$\gamma - \gamma$ COLLISIONS AS A BACKGROUND FOR SEARCHES

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Minutes of the first meeting of the group

On Thursday April 29th, an informal meeting among the $\gamma - \gamma$ contacts took place, in the context of the LEP2 MC workshop. As a result of the discussion, the following emerged:

1. gamma-gamma physics as a background poses problems especially in the low mass regime, where, particularly for the hadronic processes, the predictions of the available Monte Carlos can be inaccurate.

2. It was the decided that, as a first step of the work, each of the 4 experimental collaborations will provide a list of the used Monte Carlo programs for any relevant kinematical configuration and/or process. Such a list will serve to compare the 4 different experimental strategies and also to stimulate a confirmation (or disconfirmation) from theorists about the correctness of the adopted procedures.

3. In a next meeting, each collaboration will show plots and distributions for low mass hadronic and leptonic MC gamma-gamma events, where problems for searches are expected to be particularly serious. It would be desirable to provide in the plots also an example of the signal contribution.

A detailed description of the adopted selection cuts, and possibly a list of the ingredients contained in the the used programs, should also be given.

A preliminary document by DELPHY

There has been a discussion within DELPHI concerning the simulation of two-photon events, led by Sharka Todorovova and Tiziano Camporesi. In this context, it was decided to generate events with Wgg>3GeV, transverse energy, sum[Ei*sin(thetai)] > 3 GeV and one charged particle with pt>1.2 GeV. It was felt that the region 1GeV<Wgg<3GeV is badly known, but a separate sample will be generated there to allow some control of the effects of applied cuts. In some sense this shows where we stand. It would be desirable to reduce the cut below Wgg=3GeV, and the question is how far this could be carried out without introducing errors in the cross-section larger than 20%, say.

As an example of analysis cuts in the case of charginos and neutralinos with small mass splitting the following could be taken (from the chargino search at 184 GeV):

Semi-leptonic topology (i.e. one chargino to leptonic, one to hadronic):
No of charged particles>3
1 isolated (20 degrees) lepton with 1GeV<p<20GeV
Pt of event > 4 GeV
E in 20 degree fwd code < 40% of visible E(visible)
E(visible) < 30 GeV
Angles between jets and beam axis >24 degrees
Acoplanarity (=180 - angle(jet,jet) in transverse plane) > 15 degrees
==> sigma=0.06 pb at 184 GeV

Hadronic topology:
No of charged particles>5, no isolated lepton
Pt of event > 5 GeV
E in 20 degree fwd code < 25% of visible E(visible)
Angle between total momentum and beam axis > 30 degrees
M(visible) < 25 GeV

Angles between jets and beam axis >24 degrees
Scaled acoplanarity (=acop. * sin(min. jet theta)> 40 degrees
==> sigma=0.07 pb at 184 GeV

In both these cases the two-photon background dominates, and it would be useful with a solid estimate of the theoretical errors on such cross-sections, which (hopefully) should not exceed 10-20%.

Calculations of chargino decays have been performed for mass differences between charginos and neutralinos down to zero (Chen, Drees & Gunion, Thomas&Wells), and have been used in a DELPHI search for charginos with accompanying ISR photons. The low delta-M case is also being studied in other channels (e.g. stop decays), and it is therefore important to obtain as good an understanding as possible of the low mass two-photon interactions. Once a signal seems to appear the background calculation will become crucial!

Document prepared by Klas Hultqvist.