Involving the new generations in Fermilab endeavors

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Fermilab S&T Directorates and Centers

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

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

EMERGING TECHNOLOGIES
- Push boundaries in Quantum, AI, microelectronics

APPLIED PHYSICS AND SUPERCONDUCTING TECHNOLOGY
- Develop technologies for particle experiments

COMPUTATIONAL SCIENCE / AI
- Provide infrastructures for data handling/analysis

Superconducting Quantum Materials and Systems
- A DOE National Quantum Information Science Research Center

~ 1800 EMPLOYEES +
THOUSANDS OF VISITORS
Italy @Fermilab, some history

COLLIDER DETECTOR AT FERMILAB (CDF), SINCE EARLY 80s
• ~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)
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, UDINE (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, ~9,000$ FOR THE SPONSOR

- U.S. Department of Energy at Fermilab
- INFN - Italian National Institute of Nuclear Physics
- Sant’Anna School of Advanced Studies (Pisa)
- ASI - Italian Space Agency (for internships at U.S. Space Science Labs)
- University of Pisa
Applicants Benefits

WHAT FERMILAB PROVIDES

• Weekly stipend: ~600 $  
• Free housing in Fermilab Dorms  
• 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’s 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

January – April
Receive Supervisors’ Training Programs

+5 weeks (August)
MidTerm Review

+9 weeks (September)
Final Review

October
Final Exam at UNIPI

5/8/23
Marco Mambelli I Involving the new generations in Fermilab endeavors
Summer Students Statistics (1983 – 2022)

Total of ~570 students
## Summer Students Statistics (1983 – 2022)

<table>
<thead>
<tr>
<th>Involved Universities (1984-2022)</th>
<th>570 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pisa</td>
<td>52%</td>
</tr>
<tr>
<td>Roma</td>
<td>10%</td>
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<tr>
<td>Padova</td>
<td>8%</td>
</tr>
<tr>
<td>Milano</td>
<td>8%</td>
</tr>
<tr>
<td>Bologna</td>
<td>7%</td>
</tr>
<tr>
<td>Torino</td>
<td>2%</td>
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<tr>
<td>Trieste</td>
<td>2%</td>
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<tr>
<td>Napoli</td>
<td>2%</td>
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<tr>
<td>Ferrara</td>
<td>1%</td>
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<tr>
<td>Cassino</td>
<td>&lt;1%</td>
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<tr>
<td>Udine</td>
<td>&lt;1%</td>
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<tr>
<td>Siena</td>
<td>&lt;1%</td>
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<tr>
<td>Firenze</td>
<td>&lt;1%</td>
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<tr>
<td>Parma</td>
<td>&lt;1%</td>
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<tr>
<td>Messina</td>
<td>&lt;1%</td>
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<tr>
<td>Lecce</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>L'Aquila</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Ancona</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Bari</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>International</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Training Programs (2008-2022)</th>
<th>290 students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle Physics Division</td>
<td>62%</td>
</tr>
<tr>
<td>Technical Division</td>
<td>20%</td>
</tr>
<tr>
<td>Accelerator Division</td>
<td>10%</td>
</tr>
<tr>
<td>Scientific Computing Division</td>
<td>8%</td>
</tr>
</tbody>
</table>
Internships at Space Science Labs

Stanford, SLAC

Fermilab, Argonne, Purdue, Colorado, Arizona

Caltech

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 HOSTED AT INFN – LNF

• SEMINARS OF FERMILAB EXPERIMENTS / TECHNOLOGIES

• VISITS TO LNF INFRASTRUCTURES / HANDS-ON TRAINING BY INFN EXPERTS
Year 2022, we were back at Fermilab

• 21 SUMMER STUDENTS WILL BE AT FERMILAB ON JULY 25 FOR 9 WEEKS
  3-DAY FULL IMMERSION WORKSHOP AT UNIPI AND INFN PISA
  (JULY 18-20, 2022)

• SEMINARS OF FERMILAB EXPERIMENTS / TECHNOLOGIES AND ORGANIZATION

• VISIT TO THE EUROPEAN GRAVITATIONAL OBSERVATORY AND VIRGO
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
• 2023 program under way

~570 SUMMER STUDENTS IN THE PROGRAM SINCE 1983

• Many former Summer Students then developed their career at Fermilab with a Master Thesis and a PhD