



The Loop-Verein

Higher Order Corrections for
standard e^+e^- – Annihilation Processes
at High Energies

Conveners: F. Jegerlehner, DESY Zeuthen
N.N.

ECFA/DESY Linear Collider Workshop

~~– 5.-8. May 2000 –
Padova, Italy~~

22.-25. Sept. 2000
Hamburg

Talks: The Loop Verein WG (ECFA/DESY LCWS Hamburg)

Speaker	Title	Time
Sunday September 24	09:00-10:30	
F. Jegerlehner,	Introduction and summary of Padova meeting	10'
S. Jadach	KKMC Status report	20'
W. Placzek	W-pair production with YFSWW/KORALW	10'
M. Skrzypek	Comparison of YFSWW and KORALW	20'
A. Vicini,	1--loop EWRC to four fermion production	20'
Sunday September 24	13:30-15:30	
K. Kolodziej	Mass effects in hard photon radiation of four fermion production	20'
O. Veretin	Evaluation of massive multiloop diagrams: from approximate to exact results.	20'
	Discussion	20'

Fred Jegerlehner

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Recent progress:

① 2-loop for 2 → 2 processes

Tensor reduction to Master Integrals:

works; integration by parts, dimensional shift, Lorentz inv.

sufficient number of relations

size of expressions reasonable

*⇒ Th. Brist, G. Heinrich
D=4 zero Gram determinant
case worked out.*

Analytic results in terms of Master Integrals:

On-shell double boxes !

→ one leg off shell $e^+e^- \rightarrow 3$ jet

Planar: Smirnov 99, Smirnov & Veretin 99

*Th. Brist
Behrman-Reinhold*

Non-planar: Tausk 99, Anastasiou et al. 00

*missing piece (N. Cloven Basten) ⇒ solved
Behrman, Reinhold*

2 → 2 scattering at 2-loop: QED + QCD (massless)

now feasible; has to be worked out

Glover et al., Binoth et al.

Bhabha 2-loop QED

⇒ talk T. Binoth Padova

$e^+e^-, q\bar{q}, \dots \rightarrow 2f$ in QED (Burgers et al. 89) and QCD

(ISR: $e^+e^- \rightarrow \mu^+\mu^-$)

$e^+e^- \rightarrow 2f$ at 1-loop, QED with analytic cuts at LEP2 and LC

energies (ZFITTER) (M. Jack, T. Riemann et al. 00)

EW 2-loop selfenergies and form factors: groups at Karlsruhe,

Bielefeld, Zeuthen, ... ⇒ talk G. Weiglein;

*D. Veretin also meeting
progress report*

*Note: full electroweak 2-loop 2 → 2 far away
massive particles!
very complicated*

② 1-loop for 2 \rightarrow 4 processes

□ WW double pole approximation:

RacoonWW: Denner et al. 99 \Rightarrow talk M. Roth

YFSWW: Jadach et al. 99 \Rightarrow talk W. Placzek

now at few per mille level ?

M. Skrzypek

this meeting comparison with KORALW

also: hard Bremsstrahlung incl. exact mass effects available

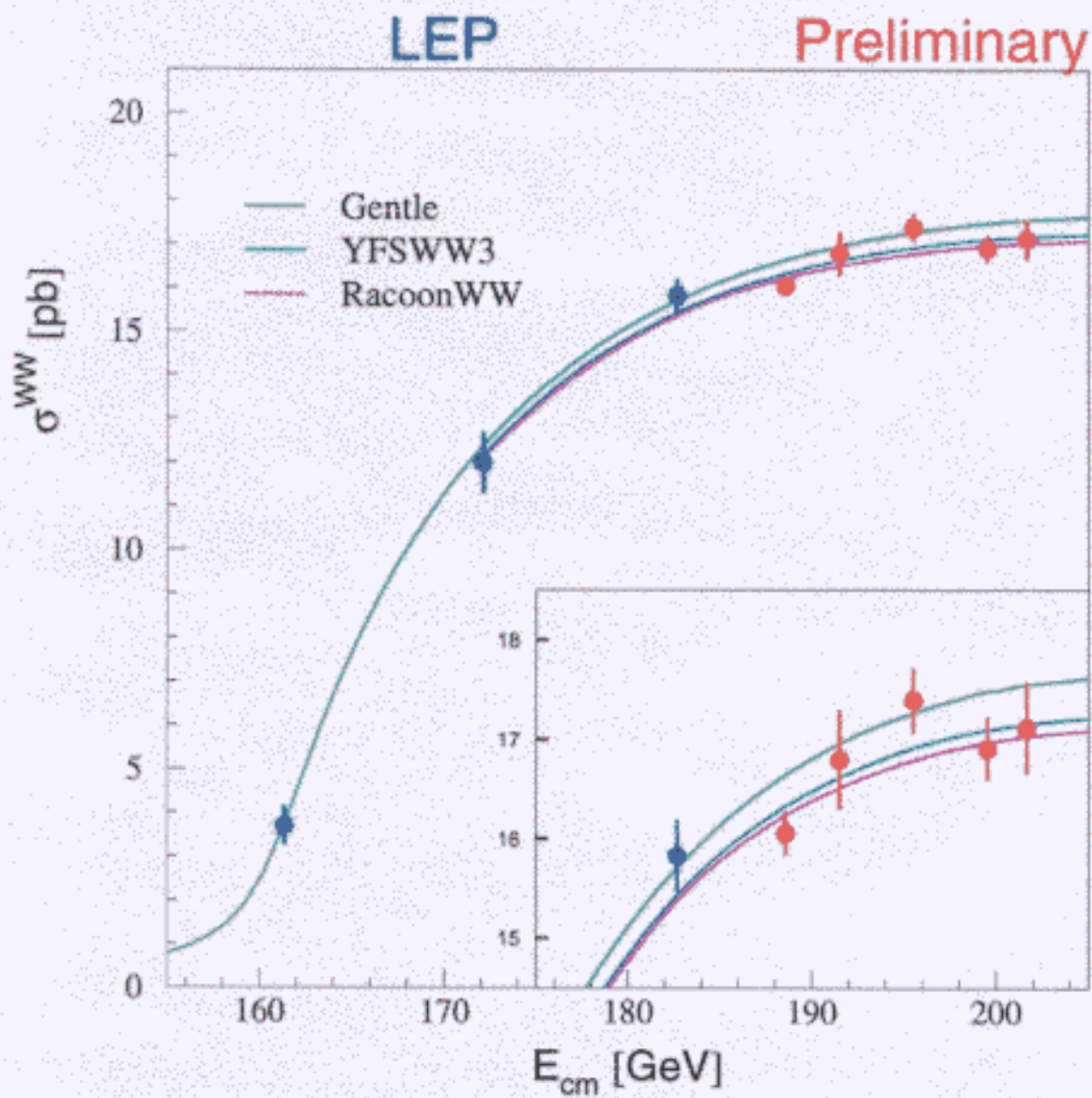
F.J. & K. Kołodziej 99

\Rightarrow *K. Kołodziej this meeting progress report.*

□ Full electroweak at 1-loop:

in progress: A. Vicini (talk A. Vicini Obernai)

\Rightarrow *A. Vicini this meeting progress report.*



③ Leading EWRC at high energies

Leading EW Sudakov Logs:

- P. Ciafaloni et al. 99 (talk P. Ciafaloni Obernai)
- V. Fadin et al. 99 (talk M. Melles Obernai)
- J. Kühn et al. 99 (talk J. Kühn Obernai)
- W. Beenakker et al. 00 (talk W. Beenakker Bastei)

!!! all results differ!!! \Rightarrow now convergence!

? what is the right question to ask ?

different groups seem to calculate different things

Bloch-Nordsieck Violating:

M. Ciafaloni et al. 00 \Rightarrow talk D. Comelli

Subleading EW Sudakov Logs:

M. Melles 00 \Rightarrow talk M. Melles

J. Kühn et al. 00 (talk Bastei)

} results agree!
 \Rightarrow exponentiation

Message: Very large EWRC at TeV energies ($\sim 20\%$ at 1 TeV)!

Mandatory to calculate them for the relevant observables

Conclusion

- good progress in "The Loop Verein"
 - many very interesting new results since Obernai
- a lot of interesting discussions are going on
- Plans: Summary reports on the different topics
- Prospects for Blabla ^{← 2-loop @60} and etc⁻, jets look much better
- To match precision requirements for high luminosity LC → still long way to go, I think.