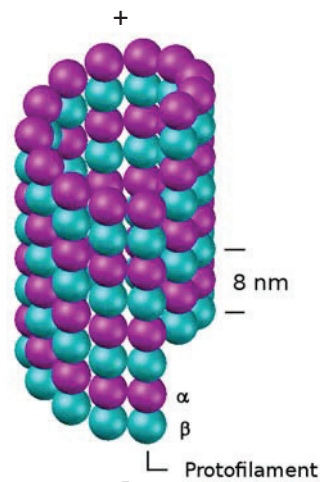


Aligning Filaments: Microtubules

Microtubule Structure



A 13 PF Microtubule

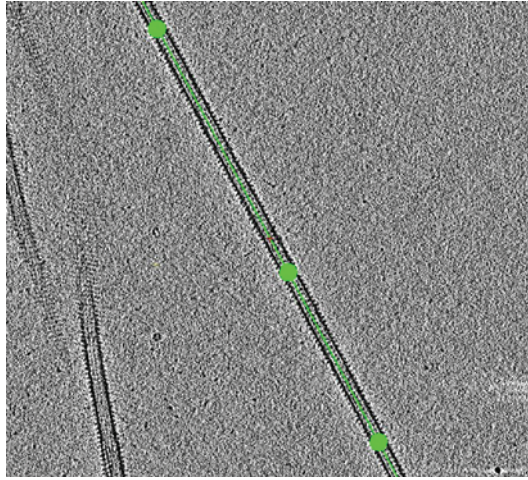
Microtubule Structure - Examples

- 13 PF
 - straight PFs (no supertwist), seam
- 14 PF
 - supertwist, seam
- 15, 16 PF
 - supertwist, no seam (helical)
- Alignment search strategies will vary!

Modeling 8 nm Axial Repeat

- In all cases, want points every ~8 nm axially
- Tedious and inaccurate to place manually
- Solution:
 - Handful of points define path of tube center
 - Run addModPoints to get desired spacing

Initial Model: Tube Center

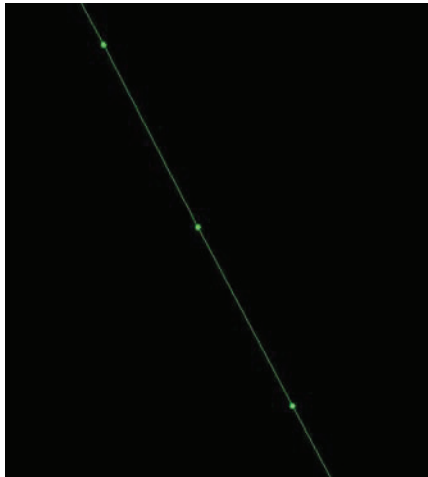


III. MT Initial Alignment

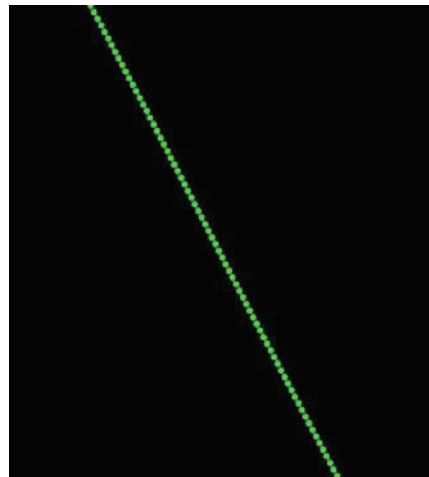
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Use addModPts For Desired Spacing



Initial Model



Points Added

III. MT Initial Alignment

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13 PF Search Strategy

- Straight (no supertwist), seam
- No axial randomization
- Align particle Y axes
- Missing wedge artifacts will be present
- Goal: visualize seam well enough to latter combine tubes with varying orientations to reduce / eliminate missing wedge artifacts

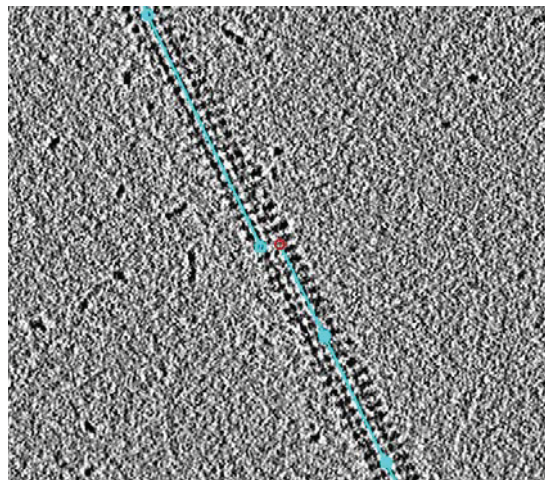
15-16 PF Search Strategy

- Slight supertwist, helical 16 nm pitch (no seam)
- Align particle Y axes + axial randomization
- $360 / 15 = 24^\circ$ ϕ (Phi) search range
- Will be able to exploit helical symmetry
- Can also use modTwist2EM as described next for twisted, non-helical tubes

Other Numbers of PFs

- Supertwist and seam
- Twist can help reduce missing wedge artifacts
- How to handle the twisted seam?
 - Trace protofilaments (follow supertwist)
 - Object 1: points follow center of tube
 - Object 2: points follow protofilaments on surface
 - Contours correspond to protofilaments
 - Object 1 and 2 points in 1-to-1 correspondence (axial posn)
 - modTwist2EM generates an initial motive list which compensates for the supertwist
- Model twisted PFs before running addModPts (special addModPts mode for this case)

Sample Model Following PFs



Questions?