

## Supporting Information A for

### Insights into the 3D connected pore structure within monodisperse mesoporous silica nanoparticles by cryogenic electron tomography

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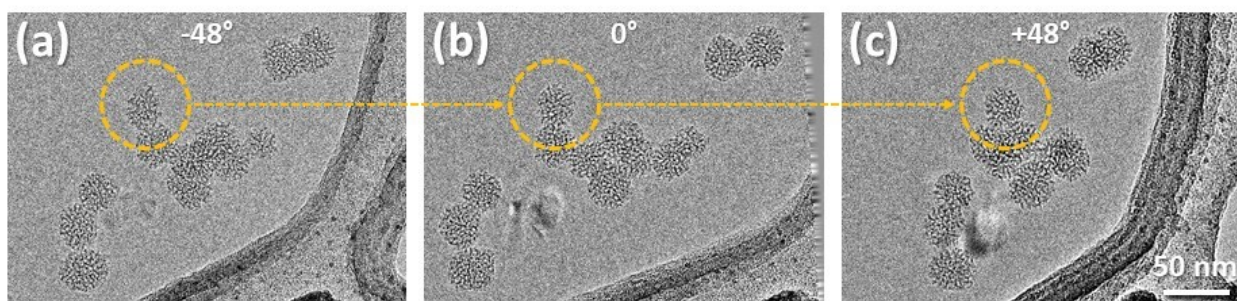
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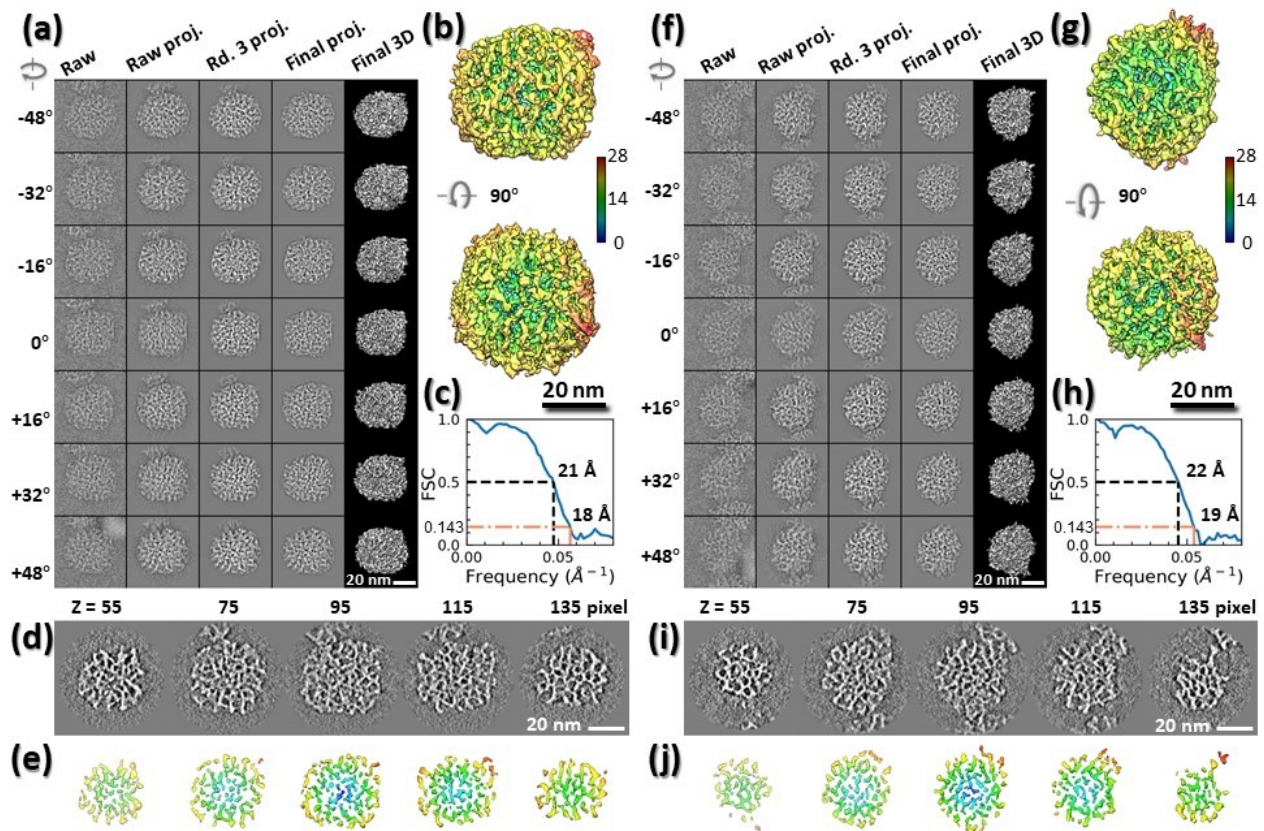
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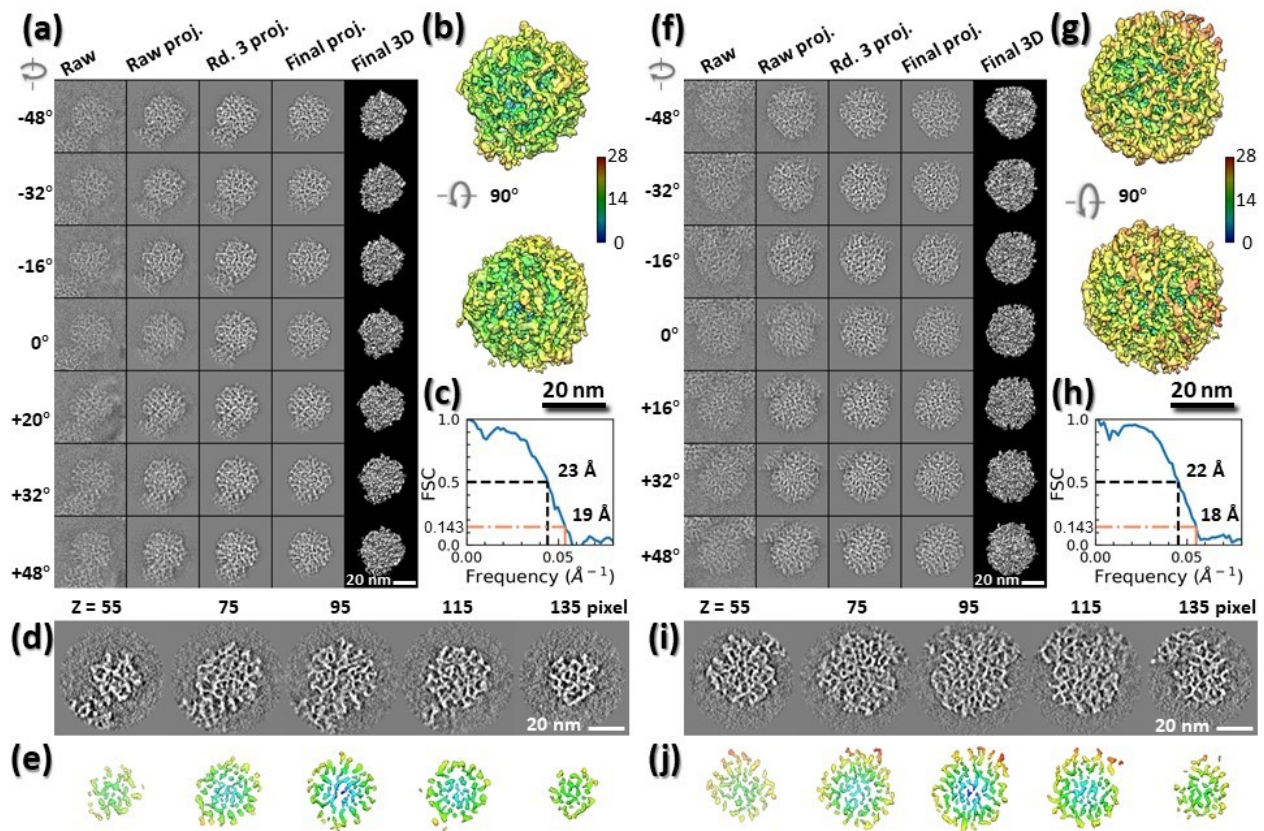
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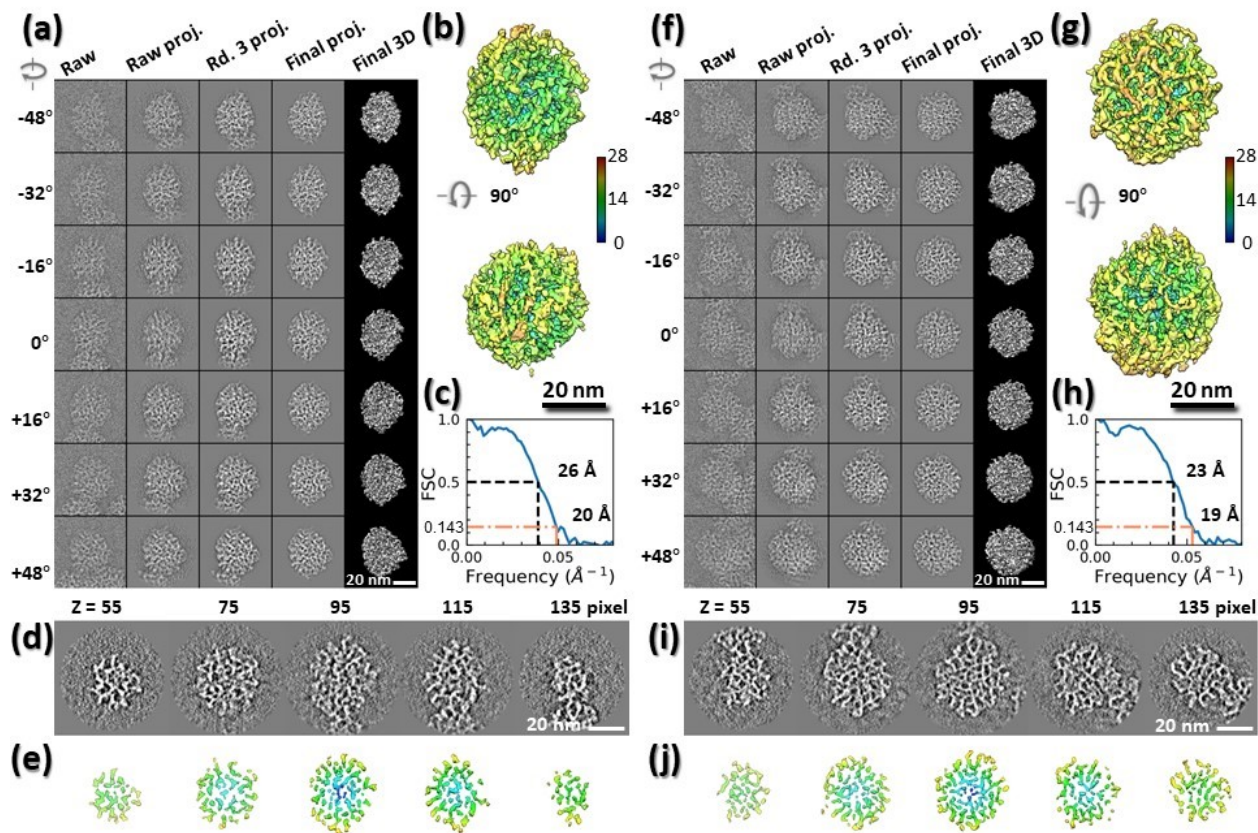
**Figure S1.** Three representative views of the cryo-ET tilt series of MSNs.



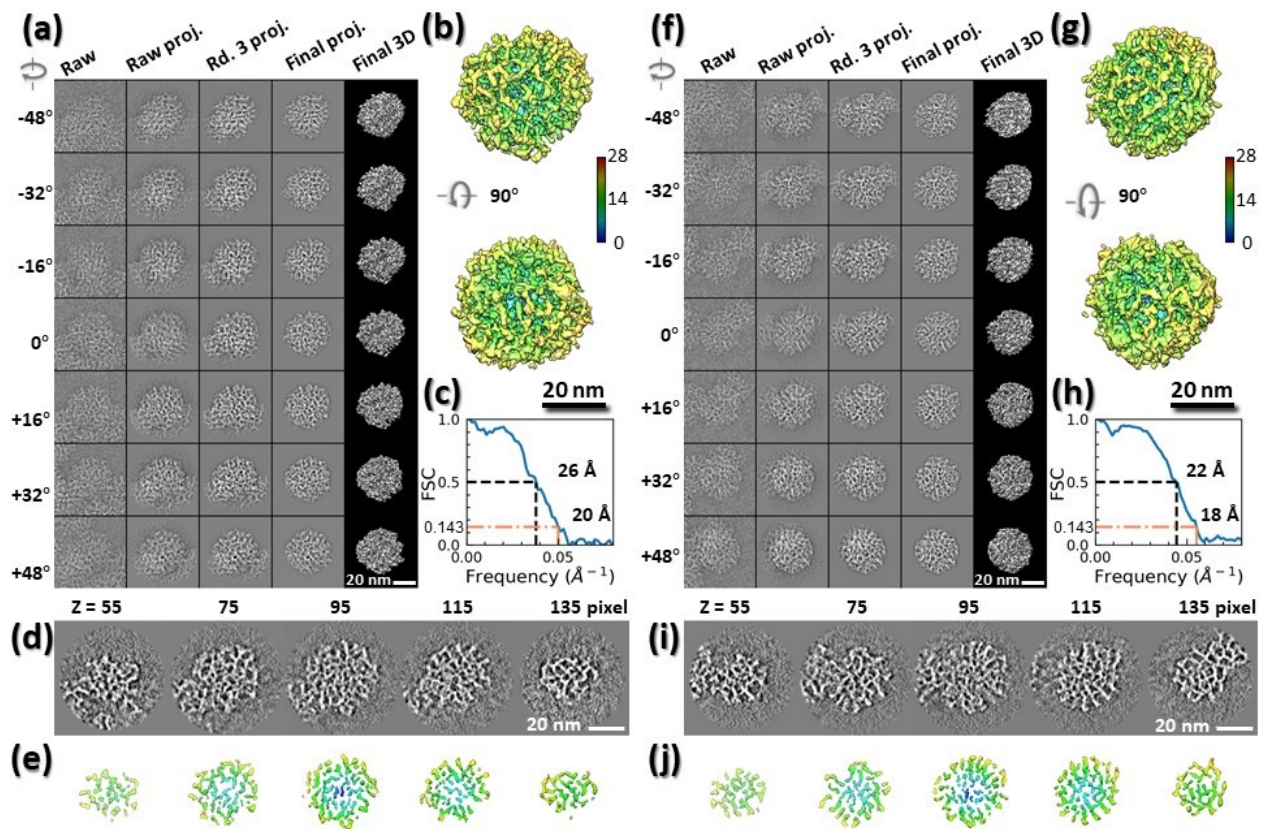
**Figure S2.** Cryo-ET 3D reconstruction of the 1<sup>st</sup> and 2<sup>nd</sup> particle of MSNs by IPET: **(a)** The process of 3D reconstruction of the 1<sup>st</sup> particle. Seven representative tilt images of the particle are gradually aligned via an iterative refinement. **(b)** Final 3D density map was colored by radius; the color bar indicates the distance from the geometry center of particle (unit: nm). **(c)** The FSC curve shows the resolution of the final 3D map was 18 Å at the criteria of 0.143. **(d)** The X-Y slices (thickness = 1.7 nm) of the spherical masked 3D map at different Z heights (Box size: X = Y = Z = 192 pixels; 1 pixel = 3.34 Å). **(e)** The X-Y slices (thickness = 1.7 nm) of the iso-surface rendered final 3D map at different Z heights. **(f-j)** The process of 3D reconstruction of the 2<sup>nd</sup> particle. The FSC curve shows the resolution of the final 3D map was 19 Å at the criteria of 0.143.



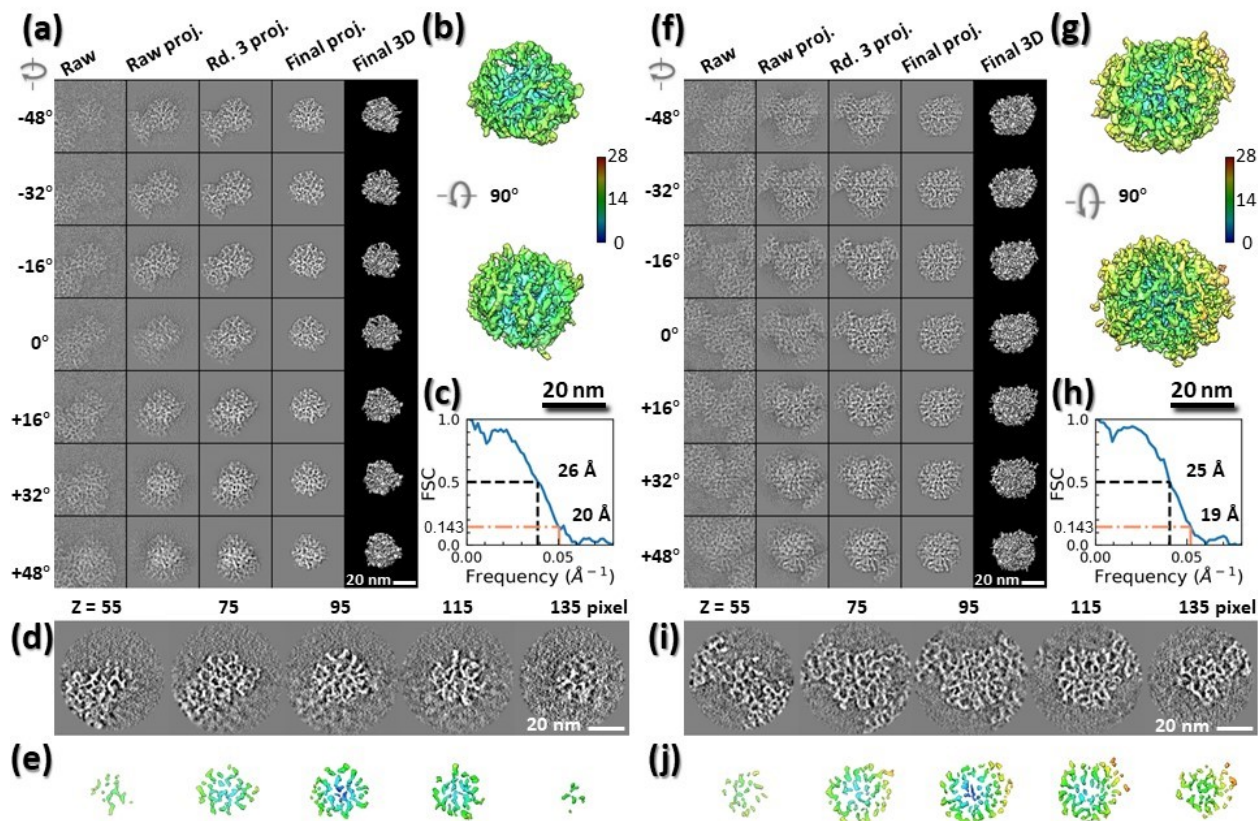
**Figure S3.** Cryo-ET 3D reconstruction of the 3<sup>rd</sup> and 4<sup>th</sup> particle of MSNs by IPET: **(a)** The process of 3D reconstruction of the 3<sup>rd</sup> particle. Seven representative tilt images of the particle are gradually aligned via an iterative refinement. **(b)** Final 3D density map was colored by radius; the color bar indicates the distance from the geometry center of particle (unit: nm). **(c)** The FSC curve shows the resolution of the final 3D map was 19 Å at the criteria of 0.143. **(d)** The X-Y slices (thickness = 1.7 nm) of the spherical masked 3D map at different Z heights (Box size: X = Y = Z = 192 pixels, 1 pixel = 3.34 Å). **(e)** The X-Y slices (thickness = 1.7 nm) of the iso-surface rendered final 3D map at different Z heights. **(f-j)** The process of 3D reconstruction of the 4<sup>th</sup> particle. The FSC curve shows the resolution of the final 3D map was 18 Å at the criteria of 0.143.



**Figure S4.** Cryo-ET 3D reconstruction of the 5<sup>th</sup> and 6<sup>th</sup> particle of MSNs by IPET: **(a)** The process of 3D reconstruction of the 5<sup>th</sup> particle. Seven representative tilt images of the particle are gradually aligned via an iterative refinement. **(b)** Final 3D density map was colored by radius; the color bar indicates the distance from the geometry center of particle (unit: nm). **(c)** The FSC curve shows the resolution of the final 3D map was 20 Å at the criteria of 0.143. **(d)** The X-Y slices (thickness = 1.7 nm) of the spherical masked 3D map at different Z heights (Box size: X = Y = Z = 192 pixels; 1 pixel = 3.34 Å). **(e)** The X-Y slices (thickness = 1.7 nm) of the iso-surface rendered final 3D map at different Z heights. **(f-j)** The process of 3D reconstruction of the 6<sup>th</sup> particle. The FSC curve shows the resolution of the final 3D map was 19 Å at the criteria of 0.143.



**Figure S5.** Cryo-ET 3D reconstruction of the 7<sup>th</sup> and 8<sup>th</sup> particle of MSNs by IPET: **(a)** The process of 3D reconstruction of the 7<sup>th</sup> particle. Seven representative tilt images of the particle are gradually aligned via an iterative refinement. **(b)** Final 3D density map was colored by radius; the color bar indicates the distance from the geometry center of particle (unit: nm). **(c)** The FSC curve shows the resolution of the final 3D map was 20 Å at the criteria of 0.143. **(d)** The X-Y slices (thickness = 1.7 nm) of the spherical masked 3D map at different Z heights (Box size: X = Y = Z = 192 pixels; 1 pixel = 3.34 Å). **(e)** The X-Y slices (thickness = 1.7 nm) of the iso-surface rendered final 3D map at different Z heights. **(f-j)** The process of 3D reconstruction of the 8<sup>th</sup> particle. The FSC curve shows the resolution of the final 3D map was 18 Å at the criteria of 0.143.



**Figure S6.** Cryo-ET 3D reconstruction of the 9<sup>th</sup> and 10<sup>th</sup> particle of MSNs by IPET: **(a)** The process of 3D reconstruction of the 9<sup>th</sup> particle. Seven representative tilt images of the particle are gradually aligned via an iterative refinement. **(b)** Final 3D density map was colored by radius; the color bar indicates the distance from the geometry center of particle (unit: nm). **(c)** The FSC curve shows the resolution of the final 3D map was 20 Å at the criteria of 0.143. **(d)** The X-Y slices (thickness = 1.7 nm) of the spherical masked 3D map at different Z heights (Box size: X = Y = Z = 192 pixels; 1 pixel = 3.34 Å). **(e)** The X-Y slices (thickness = 1.7 nm) of the iso-surface rendered final 3D map at different Z heights. **(f-j)** The process of 3D reconstruction of the 10<sup>th</sup> particle. The FSC curve shows the resolution of the final 3D map was 19 Å at the criteria of 0.143.