Supplementary Figure S1

**A**: Schematic diagram illustrating the calculation of the horizontal/vertical rotation matrix $R_2(\varphi)$. White dots indicate the marker array. Rotation axis $\vec{\omega}$ and angle $\varphi$ can be deduced from the projected unit normal vector $\vec{n}_{\text{proj}}$ of the marker array.

**B**: Calculation of the torsional rotation matrix $R_1(\psi)$. Using $R_2(\varphi)$ to align normal vector of the marker array with the z-axis, the torsion angle $\psi$ is the angle between any marker in the actual position (white) and the same marker in reference position (gray) relative to the center of rotation.