Istituto Nazionale di Fisica Nucleare

IMPROVING TEACHING THROUGH RESEARCH EXPERIENCE

Danilo Domenici – Laboratori Nazionali di Frascati

on behalf of the PID group

INFN: who we are?

Italian National Institute for Nuclear Physics
born in 1951

Today a community of 2000 people
with a single mission:

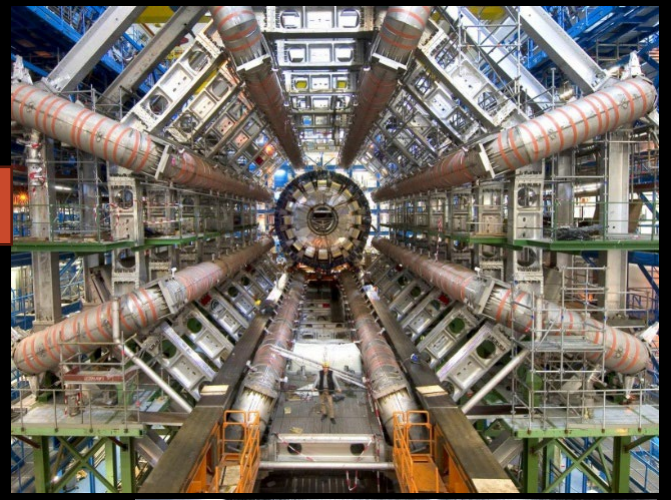
Fundamental research in particle physics
and development of related technologies

Promote and provide scientific education
and engage in diffusion of scientific culture

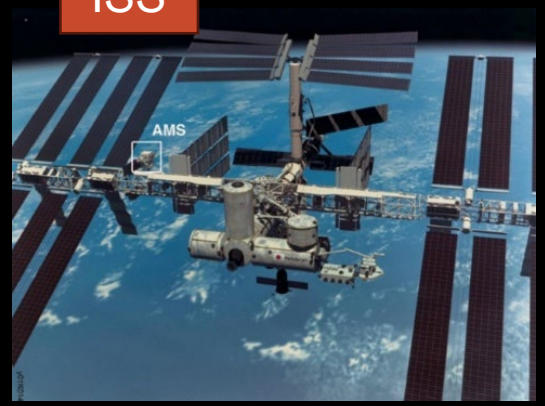
our research is international

OUTREACH

CERN

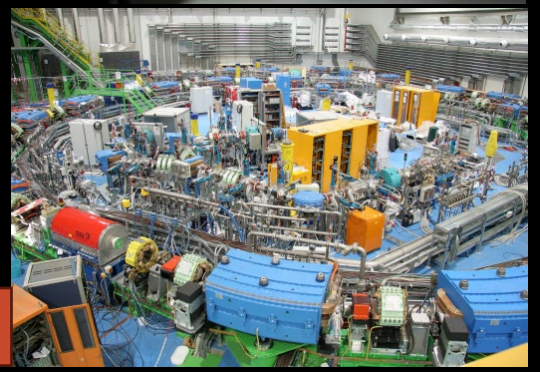


ISS

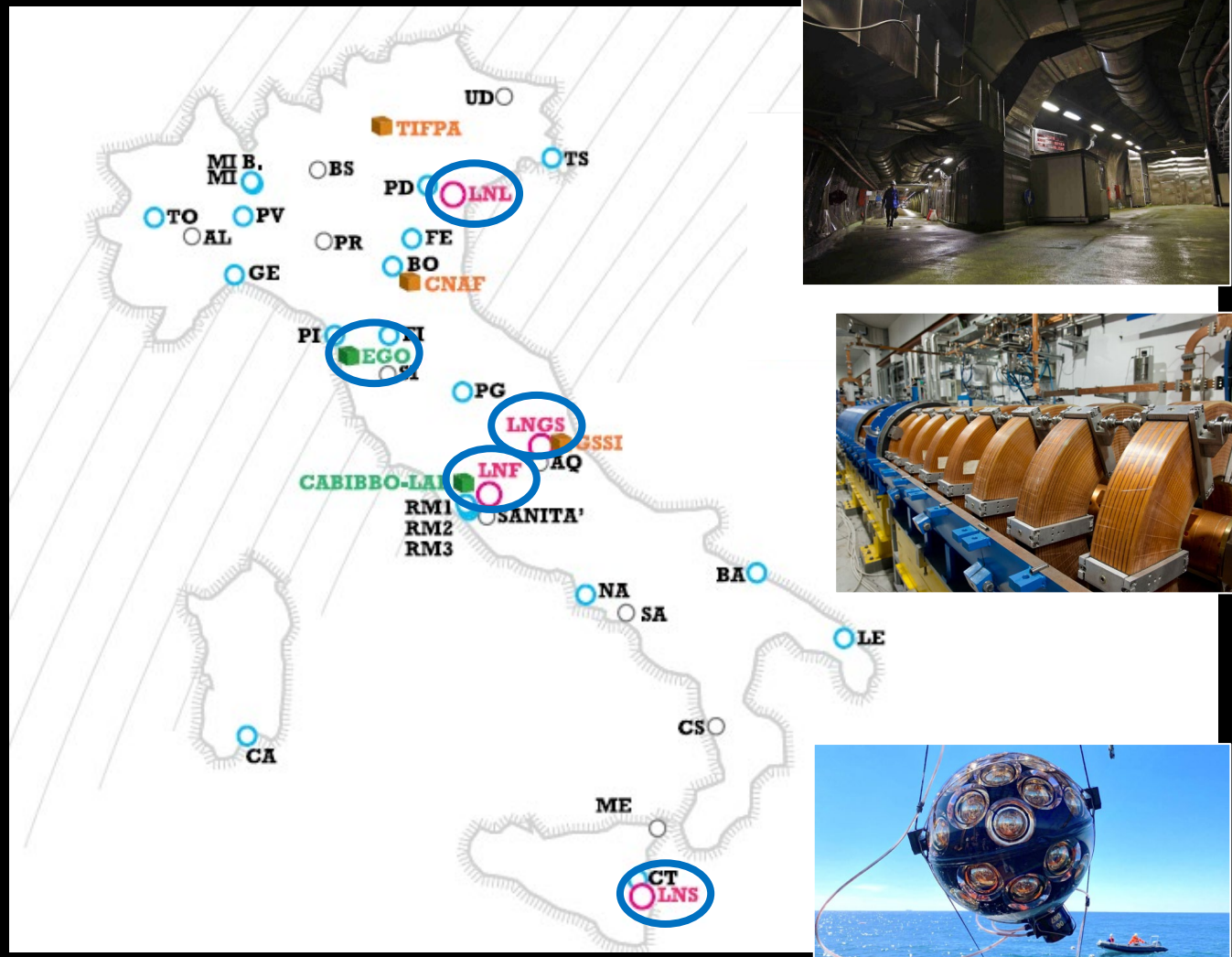


EGO

CNAO



In Italy



Diffusion overall the country both within Physics Departments of Universities and National Laboratories

Structures participating in the PID project:

Legnaro – nuclear and applied physics
Gran Sasso – underground physics
Frascati – particle accelerators
Catania – neutrino physics
EGO – gravitational waves

EGO – European Gravitational Observatory near Pisa jointly run by INFN, CNRS, NIKHEF

Goals of PID

born in 2018

Programma INFN per Docenti – INFN Program for High School Teachers

Provide high quality refresher course
Improve quality of teaching
Motivate and create direct links with INFN

Expose them to cutting-edge research

Extend their knowledge of our research centres

Create informal networks among participants and researchers

Promote interactions with existing outreach activities and promote new ones

Create new and stable links with High Schools

Improve awareness about our research

Reach students rarely touched by our initiatives

Strengthen link with territory

INFN

How it's done

Residential Course
spend one week together with our researchers
…doing actual research work!

Improve knowledge on
how cutting-edge science is done
where is done
who is doing it

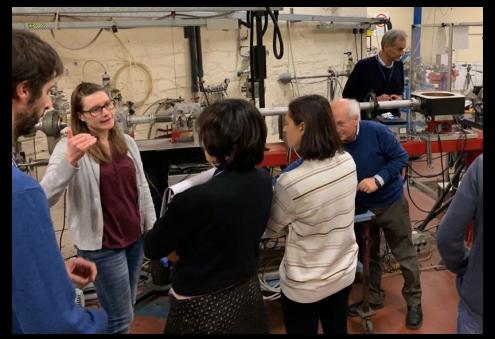
Teachers bring in their classrooms
chance to develop ideas
exchange of experience
build networks

Hands on activity with research infrastructures

Team with researchers and other teachers

Improve modern physics knowledge

Motivate teachers



Format in detail

Mornings are devoted to classes
lab-specific research (learning phase), description and introduction to hands on activities

...afternoons
participants are split in teams and perform actual physics measurements together with our researchers
Teamwork as key component of scientific research

Number of participants limited to about 25

Visits to research infrastructures
Underground labs in Gran Sasso
KM3Net Laboratory in Porto Palo di Capopassero

2018/19 - Test in Legnaro and Catania
2019/20 - Full swing
Since 2022 - Back to normal after COVID

Researchers for a Week

Time	Monday 12 Nov	Tuesday 13 Nov	Wednesday 14 Nov	Thursday 15 Nov	Friday 16 Nov
9:00 11:00	Welcome Safety rules	Cultural heritage without accelerators	Radiofrequency cavities and cyclotrons	Radiobiology	Radiopharmaceutical
11:00 13:00	Linear and electrostatic accelerators	Guided tour of LNL	Cultural heritage with accelerators	Women in science	Final discussion
13:00 14:00	Lunch	Lunch	Lunch	Lunch	Lunch
14:00 18:00	Laboratories Group A Lab1 Group B Lab2 Group C Lab3 Group D Lab4	Laboratories Group A Lab4 Group B Lab1 Group C Lab2 Group D Lab3	Laboratories Group A Lab3 Group B Lab4 Group C Lab1 Group D Lab2	Laboratories Group A Lab2 Group B Lab3 Group C Lab4 Group D Lab1	

Participants are split in groups
Lab measurements are drawn from daily operations
Play an active role!

Real research experience
Create direct links with researchers and with research laboratories
Push teachers' creativity
Do not leave them alone when back

Measuring our performance

Survey at the end course on:

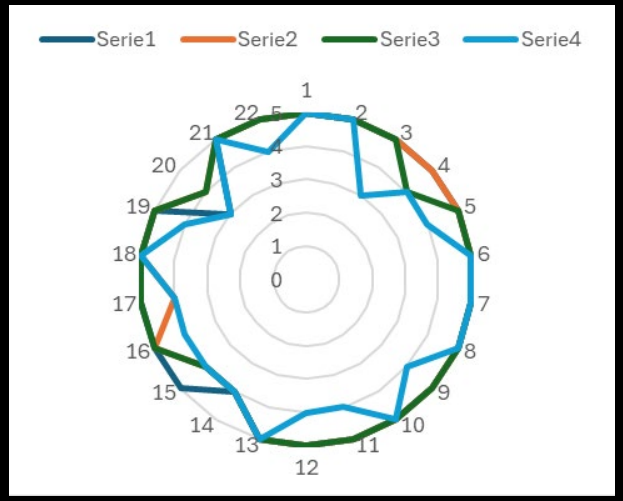
Contents
Activities
Seminars
Logistics
Expectations
Suggestions

All teams must produce a scientific report on one of their laboratories

A complete document published as internal report of the host lab

Evaluation of speakers:

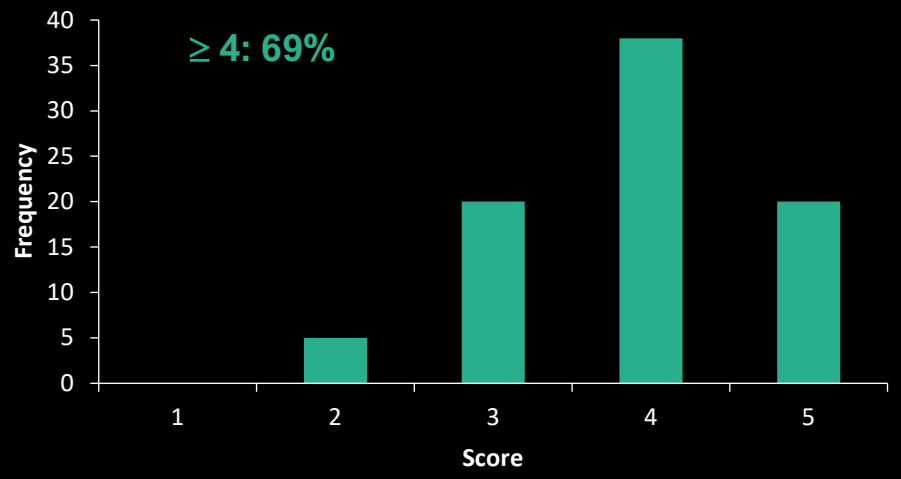
1. Expertise
2. Communication skills
3. Time management
4. *Was your preparation adequate to the lesson level?*



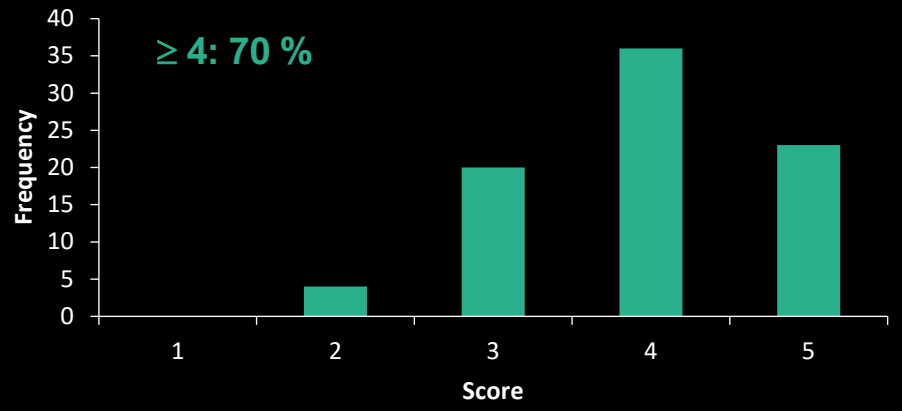
Can this be used in your work?

At the end of the stage we poll on the feeling about usefulness

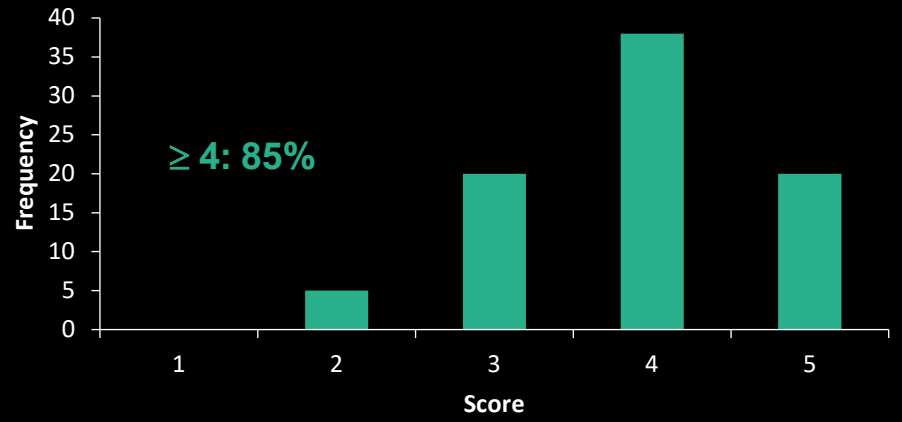
Do you think that activities you performed can be shared in the classroom with your students?



Do you think that this course will foster joint projects with colleagues?



Do you think possible to exploit material of this course in your teaching?



Ex post survey after 1 year

Impact in the classroom

Question	2022-2023 (persons = 55)	2023-2024 (persons = 79)
Did you share material with colleagues?	Yes 65%	Yes 68%
Did your teaching change?	Yes 55%	Yes 68%
How many times did you use material from the course?	Often: 14%	Often: 14%
	Sometimes: 61%	Sometimes: 68%
	Rarely: 18%	Rarely: 14%
	Never: 7%	Never: 4%
Did your didactic planning change?	Yes 40%	Yes 72%

85% of participants reported that their teaching improved

Conclusions

INFN is the Italian agency for fundamental research in particle physics

Science communication and public engagement are relevant missions of INFN

All science communications activities are coordinated by a dedicated commission (CC3M)

PID (Programma INFN per Docenti) is project dedicated to high school teachers

One-week stages are held in 4 INFN structures which make available their experimental facilities to the teachers

The unique training opportunity is often reflected in an improvement of the teaching

Thanks to Giorgio Chiarelli and Silvia Miozzi