

Photoproduction Hadronic Bkg in e^+e^- collider

Abdollah

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Resolved v.s. Direct photons

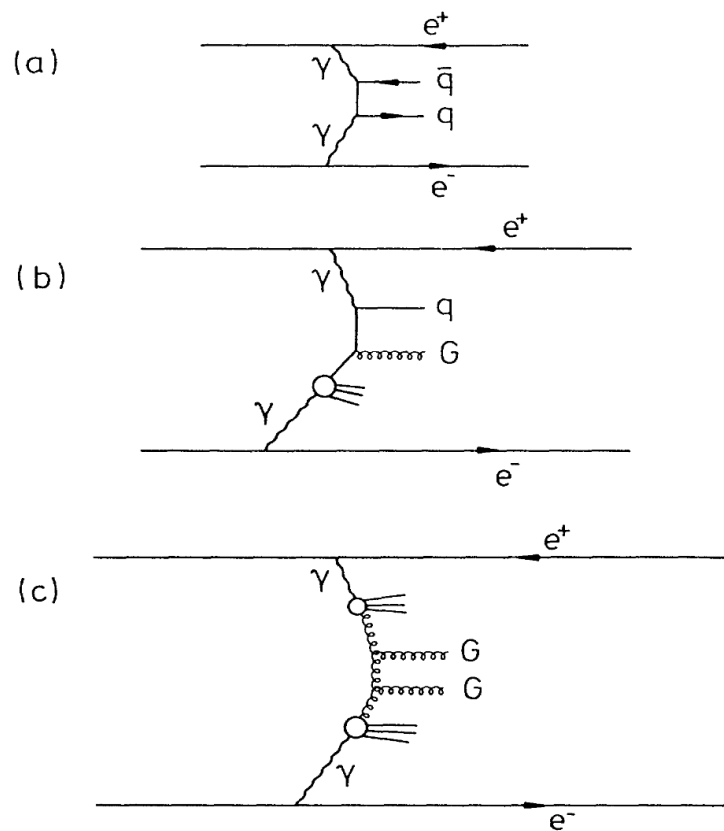


FIG. 1. Typical Feynman diagrams for the (a) direct, (b) once-resolved, and (c) twice-resolved contributions to the production of high- p_T jets in $\gamma\gamma$ collisions at e^+e^- colliders.

- Incident photon participates directly in the relevant hard scattering process
- Entire photon energy goes into the hard partonic final state
- Leads to two high- p_T jets

- In resolved photon contributions the incoming photon takes part in the hard scattering via one of its constituents, a quark or gluon
- Only a fraction x_γ of the photon energy is available for the hard scattering
- One or two “spectator” jet(s) will usually go approximately in the direction of the incident photon

hep-ph/9508221v1

Types of photon processes

mode **Photon:ProcessType** (default = **0**; minimum = 0; maximum = 4)

option **0** : Mix of relevant contributions below.

option **1** : Resolved-Resolved:

option **2** : Resolved-Direct:

option **3** : Direct-Resolved:

option **4** : Direct-Direct:

*) <https://pythia.org/latest-manual/Photoproduction.html>

Beam remnant issues

- Sometimes quarks in a resolved photon carry a very large fraction ($x \sim 1$) of the photon momentum.
- After the hard process, there is no energy left to construct the beam remnants.
- This is true especially if a heavy quark is taken out from the beam and a corresponding massive antiquark needs to be added to the remnant system to conserve flavour.
- Even though these events are allowed based on the PDFs alone, they are not physical and should be rejected.
- Therefore some amount of errors can be expected when generating events close to the edge of phase space, e.g. when collision energy is low.

```
52 // Photon-proton collisions.
53 bool photonProton      = false;
54
55 // Generate photon-photon events in leptonic or photon beams.
56 bool photonsFromElectrons = false;
57
58 // Each contributions separately or in a one combined run.
59 bool automaticMix       = true;
60
61
62
63
64
65
66 // Beam parameters.
67 pythia.readString("Beams:eCM = 200.");
68
```



Errors related to beam remnant

```
----- End PYTHIA Event Listing -----  
PYTHIA Error in BeamRemnants::setOneRemnKinematics: too big beam remnant invariant mass  
PYTHIA Error in BeamRemnants::setKinematics: kinematics construction failed  
PYTHIA Warning in ProcessLevel::roomForRemnants: No room for charm quarks in beam remnants  
PYTHIA Error in Pythia::next: partonLevel failed; try again  
PYTHIA Abort from Pythia::next: parton+hadronLevel failed; giving up  
PYTHIA Warning in ProcessLevel::roomForRemnants: No room for light quarks in beam remnants  
PYTHIA Warning in ProcessLevel::roomForRemnants: No room for bottom quarks in beam remnants
```