Purpose: To compare slit-slat collimators in single-layer and staggered arrays with standard parallel-beam collimators in a dedicated breast SPECT system.

Methods: A ring of slit-slat collimators surrounds a cylindrical region of 20 cm diameter for SPECT imaging of a pendant breast. A second ring of cameras, viewing between cameras in the first ring, may be added to give a staggered array of cameras. Such arrays could be static or rotating; for now, we assume a rotating array, for a radially symmetric ray pattern. Slit width and slat design are specified to match the spatial resolution of a low-energy all-purpose parallel-hole (LEAP) collimator at the axis of rotation. Sensitivity is calculated for arrays of slit-slat and parallel-hole collimated cameras, using the maximum number of cameras possible for each.

Results: With focal length of 5.7 cm, detector width of 6.5 cm, and 15 cm radius of rotation (ROR), the slit-slat array could contain twenty cameras for one ring, and forty cameras for two rings. A LEAP-collimated system with 10 cm ROR could contain four cameras and would have a spatial resolution of 8.0 mm at the axis of rotation. To match this, the slit-slat collimators would have slit widths of 2.2mm/1.8mm for first and second rows respectively, and slats designed for similar axial resolution. A single row of twenty slit-slat collimated cameras would have a sensitivity of 8.66x10⁻⁴ photons transmitted per photon emitted, while a staggered array would have a sensitivity of 1.28x10⁻³. The array of four LEAP-collimated cameras would have a sensitivity of 6.48 x10⁻⁴.

Conclusions: The single-ring configuration of cameras gives sensitivity 34% greater than the LEAP-collimated system, while the staggered array gives a 98% sensitivity increase. This doubling in sensitivity comes with a large increase in complexity. Further optimizations for the slit-slat system are possible in both areas.