rings_results

June 2, 2021

[1]:
```
import imageio
import numpy as np

import matplotlib.pyplot as plt
from silx.math.histogram import Histogramnd
import silx.math.fit
from scipy.interpolate import interp1d
from silx.math.fit import leastsq
import silx.gui.plot
import yaml
#%gui qt5
%matplotlib inline
```

```
/home/linus/miniconda3/envs/collimator_env/lib/python3.7/site-
packages/silx/gui/plot/matplotlib/__init__.py:59: UserWarning: matplotlib.pyplot
has already been imported, this call will have no effect.
  matplotlib.use(backend, warn=warn, force=force)
```

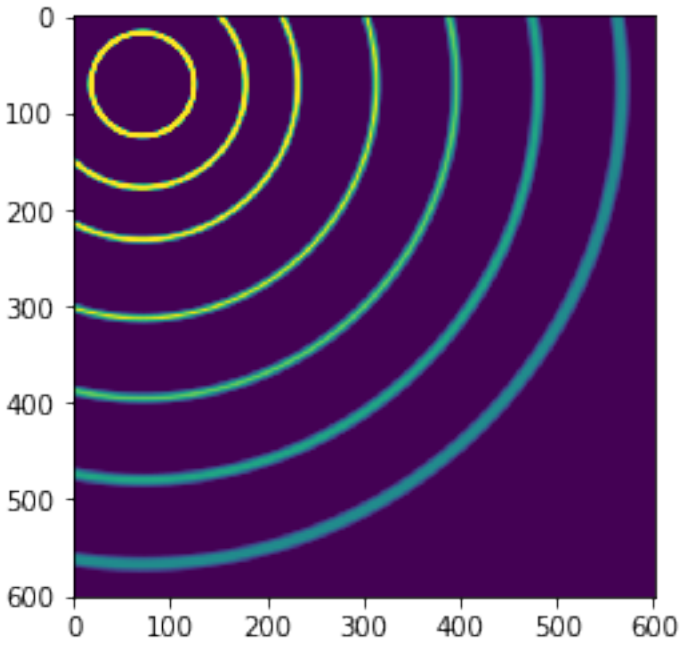
[2]:
```
config_file="../examples/id31_draft/ring_raytracing.yml"
with open(config_file, "r") as stream:
    config = yaml.load(stream, Loader=yaml.SafeLoader)

no_soller_imgs="../"+config["output_dir"]+"/no_soller.gif"
soller_imgs="../"+config["output_dir"]+"/soller.gif"
shadow_imgs="../"+config["output_dir"]+"/shadow.gif"
#no_nothing_imgs="no_nothing.gif"
```

[3]:
```
# calculate ring pattern
dis = config["ringpattern"]["pinhole_distance"]; #(*distance lightsource␣
 ↪pinhole in mm*)
widthInRadian =  np.deg2rad(config["ringpattern"]["reflection_width"])␣
 ↪#(*natual width of the reflections*)
ringpos = np.deg2rad(config["ringpattern"]["ringpositions"]) #(*angular␣
 ↪position of diffraction features*)

def CalcMinMaxRad(r):
```

```
    return np.transpose(np.array([np.tan(r - widthInRadian/2)*dis,np.tan(r +␣
 ↪widthInRadian/2)*dis]))

rings = CalcMinMaxRad(ringpos)
rings=np.array(rings).flatten()

##position in the simulation
sim_pos=np.arange(
    config["simulation_range"]["min"],
    config["simulation_range"]["max"],
    config["simulation_range"]["step"],
)
```

[4]:
```
#calculate sum image without soller
no_soller=np.array(imageio.mimread(no_soller_imgs)).astype(int)
no_soller_sum=np.sum(no_soller,axis=0)
plt.imshow(no_soller_sum)

#get normalisation intensities
#no_nothing=np.array(imageio.mimread(no_nothing_imgs)).astype(int)
```

[4]: <matplotlib.image.AxesImage at 0x7ffb855b0410>



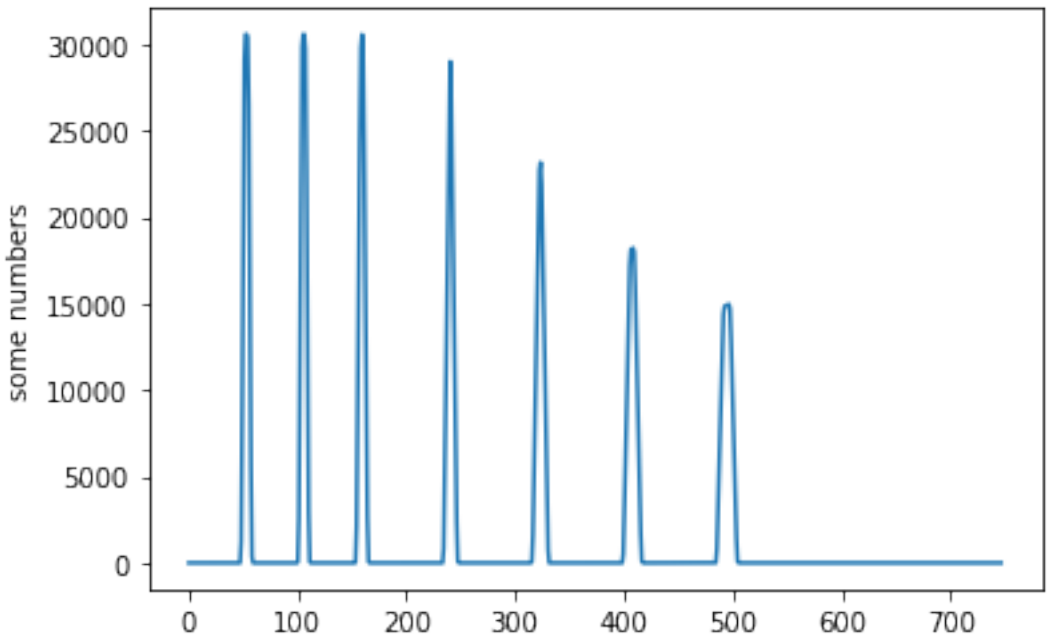
[5]:
```
#p=silx.gui.plot.Plot2D()
#p.addImage(no_soller_sum)
```

```
#p.show()
```

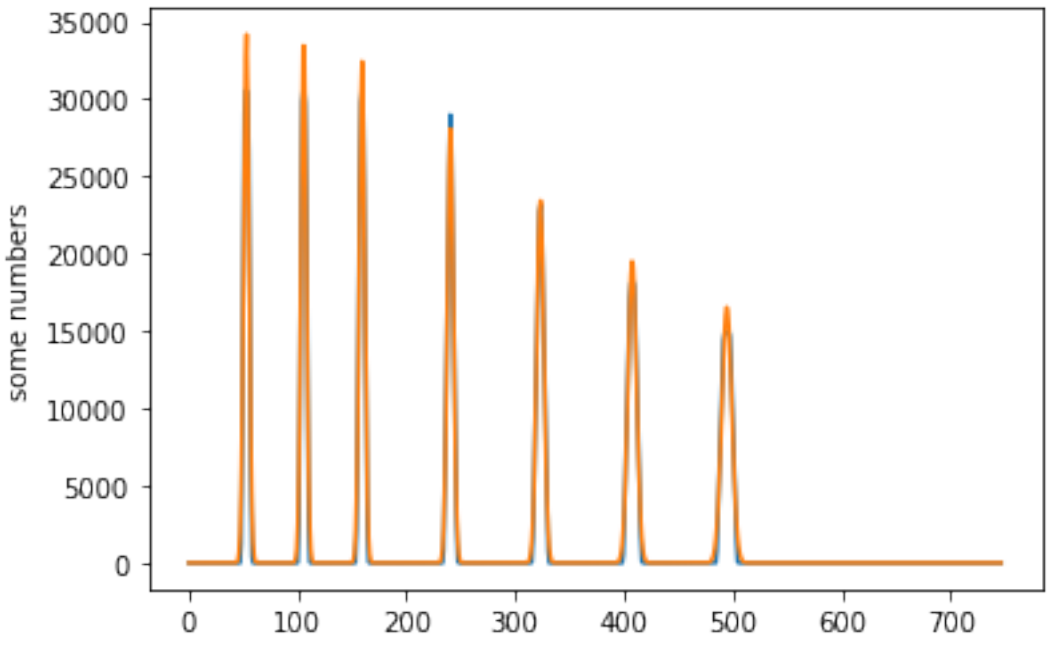
[6]:
```
def computeradius(data):

    # do the azimutal integration
    #xcenter=data.shape[0]/2
    #ycenter=data.shape[1]/2
    xcenter=72
    ycenter=72
    y, x=np.ogrid[:data.shape[0], :data.shape[1]]
    r=np.sqrt((x-xcenter)**2+(y-ycenter)**2)
    return r
```

[7]:
```
radii=computeradius(no_soller_sum)

maxRadius=int(np.ceil(radii.max()))
nbbins=maxRadius
histo_range=[0,maxRadius]
histo, w_histo, edges = Histogramnd(radii.ravel(),
                                    weights=no_soller_sum.astype(float).ravel(),
                                    n_bins=nbbins,
                                    histo_range=histo_range)
binscenter=(edges[0][1:] + edges[0][0:-1]) / 2.0
integration=w_histo/histo
integration=integration-integration.min()
```

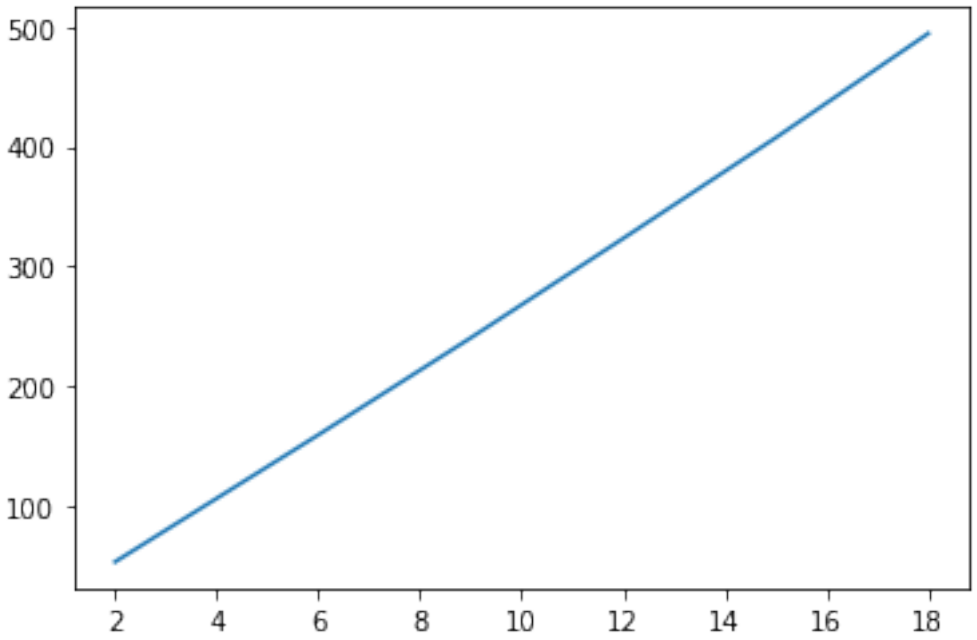
[8]:
```
plt.plot(binscenter,integration)
plt.ylabel('some numbers')
plt.show()
```



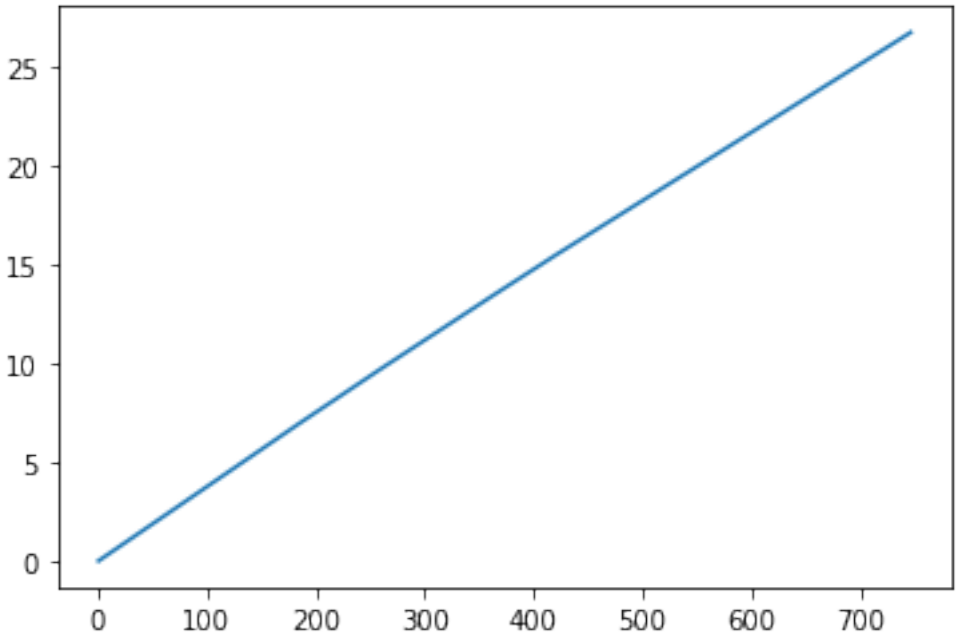
[9]:
```
peakpos_px=silx.math.fit.peaks.peak_search(integration, 10, sensitivity=3.5)
#print(peakpos_px.shape, ringpos.shape)
peakpos=binscenter[peakpos_px.astype(int)]
#print(peakpos)

intens_guess=integration[peakpos_px.astype(int)]
fwhm_guess=silx.math.fit.peaks.guess_fwhm(integration)
fwhm_guess=np.ones(intens_guess.shape[0])*fwhm_guess
init_gues=np.transpose(np.array([intens_guess,peakpos_px,fwhm_guess])).ravel()
optimal_parameters, covariance, infodict  = silx.math.fit.leastsq(model=silx.
 ↪math.fit.sum_gauss,
                    xdata=binscenter,
                    ydata=integration,
                    p0=init_gues,
                    full_output=True)



calib_fitted=silx.math.fit.sum_gauss(binscenter,optimal_parameters)

plt.plot(binscenter,integration)
plt.plot(binscenter,calib_fitted)
plt.ylabel('some numbers')
plt.show()
```



[10]:
```
plt.plot(np.rad2deg(ringpos),peakpos)
plt.show()
```



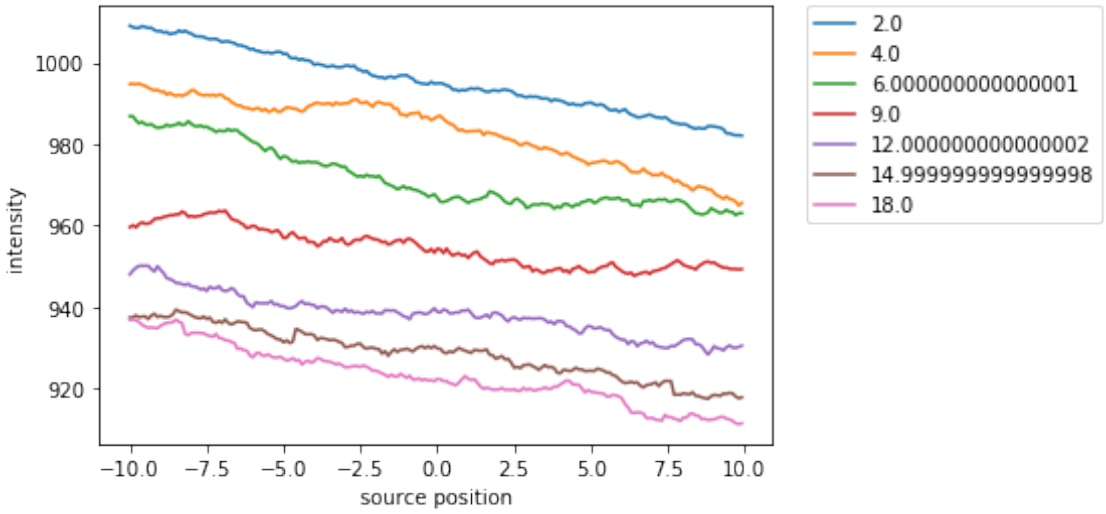
[11]:
```
f = interp1d(peakpos,np.rad2deg(ringpos),fill_value="extrapolate")
x_in_deg=f(binscenter)
plt.plot(binscenter,x_in_deg)
#plt.ylabel('some numbers')
plt.show()
```



[12]:
```
radial_intensities=[]

for i in range(0,sim_pos.shape[0]):
    histo, w_histo, edges = Histogramnd(radii.ravel(),
                                        #weights=(no_soller[i].astype(float)/
 ↪no_nothing[i].astype(float)).ravel(),
                                        weights=(no_soller[i].astype(float)).
 ↪ravel(),
                                        n_bins=nbbins,
                                        histo_range=histo_range)
    integration_frame=w_histo/histo
    integration_frame=integration_frame-integration_frame.min()

    radial_intensities.append(integration_frame)

radial_intensities=np.array(radial_intensities)

optimal_parameters_formated=optimal_parameters.reshape(int(optimal_parameters.
 ↪shape[0]/3),3)
```

```
optimal_fwhm=np.ceil(optimal_parameters_formated[:,2])*1.5

l_intens_nosoller=[]
j=0
for i in np.array([peakpos_px,optimal_fwhm]).transpose().astype(int):
    tmp=np.sum(radial_intensities[:,(i[0]-i[1]):(i[0]+i[1])],axis=1)
    l_intens_nosoller.append(tmp)
    plt.plot(sim_pos,tmp,label=str(np.rad2deg(ringpos[j])))
    j+=1
    plt.ylabel("intensity")
    plt.xlabel("source position")
plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0.)
```

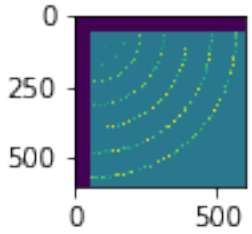
[12]: <matplotlib.legend.Legend at 0x7ffb85015f90>



[13]:
```
#calculate mask to shadow reflections outside of collimated area
shadow=np.array(imageio.mimread(shadow_imgs)).astype(int)
plt.subplot(3,1,1)
plt.imshow(shadow[1])

c10=np.argmin(np.sum(shadow[1],axis=0)[0:int(shadow[1].shape[1]/2)])
c11=np.argmin(np.sum(shadow[1],axis=0)[int(shadow[1].shape[1]/2):
 ↪])+int(shadow[1].shape[1]/2)
c00=np.argmin(np.sum(shadow[1],axis=1)[0:int(shadow[1].shape[0]/2)])
c01=np.argmin(np.sum(shadow[1],axis=1)[int(shadow[1].shape[0]/2):
 ↪])+int(shadow[1].shape[0]/2)


m=np.zeros_like(shadow[1])
```

```
m[c00::,c10::]=1
m=m.astype(np.int)

#now the same exersise with soller
#calculate sum image without soller
soller=np.array(imageio.mimread(soller_imgs)).astype(int)*m
soller_sum=np.sum(soller,axis=0)
plt.imshow(soller_sum)
```

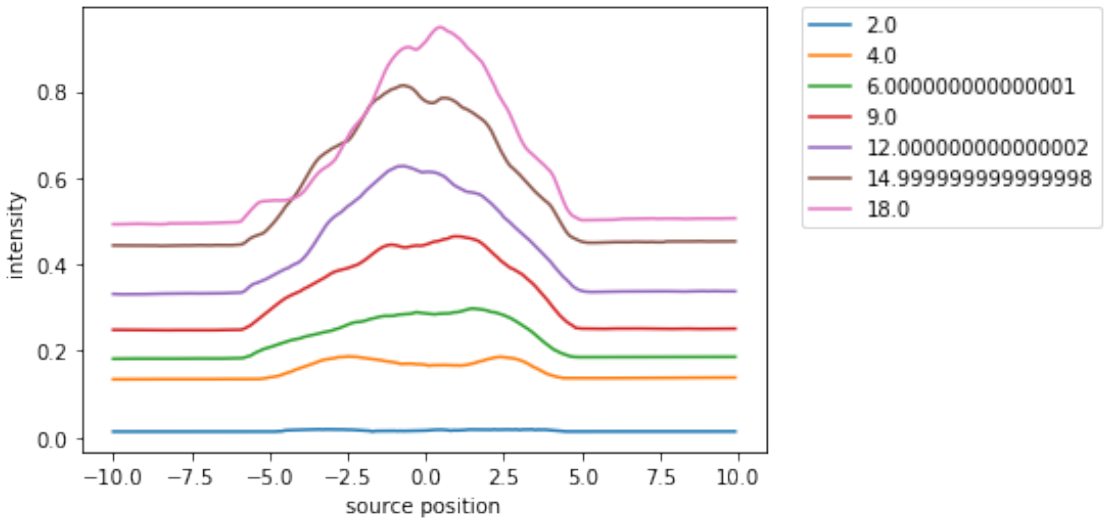
[13]: <matplotlib.image.AxesImage at 0x7ffb85d3d0d0>



[14]:
```
radial_intensities=[]

for i in range(0,sim_pos.shape[0]):
    histo, w_histo, edges = Histogramnd(radii.ravel(),
                                        weights=soller[i].astype(float).ravel(),
                                        n_bins=nbbins,
                                        histo_range=histo_range)
    integration_frame=w_histo/histo
    integration_frame=integration_frame-integration_frame.min()

    radial_intensities.append(integration_frame)

radial_intensities=np.array(radial_intensities)

optimal_parameters_formated=optimal_parameters.reshape(int(optimal_parameters.
 ↪shape[0]/3),3)
optimal_fwhm=np.ceil(optimal_parameters_formated[:,2])*1.5

l_intens=[]
j=0
for i in np.array([peakpos_px,optimal_fwhm]).transpose().astype(int):
    tmp=np.sum(radial_intensities[:,(i[0]-i[1]):(i[0]+i[1])],axis=1)
    tmp=tmp/l_intens_nosoller[j]
    l_intens.append(tmp-np.min(tmp))
    plt.plot(sim_pos,tmp,label=str(np.rad2deg(ringpos[j])))
```

```
    j+=1
    plt.ylabel("intensity")
    plt.xlabel("source position")
plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0.)
```

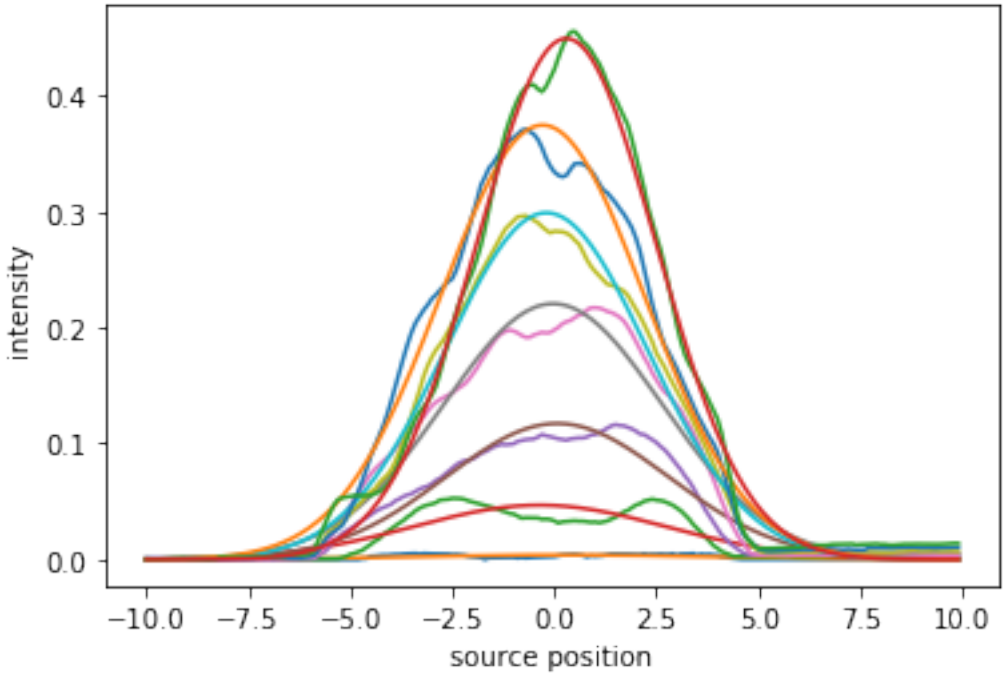
[14]: <matplotlib.legend.Legend at 0x7ffb84fc0a90>



[15]:
```
j=0
for l in l_intens:
    intens_guess=np.max(l)
    #fwhm_guess=silx.math.fit.peaks.guess_fwhm(l)
    ma=np.max(l)
    fwhm_guess=np.abs(sim_pos[np.argmax(l)]-np.abs(sim_pos[np.argmin(np.
 ↪abs(l-ma/2))]))
    #fwhm_guess=1
    init_gues=np.array([intens_guess,0,fwhm_guess])
    optimal_parameters, covariance, infodict  = silx.math.fit.
 ↪leastsq(model=silx.math.fit.sum_gauss,
                     xdata=sim_pos,
                     ydata=l,
                     p0=init_gues,
                     full_output=True)

    fitted=silx.math.fit.sum_gauss(sim_pos,optimal_parameters)

    plt.plot(sim_pos,l)
    plt.plot(sim_pos,fitted)

    plt.ylabel("intensity")
```

```
    plt.xlabel("source position")

    print(np.round(np.rad2deg(ringpos[j])),'  ',optimal_parameters[2])
    j+=1
```

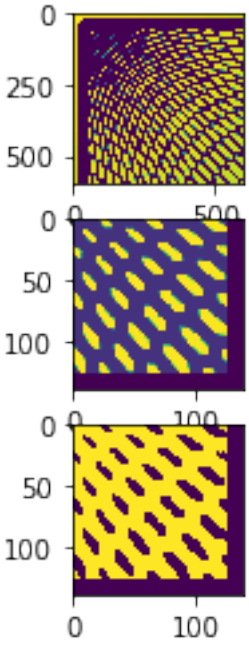
```
2.0    8.596924868636881
4.0    7.272152629916695
6.0    6.430675693270989
9.0    6.301046812563056
12.0    5.822748935111013
15.0    5.885625655770407
18.0    5.175429173159246
```



[16]:
```
#calculate transmission
shadow=np.array(imageio.mimread(shadow_imgs)).astype(int)
plt.subplot(3,1,1)
plt.imshow(shadow[1])

c10=np.argmin(np.sum(shadow[1],axis=0)[0:int(shadow[1].shape[1]/2)])
c11=np.argmin(np.sum(shadow[1],axis=0)[int(shadow[1].shape[1]/2):
 ↪])+int(shadow[1].shape[1]/2)
c00=np.argmin(np.sum(shadow[1],axis=1)[0:int(shadow[1].shape[0]/2)])
c01=np.argmin(np.sum(shadow[1],axis=1)[int(shadow[1].shape[0]/2):
 ↪])+int(shadow[1].shape[0]/2)
```

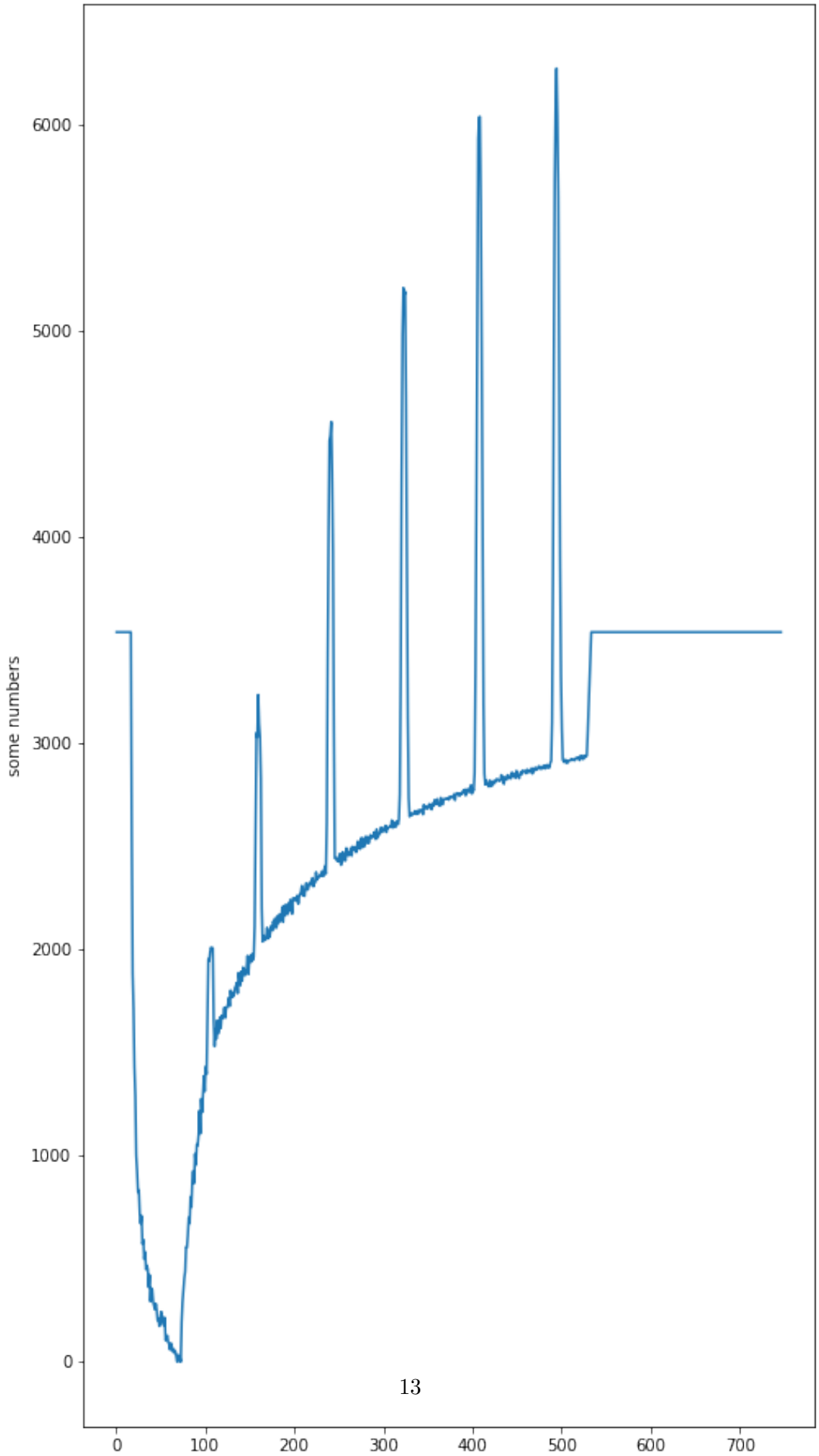
```
plt.rcParams['figure.figsize']=[8,16]

m=np.zeros_like(shadow[1])
m[c00:c01,c10:c11]=1
m=m.astype(np.bool)
det=shadow[1]
det[np.logical_not(m)]=0
flat=shadow[0]
flat[np.logical_not(m)]=0
sub=np.abs(flat-det)
sub[sub>15]=1
sub[sub>1]=0
flat[flat>1]=1
#det[det>np.min(det[det>0])]=1
plt.subplot(3,1,2)
plt.imshow(det[180:320,180:320])
plt.subplot(3,1,3)
plt.imshow(sub[180:320,180:320])
print("Transmission:",np.sum(sub)/np.sum(flat))
```

```
Transmission: 0.853922953603911
```



[17]:
```
maxRadius=int(np.ceil(radii.max()))
nbbins=maxRadius
histo_range=[0,maxRadius]
```

```
histo, w_histo, edges = Histogramnd(radii.ravel(),
                                    weights=soller_sum.astype(float).ravel(),
                                    n_bins=nbbins,
                                    histo_range=histo_range)
binscenter=(edges[0][1:] + edges[0][0:-1]) / 2.0
integration=w_histo/histo
integration=integration-integration.min()
plt.plot(binscenter,integration)
plt.ylabel('some numbers')
plt.show()
```


some numbers
0
1000
2000
3000
4000
5000
6000
0
100
200
300
400
500
600
700

[18]:
```
soller_imgs
```

[18]:
```
'../examples/id31_draft/raytracing_output_3_3_5_5/soller.gif'
```