A generalized phase-space source model was developed for simulating arbitrary, external beam, intensity distributions using the Monte Carlo method. The source model is comprised of a photon fluence map divided into 6400, 1 mm^2 elements, located between the primary and secondary collimators. Each particle originating from the fluence map is characterized by the seven phase space parameters, position (x, y, z), direction (u, v, w) and energy. The map was reconstructed from fluence, energy, and directional spectra acquired by modeling components of the linear accelerator (linac) head using the Monte Carlo code MCNP4b. Fluence and energy spectra were generated using MCNP next event estimators which accumulate a score for each source or collision event. Directional spectra were obtained using a modified surface current tally. For each spectrum, a cumulative probability distribution was calculated and used for sampling. This method requires a minimal amount of storage in comparison to a complete phase-space description of the linac source. The source can be used to model wedges as well as intensity-modulated fields. Fluence, energy, and directional spectra for the wedge were acquired using an MCNP homogeneous water phantom located between the wedge and the secondary collimators. Depth dose benchmarks for a 6 MV photon beam for open and wedged fields from 5x5 cm^2 to 20x20 cm^2 are within 2% of measurement. In addition, irregular field profile calculations show good agreement with the original intensity distributions.