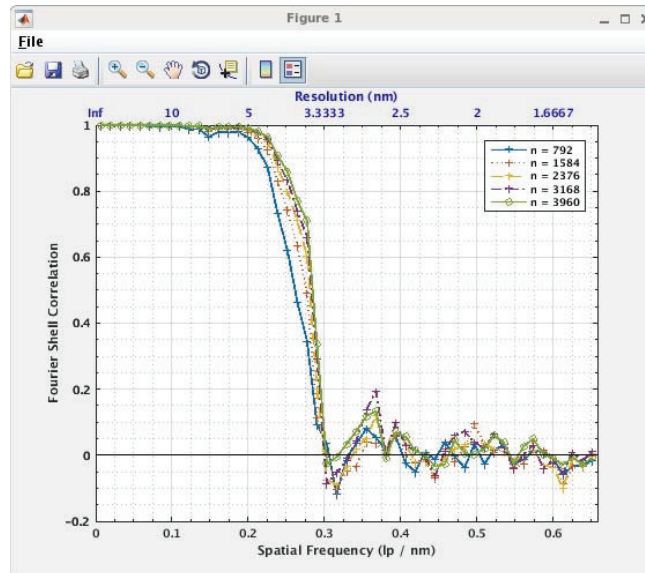


Fourier Shell Correlation

The Key Idea

- Correlation between volumes can be written as a product in Fourier space
- The Fourier space product can be split into shells by radial frequency
- Compute plot of correlation versus frequency

Sample FSC Curve



X. FSC

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Types of FSC

- Odd / even
 - Simplest
 - Random sampling generalization allows error bars
 - Subject to bias: half datasets are not independent
- “Gold standard”
 - 2 independently aligned half datasets
 - Reduces possibility of bias
- Comparison with unrelated solution

X. FSC

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PEET FSC Programs

- calcFSC: compute simple FSC \pm errors bars
- calcUnbiasedFSC: compute gold standard FSC
- plotFSC: plot curves from above programs
- simpleFSC: compute and plot a single FSC from comparison of 2 volumes
 - Requires only volumes... no motive lists, etc.
 - Gold standard FSC
 - Comparison with independent solution

PEET FSC Programs

- calcFSC
 - Requires a single PEET alignment
- calcUnbiasedFSC
 - Requires 2 alignments with ~identical settings
- plotFSC: plot curves from above programs
- simpleFSC
 - Needs only 2 aligned volumes

Cross-correlation Coefficient and SNR

- Ideally (infinite data and uncorrelated noise):

$$CCC = \frac{SNR^2}{1 + SNR^2} = \frac{1}{1 + NSR^2}$$

$$SNR = \sqrt{\frac{CCC}{1 - CCC}}$$

- Where $SNR = \frac{S(\text{amplitude})}{N(\text{amplitude})} = \sqrt{\frac{S(\text{energy})}{N(\text{energy})}}$

FSC and Resolution

- FSC measures consistency **not** resolution
- This distinction is often overlooked or ignored
 - Resolution $\sim 1 / \text{frequency}$
 - Use $1 / \text{frequency}$ at which FSC = cutoff as resolution
- Typical cutoff values
 - 0.143 (or 0.15) for gold standard FSC
 - Corrects for using only half the data during FSC
 - 0.143 or 0.5 for ordinary odd / even FSC

Questions?