

The Italian Summer Students program at Fermilab and other US Laboratories



Emanuela Barzi, Giorgio Bellettini,
Simone Donati, **Carmela Luongo**

University and INFN Pisa



UNIVERSITÀ DI PISA



XXXIX INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS

July 4-11, 2018 Seoul, Korea

Outline

- **Fermi National Accelerator Laboratory**
- **Fermilab Summer School**
 - **Historical background**
 - **Recruitment and Sponsors**
 - **Training Programs and Logistics**
 - **Statistics (1984 – 2018)**
 - **Connections with Horizon 2020**
- **Conclusions**

Fermi National Accelerator Laboratory

- The most important laboratory in particle physics in USA
- Founded in 1967 as the National Accelerator Laboratory
- Renamed in honor of Enrico Fermi in 1974
 - 1750 employees (scientists, engineers, technicians)
 - > 3500 scientists and 1000 students from 50 countries
 - > 15000 K-12 students on educational programs every year



Wilson Hall

**Booster, one of the
Fermilab's powerful
Accelerators**

Discoveries at Fermilab

- 1977: **bottom quark**
- 1995: **top quark**, CDF and D0 experiments
- 2000: **tau neutrino**, DONUT experiment

CDF

Collider Detector at Fermilab
Fundamental contributions
from Italy and Pisa



Contribution To CDF From Italy And Pisa

- Collaboration started in 1984 and still ongoing
- ~100/600 total scientists at the time of maximum Italian presence (years 2000-2010)
- Bologna, Frascati, Padova, Pavia, Pisa, Roma, Siena, Trento, Trieste, Udine (INFN and Universities)
- ~40 from Pisa (INFN, UNIFI, SNS, UNISI)
- 5 co-spokesperson from Pisa (18 years)
- ~100 Master/35 PhD Theses

Giorgio Bellettini, Professor Emeritus of UNIFI
CDF spokesperson at the time of top discovery
One of the Summer School's coordinators



Fermilab Today

ACCELERATOR DIVISION (AD)

- Develops new accelerator techniques

TECHNICAL DIVISION (TD)

- Develops new technologies for particle physics experiments

COMPUTING DIVISION (CD)

- Computing infrastructure for data handling and analysis

PARTICLE PHYSICS DIVISION (PPD)

- Development of Lab's Intensity Frontier experiments

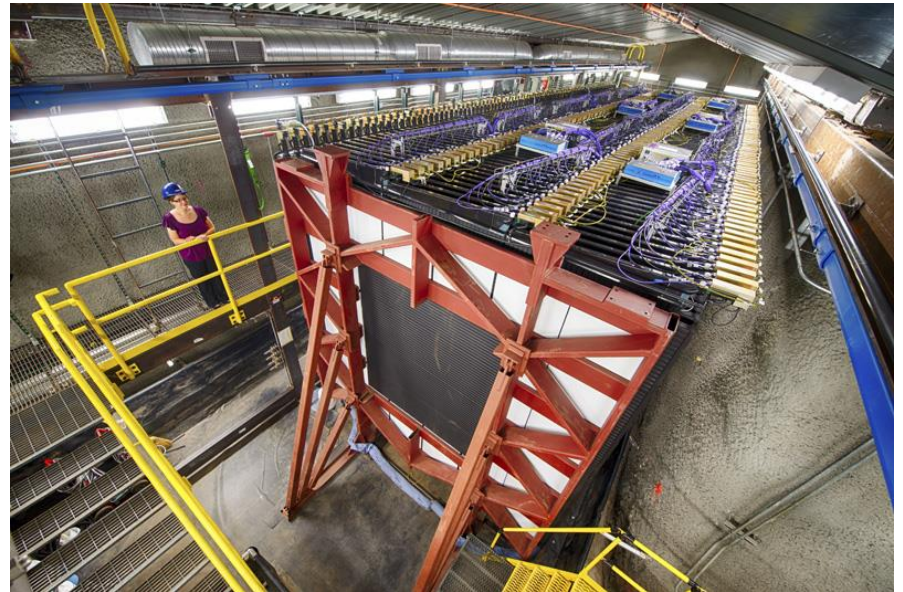
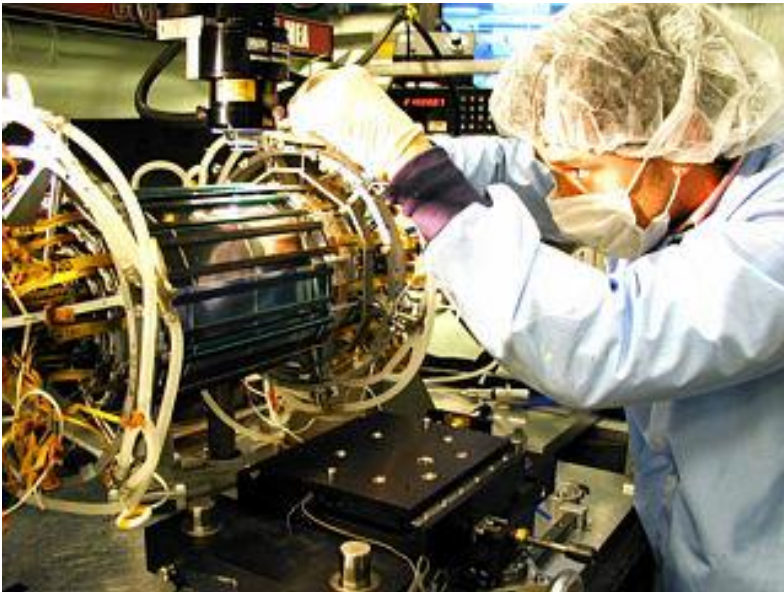


Feynman
Computer
Center



Fermilab PPD and INFN participation

- Muon to electron conversion experiment (**Mu2e**)
- Measurement of the anomalous muon magnetic moment (**Muon (g-2)**)
- Short/Long-baseline neutrino experiments (MicroBooNE, **Icarus**, SBND, **DUNE**)
- Collaboration with **CMS** at CERN Large Hadron Collider



Students' Recruitment

INTERNATIONAL PROGRAM – 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 (since Summer School creation in 2015)

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

Financial Resources

What does Fermilab provide?

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

What does not Fermilab provide?

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



Student to-do list

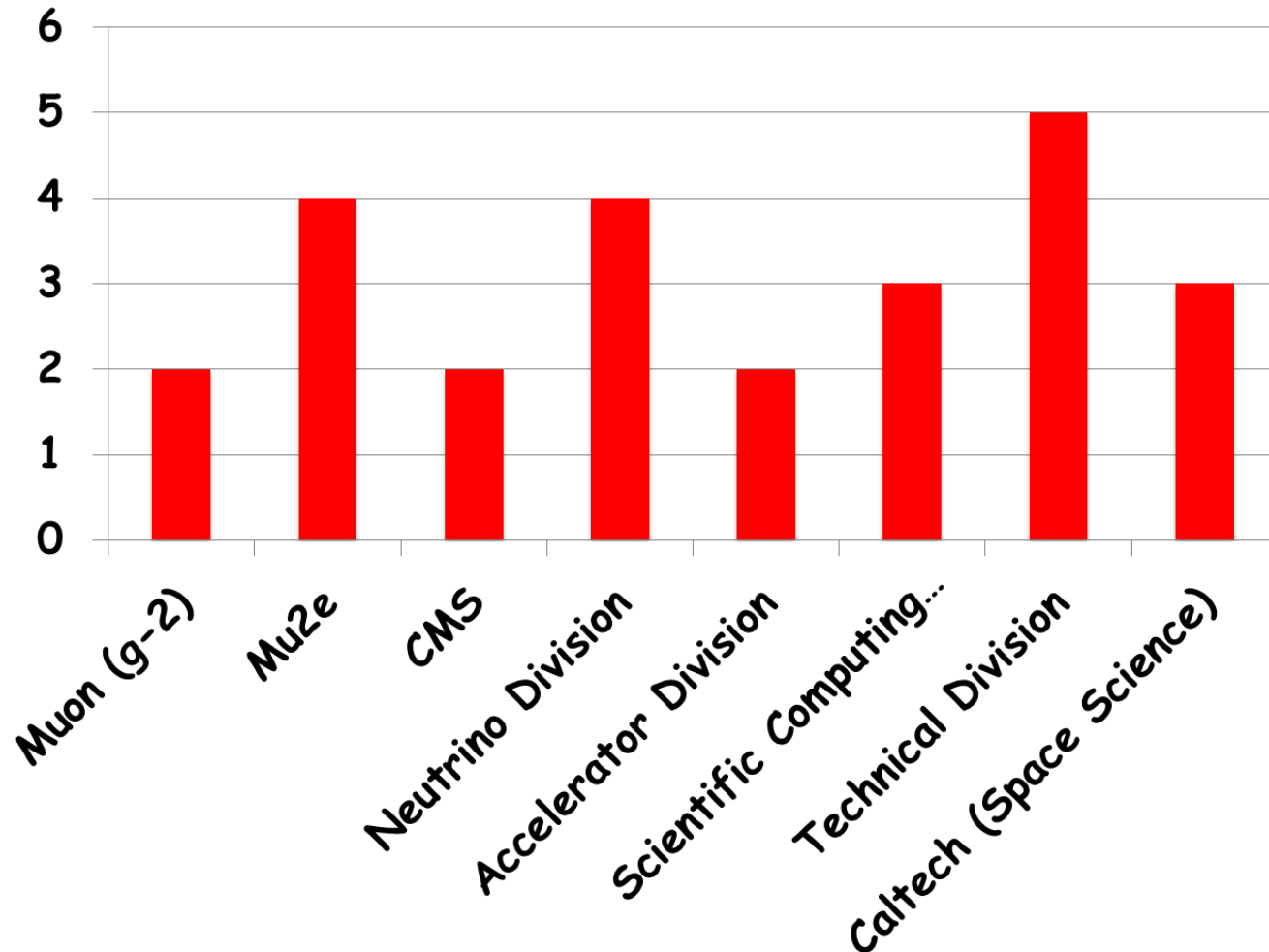
- Valid passport
- Employment and J1 Visa bureaucracy with the help of Fermilab administrative offices

Sponsorships

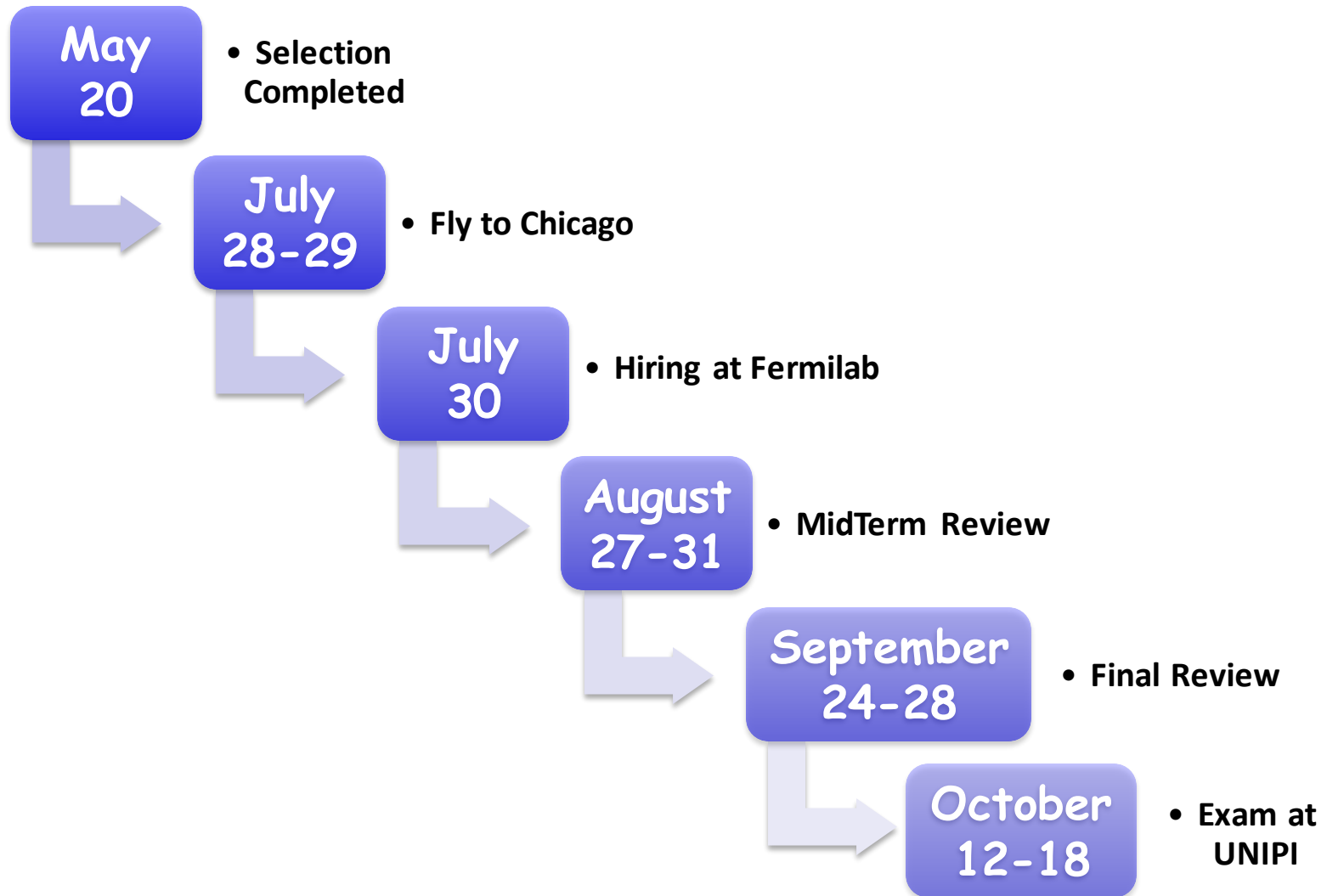
- **0 (“zero”) cost for the student**
- **~9,000 \$/student for the sponsor**
- **Department Of Energy at Fermilab**
- **Italian National Institute of Nuclear Physics**
- **Sant’Anna School of Advanced Studies (Pisa)**
- **ASI (also INAF in 2010-2011): internships at US Space Science Laboratories**
- **University of Pisa**

Training Programs (2018)

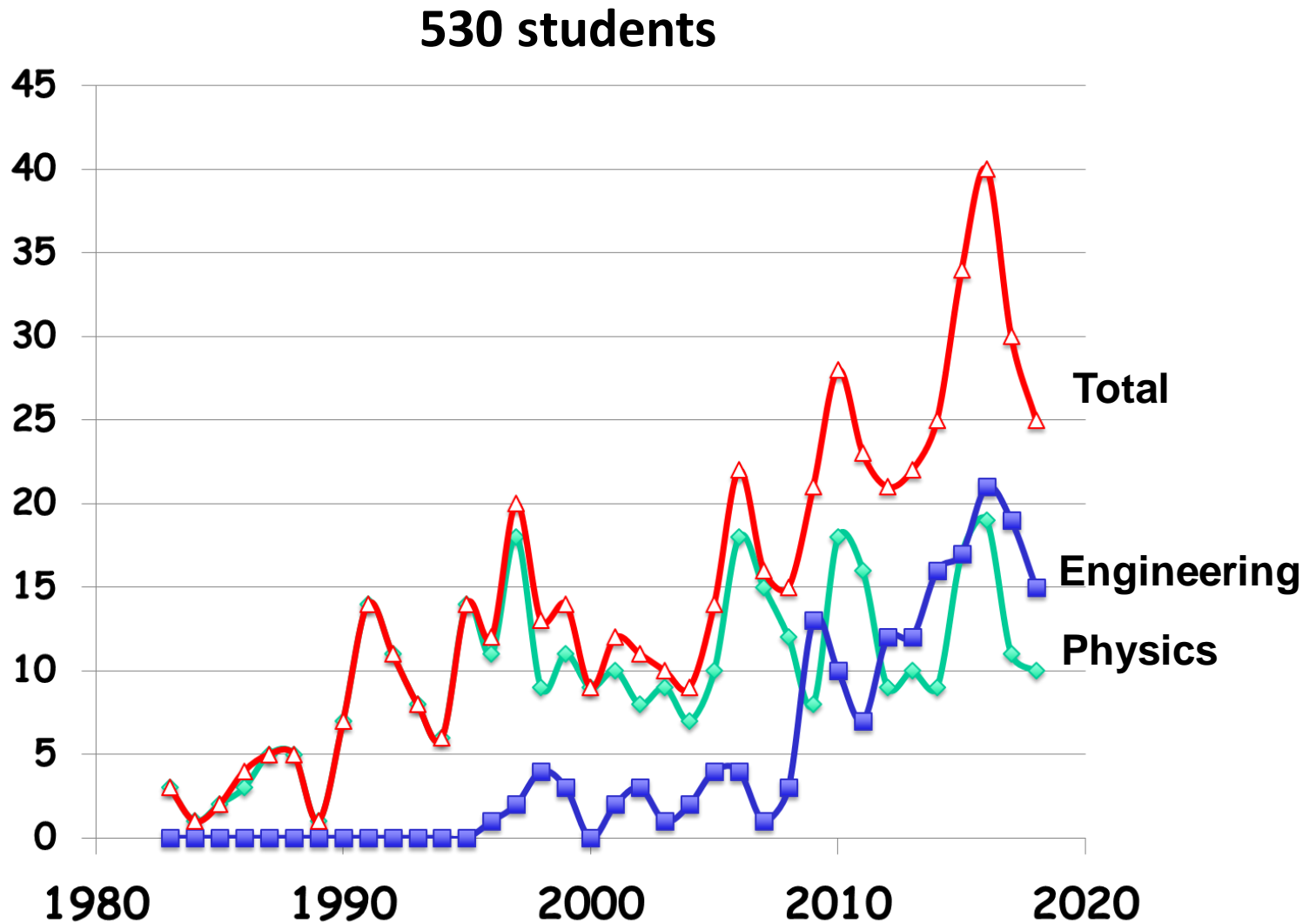
10 Physics + 15 Engineering students



Important Dates (2018)

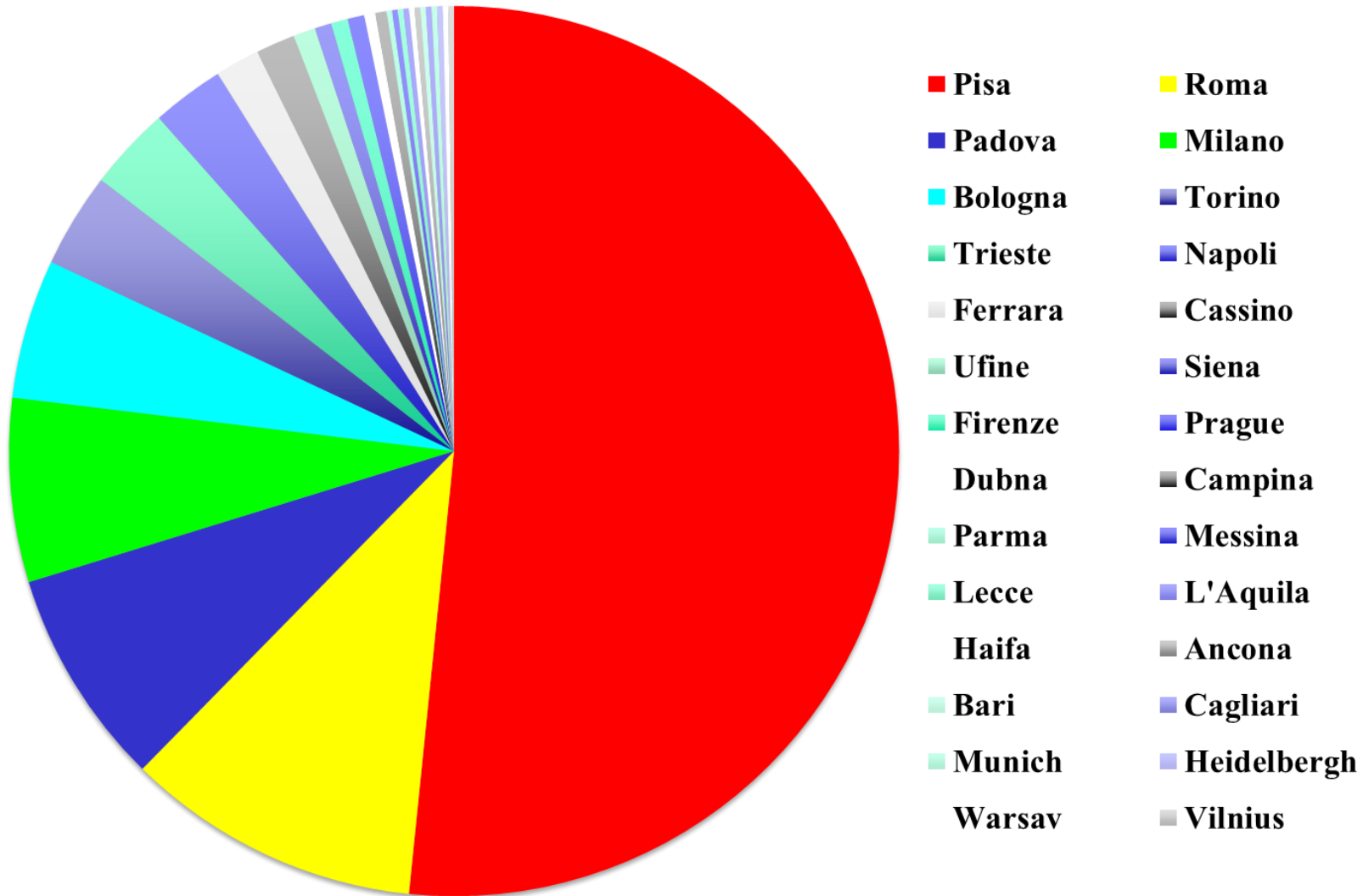


Students Statistics 1984 - 2018



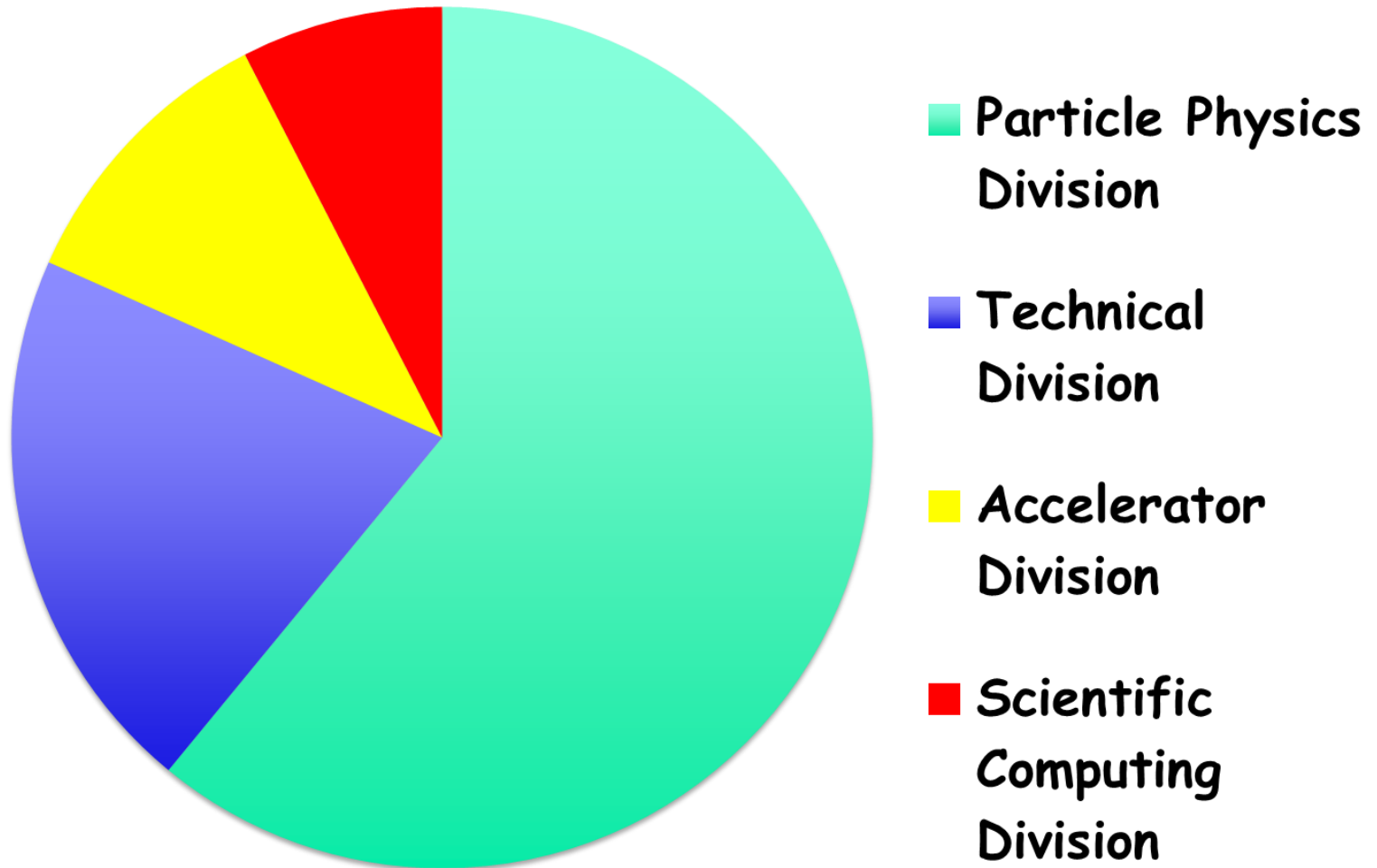
Involved Universities 1984 – 2018

530 students



Training Programs 2008-2018

250 students



Internships at Space Science Labs

Fermilab, Argonne, Purdue,
Colorado, Arizona

Stanford,
SLAC

Ames Research Center
• Thermal Protection
Sys./ARC Jets
• Info Sys./Intelligent

Jet Propulsion Laboratory
• Advanced Robotics Technology

Lewis Research Center
• Spacecraft Systems Technology
• Research and Technology
(Power, Prop., Comm.)

Goddard Space Flight Center
• Technology Development
for Space and Earth Science
• Advanced Instrument and
Sensor Technologies

NASA Headquarters
• Program Management

SSTC (Baltimore)
HSCA (Harvard)
Columbia
Princeton
Langone M. Center

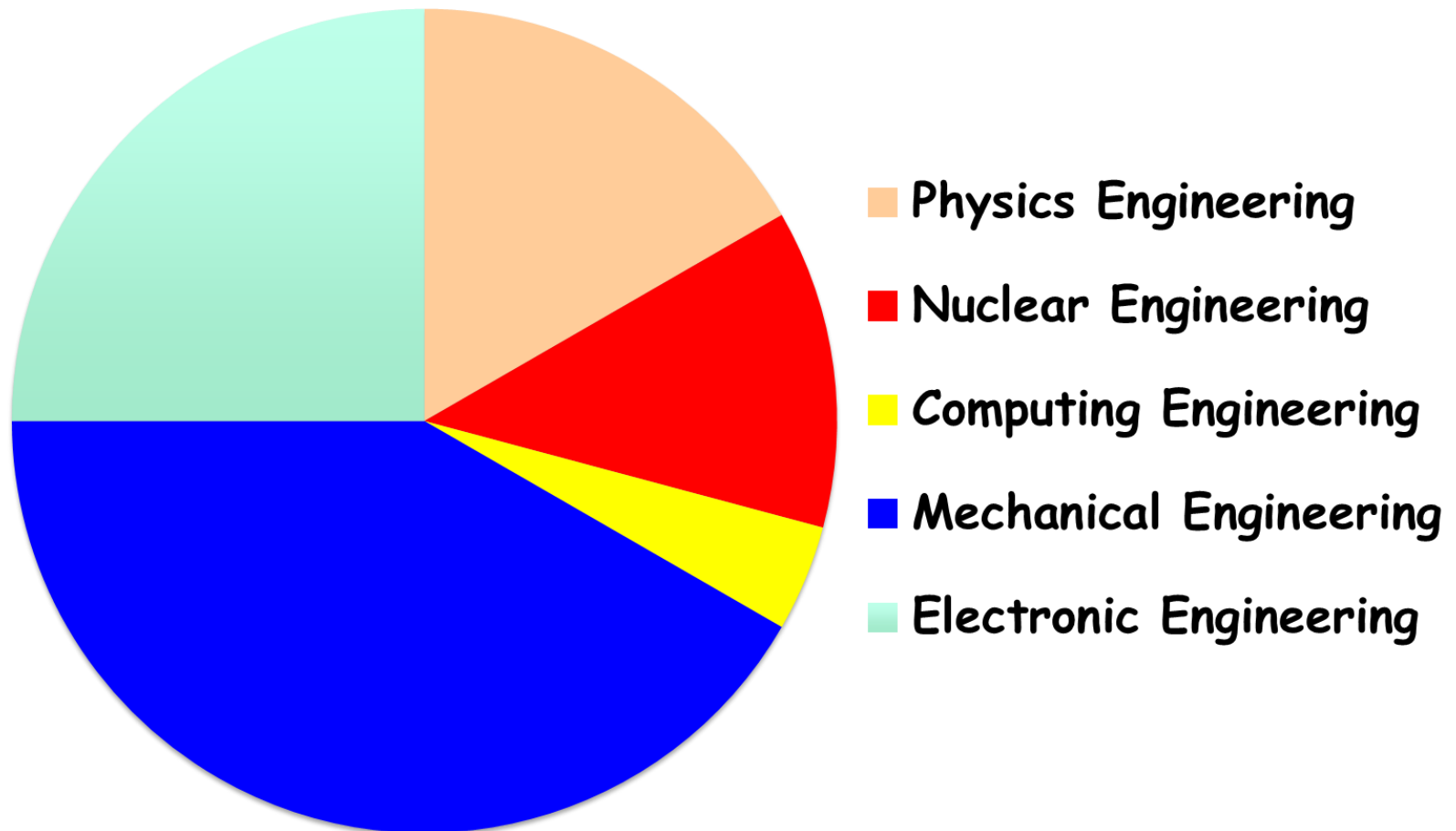
ASI, INAF, INFN (ISSNAF, CAIF) support:
25 students outside Fermilab in 2010-
2017
3 financed by ASI in 2018

Advanced
Stennis Space Center
• Propulsion Test Technologies
• Communication Remote
Sensing Application

Marshall Space Flight Center
• Propulsion Technology

TD Laurea Program 1999 - 2016

24 students had full financial support for 8 months



Connections with Horizon 2020

- Outreach towards FNAL Summer Students by researchers involved in MUSE, NEWS, INTENSE
 - Seminars, lectures, trainings, visits to Lab's infrastructures



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
- ~530 Italian Summer Students since 1984
 - Many students extended their collaboration with a Master Thesis and a PhD and started their career at Fermilab