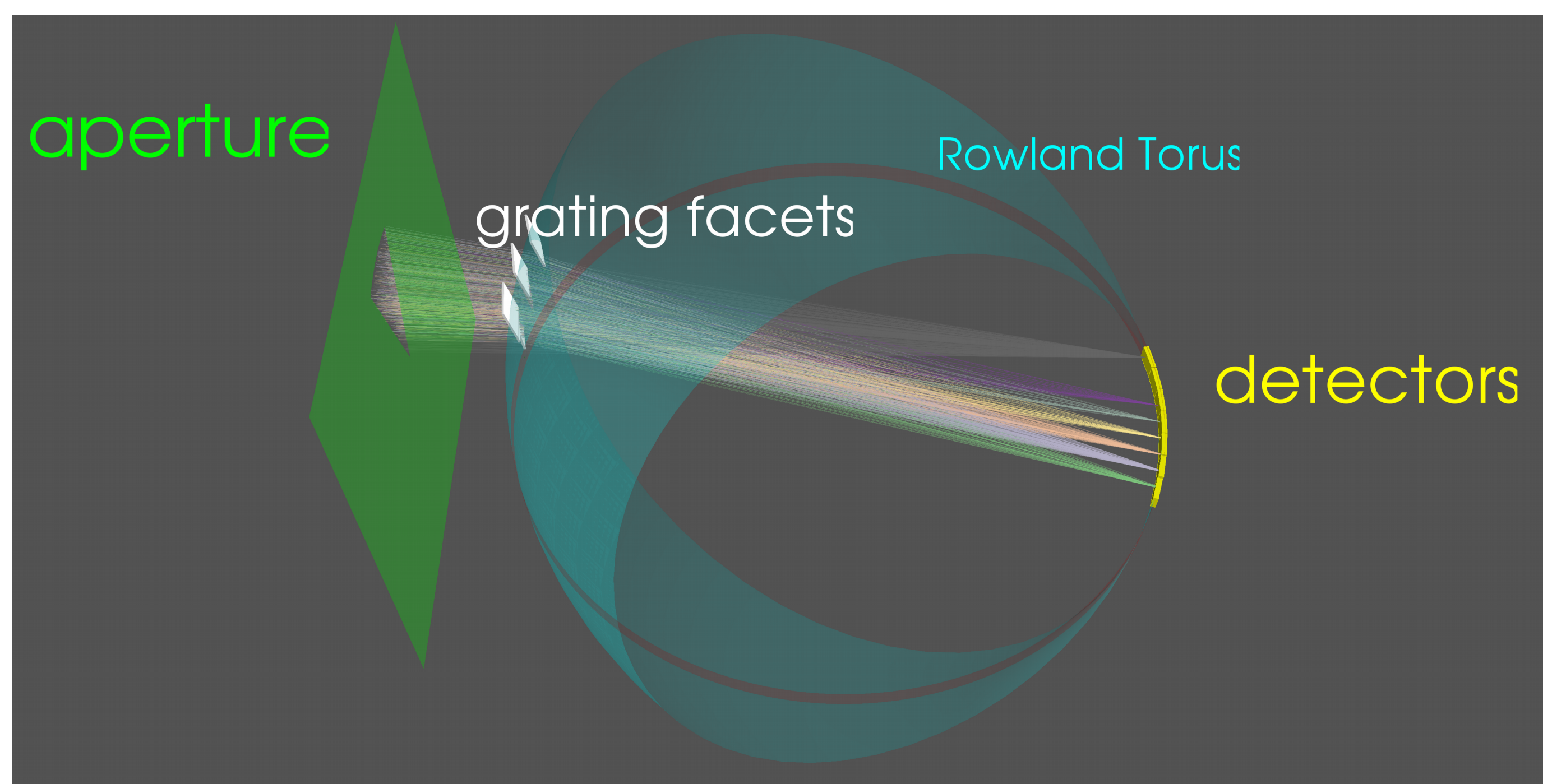




# Ray-tracing critical-angle transmission gratings for the X-ray Surveyor and Explorer-size missions

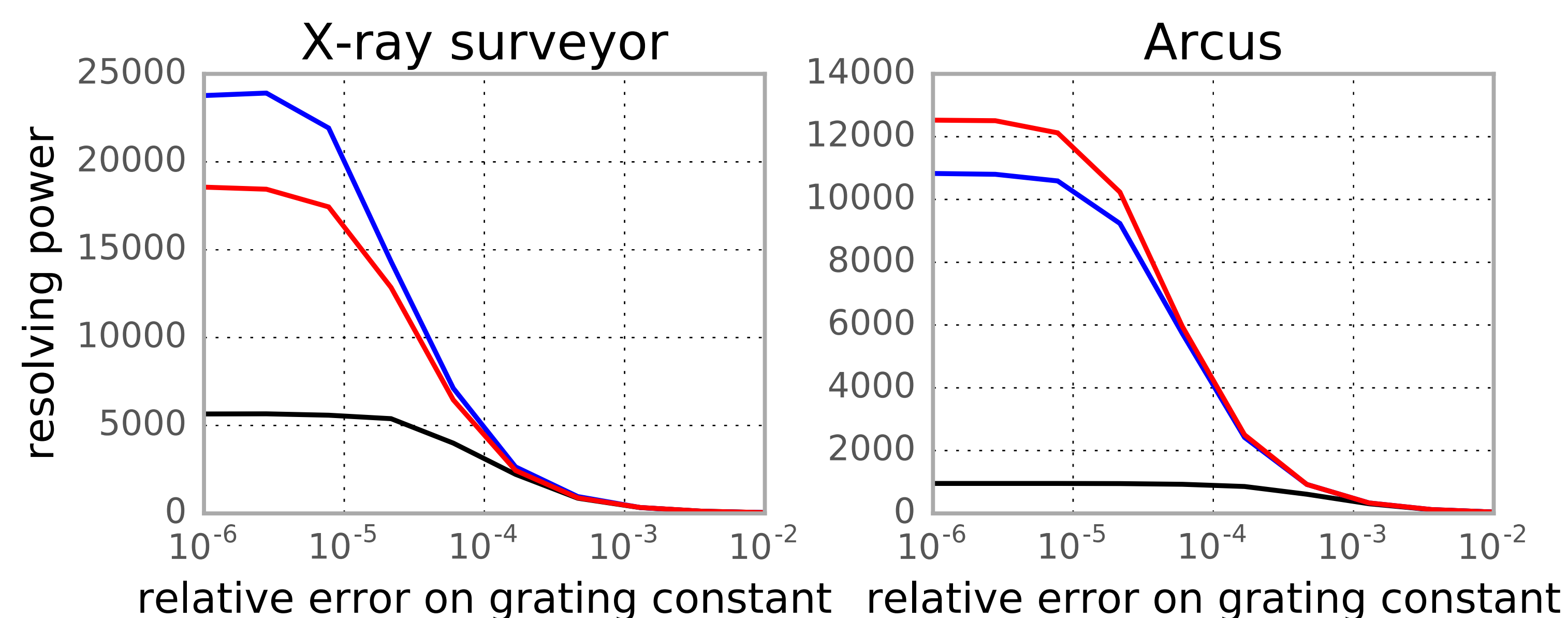
Hans M. Günther, Marshall W. Bautz, Ralf K. Heilmann, David P. Huenemoerder, Herman L. Marshall, Michael A. Nowak, Norbert S. Schulz  
 Massachusetts Institute of Technology, MIT Kavli Institute for Astrophysics and Space Research,  
 77 Massachusetts Avenue, Cambridge, MA 02139, hgunther@mit.edu

## Setup



- Two scenarios:
  - X-ray Surveyor (f=9 m, half-arcsec mirror)
  - Arcus (f=12 m, silicon pore optics)
- 30 deg azimuthal subaperture
- Critical angle transmission (CAT) gratings
  - Blaze angle ~2 deg
  - Tilted Rowland torus
  - Period 200 nm

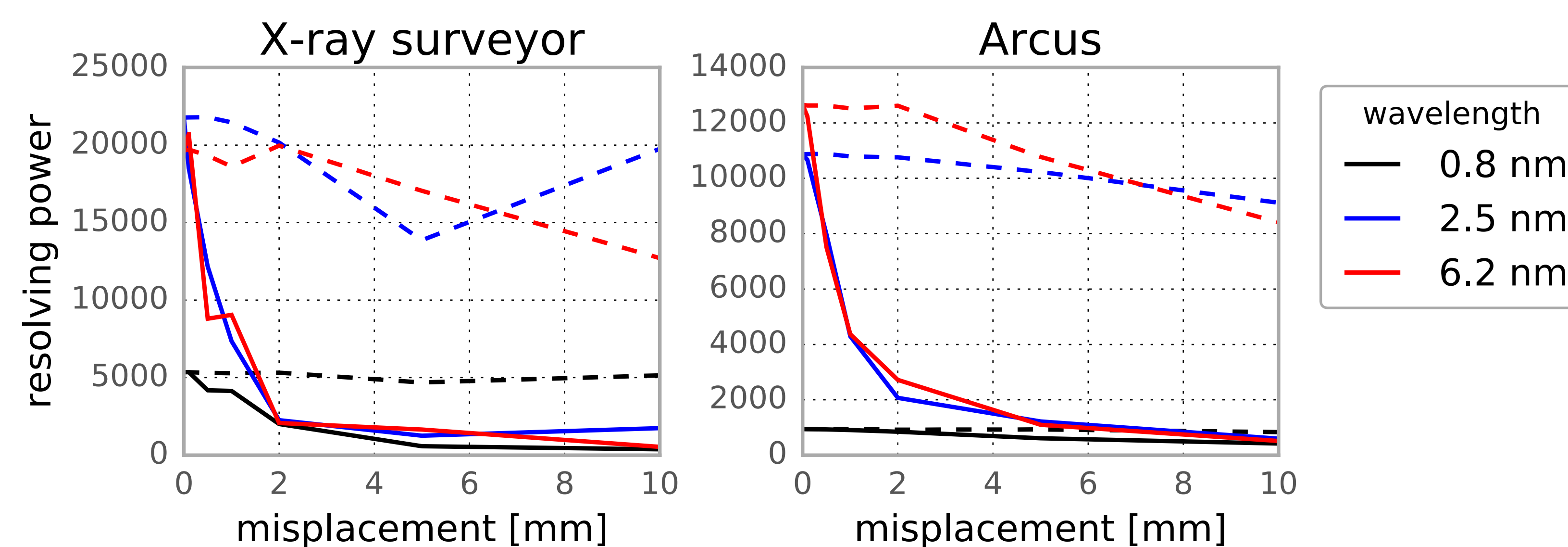
## Change of grating period



Stability of grating period 1:10<sup>5</sup>

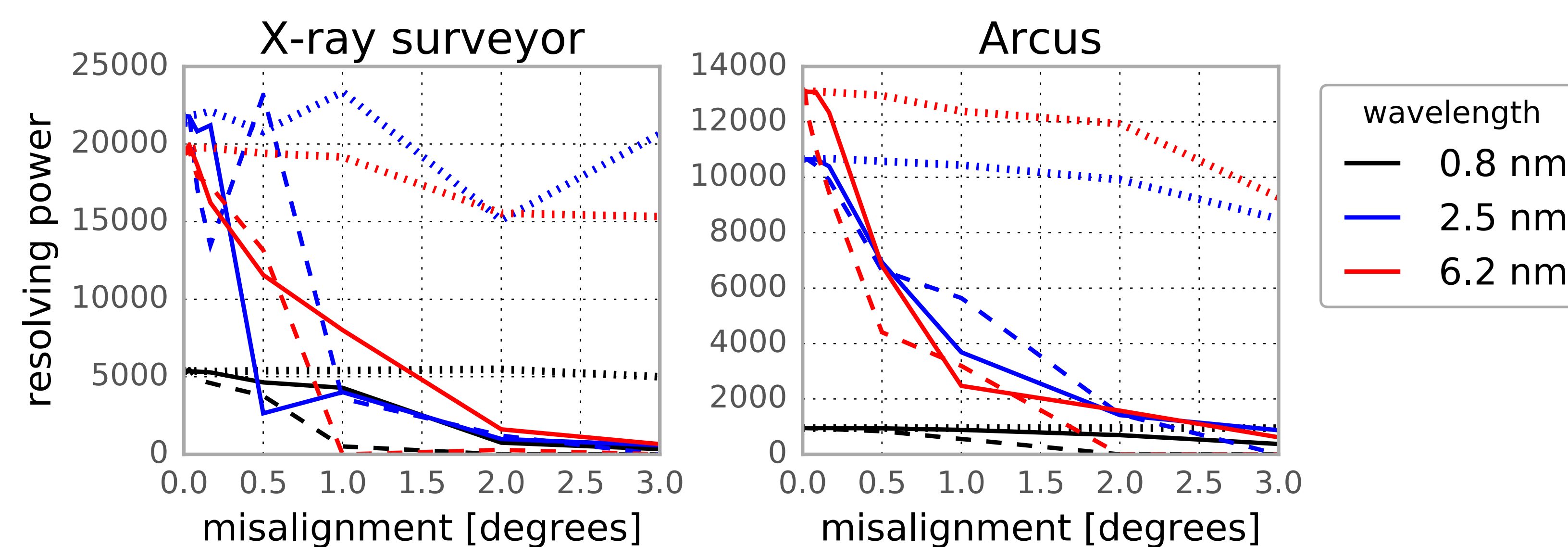
## Alignment tolerances

### Translation of gratings



Parallel to optical axis (solid lines)	0.5 mm
Perpendicular to optical axis (dashed lines)	several mm

### Rotation of gratings



around optical axis (solid lines)	5 arcmin
around groove direction (dashed line)	5 arcmin
around third axis (dotted lines)	5 degrees

CAT gratings offer a promising path to high resolution X-ray spectrographs ( $R = \lambda/\Delta\lambda = 10,000 - 20,000$ ) in the 1-10 nm range with relaxed alignment tolerances and large efficiency (Heilmann et al., paper 9905-65).