In a traditional scintillating radiation detector, an incident particle deposits energy which is partially converted into light by the scintillation medium. The scintillation photons are then detected at the boundary of the scintillator by a photosensor. By contrast, an opaque scintillator is designed to have a long absorption length, but a short scattering length for the scintillation photons it creates. Due to the short scattering length, the scintillation light in a detector volume of this type is confined to small subregions and is then collected with a lattice of wavelength-shifting fibers. Each fiber is read out into a different data-acquisition channel, such that positional information is retained. The effect is the virtual voxelization of the volume without the need for physical separation of voxels via detector segmentation. In addition to the quantity of light collected and its timing, opaque scintillators provide an additional piece of information: the spatial distribution of emitted light. This information may be able to improve the accuracy in determining the amount of energy deposited by the incident particle and thus improve the energy resolution in comparison to that achievable solely from the total amount of collected light. We present simulation studies of such a detector as well as a prototype based on an opaque formulation of a water-based liquid scintillator with 32 wavelength-shifting fibers.