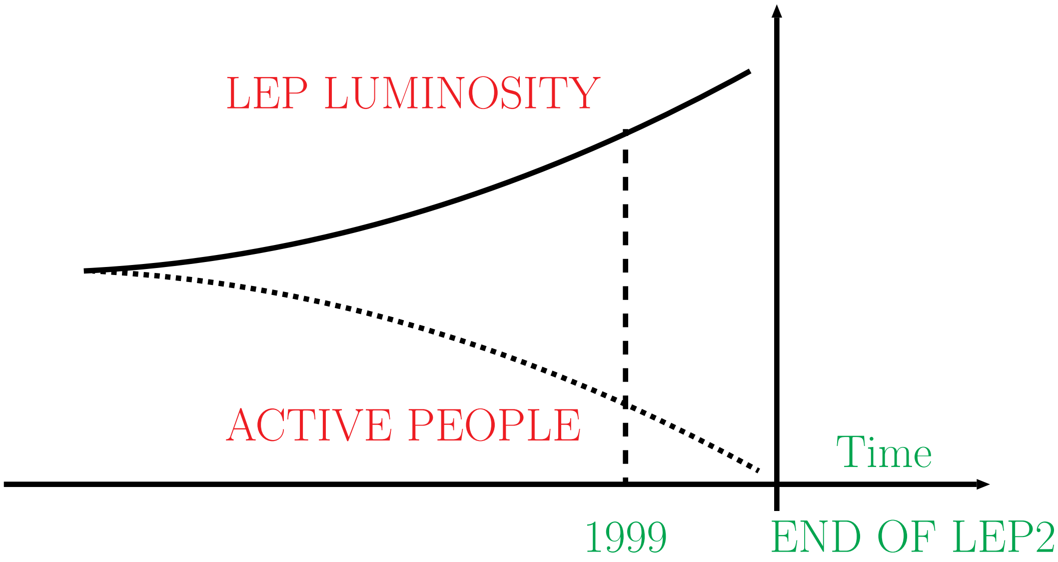
R. Pittau
CERN, 24–3–1999

SUMMARY OF THE LEP2 MONTE CARLO WORKSHOP

1) Introduction
2) List of talks and speakers
3) Some open problems
4) Conclusions

INTRODUCTION



- Improvements are still needed in the programs
- There is no time to answer all open questions

$\Rightarrow$ REALISTIC APPROACH:

a) List all problems

b) Find an answer to those that can be answered immediately

c) Try to answer those that can be answered in a short (within 1999) time scale (especially for searches)

d) Attach a theoretical error to those that cannot be answered within 1999

e) Continuation in year 2000?

Aim of this first meeting was to take step a), namely to write the SHOPPING LIST

LIST OF TALKS AND SPEAKERS

Friday March 12

1) Two fermions (Chairman: F. BERENDS)

13:30 - 14:00, expt 1: "Two fermions", M. Kobel (OPAL)

14:00 - 14:30, expt 2: "Two fermions + one visible photon", P. Bambade (DELPHI)

14:30 - 14:50, theo 1: "KK Monte Carlo for 2-fermions, total cross section and AFB", S. Jadach

14:50 - 15:10, theo 2: "Total precision of BHWIDE and BHLUMI Monte Carlos for Bhabha scattering", B. Ward

15:10 - 15:40, Coffee Break

2) Four fermions (Chairman: M. GRUENEWALD)

15:40 - 16:10, expt 3: "Finals states without forward electrons", J. B. Hansen (ALEPH)

16:10 - 16:40, expt 4: "Final states with forward electrons", A. Kounine (L3)

16:40 - 17:00, theo 3: "Precision tag of KORALW1.42, YFSWW3-1.12 and YFSZZ1.0", M. Skrzypek

17:00 - 17:20, theo 4: "QEDPS for the t-channel photon exchange", Y. Kurihara

17:20 - 17:50, theo 5: "Single W at zero e- angle", A. Ballestrero on behalf of: COMPHEP, EXCALIBUR, GRC4F, KORALW, WFACT, ERATO

3) Merging of two fermions and four fermions (Chairman: M. GRUENEWALD)

17:50 - 18:20, theo 6: "2f, 4f and 2f+4f codes", G. Passarino

18:20 - end Discussion

Saturday March 13

4) Final state gammas (Chairman: G. PASSARINO)

9:00 - 9:30, expt 5: "Final state gammas without missing E", G. Taylor (ALEPH)

9:30 - 10:00, expt 6: "Final state gammas with missing E", S. Arcelli (OPAL)

10:00 - 10:20, theo 7: "Single and multi-photon final states with missing energy", F. Piccinini

5) Two-photon (Chairman: R. PITTAU)

10:20 - 10:50, expt 7: "Low Q**2 two-photon events", M. Kienzle (L3)

10:50 - 11:20, expt 8: "High Q**2 two-photon events", R. Nisius (OPAL)

11:20 - 11:40, theo 8: "Some aspects of gamma-gamma physics", M. Dubinin

11:40 - 12:00, Discussion

6) Short communications (Chairman: F. CERUTTI)

12:00 - 12:10, "2f production with realistic cuts", T. Riemann

12:10 - 12:20, "SUSYGEN3", S. Katsanevas

12:20 - 12:30, "The GRACE-SUSY system", T. Kon

12:30 - 12:40, "Light pair correction to small-angle Bhabha scattering", A. Pallavicini

12:40 - 12:50, "COMPHEP", M. Dubinin

12:50 - 13:00, "WEXTER and ERAFITTER", C. G. Papadopoulos

13:00 - end, Discussion

$\boxed{\text{(Some) open problems in 2F}}$

- Initial-final state interference in radiative events (IFSR):
  - $\sqrt{s'}$ (after radiation) is not well defined
  - How solid is the experimental approach?
- Estimate of the missing Higher Order IFSR ($\alpha\alpha_s$)
- Pair production corrections to Bhabha (computed by the Pavia group) to be included in BHLUMI?
- s' (radiative return) not well described by BHWIDE
- Pair production: are the following 2 approaches compatible?

exp.	theo.
run separately	complete 2f+4f generator
$\neq$ classes of F.D.	(including virt. soft pair effects)
for $\neq$ regions	where one integrates over
defined with cuts	unobserved pairs
on $m_{f_1\,f_2}$	(very complex program)

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(Some) open problems in 4F

- EXCALIBUR $_{ADLO}$ $\rightarrow$ EXCALIBUR $_{UNIFIED}$
- α running for $Z\gamma^*$ processes (is this a problem?)
- p_T for the radiation (how accurate?) *

  $\Rightarrow$ VERY IMPORTANT FOR SEARCHES
- Reliability et $0°$ $e^{\pm}$ angle:

  A sub-group already started comparisons for the CC20 channel $e^+ \, e^- \rightarrow e^- \, \nu_e \, u \, \bar{d}$:

  – technical problems (difficult integration)

  – physical problems (Renormalization Scheme and scale for t-channel ISR?)

  Accuracy?

exp.	theo.
1%	$\approx$ 4%

  $\Rightarrow$ PROBLEM
- How accurate is the QCD modeling for hadronic events? (angular distributions, g^* splitting, m_b effects, fragmentation uncertainties in M_W measurements, B.E., C.R.)

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* There will be no enough time for this (full 1 loop EW calculation) $\Rightarrow$ at least an estimate of the error would be desirable

$\boxed{\text{(Some) open problems in final-state } \gamma\text{'s}}$

- $e^+e^- \to \gamma\gamma(\gamma)$:

Final exp. error	Missing H. O. effects
0.75%	$\approx 0.5 - 1\%$

Theo. uncertainty is no longer negligible

even for discovery physics !

- $e^+e^- \to \gamma\gamma\gamma(n\gamma)$ may be wrong by 20% due to missing H. O. corrections

- $\sigma(e^+e^- \to \gamma\nu\bar{\nu})$ and $\sigma(e^+e^- \to \gamma\gamma\nu\bar{\nu})$ computed by KORALZ and NUNUGPV98 agree at 1 – 2 %, but differential distributions differ.

  This might be relevant in some corner of the phase space (again for searches)

  $\Rightarrow$ it should be investigated/corrected or at least taken into account.

- To go down 1 % accuracy requires full $\mathcal{O}(\alpha)$ E. W. calculations. But no time for this

  $\Rightarrow$ Reliable estimate of the error necessary

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(Some) open problems in $\gamma\gamma$ physics

- "The" $\gamma\gamma$ Monte Carlo does not exist !

  $\gamma\gamma$ people adopt home made solutions (eg. rescaling of "wrong" Q^2 dependence in $\gamma\gamma \rightarrow \; hadrons$ predicted by PHOJET when $Q^2 > 50\; GeV^2$)

  But what about background studies by "external" people?

- PHOJET does not have $c\bar{c}$ production
- PYTHIA does not provide luminosity functions
- Inclusion of radiative corrections is needed in all MCs
- Get a smooth transition between high Q^2 and low Q^2 regime.

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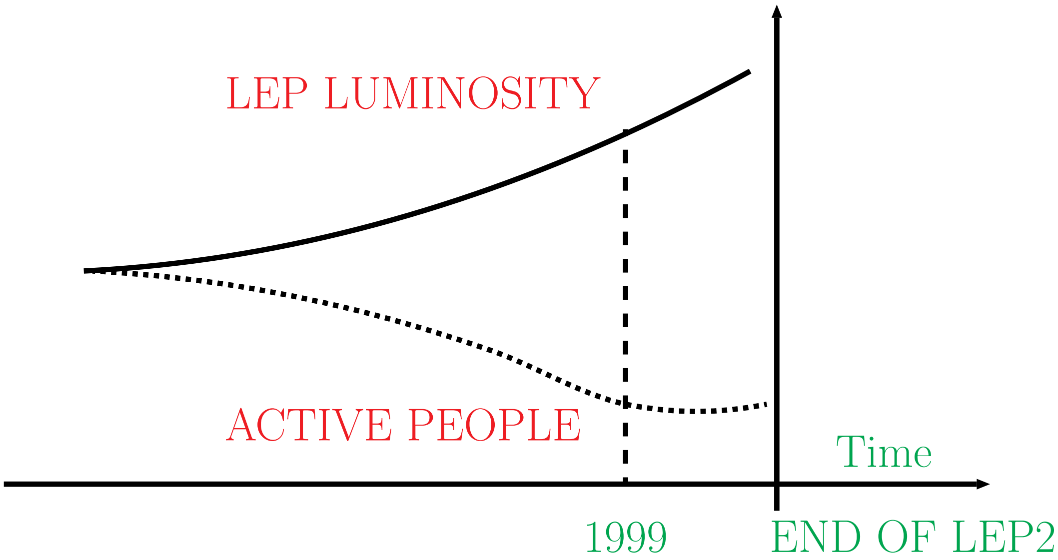
$\Rightarrow$

A lot of work is needed.

Especially to achieve a good control of the $\gamma\gamma$ processes as a background

CONCLUSIONS

- A close collaboration between theorists and experimentalist is necessary to achieve the following



- Tasks:
  - Improve what can still be improved
  - Give a reliable estimate of the error for all the rest
- This is especially important for background studies

- (Some) slides of the workshop are available in

`http://www.to.infn.it/~giampier/lep2.html`