

SENSE - Search for new physics and technological advancements
from neutrino experiments at the high intensity frontier.
A cooperative Europe-United States-Brazil effort

WP5 Dissemination and Outreach

Christian Farnese

SENSE MidTerm Review Meeting



European Commission

SENSE Web page

- <http://sesense.df.unipi.it>
- The web site reports the relevant project information, as well as a list of scientific publications and contributions to International Conferences and Workshops



SENSE - SEARCH FOR NEW PHYSICS AND TECHNOLOGICAL ADVANCEMENTS FROM NEUTRINO EXPERIMENTS AT THE HIGH INTENSITY FRONTIER. A EUROPE - UNITED STATES - BRAZIL - RUSSIA EFFORT.



SENSE is a HORIZON-MSCA-2020-01 effort (01/01/2023-31/12/2026)

DISSEMINATION: Conferences and Articles

- There has been a wide participation in International Conferences and Workshops of the staff researchers, which included oral (Talks) and written contributions (Posters) to numerous International Conferences, and publication of articles in physics and instrumentation journals.
- In the 1.2.5 Section of the Report we include some examples of participation at Conferences and articles

Papers: ICARUS

- P . Abratenko et al. [ICARUS Collaboration], “ICARUS at the Fermilab Short-Baseline Neutrino program: initial operation”, Eur. Phys. J.C. 83 (2023) 6, 467, e-Print: 2301.08634 [hep-ex];
- Maria Artero Pons for the ICARUS Collaboration, “Status and perspective of ICARUS at the Fermilab Short-Baseline Neutrino Program”, PoS EPS-HEP2024 (2024) 177;
- C. Farnese et al. [ICARUS Collaboration], “Implementation of the trigger system of the ICARUS-T600 detector at Fermilab”, Nucl. Instrum. Meth. A 1045 (2023) 167498;
- Magda Cicerchia et al. [ICARUS Collaboration], “Study of cosmic rays in the ICARUS-T600 detectors”, PoS TAUP2023 (2024) 165;
- P. Abratenko et al. [ICARUS Collaboration], “Calibration and simulation of ionization signal and electronics noise in the ICARUS liquid argon time projection chamber”, e-Print: 2407.11925 [hep-ex] (2024);
- P. Abratenko et al. [ICARUS Collaboration], “Angular dependent measurement of electron-ion recombination in liquid argon for ionization calorimetry in the ICARUS liquid argon projection chamber”, e-Print: 2407.11969 [physics.ins-det] (2024);

- Francesco Poppi et al [ICARUS Collaboration], “Status and perspective of ICARUS-T600 detector at the Fermilab Short-Baseline Neutrino program”, Nucl. Instrum. Meth. A 1072 (2025) 170113;
- F. Abd Alrahaman et al. [ICARUS Collaboration], “Search for a Hidden Sector Scalar from Kaon Decay in the DI-Muon Final State at ICARUS”, e-Print 2411.02727 [hep-ex]; B. Baibussinov et al. “Study of charging-up of PCB planes for neutrino experiment readout”, JINST 19 (2024) 11, P11012, e-Print: 2407.19105 [physics.ins-det];
- B. Baibussinov et al. “A novel liquid argon purity monitor based on ^{207}Bi ”, e-Print: 2411.10796 [physics.ins-det];
- Clara Saia et al. [ICARUS Collaboration], “Gain stability of Hamamatsu R5912-MOD photomultipliers at low temperature”, Nucl. Instrum. Meth. A 1069 (2024), 169861;
- Laura Pasqualini et al. [ICARUS Collaboration], “Status and perspective of the ICARUS experiments at the Fermilab Short Baseline Neutrino Program”, PoS HQL2023 (2024) 020;

Papers: SBND and DUNE

- P. Abratenko et al. [SBND Collaboration], “Scintillation light in SBND: simulation, reconstruction, and expected performance of the photon detection system”, *Eur. Phys. J. C* 84 (2024), no. 10, 1046;
- A. Abed Abud et al. [DUNE Collaboration], “Impact of cross-section uncertainties on supernova neutrino spectral parameter fitting in the Deep Underground Neutrino Experiment”, *Phys. Rev. D* 107 (2023) 11, 112012, e-Print: 2303.17007 [hep-ex];
- A. Abed Abud et al. [DUNE Collaboration], “Highly-parallelized simulation of a pixelated LArTPC on a GPU”, *JINST* 18 (2023) 04, P04034, e-Print: 2212.09807 [physics.comp-ph];
- A. Abed Abud et al. [DUNE Collaboration], “Identification and reconstruction of low-energy electrons in the ProtoDUNE-SP detector”, *Phys. Rev. D* 107 (2023) 9, 092012, e-Print: 2211.01166 [hep-ex];
- A. Abed Abud et al. [DUNE Collaboration], “Reconstruction of interactions in the ProtoDUNE-SP detector with Pandora”, *Eur. Phys. J. C* 83 (2023) 7, 618, e-Print: 2206.14521 [hep-ex];

- A. Abed Abud et al. [DUNE Collaboration], “DUNE Phase II: scientific opportunities, detector concepts, technological solutions”, JINST 19 (2024) 12, P12005, e-Print: 2408.12725 [physics.ins-det];
- A. Abed Abud et al. [DUNE Collaboration], “First measurement of the total inelastic cross section of positively charged kaons on argon at energies between 5.0 and 7.5 GeV”, Phys. Rev. D 110 (2024) 9, 092011, e-Print: 2408.00582 [hep-ex];
- A. Abed Abud et al. [DUNE Collaboration], “Performance of a Modular Ton-Scale Pixel-Readout Liquid Argon Time Projection Chamber”, Instruments 8 (2024) 3, 41, e-Print: 2403.03212 [physics.ins-det];
- A. Abed Abud et al. [DUNE Collaboration], “Doping liquid argon with xenon in ProtoDUNE Single-Phase: effects on scintillation light”, JINST 19 (2024) 08, P08005, e-Print: 2402.01568 [physics.ins-det];
- A. Abed Abud et al. [DUNE Collaboration], “The DUNE Far Detector Vertical Drift Technology. Technical Design Report”, JINST 19 (2024) 08, T08004, e-Print: 2312.03130 [hep-ex];

International Conferences & Workshops

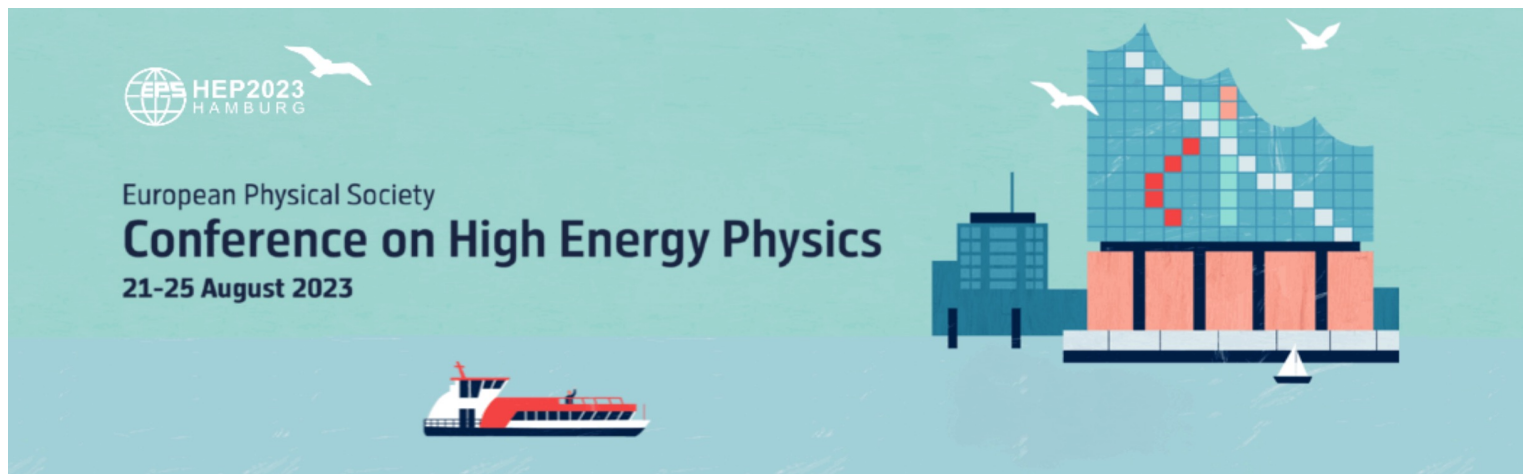
Some examples

2023

- CHEP 2023
- EPS-HEP 2023
- TAUP 2023
- SIF 2023
- XX International Workshop on Neutrino Telescopes
- XII International Conference on New Frontiers in Physics
- IPRD 2023
- ACHEP 2023
- HQL 2023
- New Perspectives 2023
- LIDINE 2023
- ISAPP 2023

2024

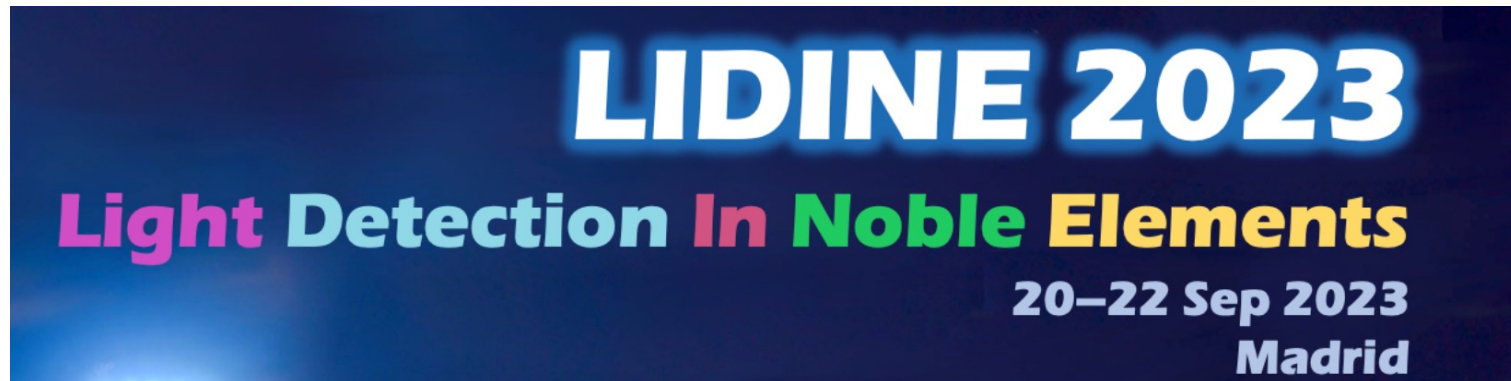
- ICHEP 2024
- PM 2024
- NEUTRINO 2024
- XIII International Conference on New Frontiers in Physics
- NOW 2024
- SIF 2024
- 35° Rencontres de Blois
- PIC 2024
- LIDINE 2024
- LLP 2024
- XVI CPAN days



EPS-HEP 2023

<https://www.eps-hep2023.eu/>


- Emanuela Barzi, G. Bellettini, S. Donati, M. Mambelli, "The Italian Summer Students Program at Fermilab: 40 years of education in particle physics and technology".
- Maria Artero Pons, "Status and perspective of ICARUS at the Fermilab Short-Baseline Neutrino Program".



LIDINE 2023

<https://agenda.ciemat.es/event/4282/timetable/?view=standard>

- Francisco Javier Nicolas, "Using scintillation light to tag events in SBND"
- Francisco Javier Nicolas, "A novel Amorphous selenium based photosensor for liquid noble detectors".
- Rodrigo Álvarez Garrote, "The SBND photon detection system".



XVIII International Conference on
Topics in Astroparticle and
Underground Physics 2023

28.08. – 01.09.2023
University of Vienna



TAUP 2023

<https://indico.cern.ch/event/1199289/>

- Emanuela Barzi, G. Bellettini, S. Donati, M. Mambelli, "The Italian Summer Students Program at Fermilab: 40 years of education in particle physics and technology".
- Magda Cicerchia, "Study of cosmic rays in the ICARUS-T600 detectors".
- José I. Crespo-Anadón, "Searches for Beyond Standard Model Physics in the SBND neutrino experiment"
- Clara Cuesta, "Supernova and solar neutrino searches at DUNE".

NEUTEL 2023

<https://agenda.infn.it/event/33107/>

- Maria Artero Pons, "Neutrino Reconstruction Analysis at ICARUS Detector".
- Filippo Varanini, "Short Baseline Neutrino Oscillations at Fermilab".
- Francesco Poppi, "The cosmogenic background rejection of the ICARUS detector at Fermilab".



IPRD 2023

<https://www.dsfta.unisi.it/it/eventi/16th-topical-seminar-innovative-particle-and-radiation-detectors-iprd23>

- D. Pasciuto (UNIFI), "Development of the Mu2e Electromagnetic Calorimeter Mechanical Structures" (Talk)
- A. Gioiosa (UNIFI), "Mu2e TDAQ and Slow Control Systems" (Talk)
- F. Spinella (INFN), "Development of the Mu2e Electromagnetic Calorimeter Front-End and Readout Electronics" (Talk)



XXXI International Conference on Neutrino Physics and Astrophysics

June 16-22, 2024 Milan, Italy



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NEUTRINO 2024

<https://neutrino2024.org/>

- D. Gibin, "ICARUS at the Short-Baseline Neutrino Program: First Results", Talk;
- F. Poppi, "Cosmic background rejection of the ICARUS Experiment at Fermilab", Poster;
- M. Cicerchia, "Data vs Monte Carlo comparison of light signal from cosmic rays in the ICARUS detectors", Poster;
- A. Campani, "Track vs shower discrimination in the event reconstruction of the ICARUS Experiment", Poster;
- Francisco Javier Nicolas, "The SBND detector at Fermilab", Poster;
- Sergio Manthey Corchado, "DUNE's sensitivity to solar neutrinos", Poster;
- Laura Pérez-Molina, "Efficiency of the Photon Detection System in DUNE Far Detectors", Poster.



ICHEP 2024

<https://indico.cern.ch/event/1291157/>

- L. Di Noto et al., "ICARUS at the Short-Baseline Neutrino program: first results", Talk;
- M. Cicerchia et al., "Light signal study of the cosmic rays in the ICARUS detector", Talk;
- D. Cherdack, "Numi at ICARUS Flux, Cross Section, and BSM Physics", Talk;
- Inés Gil Botella, "The Deep Underground Neutrino Experiment (DUNE) program", Talk;
- Sergio Manthey Corchado, "DUNE's low energy physics searches", Poster;



Otranto (Lecce, Italy)

From Sept. 2 (arrivals) to Sept. 8 (departures), 2024

NOW 2024

<https://home.ba.infn.it/~now/now2024/>

- Christian Farnese, "Searching for sterile neutrinos with ICARUS at FNAL"; Talk.



SIF 2024

<https://2024.congresso.sif.it/info>

- Laura Pasqualini, "ICARUS at the Short-Baseline Neutrino program: First results", Talk;
- Francesco Poppi "Cosmic background rejection in the ICARUS experiment at Fermilab", Talk;
- Riccardo Triozzi, "Performance of the ICARUS trigger system at the booster and NuMI neutrino beams", Talk;
- Vanessa Brio, "Neutrino event detection in ICARUS: Analysis of photomultiplier waveforms and Monte Carlo validation", Talk;
- Giovanni Chiello, "Muon momentum reconstruction in ICARSU-T600 LAr-TPC via multiple scattering" , Talk.

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
- 2024 program just concluded (13 Summer Students)

~600 SUMMER STUDENTS IN THE PROGRAM SINCE 1983

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



THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

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
- **Motivation Letter**
- **Interview**
- Good knowledge of English



THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

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)

THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

Applicants Benefits

WHAT FERMILAB PROVIDES

- Weekly stipend
- Free housing in Fermilab Dorms
- Free shared rental car
- Total cost ~17000 \$/student

WHAT FERMILAB DOES NOT PROVIDE

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

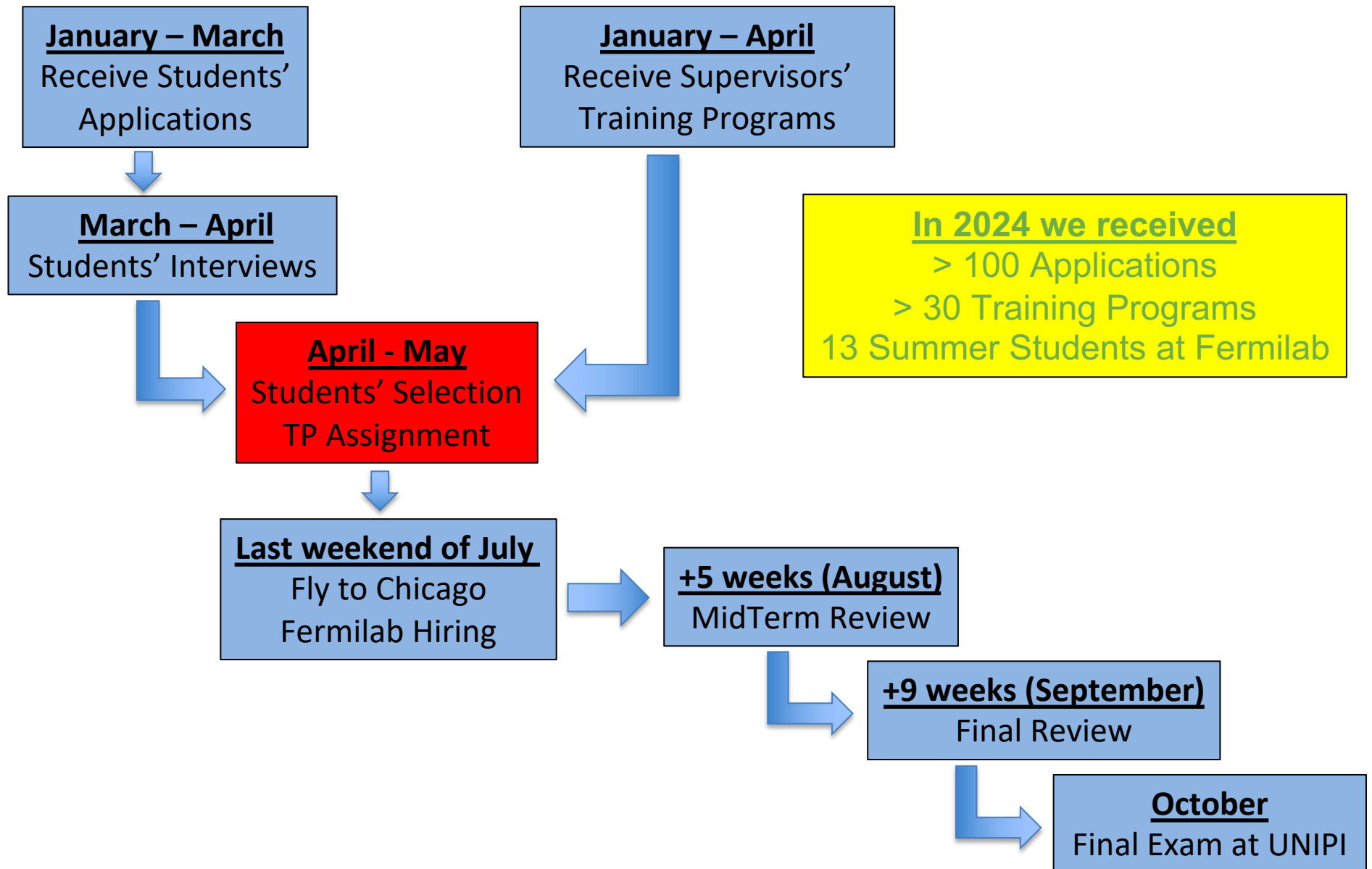
STUDENTS' TO-DO LIST

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



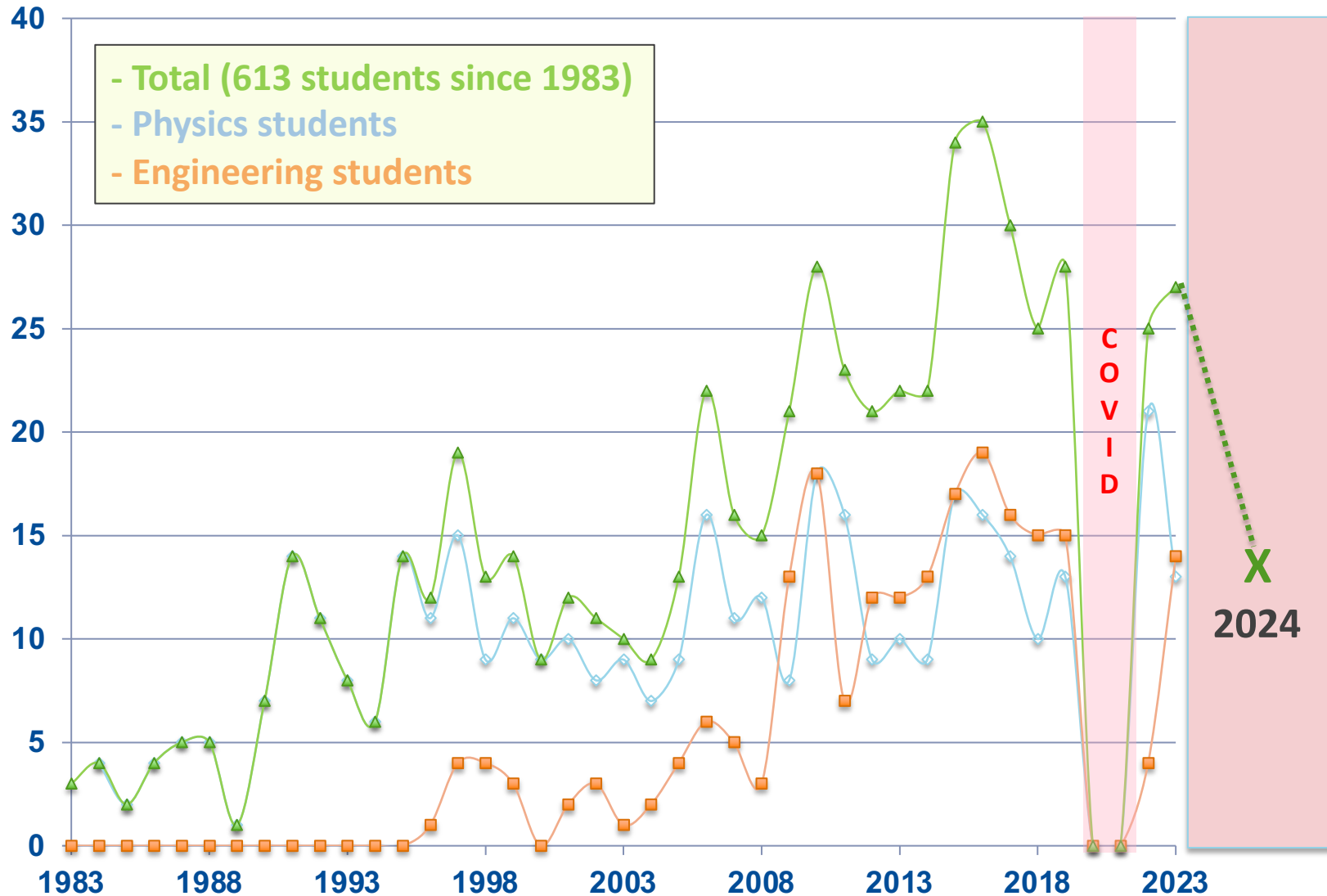
THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

Important Actions/Dates



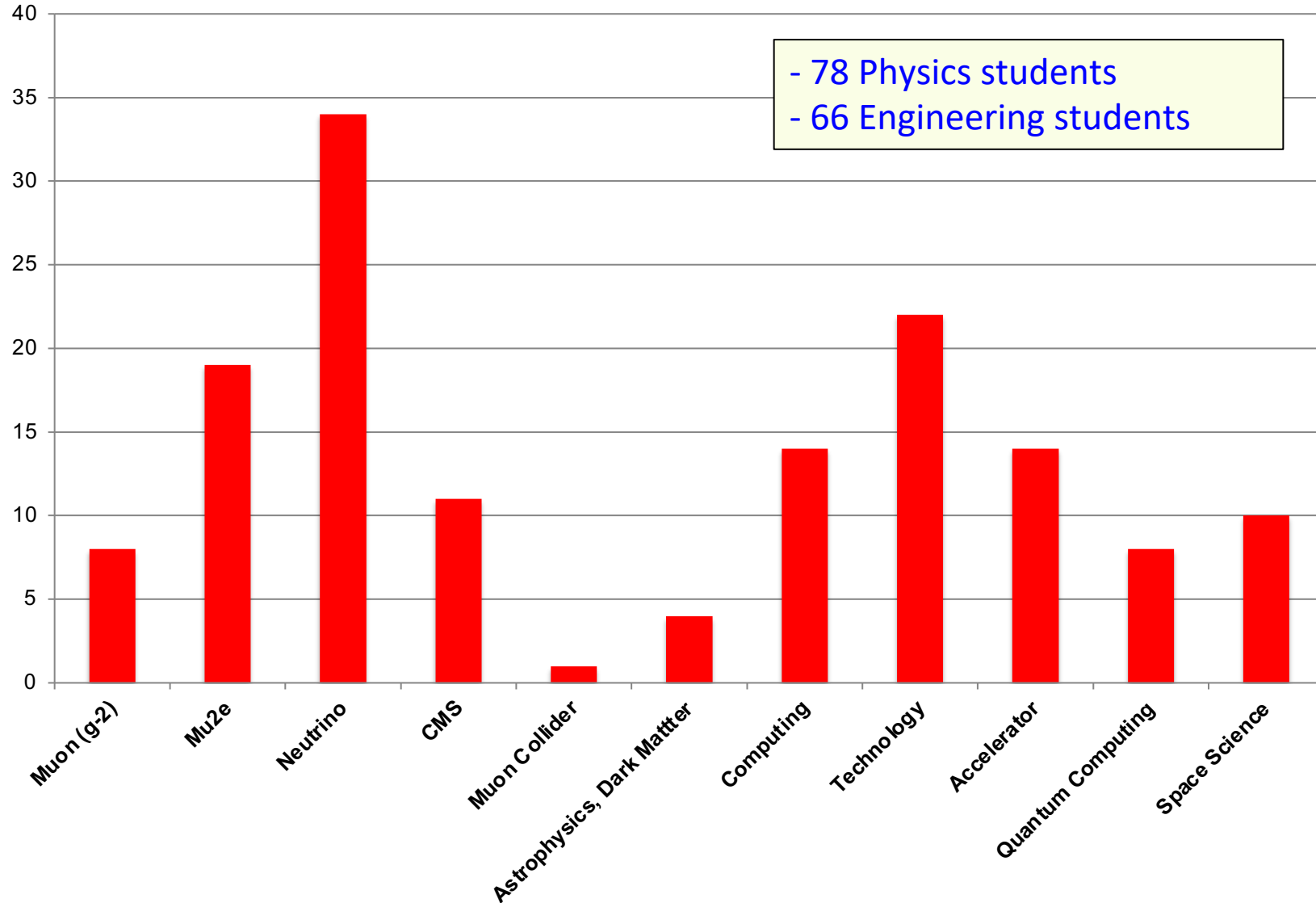
THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

Summer Students Statistics (1983 – 2024)



THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB

Training Programs (2017-2024, last 6 “years”)



THE ITALIAN SUMMER STUDENTS PROGRAM AT FERMILAB



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2025 Summer Student Italian program at Fermi National Accelerator Laboratory and other US Laboratories

July 28th – September 26th, 2025

Deadline for application March 1, 2025

The University of Pisa will organize a three-day Workshop at the Department of Physics in July 2025 to introduce the selected Summer Students to the Fermilab endeavours. Similar initiatives were organized in 2021, 2022, 2023 and 2024.

[Workshop "Fermilab 2021 Summer Students School at LNF" \(Monday, August 2, 2021 – Wednesday, August 4, 2021\)](#)

[Workshop "Summer Students at Fermilab and other US Laboratories" \(Monday, July 18, 2022 – Thursday, July 21, 2022\)](#)

[Workshop "Summer Students at Fermilab and other US Laboratories" \(Monday, July 24, 2023 – Wednesday, July 26, 2023\)](#)

[Workshop "Summer Students at Fermilab and other US Laboratories" \(Monday, July 22, 2024 – Tuesday, July 24, 2024\)](#)

Outreach Activity :

European Researchers' Night - September 29, 2023 September 27, 2024

The event aims to bring researchers closer to the general public and to increase public awareness of research and innovation activities with a view to supporting the public recognition of research and innovation activities, creating an understanding of the impact of researchers' work on citizens' daily lives and encouraging young people to embark on research careers

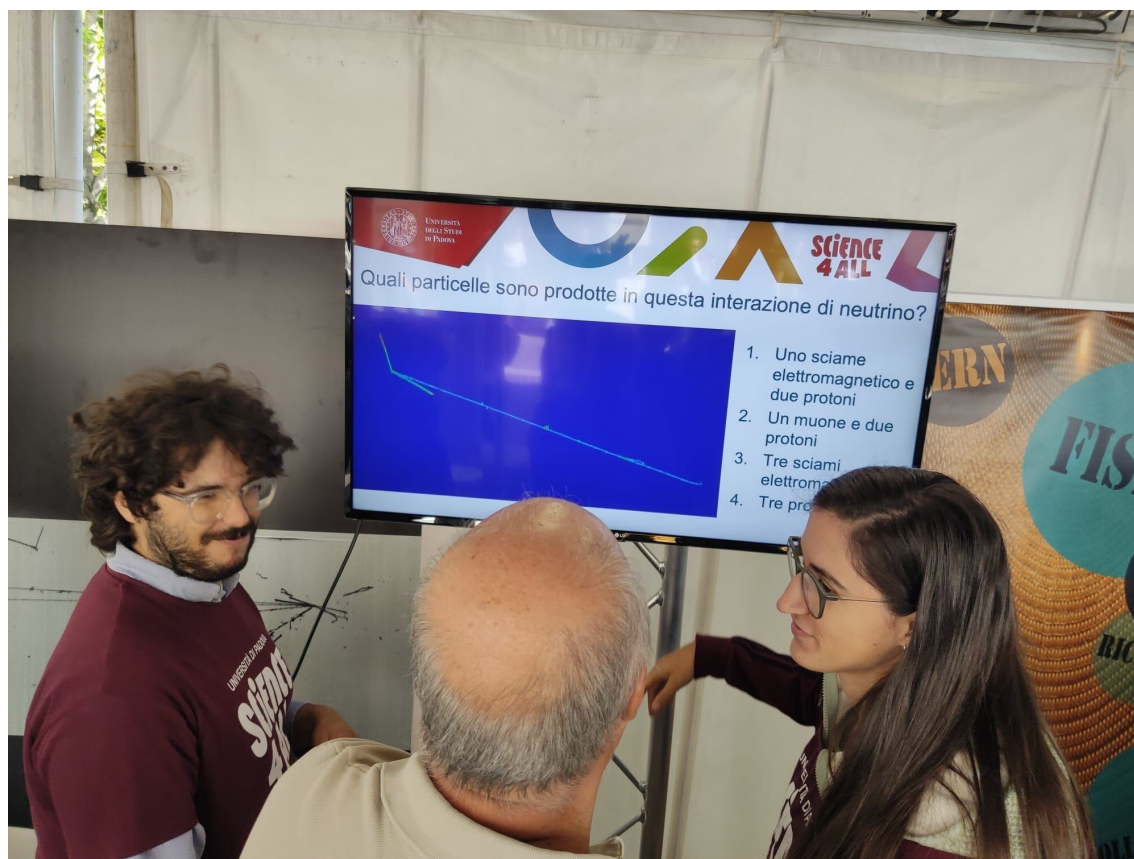
- Plenty of events across Europe:
 - INFN and UNIPPI researchers contributed to organize events in several Italian cities
 - As an example: **Science4 all organized at Padova-Italy in 2023 and 2024**



Outreach Activity:

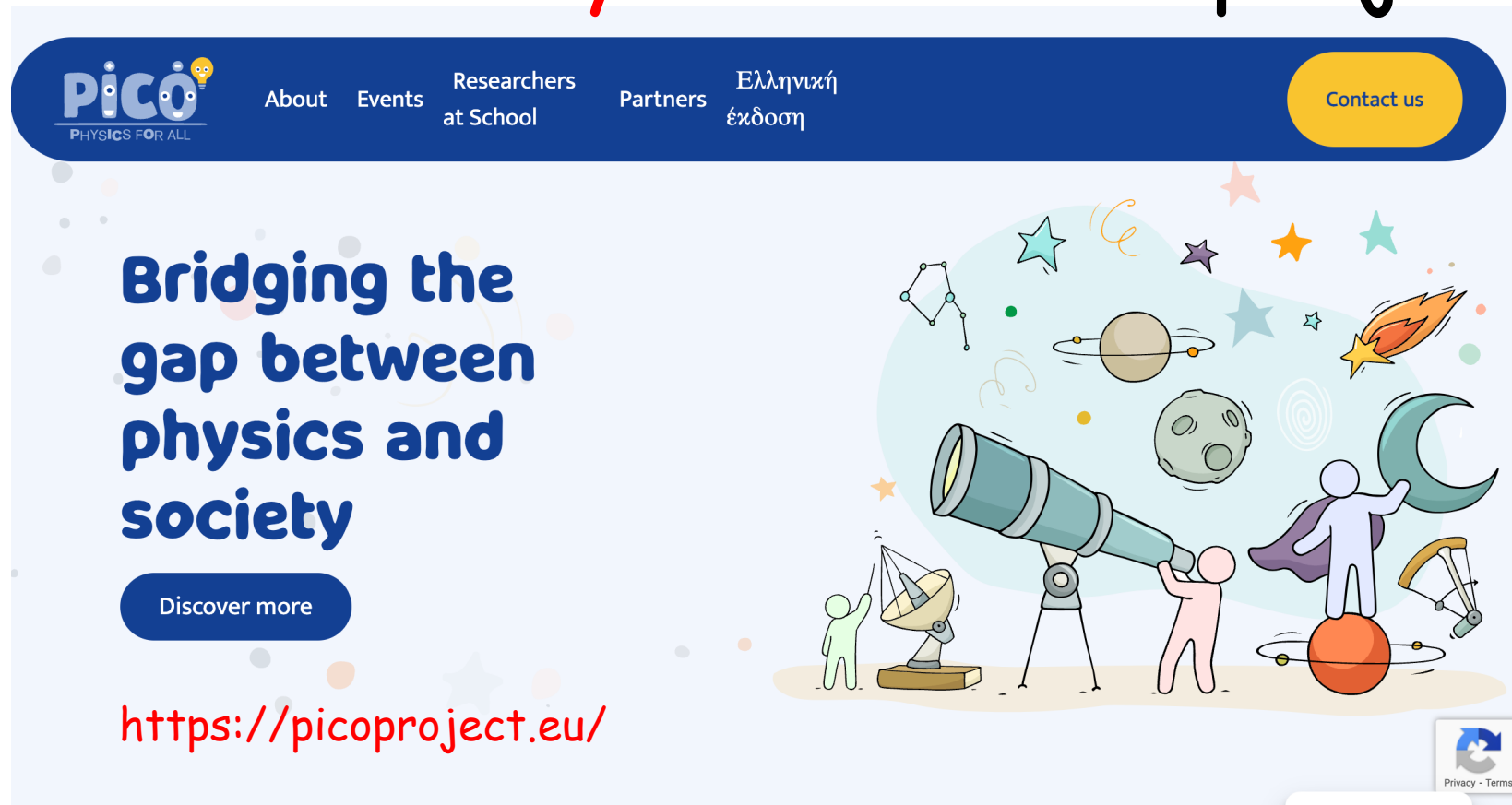


- Science4All, a scientific communication project organized by the Padova University that aimed to communicate science in a simple and fun way to everyone.
- INFN and University of Padova researchers contribute to Science4All, presenting the neutrinos, showing the neutrino events recorded by the ICARUS experiment and involving the Participants to a Quiz Game «Recognize the particles in ICARUS»



M. Artero Pons and R. Triozzi asking “Is the event in the picture a neutrino interaction?”

The «PICO» PhysICs fOr all project



The screenshot shows the homepage of the PICO project. At the top, there is a dark blue navigation bar with the PICO logo (PHYSICS FOR ALL) on the left, followed by menu items: 'About', 'Events', 'Researchers at School', 'Partners', and 'Ελληνική έκδοση'. A yellow 'Contact us' button is on the right. The main content area features the headline 'Bridging the gap between physics and society' in large blue text, with a 'Discover more' button below it. To the right is a colorful illustration of people engaged in various physics activities: one uses a telescope, another a satellite dish, and others interact with celestial models like a planet, moon, and stars. A URL <https://picoproject.eu/> is displayed in red text at the bottom left of the screenshot. A small 'Privacy - Terms' icon is visible in the bottom right corner of the website image.

- The EU-funded PICO project aims to increase citizens' awareness of fundamental physics and of the impact that discoveries in these fields have on their everyday lives.
- PICO will coordinate Researchers' Night activities and satellite events in 4 countries (Greece, Italy, France, Spain). The main events will take place in person, with a remote component to open the door of world-famous laboratories and research infrastructures, which participate in international collaborations.

