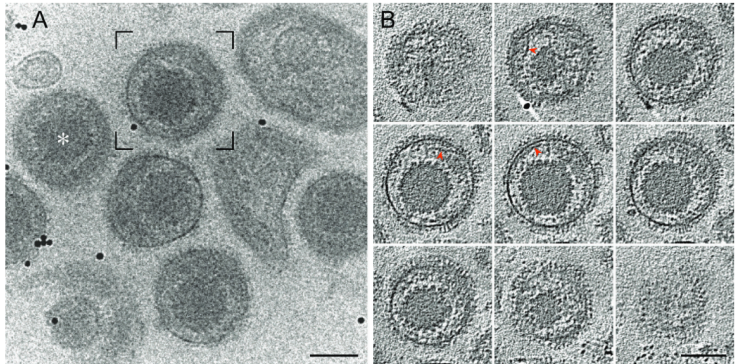


Electron Tomography and Its Limitations

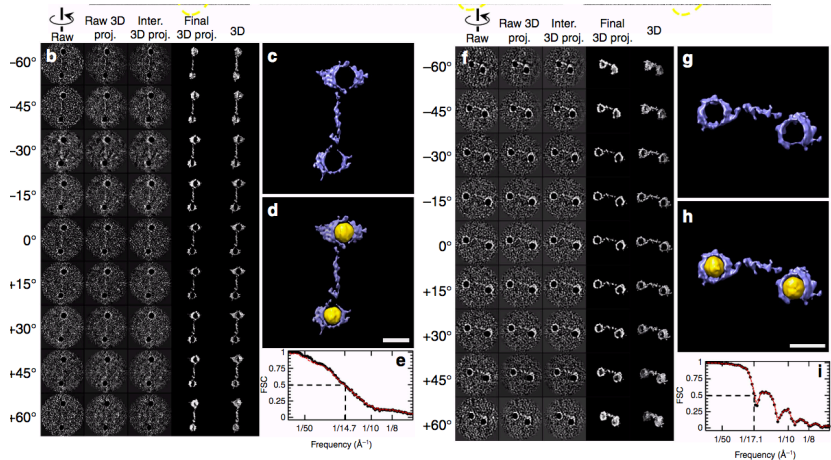
Xin Chen

August 23, 2017

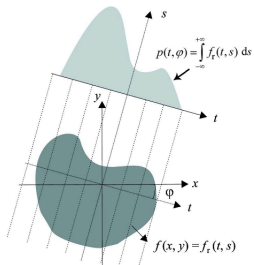
Fig. 1. Tomographic reconstruction of HSV-1 virions in vitreous ice. (A) Zero-tilt projection from a tilt series. Black dots are 10-nm gold particles used as fiducial markers. (B) Gallery of parallel slices, 15.5 nm apart and 5.2 nm thick, through the virion framed in (A). Each slice represents the average over seven planes. Red arrowheads mark filaments in the tegument. Scale bars, 100 nm.



Grnewald, Kay, et al, 2003, resolution: 7nm



Lei Zhang, et al, 2016, resolution: 17.1Å, dsDNA: 30nm, gold particle: 6nm



$$p(t, \varphi) = \int_{-\infty}^{+\infty} f(x, y) \delta(x \cos \varphi + y \sin \varphi - t) dx dy$$

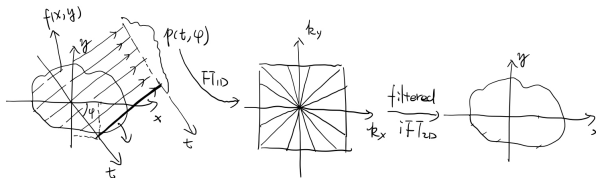
$$P(k, \varphi) = \text{FT1}[p] = \int \int f(x, y) e^{-ikx \cos \varphi -iky \sin \varphi} dx dy$$

$$= \int \int f(x, y) e^{-iux - ivk} dx dy$$

$$u = k \cos \varphi$$

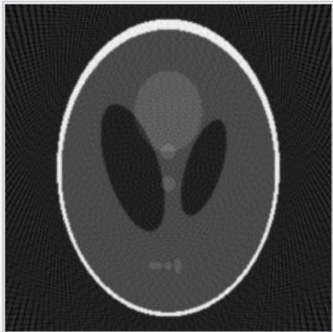
$$v = k \sin \varphi$$

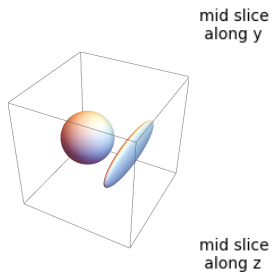
Fourier Slice Theorem: 1D FT of $p(t, \varphi)$ is equal to the slice of 2D FT of $f(x, y)$ at the angle ϕ — the math for iRadon.



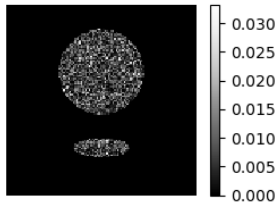


Shepp Logan phantom

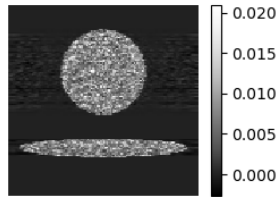
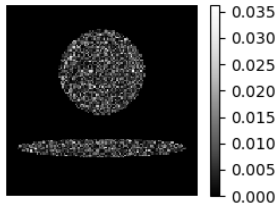
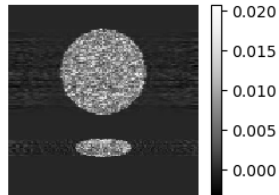
Radon Inverse Radon transform
transform



original obj



reconstructed obj



angle interval = 2 ,rms error = 0.00102

