

Discussion Session of WG II

“Imaging, Dynamics, and Photon Correlation Spectroscopy: Biological Objects”

Case studies discussed:

- Holographic imaging of eucaryotic cells
- Imaging of reproducible particles like viruses, macromolecular assemblies
- Imaging of non-reproducible medium (pico cells) to small particles like chromatin
- Imaging of 2D-arrays incl. crystals**, particles in membranes (e.g. nuclear pores)

Sample	Size* [μm]	Res. [nm]	Fluence req.	Depth/3D	longitud. coh.length	E [keV]	ΔE/E	pulse length [fs]
Cells	diam. 30****	40		- / -	>5 sample*	1.2	>2·10 ⁻⁴ ?	
“Pico cells”	1-0.3	<10***		+ / -	>5 sample*	Water window		
Viruses	0.4-0.1	<1-2		+ / +		3		20
Assemblies	0.1	<1-2		+ / +		3		20
(2D crystals)	0.1-1	<1		- / +	300 nm	3		20

* ball park number, ** huge particle, unit cell, *** including back scattering ?? ***** thin

To image the differently sized samples at different resolutions need to fine tune

- Energy
- Sample –detector distance
- Focal spot size
- $\Delta E/E$ for number of resolution elements

Detector: pixel 200 μm , 2k x 2k; with 4 pixel sampling

Sample size [μm]	λ [nm] / E [keV]*	Sample-Det Dist [m]	Achievable Res. [nm]
1	2.5 / 0.49	0.32	4
10	2.5 / 0.49	3.0	40
1	1.0 / 1.2	1.0	4
10	1.0 / 1.2	10.0	40
0.5			2
0.1			as high as poss.

* To be adjusted to energies given in table 1

SCS wish list

- **Energy range:** 0.4 keV* - 3 keV, monochromatization required (up to 10^{-4})
- **Fluence:** as high as possible, at least 10^{12} /pulse at sample**
- **Wavefront:** flat, or well defined wavefront on the size of the sample
- **Coherence:** full coherence over the size of the sample at sample plane
- **Focus:** adjustable, 4-5 times sample size as small as possible for holography (at most 100 nm), 400 nm, 1 μ m, 120 μ m)
- **Pump –probe synchronization:** Laser & THz radiation
- **Large hutch** to accommodate long, adjustable detector distance

*Water window, to be defined after talking to the experts, close to nitrogen edge might be interesting because of fluence, scatt.

** see numbers in table that are estimated to give req. resolution

