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DELPHI Collaboration

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Abstract

A preliminary analysis of the data collected in 1999 with the DELPHI detector at e^+e^- collision energies close to 192 and 196 GeV was performed in order to extract the hadronic and leptonic cross-sections as well as the leptonic forward-backward asymmetries, together with and the cross-sections for two-photon production.

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1 Introduction

Preliminary results are presented from the analyses of fermion-pair final states collected in 1999 with the DELPHI experiment at a mean centre–of–mass energy of about 192 and 196 GeV. These results complement those obtained from 1995 to 1998 [1, 2], at lower collision energies ($130 - 189$ GeV).

In the present paper inclusive hadronic, muon-pair and tau-pair final states are analysed. Measurements of the cross sections and leptonic forward–backward asymmetries for these final states are given.

Results are also given for two photon production form data at 192 and 196 GeV.

2 Measurements of $e^+e^- \to f\overline{f}$ cross-sections and asymmetries

The luminosity analysis of the data collected during LEP operation in 1999 follows closely the one described in [1]. The total experimental systematic uncertainty on the integrated luminosity determination amounts to 1.0%, to combine with a 0.25% uncertainty reflecting the precision of the theoretical calculations underlying the computation of the visible cross-section of the luminometers.

An estimate of the mean centre–of–mass energy led to values of (191.6 ± 0.1) and (195.6 ± 0.1) GeV.

The results on the cross section and leptonic forward–backward asymmetry measurements presented in this section are from the analyses of e^+e^-, $\mu^+\mu^-$, $\tau^+\tau^-$ and inclusive hadronic final states. These analyses were similar to the ones performed at lower energies and the details, such as event selection, reduced energy ($\sqrt{s'}$) determination can be found in [1]. The distributions of $\sqrt{s'}/\sqrt{s}$ obtained for the real and the simulated data are shown in Figure 1 for the hadronic channel, Figure 2 for the muon channel and Figure 3 for the tau channel.

Figures 4 and 5 show the measured hadron, muon-pair and tau-pair cross-sections and forward–backward asymmetries, for all collision energies ranging from the Z^0-peak up to 196 GeV. The curves show the ZFITTER predictions.

Overall, no significant departure of the measurements from the theoretical predictions was found.

3 $e^+e^- \to \gamma\gamma(\gamma)$

A preliminary analysis of two photon final states using the high energy data set taken by the DELPHI detector up to the end of June 1999 has been performed. The analysed data sets at e^+e^- collision energies near 192 GeV and 196 GeV correspond to integrated luminosities of 23.8 pb^{-1} and 20.9 pb^{-1} respectively.

The event selection criteria and the method for the determination of the $e^+e^- \to \gamma\gamma(\gamma)$ Born cross-section are described in detail in [5].

The trigger efficiency for $\gamma\gamma$ final states was evaluated using both Bhabha events and the trigger signals redundancy.

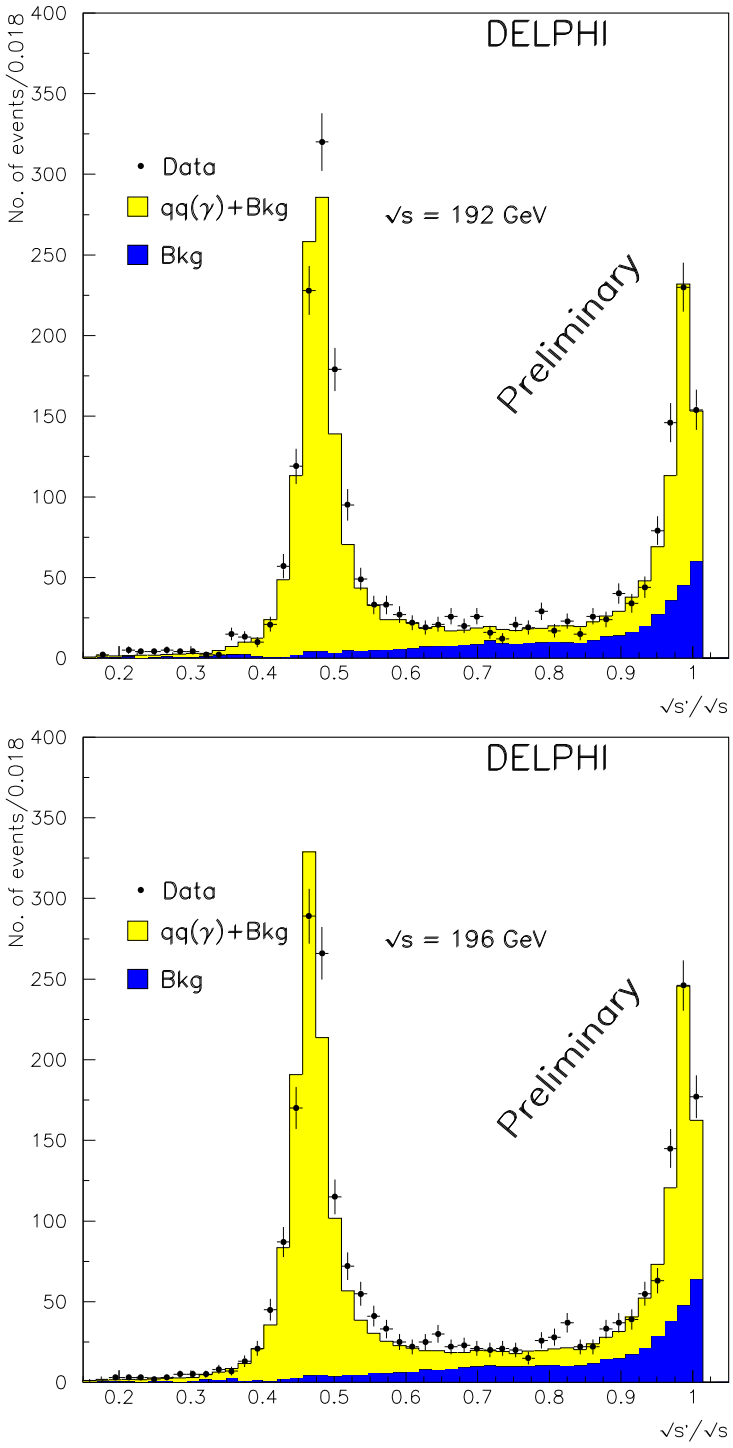

Figure 1: Distribution of the reconstructed reduced energy for the $e^+e^- \to q\bar{q}(\gamma)$ process at $\sqrt{s} \sim 192$GeV and ~ 196GeV. The points show the real data and the histogram stands for the simulated signal and background samples.

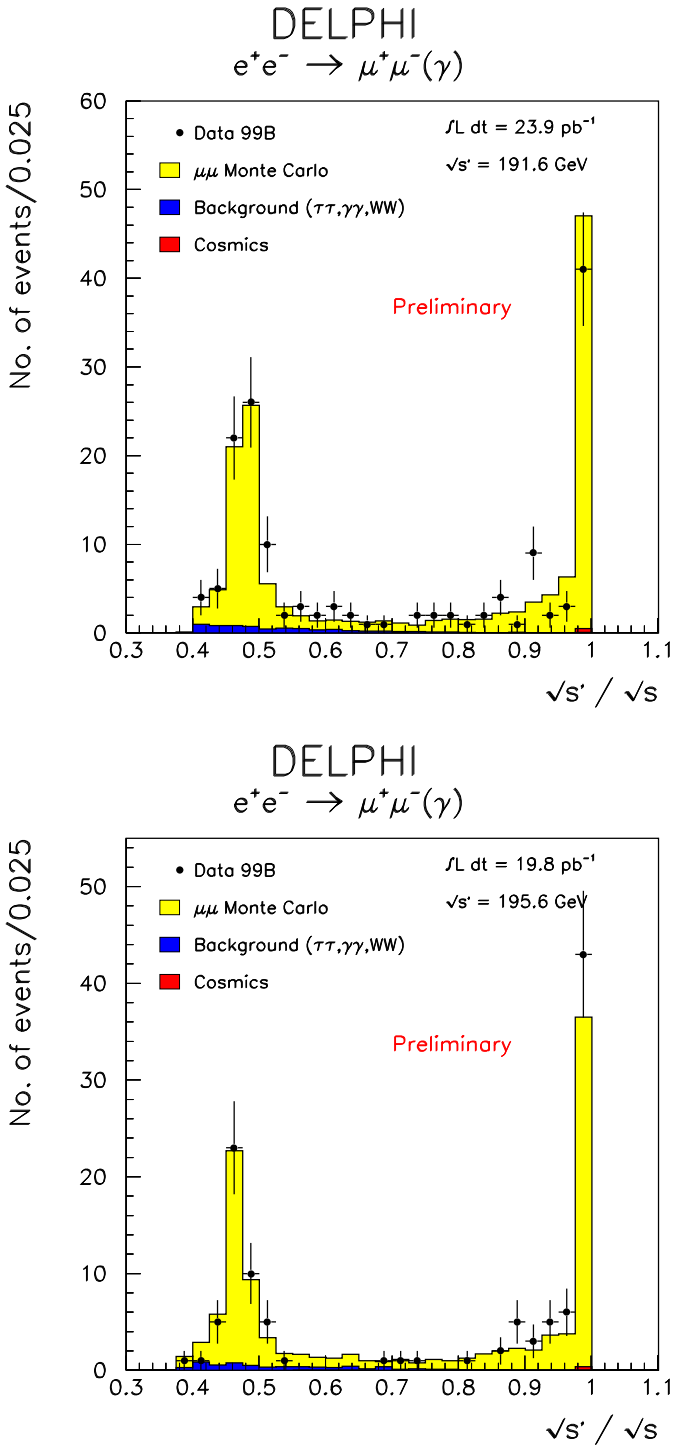

Figure 2: Distribution of the reconstructed reduced energy for the $e^+e^- \to \mu^+\mu^-(\gamma)$ process at $\sqrt{s} \sim 192$ GeV and ~ 196 GeV. The points stand for the data and the histogram represents the sample simulated with the KORALZ generator normalized to the ZFITTER predictions.

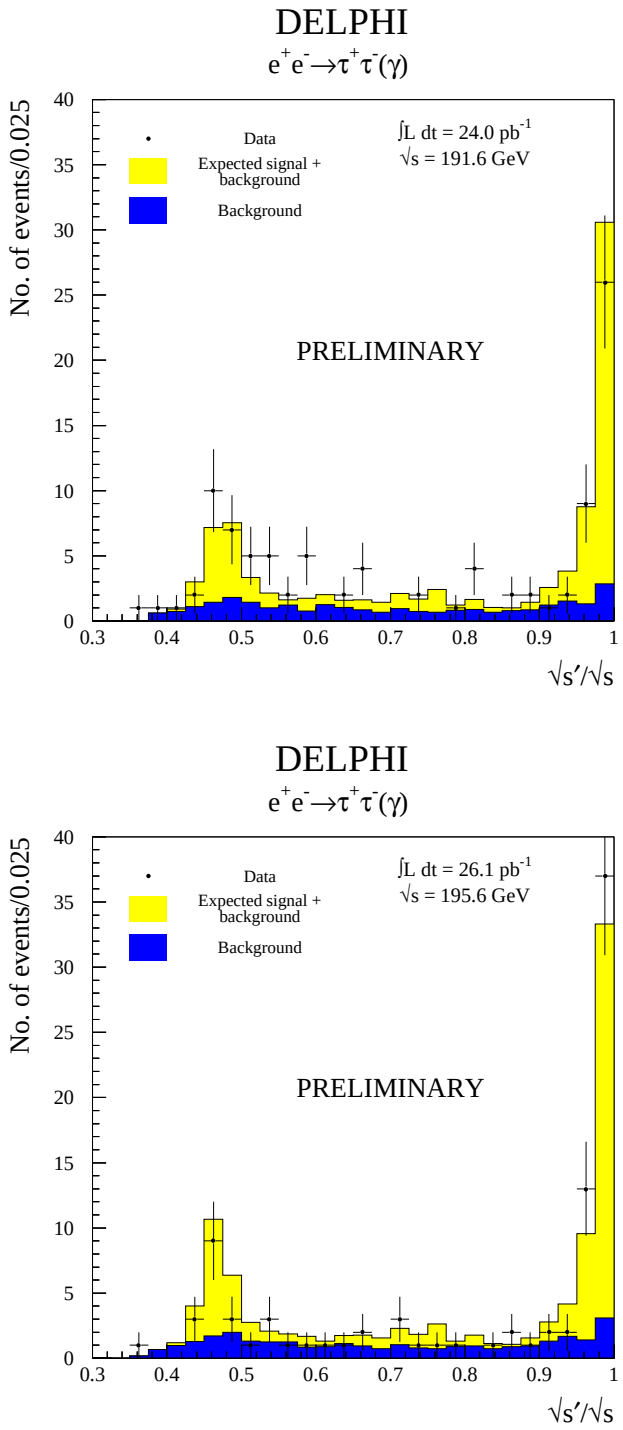

Figure 3: Distribution of the reconstructed reduced energy for the $e^+e^- \to \tau^+\tau^-$ process at $\sqrt{s} \sim 192$ GeV and ~ 196 GeV. The points stand for the data and the histogram represents the sample simulated with the KORALZ generator normalized to the ZFITTER predictions.

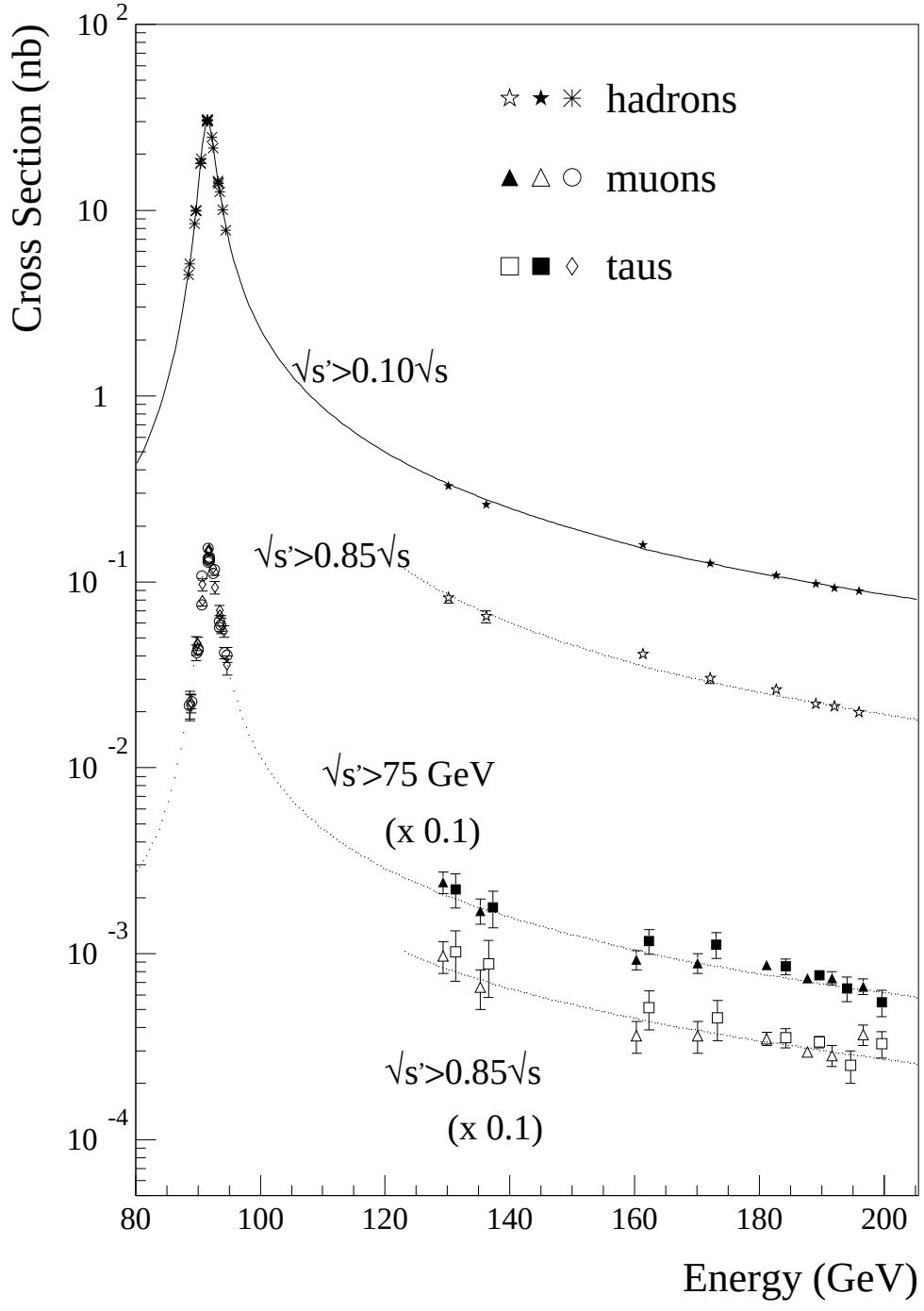

Figure 4: Cross-sections for the $e^+e^- \to q\bar{q}(\gamma)$, $\mu^+\mu^-(\gamma)$ and $\tau^+\tau^-(\gamma)$ processes measured at energies near the Z^0-resonance peak up to 196 GeV. The data at the Z resonance are the published results of the Z lineshape corrected to the acceptance $\sqrt{s'} > 0.1\sqrt{s}$ for hadrons and $\sqrt{s'} > 75$ GeV for leptons. The curves are the predictions of the ZFITTER program.

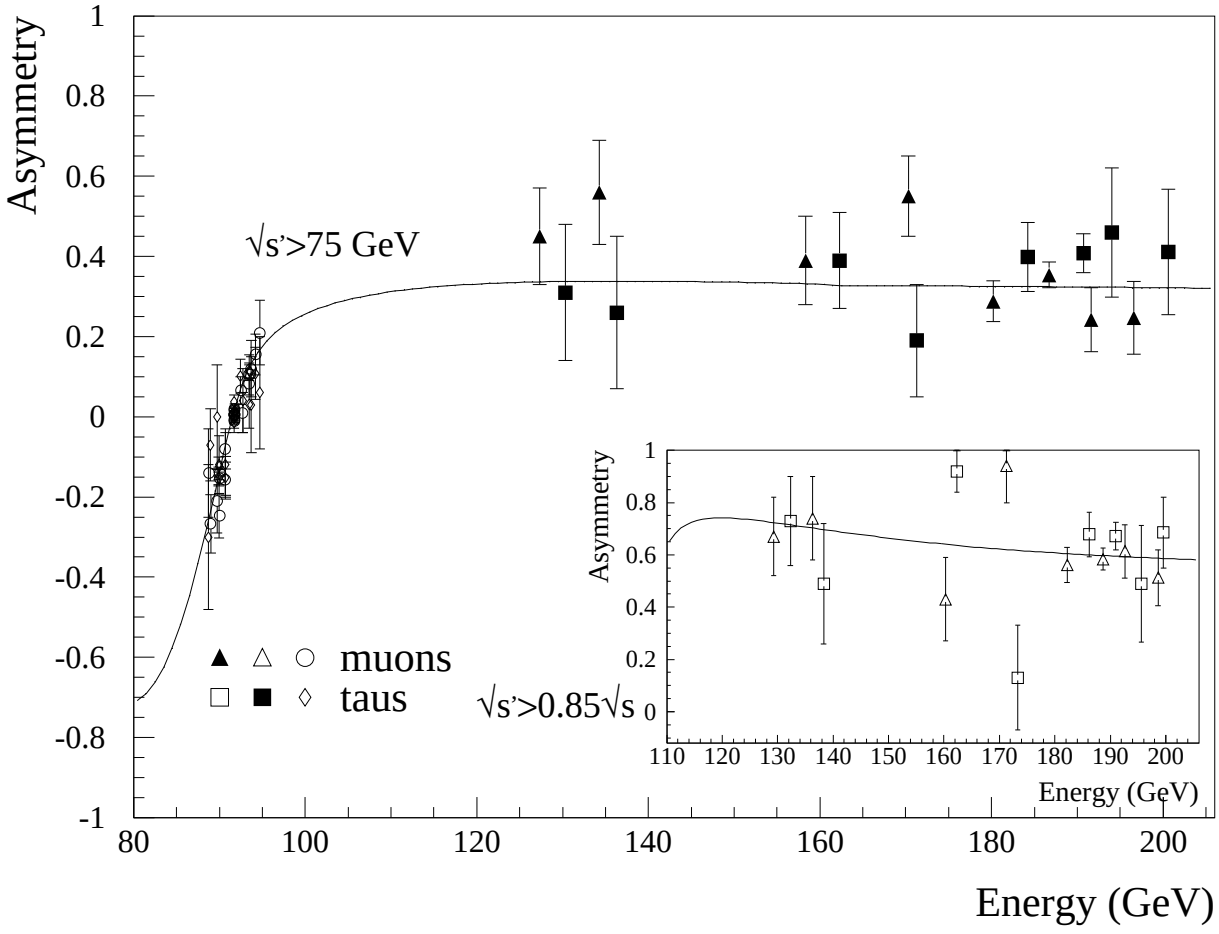

Figure 5: The forward–backward charge asymmetries in the reactions $e^+e^- \to \mu^+\mu^-(\gamma)$ and $\tau^+\tau^-(\gamma)$ measured at energies ranging from the Z^0-peak vicinity up to 196 GeV. The data at the Z resonance are the published results from Z-resonance running corrected to the acceptance $\sqrt{s'} > 75$ GeV. The curves are the predictions of the ZFITTER program.

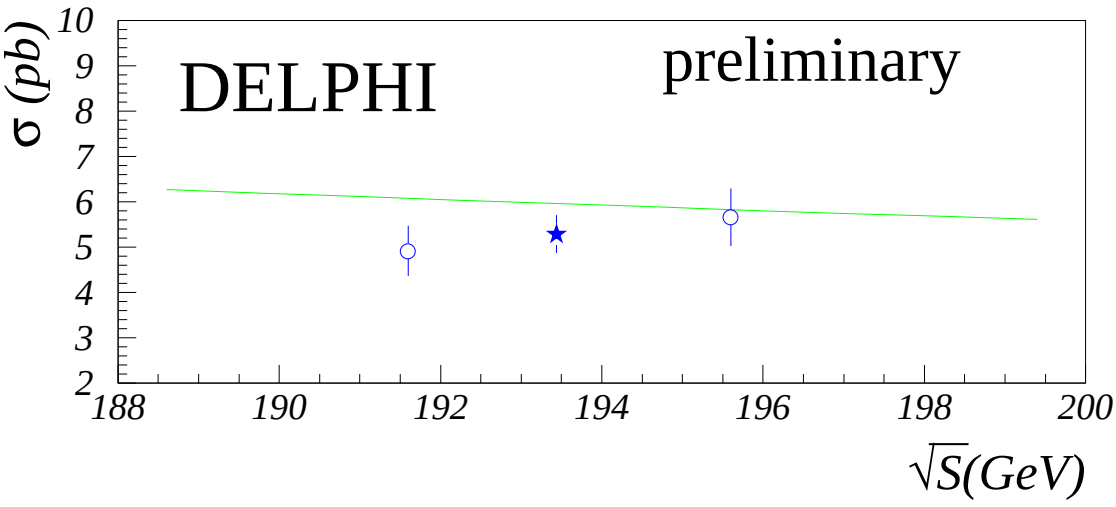

Figure 6: The Born-level total cross-section for $e^+e^- \to \gamma\gamma(\gamma)$ at 192 and 196 GeV, and the average at a centre-of-mass energy of 193.6 GeV, compared to the theoretical expectations for QED.

The Born cross-section for $e^+e^- \to \gamma\gamma(\gamma)$ was evaluated both for the 192 GeV and 196 GeV data sets. The results obtained were combined at an effective centre-of-mass energy of about 193.5 GeV, corresponding to an integrated luminosity of 44.7 pb^{-1}. The total cross section values for the data are compared to the QED prediction in figure 6 while the differential cross-section for the effective centre-of-mass energy of about 193.5 GeV is shown in figure 7.

4 Summary and conclusions

The results of the analysis of cross-sections and asymetries in the channels $e^+e^- \to \mu^+\mu^-(\gamma)$, $e^+e^- \to \tau^+\tau^-(\gamma)$ and inclusive $e^+e^- \to q\bar{q}(\gamma)$, as well as the cross section for $e^+e^- \to \gamma\gamma(\gamma)$ at $\sqrt{s} \sim 192 - 196$GeV were presented. The $e^+e^- \to f\overline{f}$ agree with the Standard Model predictions of ZFITTER. The results for $e^+e^- \to \gamma\gamma$ agree with the predictions of QED.

Acknowledgements

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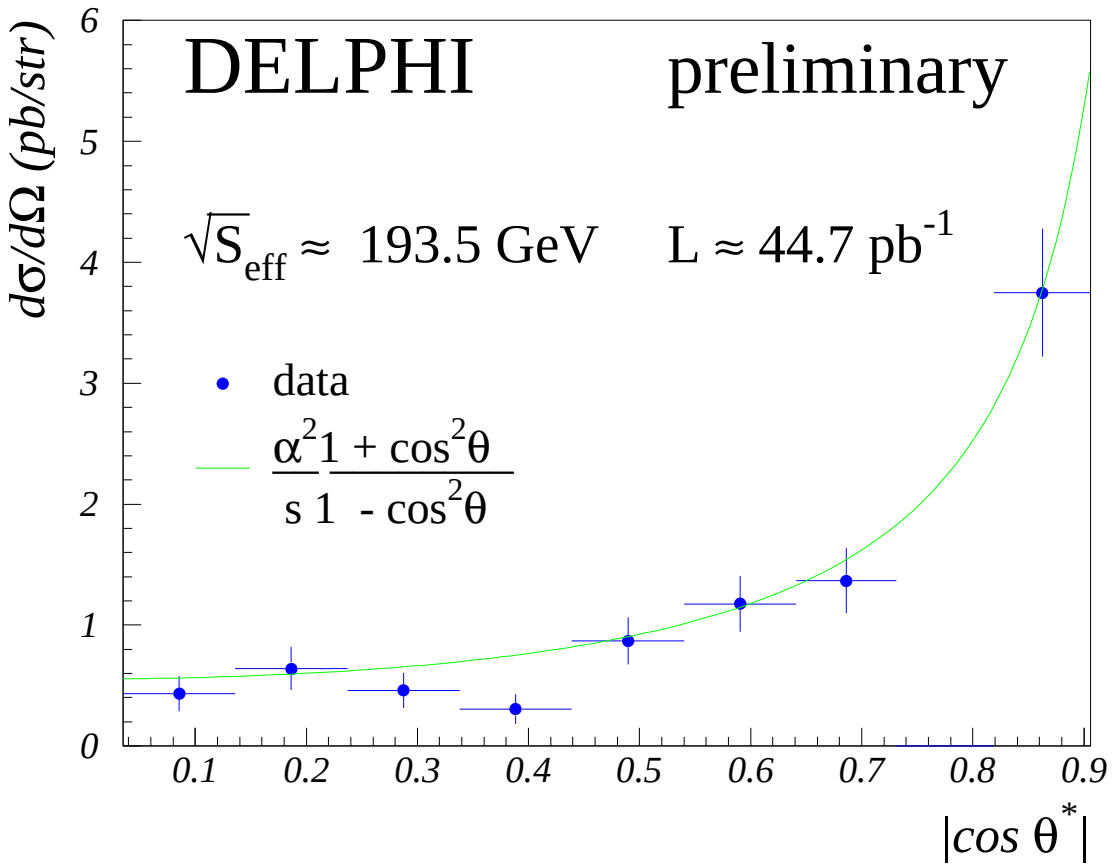

Figure 7: The differential distibution of $e^+e^- \to \gamma\gamma(\gamma)$, with respect to $\cos\theta^*$ (θ^* is the polar angle of the photons with respect to the incident electron direction) for an average of the data at centre-of-mass energies of 192 and 196 GeV, corresponding to a center of mass energy of approximatley 193.6 GeV, compared to the prediction of QED.

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