Tutorial 1: First *in-silico* microscopy image

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1 Generate the the PSF

The point spread function $PSF(l', m', n')$ is generted using the following command

```
Tut1$ siliscopy gen_psf --method gandy --paramfile parameters.
    dat --calc all --output PSF_gandy --multiprocess
```

This reads the following variables from `parameters.dat`,

- `NA` $= 1.3$ (Numerical Aperture)
- `meu` $= 1.51$ (Refractive index of immersion oil)
- `dlmn` $= 0.1, 0.1, 0.2$ nm (Voxel dimensions)
- `Plmn` $= 15, 15, 25$ nm (PSF box dimensions)
- `fs` $= 530$ (FWHM scaling factor)
- `lam1`, `lam2` $= 670, 518$ nm (Wavelength)

The command above creates two PSF files for wavelength 670 nm and 518 nm.

- `PSF_gandy_lam670_fs530.dat`
- `PSF_gandy_lam518_fs530.dat`

2 Calculate *in-silico* monochrome image intensity

The *in-silico* monochrome image intensity $I(l', m')$ is calculated using,

```
Tut1$
   siliscopy gen_mono --file dp100.gro --paramfile parameters.
   dat --psf PSF_gandy --output img100 --method slice
Tut1$
   siliscopy gen_mono --file dp2000.gro --paramfile parameters
   .dat --psf PSF_gandy --output img2000 --method slice
```

This uses the PSF files generated in the previous step (`--psf PSF_gandy`), and reads the following variables from `parameters.dat`,

- `fs` = 530
- `lam1`, `lam2` = 670, 518 nm
- `lam_names1` and `lam_names2` (Particle names)
- `dlmn` = 0.1, 0.1, 0.2 nm
- `Plmn` = 15, 15, 25 nm
- `maxlen` = 25, 25, 25 nm (Maximum MS box dimensions)
- `focus_cor` = 12.5 nm (location of object focal plane)
- `opt_axis` = 2 (Optical axis; 2 implies z-axis)
- `pbc` = xyz (Periodic boundary condition)
- `psf_type` = 0 (Type of PSF; 0 implies depth-invariant PSF)

The command above generates image data files,

- `img100_lam670_fs530.dat`
- `img100_lam518_fs530.dat`
- `img2000_lam670_fs530.dat`
- `img2000_lam518_fs530.dat`

3 Generate monochrome *in-silico* microscopy images

Monochrome *In-silico* images can be generated using the following commands,

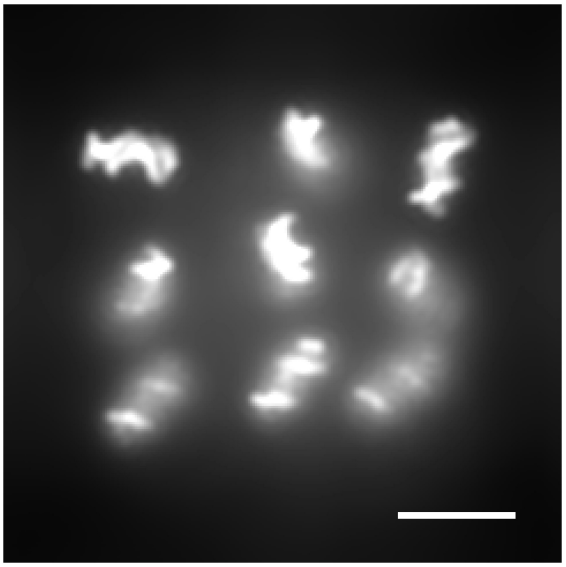
```
Tut1$ siliscopy plot --file img --paramfile parameters.dat --
    method mono --timestep 100 --calc specific --type jpeg
Tut1$ siliscopy plot --file img --paramfile parameters.dat --
    method mono --timestep 2000 --calc specific --type jpeg
```

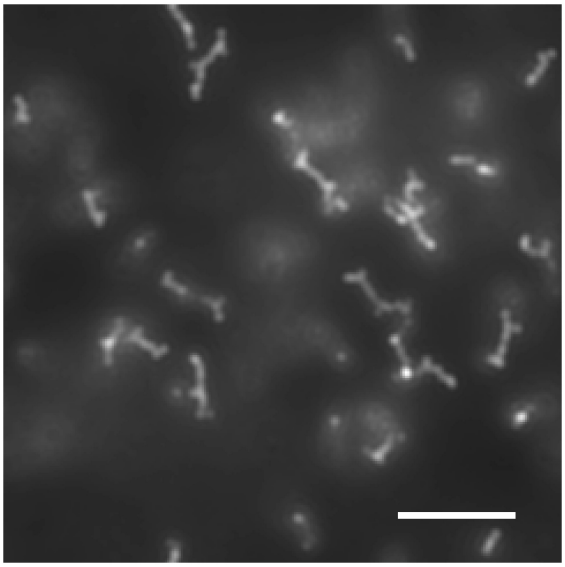
This reads the image intensity files calculated in the previous step, and reads the following variables from `parameters.dat`

- `fs` $= 530$
- `T` $= 1$ (Number of time steps used for emulating exposure)
- `scale` $= 5$ (Size of scale bar in nm)
- `dpi` $= 600$ (dots per inch)
- `lam1`, `lam2` $= 670, 518$
- `lam_I0_1`, `lam_I0_2` $= 0.13, 0.25$ (Maximum intensity)
- `dlmn` $= 0.1, 0.1, 0.2$
- `maxlen` $= 25, 25, 25$
- `opt_axis` $= 2$

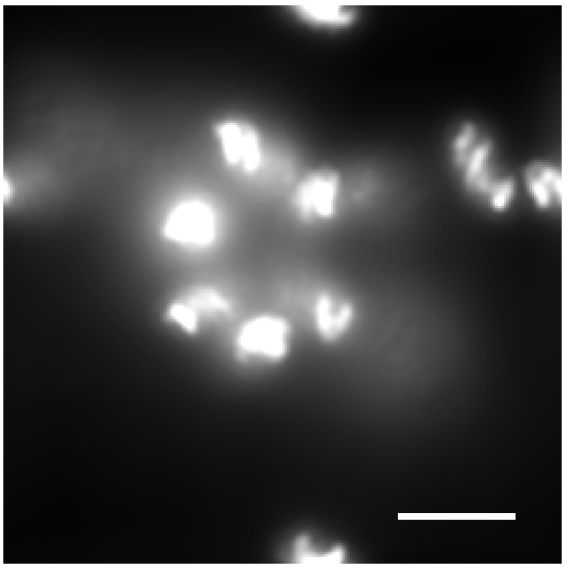
The above command generates the following images:

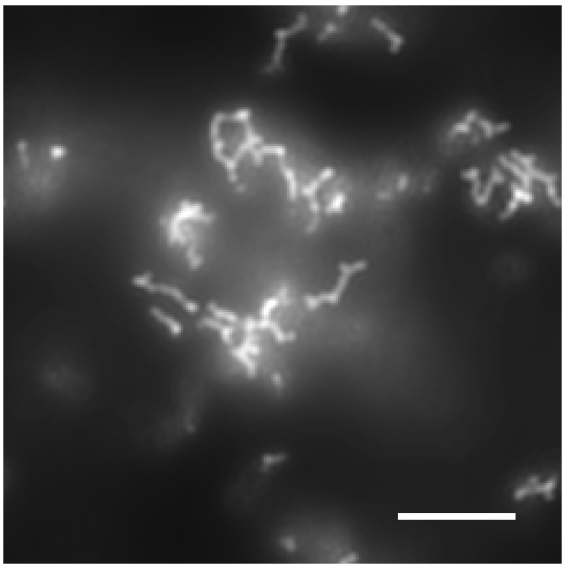
- `img100_lam670_fs530_T1_I0.13.jpeg`, `img100_lam518_fs530_T1_I0.25.jpeg`





- `img2000_lam670_fs530_T1_I0.13.jpeg`, `img2000_lam518_fs530_T1_I0.25.jpeg`





4 Generate colored *in-silico* microsocpy image.

Coloured *In-silico* images can be generated using the following commands,

```
Tut1$ siliscopy plot --file img --paramfile parameters.dat --
    method color--timestep 100 --calc specific --type jpeg
Tut1$ siliscopy plot --file img --paramfile parameters.dat --
    method color --timestep 2000 --calc specific --type jpeg
```

This reads the image intensity files calculated in the previous step, and reads the following variables from `parameters.dat`

- `fs` $= 530$
- `T` $= 1$
- `scale` $= 5$
- `dpi` $= 600$
- `lam1`, `lam2` $= 670, 518$
- `lam_I0_1`, `lam_I0_2` $= 0.13, 0.25$
- `lam_hue1`, `lam_hue2` $= 255, 60$ (Hue in degrees)
- `dlmn` $= 0.1, 0.1, 0.2$
- `maxlen` $= 25, 25, 25$
- `opt_axis` $= 2$

The above command generates the following images:

- `img100_fs530_T1_I_0.13_0.25.jpeg`, `img2000_fs530_T1_I_0.13_0.25.jpeg`