Involving the New Generations in Fermilab Future Endeavors

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The 22nd International Workshop on Neutrinos From Accelerators (NuFact 2021)
September 5-11, 2021, Virtual Event, THotel Cagliari (Italy)

This work was supported by the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska-Curie Grant Agreement no 734303, 822185, 858199, 101003460
Outline

FERMI NATIONAL ACCELERATOR LABORATORY
  • Italy @Fermilab

THE SUMMER STUDENTS PROGRAM
  • Students’ Recruitment
  • Training Programs
  • Costs and Sponsorships

  2020 Program (sadly) cancelled
  2021 Program replaced by a 3-day Workshop at LNF

  • Internships at Space Science Labs

CONCLUSIONS
Fermilab is America's particle physics and accelerator laboratory
We bring the world together to solve the mysteries of matter, energy, space and time.

What we do

Deep Underground Neutrino Experiment
Fermilab hosts DUNE and the Long-Baseline Neutrino Facility, being built by scientists and engineers from more than 30 countries.

Particle physics
Fermilab explores the universe at the smallest and largest scales, studying the fundamental particles and forces that govern our universe.

Accelerator science and technology
Fermilab designs, builds and operates powerful accelerators to investigate nature's building blocks, advancing technology for science and society.

Detectors, computing and quantum science
Fermilab pioneers the research and development of particle detection technology and scientific computing applications and facilities.
Fermilab Organization

PARTICLE PHYSICS & NEUTRINO DIVISIONS
- Design Lab’s particle physics & neutrino experiments

ACCELERATOR DIVISION
- Develop new accelerator techniques
- Provide beams for Lab’s experiments

TECHNICAL DIVISION
- Develop technologies for particle experiments

SCIENTIFIC COMPUTING DIVISION
- Provide infrastructures for data handling/analysis

~1800 EMPLOYEES + THOUSANDS OF VISITORS

Feynman Computer Center
Italy @Fermilab, some history

COLLIDER DETECTOR AT FERMILAB (CDF), SINCE 1984

• ~100/600 Italian scientists in the years 2000-2010

BOLOGNA, FRASCATI, PADOVA, PAVIA, PISA, ROMA, SIENA, TRENTO, TRIESTE, UDINE (INFN and UNIVERSITIES)

• 5 co-spokesperson from Pisa

~100 MASTER + 35 PhD THESES

The 2019 HEP prize of the EPS was awarded to the CDF and D0 Collaborations for the discovery of the top quark (1995)
Italy @Fermilab, as of today

NEW LAB’s ENDEAVOURS

• **Muon (g-2)**: Measurement of the anomalous muon magnetic moment
• **Mu2e**: Muon to electron conversion experiment
• **Icarus, SBN, DUNE**: Short/Long-baseline neutrino experiments
• ~150 Italian scientists

BOLOGNA, CATANIA, FERRARA, FRASCATI, GENOVA, GRAN SASSO, LECCE, MILANO, NAPOLI, PAVIA, PADOVA, PISA, ROMA, TRIESTE
(INFN DEPARTMENTS and UNIVERSITIES)
Students’ Recruitment

INTERNATIONAL PROGRAM
• Applications from most Italian and some European Universities

MASTER STUDENTS
• Physics/Applied Physics
• Engineering, Materials Science
• Computer Science

ADMISSION
• Curriculum Vitae
• Recommendation Letters
• Interview
• Good knowledge of English
Training Programs

AUGUST – SEPTEMBER (9 WEEKS)

PROGRAMS FOR PHYSICISTS
• Design, construction, commissioning of particle detectors/accelerators
• Simulation of particle detectors/accelerators and particle physics experiments
• Analysis of data collected by particle physics experiments

PROGRAMS FOR ENGINEERS
• Design/Test of particle detectors/accelerator components
• Design/Test of superconducting materials and magnets for particle accelerators
• Development of fast electronics components/high precision mechanics
• Development of advanced computing infrastructures

UNIVERSITY CREDITS (acknowledged by the UNIPI Summer School)
• 6 ECTS credits (ECTS, European Credit Transfer and Accumulation System)
Training Programs (2018-2019)

2018: 10 PHYSICS + 15 ENGINEERING

2019: 13 PHYSICS+15 ENGINEERING
Sponsorships

$0$ COST FOR THE STUDENT, $\sim$9,000$ FOR THE SPONSOR

- Department Of Energy at Fermilab
- Italian National Institute of Nuclear Physics
- Sant’Anna School of Advanced Studies (Pisa)
- Italian Space Agency (ASI), and Italian National Institute of Astrophysics (INAF, in 2010-2011) sponsors internships at US Space Science Labs
- University of Pisa
WHAT FERMILAB PROVIDES

• Weekly salary: ~400 $
• Free housing in Dorm
• Shared rental car
• Total cost ~9000 $/student

WHAT FERMILAB DOES NOT PROVIDE

• Round-trip journey from Italy to Chicago
• Health insurance: mandatory

STUDENTS’ TO-DO LIST

• Valid passport
• Employment and J1 Visa bureaucracy with the help of Fermilab administrative offices
Important Actions/Dates

- **January – March**: Receive Students’ Applications
- **March – April**: Students Interviews
- **April - May**: Students Selection TP Assignment
- **Last weekend of July**: Fly to Chicago Fermilab Hiring
- **+5 weeks (August)**: MidTerm Review
- **+9 weeks (September)**: Final Review
- **October**: Final Exam at UNIPI

**ICHEP 2020**: Jul 28 – Aug 6, 2020, Prague, Czech Republic

**DPF 2021**: Jul 12 – 14, 2021, Virtual Event, Florida State University

**TAUP 2021**: Aug 26 – Sep 3, 2021, Virtual Event, University of Valencia

**NuFact 2021**: Sep 5-11, 2021, Virtual Event, THotel Cagliari (Italy)
Students Statistics 1984 - 2019

~550 students
Involved Universities 1984 – 2019

~550 students

- Pisa
- Padova
- Bologna
- Trieste
- Ferrara
- Ufine
- Firenze
- Dubna
- Parma
- Lecce
- Haifa
- Bari
- Munich
- Warsaw
- Roma
- Milano
- Torino
- Napoli
- Cassino
- Siena
- Prague
- Campina
- Messina
- L'Aquila
- Ancona
- Cagliari
- Heidelberg
- Vilnius

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Training Programs 2008-2019

~270 students

- Particle Physics Division
- Technical Division
- Accelerator Division
- Scientific Computing Division
Internships at Space Science Labs

- Stanford, SLAC
- Caltech
- Fermilab, Argonne, Purdue, Colorado, Arizona
- SSTC (Baltimore)
- HSCA (Harvard)
- Columbia
- Princeton
- ASI, INAF, INFN (ISSNAF, CAIF) supported 30 students outside Fermilab in 2010-2019
Topical Workshop

Involving the new generations in the future Fermilab endeavors

(August 2-4, 2021)

3-DAY FULL IMMERSION WORKSHOP

• 25 Physics/Engineering students from Italian Universities hosted at INFN - LNF
• Seminars on Fermilab experiments (Muon (g-2), Mu2e, SBN, DUNE and more) and technologies (accelerators, detectors, computing and more)
• Hands-on training by INFN experts / Visits to LNF infrastructures
Day 1 (August 3, 2021)

1. Welcome and startup of the meeting
   🗓 Dr Stefano Miscetti (INFN)
   🕒 02/08/2021, 14:30
   Meeting Introduction

2. Welcome from LNF director and LNF overview
   🗓 Dr Fabio Bossi (LNF)
   🕒 02/08/2021, 14:40
   Meeting Introduction

3. The Gran Sasso Laboratories
   🗓 Prof. Ezio Previtali (LNGS)
   🕒 02/08/2021, 15:20
   Meeting Introduction

4. FERMILAB (History, Present, Future and Summer Student role)
   🗓 Dr Nigel Lockyer (FERMILAB)
   🕒 02/08/2021, 16:30
   Fermilab history and neu...

5. The Fermilab Neutrino Program (Short and Long Baseline)
   🗓 Dr Gina Rameika (Fermilab), Stefano Miscetti (INFN)
   🕒 02/08/2021, 17:10
   Fermilab history and neu...

6. The INFN role on the Fermilab Neutrino program
   🗓 Prof. Sergio Bertolucci (INFN and University of Padova, INFN Padova)
   🕒 02/08/2021, 17:40
   Fermilab history and neu...

7. The role of ISSNAF in USA
   🗓 Prof. Cinzia Zuffada (ISSNAF)
   🕒 02/08/2021, 18:10
   Fermilab history and neu...

Day 2 (August 4, 2021)

9. The g-2 experiment and the INFN contribution
   🗓 Dr Paolo Girotti (INFN Padova)
   🕒 03/08/2021, 09:00
   The Fermilab Muon Cam...

10. The Mu2e experiment and the INFN contribution
    🗓 Dr Stefano Miscetti (Laboratori Nazionali di...)
    🕒 03/08/2021, 09:45
    The Fermilab Muon Cam...

11. Visit to LNF Sites: DAFNE/KLOE, Syncr. Light, Visitor Center/Mu2e, Lab experience
    🕒 03/08/2021, 11:00
    Four groups of 5 students each, rotating among sites:

12. Overview of Fermilab work on Magnets
    🗓 Dr Emanuela Barzi (FERMILAB)
    🕒 03/08/2021, 14:30
    Fermilab Technological...

13. The mission of FAST R&D accelerator project
    🗓 Dr Alexander Valleyev (FERMILAB)
    🕒 03/08/2021, 15:15
    Fermilab Technological...

18. Neutrino search in the ICARUS T600 detector
    🗓 Dr Christian Farness (INFN Padova)
    🕒 03/08/2021, 16:30
    Fermilab neutrino sessio...

17. Status and commissioning of the ICARUS T600 detectors
    🗓 Dr Angela Fava (PS)
    🕒 03/08/2021, 17:00
    Fermilab neutrino sessio...

20. Physics with the NUMI beam in the T600 detector
    🗓 Dr Minerba Betancourt (FERMILAB)
    🕒 03/08/2021, 17:30
    Fermilab neutrino sessio...

19. SBND-PRISM: Sampling Multiple Off-Axis Fluxes with the Same Detector
    🗓 Dr Marco Del Tutto (FERMILAB)
    🕒 03/08/2021, 18:00
    Fermilab neutrino sessio...
Day 3 (August 4, 2021)

21. From Particle to Wiggle plot: the data analysis of the Muon g-2 experiment
   - Dr Matteo Sorbara (INFN and University...)
   - The Fermilab Muon Cam...
   - 04/08/2021, 08:55

30. High precision requires a perfect calibration: the g-2 laser system
    - Dr Elia Bottalico (INFN Pisa)
    - The Fermilab Muon Cam...
    - 04/08/2021, 09:20

22. High Intensity Muon beams: the difficult path for the Mu2e Calorimeter technical choice
    - Dr Ivano Sarra (Laboratori Nazionali...
    - The Fermilab Muon Cam...
    - 04/08/2021, 09:45

23. Visit to LNF Sites: DAFNE/KLOE, Syncr. Light, VisitorCenter/Mu2e, Lab experience
    - 04/08/2021, 11:00

24. Scientific computing at Fermilab
    - Dr Marco Mambelli (Fermilab)
    - Computing, TDAQ and Q...
    - 04/08/2021, 14:30

25. Development of a portable TDAQ system
    - Dr Ryan Rivera (FERMILAB)
    - Computing, TDAQ and Q...
    - 04/08/2021, 15:00

27. Introduction to Quantum Machine learning
    - Dr Gabriel Nathan Perdue (Fermilab)
    - Computing, TDAQ and Q...
    - 04/08/2021, 15:30

28. FNAL cosmic survey: DES, DESI and high-energy transients
    - Dr Antonella Palmeese (FERMILAB)
    - The Fermilab Cosmic Fr...
    - 04/08/2021, 16:30

29. FNAL cosmic survey: Cosmology with galaxy clusters and the Vera Rubin Observatory (LSST)
    - Dr Jim Annis (FERMILAB)
    - The Fermilab Cosmic Fr...
    - 04/08/2021, 17:10

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A 9-WEEK INTERNSHIP AT FERMILAB WOULD HAVE BEEN BETTER BUT WAS NOT POSSIBLE YET
WE ARE DOING OUR BEST TO KEEP THE CONNECTION BETWEEN FERMILAB FUTURE ENDEAVOURS AND THE STUDENTS ALIVE

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Conclusions

THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

• A multi-disciplinary 9-week internship for Physics and Engineering students
• Hands-on training on Fermilab high-tech research

~550 ITALIAN SUMMER STUDENTS SINCE 1984

• Many summer students developed their career at Fermilab with a Master Thesis and a PhD