Knowledge and Technology Transfer @INFN

(PART II)

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INFN Roma

XXIX GIORNATE DI STUDIO SUI RIVELATORI Scuola F. Bonaudi

Cogne 10-14 February 2020

Outline of the 2nd lecture

- Introduction
- Network competence centers
  - Networks with *geographically distributed nodes*
  - Networks with *complementary nodes*
  - Networks with *thematic nodes*
- Socio-economic impact studies
- Concluding remarks on this second lecture.

An important task for each institution is to find **the best method to enhance the institutional research** without interfering with the primary mission and establishing a virtuous path with results that can be quantified in respectable figures.

This lecture introduces the concept of **Competence Networks** which constitutes an excellent enhancement of our scientific and technological heritage with possible applications in a wide range of disciplinary sectors. They are useful for carrying out many of the knowledge and technology transfer activities.

The last topic of this lecture will concern with the studies of the socio-economic impact of Research.

The past…..

The attempt to identify some ***special*** or ***strategic topics*** for INFN belongs also to the past, see special projects such as **NTA** (New Acceleration Techniques), ***APENext*** (supercomputing for theoretical physics, etc.) or strategic projects such as INFN-MED (applications of physics to medicine starting from clinical trials).

Indeed these special projects have remained much more anchored to Research & Development rather than applications or even technology transfer.

….. *and the present.*

The ***Networks*** have been created in the Technology Transfer Committee as a more ***modern vision*** of this need to highlight some strategic issues, often interdisciplinary, by bringing together research groups, laboratories, know-how also held by individuals, etc. and putting everything on the net to form a concentration of skills distributed on a certain number of suitably configured nodes. A sort of ***technological districts*** or ***INFN competence centers.***

INFN Competence Networks

- Over the last years, INFN has proposed and organized, for KTT activities, some thematic networks of different types that allow greater rationalization of the resources used and better collaboration between the research labs and the researchers involved on common topics.

- This approach reduces the possible waste of resources caused either by a too strong overlap of skills or by a strong complementarity between the various activities which, however, fail to be effective without a fruitful and structured collaboration.

- The network is made up of **nodes**, where a node can be both **INFN** and **external**, even **international**.

Compared to the strategic projects of the past…

- How do they look like? The activities that are part of a network concentrate around some ***common knowledge.***
- How do they differ? They have a ***geographic distribution***, sometimes even very wide, and may also ***include very different realities*** such as consortia, companies, other entities and also make technology transfer within the network itself to increase the skills of some research groups.
- Advantages? ***Increased and aware knowledge***, greater ability to do *collaborative research*, participate in calls as a large community and not as individual groups, make more *service contracts* due to the increase in equipment and, above all, the increase in ***external visibility*** of our research.

The Competence Network

- They were borne in:
  - Technology Transfer Committee

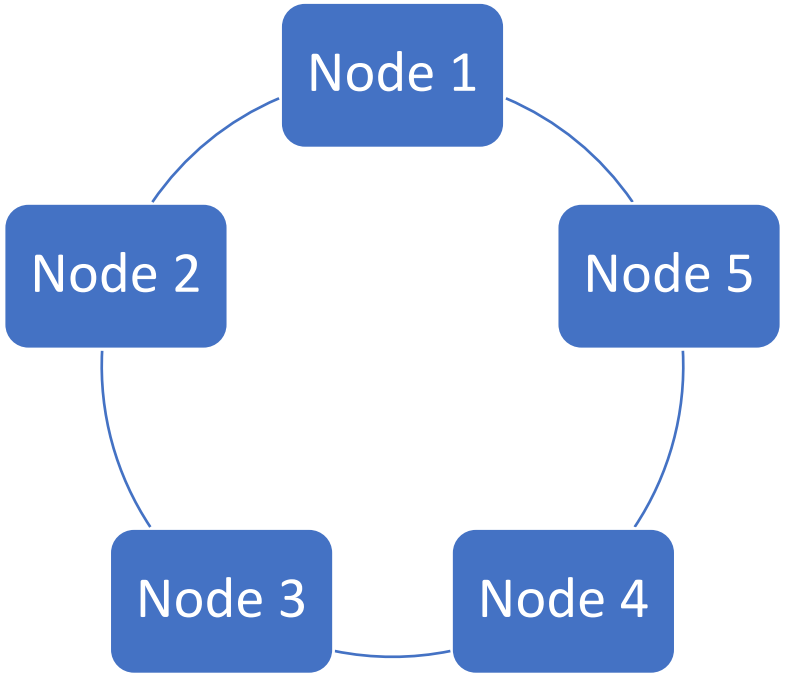
- They are supported mainly by:
  - National Scientific Committee 5 ***for R&D funding and to find scientific and technological skills***
  - External calls (POR, PON, Competitive tenders, etc.) ***for external financing and skills***
  - Consortia, ATS, etc. ***to be part of it and / or find external skills***

- They make use of:
  - Conventions, Agreements, etc. ***to include new nodes***
  - Technology Transfer Committee (CNTT) **for orientation and consolidation**

The types of INFN Competence Network

The types of Competence Networks identified at the moment are summarized in ***three different configurations.*** A general description of the approaches of each of these will be presented later on, the names given to the individual networks are purely indicative and do not fully represent the identity of the network:

- Networks with *geographically distributed nodes*
- Networks with *complementary nodes*
- Networks with *thematic nodes*

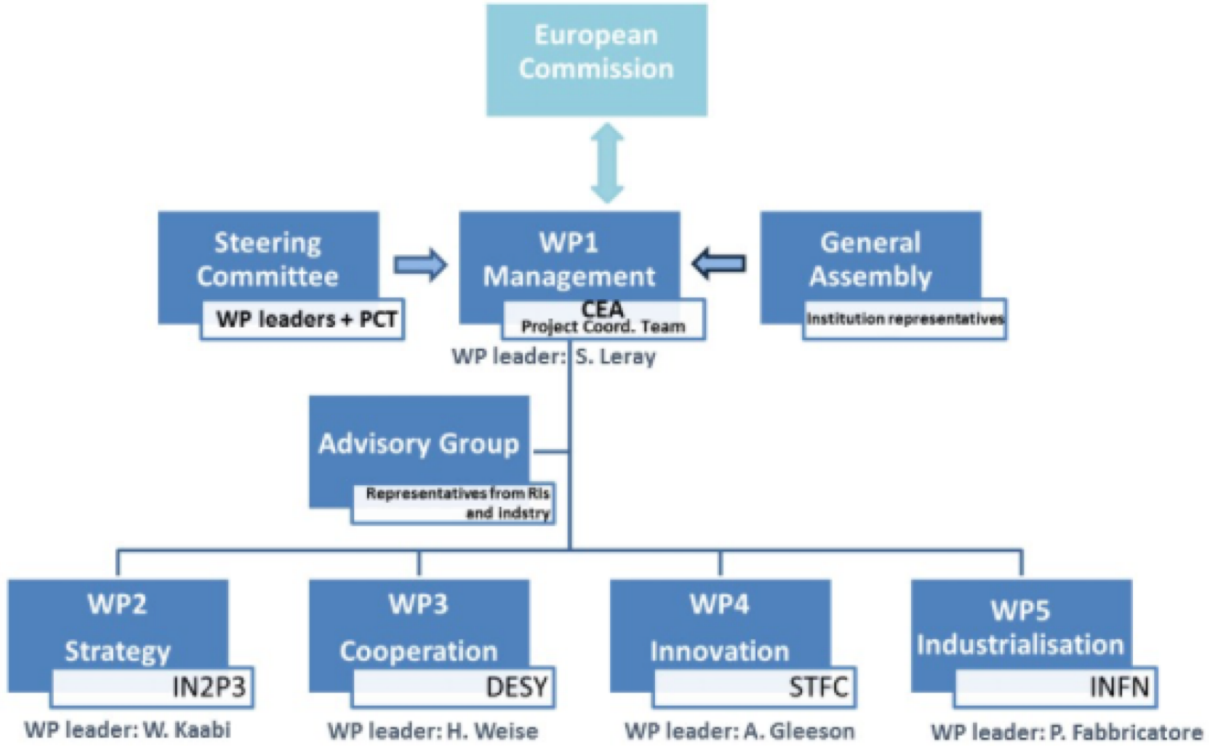


Active or identified to date netwoks

- **CH-Net** **Cultural Heritage Network UP AND RUNNING**
- **RADnet** **Irradiation Facility Network UP AND RUNNING (ASI-INFN → ASIF)**
- **FISMED** **Medical Physiscs Network IN DISCUSSION**
- **ENV-Net** **Environmental conservation and climate-related technologies UNDER STUDY**
- **…….**

- Many other issues (for example **Superconductivity**) could take advantage of this model which includes Research & Development plus enhancement.

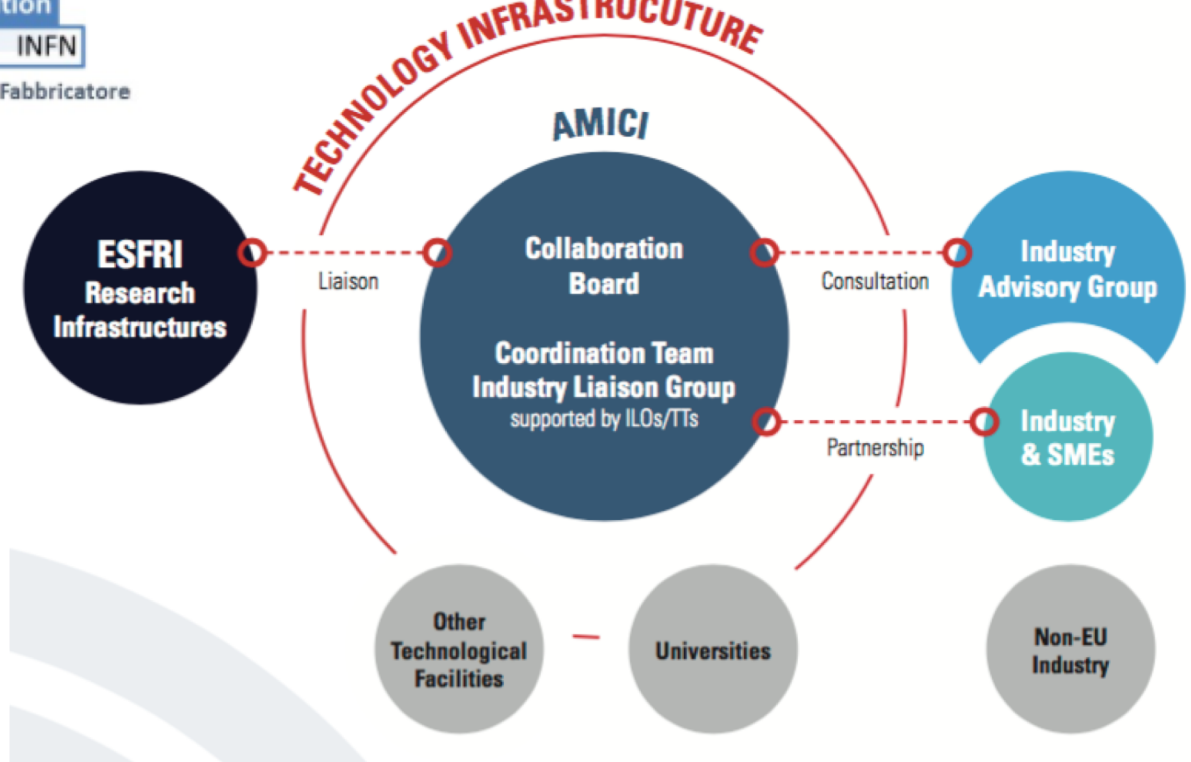
  - **AccTeCo** (INFN, Accelerator Technology Coordination)
  - **AMICI** (EU, **A**ccelerator and **M**agnet **I**nfrastructure for **C**ooperation and **I**nnovation)



CERN · cea · cnrs · DESY · INFN · KIT Karlsruher Institut für Technologie · PAUL SCHERRER INSTITUT PSI · Science & Technology Facilities Council · UPPSALA UNIVERSITET

AMICI

ACCELERATOR AND MAGNET INFRASTRUCTURE FOR COOPERATION AND INNOVATION



Networks with geographically distributed nodes

- The network is made up of ***nodes distributed over the national territory*** whose competences are partially superimposed. In practice, in each network node there is a general competence on the topic dealt with by the network, but not in all the nodes there are all the specific skills necessary to represent the global intervention capacity of the network and its potential.

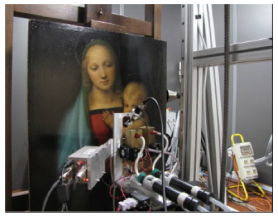
- The advantages of this network lie in the fact that, on the one hand, a strong synergy is created between nodes who have skills on a specific topic thus promoting a fruitful exchange of information and ensuring a global growth of the skills and intervention capacity of the network. On the other hand, a network configured in this way ***allows to respond to both local and national needs*** in an extended and more effective, as well as efficient way.

- In addition to this, in the case of activities involving ***participation in competitive calls***, the network is able to organize a more complete, organic and structured response by combining the aspects of territorial capillarity with those of greater availability of qualified people and usable technologies.

Why a network for cultural heritage?

- Scientific disciplines play a crucial role in:
  - ✓ knowledge of the artworks and their «state of health»;
  - ✓ conservation and restoration.

- Physics today plays a dominant role in the first field, that of diagnostics, mainly thanks to the non-invasive character of the great majority of physical techniques.
- The use of particle accelerators for analysis of artworks and dating of archaeological finds is widespread.



Tecnologie per i Beni Culturali

Analisi elementali e/o composizionali sia in laboratorio che in situ

- ✓ (μ)XRF/(μ)XRD
- ✓ (μ)Raman
- ✓ Spettrofotometria

Analisi con acceleratore

- ✓ Pixe/Pige/BS/RBS
- ✓ Ionoluminescenza

Datazioni

- ✓ Radiocarbonio (AMS)
- ✓ Termolumninescenza (TL/OSL)

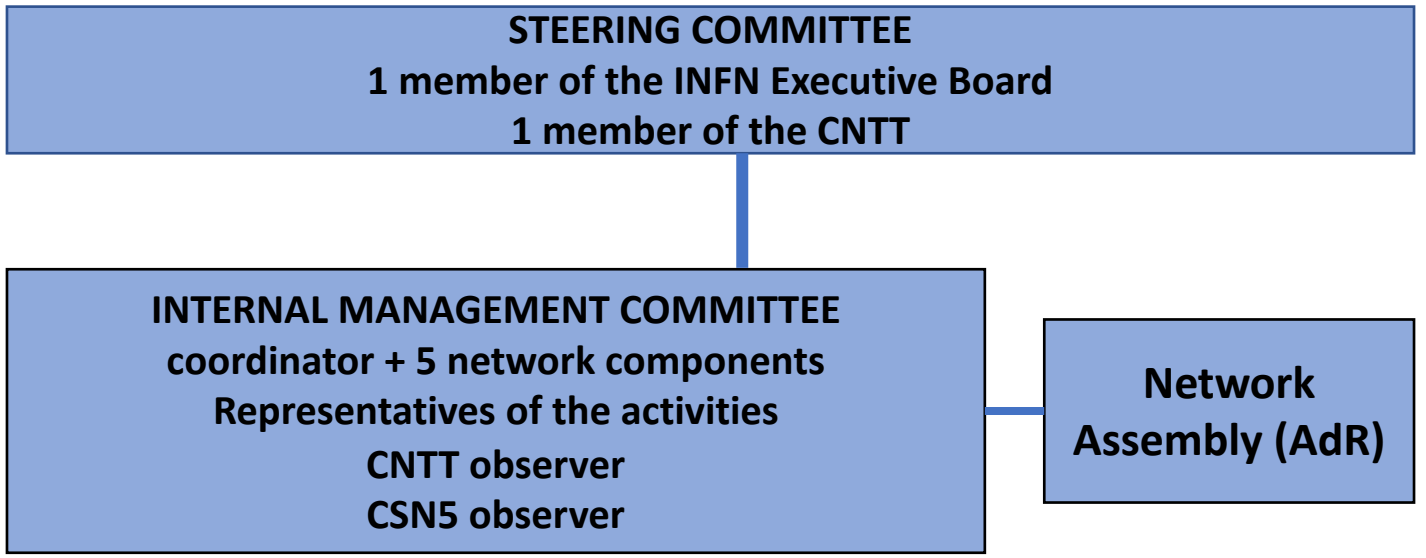
Imaging Tomografico

✓ Indagini microtomografiche in laboratorio con risoluzione spaziale massima dell'ordine di 10 μm e indagini tomografiche, sia in laboratorio che in situ, con raggi X di energia massima 200 keV

CHNet (Cultural Heritage Network)

A typical example of a network with a geographical value is represented by ***CHNet (Cultural Heritage Network)***. The governance structure guarantees centralized network management, ensuring in any case sufficient autonomy for the local nodes in their action on the territory to which they refer.

Supervise the correct operation of the network and gives general guidelines to the Coordinator. Every year the Committee receives the Work Program, the final budget and the Report of the activities carried out.



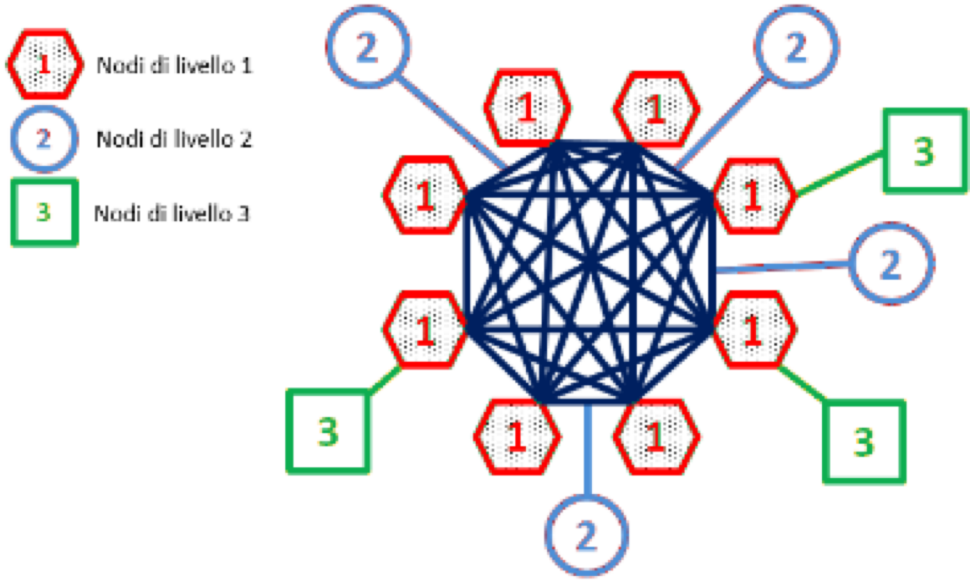
Oversees network operation

The Network Assembly is made up of all the Referents of the nodes and meets at least once a year convened and chaired by the Coordinator.

CHNet structure

CHNet was formalized on July 2017

1st level nodes:
INFN Units

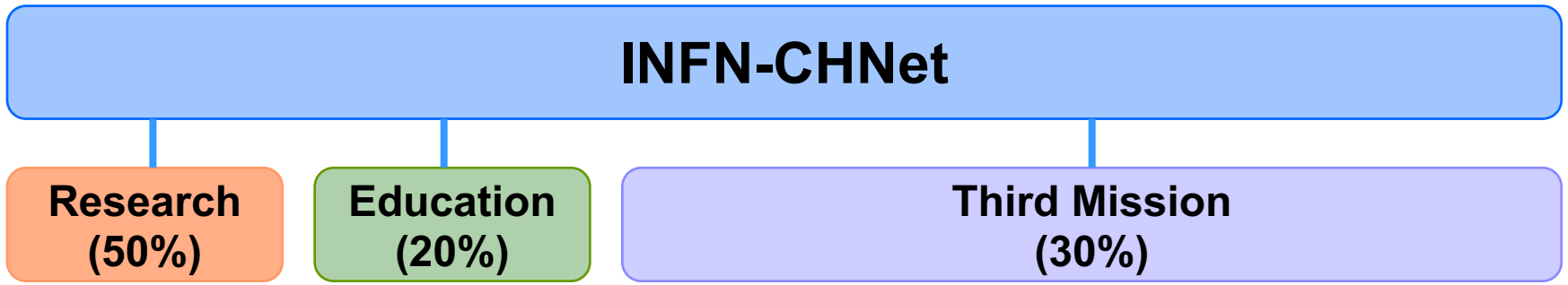


2nd level nodes:
Universities, Restoration Centers, Associations with complementary skills to those available at INFN.

3rd level nodes:
Extra_EU Universities and Research centers

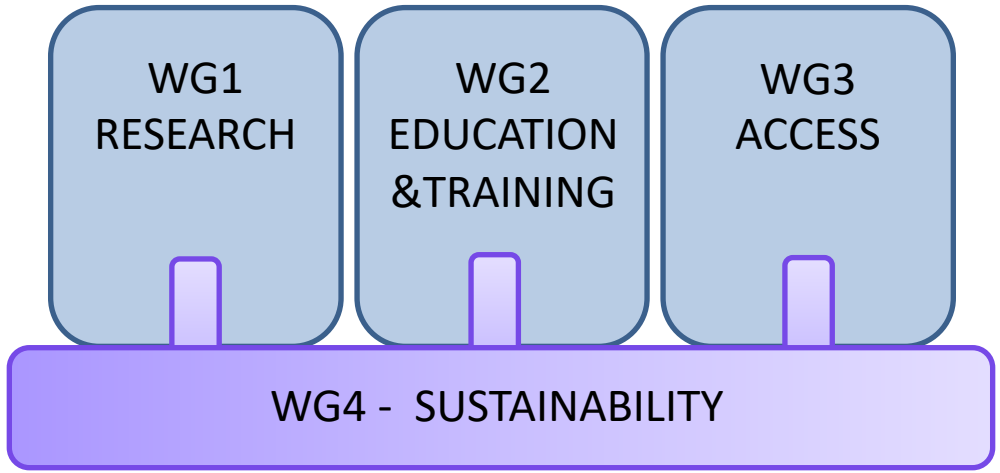
Level 3 nodes are encouraged to build subnets in their country

Activities



3 working groups that coordinate the activities of the network

CHNet working groups



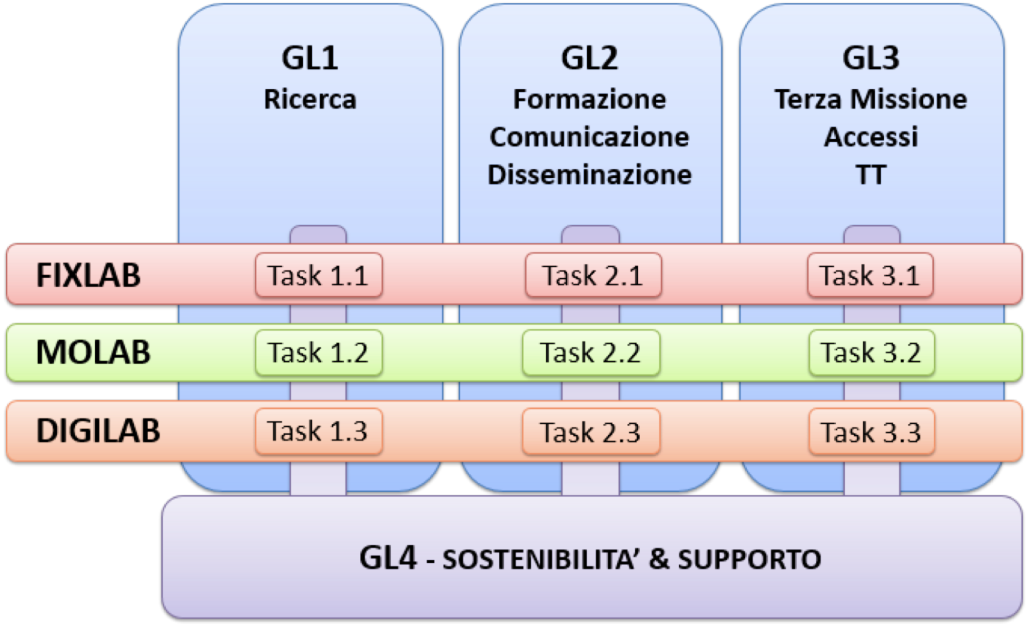
Research Infrastructure
→ Fixed, mobile and digital laboratories

INFN-CHNet works in synergy with TT

Reasearch Infrastructure

- Following the standard scheme used by the European infrastructures that provides access, the network is organized into three platforms:

  - **FIXLAB:** platform equipped with instrumentation for laboratory analyzes;
  - **MOLAB:** platform equipped with instrumentation for in situ analysis;
  - **DIGILAB:** platform equipped with storage services for data acquired from the FIXLAB and MOLAB platforms and services for the use of such data.



Fixed Labs

Medium-large scale facilities (IBA, ^{14}C, ...)

TL dating

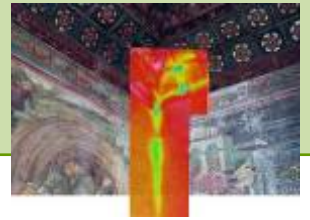
X-ray imaging

Mass Spectrometry

X-ray imaging

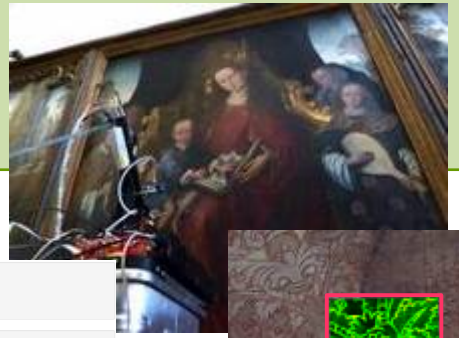
Mobile Labs

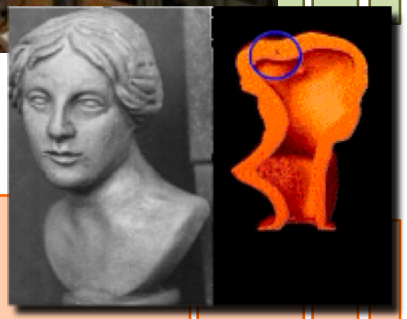
Thermography



XRD

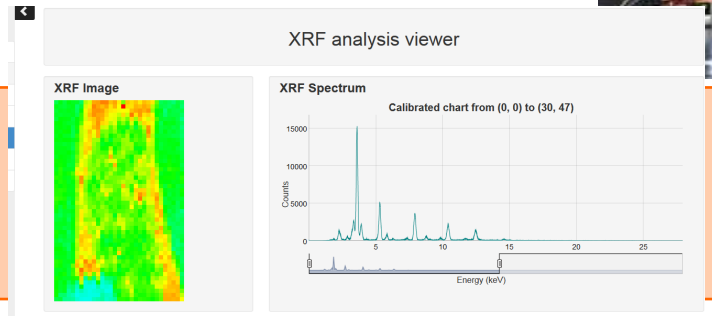
XRF





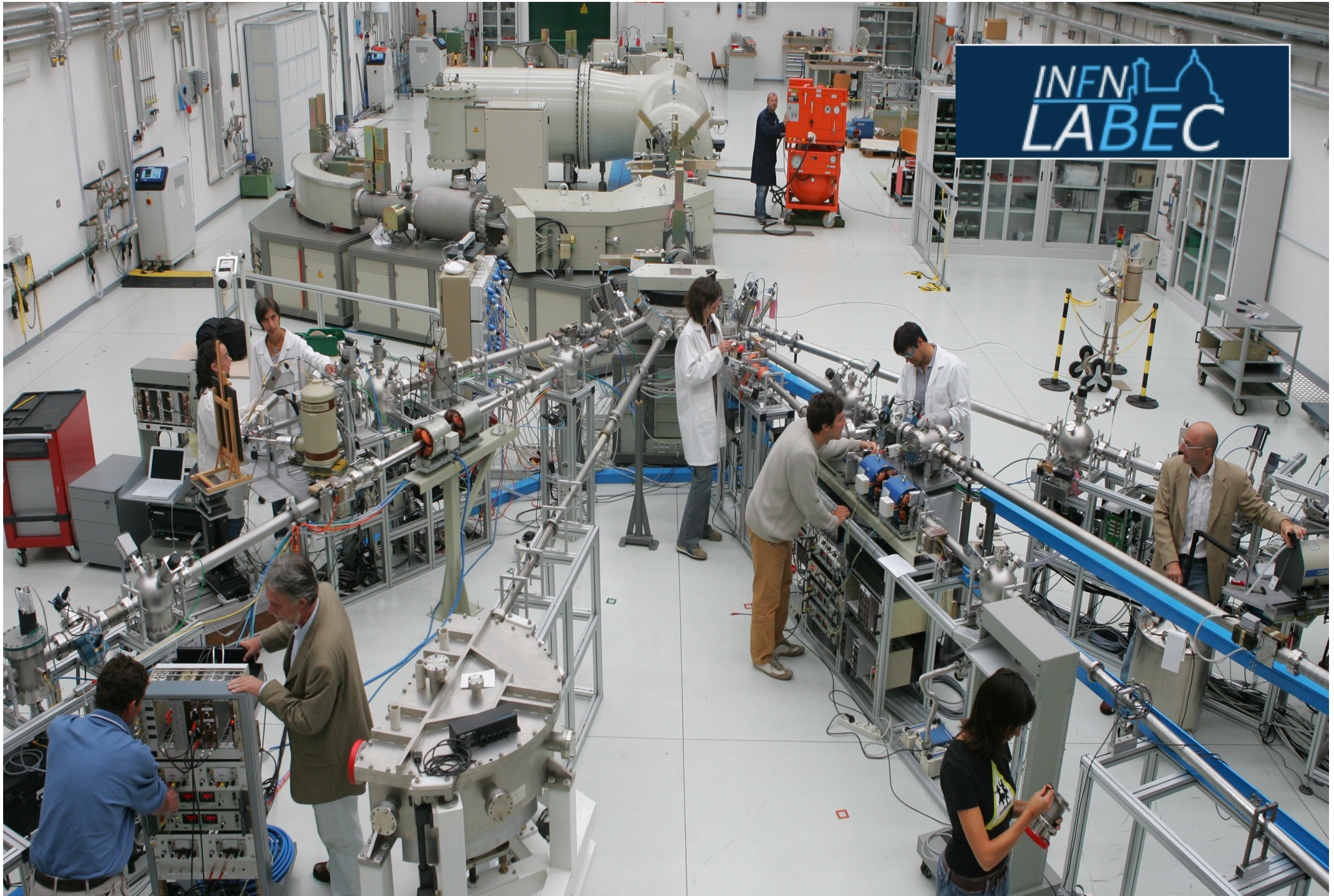
Digital Labs

Web tools for data fruition



Data Storage and fruition

Laboratorio di Tecniche Nucleari Applicate ai Beni Culturali



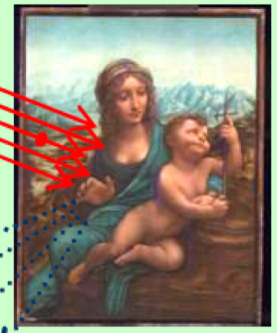
Ion Beam Analysis per i Beni Culturali

Tecniche di Ion Beam Analysis (IBA)

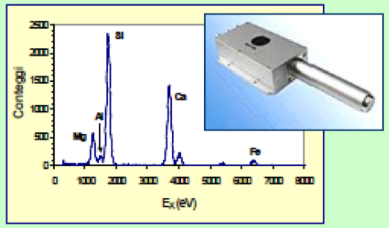
Le tecniche IBA consentono di analizzare la composizione di un materiale, utilizzandolo come bersaglio per un fascio di particelle cariche prodotte da un acceleratore (tipicamente protoni). In seguito all'interazione con le particelle del fascio, gli atomi e i nuclei del materiale emettono radiazione di energia caratteristica della specie atomica o isotopica. Rivelando quindi tale radiazione, è possibile riconoscere e quantificare gli elementi presenti nel materiale, cioè determinarne la composizione.

Acceleratore di particelle

Fascio di particelle



Rivelazione della radiazione e analisi in energia



Radiazione di energia caratteristica (raggi X, raggi gamma, particelle…)

Perchè è utile l'analisi dei materiali in campo archeometrico?

Conoscere la composizione dei materiali di un'opera d'arte o di interesse storico è fondamentale, per diversi scopi:

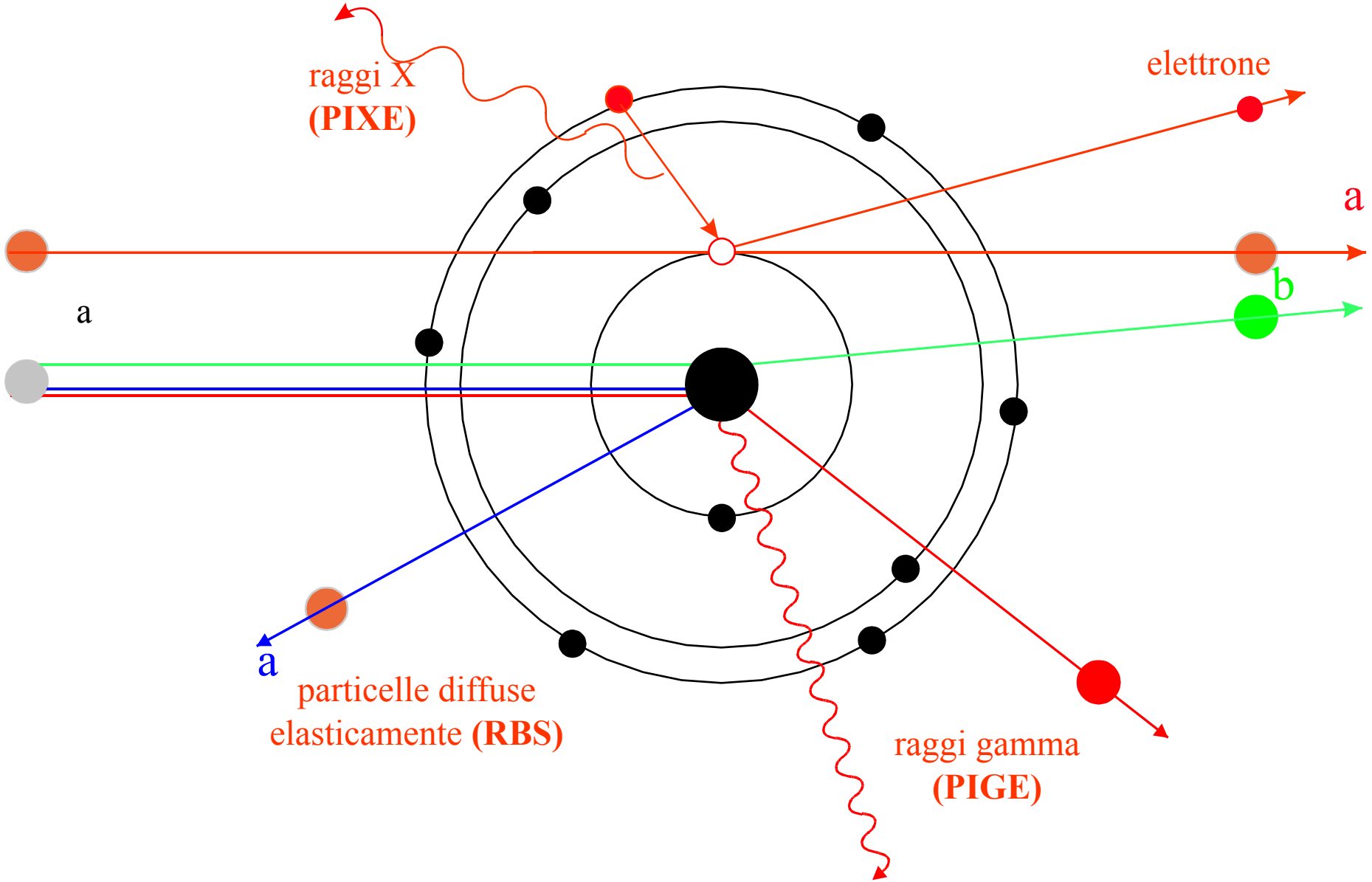
"conoscere per sapere":

- ricavare informazioni su una singola opera, conoscere le tecniche specifiche impiegate da un artista
- effettuare datazioni indirette, attribuzioni, autenticazioni (o scoperta di falsi)
- ricavare informazioni storiche per ricostruire le tecnologie disponibili nei tempi passati, le fonti di approvvigionamento delle materie prime, gli scambi economici e culturali fra diverse popolazioni…

"conoscere per intervenire":

- controllare i processi di degrado
- aiutare gli esperti nella scelta di tecniche e materiali di restauro compatibili e reversibili, e di appropriate condizioni di conservazione

Ion Beam Analysis

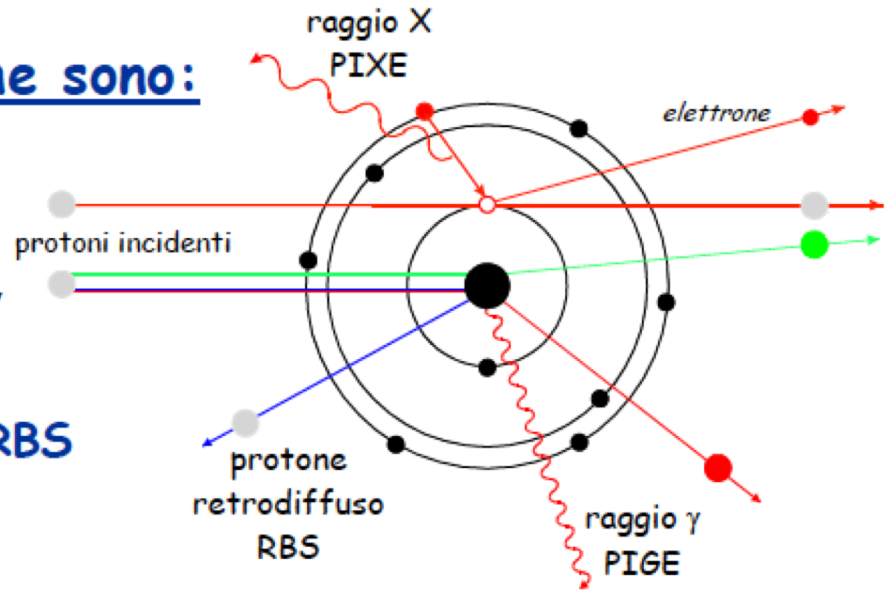


All'interno delle IBA si distinguono varie tecniche, che sfruttano per l'analisi diversi tipi di radiazione indotta da diversi processi fisici.

Le tecniche IBA più utilizzate per analisi archeometriche sono:

- ✓ **PIXE** (Particle Induced X-ray Emission) → si rivelano i raggi X emessi dagli atomi
- ✓ **PIGE** (Particle Induced Gamma-ray Emission) → si rivelano i raggi γ emessi dai nuclei

In alcuni casi possono aggiungere informazioni utili anche le tecniche **RBS** (Rutherford Backscattering Spectrometry → si rivelano le particelle incidenti "retrodiffuse" dai nuclei) e **IBIL** (Ion Beam Induced Luminescence →si rivela radiazione emessa nel visibile).



- L' analisi è tipicamente "in esterno": può essere realizzata estraendo il fascio dalle linee di vuoto in aria, permettendo di mantenere quindi il campione da analizzare in atmosfera.
- Il fascio esterno e la possibilità di usare correnti di fascio estremamente basse, le rende tecniche totalmente **non invasive e non distruttive** → consentono l'analisi di un'opera d'arte senza effettuare prelievi e senza arrecare alcun danno.

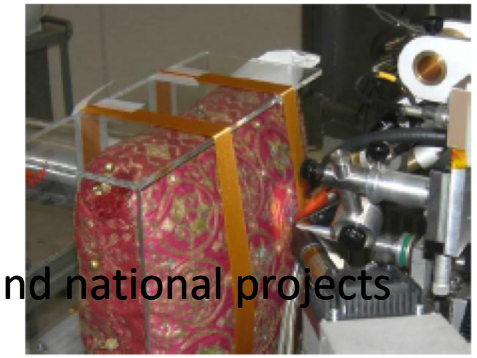
Per quali materiali e manufatti sono utili le IBA?

Dipinti su tavola e tela

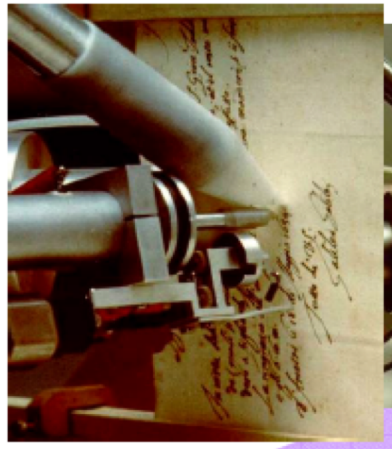
Ecco qualche esempio di opere analizzate al LABEC…

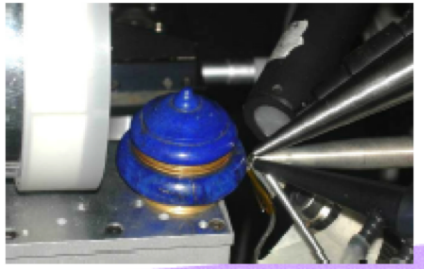
Disegni su carta preparata

Filati "metallici"



Inchiostri e miniature in antichi manoscritti e documenti storici





Manufatti in pietre dure

Tessere musive di pasta vitrea

Regional and national projects

INFN - Sezione di Firenze
Via Bruno Rossi 1
50019 Sesto Fiorentino (Fi)

INFN-CHNet : regional and national projects

RESEARCH ACTIVITIES

REGIONAL PROJECTS:	ADAMO MUSA ECODIGIT ANAGRAFE	Regione Lazio	Total funds : 945 k
	SAX NEXTO	Regione Piemonte	
	AFTTER	Regione Toscana	
NATIONAL PROJECTS:	MACHINA		Total funds : 1.77 M

INFN-CHNet- EU projects

RESEARCH ACTIVITIES

ARIADNE plus

Creation of a digital platform for the integration of archaeological datasets, including datasets from scientific campaigns.

2019-2022 > 60 kє

Coordination of national Open Science efforts across Austria, Belgium, France, Germany and Italy, ensuring their readiness for the implementation of the European Open Science Cloud (EOSC). CHNet participates with datasets from diagnostics on cultural heritage

2019-2022 ~ 90 kє

IPERION HS

E-RIHS
EUROPEAN RESEARCH INFRASTRUCTURE
FOR HERITAGE SCIENCE

Extension of IPERION CH project, supports research on heritage interpretation, preservation, documentation and management.

2020-2022 ~ 90 kє

1 EU project will be submitted next November

Education: Training Camps, Masterclasses & Games

EDUCATION ACTIVITIES

Training Camps

One-week summer schools on non-destructive in-situ diagnostic techniques on cultural heritage, organisation led by INFN in the framework of E-RIHS.it infrastructure

Target: bachelor or master degree graduated in science or humanities applied to cultural heritage, and restorers

Masterclasses “Physics in Art”

One day lessons/laboratories on specific diagnostic techniques in at least two different CHNet nodes, with a call to compare results and share ideas

Target: high school classes

Games

Acceleropoly: play to bring the proton on your sample along a particle accelerator

How old is it? : play to find out the age of your archaeological find through radiocarbon dating

Target: primary school classes

Education: Training Camps

E-RIHS.it
EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

EDUCATION ACTIVITIES

One-week Summer Schools on non-destructive in-situ Diagnostic techniques on Cultural Heritage, organisation led by INFN

Target: bachelor or master degree graduated in science or humanities applied to cultural heritage, and restorers

- Publication of a call
- Selection of about **20-30 participants**
- Laboratories **in small groups** (5-6 p) on selected artworks, with different techniques and together with researchers of ENEA, INFN, CNR and restorers of OPD

A fee is required to cover only part of the accommodation cost; the rest is covered by the MIUR

Multidisciplinary, small groups
Hands on instrumentation and artworks

(satisfaction questionnaire: **approval rating 8.5/10**)

Education: Training Camps

E-RIHS.it
EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

EDUCATION ACTIVITIES

SANSEPOLCRO (AR) 2014

L'AQUILA 2015

SIRACUSA 2016

ALGHERO (SS) 2017

GIOIA DEL COLLE (BA) 2018

CHNet: outcome 2019 (first semester)

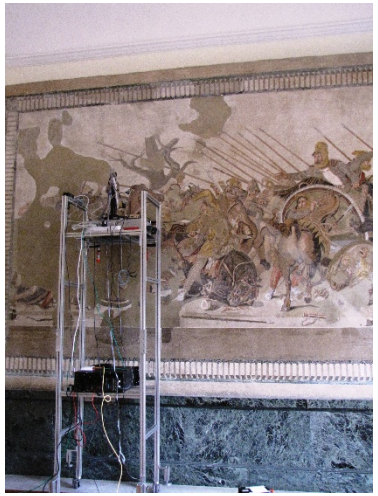
Theses: 24

First degree: 16

Master degree: 8

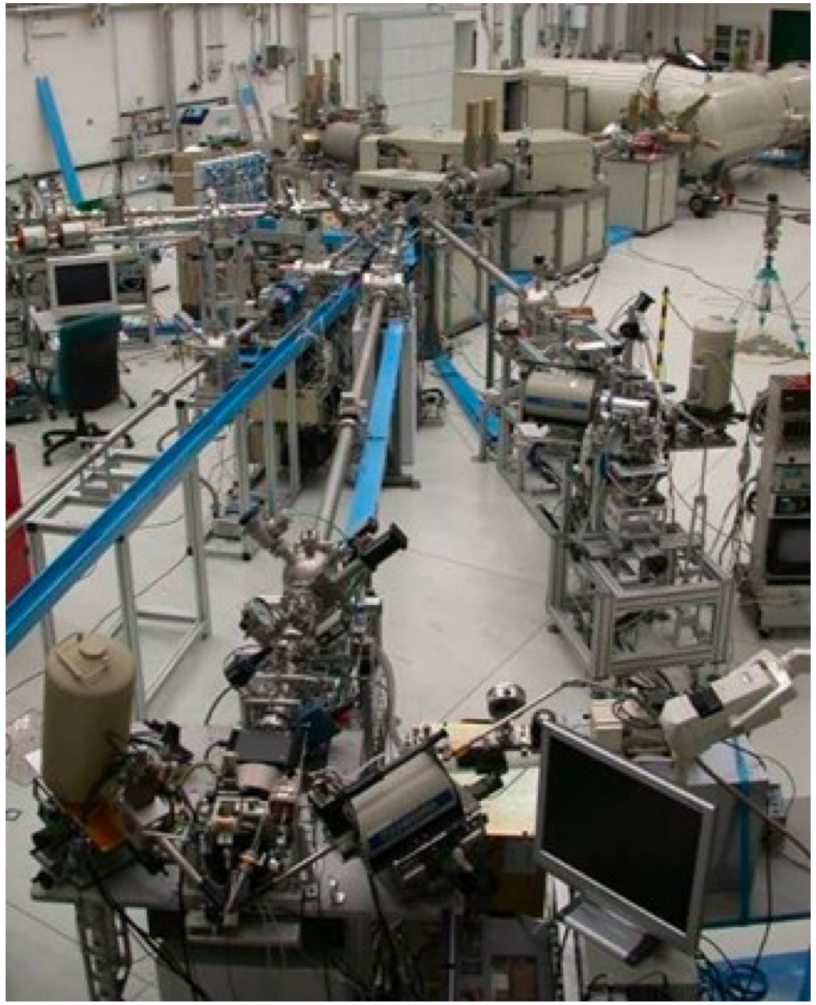
9 services for private companies
(+5 in progress)

30
accesses to the network instrumentation

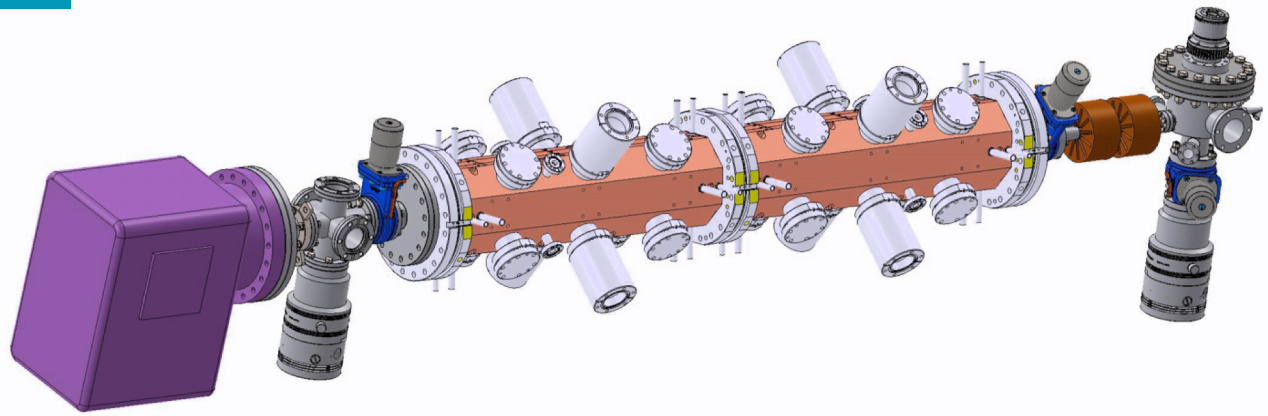


36 publications (ISI)

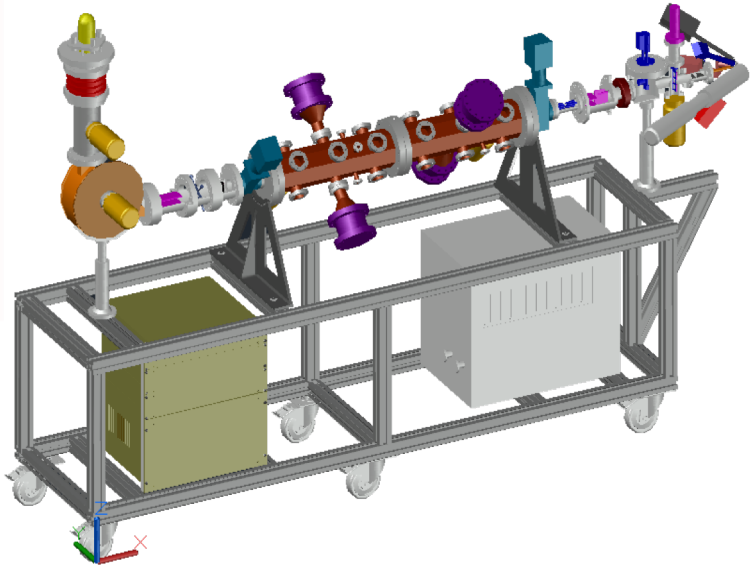
MOVABLE ACCELERATOR: MISSION IMPOSSIBILE?



MACHINA: HOW WE ARE DOING IT?



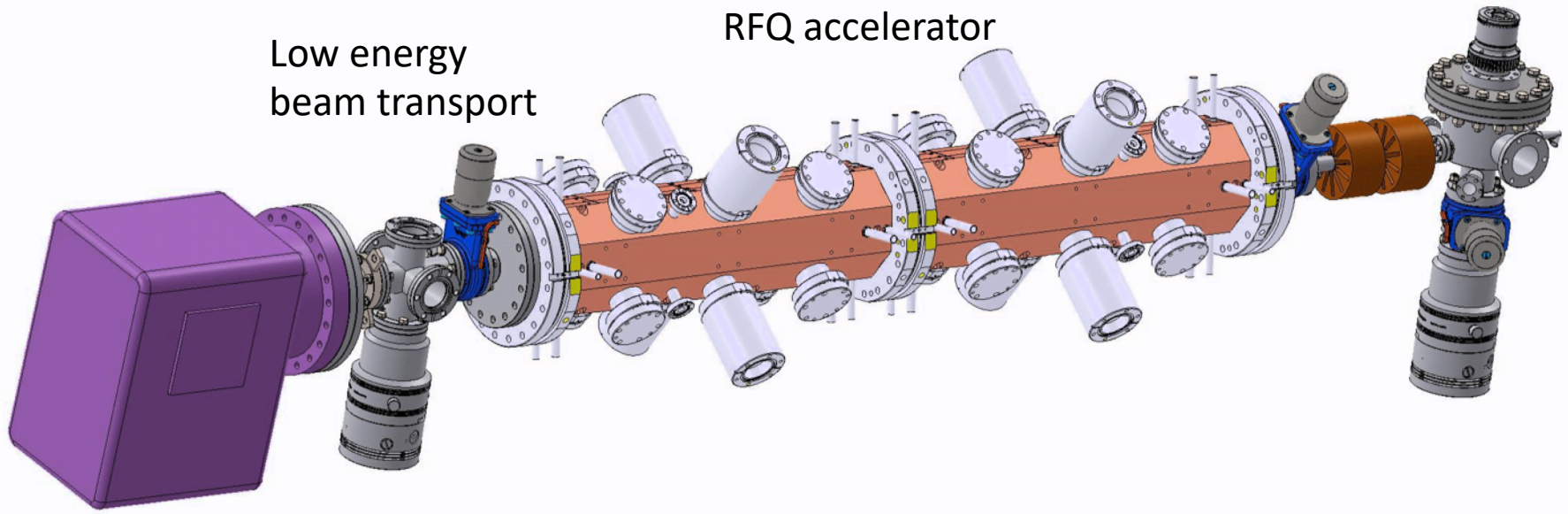
Radio-Frequency Quadrupole



Compact, transportable accelerator

INFN: L. Giuntini, L. Castelli, G. Calzolai, M. Chiari, C. Czelusniak, M.E. Fedi, M. Manetti, L. Palla and F. Taccetti;
CERN: G. Anelli, S. Atieh, A. Bilton, A. Grudiev, A. Lombardi, E. Montesinos, M. Timmins, M. Vretenar and S. Mathot.

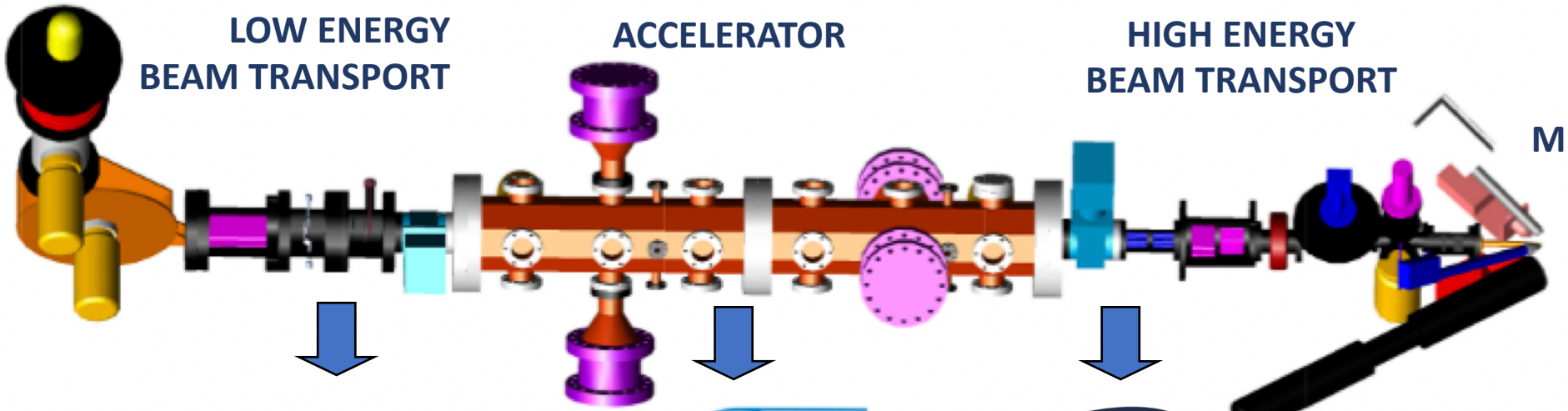
MACHINA: HOW WE ARE DOING IT?



- Accelerator: RFQ for protons, two modules, each of 1 MeV
- Direct coupling of the ion source (a RF source) to the RFQ
- Very compact (overall length < 2.5 m)

- THE SYSTEM IS **MODULAR**. FURTHER 1 MeV MODULES MIGHT BE ADDED IN THE FUTURE

MACHINA: HOW WE ARE DOING IT?



- POWER SUPPLY
- VACUUM SYSTEM
- MACHINA CONTROL SYSTEM
- INTERLOCK MANAGEMENT
- RADIO SAFETY
- COOLING SYSTEM

TESTS ON CULTURAL HERITAGE OBJECTS

MACHINA: WHEN?

The project was launched at mid-2017, funded at the beginning of 2018, aiming at being concluded in a couple of years.

Prototype in operation this year.

STAY TUNED!

http://chnet.infn.it/en/home-3/

THE FIRST APPLICATION OF MACHINA IS EXPECTED AT THE END OF 2020 FOR THE STUDY OF AN IMPORTANT MASTERPIECE AT THE OPIFCIO DELLE PIETRE DURE IN FLORENCE

Networks with complementary nodes

- The network is made up of nodes that have specific skills that are almost completely non-overlapping but as a system guarantee an effective response to well-identified issues. Within the nodes, the level of specialization is particularly high, ensuring a very effective and very high level response. In many cases the competences of the individual nodes are unique both at national and international level.

- The advantages of this network are connected to the complementarity that the individual nodes can express. In this case ***the answer that the network is able to provide goes far beyond what the single node could do***. The global response capacity in relation to specific issues allows the network to offer itself in wider areas and to guarantee a higher level of intervention on specific issues.

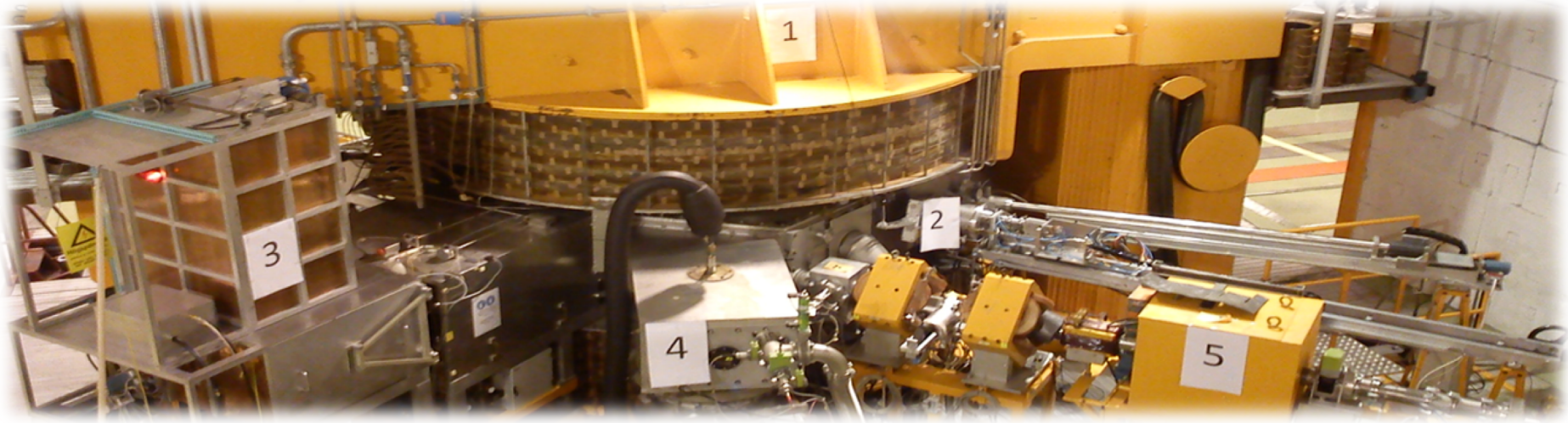
RadNet

An INFN network of national facilities to measure the resistance to radiation damage of electronic devices and systems

D.Bisello, CNTT, 22 aprile 2015

INFN interest : validation of electronics and detectors

- In the next years there will be a large activity to validate the electronics for the HL-LHC experiments.
- INFN has the accelerators to do so in the national Labs.
- Worldwide there is a general lack of such centers (In EU only 3 certified labs are ok for ESA : Louvain, PSI and Jyväskylä).
- The Space Agencies (ASI in Italy) and the companies interested in space missions are continuosly looking at qualified irradiation centers.



Single Event Effects: not only in space or colliders

SEE concerns for electronics used in:

- **Aerospace**
  - Satellites
  - Civilian and military aircraft
- **Medical**
  - Implanted electronic devices (pacemakers, defibrillators…)
- **Nuclear Industry**
  - Instrumentation and control in proximity to reactors
- **Transport**
  - Electronics in cars and trains
  - Signalling and traffic control networks
- **IT Networks and Telecommunication…**

What can we offer?

- Gamma sources, X-Ray sources
- Electron beams at BTF
- Proton beams (100 keV to 230 MeV)
- Ion beams
- In future also neutrons (also high energy with the phase δ of SPES)
- Excellent groups studying radiation damage (Bergamo/Pavia, Padova, al.)

In addition, in the field of gamma sources and neutrons from reactors, there is a consolidated experience at ENEA.

Other possible partecipating INFN Labs

- LABEC Firenze: protons/ions (3 MV)
- TIFPA Trento: protons < 230 MeV
- CNAO: protons < 240 Mev, C > 400 MeV/amu
- Napoli (Univ.): protons/ions(3 MV)
- LENA (Pavia): neutrons from reactor


CNAO synchrotron (Pavia)

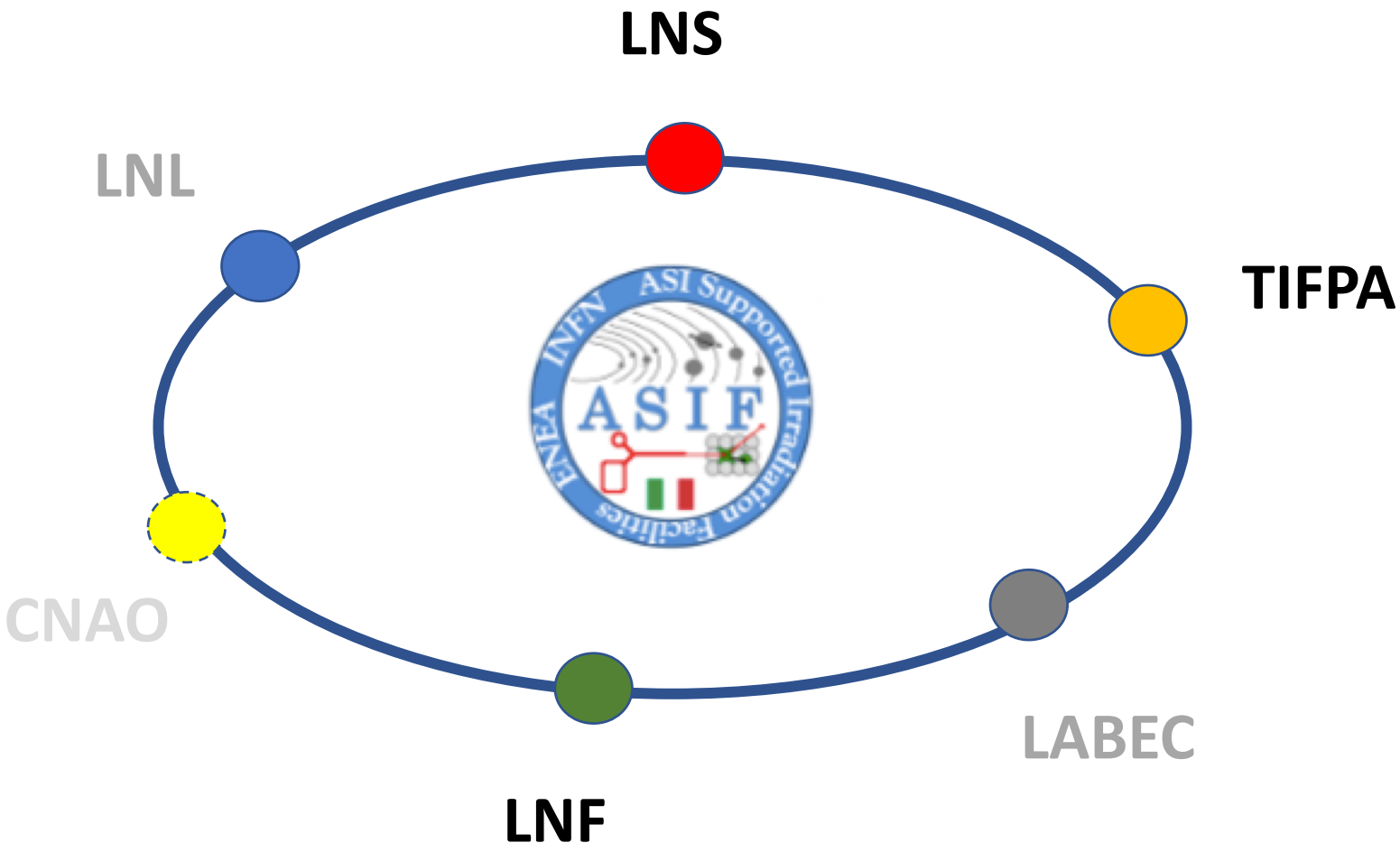
D.Bisello/INFN PD

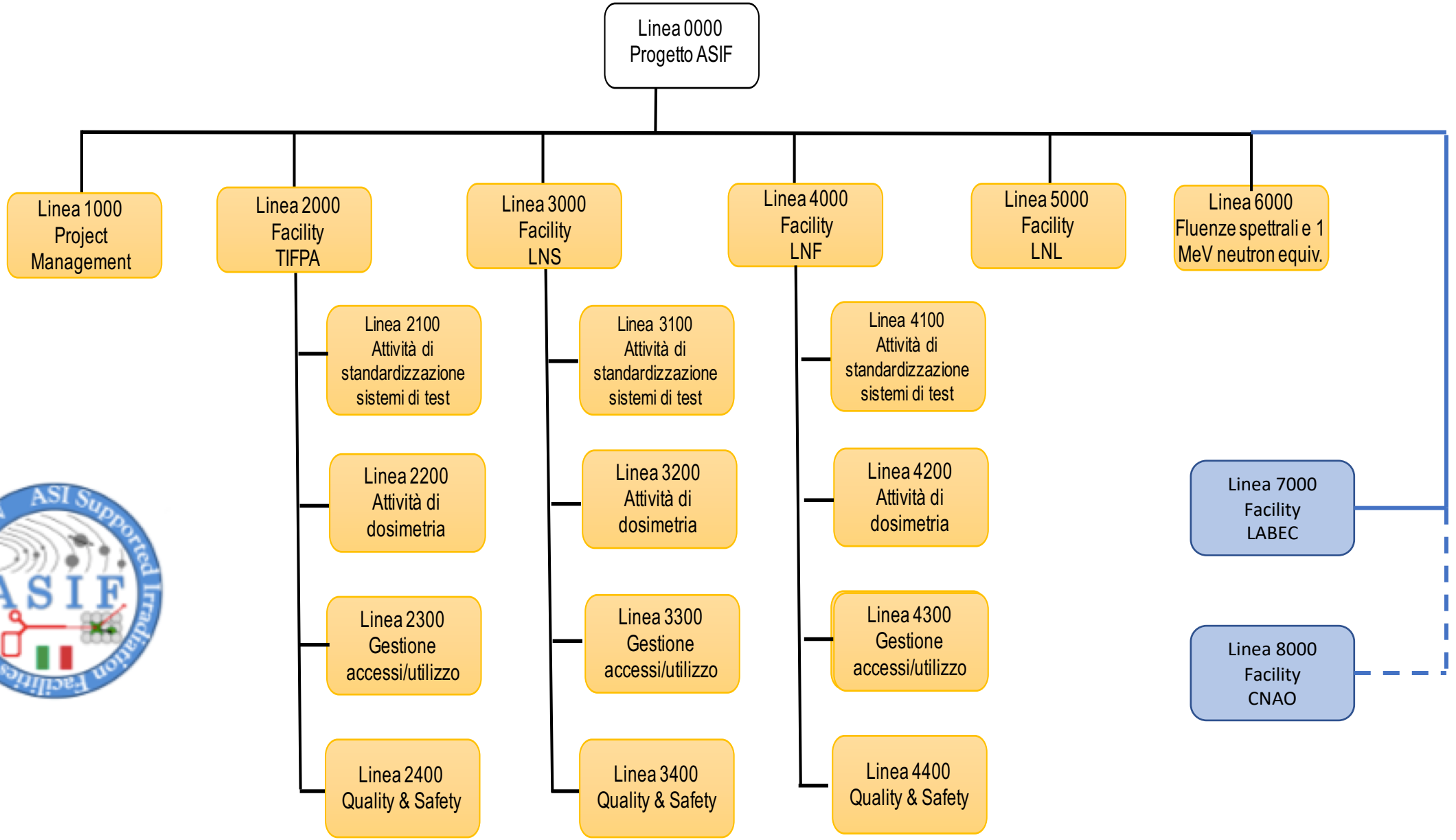
ASIF : Rete con nodi a competenza complementare

- **ASIF** è la rete connessa allo **studio e alla validazione della componentistica per le missioni spaziali**. In questo caso le aziende aerospaziali sono interessate a effettuare test di altissimo livello tecnologico sulla loro componentistica utilizzando fasci di particelle che possano simulare le condizioni presenti nello spazio profondo.

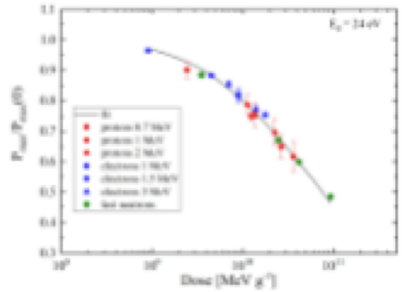
- Nei laboratori INFN esistono macchine acceleratrici in grado di fornire tutte le risposte possibili grazie alla varietà dei fasci disponibili a varie energie.

- Dall'unione di tutte queste competenze, molto specifiche e di elevatissimo livello internazionale, la rete trae una forza di intervento sulle tematiche spaziali che non ha eguali sicuramente in Italia ma che pochi altri possono esprimere al mondo.


LNS
LNL
TIFPA
CNAO
LABEC
LNF
ASIF
INFN
ENEA
ASI Supported Irradiation Facilities


Linea 0000
Progetto ASIF
Linea 1000
Project
Management
Linea 2000
Facility
TIFPA
Linea 3000
Facility
LNS
Linea 4000
Facility
LNF
Linea 5000
Facility
LNL
Linea 6000
Fluenze spettrali e 1
MeV neutron equiv.
Linea 2100
Attività di
standardizzazione
sistemi di test
Linea 2200
Attività di
dosimetria
Linea 2300
Gestione
accessi/utilizzo
Linea 2400
Quality & Safety
Linea 3100
Attività di
standardizzazione
sistemi di test
Linea 3200
Attività di
dosimetria
Linea 3300
Gestione
accessi/utilizzo
Linea 3400
Quality & Safety
Linea 4100
Attività di
standardizzazione
sistemi di test
Linea 4200
Attività di
dosimetria
Linea 4300
Gestione
accessi/utilizzo
Linea 4400
Quality & Safety
Linea 7000
Facility
LABEC
Linea 8000
Facility
CNAO

ASIF
ASI Supported Irradiation Facilities
ASI-ENEA-INFN agreement
(version 2.4.1)



website search

Search ...

asif website

- home
- about asif
- methodologies and characterization of asif facilities
- space radiation environment
- sr-niel physics handbook
- website history
- latest news

asif beam request and gateway

Currently, the ASIF gateway is still not operational.
Beam requests can be submitted using the following email addresses:

- to ENEA-Calliope, calliope.asif@enea.it
- to ENEA-Tapiro, tapiro.asif@enea.it
- to ENEA-Triga, triga.asif@enea.it
- to ENEA-FNG, fng.asif@enea.it

- to INFN-LNS, asif_lns@lists.lns.infn.it

- for all other facilities, asif@mib.infn.it

visitors from september 3, 2018

Today	131
Week	214
Month	416
Total	30983

Who Is Online

1

Online

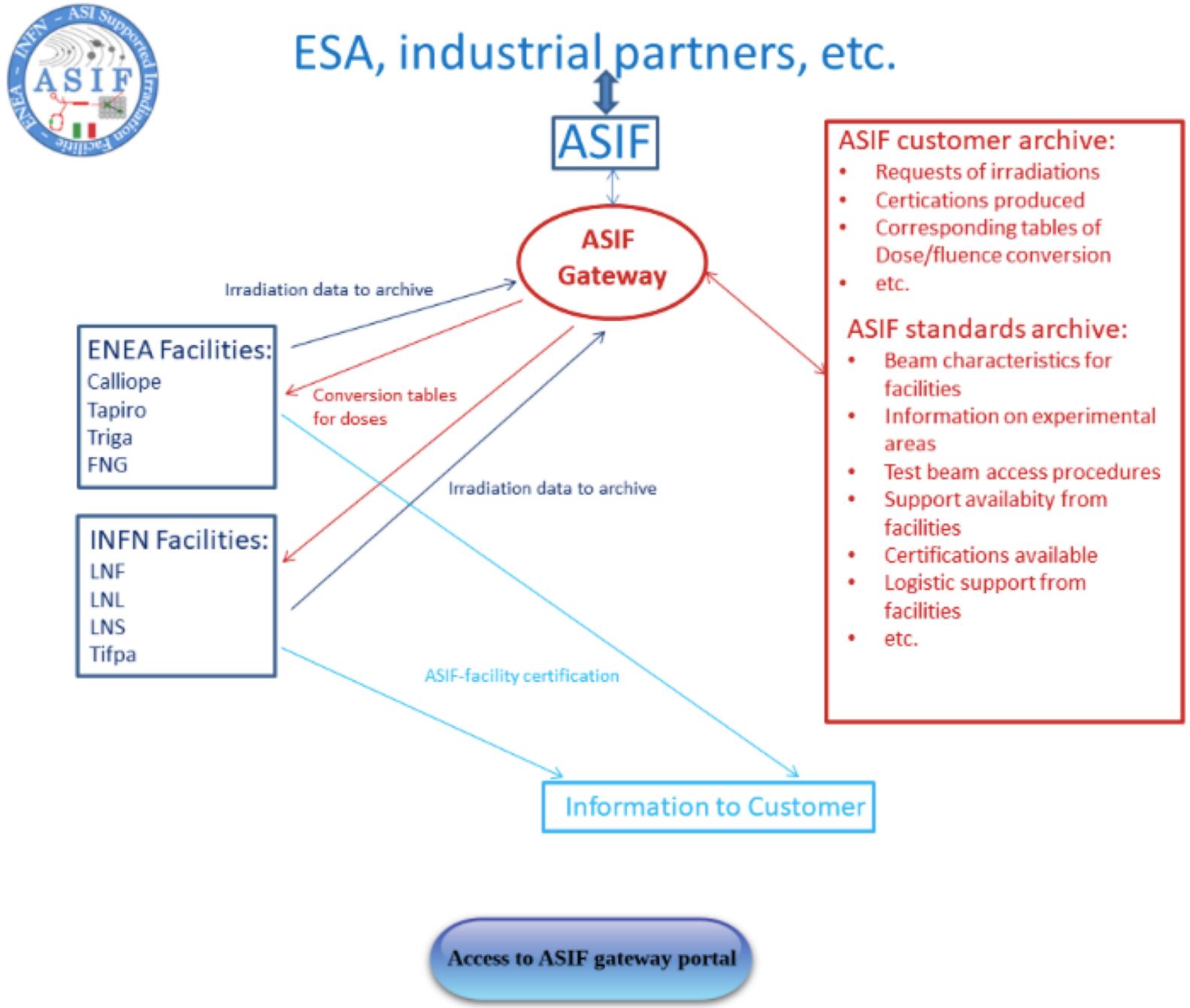
news

TNID calculator for neutrons

TID converter for protons and ions

related links

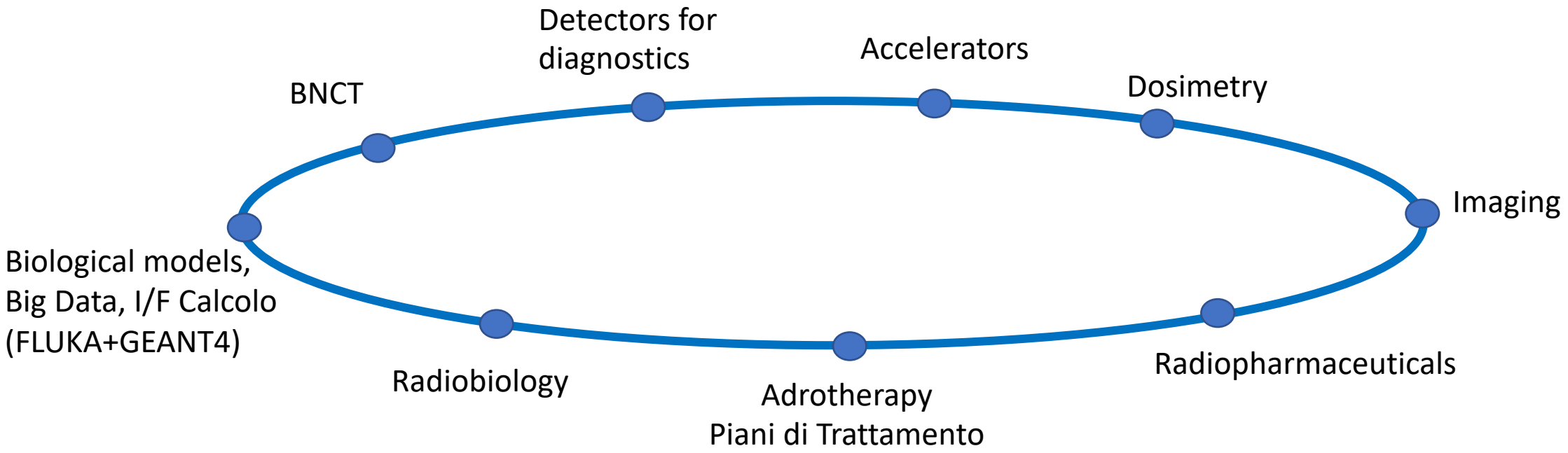
- ESCC radiation tools
- sr-niel website
- ESCC radiation standards and guidelines
- ESCC-CTB
- ECSS



Networks with thematic nodes

- The network in this case is no longer identifiable with nodes with a physical location on the territory. Each node is actually made up of all those research ***groups that have specific skills within a broader topic.***
- In this case, synergies are generated first within the individual nodes that develop a more effective intervention capacity. This ensures that the node reaches a ***"critical mass" sufficient to be competitive***, an aspect that is difficult to reach by small entities that may even conflict with each other. Within the node, it is possible to establish a programming and governance strategy that allows an efficient distribution of available resources and an effective exchange of information.
- Being part of a network of thematic nodes on a more general theme that includes them, allows you to develop an important ***transversality*** where the different skills of the nodes can be put into a system.

Medical Physics Network



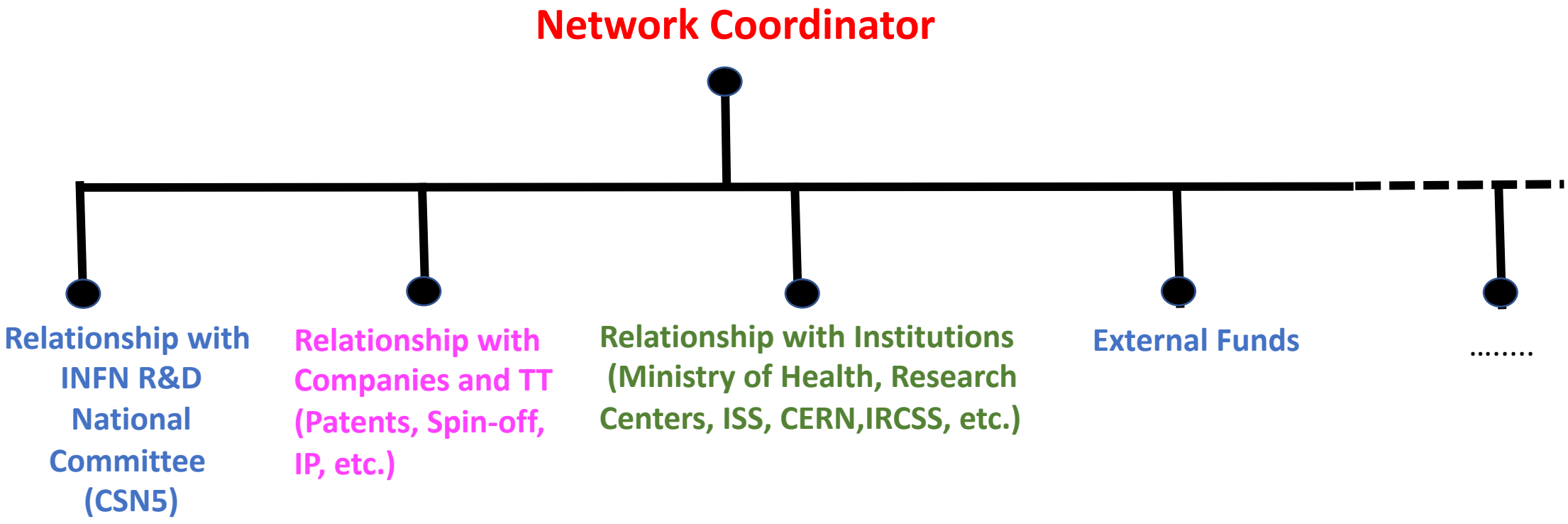
Thematic nodes: research activity financed by both INFN and external funds, TT activities, dissemination and training.

Database of collaborating Companies

Database of contracts

.....

Possibile Governance



Networks of the INFN Technological and Technical Services

- In the INFN units there is a lot of high-tech equipment that can be made available to everyone at a national level.
- For some technologies, the instrumentation can also have complementary characteristics as it is, for example, for 3-D printers with which some structures are equipped.
- 3D printing is currently the most disruptive digital technology within ***Industry 4.0***, capable (potentially) of **overturning traditional production paradigms**. This is a real revolution, given that production no longer takes place by removing material from solid material, but starts from a 3D (virtual) model and then "prints" layer by layer, exactly (or almost) as happens in the very common ink printers that we have at home or in the office. A revolution that then engages and integrates with the processes related to ***Smart Manufacturing*** and ***IoT***.
- For these reasons, we speak (more properly) of **Additive Manufacturing**. The additive production process has as input the creation of the 3D model of the object (CAD design), followed by a semi-automatic process (carried out now by all the most popular design software) of converting the file into STL format, which provides for the decomposition of the object into layers printable by 3D printers.
- ***Additive Manufacturing Network (LNGS, PD, PV, GE,….)***

Socio-economic impact studies

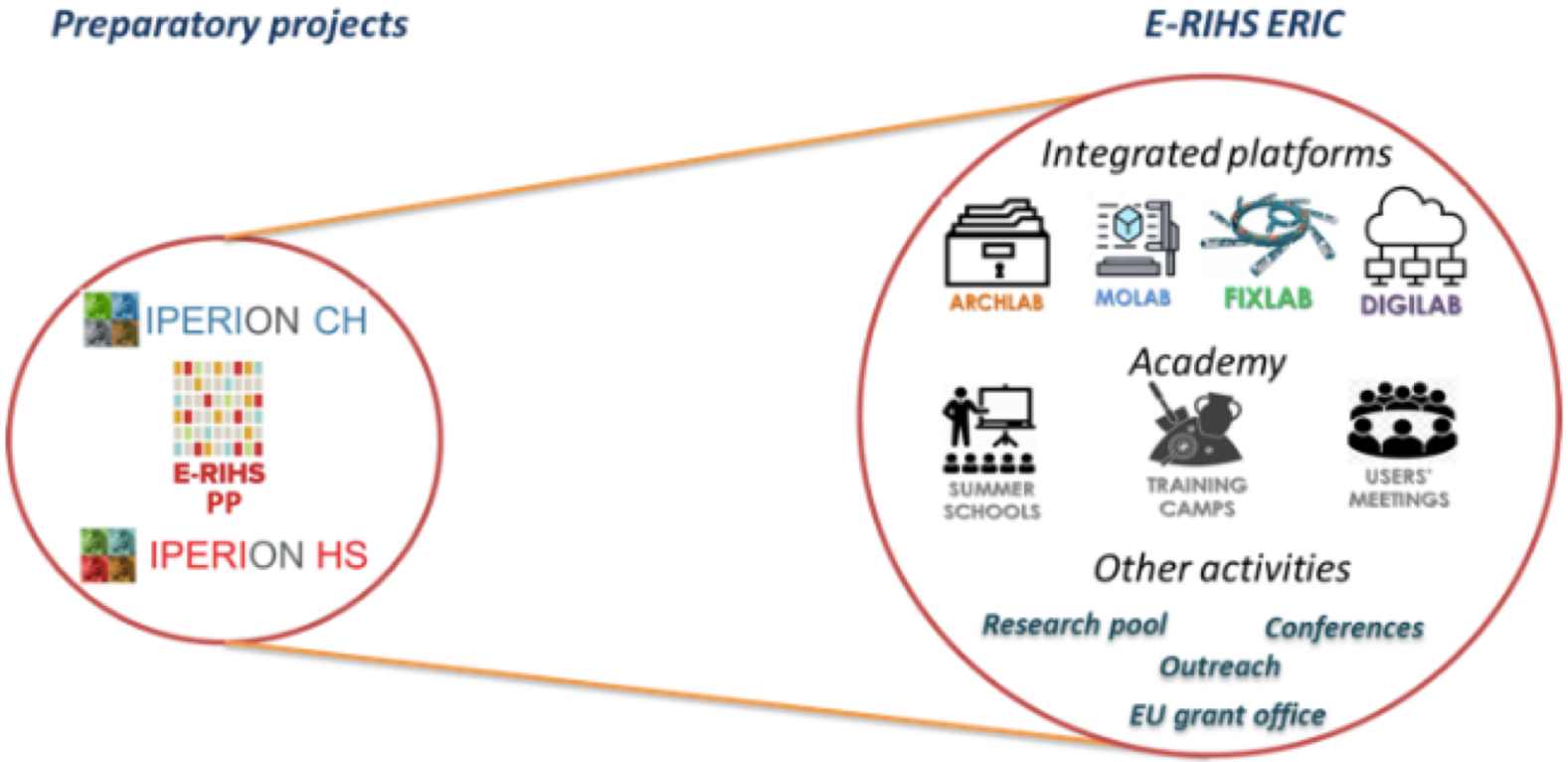
- While developing competence networks, we realized the need for a new and collateral study of what we do, in particular the ethical, cultural, social and economic value.
- The existence of networks facilitates socio-cultural and socio-economic impact studies on some relevant topics of our research, especially those with a strong social impact.
- These studies can enter into a ***«mission report»*** of the institution and be presented to the public, in general to our ***stakeholders***.
- Work has therefore started in ***collaboration with economists*** to assess the social impact of large projects (e.g. KM3net, E-RIHS, VIRGO, ET) or in general the collaboration with the Companies. We collaborate with the Carlo Cattaneo University (LIUC) of Varese, the University of Milan, the University of Catania, the University of Sassari, the GSSI and the Sant'Anna School of Advanced Studies of Pisa

An example: Cost-benefit analysis and assessment of the socio-economic impact of E-RIHS

- The methodology used for the ***ex-ante analysis*** of the impact of the ***European Research Infrastructure (RI) E-RIHS***, destined to become an ***ERIC*** in the ESFRI roadmap, combines a cost-benefit analysis aimed at quantifying direct impacts and a qualitative approach (in the form of case studies) that discusses wider impacts and paths.
- The logic of this ***mixed methodological approach*** is based on the great variety of potential impacts expected by E-RIHS and, overall, examines the detailed impact of its activities. The approach proposed in this study is solidly based on the advanced theoretical and practical bases of the assessment of the socio-economic impact of RI while being adapted to the specificities of heritage science.

Schematic representation of E-RIHS

- The analysis unit considered includes all these components, the costs and benefits of which will be adequately accounted for. In addition, IPERION CH, E-RIHS ERIC PP and IPERION HS will be included in the cost and benefit analysis. These components and projects were necessary to conceive ERIC E-RIHS, define its scientific mission and test some of the platforms and working methods that will be part of the ERIC E-RIHS services and modus operandi.
- For this reason, they are included as part of the design and configuration phase.



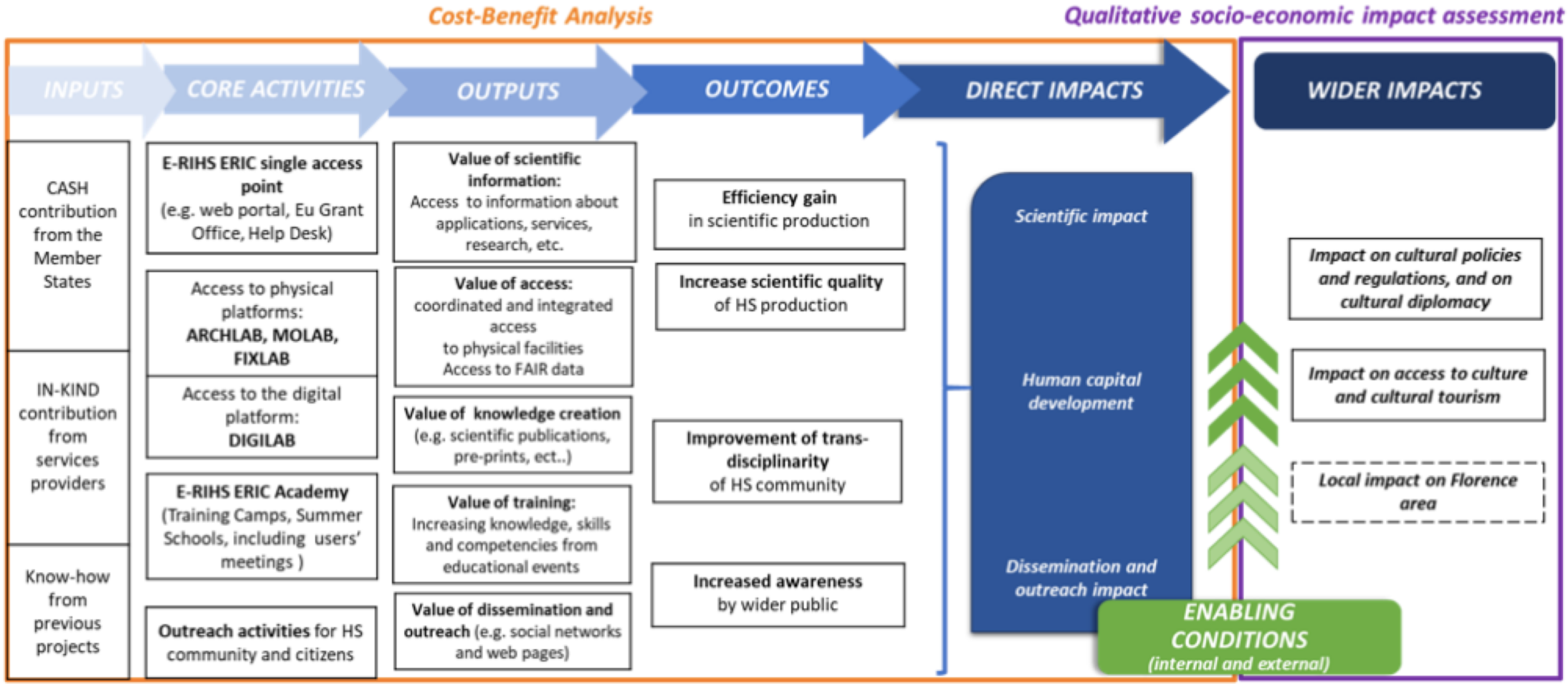
Cost-benefit analysis and assessment of the socio-economic impact of E-RIHS

CHALLENGES

- ❑ A **multidisciplinary and fragmented scientific community**, lacking a common identity, integration and cohesion
- ❑ **Restricted availability and limited access to state-of-the-art technological tools and facilities** and/or lack of skills and information to advance in heritage science research
- ❑ **Institutional and administrative fragmentation** preventing inter-institutional collaboration

OBJECTIVES

- ❑ **Giving to the heritage science community a common identity,** fostering its integration and cohesion by creating a collaborative and multidisciplinary network
- ❑ **Promoting advancement in heritage science research by offering TNAs** to state-of-the-art physical and digital research facilities and services
- ❑ **Fostering interinstitutional research collaboration by managing** the TNAs and other E-RIHS ERIC services in a coordinated and integrated way through a single access point and a unified access regulation under the umbrella of a unique governance structure



Mapping of technical-scientific skills

- CNTT initiative with the primary objective of collecting extensive information on all the technical-scientific skills present in the Institute.

- Double purpose: internal (to better understand the potential of the Institute by identifying the different skills present and their territorial distribution → know each other); external (make known to Companies or outside in general, the skills that INFN staff can make available → make themselves known).

- Methodology: language understandable to Companies and therefore we started with a model derived from the ***Enterprise Europe Network (EEN)***, a European network, created in 2008, which aims to support SMEs in terms of growth, innovation and internationalization.

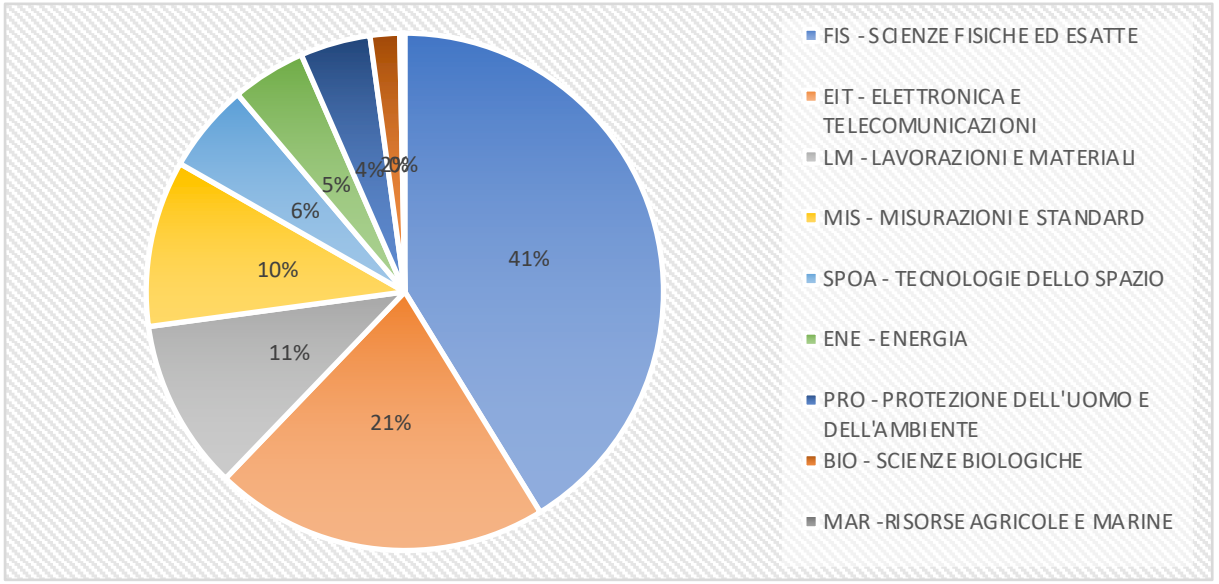
The results of the national survey

As many as 180 skills were identified and therefore three levels of investigation were defined: macro, meso and micro. The macro areas have been chosen on the basis of the known technical and scientific macro skills necessary for carrying out the work in the Body, the sub-levels have been identified among those EEN and integrating them, starting from the skills of the individual members of the TT Contact Work Group.

Launch process, management and analysis of the results, 1587 responses to the survey.

On a macro level there are overall 9 identify categories of skills.

	N	% (tot. Macro Competenze)
FIS - SCIENZE FISICHE ED ESATTE	1051	41,2%
EIT - ELETTRONICA E TELECOMUNICAZIONI	534	20,9%
LM - LAVORAZIONI E MATERIALI	272	10,7%
MIS - MISURAZIONI E STANDARD	265	10,4%
SPOA - TECNOLOGIE DELLO SPAZIO	142	5,6%
ENE - ENERGIA	118	4,6%
PRO - PROTEZIONE DELL'UOMO E DELL'AMBIENTE	112	4,4%
BIO - SCIENZE BIOLOGICHE	47	1,8%
MAR -RISORSE AGRICOLE E MARINE	8	0,3%
Totale	2549	



Conclusions

- ***Competence Networks*** represent a new path that promises a lot of synergy in the scientific and technological research of INFN, enhances it by making it more visible externally thanks also to its applications that very often have a social impact, enhances local excellence and it allows you to make technology transfer more easily, as well as access external financing.

- I believe that this way of working can ***stimulate new actions*** that complement what is already being done and which aim at ***a more solid and transparent knowledge*** and knowledge of one's own potential (INFN skills map, socio-cultural and socio-economic impact studies , enhancement of interdisciplinarity, mission balance, etc.), to always be ready for the new challenges of the times.

- In conclusion we can say that Technology Transfer activity is an enhancement of the reasearch activity, helps to disseminate instrumentation and methodology of our field, has a strong impact on innovation and, at the same time, increases the reputation of the public research in society.

- Please take care of those aspects while producing new technology and science.