

Training in the U.S. of Italian Science Students

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The science community at Fermilab is international in essence. Preserving this quality feature is essential to ensure the future of the lab. Since 1984, INFN and University of Pisa scientists performing experiments at Fermilab have been running a two-month summer training program for Italian students at the lab [1-6]. In 1984 the program involved only a few physics students from the University of Pisa, but it was later extended to other INFN groups and to engineering students. Since 2004 the program has been supported in part by DOE in the frame of an exchange agreement with INFN and has been run in part by the Cultural Association of Italians at Fermilab (CAIF, [7, 8]). In 2007 the Sant’Anna School of Advanced Studies (Pisa) established an agreement with Fermilab to share the cost of four engineering students each year. In the 36 years of its history, the program has hosted at Fermilab approximately 550 Italian students from more than 20 Italian universities and from some non-Italian universities. Several of these students returned to the U.S. for their PhD and are now employed as permanent staff at Fermilab and other labs. In addition, in the years 2010-2020, with the support of the National Institute of Space Physics (INAF), the Italian Space Agency (ASI), and CAIF, 30 students were hosted in other U.S. laboratories and universities. The steady increase of the trainees with time is shown in Fig. 1.

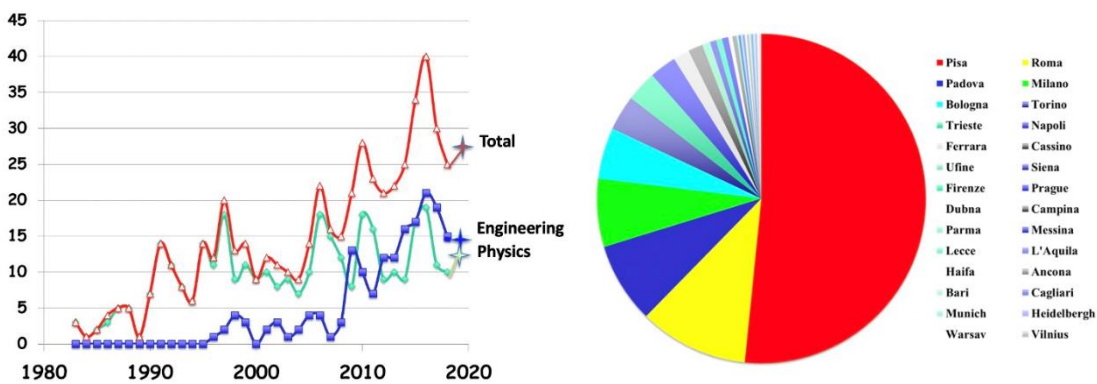


Fig. 1. (left) Distribution of the number of students selected in the years 1984-2019 (the Program of the year 2020 was cancelled): the blue curve represents the distribution of the engineering students, the green curve represents the distribution of the physics students and the red curve represents the total distribution. One notes an increased rate of engineering students in recent years, who are now as many as the physics students; (right) Frequency of accepted students as a function of the university of origin, including two non-Italian universities.

Trainings at Fermilab span over the entire range of science and technology programs of the laboratory, including local neutrino and rare particle physics experiments, the CMS experiment at CERN, astrophysical searches and analysis of astrophysical data, R&D on accelerator technologies, particle physics theory, design and construction of particle detectors and accelerator components, advanced computing and advanced data handling, superconducting R&D, theory of accelerators. Reading the final reports in the lab web site [9] is very instructive on the importance of student`s contributions.

Funded by the Italian Space Agency, each year CAIF offers to three graduate students a two-months stage in an American Space Research Center for training on space research programs. This special program is announced yearly by ASI and CAIF, who concur in selecting the best candidates among a very ample set of applicants. In close contact with the trainees, CAIF finds appropriate training programs in an US research center and helps solving the legal problems for the students to be accepted. The students are fully supported for intercontinental travel, local transportation and health insurance, and get a per-diem token fully adequate to cover their living expenses.

In 2015 the University of Pisa endorsed both programs as one of its own Summer Schools [10]. The interns are enrolled as Pisa students for the duration of the internship. They are required to write summary reports published in the Fermilab [10] and University of Pisa web pages. Upon positive evaluation by a University board, students are acknowledged 6 ECTS credits. An agreement has been signed between ASI and CAIF, for ASI to support yearly three two-months fellowships in U.S. space science.

The success of these programs is due to the high quality of the recruited students, to their assignment of appropriate programs, and importantly, to continuous monitoring of their work quality. Students are carefully followed by the program team. After a month they present an oral report on the progress of their project, that is followed by a final oral report at the end of the period. Before departure they are requested to present a written paper describing the results of their work and to comments on what they have learned during the stage. After approval, the final written reports [9] are saved as internal Fermilab scientific publications. As such they become part of the student`s curricula. Upon their return to Italy the students pass an exam with University of Pisa professors, and may be granted credits for their university course. Most universities recognize these credits, that are 6 at Pisa for physics, engineering and mathematics.

In 2019 two students have been hired at BNL to perform a similar two-months long summer training stage on particle physics science and technology as at Fermilab. Two BNL research groups interviewed students from the pool of selected ones, and offered to two of them a training period on ongoing projects of BNL, with conditions very similar to those offered at Fermilab. Their programs were completed very successfully. Hopefully this important extension at BNL of students training on physical science and technology in the U.S. will be continued in the future.

The white paper will present data from the existing programs, and a vision on how to build upon them for the future of U.S. labs.

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