

Research Division Activities

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48 LNF-SC MEETING
FRASCATI NOV 13, 2014

The goal of this talk is twofold:

A) To illustrate the various activities of the Research Division (RD) of LNF, by showing its structure and the main achievements of its service departments.

Some managing issues will also be discussed

B) To illustrate the status of the Research of the Laboratory, in the fields of competence of the RD, and to discuss the crucial issue of the governance of this process. This will naturally lead me to a discussion about the future of the Laboratory

*What i will **NOT** talk about:*

I will not give a list of construction/analysis achievements of single groups belonging to the RD for two main reasons:

1. There are presentations dedicated to a few of them today, there have been several in the past for basically all of them
2. They are too many, it would be a long boring list with scarce informational power

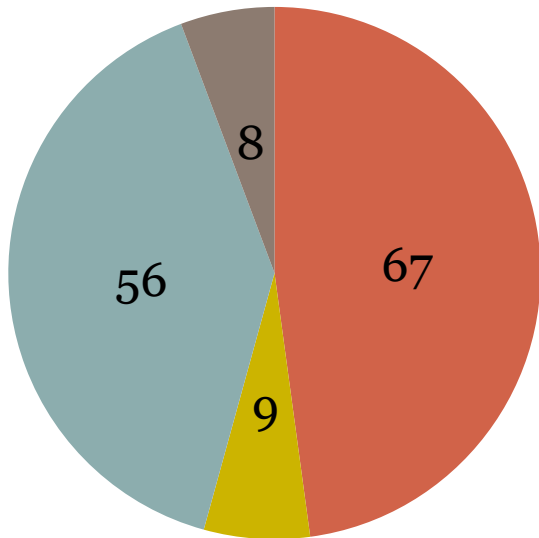
The RD is the largest (in terms of staff personnel) unit of LNF

LNF Internal Regulation (Oct. 25, 2011), freely translated by me :

Tasks and activities of the RD:

- Appertain to the RD all of the theoretical and experimental activities in the fields of nuclear subnuclear and astroparticle physics, of general and interdisciplinary physics, as well as all of the corresponding activities of development of detectors and other tools and techniques required by these experiments
- The Division manages the computing facilities and resources required by the research groups
- The Division follows all of the information and documentation activities concerning the Laboratory achievements

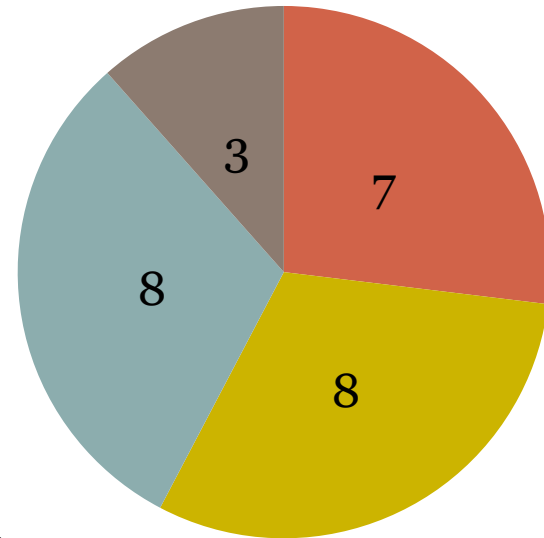
RD Staff



**Total
140**

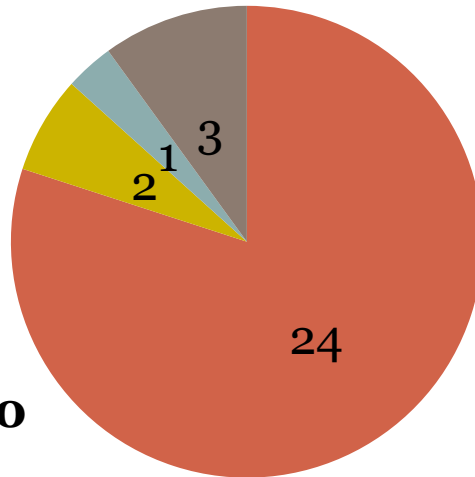
- Researchers
- Engineers
- Technicians
- Administrators

RD temporary



Total 26

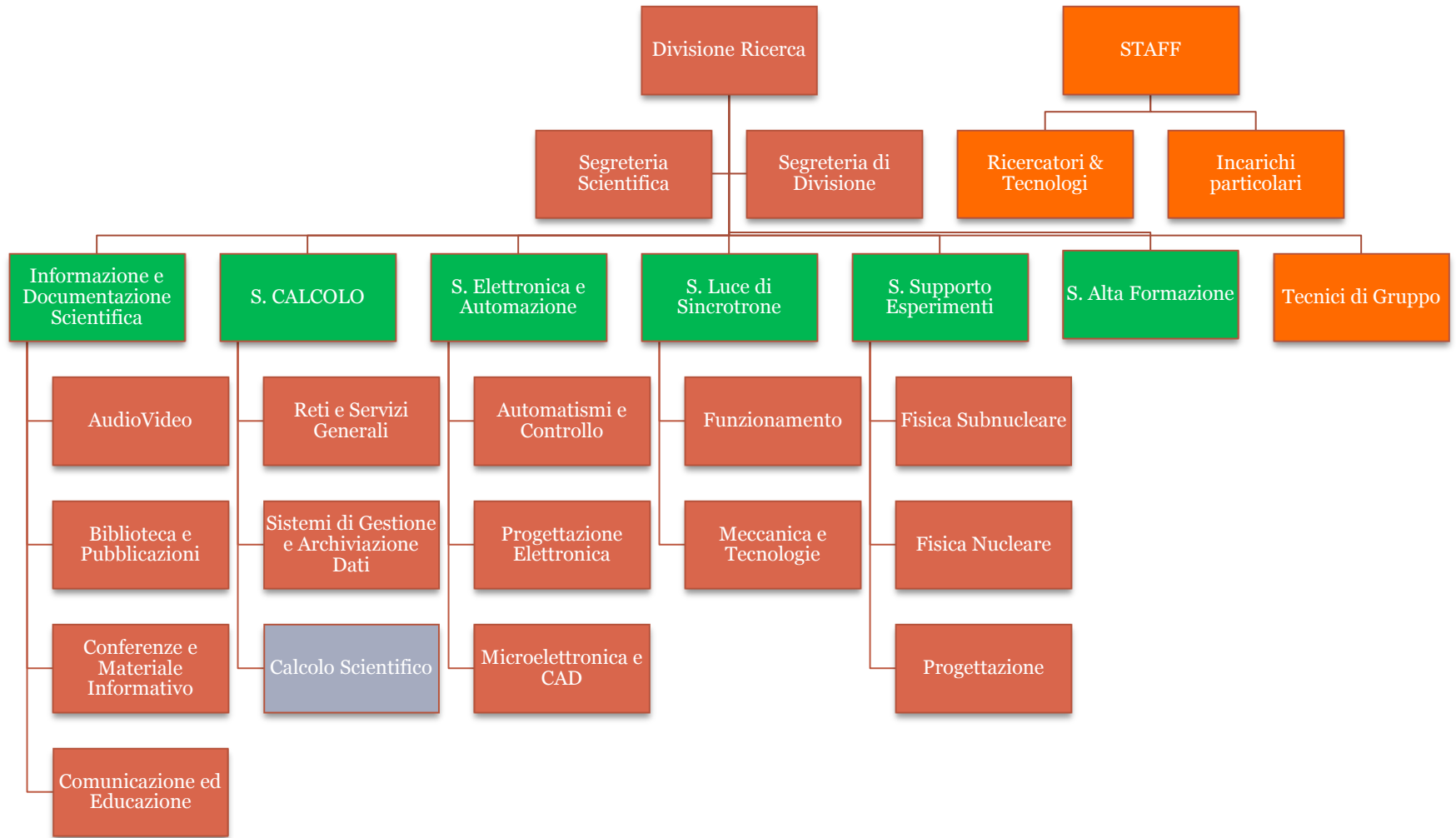
Fellowships



Total 30

- Researchers
- Engineers
- Technicians
- Administrators

RD Organization Chart



The Service Departments (in green in the previous slide) are the backbone of the Division. They are:

- The Computing Department
- The Electronics and Automation Department (SEA)
- The Experiments Support Department (SSE) including:
 - The two Detector Construction Units
 - The Experimental Apparata Design Unit (SPAS)
- The Synchrotron Light Department
- The Scientific Information and Documentation Department
- The High Education and External Funds Department

In what follows I will give a short presentation of their assignments, of their major achievements and of their more or less relevant management problems

Scientific Information and Documentation

Main Tasks:

- Information on LNF activities to schools and general public
- Organization of divulgation events inside and outside the laboratory
- Production of educational multimedia material
- Production and maintenance of a photo database
- Library management
- Production and management of LNF and INFN Internal Notes

Personnel:

1 Supervisor, 3 Staff Collaborators, 2 Temporary Collaborators, 2 Fellows
2 Staff Collaborator on part-time leave

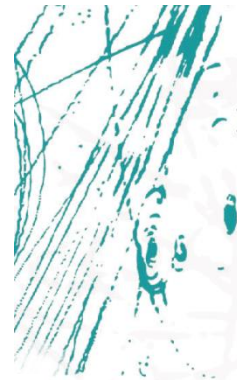
The attention to dissemination and educational activities has been growing in the last years. Actually this «third mission» is nowadays being considered as relevant as the scientific production when evaluating the quality of a scientific institution

During 2014 we have had about 9000 «visitors» spread out in several different events (open day, researchers night, seminars, stages...)

A dedicated presentation on this topic has been given by the former supervisor of the department during the last meeting of the SC

For the first time, we have decided to publish a small booklet of LNF highlight results of the past year, with the purpose of advertising the Laboratory's core activities achievements to the outside world

This year issue, referred to 2013, includes results from KLOE-2, SIDDHARTA, SPARC-LAB plus other more general information



2013

LNF Highlights

One year
of Physics
at LNF: **2013**



High Education and External Funds

Main Tasks:

- Organize high education events (at University level)
- Funds participation of LNF personnel to courses on specific technical matters
- Support to LNF personnel for application to EU funds
- Support to LNF personnel for application to national, regional funds

Personnel:

The personnel of this department is distributed among various divisions of LNF (the Supervisor for instance is AD)

I frankly believe that this department must not be under the DR control, both for its mission and for its personnel composition

Computing Department

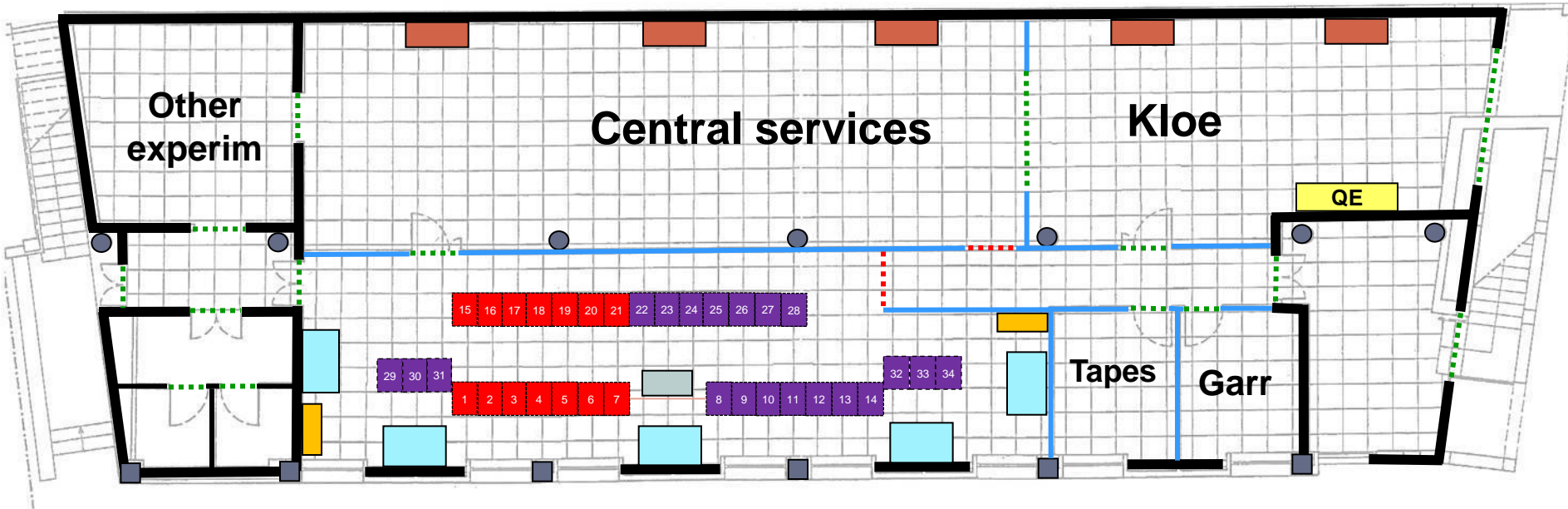
Main Tasks:

- Local Area Network
- Data Storage
- Basic Computing Services for the lab
- Nation-wide Computing Services (AAI, web, etc.)
- Support to GRID and Scientific Computing
- Support to National Projects (ex. !Chaos)
- Security Issues
- Basic User Support

Personnel:

1 Supervisor, 4 Staff Computing Scientists, 2 Temporary
Computing Scientists, 2 Fellows
User's PC Support outsourced

Thanks to recent relevant infrastructural works we have now available a new wide computing area where almost all of the hardware resides (including the ATLAS Tier2), which is completely independent in terms of UPS power and conditioning



- Rack computing
- Library
- Console

- Fan coils
- Electric switchboard

The entire laboratory has now a faster internal network connection, as well as a faster connection (10 GB/s) to the outside world

A lot of new, better hardware has also been installed, in particular for storage and servers

All in all we have a well dimensioned, potentially upgradable and highly efficient computing system

Strong support is given to the !CHAOS project an initiative aimed at developing a new software structure to realize the control systems of future accelerators and large experiments

Recently, an initiative for a fast disaster recovery system of the main sensible data management utilities (INFN personnel DB, Scientific DB, AAI...) has started with CNAF.

At present this consists essentially in a periodic data transfer to/from CNAF. A real-time disaster recovery would imply a huge software development effort for which at least 2-3 new personnel units would be required

Electronics and Automation Department (SEA)

Main Tasks:

- Design and production of analog devices
- Design and production of digital devices
- Design and production of PCBs
- Power electronics
- Microelectronics
- Automated control devices
- Support to experiments (installation, repairs....)

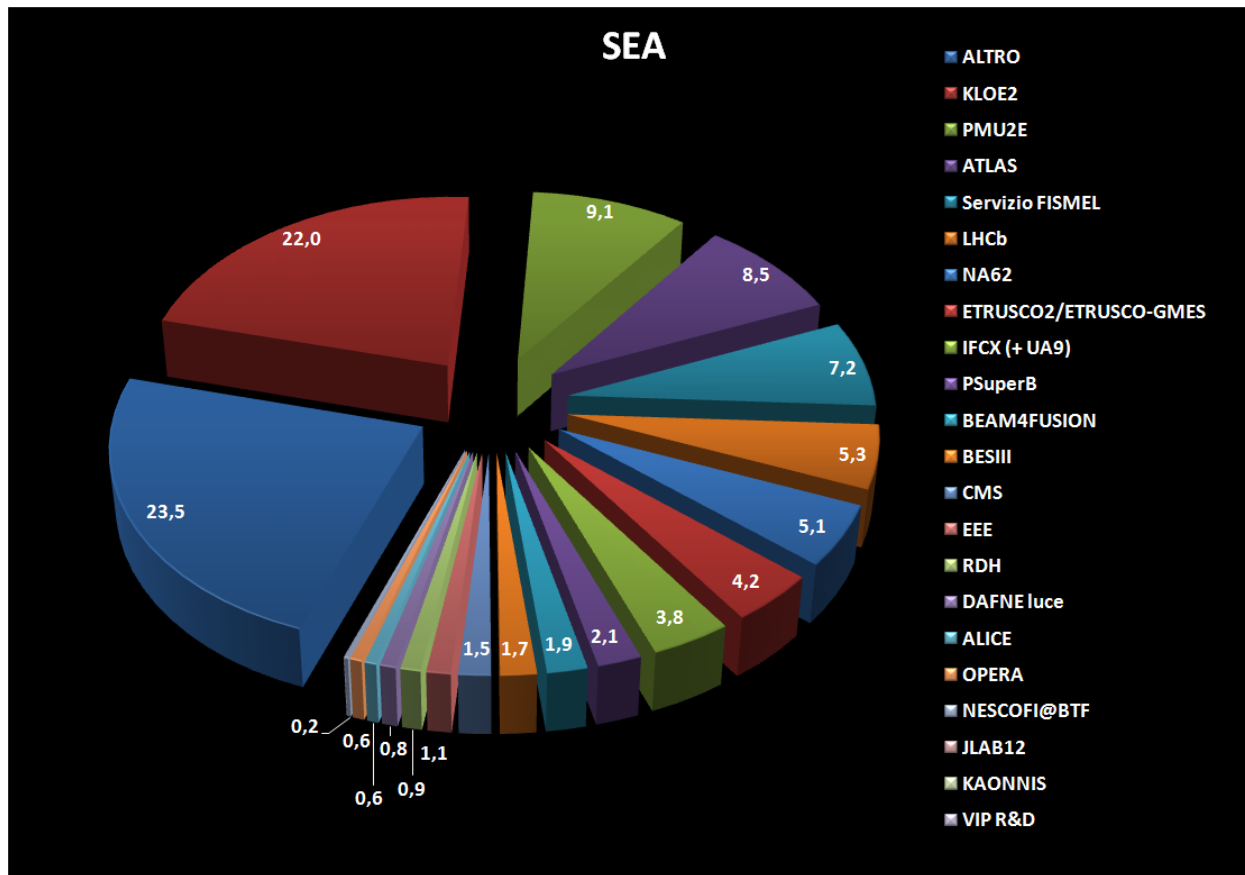
Personnel:

1 Supervisor, 7 Staff Electronics Engineers/Designers, 1 Temporary Electronic Engineer, 1 Fellow

Although the previous numbers might naively give the impression of a reasonably well dimensioned department, this is in fact not true for at least three important reasons

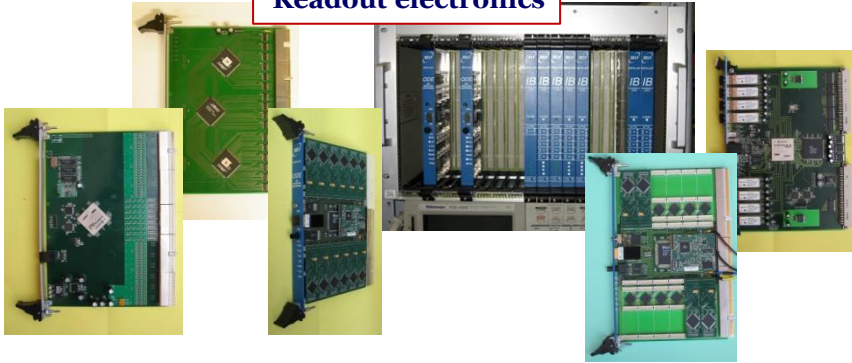
1. There is an high degree of specialization required for many of the above mentioned tasks, so that interchange of roles within the department is basically impossible
2. The average age of the staff personnel is 52 (minimum 43) so that in a few years we might loose important competences. Transfer of competence requires time and careful planning: unfortunately in the recent past we have not been able to keep any of the few brilliant young people that has worked with us
3. The amount of requests to the Department is really huge, coming from several different sources

For instance, in 2013, 22 different experimental activities have applied for support to the SEA at various levels (including sometimes work outdoors)



LHCb

Readout electronics

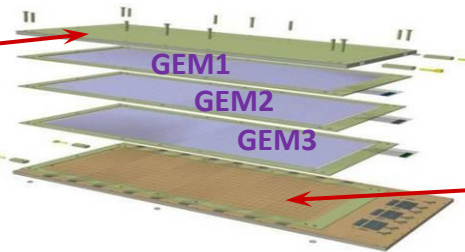
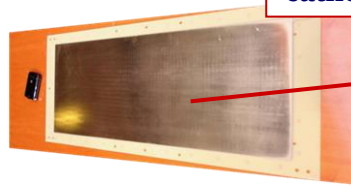


SIDDHARTA

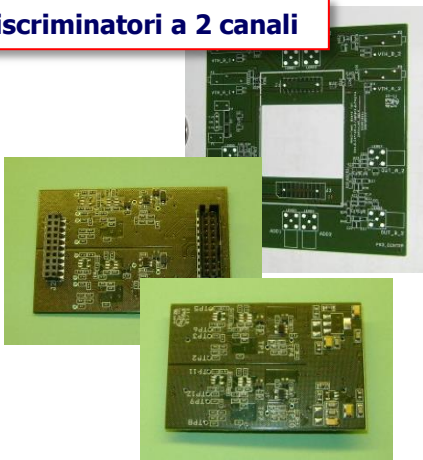
Power supply system



cathode PCB

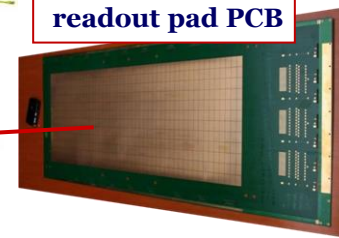


Discriminatori a 2 canali



KLOE-2

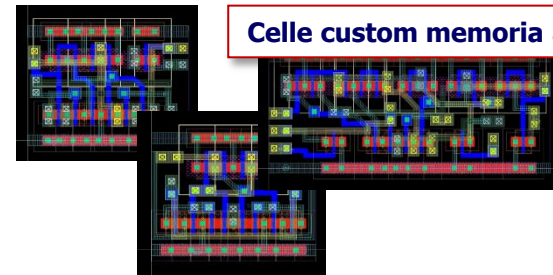
readout pad PCB



NA62

ATLAS

Celle custom memoria associativa



Support to the experiments

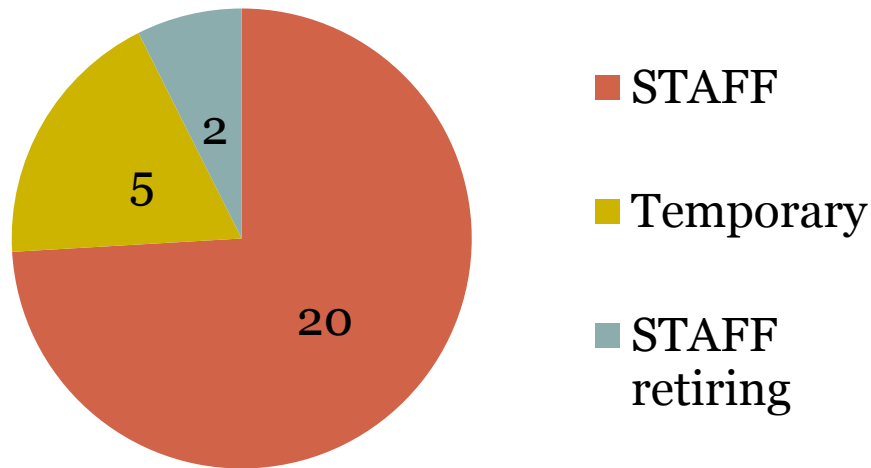
Technical support to the various experimental activities is guaranteed by two specific subunits of the RD, for a total of 9 personnel units, plus other 18 personnel units, with various technical skills, under the direct dependence of the RD Supervisor

They provide not only manpower for massive production of large apparatus but very often also technical wisdom and solid experience in the design and development of new detectors

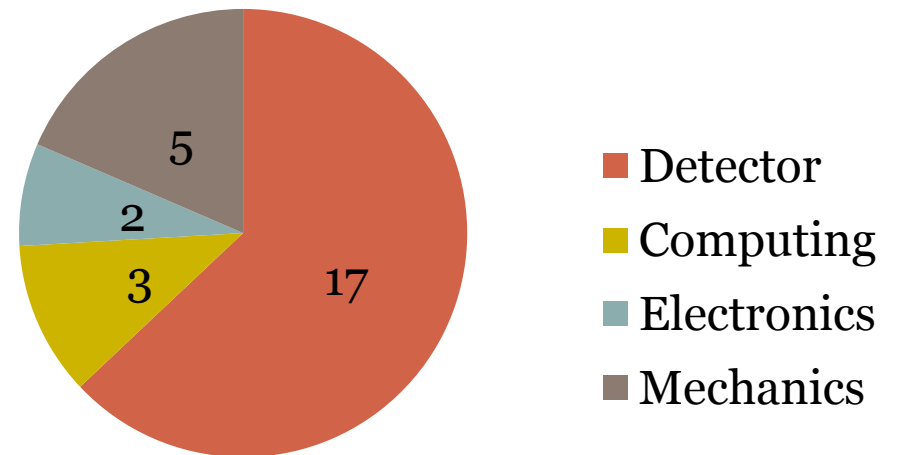
Access to these manpower resources by the various experimental activities is ruled by the RD Supervisor, typically every semester, on the basis of the actual needs and on the priorities of the Laboratory

Support to the experiments

Technicians



Competences



These numbers do not include the Design Unit (see later)

A special unit of the department (SPAS) provides support in the development of mechanical design of small and large apparatus

Main Tasks:

- Study, design and structural analysis of large apparatus
- Technical specifications for the construction or purchase of specific tools and components
- Control, test and certifications of constructions
- Coordination for the installation of large infrastructures

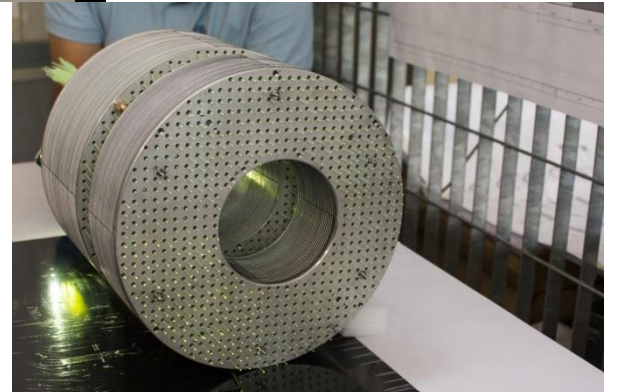
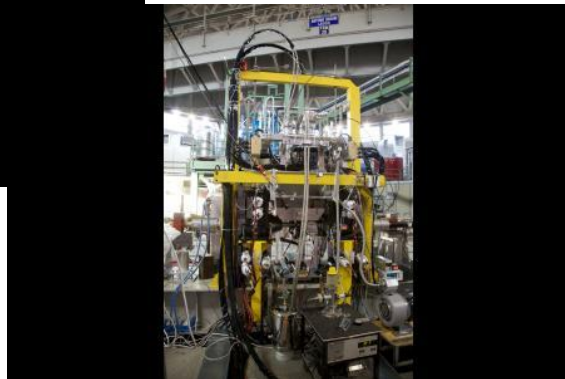
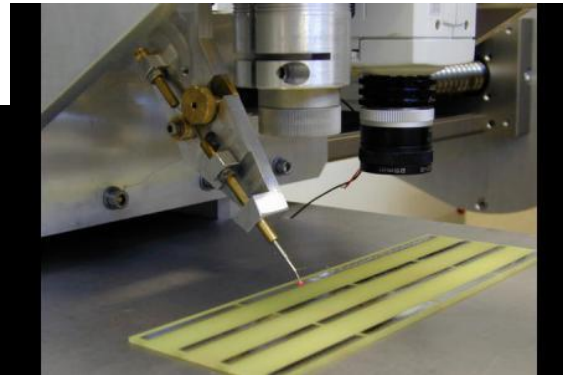
Personnel:

1 Supervisor (retires next year), 3 Staff Draftsmen, 1 Temporary Draftsman, 1 Draftsman on leave.

This unit gives often support to other laboratories needs, when requested (see for instance the decommissioning of the OPERA detector)

All in all, the amount of resources in the field of detector development and construction is relatively well dimensioned, however a few issues must be underlined:

- Some margin of organizational improvement is evident
- There is the need of efficiently transmit some fundamental competences (in particular in the field of detector development) to the new generations. This requires time and a wise policy of selection of «young blood» which is made difficult by the present italian regulations on employment (same as for the SEA)
- The amount of different activities is not always easily manageable. This will become more critical in view of the planned upgrades for the LHC experiments which will require a large amount of manpower committed on the same task for a long time period



Synchrotron Light Department

Main Tasks:

- Design and construction of tools for s.l. experiments
- Maintenance of s.l. lines of DAΦNE
- Support to experiments on s.l. lines
- Shifts

Personnel:

1 Supervisor, 6 Staff Technicians

A specific presentation dedicated to this activity will follow, so i will not detail more

A few highlights of the last 12 months' achievements of the Division are:

- Analysis of KLOE data (by both KLOE2 and AMADEUS) and operation of the KLOE-2 detector
- Continuous operation of the NAUTILUS cryogenic GW antenna
- Completion of the construction and installation of the NA62 LAV veto system at CERN
- Lot of preparatory work for all of the major LHC detectors upgrades
- Lot of preparatory work for SIDDHARTA-2
- Progress in the study of the construction of a cylindrical GEM detector for BESIII
- Major contributions to the design studies and tests of the MU2e, g-2, BELLE2 detectors
- SCF-lab activity
- Synchrotron Light Lab activity

Conclusions on Part One

The technical support departments and units of the RD are strong and rich of excellences in several fields. This has allowed us to keep the level of the research activities of the Laboratory at a high level.

Let me profit of this occasion to publically thank all the technical and administrative personnel of the Division that has produced all this

There are however some clear critical points which have to be underlined:

1. Some evident inefficiencies in the organization chart need to be corrected
2. Time goes by: the average age of the staff is > 50 ; we are not «refreshing our blood» since a few years, so we risk to loose competences forever
3. The number of funded experimental activities is very high. This does not allow a simple and efficient management of the resources

Point 3) of the previous list drives me to the second part of my talk, the one devoted to the description of the difficult game of the governance of the research of the Laboratory

I will start by reminding what are the basic rules of this game

Then I will present a few figures/plots regarding the activities of the Division and the research manpower involved in them. Some personal comment will follow

The above mentioned figures have been elaborated by me on the basis of official documents. However they have not been counterchecked so some «systematic» error might be present. I believe, though, that the basic information is correct

Every single or group of researchers of the Laboratory (in their right of INFN employees) can apply to one of the Scientific Commissions for funds to start a new or participate to an existing experimental activity.

Besides the scientific value of the proposal, in order to take a decision the Commission takes into consideration the opinion of the Director of the Laboratory about the proposal, *which reflects the strategic view of the Institute about the Laboratory's priorities*

Once the Commission approves the proposal, the activity is «open» and has its own independently managed budget. On this budget, the Director of the Laboratory has only a «formal» control power (in other words he/she takes care that resources are not mismanaged)

A similar mechanism is at work also for externally funded activities

LNF Internal Regulation (Oct. 25, 2011):

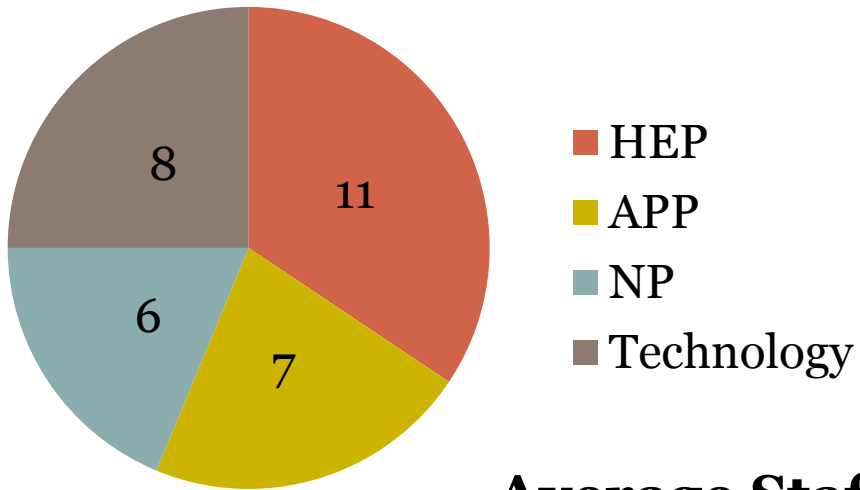
The Division Supervisor *coordinates the activity* of the Division in the framework of the global strategy of the Laboratory

The Division Supervisor acts for the Laboratory Director in the management of the Division by *coordinating its service departments* and *taking care of the accomplishment of the tasks assigned to them*

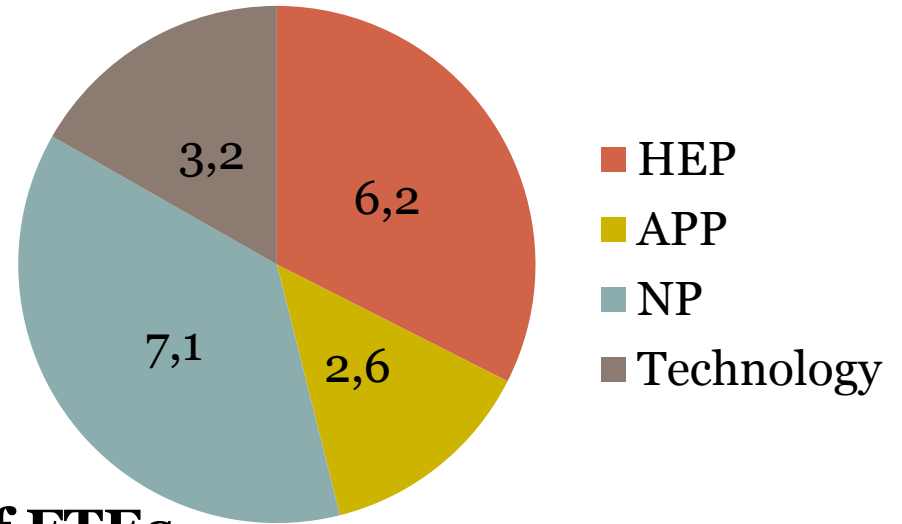
Note that in the above (and nowhere else, in fact) the verb «to steer» or similar is not used

Note also that in the organogram the researchers staff is kept separate and parallel to the Supervisor

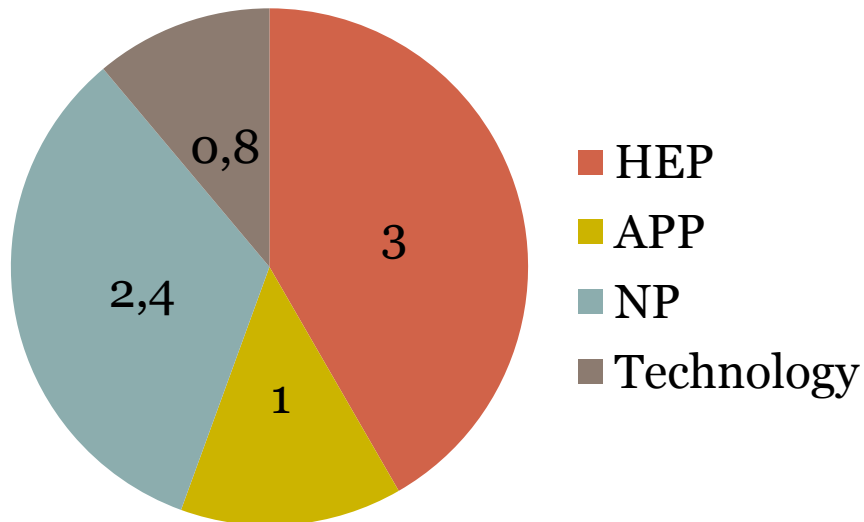
Exp. Activities on ordinary funds



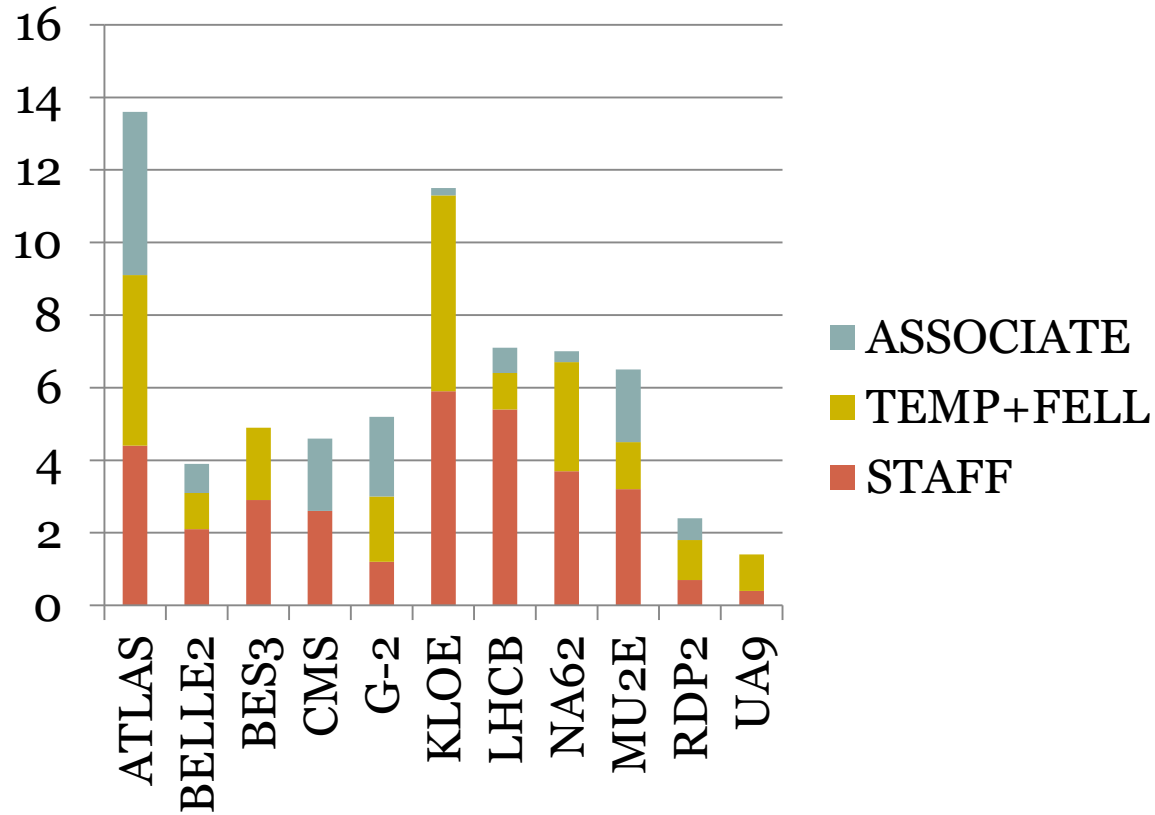
Average Total FTEs



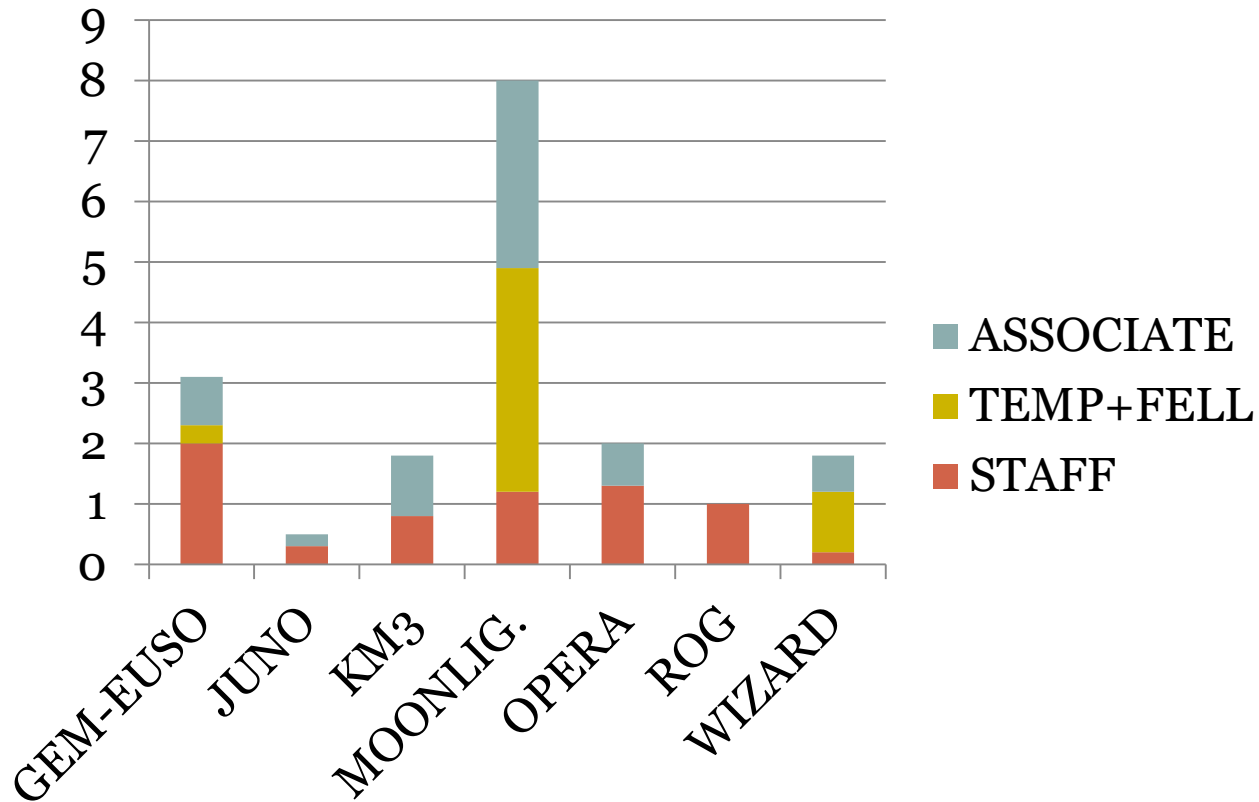
Average Staff FTEs



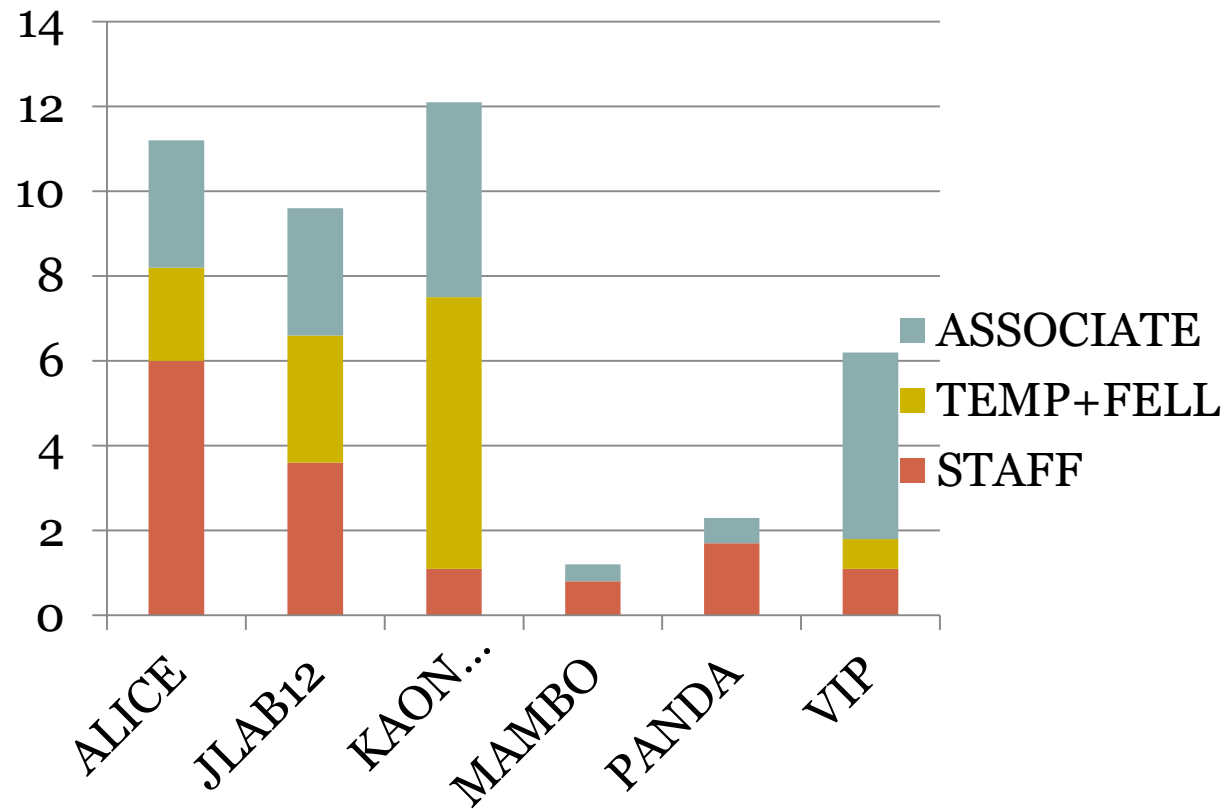
High Energy Physics (CSN1)



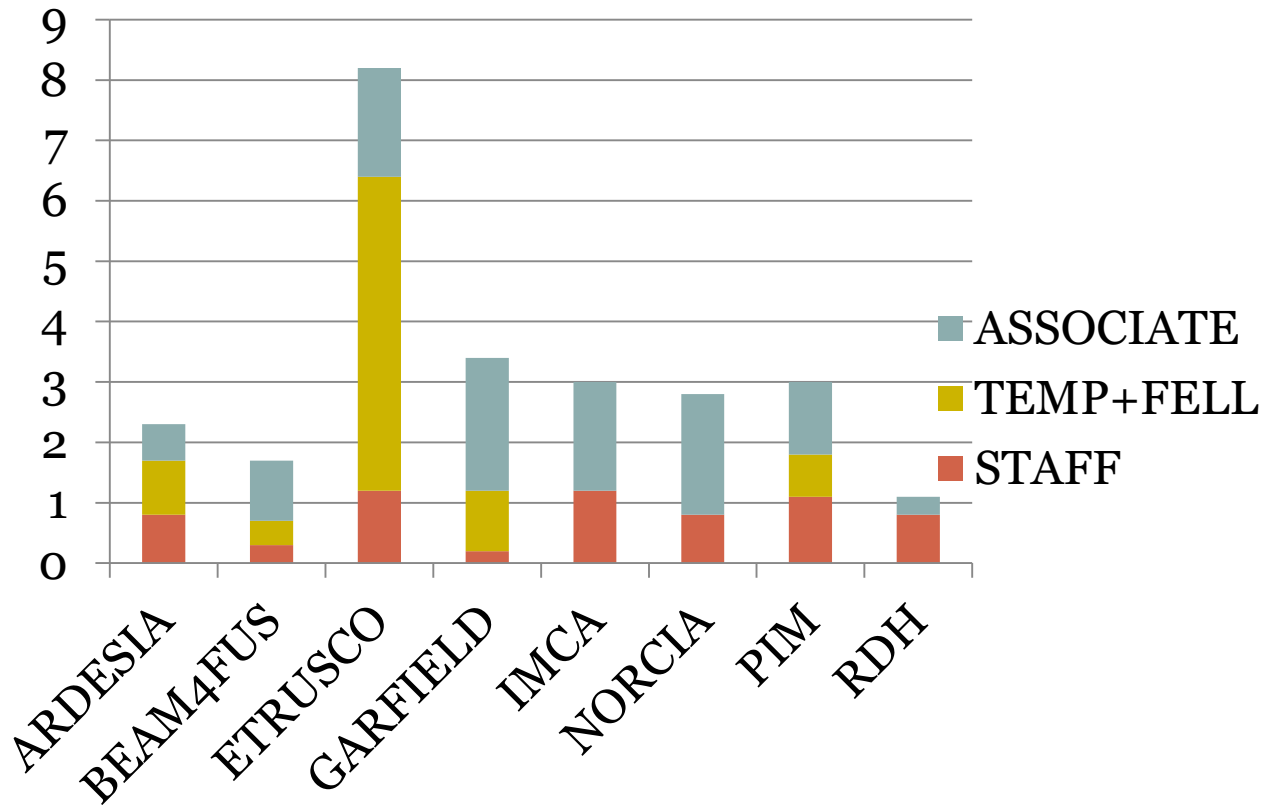
AstroParticle Physics (CSN2)



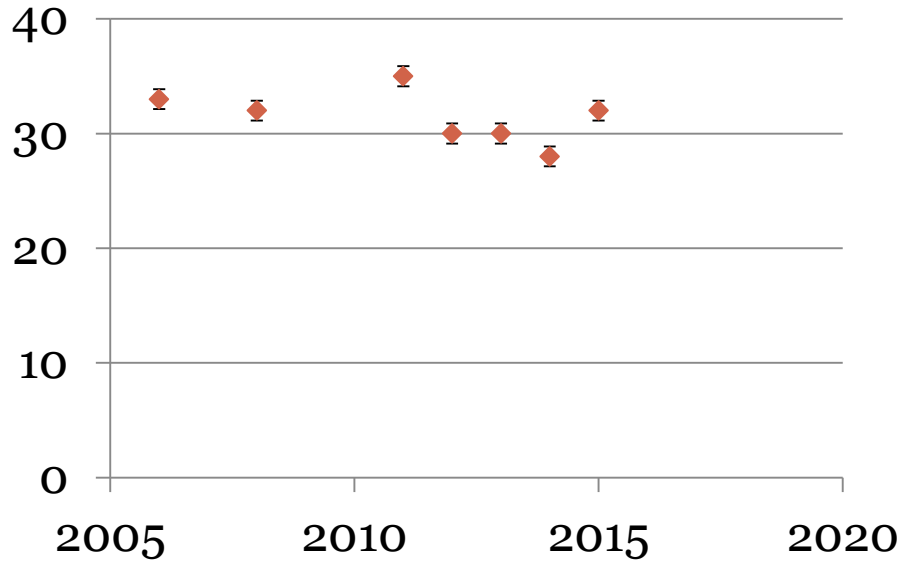
Nuclear Physics (CSN₃)



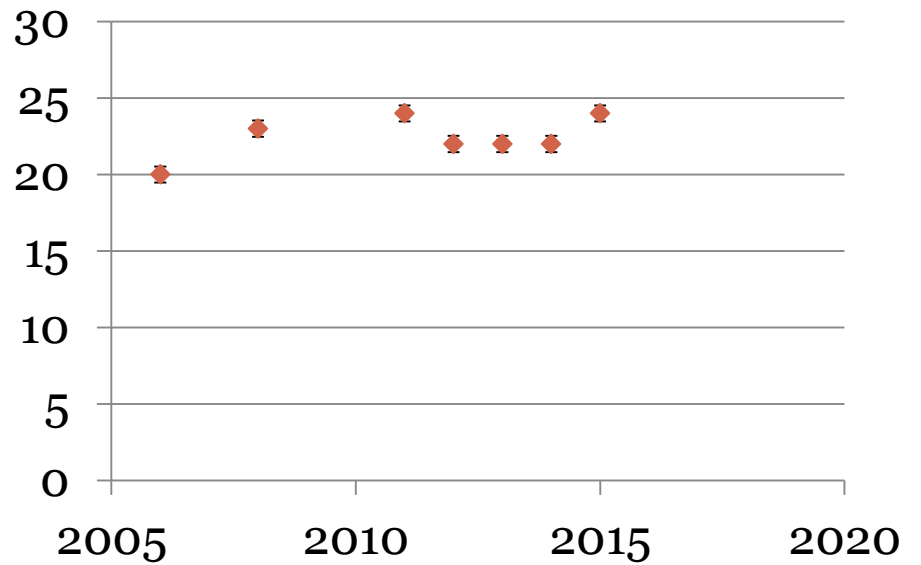
Interdisciplinary Physics (CSN5)



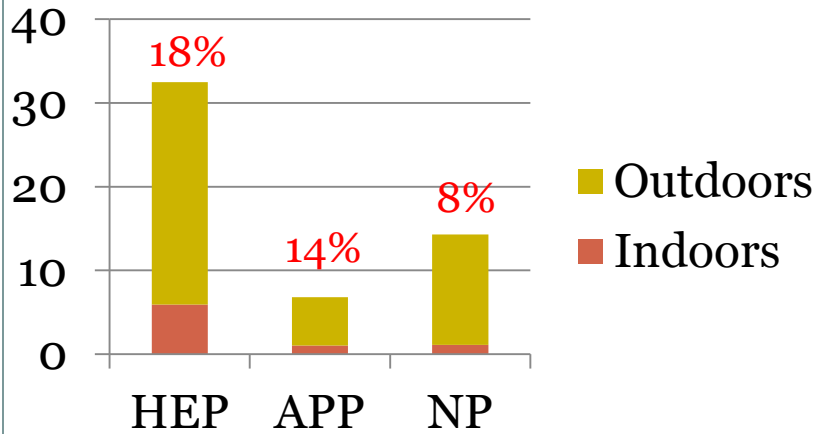
Activities



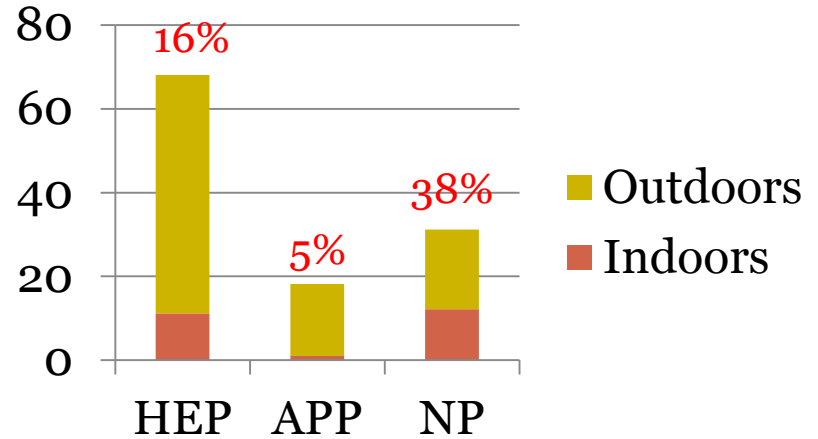
Activities HEP+APP+NP



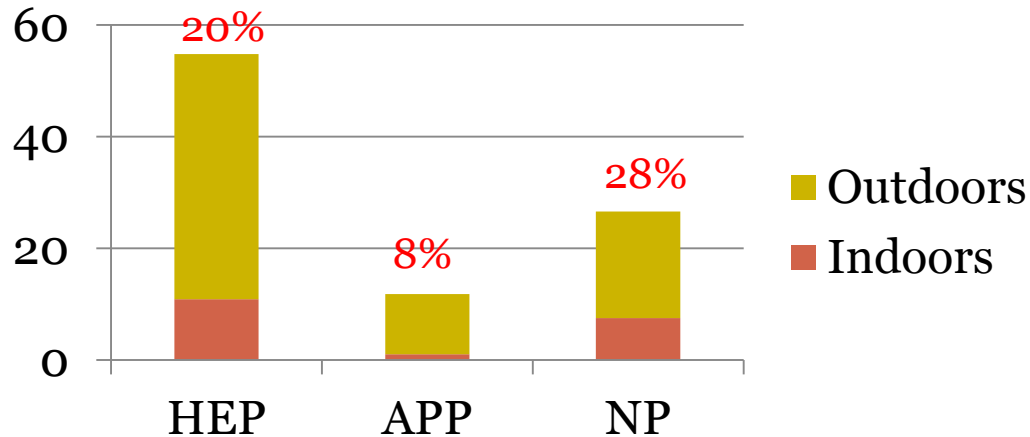
STAFF FTEs



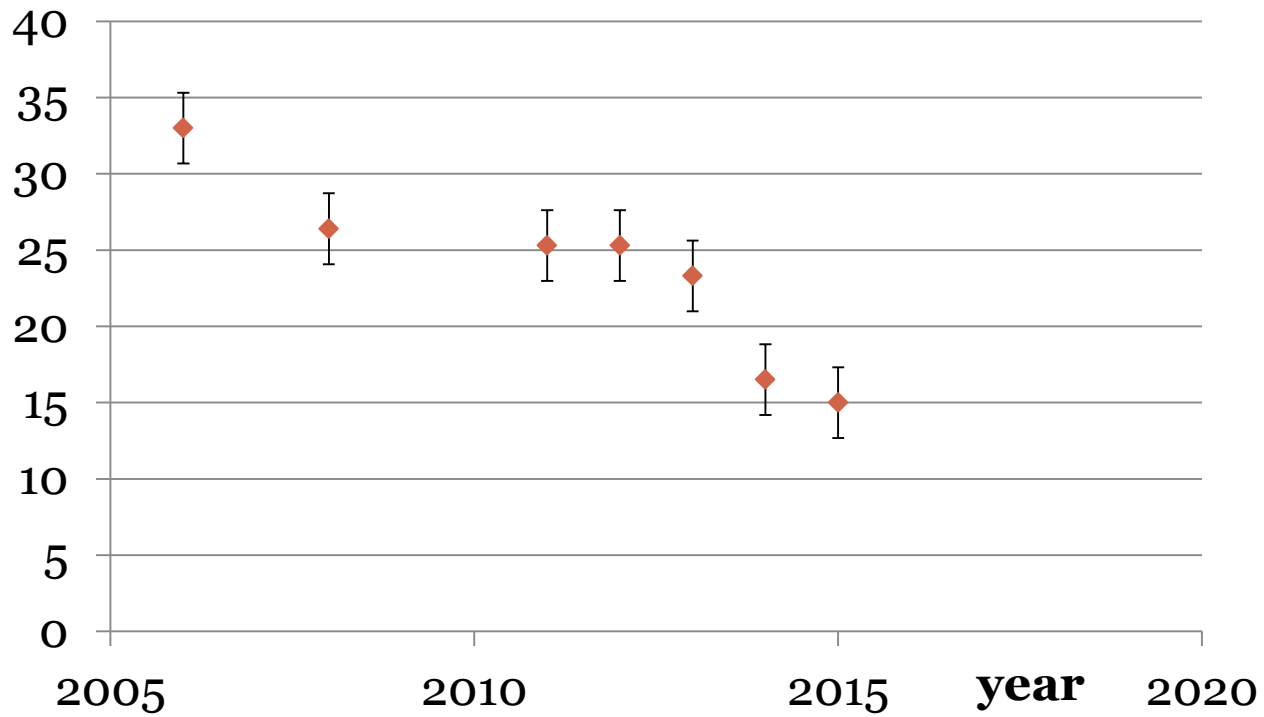
Total FTEs



STAFF+Temp+Fell FTEs



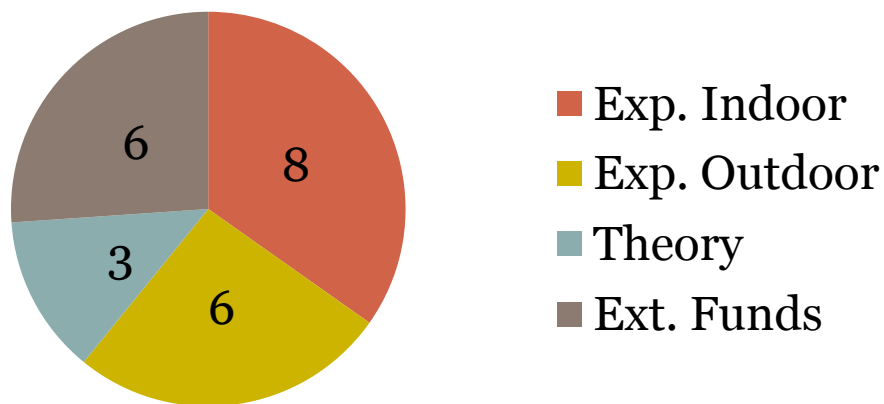
% Indoor Staff FTEs



The most obvious way to reinforce specific activities is by the appointment of postdoctoral contracts. These are of two types:

1. **Assegni di Ricerca.** Financed on local basis by the Director after consultation with Division Supervisors and Scientific Commission local coordinators. Typically 4 years contracts, ~4 per year
2. **Postdoc Fellows for foreigners.** Assigned on national basis. Typically 1-2 per year, 2 years contracts

Postdoc Research Fellowships



The numbers shown so far are a clear indication of a constantly increasing disaffection of LNF researchers towards internal activities. However also taking into account outdoors activities there is no obvious large group clearly leading the science of the laboratory, although there are many with very brilliant scientific records

This is due, in my opinion, to the lack in recent years of a well defined mission for the lab, that should have come from the Institute management (as in the early times of DAΦNE, for instance)

In order to find a solution to this problem we have called a two days meeting to discuss potential future activities able to revamp not only the RD but the entire Laboratory. The meeting was held in Frascati on November 10-11, 2014

Several potential line of research have been proposed/identified

1. Full exploitation of the capabilities of DAΦNE for nuclear/particle physics
2. DAΦNE as a instrument for studies on machine physics and future colliders
3. Use of the DAΦNE LINAC-BTF system for searches of light mediators of new interactions and/or light dark matter
4. Consolidation and extension of SPARC-Lab with the main goal of performing studies on plasma acceleration
5. Contruction of a support laboratory for space based experiments
6. Construction of a large facility for the development and construction of new particle detectors, in particular of MPGDs
7. Brand new machines...

Our intention is to elaborate on them and come out rapidly with a (small set of) proposal(s) to be submitted to the attention of the Institute's management

Let me make some basic **personal** comments about all of this

- Understanding the real ultimate capabilities of DAΦNE is mandatory: *thus the KLOE-2 run of these months is of utmost importance*
- Plasma wave acceleration has been already declared by the top management of INFN to be one of the strategic goals of the Laboratory. Therefore *the SPARC-Lab consolidation is a top priority*
- If we use DAΦNE for machine physics studies only, we will have no facility for fundamental physics in the laboratory anymore. Personally I find this perspective rather worrisome.
- The possibility of performing new experiments in the dark sector is fascinating. With the proper dose of aggressiveness *we might make LNF an (the) important laboratory for light dark matter searches at the european level*. Remember that KLOE is already in the business
- The «construction» proposals (5 and 6 in the list above) are both at the level of involving a relatively small part of the laboratory and can be run in parallel to the previous (1-4) ones, whatever is the choice. Money-wise, obviously, is another story

There are a few points to be taken into consideration and clarified before taking a sensible decision on this

- 1. The financial context:** At the recent three years plan meeting, the INFN President has clearly stated that funding at the level of (few)x10 ME can be taken into consideration. This does not give enough space for totally new initiatives
- 2. The service manpower requirements:** This is a big issue. There are obvious clashes among proposals 1-3-4, for instance and there is no obvious solution
- 3. The interest of the community:** the amount of interested people inside and outside the laboratory really willing to commit themselves on one these proposals has to be clearly understood
- 4. The time scales:** what needs/can be serialized what needs/can be parallelised?

All of the above requires careful thinking, which requires time.
Unfortunately we need to take a decision as soon as possible

As specified before, we intend to submit a short document to the INFN management to summarize our proposals. This must be done within a few months, ideally within the year's end

This is my first responsibility. I'll ask the help and advise of my colleagues at the institutional (commission coordinators) and personal level

Help and advise of this committee is absolutely welcome