



UNIVERSITÀ DI PISA



Involving the New Generations in Fermilab Future Endeavors

Emanuela Barzi, Giorgio Bellettini,
Simone Donati, Daniele Pasciuto

University and INFN Pisa

**The 22nd International Workshop on Neutrinos
From Accelerators (NuFact 2021)**

September 5- 11, 2021, Virtual Event, THotel Cagliari (Italy)

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Outline

FERMI NATIONAL ACCELERATOR LABORATORY

- Italy @Fermilab

THE SUMMER STUDENTS PROGRAM

- Students' Recruitment
- Training Programs
- Costs and Sponsorships
- Statistics (1984–2019)
 - 2020 Program (sadly) cancelled
 - 2021 Program replaced by a 3-day Workshop at LNF
- Internships at Space Science Labs

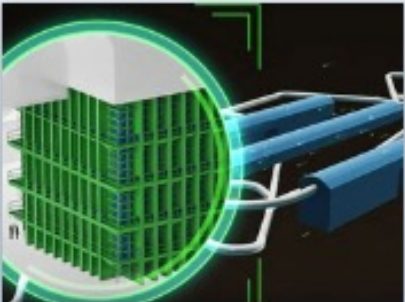
CONCLUSIONS



Fermilab is America's particle physics and accelerator laboratory

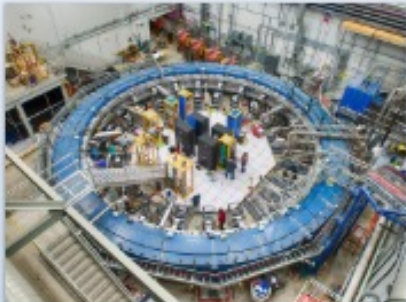
We bring the world together to solve the mysteries of matter, energy, space and time.

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

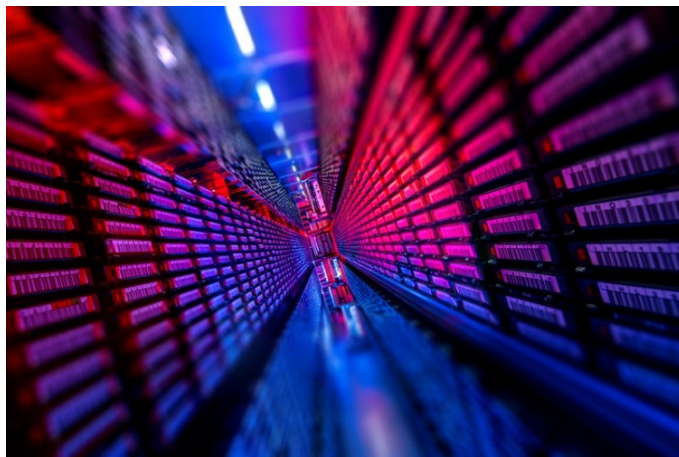
- Develop technologies for particle experiments

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

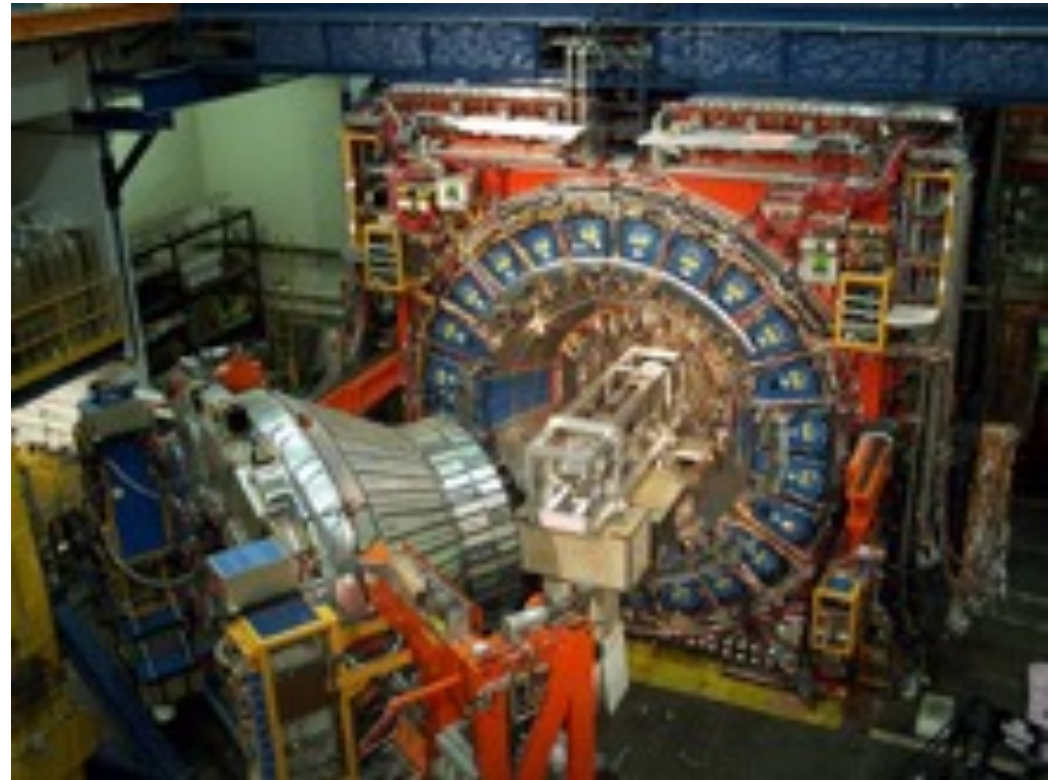
- ~100/600 Italian scientists in the years 2000-2010

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)

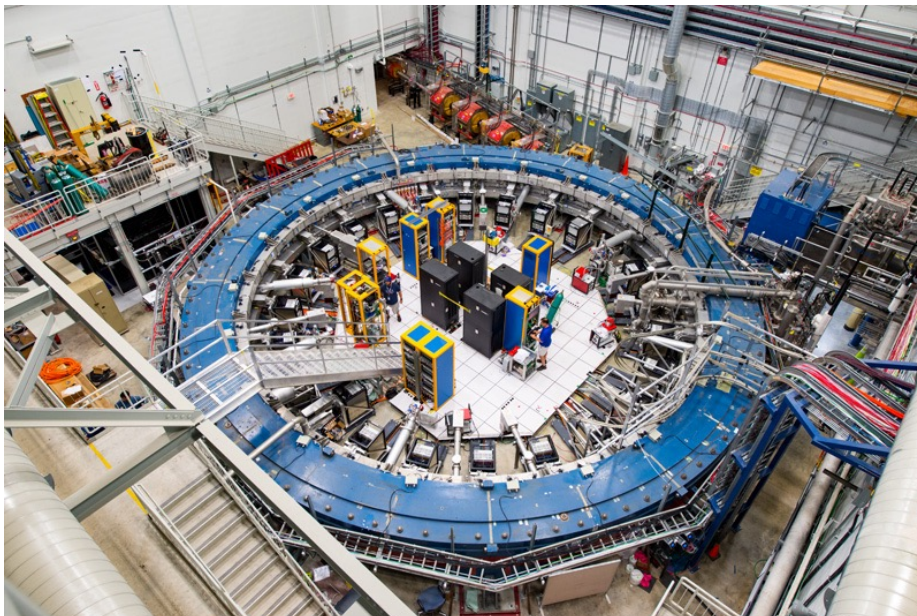


Italy @Fermilab, as of today

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

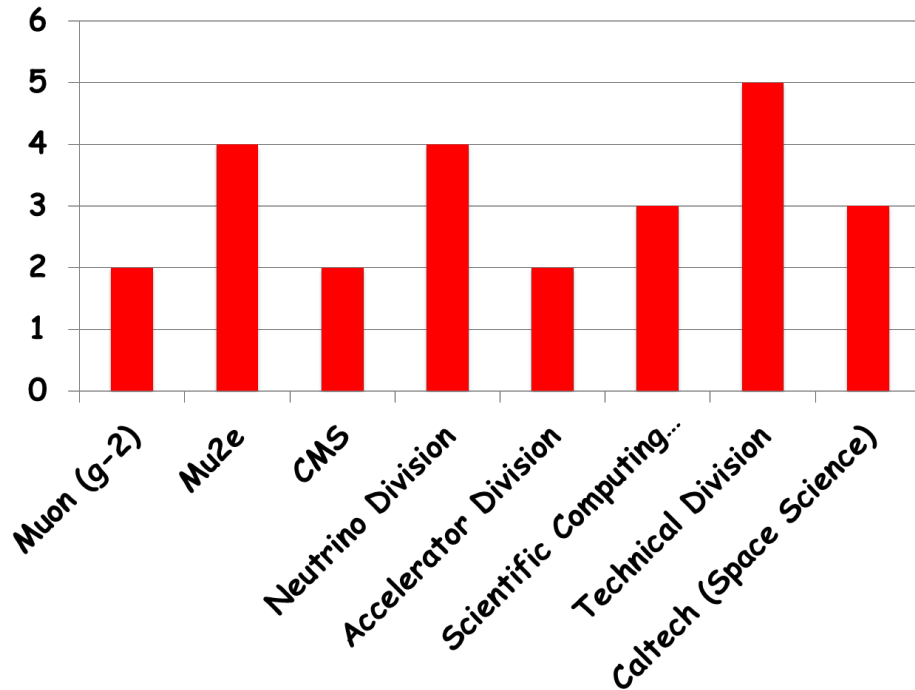
- Design/Test of particle detectors/accelerator components
- Design/Test of superconducting materials and magnets for particle accelerators
- Development of fast electronics components/high precision mechanics
- Development of advanced computing infrastructures

UNIVERSITY CREDITS (acknowledged by the UNIFI Summer School)

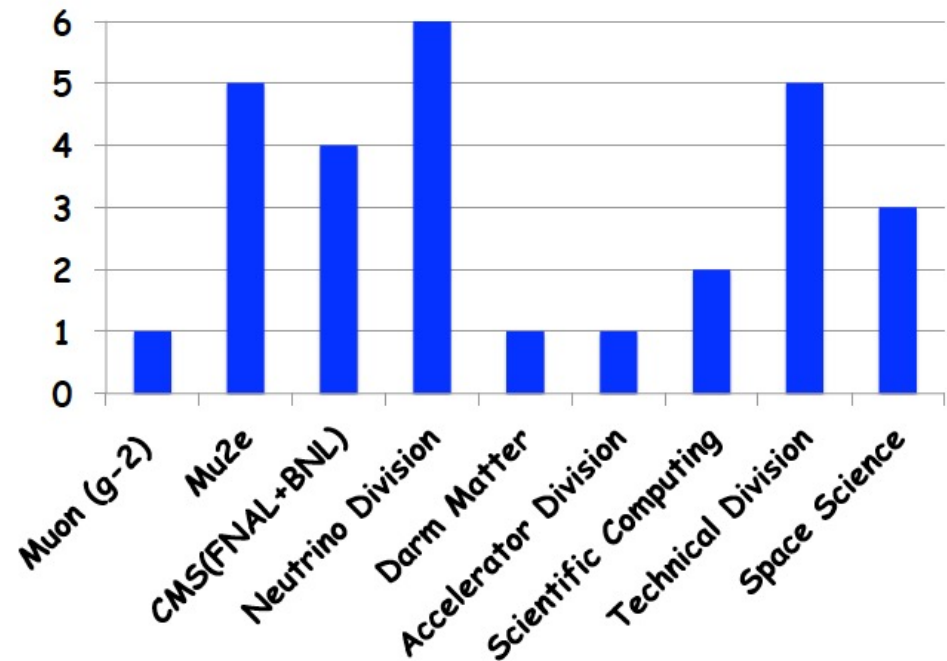
- 6 ECTS credits (ECTS, European Credit Transfer and Accumulation System)

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

- 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

Costs

WHAT FERMILAB PROVIDES

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

WHAT FERMILAB DOES NOT PROVIDE

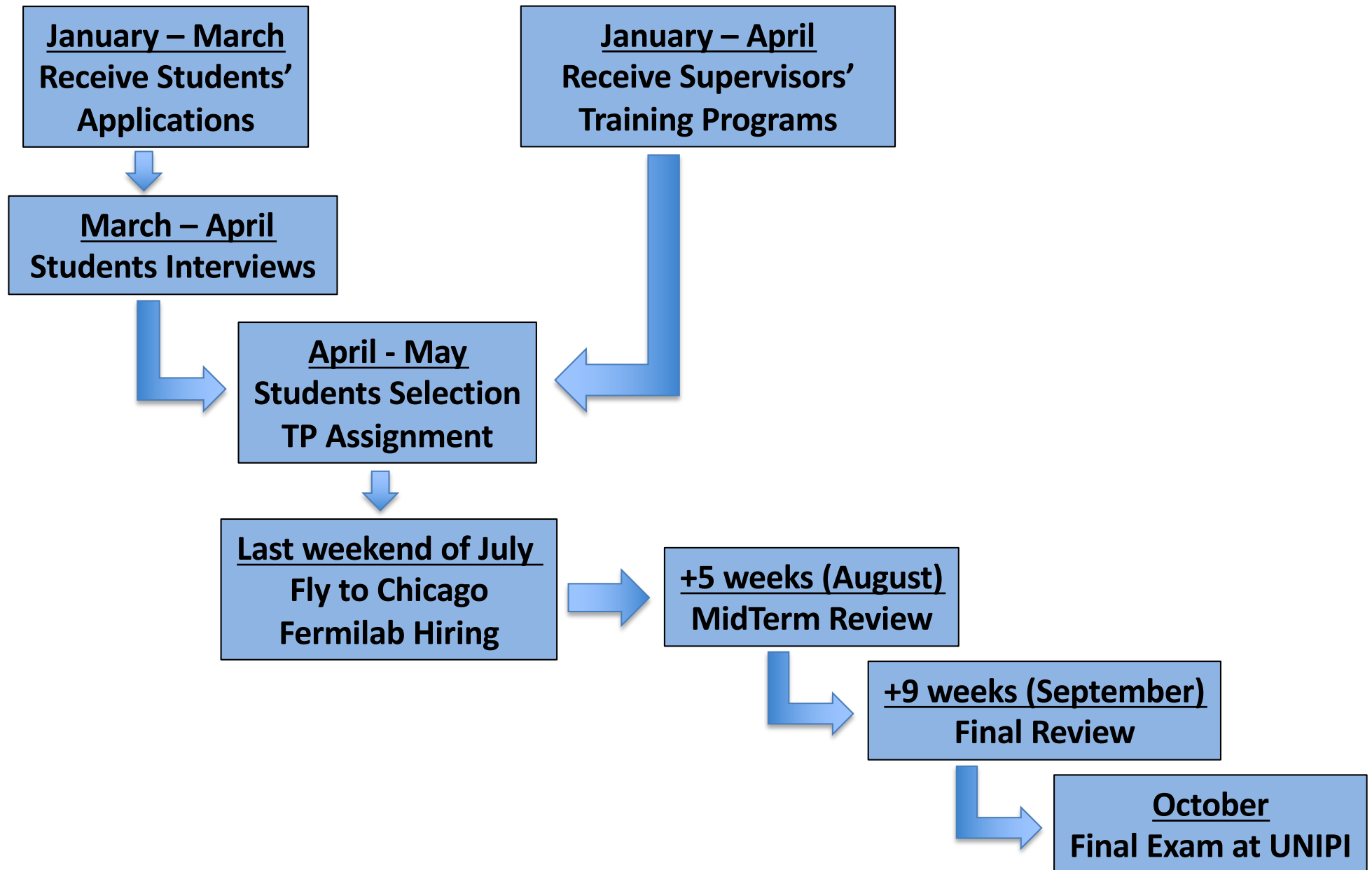
- Round-trip journey from Italy to Chicago
- Health insurance: mandatory

STUDENTS' TO-DO LIST

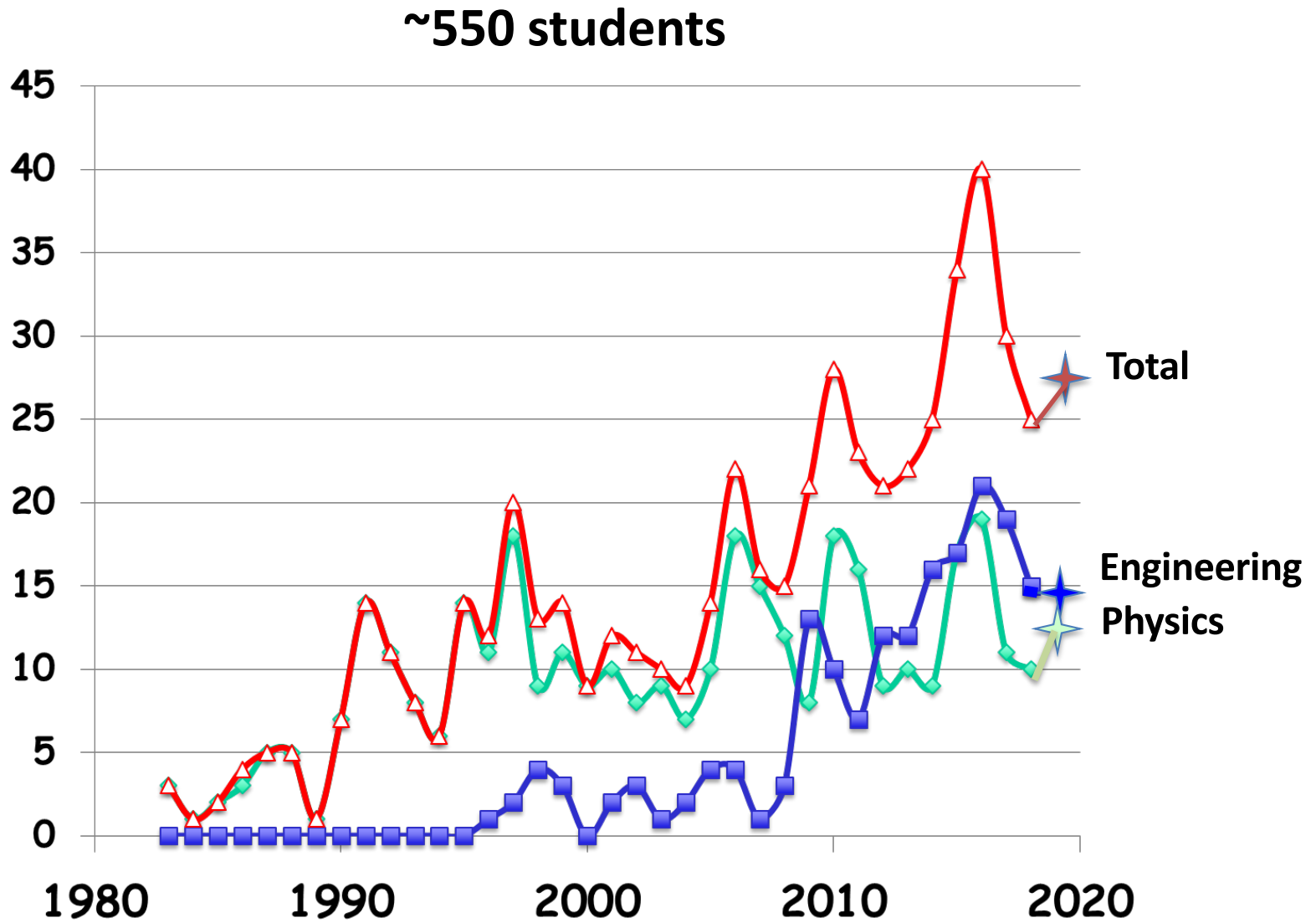
- Valid passport
- Employment and J1 Visa bureaucracy with the help of Fermilab administrative offices



Important Actions/Dates

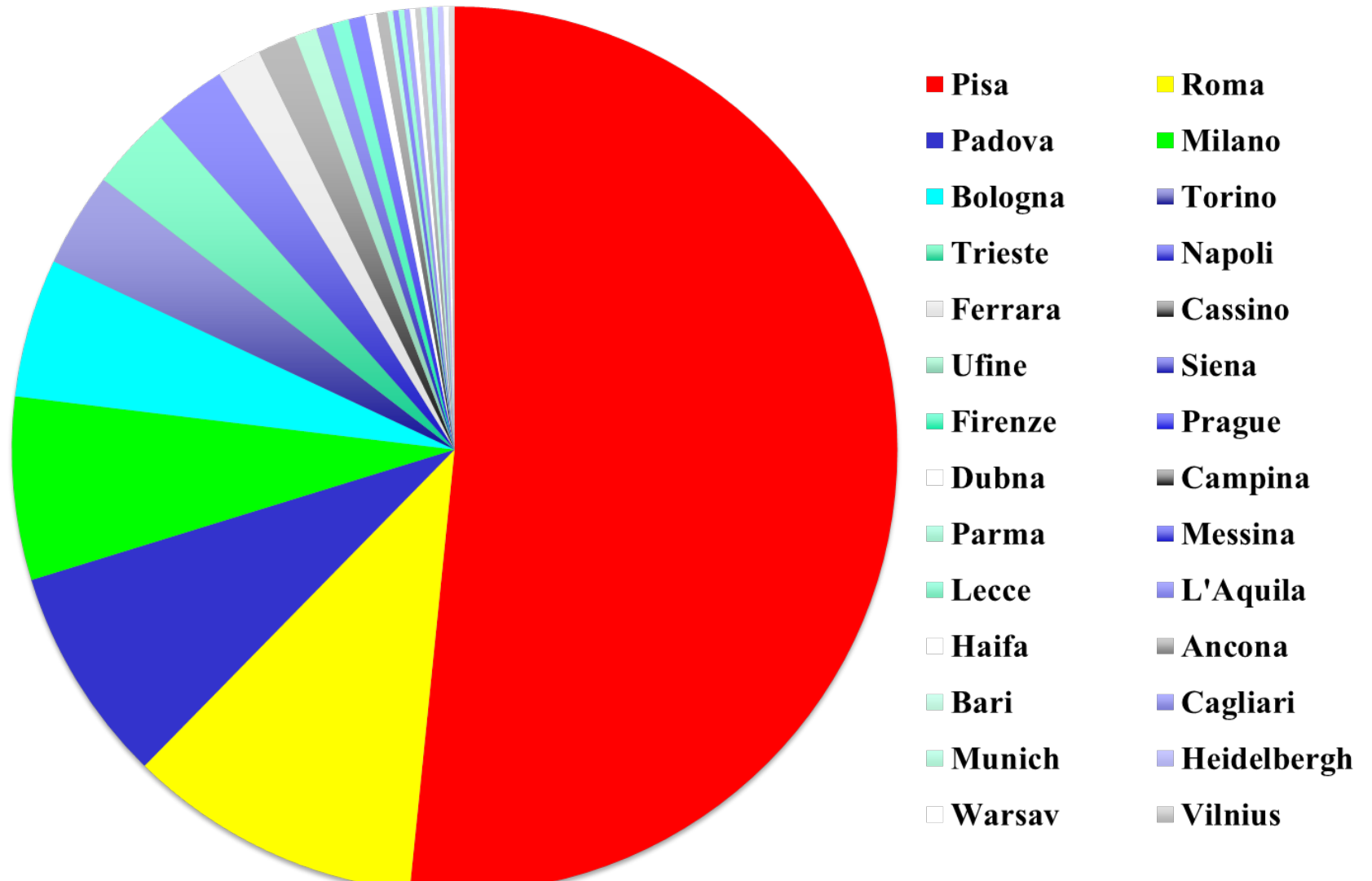


Students Statistics 1984 - 2019



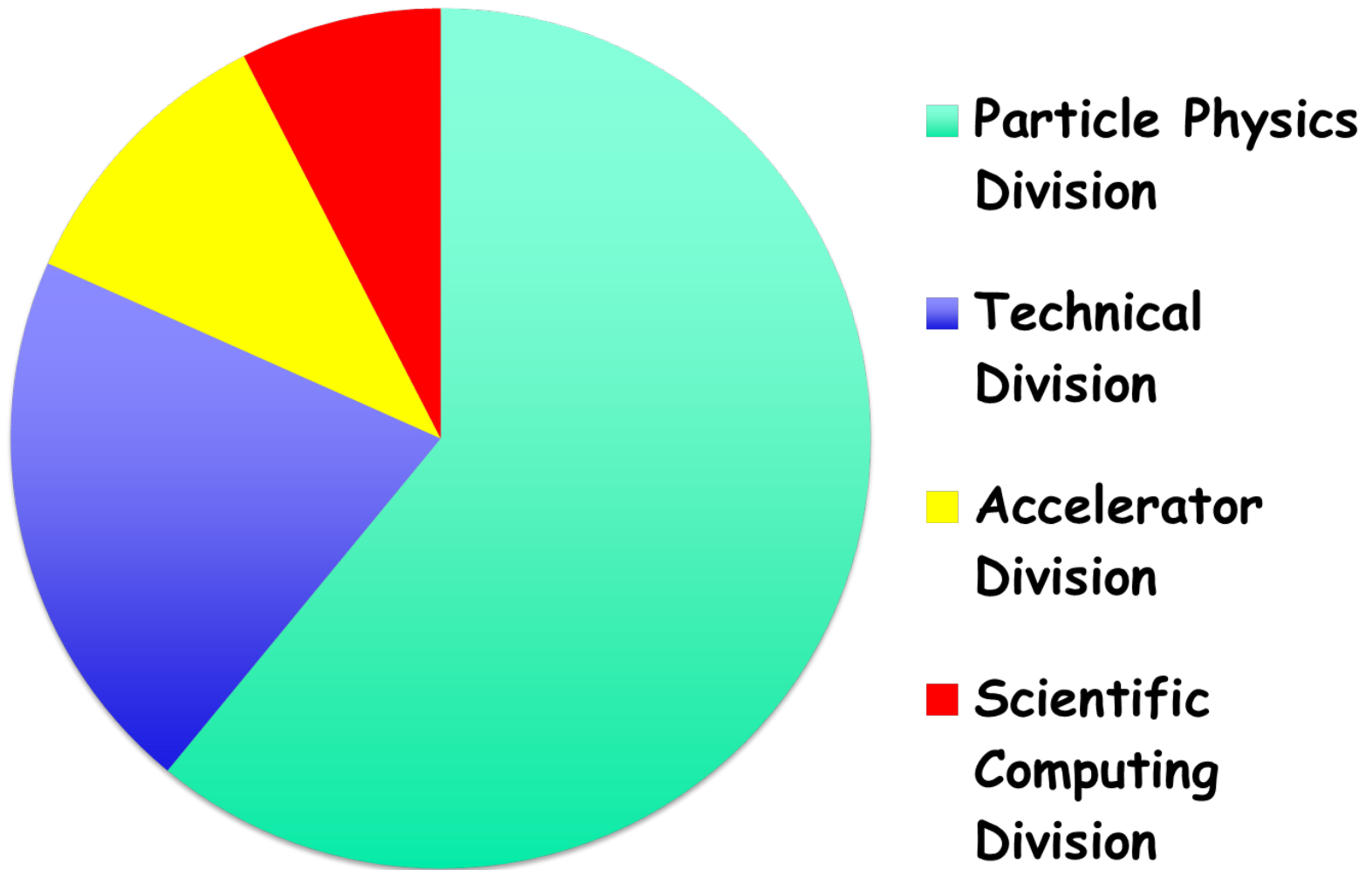
Involved Universities 1984 – 2019

~550 students

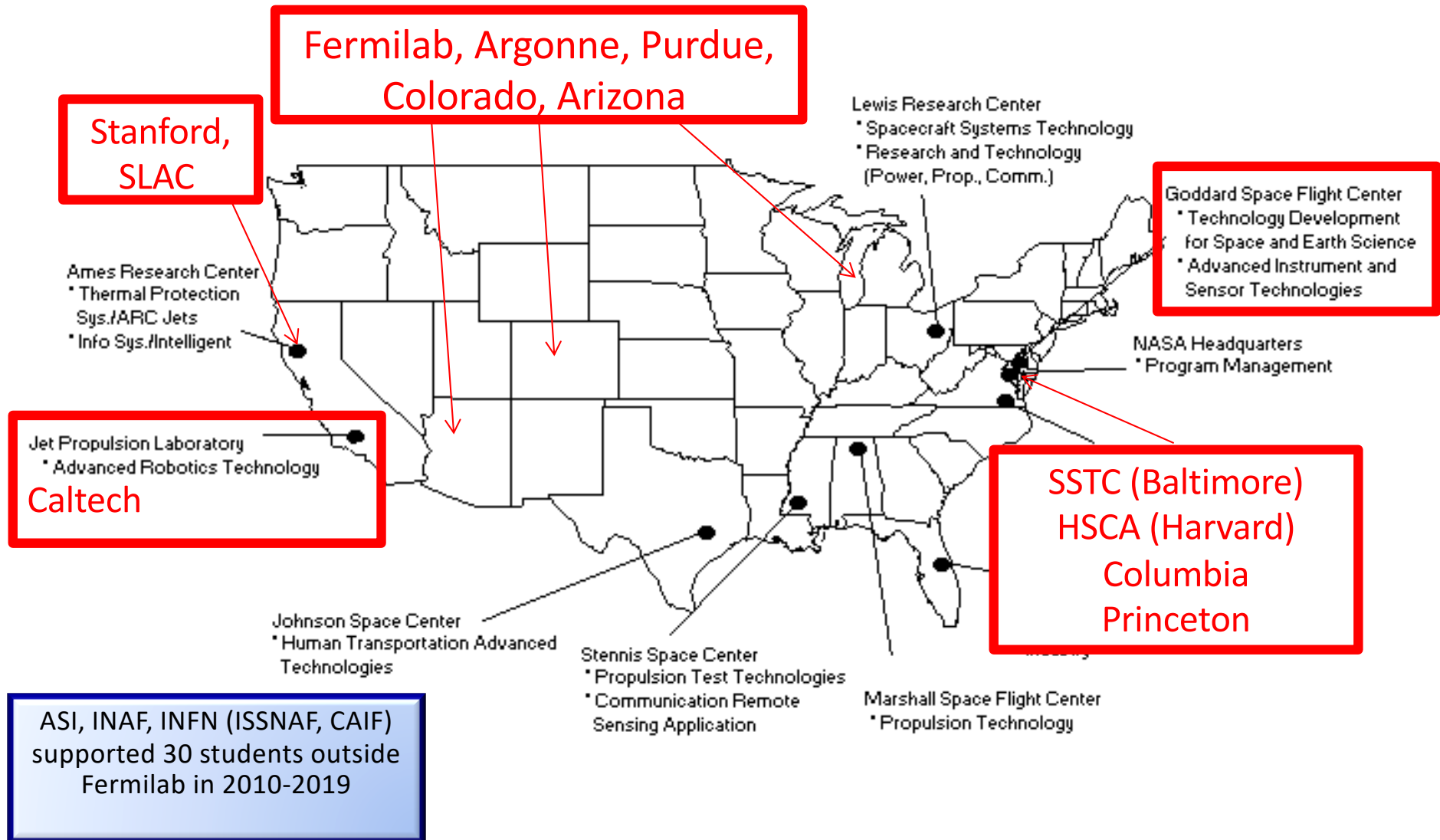


Training Programs 2008-2019

~270 students



Internships at Space Science Labs



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 (LNF)

02/08/2021, 14:30

Meeting Introduction (C...

2. Welcome from LNF director and LNF overview

Dr Fabio Bossi (LNF)

02/08/2021, 14:40

Meeting Introduction (C...

3. The Gran Sasso Laboratories

Prof. Ezio Previtali (LNGS)

02/08/2021, 15:20

Meeting Introduction (C...

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 (LNF)

02/08/2021, 17:10

Fermilab history and neu...

6. The INFN role on the Fermilab Neutrino program

Prof. Sergio Bertolucci (INFN and University...), Stefano Miscetti (Istituto Nazionale di...

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 Pisa)

03/08/2021, 09:00

The Fermilab Muon Cam...

10. The Mu2e experiment and the INFN contribution

Dr Stefano Miscetti (Laboratori Nazionali...)

03/08/2021, 09:45

The Fermilab Muon Cam...

11. Visit to LNF Sites: DAFNE/KLOE, Syncr. Light, VisitorCenter/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 Valishev (FERMILAB)

03/08/2021, 15:15

Fermilab Technological ...

18. Neutrino search in the ICARUS t600 detector

Dr Christian Farnese (INFN Padova)

03/08/2021, 16:30

Fermilab neutrino sessio...

17. Status and commissioning of the ICARUS T600 detectors

Dr Angela Fava (PD)

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...)

04/08/2021, 08:55

The Fermilab Muon Cam...

30. High precision requires a perfect calibration: the g-2 laser system

Dr Elia Bottalico (INFN Pisa)

04/08/2021, 09:20

The Fermilab Muon Cam...

22. High Intensity Muon beams: the difficult path for the Mu2e Calorimeter technical choice

Dr Ivano Sarra (Laboratori Nazionali...)

04/08/2021, 09:45

The Fermilab Muon Cam...

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)

04/08/2021, 14:30

Computing, TDAQ and Q...

25. Development of a portable TDAQ system

Dr Ryan Rivera (FERMILAB)

04/08/2021, 15:00

Computing, TDAQ and Q...

27. Introduction to Quantum Machine learning

Dr Gabriel Nathan Perdue (Fermilab)

04/08/2021, 15:30

Computing, TDAQ and Q...

28. FNAL cosmic survey: DES, DESI and high-energy transients

Dr Antonella Palmese (FERMILAB)

04/08/2021, 16:30

The Fermilab Cosmic Fr...

29. FNAL cosmic survey: Cosmology with galaxy clusters and the Vera Rubin Observatory (LSST)

Dr Jim Annis (FERMILAB)

04/08/2021, 17:10

The Fermilab Cosmic Fr...

**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**

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

