

“Emergence and Development of experimental particle physics in Mexico”

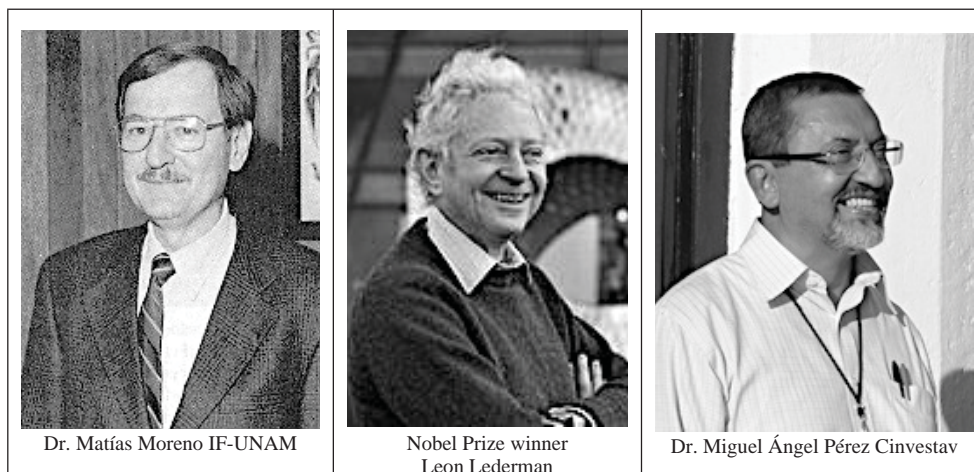
Salvador Carrillo Moreno, Universidad Iberoamericana

Birth of an idea:

Thanks to two interviews to Drs. Miguel Ángel Pérez Angón and Matías Moreno (Sep/2016), I can present to you how the idea of forming researchers in experimental particle physics in Mexico started.

There is a connection with the spread of elementary particle physics in Europe: in 1983, CERN (European Centre for Nuclear Research) supports the inclusion of Spain as a member state, as it is the case three years later with Portugal. This boosts the development, in both countries, of high energy physics. In parallel, Nobel Prize winner (1988) and second Fermilab (Fermi National Accelerator Laboratory) director (1978 to 1989), Dr. Leon Max Lederman, decides to promote the growth of experimental high energy physics in Latin America.

Fermilab is created in 1967 close to the city of Batavia (USA), and it is the equivalent, in our American continent, of CERN. Leon Lederman visits Mexico and other Latin American countries at the beginning of the eighties. By this time, only two institutions are dedicated to particle physics: Physics Institute of UNAM (IF-UNAM) and Physics Department of Cinvestav. With the active participation of Clicerio Avilés (Clic) a first “Panamerican Simposium on Physics and Technology” is held in Oaxtepec, Morelos in 1982. Both Matías and Miguel Ángel agree on the fact that this meeting became a milestone in the emergence of experimental particle physics in Mexico. It is important to highlight that the idea of encouraging stays abroad of Mexican researchers (and even the first of such stays) was conceived before the Mexican Division of Particles and Fields of the Mexican Physical Society (DPyC-SMF) was created.



“As a result of these gatherings, some colleagues from UNAM and CINVESTAV got interested in driving the training of young Mexican researchers in this area. From IF-UNAM, Jorge Flores, Clicerio Avilés and Matías Moreno decided to start this process with

the ‘conversion’ of active physicists working on high-energy physics (FAE) theoretical and phenomenological research in experimental physicists. Clicerio Avilés himself managed to succeed on this goal through long stays at Fermilab and, on his return to Mexico, created the Institute of Physics of Guanajuato University. From CINVESTAV, Augusto García, Arnulfo Zepeda and Miguel Ángel Pérez decided to take a different strategy and got several CINVESTAV students excited with the idea of perfecting his doctoral training in experimental high energy physics via thesis advised by Fermilab, CERN and DESY (Deutsches Elektronen Synchrotron, near Hamburg, in Germany) researchers [1]. This strategy was also chosen by some Brazilian colleagues, as Joao dos Anjos and Alberto Santoro.”(Miguel Ángel Pérez, 2016).

First stays abroad and a sad tragedy at CERN

Finally, the first visits are defined by the groups at IF-UNAM and CINVESTAV. Also within these institutions, the idea of creating both a Workshop and a School of the Mexican DPyC-SMF arises; but this is another story, that we leave to his protagonists. Then, in the middle of the eighties, before the foundation of the DPyC-SMF, the proposal of research stays abroad and the corresponding interaction with Fermilab (and a little later with CERN) start.

A first mention of the contest for stays abroad on high-energy physics appears in the bulletin of the SMF (Volume 4, Number 1, January-April 1990). Later on, it is included as a formal call (Volume 7, Number 3, July-September 1993); specifically, for Scientific Summers abroad, under the name Fellowship “Bruno González” in the case of the student appointed to visit CERN.

Physical engineer Bruno González, graduated at Iberoamerican University and Ph. D. student at Cinvestav, passes away during his visit at CERN as a consequence of a crash with a car (he was hit by a car while he was running his bike) very close to the lab in 1988. Since this incident, CERN commits to support every year a Mexican student in his memory. Bruno González, only child, outstanding student, who had been an excellent (very demanding) lecturer on Theoretical Mechanics, is still missed in our Community. Personally, I keep a clear remembrance of his burial, this sad loss shook profoundly all Iberoamerican University and Cinvestav students.

From my point of view, this extremely unlucky event, boosted the organizers to enlarge the call for research summers in order to allow more Mexican students to visit Fermilab and CERN and, by means of their work, honour the memory of Bruno González.

Formalization and development of the call in its current format

At the 2011 edition of the annual meeting of the DPyC-SMF and during the gathering of the General Assembly, a group of (mostly very young) experimental physicists proposes to take the reins of the contest and promote its realization outside Mexico City. Drs. Alexis Aguilar Arévalo (ICN-UNAM), Eduard de la Cruz Burelo (CINVESTAV Phys. Dept.), Pedro Podesta (Universidad Autónoma de Sinaloa) and Salvador Carrillo (Universidad Iberoamericana) make up a first National Committee, which is approved in the General Assembly. I remember a very good acceptance of this idea by the attendants and both Drs. Matías and Miguel Ángel, express very punctually the route and way the Call

should follow from then on, and ask us for a yearly report of this activity at every annual meeting of the DPyC-SMF.

Since then, the contest has been repeated annually, intending to join the best applicants, for their preparation close to the centre of Mexico and in the outer states of the Republic, alternatively (the purpose of the latter is to foster the scientific development of these areas). Along its history, the call has been held in Puebla, Sinaloa, Faculty of Sciences at UNAM, Guadalajara, Univ. Iberoamericana México, Chiapas, and this year in Universidad Autónoma del Estado de Hidalgo. The presidency of the national committee has been taken and rotated among its members voluntarily.

The format of the call has recently changed with the intention of covering the most important abilities required for the type of work that will be done during the stay. It is established in a mini-workshop format, with the participation of at least 6 people responsible, each one in charge of a course: 3 experimental lectures, two on computing and one in statistics with an introduction to experimental high-energy physics. Experimental courses intend to use particles physics detectors and are distributed in parallel sessions, in such a way that these allow evaluating the students, who are collaborating in small teams, on their aptitudes and experimental abilities. Computing sessions use software such as ROOT or PYTHIA under Unix environment. Participation of the local researchers is encouraged, including students from the state of the hosting institutions or neighbouring states.

The current format of the contest is the listed below:

- 1) Elaboration of a pdf poster, which is advertised from the web site of the event.
- 2) Promotion in social networks. The Facebook page of the event was visited by more than 1500 people during the first hours and it has more than 2000 followers by now. As the call is made, a pre-registration is required.
- 3) Pre-registration, where students general data are collected. This allows the organizers to quantify the required expenses and organize students transportation, mainly. Also, a pre-selection of the students is made at this stage.
- 4) A deadline is established for delivering the documents. After it, in less than a week, the appointed candidates start their training.
- 5) The students competition starts. It consists of a mini-workshop held during the two-days courses. It is important to emphasize that all lecturers deliver, at the end of the second day, a list with the marks achieved by every student.
- 6) Marks are averaged together on the third day and a ranking is established. Depending on the number of available stays, a list with the selected candidates for accessing the final stage of the competition is established. This final phase consists in an interview, which is carried on in English. At the end of this 10-minutes talk, time is allotted for the judges to tell freely their opinion to the contestant. The students are also asked about their preferred lab to visit. In case they are selected, this opinion is certainly taken into account. I would like to emphasize the importance of a good English level, although no proficiency is expected at this point. The visiting students will have close contact with foreign colleagues during their stays and this will strength naturally their English skills, helping their needed interaction with other collaborators along the stay.

- 7) A final ranking is made including all marks obtained in the lectures and the interview, and the joint average determines the final selection of visiting students. This process is open to the scrutiny of all judges and invited participants.

During this procedure, we were fortunate to count with –at least once- the participation of a Mexican scientist coming from one of our hosting institutions: Dr. Carlos García Hernández, from Jefferson Lab (USA). This time, Dr. Carlos García appointed directly the student who would work in this stay and also helped us to consolidate Jefferson Lab's support. We would like that this type of collaboration be promoted by other labs in the future.

The bitter with (all) the sweet

I consider that the new format has been very much successful and it has been an important achievement of the National Committee. However, the topic that remains difficult to tackle every year is the financial support for making the contest. The National Network of High-Energy Physics (RED-FAE, which is a national thematic network of CONACyT) and the same DPyC have offered support, but it has not been always enough and, in several instances, the National Committee members had to restore to funding from their own institutions, which is not always easy to obtain.

Perspectives

Unfortunately, there has not been yet any woman among the National Committee members. I cannot avoid mentioning that Drs. Elsa Fabiola Vázquez and Cristina Oropeza have participated in the three-day workshops a couple of times each. Moreover, on the 30th annual meeting of the DPyC-SMF, Dra. Karen Caballero (UNACH) and Isabel Pedraza (BUAP) were invited directly to join the National Committee. The only requested condition is that they participate continuously for at least two or three contests so that they have the chance of presiding the Committee that is appointed for simple voluntary service and in agreement with the members of the National Committee in every general Assembly of the DPyC-SMF.

A final topic that I consider worth mentioning deals with the path which needs to be promoted in the future of science (physics) in Mexico. Unfortunately, this issue has created some controversy inside our Community. I consider that independently of that, we must appreciate the labour started, more than 30 years ago, by a group of theoreticians and phenomenologists, who fostered scientific stays abroad on experimental high-energy physics. Dr. Matías is concerned with the possible brain drain affecting our most talented students, however, the result of this activity has been –beyond any doubt- beneficial for the development of experimental high-energy physics in Mexico. All members of the DPyC-SMF, we shall learn the lessons from this example and apply them to develop other related areas.

Luckily, the detailed tracking made by Dr. Jurgen Engelfried (UASL) in the period 1982-2000 includes the record of the first students benefitting of the experimental stays on high-energy physics. Later on, Dr. Marco Reyes (IF- Univ. Gto.) continued briefly this activity, but we lack some information from the early 2000's until 2011, when the members of the new group resumed this activity.

1982

Fermilab

| | | | | |
|--|---------------------|-----------|------------|-------------------------|
| | Juan Carlos D'Olivo | CINVESTAV | Ph. D. | Theory, ICN-UNAM |
| | José Mustre de León | CINVESTAV | Master Th. | Material Sc., Cinvestav |

1984

Fermilab

| | | | | |
|------|--------------------------|-----------|------------|---------------------|
| E715 | Antonio Morelos Pineda | CINVESTAV | Master Th. | Professor, IF-UASLP |
| E715 | Gerardo Moreno López | CINVESTAV | Master Th. | Professor, IFUG |
| E715 | Albino Hernández Galeana | CINVESTAV | Master Th. | IPN |

1986/7

Fermilab

| | | | | |
|--|--------------------------|-----------|------------|-----------------------------|
| | Bruno González | CINVESTAV | Master Th. | |
| | Juan Manuel Álvarez Haro | CINVESTAV | Master Th. | Economy, SHCP |
| | Juan José Alvarado Gil | CINVESTAV | Master Th. | Photoacustics, CINVESTAV UM |

1988

CERN

| | | | | |
|--|--------------------------------|-----------|--------|------------------------------------|
| | Bruno González | CINVESTAV | Ph. D. | *Passed away, CERN accident |
| | Heriberto Castilla (replacing) | CINVESTAV | Ph. D. | CINVESTAV |

1989

CERN

| | | | | |
|--|----------------------|-----------|------------|------------------------|
| | Agustín Enciso Muñoz | CINVESTAV | Master Th. | Professor, U Zacatecas |
|--|----------------------|-----------|------------|------------------------|

1990

CERN

| | | | | |
|-----|----------------------------------|------|--------|----------------------------|
| UA1 | Marco Octavio Lanzagorta Saldaña | UNAM | Intern | Computer Graphics, US Navy |
|-----|----------------------------------|------|--------|----------------------------|

1991

CERN

| | | | | |
|--|-----------------------------|------|--------|-----------------------|
| | Alejandro Corichi Rodríguez | UNAM | Intern | Gravitation, ICN-UNAM |
|--|-----------------------------|------|--------|-----------------------|

1992

CERN

| | | | | |
|-----|------------------------|-----------|------------|------------------------|
| LHC | J. Guillermo Contreras | CINVESTAV | Master Th. | CINVESTAV UM |
| LHC | Leonel Magaña | CINVESTAV | Master Th. | PostDoc, ALICE, Torino |

Fermilab

| | | | | |
|-----------|---------------------|-----------|------------|--------------------|
| SELEX | Emilio Esparza Coss | CINVESTAV | Master Th. | Med. Phys., IFUG y |
| CINVESTAV | | | | |
| E761 | J. Flores | CINVESTAV | Ph. D. | |
| E791 | Marco Reyes Santos | CINVESTAV | Ph. D. | Professor, UMSH |

1993

CERN

| | | | | |
|-----------------|---------------------------------|-------------|---------------|---|
| LHC | Salvador Carrillo Moreno | CINVESTAV | Master Th. | Ph. D., FOCUS, CINVESTAV |
| LHC | ----- | UNAM | Intern | *Abandons CERN stay |
| <u>DESY</u> | | | | |
| H1 | Fabiola Vázquez Valencia | CINVESTAV | Master Th. | Ph. D., FOCUS, CINVESTAV <u>Fermilab</u> |
| E791 | Rubén Flores Mendieta | CINVESTAV | Master Th. | Theory, IF-UASLP |
| E791 | Alberto Sánchez Hernández | CINVESTAV | Master Th. | CINVESTAV |
| <hr/> | | | | |
| 1994 | | | | |
| <u>CERN</u> | | | | |
| | Alberto Rubio Ponce | CINVESTAV | UM Master Th. | Solid State, CINVESTAV |
| | Jesús Martínez | ESFM-IPN | Intern | Ph. D., ESCOM, IPN |
| DESY | H1 Javier Espinoza | CINVESTAV | UM Master Th. | PostDoc, Sync. Rad., Seattle <u>Fermilab</u> |
| E791 | Luis Manuel Montaña Zetina | CINVESTAV | Master Th. | PostDoc, Med. Phys., Torino |
| E791 | Paulo César Lozano | CINVESTAV | Master Th. | Ph.D., Aeronautics, MIT |
| <hr/> | | | | |
| 1995 | | | | |
| <u>DESY</u> | | | | |
| H1 | Oscar Ramírez | ESFM-IPN | Intern | Computing, Germany |
| <u>Fermilab</u> | | | | |
| SELEX | Ricardo López Fernández | IF-UASLP | Master Th. | Ph.D., ALEPH, Grenoble |
| E791 | Armando Encinas Oropesa | IF-UASLP | Master Th. | Solid State Physics. |
| <hr/> | | | | |
| 1996 | | | | |
| <u>CERN</u> | | | | |
| FELIX | Benjamín Gutiérrez | UNAM | Intern | Master Th., UNAM |
| NA49 | Manuel Calderón de la Barca | CINVESTAV | Propedeutics | Ph. D., STAR, Yale |
| <u>DESY</u> | | | | |
| H1 | Miguel Mondragón | CINVESTAV | Master Th. | Ph. D., H1, Dortmund |
| | Horacio Cantú Quirino | IF-UASLP | Master Th. | |
| <u>Fermilab</u> | | | | |
| DZERO | Ivette Fuentes | FC-UNAM | Intern | Imperial College, London |
| Lab D | Liliana Velasco | FC-UNAM | Intern | Ph. D., Oxford (UK) |
| | Mónica Borunda Pacheco | FC-UNAM | Intern | Ph. D., UC Davis |
| <hr/> | | | | |
| 1997 | | | | |
| <u>CERN</u> | | | | |
| | Marciano Vargas Treviño | FCFM-BUAP | | |
| NA49 | Víctor Tapio Rangel Kuoppa | ESFM-IPN | Master Th. | Ph. D. Tampere, Finland |
| | Julio Barreiro | | | |
| <u>DESY</u> | | | | |
| H1 | Gabriela Murguía Romero | UNAM | Intern | Ph. D., UNAM |
| | Miguel Francisco Villoro-Valdés | UNAM | Intern | Astrophysics, IA-UNAM |
| <u>Fermilab</u> | | | | |
| CDF | Enrique Moreno Méndez | UNAM | Intern | Master Th., UNAM |
| DZERO | Ma.Magdalena González Sánchez | UNAM | Intern | Astronomy, U. Wisconsin |
| FOCUS | Javier González Beltrán | UNAM | | Ph. D., UNAM |
| DZERO | Ricardo Hernández Pérez | ESFM-IPN | | |
| CDF | Alfredo Raya Montaña* | EFM-Morelia | | |
| <u>SUNY</u> | | | | |
| | Bettina Delgadillo Lozano | ITESM | | |
| | Erick Rosas CIO | | | |

1998

DESY

| | | | | |
|--------|-----------------------------------|---------|--------|------------------------------|
| H1 | Andrea Vargas | BUAP | Intern | Master Th., Auger, Cinvestav |
| HERA-B | Erika Yvonne Carrasco Zavala (UK) | FC-UNAM | | Ph .D., Theory, Cambridge |

Fermilab

| | | | | |
|-------|-------------------------|---------------|--|--|
| CMS | Erika Álvarez | UNAM | | |
| CDF | Rogelio Cuevas Saavedra | UNAM | | |
| DZERO | Homero Díaz Marín | U. Michoacana | | |

1999

CERN

| | | | | |
|--|--------------------|---------|--------|--|
| | Juan Barranco M. | UDLA | Intern | |
| | Alejandro Reyes C. | FC-UNAM | Intern | |

DESY

| | | | | |
|----|----------------------------|--------------|------------|-----------------------|
| H1 | Cristo Yee (Manuel) Rendón | UA Sinaloa | Intern | |
| | Jimmy Hernández Bello | UDLA | Intern | |
| H1 | J. L. Gamboa | CINVESTAV UM | Master Th. | Master Th., CINVESTAV |

Fermilab

| | | | | |
|---------|-----------------------------------|---------|------------|------------------------|
| HyperCP | Zaida del Rosario Urrutia del Cid | IFUG | Master Th. | Master Th., E690, IFUG |
| Axion | Diana Eva Bedolla Orozco | FC-UAEM | Intern | Degree, FC-UAEM |
| SDSS | Ángel Mancar* | UNAM | | |

2000

CERN

| | | | | |
|-------|----------------------------|-----------|--|--|
| HARP | Alejandro Castillo Ramírez | CINVESTAV | | |
| ALICE | Arturo Avelino Huerta | FCFM-BUAP | | |

DESY

| | | | | |
|--------|-------------------------------|-----------|------------|---------------------|
| HERA-B | Beatriz Arellano Bautista | UDLA | | |
| HERA-B | Eric Martínez Pascual | FCFM-BUAP | | |
| HERMES | Eric Vázquez Jáuregui | UV | Master Th. | Postgrade, IF-UASLP |
| HERMES | Jorge Antonio Félix Hernández | CINVESTAV | Master Th. | Master Th., IF-UNAM |

Fermilab

| | | | | |
|------|-----------------------------------|----------------|------------|--|
| CKM | Belinka Fernández González | FCFM-BUAP | Master Th. | |
| SUNY | Adrián Pérez Galván | Iberoamericana | | |
| | Ignacio Francisco Gallardo Guerra | UNAM | | |

This record was kept by Dr. Jurgen Engelfried UASL

2001

CERN

| | | | | |
|--|-------------------------------|-----------|--|--|
| | Argelia Bernal Bautista | CINVESTAV | | |
| | Carlos Alberto Chávez Barajas | CINVESTAV | | |
| | Jorge Mercado Pérez | CINVESTAV | | |

DESY

| | | | | |
|--|---------------------------|-----------|--|--|
| | Edén Figueroa Barragán | ITESM | | |
| | Jacinta Grajales Cravioto | BUAP | | |
| | Joaquín Miranda Mena | CINVESTAV | | |
| | Lao Tse López Lozano | CINVESTAV | | |

Fermilab

| | | | | |
|--|------------------------------------|------|--|--|
| | Marié López del Puerto de la Garza | UDLA | | |
|--|------------------------------------|------|--|--|

SUNY

Julio Vargas Mena
Salvador Hernández Oliver

This record was kept by Dr. Marco Reyes IF-UGTO

The following record is being kept by the new Committee of the scientific summers on experimental high-energy physics

2012

| | | |
|----------|------------------------|------------|
| CERN | Ramón Heberto Martínez | U Sonora |
| JLab | Cesar Serna | U Gto. |
| DESY | Omar Fernando Sosa | BUAP |
| Fermilab | Grecia Guijarro | UA Sinaloa |

2013

| | | |
|----------|------------------------|------------|
| CERN | Karla J. Peña R. | U Sonora |
| DESY | Juan Manuel Grados L. | BUAP |
| Fermilab | J. Javier Rendón C. | UA Sinaloa |
| JLab | Gabriel G. Palacios S. | UAM |

2014

| | | |
|----------|------------------------|----------------|
| CERN | Diego Berdeja S. | Iberoamericana |
| DESY | Juan L. Cuspinera C. | BUAP |
| DESY | Arturo A. Santaella O. | UNAM |
| Fermilab | Oscar Meza A. | BUAP |
| JLab | Andrés Sánchez P. | CUCEI |
| Berkeley | Luis A. Zazuleta R. | U Sonora |

2015

| | | |
|----------|---------------------------|----------|
| CERN | Felipe Gilberto Ortega G. | ITESM |
| DESY | Pamela Patricia Ornlas S. | U G |
| DESY | Saulo Hernández L. | U Sonora |
| Fermilab | Gonzalo Sánchez G. | ESFM IPN |
| JLab | Edgar Abarca M. | UNAM |

2016

| | | |
|----------|---------------------------|-------|
| CERN | Edna Loredana Ruiz V. | UNAM |
| Fermilab | María Martínez C. | ITESM |
| DESY | Tania Martínez C. | BUAP |
| DESY | Laila Vleeschower | UNACH |
| JLab | Adriana Ivonne Canales R. | UNAM |
| SNOLab | José Guillermo Lara | UNAM |

References:

[1] A more complete versión of this process can be found in A. García y M.Á. Pérez, "High energy physics in Mexico: historical sketch and implications", AIP Conf. Proc. 857, 3-10 (2006).