL2) will be proposed to the Experienced Researcher in order to obtain sufficient base knowledge.

B.1.3.2 Private Sector Contribution in the Research Programme

The participation of industrial partners in this training network is essential, since the development of accelerator components and infrastructures relies on close collaboration with competent companies, and a mutual understanding of the requirements and constraints. Furthermore, the large number of components usually required cannot be manufactured by academic institutions. The demands on quality and quality assurance are such that they can only be met when a close collaboration with industry is realized. The SMEs involved in this proposal will gain access to world-class equipment which might otherwise be beyond their means.

For example, the cavity manufacturing we require for the HIE-ISOLDE project is similar for niobium-sputtered copper and bulk niobium cavities, utilising e-beam welding, clean room assembly, and specific procedures to reduce contamination. This places the SMEs involved in this proposal in a position to bid for the cavity manufacturing for a number of future projects utilising superconducting radio-frequency (SRF) cavities or normal-conducting cavities. In addition, the adherence to strict manufacturing procedures will lead to a track record in successful accelerator cavity fabrication. This will allow opportunities to be developed for the manufacturing of cavities using other techniques. This is the case of SDMS which is currently manufacturing bulk Niobium cavities for GANIL/SPIRAL2 and is contemplating developing a new assembly line for Niobium coated Copper cavities given the new opportunities with HIE-ISOLDE.

In concrete terms, the contribution of the private sector to the research programme will include performing prototyping and development work in the areas of:

- Design and prototyping of normal conducting magnets;
- Copper cavity machining and electron beam welding for superconducting cavity construction;
- Thin-film technology;
- Design and manufacturing of liquid helium based cryogenic transfer lines;
- Yoke sub-assembly of super conducting magnets;
- Design and construction of RF cryostat;
- Clean room assembly of RF ancillaries;
- Beam instrumentation.

B.1.3.3 Inter/multi-disciplinary and Inter-sectorial aspects

The very nature of research projects at CERN, involving a very wide spectrum of technologies in various fields (including electronics, electrical and mechanical engineering, vacuum technologies and cryogenics, superconducting magnets, software, data acquisition and signal processing) requires the capability to adopt a multi-disciplinary approach. This aspect is emphasized in all training activities from the R&D for the superconducting linac and its integration to the demanding multidisciplinary requirements for the high intensity design study. The young researchers from the ITN will be exposed to an array of different specialists, both at CERN and through close international collaboration with European universities, other research institutes and high-tech industry. This will enable them to broaden their horizons into many disciplines.

For the high energy linac, the trainees will learn to integrate with a wide variety of specialist groups including building engineers and infrastructure engineers for the integration of their designs into the final complex. This will require that the trainee participates in meetings for planning and defining the final specifications in terms of infrastructure. Externally, the trainees will be required to collaborate closely with other institutes and industry to fully comprehend all aspects of production and operation of the final design.

Likewise, those trainees working on the design study and beam quality will be required to cooperate within a multidiscipline environment both internally and externally to learn from past experiences and to validate proposed solutions using state of the art technologies.

B.1.3.4 Newly emerging Supra-disciplinary Fields

CERN's R&D in SC linacs, beam quality improvement and radiation hard apparatus are technologies eagerly awaited by the nuclear physics community who will only benefit from CERN's experience. From a scientific point of view, the completion of the project will provide a new and exciting tool for future physics experiments.

B.1.3.5 Training Programme

To complement hands-on training, the young researchers can take advantage of CERN's formal training programme, covering a number of different types of learning (summarized in Table 2), many directly relevant to their projects, and all of which will broaden their horizons. The CERN seminars and colloquia will provide highly relevant and topical training by specialists in accelerator technology, electronics, and informatics. The technical training programme provides a rich spectrum of courses covering engineering software packages, modern electronics design methods and tools, database technology, programming languages, and office automation software.

Table 2: Relevant elements of CERN's formal training programmes

Type of training	*Content*
Academic Training	• 14 series of 3-5 lectures each; • University postgraduate level; • Particle physics and related fields of applied science.
CERN Schools	• Accelerator School, School of Computing, European School of High Energy Physics and the Latin-American School of High Energy Physics; • Annual events organized in different countries to enhance the relationship between young students and senior physicists and engineers.
CERN Seminars and Colloquia	• Regular sessions throughout the year include specialist seminars on detectors, accelerators science and technology, electronics, informatics, and theory; delivered by specialists in each domain
Management & Communication courses, including language courses	• Extensive curriculum of management and communication topics ranging from basic communication to project management and team management for more established supervisors; • Language courses, English and French. 75 sessions with 900 participants.
Safety training	• Compulsory sessions for anyone at CERN; • Covers hazards and risks for all environments.
Science & Society Seminars	• Delivered by leading speakers to raise general awareness of the effect that science and research can have on society.
Summer Student Programme	• 6 weeks July & August, 3 hours per day on topics including accelerators, detectors, electronics, DAQ; 3rd year undergraduate level.

Technical Training	• On-demand training via 1- to 5-day courses and seminars;
	• Topics include electronics, software & systems technologies, engineering, office software and automation.
	  ◦ Mechanical design e.g. ANSYS, AutoCAD, CATIA
	  ◦ Electronics design e.g. MAGNE, MATLAB, LabVIEW
	  ◦ Software and system technologies e.g. C++, JAVA, PERL 5, Python, XML

Web-based training	• Many of the lectures, seminars and courses are recorded and available via the web; Instructor-led topics also available in the form of web-based training.

In addition, specialized training courses and tutorials by CERN experts and visiting scientists from the associated partners will be arranged at CERN. For instance, the ESR working on the SC linac integration and alignment will be trained to suitable courses covering data-acquisition and analysis methods; additional in-field courses will be also given for practicing surveying instrumentation and methods by the survey team.

Within the SC Linac Commissioning work package, the ESR will attend the basic and intermediate CERN Accelerator Schools in order to obtain a general knowledge about accelerators. He/she will follow specific courses relevant for the project (for example on beam diagnostics) and will be trained to suitable technical courses covering control software, Java programming etc. The candidate will also receive practical training from the PSB and ISOLDE operators and may collaborate with the Linac4 commissioning team where synergies are possible.

The Researchers assigned to the Radiation Protection Studies will have to participate in a training course relative to the MonteCarlo particle transport codes employed (FLUKA, GEANT4) where they will be able to discuss common issues, compare different approaches and review their individual projects with the visiting scientist and other senior experts from the FLUKA Team. Similarly, tutorials by visiting scientists and reporting by the ER and ESR working on radiation implications will take place in specialized workshops like SATIF, dealing with shielding applications.

The ERs and ESRs involved in Super Conducting cavity development, beam instrumentation, cryomodule and magnets design, beam quality improvements, will undergo specialized training through the associate partners in order to acquire knowledge of beam simulations programmes (Vector Fields, Field Precision or similar) and of beam optics programmes (Trace3D, Path, COSY infinity or similar).

Complementary Training

CERN has two official languages, English and French, so a language-training programme is offered to help or perfect written and/or oral communication in each of the two languages. Regular evaluations ensure an appropriate match between the attendant's ability and the level and speed of the course.

Also as part of the complementary training, the CERN Management & Communication Training Programme has courses addressed to all staff, fellows and students. They include:

• Language courses	• Managing Time and Stress
• Effective Communication	• Working Effectively in Teams
• Presentation skills	• Report Writing
• Chairing or Participating in Meetings	• Job Application
• Rapid Reading	• Proposal Writing

All of the Management and Communication Training courses are taught with a mix of theory and practical exercises. The CERN EU Office regularly organizes training courses on Framework proposal writing, as well as the management and evaluation of projects. In line with their preparation as future research leaders, the ERs will be requested to follow some of the Management courses.

The CERN Technology Transfer unit plans to introduce new courses on an *Introduction to the Management of Intellectual Property Rights* and *Technology Transfer*.

In fact, a core syllabus of OBLIGATORY courses will be defined at the outset, in the Career Development Plan of the ERs and ESRs. It will include at least one course per semester.

Flexible, assisted self-paced learning facilities, using a variety of pedagogical and technology-based materials and an on-site language laboratory, are also available.

Specialized Training in Radiation Protection

For the formal training programme of the Experienced Researcher in Theme 9 (General Safety and Radiation protection), we foresee the obtention of a professional certificate, allowing the researcher to become responsible for radiation protection in the trainees home country or in a European country of his choice. The qualification would be equivalent to the "Personne compétente en radioprotection (PCR)" in France or the "Expert en matière de radioprotection" in Switzerland. This implies 1 course of 2 to 3 weeks in the first year.

Formal Training Plan

Each recruited researcher will have a supervisor who will look after the researcher's integration into the project. This also includes mentoring and tutoring, especially at the start of the employment contract. After the general induction session, a personal career development plan comprising scientific and training objectives is defined in an induction interview with the supervisor. These objectives will be regularly reviewed. Clear milestones will allow all parties to monitor progress.

Experience with ITN projects at CERN has already shown that ESRs frequently undertake PhD studies during their Marie Curie fellowship; supervisors are therefore used to working with and following PhD students.

A specialized unit in CERN's Human Resources (HR) Department looks after Marie Curie Actions (People) and coordinates all administrative processes from project proposal to recruitment to production of the interim and periodic reports. This includes the induction of the researcher into CERN following recruitment, providing the requisite information on Marie Curie researcher rights, preparing the Declaration on the Conformity for each researcher and the completion of the Career Development Plan. Each recruited researcher receives a full employment contract and the HR Department scrutinizes applications from candidates to ensure that Marie Curie mobility requirements are met. On-site services available to researchers upon arrival include a housing service and, where appropriate, an installation service for newcomers.

Size of the Research Training Programme

The R&D training projects proposed will have a mix of tasks of different levels of complexity, expected duration, and calling for more or less previous research experience. As shown in Table 3 most training projects will be for ESRs and these will require 3 years to achieve the level of expertise and project results corresponding to a PhD. A smaller number of ERs positions are foreseen for young researchers to complete their research training, to develop their independence and provide them with the skills and training to become team leaders in the near future.

Table 3: Proposed distribution of different categories of researchers between the nine Work Packages

Work Package	**ESR person-months** (post-grads) Includes secondment to associated partners	**ER person-months** (post-docs) Includes secondment to associated partners	**ESR & ER person-months on secondment** to associated partners	**Visiting Scientist person-months** (>10 yr experience) Invited for research training at CERN

1. Superconducting cavity development and tests	2 x 36	1 x 24	4 (IPN-Orsay) 4 (INFN-LNL) 2 (SDMS) 2 (ZANON) 2 (CINEL) 4 (CI)	-
2. Beam instrumentation development	1 x 36	1 x 24	2 (LPC-Caen) 2 (NSCL-MSU) 2 (CINEL)	-
3. New Magnets	1 x 36	-	6 (CI) 3 (SM)	-
4. Linac integration and innovative alignement methods	2 x 36	-	2 (GANIL) 2 (CNRS/IN2P3)	-
5. Linac commissioning	1 x 36	-	3 (INFN-LNL)	-
6. New target and front-end design	5 x 36	-	6 (INFN-LNL) 4 (GANIL) 3 (IPN-Orsay) 3 (SIDeA)	-
7. ISOLDE target area upgrade	2 x 36	-	3 (INFN-LNL) 3 (GANIL)	-
8. Beam quality improvements	2 x 36	1 x 24	5 (JYFI) 5 (MPIK) 5 (NSCL-MSU)	-
9. Safety	-	1 x 24	3 (GANIL)	-
TOTAL	16 x 36 = **576**	4 x 24 = **96**	**80**	**-**

The network as a whole undertakes to provide a minimum of 672 person-months of Early Stage and Experienced Researchers whose appointment will be financed by the contract. Quantitative progress on this, with reference to the table contained in Part C and in conformance with relevant contractual provisions, will be regularly monitored at the consortium level. All contracts are Type A.

B.1.4 Management structure and procedures

B.1.4.1 Organizational Management of the ITN

The management of the ITN project and the role and responsibilities of each body is described in Table 4. The monitoring and follow-up of the research training programme is the sole responsibility of the Supervisory Board and Management Committee as mentioned below.

Table 4 ***Roles and responsibilities in the ITN Management***

	Membership	Role

Supervisory Board	Project Co-ordinator as Chairperson, the Chair of the Marie Curie Selection Committee, and the Head of the HR Recruitment, Programmes & Monitoring Group of CERN. One representative from each Associated Partner will be welcome to attend. The Supervisory Board will have a kick off meeting, with a follow up meeting after 6 months, and annual meetings thereafter.	• Approving and overseeing implementation of the training programme for scientific, technical and complementary skills, and co-ordination of the network-wide training activities; • monitoring and evaluating overall progress of the research training programme; • ensuring exchange of best training practice with the associated partners, in particular with the industrial partners.
Management Committee	Project Co-ordinator and the individual Work Package Leaders. It will have regular meetings at least every 6 months, or more frequently if required. Representative of the Associated Partners will be invited to attend.	• overall management of the research programme; • implementation of the training activities with the associated partners; • management and follow-up of the progress of the individual research projects; • organization of network-wide training (courses, workshops, summer schools); • overview of the integration of the Researchers into the research team(s); • review of the Personal Career Development Plans; • dissemination of best practices and project results.
Project Coordinator	The Project Coordinator will be a senior applied scientist/engineer from CERN's Engineering Department. The project Coordinator will have appropriate career experience in the domains of nuclear physics and accelerator science and technology.	• coordination of the ITN research training programme; • organizing and chairing the Management Committee meetings; • communication to/from the associated partners; • communication and reporting to the European Commission.
Selection Committee	The CERN Marie Curie Selection Committee will comprise the coordinators of all Marie Curie projects at CERN and representatives of all CERN departments. It is chaired by a senior CERN physicist. Meetings of the Selection Committee will be scheduled according to the ITN selection rounds. ITN Work Package Leaders will be invited as required.	• selection and appointment of the Researchers; • monitoring of gender balance and equal opportunities.

Rules for decision-making (in the ITN)

The executive decisions for the implementation of the research training programme will be taken by the Management Committee. Any changes in the research and/or training programme will have to be approved by the Supervisory Board. Where such changes may have impact on the contractual obligations of the ITN, the EC Project Officer in charge of the ITN will be informed in due course.

Conflict resolution

The Marie Curie Steering Committee chairperson and the HR Coordinator in charge of the specific project, with input from the researcher and the supervisor, will intervene to solve disputes amicably. In case amicable settlement cannot be reached, disputes will be settled in accordance with CERN's arbitration procedure as laid down in the Organization's Staff Rules and Regulations.

B.1.4.2 Recruitment Strategy

Introduction - Charter and Code of Researchers

The CERN recruitment policy, employment conditions, and staff career development prospects are in good compliance with the guidelines of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, and most of the recommendations contained therein are effectively implemented and part of internal practice. This concerns in particular the recommendations on non-discrimination, gender balance, research environment, funding and salaries, continuous training, evaluation and appraisal systems, complaints and appeals, supervision, working conditions, and career development.

Advertisement of Marie Curie positions:

All positions will be advertised on the specially-created project web site (www.cern.ch/cathi), EURAXESS, the CERN electronic recruitment tool e-RT as well as via networks inside the project and its partners (**ISOLDE Collaboration mailing list: 600 scientists, 140 institutes, 35 countries**). At CERN an extensively-used web-site contains information about possible Marie Curie Actions for which there are openings at CERN.

CERN participates in many career fairs, exhibitions, visits to technical schools, colleges, universities and job centres, with presentations, posters and brochures. Information on the Marie Curie Initial Training Network programme is a specific part of these presentations.

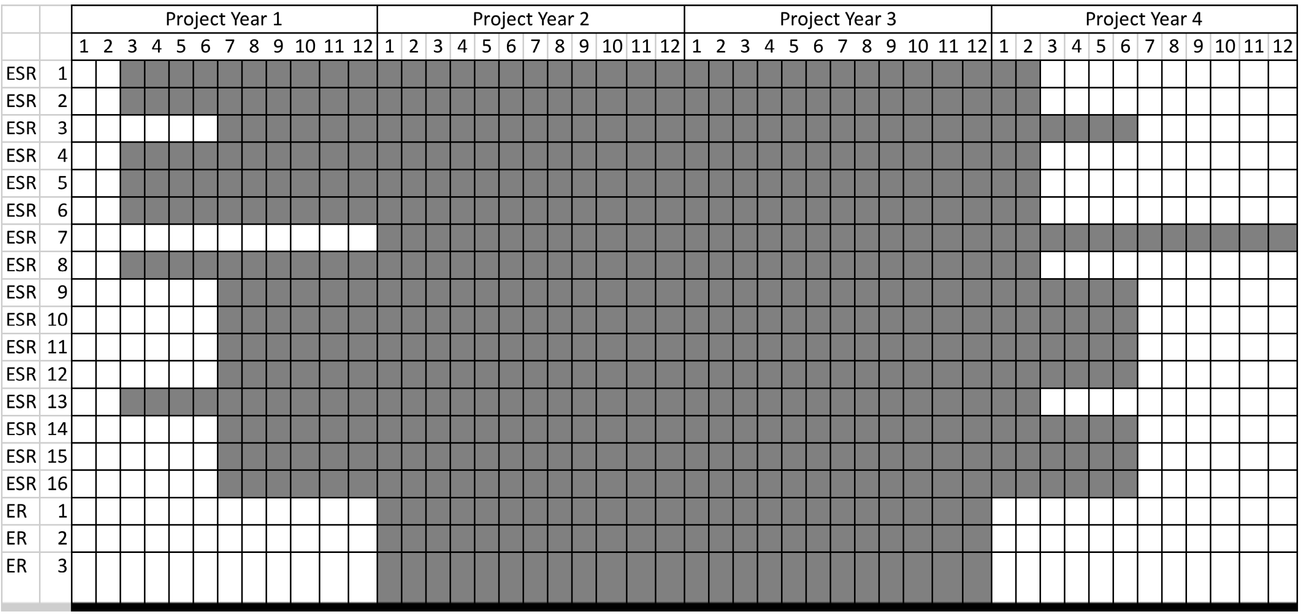
How Researchers will be selected

All applicants (both ESRs and ERs) will submit their applications via CERN's electronic recruitment system e-RT and, following screening of applications by the HR Department, will undergo rigorous selection on grounds of quality and potential, as well as a matching of their scientific profile with the job specification. Assessment is made according to academic qualifications, experience, achievements, and other elements including language knowledge, mobility and volunteer work. Candidates may be invited to meet their potential supervisors, but the final selection is under the responsibility of the Selection Committee which makes appointments under the auspices of the HR Department to ensure correct application of the rules and criteria.

The HR Department acts as guarantor for the fair and uniform application of CERN policies, in particular with regard to gender balance and related equal opportunities issues. The chairperson of the Marie Curie Selection Committee guarantees the scientific quality of appointed Researchers.

Given that the planned individual research projects for the ESRs are expected to require 3-year appointments the aim will be to recruit all of them within the first year of operation of the ITN. Furthermore, considering that there are few significant interdependencies between the individual ESR projects that would impose a specific sequence of recruitment, all Fellowships will be advertised as soon as the proposed ITN is approved, and each individual Fellowship will be filled as soon as a suitable, high-quality candidate is identified. To ensure quality the advertisement of posts and the timetable of the selection committee meetings will be adjusted as necessary so that recruitment for each individual research project is made from an adequate pool of applicants. To this same end the vacancy notices for ESR and ER Fellowships will remain open for a minimum of 4 weeks. Experience with recruitment of ESTs for Marie Curie projects at CERN has shown that in practice this method results in individual appointment starting dates being distributed reasonably evenly across the first year of the project.

Figure 1 Recruitment Gantt Chart



B.1.4.3 Strategy to Promote Equal Opportunities

For many years, CERN has had an Equal Opportunities Officer and an Equal Opportunities Advisory Panel, who :

- advise the Director-General on all matters concerning equal opportunities in the laboratory and in the development of policy in this domain.
- work towards ensuring that CERN personnel and all people working on the site understand and respect CERN's equal opportunity policy.
- advise staff members and everyone working on the CERN site on matters concerning equal opportunities.
- handle complaints of harassment.

B.1.4.4 Research Training Programme Monitoring and Follow-up

As stipulated by the ITN requirements, a Supervisory Board will be established in order to approve and oversee the implementation of the training programme for scientific, technical and complementary skills, and coordinate the network-wide training activities. The Management Committee will monitor and evaluate the overall progress of the research training programme, ensuring the exchange of best training practice with the associated partners, in particular with the industrial partners. Tools, technologies, methodologies and review schedules will be agreed early in the work plan in concertation with the lead scientist(s) of the associated partners.

As for the young researchers, the training objectives will be clearly defined in the Career Development Plan and regularly monitored to ensure coherence and monitor any deviation from the Plan (be it under-achievement of targets or identification of additional objectives). Great importance is given to regular and frequent contact between the Researcher and the supervisor and is considered the main mechanism for meeting the scientific and training objectives set out in the Career Development Plan. Regular meetings and an annual plenary meeting of Researchers and supervisors will also be organized. EC Project Officers will be invited. Researchers will all make short presentations and/or provide posters on their work.

B.1.4.5 Financial Management

The financial management will be centralized in CERN's Budget Planning Group which will take responsibility for creation of budget codes and all necessary monitoring tools as well as other formal financial arrangements; the Group works in very close collaboration with the HR Department. Expenditure for each Researcher is monitored closely according to expenditure type in order to ensure compliance with the relevant ceilings and rules of the Commission.

B.1.4.6 Risk Management

The ITN's work will form part of the HIE-ISOLDE project approved within CERN's (i) overall R&D programme for the accelerator complex upgrade and also (ii) scientific programme for fixed target and included in its Medium-Term Plan 2010 to 2015. It is however potentially subject to circumstances beyond its direct control: e.g. startup delay and/or budgetary cuts. Contingency plans have already built in the possibility to exercise and optimize the ITN research training programme via the Isolde Collaboration.

B.2 Implementation

B.2. 1 Planning of work packages, milestones and deliverables

B.2.1.1 Description of the Work Packages

The R&D activities of the ITN are broken down into nine work packages (1-9) summarized in the following tables. Management of the ITN (W.P. 0) is described in section B.1.4.1.

In this planning the timing of individual work packages is estimated in elapsed months from the effective first day of the involved ER/ESR's employment contract. The maximum duration of a work package will be 36 months. However, in practice it is expected that the recruitment process will result in individual fellowship starting dates being smeared out across the first project year. Therefore the 3-year plan described here will in reality span the full 4 years of the overall project.

Work package number	**1**	**Start date or starting event:**	Month 3
Work package title	SuperConducting Cavity Development and Tests		
Activity Type	RTD		
Person-months	**96 (ESR1: 36 months; ER1: 24 months and ESR2: 36 months)**		
Associated Partners	IPN-Orsay, INFN-LNL, SDMS, ZANON, CINEL, CI		
Objectives	Develop techniques to realize and test a SuperConducting resonant cavity of the quarter-wave type (QWR) using the technology of niobium film sputtering over a copper substrate at HIE-ISOLDE.		
Description of work	1. **ESR2**: Specification and conceptual study of the SC cavity and subsequent realization of the prototype low-beta cavity. 2. **ESR2**: Setup of the cryomodule test stand and cold tests of the SC cavity (investigation of Q-drop effect). 3. **ER1**: Development and commissioning of fast digital electronics (FPGA) for the control of the QWR cavities. 4. **ESR1**: Development and qualification of Niobium thin film sputtering techniques on copper cavities of different betas.		
Deliverables	D06. Report on the Optimization of the sputtering processes **(ESR1)** D07. Report on the SC cavity qualification measurements **(ESR1)** D08. Report on the Operational prototype of the LLRF system **(ER1)** D09. Report on LLRF tests **(ER1)** D10. Final report and/or journal publications on the QWR Cavity Dev. and Tests **(ESR2)**		

Work package number	**2**	**Start date or starting event:**	Month 7
Work package title	Beam Instrumentation Development		
Activity Type	RTD		
Person-months	**60 (ER2: 24 months and ESR3: 36 months)**		
Associated Partners	LPC-Caen, NSCL-MSU, CINEL, GANIL, INFN-LNL, CI, IPN-Orsay		
Objectives	Develop radiation-hard beam instrumentation for the 10 A*MeV SuperConducting LINAC and a particle detector suitable for measuring very faint radioactive beams.		
Description of work	1. **ER2, ESR3**: Design, fabricate and lab test prototype of position, profile and intensity monitors 2. **ER2, ESR3**: Design, fabricate and lab test prototype of phase and energy monitors. 3. **ER2, ESR3:** Design, fabricate and lab test prototype of emittance meter 4. **ER2, ESR3:** Carry out irradiation tests. 5. **ER2:** Carry out system-level integration tests and supervision work.		
Deliverables	D11. Conceptual design and sign-off specifications of beam instr. for SC Linac **(ER2)** D12. Define procedures for assembly, installation and commissioning **(ER2)** D13. Conceptual design and specifications of solid state beam instrumentation **(ESR3)** D14. Complete testing/irradiation and system-level integration test. Final conference report and/or journal publication **(ESR3)**		

Work package number	**3**	**Start date or starting event:**	Month 3
Work package title	New Magnets		
Activity Type	RTD		
Person-months	**36 (ESR4: 36 months)**		
Associated Partners	Scientific Magnetics and CI		
Objectives	Design, manufacture and commission compact warm magnets for the 10 A*MeV SuperConducting LINAC and new beam transfer line.		
Description of work	1. Specification of the magnet parameters. 2. Design and implementation of the whole magnet system. 3. Sign-off call for tender for the magnets procurement in industry. 4. Participate in preliminary system tests using the 5.5 A*MeV SuperConducting LINAC.		
Deliverables	D15. Conceptual design of beam line magnets and distribution D16. Technical specifications of beam line magnets and distribution. Final conference report and/or journal publication		

Work package number	**4**	**Start date or starting event:**	Month 3
Work package title	Linac Integration and Innovative Alignment Method		
Activity Type	RTD		
Person-months	**72 (ESR5: 36 months and ESR6: 36 months)**		
Associated Partners	GANIL, INFN-LNL, CI, IPN-Orsay		
Objectives	Carry out full integration studies for the different accelerator and experimental beam lines of HIE-ISOLDE and subsequent alignment of all the SC accelerating cavities, the beam monitors and the magnets.		
Description of work	1. **ESR5:** Carry out design and space arrangement of the HIE-ISOLDE area. 2. **ESR6:** Implement permanent internal monitoring lines to follow the relative movements of the cryo-cavities and solenoid inside each vacuum vessel. 3. **ESR6:** Design of specific electro-optics cameras and control applications. 4. **ESR6:** Electro-optical & environmental characterization of optical packages.		
Deliverables	D17. Final report on integration studies (**ESR5)** D18. Report on implementation and commissioning (including procedures) of the complete alignment system (**ESR6)**		

Work package number	**5**	**Start date or starting event:**	Month 13
Work package title	SuperConducting Linac Commissioning		
Activity Type	RTD		
Person-months	**36 (ESR7: 36 months)**		
Associated Partners	GANIL, INFN-LNL, CI, IPN-Orsay		
Objectives	The ESR training will be focused on the development of machine tune-up procedures that will later be implemented in the control software for the linac operation and active participation in the startup of the machine.		
Description of work	1. Draft the specification of the controls and of the beam monitoring tools specific to the HIE-REX Linac 2. Definition of tuning procedures and management of machine protection and alarm system 3. Draft console applications to be used by the operators for the Linac tuning and monitoring 4. Follow progress of the different aspects of the Linac design, construction and installation 5. Assist in the commissioning of the new machine		
Deliverables	D19. Report on commissioning schedule, general tuning procedure, specifications for controls and beam diagnostics D20. Commissioning report. Final conference report and/or journal publication		

Work package number	**6**	**Start date or starting event:**	Month 3
Work package title	Studies for ISOL Target and Front-End Upgrades		
Activity Type	RTD		
Person-months	**180 (ESR8; ESR9; ESR10, ESR11 and ESR12: 36 months each)**		
Associated Partners	GANIL, INFN-LNL, IPN-Orsay, JYFI, SIDeA		
Objectives	The ESR training will be focused on R&D work on ion sources, target material and beam purification. Key issues include the study of target materials and maintaining the production rates of radioisotopes, thermal and shock studies, radiation protection and beam optics.		
Description of work	1. **ESR8:** Carry out simulations of proton beam interactions with existing and potential target materials using FEM structural codes 2. **ESR8:** Establish experimental programme to validate the simulations and verify the production rates and diffusion constants for different material prototypes 3. **ESR9:** Carry out post irradiation analysis of used target and ion source systems with respect to fatigue and failure 4. **ESR9:** On-line tests with specific proton-beam pulse sequences and measurements using the Laser Doppler Vibrometer 5. **ESR10:** Optimization of the target(s) design for the study and optimization of different layout scenarii in terms of radiation protection issues, including benchmarking of code 6. **ESR11:** Carry out beam optics simulations as a function of target and ion source parameters and beam profile requirements for mass separation 7. **ESR11:** Draft functional and conceptual design of a new Front End including its integration into the existing facility 8. **ESR12:** Perform design study for the low-level control of the new front end and the High Resolution Separator (HSR) magnet 9. **ESR12:** Carry out dedicated study on state-of-the-art high accuracy positioning and sensor systems for the extraction electrodes as well as the control of devices for the safe manipulation of the target		
Deliverables	D21. Publication of test results and post analysis for the ISOL target material studies **(ESR8)** D22. Report on the fatigue analysis of the ISOL target **(ESR9)** D23. Final Report on the conceptual design of the ISOL target **(ESR9)** D24. Publication of the Safety File and risk analysis of the ISOL target **(ESR10)** D25. Final conference report and/or journal publication for the target layout optimization **(ESR10)** D26. Functional specifications of the extraction optics and front-end **(ESR11)** D27. Conceptual design, risk analysis and Safety File for the extraction optics and new front-end **(ESR11)** D28. Report on the front-end and HSR magnet control **(ESR12)** D29. Prototype of front-end control system including actuators and sensors **(ESR12)** D30. Simulator of the HSR dipole integrated magnetic field **(ESR12)** D31. Prototype of the HSR magnet control system **(ESR12)**		

Work package number	7	Start date or starting event:	Month 3
Work package title	ISOLDE Target Area and Class-A Laboratory Upgrade		
Activity Type	RTD		
Person-months	**72 (ESR13: 36 months and ESR14: 36 months)**		
Associated Partners	GANIL and INFN-LNL		
Objectives	The ESRs will acquire the necessary knowledge and collaborate to the different phases of the design of HVAC and cooling systems for the future HIE-ISOLDE facility and participate actively in the startup of the machine.		
Description of work	1. **ESR13:** Dimension the components of the Cooling and Ventilation installations 2. **ESR13:** Define and integrate the Cooling and Ventillation plant in the general layout of the building 3. **ESR13:** Elaborate the technical specifications and participate in the call for tender for the procurement in industry 4. **ESR14:** Present a planning, perform the engineering study, organize tests and carry out the preliminary design and integration of the new vacuum system 5. **ESR14:** Optimize the choice of control and diagnostic equipments 6. **ESR14:** Design a new gas recuperation system taking into account radiation safety and contamination hazards		
Deliverables	D32. Report on existing facilities (**ESR13**) D33. Design report on the Cooling and Ventilation upgrade for HIE-ISOLDE (**ESR13**) D34. Engineering study on the High-Vacuum requirements (**ESR14**) D35. Design report on the gas recuperation system upgrade for HIE-ISOLDE (**ESR14**)		

Work package number	8	Start date or starting event:	Month 7
Work package title	Radioactive Ion Beams Quality Improvements		
Activity Type	RTD		
Person-months	**96 (ESR15: 36 months; ESR16: 36 months and ER3: 24 months)**		
Associated Partners	JYFI, MPIK, NSCL-MSU, Scientific Magnetics,		
Objectives	The ESRs will acquire the necessary knowledge and collaborate to the different studies for the improvements of the radioactive ion beam quality in both resolution and purity.		
Description of work	1. **ESR15:** Define the functional and technical specifications for the production of an off-line separator 2. **ESR15:** Assembly and commissioning of the off-line separator 3. **ESR15:** Carry out design study of a high resolution magnet including the integration of multi-pole corrections 4. **ESR15:** Elaborate the technical specifications and participate in the call for tender for the procurement in industry 5. **ESR16:** Elaborate a functional and conceptual design of a Radio Frequency Quadrupole Cooler and Buncher (RFQCB) 6. **ESR16:** Provide a design for a pre-mass separator and setup a test stand 7. **ER3:** Carry out high-current electron beam simulations in order to establish a viable electron beam design 8. **ER3:** Carry out beam-optics simulation of the A/q-separator connecting the EBIS breeder to the existing linac		
Deliverables	D36. Specifications for Off-line separator (**ESR15**) D37. Full design Report of high resolution magnet (**ESR15**) D38. Specifications for call for tender (**ESR15**) D39. Design report of a Radio Frequency Quadrupole Cooler and Buncher (**ESR16**) D40. Functional specifications and Conceptual Design Report of a Pre-mass separator (**ESR16**) D41. Final conference report and/or journal publication on test results (**ESR16**) D42. Report on Charge Breeder design (**ER3**) D43. Final report on magnetic field, electron beam and ion trapping performance (**ER3**) D44. Final report on results from the cathode tests (**ER3**)		

Work package number	9	Start date or starting event:	Month 13
Work package title	General Safety and Radiation Protection Implication Studies		
Activity Type	RTD		
Person-months	**24 (ER4: 24 months)**		
Associated Partners	GANIL and IPN-Orsay		
Objectives	The ER will acquire the necessary knowledge in the radiation protection aspects of the extension of the REX post-accelerator for radioactive ions He will collaborate with the teams in charge of the rebuilding of the target area for allowing a primary beam power between 10 kW and 30 kW – a factor of 3 to 10 above the present beam power at ISOLDE. The ER will also participate actively in the startup of the machine.		
Description of work	1. Draft parts of the HIE-ISOLDE safety file dealing with radiation protection 2. Provide professional assistance to solving questions of radiation safety 3. Estimate the activation and radiation levels from beam loss of heavy ions 4. Estimate the radiation levels from x-ray emission of RF cavities 5. Apply and monitor the foreseen protection systems 6. Assist in the commissioning of the new machine		
Deliverables	D45. Design report on the shielding of the future post-accelerator D46. Final report on the radioactive waste disposal and inventory		

B.2.1.2 Project Deliverables and Milestones

Figure 2 provides an indicative overview of the work plan, the milestones and the deliverables for the proposed research training described in the preceding sections. The specific training, conferences and workshops will take place across the whole duration of the contract period with the bulk of specific training taking place within the first year. Internship dates with industry and associated partners are indicative and are subject to change.

Please note that, although the timescales for the research training projects show them running from month 1 through to month 36 but due to staggered starting dates we expect the ITN project activities to run throughout the full 4-year funding span.

Figure 2 Indicative work plan overview for the 9 research training themes
D denotes 'deliverable'; M denotes 'milestone'; TC denotes 'training course(s)'; W denotes 'workshop'; I denotes 'internship'

			1st Project year (months)	2nd Project year (months	3rd Project year (months)
		RESEARCH TRAINING THEME & TASK DESCRIPTION	3 6 9 12	15 18 21 24	27 30 33 36
	D00	Project Website			
	M01	Kick-off meeting of Management Committee.			
	M02	First ESR appointment			
	M03	Complete selection and recruitment of all ESRs and ERs			
	D01	First progress report (management)			
	D02	First periodic report (management)			
	D03	Second progress report (management)			
	D04	Second periodic report (management)			month 48 >
	D05	Final project report (management)			month 48 >
			1st ESR or ER year (months)	2nd ESR or ER year (months	3rd ESR or ER year (months)
1		***Theme 1: SC Cavity Development & Tests***	3 6 9 12	15 18 21 24	27 30 33 36
ESR1		*Cavity Development*			
	M04	Conceptual design and specifications			
	D06	Optimization of the sputtering processes			
	D07	Final report on the SC cavity qualification measurements			
	TC1	Specific training			
	W1	CAS, Conferences, workshops			
	I1	Internship in industry and associated partners			
ER1		*LLRF System*			
	M05	Conceptual design and specifications			
	D08	Operational prototype of low level RF system			
	D09	Final report on LLRF tests			
	TC2	Specific training			
	W2	CAS, Conferences, workshops			
	I2	Secondment to associated partners			
ESR2		*Cavity and Cryomodule Tests*			
	M06	Conceptual design and specifications for QWRs			
	M07	Cold test of QWR cavity prototype			
	M08	procedures and recording of test results			
	D10	Reports and publications			
	I3	Internship in industry and associated partners			
2		***Theme 2: Beam Instrumentation Development***	3 6 9 12	15 18 21 24	27 30 33 36
ER2		*Beam Instruments*			
	D11	Conceptual design and specifications of beam instrumentation for SC Linac			
	D12	Define procedures for assembly, installation and commissioning			
	TC3	Specific training			
	W3	CAS, Conferences, workshops			
	I4	Secondment to associated partners			
ESR3		*Solid State Detectors*			
	D13	Conceptual design and specifications of solid state beam instrumentation for SC Linac			
	M09	Production and commissioning of prototype			
	D14	Publication of test results			
	TC4	Specific training			
	W4	CAS, Conferences, workshops			
	I5	Internship in industry and associated partners			

3		***Theme 3: Transfer Line Magnets***	3 6 9 12 15 18 21 24 27 30 33 36
ESR4	M10	Identification of requirements	
	D15	Conceptual design of beam line magnets and distribution	
	D16	Technical specifications of beam line magnets and distribution	
	M11	Commissioning of magnets	
	TC5	Magnet design, CERN specific courses	
	W5	CAS, Conferences, workshops	
	I6	Secondment to Cockcroft Institute	
4		***Theme 4: Integration Studies and Alignment***	3 6 9 12 15 18 21 24 27 30 33 36
ESR5		*Integration Studies*	
	M12	Identification of equipment and infrastructure	
	M13	CAD of integration studies	
	D17	Final report and documentation	
	I7	Secondment to associated partners	
ESR6		*Innovative Alignment Method*	
	M14	Identification of requirements for BCAM test	
	M15	Modification of mechanical elements and data acquisition	
	D18	Final integration and commissioning procedures	
	M16	Alignment of SC Linac	
	TC6	Data acquisition and analysis methods	
	I8	Secondment to associated partners	
5		***Theme 5: Line Commissioning***	3 6 9 12 15 18 21 24 27 30 33 36
ESR7	D19	Commissioning schedule, specifications for controls and beam diagnostics	
	M17	First tests with beam	
	M18	Full scale test, characterize beam quality and linac performance.	
	D20	Commissioning report	
	TC7	Programming, beam diagnostics	
	W6	CAS, Conferences, workshops	
	I9	Secondment to associated partners	
6		***Theme 6: Studies for ISOL Target & Front End Upgrades***	3 6 9 12 15 18 21 24 27 30 33 36
ESR8		*Target Material Studies*	
	M19	Identification of target materials and future proposals	
	M20	Off-line studies of potential target materials	
	M21	On-line studies of potential target materials	
	D21	Publication of test results and post analysis	
	TC8	ANSYS-AUTODYN, FLUKA	
	W7	CAS, Conferences, workshops	
	I10	Secondment to associated partners	
ESR9		*Target Conceptual Design - Mechanics*	
	D22	Simulations of target fatigue	
	M22	Post irradiation analysis	
	M23	Off-line studies	
	M24	On-line studies with laser vibrometer	
	D23	Final report	
	TC9	CATIA, ANSYS-AUTODYN	
	I11	Secondment to associated partners	
ESR10		*Target Conceptual Design - Physics*	
	M25	Simulation of present layout	
	M26	Design of new target	
	M27	Design of shielding scenarii	
	D24	Safety file & risk analysis	
	M28	Validation through measurements	
	D25	Final report	
	TC10	FLUKA, ANSYS Workbench	
	W8	CAS, Conferences, workshops	
	I12	Secondment to associated partners	
ESR11		*Extraction Optics and Front End Design*	
	M29	Identification of requirements for project	
	D26	Functional specifications	
	D27	Conceptual design, risk analysis and safety file	
	TC11	CATIA, ANSYS Workbench, Optics simulation codes	
	W9	CAS, Conferences, workshops	
	I13	Secondment to associated partners	
ESR12		*Low level Controls*	
	M30	Control system functional specifications	
	M31	Front-end control system design study	
	M32	HSR magnet control system design study	
	D28	Report on front-end and HSR magnet specs	
	D29	Prototype of front-end control system	
	D30	Simulator of the HSR magnetic field	
	D31	Prototype of the HSR magnet control system	
	TC12	Training on PLC programming	
	TC13	Training on LabView and LabView RT	
	I14	Secondment to SIDeA	

7		***Theme 7: ISOLDE Target Area Upgrade***	3 6 9 12 15 18 21 24 27 30 33 36
ESR13		*Cooling and Ventilation Systems*	
	D32	Report on similar systems at other facilities	
	D33	Design report on HIE-ISOLDE upgrade	
	M33	International market survey, call for tender documents	
	TC14	Ventilation, fluid dynamics training	
	I15	Internships at European sites & associated partners	
ESR14		*Vacuum Systems*	
	M34	Identification of vacuum requirements	
	D34	Engineering study of upgrade	
	M35	Prototype testing	
	D35	Gas recuperation design report	
	TC15	Specific training on vacuum systems	
	W10	CAS, Conferences, workshops	
	I16	Internships at European sites & associated partners	
8		***Theme 8: Radioactive Ion Beams Quality Improvement***	3 6 9 12 15 18 21 24 27 30 33 36
ESR15		*Off-line separator & High Resolution Mass Separator*	
	D36	Off-line separator specifications	
	M36	Assembly and commissioning of off-line separator	
	D37	Design report of HRS magnet	
	D38	Specifications of HRS magnet for international market survey	
	TC16	Beam optics simulation codes	
	I17	Secondment to associated partners	
ESR16		*RFQ Cooler and Pre-Separator*	
	D39	RFQBC design report	
	D40	Pre-mass separator design report	
	M37	Set up pre-mass separator test stand	
	M38	Prototype testing	
	D41	Publication	
	TC17	Beam optics simulation codes	
	W11	CAS, Conferences, workshops	
	I18	Secondment to associated partners	
ER3		*Charge Breeder Upgrade*	
	M39	Evaluation of requirements	
	M40	Report on magnet configuration and Electron Beam design	
	D42	Charge Breeder design report	
	M41	Setup of cathode test bench	
	D43	Report on test results	
	D44	Final report	
	TC18	Ion optics simulation codes	
	W12	CAS, Conferences, workshops	
	I19	Internship to NSCL-MSU and other associated partners	
9		***Theme 9: Safety & Radiation Protection***	3 6 9 12 15 18 21 24 27 30 33 36
ER4	M42	Comparison of different radiation transport codes	
	M43	Estimation of beam loss of heavy ions	
	M44	Estimation of radiation levels from x-ray emission of RF cavities and comparison with measurements	
	D45	Design of shielding of the future Post-accelerator	
	M45	Incurred radiation levels during maintenance	
	D46	Estimation of radioactive waste disposal and inventory	
	TC19	Specific courses in radioprotection and Monte Carlo codes	
	W13	CAS, Conferences, workshops	
	I20	Secondment to associated partners	

Table 5 Indicative project deliverables featuring in figure 2 for approval by REA

Theme number	Del. no.	Titles of the Research Training Themes and Description of Deliverables and Milestones	Nature1	Dissemination level	Delivery date[2]
0		**General global project deliverables**			
	D00	Project website	O	Public	0
	D01	First progress report	R	Public	12
	D02	First periodic report	R	Public	24
	D03	Second progress report	R	Public	36
	D04	Second periodic report	R	Public	48
	D05	Final project report	R	Public	48
1		**SC Cavity Development and Tests**			
	D10	Final report on the QWR Cavity Development and Tests	R	Public	36
2		**Beam Instrumentation Development**			
	D14	Complete testing/irradiation and system-level integration	R	Public	42
3		**Transfer Line Magnets (ESR#4)**			
	D16	Technical specifications of beam line magnets and	R	Public	18
4		**Integration Studies and Alignment**			
	D18	Final integration and commissioning procedures	R	Public	24
5		**Line Commissioning**			
	D20	Commissioning report	R	Public	48
6		**Studies for ISOL Target & Front End Upgrades**			
	D25	Final report of the target layout optimization	R	Restricted	36
	D29	Prototype of front-end control system including actuators	P	n/a	24
7		**ISOLDE target Area Upgrade**			
	D33	Design report on the HIE-ISOLDE upgrade	R	Public	24
8		**Radioactive Ion Beams Quality Improvement**			
	D44	Final Report	R	Public	36
9		**Safety & Radiation Protection**			
	D45	Design of shielding of the future Post-accelerator	R	Public	27

Table 6 Indicative Planning of Project Reporting Meetings

Tentative schedule of project reviews			
Review no.	**Tentative timing, i.e. after month X = end of a reporting period**	***planned venue of review***	***Comments , if any***
1	Kick-off meeting : 1	**CERN**	
2	12-month review : 12	**CERN**	
3	Mid-Term Review (with REA): 22	**CERN**	
4	36-month review : 36	**CERN**	
5	Final project meeting : 48	**CERN**	

1 The nature of the deliverable is coded as follows: **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other
2 For research themes 1-9 the delivery dates are measured in months from the start of individual ESR contracts.

B.2.2 Planning of conference and Visiting Researchers contribution

The researchers will also be able to participate in highly relevant schools, international workshops and conferences, such as those described in table 3:

Table 3: Schools, Workshops and Conferences of particular relevance to the ESRs and ERs of CATHI

• The CERN Accelerator School holds training courses for accelerator physicists and engineers twice a year. The courses take place in conference centres in different member states of CERN and consist of a programme of lectures and tutorials spread over a period of one or two weeks. The school offer basic, intermediate and specialist courses.
• The ***LINAC conference*** is bi-yearly international conference series that provide a unique opportunity for LINAC specialists from around the world to interact and to exchange their achievements. It includes keynote presentations by industry and academic researchers, panel discussions, and parallel oral and poster presentation sessions especially suitable for first conference presentation experiences by young researchers.
• The ***IPAC conference*** is a yearly international conference on particle accelerators. It includes keynote presentations by industry and academic researchers, panel discussions, and parallel oral and poster presentation sessions. Typically it host about 2000 participants.
• The ***SRF workshop*** will cover the latest advances in the science, technology, and applications of superconducting RF. The program consists of invited review talks, poster sessions and “hot-topic” discussion sessions. A special emphasis will be placed on providing a forum for student researchers to present their results. Special tutorials will be held before the actual conference start. These are designed to provide an in-depth overview of SRF related subjects for scientists and engineers new to the field, or those who simply want a refresher.
• ***International Conference on Ions Sources (ICIS)*** dedicated to the development and results from various types of ion sources for accelerators.
• ***International Conference on Electromagnetic Isotope Separators and Techniques Related to their Applications (EMIS)*** is a conference dedicated to the production of radioactive nuclear beams and covers all aspects of mass separators and accelerators.
• ***Radioactive Nuclear Beams (RNB) and Exotic Nuclei and Atomic Masses (ENAM)*** are now a combined conference covering all aspects of nuclear physics as well as the tools for their production.

B.3 Impact

B.3.1 Research Indicators of Progress

In order to allow REA Services to assess progress with respect to (i) the research, (ii) the training and (iii) the management and impact, the network **will** provide the following indicators of progress in its periodic, mid-term review and final reports listed:

Table 9: Indicators of Progress that will be used in reporting

Indicators of progress for Research Activities:

- General progress with research activities programmed at individual, participant team and network level. Possible problems encountered and the nature/justification for any adjustments to the original research work plan and/or timetable.
- Highlights of scientific achievements and recognitions (such as innovative developments, scientific/technological breakthrough, publications, patents, awards and prizes, etc.).
- Progress on cross interaction among disciplines and between academic and industrial partners, other stakeholders or relevant user groups.
- Specialist exchange among network teams and visit of Senior Researchers from inside and/or outside the network.
- Individual and joint publications, directly related to the work undertaken within the project (including citation index).

Indicators of progress for Training Activities:

- General progress with training programmed at individual, participant team and network level (career development plan, supervision, coaching or mentoring in place at the host institution.
- The rate of recruitments of ESR/ER by the (monosite) network (ratio person-months filled/offered) and time and duration of each individual appointment.
- The nature and justification for any deviation from the original plan (as referred to table A3.1 of part C) or any adjustments to the original research work plan and/or timetable.
- The number and place of the short visits/secondments undertaken or organized by each ESR and ER within the network (to associated members including number of visits of the ESR and ER to their home scientific community).
- Participation in training events and network meetings (workshops, seminars, summer schools, etc.) and to international conferences (number, names, place, date).
- Achievements regarding the acquisition of complementary skills (such as project management, presentation skills, language courses, ethics, intellectual property rights, communication, entrepreneurship, etc.).
- Level of satisfaction of the trainees (e.g. as expressed in response to questionnaire and their expectation to present their PhD thesis and when).
- Highlights on more particularly innovative developments (novel concepts, approaches, methods and/or products) and on wider societal and/or ethical components of the project, such as public outreach activities.
- Participation of fellows in international conferences / dissemination of their own results

Indicators of progress for Management and Impact:

- Effectiveness of networking, communication and decision-making between partners (at all levels: coordinator, team leaders, supervisor, ESRs and ERs), between the network and the REA, and with the industrial and/or other relevant stakeholders.
- Effectiveness of the recruitment strategy in term of equal opportunities (including gender balance) and open competition at international level.
- Effectiveness of the "training events and conferences" open to external participants and integration in the training programme.

- Effective contribution of Visiting Scientists to the research training programme.
- Development of any specific planning and management tool(s) and databases, management of intellectual property and commercialization of network research output (if applicable).
- Nature and justification for adjustments, if any, to the original training plan and/or timetable (e.g. opportunities for new collaborations regarding training activities).

B. 3.2 Dissemination and Impact

B.3.2.1 Dissemination of Best Practices

Upon arrival at CERN, training starts on day one: all Researchers receive an *induction briefing* session on issues regarding CERN administration related to the Marie Curie project. In addition to this, the CERN managers are well used to setting objectives for newcomer staff, so this is particularly useful when drawing up the compulsory Career Development Plan with the Researcher.

Looking towards the end of the Researcher's contract: as a contribution to CERN's plans for best HR practices, the HR Department asks Researchers to fill in an exit questionnaire and is working on an *Alumni project* to keep in touch with former employees - this would be used in the compulsory follow-up of Researchers who have been at CERN on all of the Framework Programme projects.

B.3.2.2 Dissemination of results

CERN's policy concerning the dissemination of its research results is to make them available in the public domain through refereed scientific journals, conference proceedings, documentation published on its website, or through the series of *CERN Reports* published by its own Scientific Information Service. Except as detailed in the next section, the results of this ITN will be disseminated according to this policy and using these same channels both during the lifetime of the project and afterwards.

The Management Committee will stimulate the Early Stage Researchers to submit the publications, resulting from the project, to open access repositories and journals, in line with the recommendations of the EC on open access to scientific information. Similarly, the Management Committee will stimulate the ESRs to make workshop and conference talks and presentations. In particular, the Early Stage Researchers involved in this ITN will present their results and receive feedback at the annual ISOLDE Workshop and other workshops organized by the associated partners. Conference presentations will be expected at IoP Nuclear Physics, EMIS, EURORIB and RNB-ENAM where the progress on the HIE-ISOLDE project is eagerly awaited by the international community.

The different mechanisms described above give the young Researchers ample opportunity to hone their skills in writing or making presentations. A Project web site (www.cern.ch/cathi) will also be used to disseminate information on the project in so far as industrial / confidentiality clauses allow.

B.3.2.3 Management of Intellectual Property Rights

The general rules for access, use and dissemination of Intellectual Property, defined in the FP7 Rules for Participation, will be applicable to this ITN project.

The research training work with the industrial partners will be carried out in the framework of partnership agreements which would be concluded between CERN and the other members of the Isolde Collaboration. This ensures that the IP rights and policies of all partners are respected.

Non-disclosure agreements may be required by industrial partners (be they formally associated ITN partners or not) and/or some of the associated technology institutes before granting access to detailed information about their research work or proprietary technologies, or for example to govern the publication of comparative performance figures measured for different commercial equipment or technologies. Agreements between the

ITN and some of the industrial associated partners may need to be established early in the work programme in order to ensure that the IP rights and policies of all partners are respected; that concerns in particular results which may have industrial or commercial applications. CERN's Technology Transfer Unit will assist the ITN with IPR issues and steps towards potential commercial exploitation of results, if appropriate.

As a beneficiary of an ITN Grant, CERN will ensure that the project results be disseminated as swiftly as possible. Nonetheless, the dissemination activities shall be compatible with the protection of intellectual property of the associated partners involved.

B.3.2.4 Contribution to the Policy Objective of Structuring Initial Research Training Capacity at the European level

CATHI will work towards a more co-ordinated approach to research training at an international level, and foster mutual recognition of training modules.

The early stage trainees will be part of a multidisciplinary, international collaboration involving other young postgraduates from different countries, as well as several research institutions and/or universities across Europe and North America (US, Canada). Some of the training will take place in collaborating universities or research laboratories, in both the public and private sectors. The active links with colleagues from other countries will enhance the European dimension of the training, and provide momentum to a more coordinated approach to research training.

CATHI institutes have extensive experience in running Doctoral Student programmes in very close collaboration with other universities/institutes, in addition to hosting a large number of PhD students funded by national agencies. Through these, and the large number of trainees supported through current Marie Curie projects in which some members of the network were involved (CERN, GANIL, INFN, CNRS, Max Planck Institute), the partners contribute significantly to encouraging synergies and structuring effects, and actively foster the mutual recognition of training and mobility. This will continue and will be further developed under the present action.

CATHI researchers in the field of superconducting cavity development, will profit from the set-up at CERN of a state-of-the-art test stand facility to measure and characterize new niobium-coated cavities, to qualify new Low-Level Radio Frequency control systems and to perform mechanical studies under cryogenic conditions. This facility could also serve other European or International projects like SPIRAL2, SPES, EURISOL, ESS and FAIR.

Potential for establishing long-term collaborations and lasting structured training programmes.

Radioactive beams, for which ISOLDE was a precursor, have transformed the landscape of low energy Nuclear Physics and several new (SPES at INFN-LNL) or upgraded facilities (HIE-ISOLDE at CERN and SPIRAL2 at GANIL) are currently being constructed or discussed. All three European ISOL facilities, and as well as FAIR will be necessary to cover the broad physics programme laid out for radioactive beams in the next decade and the needs of the community. This has been recognized in the long range plan of NuPECC, in which HIE-ISOLDE is cited as an essential "intermediate generation" facility on the path to EURISOL.

Individual researchers will be involved in a large spectrum of research activities, spanning from cryogenics, RF, beam dynamics, cavity fabrication, control systems, target/ion source development, and UHV technology, carried out via joint projects with industrial and academic institutions. Through the network's existence, they will have access to an outstanding range of expertise and infrastructure, and will be part of forefront R&D activities at an international level. Having profited from the numerous advantages and having appreciated the value of such international collaborations, they are likely to use this approach in their future research projects.

The mobility of young researchers and visiting scientists within the ITN will reinforce the longer-term collaboration between the partners, who will profit not only from cross-fertilization between sectors, but also from synergies and the pooling of resources between partners with similar research goals.

The necessary research and development, prototyping, construction, installation and commissioning will be carried out at CERN in close collaboration with the associated partners listed in B1. Those partners have a wealth of skills, recently applied within the ERLP/ALICE and EMMA projects (Cockroft Institute), ALPI (INFN-Legnaro), SPIRAL2 at GANIL and ISAC2 (TRIUMF), which are well matched to the requirements of the CATHI proposal.

B.3.2.5 Contribution to the Policy Objective of Enhancing Public-Private Sector Collaborations in Terms of Research Training

The participation of industrial partners in this training network is essential, since the development of accelerator components and infrastructures for HIE-ISOLDE relies on close collaboration with competent companies, and a mutual understanding of the requirements and constraints. There will be research opportunities in beam dynamics, SC cavity and cryomodule design and fabrication, low-level RF control system and beam diagnostics, target material development, fostering the emergence of new technologies and products.

In North America, both the ISAC2 facility at TRIUMF (which has recently started operation with a restricted range of radioisotopes developed as beams) and the Holifield Radioactive Ion Beam Facility at Oak Ridge have plans to upgrade their RIB capability to include intense photofission production. Additionally, funding opportunities have been announced for the Facility for Rare Isotope Beams (NSCL-MSU), of comparable physics reach to EURISOL. There is a clear opportunity for the European initiatives to lead in this area and by participating in CATHI the industrial partners can play a central role in European ISOL strategy.

By developing expertise in SC linear accelerator technology, the industrial partners would be in an excellent position to play a role in the replacement of CERN's injector chain of accelerators scheduled for the next decade. For facility developments beyond the middle of the next decade, the EU Design Study for EURISOL has carried out the R&D necessary to overcome the most technologically demanding challenges presented by this third-generation ISOL source, as well as a conceptual study for neutrino beta-beam production. CATHI associated institutional partners played leading roles in this Design Study. Since the EURISOL post-accelerator will be superconducting, investment in SC technology will allow the industrial partners to play a key role in this future facility and in other RIB devices, such as the beta-beam decay ring that requires RIB injection. The construction of a high-power proton driver at CERN would allow the HIE-ISOLDE facility to evolve towards EURISOL during 2015-2020.

B.3.2.6 Risk assessment and related communication strategy

No potential risks (real or perceived) for society/citizens associated with the project has been identified.

B4. Ethical Issues

(N/A)

B5. Gender Aspects

Recent surveys have shown that female students and scientists are under-represented in many engineering and scientific fields. Particle Physics is one of these fields. In the present project, the promotion of gender balance will be addressed through several lines of actions, such as:

- encouraging applications from female individuals at all levels within the ITN.
- inviting female Researchers to deliver talks at the annual workshops and topical meetings, organized by the ITN.

Since 1993 CERN has been actively applying its strong Equal Opportunities (EO) policy. With emphasis initially placed on recruitment and gender-related issues, activities have now broadened to include other EO issues such as dignity and respect, life-work balance, culture, age and gender diversity. With the aim of increasing the number of women coming into and retaining them in the field of particle physics, CERN has also been an active member of the FP6 initiative SET-Routes and has introduced new courses in its internal Management & Communication curriculum which specifically address issues of women in management.

To minimise gender bias and achieve a broader perspective in the approach to work, statutory working groups and selection boards at CERN are required to include women and this is also the case for the Marie Curie Selection Committee. In addition, potential supervisors will be asked to pay particular attention to female candidates when applications are circulated.

To improve female participation in all job categories and at all levels, gender distribution is monitored and statistics are published annually (experience has shown the absence of any gender bias at the selection level). In training lectures and seminars, particular attention is paid to choosing, whenever possible, women scientists as speakers in order to provide positive role models to young female scientists.

PART C: OVERALL INDICATIVE PROJECT DELIVERABLES

A3.1:
Overall Indicative Project Deliverables

Project Number [1]	264330	Project Acronym [2]	CATHI

One Form per Project

	Initial Training 0-5 years						Visiting Researchers						Total
	Early-Stage researchers			Experienced researchers			Visiting Researchers (<10)			Visiting Researchers (>10)			
	Months	Researchers	% Fixed amount contract (B)	Months	Researchers	% Fixed amount contract (B)	Months	Researchers	% Fixed amount contract (B)	Months	Researchers	% Fixed amount contract (B)	Months
CERN	576	16	0%	96	4	0%	0	0	0%	0	0	0%	672
Overall Total	576	16	0%	96	4	0%	0	0	0%	0	0	0%	672

PART D: OVERALL MAXIMUM COMMUNITY CONTRIBUTION

A3.2:
Overall Maximum Community Contribution

Project Number [1]	264330	Project Acronym [2]	CATHI

One Form per Project

The project is lab based ☒

Overcome 40% budget rule for Switzerland

	Monthly living and mobility allowance (A)	Travel allowance (B)	Career exploratory allowance (C)	Contribution to the participation expenses of eligible researchers (D)	Contribution to the research/ training/ transfer of knowledge programme expenses (E)	Management activities (including audit certification) (G)	Contribution to overheads (H)	Total
Year 1	481,780.89	15,000	30,000	70,800	141,600	24,392.97	73,918.09	837,491.95
Year 2	1,066,560.67	20,000	10,000	144,000	288,000	60,446.47	152,865.07	1,731,951.21
Year 3	1,066,560.67	20,000	0	144,000	288,000	60,116.47	151,865.07	1,720,631.21
Year 4	302,133.77	1,000	0	44,400	88,800	14,399.01	43,633.38	494,366.16
Total	2,917,216.00	56,000	40,000	403,200	806,400	139,352.92	422,281.61	4,784,450.63

APPENDIX – Extract from People Work Programme 2010

Table 3.1 gives the yearly reference rates for calculating the monthly living allowances of each eligible researcher. The amounts per year are given in Euros per category of researchers who are recruited under an employment contract/fellowship with full social security coverage. These amounts include the provisions for all compulsory deductions under national applicable legislation and represent an increase of roughly 3.9% over the 2009 work programme, reflecting the average inflation in the EU during the intervening period as published by EUROSTAT.

Table 3.1: Yearly reference rates for monthly living allowances under employment contracts (Correction Coefficient index 100)[34]

Researchers Categories	EUR/year
Early-stage researchers	**36 700**
Experienced researchers (< 10 years experience)	**56 400**
Experienced researchers (>10 years experience)	**84 500**

Along with the living allowance, a **mobility allowance** will be paid for some categories of researchers as specified in Table 3.4, which will take due account of the family situation of the researcher. In this context family is defined as persons linked to the researcher by (i) marriage, or (ii) a relationship with equivalent status to a marriage recognised by the national legislation of the country of the host organisation or of the nationality of the researcher; or (iii) dependant children who are actually being maintained by the researcher. This allocation, as well as the travel allowance, will only be due for researchers doing a trans-national mobility.

The annual **travel allowances** are specified in Table 3.2. For researchers eligible to receive travel allowances, the allowance is based on the direct distance (in a straight line) between the place of origin and the host institution of the researcher, calculated on the basis of one payment for every period of 12 months or less, when the first period or the last one is less than 12 months. Only one travel allowance shall be paid per period of 12 months, independently of possible interruptions or stays with different partners.

Table 3.2: Annual travel allowances

Distance (km)	Fixed-amount contribution (EUR)
< 500	250
500 – 1 000	500
1 000 – 1 500	750
1 500 – 2 500	1 000
2 500 – 5 000	1 500
5 000 – 10 000	2 000
>10 000	2 500

Table 3.3 Correction Coefficients

The EU-27 Member States[35]

Austria	107.8
Belgium**	100.0
Bulgaria	86.3
Cyprus	89.2
Czech Republic	98.1
Denmark	139.4

Estonia	85.0
Finland	119.8
France	115.5
Germany	98.9
Greece	95.0
Hungary	94.0

Ireland	121.9
Italy	111.5
Latvia	85.1
Lithuania	76.3
Luxembourg**	100
Malta	85.0

Netherlands	109.1
Poland	93.8
Portugal	91.7
Romania	75.2
Slovak Rep.	87.3
Slovenia	90.2

Spain	101.6
Sweden	115.3
UK	125.6

** Belgium and Luxembourg are the basis of the correction coefficient and is therefore always static at 100,0

[35] Based on the Council Regulation No 1323/2008 of 18 Dec 2008 (OJ L345, 23.12.2008, page 10), adjusting the correction coefficients applicable to the remuneration of officials of the European Communities, with the exception of Bulgaria where the coefficient has been updated in the Commission Decision of 18 March 2009 (OJ L80 of 26.3.2009, page 14).

The non-EU Countries and New Caledonia a French overseas territory[36]

Albania	78.5	Cameroon	109.7	Ethiopia	77.8	Ivory Coast**	98.7	Morocco	86.9	Senegal	88.1	Trinidad & Tobago	61.6
Algeria	87.5	Canada	78.9	Fiji	72.2	Japan	105	Mozambique	71.9	Serbia	73.9	Tunisia	68.7
Angola	112.8	Cape Verde	74.4	FYROM	71.1	Jordan	70	Namibia	57.5	Sierra Leone	68.9	Turkey	80.7
Argentina	54.7	Cen African Rep.	113.1	Gabon	110.4	Kazakhstan	73.3	Nepal	66	Singapore	95.8	Uganda	69.9
Armenia	71.1	Chad	129.3	Gambia	70.3	Kenya	73.8	**New Caledonia**	**140.4**	Solomon Islands	85.6	Ukraine	109.4
Australia	108.5	Chile	57.7	Gaza Strip	103.1	Kosovo	57.5	New Zealand	89.8	South Africa	46.9	Uzbekistan	45.4
Azerbaijan	72.9	China	74.6	Georgia	99.7	Kyrgyzstan	86.7	Nicaragua	46.2	South Korea	90.7	US	88.3
Bangladesh	45.4	Colombia	79.2	Ghana	54.3	Laos	77.6	Niger	85.7	Sri Lanka	58.1	Uruguay	73.2
Barbados	105.5	Congo	129.1	Guatemala	70.7	Lebanon	80	Nigeria	93	Sudan	68.8	Vanuatu	105.6
Belarus	62.7	Costa Rica	68.7	Guinea	55.7	Lesotho	47.3	Norway	131.2	Suriname	39.7	Venezuela	61
Benin	92.9	Côte d'Ivoire	99.9	Guinea-Bissau	114.6	Liechtenstein***	110.1	Pakistan	43.9	Swaziland	46.4	Vietnam	40.2
Bermuda	151.5	Croatia	106.3	Guyana	53.5	Madagascar	84.2	Panama	52.2	Switzerland	110.1	West Bank	103.1
Bolivia	49.5	Cuba	73.5	Haiti	104.2	Malawi	63.6	Papua NewGuinea	73.5	Syria	66.8	Yemen	57
Bosnia & Herzegovina	70.7	Dem Rep Congo	112.3	Honduras	60.3	Malaysia	65.8	Paraguay	83.6	Taiwan	77.3	Zambia	63.2
Botswana	46	Djibouti	85.4	Hong Kong	83.4	Mali	83.5	Peru	67.4	Tajikistan	61.2		
Brazil	95.5	Dominican Rep.	58.2	Iceland*	131.2	Mauritania	61.2	Philippines	61	Tanzania	61.4		
Burkina Faso	96.5	Ecuador	57.9	India	50.9	Mauritius	72.6	Russia	121.8	Thailand	52.4		
Cambodia	62.7	Egypt	33.8	Indonesia	59.3	Mexico	69.7	Rwanda	82.7	Timor Leste	56.6		
		El Salvador	63.6	Israel	118.9	Moldova	67.1	Samoa	65.5	Togo	87		
		Eritrea	41.9	Jamaica	86.1	Montenegro	68.9	Saudi Arabia	79.1	Tonga	85		

These Correction Coefficients were published on 14th July 2009, in OJ L 181/1-7

Exceptions:
* For Iceland the coefficient for Norway applies.
** This is the Correction Coefficient introduced for specific countries as per Commission Decision published in IA No 24-2008/08.05.2008, "Weightings applicable in third countries, Articles 12 and 13 of Annex X to the Staff Regulations.
*** For Liechtenstein the coefficient for Switzerland applies.