

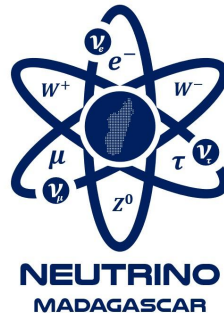


The University of Antananarivo Madagascar Neutrino Experimental Physics



Laza Rakotondravohitra
Feno Andrianala

Feb, 27 2024
The ASP Online Seminars



Outline

a/ The University of Antananarivo Madagascar

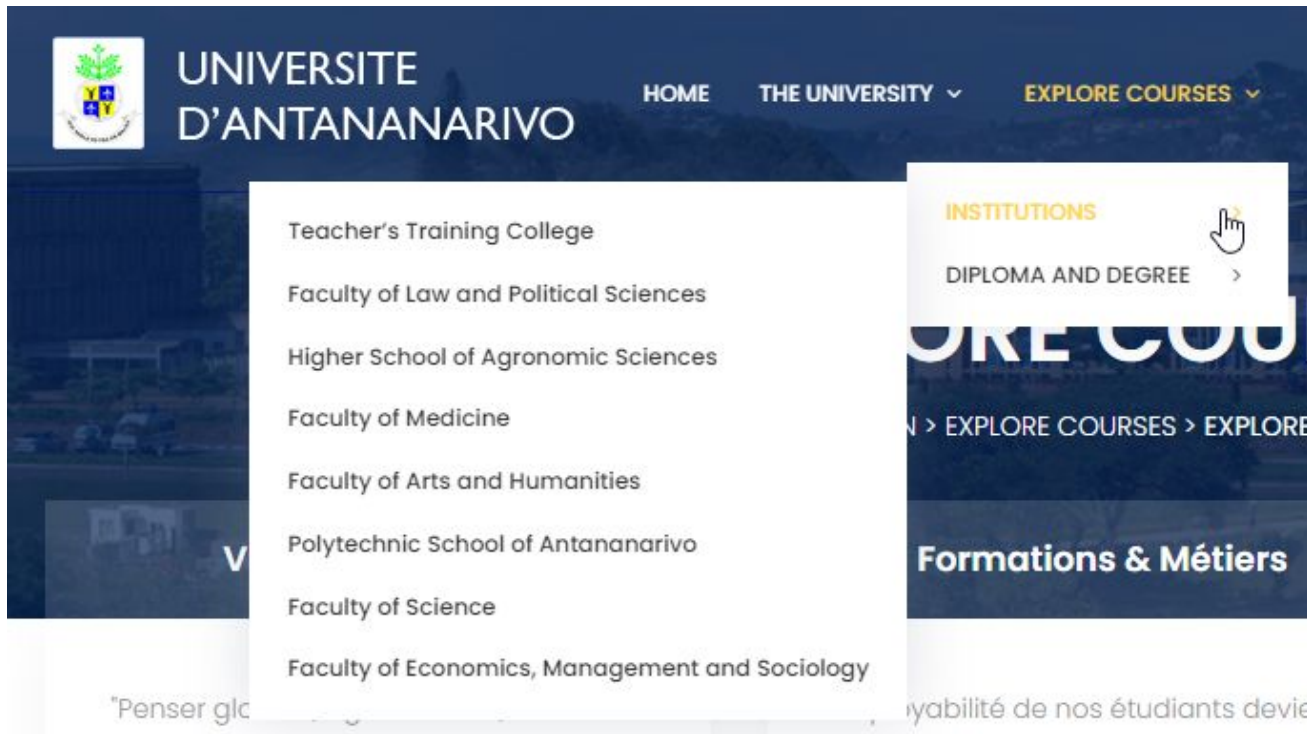
- The Department of Physics specialities

b/ Neutrino Physics at the University of Antananarivo

- Deep Underground Neutrino Experiment DUNE Member
 - Structure of the group for the University of Antananarivo
 - Main purpose of the group
 - Students past/current
- GENIE- Event Generator & Global Analysis of Neutrino Scattering Data
 - Mentorship goals
 - Current initiative

c/ Challenges

d/ Where are our students now?



"Penser glo... yabilité de nos étudiants devie



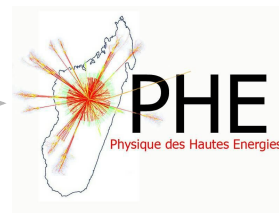
The University of Antananarivo



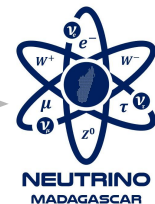
Faculté de Sciences



Department of Physics



PHE: Physique des Hautes Énergies



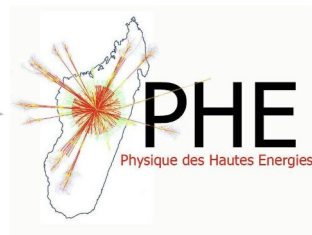
Neutrino Experimental Physics

Department of Physics at the University of Antananarivo

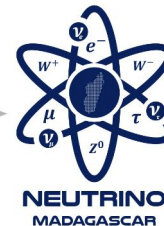
- Physics specialities:
 - Applied Nuclear Physics- INSTN
(Institut National des Sciences et Techniques Nucléaires)
 - Astronomy
 - Climatology and Oceanography
 - Sustainable Energies and Environment
 - Geophysics
- High Energy Physics specialities:
 - iHEP MAD Phenomenology and Theoretical High Energy Physics
(<https://hepmad23.sciencesconf.org/>)
 - PHE (Physique des Hautes Énergies)
Experimental High Energy Physics
 - Only 2 HEP Experimental Physicist from Madagascar
 - 6 currently active students (MS and PhD)



Department of Physics

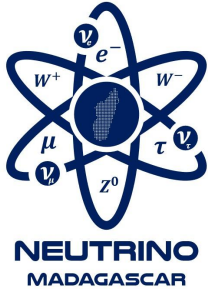


PHE: Physique des Hautes Énergies



Neutrino Experimental Physics

Experimental high energy physics in Madagascar



Joined Deep Neutrino Underground Experiment in 2016
The University of Antananarivo have currently have 10 active members.

1- Leadership of the group:

- Pr. Roland Raboanary
- Feno Andrianala and L.Rakotondravohitra

2- International collaborators

- D Martinez - South Dakota/Columbia - (2017 to current)
- S Dytman - University of Pittsburgh - (2018 to current)
- The African School of Physics - M.Bishai and K. Assamangan at BNL (ASP Alumni Short-Term research)

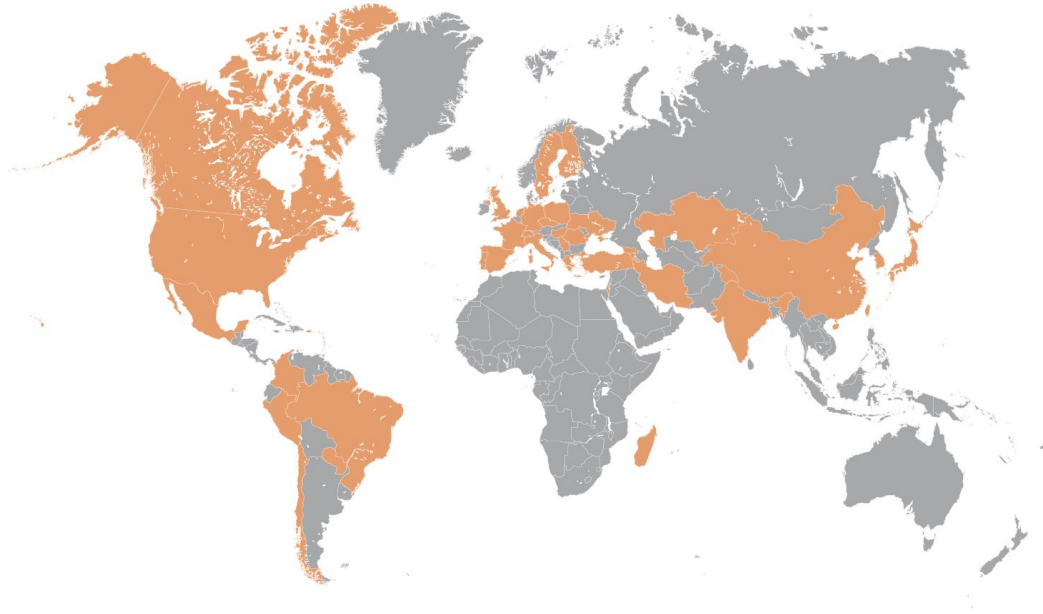
3- Successfully placed 4 PHD/ 1 MS students in the US

- By 2025, there will be 5 additional Neutrino Experimental High Energy Physicists

From Madagascar

The DUNE Collaboration

1,400 collaborators from over 200 institutions in over 35 countries plus CERN



DUNE is led by two scientific spokespersons, Mary Bishai, senior scientist at Brookhaven National Laboratory, and Sergio Bertolucci, professor of physics at the University of Bologna in Italy.

DUNE at LBNL | About | How it works | News | People | For neighbors and businesses | For the teams |

- Università degli Studi di Genova, Istituto Nazionale di Fisica Nucleare Genova (INFN Genova)
- Università degli Studi di Padova (University of Padua; UNIPD)
- Università degli Studi di Pavia, Istituto Nazionale di Fisica Nucleare Sezione di Pavia
- Università del Salento, Istituto Nazionale di Fisica Nucleare
- Università di Ferrara, Istituto Nazionale di Fisica Nucleare
- Università di Pisa

Japan

- High Energy Accelerator Research Organization (KEK)
- Iwate University
- Kavli Institute for the Physics and Mathematics of the Universe (WPI / IPMU)
- National Institute of Technology, Kure College

Kazakhstan

- Institute of Nuclear Physics, Almaty

Madagascar

- Université d'Antananarivo (University of Antananarivo)

Mexico

- El Centro de Investigación y de Estudios Avanzados del IPN (Cinvestav)
- Universidad de Colima
- Universidad de Guanajuato

Netherlands

- National Institute of Subatomic Physics Nikhef (Nikhef)

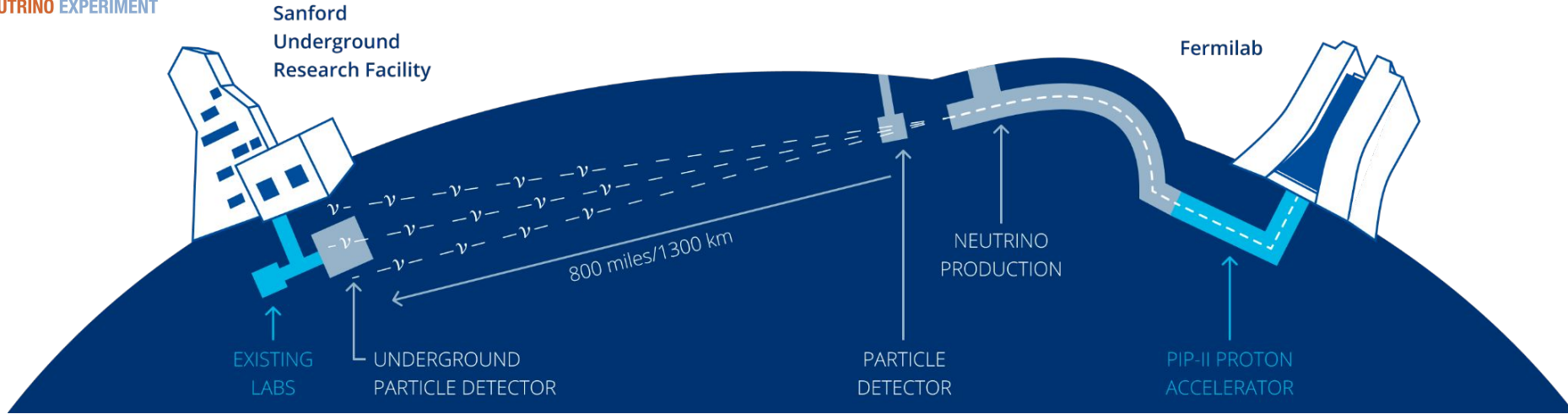
Paraguay

- Universidad Nacional de Asunción (UNA)

Peru

- Comisión Nacional de Investigación y Desarrollo Aeroespacial (CONIDA)
- Pontificia Universidad Católica del Perú (PUCP)
- Universidad Nacional de Ingeniería

The Deep Underground Neutrino Experiment



- 1- Beneficiary of the ASP-Alumni short term program supervisor by Dr.Bishai and Dr.Assamangan
 - Unique opportunity in cold-electronic projects
- 2-The University of Antananarivo Involvement mentored by Dr.Martinez from South Dakota/Columbia
 - Far detector project
 - Analysis in the near future with Proto-DUNE data
 - Cryogenic Antenna

LArASIC lifetime study at cryogenic temperature

Rado Fanantenana Razakamiandra
on behalf of the Cold Electronic group
February 9th, 2023



Universal performance analysis of the DUNE Front-End Motherboards for quality control(QC)



Rado Fanantenana, Razakamiandra
University of Antananarivo, Madagascar

01/24/2023
Brookhaven National Laboratory



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Analysis of QC results from the DUNE LArASIC chip testing



Antalia Ariel Rabarisoa
University of Antananarivo - Madagascar

01/24/2023
Brookhaven National Laboratory



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- 2023 outcome: On-site and hand-on experience at Brookhaven National Laboratory thanks to the ASP-Alumni short term program
- 2024 has 3 Masters thesis on-going at the University of Antananarivo- We anticipate onsite training at the DUNE Far Detector



The University of Antananarivo And Genie Event Generator & Global Analysis of Neutrino Scattering Data

- Led by Dr.Feno Andrianala locally and Pr.S.Dytman from University of Pittsburgh

- Unique Advanced courses in Neutrino Physics

1. Neutrino oscillations

2. Neutrino–nucleus cross sections

3. Neutrino–nucleus cross section simulation

4. Electron–nucleus cross sections

5. Hadron–nucleus cross sections and outlook



The University of Antananarivo And Genie Event Generator & Global Analysis of Neutrino Scattering Data

REVIEW THE TIME OF YOUR SESSION/TALK

All listed times are in Pacific Time. Please double-check the time of your presentation the week before the meeting, to ensure that you are prepared. APS reserves the right to adjust certain presentation times.

[APS APRIL MEETING 2024 SCIENTIFIC PROGRAM](#)

SCHEDULING NOTICE FOR:

Unconfirmed Contributed Oral Speaker: (M16) Implementation of the new cross sections for hadron transport models in GENIE.

Computational Physics II: From Neutrinos to Black Holes

Room: SAFE Credit Union Convention Center: Ballroom B8, Floor 2

PHYSICAL REVIEW D
covering particles, fields, gravitation, and cosmology

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Comparison of validation methods of simulations for final state interactions in hadron production experiments

S. Dytman, Y. Hayato, R. Raboanary, J. T. Sobczyk, J. Tena-Vidal, and N. Vololoniaina
Phys. Rev. D **104**, 053006 – Published 17 September 2021

Article References Citing Articles (18) PDF HTML Export Citation

ABSTRACT

Neutrino cross section and oscillation measurements depend critically on modeling of hadronic final state interactions (FSI). Often, this is one of the largest components of uncertainty in a measurement. This is because of the difficulty in modeling strong interactions in nuclei in a consistent quantum-mechanical framework. FSI models are most often validated using hadron-nucleus data which introduces further uncertainties. The alternative is to use transparency data where the hadron starts propagating from inside the nucleus and the probability of interaction is measured as a function of hadron energy. This work examines the relationship between the π^+ and proton total reaction cross section and transparency from a simulation viewpoint.

Issue
Vol. 104, Iss. 5 – 1 September 2021

Check for updates

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- Currently 2 Malagasy are becoming experts in Monte Carlo Event Generator and Neutrino Scattering
 - N.Vololoniaina
 - F.Anjarazafy
- 2024: ongoing masters thesis in Monte Carlo Neutrino FSI study
 - I.L. RAFIDISON

Neutrino Physics Group in Madagascar: Approach and Goals



- Students are selected based on undergraduate performance
- Remote training in Neutrino Scattering and Monte Carlo with GENIE
- Building good data analytics skills and software development
- Encourage collaborative mindset

Refer to ASP when opportunity arise.
E.g.
1-Biennial ASP
2-ASP Alumni short term program



Neutrino Physics Group in Madagascar: Approach and Goals

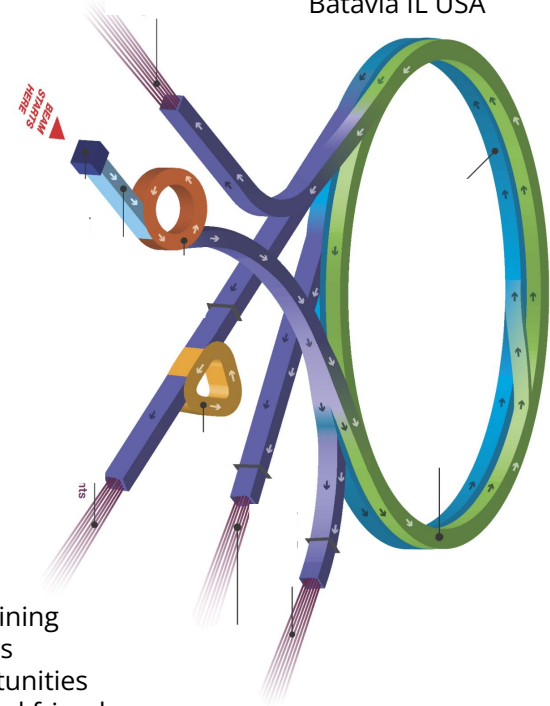


University of Antananarivo
Madagascar



First African School of Physics
Stellenbosch, Cape Town South-Africa

Fermi National Accelerator Laboratory
Batavia IL USA



Completed training
Open doors
Countless opportunities
Lifelong mentors and friends
.....

Professional career

Remember home and
give back



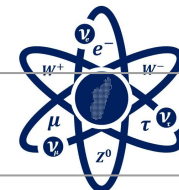


Neutrino Physics Group in Madagascar: Challenges



- 1- Full time students, full time worker, part-time researcher
 - All our students have a full time job outside of academia
 - No funding to focus solely on research
- 2- Learning curve in building collaborations with other institutions
 - A small group with limited resources
- 3- Research Isolation
 - Building collaborations with other African countries who are closer
 - Expand collaborations, work in progress.
- 3- Remote research:
 - All our students/researcher works from home. Slow internet.
 - We are looking for collaborative project to build our small lab where students can have access to appropriate computing power

We do it for the students: Past success



**NEUTRINO
MADAGASCAR**

Names	US Internship/Sponsor	year	Length	Current location
1- Navalona Ramanantoanina	U of Pittsburgh Internship	2017	9 mo.	Madagascar/ industry
2- Narisoa marc Vololoniaina	U of Pittsburgh Internship	2017	9 mo.	Madagascar/Faculty
3- Herilala RAZAFINIME	Neutrino Division/Fermilab	2018	6 mo.	Phd Student at U of Cincinnati
4- Miriama RAJAOALISOA	Neutrino Division/Fermilab	2018	6 mo	Phd Student at U of Cincinnati
5- Manoa Andriamirado	Illinois Institute of Technology	2019	5 ye	Phd Student at Illinois Institute of Technology
6- Andriaseta Sitraka	South Dakota School of Mine	2019	2 ye	Graduated/ moving to Germany
7- Antalia Ariel	ASP Short Term program at BNL	2022	6 mo	Madagascar/ applying for PHD in US
8- Rado FANANTENANA	ASP Short Term program at BNL	2022	6 mo	PhD student at Stony Brook University

Current students:

Names	Project	Joined
1- Fleuri Anjarazafy	GENIE-Monte Carlo Validation-implementation	2022
2- Angelo RALAIKOTO	DUNE Far Detector/GENIE	2023
3- Irintsoa Laamiy RAFIDISON	GENIE Neutrino Scattering	2023
4- Steval Stone Randriamanampisoa	Cold Electronic and Antenna-DUNE	2023
5- ROTSY Andriamiharinaivalona Toetrasoa	DUNE Far Detector	2023
6- Antalia Ariel	DUNE Cold Electronics	2021

symmetry

dimensions of particle physics

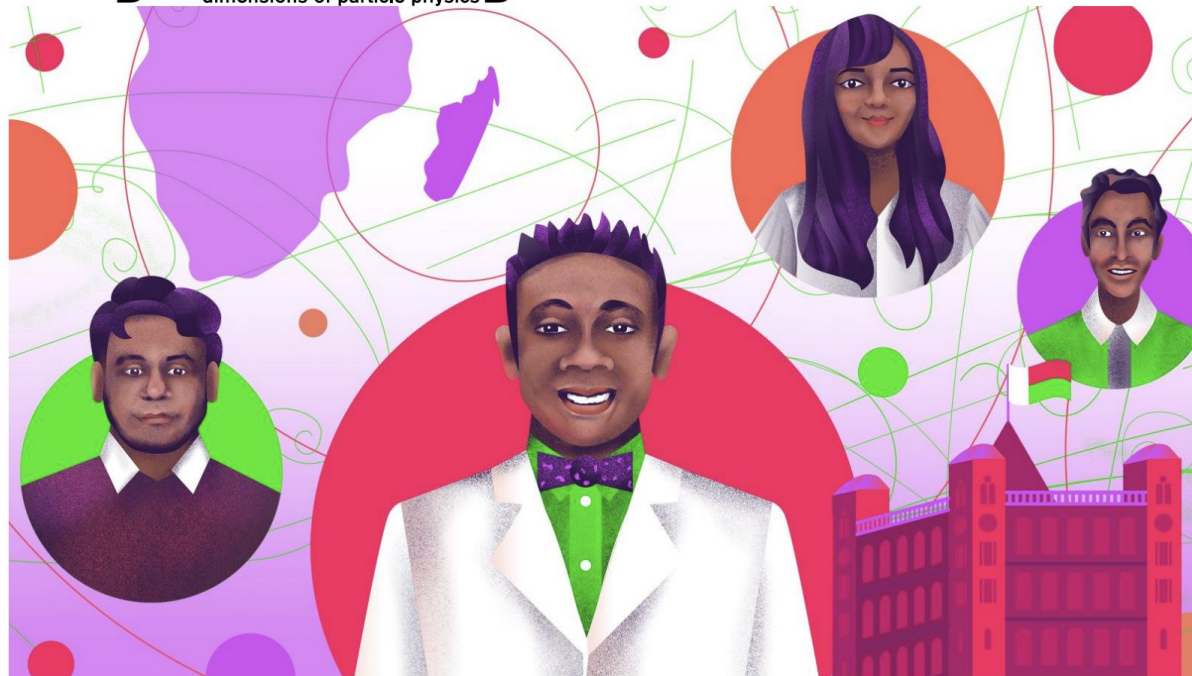


Illustration by Sandbox Studio, Chicago with Kimberly Boustead

Madagascar's path to neutrino physics