FALCON

Roberto Pittau

Departamento de Física Teórica y del Cosmos
Universidad de Granada

May 26, 2008

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- Full Automatic 1-Loop COmputations Numerically

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- Full Automatic 1-Loop COmputations Numerically
- Facilitar cálculos Automáticos a 1-Lazo COn métodos Numéricos

Physics preliminaries

- For TeV collider physics hard multi-particle final states are ubiquitous and theoretical calculations can not provide reliable predictions without taking into account **1-loop corrections**.

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- AUTOMATION is NECESSARY for **1-loop corrections**.

Physics preliminaries

- Example of K-factor (T. Binoth, G. Ossola, C. Papadopoulos, R. Pittau, arXiv:0804.0350 [hep-ph]):

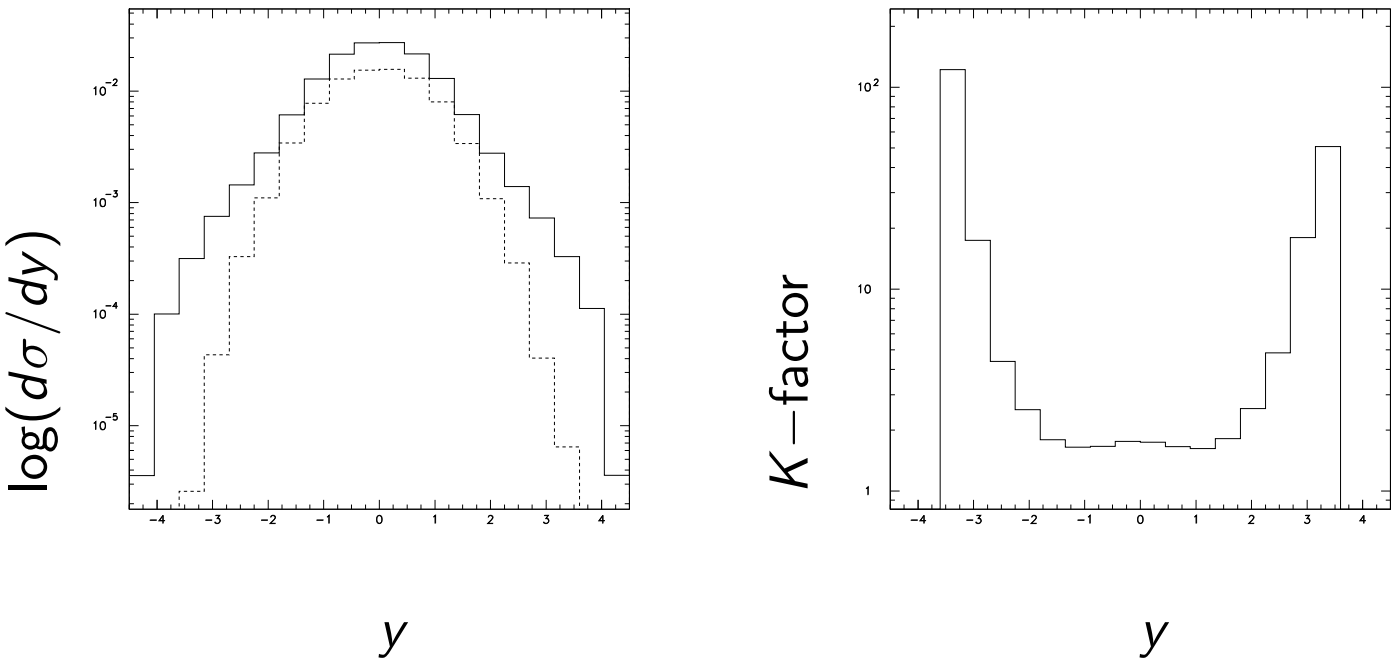

Figure: Rapidity distribution, at the LHC, for $pp \to W^+W^-W^+$: NLO (solid line) compared with the LO contribution (dashed line).

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- Automation has been reached at the Tree Level (TL), mainly due to the use of *Tree-Level Recursion Relations* instead of Feynman Diagrams. Many Computer Codes are available, among the most used ones there is ALPGEN.

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- Automation has been reached at the Tree Level (TL), mainly due to the use of *Tree-Level Recursion Relations* instead of Feynman Diagrams. Many Computer Codes are available, among the most used ones there is `ALPGEN`.
- Automation is MISSING for **1-loop corrections**.
- R. Pittau *et al.* introduced a new method (OPP *) to compute **1-loop corrections** that allows the use of *1-loop Recursion Relations* and AUTOMATION.

* G. Ossola, C. Papadopoulos, R. Pittau, Nucl.Phys.B763:147-169,2007, JHEP 0707:085,2007, 0803:042,2008 and 0805:004,2008.

Objective of the Project

- The goal of the proposed project is using the OPP method to extend widely used programs such as ALPGEN to include, in a fully automatic fashion, **1-loop corrections**, using, as an input, *only the Lagrangian of the model under study*, inside the SM of in any theory BSM.

The members of the applying Team

- Roberto Pittau **(P.I.)**
  [Profesor Titular at the U. of *Granada*]

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  [Postdoc at the U. of *Granada*]
- Maria Vittoria Garzelli
  [Postdoc at the U. of *Milan* (Italy)]

The P.I.'s scientific background

Roberto Pittau **(P.I.)**

- **RESEARCH ACTIVITIES**:
  - High Energy Phenomenology;
  - Collider Physics.

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  - ALPGEN [@Hadron Colliders (LHC and Tevatron)].
- **SCIENTIFIC PROFILE**:
  - 71 papers and 2401 citations in HEP-Spires;
  - Editor and/or contributor of 3 CERN Yellow Books.

The P.I.'s Projects at the Host Institution

Most important P.I.'s **Past** Projects:

- **FPA2006-05294** (2006-2011), P.I. F. del Águila Giménez;
- **HPRN-CT-2000-00149** (2000-2005), P.I. F. del Águila Giménez;
- **ERBCHRXCT920004** (1993-1996), P.I. F. del Águila Giménez.

Most important P.I.'s **Present** and **Future** Projects:

- **MRTN-CT-2006-035505** (2006-2010), P.I. C. Papadopuolos;
- **MTKD-CT-2004-014319** (2004-2009), P.I. C. Papadopuolos;
- **Red Temática de LHC** (convocatoria 2008),

  B. Adeva Andany (P.I.), J. Cuevas Maestro, M. J. Herrero Solans, R. Pittau.

The P.I.'s Collaborations

P.I.'s E.U. Network Collaborations:

- Nodes:
  a) CERN (M.L. Mangano)
  b) DEMOKRITOS-Athens (C. Papadopoulos)
  c) U. of Granada (F. del Águila, J. A. Aguilar-Saavedra, ATLAS)
  d) U. of Nijmegen (R. Kleiss)
  e) U. of Torino (G. Passarino)

P.I.'s Other Collaborations:

- U. of Edinburgh (T. Binoth)
- U. of Southampton (S. Moretti)

The background of the other members of the group

- Fabio Maltoni has a strong background in 1-loop calculations and in the automation of complicated computations, in QCD and beyond, at Hadron-Hadron and Lepton-Lepton Colliders.

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- Petros Draggiotis has a large experience in the Recursion Relations needed to carry out the project.
- Maria Vittoria Garzelli has a good knowledge of the Numerical, Statistical and Monte Carlo techniques indispensable to implement the 1-loop algorithms in ALPGEN, and she is an expert in FORTRAN and C++ programming languages.

The Budget of the Project

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  - Laptops;
  - Dedicated software (advanced Fortran 95/C++ compilers and MATHEMATICA licenses);
- TOTAL= 90.000 Euros (108.900 Euros including taxes).

Conclusions

Thanks for your attention!

On behalf of the FALCON team