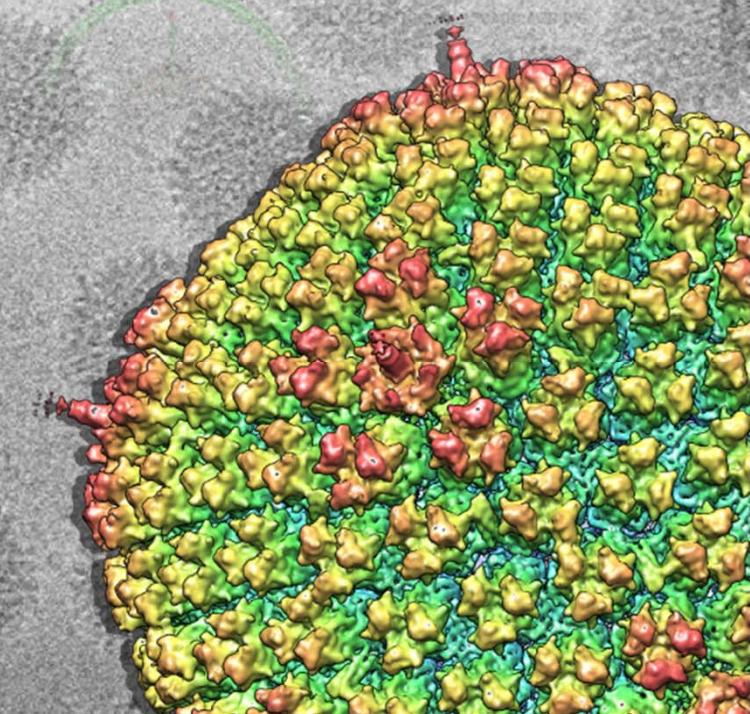
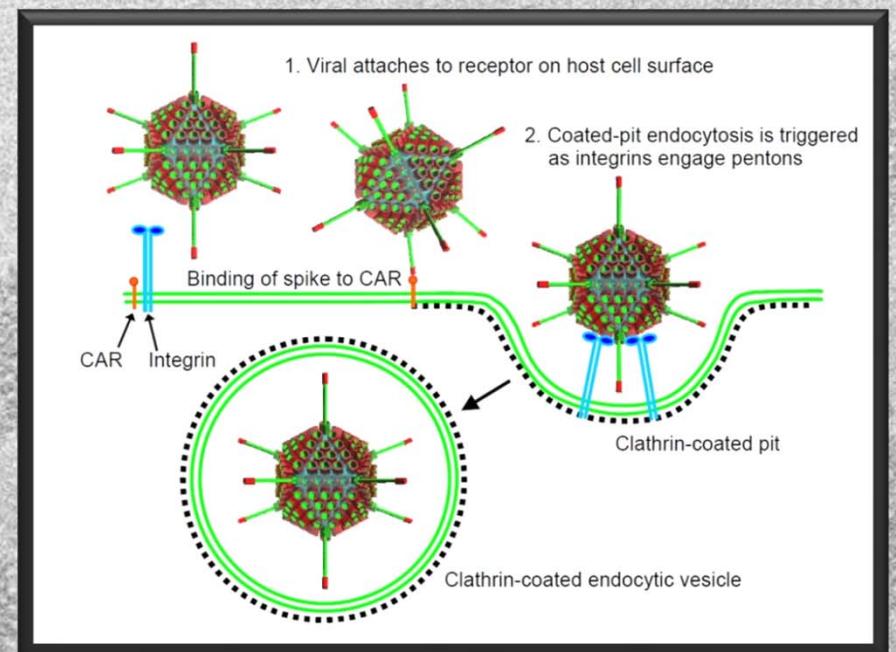


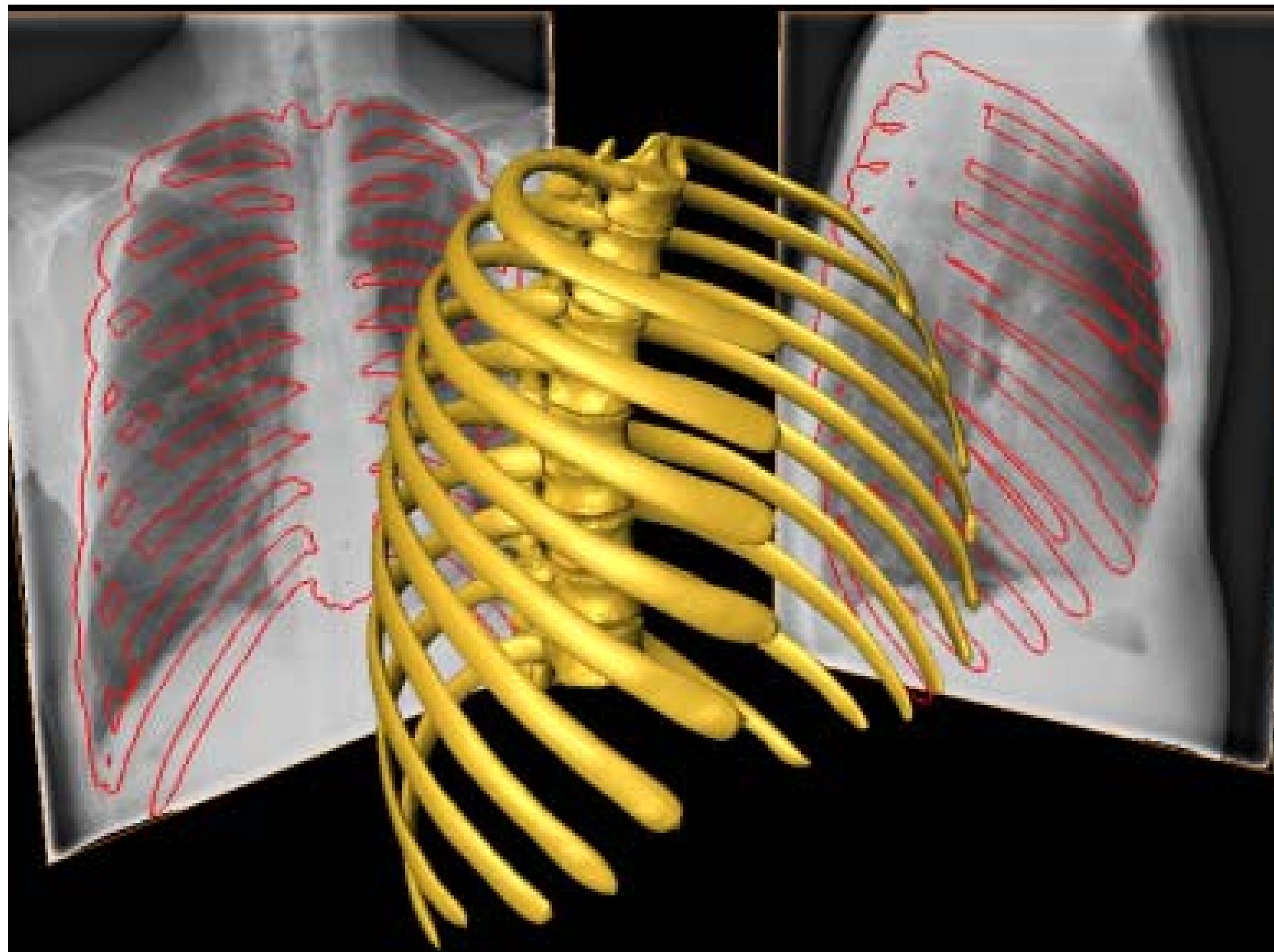
Introducción al procesamiento de Imagen en Microscopia Electrónica

I2PC

Escuela Politecnica Superior
Instruct Image Processing Center, CNB-CSIC
Roberto Marabini Ruiz







What we do...

... in more detail



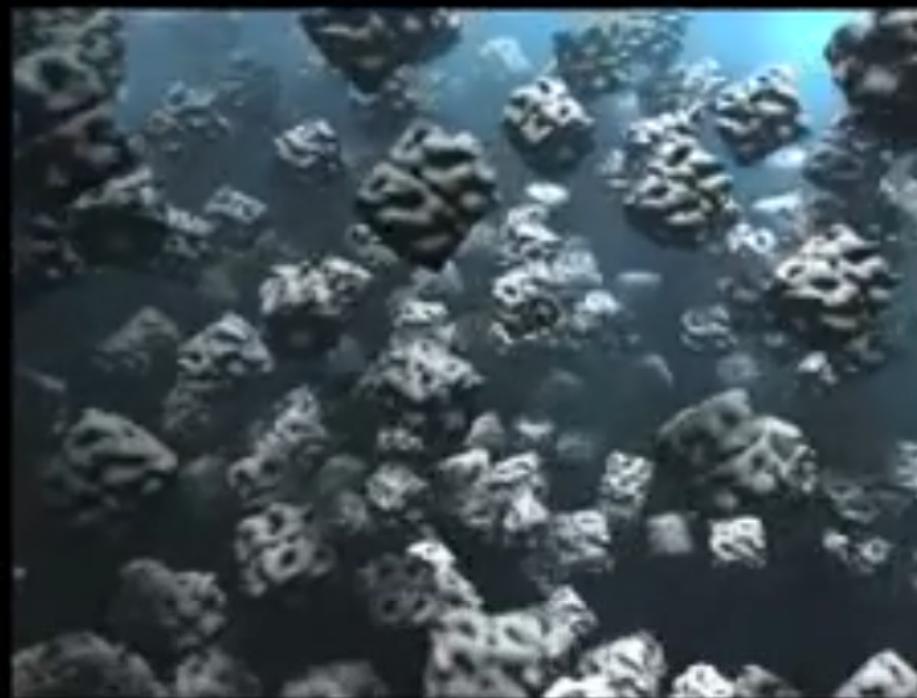
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That is how we go from sample in solution...

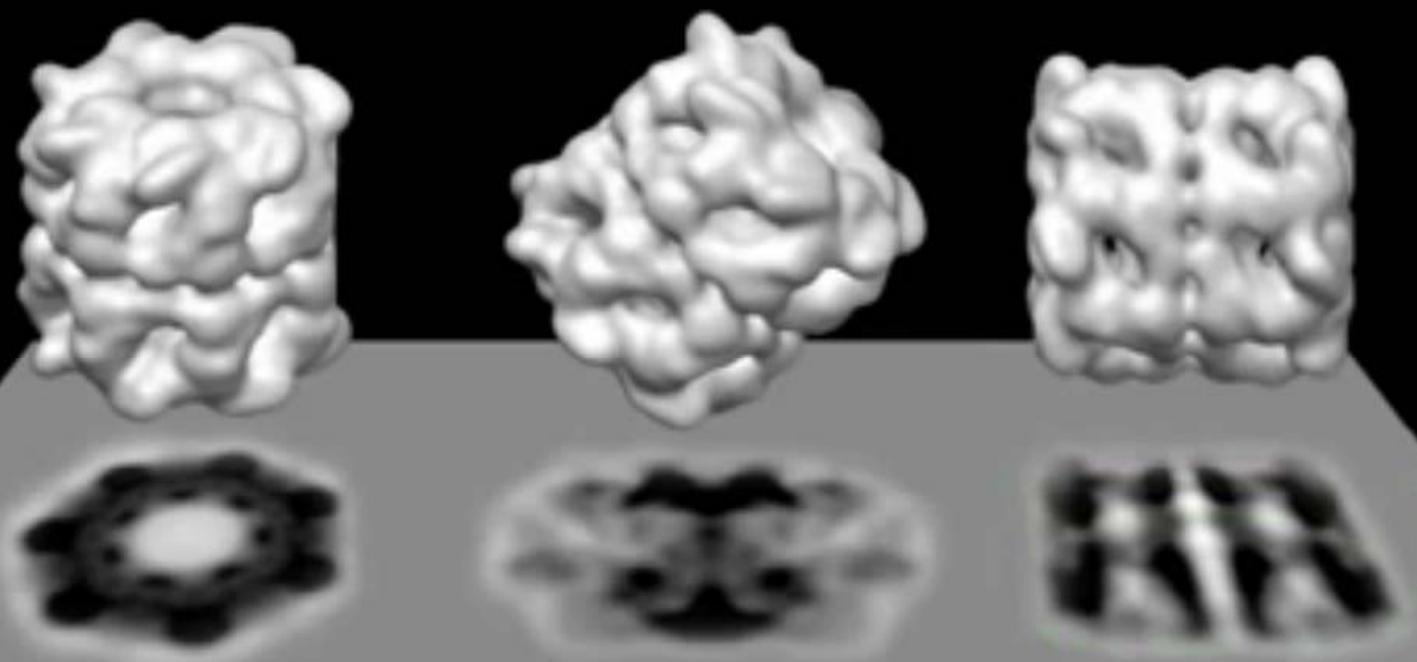


...to molecules frozen in thin ice

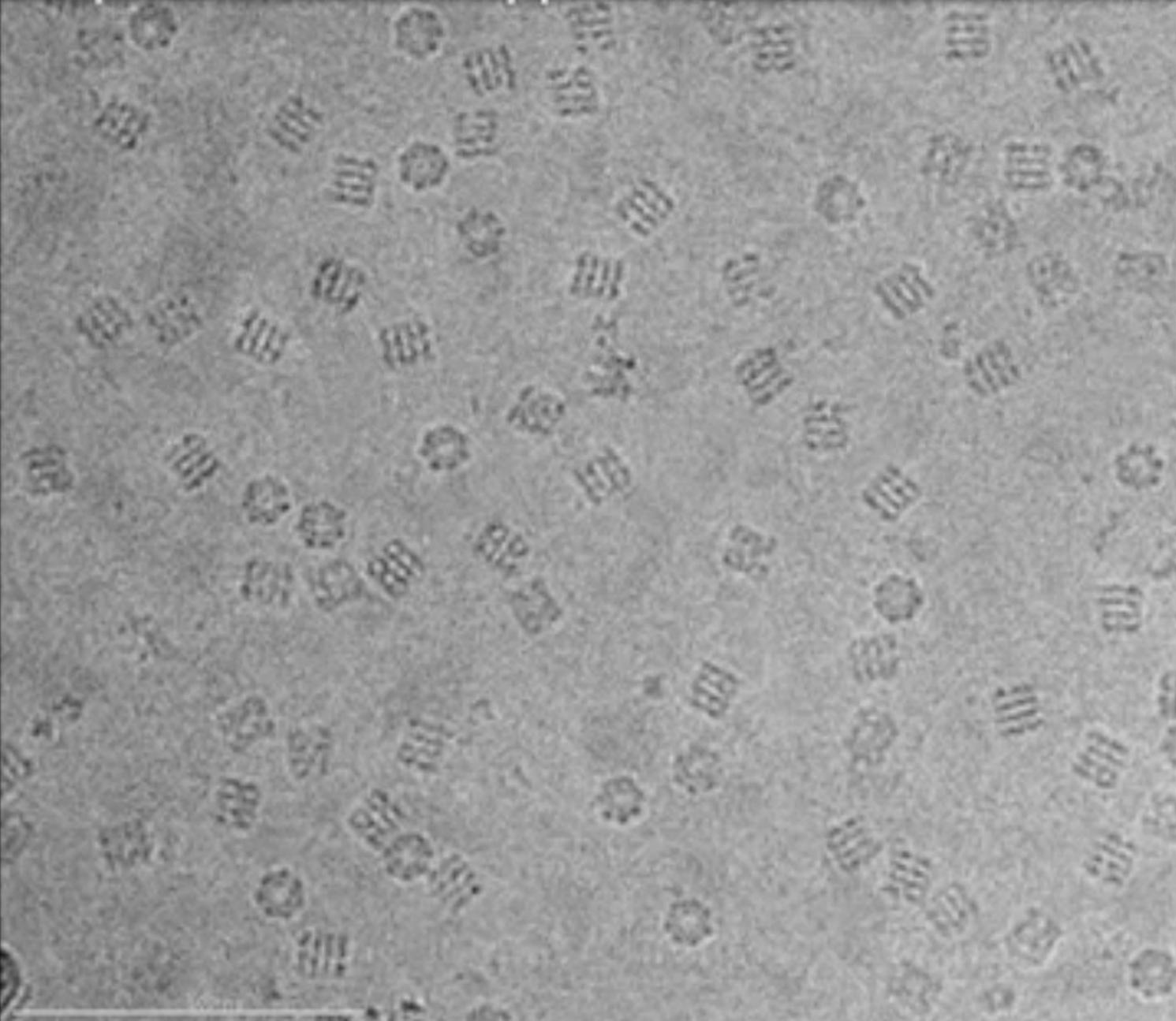
Here are three molecules trapped
in different orientations



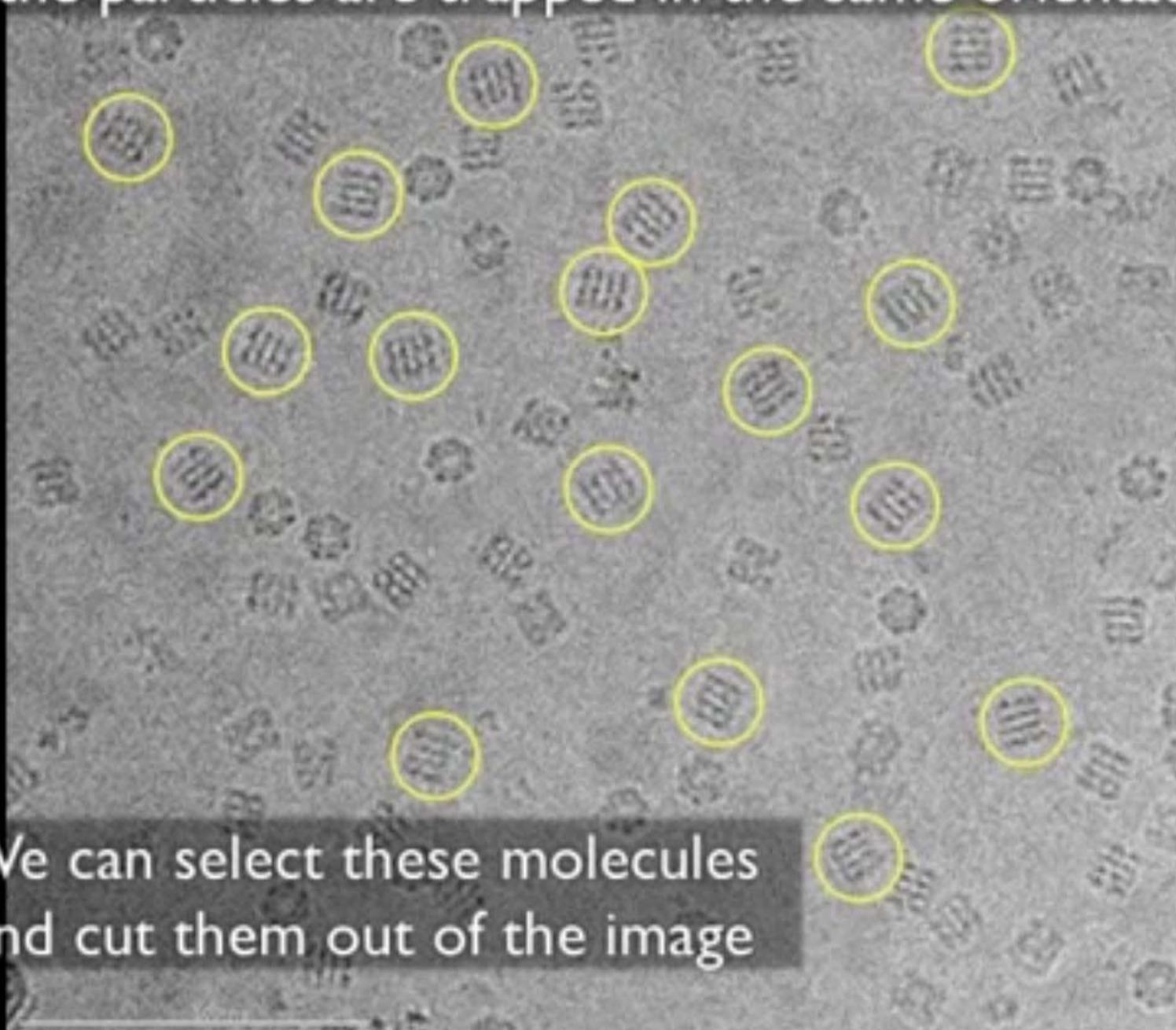
When we shoot the molecules with an electron beam,
the orientation of the particles leaves a unique “shadow”



Even though the image is noisy, we can see that some of the particles are trapped in the same orientation



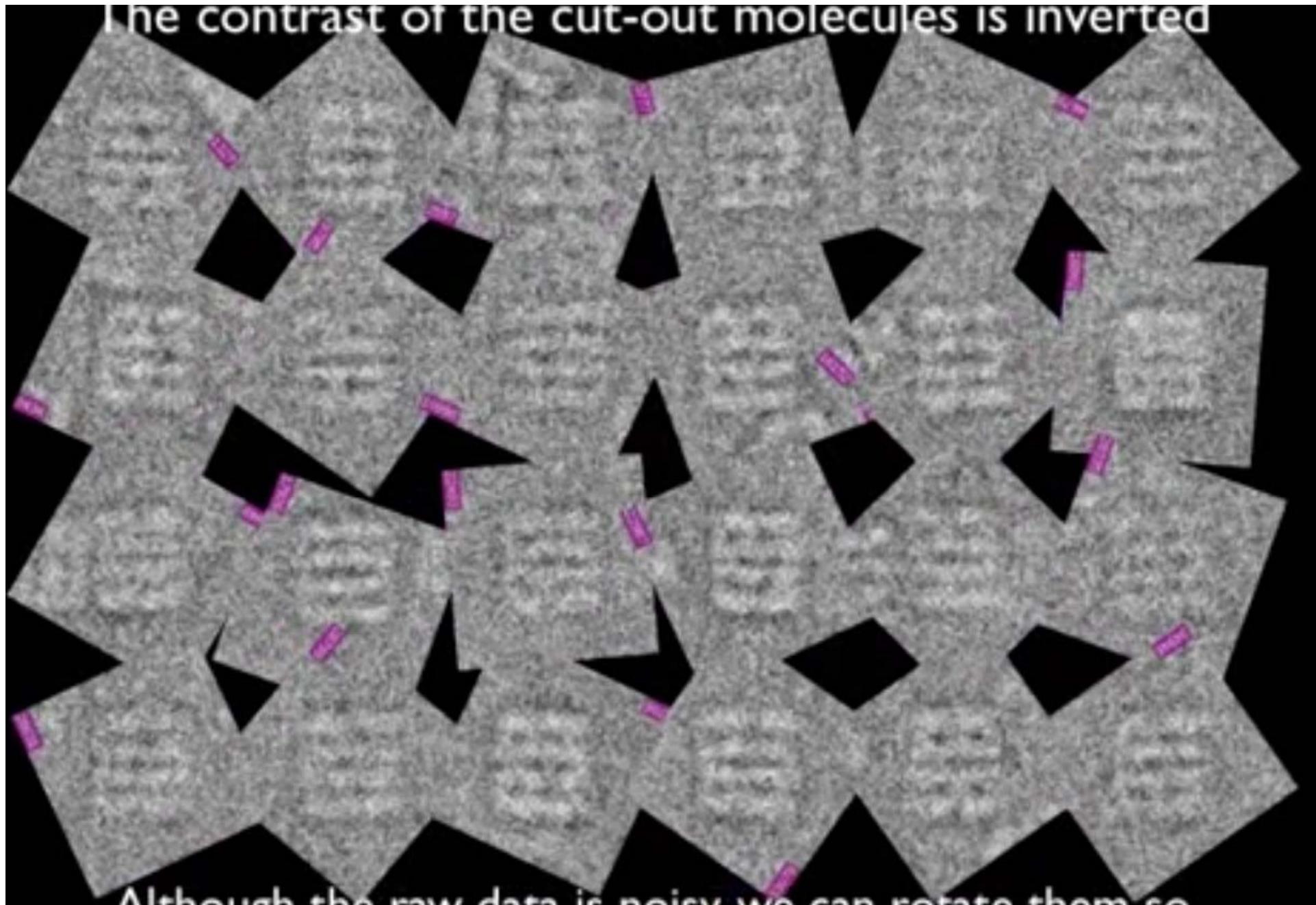
Even though the image is noisy, we can see that some of the particles are trapped in the same orientation



We can select these molecules
and cut them out of the image

100	1007	1007	1007	1007	1007
100	1008	1008	1008	1008	1008
100	1009	1009	1009	1009	1009
100	1010	1010	1010	1010	1010
100	1011	1011	1011	1011	1011

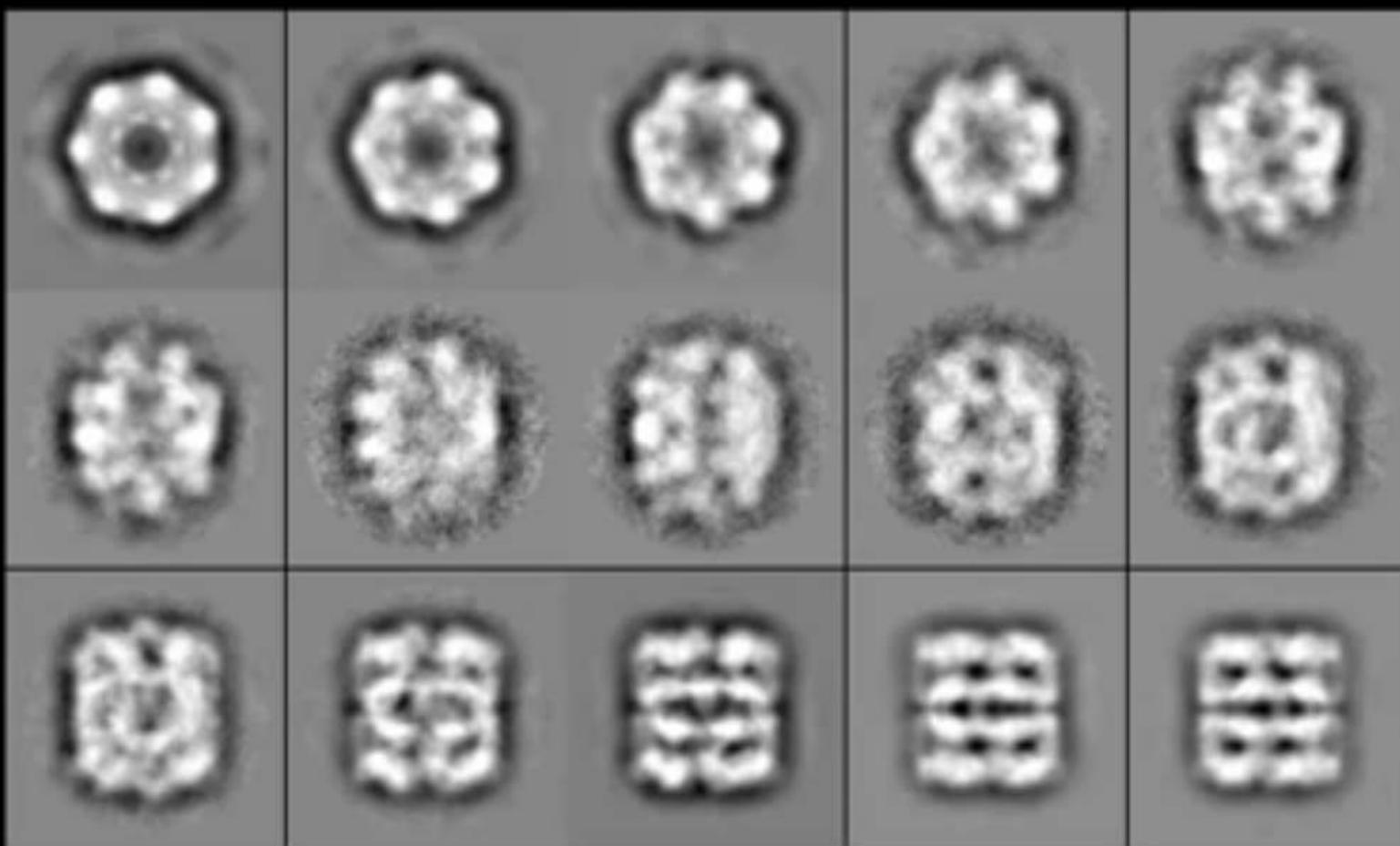
The contrast of the cut-out molecules is inverted



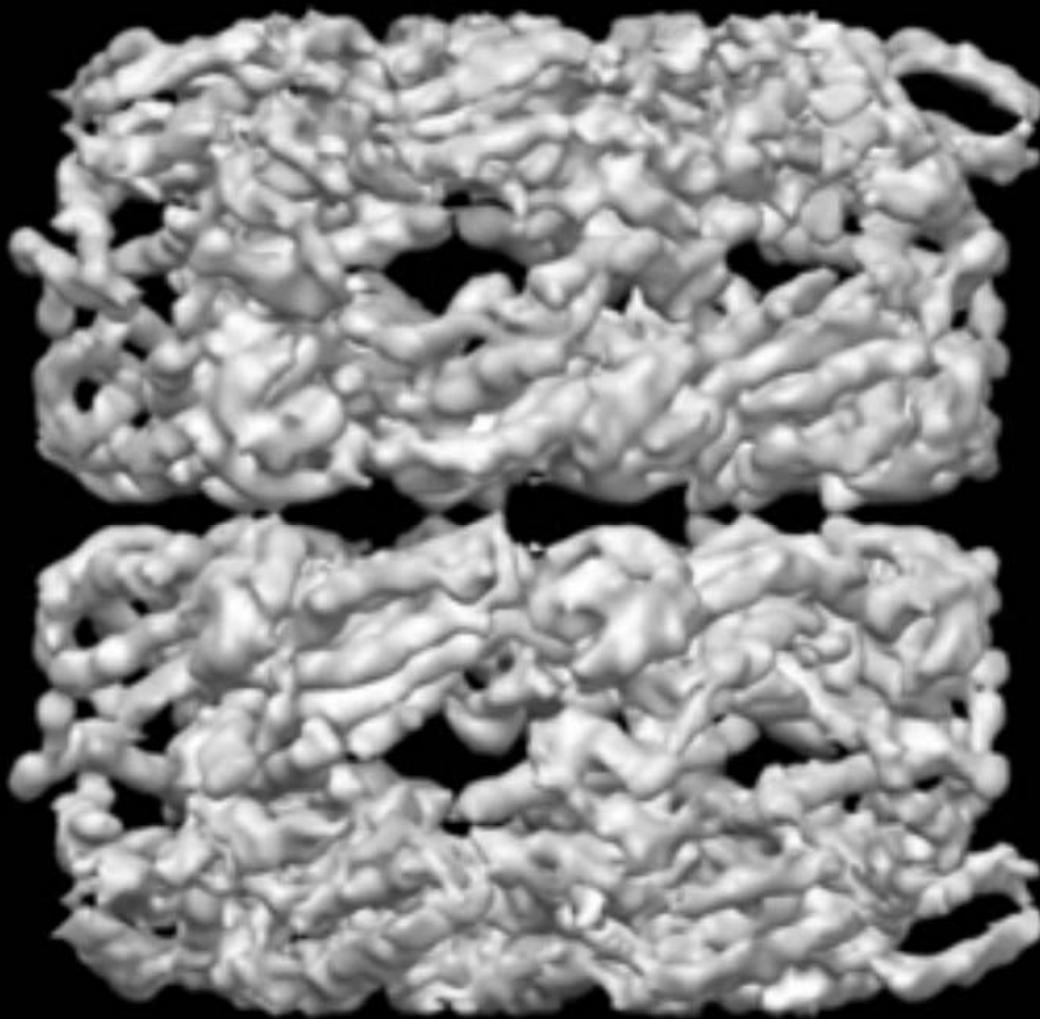
Although the raw data is noisy, we can rotate them so
that all the molecules are in the same orientation

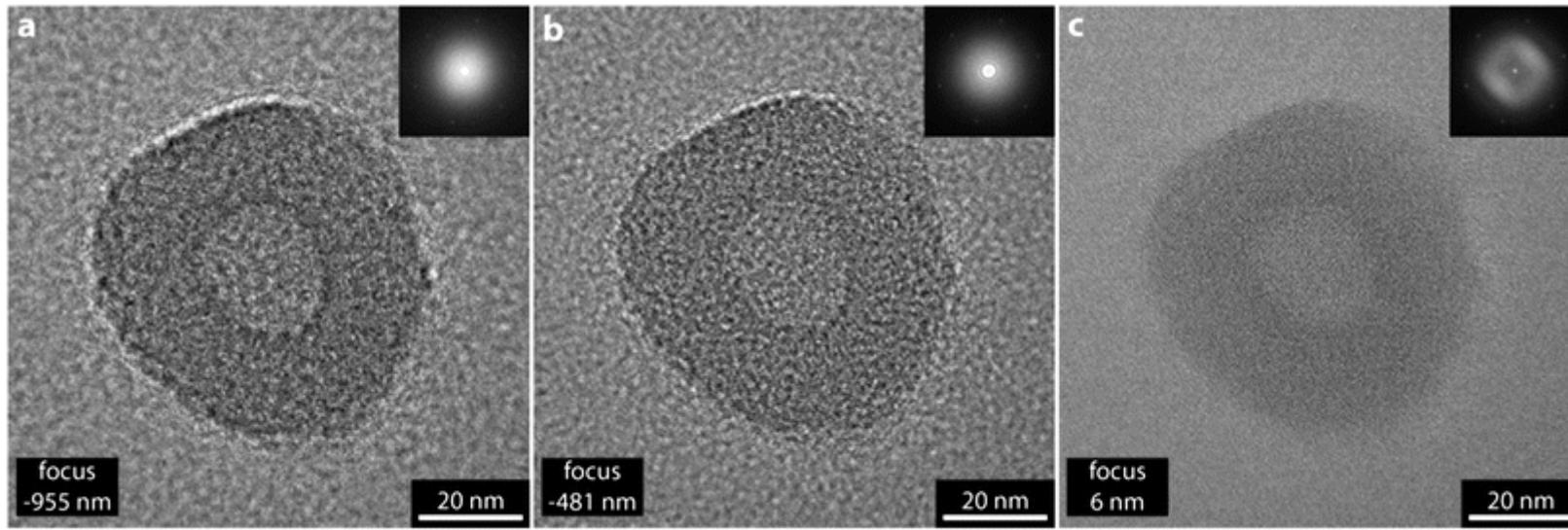


We perform this same process for the different orientations of the molecule



Then we gather all these views and
combine them computationally

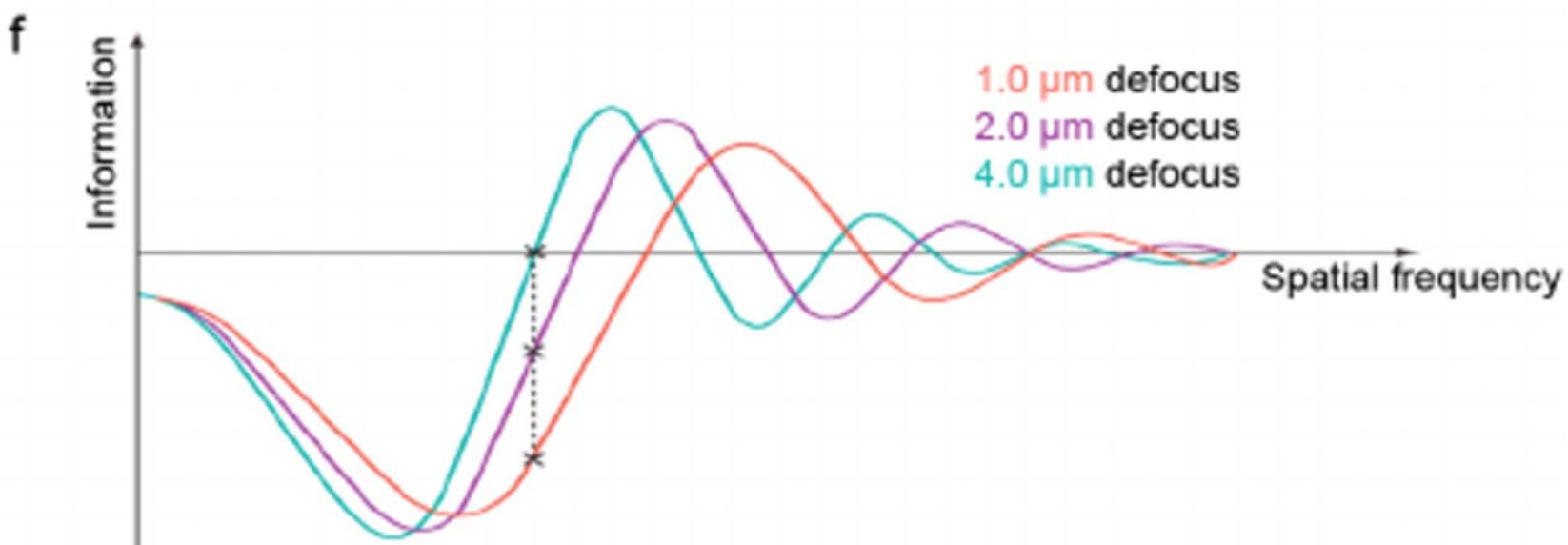
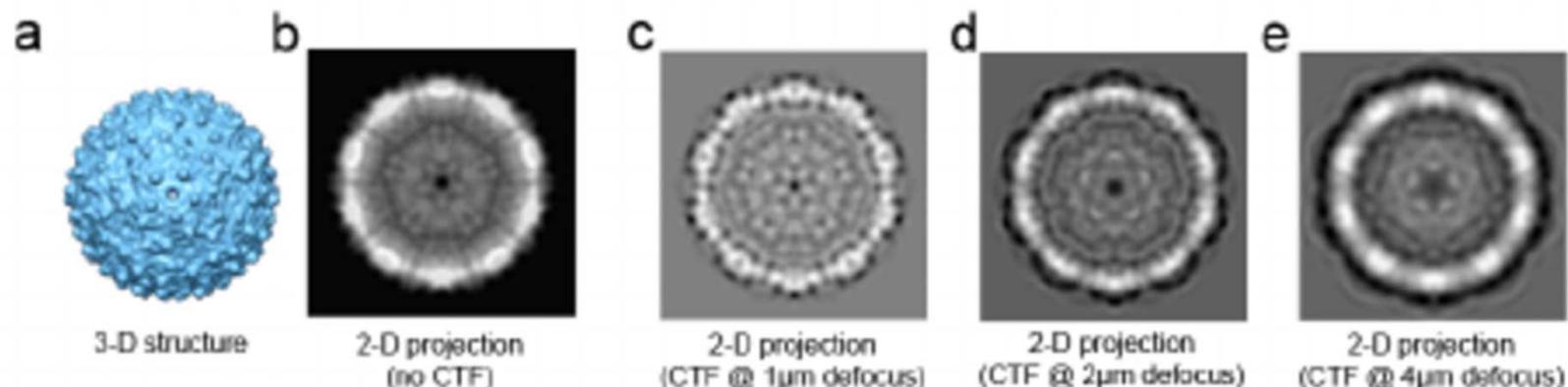




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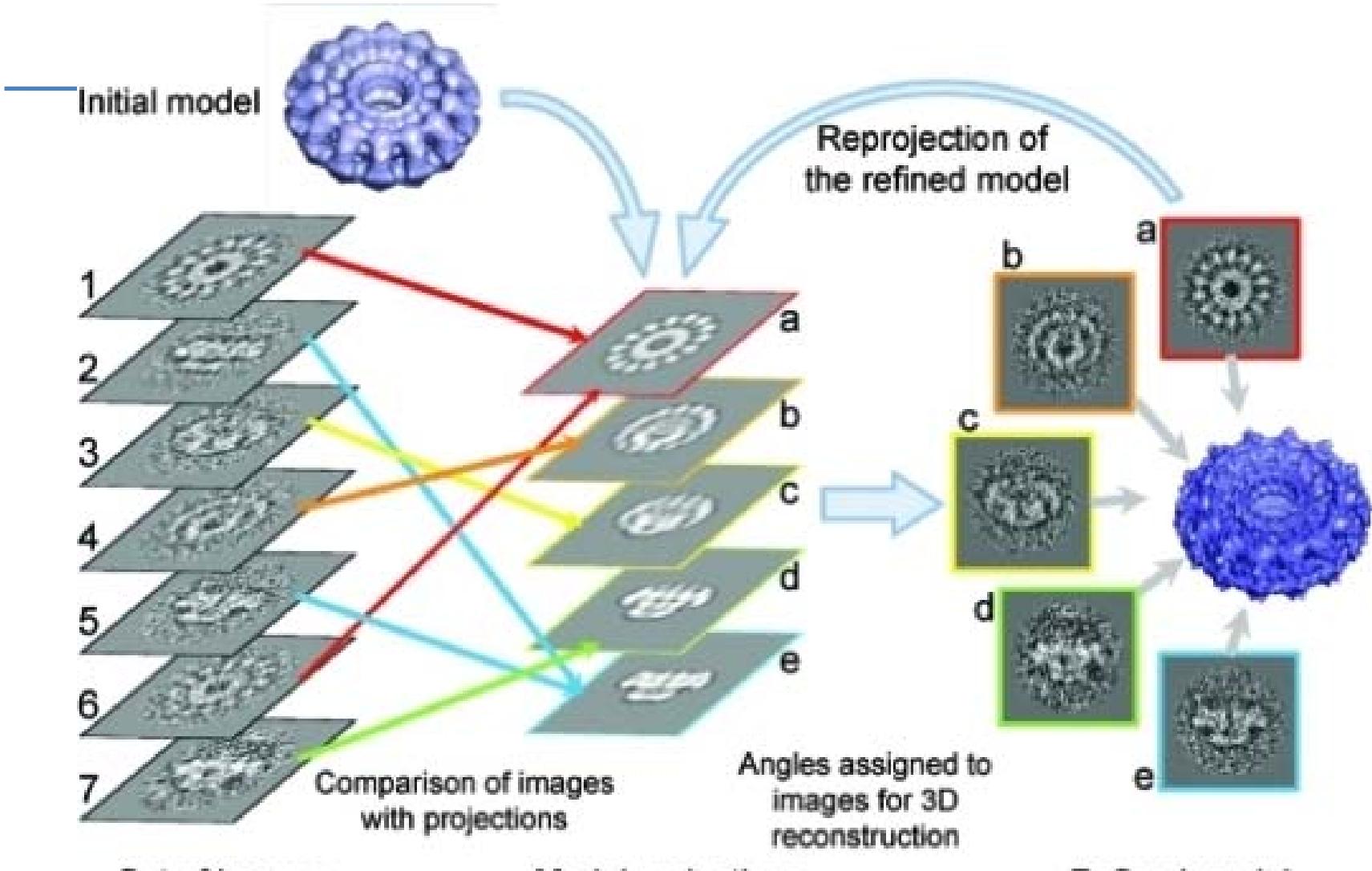
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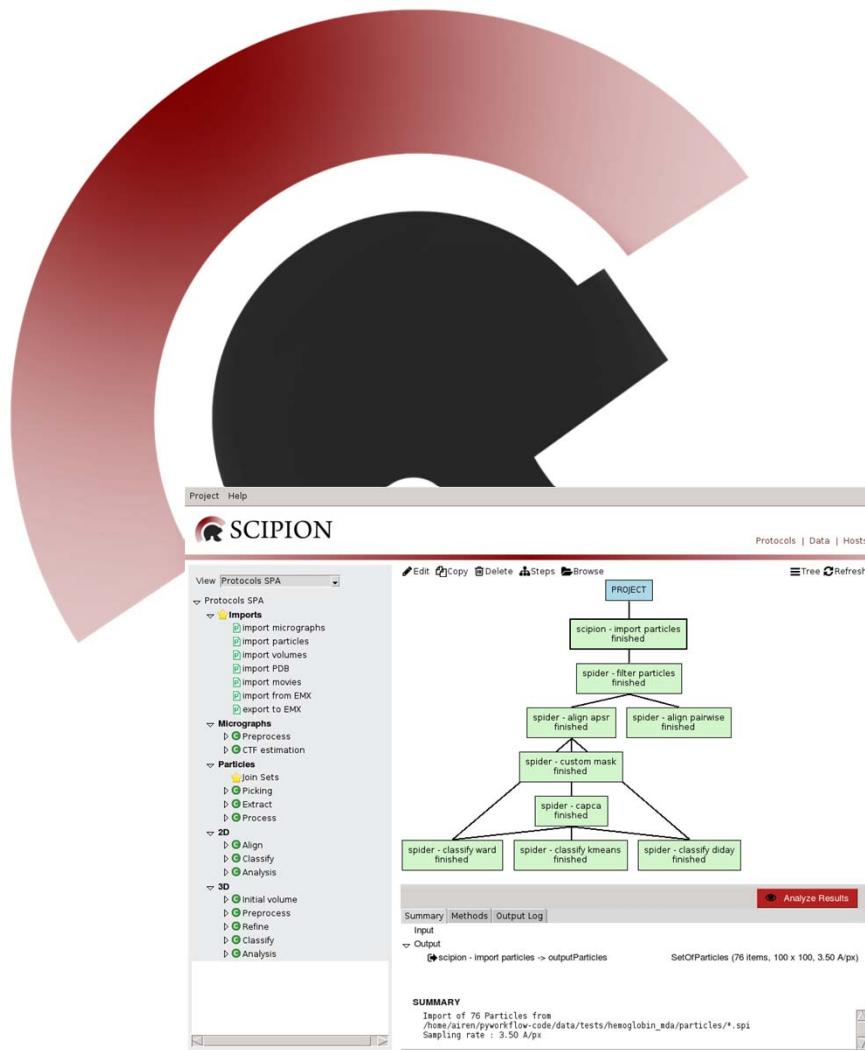
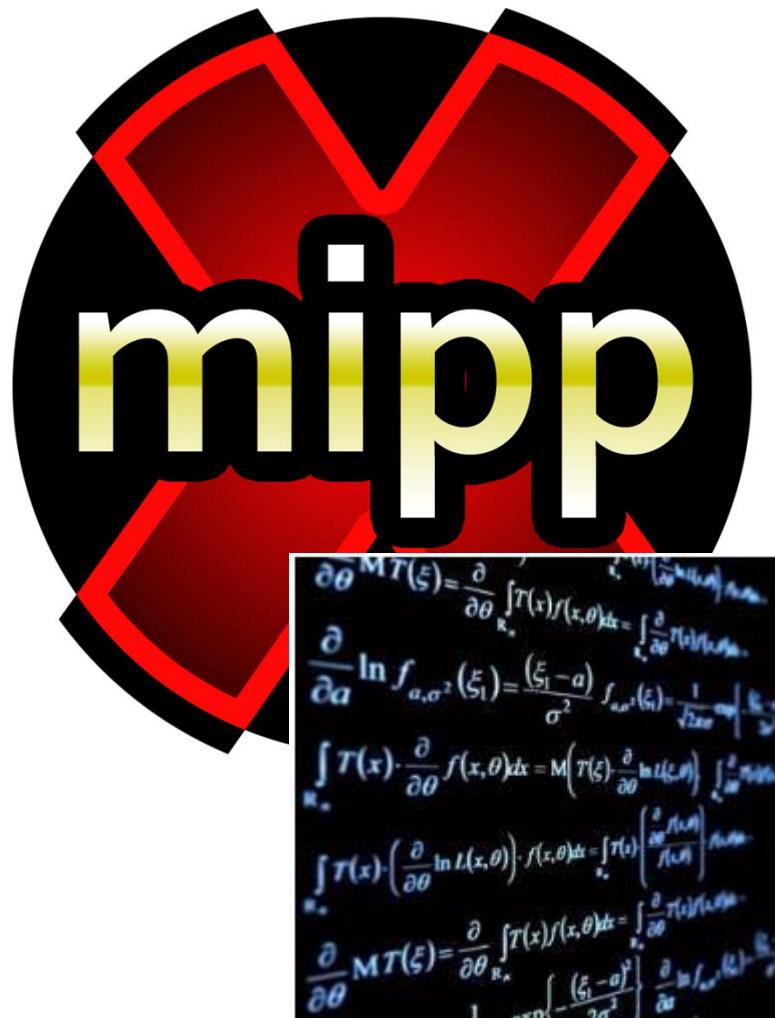
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