Localizing a radiation source in 3D could be improved by radiation imaging techniques and innovative visualization methods such as augmented reality (AR), in applications such as treaty verification, routine rad safety, and emergency nuclear scenarios. The University of Michigan’s particle imager, the H2DPI, can localize a source in angular space by reconstructing double scatter events. Aggregating angular information from either multiple H2DPIs or a single mobile H2DPI makes it possible to localize a radiation source in 3D; this location could then be intuitively visualized using augmented reality (AR). To achieve this, we interpret double scatter incidence cones from the H2DPI in 3D space. Whilst intersecting cones from a single H2DPI leads to angular localization, intersecting cones from multiple imagers allows for 3D source localization. We describe the implementation of a 3D localization algorithm and then discuss relevant parameters, such as the number of cones required for precise localization. To complement this development, we also describe a deep learning based neural prediction of the angular incidence using only count rates, thereby reducing the required measurement time and leading to faster informative visuals in AR.