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A Simple, Low Intensity Monochromatic Photon Beam

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A Simple, Low Intensity Monochromatic Photon Beam

A simple arrangement is proposed for generating monochromatic photons in the intensity range ~10-1000 per second from electron beams. This has been used at the Nevis Laboratory for calibrating gamma detectors in the ~100 MeV region, but should find application in the GeV region for calibrations and bubble chamber irradiations.

Consider for example a 4 GeV/c electron beam with typically $\Delta p/p$ ~ few percent, and an intensity $\leq 10^6$/sec (peak intensity $< 10^8$/sec). This is incident on a beryllium target 0.1 radiation length long preceded by a coincidence telescope and followed by a high efficiency veto counter. This arrangement then counts events in which a 4 GeV/c electron radiates all but E MeV into a single photon. At 0.1 r.l., the multiple processes that would seriously degrade the resulting 4 GeV photon beam are rare ($\leq$few percent). In the example chosen E $\leq$ 10 MeV and so the energy spread is essentially that of the incident electron beam. The intensity is approximately

$$\frac{10}{4000} \times \frac{1}{10} = .25 \times 10^{-3}$$

of the electron beam and so can be as high as 2.5×10^2 photon/sec. Clearly a hydrogen target would do somewhat better. The angular divergence of the beam is also essentially that of the original electron beam.