Physics at Colliders
HPRN-CT-2000-00149

Midterm Meeting

Durham, April 9, 2002

Torino

http://www.to.infn.it/giampier/net.html

Period: August 1, 2000 - March 31, 2002

Elena Accomando (2003 Post - Doc from PSI)
Andrej Arbuzov (Post - Doc till 31/1/2001)
Alessandro Ballestrero (staff)
Lee Garland (after 1/10/2002 Post - Doc)
Ezio Maina (staff)
Giampiero Passarino (staff - scientist in charge)
Roberto Pittau (staff)
Sandro Uccirati (Ph.D.)

First Graduate School in Physics at Colliders Turin, October 2-6, 2001

- **W. Beenakker**: Sudakov logarithms in the Standard Model
- **F. Feruglio**: Selected Topics in Physics beyond the Standard Model
- **S. Jadach**: Monte Carlo techniques in High Energy Physics
- **J.J. van der Bij**: Selected Topics in Higgs Physics
- **P. Zerwas**: An Introduction to SUSY

Torino funding (no money from EU)

Joint Publications

Precision Electroweak Physics

- ▷ 1 (see midterm report)
- ▷ 5 (see midterm report)
- ▷ + (see next slides)

Milestones - Teams

We have done **a lot more** than it seems...

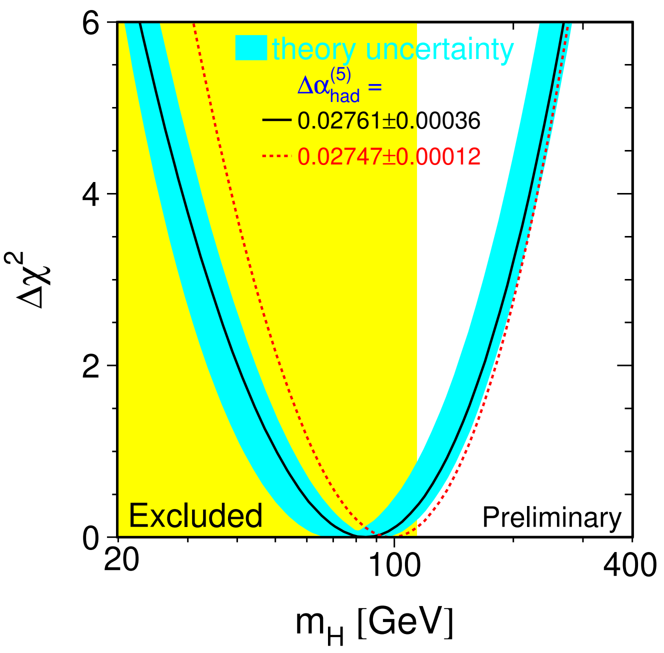

Figure 1: Milestones: *TOPAZ0 - ZFITTER* based

TOPAZ0 © **TORINO**

The most *celebrated* figure of the Lep era

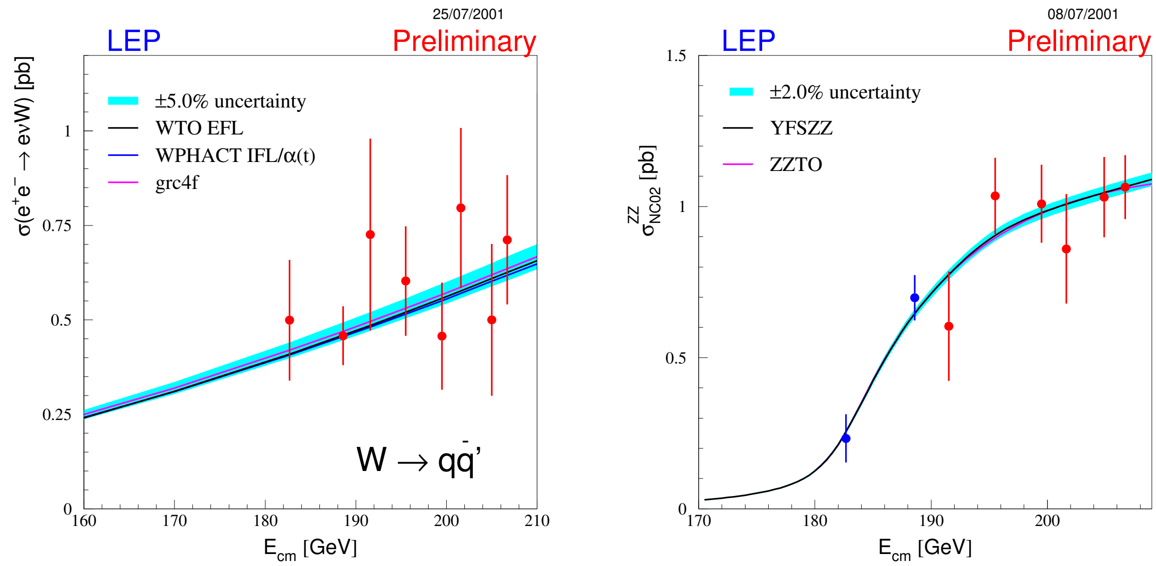

Figure 2: Milestones

WPHACT, WTO, ZZTO © **TORINO**

Addressed Milestones

EW (higher order) corrections in e^+e^-, W and 4-fermion production, constraints on the **SM**

$\nabla\nabla\nabla$

THERE ARE SEVERAL

well-defined PROJECTS,

we are (re)-bulding interlinks

$\nabla\nabla\nabla$

Algebraic - Numerical Evaluation of Multi - Loop Feynman Diagrams

$\Longrightarrow$ *fallout* in all five areas

▷ Papers:

1. **AN APPROACH TOWARD THE NUMERICAL EVALUATION OF MULTILOOP FEYNMAN DIAGRAMS**
   G. Passarino, Nucl.Phys.B619:257-312,2001, e-Print Archive: hep-ph/0108252
2. **ALGEBRAIC NUMERICAL EVALUATION OF FEYNMAN DIAGRAMS: TWO LOOP SELFENERGIES**
   G. Passarino and S. Uccirati, e-Print Archive: hep-ph/0112004

▷ Collaborations:

1. **Andrea Ferroglia**, NYU $\to$ Freiburg;
2. **Massimo Passera**, Padova.

CALCULUS FOR PRECISION HIGH-ENERGY PHYSICS

▷ Papers:

1. **PROJECT CALCPHEP: CALCULUS FOR PRECISION HIGH-ENERGY PHYSICS**
   D. Bardin, G. Passarino, L. Kalinovskaya, P. Christova, A. Andonov, S. Bondarenko and G. Nanava
   hep-ph/0202004
2. **A PRACTICAL APPROACH FOR EXPONENTIATION OF QED CORRECTIONS IN ARBITRARY PROCESSES**
   G. Passarino, Nucl.Phys.B619:313-358,2001, hep-ph/0108255
3. **ATOMIC PARITY VIOLATION AND PRECISION PHYSICS**
   D. Bardin, P. Christova, L. Kalinovskaya and G. Passarino, Eur.Phys.J.C22:99-104,2001, hep-ph/0102233

CALCULUS FOR PRECISION
HIGH ENERGY PHYSICS

- ▷ Papers

  1. **TESLA Technical Design Report Part III: Physics at an e^+e^- Linear Collider**
     R.D. Heuer et al.
     hep-ph/0106315
  2. **WPHACT 2.0 A fully massive Monte Carlo generator for four fermion physics at e^+e^- colliders.**
     E. Accomando, A. Ballestrero, E. Maina
     in preparation
  3. **FOUR-FERMION SIMULATION AT LEP2 IN DELPHI.**
     A. Ballestrero, R. Chierici, E. Migliore, F. Cossutti
     in preparation

▷ Collaborations

- Elena Accomando, PSI

▷ Projects

1. Improvements for future n-fermion MonteCarlos on: integration, unweighted generation, ISR for multi scale processes, radiative corrections.

2. Phenomenology of six fermion at LHC for WW scattering and **Higgs** physics

3. New code for semi-automatic helicity amplitude computations

Closed Project:

Fully massive $4 - f(\gamma)$ production at $e + e-$ colliders, including: Leading Higher order contributions (Fermion Loop, p_t spectrum)

Produced Paper:

- "**NEXTCALIBUR**: A FOUR FERMION GENERATOR FOR ELECTRON POSITRON COLLISIONS",
  F. A.Berends, C.G. Papadopoulos and R. Pittau,
  Comput. Phys. Commun. 136: 148-172, 2001.

Partecipants:

- NCSR-D (Demokritos)
- Torino
- KUN (Leiden)

Running Projects:

1– Gauge invariant treatment of instable particles preserving Unitarity (merging of BBC approach + Fermion Loop)

Partecipants:

- Wim Beenakker (Nijmegen)
- Alexander Chapovsky (Aachen)
- Costas Papadopoulos (Demokritos)
- Roberto Pittau (Torino)

2− MC Techniques for Multi Particle production at Hadron Colliders

Partecipants:

- Roberto Pittau (Torino)

- Everyone interested (parallel activity by the Nijmegen and Demokritos groups)

EW CORRECTIONS TO QCD DOMINATED PROCESSES

▷ Partecipants:

1. **D. Ross** Southhampton,
2. **E. Maina** Torino,
3. **S. Moretti** Durham - Cern