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luizno.bjp@gmail.com

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Paula, Leandro de
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Experimental High Energy Physics

Leandro de Paula

LAPE - Instituto de Física, Universidade Federal do Rio de Janeiro

CP 68528, 21941-972 Rio de Janeiro, RJ, Brazil

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A summary of the contributions on experimental high energy physics to the XXIV Brazilian National Meeting on Particle and Fields is presented. There were 5 invited talks and 32 submitted contributions. The active Brazilian groups are involved in several interesting projects but suffer from the lack of funding and interaction with Brazilian theorists.

1 Introduction

The XXIV Brazilian Meeting on Particles and Fields (XXIV ENFPC) have shown that, in spite of the small size, the high energy physics community is very active. The Brazilian experimental groups participate in several international collaborations and are working in relevant subjects.

Two plenary sessions were dedicated to future experiments. Hans Dijkstra, from CERN¹, presented the LHCb detector. It is a second generation CP dedicated experiment which is being built by an international collaboration with the participation of two Brazilian groups. David Reyna, from Argonne National Laboratory, presented a proposal of an experiment to measure the neutrino θ_{13} mixing angle.

Three parallel sessions presented experiments in very different stages of development. Arthur Maciel, from Northern Illinois University, discussed a proposal for the next e^+e^- collider, Marcelo Leigui, from Unicamp, presented the Pierre Auger Observatory status report and Ignacio Bediaga, from CBPF, showed results on light scalar mesons.

The 10 oral communications and 22 posters presented during the meeting showed a good portrait of the field in Brazil. Although it is an experimental project, the communications related to the Schemberg Detector will be covered by the Gravitation and Cosmology report.

2 Collider Experiments

Since the mid 90's the main effort of Brazilian high energy physicists has been concentrated on Collider Experiments, following an international tendency. For many years the main activity on this field was on DELPHI and D0 collaborations. As DELPHI stopped taking data in 2000 and the RUN II of the Tevatron is only starting, after a long period dedicated to upgrade the detectors and the accelerator, the number of publication of these collaborations decreased. Brazilian

groups are moving now to LHC collaborations as showed by the number of contributions from the LHCb and the ATLAS collaborations. They are 50% of all the high energy physics contributions to the meeting.

LHCb

LHCb² is an experiment dedicated to the study of CP violation in the b sector. It is supposed to start operation in 2007 at the LHC collider. Two Brazilian groups, one from LAPE-IF-UFRJ and one from CBPF belong to the international collaboration that is building the detector. The UFRJ group presented eight contributions reporting the work done by researchers and graduated students. One poster was on detector development. One oral communication and five posters showed Monte Carlo studies of the detector physics performance. They established the detector precision in obtaining the unitary triangle parameter $\sin(2\beta)$ and γ , study the possibility to observe, for the first time the rare decays $B_d \rightarrow K^* \mu \mu$ and $B_s \rightarrow \mu \mu$ and presented a control channel and quality check tools for MC production.

ATLAS

A group from UFRJ belongs to the ATLAS³ collaboration that is also building a detector for the LHC collider at CERN. The researchers and students of the group are working in the development of the electronics of the hadron trigger. Eight contributions have been presented, four oral communications and two posters. They reported beam test calibrations and electronic cards tests.

¹<http://www.cern.ch>

²<http://lhcb.cern.ch>

³<http://atlas.web.cern.ch/Atlas/Welcome.html>

DELPHI

Two Brazilian groups participate on the DELPHI⁴ collaboration. Although LEP stopped collisions in 2000, there are still data analysis going on. The group formed by researchers from CBPF and UERJ presented, in a poster, preliminary results on a search for a double charged Higgs.

D0

Several Brazilian institutions participate in the D0⁵ collaboration that operates a detector in the Tevatron collider. The data of Run II are not yet available but in a poster, from a UERJ researcher, the Forward Proton Detector was presented. This detector, built in Brazil, is in use and its purpose is to study diffractive Physics.

3 Fixed Target Experiments

Brazilian groups have been collaborating in Fermilab⁶, in fixed target experiments, since the 80's. The number of physicists involved in those collaboration decreased when LEP and the collider experiments in Fermilab started to take data. There are still some collaboration going on at the Fermilab fixed target experiments, they were responsible for 13% of the XXIV ENFPC communications.

E791 - FOCUS

A group from CBPF participating in E791⁷ and FOCUS⁸ collaborations at Fermilab. In one parallel talk and in a poster evidences of the observation of the scalar mesons σ and κ in E791 data were presented. Another poster was dedicated to the same subject. It showed preliminary studies indicating that with FOCUS data more precise measurements could be achieved.

KTeV

Preliminary results about the observation of the neutral cascade muon semi-leptonic decay in KTeV⁹ were presented in an oral communication by members of a Unicamp group.

E769

One poster, from authors from CBPF and UERJ, presented preliminary measurements of Λ and $\bar{\Lambda}$ polarization using E769¹⁰ data.

⁴<http://delphiwww.cern.ch/>

⁵<http://www-d0.fnal.gov/>

⁶<http://www.fnal.gov>

⁷<http://ppd.fnal.gov/experiments/e791/welcome.html>

⁸<http://www-focus.fnal.gov>

⁹<http://kpasa.fnal.gov:8080/public/ktev.html>

¹⁰<http://ppd.fnal.gov/experiments/e769/e769.html>

¹¹<http://www.auger.org>

4 Cosmic Rays Experiments

Brazil has a long tradition in cosmic rays experiments. At the end of the 90's several groups joined the Pierre Auger Observatory (PAO)¹¹ project and this became one of the largest high energy physics project in the country. The communications from PAO represented 16% of the this session.

PAO

Due to the importance of PAO in our community, the organizers of the ENFPC have always dedicated one of the invited talk in to this collaboration. Marcelo Leigui, from Unicamp, presented a status report of the construction of the Argentinian site in a parallel session. In two oral communications and three posters several results of detector calibration and simulations were presented by researchers from Unicamp, UFF, UFRJ and CBPF. The observatory is already the larger ground array in the world and some of the its fluorescence detectors were ready. Data are being taken for calibration.

5 Instrumentation

There are also some projects development that are not linked to any collaboration. Unfortunately they are only 13% of the contributions. This small number can be explained by the fact that almost all Brazilian groups started activities in this field working in data analysis and by the great difficulty in getting regular funding for this kind of projects.

In a oral communication from a CBPF group it was presented a double-GEM detector. Two posters from UERJ's group showed detector electronic development. A statistical method for data analysis was presented, in a poster, by a UFRJ group.

6 New Projects

In this meeting three new projects, all involving international collaborations, were proposed to Brazilian groups. This is a clear indication of the visibility, for the international community, of the Brazilian high energy physics groups.

Neutrino Experiment

In a plenary session, David Reyna, from Argonne National Laboratory, exposed a proposal of a reactor based experiment. The purpose is to obtain the last unmeasured component of the neutrino mixing matrix, θ_{13} . One of the best sites in the world to do the experiment is close to Angra dos Reis reactor. After discussions with the community it was decided to prepare a proposal of such a project.

Next e^+e^- collider

Arthur Maciel, from Northern Illinois University, presented the reasons that led the high energy physics community to propose the construction of a next generation linear e^+e^- collider¹². General ideas of the physics program, as well as the collider itself and the detectors were discussed. Brazilian groups were invited to join this project.

EUSO

A project designed to observe the Ultra High Energy Cosmic Rays using the Earth atmosphere as a calorimeter was presented in the XXIV ENFPC, the Extreme Space Universe Observatory Project (ESUO¹³). This collaboration will observe the fluorescence of a UHECR shower using a telescope located on the International Space Station. The project was presented by J. A. Ortiz from IAG-USP.

7 Comments and Conclusions

In spite of being very young (before mid 80's the activity in this area in Brazil was weak) the Brazilian high energy physics community is very active. It is very good to see that Brazilian groups have chosen to grow in a competitive environment by getting involved in important projects and did not stay tied to marginal fields.

Invitations to join new collaborations and the positive results in several projects show the maturity of the area in Brazil, but there are three serious problems that should be discussed soon by the Brazilian particle and field physicists.

- There is a serious problem of communication between the different experimental groups and between this groups and the theoretical physicists. There are three clear indications of that: the number of experimental international collaborations is larger than the Brazilian funding possibilities, the number of experimental physicists is too small and the subjects presented

in the experimental and phenomenological sessions of this meeting have no overlap.

- The experimental community is very small, it represents about 10% of the particle and field Brazilian physicists. It is not healthy to have such a heavy theoretical dominance. Also it is concentrated only in three cities, Rio, Campinas and São Paulo.
- There is a very serious problem of funding. The high energy projects have a time scale of several years and the participating groups need to have approved projects for the corresponding time. In the experiments at big international accelerators as CERN and Fermilab, there is a huge infra structure. It is asked to the members of the collaborations that operate detectors at these accelerators to pay contributions that have the purpose to help in the maintenance of the equipment. The Brazilian funding agencies do not foresee neither the existence of several year projects nor the payment of this kind of contributions.

Even representing more than 50% of the activities in the area, none of the groups belonging to CERN or Fermilab collaborations have never had regular support from any agency. Until 2000 there was an agreement between CERN and CNPq that covered the equivalent of twelve trips of one month of Brazilian researchers to CERN. This has not been renewed and from October 02 to September 03 only one Brazilian physicist got support for a stay at CERN.

It is clear for the Brazilian high energy physicists that if a solution for this problems is not found the field is in real danger. The organization of a symposium dedicated to discuss this points seems to be a good possibility.

Acknowledgments

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¹²<http://www-td.fnal.gov/lc/lc.html>

¹³<http://www.euso-mission.org/>