

Electronic services



Istituto Nazionale di Fisica Nucleare

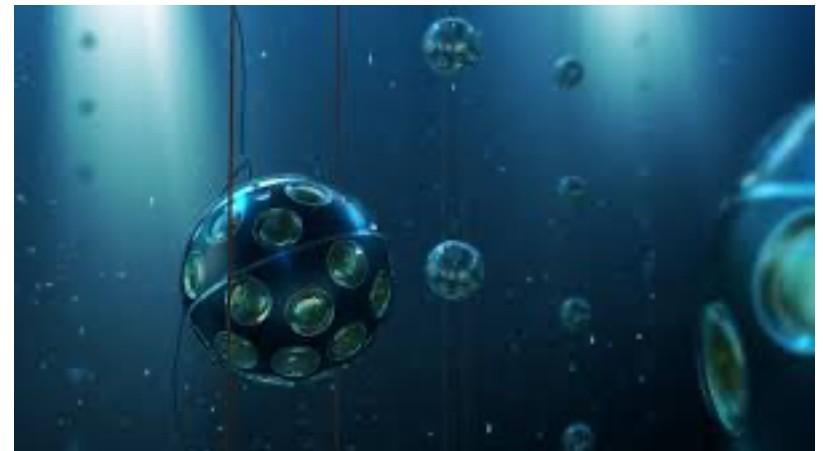
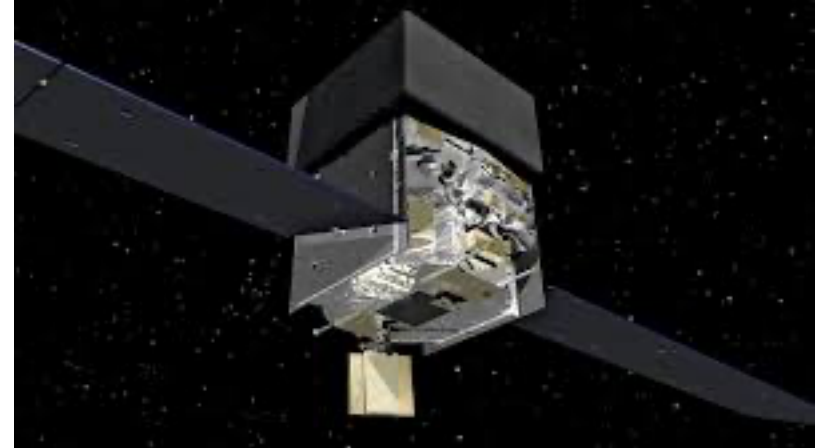
What is a service?

What is a service?



A coordinated pool of persons, skills and tools that are organised on a structured way to address specific projects

Why electronic services?



...from earlier than you think!

A. F. Kovarik On the automatic registration of α -particles, β -particles and γ -Ray and X-Ray pulses.

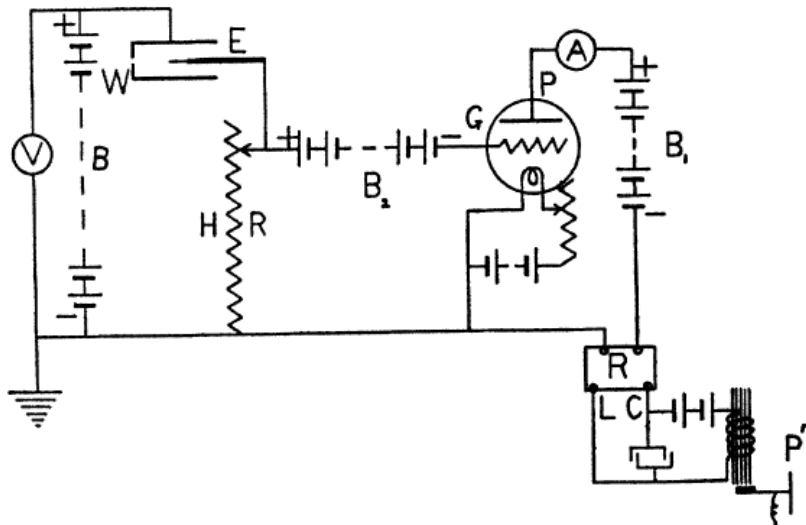


Fig. 1.

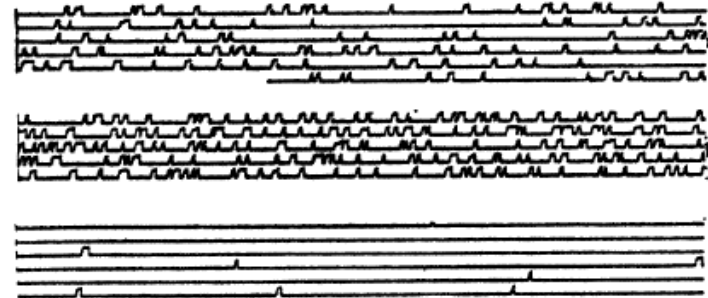
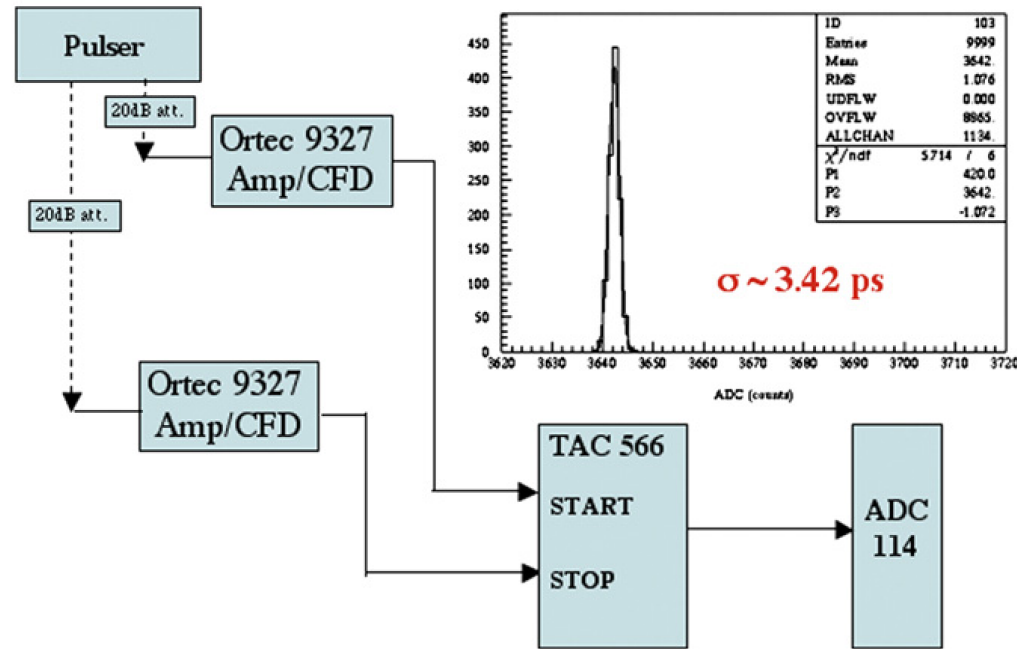
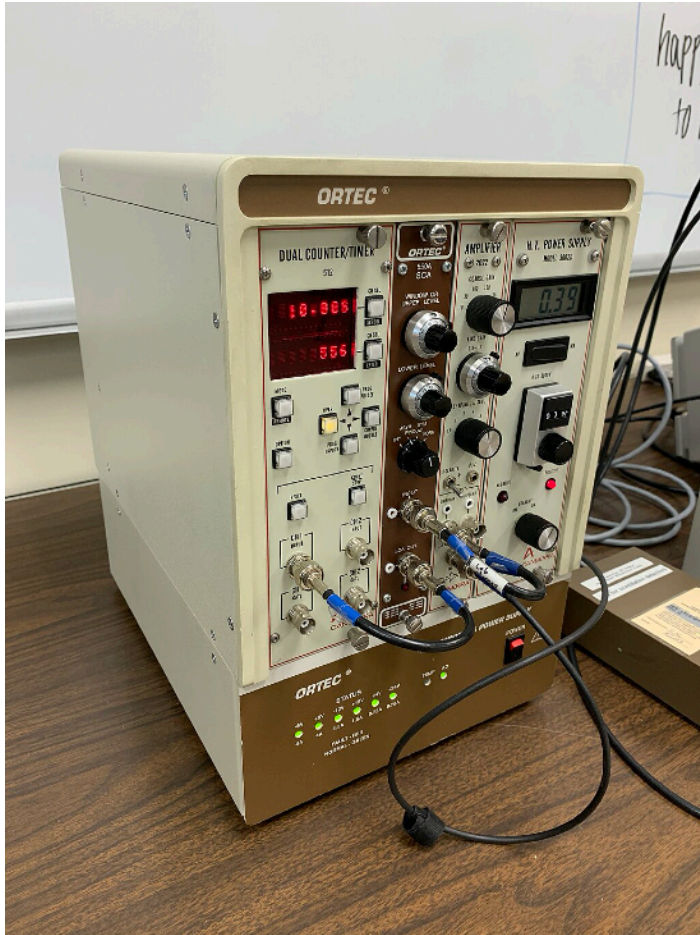


Fig. 2.

Excerpt from Kovarik acknowledgments....

I desire to express my sincere thanks to the Western Electric Company, or the special sensitive relay and the audion bulb, both of which they kindly loaned me for my experiments.

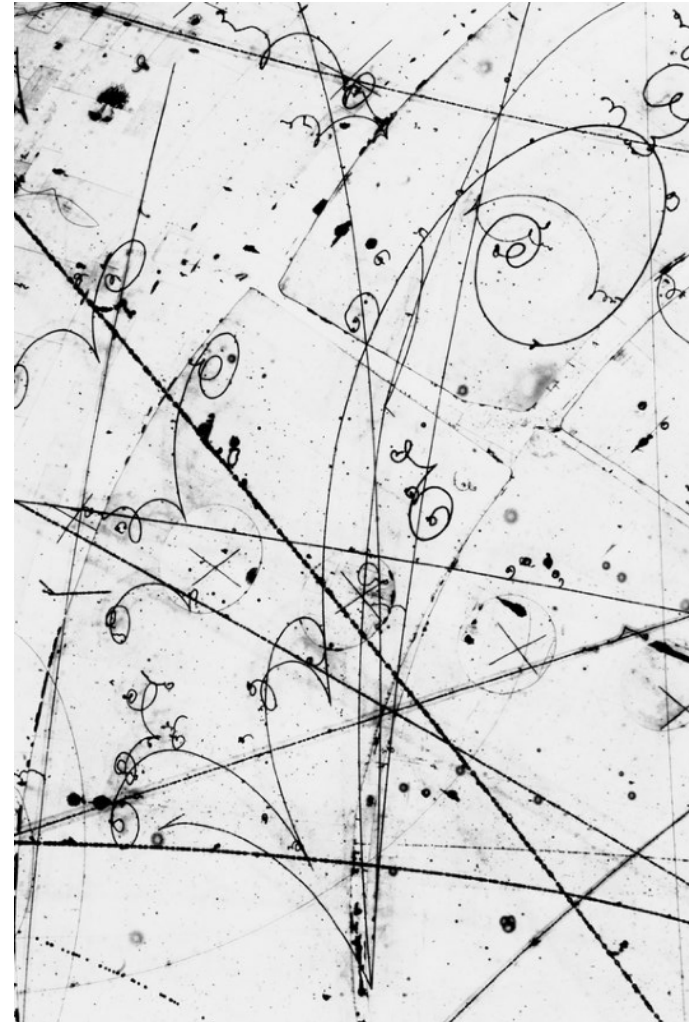
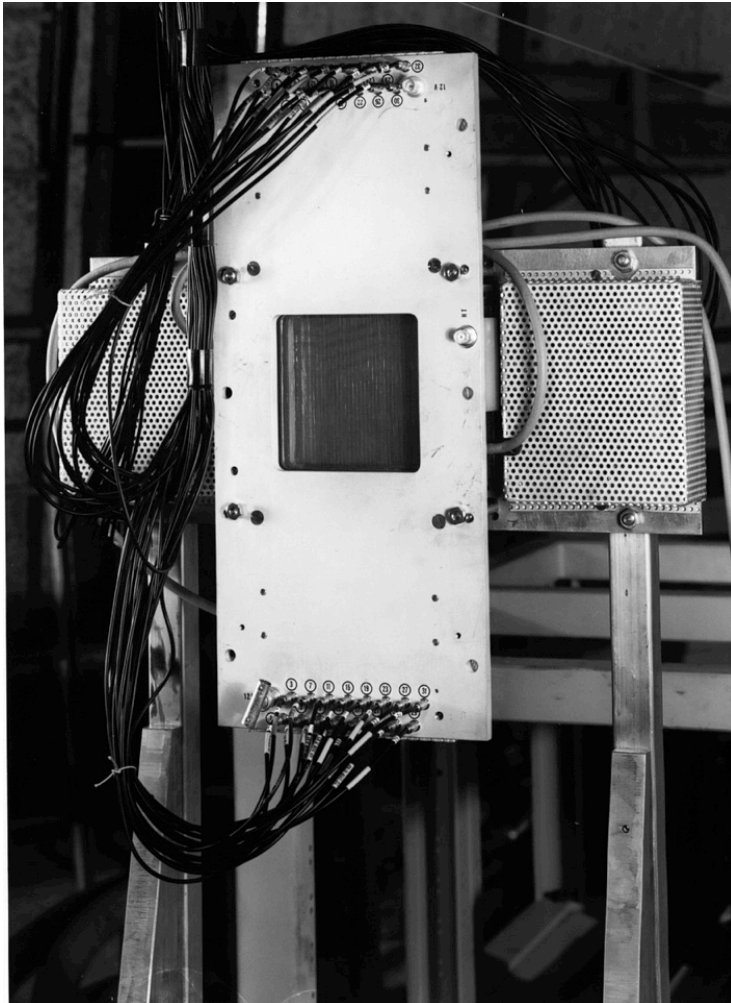
Standard in nuclear electronics



- Just putting modules together?

From visual to electronics detectors

FIRST MWPC (1968)

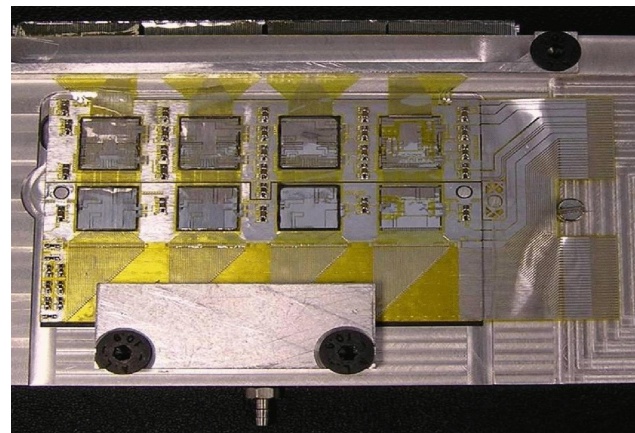
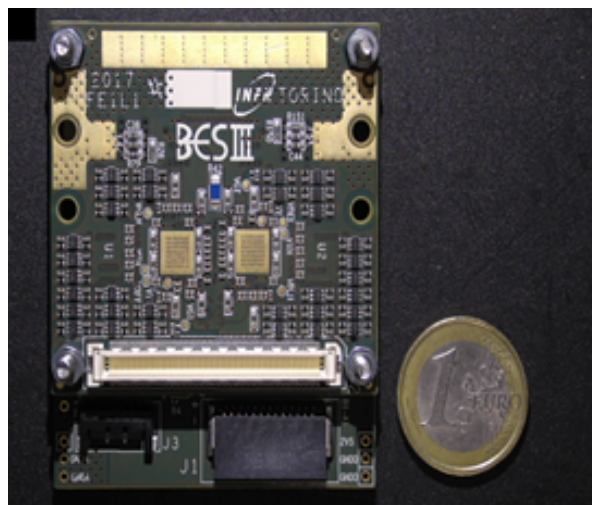
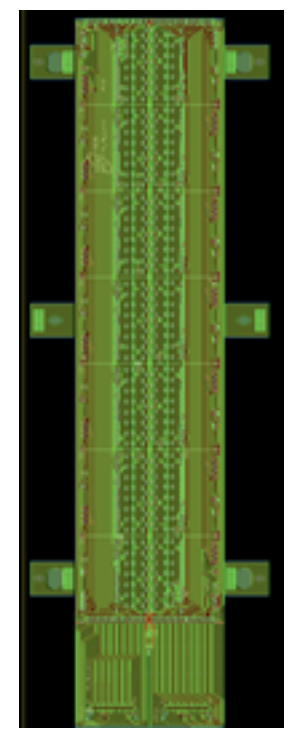
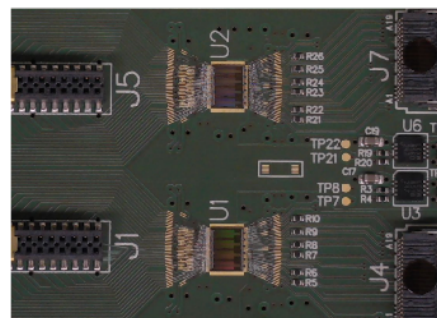
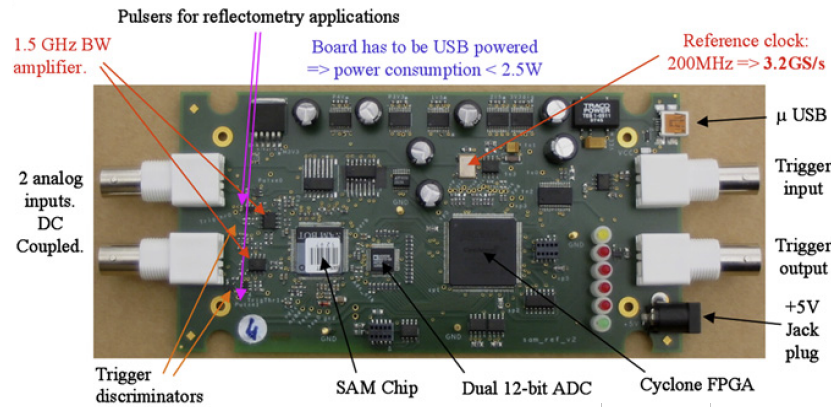
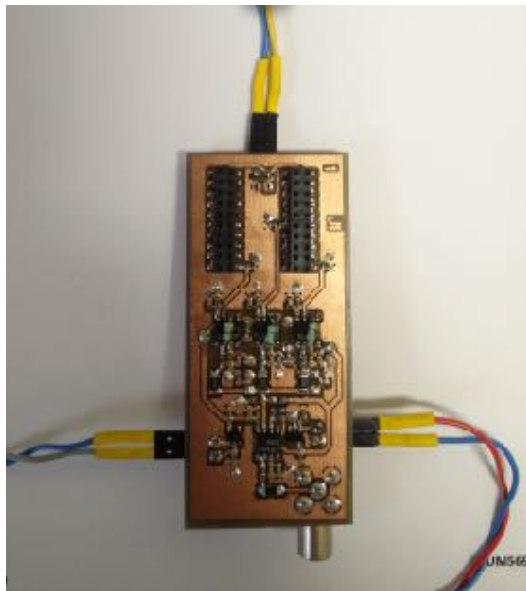


...and before PCBs

https://en.wikipedia.org/wiki/Point-to-point_construction



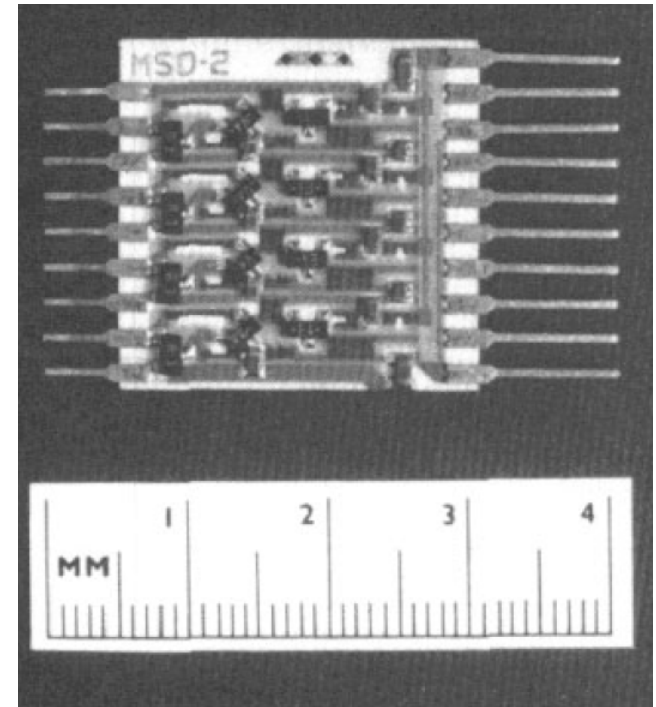
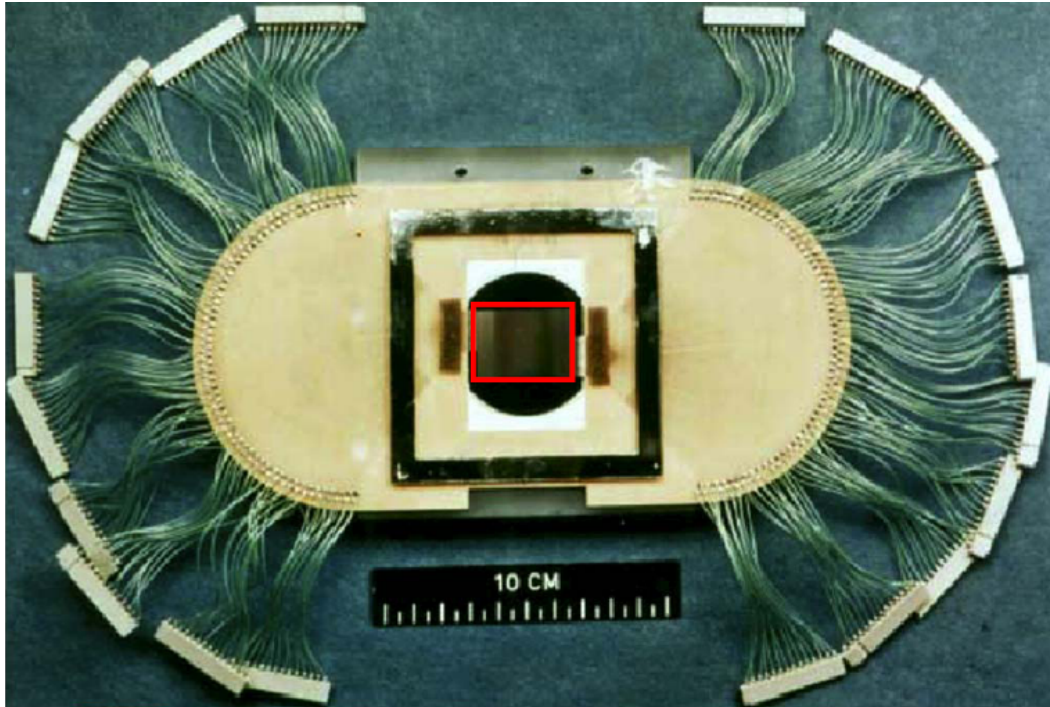
PCB design



- **PCBs are routinely designed in house**
- **Professional EDA tools needed**
- **Wide range of complexity, from simple two layers to complex multi-layers hosting very complex circuits and requiring complex design (signal integrity, power analysis, etc..)**
- **In house fabrication and assembly capability may change from sites to site**
- **Common pattern: design in house and fabrication/assembly by dedicated companies**
- **Some steps typically done in house (e.g. wire bonding of bare chips), some critical steps in the integration of large detectors, etc.**

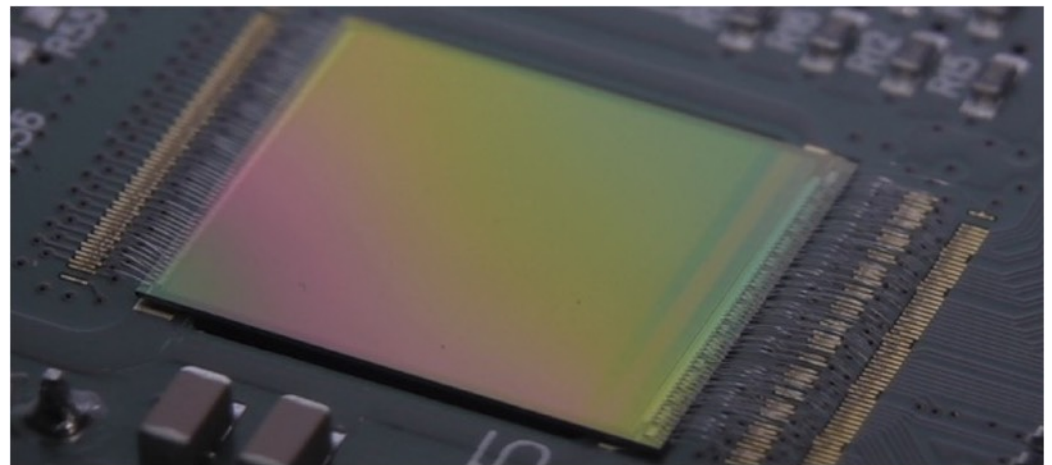
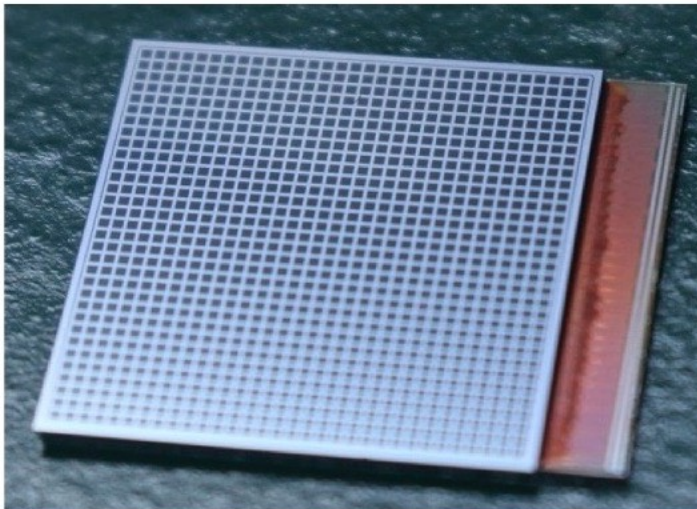
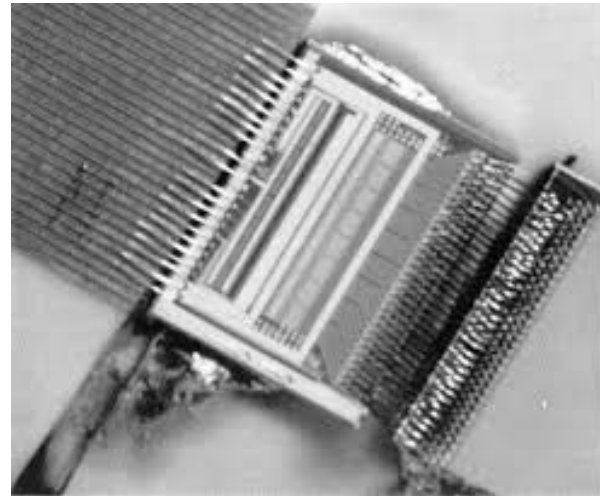
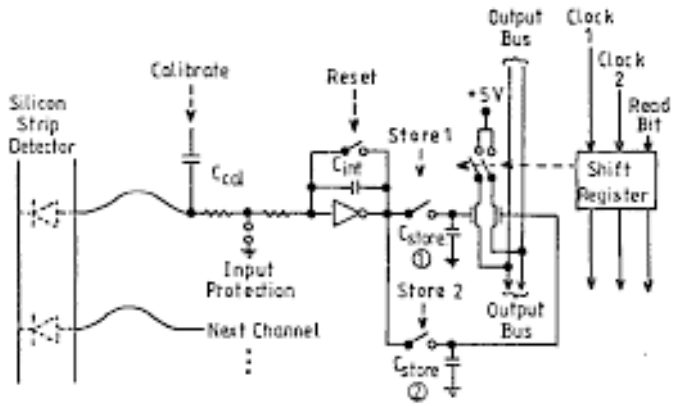
First microstrip detectors

- NA11 silicon detectors, 1990

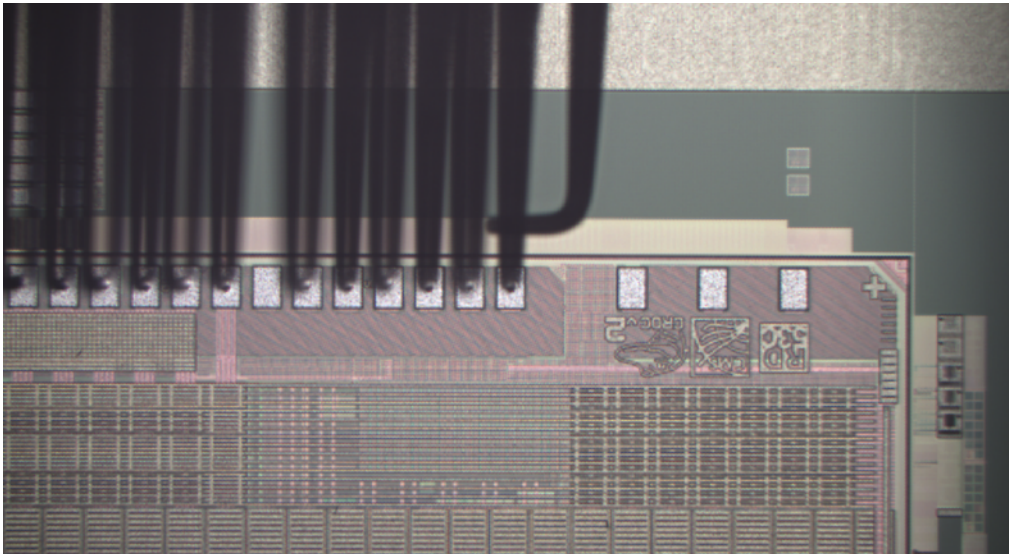
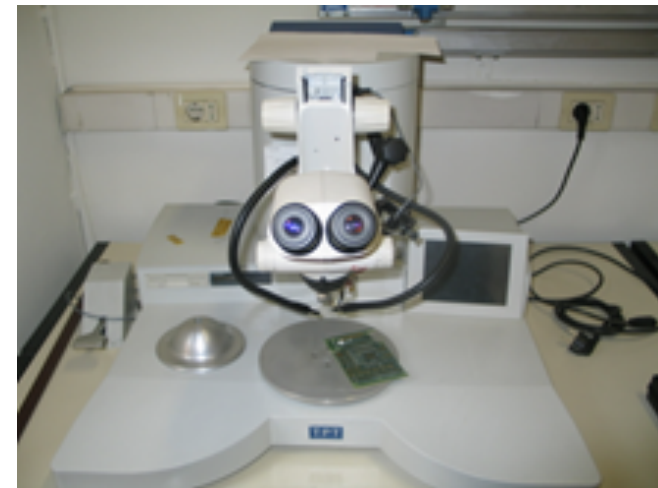
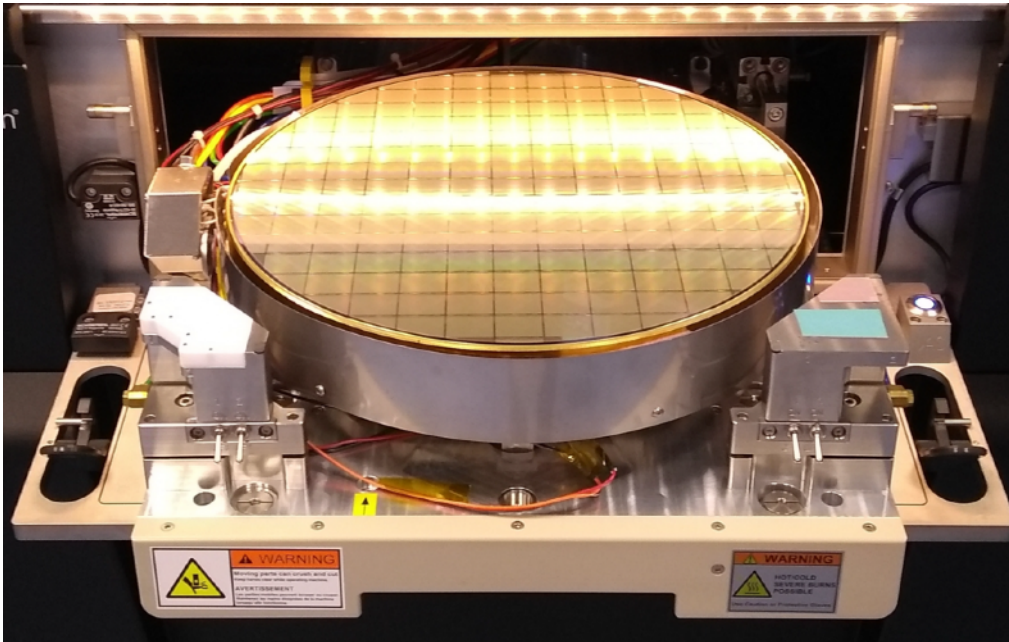


- Silicon detectors made indispensable the use of ASICs for readout
- Due to the many advantages (integration density, low noise, lower power) integrated circuits became soon popular for the readout also of other kind of detectors

From PCBs to ICs



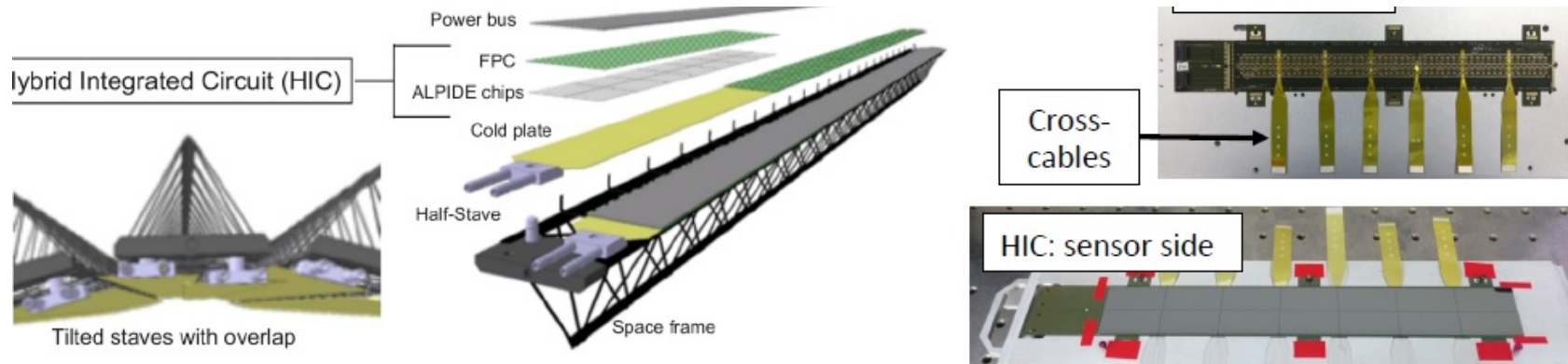
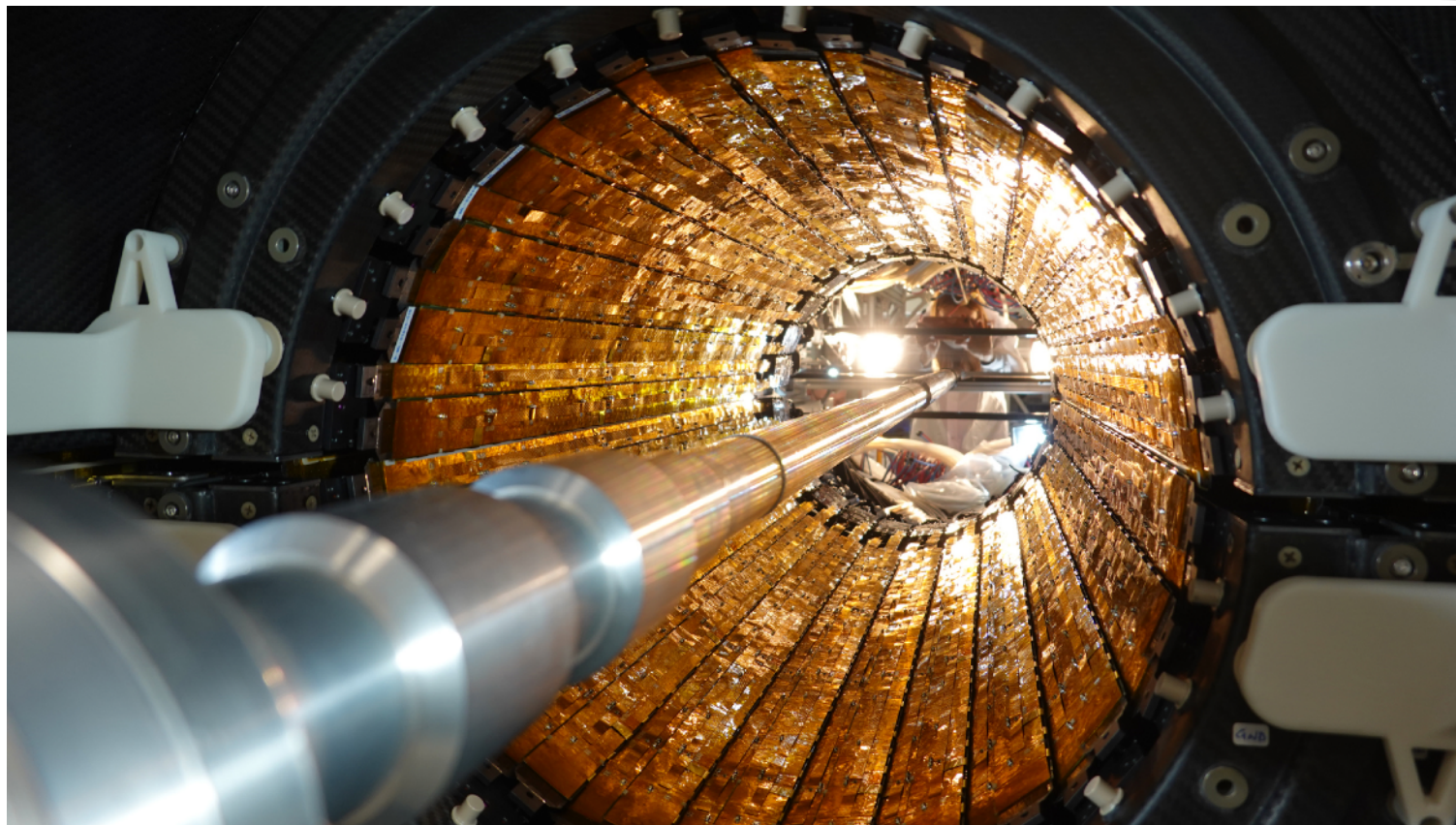
ASIC testing and handling



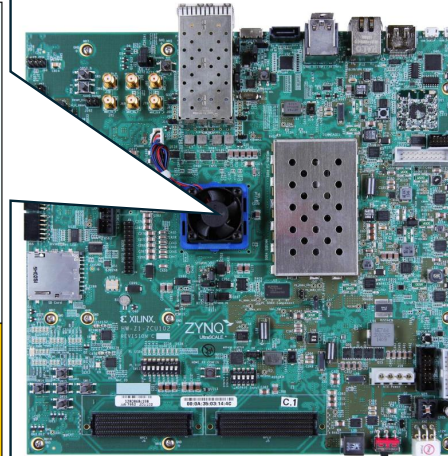
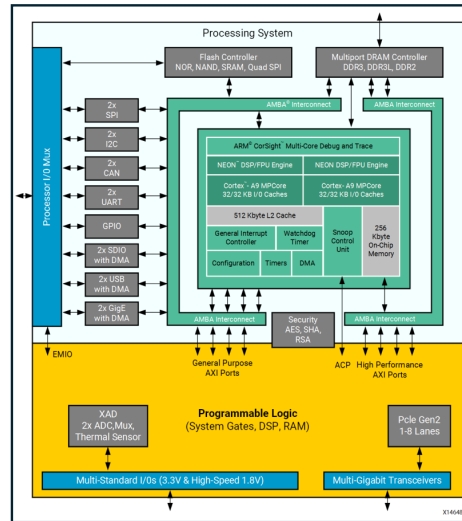
- Proximity testing
- Long term testing
- Assembly

- **ASIC are used only when commercial components are not viable**
- **Professional EDA tools**
- **The complexity change a lot: from small chips with an handful of channels doing simple processing to large and complex systems**
- **A special role is being gained by CMOS sensors**
- **The technology is very expensive and unforgiving**
- **ASIC development cycles are typically long**
- **There are a few design groups within INFN, but no everywhere**
- **Critical mass is a key factor, especially to design large ASICs**

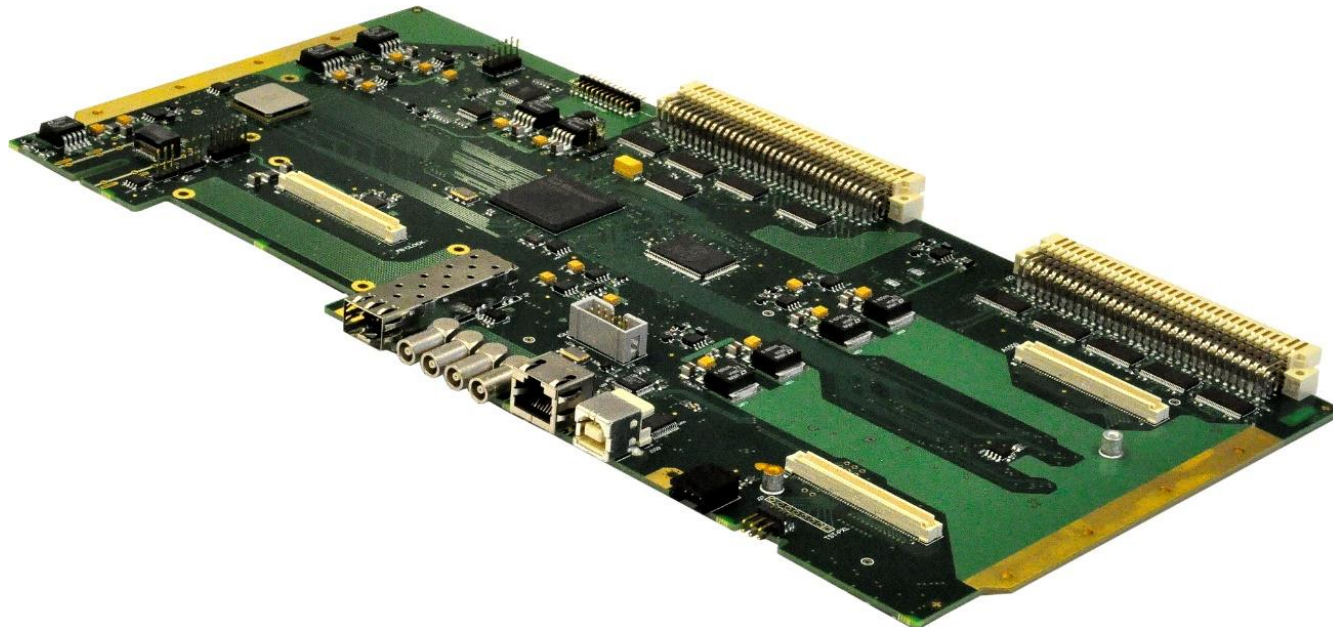
From PCBs and ICs to full systems



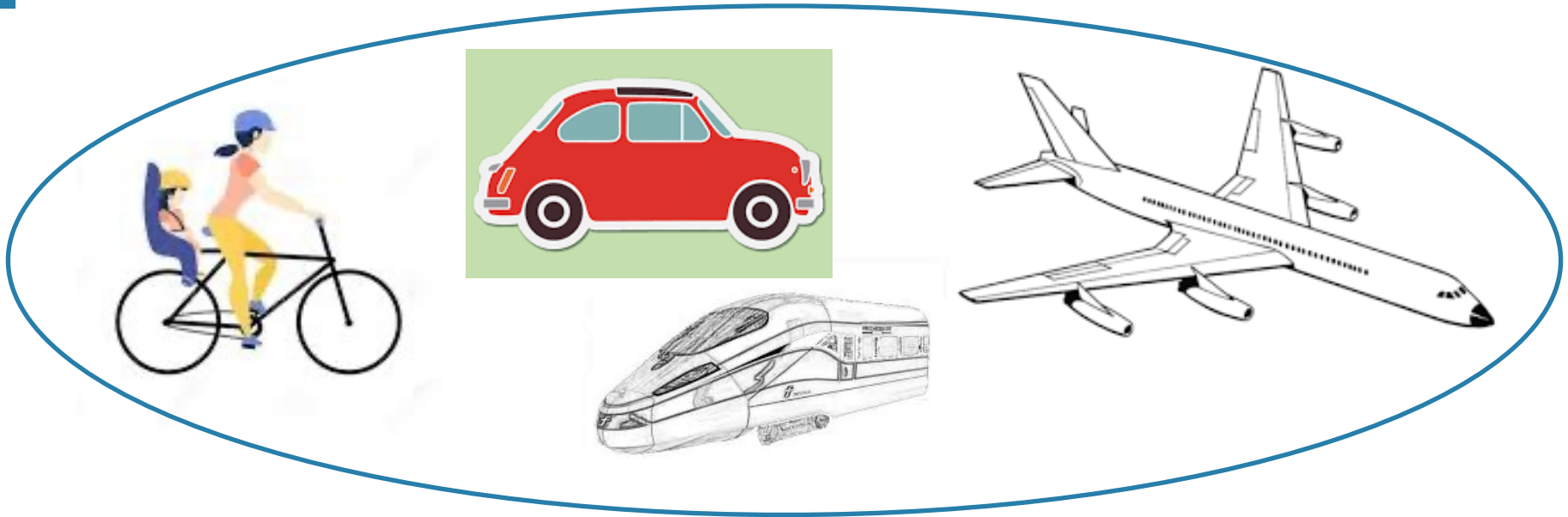
FPGA programming and boards



Example: AMD/Xilinx MPSoC Architecture, ZCU102

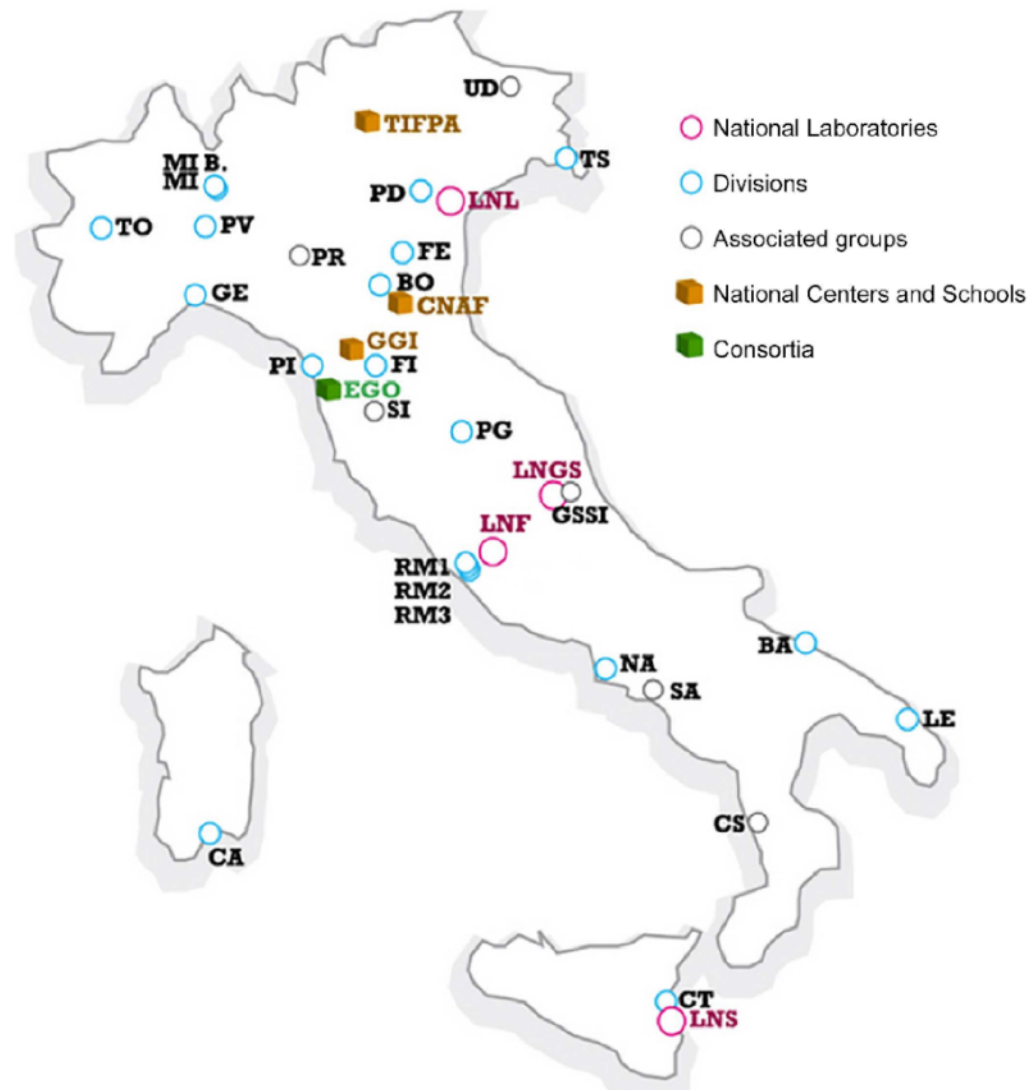


- **Most, if not all, projects require today some specialised firmware running on a FPGA**
- **In some cases, FPGA firmware development can be very complex**
- **DAQs need continuous support and tend to be often upgraded**
- **Some small scale applications can be run on development kits, but complex systems require the development of ad hoc PCBs**
- **FPGAs are complex...PCBs hosting them are also complex!**



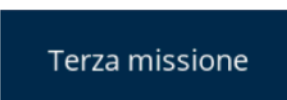
- **Electronic services need to manage very different technologies**
- **INFN is a federal organization. A common pattern has local peculiarities**
- **But in a network what you do not find locally, you may find elsewhere**
- **Some services are more diversified than others (size of the local unit counts)**
- **Both services and infrastructure management**

Electronics services at INFN

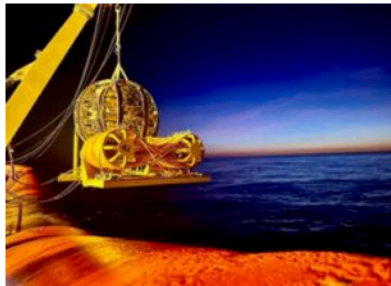


- Each unit has its own service, usually with key features and competences

Finding info's



Benvenuto nel sito della Sezione di Trieste dell'INFN



Seminario sui nuovi risultati del telescopio per neutrini KM3NeT
10/02/2025

Mercoledì 12 febbraio appuntamento in Aula B per seguire in diretta la conferenza stampa

[Approfondisci](#)

1 2 3 4 5 >

[Tutte le notizie](#)

L'[Istituto Nazionale di Fisica Nucleare \(INFN\)](#) riunisce ricercatori che vogliono scoprire i meccanismi dell'infinitamente piccolo come dell'infinitamente grande. A tal fine inventano e sviluppano tecnologie innovative con cui realizzare misure tra le più precise che l'umanità possa fare.

L'INFN è uno dei più prestigiosi ed importanti Istituti italiani di ricerca, sia teorica che sperimentale, nei campi della fisica subnucleare, nucleare e astroparticellare, nonché nella ricerca e sviluppo tecnologico pertinenti all'attività in tali settori.

Le attività di ricerca dell'INFN si svolgono tutte in un ambito di competizione internazionale ed in stretta collaborazione con il mondo universitario italiano, sulla base di consolidati e pluridecennali rapporti.

COMMUNITY

Portale INFN	
Gestione emergenze	Webmail @ts.infn.it
Login pagine riservate	Elenco telefonico

- > Organi istituzionali
- > Attività di ricerca
- > Servizi locali
- > Amministrazione
- > Direzione e personale
- > Servizio calcolo e reti
- > Laboratorio di elettronica
- > Prevenzione e protezione
- > Progettazione e officina meccanica
- > Servizio tecnico generale
- > Utilità e strumenti

Laboratorio di elettronica

[Versione stampabile](#)

Personale

Il personale del Laboratorio di elettronica attualmente è costituito da 8 collaboratori tecnici altamente qualificati per svolgere le seguenti attività:

- Progettazione elettronica.
- Progettazione schede a circuito stampato (PCB) multilayer.
- Realizzazione e test di collaudo dei PCB.
- Allestimento banchi di test ed esecuzione di misure sperimentali su circuiti integrati sviluppati nell'ambito delle attività di ricerca.
- Progettazione e realizzazione di piccoli supporti e jig meccanici, indispensabili nei montaggi delle apparecchiature.
- Caratterizzazione dispositivi a semiconduttore.
- Montaggio con microsaldatura a ultrasuoni di dispositivi a semiconduttore ed elettronica corrispondente, utilizzando 4 macchine di microsaldatura disponibili per l'uso nella Sezione, compreso "deep access" e "ball bonding".
- Montaggio di sistemi di rivelatori ed elettronica corrispondente per vari esperimenti e progetti di sviluppo tecnologico.
- Realizzazione di stampa 3D FDM (Fused Deposition Modeling)

Strumentazione

Progettazione Elettronica

LNGS overview

Organization

Director

Divisions & Services

Research Division

Secretariat

Computing & Network

Chemistry & Chemical Plants

Special Techniques for detection
of rare events

Cryogenics and Vacuum

Electronics

Accelerators

Technical & General Service Division

Secretariat

Fluid Systems and Lifting
Equipment

Electrical Plants

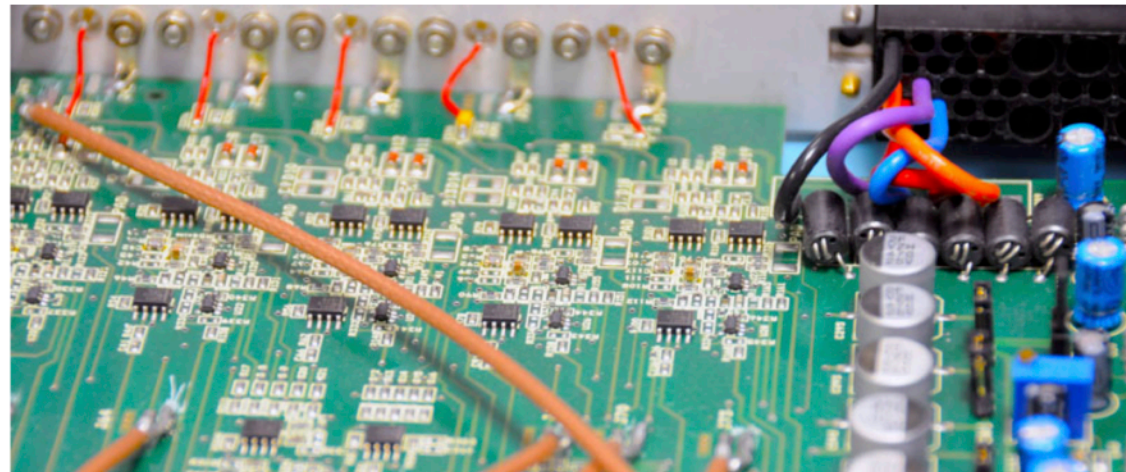
Fire, Security and Supervision

Building

Underground Facility and Special
Projects

Mechanics

Electronics



Activities and support provided by Electronic Service

The electronic service provides support to the experimental activities and to the other services of LNGS for the development and implementation of electronic devices.

The service is in charge of the following activities:

- design and implementation of analog and digital electronic devices;
- design and realization of programmable logic circuits;

- **Each service is coordinated by a person appointed by the local director**
- **This person should be the first contact points**
- **Activities are planned on a yearly basis. Many activities span several years**
- **Some buffer is usually left for contingency**
- **Facilities are usually accessible to associated personnel, provided they are properly trained in both operation and safety**
- **A service is not a self-service...**
- **FPGAs and ASICs design also carried-out in University groups**