Measuring photon polarization using aligned crystals

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The Na59 experiment at CERN took data during the summers of 1999 and 2000, to investigate the possibility of creating circularly polarized photons starting from unpolarized 180 GeV electrons using aligned crystals. The linear polarization obtained from coherent bremsstrahlung has been analyzed with the calorimeter using the pile-up spectrum and reported elsewhere [1].
In this work, results from the reconstruction of the single photon energy spectra using the pair spectrometer are presented. Using the asymmetry of the pair production cross section in an aligned crystal, photon polarization is measured. The measured polarization is then compared to the theoretical predictions for different radiator and analyzer crystal settings.
Using the asymmetry method, for the first time in the 40-160 GeV range, the birefringence of crystals [2] is tested to measure the conversion of linear photon polarization into circular using a tertiary aligned crystal.
Finally, the implications of the availability of a high energy circularly polarized photon beam are discussed.

References

[1] Na59 Collaboration, International Journal of Modern Physics A**16** (2001) 1071.
[2] N. Cabbibo, G.Da Prato, G.De Franceschi, U.Mosco, Phys Lett **B 459** Physics A**16** (1962) 347.