

# Les Rencontres de Physique de la Vallée d'Aoste

## La Thuile, Aosta Valley, Italy February 26 - March 3, 2012

PHYSICS in LATIN AMERICA  
(seen with european eyes)





The history of the Physics in Brazil is also the history of the Development of the High Energy Physics in Brazil and the Centro Brasileiro de Pesquisas Físicas (CBPF) the oldest Physics Research Center was in the center of many activities of this development.

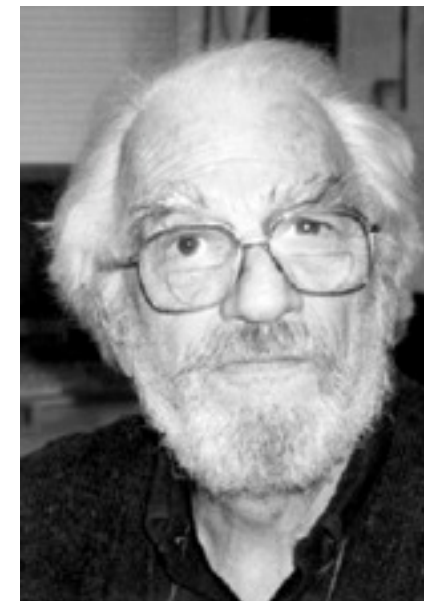
The High Energy Physics started in the University of S. Paulo with Gleb Wataghin. Mario Schenberg, ~~Marcelo~~ Damy de Souza Santos, Walter Schutzer Ugo Camerini e Giuseppe Occhialini in 1934.

Lattes was a student of the group but very early published papers with the physicists that were the founders of the HEP in Brazil.

Gleb Wataghin



Giuseppe Occhialini Marce loDamy



Ugo Camerini

## After 1961

- R. Salmeron went to Paris to the Ecole Polytechnique
  - J. Leite Lopes went to Strasbourg - France
  - J. Tiomno went to United States for Short time
- Many colleagues went to Europe/USA.

A Universidade Interrompida: Brasilia 1964 - 1965, Edited by UNB- (this book was written by R. Salmeron)

- Only 1976 when the General President Ernesto Geisel decide the absorption of CBPF by CNPq then, become an Institute of Research of CNPq. The groups of Research coming back to CBPF.
- In 1977 I came back to Brazil. We found a Department of Theoretical Physics with Cosmology and Particle. It is interesting to note that many colleagues were against the start again Particle Research at CBPF.

➤ In 1981, the initiative of Leon Lederman starts a new era of Physics not only in Brazil but also in all Latin America.

Leon would like to discuss the idea of a FERMILAB Panamerican Laboratory like CERN for Europe.

This was not possible unfortunately, but the High Energy Physics started strong activities in Latin America.

- \* 1981 - 1st. Symposium in México  
(Thanks to Glicério Avilez)
- \* 1982 and 1987 - 2nd. and 3<sup>rd</sup>. Symposium in Brazil
- \* 1989 - 4th. Symposium in Argentina
- \* 1992 - 5th. Symposium in Colombia





## D0 - Collaboration



Alberto Santoro





# *Participación del Departamento de Física en EHEP*

**La participación del Departamento de Física en el área de  
Física Experimental de Altas Energías inició de la década de los 80's**

**Gerardo Moreno**  
(IF-UG)

**Luis Villaseñor**  
(IFM-UMSNH)

**Antonio Morelos**  
(IF-UASLP)

**Miguel Vargas**  
(IF-UG)

**CERN-UA1**

**FERMILAB-E605**

**DESY-ARGUS**

**Bruno González**  
(†)

**Gerardo Herrera**  
(DF-CIEA)

**FERMILAB-E791**

**FERMILAB-D0**

**Heriberto Castilla**  
(DF-CIEA)

**Héctor Méndez**  
(Univ. Mayaguez)

**Arturo Fernández**  
(ECFM-BUAP)





# *Participación del Departamento de Física en EHEP*

Y se consolidó en la década de los 90's

**Marco A. Reyes**  
(IF-UG)

**Raúl Hernández**  
(UV)

**José L. González**  
(UdeG)

**FERMILAB-E690**

**FERMILAB-E791**

**Leonel Magaña**  
(Tec-Morelia)

**DESY-H1**

**FERMILAB-D0**

**FERMILAB-CDF**

**Alberto Sánchez**  
(DF-CIEA)

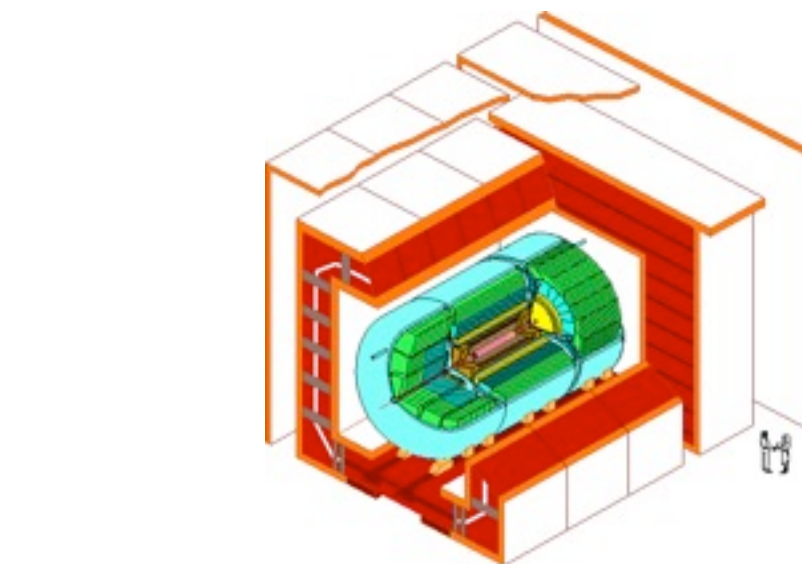
**Guillermo Contreras**  
(CIEA-Mérida)

**FERMILAB-FOCUS**

**Salvador Carrillo**  
(U. Iberoamericana)

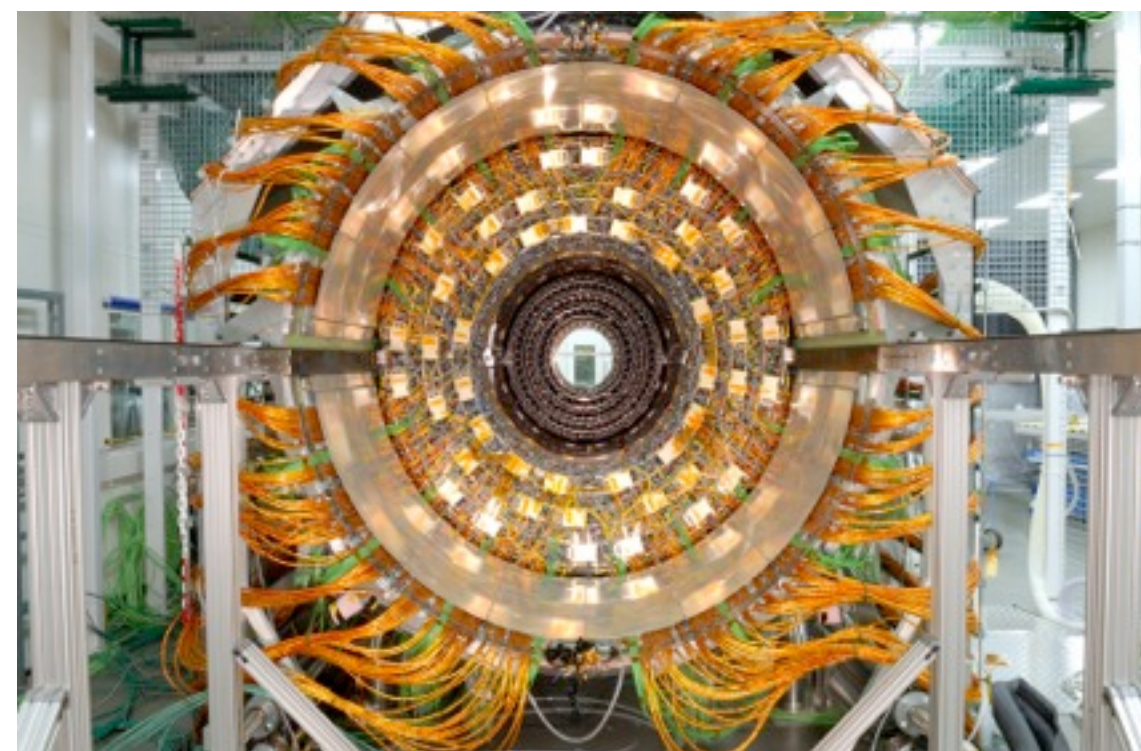
**Fabiola Velázquez**  
(U.Iberoamericana)

**Luis M. Montaña**  
(DF-CIEA)



Experimento Dzero:  
CINVESTAV ha participado desde  
1992

Experimento CMS:  
CINVESTAV participa desde  
2003





# The situation in Latin-America in 2002, after a review by J.A. Rubio



- $\approx 800$  scientists of HEP and related technologies.
- $\approx 45\%$  experimentalists and engineers.
- $\approx 25\%$  CERN collaborators.
- $\approx 45\%$  are doc. or postdoc. students.
- $\approx 70$  registered CERN users.
- theory groups  $\approx 60$
- experimental & technical groups  $\approx 20$ :
  - Fermilab  $\approx 40\%$
  - CERN  $\approx 30\%$
  - DESY  $\approx 5\%$
  - Auger  $\approx 20\%$

# Conclusions of JA Rubio's Report (2002)

...in summary, Latin America has an important Particle Physics community with a high potential, particularly in the larger countries, and is well prepared to participate successfully in the frontier experiments in the field, particularly those at the LHC (Large Hadron Collider) project from CERN.

Currently, there are about 65 CERN users from Latin-America, either using the personnel programmes of the Organization or detached by their institutes.



# WHAT IS CERN?

Presentation to  
H.E. RONALDO MOTA SARDENBERG  
Science Minister of Brazil

*Luciano Maiani. CERN. Geneva*

July 18, 2002



# Strengthening Brazil - CERN collaboration (2)

- Brazil could become CERN Observer State, joining Israel, Japan, Russia, United States, Turkey and, in the near future, India.
- This might be possible through:
  - “In kind” contributions from Brazilian industry to the LHC.
  - A 5 years training programme for Brazilian engineers and physicists, which will also help in the construction of the LHC.
  - Technology domains: low temperature superconductors, superconducting magnets, cryogenic techniques, ultra-high vacuum techniques and equipment, powering aspects of superconducting magnets, process control and automation, simulation and computation and technology transfer.



# The Joint CERN - CLAF School of Physics

- for students preparing a PhD in experimental high energy physics.
- First edition in Itacuruçá, organized by B. Marechal (UFRJ) and E. Lillestol (CERN).
- 72 students: 57 students from 8 Latin American countries (17 from Brazil), 13 from Europe and 2 from the US.
- Supported by Brazil, Mexico and CLAF in LA and CERN, Spain, Portugal, France and Italy in Europe.
- Joint CERN – Latin American Steering Committee was set up, to prepare a Plan of Action that will be submitted to the relevant authorities.



## Visit of UERJ Rector





# Objectives



**Academic Co-operation Programme between  
European Union and Latin America**

**HELEN**

**High Energy Physics Latin American-European Network**

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**HELEN has operated from  
July 2005 to April 2009**

## Objectives

1. To train young generations of physicists in **High Energy Physics**, in which Europe is world leader, thereby promoting fundamental physics in Latin American countries and contributing to the modernization of physics education there.
2. **CERN, DESY** and **Gran Sasso** facilities, in particular the **Large Hadron Collider (LHC)**, **HERA** and their experiments, as well as the **Auger Experiment** in Argentina are fundamental tools for an advanced training programme.
3. To facilitate access of Latin American countries to the technological benefits in the accelerator, detector and information technology domains (**GRID** as an example).
4. To strengthen the integration of the European and Latin American Physics communities.





## QUANTUM DIARIES

Quantum Diaries Home

## ÚLTIMAS ENTRADAS

HELEN: the future started in Rio

## ARCHIVOS

noviembre 2005

octubre 2005

septiembre 2005

agosto 2005

julio 2005

mayo 2005

abril 2005

marzo 2005

febrero 2005

enero 2005

Sindicar este sitio (XML)

« [La Bahía](#) | [Inicio](#) | [Collaboration Meeting approaches](#) »

febrero 03, 2005

## HELEN is approved !



Not all days start with a nice series of emails. Fortunately today is one of those!

The first one was a message announcing that the European Union has approved our **HELEN** project. Then followed a long series of congratulation emails, with statements like

"**HELEN** will boost the European - Latin American collaborations in HEP!"

**HELEN** stands for *High-Energy Latin-European Network*. It is a scientific cooperation agreement, signed by [CERN](#), [DESY](#), labs/universities from eight latin-american countries (Argentina, Brasil, Chile, Colombia, Cuba, México, Perú y Venezuela), the four "latin-european" countries (Spain, France, Portugal, Italy) and other less latin ones (Greece, Sweden, UK).

**HELEN** is an [alfa](#) project. "She" will provide mobility and research grants, for students, technicians and physicists from Latin America to work on collaboration projects with the european labs. Her "father" is Juan Antonio Rubio, who was the CERN contact for Latin America (he is now the head of [CIEMAT](#) in Madrid), and its project leader is Luciano Maiani (the former CERN Director). Verónica Riquer, a CERN physicist from México is the project manager, and there are contact persons in each country.



@ CINVESTAV, April 2005:  
it is going to be like this!





# Trainees at CERN

## (Jan. 2006)



CERN  
COURIER

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### Faces and Places

#### Faces and Places (page 5)

##### HELEN brings Latin Americans to CERN

The training programme supported by the High Energy Physics Latin American- European Network (HELEN) is in full swing. For 2006, the programme has assigned about 70 fellowships to be spent at CERN by Latin American students and young physicists. The fellowships are centred on the experiments at the Large Hadron Collider (LHC), theory, the DataGRID and technology transfer. Other fellowships are to be spent at European and Latin American universities, bringing the total for the first year of the programme to more than 100 fellowships, with an average duration of three months.

Now a small but active HELEN community is building up at CERN, and has established a HELEN club to allow the exchange of views and to help newcomers in the

complex CERN environment. Jose Salicio Diez of the Physics Department coordinates HELEN at CERN.



#### [Latin American students](#)

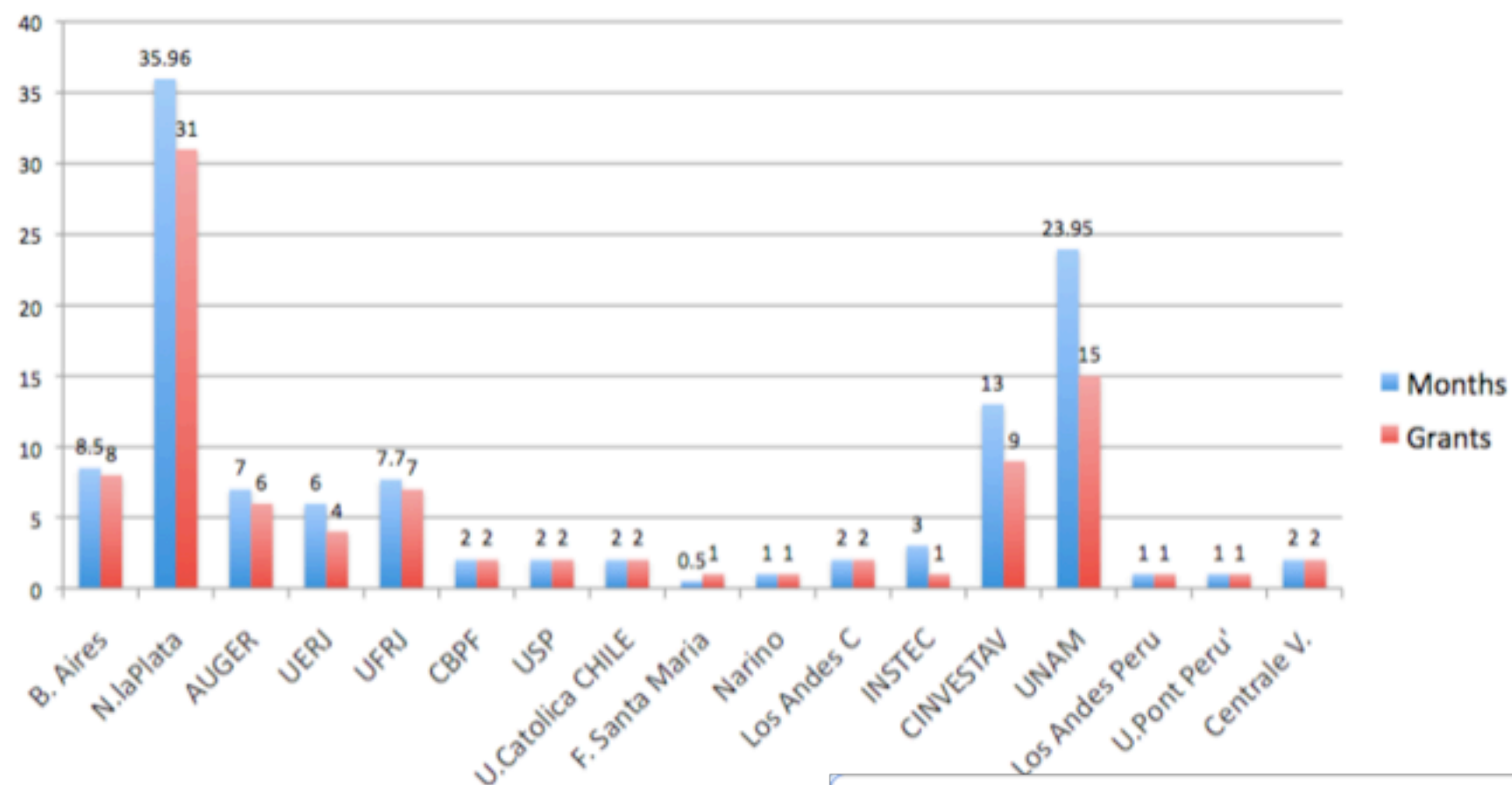
Latin American students who have arrived at CERN to take up fellowships during the first months of 2006 relax in front of the LHC collaboration buildings, together with the deputy coordinator of HELEN, Veronica Riquer (centre), from Rome University and INFN.



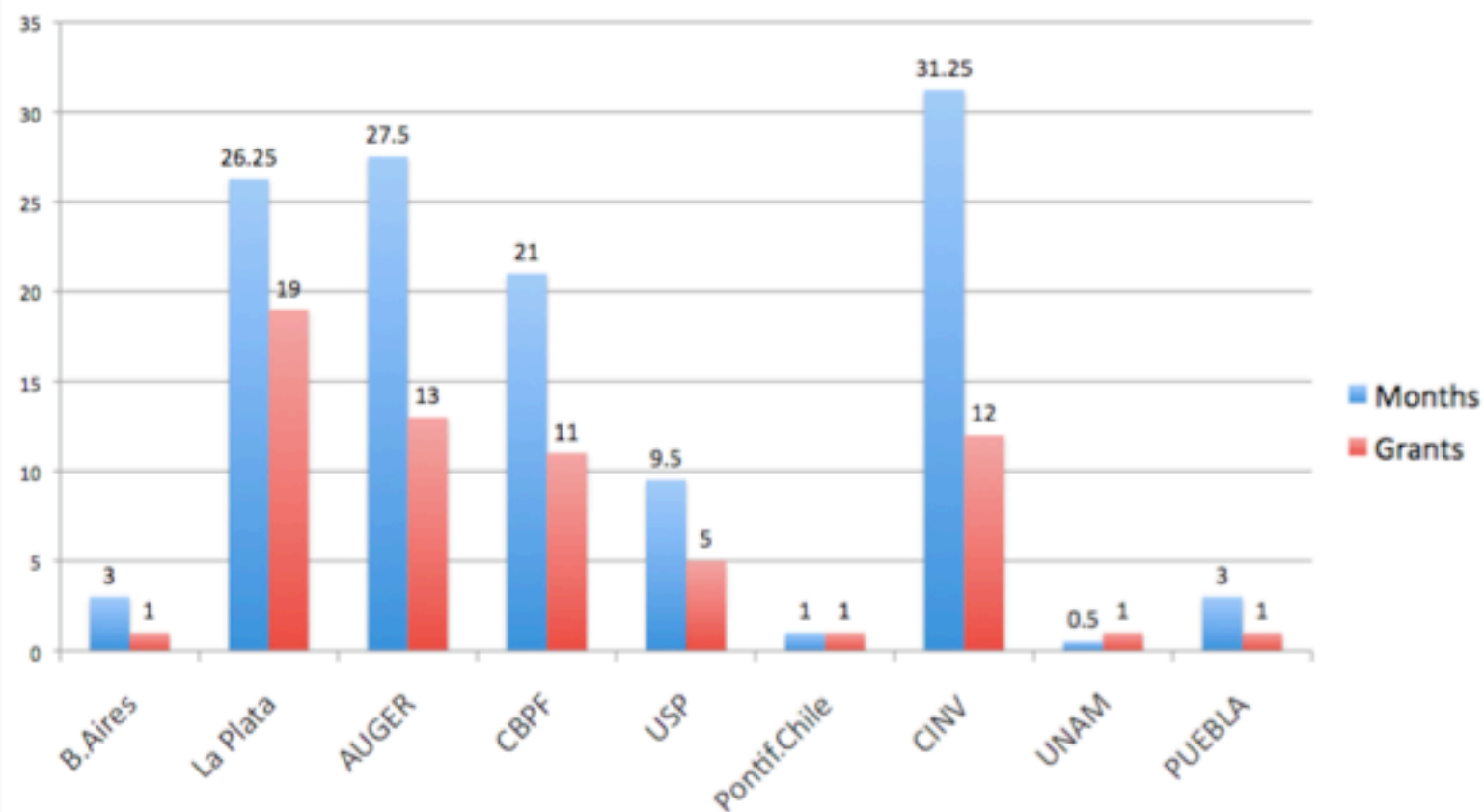
# HELEN, some data

- **HELEN** (final balance):
  - Participants in LA: 22 institutes from Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Peru, Venezuela
  - Participants in Europe: 16 institutions from France, Germany, Italy, Portugal, Spain and CERN
  - Period: from July 2005 to April 2009
  - Cost: 3.2 Million Euro
  - European Union contribution: 2.4 Million Euro
  - CERN contribution: 450 Thousands Euro
  - LA contribution: 320 Thousands Euro (about 10% of total cost)
  - **HELEN** has assigned Grants to undergraduate, graduate, postdoc and staff researchers as follows:
    - LA to EU: 425 grants (1354 months) ,
    - EU to LA: 95 grants (119 months),
    - LA to LA: 64 grants (123 months).
  - for a total of 584 Grants (1596 months/person).

## Europe to Latin America (HELEN total)

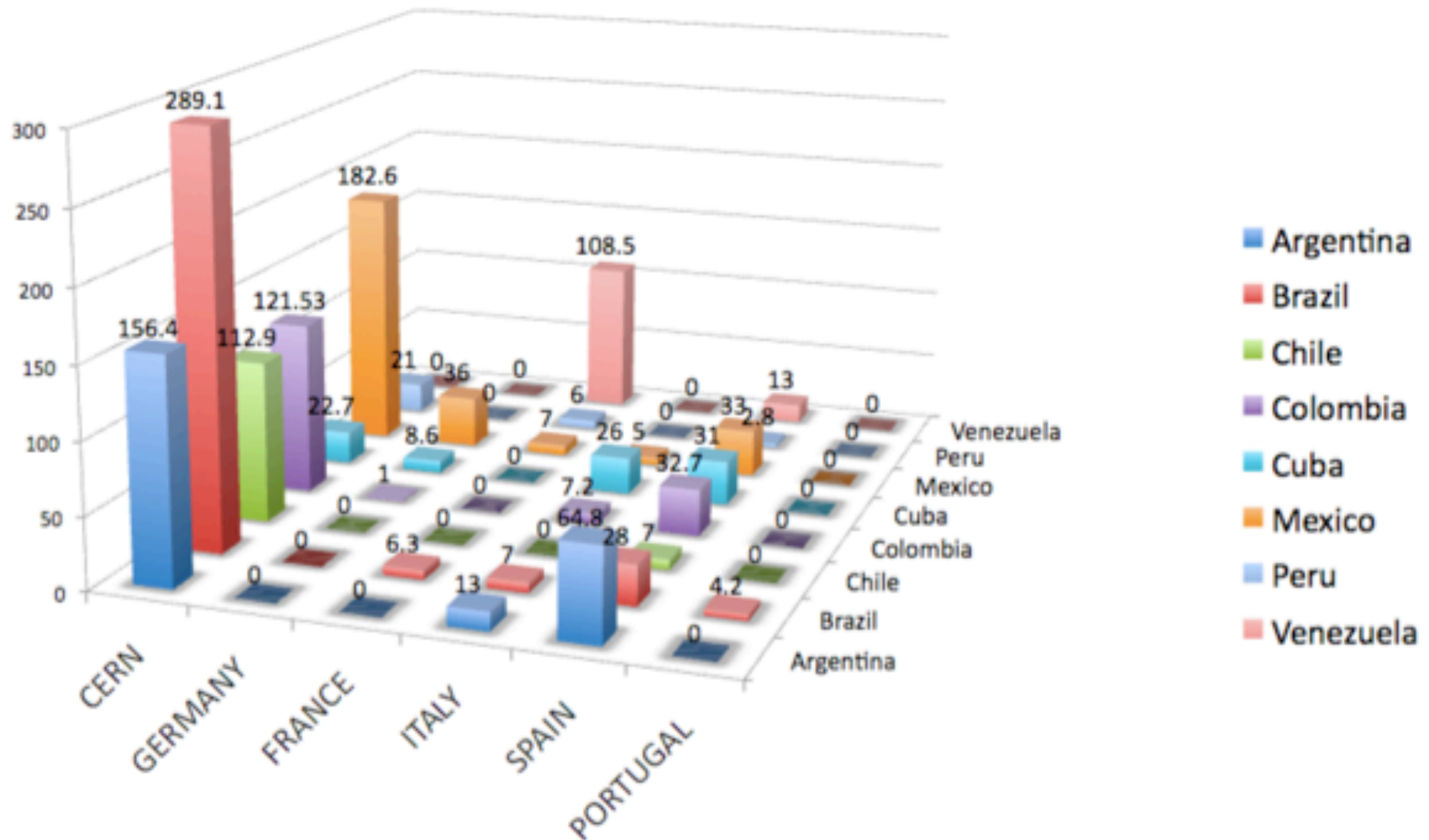


## Latin America to Latin America (HELEN total)

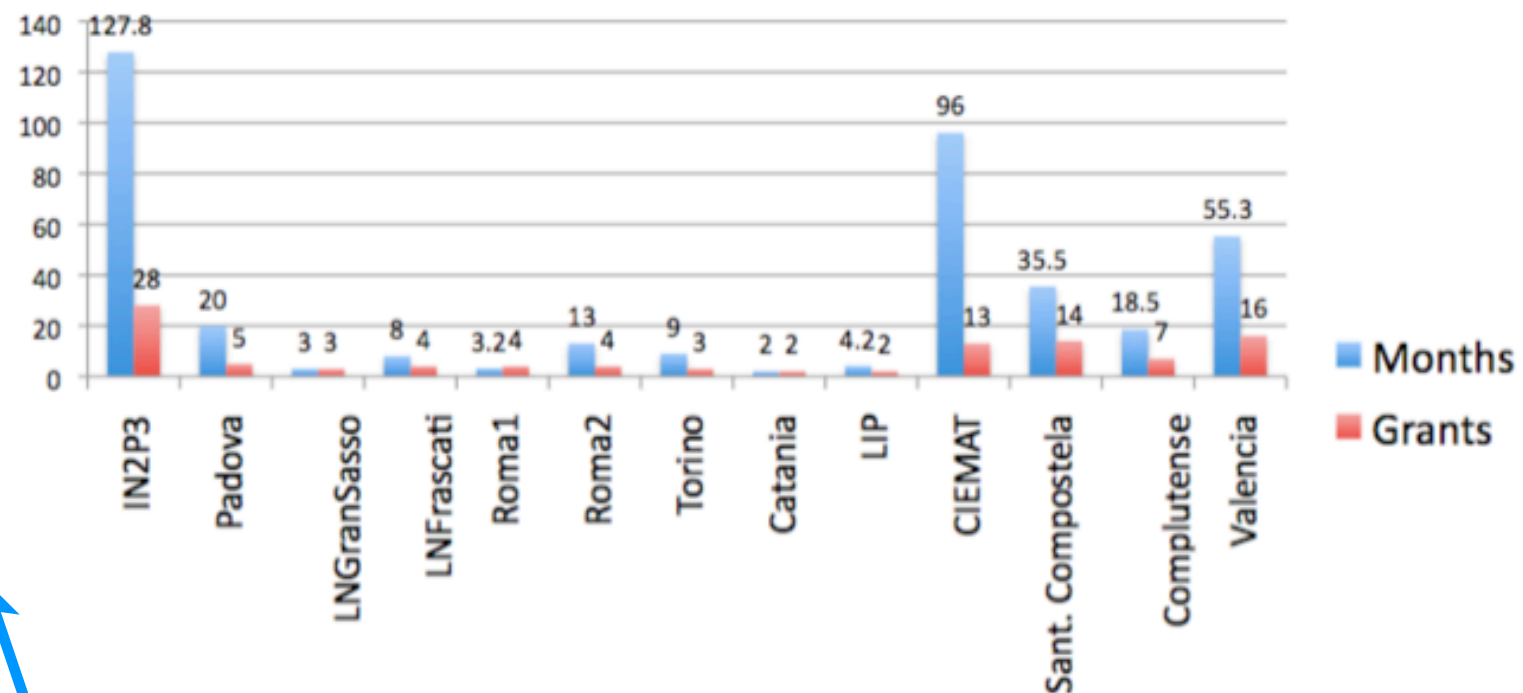




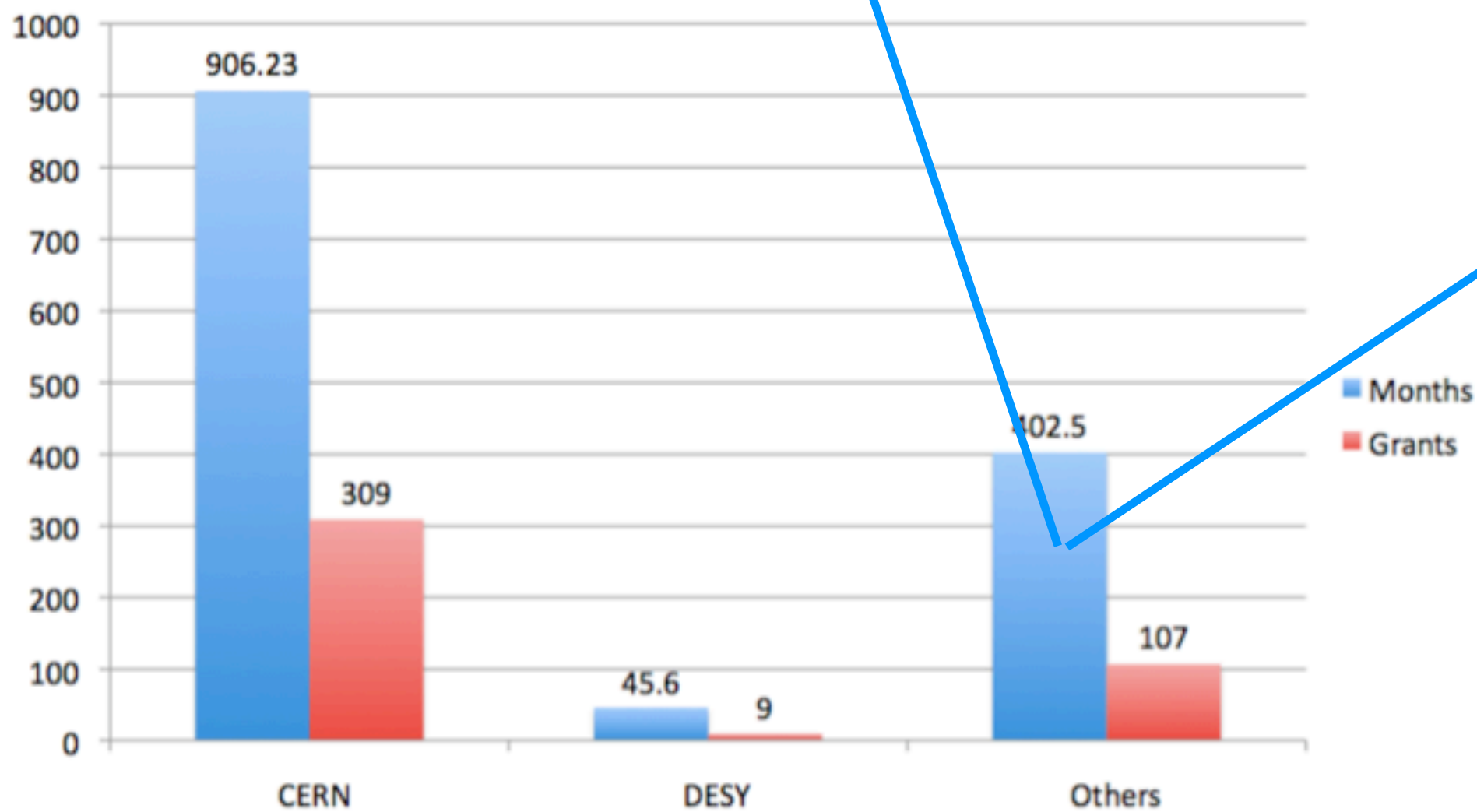
## Latin America to Europe (Months, total HELEN)



## Others (HELEN total)

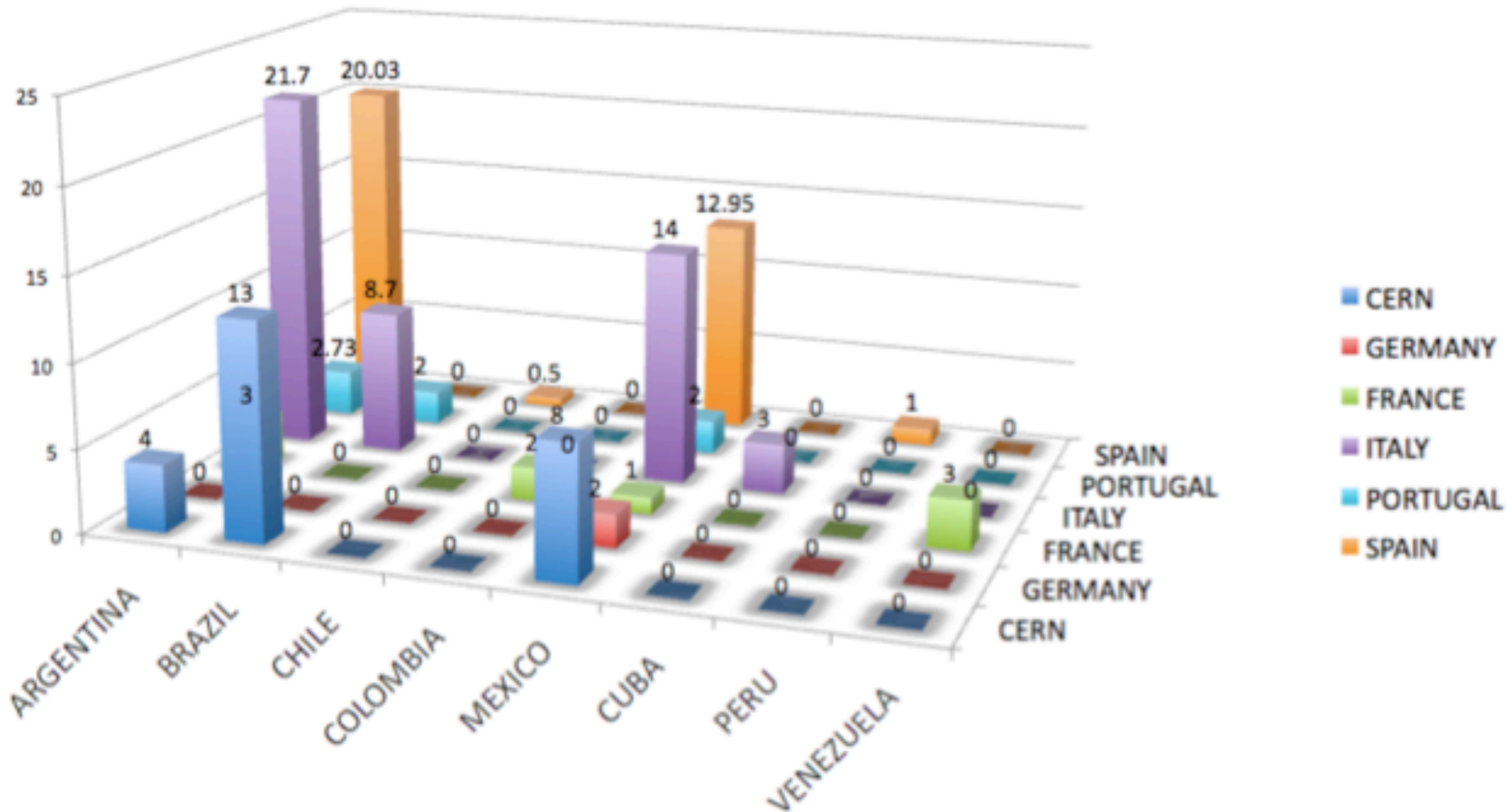


## Latin America to Europe (HELEN total)



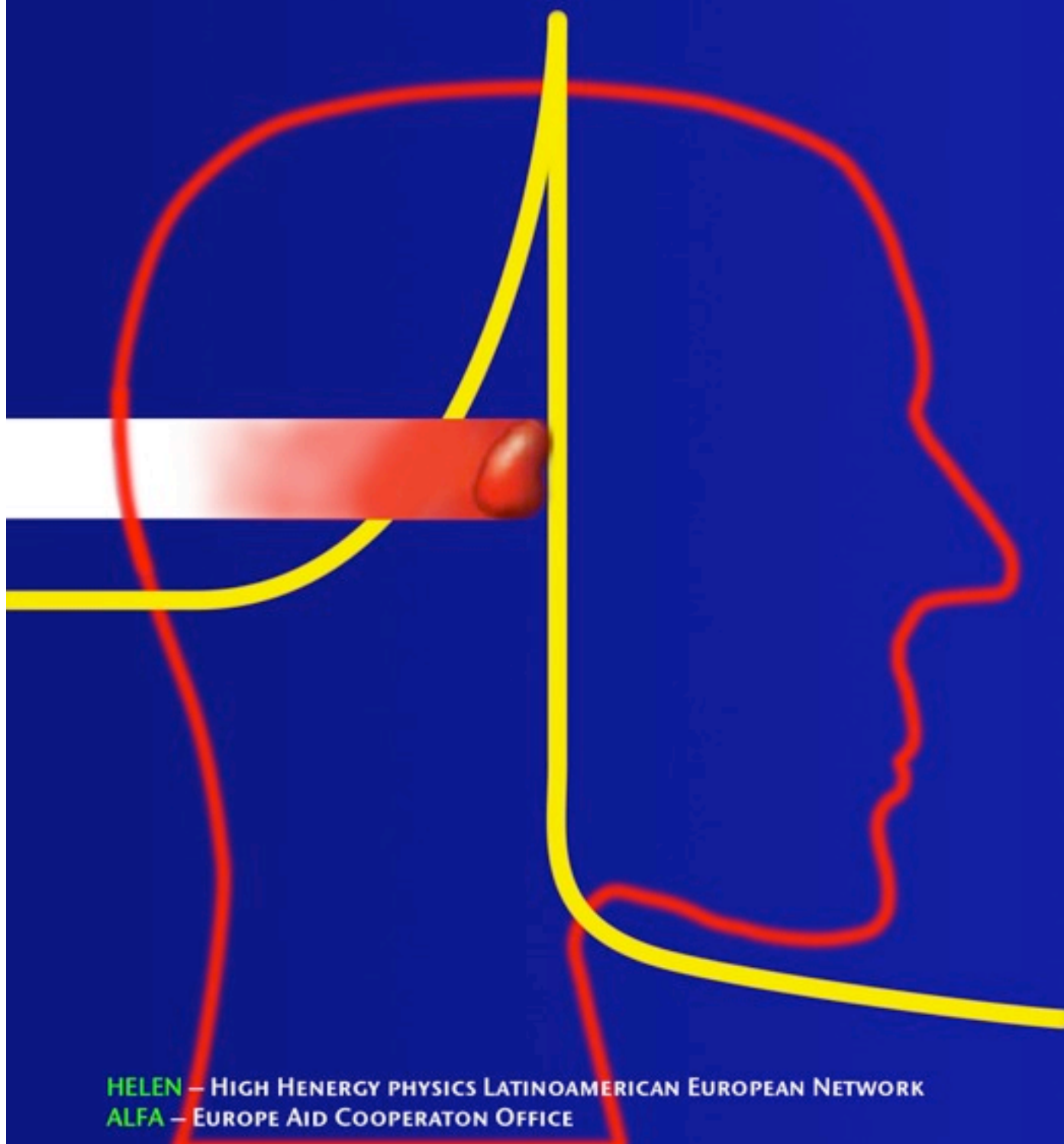


## Europe to Latin America (Months, total HELEN)



# HADRONTHERAPY WORKSHOP

CENTRO DE INVESTIGACIÓN Y ESTUDIOS AVANZADOS  
INSTITUTO POLITÉCNICO NACIONAL  
MEXICO DF, MEXICO, 28TH-30TH MAY, 2007



## Organizing Committee:

G. Herrera Corral, L. Maiani, V. Riquer, M. Streit-Bianchi, A. Zepeda

## Talks

U. Amaldi,  
University of Milano Bicocca and TERA Foundation

R. Miralbell,  
University of Geneva and HUG

L. Maiani,  
University la Sapienza, Rome

M. Dosanjh, CERN

Miguel Embid  
Medical Physics Group, CIEMAT

G. Baroni  
Bioengineering Department, Polytechnic University of Milan

G. Herrera Corral, CINVESTAV

HELEN – HIGH HENERGY PHYSICS LATINOAMERICAN EUROPEAN NETWORK  
ALFA – EUROPE AID COOPERATON OFFICE



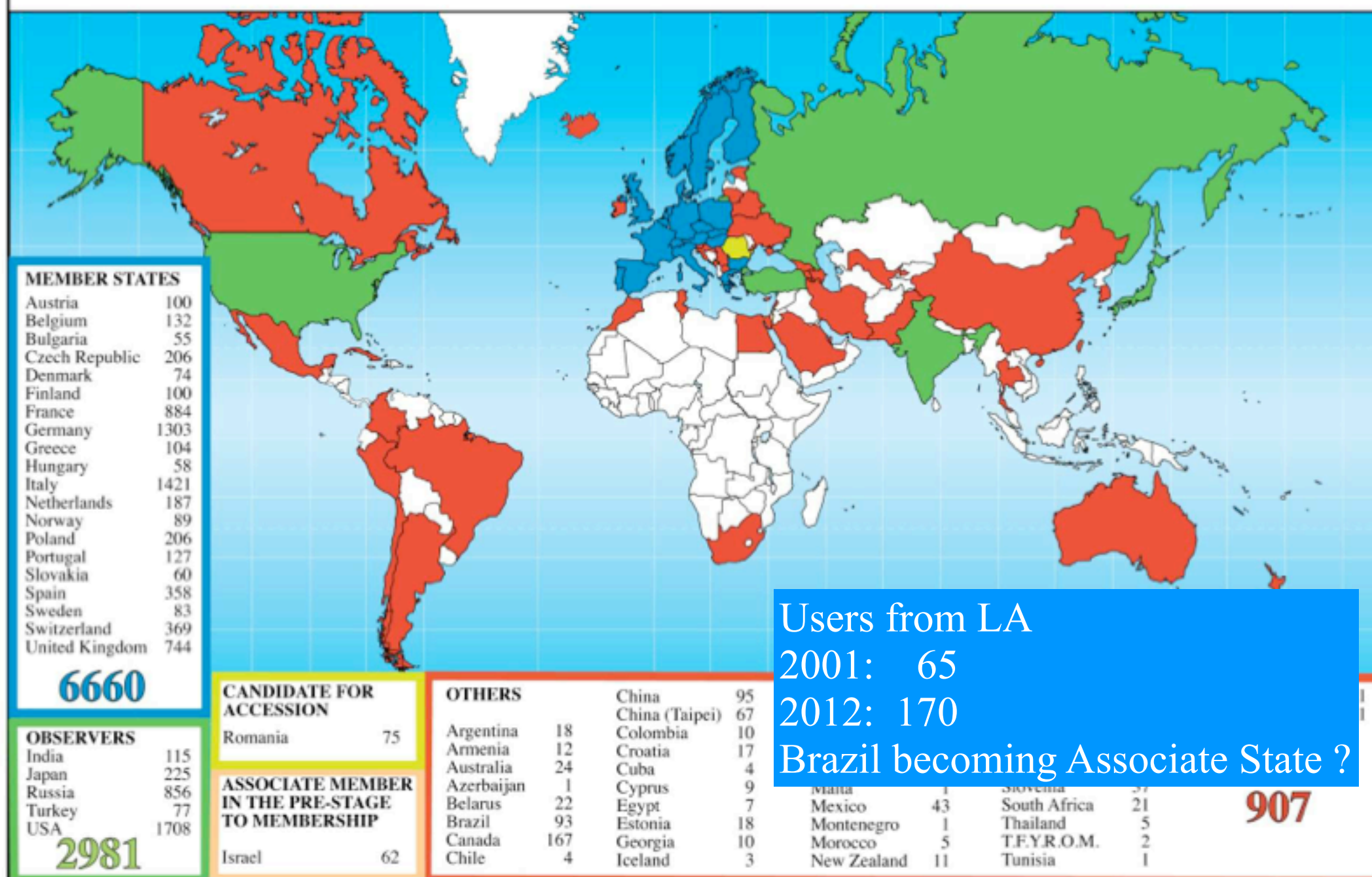


# La ciencia se hace cada vez mas global

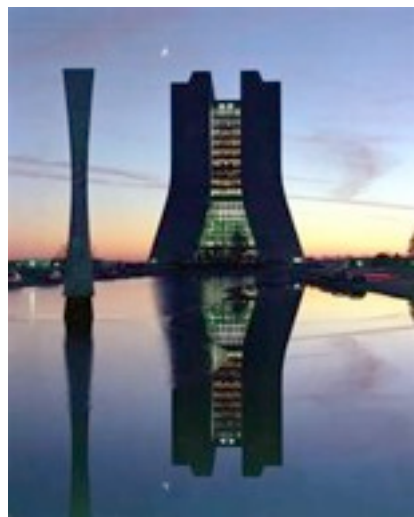


Jose Salicio Diez

## Distribution of All CERN Users by Nation of Institute on 9 January 2012



# *Participación Actual en EHEP*





**HELEN has helped in a decisive way to foster and consolidate the very fruitful collaboration with Latin American colleagues and Institutions in the case of ATLAS**

**In particular the contributions from students and young researchers are a strong asset to the experiment, in addition to the institutional strengthening of the Collaboration and its resources**



**Before HELEN (2004)**



**After HELEN (October 2007)**





**The establishment of the formal collaboration got a strong boost by the Presidential visit of HE Mrs Michelle Bachelet Jeria on 3<sup>rd</sup> June 2007**

**She was accompanied by the President of CONICYT, Mrs Vivian Heyl, and the two Rectors Profs P Rosso (PUC) and J Rodriguez (UTFSM)**







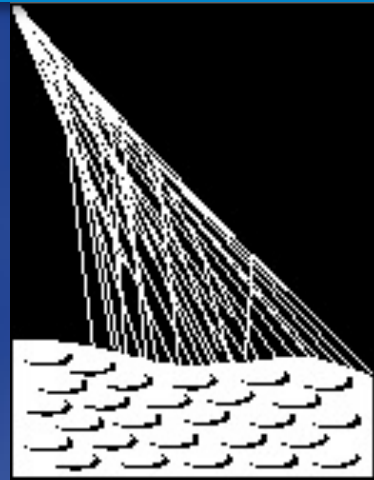
# *Participación Actual Pierre Auger Observatory Desde 1996*

## **The Pierre Auger Observatory Malargue (Mendoza, Argentina)**

*Anulfo Zepeda*

*Cinvestav, Mex.*

*Oct- 2011*



**PIERRE  
AUGER  
OBSERVATORY**





The [Pierre Auger Collaboration](#) includes more than 490 scientists from Argentina, Australia, Bolivia, Brazil, Croatia, the Czech Republic, France, Germany, Italy, Mexico, Netherlands, Poland, Portugal, Slovenia, Spain, the United Kingdom, the United States, and Vietnam. These countries are highlighted in green in the above map.

HELEN and EPLANET support participation of Argentina, Brazil, France, Germany, Italy, Mexico, Portugal, Spain, the United Kingdom





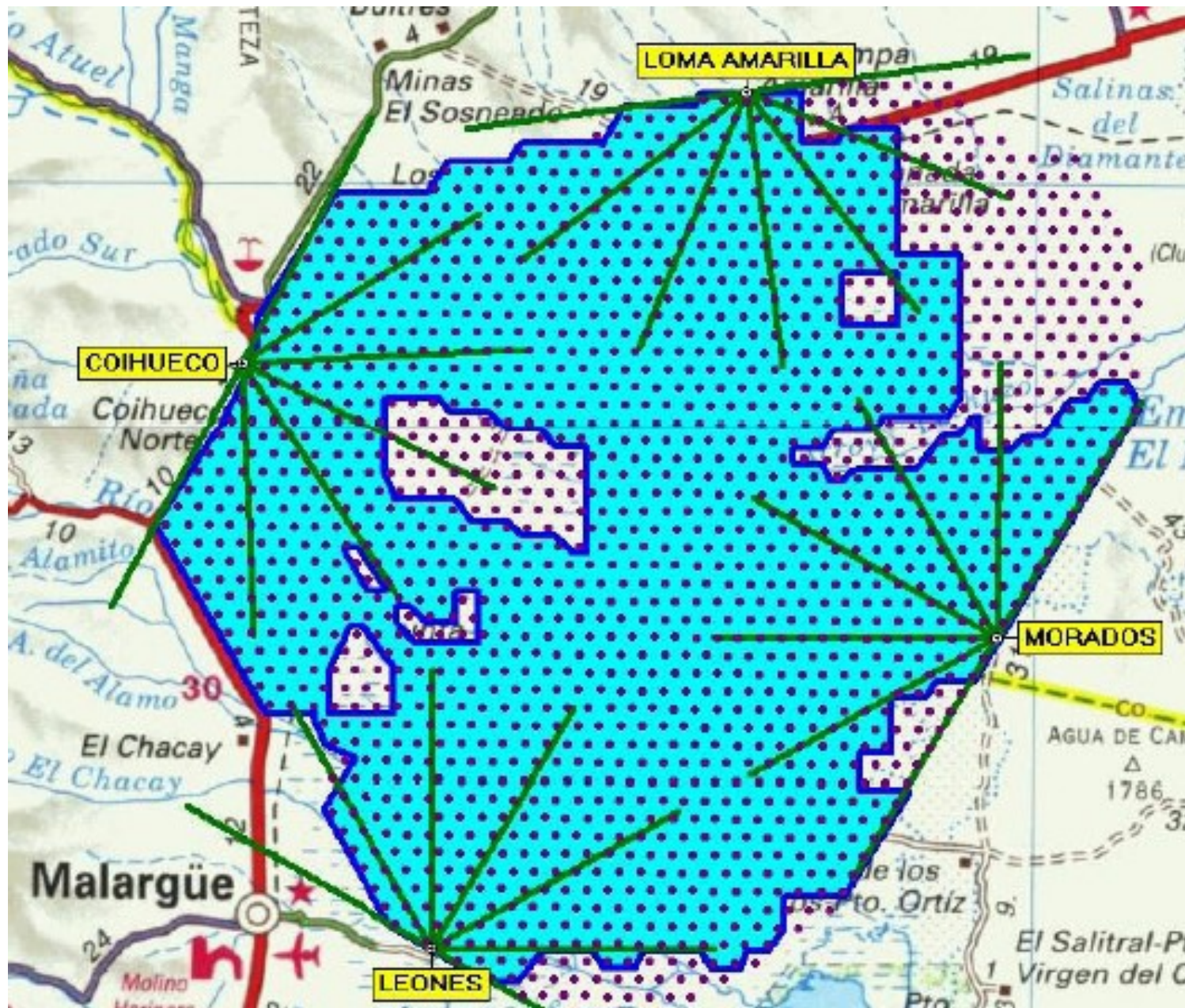
La Ruta Quarenta @ MALARGUE





At the highest energies, only few cosmic rays arrive per km<sup>2</sup> per century ! to see some, a huge detector is required

## THE PIERRE AUGER OBSERVATORY

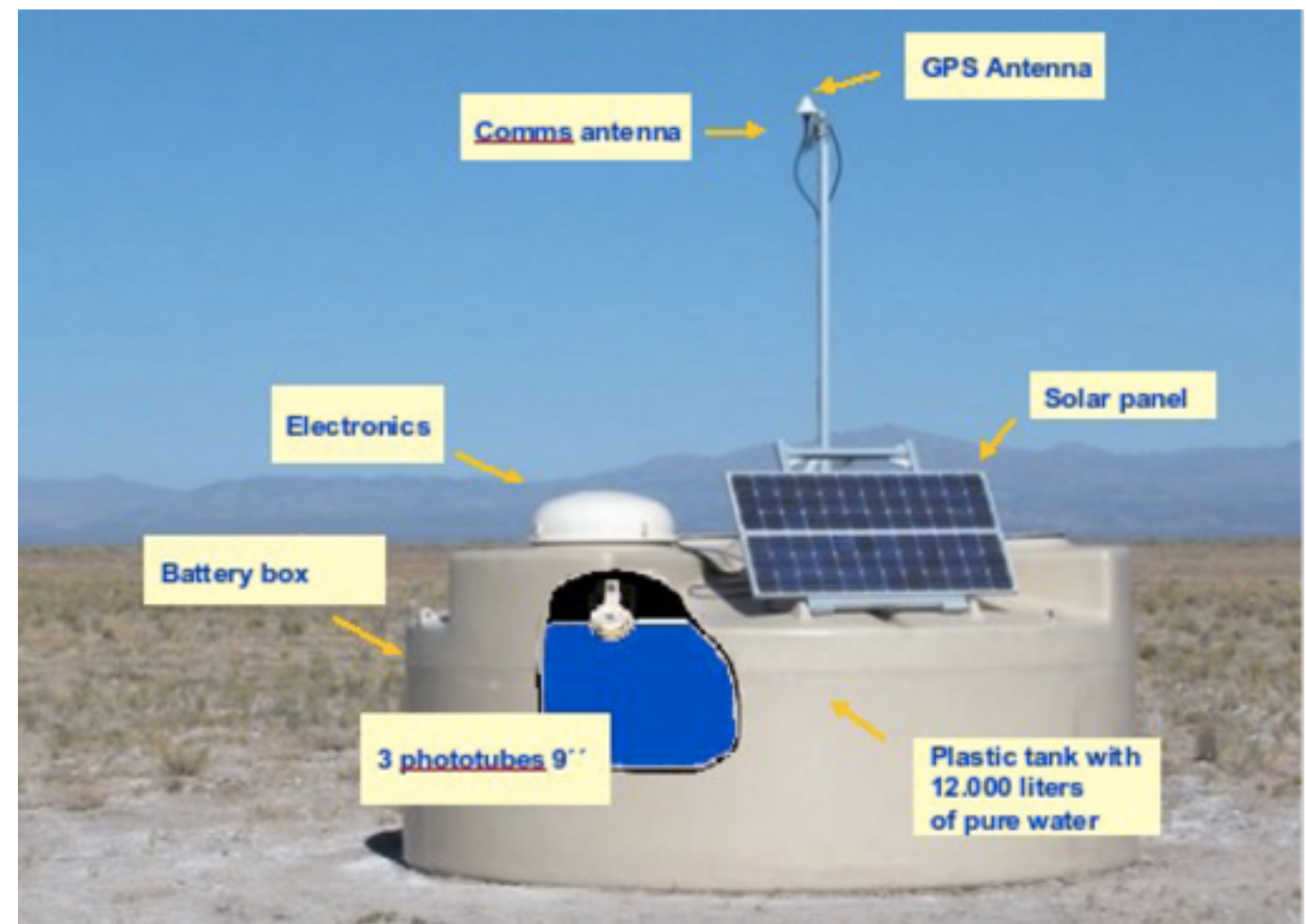


SD 100% DC  
FD 13% DC

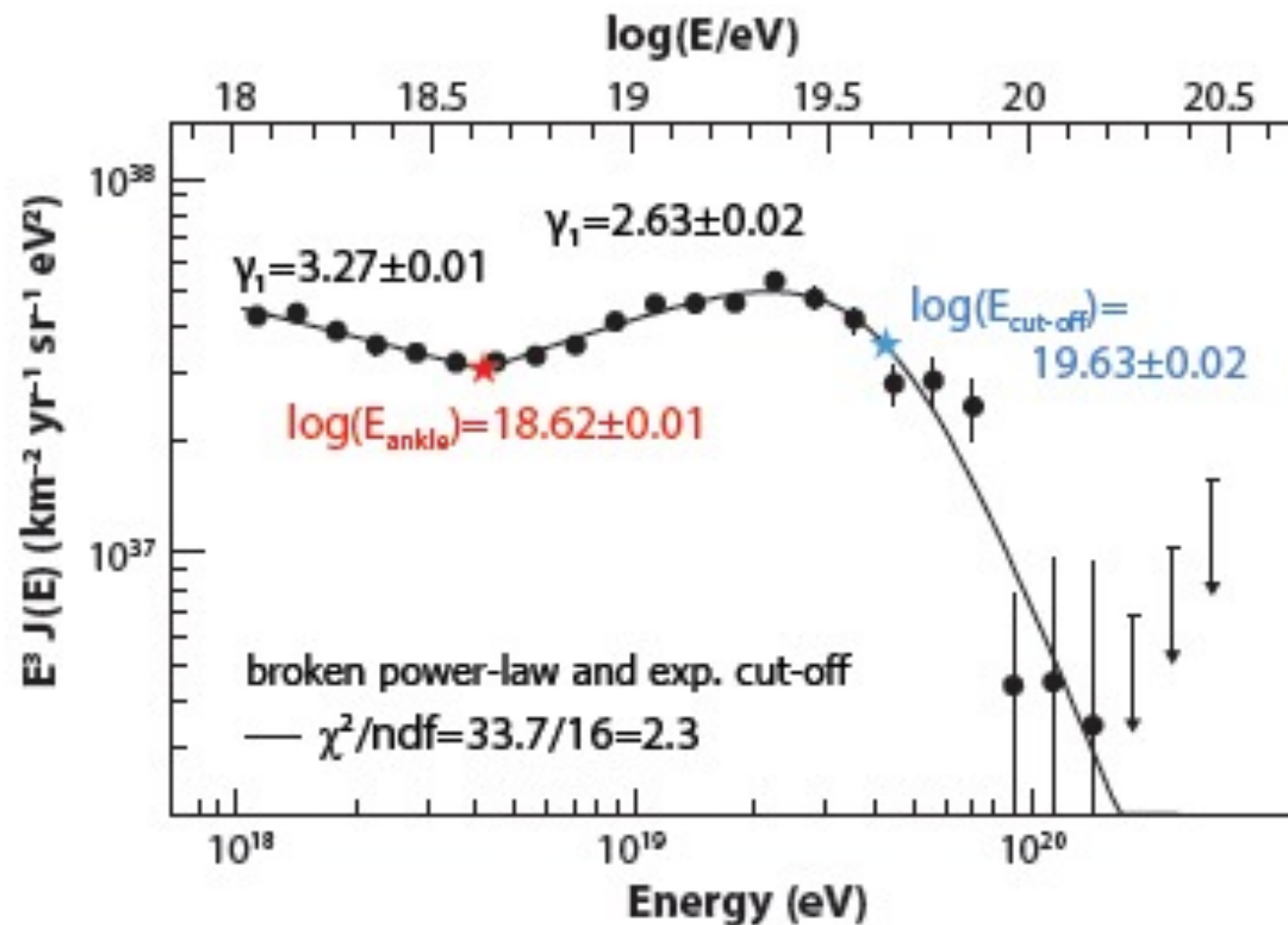
1600 detectors over 3000 km<sup>2</sup> (triangular grid with sides of 1.5km)  
and 24 telescopes



# surface detector



# SD + Hybrid Combined Spectrum

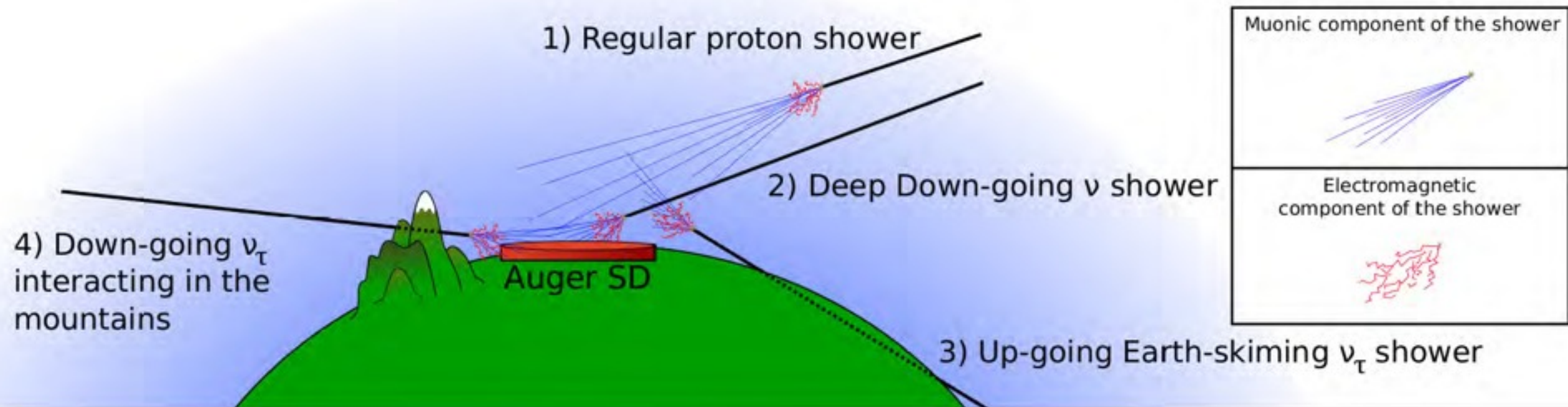


**Exposure = 20 905 km<sup>2</sup> sr yr (60% increase over PLB 685 (2010) 239)**

**Inclined showers add another 5 300 km<sup>2</sup> sr yr (→ #724)**



# Update of Neutrino Limits



## Search for

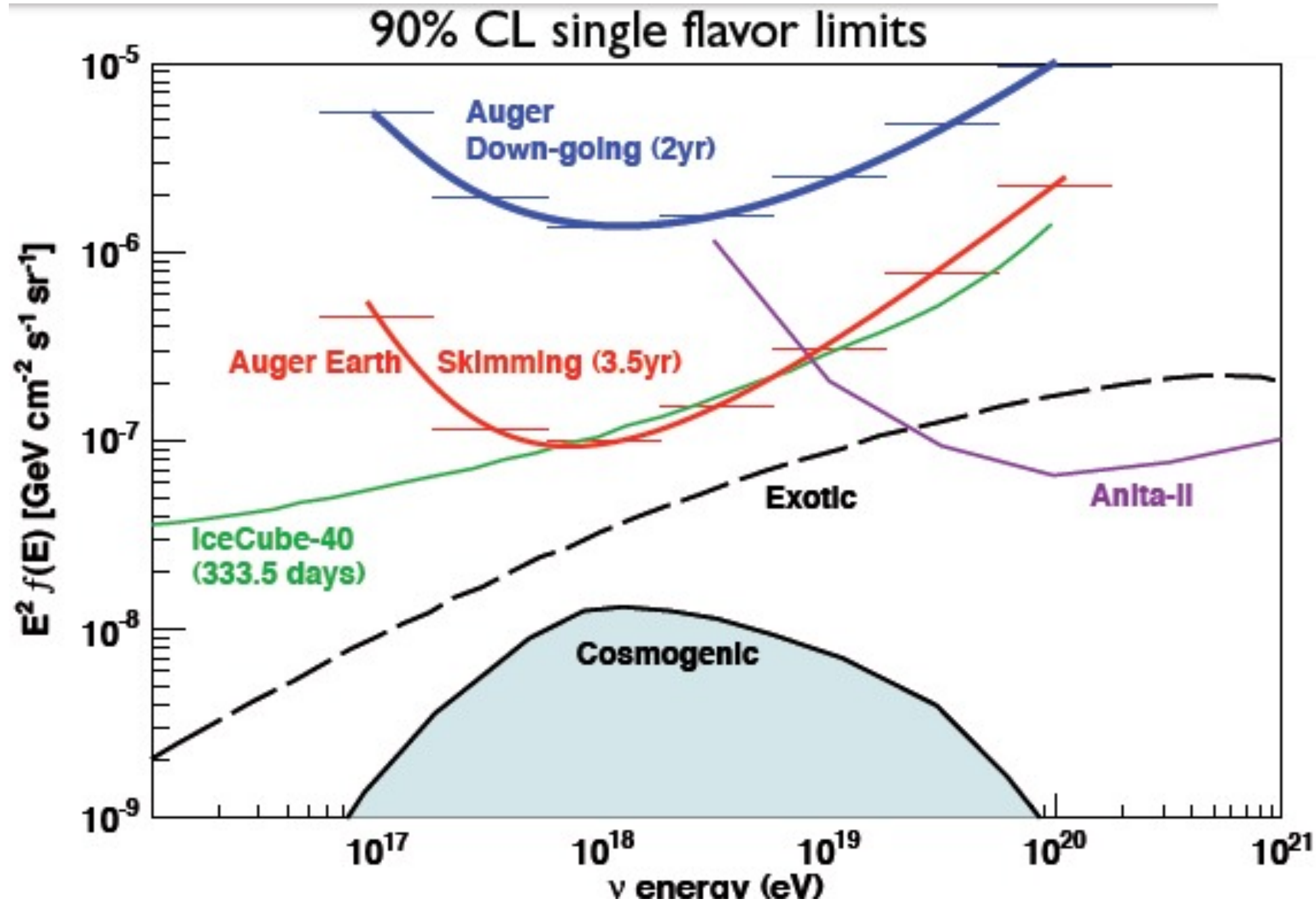
- up-going Earth-skimming showers
- down-going Neutrino showers

## Search criteria

- young  $\nu$  induced showers  $\rightarrow$  wide time distribution in tanks
- elongated footprint of inclined shower
- propagation speed of shower front at ground sensitive to all flavors

no  
candidates  
found

# Diffuse Neutrino Limits



Integral:  $k < 2.8 \cdot 10^{-8} \text{ GeV cm}^2 \text{ s}^{-1} \text{ sr}^{-1}$  from  $1.6 \cdot 10^{17} - 2.0 \cdot 10^{19} \text{ eV}$  ( $\nu_\tau$ )

$k < 1.7 \cdot 10^{-7} \text{ GeV cm}^2 \text{ s}^{-1} \text{ sr}^{-1}$  from  $1.0 \cdot 10^{17} - 1.0 \cdot 10^{20} \text{ eV}$  (all  $\nu$ )



CERN2004



VERONICA

Alberto



CERN 2004



ALICE setup, includes the ACORDE (trigger system) on top of the magnet. The TPC is the main detector of ALICE and it will also be used to track atmospheric muons. The TRD and the TOF can be used to improve the event information.

ALICE is located underground with 30 m of overburden rock. Only atmospheric muons with energy  $E_\mu > 15$  GeV can reach the experiment.



ACORDE, the proposed trigger system is an array of silicon detector modules located on the three top sections of the magnet. They give the trigger signal when atmospheric muons cross the ALICE detectors.

Main physics topics that can be



ALICE

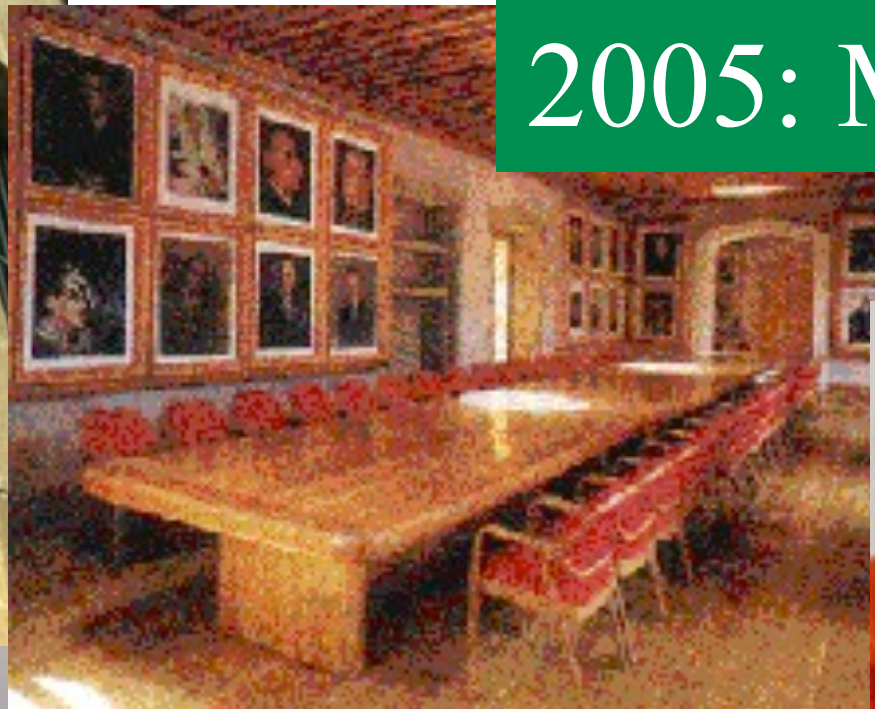
MEXICO

Arturo

Maiani

Zepeda & Wife





2005: Mexico



2005: Rio







# 2006: CERN





# HELEN niños Summer 2007





# CERN Marathon, 2008





# A new European Project: EPLANET

<http://www.roma1.infn.it/exp/eplanet/>

- belongs to IRSES- Marie Curie
- France, Italy, Portugal, Spain, UK, CERN for Europe;
- LA: only for Countries that have signed a Science&Technology agreement with EU Commission (Argentina, Brazil, Chile, Mexico);
- CERN provides additional funds to support exchanges with Colombia, Peru and Venezuela
- 4 years, budget 3.245 ME, 1803 months;
- started 1feb 2011 (about 2 years gap from HELEN).





# EPLANET

LA to Europe during the lifetime of the project (4 years)

	Months	Fraction
<b>CERN</b>	956	79%
<b>ES</b>	102	8%
<b>FR</b>	58	5%
<b>IT</b>	76	6%
<b>UK</b>	11	1%
<b>Total</b>	<b>1203</b>	<b>100%</b>

	Months
<b>CERN</b>	956
<b>CIEMAT</b>	14
<b>CPT</b>	34
<b>IN2P3</b>	24
<b>INFN</b>	76
<b>Leeds</b>	11
<b>UAH</b>	4
<b>UB</b>	17
<b>UCM</b>	9
<b>USC</b>	40
<b>UV</b>	18
<b>Total</b>	<b>1203</b>

Europe to LA (4 years)

		Months
AR	<b>CAB</b>	29
AR	<b>CNEA</b>	9
AR	<b>UBA</b>	41
AR	<b>UNLP</b>	47
AR	<b>UNLP/OPA</b>	149
AR	<b>UNMP</b>	4
BR	<b>CBPF</b>	37
BR	<b>UERJ</b>	13
BR	<b>UFRJ</b>	29
BR	<b>UNICAMP</b>	7
BR	<b>USP</b>	59
CL	<b>PUCC</b>	56
CL	<b>UTFSM</b>	9
MX	<b>BUAP</b>	10
MX	<b>CINVESTAV</b>	39
MX	<b>UGTO</b>	1
MX	<b>UNAM</b>	61
	<b>Total</b>	<b>600</b>





# E-PLANET (LA → EU)

LA to EU	Early Stage (m)	Experienced (m)	# of Grants	Months Total
CAB	3	22	25	25
CNEA	18	5	12	23
UBA	58	30	26	88
UNLP	85	34	44	119
UNMP	36	8	10	44
CBPF	39	30	17	69
UERJ	79	56	33	135
UFRJ	65	30	19	95
UNESP		24	16	24
UNICAMP	16	13	10	29
USP	42	18	22	60
PUCC	54	17	21	71
UTFSM	49	16	16	65
BUAP	45	40	17	85
CINVESTAV	27	73	30	100
UGTO	11	19	13	30
UMSNH	12	4	8	16
UNAM	56	69	40	125
<b>Total</b>	<b>695</b>	<b>508</b>	<b>379</b>	<b>1203</b>

4 countries and 18 institutions from Latin America participate in EPLANET

~ 300 months/year of stays in Europe financed by EC

More than 75% of the total for stays at CERN

EPLANET will give to many scientist from LA the opportunity to exploit the analysis of the LHC data and to benefit from the contacts and discussions with world wide scientists





# European Particle physics Latin American NETwork (EPLANET)



European  
Commission



PEOPLE  
EU - FP7

Last Update: 05/May/2011



Welcome to EPLANET

Home

Introduction

Objectives

Implementation

Organization

Results

Contacts

Mirror-LatinAmerica



Credits:  
Black hole simulation realized  
by ATLAS-CERN Team

Visitor No. \_\_\_\_\_

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Maintained by: Dr. Veronica Riquer Ramirez Dr. Rodrigo Pelayo Dr. Xavier E. Amador

