



UNIVERSITÀ DI PISA



Involving the New Generations in Fermilab Endeavors

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University and INFN Pisa

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July 31 – August 6, 2022, Salt Lake City, Utah

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Fermilab

Fermilab is America's particle physics and accelerator laboratory

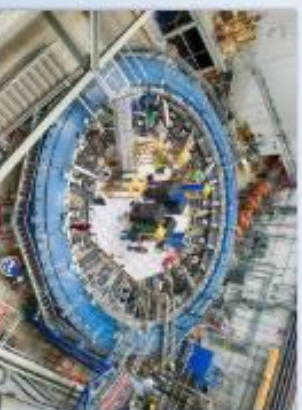
We bring the world together to solve the mysteries of matter, energy, space and time.

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.

Italy @Fermilab, some history

COLLIDER DETECTOR AT FERMILAB (CDF), SINCE EARLY 80s

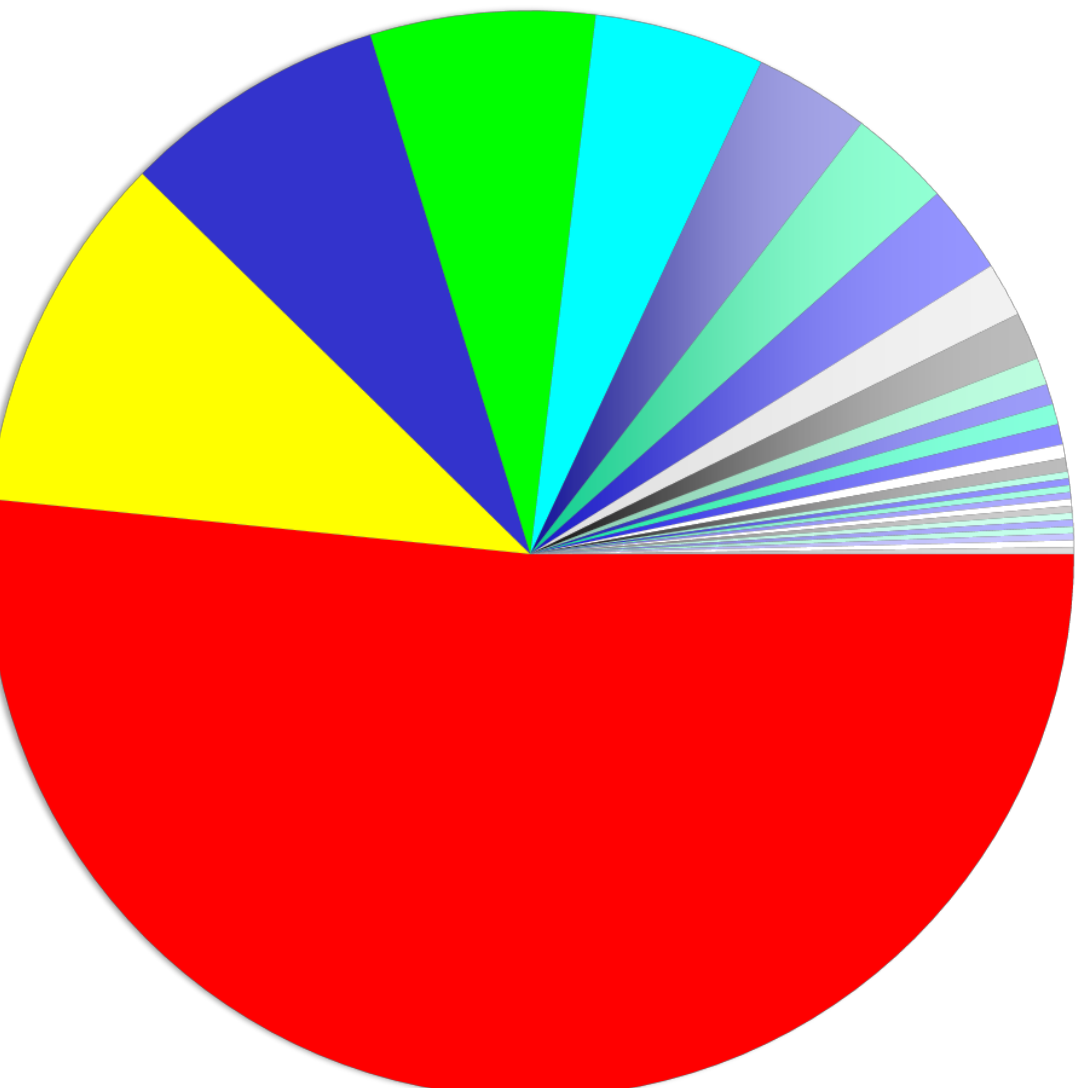
- ~100/600 Italian scientists in the years 2000-2010
BOLOGNA, FRASCATI, PADOVA, PAVIA, PISA, ROMA, SIENA, TRENTO, TRIESTE, UDINE (INFN and UNIVERSITIES)
- 5 co-spokesperson from Pisa
~100 MASTER + 35 PhD THESES

The 2019 HEP prize of the EPS
was awarded to the CDF and D0
Collaborations for the discovery
of the top quark (1995)



Involved Universities 1984 – 2019 + 2022

~570 students



Summer Students Statistics (1983 – 2022)

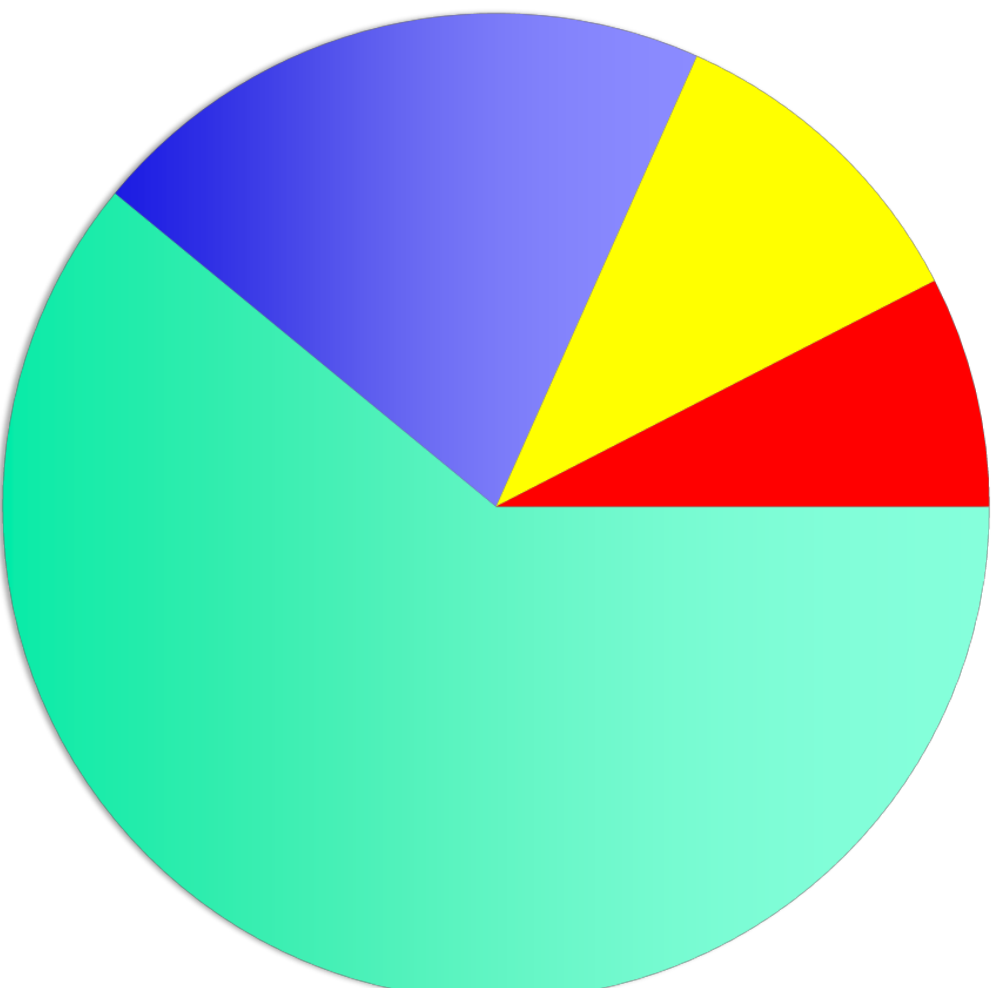
Involved Universities (1984-2022)	570 students
Pisa	52%
Roma	10%
Padova	8%
Milano	8%
Bologna	7%
Torino	2%
Trieste	2%
Napoli	2%
Ferrara	1%
Cassino	<1%
Udine	<1%
Siena	<1%
Firenze	<1%
Parma	<1%
Messina	<1%
Lecce	<1%
L'Aquila	<1%
Ancona	<1%
Bari	<1%
International	1%



Training Programs (2008-2022)	290 students
Particle Physics Division	62%
Technical Division	20%
Accelerator Division	10%
Scientific Computing Division	8%

Training Programs 2008 – 2019 + 2022

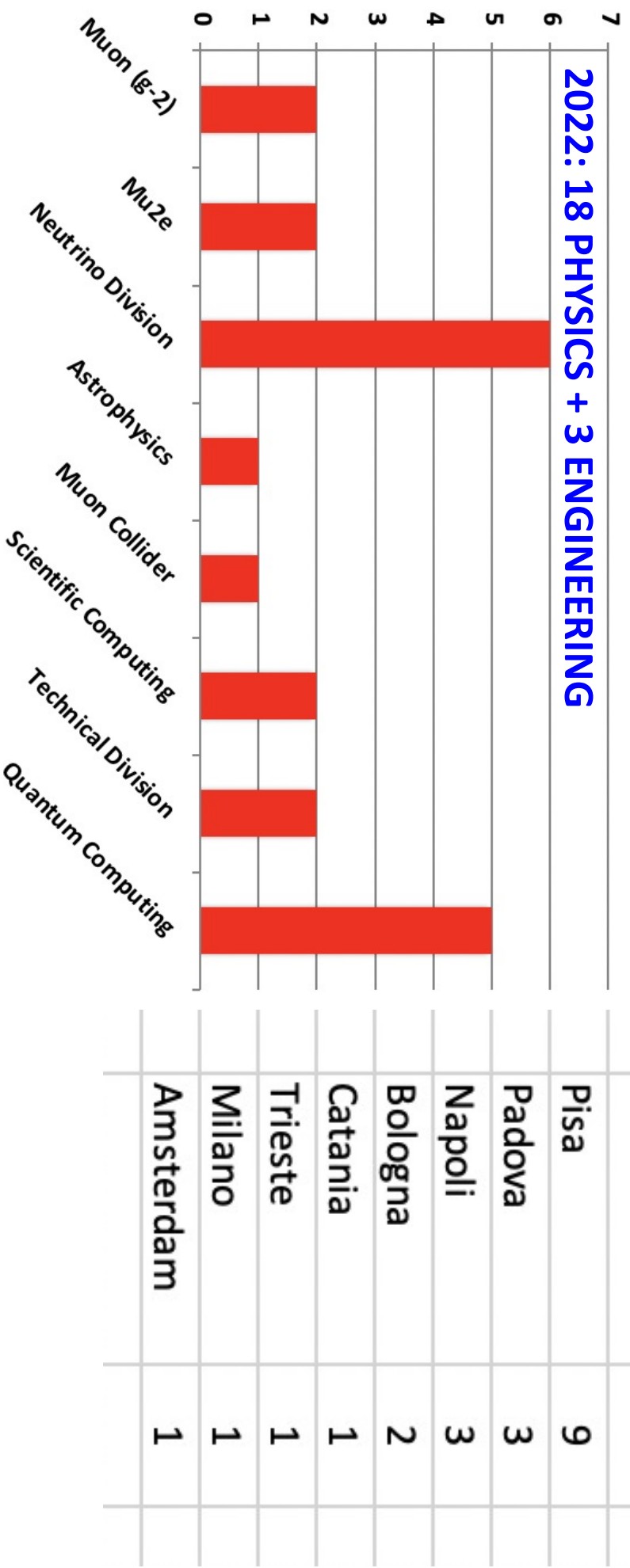
~290 students



- Particle Physics Division
- Technical Division
- Accelerator Division
- Scientific Computing Division

Year 2022, Fermilab, we are back

- 21 SUMMER STUDENTS WILL BE AT FERMILAB ON JULY 25 FOR 9 WEEKS
3-DAY FULL IMMERSION WORKSHOP AT UNIFI AND INFN PISA
(JULY 18-20, 2022)
- SEMINARS OF FERMILAB EXPERIMENTS / TECHNOLOGIES AND ORGANIZATION
- VISIT TO THE EUROPEAN GRAVITATIONAL OBSERVATORY AND VIRGO



Costs

WHAT FERMI LAB PROVIDES

- Weekly salary: ~600 \$
- Free housing in Fermilab Dorms
- Shared rental car
- Total cost ~9000 \$/student

WHAT FERMI LAB DOES NOT PROVIDE

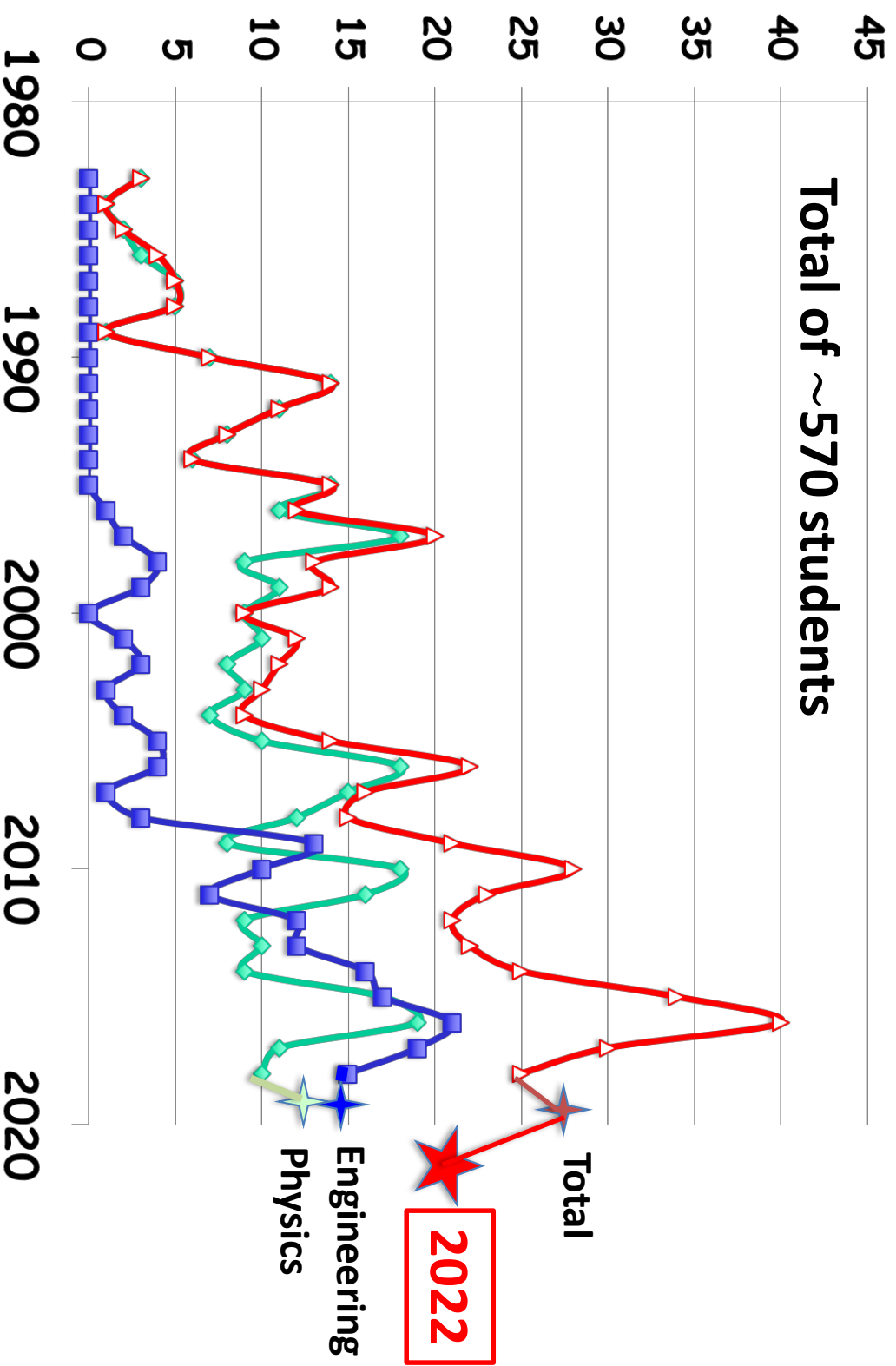
- Round-trip journey from Italy to Chicago
- Health insurance: mandatory

STUDENTS' TO-DO LIST

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



Summer Students Statistics (1983 – 2022)



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 UNPI Summer School)

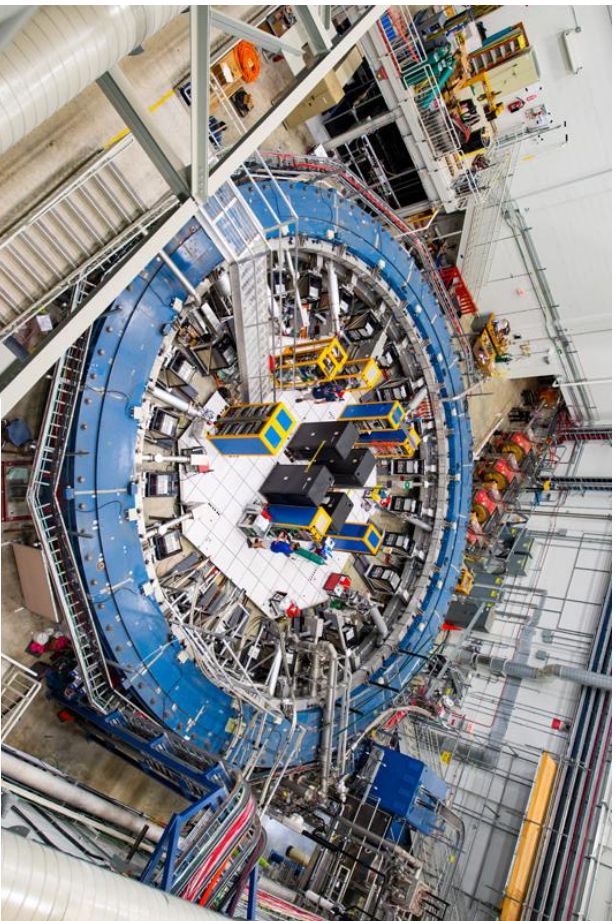
- 6 ECTS credits (ECTS, European Credit Transfer and Accumulation System)

Italy @Fermilab, as of today

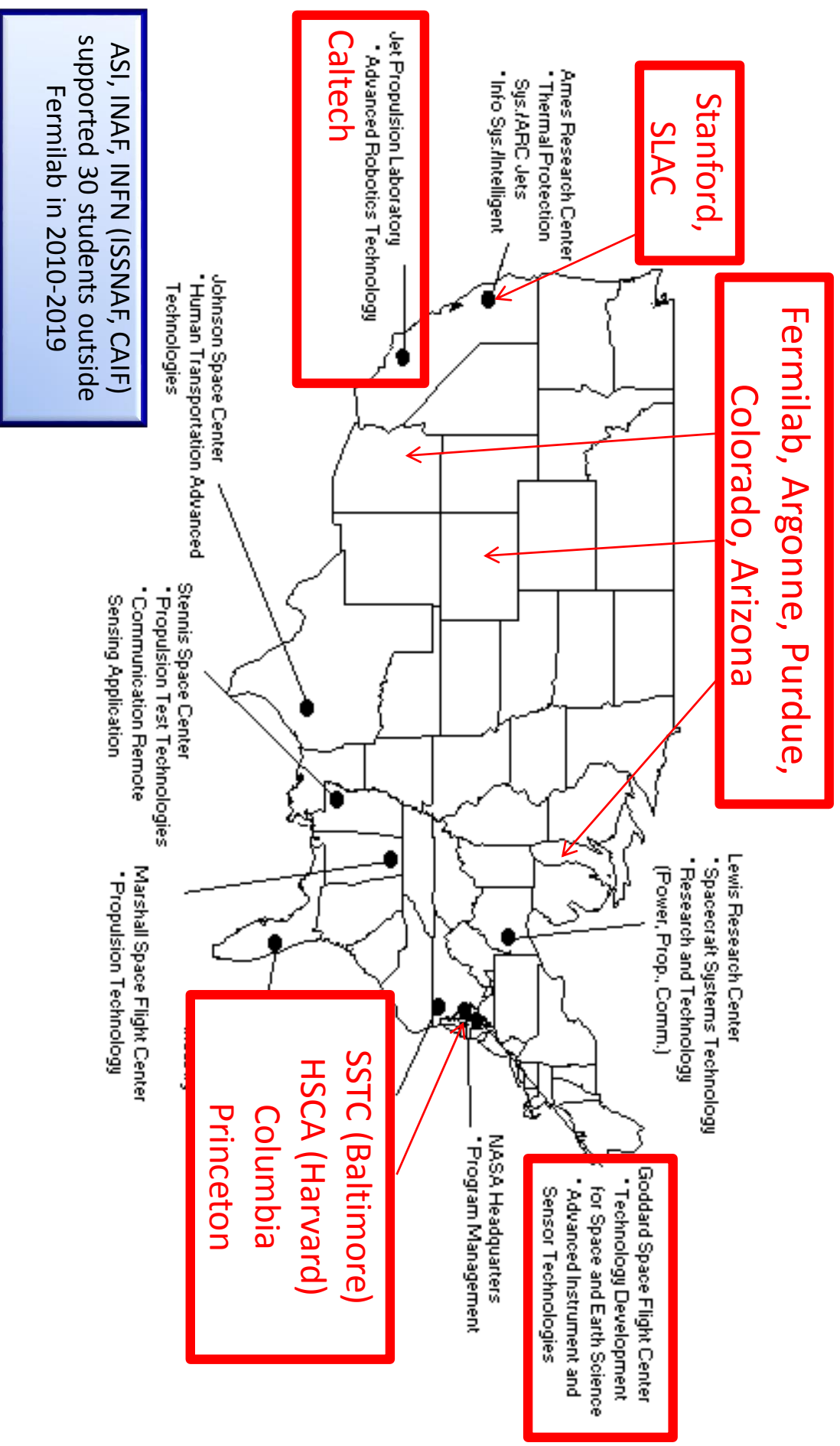
NEW LAB'S ENDEAVOURS

- **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, UDINE (INFN DEPARTMENTS and UNIVERSITIES)



Internships at Space Science Labs



Conclusions

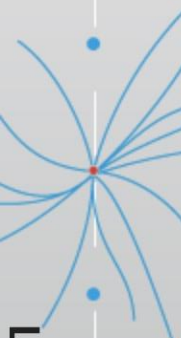
THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

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

~570 ITALIAN SUMMER STUDENTS SINCE 1983

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





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, Synchrotron 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 F...

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 F...

**THE INFN-LNF 2021 WORKSHOP REPLACED THE 9-WEEK INTERNSHIP
AT FERMILAB WHICH WAS NOT POSSIBLE YET
WE HAVE BEEN DOING OUR BEST TO KEEP THE CONNECTION
BETWEEN FERMILAB FUTURE ENDEAVOURS AND THE MASTER
STUDENTS ALIVE**