Supporting Information (SI) and Legends:

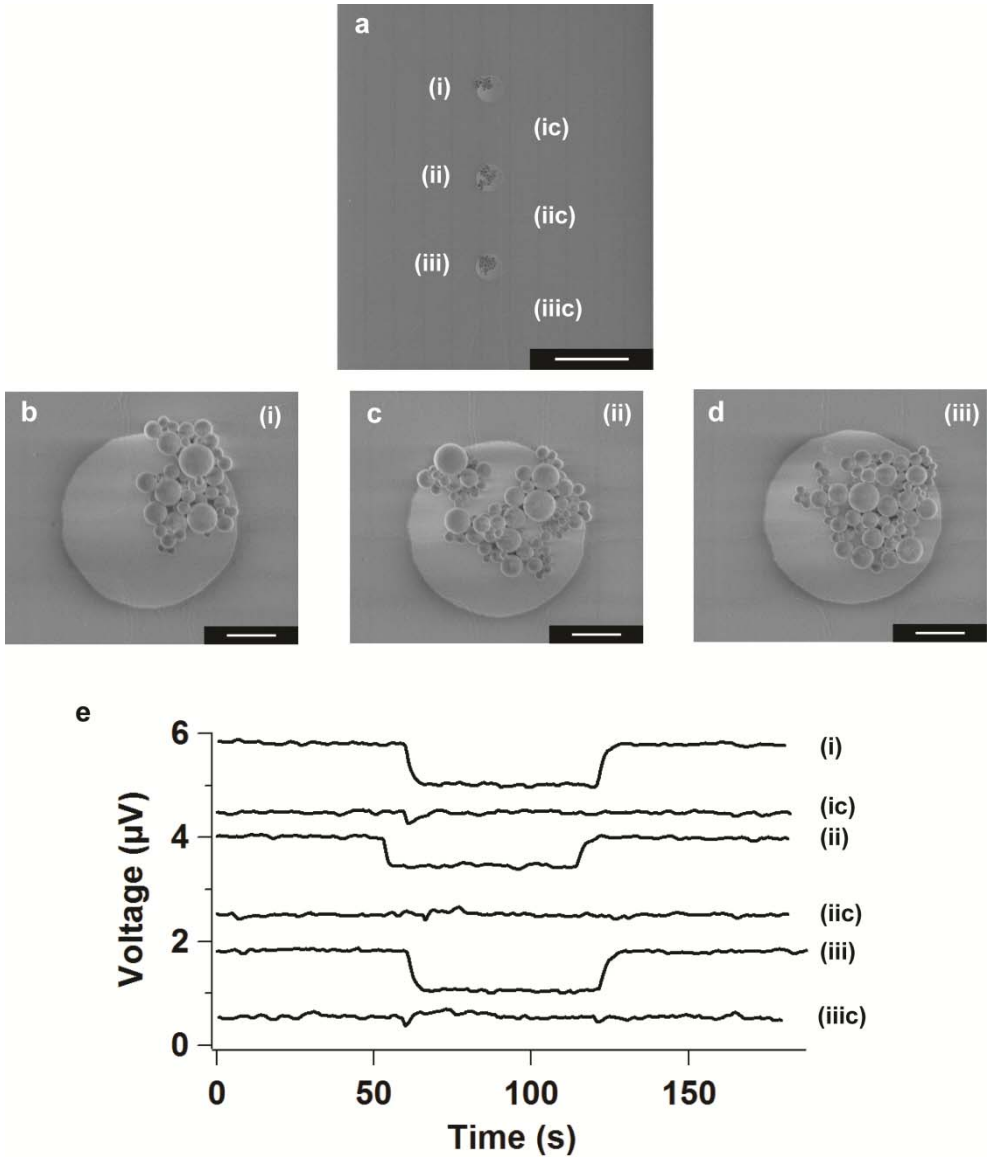

Figure S1. (a) SEM micrograph depicting label-free, three-strand DNA assembly of all six junctions of a Hall magnetometer. Scale bar (a) = 10 μm. (b-d) SEM micrographs at higher magnification of the three active Hall junctions, where the ratio of beads entirely or partially over the Hall junction versus beads outside of the junction are (b) 8/41, (c)11/68, and (d) 12/73. Scale bars (b-d) = 1 μm. (e) Hall responses for three active junctions (i, ii, iii) and three non-active control junction (ic, iic, iiic) are plotted as Hall voltage versus time; the presence of superparamagnetic (SPM) nanobeads over the active Hall junctions results in a drop in Hall voltage when a dc magnetic field is applied. When the dc magnetic field is removed the signal returns to baseline.

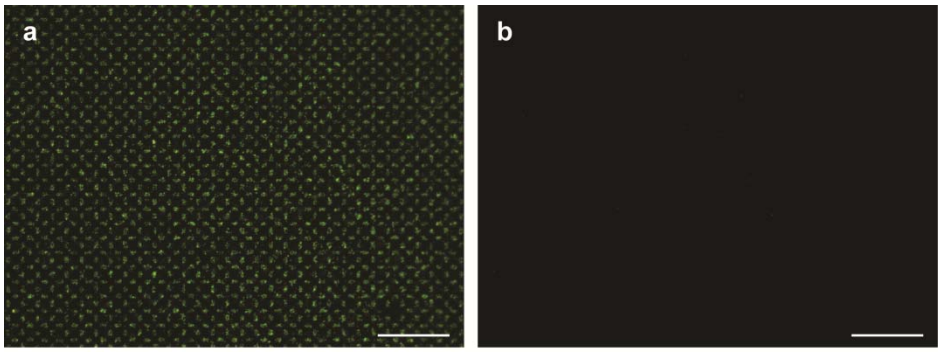

Figure S2. (a-b) Three-strand DNA assembly onto a mimic array (patterned on a GaAs substrate) for (a) complementary target and (b) for non-complementary target. The presence of green fluorescence indicates the location of the SPM nanobeads. Scale bars = 50 μm.

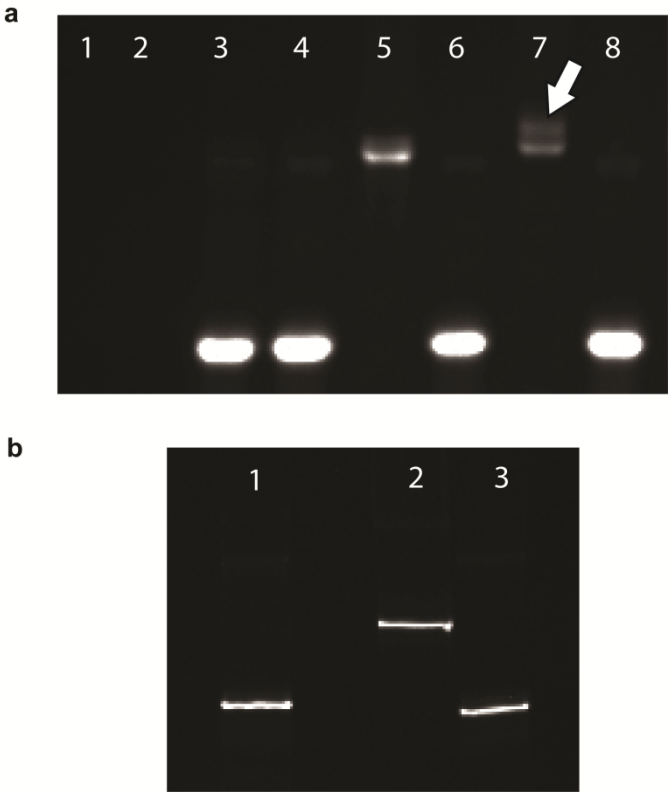

Figure S3. (a) Native polyacrylamide gel electrophoresis characterization for the three-strand DNA assembly in the absence of nanobeads showing different mobilities of (1) visual loading dye not observed under fluorescent excitation, (2) reporter strand (disulfide 20mer) and complementary target, (3) probe strand (fluorescein labeled 15mer), (4) reporter and probe strands, (5) probe and complementary target, (6) probe and non-complementary target, (7) reporter, probe, and complementary target, (8) reporter, probe, and non-complementary target. The visible bands (3-8) originate from the internal fluorescein modification on the probe strand and the differences in mobility reflect the assembling of the three-strand DNA structure. The arrow in (7) signifies the three-strand DNA product. (b) Native polyacrylamide gel electrophoresis characterization for the three-strand DNA assembly in the absence of nanobeads showing different mobility of (1) probe strand (fluorescein labeled 35mer), (2) complementary reporter and probe strands, (3) non-complementary reporter and probe strands. The visible bands (1-3) originate from the internal fluorescein modification on the probe strand and the differences in mobility reflect the assembling of the two-strand DNA structure.