The calibration of an array of closely spaced radiation detectors with non-uniform sensitivity can be technically very challenging. A method has been developed which significantly simplifies the calibration of relative radiation response of detectors in an array. An array of detectors is irradiated with a radiation field wider than the array. The positions of detectors in the array are substituted once by translation in order to calculate the neighboring detector sensitivities and once by rotation of 180^0 in order to calculate mirror detector sensitivities. With these two movements, a set of equations can be derived which solves for the calibration factor of each detector, relative to one detector in the array. This method has little dependence on dose rate stability, field flatness or symmetry. The only requirement is that the profile shape of wide radiation field is reproducible for three measurements and that the array movement does not affect the scatter conditions. The method itself results in a measurement of the radiation intensity along the array, which makes it a self-calibration measurement technique. Theory is first developed for the Sun Nuclear Profiler, which is the linear array of detectors, and then expanded to two-dimensional arrays. This technique holds a great promise for the calibration of any type of radiation detector array in which the sensitivity of each detector varies appreciably.