Leandro G. Almeida
Research P2IO Report

1 Project goals

My understanding of the project goals included a comparison of NLL results in hadron- hadron scattering, and the possible understanding of forward scattered jets in hadron-hadron collision. But I did not read or was made aware of the specifics of the P2IO grant goals, so I do not feel I am qualified to answer this question.

2 Description of work achieved

I joined LPT-Orsay in September 2012, during my 1 year stay I worked on the resummation of large logarithms in hadron-hadron scattering and gauge particle-hadron scattering. In particular we attempted to understand the relation between the different methods of resummation. At time, I also finished a study of Higgs cross-sections produced by color gauge singlets, whose resummation is directly related to gauge particle hadron scattering processes.

At the NLL level, I studied processes in jet production in hadronic colliders [1] and compared them with Soft Collinear Methods, providing the first results of a direct comparison between two NLL accurate methods, specifically their finite differences and higher order corrections which may be present due to particular way $N^n LL$ are defined. We showed how to effects of difference choices of scale could impact these differences. These scales are particular important for understanding event shapes in jet production in hadron-hadron collision at all center of mass energies. We compared these results with data from current Monte-Carlos generators. We also provided a guideline for future comparisons, and presentation of results such that there are less ambiguity between calculations.

Including corrections at NNLL, I studied the production cross-section for Higgs production from gauge singlets [2]. This work will be particular important in the operation of linear e^+e^- collider. The production of hadrons from this interaction can be resummed to NNLL order and directly related to resummation logarithms associated with the photon-hadron scattering processes. We studied the effects of all known corrections and their contributions, including the possible effect of unknown corrections, given the current known errors in all known parameters that influence the calculations and measurements.

3 Publications

During the course of the year I was supported by P2IO I had two published works, which were direct influence by the work I was performing at LPT-Orsay. The P2IO contributions were cited in the papers. These works are:

- "Comparing and counting logs in direct and effective methods of QCD resummation," L. G. Almeida, S. D. Ellis, C. Lee, G. Sterman, I. Sung and J. R. Walsh, JHEP **1404**, 174 (2014) [arXiv:1401.4460 [hep-ph]].

- "Study of the standard model Higgs boson partial widths and branching fractions," L. G. Almeida, S. J. Lee, S. Pokorski and J. D. Wells, Phys. Rev. D **89**, no. 3, 033006 (2014) [arXiv:1311.6721 [hep-ph]].

There is a further paper which is still under work that was also influenced by my time funded by P2IO.

4   Relevance of the project within P2IO

I was not made aware of how the project fell in the overall P2IO goals, nor did at any point was aware that was requirement. I do not feel I am qualified to answer this question

5   For R&D only: possible valorization of the project

I suspect there is little to no valorization at the moment however I do not feel I am qualified to answer this question.

6   For R&D only: expenses sharing

There was no other expenses allowed besides the my salary as far as I was made aware.

7   For end of contract post-docs: position after P2IO

I began working at Ecole Normale Superioure-Paris in a postdoctoral position in October 2013.

References

[1] L. G. Almeida, S. D. Ellis, C. Lee, G. Sterman, I. Sung and J. R. Walsh, "Comparing and counting logs in direct and effective methods of QCD resummation," JHEP **1404**, 174 (2014) [arXiv:1401.4460 [hep-ph]].

[2] L. G. Almeida, S. J. Lee, S. Pokorski and J. D. Wells, "Study of the standard model Higgs boson partial widths and branching fractions," Phys. Rev. D **89**, no. 3, 033006 (2014) [arXiv:1311.6721 [hep-ph]].