Inverse treatment planning for intensity modulated fields often involves optimizing the beam weights of narrow beam elements. To do this, a matrix of doses from each beam element to each anatomy point is required. The dose computation used in this case has unusual characteristics relative to that for broad beams. All properties which depend on the overall shape of the collimator are unknown, such as the amount of head scatter through the collimator, transmission and scattering effects of the collimator, and the output factor. Another characteristic of beam element dose computation is that the voxel size for each interaction point is well defined; e.g. the multileaf collimator leaves have a fixed width. We have rebinned the polar coordinate convolution/superposition kernels generated by T. R. Mackie [Phys.Med.Bio. 33(1)1-20] into Cartesian coordinates at several spatial resolutions (1mm, 5mm, and 1cm in the beam direction). For all resolutions, the lateral size is 2.5mm by 2.5mm, which allows the generation of 1cm by 2.5mm beam elements during dose computation. Because the lateral size differs from the spatial resolution, these kernels are not a true Cartesian rebinning of the polar kernels. For each dose point and beam element, the dose from each sample point along the ray is summed. Tissue inhomogeneities are accounded for by scaling the fluence and kernels by the radiological path lengths. Our choice to use 3D kernels is motivated by their intended use for dose computation in head/neck and mediastinum cases, where tissue inhomogeneity must be carefully accounted for.